Tipp 2014 - Third International Conference on Technology and Instrumentation in Particle Physics

Report of Contributions

http://indico.cern.ch/e/tipp2014

Contribution ID : **177** Type : **Oral**

10 Gb/s Radiation-Hard VCSEL Array Driver

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

Planned upgrades to the LHC at CERN will increase its energy and luminosity. These advancements will require increasing the optical data communication bandwidth to fully exploit the accelerator and detector upgrades. This require much increased per-fiber output data rates of up to 10 Gb/s. While 10 Gb/s optical links are mature in industry, as yet there are none that have sufficient radiation hardness for the most challenging HEP deployments. We will present results from an R&D project to produce a radiation-hard VCSEL driver ASIC capable of 10 Gb/s operation per-channel. Commercial VCSEL arrays operating at 10 Gb/s are now readily available and have been proven to be radiation-hard in previous studies. Thus, the ultimate goal of the R&D is to develop an ASIC that contains a 12-channel array of 10 Gb/s VCSEL drivers. However, at this stage in our R&D we are targeting fabrication of a preliminary four-channel test chip in a 65 nm CMOS process. The four channels in the ASIC will be used to qualify the performance and radiation hardness of different driver topologies before settling on a preferred topology for the 12-channel ASIC. The ASIC will include an 8-bit DAC and band gap reference to be used for remotely controlling the VCSEL bias and modulation currents. We will present the circuit designs of the four-driver topologies included within the ASIC along with results from extracted layout simulations.

Summary

Primary author(s) : Prof. GAN, Kock Kiam (Ohio State University (US))

Presenter(s) : Prof. GAN, Kock Kiam (Ohio State University (US))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **406** Type : **Oral**

128 channel waveform sampling digitizer/readout in the TOP counter for the Belle II upgrade

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

Extremely fast timing from Micro-Channel Plate PhotoMultiplier Tubes (MCP-PMTs) and multi-gigasample per second (GSa/s) waveform sampling ASICs will allow precision timing to play a pivotal role in the next-generation of Ring Imaging Cherenkov (RICH) detectors. We have developed a second prototype of the electronics to instrument the Time of Propagation (TOP) counter for the Belle II detector at KEK in Tsukuba, Japan. The front-end electronics modules consist of an array of waveform sampling / digitizing ASICs controlled by FPGAs with embedded microprocessor cores. The ASICs digitize amplified signals from an array of multi-anode MCP-PMTs coupled to a quartz radiator bar. Unwanted artifacts in the data are corrected with digital signal processing and feature-extraction on the front-end. Readout and control are done via multi-gigabit per second fiber optic links to a custom back-end.

A previous generation of these modules has been running in a prototype Focusing Detection of Internally Reflected Cherenkov (fDIRC) counter mounted in a Cosmic-Ray Stand (CRT) at SLAC continuously for over 12 months. The most recent version was taken to a beam test at SPring-8/LEPS in Japan in mid-2013. These experiences have influenced the design of the next set of ASICs and PCBs for the front-end, and we will present details on the latest generation.

Summary

We will present details on the latest generation of the front-end electronics (amplifiers, ASIC, FPGA/SoC, PCBs) in the TOP counter for the Belle II upgrade at KEK in Tsukuba, Japan.

Primary author(s) : Mr. ANDREW, Matthew (University of Hawaii)

Co-author(s) : Dr. NISHIMURA, Kurtis (SLAC); Dr. KIRBY, Brian (University of Hawaii at Manoa); Dr. VARNER, Gary (University of Hawaii); Mr. BYNES, James (University of Hawaii)

Presenter(s) : Mr. ANDREW, Matthew (University of Hawaii)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **82** Type : **Oral**

3D Particle Track Reconstruction in a Single Layer CdTe-Pixel Detector

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Many experiments, especially low-background experiments like the search for neutrinoless double beta decay, and applications, like Compton-imaging, would highly benefit from a room-temperature semiconductor voxel detector technology. A voxel detector is a 2D pixelated device which is able to determine the 3d coordinate (the depth of interaction) in every pixel. Thus, it can be used to reconstruct 3D-particle tracks that can be used for particle identification.
We developed a method to reconstruct the depth of interaction from properties that in principle could be directly measured with an optimized semiconductor detector. We applied the method to simulation data and investigated the reconstruction results under different parameters.
For an experimental proof-of-principle we used a Timepix detector with a 1 mm thick CdTe sensor and 110 μm pixel size. We evaluated data of electrons with a kinectic energy of 4.4 GeV wherefore they can be treated as minimal ionizing in our case. Despite the fact that the current Timepix cannot deliver all the necessary information for the algorithm, we successfully performed the reconstruction for electron track by employing this property (minimal ionization).
The reconstruction method and recent results on the z-position resolution will be presented.

Summary

Primary author(s) : Mr. FILIPENKO, Mykhaylo (Erlangen Center for Astroparticle Physics - ECAP)

Co-author(s) : Mr. GLEIXNER, Thomas (ECAP); Mr. MICHEL, Thilo (ECAP); ANTON, Gisela (ECAP)

Presenter(s) : Mr. FILIPENKO, Mykhaylo (Erlangen Center for Astroparticle Physics - ECAP)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **233** Type : **Oral**

A High Performance Multi-Core FPGA Implementation for 2D Pixel Clustering for the ATLAS Fast TracKer (FTK) Processor

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

The high performance multi-core 2D pixel clustering FPGA implementation used for the input system of the ATLAS Fast TracKer (FTK) processor is presented. The input system for the FTK processor will receive data from the Pixel and micro-strip detectors read out drivers (RODs) at 760Gbps, the full rate of level 1 triggers. Clustering is required as a method to reduce the high rate of the received data before further processing, as well as to determine the cluster centroid for obtaining obtain the best spatial measurement. Our implementation targets the pixel detectors and uses a 2D-clustering algorithm that takes advantage of a moving window technique to minimize the logic required for cluster identification. The design is fully generic and the cluster detection window size can be adjusted for optimizing the cluster identification process. The implementation can be parallelized by instantiating multiple cores to identify different clusters independently thus exploiting more FPGA resources. This flexibility makes the implementation suitable for a variety of demanding image processing applications. The implementation is robust against bit errors in the input data stream and drops all data that cannot be identified. In the unlikely event of missing control words, the implementation will ensure stable data processing by inserting the missing control words in the data stream.

The 2D pixel clustering implementation is developed and tested in both single flow and parallel versions. The first parallel version with 16 parallel cluster identification engines is presented. The input data from the RODs are received through S-Links and a single data stream is also required by the processing units that follow the clustering implementation. Data parallelizing (demultiplexing) and serializing (multiplexing) modules are introduced in order to accommodate the parallelized version and restore the data stream to a single flow afterwards. The results of the first hardware tests of the single flow implementation on the custom FTK input mezzanine (IM) board are presented. We report on the integration of 16 parallel engines in the same FPGA, the resulting performances and the first parallel version hardware tests. The parallel 2D-clustering implementation has sufficient processing power to meet the specification for the Pixel layers of ATLAS, for up to 80 overlapping pp collisions that correspond to the maximum LHC luminosity planned until 2022.

Summary

Primary author(s) : SOTIROPOULOU, Calliope-louisa (Aristotle Univ. of Thessaloniki (GR))

Presenter(s) : SOTIROPOULOU, Calliope-louisa (Aristotle Univ. of Thessaloniki (GR))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **326** Type : **Oral**

A High-Speed Electron Beam Profile Monitor for the Synchrotron Radiation Source

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The real-time processing of the electron beam parameters is a necessary procedure to optimize the key characteristics of the synchrotron radiation source using feedback loops. The actual problem is to study multi-bunch beam instabilities. To solve this problem a high-speed electron beam profile monitor is developed. This device includes a photodetector unit and signal recorder. The photodetector unit is bult on a photodiode strip consisting of 16 integrated avalanche photodiodes. Electric pulses from the photodiodes are fed to inputs of analog integrators. The integrator is designed for input pulse repetition rate of 200 MHz. The 16-channel signal recorder fixes the integrals values, performs their 12-bit analog-to-digital conversion and buffering in the internal 3 Gb memory. The accumulated data is transferred via Ethernet 100BASE-T. The device described must continuously implement 15625000 measurements of the vertical or horizontal electron beam profile at 16 points with a time resolution of 5 ns.

Summary

The electron beam quality determines the main synchrotron radiation characteristics therefore beam diagnostics is of great importance for synchrotron radiation source performance. The real-time processing of the electron beam parameters is a necessary procedure to optimize the key characteristics of the source using feedback loops.

The frequency of electron beam turning in the synchrotron storage ring is about 1 MHz. In multi-bunch mode electrons are grouped into a series of bunches. The bunch repetition frequency depends on the total number of bunches and usually reaches hundreds of MHz. The actual problem is to study multi-bunch beam instabilities.

To solve this problem a high-speed electron beam profile monitor is developed. This device includes a photodetector unit and signal recorder. The photodetector unit is bult on a photodiode strip consisting of 16 integrated avalanche photodiodes. It takes the radiation intensity distribution on the electron beam profile. Electric pulses from the photodiodes are fed to inputs of analog integrators. The integrator operates continuously without reset between two adjacent pulses. Varying continuously the integrator output level consistently takes the value of the every input pulse integral. This technique improves the integrator performance. The integrator is designed for input pulse repetition rate of 200 MHz. The 16-channel signal recorder fixes the integrals values, performs their 12-bit analog-to-digital conversion and buffering in the internal 3 Gb memory. The accumulated data is transferred via Ethernet 100BASE-T.

The device design has been completed. The program shell developing is in progress. The prototype of the analog integrator has been tested. The next stage is the whole device prototyping and testing at Siberia-2 which has a close bunch repetition frequency of 181.6 MHz. The device described must continuously implement 15625000 measurements of the vertical or horizontal electron beam profile at 16 points with a time resolution of 5 ns.

Primary author(s) : Mr. KOTELNIKOV, Aleksandr (Budker Institute of Nuclear Physics)

Co-author(s) : Dr. MESHKOV, Oleg (Budker Institute of Nuclear Physics); Dr. KHILCHENKO, Aleksandr (Budker Institute of Nuclear Physics); Mr. KVASHNIN, Andrey (Budker Institute of Nuclear Physics); Mr. ZUBAREV, Peter (Budker Institute of Nuclear Physics); Ms. IVANENKO, Svetlana (Budker Institute of Nuclear Physics); Ms. PURYGA, Ekaterina (Budker Institute of Nuclear Physics); IVANOVA, Alina (Budker Institute of Nuclear Physics)

Presenter(s) : Mr. KOTELNIKOV, Aleksandr (Budker Institute of Nuclear Physics)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **122** Type : **Oral**

A Kind of Electrostatic Focusing MCP-PMT

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

In order to meet the needs of JUNO, we design and manufacture a kind of electrostatic focusing MCP-PMT which has very low radioactive background by introducing pure raw materials and controlling melting and artificial fine blowing process. This MCP-PMT has high photon detection efficiency which results from using transmission photocathode and reflection photocathode simultaneously, and the total quantum efficiency reaches approximately 30%. Good design of focusing electrode and appropriate distribution of voltage can ensure 95% photoelectrons entering the surface of MCP. The electron multiplication system consists of 4 MCPs that each of the two pieces of MCP is a component, by optimizing the voltages of each MCP and the gaps between MCPs, the gain obtained is greater than 107 and the peak to valley ratio of single photoelectron is about 2. For anode optimization, we design two kinds of configuration to reduce signal ringing, the one is metal mesh and plate, the other is micro-strip line. Finally, by using signal cable which impedance matches the anode, we obtain very single photoelectron signal.

Summary

Primary author(s) : Prof. LIU, Shulin (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China); Prof. WANG, Yifang (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China)

Co-author(s) : Prof. ZHAO, Tianchi (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China); Prof. SI, Shuguang (Nanjing Branch, North Night Vision Technology CO., Ltd, No. 2, Kangping street, 211011, Nanjing, China); Dr. LIU, Hulin (Xi'an Institute of Optics and Precision Mechanics, No.17, Information Avenue, 710119, Xi'an, China); Dr. QIAN, Sen (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China); Prof. SUN, Jianning (Nanjing Branch, North Night Vision Technology CO., Ltd, No. 2, Kangping street, 211011, Nanjing, China); Prof. TIAN, Jinshou (Xi'an Institute of Optics and Precision Mechanics, No.17, Information Avenue, 710119, Xi'an, China); Prof. ZHOU, Jianxun (Nanjing Branch, North Night Vision Technology CO., Ltd, No. 2, Kangping street, 211011, Nanjing, China); Dr. CHEN, Ping (Xi'an Institute of Optics and Precision Mechanics, No.17, Information Avenue, 710119, Xi'an, China)

Presenter(s) : Prof. LIU, Shulin (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **69** Type : **Oral**

A Muon Trigger with high pT-resolution for Phase-II of the LHC Upgrade, based on the ATLAS Muon Drift Tube Chambers (MDT)

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

Speaker: V. Gabrielyan on behalf of the ATLAS Muon Collaboration The Level-1 (L1) trigger for muons with high transverse momentum (pT) in ATLAS is based on chambers with excellent time resolution, able to identify muons coming from a particular beam crossing. These trigger chambers also provide a fast pT-measurement of the muons, the accuracy of the measurement being limited by the moderate spatial resolution of the chambers along the deflecting direction of the magnetic field (eta-coordinate). The higher luminosity foreseen for Phase-II puts stringent limits on the L1 trigger rates, and a way to control these rates would be to improve the spatial resolution of the triggering system, drastically sharpening the turn-on curve of the L1 trigger. To do this, the precision tracking chambers (MDT) can be used in the L1 trigger, provided the corresponding trigger latency is increased as foreseen. The trigger rate reduction is accomplished by strongly decreasing the rate of triggers from muons with pT lower than a predefined threshold (typically 20 GeV), which would otherwise trigger the DAQ. We describe the architecture for reading out the MDT synchronously w.r.t. the relevant beam crossing and in a sufficiently fast way to fit into the available L1 latency. The adaption to chamber geometries in barrel and end-cap will also be discussed. We present results of a prototype test at the Gamma Irradiation Facility (GIF) at CERN as well as the performance of a demonstrator module, containing most of the required functionality. In addition, simulation results are shown which demonstrate the rejection efficiency for muons below a given pT-threshold, taking into account deteriorating effects like delta-rays, conversion background and tube inefficiencies.

Summary

The Level-1 (L1) trigger for muons with high transverse momentum (pT) in ATLAS is based on chambers with excellent time resolution (better than 20 ns), able to identify muons coming from a particular beam crossing. About 600 of these trigger chambers are located in the central region (eta<1) of ATLAS, while about 3600 are covering the forward region (1<eta<2.4). In the central and forward region the chamber technology is of the RPC and TGC type, respectively. A detailed description of the present ATLAS trigger scheme and chamber technologies is given in reference [1]. The trigger chambers also provide a fast pT-measurement of the muons, the accuracy of the measurement being limited by the moderate spatial resolution of the chambers along the deflecting direction of the magnetic field (eta-coordinate). The limited momentum resolution of the trigger chambers weakens the selectivity of the L1 trigger for high-pT muons above a predefined threshold, like 20 GeV, allowing muons below threshold to cause “fake” triggers, mostly corresponding to event signatures without physics interest. The higher luminosity foreseen for Phase-II puts stringent limits on the L1 trigger rates, and a way to control these rates would be to improve the spatial resolution of the triggering system, drastically sharpening the turn-on curve of the L1 trigger with respect to pT. This is possible due to the close matching between trigger and MDT precision chambers in the Muon spectrometer. The selectivity for high-pT tracks can thus be improved by combining the excellent spatial resolution of the MDT with the time resolution of the trigger chambers. In this concept, the trigger chambers will be used to define regions of Interest (RoI) inside which high-pT muon candidates have been identified. MDT hits in the RoI(s) are passed to the trigger logic, where they are used for an accurate estimate of the track momentum, leading to an efficient suppression of sub-threshold muon triggers. In order to collect the MDT hit coordinates early enough for use in the L1 trigger logic, the relevant hits are read out through a priority readout chain, independent of the standard, asynchronous readout. Considering only MDT hits inside the RoI(s) strongly reduces bandwidth requirements and latencies, in such a way that transfer and processing of the MDT for the L1 trigger decision can be accomplished within the 20 mysec L1 latency, available in Phase-II. We present the architecture of the MDT trigger system together with estimates of latency and spatial resolution as well as test results from a prototype, performed at the CERN Gamma Irradiation Facility (GIF) early this year. We also present results from a demonstrator module, containing all essential components of the readout system to be used in Phase-II. In addition, simulation results are shown which demonstrate the rejection efficiency for muons below a given pT-threshold, taking into account deteriorating effects like delta-rays, conversion background and tube inefficiencies. [1] ATLAS collaboration, The ATLAS experiment at the CERN LHC, 2008 JINST 3 S08003

Primary author(s) : RICHTER, Robert (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Co-author(s) : KROHA, Hubert (MPI for Physics, Munich); OTT, Sebastian (MPI for Physics, Munich); KORTNER, Oliver (MPI for Physics, Munich); FRAS, Markus (MPI for Physics, Munich); GABRIELYAN, Vazgen (MPI for Physics, Munich); DANIELYAN, Varuzhan (MPI for Physics, Munich); FINK, David (MPI for Physics); NOWAK, Sebastian (MPI for Physics, Munich); SCHWEGLER, Philipp (MPI for Physics, Munich); ABOVYAN, Sergey (MPI for Physics, Munich)

Presenter(s) : GABRIELYAN, Vazgen (MPI for Physics, Munich)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **430** Type : **Oral**

A New Generation of Charge Integrating ADC (QIE) for the CMS HCAL Upgrade

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

The CMS experiment at the CERN Large Hadron Collider (LHC) will upgrade the photodetection and readout systems of its hadron calorimeter (HCAL) through the second long shutdown of the LHC in 2018. A central feature of this upgrade is the development of two new versions of the QIE (Charge Integrating Encoder), a Fermilab-designed custom ASIC for measurement of charge from detectors in high-rate environments. These most recent additions to the QIE family feature 3 fC sensitivity, 17-bits of dynamic range with logarithmic response, a Time-to-Digital Converter (TDC) with sub-nanosecond resolution all with 16 bits of readout per bunch crossing. The device is capable of dead-timeless operation at 40 MHz, making it ideal for calorimetry at the LHC. We present bench measurements and integration studies that characterize the performance, radiation tolerance measurements, and plans for deployment in the upgraded CMS detector.

Summary

Primary author(s) : HIRSCHAUER, Jim (Fermi National Accelerator Lab. (US))

Presenter(s) : HUGHES, Elliot (Rutgers, State Univ. of New Jersey (US))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **24** Type : **Oral**

A Zero Ion Backflow electron multiplier operating in noble gases

Monday, 2 June 2014 16:50 (0:20)

Abstract content

We present a new concept for the suppression of the secondary ions in gaseous detectors. The Zero Ion Backflow electron multiplier operates in a noble gas atmosphere and supress the ion backflow to the level of the primary ionization, totally blocking the secondary ions that are produced in the multiplier. This detector is composed by a proportional scintillation region, composed by two highly transparent meshes, followed by a gaseous photon-multiplier. The primary electrons drift through the proportional scintillation region under the influence of an electric field below the ionization threshold of the gas, emitting electroluminescence without the production of secondary ions. The electroluminescence signals are collected by the gaseous photon multiplier, composed by a gaseous electron multiplier coupled to a CsI phothocade, and further amplified by electron avalanche. The positive ions that result from electron avalanches in the gaseous photomultiplier are prevented from reaching the conversion region by an electrostatic separation between the proportional scintillation region and the gaseous photomultiplier. The ion back flow is therefore reduced to the level of the primary ionization and is totally independent on the electron avalanches that occur on the gaseous photomultiplier.

Summary

We present the results obtained with the Zero Ion Backflow electron multiplier operated in pure Xenon equipped with a proportional scintillation region of 6 mm. The gaseous photomultiplier is composed by a double GEM cascade coupled to a CsI photocathode, separated from the proportional scintillation region by an extraction region with 2 mm. The transference of the secondary ions from the gaseous photomultiplier to the proportional scintillation region is dependent on the electric field between these two regions, EExtraction, that also influences the photoelectron extraction from the CsI photocathode. We have determined the influence of this field on the levels of ion backflow and on the photo-electron extraction. A value between 0.1 and 0.2 kV/cm*bar was found to ensure simultaneously maximum relative photoelectron extraction and full ion backflow suppression. Energy resolution of 17% was measured when irradiating the detector with 5.9 keV x-rays.

Primary author(s) : Mr. AMARO, Fernando (Coimbra University)

Co-author(s) : DOS SANTOS, Joaquim (University of Coimbra); VELOSO, joao (university of aveiro); Mr. BALL, Markus (Technical University Munich)

Presenter(s) : Mr. AMARO, Fernando (Coimbra University)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **101** Type : **Oral**

A compact scintillation detector for mobile neutron spectroscopy

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

A compact scintillation detector, comprising of plastic scintillators capable of pulse shape discrimination, coupled to silicon photomultipliers and digital readout electronics, has been constructed and characterised using a range of neutron and gamma radiation fields with energies between 0.5 and 14 MeV. Experimental measurements will be presented and compared with simulations built using GEANT4. In addition, measurements with neutron beams ranging in energy between 14 MeV and 66 MeV, produced at the iThemba LABS cyclotron facility will be used to illustrate the pulse shape discrimination capabilities of the digital data acquisition system. The potential of the device for both dosimetry and security applications will be discussed, together with the challenges of implementing a compact neutron/gamma-ray detector for use in industry.

Summary

Primary author(s) : Mr. COMRIE, Angus (University of Cape Town)

Co-author(s) : Prof. BUFFLER, Andy (University of Cape Town); Dr. SMIT, Ricky (iThemba LABS); Dr. WOERTCHE, Heinrich (INCAS3)

Presenter(s) : Mr. COMRIE, Angus (University of Cape Town)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **285** Type : **Oral**

A dark matter search using CCDs

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

DAMIC is a novel dark matter search experiment that has a unique sensitivity to hypothetic dark matter particles with masses below 10 GeV. Due to the CCD's low electronic readout noise (R.M.S. ~ 3 eV), this instrument is able to reach a detection threshold of 60 eV, suitable for the search in the low mass range. The excellent energy response and high spatial resolution of a CCD image allow a powerful background characterization. Early DAMIC runs determined the world's best cross-section limits for WIMPs with masses below 4 GeV. Here we report on DAMIC100, a fully funded dark matter search detector with a target mass of 100 grams of silicon that will be installed at Snolab during the Summer of 2014. We also discuss the challenges associated with the scale-up of the experiment, the calibration efforts for low energy nuclear recoils in silicon, and the prospects for the first physics results after a one year run.

Summary

Primary author(s) : IZRAELEVITCH, Federico (Fermilab)

Co-author(s) : DAMIC COLLABORATION, (DArk Matter In Ccds) (Fermilab)

Presenter(s) : IZRAELEVITCH, Federico (Fermilab)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **346** Type : **Oral**

A fast, low-power, multichannel 6-bit ADC ASIC with data serialization

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

The multichannel 6-bit ADC ASIC with data serialization was designed in view of LHCb Tracker System Upgrade. The first prototype was designed and fabricated in CMOS 130 nm technology. The main chip components are 8 channels of fast, very low power (<0.5 mW per channel) 6-bit SAR ADCs, data serialization circuitry based on ultra-low power internal PLL and fast SLVS I/O differential interface. The nominal ADC sampling frequency is 40 MHz but the operation beyond 80 MHz is possible. Various modes of data serialization were implemented, the main three are: A) test mode - with 6 bits from the selected ADC sent to 6 SLVS differential outputs; B) partial serialization - when output bits of each ADC are serialized, with frequency multiplied six times by PLL, into separate SLVS output; C) full serialization - when output of all (6) bits of all (8) ADCs are serialized into one SLVS output. In addition to standard operation the serialization circuitry contains also a block generating the test data (instead of using ADC output bits) which are serialized and sent out. This block is added for better ASIC testability and it allows to generate test patterns based on binary or pseudo-random counters. The ultra-low power (<1 mW) PLL was designed to generate clock in a wide frequency range, from tens of MHz to few GHz. The SLVS interface was designed for data rates beyond 1 GHz.
The description of the ASIC architecture and the results of measurements, in particular all main functionalities/blocks i.e. ADC, PLL, SLVS and serializer will be presented.

Summary

Primary author(s) : FIRLEJ, Miroslaw (AGH University of Science and Technology (PL)); Dr. FIUTOWSKI, Tomasz (AGH University of Science and Technology (PL)); Prof. IDZIK, Marek (AGH University of Science and Technology (PL)); MORON, Jakub (AGH University of Science and Technology (PL)); Dr. SWIENTEK, Krzysztof Piotr (AGH University of Science and Technology (PL))

Presenter(s) : Dr. SWIENTEK, Krzysztof Piotr (AGH University of Science and Technology (PL))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **202** Type : **Oral**

A multi-purpose digital acoustic sensor and its application in the deep-sea environment

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

The KM3NeT project is a deep-sea research infrastructure that will host a neutrino telescope with a volume of several cubic kilometres as well as Earth and Sea science instrumentation for monitoring the deep Mediterranean Sea. Within the project, a variety of acoustic topics are pursued: from acoustic position calibration of the flexible detector structures of the neutrino telescope over acoustic marine life monitoring to acoustic detection of ultra-high energy neutrinos. For these tasks - with a focus on position calibration - a multi-purpose digital acoustic sensor was developed that is integrated into the active elements of the detector: glass spheres holding photomultipliers, readout electronics and additional instrumentation. The sensor directly provides high-bandwidth digital data in standard audio format, its firmware is exchangeable. The data is sampled at about 200 kHz with 24-bit accuracy. The acoustically sensitive piezo-electric ceramic together with circuitry for pre-amplification, filtering, digitization and data formatting (using an FPGA) are implemented in a very compact design (2cm diameter and 3cm length). The sensor is flexible in application: it is shielded from electromagnetic interference, can be attached to the inside of containers, and can be coated for direct usage in water. The design and characteristics of the acoustic sensor are described and possible applications are discussed.

Summary

A multi-purpose digital acoustic sensor has been developed primarily for acoustic position calibration of the KM3NeT detector. Its small size and its flexible firmware allow for a wide range of applications.

Primary author(s) : GRAF, Kay (University of Erlangen)

Presenter(s) : GRAF, Kay (University of Erlangen)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **167** Type : **Oral**

A real x-y microbulk Micromegas with segmented mesh

Monday, 2 June 2014 16:30 (0:20)

Abstract content

We present for a first time, the development of Micromegas detectors based on Microbulk technology with segmented mesh. The space charge produced within the amplification volume induces both signals and the mesh strips provide the y coordinate while the anode strips the x coordinate. The manufacturing of a segmented mesh simplifies the x-y readout that up to now was produced in a complicated and delicate way due to the x-y strips formation (x-pads link in the front and y-pads link via through holes in the back plane) and had a high risk of deteriorating the detector quality or even damaging the detector in the last stages of construction. This R&D is a project supported by the RD51 collaboration. The design and manufacturing has been optimized and produced segmented mesh Microbulk Micromegas with excellent properties in Energy resolution, stability and good position resolution. We have designed appropriate FE-electronics for providing the bias HV to every individual mesh strip and reading it out. The design aims to an ultra low background, ultra low threshold detector appropriate for rare event searches, thanks to its low material budget that may further improve the excellent Microbulk technology background properties close to ~(few)x10-7 cnts/keV/cm2/s. We will present details of the design and the manufacturing of the segmented mesh microbulk, results on the detector performance, prospects for further improvements and possibilities that open for rare processes, neutron detection and other applications. We believe that this design constitutes a break-through in the Micro Pattern Gaseous Detectors developments.

Summary

Primary author(s) : Dr. GERALIS, Theodoros (NCSR Demokritos)

Co-author(s) : Mr. AZNAR, Fransisco (University of Zaragoza); Dr. IGUAZ, Fransisco J. (University of Zaragoza); Dr. DAFNI, Theopisti (University of Zaragoza); Dr. FERRER RIBAS, Esther (IRFU Sacaly); Dr. PAPAEVANGELOU, Thomas (IRFU Sacaly); Dr. DAVENPORT, Martyn (CERN); Dr. FERRY, Serge (CERN); Dr. DE OLIVEIRA, Rui (CERN); Mr. KALAMARIS, Athanasios (NCSR Demokritos); Dr. KEBBIRI, Mariam (IRFU Saclay)

Presenter(s) : Dr. GERALIS, Theodoros (NCSR Demokritos)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **153** Type : **Oral**

A scalable gigabit data acquisition system for calorimeters for linear collider

Monday, 2 June 2014 17:10 (0:20)

Abstract content

This article presents the scalable Data Acquisition (DAQ) system that has been designed for prototypes of ultra-granular calorimeters for the International Linear Collider (ILC). Our design is generic enough to cope with other applications with some minor adaptations. The DAQ is made up of four different modules, including an optional one. One Detector InterFace (DIF) is placed at each end of the detector elements (SLAB) to communicate with up to 160 ASICs. A single HDMI cable is used to transmit both slow-control and readout data over a serial 8b/10b encoded characters at 50 Mb/s to the Gigabit Concentrator Card (GDCC). The GDCC controls up to 7 DIFs, it is distributing the system clock and ASICs configuration, and collecting data from them. Each DIFs data packet is encapsulated in Ethernet format and sent out via an optical or copper link. The Data Concentrator Card (DCC) is a multiplexer (1 to 8) that can be optionally inserted between the GDCC and the DIFs, increasing the number of managed ASICs by the GDCC. Using a single GDCC and 7 DCCs would allow a single PC to control and readout up to 8960 ASICs (˜ 500000 channels). The fourth card is the Clock and Control Card (CCC) that provides a clock and control fanout to up to 8 GDCCs and therefore to the entire system. A software suite (named Calicoes) written in C and Python manages the overall system. This system have been used for several tests on the SiW-ECAL prototype detector (1800 channels). The full design and test results will here detailed.

Summary

Primary author(s) : GASTALDI, Franck (Ecole Polytechnique (FR))

Co-author(s) : CORNAT, Remi Jean Noel (Ecole Polytechnique (FR)); MAGNIETTE, Frederic Bruno (Ecole Polytechnique (FR))

Presenter(s) : GASTALDI, Franck (Ecole Polytechnique (FR))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **318** Type : **Oral**

A serializer ASIC of 16 Gb/s for data transmission over fiber for detector front-end readout in a particle experiment

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

We report an ASIC development based on a commercial 0.25-micron silicon-on-sapphire CMOS technology. This ASIC is a dual channel serializer sharing one LC-PLL with 8 Gb/s each channel and a total data throughput of 16 Gb/s for each chip. The prototype packaged in QFN is measured from 7.2 to 8.5 Gb/s each channel, limited by the tuning range of the PLL. This design is for an optical link that is under development to read out the front-end board in the trigger upgrade of the Liquid Argon Calorimeter (LAr) in ATLAS. We will present design details and prototype measurement results. We will also discuss the experience on the QFN package for high-speed signals.

Summary

Primary author(s) : YE, Jingbo (Southern Methodist University, Department of Physics)

Co-author(s) : Prof. GONG, Datao (Department of Physics, SMU); Prof. LIU, Tiankuan (Department of Physics, SMU); Ms. LI, Xiaoting (Department of Physics, SMU)

Presenter(s) : YE, Jingbo (Southern Methodist University, Department of Physics)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **348** Type : **Oral**

A small dual-phase xenon TPC with APD and PMT readout for the study of liquid xenon scintillation

Monday, 2 June 2014 16:50 (0:20)

Abstract content

Liquid xenon is used in many fields as detector medium. Dark Matter experiments based on liquid xenon have set the most stringent limits in the past decade and are still leading the field. Also in other areas of particle physics xenon is used as detector medium, for example in the search for neutrinoless double beta decay (EXO), in the search for lepton flavor violation (MEG) or in envisioned projects like gamma-ray telescopes on satellites. There is also ongoing research on xenon-based detectors for medical imaging. Although widely used, the scintillation process of liquid xenon, especially at low recoil energies (few keV), is not well understood.
The MainzTPC, a small 3D position-sensitive dual-phase xenon TPC, has the goal to improve our understanding of the scintillation process and the field quenching in liquid xenon. The MainzTPC uses two PMTs (Hamamatsu R6041) to detect and measure the fast primary scintillation light including its shape. Additionally an array of eight large area avalanche photo diodes (LA-APDs) detects the large proportional scintillation providing x/y resolution. Here we report on the performance of the TPC and the response of the LA-APDs to the xenon scintillation light.

Summary

The design of the MainzTPC and the according cryo-system is finished and its assembly is ongoing at the moment. Till the TIPP2014 we expect to have the TPC running and first tests performed. Meanwhile the photo sensors that will be used are tested and characterized. The large area APDs are tested in liquid xenon on quantum efficiency for the xenon scintillation light as well as voltage and temperature dependence of their internal gain (g>1000).
Also, the DAQ using a high sample rate (5GS/s) FADC is set up in parallel to the measurements of the light detectors and construction and assembly of the TPC. In the talk, we will report on the response of the photo sensors (especially the APDs) and the comissioning and first results from the comissioning of the TPC.

Primary author(s) : BESKERS, Bastian (Johannes Gutenberg University Mainz); SISSOL, Pierre (Johannes Gutenberg University Mainz)

Co-author(s) : Dr. GRIGNON, Cyril (Johannes Gutenberg University Mainz); OTHEGRAVEN, Rainer (Johannes Gutenberg University Mainz); SCHEIBELHUT, Melanie (Johannes Gutenberg University Mainz); Prof. OBERLACK, Uwe (Johannes Gutenberg University Mainz)

Presenter(s) : BESKERS, Bastian (Johannes Gutenberg University Mainz)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **39** Type : **Oral**

A specialized processor for track reconstruction at the LHC crossing rate

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

We present the results of an R\&D study for a specialized processor capable of precisely reconstructing events with hundreds of charged-particle tracks in pixel detectors at 40 MHz, thus suitable for processing LHC events at the full crossing frequency. For this purpose we design and test a massively parallel pattern-recognition algorithm, inspired by studies of the processing of visual images by the brain as it happens in nature. We find that high-quality tracking in large detectors is possible with sub-microsecond latencies if the algorithm is implemented in modern, high-speed, high-bandwidth FPGA devices.

Summary

Primary author(s) : TONELLI, Diego (CERN)

Co-author(s) : ABBA, Andrea (Università degli Studi e INFN Milano (IT)); Dr. BEDESCHI, Franco (Sezione di Pisa (IT)); CAPONIO, Francesco (Università degli Studi e INFN Milano (IT)); CITTERIO, Mauro (Università degli Studi e INFN Milano (IT)); MARINO, Pietro (Sezione di Pisa (IT)); MORELLO, Michael Joseph (SNS and INFN-Pisa); NERI, Nicola (Università degli Studi e INFN Milano (IT)); PETRUZZO, Marco (INFN Milano); NINCI, Daniele (INFN Pisa); PIUCCI, Alessio (Sezione di Pisa (IT)); PUNZI, Giovanni (Sezione di Pisa (IT)); RISTORI, Luciano (INFN and Fermilab); SPINELLA, Franco (Sezione di Pisa (IT)); STRACKA, Simone (Sezione di Pisa (IT)); alberto (Politecnico di Milano & INFN Milano); GERACI, Angelo (Politecnico di Milano & INFN Milano)

Presenter(s) : TONELLI, Diego (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **64** Type : **Oral**

AGIPD, the electronics for a high speed X-ray imager at the Eu-XFEL

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

The AGIPD (Adaptive Gain Integrated Pixel Detector) X-ray imaging camera will operate at the X-ray Free Electron Laser, Eu-XFEL, under construction in Hamburg, Germany. Key parameters are 1Mega 200μm square pixels, single 12.4 keV photon detection and a dynamic range to 10000/pixel/image. The developed sensors, ASICs, PCB-electronics and FPGA-firmware acquire individual images per bunch at 27000 bunches/s, packed into 10 bunch-trains/s with a bunch separation of 220 ns. Bunch-trains are handled by 352 analogue storage cells within each pixel of the ASIC and written to written during the 0.6msec train delivery. Random addressing provides reusability of each cell after an image has been declared as low-quality. Digitization is performed between trains (99.4 msec).

The talk will introduce all functional blocks, concentrating on the DAQ-chain PCB-electronics: a dense area of 1024 ADC-channels, each with a pickup-noise filtering and sampling of up to 50 MS/s/ADC and a serial output of 700 Mbit/s/ADC. FPGAs operate the ASICs synchronized to the bunch structure and collect the bit streams from 64 ADCs/FPGA. Pre-sorted data is transmitted on 10 GbE links out of the camera head using the time between trains. The control and monitoring of the camera with 700 A current consumption is based on a micro-controller and I2C bus with an addressing architecture allowing many devices and identical modules. The high currents require planned return paths at the system level. First experimental experience of the constructed components will be presented.

Summary

Primary author(s) : GOETTLICHER, Peter (Deutsches Elektronen-Synchrotron (DE))

Co-author(s) : AGIPD-CONSORTIUM, . (DESY, PSI, University-Bonn, University-Hamburg)

Presenter(s) : GOETTLICHER, Peter (Deutsches Elektronen-Synchrotron (DE))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **87** Type : **Oral**

Aerogel Cherenkov counters for experiments at VEPP-2000 e+e- collider with SND detector

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

For experiments at VEPP-2000 e+e- collider with SND detector the particle identification system based on the threshold aerogel Cherenkov counters was developed. The counter design is based on ASHIPH technique (Aerogel, SHifter, PHotomultiplier). Cherenkov light emitted in aerogel is collected by a wavelength shifter and detected by a photomultiplier tube based on microchannel plates (MCP PMT). For the particle identification two systems with different refractive indexes of aerogel were manufactured: with n=1.13 for the separation of pi and K mesons up to particle energy of 1 GeV and with n=1.05 for e/pi separation up to particle energy of 0.45 GeV. The construction of the aerogel Cherenkov counter is described. Main characteristics of counters measured using particles (e, mu, pi, K) produced in e+e- annihilation are presented.

Summary

Experiments at the VEPP-2000 e+e- collider with upgraded SND detector have been started in the Budker Institute of Nuclear Physics (Novosibirsk, Russia) in 2010. The designed parameters of VEPP-2000 are the following: center-of-mass energy is up to 2 GeV, luminosity is 10^32 cm^-2s^-1. Development of the new particle identification system based on the threshold aerogel Cherenkov counters was a part of the SND upgrade. The counter design is based on ASHIPH technique (Aerogel, SHifter, PHotomultiplier). Cherenkov light emitted in aerogel is collected by a wavelength shifter, re-emited and transported to the photocathode. A microchannel plate photomultiplier tube (MCP PMT) with multialkali photocathode is chosen as a photodetector. For the particle identification at different energies two systems with different refractive indexes of aerogel were manufactured: with n=1.13 for the separation of pi and K mesons up to particle energy of 1 GeV and with n=1.05 for e/pi separation up to particle energy of 0.45 GeV. The system with n=1.13 was calibrated with particles (e, mu, pi, K) produced in e+e- collisions. The signal magnitude from ultrarelativistic electron is 6-8 photoelectrons. This system provides pion suppression by more than two orders of magnitude in the momentum range from 0.35 to 1.00 GeV/c. The measurements of characteristics of system with n=1.05 have been done using particles from e+e->e+e- and e+e->mu+mu- reactions. The average signal from electrons is 3.5 photoelectrons.

Primary author(s) : MARTIN, Karina (Budker Institute of Nuclear Physics)

Co-author(s) : Prof. SEREDNYAKOV, Sergey (Budker Institute of Nuclear Physics); BELOBORODOV, Konstantin (Budker Institute of Nuclear Physics); Dr. GOLUBEV, Vladimir (Budker Institute of Nuclear Physics)

Presenter(s) : MARTIN, Karina (Budker Institute of Nuclear Physics)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **279** Type : **Oral**

Aerogel RICH counter for the Belle II forward PID

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

The Belle II spectrometer, a follow up of the very successful Belle experiment, is under construction at the SuperKEKB electron-positron collider at KEK in Japan. For the PID system in the forward region of the spectrometer, a proximity focusing RICH counter with aerogel radiator is being developed. For this counter we have devised a focusing radiator consisting of two aerogel layers with increasing refractive index along the particle path, which results in a focusing of Cherenkov light at the photon detector plane. In this way, a thicker radiator can be used, and the number of photons can be increased without degrading the single photon Cherenkov angle resolution. The detector will provide a 4 σ separation of pions and kaons up to momenta of 4 GeV/c, at the kinematic limits of the experiment. The main challenge was, however, a reliable multichannel sensor for single photons that operates in the high magnetic field of the spectrometer (1.5 T) and withstands the radiation levels expected in the experiment. A 144-channel Hybrid Avalanche Photo-Detector (HAPD) was developed in a collaboration with Hamamatsu Photonics K.K. The design of the detector components is currently being finalized and part of the mass production has already started. The counter will be ready for installation in 2015. We will report on the tests of the prototypes conducted with test beams at CERN and DESY, and the optimization and performance studies of the counter final design, based on the Geant4 simulation.

Summary

Primary author(s) : SANTELJ, Luka (Jozef Stefan Institute)

Presenter(s) : SANTELJ, Luka (Jozef Stefan Institute)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **347** Type : **Oral**

An EUDET/AIDA Pixel Beam Telescope for Detector Development

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

A high resolution ($\sigma \sim 2\mu m$) beam telescope based on monolithic active pixel sensors (MAPS) was developed within the EUDET collaboration. The telescope consists of six monolithic active pixel sensor planes (Mimosa26) with a pixel pitch of 18.4 \mu m and thinned down to 50 \mu m. The excellent resolution, readout rate and DAQ integration capabilities made the telescope a primary test beam tool for many groups including several CERN based experiments.

Within the European detector infrastructure project AIDA the test beam telescope is being further extended in terms of cooling and powering infrastructure, read-out speed, area of acceptance, and precision. In order to provide a system optimized for the different requirements by the user community a combination of various state-of-the-art pixel technologies is foreseen. Furthermore, new central dead-time-free trigger logic unit (TLU) has been developed to provide LHC-speed response with one-trigger-per-particle operating mode and a synchronous clock for all connected devices. In this report, the design and current development status of this even more flexible telescope with three different pixel technologies (TimePix, Mimosa, ATLAS FE-I4) will be presented.

Summary

Primary author(s) : RUBINSKIY, Igor (Deutsches Elektronen-Synchrotron (DESY)-Unknown-Unknown); PERREY, Hanno (Deutsches Elektronen-Synchrotron (DE))

Presenter(s) : RUBINSKIY, Igor (Deutsches Elektronen-Synchrotron (DESY)-Unknown-Unknown)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **216** Type : **Oral**

An InGrid based Low Energy X-ray Detector for the CAST Experiment

Monday, 2 June 2014 17:10 (0:20)

Abstract content

The CERN Axion Solar Telescope (CAST) is searching for axions and other new particles coupling to photons and emerging from the sun. Those particles are converted into soft X-ray photons in a high magnetic field. To enhance sensitivity for physics beyond the Standard Model it is necessary to cope with weak couplings and low energies, thus requiring an efficient background discrimination as well as a detection threshold below 1 keV.
A promising candidate for a future CAST detector is an InGrid based X-ray detector. This detector combines the high spatial resolution of a pixelized readout with a highly granular Micromegas gas amplification stage. Fabrication by photolithographic postprocessing techniques allows to match the amplification grid to the pixels. The thereby achieved overall high granularity facilitates detection of single electrons which allows to determine the X-ray energy by electron counting. Additionally, rejection of background events mostly originating from cosmic rays is provided by an event shape analysis exploiting the high spatial resolution. A first prototype achieved a background reduction of roughly 120 and an energy resolution of 5.2 % at 5.9 keV.
In order to demonstrate its low detection threshold an InGrid based detector was tested in the CAST Detector Lab where an X-ray generator for energies down to a few hundred eV is available. Results of these tests demonstrating the detector's ability to detect the carbon K_α line at 277 eV will be presented as well as a short report on the installation at the CAST experiment.

Summary

Primary author(s) : KRIEGER, Christoph (Universitaet Bonn (DE))

Co-author(s) : KAMINSKI, Jochen (Universitaet Bonn (DE)); DESCH, Klaus (Universitaet Bonn (DE)); VAFEIADIS, Theodoros (CERN); LUPBERGER, Michael (Universitaet Bonn (DE))

Presenter(s) : KRIEGER, Christoph (Universitaet Bonn (DE))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **419** Type : **Oral**

Application Specific Photonic Integrated Circuits for High Energy Physics Applications

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

Physics experiments generally deal with enormous data throughput. The density of the data is increasing with upgrades on the detectors and experiments. Fiber optic communication with its high bandwidth and high capacity provides an effective solution. In experiments like the KM3NeT, cost-effective long haul optical communication is desired. A Dense Wavelength Division Multiplexed (DWDM) based multi-channel readout with minimum number of fibres over a large distance is a significant challenge. However, in the detectors at the Large Hadron Collider (LHC) or similar facilities, distances are short, but the optical readout systems are exposed to radiation. So, radiation hardness of optical links and/or circuits is an important requirement. Photonic integrated circuit design is going through an exciting phase with generic integration philosophy. Thanks to the availability of MPWs, it is getting easier to design and test an Application Specific Photonic Integrated Circuit (ASPIC). With such broad range of physics applications, we demonstrate examples of ASPICs designed for high energy physics using generic integration platforms.

Summary

Primary author(s) : GAJANANA, Deepak (NIKHEF (NL))

Co-author(s) : VAN BEUZEKOM, Martin (NIKHEF (NL)); Dr. LEIJTENS, Xaveer (Eindhoven University of Technology); Prof. SMIT, Meint (Eindhoven University of Technology)

Presenter(s) : GAJANANA, Deepak (NIKHEF (NL))

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **360** Type : **Oral**

Applications of embedded full gamma spectrum decomposition

Friday, 6 June 2014 12:20 (0:20)

Abstract content

A self-contained gamma radiation spectrometer with embedded and automated temperature stabilization and full spectral analysis is presented. It consists of a crystal and PMT setup that is read-out using fast ADC and FPGA technology. The maximum dead-time has been established at 1.14 us and the energy resolution at 662 keV is 7%. Full spectral analysis has been implemented for naturally occurring radioisotopes of Potassium, Thorium, Uranium, Radon and their progeny. Further developments, including pile-up correction, neutron detection and miniaturization will be discussed. This technology allows the production of sensor nodes that can be used in many applications. Special attention will be given in to sensor nodes for measurements in hard to reach environments. Environmental monitoring in remote regions of Canada will be discussed as an example as well as precision farming, nuclear reactor monitoring and mining.

Summary

Primary author(s) : MOL, Aran (I)

Presenter(s) : MOL, Aran (I)

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **76** Type : **Oral**

Associative Memory computing power and its simulation.

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The associative memory (AM) system is a computing device made of hundreds of AM ASICs chips designed to perform "pattern matching" at very high speed. Since each AM chip stores a data base of 130000 pre-calculated patterns and large numbers of chips can be easily assembled together, it is possible to produce huge AM banks. Speed and size of the system are crucial for real-time High Energy Physics applications, such as the ATLAS Fast TracKer (FTK) Processor. Using 80 million channels of the ATLAS tracker, FTK finds tracks within 100 micro seconds. The simulation of such a parallelized system is an extremely complex task if executed in commercial computers based on normal CPUs. The algorithm performance is limited, due to the lack of parallelism, and in addition the memory requirement is very large. In fact the AM chip uses a content addressable memory (CAM) architecture. Any data inquiry is broadcast to all memory elements simultaneously, thus data retrieval time is independent of the database size. The great computing power is also supported by a very powerful I/O. Each incoming hit reaches all the patterns in the AM system within the same clock cycle (10 ns). We report on the organization of the simulation into multiple jobs to satisfy the memory constraints and on the optimization performed to reduce the processing time. Finally, we introduce the idea of a new computing unit based on a small number of AM chips that could be plugged inside commercial PCs as coprocessors. This unit would both satisfy the need for very large memory and significantly reduce the simulation time due to the use of the highly parallelized AM chips.

Summary

Primary author(s) : Dr. SALVATORE, Fabrizio (University of Sussex (GB))

Co-author(s) : Dr. VOLPI, Guido (Sezione di Pisa (IT))

Presenter(s) : Dr. VOLPI, Guido (Sezione di Pisa (IT))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **249** Type : **Oral**

Athena, the next large ESA mission to study the Hot and Energetic Universe

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

The hot and energetic Universe has been selected by ESA as its next large class mission with a scheduled launch date in 2028. This mission will have a large collecting area (2 m2) with focussing optics and in the focal plane two interchangeable instruments: a Si-based DEPFET detector which is optimised for its field of view and its count rate capability. The second instrument is a cryogenic calorimeter array which is optimised for its high spectral resolution. In this presentation we will describe the science and instrumentation of this challenging mission.

Summary

Primary author(s) : Dr. DEN HERDER, Jan-Willem (SRON Netherlands Institute for Space Research)

Presenter(s) : Dr. DEN HERDER, Jan-Willem (SRON Netherlands Institute for Space Research)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **199** Type : **Oral**

Axion helioscopes update: the status of CAST & IAXO

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

After almost 35 years since their suggestion as a good solution to the strong CP-problem, axions remain one of the viable candidates for the Dark Matter, although still eluding detection. Most of the methods for their detection are based on their coupling to photons, one of the most promising ones being the helioscope technique. We will report on the current status of the CERN Axion Solar Telescope and the future International Axion Observatory (IAXO). Recent results from the second part of CAST phase II, where the magnet bores were filled with 3He gas at variable pressure achieving sensibilities on the axion mass up to 1.2 eV, will be presented. Currently CAST is expecting to improve sensitivity to solar axions with rest mass below 0.02 eV/c^2 after the upgrade of the X-ray detectors and with the implementation of a second X-ray optic. At the same time, it is exploring other possibilities at the low energy physics frontier. On the other hand IAXO, the fourth generation axion helioscope, aims to improve CAST's performance in terms of axion-photon coupling by 1-1.5 orders of magnitude. The details of the project building a dedicated magnet, optics and x-ray detectors will be given.

Summary

Primary author(s) : Dr. DAFNI, Theopisti (Universidad de Zaragoza (ES))

Presenter(s) : IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES))

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **242** Type : **Oral**

Barium-ion tagging for ^{136}Xe double-beta decay studies with EXO

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

The nature of the neutrino, i.e. whether it is a Dirac or Majorana particle, remains a mystery. Decay experiments that search for the lepton-number violating neutrino-less double decay ($0\nu\beta\beta$) are an experimental approach to answer this question. EXO-200 is one such experiment, searching for a $0\nu\beta\beta$ signal in the $\beta\beta$ decay of ^{136}Xe to its daughter isotope ^{136}Ba. This detector, located at the WIPP site in New Mexico, USA, contains ˜200 kg liquid Xe enriched to ˜80%.
In order to further push sensitivity, it is necessary to suppress the background (currently dominated by gamma rays) and increase the mass of the parent isotope. A unique advantage of a Xe time-projection chamber (TPC) is the possibility to extract into vacuum and identify (to tag) Ba-daughter ions. This tagging possibility, combined with enough energy resolution to separate $0\nu\beta\beta$ from $2\nu\beta\beta$ decays, allows one to dramatically reduce the background of the measurement to virtually zero.
EXO has started development of nEXO, a multi-ton scale TPC. In addition, Ba-tagging techniques, in both liquid and gas phase TPCs, are under development. In a liquid Xe TPC, the Ba ion will be extracted mechanically by a probe. In a high pressure (10 bar) gas Xe TPC, the Ba ion will be extracted into vacuum through a supersonic nozzle combined with an extraction RF-funnel. The current status of these Ba-tagging techniques will be presented and possible future developments will be discussed.

Summary

Primary author(s) : BRUNNER, Thomas (S)

Presenter(s) : BRUNNER, Thomas (S)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **203** Type : **Oral**

Beam profile measurements based on modern vertex detectors and beam-gas interactions

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

A novel, non-disruptive technique to measure transverse beam shapes was recently demonstrated by the LHCb experiment at the Large Hadron Collider (LHC). The technique is based on the detection of beam-gas interaction vertices with a tracking detector and was used in LHCb to obtain a 1.4% precision on the luminosity calibration. A new device, the Beam-Gas Vertex (BGV) system, is now under development to perform dedicated beam size measurements at the LHC at any beam energy and intensity. This technique could be applied to other particle accelerators. The BGV tracking detectors will be based on scintillating fibre modules read out by silicon photomultipliers. These modules are very similar in performance requirements and environmental constraints to the fibre tracker modules of the LHCb Upgrade and are therefore developed in close cooperation. The design studies, selected R&D results and the expected performance of the BGV demonstrator system will be presented.

Summary

Primary author(s) : BARSCHEL, Colin (CERN)

Co-author(s) : FERRO-LUZZI, Massimiliano (CERN)

Presenter(s) : BARSCHEL, Colin (CERN); FERRO-LUZZI, Massimiliano (CERN)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **106** Type : **Oral**

Boosting Event Building Performance using Infiniband FDR for the CMS Upgrade

Monday, 2 June 2014 16:50 (0:20)

Abstract content

As part of the CMS upgrade during CERN's shutdown period (LS1), the CMS data acquisition system is incorporating Infiniband FDR technology to boost event building performance for operation from 2015 onwards. Infiniband promises to provide substantial increase in data transmission speeds compared to the older 1GE network used during the 2009-2013 LHC run. Several options exist to end user developers when choosing a foundation for software upgrades, including the uDAPL (DAT Collaborative) and Infiniband verbs libraries (OFED). Due to advances in technology, the CMS data acquisition system will be able to achieve the required throughput of 100 kHz with increased event sizes while downsizing the number of nodes by using a combination of 10GE, 40GE and 56 GB Infiniband FDR. This paper presents the analysis and results of a comparison between GE and Infiniband solutions as well as a look at how they integrate into an event building architecture, while preserving the portability, scalability, efficiency and the deterministic latency expected in a high end data acquisition network.

Summary

Primary author(s) : FORREST, Andrew Kevin (CERN); ORSINI, Luciano (CERN); PETRUCCI, Andrea (CERN)

Co-author(s) : Dr. DOBSON, Marc (CERN); DUPONT, Aymeric Arnaud (CERN); ERHAN, Samim (Univ. of California Los Angeles (US)); GIGI, Dominique (CERN); GLEGE, Frank (CERN); GOMEZ CEBALLOS RETUERTO, Guillelmo (Massachusetts Inst. of Technology (US)); GOMEZ-REINO GARRIDO, Robert (CERN); Dr. HEGEMAN, Jeroen (CERN); HOLZNER, Andre Georg (Univ. of California San Diego (US)); MASETTI, Lorenzo (CERN); MEIJERS, Frans (CERN); MESCHI, Emilio (CERN); MOMMSEN, Remi (Fermi National Accelerator Lab. (US)); MOROVIC, Srecko (CERN); NUNEZ BARRANCO FERNANDEZ, Carlos (CERN); O'DELL, Vivian (Fermi National Accelerator Lab. (US)); PAUS, Christoph (Massachusetts Inst. of Technology (US)); PIERI, Marco (Univ. of California San Diego (US)); Dr. RACZ, Attila (CERN); SAKULIN, Hannes (CERN); BAWEJ, Tomasz Adrian (CERN); SCHWICK, Christoph (CERN); STIEGER, Benjamin (CERN); SUMOROK, Konstanty (Massachusetts Inst. of Technology (US)); Mr. VEVERKA, Jan (Massachusetts Inst. of Technology (US)); ZEJDL, Petr (CERN); BEHRENS, Ulf (DESY); BRANSON, James Gordon (Univ. of California San Diego (US)); CHAZE, Olivier (CERN); CITTOLIN, Sergio (Univ. of California San Diego (US)); DARLEA, Georgiana Lavinia (Massachusetts Inst. of Technology (US)); DELDICQUE, Christian (CERN)

Presenter(s) : FORREST, Andrew Kevin (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **416** Type : **Oral**

Bridging the gap between science and society

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

In The Netherlands policy makers have frequently addressed the 'gap' between the excellent standing of Dutch fundamental research and the perceived inability to translate that into profitable commercial activities. Although Nikhef's primary focus is and will be curiosity driven research, pushing the boundaries of the fundamental knowledge, a key intangible societal gain. Nikhef also acknowledges the increased importance of more tangible societal impact, hence resulting in concrete (industrial) applicability ('valorization').
There are several ways to transfer research results, usually a technology in which Nikhef has vested intellectual property rights (IPR): selling, licensing or become an 'entrepreneur'. Since several years Nikhef has worked towards enabling this last route. Building further on FOM's valorization policy and together with our partner, 1&12 Investment Partners, a holding company, called Particle Physics Inside Products (P2IP bv) has been established. P2IP is the legal entity from which Nikhef-FOM can participate in a subsidiary start-up. It has established a supervisory board that monitors its participations (currently three), assesses new opportunities and explores new activities. Recently our sister FOM-institute AMOLF joined P2IP.
We will highlight the experiences so far with startup companies emanating from the Nikhef scientific programme. Some of them are not participations of P2IP. We will also sketch the environment of the Amsterdam Venture Lab in which these startup activities are embedded.

Summary

Primary author(s) : Dr. POOLMAN, Hans Roeland (Amsterdam Scientific Instruments); VAN RIJN, Arnold Johan (NIKHEF)

Co-author(s) : Dr. BOSMA, Marten (Amsterdam Scientific Instruments)

Presenter(s) : Dr. BOSMA, Marten (Amsterdam Scientific Instruments)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **5** Type : **Oral**

CENNS: A new method for measuring Coherent Elastic Neutrino Nucleus Scattering

Friday, 6 June 2014 14:00 (0:20)

Abstract content

A recent study showed background limits to future dark matter searches coming from Coherent Elastic Neutrino Nucleus Scattering (CENNS) interactions of astrophysical and atmospheric neutrinos. There are a few possible ways to improve the limits by using directional measurements of the neutrino interactions and/or measuring time variation of the interactions. However, this CENNS background limit is a robust lower bound which can not be substantially reduced. Measuring the CENNS cross section and performing subsequent tests of higher energy neutrino interactions on various target materials will be extremely beneficial to future dark matter experiments.

We present a experimental method for measuring the process of CENNS. This method uses a low-energy threshold detector situated transverse to a high energy neutrino beam production target. This detector would be sensitive to the low energy neutrinos arising from pion decays-at-rest in the target. In this talk we will present the results of the beam induced background measurement, detector R&D and systematic uncertainties.

Summary

Primary author(s) : Dr. YOO, Jonghee (Fermilab); FILIPENKO, Mykhaylo (F)

Presenter(s) : RAMBERG, erik (Fermilab)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **274** Type : **Oral**

CERN-GIF++: a new irradiation facility to test large-area particle detectors for the high-luminosity LHC program

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

The high-luminosity LHC (HL-LHC) upgrade is setting a new challenge for particle detector technologies. The increase in luminosity will produce a higher particle background with respect to present conditions. Performance and stability of detectors at LHC and future upgrade systems will remain the subject of extensive studies. The current CERN-Gamma Irradiation Facility (GIF) has been intensively used to simultaneously expose detectors to the photons from a 137Cesium source and to high energy particles from the X5 beam line in SPS West Area for many years. From 2004 onwards, only the 137Cesium source is available for irradiations and the shutdown of the present facility is scheduled for the end of 2014.
The present contribution describes a joint project between CERN-EN and CERN-PH departments to design and build the new CERN GIF++ facility. GIF++ will be a unique place where high energy charged particle beams (mainly muon beam with momentum up to 100 GeV/c) are combined with a 14 TBq 137Cesium source. The higher source activity will produce a background gamma field which is a factor 30 more intense than that at GIF, allowing to cumulate doses equivalent to HL-LHC experimental conditions in a reasonable time. The 100 m2 GIF++ irradiation bunker has two independent irradiation zones making it possible to test real size detectors, of up to several m2, as well as a broad range of smaller prototype detectors and electronic components. The photon flux of each irradiation zone will be tuned using a set of Lead filters with attenuation factors from zero to 50000. Flexible services and infrastructure including electronic racks, gas systems, radiation and environmental monitoring systems, and ample preparation zone will allow time effective installation of detectors. A dedicated control system will provide the overview of the status of the facility and archive relevant information. The collaboration between CERN and the users' detector community, the latter providing detector specific infrastructures within the framework of the FP7 AIDA project, will bring the new facility to operation by the end of 2014.

Summary

Primary author(s) : GUIDA, Roberto (CERN)

Co-author(s) : COLLABORATION, GIF++ (CERN)

Presenter(s) : JAEKEL, Martin Richard (CERN)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **342** Type : **Oral**

CITIROC : a new front-end ASIC for SiPM read-out

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

Citiroc is a 32-channel front-end ASIC designed to readout silicon photo-multipliers (SiPM). Citiroc allows triggering down to 1/3 pe and provides the charge measurement with a good noise rejection. Moreover, Citiroc outputs the 32-channel triggers with a high accuracy (100 ps). An adjustment of the SiPM high-voltage is possible using a channel-by-channel DAC connected to the ASIC inputs. That allows a fine SiPM gain and dark noise adjustment at the system level to correct for the non-uniformity of SiPMs. Timing measurement down to 100 ps RMS jitter is possible along with 1% linearity energy measurement up to 2500 p.e. The power consumption is about 2mW/channel, excluding ASIC outing buffer

Summary

Citiroc is a new ASIC designed by Weeroc, a start-up company from the Omega micro-electronics group of IN2P3/CNRS. Each channel of this new ASIC embeds a front-end read-out chain composed of two AC-coupled voltage low-noise preamplifier with variable-gain adjustment. The utility of the gain tuning on the preamplifiers is twofold. On the first hand it allows to compensate non-uniformity between channels by finely adjusting gain channel by channel, on the second hand, it allows to adjust the general gain of the amplification chain to adjust the read-out chain to the SiPM gain, allowing a large choice of SiPM on the system to be used. Citiroc has a new channel-by-channel trigger chain composed of a fast shaper followed by two discriminators with individual channel-by-channel threshold adjustment to be able to trig on the first photo-electron and validate the trigger on the first few photoelectrons. That double trigger allows a great dark noise rejection at the first stage of the read-out chain and avoids saturating the DAQ with noise events. Each trigger channel can be masked in case of noisy channel, latched, or output the discriminator output as is depending on user needs. A general ASIC trigger is also outputted through a 32-input trigger OR. Citiroc energy measurement is composed of two variable-gain shapers to get energy measurement from one to 2500 photoelectron with 1% linearity. Charge proportional to energy can be stored in an analogue memory using either an analogue memory or a peak-sensing detector to get rid of the hold signal versus trigger delay. A channel-by-channel input DAC allows adjusting the high voltage of the SiPM over 5V with 8-bit resolution to correct for SiPM over-voltage non-uniformity. Citiroc outputs 32 trigger outputs as well as a multiplexed tri-state hit-register to allow several Citiroc to be serialized on a single hit-register serial bus. Citiroc outputs two multiplexed analogue outputs to read-out the charge on both low and high gain to ease the low-gain and low-gain channel inter-calibration. Citiroc also embed a general 10-bit DAC for coarse general threshold adjustment. Voltage references in the ASIC are done with a bandgap to improve power supply rejection ratio and temperature sensitivity of the ASIC. Citiroc is aimed to be mounted very close to the SiPM in the systems it will be used in. A temperature sensor has been embedded to allow users to finely sense the temperature within their multi-channel system to correct for SiPM gain over voltage adjustment with temperature. As a conclusion Citiroc has been designed to be as versatile as possible for SIPM read-out. It is aimed to be used in large system and has been optimized to ease the SiPM adjustment and reduce has much as possible the data flow

through the DAQ by filtering the SiPM noise at the front-end level. Citiroc will be used in a first telescope prototype for the CTA experiment and is aimed to be used in medical systems such as PET or gamma cameras using SiPM. A test board with ergonomic GUI software is available for Citiroc evaluation.

Primary author(s) : DE LA TAILLE, Christophe (OMEGA/IN2P3); FLEURY, Julien (Weeroc); Ms. SEGUIN-MOREAU, Nathalie (OMEGA/IN2P3); Mr. RAUX, Ludovic (OMEGA/IN2P3); Mr. CALLIER, Stéphane (OMEGA/IN2P3); Dr. MARTIN CHASSARD, Gisele (OMEGA/IN2P3); AHMAD, Salleh (Weeroc SAS)

Co-author(s) : CATALANO, Osvaldo (INAF)

Presenter(s) : FLEURY, Julien (Weeroc)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **398** Type : **Oral**

CLARO-CMOS: a fast, low power and radiation-hard front-end ASIC for single-photon counting in 0.35 micron CMOS technology

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

The CLARO-CMOS is a prototype ASIC that allows fast photon counting with 5 ns peaking time, a recovery time to baseline smaller than 25 ns, and a power consumption of about 1 mW per channel. This chip is capable of single-photon counting with multi-anode photomultiplier tubes (Ma-PMTs), and finds applications also in the read-out of silicon photomultipliers and microchannel plates. The prototype is realized in AMS 0.35 micron CMOS technology. In the LHCb RICH environment, over ten years of operation at the nominal luminosity expected after the upgrade in Long Shutdown 2, the ASIC must withstand a total fluence of about 6x10^12 1 MeV neq/cm2 and a total ionizing dose of 400 krad. A systematic evaluation of the radiation effects on the CLARO-CMOS performance is therefore crucial to ensure long-term stability of the electronics front-end. The results of multi-step irradiation tests with neutrons up to the fluence of 10^14 1 MeV neq/cm^2, with protons up to the dose of 8 Mrad and with X-rays up to the dose of 8 Mrad are presented, including measurement of single event effects during irradiation and chip performance evaluation before and after each irradiation step. In addition, systematic tests have been done on the single-photon counting performance of the CLARO-CMOS coupled to a Hamamatsu R11265 Ma-PMT, that is the baseline solution for the upgraded LHCb RICH photo-detectors. Such results are presented as well.

Summary

The CLARO-CMOS is a prototype ASIC primarily designed for single-photon counting with multi-anode photomultipliers (Ma-PMTs). The chip allows fast photon counting up to 40 MHz with power consumption in the order of 1 mW per channel. It was developed in the framework of the LHCb RICH detectors upgrade at CERN, but also found application in the readout of Silicon photomultipliers (SiPMs) and microchannel plates (MCP-PMTs) [1,2]. The prototype has four channels, each made of a charge amplifier with settable gain (3 bits) and a comparator with settable threshold (5 bits) that allow tuning the response of the chip to the gain spread of the PMT pixels. The threshold can be set just above noise to allow an efficient single-photon counting with Ma-PMTs. In the readout of SiPMs, the threshold can be set above the single photon signals, allowing to count events with two or more photoelectrons with high efficiency and good separation of the photoelectron peaks.
The prototype is realized in a 0.35 micron CMOS technology. In the LHCb RICH environment, over ten years of operation at the nominal luminosity for the upgrade, the ASIC must withstand a total fluence of about 6x10^12 1 MeV neq/cm^2 and a total ionizing dose of 400 krad.
We present results of multi-step irradiation tests with neutrons up to the fluence of 10^14 1 MeV neq/cm^2, with protons up to the dose of 8 Mrad and with X-rays up to the dose of 8 Mrad. During irradiation, cumulative effects on the performance of the analog parts of the chip and single event effects (SEE) were evaluated. The chips were biased continuously and the chip threshold voltages were measured regularly, in order to detect possible single event upsets (SEUs) affecting the threshold DAC settings. Power consumption was also monitored

online, and an additional circuit provided protection against Single Event Latchup (SEL). A picture of one of the irradiation setups can be seen in Figure 1. S-curves were measured before and after each irradiation step, to follow the evolution of counting efficiency, threshold shifts and noise during the irradiation.

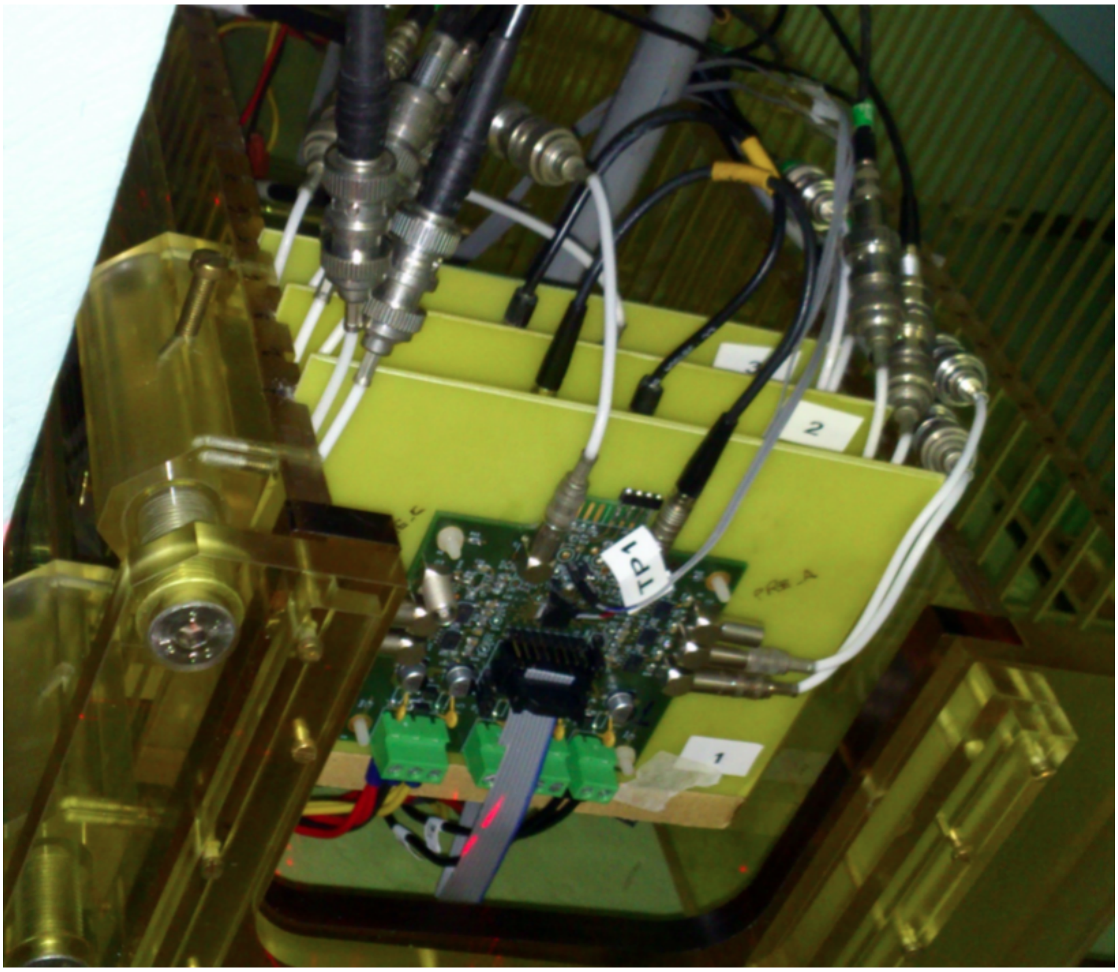

Figure 1: Figure 1. Picture of the setup used to irradiate three CLARO-CMOS chips at the neutron irradiation line of the Université Catholique de Louvain Cyclotron Facility (Louvain-la-Neuve, Belgium). The visible cables are used for powering and configuring the chips, monitoring single event effects on-line and measuring chips performance

Figure 1. Picture of the setup used to irradiate three CLARO-CMOS chips at the neutron irradiation line of the Université Catholique de Louvain Cyclotron Facility (Louvain-la-Neuve, Belgium). The visible cables are used for powering and configuring the chips, monitoring single event effects on-line and measuring chips performance.
The electrical performances of the CLARO-CMOS chip coupled to the Hamamatsu R11265 Ma-PMT are presented as well. For these tests a dedicated PCB was designed to connect the chips to the Ma-PMT with minimal contribution of parasitic capacitances at the input, and allowed to obtain very low noise and crosstalk. This readout scheme simulates the baseline read-out solution for the upgraded RICH detectors of the LHCb experiment. To mimic the conditions expected in the upgraded LHCb RICH environment, single photons in the blue range were generated using LED and diode laser. The speed of the CLARO signals and the low power consumption were demonstrated. Single-photon spectra from the Ma-PMT pixels were nicely reconstructed with a threshold scan, showing that the binary

outputs allow precise characterization of the Ma-PMT. Also, crosstalk between neighboring pixels was shown to be negligible.

References:
1 P. Carniti et al., "CLARO-CMOS, a very low power ASIC for fast photon counting with pixellated photodetectors", Journal of Instrumentation 7 (2012) P11026
[2] P. Carniti et al., "CLARO-CMOS, an ASIC for single photon counting with Ma-PMTs, MCPs and SiPMs", Journal of Instrumentation 8 (2013) C01029

Primary author(s) : FIORINI, Massimiliano (Universita di Ferrara (IT))

Co-author(s) : Dr. ANDREOTTI, Mirco (INFN Ferrara); MAINO, Matteo (Universita & INFN, Milano-Bicocca (IT)); Mr. MALAGUTI, Roberto (INFN Sezione di Ferrara); PESSINA, Gianluigi (Universita & INFN, Milano-Bicocca (IT)); TOMASSETTI, Luca (University of Ferrara and INFN); BALDINI, Wander (Universita di Ferrara (IT)); CALABRESE, Roberto (Universita di Ferrara (IT)); CARNITI, Paolo (Universita & INFN, Milano-Bicocca (IT)); CASSINA, Lorenzo (Universita & INFN, Milano-Bicocca (IT)); COTTA RAMUSINO, Angelo (Universita di Ferrara (IT)); GIACHERO, Andrea (Universita & INFN, Milano-Bicocca (IT)); GOTTI, Claudio (Universita & INFN, Milano-Bicocca (IT)); LUPPI, Eleonora (Universita di Ferrara (IT))

Presenter(s) : GOTTI, Claudio (Universita & INFN, Milano-Bicocca (IT))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **420** Type : **Oral**

CMB Detector Technology and the South Pole Telescope

Friday, 6 June 2014 11:40 (0:20)

Abstract content

Advances in CMB instrumentation have opened a new era for studying fundamental physics through precision measurements of the Cosmic Microwave Background (CMB). CMB measurements are critical for our understanding of cosmology and provides a unique probe of Dark Energy, the Cosmic Neutrino Background, and the physics of inflation. The South Pole Telescope (SPT) collaboration has been actively developing new CMB detectors and has implemented focal plane arrays using state-of-the-art Transition Edge Sensor (TES) technology to enable new CMB science. Results include the first discovery of unknown galaxy clusters using the Sunyaev-Zeldovich effect and the first detection of the CMB B-mode polarization signal from gravitational lensing. In this talk, I will give an overview of the technological developments for the SPT science program and will illustrate how innovation in instrumentation has enabled new science. I will discuss the technical challenges limiting CMB experiments and describe how the ongoing SPT detector R&D program aims to overcome these limitations.

Summary

Primary author(s) : CHANG, clarence (Argonne National Lab)

Presenter(s) : CHANG, clarence (Argonne National Lab)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **312** Type : **Oral**

CMD-3 TOMA DAQ goes to KEDR detector.

Monday, 2 June 2014 17:30 (0:20)

Abstract content

CMD-3 detector of VEPP2000 e+e- collider, BINP, Russia, is under data taking for a few runs. It's Time Oriented Measurement and Acquire (TOMA) DAQ demonstrates stable operation and targeted performance. During DAQ life cycle it was few times expanded in number and nomenclature of digitizer boards so as new functionality features was switched on. There are no interference or backward compatibility problems observed. This is due to special design based on idea to exchange some hardware logical complexity to precise time control complexity known as synchronization. Using this idea to distinguish synchronization modes the CMD-3 modular approach specification was built. This specification connects DAQ function's with synchronization modes and makes all hardware modules the same hierarchy level e.g. independent. Hardware modules are realized as HDL descriptions suitable to implement in any modern FPGA. KEDR detector of VEPP-4 e+e- collider is now constrained with it's DAQ performance. To solve this problem we make step by step change of KEDR DAQ hardware with CMD-3 DAQ hardware. Dramatically difference in timing is addressed with modification of HDL parameters. At process completion DAQ performance will increase in 20..40 times.

Summary

CMD-3 and KEDR is mid scale universal detectors for HEP. But it's energy range, DAQ technique and colliding machines is totally different. This talk describes how to really isolate modules in "modular approach" and how it can help to address system requirements. Also, some details are discussed.

Primary author(s) : Mr. RUBAN, Alexander (A.)

Co-author(s) : KOZYREV, Alexey (BINP)

Presenter(s) : Mr. RUBAN, Alexander (A.)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **232** Type : **Oral**

CMS Forward Calorimetry R&D for Phase II Upgrade

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

Forward calorimeters in CMS will need to be upgraded for the High Luminosity LHC (HL-LHC) operations, which is planned to be started in 2025. The major challenge is to preserve/improve the high performance of the current forward detectors while designing the detectors considerably radiation hard. This report will concentrate on the need for the upgrade, major challenges and various proposed R&D concepts suitable for the Phase II upgrade framework. Various designs will be discussed with recent information about the beam tests and laboratory measurements.

Summary

Primary author(s) : BILKI, Burak (University of Iowa (US))

Presenter(s) : BILKI, Burak (University of Iowa (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **196** Type : **Oral**

CMS Trigger Improvements towards Run II

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

The trigger systems of the LHC detectors play a crucial role in determining the physics capabilities of the experiments. A reduction of several orders of magnitude of the event rate is needed to reach values compatible with detector readout, offline storage and analysis capability. The CMS experiment has been designed with a two-level trigger system: the Level-1 Trigger (L1T), implemented on custom-designed electronics, and the High Level Trigger (HLT), a streamlined version of the CMS offline reconstruction software running on a computer farm. Both systems need to provide an efficient and fast selection of events, to keep the average write-out rate below 450Hz. For Run II, the doubling of both the center of mass energy to 13 TeV and the collision rate to 40 MHz, will imply increased cross sections and out-of-time pile-up. We will present the improvements brought to both L1T and HLT strategies to meet those new challenges.

Summary

Primary author(s) : VANDER DONCKT, Muriel (Universite Claude Bernard-Lyon I (FR))

Presenter(s) : VANDER DONCKT, Muriel (Universite Claude Bernard-Lyon I (FR))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **287** Type : **Oral**

CO2 cooling system for Insertable B Layer detector into the ATLAS experiment

Monday, 2 June 2014 16:50 (0:20)

Abstract content

CO2 cooling has become a very interesting technology for current and future tracking particle detectors. A key advantage of using CO2 as refrigerant is the high heat transfer capability allowing a significant material budget saving, which is a critical element in state of the art detector technologies. At CERN new CO2 cooling system has been constructed to serve for new ATLAS Insertable B-Layer (IBL) detector. Two independent cooling units, sharing one common accumulator, placed about 100m from the heat source, are designed to cool 14 individual staves with evaporative CO2 at the given pressure. This paper describes the general system design, innovative redundancy approach, maintenance philosophy, control system implementation and the commissioning results including the performance tests in the proximity of the detector. Additionally the different failure scenarios and recovery techniques including cooling units swap procedure will be discussed. The system tests and challenging commissioning proved precise temperature control over the long distance and expected performance. Looking forward for the IBL detector installation, cooling system will be prepared to serve for the next Large Hadron Collider physics run.

Summary

Primary author(s) : ZWALINSKI, Lukasz (CERN)

Co-author(s) : BORTOLIN, Claudio (University of Innsbruck (AT)); OSTREGA, Maciej Stanislaw (AGH University of Science and Technology (PL)); VAN OVERBEEK, Martijn Gerardus (NIKHEF (NL)); PETAGNA, Paolo (CERN); VERLAAT, Bart (NIKHEF (NL)); VOGT, Sven (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); ZIMNY, Michal Zbigniew (AGH University of Science and Technology (PL)); Mr. ROELAND, Erno (Nikhef); BLASZCZYK, Tomasz Piotr (AGH University of Science and Technology (PL)); BERRY, Stephane (CERN); CORBAZ, Florian (CERN); GLONTI, George (National Technical Univ. of Athens (GR)); CRESPO-LOPEZ, Olivier (CERN); GODLEWSKI, Jan (CERN); LIPPERT, Markus (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); NICHILO, Sylvain (CERN)

Presenter(s) : ZWALINSKI, Lukasz (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **181** Type : **Oral**

COMETH: a CMOS pixel sensor for a highly miniaturized high-flux radiation monitor

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The need for miniaturized and versatile real-time radiation monitors has become a general trend for spacecraft applications. It requires a highly integrated detection system with the ability to identify ion species in a high flux mixed environment. We have proposed 1 a new strategy to meet these requirements with a single CMOS pixel chip. This sensor is based on a matrix of 50×50 μm2 pixels, read out in rolling-shutter mode, and features columns ended by 3-bit ADCs with tunable threshold. An embedded digital algorithm extracts the particle properties from the hit information to provide the radiation flux on–line. A reduced scale prototype with 32×32 pixels and 32 column ADCs has been designed and fabricated in a 0.35 μm process. The layout of the identifying and counting algorithm, downstream the pixel matrix, was developed in the same process. A full simulation of this layout for a subset of columns was used to check the algorithm output against many inputs. Test results obtained with X-rays, ß- particles and laser illumination, confirm previous simulations addressing gain and linearity. Column ADCs also show expected features. Those measurements validate the possibility to monitor proton and electron fluxes up to 107 particles•cm-2•s-1 and distinguish proton from electron for energies lower than 50 MeV. 1 Y.Zhou et al., JINST 7 (2012) C12003.
*COMETH: Counter for Monitoring the Energy and Type of charged particles in High flux

Summary

Primary author(s) : JAASKELAINEN, Kimmo (Institut Pluridisciplinaire Hubert Curien (FR)); WINTER, Marc (Institut Pluridisciplinaire Hubert Curien (FR)); ZHOU, Yang (Institut Pluridisciplinaire Hubert Curien (FR)); BAUDOT, Jerome (Institut Pluridisciplinaire Hubert Curien (FR)); GUO HU, Christine (Institut Pluridisciplinaire Hubert Curien (FR)); HU, Yongcai (Institut Pluridisciplinaire Hubert Curien (FR))

Presenter(s) : ZHOU, Yang (Institut Pluridisciplinaire Hubert Curien (FR))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **176** Type : **Oral**

Calibrating photon detection efficiency in IceCube

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The IceCube neutrino observatory is composed of more than five thousand Digital Optical Modules (DOMs), installed on the surface and at depths between 1500 and 2500 m in clear ice at the South Pole. Each DOM incorporates a 10" diameter photomultiplier tube (PMT) intended to detect light emitted when high energy neutrinos interact with atoms in the ice. Depending on the energy of the neutrino and the distance from debris particle tracks, PMTs can be hit by up to several thousand photons. The number of photons per PMT and their time distribution is used to reject background events and to determine the energy and direction of each neutrino. The detector energy scale was established with good precision independent of lab measurements on DOM optical sensitivity, based on light yield from stopping muons and calibration of ice properties. A laboratory setup has now been developed to more precisely measure the DOM optical sensitivity as a function of angle and wavelength. DOM sensitivities are measured in water using a broad beam of light whose intensity is measured with a NIST calibrated photodiode. This study will refine the current knowledge of IceCube response and lay a foundation for future precision upgrades to the detector.

Summary

Primary author(s) : WENDT, Christopher (UW Madison / WIPAC); TOSI, Delia (UW Madison / WIPAC)

Presenter(s) : WENDT, Christopher (UW Madison / WIPAC); TOSI, Delia (UW Madison / WIPAC)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **133** Type : **Oral**

Calibration System with Notched Fibres

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

Modern detectors with significantly increasing number of active channels require new approach for calibration. The calibration system on the first prototype of the AHCAL in CALICE used one optical fibre for each of 7608 channels to distribute calibration light to tiles with SiPM. As the proposed analogue hadronic calorimeter for ILC should have around 10ˆ6 channels, the former system is inapplicable due to spatial requirements and manufacture difficulties. Now two ways of light distribution are considered. The first one is focused on the implementation of one LED placed directly on PCB for each SiPM channel. The second one is focused on a simplified fibre distribution system using one fibre with taps for more channels. It uses so called notched fibre and will be presented here. The system allows to calibrate one row of 72 scintillation tiles read by SiPMs using one driver with one LED and three subsequent notched fibres. We will present principals, parameters of current system and requirements for future development to allow reliable manufacturing. Benefits and drawbacks of notched fibre system with a comparison to the system with embedded LED for each SiPM channel is also discussed.

Further we report on latest version of the electronics for calibration and monitoring system developed for single UV-LED. The system is based on original fast (3 ns pulsewidth) and precise LED driver called QMB. Due to its high dynamic range of precise a few nanosecond pulses it is flexible to all necessary monitoring and calibration task for SiPM like detectors.

Summary

Primary author(s) : SMOLIK, Jan (Acad. of Sciences of the Czech Rep. (CZ)); POLAK, Ivo (Acad. of Sciences of the Czech Rep. (CZ))

Presenter(s) : SMOLIK, Jan (Acad. of Sciences of the Czech Rep. (CZ))

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **236** Type : **Oral**

Calorimeters for precision timing measurements in high energy physics

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

Current and future high energy physics particle colliders are capable to provide instantaneous luminosities of 1034 cm-2s-1 and above. The high center of mass energy, the large number of simultaneous collision of beam particles in the experiments and the very high repetition rates of the collision events pose huge challenges. They result in extremely high particle fluxes, causing very high occupancies in the particle physics detectors operating at these machines. To reconstruct the physics events, the detectors have to make as much information as possible available on the final state particles. We discuss how timing information with a precision of around 10 ps and below can aid the reconstruction of the physics events under such challenging conditions. High-energy photons play a crucial role in this context. About one third of the particle flux originating from high-energy hadron collisions is detected as photons, stemming from the decays of neutral mesons. In addition, many key physics signatures under study are identified by high-energy photons in the final state. They pose a particular challenge in that they can only be detected once they convert in the detector material. The particular challenge in measuring the time of arrival of a high-energy photon lies in the stochastic component of the distance to the initial conversion and the size of the electromagnetic shower. They extend spatially over distances with propagation times of the initial photon and the subsequent electromagnetic shower larger compared to the desired precision.

We present studies and measurements from test beams and a cosmic muon test stand for calorimeter based timing measurements to explore the ultimate timing precision achievable for high-energy photons of 10 GeV and above. We put particular focus on techniques to measure the timing with a precision of about 10 ps in association with the energy of the photon. For calorimeters utilizing scintillating materials and light guiding components, the propagation speed of the scintillation light in the calorimeter is important. We present studies and measurements of the propagation speed on a range of detector geometries. Finally, possible applications of precision timing in future high-energy physics experiments are discussed.

Summary

Primary author(s) : APRESYAN, Artur (California Institute of Technology (US))

Co-author(s) : BORNHEIM, Adolf (California Institute of Technology (US)); DUARTE, Javier Mauricio (California Institute of Technology (US)); PENA HERRERA, Cristian Ignacio (California Institute of Technology (US)); SPIROPULU, Maria (California Institute of Technology (US)); Dr. RONZHIN, Anatoly (Fermilab)

Presenter(s) : APRESYAN, Artur (California Institute of Technology (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **362** Type : **Oral**

Calorimetry in ALICE at LHC

Monday, 2 June 2014 17:10 (0:20)

Abstract content

ALICE at the Large Hadron Collider (LHC) is the dedicated experiment focused on heavy ion collisions at LHC, to study a de-confined matter of quarks and gluons, called Quark Gluon Plasma (QGP). Among the sub-detector systems in AILCE, there are two types of calorimetry in the central barrel. One is EMCal (Lead-Scintillator, a sampling electromagnetic calorimeter with a WLS fiber and APD readout), having a wide geometrical acceptance to measure jets, and photons and neutral mesons with a moderate energy resolution. Another type of calorimeter is PHOS (PHOton Spectrometer), $PbWO_4$ crystal with APD readout for high granularity and higher precision energy measurement for photons.
In this talk, we review those detectors performance in ALICE, and show a ongoing upgrade project in calorimetry, DCAL (Di-jet Calorimeter), an extension of EMCal coverage to measure back-to-back jets. Furthermore, we present an upgrade proposal for the forward direction calorimetry, FOCAL, to measure direct photons in $\eta = 3.3 - 5.3$, by using a nobel technology of silicon photo-diodes with absorbers based electromagnetic calorimeter for photons, together with a conventional hadron calorimeter for jets. The current status of FOCAL R\&D project will be presented.

Summary

Primary author(s) : CHUJO, Tatsuya (University of Tsukuba (JP))

Presenter(s) : CHUJO, Tatsuya (University of Tsukuba (JP))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **43** Type : **Oral**

Characterization and X-Ray Damage of Silicon Photomultipliers

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

Abstract–For Hamamatsu silicon-photomultipliers (SiPM) S10362-11-050P before and after irradiation to 200 Gy, 20 kGy, 2 MGy and 20 MGy, forward current–voltage, reverse current–voltage, capacitance/conductance–voltage, capacitance/conductance–frequency, pulse shape and pulse height measurements below and above the breakdown voltage were performed. The data were analysed using an electrical model of the SiPM which allowed determining characteristic parameters like pixel capacitance, quench resistor and quench capacitance, parasitic resistance, and breakdown voltage in different ways, and studying their dependence on X-ray dose. In addition, the doping profile and the electric field distribution in the SiPM have been determined. It is found that the electrical model provides a consistent description of the data. The main changes with X-ray dose are a decrease of the parasitic resistance, and an increase in dark current due to current generation at the Si-SiO2 interface. Whereas for dose values of 20 kGy and below the surface generation current hardly affects the properties of the SiPM above the breakdown voltage, it gets amplified for dose values above 20 kGy resulting in a significant increase in dark-count rate. Apart from this effect, the performance of the Hamamatsu SiPM as high-gain photo detector is hardly affected by X-ray radiation up to a of 20 MGy.

Summary

Hamamatsu Silicon Photo Multipliers (SiPM) of the type S10362-11-050P are characterized and the change of their parameters after irradiation to X-rays of 200 Gy, 20 kGy, 2 MGy and 20 MGy determined. A novel method how characteristic parameters of SiPMs can be obtained in different ways is presented.

Primary author(s) : Prof. KLANNER, Robert (Univ. Hamburg)

Co-author(s) : Prof. GARUTTI, Erika (Univ. Hamburg); XU, Chen (DESY); HELLWEG, Wolf Lukas (Univ. Hamburg)

Presenter(s) : Prof. GARUTTI, Erika (Univ. Hamburg)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **337** Type : **Oral**

Characterization of Ni/SnPb-TiW/Pt Flip Chip Interconnections in Silicon Pixel Detector Modules

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

In contemporary high energy physics experiments, silicon detectors are essential for recording the trajectory of new particles generated by multiple simultaneous collisions. To guarantee high sensitivity near the collision point, modern particle tracking systems may feature 100 million channels, or pixels, which need to be individually connected to read-out chains. Silicon pixel detectors are typically connected to readout chips by flip-chip bonding using solder bumps.

The electrical and mechanical quality of the flip-chip interconnects are important for the proper functioning of the particle tracking system in order to minimize the number of dead read-out channels. Furthermore, the detector modules must be robust enough to endure the handling during the installation and the heat generation and the cooling during the operation.

The silicon pixel detector modules were constructed by flip chip bonding 16 readout chips to a single sensor. Eutectic SnPb solder bumps were deposited on the readout chips and the sensor chips had TiW/Pt thin film UBM (under bump metallization). The modules were assembled at Advacam Ltd operating at Micronova Nanofabrication Centre.

We studied the quality and uniformity of the interconnections using Scanning White Light Interferometry (SWLI), stylus profiler and performing destructive pull-strength tests. Furthermore, we compared the results of the characterization of interconnections to those of module performance measurements. According to our results, the Ni/SnPb-TiW/Pt interconnections are excellent for flip-chip bonding pixel detector modules.

Summary

Primary author(s) : Ms. KARADZHINOVA, Aneliya (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland)

Co-author(s) : Mr. NOLVI, Anton (Department of Physics, University of Helsinki, PO Box 64, 00014, Helsinki, Finland); Dr. HÄRKÖNEN, Jaakko (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Dr. LUUKKA, Panja (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Dr. MÄENPÄÄ, Teppo (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Dr. TUOMINEN, Eija (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Prof. HAEGGSTRÖM, Edward (Department of Physics, University of Helsinki, PO Box 64, 00014, Helsinki, Finland); Dr. KALLIOPUSKA, Juha (Advacam Ltd, Tietotie 3, Espoo, Finland); Dr. VÄHÄNEN, Sami (Advacam Ltd, Tietotie 3, Espoo, Finland); Dr. KASSAMAKOV, Ivan (Department of Physics, University of Helsinki, PO Box 64, 00014, Helsinki, Finland)

Presenter(s) : Ms. KARADZHINOVA, Aneliya (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **41** Type : **Oral**

Characterization of a Spherical Proportional Counter in argon-based mixtures

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

The Spherical Proportional Counter is a novel type of radiation detector, with a low energy threshold (typically below 100 eV) and good energy resolution. This detector is being developed by the network NEWs, which includes several applications. We can name between many others Dark Matter searches, low level radon and neutron counting or low energy neutrino detection from supernovas or nuclear reactors via neutrino-nucleus elastic scattering. In this context, this works will present the characterization of a spherical detector of 1 meter diameter using two argon-based mixtures (with methane and isobutane) and for gas pressures between 50 and 1500 mbar. In each case, the energy resolution shows its best value in a wide range of gains, limited by the ballistic effect at low gains and by feedback at high gains. Moreover, the best energy resolution shows a degradation with pressure. These two effects will be discussed in terms of gas avalanche properties. Finally, the effect of an electrical field corrector in the homogeneity of the gain and the energy threshold measured in our setup will be also discussed.

Summary

Primary author(s) : IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES)); Ms. RODRÍGUEZ ARRUGA, Asunción (Universidad de Zaragoza (ES))

Co-author(s) : GARCIA IRASTORZA, Igor (Universidad de Zaragoza (ES))

Presenter(s) : IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES))

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **402** Type : **Oral**

Close Cathode Chamber: cost efficient and lightweight detector for tracking applications

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The Close Cathode Chamber (CCC) is an asymmetric Multi-Wire Proportional Chamber (MWPC), which, owing to its specifically optimized field structure, has key advantages relative to the classical MWPC design. The CCC contains alternating field wires and anode (sense) wires, and the wire plane is asymmetric with respect to two parallel planes, being as close as 1.5mm typically to one of the planes for 2mm wire spacing. We have shown that this arrangement minimizes the dependence of the avalanche gain on detector wall planarity 1, and specifically, insensitivity to corresponding mechanical distortions or internal overpressure (causing bulging). Such feature allows one to build CCC chambers with small overall material budget, avoiding also the thick frames typical for MWPC-s. Careful studies confirmed that signal formation and position resolution correspond to that in classical MWPC-s. The dead zones created by internal support structures have been evaluated [2]. CCC detectors have found application in a portable cosmic muon tracking system [3],[4], proving their mechanical and operational stability under hars and varying environmental conditions.

1 D. Varga et al.: NIM A648 (2011) 163-167
[2] D. Varga et al.: NIM A698 (2013) 11-18
[3] G. G. Barnaföldi et al.: NIM A689 (2012) 60-69
[4] L. Oláh et al.: Geosci. Instrum. Method. Data Syst. (2012) 2 781-800

Summary

Primary author(s) : VARGA, Dezso (Wigner RCP); HAMAR, Gergo (Wigner RCP)

Presenter(s) : VARGA, Dezso (Wigner RCP)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **363** Type : **Oral**

Columbia Univeristy R&D program for large mass DarkMatter detector with LXe TPC

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The next generation of Dark Matter detectors based on dual-phase (liquid/gas) Xenon Time Projection Chambers (TPCs) will require an active volume of liquid with a mass on the tonne-scale in order to reach the desired sensitivity to WIMP-nucleon interactions. One natural and effective way to increase the target mass is to build a TPC with larger cross-sectional area and longer drift distance. Construction and operation of such a detector leads to many new issues and technological challenges which need to be addressed. One example is that electronegative impurities in the liquid must be at or below the ppb level, to prevent loss of the charge signal. This challenge can be overcome with an efficient filtering system for the evaporated liquid, capable of a circulation rate on the order of 100 SLPM. This high flow rate, however, requires an increased heat input to take advantage of the high cross-section for purification of the hot Xenon gas. Another well-known, major challenge to a tonne-scale detector is the requirement of very high voltage (~ 50-100 kV) to generate a suitable drift field inside the TPC. Work is under way at Columbia University to study these and other issues associated with the construction of XENON1T with the so-called DEMONSTRATOR R&D program. In this talk, we will highlight the major results of this effort.

Summary

An extensive R&D program is on ongoing at the Columbia University to address the main technical issues of a possible multi-ton DarkMatter LXe TPC. In this talk we review in detail the studies done so far.

Primary author(s) : Dr. MESSINA, Marcello (Columbia University)

Presenter(s) : Dr. MESSINA, Marcello (Columbia University)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **375** Type : **Oral**

Commissioning of the CUORE cryostat: the first experimental setup for bolometric detectors at the 1 tonne scale

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The Cryogenic Underground Observatory for Rare Events (CUORE) is a 1-ton scale bolometric experiment. The CUORE detector is an array of 988 TeO2 crystals arranged in a cylindrical compact and granular structure of 19 towers. This will be by far the largest bolometric mass ever operated. These detectors will need a base temperature around 10 mK in order to meet the performance specifications. To cool the CUORE detector a large cryogenic-free cryostat with five pulse tubes and one specifically designed high-power dilution refrigerator has been designed. The cryostat (4K refrigerator with Pulse Tubes) and Dilution Unit were first tested independently and than merged together. We report here the detailed description of the cryostat for the CUORE experiment together with the results of the validation tests done in 2014.

Summary

Primary author(s) : CHOTT, Nicholas (University of South Carolina)

Presenter(s) : CHOTT, Nicholas (University of South Carolina)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **79** Type : **Oral**

Construction and commissioning of a setup to study ageing phenomena in high rate gas detectors

Friday, 6 June 2014 12:00 (0:20)

Abstract content

A very accurate apparatus has been constructed and commissioned at the GSI detector laboratory, which will be dedicated for many objectives. Among these objectives; investigation of the ageing phenomena of high rate gaseous detectors, the ageing influences of the construction materials of the gaseous detectors, long term monitoring of gaseous detectors tolerance, planned to be used in The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany. It is very important, in ageing studies, to sense the detector degradation, if any, in reasonable time period and with a particle rate comparable to that in real experiments. In order to reach the envisaged accuracy, several optimizations have been implemented over the design of the used counters, the setup approach and automation and the gas system. In this article, details of the experimental setup, the systematic optimization tests, studies of ageing and anti-ageing manifestations, and results of the influence of different construction materials will be presented.

Summary

Primary author(s) : ABUHOZA, Alhussain (GSI)

Co-author(s) : Dr. BISWAS, Saikat (GSI); FRANKENFELD, Uli (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); Dr. SCHMIDT, Christian Joachim (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); SCHMIDT, Hans Rudolf (Eberhard-Karls-Universitaet Tuebingen (DE)); HEHNER, Joerg Lothar (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter(s) : ABUHOZA, Alhussain (GSI)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **99** Type : **Oral**

Construction and commissioning of the KLOE-2 Inner Tracker

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

The KLOE-2 experiment is starting its data taking at the DAΦNE [U+03D5]-factory at the Frascati National Laboratory of the INFN. The experiment is continuing the successful physics program of KLOE, that collected 2.5 fb-1 of integrated luminosity between 2001 and 2006. For the new data taking campaign the detector, consisting of a huge Drift Chamber and a Electromagnetic Calorimeter working in a 0.5 T axial magnetic field, has been upgraded. One of the upgrades involves the tracking system, with the insertion of a GEM-based detector in the space separating the DAΦNE interaction region and the inner wall of the Drift Chamber. The Inner Tracker, composed of four coaxial cylindrical triple-GEMs, is a kapton-based detector allowing us to keep the total material budget below 2% X0, as required in order to minimize the multiple scattering of low-momentum tracks. Novel and advanced solutions were developed to cope with the challenging problems that arose during the construction phase. The tracker achieves 200 µm spatial resolution in the transverse plane and 500 µm along the beam direction. The two coordinates are provided by a dedicated XV readout pattern coupled to the GASTONE front-end, a 64 channel ASIC with digital output specially developed for this detector. The first results from the commissioning of the detector will be shown, including the preliminary response of the detector to cosmic-ray muons and DAΦNE beam interactions.

Summary

Primary author(s) : MORELLO, Gianfranco (Istituto Nazionale Fisica Nucleare (IT))

Co-author(s) : BALLA, Alessandro (Istituto Nazionale Fisica Nucleare (IT)); DE ROBERTIS, Giuseppe (Universita e INFN (IT)); DI DOMENICO, Antonio (Universita e INFN, Roma I (IT)); DOMENICI, Danilo (Istituto Nazionale Fisica Nucleare (IT)); DONG, Jing (INFN); FANIZZI, Giampiero (INFN Sezione di Bari (IT)); FELICI, Giulietto (Laboratori Nazionali di Frascati (LNF)); GATTA, Maurizio (Istituto Nazionale Fisica Nucleare (IT)); LACALAMITA, Nicola (Universita e INFN (IT)); LIUZZI, Raffaele (INFN Sezione di Bari (IT)); MONGELLI, Maurizio (INFN Sezione di Bari (IT)); BENCIVENNI, Giovanni (Istituto Nazionale Fisica Nucleare (IT)); PALLADINO, Anthony (LNF-INFN); PELOSI, Alessandro (Istituto Nazionale di Fisica Nucleare Sezione di Roma 1); QUINTIERI, Lina (LNF-INFN); RANIERI, Antonio (Universita e INFN (IT)); TSKHADADZE, Edisher (Joint Inst. for Nuclear Research (RU)); VALENTINO, Vincenzo (INFN Sezione di Bari (IT)); Dr. BRANCHINI, Paolo (Roma Tre Universita Degli Studi (IT)); BUDANO, Antonio (Roma Tre Universita Degli Studi (IT)); CAPODIFERRO, Manlio ("Sapienza" Università di Roma (IT)); CERIONI, Stefano (Istituto Nazionale Fisica Nucleare (IT)); CIAMBRONE, Paolo (Istituto Nazionale Fisica Nucleare (IT)); CZERWINSKI, Eryk (LNF-INFN); DE LUCIA, Erika (Istituto Nazionale Fisica Nucleare (IT))

Presenter(s) : MORELLO, Gianfranco (Istituto Nazionale Fisica Nucleare (IT))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **221** Type : **Oral**

Construction of a large-size four plane micromegas detector

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

In view of the use of micromegas detectors for the upgrade of the ATLAS muon system, we have constructed two detector quadruplets with an area of 0.5 m^2 per plane serving as prototypes for future ATLAS chambers. They are based on the resistive-strip technology and thus spark tolerant. The detectors were built in a modular way. The quadruplets consist of two double-sided readout panels with 128 μm high support pillars and three support (or drift) panels equipped with the micromesh and the drift electrode. The distance of the micromesh from the drift-electrode determines the drift (or conversion) gap. The panels are bolted together such that the detector can be opened and cleaned, if required. Each readout plane comprises 1024 strips with a pitch of 0.4 mm. Two of the readout planes are equipped with readout strips inclined by 1.5 degree. The quadruplet thus delivers track coordinates with a resolution of better than 100 μm in the precision coordinate and 1 mm in the second coordinate. We will present the detector concept, our experience with the detector construction, and the evaluation of the detectors with cosmic rays and x-rays. One of the quadruplets will be installed in ATLAS in summer 2014, equipped with the newly developed digital VMM readout chip.

Summary

Primary author(s) : IENGO, Paolo (INFN Napoli (IT))

Co-author(s) : BIANCO, Michele (C); WOTSCHACK, Joerg (CERN); DANIELSSON, Hans (CERN); DE OLIVEIRA, Rui (CERN); KUGER, Fabian (Bayerische Julius Max. Universitaet Wuerzburg (DE)); LIN, Tai-Hua (Johannes-Gutenberg-Universitaet Mainz (DE)); PEREZ GOMEZ, Francisco (CERN); SCHOTT, Matthias (CERN); SEKHNIAIDZE, Givi (Universita e INFN (IT)); VALDERANIS, Chrysostomos (Johannes-Gutenberg-Universitaet Mainz (DE))

Presenter(s) : IENGO, Paolo (INFN Napoli (IT))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **352** Type : **Oral**

Cooling for the LHCb Upgrade Scintillating Fibre Tracker

Monday, 2 June 2014 17:10 (0:20)

Abstract content

As part of the LHCb Phase-II upgrade programme, the existing downstream tracking systems will be replaced by a new scintillating fibre tracker read out by multi-channel silicon photomultipliers (SiPM). To ensure high tracking performance over the entire experiment's lifetime, the SiPMs will be operated at sub-zero temperatures, down to -40°C.

This presentation outlines the proposed SiPM cooling system and describes the design considerations which led to the choice of the mono-phase liquid cooling solution. The requirements on the temperature uniformity and stability are discussed, along with the constraints which thermal considerations impose on the mechanical design of the tracker modules. The prospective refrigerants (C6F14 and 3M Novec thermal fluids) are compared with each other, including their effect on the environment.

The SiPM cooling system consists of the remote cooling plant, insulated transfer lines, the local distribution pipework and the cooling structures inside 288 read-out boxes spread over twelve 5x6 m2 tracker planes. The main design challenges of this system are associated with its large extent (about 150 m of linear SiPM arrays to be cooled) and severe constraints on the geometrical envelope and, hense, insulation. Since the SiPM themselves produce very little heat, the estimated heat load of the cooling plant, 13 kW, is dominated by the heat influx through the insulation of read-out boxes, interconnection and transfer lines. Main system design parameters, as well as the latest results of the thermal mock-up tests, are summarised.

Summary

Primary author(s) : GORBOUNOV, Petr (CERN and ITEP(Moscow))

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH))

Presenter(s) : GORBOUNOV, Petr (CERN and ITEP(Moscow))

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **100** Type : **Oral**

Correction for pile-up effect based on pixel-by-pixel calibration for tomography with Medipix3RX detector

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

The dispersion of individual pixels parameters are widely studied in the field of hybrid pixel detectors for X-ray detection. CERN is developing methods of thresholds equalization to correct for threshold dispersion between pixels of the Medipix3RX readout chip. In this paper, we focus on the complex problem of pixel-to-pixel dead time dispersion, which cannot be corrected by simple flat field normalization, contrary to the residual threshold dispersion after equalization. In tomography, dead time inhomogeneity is responsible for ring artefacts, in addition to global underestimation of the attenuation coefficients due to pile-up. While the main methods of ring artefact correction are purely mathematical, our strategy was to develop a method based on dead time calibration to be able to remove ring artefacts and at the same time to restore the correct quantitative attenuation coefficients. Our original correction method is based on a calibrated dead time map associated to an iterative correction on the sinograms. We performed a fine analysis of dead time dispersion and compared it to our model of photonic noise propagation to validate the calibration step. The results of the pile-up correction with a single Medipix3RX ASIC bump bonded to 200 microns Silicon sensor using a standard X Ray generator showed quantitative improvements of transmission images of Al filters, increasing by a factor 3 the signal-to-noise ratio after pile up correction within the flux range [5E3 – 2E5] photons/pixel/s. We are currently validating the method on the tomographic beam line of the Brazilian Synchrotron (LNLS).

Summary

Primary author(s) : RINKEL, Jean (L)

Co-author(s) : Ms. DE PAIVA MAGALHÃES, Debora (LNLS)

Presenter(s) : RINKEL, Jean (L)

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **385** Type : **Oral**

Demonstration of a Water Cherenkov Optical Time-Projection Chamber (OTPC)

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

We describe a prototype water-based optical time projection chamber (OTPC), in which tracks of relativistic charged particles are reconstructed using the emitted Cherenkov radiation. The detector is a vertical cylindrical ~40 kg water mass that is instrumented with a combination of 2×2 in^2 microchannel plate (MCP) photodetectors and 3×3 in^2 mirrors on the sides, in a stereo configuration. For each MCP, a mirror is mounted on the opposite side of the cylinder allowing for the detection of both direct and reflected photons. Each MCP photomultiplier has 60 channels of waveform digitizing readout in which the waveforms are read out on a transmission line anode. The system's time (~50 ps) and spatial (~1 mm) resolution tagging of single photons allow for precision track reconstruction using both the prompt and reflected light. Particle tracks are reconstructed by fitting the vertical and azimuth photon time projection data, extracting 3D tracks and the Cherenkov angle. First results from cosmic ray muons will be presented.

Summary

Primary author(s) : OBERLA, eric (uchicago)

Co-author(s) : FRISCH, henry (u); WETSTEIN, Matthew (University of Chicago); ELAGIN, Andrey (University of Chicago)

Presenter(s) : OBERLA, eric (uchicago)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **171** Type : **Oral**

Design Studies of the Electromagnetic and Hadronic Calorimeters for sPHENIX

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The PHENIX Experiment at RHIC is planning a series of major upgrades that will transform the current PHENIX detector into a new detector, sPHENIX, which will be used to carry out a systematic measurement of jets in heavy ion collisions in order to study the phase transition of normal nuclear matter to the Quark Gluon Plasma near its critical temperature. The baseline design of sPHENIX will utilize the former BaBar solenoid magnet and incorporate two new calorimeters, one electromagnetic (EMCAL) and another hadronic (HCAL), that will be used to measure jets in the central region. The calorimeters will cover a region of ±1.1 in pseudorapidity and 2pi in phi, and will result in a factor of 6 increase in acceptance over the present PHENIX detector. The HCAL will be first hadronic calorimeter ever used in an experiment at RHIC and will enable this first comprehensive study of jets in heavy ion collisions. It will be based on scintillator plates interspersed between steel absorber plates that are read out using wavelength shifting fibers. It will have a total depth of ~ 5 Labs that will be divided into two longitudinal sections, and will have an energy resolution ~ 50%/$\sqrt{}$E for single particles and <100%/$\sqrt{}$E for jets. The EMCAL will be a tungsten-scintillating fiber design, and will have a depth of ~ 17 X0 and an energy resolution of ~ 15%/$\sqrt{}$E. Both calorimeters will be read out using silicon photomultipliers and waveform digitizing electronics. In addition, it is planned to add a preshower detector in front of the EMCAL that will consist of ~ 2 X0 of tungsten absorbers and silicon strip detectors in order to improve electron and single photon identification. This talk will discuss the detailed design of both calorimeters and the preshower, and the construction of the first prototypes of each of these devices. These prototypes were recently tested in a test beam at Fermilab and the first preliminary results of those tests will be presented. A discussion of additional upgrade plans that will transform sPHENIX into ePHENIX, which will be a detector for a future Electron Ion Collider at Brookhaven, will be discussed in a separate contribution to this conference.

Summary

The PHENIX Collaboration is planning a series of major new upgrades that will transform the current PHENIX detector at RHIC into a new, multipurpose detector that will be used to carry out a systematic study of jets in heavy ion collisions in order to study the Quark Gluon Plasma near its critical temperature, and to study polarized electron-hadron and electron-ion collisions at a future Electron Ion Collider at Brookhaven. The first in this series of upgrades is sPHENIX, which will utilize the BaBar solenoid magnet and instrument it with two new calorimeters, one electromagnetic and one hadronic, that will have full azimuthal coverage and cover 2.2 units of rapidity, thereby increasing the current PHENIX acceptance by a factor of six. The sPHENIX hadron calorimeter will be the first hadronic calorimeter ever used in an experiment at RHIC, and will enable the first study of jets at RHIC that utilizes a complete jet energy measurement. The evolution of sPHENIX to ePHENIX, which will be a new detector for eRHIC, will be described in a separate contribution to this conference. The hadronic calorimeter will be a steel plate and scintillating tile design that is read out

with wavelength shifting fibers and silicon photomultipliers (SiPMs). It will incorporate a novel design feature where the steel plates are oriented parallel to the beam direction so that they also function as the flux return for the magnet. This results in the steel plates being wedged shaped and that the sampling fraction changes with depth. However, the calorimeter will be divided into two longitudinal compartments, which allows the measurement of the longitudinal center of gravity of the shower, and thereby an event by event correction for the longitudinal shower fluctuations. It will be divided roughly into 1/3 for the front section and 2/3 for the back section, and each section will oriented at a small angle with respect to the incoming particles. Scintillating tiles are interspersed between the steel plates and read out using wavelength shifting fibers. The fibers are bundled and read out using 3x3 mm3 silicon photomultiplers (SiPMs) which operate in the fringe field of the solenoid magnet. The EMCAL will be a tungsten plate and scintillating fiber design with the plates and fibers oriented approximately along the incoming particle direction, as in the HCAL. In order to prevent channeling of particles through the calorimeter (i.e., particles that could only interact in the scintillator), the plates and fibers will either be tilted at a small angle with respect to the incoming particle, as in the HCAL, or the plates and fibers will have an accordion structure that will prevent any direct particle path through the scintillator. The fibers are brought to the back of the calorimeter where the light is collected by an array of light collecting cavities that form the readout towers and direct the light onto SiPMs. The EMCAL will have a Moliere radius ˜ 2 cm and a radiation length ˜ 7 mm. Both calorimeters will use the same SiPMs and readout electronics, thereby simplifying the combined calorimeter design and resulting in an overall cost savings. The SiPM signals are amplified by custom designed preamplifiers that provide feedback for correcting the bias voltage to compensate for gain variations with temperature. An LED monitoring system is also incorporated for gain monitoring and calibration. The signals are digitized using flash ADC electronics that was used for a previous PHENIX detector. There have been detailed design and simulation studies for both the EMCAL and HCAL and prototypes of both calorimeters have been constructed. These prototypes will be tested in a test beam at Fermilab in February 2014 where their actual performance properties will be measured. In addition, we plan to test a prototype of a silicon-tungsten preshower that would go in front of the EMCAL in the sPHENIX detector. This talk will describe the detailed design of both calorimeters and the preshower, including Monte Carlo simulations, and will discuss the first results from the prototype beam tests.

Primary author(s) : KISTENEV, Edouard (Department of Physics)

Presenter(s) : KISTENEV, Edouard (Department of Physics)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **59** Type : **Oral**

Design and Performance of the HAWC DAQ

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

The High Altitude Water Cherenkov (HAWC) Observatory, located on the Sierra Negra plateau (4100m a.s.l.) in central Mexico, is currently under construction and scheduled for completion at the end of summer 2014. The detector is comprised of tightly-packed optically-isolated water tanks, each 5 m tall and 7.3 m in diameter, which are instrumented with 4 Hamamatsu photomultiplier tubes. The tanks are used to detect the secondary charged particles produced when 100 GeV - 100 TeV gamma rays and cosmic rays interact with the atmosphere. Though the detector is under construction, the DAQ has been operating and expanding with the detector as tanks are added. The DAQ is designed to handle a final event trigger rate of >15 kHz with high uptime (>99%) and low latency (<5 s), while also analyzing events with multiple triggers and reconstruction algorithms in real time. This is achieved using a modular system based on inexpensive hardware components and open source technology for transferring data (ZeroMQ). This flexible framework is agnostic to the type of data that is transferred and it could easily be applied to other experiments. We will explain the motivation for this design, describe the DAQ in detail, and present the performance of the detector.

Summary

Primary author(s) : Mr. WISHER, Ian G. (University of Wisconsin - Madison)

Co-author(s) : HAWC, Collaboration (The HAWC Observatory)

Presenter(s) : Mr. WISHER, Ian G. (University of Wisconsin - Madison)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **229** Type : **Oral**

Design and development of the Power Supply Board within the Digital Optical Module in KM3NeT

Friday, 6 June 2014 14:00 (0:20)

Abstract content

KM3NeT is a deep-sea neutrino telescope of very large scale (several km3) to be deployed and operated in the Mediterranean Sea. Neutrino-induced charged particles are detected by measuring their Cherenkov light in sea-water, using photomultiplier tubes (PMTs) inside transparent and pressure resistant spherical enclosures. The aim is to instrument several km3 of sea volume with tens of thousands of optical sensors, connected to the shore through electro-optical cables up to 100km. The KM3NeT collaboration has successfully developed an optical sensor, the Digital Optical Module (DOM), by placing 31, 3-inch PMTs in a 17-inch glass sphere along with the readout electronics. Each DOM is supplied power through a high voltage (400 VDC) line from the shore, converted to low voltage (12 VDC) before entering the DOM. The Power Supply Board (PB), situated inside the DOM, is used to produce seven voltage rails as required by the DOM electronic modules. This paper summarizes the design considerations of the PB and the results of the trial runs so far. Efficiency, testing, manufacturing and reliability issues are also addressed in connection to the project overall objectives.

Summary

Primary author(s) : Dr. BELIAS, Anastasios (NCSR Demokritos)

Co-author(s) : Dr. MANOLOPOULOS, Konstantinos (NCSR Demokritos)

Presenter(s) : Dr. BELIAS, Anastasios (NCSR Demokritos); Dr. MANOLOPOULOS, Konstantinos (NCSR Demokritos)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **378** Type : **Oral**

Design of a Low-Noise, Charge Sensitive Amplifier for MCP-PMT Detector Readout

Friday, 6 June 2014 11:20 (0:20)

Abstract content

Readout of micro-channel plate detectors using cross strip anodes require low noise, fast charge sensitive amplifier (CSA) front-end electronics. The goal of this CSA project is to improve noise and shaping time from the “PreShape32” amplifier ASIC of the RD-20 collaboration at CERN, presently used in the readout system. A target noise of 100e- + 50e-/pF (<1000e- noise overall) with <100ns shaping time is desired. Overall gain should be better than 5mV/fC. Two amplifiers have been manufactured and tested (CSAv1 and CSAv2) with a third presently being designed. All have been designed using a 130nm IBM CMOS process.

Summary

Primary author(s) : Dr. COONEY, Michael (University of Hawai'i at Manoa)

Co-author(s) : Dr. VARNER, Gary (University of Hawai'i at Manoa); Mr. CUMMING, Harley (University of Hawai'i at Manoa); Dr. ANDREJ, Seljak (University of Hawai'i at Manoa); Dr. VALLERGA, John (University of California, Berkeley); Mr. RAFFANTI, Rick (Techne Instruments)

Presenter(s) : Dr. COONEY, Michael (University of Hawai'i at Manoa)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **303** Type : **Oral**

Design, construction and commissioning of a 15 kW CO2 evaporative cooling system for particle physics detectors: lessons learnt and perspectives for further development

Monday, 2 June 2014 16:10 (0:20)

Abstract content

Since 2000, a few particle physics detectors have been using evaporative Carbon Dioxide (CO2) for their low temperature cooling systems, showing exceptional performances and stability in their full range of operation. The excellent physical, thermal and fluid dynamic properties of CO2, coupled to its radiation hardness, make it a very interesting option for the cooling systems of the next generation vertex and tracking detectors. In order to match the requirements of the CMS Pixel Phase I upgrade, a 15 kW cooling system featuring evaporative CO2 has been designed, constructed and commissioned in 2013, as a full-scale prototype of the final system. This paper describes the challenges during the design and construction phases, highlights the performance achieved during commissioning, and describes the optimisation of the design for the final system. Results of the performance tests, including stability of the temperature regulation while power cycling are illustrated as well. An outlook on further scaling up is given in view of designs for higher cooling power, as needed for the next generation of tracking detectors for the LHC experiments.

Summary

Primary author(s) : TROPEA, Paola (CERN)

Co-author(s) : DAGUIN, Jerome (CERN); ZWALINSKI, Lukasz (CERN); D'AURIA, Andrea (CERN); GODLEWSKI, Jan (CERN); OSTREGA, Maciej Stanislaw (AGH University of Science and Technology (PL)); MARQUES PINHO NOITE, Joao (CERN); PAVIS, Steven (CERN); PETAGNA, Paolo (CERN); POSTEMA, Hans (CERN); VERLAAT, Bart (NIKHEF-CERN)

Presenter(s) : TROPEA, Paola (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **247** Type : **Oral**

Detection of Proportional Scintillation in Liquid Xenon

Monday, 2 June 2014 17:30 (0:20)

Abstract content

We present results from measurements to detect proportional scintillation light near thin wires in liquid xenon (LXe). LXe time projection chamber (TPC) has superior features for the direct detection of Weakly Interacting Massive Particles (WIMPs) as demonstrated by the Xenon10 and Xenon100 experiments and more recently also by LUX. Future upgrades of these experiments with a TPC containing several tonnes of LXe presents some technical challenges which could be removed with the detection of the proportional scintillation in liquid phase. First measurements of the proportional scintillation in LXe were reported more than 30 years ago. In light of the advantages of the approach for the future large scale LXe detectors for the Dark Matter search we have carried out new measurements in LXe using thin wires and a gas electron multiplier. The experiment set-up and results from this R&D carried out at Columbia University Nevis Lab will be presented.

Summary

Primary author(s) : Dr. NAGANOMA, Junji (Rice University)

Co-author(s) : Prof. APRILE, Elena (Columbia University); Dr. SHAGIN, Petr (Rice University); Dr. WALL, Richard (Rice University); Dr. BUDNIK, Ranny (Columbia University); Mr. CONTRERAS, Hugo (Columbia University); Mr. GOETZKE, Luke (Columbia University); Ms. ROSIE, Hood (Columbia University); Dr. MELGAREJO FERNANDEZ, Antonio (Columbia University); Dr. MESSINA, Marcello (Columbia University); Dr. PLANTE, Guillaume (Columbia University); Dr. RIZZO, Alfio (Columbia University)

Presenter(s) : Dr. NAGANOMA, Junji (Rice University)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **321** Type : **Oral**

Development and Evaluation of Event-Driven SOI Pixel Detector for X-ray Astronomy

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

We have been developing a monolithic active pixel sensor with the silicon-on-insulator (SOI) CMOS technology for use in future X-ray astronomical satellite mission. Our objective is to replace the X-ray Charge Coupled Device, which is the standard detector in the field, by offering high coincidence time resolution ($\sim$ 50 ns), superior hit-position readout time ($\sim$ 10 μs), and wider bandpass (0.3 – 40 keV) in addition to having comparable performances in imaging spectroscopy. In order to realize this detector, we have developed prototype detectors, called "XRPIX" series. XRPIX contains comparator circuit in each pixel to detect an X-ray photon injection; it offers intra-pixel hit trigger (timing) and two-dimensional hit-pattern (position) outputs. Therefore, XRPIX is capable of direct access to selected pixels to read out the signal amplitude. X-ray readout by this function is called "Event-Driven readout".

In our previous study, we successfully demonstrated the acquisition of X-ray spectra in Event-Driven readout. Although some problems still remain in operation of the circuit, a detailed investigating operation of XRPIX revealed their cause recently. Moreover, we designed a new prototype which has charge sensitive amplifier in each pixel in order to increase the gain and improve energy resolution. Then, the readout noise is 33 e- rms and the energy resolution is about 300 eV FWHM at 5.9 keV. In this presentation, we report on the development and evaluation of XRPIX about Event-Driven readout.

Summary

Primary author(s) : Mr. TAKEDA, Ayaki (SOKENDAI/KEK)

Co-author(s) : Prof. ARAI, Yasuo (High Energy Accelerator Research Organization (KEK)); Prof. TSURU, Takeshi (Kyoto University); Dr. TANAKA, Takaaki (Kyoto University); Mr. MATSUMURA, Hideaki (Kyoto University); Mr. NAKASHIMA, Shinya (Kyoto University); Dr. MORI, Koji (Miyazaki University); Mr. NISHIOKA, Yusuke (Miyazaki University); Mr. TAKENAKA, Ryota (Miyazaki University); Dr. KOHMURA, Takayoshi (Kogakuin University); Mr. IMAMURA, Toshifumi (A-R-Tec Corp.); Mr. OHMOTO, Takafumi (A-R-Tec Corp.); Prof. IWATA, Atsushi (A-R-Tec Corp.)

Presenter(s) : Mr. TAKEDA, Ayaki (SOKENDAI/KEK)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **96** Type : **Oral**

Development and test of a versatile DAQ system based on the ATCA standard

Friday, 6 June 2014 15:00 (0:20)

Abstract content

A DAQ system based on custom electronics (Scalable Readout System - SRS) has been developed inside the Micro Pattern Gaseous Detector community (RD51 Collaboration) in the recent years and is now being upgraded for large scale applications using the Advanced Telecommunications Computing Architecture (ATCA) platform. We present the development and test of a readout system which consists of an ATCA crate, with high-speed backplane, front-end cards based on custom ATCA blades and custom readout units. The flexibility and modularity of the system makes it a powerful tool to be used in simple setups like cosmic stands or test beams, as well as allowing for the integration into a more complex DAQ framework. It will be used for Micromegas detector certification but also for the readout of a Micromegas prototype detector in the ATLAS experiment. The certification applications include small to medium size lab and test beam setups as well as a 32-64k channel test facility for the certification of the Micromegas detectors for the ATLAS muon system upgrade. The integration of this system into the complex ATLAS online TDAQ will allow us to read out a Micromegas prototype detector with 4096 channels during the upcoming LHC run period.

Summary

Primary author(s) : BIANCO, Michele (CERN); LOESEL, Philipp Jonathan (Ludwig-Maximilians-Univ. Muenchen (DE)); SIDIROPOULOU, Ourania (Aristotle Univ. of Thessaloniki (GR)); ZIBELL, Andre (Bayerische Julius Max. Universitaet Wuerzburg (DE))

Presenter(s) : SIDIROPOULOU, Ourania (Aristotle Univ. of Thessaloniki (GR))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **42** Type : **Oral**

Development of CMOS Pixel Sensor Featuring Pixel-Level Discrimination for the ALICE-ITS Upgrade

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

The CMOS pixel sensor (CPS) based on the TowerJazz 180nm CIS process can provide qualified radiation hardness for the ALICE-ITS upgrade. Meanwhile, full CMOS integration in the pixel is achievable due to the availability of deep P-well. Therefore, a novel concept of pixel with integrated discriminator was realized to develop a fast and power efficient rolling shutter CPS architecture for the ALICE-ITS upgrade. Compared with the conventional CPS using column-level discrimination, the in-pixel discrimination sets the analog processing within the pixel. Thus the analog buffer driving the long distance column bus is no longer needed and the static current consumption per pixel can be largely reduced from 120μA down to 15μA. Besides, the row processing time can be halved down to 100ns thanks to small local parasitic. As a proof of concept, the prototype chip called AROM0 was fabricated in April 2013. Full functionality and the noise performance of the chip have been validated in laboratory test. Based on the experience of AROM0, the improved pixel designs have been implemented in the chip called AROM1 which is an intermediate prototype chip anticipating the final sensor architecture proposed for the ALICE-ITS upgrade. It features the pixel array of 64 $\times$ 64 with double-row readout while integrating the on-chip biasing/reference control and JTAG programmable sequence management circuitry.
This paper will present the design and test results of AROM0. It'll also discuss the improvement in AROM1 and present the test results of this sensor which is expected in early 2014.

Summary

Primary author(s) : WANG, Tianyang (IPHC)

Co-author(s) : PHAM, Thanh Hung (CNRS); DOROKHOV, Andrei (IPHC); Dr. HU, Christine (IPHC/IN2P3); Prof. HU, Yann (IPHC)

Presenter(s) : WANG, Tianyang (IPHC)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **115** Type : **Oral**

Development of Hybrid Avalanche Photo Detector and its Readout Electronics for the Belle II Aerogel RICH counter

Friday, 6 June 2014 14:00 (0:20)

Abstract content

For the Belle II experiment at the superKEKB accelerator, we have been developing a proximity focusing ring imaging Cherenkov detector using a silica aerogel as a radiator (A-RICH). This counter is designed to be used at the forward endcap region and to have pion/kaon separation with more than 4-sigma deviations at momenta up to 4 GeV/c. 144-channel Hybrid Avalanche Photo-Detector (HAPD) modules developed with Hamamatsu Photonics K.K. have been adopted as the photon detectors for the A-RICH. A total of 420 HAPD will be used in Belle II detector. We started the mass production of the HAPD. Quality of the manufactured HAPD is checked by a system that we developed. We report the status of the quality check that consists of the leakage current measurement, channel-by-channel noise level measurement, the 2-dimensional scan for photon detection, and the quantum efficiency measurement for the photo cathode. As for the readout of about 60,000 channels from the A-RICH, we developed an ASIC for the amplification and digitization of the signal from HAPDs. We started the mass production of the ASIC last year. Then we plan to test all the ASIC chips before mounting them on the front-end boards attached to HAPDs. The data from several front-end boards will be merged into one board, and are sent to the Belle II central DAQ system by an optical link called Belle2Link. For this purpose, modules called “merger board” located inside the detector are under development. Each merger board is connected to 6 front-end boards, and has an FPGA for the data merging and transmission. We are developing the firmware for the FPGA and testing it. In this presentation, status of the mass production of HAPDs and ASICs, and the development and test results for the merger board will be reported.

Summary

Primary author(s) : Mr. IWATA, Shuichi (Tokyo Metropolitan University)

Presenter(s) : Mr. IWATA, Shuichi (Tokyo Metropolitan University)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **302** Type : **Oral**

Development of Kinetic Inductance Detectors for a 3 mm camera

Friday, 6 June 2014 11:20 (0:20)

Abstract content

Millimetre-wave astronomical observations have an enormous discovery potential in the study of the earliest stages of the evolution of the universe, clusters of galaxies, high redshift objects, and star formation regions. One of the challenges today is to perform observations with the finest angular resolution, in order to accurately investigate the nature of these astrophysical sources. While for spectroscopic investigations of point-like sources ALMA is the obvious solution, for continuum measurements of diffuse sources large single-dish telescopes (e.g. GBT, TML, IRAM, SRT, etc.) equipped with large-format bolometeric cameras provide a much higher mapping speed. Kinetic Inductance Detectors represent an interesting option for the detector array, due to their easiness to multiplex and their capability to efficiently tackle with atmospheric issues. We are developing Aluminum Lumped Element KIDs for the 3 mm atmospheric window (W-band). While interesting performance of KIDs has already been demonstrated for the1 and 2 mm windows, further technological development is needed for their use at longer wavelengths. In this contribution we analyze the main issues of such a R&D (like minimum operation frequency, operation in high background conditions, size of the array etc.) and present the results of optical tests of the first devices. We also discuss their possible application in an imaging differential spectrometer for the Sardinia Radio Telescope, the largest Italian radio astronomy facility.

Summary

Primary author(s) : Dr. CRUCIANI, Angelo (University La Sapienza, Rome, Italy)

Co-author(s) : Dr. BATTISTELLI, Elia (University La Sapienza, Rome, Italy); Dr. CASTELLANO, Maria Gabriella (IFN - CNR, Rome, Italy); Dr. COPPOLECCHIA, Alessandro (University La Sapienza, Rome, Italy); Mr. D'ADDABBO, Antonio (Institut Néel, Grenoble, France); Prof. D'AMICO, Nichi (University of Cagliari and INAF, Cagliari, Italy); Prof. DE BERNARDIS, Paolo (University La Sapienza, Rome, Italy); Prof. MASI, Silvia (University La Sapienza, Rome, Italy); Mr. PAIELLA, Alessandro (University La Sapienza, Rome, Italy)

Presenter(s) : Dr. CRUCIANI, Angelo (University La Sapienza, Rome, Italy)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **166** Type : **Oral**

Development of MTCA/xTCA/ATCA based instrumentation for partical physics at IHEP

Friday, 6 June 2014 15:20 (0:20)

Abstract content

This talk briefs the development of instrumentation for particle physics experiment based on the ATCA/MTCA/xTCA specifications. Examples includes hardware for LLRF, Compute Node(ATCA compatible) for PANDA experiment, Lumird for BESIII Luminosity readout, Compute Node(xTCA compatible) for DEPFET/PXD detector, digitizer and trigger for TREND experiment. discussion on the back-end readout electronics trend is discussed.

Summary

As one of the 4 sponsor labs(DESY,FNAL,IHEP,SLAC) of the new standard–"xTCA for Physics", shortaed as xTCA, IHEP/Triglab deeply envolved in the development of the backend instrument for pariticle physics. Experience has been gained with acceptance by experiments and/or usage. More detailed information will be given

Primary author(s) : LIU, Zhen-An (I)

Presenter(s) : LIU, Zhen-An (I)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **260** Type : **Oral**

Development of Microwave Kinetic Inductance Detectors for phonon and photon detections

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

We present our recent developments of Microwave Kinetic Inductance Detectors (MKIDs) for phonon and photon detections. An MKID is a type of superconducting detectors. Cooper-pair breaking caused by deposited energy changes the kinetic inductance of the superconductor. Consisting of LC resonators formed by a thin superconducting metal layer, it detects the energy by sensing the change of the inductance. By using the MKIDs we can readout the detectors with frequency-domain multiplexing.
Since the bound energy of Cooper-pairs is order of milli-electron volt and the detectors are operated at low temperature of less than 1K, MKIDs have high energy resolutions and low noise levels. The highly sensitive detectors can be applied to measurements that require the detection of very week signals, for instance dark matter search. We are developing MKIDs that are formed with the combination of two metal layers of Al and Nb. By using two superconducting metal layers, we can confine the quasi-particles in a certain region due to the difference of the energy gaps and expect an increase of the sensitivity.
We have developed Nb/Al MKIDs for the detections of photons and phonons. For the former, we aim to apply the MKIDs to a He scintillation detector for a search of light dark matter with liquid He TPC. The latter would be applied not only to the dark matter search but also to X-ray detections with the high energy resolution and a high acceptance for future material science.

Summary

Primary author(s) : Dr. ISHINO, Hirokazu (Okayama University)

Co-author(s) : Prof. HAZUMI, Masashi (High Energy Accelerator Research Organization (KEK)); Dr. KIBAYASHI, Atsuko (Okayama University); YOSHIDA, Mitsuhiro (High Energy Accelerator Research Organization (KEK)); Dr. KIBE, Yoshiaki (Okayama University); Mr. WATANABE, Hiroki (Sokendai); Dr. SATO, Nobuaki (High Energy Accelerator Research Organization (KEK)); Mr. YAMADA, Yousuke (Okayama University); Mr. OKAMOTO, Akinori (Okayama University)

Presenter(s) : Dr. ISHINO, Hirokazu (Okayama University)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **307** Type : **Oral**

Development of Real time ⁹⁰Sr counter applying Cherenkov light detection

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

Radioisotope have been emitted around Japan by a nuclear accident at the Fukushima No. 1 nuclear power plant in March 2011. A problem is the contaminated water including the atomic nucleus which relatively has a long half-life time such as 90Sr, 137Cs generated from 235U used for nuclear fuel in particular. Particular, since 90Sr has a long biological half-life time (49 years), it is dangerous to cause internal exposure. Therefore, real-time 90Sr counter is required. It is relatively easy to identify a nucleus emitting gamma ray. But it is more difficult to identify a nucleus emitting pure beta ray such as 90Sr. Typically, measurement of a radioactivity absolute value of 90Sr takes a month at least to give a result. At first, we aim to identify 90Sr/137Cs by threshold type Cherenkov detection. It needs radiator which has less than 1.0492 of refractive index for identification 2.28 MeV of maximum kinematic energy of beta ray from 90Sr and 1.17 MeV of maximum kinematic energy of beta ray from 137Cs. Recent, The material satisfying this request does not exist expect the silica aerogel. We produced prototype and evaluated performance. We achieved 103 of Sr/Cs detection efficiency ratio, 10-3 Hz/ Bq of 90Sr sensitivity at one minute.

Summary

Primary author(s) : Mr. ITO, hiroshi (Chiba University)

Co-author(s) : Mr. IIJIMA, Shutaro (Chiba University); Mr. HAN, Soorim (Chiba University); Mr. KAWAI, Hideyuki (Chiba University); Mr. KODAMA, Satoshi (Chiba University); Mr. KUMOGOSHI, Daisuke (Chiba University); Mr. MASE, Keiichi (Chiba University); Mr. TABATA, Makoto (Chiba University)

Presenter(s) : Mr. ITO, hiroshi (Chiba University)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **159** Type : **Oral**

Development of Superconducting Tunnel Junction Detectors as a far-infrared single photon detector for neutrino decay search

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

We present the development of Superconducting Tunnel Junction (STJ) detectors as far-infrared single photon detector motivated by application to a search for radiative decay of cosmic background neutrino. The photon energy spectrum from the neutrino radiative decays is expected to have a sharp edge at high energy end in a far-infrared region ranging from 14meV to 25meV (from 50um to 90um in wavelength). We explore the the cosmic infrared background photon energy spectrum in this region for feeble contribution from neutrino decays. Thus, the detector is required to measure photon-by-photon energies with high resolution enough to identify the edge structure, and designed for a rocket or satellite experiment. One of our choices for the detector is STJ using hafnium (Hf-STJ) which is expected to have 2% energy resolution for single photon of 25meV due to very small gap energy of hafnium. Another choice for the detector is a combination of the diffraction grating and array of niobium-aluminum STJ (Nb/Al-STJ) pixels, where each Nb/Al-STJ pixel is capable of single photon detection for a far-infrared photon delivered to each pixel according to its wavelength by the grating. For the Hf-STJ development, we have successfully produced a superconducting-insulator-superconducting structure using hafnium, that is confirmed by Josephson current, and observed a response to visible light illumination, although much higher leak current than its requirement is a major issue to be resolved. For the Nb/Al-STJ, it is also challenging that an amplifier at extremely low noise level of 10 electron-equivalent-noise is required.

Summary

Primary author(s) : TAKEUCHI, Yuji (University of Tsukuba)

Co-author(s) : KIM, Shin Hong (University of Tsukuba); KIUCHI, Kenji (University of Tsukuba); NAGATA, Kazuki (University of Tsukuba); KASAHARA, Kota (University of Tsukuba); OKUDAIRA, Takuya (University of Tsukuba); ICHIMURA, Tatsuya (University of Tsukuba); KANAMARU, Masahiro (University of Tsukuba); MORIUCHI, Kouya (University of Tsukuba); SENZAKI, Ren (University of Tsukuba); IKEDA, Hirokazu (JAXA/ISAS); MATSUURA, Shuji (JAXA/ISAS); WADA, Takehiko (JAXA/ISAS); ISHINO, Hirokazu (Okayama University); KIBAYASHI, Atsuko (Okayama University); MIMA, Satoru (RIKEN); YOSHIDA, Takuo (University of Fukui); KOMURA, Shota (University of Fukui); ORIKASA, Keishuke (University of Fukui); HIROSE, Ryuta (University of Fukui); KATO, Yukihiro (Kinki University); HAZUMI, Masashi (KEK); ARAI, Yasuo (KEK); RAMBERG, Erik (Fermilab); YOO, Jonghee (Fermilab); KOZLOVSKY, Mark (Fermilab); RUBINOV, Paul (Fermilab); SERGATSKOV, Dmitri (Fermilab); KIM, Soo-Bong (Seoul National University)

Presenter(s) : TAKEUCHI, Yuji (University of Tsukuba)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **147** Type : **Oral**

Development of Superconducting Tunnel Junction Photon Detector on SOI Preamplifier Board to Search for Radiative decays of Cosmic Background Neutrino.

Friday, 6 June 2014 15:00 (0:20)

Abstract content

We develop superconducting tunnnel junction (STJ) to search for radiative decays of cosmic background neutrino using cosmic infrared background energy spectrum. The requirement for performance of the detector in our experiment is to detect a single far-infrared photon. We can detect a single far-infrared photon with Nb/Al-STJ theoretically. So far we have not succeeded in detecting it yet because the signal of a single far-infrared photon with the STJ is too small comaparing with the present noise of our electronics. To solve this problem, we use a charge sensitive preamplifier that can operate at low temperature around 1K to improve the signal-to-noise ratio of STJ. cSOI(Silicon on Insulator) preamplifier is a candidate of the preamplifier as it was proved to operate at 4K by a JAXA/KEK group. We have developed a STJ processed on a SOI preamplifier board to make this detector compact. Firstly, we have processed STJ on a SOI board with only SOI-MOSFET's to check the connection between STJ and SOIFET and the STJ processing without any damage on SOIFET. We confirmed that the SOIFET had excellent performance below 1K and the STJ on SOI could operate normally. Then we made and tested the second version of SOI-STJ detector with the readout circuit on SOI wafer as the charge sensitive amplifier. We will report the present status of development of this SOI-STJ detector.

Summary

Primary author(s) : KASAHARA, Kota (University of Tsukuba (JP))

Co-author(s) : Prof. KIM, Shinhong (University of Tsukuba); Prof. ISHINO, Hirokazu (Okayama University); Prof. HAZUMI, Masashi (KEK); Prof. YOSHIDA, Takuo (Fukui University); Prof. RAMBERG, Erik (Fermilab); Prof. WADA, Takehiko (JAXA); Dr. MIMA, Satoru (RIKEN); Prof. ARAI, Yasuo (KEK); Prof. KATO, Yukihiro (Kinki University); Mr. NAGASE, Koichi (JAXA); Prof. MATSUURA, Shuji (JAXA); Prof. TAKEUCHI, Yuji (University of Tsukuba); Mr. RUVINOV, Paul (Fermilab); Prof. KOZLOVSKY, Mark (Fermilab); Prof. SERGATSKOV, Dmitri (Fermilba); Mr. KIUCHI, Kenji (University of Tsukuba (JP)); Mr. NAGATA, Kazuki (University of Tsukuba (JP)); Mr. OKUDAIRA, Takuya (University of Tsukuba); Mr. ICHIMURA, Tatsuya (University of Tsukuba); Mr. KANAMARU, Masahiro (University of Tsukuba); Mr. MORIUCHI, Koya (University of Tsukuba); Mr. SENZAKI, Ren (University of Tsukuba)

Presenter(s) : KASAHARA, Kota (University of Tsukuba (JP))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **292** Type : **Oral**

Development of X-ray SOI Pixel Sensors: Investigation of Charge-Collection Efficiency

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

We have been developing X-ray SOIPIXs, monolithic active pixel sensors based on the Silicon-On-Insulator (SOI) CMOS technology for next-generation X-ray astronomy satellites. Their high time resolution (˜micro sec) and event trigger output function enable us to reduce non-X-ray background by two orders of magnitude at 20 keV, compared with X-ray CCDs widely used in current X-ray astronomy sattelites. A fully depleted thick depletion layer with back-side illumination offers wide band coverage of ∼0.3–40 keV. We already achieved thick and full depletion layer with a thickness of 500 micron. We will report recent progress in our development in this presentation. We measured sub-pixel charge-collection efficiency of our device by irradiating it with pencil beam X-rays at SPring-8. We found that a part of signal charges is lost at the pixel boundaries. We found that the amount of the charge loss depends on back-bias voltages. It leads us to a hypothesis that the strength of electric fields at the interface between the sensor and silicon dioxide layers determines the charge collection efficiency. We will test the hypothesis by comparing the experimental results with TCAD simulations.

Summary

Primary author(s) : MATSUMURA, Hideaki (Kyoto University)

Co-author(s) : TSURU, Takeshi (Kyoto University); Dr. TANAKA, Takaaki (Kyoto University); Dr. NAKASHIMA, Shinya (Kyoto University); ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); TAKEDA, Ayaki (SOKENDAI); MORI, koji (University of Miyazaki); NISHIOKA, Yusuke (University of Miyazaki); TAKENAKA, Ryota (University of Miyazaki); KOHMURA, Takayoshi (Kogakuin University)

Presenter(s) : MATSUMURA, Hideaki (Kyoto University)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **366** Type : **Oral**

Development of a 20cm-by-20cm "hot" indium-alloy hermetic seal in an inert atmosphere for photo-detector assembly

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

The Large-Area Picosecond Photo-Detector Collaboration (LAPPD) is currently developing a large-area, modular photo-detector system composed of thin, planar, glass-body modules, each with two 20x20-cm-squared ALD-functionalized MCPs in a chevron geometry. In the case of LAPPD, hermetic sealing between the entrance window and the detector body is complicated by the square shape of the detector and the large area. We have successfully demonstrated a technique to make a vacuum seal for the LAPPD detectors by using an indium-alloy above its melting temperature on a flat pre-coated glass surface in an inert atmosphere. While this technique has been developed in a glove box filled with an inert gas, it can be adapted for the use in a vacuum transfer assembly process.

Summary

Primary author(s) : ELAGIN, ANDREY (University of Chicago); FRISCH, Henry (University of Chicago); NORTHROP, Richard (University of Chicago)

Co-author(s) : OBAID, Razib (Illinois Institute of Technology); HEINTZ, Mary (University of Chicago); WETSTEIN, Matthew (University of Chicago); ADAMS, Bernhard (Argonne National Laboratory)

Presenter(s) : ELAGIN, ANDREY (University of Chicago)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **169** Type : **Oral**

Development of a Data Acquisition System for the Belle II Silicon Vertex Detector

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The Silicon Vertex Detector (SVD) is one of the main detectors in the Belle II experiment (KEK, Japan) which takes essential roles in the decay-vertex determination, low-energy-track reconstruction, and background rejection. The SVD consists of four layers of Double-sided Silicon Strip Detectors (DSSD) and is being developed toward the start of the Belle II experiment in 2016. Due to more than 220,000 strips in the whole SVD and the Belle II maximum trigger rate of 30 kHz, the integration of a large number of readout channels and the reduction of data size are challenging issues on the development of the SVD readout electronics. APV25 chips are employed to read the DSSD signals, and Flash-ADC (FADC) boards digitize and decode the outputs of the APV25s. To increase the integration density of the readout channels, one FADC board processes 48 APV25 outputs with one FPGA. The FPGA performs pedestal-subtraction, two-step common-mode correction, and zero-suppression for the sake of the data reduction. The development of the first prototype of the SVD readout system was completed in Dec. 2013, and the performance study of this system was done in an electron beam at DESY in Jan. 2014. In the beam test, the prototype system was implemented into the Belle II DAQ for the first time and the whole data-streaming was successfully operated. In this presentation, we will introduce features of the SVD readout system, and report on prototype performance results from the beam test, as well as future prospects for the Belle II experiment.

Summary

Primary author(s) : NAKAMURA, Katsuro (KEK)

Co-author(s) : BERGAUER, Thomas (HEPHY); NAKAO, Mikihiko (KEK); NATKANIEC, Zbigniew (IFJ); OSTROWICZ, Waclaw (IFJ); PAOLONI, Eugenio (INFN Pisa and Univ. of Pisa); SCHNELL, Michael (Univ. of Bonn); SUZUKI Y., Soh (KEK); THALMEIER, Richard (HEPHY); TSUBOYAMA, Toru (KEK); YAMADA, Satoru (KEK); YIN, Hao (HEPHY); CASAROSA, Giulia (INFN Pisa); FRIEDL, Markus (HEPHY); HARA, Koji (KEK); HIGUCHI, Takeo (Kavli IPMU (WPI)); IRMLER, Christian (HEPHY); ITOH, Ryosuke (KEK); KONNO, Tomoyuki (Tokyo Metropolitan Univ.); LIU, Zhen-An (IHEP)

Presenter(s) : NAKAMURA, Katsuro (KEK)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **316** Type : **Oral**

Development of a Drift Chamber Detector for Large Area Applications of Muon Tomography

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

Cosmic ray muon tomography is a novel three-dimensional imaging technique able to image objects in dense or cluttered containers. The technique's ability to discriminate differing materials relies on the multiple Coulomb scattering of cosmic ray muons and as such depends strongly on the tracking resolution of the detector module. Similarly other detector properties have a strong effect of the technique's attractiveness for various applications: Due to the rate of background cosmic ray muons, timely imaging is only made possible by high detector efficiencies, large tracking solid angles and minimising dead areas; a low-cost, scalable, and easy-to-construct detector are also desirable properties, particularly for applications requiring large detector areas. We report on the development of a simplified single wire drift chamber for large area applications aiming to realise these benefits. Particularly we describe developments aimed at facilitating an easy-to-construct detector and reducing the overall cost of a future system. Performance studies of single and few-detector stack systems are reported including gas, resolution and efficiency studies. Then our considerations of a proposed design for a prototype detector module are also discussed.

Summary

Primary author(s) : Dr. STEER, Chris (AWE)

Co-author(s) : BURNS, Jonathan (A); QUILLIN, steve (AWE); Dr. STAPLETON, Matthew (AWE); SNOW, Stephen (Dept.of Phys.&Astronomy,SchusterLab)

Presenter(s) : Dr. STEER, Chris (AWE)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **289** Type : **Oral**

Development of a High Rate proton Computed Tomography Detector system

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

Proton computed tomography (pCT) offers an alternative to x-ray imaging with potential for three dimensional imaging, reduced radiation exposure, and in-situ imaging. The second generation pCT system being developed at Northern Illinois University in collaboration with Fermilab and Delhi University is comprised of a tracking system, a calorimeter or the range detector, data acquisition system, a computing farm, and software algorithms for image reconstruction. The proton beam encounters the upstream tracking detectors, the patient or phantom, the downstream tracking detectors, and a calorimeter. The tracking detectors are scintillating fibers and the calorimeter is made up of stacked scintillator plates. The data acquisition sends the proton scattering information to an offline computing farm. The pCT detector design allows for an increased data acquisition rate (up to 5 million proton tracks per second) and an improved imaging algorithm, which significantly reduced reconstruction times of three dimensional images. In this presentation, we will present the current status of the pCT detector system, development of the complete detector simulation and reconstruction tools and their validation, and preliminary test beam data analysis with the full pCT detector system.

Summary

Primary author(s) : Prof. NAIMUDDIN, Md (Delhi University)

Presenter(s) : Prof. NAIMUDDIN, Md (Delhi University)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **91** Type : **Oral**

Development of a High-Sensitive and Low-Cost Imaging Gamma-Ray Camera γI (Gamma Eye)

Friday, 6 June 2014 15:20 (0:20)

Abstract content

We developed a Compton camera γI (Gamma Eye) using CsI (Tl) scintillators for measurement of arrival direction of gamma rays produced by radioactive cesium released into the environment from the Fukushima Dai-ichi Nuclear Power Plant accident due to the great east Japan earthquake and subsequent tsunamis in 2011. The radiation exposure of residents remains extremely a serious problem in Japan. The capability of gamma-ray imaging with good angular resolution is a key feature for identification of radiation hotspots and effective decontamination operation. A detector using Compton kinematics is one of the best candidates. Some Compton cameras for such purpose are being developed so far. However, they are not sufficient to cover a wide contamination area with the dose rate in air of $< 1\mu$Sv/hour around the Fukushima Power Plant because of their low detection efficiency and/or very high cost. Thus we developed a novel Compton camera γI (Gamma Eye) with high sensitivity and low-cost. It consists of 2 arrays of detectors which act as a Compton scatterer and absorber. Energies deposited by Compton scattered electrons and subsequent photoelectric absorption measured by photomultipliers are used for image reconstruction. Each array consists of 8 large CsI (Tl) scintillator cubes, 3.5cm on a side, which are inexpensive and have good energy resolution. The 2 arrays are separated by 40cm to provide a 60-degree wide field of view as well as to keep position determination accuracy < 5 degree. The imaging capability was verified by test measurements in Fukushima Prefecture together with the laboratory tests.

Summary

Primary author(s) : Ms. KAGAYA, Mika (Ibaraki University)

Co-author(s) : Prof. ENOMOTO, Ryoji (Tokyo University (ICRR)); Prof. KATAGIRI, Hideaki (Ibaraki University); Prof. MURAISHI, Hiroshi (Kitasato University); Prof. YOSHIDA, Tatsuo (Ibaraki University); Prof. YANAGITA, Shohei (Ibaraki University); Prof. TAKEDA, Toru (Kitasato University); Mr. NAKAYAMA, Kohei (Ibaraki University); Mr. HANAFUSA, Ryuji (Fuji Electric); Mr. ITO, Yoshikazu (Fuji Electric); Mr. HOSOKAWA, Masao (Fuji Electric); Mr. SATO, Kazuhiro (Shinsei Corporation)

Presenter(s) : Ms. KAGAYA, Mika (Ibaraki University)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **163** Type : **Oral**

Development of a Muon Polarimeter for the T-violation Search Experiment at J-PARC

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

TREK is a precision-frontier experiment, planned at J-PARC (Tokai, Japan), for a T-violation search in Kaon decays into the pi0 mu+ nu final state. The signature is a non-zero transverse polarization (P_T) of muons in the direction perpendicular to the decay plane. Using the same process the E246 experiment at KEK has set an upper limit on | P_T | < 0.0050 at the 90% confidence level. TREK is an upgrade of E246 with the goal of achieving more than a factor of 20 higher sensitivity using high intensity Kaon beam from J-PARC and the detector with major upgrades that include a new GEM tracker, new photon device for the CsI(Tl) calorimeter and a new magnet system providing uniform field. The most important element of TREK is the new muon polarimeter of novel design, incorporating an active muon stopper instrumented by an array of drift tubes for tracking. This design allows the tracks of muons and positrons to be reconstructed, providing a large acceptance for positrons with higher analyzing power, background suppression, and handles for controlling systematic uncertainties such as those arising from uncertainty on the decay position and its distribution. We present an overview of the TREK experiment and detail of the muon polarimeter R&D with results of studies using Monte Carlo simulation and beam tests of the full size prototype.

Summary

Primary author(s) : KOBAYASHI, Aine (University of Tokyo (JP))

Co-author(s) : KAWAMOTO, Tatsuo (University of Tokyo (JP)); IMAZATO, Jun (KEK); YOSHIHARA, Keisuke (University of Tokyo (JP)); Prof. SHIMIZU, Suguru (Osaka University(JP)); Prof. IGARASHI, Youichi (KEK); Prof. YAMAZAKI, Hirohito (Tohoku University(JP)); Prof. HASINOFF, Mike (University of British Columbia (CA))

Presenter(s) : KOBAYASHI, Aine (University of Tokyo (JP))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **399** Type : **Oral**

Development of a Small Form Factor (6cm x 6cm) Picosecond Photodetector as a Path Towards the Commercialization of 20cm x 20cm Large Area Pico-second Photodetector Devices with Incom Inc.

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

The Large Area Picosecond Photo-Detector Collaboration (LAPPD) is currently developing a large-area, modular photo-detector system composed of thin, planar, glass-body modules, each with two 20cm x 20cm ALD-functionalized MCPs in a chevron geometry. The collaboration is working closely with industry partner Incom, Inc. towards the commercialization of this technology. One of the major challenges has been to successfully seal a top window to the hermetic glass package module. The collaboration is pursuing multiple sealing techniques; one a hot solder sealing technique and a second thermo-compression sealing technique. In this talk, I will present results from a thermo-compression seal of a top window to a 20cm x 20cm glass package module with a pump out port for leak checking the seal and describe the path towards commercialization of the 20cm x 20cm devices with Incom, Inc. As an intermediate step towards building a full system for making 20cm x 20cm devices, but independent from the LAPPD collaboration, Argonne has also developed a small form-factor (6cm x 6cm) photodetector development facility consisting of a four vacuum chamber system: loadlock, bake and scrub chamber, photocathode deposition chamber, and sealing chamber. Successful thermo-compression sealing of the 6cm x 6cm photodetector prototypes at the Argonne development facility has been accomplished in the sealing chamber. The entire system has recently undergone a bakeout and is currently achieving an ultra-high vacuum base pressure throughout the system with photocathode fabrication underway. An overview of results from the first working 6cm x 6cm active area detectors based on the ALD micro-channel plate, all glass body technology will be presented as available.

Summary

Primary author(s) : BYRUM, Karen (Argonne National Lab)

Co-author(s) : Dr. BENNIS, Daniel (Incom, Inc.); Dr. CRAVEN, Christopher (Incom, Inc.); Dr. DEMARTEAU, Marcel (Argonne National Laboratory); Dr. ELAM, Jeffrey (Argonne National Laboratory); Dr. GREGAR, Joseph (Argonne National Laboratory); Dr. MANE, Anil (Argonne National Laboratory); Dr. MINOT, Michael (Incom, Inc.); Dr. O'MAHONY, Aileen (Incom, Inc.); Dr. RENAUD, Joseph (Incom, Inc.); Dr. VIRGO, Mathew (Argonne National Laboratory); Dr. WAGNER, Robert (Argonne National Laboratory); Dr. WALTERS, Dean (Argonne National Laboratory); Dr. WANG, Xing (Argonne National Laboratory); Dr. XIA, Lei (Argonne National Laboratory); Dr. XIE, Junqi (Argonne National Laboratory)

Presenter(s) : BYRUM, Karen (Argonne National Lab)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **299** Type : **Oral**

Development of a continuous radon monitor

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

A continuous radon monitor with high sensitivity for radon based on electrostatic collection has been developed. Energy of alpha particle emission from 218Po and 214Po has been discriminated by alpha spectrometry, and an iterative correction factor has been applied to determine residual 218Po particle effect of one measurement on the next and second, then the actual counts of 218Po have been achieved.An automatic compensation method for detection efficiency of 218Po particle influenced by temperature and humidity was also introduced. The continuous radon monitor is able to trace the change of radon concentration quickly and accurately under different absolute humidity without drying tube. It is suitable for long-term continuous measurement of radon concentration in the environment of various temperatures and humidity without guarded.

Summary

Primary author(s) : Prof. XIAO, Detao (University of South China, Hengyang China)

Co-author(s) : Mr. HE, Zhengzhong (University of South China,Hengyang China); Mr. SHAN, Jiang (University of South China,Hengyang China); Mr. ZHOU, Qingzhi (University of South China,Hengyang China); Mr. LI, Zhiqiang (University of South China,Hengyang China)

Presenter(s) : Prof. XIAO, Detao (University of South China, Hengyang China)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **81** Type : **Oral**

Development of solid xenon detectors for low-background experiments

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

In modern astroparticle physics, noble gases are often chosen as detector material for a wide range of different experiments. Noble gases can provide a very long electron drift distance which is required for large-scale low-background experiments such as the search for dark matter or for the neutrinoless double beta decay.
Due to the higher density, xenon is often used in the liquid instead of gaseous state, which allows a larger detection mass at constant volume. However, solid xenon detectors could provide additional advantages over liquid xenon setups.
We present the results of recent experiments on large xenon crystals grown from the liquid phase. We successfully measured the scintillation light from ionizing radiation in the crystal and compared it to Monte Carlo simulations. Also, we studied the drift of electrons over several centimeters. The results suggest a higher drift velocity and a better collection efficiency of secondary electrons than in the case of liquid xenon.
Our work is the basis of the future development of new kind of TPC using solid xenon in combination with the Timepix detector. It would benefit from the excellent electron drift characteristics of xenon. A new detector design involving both solid xenon and the Timepix detector will be presented.

Summary

Primary author(s) : Mr. WAGENPFEIL, Michael (ECAP)

Co-author(s) : Mr. FILIPENKO, Mykhaylo (ECAP); Dr. YOO, Jonghee (Fermi National Accelerator Laboratory); Dr. MICHEL, Thilo (ECAP); Dr. PAHLKA, Benton (Fermi National Accelerator Labratory); Prof. ANTON, Gisela (ECAP)

Presenter(s) : Mr. WAGENPFEIL, Michael (ECAP)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **55** Type : **Oral**

Development of technological prototype of silicon-tungsten electromagnetic calorimeter for ILD.

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

The best jet energy resolution required for precise physics measurements at ILC is achievable using a Particle Flow Algorithm (PFA) and highly granular calorimeters. As it was shown by CALICE international R&D collaboration, the silicon-tungsten imaging electromagnetic calorimeter provides the best granularity and jet resolution. After proving the PFA concept with physical prototypes in 2006-2011, an emphasis is now moved to building a technological prototype satisfying challenging physical, mechanical, electronic and thermal requirements. All chosen technologies should be reliable and scalable for a mass production of a future detector. We report on the current status of R&D, in particular, on beam, cosmic and charge injection tests of the technological prototype and on the tests of ECAL mechanical structure with embedded fiber Bragg grating optical sensors. We also report on our plans to build a realistic almost full-scale prototype detector of 1-1.5 m length and test it together with an existing 600 kg carbon fiber - tungsten mechanical structure in 2015 at CERN beams.

Summary

Primary author(s) : CORNAT, Remi Jean Noel (Ecole Polytechnique (FR)); Dr. ANDUZE, Marc (LLR); BALAGURA, Vladislav (Ecole Polytechnique (FR))

Co-author(s) : ON BEHALF OF ALL ILD SIW ECAL GROUP, . (.)

Presenter(s) : BALAGURA, Vladislav (Ecole Polytechnique (FR))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **194** Type : **Oral**

Development of the upgraded LHCf calorimeter with Gd2SiO5 (GSO) scintillators.

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The Large Hadron Collider forward (LHCf) experiment is designed to measure the hadronic production cross sections of neutral particles emitted in the very forward angles in p-p collision at the LHC. LHCf has reported energy spectra of forward photons and neutral pions at $\sqrt{s}$ = 900 GeV and 7 TeV proton-proton collisions measured at LHC. Forward spectra can be helpful in verifying cosmic ray interaction models. The next operation in 2015 is expected under much higher radiation dose. Therefore, we are upgrading the detectors, especially their scintillators, to be radiation harder one. Plastic scintillator layers and Scintillating Fiber (SciFi) tracker are replaced with GSO layers and fine GSO hodoscope respectively. Basic properties of new sensors of the upgraded detector are measured by 400 MeV/n carbon beams at the Heavy Ion Medical Accelerator in Chiba (HIMAC) in June, 2012. Energy resolution and position resolution of the upgraded detector are evaluated by using electron beams of 50-250 GeV at Super Proton Synchrotron (SPS) in summer, 2012.
The results are understood by Monte Carlo simulations and are good enough for the requirements of the LHCf experiment.

Summary

Primary author(s) : Mr. MAKINO, Yuya (STEL, Nagoya University)

Co-author(s) : Prof. ITOW, Yoshitaka (STEL, Nagoya University); SUGIURA, Yuki (STEL, Nagoya University); MENJO, Hiroaki (Nagoya University (JP)); YOSHIDA, Kenji (Shibaura Institute of Technology (JP)); KASAHARA, Katsuaki (Waseda University (JP)); SHIMIZU, Yuki (Waseda University); SUZUKI, Takuya (Waseda University); TORII, Shoji (Waseda University (JP)); TAMURA, Tadahisa (Kanagawa University (JP)); HAGUENAUER, Maurice (Ecole Polytechnique Federale de Lausanne (CH)); TURNER, William C (Lawrence Berkeley Laboratory); KAWADE, Kentaro (N); ADRIANI, Oscar (Dipartimento di Fisica); BONECHI, Lorenzo (Istituto Nazionale di Fisica Nucleare (INFN)); BONGI, Massimo (Universita e INFN (IT)); D'ALESSANDRO, Lel (Universita e INFN (IT)); DELPRETE, Marina (Universita e INFN (IT)); MITSUKA, Gaku (Nagoya University (JP)); PAPINI, Paolo (INFN sezione di Firenze); Dr. RICCIARINI, Sergio Bruno (INFN); CASTELLINI, Guido (Dipartimento di Fisica); TRICOMI, Alessia (Universita e INFN (IT)); Dr. MASUDA, Kimiaki (STEL, Nagoya University); FAUS-GOLFE, Angeles (Instituto de Fisica Corpuscular (IFIC) UV-CSIC); PERROT, Anne-Laure (CERN); GRANDI, M. (Universita e INFN (IT)); VELASCO, J. (IFIC, Centro Mixto CSIC-UVEG, Spain); Dr. MATSUBARA, Yutaka (STEL, Nagoya University); MATSUBAYASHI, Eri (STEL, Nagoya University); Prof. MURAKI, Yasushi (STEL, Nagoya University); SAKO, Takashi (Nagoya University (JP)); Dr. SAKURAI, Nobuyuki (STEL, Nagoya University); ZHOU, Qidong (STEL, Nagoya University)

Presenter(s) : Mr. MAKINO, Yuya (STEL, Nagoya University)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **90** Type : **Oral**

Development of thin n-in-p pixel modules for the ATLAS upgrade at HL-LHC

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

We present the results of the characterization performed on n-in-p pixel modules produced with thin sensors, ranging in thickness from 100 to 200 µm, assembled to the ATLAS FE-I3 and FE-I4 read-out chips. Among these samples, the sensors produced at VTT (Finland), 100 µm thick, have been processed to obtain active edges, which considerably reduce the dead area at the periphery of the device down to 50 µm per side. This feature, together with the very reduced material budget, makes them attractive candidates to instrument the inner layers of the upgraded pixel system at HL-LHC. n-in-p sensors, 200 µm thick, with a standard guard-ring, produced by CIS (Germany) are manufactured without an handle-wafer and they represent reliable and cost-effective detectors to cover the large surface of the outer layers of the new pixel system. The different flavors of n-in-p pixel sensors are characterized by means of scans with radioactive sources and beam tests at the CERN-SPS and DESY. The results of these measurements will be discussed for devices before and after irradiation up to a fluence of 1.5x1016 neq cm-2 . The charge collection and tracking efficiency will be compared for the different sensor thicknesses.

Summary

Primary author(s) : MACCHIOLO, Anna (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Co-author(s) : PASCHEN, Botho Albrecht (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); Dr. NISIUS, Richard (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); TERZO, Stefano (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); WEIGELL, Philipp (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Presenter(s) : MACCHIOLO, Anna (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **409** Type : **Oral**

Developments in light readout for noble liquid experiments

Monday, 2 June 2014 17:10 (0:20)

Abstract content

SiGHT stays for Silicon Geiger Hybrid Tube for light detection. Our goal is to construct a modern, high performance, low radioactivity photo detector working at liquid argon and xenon temperature. The idea is to replace the classical dynodic chain of a PMT with a SiPM acting as an electron multiplying detector embedded in a low-radioactive fused silica envelope. This invention would represent a major breakthrough for the experiments of direct dark matter search with noble liquids. The status of the art of the project as well as preliminary results will be illustrated in this talk.

Summary

Primary author(s) : FIORILLO, Giuliana (Università degli Studi di Napoli "Federico II" e INFN (IT)); ROSSI, Biagio (Universita e INFN (IT))

Presenter(s) : ROSSI, Biagio (Universita e INFN (IT))

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **339** Type : **Oral**

Diamond Detectors for beam instrumentation

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

Diamond is perhaps the most versatile, efficient and radiation tolerant material available for use in beam detectors with a correspondingly wide range of applications in beam instrumentation. Numerous practical applications have demonstrated and exploited the sensitivity of diamond to charged particles, photons and neutrons. In this presentation, emphasis will be given to fast beam loss monitoring at the LHC and to neutron detection, where diamond can potentially be used as an He-3 replacement.

Summary

Diamond detectors have proven to be useful as fast beam loss instrumentation. At the LHC bunch-by-bunch losses are resolved and lead to new insight into the behaviour of the accelerator. Recent research has shown that diamond is also a proper candidate for neutron detection, where it proves to be a potential candidate to replace He-3 in the future.

Primary author(s) : Dr. ERICH, Griesmayer (CIVIDEC Instrumentation)

Co-author(s) : Mr. KAVRIGIN, Pavel (CIVIDEC)

Presenter(s) : Dr. ERICH, Griesmayer (CIVIDEC Instrumentation)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **262** Type : **Oral**

Diamond particle detectors systems in high energy physics

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

With the first three years of the LHC running complete, ATLAS and CMS are planning to upgrade their innermost tracking layers with more radiation hard technologies. Chemical Vapor Deposition (CVD) diamond is one such technology. CVD diamond has been used extensively in beam condition monitors as the innermost detectors in the highest radiation areas of BaBar, Belle, CDF and all LHC experiments. This talk will describe the lessons learned in constructing the ATLAS Beam Conditions Monitor (BCM), Diamond Beam Monitor (DBM) and the CMS Pixel Luminosity Telescope (PLT) all of which are based on CVD diamond with the goal of elucidating the issues that should be addressed for future diamond based detector systems. The talk will also present the first beam test results of prototype diamond devices with 3D detector geometry that should further enhance the radiation tolerance of this material.

Summary

Primary author(s) : TRISCHUK, William (University of Toronto (CA))

Co-author(s) : KAGAN, Harris (Ohio State University); OTHER, Members of (The RD42 Collaboration)

Presenter(s) : Prof. GAN, Kock Kiam (Ohio State University (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **237** Type : **Oral**

Direct Dark Matter Detection with the XENON and DARWIN experiments

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The XENON1T detector, currently under construction at the Gran Sasso Underground Laboratory (LNGS) in Italy, is a dual-phase (liquid-gas) xenon time-projection chamber (TPC) for particle detection. It is the successor of XENON100, which reached its sensitivity goal with the last limits on spin-independent WIMP-nucleus interaction (2e-45 cm^2 at 55GeV/c^2), the world-leading result at the time of publication. The construction of the water tank, to be employed as a shield for environmental radiation and as a Cerenkov muon veto, has ended at LNGS in 2013, most other subsystems are currently under construction. The total amount of xenon to be housed in the XENON1T cryostat is 3t, with a fiducial mass of about 1t. In order to detect the prompt and proportional VUV scintillation light from particle interactions with the xenon target, two arrays of 3-inch Hamamatsu R11410 photomultiplier tubes will be installed on the top and bottom of the TPC. The assembly of the inner detector components is planned for late 2014, and the science goal can be reached after two years of continuous operation by 2017. The next step in the XENON dark matter search program is the XENONnT project. It will double the amount of xenon in the sensitive volume (~6t), which would allow to fiducialize the target to ~4t. The XENONnT TPC with the inner cryostat vessel will be constructed while XENON1T is taking data, and will be installed in the same outer vessel and the water shield as XENON1T. The exploration of the entire experimentally accessible WIMP parameter space, down to a region where solar neutrino interactions become an irreducible background (and eventually provide a possibility to precisely measure their low-energy spectrum in real-time), is foreseen with an ultimate experiment at the 20 ton scale. The design and R&D works for such a project were initiated by the DARWIN (DArk Matter WImp search with Noble Liquids) consortium. In this talk, the current status and the plans of the XENON collaboration will be presented, with focus on the design details of the XENON1T experiment, as well as on the future multi-ton DARWIN project.

Summary

Primary author(s) : Dr. KISH, Alex (Physik-Institut UZH)

Presenter(s) : Dr. KISH, Alex (Physik-Institut UZH)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **120** Type : **Oral**

Electrode material and Detector Response for Gaseous detectors

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The gaseous detectors can be used in variety of applications including particle detection, medical imaging and radiological applications. We will present an extensive study of optical, structural and electrical properties performed for different electrode materials for gaseous detectors such as Resistive Plate Chambers. We also present the gas mixture composition studies with different gases for their detector performance and response. We include study on the variation of efficiency, counting rate over the period of operation and the leakage current dependence upon the temperature and humidity for different sizes of detectors. We hereby also cover similar but preliminary results on GEM detector.

Summary

Primary author(s) : Dr. KUMAR, Ashok (University of Delhi (IN))

Presenter(s) : Dr. KUMAR, Ashok (University of Delhi (IN))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **4** Type : **Oral**

Electron Test Beams at SLAC

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

We present the current status and plans of the various electron test beams available at SLAC National Accelerator Laboratory. They span an energy range of a few MeV in our ASTA, mainly used for gun development and RF structure testing, NLCTA, a 120 to 200 MeV linac for free electron laser seeding, dielectric laser acceleration and medical studies, to ESTB, the End Station (A) Test Beam, which uses 5 Hz of the LCLS 2 to 16GeV beam for ILC MDI and detector R&D studies with primary beam and singel electrons, to FACET, which has a very compressed and small spot size 20GeV beam for plasma wakefield acceleration, material science and other advanced acceleration concepts studies. For all these facilities an overview of past, present and future experiments and plans will be given.

Summary

Primary author(s) : Dr. HAST, Carsten (SLAC)

Presenter(s) : Dr. HAST, Carsten (SLAC)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **29** Type : **Oral**

EndoTOFPET-US: a novel multimodal tool for endoscopy and positron emission tomography

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

The EndoTOFPET-US project aims to jointly exploit Time-Of-Flight Positron Emission Tomography (TOFPET) and ultrasound endoscopy with a multi-modal instrument for diagnostic and therapeutic oncology. The development of two novel detectors is required, a PET head extension for a commercial US endoscope placed close to the region of interest (ROI) and a PET plate over the patient's abdomen in coincidence with the PET head. Technological challenges include: 1 mm image spatial resolution (SR), an unprecedented 200ps Coincidence Time Resolution (CTR) for enhanced background rejection, online tracking of both detectors and image reconstruction of images with partial volume information from an asymmetric geometry. The paper will present results achieved with the first prototype components of the EndoTOFPET-US detector. Characterization of 4096 LYSO crystals glued to 256 Hammamatsu MPPC matrices of 4x4 photo-detectors each, performance tests of two candidate ASIC chips for fast TOF readout, and performance studies of the digital silicon-photomultiplier detector for the endoscopic probe will be presented. The first system integration measurements will be shown, which demonstrate that the requirements in terms of SR and CTR are at reach.

Summary

Primary author(s) : GARUTTI, Erika (DESY)

Presenter(s) : GARUTTI, Erika (DESY)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **32** Type : **Oral**

Energy measurement with the SDHCAL prototype

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

The SDHCAL prototype that was completed in 2012 was exposed to beams of pions, electrons of different energies at the SPS of CERN for a total time period of 5 weeks. The data are being analyzed within the CALICE collaboration. However preliminary results indicate that a highly granular hadronic calorimeter conceived for PFA application is also a powerful tool to separate pions from electrons. The SDHCAL provides also a very good resolution of hadronic showers energy measurement. The use of multi-threshold readout mode shows a clear improvement of the resolution at energies exceeding 30 GeV with respect to the binary readout mode. New ideas to improve on the energy resolution using the topology of hadronic showers will be presented.

Summary

Primary author(s) : Dr. PETRUKHIN, Alexey (IPNL/CNRS)

Presenter(s) : Dr. PETRUKHIN, Alexey (IPNL/CNRS)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **134** Type : **Oral**

Energy response and temperature dependence of Ce:GAGG and Pr:LuAG coupled to SiPM

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

Molecular imaging modalities require sensor systems capable of detecting and identifying gamma rays emitted by radio-tracers as well as providing the complete position information. The combination of dense, new scintillator materials with compact photon detector solutions insensitive to magnetic fields provides a promising prospect to meet the requirements in modern combined molecular imaging modalities. The energy response and temperature dependence of both, the scintillator and photon sensor has been studied for two scintillator materials, Pr:LuAG and Ce:GAGG coupled to either a n-on-p or p-on-n type SiPM. The performance was compared to a CsI crystal coupled to a conventional small vacuum based photon sensor.

Summary

We studied new combinations of inorganic scintillators and SiPM in comparison to more established technologies to evaluate their suitability for nuclear imaging modalities in medicine.

Primary author(s) : Dr. SEITZ, Bjoern (University of Glasgow)

Co-author(s) : Dr. STEWART, Andrew (University of Glasgow); Mr. KAHLENBERG, Jan (University of Glasgow)

Presenter(s) : Dr. SEITZ, Bjoern (University of Glasgow)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **48** Type : **Oral**

Engineering studies for the inner region of the CLIC detector concepts

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

The strict requirements in terms of material budget for the inner region of the CLIC detector concepts require the use of a dry gas for the cooling of the respective sensors. This, in conjunction with the compactness of the inner volumes, poses several challenges for the design of a cooling system that is able to fulfil the required detector specifications. This presentation introduces a detector cooling strategy using dry air as a coolant and shows the results of computational fluid dynamics simulations and experimental measurements used to validate the proposed strategy. Furthermore, the progress on the development of lightweight detector support structures that fulfil both mass and stiffness requirements is also reported.

Summary

Primary author(s) : DUARTE RAMOS, Fernando (CERN)

Co-author(s) : NUIRY, Francois-Xavier (CERN); KLEMPT, Wolfgang (CERN); VILLAREJO BERMUDEZ, Miguel-Angel (Universidad de Valencia (ES))

Presenter(s) : DUARTE RAMOS, Fernando (CERN)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **71** Type : **Oral**

Evolution of the ReadOut System of the ATLAS experiment

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The ReadOut System (ROS) is a central and essential part of the ATLAS DAQ system. It receives and buffers data of events accepted by the first-level trigger from all subdetectors and first-level trigger subsystems. Event data are subsequently forwarded to the High-Level Trigger system and Event Builder via a 1 GbE-based network. The ATLAS ROS is completely renewed in view of the demanding conditions ex pected during LHC Run 2 and Run 3, to replace obsolete technologies and space constraints require it to be compact. The new ROS will consist of roughly 100 Linux-based 2U high rack mounted server PCs, each equipped with 2 PCIe I/O cards and two four 10 GbE interfaces. The FPGA-based PCIe I/O cards, developed by the ALICE collaboration, will be configured with ATLAS-specific firmware, the so-called RobinNP firmware. They will provide the connectivity to about 2000 optical point-to-point links conveying the ATLAS event data. This dense configuration provides an excellent test bench for studying I/O efficiency and challenges in current COTS PC architectures with non-uniform memory and I/O access paths. In this paper we will report on the requirements for Run 2 and on design choices for a system complying with and possibly exceeding them, as well as discuss the results of performance measurements for different computer architectures, highlighting the effects of non-uniform resource distributions. Finally we will present the status of the project and outlook for operation in 2015.

Summary

Primary author(s) : Dr. SALVATORE, Fabrizio (University of Sussex (GB))

Presenter(s) : VANDELLI, Wainer (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **160** Type : **Oral**

Experimental results for the Cherwell 1 and 2 MAPS sensors

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

We report on the status and performance of the CMOS Monolithic Active Pixel Sensor (MAPS) Cherwell 1 and 2 sensors for the detection of charged particles in vertexing, tracking, and calorimetry applications. Cherwell is a 4-T CMOS sensor in 180 nm technology on a 12um epitaxial substrate with low-noise, low-power, in-pixel correlated double sampling, and high conversion gain.
Cherwell 1 consists of four arrays, two optimized for vertexing and tracking applications, and two for digital calorimetry applications. The vertexing arrangements have a matrix of 96x48 pixels with a pitch of 25 um. The "reference array" is readout on a rolling shutter base with a fine resolution 12-bit, single-slope column parallel ADC. The "strixel" array has the readout and ADC circuits embedded in the space between the pixel diodes. The two sections for calorimetry have a matrix of 96x48 pixels with 25 um pitch and 48x24 pixels with 50 um pitch, respectively. Additional circuitry is added to provide charge summing of 2x2 pixels during readout.
Cherwell 2 is a prototype candidate sensor to be used in the upgrade of the ALICE Inner Tracker System at the LHC. It has three variants of a 128x128 pixel array on a 20um pitch using the strixel technology.
We report on the characterisation and performance of the prototypes, on the test bench and at the test beam.

Summary

Performance of two prototype CMOS MAPS sensors.

Primary author(s) : WILSON, Fergus (STFC - Rutherford Appleton Lab. (GB))

Co-author(s) : BEVAN, Adrian (University of London (GB)); TURCHETTA, renato (ral-stfc); LEMMON, Roy Crawford (STFC Daresbury Laboratory (GB)); VELTHUIS, Jaap

Presenter(s) : WILSON, Fergus (STFC - Rutherford Appleton Lab. (GB))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **291** Type : **Oral**

Fiber based hydrophones for ultra-high energy neutrino detection

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

It is a well studied process [1,2] of energy deposition of cosmic ray particles in water that generate thermo-acoustic signals. Hydrophones of sufficient sensitivity could measure this signal and provide a means of detecting ultra-high energetic cosmic neutrinos. We investigate optical fiber-based hydrophone technology that could potentially have several advantages over conventional hydrophones based on piezo ceramics. Optical fibers form a natural way to create a distributed sensing system in which several sensors are attached to a single fiber. The detection system in this case will consist of several sensors, an erbium doped fiber laser and an interferometric interogator. Next to the advantage of having multiple sensors on a single fiber, this technology has a low power consumption and no electromagnetic interference with other read-out electronics. Maybe even more important, fiber optics technology provides a cost-effective and straightforward way to implement a large number of hydrophones. This allows to establish a large scale experimental set-up with multi km^3 detection volume that is required for the expected low event rate of neutrino interactions at energies exceeding 10 PeV.
In this talk we will show the results of several measurement campaigns, e. g. in an anechoic bassin for calibration and hydrophone sensitivity measurements. Based on these measurements and realistic simulations we will investigate the feasibility of a potential future large scale neutrino detector based on fiber-based hydrophones.
1 G. A. Askaryan. Acoustic recording of neutrinos. Zemlia i Vselennaia 1 p13 (1979).
[2] J. G. Learned. Acoustic radiation by charged atomic particles in liquids: An analysis. Phys. Rev. D 19 p 3293 (1979).

Summary

Primary author(s) : Dr. BUIS, Ernst-Jan (TNO)

Co-author(s) : Mr. NIEUWLAND, Remco (TNO); Mr. TOET, Peter (TNO); Mr. DOPPENBERG, Ed (TNO); Dr. VAN EIJK, Daan (TNO); Dr. LAHMANN, Robert (Erlangen Centre for Astroparticle Physics, University of Erlangen)

Presenter(s) : Dr. BUIS, Ernst-Jan (TNO)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **60** Type : **Oral**

Fine Segmented Scintillator ECAL

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

The idea of using scintillator strips coupled with Pixelated Photon-Detector(PPD) has provided the ILD an electromagnetic calorimeter(ECAL) option with a lower cost. In the FNAL 2009 beam test, it was found that the prototype calorimeter of 30 layers could meet the stringent requirements of the ILD. Following this, efforts has been made to develop a more feasible ECAL in terms of performance, size and cost. With a more compact readout electronics and improved PPD, 2 layers of embedded front end electronics technological prototype was fabricated using 3 layers of 180x180mm^2 ECAL base unit(EBU), in which each EBU has 144 channels of 45x5mm scintillator strip coupled with the improved PPD. The two layers are arranged orthogonally and by using the Strip Splitting Algorithm(SSA), we could create a fine granularity of 5x5mm^2 for the Particle Flow Algorithm application. The layers were tested at DESY and the results of this beam test shall be presented. In addition, various studies has been made on the scintillator strip in order to further improve the ScECAL's performance such as to reduce the dead volume by PPD etc. The findings of these studies shall also be discussed and compared with the simulation results.

Summary

The ScECAL technological prototype shows no significant problems operating in a multilayer configuration and the SSA works well. The results from the beam test shows good energy deposit, low noisy or dead channel ratio and good scintillator uniformity. By modifying the scintillator strip shape and configuration, these performance can be further improved.

Primary author(s) : HAMASAKI, Ryutaro (Shinshu University); IEKI, Sei (University of Tokyo); KOTERA, Katsushige (Shinshu University); OGAWA, Tomohisa (Shinshu University); Dr. OOTANI, Wataru (ICEPP, University of Tokyo); Prof. TAKESHITA, Toru (Shinshu University (JP)); TEH, Lloyd (Shinshu University); TSUZUKI, Takuya (Shinshu University)

Presenter(s) : TEH, Lloyd (Shinshu University)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **281** Type : **Oral**

Firmware development and testing of the ATLAS IBL Back-Of-Crate card

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The ATLAS experiment is the the largest of the four LHC experiments. Currently its Pixel-Detector is being upgraded with a new innermost 4th layer, the Insertable b-Layer (IBL). The upgrade will result in better tracking efficiency and compensate radiation damages of the Pixel-Detector. Newly developed front-end electronics (FE-I4) will require a complete re-design of the Off-Detector- Electronics consisting of the Back-Of-Crate card (BOC) and the Read-Out-Driver (ROD). The main purpose of the BOC card is the distribution of the LHC clock to all Pixel-Detector components as well as interfacing the detector and the higher-level-readout optically. It is equipped with three Xilinx Spartan-6 FPGAs, one BOC Control FPGA (BCF) and two BOC Main FPGAs (BMF). The BMF are responsible for the signal processing of all incoming and outgoing data. The data-path to the detector is running a 40 MHz bi-phase-mark encoded stream. This stream is delayed by a fine delay block using Spartan-6 IODELAY primitives. The primitives are reconfigured using partial reconfiguration inside the FPGA. The 160 MHz 8b10b-encoded data-path from the detector is phase and word-aligned in the firmware and then forwarded to the ROD after decoding. The ROD it will send out the processed data which is then forwarded to the higher-level readout by the BOC card. An overview of the firmware, which has been developed, will be presented together with the results from production tests and the system test at CERN. One focus will be the partial reconfiguration and the results of the fine delay measurements.

Summary

For the new innermost layer of the ATLAS Pixel-Detector at CERN new off-detector hardware needs to be developed. The Back-Of-Crate card (BOC) is driving the optical interface to the detector and distributing the LHC clock to all detector components. A brief overview of the firmware and test results from production and system test will be presented. Abstract

Primary author(s) : WENSING, Marius (Bergische Universitaet Wuppertal (DE))

Co-author(s) : FLICK, Tobias (Bergische Universitaet Wuppertal (DE)); BINDI, Marcello (Georg-August-Universitaet Goettingen (DE)); MATTIG, Peter (Bergische Universitaet Wuppertal (DE)); KUGEL, Andreas (Ruprecht-Karls-Universitaet Heidelberg (DE)); FALCHIERI, Davide (Universita e INFN (IT)); TRAVAGLINI, Riccardo (Universita e INFN (IT)); GABRIELLI, Alessandro (Universita e INFN (IT)); HEIM, Timon (Bergische Universitaet Wuppertal (DE)); POTAMIANOS, Karolos (Lawrence Berkeley National Lab. (US)); GROSSE-KNETTER, Joern (Georg-August-Universitaet Goettingen (DE))

Presenter(s) : WENSING, Marius (Bergische Universitaet Wuppertal (DE))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **283** Type : **Oral**

Firmware development and testing of the ATLAS Pixel Detector / IBL ROD card

Friday, 6 June 2014 11:20 (0:20)

Abstract content

The ATLAS Experiment is reworking and upgrading systems during the current LHC shut down. In particular, the Pixel detector is inserting an additional inner layer called Insertable B-Layer (IBL). The Readout-Driver card (ROD), the Back-of-Crate card (BOC), and the S-Link together form the essential frontend data path of the IBL's off-detector DAQ system. The strategy for IBLROD firmware development focused on migrating and tailoring HDL code blocks from PixelROD to ensure modular compatibility in future ROD upgrades, in which a unified code version will interface with IBL and Pixel layers. Essential features such as data formatting, frontend-specific error handling, and calibration are added to the ROD data path. An IBLDAQ testbench using realistic frontend chip model was created to serve as an initial framework for full offline electronic system simulation. In this document, major firmware achievements concerning the IBLROD data path implementation, tested in testbench and on ROD prototypes, will be reported. Recent Pixel collaboration efforts focus on finalizing hardware and firmware tests for IBL. Time plan is to approach a final IBL DAQ phase by the end of 2014.

Summary

Primary author(s) : TRONCON, Clara (Milano Universita e INFN (IT)); CHEN, Shaw-Pin (University of Washington (US))

Presenter(s) : CHEN, Shaw-Pin (University of Washington (US))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **119** Type : **Oral**

First Measurements of SuperCDMS SNOLAB 100 mm Diameter Germanium Dark Matter Detectors with Interleaved Charge and Phonon Channels

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

The first phase of the Super Cryogenic Dark Matter Search (SuperCDMS) SNOLAB experiment shall consist of a 110 kg array of germanium and silicon athermal phonon detectors. It is expected to reach an order of magnitude better sensitivity than has been achieved so far by the best experiments in the field. The technical challenges of commissioning a payload of this size have led to the development of 1.4 kg germanium detectors (100 mm diameter, 33 mm thick), which are 2.3 times larger than those presently in use in the SuperCDMS experiment at Soudan. The first results from testing of a prototype detector with interleaved phonon and charge channels are presented. The test results are promising for the use of these detectors in the next phase of SuperCDMS.

Summary

Primary author(s) : Dr. CHAGANI, H. (University of Minnesota)

Co-author(s) : Dr. BAUER, D. A. (Fermi National Accelerator Laboratory); Dr. HALL, J. (Fermi National Accelerator Laboratory); Dr. HASI, J. (SLAC National Accelerator Laboratory); Mr. HANSEN, S. (Fermi National Accelerator Laboratory); Dr. KELSEY, M. (SLAC National Accelerator Laboratory); Ms. KENNEDY, A. (University of Minnesota); Dr. KENNEY, C. J. (SLAC National Accelerator Laboratory); Dr. LEMAN, S. W. (Massachusetts Institute of Technology); Prof. MANDIC, V. (University of Minnesota); Dr. MIRABOLFATHI, N. (University of California, Berkeley); Mr. MONIN, S. (University of Minnesota); Dr. BRANDT, D. (SLAC National Accelerator Laboratory); Mr. NAGASAWA, D. (Stanford University); Dr. NOVAK, L. (Stanford University); Dr. PARTRIDGE, R. (SLAC National Accelerator Laboratory); Mr. PHENICIE, C. (University of Minnesota); Mr. PAGE, K. (Queen's University Kingston); Dr. PYLE, M. (University of California, Berkeley); Ms. RADPOUR, R. (University of Minnesota); Prof. RAU, W. (Queen's University Kingston); Mr. RESCH, R. (SLAC National Accelerator Laboratory); Prof. SADOULET, B. (University of California, Berkeley); Dr. BRINK, P. L. (SLAC National Accelerator Laboratory); Mr. SEITZ, D. N. (University of California, Berkeley); Dr. SERFASS, B. (University of California, Berkeley); Dr. SHANK, B. (Stanford University); Mr. STRANDBERG, D. (University of Minnesota); Dr. TOMADA, A. (SLAC National Accelerator Laboratory); Dr. VILLANO, A. N. (University of Minnesota); Mr. YEN, J. (Stanford University); Prof. YOUNG, B. A. (Santa Clara University); Mr. ZHANG, J. (University of Minnesota); Prof. CABRERA, B. (Stanford University); Mr. CHERRY, M. (Stanford University); Mr. CODOREANU, G. A. (University of Minnesota); Dr. DO COUTO E SILVA, E. (SLAC National Accelerator Laboratory); Prof. CUSHMAN, P. (University of Minnesota); Dr. GODFREY, G. L. (SLAC National Accelerator Laboratory)

Presenter(s) : Dr. CHAGANI, H. (University of Minnesota)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **272** Type : **Oral**

First prototype of a silicon tracker using an 'artificial retina' for fast track finding

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

We report on the R&D for a first prototype of a silicon tracker with trigger capabilities based on a novel approach for fast track finding. The working principle is inspired from neurobiology, in particular by the processing of visual images by the brain as it happens in nature. It is based on extensive parallelization of data distribution and pattern recognition. In this work we report on the design of a practical device that consist of a telescope based on single-sided silicon detectors; we describe the data acquisition system and the implementation of the track finding algorithms using available digital logic of commercial FPGA devices. Tracking performance and trigger capabilities of the device are discussed along with perspectives for future applications.

Summary

Primary author(s) : NERI, Nicola (Università degli Studi e INFN Milano (IT))

Co-author(s) : ABBA, Andrea (Università degli Studi e INFN Milano (IT)); WALSH, John (Sezione di Pisa (IT)); PETRUZZO, Marco (Universita' di Milano & INFN Milano); Dr. CAPONIO, Francesco (INFN Milano); Prof. GERACI, Angelo (Politecnico di Milano & INFN Milano); COELLI, Simone (INFN Milano); MONTI, Mauro (INFN Milano); PIUCCIO, Alessio (Unversita' di Pisa & INFN Pisa); CITTERIO, Mauro (Università degli Studi e INFN Milano (IT)); MARINO, Pietro (Sezione di Pisa (IT)); MORELLO, Michael Joseph (SNS and INFN-Pisa); PUNZI, Giovanni (Sezione di Pisa (IT)); RISTORI, Luciano (INFN and Fermilab); SPINELLA, Franco (Sezione di Pisa (IT)); STRACKA, Simone (Sezione di Pisa (IT)); TONELLI, Diego (CERN)

Presenter(s) : NERI, Nicola (Università degli Studi e INFN Milano (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **224** Type : **Oral**

First results from a 10bar Xe-TPC with 1kg fiducial mass, read out with Micro-Pattern Gas Detectors

Friday, 6 June 2014 15:00 (0:20)

Abstract content

Microbulk-Micromegas constitutes a new generation of Micromegas (MICRO MEsh GAseous Structure) used for the detection and tracking of particles. Its simplicity, inherited from its constituent element –a double copper-clad kapton foil–, enhances its radiopurity, making it particularly well suited for Rare Event searches. The energy resolution is amongst the best obtained with Micro-Pattern Gaseous Detectors (MPGD), with potential for an extremely fine segmentation, at the 100um scale or better. Within the R&D framework of the NEXT-100 ββ0ν experiment, we have commissioned a medium-size 70-liter, 700cm2(readout) x 38cm(drift) Xenon TPC with an 8mm x 8mm pixelated-readout (dubbed NEXT-MM) and operated it up to 10bar pressure (1kg fiducial mass).
We will present a full 3D characterization of the system at 1, 3 and 10bar pressure for point-like electron tracks stemming from low-energy X-rays (30keV), as well as extended ones from gamma-ray interactions (511keV), of interest in the most appealing next generation Xenon-based experiments. Emphasis will be put on the achievable energy resolution, energy threshold and topological capabilities.
Xenon has been doped with a mild 1-2% content of TMA. Ionization-wise Xe-TMA forms a convenient Penning mixture while TMA is known to exhibit fluorescence in the near-visible range thus eventually allowing for S1 (primary scintillation) sensitivity.

Summary

Primary author(s) : GONZALEZ DIAZ, Diego (Universidad de Zaragoza (ES))

Presenter(s) : GONZALEZ DIAZ, Diego (Universidad de Zaragoza (ES))

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **35** Type : **Oral**

First years of running for the LHCb calorimeter system

Monday, 2 June 2014 17:30 (0:20)

Abstract content

The LHCb experiment is dedicated to precision measurements of CP violation and rare decays of B hadrons at the Large Hadron Collider (LHC) at CERN (Geneva). It comprises a calorimeter system composed of four subdetectors: an electromagnetic calorimeter (ECAL) followed by a hadron calorimeter (HCAL). In addition the system includes in front of them the Scintillating Pad Detector (SPD) and Pre-Shower (PS). They are used to select transverse energy hadron, electron and photon candidates for the first trigger level and they provides the identification of electrons, photons and hadrons as well as the measurement of their energies and positions.
The calorimeter has been pre-calibrated before its installation in the pit, and the calibration techniques have been tested with the data taken in 2010. During operation, hadronic, leptonic and photon triggers of particular interest for hadronic B decays and radiative decays are provided by the calorimeter system.
The design and construction characteristics of the LHCb calorimeter will be recalled. Strategies for monitoring and calibration during data taking will be detailed in all aspects. Scintillating fibres, plastics and photomultipliers suffer from ageing due to radiation damage or high currents. Different methods which are used to calibrate the detectors and to recover the initial performances will be presented. The performances achieved will be illustrated in selected channels of interest for B physics.

Summary

The LHCb experiment is dedicated to precision measurements of CP violation and rare decays of B hadrons at the Large Hadron Collider (LHC) at CERN (Geneva) [1, 2]. LHCb is a single-arm spectrometer with a forward angular coverage from approximately 10 mrad to 300 mrad. It comprises a calorimeter system composed of four subdetectors [3], selecting transverse energy hadron, electron and photon candidates for the first trigger level (L0), which makes a decision 4μs after the interaction. It provides the identification of electrons, photons and hadrons as well as the measurement of their energies and positions. The set of constraints resulting from these functionalities defines the general structure and the main characteristics of the calorimeter system and its associated electronics. A classical structure of an electromagnetic calorimeter (ECAL) followed by a hadron calorimeter (HCAL) has been adopted. In addition the system includes in front of them the Scintillating Pad Detector (SPD) and Pre-Shower (PS), which are two planes of scintillating pads separated by a 2.5 radiation length lead sheet, aimed at tagging the electric charge and the electromagnetic nature of the calorimeter clusters for the first level of trigger. ECAL, PS and SPD account for about 6000 channels each with three degrees of granularity, concentric around the beam pipe, namely, the inner, the middle and the outer parts. HCAL is made of about 1500 channels and is divided into two parts only. All four detectors are arranged in pseudo-projective geometry and follow the general principle of reading the light from scintillator tiles with wave-length shifting fibers, and transporting the light towards photomultipliers, all following the 25 ns readout. During operation, hadronic, leptonic and photon triggers of particular interest for hadronic B decays and radiative decays were provided by the calorimeter system. The calorimeter has been pre-calibrated before its installation in the pit, and each part of the calorimeter system follows a different strategy for calibration. The calibration techniques

have been tested with the data taken in 2010 and have evolved to improve performances taking benefit of the high statistics recorded. Detector ageing are scrutinized regularly. They affect detector response and trigger rates but the severity of the impact on data depends on the detector type and of its use. Calibration techniques are also used to compensate for these effects. Regularly, a precise calibration is derived from a large sample of pi0 from two separated photons. Short term effects are followed with electrons from conversion looking at the ratio of the deposited energy of the electron in the calorimeter to its momentum measured by the tracking system (E/p) in ranges of ~40 pb-1. Initial performances of the electromagnetic calorimeter and its expected resolution are recovered for pi0 and B decays including photons.
The design and construction characteristics of the LHCb calorimeter will be recalled. Strategies for monitoring and calibration during data taking will be detailed in all aspects. Scintillating fibres, plastics and photomultipliers suffer from ageing due to radiation damage or high currents. Different methods which are used to calibrate the detectors and to recover the initial performances will be presented. The performances achieved will be illustrated in selected channels of interest for B physics.
References: 1 LHCb Collaboration, The LHCb Detector at the LHC, JINST 3 S08005 (2008), and references therein. [2] LHCb collaboration, A large Hadron Collider Beauty experiment, Technical Proposal, CERN/LHCC 1998-004. [3] LHCb Collaboration, LHCb calorimeters Technical Design Report, Technical Design Report, CERN/LHCC 2000-036.

Primary author(s) : PERRET, Pascal (Univ. Blaise Pascal Clermont-Fe. II (FR))

Presenter(s) : PERRET, Pascal (Univ. Blaise Pascal Clermont-Fe. II (FR))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **129** Type : **Oral**

Frontend Electronics for high-precision single photo-electron timing

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

High-precision single photon timing with resolutions well below 100 ps is becoming increasingly important. It enables new detector designs, like the Time-of-Propagation DIRC of Belle II, or the TORCH upgrade for LHCb, and to improve existing designs, e.g. allow chromatic corrections in DIRCs. These applications have in common a high channel density, limited available space and low power consumption.
We report on Frontend Electronics developed for the PANDA Barrel DIRC. The customised design utilises high-bandwidth pre-amplifiers and fast discriminators providing LVDS output signals which can be directly fed into the TRBv3 readout using FPGA-TDCs with a precision better than 20ps RMS. The discriminators also provide Time-over-Threshold (ToT) information which can be used for walk corrections thus improving the obtainable timing resolution. Two types of cards, optimised for reading out 64-channel Photonis Planacon MCP-PMTs, were tested: one based on the NINO ASIC and the other, called PADIWA, on FPGA-based discriminators. Both types feature 16 channels per card, thus requiring four cards to read out one 64-channel MCP-PMT. Power consumption for the complete readout of one Planacon MCP-PMT is approx. 10W for the NINO FEE and approx. 5W for the PADIWA FEE.
The timing performance of the cards was tested with a fast laser system and also in a test experiment at the MAMI accelerator in Mainz using a small DIRC prototype to image Cherenkov patterns. In both cases, using the ToT information, a timing resolution of better than 100ps was found for the complete readout chain.

Summary

Primary author(s) : Dr. HOEK, Matthias (Johannes Gutenberg-Universitaet Mainz); Mr. CARDINALI, Matteo (Johannes Gutenberg-Universitaet Mainz)

Presenter(s) : Dr. HOEK, Matthias (Johannes Gutenberg-Universitaet Mainz); Mr. CARDINALI, Matteo (Johannes Gutenberg-Universitaet Mainz)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **170** Type : **Oral**

Future Upgrades for the PHENIX Experiment at RHIC: From sPHENIX to ePHENIX

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

The PHENIX Experiment at RHIC is planning a series of major upgrades that will enable a comprehensive measurement of jets in relativistic heavy ion collisions, provide enhanced physics capabilities for studying nucleon-nucleus and polarized proton collisions, and allow a detailed study of electron-nucleus collisions at a future Electron Ion Collider (eRHIC) at Brookhaven. These upgrades will include a number of major new detector systems. The first stage, sPHENIX, will utilize the former BaBar solenoid magnet and will include two new large calorimeters, one electromagnetic and another hadronic, for measuring jets in heavy ion collisions. These calorimeters will cover a region of ±1.1 in pseudorapidity and 2pi in phi, and will result in a factor of 6 increase in acceptance over the present PHENIX detector. Plans are also being developed to add a preshower detector in front of the electromagnetic calorimeter and additional tracking inside the magnet. The current RHIC schedule would allow the installation of sPHENIX to take place starting around 2017-2018 and begin taking data ˜2020. Following this, RHIC would be transformed into an Electron Ion Collider and additional detectors would be added to sPHENIX to convert it to ePHENIX which would serve as a detector for eRHIC. This would involve adding additional tracking in the form of a central TPC and a system of GEM trackers, a high resolution crystal endcap calorimeter, a forward electromagnetic and hadronic calorimeter, and a set of particle id detectors, including a DIRC, a gas RICH and an aerogel detector. This talk will discuss the evolution of the current PHENIX detector to sPHENIX and ePHENIX, the R&D that is being pursued to develop the various detectors that will be needed, and the opportunities and challenges for each of their technologies. A separate contribution to this conference will describe the central electromagnetic and hadronic calorimeters for sPHENIX, including results from a recent beam test of prototypes of both of these detectors at Fermilab.

Summary

The PHENIX Experiment has been running at RHIC since 2000 and has accumulated a wealth of data on relativistic heavy ion collisions, nucleon-nucleus collisions and polarized proton collisions. It is one of the major RHIC experiments that contributed to the discovery of the Quark Gluon Plasma and is still in operation today. It has been focused on the systematic study of the QGP near its critical temperature using a variety of different probes, but questions such as how and why the quark-gluon plasma behaves as a perfect fluid in the vicinity of strongest coupling (near 1–2 Tc) can only be fully addressed with jet observables at RHIC energies which probe the medium over a variety of length scales. Comparing these measurements with ones probing higher temperatures at the LHC will provide valuable insight into the thermodynamics of QCD. PHENIX in its present form covers roughly half of the full azimuthal acceptance and 0.7 units of rapidity with a suite of different detectors, including an electromagnetic calorimeter. In order to increase this coverage for a complete systematic study of jets, the PHENIX Collaboration is proposing a new upgraded detector, sPHENIX, that will utilize the former BaBar solenoid magnet and instrument it with two new calorimeters, one electromagnetic and one hadronic, that will cover the full azimuth

and 2.2 units of rapidity. The hadronic calorimeter will be a steel plate and scintillating tile design that is read out with wavelength shifting fibers and silicon photomultipliers (SiPMs). The EMCAL will be a tungsten-scintillating fiber design that will also be read out using SiPMs. There are also plans to add a silicon-tungsten preshower detector in front of the EMCAL. The initial tracking system for sPHENIX will utilize the existing PHENIX silicon vertex detector, and will add additional silicon tracking layers in the future. The current plan is to run with the existing PHENIX detector through 2016 followed by the installation of sPHENIX in 2017. Data taking with sPHENIX would begin ˜ 2020 and last 2-3 years. This would then be followed by the transition of RHIC to an Electron Ion Collider (eRHIC), which would collide electrons, initially up to 10 GeV, with hadrons up to 250 GeV and heavy ions up to 100 GeV/A. eRHIC will allow a detailed study of the spin and momentum structure of the nucleon, an investigation of the onset of gluon saturation in heavy nuclei, and the study of hadronization in cold nuclear matter. sPHENIX will also be transformed into a new enhanced detector, ePHENIX, that will provide the necessary capabilities to study this new physics. This will include the addition of a high resolution crystal calorimeter in the electron going direction and a forward spectrometer in the hadron going direction. The forward spectrometer will consist of an EMCAL and HCAL, similar in design to the central sPHENIX calorimeters, along with a gas RICH that utilizes a photosensitive GEM detector and an aerogel Cherenkov detector. The central region will be augmented with a fast drift TPC with a GEM readout and full azimuthal coverage a DIRC detector. Additional GEM trackers will also be added to the central, forward and backward going regions. The plan would be for eRHIC and ePHENIX to start taking data sometime in the mid to late 2020's. This talk will describe the long range plans for RHIC and the PHENIX detector, but will focus mainly on the new detectors and technologies that are planned for sPHENIX and ePHENIX. The two new calorimeters for sPHENIX have already undergone considerable design and prototypes of each detector have been constructed. These prototypes will be tested at Fermilab in February 2014 and preliminary results from these tests should be available by the time of the conference. The calorimeters and the test results will be described in a separate contribution to the conference.

Primary author(s) : Dr. WOODY, Craig (Brookhaven National Lab)

Presenter(s) : Dr. WOODY, Craig (Brookhaven National Lab)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **330** Type : **Oral**

GPU for online processing in low-level trigger

Friday, 6 June 2014 12:00 (0:20)

Abstract content

We describe a pilot project for the use of GPUs (Graphics processing units) in online triggering applications for high energy physics experiments.
General-purpose computing on GPUs is emerging as a new paradigm in several fields of science, although so far applications have been tailored to the specific strengths of such devices as accelerator in offline computation. With the steady reduction of GPU latencies, and the increase in link and memory throughput, the use of such devices for real-time applications in high-energy physics data acquisition and trigger systems is becoming ripe.
We will discuss in details the use of online parallel computing on GPU for synchronous low level trigger. We will show the results of two solution to reduce the data transmission latency: the first based on fast capture special driver and the second based on direct GPU communication using NaNet, a multi-standard, FPGA-based, low-latency, PCIe network interface card with GPUDirect capabilities. We will present preliminary results on a first field test in the CERN NA62 experiment.
This study is done in the framework of GAP (GPU application project), a wider project intended to study the use of GPUs in real-time applications.

Summary

Primary author(s) : LAMANNA, Gianluca (Sezione di Pisa (IT))

Co-author(s) : SOZZI, Marco (Sezione di Pisa (IT)); BIAGIONI, Andrea (INFN); FIORINI, Massimiliano (Universita di Ferrara (IT)); COTTA RAMUSINO, Angelo (Universita di Ferrara (IT)); CHIOZZI, Stefano (Universita di Ferrara (IT)); GIANOLI, Alberto (Universita di Ferrara (IT)); Dr. NERI, Ilaria (University of Ferrara); Dr. PAOLUCCI, Pier Stanislao (INFN Roma); Dr. SIMULA, Francesco (INFN Roma); PIANDANI, Roberto (Sezione di Pisa (IT)); FANTECHI, Riccardo (INFN - Sezione di Pisa); SANTONI, Cristiano (Universita e INFN (IT)); PICCINI, Mauro (INFN - Sezione di Perugia (IT)); MESSINA, Andrea (CERN); BAUCE, Matteo (Universita e INFN, Roma I (IT)); LONARDO, Alessandro (Universita e INFN, Roma I (IT)); VICINI, Piero (INFN Rome Section)

Presenter(s) : FIORINI, Massimiliano (Universita di Ferrara (IT))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **102** Type : **Oral**

Genetic multiplexing for particle detectors

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

Modern physics experiments require particle detectors with excellent performance, in particular the spatial resolution of trackers. This usually leads to systems with very high numbers of electronic channels, from 10,000 to several millions. All these channels represent a significant cost of an apparatus, even if in many cases the useful signal is concentrated on a small fraction of them, for a given event. Using the redundancy of the signal, in particular in Micro-Pattern Gaseous Detectors (MPGDs), we have developed a multiplexing technique that can considerably reduce the size of the electronics. A first Micromegas prototype has been tested with 1024 strips readout by 61 channels, showing à 90% efficiency to MIPs. Another prototype built from the resistive technology will be tested in April, to reach efficiency close to 100%. This multiplexing can be easily used in physics experiments to optimize the size of the electronics to the incident flux, and extended to other types of detectors. Furthermore, it offers many new applications beyond particle physics, like in volcanology or archeology. Several industrials also express interest for this technology, in particular for mining exploration.

Summary

Primary author(s) : PROCUREUR, Sebastien (CEA/IRFU,Centre d'etude de Saclay Gif–sur-Yvette (FR))

Presenter(s) : PROCUREUR, Sebastien (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **158** Type : **Oral**

HARPO - TPC for High Energy Astrophysics and Polarimetry from the MeV to the TeV

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

Observation of high-energy sources requires gamma-ray telescopes aboard balloons or satellites to study thermal and non thermal phenomena (black holes, neutron stars, active galactic nuclei, supernovae, supernova remnants, and gamma-ray bursts). In recent years, R&D has been mainly active to improve the sensitivity required for polarimetry. In this context, a concept of a Time Projection Chamber (TPC) was proposed as an active target and pair production imager with a high angular resolution and background reduction capabilities.
After introducing the HARPO TPC and its potential as gamma-ray telescope, we will present the characterization of the TPC readout plane which provides gas electron amplication within a microstructure composed of the association of a Micromegas and Gas Electron Multiplier. Recent results using cosmic-ray events will be shown and nally the beam test, scheduled this year, with polarized photon at MeV energy will be discussed.

Summary

D. Bernard, P. Bruel, M. Frotin, Y. Geerebaert, B. Giebels, P. Gros, D. Horan, P. Poilleux, I. Semeniouk, S. Wang
LLR, Ecole Polytechnique CNRS/IN2P3, 91128 Palaiseau France
S. Anvar, D. Attie, P. Colas, A. Delbart, D. Gotz, P. Sizun
CEA, Irfu, CEA-Saclay, F-91191 Gif-sur-Yvette, France

Primary author(s) : Dr. ATTIE, David (CEA/DSM/DAPNIA/SPP); GROS, Philippe (Ecole Polytechnique (FR))

Presenter(s) : GROS, Philippe (Ecole Polytechnique (FR))

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **162** Type : **Oral**

High granularity scanner for MPGD based photon detectors

Monday, 2 June 2014 17:30 (0:20)

Abstract content

Gaseous detectors can be made sensitive to photons, and become excellent choice for applications such as Cherenkov radiation imaging for particle identification. Micopattern Gaseous Detector (MPGD) technologies opened new ways to photon detection, where the possibility for reduced ion feedback, better timing and the suppression of non-photon signals are factors of improved performance. On the other hand the microstructure of an MPGD renders the photo-electron emission, transfer and subsequent detection to be a very complex process.
We have developed a high resolution UV photon scanner, where single photon-electron response measures local detection efficiency and gas gain with position resolution better than 100 microns. Studies on Thick GEM based photon detectors proved the existence of inefficient symmetry points, and shed light on hole-gain structure and microscale variance. In fact practically all MPGD detectors, even if not designed for photon detection in the first place, can be made sensitive, and thus be explored, by the scanning system. Measurement of the microsturcture of the charge transport can lead to a better understanding of the detection mechanisms, and help in optimization of various MPGD, especially for Cherenkov detectors.
The presentaion will focus on details of the critical parts of such a system; and recent results on TGEM microstructure with its dependence on the applied micropattern configurations.
Ref.: Nucl.Instr.Meth. A 694 (2012) 16

Summary

Primary author(s) : HAMAR, Gergo (Wigner RCP, Budapest); VARGA, Dezso (Wigner RCP, Budapest)

Presenter(s) : HAMAR, Gergo (Wigner RCP, Budapest)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **44** Type : **Oral**

High rate, fast timing RPC for future LHC experiments upgrade

Friday, 6 June 2014 11:20 (0:20)

Abstract content

New generation of RPC using semi-conductive plates could provide an excellent choice for the upgrade of LHC muon detectors. These cost-effective GRPC stand high particle rate. The excellent timing they can provide could allow to improve on the trigger rate and reduce the pileup consequences of the LHC luminosity increase.
Single and multi-gap GRPC using low-resistivity glass are being proposed to equip high eta region of experiments such CMS. Electronics readout with a time measurment precison of less than 25 ps is being developped to equip such detectors.

Summary

With the increase of the LHC luminosity foreseen in the coming years many detectors currently used in the different LHC experiments will be dramatically impacted and some need to be replaced. The new ones should be capable not only to support the high particle rate but also to provide excellent timing to reduce the data ambiguity due to the expected high pileup. RPC using low-resistivity glass are proposed to equip the very forward region of the LHC experiments. In their single-gap version they can stand rates of few kHz/cm2. Their time precision of about 1ns could in principle allow to reduce the noise contribution, leading to an improvement of the trigger rate. In their multi-gap version they can do better in both the particle rate detection and the time precision measurement. Time precision of less 25 ps could be obtained. This aims at reducing the ambiguity the high expected pileup will introduce. In both cases new electronics equipped with excellent timing precision measurement are being developed to read out the RPC detectors. Tests are ongoing to validate the different scenarios.

Primary author(s) : Prof. LAKTINEH, Laktineh (Universite Claude Bernard-Lyon I (FR))

Presenter(s) : Prof. LAKTINEH, Laktineh (Universite Claude Bernard-Lyon I (FR))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **123** Type : **Oral**

High sensitivity observation for celestial MeV gamma rays by Electron Tracking Compton camera with a balloon borne experiment

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

For next MeV gamma-ray astronomy, we developed Electron Tracking Compton Camera (ETCC) consisting of a Time projection Chamber and pixel scintillators. By measuring the track of an electron, ETCC measures the direction of gamma-rays as a small arc, which provides a good background rejection using the kinematical test and energy loss rate of the track (particle identification), and clear imaging. Already we revealed its strong background rejection ability by the balloon experiment (a 10cm-cube ETCC: SMILE-I) in 2006, where 98% background events were removed. In 2013 we completed a 30cm cube ETCC to catch gamma-rays from Crab in next SMILE-II balloon experiment with >5shigma for several hours. The tracking efficiency was improved with 10 times, which enables to select the Compton event in TPC using only the energy loss rate of the track with distinguishing it from all backgrounds. Thus, we can extract the maximum detection efficiency expected by the simulation. Also SPD angle provides a several times better contract in image than conventional Compton method. Then, SMILE-II would provide a 5times better sensitivity than COMPTEL with the use of 3atm CF4 gas, and 40cm-cube ETCCs onboard satellite is expected to reach near 10-12 ergcm-2s-1. To verify this performance, SMILE-II was irradiated by secondary gammas and neutron from water target using 140MeV proton beam, and measured the clear image of a weak source under 10times stronger radiation than that in the balloon altitude. Here we will present the detail of the SMIEL-II performance including this beam test.

Summary

Primary author(s) : TANIMORI, Toru (Kyoto University)

Co-author(s) : Prof. KUBO, Hidetoshi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMURA, Yoshitaka (Department of Physics, Kyoto University, Kyoto, Japan); Mr. ODA, Makoto (Department of Physics, Kyoto University, Kyoto, Japan); Dr. SONODA, Shinya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TOMONO, Dai Tomono (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TAKADA, Atsushi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIUCHI, Kentaro (epartment of Physics, Kobe University, Japan); Dr. PARKER, Joseph (Department of Physics, Kyoto University, Kyoto, Japan); Mr. KOMURA, Shotaro (Department of Physics, Kyoto University, Kyoto, Japan); Mr. SAWANO, Tatsuya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. NAKAMURA, Kiseki (Department of Physics, Kyoto University, Kyoto, Japan); Mr. NAKAMURA, Shogo (Department of Physics, Kyoto University, Kyoto, Japan); Mr. MATSUOKA, Yoshihiro (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMOTO, Tatsuya (Research Institute for Sustainable Humanosphere, Kyoto Univ.Japan)

Presenter(s) : TANIMORI, Toru (Kyoto University)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **431** Type : **Oral**

High-gradient accelerator technology

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

In contrast to existing linear accelerators (LINAC) based on superconductivity, several institutes are currently developing high gradient LINACs based on normal-conducting cavities. A LINAC based on this technique has some intrinsic advantages over their superconducting cousins e.g. lack the necessity for cryogenic cooling, can obtain larger accelerating gradients and hence allow for a reduced length of the accelerator. These advantages are key in the realization of multi GeV/TeV research accelerators such as the Compact Linear Collider at CERN.

The mechanical properties of these high-gradient accelerator parts touch the limits of what is achievable with currently available manufacturing techniques. The increasing technical specifications and demands for volume-production not only drive industry to improve their currently available techniques but also to industrialize techniques newly developed by the research institutes. In this process of maturation from a proof-of-principle setup to building a fully operational accelerator, science will benefit from the knowledge in industry on redesign for manufacturability and series production. On the other hand, the newly achieved and industrialized competences are typically not limited to the fabrication of accelerator parts but applicable over a broader range of products. Hence, the main-stream customers of the industrial partners will finally benefit to from the "technology transfer" too.

Furthermore, normal-conducting techniques are not limited to research accelerators but also find their ways in commercial and medical applications. Applications in which other advantages of the normal conducting accelerator e.g. cost of owner-ship, real-estate size, reliability and maintainability play a far more important role than the shear accelerating gradient.

Summary

Primary author(s) : Dr. JANSSEN, Xander (VDL ETG Research)

Presenter(s) : Dr. JANSSEN, Xander (VDL ETG Research)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **152** Type : **Oral**

High-precision fiber-optical timing distribution systems over large distances and their application to astroparticle physics facilities

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

Future astroparticle physics facilities like CTA 1 and KM3NeT [2] require a relative timing precision better than 1 ns between detector elements separated by up to 100 km. At the same time, fiber-optical links for high-capacity data transfer from detector elements to central processing facilities are needed. The Open Hardware project White Rabbit [3] provides both data and time transfer functionality over the same optical fiber, and its implementation is currently being investigated for both facilities. Here, we present the current implementation status and performance measurements. In addition, propagation delays of optical 10 Gb/s data over a 75 km long amplified fiber link have recently been determined with an uncertainty of 4 ps [4]. This opens up the possibility of even more precise, picosecond-level precision time transfer over long-distance optical communication links for wide-area astroparticle detector arrays.
1 http://www.cta-observatory.org/ [2] http://www.km3net.org/ [3] http://www.ohwr.org/projects/white-rabbit [4] http://www.opticsinfobase.org/oe/fulltext.cfm?uri=oe-21-26-32643&id=276383

Summary

Primary author(s) : BERGE, David (NIKHEF (NL))

Co-author(s) : JANSWEIJER, Peter Paul Maarten (NIKHEF (NL)); DE JONG, Maarten (NIKHEF (NL)); Mr. KLUIT, Ruud (Nikhef (NL)); Dr. KOELEMEIJ, Jeroen (LaserLaB and Dept. Physics & Astronomy, VU University)

Presenter(s) : BERGE, David (NIKHEF (NL)); JANSWEIJER, Peter Paul Maarten (NIKHEF (NL)); Dr. KOELEMEIJ, Jeroen (LaserLaB and Dept. Physics & Astronomy, VU University)

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **164** Type : **Oral**

Impact of Low-Dose Electron Irradiation on the Charge Collection of n+p Silicon Strip Sensors

Friday, 6 June 2014 15:00 (0:20)

Abstract content

The response of p+n strip sensors to electrons from a 90Sr source and focussed laser light with different wave lengths was measured using the ALiBaVa read-out system. The measurements were performed over a period of several weeks, during which a number of operating conditions were varied. The sensors were fabricated by Hamamatsu on 200 μm thick float-zone silicon. Their pitch is 80 μm, and both p-stop and p-spray isolation of the p+n strips were studied. The electrons from the 90Sr source were collimated to a spot with a full-width-at-half maximum of 1.8 mm at the sensor and the dose rate at the maximum in the SiO2 was about 0.6 mGy/s. The estimated dose at the end of the measurements was about 1 kGy in SiO2. In addition, test structures (pad diodes, MOS capacitors with and without p-stop and p-spray implants, and gate-controlled diodes) fabricated together with the sensors, were investigated for X-ray doses of up to 1 kGy in SiO2 in order to determine technological parameters and their dependencies on X-ray dose. As function of irradiation time with the 90Sr source significant changes in charge collection and charge sharing are observed. Annealing studies with temperatures up to 80°C have shown that the observed changes are only partially reversed. The observations are qualitatively explained with the help of TCAD simulations. The relevance of the measurements for the design and the use of p+n strip sensors in different radiation environments are discussed.

Summary

Primary author(s) : Mr. KLANNER, Robert (University of Hamburg)

Presenter(s) : Mr. KLANNER, Robert (University of Hamburg)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **213** Type : **Oral**

Impact of the radiation background on the CMS muon high-eta upgrade for the LHC high luminosity scenario

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The CMS experiment is preparing an upgrade of its muon detection system, one of the main purposes is to extend the muon detection capabilities in the very forward region (|eta|>1.6) with the installation of new stations of Cathode Strip Chambers (CSC) and Gas Electron Multiplier (GEM) detector technologies for the second (2019) and third (2023) CMS upgrade scenarios. With the increase of the LHC luminosity to 10E34cm-2s-1 an unprecedented and hostile radiation environment will be created, the subsystems most affected will be the ones located in the very forward region where the intense flux of neutrons and photons (from nuclear interactions) can potentially degrade the performance in terms of muon detection and triggering. Using FLUKA simulation the expected radiation background rates are calculated for the regions of interest, the impact on the detector performance is evaluated and possible radiation shielding scenarios are studied.

Summary

Primary author(s) : CASTANEDA HERNANDEZ, Alfredo Martin (Texas A & M University (US))

Presenter(s) : CASTANEDA HERNANDEZ, Alfredo Martin (Texas A & M University (US))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **0** Type : **Oral**

Improvements to the Fermilab Test Beam Facility

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

The Fermilab Test Beam Program provides flexible, equal, and open access to test beams for all detector tests, with relatively low bureaucratic overhead and a guarantee of safety, coordination, and oversight. The facility provides a multitude of particle and energy types, as well as an array of instrumentation with an extensive infrastructure. Recently Fermilab went through a 14 month downtime for accelerator and facility upgrades. During this time, many extensive upgrades were made to the facility including temperature regulation, remote control systems, and instrumentation upgrades.

Summary

The Fermilab Test Beam Program provides flexible, equal, and open access to test beams for all detector tests, with relatively low bureaucratic overhead and a guarantee of safety, coordination, and oversight. The facility provides a multitude of particle and energy types, as well as an array of instrumentation with an extensive infrastructure. Recently Fermilab went through a 14 month downtime for accelerator and facility upgrades. During this time, many extensive upgrades were made to the facility including temperature regulation, remote control systems, and instrumentation upgrades. Patch Panel, Cable, & Network Upgrade Insulation of MT6.2 Enclosure Addition of 2C hut Camera Upgrade Alignment Laser Upgrade Communication System Upgrade Tracking System Upgrade Control Rooms re-configuration Electronics Room Re-configuration Motion Table Control System Upgrade

Primary author(s) : SOHA, Aria (Fermilab)

Presenter(s) : SOHA, Aria (Fermilab)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **227** Type : **Oral**

InGrid: Pixelated Micromegas detectors for a pixel TPC

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

Within the LCTPC collaboration several possibilities to build a time projection chamber for a linear collider are studied. In all concepts, micro-pattern gaseous detectors (MPGD) are used as amplification structure. Compared to the traditional pad-based readouts used in most cases, a pixelated TPC is a new approach. Only pixel ASICs can reflect the high granularity of MPGDs from the readout side. The idea to combine these two technologies was already conceived ten years ago. Such devices, called InGrids, are produced in a photolithographic process, when a grid is post-processed on a Timepix ASIC.

While the first InGrids were built on a single chip basis at the University of Twente, today whole wafers with 107 chips can be processed at the Fraunhofer IZM Berlin. Such a mass production is one cornerstone on the way to a pixel TPC. As a first step, a demonstrator module with about 100 InGrids is under development in our group. Another key element for this project is the system to read out such a module. The Scalable Readout System (SRS), developed by the RD51 collaboration, is suitable for this task as it is based on a modular structure, that can be extended from a single chip readout to larger systems.

In test beam campaign with a sub-component of the demonstrator module the readout system, the InGrid detectors and other components were successfully tested. Besides these results, the roadmap to a pixel TPC demonstrator will be presented.

Summary

Primary author(s) : LUPBERGER, Michael (University of Bonn)

Presenter(s) : LUPBERGER, Michael (University of Bonn)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4b) MEMS

Contribution ID : **97** Type : **Oral**

Interferometric Readout for a Monolithic Accelerometer, towards the fm/rtHz

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

In order to make a really precise vibration sensor, a monolithic accelerometer, in which a mass is suspended by a pendulum and an inverted pendulum, is read out using a tabletop Michelson interferometer (IFO). To measure the position of the mass, a corner cube attached to the suspended mass is used. The signals in both arms of the IFO are monitored, matched and subtracted, using this differential signal as an error signal in a feedback loop driving the voice coil actuating to the other side of the suspended mass. Pursuing to be shot-noise limited from 5Hz onwards and having a upper limit to the bandwidth of about 200Hz, the resolution is pushed towards the fm/rtHz.

Summary

The upgrade for the Virgo Gravitational Wave Observatory (Cascina, Italy) necessitates for added sensing which has to be seismically isolated as well. Nikhef has built the compact isolator to do this, but to measure its residual motion in full assembly, no (commercial) sensor is available that is good enough to actually measure it. A novel vibration sensor is built at Nikhef by using an interferometric readout of a monolithic accelerometer. This system is also being researched at Nikhef in a fiber version, so that it can be used in monitoring the vibration in the magnetic and radiation environment of the quadrupole magnets a (future) linear collider such as CLiC or the ILC.

Primary author(s) : Mr. VAN HEIJNINGEN, Joris (Nikhef)

Co-author(s) : Prof. VAN DEN BRAND, Jo (VU/ NIkhef); Dr. RABELING, David (ANU); Dr. BERTOLINI, Alessandro (Nikhef)

Presenter(s) : Mr. VAN HEIJNINGEN, Joris (Nikhef)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **191** Type : **Oral**

Irradiation effect on the response of the scintillators in the ATLAS Tile Calorimeter

Monday, 2 June 2014 16:10 (0:20)

Abstract content

The Tile Calorimeter (TileCal) is the central hadronic calorimeter of the ATLAS experiment at the LHC. Together with other calorimeters, it provides precise measurements of hadrons, jets, taus and missing transverse energy. The monitoring and equalisation of the calorimeter response at each stage of the signal development is allowed by a movable 137Cs radioactive source, a laser calibration system and a charge injection system. Moreover, during the LHC data taking, an integrator based readout provides the signals coming from inelastic proton-proton collisions at low momentum transfer (minimum bias currents) and allows to monitor the instantaneous ATLAS luminosity as well as the response of calorimeter cells. Minimum bias currents have been used to detect and quantify the effect of TileCal scintillators irradiation using the data taken during 2012 that corresponds to about 21 fb-1 of integrated luminosity. Moreover, the response variation for an irradiated cell has been studied combining the information from three calibration systems (cesium, laser and minimum bias). The result of the irradiation on the calorimeter response will be reported.

Summary

Primary author(s) : FRACCHIA, Silvia (Universitat Autònoma de Barcelona (ES))

Presenter(s) : FRACCHIA, Silvia (Universitat Autònoma de Barcelona (ES))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **290** Type : **Oral**

LUCIFER: Neutrinoless Double Beta decay search with scintillating bolometers

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

The Neutrinoless Double Beta Decay (0νDBD) is a powerful tool to test physics beyond the Standard Model and to get insights on the Majorana neutrino nature and mass. Bolometers are excellent detectors to search for this rare decay, thanks to their good energy resolution and to the low background conditions in which they can operate. The current challenge consists in the reduction of the background, represented by environmental γs and αs, in view of a zero background experiment. This can be obtained with the approach of the LUCIFER project, funded by an European grant, which is based the double read–out of the heat and scintillation light produced by ZnSe scintillating bolometers, that allows to discriminate between β/γ and α particles. The LUCIFER experiment aims at a background lower than 10^3 counts/keV/kg/y in the energy region of the 0νDBD of ^{82}Se, an order of magnitude lower with respect to the present generation experiments. Such a low background level will provide a sensitivity on the effective neutrino mass of the order of 100 meV. We describe the current status of the LUCIFER project, including results of the recent R&D activity.

Summary

Primary author(s) : Ms. TOMEI, Claudia (INFN Sezione di Roma); PIPERNO, Gabriele

Presenter(s) : PIPERNO, Gabriele

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **15** Type : **Oral**

Laboratory tests for Diode-Laser based Calibration Systems for Fast Time-of-Flight Systems

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

Time-of-flight systems, based on scintillators, may reach good intrinsic time resolution, by using fast scintillators and photomultipliers. Examples are the large time-of-flight system constructed for the HARP experiment at CERN PS (˜150 ps detector resolution) or the most demanding time-of-flight system of the MICE experiment at RAL (˜50-60 ps detector resolution). This level of intrinsic timing resolutions puts demanding requirements on the laser based calibration system for day by day time monitoring. Such as system may be realized by splitting a fast laser beam (FWHM˜ 30 ps) to a fast photodiode, giving the START for the TDC system, and injecting the laser light into a system of fibers that transmit the pulse to the individual counters to be calibrated, giving the STOP signal. Due to the limited power of diode-laser systems (up to 1 W) extreme care must be put to minimize power losses. The choice of the type of optical fiber to be used (multimode vs single-mode)is another critical issue. Step-index multimode fibers has been chosen giving the best trade-off between input power loss minimization and timing properties of the system. Timing characterization were done with a sampling HP54750A scope with a 20 GHz bandwidth. Additional tests to study the temperature dependence of the system components were done with a precision LAUDA PR845 cooling thermostat. A system based on optical switches, fused fiber splitters and an ultrafast diode-laser will be described, together with the laboratory tests needed to optimize the choice of components and characterize completely the timing performances.

Summary

Primary author(s) : Dr. BONESINI, Maurizio (Sezione INFN Milano Bicocca)

Co-author(s) : BERTONI, Roberto (Sezione INFN Milano Bicocca); DE BARI, Antonio (Sezione INFN e Universita' di Pavia); ROSSELLA, Massimo (Sezione INFN Pavia)

Presenter(s) : Dr. BONESINI, Maurizio (Sezione INFN Milano Bicocca)

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **198** Type : **Oral**

Large Area Microchannel Plates for LAPPD^{TM}

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

Manufacturing plans for "next generation" microchannel plates (MCPs) and the technical advantages enabled by this evolving technology will be presented. The Large Area Picosecond Photodetector (LAPPD^{TM}) is an MCP based photodetector, capable of imaging, with high spatial and temporal resolution in a hermetic package with an active area of 400 square centimeters. A key component of LAPPD^{TM} is a chevron pair of large area (203 mm x 203 mm) MCPs. The manufacture of these large-area high performance MCPs has been enabled by the convergence of two technological breakthroughs. The first to be presented, is the ability to produce large blocks of hollow, micron-sized glass capillary arrays (GCAs) developed by Incom Inc. The Incom process is based on the use of hollow capillaries in the glass drawing process, eliminating the need to remove core material by chemical etching. The arrays are fabricated as large blocks that can be sliced to form large area wafers, without regard to the conventional limits of L/d (capillary length / pore diameter). Moreover, borosilicate glass is less expensive than the prior-art leaded glass, and is more environmentally friendly. The second breakthrough to be presented is the advent of atomic layer deposition (ALD) coating methods and materials to functionalize GCAs to impart the necessary resistive and secondary emission properties suitable for large area detector applications. Recent results demonstrating the high performance, uniformity and long term stability of the current MCP product under various operating conditions will be presented.

Summary

Primary author(s) : Dr. MINOT, Michael (Incom Inc.)

Co-author(s) : Dr. O'MAHONY, Aileen (Incom Incl); Dr. SIEGMUND, Oswald (University of California); Dr. MCPHATE, Jason (Univ. of California, Berkeley); Dr. FRISCH, Henry (University of Chicago); Dr. WETSTEIN, Matthew (Argonne National Laboratory); Dr. ELAGIN, Andrey (University of Chicago); Mr. NORTHROP, Richard (University of Chicago); Mr. CRAVEN, Christopher (Incom Inc.); Mr. BENNIS, Daniel (Incom Inc.); Mr. RENAUD, Joseph (Incom Inc.); Mr. STOCHAJ, Michael (Incom Inc.); Mr. BOND, Justin (Incom Inc.); Dr. ELAM, Jeffrey (Argonne National Laboratory); Dr. MANE, Anil (Argonne National Laboratory); Dr. WAGNER, Robert (Argonne National Laboratory)

Presenter(s) : Mr. CRAVEN, Christopher (Incom Inc.)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **278** Type : **Oral**

Light-yield results of 1 liter liquid argon scintillation detector based on Silicon Photo Multipliers operating at cryogenic temperature

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

We present the results obtained with a liquid argon scintillation detector with light read-out completely based on SiPM. We used a 1 liter PTFE chamber observed by an array of 7 large area SiPMs (Hamamatsu S11828-3344M) covering about the 4% of the internal surface. The chamber is lined with a reflective foil (3M VIKUITI) evaporated with a wavelength shifter (TetraPhenyl Butadiene). This solution allows to convert the UV photons to the visible band, thus matching the SiPM sensitivity window while maximizing light collection. The measured light-yield is comparable with the highest light-yield values obtained in similar conditions using standard 3" cryogenic PMT's (Hamamatsu R11065) for a 3 times higher photo-cathodic coverage. The present result, combined with the other well known intrinsic SiPM advantages (compact design, contained costs, low bias voltage,. . .) represents a step forward in the confirmation of the SiPM technology as a real alternative to standard PMT-based read-out systems for application in cryogenic noble liquid detectors.

Summary

Primary author(s) : Dr. ANTONELLO, maddalena (INFN); CANCI, Nicola (INFN-LNGS); MACHADO, Ana Amelia (INFN - LNGS); SEGRETO, Ettore (INFN); Dr. VIGNOLI, Chiara (INFN-LNGS)

Co-author(s) : Dr. BONFINI, Giuseppe (INFN-LNGS); Dr. CANDELA, Attanasio (INFN-LNGS)

Presenter(s) : SEGRETO, Ettore (INFN)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **179** Type : **Oral**

MPGD-based counters of single photons for Cherenkov imaging counters.

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Architectures based on MicroPattern Gas Detectors (MPGD) represent a possible answer to the quest for novel gaseous counters with single photon detection capability able to overcome all the limitations of the present generation of gaseous photon detectors. In Cherenkov imaging counters, gaseous photon detectors are still the unique option when insensitivity to magnetic field, low material budget, and affordable costs in view of large detection surfaces are required. A systematic R&D programme has been performed for several years to develop novel gas photon detectors base on an arrangement of multiple layers of THick-Gas Electron Multipliers (THGEM): a deep understanding of the THGEM characteristics has been achieved and their parameters have been optimised in view of the photon detection application. Large gains are required to detect effectively single photoelectrons and, after the optimisation process, the novel detectors exhibit electrical stability up to gains as high as to 1-2 x 105 also in presence of radioactive backgrounds. The delicate aspect of the photoelectron extraction from a GEM-like photocathode has been studied in detail and conditions for effective extraction have been obtained. The suppression of the signal produced by ionising particles crossing the photon detectors has been proven. In parallel with establishing the detector principle, the engineering towards large-size counters is ongoing and an intermediate size detector with 300 x 300 mm2 active surface has been successfully operated. Recently a new hybrid approach has been considered: an architecture where the last multiplication stage is obtained by using a Micromegas arrangement. The completed R&D studies and the engineering aspects are summarised and the characterization of the hybrid detector prototypes are reported.

Summary

Nowadays, the Cherenkov imaging technique for Particle IDentification (PID) has been established as a robust, reliable experimental approach thanks to the use in several experiments. They are used and foreseen in the experimental apparata of several future research programmes. The effectiveness of visible and UV single photon detection is at the basis of the success of these counters. So far, only vacuum-based detectors and gaseous photon detectors have been adopted. Other photon detectors being developed are interesting only for applications in the far future. Gaseous photon detectors are still the only available option to instrument detection surfaces when insensitivity to magnetic field, low material budget, and affordable costs in view of large detection surfaces are required. The present generation of gaseous photon detectors, namely MWPC where a cathode plane is formed by a Printed Circuit Board (PCB) segmented in pads and coated with a CsI film, adopted in several experiments (NA44, HADES, COMPASS, STAR, JLab-HallA and ALICE) exhibit some performance limitations: ageing, causing a severe decrease of the quantum efficiency after a collected charge of the order of some mC/cm2, feedback pulses with a rate increasing at large gain-values, and long recovery time (about 1 day) after an occasional discharge in the detector. These limitations are related to the photon feedback from the multiplication region and to the bombardment of the CsI photocathode film by the positive ions generated in the multiplication process. They impose to operate at low gain (a few times 104), resulting in

two relevant consequences: the efficiency of single photoelectron detection is reduced and rate limitations are present. Moreover, in these detectors the signal formation is intrinsically slow. There is a clear quest for novel gaseous photon detectors with advanced characteristics, namely intrinsically fast signals and reduced photon and ion backflow to operate at larger gains and to ensure longer detector life-time. In a multilayer structure of electron multipliers, the photons from the multiplication process cannot reach the photocathode and a good fraction of the ions is trapped in the intermediate layers. The signal is mainly due to the electron motion, namely its development is fast. GEM-based photon detectors coupled to semi transparent or reflective photocathodes have been proposed shortly after the introduction of the GEM concept. The threshold Cherenkov counter Hadron Blind Detector (HBD) of the PHENIX experiment at BNL RHIC represents the first application of these ideas, even if high gain is not required in a threshold counter. THich GEMs (THGEM), introduced in parallel by several groups about ten years ago, are electron multipliers derived from the GEM design, by scaling the geometrical parameters and changing the production technology. Large gains and good rate capabilities have been reported for detectors with single or double THGEM layers. THGEMs can be produced in large series and large size at moderate cost with standard PCB technology, in spite of the large number of holes: some millions per square meter. THGEMs have intrinsic mechanical stiffness, and they are robust against damages produced by electrical discharges. Moreover, thanks to the reduced gaps between the multiplication stages, these detectors can be successfully used in magnetic field. The basic architecture of the THGEM-based photon detector that we propose consists in multiple, typically triple, THGEM layers, where the top face of the first layer is coated with a CsI film and acts as a reflective photocathode. The electron multiplication takes place in the THGEM holes thanks to the dipole electric field obtained biasing the two PCB faces. A plane of drift wires defines the drift electric field above the first THGEM layer. The field between two THGEM layers acts as a transfer field; an induction field is applied between the bottom face of the last THGEM and the anode electrode. The signals are collected at the anode plane, formed by a PCB segmented in pads. Our R&D studies performed using single and multiple THGEM arrangements to detect ionising particles or UV photons in laboratory and test beam exercises have been dedicated to explore the characteristics of the THGEM multipliers and the role of the various geometrical parameters, and to establish the guidelines towards the optimisation of the basic architecture. More than 50 different small size THGEM samples (30 x 30 mm2) have been characterised. The measurement campaigns have been accompanied by simulation studies. The main outcomes are summarised in the following. • The rim is the clearance ring around the holes. The THGEM maximum gain is increased by more than an order of magnitude by adopting large rims, namely annulus width of the order of 100 µm. These THGEMs exhibit relevant gain dependence versus rate and over time. These gain variations are absent or negligible for no rim or small rim THGEMs. On the basis of these facts, we have selected THGEM with the minimum rim imposed by the production technology to remove the drilling residuals at the hole edge, namely annulus width smaller than 10 µm. • The large gains ensured by sizable rims can be recovered by increasing the THGEM thickness up to 0.8-1 mm: these thickness-values are ideal for the second and third THGEM layers. • The time response is satisfactory: the typical resolution obtained with THGEM-AGPs is 7 ns r.m.s.. • Concerning photoelectron extraction efficiency from the CsI photoconverting layer, it is clearly established that the effective extraction rate depends on the gas atmosphere in the detector and requires an electric field $\geq$ 1000 V/cm at the photocathode surface. At the THGEM surface, the electric field is dominated by the THGEM bias and it has a minimum at the critical point, namely the centre of the equilateral triangle, which is the unit cell of the THGEM pattern. Higher electric fields at the critical point can be obtained by reducing the THGEM thickness and values around 0.3-0.4 mm are selected: this is the thickness suggested for the photocathode THGEM. • Photon backflow from the multiplication region to the photocathode plane is almost totally suppressed; ion backflow rate depend on the geometry details; in prototypes with staggered hole alignment it is lower than 10 %. • Triple THGEM configurations can provide gains up to 106 when detecting single photoelectrons; the gain has to be reduced in radioactive environments. This gain reduction is made less severe by applying appropriate voltage bias in front of the photocathode to suppress the ionising particle signal: the novel detectors can operate at gains at least one order of magnitude larger than the present ones. In conclusion, the THGEM-based photon detectors can satisfy all the requirements posed to overcome the limitation of the present gaseous photon detectors. In parallel with establishing the detector principle, the engineering towards large-size counters is ongoing. An essential goal of the project is to provide large size detectors with minimal dead zones while preserving the optimised characteristics obtained within the R&D studies. Some samples of good quality large size THGEMs (600 x 600 mm2) have been produced proving the feasibility of large boards. The voltages applied to the electrodes can be as high as 8 kV. Minimum dead zones can be obtained with an accurate mechanical design and the correct choice of the materials for the detector vessel, and appropriate HV distribution to the many electrodes. The goal is a dead area below 10%. An intermediate size detector with 300 x 300 mm2 active surface satisfying this prescription has been successfully operated. Recently a new hybrid approach has been considered: an architecture where the last multiplication stage is obtained by using a Micromegas arrangement. Stable operation at large gain (> 106) has been obtained detecting single photons. The hydrid detector has recently been characterized.

The R&D studies and the engineering aspects are summarised; the characterization of the hybrid architecture prototypes is also reported.

Primary author(s) : LEVORATO, Stefano (INFN Trieste)

Presenter(s) : LEVORATO, Stefano (INFN Trieste)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **328** Type : **Oral**

Many-core studies on pattern-recognition in the LHCb experiment

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

The LHCb experiment is entering in its upgrading phase, with its detector and read-out system re-designed to cope with the increased LHC energy after the long shutdown of 2018. In this upgrade, a trigger-less data acquisition is being developed to read-out the full detector at the bunch-crossing rate of 40 MHz. In particular, the High Level Trigger (HLT) system, where the bulk of the trigger decision is implemented via software on a CPU farm, has to be heavily revised. Since the small LHCb event size (about 100 kB after the upgrade), many-core architectures such as General Purpose GPU (GPGPU) and multi-core CPUs can be used to process many events in parallel for real-time selection, and may offer a solution for reducing the cost of the HLT farm. Track reconstruction and vertexing are the more time-consuming applications running in HLT and therefore are the first to be ported on many-core. In this talk we discussed the studies ongoing in LHCb for implementing pattern-recogniton algorithms for the Velo detector on many-core systems. We present our solution for porting the existing Velo tracking algorithm (FastVelo) on GPGPU, and we show the achieved performance. We plan to test the parallelized version of FastVelo during the data-taking in 2015 and assess the impact of the many-core solution on the HLT infrastructure. We discuss also other tracking algorithms in view of the upgrade and their preliminary performaces.

Summary

Primary author(s) : GALLORINI, Stefano (Universita e INFN (IT))

Co-author(s) : LUCCHESI, Donatella (Universita e INFN (IT)); Mr. GIANELLE, Alessio (Universita e INFN (IT)); CORVO, Marco (INFN); COLLAZUOL, Gianmaria (U); SESTINI, Lorenzo (Universita e INFN (IT)); LUPATO, Anna (Universita di Ferrara (IT)); NEUFELD, Niko (CERN); CAMPORA PEREZ, Daniel Hugo (CERN); VILASIS CARDONA, Xavier (University of Barcelona (ES))

Presenter(s) : GALLORINI, Stefano (Universita e INFN (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **261** Type : **Oral**

Measurement of nm Electron Beam Sizes using Laser Interference by Shintake Monitor

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

The Shintake Monitor is an essential beam tuning device installed at the interaction point of ATF2 to measure its nm order vertical e- beam sizes (σy*). It is crucial for verifying ATF2's Goal 1 of focusing σy* down to 37 nm in order to verify a final focus system of linear colliders featuring the Local Chromaticity Correction scheme. The e- beam collides with a target of laser interference fringes, and σy*is derived from the modulation depth of the resulting Compton signal photons measured by a downstream gamma detector. Shintake Monitor is the only existing device capable of measuring σy* as small as 25 nm, and can accommodates a wide range of σy*from 20 nm to a few μm with better than 10% accuracy by switching between several laser crossing angle modes. Major hardware upgrades contributed to suppressing errors and the demonstration of measurement stability of 5 - 10%. In 2013, continuous measurement of the smallest ever σy* of below 65 nm has been achieved. Analysis of systematic errors indicates the possibility that smaller beam sizes have been achieved. This paper describes the monitor's design concepts and performance, and an extensive study of errors with the aim of high precision in measuring the even smaller σy* anticipated to be achieved at ATF2 in near future.

Summary

Primary author(s) : YAN, Jacqueline (T)

Presenter(s) : YAN, Jacqueline (T)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **371** Type : **Oral**

Measuring directionality in double-beta decay and neutrino interactions with kiloton-scale scintillation detectors

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

We present initial studies of a technique for separating scintillation and Cherenkov light in a large liquid scintillator detector in order to reconstruct directionality for electrons with energies typical of neutrino-electron scattering (5 MeV) and double-beta decay (2.1 MeV and 1.4 MeV).
On average scintillation light is delayed with respect to the direct Cherenkov light due to chromatic dispersion and the finite time of the scintillation processes; early light thus contains directional information. Using a GEANT4 simulation of a 6.5m-radius spherical detector with 100% coverage of photodetectors having transit-time-spread (TTS) of 100 ps, we have shown that a time cut on the early light is effective at isolating the directional light, improving the ratio of Cherenkov to scintillation light from $R_{c/s}$=0.02 to $R_{c/s}$=0.63 for 5 MeV electrons originating at the detector center. This ratio is degraded by a factor of 2.5 if typical photomultipliers with TTS=1.28 ns are used. The ratio for TTS=100 ps can be further improved by a factor of 1.6 by using red-enhanced photocathodes, or by 1.4 by using narrow-emission scintillators.
We discuss a technique for extracting particle direction, and evaluate several detector developments in timing, photodetector spectral response, and scintillator emission spectra that could be used to realize direction reconstruction in a kiloton-scale detector.

Summary

See http://arxiv.org/abs/1307.5813

Primary author(s) : ABERLE, Christoph (University of California, Los Angeles); ELAGIN, Andrey (University of Chicago); FRISCH, Henry (University of Chicago); WETSTEIN, Matthew (University of Chicago); WINSLOW, Lindley (University of California, Los Angeles)

Presenter(s) : ELAGIN, Andrey (University of Chicago)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **21** Type : **Oral**

Micro Pattern Gas Detector Technologies and Applications - the work of the RD51 Collaboration

Abstract content

Driven by the availability of modern photolithographic techniques, the Micro Pattern Gas Detectors (MPGD) have been introduced in the last years of the 20th century by pioneer activities: Gas Electron Multipliers (GEM) and Micromegas, later followed by thick-GEM, resistive GEM (RETGEM) and novel micro-pattern devices. Nowadays, a flourishing of R&D activities dedicated to MPGDs and of diversified applications is ongoing, largely favored by the technological collaboration RD51, whose aims are to facilitate the development of these advanced gas-avalanche detector technologies and associated electronic-readout systems, for applications in basic and applied research. The areas of activities within RD51 include MPGD technology and new structures, device characterization, software and simulations, electronics, MPGD production, common test facilities, and applications of MPGD. By this coverage of all aspects of MPGD, RD51 aims to bring together leading experts in the field for the development of new technology and colleagues using this technology for a wide array of applications. This talk will review the activities of the RD51 by summarising the first five years of the Collaboration activity and by anticipating the future programmes, planned over the next five years.

Summary

This talk will cover the work of the CERN-based RD51 Collaboration developing Micro Pattern Gas Detectors for a wide range of applications.

Primary author(s) : Dr. DALLA TORRE, Silvia (INFN Trieste)

Presenter(s) : Dr. DALLA TORRE, Silvia (INFN Trieste)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **113** Type : **Oral**

Microchannel evaporative CO2 cooling for the LHCb VELO Upgrade

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The LHCb Vertex Detector (VELO) will be upgraded in 2018 to a lightweight, pixel detector capable of 40 MHz readout and operation in very close proximity to the LHC beams. The thermal management of the system will be provided by evaporative CO2 circulating in microchannels embedded within thin silicon plates. This solution has been selected due to the excellent thermal efficiency, the absence of thermal expansion mismatch with silicon ASIC's and sensors, the radiation hardness of CO2, and very low contribution to the material budget.
Although microchannel cooling is gaining considerable attention for applications related to microelectronics, it is still a novel technology for particle physics experiments, in particular when combined with evaporative CO2 cooling. The R&D effort for LHCb is focusing on the design and layout of the channels together with a fluidic connector and its attachment to withstand pressures in excess of 200 bars. This talk will describe the design and optimization of the cooling system for LHCb together with latest prototyping results.
Even distribution of the coolant is ensured by means of the use of restrictions implemented before the entrance to a race-track layout of the main cooling channels. The coolant flow and pressure drop has been simulated together with the thermal performance of the device. The results can be compared to the cooling performance of prototype plates operating in vacuum. The design of a suitable low mass connector, together with the bonding technique to the cooling plate will be described.
Long term reliability as well as resistance to extremes of pressure and temperature is of prime importance. The setup and operation of a cyclic stress test of the prototype cooling channel designs will be described.

Summary

The status and R&D for microchannel cooling for the LHCb VELO upgrade will be described, as outlined in the abstract above.

Primary author(s) : COLLINS, Paula (CERN)

Presenter(s) : COLLINS, Paula (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **388** Type : **Oral**

Microfabrication Activities in the Engineering Office of the PH-DT Group at CERN

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

Micro-technologies are being investigated within the Engineering Office of the Detector Technologies Group (PH-DT) in the CERN Physics Department. This effort aims at developing novel types of detectors and implementing alternative approaches to on-detector services benefitting from standard microfabrication techniques. Recently, a new type of scintillation detector based on microfluidics has been demonstrated. It is being considered as potential candidate for particle tracking and beam monitoring devices in High Energy Physics and medical applications. A similar microfluidic approach has been adopted to develop ultra-thin silicon on-detector active cooling systems. Such systems have been selected for the thermal management of the NA62 GigaTracKer pixel detectors and for the 2018 major upgrade of the LHCb VeLo vertex detector. They are also studied for the most inner layers of the ALICE ITS upgrade. A third application aims at studying the heat transfer of superfluid Helium II in a network of microchannels embedded in a glass substrate in view of an improved insulation for the LHC supraconducting magnets.
To meet the requirements of Particle Physics experiments, these devices need to be as thin and light as possible resulting in membranes of the order of 50 μm or less. The fracture mechanics of thin silicon layers is not well understood and it is currently being studied within the Engineering Office through experimental testing and Finite Element Analysis (FEA). In order to better understand the mechanics of such small silicon membranes, test devices are fabricated in the class 100 MEMS cleanroom at the EPFL Center of MicroNanoTechnology and they are characterized at CERN. The experimental results are then compared with the FEA analysis performed in ANSYS.
This paper will review the microsystems engineering efforts of the PH-DT group through the description of the projects and studies ongoing at CERN.

Summary

Primary author(s) : MAPELLI, Alessandro (CERN)

Co-author(s) : CATINACCIO, Andrea (CERN); DEGRANGE, Jordan (CERN); ROMAGNOLI, Giulia (Universita e INFN (IT)); MAODDI, Pietro (Ecole Polytechnique Federale de Lausanne (CH)); ALVAREZ FEITO, Diego (CERN)

Presenter(s) : MAPELLI, Alessandro (CERN)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4b) MEMS

Contribution ID : **359** Type : **Oral**

Micromegas for sampling calorimetry

Monday, 2 June 2014 17:50 (0:20)

Abstract content

Micromegas is an attractive option for a gaseous sampling calorimeter. It delivers proportional and fast signals, achieves high efficiency to minimum ionising particles with a compact design and shows well-uniform performance over meter-square areas. The current R&D focuses on large-size spark-protected Micromegas with integrated front-end electronics. It targets an application at future linear colliders (LC) and possible upgrades of LHC experiments for the running at high luminosity. Prototyping work and characterisation results will be reported with a special emphasis on the impact of the resistive layer on the calorimeter signals.

Summary

A few technologically-advanced prototypes of 1x1 m2 were constructed. Optimised for Particle-Flow hadron calorimetry at a LC, they are segmented into pads of 1x1 cm2, each read out by simple threshold electronics. Their standalone performance were studied in great details in testbeams. In addition, expected performance of a Micromegas calorimeter were deduced from the measured three-dimensional shape of high-energy pion showers inside the CALICE semi-digital hadron calorimeter (SDHCAL).
Absorption in the gas of highly ionising particles produced in hadron showers occasionally triggers a discharge. This can be a serious show-stopper for high-rate applications such as forward calorimetry at a high-luminosity LHC experiment. Discharge protections based on resistive films were successfully implemented on small-size prototypes. Several resistive configurations were actually studied to minimise the time necessary for charge evacuation and the resulting efficiency and linearity losses.

Primary author(s) : CHEFDEVILLE, Maximilien (Centre National de la Recherche Scientifique (FR))

Presenter(s) : CHEFDEVILLE, Maximilien (Centre National de la Recherche Scientifique (FR))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **94** Type : **Oral**

Monolithic pixel detectors fabricated with single and double SOI wafers

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

Monolithic pixel detectors using 0.2 um FD-SOI pixel process have been developed since 2006. An SOI wafer is utilized for sensor and electronics. The top silicon is used for SOI-CMOS circuit, and the substrate is used for a radiation sensor. There is a buried oxide layer between two silicon materials, and these are connected each other through Tungsten via. SOI-CMOS circuit has smaller parasitic capacitance compared with bulk CMOS, and therefore high-speed, low noise and low power circuits can be fabricated. Since a bump bonding is not used, the sensors have high gain with smaller pixel size. Double SOI wafers are also available. In this case, the middle SOI layers are used for shield layer against the back-gate effect and cross talk. When the voltages are applied in the middle layer, the distribution of charge traps caused by radiation in the silicon oxide can be controlled which helps to enhance radiation tolerance. KEK has organized Multi Project Wafer (MPW) runs twice a year and several types of SOI detectors has been developed and evaluated using IR laser and radiation sources. We are also trying to solve existing problems such as sensor-circuit crosstalk and radiation hardness by utilizing double SOI wafers. In this presentation, evaluation test results of up-to-date SOI pixel detectors will be shown.

Summary

Primary author(s) : MIYOSHI, Toshinobu (KEK)

Co-author(s) : ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); Mr. TAUCHI, Kazuya (KEK); Mr. FUJITA, Yowichi (KEK); TAKEDA, Ayaki (SOKENDAI); IKEMOTO, Yukiko (KEK); HARA, Kazuhiko (University of Tsukuba (JP)); Dr. TSUBOYAMA, Toru (KEK, High Energy Accelerator Research Organization); UNNO, Yoshinobu (High Energy Accelerator Research Organization (JP)); IKEGAMI, Yoichi (High Energy Accelerator Research Organization (JP)); HONDA, Shunsuke (University of Tsukuba (JP)); MITSUI, Shingo (High Energy Accelerator Research Organization (JP))

Presenter(s) : MIYOSHI, Toshinobu (KEK)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **335** Type : **Oral**

Multi-Gigabit Wireless Data Transfer for Tracker Readout Systems

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

State-of-the-art tracking detector systems as the ATLAS silicon micro-strip tracker will after the upgrade in 2022, require an overall readout bandwidth between 50 and 100 Tb/s. To allow such a highly granular tracker to contribute to the first level trigger decision or event filtering, a fast readout system with a tremendous bandwidth is therefore essential. With up to 9 GHz of continous license free bandwidth allocated worldwide centerd around 60 GHz, a fast readout system using a wireless data transfer at that carrier frequency becomes feasible. A prototype transceiver at 60 GHz with 9 GHz bandwidth is currently under development at University of Heidelberg using the IBM 0.13µm SiGe HBT BiCMOS process. The design is based on the well known superheterodyne transceiver architecture. The targeted data rate for our first prototype is 4.5 gigabit per second over a distance of 20 cm. The Multi-Gigabit transceiver system, its individual blocks and key issues of the system design will be explained in detail in this talk.

Summary

Primary author(s) : Mr. SOLTVEIT, Hans Kristian (Ruprecht-Karls-Universitaet Heidelberg (DE))

Co-author(s) : WIEDNER, Dirk (Ruprecht-Karls-Universitaet Heidelberg (DE)); SCHOENING, Andre (Ruprecht-Karls-Universitaet Heidelberg (DE))

Presenter(s) : Mr. SOLTVEIT, Hans Kristian (Ruprecht-Karls-Universitaet Heidelberg (DE))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **49** Type : **Oral**

Neutron Background Detection for a Hard X-ray Balloon-borne Polarimeter

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

PoGOLite is a balloon-borne hard X-ray polarimeter. It determines polarisation by measuring the azimuthal angular distribution of Compton scattered photons in a plastic scintillator array. The use of an all plastic target yields a relatively large but low mass detection area. The dominant source of background for the polarisation measurements has been shown through Geant4 simulations to originate from high energy (MeV range) atmospheric neutrons. Neutrons can pass the instrument's Bismuth Germanium Oxide (BGO) anticoincidence shield undetected and subsequently scatter between plastic scintillator elements to produce a polarisation signature. A passive 15 cm thick polyethylene shield surrounding the polarimeter reduces the neutron induced background by an order of magnitude. The background level remains however significant, prompting the need for active monitoring of the continuously changing neutron flux. For this purpose PoGOLite makes use of a neutron sensitive phoswich scintillator cell. The phoswich cell consists of a 5 mm thick Lithium Calcium Aluminium Fluoride (LiCAF) scintillator, used for neutron detection. The LiCAF is surrounded by a BGO anticoincidence system. This small light weight detector can therefore be used to measure the neutron flux even in high radiation environments. This type of neutron detector was tested on a separate dedicated stratospheric balloon mission, called PoGOLino, prior to the PoGOLite flight which took place in July 2013. Results from both flights will be presented and implications on the polarisation measurements of PoGOLite from 2013 will be discussed.

Summary

Primary author(s) : Mr. KOLE, Merlin (KTH - Royal Institute of Technology)

Co-author(s) : Prof. FUKAZAWA, Yasushi (Hiroshima University); Dr. FUKUDA, Kentaro (Tokuyama Corporation); Mr. ISHIZU, Sumito (Tokuyama Corporation); Dr. JACKSON, Miranda (KTH - Royal Institute of Technology); Dr. KAWAGUCHI, Noriaki (Tokuyama Corporation); Mr. KAWANO, Takafumi (Hiroshima University); Dr. KISS, Mozsi (KTH - Royal Institute of Technology); Dr. MORETTI, Elena (KTH - Royal Institute of Technology); Prof. PEARCE, Mark (KTH - Royal Institute of Technology); Mr. RYDSTROM, Stefan (KTH - Royal Institute of Technology); Dr. TAKAHASHI, Hiromitsu (Hiroshima University); Dr. YANAGIDA, Takayuki (Kyushu Institute of Technology); Dr. CHAUVIN, Maxime (KTH - Royal Institute of Technology); Mr. VICTOR, Mikhalev (KTH - Royal Institute of Technology)

Presenter(s) : Mr. KOLE, Merlin (KTH - Royal Institute of Technology)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **151** Type : **Oral**

Neutron-insensitive gamma-ray detector with aerogel for rare neutral-kaon decay experiment

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

A novel gamma-ray detector which is highly sensitive to photons but insensitive to neutrons has been developed for the rare neutral-kaon decay experiment (KOTO experiment) at J-PARC. This experiment aims to study the KL->pi0nunubar decay with an electromagnetic calorimeter and hermetic veto detectors surrounding the the decay region. The veto counters located in the beam should be able to detect such photons as to be escaping to the direction with high efficiencies under the huge neutron flux of 500MHz.
This detector consists of a series of modules of lead and aerogel pairs. Incident photons are converted to electrons and positrons in lead sheets and the photons from their Cerenkov radiation in the aerogel sheets are viewed by photomultiplier tubes. Since protons or charged pions, which are mainly produced by neutrons, do not emit the Cerenkov light because of their small velocity, excellent blindness to neutrons can be achieved while keeping high photon detection efficiency around 99.9% for the energies larger than 1 GeV. The half of the modules of the detector were installed and used as an in-beam photon veto detector in the first physics data taking of the KOTO experiment. The detector operated stably during 1 week of data taking and the expected performance on photon detection was confirmed as a result of evaluation using KL->3pi0 decay events.
In this presentation, the design of this detector, stability and performance studies in the physics data taking, and the future prospects will be reported.

Summary

Primary author(s) : MAEDA, Yosuke (Kyoto University)

Presenter(s) : MAEDA, Yosuke (Kyoto University)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **253** Type : **Oral**

New diamond detector structure and related front-end electronics for TOF application

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

The results obtained at BTF (Beam Test Facility) of Frascati with 500 MeV electrons working at single electron mode and with cosmic rays have shown a time resolution of the order of 100 ps with a polycrystalline diamond detector of 1.25 mm total thickness and a surface of 3x3 mm^2 operated at 350 V. To achieve this performance, a new structure of the diamond detector and a dedicated front-end electronics have been developed. The results obtained will be compared with standard mono and polycrystalline diamond detectors. This new structure of the detector together with the dedicated front-end electronics suggest the possibility to realize diamond detectors for MIPs with time resolution of the order of few tens ps.

Summary

Primary author(s) : PAOLOZZI, Lorenzo (Universita e INFN Roma Tor Vergata (IT)); CARDARELLI, Roberto (Universita e INFN Roma Tor Vergata (IT)); DI CIACCIO, Anna (Universita e INFN Roma Tor Vergata (IT))

Presenter(s) : PAOLOZZI, Lorenzo (Universita e INFN Roma Tor Vergata (IT))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **280** Type : **Oral**

Overview of the Insertable B-Layer (IBL) Project of the ATLAS experiment at the Large Hadron Collider

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

The ATLAS experiment will upgrade its Pixel Detector with the installation of a new pixel layer in 2014. The new sub-detector, named Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new smaller radius beam-pipe at a radius of 3.3 cm. To cope with the high radiation and pixel occupancy due to the proximity to the interaction point, a new read-out chip and two different silicon sensor technologies (planar and 3D) have been developed. Furthermore, the physics performance will be improved through the reduction of pixel size while targeting for a low material budget should be imposed, pushing for a new mechanical support using lightweight staves and a CO2 based cooling system. An overview of the IBL project as well as the present experience in its construction will be presented, focusing on the staves production, qualification of the assembly procedure, integration of the staves around the beam pipe and commissioning of the detector.

Summary

The ATLAS experiment will upgrade its Pixel Detector with the installation of a new pixel layer in 2014. The new sub-detector, named Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new smaller radius beam-pipe at a radius of 3.3 cm.

An overview of the IBL project as well as the present experience in its construction will be presented, focusing on the staves production, qualification of the assembly procedure, integration of the staves around the beam pipe and commissioning of the detector.

Primary author(s) : TRONCON, Clara (Milano Universita e INFN (IT))

Co-author(s) : LAPOIRE, Cecile (Universitaet Bonn (DE)/CERN)

Presenter(s) : LAPOIRE, Cecile (Universitaet Bonn (DE)/CERN)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **146** Type : **Oral**

PETIROC2 : 32 ch SiGe SiPM readout ASIC for GHz time and charge measurement

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

PETIROC2 is a 32 channel readout ASIC for high speed readout of SiPM matrixes. It features a 1 GHz 20 dB preamp followed by 1 GHz high speed discriminator and time-to-amplitude converter to measure the time down to 50 ps. A variable shaper channel measures the charge over 10 bits and also feeds a discriminator for high level signal trigger. The time and charge signals are digitized internally so that the chips can output only digital signals. The ASIC is realize in SiGe 0.35um technology and takes largely advantage of the SiGe bipolar transistors to achieve GHz bandwidhts at a few mW power/channel. The chip was submitted in november 13 and is presently at dicing, experimental results will be available at the conference.

Summary

Primary author(s) : Dr. DE LA TAILLE, Christophe (OMEGA CNRS/IN2P3 et Ecole Polytechnique (FR))

Co-author(s) : CALLIER, Stéphane (OMEGA / IN2P3 - CNRS); Dr. TONGBONG, Jeanne (CNRS); Mr. DULUCQ, FREDERIC (CNRS/IN2P3); FLEURY, Julien (WEEROC); Dr. AHMAD, Salleh (WEEROC FRANCE); MARTIN CHASSARD, Gisele (OMEGA (FR)); Mr. RAUX, Ludovic (OMEGA IN2P3); SEGUIN-MOREAU, Nathalie (IN2P3 & Ecole Polutechnique (FR)); BLIN, Sylvie (CNRS); THIENPONT, Damien (IN2P3/OMEGA)

Presenter(s) : Dr. DE LA TAILLE, Christophe (OMEGA CNRS/IN2P3 et Ecole Polytechnique (FR))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **226** Type : **Oral**

POLARBEAR-2 receiver system on the Simons Array telescopes for CMB polarization measurements

Friday, 6 June 2014 12:00 (0:20)

Abstract content

POLARBEAR-2 (PB-2) is a new receiver system which will be mounted on the Simons Array telescope in early 2015 for Cosmic Microwave Background (CMB) polarization measurements at the Atacama desert in Chile. The main science goal is to detect or set an upper limit of the inflationary gravitational wave B-mode. Another important topic is to probe the large scale structure in the universe and constrain the sum of the neutrino masses by measuring the weak gravitational lensing B-mode signal. PB-2 receiver is a cryostat cooled by two pulse-tube coolers and a sorption refrigerator. The receiver has 7588 dual-band antenna-coupled AlTi bilayer Transition Edge Sensor (TES) bolometers for simultaneous measurements at 95 and 150 GHz with the expected array sensitivity (NET) = 5.7uKsˆ1/2. The TES array is on the 350 mm diameter large focal plane cooled to 0.25 Kelvin and is read out by frequency domain multiplexing with superconducting quantum interface device (SQUID) amplifiers housed on the 4 Kelvin stage. Optical elements such as an alumina filter, metal mesh filters, alumina lenses and a half wave plate are carefully designed to meet the thermal and optical requirements of PB-2. We present an overview of PB-2 receiver system and the current status of its development.

Summary

Primary author(s) : Dr. HORI, Yasuto (KEK)

Presenter(s) : Dr. HORI, Yasuto (KEK)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **18** Type : **Oral**

Performance Of Thin Edgeless N-on-p Planar Pixel Sensors For ATLAS Upgrades

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

In view of the LHC upgrade phases towards the High Luminosity LHC (HL-LHC), the ATLAS experiment plans to upgrade the Inner Detector with an all-silicon system. Because of its radiation hardness and cost effectiveness, the n-on-p silicon technology is a promising candidate for a large area pixel detector. The paper reports on the joint development, by LPNHE and FBK, of novel n-on-p edgeless planar pixel sensors, making use of the active trench concept for the reduction of the dead area at the periphery of the device. After discussing the sensor technology, a complete overview of the electrical characterization of the produced devices will be given, together with results on the charge collection efficiency. Measurements on irradiated devices will be presented too. The results will be compared to device simulations we run and to other current edgeless planar productions aimed at the ATLAS tracker upgrade for the HL-LHC. Eventually results from beam test measurements with minimum ionizing particles, such as hit and charge collection efficiency - in particular at the sensor periphery, for these edgeless sensors will be discussed.

Summary

Primary author(s) : BOMBEN, Marco (Centre National de la Recherche Scientifique (FR))

Co-author(s) : CALDERINI, Giovanni (Centre National de la Recherche Scientifique (FR)); MARCHIORI, Giovanni (LPNHE Paris); CHAUVEAU, Jacques (Centre National de la Recherche Scientifique (FR)); LA ROSA, Alessandro (Universite de Geneve (CH)); GIACOMINI, Gabriele (Fondazione Bruno Kessler); BOSCARDIN, Maurizio (FBK Trento); ZORZI, Nicola (Fondazione Bruno Kessler - FBK); BOSISIO, Luciano (Universita e INFN (IT)); BAGOLINI, Alvise (Fondazione Bruno Kessler, Centro per i Materiali e i Microsistemi (FBK-CMM) Povo di Trento (TN), Italy)

Presenter(s) : BOMBEN, Marco (Centre National de la Recherche Scientifique (FR))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **128** Type : **Oral**

Performance evaluation of new photodetectors for Hyper-Kamiokande

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

We have been developing new photodetectors for the Hyper-Kamiokande (Hyper-K) detector, which is proposed as a next generation Megaton class water Cherenkov detector. There are three candidate photodetectors; One is a 20-inch venetian blind dynode type PMT (R3600) which is used in Super-Kamiokande. Second is a newly developed box and line dynode type PMT which has a better collection efficiency and timing response than R3600. The other one, a large-aperture Hybrid Photo-Detector (HPD), is also newly developed and uses an avalanche diode instead of dynodes to multiply photoelectrons. Compared to PMT, the HPD has a simpler structure, better collection efficiency, better timing response, and better single photoelectron charge resolution. A high quantum efficiency (QE) is a common option for the three candidates and it was applied for the R3600 at first. The high-QE R3600 has 30 % QE at maximum peak, 1.4 times higher than that of the R3600 used in Super-Kamiokande. In order to evaluate the performance and usability of the candidate photodetectors, we perform a long-term test with a 200-ton water Cherenkov detector located in Kamioka mine. The progress of the long-term test of 8-inch HPDs and high-QE R3600s will be reported. The status of R & D of the 20-inch box & line PMTs and 20-inch HPDs will be also presented. We plan to choose the photodetectors for Hyper-K in 2016.

Summary

Primary author(s) : Mr. SUDA, Yusuke (Department of Physics, University of Tokyo)

Co-author(s) : Dr. NISHIMURA, Yasuhiro (Research Center for Cosmic Neutrinos, Institute for Cosmic Ray Research, University of Tokyo); Ms. HIROTA, Seiko (Department of Physics, Kyoto University); Mr. OKAJIMA, Yuji (Department of Physics, Tokyo Institute of Technology); Prof. AIHARA, Hiroaki (Department of Physics, University of Tokyo); Prof. YOKOYAMA, Masashi (Department of Physics, University of Tokyo); Prof. SHIOZAWA, Masato (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Prof. HAYATO, Yoshinari (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Dr. NAKAYAMA, Shoei (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Dr. TANAKA, Hidekazu (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Prof. NAKAYA, Tsuyoshi (Department of Physics, Kyoto University); Dr. TAKETA, Akimichi (Earthquake Research Institute, University of Tokyo); Dr. KAWAI, Yoshihiko (Hamamatsu Photonics K.K.); Dr. OHMURA, Takayuki (Hamamatsu Photonics K.K.); Dr. SUZUKI, Masatoshi (Hamamatsu Photonics K.K.)

Presenter(s) : Mr. SUDA, Yusuke (Department of Physics, University of Tokyo)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **332** Type : **Oral**

Performance of FlexToT Time Based PET Readout ASIC for Depth of Interaction Measurements

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

This work discusses the capability of a time based readout ASIC, the so-called FlexToT ASIC, to perform Depth of Interaction (DOI) measurements. In particular we will analyse the performance of the ASIC with a Phoswich PET module. FlexToT ASIC is optimized for readout of common cathode Silicon Photo- Multipliers arrays with direct coupling and individual anode voltage control. FlexToT presents the following features: wide dynamic range, high speed, low input impedance, multi channel, low power and separated timing and charge signal output. It has 16 independent outputs for energy, a single fast timing output and pile-up detection. We will present experimental results on identification of the signal of different crystals (BGO and LYSO) based on timing and energy signals.

Summary

This work discusses the capability of a time based readout ASIC, the so-called FlexToT ASIC, to perform Depth of Interaction (DOI) measurements. In particular we will analyze the performance of the ASIC with a Phoswich PET module. FlexToT ASIC is optimized for readout of common cathode Silicon Photo- Multipliers arrays with direct coupling and individual anode voltage control. FlexToT presents the following features: wide dynamic range, high speed, low input impedance, multi channel, low power and separated timing and charge signal output. It has 16 independent outputs for energy, a single fast timing output and pile-up detection. FlexToT ASIC has 16 independent outputs for energy aa single fast timing output and pile-up detection. The low jitter current mode processing together with a configurable differential current mode logic (CML) output provides a timing signal suitable for Time of Flight (TOF) measurements. Each channel delivers a digital output of a Time Over Threshold (TOT) type with a pulse width proportional to peak current (charge) input. We will present experimental results on the identification of interactions on different crystals (BGO and LYSO) combining time and energy measurements. Figure 1 shows preliminary results on FlexToT capability for Phoswich operation. The information provided by time and energy channels of FlexToT seems to be sufficient to discriminate signals of GSO and LYSO crystals excited by a Na22 source.

Primary author(s) : GASCON, David (University of Barcelona (ES)); TRENADO GARCIA, Juan (University of Barcelona (ES))

Co-author(s) : GRACIANI DIAZ, Ricardo (University of Barcelona (ES)); MARIN, Jesus (CIEMAT); PEREZ-MORALES, Jose Manuel (CIEMAT); SANUY CHARLES, Andreu (University of Barcelona (ES)); Dr. CASANOVA, Raimon (University of Barcelona); Mr. SANCHEZ, David (University of Barcelona); SARASOLA, Iciar (CIEMAT); FEIXAS, Lluis

(CIEMAT); RATO, Pedro (CIEMAT); CELA, Jose Manuel (CIEMAT); MARTINEZ, Gustavo (CIEMAT)

Presenter(s) : GASCON, David (University of Barcelona (ES)); TRENADO GARCIA, Juan (University of Barcelona (ES))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **14** Type : **Oral**

Performance of Three Dimensional Integrated Circuits Bonded to Sensors

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

We report on the processing and performance of 3D integrated circuits (3DIC) bonded to silicon sensors. The circuits were part of the Fermilab-sponsored two-tier 0.13 micron run at Tezzaron/ Global Foundries. They include designs for the CMS track trigger, ILC vertex detectors, and x-ray correlation spectroscopy. Sensors were bonded to the 3DICs using die-to-die solder ball bonding as well as with a chip-to-wafer oxide bonding process (Ziptronix DBI) similar to the wafer-to-wafer bonding process used for the 3DICs.

Summary

Primary author(s) : Dr. LIPTON, Ronald (Fermi National Accelerator Lab. (US))

Co-author(s) : Dr. DEPTUCH, Grzegorz (Fermi National Accelerator Lab. (US)); Mr. YAREMA, Ray (FNAL); GRYBOS, Pawel (High Energy Department); SZCZYGIEL, Robert (AGH UST); TRIMPL, Marcel (Fermilab); HOFF, Jim (Fermilab); THOM, Julia (Cornell University (US)); WITTICH, Peter (Cornell University (US)); YE, Zhenyu (Fermi National Accelerator Lab. (US)); SIDDONS, Peter (Brookhaven National Laboratory); Prof. TRIPATHI, Mani (University of California Davis (US)); HEINTZ, Ulrich (Brown University (US)); NARAIN, Meenakshi (Brown University (US))

Presenter(s) : Dr. LIPTON, Ronald (Fermi National Accelerator Lab. (US))

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4c) 3D integration

Contribution ID : **234** Type : **Oral**

Performance of the AMS-02 Electromagnetic Calorimeter in Space

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The Alpha Magnetic Spectrometer (AMS-02) is a high-energy particle detector deployed on the International Space Station (ISS) since May 19, 2011 to conduct a long-duration mission on fundamental physics research in space. The main scientific goals of the mission are the detection of antimatter and dark matter through the study of the spectra and fluxes of protons, electrons, nuclei until the iron, their antiparticles, and gamma-rays in the GeV to TeV energy range. The Electromagnetic CALorimeter (ECAL) is required to measure e+, e- and gamma spectra and to discriminate electromagnetic showers from hadronic cascades. To fulfill these requirements the ECAL is based on a lead/scintillating fiber sandwich, providing a 3 Dimensional imaging reconstruction of the showers. The high granularity consists of 18 samplings in the longitudinal direction, and 72 samplings in the lateral direction. Measurements of ECAL parameters in space and performance in term of energy and angular resolutions, linearity, proton rejections will be reviewed.

Summary

Primary author(s) : INCAGLI, Marco (Sezione di Pisa (IT))

Presenter(s) : INCAGLI, Marco (Sezione di Pisa (IT))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **295** Type : **Oral**

Performance of the MCP-PMTs for the TOP counter in the Belle II experiment

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

We developed the micro-channel-plate (MCP) PMT for the Time-of-Propagation (TOP) counter, which is a novel Cherenkov counter to be used for particle identification in the Belle II experiment. The developed MCP-PMT has excellent performance for single photon detection; a timing resolution of about 40ps (sigma, including readout jitter), a nominal gain as high as 2 x 10^6, and a position sensitivity of about 5mm with 4 x 4 anode. In the Belle II TOP counter, 512 MCP-PMTs are used under a magnetic field of 1.5T. The performance details were inspected with and without the magnetic field. The gain on each anode was found to vary up to a factor of two over the 16 anodes in some of the MCP-PMTs. We will discuss on this issue. The gain was dropped by 20-80% in a 1.5T magnetic field. The reason is considered that the secondary electrons can be localized and the electron amplification can be saturated. The rate of the gain drop seems to have a correlation with the high-voltage applied to obtain the nominal gain. We will discuss on the gain drop and its rate. The photon detection efficiency was also measured in a 1.5T magnetic field. The results on about 300 MCP-PMTs will be reported. Regarding the lifetime of the MCP-PMT, we succeeded in extending the lifetime significantly by introducing the atomic layer deposition technique on MCP coating. The results of the lifetime measurements will be reported.

Summary

Primary author(s) : Mr. YONEKURA, Takuya (Nagoya university)

Co-author(s) : Prof. IIJIMA, Toru (Nagoya university); Mr. FURUMURA, Daiki (Nagoya university); Dr. INAMI, Kenji (Nagoya university); Dr. SUZUKI, Kazuhito (Nagoya university); Dr. MATSUOKA, Kodai (Nagoya university); Dr. HAYAKAWA, Tomokatsu (Nagoya university); Dr. KATO, Yuji (Nagoya university); Dr. SATO, Yutaro (Nagoya university); Mr. HIROSE, Shigeki (Nagoya university); Mr. ITO, Yuhei (Nagoya university)

Presenter(s) : Mr. YONEKURA, Takuya (Nagoya university)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **240** Type : **Oral**

Performance study of the TOP counter with the 2 GeV/c positron beam at LEPS

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

The TOP (Time-Of-Propagation) counter is a novel ring-imaging Cherenkov detector for particle identification in Belle II. Our goal is to identify up to 3 GeV/c kaons and pions with a pion efficiency of 95% and a fake-pion rate of 5% or better. The TOP counter mainly consists of a 2.7 m long quartz radiator bar and 32 micro-channel-plate PMTs. It measures the time of propagation of the Cherenkov photons in the quartz bar with a resolution of 50 ps to reconstruct the Cherenkov "ring" image in the detection time and position plane. A prototype TOP counter which was close to the final design was tested with the 2 GeV/c positron beam at the LEPS beam line in SPring-8, Japan. The test was successful and a beautiful pattern of the Cherenkov image was obtained as expected for the first time. This talk will focus on the results of the beam test, and the principle of the TOP counter will be demonstrated. The results include the number of detected photons per event, the distributions of the time of propagation, the reconstructed velocity of the positron on event by event basis, study for the particle identification based on the Likelihood ratio analysis and comparisons with the Monte Carlo simulation.

Summary

Primary author(s) : Dr. MATSUOKA, Kodai (Nagoya University)

Presenter(s) : Dr. MATSUOKA, Kodai (Nagoya University)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **258** Type : **Oral**

Phase camera development for gravitational wave detectors

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

We will report a study of the phase camera, which is a wave-front sensor of laser. This sensor is utilized for observing phase-modulated laser in an interferometer of gravitational wave (GW) detectors. The GW detectors are well sophisticated apparatus that need accurate position controls for mirrors. The laser modulation/demodulation is used for readout of the mirror displacement in such accurate control. Laser sideband signals created by phase modulation become very important not only for the control but also sensitivity of detector because the quality of controls affect a noise level. We are preparing this phase camera for VIRGO, which is a GW detector placed in Pisa. The sideband signals in power recycling cavity are easily degraded by mirror aberrations in VIRGO. In order to correct such mirror aberrations, CO2 laser and compensation plates will be prepared, and then, our phase camera will be used to see mirror aberrations through the state of sidebands. Hence, this phase camera can contribute to VIRGO for making high performance controls.

Summary

Primary author(s) : AGATSUMA, Kazuhiro (Nikhef)

Co-author(s) : VAN DEN BRAND, Jo (Nikhef); VAN BEUZEKOM, Martin (Nikhef)

Presenter(s) : AGATSUMA, Kazuhiro (Nikhef)

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **314** Type : **Oral**

Photodetector R&D for the Belle II upgraded forward Electromagnetic Calorimeter

Friday, 6 June 2014 12:00 (0:20)

Abstract content

The Belle II experiment will operate at the SuperKEKB e+e− collider, designed to reach a peak luminosity of 8×10ˆ35 cm−2 s−1 at the Ypsilon(4S). The high background environment of SuperKEKB poses serious challenges to the design of the Belle II detector. In particular, an upgrade of the forward Electromagnetic Calorimeter is foreseen: the new calorimeter will use pure CsI crystals, which have a faster scintillation light emission and lower light yield than the CsI(Tl) crystals presently used. An intense R&D program is ongoing to select the optimal photodetector to meet the stringent requirements set by the use of pure CsI in Belle II. A study of equivalent noise, resolution, radiation hardness and stability of low noise, high-gain avalanche photodiodes obtained by reading single pure CsI crystals will be presented. Our preliminary results indicate that a readout chain using these devices meets the requirements for the Belle II calorimeter and represents a cost-effective choice for the readout of pure CsI crystals in general.

Summary

Primary author(s) : ALOISIO, Alberto (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); BACCARO, Stefania (ENEA UTTMAT, Casaccia (RM) and INFN Sezione di Roma); FINOCCHIARO, Giuseppe (Laboratori Nazionali di Frascati dell'INFN); FIORE, Salvatore (ENEA UTTMAT, Casaccia (RM) and NFN Sezione di Roma); GIORDANO, Raffaele (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); LUBRANO, Pasquale (INFN Sezione di Perugia); MANONI, elisa (INFN Sezione di Perugia); ORDINE, antonio (INFN Sezione di Napoli); PASSERI, Antonio (INFN sezione di Roma Tre); PATTERI, piero (Laboratori Nazionali di Frascati dell'INFN); PERUZZI, Ida (Laboratori Nazionali di Frascati dell'INFN); PICCOLO, Marcello (Istituto Nazionale di Fisica Nucleare (INFN)); Dr. BRANCHINI, Paolo (INFN sezione di Roma Tre); ROSSI, Alessandro (INFN Perugia); SCIACCA, Crisostomo (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); CAVALIERE, Sergio (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); CECCHI, Claudia (Universita' degli Studi di Perugia and INFN Sezione di Perugia); CEMMI, Alessia (ENEA UTTMAT, Casaccia (RM) and INFN Sezione di Roma); DE LUCIA, Erika (Laboratori Nazionali di Frascati dell'INFN); DE NARDO, Guglielmo (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); DE SANGRO, Riccardo (INFN - LNF); FELICI, Giulietto (Laboratori Nazionali di Frascati dell'INFN)

Presenter(s) : DE LUCIA, Erika (Laboratori Nazionali di Frascati dell'INFN)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **389** Type : **Oral**

Pixel sensors with different pitch layouts for ATLAS Phase-II upgrade

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

Different pitch layouts are considered for the pixel detector being designed for the ATLAS upgraded tracking system which will be operating at the High Luminosity LHC. The tracking performance in the Endcap pixel regions could benefit from pixel layouts which differ from the geometries used in the barrel region. Also, the performance in different barrel layers and eta regions could be optimized using different pixel sizes. This presentation will report on the development and tests of pitch layouts which could be readout by the FE-I4 ASICs. The pixel geometries include 50x250 um2, 25x500 um2, 100x125 um2, 125x167 um2, 50x2000 um2 and 25x2000 um2. The sensors with geometries 50x250 um2, 25x500 um2 and 100x125 um2 were irradiated and tested at the DESY testbeam. These and other testbeam results as well as results from characterization of these sensors in the laboratory will be presented.

Summary

Primary author(s) : MILOVANOVIC, Marko (University of Liverpool (GB)); BURDIN, Sergey (University of Liverpool (GB))

Co-author(s) : BUTTAR, Craig (University of Glasgow (GB)); BATES, Richard (University of Glasgow (GB)); Dr. BLUE, Andrew (University of Glasgow); DOONAN, Kate (University of Glasgow (GB)); WRAIGHT, Kenneth Gibb (University of Glasgow (GB)); MCMULLEN, Thomas (University of Glasgow (GB)); STEWART, Andrew (U); PATER, Joleen (University of Manchester (GB)); EISENHARDT, Stephan (University of Edinburgh (GB)); MILLS, Corrinne (University of Edinburgh (GB)); Prof. ALLPORT, Philip Patrick (University of Liverpool (GB)); MATHESON, John (STFC - Rutherford Appleton Lab. (GB)); LIPP, John (Science and Technology Facilities Council); SIDIROPOULOS, Georgios (University of Edinburgh (GB)); ASHBY, Joseph (University of Glasgow (GB)); DOHERTY, Frederick (University of Glasgow (GB)); MCEWAN, Fiona (University of Glasgow (GB)); CASSE, Gianluigi (University of Liverpool (GB)); DERVAN, Paul (University of Liverpool (GB)); FORSHAW, Dean Charles (University of Liverpool (GB)); HAYWARD, Helen (University of Liverpool (GB)); TSURIN, Ilya (University of Liverpool (GB)); WONSAK, Sven (University of Liverpool (GB)); WORMALD, Michael (University of Liverpool (GB))

Presenter(s) : MILOVANOVIC, Marko (University of Liverpool (GB))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **85** Type : **Oral**

Planar silicon sensors for the CMS Tracker phase II upgrade

Friday, 6 June 2014 14:00 (0:20)

Abstract content

The CMS tracker collaboration is aiming to identify the best suited silicon materials and sensor thicknesses for future tracking detectors for the high luminosity phase of the Large Hadron Collider (HL-LHC). Therefore, a large material investigation and irradiation campaign was initiated. \\% A variety of silicon $p-in-n$ and $n-in-p$ test-sensors made from Float Zone (FZ), Magnetic Czochralski (MCz) and epitaxially grown (Epi) materials were manufactured in different sensor thicknesses by one single industrial producer (Hamamatsu Photonics K.K.). \\% The samples have been irradiated with 1 MeV neutrons, protons and subsequently with both particle types corresponding to fluences as expected for the positions of detector layers in the future tracker (up to $\Phi = 10^{16}$ cm^{-2}). \\% All materials have been characterized before and after irradiations, and throughout an annealing treatment. The measurements performed on the structures include electrical sensor characterization, measurement of the collected charge injected with beta sources and laser light and bulk defect characterization. In this talk, latest results from the campaign are presented.

Summary

Primary author(s) : Prof. MAZUMDAR, Kajari (Tata Inst. of Fundamental Research (IN))

Presenter(s) : JUNKES, Alexandra (Hamburg University (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **294** Type : **Oral**

Production of Scintillating Fiber Modules for high resolution tracking devices

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

In high energy physics experiments tracking detectors consisting of scintillating fibers readout by linear arrays of silicon photomultipliers have become a competitive alternative to silicon strip detectors.

The modules produced at the Ist Physics Institute of RWTH Aachen University are made out of ribbons of 0.25˜mm diameter scintillating fibers. Ribbons with different amounts of layers and with lengths between 0.3˜m and 3.0˜m have been produced. A spatial resolution of 0.05 mm was achieved with prototypes and experiments (e.g. PERDaix) using these scintillating fiber modules as tracking detectors.

The established process of the scintillating fiber module production and quality control measurements will be presented in detail.

Summary

Primary author(s) : KIRN, Thomas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Co-author(s) : SCHAEL, Stefan (Rheinisch-Westfaelische Tech. Hoch. (DE)); GREIM, Roman (RWTH Aachen); SCHATEIKIS, Tobias Marcus (Rheinisch-Westfaelische Tech. Hoch. (DE)); WLOCHAL, Michael (Rheinisch-Westfaelische Tech. Hoch. (DE)); SCHWERING, Georg (Rheinisch-Westfaelische Tech. Hoch. (DE)); KARPINSKI, Waclaw (Rheinisch-Westfaelische Tech. Hoch. (DE)); SCHULTZ VON DRATZIG, Arndt (RWTH Aachen)

Presenter(s) : KIRN, Thomas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **308** Type : **Oral**

Prospects for spectral CT with Medipix detectors

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

In the development of X-ray Computed Tomography (CT) in medical imaging, one is working to implement spectral information. While keeping the dose level the same, or even lower, than in conventional systems, spectral CT offers the possibility to measure energy dependent features of different tissues that will allow the extraction of additional information about the patient, eventually leading to real color CT. Spectral CT can be achieved through the application of energy sensitive pixel detectors, such as Medipix-based semiconductor devices and by the implementation of reconstruction algorithms where the energy information is taken into account. In this paper, we present the latest results of our work on spectral CT with Medipix detectors and specifically on detector characterization and the development of algorithms that include energy information.

Summary

Primary author(s) : SCHIOPPA, Enrico Junior (NIKHEF (NL))

Co-author(s) : VISSER, Janvs (NIKHEF (NL)); KOFFEMAN, Els (NIKHEF (NL)); Dr. UHER, Josef (Amsterdam Scientific Instruments)

Presenter(s) : SCHIOPPA, Enrico Junior (NIKHEF (NL))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **26** Type : **Oral**

R&D for Solid Xenon Particle Detector

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

The solid (crystallin) phase of xenon possesses many of the same advantages of liquid xenon as a particle detector material including good transparency, self-shielding, low intrinsic background, and high scintillation light yield. Many of the properties of solid xenon have been measured previously employing small volumes and thin films. Two major R\&D issues must be addressed to make a solid xenon particle detector; the demonstration of the scalability of solid xenon and the capability to readout scintillation lights and ionization signals from the solid xenon. Both issues are being addressed with a dedicated cryogenic system at Fermilab. In this talk, we will report the recent results of the solid xenon detector R&D.

Summary

Primary author(s) : YOO, Jonghee (Fermilab); RAMBERG, erik (Fermilab)

Presenter(s) : FILIPENKO, Mykhaylo (F)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **131** Type : **Oral**

R&D of water-based liquid scintillator as a reactor anti-neutrino detector

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

Neutrino energy measurement is very important not only for a neutrino oscillation experiment but for a nuclear reactor monitor requested by IAEA (International Atomic Energy Agency) as one of their safeguards against misuse of nuclear technology and nuclear materials. The requirements for the reactor monitor are to be nonflammable and nonvolatile. As such a detector, we are developping a water-based liquid scintillator. One of the problems of a water-based scintillator is that it is difficult to get enough light yield bucause most of the known luminescent agents are difficult to dissolve in water. We tried to dissolve a liminescent agent in water with sevarel surfactants and measured the light yield varying concentrations of the liminescent agent and surfactants. The scintillators are contained in a vial (4cm diameter and 6cm height) and the light yield is measured using compton edge electrons by gamma-rays from a cobalt 60. We used a blue LED for light yield calibration. As one of the results, we got about 30 photo-electrons for a scintillator consisting of water, PPO (luminescent agent), Bis-MSB (wavelength shifter), and sodium dodecylsulfate (surfactant). Neutrino interactions are identified by a well-known coincidence of a prompt positron signal followed by a delayed neutron capture by gadlinium. In addition to the light yield measurement described previously, we will report about development of the gadlinium-loaded water-based liquid scintillator.

Summary

Primary author(s) : Dr. SUZUKI, Atsumu (Kobe University)

Co-author(s) : Prof. HARA, Toshio (Kobe University)

Presenter(s) : Dr. SUZUKI, Atsumu (Kobe University)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **349** Type : **Oral**

Radiation Tolerance of the Outer Tracker in the Forward Region at the LHC

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

The LHCb experiment is designed to study B-decays at the LHC, and as such is constructed as a forward spectrometer. The large particle density in the forward region poses extreme challenges to the subdetectors, in terms of hit occupancies and radiation tolerance.
To accurately and efficiently detect the charged decay particles in the high-density particle environment of the LHC the Outer Tracker (OT) has been constructed. The OT is a gaseous straw tube detector, consisting of 53,760 straw tubes, covering an area of 360 m2 of double layers.
At the time of the conference, the performance of the OT during run I of the LHC has been scrutinized. The detector has operated under nominal LHC conditions for a period of over 2 years, corresponding to an integrated luminosity of approximately 3 fb-1. A remarkable radiation resistance of this sensitive gas detector is reported. Unlike most other subdetectors in LHCb, constructed with various technologies, no sign of ageing is observed after having received a total dose corresponding to about 100 mC/cm in the hottest region.
Two independent and complementary methods have been used to measure the radiation resistance of this gas detector in the forward region at the LHC. One method uses a dedicated setup in situ, with which a 90Sr source is scanned over the surface of part of the OT detector. The second method utilizes reconstructed tracks duing LHC operation, with which the hit efficiency over the full detector surface is determined at increased amplifier threshold.

Summary

Primary author(s) : TUNING, Niels (NIKHEF (NL)); KARBACH, Till Moritz (CERN)

Presenter(s) : KARBACH, Till Moritz (CERN)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **144** Type : **Oral**

Radio Detection of Cosmic Rays at the Auger Engineering Radio Array

Friday, 6 June 2014 12:20 (0:20)

Abstract content

The Pierre Auger Observatory detects ultra-high energy cosmic rays by measuring extensive air showers induced in the earth's atmosphere. Besides established detection techniques using a 3000 km2 array of particle detectors sampling shower particles at ground level, and detecting fluorescence light emitted during the shower development with telescopes, the Observatory explores the potential of radio detection of cosmic rays with the Auger Engineering Radio Array (AERA). Radio detection has the potential to provide information on e.g. cosmic ray shower properties with a duty-cycle not limited by day and moon light as in case of the fluorescence technique. AERA consists of 124 autonomous detector stations sensitive to MHz frequencies. The stations feature dual-polarized radio antennas, custom low-noise analog and digital electronics and a broad-band wireless communication system. With AERA we face the challenge of self-triggering on the radio pulse in a background dominated environment by implementing various real-time signal processing strategies within the station electronics. Complementary, we explore the potential of the radio technique as an integral part of future multi-component detectors by utilizing trigger information from the other Auger detectors and recently, by particle detectors integrated in the radio stations. We will discuss the current cosmic ray measurements and the status and prospects of AERA.

Summary

Primary author(s) : Mr. WEIDENHAUPT, Klaus (RWTH Aachen University)

Co-author(s) : AUGER COLLABORATION, Pierre (Observatorio Pierre Auger)

Presenter(s) : Mr. WEIDENHAUPT, Klaus (RWTH Aachen University)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **127** Type : **Oral**

Real-time Imaging of prompt gammas in proton therapy using improved Electron Tracking Compton Camera (ETCC)

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

We have developed an Electron-Tracking Compton Camera (ETCC) for medical imaging due to its wide energy dynamic range (200 - 1500keV) and abilities of background rejection and clear imaging using the tracking information of the recoil electron. Thus this camera has a potential of developing the new reagents for molecular imaging. Until now we have carried out several imaging reagent studies such as : (1) F-18-FDG (511keV) and I-131-MIBG (364keV) for double clinical tracer imaging, (2) Zn-65(1116keV),Mn-54, Fe-59 in mouse for high energy gamma emitting RI imaging. In addition, ETCC can image continuum spectral gamma-rays by removing background particle using dE/dx of the track. ETCC has a potential of real-time monitoring of the Bragg peak location by detecting prompt gammas. We successfully obtained the images of both 511keV and continuum high energy gamma rays (800-2000keV) from the water target irradiated by 140MeV proton (Kurosawa, Cur. Apl. Phys, 12 (2012), pp. 364). In 2013 we have completed a 30cm cube ETCC to catch gamma-rays, of which tracking efficiency was improved with 10 times. It enables to select the Compton event contained in TPC using only the energy loss rate of the track with distinguishing it from all backgrounds. Eventually its sensitivity is improved by a factor of 100. A similar imaging test for prompt gammas using 140MeV proton beam was recently carried out, of which intensity was increased more 10 times than previous experiment. Here I present new performance of the improved ETCC and the results of the beam test.

Summary

Primary author(s) : TANIMORI, Toru (Department of Physics, Kyoto University, Japan)

Co-author(s) : Prof. KUBO, Hidetoshi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMURA, Yoshitaka (Department of Physics, Kyoto University, Kyoto, Japan); Mr. ODA, makoto (Department of Physics, Kyoto University, Kyoto, Japan); Dr. SONODA, Shinya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TOMONO, Dai (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TAKADA, Atsushi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. KUROSAWA, Shunsuke (Institute of Material Research, Tohoku Univ. Japan); Prof. MIUCHI, Kentaro (Department of Physics, Kobe University, Japan); Dr. PARKER, Joseph (Department of Physics, Kyoto University, Kyoto, Japan); Mr. KOMURA, Shotaro (Department of Physics, Kyoto University, Kyoto, Japan); Mr. SAWANO, Tatsuya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. NAKAMURA, Kiseki (Department of Physics, Kyoto University, Kyoto, Japan); Mr. NAKAMURA, Shogo (Department of Physics, Kyoto University, Kyoto, Japan); Mr. MATSUOKA, Yoshihiro (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMOTO, Tatsuya (Research Institute for Sustainable Humanosphere, Kyoto Univ.Japan)

Presenter(s) : TANIMORI, Toru (Department of Physics, Kyoto University, Japan)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **50** Type : **Oral**

Recent Status of Front-end Electronics for DEPFET pixel detectors for Belle-II

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The Belle II experiment, which will start after 2015 at the Super-KEKB accelerator in Japan, will focus on the precision measurement of the CP-violation mechanism and on the search for physics beyond the Standard Model. To cope with considerably increased background, a pixel vertex detector (PXD) based on DEPFET technology has been developed. The PXD consists of two layers of DEPFET sensor modules located at 1.8 and 2.2 cm radii. Each module has a sensitive area, which is thinned down to 75 μm and steered with three types of ASICs: Switcher, Drain Current Digitizer (DCD) and Data Handling Processor (DHP). Switcher chips are designed to steer the pixel matrix of the sensitive area. The DCD chips digitize the drain current coming from the pixels. All ASICs will be directly bump-bonded to the balcony of the all-silicon DEPFET module. Its excellent spatial resolution (in the order of several microns) and low material budget was one of the decisive factors determining the choice of this technology for the first time. We report on the current status of the front-end electronics development, including the recent results from the first full-scale module prototype and chip testing.

Summary

The Belle-II pixel detector (PXD) has been developed based on DEPFET technology. The PXD requires three types of steering front-end electronics, and the development of the Data Handling Processor (DHP) is currently imperative. The DHP is designed to steer the readout from the DEPFET matrix by sending the control signals to the other two chips and sending the data off the module to the back-end data handling hybrid over a 15 m long electrical output link with a rate of 1.6 Gbps. Such high performance constraints for the digital data processing make the DHP implementation extremely challenging. Several conceptual solutions for the digital data processing blocks were proposed and implemented. Currently, three prototype DHPs have been produced with different technology and the first production version designed with a 65-nm standard CMOS technology has been delivered. The chip is currently under testing and is expected to be the production chip version, suitable for assembly on PXD modules.

Primary author(s) : KISHISHITA, Tetsuichi (University of Bonn)

Co-author(s) : HEMPEREK, Tomasz (Universitaet Bonn (DE)); Dr. KRÜGER, Hans (University of Bonn); LEMARENKO, Mikhail (Universitaet Bonn (DE)); Mr. LÜTTICKE, Florian (University of Bonn); Mr. GERMIC, Leonard (University of Bonn); Dr. MARINAS, Carlos (University of Bonn); WERMES, Norbert (Universitaet Bonn (DE))

Presenter(s) : KISHISHITA, Tetsuichi (University of Bonn)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **269** Type : **Oral**

Recent results of diamond radiation tolerance

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

Progress in experimental particle physics in the coming decade depends crucially upon the ability to carry out experiments at high energies and high luminosities. These two conditions imply that future experiments will take place in very high radiation areas. In order to perform these complex and perhaps expensive experiments new radiation hard technologies will have to be developed. Chemical Vapor Deposition (CVD) diamond has been developed as a radiation tolerant material for use very close to the interaction region where detectors must operate in extreme radiation conditions. During the past few years many CVD diamond devices have been manufactured and tested. As a detector for high radiation environments CVD diamond benefits substantially from its radiation hardness, very low leakage current, low dielectric constant, fast signal collection and ability to operate at room temperature. As a result CVD diamond has now been used extensively in beam conditions monitors at every experiment in the LHC. In addition, CVD diamond is now being considered as a sensor material for particle tracking detectors closest to the interaction region where the most extreme radiation conditions exist. We will present the present state-of-the-art of polycrystalline CVD diamond and single crystal CVD diamond and the latest results on the radiation tolerance of these materials for a range of protons, pions and neutrons obtained from strip detectors constructed with these materials.

Summary

Primary author(s) : KAGAN, Harris (Ohio State University (US))

Co-author(s) : TRISCHUK, William (University of Toronto (CA)); OTHER, Members of RD42 (The RD42 Collaboration)

Presenter(s) : Dr. HITS, Dmitry (Eidgenoessische Tech. Hochschule Zuerich (CH))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **141** Type : **Oral**

SPACIROC3: A Front-End Readout ASIC for JEM-EUSO cosmic ray observatory

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The SPACIROC ASIC is designed for the JEM-EUSO fluorescence-imaging telescope on board of the International Space Station. Its goal is the detection of Extreme Air Showers (EAS) above a few 10^19 eV, developing underneath at a distance of about 400 km, in the troposphere. The SPACIROC family is dedicated to readout 64-channel Multi Anode PMT (MAPMT) or similar detectors. The two main features of this ASIC are the photon counting for each input and the charge-to-time (Q-to-T) conversions for each 8-channel sum. In the photon counting mode, the 100% trigger efficiency is achieved for 1/3 photo-electron (pe) input charges and in order to avoid pile-up in case of a large flux of photons, the double pulse resolution is required to be shorter than 10ns. For the Q-to-T converter, the ASIC should operate in a large dynamic range (1pe to 100pe per pixel). The operating conditions of JEM-EUSO require having low power dissipation (1mW/channel). High-speed performances with low power are obtained thanks to the SiGe technology used for the ASIC. This ASIC has been submitted in three successive versions: SPACIROC1, which showed global good behavior, has been used to equip the EUSO-BALLON instrument. The second version was a conservative design to improve performances and decrease power consumption. The third version has been designed to improve the double pulse separation and to increase the charge dynamic range thanks to new front end architecture. The design and performances (with and without MAPMT) of the third version of SPACIROC are presented in TIPP2014 paper.

Summary

Primary author(s) : Mrs. BLIN, Sylvie (OMEGA Ecole Polytechnique&CNRS/IN2P3)

Co-author(s) : Mr. BARRILLON, Pierre (CNRS/IN2P3/LAL); Mr. DULUCQ, Frederic (OMEGA Ecole Polytechnique&CNRS/IN2P3); Mrs. DAGORET-CAMPAGNE, Sylvie (CNRS/IN2P3/LAL); Mr. DE LA TAILLE, Christophe (OMEGA Ecole Polytechnique&CNRS/IN2P3); Ms. MIYAMOTO, Hiroko (CNRS/IN2P3/LAL); Mr. MORETTO, Camille (CNRS/IN2P3/LAL); Mr. RABANAL, Julio (CNRS/IN2P3/LAL); Mr. THIENPONT, Damien (OMEGA Ecole Polytechnique&CNRS/IN2P3); Ms. TONGBONG, Jeanne (OMEGA Ecole Polytechnique&CNRS/IN2P3)

Presenter(s) : Mrs. BLIN, Sylvie (OMEGA Ecole Polytechnique&CNRS/IN2P3)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **23** Type : **Oral**

Scintillating Fiber Detector for the Beam Loss Proton Measurements at J-PARC Linac

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

In the J-PARC linac, due to its high intensity H- beam, significant beam loss has been observed at the downstream straight beam line section called ACS (Annular-Coupled Structure linac). The loss is mainly due to a proton which is produced due to double electron stripping of the Hˆ- beam by the residual gas inside the beam pipe, and the titanium beam pipe. We have developed a detector system consisting of 8 planes of scintillating fiber hodoscopes in order to measure proton tracks emitted from the beam pipe of the J-PARC linac. The system measures positions of the charged particle tracks in a small solid angle, and also measures the time-of-flight of each particle. We show angular and energy distribututions of the proton tracks measured in 2012-2013. We also show comparison of the results with simulation.

Summary

Primary author(s) : OLGA, Konstantinova (KEK)

Co-author(s) : Mr. MIURA, Akihiko (Japan Atomic Energy Agency); SAKO, Hiroyuki (Japan Atomic Research Agency); Dr. MARUTA, Tomofumi (KEK)

Presenter(s) : OLGA, Konstantinova (KEK)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **356** Type : **Oral**

Scintillating Fibre and Radiation Damage Studies for the LHCb Upgrade

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

The Scintillating Fibre (SciFi) Tracker for the LHCb Upgrade (CERN/LHCC 2014-001; LHCb TDR 15) is based on 2.5 m long multi-layered ribbons of 0.250 mm diameter Kuraray SCSF-78MJ scintillating fibre as the active medium and signal transport over covering 350 m^2 with silicon photomultiplier (SiPM) arrays for photo-readout. Over 10,000 km of fibre will turned into precision detector elements. The performance of the detector depends crucially on the geometrical and optical fibre parameters and, in particular, on their possible degradation due to ionizing radiation. The dearth of results for this fibre type in the total ionizing dose range of the upgrade, 60 Gy up to 35 kGy, along with conflicting conclusions regarding annealing and dose rate behaviour in literature, required a set of irradiation campaigns to estimate the behaviour of the full detector over its lifetime, especially as it is non-linear with dose. We will present results from the irradiation experiments performed by the LHCb SciFi collaboration over the last two years which show a behaviour due to radiation damage consistent with published models for polystyrene-based fibres, and are able to reproduce these results in various test facilities and beams. Other measurements of the fibre properties will be shown as well.

Summary

Primary author(s) : JORAM, Christian (CERN)

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH)); LEVERINGTON, Blake (Ruprecht-Karls-Universitaet Heidelberg (DE))

Presenter(s) : DECKENHOFF, Mirco (Technische Universitaet Dortmund (DE))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **165** Type : **Oral**

Sharing high speed optical data transmission links with Slow Control stream

Friday, 6 June 2014 14:20 (0:20)

Abstract content

An unified overall readout and optical high speed data transmission, called Belle2link, has been designed for use between Front-End electronics of all sub-detectors and the backend data acquisition in the Belle II experiment at KEK, Japan. These links provide not only a good electrical isolation, but also a bidirectional centralized data collection and command distribution. Further more the capacity of the gigabit fiber is far more than be needed, which stimulated us a idea to share the high speed data link with the slow control function(detector parameters setting). In addition to the description of belle2link in TIPP2011, this talk describes in detail about the relization of this slow control, including parameter setting in frontend electronics, combining slow control data in FE part with and separating slow control data in BE part from detector physics data, data priority management, single command mode and batch commands mode implementation. Tests made with drift chamber and silicon vertex detector systems are provided together with results and discussions.

Summary

The Belle2link, an unified overall readout with optical high speed data transmission shared with slow control functionality of detector parameter control has been designed for the Belle II experiment at KEK, Japan. A model system based on drift chamber system was successful and tt has been accepted by the collaboration. System for Drift Chamber had passed with cosmic ray test and beam test, system for Silicon Virtex Detector is now under beam test at DESY, Germany which showed also a success. Implementation and tests to other systems are under going.

Primary author(s) : Prof. LIU, Zhen-An (IHEP)

Presenter(s) : Prof. LIU, Zhen-An (IHEP)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **156** Type : **Oral**

Shower characteristics of particles with momenta from up to 100 GeV in the CALICE Scintillator-Tungsten HCAL

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

ABSTRACT: We present a study of the showers initiated by high momentum (up to 100 GeV) positrons, pions and protons in the highly granular CALICE analogue scintillator-tungsten hadronic calorimeter. The data were taken at the CERN PS and SPS. The analysis includes measurements of the calorimeter response to each particle type and studies of the longitudinal and radial shower development. The results are compared to several GEANT4 simulation models.

Summary

Primary author(s) : KLEMPT, Wolfgang (CERN)

Presenter(s) : KLEMPT, Wolfgang (CERN)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **400** Type : **Oral**

Silicon Photomultiplier Camera for Schwarzschild-Couder Cherenkov Telescopes

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

The Cherenkov Telescope Array (CTA) is an atmospheric Cherenkov observatory that will image the cosmos in very-high-energy gamma rays. CTA will study the highest-energy particle accelerators in the Universe and potentially confirm the particle nature of dark matter. We have designed an innovative Schwarzschild-Couder telescope which uses two mirrors to achieve excellent optical performance across a wide field of view. The small plate scale of the dual-mirror optics enables a compact camera which uses modern technology including silicon photomultipliers and the TARGET application-specific integrated circuit to read out a finely pixelated focal plane of 11,328 channels with modest weight, volume, cost, and power consumption. The camera design is hierarchical and modular at each level, enabling robust construction, operation, and maintenance. A prototype telescope is under construction and will be commissioned at the VERITAS site in Arizona. An array of such telescopes will provide excellent angular resolution and sensitivity in the core energy range of CTA, from 100 GeV to several TeV.

Summary

Primary author(s) : Prof. VANDENBROUCKE, Justin (UW Madison)

Presenter(s) : Prof. VANDENBROUCKE, Justin (UW Madison)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **350** Type : **Oral**

Silicon Photomultipliers for the LHCb Upgrade Scintillating Fibre Tracker

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

Silicon photomultipliers (SiPMs) are solid state photo detectors that combine all of the features necessary for the photon detection of a high resolution scintillating fibre tracker. Two SiPM manufacturers, Hamamatsu and KETEK have developed customized devices for SciFi Tracker application in the context of the LHCb tracker upgrade. These custom devices provide high photon detection efficiency (PDE) in a large wavelength range, high reliability due to its simple mechanical construction, a high density multi-channel package and are of sufficiently low cost to build a large area tracking device. There are several challenging requirements placed on the photo-detector mainly due to the neutron radiation environment and the low light output of the long scintillating fibre modules. New devices with the latest technological improvements implemented are available in spring 2014. This includes devices with different optical isolation between pixels (trenches) and different pixel sizes. The dark noise rate (DCR) increases strongly with irradiation and the noise cluster rate of the tracking device can only be kept sufficiently low at a temperature of -40°C. We present the results on PDE, cross-talk and noise before and after neutron irradiation at various temperatures. The results are compared for the latest and the devices based on the standard technology.

Summary

Primary author(s) : HAEFELI, Guido (Ecole Polytechnique Federale de Lausanne (CH))

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH))

Presenter(s) : XU, Zhirui (Ecole Polytechnique Federale de Lausanne (CH))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **340** Type : **Oral**

Silicon Sensors for High-Luminosity Trackers – RD50 Status Report

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

The revised schedule for the LHC upgrade foresees a significant increase of the luminosity of the LHC by upgrading towards the HL-LHC (High Luminosity-LHC). The final upgrade is planned for around 2023, followed by the HL-LHC running. This is motivated by the need to harvest the maximum physics potential from the machine. It is clear that the high integrated luminosity of 3000 fb-1 will result in very high radiation levels, which manifest a serious challenge for the detectors. This is especially true for the tracking detectors installed close to the interaction point. For HL-LHC, all-silicon central trackers are being studied in ATLAS, CMS and LHCb, with extremely radiation hard silicon sensors to be employed in the innermost layers. Within the RD50 Collaboration, a massive R&D program is underway, with an open cooperation across experimental boundaries to develop silicon sensors with sufficient radiation tolerance. One research topic is to study sensors made from p-type silicon bulk, which have superior radiation hardness as they collect electrons instead of holes. A further area of activity is the development of advanced sensor types like 3D detectors designed for the extreme radiation levels expected for the inner layers. We will present results of several detector technologies and silicon materials at radiation levels corresponding to HL-LHC fluences. Observations of charge multiplication effects at very high bias voltages in a number of detectors will be reported. Based on our results, we will give recommendations for the silicon detectors to be used for LHC detector upgrades.

Summary

Primary author(s) : KUEHN, Susanne (Albert-Ludwigs-Universitaet Freiburg (DE))

Presenter(s) : KUEHN, Susanne (Albert-Ludwigs-Universitaet Freiburg (DE))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **407** Type : **Oral**

Stability and homogeneity: key detector characteristics for good quality high-yield experimental data.

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

The high coherence, high peak power and short pulses duration of modern light sources (e.g. X-ray Free-Electron Lasers - XFELs) are particularly well suited for time-resolved pump-probe and coherent diffraction studies. In many pump-probe experiments small differences in signal produced by ground and excited states have to be detected and resolved. Poisson statistics dictates that ˜ 1 million of photons are needed to resolve an effect with 1/1000 precision. This requires detector systems with tremendous dynamic resolution and sources capable to provide either pulses with high intensity and moderate repetition rate or very high repetition rate with moderate intensity. The typical approach is to average many frames. However source, pump-laser and sample instability make blind averages not really useful. It is therefore critical to preserve the information of each single pulse: comprising beamline and accelerator diagnostics, laser to FEL timing, and detector. Data can then be sorted out, binned and correlated, before the averaging procedure. Further even when the detector is capable of better-than-Poisson performance for a single image, it's not guaranteed that the detector error will be smaller than the summed Poisson statistics when many frames will be averaged. Non-gaussian non-ergodic processes can dominate the error limiting the achievable resolution. Detector stability and homogeneity are equally important for X-ray Photon Correlation Spectroscopy (XPCS), where in addition small pixel and single photon resolution are needed. Deep understanding of the detection system and careful calibration are necessary for good quality high yield data. While these techniques have been used since long time in the High-Energy and Particle Physics communities, they are relatively new in the field of Photon Science. Examples of applications and optimization will be presented.

Summary

Primary author(s) : CARINI, Gabriella (SLAC)

Co-author(s) : HERRMANN, Sven (SLAC); LEMKE, Henrik (LCLS/SLAC); ROBERT, Aymeric (LCLS/SLAC); SIKORSKI, Marcin (LCLS/SLAC); SANGHOON, Song (LCLS/SLAC); ZHU, Diling (LCLS/SLAC)

Presenter(s) : CARINI, Gabriella (SLAC)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **40** Type : **Oral**

Status of KamLAND-Zen and purification methods

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

KamLAND-Zen experiment was started data taking from October 2011 to search for neutrino less double beta decay. The Mini-balloon filled with 136Xe loaded liquid scintillator was installed in the KamLAND detector. From the first result of KamLAND-Zen, there was the BG peak at 2.6 MeV region. As a result of data analysis, it was found that 110mAg was the BG candidate. The purification system of xenon and liquid scintillator were developed to remove the 110mAg BG. 136Xe gas was collected from the liquid scintillator in the Mini-balloon to purify 136Xe gas and liquid scintillator, respectively. In addition, 136Xe gas was purified using SASE getter just before dissolving 136Xe into liquid scintillator. The 2nd phase of KamLAND-Zen was started in 2013. I will report the status of KamLAND-Zen and purification methods.

Summary

Primary author(s) : Dr. UESHIMA, Kota (Tohoku University RCNS)

Presenter(s) : Dr. UESHIMA, Kota (Tohoku University RCNS)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **33** Type : **Oral**

Status of the CMS Phase 1 Pixel Upgrade

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

The silicon pixel detector is the innermost component of the CMS tracking system, providing high precision space point measurements of charged particle trajectories. Before 2018 the instantaneous luminosity of the LHC is expected to reach 2x1034cm−2s−1, which will significantly increase the number of interactions per bunch crossing. The current pixel detector of CMS was not designed to work efficiently in such a high occupancy environment and will be degraded by substantial data-loss introduced by buffering in the analogue readout chip (ROC) and effects of radiation damage in the sensors, built up over the operational period. To maintain a high tracking efficiency, CMS has planned to replace the current pixel system during „Phase 1" (2016/17) by a new lightweight detector, equipped with an additional 4th layer in the barrel, and one additional forward/backward disk. A new digital ROC has been designed, with increased buffers to minimize data-loss, and a digital readout protocol to increase the readout speed. Prototypes of digital single-chip modules have been characterized in an electron test beam at DESY, before and after irradiation. Even after the expected 4th layer lifetime dose of 130kGy, the prototypes were measured to be ˜99% efficient and the spacial resolution remained ˜7µm. Furthermore, energy calibrations using monochromatic X-rays were performed, and its dependence on irradiation and temperature were studied. This talk will give an overview of the upgraded detector with an emphasis on the status of the module production and testing of the 4th layer, which is being assembled and pretested by German institutes.

Summary

This talk will give an overview of the CMX pixel "Phase 1" upgrade with an emphasis on the status of the module production and testing of the 4th layer.

Primary author(s) : Dr. MATTIG, Stefan (Hamburg University (DE))

Presenter(s) : Dr. MATTIG, Stefan (Hamburg University (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **301** Type : **Oral**

Status of the CUORE and CUORE-0 experiments at Gran Sasso

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

CUORE is a 741 kg array of TeO2 bolometers for the search of neurinoless double beta decay in Te-130. The detector is being constructed at the Laboratori Nazionali del Gran Sasso, Italy, where it will start taking data in 2015. If the target background of 0.01 counts/(keV kg y) will be reached, in five years of data taking CUORE will have an half life sensitivity of about 1026 y. CUORE-0 is a smaller experiment constructed to test and demonstrate the performances expected for CUORE. The detector is a single tower of 52 CUORE-like bolometers that started taking data in spring 2013. The status and perspectives of CUORE will be discussed, and the first CUORE-0 data will be presented.

Summary

Primary author(s) : GORLA, Paolo (LNGS)

Presenter(s) : JON, Ouellet (LBL)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **255** Type : **Oral**

Study of Columnar Recombination in Xe+trymethilamine Mixtures using a Micromegas-TPC

Friday, 6 June 2014 12:20 (0:20)

Abstract content

Electron-ion recombination is experimentally studied in Xe+trimethylamine mixtures, motivated by its potential use for directional dark matter searches. A time projection chamber of 2.4 l with a novel configuration formed by two symmetric drift regions with two microbulk-Micromegas readouts is used to measure the recombination of α- and γ-particles, which are emitted in coincidence by an ^{241}Am source. A gas mixture of 98\%Xe+2\%TMA is used, varying the pressure from 2 to 10 bar, and the reduced drift field within 10-400 V/cm/bar range.
Both α-and γ-particles exhibit recombination as the electric drift field decreases, being stronger for α- particles. This is partially explained by columnar recombination due to the dependency observed with the track angle (relative to the direction of electric drift field). The comparison of the data with the theoretical models for recombination will be shown and discussed.
These results support a suggestion that has been recently put forward on how to obtain a directional signal in the recoils induced by Dark Matter interactions with xenon-gas. In fact, there are already efforts trying to pursue directionality but with very low masses.

Summary

Primary author(s) : Ms. HERRERA MUÑOZ, Diana Carolina (University of Zaragoza)

Co-author(s) : GARCIA IRASTORZA, Igor (Universidad de Zaragoza (ES)); GONZALEZ DIAZ, Diego (Universidad de Zaragoza (ES)); Mr. DAFNI, Theopisti (Universidad de Zaragoza (ES)); BASTOS DE OLIVEIRA, Carlos Alberto (Lawrence Berkeley National Lab, CA, USA); LONG, Megan (L); IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES)); RENNER, Joshua (UC Berkeley / Lawrence Berkeley National Lab); Dr. GOLDSCHMIDT, Azriel (UC Berkeley /Lawrence Berkely National Lab); Dr. CEBRIAN, Susana (Universidad de Zaragoza (ES)); Dr. LUZON, Gloria (Universidad de Zaragoza)

Presenter(s) : Ms. HERRERA MUÑOZ, Diana Carolina (University of Zaragoza)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **145** Type : **Oral**

Study of a Large Prototype TPC using Micro-Pattern Gas Detectors

Monday, 2 June 2014 16:10 (0:20)

Abstract content

In the last decade, R&D of detectors for the future International Linear Collider (ILC) has been carried out by the community. The International Large Detector (ILD) is one detector concept at the ILC where calorimetry and tracking systems are combined. The tracking system consists of a Si vertex detector and forward tracking disks coupled to a large volume Time Projection Chamber (TPC).

Within the framework of the LC-TPC collaboration, a Large Prototype (LP) TPC has been built as a demonstrator. Its endplate is able to contain up to seven identical Micro-Pattern Gas Dectectors (MPGD) modules. Recently, the LP has been equipped with resistive anode Micromegas (MM) or Gas electron Multiplier (GEM) modules. Both the MM and GEM technologies have been studied with a 5 GeV electron beam in a 1 Tesla magnet.

After introducing the LP, the current status, recent results (drift velocity, field distortions, ion gate and spatial resolution measurements) as well as future plans of the LC-TPC R&D with MM and GEM will be presented.

Summary

on behalf of the LC-TPC collaboration

Primary author(s) : Dr. ATTIE, David (CEA/Irfu)

Presenter(s) : Dr. ATTIE, David (CEA/Irfu)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **397** Type : **Oral**

Study of the Radiation Damage of Hamamatsu Silicon Photo Multipliers

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

An irradiation test on 16 Silicon Photo Multipliers produced by Hamamatsu has been performed in Louvain-la-Neuve at the CRC-CYCLONE 110 facility. The devices has been irradiated with neutrons in three dose steps: 5x10ˆ8 1MeV-neutron equivalent (neq), 5x10ˆ9 neq and 5x10ˆ10 neq. After each irradiation step the characteristic current-voltage curves and a high statistics sample of the dark noise waveforms have been recorded for offline analysis. In the proposed contribution we will present the results on the variation of the main SiPM parameters as a function of the dose for the devices under study, that include as well special "Radiation Hard" designs.

Summary

Silicon Photo Multipliers (SiPMs) are novel solid state photon detectors based on matrices of Geiger mode APDs. The interest of the scientific community for these devices has constantly increased since their (recent) development, thanks to their very appealing characteristics. They can in fact guarantee the same performances of standard vacuum tube photo multipliers with many advantages: single photon counting capability, compactness (few mm), low bias voltage (< 100V) , insensitivity to magnetic fieds etc. . . They have also a few drawbacks though, like the high dark noise rate and the radiation damage, which cause a degradation of the main parameters (i.e. gain, dark noise, photon counting capability. . .). The first issue has been addressed by the manufacturers, with significative improvements in the last years. The radiation damage is, instead, an intrinsic effect that is of paramount importance to understand, especially for applications where a high radiation environment is expected (like in High Energy Physics experiments). SiPMs producers are prototyping new devices to face this issue and it is very important to have a feedback from the final users.
In the proposed contribution we will present results of the irradiation test of 16 SiPMs from Hamamatsu, including non commercial "Radiation Hard" devices. The sample under study is made of 16 SiPMs with the same geometrical parameters (a square 1x1 mm2 active area and 50μm pixels) but realized with 8 different constructive methodologies (2 SiPM per type). The devices have been irradiated with neutrons in Leuven la Neuve at the CRC-CYCLONE 110 facility, with integrated 1 MeV equivalent doses of: 5x10ˆ8 neq, 5x10ˆ9 neq and 5x10ˆ10 neq. (values where is maximum the rate of change of the performances.). The experimental setup consisted of: a custom made PCB, for the mechanical support, bias and readout of the SiPMs signals; a commercial National Instrument CompactRIO system, for the readout of the currents and of the temperature; a high performances waveform digitizer (5GS/s, 12 bits) and a Keithley picoammeter for the I-V curves.
After each irradiation step and for each device, we measured the current versus voltage (I-V) characteristic curve and, thanks to the high resolution wavewform digitizer, we stored a high statistics (100 k-events per SiPM) sample of dark noise signals. The offline analsysis of the above data will allow us to measure the change in the main parameters of the devices: dark current, dark noise (rate and spectra) and, possibly, the gain (for the latter parameter, it can be measured as long as the single photo electron peaks are visible).
The results of the above measurements will be presented.

Primary author(s) : BALDINI, Wander (Universita di Ferrara (IT)); CALABRESE, Roberto (Universita di Ferrara (IT)); COTTA RAMUSINO, Angelo (Universita di Ferrara (IT)); FIORINI, Massimiliano (Universita di Ferrara (IT)); LUPPI, Eleonora (Universita di Ferrara (IT)); TOMASSETTI, Luca (University of Ferrara and INFN); TELLARINI, Giulia (Universita di Ferrara (IT)); DALCORSO, Flavio (University of Padova and INFN); MALAGUTI, Roberto (Ferrara INFN); Dr. ANDREOTTI, Mirco (INFN Ferrara)

Presenter(s) : BALDINI, Wander (Universita di Ferrara (IT)); FIORINI, Massimiliano (Universita di Ferrara (IT))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **16** Type : **Oral**

Systematic Study of a SiPMT array readout for fast time-of-flight detectors

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

Array of SiPMTs may be used, in place of fast conventional photomultipliers (PMTs), for the readout of scintillator based time-of-flight systems. These new detectors are insensitive to external magnetic fields, have lower cost than traditional PMTs and present a compact design. Comparison of the obtained timing resolutions as respect to the baseline one (~ 50 ps) obtained with Hamamatsu R4998 PMTs are reported. Results using arrays from Hamamatsu, SenSL, Advansid will be shown. Tests were done in laboratory both with cosmics and an home developed laser system, based on a fast Avtech pulse and a Nichia laser-diode, capable of simulating the signal from a MIP. Up to four scintillator detectors were testes in parallel, distributing the light signal using a fused fiber splitter.

Summary

Primary author(s) : Dr. BONESINI, Maurizio (Universita & INFN, Milano-Bicocca (IT))

Co-author(s) : BERTONI, Roberto (Sezione INFN Milano Bicocca); DE BARI, Antonio (Sezione INFN e Universita' di Pavia); ROSSELLA, Massimo (Sezione INFN Pavia); NARDO', Roberto (Sezione INFN e Universita' Pavia); PRATA, Marco (Sezione INFN Pavia); BARNABA, Orlando (Sezione INFN Pavia)

Presenter(s) : Dr. BONESINI, Maurizio (Universita & INFN, Milano-Bicocca (IT))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **282** Type : **Oral**

TORCH - a Cherenkov based Time-of-Flight Detetor

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

TORCH (Time Of internally Reflected CHerenkov radiation) is an innovative time-of-flight system designed to provide particle identification over large areas up to a momentum of 10 GeV/c. Cherenkov photons emitted within a 1 cm thick quartz radiator are propagated by internal reflection and imaged on to an array of Micro-Channel Plate photomultiplier tubes (MCPs). Performing 3σ pion/kaon separation at the limits of this momentum regime requires a time-of-flight resolution per track of 10-15 ps, over a ~10m flight path. With ~30 detected photons per track the required single-photon time resolution is ~70 ps. This presentation will discuss the development of the TORCH R&D program and present an outline for future work.

Summary

TORCH (Time Of internally Reflected CHerenkov radiation) is a highly compact Time-of-Flight (ToF) system utilizing Cherenkov radiation to achieve particle identification up to 10 GeV/c. At the upper limit of this momentum, a 10-15 ps resolution per track is required to achieve a 3σ ToF difference between pions and kaons.
TORCH will consist of a 1cm thick radiator plate equipped with light guides along the top and bottom of the plate which focus the produced Cherenkov radiation onto a series of micro-channel plate photomultipliers (MCPs). Precise timing of the arrival of the photons and their association with a particle track is then used to determine the particle time-of-flight. Around 30 photons are expected to be detected per track which results in a required time resolution per photon of around 70 ps. The time of propagation of each photon through the plate is governed by its wavelength which affects both its speed of propagation and its Cherenkov emission angle, and by measuring this angle to 1mrad precision TORCH will correct for chromatic dispersion.
The performance of the system relies on the MCP combining fast timing and longevity in high radiation environments, with a high granularity to allow precise measurement of the Cherenkov angle. Development of a 53 mm x 53 mm active area device with 8x128 effective pixel granularity, sub 50ps time resolution and long lifetime is under way with an industrial partner as part of the TORCH development.
A GEANT-4 simulation of the TORCH detector and its performance is currently being developed, taking accounting for the contributions to the overall TORCH resolution. This talk will focus on the requirements of the TORCH design and R&D developments including progress toward a prototype and the development and laboratory tests of the MCP.

Primary author(s) : COWIE, Euan Niall (University of Bristol (GB))

Co-author(s) : BROOK, Nicholas (BRISTOL); KERI, Tibor (University of Oxford (GB)); PIEDIGROSSI, Didier (CERN); FOPMA, Johan Maria (University of Oxford (GB)); CASTILLO GARCIA, Lucia (Ecole Polytechnique Federale de Lausanne (CH)); CUSSANS, David (University of Bristol (GB)); D'AMBROSIO, Carmelo (CERN); FORTY, Roger (CERN); FREI, Christoph (CERN); GAO, Rui (University of Oxford (GB)); GYS, Thierry (CERN); Prof. HARNEW, Neville (University of Oxford (GB))

Presenter(s) : COWIE, Euan Niall (University of Bristol (GB))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **241** Type : **Oral**

TRB3 Platform for Time, Amplitude and Charge Digitisation

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

One of the most crucial parts of the particle physics experiments, data digitisation, is being driven by the higher specifications for better particle identification. This increasing push by the experiments motivates the developers for different and better solutions for time, amplitude and charge digitisation methods. In our work we explain our solution for the tasks: TRB3 Platform.

The TRB3 board consists of 5 large (150K LUTs) and economical Lattice ECP3-FPGAs, which can be used for different tasks (e.g. data digitisation and data concentration) and adapted to different requirements. Time measurements done by the TRB3 are based on FPGA-TDC technology with 265 channels on board and have time precision as low as 7.4ps on a single channel. The TDC channels can be altered to measure different edges of the input signals allowing ToF and ToT measurements as required. Having TDC-FPGA implemented allows also to build an analogue digital converter directly in the FPGA by using the internal FPGA-LVDS buffers as comparators for measured signals and predefined reference signals. First implementations suggest that an 8 bit ADC with a dynamic range of 0-2v is possible. Charge-to-Digital-Converters (QDCs) can also be realised by very simple analogue FEE together with the TDCs for detectors (e.g. Electromagnetic Calorimeters), which require precise charge information. The concept for the QDC is a modified Wilkinson-ADC, where the charge information is encoded in the pulse width and measured by the TDC. The specification we would like to reach is <0.5% charge precision.

Summary

Primary author(s) : Mr. UGUR, Cahit (GSI Helmholtzzentrum für Schwerionenforschung GbmH)

Co-author(s) : Dr. TRAXLER, Michael (GSI Helmholtzzentrum für Schwerionenforschung GmbH); Dr. MICHEL, Jan (Goethe University Frankfurt); Dr. KOENIG, Wolfgang (GSI Helmholtzzentrum für Schwerionenforschung GmbH); KORCYL, Grzegorz (Jagiellonian University (PL)); Dr. PALKA, Marek (Jagiellonian University (PL))

Presenter(s) : Mr. UGUR, Cahit (GSI Helmholtzzentrum für Schwerionenforschung GbmH)

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **410** Type : **Oral**

Tech transfer or give-and-take? On the history and future of silicon photomultipliers in medical imaging and other domains.

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

The silicon photomultiplier (SiPM) is a photosensor that can be fabricated in cost-effective CMOS technology while offering high internal gain, fast response, and insensitivity to magnetic fields. The first prototype devices were developed in the late 1990s. Commercial products, including arrays of SiPMs with a total sensitive area of several square cm, became available in the mid-2000's. The potential of the SiPM as an alternative for the vacuum photomultiplier tube (PMT) in scintillation detectors for nuclear physics, particle physics, medical imaging, and other domains, was quickly recognized by a number of academic and industrial groups worldwide. The high utilization potential of SiPMs, combined with a healthy degree of competition between SiPM developers, has resulted in rapid improvement of their performance, robustness, and availability. Further innovations, such as fully digital implementations of the silicon photomultiplier (dSiPM), have been introduced in the meantime. Today, large-scale application is imminent in the domain of medical imaging, where two of the largest manufacturers of positron emission tomography (PET) devices have just released SiPM-based PET/CT and PET/MRI scanners for clinical use. With a coincidence resolving time (CRT) of ˜350 ps FWHM, these systems redefine the state-of-the-art in clinical time-of-flight (TOF) PET imaging. This talk discusses the introduction of SiPMs in PET detector technology as a process of give-and-take with particle physics and other domains, highlights research activities that are expected to further improve PET image quality, and indicates how some of the ongoing developments in TOF-PET(/MRI) instrumentation may be of use to other domains as well.

Summary

Primary author(s) : Dr. SCHAART, Dennis (Delft University of Technology)

Presenter(s) : Dr. SCHAART, Dennis (Delft University of Technology)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **270** Type : **Oral**

Test on VSiPMT prototypes

Friday, 6 June 2014 14:40 (0:20)

Abstract content

Vacuum Silicon PhotoMultiplier Tube (VSiPMT) is an innovative photodetector based on the combination of SiPM and PMT technologies. The basic idea consists in replacing the classical dynode chain of a PhotoMultiplier Tube with a SiPM. Such a design was proposed by our group in order to match the goal of a large photocathode sensitive area with the unrivalled photon counting performances of SiPMs. Moreover, much more improvements with respect to the standard PMT technology are expected to be obtained by VSiPMTs. First of all, the absence of the standard dynode chain will lead to avoid using voltage dividers and, hence, to a much lower power consumption. Transit Time Spread is expected to be sensibly reduced, since there will be no dynode chain spread, while Single Photoelectron resolution and gain stability will be much improved. In the proposed configuration, the SiPM acts as an electron multiplying detector. Therefore, the proof of feasibility of VSiPMT has required a thorough study both from a theoretical and experimental point of view. The extremely encouraging results obtained by our group led us to a new, advanced phase, consisting in the test of some VSiPMT prototypes realized by Hamamatsu. Our results show that VSiPMT prototypes performances go far beyond our expectations, thus charting the course for the development of an unrivalled innovative photon detection technology. In the present work we will describe accurately the results of our tests on Hamamatsu prototypes and we will show our studies and our purposes for the optimization of the device.

Summary

The detection of (single) photons is an essential experimental tool for a wide range of research areas. To date, in astroparticle physics experiments based on Cherenkov detectors a crucial role has been played by photomultiplier tubes. PMT technology has been improved continuously in the last years: the quantum efficiency of the photocathode has now reached a level of 40%, close to the theoretical maximum; single photon sensitivity and time resolution have been improved by a careful design of electrostatic focusing on the 1st dynode; with new coatings the secondary electron yield of dynodes has greatly improved, reducing the required number of dynodes and their size. Nevertheless standard photomultiplier tubes suffer the following drawbacks:
• fluctuations in the first dynode gain make single photon counting difficult; • linearity is strongly related to the gain and decreases as the latter increases; • transit time spreads over large fluctuations; • mechanical structure is complex, voluminous, rather massive and expensive; • they are sensitive to magnetic fields.
Moreover, in low background experiments the radioactivity of the photomultiplier components is a key concern. In fact, in many applications PMTs can dominate the total radioactivity of the detector. A significant effort is being made by manufacturers and research teams in order to reduce the background from photomultiplier tubes by rigorous choice of the raw materials used for all components. However, significant traces of radioactive nuclei are encountered in the metal and ceramic parts of the electron multiplication system. Hybrid photodetectors, not using dynode structures for amplification, are an attractive solution. In fact, in this type of device photoelectrons emerging from the photocathode are focused onto a silicon detector. As silicon is virtually free of radioactivity and the mass of the photodiode can be very small, the background from the inner part of the tube can be significantly reduced.

The Vacuum Silicon PhotoMultiplier Tube (VSiPMT) is an innovative photodetector based on the combination of SiPM and PMT technologies. The basic idea consists in replacing the classical dynode chain of a PhotoMultiplier Tube with a SiPM. Such a design was proposed by our group in order to match the goal of a large photocathode sensitive area with the unrivalled photon counting performances of SiPMs. Moreover, much more improvements with respect to the standard PMT technology are expected to be obtained by VSiPMTs. First of all, the absence of the standard dynode chain will lead to avoid using voltage dividers and, hence, to a much lower power consumption. Transit Time Spread is expected to be sensibly reduced, since there will be no dynode chain spread, while Single Photoelectron resolution and gain stability will be much improved. Differently from standard hybrids based on APDs, in the VSiPMT the HV between the photocathode and the silicon device is limited to 2-4 kV. Moreover, this HV is needed for the transportation of the photoelectrons and to make them overcome the SiO2 coating layer covering the SiPM. Therefore, the photoelectrons need a much lower voltage to be detected by a SiPM. The multiplication given by the SiPM is independent of the kinetic energy of the photoelectrons, as the output signal of a SiPM is independent of the number of electrons/holes created by the photoelectron in the same cell and is instead proportional to the number of cells fired. Several studies have been performed in last years by the INFN Napoli group on this subject. On the base of the very encouraging results obtained by our group, a first prototype of the VSiPMT has been developed in collaboration with Hamamatsu and tested in our labs. The measured performances are extremely encouraging. The work function of the VSiPMT has been evaluated showing a good linearity with satisfactory gain output G=(3÷6)·105. This prototype showed extremely good photon counting capabilities thanks to the very good performance in terms of SPE resolution (<17%), peak-to-valley ratio (> 60) and Transit Time Spread (< 0.5 ns). With an optimized design, the VSiPMT will exhibit several attractive features such as:
• excellent single photon detection; • high gain; • small electron amplification system size; • negligible power consumption; • low radioactivity background; • weak dependence on magnetic fields; • small price with respect to PMTs; • good performance at low temperature.
In this work we will provide an accurate description of the prototypes and of the extremely encouraging results of our tests. Moreover, we will show our studies and our purposes for the optimization of the device.

Primary author(s) : Dr. VIVOLO, Daniele (Università degli Studi di Napoli Federico II and INFN Napoli)

Co-author(s) : Prof. BARBARINO, Giancarlo (Università degli studi di Napoli - Federico II and INFN Naples); Dr. BARBATO, Felicia Carla Tiziana (Università degli studi di Napoli - Federico II and INFN Naples); DE ASMUNDIS, Riccardo (Universita e INFN (IT)); DE ROSA, Gianfranca (INFN); FIORILLO, Giuliana (Universita e INFN (IT)); MIGLIOZZI, Pasquale (Universita e INFN (IT)); MOLLO, Carlos Maximiliano (INFN); ROSSI, Biagio (Laboratorium fuer Hochenergiephysik-Universitaet Bern-Unknown)

Presenter(s) : Dr. VIVOLO, Daniele (Università degli Studi di Napoli Federico II and INFN Napoli)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **173** Type : **Oral**

The Askaryan Radio Array: Detector Design & Operation

Friday, 6 June 2014 15:20 (0:20)

Abstract content

The Askaryan Radio Array (ARA), currently under construction at the South Pole, is a large-scale cosmogenic neutrino detector designed to observe the coherent radio pulses associated with neutrino-induced cascades in the radio-transparent cold Antarctic ice. The detector incorporates novel bore-hole antenna designs, RF over fiber technology, custom ASIC digitizer, FPGA-based triggering, and ruggedized embedded computer systems all deployed in the South Pole ice sheet.

Summary

Primary author(s) : DUVERNOIS, Michael (University of Wisconsin)

Presenter(s) : DUVERNOIS, Michael (University of Wisconsin)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **408** Type : **Oral**

The Atmospheric Neutrino Neutron Experiment (ANNIE)

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

Neutron tagging in Gadolinium-doped water may play a significant role in reducing backgrounds from atmospheric neutrinos in next generation proton-decay searches using megaton-scale Water Cherenkov detectors. Similar techniques might also be useful in the detection of supernova neutrinos. Accurate determination of neutron tagging efficiencies will require a detailed understanding of the number of neutrons produced by neutrino interactions in water as a function of momentum transferred. We are developing a proposal for an experiment to be built on the Fermilab Booster Neutrino Beam, the Atmospheric Neutrino Neutron Interaction Experiment (ANNIE), which is designed to measure the neutron yield of atmospheric neutrino interactions in gadolinium-doped water. An innovative aspect of the ANNIE design is the use of precision timing to localize interaction vertices in the small fiducial volume of the detector. We propose to achieve this by using early production of LAPPDs (Large Area Picosecond Photodetectors). This experiment will be a first application of these devices demonstrating their feasibility for Water Cherenkov neutrino detectors. In this talk we will discuss the technological aspects of the ANNIE detector, with particular emphasis on work involved in adapting LAPPDs for the measurement.

Summary

http://arxiv.org/abs/1402.6411

Primary author(s) : WETSTEIN, Matthew (University of Chicago)

Presenter(s) : WETSTEIN, Matthew (University of Chicago)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **377** Type : **Oral**

The CERN NA62 experiment: Trigger and Data Acquisition

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

The main goal of the NA62 experiment at CERN is to measure the Branching Ratio (BR) of the ultra-rare decay of a charged kaon into a charged pion and two neutrinos (K+→π+νν). It aims to collect about 100 events in two years of data taking and to test the Standard Model of Particle Physics (SM), using the positive charged proton beam provided by SPS accelerator. The key issues are readout uniformity of sub-detectors, scalability, efficient online selection and lossless high-rate readout. The TDCB and the TEL62 boards are the common blocks of the fully digital Trigger and Data Acquisition system (TDAQ) and they will be used for most sub-detectors in the high-flux rare decay experiment. TDCBs measure hit times for sub-detectors, TEL62s process and store them in a buffer, extracting only those requested by the trigger system, which merges trigger primitives also produced by TEL62s. The complete dataflow and firmware organization are described.

Summary

The NA62 experiment at the CERN SPS aims at measuring the ultra-rare kaon decay K+ → π+νν as a highly sensitive test of the Standard Model (SM) and a search for New Physics. The detection of this process is very challenging due to the smallness of the signal and the presence of a very large background, therefore a very low undetected DAQ inefficiency, below 10–8, is an important issue. NA62 aims to collect about 100 signal events in 2 years of running. There are several detectors distributed before, along and after the 65 m long fiducial decay region: among the main ones GTK and STRAW are used for K+ and π+ tracking, CEDAR and RICH for particle identification while LAV, LKR and MUV to veto photons, positrons and muons. A scintillator hodoscope (CHOD) acts as a fast timing and trigger device. The devices used for this purpose are a general-purpose trigger and data acquisition board (TEL62) and its mezzanine cards (TDCB) hosting high-performance TDC chips. The TDCB houses 4 HPTDC chips developed at CERN, each HPTDC provides 32 TDC channels operating in fully digital mode at 98 ps LSB resolution, with some internal buffering for multi-hit capability and a trigger-matching logic allowing the extraction of hits in selected time windows. The TDCs produce two 32 bit-long words for each LVDS signal in each channel, one word for the time of the leading edge of the pulse and one for its trailing edge. The data are then buffered before being read periodically by the on-board FPGA, which adds a time-stamp and a counter to the data stream and addresses it to the TEL62. Several other features are implemented in the TDCB firmware, including a TDC data simulator for testing purposes, the possibility of triggering front-end board calibration signals through an output line and the controller for two on-board 2 MB SRAM memories usable for monitoring or online processing. The TEL62, a highly-improved version of the TELL1 board developed by EPFL Lausanne for the LHCb experiment, is the main device of the NA62 TDAQ: about 100 cards will be installed on the experiment. The board architecture is based on a star topology: 4 "Pre-Processing" (PP) Altera FPGAs are connected to a single "Sync-Link" (SL) Altera FPGA. The 4 PPs are directly connected to the 4 mezzanines, for a total of 512 input channels. The amount of data arriving from the TDCs can be up to a few tens of

MB/s per channel, depending on the sub-detector. Data are organized in packets, each one related to time frames of 6.4 us duration. The PP has the role of collecting and merging the data and later organizing them on the fly in a 2GB DDR2 memory, where each page is related to a single 6.4 us window. Inside the page data are packed using an optimized custom algorithm. Whenever a trigger arrives the data within a programmable number of 25 ns long time windows around the trigger timestamp are collected and sent to the SL. The data from the 4 PPs are merged and synchronized inside the SL, pre-processed and stored in a 1MB QDR SDRAM temporary buffer from which they are later extracted for formatting into data packets, which are sent through 4 Gigabit Ethernet links hosted on a custom daughter card to a computer farm that performs additional cuts and eventually writes events to permanent storage. Some detectors don't use this common TDAQ system, like the Liquid Krypton (LKr) calorimeter and the silicon Gigatracker. The Liquid Krypton calorimeter will be readout by Calorimeter REAdout Modules (CREAMs) which providing 40 MHz 14 bit sampling for all 13248 calorimeter channels, data buffering, optional zero suppression and programmable trigger sums for the L0 Lkr calorimeter trigger processor, also based on TEL62 boards. The Gigatracker readout is based on the TDCpix ASIC designed to meet the requirements of the detector: the chip readout efficiency is expected to be larger than 99% and each of the readout hits needs to be time stamped with a resolution better than 200 ps rms. The design rate for the Level 0 (L0) trigger output is below 1 MHz (with 1 ms latency). After L0, data are moved to PCs, and further trigger levels are implemented in software. All electronic boards run on a common, centrally generated, free-running synchronous 40 MHz clock. The L0 trigger is fully digitally implemented, using the very same data which is subsequently read out, to avoid duplicating trigger and data acquisition branches and to allow accurate offline monitoring; a central trigger processor will asynchronously match the L0 trigger primitives generated with a good time resolution by a few fast sub-detectors, and dispatch a (synchronous) L0 signal to every board through the above mentioned clock distribution system. The system has been extensively tested at the end of 2012 during a technical run at CERN. The TALK board, a TEL62 multifunction daughter board, was used as L0 Trigger Processor (L0TP): it merges trigger primitives arriving from several subdetectors and sends trigger decisions back. The TALK board design was started by the need to provide a trigger interface between the TTC and the old NA48 trigger distribution system, in order to read the LKr calorimeter with the NA48 readout hardware during the technical run. Additional functions in the firmware have been added: driver for the calibration of the calorimeter, test bench controller for the characterization of the new CREAM boards for the LKr readout, and prototype of L0TP. The prototype L0TP implements the logic to receive both triggers based on synchronous logic pulses and primitive packets generated by TEL62s, which are received through some of its five Ethernet channels. Communication with the PC is also done through an Ethernet interface. Besides the operation as a daughter board for the TEL62, a 6U VME frame to use the TALK board inside a VME crate was developed. In normal running system operation is driven centrally by the TDAQ management system; L0 triggers are dispatched to sub-detectors by the L0TP, with its Local Trigger Unit (LTU), a slightly modified version of the ALICE LTU, that acts as transparent dispatcher of these triggers to the subdetector TTCex; the TTCex modules, built by CERN PH/ESE, do encode the clock and trigger signals onto optical fibres and send them to the readout modules. Sub-detector data frames are sent to a farm of PCs for further data reduction.

Primary author(s) : PINZINO, Jacopo (Sezione di Pisa (IT))

Co-author(s) : FANTECHI, Riccardo (Sezione di Pisa (IT)); SOZZI, Marco (Sezione di Pisa (IT)); LAMANNA, Gianluca (Sezione di Pisa (IT)); VENDITTI, Stefano (CERN); ANGELUCCI, Bruno (Sezione di Pisa (IT)); SPINELLA, Franco (Sezione di Pisa (IT)); PEDRESCHI, Elena (Sezione di Pisa (IT)); PIANDANI, Roberto (Sezione di Pisa (IT))

Presenter(s) : PINZINO, Jacopo (Sezione di Pisa (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **248** Type : **Oral**

The CMS Electromagnetic Calorimeter: lessons learned during LHC run 1, overview and future projections

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The Electromagnetic Calorimeter (ECAL) of the Compact Muon Solenoid (CMS) experiment at the LHC is a hermetic, fine grained, homogeneous calorimeter, comprising 75848 lead tungstate scintillating crystals. We highlight the key role of the ECAL in the discovery and elucidation of the Standard Model Higgs boson during LHC Run I. We discuss, with reference to specific examples from LHC Run I, the challenges of operating a crystal calorimeter at a hadron collider. Particular successes, chiefly in terms of achieving and maintaining the required detector energy resolution in the harsh radiation environment of the LHC, are described. The prospects for LHC Run II (starting in 2015) are discussed, building upon the experience gained from Run I. The high luminosity upgrade of the LHC (HL-LHC) is expected to be operational from about 2025 to 2035 and will provide instantaneous and integrated luminosities of around 5 x 10^34 cm-2 s-1 and 3000 fb-1 respectively. We outline the challenges that ECAL will face and motivate the evolution of the detector that is thought to be necessary to maintain its performance throughout LHC and High-Luminosity LHC operation.

Summary

Primary author(s) : MARTELLI, Arabella (INFN e Università Milano-Bicocca (IT))

Presenter(s) : MARTELLI, Arabella (INFN e Università Milano-Bicocca (IT))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **327** Type : **Oral**

The COMET Straw Tracker System

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

The COMET experiment at J-PARC aims to search for a lepton-flavour violating process of muon to electron conversion in a muonic atom, μ-e conversion, with a branching-ratio sensitivity of better than 10^{-16}, 4 orders of magnitude better than the present limit, in order to explore the parameter region predicted by most of well-motivated theoretical models beyond the Standard Model. The need for this sensitivity places several stringent requirements on the detector development. The experiment requires to detect the monochromatic electron of 105 MeV, the momentum resolution is primarily limited by the multiple scattering effect for this momentum region. In addition, high power proton driver is essential to accumulate an enough statistics, *ie.* high rate capability is necessary. Thus we need the very light material detector which can handle the high intensity beam in order to achieve an excellent momentum resolution, better than 200 keV/c, and to accumulate an enough statistics, up to $5 \times 10^9 \mu^-$/s. In order to fulfill such requirements, we decided to develop the straw-base planar tracker which is operational in the vacuum and made by the extremely light material. The COMET straw tracker consists of 10 mm diameter tube, longer than 1 m length, with 20 μm thickness Mylar foil and 70 nm aluminum deposition, even thinner material down to 12 μm thickness is under development by the ultrasonic welding technique. In this presentation, the development of COMET straw tracker is described including the prospect of final detector construction.

Summary

Primary author(s) : Dr. NISHIGUCHI, Hajime (KEK)

Co-author(s) : Dr. TSAMALAIDZE, Zviadi (JINR); Dr. EVTOUKHOVITCH, Petr (JINR); Dr. UENO, Kazuki (KEK); Prof. MIHARA, Satoshi (KEK); Mr. TSVERAVA, Nikolozi (JINR); Dr. VOLKOV, Alexander (JINR); Dr. MOISEENKO, Anatoly (JINR)

Presenter(s) : Dr. NISHIGUCHI, Hajime (KEK)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **186** Type : **Oral**

The DIRC Detectors at the PANDA Experiment

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

The PANDA experiment at the new FAIR facility at GSI will perform charmonium spectroscopy and search for gluonic excitations using high luminosity antiproton beams from 1.5 to 15 GeV/c. To accomplish the scientific goals a high performance kaon/pion separation up to 4 GeV/c is mandatory. Because of space limitations the main components of the particle identification system will consist of DIRC (Detection of Internally Reflected Cherenkov light) detectors residing inside a magnetic field of up to 2 Tesla. A barrel DIRC with fused silica radiator bars will surround the target at a radial distance of 48 cm and will cover a polar angle range of 22 to 140 degrees; an endcap DIRC built of a segmented fused silica disc of 210 cm diameter will be installed in the forward region to cover the polar angles from 5 to 22 degrees.
There are several challenging issues with the PANDA DIRCs to be discussed in this presentation: the photon rates can reach a few MHz/cm2 and photon detection inside the magnetic field is required. The limited space available for both DIRCs enforces the use of special optics to focus the Cherenkov photons onto the readout planes, its final choice being still under investigation. For the high rate signal readout several frontend options are being studied.
The different design and readout options for both DIRCs were investigated with small scale prototypes using particle beams at CERN, DESY and GSI. Important results of these test runs will be presented and compared to simulations.

Summary

Primary author(s) : Dr. LEHMANN, Albert (University Erlangen-Nuremberg)

Presenter(s) : Dr. LEHMANN, Albert (University Erlangen-Nuremberg)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **175** Type : **Oral**

The Data Acquisition System for the KOTO detector

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The goal of KOTO experiment at J-PARC is to discover and measure the rate of the rare decay KL -> pi0-nu-nubar, for which the Standard Model predicts a branching ratio of (2.4 +/- 0.4)x10E-11 . The experiment is a follow-up to E391 at KEK with a completely new readout electronics, trigger and data acquisition system. The KOTO DAQ comprises a front-end 14-Bit, 125MHz ADC board and a two-level hardware trigger electronics. The ADC board injects the frontend detector signals into a low pass filter before digitization. The digitized pulses are stored inside a 4 µs deep pipeline while waiting for the first level trigger decision, based on a minimum energy deposition in the CsI calorimeter in anti-coincidence with signals in veto detectors. Data is then buffered inside a L2 trigger board, which calculates the center-of-energy of the event. Data accepted by the second level trigger board is read out via a front panel 1Gb Ethernet port into a computer cluster through a network switch using UDP protocol. After several commissioning runs in 2011 and 2012, KOTO has taken the first physics run in May 2013. We will review the performance of the DAQ during this run as well as plans to upgrade the clock distribution system and the overall trigger hardware connectivity. Finally we present a redesign of the Level 2 trigger and readout electronics able to accommodate the increase in data rate expected in the next few years.

Summary

Primary author(s) : XU, Jia (University of Michigan); SHARMA, Arjun (University of Chicago)

Co-author(s) : HUTCHESON, Melissa (University of Michigan); CAI, Tejin (University of Chicago); SHARMA, Arjun (University of Chicago); TECCHIO, Monica (University of Michigan); CAMPBELL, Myron (High Energy Physics); AMEEL, Jon (U); SUJIYAMA, Yasuyuki (Osaka University); CARRUTH, Celeste (University of Michigan); WHALLON, Nikola (University of Michigan); SU, Stephanie (University of Michigan); MICALLEF, Jessica (University of Michigan)

Presenter(s) : SU, Stephanie (University of Michigan)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **13** Type : **Oral**

The EUSO-Balloon Instrument

Friday, 6 June 2014 11:00 (0:20)

Abstract content

EUSO-Balloon is a pathfinder mission for JEM-EUSO (Extreme Universe Space Observatory on-board the Japanese Experiment Module), the near-UV telescope proposed to be installed on board the International Space Station (ISS) before the end of this decade. The main objective of this pathfinder mission is to perform a full scale end-to-end test of all the key technologies and instrumentation of JEM-EUSO detectors and to prove the entire detection chain. The JEM-EUSO instrument consists of an UV telescope designed to focus the signal of the UV tracks generated by Extreme Energy Cosmic Rays propagating in Earth's atmosphere, onto a finely pixelized UV camera. The EUSO-Balloon instrument, smaller respect to the one designed for the ISS, is currently developed as a payload of a stratospheric balloon operated by the French Centre National d'Études Spatiales (CNES) and will be launched during the CNES flight campaign in August 2014. This telescope will point towards the nadir from a float altitude of about 40 km. With its Fresnel Optics and Photo-Detector Module, EUSO-Balloon will monitor a 12x12° wide field of view in a wavelength range between 290 and 430 nm, at a rate of 400'000 frames/sec. In this paper, we will review the main stages of the signal processing of the EUSO-Balloon instrument: the photodetection, the analog electronics, the trigger stages, which select events while rejecting random background, the electronic acquisition system which performs the data management and the monitoring, allowing the instrument control during operation.

Summary

Primary author(s) : SCOTTI, Valentina; Dr. OSTERIA, Giuseppe (INFN NA)

Presenter(s) : SCOTTI, Valentina

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **95** Type : **Oral**

The Fast TracKer Processing Unit future evolution

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

The Fast Tracker (FTK) processor 1 for the ATLAS experiment has a computing core made of 128 Processing Units that reconstruct tracks in the silicon detector in a ~100 μsec deep pipeline. The track parameter resolution provided by FTK enables the HLT trigger to identify efficiently and reconstruct significant samples of fermionic Higgs decays.
Data processing speed is achieved with custom VLSI pattern recognition, linearized track fitting executed inside modern FPGAs, pipelining, and parallel processing. One large FPGA executes full resolution track fitting inside low resolution candidate tracks found by a set of 16 custom Asic devices, called Associative Memories (AM chips) [2].
The FTK dual structure, based on the cooperation of VLSI dedicated AM and programmable FPGAs, is maintained to achieve further technology performance, miniaturization and integration of the current state of the art prototypes. This allows to fully exploit new applications within and outside the High Energy Physics field.
We plan to increase the FPGA parallelism by associating one FPGA to each AM chip. The FPGA configures and handles the AM and provides a flexible computing power to process the shapes selected by the AM. The goals of this new elementary unit made of 2 chips are: maximum parallelism exploitation, low power consumption, execution time at least 1000 times shorter than the best commercial CPUs, distributed debugging and monitoring tools suited for a pipelined, highly parallelized structure, high degree of configurability to face different applications with maximum efficiency.
We report on the design of the FPGA logic performing all the complementary functions of the pattern matching inside the AM. We also show the results of the simulation of the AM and FPGA logics attached together.
1 Andreani et al., The FastTracker Real Time Processor and Its Impact on Muon Isolation, Tau and b-Jet Online Selections at ATLAS, 2012 TNS Vol.: 59 , Issue:2, pp, 348 – 357
[2] A. Andreani et al., "The AMchip04 and the processing unit prototype for the FastTracker", IOP J. Instr. 7, C08007 (2012).

Summary

Primary author(s) : GARELLI, Nicoletta (SLAC National Accelerator Laboratory (US))

Presenter(s) : GENTSOS, Christos (Aristotle Univ. of Thessaloniki (GR))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **66** Type : **Oral**

The FlashCam Camera for the Medium-Sized Telescopes of CTA

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

The Cherenkov Telescope Array (CTA) is the next generation ground-based instrument for the detection of cosmic gamma-rays with energies from about 20 GeV up to several hundred TeV. It is envisaged to be comprised of large-, medium- and small-sized telescopes (23m, 10-12m and 4m mirror aperture, respectively). Within the scope of the FlashCam project, a novel camera for the medium-sized telescopes of CTA has been developed. Its integration follows a horizontal architecture, where the photon detector plane (hosting photosensors and preamplifiers) is a self-contained unit interfaced through analog signal transmission cables to crates containing the readout electronics. The FlashCam design features fully digital readout and trigger electronics based on commercial ADCs and FPGAs as key components. In this way different type of digitization schemes and trigger logics can be implemented, without exchanging any hardware. The data transfer from the camera to a server is Ethernet-based, and processing rates (including event building) up to about 2 GBytes/sec have been achieved. Together with the dead-time free signal digitization this allows to operate at trigger rates up to several tens of kHz. Extensive tests and measurements with a 144-pixel setup (equipped with photomultipliers and electronics) have been performed, the results of which will be reported. In addition, the status of the preparations for a 1764-pixel prototype with full-scale mechanics and cooling system will be presented.

Summary

Primary author(s) : WEITZEL, Quirin (Max-Planck-Institut fuer Kernphysik Heidelberg)

Co-author(s) : BAUER, Christian (Max-Planck-Institut fuer Kernphysik Heidelberg); KALKUHL, Christoph (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); KASPEREK, Jerzy (AGH University of Science and Technology Krakow); KIHM, Thomas (Max-Planck-Institut fuer Kernphysik Heidelberg); KOZIOL, Jerzy (Jagiellonian University Krakow); LAHMANN, Robert (Physikalisches Institut, Universitaet Erlangen); MANALAYSAY, Aaron (Physik-Institut, Universitaet Zuerich); MARSZALEK, Adam (Jagiellonian University Krakow); PUEHLHOFER, Gerd (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); RAJDA, Pawel (AGH University of Science and Technology Krakow); REIMER, Olaf (Institut fuer Astro und Teilchenphysik, Universitaet Innsbruck); EISENKOLB, Felix (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); ROMASZKAN, Wojciech (AGH University of Science and Technology Krakow); RUPINSKI, Marcin (AGH University of Science and Technology Krakow); SCHANZ, Thomas (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); SCHWAB, Thomas (Max-Planck-Institut fuer Kernphysik Heidelberg); STEINER, Stefan (Physik-Institut, Universitaet Zuerich); STRAUMANN, Ueli (Physik-Institut, Universitaet Zuerich); TENZER, Christoph (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); VOLLHARDT, Achim (Physik-Institut, Universitaet Zuerich); WINIARSKI, Krzysztof (AGH University of Science and

Technology Krakow); ZIETARA, Krzysztof (Jagiellonian University Krakow); FLORIN, Daniel (Physik-Institut, Universitaet Zuerich); FOEHR, Christian (Max-Planck-Institut fuer Kernphysik Heidelberg); GADOLA, Arno (Physik-Institut, Universitaet Zuerich); GARRECHT, Frank (Max–Planck-Institut fuer Kernphysik Heidelberg); HERMANN, German (Max-Planck-Institut fuer Kernphysik Heidelberg); JUNG, Ira (Physikalisches Institut, Universitaet Erlangen); KALEKIN, Oleg (Physikalisches Institut, Universitaet Erlangen)

Presenter(s) : WEITZEL, Quirin (Max-Planck-Institut fuer Kernphysik Heidelberg)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **30** Type : **Oral**

The High-Voltage Monolithic Active Pixel Sensor for the Mu3e Experiment

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

The Mu3e experiment searches for the lepton flavor violating decay $\mu^+ \rightarrow e^+e^-e^+$. We are aiming for a sensitivity of one in 10^{16} μ-decays. To measure the momentum and vertex position of low momentum electrons (10 - 53 MeV/c) originating from such a rare decay with high precision, a tracking detector built from High-Voltage Monolithic Active Pixel Sensors (HV-MAPS) is implemented.

The MUPIX chips are HV-MAPS designed for Mu3e and are implemented in 180 nm HV-CMOS technology. HV-MAPS is the technology of choice because it can be thinned to 50˜μm, is radiation-tolerant, has a high time resolution, and is low cost. Furthermore, the pixel electronics are embedded inside the sensor chip to reduce the material budget.

Performance results of the MUPIX4 chip are presented. In 2013, we tested the MUPIX4 chip using a 1 - 6˜GeV electron beam at DESY. The discussed results include the spatial resolution, time resolution, and efficiency of the MUPIX4 chip.

Summary

Primary author(s) : Dr. SHRESTHA, Shruti (Physikalisches Institut Heidelberg)

Presenter(s) : Dr. SHRESTHA, Shruti (Physikalisches Institut Heidelberg)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **343** Type : **Oral**

The LHCb Upgrade Scintillating Fibre Tracker

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The Scintillating Fibre (SciFi) Tracker is designed to replace the current downstream tracking detectors in the LHCb Upgrade during 2018 (CERN/LHCC 2014-001; LHCb TDR 15). The operation and the results obtained from the data collected 2011 and 2012 demonstrate that the current detector is robust and functioning very well. However, the limit of $\mathcal{O}(1\ \mathrm{fb}^{-1})$ of data per year cannot be overcome without improving the detector. After 2018, it is planned to run with an increased luminosity of $1-2\times10^{33}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$ to collect up to 50 fb^{-1} of data. This will be achieved using 25 ns bunch spacing with the average number of proton-proton interactions per bunch crossing $\nu = 3.8 - 7.6$. Collecting data at this luminosity will only be possible if the detector is improved by increasing the readout of the front-end electronics to 40MHz and implementing a more flexible software-based triggering system that will increase the data rate as well as the efficiency. The increase in interactions per bunch crossing will result in an increased occupancy in the tracking detectors and will exceed the operational occupancy for the Outer Tracker. Here we present the SciFi Tracker as the replacement for the Outer and Inner Trackers.

The SciFi Tracker is based on 2.5 m long multi-layered ribbons from 10,000 km of 0.250 mm diameter scintillating fibre as the active medium and signal transport over 12 planes covering 350 m^2. Cooled silicon photomultiplier (SiPM) arrays with 128 channels and 0.25 mm channel width are used as readout. The front-end electronics are designed to digitize the signals from the SiPMS with a custom ASIC chip, the PACIFIC, for the approximately 560,000 channels and reconstruct the track hit position within an on-board FPGA. Several challenges facing this detector will be presented regarding the precision construction of the large active detector components, the radiation hardness of the scintillating fibres and the SiPMs, the high density readout electronics, and the necessary cooling systems.

Summary

Primary author(s) : LEVERINGTON, Blake (Ruprecht-Karls-Universitaet Heidelberg (DE))

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH))

Presenter(s) : LEVERINGTON, Blake (Ruprecht-Karls-Universitaet Heidelberg (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **9** Type : **Oral**

The LHCb trigger system: performance and outlook

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

The LHCb experiment is a spectrometer dedicated to the study of heavy flavor at the LHC. The rate of proton-proton collisions at the LHC is 15 MHz, of which only 5 kHz can be written to storage for offline analysis. For this reason the trigger system plays a key role in selecting signal events and rejecting background. In contrast to previous experiments at hadron colliders, the bulk of the LHCb trigger is implemented in software and deployed on a farm of 20k parallel processing nodes. This system, called the High Level Trigger (HLT) is responsible for reducing the rate from the maximum at which the detector can be read out, 1.1 MHz, to the 5 kHz which can be processed offline. The inherent flexibility of this software trigger allowed LHCb to run at twice its design luminosity in 2012. Simultaneously, the HLT performed far beyond the nominal design in terms of signal efficiencies, in particular for charm physics. It also showcased a number of pioneering concepts, for example: the deployment of an inclusive multivariate B-hadron tagger as the main physics trigger of the experiment, buffering of events to local disks, and simulation-free event-by-event trigger efficiency corrections. This talk will cover the design and performance of the LHCb trigger system, and discuss planned improvements beyond LS1 as well as plans for the LHCb upgrade trigger.

Summary

Primary author(s) : ALBRECHT, Johannes (Technische Universitaet Dortmund (DE)); RAVEN, Gerhard (NIKHEF (NL)); GLIGOROV, Vladimir (CERN)

Presenter(s) : ALBRECHT, Johannes (Technische Universitaet Dortmund (DE)); RAVEN, Gerhard (NIKHEF (NL)); GLIGOROV, Vladimir (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **277** Type : **Oral**

The LZ dark matter search

Monday, 2 June 2014 16:10 (0:20)

Abstract content

The LUX-ZEPLIN (LZ) experiment is a next-generation search for Weakly Interacting Massive Particles, scaling the very successful double-phase xenon technology to multi-tonne target mass. LZ will be deployed at the 4850-ft level of the Sanford Underground Research Facility (South Dakota, USA) after completion of LUX, which is presently operating there. At its core, LZ will feature a 7-tonne (active) liquid xenon TPC surrounded by two 'veto' detectors. Particle interactions in the WIMP target generate two signatures: prompt scintillation light and ionisation charge, the latter transduced to a pulse of electroluminescence light in a thin gaseous layer above the liquid. Our strategy is to mitigate radiogenic backgrounds from detector materials through a combination of self-shielding, precise vertex location, coincidence vetoing, and xenon purification – to expose a uniform background from astrophysical neutrinos. Electron recoils from solar pp neutrino scattering can be mostly discriminated by the ratio of the two signatures, which differs from that for nuclear recoil interactions expected from WIMPs. We present the project status and the sensitivity reach of this exciting instrument due to start construction soon.

Summary

Primary author(s) : ARAUJO, Henrique (Imperial College London)

Presenter(s) : ARAUJO, Henrique (Imperial College London)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **204** Type : **Oral**

The NEXT detector: an Electroluminescence Xenon TPC for neutrinoless double beta decay detection

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The NEXT Experiment aims to detect neutrinoless double beta decay using an HPXe TPC based on electroluminescence to be deployed in the Canfranc Underground Laboratory. New-generation experiments for double beta decay detection need to be sensitive to lifetimes longer than 1025 years. One remarkable challenge is the conception of a detector that enables an efficient and unambiguous identification of such a signal. Of the different detection techniques available, one has been chosen based on its suitability for complying with the key demands of this particular experiment: the capability to achieve an optimal energy resolution at the Xe Qββ energy (2.458 MeV), the event topology reconstruction competence to identify the distinct dE/dx of electron tracks, capability of high background suppression and the aptitude to be expanded to a large-scale system. Electroluminescence as the amplification technique for the primary ionisation and SiPM as the readout sensors for the topological recognition have been the elected means to integrate the experiment, combined in a high-pressure xenon Time Projection Chamber. Prototypes on which extensive studies have been performed already offered very promising results. One of these large prototypes is NEXT-DEMO, a TPC based on electroluminescence that validates the feasibility of the NEXT detector concept. This prototype is being upgraded to NEXT-NEW, which will fully operate in Canfranc Underground Laboratory. In this work, results will be presented and considerations will be made on both NEXT-DEMO and NEXT-NEW.

Summary

The Neutrino Experiment with a Xenon TPC (NEXT) aims to detect neutrinoless double beta decay using a high-pressure Xe-136 TPC based on electroluminescence to be deployed in the Canfranc Underground Laboratory, Spain. New-generation experiments for double beta decay detection need to be sensitive to lifetimes longer than 1025 years. One remarkable defy is the conception of a detector that enables an efficient and unambiguous identification of such a signal. For NEXT, the detection technique has been chosen based on its suitability for complying with the key demands of this particular experiment: the capability to achieve an optimal energy resolution at the Xe Qββ energy (2.458 MeV), the event topology reconstruction competence proving the possibility to identify the distinct dE/dx of electron tracks, capability of high background suppression and the aptitude to be expanded to a large-scale system. To achieve optimal energy resolution, electroluminescence has been chosen as the amplification technique for the primary ionisation of xenon, over the charge amplification technique. As for the readout planes, the chamber will have distinct detection planes for calorimetry and tracking, behind cathode and anode, respectively. SiPMs have been elected as the readout sensors for the topological recognition and PMTs for the energy plane. The detection process is as follows: Particles interacting in the HPXe transfer their energy to the medium through ionisation and excitation. The excitation energy is patent in the prompt emission of VUV (around 178 nm) scintillation light from the xenon gas. The ionisation tracks (positive ions and free electrons) left behind by the particle are prevented from recombine applying an electric field of 0.3–0.5 kV per cm. The ionisation electrons drift toward the TPC anode, entering a region, delimited by two highly-transparent meshes, with an even more intense electric field, 3 kV per cm per bar. There, further VUV photons

are formed isotropically by electroluminescence processes. Hence, both primary scintillation and primary ionisation produce an optical signal, which is detected in the energy plane with PMTs, located behind the cathode. The detection of the primary scintillation light constitutes the start-of-event, whereas the detection of electroluminescence light provides an energy measurement. Electroluminescent light provides tracking as well, since it is detected also at the anode plane, by means of an array of 1-mm2 SiPMs, 1cm in pitch, placed a few millimetres away from the electroluminescence region, Fig.1. Prototypes using the above described features, on which extensive studies have been performed, already offered very promising results. One of these large prototypes is NEXT-DEMO, which validates the feasibility of the NEXT detector concept. NEXT-DEMO has been fully operational at IFIC, Valencia, since 2011. A near-intrinsic energy resolution has been reached in the NEXT-DEMO prototype with a value of about 1.8% FWHM for 511 keV electrons, extrapolating to about 0.8% FWHM at Qββ=2.458 MeV, Fig.2.
Fig.1: The Separate, Optimized Functions (SOFT) concept in the NEXT experiment: EL light generated at the anode is recorded in the photosensor plane right behind it and used for tracking; it is also recorded in the photosensor plane behind the transparent cathode and used for a precise energy measurement.
Fig. 2: Energy spectrum for 511 keV gammas interacting in NEXT-DEMO. From the low-to the high energy-region, one can clearly identify the X-ray peak (˜30 keV), the Compton continuum (100-340 keV), the X-ray escape peak (˜480 keV) and the photo-electric peak (full energy).
The SiPM-based read-out planes in NEXT-DEMO have clearly demonstrated the good tracking capability of the chosen design. Straight cosmic-ray muon tracks, ˜500 keV electron tracks dominated by multiple Coulomb scattering, and isolated X-ray energy deposition of about 30 keV have been reconstructed. On the other hand, the tracking plane information can be combined with the energy (PMT) plane information in order to identify the number of Bragg peaks signaling the number of electrons ranging out in the detector. This is useful for ββ0[U+F06E] searches, since the "blob", i.e., a track segment with higher energy deposition, multiplicity per event is expected to provide an additional background suppression factor. Signal events tend to yield two "blobs" from two electrons emanating from a common vertex. In the case of background, dominated by gamma interactions, only one "blob" per event is typically expected. Energy blobs where electron tracks range out have been clearly identified in NEXT-DEMO using the energy plane information, by projecting the electron tracks' dE/dx pattern along the drift direction, Fig.3.
Fig. 3: The reconstructed track left by a photoelectric electron produced by the interaction of a 662-keV gamma (from a 137Cs calibration source) detected by NEXT-DEMO.
NEXT-DEMO has been upgraded to NEXT-NEW, which will fully operate in Canfranc Underground Laboratory. The assembly and commissioning of the detector is planned for 2014. In this presentation, results from NEXT-DEMO will be presented and considerations will be made on both NEXT-DEMO and NEXT-NEW.

Primary author(s) : Dr. MONTEIRO, Cristina M. B. (University of Coimbra) (on behalf of the NEXT Collaboration)

Presenter(s) : Dr. MONTEIRO, Cristina M. B. (University of Coimbra) (on behalf of the NEXT Collaboration)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **139** Type : **Oral**

The POSSUMUS-Detector

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

We present the newly developed Position Sensitive Scintillating Muon SiPM -Detector (POSSUMUS). This modular designed scintillation detector is capable to determine particle's position two-dimensional with resolution of a few mm for minimum ionizing particles. POSSUMUS is usable for large area trigger applications with few readout channels. The idea of this detector is to combine two trapezoidal shaped plastic scintillators to form one rectangular shaped scintillator rod. Each trapezoid in a rod is optically insulated against the other. In both trapezoids the scintillation light is collected by wavelength shifting fibers (WLS-fibers) and guided to Silicon-Photo-Multipliers (SiPM), where the light yield is detected. The SiPMs are located at opposite sites of each WLS-fiber, an automatic voltage adjustment allows for a stable gain of the detected light signals. Position resolution in the transverse direction is achieved by the geometric shape of the scintillators. The amount of light produced by incoming particles is proportional to their path length in the trapezoid and thus position dependent. The longitudinal position resolution, along the scintillator rod, is determined by the propagation time of light to either end of the rod. Because of its modularity, the POSSUMUS-detector can be used for trigger applications of different sizes with only few readout channels. By combining several scintillator rods, position sensitive areas from 100 cm2 to few m2 are achievable. In this talk we present a fully operating prototype of POSSUMUS, the multi-channel gain stabilization system for SiPMs and results for transverse and longitudinal position resolution

Summary

Primary author(s) : RUSCHKE, Alexander (Ludwig-Maximilians-Univ. Muenchen (DE))

Co-author(s) : BIEBEL, Otmar (Ludwig-Maximilians-Univ. Muenchen (DE)); HERTENBERGER, Ralf (Ludwig-Maximilians-Univ. Muenchen (DE)); MULLER, Ralph (Ludwig-Maximilians-Univ. Muenchen (DE)); Mr. GROSSMANN, Johannes (LMU)

Presenter(s) : RUSCHKE, Alexander (Ludwig-Maximilians-Univ. Muenchen (DE))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **73** Type : **Oral**

The Phase-1 Upgrade of the ATLAS First Level Calorimeter Trigger

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

The level1 calorimeter trigger (L1Calo) of the ATLAS experiment has been operating effectively since the start of LHC data taking, and has played a major role in the discovery of the Higgs boson. To face the new challenges posed by the upcoming increases of the LHC proton beam energy and luminosity, a series of upgrades is planned for L1Calo. An initial upgrade (Phase0) is scheduled to be ready for the start of the second LHC run in 2015, and a further more substantial upgrade (Phase1) is planned to be installed during the LHC shutdown expected in 2018. The calorimeter trigger aims to identify electrons, photons, taus and hadronic jets. It also determines total and missing transverse energy and can further analyse the event topology using a dedicated system incorporating information from both calorimeter and muon triggers. This paper presents the Phase1 hardware trigger developments which exploit a tenfold increase in the available calorimeter data granularity when compared to that of the current system. The calorimeter signals will be received via optical fibers and distributed to two distinct processing systems. Those systems implement sliding window algorithms and quasi offline algorithms to achieve object reconstruction and identification. The algorithms are implemented on high density electronics boards which make use of recent developments in high speed data transmission and FPGA technology. The presentation reviews the physics impact along with the current status of the hardware design and early prototypes and demonstrator boards.

Summary

Primary author(s) : GARELLI, Nicoletta (SLAC National Accelerator Laboratory (US))

Presenter(s) : HRISTOVA, Ivana Radoslavova (Humboldt-Universitaet zu Berlin (DE))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **105** Type : **Oral**

The Pixel Luminosity Telescopes a Dedicated Luminosity Monitor for CMS

Friday, 6 June 2014 15:20 (0:20)

Abstract content

The Pixel Luminosity Telescopes (PLT) will be the first dedicated luminosity monitor installed in the CMS experiment at CERN's Large Hadron Collider. It is designed to measure the bunch-by-bunch relative luminosity to high precision. It consists of a set of small angle telescopes each with three planes of pixel sensors. The full PLT will be installed in CMS for the first full energy operation of the LHC in September 2014. In the 2012-2013 LHC run a pilot PLT detector was installed consisting of both single-crystal diamond and silicon sensors giving a first look at their performance in a continuous high-rate environment. This was the first operation of a diamond pixel tracking detector in a high energy physics experiment and is providing the first data on diamond pixel sensors under high particle rate in a high radiation environment. We will report on the design, construction, testing, and installation status for the 2014 installation as well as report the findings of the single-crystal diamond based pilot detector. In addition we will discuss high-rate studies of polycrystalline diamond sensors for potential use in the PLT for the 2014 installation.

Summary

Primary author(s) : HIDAS, Dean Andrew (Rutgers, State Univ. of New Jersey (US))

Co-author(s) : PLT, Group (CMS)

Presenter(s) : HIDAS, Dean Andrew (Rutgers, State Univ. of New Jersey (US))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **338** Type : **Oral**

The RICH detector of the LHCb experiment

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

The LHCb experiment was fully operational during the Run 1 of the Large Hadron Collider in the period 2009-2013, collected more than 3 fb^{-1} of data and has produced many world first and world best measurements. The RICH system is an integral part of LHCb proving hadron identification in the momentum range of 2-100 GeV/c. The ability to separate pions and kaons in this wide momentum range is essential for the physics measurements of LHCb. The LHCb RICH system consists of two RICH detectors with three different radiators. The optical systems are made from a total of 116 mirrors (four constructed out of low mass carbon fibre) and single photon detection is achieved by 484 Hybrid Photon Detectors (HPD). The RICH detectors have been aligned and calibrated using the LHCb data and their performance evaluated using pure particle samples collected without RICH information. The performance of the RICH detectors in a high multiplicity hadron environment is excellent. The LHCb experiment is preparing for a significant upgrade during the Long Shutdown 2 of the LHC. There are advanced plans to modify the existing layout in order to conserve the current particle identification performance despite the increase in luminosity by a factor five. The alignment, calibration and performance of the LHCb RICH system will be presented, together with a few example analyses showing the contribution of the RICH. The plans for the LHCb RICH upgrade will also be presented.

Summary

Primary author(s) : Dr. PAPANESTIS, Antonis (STFC - Rutherford Appleton Lab. (GB))

Presenter(s) : Dr. PAPANESTIS, Antonis (STFC - Rutherford Appleton Lab. (GB))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **74** Type : **Oral**

The Serial Link Processor for the Fast TracKer (FTK) processor at ATLAS

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

The Associative Memory (AM) system of the FTK processor has been designed to perform pattern matching using the hit information of the ATLAS silicon tracker. The AM is the heart of the FTK and it finds track candidates at low resolution that are seeds for a full resolution track fitting. To solve the very challenging data traffic problem inside the FTK, multiple designs and tests have been performed. The currently proposed solution is named the “Serial Link Processor” and is based on an extremely powerful network of 2 Gb/s serial links. This paper reports on the design of the Serial Link Processor consisting of the AM chip, an ASIC designed and optimized to perform pattern matching, and two types of boards, the Local Associative Memory Board (LAMB), a mezzanine where the AM chips are mounted, and the Associative Memory Board (AMB), a 9U VME board which holds and exercises four LAMBs. We report also on the performance of a first prototype based on the use of a min@sic AM chip, a small but complete version of the final AM chip, built to test the new and fully serialized I/O. Also a dedicated LAMB prototype, named miniLAMB, with reduced functionalities, has been produced to test the mini@sic. The serialization of the AM chip I/O significantly simplified the LAMB design. We report on the tests and performance of the integrated system mini@sic, miniLAMB and AMB.

Summary

Primary author(s) : Dr. SALVATORE, Fabrizio (University of Sussex (GB))

Presenter(s) : LUCIANO, Pierluigi (Sezione di Pisa (IT))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **401** Type : **Oral**

The Silicon Tracking System of the CBM experiment at FAIR: detector development and system integration

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

The CBM experiment at the future Facility for Antiproton and Ion Research (FAIR) will explore the properties of nuclear matter at high net baryon densities and at moderate temperature. The key detector – a Silicon Tracking System (STS) – will reconstruct charged particle tracks created in interactions of heavy-ion beam with nuclear target at projectile energies ranging from 10 to 40 GeV/nucleon. Operation at 10 MHz interaction rate with charged particle multiplicities up to 1000 requires fast and radiation hard silicon sensors. The necessary momentum resolution of 1% imposes stringent requirements to the sensor material budget (0.3% X_0) and detector module structure.
The STS will occupy volume of about 1 m^3 defined by the aperture of a dipole magnet. It will consist of 8 tracking stations based on double-sided silicon microstrip detectors. The sensors with 58 μm pitch, size up to 62×62 mm^2 and 1024 strips per side have AC-coupled strips oriented at $\pm 7.5°$ stereo angle. Short corner strips on the opposite edges of the sensors are interconnected via second metallization layer thus avoiding insensitive areas.
Complicated design and the large number of silicon sensors needed for the construction of the STS (about 1300) require a set of quality assurance procedures that involve optical inspection, electric characterization and readout tests. We report about the development of an optical inspection system using NI LabVIEW software and Vision package for pattern recognition.
The STS readout electronics with 2.1 million channels will dissipate about 40 kW of power. To cope with it, bi-phase CO_2 evaporative cooling will be used. Performance of a test system will be presented, in particular the cooling efficiency of a custom-made heat exchanger for the front-end electronics.

Summary

Primary author(s) : Dr. LYMANETS, Anton (University of Tuebingen)

Co-author(s) : Prof. SCHMIDT, Hans Rudolf (University of Tuebingen); Mr. LAVRIK, Evgeny (University of Tuebingen)

Presenter(s) : Dr. LYMANETS, Anton (University of Tuebingen)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **58** Type : **Oral**

The Status of the MCP-PMT R&D in China

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The JUNO (Jiangmen Underground Neutrino Observatory) designed to build an underground lab on the location of JiangMen in south China as a generic underground national lab for many applications. The new promising neutrino programs request the higher performance of the detectors. It is proposed to increase the photoelectron detection efficiency of the PMT used in neutrino experiment. The researchers in IHEP designed a new type of MCP-PMT. The small MCP unit instead of the large Dynode, the transmission photocathode and the reflection photocathode were assembled in the same glass shell to form nearly 4 pai photocathode effective area to enhance the efficiency of the photoelectron detecting. Some researchers and engineers in institutes and companies in China come together to manufacture and research this type of PMT based on the MCPs. After two years R&D work, several 8 inch prototypes were produced and there performance was carefully tested in our Lab. The MCP-PMT performance test system was built in our Lab for better performance test. The characteristics of the photocathode were carefully researched by testing the I-V curve, the QE, and the QE-map for the 8 inch area photocathode uniformity. Also we measured the charge spectrum to confirm its ability for the single photoelectron spectrum. More simulation and experiment work have already done to develop an 8 inch prototype module for the MCP-PMT designed in IHEP, and the detailed will be described in this formal manuscript.

Summary

Primary author(s) : QIAN, Sen (I)

Presenter(s) : QIAN, Sen (I)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **104** Type : **Oral**

The TDCPix ASIC: Tracking for the NA62 GigaTracker

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

The TDCPix is a hybrid pixel detector readout ASIC designed for the NA62 GigaTracker detector. The requirements are a single-hit timing resolution better than 200ps RMS, a hit loss of less than 1% in the presence of a (highly non-uniform) beam rate up to 1MHz/cmˆ2. This hit rate leads to an expected data rate at the output of the chip which can reach 6Gb/s. The TDCPix comprises an asynchronously operating pixel array of 40 columns of 45 pixels, each 300 microns x 300 microns. This is instrumented with 40 Delay Locked Loop based time-to-digital converters connected to data buffering and concentrating logic. The read-out uses four 3.2Gb/s serialisers with the high speed clock being provided by a low-noise on-chip PLL. The high data rates negate the possibility of buffering whilst awaiting a trigger, thus a self triggering architecture has been adopted.
All configuration and state logic in the design deemed critical for the correct operation of the chip has been triplicated to provide increased single event effect tolerance. A number of on-chip digital-to-analogue converters provide threshold generation and trimming and are configurable through a single-signal configuration interface. The configuration and DAQ interfaces include a DC-balanced protocol layer permitting direct optical connections when the ASIC is installed in the experiment. Dedicated calibration circuitry is included to enable the required timing resolution to be reached.
The chip has been manufactured in a commercial 130nm process and testing is underway. A detailed description of the architecture and performance results will be presented.

Summary

Primary author(s) : NOY, Matthew (CERN)

Co-author(s) : Dr. AGLIERI RINELLA, Gianluca (CERN); BONACINI, Sandro (CERN); KAPLON, Jan (CERN); KLUGE, Alex (CERN); MOREL, Michel (CERN); PERKTOLD, Lukas (Graz University of Technology (AT)); POLTORAK, Karolina (AGH University of Science and Technology (PL))

Presenter(s) : NOY, Matthew (CERN)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **374** Type : **Oral**

The Thermo-Mechanical Integration of the NA62 GigaTracKer

Monday, 2 June 2014 17:30 (0:20)

Abstract content

The NA62 collaboration will pioneer the use of on-detector microfluidic cooling systems with the implementation of silicon microchannel plates in the GigaTracKer (GTK) pixel detectors in the fall of 2014.
The cooling plates consist of 130 μm silicon substrates in which 150 microchannels are embedded. They have a rectangular cross-section of 70 x 200 μm and they cover an area of 45 x 60 mm to actively remove, with liquid C6F14, the power dissipated by the TDCPix readout ASICs bump-bonded to the backside of the GTK sensors. The microfluidic cooling plates are also at the core of the mechanical integration of the GTK system. They provide structural support to the sensor and TDCPix chips interfacing them to the read-out board.
After reviewing the design, prototyping, experimental characterization and validation of this cooling system, the paper will focus on the integration of the 3 GTK detector assemblies in the beam line of the NA62 experiment.

Summary

Primary author(s) : MAPELLI, Alessandro (CERN); ROMAGNOLI, Giulia (Universita e INFN (IT)); DEGRANGE, Jordan (CERN); PETAGNA, Paolo (CERN); MOREL, Michel (CERN)

Presenter(s) : MAPELLI, Alessandro (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **138** Type : **Oral**

The Time Structure of Hadronic Showers in Analog and Digital Calorimeters confronted with Simulations

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

The intrinsic time structure of hadronic showers influences the timing capability and the required integration time of highly granular hadronic calorimeters for future collider experiments. To evaluate the influence of different active media and different absorbers, dedicated experiments with tungsten and steel hadron calorimeters of the CALICE collaboration have been carried out. These use plastic scintillator tiles with SiPM readout and RPCs, both arranged as 15 small detector cells read out with fast digitizers and deep buffers. The results of the studies provide detailed information on the time structure of hadronic showers, and are confronted with GEANT4 simulations to evaluate the realism of current hadronic shower models with respect to the time evolution of hadronic cascades.

Summary

Primary author(s) : SIMON, Frank (Max-Planck-Institut fuer Physik)

Presenter(s) : SIMON, Frank (Max-Planck-Institut fuer Physik)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **456** Type : **Oral**

The Timepix3 readout chip: design, tests and first measurements with silicon sensors

Friday, 6 June 2014 12:20 (0:20)

Abstract content

Timepix3 is a unique ASIC developed to provide fast readout in a low to medium hit rate environment. The pixel matrix consists of 256x256 pixels with a pitch of 55µm. The chip can be configured in either data driven or frame-based modes. In data driven mode the chip sends out a 48-bit package every time a pixel is hit while the shutter is open. This packet contains 18bits of Time-Of-Arrival and 10bits of Time-Over-Threshold (TOT). In data driven mode the chip can cope with a hit rate up to 40MHits/s/cm2. The finest arrival time resolution is 1.56ns. The chip can also be used in a frame-based mode providing either the same hit information as in the data driven mode or simultaneous event counting and integral TOT information per pixel.
Recently, the first Timepix3 chips bump bonded to a 300[U+F06D]m thick Silicon sensor became available. In this talk the chip and its most important design features will be introduced. Test results of the stand-alone chip will be shown, together with the first measurements obtained using assemblies with sensor.

Summary

Primary author(s) : DE GASPARI, Massimiliano (CERN)

Co-author(s) : VAN BEUZEKOM, Martin (NIKHEF (NL)); GROMOV, Vladimir (NIKHEF (NL)); Mr. KLUIT, Ruud (Nikhef (NL)); ZAPPON, Francesco (Nikhef); ZIVKOVIC, Vladimir (NIKHEF Institute); CAMPBELL, Michael (CERN); POIKELA, Tuomas Sakari (University of Turku (FI)); LLOPART CUDIE, Xavi (CERN); BREZINA, Christoph (University Bonn); DESCH, Klaus (University of Bonn); Dr. KRUTH, Andre Konrad (University of Bonn); FU, Yunan

Presenter(s) : DE GASPARI, Massimiliano (CERN)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **223** Type : **Oral**

The Triple-GEM Project for the Phase 2 Upgrade of the CMS Muon System

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

In view of the high-luminosity phase of the LHC, the CMS Collaboration is considering the use of Gas Electron Multiplier (GEM) detector technology for the upgrade of its muon system in the forward region. With their ability to handle the extreme particle rates expected in that area, such micro-pattern gas detectors can sustain a high performance and redundant muon trigger system. At the same time, with their excellent spatial resolution, they can improve the muon track reconstruction and identification capabilities of the forward detector, effectively combining tracking and triggering functions in one single device. The present status of the CMS GEM project will be reviewed, highlighting importants steps and achievements since the start of the R&D activities in 2009. Several small and full-size prototypes have been constructed with different geometries and techniques. The baseline design of the triple-GEM detectors proposed for installation in different stations of the CMS muon endcap system will be described, along with the associated frontend electronics and data-acquisition system. The expected impact on the performance of the CMS muon system will be discussed, and results from extensive test measurements of all prototypes, both in the lab and in test beams at CERN and FNAL will be presented.

Summary

Primary author(s) : TYTGAT, Michael (Ghent University (BE))

Presenter(s) : TYTGAT, Michael (Ghent University (BE))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **379** Type : **Oral**

The brain as a trigger system

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

There are significant analogies between the issues related to real-time event selection in HEP, and the issues faced by the human visual system. In fact, the visual system needs to extract rapidly the most important elements of the external world from a large flux of information, for survival purposes. A rapid and reliable detection of visual stimuli is essential for triggering autonomic responses to emotive stimuli, for initiating adaptive behaviors and for orienting towards potentially interesting/ dangerous stimuli. The speed of visual processing can be as fast as 20 ms, about only 20 times the duration of the elementary information exchanges by the action potential. The limitations to the brain capacity to process visual information, imposed by intrinsic energetic costs of neuronal activity, and ecological limits to the size of the skull, require a strong data reduction at an early stage, by creating a compact summary of relevant information, the so called "primal sketch", to be handled by further levels of processing. This is quite similar to the problem of experimental HEP of providing fast data reduction at a reasonable monetary cost, and with a practical device size.
As a result of a joint effort of HEP physicists and practicing vision scientists, we recently found evidence that not only the problems are similar, but the solutions adopted in the two cases also have strong similarities, and their parallel study can actually shed light on each other.
Modeling the visual system as a trigger processor leads to a deeper understanding, and even very specific predictions of its functionality. Conversely, the insights gained from this new approach to vision, can lead to new ideas for enhancing the capabilities of artificial vision systems, and HEP trigger systems as well.

Summary

Primary author(s) : Mrs. DEL VIVA, Maria Michela (University of Florence, Italy)

Co-author(s) : PUNZI, Giovanni (Pisa University and INFN)

Presenter(s) : Mrs. DEL VIVA, Maria Michela (University of Florence, Italy)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **63** Type : **Oral**

The dual light-emitting crystals detector for WIMPs direct searches

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

The dual light-emitting crystals can reflect the different ranges of nuclear recoils and electron recoils by the ratio of the two different scintillation components. CsI(Na) crystals at temperatures of ~-100 [U+2103] have the best performance in several candidate crystals. An experiment called CINDMS is proposed for WIMPs direct searches based on the CsI(Na) crystals detector by IHEP. The 1T-scale experimental threshold is expected to be in the world advanced level through the background estimates. The initial stage of a 50kg scale experiment called CINDMS50 is under construction at Daya Bay neutrino experiment underground laboratory for the accumulation of technology. CINDMS1T or more large-scale experiment may be located deep underground laboratory of Jinping Mountain in Sichuan, China. This location provides vastly improved shielding from cosmogenic events which will reduce interference of known backgrounds particles.

Summary

Primary author(s) : Dr. SUN, Xilei (IHEP)

Presenter(s) : Dr. SUN, Xilei (IHEP)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **98** Type : **Oral**

The new CMS DAQ system for run 2 of the LHC

Monday, 2 June 2014 16:10 (0:20)

Abstract content

The data acquisition system (DAQ) of the CMS experiment at the CERN Large Hadron Collider assembles events at a rate of 100 kHz, transporting event data at an aggregate throughput of 100 GByte/s to the high level trigger (HLT) farm. The HLT farm selects interesting events for storage and offline analysis at a rate of around 1 kHz. The DAQ system has been redesigned during the accelerator shutdown in 2013/14. The motivation is twofold: Firstly, the current compute nodes, networking, and storage infrastructure will have reached the end of their lifetime by the time the LHC restarts. Secondly, in order to handle higher LHC luminosities and event pileup, a number of sub-detectors will be upgraded, increasing the number of readout channels and replacing the off-detector readout electronics with a μTCA implementation. The new architecture will take advantage of the latest developments in the computing industry. For data concentration, 10/40 Gbit Ethernet technologies will be used, as well as an implementation of a reduced TCP/IP in FPGA for a reliable transport between custom electronics and commercial computing hardware. A 56 Gbps Infiniband FDR CLOS network has been chosen for the event builder with a throughput of ˜4 Tbps. The HLT processing is entirely file based. This allows the DAQ and HLT systems to be independent, and to use the same framework for the HLT as for the offline processing. The fully built events are sent to the HLT with 1/10/40 Gbit Ethernet via network file systems. Hierarchical collection of HLT accepted events and monitoring meta-data are stored into a global file system. This paper presents the requirements, technical choices, and performance of the new system.

Summary

Primary author(s) : MEIJERS, Frans (CERN)

Co-author(s) : BAWEJ, Tomasz Adrian (Warsaw University of Technology (PL)); ERHAN, Samim (Univ. of California Los Angeles (US)); FORREST, Andrew Kevin (University of Kent (GB)); GIGI, Dominique (CERN); GLEGE, Frank (CERN); GOMEZ CEBALLOS RETUERTO, Guillelmo (Massachusetts Inst. of Technology (US)); GOMEZ-REINO GARRIDO, Robert (CERN); Dr. HEGEMAN, Jeroen (CERN); HOLZNER, Andre Georg (Univ. of California San Diego (US)); MASETTI, Lorenzo (CERN); MESCHI, Emilio (CERN); BEHRENS, Ulf (Deutsches Elektronen-Synchrotron (DE)); MOMMSEN, Remi (Fermi National Accelerator Lab. (US)); MOROVIC, Srecko (CERN); NUNEZ BARRANCO FERNANDEZ, Carlos (CERN); O'DELL, Vivian (Fermi National Accelerator Lab. (US)); ORSINI, Luciano (CERN); PAUS, Christoph (Massachusetts Inst. of Technology (US)); PETRUCCI, Andrea (CERN); PIERI, Marco (Univ. of California San Diego (US)); Dr. RACZ, Attila (CERN); SAKULIN, Hannes (CERN); BRANSON, James Gordon (Univ. of California San Diego (US)); SCHWICK, Christoph (CERN); STIEGER, Benjamin (CERN); SUMOROK, Konstanty (Massachusetts Inst. of Technology (US)); Mr. VEVERKA, Jan (Massachusetts Inst.

of Technology (US)); ZEJDL, Petr (CERN); CHAZE, Olivier (CERN); CITTOLIN, Sergio (Univ. of California San Diego (US)); DARLEA, Georgiana Lavinia (Massachusetts Inst. of Technology (US)); DELDICQUE, Christian (CERN); Dr. DOBSON, Marc (CERN); DUPONT, Aymeric Arnaud (CERN)

Presenter(s) : Mr. VEVERKA, Jan (Massachusetts Inst. of Technology (US))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **284** Type : **Oral**

The upgrade of the ALICE Inner Tracking System - Status of the R&D on monolithic silicon pixel sensors

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

As a major part of its upgrade plans, the ALICE experiment schedules the installation of a novel Inner Tracking System (ITS) during the Long Shutdown 2 of the LHC in 2018/19. It will replace the present silicon tracker with 7 layers of Monolithic Silicon Active Pixel Sensors (MAPS) and significantly improve the detector performance in terms of tracking and rate capabilities. The choice of technology has been guided by the tight requirements on the material budget of 0.3 X_0 for the three innermost layers and backed by the significant progress in the field of MAPS in recent years.
The new ITS will in total cover a surface of 10.3 m^2 with approximately 25×10^9 pixels. The pixel chips are manufactured in the TowerJazz 180 nm CMOS imaging sensor process on wafers with high resistivity epitaxial layer. Within the ongoing R&D phase, several sensor chip prototypes have been developed and produced on different epitaxial layer thicknesses and resistivities. These chips are being characterised for their performances before and after irradiation using source tests, test beam and measurements using an infrared laser.

The present contribution will provide an overview of the ALICE ITS upgrade with a focus on the R&D activities on the pixel chip.

Summary

Primary author(s) : VAN HOORNE, Jacobus Willem (Vienna University of Technology (AT))

Presenter(s) : VAN HOORNE, Jacobus Willem (Vienna University of Technology (AT))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **201** Type : **Oral**

Timing performance of the CMS electromagnetic calorimeter and prospects for the future

Monday, 2 June 2014 16:50 (0:20)

Abstract content

The CMS electromagnetic calorimeter (ECAL) is made of 75,848 scintillating lead tungstate crystals arranged in a barrel and two endcaps. The scintillation light is read out by avalanche photodiodes in the barrel and vacuum phototriodes in the endcaps, at which point the scintillation pulse is amplified and sampled at 40 MHz by the on-detector electronics. The fast signal from the crystal scintillation enables energy as well as timing measurements from the data collected in proton-proton collisions with high energy electrons and photons. The single-channel time resolution of ECAL measured at beam tests for high energy showers is better than 100 ps. The timing resolution achieved with the data collected in proton-proton collisions at the LHC is discussed. We present how precision timing is used in current physics measurements and discuss studies of subtle calorimetric effects, such as the timing response of different crystals belonging to the same electromagnetic shower. In addition, we present prospects for the high luminosity phase of the LHC (HL-LHC), where we expect an average of 140 concurrent interactions per bunch crossing (pile-up). We discuss studies on how precision time information could be exploited for pileup mitigation and for the assignment of the collision vertex for photons. In this respect, a detailed understanding of the timing performance and of the limiting factors in time resolution are areas of ongoing studies.

Summary

Primary author(s) : BORNHEIM, Adolf (Charles C. Lauritsen Laboratory of High Energy Physics)

Presenter(s) : BORNHEIM, Adolf (Charles C. Lauritsen Laboratory of High Energy Physics)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **45** Type : **Oral**

Total Ionization Damage Compensations in Double Silicon-on-Insulator Pixel Sensors

Friday, 6 June 2014 14:00 (0:20)

Abstract content

We are developing monolithic pixel sensors based on a 0.2 um fully-depleted Silicon-on-Insulator (SOI) technology. Such sensors have properties such as high-speed operation, low-power dissipation, and SEU/SET immunity. The major issue in applications them in high-radiation environments is the total ionization damage (TID) effects. The effects are rather substantial in the SOI devices since the transistors are enclosed in the oxide layers where generated holes are trapped and affect the operation of the near-by transistors. The double SOI sensors that provide an independent electrode underneath the buried oxide (BOX) layer have been developed. A negative voltage applied to this electrode is expected to cancel positive potential due to hole traps in the BOX layer. We have irradiated transistor test elements and pixel sensors with γ-rays. By adjusting the potential of this electrode, the TID effects are shown to be compensated. The transistors irradiated to 2 MGy recovered their performances by applying a bias to the electrode. Transistors were shown to have modest differences in behaviors of TID compensations according to their types. Furthermore, differences depending on the biasing condition during irradiation were observed. The pixel sensor irradiated to 100 kGy recovered its functionality by applying a bias to the electrode. We used infrared laser pulse and γ-ray sources to evaluate TID compensations of pixel sensors. The radiation tolerance of the SOI devices has been substantially improved by employing the innovative double SOI.

Summary

Primary author(s) : HONDA, Shunsuke (University of Tsukuba (JP))

Co-author(s) : HARA, Kazuhiko (University of Tsukuba (JP)); TSURU, Takeshi (Kyoto University); MIURA, Noriyuki (Lapis Semiconductor Miyagi Co., Ltd. (JP)); KASAI, hiroki (Lapis Semiconductor Miyagi Co., Ltd. (JP)); OKIHARA, Masao (Lapis Semiconductor Co., Ltd. (JP)); ASANO, Mari (University of Tsukuba (JP)); MAEDA, tatsuya (University of Tsukuba (JP)); TOBITA, Naoshi (University of tsukuba (JP)); TSUCHIDA, Kohei (University of Tsukuba (JP)); ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); MIYOSHI, Toshinobu (KEK); OHNO, Morifumi (National Institute of Advanced Industrial Science and Technology (JP)); HATSUI, Takaki (RIKEN)

Presenter(s) : HONDA, Shunsuke (University of Tsukuba (JP))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **424** Type : **Oral**

Totally Active Scintillator Calorimeter for the Muon Ionization Cooling Experiment

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

The Electron-Muon Ranger (EMR) is a totally active scintillator detector to be installed in the muon beam of the Muon Ionization Cooling Experiment (MICE) - the R&D project for the future neutrino factory. It is aimed at measuring properties of low energy beam composed of muons, electrons and pions performing the identification particle by particle. The EMR is made of 48 intersecting layers. Each layer consists of 59 triangular scintillator bars. The granularity of the detector (2880 readout channels) makes it possible to identify tracks and measure particle ranges and shower shapes. The read-out is based on FPGA custom made electronics and commercially available modules. It was built at University of Geneva and installed at the Rutherford Appleton Laboratory in Oxford in September 2013. Tests with low energy beam (100 - 400MeV/c) revealed an exceptional performance of the detector.

Summary

Primary author(s) : ASFANDIYAROV, Ruslan (Universite de Geneve (CH))

Presenter(s) : ASFANDIYAROV, Ruslan (Universite de Geneve (CH))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **70** Type : **Oral**

Towards a Level-1 tracking trigger for the ATLAS experiment

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

The future plans for the LHC accelerator allow, through a schedule of phased upgrades, an increase in the average instantaneous luminosity by a factor 5 with respect to the original design luminosity. The ATLAS experiment at the LHC will be able to maximise the physics potential from this higher luminosity only if the detector, trigger and DAQ infrastructure are adapted to handle the sustained increase in particle production rates.

In this paper the changes expected to be required to the ATLAS detectors and trigger system to fulfill the requirement for working in such high luminosity scenario are described. The increased number of interactions per bunch crossing will result in higher occupancy in the detectors and increased rates at each level of the trigger system. The trigger selection will improve the selectivity partly from increased granularity for the sub detectors and the consequent higher resolution. One of the largest challenges will be the provision of tracking information at the first trigger level, which should allow a large increase in the rejection power at this stage of the selection and yet still allow the full physics potential of the experiment to be fulfilled. In particular, the electroweak scale still requires to keep the thresholds on the transverse momenta of particles as low as possible and tracking will provide essential information that could be used to this aim as early as possible in the trigger chain.

Studies to understand the feasibility of such a system have begun, and proceed in two directions: a fast readout for high granularity silicon detectors, and a fast pattern recognition algorithm to be applied just after the Front-End readout for specific sub detectors. Both existing, and novel technologies can offer solutions. The aim of these studies is to determine the parameter space to which this system must be adapted. The status of ongoing tests on specific hardware components crucial for this system to fully satisfy the ATLAS trigger requirements at very high luminosities and increase its potential are discussed.

Summary

Primary author(s) : GARELLI, Nicoletta (SLAC National Accelerator Laboratory (US))

Presenter(s) : CERRI, Alex (University of Sussex (GB))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **286** Type : **Oral**

Towards the integration of the MicroVertex Detector in the PANDA experiment.

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Daniela Calvo on behalf of the PANDA MVD group.
The fixed target experiment PANDA is one essential part of the FAIR facility in Darmstadt and is going to study the interactions of antiproton beams, featuring unprecedented quality and intensity, on protons and on nuclei. It includes the Micro Vertex Detector (MVD) 1, as innermost detector of the tracking system, specially able to detect secondary vertices of short-live particles. Due to the forward boost the MVD layout is asymmetric with four barrels surrounding the interaction point and six disks in the forward direction. The innermost layers are composed of hybrid epitaxial silicon pixels and the outermost ones of double sided silicon strips, with about 10^7 pixels and 2x10^5 strips channels. PANDA features a triggerless architecture, therefore the MVD has to run with a continuous data transmission at a high interaction rate (about 10^7 int./s) where hits have precise timestamps (the experiment clock is 155.52 MHz). In addition the energy loss of the particles in the sensor should be measured. To cope with these requirements custom readout chips are under development for both pixel and strip devices. The powering and cooling of the readout are challenging since the MVD volume is limited by the surrounding detectors and the routing is only foreseen in the backward direction. Support structures are made of carbon fibers and high thermally conductive carbon foam with embedded cooling pipes beneath the readout chips is integrated.
The presentation is focused on the technological aspects of the design and the integration of this detector in PANDA.
1 PANDA Collaboration, Technical Design report for the PANDA Micro Vertex Detector, arXiv:1207.6581 v2, 2011

Summary

The presentation is focused on the technological aspects of the design and the integration of the Micro Vertex Detector in the PANDA experiment.

Primary author(s) : Dr. CALVO, Daniela (INFN - Sezione di Torino)

Presenter(s) : Dr. CALVO, Daniela (INFN - Sezione di Torino)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **195** Type : **Oral**

Track reconstruction in CMS high luminosity environment

Friday, 6 June 2014 15:00 (0:20)

Abstract content

The CMS tracker is the largest silicon detector ever built, covering 200 square meters and providing an average of 14 high-precision measurements per track. Tracking is essential for the reconstruction of objects like jets, muons, electrons and tau leptons starting from the raw data from the silicon pixel and strip detectors. Track reconstruction is widely used also at trigger level as it improves objects tagging and resolution.
The CMS tracking code is organized in several levels, known as 'iterative steps', each optimized to reconstruct a class of particle trajectories, as the ones of particles originating from the primary vertex or displaced tracks from particles resulting from secondary vertices. Each iterative step consists of seeding, pattern recognition and fitting by a kalman filter, and a final filtering and cleaning. Each subsequent step works on hits not yet associated to a reconstructed particle trajectory.
The CMS tracking code is continuously evolving to make the reconstruction computing load compatible with the increasing instantaneous luminosity of LHC, resulting in a large number of primary vertices and tracks per bunch crossing. This is achieved by optimizing the iterative steps and by using new software techniques.
Tracking algorithms used in CMS are described; physics and computing performances are discussed with respect to Run 1 and Run 2 physics program and within CMS future upgrades.

Summary

Primary author(s) : Prof. MAZUMDAR, Kajari (Tata Inst. of Fundamental Research (IN))

Presenter(s) : GOETZMANN, Christophe (Institut Pluridisciplinaire Hubert Curien (FR))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **180** Type : **Oral**

Tracking at High Level Trigger in CMS

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

The trigger systems of the LHC detectors play a crucial role in determining the physics capabilities of the experiments. A reduction of several orders of magnitude of the event rate is needed to reach values compatible with detector readout, offline storage and analysis capability. The CMS experiment has been designed with a two-level trigger system: the Level-1 Trigger (L1T), implemented on custom-designed electronics, and the High Level Trigger (HLT), a streamlined version of the CMS offline reconstruction software running on a computer farm. A software trigger system requires a trade-off between the complexity of the algorithms, the sustainable output rate, and the selection efficiency. With the computing power available during the 2012 data taking the maximum reconstruction time at HLT was about 200 ms per event, at the nominal L1T rate of 100 kHz. Track reconstruction algorithms are widely used in the HLT, for the reconstruction of the physics objects as well as in the identification of b-jets and lepton isolation. Reconstructed tracks are also used to distinguish the primary vertex, which identifies the hard interaction process, from the pileup ones. This task is particularly important in the LHC environment given the large number of interactions per bunch crossing: on average 25 in 2012, and expected to be around 40 in Run II. We will present the performance of HLT tracking algorithms, discussing its impact on CMS physics programme, as well as new developments done towards the next data taking in 2015.

Summary

Primary author(s) : TOSI, Mia (Universita' degli Studi di Padova e INFN (IT))

Presenter(s) : TOSI, Mia (Universita' degli Studi di Padova e INFN (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **331** Type : **Oral**

Triroc: 64-channel SiPM read-out ASIC for PET/PET-ToF application

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

Triroc is the latest addition to SiPM readout ASICs family developed at Weeroc, a start-up company from the Omega microelectronics group of IN2P3/CNRS. This chip developed under the framework TRIMAGE European project which is aimed for building a cost effective tri-modal PET/MR/EEG brain scan. To ensure the flexibility and compatibility with any SiPM in the market, the ASIC is designed to be capable of accepting negative and positive polarity input signals.
This 64-channel ASIC, is suitable for SiPM readout which requires high accuracy timing and charge measurements. Targeted applications would be PET prototyping with time-of-flight capability. Main features of Triroc includes high dynamic range ADC up to 2500 photoelectrons and TDC fine time binning of 40 ps. Triroc requires very minimal external components which means it is a good contender for compact multichannel PET prototyping. Triroc is designed by using AMS 0.35μm SiGe technology and submitted in March 2014. The detail design of this chip will be presented.

Summary

Triroc is a 64-channel silicon photomultiplier (SiPM) readout ASIC targeted for Time-of-Flight Positron Emission Tomograpy (TOF-PET) application. This chip developed for TRIMAGE project which is aimed for building a cost effective tri-modal PET/MR/EEG brain scan.
The low-noise, DC-coupled front-end amplifiers of this ASIC accept both negative and positive input signals thus making it suitable for reading out any SiPM in the market. Moreover, individual input DC level adjustment is available for correcting the non-uniformity of SiPM gain.
In each ASIC channel, the incoming signals will be sent into two different paths: for energy and time measurements. A variable gain semi-gaussien shaper is used for shaping the input signal in energy measurements. The energy conversion is handled by a 10-bit Wilkinson ADC. This ADC is a proven design and it is expected to be linear up to 2500 photoelectrons. Additionally, a charge trigger is available and can be used for events validation at required energy such as 511 keV.
Signal from high speed input pre-amplifier is fed into a discriminator in order to provide a fast trigger for time measurements. A TDC module with coarse and 40 ps fine time is used to time-stamp this trigger.
The digitized data are collected by the digital part which is also capable to validate 511 keV events and reject noise. Running at 80 Mhz, data will be transmitted through 4-bits parallel links. Other features on the digital side are zero suppress readout and TDC data compression. In all, the ASIC should be able to process up to 30k events per second.
Triroc can be operated with minimal external components, since most of the components for SiPM readout are packed internally. This feature makes the ASIC is a good contender in compact multi-channel PET applications. Triroc is designed by using AMS 0.35μm SiGe technology and will be submitted in March 2014.

Primary author(s) : Dr. AHMAD, Salleh (Weeroc SAS)

Co-author(s) : Mr. FLEURY, Julien (Weeroc SAS); Dr. DE LA TAILLE, Christophe (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mrs. SEGUIN-MOREAU, Nathalie (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. DULUCQ, FREDERIC (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Dr. MARTIN-CHASSARD, Gisele (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. CALLIER, Stephane (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. THIENPONT, Damien (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. RAUX, Ludovic (OMEGA-Ecole Polytechnique-CNRS/IN2P3)

Presenter(s) : Dr. AHMAD, Salleh (Weeroc SAS)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **53** Type : **Oral**

Ultra-transparent DEPFET pixel detectors for future electron-positron experiments

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

The DEPFET Collaboration develops highly granular, ultra-thin pixel detectors for outstanding vertex reconstruction at future collider experiments. A DEPFET sensor, by the integration of a field effect transistor on a fully depleted silicon bulk, provides simultaneously position sensitive detector capabilities and in-pixel amplification. The characterization of the latest DEPFET prototypes has proven that a comfortable signal to noise ratio and excellent single point resolution can be achieved for a sensor thickness of 50 micrometers. The close to final auxiliary ASICs have been produced and found to operate a DEPFET pixel detector of the latest generation with the required read-out speed. A complete detector concept is being developed for the Belle II experiment at the new Japanese super flavor factory. DEPFET is not only the technology of choice for the Belle˜II vertex detector, but also a solid candidate for the ILC. Therefore, in this paper, the status of DEPFET R&D project is reviewed in the light of the requirements of the vertex detector at a future electron-positron collider.

Summary

Primary author(s) : Dr. MARINAS, Carlos (University of Bonn)

Presenter(s) : Dr. MARINAS, Carlos (University of Bonn)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **47** Type : **Oral**

Upgrade of MEG Liquid Xenon Calorimeter

Friday, 6 June 2014 12:20 (0:20)

Abstract content

The MEG experiment yielded the most stringent upper limit on the branching ratio of the flavor-violating muon decay $\mu \to e\gamma$. A major upgrade of the detector is planned to improve the sensitivity by one order of magnitude. For the upgrade, 2-inch round-shape photomultiplier tubes (PMTs) on the entrance window will be replaced by 12×12 cm^2 Multi-Pixel Photon Counters (MPPCs) to significantly improve the granularity. The higher granularity will improve the energy resolution from 2.4% to 1.1% and the position resolution from 5 mm to 2 mm around the entrance window. The MPPC in the upgraded LXe detector is required to have a high photon detection efficiency (PDE) for the LXe scintillation light in the VUV range with a good gain uniformity and to be operational in the LXe temperature (165 K). A UV-enhanced MPPC is being developed in collaboration with Hamamatsu Photonics and were tested in LXe. The single-photoelectron detection capability was confirmed, and the PDE for the LXe scintillation light was measured to be 17%. A new sensor configuration based on a series connection of the sensor segments is being developed to reduce the large sensor capacitance and thus to make the pulse shorter. The design and the expected performance of the upgraded LXe detector with a comparison with the current detector, the plan and the status for building a prototype and the final detector and the R&D results of UV-MPPC development will be discussed.

Summary

Primary author(s) : Dr. SAWADA, Ryu (ICEPP, the University of Tokyo)

Presenter(s) : Dr. SAWADA, Ryu (ICEPP, the University of Tokyo)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **254** Type : **Oral**

Upgrade of the ALICE detector

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

A Large Ion Collider Experiment (ALICE) is the detector at the CERN Large Hadron Collider (LHC) dedicated to the study of strongly interacting matter, in particular the properties of the Quark-Gluon Plasma. The ALICE collaboration plans a major upgrade of the detector during the Long Shutdown 2 (LS2) of the LHC, which is at present foreseen to start in summer 2018. The upgrade strategy is based on collecting > 10 nb^{-1} of Pb-Pb collisions at luminosities up to L = 6 x 10^{27} cm^{-2}s^{-1} corresponding to a collision rate of 50 kHz, where each collision is shipped to the online systems, either upon a minimum bias trigger or in a self-triggered or continuous fashion. Since the TPC drift time of 100 μs is 5 times longer than the average time between interactions, the presently employed gating of the TPC wire chambers must be abandoned. Instead, continuously sensitive readout detectors based on Gas Electron Multipliers (GEMs) will be implemented. Furthermore, the present silicon tracker will be replaced by a new design entirely based on monolithic pixel chips in order to achieve significantly increased secondary vertex resolution and high tracking efficiency. Other ALICE sub-detectors are upgraded to read out Pb-Pb data at 50 kHz with nominal performance. Highly efficient triggering will be ensured by a new interaction trigger detector. A new online system will be implemented that is capable of receiving and processing the full detector information.

We will present the planned ALICE upgrade concept together with a description of the individual detector upgrade plans.

Summary

Primary author(s) : LIPPMANN, Christian (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter(s) : LIPPMANN, Christian (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **67** Type : **Oral**

Upgrade of the GERDA experiment

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

The Germanium Detector Array (GERDA) experiment, located underground in the Gran Sasso National Laboratory of INFN, Italy, is searching for the neutrinoless double beta (0v2b) decay of Ge-76. It uses a new shielding concept by operating bare Ge diodes (enriched in Ge-76) in 64 m^3 of liquid argon supplemented by a 3m thick layer of water. The results of GERDA Phase I have been published recently 1. Compared to previous Ge experiments, a background reduction of about one order of magnitude could be achieved yielding the so far best limit for 0v2b decay in Ge-76 and refuting a recent claim of discovery with high probability. The upgrade to GERDA Phase II is in progress; it strives for a further reduction of background by another order of magnitude towards a level of 10^-3 cts/(keV kg yr), and for a tenfold increase in half-life sensitivity (~10^26 yr) at an exposure of about 100 kg yr. This paper will discuss the numerous challenges to be met for reaching these goals including the increase of target mass by 20 kg of new low background BEGe detectors from enriched Ge-76 material which exhibit superior pulse shape discrimination and hence background rejection power, the development of new detector mounts, cold front end electronic circuitry, cabling and contacting schemes of ultra low mass and radiopurity, as well as the implementation of a retractable hybrid liquid argon veto system consisting of photomultipliers and silicon photomultipliers coupled to fibers which efficiently rejects all backgrounds that induce scintillation light in the liquid argon.
1 GERDA collaboration, Phys.Rev.Lett. 111 (2013) 122503

Summary

Primary author(s) : KNOEPFLE, Karl Tasso (MPI Kernphysik, 69117 Heidelberg)

Presenter(s) : KNOEPFLE, Karl Tasso (MPI Kernphysik, 69117 Heidelberg)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **8** Type : **Oral**

Upgrade of the LHCb Vertex Locator

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

The upgrade of the LHCb experiment, planned for 2018, will transform the entire readout to a trigger-less system operating at 40 MHz. All data reduction algorithms will be executed in a high-level software farm, with access to all event information. This will enable the detector to run at luminosities of 1-2 x1033 /cm2/s and probe physics beyond the Standard Model in the heavy sector with unprecedented precision. The upgraded VELO must be low mass, radiation hard and vacuum compatible. It must be capable of fast pattern recognition and track reconstruction and will be required to drive data to the outside world at speeds of up to 3 Tbit/s. This challenge is being met with a new VELO design based on hybrid pixel detectors positioned to within 5 mm of the LHC colliding beams. The sensors have 55 x 55 [U+F06D]m2 pixels and the VELOPix ASIC which is being developed for the readout is based on the Timepix/Medipix family of chips. The hottest ASIC will have to cope with pixel hit rates of up to 900 MHz. The material budget will be optimised with the use of evaporative CO2 coolant circulating in microchannels within a thin silicon substrate. Microchannel cooling brings many advantages: very efficient heat transfer with almost no temperature gradients across the module, no CTE mismatch with silicon components, and low material contribution. This is a breakthrough technology being developed for LHCb. LHCb is also focussing effort on the construction of a lightweight foil to separate the primary and secondary LHC vacua, the development of high speed cables, and the metallisation and radiation qualification of the module. The 40 MHz readout will also bring significant conceptual changes to the way in which the upgrade trigger is operated. Work is in progress to incorporate momentum and impact parameter information into the trigger at the earliest possible stage, using the fast pattern recognition capabilities of the upgraded detector. The current status of the VELO upgrade will be described together with a presentation of recent test results.

Summary

Primary author(s) : Dr. RODRIGUES, Eduardo (University of Manchester (GB)); AKIBA, Kazu (Nikhef)

Presenter(s) : AKIBA, Kazu (Nikhef)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **93** Type : **Oral**

Upgrade of the Level-1 muon trigger of the ATLAS detector in the barrel-endcap transition region with RPC chambers

Friday, 6 June 2014 15:20 (0:20)

Abstract content

This report presents a project for the upgrade of the Level-1 muon trigger in the barrel-endcap transition region (1.0<|[U+019E]|<1.3) of the ATLAS detector with RPC chambers. The ATLAS Level-1 muon trigger rate is dominated by fake triggers in the Endcap region (|[U+019E]|>1) caused by charged particles originating from secondary interactions downstream of the interaction point. After the LHC phase-1 upgrade, forseen for 2018, the Level-1 muon trigger rate would saturate the allocated bandwidth unless new measures are adopted to improve the rejection of fake triggers. ATLAS is going to improve the trigger selectivity in the region |[U+019E]|>1.3 with the addition of the New Small Wheel detector as an inner trigger plane. To obtain a similar trigger selectivity in the barrel-endcap transition region 1.0<|[U+019E]|<1.3, it is proposed to add new RPC chambers at the edge of the inner layer of the barrel muon spectrometer. These chambers will be based on a three layer structure with thinner gas gaps and electrodes with respect to the ATLAS standard and a new low-profile light-weight mechanical structure that will allow the installation in the limited available space. New front-end electronics, integrating fast TDC capabilities will be used. A preliminary study based on 2012 data demonstrates that the new system could reject more than 90% of the fake triggers while maintaining high trigger efficiency. This will allow to keep a relatively low momentum threshold, while matching the rate requirements of both Phase-1 and Phase-2 LHC runs.

Summary

Primary author(s) : MASSA, Lorenzo (University of Bologna and INFN (IT))

Presenter(s) : MASSA, Lorenzo (University of Bologna and INFN (IT))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **238** Type : **Oral**

Upstream Dosimetry using a Monolithic Active Pixel Sensor (MAPS)

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

Intensity Modulated Radiotherapy (IMRT) is a treatment for cancerous tumours. These treatments are complex, with the radiation shaped using dynamic Multileaf Collimators (MLC). This increases dose to the tumour, whilst sparing healthy issue and sensitive organs. Due to the complex nature of these treatments safety is critical. Currently monitoring is from the linac itself and verification is carried out prior to the treatment. New independent dosimeters are emerging, including upstream detectors. In the upstream detector under investigation the aim is to do both real-time monitoring and verification simultaneously. The problems caused by placing a detector upstream are: attenuation from the device and generation of secondary radiation. To overcome these issues the detector must be thin and radiation hard. These criterion match that of sensors for the vertex detector of the International Linear Collider, where one of the technologies is Monolithic Active Pixel Sensors (MAPS). In this project the Achilles MAPS was used. Its suitability for upstream monitoring and verification was tested using a variety of IMRT beams. Using image reconstruction techniques an unprecedented MLC position precision of $52\pm4\mu$m was achieved using a single image. This allows the beam shape to be monitored precisely and forms the building block of a real-time monitoring device. The treatment verification was tested using the Matixx dosimeter as a reference. Comparing the dose distributions using the Gamma metric showed a 97% pass rate for 3% and 3mm, which is good enough for verification. These results will be presented, along with future prospects.

Summary

Primary author(s) : PAGE, Ryan Frank (University of Bristol (GB))

Presenter(s) : PAGE, Ryan Frank (University of Bristol (GB))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **355** Type : **Oral**

Utilization of novel Silicon Photomultipliers with bulk integrated quench resistors in tracking applications for particle physics.

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Silicon Photomultipliers (SiPMs) are a promising candidate for replacing conventional photomultiplier tubes in many applications, thanks to ongoing developments and advances in their technology. A drawback of conventional SiPMs is their limited fill factor caused by the need for a high ohmic polysilicon quench resistor and its metal lines on the surface of the devices, which in turn limits the maximum photon detection efficiency. At the Semiconductor Laboratory of the Max-Planck Society (HLL) a novel detector concept was developed integrating the quench resistor directly into the silicon bulk of the device resulting in a free entrance window on the surface. The feasibility of the concept was already confirmed by simulation and extensive studies of first prototype productions. Recently SiPMs were also considered as an attractive alternative for tracking applications in vertex detectors. The requirements for a fast response, simple design and high fill factor can all be met by SiPMs. In addition the increased trigger probability for an avalanche by minimum ionizing particles allows device operations at lower overbias voltages, resulting in a decreased noise contribution. The concept can be evolved further towards an imaging photo-detector. A new design for an application of these SiPM devices as vertex detectors with active quenching developed by the HLL and DESY as well as first simulation results will be presented. Also, first measurements of the trigger efficiency as a function of the applied overbias voltage of SiPM devices will be shown.

Summary

Primary author(s) : Mr. PETROVICS, Stefan (Semiconductor Laboratory of the Max-Planck Society)

Co-author(s) : ANDRICEK, Laci (Semiconductor Laboratory of the Max-Planck Society); SCHOPPER, Florian (Semiconductor Laboratory of the Max-Planck Society); SEFKOW, Felix (DESY); DIEHL, Inge (DESY); HANSEN, Karsten (DESY); JENDRYSIK, Christian (Semiconductor Laboratory of the Max-Planck Society); KRUEGER, Katja (DESY); LEHMANN, Raik (Semiconductor Laboratory of the Max-Planck Society); NINKOVIC, Jelena (Semiconductor Laboratory of the Max-Planck Society); RECKLEBEN, Christian (DESY); RICHTER, Rainer (Semiconductor Laboratory of the Max-Planck Society)

Presenter(s) : Mr. PETROVICS, Stefan (Semiconductor Laboratory of the Max-Planck Society)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **20** Type : **Oral**

Verification of the compton-PET and a new approach to SPECT

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

An idea of Compton-PET is not new, however, current trend to be equipped heavy and smaller scintillators makes this idea feasible and easy. Two layers which composed of 3x3 scintillator matrix read out by 9 MPPC are fabricated and tested. The results of the experiment and comparison to the simulation will be presented. Furthermore, much smaller scintillator makes to improve the SPECT resolution with small PPD which is available in the market. A new SPECT idea with such smaller scintillator and MPPC is also fabricated and tested. The results and comparison to the simulation are presented and discussed.

Summary

The compton-PET will reduce the patience dose or the testing time to be 1/3. A new SPECT will increase the special resolution to be comparable 1mm.

Primary author(s) : KOTERA, Katsushige (Shinshu University); HASEGAWA, Yoji (Shinshu University (JP)); T. Takeshita (Shinshu Univ.)

Co-author(s) : Mr. SAKO, Kunihiro (Shinshu Univ.); Mr. MIYASHITA, Yuki (Shinshu Univ.); Mr. OGURA, Takayoshi (Shinshu Univ.); Mr. TSUCHIMOTO, Koya (Shinshu Univ.)

Presenter(s) : T. Takeshita (Shinshu Univ.)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **57** Type : **Oral**

Vertex-Detector R&D for CLIC

Friday, 6 June 2014 12:00 (0:20)

Abstract content

The CLIC vertex detector must have excellent spatial resolution, full geometrical coverage extending to low polar angles, extremely low mass, low occupancy facilitated by time-tagging, and sufficient heat removal from sensors and readout. These considerations, together with the physics needs and beam structure of CLIC, push the technological requirements to the limits and imply a very different vertex detector than the ones currently in use elsewhere. A detector concept based on hybrid planar pixel-detector technology is under development for the CLIC vertex detector. It comprises fast, low-power and small-pitch readout ASICs implemented in 65 nm CMOS technology (CLICpix) coupled to ultra-thin sensors via low-mass interconnects. The power dissipation of the readout chips is reduced by means of power pulsing, allowing for a cooling system based on forced gas flow. In this talk, the CLIC vertex-detector requirements are reviewed and the current status of R&D on sensors, readout and detector integration is presented.

Summary

Primary author(s) : DANNHEIM, Dominik (CERN)

Presenter(s) : DANNHEIM, Dominik (CERN)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **36** Type : **Oral**

Wireless data transfer with mm-waves for future tracking detectors

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

Wireless data transfer has revolutionized the consumer market for the last decade giving products equipped with transmitters and receiver for wireless data transfer. Wireless technology has features attractive for data transfer in future tracking detectors. The removal of wires and connectors for data links is certainly beneficial both for the material budget and the reliability of the system. Other advantages is the freedom of routing signals which today is particularly complicated when bringing the data the first 50 cm outside the tracker. With wireless links intelligence can be built into a tracker by introducing communication between tracking layers within a Region Of Interest which would allow the construction of track primitives in real time.

The wireless signal is transmitted by a passive antenna structure which is clearly a much less complex and radiation hard object than an optical transmitter. The technology used in consumer goods are however not suitable for trackers. The first limitation is the low data transfer capacity with current 5 GHz transceivers but also the relatively large feature sizes of the components.

Due to the requirement of high data rates in detectors a high bandwidth is required. The frequency band around 60 GHz turns out to be a very promising candidate. The frequency is a strong candidate for future WLAN use hence components are available on the market. The high baseband frequency allow for data transfer of the order of several Gbit , and due to the small wave length in the mm range, only small structures are needed. The challenge is to bring the signal around or trough boundaries that are not transparent to the mm-waves like silicon detector modules or support structure. Further more low power operation and strong focusing antennas is required for massive parallelization of data transfer inside the tracker. We will present patch antennas produced on flexible Printed Circuit Board substrate that can be used in future trackers. The antennas can be connected to transceivers for data transmission/reception or be connected by wave-guides to structures capable of bringing the signal pass boundaries. This presentation aims to present results on simulation, modelling, fabrication and characterisation of such antennas. Studies of a 60 GHz data link for radial transmission of mm-waves through a ATLAS detector model will be shown.

Summary

Primary author(s) : BRENNER, Richard (Uppsala University (SE)); PELIKAN, Daniel (Uppsala University (SE))

Co-author(s) : Dr. DANCILA, Dragos (Uppsala University); GUSTAFSSON, Leif (Uppsala University); Mr. BINGEFORS, Nils (Uppsala University)

Presenter(s) : PELIKAN, Daniel (Uppsala University (SE))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **230** Type : **Oral**

progress status for the Mu2e calorimeter system

Friday, 6 June 2014 11:20 (0:20)

Abstract content

The Mu2e experiment at FNAL aims to measure the charged-lepton flavor violating neutrinoless conversion of of a negative muon into an electron. The conversion results in a monochromatic electron with an energy slightly below the rest mass of the muon (104.97 MeV). The calorimeter should confirm that the candidates reconstructed by the extremely precise tracker system are indeed conversion electrons. We therefore look for a calorimeter with a large acceptance, good energy resolution O(5%) and a reasonable position (time) resolution of ˜0.5 cm (<0.5ns). Moreover, the calorimeter should also provide a trigger for the experiment and perform a powerful mu/e particle identification. Finally, it should be able to keep functionality in an environment where the background delivers a dose of ˜ 200 Gy/year in the hottest area. It will also need to work immersed in 1 T axial magnetic field. The baseline version of the Mu2e calorimeter is composed by two disks, 11 cm wide, of inner (outer)radius of 360 (670) mm filled by ˜ 1800 hexagonal LYSO crystals. Each crystal is readout by two large area APDs. At the moment of writing, due to the increasing cost of the LYSO, we are examing cheaper alternative based on BaF2 or pure CsI crystals. We will report the tests done, at a dedicated cosmic rays test, with our medium size prototype that is constituted by 16 square LYSO crystals of 3x3x13 cm**3 read out by Hamamatsu APDs and dedicated prototypes of the Front End electronics. We will report also on the first tests done with single BaF2 and pure CsI crystals when readout by means of large area UV extended APD or SiPM.

Summary

Primary author(s) : Dr. SARRA, Ivano (LNF INFN Frascati, Italy)

Presenter(s) : Dr. SARRA, Ivano (LNF INFN Frascati, Italy)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **411** Type : **Oral**

slic: A full-featured Geant4 simulation program

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

As the complexity and resolution of particle detectors increases, the need for detailed simulation of the experimental setup also increases. We have developed efficient and flexible tools for detailed physics and detector response simulations which build on the power of the Geant4 toolkit but free the end user from any C++ coding. Geant4 is the de facto high-energy physics standard for simulating the interaction of particles with fields and materials. However, the end user is required to write their own C++ program, and the learning curve for setting up the detector geometry and defining sensitive elements and readout can be quite daunting, especially for those without previous experience or not associated with large collaborations. We have developed the Geant4-based detector simulation program, slic, which employs generic IO formats as well as a textual detector description. Extending the pure geometric capabilities of GDML, LCDD enables fields, regions, sensitive detector readout elements, etc. to be fully described at runtime using an xml file. We also describe how more complex geometries, such as those from CAD programs, can be seamlessly incorporated into the xml files. We have defined generic "hits" which can be used to model sophisticated tracking and calorimetry readouts, but the native Geant4 scoring functionality can also be used for simpler applications. Although developed within the context of HEP collider detectors, the program is completely flexible and can be used to simulate detectors in many different fields.

Summary

We present a software toolkit and computing infrastructure which allows physicists to quickly and easily contribute to detector design by modeling detector elements without requiring either C++ coding expertise or experience with Geant4. This makes it perfect for small groups in new and emerging technologies, or those not associated with large collaborations or universities with in-house expertise.

Primary author(s) : GRAF, Norman Anthony (SLAC National Accelerator Laboratory (US))

Presenter(s) : GRAF, Norman Anthony (SLAC National Accelerator Laboratory (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **177** Type : **Oral**

10 Gb/s Radiation-Hard VCSEL Array Driver

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

Planned upgrades to the LHC at CERN will increase its energy and luminosity. These advancements will require increasing the optical data communication bandwidth to fully exploit the accelerator and detector upgrades. This require much increased per-fiber output data rates of up to 10 Gb/s. While 10 Gb/s optical links are mature in industry, as yet there are none that have sufficient radiation hardness for the most challenging HEP deployments. We will present results from an R&D project to produce a radiation-hard VCSEL driver ASIC capable of 10 Gb/s operation per-channel. Commercial VCSEL arrays operating at 10 Gb/s are now readily available and have been proven to be radiation-hard in previous studies. Thus, the ultimate goal of the R&D is to develop an ASIC that contains a 12-channel array of 10 Gb/s VCSEL drivers. However, at this stage in our R&D we are targeting fabrication of a preliminary four-channel test chip in a 65 nm CMOS process. The four channels in the ASIC will be used to qualify the performance and radiation hardness of different driver topologies before settling on a preferred topology for the 12-channel ASIC. The ASIC will include an 8-bit DAC and band gap reference to be used for remotely controlling the VCSEL bias and modulation currents. We will present the circuit designs of the four-driver topologies included within the ASIC along with results from extracted layout simulations.

Summary

Primary author(s) : Prof. GAN, Kock Kiam (Ohio State University (US))

Presenter(s) : Prof. GAN, Kock Kiam (Ohio State University (US))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **406** Type : **Oral**

128 channel waveform sampling digitizer/readout in the TOP counter for the Belle II upgrade

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

Extremely fast timing from Micro-Channel Plate PhotoMultiplier Tubes (MCP-PMTs) and multi-gigasample per second (GSa/s) waveform sampling ASICs will allow precision timing to play a pivotal role in the next-generation of Ring Imaging Cherenkov (RICH) detectors. We have developed a second prototype of the electronics to instrument the Time of Propagation (TOP) counter for the Belle II detector at KEK in Tsukuba, Japan. The front-end electronics modules consist of an array of waveform sampling / digitizing ASICs controlled by FPGAs with embedded microprocessor cores. The ASICs digitize amplified signals from an array of multi-anode MCP-PMTs coupled to a quartz radiator bar. Unwanted artifacts in the data are corrected with digital signal processing and feature-extraction on the front-end. Readout and control are done via multi-gigabit per second fiber optic links to a custom back-end.

A previous generation of these modules has been running in a prototype Focusing Detection of Internally Reflected Cherenkov (fDIRC) counter mounted in a Cosmic-Ray Stand (CRT) at SLAC continuously for over 12 months. The most recent version was taken to a beam test at SPring-8/LEPS in Japan in mid-2013. These experiences have influenced the design of the next set of ASICs and PCBs for the front-end, and we will present details on the latest generation.

Summary

We will present details on the latest generation of the front-end electronics (amplifiers, ASIC, FPGA/SoC, PCBs) in the TOP counter for the Belle II upgrade at KEK in Tsukuba, Japan.

Primary author(s) : Mr. ANDREW, Matthew (University of Hawaii)

Co-author(s) : Dr. NISHIMURA, Kurtis (SLAC); Dr. KIRBY, Brian (University of Hawaii at Manoa); Dr. VARNER, Gary (University of Hawaii); Mr. BYNES, James (University of Hawaii)

Presenter(s) : Mr. ANDREW, Matthew (University of Hawaii)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **82** Type : **Oral**

3D Particle Track Reconstruction in a Single Layer CdTe-Pixel Detector

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Many experiments, especially low-background experiments like the search for neutrinoless double beta decay, and applications, like Compton-imaging, would highly benefit from a room-temperature semiconductor voxel detector technology. A voxel detector is a 2D pixelated device which is able to determine the 3d coordinate (the depth of interaction) in every pixel. Thus, it can be used to reconstruct 3D-particle tracks that can be used for particle identification.
We developed a method to reconstruct the depth of interaction from properties that in principle could be directly measured with an optimized semiconductor detector. We applied the method to simulation data and investigated the reconstruction results under different parameters.
For an experimental proof-of-principle we used a Timepix detector with a 1 mm thick CdTe sensor and 110 μm pixel size. We evaluated data of electrons with a kinectic energy of 4.4 GeV wherefore they can be treated as minimal ionizing in our case. Despite the fact that the current Timepix cannot deliver all the necessary information for the algorithm, we successfully performed the reconstruction for electron track by employing this property (minimal ionization).
The reconstruction method and recent results on the z-position resolution will be presented.

Summary

Primary author(s) : Mr. FILIPENKO, Mykhaylo (Erlangen Center for Astroparticle Physics - ECAP)

Co-author(s) : Mr. GLEIXNER, Thomas (ECAP); Mr. MICHEL, Thilo (ECAP); ANTON, Gisela (ECAP)

Presenter(s) : Mr. FILIPENKO, Mykhaylo (Erlangen Center for Astroparticle Physics - ECAP)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **233** Type : **Oral**

A High Performance Multi-Core FPGA Implementation for 2D Pixel Clustering for the ATLAS Fast TracKer (FTK) Processor

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

The high performance multi-core 2D pixel clustering FPGA implementation used for the input system of the ATLAS Fast TracKer (FTK) processor is presented. The input system for the FTK processor will receive data from the Pixel and micro-strip detectors read out drivers (RODs) at 760Gbps, the full rate of level 1 triggers. Clustering is required as a method to reduce the high rate of the received data before further processing, as well as to determine the cluster centroid for obtaining obtain the best spatial measurement. Our implementation targets the pixel detectors and uses a 2D-clustering algorithm that takes advantage of a moving window technique to minimize the logic required for cluster identification. The design is fully generic and the cluster detection window size can be adjusted for optimizing the cluster identification process. The implementation can be parallelized by instantiating multiple cores to identify different clusters independently thus exploiting more FPGA resources. This flexibility makes the implementation suitable for a variety of demanding image processing applications. The implementation is robust against bit errors in the input data stream and drops all data that cannot be identified. In the unlikely event of missing control words, the implementation will ensure stable data processing by inserting the missing control words in the data stream.

The 2D pixel clustering implementation is developed and tested in both single flow and parallel versions. The first parallel version with 16 parallel cluster identification engines is presented. The input data from the RODs are received through S-Links and a single data stream is also required by the processing units that follow the clustering implementation. Data parallelizing (demultiplexing) and serializing (multiplexing) modules are introduced in order to accommodate the parallelized version and restore the data stream to a single flow afterwards. The results of the first hardware tests of the single flow implementation on the custom FTK input mezzanine (IM) board are presented. We report on the integration of 16 parallel engines in the same FPGA, the resulting performances and the first parallel version hardware tests. The parallel 2D-clustering implementation has sufficient processing power to meet the specification for the Pixel layers of ATLAS, for up to 80 overlapping pp collisions that correspond to the maximum LHC luminosity planned until 2022.

Summary

Primary author(s) : SOTIROPOULOU, Calliope-louisa (Aristotle Univ. of Thessaloniki (GR))

Presenter(s) : SOTIROPOULOU, Calliope-louisa (Aristotle Univ. of Thessaloniki (GR))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **326** Type : **Oral**

A High-Speed Electron Beam Profile Monitor for the Synchrotron Radiation Source

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The real-time processing of the electron beam parameters is a necessary procedure to optimize the key characteristics of the synchrotron radiation source using feedback loops. The actual problem is to study multi-bunch beam instabilities. To solve this problem a high-speed electron beam profile monitor is developed. This device includes a photodetector unit and signal recorder. The photodetector unit is bult on a photodiode strip consisting of 16 integrated avalanche photodiodes. Electric pulses from the photodiodes are fed to inputs of analog integrators. The integrator is designed for input pulse repetition rate of 200 MHz. The 16-channel signal recorder fixes the integrals values, performs their 12-bit analog-to-digital conversion and buffering in the internal 3 Gb memory. The accumulated data is transferred via Ethernet 100BASE-T. The device described must continuously implement 15625000 measurements of the vertical or horizontal electron beam profile at 16 points with a time resolution of 5 ns.

Summary

The electron beam quality determines the main synchrotron radiation characteristics therefore beam diagnostics is of great importance for synchrotron radiation source performance. The real-time processing of the electron beam parameters is a necessary procedure to optimize the key characteristics of the source using feedback loops.
The frequency of electron beam turning in the synchrotron storage ring is about 1 MHz. In multi-bunch mode electrons are grouped into a series of bunches. The bunch repetition frequency depends on the total number of bunches and usually reaches hundreds of MHz. The actual problem is to study multi-bunch beam instabilities.
To solve this problem a high-speed electron beam profile monitor is developed. This device includes a photodetector unit and signal recorder. The photodetector unit is bult on a photodiode strip consisting of 16 integrated avalanche photodiodes. It takes the radiation intensity distribution on the electron beam profile. Electric pulses from the photodiodes are fed to inputs of analog integrators. The integrator operates continuously without reset between two adjacent pulses. Varying continuously the integrator output level consistently takes the value of the every input pulse integral. This technique improves the integrator performance. The integrator is designed for input pulse repetition rate of 200 MHz. The 16-channel signal recorder fixes the integrals values, performs their 12-bit analog-to-digital conversion and buffering in the internal 3 Gb memory. The accumulated data is transferred via Ethernet 100BASE-T.
The device design has been completed. The program shell developing is in progress. The prototype of the analog integrator has been tested. The next stage is the whole device prototyping and testing at Siberia-2 which has a close bunch repetition frequency of 181.6 MHz. The device described must continuously implement 15625000 measurements of the vertical or horizontal electron beam profile at 16 points with a time resolution of 5 ns.

Primary author(s) : Mr. KOTELNIKOV, Aleksandr (Budker Institute of Nuclear Physics)

Co-author(s) : Dr. MESHKOV, Oleg (Budker Institute of Nuclear Physics); Dr. KHILCHENKO, Aleksandr (Budker Institute of Nuclear Physics); Mr. KVASHNIN, Andrey (Budker Institute of Nuclear Physics); Mr. ZUBAREV, Peter (Budker Institute of Nuclear Physics); Ms. IVANENKO, Svetlana (Budker Institute of Nuclear Physics); Ms. PURYGA, Ekaterina (Budker Institute of Nuclear Physics); IVANOVA, Alina (Budker Institute of Nuclear Physics)

Presenter(s) : Mr. KOTELNIKOV, Aleksandr (Budker Institute of Nuclear Physics)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **122** Type : **Oral**

A Kind of Electrostatic Focusing MCP-PMT

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

In order to meet the needs of JUNO, we design and manufacture a kind of electrostatic focusing MCP-PMT which has very low radioactive background by introducing pure raw materials and controlling melting and artificial fine blowing process. This MCP-PMT has high photon detection efficiency which results from using transmission photocathode and reflection photocathode simultaneously, and the total quantum efficiency reaches approximately 30%. Good design of focusing electrode and appropriate distribution of voltage can ensure 95% photoelectrons entering the surface of MCP. The electron multiplication system consists of 4 MCPs that each of the two pieces of MCP is a component, by optimizing the voltages of each MCP and the gaps between MCPs, the gain obtained is greater than 107 and the peak to valley ratio of single photoelectron is about 2. For anode optimization, we design two kinds of configuration to reduce signal ringing, the one is metal mesh and plate, the other is micro-strip line. Finally, by using signal cable which impedance matches the anode, we obtain very single photoelectron signal.

Summary

Primary author(s) : Prof. LIU, Shulin (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China); Prof. WANG, Yifang (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China)

Co-author(s) : Prof. ZHAO, Tianchi (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China); Prof. SI, Shuguang (Nanjing Branch, North Night Vision Technology CO., Ltd, No. 2, Kangping street, 211011, Nanjing, China); Dr. LIU, Hulin (Xi'an Institute of Optics and Precision Mechanics, No.17, Information Avenue, 710119, Xi'an, China); Dr. QIAN, Sen (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China); Prof. SUN, Jianning (Nanjing Branch, North Night Vision Technology CO., Ltd, No. 2, Kangping street, 211011, Nanjing, China); Prof. TIAN, Jinshou (Xi'an Institute of Optics and Precision Mechanics, No.17, Information Avenue, 710119, Xi'an, China); Prof. ZHOU, Jianxun (Nanjing Branch, North Night Vision Technology CO., Ltd, No. 2, Kangping street, 211011, Nanjing, China); Dr. CHEN, Ping (Xi'an Institute of Optics and Precision Mechanics, No.17, Information Avenue, 710119, Xi'an, China)

Presenter(s) : Prof. LIU, Shulin (Institute of High Energy Physics, Chinese Academy of Sciences, Rd. Yuquan 19B, 100049, Beijing, China)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **69** Type : **Oral**

A Muon Trigger with high pT-resolution for Phase-II of the LHC Upgrade, based on the ATLAS Muon Drift Tube Chambers (MDT)

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

Speaker: V. Gabrielyan on behalf of the ATLAS Muon Collaboration The Level-1 (L1) trigger for muons with high transverse momentum (pT) in ATLAS is based on chambers with excellent time resolution, able to identify muons coming from a particular beam crossing. These trigger chambers also provide a fast pT-measurement of the muons, the accuracy of the measurement being limited by the moderate spatial resolution of the chambers along the deflecting direction of the magnetic field (eta-coordinate). The higher luminosity foreseen for Phase-II puts stringent limits on the L1 trigger rates, and a way to control these rates would be to improve the spatial resolution of the triggering system, drastically sharpening the turn-on curve of the L1 trigger. To do this, the precision tracking chambers (MDT) can be used in the L1 trigger, provided the corresponding trigger latency is increased as foreseen. The trigger rate reduction is accomplished by strongly decreasing the rate of triggers from muons with pT lower than a predefined threshold (typically 20 GeV), which would otherwise trigger the DAQ. We describe the architecture for reading out the MDT synchronously w.r.t. the relevant beam crossing and in a sufficiently fast way to fit into the available L1 latency. The adaption to chamber geometries in barrel and end-cap will also be discussed. We present results of a prototype test at the Gamma Irradiation Facility (GIF) at CERN as well as the performance of a demonstrator module, containing most of the required functionality. In addition, simulation results are shown which demonstrate the rejection efficiency for muons below a given pT-threshold, taking into account deteriorating effects like delta-rays, conversion background and tube inefficiencies.

Summary

The Level-1 (L1) trigger for muons with high transverse momentum (pT) in ATLAS is based on chambers with excellent time resolution (better than 20 ns), able to identify muons coming from a particular beam crossing. About 600 of these trigger chambers are located in the central region (eta<1) of ATLAS, while about 3600 are covering the forward region (1<eta<2.4). In the central and forward region the chamber technology is of the RPC and TGC type, respectively. A detailed description of the present ATLAS trigger scheme and chamber technologies is given in reference 1. The trigger chambers also provide a fast pT-measurement of the muons, the accuracy of the measurement being limited by the moderate spatial resolution of the chambers along the deflecting direction of the magnetic field (eta-coordinate). The limited momentum resolution of the trigger chambers weakens the selectivity of the L1 trigger for high-pT muons above a predefined threshold, like 20 GeV, allowing muons below threshold to cause "fake" triggers, mostly corresponding to event signatures without physics interest. The higher luminosity foreseen for Phase-II puts stringent limits on the L1 trigger rates, and a way to control these rates would be to improve the spatial resolution of the triggering system, drastically sharpening the turn-on curve of the L1 trigger with respect to pT. This is possible due to the close matching between trigger

and MDT precision chambers in the Muon spectrometer. The selectivity for high-pT tracks can thus be improved by combining the excellent spatial resolution of the MDT with the time resolution of the trigger chambers. In this concept, the trigger chambers will be used to define regions of Interest (RoI) inside which high-pT muon candidates have been identified. MDT hits in the RoI(s) are passed to the trigger logic, where they are used for an accurate estimate of the track momentum, leading to an efficient suppression of sub-threshold muon triggers. In order to collect the MDT hit coordinates early enough for use in the L1 trigger logic, the relevant hits are read out through a priority readout chain, independent of the standard, asynchronous readout. Considering only MDT hits inside the RoI(s) strongly reduces bandwidth requirements and latencies, in such a way that transfer and processing of the MDT for the L1 trigger decision can be accomplished within the 20 mysec L1 latency, available in Phase-II. We present the architecture of the MDT trigger system together with estimates of latency and spatial resolution as well as test results from a prototype, performed at the CERN Gamma Irradiation Facility (GIF) early this year. We also present results from a demonstrator module, containing all essential components of the readout system to be used in Phase-II. In addition, simulation results are shown which demonstrate the rejection efficiency for muons below a given pT-threshold, taking into account deteriorating effects like delta-rays, conversion background and tube inefficiencies. 1 ATLAS collaboration, The ATLAS experiment at the CERN LHC, 2008 JINST 3 S08003

Primary author(s) : RICHTER, Robert (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Co-author(s) : KROHA, Hubert (MPI for Physics, Munich); OTT, Sebastian (MPI for Physics, Munich); KORTNER, Oliver (MPI for Physics, Munich); FRAS, Markus (MPI for Physics, Munich); GABRIELYAN, Vazgen (MPI for Physics, Munich); DANIELYAN, Varuzhan (MPI for Physics, Munich); FINK, David (MPI for Physics); NOWAK, Sebastian (MPI for Physics, Munich); SCHWEGLER, Philipp (MPI for Physics, Munich); ABOVYAN, Sergey (MPI for Physics, Munich)

Presenter(s) : GABRIELYAN, Vazgen (MPI for Physics, Munich)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **430** Type : **Oral**

A New Generation of Charge Integrating ADC (QIE) for the CMS HCAL Upgrade

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

The CMS experiment at the CERN Large Hadron Collider (LHC) will upgrade the photodetection and readout systems of its hadron calorimeter (HCAL) through the second long shutdown of the LHC in 2018. A central feature of this upgrade is the development of two new versions of the QIE (Charge Integrating Encoder), a Fermilab-designed custom ASIC for measurement of charge from detectors in high-rate environments. These most recent additions to the QIE family feature 3 fC sensitivity, 17-bits of dynamic range with logarithmic response, a Time-to-Digital Converter (TDC) with sub-nanosecond resolution all with 16 bits of readout per bunch crossing. The device is capable of dead-timeless operation at 40 MHz, making it ideal for calorimetry at the LHC. We present bench measurements and integration studies that characterize the performance, radiation tolerance measurements, and plans for deployment in the upgraded CMS detector.

Summary

Primary author(s) : HIRSCHAUER, Jim (Fermi National Accelerator Lab. (US))

Presenter(s) : HUGHES, Elliot (Rutgers, State Univ. of New Jersey (US))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **24** Type : **Oral**

A Zero Ion Backflow electron multiplier operating in noble gases

Monday, 2 June 2014 16:50 (0:20)

Abstract content

We present a new concept for the suppression of the secondary ions in gaseous detectors. The Zero Ion Backflow electron multiplier operates in a noble gas atmosphere and supress the ion backflow to the level of the primary ionization, totally blocking the secondary ions that are produced in the multiplier. This detector is composed by a proportional scintillation region, composed by two highly transparent meshes, followed by a gaseous photon-multiplier. The primary electrons drift through the proportional scintillation region under the influence of an electric field below the ionization threshold of the gas, emitting electroluminescence without the production of secondary ions. The electroluminescence signals are collected by the gaseous photon multiplier, composed by a gaseous electron multiplier coupled to a CsI phothocade, and further amplified by electron avalanche. The positive ions that result from electron avalanches in the gaseous photomultiplier are prevented from reaching the conversion region by an electrostatic separation between the proportional scintillation region and the gaseous photomultiplier. The ion back flow is therefore reduced to the level of the primary ionization and is totally independent on the electron avalanches that occur on the gaseous photomultiplier.

Summary

We present the results obtained with the Zero Ion Backflow electron multiplier operated in pure Xenon equipped with a proportional scintillation region of 6 mm. The gaseous photomultiplier is composed by a double GEM cascade coupled to a CsI photocathode, separated from the proportional scintillation region by an extraction region with 2 mm. The transference of the secondary ions from the gaseous photomultiplier to the proportional scintillation region is dependent on the electric field between these two regions, EExtraction, that also influences the photoelectron extraction from the CsI photocathode. We have determined the influence of this field on the levels of ion backflow and on the photo-electron extraction. A value between 0.1 and 0.2 kV/cm*bar was found to ensure simultaneously maximum relative photoelectron extraction and full ion backflow suppression. Energy resolution of 17% was measured when irradiating the detector with 5.9 keV x-rays.

Primary author(s) : Mr. AMARO, Fernando (Coimbra University)

Co-author(s) : DOS SANTOS, Joaquim (University of Coimbra); VELOSO, joao (university of aveiro); Mr. BALL, Markus (Technical University Munich)

Presenter(s) : Mr. AMARO, Fernando (Coimbra University)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **101** Type : **Oral**

A compact scintillation detector for mobile neutron spectroscopy

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

A compact scintillation detector, comprising of plastic scintillators capable of pulse shape discrimination, coupled to silicon photomultipliers and digital readout electronics, has been constructed and characterised using a range of neutron and gamma radiation fields with energies between 0.5 and 14 MeV. Experimental measurements will be presented and compared with simulations built using GEANT4. In addition, measurements with neutron beams ranging in energy between 14 MeV and 66 MeV, produced at the iThemba LABS cyclotron facility will be used to illustrate the pulse shape discrimination capabilities of the digital data acquisition system. The potential of the device for both dosimetry and security applications will be discussed, together with the challenges of implementing a compact neutron/gamma-ray detector for use in industry.

Summary

Primary author(s) : Mr. COMRIE, Angus (University of Cape Town)

Co-author(s) : Prof. BUFFLER, Andy (University of Cape Town); Dr. SMIT, Ricky (iThemba LABS); Dr. WOERTCHE, Heinrich (INCAS3)

Presenter(s) : Mr. COMRIE, Angus (University of Cape Town)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **285** Type : **Oral**

A dark matter search using CCDs

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

DAMIC is a novel dark matter search experiment that has a unique sensitivity to hypothetic dark matter particles with masses below 10 GeV. Due to the CCD's low electronic readout noise (R.M.S. ~ 3 eV), this instrument is able to reach a detection threshold of 60 eV, suitable for the search in the low mass range. The excellent energy response and high spatial resolution of a CCD image allow a powerful background characterization. Early DAMIC runs determined the world's best cross-section limits for WIMPs with masses below 4 GeV. Here we report on DAMIC100, a fully funded dark matter search detector with a target mass of 100 grams of silicon that will be installed at Snolab during the Summer of 2014. We also discuss the challenges associated with the scale-up of the experiment, the calibration efforts for low energy nuclear recoils in silicon, and the prospects for the first physics results after a one year run.

Summary

Primary author(s) : IZRAELEVITCH, Federico (Fermilab)

Co-author(s) : DAMIC COLLABORATION, (DArk Matter In Ccds) (Fermilab)

Presenter(s) : IZRAELEVITCH, Federico (Fermilab)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **346** Type : **Oral**

A fast, low-power, multichannel 6-bit ADC ASIC with data serialization

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

The multichannel 6-bit ADC ASIC with data serialization was designed in view of LHCb Tracker System Upgrade. The first prototype was designed and fabricated in CMOS 130 nm technology. The main chip components are 8 channels of fast, very low power (<0.5 mW per channel) 6-bit SAR ADCs, data serialization circuitry based on ultra-low power internal PLL and fast SLVS I/O differential interface. The nominal ADC sampling frequency is 40 MHz but the operation beyond 80 MHz is possible. Various modes of data serialization were implemented, the main three are: A) test mode - with 6 bits from the selected ADC sent to 6 SLVS differential outputs; B) partial serialization - when output bits of each ADC are serialized, with frequency multiplied six times by PLL, into separate SLVS output; C) full serialization - when output of all (6) bits of all (8) ADCs are serialized into one SLVS output. In addition to standard operation the serialization circuitry contains also a block generating the test data (instead of using ADC output bits) which are serialized and sent out. This block is added for better ASIC testability and it allows to generate test patterns based on binary or pseudo-random counters. The ultra-low power (<1 mW) PLL was designed to generate clock in a wide frequency range, from tens of MHz to few GHz. The SLVS interface was designed for data rates beyond 1 GHz.
The description of the ASIC architecture and the results of measurements, in particular all main functionalities/blocks i.e. ADC, PLL, SLVS and serializer will be presented.

Summary

Primary author(s) : FIRLEJ, Miroslaw (AGH University of Science and Technology (PL)); Dr. FIUTOWSKI, Tomasz (AGH University of Science and Technology (PL)); Prof. IDZIK, Marek (AGH University of Science and Technology (PL)); MORON, Jakub (AGH University of Science and Technology (PL)); Dr. SWIENTEK, Krzysztof Piotr (AGH University of Science and Technology (PL))

Presenter(s) : Dr. SWIENTEK, Krzysztof Piotr (AGH University of Science and Technology (PL))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **202** Type : **Oral**

A multi-purpose digital acoustic sensor and its application in the deep-sea environment

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

The KM3NeT project is a deep-sea research infrastructure that will host a neutrino telescope with a volume of several cubic kilometres as well as Earth and Sea science instrumentation for monitoring the deep Mediterranean Sea. Within the project, a variety of acoustic topics are pursued: from acoustic position calibration of the flexible detector structures of the neutrino telescope over acoustic marine life monitoring to acoustic detection of ultra-high energy neutrinos. For these tasks - with a focus on position calibration - a multi-purpose digital acoustic sensor was developed that is integrated into the active elements of the detector: glass spheres holding photomultipliers, readout electronics and additional instrumentation. The sensor directly provides high-bandwidth digital data in standard audio format, its firmware is exchangeable. The data is sampled at about 200 kHz with 24-bit accuracy. The acoustically sensitive piezo-electric ceramic together with circuitry for pre-amplification, filtering, digitization and data formatting (using an FPGA) are implemented in a very compact design (2cm diameter and 3cm length). The sensor is flexible in application: it is shielded from electromagnetic interference, can be attached to the inside of containers, and can be coated for direct usage in water. The design and characteristics of the acoustic sensor are described and possible applications are discussed.

Summary

A multi-purpose digital acoustic sensor has been developed primarily for acoustic position calibration of the KM3NeT detector. Its small size and its flexible firmware allow for a wide range of applications.

Primary author(s) : GRAF, Kay (University of Erlangen)

Presenter(s) : GRAF, Kay (University of Erlangen)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **167** Type : **Oral**

A real x-y microbulk Micromegas with segmented mesh

Monday, 2 June 2014 16:30 (0:20)

Abstract content

We present for a first time, the development of Micromegas detectors based on Microbulk technology with segmented mesh. The space charge produced within the amplification volume induces both signals and the mesh strips provide the y coordinate while the anode strips the x coordinate. The manufacturing of a segmented mesh simplifies the x-y readout that up to now was produced in a complicated and delicate way due to the x-y strips formation (x-pads link in the front and y-pads link via through holes in the back plane) and had a high risk of deteriorating the detector quality or even damaging the detector in the last stages of construction. This R&D is a project supported by the RD51 collaboration. The design and manufacturing has been optimized and produced segmented mesh Microbulk Micromegas with excellent properties in Energy resolution, stability and good position resolution. We have designed appropriate FE-electronics for providing the bias HV to every individual mesh strip and reading it out. The design aims to an ultra low background, ultra low threshold detector appropriate for rare event searches, thanks to its low material budget that may further improve the excellent Microbulk technology background properties close to ~(few)x10-7 cnts/keV/cm2/s. We will present details of the design and the manufacturing of the segmented mesh microbulk, results on the detector performance, prospects for further improvements and possibilities that open for rare processes, neutron detection and other applications. We believe that this design constitutes a break-through in the Micro Pattern Gaseous Detectors developments.

Summary

Primary author(s) : Dr. GERALIS, Theodoros (NCSR Demokritos)

Co-author(s) : Mr. AZNAR, Fransisco (University of Zaragoza); Dr. IGUAZ, Fransisco J. (University of Zaragoza); Dr. DAFNI, Theopisti (University of Zaragoza); Dr. FERRER RIBAS, Esther (IRFU Sacaly); Dr. PAPAEVANGELOU, Thomas (IRFU Sacaly); Dr. DAVENPORT, Martyn (CERN); Dr. FERRY, Serge (CERN); Dr. DE OLIVEIRA, Rui (CERN); Mr. KALAMARIS, Athanasios (NCSR Demokritos); Dr. KEBBIRI, Mariam (IRFU Saclay)

Presenter(s) : Dr. GERALIS, Theodoros (NCSR Demokritos)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **153** Type : **Oral**

A scalable gigabit data acquisition system for calorimeters for linear collider

Monday, 2 June 2014 17:10 (0:20)

Abstract content

This article presents the scalable Data Acquisition (DAQ) system that has been designed for prototypes of ultra-granular calorimeters for the International Linear Collider (ILC). Our design is generic enough to cope with other applications with some minor adaptations. The DAQ is made up of four different modules, including an optional one. One Detector InterFace (DIF) is placed at each end of the detector elements (SLAB) to communicate with up to 160 ASICs. A single HDMI cable is used to transmit both slow-control and readout data over a serial 8b/10b encoded characters at 50 Mb/s to the Gigabit Concentrator Card (GDCC). The GDCC controls up to 7 DIFs, it is distributing the system clock and ASICs configuration, and collecting data from them. Each DIFs data packet is encapsulated in Ethernet format and sent out via an optical or copper link. The Data Concentrator Card (DCC) is a multiplexer (1 to 8) that can be optionally inserted between the GDCC and the DIFs, increasing the number of managed ASICs by the GDCC. Using a single GDCC and 7 DCCs would allow a single PC to control and readout up to 8960 ASICs (˜ 500000 channels). The fourth card is the Clock and Control Card (CCC) that provides a clock and control fanout to up to 8 GDCCs and therefore to the entire system. A software suite (named Calicoes) written in C and Python manages the overall system. This system have been used for several tests on the SiW-ECAL prototype detector (1800 channels). The full design and test results will here detailed.

Summary

Primary author(s) : GASTALDI, Franck (Ecole Polytechnique (FR))

Co-author(s) : CORNAT, Remi Jean Noel (Ecole Polytechnique (FR)); MAGNIETTE, Frederic Bruno (Ecole Polytechnique (FR))

Presenter(s) : GASTALDI, Franck (Ecole Polytechnique (FR))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **318** Type : **Oral**

A serializer ASIC of 16 Gb/s for data transmission over fiber for detector front-end readout in a particle experiment

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

We report an ASIC development based on a commercial 0.25-micron silicon-on-sapphire CMOS technology. This ASIC is a dual channel serializer sharing one LC-PLL with 8 Gb/s each channel and a total data throughput of 16 Gb/s for each chip. The prototype packaged in QFN is measured from 7.2 to 8.5 Gb/s each channel, limited by the tuning range of the PLL. This design is for an optical link that is under development to read out the front-end board in the trigger upgrade of the Liquid Argon Calorimeter (LAr) in ATLAS. We will present design details and prototype measurement results. We will also discuss the experience on the QFN package for high-speed signals.

Summary

Primary author(s) : YE, Jingbo (Southern Methodist University, Department of Physics)

Co-author(s) : Prof. GONG, Datao (Department of Physics, SMU); Prof. LIU, Tiankuan (Department of Physics, SMU); Ms. LI, Xiaoting (Department of Physics, SMU)

Presenter(s) : YE, Jingbo (Southern Methodist University, Department of Physics)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **348** Type : **Oral**

A small dual-phase xenon TPC with APD and PMT readout for the study of liquid xenon scintillation

Monday, 2 June 2014 16:50 (0:20)

Abstract content

Liquid xenon is used in many fields as detector medium. Dark Matter experiments based on liquid xenon have set the most stringent limits in the past decade and are still leading the field. Also in other areas of particle physics xenon is used as detector medium, for example in the search for neutrinoless double beta decay (EXO), in the search for lepton flavor violation (MEG) or in envisioned projects like gamma-ray telescopes on satellites. There is also ongoing research on xenon-based detectors for medical imaging. Although widely used, the scintillation process of liquid xenon, especially at low recoil energies (few keV), is not well understood.

The MainzTPC, a small 3D position-sensitive dual-phase xenon TPC, has the goal to improve our understanding of the scintillation process and the field quenching in liquid xenon. The MainzTPC uses two PMTs (Hamamatsu R6041) to detect and measure the fast primary scintillation light including its shape. Additionally an array of eight large area avalanche photo diodes (LA-APDs) detects the large proportional scintillation providing x/y resolution. Here we report on the performance of the TPC and the response of the LA-APDs to the xenon scintillation light.

Summary

The design of the MainzTPC and the according cryo-system is finished and its assembly is ongoing at the moment. Till the TIPP2014 we expect to have the TPC running and first tests performed. Meanwhile the photo sensors that will be used are tested and characterized. The large area APDs are tested in liquid xenon on quantum efficiency for the xenon scintillation light as well as voltage and temperature dependence of their internal gain (g>1000).

Also, the DAQ using a high sample rate (5GS/s) FADC is set up in parallel to the measurements of the light detectors and construction and assembly of the TPC. In the talk, we will report on the response of the photo sensors (especially the APDs) and the comissioning and first results from the comissioning of the TPC.

Primary author(s) : BESKERS, Bastian (Johannes Gutenberg University Mainz); SISSOL, Pierre (Johannes Gutenberg University Mainz)

Co-author(s) : Dr. GRIGNON, Cyril (Johannes Gutenberg University Mainz); OTHEGRAVEN, Rainer (Johannes Gutenberg University Mainz); SCHEIBELHUT, Melanie (Johannes Gutenberg University Mainz); Prof. OBERLACK, Uwe (Johannes Gutenberg University Mainz)

Presenter(s) : BESKERS, Bastian (Johannes Gutenberg University Mainz)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **39** Type : **Oral**

A specialized processor for track reconstruction at the LHC crossing rate

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

We present the results of an R\&D study for a specialized processor capable of precisely reconstructing events with hundreds of charged-particle tracks in pixel detectors at 40 MHz, thus suitable for processing LHC events at the full crossing frequency. For this purpose we design and test a massively parallel pattern-recognition algorithm, inspired by studies of the processing of visual images by the brain as it happens in nature. We find that high-quality tracking in large detectors is possible with sub-microsecond latencies if the algorithm is implemented in modern, high-speed, high-bandwidth FPGA devices.

Summary

Primary author(s) : TONELLI, Diego (CERN)

Co-author(s) : ABBA, Andrea (Università degli Studi e INFN Milano (IT)); Dr. BEDESCHI, Franco (Sezione di Pisa (IT)); CAPONIO, Francesco (Università degli Studi e INFN Milano (IT)); CITTERIO, Mauro (Università degli Studi e INFN Milano (IT)); MARINO, Pietro (Sezione di Pisa (IT)); MORELLO, Michael Joseph (SNS and INFN-Pisa); NERI, Nicola (Università degli Studi e INFN Milano (IT)); PETRUZZO, Marco (INFN Milano); NINCI, Daniele (INFN Pisa); PIUCCI, Alessio (Sezione di Pisa (IT)); PUNZI, Giovanni (Sezione di Pisa (IT)); RISTORI, Luciano (INFN and Fermilab); SPINELLA, Franco (Sezione di Pisa (IT)); STRACKA, Simone (Sezione di Pisa (IT)); alberto (Politecnico di Milano & INFN Milano); GERACI, Angelo (Politecnico di Milano & INFN Milano)

Presenter(s) : TONELLI, Diego (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **64** Type : **Oral**

AGIPD, the electronics for a high speed X-ray imager at the Eu-XFEL

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

The AGIPD (Adaptive Gain Integrated Pixel Detector) X-ray imaging camera will operate at the X-ray Free Electron Laser, Eu-XFEL, under construction in Hamburg, Germany. Key parameters are 1Mega 200μm square pixels, single 12.4 keV photon detection and a dynamic range to 10000/pixel/image. The developed sensors, ASICs, PCB-electronics and FPGA-firmware acquire individual images per bunch at 27000 bunches/s, packed into 10 bunch-trains/s with a bunch separation of 220 ns. Bunch-trains are handled by 352 analogue storage cells within each pixel of the ASIC and written to written during the 0.6msec train delivery. Random addressing provides reusability of each cell after an image has been declared as low-quality. Digitization is performed between trains (99.4 msec).

The talk will introduce all functional blocks, concentrating on the DAQ-chain PCB-electronics: a dense area of 1024 ADC-channels, each with a pickup-noise filtering and sampling of up to 50 MS/s/ADC and a serial output of 700 Mbit/s/ADC. FPGAs operate the ASICs synchronized to the bunch structure and collect the bit streams from 64 ADCs/FPGA. Pre-sorted data is transmitted on 10 GbE links out of the camera head using the time between trains. The control and monitoring of the camera with 700 A current consumption is based on a micro-controller and I2C bus with an addressing architecture allowing many devices and identical modules. The high currents require planned return paths at the system level. First experimental experience of the constructed components will be presented.

Summary

Primary author(s) : GOETTLICHER, Peter (Deutsches Elektronen-Synchrotron (DE))

Co-author(s) : AGIPD-CONSORTIUM, . (DESY, PSI, University-Bonn, University-Hamburg)

Presenter(s) : GOETTLICHER, Peter (Deutsches Elektronen-Synchrotron (DE))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **87** Type : **Oral**

Aerogel Cherenkov counters for experiments at VEPP-2000 e+e- collider with SND detector

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

For experiments at VEPP-2000 e+e- collider with SND detector the particle identification system based on the threshold aerogel Cherenkov counters was developed. The counter design is based on ASHIPH technique (Aerogel, SHifter, PHotomultiplier). Cherenkov light emitted in aerogel is collected by a wavelength shifter and detected by a photomultiplier tube based on microchannel plates (MCP PMT). For the particle identification two systems with different refractive indexes of aerogel were manufactured: with n=1.13 for the separation of pi and K mesons up to particle energy of 1 GeV and with n=1.05 for e/pi separation up to particle energy of 0.45 GeV. The construction of the aerogel Cherenkov counter is described. Main characteristics of counters measured using particles (e, mu, pi, K) produced in e+e- annihilation are presented.

Summary

Experiments at the VEPP-2000 e+e- collider with upgraded SND detector have been started in the Budker Institute of Nuclear Physics (Novosibirsk, Russia) in 2010. The designed parameters of VEPP-2000 are the following: center-of-mass energy is up to 2 GeV, luminosity is 10ˆ32 cmˆ-2sˆ-1. Development of the new particle identification system based on the threshold aerogel Cherenkov counters was a part of the SND upgrade. The counter design is based on ASHIPH technique (Aerogel, SHifter, PHotomultiplier). Cherenkov light emitted in aerogel is collected by a wavelength shifter, re-emited and transported to the photocathode. A microchannel plate photomultiplier tube (MCP PMT) with multialkali photocathode is chosen as a photodetector. For the particle identification at different energies two systems with different refractive indexes of aerogel were manufactured: with n=1.13 for the separation of pi and K mesons up to particle energy of 1 GeV and with n=1.05 for e/pi separation up to particle energy of 0.45 GeV. The system with n=1.13 was calibrated with particles (e, mu, pi, K) produced in e+e- collisions. The signal magnitude from ultrarelativistic electron is 6-8 photoelectrons. This system provides pion suppression by more than two orders of magnitude in the momentum range from 0.35 to 1.00 GeV/c. The measurements of characteristics of system with n=1.05 have been done using particles from e+e->e+e- and e+e->mu+mu- reactions. The average signal from electrons is 3.5 photoelectrons.

Primary author(s) : MARTIN, Karina (Budker Institute of Nuclear Physics)

Co-author(s) : Prof. SEREDNYAKOV, Sergey (Budker Institute of Nuclear Physics); BELOBORODOV, Konstantin (Budker Institute of Nuclear Physics); Dr. GOLUBEV, Vladimir (Budker Institute of Nuclear Physics)

Presenter(s) : MARTIN, Karina (Budker Institute of Nuclear Physics)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **279** Type : **Oral**

Aerogel RICH counter for the Belle II forward PID

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

The Belle II spectrometer, a follow up of the very successful Belle experiment, is under construction at the SuperKEKB electron-positron collider at KEK in Japan. For the PID system in the forward region of the spectrometer, a proximity focusing RICH counter with aerogel radiator is being developed. For this counter we have devised a focusing radiator consisting of two aerogel layers with increasing refractive index along the particle path, which results in a focusing of Cherenkov light at the photon detector plane. In this way, a thicker radiator can be used, and the number of photons can be increased without degrading the single photon Cherenkov angle resolution. The detector will provide a 4 σ separation of pions and kaons up to momenta of 4 GeV/c, at the kinematic limits of the experiment. The main challenge was, however, a reliable multichannel sensor for single photons that operates in the high magnetic field of the spectrometer (1.5 T) and withstands the radiation levels expected in the experiment. A 144-channel Hybrid Avalanche Photo-Detector (HAPD) was developed in a collaboration with Hamamatsu Photonics K.K. The design of the detector components is currently being finalized and part of the mass production has already started. The counter will be ready for installation in 2015. We will report on the tests of the prototypes conducted with test beams at CERN and DESY, and the optimization and performance studies of the counter final design, based on the Geant4 simulation.

Summary

Primary author(s) : SANTELJ, Luka (Jozef Stefan Institute)

Presenter(s) : SANTELJ, Luka (Jozef Stefan Institute)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **347** Type : **Oral**

An EUDET/AIDA Pixel Beam Telescope for Detector Development

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

A high resolution ($\sigma \sim 2\mu m$) beam telescope based on monolithic active pixel sensors (MAPS) was developed within the EUDET collaboration. The telescope consists of six monolithic active pixel sensor planes (Mimosa26) with a pixel pitch of 18.4 \mu m and thinned down to 50 \mu m. The excellent resolution, readout rate and DAQ integration capabilities made the telescope a primary test beam tool for many groups including several CERN based experiments.

Within the European detector infrastructure project AIDA the test beam telescope is being further extended in terms of cooling and powering infrastructure, read-out speed, area of acceptance, and precision. In order to provide a system optimized for the different requirements by the user community a combination of various state-of-the-art pixel technologies is foreseen. Furthermore, new central dead-time-free trigger logic unit (TLU) has been developed to provide LHC-speed response with one-trigger-per-particle operating mode and a synchronous clock for all connected devices. In this report, the design and current development status of this even more flexible telescope with three different pixel technologies (TimePix, Mimosa, ATLAS FE-I4) will be presented.

Summary

Primary author(s) : RUBINSKIY, Igor (Deutsches Elektronen-Synchrotron (DESY)-Unknown-Unknown); PERREY, Hanno (Deutsches Elektronen-Synchrotron (DE))

Presenter(s) : RUBINSKIY, Igor (Deutsches Elektronen-Synchrotron (DESY)-Unknown-Unknown)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **216** Type : **Oral**

An InGrid based Low Energy X-ray Detector for the CAST Experiment

Monday, 2 June 2014 17:10 (0:20)

Abstract content

The CERN Axion Solar Telescope (CAST) is searching for axions and other new particles coupling to photons and emerging from the sun. Those particles are converted into soft X-ray photons in a high magnetic field. To enhance sensitivity for physics beyond the Standard Model it is necessary to cope with weak couplings and low energies, thus requiring an efficient background discrimination as well as a detection threshold below 1 keV.
A promising candidate for a future CAST detector is an InGrid based X-ray detector. This detector combines the high spatial resolution of a pixelized readout with a highly granular Micromegas gas amplification stage. Fabrication by photolithographic postprocessing techniques allows to match the amplification grid to the pixels. The thereby achieved overall high granularity facilitates detection of single electrons which allows to determine the X-ray energy by electron counting. Additionally, rejection of background events mostly originating from cosmic rays is provided by an event shape analysis exploiting the high spatial resolution. A first prototype achieved a background reduction of roughly 120 and an energy resolution of 5.2 % at 5.9 keV.
In order to demonstrate its low detection threshold an InGrid based detector was tested in the CAST Detector Lab where an X-ray generator for energies down to a few hundred eV is available. Results of these tests demonstrating the detector's ability to detect the carbon K_α line at 277 eV will be presented as well as a short report on the installation at the CAST experiment.

Summary

Primary author(s) : KRIEGER, Christoph (Universitaet Bonn (DE))

Co-author(s) : KAMINSKI, Jochen (Universitaet Bonn (DE)); DESCH, Klaus (Universitaet Bonn (DE)); VAFEIADIS, Theodoros (CERN); LUPBERGER, Michael (Universitaet Bonn (DE))

Presenter(s) : KRIEGER, Christoph (Universitaet Bonn (DE))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **419** Type : **Oral**

Application Specific Photonic Integrated Circuits for High Energy Physics Applications

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

Physics experiments generally deal with enormous data throughput. The density of the data is increasing with upgrades on the detectors and experiments. Fiber optic communication with its high bandwidth and high capacity provides an effective solution. In experiments like the KM3NeT, cost-effective long haul optical communication is desired. A Dense Wavelength Division Multiplexed (DWDM) based multi-channel readout with minimum number of fibres over a large distance is a significant challenge. However, in the detectors at the Large Hadron Collider (LHC) or similar facilities, distances are short, but the optical readout systems are exposed to radiation. So, radiation hardness of optical links and/or circuits is an important requirement. Photonic integrated circuit design is going through an exciting phase with generic integration philosophy. Thanks to the availability of MPWs, it is getting easier to design and test an Application Specific Photonic Integrated Circuit (ASPIC). With such broad range of physics applications, we demonstrate examples of ASPICs designed for high energy physics using generic integration platforms.

Summary

Primary author(s) : GAJANANA, Deepak (NIKHEF (NL))

Co-author(s) : VAN BEUZEKOM, Martin (NIKHEF (NL)); Dr. LEIJTENS, Xaveer (Eindhoven University of Technology); Prof. SMIT, Meint (Eindhoven University of Technology)

Presenter(s) : GAJANANA, Deepak (NIKHEF (NL))

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **360** Type : **Oral**

Applications of embedded full gamma spectrum decomposition

Friday, 6 June 2014 12:20 (0:20)

Abstract content

A self-contained gamma radiation spectrometer with embedded and automated temperature stabilization and full spectral analysis is presented. It consists of a crystal and PMT setup that is read-out using fast ADC and FPGA technology. The maximum dead-time has been established at 1.14 us and the energy resolution at 662 keV is 7%. Full spectral analysis has been implemented for naturally occurring radioisotopes of Potassium, Thorium, Uranium, Radon and their progeny. Further developments, including pile-up correction, neutron detection and miniaturization will be discussed. This technology allows the production of sensor nodes that can be used in many applications. Special attention will be given in to sensor nodes for measurements in hard to reach environments. Environmental monitoring in remote regions of Canada will be discussed as an example as well as precision farming, nuclear reactor monitoring and mining.

Summary

Primary author(s) : MOL, Aran (I)

Presenter(s) : MOL, Aran (I)

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **76** Type : **Oral**

Associative Memory computing power and its simulation.

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The associative memory (AM) system is a computing device made of hundreds of AM ASICs chips designed to perform "pattern matching" at very high speed. Since each AM chip stores a data base of 130000 pre-calculated patterns and large numbers of chips can be easily assembled together, it is possible to produce huge AM banks. Speed and size of the system are crucial for real-time High Energy Physics applications, such as the ATLAS Fast TracKer (FTK) Processor. Using 80 million channels of the ATLAS tracker, FTK finds tracks within 100 micro seconds. The simulation of such a parallelized system is an extremely complex task if executed in commercial computers based on normal CPUs. The algorithm performance is limited, due to the lack of parallelism, and in addition the memory requirement is very large. In fact the AM chip uses a content addressable memory (CAM) architecture. Any data inquiry is broadcast to all memory elements simultaneously, thus data retrieval time is independent of the database size. The great computing power is also supported by a very powerful I/O. Each incoming hit reaches all the patterns in the AM system within the same clock cycle (10 ns). We report on the organization of the simulation into multiple jobs to satisfy the memory constraints and on the optimization performed to reduce the processing time. Finally, we introduce the idea of a new computing unit based on a small number of AM chips that could be plugged inside commercial PCs as coprocessors. This unit would both satisfy the need for very large memory and significantly reduce the simulation time due to the use of the highly parallelized AM chips.

Summary

Primary author(s) : Dr. SALVATORE, Fabrizio (University of Sussex (GB))

Co-author(s) : Dr. VOLPI, Guido (Sezione di Pisa (IT))

Presenter(s) : Dr. VOLPI, Guido (Sezione di Pisa (IT))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **249** Type : **Oral**

Athena, the next large ESA mission to study the Hot and Energetic Universe

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

The hot and energetic Universe has been selected by ESA as its next large class mission with a scheduled launch date in 2028. This mission will have a large collecting area (2 m2) with focussing optics and in the focal plane two interchangeable instruments: a Si-based DEPFET detector which is optimised for its field of view and its count rate capability. The second instrument is a cryogenic calorimeter array which is optimised for its high spectral resolution. In this presentation we will describe the science and instrumentation of this challenging mission.

Summary

Primary author(s) : Dr. DEN HERDER, Jan-Willem (SRON Netherlands Institute for Space Research)

Presenter(s) : Dr. DEN HERDER, Jan-Willem (SRON Netherlands Institute for Space Research)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **199** Type : **Oral**

Axion helioscopes update: the status of CAST & IAXO

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

After almost 35 years since their suggestion as a good solution to the strong CP-problem, axions remain one of the viable candidates for the Dark Matter, although still eluding detection. Most of the methods for their detection are based on their coupling to photons, one of the most promising ones being the helioscope technique. We will report on the current status of the CERN Axion Solar Telescope and the future International Axion Observatory (IAXO). Recent results from the second part of CAST phase II, where the magnet bores were filled with 3He gas at variable pressure achieving sensibilities on the axion mass up to 1.2 eV, will be presented. Currently CAST is expecting to improve sensitivity to solar axions with rest mass below 0.02 eV/c^2 after the upgrade of the X-ray detectors and with the implementation of a second X-ray optic. At the same time, it is exploring other possibilities at the low energy physics frontier. On the other hand IAXO, the fourth generation axion helioscope, aims to improve CAST's performance in terms of axion-photon coupling by 1-1.5 orders of magnitude. The details of the project building a dedicated magnet, optics and x-ray detectors will be given.

Summary

Primary author(s) : Dr. DAFNI, Theopisti (Universidad de Zaragoza (ES))

Presenter(s) : IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES))

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **242** Type : **Oral**

Barium-ion tagging for ^{136}Xe double-beta decay studies with EXO

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

The nature of the neutrino, i.e. whether it is a Dirac or Majorana particle, remains a mystery. Decay experiments that search for the lepton-number violating neutrino-less double decay ($0\nu\beta\beta$) are an experimental approach to answer this question. EXO-200 is one such experiment, searching for a $0\nu\beta\beta$ signal in the $\beta\beta$ decay of ^{136}Xe to its daughter isotope ^{136}Ba. This detector, located at the WIPP site in New Mexico, USA, contains ~200 kg liquid Xe enriched to ~80%.
In order to further push sensitivity, it is necessary to suppress the background (currently dominated by gamma rays) and increase the mass of the parent isotope. A unique advantage of a Xe time-projection chamber (TPC) is the possibility to extract into vacuum and identify (to tag) Ba-daughter ions. This tagging possibility, combined with enough energy resolution to separate $0\nu\beta\beta$ from $2\nu\beta\beta$ decays, allows one to dramatically reduce the background of the measurement to virtually zero.
EXO has started development of nEXO, a multi-ton scale TPC. In addition, Ba-tagging techniques, in both liquid and gas phase TPCs, are under development. In a liquid Xe TPC, the Ba ion will be extracted mechanically by a probe. In a high pressure (10 bar) gas Xe TPC, the Ba ion will be extracted into vacuum through a supersonic nozzle combined with an extraction RF-funnel. The current status of these Ba-tagging techniques will be presented and possible future developments will be discussed.

Summary

Primary author(s) : BRUNNER, Thomas (S)

Presenter(s) : BRUNNER, Thomas (S)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **203** Type : **Oral**

Beam profile measurements based on modern vertex detectors and beam-gas interactions

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

A novel, non-disruptive technique to measure transverse beam shapes was recently demonstrated by the LHCb experiment at the Large Hadron Collider (LHC). The technique is based on the detection of beam-gas interaction vertices with a tracking detector and was used in LHCb to obtain a 1.4% precision on the luminosity calibration. A new device, the Beam-Gas Vertex (BGV) system, is now under development to perform dedicated beam size measurements at the LHC at any beam energy and intensity. This technique could be applied to other particle accelerators. The BGV tracking detectors will be based on scintillating fibre modules read out by silicon photomultipliers. These modules are very similar in performance requirements and environmental constraints to the fibre tracker modules of the LHCb Upgrade and are therefore developed in close cooperation. The design studies, selected R&D results and the expected performance of the BGV demonstrator system will be presented.

Summary

Primary author(s) : BARSCHEL, Colin (CERN)

Co-author(s) : FERRO-LUZZI, Massimiliano (CERN)

Presenter(s) : BARSCHEL, Colin (CERN); FERRO-LUZZI, Massimiliano (CERN)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **106** Type : **Oral**

Boosting Event Building Performance using Infiniband FDR for the CMS Upgrade

Monday, 2 June 2014 16:50 (0:20)

Abstract content

As part of the CMS upgrade during CERN's shutdown period (LS1), the CMS data acquisition system is incorporating Infiniband FDR technology to boost event building performance for operation from 2015 onwards. Infiniband promises to provide substantial increase in data transmission speeds compared to the older 1GE network used during the 2009-2013 LHC run. Several options exist to end user developers when choosing a foundation for software upgrades, including the uDAPL (DAT Collaborative) and Infiniband verbs libraries (OFED). Due to advances in technology, the CMS data acquisition system will be able to achieve the required throughput of 100 kHz with increased event sizes while downsizing the number of nodes by using a combination of 10GE, 40GE and 56 GB Infiniband FDR. This paper presents the analysis and results of a comparison between GE and Infiniband solutions as well as a look at how they integrate into an event building architecture, while preserving the portability, scalability, efficiency and the deterministic latency expected in a high end data acquisition network.

Summary

Primary author(s) : FORREST, Andrew Kevin (CERN); ORSINI, Luciano (CERN); PETRUCCI, Andrea (CERN)

Co-author(s) : Dr. DOBSON, Marc (CERN); DUPONT, Aymeric Arnaud (CERN); ERHAN, Samim (Univ. of California Los Angeles (US)); GIGI, Dominique (CERN); GLEGE, Frank (CERN); GOMEZ CEBALLOS RETUERTO, Guillelmo (Massachusetts Inst. of Technology (US)); GOMEZ-REINO GARRIDO, Robert (CERN); Dr. HEGEMAN, Jeroen (CERN); HOLZNER, Andre Georg (Univ. of California San Diego (US)); MASETTI, Lorenzo (CERN); MEIJERS, Frans (CERN); MESCHI, Emilio (CERN); MOMMSEN, Remi (Fermi National Accelerator Lab. (US)); MOROVIC, Srecko (CERN); NUNEZ BARRANCO FERNANDEZ, Carlos (CERN); O'DELL, Vivian (Fermi National Accelerator Lab. (US)); PAUS, Christoph (Massachusetts Inst. of Technology (US)); PIERI, Marco (Univ. of California San Diego (US)); Dr. RACZ, Attila (CERN); SAKULIN, Hannes (CERN); BAWEJ, Tomasz Adrian (CERN); SCHWICK, Christoph (CERN); STIEGER, Benjamin (CERN); SUMOROK, Konstanty (Massachusetts Inst. of Technology (US)); Mr. VEVERKA, Jan (Massachusetts Inst. of Technology (US)); ZEJDL, Petr (CERN); BEHRENS, Ulf (DESY); BRANSON, James Gordon (Univ. of California San Diego (US)); CHAZE, Olivier (CERN); CITTOLIN, Sergio (Univ. of California San Diego (US)); DARLEA, Georgiana Lavinia (Massachusetts Inst. of Technology (US)); DELDICQUE, Christian (CERN)

Presenter(s) : FORREST, Andrew Kevin (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **416** Type : **Oral**

Bridging the gap between science and society

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

In The Netherlands policy makers have frequently addressed the 'gap' between the excellent standing of Dutch fundamental research and the perceived inability to translate that into profitable commercial activities. Although Nikhef's primary focus is and will be curiosity driven research, pushing the boundaries of the fundamental knowledge, a key intangible societal gain. Nikhef also acknowledges the increased importance of more tangible societal impact, hence resulting in concrete (industrial) applicability ('valorization').
There are several ways to transfer research results, usually a technology in which Nikhef has vested intellectual property rights (IPR): selling, licensing or become an 'entrepreneur'. Since several years Nikhef has worked towards enabling this last route. Building further on FOM's valorization policy and together with our partner, 1&12 Investment Partners, a holding company, called Particle Physics Inside Products (P2IP bv) has been established. P2IP is the legal entity from which Nikhef-FOM can participate in a subsidiary start-up. It has established a supervisory board that monitors its participations (currently three), assesses new opportunities and explores new activities. Recently our sister FOM-institute AMOLF joined P2IP.
We will highlight the experiences so far with startup companies emanating from the Nikhef scientific programme. Some of them are not participations of P2IP. We will also sketch the environment of the Amsterdam Venture Lab in which these startup activities are embedded.

Summary

Primary author(s) : Dr. POOLMAN, Hans Roeland (Amsterdam Scientific Instruments); VAN RIJN, Arnold Johan (NIKHEF)

Co-author(s) : Dr. BOSMA, Marten (Amsterdam Scientific Instruments)

Presenter(s) : Dr. BOSMA, Marten (Amsterdam Scientific Instruments)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **5** Type : **Oral**

CENNS: A new method for measuring Coherent Elastic Neutrino Nucleus Scattering

Friday, 6 June 2014 14:00 (0:20)

Abstract content

A recent study showed background limits to future dark matter searches coming from Coherent Elastic Neutrino Nucleus Scattering (CENNS) interactions of astrophysical and atmospheric neutrinos. There are a few possible ways to improve the limits by using directional measurements of the neutrino interactions and/or measuring time variation of the interactions. However, this CENNS background limit is a robust lower bound which can not be substantially reduced. Measuring the CENNS cross section and performing subsequent tests of higher energy neutrino interactions on various target materials will be extremely beneficial to future dark matter experiments.

We present a experimental method for measuring the process of CENNS. This method uses a low-energy threshold detector situated transverse to a high energy neutrino beam production target. This detector would be sensitive to the low energy neutrinos arising from pion decays-at-rest in the target. In this talk we will present the results of the beam induced background measurement, detector R&D and systematic uncertainties.

Summary

Primary author(s) : Dr. YOO, Jonghee (Fermilab); FILIPENKO, Mykhaylo (F)

Presenter(s) : RAMBERG, erik (Fermilab)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **274** Type : **Oral**

CERN-GIF++: a new irradiation facility to test large-area particle detectors for the high-luminosity LHC program

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

The high-luminosity LHC (HL-LHC) upgrade is setting a new challenge for particle detector technologies. The increase in luminosity will produce a higher particle background with respect to present conditions. Performance and stability of detectors at LHC and future upgrade systems will remain the subject of extensive studies. The current CERN-Gamma Irradiation Facility (GIF) has been intensively used to simultaneously expose detectors to the photons from a 137Cesium source and to high energy particles from the X5 beam line in SPS West Area for many years. From 2004 onwards, only the 137Cesium source is available for irradiations and the shutdown of the present facility is scheduled for the end of 2014.

The present contribution describes a joint project between CERN-EN and CERN-PH departments to design and build the new CERN GIF++ facility. GIF++ will be a unique place where high energy charged particle beams (mainly muon beam with momentum up to 100 GeV/c) are combined with a 14 TBq 137Cesium source. The higher source activity will produce a background gamma field which is a factor 30 more intense than that at GIF, allowing to cumulate doses equivalent to HL-LHC experimental conditions in a reasonable time. The 100 m2 GIF++ irradiation bunker has two independent irradiation zones making it possible to test real size detectors, of up to several m2, as well as a broad range of smaller prototype detectors and electronic components. The photon flux of each irradiation zone will be tuned using a set of Lead filters with attenuation factors from zero to 50000. Flexible services and infrastructure including electronic racks, gas systems, radiation and environmental monitoring systems, and ample preparation zone will allow time effective installation of detectors. A dedicated control system will provide the overview of the status of the facility and archive relevant information. The collaboration between CERN and the users' detector community, the latter providing detector specific infrastructures within the framework of the FP7 AIDA project, will bring the new facility to operation by the end of 2014.

Summary

Primary author(s) : GUIDA, Roberto (CERN)

Co-author(s) : COLLABORATION, GIF++ (CERN)

Presenter(s) : JAEKEL, Martin Richard (CERN)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **342** Type : **Oral**

CITIROC : a new front-end ASIC for SiPM read-out

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

Citiroc is a 32-channel front-end ASIC designed to readout silicon photo-multipliers (SiPM). Citiroc allows triggering down to 1/3 pe and provides the charge measurement with a good noise rejection. Moreover, Citiroc outputs the 32-channel triggers with a high accuracy (100 ps). An adjustment of the SiPM high-voltage is possible using a channel-by-channel DAC connected to the ASIC inputs. That allows a fine SiPM gain and dark noise adjustment at the system level to correct for the non-uniformity of SiPMs. Timing measurement down to 100 ps RMS jitter is possible along with 1% linearity energy measurement up to 2500 p.e. The power consumption is about 2mW/channel, excluding ASIC outing buffer

Summary

Citiroc is a new ASIC designed by Weeroc, a start-up company from the Omega micro-electronics group of IN2P3/CNRS. Each channel of this new ASIC embeds a front-end read-out chain composed of two AC-coupled voltage low-noise preamplifier with variable-gain adjustment. The utility of the gain tuning on the preamplifiers is twofold. On the first hand it allows to compensate non-uniformity between channels by finely adjusting gain channel by channel, on the second hand, it allows to adjust the general gain of the amplification chain to adjust the read-out chain to the SiPM gain, allowing a large choice of SiPM on the system to be used. Citiroc has a new channel-by-channel trigger chain composed of a fast shaper followed by two discriminators with individual channel-by-channel threshold adjustment to be able to trig on the first photo-electron and validate the trigger on the first few photoelectrons. That double trigger allows a great dark noise rejection at the first stage of the read-out chain and avoids saturating the DAQ with noise events. Each trigger channel can be masked in case of noisy channel, latched, or output the discriminator output as is depending on user needs. A general ASIC trigger is also outputted through a 32-input trigger OR. Citiroc energy measurement is composed of two variable-gain shapers to get energy measurement from one to 2500 photoelectron with 1% linearity. Charge proportional to energy can be stored in an analogue memory using either an analogue memory or a peak-sensing detector to get rid of the hold signal versus trigger delay. A channel-by-channel input DAC allows adjusting the high voltage of the SiPM over 5V with 8-bit resolution to correct for SiPM over-voltage non-uniformity. Citiroc outputs 32 trigger outputs as well as a multiplexed tri-state hit-register to allow several Citiroc to be serialized on a single hit-register serial bus. Citiroc outputs two multiplexed analogue outputs to read-out the charge on both low and high gain to ease the low-gain and low-gain channel inter-calibration. Citiroc also embed a general 10-bit DAC for coarse general threshold adjustment. Voltage references in the ASIC are done with a bandgap to improve power supply rejection ratio and temperature sensitivity of the ASIC. Citiroc is aimed to be mounted very close to the SiPM in the systems it will be used in. A temperature sensor has been embedded to allow users to finely sense the temperature within their multi-channel system to correct for SiPM gain over voltage adjustment with temperature. As a conclusion Citiroc has been designed to be as versatile as possible for SIPM read-out. It is aimed to be used in large system and has been optimized to ease the SiPM adjustment and reduce has much as possible the data flow

through the DAQ by filtering the SiPM noise at the front-end level. Citiroc will be used in a first telescope prototype for the CTA experiment and is aimed to be used in medical systems such as PET or gamma cameras using SiPM. A test board with ergonomic GUI software is available for Citiroc evaluation.

Primary author(s) : DE LA TAILLE, Christophe (OMEGA/IN2P3); FLEURY, Julien (Weeroc); Ms. SEGUIN-MOREAU, Nathalie (OMEGA/IN2P3); Mr. RAUX, Ludovic (OMEGA/IN2P3); Mr. CALLIER, Stéphane (OMEGA/IN2P3); Dr. MARTIN CHASSARD, Gisele (OMEGA/IN2P3); AHMAD, Salleh (Weeroc SAS)

Co-author(s) : CATALANO, Osvaldo (INAF)

Presenter(s) : FLEURY, Julien (Weeroc)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **398** Type : **Oral**

CLARO-CMOS: a fast, low power and radiation-hard front-end ASIC for single-photon counting in 0.35 micron CMOS technology

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

The CLARO-CMOS is a prototype ASIC that allows fast photon counting with 5 ns peaking time, a recovery time to baseline smaller than 25 ns, and a power consumption of about 1 mW per channel. This chip is capable of single-photon counting with multi-anode photomultiplier tubes (Ma-PMTs), and finds applications also in the read-out of silicon photomultipliers and microchannel plates. The prototype is realized in AMS 0.35 micron CMOS technology. In the LHCb RICH environment, over ten years of operation at the nominal luminosity expected after the upgrade in Long Shutdown 2, the ASIC must withstand a total fluence of about 6x10^12 1 MeV neq/cm2 and a total ionizing dose of 400 krad. A systematic evaluation of the radiation effects on the CLARO-CMOS performance is therefore crucial to ensure long-term stability of the electronics front-end. The results of multi-step irradiation tests with neutrons up to the fluence of 10^14 1 MeV neq/cm^2, with protons up to the dose of 8 Mrad and with X-rays up to the dose of 8 Mrad are presented, including measurement of single event effects during irradiation and chip performance evaluation before and after each irradiation step. In addition, systematic tests have been done on the single-photon counting performance of the CLARO-CMOS coupled to a Hamamatsu R11265 Ma-PMT, that is the baseline solution for the upgraded LHCb RICH photo-detectors. Such results are presented as well.

Summary

The CLARO-CMOS is a prototype ASIC primarily designed for single-photon counting with multi-anode photomultipliers (Ma-PMTs). The chip allows fast photon counting up to 40 MHz with power consumption in the order of 1 mW per channel. It was developed in the framework of the LHCb RICH detectors upgrade at CERN, but also found application in the readout of Silicon photomultipliers (SiPMs) and microchannel plates (MCP-PMTs) [1,2]. The prototype has four channels, each made of a charge amplifier with settable gain (3 bits) and a comparator with settable threshold (5 bits) that allow tuning the response of the chip to the gain spread of the PMT pixels. The threshold can be set just above noise to allow an efficient single-photon counting with Ma-PMTs. In the readout of SiPMs, the threshold can be set above the single photon signals, allowing to count events with two or more photoelectrons with high efficiency and good separation of the photoelectron peaks.
The prototype is realized in a 0.35 micron CMOS technology. In the LHCb RICH environment, over ten years of operation at the nominal luminosity for the upgrade, the ASIC must withstand a total fluence of about 6x10^12 1 MeV neq/cm^2 and a total ionizing dose of 400 krad.
We present results of multi-step irradiation tests with neutrons up to the fluence of 10^14 1 MeV neq/cm^2, with protons up to the dose of 8 Mrad and with X-rays up to the dose of 8 Mrad. During irradiation, cumulative effects on the performance of the analog parts of the chip and single event effects (SEE) were evaluated. The chips were biased continuously and the chip threshold voltages were measured regularly, in order to detect possible single event upsets (SEUs) affecting the threshold DAC settings. Power consumption was also monitored

online, and an additional circuit provided protection against Single Event Latchup (SEL). A picture of one of the irradiation setups can be seen in Figure 1. S-curves were measured before and after each irradiation step, to follow the evolution of counting efficiency, threshold shifts and noise during the irradiation.

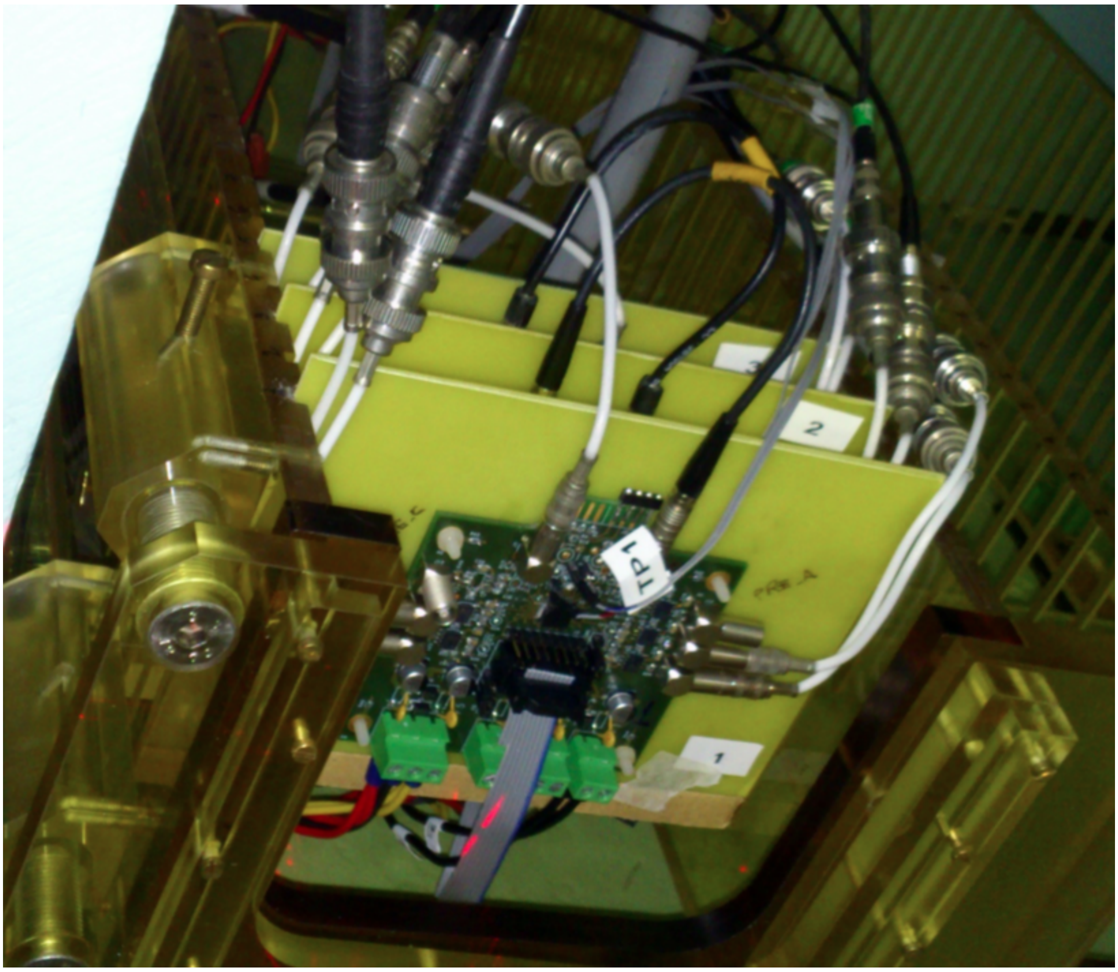

Figure 2: Figure 1. Picture of the setup used to irradiate three CLARO-CMOS chips at the neutron irradiation line of the Université Catholique de Louvain Cyclotron Facility (Louvain-la-Neuve, Belgium). The visible cables are used for powering and configuring the chips, monitoring single event effects on-line and measuring chips performance

Figure 1. Picture of the setup used to irradiate three CLARO-CMOS chips at the neutron irradiation line of the Université Catholique de Louvain Cyclotron Facility (Louvain-la-Neuve, Belgium). The visible cables are used for powering and configuring the chips, monitoring single event effects on-line and measuring chips performance.
The electrical performances of the CLARO-CMOS chip coupled to the Hamamatsu R11265 Ma-PMT are presented as well. For these tests a dedicated PCB was designed to connect the chips to the Ma-PMT with minimal contribution of parasitic capacitances at the input, and allowed to obtain very low noise and crosstalk. This readout scheme simulates the baseline read-out solution for the upgraded RICH detectors of the LHCb experiment. To mimic the conditions expected in the upgraded LHCb RICH environment, single photons in the blue range were generated using LED and diode laser. The speed of the CLARO signals and the low power consumption were demonstrated. Single-photon spectra from the Ma-PMT pixels were nicely reconstructed with a threshold scan, showing that the binary

outputs allow precise characterization of the Ma-PMT. Also, crosstalk between neighboring pixels was shown to be negligible.
References:
1 P. Carniti et al., "CLARO-CMOS, a very low power ASIC for fast photon counting with pixellated photodetectors", Journal of Instrumentation 7 (2012) P11026
[2] P. Carniti et al., "CLARO-CMOS, an ASIC for single photon counting with Ma-PMTs, MCPs and SiPMs", Journal of Instrumentation 8 (2013) C01029

Primary author(s) : FIORINI, Massimiliano (Universita di Ferrara (IT))

Co-author(s) : Dr. ANDREOTTI, Mirco (INFN Ferrara); MAINO, Matteo (Universita & INFN, Milano-Bicocca (IT)); Mr. MALAGUTI, Roberto (INFN Sezione di Ferrara); PESSINA, Gianluigi (Universita & INFN, Milano-Bicocca (IT)); TOMASSETTI, Luca (University of Ferrara and INFN); BALDINI, Wander (Universita di Ferrara (IT)); CALABRESE, Roberto (Universita di Ferrara (IT)); CARNITI, Paolo (Universita & INFN, Milano-Bicocca (IT)); CASSINA, Lorenzo (Universita & INFN, Milano-Bicocca (IT)); COTTA RAMUSINO, Angelo (Universita di Ferrara (IT)); GIACHERO, Andrea (Universita & INFN, Milano-Bicocca (IT)); GOTTI, Claudio (Universita & INFN, Milano-Bicocca (IT)); LUPPI, Eleonora (Universita di Ferrara (IT))

Presenter(s) : GOTTI, Claudio (Universita & INFN, Milano-Bicocca (IT))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **420** Type : **Oral**

CMB Detector Technology and the South Pole Telescope

Friday, 6 June 2014 11:40 (0:20)

Abstract content

Advances in CMB instrumentation have opened a new era for studying fundamental physics through precision measurements of the Cosmic Microwave Background (CMB). CMB measurements are critical for our understanding of cosmology and provides a unique probe of Dark Energy, the Cosmic Neutrino Background, and the physics of inflation. The South Pole Telescope (SPT) collaboration has been actively developing new CMB detectors and has implemented focal plane arrays using state-of-the-art Transition Edge Sensor (TES) technology to enable new CMB science. Results include the first discovery of unknown galaxy clusters using the Sunyaev-Zeldovich effect and the first detection of the CMB B-mode polarization signal from gravitational lensing. In this talk, I will give an overview of the technological developments for the SPT science program and will illustrate how innovation in instrumentation has enabled new science. I will discuss the technical challenges limiting CMB experiments and describe how the ongoing SPT detector R&D program aims to overcome these limitations.

Summary

Primary author(s) : CHANG, clarence (Argonne National Lab)

Presenter(s) : CHANG, clarence (Argonne National Lab)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **312** Type : **Oral**

CMD-3 TOMA DAQ goes to KEDR detector.

Monday, 2 June 2014 17:30 (0:20)

Abstract content

CMD-3 detector of VEPP2000 e+e- collider, BINP, Russia, is under data taking for a few runs. It's Time Oriented Measurement and Acquire (TOMA) DAQ demonstrates stable operation and targeted performance. During DAQ life cycle it was few times expanded in number and nomenclature of digitizer boards so as new functionality features was switched on. There are no interference or backward compatibility problems observed. This is due to special design based on idea to exchange some hardware logical complexity to precise time control complexity known as synchronization. Using this idea to distinguish synchronization modes the CMD-3 modular approach specification was built. This specification connects DAQ function's with synchronization modes and makes all hardware modules the same hierarchy level e.g. independent. Hardware modules are realized as HDL descriptions suitable to implement in any modern FPGA. KEDR detector of VEPP-4 e+e- collider is now constrained with it's DAQ performance. To solve this problem we make step by step change of KEDR DAQ hardware with CMD-3 DAQ hardware. Dramatically difference in timing is addressed with modification of HDL parameters. At process completion DAQ performance will increase in 20..40 times.

Summary

CMD-3 and KEDR is mid scale universal detectors for HEP. But it's energy range, DAQ technique and colliding machines is totally different. This talk describes how to really isolate modules in "modular approach" and how it can help to address system requirements. Also, some details are discussed.

Primary author(s) : Mr. RUBAN, Alexander (A.)

Co-author(s) : KOZYREV, Alexey (BINP)

Presenter(s) : Mr. RUBAN, Alexander (A.)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **232** Type : **Oral**

CMS Forward Calorimetry R&D for Phase II Upgrade

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

Forward calorimeters in CMS will need to be upgraded for the High Luminosity LHC (HL-LHC) operations, which is planned to be started in 2025. The major challenge is to preserve/improve the high performance of the current forward detectors while designing the detectors considerably radiation hard. This report will concentrate on the need for the upgrade, major challenges and various proposed R&D concepts suitable for the Phase II upgrade framework. Various designs will be discussed with recent information about the beam tests and laboratory measurements.

Summary

Primary author(s) : BILKI, Burak (University of Iowa (US))

Presenter(s) : BILKI, Burak (University of Iowa (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **196** Type : **Oral**

CMS Trigger Improvements towards Run II

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

The trigger systems of the LHC detectors play a crucial role in determining the physics capabilities of the experiments. A reduction of several orders of magnitude of the event rate is needed to reach values compatible with detector readout, offline storage and analysis capability. The CMS experiment has been designed with a two-level trigger system: the Level-1 Trigger (L1T), implemented on custom-designed electronics, and the High Level Trigger (HLT), a streamlined version of the CMS offline reconstruction software running on a computer farm. Both systems need to provide an efficient and fast selection of events, to keep the average write-out rate below 450Hz. For Run II, the doubling of both the center of mass energy to 13 TeV and the collision rate to 40 MHz, will imply increased cross sections and out-of-time pile-up. We will present the improvements brought to both L1T and HLT strategies to meet those new challenges.

Summary

Primary author(s) : VANDER DONCKT, Muriel (Universite Claude Bernard-Lyon I (FR))

Presenter(s) : VANDER DONCKT, Muriel (Universite Claude Bernard-Lyon I (FR))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **287** Type : **Oral**

CO2 cooling system for Insertable B Layer detector into the ATLAS experiment

Monday, 2 June 2014 16:50 (0:20)

Abstract content

CO2 cooling has become a very interesting technology for current and future tracking particle detectors. A key advantage of using CO2 as refrigerant is the high heat transfer capability allowing a significant material budget saving, which is a critical element in state of the art detector technologies. At CERN new CO2 cooling system has been constructed to serve for new ATLAS Insertable B-Layer (IBL) detector. Two independent cooling units, sharing one common accumulator, placed about 100m from the heat source, are designed to cool 14 individual staves with evaporative CO2 at the given pressure. This paper describes the general system design, innovative redundancy approach, maintenance philosophy, control system implementation and the commissioning results including the performance tests in the proximity of the detector. Additionally the different failure scenarios and recovery techniques including cooling units swap procedure will be discussed. The system tests and challenging commissioning proved precise temperature control over the long distance and expected performance. Looking forward for the IBL detector installation, cooling system will be prepared to serve for the next Large Hadron Collider physics run.

Summary

Primary author(s) : ZWALINSKI, Lukasz (CERN)

Co-author(s) : BORTOLIN, Claudio (University of Innsbruck (AT)); OSTREGA, Maciej Stanislaw (AGH University of Science and Technology (PL)); VAN OVERBEEK, Martijn Gerardus (NIKHEF (NL)); PETAGNA, Paolo (CERN); VERLAAT, Bart (NIKHEF (NL)); VOGT, Sven (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); ZIMNY, Michal Zbigniew (AGH University of Science and Technology (PL)); Mr. ROELAND, Erno (Nikhef); BLASZCZYK, Tomasz Piotr (AGH University of Science and Technology (PL)); BERRY, Stephane (CERN); CORBAZ, Florian (CERN); GLONTI, George (National Technical Univ. of Athens (GR)); CRESPO-LOPEZ, Olivier (CERN); GODLEWSKI, Jan (CERN); LIPPERT, Markus (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); NICHILO, Sylvain (CERN)

Presenter(s) : ZWALINSKI, Lukasz (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **181** Type : **Oral**

COMETH: a CMOS pixel sensor for a highly miniaturized high-flux radiation monitor

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The need for miniaturized and versatile real-time radiation monitors has become a general trend for spacecraft applications. It requires a highly integrated detection system with the ability to identify ion species in a high flux mixed environment. We have proposed 1 a new strategy to meet these requirements with a single CMOS pixel chip. This sensor is based on a matrix of 50×50 μm2 pixels, read out in rolling-shutter mode, and features columns ended by 3-bit ADCs with tunable threshold. An embedded digital algorithm extracts the particle properties from the hit information to provide the radiation flux on–line. A reduced scale prototype with 32×32 pixels and 32 column ADCs has been designed and fabricated in a 0.35 μm process. The layout of the identifying and counting algorithm, downstream the pixel matrix, was developed in the same process. A full simulation of this layout for a subset of columns was used to check the algorithm output against many inputs. Test results obtained with X-rays, ß- particles and laser illumination, confirm previous simulations addressing gain and linearity. Column ADCs also show expected features. Those measurements validate the possibility to monitor proton and electron fluxes up to 107 particles•cm-2•s-1 and distinguish proton from electron for energies lower than 50 MeV. 1 Y.Zhou et al., JINST 7 (2012) C12003.
*COMETH: Counter for Monitoring the Energy and Type of charged particles in High flux

Summary

Primary author(s) : JAASKELAINEN, Kimmo (Institut Pluridisciplinaire Hubert Curien (FR)); WINTER, Marc (Institut Pluridisciplinaire Hubert Curien (FR)); ZHOU, Yang (Institut Pluridisciplinaire Hubert Curien (FR)); BAUDOT, Jerome (Institut Pluridisciplinaire Hubert Curien (FR)); GUO HU, Christine (Institut Pluridisciplinaire Hubert Curien (FR)); HU, Yongcai (Institut Pluridisciplinaire Hubert Curien (FR))

Presenter(s) : ZHOU, Yang (Institut Pluridisciplinaire Hubert Curien (FR))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **176** Type : **Oral**

Calibrating photon detection efficiency in IceCube

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The IceCube neutrino observatory is composed of more than five thousand Digital Optical Modules (DOMs), installed on the surface and at depths between 1500 and 2500 m in clear ice at the South Pole. Each DOM incorporates a 10" diameter photomultiplier tube (PMT) intended to detect light emitted when high energy neutrinos interact with atoms in the ice. Depending on the energy of the neutrino and the distance from debris particle tracks, PMTs can be hit by up to several thousand photons. The number of photons per PMT and their time distribution is used to reject background events and to determine the energy and direction of each neutrino. The detector energy scale was established with good precision independent of lab measurements on DOM optical sensitivity, based on light yield from stopping muons and calibration of ice properties. A laboratory setup has now been developed to more precisely measure the DOM optical sensitivity as a function of angle and wavelength. DOM sensitivities are measured in water using a broad beam of light whose intensity is measured with a NIST calibrated photodiode. This study will refine the current knowledge of IceCube response and lay a foundation for future precision upgrades to the detector.

Summary

Primary author(s) : WENDT, Christopher (UW Madison / WIPAC); TOSI, Delia (UW Madison / WIPAC)

Presenter(s) : WENDT, Christopher (UW Madison / WIPAC); TOSI, Delia (UW Madison / WIPAC)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **133** Type : **Oral**

Calibration System with Notched Fibres

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

Modern detectors with significantly increasing number of active channels require new approach for calibration. The calibration system on the first prototype of the AHCAL in CALICE used one optical fibre for each of 7608 channels to distribute calibration light to tiles with SiPM. As the proposed analogue hadronic calorimeter for ILC should have around 10ˆ6 channels, the former system is inapplicable due to spatial requirements and manufacture difficulties. Now two ways of light distribution are considered. The first one is focused on the implementation of one LED placed directly on PCB for each SiPM channel. The second one is focused on a simplified fibre distribution system using one fibre with taps for more channels. It uses so called notched fibre and will be presented here. The system allows to calibrate one row of 72 scintillation tiles read by SiPMs using one driver with one LED and three subsequent notched fibres. We will present principals, parameters of current system and requirements for future development to allow reliable manufacturing. Benefits and drawbacks of notched fibre system with a comparison to the system with embedded LED for each SiPM channel is also discussed.

Further we report on latest version of the electronics for calibration and monitoring system developed for single UV-LED. The system is based on original fast (3 ns pulsewidth) and precise LED driver called QMB. Due to its high dynamic range of precise a few nanosecond pulses it is flexible to all necessary monitoring and calibration task for SiPM like detectors.

Summary

Primary author(s) : SMOLIK, Jan (Acad. of Sciences of the Czech Rep. (CZ)); POLAK, Ivo (Acad. of Sciences of the Czech Rep. (CZ))

Presenter(s) : SMOLIK, Jan (Acad. of Sciences of the Czech Rep. (CZ))

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **236** Type : **Oral**

Calorimeters for precision timing measurements in high energy physics

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

Current and future high energy physics particle colliders are capable to provide instantaneous luminosities of 1034 cm-2s-1 and above. The high center of mass energy, the large number of simultaneous collision of beam particles in the experiments and the very high repetition rates of the collision events pose huge challenges. They result in extremely high particle fluxes, causing very high occupancies in the particle physics detectors operating at these machines. To reconstruct the physics events, the detectors have to make as much information as possible available on the final state particles. We discuss how timing information with a precision of around 10 ps and below can aid the reconstruction of the physics events under such challenging conditions. High-energy photons play a crucial role in this context. About one third of the particle flux originating from high-energy hadron collisions is detected as photons, stemming from the decays of neutral mesons. In addition, many key physics signatures under study are identified by high-energy photons in the final state. They pose a particular challenge in that they can only be detected once they convert in the detector material. The particular challenge in measuring the time of arrival of a high-energy photon lies in the stochastic component of the distance to the initial conversion and the size of the electromagnetic shower. They extend spatially over distances with propagation times of the initial photon and the subsequent electromagnetic shower larger compared to the desired precision.

We present studies and measurements from test beams and a cosmic muon test stand for calorimeter based timing measurements to explore the ultimate timing precision achievable for high-energy photons of 10 GeV and above. We put particular focus on techniques to measure the timing with a precision of about 10 ps in association with the energy of the photon. For calorimeters utilizing scintillating materials and light guiding components, the propagation speed of the scintillation light in the calorimeter is important. We present studies and measurements of the propagation speed on a range of detector geometries. Finally, possible applications of precision timing in future high-energy physics experiments are discussed.

Summary

Primary author(s) : APRESYAN, Artur (California Institute of Technology (US))

Co-author(s) : BORNHEIM, Adolf (California Institute of Technology (US)); DUARTE, Javier Mauricio (California Institute of Technology (US)); PENA HERRERA, Cristian Ignacio (California Institute of Technology (US)); SPIROPULU, Maria (California Institute of Technology (US)); Dr. RONZHIN, Anatoly (Fermilab)

Presenter(s) : APRESYAN, Artur (California Institute of Technology (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **362** Type : **Oral**

Calorimetry in ALICE at LHC

Monday, 2 June 2014 17:10 (0:20)

Abstract content

ALICE at the Large Hadron Collider (LHC) is the dedicated experiment focused on heavy ion collisions at LHC, to study a de-confined matter of quarks and gluons, called Quark Gluon Plasma (QGP). Among the sub-detector systems in AILCE, there are two types of calorimetry in the central barrel. One is EMCal (Lead-Scintillator, a sampling electromagnetic calorimeter with a WLS fiber and APD readout), having a wide geometrical acceptance to measure jets, and photons and neutral mesons with a moderate energy resolution. Another type of calorimeter is PHOS (PHOton Spectrometer), $PbWO_4$ crystal with APD readout for high granularity and higher precision energy measurement for photons.
In this talk, we review those detectors performance in ALICE, and show a ongoing upgrade project in calorimetry, DCAL (Di-jet Calorimeter), an extension of EMCal coverage to measure back-to-back jets. Furthermore, we present an upgrade proposal for the forward direction calorimetry, FOCAL, to measure direct photons in $\eta = 3.3 - 5.3$, by using a nobel technology of silicon photo-diodes with absorbers based electromagnetic calorimeter for photons, together with a conventional hadron calorimeter for jets. The current status of FOCAL R\&D project will be presented.

Summary

Primary author(s) : CHUJO, Tatsuya (University of Tsukuba (JP))

Presenter(s) : CHUJO, Tatsuya (University of Tsukuba (JP))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **43** Type : **Oral**

Characterization and X-Ray Damage of Silicon Photomultipliers

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

Abstract–For Hamamatsu silicon-photomultipliers (SiPM) S10362-11-050P before and after irradiation to 200 Gy, 20 kGy, 2 MGy and 20 MGy, forward current–voltage, reverse current–voltage, capacitance/conductance–voltage, capacitance/conductance–frequency, pulse shape and pulse height measurements below and above the breakdown voltage were performed. The data were analysed using an electrical model of the SiPM which allowed determining characteristic parameters like pixel capacitance, quench resistor and quench capacitance, parasitic resistance, and breakdown voltage in different ways, and studying their dependence on X-ray dose. In addition, the doping profile and the electric field distribution in the SiPM have been determined. It is found that the electrical model provides a consistent description of the data. The main changes with X-ray dose are a decrease of the parasitic resistance, and an increase in dark current due to current generation at the Si-SiO2 interface. Whereas for dose values of 20 kGy and below the surface generation current hardly affects the properties of the SiPM above the breakdown voltage, it gets amplified for dose values above 20 kGy resulting in a significant increase in dark-count rate. Apart from this effect, the performance of the Hamamatsu SiPM as high-gain photo detector is hardly affected by X-ray radiation up to a of 20 MGy.

Summary

Hamamatsu Silicon Photo Multipliers (SiPM) of the type S10362-11-050P are characterized and the change of their parameters after irradiation to X-rays of 200 Gy, 20 kGy, 2 MGy and 20 MGy determined. A novel method how characteristic parameters of SiPMs can be obtained in different ways is presented.

Primary author(s) : Prof. KLANNER, Robert (Univ. Hamburg)

Co-author(s) : Prof. GARUTTI, Erika (Univ. Hamburg); XU, Chen (DESY); HELLWEG, Wolf Lukas (Univ. Hamburg)

Presenter(s) : Prof. GARUTTI, Erika (Univ. Hamburg)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **337** Type : **Oral**

Characterization of Ni/SnPb-TiW/Pt Flip Chip Interconnections in Silicon Pixel Detector Modules

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

In contemporary high energy physics experiments, silicon detectors are essential for recording the trajectory of new particles generated by multiple simultaneous collisions. To guarantee high sensitivity near the collision point, modern particle tracking systems may feature 100 million channels, or pixels, which need to be individually connected to read-out chains. Silicon pixel detectors are typically connected to readout chips by flip-chip bonding using solder bumps.

The electrical and mechanical quality of the flip-chip interconnects are important for the proper functioning of the particle tracking system in order to minimize the number of dead read-out channels. Furthermore, the detector modules must be robust enough to endure the handling during the installation and the heat generation and the cooling during the operation.

The silicon pixel detector modules were constructed by flip chip bonding 16 readout chips to a single sensor. Eutectic SnPb solder bumps were deposited on the readout chips and the sensor chips had TiW/Pt thin film UBM (under bump metallization). The modules were assembled at Advacam Ltd operating at Micronova Nanofabrication Centre.

We studied the quality and uniformity of the interconnections using Scanning White Light Interferometry (SWLI), stylus profiler and performing destructive pull-strength tests. Furthermore, we compared the results of the characterization of interconnections to those of module performance measurements. According to our results, the Ni/SnPb-TiW/Pt interconnections are excellent for flip-chip bonding pixel detector modules.

Summary

Primary author(s) : Ms. KARADZHINOVA, Aneliya (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland)

Co-author(s) : Mr. NOLVI, Anton (Department of Physics, University of Helsinki, PO Box 64, 00014, Helsinki, Finland); Dr. HÄRKÖNEN, Jaakko (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Dr. LUUKKA, Panja (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Dr. MÄENPÄÄ, Teppo (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Dr. TUOMINEN, Eija (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland); Prof. HAEGGSTRÖM, Edward (Department of Physics, University of Helsinki, PO Box 64, 00014, Helsinki, Finland); Dr. KALLIOPUSKA, Juha (Advacam Ltd, Tietotie 3, Espoo, Finland); Dr. VÄHÄNEN, Sami (Advacam Ltd, Tietotie 3, Espoo, Finland); Dr. KASSAMAKOV, Ivan (Department of Physics, University of Helsinki, PO Box 64, 00014, Helsinki, Finland)

Presenter(s) : Ms. KARADZHINOVA, Aneliya (Helsinki Institute of Physics, PO Box 64, 00014, Helsinki, Finland)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **41** Type : **Oral**

Characterization of a Spherical Proportional Counter in argon-based mixtures

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

The Spherical Proportional Counter is a novel type of radiation detector, with a low energy threshold (typically below 100 eV) and good energy resolution. This detector is being developed by the network NEWs, which includes several applications. We can name between many others Dark Matter searches, low level radon and neutron counting or low energy neutrino detection from supernovas or nuclear reactors via neutrino-nucleus elastic scattering. In this context, this works will present the characterization of a spherical detector of 1 meter diameter using two argon-based mixtures (with methane and isobutane) and for gas pressures between 50 and 1500 mbar. In each case, the energy resolution shows its best value in a wide range of gains, limited by the ballistic effect at low gains and by feedback at high gains. Moreover, the best energy resolution shows a degradation with pressure. These two effects will be discussed in terms of gas avalanche properties. Finally, the effect of an electrical field corrector in the homogeneity of the gain and the energy threshold measured in our setup will be also discussed.

Summary

Primary author(s) : IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES)); Ms. RODRÍGUEZ ARRUGA, Asunción (Universidad de Zaragoza (ES))

Co-author(s) : GARCIA IRASTORZA, Igor (Universidad de Zaragoza (ES))

Presenter(s) : IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES))

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **402** Type : **Oral**

Close Cathode Chamber: cost efficient and lightweight detector for tracking applications

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The Close Cathode Chamber (CCC) is an asymmetric Multi-Wire Proportional Chamber (MWPC), which, owing to its specifically optimized field structure, has key advantages relative to the classical MWPC design. The CCC contains alternating field wires and anode (sense) wires, and the wire plane is asymmetric with respect to two parallel planes, being as close as 1.5mm typically to one of the planes for 2mm wire spacing. We have shown that this arrangement minimizes the dependence of the avalanche gain on detector wall planarity 1, and specifically, insensitivity to corresponding mechanical distortions or internal overpressure (causing bulging). Such feature allows one to build CCC chambers with small overall material budget, avoiding also the thick frames typical for MWPC-s. Careful studies confirmed that signal formation and position resolution correspond to that in classical MWPC-s. The dead zones created by internal support structures have been evaluated [2]. CCC detectors have found application in a portable cosmic muon tracking system [3],[4], proving their mechanical and operational stability under hars and varying environmental conditions.

1 D. Varga et al.: NIM A648 (2011) 163-167
[2] D. Varga et al.: NIM A698 (2013) 11-18
[3] G. G. Barnaföldi et al.: NIM A689 (2012) 60-69
[4] L. Oláh et al.: Geosci. Instrum. Method. Data Syst. (2012) 2 781-800

Summary

Primary author(s) : VARGA, Dezso (Wigner RCP); HAMAR, Gergo (Wigner RCP)

Presenter(s) : VARGA, Dezso (Wigner RCP)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **363** Type : **Oral**

Columbia Univeristy R&D program for large mass DarkMatter detector with LXe TPC

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The next generation of Dark Matter detectors based on dual-phase (liquid/gas) Xenon Time Projection Chambers (TPCs) will require an active volume of liquid with a mass on the tonne-scale in order to reach the desired sensitivity to WIMP-nucleon interactions. One natural and effective way to increase the target mass is to build a TPC with larger cross-sectional area and longer drift distance. Construction and operation of such a detector leads to many new issues and technological challenges which need to be addressed. One example is that electronegative impurities in the liquid must be at or below the ppb level, to prevent loss of the charge signal. This challenge can be overcome with an efficient filtering system for the evaporated liquid, capable of a circulation rate on the order of 100 SLPM. This high flow rate, however, requires an increased heat input to take advantage of the high cross-section for purification of the hot Xenon gas. Another well-known, major challenge to a tonne-scale detector is the requirement of very high voltage (˜ 50-100 kV) to generate a suitable drift field inside the TPC. Work is under way at Columbia University to study these and other issues associated with the construction of XENON1T with the so-called DEMONSTRATOR R&D program. In this talk, we will highlight the major results of this effort.

Summary

An extensive R&D program is on ongoing at the Columbia University to address the main technical issues of a possible multi-ton DarkMatter LXe TPC. In this talk we review in detail the studies done so far.

Primary author(s) : Dr. MESSINA, Marcello (Columbia University)

Presenter(s) : Dr. MESSINA, Marcello (Columbia University)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **375** Type : **Oral**

Commissioning of the CUORE cryostat: the first experimental setup for bolometric detectors at the 1 tonne scale

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The Cryogenic Underground Observatory for Rare Events (CUORE) is a 1-ton scale bolometric experiment. The CUORE detector is an array of 988 TeO2 crystals arranged in a cylindrical compact and granular structure of 19 towers. This will be by far the largest bolometric mass ever operated. These detectors will need a base temperature around 10 mK in order to meet the performance specifications. To cool the CUORE detector a large cryogenic-free cryostat with five pulse tubes and one specifically designed high-power dilution refrigerator has been designed. The cryostat (4K refrigerator with Pulse Tubes) and Dilution Unit were first tested independently and than merged together. We report here the detailed description of the cryostat for the CUORE experiment together with the results of the validation tests done in 2014.

Summary

Primary author(s) : CHOTT, Nicholas (University of South Carolina)

Presenter(s) : CHOTT, Nicholas (University of South Carolina)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **79** Type : **Oral**

Construction and commissioning of a setup to study ageing phenomena in high rate gas detectors

Friday, 6 June 2014 12:00 (0:20)

Abstract content

A very accurate apparatus has been constructed and commissioned at the GSI detector laboratory, which will be dedicated for many objectives. Among these objectives; investigation of the ageing phenomena of high rate gaseous detectors, the ageing influences of the construction materials of the gaseous detectors, long term monitoring of gaseous detectors tolerance, planned to be used in The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany. It is very important, in ageing studies, to sense the detector degradation, if any, in reasonable time period and with a particle rate comparable to that in real experiments. In order to reach the envisaged accuracy, several optimizations have been implemented over the design of the used counters, the setup approach and automation and the gas system. In this article, details of the experimental setup, the systematic optimization tests, studies of ageing and anti-ageing manifestations, and results of the influence of different construction materials will be presented.

Summary

Primary author(s) : ABUHOZA, Alhussain (GSI)

Co-author(s) : Dr. BISWAS, Saikat (GSI); FRANKENFELD, Uli (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); Dr. SCHMIDT, Christian Joachim (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); SCHMIDT, Hans Rudolf (Eberhard-Karls-Universitaet Tuebingen (DE)); HEHNER, Joerg Lothar (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter(s) : ABUHOZA, Alhussain (GSI)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **99** Type : **Oral**

Construction and commissioning of the KLOE-2 Inner Tracker

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

The KLOE-2 experiment is starting its data taking at the DAΦNE [U+03D5]-factory at the Frascati National Laboratory of the INFN. The experiment is continuing the successful physics program of KLOE, that collected 2.5 fb-1 of integrated luminosity between 2001 and 2006. For the new data taking campaign the detector, consisting of a huge Drift Chamber and a Electromagnetic Calorimeter working in a 0.5 T axial magnetic field, has been upgraded. One of the upgrades involves the tracking system, with the insertion of a GEM-based detector in the space separating the DAΦNE interaction region and the inner wall of the Drift Chamber. The Inner Tracker, composed of four coaxial cylindrical triple-GEMs, is a kapton-based detector allowing us to keep the total material budget below 2% X0, as required in order to minimize the multiple scattering of low-momentum tracks. Novel and advanced solutions were developed to cope with the challenging problems that arose during the construction phase. The tracker achieves 200 µm spatial resolution in the transverse plane and 500 µm along the beam direction. The two coordinates are provided by a dedicated XV readout pattern coupled to the GASTONE front-end, a 64 channel ASIC with digital output specially developed for this detector. The first results from the commissioning of the detector will be shown, including the preliminary response of the detector to cosmic-ray muons and DAΦNE beam interactions.

Summary

Primary author(s) : MORELLO, Gianfranco (Istituto Nazionale Fisica Nucleare (IT))

Co-author(s) : BALLA, Alessandro (Istituto Nazionale Fisica Nucleare (IT)); DE ROBERTIS, Giuseppe (Universita e INFN (IT)); DI DOMENICO, Antonio (Universita e INFN, Roma I (IT)); DOMENICI, Danilo (Istituto Nazionale Fisica Nucleare (IT)); DONG, Jing (INFN); FANIZZI, Giampiero (INFN Sezione di Bari (IT)); FELICI, Giulietto (Laboratori Nazionali di Frascati (LNF)); GATTA, Maurizio (Istituto Nazionale Fisica Nucleare (IT)); LACALAMITA, Nicola (Universita e INFN (IT)); LIUZZI, Raffaele (INFN Sezione di Bari (IT)); MONGELLI, Maurizio (INFN Sezione di Bari (IT)); BENCIVENNI, Giovanni (Istituto Nazionale Fisica Nucleare (IT)); PALLADINO, Anthony (LNF-INFN); PELOSI, Alessandro (Istituto Nazionale di Fisica Nucleare Sezione di Roma 1); QUINTIERI, Lina (LNF-INFN); RANIERI, Antonio (Universita e INFN (IT)); TSKHADADZE, Edisher (Joint Inst. for Nuclear Research (RU)); VALENTINO, Vincenzo (INFN Sezione di Bari (IT)); Dr. BRANCHINI, Paolo (Roma Tre Universita Degli Studi (IT)); BUDANO, Antonio (Roma Tre Universita Degli Studi (IT)); CAPODIFERRO, Manlio ("Sapienza" Università di Roma (IT)); CERIONI, Stefano (Istituto Nazionale Fisica Nucleare (IT)); CIAMBRONE, Paolo (Istituto Nazionale Fisica Nucleare (IT)); CZERWINSKI, Eryk (LNF-INFN); DE LUCIA, Erika (Istituto Nazionale Fisica Nucleare (IT))

Presenter(s) : MORELLO, Gianfranco (Istituto Nazionale Fisica Nucleare (IT))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **221** Type : **Oral**

Construction of a large-size four plane micromegas detector

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

In view of the use of micromegas detectors for the upgrade of the ATLAS muon system, we have constructed two detector quadruplets with an area of 0.5 m^2 per plane serving as prototypes for future ATLAS chambers. They are based on the resistive-strip technology and thus spark tolerant. The detectors were built in a modular way. The quadruplets consist of two double-sided readout panels with 128 μm high support pillars and three support (or drift) panels equipped with the micromesh and the drift electrode. The distance of the micromesh from the drift-electrode determines the drift (or conversion) gap. The panels are bolted together such that the detector can be opened and cleaned, if required. Each readout plane comprises 1024 strips with a pitch of 0.4 mm. Two of the readout planes are equipped with readout strips inclined by 1.5 degree. The quadruplet thus delivers track coordinates with a resolution of better than 100 μm in the precision coordinate and 1 mm in the second coordinate. We will present the detector concept, our experience with the detector construction, and the evaluation of the detectors with cosmic rays and x-rays. One of the quadruplets will be installed in ATLAS in summer 2014, equipped with the newly developed digital VMM readout chip.

Summary

Primary author(s) : IENGO, Paolo (INFN Napoli (IT))

Co-author(s) : BIANCO, Michele (C); WOTSCHACK, Joerg (CERN); DANIELSSON, Hans (CERN); DE OLIVEIRA, Rui (CERN); KUGER, Fabian (Bayerische Julius Max. Universitaet Wuerzburg (DE)); LIN, Tai-Hua (Johannes-Gutenberg-Universitaet Mainz (DE)); PEREZ GOMEZ, Francisco (CERN); SCHOTT, Matthias (CERN); SEKHNIAIDZE, Givi (Universita e INFN (IT)); VALDERANIS, Chrysostomos (Johannes-Gutenberg-Universitaet Mainz (DE))

Presenter(s) : IENGO, Paolo (INFN Napoli (IT))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **352** Type : **Oral**

Cooling for the LHCb Upgrade Scintillating Fibre Tracker

Monday, 2 June 2014 17:10 (0:20)

Abstract content

As part of the LHCb Phase-II upgrade programme, the existing downstream tracking systems will be replaced by a new scintillating fibre tracker read out by multi-channel silicon photomultipliers (SiPM). To ensure high tracking performance over the entire experiment's lifetime, the SiPMs will be operated at sub-zero temperatures, down to -40°C.
This presentation outlines the proposed SiPM cooling system and describes the design considerations which led to the choice of the mono-phase liquid cooling solution. The requirements on the temperature uniformity and stability are discussed, along with the constraints which thermal considerations impose on the mechanical design of the tracker modules. The prospective refrigerants (C6F14 and 3M Novec thermal fluids) are compared with each other, including their effect on the environment.
The SiPM cooling system consists of the remote cooling plant, insulated transfer lines, the local distribution pipework and the cooling structures inside 288 read-out boxes spread over twelve 5x6 m2 tracker planes. The main design challenges of this system are associated with its large extent (about 150 m of linear SiPM arrays to be cooled) and severe constraints on the geometrical envelope and, hense, insulation. Since the SiPM themselves produce very little heat, the estimated heat load of the cooling plant, 13 kW, is dominated by the heat influx through the insulation of read-out boxes, interconnection and transfer lines. Main system design parameters, as well as the latest results of the thermal mock-up tests, are summarised.

Summary

Primary author(s) : GORBOUNOV, Petr (CERN and ITEP(Moscow))

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH))

Presenter(s) : GORBOUNOV, Petr (CERN and ITEP(Moscow))

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **100** Type : **Oral**

Correction for pile-up effect based on pixel-by-pixel calibration for tomography with Medipix3RX detector

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

The dispersion of individual pixels parameters are widely studied in the field of hybrid pixel detectors for X-ray detection. CERN is developing methods of thresholds equalization to correct for threshold dispersion between pixels of the Medipix3RX readout chip. In this paper, we focus on the complex problem of pixel-to-pixel dead time dispersion, which cannot be corrected by simple flat field normalization, contrary to the residual threshold dispersion after equalization. In tomography, dead time inhomogeneity is responsible for ring artefacts, in addition to global underestimation of the attenuation coefficients due to pile-up. While the main methods of ring artefact correction are purely mathematical, our strategy was to develop a method based on dead time calibration to be able to remove ring artefacts and at the same time to restore the correct quantitative attenuation coefficients. Our original correction method is based on a calibrated dead time map associated to an iterative correction on the sinograms. We performed a fine analysis of dead time dispersion and compared it to our model of photonic noise propagation to validate the calibration step. The results of the pile-up correction with a single Medipix3RX ASIC bump bonded to 200 microns Silicon sensor using a standard X Ray generator showed quantitative improvements of transmission images of Al filters, increasing by a factor 3 the signal-to-noise ratio after pile up correction within the flux range [5E3 – 2E5] photons/pixel/s. We are currently validating the method on the tomographic beam line of the Brazilian Synchrotron (LNLS).

Summary

Primary author(s) : RINKEL, Jean (L)

Co-author(s) : Ms. DE PAIVA MAGALHÃES, Debora (LNLS)

Presenter(s) : RINKEL, Jean (L)

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **385** Type : **Oral**

Demonstration of a Water Cherenkov Optical Time-Projection Chamber (OTPC)

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

We describe a prototype water-based optical time projection chamber (OTPC), in which tracks of relativistic charged particles are reconstructed using the emitted Cherenkov radiation. The detector is a vertical cylindrical ~40 kg water mass that is instrumented with a combination of 2×2 in^2 microchannel plate (MCP) photodetectors and 3×3 in^2 mirrors on the sides, in a stereo configuration. For each MCP, a mirror is mounted on the opposite side of the cylinder allowing for the detection of both direct and reflected photons. Each MCP photomultiplier has 60 channels of waveform digitizing readout in which the waveforms are read out on a transmission line anode. The system's time (~50 ps) and spatial (~1 mm) resolution tagging of single photons allow for precision track reconstruction using both the prompt and reflected light. Particle tracks are reconstructed by fitting the vertical and azimuth photon time projection data, extracting 3D tracks and the Cherenkov angle. First results from cosmic ray muons will be presented.

Summary

Primary author(s) : OBERLA, eric (uchicago)

Co-author(s) : FRISCH, henry (u); WETSTEIN, Matthew (University of Chicago); ELAGIN, Andrey (University of Chicago)

Presenter(s) : OBERLA, eric (uchicago)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **171** Type : **Oral**

Design Studies of the Electromagnetic and Hadronic Calorimeters for sPHENIX

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The PHENIX Experiment at RHIC is planning a series of major upgrades that will transform the current PHENIX detector into a new detector, sPHENIX, which will be used to carry out a systematic measurement of jets in heavy ion collisions in order to study the phase transition of normal nuclear matter to the Quark Gluon Plasma near its critical temperature. The baseline design of sPHENIX will utilize the former BaBar solenoid magnet and incorporate two new calorimeters, one electromagnetic (EMCAL) and another hadronic (HCAL), that will be used to measure jets in the central region. The calorimeters will cover a region of ±1.1 in pseudorapidity and 2pi in phi, and will result in a factor of 6 increase in acceptance over the present PHENIX detector. The HCAL will be first hadronic calorimeter ever used in an experiment at RHIC and will enable this first comprehensive study of jets in heavy ion collisions. It will be based on scintillator plates interspersed between steel absorber plates that are read out using wavelength shifting fibers. It will have a total depth of ˜ 5 Labs that will be divided into two longitudinal sections, and will have an energy resolution ˜ 50%/$\sqrt{\mathrm{E}}$ for single particles and <100%/$\sqrt{\mathrm{E}}$ for jets. The EMCAL will be a tungsten-scintillating fiber design, and will have a depth of ˜ 17 X0 and an energy resolution of ˜ 15%/$\sqrt{\mathrm{E}}$. Both calorimeters will be read out using silicon photomultipliers and waveform digitizing electronics. In addition, it is planned to add a preshower detector in front of the EMCAL that will consist of ˜ 2 X0 of tungsten absorbers and silicon strip detectors in order to improve electron and single photon identification. This talk will discuss the detailed design of both calorimeters and the preshower, and the construction of the first prototypes of each of these devices. These prototypes were recently tested in a test beam at Fermilab and the first preliminary results of those tests will be presented. A discussion of additional upgrade plans that will transform sPHENIX into ePHENIX, which will be a detector for a future Electron Ion Collider at Brookhaven, will be discussed in a separate contribution to this conference.

Summary

The PHENIX Collaboration is planning a series of major new upgrades that will transform the current PHENIX detector at RHIC into a new, multipurpose detector that will be used to carry out a systematic study of jets in heavy ion collisions in order to study the Quark Gluon Plasma near its critical temperature, and to study polarized electron-hadron and electron-ion collisions at a future Electron Ion Collider at Brookhaven. The first in this series of upgrades is sPHENIX, which will utilize the BaBar solenoid magnet and instrument it with two new calorimeters, one electromagnetic and one hadronic, that will have full azimuthal coverage and cover 2.2 units of rapidity, thereby increasing the current PHENIX acceptance by a factor of six. The sPHENIX hadron calorimeter will be the first hadronic calorimeter ever used in an experiment at RHIC, and will enable the first study of jets at RHIC that utilizes a complete jet energy measurement. The evolution of sPHENIX to ePHENIX, which will be a new detector for eRHIC, will be described in a separate contribution to this conference. The hadronic calorimeter will be a steel plate and scintillating tile design that is read out

with wavelength shifting fibers and silicon photomultipliers (SiPMs). It will incorporate a novel design feature where the steel plates are oriented parallel to the beam direction so that they also function as the flux return for the magnet. This results in the steel plates being wedged shaped and that the sampling fraction changes with depth. However, the calorimeter will be divided into two longitudinal compartments, which allows the measurement of the longitudinal center of gravity of the shower, and thereby an event by event correction for the longitudinal shower fluctuations. It will be divided roughly into 1/3 for the front section and 2/3 for the back section, and each section will oriented at a small angle with respect to the incoming particles. Scintillating tiles are interspersed between the steel plates and read out using wavelength shifting fibers. The fibers are bundled and read out using 3x3 mm3 silicon photomultiplers (SiPMs) which operate in the fringe field of the solenoid magnet. The EMCAL will be a tungsten plate and scintillating fiber design with the plates and fibers oriented approximately along the incoming particle direction, as in the HCAL. In order to prevent channeling of particles through the calorimeter (i.e., particles that could only interact in the scintillator), the plates and fibers will either be tilted at a small angle with respect to the incoming particle, as in the HCAL, or the plates and fibers will have an accordion structure that will prevent any direct particle path through the scintillator. The fibers are brought to the back of the calorimeter where the light is collected by an array of light collecting cavities that form the readout towers and direct the light onto SiPMs. The EMCAL will have a Moliere radius ~ 2 cm and a radiation length ~ 7 mm. Both calorimeters will use the same SiPMs and readout electronics, thereby simplifying the combined calorimeter design and resulting in an overall cost savings. The SiPM signals are amplified by custom designed preamplifiers that provide feedback for correcting the bias voltage to compensate for gain variations with temperature. An LED monitoring system is also incorporated for gain monitoring and calibration. The signals are digitized using flash ADC electronics that was used for a previous PHENIX detector. There have been detailed design and simulation studies for both the EMCAL and HCAL and prototypes of both calorimeters have been constructed. These prototypes will be tested in a test beam at Fermilab in February 2014 where their actual performance properties will be measured. In addition, we plan to test a prototype of a silicon-tungsten preshower that would go in front of the EMCAL in the sPHENIX detector. This talk will describe the detailed design of both calorimeters and the preshower, including Monte Carlo simulations, and will discuss the first results from the prototype beam tests.

Primary author(s) : KISTENEV, Edouard (Department of Physics)

Presenter(s) : KISTENEV, Edouard (Department of Physics)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **59** Type : **Oral**

Design and Performance of the HAWC DAQ

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

The High Altitude Water Cherenkov (HAWC) Observatory, located on the Sierra Negra plateau (4100m a.s.l.) in central Mexico, is currently under construction and scheduled for completion at the end of summer 2014. The detector is comprised of tightly-packed optically-isolated water tanks, each 5 m tall and 7.3 m in diameter, which are instrumented with 4 Hamamatsu photomultiplier tubes. The tanks are used to detect the secondary charged particles produced when 100 GeV - 100 TeV gamma rays and cosmic rays interact with the atmosphere. Though the detector is under construction, the DAQ has been operating and expanding with the detector as tanks are added. The DAQ is designed to handle a final event trigger rate of >15 kHz with high uptime (>99%) and low latency (<5 s), while also analyzing events with multiple triggers and reconstruction algorithms in real time. This is achieved using a modular system based on inexpensive hardware components and open source technology for transferring data (ZeroMQ). This flexible framework is agnostic to the type of data that is transferred and it could easily be applied to other experiments. We will explain the motivation for this design, describe the DAQ in detail, and present the performance of the detector.

Summary

Primary author(s) : Mr. WISHER, Ian G. (University of Wisconsin - Madison)

Co-author(s) : HAWC, Collaboration (The HAWC Observatory)

Presenter(s) : Mr. WISHER, Ian G. (University of Wisconsin - Madison)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **229** Type : **Oral**

Design and development of the Power Supply Board within the Digital Optical Module in KM3NeT

Friday, 6 June 2014 14:00 (0:20)

Abstract content

KM3NeT is a deep-sea neutrino telescope of very large scale (several km3) to be deployed and operated in the Mediterranean Sea. Neutrino-induced charged particles are detected by measuring their Cherenkov light in sea-water, using photomultiplier tubes (PMTs) inside transparent and pressure resistant spherical enclosures. The aim is to instrument several km3 of sea volume with tens of thousands of optical sensors, connected to the shore through electro-optical cables up to 100km. The KM3NeT collaboration has successfully developed an optical sensor, the Digital Optical Module (DOM), by placing 31, 3-inch PMTs in a 17-inch glass sphere along with the readout electronics. Each DOM is supplied power through a high voltage (400 VDC) line from the shore, converted to low voltage (12 VDC) before entering the DOM. The Power Supply Board (PB), situated inside the DOM, is used to produce seven voltage rails as required by the DOM electronic modules. This paper summarizes the design considerations of the PB and the results of the trial runs so far. Efficiency, testing, manufacturing and reliability issues are also addressed in connection to the project overall objectives.

Summary

Primary author(s) : Dr. BELIAS, Anastasios (NCSR Demokritos)

Co-author(s) : Dr. MANOLOPOULOS, Konstantinos (NCSR Demokritos)

Presenter(s) : Dr. BELIAS, Anastasios (NCSR Demokritos); Dr. MANOLOPOULOS, Konstantinos (NCSR Demokritos)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **378** Type : **Oral**

Design of a Low-Noise, Charge Sensitive Amplifier for MCP-PMT Detector Readout

Friday, 6 June 2014 11:20 (0:20)

Abstract content

Readout of micro-channel plate detectors using cross strip anodes require low noise, fast charge sensitive amplifier (CSA) front-end electronics. The goal of this CSA project is to improve noise and shaping time from the "PreShape32" amplifier ASIC of the RD-20 collaboration at CERN, presently used in the readout system. A target noise of 100e- + 50e-/pF (<1000e- noise overall) with <100ns shaping time is desired. Overall gain should be better than 5mV/fC. Two amplifiers have been manufactured and tested (CSAv1 and CSAv2) with a third presently being designed. All have been designed using a 130nm IBM CMOS process.

Summary

Primary author(s) : Dr. COONEY, Michael (University of Hawai'i at Manoa)

Co-author(s) : Dr. VARNER, Gary (University of Hawai'i at Manoa); Mr. CUMMING, Harley (University of Hawai'i at Manoa); Dr. ANDREJ, Seljak (University of Hawai'i at Manoa); Dr. VALLERGA, John (University of California, Berkeley); Mr. RAFFANTI, Rick (Techne Instruments)

Presenter(s) : Dr. COONEY, Michael (University of Hawai'i at Manoa)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **303** Type : **Oral**

Design, construction and commissioning of a 15 kW CO2 evaporative cooling system for particle physics detectors: lessons learnt and perspectives for further development

Monday, 2 June 2014 16:10 (0:20)

Abstract content

Since 2000, a few particle physics detectors have been using evaporative Carbon Dioxide (CO2) for their low temperature cooling systems, showing exceptional performances and stability in their full range of operation. The excellent physical, thermal and fluid dynamic properties of CO2, coupled to its radiation hardness, make it a very interesting option for the cooling systems of the next generation vertex and tracking detectors. In order to match the requirements of the CMS Pixel Phase I upgrade, a 15 kW cooling system featuring evaporative CO2 has been designed, constructed and commissioned in 2013, as a full-scale prototype of the final system. This paper describes the challenges during the design and construction phases, highlights the performance achieved during commissioning, and describes the optimisation of the design for the final system. Results of the performance tests, including stability of the temperature regulation while power cycling are illustrated as well. An outlook on further scaling up is given in view of designs for higher cooling power, as needed for the next generation of tracking detectors for the LHC experiments.

Summary

Primary author(s) : TROPEA, Paola (CERN)

Co-author(s) : DAGUIN, Jerome (CERN); ZWALINSKI, Lukasz (CERN); D'AURIA, Andrea (CERN); GODLEWSKI, Jan (CERN); OSTREGA, Maciej Stanislaw (AGH University of Science and Technology (PL)); MARQUES PINHO NOITE, Joao (CERN); PAVIS, Steven (CERN); PETAGNA, Paolo (CERN); POSTEMA, Hans (CERN); VERLAAT, Bart (NIKHEF-CERN)

Presenter(s) : TROPEA, Paola (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **247** Type : **Oral**

Detection of Proportional Scintillation in Liquid Xenon

Monday, 2 June 2014 17:30 (0:20)

Abstract content

We present results from measurements to detect proportional scintillation light near thin wires in liquid xenon (LXe). LXe time projection chamber (TPC) has superior features for the direct detection of Weakly Interacting Massive Particles (WIMPs) as demonstrated by the Xenon10 and Xenon100 experiments and more recently also by LUX. Future upgrades of these experiments with a TPC containing several tonnes of LXe presents some technical challenges which could be removed with the detection of the proportional scintillation in liquid phase. First measurements of the proportional scintillation in LXe were reported more than 30 years ago. In light of the advantages of the approach for the future large scale LXe detectors for the Dark Matter search we have carried out new measurements in LXe using thin wires and a gas electron multiplier. The experiment set-up and results from this R&D carried out at Columbia University Nevis Lab will be presented.

Summary

Primary author(s) : Dr. NAGANOMA, Junji (Rice University)

Co-author(s) : Prof. APRILE, Elena (Columbia University); Dr. SHAGIN, Petr (Rice University); Dr. WALL, Richard (Rice University); Dr. BUDNIK, Ranny (Columbia University); Mr. CONTRERAS, Hugo (Columbia University); Mr. GOETZKE, Luke (Columbia University); Ms. ROSIE, Hood (Columbia University); Dr. MELGAREJO FERNANDEZ, Antonio (Columbia University); Dr. MESSINA, Marcello (Columbia University); Dr. PLANTE, Guillaume (Columbia University); Dr. RIZZO, Alfio (Columbia University)

Presenter(s) : Dr. NAGANOMA, Junji (Rice University)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **321** Type : **Oral**

Development and Evaluation of Event-Driven SOI Pixel Detector for X-ray Astronomy

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

We have been developing a monolithic active pixel sensor with the silicon-on-insulator (SOI) CMOS technology for use in future X-ray astronomical satellite mission. Our objective is to replace the X-ray Charge Coupled Device, which is the standard detector in the field, by offering high coincidence time resolution (∼ 50 ns), superior hit-position readout time (∼ 10 μs), and wider bandpass (0.3 – 40 keV) in addition to having comparable performances in imaging spectroscopy. In order to realize this detector, we have developed prototype detectors, called "XRPIX" series. XRPIX contains comparator circuit in each pixel to detect an X-ray photon injection; it offers intra-pixel hit trigger (timing) and two-dimensional hit-pattern (position) outputs. Therefore, XRPIX is capable of direct access to selected pixels to read out the signal amplitude. X-ray readout by this function is called "Event-Driven readout".

In our previous study, we successfully demonstrated the acquisition of X-ray spectra in Event-Driven readout. Although some problems still remain in operation of the circuit, a detailed investigating operation of XRPIX revealed their cause recently. Moreover, we designed a new prototype which has charge sensitive amplifier in each pixel in order to increase the gain and improve energy resolution. Then, the readout noise is 33 e- rms and the energy resolution is about 300 eV FWHM at 5.9 keV. In this presentation, we report on the development and evaluation of XRPIX about Event-Driven readout.

Summary

Primary author(s) : Mr. TAKEDA, Ayaki (SOKENDAI/KEK)

Co-author(s) : Prof. ARAI, Yasuo (High Energy Accelerator Research Organization (KEK)); Prof. TSURU, Takeshi (Kyoto University); Dr. TANAKA, Takaaki (Kyoto University); Mr. MATSUMURA, Hideaki (Kyoto University); Mr. NAKASHIMA, Shinya (Kyoto University); Dr. MORI, Koji (Miyazaki University); Mr. NISHIOKA, Yusuke (Miyazaki University); Mr. TAKENAKA, Ryota (Miyazaki University); Dr. KOHMURA, Takayoshi (Kogakuin University); Mr. IMAMURA, Toshifumi (A-R-Tec Corp.); Mr. OHMOTO, Takafumi (A-R-Tec Corp.); Prof. IWATA, Atsushi (A-R-Tec Corp.)

Presenter(s) : Mr. TAKEDA, Ayaki (SOKENDAI/KEK)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **96** Type : **Oral**

Development and test of a versatile DAQ system based on the ATCA standard

Friday, 6 June 2014 15:00 (0:20)

Abstract content

A DAQ system based on custom electronics (Scalable Readout System - SRS) has been developed inside the Micro Pattern Gaseous Detector community (RD51 Collaboration) in the recent years and is now being upgraded for large scale applications using the Advanced Telecommunications Computing Architecture (ATCA) platform. We present the development and test of a readout system which consists of an ATCA crate, with high-speed backplane, front-end cards based on custom ATCA blades and custom readout units. The flexibility and modularity of the system makes it a powerful tool to be used in simple setups like cosmic stands or test beams, as well as allowing for the integration into a more complex DAQ framework. It will be used for Micromegas detector certification but also for the readout of a Micromegas prototype detector in the ATLAS experiment. The certification applications include small to medium size lab and test beam setups as well as a 32-64k channel test facility for the certification of the Micromegas detectors for the ATLAS muon system upgrade. The integration of this system into the complex ATLAS online TDAQ will allow us to read out a Micromegas prototype detector with 4096 channels during the upcoming LHC run period.

Summary

Primary author(s) : BIANCO, Michele (CERN); LOESEL, Philipp Jonathan (Ludwig-Maximilians-Univ. Muenchen (DE)); SIDIROPOULOU, Ourania (Aristotle Univ. of Thessaloniki (GR)); ZIBELL, Andre (Bayerische Julius Max. Universitaet Wuerzburg (DE))

Presenter(s) : SIDIROPOULOU, Ourania (Aristotle Univ. of Thessaloniki (GR))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **42** Type : **Oral**

Development of CMOS Pixel Sensor Featuring Pixel-Level Discrimination for the ALICE-ITS Upgrade

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

The CMOS pixel sensor (CPS) based on the TowerJazz 180nm CIS process can provide qualified radiation hardness for the ALICE-ITS upgrade. Meanwhile, full CMOS integration in the pixel is achievable due to the availability of deep P-well. Therefore, a novel concept of pixel with integrated discriminator was realized to develop a fast and power efficient rolling shutter CPS architecture for the ALICE-ITS upgrade. Compared with the conventional CPS using column-level discrimination, the in-pixel discrimination sets the analog processing within the pixel. Thus the analog buffer driving the long distance column bus is no longer needed and the static current consumption per pixel can be largely reduced from 120μA down to 15μA. Besides, the row processing time can be halved down to 100ns thanks to small local parasitic. As a proof of concept, the prototype chip called AROM0 was fabricated in April 2013. Full functionality and the noise performance of the chip have been validated in laboratory test. Based on the experience of AROM0, the improved pixel designs have been implemented in the chip called AROM1 which is an intermediate prototype chip anticipating the final sensor architecture proposed for the ALICE-ITS upgrade. It features the pixel array of 64 $\times$ 64 with double-row readout while integrating the on-chip biasing/reference control and JTAG programmable sequence management circuitry.

This paper will present the design and test results of AROM0. It'll also discuss the improvement in AROM1 and present the test results of this sensor which is expected in early 2014.

Summary

Primary author(s) : WANG, Tianyang (IPHC)

Co-author(s) : PHAM, Thanh Hung (CNRS); DOROKHOV, Andrei (IPHC); Dr. HU, Christine (IPHC/IN2P3); Prof. HU, Yann (IPHC)

Presenter(s) : WANG, Tianyang (IPHC)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **115** Type : **Oral**

Development of Hybrid Avalanche Photo Detector and its Readout Electronics for the Belle II Aerogel RICH counter

Friday, 6 June 2014 14:00 (0:20)

Abstract content

For the Belle II experiment at the superKEKB accelerator, we have been developing a proximity focusing ring imaging Cherenkov detector using a silica aerogel as a radiator (A-RICH). This counter is designed to be used at the forward endcap region and to have pion/kaon separation with more than 4-sigma deviations at momenta up to 4 GeV/c. 144-channel Hybrid Avalanche Photo-Detector (HAPD) modules developed with Hamamatsu Photonics K.K. have been adopted as the photon detectors for the A-RICH. A total of 420 HAPD will be used in Belle II detector. We started the mass production of the HAPD. Quality of the manufactured HAPD is checked by a system that we developed. We report the status of the quality check that consists of the leakage current measurement, channel-by-channel noise level measurement, the 2-dimensional scan for photon detection, and the quantum efficiency measurement for the photo cathode. As for the readout of about 60,000 channels from the A-RICH, we developed an ASIC for the amplification and digitization of the signal from HAPDs. We started the mass production of the ASIC last year. Then we plan to test all the ASIC chips before mounting them on the front-end boards attached to HAPDs. The data from several front-end boards will be merged into one board, and are sent to the Belle II central DAQ system by an optical link called Belle2Link. For this purpose, modules called “merger board” located inside the detector are under development. Each merger board is connected to 6 front-end boards, and has an FPGA for the data merging and transmission. We are developing the firmware for the FPGA and testing it. In this presentation, status of the mass production of HAPDs and ASICs, and the development and test results for the merger board will be reported.

Summary

Primary author(s) : Mr. IWATA, Shuichi (Tokyo Metropolitan University)

Presenter(s) : Mr. IWATA, Shuichi (Tokyo Metropolitan University)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **302** Type : **Oral**

Development of Kinetic Inductance Detectors for a 3 mm camera

Friday, 6 June 2014 11:20 (0:20)

Abstract content

Millimetre-wave astronomical observations have an enormous discovery potential in the study of the earliest stages of the evolution of the universe, clusters of galaxies, high redshift objects, and star formation regions. One of the challenges today is to perform observations with the finest angular resolution, in order to accurately investigate the nature of these astrophysical sources. While for spectroscopic investigations of point-like sources ALMA is the obvious solution, for continuum measurements of diffuse sources large single-dish telescopes (e.g. GBT, TML, IRAM, SRT, etc.) equipped with large-format bolometeric cameras provide a much higher mapping speed. Kinetic Inductance Detectors represent an interesting option for the detector array, due to their easiness to multiplex and their capability to efficiently tackle with atmospheric issues. We are developing Aluminum Lumped Element KIDs for the 3 mm atmospheric window (W-band). While interesting performance of KIDs has already been demonstrated for the1 and 2 mm windows, further technological development is needed for their use at longer wavelengths. In this contribution we analyze the main issues of such a R&D (like minimum operation frequency, operation in high background conditions, size of the array etc.) and present the results of optical tests of the first devices. We also discuss their possible application in an imaging differential spectrometer for the Sardinia Radio Telescope, the largest Italian radio astronomy facility.

Summary

Primary author(s) : Dr. CRUCIANI, Angelo (University La Sapienza, Rome, Italy)

Co-author(s) : Dr. BATTISTELLI, Elia (University La Sapienza, Rome, Italy); Dr. CASTELLANO, Maria Gabriella (IFN - CNR, Rome, Italy); Dr. COPPOLECCHIA, Alessandro (University La Sapienza, Rome, Italy); Mr. D'ADDABBO, Antonio (Institut Néel, Grenoble, France); Prof. D'AMICO, Nichi (University of Cagliari and INAF, Cagliari, Italy); Prof. DE BERNARDIS, Paolo (University La Sapienza, Rome, Italy); Prof. MASI, Silvia (University La Sapienza, Rome, Italy); Mr. PAIELLA, Alessandro (University La Sapienza, Rome, Italy)

Presenter(s) : Dr. CRUCIANI, Angelo (University La Sapienza, Rome, Italy)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **166** Type : **Oral**

Development of MTCA/xTCA/ATCA based instrumentation for partical physics at IHEP

Friday, 6 June 2014 15:20 (0:20)

Abstract content

This talk briefs the development of instrumentation for particle physics experiment based on the ATCA/MTCA/xTCA specifications. Examples includes hardware for LLRF, Compute Node(ATCA compatible) for PANDA experiment, Lumird for BESIII Luminosity readout, Compute Node(xTCA compatible) for DEPFET/PXD detector, digitizer and trigger for TREND experiment. discussion on the back-end readout electronics trend is discussed.

Summary

As one of the 4 sponsor labs(DESY,FNAL,IHEP,SLAC) of the new standard–"xTCA for Physics", shortaed as xTCA, IHEP/Triglab deeply envolved in the development of the backend instrument for pariticle physics. Experience has been gained with acceptance by experiments and/or usage. More detailed information will be given

Primary author(s) : LIU, Zhen-An (I)

Presenter(s) : LIU, Zhen-An (I)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **260** Type : **Oral**

Development of Microwave Kinetic Inductance Detectors for phonon and photon detections

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

We present our recent developments of Microwave Kinetic Inductance Detectors (MKIDs) for phonon and photon detections. An MKID is a type of superconducting detectors. Cooper-pair breaking caused by deposited energy changes the kinetic inductance of the superconductor. Consisting of LC resonators formed by a thin superconducting metal layer, it detects the energy by sensing the change of the inductance. By using the MKIDs we can readout the detectors with frequency-domain multiplexing.
Since the bound energy of Cooper-pairs is order of milli-electron volt and the detectors are operated at low temperature of less than 1K, MKIDs have high energy resolutions and low noise levels. The highly sensitive detectors can be applied to measurements that require the detection of very week signals, for instance dark matter search. We are developing MKIDs that are formed with the combination of two metal layers of Al and Nb. By using two superconducting metal layers, we can confine the quasi-particles in a certain region due to the difference of the energy gaps and expect an increase of the sensitivity.
We have developed Nb/Al MKIDs for the detections of photons and phonons. For the former, we aim to apply the MKIDs to a He scintillation detector for a search of light dark matter with liquid He TPC. The latter would be applied not only to the dark matter search but also to X-ray detections with the high energy resolution and a high acceptance for future material science.

Summary

Primary author(s) : Dr. ISHINO, Hirokazu (Okayama University)

Co-author(s) : Prof. HAZUMI, Masashi (High Energy Accelerator Research Organization (KEK)); Dr. KIBAYASHI, Atsuko (Okayama University); YOSHIDA, Mitsuhiro (High Energy Accelerator Research Organization (KEK)); Dr. KIBE, Yoshiaki (Okayama University); Mr. WATANABE, Hiroki (Sokendai); Dr. SATO, Nobuaki (High Energy Accelerator Research Organization (KEK)); Mr. YAMADA, Yousuke (Okayama University); Mr. OKAMOTO, Akinori (Okayama University)

Presenter(s) : Dr. ISHINO, Hirokazu (Okayama University)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **307** Type : **Oral**

Development of Real time ⁹⁰Sr counter applying Cherenkov light detection

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

Radioisotope have been emitted around Japan by a nuclear accident at the Fukushima No. 1 nuclear power plant in March 2011. A problem is the contaminated water including the atomic nucleus which relatively has a long half-life time such as 90Sr, 137Cs generated from 235U used for nuclear fuel in particular. Particular, since 90Sr has a long biological half-life time (49 years), it is dangerous to cause internal exposure. Therefore, real-time 90Sr counter is required. It is relatively easy to identify a nucleus emitting gamma ray. But it is more difficult to identify a nucleus emitting pure beta ray such as 90Sr. Typically, measurement of a radioactivity absolute value of 90Sr takes a month at least to give a result. At first, we aim to identify 90Sr/137Cs by threshold type Cherenkov detection. It needs radiator which has less than 1.0492 of refractive index for identification 2.28 MeV of maximum kinematic energy of beta ray from 90Sr and 1.17 MeV of maximum kinematic energy of beta ray from 137Cs. Recent, The material satisfying this request does not exist expect the silica aerogel. We produced prototype and evaluated performance. We achieved 103 of Sr/Cs detection efficiency ratio, 10-3 Hz/ Bq of 90Sr sensitivity at one minute.

Summary

Primary author(s) : Mr. ITO, hiroshi (Chiba University)

Co-author(s) : Mr. IIJIMA, Shutaro (Chiba University); Mr. HAN, Soorim (Chiba University); Mr. KAWAI, Hideyuki (Chiba University); Mr. KODAMA, Satoshi (Chiba University); Mr. KUMOGOSHI, Daisuke (Chiba University); Mr. MASE, Keiichi (Chiba University); Mr. TABATA, Makoto (Chiba University)

Presenter(s) : Mr. ITO, hiroshi (Chiba University)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **159** Type : **Oral**

Development of Superconducting Tunnel Junction Detectors as a far-infrared single photon detector for neutrino decay search

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

We present the development of Superconducting Tunnel Junction (STJ) detectors as far-infrared single photon detector motivated by application to a search for radiative decay of cosmic background neutrino. The photon energy spectrum from the neutrino radiative decays is expected to have a sharp edge at high energy end in a far-infrared region ranging from 14meV to 25meV (from 50um to 90um in wavelength). We explore the the cosmic infrared background photon energy spectrum in this region for feeble contribution from neutrino decays. Thus, the detector is required to measure photon-by-photon energies with high resolution enough to identify the edge structure, and designed for a rocket or satellite experiment. One of our choices for the detector is STJ using hafnium (Hf-STJ) which is expected to have 2% energy resolution for single photon of 25meV due to very small gap energy of hafnium. Another choice for the detector is a combination of the diffraction grating and array of niobium-aluminum STJ (Nb/Al-STJ) pixels, where each Nb/Al-STJ pixel is capable of single photon detection for a far-infrared photon delivered to each pixel according to its wavelength by the grating. For the Hf-STJ development, we have successfully produced a superconducting-insulator-superconducting structure using hafnium, that is confirmed by Josephson current, and observed a response to visible light illumination, although much higher leak current than its requirement is a major issue to be resolved. For the Nb/Al-STJ, it is also challenging that an amplifier at extremely low noise level of 10 electron-equivalent-noise is required.

Summary

Primary author(s) : TAKEUCHI, Yuji (University of Tsukuba)

Co-author(s) : KIM, Shin Hong (University of Tsukuba); KIUCHI, Kenji (University of Tsukuba); NAGATA, Kazuki (University of Tsukuba); KASAHARA, Kota (University of Tsukuba); OKUDAIRA, Takuya (University of Tsukuba); ICHIMURA, Tatsuya (University of Tsukuba); KANAMARU, Masahiro (University of Tsukuba); MORIUCHI, Kouya (University of Tsukuba); SENZAKI, Ren (University of Tsukuba); IKEDA, Hirokazu (JAXA/ISAS); MATSUURA, Shuji (JAXA/ISAS); WADA, Takehiko (JAXA/ISAS); ISHINO, Hirokazu (Okayama University); KIBAYASHI, Atsuko (Okayama University); MIMA, Satoru (RIKEN); YOSHIDA, Takuo (University of Fukui); KOMURA, Shota (University of Fukui); ORIKASA, Keishuke (University of Fukui); HIROSE, Ryuta (University of Fukui); KATO, Yukihiro (Kinki University); HAZUMI, Masashi (KEK); ARAI, Yasuo (KEK); RAMBERG, Erik (Fermilab); YOO, Jonghee (Fermilab); KOZLOVSKY, Mark (Fermilab); RUBINOV, Paul (Fermilab); SERGATSKOV, Dmitri (Fermilab); KIM, Soo-Bong (Seoul National University)

Presenter(s) : TAKEUCHI, Yuji (University of Tsukuba)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **147** Type : **Oral**

Development of Superconducting Tunnel Junction Photon Detector on SOI Preamplifier Board to Search for Radiative decays of Cosmic Background Neutrino.

Friday, 6 June 2014 15:00 (0:20)

Abstract content

We develop superconducting tunnnel junction (STJ) to search for radiative decays of cosmic background neutrino using cosmic infrared background energy spectrum. The requirement for performance of the detector in our experiment is to detect a single far-infrared photon. We can detect a single far-infrared photon with Nb/Al-STJ theoretically. So far we have not succeeded in detecting it yet because the signal of a single far-infrared photon with the STJ is too small comaparing with the present noise of our electronics. To solve this problem, we use a charge sensitive preamplifier that can operate at low temperature around 1K to improve the signal-to-noise ratio of STJ. cSOI(Silicon on Insulator) preamplifier is a candidate of the preamplifier as it was proved to operate at 4K by a JAXA/KEK group. We have developed a STJ processed on a SOI preamplifier board to make this detector compact. Firstly, we have processed STJ on a SOI board with only SOI-MOSFET's to check the connection between STJ and SOIFET and the STJ processing without any damage on SOIFET. We confirmed that the SOIFET had excellent performance below 1K and the STJ on SOI could operate normally. Then we made and tested the second version of SOI-STJ detector with the readout circuit on SOI wafer as the charge sensitive amplifier. We will report the present status of development of this SOI-STJ detector.

Summary

Primary author(s) : KASAHARA, Kota (University of Tsukuba (JP))

Co-author(s) : Prof. KIM, Shinhong (University of Tsukuba); Prof. ISHINO, Hirokazu (Okayama University); Prof. HAZUMI, Masashi (KEK); Prof. YOSHIDA, Takuo (Fukui University); Prof. RAMBERG, Erik (Fermilab); Prof. WADA, Takehiko (JAXA); Dr. MIMA, Satoru (RIKEN); Prof. ARAI, Yasuo (KEK); Prof. KATO, Yukihiro (Kinki University); Mr. NAGASE, Koichi (JAXA); Prof. MATSUURA, Shuji (JAXA); Prof. TAKEUCHI, Yuji (University of Tsukuba); Mr. RUVINOV, Paul (Fermilab); Prof. KOZLOVSKY, Mark (Fermilab); Prof. SERGATSKOV, Dmitri (Fermilba); Mr. KIUCHI, Kenji (University of Tsukuba (JP)); Mr. NAGATA, Kazuki (University of Tsukuba (JP)); Mr. OKUDAIRA, Takuya (University of Tsukuba); Mr. ICHIMURA, Tatsuya (University of Tsukuba); Mr. KANAMARU, Masahiro (University of Tsukuba); Mr. MORIUCHI, Koya (University of Tsukuba); Mr. SENZAKI, Ren (University of Tsukuba)

Presenter(s) : KASAHARA, Kota (University of Tsukuba (JP))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **292** Type : **Oral**

Development of X-ray SOI Pixel Sensors: Investigation of Charge-Collection Efficiency

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

We have been developing X-ray SOIPIXs, monolithic active pixel sensors based on the Silicon-On-Insulator (SOI) CMOS technology for next-generation X-ray astronomy satellites. Their high time resolution (˜micro sec) and event trigger output function enable us to reduce non-X-ray background by two orders of magnitude at 20 keV, compared with X-ray CCDs widely used in current X-ray astronomy sattelites. A fully depleted thick depletion layer with back-side illumination offers wide band coverage of ∼0.3–40 keV. We already achieved thick and full depletion layer with a thickness of 500 micron. We will report recent progress in our development in this presentation. We measured sub-pixel charge-collection efficiency of our device by irradiating it with pencil beam X-rays at SPring-8. We found that a part of signal charges is lost at the pixel boundaries. We found that the amount of the charge loss depends on back-bias voltages. It leads us to a hypothesis that the strength of electric fields at the interface between the sensor and silicon dioxide layers determines the charge collection efficiency. We will test the hypothesis by comparing the experimental results with TCAD simulations.

Summary

Primary author(s) : MATSUMURA, Hideaki (Kyoto University)

Co-author(s) : TSURU, Takeshi (Kyoto University); Dr. TANAKA, Takaaki (Kyoto University); Dr. NAKASHIMA, Shinya (Kyoto University); ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); TAKEDA, Ayaki (SOKENDAI); MORI, koji (University of Miyazaki); NISHIOKA, Yusuke (University of Miyazaki); TAKENAKA, Ryota (University of Miyazaki); KOHMURA, Takayoshi (Kogakuin University)

Presenter(s) : MATSUMURA, Hideaki (Kyoto University)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **366** Type : **Oral**

Development of a 20cm-by-20cm "hot" indium-alloy hermetic seal in an inert atmosphere for photo-detector assembly

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

The Large-Area Picosecond Photo-Detector Collaboration (LAPPD) is currently developing a large-area, modular photo-detector system composed of thin, planar, glass-body modules, each with two 20x20-cm-squared ALD-functionalized MCPs in a chevron geometry. In the case of LAPPD, hermetic sealing between the entrance window and the detector body is complicated by the square shape of the detector and the large area. We have successfully demonstrated a technique to make a vacuum seal for the LAPPD detectors by using an indium-alloy above its melting temperature on a flat pre-coated glass surface in an inert atmosphere. While this technique has been developed in a glove box filled with an inert gas, it can be adapted for the use in a vacuum transfer assembly process.

Summary

Primary author(s) : ELAGIN, ANDREY (University of Chicago); FRISCH, Henry (University of Chicago); NORTHROP, Richard (University of Chicago)

Co-author(s) : OBAID, Razib (Illinois Institute of Technology); HEINTZ, Mary (University of Chicago); WETSTEIN, Matthew (University of Chicago); ADAMS, Bernhard (Argonne National Laboratory)

Presenter(s) : ELAGIN, ANDREY (University of Chicago)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **169** Type : **Oral**

Development of a Data Acquisition System for the Belle II Silicon Vertex Detector

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The Silicon Vertex Detector (SVD) is one of the main detectors in the Belle II experiment (KEK, Japan) which takes essential roles in the decay-vertex determination, low-energy-track reconstruction, and background rejection. The SVD consists of four layers of Double-sided Silicon Strip Detectors (DSSD) and is being developed toward the start of the Belle II experiment in 2016. Due to more than 220,000 strips in the whole SVD and the Belle II maximum trigger rate of 30 kHz, the integration of a large number of readout channels and the reduction of data size are challenging issues on the development of the SVD readout electronics. APV25 chips are employed to read the DSSD signals, and Flash-ADC (FADC) boards digitize and decode the outputs of the APV25s. To increase the integration density of the readout channels, one FADC board processes 48 APV25 outputs with one FPGA. The FPGA performs pedestal-subtraction, two-step common-mode correction, and zero-suppression for the sake of the data reduction. The development of the first prototype of the SVD readout system was completed in Dec. 2013, and the performance study of this system was done in an electron beam at DESY in Jan. 2014. In the beam test, the prototype system was implemented into the Belle II DAQ for the first time and the whole data-streaming was successfully operated. In this presentation, we will introduce features of the SVD readout system, and report on prototype performance results from the beam test, as well as future prospects for the Belle II experiment.

Summary

Primary author(s) : NAKAMURA, Katsuro (KEK)

Co-author(s) : BERGAUER, Thomas (HEPHY); NAKAO, Mikihiko (KEK); NATKANIEC, Zbigniew (IFJ); OSTROWICZ, Waclaw (IFJ); PAOLONI, Eugenio (INFN Pisa and Univ. of Pisa); SCHNELL, Michael (Univ. of Bonn); SUZUKI Y., Soh (KEK); THALMEIER, Richard (HEPHY); TSUBOYAMA, Toru (KEK); YAMADA, Satoru (KEK); YIN, Hao (HEPHY); CASAROSA, Giulia (INFN Pisa); FRIEDL, Markus (HEPHY); HARA, Koji (KEK); HIGUCHI, Takeo (Kavli IPMU (WPI)); IRMLER, Christian (HEPHY); ITOH, Ryosuke (KEK); KONNO, Tomoyuki (Tokyo Metropolitan Univ.); LIU, Zhen-An (IHEP)

Presenter(s) : NAKAMURA, Katsuro (KEK)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **316** Type : **Oral**

Development of a Drift Chamber Detector for Large Area Applications of Muon Tomography

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

Cosmic ray muon tomography is a novel three-dimensional imaging technique able to image objects in dense or cluttered containers. The technique's ability to discriminate differing materials relies on the multiple Coulomb scattering of cosmic ray muons and as such depends strongly on the tracking resolution of the detector module. Similarly other detector properties have a strong effect of the technique's attractiveness for various applications: Due to the rate of background cosmic ray muons, timely imaging is only made possible by high detector efficiencies, large tracking solid angles and minimising dead areas; a low-cost, scalable, and easy-to-construct detector are also desirable properties, particularly for applications requiring large detector areas. We report on the development of a simplified single wire drift chamber for large area applications aiming to realise these benefits. Particularly we describe developments aimed at facilitating an easy-to-construct detector and reducing the overall cost of a future system. Performance studies of single and few-detector stack systems are reported including gas, resolution and efficiency studies. Then our considerations of a proposed design for a prototype detector module are also discussed.

Summary

Primary author(s) : Dr. STEER, Chris (AWE)

Co-author(s) : BURNS, Jonathan (A); QUILLIN, steve (AWE); Dr. STAPLETON, Matthew (AWE); SNOW, Stephen (Dept.of Phys.&Astronomy,SchusterLab)

Presenter(s) : Dr. STEER, Chris (AWE)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **289** Type : **Oral**

Development of a High Rate proton Computed Tomography Detector system

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

Proton computed tomography (pCT) offers an alternative to x-ray imaging with potential for three dimensional imaging, reduced radiation exposure, and in-situ imaging. The second generation pCT system being developed at Northern Illinois University in collaboration with Fermilab and Delhi University is comprised of a tracking system, a calorimeter or the range detector, data acquisition system, a computing farm, and software algorithms for image reconstruction. The proton beam encounters the upstream tracking detectors, the patient or phantom, the downstream tracking detectors, and a calorimeter. The tracking detectors are scintillating fibers and the calorimeter is made up of stacked scintillator plates. The data acquisition sends the proton scattering information to an offline computing farm. The pCT detector design allows for an increased data acquisition rate (up to 5 million proton tracks per second) and an improved imaging algorithm, which significantly reduced reconstruction times of three dimensional images. In this presentation, we will present the current status of the pCT detector system, development of the complete detector simulation and reconstruction tools and their validation, and preliminary test beam data analysis with the full pCT detector system.

Summary

Primary author(s) : Prof. NAIMUDDIN, Md (Delhi University)

Presenter(s) : Prof. NAIMUDDIN, Md (Delhi University)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **91** Type : **Oral**

Development of a High-Sensitive and Low-Cost Imaging Gamma-Ray Camera γI (Gamma Eye)

Friday, 6 June 2014 15:20 (0:20)

Abstract content

We developed a Compton camera γI (Gamma Eye) using CsI (Tl) scintillators for measurement of arrival direction of gamma rays produced by radioactive cesium released into the environment from the Fukushima Dai-ichi Nuclear Power Plant accident due to the great east Japan earthquake and subsequent tsunamis in 2011. The radiation exposure of residents remains extremely a serious problem in Japan. The capability of gamma-ray imaging with good angular resolution is a key feature for identification of radiation hotspots and effective decontamination operation. A detector using Compton kinematics is one of the best candidates. Some Compton cameras for such purpose are being developed so far. However, they are not sufficient to cover a wide contamination area with the dose rate in air of $< 1\mu$Sv/hour around the Fukushima Power Plant because of their low detection efficiency and/or very high cost. Thus we developed a novel Compton camera γI (Gamma Eye) with high sensitivity and low-cost. It consists of 2 arrays of detectors which act as a Compton scatterer and absorber. Energies deposited by Compton scattered electrons and subsequent photoelectric absorption measured by photomultipliers are used for image reconstruction. Each array consists of 8 large CsI (Tl) scintillator cubes, 3.5cm on a side, which are inexpensive and have good energy resolution. The 2 arrays are separated by 40cm to provide a 60-degree wide field of view as well as to keep position determination accuracy < 5 degree. The imaging capability was verified by test measurements in Fukushima Prefecture together with the laboratory tests.

Summary

Primary author(s) : Ms. KAGAYA, Mika (Ibaraki University)

Co-author(s) : Prof. ENOMOTO, Ryoji (Tokyo University (ICRR)); Prof. KATAGIRI, Hideaki (Ibaraki University); Prof. MURAISHI, Hiroshi (Kitasato University); Prof. YOSHIDA, Tatsuo (Ibaraki University); Prof. YANAGITA, Shohei (Ibaraki University); Prof. TAKEDA, Toru (Kitasato University); Mr. NAKAYAMA, Kohei (Ibaraki University); Mr. HANAFUSA, Ryuji (Fuji Electric); Mr. ITO, Yoshikazu (Fuji Electric); Mr. HOSOKAWA, Masao (Fuji Electric); Mr. SATO, Kazuhiro (Shinsei Corporation)

Presenter(s) : Ms. KAGAYA, Mika (Ibaraki University)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **163** Type : **Oral**

Development of a Muon Polarimeter for the T-violation Search Experiment at J-PARC

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

TREK is a precision-frontier experiment, planned at J-PARC (Tokai, Japan), for a T-violation search in Kaon decays into the pi0 mu+ nu final state. The signature is a non-zero transverse polarization (P_T) of muons in the direction perpendicular to the decay plane. Using the same process the E246 experiment at KEK has set an upper limit on | P_T | < 0.0050 at the 90% confidence level. TREK is an upgrade of E246 with the goal of achieving more than a factor of 20 higher sensitivity using high intensity Kaon beam from J-PARC and the detector with major upgrades that include a new GEM tracker, new photon device for the CsI(Tl) calorimeter and a new magnet system providing uniform field. The most important element of TREK is the new muon polarimeter of novel design, incorporating an active muon stopper instrumented by an array of drift tubes for tracking. This design allows the tracks of muons and positrons to be reconstructed, providing a large acceptance for positrons with higher analyzing power, background suppression, and handles for controlling systematic uncertainties such as those arising from uncertainty on the decay position and its distribution. We present an overview of the TREK experiment and detail of the muon polarimeter R&D with results of studies using Monte Carlo simulation and beam tests of the full size prototype.

Summary

Primary author(s) : KOBAYASHI, Aine (University of Tokyo (JP))

Co-author(s) : KAWAMOTO, Tatsuo (University of Tokyo (JP)); IMAZATO, Jun (KEK); YOSHIHARA, Keisuke (University of Tokyo (JP)); Prof. SHIMIZU, Suguru (Osaka University(JP)); Prof. IGARASHI, Youichi (KEK); Prof. YAMAZAKI, Hirohito (Tohoku University(JP)); Prof. HASINOFF, Mike (University of British Columbia (CA))

Presenter(s) : KOBAYASHI, Aine (University of Tokyo (JP))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **399** Type : **Oral**

Development of a Small Form Factor (6cm x 6cm) Picosecond Photodetector as a Path Towards the Commercialization of 20cm x 20cm Large Area Pico-second Photodetector Devices with Incom Inc.

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

The Large Area Picosecond Photo-Detector Collaboration (LAPPD) is currently developing a large-area, modular photo-detector system composed of thin, planar, glass-body modules, each with two 20cm x 20cm ALD-functionalized MCPs in a chevron geometry. The collaboration is working closely with industry partner Incom, Inc. towards the commercialization of this technology. One of the major challenges has been to successfully seal a top window to the hermetic glass package module. The collaboration is pursuing multiple sealing techniques; one a hot solder sealing technique and a second thermo-compression sealing technique. In this talk, I will present results from a thermo-compression seal of a top window to a 20cm x 20cm glass package module with a pump out port for leak checking the seal and describe the path towards commercialization of the 20cm x 20cm devices with Incom, Inc. As an intermediate step towards building a full system for making 20cm x 20cm devices, but independent from the LAPPD collaboration, Argonne has also developed a small form-factor (6cm x 6cm) photodetector development facility consisting of a four vacuum chamber system: loadlock, bake and scrub chamber, photocathode deposition chamber, and sealing chamber. Successful thermo-compression sealing of the 6cm x 6cm photodetector prototypes at the Argonne development facility has been accomplished in the sealing chamber. The entire system has recently undergone a bakeout and is currently achieving an ultra-high vacuum base pressure throughout the system with photocathode fabrication underway. An overview of results from the first working 6cm x 6cm active area detectors based on the ALD micro-channel plate, all glass body technology will be presented as available.

Summary

Primary author(s) : BYRUM, Karen (Argonne National Lab)

Co-author(s) : Dr. BENNIS, Daniel (Incom, Inc.); Dr. CRAVEN, Christopher (Incom, Inc.); Dr. DEMARTEAU, Marcel (Argonne National Laboratory); Dr. ELAM, Jeffrey (Argonne National Laboratory); Dr. GREGAR, Joseph (Argonne National Laboratory); Dr. MANE, Anil (Argonne National Laboratory); Dr. MINOT, Michael (Incom, Inc.); Dr. O'MAHONY, Aileen (Incom, Inc.); Dr. RENAUD, Joseph (Incom, Inc.); Dr. VIRGO, Mathew (Argonne National Laboratory); Dr. WAGNER, Robert (Argonne National Laboratory); Dr. WALTERS, Dean (Argonne National Laboratory); Dr. WANG, Xing (Argonne National Laboratory); Dr. XIA, Lei (Argonne National Laboratory); Dr. XIE, Junqi (Argonne National Laboratory)

Presenter(s) : BYRUM, Karen (Argonne National Lab)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **299** Type : **Oral**

Development of a continuous radon monitor

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

A continuous radon monitor with high sensitivity for radon based on electrostatic collection has been developed. Energy of alpha particle emission from 218Po and 214Po has been discriminated by alpha spectrometry, and an iterative correction factor has been applied to determine residual 218Po particle effect of one measurement on the next and second, then the actual counts of 218Po have been achieved.An automatic compensation method for detection efficiency of 218Po particle influenced by temperature and humidity was also introduced. The continuous radon monitor is able to trace the change of radon concentration quickly and accurately under different absolute humidity without drying tube. It is suitable for long-term continuous measurement of radon concentration in the environment of various temperatures and humidity without guarded.

Summary

Primary author(s) : Prof. XIAO, Detao (University of South China, Hengyang China)

Co-author(s) : Mr. HE, Zhengzhong (University of South China,Hengyang China); Mr. SHAN, Jiang (University of South China,Hengyang China); Mr. ZHOU, Qingzhi (University of South China,Hengyang China); Mr. LI, Zhiqiang (University of South China,Hengyang China)

Presenter(s) : Prof. XIAO, Detao (University of South China, Hengyang China)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **81** Type : **Oral**

Development of solid xenon detectors for low-background experiments

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

In modern astroparticle physics, noble gases are often chosen as detector material for a wide range of different experiments. Noble gases can provide a very long electron drift distance which is required for large-scale low-background experiments such as the search for dark matter or for the neutrinoless double beta decay.
Due to the higher density, xenon is often used in the liquid instead of gaseous state, which allows a larger detection mass at constant volume. However, solid xenon detectors could provide additional advantages over liquid xenon setups.
We present the results of recent experiments on large xenon crystals grown from the liquid phase. We successfully measured the scintillation light from ionizing radiation in the crystal and compared it to Monte Carlo simulations. Also, we studied the drift of electrons over several centimeters. The results suggest a higher drift velocity and a better collection efficiency of secondary electrons than in the case of liquid xenon.
Our work is the basis of the future development of new kind of TPC using solid xenon in combination with the Timepix detector. It would benefit from the excellent electron drift characteristics of xenon. A new detector design involving both solid xenon and the Timepix detector will be presented.

Summary

Primary author(s) : Mr. WAGENPFEIL, Michael (ECAP)

Co-author(s) : Mr. FILIPENKO, Mykhaylo (ECAP); Dr. YOO, Jonghee (Fermi National Accelerator Laboratory); Dr. MICHEL, Thilo (ECAP); Dr. PAHLKA, Benton (Fermi National Accelerator Labratory); Prof. ANTON, Gisela (ECAP)

Presenter(s) : Mr. WAGENPFEIL, Michael (ECAP)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **55** Type : **Oral**

Development of technological prototype of silicon-tungsten electromagnetic calorimeter for ILD.

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

The best jet energy resolution required for precise physics measurements at ILC is achievable using a Particle Flow Algorithm (PFA) and highly granular calorimeters. As it was shown by CALICE international R&D collaboration, the silicon-tungsten imaging electromagnetic calorimeter provides the best granularity and jet resolution. After proving the PFA concept with physical prototypes in 2006-2011, an emphasis is now moved to building a technological prototype satisfying challenging physical, mechanical, electronic and thermal requirements. All chosen technologies should be reliable and scalable for a mass production of a future detector. We report on the current status of R&D, in particular, on beam, cosmic and charge injection tests of the technological prototype and on the tests of ECAL mechanical structure with embedded fiber Bragg grating optical sensors. We also report on our plans to build a realistic almost full-scale prototype detector of 1-1.5 m length and test it together with an existing 600 kg carbon fiber - tungsten mechanical structure in 2015 at CERN beams.

Summary

Primary author(s) : CORNAT, Remi Jean Noel (Ecole Polytechnique (FR)); Dr. ANDUZE, Marc (LLR); BALAGURA, Vladislav (Ecole Polytechnique (FR))

Co-author(s) : ON BEHALF OF ALL ILD SIW ECAL GROUP, . (.)

Presenter(s) : BALAGURA, Vladislav (Ecole Polytechnique (FR))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **194** Type : **Oral**

Development of the upgraded LHCf calorimeter with Gd2SiO5 (GSO) scintillators.

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The Large Hadron Collider forward (LHCf) experiment is designed to measure the hadronic production cross sections of neutral particles emitted in the very forward angles in p-p collision at the LHC. LHCf has reported energy spectra of forward photons and neutral pions at $\sqrt{s} = 900$ GeV and 7 TeV proton-proton collisions measured at LHC. Forward spectra can be helpful in verifying cosmic ray interaction models. The next operation in 2015 is expected under much higher radiation dose. Therefore, we are upgrading the detectors, especially their scintillators, to be radiation harder one. Plastic scintillator layers and Scintillating Fiber (SciFi) tracker are replaced with GSO layers and fine GSO hodoscope respectively. Basic properties of new sensors of the upgraded detector are measured by 400 MeV/n carbon beams at the Heavy Ion Medical Accelerator in Chiba (HIMAC) in June, 2012. Energy resolution and position resolution of the upgraded detector are evaluated by using electron beams of 50-250 GeV at Super Proton Synchrotron (SPS) in summer, 2012.
The results are understood by Monte Carlo simulations and are good enough for the requirements of the LHCf experiment.

Summary

Primary author(s) : Mr. MAKINO, Yuya (STEL, Nagoya University)

Co-author(s) : Prof. ITOW, Yoshitaka (STEL, Nagoya University); SUGIURA, Yuki (STEL, Nagoya University); MENJO, Hiroaki (Nagoya University (JP)); YOSHIDA, Kenji (Shibaura Institute of Technology (JP)); KASAHARA, Katsuaki (Waseda University (JP)); SHIMIZU, Yuki (Waseda University); SUZUKI, Takuya (Waseda University); TORII, Shoji (Waseda University (JP)); TAMURA, Tadahisa (Kanagawa University (JP)); HAGUENAUER, Maurice (Ecole Polytechnique Federale de Lausanne (CH)); TURNER, William C (Lawrence Berkeley Laboratory); KAWADE, Kentaro (N); ADRIANI, Oscar (Dipartimento di Fisica); BONECHI, Lorenzo (Istituto Nazionale di Fisica Nucleare (INFN)); BONGI, Massimo (Universita e INFN (IT)); D'ALESSANDRO, Lel (Universita e INFN (IT)); DELPRETE, Marina (Universita e INFN (IT)); MITSUKA, Gaku (Nagoya University (JP)); PAPINI, Paolo (INFN sezione di Firenze); Dr. RICCIARINI, Sergio Bruno (INFN); CASTELLINI, Guido (Dipartimento di Fisica); TRICOMI, Alessia (Universita e INFN (IT)); Dr. MASUDA, Kimiaki (STEL, Nagoya University); FAUS-GOLFE, Angeles (Instituto de Fisica Corpuscular (IFIC) UV-CSIC); PERROT, Anne-Laure (CERN); GRANDI, M. (Universita e INFN (IT)); VELASCO, J. (IFIC, Centro Mixto CSIC-UVEG, Spain); Dr. MATSUBARA, Yutaka (STEL, Nagoya University); MATSUBAYASHI, Eri (STEL, Nagoya University); Prof. MURAKI, Yasushi (STEL, Nagoya University); SAKO, Takashi (Nagoya University (JP)); Dr. SAKURAI, Nobuyuki (STEL, Nagoya University); ZHOU, Qidong (STEL, Nagoya University)

Presenter(s) : Mr. MAKINO, Yuya (STEL, Nagoya University)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **90** Type : **Oral**

Development of thin n-in-p pixel modules for the ATLAS upgrade at HL-LHC

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

We present the results of the characterization performed on n-in-p pixel modules produced with thin sensors, ranging in thickness from 100 to 200 µm, assembled to the ATLAS FE-I3 and FE-I4 read-out chips. Among these samples, the sensors produced at VTT (Finland), 100 µm thick, have been processed to obtain active edges, which considerably reduce the dead area at the periphery of the device down to 50 µm per side. This feature, together with the very reduced material budget, makes them attractive candidates to instrument the inner layers of the upgraded pixel system at HL-LHC. n-in-p sensors, 200 µm thick, with a standard guard-ring, produced by CIS (Germany) are manufactured without an handle-wafer and they represent reliable and cost-effective detectors to cover the large surface of the outer layers of the new pixel system. The different flavors of n-in-p pixel sensors are characterized by means of scans with radioactive sources and beam tests at the CERN-SPS and DESY. The results of these measurements will be discussed for devices before and after irradiation up to a fluence of 1.5x1016 neq cm-2 . The charge collection and tracking efficiency will be compared for the different sensor thicknesses.

Summary

Primary author(s) : MACCHIOLO, Anna (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Co-author(s) : PASCHEN, Botho Albrecht (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); Dr. NISIUS, Richard (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); TERZO, Stefano (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); WEIGELL, Philipp (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Presenter(s) : MACCHIOLO, Anna (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **409** Type : **Oral**

Developments in light readout for noble liquid experiments

Monday, 2 June 2014 17:10 (0:20)

Abstract content

SiGHT stays for Silicon Geiger Hybrid Tube for light detection. Our goal is to construct a modern, high performance, low radioactivity photo detector working at liquid argon and xenon temperature. The idea is to replace the classical dynodic chain of a PMT with a SiPM acting as an electron multiplying detector embedded in a low-radioactive fused silica envelope. This invention would represent a major breakthrough for the experiments of direct dark matter search with noble liquids. The status of the art of the project as well as preliminary results will be illustrated in this talk.

Summary

Primary author(s) : FIORILLO, Giuliana (Università degli Studi di Napoli "Federico II" e INFN (IT)); ROSSI, Biagio (Universita e INFN (IT))

Presenter(s) : ROSSI, Biagio (Universita e INFN (IT))

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **339** Type : **Oral**

Diamond Detectors for beam instrumentation

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

Diamond is perhaps the most versatile, efficient and radiation tolerant material available for use in beam detectors with a correspondingly wide range of applications in beam instrumentation. Numerous practical applications have demonstrated and exploited the sensitivity of diamond to charged particles, photons and neutrons. In this presentation, emphasis will be given to fast beam loss monitoring at the LHC and to neutron detection, where diamond can potentially be used as an He-3 replacement.

Summary

Diamond detectors have proven to be useful as fast beam loss instrumentation. At the LHC bunch-by-bunch losses are resolved and lead to new insight into the behaviour of the accelerator. Recent research has shown that diamond is also a proper candidate for neutron detection, where it proves to be a potential candidate to replace He-3 in the future.

Primary author(s) : Dr. ERICH, Griesmayer (CIVIDEC Instrumentation)

Co-author(s) : Mr. KAVRIGIN, Pavel (CIVIDEC)

Presenter(s) : Dr. ERICH, Griesmayer (CIVIDEC Instrumentation)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **262** Type : **Oral**

Diamond particle detectors systems in high energy physics

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

With the first three years of the LHC running complete, ATLAS and CMS are planning to upgrade their innermost tracking layers with more radiation hard technologies. Chemical Vapor Deposition (CVD) diamond is one such technology. CVD diamond has been used extensively in beam condition monitors as the innermost detectors in the highest radiation areas of BaBar, Belle, CDF and all LHC experiments. This talk will describe the lessons learned in constructing the ATLAS Beam Conditions Monitor (BCM), Diamond Beam Monitor (DBM) and the CMS Pixel Luminosity Telescope (PLT) all of which are based on CVD diamond with the goal of elucidating the issues that should be addressed for future diamond based detector systems. The talk will also present the first beam test results of prototype diamond devices with 3D detector geometry that should further enhance the radiation tolerance of this material.

Summary

Primary author(s) : TRISCHUK, William (University of Toronto (CA))

Co-author(s) : KAGAN, Harris (Ohio State University); OTHER, Members of (The RD42 Collaboration)

Presenter(s) : Prof. GAN, Kock Kiam (Ohio State University (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **237** Type : **Oral**

Direct Dark Matter Detection with the XENON and DARWIN experiments

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The XENON1T detector, currently under construction at the Gran Sasso Underground Laboratory (LNGS) in Italy, is a dual-phase (liquid-gas) xenon time-projection chamber (TPC) for particle detection. It is the successor of XENON100, which reached its sensitivity goal with the last limits on spin-independent WIMP-nucleus interaction (2e-45 cm^2 at 55GeV/c^2), the world-leading result at the time of publication. The construction of the water tank, to be employed as a shield for environmental radiation and as a Cerenkov muon veto, has ended at LNGS in 2013, most other subsystems are currently under construction. The total amount of xenon to be housed in the XENON1T cryostat is 3t, with a fiducial mass of about 1t. In order to detect the prompt and proportional VUV scintillation light from particle interactions with the xenon target, two arrays of 3-inch Hamamatsu R11410 photomultiplier tubes will be installed on the top and bottom of the TPC. The assembly of the inner detector components is planned for late 2014, and the science goal can be reached after two years of continuous operation by 2017. The next step in the XENON dark matter search program is the XENONnT project. It will double the amount of xenon in the sensitive volume (˜6t), which would allow to fiducialize the target to ˜4t. The XENONnT TPC with the inner cryostat vessel will be constructed while XENON1T is taking data, and will be installed in the same outer vessel and the water shield as XENON1T. The exploration of the entire experimentally accessible WIMP parameter space, down to a region where solar neutrino interactions become an irreducible background (and eventually provide a possibility to precisely measure their low-energy spectrum in real-time), is foreseen with an ultimate experiment at the 20 ton scale. The design and R&D works for such a project were initiated by the DARWIN (DArk Matter WImp search with Noble Liquids) consortium. In this talk, the current status and the plans of the XENON collaboration will be presented, with focus on the design details of the XENON1T experiment, as well as on the future multi-ton DARWIN project.

Summary

Primary author(s) : Dr. KISH, Alex (Physik-Institut UZH)

Presenter(s) : Dr. KISH, Alex (Physik-Institut UZH)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **120** Type : **Oral**

Electrode material and Detector Response for Gaseous detectors

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The gaseous detectors can be used in variety of applications including particle detection, medical imaging and radiological applications. We will present an extensive study of optical, structural and electrical properties performed for different electrode materials for gaseous detectors such as Resistive Plate Chambers. We also present the gas mixture composition studies with different gases for their detector performance and response. We include study on the variation of efficiency, counting rate over the period of operation and the leakage current dependence upon the temperature and humidity for different sizes of detectors. We hereby also cover similar but preliminary results on GEM detector.

Summary

Primary author(s) : Dr. KUMAR, Ashok (University of Delhi (IN))

Presenter(s) : Dr. KUMAR, Ashok (University of Delhi (IN))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **4** Type : **Oral**

Electron Test Beams at SLAC

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

We present the current status and plans of the various electron test beams available at SLAC National Accelerator Laboratory. They span an energy range of a few MeV in our ASTA, mainly used for gun development and RF structure testing, NLCTA, a 120 to 200 MeV linac for free electron laser seeding, dielectric laser acceleration and medical studies, to ESTB, the End Station (A) Test Beam, which uses 5 Hz of the LCLS 2 to 16GeV beam for ILC MDI and detector R&D studies with primary beam and singel electrons, to FACET, which has a very compressed and small spot size 20GeV beam for plasma wakefield acceleration, material science and other advanced acceleration concepts studies. For all these facilities an overview of past, present and future experiments and plans will be given.

Summary

Primary author(s) : Dr. HAST, Carsten (SLAC)

Presenter(s) : Dr. HAST, Carsten (SLAC)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **29** Type : **Oral**

EndoTOFPET-US: a novel multimodal tool for endoscopy and positron emission tomography

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

The EndoTOFPET-US project aims to jointly exploit Time-Of-Flight Positron Emission Tomography (TOFPET) and ultrasound endoscopy with a multi-modal instrument for diagnostic and therapeutic oncology. The development of two novel detectors is required, a PET head extension for a commercial US endoscope placed close to the region of interest (ROI) and a PET plate over the patient's abdomen in coincidence with the PET head. Technological challenges include: 1 mm image spatial resolution (SR), an unprecedented 200ps Coincidence Time Resolution (CTR) for enhanced background rejection, online tracking of both detectors and image reconstruction of images with partial volume information from an asymmetric geometry. The paper will present results achieved with the first prototype components of the EndoTOFPET-US detector. Characterization of 4096 LYSO crystals glued to 256 Hammamatsu MPPC matrices of 4x4 photo-detectors each, performance tests of two candidate ASIC chips for fast TOF readout, and performance studies of the digital silicon-photomultiplier detector for the endoscopic probe will be presented. The first system integration measurements will be shown, which demonstrate that the requirements in terms of SR and CTR are at reach.

Summary

Primary author(s) : GARUTTI, Erika (DESY)

Presenter(s) : GARUTTI, Erika (DESY)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **32** Type : **Oral**

Energy measurement with the SDHCAL prototype

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

The SDHCAL prototype that was completed in 2012 was exposed to beams of pions, electrons of different energies at the SPS of CERN for a total time period of 5 weeks. The data are being analyzed within the CALICE collaboration. However preliminary results indicate that a highly granular hadronic calorimeter conceived for PFA application is also a powerful tool to separate pions from electrons. The SDHCAL provides also a very good resolution of hadronic showers energy measurement. The use of multi-threshold readout mode shows a clear improvement of the resolution at energies exceeding 30 GeV with respect to the binary readout mode. New ideas to improve on the energy resolution using the topology of hadronic showers will be presented.

Summary

Primary author(s) : Dr. PETRUKHIN, Alexey (IPNL/CNRS)

Presenter(s) : Dr. PETRUKHIN, Alexey (IPNL/CNRS)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **134** Type : **Oral**

Energy response and temperature dependence of Ce:GAGG and Pr:LuAG coupled to SiPM

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

Molecular imaging modalities require sensor systems capable of detecting and identifying gamma rays emitted by radio-tracers as well as providing the complete position information. The combination of dense, new scintillator materials with compact photon detector solutions insensitive to magnetic fields provides a promising prospect to meet the requirements in modern combined molecular imaging modalities. The energy response and temperature dependence of both, the scintillator and photon sensor has been studied for two scintillator materials, Pr:LuAG and Ce:GAGG coupled to either a n-on-p or p-on-n type SiPM. The performance was compared to a CsI crystal coupled to a conventional small vacuum based photon sensor.

Summary

We studied new combinations of inorganic scintillators and SiPM in comparison to more established technologies to evaluate their suitability for nuclear imaging modalities in medicine.

Primary author(s) : Dr. SEITZ, Bjoern (University of Glasgow)

Co-author(s) : Dr. STEWART, Andrew (University of Glasgow); Mr. KAHLENBERG, Jan (University of Glasgow)

Presenter(s) : Dr. SEITZ, Bjoern (University of Glasgow)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **48** Type : **Oral**

Engineering studies for the inner region of the CLIC detector concepts

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

The strict requirements in terms of material budget for the inner region of the CLIC detector concepts require the use of a dry gas for the cooling of the respective sensors. This, in conjunction with the compactness of the inner volumes, poses several challenges for the design of a cooling system that is able to fulfil the required detector specifications. This presentation introduces a detector cooling strategy using dry air as a coolant and shows the results of computational fluid dynamics simulations and experimental measurements used to validate the proposed strategy. Furthermore, the progress on the development of lightweight detector support structures that fulfil both mass and stiffness requirements is also reported.

Summary

Primary author(s) : DUARTE RAMOS, Fernando (CERN)

Co-author(s) : NUIRY, Francois-Xavier (CERN); KLEMPT, Wolfgang (CERN); VILLAREJO BERMUDEZ, Miguel-Angel (Universidad de Valencia (ES))

Presenter(s) : DUARTE RAMOS, Fernando (CERN)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **71** Type : **Oral**

Evolution of the ReadOut System of the ATLAS experiment

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The ReadOut System (ROS) is a central and essential part of the ATLAS DAQ system. It receives and buffers data of events accepted by the first-level trigger from all subdetectors and first-level trigger subsystems. Event data are subsequently forwarded to the High-Level Trigger system and Event Builder via a 1 GbE-based network. The ATLAS ROS is completely renewed in view of the demanding conditions ex pected during LHC Run 2 and Run 3, to replace obsolete technologies and space constraints require it to be compact. The new ROS will consist of roughly 100 Linux-based 2U high rack mounted server PCs, each equipped with 2 PCIe I/O cards and two four 10 GbE interfaces. The FPGA-based PCIe I/O cards, developed by the ALICE collaboration, will be configured with ATLAS-specific firmware, the so-called RobinNP firmware. They will provide the connectivity to about 2000 optical point-to-point links conveying the ATLAS event data. This dense configuration provides an excellent test bench for studying I/O efficiency and challenges in current COTS PC architectures with non-uniform memory and I/O access paths. In this paper we will report on the requirements for Run 2 and on design choices for a system complying with and possibly exceeding them, as well as discuss the results of performance measurements for different computer architectures, highlighting the effects of non-uniform resource distributions. Finally we will present the status of the project and outlook for operation in 2015.

Summary

Primary author(s) : Dr. SALVATORE, Fabrizio (University of Sussex (GB))

Presenter(s) : VANDELLI, Wainer (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **160** Type : **Oral**

Experimental results for the Cherwell 1 and 2 MAPS sensors

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

We report on the status and performance of the CMOS Monolithic Active Pixel Sensor (MAPS) Cherwell 1 and 2 sensors for the detection of charged particles in vertexing, tracking, and calorimetry applications. Cherwell is a 4-T CMOS sensor in 180 nm technology on a 12um epitaxial substrate with low-noise, low-power, in-pixel correlated double sampling, and high conversion gain.
Cherwell 1 consists of four arrays, two optimized for vertexing and tracking applications, and two for digital calorimetry applications. The vertexing arrangements have a matrix of 96x48 pixels with a pitch of 25 um. The "reference array" is readout on a rolling shutter base with a fine resolution 12-bit, single-slope column parallel ADC. The "strixel" array has the readout and ADC circuits embedded in the space between the pixel diodes. The two sections for calorimetry have a matrix of 96x48 pixels with 25 um pitch and 48x24 pixels with 50 um pitch, respectively. Additional circuitry is added to provide charge summing of 2x2 pixels during readout.
Cherwell 2 is a prototype candidate sensor to be used in the upgrade of the ALICE Inner Tracker System at the LHC. It has three variants of a 128x128 pixel array on a 20um pitch using the strixel technology.
We report on the characterisation and performance of the prototypes, on the test bench and at the test beam.

Summary

Performance of two prototype CMOS MAPS sensors.

Primary author(s) : WILSON, Fergus (STFC - Rutherford Appleton Lab. (GB))

Co-author(s) : BEVAN, Adrian (University of London (GB)); TURCHETTA, renato (ral-stfc); LEMMON, Roy Crawford (STFC Daresbury Laboratory (GB)); VELTHUIS, Jaap

Presenter(s) : WILSON, Fergus (STFC - Rutherford Appleton Lab. (GB))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **291** Type : **Oral**

Fiber based hydrophones for ultra-high energy neutrino detection

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

It is a well studied process [1,2] of energy deposition of cosmic ray particles in water that generate thermo-acoustic signals. Hydrophones of sufficient sensitivity could measure this signal and provide a means of detecting ultra-high energetic cosmic neutrinos. We investigate optical fiber-based hydrophone technology that could potentially have several advantages over conventional hydrophones based on piezo ceramics. Optical fibers form a natural way to create a distributed sensing system in which several sensors are attached to a single fiber. The detection system in this case will consist of several sensors, an erbium doped fiber laser and an interferometric interogator. Next to the advantage of having multiple sensors on a single fiber, this technology has a low power consumption and no electromagnetic interference with other read-out electronics. Maybe even more important, fiber optics technology provides a cost-effective and straightforward way to implement a large number of hydrophones. This allows to establish a large scale experimental set-up with multi km^3 detection volume that is required for the expected low event rate of neutrino interactions at energies exceeding 10 PeV.

In this talk we will show the results of several measurement campaigns, e. g. in an anechoic bassin for calibration and hydrophone sensitivity measurements. Based on these measurements and realistic simulations we will investigate the feasibility of a potential future large scale neutrino detector based on fiber-based hydrophones.

1 G. A. Askaryan. Acoustic recording of neutrinos. Zemlia i Vselennaia 1 p13 (1979).

[2] J. G. Learned. Acoustic radiation by charged atomic particles in liquids: An analysis. Phys. Rev. D 19 p 3293 (1979).

Summary

Primary author(s) : Dr. BUIS, Ernst-Jan (TNO)

Co-author(s) : Mr. NIEUWLAND, Remco (TNO); Mr. TOET, Peter (TNO); Mr. DOPPENBERG, Ed (TNO); Dr. VAN EIJK, Daan (TNO); Dr. LAHMANN, Robert (Erlangen Centre for Astroparticle Physics, University of Erlangen)

Presenter(s) : Dr. BUIS, Ernst-Jan (TNO)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **60** Type : **Oral**

Fine Segmented Scintillator ECAL

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

The idea of using scintillator strips coupled with Pixelated Photon-Detector(PPD) has provided the ILD an electromagnetic calorimeter(ECAL) option with a lower cost. In the FNAL 2009 beam test, it was found that the prototype calorimeter of 30 layers could meet the stringent requirements of the ILD. Following this, efforts has been made to develop a more feasible ECAL in terms of performance, size and cost. With a more compact readout electronics and improved PPD, 2 layers of embedded front end electronics technological prototype was fabricated using 3 layers of 180x180mm^2 ECAL base unit(EBU), in which each EBU has 144 channels of 45x5mm scintillator strip coupled with the improved PPD. The two layers are arranged orthogonally and by using the Strip Splitting Algorithm(SSA), we could create a fine granularity of 5x5mm^2 for the Particle Flow Algorithm application. The layers were tested at DESY and the results of this beam test shall be presented. In addition, various studies has been made on the scintillator strip in order to further improve the ScECAL's performance such as to reduce the dead volume by PPD etc. The findings of these studies shall also be discussed and compared with the simulation results.

Summary

The ScECAL technological prototype shows no significant problems operating in a multilayer configuration and the SSA works well. The results from the beam test shows good energy deposit, low noisy or dead channel ratio and good scintillator uniformity. By modifying the scintillator strip shape and configuration, these performance can be further improved.

Primary author(s) : HAMASAKI, Ryutaro (Shinshu University); IEKI, Sei (University of Tokyo); KOTERA, Katsushige (Shinshu University); OGAWA, Tomohisa (Shinshu University); Dr. OOTANI, Wataru (ICEPP, University of Tokyo); Prof. TAKESHITA, Toru (Shinshu University (JP)); TEH, Lloyd (Shinshu University); TSUZUKI, Takuya (Shinshu University)

Presenter(s) : TEH, Lloyd (Shinshu University)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **281** Type : **Oral**

Firmware development and testing of the ATLAS IBL Back-Of-Crate card

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The ATLAS experiment is the the largest of the four LHC experiments. Currently its Pixel-Detector is being upgraded with a new innermost 4th layer, the Insertable b-Layer (IBL). The upgrade will result in better tracking efficiency and compensate radiation damages of the Pixel-Detector. Newly developed front-end electronics (FE-I4) will require a complete re-design of the Off-Detector- Electronics consisting of the Back-Of-Crate card (BOC) and the Read-Out-Driver (ROD). The main purpose of the BOC card is the distribution of the LHC clock to all Pixel-Detector components as well as interfacing the detector and the higher-level-readout optically. It is equipped with three Xilinx Spartan-6 FPGAs, one BOC Control FPGA (BCF) and two BOC Main FPGAs (BMF). The BMF are responsible for the signal processing of all incoming and outgoing data. The data-path to the detector is running a 40 MHz bi-phase-mark encoded stream. This stream is delayed by a fine delay block using Spartan-6 IODELAY primitives. The primitives are reconfigured using partial reconfiguration inside the FPGA. The 160 MHz 8b10b-encoded data-path from the detector is phase and word-aligned in the firmware and then forwarded to the ROD after decoding. The ROD it will send out the processed data which is then forwarded to the higher-level readout by the BOC card. An overview of the firmware, which has been developed, will be presented together with the results from production tests and the system test at CERN. One focus will be the partial reconfiguration and the results of the fine delay measurements.

Summary

For the new innermost layer of the ATLAS Pixel-Detector at CERN new off-detector hardware needs to be developed. The Back-Of-Crate card (BOC) is driving the optical interface to the detector and distributing the LHC clock to all detector components. A brief overview of the firmware and test results from production and system test will be presented.
Abstract

Primary author(s) : WENSING, Marius (Bergische Universitaet Wuppertal (DE))

Co-author(s) : FLICK, Tobias (Bergische Universitaet Wuppertal (DE)); BINDI, Marcello (Georg-August-Universitaet Goettingen (DE)); MATTIG, Peter (Bergische Universitaet Wuppertal (DE)); KUGEL, Andreas (Ruprecht-Karls-Universitaet Heidelberg (DE)); FALCHIERI, Davide (Universita e INFN (IT)); TRAVAGLINI, Riccardo (Universita e INFN (IT)); GABRIELLI, Alessandro (Universita e INFN (IT)); HEIM, Timon (Bergische Universitaet Wuppertal (DE)); POTAMIANOS, Karolos (Lawrence Berkeley National Lab. (US)); GROSSE-KNETTER, Joern (Georg-August-Universitaet Goettingen (DE))

Presenter(s) : WENSING, Marius (Bergische Universitaet Wuppertal (DE))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **283** Type : **Oral**

Firmware development and testing of the ATLAS Pixel Detector / IBL ROD card

Friday, 6 June 2014 11:20 (0:20)

Abstract content

The ATLAS Experiment is reworking and upgrading systems during the current LHC shut down. In particular, the Pixel detector is inserting an additional inner layer called Insertable B-Layer (IBL). The Readout-Driver card (ROD), the Back-of-Crate card (BOC), and the S-Link together form the essential frontend data path of the IBL's off-detector DAQ system. The strategy for IBLROD firmware development focused on migrating and tailoring HDL code blocks from PixelROD to ensure modular compatibility in future ROD upgrades, in which a unified code version will interface with IBL and Pixel layers. Essential features such as data formatting, frontend-specific error handling, and calibration are added to the ROD data path. An IBLDAQ testbench using realistic frontend chip model was created to serve as an initial framework for full offline electronic system simulation. In this document, major firmware achievements concerning the IBLROD data path implementation, tested in testbench and on ROD prototypes, will be reported. Recent Pixel collaboration efforts focus on finalizing hardware and firmware tests for IBL. Time plan is to approach a final IBL DAQ phase by the end of 2014.

Summary

Primary author(s) : TRONCON, Clara (Milano Universita e INFN (IT)); CHEN, Shaw-Pin (University of Washington (US))

Presenter(s) : CHEN, Shaw-Pin (University of Washington (US))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **119** Type : **Oral**

First Measurements of SuperCDMS SNOLAB 100 mm Diameter Germanium Dark Matter Detectors with Interleaved Charge and Phonon Channels

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

The first phase of the Super Cryogenic Dark Matter Search (SuperCDMS) SNOLAB experiment shall consist of a 110 kg array of germanium and silicon athermal phonon detectors. It is expected to reach an order of magnitude better sensitivity than has been achieved so far by the best experiments in the field. The technical challenges of commissioning a payload of this size have led to the development of 1.4 kg germanium detectors (100 mm diameter, 33 mm thick), which are 2.3 times larger than those presently in use in the SuperCDMS experiment at Soudan. The first results from testing of a prototype detector with interleaved phonon and charge channels are presented. The test results are promising for the use of these detectors in the next phase of SuperCDMS.

Summary

Primary author(s) : Dr. CHAGANI, H. (University of Minnesota)

Co-author(s) : Dr. BAUER, D. A. (Fermi National Accelerator Laboratory); Dr. HALL, J. (Fermi National Accelerator Laboratory); Dr. HASI, J. (SLAC National Accelerator Laboratory); Mr. HANSEN, S. (Fermi National Accelerator Laboratory); Dr. KELSEY, M. (SLAC National Accelerator Laboratory); Ms. KENNEDY, A. (University of Minnesota); Dr. KENNEY, C. J. (SLAC National Accelerator Laboratory); Dr. LEMAN, S. W. (Massachusetts Institute of Technology); Prof. MANDIC, V. (University of Minnesota); Dr. MIRABOLFATHI, N. (University of California, Berkeley); Mr. MONIN, S. (University of Minnesota); Dr. BRANDT, D. (SLAC National Accelerator Laboratory); Mr. NAGASAWA, D. (Stanford University); Dr. NOVAK, L. (Stanford University); Dr. PARTRIDGE, R. (SLAC National Accelerator Laboratory); Mr. PHENICIE, C. (University of Minnesota); Mr. PAGE, K. (Queen's University Kingston); Dr. PYLE, M. (University of California, Berkeley); Ms. RADPOUR, R. (University of Minnesota); Prof. RAU, W. (Queen's University Kingston); Mr. RESCH, R. (SLAC National Accelerator Laboratory); Prof. SADOULET, B. (University of California, Berkeley); Dr. BRINK, P. L. (SLAC National Accelerator Laboratory); Mr. SEITZ, D. N. (University of California, Berkeley); Dr. SERFASS, B. (University of California, Berkeley); Dr. SHANK, B. (Stanford University); Mr. STRANDBERG, D. (University of Minnesota); Dr. TOMADA, A. (SLAC National Accelerator Laboratory); Dr. VILLANO, A. N. (University of Minnesota); Mr. YEN, J. (Stanford University); Prof. YOUNG, B. A. (Santa Clara University); Mr. ZHANG, J. (University of Minnesota); Prof. CABRERA, B. (Stanford University); Mr. CHERRY, M. (Stanford University); Mr. CODOREANU, G. A. (University of Minnesota); Dr. DO COUTO E SILVA, E. (SLAC National Accelerator Laboratory); Prof. CUSHMAN, P. (University of Minnesota); Dr. GODFREY, G. L. (SLAC National Accelerator Laboratory)

Presenter(s) : Dr. CHAGANI, H. (University of Minnesota)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **272** Type : **Oral**

First prototype of a silicon tracker using an 'artificial retina' for fast track finding

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

We report on the R&D for a first prototype of a silicon tracker with trigger capabilities based on a novel approach for fast track finding. The working principle is inspired from neurobiology, in particular by the processing of visual images by the brain as it happens in nature. It is based on extensive parallelization of data distribution and pattern recognition. In this work we report on the design of a practical device that consist of a telescope based on single-sided silicon detectors; we describe the data acquisition system and the implementation of the track finding algorithms using available digital logic of commercial FPGA devices. Tracking performance and trigger capabilities of the device are discussed along with perspectives for future applications.

Summary

Primary author(s) : NERI, Nicola (Università degli Studi e INFN Milano (IT))

Co-author(s) : ABBA, Andrea (Università degli Studi e INFN Milano (IT)); WALSH, John (Sezione di Pisa (IT)); PETRUZZO, Marco (Universita' di Milano & INFN Milano); Dr. CAPONIO, Francesco (INFN Milano); Prof. GERACI, Angelo (Politecnico di Milano & INFN Milano); COELLI, Simone (INFN Milano); MONTI, Mauro (INFN Milano); PIUCCIO, Alessio (Unversita' di Pisa & INFN Pisa); CITTERIO, Mauro (Università degli Studi e INFN Milano (IT)); MARINO, Pietro (Sezione di Pisa (IT)); MORELLO, Michael Joseph (SNS and INFN-Pisa); PUNZI, Giovanni (Sezione di Pisa (IT)); RISTORI, Luciano (INFN and Fermilab); SPINELLA, Franco (Sezione di Pisa (IT)); STRACKA, Simone (Sezione di Pisa (IT)); TONELLI, Diego (CERN)

Presenter(s) : NERI, Nicola (Università degli Studi e INFN Milano (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **224** Type : **Oral**

First results from a 10bar Xe-TPC with 1kg fiducial mass, read out with Micro-Pattern Gas Detectors

Friday, 6 June 2014 15:00 (0:20)

Abstract content

Microbulk-Micromegas constitutes a new generation of Micromegas (MICRO MEsh GAseous Structure) used for the detection and tracking of particles. Its simplicity, inherited from its constituent element –a double copper-clad kapton foil–, enhances its radiopurity, making it particularly well suited for Rare Event searches. The energy resolution is amongst the best obtained with Micro-Pattern Gaseous Detectors (MPGD), with potential for an extremely fine segmentation, at the 100um scale or better. Within the R&D framework of the NEXT-100 ββ0ν experiment, we have commissioned a medium-size 70-liter, 700cm2(readout) x 38cm(drift) Xenon TPC with an 8mm x 8mm pixelated-readout (dubbed NEXT-MM) and operated it up to 10bar pressure (1kg fiducial mass).
We will present a full 3D characterization of the system at 1, 3 and 10bar pressure for point-like electron tracks stemming from low-energy X-rays (30keV), as well as extended ones from gamma-ray interactions (511keV), of interest in the most appealing next generation Xenon-based experiments. Emphasis will be put on the achievable energy resolution, energy threshold and topological capabilities.
Xenon has been doped with a mild 1-2% content of TMA. Ionization-wise Xe-TMA forms a convenient Penning mixture while TMA is known to exhibit fluorescence in the near-visible range thus eventually allowing for S1 (primary scintillation) sensitivity.

Summary

Primary author(s) : GONZALEZ DIAZ, Diego (Universidad de Zaragoza (ES))

Presenter(s) : GONZALEZ DIAZ, Diego (Universidad de Zaragoza (ES))

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **35** Type : **Oral**

First years of running for the LHCb calorimeter system

Monday, 2 June 2014 17:30 (0:20)

Abstract content

The LHCb experiment is dedicated to precision measurements of CP violation and rare decays of B hadrons at the Large Hadron Collider (LHC) at CERN (Geneva). It comprises a calorimeter system composed of four subdetectors: an electromagnetic calorimeter (ECAL) followed by a hadron calorimeter (HCAL). In addition the system includes in front of them the Scintillating Pad Detector (SPD) and Pre-Shower (PS). They are used to select transverse energy hadron, electron and photon candidates for the first trigger level and they provides the identification of electrons, photons and hadrons as well as the measurement of their energies and positions.

The calorimeter has been pre-calibrated before its installation in the pit, and the calibration techniques have been tested with the data taken in 2010. During operation, hadronic, leptonic and photon triggers of particular interest for hadronic B decays and radiative decays are provided by the calorimeter system.

The design and construction characteristics of the LHCb calorimeter will be recalled. Strategies for monitoring and calibration during data taking will be detailed in all aspects. Scintillating fibres, plastics and photomultipliers suffer from ageing due to radiation damage or high currents. Different methods which are used to calibrate the detectors and to recover the initial performances will be presented. The performances achieved will be illustrated in selected channels of interest for B physics.

Summary

The LHCb experiment is dedicated to precision measurements of CP violation and rare decays of B hadrons at the Large Hadron Collider (LHC) at CERN (Geneva) [1, 2]. LHCb is a single-arm spectrometer with a forward angular coverage from approximately 10 mrad to 300 mrad. It comprises a calorimeter system composed of four subdetectors [3], selecting transverse energy hadron, electron and photon candidates for the first trigger level (L0), which makes a decision 4μs after the interaction. It provides the identification of electrons, photons and hadrons as well as the measurement of their energies and positions. The set of constraints resulting from these functionalities defines the general structure and the main characteristics of the calorimeter system and its associated electronics. A classical structure of an electromagnetic calorimeter (ECAL) followed by a hadron calorimeter (HCAL) has been adopted. In addition the system includes in front of them the Scintillating Pad Detector (SPD) and Pre-Shower (PS), which are two planes of scintillating pads separated by a 2.5 radiation length lead sheet, aimed at tagging the electric charge and the electromagnetic nature of the calorimeter clusters for the first level of trigger. ECAL, PS and SPD account for about 6000 channels each with three degrees of granularity, concentric around the beam pipe, namely, the inner, the middle and the outer parts. HCAL is made of about 1500 channels and is divided into two parts only. All four detectors are arranged in pseudo-projective geometry and follow the general principle of reading the light from scintillator tiles with wave-length shifting fibers, and transporting the light towards photomultipliers, all following the 25 ns readout. During operation, hadronic, leptonic and photon triggers of particular interest for hadronic B decays and radiative decays were provided by the calorimeter system. The calorimeter has been pre-calibrated before its installation in the pit, and each part of the calorimeter system follows a different strategy for calibration. The calibration techniques

have been tested with the data taken in 2010 and have evolved to improve performances taking benefit of the high statistics recorded. Detector ageing are scrutinized regularly. They affect detector response and trigger rates but the severity of the impact on data depends on the detector type and of its use. Calibration techniques are also used to compensate for these effects. Regularly, a precise calibration is derived from a large sample of pi0 from two separated photons. Short term effects are followed with electrons from conversion looking at the ratio of the deposited energy of the electron in the calorimeter to its momentum measured by the tracking system (E/p) in ranges of ˜40 pb-1. Initial performances of the electromagnetic calorimeter and its expected resolution are recovered for pi0 and B decays including photons.
The design and construction characteristics of the LHCb calorimeter will be recalled. Strategies for monitoring and calibration during data taking will be detailed in all aspects. Scintillating fibres, plastics and photomultipliers suffer from ageing due to radiation damage or high currents. Different methods which are used to calibrate the detectors and to recover the initial performances will be presented. The performances achieved will be illustrated in selected channels of interest for B physics.
References: 1 LHCb Collaboration, The LHCb Detector at the LHC, JINST 3 S08005 (2008), and references therein. [2] LHCb collaboration, A large Hadron Collider Beauty experiment, Technical Proposal, CERN/LHCC 1998-004. [3] LHCb Collaboration, LHCb calorimeters Technical Design Report, Technical Design Report, CERN/LHCC 2000-036.

Primary author(s) : PERRET, Pascal (Univ. Blaise Pascal Clermont-Fe. II (FR))

Presenter(s) : PERRET, Pascal (Univ. Blaise Pascal Clermont-Fe. II (FR))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **129** Type : **Oral**

Frontend Electronics for high-precision single photo-electron timing

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

High-precision single photon timing with resolutions well below 100 ps is becoming increasingly important. It enables new detector designs, like the Time-of-Propagation DIRC of Belle II, or the TORCH upgrade for LHCb, and to improve existing designs, e.g. allow chromatic corrections in DIRCs. These applications have in common a high channel density, limited available space and low power consumption.
We report on Frontend Electronics developed for the PANDA Barrel DIRC. The customised design utilises high-bandwidth pre-amplifiers and fast discriminators providing LVDS output signals which can be directly fed into the TRBv3 readout using FPGA-TDCs with a precision better than 20ps RMS. The discriminators also provide Time-over-Threshold (ToT) information which can be used for walk corrections thus improving the obtainable timing resolution. Two types of cards, optimised for reading out 64-channel Photonis Planacon MCP-PMTs, were tested: one based on the NINO ASIC and the other, called PADIWA, on FPGA-based discriminators. Both types feature 16 channels per card, thus requiring four cards to read out one 64-channel MCP-PMT. Power consumption for the complete readout of one Planacon MCP-PMT is approx. 10W for the NINO FEE and approx. 5W for the PADIWA FEE.
The timing performance of the cards was tested with a fast laser system and also in a test experiment at the MAMI accelerator in Mainz using a small DIRC prototype to image Cherenkov patterns. In both cases, using the ToT information, a timing resolution of better than 100ps was found for the complete readout chain.

Summary

Primary author(s) : Dr. HOEK, Matthias (Johannes Gutenberg-Universitaet Mainz); Mr. CARDINALI, Matteo (Johannes Gutenberg-Universitaet Mainz)

Presenter(s) : Dr. HOEK, Matthias (Johannes Gutenberg-Universitaet Mainz); Mr. CARDINALI, Matteo (Johannes Gutenberg-Universitaet Mainz)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **170** Type : **Oral**

Future Upgrades for the PHENIX Experiment at RHIC: From sPHENIX to ePHENIX

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

The PHENIX Experiment at RHIC is planning a series of major upgrades that will enable a comprehensive measurement of jets in relativistic heavy ion collisions, provide enhanced physics capabilities for studying nucleon-nucleus and polarized proton collisions, and allow a detailed study of electron-nucleus collisions at a future Electron Ion Collider (eRHIC) at Brookhaven. These upgrades will include a number of major new detector systems. The first stage, sPHENIX, will utilize the former BaBar solenoid magnet and will include two new large calorimeters, one electromagnetic and another hadronic, for measuring jets in heavy ion collisions. These calorimeters will cover a region of ± 1.1 in pseudorapidity and 2pi in phi, and will result in a factor of 6 increase in acceptance over the present PHENIX detector. Plans are also being developed to add a preshower detector in front of the electromagnetic calorimeter and additional tracking inside the magnet. The current RHIC schedule would allow the installation of sPHENIX to take place starting around 2017-2018 and begin taking data ˜2020. Following this, RHIC would be transformed into an Electron Ion Collider and additional detectors would be added to sPHENIX to convert it to ePHENIX which would serve as a detector for eRHIC. This would involve adding additional tracking in the form of a central TPC and a system of GEM trackers, a high resolution crystal endcap calorimeter, a forward electromagnetic and hadronic calorimeter, and a set of particle id detectors, including a DIRC, a gas RICH and an aerogel detector. This talk will discuss the evolution of the current PHENIX detector to sPHENIX and ePHENIX, the R&D that is being pursued to develop the various detectors that will be needed, and the opportunities and challenges for each of their technologies. A separate contribution to this conference will describe the central electromagnetic and hadronic calorimeters for sPHENIX, including results from a recent beam test of prototypes of both of these detectors at Fermilab.

Summary

The PHENIX Experiment has been running at RHIC since 2000 and has accumulated a wealth of data on relativistic heavy ion collisions, nucleon-nucleus collisions and polarized proton collisions. It is one of the major RHIC experiments that contributed to the discovery of the Quark Gluon Plasma and is still in operation today. It has been focused on the systematic study of the QGP near its critical temperature using a variety of different probes, but questions such as how and why the quark-gluon plasma behaves as a perfect fluid in the vicinity of strongest coupling (near 1–2 Tc) can only be fully addressed with jet observables at RHIC energies which probe the medium over a variety of length scales. Comparing these measurements with ones probing higher temperatures at the LHC will provide valuable insight into the thermodynamics of QCD. PHENIX in its present form covers roughly half of the full azimuthal acceptance and 0.7 units of rapidity with a suite of different detectors, including an electromagnetic calorimeter. In order to increase this coverage for a complete systematic study of jets, the PHENIX Collaboration is proposing a new upgraded detector, sPHENIX, that will utilize the former BaBar solenoid magnet and instrument it with two new calorimeters, one electromagnetic and one hadronic, that will cover the full azimuth

and 2.2 units of rapidity. The hadronic calorimeter will be a steel plate and scintillating tile design that is read out with wavelength shifting fibers and silicon photomultipliers (SiPMs). The EMCAL will be a tungsten-scintillating fiber design that will also be read out using SiPMs. There are also plans to add a silicon-tungsten preshower detector in front of the EMCAL. The initial tracking system for sPHENIX will utilize the existing PHENIX silicon vertex detector, and will add additional silicon tracking layers in the future. The current plan is to run with the existing PHENIX detector through 2016 followed by the installation of sPHENIX in 2017. Data taking with sPHENIX would begin ~ 2020 and last 2-3 years. This would then be followed by the transition of RHIC to an Electron Ion Collider (eRHIC), which would collide electrons, initially up to 10 GeV, with hadrons up to 250 GeV and heavy ions up to 100 GeV/A. eRHIC will allow a detailed study of the spin and momentum structure of the nucleon, an investigation of the onset of gluon saturation in heavy nuclei, and the study of hadronization in cold nuclear matter. sPHENIX will also be transformed into a new enhanced detector, ePHENIX, that will provide the necessary capabilities to study this new physics. This will include the addition of a high resolution crystal calorimeter in the electron going direction and a forward spectrometer in the hadron going direction. The forward spectrometer will consist of an EMCAL and HCAL, similar in design to the central sPHENIX calorimeters, along with a gas RICH that utilizes a photosensitive GEM detector and an aerogel Cherenkov detector. The central region will be augmented with a fast drift TPC with a GEM readout and full azimuthal coverage a DIRC detector. Additional GEM trackers will also be added to the central, forward and backward going regions. The plan would be for eRHIC and ePHENIX to start taking data sometime in the mid to late 2020's. This talk will describe the long range plans for RHIC and the PHENIX detector, but will focus mainly on the new detectors and technologies that are planned for sPHENIX and ePHENIX. The two new calorimeters for sPHENIX have already undergone considerable design and prototypes of each detector have been constructed. These prototypes will be tested at Fermilab in February 2014 and preliminary results from these tests should be available by the time of the conference. The calorimeters and the test results will be described in a separate contribution to the conference.

Primary author(s) : Dr. WOODY, Craig (Brookhaven National Lab)

Presenter(s) : Dr. WOODY, Craig (Brookhaven National Lab)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **330** Type : **Oral**

GPU for online processing in low-level trigger

Friday, 6 June 2014 12:00 (0:20)

Abstract content

We describe a pilot project for the use of GPUs (Graphics processing units) in online triggering applications for high energy physics experiments.
General-purpose computing on GPUs is emerging as a new paradigm in several fields of science, although so far applications have been tailored to the specific strengths of such devices as accelerator in offline computation. With the steady reduction of GPU latencies, and the increase in link and memory throughput, the use of such devices for real-time applications in high-energy physics data acquisition and trigger systems is becoming ripe.
We will discuss in details the use of online parallel computing on GPU for synchronous low level trigger. We will show the results of two solution to reduce the data transmission latency: the first based on fast capture special driver and the second based on direct GPU communication using NaNet, a multi-standard, FPGA-based, low-latency, PCIe network interface card with GPUDirect capabilities. We will present preliminary results on a first field test in the CERN NA62 experiment.
This study is done in the framework of GAP (GPU application project), a wider project intended to study the use of GPUs in real-time applications.

Summary

Primary author(s) : LAMANNA, Gianluca (Sezione di Pisa (IT))

Co-author(s) : SOZZI, Marco (Sezione di Pisa (IT)); BIAGIONI, Andrea (INFN); FIORINI, Massimiliano (Universita di Ferrara (IT)); COTTA RAMUSINO, Angelo (Universita di Ferrara (IT)); CHIOZZI, Stefano (Universita di Ferrara (IT)); GIANOLI, Alberto (Universita di Ferrara (IT)); Dr. NERI, Ilaria (University of Ferrara); Dr. PAOLUCCI, Pier Stanislao (INFN Roma); Dr. SIMULA, Francesco (INFN Roma); PIANDANI, Roberto (Sezione di Pisa (IT)); FANTECHI, Riccardo (INFN - Sezione di Pisa); SANTONI, Cristiano (Universita e INFN (IT)); PICCINI, Mauro (INFN - Sezione di Perugia (IT)); MESSINA, Andrea (CERN); BAUCE, Matteo (Universita e INFN, Roma I (IT)); LONARDO, Alessandro (Universita e INFN, Roma I (IT)); VICINI, Piero (INFN Rome Section)

Presenter(s) : FIORINI, Massimiliano (Universita di Ferrara (IT))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **102** Type : **Oral**

Genetic multiplexing for particle detectors

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

Modern physics experiments require particle detectors with excellent performance, in particular the spatial resolution of trackers. This usually leads to systems with very high numbers of electronic channels, from 10,000 to several millions. All these channels represent a significant cost of an apparatus, even if in many cases the useful signal is concentrated on a small fraction of them, for a given event. Using the redundancy of the signal, in particular in Micro-Pattern Gaseous Detectors (MPGDs), we have developed a multiplexing technique that can considerably reduce the size of the electronics. A first Micromegas prototype has been tested with 1024 strips readout by 61 channels, showing à 90% efficiency to MIPs. Another prototype built from the resistive technology will be tested in April, to reach efficiency close to 100%. This multiplexing can be easily used in physics experiments to optimize the size of the electronics to the incident flux, and extended to other types of detectors. Furthermore, it offers many new applications beyond particle physics, like in volcanology or archeology. Several industrials also express interest for this technology, in particular for mining exploration.

Summary

Primary author(s) : PROCUREUR, Sebastien (CEA/IRFU,Centre d'etude de Saclay Gif–sur-Yvette (FR))

Presenter(s) : PROCUREUR, Sebastien (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **158** Type : **Oral**

HARPO - TPC for High Energy Astrophysics and Polarimetry from the MeV to the TeV

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

Observation of high-energy sources requires gamma-ray telescopes aboard balloons or satellites to study thermal and non thermal phenomena (black holes, neutron stars, active galactic nuclei, supernovae, supernova remnants, and gamma-ray bursts). In recent years, R&D has been mainly active to improve the sensitivity required for polarimetry. In this context, a concept of a Time Projection Chamber (TPC) was proposed as an active target and pair production imager with a high angular resolution and background reduction capabilities.
After introducing the HARPO TPC and its potential as gamma-ray telescope, we will present the characterization of the TPC readout plane which provides gas electron amplication within a microstructure composed of the association of a Micromegas and Gas Electron Multiplier. Recent results using cosmic-ray events will be shown and nally the beam test, scheduled this year, with polarized photon at MeV energy will be discussed.

Summary

D. Bernard, P. Bruel, M. Frotin, Y. Geerebaert, B. Giebels, P. Gros, D. Horan, P. Poilleux, I. Semeniouk, S. Wang
LLR, Ecole Polytechnique CNRS/IN2P3, 91128 Palaiseau France
S. Anvar, D. Attie, P. Colas, A. Delbart, D. Gotz, P. Sizun
CEA, Irfu, CEA-Saclay, F-91191 Gif-sur-Yvette, France

Primary author(s) : Dr. ATTIE, David (CEA/DSM/DAPNIA/SPP); GROS, Philippe (Ecole Polytechnique (FR))

Presenter(s) : GROS, Philippe (Ecole Polytechnique (FR))

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **162** Type : **Oral**

High granularity scanner for MPGD based photon detectors

Monday, 2 June 2014 17:30 (0:20)

Abstract content

Gaseous detectors can be made sensitive to photons, and become excellent choice for applications such as Cherenkov radiation imaging for particle identification. Micopattern Gaseous Detector (MPGD) technologies opened new ways to photon detection, where the possibility for reduced ion feedback, better timing and the suppression of non-photon signals are factors of improved performance. On the other hand the microstructure of an MPGD renders the photo-electron emission, transfer and subsequent detection to be a very complex process.
We have developed a high resolution UV photon scanner, where single photon-electron response measures local detection efficiency and gas gain with position resolution better than 100 microns. Studies on Thick GEM based photon detectors proved the existence of inefficient symmetry points, and shed light on hole-gain structure and microscale variance. In fact practically all MPGD detectors, even if not designed for photon detection in the first place, can be made sensitive, and thus be explored, by the scanning system. Measurement of the microsturcture of the charge transport can lead to a better understanding of the detection mechanisms, and help in optimization of various MPGD, especially for Cherenkov detectors.
The presentaion will focus on details of the critical parts of such a system; and recent results on TGEM microstructure with its dependence on the applied micropattern configurations.
Ref.: Nucl.Instr.Meth. A 694 (2012) 16

Summary

Primary author(s) : HAMAR, Gergo (Wigner RCP, Budapest); VARGA, Dezso (Wigner RCP, Budapest)

Presenter(s) : HAMAR, Gergo (Wigner RCP, Budapest)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **44** Type : **Oral**

High rate, fast timing RPC for future LHC experiments upgrade

Friday, 6 June 2014 11:20 (0:20)

Abstract content

New generation of RPC using semi-conductive plates could provide an excellent choice for the upgrade of LHC muon detectors. These cost-effective GRPC stand high particle rate. The excellent timing they can provide could allow to improve on the trigger rate and reduce the pileup consequences of the LHC luminosity increase.
Single and multi-gap GRPC using low-resistivity glass are being proposed to equip high eta region of experiments such CMS. Electronics readout with a time measurment precison of less than 25 ps is being developped to equip such detectors.

Summary

With the increase of the LHC luminosity foreseen in the coming years many detectors currently used in the different LHC experiments will be dramatically impacted and some need to be replaced. The new ones should be capable not only to support the high particle rate but also to provide excellent timing to reduce the data ambiguity due to the expected high pileup. RPC using low-resistivity glass are proposed to equip the very forward region of the LHC experiments. In their single-gap version they can stand rates of few kHz/cm2. Their time precision of about 1ns could in principle allow to reduce the noise contribution, leading to an improvement of the trigger rate. In their multi-gap version they can do better in both the particle rate detection and the time precision measurement. Time precision of less 25 ps could be obtained. This aims at reducing the ambiguity the high expected pileup will introduce. In both cases new electronics equipped with excellent timing precision measurement are being developed to read out the RPC detectors. Tests are ongoing to validate the different scenarios.

Primary author(s) : Prof. LAKTINEH, Laktineh (Universite Claude Bernard-Lyon I (FR))

Presenter(s) : Prof. LAKTINEH, Laktineh (Universite Claude Bernard-Lyon I (FR))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **123** Type : **Oral**

High sensitivity observation for celestial MeV gamma rays by Electron Tracking Compton camera with a balloon borne experiment

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

For next MeV gamma-ray astronomy, we developed Electron Tracking Compton Camera (ETCC) consisting of a Time projection Chamber and pixel scintillators. By measuring the track of an electron, ETCC measures the direction of gamma-rays as a small arc, which provides a good background rejection using the kinematical test and energy loss rate of the track (particle identification), and clear imaging. Already we revealed its strong background rejection ability by the balloon experiment (a 10cm-cube ETCC: SMILE-I) in 2006, where 98% background events were removed. In 2013 we completed a 30cm cube ETCC to catch gamma-rays from Crab in next SMILE-II balloon experiment with >5shigma for several hours. The tracking efficiency was improved with 10 times, which enables to select the Compton event in TPC using only the energy loss rate of the track with distinguishing it from all backgrounds. Thus, we can extract the maximum detection efficiency expected by the simulation. Also SPD angle provides a several times better contract in image than conventional Compton method. Then, SMILE-II would provide a 5times better sensitivity than COMPTEL with the use of 3atm CF4 gas, and 40cm-cube ETCCs onboard satellite is expected to reach near 10-12 ergcm-2s-1. To verify this performance, SMILE-II was irradiated by secondary gammas and neutron from water target using 140MeV proton beam, and measured the clear image of a weak source under 10times stronger radiation than that in the balloon altitude. Here we will present the detail of the SMIEL-II performance including this beam test.

Summary

Primary author(s) : TANIMORI, Toru (Kyoto University)

Co-author(s) : Prof. KUBO, Hidetoshi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMURA, Yoshitaka (Department of Physics, Kyoto University, Kyoto, Japan); Mr. ODA, Makoto (Department of Physics, Kyoto University, Kyoto, Japan); Dr. SONODA, Shinya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TOMONO, Dai Tomono (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TAKADA, Atsushi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIUCHI, Kentaro (epartment of Physics, Kobe University, Japan); Dr. PARKER, Joseph (Department of Physics, Kyoto University, Kyoto, Japan); Mr. KOMURA, Shotaro (Department of Physics, Kyoto University, Kyoto, Japan); Mr. SAWANO, Tatsuya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. NAKAMURA, Kiseki (Department of Physics, Kyoto University, Kyoto, Japan); Mr. NAKAMURA, Shogo (Department of Physics, Kyoto University, Kyoto, Japan); Mr. MATSUOKA, Yoshihiro (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMOTO, Tatsuya (Research Institute for Sustainable Humanosphere, Kyoto Univ.Japan)

Presenter(s) : TANIMORI, Toru (Kyoto University)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **431** Type : **Oral**

High-gradient accelerator technology

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

In contrast to existing linear accelerators (LINAC) based on superconductivity, several institutes are currently developing high gradient LINACs based on normal-conducting cavities. A LINAC based on this technique has some intrinsic advantages over their superconducting cousins e.g. lack the necessity for cryogenic cooling, can obtain larger accelerating gradients and hence allow for a reduced length of the accelerator. These advantages are key in the realization of multi GeV/TeV research accelerators such as the Compact Linear Collider at CERN.
The mechanical properties of these high-gradient accelerator parts touch the limits of what is achievable with currently available manufacturing techniques. The increasing technical specifications and demands for volume-production not only drive industry to improve their currently available techniques but also to industrialize techniques newly developed by the research institutes. In this process of maturation from a proof-of-principle setup to building a fully operational accelerator, science will benefit from the knowledge in industry on redesign for manufacturability and series production. On the other hand, the newly achieved and industrialized competences are typically not limited to the fabrication of accelerator parts but applicable over a broader range of products. Hence, the main-stream customers of the industrial partners will finally benefit to from the "technology transfer" too.
Furthermore, normal-conducting techniques are not limited to research accelerators but also find their ways in commercial and medical applications. Applications in which other advantages of the normal conducting accelerator e.g. cost of owner-ship, real-estate size, reliability and maintainability play a far more important role than the shear accelerating gradient.

Summary

Primary author(s) : Dr. JANSSEN, Xander (VDL ETG Research)

Presenter(s) : Dr. JANSSEN, Xander (VDL ETG Research)

Session Classification : V.a Industrial Liaisons

Track Classification : Technology transfer: 5a) Industry Liaisons

Contribution ID : **152** Type : **Oral**

High-precision fiber-optical timing distribution systems over large distances and their application to astroparticle physics facilities

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

Future astroparticle physics facilities like CTA 1 and KM3NeT [2] require a relative timing precision better than 1 ns between detector elements separated by up to 100 km. At the same time, fiber-optical links for high-capacity data transfer from detector elements to central processing facilities are needed. The Open Hardware project White Rabbit [3] provides both data and time transfer functionality over the same optical fiber, and its implementation is currently being investigated for both facilities. Here, we present the current implementation status and performance measurements. In addition, propagation delays of optical 10 Gb/s data over a 75 km long amplified fiber link have recently been determined with an uncertainty of 4 ps [4]. This opens up the possibility of even more precise, picosecond-level precision time transfer over long-distance optical communication links for wide-area astroparticle detector arrays.
1 http://www.cta-observatory.org/ [2] http://www.km3net.org/ [3] http://www.ohwr.org/projects/white-rabbit [4] http://www.opticsinfobase.org/oe/fulltext.cfm?uri=oe-21-26-32643&id=276383

Summary

Primary author(s) : BERGE, David (NIKHEF (NL))

Co-author(s) : JANSWEIJER, Peter Paul Maarten (NIKHEF (NL)); DE JONG, Maarten (NIKHEF (NL)); Mr. KLUIT, Ruud (Nikhef (NL)); Dr. KOELEMEIJ, Jeroen (LaserLaB and Dept. Physics & Astronomy, VU University)

Presenter(s) : BERGE, David (NIKHEF (NL)); JANSWEIJER, Peter Paul Maarten (NIKHEF (NL)); Dr. KOELEMEIJ, Jeroen (LaserLaB and Dept. Physics & Astronomy, VU University)

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **164** Type : **Oral**

Impact of Low-Dose Electron Irradiation on the Charge Collection of n+p Silicon Strip Sensors

Friday, 6 June 2014 15:00 (0:20)

Abstract content

The response of p+n strip sensors to electrons from a 90Sr source and focussed laser light with different wave lengths was measured using the ALiBaVa read-out system. The measurements were performed over a period of several weeks, during which a number of operating conditions were varied. The sensors were fabricated by Hamamatsu on 200 μm thick float-zone silicon. Their pitch is 80 μm, and both p-stop and p-spray isolation of the p+n strips were studied. The electrons from the 90Sr source were collimated to a spot with a full-width-at-half maximum of 1.8 mm at the sensor and the dose rate at the maximum in the SiO2 was about 0.6 mGy/s. The estimated dose at the end of the measurements was about 1 kGy in SiO2. In addition, test structures (pad diodes, MOS capacitors with and without p-stop and p-spray implants, and gate-controlled diodes) fabricated together with the sensors, were investigated for X-ray doses of up to 1 kGy in SiO2 in order to determine technological parameters and their dependencies on X-ray dose. As function of irradiation time with the 90Sr source significant changes in charge collection and charge sharing are observed. Annealing studies with temperatures up to 80°C have shown that the observed changes are only partially reversed. The observations are qualitatively explained with the help of TCAD simulations. The relevance of the measurements for the design and the use of p+n strip sensors in different radiation environments are discussed.

Summary

Primary author(s) : Mr. KLANNER, Robert (University of Hamburg)

Presenter(s) : Mr. KLANNER, Robert (University of Hamburg)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **213** Type : **Oral**

Impact of the radiation background on the CMS muon high-eta upgrade for the LHC high luminosity scenario

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The CMS experiment is preparing an upgrade of its muon detection system, one of the main purposes is to extend the muon detection capabilities in the very forward region (|eta|>1.6) with the installation of new stations of Cathode Strip Chambers (CSC) and Gas Electron Multiplier (GEM) detector technologies for the second (2019) and third (2023) CMS upgrade scenarios. With the increase of the LHC luminosity to 10E34cm-2s-1 an unprecedented and hostile radiation environment will be created, the subsystems most affected will be the ones located in the very forward region where the intense flux of neutrons and photons (from nuclear interactions) can potentially degrade the performance in terms of muon detection and triggering. Using FLUKA simulation the expected radiation background rates are calculated for the regions of interest, the impact on the detector performance is evaluated and possible radiation shielding scenarios are studied.

Summary

Primary author(s) : CASTANEDA HERNANDEZ, Alfredo Martin (Texas A & M University (US))

Presenter(s) : CASTANEDA HERNANDEZ, Alfredo Martin (Texas A & M University (US))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **0** Type : **Oral**

Improvements to the Fermilab Test Beam Facility

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

The Fermilab Test Beam Program provides flexible, equal, and open access to test beams for all detector tests, with relatively low bureaucratic overhead and a guarantee of safety, coordination, and oversight. The facility provides a multitude of particle and energy types, as well as an array of instrumentation with an extensive infrastructure. Recently Fermilab went through a 14 month downtime for accelerator and facility upgrades. During this time, many extensive upgrades were made to the facility including temperature regulation, remote control systems, and instrumentation upgrades.

Summary

The Fermilab Test Beam Program provides flexible, equal, and open access to test beams for all detector tests, with relatively low bureaucratic overhead and a guarantee of safety, coordination, and oversight. The facility provides a multitude of particle and energy types, as well as an array of instrumentation with an extensive infrastructure. Recently Fermilab went through a 14 month downtime for accelerator and facility upgrades. During this time, many extensive upgrades were made to the facility including temperature regulation, remote control systems, and instrumentation upgrades. Patch Panel, Cable, & Network Upgrade Insulation of MT6.2 Enclosure Addition of 2C hut Camera Upgrade Alignment Laser Upgrade Communication System Upgrade Tracking System Upgrade Control Rooms re-configuration Electronics Room Re-configuration Motion Table Control System Upgrade

Primary author(s) : SOHA, Aria (Fermilab)

Presenter(s) : SOHA, Aria (Fermilab)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **227** Type : **Oral**

InGrid: Pixelated Micromegas detectors for a pixel TPC

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

Within the LCTPC collaboration several possibilities to build a time projection chamber for a linear collider are studied. In all concepts, micro-pattern gaseous detectors (MPGD) are used as amplification structure. Compared to the traditional pad-based readouts used in most cases, a pixelated TPC is a new approach. Only pixel ASICs can reflect the high granularity of MPGDs from the readout side. The idea to combine these two technologies was already conceived ten years ago. Such devices, called InGrids, are produced in a photolithographic process, when a grid is post-processed on a Timepix ASIC.
While the first InGrids were built on a single chip basis at the University of Twente, today whole wafers with 107 chips can be processed at the Fraunhofer IZM Berlin. Such a mass production is one cornerstone on the way to a pixel TPC. As a first step, a demonstrator module with about 100 InGrids is under development in our group. Another key element for this project is the system to read out such a module. The Scalable Readout System (SRS), developed by the RD51 collaboration, is suitable for this task as it is based on a modular structure, that can be extended from a single chip readout to larger systems.
In test beam campaign with a sub-component of the demonstrator module the readout system, the InGrid detectors and other components were successfully tested. Besides these results, the roadmap to a pixel TPC demonstrator will be presented.

Summary

Primary author(s) : LUPBERGER, Michael (University of Bonn)

Presenter(s) : LUPBERGER, Michael (University of Bonn)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4b) MEMS

Contribution ID : **97** Type : **Oral**

Interferometric Readout for a Monolithic Accelerometer, towards the fm/rtHz

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

In order to make a really precise vibration sensor, a monolithic accelerometer, in which a mass is suspended by a pendulum and an inverted pendulum, is read out using a tabletop Michelson interferometer (IFO). To measure the position of the mass, a corner cube attached to the suspended mass is used. The signals in both arms of the IFO are monitored, matched and subtracted, using this differential signal as an error signal in a feedback loop driving the voice coil actuating to the other side of the suspended mass. Pursuing to be shot-noise limited from 5Hz onwards and having a upper limit to the bandwidth of about 200Hz, the resolution is pushed towards the fm/rtHz.

Summary

The upgrade for the Virgo Gravitational Wave Observatory (Cascina, Italy) necessitates for added sensing which has to be seismically isolated as well. Nikhef has built the compact isolator to do this, but to measure its residual motion in full assembly, no (commercial) sensor is available that is good enough to actually measure it. A novel vibration sensor is built at Nikhef by using an interferometric readout of a monolithic accelerometer. This system is also being researched at Nikhef in a fiber version, so that it can be used in monitoring the vibration in the magnetic and radiation environment of the quadrupole magnets a (future) linear collider such as CLiC or the ILC.

Primary author(s) : Mr. VAN HEIJNINGEN, Joris (Nikhef)

Co-author(s) : Prof. VAN DEN BRAND, Jo (VU/ NIkhef); Dr. RABELING, David (ANU); Dr. BERTOLINI, Alessandro (Nikhef)

Presenter(s) : Mr. VAN HEIJNINGEN, Joris (Nikhef)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **191** Type : **Oral**

Irradiation effect on the response of the scintillators in the ATLAS Tile Calorimeter

Monday, 2 June 2014 16:10 (0:20)

Abstract content

The Tile Calorimeter (TileCal) is the central hadronic calorimeter of the ATLAS experiment at the LHC. Together with other calorimeters, it provides precise measurements of hadrons, jets, taus and missing transverse energy. The monitoring and equalisation of the calorimeter response at each stage of the signal development is allowed by a movable 137Cs radioactive source, a laser calibration system and a charge injection system. Moreover, during the LHC data taking, an integrator based readout provides the signals coming from inelastic proton-proton collisions at low momentum transfer (minimum bias currents) and allows to monitor the instantaneous ATLAS luminosity as well as the response of calorimeter cells. Minimum bias currents have been used to detect and quantify the effect of TileCal scintillators irradiation using the data taken during 2012 that corresponds to about 21 fb-1 of integrated luminosity. Moreover, the response variation for an irradiated cell has been studied combining the information from three calibration systems (cesium, laser and minimum bias). The result of the irradiation on the calorimeter response will be reported.

Summary

Primary author(s) : FRACCHIA, Silvia (Universitat Autònoma de Barcelona (ES))

Presenter(s) : FRACCHIA, Silvia (Universitat Autònoma de Barcelona (ES))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **290** Type : **Oral**

LUCIFER: Neutrinoless Double Beta decay search with scintillating bolometers

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

The Neutrinoless Double Beta Decay (0νDBD) is a powerful tool to test physics beyond the Standard Model and to get insights on the Majorana neutrino nature and mass. Bolometers are excellent detectors to search for this rare decay, thanks to their good energy resolution and to the low background conditions in which they can operate. The current challenge consists in the reduction of the background, represented by environmental γs and αs, in view of a zero background experiment. This can be obtained with the approach of the LUCIFER project, funded by an European grant, which is based the double read–out of the heat and scintillation light produced by ZnSe scintillating bolometers, that allows to discriminate between β/γ and α particles. The LUCIFER experiment aims at a background lower than 10^3 counts/keV/kg/y in the energy region of the 0νDBD of ^{82}Se, an order of magnitude lower with respect to the present generation experiments. Such a low background level will provide a sensitivity on the effective neutrino mass of the order of 100 meV. We describe the current status of the LUCIFER project, including results of the recent R&D activity.

Summary

Primary author(s) : Ms. TOMEI, Claudia (INFN Sezione di Roma); PIPERNO, Gabriele

Presenter(s) : PIPERNO, Gabriele

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **15** Type : **Oral**

Laboratory tests for Diode-Laser based Calibration Systems for Fast Time-of-Flight Systems

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

Time-of-flight systems, based on scintillators, may reach good intrinsic time resolution, by using fast scintillators and photomultipliers. Examples are the large time-of-flight system constructed for the HARP experiment at CERN PS (~150 ps detector resolution) or the most demanding time-of-flight system of the MICE experiment at RAL (~50-60 ps detector resolution). This level of intrinsic timing resolutions puts demanding requirements on the laser based calibration system for day by day time monitoring. Such as system may be realized by splitting a fast laser beam (FWHM~ 30 ps) to a fast photodiode, giving the START for the TDC system, and injecting the laser light into a system of fibers that transmit the pulse to the individual counters to be calibrated, giving the STOP signal. Due to the limited power of diode-laser systems (up to 1 W) extreme care must be put to minimize power losses. The choice of the type of optical fiber to be used (multimode vs single-mode)is another critical issue. Step-index multimode fibers has been chosen giving the best trade-off between input power loss minimization and timing properties of the system. Timing characterization were done with a sampling HP54750A scope with a 20 GHz bandwidth. Additional tests to study the temperature dependence of the system components were done with a precision LAUDA PR845 cooling thermostat. A system based on optical switches, fused fiber splitters and an ultrafast diode-laser will be described, together with the laboratory tests needed to optimize the choice of components and characterize completely the timing performances.

Summary

Primary author(s) : Dr. BONESINI, Maurizio (Sezione INFN Milano Bicocca)

Co-author(s) : BERTONI, Roberto (Sezione INFN Milano Bicocca); DE BARI, Antonio (Sezione INFN e Universita' di Pavia); ROSSELLA, Massimo (Sezione INFN Pavia)

Presenter(s) : Dr. BONESINI, Maurizio (Sezione INFN Milano Bicocca)

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **198** Type : **Oral**

Large Area Microchannel Plates for LAPPD^{TM}

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

Manufacturing plans for "next generation" microchannel plates (MCPs) and the technical advantages enabled by this evolving technology will be presented. The Large Area Picosecond Photodetector (LAPPD^{TM}) is an MCP based photodetector, capable of imaging, with high spatial and temporal resolution in a hermetic package with an active area of 400 square centimeters. A key component of LAPPD^{TM} is a chevron pair of large area (203 mm x 203 mm) MCPs. The manufacture of these large-area high performance MCPs has been enabled by the convergence of two technological breakthroughs. The first to be presented, is the ability to produce large blocks of hollow, micron-sized glass capillary arrays (GCAs) developed by Incom Inc. The Incom process is based on the use of hollow capillaries in the glass drawing process, eliminating the need to remove core material by chemical etching. The arrays are fabricated as large blocks that can be sliced to form large area wafers, without regard to the conventional limits of L/d (capillary length / pore diameter). Moreover, borosilicate glass is less expensive than the prior-art leaded glass, and is more environmentally friendly. The second breakthrough to be presented is the advent of atomic layer deposition (ALD) coating methods and materials to functionalize GCAs to impart the necessary resistive and secondary emission properties suitable for large area detector applications. Recent results demonstrating the high performance, uniformity and long term stability of the current MCP product under various operating conditions will be presented.

Summary

Primary author(s) : Dr. MINOT, Michael (Incom Inc.)

Co-author(s) : Dr. O'MAHONY, Aileen (Incom Incl); Dr. SIEGMUND, Oswald (University of California); Dr. MCPHATE, Jason (Univ. of California, Berkeley); Dr. FRISCH, Henry (University of Chicago); Dr. WETSTEIN, Matthew (Argonne National Laboratory); Dr. ELAGIN, Andrey (University of Chicago); Mr. NORTHROP, Richard (University of Chicago); Mr. CRAVEN, Christopher (Incom Inc.); Mr. BENNIS, Daniel (Incom Inc.); Mr. RENAUD, Joseph (Incom Inc.); Mr. STOCHAJ, Michael (Incom Inc.); Mr. BOND, Justin (Incom Inc.); Dr. ELAM, Jeffrey (Argonne National Laboratory); Dr. MANE, Anil (Argonne National Laboratory); Dr. WAGNER, Robert (Argonne National Laboratory)

Presenter(s) : Mr. CRAVEN, Christopher (Incom Inc.)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **278** Type : **Oral**

Light-yield results of 1 liter liquid argon scintillation detector based on Silicon Photo Multipliers operating at cryogenic temperature

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

We present the results obtained with a liquid argon scintillation detector with light read-out completely based on SiPM. We used a 1 liter PTFE chamber observed by an array of 7 large area SiPMs (Hamamatsu S11828-3344M) covering about the 4% of the internal surface. The chamber is lined with a reflective foil (3M VIKUITI) evaporated with a wavelength shifter (TetraPhenyl Butadiene). This solution allows to convert the UV photons to the visible band, thus matching the SiPM sensitivity window while maximizing light collection. The measured light-yield is comparable with the highest light-yield values obtained in similar conditions using standard 3" cryogenic PMT's (Hamamatsu R11065) for a 3 times higher photo-cathodic coverage. The present result, combined with the other well known intrinsic SiPM advantages (compact design, contained costs, low bias voltage,. . .) represents a step forward in the confirmation of the SiPM technology as a real alternative to standard PMT-based read-out systems for application in cryogenic noble liquid detectors.

Summary

Primary author(s) : Dr. ANTONELLO, maddalena (INFN); CANCI, Nicola (INFN-LNGS); MACHADO, Ana Amelia (INFN - LNGS); SEGRETO, Ettore (INFN); Dr. VIGNOLI, Chiara (INFN-LNGS)

Co-author(s) : Dr. BONFINI, Giuseppe (INFN-LNGS); Dr. CANDELA, Attanasio (INFN-LNGS)

Presenter(s) : SEGRETO, Ettore (INFN)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **179** Type : **Oral**

MPGD-based counters of single photons for Cherenkov imaging counters.

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Architectures based on MicroPattern Gas Detectors (MPGD) represent a possible answer to the quest for novel gaseous counters with single photon detection capability able to overcome all the limitations of the present generation of gaseous photon detectors. In Cherenkov imaging counters, gaseous photon detectors are still the unique option when insensitivity to magnetic field, low material budget, and affordable costs in view of large detection surfaces are required. A systematic R&D programme has been performed for several years to develop novel gas photon detectors base on an arrangement of multiple layers of THick-Gas Electron Multipliers (THGEM): a deep understanding of the THGEM characteristics has been achieved and their parameters have been optimised in view of the photon detection application. Large gains are required to detect effectively single photoelectrons and, after the optimisation process, the novel detectors exhibit electrical stability up to gains as high as to 1-2 x 105 also in presence of radioactive backgrounds. The delicate aspect of the photoelectron extraction from a GEM-like photocathode has been studied in detail and conditions for effective extraction have been obtained. The suppression of the signal produced by ionising particles crossing the photon detectors has been proven. In parallel with establishing the detector principle, the engineering towards large-size counters is ongoing and an intermediate size detector with 300 x 300 mm2 active surface has been successfully operated. Recently a new hybrid approach has been considered: an architecture where the last multiplication stage is obtained by using a Micromegas arrangement. The completed R&D studies and the engineering aspects are summarised and the characterization of the hybrid detector prototypes are reported.

Summary

Nowadays, the Cherenkov imaging technique for Particle IDentification (PID) has been established as a robust, reliable experimental approach thanks to the use in several experiments. They are used and foreseen in the experimental apparata of several future research programmes. The effectiveness of visible and UV single photon detection is at the basis of the success of these counters. So far, only vacuum-based detectors and gaseous photon detectors have been adopted. Other photon detectors being developed are interesting only for applications in the far future. Gaseous photon detectors are still the only available option to instrument detection surfaces when insensitivity to magnetic field, low material budget, and affordable costs in view of large detection surfaces are required. The present generation of gaseous photon detectors, namely MWPC where a cathode plane is formed by a Printed Circuit Board (PCB) segmented in pads and coated with a CsI film, adopted in several experiments (NA44, HADES, COMPASS, STAR, JLab-HallA and ALICE) exhibit some performance limitations: ageing, causing a severe decrease of the quantum efficiency after a collected charge of the order of some mC/cm2, feedback pulses with a rate increasing at large gain-values, and long recovery time (about 1 day) after an occasional discharge in the detector. These limitations are related to the photon feedback from the multiplication region and to the bombardment of the CsI photocathode film by the positive ions generated in the multiplication process. They impose to operate at low gain (a few times 104), resulting in two relevant consequences: the efficiency of single photoelectron detection is reduced and rate limitations are present. Moreover, in these detectors the signal formation is intrinsically slow. There is a clear quest for novel gaseous photon detectors with advanced characteristics, namely intrinsically fast signals and reduced photon and ion backflow to operate at larger gains and to ensure longer detector life-time. In a multilayer structure of electron multipliers, the photons from the multiplication process cannot reach the photocathode and a good fraction of the ions is trapped in the intermediate layers. The signal is mainly due to the electron motion, namely its development is fast. GEM-based photon detectors coupled to semi transparent or reflective photocathodes have been proposed shortly after the introduction of the GEM concept. The threshold Cherenkov counter Hadron Blind Detector (HBD) of the PHENIX experiment at BNL RHIC represents the first application of these ideas, even if high gain is not required in a threshold counter. THich GEMs (THGEM), introduced in parallel by several groups about ten years ago, are electron multipliers derived from the GEM design, by scaling the geometrical parameters and changing the production technology. Large gains and good rate capabilities have been reported for detectors with single or double THGEM layers. THGEMs can be produced in large series and large size at moderate cost with standard PCB technology, in spite of the large number of holes: some millions per square meter. THGEMs have intrinsic mechanical stiffness, and they are robust against damages produced by electrical discharges. Moreover, thanks to the reduced gaps between the multiplication stages, these detectors can be successfully used in magnetic field. The basic architecture of the THGEM-based photon detector that we propose consists in multiple, typically triple, THGEM layers, where the top face of the first layer is coated with a CsI film and acts as a reflective photocathode. The electron multiplication takes place in the THGEM holes thanks to the dipole electric field obtained biasing the two PCB faces. A plane of drift wires defines the drift electric field above the first THGEM layer. The field between two THGEM layers acts as a transfer field; an induction field is applied between the bottom face of the last THGEM and the anode electrode. The signals are collected at the anode plane, formed by a PCB segmented in pads. Our R&D studies performed using single and multiple THGEM arrangements to detect ionising particles or UV photons in laboratory and test beam exercises have been dedicated to explore the characteristics of the THGEM multipliers and the role of the various geometrical parameters, and to establish the guidelines towards the optimisation of the basic architecture. More than 50 different small size THGEM samples (30 x 30 mm2) have been characterised. The measurement campaigns have been accompanied by simulation studies. The main outcomes are summarised in the following. • The rim is the clearance ring around the holes. The THGEM maximum gain is increased by more than an order of magnitude by adopting large rims, namely annulus width of the order of 100 µm. These THGEMs exhibit relevant gain dependence versus rate and over time. These gain variations are absent or negligible for no rim or small rim THGEMs. On the basis of these facts, we have selected THGEM with the minimum rim imposed by the production technology to remove the drilling residuals at the hole edge, namely annulus width smaller than 10 µm. • The large gains ensured by sizable rims can be recovered by increasing the THGEM thickness up to 0.8-1 mm: these thickness-values are ideal for the second and third THGEM layers. • The time response is satisfactory: the typical resolution obtained with THGEM-AGPs is 7 ns r.m.s.. • Concerning photoelectron extraction efficiency from the CsI photoconverting layer, it is clearly established that the effective extraction rate depends on the gas atmosphere in the detector and requires an electric field $\geq$ 1000 V/cm at the photocathode surface. At the THGEM surface, the electric field is dominated by the THGEM bias and it has a minimum at the critical point, namely the centre of the equilateral triangle, which is the unit cell of the THGEM pattern. Higher electric fields at the critical point can be obtained by reducing the THGEM thickness and values around 0.3-0.4 mm are selected: this is the thickness suggested for the photocathode THGEM. • Photon backflow from the multiplication region to the photocathode plane is almost totally suppressed; ion backflow rate depend on the geometry details; in prototypes with staggered hole alignment it is lower than 10 %. • Triple THGEM configurations can provide gains up to 106 when detecting single photoelectrons; the gain has to be reduced in radioactive environments. This gain reduction is made less severe by applying appropriate voltage bias in front of the photocathode to suppress the ionising particle signal: the novel detectors can operate at gains at least one order of magnitude larger than the present ones. In conclusion, the THGEM-based photon detectors can satisfy all the requirements posed to overcome the limitation of the present gaseous photon detectors. In parallel with establishing the detector principle, the engineering towards large-size counters is ongoing. An essential goal of the project is to provide large size detectors with minimal dead zones while preserving the optimised characteristics obtained within the R&D studies. Some samples of good quality large size THGEMs (600 x 600 mm2) have been produced proving the feasibility of large boards. The voltages applied to the electrodes can be as high as 8 kV. Minimum dead zones can be obtained with an accurate mechanical design and the correct choice of the materials for the detector vessel, and appropriate HV distribution to the many electrodes. The goal is a dead area below 10%. An intermediate size detector with 300 x 300 mm2 active surface satisfying this prescription has been successfully operated. Recently a new hybrid approach has been considered: an architecture where the last multiplication stage is obtained by using a Micromegas arrangement. Stable operation at large gain (> 106) has been obtained detecting single photons. The hydrid detector has recently been characterized.

The R&D studies and the engineering aspects are summarised; the characterization of the hybrid architecture prototypes is also reported.

Primary author(s) : LEVORATO, Stefano (INFN Trieste)

Presenter(s) : LEVORATO, Stefano (INFN Trieste)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **328** Type : **Oral**

Many-core studies on pattern-recognition in the LHCb experiment

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

The LHCb experiment is entering in its upgrading phase, with its detector and read-out system re-designed to cope with the increased LHC energy after the long shutdown of 2018. In this upgrade, a trigger-less data acquisition is being developed to read-out the full detector at the bunch-crossing rate of 40 MHz. In particular, the High Level Trigger (HLT) system, where the bulk of the trigger decision is implemented via software on a CPU farm, has to be heavily revised. Since the small LHCb event size (about 100 kB after the upgrade), many-core architectures such as General Purpose GPU (GPGPU) and multi-core CPUs can be used to process many events in parallel for real-time selection, and may offer a solution for reducing the cost of the HLT farm. Track reconstruction and vertexing are the more time-consuming applications running in HLT and therefore are the first to be ported on many-core. In this talk we discussed the studies ongoing in LHCb for implementing pattern-recogniton algorithms for the Velo detector on many-core systems. We present our solution for porting the existing Velo tracking algorithm (FastVelo) on GPGPU, and we show the achieved performance. We plan to test the parallelized version of FastVelo during the data-taking in 2015 and assess the impact of the many-core solution on the HLT infrastructure. We discuss also other tracking algorithms in view of the upgrade and their preliminary performaces.

Summary

Primary author(s) : GALLORINI, Stefano (Universita e INFN (IT))

Co-author(s) : LUCCHESI, Donatella (Universita e INFN (IT)); Mr. GIANELLE, Alessio (Universita e INFN (IT)); CORVO, Marco (INFN); COLLAZUOL, Gianmaria (U); SESTINI, Lorenzo (Universita e INFN (IT)); LUPATO, Anna (Universita di Ferrara (IT)); NEUFELD, Niko (CERN); CAMPORA PEREZ, Daniel Hugo (CERN); VILASIS CARDONA, Xavier (University of Barcelona (ES))

Presenter(s) : GALLORINI, Stefano (Universita e INFN (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **261** Type : **Oral**

Measurement of nm Electron Beam Sizes using Laser Interference by Shintake Monitor

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

The Shintake Monitor is an essential beam tuning device installed at the interaction point of ATF2 to measure its nm order vertical e- beam sizes (σy*). It is crucial for verifying ATF2's Goal 1 of focusing σy* down to 37 nm in order to verify a final focus system of linear colliders featuring the Local Chromaticity Correction scheme. The e- beam collides with a target of laser interference fringes, and σy*is derived from the modulation depth of the resulting Compton signal photons measured by a downstream gamma detector. Shintake Monitor is the only existing device capable of measuring σy* as small as 25 nm, and can accommodates a wide range of σy*from 20 nm to a few μm with better than 10% accuracy by switching between several laser crossing angle modes. Major hardware upgrades contributed to suppressing errors and the demonstration of measurement stability of 5 - 10%. In 2013, continuous measurement of the smallest ever σy* of below 65 nm has been achieved. Analysis of systematic errors indicates the possibility that smaller beam sizes have been achieved. This paper describes the monitor's design concepts and performance, and an extensive study of errors with the aim of high precision in measuring the even smaller σy* anticipated to be achieved at ATF2 in near future.

Summary

Primary author(s) : YAN, Jacqueline (T)

Presenter(s) : YAN, Jacqueline (T)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **371** Type : **Oral**

Measuring directionality in double-beta decay and neutrino interactions with kiloton-scale scintillation detectors

Thursday, 5 June 2014 17:30 (0:20)

Abstract content

We present initial studies of a technique for separating scintillation and Cherenkov light in a large liquid scintillator detector in order to reconstruct directionality for electrons with energies typical of neutrino-electron scattering (5 MeV) and double-beta decay (2.1 MeV and 1.4 MeV).
On average scintillation light is delayed with respect to the direct Cherenkov light due to chromatic dispersion and the finite time of the scintillation processes; early light thus contains directional information. Using a GEANT4 simulation of a 6.5m-radius spherical detector with 100% coverage of photodetectors having transit-time-spread (TTS) of 100 ps, we have shown that a time cut on the early light is effective at isolating the directional light, improving the ratio of Cherenkov to scintillation light from $R_{c/s}$=0.02 to $R_{c/s}$=0.63 for 5 MeV electrons originating at the detector center. This ratio is degraded by a factor of 2.5 if typical photomultipliers with TTS=1.28 ns are used. The ratio for TTS=100 ps can be further improved by a factor of 1.6 by using red-enhanced photocathodes, or by 1.4 by using narrow-emission scintillators.
We discuss a technique for extracting particle direction, and evaluate several detector developments in timing, photodetector spectral response, and scintillator emission spectra that could be used to realize direction reconstruction in a kiloton-scale detector.

Summary

See http://arxiv.org/abs/1307.5813

Primary author(s) : ABERLE, Christoph (University of California, Los Angeles); ELAGIN, Andrey (University of Chicago); FRISCH, Henry (University of Chicago); WETSTEIN, Matthew (University of Chicago); WINSLOW, Lindley (University of California, Los Angeles)

Presenter(s) : ELAGIN, Andrey (University of Chicago)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **21** Type : **Oral**

Micro Pattern Gas Detector Technologies and Applications - the work of the RD51 Collaboration

Abstract content

Driven by the availability of modern photolithographic techniques, the Micro Pattern Gas Detectors (MPGD) have been introduced in the last years of the 20th century by pioneer activities: Gas Electron Multipliers (GEM) and Micromegas, later followed by thick-GEM, resistive GEM (RETGEM) and novel micro-pattern devices. Nowadays, a flourishing of R&D activities dedicated to MPGDs and of diversified applications is ongoing, largely favored by the technological collaboration RD51, whose aims are to facilitate the development of these advanced gas-avalanche detector technologies and associated electronic-readout systems, for applications in basic and applied research. The areas of activities within RD51 include MPGD technology and new structures, device characterization, software and simulations, electronics, MPGD production, common test facilities, and applications of MPGD. By this coverage of all aspects of MPGD, RD51 aims to bring together leading experts in the field for the development of new technology and colleagues using this technology for a wide array of applications. This talk will review the activities of the RD51 by summarising the first five years of the Collaboration activity and by anticipating the future programmes, planned over the next five years.

Summary

This talk will cover the work of the CERN-based RD51 Collaboration developing Micro Pattern Gas Detectors for a wide range of applications.

Primary author(s) : Dr. DALLA TORRE, Silvia (INFN Trieste)

Presenter(s) : Dr. DALLA TORRE, Silvia (INFN Trieste)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **113** Type : **Oral**

Microchannel evaporative CO2 cooling for the LHCb VELO Upgrade

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The LHCb Vertex Detector (VELO) will be upgraded in 2018 to a lightweight, pixel detector capable of 40 MHz readout and operation in very close proximity to the LHC beams. The thermal management of the system will be provided by evaporative CO2 circulating in microchannels embedded within thin silicon plates. This solution has been selected due to the excellent thermal efficiency, the absence of thermal expansion mismatch with silicon ASIC's and sensors, the radiation hardness of CO2, and very low contribution to the material budget.
Although microchannel cooling is gaining considerable attention for applications related to microelectronics, it is still a novel technology for particle physics experiments, in particular when combined with evaporative CO2 cooling. The R&D effort for LHCb is focusing on the design and layout of the channels together with a fluidic connector and its attachment to withstand pressures in excess of 200 bars. This talk will describe the design and optimization of the cooling system for LHCb together with latest prototyping results.
Even distribution of the coolant is ensured by means of the use of restrictions implemented before the entrance to a race-track layout of the main cooling channels. The coolant flow and pressure drop has been simulated together with the thermal performance of the device. The results can be compared to the cooling performance of prototype plates operating in vacuum. The design of a suitable low mass connector, together with the bonding technique to the cooling plate will be described.
Long term reliability as well as resistance to extremes of pressure and temperature is of prime importance. The setup and operation of a cyclic stress test of the prototype cooling channel designs will be described.

Summary

The status and R&D for microchannel cooling for the LHCb VELO upgrade will be described, as outlined in the abstract above.

Primary author(s) : COLLINS, Paula (CERN)

Presenter(s) : COLLINS, Paula (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **388** Type : **Oral**

Microfabrication Activities in the Engineering Office of the PH-DT Group at CERN

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

Micro-technologies are being investigated within the Engineering Office of the Detector Technologies Group (PH-DT) in the CERN Physics Department. This effort aims at developing novel types of detectors and implementing alternative approaches to on-detector services benefitting from standard microfabrication techniques. Recently, a new type of scintillation detector based on microfluidics has been demonstrated. It is being considered as potential candidate for particle tracking and beam monitoring devices in High Energy Physics and medical applications. A similar microfluidic approach has been adopted to develop ultra-thin silicon on-detector active cooling systems. Such systems have been selected for the thermal management of the NA62 GigaTracKer pixel detectors and for the 2018 major upgrade of the LHCb VeLo vertex detector. They are also studied for the most inner layers of the ALICE ITS upgrade. A third application aims at studying the heat transfer of superfluid Helium II in a network of microchannels embedded in a glass substrate in view of an improved insulation for the LHC supraconducting magnets.
To meet the requirements of Particle Physics experiments, these devices need to be as thin and light as possible resulting in membranes of the order of 50 μm or less. The fracture mechanics of thin silicon layers is not well understood and it is currently being studied within the Engineering Office through experimental testing and Finite Element Analysis (FEA). In order to better understand the mechanics of such small silicon membranes, test devices are fabricated in the class 100 MEMS cleanroom at the EPFL Center of MicroNanoTechnology and they are characterized at CERN. The experimental results are then compared with the FEA analysis performed in ANSYS.
This paper will review the microsystems engineering efforts of the PH-DT group through the description of the projects and studies ongoing at CERN.

Summary

Primary author(s) : MAPELLI, Alessandro (CERN)

Co-author(s) : CATINACCIO, Andrea (CERN); DEGRANGE, Jordan (CERN); ROMAGNOLI, Giulia (Universita e INFN (IT)); MAODDI, Pietro (Ecole Polytechnique Federale de Lausanne (CH)); ALVAREZ FEITO, Diego (CERN)

Presenter(s) : MAPELLI, Alessandro (CERN)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4b) MEMS

Contribution ID : **359** Type : **Oral**

Micromegas for sampling calorimetry

Monday, 2 June 2014 17:50 (0:20)

Abstract content

Micromegas is an attractive option for a gaseous sampling calorimeter. It delivers proportional and fast signals, achieves high efficiency to minimum ionising particles with a compact design and shows well-uniform performance over meter-square areas. The current R&D focuses on large-size spark-protected Micromegas with integrated front-end electronics. It targets an application at future linear colliders (LC) and possible upgrades of LHC experiments for the running at high luminosity. Prototyping work and characterisation results will be reported with a special emphasis on the impact of the resistive layer on the calorimeter signals.

Summary

A few technologically-advanced prototypes of 1x1 m2 were constructed. Optimised for Particle-Flow hadron calorimetry at a LC, they are segmented into pads of 1x1 cm2, each read out by simple threshold electronics. Their standalone performance were studied in great details in testbeams. In addition, expected performance of a Micromegas calorimeter were deduced from the measured three-dimensional shape of high-energy pion showers inside the CALICE semi-digital hadron calorimeter (SDHCAL).
Absorption in the gas of highly ionising particles produced in hadron showers occasionally triggers a discharge. This can be a serious show-stopper for high-rate applications such as forward calorimetry at a high-luminosity LHC experiment. Discharge protections based on resistive films were successfully implemented on small-size prototypes. Several resistive configurations were actually studied to minimise the time necessary for charge evacuation and the resulting efficiency and linearity losses.

Primary author(s) : CHEFDEVILLE, Maximilien (Centre National de la Recherche Scientifique (FR))

Presenter(s) : CHEFDEVILLE, Maximilien (Centre National de la Recherche Scientifique (FR))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **94** Type : **Oral**

Monolithic pixel detectors fabricated with single and double SOI wafers

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

Monolithic pixel detectors using 0.2 um FD-SOI pixel process have been developed since 2006. An SOI wafer is utilized for sensor and electronics. The top silicon is used for SOI-CMOS circuit, and the substrate is used for a radiation sensor. There is a buried oxide layer between two silicon materials, and these are connected each other through Tungsten via. SOI-CMOS circuit has smaller parasitic capacitance compared with bulk CMOS, and therefore high-speed, low noise and low power circuits can be fabricated. Since a bump bonding is not used, the sensors have high gain with smaller pixel size. Double SOI wafers are also available. In this case, the middle SOI layers are used for shield layer against the back-gate effect and cross talk. When the voltages are applied in the middle layer, the distribution of charge traps caused by radiation in the silicon oxide can be controlled which helps to enhance radiation tolerance. KEK has organized Multi Project Wafer (MPW) runs twice a year and several types of SOI detectors has been developed and evaluated using IR laser and radiation sources. We are also trying to solve existing problems such as sensor-circuit crosstalk and radiation hardness by utilizing double SOI wafers. In this presentation, evaluation test results of up-to-date SOI pixel detectors will be shown.

Summary

Primary author(s) : MIYOSHI, Toshinobu (KEK)

Co-author(s) : ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); Mr. TAUCHI, Kazuya (KEK); Mr. FUJITA, Yowichi (KEK); TAKEDA, Ayaki (SOKENDAI); IKEMOTO, Yukiko (KEK); HARA, Kazuhiko (University of Tsukuba (JP)); Dr. TSUBOYAMA, Toru (KEK, High Energy Accelerator Research Organization); UNNO, Yoshinobu (High Energy Accelerator Research Organization (JP)); IKEGAMI, Yoichi (High Energy Accelerator Research Organization (JP)); HONDA, Shunsuke (University of Tsukuba (JP)); MITSUI, Shingo (High Energy Accelerator Research Organization (JP))

Presenter(s) : MIYOSHI, Toshinobu (KEK)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **335** Type : **Oral**

Multi-Gigabit Wireless Data Transfer for Tracker Readout Systems

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

State-of-the-art tracking detector systems as the ATLAS silicon micro-strip tracker will after the upgrade in 2022, require an overall readout bandwidth between 50 and 100 Tb/s. To allow such a highly granular tracker to contribute to the first level trigger decision or event filtering, a fast readout system with a tremendous bandwidth is therefore essential. With up to 9 GHz of continous license free bandwidth allocated worldwide centerd around 60 GHz, a fast readout system using a wireless data transfer at that carrier frequency becomes feasible. A prototype transceiver at 60 GHz with 9 GHz bandwidth is currently under development at University of Heidelberg using the IBM 0.13µm SiGe HBT BiCMOS process. The design is based on the well known superheterodyne transceiver architecture. The targeted data rate for our first prototype is 4.5 gigabit per second over a distance of 20 cm. The Multi-Gigabit transceiver system, its individual blocks and key issues of the system design will be explained in detail in this talk.

Summary

Primary author(s) : Mr. SOLTVEIT, Hans Kristian (Ruprecht-Karls-Universitaet Heidelberg (DE))

Co-author(s) : WIEDNER, Dirk (Ruprecht-Karls-Universitaet Heidelberg (DE)); SCHOENING, Andre (Ruprecht-Karls-Universitaet Heidelberg (DE))

Presenter(s) : Mr. SOLTVEIT, Hans Kristian (Ruprecht-Karls-Universitaet Heidelberg (DE))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **49** Type : **Oral**

Neutron Background Detection for a Hard X-ray Balloon-borne Polarimeter

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

PoGOLite is a balloon-borne hard X-ray polarimeter. It determines polarisation by measuring the azimuthal angular distribution of Compton scattered photons in a plastic scintillator array. The use of an all plastic target yields a relatively large but low mass detection area. The dominant source of background for the polarisation measurements has been shown through Geant4 simulations to originate from high energy (MeV range) atmospheric neutrons. Neutrons can pass the instrument's Bismuth Germanium Oxide (BGO) anticoincidence shield undetected and subsequently scatter between plastic scintillator elements to produce a polarisation signature. A passive 15 cm thick polyethylene shield surrounding the polarimeter reduces the neutron induced background by an order of magnitude. The background level remains however significant, prompting the need for active monitoring of the continuously changing neutron flux. For this purpose PoGOLite makes use of a neutron sensitive phoswich scintillator cell. The phoswich cell consists of a 5 mm thick Lithium Calcium Aluminium Fluoride (LiCAF) scintillator, used for neutron detection. The LiCAF is surrounded by a BGO anticoincidence system. This small light weight detector can therefore be used to measure the neutron flux even in high radiation environments. This type of neutron detector was tested on a separate dedicated stratospheric balloon mission, called PoGOLino, prior to the PoGOLite flight which took place in July 2013. Results from both flights will be presented and implications on the polarisation measurements of PoGOLite from 2013 will be discussed.

Summary

Primary author(s) : Mr. KOLE, Merlin (KTH - Royal Institute of Technology)

Co-author(s) : Prof. FUKAZAWA, Yasushi (Hiroshima University); Dr. FUKUDA, Kentaro (Tokuyama Corporation); Mr. ISHIZU, Sumito (Tokuyama Corporation); Dr. JACKSON, Miranda (KTH - Royal Institute of Technology); Dr. KAWAGUCHI, Noriaki (Tokuyama Corporation); Mr. KAWANO, Takafumi (Hiroshima University); Dr. KISS, Mozsi (KTH - Royal Institute of Technology); Dr. MORETTI, Elena (KTH - Royal Institute of Technology); Prof. PEARCE, Mark (KTH - Royal Institute of Technology); Mr. RYDSTROM, Stefan (KTH - Royal Institute of Technology); Dr. TAKAHASHI, Hiromitsu (Hiroshima University); Dr. YANAGIDA, Takayuki (Kyushu Institute of Technology); Dr. CHAUVIN, Maxime (KTH - Royal Institute of Technology); Mr. VICTOR, Mikhalev (KTH - Royal Institute of Technology)

Presenter(s) : Mr. KOLE, Merlin (KTH - Royal Institute of Technology)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **151** Type : **Oral**

Neutron-insensitive gamma-ray detector with aerogel for rare neutral-kaon decay experiment

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

A novel gamma-ray detector which is highly sensitive to photons but insensitive to neutrons has been developed for the rare neutral-kaon decay experiment (KOTO experiment) at J-PARC. This experiment aims to study the KL->pi0nunubar decay with an electromagnetic calorimeter and hermetic veto detectors surrounding the the decay region. The veto counters located in the beam should be able to detect such photons as to be escaping to the direction with high efficiencies under the huge neutron flux of 500MHz.
This detector consists of a series of modules of lead and aerogel pairs. Incident photons are converted to electrons and positrons in lead sheets and the photons from their Cerenkov radiation in the aerogel sheets are viewed by photomultiplier tubes. Since protons or charged pions, which are mainly produced by neutrons, do not emit the Cerenkov light because of their small velocity, excellent blindness to neutrons can be achieved while keeping high photon detection efficiency around 99.9% for the energies larger than 1 GeV. The half of the modules of the detector were installed and used as an in-beam photon veto detector in the first physics data taking of the KOTO experiment. The detector operated stably during 1 week of data taking and the expected performance on photon detection was confirmed as a result of evaluation using KL->3pi0 decay events.
In this presentation, the design of this detector, stability and performance studies in the physics data taking, and the future prospects will be reported.

Summary

Primary author(s) : MAEDA, Yosuke (Kyoto University)

Presenter(s) : MAEDA, Yosuke (Kyoto University)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **253** Type : **Oral**

New diamond detector structure and related front-end electronics for TOF application

Thursday, 5 June 2014 11:40 (0:20)

Abstract content

The results obtained at BTF (Beam Test Facility) of Frascati with 500 MeV electrons working at single electron mode and with cosmic rays have shown a time resolution of the order of 100 ps with a polycrystalline diamond detector of 1.25 mm total thickness and a surface of 3x3 mm^2 operated at 350 V. To achieve this performance, a new structure of the diamond detector and a dedicated front-end electronics have been developed. The results obtained will be compared with standard mono and polycrystalline diamond detectors. This new structure of the detector together with the dedicated front-end electronics suggest the possibility to realize diamond detectors for MIPs with time resolution of the order of few tens ps.

Summary

Primary author(s) : PAOLOZZI, Lorenzo (Universita e INFN Roma Tor Vergata (IT)); CARDARELLI, Roberto (Universita e INFN Roma Tor Vergata (IT)); DI CIACCIO, Anna (Universita e INFN Roma Tor Vergata (IT))

Presenter(s) : PAOLOZZI, Lorenzo (Universita e INFN Roma Tor Vergata (IT))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **280** Type : **Oral**

Overview of the Insertable B-Layer (IBL) Project of the ATLAS experiment at the Large Hadron Collider

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

The ATLAS experiment will upgrade its Pixel Detector with the installation of a new pixel layer in 2014. The new sub-detector, named Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new smaller radius beam-pipe at a radius of 3.3 cm. To cope with the high radiation and pixel occupancy due to the proximity to the interaction point, a new read-out chip and two different silicon sensor technologies (planar and 3D) have been developed. Furthermore, the physics performance will be improved through the reduction of pixel size while targeting for a low material budget should be imposed, pushing for a new mechanical support using lightweight staves and a CO2 based cooling system. An overview of the IBL project as well as the present experience in its construction will be presented, focusing on the staves production, qualification of the assembly procedure, integration of the staves around the beam pipe and commissioning of the detector.

Summary

The ATLAS experiment will upgrade its Pixel Detector with the installation of a new pixel layer in 2014. The new sub-detector, named Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new smaller radius beam-pipe at a radius of 3.3 cm.

An overview of the IBL project as well as the present experience in its construction will be presented, focusing on the staves production, qualification of the assembly procedure, integration of the staves around the beam pipe and commissioning of the detector.

Primary author(s) : TRONCON, Clara (Milano Universita e INFN (IT))

Co-author(s) : LAPOIRE, Cecile (Universitaet Bonn (DE)/CERN)

Presenter(s) : LAPOIRE, Cecile (Universitaet Bonn (DE)/CERN)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **146** Type : **Oral**

PETIROC2 : 32 ch SiGe SiPM readout ASIC for GHz time and charge measurement

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

PETIROC2 is a 32 channel readout ASIC for high speed readout of SiPM matrixes. It features a 1 GHz 20 dB preamp followed by 1 GHz high speed discriminator and time-to-amplitude converter to measure the time down to 50 ps. A variable shaper channel measures the charge over 10 bits and also feeds a discriminator for high level signal trigger. The time and charge signals are digitized internally so that the chips can output only digital signals. The ASIC is realize in SiGe 0.35um technology and takes largely advantage of the SiGe bipolar transistors to achieve GHz bandwidhts at a few mW power/channel. The chip was submitted in november 13 and is presently at dicing, experimental results will be available at the conference.

Summary

Primary author(s) : Dr. DE LA TAILLE, Christophe (OMEGA CNRS/IN2P3 et Ecole Polytechnique (FR))

Co-author(s) : CALLIER, Stéphane (OMEGA / IN2P3 - CNRS); Dr. TONGBONG, Jeanne (CNRS); Mr. DULUCQ, FREDERIC (CNRS/IN2P3); FLEURY, Julien (WEEROC); Dr. AHMAD, Salleh (WEEROC FRANCE); MARTIN CHASSARD, Gisele (OMEGA (FR)); Mr. RAUX, Ludovic (OMEGA IN2P3); SEGUIN-MOREAU, Nathalie (IN2P3 & Ecole Polutechnique (FR)); BLIN, Sylvie (CNRS); THIENPONT, Damien (IN2P3/OMEGA)

Presenter(s) : Dr. DE LA TAILLE, Christophe (OMEGA CNRS/IN2P3 et Ecole Polytechnique (FR))

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **226** Type : **Oral**

POLARBEAR-2 receiver system on the Simons Array telescopes for CMB polarization measurements

Friday, 6 June 2014 12:00 (0:20)

Abstract content

POLARBEAR-2 (PB-2) is a new receiver system which will be mounted on the Simons Array telescope in early 2015 for Cosmic Microwave Background (CMB) polarization measurements at the Atacama desert in Chile. The main science goal is to detect or set an upper limit of the inflationary gravitational wave B-mode. Another important topic is to probe the large scale structure in the universe and constrain the sum of the neutrino masses by measuring the weak gravitational lensing B-mode signal. PB-2 receiver is a cryostat cooled by two pulse-tube coolers and a sorption refrigerator. The receiver has 7588 dual-band antenna-coupled AlTi bilayer Transition Edge Sensor (TES) bolometers for simultaneous measurements at 95 and 150 GHz with the expected array sensitivity (NET) = 5.7uKsˆ1/2. The TES array is on the 350 mm diameter large focal plane cooled to 0.25 Kelvin and is read out by frequency domain multiplexing with superconducting quantum interface device (SQUID) amplifiers housed on the 4 Kelvin stage. Optical elements such as an alumina filter, metal mesh filters, alumina lenses and a half wave plate are carefully designed to meet the thermal and optical requirements of PB-2. We present an overview of PB-2 receiver system and the current status of its development.

Summary

Primary author(s) : Dr. HORI, Yasuto (KEK)

Presenter(s) : Dr. HORI, Yasuto (KEK)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **18** Type : **Oral**

Performance Of Thin Edgeless N-on-p Planar Pixel Sensors For ATLAS Upgrades

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

In view of the LHC upgrade phases towards the High Luminosity LHC (HL-LHC), the ATLAS experiment plans to upgrade the Inner Detector with an all-silicon system. Because of its radiation hardness and cost effectiveness, the n-on-p silicon technology is a promising candidate for a large area pixel detector. The paper reports on the joint development, by LPNHE and FBK, of novel n-on-p edgeless planar pixel sensors, making use of the active trench concept for the reduction of the dead area at the periphery of the device. After discussing the sensor technology, a complete overview of the electrical characterization of the produced devices will be given, together with results on the charge collection efficiency. Measurements on irradiated devices will be presented too. The results will be compared to device simulations we run and to other current edgeless planar productions aimed at the ATLAS tracker upgrade for the HL-LHC. Eventually results from beam test measurements with minimum ionizing particles, such as hit and charge collection efficiency - in particular at the sensor periphery, for these edgeless sensors will be discussed.

Summary

Primary author(s) : BOMBEN, Marco (Centre National de la Recherche Scientifique (FR))

Co-author(s) : CALDERINI, Giovanni (Centre National de la Recherche Scientifique (FR)); MARCHIORI, Giovanni (LPNHE Paris); CHAUVEAU, Jacques (Centre National de la Recherche Scientifique (FR)); LA ROSA, Alessandro (Universite de Geneve (CH)); GIACOMINI, Gabriele (Fondazione Bruno Kessler); BOSCARDIN, Maurizio (FBK Trento); ZORZI, Nicola (Fondazione Bruno Kessler - FBK); BOSISIO, Luciano (Universita e INFN (IT)); BAGOLINI, Alvise (Fondazione Bruno Kessler, Centro per i Materiali e i Microsistemi (FBK-CMM) Povo di Trento (TN), Italy)

Presenter(s) : BOMBEN, Marco (Centre National de la Recherche Scientifique (FR))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **128** Type : **Oral**

Performance evaluation of new photodetectors for Hyper-Kamiokande

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

We have been developing new photodetectors for the Hyper-Kamiokande (Hyper-K) detector, which is proposed as a next generation Megaton class water Cherenkov detector. There are three candidate photodetectors; One is a 20-inch venetian blind dynode type PMT (R3600) which is used in Super-Kamiokande. Second is a newly developed box and line dynode type PMT which has a better collection efficiency and timing response than R3600. The other one, a large-aperture Hybrid Photo-Detector (HPD), is also newly developed and uses an avalanche diode instead of dynodes to multiply photoelectrons. Compared to PMT, the HPD has a simpler structure, better collection efficiency, better timing response, and better single photoelectron charge resolution. A high quantum efficiency (QE) is a common option for the three candidates and it was applied for the R3600 at first. The high-QE R3600 has 30 % QE at maximum peak, 1.4 times higher than that of the R3600 used in Super-Kamiokande. In order to evaluate the performance and usability of the candidate photodetectors, we perform a long-term test with a 200-ton water Cherenkov detector located in Kamioka mine. The progress of the long-term test of 8-inch HPDs and high-QE R3600s will be reported. The status of R & D of the 20-inch box & line PMTs and 20-inch HPDs will be also presented. We plan to choose the photodetectors for Hyper-K in 2016.

Summary

Primary author(s) : Mr. SUDA, Yusuke (Department of Physics, University of Tokyo)

Co-author(s) : Dr. NISHIMURA, Yasuhiro (Research Center for Cosmic Neutrinos, Institute for Cosmic Ray Research, University of Tokyo); Ms. HIROTA, Seiko (Department of Physics, Kyoto University); Mr. OKAJIMA, Yuji (Department of Physics, Tokyo Institute of Technology); Prof. AIHARA, Hiroaki (Department of Physics, University of Tokyo); Prof. YOKOYAMA, Masashi (Department of Physics, University of Tokyo); Prof. SHIOZAWA, Masato (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Prof. HAYATO, Yoshinari (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Dr. NAKAYAMA, Shoei (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Dr. TANAKA, Hidekazu (Kamioka Observatory, Institute for Cosmic Ray Research, University of Tokyo); Prof. NAKAYA, Tsuyoshi (Department of Physics, Kyoto University); Dr. TAKETA, Akimichi (Earthquake Research Institute, University of Tokyo); Dr. KAWAI, Yoshihiko (Hamamatsu Photonics K.K.); Dr. OHMURA, Takayuki (Hamamatsu Photonics K.K.); Dr. SUZUKI, Masatoshi (Hamamatsu Photonics K.K.)

Presenter(s) : Mr. SUDA, Yusuke (Department of Physics, University of Tokyo)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **332** Type : **Oral**

Performance of FlexToT Time Based PET Readout ASIC for Depth of Interaction Measurements

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

This work discusses the capability of a time based readout ASIC, the so-called FlexToT ASIC, to perform Depth of Interaction (DOI) measurements. In particular we will analyse the performance of the ASIC with a Phoswich PET module. FlexToT ASIC is optimized for readout of common cathode Silicon Photo- Multipliers arrays with direct coupling and individual anode voltage control. FlexToT presents the following features: wide dynamic range, high speed, low input impedance, multi channel, low power and separated timing and charge signal output. It has 16 independent outputs for energy, a single fast timing output and pile-up detection. We will present experimental results on identification of the signal of different crystals (BGO and LYSO) based on timing and energy signals.

Summary

This work discusses the capability of a time based readout ASIC, the so-called FlexToT ASIC, to perform Depth of Interaction (DOI) measurements. In particular we will analyze the performance of the ASIC with a Phoswich PET module. FlexToT ASIC is optimized for readout of common cathode Silicon Photo- Multipliers arrays with direct coupling and individual anode voltage control. FlexToT presents the following features: wide dynamic range, high speed, low input impedance, multi channel, low power and separated timing and charge signal output. It has 16 independent outputs for energy, a single fast timing output and pile-up detection. FlexToT ASIC has 16 independent outputs for energy aa single fast timing output and pile-up detection. The low jitter current mode processing together with a configurable differential current mode logic (CML) output provides a timing signal suitable for Time of Flight (TOF) measurements. Each channel delivers a digital output of a Time Over Threshold (TOT) type with a pulse width proportional to peak current (charge) input. We will present experimental results on the identification of interactions on different crystals (BGO and LYSO) combining time and energy measurements. Figure 1 shows preliminary results on FlexToT capability for Phoswich operation. The information provided by time and energy channels of FlexToT seems to be sufficient to discriminate signals of GSO and LYSO crystals excited by a Na22 source.

Primary author(s) : GASCON, David (University of Barcelona (ES)); TRENADO GARCIA, Juan (University of Barcelona (ES))

Co-author(s) : GRACIANI DIAZ, Ricardo (University of Barcelona (ES)); MARIN, Jesus (CIEMAT); PEREZ-MORALES, Jose Manuel (CIEMAT); SANUY CHARLES, Andreu (University of Barcelona (ES)); Dr. CASANOVA, Raimon (University of Barcelona); Mr. SANCHEZ, David (University of Barcelona); SARASOLA, Iciar (CIEMAT); FEIXAS, Lluis

(CIEMAT); RATO, Pedro (CIEMAT); CELA, Jose Manuel (CIEMAT); MARTINEZ, Gustavo (CIEMAT)

Presenter(s) : GASCON, David (University of Barcelona (ES)); TRENADO GARCIA, Juan (University of Barcelona (ES))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **14** Type : **Oral**

Performance of Three Dimensional Integrated Circuits Bonded to Sensors

Wednesday, 4 June 2014 16:40 (0:20)

Abstract content

We report on the processing and performance of 3D integrated circuits (3DIC) bonded to silicon sensors. The circuits were part of the Fermilab-sponsored two-tier 0.13 micron run at Tezzaron/ Global Foundries. They include designs for the CMS track trigger, ILC vertex detectors, and x-ray correlation spectroscopy. Sensors were bonded to the 3DICs using die-to-die solder ball bonding as well as with a chip-to-wafer oxide bonding process (Ziptronix DBI) similar to the wafer-to-wafer bonding process used for the 3DICs.

Summary

Primary author(s) : Dr. LIPTON, Ronald (Fermi National Accelerator Lab. (US))

Co-author(s) : Dr. DEPTUCH, Grzegorz (Fermi National Accelerator Lab. (US)); Mr. YAREMA, Ray (FNAL); GRYBOS, Pawel (High Energy Department); SZCZYGIEL, Robert (AGH UST); TRIMPL, Marcel (Fermilab); HOFF, Jim (Fermilab); THOM, Julia (Cornell University (US)); WITTICH, Peter (Cornell University (US)); YE, Zhenyu (Fermi National Accelerator Lab. (US)); SIDDONS, Peter (Brookhaven National Laboratory); Prof. TRIPATHI, Mani (University of California Davis (US)); HEINTZ, Ulrich (Brown University (US)); NARAIN, Meenakshi (Brown University (US))

Presenter(s) : Dr. LIPTON, Ronald (Fermi National Accelerator Lab. (US))

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4c) 3D integration

Contribution ID : **234** Type : **Oral**

Performance of the AMS-02 Electromagnetic Calorimeter in Space

Friday, 6 June 2014 11:40 (0:20)

Abstract content

The Alpha Magnetic Spectrometer (AMS-02) is a high-energy particle detector deployed on the International Space Station (ISS) since May 19, 2011 to conduct a long-duration mission on fundamental physics research in space. The main scientific goals of the mission are the detection of antimatter and dark matter through the study of the spectra and fluxes of protons, electrons, nuclei until the iron, their antiparticles, and gamma-rays in the GeV to TeV energy range. The Electromagnetic CALorimeter (ECAL) is required to measure e+, e- and gamma spectra and to discriminate electromagnetic showers from hadronic cascades. To fulfill these requirements the ECAL is based on a lead/scintillating fiber sandwich, providing a 3 Dimensional imaging reconstruction of the showers. The high granularity consists of 18 samplings in the longitudinal direction, and 72 samplings in the lateral direction. Measurements of ECAL parameters in space and performance in term of energy and angular resolutions, linearity, proton rejections will be reviewed.

Summary

Primary author(s) : INCAGLI, Marco (Sezione di Pisa (IT))

Presenter(s) : INCAGLI, Marco (Sezione di Pisa (IT))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **295** Type : **Oral**

Performance of the MCP-PMTs for the TOP counter in the Belle II experiment

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

We developed the micro-channel-plate (MCP) PMT for the Time-of-Propagation (TOP) counter, which is a novel Cherenkov counter to be used for particle identification in the Belle II experiment. The developed MCP-PMT has excellent performance for single photon detection; a timing resolution of about 40ps (sigma, including readout jitter), a nominal gain as high as 2 x 10^6, and a position sensitivity of about 5mm with 4 x 4 anode. In the Belle II TOP counter, 512 MCP-PMTs are used under a magnetic field of 1.5T. The performance details were inspected with and without the magnetic field. The gain on each anode was found to vary up to a factor of two over the 16 anodes in some of the MCP-PMTs. We will discuss on this issue. The gain was dropped by 20-80% in a 1.5T magnetic field. The reason is considered that the secondary electrons can be localized and the electron amplification can be saturated. The rate of the gain drop seems to have a correlation with the high-voltage applied to obtain the nominal gain. We will discuss on the gain drop and its rate. The photon detection efficiency was also measured in a 1.5T magnetic field. The results on about 300 MCP-PMTs will be reported. Regarding the lifetime of the MCP-PMT, we succeeded in extending the lifetime significantly by introducing the atomic layer deposition technique on MCP coating. The results of the lifetime measurements will be reported.

Summary

Primary author(s) : Mr. YONEKURA, Takuya (Nagoya university)

Co-author(s) : Prof. IIJIMA, Toru (Nagoya university); Mr. FURUMURA, Daiki (Nagoya university); Dr. INAMI, Kenji (Nagoya university); Dr. SUZUKI, Kazuhito (Nagoya university); Dr. MATSUOKA, Kodai (Nagoya university); Dr. HAYAKAWA, Tomokatsu (Nagoya university); Dr. KATO, Yuji (Nagoya university); Dr. SATO, Yutaro (Nagoya university); Mr. HIROSE, Shigeki (Nagoya university); Mr. ITO, Yuhei (Nagoya university)

Presenter(s) : Mr. YONEKURA, Takuya (Nagoya university)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **240** Type : **Oral**

Performance study of the TOP counter with the 2 GeV/c positron beam at LEPS

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

The TOP (Time-Of-Propagation) counter is a novel ring-imaging Cherenkov detector for particle identification in Belle II. Our goal is to identify up to 3 GeV/c kaons and pions with a pion efficiency of 95% and a fake-pion rate of 5% or better. The TOP counter mainly consists of a 2.7 m long quartz radiator bar and 32 micro-channel-plate PMTs. It measures the time of propagation of the Cherenkov photons in the quartz bar with a resolution of 50 ps to reconstruct the Cherenkov "ring" image in the detection time and position plane. A prototype TOP counter which was close to the final design was tested with the 2 GeV/c positron beam at the LEPS beam line in SPring-8, Japan. The test was successful and a beautiful pattern of the Cherenkov image was obtained as expected for the first time. This talk will focus on the results of the beam test, and the principle of the TOP counter will be demonstrated. The results include the number of detected photons per event, the distributions of the time of propagation, the reconstructed velocity of the positron on event by event basis, study for the particle identification based on the Likelihood ratio analysis and comparisons with the Monte Carlo simulation.

Summary

Primary author(s) : Dr. MATSUOKA, Kodai (Nagoya University)

Presenter(s) : Dr. MATSUOKA, Kodai (Nagoya University)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **258** Type : **Oral**

Phase camera development for gravitational wave detectors

Wednesday, 4 June 2014 12:00 (0:20)

Abstract content

We will report a study of the phase camera, which is a wave-front sensor of laser. This sensor is utilized for observing phase-modulated laser in an interferometer of gravitational wave (GW) detectors. The GW detectors are well sophisticated apparatus that need accurate position controls for mirrors. The laser modulation/demodulation is used for readout of the mirror displacement in such accurate control. Laser sideband signals created by phase modulation become very important not only for the control but also sensitivity of detector because the quality of controls affect a noise level. We are preparing this phase camera for VIRGO, which is a GW detector placed in Pisa. The sideband signals in power recycling cavity are easily degraded by mirror aberrations in VIRGO. In order to correct such mirror aberrations, CO2 laser and compensation plates will be prepared, and then, our phase camera will be used to see mirror aberrations through the state of sidebands. Hence, this phase camera can contribute to VIRGO for making high performance controls.

Summary

Primary author(s) : AGATSUMA, Kazuhiro (Nikhef)

Co-author(s) : VAN DEN BRAND, Jo (Nikhef); VAN BEUZEKOM, Martin (Nikhef)

Presenter(s) : AGATSUMA, Kazuhiro (Nikhef)

Session Classification : IV.d Photonics

Track Classification : Emerging technologies: 4d) Photonics

Contribution ID : **314** Type : **Oral**

Photodetector R&D for the Belle II upgraded forward Electromagnetic Calorimeter

Friday, 6 June 2014 12:00 (0:20)

Abstract content

The Belle II experiment will operate at the SuperKEKB e+e− collider, designed to reach a peak luminosity of 8×10ˆ35 cm−2 s−1 at the Ypsilon(4S). The high background environment of SuperKEKB poses serious challenges to the design of the Belle II detector. In particular, an upgrade of the forward Electromagnetic Calorimeter is foreseen: the new calorimeter will use pure CsI crystals, which have a faster scintillation light emission and lower light yield than the CsI(Tl) crystals presently used. An intense R&D program is ongoing to select the optimal photodetector to meet the stringent requirements set by the use of pure CsI in Belle II. A study of equivalent noise, resolution, radiation hardness and stability of low noise, high-gain avalanche photodiodes obtained by reading single pure CsI crystals will be presented. Our preliminary results indicate that a readout chain using these devices meets the requirements for the Belle II calorimeter and represents a cost-effective choice for the readout of pure CsI crystals in general.

Summary

Primary author(s) : ALOISIO, Alberto (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); BACCARO, Stefania (ENEA UTTMAT, Casaccia (RM) and INFN Sezione di Roma); FINOCCHIARO, Giuseppe (Laboratori Nazionali di Frascati dell'INFN); FIORE, Salvatore (ENEA UTTMAT, Casaccia (RM) and NFN Sezione di Roma); GIORDANO, Raffaele (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); LUBRANO, Pasquale (INFN Sezione di Perugia); MANONI, elisa (INFN Sezione di Perugia); ORDINE, antonio (INFN Sezione di Napoli); PASSERI, Antonio (INFN sezione di Roma Tre); PATTERI, piero (Laboratori Nazionali di Frascati dell'INFN); PERUZZI, Ida (Laboratori Nazionali di Frascati dell'INFN); PICCOLO, Marcello (Istituto Nazionale di Fisica Nucleare (INFN)); Dr. BRANCHINI, Paolo (INFN sezione di Roma Tre); ROSSI, Alessandro (INFN Perugia); SCIACCA, Crisostomo (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); CAVALIERE, Sergio (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); CECCHI, Claudia (Universita' degli Studi di Perugia and INFN Sezione di Perugia); CEMMI, Alessia (ENEA UTTMAT, Casaccia (RM) and INFN Sezione di Roma); DE LUCIA, Erika (Laboratori Nazionali di Frascati dell'INFN); DE NARDO, Guglielmo (Universita' degli Studi di Napoli "Federico II" and INFN Sezione di Napoli); DE SANGRO, Riccardo (INFN - LNF); FELICI, Giulietto (Laboratori Nazionali di Frascati dell'INFN)

Presenter(s) : DE LUCIA, Erika (Laboratori Nazionali di Frascati dell'INFN)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **389** Type : **Oral**

Pixel sensors with different pitch layouts for ATLAS Phase-II upgrade

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

Different pitch layouts are considered for the pixel detector being designed for the ATLAS upgraded tracking system which will be operating at the High Luminosity LHC. The tracking performance in the Endcap pixel regions could benefit from pixel layouts which differ from the geometries used in the barrel region. Also, the performance in different barrel layers and eta regions could be optimized using different pixel sizes. This presentation will report on the development and tests of pitch layouts which could be readout by the FE-I4 ASICs. The pixel geometries include 50x250 um2, 25x500 um2, 100x125 um2, 125x167 um2, 50x2000 um2 and 25x2000 um2. The sensors with geometries 50x250 um2, 25x500 um2 and 100x125 um2 were irradiated and tested at the DESY testbeam. These and other testbeam results as well as results from characterization of these sensors in the laboratory will be presented.

Summary

Primary author(s) : MILOVANOVIC, Marko (University of Liverpool (GB)); BURDIN, Sergey (University of Liverpool (GB))

Co-author(s) : BUTTAR, Craig (University of Glasgow (GB)); BATES, Richard (University of Glasgow (GB)); Dr. BLUE, Andrew (University of Glasgow); DOONAN, Kate (University of Glasgow (GB)); WRAIGHT, Kenneth Gibb (University of Glasgow (GB)); MCMULLEN, Thomas (University of Glasgow (GB)); STEWART, Andrew (U); PATER, Joleen (University of Manchester (GB)); EISENHARDT, Stephan (University of Edinburgh (GB)); MILLS, Corrinne (University of Edinburgh (GB)); Prof. ALLPORT, Philip Patrick (University of Liverpool (GB)); MATHESON, John (STFC - Rutherford Appleton Lab. (GB)); LIPP, John (Science and Technology Facilities Council); SIDIROPOULOS, Georgios (University of Edinburgh (GB)); ASHBY, Joseph (University of Glasgow (GB)); DOHERTY, Frederick (University of Glasgow (GB)); MCEWAN, Fiona (University of Glasgow (GB)); CASSE, Gianluigi (University of Liverpool (GB)); DERVAN, Paul (University of Liverpool (GB)); FORSHAW, Dean Charles (University of Liverpool (GB)); HAYWARD, Helen (University of Liverpool (GB)); TSURIN, Ilya (University of Liverpool (GB)); WONSAK, Sven (University of Liverpool (GB)); WORMALD, Michael (University of Liverpool (GB))

Presenter(s) : MILOVANOVIC, Marko (University of Liverpool (GB))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **85** Type : **Oral**

Planar silicon sensors for the CMS Tracker phase II upgrade

Friday, 6 June 2014 14:00 (0:20)

Abstract content

The CMS tracker collaboration is aiming to identify the best suited silicon materials and sensor thicknesses for future tracking detectors for the high luminosity phase of the Large Hadron Collider (HL-LHC). Therefore, a large material investigation and irradiation campaign was initiated. \\% A variety of silicon $p-in-n$ and $n-in-p$ test-sensors made from Float Zone (FZ), Magnetic Czochralski (MCz) and epitaxially grown (Epi) materials were manufactured in different sensor thicknesses by one single industrial producer (Hamamatsu Photonics K.K.). \\% The samples have been irradiated with 1 MeV neutrons, protons and subsequently with both particle types corresponding to fluences as expected for the positions of detector layers in the future tracker (up to $\Phi = 10^{16}$ cm^{-2}). \\% All materials have been characterized before and after irradiations, and throughout an annealing treatment. The measurements performed on the structures include electrical sensor characterization, measurement of the collected charge injected with beta sources and laser light and bulk defect characterization. In this talk, latest results from the campaign are presented.

Summary

Primary author(s) : Prof. MAZUMDAR, Kajari (Tata Inst. of Fundamental Research (IN))

Presenter(s) : JUNKES, Alexandra (Hamburg University (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **294** Type : **Oral**

Production of Scintillating Fiber Modules for high resolution tracking devices

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

In high energy physics experiments tracking detectors consisting of scintillating fibers readout by linear arrays of silicon photomultipliers have become a competitive alternative to silicon strip detectors.

The modules produced at the Ist Physics Institute of RWTH Aachen University are made out of ribbons of 0.25˜mm diameter scintillating fibers. Ribbons with different amounts of layers and with lengths between 0.3˜m and 3.0˜m have been produced. A spatial resolution of 0.05 mm was achieved with prototypes and experiments (e.g. PERDaix) using these scintillating fiber modules as tracking detectors.

The established process of the scintillating fiber module production and quality control measurements will be presented in detail.

Summary

Primary author(s) : KIRN, Thomas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Co-author(s) : SCHAEL, Stefan (Rheinisch-Westfaelische Tech. Hoch. (DE)); GREIM, Roman (RWTH Aachen); SCHATEIKIS, Tobias Marcus (Rheinisch-Westfaelische Tech. Hoch. (DE)); WLOCHAL, Michael (Rheinisch-Westfaelische Tech. Hoch. (DE)); SCHWERING, Georg (Rheinisch-Westfaelische Tech. Hoch. (DE)); KARPINSKI, Waclaw (Rheinisch-Westfaelische Tech. Hoch. (DE)); SCHULTZ VON DRATZIG, Arndt (RWTH Aachen)

Presenter(s) : KIRN, Thomas (Rheinisch-Westfaelische Tech. Hoch. (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **308** Type : **Oral**

Prospects for spectral CT with Medipix detectors

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

In the development of X-ray Computed Tomography (CT) in medical imaging, one is working to implement spectral information. While keeping the dose level the same, or even lower, than in conventional systems, spectral CT offers the possibility to measure energy dependent features of different tissues that will allow the extraction of additional information about the patient, eventually leading to real color CT. Spectral CT can be achieved through the application of energy sensitive pixel detectors, such as Medipix-based semiconductor devices and by the implementation of reconstruction algorithms where the energy information is taken into account. In this paper, we present the latest results of our work on spectral CT with Medipix detectors and specifically on detector characterization and the development of algorithms that include energy information.

Summary

Primary author(s) : SCHIOPPA, Enrico Junior (NIKHEF (NL))

Co-author(s) : VISSER, Janvs (NIKHEF (NL)); KOFFEMAN, Els (NIKHEF (NL)); Dr. UHER, Josef (Amsterdam Scientific Instruments)

Presenter(s) : SCHIOPPA, Enrico Junior (NIKHEF (NL))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **26** Type : **Oral**

R&D for Solid Xenon Particle Detector

Wednesday, 4 June 2014 17:40 (0:20)

Abstract content

The solid (crystallin) phase of xenon possesses many of the same advantages of liquid xenon as a particle detector material including good transparency, self-shielding, low intrinsic background, and high scintillation light yield. Many of the properties of solid xenon have been measured previously employing small volumes and thin films. Two major R\&D issues must be addressed to make a solid xenon particle detector; the demonstration of the scalability of solid xenon and the capability to readout scintillation lights and ionization signals from the solid xenon. Both issues are being addressed with a dedicated cryogenic system at Fermilab. In this talk, we will report the recent results of the solid xenon detector R&D.

Summary

Primary author(s) : YOO, Jonghee (Fermilab); RAMBERG, erik (Fermilab)

Presenter(s) : FILIPENKO, Mykhaylo (F)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **131** Type : **Oral**

R&D of water-based liquid scintillator as a reactor anti-neutrino detector

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

Neutrino energy measurement is very important not only for a neutrino oscillation experiment but for a nuclear reactor monitor requested by IAEA (International Atomic Energy Agency) as one of their safeguards against misuse of nuclear technology and nuclear materials. The requirements for the reactor monitor are to be nonflammable and nonvolatile. As such a detector, we are developping a water-based liquid scintillator. One of the problems of a water-based scintillator is that it is difficult to get enough light yield bucause most of the known luminescent agents are difficult to dissolve in water. We tried to dissolve a liminescent agent in water with sevarel surfactants and measured the light yield varying concentrations of the liminescent agent and surfactants. The scintillators are contained in a vial (4cm diameter and 6cm height) and the light yield is measured using compton edge electrons by gamma-rays from a cobalt 60. We used a blue LED for light yield calibration. As one of the results, we got about 30 photo-electrons for a scintillator consisting of water, PPO (luminescent agent), Bis-MSB (wavelength shifter), and sodium dodecylsulfate (surfactant). Neutrino interactions are identified by a well-known coincidence of a prompt positron signal followed by a delayed neutron capture by gadlinium. In addition to the light yield measurement described previously, we will report about development of the gadlinium-loaded water-based liquid scintillator.

Summary

Primary author(s) : Dr. SUZUKI, Atsumu (Kobe University)

Co-author(s) : Prof. HARA, Toshio (Kobe University)

Presenter(s) : Dr. SUZUKI, Atsumu (Kobe University)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **349** Type : **Oral**

Radiation Tolerance of the Outer Tracker in the Forward Region at the LHC

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

The LHCb experiment is designed to study B-decays at the LHC, and as such is constructed as a forward spectrometer. The large particle density in the forward region poses extreme challenges to the subdetectors, in terms of hit occupancies and radiation tolerance.
To accurately and efficiently detect the charged decay particles in the high-density particle environment of the LHC the Outer Tracker (OT) has been constructed. The OT is a gaseous straw tube detector, consisting of 53,760 straw tubes, covering an area of 360 m2 of double layers.
At the time of the conference, the performance of the OT during run I of the LHC has been scrutinized. The detector has operated under nominal LHC conditions for a period of over 2 years, corresponding to an integrated luminosity of approximately 3 fb-1. A remarkable radiation resistance of this sensitive gas detector is reported. Unlike most other subdetectors in LHCb, constructed with various technologies, no sign of ageing is observed after having received a total dose corresponding to about 100 mC/cm in the hottest region.
Two independent and complementary methods have been used to measure the radiation resistance of this gas detector in the forward region at the LHC. One method uses a dedicated setup in situ, with which a 90Sr source is scanned over the surface of part of the OT detector. The second method utilizes reconstructed tracks duing LHC operation, with which the hit efficiency over the full detector surface is determined at increased amplifier threshold.

Summary

Primary author(s) : TUNING, Niels (NIKHEF (NL)); KARBACH, Till Moritz (CERN)

Presenter(s) : KARBACH, Till Moritz (CERN)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **144** Type : **Oral**

Radio Detection of Cosmic Rays at the Auger Engineering Radio Array

Friday, 6 June 2014 12:20 (0:20)

Abstract content

The Pierre Auger Observatory detects ultra-high energy cosmic rays by measuring extensive air showers induced in the earth's atmosphere. Besides established detection techniques using a 3000 km2 array of particle detectors sampling shower particles at ground level, and detecting fluorescence light emitted during the shower development with telescopes, the Observatory explores the potential of radio detection of cosmic rays with the Auger Engineering Radio Array (AERA). Radio detection has the potential to provide information on e.g. cosmic ray shower properties with a duty-cycle not limited by day and moon light as in case of the fluorescence technique. AERA consists of 124 autonomous detector stations sensitive to MHz frequencies. The stations feature dual-polarized radio antennas, custom low-noise analog and digital electronics and a broad-band wireless communication system. With AERA we face the challenge of self-triggering on the radio pulse in a background dominated environment by implementing various real-time signal processing strategies within the station electronics. Complementary, we explore the potential of the radio technique as an integral part of future multi-component detectors by utilizing trigger information from the other Auger detectors and recently, by particle detectors integrated in the radio stations. We will discuss the current cosmic ray measurements and the status and prospects of AERA.

Summary

Primary author(s) : Mr. WEIDENHAUPT, Klaus (RWTH Aachen University)

Co-author(s) : AUGER COLLABORATION, Pierre (Observatorio Pierre Auger)

Presenter(s) : Mr. WEIDENHAUPT, Klaus (RWTH Aachen University)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **127** Type : **Oral**

Real-time Imaging of prompt gammas in proton therapy using improved Electron Tracking Compton Camera (ETCC)

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

We have developed an Electron-Tracking Compton Camera (ETCC) for medical imaging due to its wide energy dynamic range (200 - 1500keV) and abilities of background rejection and clear imaging using the tracking information of the recoil electron. Thus this camera has a potential of developing the new reagents for molecular imaging. Until now we have carried out several imaging reagent studies such as : (1) F-18-FDG (511keV) and I-131-MIBG (364keV) for double clinical tracer imaging, (2) Zn-65(1116keV),Mn-54, Fe-59 in mouse for high energy gamma emitting RI imaging. In addition, ETCC can image continuum spectral gamma-rays by removing background particle using dE/dx of the track. ETCC has a potential of real-time monitoring of the Bragg peak location by detecting prompt gammas. We successfully obtained the images of both 511keV and continuum high energy gamma rays (800-2000keV) from the water target irradiated by 140MeV proton (Kurosawa, Cur. Apl. Phys, 12 (2012), pp. 364). In 2013 we have completed a 30cm cube ETCC to catch gamma-rays, of which tracking efficiency was improved with 10 times. It enables to select the Compton event contained in TPC using only the energy loss rate of the track with distinguishing it from all backgrounds. Eventually its sensitivity is improved by a factor of 100. A similar imaging test for prompt gammas using 140MeV proton beam was recently carried out, of which intensity was increased more 10 times than previous experiment. Here I present new performance of the improved ETCC and the results of the beam test.

Summary

Primary author(s) : TANIMORI, Toru (Department of Physics, Kyoto University, Japan)

Co-author(s) : Prof. KUBO, Hidetoshi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMURA, Yoshitaka (Department of Physics, Kyoto University, Kyoto, Japan); Mr. ODA, makoto (Department of Physics, Kyoto University, Kyoto, Japan); Dr. SONODA, Shinya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TOMONO, Dai (Department of Physics, Kyoto University, Kyoto, Japan); Dr. TAKADA, Atsushi (Department of Physics, Kyoto University, Kyoto, Japan); Dr. KUROSAWA, Shunsuke (Institute of Material Research, Tohoku Univ. Japan); Prof. MIUCHI, Kentaro (Department of Physics, Kobe University, Japan); Dr. PARKER, Joseph (Department of Physics, Kyoto University, Kyoto, Japan); Mr. KOMURA, Shotaro (Department of Physics, Kyoto University, Kyoto, Japan); Mr. SAWANO, Tatsuya (Department of Physics, Kyoto University, Kyoto, Japan); Dr. NAKAMURA, Kiseki (Department of Physics, Kyoto University, Kyoto, Japan); Mr. NAKAMURA, Shogo (Department of Physics, Kyoto University, Kyoto, Japan); Mr. MATSUOKA, Yoshihiro (Department of Physics, Kyoto University, Kyoto, Japan); Dr. MIZUMOTO, Tatsuya (Research Institute for Sustainable Humanosphere, Kyoto Univ.Japan)

Presenter(s) : TANIMORI, Toru (Department of Physics, Kyoto University, Japan)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **50** Type : **Oral**

Recent Status of Front-end Electronics for DEPFET pixel detectors for Belle-II

Friday, 6 June 2014 11:00 (0:20)

Abstract content

The Belle II experiment, which will start after 2015 at the Super-KEKB accelerator in Japan, will focus on the precision measurement of the CP-violation mechanism and on the search for physics beyond the Standard Model. To cope with considerably increased background, a pixel vertex detector (PXD) based on DEPFET technology has been developed. The PXD consists of two layers of DEPFET sensor modules located at 1.8 and 2.2 cm radii. Each module has a sensitive area, which is thinned down to 75 µm and steered with three types of ASICs: Switcher, Drain Current Digitizer (DCD) and Data Handling Processor (DHP). Switcher chips are designed to steer the pixel matrix of the sensitive area. The DCD chips digitize the drain current coming from the pixels. All ASICs will be directly bump-bonded to the balcony of the all-silicon DEPFET module. Its excellent spatial resolution (in the order of several microns) and low material budget was one of the decisive factors determining the choice of this technology for the first time. We report on the current status of the front-end electronics development, including the recent results from the first full-scale module prototype and chip testing.

Summary

The Belle-II pixel detector (PXD) has been developed based on DEPFET technology. The PXD requires three types of steering front-end electronics, and the development of the Data Handling Processor (DHP) is currently imperative. The DHP is designed to steer the readout from the DEPFET matrix by sending the control signals to the other two chips and sending the data off the module to the back-end data handling hybrid over a 15 m long electrical output link with a rate of 1.6 Gbps. Such high performance constraints for the digital data processing make the DHP implementation extremely challenging. Several conceptual solutions for the digital data processing blocks were proposed and implemented. Currently, three prototype DHPs have been produced with different technology and the first production version designed with a 65-nm standard CMOS technology has been delivered. The chip is currently under testing and is expected to be the production chip version, suitable for assembly on PXD modules.

Primary author(s) : KISHISHITA, Tetsuichi (University of Bonn)

Co-author(s) : HEMPEREK, Tomasz (Universitaet Bonn (DE)); Dr. KRÜGER, Hans (University of Bonn); LEMARENKO, Mikhail (Universitaet Bonn (DE)); Mr. LÜTTICKE, Florian (University of Bonn); Mr. GERMIC, Leonard (University of Bonn); Dr. MARINAS, Carlos (University of Bonn); WERMES, Norbert (Universitaet Bonn (DE))

Presenter(s) : KISHISHITA, Tetsuichi (University of Bonn)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **269** Type : **Oral**

Recent results of diamond radiation tolerance

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

Progress in experimental particle physics in the coming decade depends crucially upon the ability to carry out experiments at high energies and high luminosities. These two conditions imply that future experiments will take place in very high radiation areas. In order to perform these complex and perhaps expensive experiments new radiation hard technologies will have to be developed. Chemical Vapor Deposition (CVD) diamond has been developed as a radiation tolerant material for use very close to the interaction region where detectors must operate in extreme radiation conditions. During the past few years many CVD diamond devices have been manufactured and tested. As a detector for high radiation environments CVD diamond benefits substantially from its radiation hardness, very low leakage current, low dielectric constant, fast signal collection and ability to operate at room temperature. As a result CVD diamond has now been used extensively in beam conditions monitors at every experiment in the LHC. In addition, CVD diamond is now being considered as a sensor material for particle tracking detectors closest to the interaction region where the most extreme radiation conditions exist. We will present the present state-of-the-art of polycrystalline CVD diamond and single crystal CVD diamond and the latest results on the radiation tolerance of these materials for a range of protons, pions and neutrons obtained from strip detectors constructed with these materials.

Summary

Primary author(s) : KAGAN, Harris (Ohio State University (US))

Co-author(s) : TRISCHUK, William (University of Toronto (CA)); OTHER, Members of RD42 (The RD42 Collaboration)

Presenter(s) : Dr. HITS, Dmitry (Eidgenoessische Tech. Hochschule Zuerich (CH))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **141** Type : **Oral**

SPACIROC3: A Front-End Readout ASIC for JEM-EUSO cosmic ray observatory

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The SPACIROC ASIC is designed for the JEM-EUSO fluorescence-imaging telescope on board of the International Space Station. Its goal is the detection of Extreme Air Showers (EAS) above a few 10^19 eV, developing underneath at a distance of about 400 km, in the troposphere. The SPACIROC family is dedicated to readout 64-channel Multi Anode PMT (MAPMT) or similar detectors. The two main features of this ASIC are the photon counting for each input and the charge-to-time (Q-to-T) conversions for each 8-channel sum. In the photon counting mode, the 100% trigger efficiency is achieved for 1/3 photo-electron (pe) input charges and in order to avoid pile-up in case of a large flux of photons, the double pulse resolution is required to be shorter than 10ns. For the Q-to-T converter, the ASIC should operate in a large dynamic range (1pe to 100pe per pixel). The operating conditions of JEM-EUSO require having low power dissipation (1mW/channel). High-speed performances with low power are obtained thanks to the SiGe technology used for the ASIC. This ASIC has been submitted in three successive versions: SPACIROC1, which showed global good behavior, has been used to equip the EUSO-BALLON instrument. The second version was a conservative design to improve performances and decrease power consumption. The third version has been designed to improve the double pulse separation and to increase the charge dynamic range thanks to new front end architecture. The design and performances (with and without MAPMT) of the third version of SPACIROC are presented in TIPP2014 paper.

Summary

Primary author(s) : Mrs. BLIN, Sylvie (OMEGA Ecole Polytechnique&CNRS/IN2P3)

Co-author(s) : Mr. BARRILLON, Pierre (CNRS/IN2P3/LAL); Mr. DULUCQ, Frederic (OMEGA Ecole Polytechnique&CNRS/IN2P3); Mrs. DAGORET-CAMPAGNE, Sylvie (CNRS/IN2P3/LAL); Mr. DE LA TAILLE, Christophe (OMEGA Ecole Polytechnique&CNRS/IN2P3); Ms. MIYAMOTO, Hiroko (CNRS/IN2P3/LAL); Mr. MORETTO, Camille (CNRS/IN2P3/LAL); Mr. RABANAL, Julio (CNRS/IN2P3/LAL); Mr. THIENPONT, Damien (OMEGA Ecole Polytechnique&CNRS/IN2P3); Ms. TONGBONG, Jeanne (OMEGA Ecole Polytechnique&CNRS/IN2P3)

Presenter(s) : Mrs. BLIN, Sylvie (OMEGA Ecole Polytechnique&CNRS/IN2P3)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **23** Type : **Oral**

Scintillating Fiber Detector for the Beam Loss Proton Measurements at J-PARC Linac

Wednesday, 4 June 2014 12:20 (0:20)

Abstract content

In the J-PARC linac, due to its high intensity H- beam, significant beam loss has been observed at the downstream straight beam line section called ACS (Annular-Coupled Structure linac). The loss is mainly due to a proton which is produced due to double electron stripping of the H^- beam by the residual gas inside the beam pipe, and the titanium beam pipe. We have developed a detector system consisting of 8 planes of scintillating fiber hodoscopes in order to measure proton tracks emitted from the beam pipe of the J-PARC linac. The system measures positions of the charged particle tracks in a small solid angle, and also measures the time-of-flight of each particle. We show angular and energy distribututions of the proton tracks measured in 2012-2013. We also show comparison of the results with simulation.

Summary

Primary author(s) : OLGA, Konstantinova (KEK)

Co-author(s) : Mr. MIURA, Akihiko (Japan Atomic Energy Agency); SAKO, Hiroyuki (Japan Atomic Research Agency); Dr. MARUTA, Tomofumi (KEK)

Presenter(s) : OLGA, Konstantinova (KEK)

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **356** Type : **Oral**

Scintillating Fibre and Radiation Damage Studies for the LHCb Upgrade

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

The Scintillating Fibre (SciFi) Tracker for the LHCb Upgrade (CERN/LHCC 2014-001; LHCb TDR 15) is based on 2.5 m long multi-layered ribbons of 0.250 mm diameter Kuraray SCSF-78MJ scintillating fibre as the active medium and signal transport over covering 350 m^2 with silicon photomultiplier (SiPM) arrays for photo-readout. Over 10,000 km of fibre will turned into precision detector elements. The performance of the detector depends crucially on the geometrical and optical fibre parameters and, in particular, on their possible degradation due to ionizing radiation. The dearth of results for this fibre type in the total ionizing dose range of the upgrade, 60 Gy up to 35 kGy, along with conflicting conclusions regarding annealing and dose rate behaviour in literature, required a set of irradiation campaigns to estimate the behaviour of the full detector over its lifetime, especially as it is non-linear with dose. We will present results from the irradiation experiments performed by the LHCb SciFi collaboration over the last two years which show a behaviour due to radiation damage consistent with published models for polystyrene-based fibres, and are able to reproduce these results in various test facilities and beams. Other measurements of the fibre properties will be shown as well.

Summary

Primary author(s) : JORAM, Christian (CERN)

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH)); LEVERINGTON, Blake (Ruprecht-Karls-Universitaet Heidelberg (DE))

Presenter(s) : DECKENHOFF, Mirco (Technische Universitaet Dortmund (DE))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **165** Type : **Oral**

Sharing high speed optical data transmission links with Slow Control stream

Friday, 6 June 2014 14:20 (0:20)

Abstract content

An unified overall readout and optical high speed data transmission, called Belle2link, has been designed for use between Front-End electronics of all sub-detectors and the backend data acquisition in the Belle II experiment at KEK, Japan. These links provide not only a good electrical isolation, but also a bidirectional centralized data collection and command distribution. Further more the capacity of the gigabit fiber is far more than be needed, which stimulated us a idea to share the high speed data link with the slow control function(detector parameters setting). In addition to the description of belle2link in TIPP2011, this talk describes in detail about the relization of this slow control, including parameter setting in frontend electronics, combining slow control data in FE part with and separating slow control data in BE part from detector physics data, data priority management, single command mode and batch commands mode implementation. Tests made with drift chamber and silicon vertex detector systems are provided together with results and discussions.

Summary

The Belle2link, an unified overall readout with optical high speed data transmission shared with slow control functionality of detector parameter control has been designed for the Belle II experiment at KEK, Japan. A model system based on drift chamber system was successful and tt has been accepted by the collaboration. System for Drift Chamber had passed with cosmic ray test and beam test, system for Silicon Virtex Detector is now under beam test at DESY, Germany which showed also a success. Implementation and tests to other systems are under going.

Primary author(s) : Prof. LIU, Zhen-An (IHEP)

Presenter(s) : Prof. LIU, Zhen-An (IHEP)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **156** Type : **Oral**

Shower characteristics of particles with momenta from up to 100 GeV in the CALICE Scintillator-Tungsten HCAL

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

ABSTRACT: We present a study of the showers initiated by high momentum (up to 100 GeV) positrons, pions and protons in the highly granular CALICE analogue scintillator-tungsten hadronic calorimeter. The data were taken at the CERN PS and SPS. The analysis includes measurements of the calorimeter response to each particle type and studies of the longitudinal and radial shower development. The results are compared to several GEANT4 simulation models.

Summary

Primary author(s) : KLEMPT, Wolfgang (CERN)

Presenter(s) : KLEMPT, Wolfgang (CERN)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **400** Type : **Oral**

Silicon Photomultiplier Camera for Schwarzschild-Couder Cherenkov Telescopes

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

The Cherenkov Telescope Array (CTA) is an atmospheric Cherenkov observatory that will image the cosmos in very-high-energy gamma rays. CTA will study the highest-energy particle accelerators in the Universe and potentially confirm the particle nature of dark matter. We have designed an innovative Schwarzschild-Couder telescope which uses two mirrors to achieve excellent optical performance across a wide field of view. The small plate scale of the dual-mirror optics enables a compact camera which uses modern technology including silicon photomultipliers and the TARGET application-specific integrated circuit to read out a finely pixelated focal plane of 11,328 channels with modest weight, volume, cost, and power consumption. The camera design is hierarchical and modular at each level, enabling robust construction, operation, and maintenance. A prototype telescope is under construction and will be commissioned at the VERITAS site in Arizona. An array of such telescopes will provide excellent angular resolution and sensitivity in the core energy range of CTA, from 100 GeV to several TeV.

Summary

Primary author(s) : Prof. VANDENBROUCKE, Justin (UW Madison)

Presenter(s) : Prof. VANDENBROUCKE, Justin (UW Madison)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **350** Type : **Oral**

Silicon Photomultipliers for the LHCb Upgrade Scintillating Fibre Tracker

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

Silicon photomultipliers (SiPMs) are solid state photo detectors that combine all of the features necessary for the photon detection of a high resolution scintillating fibre tracker. Two SiPM manufacturers, Hamamatsu and KETEK have developed customized devices for SciFi Tracker application in the context of the LHCb tracker upgrade. These custom devices provide high photon detection efficiency (PDE) in a large wavelength range, high reliability due to its simple mechanical construction, a high density multi-channel package and are of sufficiently low cost to build a large area tracking device. There are several challenging requirements placed on the photo-detector mainly due to the neutron radiation environment and the low light output of the long scintillating fibre modules. New devices with the latest technological improvements implemented are available in spring 2014. This includes devices with different optical isolation between pixels (trenches) and different pixel sizes. The dark noise rate (DCR) increases strongly with irradiation and the noise cluster rate of the tracking device can only be kept sufficiently low at a temperature of -40°C. We present the results on PDE, cross-talk and noise before and after neutron irradiation at various temperatures. The results are compared for the latest and the devices based on the standard technology.

Summary

Primary author(s) : HAEFELI, Guido (Ecole Polytechnique Federale de Lausanne (CH))

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH))

Presenter(s) : XU, Zhirui (Ecole Polytechnique Federale de Lausanne (CH))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **340** Type : **Oral**

Silicon Sensors for High-Luminosity Trackers – RD50 Status Report

Tuesday, 3 June 2014 16:30 (0:20)

Abstract content

The revised schedule for the LHC upgrade foresees a significant increase of the luminosity of the LHC by upgrading towards the HL-LHC (High Luminosity-LHC). The final upgrade is planned for around 2023, followed by the HL-LHC running. This is motivated by the need to harvest the maximum physics potential from the machine. It is clear that the high integrated luminosity of 3000 fb-1 will result in very high radiation levels, which manifest a serious challenge for the detectors. This is especially true for the tracking detectors installed close to the interaction point. For HL-LHC, all-silicon central trackers are being studied in ATLAS, CMS and LHCb, with extremely radiation hard silicon sensors to be employed in the innermost layers. Within the RD50 Collaboration, a massive R&D program is underway, with an open cooperation across experimental boundaries to develop silicon sensors with sufficient radiation tolerance. One research topic is to study sensors made from p-type silicon bulk, which have superior radiation hardness as they collect electrons instead of holes. A further area of activity is the development of advanced sensor types like 3D detectors designed for the extreme radiation levels expected for the inner layers. We will present results of several detector technologies and silicon materials at radiation levels corresponding to HL-LHC fluences. Observations of charge multiplication effects at very high bias voltages in a number of detectors will be reported. Based on our results, we will give recommendations for the silicon detectors to be used for LHC detector upgrades.

Summary

Primary author(s) : KUEHN, Susanne (Albert-Ludwigs-Universitaet Freiburg (DE))

Presenter(s) : KUEHN, Susanne (Albert-Ludwigs-Universitaet Freiburg (DE))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **407** Type : **Oral**

Stability and homogeneity: key detector characteristics for good quality high-yield experimental data.

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

The high coherence, high peak power and short pulses duration of modern light sources (e.g. X-ray Free-Electron Lasers - XFELs) are particularly well suited for time-resolved pump-probe and coherent diffraction studies. In many pump-probe experiments small differences in signal produced by ground and excited states have to be detected and resolved. Poisson statistics dictates that ˜ 1 million of photons are needed to resolve an effect with 1/1000 precision. This requires detector systems with tremendous dynamic resolution and sources capable to provide either pulses with high intensity and moderate repetition rate or very high repetition rate with moderate intensity. The typical approach is to average many frames. However source, pump-laser and sample instability make blind averages not really useful. It is therefore critical to preserve the information of each single pulse: comprising beamline and accelerator diagnostics, laser to FEL timing, and detector. Data can then be sorted out, binned and correlated, before the averaging procedure. Further even when the detector is capable of better-than-Poisson performance for a single image, it's not guaranteed that the detector error will be smaller than the summed Poisson statistics when many frames will be averaged. Non-gaussian non-ergodic processes can dominate the error limiting the achievable resolution. Detector stability and homogeneity are equally important for X-ray Photon Correlation Spectroscopy (XPCS), where in addition small pixel and single photon resolution are needed. Deep understanding of the detection system and careful calibration are necessary for good quality high yield data. While these techniques have been used since long time in the High-Energy and Particle Physics communities, they are relatively new in the field of Photon Science. Examples of applications and optimization will be presented.

Summary

Primary author(s) : CARINI, Gabriella (SLAC)

Co-author(s) : HERRMANN, Sven (SLAC); LEMKE, Henrik (LCLS/SLAC); ROBERT, Aymeric (LCLS/SLAC); SIKORSKI, Marcin (LCLS/SLAC); SANGHOON, Song (LCLS/SLAC); ZHU, Diling (LCLS/SLAC)

Presenter(s) : CARINI, Gabriella (SLAC)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **40** Type : **Oral**

Status of KamLAND-Zen and purification methods

Thursday, 5 June 2014 16:10 (0:20)

Abstract content

KamLAND-Zen experiment was started data taking from October 2011 to search for neutrino less double beta decay. The Mini-balloon filled with 136Xe loaded liquid scintillator was installed in the KamLAND detector. From the first result of KamLAND-Zen, there was the BG peak at 2.6 MeV region. As a result of data analysis, it was found that 110mAg was the BG candidate. The purification system of xenon and liquid scintillator were developed to remove the 110mAg BG. 136Xe gas was collected from the liquid scintillator in the Mini-balloon to purify 136Xe gas and liquid scintillator, respectively. In addition, 136Xe gas was purified using SASE getter just before dissolving 136Xe into liquid scintillator. The 2nd phase of KamLAND-Zen was started in 2013. I will report the status of KamLAND-Zen and purification methods.

Summary

Primary author(s) : Dr. UESHIMA, Kota (Tohoku University RCNS)

Presenter(s) : Dr. UESHIMA, Kota (Tohoku University RCNS)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **33** Type : **Oral**

Status of the CMS Phase 1 Pixel Upgrade

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

The silicon pixel detector is the innermost component of the CMS tracking system, providing high precision space point measurements of charged particle trajectories. Before 2018 the instantaneous luminosity of the LHC is expected to reach 2x1034cm−2s−1, which will significantly increase the number of interactions per bunch crossing. The current pixel detector of CMS was not designed to work efficiently in such a high occupancy environment and will be degraded by substantial data-loss introduced by buffering in the analogue readout chip (ROC) and effects of radiation damage in the sensors, built up over the operational period. To maintain a high tracking efficiency, CMS has planned to replace the current pixel system during „Phase 1" (2016/17) by a new lightweight detector, equipped with an additional 4th layer in the barrel, and one additional forward/backward disk. A new digital ROC has been designed, with increased buffers to minimize data-loss, and a digital readout protocol to increase the readout speed. Prototypes of digital single-chip modules have been characterized in an electron test beam at DESY, before and after irradiation. Even after the expected 4th layer lifetime dose of 130kGy, the prototypes were measured to be ˜99% efficient and the spacial resolution remained ˜7μm. Furthermore, energy calibrations using monochromatic X-rays were performed, and its dependence on irradiation and temperature were studied. This talk will give an overview of the upgraded detector with an emphasis on the status of the module production and testing of the 4th layer, which is being assembled and pretested by German institutes.

Summary

This talk will give an overview of the CMX pixel "Phase 1" upgrade with an emphasis on the status of the module production and testing of the 4th layer.

Primary author(s) : Dr. MATTIG, Stefan (Hamburg University (DE))

Presenter(s) : Dr. MATTIG, Stefan (Hamburg University (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **301** Type : **Oral**

Status of the CUORE and CUORE-0 experiments at Gran Sasso

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

CUORE is a 741 kg array of TeO2 bolometers for the search of neurinoless double beta decay in Te-130. The detector is being constructed at the Laboratori Nazionali del Gran Sasso, Italy, where it will start taking data in 2015. If the target background of 0.01 counts/(keV kg y) will be reached, in five years of data taking CUORE will have an half life sensitivity of about 1026 y. CUORE-0 is a smaller experiment constructed to test and demonstrate the performances expected for CUORE. The detector is a single tower of 52 CUORE-like bolometers that started taking data in spring 2013. The status and perspectives of CUORE will be discussed, and the first CUORE-0 data will be presented.

Summary

Primary author(s) : GORLA, Paolo (LNGS)

Presenter(s) : JON, Ouellet (LBL)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **255** Type : **Oral**

Study of Columnar Recombination in Xe+trymethilamine Mixtures using a Micromegas-TPC

Friday, 6 June 2014 12:20 (0:20)

Abstract content

Electron-ion recombination is experimentally studied in Xe+trimethylamine mixtures, motivated by its potential use for directional dark matter searches. A time projection chamber of 2.4 l with a novel configuration formed by two symmetric drift regions with two microbulk-Micromegas readouts is used to measure the recombination of α- and γ-particles, which are emitted in coincidence by an ^{241}Am source. A gas mixture of 98\%Xe+2\%TMA is used, varying the pressure from 2 to 10 bar, and the reduced drift field within 10-400 V/cm/bar range.
Both α-and γ-particles exhibit recombination as the electric drift field decreases, being stronger for α- particles. This is partially explained by columnar recombination due to the dependency observed with the track angle (relative to the direction of electric drift field). The comparison of the data with the theoretical models for recombination will be shown and discussed.
These results support a suggestion that has been recently put forward on how to obtain a directional signal in the recoils induced by Dark Matter interactions with xenon-gas. In fact, there are already efforts trying to pursue directionality but with very low masses.

Summary

Primary author(s) : Ms. HERRERA MUÑOZ, Diana Carolina (University of Zaragoza)

Co-author(s) : GARCIA IRASTORZA, Igor (Universidad de Zaragoza (ES)); GONZALEZ DIAZ, Diego (Universidad de Zaragoza (ES)); Mr. DAFNI, Theopisti (Universidad de Zaragoza (ES)); BASTOS DE OLIVEIRA, Carlos Alberto (Lawrence Berkeley National Lab, CA, USA); LONG, Megan (L); IGUAZ GUTIERREZ, Francisco Jose (Universidad de Zaragoza (ES)); RENNER, Joshua (UC Berkeley / Lawrence Berkeley National Lab); Dr. GOLDSCHMIDT, Azriel (UC Berkeley /Lawrence Berkely National Lab); Dr. CEBRIAN, Susana (Universidad de Zaragoza (ES)); Dr. LUZON, Gloria (Universidad de Zaragoza)

Presenter(s) : Ms. HERRERA MUÑOZ, Diana Carolina (University of Zaragoza)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **145** Type : **Oral**

Study of a Large Prototype TPC using Micro-Pattern Gas Detectors

Monday, 2 June 2014 16:10 (0:20)

Abstract content

In the last decade, R&D of detectors for the future International Linear Collider (ILC) has been carried out by the community. The International Large Detector (ILD) is one detector concept at the ILC where calorimetry and tracking systems are combined. The tracking system consists of a Si vertex detector and forward tracking disks coupled to a large volume Time Projection Chamber (TPC).
Within the framework of the LC-TPC collaboration, a Large Prototype (LP) TPC has been built as a demonstrator. Its endplate is able to contain up to seven identical Micro-Pattern Gas Dectectors (MPGD) modules. Recently, the LP has been equipped with resistive anode Micromegas (MM) or Gas electron Multiplier (GEM) modules. Both the MM and GEM technologies have been studied with a 5 GeV electron beam in a 1 Tesla magnet.
After introducing the LP, the current status, recent results (drift velocity, field distortions, ion gate and spatial resolution measurements) as well as future plans of the LC-TPC R&D with MM and GEM will be presented.

Summary

on behalf of the LC-TPC collaboration

Primary author(s) : Dr. ATTIE, David (CEA/Irfu)

Presenter(s) : Dr. ATTIE, David (CEA/Irfu)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **397** Type : **Oral**

Study of the Radiation Damage of Hamamatsu Silicon Photo Multipliers

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

An irradiation test on 16 Silicon Photo Multipliers produced by Hamamatsu has been performed in Louvain-la-Neuve at the CRC-CYCLONE 110 facility. The devices has been irradiated with neutrons in three dose steps: 5x10ˆ8 1MeV-neutron equivalent (neq), 5x10ˆ9 neq and 5x10ˆ10 neq. After each irradiation step the characteristic current-voltage curves and a high statistics sample of the dark noise waveforms have been recorded for offline analysis. In the proposed contribution we will present the results on the variation of the main SiPM parameters as a function of the dose for the devices under study, that include as well special "Radiation Hard" designs.

Summary

Silicon Photo Multipliers (SiPMs) are novel solid state photon detectors based on matrices of Geiger mode APDs. The interest of the scientific community for these devices has constantly increased since their (recent) development, thanks to their very appealing characteristics. They can in fact guarantee the same performances of standard vacuum tube photo multipliers with many advantages: single photon counting capability, compactness (few mm), low bias voltage ($<$ 100V) , insensitivity to magnetic fieds etc… They have also a few drawbacks though, like the high dark noise rate and the radiation damage, which cause a degradation of the main parameters (i.e. gain, dark noise, photon counting capability…). The first issue has been addressed by the manufacturers, with significative improvements in the last years. The radiation damage is, instead, an intrinsic effect that is of paramount importance to understand, especially for applications where a high radiation environment is expected (like in High Energy Physics experiments). SiPMs producers are prototyping new devices to face this issue and it is very important to have a feedback from the final users.
In the proposed contribution we will present results of the irradiation test of 16 SiPMs from Hamamatsu, including non commercial "Radiation Hard" devices. The sample under study is made of 16 SiPMs with the same geometrical parameters (a square 1x1 mm2 active area and 50μm pixels) but realized with 8 different constructive methodologies (2 SiPM per type). The devices have been irradiated with neutrons in Leuven la Neuve at the CRC-CYCLONE 110 facility, with integrated 1 MeV equivalent doses of: 5x10ˆ8 neq, 5x10ˆ9 neq and 5x10ˆ10 neq. (values where is maximum the rate of change of the performances.). The experimental setup consisted of: a custom made PCB, for the mechanical support, bias and readout of the SiPMs signals; a commercial National Instrument CompactRIO system, for the readout of the currents and of the temperature; a high performances waveform digitizer (5GS/s, 12 bits) and a Keithley picoammeter for the I-V curves.
After each irradiation step and for each device, we measured the current versus voltage (I-V) characteristic curve and, thanks to the high resolution wavewform digitizer, we stored a high statistics (100 k-events per SiPM) sample of dark noise signals. The offline analsysis of the above data will allow us to measure the change in the main parameters of the devices: dark current, dark noise (rate and spectra) and, possibly, the gain (for the latter parameter, it can be measured as long as the single photo electron peaks are visible).
The results of the above measurements will be presented.

Primary author(s) : BALDINI, Wander (Universita di Ferrara (IT)); CALABRESE, Roberto (Universita di Ferrara (IT)); COTTA RAMUSINO, Angelo (Universita di Ferrara (IT)); FIORINI, Massimiliano (Universita di Ferrara (IT)); LUPPI, Eleonora (Universita di Ferrara (IT)); TOMASSETTI, Luca (University of Ferrara and INFN); TELLARINI, Giulia (Universita di Ferrara (IT)); DALCORSO, Flavio (University of Padova and INFN); MALAGUTI, Roberto (Ferrara INFN); Dr. ANDREOTTI, Mirco (INFN Ferrara)

Presenter(s) : BALDINI, Wander (Universita di Ferrara (IT)); FIORINI, Massimiliano (Universita di Ferrara (IT))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **16** Type : **Oral**

Systematic Study of a SiPMT array readout for fast time-of-flight detectors

Wednesday, 4 June 2014 16:20 (0:20)

Abstract content

Array of SiPMTs may be used, in place of fast conventional photomultipliers (PMTs), for the readout of scintillator based time-of-flight systems. These new detectors are insensitive to external magnetic fields, have lower cost than traditional PMTs and present a compact design. Comparison of the obtained timing resolutions as respect to the baseline one (~ 50 ps) obtained with Hamamatsu R4998 PMTs are reported. Results using arrays from Hamamatsu, SenSL, Advansid will be shown. Tests were done in laboratory both with cosmics and an home developed laser system, based on a fast Avtech pulse and a Nichia laser-diode, capable of simulating the signal from a MIP. Up to four scintillator detectors were testes in parallel, distributing the light signal using a fused fiber splitter.

Summary

Primary author(s) : Dr. BONESINI, Maurizio (Universita & INFN, Milano-Bicocca (IT))

Co-author(s) : BERTONI, Roberto (Sezione INFN Milano Bicocca); DE BARI, Antonio (Sezione INFN e Universita' di Pavia); ROSSELLA, Massimo (Sezione INFN Pavia); NARDO', Roberto (Sezione INFN e Universita' Pavia); PRATA, Marco (Sezione INFN Pavia); BARNABA, Orlando (Sezione INFN Pavia)

Presenter(s) : Dr. BONESINI, Maurizio (Universita & INFN, Milano-Bicocca (IT))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **282** Type : **Oral**

TORCH - a Cherenkov based Time-of-Flight Detetor

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

TORCH (Time Of internally Reflected CHerenkov radiation) is an innovative time-of-flight system designed to provide particle identification over large areas up to a momentum of 10 GeV/c. Cherenkov photons emitted within a 1 cm thick quartz radiator are propagated by internal reflection and imaged on to an array of Micro-Channel Plate photomultiplier tubes (MCPs). Performing 3σ pion/kaon separation at the limits of this momentum regime requires a time-of-flight resolution per track of 10-15 ps, over a ˜10m flight path. With ˜30 detected photons per track the required single-photon time resolution is ˜70 ps. This presentation will discuss the development of the TORCH R&D program and present an outline for future work.

Summary

TORCH (Time Of internally Reflected CHerenkov radiation) is a highly compact Time-of-Flight (ToF) system utilizing Cherenkov radiation to achieve particle identification up to 10 GeV/c. At the upper limit of this momentum, a 10-15 ps resolution per track is required to achieve a 3σ ToF difference between pions and kaons.
TORCH will consist of a 1cm thick radiator plate equipped with light guides along the top and bottom of the plate which focus the produced Cherenkov radiation onto a series of micro-channel plate photomultipliers (MCPs). Precise timing of the arrival of the photons and their association with a particle track is then used to determine the particle time-of-flight. Around 30 photons are expected to be detected per track which results in a required time resolution per photon of around 70 ps. The time of propagation of each photon through the plate is governed by its wavelength which affects both its speed of propagation and its Cherenkov emission angle, and by measuring this angle to 1mrad precision TORCH will correct for chromatic dispersion.
The performance of the system relies on the MCP combining fast timing and longevity in high radiation environments, with a high granularity to allow precise measurement of the Cherenkov angle. Development of a 53 mm x 53 mm active area device with 8x128 effective pixel granularity, sub 50ps time resolution and long lifetime is under way with an industrial partner as part of the TORCH development.
A GEANT-4 simulation of the TORCH detector and its performance is currently being developed, taking accounting for the contributions to the overall TORCH resolution. This talk will focus on the requirements of the TORCH design and R&D developments including progress toward a prototype and the development and laboratory tests of the MCP.

Primary author(s) : COWIE, Euan Niall (University of Bristol (GB))

Co-author(s) : BROOK, Nicholas (BRISTOL); KERI, Tibor (University of Oxford (GB)); PIEDIGROSSI, Didier (CERN); FOPMA, Johan Maria (University of Oxford (GB)); CASTILLO GARCIA, Lucia (Ecole Polytechnique Federale de Lausanne (CH)); CUSSANS, David (University of Bristol (GB)); D'AMBROSIO, Carmelo (CERN); FORTY, Roger (CERN); FREI, Christoph (CERN); GAO, Rui (University of Oxford (GB)); GYS, Thierry (CERN); Prof. HARNEW, Neville (University of Oxford (GB))

Presenter(s) : COWIE, Euan Niall (University of Bristol (GB))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **241** Type : **Oral**

TRB3 Platform for Time, Amplitude and Charge Digitisation

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

One of the most crucial parts of the particle physics experiments, data digitisation, is being driven by the higher specifications for better particle identification. This increasing push by the experiments motivates the developers for different and better solutions for time, amplitude and charge digitisation methods. In our work we explain our solution for the tasks: TRB3 Platform.

The TRB3 board consists of 5 large (150K LUTs) and economical Lattice ECP3-FPGAs, which can be used for different tasks (e.g. data digitisation and data concentration) and adapted to different requirements. Time measurements done by the TRB3 are based on FPGA-TDC technology with 265 channels on board and have time precision as low as 7.4ps on a single channel. The TDC channels can be altered to measure different edges of the input signals allowing ToF and ToT measurements as required. Having TDC-FPGA implemented allows also to build an analogue digital converter directly in the FPGA by using the internal FPGA-LVDS buffers as comparators for measured signals and predefined reference signals. First implementations suggest that an 8 bit ADC with a dynamic range of 0-2v is possible. Charge-to-Digital-Converters (QDCs) can also be realised by very simple analogue FEE together with the TDCs for detectors (e.g. Electromagnetic Calorimeters), which require precise charge information. The concept for the QDC is a modified Wilkinson-ADC, where the charge information is encoded in the pulse width and measured by the TDC. The specification we would like to reach is <0.5% charge precision.

Summary

Primary author(s) : Mr. UGUR, Cahit (GSI Helmholtzzentrum für Schwerionenforschung GbmH)

Co-author(s) : Dr. TRAXLER, Michael (GSI Helmholtzzentrum für Schwerionenforschung GmbH); Dr. MICHEL, Jan (Goethe University Frankfurt); Dr. KOENIG, Wolfgang (GSI Helmholtzzentrum für Schwerionenforschung GmbH); KORCYL, Grzegorz (Jagiellonian University (PL)); Dr. PALKA, Marek (Jagiellonian University (PL))

Presenter(s) : Mr. UGUR, Cahit (GSI Helmholtzzentrum für Schwerionenforschung GbmH)

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **410** Type : **Oral**

Tech transfer or give-and-take? On the history and future of silicon photomultipliers in medical imaging and other domains.

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

The silicon photomultiplier (SiPM) is a photosensor that can be fabricated in cost-effective CMOS technology while offering high internal gain, fast response, and insensitivity to magnetic fields. The first prototype devices were developed in the late 1990s. Commercial products, including arrays of SiPMs with a total sensitive area of several square cm, became available in the mid-2000's. The potential of the SiPM as an alternative for the vacuum photomultiplier tube (PMT) in scintillation detectors for nuclear physics, particle physics, medical imaging, and other domains, was quickly recognized by a number of academic and industrial groups worldwide. The high utilization potential of SiPMs, combined with a healthy degree of competition between SiPM developers, has resulted in rapid improvement of their performance, robustness, and availability. Further innovations, such as fully digital implementations of the silicon photomultiplier (dSiPM), have been introduced in the meantime. Today, large-scale application is imminent in the domain of medical imaging, where two of the largest manufacturers of positron emission tomography (PET) devices have just released SiPM-based PET/CT and PET/MRI scanners for clinical use. With a coincidence resolving time (CRT) of ˜350 ps FWHM, these systems redefine the state-of-the-art in clinical time-of-flight (TOF) PET imaging. This talk discusses the introduction of SiPMs in PET detector technology as a process of give-and-take with particle physics and other domains, highlights research activities that are expected to further improve PET image quality, and indicates how some of the ongoing developments in TOF-PET(/MRI) instrumentation may be of use to other domains as well.

Summary

Primary author(s) : Dr. SCHAART, Dennis (Delft University of Technology)

Presenter(s) : Dr. SCHAART, Dennis (Delft University of Technology)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **270** Type : **Oral**

Test on VSiPMT prototypes

Friday, 6 June 2014 14:40 (0:20)

Abstract content

Vacuum Silicon PhotoMultiplier Tube (VSiPMT) is an innovative photodetector based on the combination of SiPM and PMT technologies. The basic idea consists in replacing the classical dynode chain of a PhotoMultiplier Tube with a SiPM. Such a design was proposed by our group in order to match the goal of a large photocathode sensitive area with the unrivalled photon counting performances of SiPMs. Moreover, much more improvements with respect to the standard PMT technology are expected to be obtained by VSiPMTs. First of all, the absence of the standard dynode chain will lead to avoid using voltage dividers and, hence, to a much lower power consumption. Transit Time Spread is expected to be sensibly reduced, since there will be no dynode chain spread, while Single Photoelectron resolution and gain stability will be much improved. In the proposed configuration, the SiPM acts as an electron multiplying detector. Therefore, the proof of feasibility of VSiPMT has required a thorough study both from a theoretical and experimental point of view. The extremely encouraging results obtained by our group led us to a new, advanced phase, consisting in the test of some VSiPMT prototypes realized by Hamamatsu. Our results show that VSiPMT prototypes performances go far beyond our expectations, thus charting the course for the development of an unrivalled innovative photon detection technology. In the present work we will describe accurately the results of our tests on Hamamatsu prototypes and we will show our studies and our purposes for the optimization of the device.

Summary

The detection of (single) photons is an essential experimental tool for a wide range of research areas. To date, in astroparticle physics experiments based on Cherenkov detectors a crucial role has been played by photomultiplier tubes. PMT technology has been improved continuously in the last years: the quantum efficiency of the photocathode has now reached a level of 40%, close to the theoretical maximum; single photon sensitivity and time resolution have been improved by a careful design of electrostatic focusing on the 1st dynode; with new coatings the secondary electron yield of dynodes has greatly improved, reducing the required number of dynodes and their size. Nevertheless standard photomultiplier tubes suffer the following drawbacks:
• fluctuations in the first dynode gain make single photon counting difficult; • linearity is strongly related to the gain and decreases as the latter increases; • transit time spreads over large fluctuations; • mechanical structure is complex, voluminous, rather massive and expensive; • they are sensitive to magnetic fields.
Moreover, in low background experiments the radioactivity of the photomultiplier components is a key concern. In fact, in many applications PMTs can dominate the total radioactivity of the detector. A significant effort is being made by manufacturers and research teams in order to reduce the background from photomultiplier tubes by rigorous choice of the raw materials used for all components. However, significant traces of radioactive nuclei are encountered in the metal and ceramic parts of the electron multiplication system. Hybrid photodetectors, not using dynode structures for amplification, are an attractive solution. In fact, in this type of device photoelectrons emerging from the photocathode are focused onto a silicon detector. As silicon is virtually free of radioactivity and the mass of the photodiode can be very small, the background from the inner part of the tube can be significantly reduced.

The Vacuum Silicon PhotoMultiplier Tube (VSiPMT) is an innovative photodetector based on the combination of SiPM and PMT technologies. The basic idea consists in replacing the classical dynode chain of a PhotoMultiplier Tube with a SiPM. Such a design was proposed by our group in order to match the goal of a large photocathode sensitive area with the unrivalled photon counting performances of SiPMs. Moreover, much more improvements with respect to the standard PMT technology are expected to be obtained by VSiPMTs. First of all, the absence of the standard dynode chain will lead to avoid using voltage dividers and, hence, to a much lower power consumption. Transit Time Spread is expected to be sensibly reduced, since there will be no dynode chain spread, while Single Photoelectron resolution and gain stability will be much improved. Differently from standard hybrids based on APDs, in the VSiPMT the HV between the photocathode and the silicon device is limited to 2-4 kV. Moreover, this HV is needed for the transportation of the photoelectrons and to make them overcome the SiO2 coating layer covering the SiPM. Therefore, the photoelectrons need a much lower voltage to be detected by a SiPM. The multiplication given by the SiPM is independent of the kinetic energy of the photoelectrons, as the output signal of a SiPM is independent of the number of electrons/holes created by the photoelectron in the same cell and is instead proportional to the number of cells fired. Several studies have been performed in last years by the INFN Napoli group on this subject. On the base of the very encouraging results obtained by our group, a first prototype of the VSiPMT has been developed in collaboration with Hamamatsu and tested in our labs. The measured performances are extremely encouraging. The work function of the VSiPMT has been evaluated showing a good linearity with satisfactory gain output G=(3÷6)·105. This prototype showed extremely good photon counting capabilities thanks to the very good performance in terms of SPE resolution (<17%), peak-to-valley ratio (> 60) and Transit Time Spread (< 0.5 ns). With an optimized design, the VSiPMT will exhibit several attractive features such as:
• excellent single photon detection; • high gain; • small electron amplification system size; • negligible power consumption; • low radioactivity background; • weak dependence on magnetic fields; • small price with respect to PMTs; • good performance at low temperature.
In this work we will provide an accurate description of the prototypes and of the extremely encouraging results of our tests. Moreover, we will show our studies and our purposes for the optimization of the device.

Primary author(s) : Dr. VIVOLO, Daniele (Università degli Studi di Napoli Federico II and INFN Napoli)

Co-author(s) : Prof. BARBARINO, Giancarlo (Università degli studi di Napoli - Federico II and INFN Naples); Dr. BARBATO, Felicia Carla Tiziana (Università degli studi di Napoli - Federico II and INFN Naples); DE ASMUNDIS, Riccardo (Universita e INFN (IT)); DE ROSA, Gianfranca (INFN); FIORILLO, Giuliana (Universita e INFN (IT)); MIGLIOZZI, Pasquale (Universita e INFN (IT)); MOLLO, Carlos Maximiliano (INFN); ROSSI, Biagio (Laboratorium fuer Hochenergiephysik-Universitaet Bern-Unknown)

Presenter(s) : Dr. VIVOLO, Daniele (Università degli Studi di Napoli Federico II and INFN Napoli)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **173** Type : **Oral**

The Askaryan Radio Array: Detector Design & Operation

Friday, 6 June 2014 15:20 (0:20)

Abstract content

The Askaryan Radio Array (ARA), currently under construction at the South Pole, is a large-scale cosmogenic neutrino detector designed to observe the coherent radio pulses associated with neutrino-induced cascades in the radio-transparent cold Antarctic ice. The detector incorporates novel bore-hole antenna designs, RF over fiber technology, custom ASIC digitizer, FPGA-based triggering, and ruggedized embedded computer systems all deployed in the South Pole ice sheet.

Summary

Primary author(s) : DUVERNOIS, Michael (University of Wisconsin)

Presenter(s) : DUVERNOIS, Michael (University of Wisconsin)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **408** Type : **Oral**

The Atmospheric Neutrino Neutron Experiment (ANNIE)

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

Neutron tagging in Gadolinium-doped water may play a significant role in reducing backgrounds from atmospheric neutrinos in next generation proton-decay searches using megaton-scale Water Cherenkov detectors. Similar techniques might also be useful in the detection of supernova neutrinos. Accurate determination of neutron tagging efficiencies will require a detailed understanding of the number of neutrons produced by neutrino interactions in water as a function of momentum transferred. We are developing a proposal for an experiment to be built on the Fermilab Booster Neutrino Beam, the Atmospheric Neutrino Neutron Interaction Experiment (ANNIE), which is designed to measure the neutron yield of atmospheric neutrino interactions in gadolinium-doped water. An innovative aspect of the ANNIE design is the use of precision timing to localize interaction vertices in the small fiducial volume of the detector. We propose to achieve this by using early production of LAPPDs (Large Area Picosecond Photodetectors). This experiment will be a first application of these devices demonstrating their feasibility for Water Cherenkov neutrino detectors. In this talk we will discuss the technological aspects of the ANNIE detector, with particular emphasis on work involved in adapting LAPPDs for the measurement.

Summary

http://arxiv.org/abs/1402.6411

Primary author(s) : WETSTEIN, Matthew (University of Chicago)

Presenter(s) : WETSTEIN, Matthew (University of Chicago)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **377** Type : **Oral**

The CERN NA62 experiment: Trigger and Data Acquisition

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

The main goal of the NA62 experiment at CERN is to measure the Branching Ratio (BR) of the ultra-rare decay of a charged kaon into a charged pion and two neutrinos (K+→π+νν). It aims to collect about 100 events in two years of data taking and to test the Standard Model of Particle Physics (SM), using the positive charged proton beam provided by SPS accelerator. The key issues are readout uniformity of sub-detectors, scalability, efficient online selection and lossless high-rate readout. The TDCB and the TEL62 boards are the common blocks of the fully digital Trigger and Data Acquisition system (TDAQ) and they will be used for most sub-detectors in the high-flux rare decay experiment. TDCBs measure hit times for sub-detectors, TEL62s process and store them in a buffer, extracting only those requested by the trigger system, which merges trigger primitives also produced by TEL62s. The complete dataflow and firmware organization are described.

Summary

The NA62 experiment at the CERN SPS aims at measuring the ultra-rare kaon decay K+ → π+νν as a highly sensitive test of the Standard Model (SM) and a search for New Physics. The detection of this process is very challenging due to the smallness of the signal and the presence of a very large background, therefore a very low undetected DAQ inefficiency, below 10–8, is an important issue. NA62 aims to collect about 100 signal events in 2 years of running. There are several detectors distributed before, along and after the 65 m long fiducial decay region: among the main ones GTK and STRAW are used for K+ and π+ tracking, CEDAR and RICH for particle identification while LAV, LKR and MUV to veto photons, positrons and muons. A scintillator hodoscope (CHOD) acts as a fast timing and trigger device. The devices used for this purpose are a general-purpose trigger and data acquisition board (TEL62) and its mezzanine cards (TDCB) hosting high-performance TDC chips. The TDCB houses 4 HPTDC chips developed at CERN, each HPTDC provides 32 TDC channels operating in fully digital mode at 98 ps LSB resolution, with some internal buffering for multi-hit capability and a trigger-matching logic allowing the extraction of hits in selected time windows. The TDCs produce two 32 bit-long words for each LVDS signal in each channel, one word for the time of the leading edge of the pulse and one for its trailing edge. The data are then buffered before being read periodically by the on-board FPGA, which adds a time-stamp and a counter to the data stream and addresses it to the TEL62. Several other features are implemented in the TDCB firmware, including a TDC data simulator for testing purposes, the possibility of triggering front-end board calibration signals through an output line and the controller for two on-board 2 MB SRAM memories usable for monitoring or online processing. The TEL62, a highly-improved version of the TELL1 board developed by EPFL Lausanne for the LHCb experiment, is the main device of the NA62 TDAQ: about 100 cards will be installed on the experiment. The board architecture is based on a star topology: 4 "Pre-Processing" (PP) Altera FPGAs are connected to a single "Sync-Link" (SL) Altera FPGA. The 4 PPs are directly connected to the 4 mezzanines, for a total of 512 input channels. The amount of data arriving from the TDCs can be up to a few tens of

MB/s per channel, depending on the sub-detector. Data are organized in packets, each one related to time frames of 6.4 us duration. The PP has the role of collecting and merging the data and later organizing them on the fly in a 2GB DDR2 memory, where each page is related to a single 6.4 us window. Inside the page data are packed using an optimized custom algorithm. Whenever a trigger arrives the data within a programmable number of 25 ns long time windows around the trigger timestamp are collected and sent to the SL. The data from the 4 PPs are merged and synchronized inside the SL, pre-processed and stored in a 1MB QDR SDRAM temporary buffer from which they are later extracted for formatting into data packets, which are sent through 4 Gigabit Ethernet links hosted on a custom daughter card to a computer farm that performs additional cuts and eventually writes events to permanent storage. Some detectors don't use this common TDAQ system, like the Liquid Krypton (LKr) calorimeter and the silicon Gigatracker. The Liquid Krypton calorimeter will be readout by Calorimeter REAdout Modules (CREAMs) which providing 40 MHz 14 bit sampling for all 13248 calorimeter channels, data buffering, optional zero suppression and programmable trigger sums for the L0 Lkr calorimeter trigger processor, also based on TEL62 boards. The Gigatracker readout is based on the TDCpix ASIC designed to meet the requirements of the detector: the chip readout efficiency is expected to be larger than 99% and each of the readout hits needs to be time stamped with a resolution better than 200 ps rms. The design rate for the Level 0 (L0) trigger output is below 1 MHz (with 1 ms latency). After L0, data are moved to PCs, and further trigger levels are implemented in software. All electronic boards run on a common, centrally generated, free-running synchronous 40 MHz clock. The L0 trigger is fully digitally implemented, using the very same data which is subsequently read out, to avoid duplicating trigger and data acquisition branches and to allow accurate offline monitoring; a central trigger processor will asynchronously match the L0 trigger primitives generated with a good time resolution by a few fast sub-detectors, and dispatch a (synchronous) L0 signal to every board through the above mentioned clock distribution system. The system has been extensively tested at the end of 2012 during a technical run at CERN. The TALK board, a TEL62 multifunction daughter board, was used as L0 Trigger Processor (L0TP): it merges trigger primitives arriving from several subdetectors and sends trigger decisions back. The TALK board design was started by the need to provide a trigger interface between the TTC and the old NA48 trigger distribution system, in order to read the LKr calorimeter with the NA48 readout hardware during the technical run. Additional functions in the firmware have been added: driver for the calibration of the calorimeter, test bench controller for the characterization of the new CREAM boards for the LKr readout, and prototype of L0TP. The prototype L0TP implements the logic to receive both triggers based on synchronous logic pulses and primitive packets generated by TEL62s, which are received through some of its five Ethernet channels. Communication with the PC is also done through an Ethernet interface. Besides the operation as a daughter board for the TEL62, a 6U VME frame to use the TALK board inside a VME crate was developed. In normal running system operation is driven centrally by the TDAQ management system; L0 triggers are dispatched to sub-detectors by the L0TP, with its Local Trigger Unit (LTU), a slightly modified version of the ALICE LTU, that acts as transparent dispatcher of these triggers to the subdetector TTCex; the TTCex modules, built by CERN PH/ESE, do encode the clock and trigger signals onto optical fibres and send them to the readout modules. Sub-detector data frames are sent to a farm of PCs for further data reduction.

Primary author(s) : PINZINO, Jacopo (Sezione di Pisa (IT))

Co-author(s) : FANTECHI, Riccardo (Sezione di Pisa (IT)); SOZZI, Marco (Sezione di Pisa (IT)); LAMANNA, Gianluca (Sezione di Pisa (IT)); VENDITTI, Stefano (CERN); ANGELUCCI, Bruno (Sezione di Pisa (IT)); SPINELLA, Franco (Sezione di Pisa (IT)); PEDRESCHI, Elena (Sezione di Pisa (IT)); PIANDANI, Roberto (Sezione di Pisa (IT))

Presenter(s) : PINZINO, Jacopo (Sezione di Pisa (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **248** Type : **Oral**

The CMS Electromagnetic Calorimeter: lessons learned during LHC run 1, overview and future projections

Monday, 2 June 2014 16:30 (0:20)

Abstract content

The Electromagnetic Calorimeter (ECAL) of the Compact Muon Solenoid (CMS) experiment at the LHC is a hermetic, fine grained, homogeneous calorimeter, comprising 75848 lead tungstate scintillating crystals. We highlight the key role of the ECAL in the discovery and elucidation of the Standard Model Higgs boson during LHC Run I. We discuss, with reference to specific examples from LHC Run I, the challenges of operating a crystal calorimeter at a hadron collider. Particular successes, chiefly in terms of achieving and maintaining the required detector energy resolution in the harsh radiation environment of the LHC, are described. The prospects for LHC Run II (starting in 2015) are discussed, building upon the experience gained from Run I. The high luminosity upgrade of the LHC (HL-LHC) is expected to be operational from about 2025 to 2035 and will provide instantaneous and integrated luminosities of around 5 x 10^34 cm-2 s-1 and 3000 fb-1 respectively. We outline the challenges that ECAL will face and motivate the evolution of the detector that is thought to be necessary to maintain its performance throughout LHC and High-Luminosity LHC operation.

Summary

Primary author(s) : MARTELLI, Arabella (INFN e Università Milano-Bicocca (IT))

Presenter(s) : MARTELLI, Arabella (INFN e Università Milano-Bicocca (IT))

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **327** Type : **Oral**

The COMET Straw Tracker System

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

The COMET experiment at J-PARC aims to search for a lepton-flavour violating process of muon to electron conversion in a muonic atom, μ-e conversion, with a branching-ratio sensitivity of better than 10^{-16}, 4 orders of magnitude better than the present limit, in order to explore the parameter region predicted by most of well-motivated theoretical models beyond the Standard Model. The need for this sensitivity places several stringent requirements on the detector development. The experiment requires to detect the monochromatic electron of 105 MeV, the momentum resolution is primarily limited by the multiple scattering effect for this momentum region. In addition, high power proton driver is essential to accumulate an enough statistics, *ie*. high rate capability is necessary. Thus we need the very light material detector which can handle the high intensity beam in order to achieve an excellent momentum resolution, better than 200 keV/c, and to accumulate an enough statistics, up to $5 \times 10^9 \mu^-$/s. In order to fulfill such requirements, we decided to develop the straw-base planar tracker which is operational in the vacuum and made by the extremely light material. The COMET straw tracker consists of 10 mm diameter tube, longer than 1 m length, with 20 μm thickness Mylar foil and 70 nm aluminum deposition, even thinner material down to 12 μm thickness is under development by the ultrasonic welding technique. In this presentation, the development of COMET straw tracker is described including the prospect of final detector construction.

Summary

Primary author(s) : Dr. NISHIGUCHI, Hajime (KEK)

Co-author(s) : Dr. TSAMALAIDZE, Zviadi (JINR); Dr. EVTOUKHOVITCH, Petr (JINR); Dr. UENO, Kazuki (KEK); Prof. MIHARA, Satoshi (KEK); Mr. TSVERAVA, Nikolozi (JINR); Dr. VOLKOV, Alexander (JINR); Dr. MOISEENKO, Anatoly (JINR)

Presenter(s) : Dr. NISHIGUCHI, Hajime (KEK)

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **186** Type : **Oral**

The DIRC Detectors at the PANDA Experiment

Wednesday, 4 June 2014 11:40 (0:20)

Abstract content

The PANDA experiment at the new FAIR facility at GSI will perform charmonium spectroscopy and search for gluonic excitations using high luminosity antiproton beams from 1.5 to 15 GeV/c. To accomplish the scientific goals a high performance kaon/pion separation up to 4 GeV/c is mandatory. Because of space limitations the main components of the particle identification system will consist of DIRC (Detection of Internally Reflected Cherenkov light) detectors residing inside a magnetic field of up to 2 Tesla. A barrel DIRC with fused silica radiator bars will surround the target at a radial distance of 48 cm and will cover a polar angle range of 22 to 140 degrees; an endcap DIRC built of a segmented fused silica disc of 210 cm diameter will be installed in the forward region to cover the polar angles from 5 to 22 degrees.
There are several challenging issues with the PANDA DIRCs to be discussed in this presentation: the photon rates can reach a few MHz/cm2 and photon detection inside the magnetic field is required. The limited space available for both DIRCs enforces the use of special optics to focus the Cherenkov photons onto the readout planes, its final choice being still under investigation. For the high rate signal readout several frontend options are being studied.
The different design and readout options for both DIRCs were investigated with small scale prototypes using particle beams at CERN, DESY and GSI. Important results of these test runs will be presented and compared to simulations.

Summary

Primary author(s) : Dr. LEHMANN, Albert (University Erlangen-Nuremberg)

Presenter(s) : Dr. LEHMANN, Albert (University Erlangen-Nuremberg)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **175** Type : **Oral**

The Data Acquisition System for the KOTO detector

Monday, 2 June 2014 17:50 (0:20)

Abstract content

The goal of KOTO experiment at J-PARC is to discover and measure the rate of the rare decay KL -> pi0-nu-nubar, for which the Standard Model predicts a branching ratio of (2.4 +/- 0.4)x10E-11 . The experiment is a follow-up to E391 at KEK with a completely new readout electronics, trigger and data acquisition system. The KOTO DAQ comprises a front-end 14-Bit, 125MHz ADC board and a two-level hardware trigger electronics. The ADC board injects the frontend detector signals into a low pass filter before digitization. The digitized pulses are stored inside a 4 µs deep pipeline while waiting for the first level trigger decision, based on a minimum energy deposition in the CsI calorimeter in anti-coincidence with signals in veto detectors. Data is then buffered inside a L2 trigger board, which calculates the center-of-energy of the event. Data accepted by the second level trigger board is read out via a front panel 1Gb Ethernet port into a computer cluster through a network switch using UDP protocol. After several commissioning runs in 2011 and 2012, KOTO has taken the first physics run in May 2013. We will review the performance of the DAQ during this run as well as plans to upgrade the clock distribution system and the overall trigger hardware connectivity. Finally we present a redesign of the Level 2 trigger and readout electronics able to accommodate the increase in data rate expected in the next few years.

Summary

Primary author(s) : XU, Jia (University of Michigan); SHARMA, Arjun (University of Chicago)

Co-author(s) : HUTCHESON, Melissa (University of Michigan); CAI, Tejin (University of Chicago); SHARMA, Arjun (University of Chicago); TECCHIO, Monica (University of Michigan); CAMPBELL, Myron (High Energy Physics); AMEEL, Jon (U); SUJIYAMA, Yasuyuki (Osaka University); CARRUTH, Celeste (University of Michigan); WHALLON, Nikola (University of Michigan); SU, Stephanie (University of Michigan); MICALLEF, Jessica (University of Michigan)

Presenter(s) : SU, Stephanie (University of Michigan)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **13** Type : **Oral**

The EUSO-Balloon Instrument

Friday, 6 June 2014 11:00 (0:20)

Abstract content

EUSO-Balloon is a pathfinder mission for JEM-EUSO (Extreme Universe Space Observatory on-board the Japanese Experiment Module), the near-UV telescope proposed to be installed on board the International Space Station (ISS) before the end of this decade. The main objective of this pathfinder mission is to perform a full scale end-to-end test of all the key technologies and instrumentation of JEM-EUSO detectors and to prove the entire detection chain. The JEM-EUSO instrument consists of an UV telescope designed to focus the signal of the UV tracks generated by Extreme Energy Cosmic Rays propagating in Earth's atmosphere, onto a finely pixelized UV camera. The EUSO-Balloon instrument, smaller respect to the one designed for the ISS, is currently developed as a payload of a stratospheric balloon operated by the French Centre National d'Études Spatiales (CNES) and will be launched during the CNES flight campaign in August 2014. This telescope will point towards the nadir from a float altitude of about 40 km. With its Fresnel Optics and Photo-Detector Module, EUSO-Balloon will monitor a 12x12° wide field of view in a wavelength range between 290 and 430 nm, at a rate of 400'000 frames/sec. In this paper, we will review the main stages of the signal processing of the EUSO-Balloon instrument: the photodetection, the analog electronics, the trigger stages, which select events while rejecting random background, the electronic acquisition system which performs the data management and the monitoring, allowing the instrument control during operation.

Summary

Primary author(s) : SCOTTI, Valentina; Dr. OSTERIA, Giuseppe (INFN NA)

Presenter(s) : SCOTTI, Valentina

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **95** Type : **Oral**

The Fast TracKer Processing Unit future evolution

Tuesday, 3 June 2014 11:20 (0:20)

Abstract content

The Fast Tracker (FTK) processor 1 for the ATLAS experiment has a computing core made of 128 Processing Units that reconstruct tracks in the silicon detector in a ~100 µsec deep pipeline. The track parameter resolution provided by FTK enables the HLT trigger to identify efficiently and reconstruct significant samples of fermionic Higgs decays.
Data processing speed is achieved with custom VLSI pattern recognition, linearized track fitting executed inside modern FPGAs, pipelining, and parallel processing. One large FPGA executes full resolution track fitting inside low resolution candidate tracks found by a set of 16 custom Asic devices, called Associative Memories (AM chips) [2].
The FTK dual structure, based on the cooperation of VLSI dedicated AM and programmable FPGAs, is maintained to achieve further technology performance, miniaturization and integration of the current state of the art prototypes. This allows to fully exploit new applications within and outside the High Energy Physics field.
We plan to increase the FPGA parallelism by associating one FPGA to each AM chip. The FPGA configures and handles the AM and provides a flexible computing power to process the shapes selected by the AM. The goals of this new elementary unit made of 2 chips are: maximum parallelism exploitation, low power consumption, execution time at least 1000 times shorter than the best commercial CPUs, distributed debugging and monitoring tools suited for a pipelined, highly parallelized structure, high degree of configurability to face different applications with maximum efficiency.
We report on the design of the FPGA logic performing all the complementary functions of the pattern matching inside the AM. We also show the results of the simulation of the AM and FPGA logics attached together.
1 Andreani et al., The FastTracker Real Time Processor and Its Impact on Muon Isolation, Tau and b-Jet Online Selections at ATLAS, 2012 TNS Vol.: 59 , Issue:2, pp, 348 – 357
[2] A. Andreani et al., "The AMchip04 and the processing unit prototype for the FastTracker", IOP J. Instr. 7, C08007 (2012).

Summary

Primary author(s) : GARELLI, Nicoletta (SLAC National Accelerator Laboratory (US))

Presenter(s) : GENTSOS, Christos (Aristotle Univ. of Thessaloniki (GR))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **66** Type : **Oral**

The FlashCam Camera for the Medium-Sized Telescopes of CTA

Wednesday, 4 June 2014 17:00 (0:20)

Abstract content

The Cherenkov Telescope Array (CTA) is the next generation ground-based instrument for the detection of cosmic gamma-rays with energies from about 20 GeV up to several hundred TeV. It is envisaged to be comprised of large-, medium- and small-sized telescopes (23m, 10-12m and 4m mirror aperture, respectively). Within the scope of the FlashCam project, a novel camera for the medium-sized telescopes of CTA has been developed. Its integration follows a horizontal architecture, where the photon detector plane (hosting photosensors and preamplifiers) is a self-contained unit interfaced through analog signal transmission cables to crates containing the readout electronics. The FlashCam design features fully digital readout and trigger electronics based on commercial ADCs and FPGAs as key components. In this way different type of digitization schemes and trigger logics can be implemented, without exchanging any hardware. The data transfer from the camera to a server is Ethernet-based, and processing rates (including event building) up to about 2 GBytes/sec have been achieved. Together with the dead-time free signal digitization this allows to operate at trigger rates up to several tens of kHz. Extensive tests and measurements with a 144-pixel setup (equipped with photomultipliers and electronics) have been performed, the results of which will be reported. In addition, the status of the preparations for a 1764-pixel prototype with full-scale mechanics and cooling system will be presented.

Summary

Primary author(s) : WEITZEL, Quirin (Max-Planck-Institut fuer Kernphysik Heidelberg)

Co-author(s) : BAUER, Christian (Max-Planck-Institut fuer Kernphysik Heidelberg); KALKUHL, Christoph (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); KASPEREK, Jerzy (AGH University of Science and Technology Krakow); KIHM, Thomas (Max-Planck-Institut fuer Kernphysik Heidelberg); KOZIOL, Jerzy (Jagiellonian University Krakow); LAHMANN, Robert (Physikalisches Institut, Universitaet Erlangen); MANALAYSAY, Aaron (Physik-Institut, Universitaet Zuerich); MARSZALEK, Adam (Jagiellonian University Krakow); PUEHLHOFER, Gerd (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); RAJDA, Pawel (AGH University of Science and Technology Krakow); REIMER, Olaf (Institut fuer Astro und Teilchenphysik, Universitaet Innsbruck); EISENKOLB, Felix (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); ROMASZKAN, Wojciech (AGH University of Science and Technology Krakow); RUPINSKI, Marcin (AGH University of Science and Technology Krakow); SCHANZ, Thomas (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); SCHWAB, Thomas (Max-Planck-Institut fuer Kernphysik Heidelberg); STEINER, Stefan (Physik-Institut, Universitaet Zuerich); STRAUMANN, Ueli (Physik-Institut, Universitaet Zuerich); TENZER, Christoph (Institut fuer Astronomie und Astrophysik, Universitaet Tuebingen); VOLLHARDT, Achim (Physik-Institut, Universitaet Zuerich); WINIARSKI, Krzysztof (AGH University of Science and

Technology Krakow); ZIETARA, Krzysztof (Jagiellonian University Krakow); FLORIN, Daniel (Physik-Institut, Universitaet Zuerich); FOEHR, Christian (Max-Planck-Institut fuer Kernphysik Heidelberg); GADOLA, Arno (Physik-Institut, Universitaet Zuerich); GARRECHT, Frank (Max–Planck-Institut fuer Kernphysik Heidelberg); HERMANN, German (Max-Planck-Institut fuer Kernphysik Heidelberg); JUNG, Ira (Physikalisches Institut, Universitaet Erlangen); KALEKIN, Oleg (Physikalisches Institut, Universitaet Erlangen)

Presenter(s) : WEITZEL, Quirin (Max-Planck-Institut fuer Kernphysik Heidelberg)

Session Classification : II.b Astro & Space

Track Classification : Experiments: 2b) Astrophysics and Space Instrumentation

Contribution ID : **30** Type : **Oral**

The High-Voltage Monolithic Active Pixel Sensor for the Mu3e Experiment

Thursday, 5 June 2014 11:00 (0:20)

Abstract content

The Mu3e experiment searches for the lepton flavor violating decay $\mu^+ \to e^+e^-e^+$. We are aiming for a sensitivity of one in 10^{16} μ-decays. To measure the momentum and vertex position of low momentum electrons (10 - 53 MeV/c) originating from such a rare decay with high precision, a tracking detector built from High-Voltage Monolithic Active Pixel Sensors (HV-MAPS) is implemented.
The MUPIX chips are HV-MAPS designed for Mu3e and are implemented in 180 nm HV-CMOS technology. HV-MAPS is the technology of choice because it can be thinned to 50˜μm, is radiation-tolerant, has a high time resolution, and is low cost. Furthermore, the pixel electronics are embedded inside the sensor chip to reduce the material budget.

Performance results of the MUPIX4 chip are presented. In 2013, we tested the MUPIX4 chip using a 1 - 6˜GeV electron beam at DESY. The discussed results include the spatial resolution, time resolution, and efficiency of the MUPIX4 chip.

Summary

Primary author(s) : Dr. SHRESTHA, Shruti (Physikalisches Institut Heidelberg)

Presenter(s) : Dr. SHRESTHA, Shruti (Physikalisches Institut Heidelberg)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **343** Type : **Oral**

The LHCb Upgrade Scintillating Fibre Tracker

Friday, 6 June 2014 14:40 (0:20)

Abstract content

The Scintillating Fibre (SciFi) Tracker is designed to replace the current downstream tracking detectors in the LHCb Upgrade during 2018 (CERN/LHCC 2014-001; LHCb TDR 15). The operation and the results obtained from the data collected 2011 and 2012 demonstrate that the current detector is robust and functioning very well. However, the limit of $\mathcal{O}(1\ \mathrm{fb}^{-1})$ of data per year cannot be overcome without improving the detector. After 2018, it is planned to run with an increased luminosity of $1-2\times10^{33}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$ to collect up to 50 fb^{-1} of data. This will be achieved using 25 ns bunch spacing with the average number of proton-proton interactions per bunch crossing $\nu = 3.8-7.6$. Collecting data at this luminosity will only be possible if the detector is improved by increasing the readout of the front-end electronics to 40MHz and implementing a more flexible software-based triggering system that will increase the data rate as well as the efficiency. The increase in interactions per bunch crossing will result in an increased occupancy in the tracking detectors and will exceed the operational occupancy for the Outer Tracker. Here we present the SciFi Tracker as the replacement for the Outer and Inner Trackers.
The SciFi Tracker is based on 2.5 m long multi-layered ribbons from 10,000 km of 0.250 mm diameter scintillating fibre as the active medium and signal transport over 12 planes covering 350 m^2. Cooled silicon photomultiplier (SiPM) arrays with 128 channels and 0.25 mm channel width are used as readout. The front-end electronics are designed to digitize the signals from the SiPMS with a custom ASIC chip, the PACIFIC, for the approximately 560,000 channels and reconstruct the track hit position within an on-board FPGA. Several challenges facing this detector will be presented regarding the precision construction of the large active detector components, the radiation hardness of the scintillating fibres and the SiPMs, the high density readout electronics, and the necessary cooling systems.

Summary

Primary author(s) : LEVERINGTON, Blake (Ruprecht-Karls-Universitaet Heidelberg (DE))

Co-author(s) : BLANC, Fred (Ecole Polytechnique Federale de Lausanne (CH))

Presenter(s) : LEVERINGTON, Blake (Ruprecht-Karls-Universitaet Heidelberg (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **9** Type : **Oral**

The LHCb trigger system: performance and outlook

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

The LHCb experiment is a spectrometer dedicated to the study of heavy flavor at the LHC. The rate of proton-proton collisions at the LHC is 15 MHz, of which only 5 kHz can be written to storage for offline analysis. For this reason the trigger system plays a key role in selecting signal events and rejecting background. In contrast to previous experiments at hadron colliders, the bulk of the LHCb trigger is implemented in software and deployed on a farm of 20k parallel processing nodes. This system, called the High Level Trigger (HLT) is responsible for reducing the rate from the maximum at which the detector can be read out, 1.1 MHz, to the 5 kHz which can be processed offline. The inherent flexibility of this software trigger allowed LHCb to run at twice its design luminosity in 2012. Simultaneously, the HLT performed far beyond the nominal design in terms of signal efficiencies, in particular for charm physics. It also showcased a number of pioneering concepts, for example: the deployment of an inclusive multivariate B-hadron tagger as the main physics trigger of the experiment, buffering of events to local disks, and simulation-free event-by-event trigger efficiency corrections. This talk will cover the design and performance of the LHCb trigger system, and discuss planned improvements beyond LS1 as well as plans for the LHCb upgrade trigger.

Summary

Primary author(s) : ALBRECHT, Johannes (Technische Universitaet Dortmund (DE)); RAVEN, Gerhard (NIKHEF (NL)); GLIGOROV, Vladimir (CERN)

Presenter(s) : ALBRECHT, Johannes (Technische Universitaet Dortmund (DE)); RAVEN, Gerhard (NIKHEF (NL)); GLIGOROV, Vladimir (CERN)

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **277** Type : **Oral**

The LZ dark matter search

Monday, 2 June 2014 16:10 (0:20)

Abstract content

The LUX-ZEPLIN (LZ) experiment is a next-generation search for Weakly Interacting Massive Particles, scaling the very successful double-phase xenon technology to multi-tonne target mass. LZ will be deployed at the 4850-ft level of the Sanford Underground Research Facility (South Dakota, USA) after completion of LUX, which is presently operating there. At its core, LZ will feature a 7-tonne (active) liquid xenon TPC surrounded by two 'veto' detectors. Particle interactions in the WIMP target generate two signatures: prompt scintillation light and ionisation charge, the latter transduced to a pulse of electroluminescence light in a thin gaseous layer above the liquid. Our strategy is to mitigate radiogenic backgrounds from detector materials through a combination of self-shielding, precise vertex location, coincidence vetoing, and xenon purification – to expose a uniform background from astrophysical neutrinos. Electron recoils from solar pp neutrino scattering can be mostly discriminated by the ratio of the two signatures, which differs from that for nuclear recoil interactions expected from WIMPs. We present the project status and the sensitivity reach of this exciting instrument due to start construction soon.

Summary

Primary author(s) : ARAUJO, Henrique (Imperial College London)

Presenter(s) : ARAUJO, Henrique (Imperial College London)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **204** Type : **Oral**

The NEXT detector: an Electroluminescence Xenon TPC for neutrinoless double beta decay detection

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The NEXT Experiment aims to detect neutrinoless double beta decay using an HPXe TPC based on electroluminescence to be deployed in the Canfranc Underground Laboratory. New-generation experiments for double beta decay detection need to be sensitive to lifetimes longer than 1025 years. One remarkable challenge is the conception of a detector that enables an efficient and unambiguous identification of such a signal. Of the different detection techniques available, one has been chosen based on its suitability for complying with the key demands of this particular experiment: the capability to achieve an optimal energy resolution at the Xe Qββ energy (2.458 MeV), the event topology reconstruction competence to identify the distinct dE/dx of electron tracks, capability of high background suppression and the aptitude to be expanded to a large-scale system. Electroluminescence as the amplification technique for the primary ionisation and SiPM as the readout sensors for the topological recognition have been the elected means to integrate the experiment, combined in a high-pressure xenon Time Projection Chamber. Prototypes on which extensive studies have been performed already offered very promising results. One of these large prototypes is NEXT-DEMO, a TPC based on electroluminescence that validates the feasibility of the NEXT detector concept. This prototype is being upgraded to NEXT-NEW, which will fully operate in Canfranc Underground Laboratory. In this work, results will be presented and considerations will be made on both NEXT-DEMO and NEXT-NEW.

Summary

The Neutrino Experiment with a Xenon TPC (NEXT) aims to detect neutrinoless double beta decay using a high-pressure Xe-136 TPC based on electroluminescence to be deployed in the Canfranc Underground Laboratory, Spain. New-generation experiments for double beta decay detection need to be sensitive to lifetimes longer than 1025 years. One remarkable defy is the conception of a detector that enables an efficient and unambiguous identification of such a signal. For NEXT, the detection technique has been chosen based on its suitability for complying with the key demands of this particular experiment: the capability to achieve an optimal energy resolution at the Xe Qββ energy (2.458 MeV), the event topology reconstruction competence proving the possibility to identify the distinct dE/dx of electron tracks, capability of high background suppression and the aptitude to be expanded to a large-scale system. To achieve optimal energy resolution, electroluminescence has been chosen as the amplification technique for the primary ionisation of xenon, over the charge amplification technique. As for the readout planes, the chamber will have distinct detection planes for calorimetry and tracking, behind cathode and anode, respectively. SiPMs have been elected as the readout sensors for the topological recognition and PMTs for the energy plane. The detection process is as follows: Particles interacting in the HPXe transfer their energy to the medium through ionisation and excitation. The excitation energy is patent in the prompt emission of VUV (around 178 nm) scintillation light from the xenon gas. The ionisation tracks (positive ions and free electrons) left behind by the particle are prevented from recombine applying an electric field of 0.3–0.5 kV per cm. The ionisation electrons drift toward the TPC anode, entering a region, delimited by two highly-transparent meshes, with an even more intense electric field, 3 kV per cm per bar. There, further VUV photons

are formed isotropically by electroluminescence processes. Hence, both primary scintillation and primary ionisation produce an optical signal, which is detected in the energy plane with PMTs, located behind the cathode. The detection of the primary scintillation light constitutes the start-of-event, whereas the detection of electroluminescence light provides an energy measurement. Electroluminescent light provides tracking as well, since it is detected also at the anode plane, by means of an array of 1-mm2 SiPMs, 1cm in pitch, placed a few millimetres away from the electroluminescence region, Fig.1. Prototypes using the above described features, on which extensive studies have been performed, already offered very promising results. One of these large prototypes is NEXT-DEMO, which validates the feasibility of the NEXT detector concept. NEXT-DEMO has been fully operational at IFIC, Valencia, since 2011. A near-intrinsic energy resolution has been reached in the NEXT-DEMO prototype with a value of about 1.8% FWHM for 511 keV electrons, extrapolating to about 0.8% FWHM at Qββ=2.458 MeV, Fig.2.
Fig.1: The Separate, Optimized Functions (SOFT) concept in the NEXT experiment: EL light generated at the anode is recorded in the photosensor plane right behind it and used for tracking; it is also recorded in the photosensor plane behind the transparent cathode and used for a precise energy measurement.
Fig. 2: Energy spectrum for 511 keV gammas interacting in NEXT-DEMO. From the low- to the high energy-region, one can clearly identify the X-ray peak (˜30 keV), the Compton continuum (100-340 keV), the X-ray escape peak (˜480 keV) and the photo-electric peak (full energy).
The SiPM-based read-out planes in NEXT-DEMO have clearly demonstrated the good tracking capability of the chosen design. Straight cosmic-ray muon tracks, ˜500 keV electron tracks dominated by multiple Coulomb scattering, and isolated X-ray energy deposition of about 30 keV have been reconstructed. On the other hand, the tracking plane information can be combined with the energy (PMT) plane information in order to identify the number of Bragg peaks signaling the number of electrons ranging out in the detector. This is useful for ββ0[U+F06E] searches, since the "blob", i.e., a track segment with higher energy deposition, multiplicity per event is expected to provide an additional background suppression factor. Signal events tend to yield two "blobs" from two electrons emanating from a common vertex. In the case of background, dominated by gamma interactions, only one "blob" per event is typically expected. Energy blobs where electron tracks range out have been clearly identified in NEXT-DEMO using the energy plane information, by projecting the electron tracks' dE/dx pattern along the drift direction, Fig.3.
Fig. 3: The reconstructed track left by a photoelectric electron produced by the interaction of a 662-keV gamma (from a 137Cs calibration source) detected by NEXT-DEMO.
NEXT-DEMO has been upgraded to NEXT-NEW, which will fully operate in Canfranc Underground Laboratory. The assembly and commissioning of the detector is planned for 2014. In this presentation, results from NEXT-DEMO will be presented and considerations will be made on both NEXT-DEMO and NEXT-NEW.

Primary author(s) : Dr. MONTEIRO, Cristina M. B. (University of Coimbra) (on behalf of the NEXT Collaboration)

Presenter(s) : Dr. MONTEIRO, Cristina M. B. (University of Coimbra) (on behalf of the NEXT Collaboration)

Session Classification : II.c Neutrino

Track Classification : Experiments: 2c) Detectors for neutrino physics

Contribution ID : **139** Type : **Oral**

The POSSUMUS-Detector

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

We present the newly developed Position Sensitive Scintillating Muon SiPM -Detector (POSSUMUS). This modular designed scintillation detector is capable to determine particle's position two-dimensional with resolution of a few mm for minimum ionizing particles. POSSUMUS is usable for large area trigger applications with few readout channels. The idea of this detector is to combine two trapezoidal shaped plastic scintillators to form one rectangular shaped scintillator rod. Each trapezoid in a rod is optically insulated against the other. In both trapezoids the scintillation light is collected by wavelength shifting fibers (WLS-fibers) and guided to Silicon-Photo-Multipliers (SiPM), where the light yield is detected. The SiPMs are located at opposite sites of each WLS-fiber, an automatic voltage adjustment allows for a stable gain of the detected light signals. Position resolution in the transverse direction is achieved by the geometric shape of the scintillators. The amount of light produced by incoming particles is proportional to their path length in the trapezoid and thus position dependent. The longitudinal position resolution, along the scintillator rod, is determined by the propagation time of light to either end of the rod. Because of its modularity, the POSSUMUS-detector can be used for trigger applications of different sizes with only few readout channels. By combining several scintillator rods, position sensitive areas from 100 cm2 to few m2 are achievable. In this talk we present a fully operating prototype of POSSUMUS, the multi-channel gain stabilization system for SiPMs and results for transverse and longitudinal position resolution

Summary

Primary author(s) : RUSCHKE, Alexander (Ludwig-Maximilians-Univ. Muenchen (DE))

Co-author(s) : BIEBEL, Otmar (Ludwig-Maximilians-Univ. Muenchen (DE)); HERTENBERGER, Ralf (Ludwig-Maximilians-Univ. Muenchen (DE)); MULLER, Ralph (Ludwig-Maximilians-Univ. Muenchen (DE)); Mr. GROSSMANN, Johannes (LMU)

Presenter(s) : RUSCHKE, Alexander (Ludwig-Maximilians-Univ. Muenchen (DE))

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **73** Type : **Oral**

The Phase-1 Upgrade of the ATLAS First Level Calorimeter Trigger

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

The level1 calorimeter trigger (L1Calo) of the ATLAS experiment has been operating effectively since the start of LHC data taking, and has played a major role in the discovery of the Higgs boson. To face the new challenges posed by the upcoming increases of the LHC proton beam energy and luminosity, a series of upgrades is planned for L1Calo. An initial upgrade (Phase0) is scheduled to be ready for the start of the second LHC run in 2015, and a further more substantial upgrade (Phase1) is planned to be installed during the LHC shutdown expected in 2018. The calorimeter trigger aims to identify electrons, photons, taus and hadronic jets. It also determines total and missing transverse energy and can further analyse the event topology using a dedicated system incorporating information from both calorimeter and muon triggers. This paper presents the Phase1 hardware trigger developments which exploit a tenfold increase in the available calorimeter data granularity when compared to that of the current system. The calorimeter signals will be received via optical fibers and distributed to two distinct processing systems. Those systems implement sliding window algorithms and quasi offline algorithms to achieve object reconstruction and identification. The algorithms are implemented on high density electronics boards which make use of recent developments in high speed data transmission and FPGA technology. The presentation reviews the physics impact along with the current status of the hardware design and early prototypes and demonstrator boards.

Summary

Primary author(s) : GARELLI, Nicoletta (SLAC National Accelerator Laboratory (US))

Presenter(s) : HRISTOVA, Ivana Radoslavova (Humboldt-Universitaet zu Berlin (DE))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **105** Type : **Oral**

The Pixel Luminosity Telescopes a Dedicated Luminosity Monitor for CMS

Friday, 6 June 2014 15:20 (0:20)

Abstract content

The Pixel Luminosity Telescopes (PLT) will be the first dedicated luminosity monitor installed in the CMS experiment at CERN's Large Hadron Collider. It is designed to measure the bunch-by-bunch relative luminosity to high precision. It consists of a set of small angle telescopes each with three planes of pixel sensors. The full PLT will be installed in CMS for the first full energy operation of the LHC in September 2014. In the 2012-2013 LHC run a pilot PLT detector was installed consisting of both single-crystal diamond and silicon sensors giving a first look at their performance in a continuous high-rate environment. This was the first operation of a diamond pixel tracking detector in a high energy physics experiment and is providing the first data on diamond pixel sensors under high particle rate in a high radiation environment. We will report on the design, construction, testing, and installation status for the 2014 installation as well as report the findings of the single-crystal diamond based pilot detector. In addition we will discuss high-rate studies of polycrystalline diamond sensors for potential use in the PLT for the 2014 installation.

Summary

Primary author(s) : HIDAS, Dean Andrew (Rutgers, State Univ. of New Jersey (US))

Co-author(s) : PLT, Group (CMS)

Presenter(s) : HIDAS, Dean Andrew (Rutgers, State Univ. of New Jersey (US))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **338** Type : **Oral**

The RICH detector of the LHCb experiment

Wednesday, 4 June 2014 11:00 (0:20)

Abstract content

The LHCb experiment was fully operational during the Run 1 of the Large Hadron Collider in the period 2009-2013, collected more than 3 fb^{-1} of data and has produced many world first and world best measurements. The RICH system is an integral part of LHCb proving hadron identification in the momentum range of 2-100 GeV/c. The ability to separate pions and kaons in this wide momentum range is essential for the physics measurements of LHCb. The LHCb RICH system consists of two RICH detectors with three different radiators. The optical systems are made from a total of 116 mirrors (four constructed out of low mass carbon fibre) and single photon detection is achieved by 484 Hybrid Photon Detectors (HPD). The RICH detectors have been aligned and calibrated using the LHCb data and their performance evaluated using pure particle samples collected without RICH information. The performance of the RICH detectors in a high multiplicity hadron environment is excellent. The LHCb experiment is preparing for a significant upgrade during the Long Shutdown 2 of the LHC. There are advanced plans to modify the existing layout in order to conserve the current particle identification performance despite the increase in luminosity by a factor five. The alignment, calibration and performance of the LHCb RICH system will be presented, together with a few example analyses showing the contribution of the RICH. The plans for the LHCb RICH upgrade will also be presented.

Summary

Primary author(s) : Dr. PAPANESTIS, Antonis (STFC - Rutherford Appleton Lab. (GB))

Presenter(s) : Dr. PAPANESTIS, Antonis (STFC - Rutherford Appleton Lab. (GB))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **74** Type : **Oral**

The Serial Link Processor for the Fast TracKer (FTK) processor at ATLAS

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

The Associative Memory (AM) system of the FTK processor has been designed to perform pattern matching using the hit information of the ATLAS silicon tracker. The AM is the heart of the FTK and it finds track candidates at low resolution that are seeds for a full resolution track fitting. To solve the very challenging data traffic problem inside the FTK, multiple designs and tests have been performed. The currently proposed solution is named the "Serial Link Processor" and is based on an extremely powerful network of 2 Gb/s serial links. This paper reports on the design of the Serial Link Processor consisting of the AM chip, an ASIC designed and optimized to perform pattern matching, and two types of boards, the Local Associative Memory Board (LAMB), a mezzanine where the AM chips are mounted, and the Associative Memory Board (AMB), a 9U VME board which holds and exercises four LAMBs. We report also on the performance of a first prototype based on the use of a min@sic AM chip, a small but complete version of the final AM chip, built to test the new and fully serialized I/O. Also a dedicated LAMB prototype, named miniLAMB, with reduced functionalities, has been produced to test the mini@sic. The serialization of the AM chip I/O significantly simplified the LAMB design. We report on the tests and performance of the integrated system mini@sic, miniLAMB and AMB.

Summary

Primary author(s) : Dr. SALVATORE, Fabrizio (University of Sussex (GB))

Presenter(s) : LUCIANO, Pierluigi (Sezione di Pisa (IT))

Session Classification : III.c Embedded Software

Track Classification : Data-processing: 3c) Embedded software

Contribution ID : **401** Type : **Oral**

The Silicon Tracking System of the CBM experiment at FAIR: detector development and system integration

Wednesday, 4 June 2014 18:00 (0:20)

Abstract content

The CBM experiment at the future Facility for Antiproton and Ion Research (FAIR) will explore the properties of nuclear matter at high net baryon densities and at moderate temperature. The key detector – a Silicon Tracking System (STS) – will reconstruct charged particle tracks created in interactions of heavy-ion beam with nuclear target at projectile energies ranging from 10 to 40 GeV/nucleon. Operation at 10 MHz interaction rate with charged particle multiplicities up to 1000 requires fast and radiation hard silicon sensors. The necessary momentum resolution of 1% imposes stringent requirements to the sensor material budget (0.3% X_0) and detector module structure.
The STS will occupy volume of about 1 m^3 defined by the aperture of a dipole magnet. It will consist of 8 tracking stations based on double-sided silicon microstrip detectors. The sensors with 58 μm pitch, size up to 62×62 mm^2 and 1024 strips per side have AC-coupled strips oriented at $\pm 7.5°$ stereo angle. Short corner strips on the opposite edges of the sensors are interconnected via second metallization layer thus avoiding insensitive areas.
Complicated design and the large number of silicon sensors needed for the construction of the STS (about 1300) require a set of quality assurance procedures that involve optical inspection, electric characterization and readout tests. We report about the development of an optical inspection system using NI LabVIEW software and Vision package for pattern recognition.
The STS readout electronics with 2.1 million channels will dissipate about 40 kW of power. To cope with it, bi-phase CO_2 evaporative cooling will be used. Performance of a test system will be presented, in particular the cooling efficiency of a custom-made heat exchanger for the front-end electronics.

Summary

Primary author(s) : Dr. LYMANETS, Anton (University of Tuebingen)

Co-author(s) : Prof. SCHMIDT, Hans Rudolf (University of Tuebingen); Mr. LAVRIK, Evgeny (University of Tuebingen)

Presenter(s) : Dr. LYMANETS, Anton (University of Tuebingen)

Session Classification : IV.abc Cooling & MEMS & 3D

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **58** Type : **Oral**

The Status of the MCP-PMT R&D in China

Thursday, 5 June 2014 16:30 (0:20)

Abstract content

The JUNO (Jiangmen Underground Neutrino Observatory) designed to build an underground lab on the location of JiangMen in south China as a generic underground national lab for many applications. The new promising neutrino programs request the higher performance of the detectors. It is proposed to increase the photoelectron detection efficiency of the PMT used in neutrino experiment. The researchers in IHEP designed a new type of MCP-PMT. The small MCP unit instead of the large Dynode, the transmission photocathode and the reflection photocathode were assembled in the same glass shell to form nearly 4 pai photocathode effective area to enhance the efficiency of the photoelectron detecting. Some researchers and engineers in institutes and companies in China come together to manufacture and research this type of PMT based on the MCPs. After two years R&D work, several 8 inch prototypes were produced and there performance was carefully tested in our Lab. The MCP-PMT performance test system was built in our Lab for better performance test. The characteristics of the photocathode were carefully researched by testing the I-V curve, the QE, and the QE-map for the 8 inch area photocathode uniformity. Also we measured the charge spectrum to confirm its ability for the single photoelectron spectrum. More simulation and experiment work have already done to develop an 8 inch prototype module for the MCP-PMT designed in IHEP, and the detailed will be described in this formal manuscript.

Summary

Primary author(s) : QIAN, Sen (I)

Presenter(s) : QIAN, Sen (I)

Session Classification : I.d Photon

Track Classification : Sensors: 1d) Photon Detectors

Contribution ID : **104** Type : **Oral**

The TDCPix ASIC: Tracking for the NA62 GigaTracker

Thursday, 5 June 2014 17:10 (0:20)

Abstract content

The TDCPix is a hybrid pixel detector readout ASIC designed for the NA62 GigaTracker detector. The requirements are a single-hit timing resolution better than 200ps RMS, a hit loss of less than 1% in the presence of a (highly non-uniform) beam rate up to 1MHz/cm^2. This hit rate leads to an expected data rate at the output of the chip which can reach 6Gb/s. The TDCPix comprises an asynchronously operating pixel array of 40 columns of 45 pixels, each 300 microns x 300 microns. This is instrumented with 40 Delay Locked Loop based time-to-digital converters connected to data buffering and concentrating logic. The read-out uses four 3.2Gb/s serialisers with the high speed clock being provided by a low-noise on-chip PLL. The high data rates negate the possibility of buffering whilst awaiting a trigger, thus a self triggering architecture has been adopted.

All configuration and state logic in the design deemed critical for the correct operation of the chip has been triplicated to provide increased single event effect tolerance. A number of on-chip digital-to-analogue converters provide threshold generation and trimming and are configurable through a single-signal configuration interface. The configuration and DAQ interfaces include a DC-balanced protocol layer permitting direct optical connections when the ASIC is installed in the experiment. Dedicated calibration circuitry is included to enable the required timing resolution to be reached.

The chip has been manufactured in a commercial 130nm process and testing is underway. A detailed description of the architecture and performance results will be presented.

Summary

Primary author(s) : NOY, Matthew (CERN)

Co-author(s) : Dr. AGLIERI RINELLA, Gianluca (CERN); BONACINI, Sandro (CERN); KAPLON, Jan (CERN); KLUGE, Alex (CERN); MOREL, Michel (CERN); PERKTOLD, Lukas (Graz University of Technology (AT)); POLTORAK, Karolina (AGH University of Science and Technology (PL))

Presenter(s) : NOY, Matthew (CERN)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **374** Type : **Oral**

The Thermo-Mechanical Integration of the NA62 GigaTracKer

Monday, 2 June 2014 17:30 (0:20)

Abstract content

The NA62 collaboration will pioneer the use of on-detector microfluidic cooling systems with the implementation of silicon microchannel plates in the GigaTracKer (GTK) pixel detectors in the fall of 2014.
The cooling plates consist of 130 μm silicon substrates in which 150 microchannels are embedded. They have a rectangular cross-section of 70 x 200 μm and they cover an area of 45 x 60 mm to actively remove, with liquid C6F14, the power dissipated by the TDCPix readout ASICs bump-bonded to the backside of the GTK sensors. The microfluidic cooling plates are also at the core of the mechanical integration of the GTK system. They provide structural support to the sensor and TDCPix chips interfacing them to the read-out board.
After reviewing the design, prototyping, experimental characterization and validation of this cooling system, the paper will focus on the integration of the 3 GTK detector assemblies in the beam line of the NA62 experiment.

Summary

Primary author(s) : MAPELLI, Alessandro (CERN); ROMAGNOLI, Giulia (Universita e INFN (IT)); DEGRANGE, Jordan (CERN); PETAGNA, Paolo (CERN); MOREL, Michel (CERN)

Presenter(s) : MAPELLI, Alessandro (CERN)

Session Classification : IV.a Cooling

Track Classification : Emerging technologies: 4a) Cooling and cryogenics

Contribution ID : **138** Type : **Oral**

The Time Structure of Hadronic Showers in Analog and Digital Calorimeters confronted with Simulations

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

The intrinsic time structure of hadronic showers influences the timing capability and the required integration time of highly granular hadronic calorimeters for future collider experiments. To evaluate the influence of different active media and different absorbers, dedicated experiments with tungsten and steel hadron calorimeters of the CALICE collaboration have been carried out. These use plastic scintillator tiles with SiPM readout and RPCs, both arranged as 15 small detector cells read out with fast digitizers and deep buffers. The results of the studies provide detailed information on the time structure of hadronic showers, and are confronted with GEANT4 simulations to evaluate the realism of current hadronic shower models with respect to the time evolution of hadronic cascades.

Summary

Primary author(s) : SIMON, Frank (Max-Planck-Institut fuer Physik)

Presenter(s) : SIMON, Frank (Max-Planck-Institut fuer Physik)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **456** Type : **Oral**

The Timepix3 readout chip: design, tests and first measurements with silicon sensors

Friday, 6 June 2014 12:20 (0:20)

Abstract content

Timepix3 is a unique ASIC developed to provide fast readout in a low to medium hit rate environment. The pixel matrix consists of 256x256 pixels with a pitch of 55µm. The chip can be configured in either data driven or frame-based modes. In data driven mode the chip sends out a 48-bit package every time a pixel is hit while the shutter is open. This packet contains 18bits of Time-Of-Arrival and 10bits of Time-Over-Threshold (TOT). In data driven mode the chip can cope with a hit rate up to 40MHits/s/cm2. The finest arrival time resolution is 1.56ns. The chip can also be used in a frame-based mode providing either the same hit information as in the data driven mode or simultaneous event counting and integral TOT information per pixel.
Recently, the first Timepix3 chips bump bonded to a 300[U+F06D]m thick Silicon sensor became available. In this talk the chip and its most important design features will be introduced. Test results of the stand-alone chip will be shown, together with the first measurements obtained using assemblies with sensor.

Summary

Primary author(s) : DE GASPARI, Massimiliano (CERN)

Co-author(s) : VAN BEUZEKOM, Martin (NIKHEF (NL)); GROMOV, Vladimir (NIKHEF (NL)); Mr. KLUIT, Ruud (Nikhef (NL)); ZAPPON, Francesco (Nikhef); ZIVKOVIC, Vladimir (NIKHEF Institute); CAMPBELL, Michael (CERN); POIKELA, Tuomas Sakari (University of Turku (FI)); LLOPART CUDIE, Xavi (CERN); BREZINA, Christoph (University Bonn); DESCH, Klaus (University of Bonn); Dr. KRUTH, Andre Konrad (University of Bonn); FU, Yunan

Presenter(s) : DE GASPARI, Massimiliano (CERN)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **223** Type : **Oral**

The Triple-GEM Project for the Phase 2 Upgrade of the CMS Muon System

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

In view of the high-luminosity phase of the LHC, the CMS Collaboration is considering the use of Gas Electron Multiplier (GEM) detector technology for the upgrade of its muon system in the forward region. With their ability to handle the extreme particle rates expected in that area, such micro-pattern gas detectors can sustain a high performance and redundant muon trigger system. At the same time, with their excellent spatial resolution, they can improve the muon track reconstruction and identification capabilities of the forward detector, effectively combining tracking and triggering functions in one single device. The present status of the CMS GEM project will be reviewed, highlighting importants steps and achievements since the start of the R&D activities in 2009. Several small and full-size prototypes have been constructed with different geometries and techniques. The baseline design of the triple-GEM detectors proposed for installation in different stations of the CMS muon endcap system will be described, along with the associated frontend electronics and data-acquisition system. The expected impact on the performance of the CMS muon system will be discussed, and results from extensive test measurements of all prototypes, both in the lab and in test beams at CERN and FNAL will be presented.

Summary

Primary author(s) : TYTGAT, Michael (Ghent University (BE))

Presenter(s) : TYTGAT, Michael (Ghent University (BE))

Session Classification : I.c Gaseous

Track Classification : Sensors: 1c) Gaseous Detectors

Contribution ID : **379** Type : **Oral**

The brain as a trigger system

Tuesday, 3 June 2014 17:30 (0:20)

Abstract content

There are significant analogies between the issues related to real-time event selection in HEP, and the issues faced by the human visual system. In fact, the visual system needs to extract rapidly the most important elements of the external world from a large flux of information, for survival purposes. A rapid and reliable detection of visual stimuli is essential for triggering autonomic responses to emotive stimuli, for initiating adaptive behaviors and for orienting towards potentially interesting/ dangerous stimuli. The speed of visual processing can be as fast as 20 ms, about only 20 times the duration of the elementary information exchanges by the action potential. The limitations to the brain capacity to process visual information, imposed by intrinsic energetic costs of neuronal activity, and ecological limits to the size of the skull, require a strong data reduction at an early stage, by creating a compact summary of relevant information, the so called "primal sketch", to be handled by further levels of processing. This is quite similar to the problem of experimental HEP of providing fast data reduction at a reasonable monetary cost, and with a practical device size.
As a result of a joint effort of HEP physicists and practicing vision scientists, we recently found evidence that not only the problems are similar, but the solutions adopted in the two cases also have strong similarities, and their parallel study can actually shed light on each other.
Modeling the visual system as a trigger processor leads to a deeper understanding, and even very specific predictions of its functionality. Conversely, the insights gained from this new approach to vision, can lead to new ideas for enhancing the capabilities of artificial vision systems, and HEP trigger systems as well.

Summary

Primary author(s) : Mrs. DEL VIVA, Maria Michela (University of Florence, Italy)

Co-author(s) : PUNZI, Giovanni (Pisa University and INFN)

Presenter(s) : Mrs. DEL VIVA, Maria Michela (University of Florence, Italy)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5c) Biology&Material Science

Contribution ID : **63** Type : **Oral**

The dual light-emitting crystals detector for WIMPs direct searches

Wednesday, 4 June 2014 17:20 (0:20)

Abstract content

The dual light-emitting crystals can reflect the different ranges of nuclear recoils and electron recoils by the ratio of the two different scintillation components. CsI(Na) crystals at temperatures of ~-100 [U+2103] have the best performance in several candidate crystals. An experiment called CINDMS is proposed for WIMPs direct searches based on the CsI(Na) crystals detector by IHEP. The 1T-scale experimental threshold is expected to be in the world advanced level through the background estimates. The initial stage of a 50kg scale experiment called CINDMS50 is under construction at Daya Bay neutrino experiment underground laboratory for the accumulation of technology. CINDMS1T or more large-scale experiment may be located deep underground laboratory of Jinping Mountain in Sichuan, China. This location provides vastly improved shielding from cosmogenic events which will reduce interference of known backgrounds particles.

Summary

Primary author(s) : Dr. SUN, Xilei (IHEP)

Presenter(s) : Dr. SUN, Xilei (IHEP)

Session Classification : II.d Dark Matter

Track Classification : Experiments: 2d) Dark Matter Detectors

Contribution ID : **98** Type : **Oral**

The new CMS DAQ system for run 2 of the LHC

Monday, 2 June 2014 16:10 (0:20)

Abstract content

The data acquisition system (DAQ) of the CMS experiment at the CERN Large Hadron Collider assembles events at a rate of 100 kHz, transporting event data at an aggregate throughput of 100 GByte/s to the high level trigger (HLT) farm. The HLT farm selects interesting events for storage and offline analysis at a rate of around 1 kHz. The DAQ system has been redesigned during the accelerator shutdown in 2013/14. The motivation is twofold: Firstly, the current compute nodes, networking, and storage infrastructure will have reached the end of their lifetime by the time the LHC restarts. Secondly, in order to handle higher LHC luminosities and event pileup, a number of sub-detectors will be upgraded, increasing the number of readout channels and replacing the off-detector readout electronics with a μTCA implementation. The new architecture will take advantage of the latest developments in the computing industry. For data concentration, 10/40 Gbit Ethernet technologies will be used, as well as an implementation of a reduced TCP/IP in FPGA for a reliable transport between custom electronics and commercial computing hardware. A 56 Gbps Infiniband FDR CLOS network has been chosen for the event builder with a throughput of ˜4 Tbps. The HLT processing is entirely file based. This allows the DAQ and HLT systems to be independent, and to use the same framework for the HLT as for the offline processing. The fully built events are sent to the HLT with 1/10/40 Gbit Ethernet via network file systems. Hierarchical collection of HLT accepted events and monitoring meta-data are stored into a global file system. This paper presents the requirements, technical choices, and performance of the new system.

Summary

Primary author(s) : MEIJERS, Frans (CERN)

Co-author(s) : BAWEJ, Tomasz Adrian (Warsaw University of Technology (PL)); ERHAN, Samim (Univ. of California Los Angeles (US)); FORREST, Andrew Kevin (University of Kent (GB)); GIGI, Dominique (CERN); GLEGE, Frank (CERN); GOMEZ CEBALLOS RETUERTO, Guillelmo (Massachusetts Inst. of Technology (US)); GOMEZ-REINO GARRIDO, Robert (CERN); Dr. HEGEMAN, Jeroen (CERN); HOLZNER, Andre Georg (Univ. of California San Diego (US)); MASETTI, Lorenzo (CERN); MESCHI, Emilio (CERN); BEHRENS, Ulf (Deutsches Elektronen-Synchrotron (DE)); MOMMSEN, Remi (Fermi National Accelerator Lab. (US)); MOROVIC, Srecko (CERN); NUNEZ BARRANCO FERNANDEZ, Carlos (CERN); O'DELL, Vivian (Fermi National Accelerator Lab. (US)); ORSINI, Luciano (CERN); PAUS, Christoph (Massachusetts Inst. of Technology (US)); PETRUCCI, Andrea (CERN); PIERI, Marco (Univ. of California San Diego (US)); Dr. RACZ, Attila (CERN); SAKULIN, Hannes (CERN); BRANSON, James Gordon (Univ. of California San Diego (US)); SCHWICK, Christoph (CERN); STIEGER, Benjamin (CERN); SUMOROK, Konstanty (Massachusetts Inst. of Technology (US)); Mr. VEVERKA, Jan (Massachusetts Inst.

of Technology (US)); ZEJDL, Petr (CERN); CHAZE, Olivier (CERN); CITTOLIN, Sergio (Univ. of California San Diego (US)); DARLEA, Georgiana Lavinia (Massachusetts Inst. of Technology (US)); DELDICQUE, Christian (CERN); Dr. DOBSON, Marc (CERN); DUPONT, Aymeric Arnaud (CERN)

Presenter(s) : Mr. VEVERKA, Jan (Massachusetts Inst. of Technology (US))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **284** Type : **Oral**

The upgrade of the ALICE Inner Tracking System - Status of the R&D on monolithic silicon pixel sensors

Tuesday, 3 June 2014 17:10 (0:20)

Abstract content

As a major part of its upgrade plans, the ALICE experiment schedules the installation of a novel Inner Tracking System (ITS) during the Long Shutdown 2 of the LHC in 2018/19. It will replace the present silicon tracker with 7 layers of Monolithic Silicon Active Pixel Sensors (MAPS) and significantly improve the detector performance in terms of tracking and rate capabilities. The choice of technology has been guided by the tight requirements on the material budget of 0.3 X_0 for the three innermost layers and backed by the significant progress in the field of MAPS in recent years.
The new ITS will in total cover a surface of 10.3 m^2 with approximately 25×10^9 pixels. The pixel chips are manufactured in the TowerJazz 180 nm CMOS imaging sensor process on wafers with high resistivity epitaxial layer. Within the ongoing R&D phase, several sensor chip prototypes have been developed and produced on different epitaxial layer thicknesses and resistivities. These chips are being characterised for their performances before and after irradiation using source tests, test beam and measurements using an infrared laser.

The present contribution will provide an overview of the ALICE ITS upgrade with a focus on the R&D activities on the pixel chip.

Summary

Primary author(s) : VAN HOORNE, Jacobus Willem (Vienna University of Technology (AT))

Presenter(s) : VAN HOORNE, Jacobus Willem (Vienna University of Technology (AT))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **201** Type : **Oral**

Timing performance of the CMS electromagnetic calorimeter and prospects for the future

Monday, 2 June 2014 16:50 (0:20)

Abstract content

The CMS electromagnetic calorimeter (ECAL) is made of 75,848 scintillating lead tungstate crystals arranged in a barrel and two endcaps. The scintillation light is read out by avalanche photodiodes in the barrel and vacuum phototriodes in the endcaps, at which point the scintillation pulse is amplified and sampled at 40 MHz by the on-detector electronics. The fast signal from the crystal scintillation enables energy as well as timing measurements from the data collected in proton-proton collisions with high energy electrons and photons. The single-channel time resolution of ECAL measured at beam tests for high energy showers is better than 100 ps. The timing resolution achieved with the data collected in proton-proton collisions at the LHC is discussed. We present how precision timing is used in current physics measurements and discuss studies of subtle calorimetric effects, such as the timing response of different crystals belonging to the same electromagnetic shower. In addition, we present prospects for the high luminosity phase of the LHC (HL-LHC), where we expect an average of 140 concurrent interactions per bunch crossing (pile-up). We discuss studies on how precision time information could be exploited for pileup mitigation and for the assignment of the collision vertex for photons. In this respect, a detailed understanding of the timing performance and of the limiting factors in time resolution are areas of ongoing studies.

Summary

Primary author(s) : BORNHEIM, Adolf (Charles C. Lauritsen Laboratory of High Energy Physics)

Presenter(s) : BORNHEIM, Adolf (Charles C. Lauritsen Laboratory of High Energy Physics)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **45** Type : **Oral**

Total Ionization Damage Compensations in Double Silicon-on-Insulator Pixel Sensors

Friday, 6 June 2014 14:00 (0:20)

Abstract content

We are developing monolithic pixel sensors based on a 0.2 um fully-depleted Silicon-on-Insulator (SOI) technology. Such sensors have properties such as high-speed operation, low-power dissipation, and SEU/SET immunity. The major issue in applications them in high-radiation environments is the total ionization damage (TID) effects. The effects are rather substantial in the SOI devices since the transistors are enclosed in the oxide layers where generated holes are trapped and affect the operation of the near-by transistors. The double SOI sensors that provide an independent electrode underneath the buried oxide (BOX) layer have been developed. A negative voltage applied to this electrode is expected to cancel positive potential due to hole traps in the BOX layer. We have irradiated transistor test elements and pixel sensors with γ-rays. By adjusting the potential of this electrode, the TID effects are shown to be compensated. The transistors irradiated to 2 MGy recovered their performances by applying a bias to the electrode. Transistors were shown to have modest differences in behaviors of TID compensations according to their types. Furthermore, differences depending on the biasing condition during irradiation were observed. The pixel sensor irradiated to 100 kGy recovered its functionality by applying a bias to the electrode. We used infrared laser pulse and γ-ray sources to evaluate TID compensations of pixel sensors. The radiation tolerance of the SOI devices has been substantially improved by employing the innovative double SOI.

Summary

Primary author(s) : HONDA, Shunsuke (University of Tsukuba (JP))

Co-author(s) : HARA, Kazuhiko (University of Tsukuba (JP)); TSURU, Takeshi (Kyoto University); MIURA, Noriyuki (Lapis Semiconductor Miyagi Co., Ltd. (JP)); KASAI, hiroki (Lapis Semiconductor Miyagi Co., Ltd. (JP)); OKIHARA, Masao (Lapis Semiconductor Co., Ltd. (JP)); ASANO, Mari (University of Tsukuba (JP)); MAEDA, tatsuya (University of Tsukuba (JP)); TOBITA, Naoshi (University of tsukuba (JP)); TSUCHIDA, Kohei (University of Tsukuba (JP)); ARAI, Yasuo (High Energy Accelerator Research Organization (JP)); MIYOSHI, Toshinobu (KEK); OHNO, Morifumi (National Institute of Advanced Industrial Science and Technology (JP)); HATSUI, Takaki (RIKEN)

Presenter(s) : HONDA, Shunsuke (University of Tsukuba (JP))

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **424** Type : **Oral**

Totally Active Scintillator Calorimeter for the Muon Ionization Cooling Experiment

Thursday, 5 June 2014 16:50 (0:20)

Abstract content

The Electron-Muon Ranger (EMR) is a totally active scintillator detector to be installed in the muon beam of the Muon Ionization Cooling Experiment (MICE) - the R&D project for the future neutrino factory. It is aimed at measuring properties of low energy beam composed of muons, electrons and pions performing the identification particle by particle. The EMR is made of 48 intersecting layers. Each layer consists of 59 triangular scintillator bars. The granularity of the detector (2880 readout channels) makes it possible to identify tracks and measure particle ranges and shower shapes. The read-out is based on FPGA custom made electronics and commercially available modules. It was built at University of Geneva and installed at the Rutherford Appleton Laboratory in Oxford in September 2013. Tests with low energy beam (100 - 400MeV/c) revealed an exceptional performance of the detector.

Summary

Primary author(s) : ASFANDIYAROV, Ruslan (Universite de Geneve (CH))

Presenter(s) : ASFANDIYAROV, Ruslan (Universite de Geneve (CH))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **70** Type : **Oral**

Towards a Level-1 tracking trigger for the ATLAS experiment

Thursday, 5 June 2014 11:20 (0:20)

Abstract content

The future plans for the LHC accelerator allow, through a schedule of phased upgrades, an increase in the average instantaneous luminosity by a factor 5 with respect to the original design luminosity. The ATLAS experiment at the LHC will be able to maximise the physics potential from this higher luminosity only if the detector, trigger and DAQ infrastructure are adapted to handle the sustained increase in particle production rates.
In this paper the changes expected to be required to the ATLAS detectors and trigger system to fulfill the requirement for working in such high luminosity scenario are described. The increased number of interactions per bunch crossing will result in higher occupancy in the detectors and increased rates at each level of the trigger system. The trigger selection will improve the selectivity partly from increased granularity for the sub detectors and the consequent higher resolution. One of the largest challenges will be the provision of tracking information at the first trigger level, which should allow a large increase in the rejection power at this stage of the selection and yet still allow the full physics potential of the experiment to be fulfilled. In particular, the electroweak scale still requires to keep the thresholds on the transverse momenta of particles as low as possible and tracking will provide essential information that could be used to this aim as early as possible in the trigger chain.
Studies to understand the feasibility of such a system have begun, and proceed in two directions: a fast readout for high granularity silicon detectors, and a fast pattern recognition algorithm to be applied just after the Front-End readout for specific sub detectors. Both existing, and novel technologies can offer solutions. The aim of these studies is to determine the parameter space to which this system must be adapted. The status of ongoing tests on specific hardware components crucial for this system to fully satisfy the ATLAS trigger requirements at very high luminosities and increase its potential are discussed.

Summary

Primary author(s) : GARELLI, Nicoletta (SLAC National Accelerator Laboratory (US))

Presenter(s) : CERRI, Alex (University of Sussex (GB))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **286** Type : **Oral**

Towards the integration of the MicroVertex Detector in the PANDA experiment.

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Daniela Calvo on behalf of the PANDA MVD group.
The fixed target experiment PANDA is one essential part of the FAIR facility in Darmstadt and is going to study the interactions of antiproton beams, featuring unprecedented quality and intensity, on protons and on nuclei. It includes the Micro Vertex Detector (MVD) 1, as innermost detector of the tracking system, specially able to detect secondary vertices of short-live particles. Due to the forward boost the MVD layout is asymmetric with four barrels surrounding the interaction point and six disks in the forward direction. The innermost layers are composed of hybrid epitaxial silicon pixels and the outermost ones of double sided silicon strips, with about 10ˆ7 pixels and 2x10ˆ5 strips channels. PANDA features a triggerless architecture, therefore the MVD has to run with a continuous data transmission at a high interaction rate (about 10ˆ7 int./s) where hits have precise timestamps (the experiment clock is 155.52 MHz). In addition the energy loss of the particles in the sensor should be measured. To cope with these requirements custom readout chips are under development for both pixel and strip devices. The powering and cooling of the readout are challenging since the MVD volume is limited by the surrounding detectors and the routing is only foreseen in the backward direction. Support structures are made of carbon fibers and high thermally conductive carbon foam with embedded cooling pipes beneath the readout chips is integrated.
The presentation is focused on the technological aspects of the design and the integration of this detector in PANDA.
1 PANDA Collaboration, Technical Design report for the PANDA Micro Vertex Detector, arXiv:1207.6581 v2, 2011

Summary

The presentation is focused on the technological aspects of the design and the integration of the Micro Vertex Detector in the PANDA experiment.

Primary author(s) : Dr. CALVO, Daniela (INFN - Sezione di Torino)

Presenter(s) : Dr. CALVO, Daniela (INFN - Sezione di Torino)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **195** Type : **Oral**

Track reconstruction in CMS high luminosity environment

Friday, 6 June 2014 15:00 (0:20)

Abstract content

The CMS tracker is the largest silicon detector ever built, covering 200 square meters and providing an average of 14 high-precision measurements per track. Tracking is essential for the reconstruction of objects like jets, muons, electrons and tau leptons starting from the raw data from the silicon pixel and strip detectors. Track reconstruction is widely used also at trigger level as it improves objects tagging and resolution.
The CMS tracking code is organized in several levels, known as 'iterative steps', each optimized to reconstruct a class of particle trajectories, as the ones of particles originating from the primary vertex or displaced tracks from particles resulting from secondary vertices. Each iterative step consists of seeding, pattern recognition and fitting by a kalman filter, and a final filtering and cleaning. Each subsequent step works on hits not yet associated to a reconstructed particle trajectory.
The CMS tracking code is continuously evolving to make the reconstruction computing load compatible with the increasing instantaneous luminosity of LHC, resulting in a large number of primary vertices and tracks per bunch crossing. This is achieved by optimizing the iterative steps and by using new software techniques.
Tracking algorithms used in CMS are described; physics and computing performances are discussed with respect to Run 1 and Run 2 physics program and within CMS future upgrades.

Summary

Primary author(s) : Prof. MAZUMDAR, Kajari (Tata Inst. of Fundamental Research (IN))

Presenter(s) : GOETZMANN, Christophe (Institut Pluridisciplinaire Hubert Curien (FR))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **180** Type : **Oral**

Tracking at High Level Trigger in CMS

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

The trigger systems of the LHC detectors play a crucial role in determining the physics capabilities of the experiments. A reduction of several orders of magnitude of the event rate is needed to reach values compatible with detector readout, offline storage and analysis capability. The CMS experiment has been designed with a two-level trigger system: the Level-1 Trigger (L1T), implemented on custom-designed electronics, and the High Level Trigger (HLT), a streamlined version of the CMS offline reconstruction software running on a computer farm. A software trigger system requires a trade-off between the complexity of the algorithms, the sustainable output rate, and the selection efficiency. With the computing power available during the 2012 data taking the maximum reconstruction time at HLT was about 200 ms per event, at the nominal L1T rate of 100 kHz. Track reconstruction algorithms are widely used in the HLT, for the reconstruction of the physics objects as well as in the identification of b-jets and lepton isolation. Reconstructed tracks are also used to distinguish the primary vertex, which identifies the hard interaction process, from the pileup ones. This task is particularly important in the LHC environment given the large number of interactions per bunch crossing: on average 25 in 2012, and expected to be around 40 in Run II. We will present the performance of HLT tracking algorithms, discussing its impact on CMS physics programme, as well as new developments done towards the next data taking in 2015.

Summary

Primary author(s) : TOSI, Mia (Universita' degli Studi di Padova e INFN (IT))

Presenter(s) : TOSI, Mia (Universita' degli Studi di Padova e INFN (IT))

Session Classification : III.b Trigger & DAQ

Track Classification : Data-processing: 3b) Trigger and Data Acquisition Systems

Contribution ID : **331** Type : **Oral**

Triroc: 64-channel SiPM read-out ASIC for PET/PET-ToF application

Thursday, 5 June 2014 12:00 (0:20)

Abstract content

Triroc is the latest addition to SiPM readout ASICs family developed at Weeroc, a start-up company from the Omega microelectronics group of IN2P3/CNRS. This chip developed under the framework TRIMAGE European project which is aimed for building a cost effective tri-modal PET/MR/EEG brain scan. To ensure the flexibility and compatibility with any SiPM in the market, the ASIC is designed to be capable of accepting negative and positive polarity input signals.
This 64-channel ASIC, is suitable for SiPM readout which requires high accuracy timing and charge measurements. Targeted applications would be PET prototyping with time-of-flight capability. Main features of Triroc includes high dynamic range ADC up to 2500 photoelectrons and TDC fine time binning of 40 ps. Triroc requires very minimal external components which means it is a good contender for compact multichannel PET prototyping. Triroc is designed by using AMS 0.35μm SiGe technology and submitted in March 2014. The detail design of this chip will be presented.

Summary

Triroc is a 64-channel silicon photomultiplier (SiPM) readout ASIC targeted for Time-of-Flight Positron Emission Tomograpy (TOF-PET) application. This chip developed for TRIMAGE project which is aimed for building a cost effective tri-modal PET/MR/EEG brain scan.
The low-noise, DC-coupled front-end amplifiers of this ASIC accept both negative and positive input signals thus making it suitable for reading out any SiPM in the market. Moreover, individual input DC level adjustment is available for correcting the non-uniformity of SiPM gain.
In each ASIC channel, the incoming signals will be sent into two different paths: for energy and time measurements. A variable gain semi-gaussien shaper is used for shaping the input signal in energy measurements. The energy conversion is handled by a 10-bit Wilkinson ADC. This ADC is a proven design and it is expected to be linear up to 2500 photoelectrons. Additionally, a charge trigger is available and can be used for events validation at required energy such as 511 keV.
Signal from high speed input pre-amplifier is fed into a discriminator in order to provide a fast trigger for time measurements. A TDC module with coarse and 40 ps fine time is used to time-stamp this trigger.
The digitized data are collected by the digital part which is also capable to validate 511 keV events and reject noise. Running at 80 Mhz, data will be transmitted through 4-bits parallel links. Other features on the digital side are zero suppress readout and TDC data compression. In all, the ASIC should be able to process up to 30k events per second.
Triroc can be operated with minimal external components, since most of the components for SiPM readout are packed internally. This feature makes the ASIC is a good contender in compact multi-channel PET applications. Triroc is designed by using AMS 0.35μm SiGe technology and will be submitted in March 2014.

Primary author(s) : Dr. AHMAD, Salleh (Weeroc SAS)

Co-author(s) : Mr. FLEURY, Julien (Weeroc SAS); Dr. DE LA TAILLE, Christophe (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mrs. SEGUIN-MOREAU, Nathalie (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. DULUCQ, FREDERIC (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Dr. MARTIN-CHASSARD, Gisele (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. CALLIER, Stephane (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. THIENPONT, Damien (OMEGA-Ecole Polytechnique-CNRS/IN2P3); Mr. RAUX, Ludovic (OMEGA-Ecole Polytechnique-CNRS/IN2P3)

Presenter(s) : Dr. AHMAD, Salleh (Weeroc SAS)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **53** Type : **Oral**

Ultra-transparent DEPFET pixel detectors for future electron-positron experiments

Tuesday, 3 June 2014 12:20 (0:20)

Abstract content

The DEPFET Collaboration develops highly granular, ultra-thin pixel detectors for outstanding vertex reconstruction at future collider experiments. A DEPFET sensor, by the integration of a field effect transistor on a fully depleted silicon bulk, provides simultaneously position sensitive detector capabilities and in-pixel amplification. The characterization of the latest DEPFET prototypes has proven that a comfortable signal to noise ratio and excellent single point resolution can be achieved for a sensor thickness of 50 micrometers. The close to final auxiliary ASICs have been produced and found to operate a DEPFET pixel detector of the latest generation with the required read-out speed. A complete detector concept is being developed for the Belle II experiment at the new Japanese super flavor factory. DEPFET is not only the technology of choice for the Belle˜II vertex detector, but also a solid candidate for the ILC. Therefore, in this paper, the status of DEPFET R&D project is reviewed in the light of the requirements of the vertex detector at a future electron-positron collider.

Summary

Primary author(s) : Dr. MARINAS, Carlos (University of Bonn)

Presenter(s) : Dr. MARINAS, Carlos (University of Bonn)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **47** Type : **Oral**

Upgrade of MEG Liquid Xenon Calorimeter

Friday, 6 June 2014 12:20 (0:20)

Abstract content

The MEG experiment yielded the most stringent upper limit on the branching ratio of the flavor-violating muon decay $\mu \to e\gamma$. A major upgrade of the detector is planned to improve the sensitivity by one order of magnitude. For the upgrade, 2-inch round-shape photomultiplier tubes (PMTs) on the entrance window will be replaced by 12×12 cm^2 Multi-Pixel Photon Counters (MPPCs) to significantly improve the granularity. The higher granularity will improve the energy resolution from 2.4% to 1.1% and the position resolution from 5 mm to 2 mm around the entrance window. The MPPC in the upgraded LXe detector is required to have a high photon detection efficiency (PDE) for the LXe scintillation light in the VUV range with a good gain uniformity and to be operational in the LXe temperature (165 K). A UV-enhanced MPPC is being developed in collaboration with Hamamatsu Photonics and were tested in LXe. The single-photoelectron detection capability was confirmed, and the PDE for the LXe scintillation light was measured to be 17%. A new sensor configuration based on a series connection of the sensor segments is being developed to reduce the large sensor capacitance and thus to make the pulse shorter. The design and the expected performance of the upgraded LXe detector with a comparison with the current detector, the plan and the status for building a prototype and the final detector and the R&D results of UV-MPPC development will be discussed.

Summary

Primary author(s) : Dr. SAWADA, Ryu (ICEPP, the University of Tokyo)

Presenter(s) : Dr. SAWADA, Ryu (ICEPP, the University of Tokyo)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **254** Type : **Oral**

Upgrade of the ALICE detector

Tuesday, 3 June 2014 12:00 (0:20)

Abstract content

A Large Ion Collider Experiment (ALICE) is the detector at the CERN Large Hadron Collider (LHC) dedicated to the study of strongly interacting matter, in particular the properties of the Quark-Gluon Plasma. The ALICE collaboration plans a major upgrade of the detector during the Long Shutdown 2 (LS2) of the LHC, which is at present foreseen to start in summer 2018. The upgrade strategy is based on collecting > 10 nb^{-1} of Pb-Pb collisions at luminosities up to L = 6 x 10^{27} cm^{-2}s^{-1} corresponding to a collision rate of 50 kHz, where each collision is shipped to the online systems, either upon a minimum bias trigger or in a self-triggered or continuous fashion. Since the TPC drift time of 100 μs is 5 times longer than the average time between interactions, the presently employed gating of the TPC wire chambers must be abandoned. Instead, continuously sensitive readout detectors based on Gas Electron Multipliers (GEMs) will be implemented. Furthermore, the present silicon tracker will be replaced by a new design entirely based on monolithic pixel chips in order to achieve significantly increased secondary vertex resolution and high tracking efficiency. Other ALICE sub-detectors are upgraded to read out Pb-Pb data at 50 kHz with nominal performance. Highly efficient triggering will be ensured by a new interaction trigger detector. A new online system will be implemented that is capable of receiving and processing the full detector information.
We will present the planned ALICE upgrade concept together with a description of the individual detector upgrade plans.

Summary

Primary author(s) : LIPPMANN, Christian (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter(s) : LIPPMANN, Christian (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **67** Type : **Oral**

Upgrade of the GERDA experiment

Tuesday, 3 June 2014 16:50 (0:20)

Abstract content

The Germanium Detector Array (GERDA) experiment, located underground in the Gran Sasso National Laboratory of INFN, Italy, is searching for the neutrinoless double beta (0v2b) decay of Ge-76. It uses a new shielding concept by operating bare Ge diodes (enriched in Ge-76) in 64 m^3 of liquid argon supplemented by a 3m thick layer of water. The results of GERDA Phase I have been published recently 1. Compared to previous Ge experiments, a background reduction of about one order of magnitude could be achieved yielding the so far best limit for 0v2b decay in Ge-76 and refuting a recent claim of discovery with high probability. The upgrade to GERDA Phase II is in progress; it strives for a further reduction of background by another order of magnitude towards a level of 10^-3 cts/(keV kg yr), and for a tenfold increase in half-life sensitivity (~10^26 yr) at an exposure of about 100 kg yr. This paper will discuss the numerous challenges to be met for reaching these goals including the increase of target mass by 20 kg of new low background BEGe detectors from enriched Ge-76 material which exhibit superior pulse shape discrimination and hence background rejection power, the development of new detector mounts, cold front end electronic circuitry, cabling and contacting schemes of ultra low mass and radiopurity, as well as the implementation of a retractable hybrid liquid argon veto system consisting of photomultipliers and silicon photomultipliers coupled to fibers which efficiently rejects all backgrounds that induce scintillation light in the liquid argon.
1 GERDA collaboration, Phys.Rev.Lett. 111 (2013) 122503

Summary

Primary author(s) : KNOEPFLE, Karl Tasso (MPI Kernphysik, 69117 Heidelberg)

Presenter(s) : KNOEPFLE, Karl Tasso (MPI Kernphysik, 69117 Heidelberg)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **8** Type : **Oral**

Upgrade of the LHCb Vertex Locator

Tuesday, 3 June 2014 11:40 (0:20)

Abstract content

The upgrade of the LHCb experiment, planned for 2018, will transform the entire readout to a trigger-less system operating at 40 MHz. All data reduction algorithms will be executed in a high-level software farm, with access to all event information. This will enable the detector to run at luminosities of 1-2 x1033 /cm2/s and probe physics beyond the Standard Model in the heavy sector with unprecedented precision. The upgraded VELO must be low mass, radiation hard and vacuum compatible. It must be capable of fast pattern recognition and track reconstruction and will be required to drive data to the outside world at speeds of up to 3 Tbit/s. This challenge is being met with a new VELO design based on hybrid pixel detectors positioned to within 5 mm of the LHC colliding beams. The sensors have 55 x 55 [U+F06D]m2 pixels and the VELOPix ASIC which is being developed for the readout is based on the Timepix/Medipix family of chips. The hottest ASIC will have to cope with pixel hit rates of up to 900 MHz. The material budget will be optimised with the use of evaporative CO2 coolant circulating in microchannels within a thin silicon substrate. Microchannel cooling brings many advantages: very efficient heat transfer with almost no temperature gradients across the module, no CTE mismatch with silicon components, and low material contribution. This is a breakthrough technology being developed for LHCb. LHCb is also focussing effort on the construction of a lightweight foil to separate the primary and secondary LHC vacua, the development of high speed cables, and the metallisation and radiation qualification of the module. The 40 MHz readout will also bring significant conceptual changes to the way in which the upgrade trigger is operated. Work is in progress to incorporate momentum and impact parameter information into the trigger at the earliest possible stage, using the fast pattern recognition capabilities of the upgraded detector. The current status of the VELO upgrade will be described together with a presentation of recent test results.

Summary

Primary author(s) : Dr. RODRIGUES, Eduardo (University of Manchester (GB)); AKIBA, Kazu (Nikhef)

Presenter(s) : AKIBA, Kazu (Nikhef)

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **93** Type : **Oral**

Upgrade of the Level-1 muon trigger of the ATLAS detector in the barrel-endcap transition region with RPC chambers

Friday, 6 June 2014 15:20 (0:20)

Abstract content

This report presents a project for the upgrade of the Level-1 muon trigger in the barrel-endcap transition region (1.0<|[U+019E]|<1.3) of the ATLAS detector with RPC chambers. The ATLAS Level-1 muon trigger rate is dominated by fake triggers in the Endcap region (|[U+019E]|>1) caused by charged particles originating from secondary interactions downstream of the interaction point. After the LHC phase-1 upgrade, forseen for 2018, the Level-1 muon trigger rate would saturate the allocated bandwidth unless new measures are adopted to improve the rejection of fake triggers. ATLAS is going to improve the trigger selectivity in the region |[U+019E]|>1.3 with the addition of the New Small Wheel detector as an inner trigger plane. To obtain a similar trigger selectivity in the barrel-endcap transition region 1.0<|[U+019E]|<1.3, it is proposed to add new RPC chambers at the edge of the inner layer of the barrel muon spectrometer. These chambers will be based on a three layer structure with thinner gas gaps and electrodes with respect to the ATLAS standard and a new low-profile light-weight mechanical structure that will allow the installation in the limited available space. New front-end electronics, integrating fast TDC capabilities will be used. A preliminary study based on 2012 data demonstrates that the new system could reject more than 90% of the fake triggers while maintaining high trigger efficiency. This will allow to keep a relatively low momentum threshold, while matching the rate requirements of both Phase-1 and Phase-2 LHC runs.

Summary

Primary author(s) : MASSA, Lorenzo (University of Bologna and INFN (IT))

Presenter(s) : MASSA, Lorenzo (University of Bologna and INFN (IT))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades

Contribution ID : **238** Type : **Oral**

Upstream Dosimetry using a Monolithic Active Pixel Sensor (MAPS)

Wednesday, 4 June 2014 11:20 (0:20)

Abstract content

Intensity Modulated Radiotherapy (IMRT) is a treatment for cancerous tumours. These treatments are complex, with the radiation shaped using dynamic Multileaf Collimators (MLC). This increases dose to the tumour, whilst sparing healthy issue and sensitive organs. Due to the complex nature of these treatments safety is critical. Currently monitoring is from the linac itself and verification is carried out prior to the treatment. New independent dosimeters are emerging, including upstream detectors. In the upstream detector under investigation the aim is to do both real-time monitoring and verification simultaneously. The problems caused by placing a detector upstream are: attenuation from the device and generation of secondary radiation. To overcome these issues the detector must be thin and radiation hard. These criterion match that of sensors for the vertex detector of the International Linear Collider, where one of the technologies is Monolithic Active Pixel Sensors (MAPS). In this project the Achilles MAPS was used. Its suitability for upstream monitoring and verification was tested using a variety of IMRT beams. Using image reconstruction techniques an unprecedented MLC position precision of $52\pm4\mu$m was achieved using a single image. This allows the beam shape to be monitored precisely and forms the building block of a real-time monitoring device. The treatment verification was tested using the Matixx dosimeter as a reference. Comparing the dose distributions using the Gamma metric showed a 97% pass rate for 3% and 3mm, which is good enough for verification. These results will be presented, along with future prospects.

Summary

Primary author(s) : PAGE, Ryan Frank (University of Bristol (GB))

Presenter(s) : PAGE, Ryan Frank (University of Bristol (GB))

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **355** Type : **Oral**

Utilization of novel Silicon Photomultipliers with bulk integrated quench resistors in tracking applications for particle physics.

Friday, 6 June 2014 14:20 (0:20)

Abstract content

Silicon Photomultipliers (SiPMs) are a promising candidate for replacing conventional photomultiplier tubes in many applications, thanks to ongoing developments and advances in their technology. A drawback of conventional SiPMs is their limited fill factor caused by the need for a high ohmic polysilicon quench resistor and its metal lines on the surface of the devices, which in turn limits the maximum photon detection efficiency. At the Semiconductor Laboratory of the Max-Planck Society (HLL) a novel detector concept was developed integrating the quench resistor directly into the silicon bulk of the device resulting in a free entrance window on the surface. The feasibility of the concept was already confirmed by simulation and extensive studies of first prototype productions. Recently SiPMs were also considered as an attractive alternative for tracking applications in vertex detectors. The requirements for a fast response, simple design and high fill factor can all be met by SiPMs. In addition the increased trigger probability for an avalanche by minimum ionizing particles allows device operations at lower overbias voltages, resulting in a decreased noise contribution. The concept can be evolved further towards an imaging photo-detector. A new design for an application of these SiPM devices as vertex detectors with active quenching developed by the HLL and DESY as well as first simulation results will be presented. Also, first measurements of the trigger efficiency as a function of the applied overbias voltage of SiPM devices will be shown.

Summary

Primary author(s) : Mr. PETROVICS, Stefan (Semiconductor Laboratory of the Max-Planck Society)

Co-author(s) : ANDRICEK, Laci (Semiconductor Laboratory of the Max-Planck Society); SCHOPPER, Florian (Semiconductor Laboratory of the Max-Planck Society); SEFKOW, Felix (DESY); DIEHL, Inge (DESY); HANSEN, Karsten (DESY); JENDRYSIK, Christian (Semiconductor Laboratory of the Max-Planck Society); KRUEGER, Katja (DESY); LEHMANN, Raik (Semiconductor Laboratory of the Max-Planck Society); NINKOVIC, Jelena (Semiconductor Laboratory of the Max-Planck Society); RECKLEBEN, Christian (DESY); RICHTER, Rainer (Semiconductor Laboratory of the Max-Planck Society)

Presenter(s) : Mr. PETROVICS, Stefan (Semiconductor Laboratory of the Max-Planck Society)

Session Classification : I.b Semiconductors

Track Classification : Sensors: 1b) Semiconductor Detectors

Contribution ID : **20** Type : **Oral**

Verification of the compton-PET and a new approach to SPECT

Tuesday, 3 June 2014 16:10 (0:20)

Abstract content

An idea of Compton-PET is not new, however, current trend to be equipped heavy and smaller scintillators makes this idea feasible and easy. Two layers which composed of 3x3 scintillator matrix read out by 9 MPPC are fabricated and tested. The results of the experiment and comparison to the simulation will be presented. Furthermore, much smaller scintillator makes to improve the SPECT resolution with small PPD which is available in the market. A new SPECT idea with such smaller scintillator and MPPC is also fabricated and tested. The results and comparison to the simulation are presented and discussed.

Summary

The compton-PET will reduce the patience dose or the testing time to be 1/3. A new SPECT will increase the special resolution to be comparable 1mm.

Primary author(s) : KOTERA, Katsushige (Shinshu University); HASEGAWA, Yoji (Shinshu University (JP)); T. Takeshita (Shinshu Univ.)

Co-author(s) : Mr. SAKO, Kunihiro (Shinshu Univ.); Mr. MIYASHITA, Yuki (Shinshu Univ.); Mr. OGURA, Takayoshi (Shinshu Univ.); Mr. TSUCHIMOTO, Koya (Shinshu Univ.)

Presenter(s) : T. Takeshita (Shinshu Univ.)

Session Classification : V.b Health & Bio

Track Classification : Technology transfer: 5b) Health and healthcare

Contribution ID : **57** Type : **Oral**

Vertex-Detector R&D for CLIC

Friday, 6 June 2014 12:00 (0:20)

Abstract content

The CLIC vertex detector must have excellent spatial resolution, full geometrical coverage extending to low polar angles, extremely low mass, low occupancy facilitated by time-tagging, and sufficient heat removal from sensors and readout. These considerations, together with the physics needs and beam structure of CLIC, push the technological requirements to the limits and imply a very different vertex detector than the ones currently in use elsewhere. A detector concept based on hybrid planar pixel-detector technology is under development for the CLIC vertex detector. It comprises fast, low-power and small-pitch readout ASICs implemented in 65 nm CMOS technology (CLICpix) coupled to ultra-thin sensors via low-mass interconnects. The power dissipation of the readout chips is reduced by means of power pulsing, allowing for a cooling system based on forced gas flow. In this talk, the CLIC vertex-detector requirements are reviewed and the current status of R&D on sensors, readout and detector integration is presented.

Summary

Primary author(s) : DANNHEIM, Dominik (CERN)

Presenter(s) : DANNHEIM, Dominik (CERN)

Session Classification : III.a FE & ASICs

Track Classification : Data-processing: 3a) Front-end Electronics

Contribution ID : **36** Type : **Oral**

Wireless data transfer with mm-waves for future tracking detectors

Tuesday, 3 June 2014 11:00 (0:20)

Abstract content

Wireless data transfer has revolutionized the consumer market for the last decade giving products equipped with transmitters and receiver for wireless data transfer. Wireless technology has features attractive for data transfer in future tracking detectors. The removal of wires and connectors for data links is certainly beneficial both for the material budget and the reliability of the system. Other advantages is the freedom of routing signals which today is particularly complicated when bringing the data the first 50 cm outside the tracker. With wireless links intelligence can be built into a tracker by introducing communication between tracking layers within a Region Of Interest which would allow the construction of track primitives in real time.

The wireless signal is transmitted by a passive antenna structure which is clearly a much less complex and radiation hard object than an optical transmitter. The technology used in consumer goods are however not suitable for trackers. The first limitation is the low data transfer capacity with current 5 GHz transceivers but also the relatively large feature sizes of the components.

Due to the requirement of high data rates in detectors a high bandwidth is required. The frequency band around 60 GHz turns out to be a very promising candidate. The frequency is a strong candidate for future WLAN use hence components are available on the market. The high baseband frequency allow for data transfer of the order of several Gbit , and due to the small wave length in the mm range, only small structures are needed. The challenge is to bring the signal around or trough boundaries that are not transparent to the mm-waves like silicon detector modules or support structure. Further more low power operation and strong focusing antennas is required for massive parallelization of data transfer inside the tracker. We will present patch antennas produced on flexible Printed Circuit Board substrate that can be used in future trackers. The antennas can be connected to transceivers for data transmission/reception or be connected by wave-guides to structures capable of bringing the signal pass boundaries. This presentation aims to present results on simulation, modelling, fabrication and characterisation of such antennas. Studies of a 60 GHz data link for radial transmission of mm-waves through a ATLAS detector model will be shown.

Summary

Primary author(s) : BRENNER, Richard (Uppsala University (SE)); PELIKAN, Daniel (Uppsala University (SE))

Co-author(s) : Dr. DANCILA, Dragos (Uppsala University); GUSTAFSSON, Leif (Uppsala University); Mr. BINGEFORS, Nils (Uppsala University)

Presenter(s) : PELIKAN, Daniel (Uppsala University (SE))

Session Classification : I.e Novel Technologies

Track Classification : Sensors: 1e) Novel technologies

Contribution ID : **230** Type : **Oral**

progress status for the Mu2e calorimeter system

Friday, 6 June 2014 11:20 (0:20)

Abstract content

The Mu2e experiment at FNAL aims to measure the charged-lepton flavor violating neutrinoless conversion of of a negative muon into an electron. The conversion results in a monochromatic electron with an energy slightly below the rest mass of the muon (104.97 MeV). The calorimeter should confirm that the candidates reconstructed by the extremely precise tracker system are indeed conversion electrons. We therefore look for a calorimeter with a large acceptance, good energy resolution O(5%) and a reasonable position (time) resolution of ˜0.5 cm (<0.5ns). Moreover, the calorimeter should also provide a trigger for the experiment and perform a powerful mu/e particle identification. Finally, it should be able to keep functionality in an environment where the background delivers a dose of ˜ 200 Gy/year in the hottest area. It will also need to work immersed in 1 T axial magnetic field. The baseline version of the Mu2e calorimeter is composed by two disks, 11 cm wide, of inner (outer)radius of 360 (670) mm filled by ˜ 1800 hexagonal LYSO crystals. Each crystal is readout by two large area APDs. At the moment of writing, due to the increasing cost of the LYSO, we are examing cheaper alternative based on BaF2 or pure CsI crystals. We will report the tests done, at a dedicated cosmic rays test, with our medium size prototype that is constituted by 16 square LYSO crystals of 3x3x13 cm**3 read out by Hamamatsu APDs and dedicated prototypes of the Front End electronics. We will report also on the first tests done with single BaF2 and pure CsI crystals when readout by means of large area UV extended APD or SiPM.

Summary

Primary author(s) : Dr. SARRA, Ivano (LNF INFN Frascati, Italy)

Presenter(s) : Dr. SARRA, Ivano (LNF INFN Frascati, Italy)

Session Classification : I.a Calorimetry

Track Classification : Sensors: 1a) Calorimetry

Contribution ID : **411** Type : **Oral**

slic: A full-featured Geant4 simulation program

Thursday, 5 June 2014 12:20 (0:20)

Abstract content

As the complexity and resolution of particle detectors increases, the need for detailed simulation of the experimental setup also increases. We have developed efficient and flexible tools for detailed physics and detector response simulations which build on the power of the Geant4 toolkit but free the end user from any C++ coding. Geant4 is the de facto high-energy physics standard for simulating the interaction of particles with fields and materials. However, the end user is required to write their own C++ program, and the learning curve for setting up the detector geometry and defining sensitive elements and readout can be quite daunting, especially for those without previous experience or not associated with large collaborations. We have developed the Geant4-based detector simulation program, slic, which employs generic IO formats as well as a textual detector description. Extending the pure geometric capabilities of GDML, LCDD enables fields, regions, sensitive detector readout elements, etc. to be fully described at runtime using an xml file. We also describe how more complex geometries, such as those from CAD programs, can be seamlessly incorporated into the xml files. We have defined generic "hits" which can be used to model sophisticated tracking and calorimetry readouts, but the native Geant4 scoring functionality can also be used for simpler applications. Although developed within the context of HEP collider detectors, the program is completely flexible and can be used to simulate detectors in many different fields.

Summary

We present a software toolkit and computing infrastructure which allows physicists to quickly and easily contribute to detector design by modeling detector elements without requiring either C++ coding expertise or experience with Geant4. This makes it perfect for small groups in new and emerging technologies, or those not associated with large collaborations or universities with in-house expertise.

Primary author(s) : GRAF, Norman Anthony (SLAC National Accelerator Laboratory (US))

Presenter(s) : GRAF, Norman Anthony (SLAC National Accelerator Laboratory (US))

Session Classification : II.a Experiments & Upgrades

Track Classification : Experiments: 2a) Experiments & Upgrades