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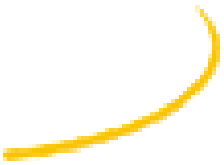

Book of Abstracts

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Corresponding Author: chris.fabjan@cern.ch

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Greetings

Plenary 1 / **298**

Particle detector applications in medicine

Corresponding Author: hartmut@scipp.ucsc.edu

Particle detectors find increasing applications in medicine. The broad spectrum of particles used in medicine requires a variety of instruments, which are mostly based on concepts originally developed within HEP, Nuclear Physics or Astro-physics. The optimization of these instruments for clinical use will be shown on examples in dosimetry, beam diagnostics and in the wide field of imaging.

Plenary 1 / **294**

Detectors for astroparticle physics and dark matter searches

Corresponding Author: lbaudis@physik.uzh.ch

Astroparticle physics is an exciting new field of research at the interface between particle physics, astrophysics and cosmology. After briefly addressing some of the fundamental questions it is trying to answer, I will review the newest experimental developments in this varied field, with emphasis on present and future detector technologies for dark matter searches.

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Information from the Organizers

Corresponding Author: manfred.krammer@oeaw.ac.at

Plenary 2 / **305**

Conception of the MedAustron Accelerator Complex and Present Status

MedAustron is a synchrotron based light-ion beam therapy centre for cancer treatment as well as for clinical and non-clinical research, currently in the construction phase. The accelerator design is based on the CERN-PIMMS study and its technical implementation by the Italian CNAO Foundation. Whilst the choice of basic machine parameters was driven by medical requirements, the accelerator complex design was also optimized to offer flexibility for research operation. The potential of the synchrotron is being exploited to increase the maximum proton energy far beyond the medical needs to up to 800 MeV, for experimental physics applications, mainly in the areas of proton scattering and detector research. The accelerator layout allows for the installation of up to four ion source –spectrometer units, to provide various ion types. To decouple research and medical operation, a dedicated irradiation room for non-clinical research was included . This presentation provides a status overview over the whole project detailing the achieved progress of the building construction and technical infrastructure installation in Wiener Neustadt, Austria, as well as of the accelerator development, performed at CERN.

Plenary 2 / **293**

Neutron detectors

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We present new neutron detector concepts for ultra-cold, cold and fast neutrons. The developments are driven by the experimental needs: the next generation of neutron lifetime experiments require high rate capacities of 100 x 10ˆ6 sˆ{-1}, gravity tests at short distances need a detector with a spatial resolution of a micron at low background, time of flight experiments require a time resolution of 10µs , and experiments at neutron centers need large area detectors of 1 m2 to 10 m2. Due to a helium shortage the focus is on boron as a neutron converter for large area detectors.

Plenary 2 / **270**

A Time Projection Chamber for High-Rate Experiments: Towards an Upgrade of the ALICE TPC

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A Time Projection Chamber (TPC) is a powerful detector for 3-dimensional tracking and particle identification for ultra-high multiplicity events. It is the central tracking device of many experiments, e.g. the ALICE experiment at CERN. The necessity of a switching electrostatic gate, which prevents ions produced in the amplification region of MWPCs from entering the drift volume, however, restricts its application to trigger rates of the order of 1 kHz.
Charge amplification by Gas Electron Multiplier (GEM) foils instead of proportional wires oers an intrinsic suppression of the ion backflow, although not to the same level as a gating grid. Detailed Monte Carlo simulations have shown that the distortions due to residual space charge from backdrifting ions can be limited to a few cm, and thus can be corrected using standard calibration techniques. A prototype GEM-TPC has been built which is the detector with the largest active volume of this kind up to now. It has been commissioned with cosmics and particle beams at the FOPI experiment at GSI, and was employed for a physics measurement with pion beams.
For future operation of the ALICE TPC at the CERN LHC beyond 2019, where Pb-Pb collision rates of 50 kHz are expected, it is planned to replace the existing MWPCs by GEM detectors, operated in a continuous, triggerless readout mode, thus allowing an increase in event rate by a factor of 100. As a first step of the RD program, a prototype of an Inner Readout Chamber was equipped with large-size GEM foils and exposed to beams of protons, pions and electrons from the CERN PS.
In this presentation, new results will be shown concerning ion backflow, spatial and momentum resolution of a GEM-TPC in a running experiment, detector calibration, dE=dx resolution, and high-rate performance with both detector prototypes. The perspectives of a GEM-TPC for ALICE with continuous readout will be discussed and the expected performance will be presented.

quote your primary experiment:

ALICE

Plenary 2 / **295**

Recent developments in silicon detectors

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I will present a very brief history of silicon detectors in physics experiments culminating in the spectacular systems now delivering great physics in the CERN/LHC. An overview of the status of the present RD towards future applications will follow.

Plenary 2 / **13**

DC-DC Powering for the CMS Pixel Upgrade

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The CMS experiment plans to replace the silicon pixel detector by a new one with improved rate capability and an additional detection layer at the end of 2016. In order to cope with the increased number of detector modules the new pixel detector will be powered via DC-DC converters close to the sensitive detector volume. This talk will review the DC-DC powering scheme and report on the ongoing RD program to develop converters for the pixel upgrade. Design choices will be dicussed and results from the electrical and thermal characterisation of converter prototypes will be shown. An emphasis will be put on system tests with up to 24 converters. The performance of pixel modules powered by DC-DC converters is compared to conventional powering. The integration of the DC-DC powering scheme into the pixel detector will be described and system design issues will be reviewed.

quote your primary experiment:

CMS

Plenary 2 / **98**

LePix –a high resistivity, fully depleted monolithic pixel detector

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The LePix project explores monolithic pixel sensors fabricated in a 90nm CMOS technology for which more lightly doped substrates are available. This maintains the advantages usually offered by Monolithic Active Pixel Sensors (MAPS), like a low input capacitance, having a single piece detector and using a standard CMOS production line, but offers charge collection by drift from a depleted region several tens of microns deep into the substrate, and therefore an excellent signal to noise ratio and a radiation tolerance superior to conventional un-depleted MAPS. Such sensors are expected to offer significant cost savings and reduction of power consumption for the same performance, leading to the use of much less material in the detector (less cooling and less copper), addressing one of the main limitations of present day particle tracking systems.
A review on the technology and the most important experimental results achieved so far will be presented. The focus will be on the latest evolution of the project, which uses detectors thinned down to 50 um to obtain back illuminated sensors operated in full depletion mode. By back-processing the chip and collecting the charge from the full substrate it is hence possible to efficiently detect soft X-rays up to 10 keV. Test beam results from synchrotron light tests as well as potential application of this monolithic device will be discussed.

quote your primary experiment:

CMS

Art and History of Vienna / **303**

Art and History of Vienna

The city of Vienna was essentially founded by the ancient Romans. In the late middle ages, it became the capital of the Habsburg Empire, and consequently grew in size and importance. Even though there are some Roman excavations, most of the architectural heritage originates from the monarchy. In particular, the turn of the 19th to 20th centuries was undoubtedly a peak in many aspects of arts and culture, and even the population of Vienna was then higher than today. Nonetheless, the monarchy terminated almost hundred years ago and gave way to modernism. All periods of fine arts are represented in Vienna, by architecture as well as in museums. In addition, performing arts and classical music are offered in various places. This presentation will provide an overview of the history of Vienna, the periods of art and where to spot them, with a particular focus on the locations where social events will take place during this conference.

Plenary 3 / **296**

Did the LHC detectors meet expectations?

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By showing comparisons between the achieved performance and the expected one from the various sub-detectors of the large LHC Experiments at conditions that exceed the original design, it will be shown that the first answer is yes, BUT. The BUT will be dedicated to various problems encountered with industrial orders and design mistakes, and what lessons one should learn from these issues.

Plenary 3 / **91**

Status and future of the ATLAS Pixel Detector at the LHC”

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The ATLAS Pixel Detector is the innermost detector of the ATLAS experiment at the Large Hadron Collider at CERN. The detector provides hermetic coverage with three cylindrical layers and three layers of forward and backward pixel detectors. It consists of approximately 80 million pixels that are individually read out via chips bump-bonded to 1744 n-in-n silicon substrates. In this talk, results from the successful operation of the Pixel Detector at the LHC and its status after three years of operation will be presented, including monitoring, calibration procedures, timing optimization and detector performance. The record breaking instantaneous luminosities of 7.7 x 10ˆ33 cm-2 s-1 recently surpassed at the Large Hadron Collider generate a rapidly increasing particle fluence in

the ATLAS Pixel Detector. As the radiation dose accumulates, the first effects of radiation damage are now observable in the silicon sensors. A regular monitoring program has been conducted and reveals an increase in the silicon leakage current, which is found to be correlated with the rising radiation dose recorded by independent sensors within the inner detector volume. In the longer-term crystal defect formation in the silicon bulk is expected to alter the effective doping concentration, producing type-inversion and ultimately an increase of the voltage required to fully deplete the sensor. The fourth pixel layer at the radius of 3.5 cm will be added during the long shutdown 2013-2014 together with the replacement of pixel services. Letter of Intent is in preparation for the completely new pixel detector after 2023, capable to take data with extremely high instantaneous luminosities of 5 x 10ˆ34 cm-2 s-1 at High Luminosity LHC.

quote your primary experiment:

ATLAS

Plenary 3 / **274**

THE LHCB DETECTOR UPGRADE

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The LHCb collaboration presented a Letter of Intent (LOI) to the LHCC in March 2011 for a major upgrading of the detector during Long Shutdown 2 (2018) and intends to collect a data sample of 50/fb in the LHC and High-Luminosity-LHC eras. The aim is to operate the experiment at an instantaneous luminosity 2.5 times above the present operational luminosity, which has already been pushed to twice the design value. Reading out the detector at 40MHz allows to increase the trigger efficiencies especially for the hadronic decay modes. The physics case and the strategy for the upgrade have been endorsed by the LHCC.
This paper presents briefly the physics motivations for the LHCb upgrade and the proposed changes to the detector and trigger.

quote your primary experiment:

LHCb

Podium discussion on the Electromagnetic Calorimeters of ATLAS and CMS / **309**

ATLAS

Corresponding Author: martin.aleksa@cern.ch

Podium discussion on the Electromagnetic Calorimeters of ATLAS and CMS / **310**

CMS

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Astroparticle Detectors / 79

The Spectrometer/Telescope for Imaging X-rays (STIX) on-board Solar Orbiter

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Solar Orbiter is a sun-observing mission of the European Space Agency, addressing the interaction between the sun and the heliosphere (launch is scheduled for 2017). The satellite will carry ten instruments, and will approach the sun to 0.28 astronomical units, allowing unprecedented high-resolution measurements. The X-ray imaging spectrometer on-board Solar Orbiter is called STIX (Spectrometer/Telescope for Imaging X-rays).
This report will give a brief overview of its scientific goal and cover in more detail the instrument design and challenges. STIX will determine the intensity, spectrum, timing, and location of thermal and accelerated electrons near the Sun through their Bremsstrahlung X-ray emission.
STIX uses indirect Fourier imaging. The sun is observed through pairs of fine grids, separated by 55 cm. The grids of one pair are slightly different in pitch and rotation angle and cast a Moire pattern on the detectors underneath. Count rates of X-rays passing the grids as function of energy are determined with CdTe semiconductor sensors. Each sensor is pixelized to sample the Moire pattern and to cover of an extended dynamic range in count rates. The sensors are bonded to front-end amplifier units and thermally coupled to a space-craft cold finger to operate below -20 deg Celsius in the +50 deg Celsius environment.
The instrument data processing unit allows autonomous operation over extended periods of time (up to 80 days) and provides the space-craft interfaces.

quote your primary experiment:

STIX

Gaseous Detectors / 101

Production and Test of the Cylindrical-GEM detectors for the KLOE-2 Inner Tracker

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The upgrade of the KLOE detector at the DAFNE Phi-factory foresees the insertion of a new Inner Tracker device around the interaction region, composed by four tracking layers with diameters from 260 mm to 410 mm and an active length of 700 mm.
Each layer is realized as a cylindrical triple-GEM detector, a solution that allows to keep the total material budget under 2% of X0, of utmost importance to limit the multiple scattering of low-momentum tracks at KLOE-2, and to minimize dead spaces. The peculiar readout pattern with XV strips provides a spatial resolution of about 200 um on both views.
A dedicated readout system has been developed within the KLOE-2 collaboration. It is composed by a digital readout front-end card based on the GASTONE ASIC and a General Interface Board with a configurable FPGA architecture and Gigabit Ethernet.
The three innermost layers have been built and extensively tested with a beta source and cosmic-rays, and the construction of the fourth layer has started. The insertion inside the KLOE apparatus is foreseen in spring 2013. The construction procedure and the results of the validation tests will be reported.

quote your primary experiment:

KLOE-2

Semiconductor Detectors 1 / 48

Development of thin n-in-p pixel sensors with active edges and recent results of the ATLAS Planar Pixel R&D project

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A summary of the recent results of the ATLAS Planar Pixel RD project will be given, with a focus on thin n-in-p detectors, with an active thickness from 75 μm to 200 μm, from productions of the MPI Semiconductor Laboratory, VTT and FBK-CMM. The MPI-HLL thin n-in-p pixels were interconnected using the ATLAS FE-I3 and FE-I4 read-out chips, with standard solder bump-bonding and in case of the 75 μm detectors with Solid-Liquid-InterDiffusion (SLID), an interconnection technique developed by the Fraunhofer Institute EMFT in Munich. The results of the characterization before and

after irradiation up to a fluence of 1016 neq cm-2 will be shown, using radioactive sources and beam tests. The VTT and FBK-CM pixel sensors make use of active trenches to reduce the inactive area at the edges of the devices. The reconstructed hit efficiency, obtained with VTT modules in beam tests will be discussed. An overview of the device simulations of pre- and post-irradiated FBK-CMM samples, together with the first electrical characterization of the produced devices will be given. Within the PPS Collaboration, alternative approaches to achieve active edges are also investigated, as the Scribe- Cleave-Passivate Approach, developed by the SCIPP group in collaboration with the U.S. Naval Research Laboratory (NRL). As a post processing step, this allows to achieve slim edges also for already produced sensors with a traditional design.
Finally the performance of n-in-n pixel sensors up to a fluence of 2x1016 neq cm-2 will be shown, using sensors from productions at CiS employing designs by the TU Dortmund group.

quote your primary experiment:

ATLAS

Astroparticle Detectors / 86

Homogeneous and isotropic calorimetry for space experiments

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Calorimetry plays an essential role in experiments for observing very high energy gamma and cosmic rays in space. Geometrical dimensions and mass of the calorimeter are the main limiting factors. The available mass depends on the design of the detector and the total available mass of the payload. It is therefore important to optimize the geometrical acceptance of the calorimeter for rare events, its granularity for the identification of the arriving particle and its depth for the energy measurement. We studied the design of a calorimeter that could simultaneously optimize these characteristics assuming a limit mass of about 1.6 t. The best choice resulted to be a homogeneous calorimeter made by cesium iodide (CsI), as the best compromise between the radiation and interaction lengths of the material. The most convenient geometry is cubic and isotropic to detect particles arriving from any direction in space, thus maximizing the acceptance; granularity is obtained by filling the cubic volume with small cubic CsI crystal. The total depth in any direction is very high both in radiation and interaction lengths, and allows for electromagnetic particle identification better than 10-5 and optimal energy measurement. Side of the crystal and needed space between them for managing their mechanical support and external electrical connections have been studied. A prototype has been realized and preliminary tests on high energy electron and proton beams are reported.

quote your primary experiment:

Gamma400

Gaseous Detectors / 49

Development of a new generation of micropattern gaseous detectors for high energy physics, astrophysics and medical applications

Author: Vladimir Peskov[1]

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During the last two years, our team has developed a cost effective technology of manufacturing various types of micropattern gaseous detectors designed for applications in many fields. The designs of these detectors feature a matrix of thin metallic readout strip located under segmented resistive electrodes. This electrode configuration makes such detectors very robust, allows them to be operated at exceptionally high gas gains, and enables withstanding long-term continuous sparking (if it appears) and achieving a very good 2D position resolution. We will describe the results obtained from systematic studies of these detectors and their optimization for high rate applications.
Three examples of successful applications, in which our team is deeply involved, will be presented: CsI-RICH detector prototypes for ALICE upgrade, a prototype of novel double-phase LAr detector with a CsI photocathode immersed inside the LAr and a medical/security applications including to a TOF-PET device. The results so far obtained are very encouraging and show that these new micropattern detectors may have a great future.

quote your primary experiment:

ALICE

Semiconductor Detectors 1 / 185

Test Results of 3D Silicon Pixel Sensors for Future ATLAS Upgrades

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3D Silicon pixel detectors, selected to make-up 25% of the ATLAS Insertable B-Layer (IBL) and 100% of the ATLAS Forward Physics (AFP) tracking system, were studied in an intense laboratory and beam test qualification program in 2011 and 2012. The IBL is a new pixel layer which will be installed between the current ATLAS pixel detector and a new, thinner beam pipe of radius 3.2 cm during the phase 0 long shut-down in 2013-14. Beam tests of sensors before and after irradiation were performed using 4 GeV positrons at DESY, Germany and 180 GeV pions from the SPS at CERN, Switzerland. Sensors were bump-bonded to ATLAS FE-I3 front-end readout cards and also to the new FE-I4 cards, which have a smaller pixel size of 50 μm x 250 μm and faster readout compared to FE-I3. Tracks were reconstructed using data from the EUDET and ACONITE beam telescopes delivering a resolution of 3 μm. At a variety of angles, thresholds and bias voltages, studies into radiation hardness, charge collection efficiency, charge sharing and edge efficiency were performed to both qualify the 3D Silicon sensors to IBL requirements and to analyse improved manufacturing techniques for future ATLAS upgrades.

quote your primary experiment:

ATLAS

Gaseous Detectors / 129

Ageing studies of resistive Micromegas detectors for HL-LHC

Authors: Alan Peyaud[1]; Arnaud Giganon[1]; David Attié[1]; Esther Ferrer-Ribas[1]; Fabien Jeanneau[2]; Ioannis Giomataris[1]; Jacques Derré[1]; Javier Galan[1]; Philippe Schune[1]

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Resistive-anode Micromegas detectors are in development since several years, in an effort to solve the problem of sparks when working in high flux and high radiations environment like in the HL-LHC (ten times the luminosity of the LHC). They have been chosen as one of the technologies that will be part of the ATLAS New Small Wheel project (forward muon system). An ageing study is mandatory to assess their capabilities to handle the HL-LHC environment on a long-term period.
A prototype has been exposed to several types of irradiations (X-rays, cold neutrons, 60Co gammas) up to an equivalent HL-LHC time of more than five years without showing any degradation of the performances in terms of gain and energy resolution. Beam test studies are foreseen in October 2012 to assess the tracking performances (efficiency, spatial resolution, ⋯). Results of ageing studies and beam test performances are reported in this paper.

quote your primary experiment:

ATLAS Micromegas Ageing

Semiconductor Detectors 1 / 4

Testbeam and laboratory test results of irradiated 3D CMS pixel detectors

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The CMS pixel detector is the innermost tracking device at the LHC, reconstructing the interaction vertices and charged particle trajectories. The current planar sensors located in the innermost layer of the pixel detector will be exposed to very high fluences which will degrade their performances. As a possible replacement of planar pixel sensors for the High Luminosity-LHC or HL-LHC, 3D silicon technology is under consideration due to their expected good performances in harsh radiation environments. The Deep-Reactive-Ion-Etching (DRIE) plays the key role in fabricating innovative 3D silicon detectors in which readout and ohmic electrodes are processed through the silicon substrate in place of being implanted on silicon surface. The 3D CMS pixel devices, which were processed at FBK, CNM, and SINTEF. They were bump bonded to the CMS pixel readout chip, characterized in the laboratory, and testbeams carried out at FNAL. We report the laboratory and testbeam measurement results for the irradiated 3D CMS pixel devices.

quote your primary experiment:

CMS

Astroparticle Detectors / 188

Euso Balloon: a pathfinder mission for the JEM-EUSO experiment

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The JEM-EUSO instrument is a wide-angle refractive telescope in near-UV wavelength region being proposed for attachment to the Japanese Experiment Module onboard ISS. The main scientific goal of the mission is the study of Ultra High Energy cosmic Rays. The instrument consists of high transmittance optical Fresnel lenses with a diameter of 2.5 m, a focal surface covered by 4932 MAPMTs of 64 pixels, front-end readout, trigger and system electronics.
In this paper will be presented the EUSO-BALLOON experiment, the JEM EUSO pathfinder mission, in which a telescope of smaller dimension respect to the one designed for the ISS, will be mounted in an unpressurized gondola of a stratospheric balloon which will float at 42 km above the sea level. We will describe in detail the Electronic System which performs instrument control and data management in such a critical environment.
The main objective of this pathfinder mission, planned for the 2014, 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 global detection chain. EUSO-BALLOON will measure the atmospheric and terrestrial UV background components, in different observational modes, fundamental for the development of the simulations. Through a series of stratospheric balloon flights performed by CNES, EUSO-Balloon also has the potential to detect Extensive Air Showers from above, paving the way for any future large scale, space-based UHECR observatory.

quote your primary experiment:

JEM-EUSO

Astroparticle Detectors / 155

The Tunka multi –component EAS detector for high energy cosmic ray studies.

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In autumn of 2012 a EAS Cherenkov light array Tunka-133 with $\sim$3\,km^2 geometrical area in the Tunka Valley (50 km from Lake Baikal) for a detailed study of the cosmic ray energy spectrum and the mass composition with energy above 10^{16} eV was combined with new Tunka-Rex (Tunka radio extension) array of about 20 antennas measures the radio emission of cosmic-ray air showers. The last is triggered by the Cherenkov detectors of the Tunka-133 array. The radio-Cherenkov-hybrid measurements thus offer a unique opportunity for a cross-calibration of both detection methods. The main goal of Tunka-Rex is to determine the precision of the radio reconstruction for the energy and the atmospheric depth of the shower maximum, and thus to experimentally test theoretical predictions that the radio precision can be similar to the precision of air-Cherenkov and fluorescence measurements. At the same time, Tunka-Rex can demonstrate that radio measurements can be performed on a large area for a relatively cheap price, since the antennas will be connected to the already existing Tunka DAQ.
The results on the all particles energy spectrum and the mean depth of the EAS maximu vs. primary energy derived from the data of three winter seasons (2009–2012) are presented.
Plans for future upgrades –deployment of remote clusters, a scintillator detector network and a prototype of the HiSCORE gamma-telescope –are discussed.

quote your primary experiment:

Tunka, Baikal

Semiconductor Detectors 1 / **135**

Technology and characterization results in new 3D double sided pixel detectors for future colliders

Authors: David Quirion[1]; Francisca Javiela Muñoz Sánchez[2]; Giulio Pellegrini[3]; Iván Vila[4]; Manuel Lozano[1]; Marcos Fernández García[5]; Richard Jaramillo[4]; Tilman Rohe[6]

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Future colliders, like High Luminosity Large Hadron Collider (HL-LHC) or future generation of colliders will deliver higher radiation doses to the detectors, specifically those closer to the beam line. The instantaneous luminosity as well as the particle fluxes at the detectors, will be increased considerably. Inner tracker detectors will be the most affected part, increasing substantially its occupancy and radiation damage. In order to conserve the sensors performance under this new conditions, the pixel sensor technologies have to be improved. The new requirements demand the use of new silicon technologies instead of actual pixel planar sensors. Planar sensors have not shown enough radiation hardness for the innermost layers where the radiation doses can reach values around 1*10^16 neq/cm2. 3D sensors technologies are one of the candidates in the closest layers to the beam pipe. They show higher radiation hardness,
and the double sided design provide some additional technical advantages.
Several wafers have been produced at the IMB-CNM (Barcelona, Spain), implementing two different pitches between p-electrodes. First characterizations have been developed at IMB-CNM and PSI (Villigen, Switzerland). Results after electrical characterization and radioactive source test
(90 Sr), before and after irradiation will be presented.

quote your primary experiment:

CMS upgrade

Gaseous Detectors / **83**

Study of a Large Prototype TPC using integrated electronics and resistive Micromegas detectors

Author: David ATTIE[1]

[1] *CEA/DSM/DAPNIA/SPP*

Significant RD on detectors for the future International Linear Collider (ILC) has been carried out by the community in the last decade. 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 vertex detector and a large volume Time Projection Chamber (TPC).
Within the framework of the LCTPC collaboration, a Large Prototype (LP) TPC has been built. Its

endplate can accommodate up to seven identical modules of Micro Pattern Gas Detector (MPGD) representative of the final design.
With 3 mm wide by 7 mm high pads, a point resolution of 60 microns per pad-row has been reached by a single-module of resistive anode Micromegas with fully integrated electronics.
In July 2012, data were taken with 6 modules of such technology allowing the study of cracks, distorsions and module misalignment. After introducing the LP, first analysis results of multi-module configuration will be presented.

quote your primary experiment:

ILC

Gaseous Detectors / **249**

Measurements of the Gain, Time Resolution, and Spatial Resolution of a 20x20cm MCP-based Picosecond Photo-Detector

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Microchannel plates (MCPs) allow for micron-level spatial imaging and picosecond-level time resolution, making them a good solution for the next generation of photo-detectors aiming for precision time-of-flight measurements. The Large-Area Picosecond Photo-Detector Collaboration (LAPPD) is currently developing a 20x20cm, thin, planar, glass-body detector with the MCPs serving as the gain stage. In such a detector photo-electrons ejected from a photo-cathode produce a cascade of secondary electrons in the pores of a pair of MCP's which are consequently collected at the anode circuit. The modular design allows covering large areas while keeping the number of electronics channels low. We report on the recent progress in the development of the detector components. We have built a complete detector system approximating the final detector design. We have measured gain up to 2×10^7, time-of-flight resolution of $\sim$60˜ps, differential time resolution of $\sim$6˜ps, and spatial resolution of $\sim$0.6˜mm.

quote your primary experiment:

LAPPD

Astroparticle Detectors / **229**

Large area water Cherenkov array for air shower detection at high altitude

Author: Zhiguo Yao[1]

[1] *IHEP, Beijing*

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Large Area Water Cherenkov Array (LAWCA), a newly planned water Cherenkov detector, is to be built in Yangbajing, Tibet, China by the end of 2014, for detecting air showers at high altitude of 4300 m a.s.l. The LAWCA detector, amounting to an area of 23,000 m2 and built adjacent to the ARGO-YBJ detector, mainly aims to all sky survey for transient sources. A cross calibration between LAWCA

and ARGO-YBJ can make us to better understand the systematic errors. In this presentation, the design, the performance and the schedule of LAWCA experiment is to be introduced.

quote your primary experiment:

LAWCA

Semiconductor Detectors 1 / 126

DEPFET pixels as a vertex detector for the Belle II experiment

Author: Zdenek Dolezal[1]

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The successful heavy flavour factory KEKB, operating between 1999 and 2010 at KEK, Tsukuba, Japan, is currently being upgraded and is foreseen to start commissioning in the fall of 2014. The new e+e- collider (SuperKEKB) will provide an instantaneous luminosity of 8x10ˆ35 cmˆ2/s, 40 times higher than the current world record set by KEKB.
In order to handle the increased event rate and the higher background and to provide high data quality, the Belle detector is upgraded to Belle II. The increased particle rate requires a new vertex pixel detector with high granularity. This silicon detector will be based on the DEPFET technology and will consist of two layers of active pixel sensors. By integrating a field effect transistor into every pixel on top of a fully depleted bulk, the DEPFET technology combines detection as well as in-pixel amplification. This technology allows excellent signal to noise performance, complemented by a very low material budget by thinning down the sensors to 75 microns.
The sensors will be operated with the dedicated chain of steering and readout ASICs. In this presentation the key parameters of the sensor design will be presented, together with the individual ASICS. Furthermore, supplemental systems like cooling, powering, mechanics, etc. will be described. Results of the prototypes tested in various particle beams will be shown as well as the expected performance at SuperKEKB.

quote your primary experiment:

Belle II

Astroparticle Detectors / 40

Status of Super-Kamiokande gadolinium project

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Corresponding Author: takaaki@fphy.hep.okayama-u.ac.jp

In the universe, there exist supernova relic neutrinos (SRN) which have been released from all past supernova explosions. Super Kamiokande (SK) has conducted search for these SRN events via inverse beta decay interaction in the detector, and it is about to reach the SRN signals with sensitivity of about a factor of 2. But, it is still difficult to observe them since the search is limited by background. The addition of gadolinium (Gd) compound in the SK was proposed. Gd has the largest thermal neutron capture cross-section among all stable nuclei and gives total 8 MeV gamma cascade in the capture process. By coincidental tagging of positron and gamma-rays from Gd neutron capture, we can identify the SRN inverse beta decays signal.This technique can lead us to the first observation of a

SRN signal in SK. We will demonstrate the principle of a Gd-doped water Cherenkov detector (transparency of the Gd-doped water, Gd-doped water circulation method), neutron capture efficiency, etc) with test dedicate facility called EGADS. EGADS consists of 200 ton water Cherenkov detector, a Gd mixing pre-treatment device, Gd-doped water circulation system, and water transparency measurement device. We have checked Gd-doped water circulation with EGADS purification system since 2012. The PMTs and DAQ are ready and these performances have been studied. The evaluation of the overall performance of EGADS will start in 2013 after the PMT installation. The current status of the EGADS will be shown.

quote your primary experiment:

neutrino physics

Semiconductor Detectors 1 / 108

Beam test results of triggerless pixel prototypes for the PANDA MVD

Author: Daniela Calvo[1]

Co-authors: Alessandra Filippi [2]; Angelo Rivetti [2]; Francesca De Mori [3]; Gianni Mazza [2]; Hans Zaunick [4]; Kai-Thomas Brinkmann [5]; Laura Zotti [3]; Paolo De Remigis [2]; Richard Wheadon [2]; Robert Schnell [6]; Simone Bianco [7]; Simonetta Marcello [3]; Tommaso Quagli [6]

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The PANDA experiment will make use of cooled antiproton beams at the future FAIR facility. The physics goals dictate basic requirements to the Micro Vertex Detector of the experiment such as the capability to resolve secondary vertices of short-lived particles, limited material budget, additional information to the global PID by energy loss meaurement. Continuous readout and radiation tolerance are additional requests to the MVD, composed of thinned epitaxial silicon pixel and double sided silicon microstrips arranged in an asymmetric layout of four barrels around the interaction point and six forward disks. Thinned epitaxial silicon pixel assemblies (100umx100um each pixel) read out by ToPix_3 ASICs, developed in the 130 nm CMOS technology, have been tested at CERN-T9. The circuit is triggerless and then the channels are able to detect signals and transmit the information with a precise time stamp, including the energy loss measurement using the Time over Threshold technique. A single assembly was studied at several rotation angles using a strip tracking telescope, and a dedicated pixel tracking station, composed of four pixel planes, allowed to study the assembly performance in terms of residuals and efficiency, developing dedicated algorithms based on time windows to select hits belonging to the same event. 100 um and 150 um epitaxial silicon sensors were studied and an assembly pre-irradiated with neutrons was tested too. The results will be presented.

quote your primary experiment:

PANDA

Gaseous Detectors / 109

ATLAS Transition Radiation Tracker (TRT): Straw Tube Gaseous Detectors at High Rates

Author: Adrian Vogel[1]

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The ATLAS Transition Radiation Tracker (TRT) is the outermost of the three tracking subsystems of the ATLAS Inner Detector The ATLAS detector is located at LHC/CERN. We report on how these gaseous detectors ("straw tubes") are performing during the ATLAS 2011 and 2012 runs where the TRT experiences higher rates than previously encountered.
The TRT contains ˜300000 thin-walled proportional-mode drift tubes providing on average 30 two-dimensional space points with ˜130 μm resolution for charged particle tracks with $|\eta| < 2$ and $pT > 0.5$ GeV. Along with continuous tracking, the TRT provides electron identification capability through the detection of transition radiation X-ray photons. During the ATLAS 2012 proton-proton data runs, the TRT is operating successfully while being subjected to the highest rates of incident particles ever experienced by a large scale gaseous tracking system. As of the submission date of this abstract, the TRT has collected data in an environment with instantaneous proton-proton luminosity of ˜0.8 x 10ˆ34 s-1cm-2. While shadowing effects caused by up to 40 simultaneous proton-proton collisions per bunch crossing are noticeable, the TRT performs significantly better than design. It also contributes to the combined tracking system pT resolution and to electron identification. During LHC heavy ion running in 2011, the TRT contributed to measuring track pT even in events where overall occupancy exceeded 50%.

quote your primary experiment:

ATLAS

Gaseous Detectors / 239

TRD detector development for CBM experiment

Author: Mariana Petris[1]

Co-authors: Alexandru Bercuci [1]; Cyrano Bergmann [2]; Daniel Bartos [1]; David Emschermann [2]; Florin Constantin [1]; Gheorghe Caragheorgheopol [1]; Ionela Berceanu [1]; Joern Adamczewski-Musch [3]; Johannes Wessels [2]; Madalina Tarzila [1]; Mihai Petrovici [1]; Sergey Linev [4]; Vasile Catanescu [1]; Victor Simion [1]

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A TRD prototype based on a single multiwire proportional chamber coupled with a small drift region was developed for the most inner part of the CBM-TRD subdetector. It preserves the same gas thickness for transition radiation absorption as the small size double-sided prototype for which an extrapolated pion efficiency of ˜1% for a six layers configuration was obtained and fulfills the requirement of high geometrical efficiency of the CBM-TRD stations. With the aim to access the position information in both coordinates of the readout electrode pad-plane (across and along the pads) with a single TRD layer, the original rectangular pads of the read-out electrode were split diagonally, each triangular pad being readout separately. A new Fast Analog Signal Processor (FASP) for pad signal processing has been developed. The detectors were tested with a mixed electron/pion beam

of 1-10 GeV/c momenta at CERN PS. A pion efficiency of 1.18% for a six layer configuration based on such an architecture was obtained. The performance in two dimensional position resolution is reported. Based on these results, the geometry of the most inner zone of the first CBM-TRD station was designed.

quote your primary experiment:

CBM/FAIR

Astroparticle Detectors / 191

Development of Hybrid Photo-Detector for the Hyper-Kamiokande Project

Authors: Isao Kametani[1]; Seiko Hirota[2]; Yasuhiro Nishimura[3]; Yusuke Suda[3]; Yuto Haga[1]

Co-authors: Akihiro Minamino [2]; Atsuko Ichikawa [4]; HIroaki Aihara [3]; Hiroyuki Sekiya [1]; Keiji Tateishi [2]; Kunxian Huang [2]; Makoto Miura [1]; Masashi Yokoyama [3]; Masato Shiozawa [1]; Masato Suzuki [5]; Masayuki Nakahata [1]; Motoyasu Ikeda [2]; Shoei Nakayama [1]; Takayuki Ohmura [5]; Tsuyoshi Nakaya [2]; Vagins Mark [6]; Yoichiro Suzuki [7]; Yoshihiko Kawai [5]; Yoshinari Hayato [3]

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A hybrid photo-detector (HPD) is being developed for the Hyper-Kamiokande experiment, a next-generation underground water Cherenkov detector designed to study a wide range of topics in physics and astronomy.
To establish the feasibility of HPDs for Hyper-Kamiokande, we plan to study their long-term stability and determine their neutrino detection performance. The HPD is a hybridization of a photomultiplier tube and an avalanche diode (AD), in which photoelectrons are amplified in 2 steps: bombardment from the photocatode to the AD surface under high voltage (˜8kV) and from the internal AD avalanche. For this reason , the HPD is expected to achieve higher single photon sensitivity and better timing resolution at a lower mass production cost than the conventional PMTs used in the baseline design of Hyper-Kamiokande. Implementation of HPDs in Hyper-Kamiokande could therefore improve its physics sensitivity.
As part of our RD we will evaluate the performance of a water Cherenkov detector using small size, 8-inch HPDs in 200-ton water tank before developing a 20-inch HPD for Hyper-Kamiokande.
As a preparation for validation studies in 200-ton tank. The basic performance of sn 8-inch HPD was measured such as single photon sensitivity, timing resolution, uniformity of response, thermal and magnetic dependence and so on. Also we operated it in small water tank to guarantee safe and stable operation. These results and status will be presented.

quote your primary experiment:

HyperKamiokande HPD neutrino

Semiconductor Detectors 1 / 35

Fabrication, Characterisation and Test of a 3D Diamond Detector for Ionising Radiation

Authors: Alexander Oh[1]; Benoit CAYLAR[2]

Co-authors: Dmitry Hits [3]; Dominique TROMSON [2]; Felix Caspar Bachmair [3]; Harris Kagan [4]; Iain Haughton [1]; José ALVAREZ [5]; Lukas Baeni [3]; Michal POMORSKI [2]; Philippe BERGONZO [2]; Richard Kass [6]; linn li [7]

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We report on the fabrication and test of the first prototype of a 3D diamond detector for applications in particle physics. Polycrystalline and single-crystal CVD diamond samples have been processed with a femto-second laser to create arrays of graphitic columns with a diameter of a few microns. This 3D geometry of read-out electrodes enhances the radiation hardness due to the reduced carrier drift path compared to conventional planar detector geometries. Such an approach had been successfully tested for silicon detectors where a significant improvement in radiation hardness has been obtained. By processing 3D electrodes, we studied the gain brought to the performances of CVD diamond detectors. The prototypes used conductive graphitic micro-channels, as fabricated within the diamond bulk using an femtosecond IR laser (800 nm). Electronic properties of the device were evaluated, including current-voltage, transient-current, and charge collection efficiency characteristics using a Sr-90 Source. Complete prototype single-crystal and polycrystalline 3D diamond detectors with multi-channel charge integrating read-out have been tested with minimum ionising radiation in particle beams (proton/pion beam at CERN). Finally IBIC measurements were used under heavy ions to probe the benefit of the approach and evaluate the gain in terms of radiation hardness. The obtained results prove the viability of 3D diamond detectors for particle physics for the first time.

quote your primary experiment:

Collaboration with RD42

Gaseous Detectors / 190

GridPix Characterisation and Development

Author: Willem Koppert[1]

Co-authors: Fransen Martin [1]; Frederik Hartjes [1]; Harry Van Der Graaf [1]; Jan Timmermans [2]; Jurriaan Schmitz [3]; Klaus Desch [4]; Niels Van Bakel [5]; Paul Colas [6]; Rolf Schon [5]; Yevgen Bilevych [4]

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The innovative GridPix detector is a micro TPC, read out with a Timepix pixelchip. Each individual element of the 256x256 pixel-matrix is connected to a preamplifier, discriminator and TDC (100MHz) for time of arrival measurements. By using wafer post processing techniques an aluminium grid is placed on top of the chip. When operated, the electric field in between the grid and the chip is sufficient to create single electron induced avalanches which are measured by the pixels. The digital counter is used to record the relative time enabling reconstruction of high precision 3D track segments. A SiRN protection layer protects the chip from discharges.
Gossips are GridPix detectors proposed as inner tracker detectors in ATLAS. Because of the LHC frequency a drift gap of 1 mm is required. Low diffusion and sufficient ionisations are essential for accurate 3D tracking. Currently, time walk is the dominant error in the drift direction. In a detailed study, recent test beam data gave insight into the contribution of both diffusion and time walk to the positional and angular resolutions of a Gossip detector. In addition long term tests show that the protection layer successfully quenches discharges preventing harm to the chip.
Recently, GridPix detectors were successfully made on full wafer scale, to meet the demand for more reliable and cheaper devices in large quantities. Wafer scale production opens a large variety of new possibilities and novel applications for GridPix.

quote your primary experiment:

Gossip, GridPix, MPGD

Scintillating Detectors / 257

A Prototype Scintillating-Fibre Tracker for the Cosmic-ray Muon Tomography of Legacy Nuclear Waste Containers

Author: David Mahon[1]

Co-authors: Anthony Clarkson [1]; Bryan McKinnon [1]; Cassie Staines [2]; Colin Zimmerman [2]; Craig Shearer [2]; David Hamilton [1]; David Ireland [1]; Guangliang Yang [1]; Matthias Hoek [1]; Morgan Murray [1]; Ralf Kaiser [1]; Russell Johnstone [2]; Scott Lumsden [1]; Sian Nutbeam-Tuffs [1]; Tibor Keri [1]

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Cosmic-ray muons are highly penetrative charged particles observed at sea level at a rate of 1 per square cm per min. They interact with matter primarily through Coulomb scattering. These properties are exploited in muon tomography to image objects inside industrial nuclear waste containers. A prototype scintillating-fibre detector has been developed at the University of Glasgow in collaboration with the UK National Nuclear Laboratory. This consists of two tracking modules above and two below the container to be assayed. Each module consists of two orthogonal planes of 2mm-pitch fibres yielding one spacepoint. Per plane, 128 fibres are read out by a Hamamatsu H8500 64-channel MAPMT with two fibres multiplexed onto each pixel. A dedicated mapping scheme has been developed to avoid spacepoint ambiguities and retain the high spatial resolution provided by the fibres. The configuration allows the reconstruction of the incoming and scattered muon trajectories, thus enabling the container content, with respect to atomic number Z, to be determined. A likelihood-based image reconstruction algorithm was developed and tested using a dedicated GEANT4 simulation of the prototype system and detailed modeling of muonic properties. Images reconstructed from this simulation are presented in comparison with preliminary results from data taken on a test setup. The experimental results verify the simulation and show clear discrimination between the low, medium and high-Z materials imaged.

quote your primary experiment:

Glasgow Muon Tomography

Cherenkov Detectors / 285

First Particle Identification with a Disc DIRC Detector

Author: Klaus Föhl[1]

Co-authors: Alexander Becker [1]; Avetik Hayrapetyan [1]; Benno Kröck [1]; Daniel Mühlheim [1]; Julian Rieke [1]; Michael Johannes Düren [2]; Oliver Merle [1]; Yong Liu [1]

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The PANDA experiment at the FAIR laboratory, currently under construction at GSI in Darmstadt, Germany, requires excellent Particle Identification for its study of proton-antiproton reactions in the few GeV energy range. In the confined space of the PANDA Target Spectrometer, two RICH-type Cherenkov detectors mainly aim at pion-kaon separation: a Barrel-DIRC detector patterned after the BaBar-DIRC covering the central angles, and a Disc-DIRC detector for the forward theta angle range from 5 to 22 degrees. Such a Disc-DIRC design has not yet been used in production experiments.
A demonstrator prototype, one quarter segment scaled to 80 percent of the PANDA geometry, constructed at Giessen university and equipped with 480 sensor pixels, has measured particles of several GeV/c in a cocktail secondary beam delivered by the T9 test beamline at CERN in October 2012. First analysis of the recorded hit patterns will be presented, compared to simulations and discussed.

quote your primary experiment:

PANDA

Semiconductor Detectors 2 / 66

The LHCb Silicon Tracker

Authors: Abraham Antonio Gallas Torreira[1]; Mark Tobin[2]

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The LHCb experiment is designed to perform high-precision measurements of CP violation and search for New Physics using the enormous flux of beauty and charm hadrons produced at the LHC. The LHCb detector is a single-arm spectrometer with excellent tracking and particle identification capabilities.
The Silicon Tracker is part of the tracking system and measures very precisely the particle trajectories coming from the interaction point in the region of high occupancies around the beam axis. The LHCb Silicon Tracker covers a total sensitive area of about 12 m2 using silicon micro-strip detectors with long
readout strips. It consists of one four-layer tracking station before the LHCb dipole magnet and three stations after. The detector has performed extremely well since the start of the LHC operation despite the fact that the experiment is collecting data at instantaneous luminosities well above the design value.
This paper reports on the operation and performance of the Silicon Tracker during the Physics data taking at the LHC during the last two years. The calibration procedures put in place will be discussed

in addition to the intrinsic detector efficiency and resolution of the detector. Finally, measurements of the
observed radiation damage will be shown and compared to that expected from simulation.

quote your primary experiment:

LHCb

Semiconductor Detectors 2 / **226**

The Belle II Silicon Vertex Detector

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The KEK-B machine and the Belle experiment in Tsukuba (Japan) are now undergoing an upgrade, leading to an ultimate luminosity of 8x10^35 cm-2 s-1 in order to measure rare decays in the B system with high statistics.
The previous vertex detector cannot cope with a 40-fold increase of luminosity and thus needs to be replaced. Belle II will be equipped with a two-layer Pixel Detector, surrounding the beam pipe, and four layers of double-sided silicon strip sensors (SVD=Silicon Vertex Detector) at higher radii than its predecessor. The SVD will have a total sensitive area of 1.14m2 and 223,744 channels - twice as many as the old detector.
All silicon sensors will be made from 6" wafers in order to maximize their size and thus reduce the relative contribution of support structure. The forward part has slanted sensors of trapezoidal shape to improve the measurement precision and minimize the amount of material as seen by particles from the vertex. Fast-shaping front-end amplifiers will be used in conjunction with an online hit time reconstruction algorithm in order to reduce the occupancy to the level of a few percent at most. A novel "Origami" chip-on-sensor scheme is used to minimize both the distance between strips and amplifier (thus reducing the electronic noise) as well as the overall material budget.
We will report on the status of the Belle II SVD and its components, including sensors, front-end detector ladders, mechanics, cooling and the readout electronics.

quote your primary experiment:

Belle II

Cherenkov Detectors / **160**

Performance study of a position sensitive SiPM detector for Cherenkov applications

Author: Mariana Narcisa Rihl[1]

Co-authors: Johann Marton [2]; Ken Suzuki [3]; Lukas Gruber [3]; Stefan Brunner [3]

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Silicon photomultipliers (SiPMs) are multi-pixel APDs operated in Geiger mode. This photon detection technology is characterized by a high photon detection efficiency, low costs and an insensitivity to magnetic fields. These attributes make them suitable for detectors in many research fields, such as particle physics, nuclear physics or medical imaging.
A prototype of a position sensitive Cherenkov detector was built, consisting of an array of 8 x 8 SiPMs with a light concentrator on top. The SiPMs have an active area of 3 x 3 mm2 with a pixel size of 100 x 100 µm2. With an entrance surface of 7 x 7 mm2 and an exit surface of 3 x 3 mm2, the light guide increases the detection area of the module, while providing sufficient position resolution for example for the barrel DIRC detector of the PANDA experiment at FAIR in Darmstadt
The detector was tested under laboratory conditions by scanning the array in two dimensions, using a pulsed light-beam and two step motors. The light source is an LED with a wavelength range of 465-475 nm. The beam diameter was about the size of a SiPM pixel and the step size to move the beam was 100 µm.
To define the collection efficiency of the light concentrator, measurements were done with and without light concentrator respectively and in dependence of the incident beam angle. The results will be compared with previous simulations and will be presented during the conference.

quote your primary experiment:

SiPM, Array, Efficiency

Scintillating Detectors / 6

Handy Compton camera using 3D position-sensitive scintillators coupled with large-area monolithicMPPC arrays

Author: Jun Kataoka[1]

Co-authors: Aya Kishimoto [1]; Kenshiro Takeuchi [1]; Masato Hirayanagi [2]; Shinji Ohsuka [3]; Shunsuke Adachi [2]; Sigeyuki Nakamura [2]; Takeshi Nakamori [1]; Takuya Fujita [1]; Takuya Kato [1]; Toru Nishiyama [1]

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One year after Japan's nuclear disaster, the invisible threat of radiation lingers around homes and businesses near the Fukushima Daiichi Nuclear Plant. Various gamma cameras are being developed and are now undergoing careful field tests. Although some are compact, the detector weight still exceeds 10 kg due to the thick mechanical collimator. Other models use electronic collimation but have relatively poor sensitivity especially for 137Cs and 134Cs gamma rays. We are developing a novel Compton camera weighing only ~1 kg and just ~10 cm cubic in size. Despite its compactness however, the camera realizes wide 180 deg vision with its sensitivity ~50 times superior to other cameras being tested in Fukushima. We expect that a hotspot producing a 5 micro-Sv/h dose at a distance of 3 meters can be imaged every 10 sec. The prototype camera consists of two identical 1 cm cubic 3D position-sensitive scintillation detectors (Ce:GAGG), developed through key in-house technology. By measuring the pulse-height ratio of MPPC-arrays coupled at both ends of a scintillation crystal block, the depth of interaction is obtained as well as the usual 2D positions. The average energy resolution of 10 % was obtained with the angular resolution better than 10 deg (FWHM) for 662 keV gamma rays. These results suggest that this gamma camera design is versatile and offers promise in various applications; not only as a survey device but also for nuclear medicine and high energy astrophysics.

quote your primary experiment:

high energy astrophysics

Semiconductor Detectors 2 / 225

A Low Mass On-chip Readout Scheme for Double-sided Silicon Strip Detectors

Author: Christian Irmler[1]

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B-factories like the KEK-B in Tsukuba, Japan, operate at relatively low energies and thus require detectors with very low material budget in order to minimize multiple scattering. On the other hand, front-end chips with short shaping time like the APV25 have to be placed as close to the sensor strips as possible to reduce the capacitive load, which mainly determines the noise figure.
In order to achieve both - minimal material budget and low noise - we developed a readout scheme for double-sided silicon detectors, where the APV25 chips are placed on a flexible circuit, which is glued onto the top side of the sensor. The bottom-side strips are connected by two flexible circuits, which are bent around the edge of the sensor.
This so-called "Origami"design will be utilized to build the Silicon Vertex Detector of the Belle II experiment, which will consist of 4 layers made from ladders with up to five double-sided silicon strip sensors in a row. Each ladder will be supported by two ribs made of a carbon fiber and Airex foam core sandwich. The heat dissipated by the front-end chips will be removed by a highly efficient two-phase CO2 system. Thanks to the Origami concept, all APV chips are aligned in a row and thus can be cooled by a single thin cooling pipe per ladder.
We will present the concept and the assembly procedure of the Origami chip-on-sensor modules, and show results of beam tests which were performed at CERN on prototype modules.

quote your primary experiment:

Belle II

Scintillating Detectors / 50

Recent developments on heavy inorganic scintillators with photonic crystal enhanced light extraction.

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One of the problems in heavy scintillating materials is related to their high index of refraction. As a consequence, a large part of the scintillation light produced in the bulk material is trapped inside the crystal due to total internal reflection. Recent developments in the area of nanophotonics were showing now that those limitations can be overcome by introducing a photonic crystal slab at the outcoupling surface of the scintillator. In previous work we could show a theoretical light yield improvement of various scintillator materials when applying such a structure at the outcoupling side of the crystal. During the last two years we were working on further improving the structure towards maximal light extraction but also for better timing. In addition we refined our simulation tools to provide better information on the angular and timing distribution of emitted photons from the PhC structure. In the practical part of this work we show the results of the first PhC enhanced scintillator samples. Through the deposition of an auxiliary layer of silicon nitride and the adaptation of the standard electron beam lithography parameters we could successfully produce several PhC slabs on top of 1.2 x 2.x 5mm3 lutetium oxyorthosilicate scintillators. In the characterization process, the PhC samples showed a 30-60% light yield improvement when compared to an unstructured reference scintillator.

quote your primary experiment:

CMS

Cherenkov Detectors / **222**

The ATLAS Forward Detectors LUCID, ALFA and AFP –Past, Present and Future

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LUCID is a gas Cerenkov detector deployed near to the beam-pipe at 17 m either side of the ATLAS Intersection point. The LUCID detector - when calibrated via a Van der Meer scan –is now measuring absolute luminosity on a bunch-by-bunch basis. It is now measuring integrated luminosity up to high luminosity with a precision of around 3%. The technical challenges that had to faced to make this measurement as well as upgrade plans for LUCID will be presented. In addition to LUCID, we will discuss that ALFA detector (Absolute Luminosity for ATLAS) and its status as well as the progress on the ATLAS Forward Protons project (AFP) that plans to deploy detectors to tag and measure, with 3-D silicon detectors, both protons in exclusive central diffractive processes.

quote your primary experiment:

ATLAS

Scintillating Detectors / **88**

Performance of Novel Oxide Scintillator Ce:(La,Gd)_2Si_2O_7 with a high energy resolution

Author: Akira Suzuki[1]

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Recently, we have developed a novel oxide scintillator (La,Gd)_2Si_2O_7 (La-GPS) crystal doped with 1-mol\% Ce grown by floating zone method. This crystal had excellent scintillation properties measured with a photomultiplier (PMT, Hamamatsu R7600U): a high light output of approximately 36,000 photons/MeV, good energy resolution (FWHM) of 5.0\% at 662 keV and fast decay time of 46 ns. Moreover, this material had no hygroscopic nature and intrinsic background. The maximum emission wavelength was approximately 390 nm.
In addition, the Ce:La-GPS crystal had a good energy resolution (FWHM) of 7.7 \pm 0.1\% at 662 keV, even though we used a multi-pixel photon counter (MPPC, Hamamatsu S10362-33-050C) at 26.0 \pm 0.1^{\circ}C. La-GPS can be the most appropriate choice in low-counting-rate applications such as a Compton camera and radiation monitor. In this presentation, we report the performance of La-GPS scintillator.

quote your primary experiment:

Novel Scintillators

Cherenkov Detectors / 127

Design and performance study of the TOP counter

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A novel RICH detector called TOP counter has been developed for particle identification in Belle II. It measures a time of propagation (TOP) of Cherenkov photons traveling in the quartz radiator with a precision of 50 psec and reconstructs the Cherenkov ring image in the photon detection position-time plane. The key features of the TOP counter will be presented: a 2.5 m long quartz radiator composed of two quartz bars glued together, each of which is polished with roughness < 0.5 nm in RMS and flatness < 6.3 um to keep the Cherenkov ring image after hundreds of reflections on its surface; the focusing mirror at the end of the quartz to minimize the chromatic dispersion; at the other end 32 micro-channel-plate photomultiplier tubes (MCP-PMTs), which are capable of detecting single photons with a timing resolution better than 50 psec. In addition, photon incident angle and polarization dependences of the MCP-PMT quantum efficiency will also be discussed because they are specifically important for the TOP counter which detects linearly polarized Cherenkov photons at various angles. A full-size prototype of the TOP counter was successfully built and it was tested with the 1-2 GeV electron beam at the Laser Electron Photon beamline at SPring-8 (LEPS). The obtained performance of the TOP counter prototype (for instance, the resolution of the reconstructed particle velocity) was as expected. Finally, the status and plan of the TOP counter construction will be presented.

quote your primary experiment:

Belle II

Semiconductor Detectors 2 / 248

Resolution studies on the ohmic side of silicon microstrip sensors

Author: Manfred Valentan[1]

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High precision collider experiments at lepton accelerators and b-factories need highly accurate position resolution while preserving a low material budget for precise particle tracking. Thin double-sided silicon detectors (DSSDs) fulll both requirements, if a careful sensor
design is applied to preserve a high charge collection effciency.
In this continuation of a previous study we investigate the p-stop and the p-spray blocking methods for strip isolation on the n-side (ohmic side) of DSSDs with n-type bulk. We compare three different p-stop patterns: the common p-stop pattern, the atoll p-stop pattern and a combination of these patterns, whereas for every pattern four different geometric layouts are considered. Moreover we investigate the effect of the strip isolation on sensors with one intermediate strip. Sensors featuring these p-stop patterns and the p-spray blocking method were tested in a 120 GeV/c hadron beam at the SPS at CERN, gamma-irradiated to 100 kGy at SCK-CEN (Mol, Belgium), and immediately afterwards tested again in the same setup as before.
In this new study we used a renwed p-stop design, had all sensor types irradiated, and for the first

time use point resolution values obtained by particle tracking for judging the sensor performance. The results of these tests are used to optimize the design of DSSDs for the Belle II experiment at KEK (Tsukuba, Japan).

quote your primary experiment:

Belle II

Semiconductor Detectors 2 / **106**

The upgrade of the ALICE Inner Tracking System

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ALICE is a general purpose experiment dedicated to the study of nucleus-nucleus collisions at LHC. After more than 3 years of successful operation, an upgrade of the apparatus during the second long shutdown of LHC (LS2) in 2017/18 is under study. One of the major goal of the proposed upgrade is to extend the physics reach for rare probes at low transverse momentum. The current Inner Tracking System (ITS), made of 6 layers of three technologies of silicon detectors, plays a key role in the determination of the primary and secondary vertices, complements the tracking performed by the Time Projection Chamber and the particle identification at low momentum by means of the specific energy loss dE/dx in silicon. The new ITS will consist of 7 layers of silicon detectors with significantly increased single point resolution and reduced material budget, allowing an improvement of a factor 3 of the impact parameter resolution. Moreover the data rate capability of the new ITS will be able to record the full expected LHC lead-lead interaction rate of 50 kHz, almost two orders of magnitude above the present readout rate. In this contribution the technical requirements and the ongoing developments of the different detector technologies under study will be presented, together with the first results from prototypes and the integration concepts.

quote your primary experiment:

ALICE ITS

Scintillating Detectors / **5**

Development of liquid scintillator containing zirconium complex for neutrinoless double beta decay experiment

Author: Yoshiyuki Fukuda[1]

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An organic liquid scintillator containing zirconium complex was studied for neutrinosless double beta decay. We have synthesized tetrakis(8-quinolinolate) zirconium as a complex and found their good solubility (2 w.t.%) in Benzonitrile, which has good light yield of primary scintillation for

gamma-rays. The photo-luminescence was measured, and the maximum peak was found around 548nm. We made liquid scintillator cocktail using both PPO and POPOP, and measured energy spectrum from induced gamma rays. However, the light yield was very small. In order to shorten emission wave length, we introduced Dimethoxy-Tiazine as substituent group, and succeeded to obtain larger quantum yield and light yield than those of original complex. We are developing another zirconium complex. Zirconium beta-diketon complex has a huge solubility (over 10w.t.%) for anisole, however, it does not have a luminescence, and the absorbance of ligand overlaps with the luminescence from anisole. Therefore, the light yield should be weaker as proportional to the concentration of complex. In order to avoid this problem, we are planning to synthesize beta-keto ester complex with -OC3H7 or -OC2H5 substituent groups. These complexes have much shorter wavelength of the absorbance than the emission of anisole. We are also synthesizing Zr-ODZ complex, which should have both large quantum yield and good emission wave length. Here we report these new ideas of liquid scintillator containing zirconium complex.

quote your primary experiment:

SuperKamiokande, XMASS, T2K

Cherenkov Detectors / 144

STATUS OF THE NA62 RICH

Author: Patrizia Cenci[1]

[1] *INFN Perugia (IT)*

NA62 is the last generation kaon experiment at CERN. Its main goal is to collect about 100 K+⟶π+νν events with 10% background. This implies to collect 10ˆ13 K+ decays with a backgound rejection factor of at least 10ˆ12. The challenging aspect of the experiment is the suppression of K decays with branching ratio up to 10 orders of magnitude higher than the signal and similar experimental signature, such as K+⟶μ+ν. To this purpose good PID (Particle IDentification) and kinematic rejection are required. Precise timing is needed to correctly associate the π+ with the parent K+ in an high rate environment.
A RICH detector is proposed as PID element, to identify μ contaminating the π sample in the 15-35 GeV/c momentum range with inefficieny lower than 1% and to measure the π arrival time with precision better than 100 ps. It will also be a key element for the 1-track trigger.
A vacuum-proof cylindrical vessel with 4 m diameter, about 17.5 m long, will be filled with Ne gas at atmospheric pressure. The Cherenkov light will be reflected by a mosaic of 20 hexagonal mirrors with 17 m focal length and collected by about 2000 PMT.
The construction of the detector is almost completed and the installation will start in 2013.
New and final results of the last prototype test at CERN, the updated description of the detector and the current status of the construction, the readout electronics and the trigger system based on the RICH will be presented.

quote your primary experiment:

NA62

Semiconductor Detectors 2 / 89

Development of a Level 1 Track Trigger for the CMS Experiment towards a High-Luminosity LHC scenario

Author: Nicola Pozzobon[1]

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Over the next decade, several upgrades in the LHC and its injector chain will eventually increase the luminosity by up to a factor of 10 compared to the original design figure of 1034 cm-2s-1. In order to cope with the large number of interactions per bunch crossing, a novel tracking system for the CMS experiment will be designed and built. The new tracker will also provide information to the Level-1 trigger decision, in order to improve the ability of selecting interesting physics channels in a higher density environment.
The CMS collaboration is developing a novel module concept ("pT module"), where signals from two closely-spaced sensors are correlated in the front-end electronics, to select pairs of hits compatible with particle pT above a certain threshold. Selected pairs of hits, called "track stubs", represent between 5% and 10% of the overall data rate: such reduction factor enables the data processing at Level-1.
Two main types of pT modules are being developed, one based on strip sensors, and the other coupling a strip sensor with a pixelated sensor, which provides also precise information in the z coordinate.
The main features of the pT module options under development are reviewed, as well as the benchmark results from simulation studies.

quote your primary experiment:

CMS

Scintillating Detectors / 130

The dual light-emitting crystals detector for WIMPs direct searches

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Co-authors: Jun Cao [1]; Junguang Lu [1]; Liang Zhan [1]; Tao Hu [1]; Yifang Wang [1]

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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 ℃ 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 100 kg scale experiment called CINDMS100 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.

quote your primary experiment:

HERD CINDMS

Cherenkov Detectors / 103

R&D for the high momentum particle identification upgrade detector for ALICE at LHC

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The Very High Momentum Particle Identification (VHMPID) detector has been proposed as upgrade for the ALICE experiment at LHC to extend charged hadron track-by-track identification in the momentum range 5-25 GeV/c. It is a RICH counter with focusing geometry using pressurized perfluorobutane (C4F8O) as Cherenkov radiator. Three options are currently being investigated for the photon detector: a MWPC with CsI photocathode, a triple Thick GEM counter with top element coated with CsI and a commercial micro-channel plate with bialkali photocathode (Photonis Planacon XP85012). We will discuss the results of beam tests performed on RICH prototypes using both liquid C6F14 radiator (in proximity focusing geometry for reference measurements) and for the first time pressurized C4F8O gaseous radiator. In particular we will present studies of a CsI based gaseous photon detector equipped with a MWPC having adjustable anode-cathode gap, aiming at the optimization of the chamber layout and performance in the detection of single photoelectrons.

quote your primary experiment:

ALICE

Semiconductor Detectors 2 / 228

A new vendor for high volume production of silicon particle detectors

Author: Marko Dragicevic[1]

Co-authors: Edwin Fruhwirth [1]; Thomas Bergauer [1]; Wolfgang Treberer-Treberspurg [1]

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Most modern particle physics experiments use silicon based sensors for their tracking systems. These sensors are able to detect particles generated in high energy collisions with high spatial resolution and therefore allow the precise reconstruction of particle tracks. So far only a few vendors were capable of producing silicon strip sensors with the quality needed in particle physics experiments. Together with the European-based semiconductor manufacturer Infineon Technologies AG (Infineon) the Institute of High Energy Physics of the Austrian Academy of Sciences (HEPHY) developed planar silicon strip sensors in p-on-n technology. This talk presents the development, production, electrical characterization, beam tests and gamma-irradiation of the first sensors produced by Infineon. This cooperation offers the possibility to establish Infineon as a high quality vendor for particle physics detectors capable of a high volume production required by future particle physics experiments.

quote your primary experiment:

Generic

Scintillating Detectors / 77

Scintillating bolometers: a promising tool for rare decays search

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The first idea of using a scintillating bolometer was suggested for solar neutrino experiments in 1989. After many years of developments, now we are able to exploit this experimental technique, based on the calorimetric approach with cryogenic particle detectors, to investigate rare events such as Neutrinoless Double Beta Decay and interaction of Dark Matter candidates.
The possibility to have high resolution detectors in which a very large part of the natural background can be discriminated with respect to the weak expected signal, results very appealing. The goal can be achieved by means of scintillating bolometers, which allow to distinguish the different type of interactions in the detector. The simultaneous read-out of the heat and scintillation signals made with two independent bolometers enable this precious feature, leading to possible background free experiment.
In the frame of the LUCIFER project, we report on how exploiting this technique to investigate Double Beta Decay for different isotope candidates. Moreover we demonstrate how scintillating bolometers are suitable for investigating other rare events such as alpha decays of long living isotopes of Lead and Bismuth.

quote your primary experiment:

LUCIFER

Cherenkov Detectors / 117

Beam test of FARICH prototype with dSiPM

Authors: Alexei Onuchin[1]; Sergey Kononov[1]

Co-authors: Alexander Barnyakov [2]; Alexander Danilyuk [3]; Alexei Talyshev [2]; Alexeii Kurepin [4]; Alexey Buzykaev [2]; Andrei Reshetin [4]; Ben Zwaans [5]; Carsten Degenhardt [5]; Dmitry Finogeev [4]; Evgeniy Kravchenko [2]; Evgueni Usenko [6]; Ivan Kuyanov [2]; Ivan Ovtin [2]; Mikhail Barnyakov [2]; Oliver Muelhens [5]; Ralf Dorscheid [5]; Stepan Razin [4]; Tatiana Karavicheva [4]; Thomas Frach [5]; Vasiliy Gulevich [2]; Victor Bobrovnikov [2]

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FARICH is a modern RICH detector based on variable refractive index ‘focusing’ aerogel. Silicon photomultipliers (SiPM) can be successfully employed in large RICH detectors due to their potentially low costs, compactness and immunity to magnetic field. Recently Philips has developed a digital silicon photomultiplier (dSiPM) by integrating readout electronics on the same chip as the array of avalanche diodes using conventional CMOS process technology. dSiPM is a very promising candidate for modern high-energy physics detectors because it cardinally solves the problem of front-end electronics integration for high channel density and the solution is easily scalable. Moreover, dSiPM enables a significant reduction of dark count rates by switching off noisy SPADs.
In June 2012 we tested a FARICH detector prototype based on dSiPM from Philips at the CERN PS T10 beam channel. The prototype consists of a 20x20 cm photon detector using 2304 dSiPM pixels of 4x4 mm size each. In order to reduce dark count rates the detector was cooled to -40C in addition to disabling individual SPADs. Two aerogel samples produced in Novosibirsk were studied. One

is a four-layer 'focusing' aerogel and the other is a homogeneous aerogel. We have observed rings with 0.8 mm ring radius resolution and 14 photoelectrons for 6 GeV/c pions in the 'focusing' aerogel. Particle separation capability of FARICH along with several other results will be presented and compared to MC simulations.

quote your primary experiment:

Super CharmTau factory

Semiconductor Detectors 3 / **234**

Silicon Sensors for HL-LHC Tracking Detectors –RD50 Status Report

Authors: Igor Mandic[1]; Ulrich Parzefall[2]

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It is foreseen to significantly increase the luminosity of the LHC by upgrading towards the HL-LHC (High Luminosity LHC) in order to harvest the maximum physics potential. Especially the PhaseII-Upgrade foreseen for 2021 will mean unprecedented radiation levels. All-silicon central trackers are being studied in ATLAS, CMS and LHCb, with extremely radiation hard silicon sensors to be employed on the innermost layers. Within the RD50 Collaboration, a massive RD programme is underway 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 a superior radiation hardness as they collect electrons instead of holes. A further area of activity is the development of advanced sensor types like 3D silicon 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. In this context, we will show first measurements from a set of dedicated detectors designed in order to better understand the charge multiplication mechanism,
Based on our results, we will give recommendations for the silicon detectors to be used for LHC detector upgrades.

quote your primary experiment:

RD50

Calorimeters / **273**

PERFORMANCE OF THE LHCb DETECTOR DURING THE LHC PROTON RUNS 2010- 2012

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The status and performance of the LHCb detector during the physics LHC physics run is described. The LHCb detector has a number of notable features including: 12 micron resolution in the transverse plane on 30-35 track primary vertices, pion and kaon separation from 1 to 100 GeV, and 1 MHz full readout of all sub-systems. The detector is being operating at twice its design Luminosity and the sub-system performance will be discussed. Hardware and software based trigger levels are utilised to efficiently select leptonic and hadronic decays of beauty and charm hadrons. During 2012 a so called 'deferred'triggering scheme has been used and will be presented. The alignment, tracking and particle identification performance will be discussed, together with effects of detector ageing.

quote your primary experiment:

LHCb

Calorimeters / **11**

The CMS electromagnetic calorimeter: performance and role in the discovery of the Higgs boson

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The signature of the two-photon decay of a low-mass Higgs boson is a narrow resonance, smeared by the photon energy resolution, over a large continuum background. The excellent energy resolution and photon identification capabilities of the CMS electromagnetic calorimeter (ECAL) at the LHC enhance the experimental sensitivity to this decay mode. The ECAL is a hermetic, fine grained and homogeneous calorimeter containing 75848 lead-tungstate (PbWO4) crystals, located inside the CMS superconducting solenoidal magnet. The scintillation light is detected by avalanche photodiodes (APDs) in the barrel section and by vacuum phototriodes (VPTs) in the two endcap sections. A silicon/lead pre-shower detector is installed in front of the endcaps. The ECAL performance is presented in detail and its role in the hunt for the Higgs boson, through the two-photon decay mode, is discussed.

quote your primary experiment:

CMS

Semiconductor Detectors 3 / **10**

Study of High-dose X-ray Radiation Damage of Silicon Sensors

Author: Robert Klanner[1]

Co-authors: Eckhart Fretwurst [1]; Ioana Pintilie [2]; Jiaguo Zhang [1]; Joern Schwandt [1]

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The high intensity and high repetition rate of XFEL, the European X-Ray Free-Electron Laser presently under construction in Hamburg, results in X-ray doses of up to 1 GGy in pixel sensors for 3 years of operation. Within the AGIPD Collaboration the Hamburg group has systematically studied X-ray damage using test structures and segmented sensors fabricated on high-ohmic n-type silicon. MOS Capacitors and Gate Controlled Diodes from 4 vendors with different crystal orientations and different technological parameters, as well as strip sensors have been irradiated in the dose range between 10 kGy and 1 GGy. Current-Voltage, Capacitance/Conductance-Voltage and Thermal Dielectric Relaxation Current measurements were used to extract oxide-charge densities, interface-trap densities and surface-current densities as function of dose and annealing conditions. The results have been implemented into TCAD simulations, and the radiation performance of strip sensors and guard ring structures simulated and compared to the experimental results. Finally, with the help of detailed TCAD simulations, the layout and technological parameters of the AGIPD pixel sensor has been optimized. It is found that the optimization for sensor exposed to high X-ray doses is significantly different than of non-irradiated sensors and that the specifications of the AGIPD sensor can be met.

quote your primary experiment:

European XFEL

Semiconductor Detectors 3 / **203**

Planar silicon sensors for the CMS Tracker upgrade

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The CMS tracker collaboration has initiated a large material investigation and irradia- tion campaign to identify the silicon material and design that fulfills all requirements for detectors for the high luminosity phase of the Large Hadron Collider (HL-LHC).
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 by one single industrial producer (Hamamatsu Photonics K.K.). Thus guaranteeing similar conditions for the production and design of the test-structures, properties of different silicon materials and design choices have been systematically studied and compared.
The samples have been irradiated with 1 MeV neutrons and protons corresponding to max- imal fluences as expected for the positions of detector layers in the future tracker. Three different proton energies have been used (23 MeV, 800 MeV and 23 GeV) in order to eval- uate the energy dependance of the defect generation in oxygen rich material.
All materials have been characterized before and after irradiations, and throughout an an- nealing 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, results from the ongoing campaign are presented.

quote your primary experiment:

CMS tracker Collaboration

Calorimeters / **9**

New results from the RD52 (DREAM) project

Author: Richard WIGMANS[1]

[1] *Texas Tech University*

Simultaneous detection of the Cherenkov light and scintillation light produced in hadron showers makes it possible to measure the electromagnetic shower fraction event by event and thus eliminate the detrimental effects of fluctuations in this fraction on the performance of hadron calorimeters. In the RD52 (DREAM) project, the possibilities of this dual-readout calorimetry are investigated and optimized. In this talk, the latest results of this project will be presented. These results concern the performance of a matrix of molybdenum doped lead tungstate crystals built for this purpose, new data on the application of the polarization of Cherenkov light in this context, particle ID based on the time structure of the signals, and the first test results of prototype modules for the new full-scale DREAM fiber calorimeter.

quote your primary experiment:

RD52

Semiconductor Detectors 3 / 224

Investigating Radiation induced Bulk Defects and its Influence on Doping Profiles

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In most High Energy Physics (HEP) experiments tracking and vertexing is realized by silicon detectors. Sensors, which are foreseen to be used at future collider experiments like the HL-LHC are exposed to a very challenging radiation environment. Due to radiation induced lattice defects the effective doping concentration of such sensors crucially changes and additional energy levels inside the band gap are created. Frequency dependent Capacitance Voltage (CV) methods are used to investigate deep-levels defects. The radiation influence on shallow-level defects in the bulk as well as in doping profiles is investigated with a Spreading Resistance Probe (SRP) technique. Therefore the doping profiles of neutron irradiated n-bulk samples were measured with SRP and a decreasing implantation depth with increasing fluences is determined. Additional CV measurements on electrical structures of the same samples were done. The results contain effects not considered in literature and are of special interest concerning the problems of type inversion and double junction.

quote your primary experiment:

CMS

Calorimeters / 231

Construction and testing of a large scale prototype of a silicon tungsten electromagnetic calorimeter for a future lepton collider

Author: Roman Poeschl[1]

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The CALICE collaboration is preparing large scale prototypes for highly granular calorimeters for detectors to be operated at a future linear electron positron collider. After several beam campaigns at DESY, CERN and FNAL, the CALICE collaboration has demonstrated the principle of highly granular electromagnetic calorimeters with a first prototype called physics prototype. The next prototype, called technological prototype, addresses the engineering challenges which come along with the realisation of highly granular calorimeters.
This prototype will comprise 30 layers where each layer is composed of four 9 cm x 9 cm silicon wafer. The front end electronics is integrated into the detector layers. The size of each pixel is 5 mm x 5 mm.
This prototype enters its construction phase. We present results of the first layers of the technological prototype obtained during beam test campaigns in spring and summer 2012. According to these results the signal over noise ratio of the detector exceeds the RD goal of 10:1.
The front end electronics will be power pulsed synchronous to the time structure of the beam at the linear collider. This most important feature will be tested during the winter 2012/13. The test will comprise beam tests with high energy particles and functional tests in a magnetic field. The talk will report on these results as well. Finally the next RD steps and the way towards the construction of a full detector will be outlined.

quote your primary experiment:

CALICE

Calorimeters / 169

Polarization as a Tool in High Energy Calorimetry

Author: Nural Akchurin[1]

[1] *Texas Tech University (US)*

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The signals from a high-Z scintillating crystal (BSO) are studied to characterize Cherenkov light polarization and to measure the longitudinal polarization profile of Cherenkov light in electromagnetic showers. The scintillation and Cherenkov lights can be separated by making use of the fact that the latter is polarized in the context of dual-readout calorimetry. In addition, this unique characteristic of Cherenkov light opens up a new set of possibilities that range from high-energy calorimetry to atmospheric air showers where significant improvements seem possible.

quote your primary experiment:

CMS, DREAM

Semiconductor Detectors 3 / 196

Performance and Radiation Damage Effects in the LHCb Vertex Locator

Author: Eduardo Rodrigues[1]

[1] *University of Manchester (GB)*

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LHCb is a dedicated experiment to study New Physics in the decays of heavy hadrons at the Large Hadron Collider (LHC). Heavy hadrons are identified through their flight distance in the VELO, the retractable silicon-strip vertex detector surrounding the LHCb interaction point at only 7 mm from the beam during normal LHC operation.
Both VELO halves comprise 21 silicon micro-strip modules each. A module is made of two n-on-n 300 μm thick half-disc sensors with R- and phi-measuring geometry, mounted on a carbon fibre support paddle. The minimum pitch is approximately 40 μm. The detector is also equipped with the only n-on-p module operating at the LHC.
The performance of the VELO in its three years of successful operation during the LHC physics runs will be presented. Highlights will include alignment, cluster finding efficiency, single hit resolution, and impact parameter and vertex resolutions.
The VELO module sensors receive a large and non-uniform radiation dose having inner and outer radii of only 7 and 42 mm, respectively. In this extreme and highly non-uniform radiation environment type-inversion of the inner part of the n-on-n sensors has already been measured.
Radiation damage is monitored and studied in three ways: (1) dependence of sensor currents on voltage and temperature; (2) noise versus voltage behaviour; and (3) cluster finding efficiency. Results will be presented in all three areas with updates based on recent results from the 2012 LHC running.

quote your primary experiment:

LHCb experiment

Calorimeters / 247

A totally Active Scintillator Calorimeter for the Muon Ionization Cooling Experiment

Author: Ruslan Asfandiyarov[1]

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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 main RD 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. It is shown that the granularity of the detector 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. Currently it is being built at the University of Geneva and it is planned to install it in MICE in the first quarter of 2013.

quote your primary experiment:

MICE

Semiconductor Detectors 3 / 236

Analysis of test beam data by global optimization methods

Authors: Are Strandlie[1]; Christian Irmler[2]; Havard Ervik Gjersdal[3]; Manfred Valentan[2]; Markus Friedl[2]; Rudolf Fruhwirth[2]; Thomas Bergauer[2]; Thomas Spielauer[2]

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[3] *University of Oslo (NO)*

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Successful track reconstruction in a silicon tracking device depends on the quality of the alignment, on the knowledge of the sensor resolution, and on the knowledge of the amount of material traversed by the particles. We describe algorithms for the concurrent estimation of alignment parameters, sensor resolutions and material thickness in the context of a test-beam setup. They are based on a global optimization approach and are designed to work both with and without prior information from a reference telescope. We present results from two beam tests with sensors designed for the Belle II Silicon Vertex Detector. We also discuss whether and how the global optimization approach can be transferred from a simple test-beam setup to a full-scale tracker.

quote your primary experiment:

Belle II

Calorimeters / 137

A LYSO calorimeter for the SuperB factory

Author: Alessandro Rossi[1]

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The SuperB project is an asymmetric e+e− accelerator of 10ˆ36cm−2s−1 design luminosity, capable of collecting a data sample of 75 ab−1 in five years running. The SuperB electromagnetic calorimeter (EMC) provides energy and direction measurement of photons and electrons, and is used for identification of electrons versus other charged particles. In particular we present its design, geometry study and related simulations, as well as RD on LYSO crystals and developments on readout electronics. A matrix of 25 crystals has been tested at the Beam Test Facility of Frascati (BTF) in May 2011 at energies between 100 MeV and 500 MeV. Results from this test are presented.

quote your primary experiment:

SuperB

Semiconductor Detectors 3 / 251

Track finding in silicon trackers with a small number of layers

Author: Robin Glattauer[1]

Co-authors: Jakob Lettenbichler [2]; Moritz Nadler ; Rudolf Fruhwirth [2]; Winfried Mitaroff [2]

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We present software based on novel techniques, developed for track finding in silicon trackers with a small number of layers. The core algorithm is a cellular automaton, followed by a Kalman filter and Hopfield neural network. We present results from two test cases. The first one is the Forward Tracking Detector (FTD) of the International Large Detector (ILD) at a future linear collider, which covers the forward and the backward region between the beam tube and the TPC. It consists of 7 disk-shaped silicon detectors on either side - two with pixel sensors and five with double-sided silicon strip sensors. We give some details on the implementation in the ILD software framework, and present results on simulated events without and with background. These show that our method performs better than the previously used one in terms of efficiency, ghost rate and processing speed. The second test case is the Silicon Vertex Detector (SVD) of the Belle II experiment at the B factory at KEK, which is a new device between the vertex detector and the central drift chamber. It consists of only four cylindrical layers of double-sided silicon strip sensors. The focus of this study is on the reconstruction of very low momentum tracks that miss the surrounding drift chamber. We present results from simulated data, including ghost hits and hits from the machine background.

quote your primary experiment:

ILD, Belle II

Medical Applications / 156

Development and Performance Evaluation of a Simultaneous PET-MR Detector based on the ClearPEM Technology

Author: Jorge A. Neves[1]

Co-authors: Arthur W. Magill [2]; Catarina Ortigão [3]; José C. Silva [3]; João Varela [3]; Ricardo Bugalho [1]; Rolf Gruetter [2]; Rui Silva [2]

[1] *LIP - Laboratory of Instrumentation and Experimental Particle Physics, Lisbon, Portugal*

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[3] *LIP - Laboratory of Instrumentation and Experimental Particle Physics , Lisbon, Portugal*

We present a feasibility study of the ClearPEM technology for simultaneous PET-MR imaging. The basic ClearPEM detector module is composed of 12 LYSO:Ce crystal matrices, each with 4x8 individual crystals (2x2x20mm3) optically coupled on both ends to S8550 hamamatsu APD arrays that are read out by two front-end boards. Each board integrates two low-noise ASICs of 192 channels each for APD readout, pulse amplification and shaping. The board also performs sequential analog-to-digital conversion and data serialization and transmission to the off-detector DAQ system.
Mutual electromagnetic interference effects between both systems were evaluated on a 7T MR scanner by characterizing the response behavior and the tolerance of the ClearPEM detectors and front-end electronics to the pulsed RF power and the switched magnetic field gradients; and by analyzing the MR system performance degradation from noise pickup into the RF receiver chain, and from magnetic susceptibility artifacts caused by PET front-end materials.
In the present work we will also present the first detection performance results of the ClearPEM module working simultaneously with a MRI acquisition; and our prototype developments on a new approach of a ClearPEM based detector for simultaneous small-animal PET-MR imaging at ultra-high magnetic fields (9.4 and 14.1T).

quote your primary experiment:

PET-MR Imaging

Electronics / 100

A Tracker for the Mu3e Experiment based on High-Voltage Monolithic Active Pixel Sensors

Author: Niklaus Berger[1]

[1] *Uni Heidelberg*

Corresponding Author: nberger@physi.uni-heidelberg.de

The Mu3e experiment searches for the lepton flavour violating decay μ+⟶e+e-e+, aiming for a branching fraction sensitivity of 10-16. This requires an excellent momentum resolution for low energy electrons, high rate capability and a large acceptance. In order to minimize multiple scattering, the amount of material has to be as small as possible. These challenges can be met with a tracker built from high-voltage monolithic active pixel sensors (HV-MAPS), which can be thinned to 50 μm and which incorporate the complete read-out electronics on the sensor chip. To further minimise material, the sensors are supported by a mechanical structure built from 25 μm thick Kapton foil and cooled with gaseous helium.
The talk discusses the progress towards building this tracker in the areas of sensor development, mechanics and cooling.

quote your primary experiment:

Mu3e

Electronics / 36

Optimisation of CMOS pixel sensors for high performance vertexing and tracking

Author: Jerome Baudot[1]

[1] *Institut Pluridisciplinaire Hubert Curien (FR)*

Corresponding Author: baudot@in2p3.fr

CMOS pixel sensors (CPS) with a column parallel read-out architecture and developed in a 0.35 um technology have already met the requirements of several high energy projects (EUDET, STAR-HFT, ILC) where spatial resolution and material budget govern the specifications. The full potential of CPS is however not yet reached, and can answer the demand of future vertex detectors (ALICE, SuperB, eIC) for faster integration time and stronger radiation tolerance, on condition to exploit a CMOS process with the appropriate characteristics.
In this context, we report on the in-beam test of a CPS prototype fabricated in a 0.18 um technology processed over a low doping epitaxial layer. Results indicate excellent charge collection properties greatly alleviating the irradiation effect up to the range of 1014 n_eq/cm2 and 1 MRad. This observation holds as well for rectangular-shape pixels, which offer the added value of a reduced integration time in the proposed read-out architecture.
Based on these achievements, we indicate the development path toward sensors featuring integration time much below 50 microsecond or large wedge-shape surface for forward tracking, always using the initial column-parallel read-out approach. Our conclusion underlines that the virtue of this architecture lies in its low power dissipation, a few 100 mW/cm2. Indeed it guarantees to keep the benefit of the genuine very low material budget of monolithic sensors, of prime importance for tracking systems.

quote your primary experiment:

ILD

Medical Applications / 146

Combining Endoscopic Ultrasound with Time-Of-Flight PET: the EndoTOFPET-US Project

Author: Benjamin Armand Frisch[1]

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Corresponding Author: benjamin.frisch@cern.ch

Prostate cancer is the second most frequently diagnosed cancer in males. Pancreas cancer, on the other hand, is among the deadliest cancers. Both require advanced imaging techniques for their diagnosis and staging. The endoTOFPET-US collaboration develops a multimodal imaging technique for endoscopic exams. It combines the benefits of high resolution metabolic imaging with Time-Of-Flight Positron Emission Tomography (PET) and anatomical imaging with ultrasound (US).
EndoTOFPET-US consists in an PET head extension for a commercial US endoscope and a PET plate outside the body in coincidence with the head. This paper presents the functionality and development of this novel instrument. The high level of miniaturization and integration creates challenges in fields such as scintillating crystals, ultra-fast photo-detection, highly integrated electronics, system integration and image reconstruction.
Amongst the developments, we highlight the use of fast scintillators coupled to optical elements that concentrate the light on the active area of the photodetector as well as fast and compact digital SiPMs with single SPAD readout to obtain the best coincidence time resolution (CTR). In view of the targeted resolution of ˜1 mm in the reconstructed image, we present a prototype detector system with a CTR of better than 240ps FWHM. We discuss the challenges in simulating such a system and introduce reconstruction algorithms based on graphics processing units (GPU).

quote your primary experiment:

endoTOFPET-US Collaboration

Medical Applications / 272

A PET TOF endorectal probe, compatible with MRI, for diagnosis and follow up of prostate and other pelvic region cancers

Author: Franco Garibaldi[1]

Co-authors: Angelo Rivetti [2]; Francesco Cusanno [3]; Luigi Cosentino [4]; Paolo Finocchiaro [5]; Paolo Musico [6]

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Prostate Carcinoma, is a heterogeneous disease, asymptomatic to rapidly systemic malignancy. Standard techniques cannot detect early disease. An endorectal PET-TOF MRI probe would solve the problem. The internal probe has to be used in coincidence with external dedicated detectors and/or a standard PET. The performance of the probe dominates, with improvement in spatial resolution and efficiency. The electronics has to measure with a precision of 300 ps or less. The photodetectors

have to be Silicon Photomultipliers (SiPM), for timing properties, compactness and MRI compatibility. Dual imaging agents PET allow for a trimodality imaging platform, helping in detecting limph nodes and tumor margins. Results from simulation show spatial resolution of ˜1.5 mm for source distances up to 80 mm; the efficiency is significantly improved with respect to the external PET. A discrete electronics system, based on ASIC has been designed and built. Minidetectors have been built and tested. We obtained, for the first time, timing resolution of 300 ps and at the same time Depth Of Interaction (DOI) resolution of 1 mm or less. The proposed detector can be used for several dieases.. It is an advanced and innovative multimodality imaging molecular system of the pelvic region that will merge anatomical and metabolic details from (simultaneous) TOF-PET/MRI imagers for diagnosis and follow up of several cancers: Adenocarcinoma Endocervical, and Lynch Syndrome in women and Prostate cancer in men

quote your primary experiment:

TOPEM

Electronics / 116

Monolithic pixel detectors with 0.2 um FD-SOI pixel process technology

Author: Toshinobu Miyoshi[1]

Co-authors: Ayaki Takeda [2]; Hirofumi Tadokoro [3]; Kazuhiko Hara [4]; Kazuya Tauchi [1]; Masashi Yanagihara [3]; Morifumi Ohno [3]; Ryo Ichimiya [1]; Shinya Nakashima [5]; Syukyo Gando Ryu [5]; Tadashi Chiba [3]; Takashi Kohriki [1]; Takeshi Tsuru [5]; Toru Tsuboyama [1]; Yasuo Arai [1]; Yasushi Igarashi [3]; Yoichi Ikegami [1]; Yoshimasa Ono [6]; Yoshinobu Unno [1]; Yowichi Fujita [1]; Yukiko Ikemoto [1]

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Truly monolithic pixel detectors were fabricated with 0.2 um SOI pixel process technology by collaborating with LAPIS Semiconductor Co., Ltd. for particle tracking experiment, X-ray imaging and medical application. CMOS circuits were fabricated on a thin SOI layer and connected to diodes formed on the silicon handle wafer through the buried oxide layer. We can choose the handle wafer and therefore high-resistivity silicons are also available. When Float Zone (FZ-) SOI wafers in which the thickness is about 500 um are used as the handle wafer, it can be fully-depleted with back-bias voltages of about 100 V. Double SOI (D-SOI) wafers fabricated from Czochralski(CZ)-SOI wafers were newly obtained and successfully processed in 2012. The top SOI layers are used as electric circuits and the middle SOI layers used as a shield layer against the back-gating effect, the cross-talk between sensors and CMOS circuits, and the total ionizing dose (TID) effect. KEK organizes Multi Project Wafer (MPW) runs in every year, in which many designs provided by Universities and institutions over the world are put together. In 2012, we developed several types of pixel detectors and some transistor test chips. Characteristics of the transistors and sensors fabricated with D-SOI were compared with that with single SOI. In presentation, the up-to-date test results will be shown.

quote your primary experiment:

SOI

Medical Applications / 167

COMPET: High Resolution High Sensitivity MRI Compatible Pre-Clinical PET Scanner

Author: Kim-Eigard Hines[1]

Co-authors: Arne Skretting [2]; David Volgyes [1]; Erlend Bolle [3]; Michael Rissi [4]; Ole Dorholt [3]; Ole Rohne [3]; Steinar Stapnes [5]; j.g Bjaalie [1]

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COMPET is a pre-clinical MRI compatible PET scanner which decouples sensitivity and resolution by the use of a novel detector design. The detector is built using square 8 × 8 cm layers consisting of 30 LYSO crystals interleaved with 24 Wavelength shifting fibers (WLS). By stacking several layers into a module, the point-of-interaction (POI) can be measured in 3D. Four layers forms a PET ring where the sensitivity can be increased by stacking several layers. The layers can be stacked such that no inter-crystal or inter-module gap is formed. COMPET has used four assembled layers for module and scanner characterization. The modules are connected to the COMPET data-acquisition chain and the images are reconstructed with a novel geometry independent COMPET image reconstruction algorithm. Time and Energy resolution has been resolved and found to be 1.2 ns and 14% respectively. Tests for MRI interference and count rate performance has been carried out. The reconstruction algorithm has been verified with data acquired from COMPET full ring PET scanner.

quote your primary experiment:

COMPET

Electronics / 15

3-Dimensional ASIC Development at Fermilab

Author: erik ramberg[1]

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Corresponding Author: ramberg@fnal.gov

For several years, Fermilab has been heavily involved in the development of novel 3-dimensional analog and digital ASIC circuits. These devices consist of thinned wafer layers with circuits bonded to each other to act as monolithic forms. Communication between the layers and across the stacks is achieved with micron-size through-silicon-vias. Enabling a new dimension in integrated circuits allows for new forms of virtually edgeless detectors, in-situ signal processing, and flexibility of attachment to sensors. We are exploring various applications for these type of circuits, including high energy particle track-triggering, highly granular trackers and time correlating X-ray imagers for photon science. Another application of the 3D technology is a hardware track finding engine using stacked associative memory structures for LHC upgrades. I will summarize Fermilab's work in this area, including test results on fabricated chips and plans for the future.

quote your primary experiment:

Detector R&D

Medical Applications / 233

Study of a Cherenkov TOF PET module

Author: Rok Dolenec[1]

Co-authors: Peter Krizan [2]; Rok Pestotnik [3]; Samo Korpar [4]

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A time-of-flight positron emission tomography (TOF PET) prototype apparatus, based on the principles of Cherenkov photon detection, was tested in experiments with a simple phantom. The time resolution obtained with such a system was 116 ps FWHM, with the single detector efficiency of 4.3%. Such excellent time resolution enabled a very fast image reconstruction algorithm to achieve results comparable to that of much more computing-intensive algorithms.

quote your primary experiment:

Belle

Electronics / 140

The first fully functional 3D CMOS chip with Deep N-well active pixel sensors for the ILC vertex detector

Author: Gianluca Traversi[1]

Co-authors: Alessia Manazza [2]; Lodovico Ratti [3]; Luigi Gaioni [4]; Massimo Manghisoni [5]; Valerio Re [6]

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This work presents the characterization of Deep N-Well (DNW) active pixel sensors fabricated in a vertically integrated technology. The DNW approach takes advantage of the triple well structure to lay out a sensor with relatively large charge collecting area (as compared to standard three transistor MAPS), while the readout is performed by a classical signal processing chain for capacitive detectors. This new 3D design relies upon stacking two homogeneous tiers fabricated in a 130nm CMOS process where the top tier is thinned down to about 12um to expose the through silicon vias (TSV), therefore making connection to the buried circuit possible. This technology has been used to design a fine pitch 3D CMOS sensor with sparsification capabilities, in view of vertexing applications to the International Linear Collider (ILC) experiments. Results from the characterization activity on

the SDR1 chip and on different kind of test structures, including single pixels, 3x3, 8x8 and 16x16 matrices will be presented at the conference.

quote your primary experiment:

ILC

Electronics / **47**

The TDCpix readout ASIC: a 75 ps resolution timing front-end for the NA62 Gigatracker hybrid pixel detector

Author: Gianluca Aglieri Rinella[1]

Co-authors: Alex Kluge [1]; Jan Kaplon [1]; Karolina Poltorak [2]; Lukas Perktold [3]; Matthew Noy [1]; Michel Morel [1]; Pierre Jarron [4]; Sandro Bonacini [1]

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The TDCpix is a novel pixel readout ASIC for the NA62 Gigatracker detector. NA62 is a new experiment being installed at the CERN Super Proton Synchrotron. Its Gigatracker detector shall provide on-beam tracking and time stamping of individual particles with a time resolution of 150 ps rms. It will consist of three tracking stations, each with one hybrid pixel sensor. The peak flow of particles crossing the detector modules reaches 1.27 MHz/mmˆ2 for a total rate of about 0.75 GHz. Ten TDCpix chips will be bump-bonded to every silicon pixel sensor. Each chip shall perform time stamping of 100 M particle hits per second with a timing accuracy better than 200 ps rms and a detection efficiency above 99%. The TDCpix chip has been designed in a 130 nm CMOS technology.
It will feature 45 × 40 square pixels of 300×300 μmˆ2 and a complex End of Column peripheral region including an array of TDCs based on DLLs, four high speed serializers, a low-jitter PLL, readout and control circuits. This contribution will describe the complete design of the final TDCpix ASIC. It will discuss design choices, the challenges faced and some of the lessons learned. Furthermore, experimental results from the testing of circuit prototypes will be presented. These demonstrate the achievement of key performance figures such as a time resolution of the processing chain of 75 ps rms and the capability of time stamping charged particles with an overall resolution below 200 ps rms.

quote your primary experiment:

NA62

Medical Applications / **55**

DEVELOPMENT OF A PET DETECTOR MODULE WITH DEPTH OF INTERACTION CAPABILITY

Author: Matteo Morrocchi[1]

Co-authors: Alberto Del Guerra [2]; Cristiano Santoni [3]; Cristoforo Marzocca [4]; Francesco Corsi [5]; Francesco Pennazio [6]; Giovanni Ambrosi [3]; Giovanni Pirrone [2]; Maria Giuseppina Bisogni [2]; Maria Ionica [7]; Naema Marino [2]; Piergiorgio Cerello [8]; Richard Wheadon [8]

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The 4DM-PET experiment aims to develop an innovative detector module for PET applications. The device is composed of a continuous LYSO scintillator crystal coupled to two SiPM matrices on its top and bottom surfaces. The peculiarity in using a continuous crystal is the ability to reconstruct the Depth of Interaction of the 511 keV photons generated by the annihilation of the positrons emitted by the radiotracer.
A first small prototype module has been built. It is composed of a LYSO crystal, 20x20x10 mm3 coupled on larger surfaces with arrays of SiPMs (4x4 pixel, 4x4 mm2 each) . The lateral faces of the crystal slab are black painted to avoid reflection of light. The Detector is read by custom designed Front-End ASICs.
We have scanned the detector in the three coordinates with pencil beams produced by collimated radioactive sources in order to investigate the spatial resolution capabilities of the module. The results achieved in terms of Depth of Interaction reconstruction and Point Spread Function at different positions on the detector surface are presented.

quote your primary experiment:

4DM-PET

Medical Applications / 24

Recent results on the development of a proton Computed Tomography system

Author: Mara Bruzzi[1]

Co-authors: C Pugliatti [2]; Carlo Civinini [1]; Cinzia Talamonti [3]; Concetta Stancampiano [2]; Domenico Lo Presti [4]; Eleonora Vanzi [5]; F Romano [6]; Giacomo Cuttone [7]; Margherita Zani [3]; Marta Bucciolini [8]; Monica Scaringella [9]; Nunzio Randazzo [2]; Pablo Cirrone [10]; Riccardo Mori [11]; Stefania Pallotta [12]; Valeria Sipala [13]

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Proton Computed Tomography (pCT) is an imaging technique based on the use of proton beams with kinetic energies above 200 MeV to directly measure stopping power (SP) distributions inside the tissue volume. PRIMA (PRoton IMAging) is an italian collaboration working on the development of a pCT scanner based on a tracker and a calorimeter to measure single protons trajectory and residual energy. The tracker is composed by 4 x-y planes of silicon microstrip detectors to measure entry and exit positions and angles. Residual energy is measured by a segmented calorimeter composed by YAG:Ce scinitillating crystals which also provides the trigger signal for the read-out chain. A first prototype of pCT scanner, with an active area of about 5x5 cm2 and a data rate capability of 10 kHz, has been constructed and characterized with 60 MeV protons at Laboratori Nazionali del Sud –Catania (Italy) and with 180 MeV protons at Svedberg Laboratory –Uppsala (Sweden). A new pre-clinical prototype with an extended active area up to ˜ 5x20 cm2, real time data acquisition and a data rate up to 1 MHz is under development. Test beam results of the present prototype and a description of the new prototype under development will be presented. Moreover, first results concerning tomographic image reconstruction will be presented and discussed.

quote your primary experiment:

PRIMA-INFN Project

Electronics / **7**

First Results from Medipix in Space

Author: Lawrence Pinsky[1]

Co-authors: Amir Bahadori [2]; Daniel Turecek [3]; Jan Jakubek [3]; John Paulo Idarraga Munoz [1]; Martin Kroupa [4]; Stanislav Pospisil [5]; Zdenek Vykydal [3]

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A talk was given at the last VCI demonstrating the capabilities of the pixel detector technology developed by the CERN-based Medipix2 Collaboration and outlining the plans to develop dosimeters and radiation area monitors for use in characterizing space radiation. In the interim, a number of devices have been sent to the International Space Station and are being used to obtain operating these devices in that environment. This has been coupled with an extensive ground-based accelerator evaluation of the response of these detectors to incident charged particles including heavy ions in order to evaluate both the effects of the ionization of such large quantities of electron-hole pairs in initially fully depleted Si sensors, as well as the impact on the front end electronics within each pixel in such situations. The result of these investigations and a preliminary report on the initial experience in space will be presented along with an overview of the future plans for deployments in space and the desirable characteristics for the next generation of these detectors from the Medipix3 Collaboration.

quote your primary experiment:

Medipix2 & Medipix3

Electronics / **311**

The ATLAS Muon Trigger –Experiences and Performances in the first 3 years of LHC pp runs

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The ATLAS experiment at CERN's Large Hadron Collider (LHC) deploys three-levels processing scheme for the trigger system. The level-1 muon trigger system gets its input from fast muon trigger detectors. Fast sector logic boards select muon candidates, which are passed via an interface board to the central trigger processor and then to the High Level Trigger (HLT). The muon HLT is purely software based and encompasses a level-2 trigger followed by an event filter for a staged trigger approach. It has access to the data of the precision muon detectors and other detector elements to refine the muon hypothesis.
The ATLAS experiment has taken data with high efficiency continuously over entire running periods form 2010 to 2012, for which sophisticated triggers to guard the highest physics output while reducing effectively the event rate were mandatory.
The ATLAS Muon trigger has successfully adapted to this changing environment. The selection strategy has been optimized for the various physics analysis involving muons in the final state. This includes for example the combined trigger signatures with electron and jet trigger objects, and so-called full-scan triggers, which make use of the full event information to search for di-lepton signatures, seeded by single lepton objects.
This presentation summarizes these 3 years experiences in ATLAS muon trigger and reports about efficiency, resolution, and general performance of the muon trigger.

quote your primary experiment:

ATLAS

Medical Applications / 57

A new X-Ray imaging system based on Chromatic Photon Counting technology

Author: Ronaldo Bellazzini[1]

Co-authors: Alessandro Brez [1]; Gloria Spandre [1]; Massimo Minuti [1]; Michele Pinchera [1]

[1] *INFN-Pisa and PIXIRAD IMAGING COUNTERS srl*

An innovative X-ray imaging sensor with intrinsic digital characteristics is presented. It is based on Chromatic Photon Counting technology. The detector is able to count
individually the incident X-ray photons and to separate them according to their energy (two'color' images per exposure). The energy selection occurs in real time and at radiographic imaging speed (GHz global counting rate). Photon counting, color mode and a very high spatial
resolution (more than 10 l.p./mm at MTF50) allow to obtain an optimal ratio between image quality and absorbed dose. The individual building block of the imaging system is a two-side buttable pixellated CdTe crystal coupled to a very large area CMOS ASIC. Up to 8 tiles have been assembled together to obtain a very large sensitive area imaging system (25×2.5 cm^2). A dedicated machine to perform X-ray slot-scanning imaging has been designed, built and tested. Results from in depth testing of several configuration of sensors are discussed. ' Color' X-ray images from 3x2.5 to 25x25 cm2 area will be shown. A new 'plug and play' unit will be presented. To be fully operational, this unit requires only an external 12 V, lap-top type, power supply.
The X-Ray imaging system is the technological platform of PIXIRAD Imaging Counters s.r.l., a recently constituted INFN spin-off company.

quote your primary experiment:

Pixirad

Plenary 4 / **12**

Imaging Hadron Calorimetry for Future Lepton Colliders

Author: Jose Repond[1]

[1] *Argonne National Laboratory*

To fully exploit the physics potential of a future Lepton Collider will require unprecedented jet energy and (di)-mass resolution. To achieve this goal, detectors optimized for the application of Particle Flow Algorithms (PFAs) are being conceived. The application of PFAs requires calorimeters with very fine segementation of the readout, so-called imaging calorimeters.
This talk will review the main developments in imaging hadron calorimetry geared towards implementation in a future Lepton Collider detector. The talk covers recent results from the large prototypes of the CALICE collaboration, such as the Scintillator Analog Hadron Calorimeter (AHCAL) and the Digital Hadron Calorimeters (DHCAL and SDHCAL). In addition, precision measurements of the development of hadronic showers as function of time will be presented.

quote your primary experiment:

CALICE

Plenary 4 / **260**

Antihydrogen Detection in the ALPHA -Experiment

Author: Petteri Pusa[1]

Co-authors: David Seddon [2]; Jim Thornhill [2]; Joseph Mckenna [2]; Paul Nolan [2]; Wells David [2]

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The principal aim of the ALPHA experiment at is to trap cold atomic antihydrogen and study it' s properties, and, ultimately, perform precision comparison between hydrogen and antihydrogen atomic spectra. Recently, several important milestones have been achieved, including long confinement of antihydrogen atoms and the first spectroscopic measurements done on the antihydrogen atoms.
The main experimental tool for the antihydrogen detection in the experiment is the ALPHA silicon vertex detector. The detector consists of three concentric barrels of 144 double sided silicon sensors and provides information on the time evolution of antiproton plasmas and individual annihilation events. Characteristics of the detector will be given along with the current status of the experiment.

quote your primary experiment:

ALPHA (CERN)

Plenary 4 / 282

The aerogel RICH for the Belle II spectrometer

Author: Rok Pestotnik[1]

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Corresponding Author: rok.pestotnik@ijs.si

For the Belle II spectrometer we are developing the proximity focusing RICH with aerogel as an radiator. It will be positioned in the small space between the drift chamber and the electromagnetic calorimeter inside a strong magnetic field of 1.5 T in the forward direction of the spectrometer and will enable the efficent separation of kaons from pions in the wide range of particle momenta from 0.5 up to 4 GeV/c. The chosen photo sensor - Hybrid Avalanche Photo Diode should be able to detect single photons with high efficiency and in addition it has to be resistant to high radiation doses of 10^12 neutrons/cm2 and 100 Gy of gammas in 10 years of operation. In the contribution the design of the detector will be presented. We will show the beam test results of the detector prototype, the results of the tests in the magnetic field and the results of the irradiation tests of photo sensor samples.

quote your primary experiment:

Belle II

Plenary 4 / 85

A Ring Imaging Cherenkov Detector for CLAS12

Author: Rachel Montgomery[1]

[1] *University of Glasgow*

The energy increase of Jefferson Laboratory's Continuous Electron Beam Accelerator Facility (CEBAF) to 12GeV promises to greatly extend the physics reach of its experiments. This will include an upgrade of the CEBAF Large Acceptance Spectrometer (CLAS) to CLAS12, offering unique possibilities to study internal nucleon dynamics. For this, excellent hadron identification over the full kinematical range is essential. In the base equipment this is achieved in CLAS12 by Cherenkov and time-of-flight counters. However improved hadron identification at momenta from 3 to 8GeV/c can be obtained by the installation of a Ring Imaging CHerenkov (RICH) detector into the forward region of CLAS12. There are several design constraints imposed upon the detector, in order that it complies with geometry and performance requirements. A novel hybrid imaging design incorporating mirrors, aerogel radiators and Hamamatsu H8500 multianode photomultiplier tubes has therefore been proposed. Depending upon the incident particle track angle, Cherenkov light will either be imaged directly by a proximity imaging setup or detected after a series of reflections and multiple passes through the aerogel. This paper presents an overview of the detector design and current status, including recent small- and large-scale prototype results from cosmics and mixed hadron beam tests respectively.

quote your primary experiment:

CLAS12

Plenary 4 / 214

LUX: A dual phase Xe TPC for direct dark matter detection

Author: Richard Ott[1]

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Direct detection of WIMP dark matter (DM) requires highly sensitive, ultra-low background detectors, which maximize the target mass. The two-phase Time Projection Chamber (TPC) technique, employed by the Large Underground Xenon (LUX) detector, takes advantage of the anti-correlated scintillation and ionization properties of liquid Xe to achieve a projected sensitivity of DM-nucleon cross section $< 2 \times 10^{-}46\mathrm{cm}^2$ (for 60 GeV WIMPs). In order to realize this, it employs a large water shield, careful radio-screening of materials, and extensive Xe purification, thereby lowering background. Results from surface operation of the LUX detector and preliminary results from underground commissioning will be presented. Critical figures of merit, such as electron drift lifetime, light collection efficiency, and discrimination power, will be discussed.

quote your primary experiment:

LUX

Plenary 5 / **299**

Detection methods at reactor neutrino experiments

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In 2011 and 2012, the smallest neutrino mixing angle θ_{13} was determined to be unexpected large by reactor neutrino experiments Daya Bay, Double Chooz, and RENO, and accelerator experiments T2K and MINOS. The most precise measurement is $\sin^2 2\theta_{13} = 0.089 \pm 0.010(stat.) \pm 0.005(syst.)$, provided by Daya Bay. The measurement of θ_{13} opened the gateway to the mass hierarchy and CP phase measurements. It also marked the beginning of precision measurements in neutrino studies. With near-far relative measurement and improvements in detector design, the relative precision of neutrino detectors reached 0.2%. In this talk, detection methods for reactor neutrinos are reviewed. The highlighted techniques include gadolinium-doped liquid scintillator, three-layer detector, functionally identical detectors, reflective panel, background shielding, energy calibration, etc.

Plenary 5 / **195**

A Packet-based Precise Timing and Synchronous DAQ Network for LHAASO Project

Author: Qiang Du[1]

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Aiming to high sensitivity and wide spectrum of cosmic ray detection, the one-square km complex detector array (KM2A) of Large High Altitude Air Shower Observatory (LHAASO) project consists of

5631 electron detectors, 1221 muon detectors, spreading over 1.2 square km. To precisely reconstruct the air shower events with high angular resolution, all detector electronics and digitizers should work in synchronous acquisition mode with global timing error less than 500ps (rms). This large scale and high precision timing requirement exceeds the capability or feasibility of traditional method such as GPS and echo-delay calibration. Recently an emerging method named White Rabbit (WR) was proposed and demostrated as a cost-effective solution that combines Giga-byte Ethernet and sub-nanosecond precision timing link via the same fiber media. Furthermore, the White Rabbit network also enables direct digitization and trigger-less data acquisition mode for each detector, which will greatly reduce the complexity and improve the performance of the DAQ system. In this paper we will demostrate the design and development status of a WR tming and DAQ network for KM2A in LHAASO project.

quote your primary experiment:

LHAASO

Plenary 5 / **181**

Particle tracking at 4K: The Fast Annihilation Cryogenic Tracking (FACT) detector for the AEgIS antimatter gravity experiment

Authors: Carlo Canali[1]; James Storey[1]

Co-authors: Akitaka Ariga [2]; Antonio Ereditato [3]; Christian Regenfus [1]; Ciro Pistillo [3]; Claude Amsler [1]; Igor Kreslo [3]; Jacky Rochet [4]; Jiro Kawada [3]; Mitsuhiro Kimura [3]; Paola Scampoli [5]; Saverio Braccini [3]; Tomoko Ariga [6]

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The AEgIS experiment is an international collaboration with the goal of performing the first direct measurement of the earth's gravitational acceleration on antimatter. Critical to the success of AEgIS is the production of cold antihydrogen (Hbar) atoms. The FACT detector will be used to measure the production and temperature of Hbar atoms and for establishing the formation of a beam. The operating requirements for this detector are very challenging: it must be able to identify each of the thousand or so annihilations in the 1ms period of pulsed Hbar production, operate at 4K inside a 1T solenoidal field and not produce more than 10W of heat. The FACT detector consists of two concentric cylindrical layers of 400 scintillator fibers with a 1mm diameter and a 0.6 mm pitch. The scintillating fibers are coupled to clear fibers which transport the scintillation light to 800 silicon photomultipliers. Each silicon photomultiplier signal is connected to a linear amplifier and a fast discriminator, the outputs of the which are sampled continuously by FPGAs.
In the course of the developments for the FACT detector we have established the performance of scintillating fibers at 4K by means of a cosmic-ray tracker operating in a 4K cryostat. The FACT detector will be installed in the AEgIS apparatus in October 2012 and will be used to study Hbar formation. This talk will present the design of the FACT detector and provide first results of the detector operation in the AEgIS apparatus.

quote your primary experiment:

AEgIS

Plenary 5 / **125**

Imaging of phantoms and small animals with the AX-PET demonstrator

Author: Christian Joram[1]

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We have developed a fully operational PET demonstrator set-up which allows true 3D reconstruction of the 511 keV photons and therefore leads to practically parallax free images. The AX-PET concept is based on thin 100 mm long scintillation crystals (LYSO), axially oriented and arranged in layers around the field of view. Layers of wavelength shifting plastic strips mounted in between the crystal layers give the axial coordinate. Both crystals and WLS strips are individually read out by G-APD (SiPM) photodetectors. The fully scalable concept overcomes the dilemma of sensitivity versus spatial resolution which is inherent to classical PET designs.
A demonstrator set-up based on two axial modules was exhaustively characterized using point-like sources, phantoms filled with radiotracer and finally rats and a mouse. The results entirely meet the performance expectations (< 2 mm FWHM in all 3 coordinates over the complete field of view) and also demonstrated the ability to include Compton interactions (inter-crystal scatter) in the reconstruction without noticeable performance loss.
Our recent studies focus on a TOF extension of the AX-PET concept making use of the novel digital SiPM detectors by Philips. After reproducing comparable energy and spatial resolution on a small digital AX-PET set-up, we could already demonstrate a coincidence time resolution well below 300 ps FWHM.

quote your primary experiment:

AX-PET

304

Award Ceremony

300

Summary Talk

Corresponding Author: ariella.cattai@cern.ch

Board: 76 / **27**

The PANDA Luminosity Detector

Author: Miriam Fritsch[1]

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The PANDA experiment will be built at the new accelerator facility FAIR in Darmstadt (Germany). It is optimized for hadron spectroscopy especially in the charm sector. Main topics of the PANDA physics program are the search for new and predicted states and the precise measurement of the line shape of new and already discovered resonances, e.g. the X(3872). This will be done by using the energy scan method for measuring the line shape very precisely and by the determination of the quantum numbers. Crucial for these measurements is the precise determination of the luminosity at each energy point for normalization of the data taken.
For the measurement of the luminosity, elastically scattered antiprotons at extreme forward angles will be used in the angular range of 3.5 to 8 mrad. The very precise determination of the scattering angles of the antiprotons and the separation of the scattered antiprotons from inelastic background reactions are only two of the challenges of this detector system. The luminosity detector will use 4 planes of HV-MAPS (High Voltage Monolithic Active Pixel Sensors) for the reconstruction of the tracks. The active area of the detector extends from 3.5 to 10 cm from the beam axis. The whole detector system will be operated in vacuum in order to reduce the systematic uncertainty due to multiple scattering.
The design and current status of the PANDA luminosity detector will be presented.

quote your primary experiment:

Luminositydetector PANDA FAIR

Board: 21 / **51**

GEM-based thermal neutron beam monitors for spallation sources

Authors: Carlo Cazzaniga[1]; Espedito Vassallo[2]; Fabrizio Murtas[3]; Gabriele Croci[4]; Gerardo Claps[5]; Giovanni Grosso[2]; Giuseppe Gorini[6]; Marco Tardocchi[2]; Roberto Caniello[2]

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The development of new neutron instrumentation and facilities is held back by the well-known problem of 3He shortage. The research of reliable substitutes is an important task for the affordability of new neutron scattering instrumentation for future spallation sources like ESS. In the framework of the development of the European Spallation Source (ESS) the GEM (Gas Electron Multiplier) is one of the detector technologies that have been proposed as thermal neutron sensor. GEM detectors combine high rate capability, coverage of 1 m2 area and resolution better than 0.5 cm and their use as thermal neutron detector requires conversion of neutrons into a charged particle. The approach considered here is the bGEM, i.e. to equip GEM detectors with a converter cathode containing 10B. A first prototype of bGEM detector has been realized and successfully tested in a neutron beam campaign held at the ISIS-RAL facility. Neutron beam profile, time of flight spectrum, efficiency to thermal neutrons and gamma background suppression have been measured. This first prototype represents only the first step towards the realization of thermal neutrons detectors with an efficiency of 30-50% as alternatives to 3He tubes.

quote your primary experiment:

Board: 81 / **136**

Design and Characterization of the VMM1 ASIC for Micropattern Gas Detectors

Author: Jessica Metcalfe[1]

Co-authors: Emerson Vernon [2]; Gianluigi De Geronimo [2]; Jack Fried [2]; Neena Nambiar [2]; Sarah Louise Jones [3]; Shaorui Li [2]; Venetios Polychronakos [1]

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We present here the measurements of the first prototype VMM1 ASIC designed at Brookhaven National Laboratory in 130 nm CMOS and fabricated in spring 2012. The 64-channel ASIC features a novel design for use with several types of micropattern gas detectors. The data driven system measures peak amplitude and timing information in tracking mode and first channel hit address in trigger mode. Several programmable gain and integration times allows the flexibility to work with Micromegas, Thin Gap Chambers (TGCs), and Gas Electron Multiplier (GEM) detectors. The IC design architecture and features will be presented along with measurements characterizing the performance of the VMM1 such as noise, linearity of the response, time walk, and calibration range. The concept for use with Micromegas in ATLAS Upgrade will also be covered including characterization under test beam conditions.

quote your primary experiment:

ATLAS

Board: 42 / **41**

A Detector for Proton Computed Tomography Project

Authors: Alexandre Dychkant[1]; George Coutrakon[1]; Gerald Blazey[1]; Vishnu Zutshi[1]

Co-author: Eric Johnson [1]

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We present a status of detector for proton computing tomography project using scintillating fiber trackers and a scintillator stack. The area of range stack is about 27cm by 36cm. It consists of 96 scintillating tiles of 3.2mm thickness readout with 1.2 mm diameter Y11 Kuraray WLS fibers connected to 192 silicon photo detectors. Extensive research for optimization light output and uniformity of response to radioactive source will be reported. Prototype of modular-frame design was 200 MeV proton beam and Bragg peak tested. In this presentation we focus on the current state of the detector and preliminary results from test beam runs. Full hardware system will be ready for commissioning in April 2013.

quote your primary experiment:

Proton Computed Tomography

Board: 28 / **145**

Performance of the low-mass drift chamber system of the MEG experiment

Author: Malte Hildebrandt[1]

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The MEG experiment searches for the lepton flavour violating decay mue ⟶ e + gamma and is located at the Paul Scherrer Institut (PSI) in Switzerland. The analysis of the combined data sample from 2009 and 2010 gives an upper limit of 2.4•10-12 (90% C.L.) on the branching ratio which is the most stringent limit up to date.
The drift chamber system is designed to ensure precision measurements of 52.8 MeV/c positrons.
The system consists of 16 drift chamber modules and is part of the innovative positron spectrometer of the MEG experiment.
The chamber construction is a low-mass construction in order to reduce multiple scattering and therefore minimize effects on tracking resolution in the sensitive area. The total amount of material sums up to a radiation length of only 0.026 % per module and in average of only 0.2 % along the positron trajectory.
To reach the required spatial resolution the method of charge division on the anode wires is used in combination with cathode Vernier pattern readout. A single hit resolution of 680 micron was achieved in axial and on average of 230 micron in transverse direction.
The back tracking capability of the positron spectrometer allows a vertex resolution at the muon stopping target of ˜7 mrad in phi and ˜11 mrad in theta, respectively, corresponding to a resolution of ˜1.5 mm for the decay vertex coordinates.
The momentum resolution of 0.6 % was determined by using the high momentum edge of the Michel positron spectrum.

quote your primary experiment:

MEG

Board: 60 / **171**

Development of thin edgeless silicon pixel sensors on epitaxial wafers

Author: Maurizio Boscardin[1]

Co-authors: Costanza Cavicchioli [2]; Gabriele Giacomini [1]; Giacomo Contin [3]; Gianluca Aglieri Rinella [2]; Irina Rashevskaya [3]; Luciano Bosisio [3]; Michel Morel [2]; Michele Caselle [4]; Nicola Zorzi [1]; Petra Riedler [5]; Romualdo Santoro [2]; Sabina Ronchin [1]; Valerio Altini [6]; Vito Manzari [7]

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This paper reports the development of a novel p-on-n thin edgeless planar sensor for a hybrid pixel detector, compatible with the ALICE front-end electronics, fabricated by FBK-CMM on epitaxial material. The aim of this development is to manufacture a hybrid pixel detector of very low material budget compared to the state-of-the-art of such devices. This task has been carried on following a two-steps approach. First, pixel sensors fabricated on epitaxial wafers have been thinned down to 100 μm after bump deposition and then flip-chip bonded to ALICE readout chips. The performance of the detector has been studied in a beam test performed at the CERN SPS; results on detection efficiency and cluster size as a function of the depletion voltage, the discriminator threshold and the track incidence angle will be discussed. The second phase, the "active edge"concept has been exploited in order to reduce the dead area at the periphery of the device. An overview of the key technological steps and the first electrical characterization of this type of sensors will be given.

quote your primary experiment:

ALICE

Board: 36 / **213**

THGEM-based Photon Detectors for the upgrade of COMPASS RICH-1

Author: Fulvio Tessarotto[1]

[1] *INFN Trieste*

An important upgrade of COMPASS RICH-1 has recently been approved: it mainly consists in replacing MWPC-based photon detectors with THGEM-based ones.
The new detectors have been developed in an extensive RD project, through three steps:
1) study of the response of single THGEM's with various geometries and different conditions, by systematic measurements and simulations of the electrostatic fields,
2) building of several small size detector prototypes, and operating them in laboratory and during test beam runs,
3) solving the challenging engineering problems related to the construction of large area THGEM-based photon detectors and their use on RICH counters.
The detector has a triple THGEM layer architecture with a CsI film acting as a reflective photocathode on the first layer.
It provides efficient detection of Cherenkov photons, stable operation at gain of 100,000 and time resolution better than 10 ns.
The new COMPASS RICH-1 upgrade project will be presented after describing the steps of the RD and the structure and characteristics of COMPASS THGEM-based photon detectors.
The performance of small and large size prototypes will be discussed.

quote your primary experiment:

COMPASS

Board: 66 / **284**

Complex Assemblies of Future Silicon Detectors

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As detectors in HEP require increasingly complex assembly procedures, the availability of a wide variety of interconnect technologies provides more options for overcoming obstacles in generic RD. I will present recent progress and challenges faced in various interconnect technologies: gold stud and double gold stud bonding, deposition and bonding of indium bumps, solder dispensing and solder ball bonding, and bonding using conductive epoxy. Examples of each technique will be presented and analyzed in the context of ongoing generic RD. Optimization of procedures, ideal parameters, and expected yields will be presented, keeping in view potential applications for future collider experiments.

quote your primary experiment:

Generic R&D

Board: 97 / **259**

A 10 MS/s 8-bit Charge-Redistribution ADC for Hybrid Pixel Applications in 65 nm CMOS

Author: Tetsuichi Kishishita[1]

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The design and the measurements of an 8-bit SAR ADC, based on a charge-redistribution DAC, developed for future hybrid pixel applications are presented.
This ADC is characterized by superior power efficiency and small area, realized by employing a lateral metal-metal capacitor array and a dynamic 2-stage comparator.
To avoid the need for a high-speed clock and its associated power consumption, an asynchronous logic is implemented in a logic control cell.
A test chip has been developed in a 65-nm CMOS technology, including eight different flavors of the capacitor layouts, two transimpedance amplifiers for signal inputs, and a custom-made LVDS driver for data transmission. The integral (INL) and differential (DNL) nonlinearities are measured below 0.5 LSB and 0.8 LSB respectively, for the best channel with 10 MS/s. The typical area is 40˜¥mum ¥$times$ 70˜¥mum per channel.
The power consumption is estimated as 4˜¥muW at 1 MS/s and 38˜¥muW at 10 MS/s with a supply rail of 1.2 V.
These promising performances based on a natural radiation hardness of transistors due to its thin gate oxide thickness are fascinating for future hybrid detector applications such as a two dimensional readout ASIC for CdTe/CdZnTe detectors with pixel pitch of 200–300˜¥mum to realize future hard X-ray space observations, or low-noise and fast readout architecture of the DEPFET and Fine Pixel CCD (FPCCD) as an option of the future ILC(International Linear Collider) vertex detector.

quote your primary experiment:

Belle-II

Board: 71 / **218**

Development of frequency-domain readout of Transition Edge Sensor bolometers for the POLARBEAR-2 Cosmic Microwave Background

Author: Kaori Hattori[1]

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The POLARBEAR-2 Cosmic Microwave Background (CMB) experiment aims to observe B-mode polarization with high sensitivity to explore gravitational lensing of CMB and inflationary gravitational waves. We will build a receiver that has 7,588 antenna-coupled, polarization sensitive Transition Edge Sensor (TES) bolometers. The kilopixel arrays of multi-band polarization-sensitive pixels are necessary to achieve the high sensitivity and stringent control of systematic errors required by these science goals. For the large array's readout, we employ digital frequency-domain multiplexing and multiplex 32 bolometers through a single superconducting quantum interference device (SQUID). An 8-bolometer frequency-domain multiplexed readout has been deployed on multiple experiments. Extending that architecture to 32 bolometers requires an increase in the bandwidth of the SQUID electronics. To achieve this, we have implemented Digital Active Nulling (DAN) on the digital frequency multiplexing platform. With DAN, digital feedback is calculated for each bolometer, extending the useful bandwidth of the SQUID amplifier. Another factor limiting the current bandwidth is parasitic inductance, which we have reduced in our new readout architecture. We will show frequency-domain multiplexing up to 3 MHz.

quote your primary experiment:

POLARBEAR2

Board: 73 / **289**

The GAMMA Experiment on Mt. Aragats: Status 2012

Author: Henrik Vardanyan[1]

[1] *Alikhanyan National Laboratory*

The current status of the GAMMA experiment on Mt. Aragats in Armenia is presented. A modernization of the GAMMA muon underground detector array was recently completed between October 2011 and February 2012. Sixty additional muon scintillation detectors were constructed and are now

taking data. This will improve the selection of muon-poor showers, and the primary energy estimation and also provide improved information on the primary cosmic-ray mass composition.

quote your primary experiment:

GAMMA

Board: 94 / **242**

GASTONE64 a new front-end ASIC for the cylindrical GEM Inner Tracker of KLOE experiment at DAFNE

Author: Flavio Loddo[1]

Co-authors: Alessandro Balla [2]; Alessandro Pelosi [3]; Antonio Budano [4]; Antonio Di Domenico [5]; Antonio Ranieri [6]; Danilo Domenici [7]; Edisher Tshadadze [8]; Erika De Lucia [9]; Giampiero Fanizzi [10]; Gianfranco Morello [11]; Giovanni Bencivenni [7]; Giulietto Felici [2]; Giuseppe De Robertis [6]; Jing Dong [12]; Lina Quintieri [8]; Manlio Capodiferro [13]; Maurizio Gatta [3]; Maurizio Mongelli [14]; Nicola Lacalamita [6]; Paolo Branchini [4]; Paolo Ciambrone [7]; Raffaele Liuzzi [14]; Stefano Cerioni [7]; Vincenzo Valentino [14]

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A 64-channel mixed analog-digital ASIC named GASTONE64 has been developed to readout the cylindrical GEM inner tracking detector of the KLOE apparatus at the e+e- DAFNE collider. It has been designed in the CMOS 0.35 μm technology and each analog channel is made of preamplifier, shaper and discriminator. The expected input charge ranges between few fC up to 40 fC, thus the charge sensitivity is set to 20 mV/fC while the equivalent input noise charge (ENC) is 800 e- + 40 e-/pF. The discriminated signals are read-out serially at 100 MBit/s using LVDS levels. The power consumption is about 3.6 mW/channel. After the successful tests on prototypes, the chip has been fully produced as well as the front-end boards to fully equip the detector. The test results of the measurements both on the test bench and on the detector will be shown.

quote your primary experiment:

KLOE

Board: 100 / **291**

Power pulsing of the CMOS sensor Mimosa 26

Author: Oleg Kuprash[1]

[1] *DESY*

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Power pulsing of the CMOS sensors for the ILC vertex detector is one of possibilities of reduction power consumption by the detector. It is possible because of specific bunch train structure at ILC, which allows to switch off or at least reduce the power between the bunch trains. Mimosa 26 is the final sensor chip of EUDET JRA1 beam telescope for the ILC vertex detector studies. The chip shows reasonably good behaviour under power pulsing conditions. The power pulsing allow significantly reduce heating of the chip and will divide power consumption approximately by a factor 5.

quote your primary experiment:

ILC

Board: 78 / **58**

A Portable Telescope Based on the Alibava System for Test Beam Studies

Authors: Carlos Lacasta Llacer[1]; Gianluigi Casse[2]; Jose Bernabeu Verdu[3]; Salvador Marti i Garcia[4]

Co-authors: Ashley Greenall [2]; Carmen Garcia [5]; Dean Charles Forshaw [2]; Giulio Pellegrini [3]; Ilya Tsurin [2]; Joaquin Rodriguez [6]; Manuel Lozano Fantoba [3]; Miguel Ullan Comes [3]

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A test beam telescope has been built using the ALIBAVA system to drive its data acquisition. The basic telescope planes consist in four XYT stations. Each station is built from a detector board with two 80-micron-pitch sensors, mounted one in each side and their strips crossing at 90 degrees. The ensemble is coupled to an ALIBAVA daughter board. These stations act as reference frame and allow a precise track reconstruction. The system is triggered by the coincidence signal of the two scintillators located up and down stream. The telescope can hold several devices under tests. Those may be mounted on detector boards coupled to the ALIBAVA daughter board. Each ALIBAVA daughter board (either linked to XYT station or a device under test) is subsequently read by its corresponding mother board. The acquisition system can hold up to 16 mother boards. The whole system is controlled by a master board that synchronizes all the mother boards and collects all the data. The off-line analysis software has been developed to study the charge collection, cluster width, tracking efficiency, resolution, etc, of the devices under test. Moreover, the built-in ALIBAVA TDC allows the analysis of the time profile of the device signal.
The ALIBAVA Telescope has been successfully operated in two test runs at the DESY and CERN-SPS beam lines. The complete telescope system will be described and the preliminary results will be presented.

quote your primary experiment:

ALIBAVA

297

New developments in TPCs and other gaseous detectors - CANCELLED !!

Corresponding Author: drnygren@lbl.gov

Gaseous detectors enter their second century of duty in elementary particle and nuclear physics with undiminished versatility and promise. Although partially eclipsed in the LHC era of high luminosity, new varieties of gas-based systems and TPCs have emerged, and truly new ideas are on the drawing board. In this short talk, I look back briefly to the earliest beginnings to illustrate opportunities overlooked, but mainly emphasize new advances - fully realized or conceptual.

Board: 62 / **198**

Embedded Pitch Adapters for the ATLAS Tracker Upgrade

Author: Miguel Ullan Comes[1]

Co-authors: Carlos Lacasta Llacer [2]; Celeste Fleta Corral [1]; Giulio Pellegrini [1]; Manuel Lozano Fantoba [1]; Victor Hugo Benitez Casma [1]

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In the ATLAS SCT modules there is a large pitch dissimilarity between detector and chip pads. The adaptation is made via glass plates with metal tracks named pitch adapters (PA). Our new approach for the ATLAS Tracker Upgrade prototypes is using a second metal layer in the sensor fabrication to implement PA built in the detector to overcome the pitch dissimilarity and avoid the use of a separated PA.
The main technological challenges are based on the impossibility of high temperature processing steps after the deposition of the first metal layer. This difficulty is overcome by the use of Plasma Enhanced Chemical Vapour Deposition (PECVD) for the inter-layer oxide. Device challenges are related to the possible crosstalk, which would degrade the noise, and the possible signal pick-up from the bulk, with the consequence of signal reduction. There is also a possible degradation of sensor channel yield due to statistical defects on the embedded PA tracks. In order to minimize crosstalk and reduce yield degradation, the design optimization criteria consist of obtaining minimum track length and maximum crossing angle between PA tracks and the strips.
The embedded PA have been fabricated on large sensors for the ATLAS-Upgrade Endcap Tracker to tests their performance and suitability. Initial tests confirm proper fabrication of the second metal tracks. Detailed results on the device performance will be shown in the conference.

quote your primary experiment:

ATLAS

Board: 31 / **172**

Test beam performance studies with the sTGC

Author: Yan Benhammou[1]

Co-authors: Giora Mikenberg [2]; Nahman Lupu [3]

[1] *Tel Aviv University*

[2] *Weizmann Institute for Science*

[3] *Technion Institute*

The forthcoming luminosity upgrade of LHC to super-LHC (sLHC) will increase the expected background rate in the forward region of the ATLAS Muon Spectrometer by approximately the factor of five. Some of the present Muon Spectrometer components will fail to cope with these high rates and will have to be replaced. The results of a test of a device consisting of 8 layers of Thin Gap Chambers (TGC) using the 180 GeV/c muons at the SPS-H8 muon beam at CERN are presented. The goal of the test was to study the tracking and triggering capabilities of the newly developed TGC system in the ATLAS muon spectrometer after high-luminosity upgrades of the LHC. The analysis of the recorded data shows a very good position resolution as a function of angle, varying from 100 to 150 microns for each plane for its use in trigger to 60 to 130 microns with offline reconstruction, as a function of the incident angle. Another test in the same beam conditions, has been realized in order to check a new electronic chain (very front end and front end) ; this new front end has been developed for the micromegas detectors and slightly modified for the TGC;the first results of this tests are presented.

quote your primary experiment:

ATLAS TGC sLHC

Board: 39 / **69**

Barrel calorimeter of the CMD-3 detector

Author: Kirill Mikhailov[1]

[1] *B*

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During 2010 year the CMD-3 detector has started to collect experimental data produced at e+e- collider VEPP-2000 at Budker Institute of Nuclear Physics.
CMD-3 is a general purpose detector designed to study of e+e-annihilation in to hadrons in the wide energy range, sqrt(s) = 0.3 : 2 GeV. The barrel electromagnetic calorimeter of the detector consists of two subsystems: closest to the beam pipe barrel liquid xenon calorimeter and outer barrel calorimeter based on CsI scintillation crystals.
The LXe calorimeter contains 400 liters of LXe, covers solid angle ˜0.8 X 4Pi and has a thickness equal to 5X0 . The electrodes structure of calorimeter provides possibility to measure deposited energy, reconstruct tracks of charged particles and analyze the deposited energy distribution in the calorimeter volume.
The CsI calorimeter consists of 8 octants, located around the LXe calorimeter, and contains 1152 counters. Each counter is based on CSI(Tl) or CsI(Na) crystals of 6 X 6 X 15 cmˆ3 size that corresponds to 8X0 for transverse to beam direction.
The total thickness of barrel calorimeter is equal to 13X0.The measured spatial resolution for cosmic muons tracks is about 1.5 mm. The measured energy resolution for 1 GeV electrons is about 4%. Obtained resolutions are close to designed values. The design of calorimeter and its current performance are presented in report.

quote your primary experiment:

CMD-3

Board: 90 / **197**

Evaluation of the Timepix chip radiation hardness using 60Co source.

Author: Martin Hejtmanek[1]

Co-authors: Maria Carna [1]; Michal Marcisovsky [1]

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Radiation hardness and stability of detection properties are critical parameters in applications of semiconductor radiation detectors.
The 0.25 um CMOS technology provides high degree of inherent radiation hardness to displacement and ionization damage.
The active volumes of sensor and readout chip are insensitive to the ionization damage effects, contrary to the SiO2 insulating layers. The insulating layers have low mobility of holes, which get trapped and present themselves as a space charge, which shifts the working points of MOS transistors, increases leakage and dark currents in sensors.
Here, we present the study of operational, detection and signal processing properties of the irradiated Timepix chip exposed to a high-flux 60Co source to the operational limits of the chip. The annealing process at the room temperature was evaluated, using 90Sr and 241Am sources to measure the detector response over a time period.

quote your primary experiment:

Medipix

Board: 69 / **182**

a bi-directional fixed-latency clock distribution system

Author: Yifan Yang[1]

Co-authors: Aongus Murchadha [1]; Kael Hanson [1]; Michael Korntheuer [1]; Thomas Meures [1]

[1] *IIHE*

The Askar'yan Radio Array (ARA) is an ultrahigh-energy neutrino telescope, currently under construction at the geographic South Pole.It is designed to detect GZK neutrinos (E > 100 PeV) by means of radiofrequency emission from electromagnetic cascades formed when these neutrinos interact with nuclei in the ice.The full array will contain 37 stations that cover 160 km2 surface area. Each station consists of 4, 15 cm diameter boreholes spaced up to 70 m apart and 200 m deep. In each hole there are 2 VPOL and 2 HPOL antennas to pick up the weak radio signals, a custom designed ASIC is used to digitize the signals in excess of 3 GSPS. It requires synchronized clocks for all channels within a station: clocks in 4 holes need exactly the same frequency and must maintain a fixed phase difference amongst each other, a skew jitter less than 50 ps being acceptable.
A prototye of clock distribution system through optical fiber has been designed and tested, by using GTP embedded in spartan6 FPGA and an external jitter cleaner, a clean copy of a main clock can be generated from the recovered clock, a skew jitter less than 30ps is achieved .In addition , a bi-directional fixed latency link can be established by a fixe delay jitter cleaner and a custom designed comma detect and clock alignment module.
The poster will explain the architecture of the clock distribution system as well as the implementation of the bi-directional fixed-latency link.

quote your primary experiment:

ARA

Board: 80 / **134**

All-in-one readout electronics for Belle-II Central Drift Chamber

Author: Nanae Taniguchi[1]

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For the Belle-II experiment at KEK, a Central Drift Chamber (CDC) with a readout electronics are required to be upgraded to cope with the design luminosity of 8 x 10ˆ35/cmˆ2s. The readout electronics system will be completely replaced.
The new readout electronics system must handle higher trigger rates with less dead time. The front-end electronics are located close to detector and send digitized signal through optical fibers. The new ASIC chips, FADC and FPGA are assembled on a single board. An amplifier, shaper and discriminator are implemented in the ASIC chip. The drift time and signal charged are measured with a TDC on the FPGA and a slow FADC, respectively. In this talk, the latest results of the RD and the performance of the readout board with test beam will be presented.

quote your primary experiment:

Belle II

Board: 70 / **207**

Rejection of surface background in thermal detectors

Author: Lucia Canonica[1]

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Thermal detectors have recently achieved a leading role in the fields of Neutrinoless Double Beta Decay and Dark Matter searches thanks to their excellent energy resolution and to the wide choice of absorber materials. In these fields the background coming from surface contaminations is frequently dominant.
We propose a scintillation-based approach for tagging this type of background and discuss the innovative application of this technique in non-scintillating bolometric detectors which will allow a more favorable signal to background ratio.
The first results of this promising technique are presented and discussed.

quote your primary experiment:

ABSuRD

Board: 93 / **212**

Characterization of novel Hamamatsu Multi Pixel Photon Counter Array for Gluex experiment On Jefferson Lab, Hall-D

Authors: Hayk Hakobyan[1]; Orlando Soto[1]; Rimsky Rojas[1]; Sergey Kuleshov[1]

Co-authors: Alam Toro [1]; William Brooks [1]

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The novel Hamamatsu Multi Pixel Photon Counter Array S12045(X) consists of an array of 3600 APD (avalanche photo diode) pixels, each one working in Limited Geiger mode with inverse bias voltage around 70[V]. The pixels are grouped into 16 independent electronic channels (16 MPPCs with 225 pixels each). We studied the main features of each channel on 2800 MPPC arrays, at different temperatures (5°C, 7°C, 20°C). Two measurement systems were built to extract Gain, Breakdown Voltage, Photon Detection Efficiency (PDE), Inter-pixel Cross-talk and Dark rate for each electronic channel. The complete characterization process of novel MPPC arrays used in GlueX experiment (Jefferson Lab, Hall D) as well as the hardware and the performed data analysis will be presented, which include new analytical expressions to obtain the number of photo-electrons and Inter-pixel Cross-Talk. All result are corresponding to different operational condition (temperature, bias voltage). The dynamical behavior of characterization parameters and the analysis of the best operational point will be discussed.

quote your primary experiment:

JLab HallD Gluex

Board: 15 / **28**

Novel glass ceramic-type micropattern gas detector with PEG3C

Author: Fuyuki Tokanai[1]

Co-authors: Hajime Kikuchi [2]; Hirohisa Sakurai [3]; Hiroyuki Sugiyama [4]; Mirei Takeyama [3]; Noboru Ohishi [5]; Shuichi Gunji [3]; Shunji Kishimoto [6]; Takashi Fushie [2]; Takayuki SUMIYOSHI [7]; Teruyuki Okada [4]; Toru Moriya [3]

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A new glass ceramic plate (GCP) has been developed for a hole-type micropattern gas detector (MPGD). The material of the GP is crystallized photosensitive etching glass (PEG3C) made by HOYA CORP. The micropattern is structured in the glass by ultraviolet photolithography through a photomask. The PEG3C has greater bending strength than conventional glass, allowing one to form microstructures in a thickness of less than 200 micro m and an effective area of 30 cm × 30 cm.
Our first prototype of the MPGD made of PEG3C has a thickness of 150 micro m and an effective diameter of 20 mm. The diameter and pitch of each hole are 100 and 360 micro m, respectively. The electrodes are made of Cu/Cr fabricated onto the two flat surfaces of a plate. A basic performance test of the hole-type MPGD was carried out with an X-ray source for a Ne (90%) + CF4 (10%) gas mixture at 1 atm. A gain of up to 6×104 and an energy resolution of 18% were obtained for 6 keV X-rays. It has also been shown that there is little charging-up effect in the PEG3C. In this conference, we report on the characteristics of the novel hole-type MPGD with PEG3C.

quote your primary experiment:

SHE

Board: 16 / **29**

Concise quantum efficiency measurement system for gaseous photomultiplier

Author: toru moriya[1]

Co-authors: Fuyuki Tokanai [2]; Hironobu Kawabata [3]; Hiroyuki Sugiyama [4]; Horohisa Sakurai [5]; Mirei Takeyama [5]; Noboru Ohishi [6]; Shuichi Gunji [5]; Takayuki SUMIYOSHI [7]; Takayuki Sohtome [3]; Teruyuki Okada [4]

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We have been developing gaseous photomultiplier tubes (PMTs) with a bialkali photocathode combined with micropattern gas detectors (MPGDs) such as a glass capillary plate (CP), a gas electron multiplier (GEM), and a Micromegas detector. The sensitivity of a photomultiplier is described in terms of its quantum efficiency (QE), i.e., the number of photoelectrons emitted from the photocathode divided by the number of incident photons. The QE is very important for many experiments, especially when dealing with low photon statistics. A concise QE measurement system has been developed to evaluate the characteristics of the sealed gaseous photomultiplier tube (PMT) with a bi-alkali photocathode. The QE measurement system consists of a Xe arc lamp source, reflective optics and filters, a monochromator, and a reference Si photodiode detector. Using the system, we evaluated the QE, gain, and long-term stability of the gaseous PMT. This latest development of the gaseous PMT is described here.

quote your primary experiment:

SHE

Board: 53 / **54**

Performance of the CLAS12 Silicon Vertex Tracker module

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For the 12 GeV upgrade, the CLAS12 experiment has designed a Silicon Vertex Tracker (SVT) using single sided microstrip sensors fabricated by Hamamatsu. The sensors have graded angle design to minimize dead areas and a readout pitch of 156 μm, with intermediate strip. Double sided SVT module hosts three daisy-chained sensors on each side with total strip length of 33 cm. There are 512 channels per module read out by four Fermilab Silicon Strip Readout (FSSR2) chips featuring data driven architecture, mounted on a rigid-flex hybrid. Modules are assembled on the barrel using unique cantilevered geometry to minimize amount of material in the tracking volume. Design and performance of the SVT modules is presented, focusing on results of electrical measurements.

quote your primary experiment:

CLAS12 TJNAF

Board: 67 / **84**

The Air Microwave Yield (AMY) experiment to measure the GHz emission from air shower plasmas

Author: Gonzalo Rodriguez[1]

[1] *Universisdad Santiago de Compostela*

The AMY experiment aims to measure the Microwave Bremsstrahlung Radiation (MBR) emitted by air-showers secondary electrons accelerating in collisions with neutral molecules of the atmosphere. The measurements are performed at the Beam Test Facility (BTF) of Frascati INFN National Laboratories. The experiment will characterize the process to be used in a next generation detectors of ultra-high energy cosmic rays (up to 10^{20} eV). This technique could provide a full longitudinal profile measurement (like the Fluorescence Detector) but with a 100% duty cycle.

quote your primary experiment:

Pierre Auger Observatory

Board: 87 / **186**

New photon detector device based on a matrix of PPDs with FPGA-based digital readout

Author: Carlos Maximiliano Mollo[1]

Co-authors: Andrea Russo [2]; Daniele Vivolo [2]; Giancarlo Barbarino [3]; Gianfranca De Rosa [1]; Pasquale Migliozzi [4]; Riccardo De Asmundis [4]

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Light detection through photosensitive devices represents one of the key issues for a large variety of experiments.
In the recent years, Pixelated Photon Detectors (PPDs) based on limited Geiger-mode avalanche have been extensively studied in view of their future applications.
However, their use is strongly limited by their small sensitive surfaces and by the fact that any increment in the surface turns out into an increase of the dark count rate.
In the present work we describe the dark count rate reduction obtained by using a FPGA-based logical circuit for fast pre-processing of pulses from a 3 × 3 matrix of PPDs. The prototype we developed supports two PPDs: we show that a rate reduction from 2.8 Mcps (Mega counts per second) down to 0.13 Mcps at the lowest threshold (0.5 photon-equivalent) and from 0.8 kcps down to 0.005 cps for the highest threshold (3.5 photon-equivalent)is obtainable. We also introduce a possible application based on the use of a 3x3 matrix of PPDs at very low temperatures (approx. -190 C) in dark matter search experiments.

quote your primary experiment:

KM3NET

Board: 37 / **216**

Performance of a new generation RPCs for particle physics at colliders of the next generation.

Author: Lorenzo Paolozzi[1]

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The upgrade of present and future experiments in particle physics at high luminosity colliders will require a level one trigger of high selectivity and robustness in order to cope with the very heavy background levels. This selectivity requires detectors with very good space and time resolution operating at high rate.
We present in this paper the latest developments of the RPC detectors concerning rate capability (up to 30kHz/cm2), space resolution (few hundred microns) and time resolution (few hundred picoseconds). We also show that this improvement required the development of a fast, low noise and large dynamics front end electronics and a better understanding of the detector physics.

quote your primary experiment:

ATLAS

Board: 48 / **217**

Charge Collection Mapping of a Novel Ultra-Thin Silicon Strip Detector for Hadrontherapy Beam Monitoring

Author: Mohamed Bouterfa[1]

Co-authors: Denis Flandre [1]; Eduardo Cortina Gil [1]; Geoffrey Alexandre [1]

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For precise treatment purposes in hadrontherapy, the particle beam has to be monitored in real time without being degraded. For the first time, silicon strip detectors have been fabricated over an area as large as 4.5cm x 4.5cm with ultra low thickness of 20µm. Ultra-thin detectors offer the following considerable advantages: a significantly reduced beam scattering, a higher radiation hardness which leads to an improved detector lifetime, and a much better collection efficiency.
In a previous work, the novel sensor has been described and a global macroscopic dosimetry characterization has been proposed. The latter characterization provides practical information for the detector daily use however it does not help to improve the local microscopic knowledge of the sensor. This work therefore presents a micrometric-accuracy collection characterization of this new generation of ultra-thin silicon strip detectors.
This goal is reached thanks to a 1060nm-wavelength micrometric-sized laser that can be positioned relatively to the sensor with a submicron precision for the three different axes.
The measured charge collection mapping over the wafer surface was compared to device simulations performed on ATLAS (Silvaco).

This study gives a much better knowledge of the inefficient areas of the sensor and allows therefore optimization for future designs.

quote your primary experiment:

detector collection mapping

Board: 59 / **165**

ATLAS Silicon Microstrip Tracker Operation and Performance

Author: Gaetano Barone[1]

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The Semi-Conductor Tracker (SCT) is a silicon strip detector and one of the key precision tracking devices in the Inner Detector of the ATLAS experiment at CERN LHC.
The SCT is constructed of 4088 silicon detector modules for a total of 6.3 million strips. Each module is designed, constructed and tested to operate as a stand-alone unit, mechanically, electrically, optically and thermally. The modules are mounted into two types of structures: one barrel (4 cylinders) and two end-cap systems (9 disks on each end of the barrel).
In the talk the current results from the successful operation of the SCT Detector at the LHC and its status after three years of operation will be presented.
We will report on the operation of the detector including an overview of the issues we encountered and the observation of significant increases in leakage currents (as expected) from bulk damage due to non-ionising radiation. The main emphasis will be given to the tracking performance of the SCT and the data quality during the >2 years of data taking of proton-proton collision data at 7 TeV (and short periods of heavy ion collisions). The SCT has been fully operational throughout all data taking periods, delivering high quality tracking data.
The SCT running experience will then be used to extract valuable lessons for future silicon strip detector projects.

quote your primary experiment:

ATLAS

Board: 49 / **219**

A Gaseous Compton Camera using a 2D sensitive gaseous phtotomultiplier for Nuclear Medical Imaging

Author: João Veloso[1]

Co-authors: Ana Silva [1]; Carlos Azevedo [2]; Fábio Pereira [1]; Lara Carramate [1]; Pedro Correia [1]; Tiago Lopes [1]

[1] *I3N, Physics Department, University of Aveiro*

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A concept of a Compton Camera (CC) based on a High Pressure Electroluminescence Chamber coupled to a position sensitive Gaseous PhotoMultiplier (GPM) for Nuclear Medical Imaging (NMI), is proposed.

A Compton Camera presents a different solution of the Gamma Camera (GC) as it provides position and energy information about the incoming photon via electronic "collimator", instead of the use of a mechanical collimator responsible for the huge reduction of the sensitivity of the GC.
In the proposed concept the high pressure chamber filled with a mixture of noble gases up to 20 bar, has a drift/conversion region which acts as the active detection medium and a scintillation region where the drift electrons produce VUV photons that are detected by the 2D-position sensitive GPM, using a reflective CsI photocathode on top of a cascade of THGEMs. The third dimension of the interaction position is determined by the electrons drift time. The information of the 3D interaction position and deposited energy, will allows to determine the cone of emission and so, image reconstruction.
In this work we present the developments of the proposed Compton Camera with an 12 cm diameter active area. Comparison with other systems will be presented together with simulations of the detector response and initial experimental results, as well as the GPM imaging capability to detect VUV light.

quote your primary experiment:

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Board: 58 / **164**

Pulse shape discrimination at low energies with a double sided silicon low pitch strip detector

Authors: Bernard Genolini[1]; Daniele Mengoni[2]; Jose Dueñas[3]; Marlène Assie[4]

Co-authors: Daisuke Suzuki [4]; Didier Beaumel [4]; Emmanuel Rauly [4]; Fairouz Hammache [4]; Ismael Martel [3]; Jacques Guillot [4]; Marin Chabot [4]; Nicolas de Séréville [4]; Sébastien Ancelin [4]; Tatjana Faul [4]; Valérie Le Ven [4]; Yorick Blumenfeld [5]

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We achieved particle separation of proton, deuterium and tritium at energies ranging between 2 and 10 MeV by the processing of digitized signals obtained with a double-sided silicon 485-µm pitch strip detector. Light charged particles were produced in a nuclear reaction induced by a 34-MeV beam of 7Li impinging on a 12C target. We employed a neutron transmutation doped (nTD) 500-µm thick silicon detector in a low-field injection setup and collected the signals with a two-output preamplifier: one performing wide band amplification, the other integration. We recorded the signals with a 300-MHz bandwidth, 14-bit, 1-GSPS digitizer. We estimate with a preliminary analysis that we obtained a separation between protons and deuterons of at least 5 standard deviations at 2 MeV. We will compare different algorithms for the pulse shape discrimination, with the goal of a simplified front-end electronics in mind for the processing of the 15,000 channels for the new state-of-the-art detectors for low energy nuclear physics like GASPARD, HYDE and TRACE which should make use of such techniques.

quote your primary experiment:

GASPARD HYDE TRACE

Board: 26 / **131**

Development of GEM tracker for J-PARC E16 experiment

Author: Yusuke Komatsu[1]

Co-authors: Daisuke Kawama [2]; Kouki Kanno [1]; Kyoichiro Ozawa [3]; Michiko Sekimoto [3]; Satoshi Yokkaichi [2]; Shinichi Masumoto [1]; Takuya Shibukawa [1]; Tomonori Takahashi [2]; Wataru Nakai [1]; Yoki Aramaki [2]; Yosuke Watanabe [1]; Yuki Obara [1]

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The J-PARC E16 experiment measures the mass modification of phi meson in nuclear matter at J-PARC high-momentum beam line to study an origin of hadron mass. The tracking detector of the experiment is composed of three layers of position sensitive devices that employ 10 cm x 10 cm, 20 cm x 20 cm and 30 cm x 30 cm Gas Electron Multipliers (GEMs) and two-dimensional readout boards. Required position resolution is 100 μm upto the incident angle of 30°.
We have successfully generated all sizes of GEM foils using a wet-etching method in Japan. The avalanche gain is tested with 55Fe X-ray source to check the healthiness of the foils and the gain of 10ˆ4 is achieved for all the sizes.
Position resolution and efficiency are evaluated in the beam test. Position resolution of better than 100 μm is obtained for 0°incident angle by calculating the weighted mean of charge. Inclined tracks have worse resolutions using the same method. Thus, we have developed a new technique to measure a position using arrival timing information of generated charge clusters in a drift gap. Arrival timings are measured by the timings of signals from read-out strips. Timing information is converted to a cluster generated position in the drift gap using a known drift velocity. Cluster generated positions are fitted by a linear function and a hit position can be calculated by a fitting result. As a result, position resolution of 105 μm is obtained for 15°beam by the timing analysis.

quote your primary experiment:

J-PARC E16

Board: **27** / **139**

Time Projection Chambers with Integrated Pixels and their Application in Dark Matter Search, Fast Neutron Detection, and Beam Commissioning

Authors: Sven Vahsen[1]; ilsoo seong[2]

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We present our most recent work on the use of integrated silicon pixel electronics (pixels) to readout gas-filled Time Projection Chambers (TPCs). Employing Gas Electron Multipliers (GEMs) to amplify the signal we are able to detect single electrons produced from ionization with high efficiency. These technologies also allow ionization in the target gas to be detected with low noise and excellent position and time resolution. This type of detector has great promise to measure the direction and energy of neutral particles via nuclear recoils in the gas. We present data from cosmic muon, x-rays, alpha particles, and fast neutrons, using the FE-I3 pixel chip developed for the ATLAS detector at the LHC. We also discuss the technical issues relating to the upgrade of our detector to the FE-I4 pixel chip. This chip, also developed by the ATLAS collaboration, has several advantages, namely

a larger active area, and simplified data acquisition system. We also report on ongoing simulation studies and refinement of the first prototype at the University of Hawaii (UH), and present several applications including: direction-sensitive searches for WIMP dark matter (D3/DMTPC), neutron detection of in the context of homeland security (DiNO), and beam background monitoring at the SuperKEKB accelerator.

quote your primary experiment:

Dark Matter D3

Board: 14 / **26**

Operation, performance and upgrade of the CMS RPC muon system at LHC

Author: Marcello Abbrescia[1]

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The Resistive Plate Chambers are used in CMS as dedicated muon trigger detectors in both barrel and endcap regions. They also contribute to the identification, reconstruction and tracking of the muons, together with Drift tube in the barrel and Cathod Strip Chambers in the endcaps.
We will report about the operations and performance of the system after two years of LHC activities with increasing instantaneous luminosity. This period allowed to accumulate enough statistics to measure the detector performance with an unprecedented accuracy on a such large amount of chambers. This gave new highlights both on the detector fundamentals and on the operational aspects.
Special attention will be given to the stability of the system and to the working point calibration procedures. Comparison between the initial performance and the present one will be drawn, and an overall view of what has been learned in a more than two years operation of one of the largest systems based on RPC will be given. Also issues related to detector aging will be discussed.
In addition, an outline of the upgrade foreseen for the system during the Long Shutdown 1 in 2013-14 will be presented.

quote your primary experiment:

CMS

Board: 75 / **20**

A SiPM based readout system for lead tungstate crystals

Author: Alessandro Berra[1]

Co-authors: Aldo Penzo [2]; Daniela Lietti [3]; Erik Vallazza [4]; Irina Rashevskaya [5]; Luciano Bosisio [5]; Michela Prest [6]; Valter Bonvicini [7]

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In recent years Silicon Photomultipliers (SiPMs) have been proposed as a new type of readout system for scintillating detectors in many experiments. SiPMs consist of a matrix of parallel-connected silicon micro-pixels, which are independent photon counters working in limited Geiger mode with very high gain ($\sim 10^6$). This contribution presents the use of SiPMs (manufactured by FBK-irst) as the readout system of a 3x3 matrix of lead tungstate crystals. The $PbWO_4$ crystals have been provided by the CMS-ECAL group and are pre-production prototypes of the endcap section of the CMS electromagnetic calorimeter; they have a trapezoidal shape (with a front section of 2.86x2.86˜cm^2 and a rear one of 2.96x2.96˜cm^2) and are 22˜cm long, corresponding to 24.7˜X_0. Each crystal will be readout using four SiPMs characterized by an active area of 4x4˜mm^2 and 6400 cells, hosted on the same PCB. The gain equalization and its variation with the temperature will be corrected using a LED system directly integrated on each PCB. A front-end board based on the MAROC3 ASIC will be used for the readout of the SiPMs signal. The performance of the crystal matrix in terms of linearity and energy resolution will be tested in November 2012 at CERN at the SPS-H2 and PS-T9 beamlines in the 1-150˜GeV energy range.

quote your primary experiment:

TWICE

Board: 1 / **22**

The MURAY project: volcano radiography with cosmic-ray muons

Author: Giulio Saracino[1]

[1] *Università Federico II di Napoli e INFN (IT)*

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Cosmic-ray muon radiography is a technique for imaging the variation of density inside the top few hundred meters of a volcanic cone. It is based on the penetration capability of the high energy muon component of the cosmic radiation. The measurement of muon absorption allows the evaluation of the average density along the observation line with a spatial resolution up to tens of meters, in optimal detection conditions. Muon radiography can thus provide images of the top region of a volcano edifice with a resolution that is considerably better than that typically achieved with conventional methods. Such precise measurements are expected to provide us with information on anomalies in the rock density distribution. The MURAY project has developed a muon telescopes prototype. The telescopes is required to be able to work in harsh environment and to have low power consumption, good angular and time resolutions, large active area and modularity. The telescope consists of three X-Y planes of one square meter area made by plastic scintillator strips of triangular shape. Each strip is read by a fast wavelength shifting fibre coupled to a Silicon photomultiplier. The readout electronics is based on the SPIROC/EASIROC ASIC. The prototype is under test and will be soon installed at Mt Vesuvius. The detector technology and first results will be presented.

quote your primary experiment:

MURAY

Board: 24 / **95**

Development of very low threshold detection system for low-background experiments

Authors: Dmitri Akimov[1]; Ivan Alexandrov[2]

[1] *ITEP, Moscow*

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A concept of readout of noble gas two-phase emission detectors by means of multipixel avalanche Geiger photodiodes (MGPDs or SiPMs) and a THGEM structure is presented.
It is well known that a two-phase emission technique with noble gases is a very sensitive method of detection of very small ionisation signals (down to few or single ionisation electrons). Electroluminescent "amplification"provides the unique possibility to detect reliably even the single ionisation electron extracted from the liquid to the gas phase. Due to this reason such detectors are currently successfully used in the Dark Matter search experiments and are considered for the use in the neutrino experiments: for coherent scattering of reactor antineutrino off atomic nuclei.
To increase the capabilities of a two-phase detector a system of THGEM + WLS (wavelength shifter) +MGPD is used for its readout. Additional amplification of the charge in the THGEM holes gives the large light signal of electroluminescence detected with an array of SiPMs. This readout system provides the mm accuracy for even very low-energy events, that is important for the reliable separation of the rare physical events from the background ones caused by spontaneous emission of the electrons from the liquid noble gas surface. The results of analysis experimental data and comparison MC simulations are present.

quote your primary experiment:

xenon MPGP GEM

Board: 65 / **281**

Novel Fabrication Techniques for Low Mass Composite Structures in Silicon Particle Detectors

Author: Neal David Hartman[1]

Co-authors: Eric Anderssen [1]; Joseph Silber [2]; Mauricio Garcia-Sciveres [1]; Murdock Gilchriese [1]; Thomas Allan Johnson [3]

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Detector structural design is governed by competing demands of reducing mass while maximizing stability and accuracy. These demands can only be met by fiber reinforced composite laminates. As detecting sensors and electronics become lower mass, the motivation to reduce structure as a proportion of overall mass pushes modern detector structures to the minimum limits of composite ply thickness, while demanding maximum stiffness afforded by ultra-high modulus graphite fibers. However, classical approaches to composite laminate design require symmetric laminates and flat structures, in order to minimize warping during fabrication. This constraint of symmetry in laminate design, and a "flat plate" approach to fabrication, results in heavier structures. This study presents an approach to fabricating stable and accurate, geometrically complex composite structures by bonding warped, asymmetric, but ultra-thin component laminates together in an accurate tool, achieving final overall precision normally associated with planar structures. This technique has been used to fabricate a prototype "I-beam" that support two layers of detecting elements, while being up to 4 times stiffer and up to 30% lower mass than two comparable, independent planar structures (classically known as "staves"). This fabrication technique may be extended to even more complex shapes, combining more detecting elements and reducing structural overhead, all while maintaining excellent stability and accuracy.

quote your primary experiment:

ATLAS Pixel Detector

Board: 74 / **8**

Extended lifetime MCP-PMTs: Characterisation and Lifetime measurements of ALD coated Microchannel Plates, in a sealed photomultiplier tube

Authors: James Milnes[1]; Thomas Conneely[1]

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Atomic Layer Deposition (ALD) coating of Microchannel Plates (MCP) has been shown to offer significant performance advantages MCP-PMTs. ALD is a chemical process used to deposit atomic mono-layers on a substrate. A process has been developed to deposit a surface with improved secondary emission yield on to a MCP substrate. The principal advantage of a higher SEY is the ability to achieve significantly higher gain at the same operating voltage across a single MCP. Further to this, it is suspected the atomic mono-layers deposited by ALD coating prevents desorption of gaseous contaminants in the MCP glass. The ions produced during desorption are widely believed to be a direct cause of photocathode aging in MCP-PMTs, leading to the hope that ALD coating can improve MCP-PMT lifetime.
To fully characterise the performance of ALD coated MCPs two MCP-PMTs were manufactured, one ALD coated and the other used as a control. Each detector's gain, DQE, pulse shape and timing jitter were measured followed by a life test of the tubes. The ALD coated tube was found to have a higher gain at the same operating voltage, whilst being equivalent to a standard MCP in other performance characteristics. ALD coating gave a dramatically improved life time, after 5.16 C/cm2 total charge extracted, there was no measurable effect on photocathode QE, although MCP gain dropped by approximately 35%.

quote your primary experiment:

MCP detector development

Board: 41 / **286**

RxB drift momentum spectrometer

Author: Xiangzun WANG[1]

Co-authors: Gertrud Konrad [2]; Hartmut Abele [3]

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We propose a new type of momentum spectrometer, which uses the RxB drift effect to disperse the charged particles in a uniformly curved magnetic field, and measures the particles with large phase space acceptance and high resolution. This kind of RxB spectrometer is designed for the momentum analyses of the decay electrons and protons in the PERC (Proton and Electron Radiation Channel) beam station, which provides a strong magnetic field to guide the charged particles in the instrument. Instead of eliminating the guiding field, the RxB spectrometer evolves the field gradually to the

analysing field, and the charged particles can be adiabatically transported during the dispersion and detection. The drifts of the particles have similar properties as their dispersion in the normal magnetic spectrometer. Besides, the RxB spectrometer is especially ideal for the measurements of particles with low momenta and large incident angles. We present a design of the RxB spectrometer, which can be used in PERC. For the particles with solid angle smaller than 88 msr, the maximum aberration is below 1E-4. The resolution of the momentum spectra can reach 14.4 keV/c, if the particle position measurements have a resolution of 1 mm.

quote your primary experiment:

PERC

Board: 63 / **262**

Ultra-lightweight systems for new ALICE Inner Tracker

Author: Grigori Feofilov[1]

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We present practical solutions, design and examples of technologies of the low-mass, low-Z structures with various integrated cooling systems to be used for Monolithic arrays of pixel detectors (MAPS) for ALICE [1] at the LHC. These promising, high speed, precise, high granularity, 50 um thin pixel detectors will be used for particle tracking and vertex determination in the upgraded ALICE Inner Tracking System. The physics requirements are imposing severe constraints in terms of mass minimization of all mechanical, cooling and signal cables structures, and in terms of precision and stability of the detector support structure.
Several technologies are presented. They include air-cooling and liquid cooling options: extremely low-mass (about 1.4 g, l=30cm) Carbon Fiber (CF) based support structures with cooling ducts, CF Wound Truss Structure plus CF Plate with Embedded Pipes, Si- and Polyimide- micro-channel cooling. Results of the first heat drain tests are showing that these ultra-lightweight systems are meeting the basic requirements in terms of cooling up to 0.5 Watt/cm2. The design ensures the radiation transparency at the level of about 0.31% of X0 per layer for the layers forming the Inner Barrel.

quote your primary experiment:

ALICE

Board: 50 / **265**

Detection Sensitivity and Light Collection Studies of an APD-based High Packing-Fraction LYSO:Ce Matrix for PET Applications

Author: Jorge Neves[1]

Co-authors: Catarina Ortigão [1]; José C. Silva [1]; João Varela [1]; Ricardo Bugalho [1]; Viesturs Veckalns [1]

[1] *LIP - Laboratory of Instrumentation and Experimental Particle Physics*

The ClearPEM is a dedicated APD-based PET detector for high-resolution breast cancer imaging. The basic detector module is composed of 12 LYSO:Ce crystal matrices, each with 4x8 individual crystals (2x2x20mm3) optically coupled on both ends to S8550 Hamamatsu APD arrays for the scintillation light readout.
In the present design, the sensitive area corresponding to the LYSO:Ce crystals is ˜46%, being the

dead space due the existing gaps between the detector modules, encapsulation and BaSO4 reflective walls.
To improve the overall sensitivity of the system, a new compact crystal matrix geometry was designed aiming to minimize the existing dead spaces. From geometrical considerations the active area will increase up to 76%. However, and due to the different cross-section matching factors between the APD pixels active area and each individual crystals, a study on the effects on the energy and time resolution, optical crosstalk and on the depth-of-interaction capability is required.
In this conference we present an experimental study on the improvement of the sensitivity with this new compact matrix, and a characterization of its effects on the overall detector performance.

quote your primary experiment:

ClearPEM

Board: 77 / **56**

An Optimization of the FPGA/NIOS Adaptive FIR Filter Using Linear Prediction to Reduce Narrow Band RFI for the Next Generation Ground-Based Ultra-High Energy Cosmic-Ray Experiment.

Author: Zbigniew Szadkowski[1]

Co-authors: Daniel Fraenkel [2]; Dariusz Glas [1]; Remigiusz Legumina [1]

[1] *University of Lodz*

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The electromagnetic part of an extensive air shower developing in the atmosphere provides significant information complementary to that obtained by water Cherenkov detectors which are predominantly sensitive to the muonic content of an air shower at ground. The emissions can be observed in the frequency band between 10 - 100 MHz. However, this frequency range is significantly contaminated by narrow-band RFI and other human-made distortions. Auger Engineering Radio Array suppresses an RFI by multiple time-to-frequency domain conversions using an FFT procedure. An alternative approach developed in this paper is an adaptive FIR filter based on a linear prediction (LP). The coefficients for the linear predictor are dynamically refreshed and calculated in the virtual NIOS® processor. The Levinson recursion, used to obtain the filter coefficients is also supported by a direct multiplication in the DSP blocks of the logic FPGA segment. The radio detector is an autonomous system installed on the Argentinean pampas and supplied from a solar panel. A power consumption vs. a powerful calculation capacity inside the FPGA is a factor. Results show that a LP approach is more power efficient than the FFT one for 64-point linear predictor. The LP method introduces also less digital distortion than FFT procedures based on streaming architecture and disentangling trick. The LP filter is being developed for the next generation of cosmic rays detector supported by the ASPERA-2 consortium.

quote your primary experiment:

Pierre Auger Observatory

Board: 33 / **199**

Floating Strip Micromegas Detectors

Authors: Alexander Ruschke[1]; Andre Zibell[1]; Jonathan Frederik Bortfeldt[1]; Ralf Hertenberger[1]; otmar biebel[2]

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[2] *Fakultät für Physik, Ludwig-Maximilians-Universität München*

Floating strip Micromegas detectors are a novel concept, simple in construction and reliably to manufacture. All materials used are intrinsically radiation resistant such these detectors are expected to be applicable under extremely high background radiation conditions. The presentation reports on measurement of spatial and temporal resolution and its homogeneity across the detector surface of a 50 x 50 cmˆ2 floating strip Micromegas performed recently at the pion and muon test beams at CERN. Impacts due to highly ionizing particles which could trigger discharges are investigated. The performance of the floating strip Micromegas detector under high energy neutrons of fluences as high as 10ˆ7/cmˆ2/s and with protons acting as highly ionizing
particles will be studied using the neutron and proton irradiation facility setup at the Garching-Munich tandem accelerator laboratory.

quote your primary experiment:

n/a

Board: 56 / **147**

A novel 2D position-sensitive microstrip sensor

Author: Ivan Vila Alvarez[1]

Co-authors: Daniela Bassignana [2]; David Quirion [3]; Esteban Curras [4]; Francisca Munoz Sanchez [1]; Giulio Pellegrini [5]; Javier Gonzalez Sanchez [1]; Manuel Lozano Fantoba [5]; Marcos Fernandez Garcia [1]; Richard Jaramillo [6]

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In the context of the future silicon-based particle tracking systems for the International Linear Collider, we introduce a novel 2D position-sensitive microstrip detector where the resistive charge division method was implemented by replacing the metallic electrodes with slightly resistive electrodes made of polycrystalline silicon. A characterization of two proof-of-concept prototypes with different electrode resistivities was carried out using a pulsed near-infrared laser. The experimental results were compared against an electrical simulation of the sensor's equivalent circuit including the electronics readout chain. The good agreement between the experimental results and simulation establish the soundness of resistive charge division method in silicon microstrips sensors and validates the developed simulation as a tool for optimizing the charge-division method on microstrip sensors. Results obtained in 2011 and 2012 testbeam campaigns are also presented. Evolved sensor designs with integrated signal vias to facilitated the implementation of such technology in a real silicon tracker system will be presented and discussed.

quote your primary experiment:

International Linear Detector

Board: 32 / **194**

The Status of the GEM Project for CMS High Eta Muon system

Authors: Gilles De Lentdecker[1]; Patrizia Barria[2]

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The dedicated CMS RD program was launched to study the feasibility of using micropattern detectors for the instrumentation of the vacant $|\eta| > 1.6$ region in the present RPC endcap system. The proposed detector for CMS is a triple-GEM trapezoidal chamber, equipped with 1D readout, with dimensions (990x440-220) cm2. While during 2010-2011 the collaboration worked on the prototyping of the detector, during the first part of 2012 the new developed assembly technique, that will be used for the mass production, has been adopted. GEMs can provide precision tracking and fast trigger information, contributing on one hand to the improvement of the CMS muon Trigger and on the other hand to provide missing redundancy in the high-eta region. In the view of the next LHC long shutdown (LS1) the GEMs for CMS collaboration designed and built four full-size Triple GEM-based muon detectors. The proposed detectors, designed with a new assembly technique, are conceived to meet the stringent requirements given by the hostile environment at CMS. During 2012 several measurements have been performed using X-rays and muon/pion beams at the CERN SPS. In this paper the experience summarized above and preliminary results at the beam tests of the performance of the new full-size production prototypes will be discussed.

quote your primary experiment:

CMS

Board: 64 / **275**

Silicon Micro-structuring for Advanced Cooling and Improved Engineering of Tracking Detectors

Authors: Alessandro Mapelli[1]; Andrea Francescon[2]; Aurelie Pezous[3]; Georg Nuessle[4]; Giulia Romagnoli[2]; Paolo Petagna[1]; Philippe Renaud[5]

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Future silicon trackers target a drastic material budget reduction while requiring highly effective cooling and mechanical stability. Through standard micro-fabrication processes, it is possible to produce ultra-thin thermal management devices tailored to specific applications and largely overcoming the performance of traditional cooling approaches. The NA62 experiment has recently adopted a cooling solution based on a 130 micron-thick silicon micro-channel plate for its GTK detector and proposals are presently being considered for the upgrade of the ALICE ITS and of the LHCb Velo (the latter detailed in a separate paper). Silicon micro-fabrication techniques also provide powerful means for improved engineering of tracking detectors: realistic silicon mock-ups of chips and sensors permit to anticipate detailed module integration studies: thermal management, planarity issues, mechanical stability, wire bonding and servicing, among others. In perspective, the adoption of MEMS-based (Micro-Electro-Mechanical Systems) solutions for local sensing and actuation

might also allow for a new generation of "smart"detectors with improved performance and reduced mass.

quote your primary experiment:

NA62, ALICE

Board: 44 / **87**

Development of a fast Proton Range Radiography system for quality assurance in hadrontheraphy

Author: Martina Bucciantonio[1]

Co-authors: David Watts [1]; Fabio Sauli [1]; Robert Kieffer [1]; Ugo Amaldi [1]

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We describe the development of a Proton Range Radiography system with an imaging area of 30x30 cm2 for two dimensional mapping of the integrated density in a target.
Proton transmission radiographic images are produced by measuring with a pair of position-sensitive detectors (GEM chambers) the direction of the protons transmitted through the patient, and with a stack of scintillators the residual range of the protons leaving the patient. To match the data rate requirements of an in-beam diagnostic, a novel data acquisition system for the tracking detectors has been designed to operate at one MHz data flow. Laboratory tests exposing the GEM detector with high flux X-rays demonstrate the fast response of the new data acquisition system. Images of several phantoms have been recorded to demonstrate the GEM position accuracy.

quote your primary experiment:

Tera-Aqua

Board: 46 / **173**

Development of PS-TEPC (Position Sensitive Tissue Equivalent Proportional Chamber

Author: Yuji Kishimoto[1]

Co-authors: Aiko Nagamatsu [2]; Kazuhiro Terasawa [3]; Kazutoshi Takahashi [1]; Kentaro Miuchi [4]; Kiwamu Saito [1]; Tadayoshi Doke [5]; Tetsuhito Fese [2]; Yukio Uchihori [6]

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Radiation effects on human body are evaluated using dose equivalent H, defined as a product of an absorbed dose D and a quality factor Q given as a function of LET. In space, there exist many kinds of cosmic radiations, where primary charged particles and neutrons generated secondarily are the

main components contributing to radiation dose. Since LET of these radiations widely distributes, it is essential to measure directly LET to evaluate H. A Tissue Equivalent Proportional Counter (TEPC) has been used as a standard space dosimeter. In TEPC, however, no position information is given and LET is assumed to be equal to a lineal energy y (the deposited energy divided by mean chord length of detector) for a real time dose measurement. Obviously, y does not represent LET accurately, and H obtained with TEPC is reported to be more than twice that measured with the other real LET spectrometer. We have been developing a new space dosimeter named as PS-TEPC, which is based on a time projection chamber (TPC) using a micro-pixel chamber (μ-PIC) as a 2-demetional readout device. We constructed a small TPC with tissue-equivalent materials, and demonstrated successfully the feasibility from the results of 3D-tracking and the energy measurements performed for heavy ion beams. Experiments using PS-TEPC are scheduled to start from 2014-2015 in the International Space Station. We are trying to complete a prototype of PS-TEPC usable in space. The present status of PS-TEPC will be given.

quote your primary experiment:

Space radiation measurement

Board: 96 / **254**

First results of energy and timing resolution of FBK RGB-SiPMs coupled to Ce:GAGG scintillator

Author: Alessandro Ferri[None]

Co-authors: Alberto Gola [1]; Alessandro Tarolli [2]; Claudio Piemonte [2]; Nicola Serra [2]; Nicola Zorzi [3]; Tiziana Pro [2]

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In this work we present the first results of energy and timing resolution of FBK RGB SiPM coupled to a novel gadolinium based scintillator crystal: Ce:GAGG (Ce:Gd3Al2Ga3O12). Ce:GAGG is a promising scintillator because of its attractive properties of very high light yield (46000 γ/MeV), high density (6.63 g/cm3), good intrinsic energy resolution (4.9% @ 662 keV) and non-self radiation. We measured energy and timing resolution of this crystal when coupled to RGB-SiPM 50x50 μm2 cell. We considered two crystal geometries: "cube"like (3x3x5 mm3) and "PET"like (3.8x3.8x20 mm3). The "cube"geometry achieved a CRT of 275 ps with an energy resolution of 7.7% (@ 511 keV). These results are very promising not only for PET but also SPECT or gamma camera applications where the energy resolution is crucial.

quote your primary experiment:

FBK SiPM GAGG

Board: 4 / **170**

Gamma ray spectroscopy measurements for diagnosis of ITER plasmas

Authors: Carlo Cazzaniga[1]; Gabriele Croci[2]; Giovanni Grosso[2]; Giuseppe Gorini[1]; Luca Giacomelli[1]; Marco Tardocchi[2]; Massimo Nocente[1]

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The goal of ITER, the next generation tokamak, is to obtain and control fusion plasmas with high thermonuclear output power, in order to demonstrate the feasibility of a commercial fusion reactor. In this context nuclear radiation diagnostics, such as neutron and γ-ray spectroscopy, will play a crucial role. Gamma ray spectroscopy is a diagnostic of fast ions and of the confined fusion alpha particles in a fusion plasma device. For this application high energy resolution (say a few percent for gamma ray energies in the range 1-5 MeV) and a high count rate capability, ideally up to a few MHz, are required. Furthermore, the detector will have to withstand the high neutron fluxes produced by the main fusion reactions between deuterium and tritium. Experimental results obtained at nuclear accelerator have demonstrated that the requirements on the energy resolution and count rate can be matched with a LaBr3(Ce) detector equipped with a fast digital data acquisition. In this work, we present recent measurements on the response function of the detector to 2.45 MeV neutrons. The measured data are successfully reproduced by Monte Carlo simulations that shed light on the interaction mechanism between the neutrons and the detector. The presented results are of relevance for the optimization of the detector design, line of sights and neutron shielding for gamma ray spectroscopy measurements on ITER.

quote your primary experiment:

Board: 38 / **308**

Novel thin THGEM-based DHCAL sampling elements for future HEP experiments: Fresh beam-test results

Authors: Adam Yigal Rubin[1]; Amos Breskin[1]; Carlos Azevedo[2]; Eraldo Oliveri[3]; Hugo Natal da Luz[4]; Joao F.C.A. Veloso[5]; Joaquim dos Santos[4]; L Moleri[6]; Lior Arazi[7]; Michael Pitt[8]

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Thick Gas Electron Multipliers (THGEMs) have the potential of constituting robust sampling elements in Digital Hadron Calorimetry (DHCAL), in future HEP Colliders like the ILC. We report on the properties of novel, most promising single- and double-THGEM structures, with multipliers mounted in a WELL configuration on top a segmented resistive layer coupled to readout pads; the overall thickness of the detector is about 5 mm (excluding the electronics). A 10x10 cm2 prototype, with 1 cm2 pads and APV-SRS readout, was very recently investigated in muon and pion beams, studying several multiplier configurations. Full efficiency, as high as 98%, was demonstrated with average pad-multiplicity as low as 1.1. The local efficiency and multiplicity values across the pad surface are provided as well. The use of the resistive anode resulted in a dramatic decrease in discharge magnitude, with typical potential drops of only a few volts; such micro-discharges occurred with probabilities of the order of 10ˆ-6 for muons and 10ˆ-5 for pions, in rates as high as a few kHz/cm2. The detector operated stably throughout the run, with no observable gain shifts and

nearly no disruption of data acquisition. Further optimization work and research on larger detectors are underway.

Board: 95 / **244**

A bump-bondable DSSC Pixel Readout ASIC for DEPFET Sensor Matrices at the European XFEL

Authors: Jan Soldat[1]; Peter Fischer[1]

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The DSSC (DEPFET Sensor with Signal Compression) consortium develops a 1MPixel detector for low energy X-rays at the European XFEL. The XFEL will produce 10 bursts per second, each containing 2880 X-ray pulses with a repetition rate of 4.5 MHz. X-ray photons of 0.5 – 6 keV are absorbed in hexagonal DEPFET pixels of 229 × 204 µm2 pitch with a nonlinear characteristic to achieve a high dynamic range. The sensors will be bump-bonded to readout ASICs of 64 × 64 pixels. Each pixel contains a filter with trapezoidal weighting function, a single slope ADC of 8-9 Bit resolution and a digital memory to store 640 events. A veto mechanism allows to discard uninteresting events. The analog part is powered down and the digital hit data is read out serially during the ≈ 100ms long burst gaps. The first fully functional bump-bonded prototype matrix chip of 16 x 8 pixels has been characterized electronically and with nonlinear DEPFET sensors. The ASIC architecture, the control, readout and veto mechanisms and an outlook to the large 64 x 64 pixel chip will be presented.

quote your primary experiment:

European XFEL

Board: 17 / **31**

Characterization and simulation of resistive-MPGDs with resistive strip and layer topologies

Author: Javier Galan Lacarra[1]

Co-authors: Alain Delbart [1]; Alan Peyaud [1]; Fabien Jeanneau [1]; Ioanis Giomataris [1]; Joerg Wotschack [2]; Philippe Schune [1]; Rui De Oliveira [2]; Thomas Papaevangelou [1]; esther ferrer ribas

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The use of resistive technologies to MPGD detectors is taking advantage for many new applications, including high rate and energetic particle flux scenarios. The recent use of these technologies in large area detectors makes necessary to understand and characterize the response of this type of detectors in order to optimize or constrain the parameters used in its production, material resistivity, strip width, or layer thickness. The values to be chosen will depend on the environmental conditions in which the detector will be placed, and the requirements in time resolution and gain, improving the detector performance for each given application.
We present two different methods to calculate the propagation of charge diffusion through different resistive topologies; one is based on a FEM of solving the telegraph equation in our particular strip detector scheme, the other is based on a semi-analytical approach of charge diffusion and is used to determine the charge evolution in a resistive layer.
The results will be compared to those obtained experimentally with a piggyback structure, based on resistive plate technology, and with different resistive-strip micromegas prototypes which are based on the technology which was developed for the LHC ATLAS upgrade. The results obtained with the simulation will be extrapolated to larger detector areas to estimate the effects of the resistivity on the gain homogeneity as a function of the strip length.

quote your primary experiment:

ATLAS LHC upgrade

Board: 8 / **30**

Particle identification system based on dense aerogel

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For experiments with the SND detector at the electron-positron collider VEPP-2000 a new particle identification system is designed, constructed, and put into operation. The system is designed for the separation of π and K mesons up to particle energy of 1 GeV, in the case of dense aerogel with a refractive index n = 1.13, and e/π-separation energy up to 0.45 GeV, in the case of the aerogel with n = 1.05. Cherenkov radiator is dense aerogel with a refractive index n = 1.13. Structurally, the system has the form of a barrel, divided into 9 sections in the axial angle. Light collection is implemented through green wave length shifter on the flat PMT with micro channel plate. MIP particle creates a signal 6—10 photoelectrons. The system was calibrated on the e, μ, π and K particles produced in e+e−—collisions.
The present report is a preliminary result on the measurement cross-section of the process e+e−⟶ K+K−.

quote your primary experiment:

Spherical neutral detector

Board: 18 / **37**

A two-phase Cryogenic Avalanche Detector in Ar with THGEM/GAPD-matrix optical readout

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Two-phase Cryogenic Avalanche Detectors (CRADs) with THGEM multipliers have become an emerging technique for rare-event experiments. In this work we describe the performance of a two-phase CRAD in Ar with double-THGEM charge multiplier combined with a matrix of Geiger-mode APDs (GAPDs), optically recording THGEM avalanche signals in the Near Infrared (NIR) spectral range. The charge and light yields and the spatial resolution of such a combined THGEM/GAPD-matrix multiplier have been measured in the two-phase Ar CRAD. The applicability of such a technique to dark matter search and coherent neutrino-nucleus scattering experiments, in terms of providing ultimate (single-electron) sensitivity at higher (sub-cm) spatial resolution, is discussed.

quote your primary experiment:

Cryogenic Avalanche Detectors

Board: 43 / **65**

Design of a muon tomography system with a plastic scintillator and wavelength-shifting fiber arrays

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Muon tomography can be utilized to detect high-density materials such as special nuclear material(SNM) and shielding board by traking the incoming and outgoing trajectories of muon. We designed a muon tomography system consisting of four detector modules. Each module is composed of a large-area plastic scintillator, wavelength shifting(WLS) fibers placed on the top and bottom of the scintillator and PSPMT. WLS fiber arrays are aligned in orthogonal directions to each other and represent the ligth distribution in the x and y directions, respectively. Light photons produced by muon particle inside the plastic scintillator are absorbed by the WLS fiber and the re-emitted green light is guided by total internal reflection to the PSPMT. In this study, we characterized the effect of design parameters such as the scintillator size and thickness, WLS fiber size, number and interval on the image quality through DETECT2000 simulation. The optimal parameters were derived and one detector module was developed. Experimental results agreed well with simulation. This result indicates that the detector module is feasible for muon tomography system.

quote your primary experiment:

Muon, WLS, DETECT2000,

Board: 9 / **67**

Detection of the Cerenkov Light from a TeO2 Crystal

Authors: Cecilia Voena[1]; Davide Pinci[1]; Fabio Bellini[2]; Filippo Orio[1]; Ioan Dafinei[1]; Marco Vignati[1]; Michela Marafini[3]; Nicola Casali[4]; Silvio Morganti[1]

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Bolometers have proven to be good detectors to search for rare processes because of their excellent energy resolution and for their extremely low intrinsic background. In this kind of experiments, the capability of discriminating the signal produced by the alpha particles represents an important aspect for the background reduction. One possibility for obtaining such a discrimination is provided by the detection of the Cerenkov light which, at the low energies of the natural radioactivity, is emitted only by electrons. In this presentation, the results of measurements of the Cerenkov light yield of TeO2 at room temperature are reported. The signals produced by cosmic rays in the crystal are readout on two opposite faces by two Photo-Multiplier Tubes (PMTs). These signals show a rise and a decay times of few nanoseconds. A clear evidence of the directionality of the main part of the detected light is also found. These measurements represent the first clear indication that Cerenkov light is the main, if not even the only, component of the light signal in a TeO2 crystal. These results open the possibility to make large improvements in the performance of experiments based on this kind of materials.

quote your primary experiment:

CUORE

Board: 40 / **252**

Development of nuclear emulsions with 1 micron accuracy for the AEgIS experiment.

Author: Mitsuhiro Kimura[1]

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The goal of the AEgIS experiment (CERN AD-6) is a test of the Weak Equivalence Principle for antimatter. We will measure the earth's gravitational acceleration g on antihydrogen atoms that have been launched in a horizontal vacuum tube. A position sensitive detector will detect their annihilation at the end of the tube. The goal is to determine g with a 1% accuracy. The University of Bern proposes to use nuclear emulsions with submicron resolution for the detector, which will improve the resolution by an order of magnitude compared to the original AEgIS proposal. The detector has to operate in vacuum, a condition that has not been investigated so far with emulsions, and which is the subject of this RD work. In 2012 we tested emulsion films at 8x10^-6 mbar and room temperature with 5 MeV antiprotons from CERN's antiproton decelerator. The annihilation vertices could be observed directly on the emulsion surface using the microscope facility available in Bern for the analysis of the OPERA data. We could successfully reconstruct the annihilation vertices with a resolution of 1-2 microns on the impact parameter. Results of the tests will be presented, and plans for future developments will be discussed.

quote your primary experiment:

AEgIS

Board: 47 / **175**

New Approaches for Improvement of Time-of-Flight PET

Author: Stefan Enrico Brunner[1]

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Advances in detector technology led to the construction of commercial time of flight (TOF) positron emission tomography (PET) devices, resulting in enhanced image contrast, lower patient's dose and shorter examination times. Commercial TOF-PET scanners with coincidence time resolutions of 500-600 ps FWHM are already available. Goal of this work is the improvement of time resolution for TOF-PET using Silicon photomultipliers (SiPM).
Along with many comparable features to ordinary vacuum photomultipliers, SiPM are considerably smaller in size and insensitive to magnetic fields, which makes them usable for hybrid devices such as PET-NMR. Their small size allows new detector geometries which may result in higher detection efficiency of scintillation photons, yielding improved time resolution for TOF.
For the development of a future TOF-PET prototype, Monte Carlo simulations using Geant4 have been started to optimize the detector parameters. Energy and time information of the photons arriving at the SiPM, as well as their creation process have been simulated. The results reveal that especially photons created by the Cherenkov effect are crucial for good timing as they arrive at the photodetector first.
In addition, the data was used to simulate the electronic output signals of SiPM, including the influence of amplifiers. The results will be used for optimization of electronics including dead time and improved efficiency regarding a future application in TOF-PET.

quote your primary experiment:

SiPM, TOF-PET

Board: 13 / **256**

The MICE beamline PID instrumentation for a precise emittance measurement

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The International Muon Ionization Cooling Experiment (MICE) will carry out a systematic investigation of ionization cooling of a muon beam, for the future Neutrino Factory and the Muon Collider. As the emittance measurement will be done on a particle-by-particle basis, a sophisticated beam instrumentation is needed to measure both particle coordinates and timing

vs RF in a harsh environment due to high particle rates, fringe magnetic fields and RF backgrounds. A PID system, based on three x/y time-of-flight stations (with resolutions around 50 ps), two Aerogel Cerenkov counters and a KLOE-like calorimeter (KL) has been constructed and has allowed the commissioning of the MICE muon beamline.
PID detector performances will be shown and their use for a preliminary estimate of the beamline emittance and the MICE muon beam pion contamination will be illustrated.

quote your primary experiment:

MICE

Board: 5 / **255**

Development of high light yield and high energy resolution inorganic scintillator crystals

Author: Akira Yoshikawa[1]

Co-authors: Kei Kamada [2]; Shunsuke Kurosawa [3]; Yuui Yokota [2]

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High-light-output and good-energy-resolution scintillators are required in various fields. Ce:LaBr_3 has recently been proposed and showed a high light output of \sim 60,000 ph./MeV; however, it has strongly hygroscopic and a smaller effective-atomic-number of 46.9 than other scintillators with that of more than 50, typically. A Ce:Lu_2SiO_5 (Ce:LSO) scintillator is chemically stable and has a good light output of 30,000 ph./MeV, while Ce:LSO has an intrinsic background from Lu-176 (natural abundance of 2.59\%). Recently, using our own crystal growth technique with prompt and complete cycle of characterization system, we have developed high-light-yield and high-energy-resolution scintillators such as multi-component garnet Ce:(Gd,Lu,Y)*3(Al,Ga)_5O*{12} (LY\sim 65,000 ph/MeV, \Delta E/E<4.0, decay time \sim 90 ns) and Eu:SrI_2 (LY\sim 80,000 ph/MeV, \Delta E/E<4.0, decay time \sim 1.5\mu s), where LY and \Delta E/E are light output and FWHM energy resolution at 662 keV, respectively. In this presentation, we will show the strategy of new scintillator development. These crystals will be introduced together with the design rule, crystal growth capability, luminescent study and the result of performance test.

quote your primary experiment:

scintillator

Board: 86 / **183**

Assembly technology of 4-side buttable MPPC

Author: Koei Yamamoto[1]

Co-authors: Akihiro Oguri [2]; Hayatsu Kenzo [2]; Kenichi Sato [2]; Noburo Hosokawa [2]; Ryuta Yamada [2]; Takeshi Shimohara [2]; Terumasa Nagano [2]; Yuki Ohkuwa [2]

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Multi-Pixel Photon Counter (MPPC) is solid-state photon counting device using Geiger-mode APD with self-quenching resistor. The features of MPPC are low bias voltage operation, high gain, compactness, robustness and insensitive to magnetic field.
A Large-area MPPC is suitable for TOF-PEF and astrophysicists application. We have already developed a monolithic array which is consisted a 4x4 matrix and each pixel size is 3x3 mm2. It has three-sided buttable package and less dead space than a simple discrete MPPC array. It is obtained better performance but still necessary to improve detection efficiency and uniformize characteristics (operation voltage, quenching resistor, sensitivity, timing resolution etc.) of each pixel.
We have developed TSV (silicon through via) technology for MPPC, and now we are developing a discrete array of TSV-MPPCs to enhance the fill factor and pixel uniformity. The MPPC chips which have TSV electrodes are accurately mounted on dead-space-less packages by bump bonding and also bumped on substrate with narrow gap. Because the dead space is decreased by eliminating wire-bonding pad, it is possible that the TSV-MPPC arrays are tiled in four-sided buttable. The variation of characteristics between each pixel can be minimized by selected the single MPPCs which have uniform characteristics to the pixel components. This improvement will be effective for high time resolving ability.

quote your primary experiment:

MPPC

Board: 85 / **180**

The UV sensitivity improvement of MPPC

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MPPC (Multi-Pixel Photon Counter) is the kind of solid state photon counting device operating in geiger-mode. The features of the MPPC is the high gain (up to 10^5 to 10^6), high time resolution and high sensitivity around 400-500nm. These characteristics are well matched to the general scintillation applications like PET.
In recent physics experiment applications, it seems that the liquid scintillator play the important role to find out new phenomena. We think that the MPPC contribute to fulfill the requirements with its high S/N characteristics. But there were several concerns to recommend the MPPC in this application region. One is the wavelength miss-match between the MPPC sensitive region and the liquid scintillator emission (ex. 128nm(liq.-Ar), 175nm(liq.-Xe)). And another is low temperature environment. The temperature stress will cause several kind of damage to the device package. And characteristics of the MPPC will change largely. Especially, the rapid increase of the quenching resistor at low temperature region makes the pulse shape to be lower and longer than room temperature. We have tried to adjust the peak sensitivity wavelength by the AR (Anti-Refractive) coating and depth of the active region. We'll show the temperature dependence of the quenching resistor will greatly suppressed by introducing new technology. We are also trying best matching materials (substrate, resin and adhesive) to achieve the high reliability package at low temperature condition.

quote your primary experiment:

MPPC

Board: 88 / **189**

Upgrade of Liquid xenon gamma-ray detector in MEG experiment

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In the MEG experiment, we are searching for the lepton flavor violating decay, mu->e+gamma, with the highest sensitivity. We have recently published the current tightest upper limit of the branching ratio of 2.4x10^-12, and aim at reaching a sensitivity of 6x10^-13 in 2013 as the goal of the current phase of the experiment.
We are planning a major upgrade of the experiment including an upgrade of the liquid xenon (LXe) gamma-ray detector. The current 2-inch photomultiplier tubes on the gamma-ray incident face will be replaced with smaller photo-sensors such as MPPCs in order to significantly improve the resolutions and efficiency. The improved performance of the LXe detector would help to greatly reduce the background and thus to improve the sensitivity of the experiment.
A MPPC operational in LXe is under development in collaboration with Hamamatsu Photonics. One of the difficulties is that the commercial MPPC is not sensitive to the LXe scintillation light in VUV region. We are improving the UV-sensitivity by modifying the parameters of the MPPCs and recently succeeded to detect the scintillation light with the first prototypes.
The design concept and the expected performance of the upgraded LXe detector will be described. The status and plan of the RD of the upgraded detector will also be presented placing emphasis on the development of the UV-enhanced MPPC.

quote your primary experiment:

MEG experiment

Board: 54 / **90**

A new CVD Diamond Mosaic-Detector for (n,a) Cross-Section Measurements at the n_TOF Experiment at CERN

Authors: Carlos Guerrero Sanchez[1]; Christina Weiss[2]; Erich Griesmayer[2]

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At the n_TOF experiment at CERN a dedicated detector, which consists of an array of 9 sCVD diamond detectors, has been developed for (n,a) cross-section measurements. The detector has been characterized and a first cross-section measurement has been performed for the 59Ni(n,a)56Fe reaction in 2012. The characteristics of the detector, its performance during the cross-section measurement and preliminary results of the experiment will be presented.
CIVIDEC Instrumentation GmbH, Vienna, Austria, sponsored this work.

quote your primary experiment:

n_TOF CERN

Board: 29 / **161**

Performance of Drift Tube Detectors at Very High Counting Rates at High-Luminosity LHC

Author: Hubert Kroha[1]

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The performance of pressurized drift-tube chambers at very high background counting rates has been studied at the Gamma Irradiation Facility (GIF) at CERN and in an intense 20 MeV proton beam at the Munich Van-der-Graaf tandem accelerator for applications as large-area precision muon tracking detectors at high-luminosity upgrades of the Large Hadron Collider (LHC). The present ATLAS muon drift-tube (MDT) chambers with 30mm tube diameter are designed to cope with gamma and neutron background rates of up to 500 Hz per square cm or 300 kHz per tube. Background rates of up to 14 kHz per square cm and 1150 kHz per tube are expected at LHC upgrades. The test results for gamma irradiation rates of up to 1400 kHz per tube and 8.5 kHz per square cm and for proton rates up to 2800 kHz per tube and 1330˜kHz per square cm show that by reducing the drift-tube diameter to 15 mm while leaving the other operating parameters unchanged, the rate capability is vastly increased. With the 3.8 times shorter maximum drift time of 185 ns the drift-tube occupancy per unit length is reduced by a factor of 7.6. The degradation rate of the drift-tube spatial resolution due to space charge effects is reduced by more than an order of magnitude. The shorter maximum drift time allows also for a reduction of the adjustable deadtime of the MDT readout electronics from 790 ns to the minimum of 175 ns leading to a decisive improvement of the muon hit reconstruction efficiency.

quote your primary experiment:

ATLAS

Board: 45 / **115**

Basic Performance of a New Positron Emission Mammography (PEM) using Pr:LuAG Scintillator Crystals

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In this report, a positron emission mammography (PEM) using a Pr:Lu₃Al₅O₁₂ (LuAG) scintillator will be discussed. PET is modality of annihilation gamma-rays scanner and the PEM is a PET dedicated for breast cancer. We have developed a new PEM scanner with planer detectors. As the scanner angle and the distance between the pair of opposite detectors can be controlled depending on the scanning conditions, it was realized to scan breast images in different positions. One-side of the scanner was composed of four detector units and one detector unit consisted of a 20×64 pixels scintillator array optically coupled with three H8500 PMTs. As a scintillator, Pr:LuAG was installed which possesses interesting properties such as a very fast decay time of 20.1 ns, a good energy resolution of 4.2% and a high light yield of 22,000 photon/MeV. The pixel size of the Pr:LuAG was 2.1×2.1×15 mm³ and a BaSO₄-type reflector was used for the array assembly. By the fundamental investigation of the PEM, the spatial resolution measured using a ²²Na point source was found to be 1.1 mm for image planes parallel to the detector faces. The time resolution was 3.1 ns and the energy resolution was 11.6% (@511 keV) at the center of the detector. In addition, we have performed the clinical trials and compared with the images detected by the PET. As the spatial resolution of PEM was better than PET, advantages of PEM were clearly shown.

quote your primary experiment:

PET breast cancer

Board: 3 / **150**

The CHarged ANTIcounter for the NA62 experiment at CERN

Author: Fabio Ambrosino[1]

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The CHANTI is a charged hodoscope with many innovative features in order to cope with the needs of the NA62 experiment at CERN. Its main aim is to veto the inelastic interaction of the NA62 beam with the Si beam spectrometer called Gigatracker (GTK). Although a fraction of less than 10-3 of the beam particles will suffer an inelastic interaction with the GTK, the huge flux of K crossing the GTK (about *810^13 in two years of data taking) and the low rate of the signal K+->pi+ nu nubar (*810^-11 according to Standard Model predictions) makes these events a potentially harmful background if not vetoed.
CHANTI is a series of six guard rings, to be operated in vacuum, and covering a wide angular region downstream the last GTK station.
Its main features are: time resolution <1 ns, crack-free design and high light yield in order to maximize efficiency for charged particles, xy position determination, low outgassing and low power dissipation in vacuum, capability to sustain relatively high rates.
This has been achieved by using triangularly shaped scintillator bars coupled with fast wavelength shifting fibers, each read via a Silicon Photomultiplier (SiPM).
All of the bars have been assembled and tested during 2012 and the first of the six stations has been assembled in July 2012 and tested using the prototype of a dedicated front-end board providing fast amplification of the signal, fine bias voltage setting and both current and temperature monitoring for each channel.

quote your primary experiment:

NA62

Board: 99 / **276**

Prototyping the Micro Vertex Detector of the Compressed Baryonic Matter Experiment at FAIR.

Author: Michal Koziel[1]

Co-authors: Bertram Neumann [1]; Borislav Milanovic [1]; Christian Muentz [1]; Ingo Fröhlich [2]; Jan Michel [3]; Joachim Stroth [4]; Michael Deveaux [1]; Michael Wiebusch [1]; Norbert Bialas [5]; Qiyan Li [1]; Roland Weirich [1]; Samir Amar-Youcef [6]; Stefan Schreiber [1]; Tobias Tischler

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The Compressed Baryonic Matter Experiment (CBM) is one of the core experiments of the future FAIR facility at Darmstadt/Germany. The fixed-target experiment will explore the phase diagram of strongly interacting matter in the regime of highest net baryon densities with numerous probes, among them open charm. Open charm reconstruction requires a vacuum compatible Micro Vertex Detector (MVD) with unprecedented properties. Its sensor technology has to feature a spatial resolution of <5µm, a non-ionizing radiation tolerance of >1013 neq/cm², an ionizing radiation tolerance of 3 Mrad and a readout time of few 10 µs/frame. Thinned Monolithic Active Pixels Sensors, developed at IPHC Strasbourg, are promising candidates, if integrated in an ultra-thin detector, employing high-performance materials such as thermal CVD-Diamond. The need of prototyping and characterizing the CBM-MVD motivated the construction of a ultra-low mass, high precision detector setup incorporating several prototype stations. Each station contains 2 (single-sided station) or 4 (double-sided station) identical 50 µm thick CMOS sensors. The sensors are glued to CVD diamond carriers which provide at the same time a mechanical support and an efficient heat evacuation.

This contribution will focus on mechanical integration and operation of the telescope as well as the concept of the customized DAQ system.

quote your primary experiment:

CBM

Board: 82 / **159**

Proof of the feasibility of Vacuum Silicon PhotoMultiplier Tube (VSiPMT)

Author: Daniele Vivolo[1]

Co-authors: Andrea Russo [2]; Carlos Maximiliano Mollo [3]; Felicia Carla Tiziana Barbato [2]; Giancarlo Barbarino [4]; Gianfranca De Rosa [3]; Pasquale Migliozzi [5]; Riccardo De Asmundis [5]

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VSiPMT (Vacuum Silicon PhotoMultiplier Tube) is an innovative hybrid photon detector suggested by our group in order to combine the performances and the potential of PPD technology with a hemispherical glass PMT standard envelope. Our purpose is to combine the key features of a PPD (high quantum efficiency, low operation voltages, insensitivity to magnetic fields and robustness) with the large sensitive area of a photocathode. The PPD therefore acts as an electron detector. In order to study the performances of the PPD in such a configuration we carried out a preliminary work going from the characterization of a special non-windowed Hamamatsu MPPC with a pulsed laser source to the realization of a Geant4-based simulation of the interaction between the PPD and an electron beam. The last step consists in the characterization of the PPD with an electron source. In this work we will provide a detailed description of the experimental setup and of our preliminary measurements.

quote your primary experiment:

KM3-Net

Board: 57 / **158**

Development of a 32 detector CdTe matrix for the SVOM ECLAIRs X/Gamma camera

Authors: Guillaume Nasser[1]; Karine Lacombe[1]

Co-authors: Baptiste Houret [1]; Bertrand Cordier [2]; Carine Amoros [1]; Damien Rambaud [1]; Didier Barret [3]; François Gonzalez [4]; Gilbert Rouaix [1]; Jean-Luc Atteia [3]; Karine Mercier [4]; Marc Billot [4]; Olivier Gevin [2]; Olivier Godet [3]; Pascale Ramon [1]; Pierre Mandrou [1]; Roger Pons [1]; Vincent Waegebaert [1]

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ECLAIRs, a 2D coded-mask imaging telescope on the Sino-French SVOM space mission, will detect and locate GRBs between 4 and 150 keV. The detector array is an assembly of 6400 Schottky CdTe semiconductor detectors of size 4x4x1 mm3, biased from -100V to -600V and operated at -20℃ to minimize the leakage current and maximize the polarization time due to Schottky barrier lowering. The remarkable low-energy threshold for a space instrument is achieved through an extensive detectors selection, the choice of a low-noise 32 channels ASIC, and the realization of an innovative hybrid detection module formed by a thick film ceramic holding 32 detectors with their high voltage grid, and an HTCC ceramic housing the ASIC chip within an hermetic cavity.
In this paper, we describe a complete 4 by 8 hybrid matrix and explain the results of tests comparing the different sources of noise such as design capacitances, leakage currents after sticking detectors on ceramic and the ENC measured on the ASIC ceramic module. We confront these values with the energy threshold and FWHM measured on spectra made with calibrated radioactive sources such as Am-241, Co-57 and Fe-55 inside a vacuum chamber at -20℃ and parameters chosen to get the best performance. Finally, we will present the superposition of 32 calibrated spectra of version 3 matrix, showing the excellent homogeneity of 32 detectors and the achievement of a detection threshold of 4 keV.

quote your primary experiment:

Space CdTe Detectors

Board: 12 / **238**

Development of single crystals with a high index of refraction

Author: Shunsuke Kurosawa[1]

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Cherenkov counter is used in High Energy Physics or Nuclear Physics, and it is expected to be applied to medical imaging. Time-of-flight Positron emission tomography (TOF-PET) is one of the next-generation medical imaging methods, and a scintillator with a fast decay time is required. However, fast scintillation decay times are typically 10 - 30 nsec, and this order is not sufficient for TOF-PET. Thus, we try to develop the new crystals a high refractive index as a Cherenkov radiator, and we investigated these single crystals The sample crystals had a high refractive index of over 2.5 at 400 nm. In this presentation, we report and evaluate these crystals as a Cherenkov radiator.

quote your primary experiment:

Scintillator

Board: 6 / **279**

Progress with the MICE scintillating fibre trackers

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The International Muon Ionisation Cooling Experiment (MICE) is a proof of principle demonstration of ionisation cooling, for application in a future neutrino factory or muon collider. MICE is under construction at the Rutherford Appleton Laboratory (UK), where a dedicated beam line has been commissioned to transport particles produced inside the ISIS accelerator facility.
The beam emittance will be measured using two scintillating fibre trackers on each side of the cooling channel, which will be mounted inside a 4T Solenoid. As particles pass through the tracker, their position will be measured at 5 stations, each of which provides a position resolution of less than 0.5mm.
The fibre trackers have been validated using cosmic ray tests, which have allowed the light yield and track efficiency to be found. In addition, a spare tracking station was exposed to the MICE beam, which has enabled the tracker readout to be integrated with the MICE DAQ for the first time. This test required the integration gate on the D0 AFE-IIt readout boards to be synchronised with particles arriving, using diagnostic signals from ISIS. Finally the performance of a tracker station has been measured using 200MeV/c muons.

quote your primary experiment:

MICE

Board: 11 / **232**

Study of Highly Transparent Silica Aerogel for the Belle II RICH Counter

Author: Ichiro Adachi[1]

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Proximity focusing RICH based on a silica aerogel as a Cherenkov radiator has been developed for new particle identification device in the Belle II end-cap detector. For this detector, we propose new concept to employ dual aerogel layers with different refractive indices so that Cherenkov photons from each layer can be imaged as an overlapped ring on the photodetector plan. In this new idea on Cherenkov radiator, optical properties of aerogel tile in larger refractive index is of our prime importance since it is located downstream and all Cherenkov photons generated in radiator medium pass through this tile. However, it is difficult to produce transparent aerogels with refractive index n>1.055 using a conventional method. Therefore, a pioneering aerogel production technique called as pin-drying(PD) method was introduced for the first time to improve transparency of the aerogel tile with larger index. In this method, synthesis process is carried out to make alcogel in the usual way. Then, as a new procedure, refractive index of each tile is controlled by changing volume size, where alcogel is placed in a semi-sealed container to proceed smooth shrinkage of alcogel. Using PD method, transmission length at wave-length of 400 nm was achieved to be more than 50 mm for the aerogel with n>˜1.060. Newly produced aerogels were tested in beam at CERN PS in 2011. Clear Cherenkov image was detected, demonstrating our new aerogel is transparent enough to be adopted for the real detector.

quote your primary experiment:

Belle II

Board: 7 / **280**

Development of Pixelated Scintillaton Detector for Highly Precise Timing Measurement in MEG Upgrade

Author: Wataru Ootani[1]

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The MEG experiment is searching for the lepton flavour decay, $\mu^+ \to e^+\gamma$, with an unprecedented sensitivity.
We plan to upgrade the experiment to search for the decay down to a branching ratio sensitivity of around 5×10^{-14}, which would improve the sensitivity goal of the current experiment by one order of magnitude.
A pixelated scintillation detector is under development for the upgraded experiment to significantly improve the positron time measurement.
Each segment pixel is a small ultra-fast plastic scintillator plate with silicon photomultiplier (SiPM)

readout.
A high timing resolution at a level of 30-35\,ps is expected for the signal positron by averaging the positron impact times over multiple hit pixels.
The concept and the expected performance of the proposed detector will be presented as well as the RD status including the performance measured with a prototype of the pixel counter.

quote your primary experiment:

MEG

Board: 10 / **119**

The Focusing DIRC: an innovative PID detector

Author: Nicolas Arnaud[1]

Co-authors: Abdelmowafak El Berni [2]; Achille Stocchi [2]; Alexander Barnyakov [3]; Alexei Onuchin [4]; Biplab Dey [5]; Blair Ratcliff [6]; Christophe Beigbeder-Beau [7]; David Leith [8]; Dmitry Shtol [4]; Dominique Robert Breton [7]; Douglas Roberts [9]; Ellie Twedt [10]; Evgeniy Kravchenko [11]; Fabio Gargano [12]; Francesco Giordano [12]; Francesco Loparco [13]; Gabriele Simi [10]; Gary Varner [14]; Gianmaria Collazuol [15]; Hassan Jawahery [16]; Jerry Va'vra [6]; Jihane Maalmi [17]; Kurtis Nishimura [18]; Leonid Burmistrov [19]; Mario Nicola Mazziotta [20]; Mario Posocco [21]; Martino Borsato [22]; Massimo Benettoni [13]; Mikhail Barnyakov [23]; Roberto Stroili [24]; Sergey A. Kononov [25]; Vanessa Tocut [26]; Véronique Puill ; hervé lebbolo [27]

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The FDIRC (Focusing Detector of Internally Reflected Cherenkov light) is a new concept of PID detector which aims at separating kaons from pions up to a few GeV/c. It is the successor of the BaBar DIRC and benefits from the knowledge accumulated with a first FDIRC prototype built and operated at SLAC.
The FDIRC is intended to be used at the SuperB experiment whose luminosity will be 100 times higher than for PEP-II and KEK-B. Backgrounds will be higher as well; yet, the FDIRC has been designed to perform at least as the DIRC. The main improvement is a complete redesign of the photon camera, moving from a huge tank of ultra-pure water to much smaller focusing cameras with sophisticated solid fused-silica optics. The BaBar camera was sensitive to background and its operation required constant attention.
The new cameras are instrumented with Hamamatsu H-8500 MaPMTs, readout by new front-end electronics. The detection chain will be 10 times faster than in BaBar, to reject more background and measure more accurately Cherenkov angles.
A full-scale FDIRC prototype has been successfully built at SLAC and will soon start taking cosmics data. The aim of this test is to validate the camera design, measure the Cherenkov angle resolution, test the electronics and validate the FDIRC simulation.
In this talk, we summarize the FDIRC design, present the status of the prototype test at SLAC and review all activities ongoing in the various labs participating to the development of the FDIRC.

quote your primary experiment:

SuperB, BaBar

Board: 20 / **44**

A Study of Gd-based Parallel Plate Avalanche Counter for Thermal Neutrons by MC Simulation

Author: Jamil Muhammad[1]

Co-authors: Ahmad Farzana [2]; H.G. Kim [3]; J. T Rhee [1]; Y. J Jeon [2]

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In this work, we demonstrate the feasibility and characteristics of a single-gap parallel plate avalanche counter (PPAC) as low energy neutrons detector based on the Gd-converter coating. The incident low energy neutrons upon falling on the Gd-converter surface, produce internal conversion electrons, which are evaluated and detected. For estimating the performance of the Gd-based PPAC, a simulation test has been taken using GEANT4 Monte Carlo code. In this work, we demonstrate the feasibility and characteristics of a single-gap parallel plate avalanche counter (PPAC) as low energy neutrons detector based on the Gd-converter coating. The incident low energy neutrons upon falling on the Gd-converter surface, produce internal conversion electrons, which are evaluated and detected. For estimating the performance of the Gd-based PPAC, a simulation test has been taken using GEANT4 Monte Carlo code. The detector's response as a function of incident neutron energies in the range of En= 25 meV to En=100 meV, has been evaluated with two different physics lists e.g., the QGSP_BIC_HP and the QGSP_BERT_HP. Using the QGSP_BIC_HP physics list and with 5 μm converter thickness, the detection efficiencies of 11.8%, 18.48% and 30.28% have been achieved for the forward-, backward- and as a total converter-based PPAC response, respectively. On the other hand, considering the same converter thickness and detector configurations, with the QGSP_BERT_HP physics list the efficiencies were 12.19%, 18.62% and 30.81% respectively. A brief discussion on the results is also performed.

quote your primary experiment:

PPAC, Themal Neutrons

Board: 91 / **200**

FTK: A Hardware Track Finder for the ATLAS Trigger System

Author: Lauren Alexandra Tompkins[1]

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The LHC experiments are preparing for instantaneous luminosities above $1 \times 10^{34} cm^{-2} s^{-1}$ as early as 2015. In order to select the rare events of interest in such dense environments, detailed event information is necessary. In particular, the highly granular single particle information of tracking detectors is crucial for the selection of isolated leptons, taus and b-jets in the face of large vertex multiplicities. We report on the developement of the ATLAS FastTracker (FTK), a hardware based track finder which will reconstruct all tracks with a momentum greater than 1 GeV/c up to luminosties of $3 \times 10^{34} cm^{-2} s^{-1}$ at an event input rate of 100 kHz and a latency of a few hundred microseconds. The track information will be available to the Level 2 processors at the beginning of event processing. Significant progress towards a phased installation beginning in 2015 has been achieved. A pre-prototype of the pattern recognition board is taking data in the fall of 2012 and prototypes for all boards in the system will be constructed in early 2013. We report on the system design as well as the performance of the pre-prototypes.

quote your primary experiment:

ATLAS

Board: 72 / **250**

Tunka-HiSCORE –a new array for multi-TeV gamma-astronomy

Author: Oleg Gress[1]

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Tunka-HiSCORE (HiSCORE –Hundred Square-km Cosmic Origin Explorer) –is a new Cherenkov EAS array for multi –TeV gamma-ray astronomy and CR studies. The array will consist of wide–angle (0.6 ster) optical stations with 150 m distance between individual stations. The array will be constructed in several stages: beginning with a 1 km2 array at the first stage up to 100 km2 at the last stage.
The first four stations have been installed during 2012 in Tunka Valley (50 km from Southern tip of Lake Baikal) at the site of the Tunka-133 array. We describe the construction of the optical stations and the array DAQ, and present the first results of common operation of the new optical stations with the Tunka-133 array.

quote your primary experiment:

Tunka-133

Board: 35 / **209**

A Time Projection Chamber for the Crystal Ball experiment at MAMI

Author: Wolfgang Gradl[1]

Co-authors: Martin Wolfes [1]; Oliver Steffen [1]

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The Crystal Ball Collaboration at the electron accelerator MAMI in Mainz studies photo-induced reactions on nucleons and nuclei with energy tagged photons produced via bremsstrahlung. The Crystal Ball/TAPS calorimeters form a 4pi detector optimized for the detection of neutral final states. The inner detector system includes a two-layer multi-wire proportional chamber (MWPC) for the detection of
charged particle tracks.
The future physics programme of the experiment includes the study of rare decays of the omega and eta' mesons, which can only be produced by the high-end tail of the bremsstrahlung spectrum. Therefore all detectors have to cope with increased multiplicities and rates from background reactions.
The increased rate of charged particles in the current and future physics programme exceeds the rate capabilities of the presently installed MWPC. As a replacement option, a Time Projection Chamber (TPC) with triple-GEM readout is being considered. Besides higher rate capabilities, such a detector allows real track reconstruction with better angular resolution and may contribute to particle identification.
A test setup was installed in Mainz, and a small TPC prototype with triple-GEM readout was put into operation. In this talk, we present design considerations for such a tracking device for Crystal Ball and report on first results of tests with cosmic particles and electrons from the MAMI beam.

quote your primary experiment:

TPC CrystalBall MAMI

Board: 68 / **148**

Development of Microwave Kinetic Inductance Detectors and a newly-developed Readout System for LiteBIRD

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Primordial gravitational waves generated by inflation have produced an odd-parity pattern "B-mode" in the cosmic microwave background (CMB) polarization. LiteBIRD (Light satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection) aims at detecting this B-mode polarization precisely. It requires about 2000 detectors capable of detecting a frequency range from 50 to 250 GHz with ultra low noise. Superconducting detectors are suitable for this requirement. We have fabricated and tested MKIDs and developed a
new readout system.
We have designed antenna-coupled MKIDs. Quasi-particles are created by incident radiation and are detected as a change of the surface impedance of a superconductor strip. This change of the surface impedance is translated to the change of the resonant frequency of a microwave signal transmitted through the resonator. We also have developed a new readout system for MKIDs. The newly-developed readout system is not only able to read out the IQ signals with the homodyne detection for multi-channels, but also provides a unique feature of tracking the resonant frequency of target resonator. This mechanism enables us to detect signals with a large dynamic range. We report the recent RD status of developing MKIDs and the read-out system for LiteBIRD.

quote your primary experiment:

astro-particle physics

Board: 34 / **205**

Studies on fast timing and high precision tracking trigger based on Resistive Plate Chambers

Authors: Junjie Zhu[1]; Liang Han[2]

Co-author: ATLAS Muon Collaboration

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We report our studies of fast timing and high precision tracking trigger using Resistive Plate Chambers (RPCs). Two beam tests were carried out with 180 GeV muons at CERN using 1.0 - 1.15 mm gas-gap RPCs equipped with readout strips of 1.27 mm in pitch. This is the first time RPCs with fine-pitch readout strips have been tested with high energy muons to explore the capabilities of precision tracking and triggering simultaneously. RPC signals are acquired with precision timing TDCs and charge ADCs electronic circuits at both ends of the strips. The time resolution is measured to be less than 0.6 ns and the spatial resolution is found to be 200 um using charge information and 287 um using timing information. The dual-ended readout allows to determine the mean and the difference of the signal arrival times from both ends. The mean time is found to be independent of the incident particle position along the strip and is useful for triggering purposes. The time difference yields a determination of the hit position with a precision of 7.5 mm along the strip. These results demonstrate the feasibility of using RPCs as high precision tracking trigger devices.

quote your primary experiment:

ATLAS

Board: 25 / **121**

Comparison of BULK Micromegas with different amplification gaps

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The bulk Micromegas detector is considered to be a promising candidate for building TPCs for several future experiments including the projected linear colliders. The novel production technique adapted for fabricating the bulk is particularly suited for compact and robust low mass detectors. The standard bulk with a spacing of 128 micron has already established itself as a good choice for its performances in terms of gas gain uniformity, energy and space point resolution, and for its capability to efficiently pave large readout surfaces with minimized dead zone. The present work

involves the comparison of this standard bulk with a relatively less used bulk Micromegas detector having a larger amplification gap of 192 micron. Detector gain, energy resolution and electron transparency of these Micromegas have been measured under different conditions in various argon based gas mixtures to evaluate their performance. These measured detector characteristics have also been compared in detail to numerical simulations using the Garfield simulation framework that combines packages such as neBEM, Magboltz and Heed. Further, we have carried out another numerical study to determine the effect of dielectric spacers on different detector features. A comprehensive comparison of the two detectors have been presented and analysed throughout the work.

quote your primary experiment:

Micropattern Gas Detectors

Board: 98 / **267**

New developments on Silicon photo-multipliers for visible and near-UV light at FBK

Author: Claudio Piemonte[1]

Co-authors: Alberto Gola [2]; Alessandro Ferri ; Alessandro Tarolli [1]; Nicola Serra [1]; Nicola Zorzi [1]; Tiziana Pro [1]

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In this contribution, we will show selected results on the research and development FBK is carrying out on Silicon Photomultipliers for the detection of visible and near-ultraviolet light. We developed two complementary technologies having similar characteristics in terms of breakdown voltage (˜30V), breakdown voltage temperature dependence (25mV/C) but different peak sensitivity wavelengths. The first, called RGB-SiPM, has a wide peak ranging from 450 to 600nm whereas the second, called NUV-SiPM, from 380 to 410nm. The maximum efficiency in both cases is higher than 30% for a 50x50um2 cell size with 42% fill factor. At maximum bias, primary dark noise is on the level of 500 and 150kHz/mm2, respectively. As a further technological step, we redesigned the dead border region around the SiPM cell to maximize the fill factor. We produced first RGB-SiPM prototypes with a 15x15um2 cell having a very high fill factor of 45% and a measured detection efficiency of about 30% at 550nm.

quote your primary experiment:

Sublima

Board: 83 / **166**

Latest results of the R&D on CMOS MAPS for the Layer0 of the SuperB Silicon Vertex Tracker

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Physics and high background conditions set very challenging requests on readout speed, low material budget and resolution for the innermost layer (the Layer0) of the SuperB Silicon Vertex Tracker operated at the full luminosity.
Monolithic Active Pixel Sensors are very appealing in this application because the thin sensitive region allows grinding the substrate to tens of microns.
Deep N-well MAPS, developed in the ST 130 nm CMOS technology, achieved in-pixel sparsification and fast time stamping. Further performance improvements are being explored with an intense RD program, including both vertical integration and 2D MAPS with the INMAPS quadruple well.
For the 3D (Tezzaron/Chartered) process, several chips have been characterized with IR laser, radioactive sources and beam. The results on the various sensors (3x3 matrix with analog information available and 8x32 digital matrix) are reported, with the design implemented in the second foundry run.
The other approach exploits the features of the quadruple well and the high resistivity epitaxial layer of the INMAPS 180 nm process. This technology allows overcoming the main limitations of the DNW MAPS, in terms of collection efficiency and radiation hardness in a timeline reasonable for application in SuperB. An irradiation campaign with neutrons has been performed on small matrices and other test-structures. These promising results together with the response of the sensors to high energy charged tracks are presented.

quote your primary experiment:

SuperB

Board: 19 / **39**

R&D on a Fast LXe TPC with real-time event reconstruction

Authors: Giovanni Signorelli[1]; Simeone Dussoni[2]

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The FOXFIRE project aims at the realization of a Liquid Xenon TPC devoted to high rate medium energy particle physics experiments. Liquid Xenon has several attractive properties to be exploited in the detection of particles in the 10-100MeV energy range with superior time and energy resolution, by using the scintillation light read out with suitable photo-detectors. A complementary approach with a TPC readout scheme can improve the spacial resolution to a level of a few hundred microns. We are studying both the feasibility of a light readout by means of Silicon PhotoMultipliers optimized for the Xenon emission spectrum as well as on an innovative micro-machined device capable of charge multiplication in liquid phase. The whole system will be equipped with a readout electronics capable of online reconstruction of events in order to release trigger decisions as well as to deal with multi-hit events, allowing the detector to sustain a high rate of interactions.
Preliminary measurements on single parts of the instrument are presented.

quote your primary experiment:

High precision measurements