

# 8th International Conference on Position Sensitive Detectors



## Report of Contributions

Contribution ID: 6

Type: **Keynote talk**

## Novel Gas-based Detection Techniques

*Monday, 1 September 2008 10:50 (40 minutes)*

100 years ago, in Manchester, Hans Geiger operated the first gaseous detector, which was the basis for 'wire chambers', widely applied as track imaging in particle physics experiments.

In wire chambers gas amplification occurs, close to the wire surface, due to the strong ( $1/R$ ) electric field. This enables the detection of the few single electrons created in the gas by ionisation radiation.

In Micro Pattern Gas Detectors, areas with a strong electric avalanche field are created by one or more conductive perforated planes (grid).

The granularity of such a detector is determined by the hole pitch and can be much better in comparison to wire chambers.

With each grid hole equipped with its own readout channel (preamp, shaper, discriminator) in the form of an active pixel array in a CMOS chip, this micro-granularity is pursued: each hole is a stand-alone detector. This matches future demands on occupancy, position resolution and time resolution for high radiation trackers at future ILC, CLIC or sLHC colliders.

Chip manufacturing processes made two innovations possible: the integration of Micro Pattern Gas Detectors with pixel chips (Integrated Grid, InGrid), and the deposit of a high-resistivity protection layer on top of pixel chips. This 'wafer post processing' technology may enable next innovations such as micro channel plates and secondary emission foils. Essentially, the application of gas as detection material, compared to, for instance, Si, offers several advantages, relevant for future tracking and imaging detector developments. For this, the development of TimePix-2, a new general-purpose pixel chip, is essential.

**Primary author:** Prof. VAN DER GRAAF, Harry

**Presenter:** Prof. VAN DER GRAAF, Harry

**Session Classification:** Novel Gas-based Detection Techniques

**Track Classification:** Novel Gas-based Detection Techniques

Contribution ID: 7

Type: **Keynote talk**

# Optical and IR Applications in Astronomy and Astrophysics

*Monday, 1 September 2008 13:50 (40 minutes)*

The set comprising of silicon charge-coupled devices, low band-gap infrared arrays and bolometer arrays provide astronomers with position-sensitive photon detectors from the X-ray to the sub-mm. In recent years the most significant advances have occurred in the near-infrared part of the spectrum because not only have the detector formats caught up with those of CCDs but also because the advent of adaptive optics has meant that very largest telescopes can achieve their diffraction limit in the infrared. Thus infrared cameras, spectrometers and hybrid instruments that measure spatial and spectral information simultaneously are now commanding the greatest attention on telescopes from 6.5-10 meters in effective aperture. Scientific applications of these new infrared instruments span everything from the search for nearby solar systems to the orbital motions of stars about the massive black hole at the center of the Milky Way and studies of the first galaxies to form in the high redshift Universe. Background, principles and applications of infrared array detectors to astronomy and astrophysics will be discussed with particular emphasis on work at the W. M. Keck 10-m telescope on Mauna Kea, Hawaii.

**Primary author:** Prof. MCLEAN, Ian**Presenter:** Prof. MCLEAN, Ian**Session Classification:** Applications in Astronomy and Astrophysics**Track Classification:** Applications in Astronomy and Astrophysics

Contribution ID: 8

Type: **Keynote talk**

## **X-ray and Gamma-ray Detectors for Astrophysics**

*Monday, 1 September 2008 16:20 (40 minutes)*

Position Sensitive Detectors play a key role in X-ray and Gamma-ray Astronomy as they allow imaging and spectroscopy of astrophysical sources throughout the Universe. At these high energies, photons are generally characterized individually, requiring sensitive and rapid low-noise charge amplifiers to extract the information. In this review I will describe the detector technologies that are currently employed in this fields and outline the challenges and requirements for the future.

**Primary author:** Prof. KNÖDLESEDER, Jürgen

**Presenter:** Prof. KNÖDLESEDER, Jürgen

**Session Classification:** Detectors for Astrophysics and Astro-Particle Physics

**Track Classification:** Detectors for Astrophysics and Astro-Particle Physics

Contribution ID: 9

Type: **Keynote talk**

## What the Advanced Gamma Tracking Array can do for us: Nuclear science in the 21st century

*Tuesday, 2 September 2008 09:00 (40 minutes)*

High-resolution gamma-ray detectors based on high-purity germanium crystals (HPGe) are one of the key workhorses of experimental nuclear science. The technical development of such detector technology has been dramatic in recent years. Large volume, high-granularity, electrically segmented HPGe detectors have been realised and a methodology to improve position sensitivity using pulse-shape analysis coupled with the novel technique of gamma-ray tracking has been developed.

Each major technical advance in gamma-ray detection devices has resulted in significant new insights into the structure of atomic nuclei. The next major step in gamma-ray spectroscopy involves achieving the goal of a 4pi ball of Germanium detectors by using the technique of gamma-ray energy tracking in electrically segmented Germanium crystals. The resulting spectrometer will have an unparalleled level of detection power for nuclear electromagnetic radiation [1]. Collaborations have been established in Europe (AGATA) [2] and the USA (GRETA/GRETINA) to build gamma-ray tracking spectrometers [3].

This presentation will discuss the status of the AGATA (Advanced GAMMA Tracking Array) spectrometer and will provide an insight into how the device will be exploited at European facilities such as INFN Legnaro, GANIL and the future FAIR facility in Darmstadt, Germany.

[1] J. Simpson, J. Phys. G 31 (2005) S1801-S1806.

[2] J. Simpson, Acta Phys. Pol. B36 1383 (2005)

[3] M.A. Delaplanque, NIM A 430 (1999) 292

**Primary author:** Dr BOSTON, Andrew

**Presenter:** Dr BOSTON, Andrew

**Session Classification:** Applications in Nuclear Physics

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 10

Type: **Keynote talk**

## **Applications of position sensitive detectors in Nuclear Medicine and Radiology**

*Tuesday, 2 September 2008 11:50 (40 minutes)*

The use of imaging techniques in medicine continues to expand. Over the last decade, there has been a 30% increase in the number of investigations, with CT scans rising by almost three fold. The use of x-ray film has given way to the digital detector and companies strive for continuous improvement in both resolution and sensitivity. The latter is particularly important in terms of reducing the population radiation burden and in making screening programmes viable. Improvements in detector materials must be supplemented by improvements in read out and analysis electronics in order to provide faster framing rates. In Nuclear Medicine, the introduction of faster electronics has enabled the clinical implementation of time-of-flight systems, while real-time imaging in radiotherapy is being used to improve tumour/normal tissue dose ratios.

**Primary author:** Prof. ELLIOTT, Alex**Presenter:** Prof. ELLIOTT, Alex**Session Classification:** Applications in Nuclear Medicine and Radiology**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 11

Type: **Keynote talk**

## A Biological Position Sensitive Detector

*Tuesday, 2 September 2008 16:10 (40 minutes)*

The back of the eye is lined by an extraordinary biological position sensitive detector, the retina. This living neural network is able to extract vital information about the external visual world, and transmit this information in a timely manner to the brain. In this talk, after a brief introduction to retinal architecture, I will describe how we measure the functional properties of the retina, show what we have learned about its functional organization, and discuss studies aimed at guiding the design of retinal prosthetic devices. This project was inspired by the development of position sensitive detectors for high energy physics experiments.

**Primary author:** LITKE, Alan (Santa Cruz Institute for Particle Physics (SCIPP))

**Presenter:** LITKE, Alan (Santa Cruz Institute for Particle Physics (SCIPP))

**Session Classification:** Position Sensitive Detectors for Biology

**Track Classification:** Position Sensitive Detectors for Biology

Contribution ID: 12

Type: **Keynote talk**

## **Detectors for Synchrotron Radiation and Spallation Neutron Sources**

*Wednesday, 3 September 2008 09:00 (40 minutes)*

The development of new synchrotron light and neutron sources and the concomitant increase in experimental complexity places challenging demands on detector technologies. For any given instrument, combinations of one or more of; high count rate, high spatial resolution, high temporal resolution and wide bandwidth are required. A survey of some of the technologies currently being developed and deployed to address these challenges will be presented.

**Primary author:** Prof. ECCLESTON, Roger

**Presenter:** Prof. ECCLESTON, Roger

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources



Contribution ID: 13

Type: **Keynote talk**

# X- and gamma-ray detector development for space applications

*Wednesday, 3 September 2008 12:10 (40 minutes)*

As space missions have evolved, the scientific programs they carry out are becoming increasingly multi-disciplinarian and multi-waveband. This in turn, requires a broader range of measurements to be performed and therefore more instruments to be flown. Whereas, thirty years ago the average planetary mission carried, say, 4 prime instruments, it may now carry 10 or 12. However, a commensurate increase in spacecraft mass, power or funding has not been forthcoming. As a consequence, instruments are becoming increasingly resource limited and thus a new approach to payload design and construction is required. Several strategies are being pursued by the Advanced Concepts and Technology Preparation Division of ESA. These include, the so-called HIPS (Highly Integrated Payload Suite) concept [1], miniaturization, the use of advanced technologies and smart or targeted materials [2]. HIPS achieves mass savings by sharing resources, functions and real estate amongst the instruments and spacecraft. Miniaturization achieves resource optimization through mass and power reduction, which for X and gamma-ray detectors is difficult to realize without a similar reduction in sensitivity. The third and fourth strategies are potentially the most rewarding, especially when applied to X- and gamma-ray detection systems since present day systems are almost exclusively designed around conventional technologies which require ancillary support in terms of cooling systems, high voltage supplies, radiation shielding and complex readout sensors, etc. These in turn load spacecraft resources, increase complexity and reduce reliability. Clearly what is needed are sensors that fulfill the detection requirements but do not require additional services and this is where advanced technologies and particularly targeted materials come into play. In this paper, we describe a range of detector developments at ESA which concentrate on new materials and techniques in an effort to reduce spacecraft resources without compromising performance.

Keywords: X-ray detectors, Gamma-ray detectors, semiconductors, scintillators

[1] S. Kraft, M. Collon, J. Montella, E.J. Buis, M. Beijersbergen, J. Harris, C. Erd, P. Falkner, R. Schulz, A. Peacock, "On the Concept of the Highly Integrated Payload Suite for use in future planetary Missions: the Example of the BepiColombo Mercury Planetary Orbiter", Proc. of the Fifth IAA International Conference on Low-Cost Planetary Missions, ed. R.A. Harris, ESA SP-542, (2003) pp 219-226.

[2] D.H. Lumb, A. Owens, M. Bavdaz, T. Peacock, "Development of Compound Semiconductor Detectors at ESA", Nucl. Instr. and Meth., A568 (2006) pp. 427-432.

**Primary author:** Prof. OWENS, Alan

**Presenter:** Prof. OWENS, Alan

**Session Classification:** Applications in Space Science

**Track Classification:** Applications in Space Science

Contribution ID: 14

Type: **Keynote talk**

## Novel Photon Detection Systems

*Wednesday, 3 September 2008 16:10 (40 minutes)*

Recent developments in photo-detectors and photo-detector systems are reviewed. The main emphasis is made on SiPMs - novel very attractive photo-detectors. Their main features are described. Properties of detectors manufactured by different producers are compared. Different applications are discussed including calorimetry, muon detection, tracking, Cherenkov light detection, and time of flight measurements. A comparison with other photo-detectors is made.

**Primary author:** Prof. DANILOV, Mikhail**Presenter:** Prof. DANILOV, Mikhail**Session Classification:** Novel Photon Detection Systems**Track Classification:** Novel Photon Detection Systems

Contribution ID: 15

Type: **Keynote talk**

## Applications in Particle Physics

*Thursday, 4 September 2008 09:00 (40 minutes)*

We summarize the state of position sensitive detectors for particle physics. Particular attention is given to the technologies for the next generation of detector replacements and upgrades for the LHC. The latest developments in radiation hard devices are reported together with recent results on novel devices. A brief review of possible applications of these new technologies to future experiments, and their potential impact, is given.

**Primary author:** BOWCOCK, Themis (University of Liverpool)

**Presenter:** BOWCOCK, Themis (University of Liverpool)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 16

Type: **Keynote talk**

## Gas Pixel Detectors and Beyond

*Thursday, 4 September 2008 13:30 (40 minutes)*

With the Gas Pixel Detector (GPD), the class of micro-pattern gas detectors has reached a complete integration between the gas amplification structure and the read-out electronics. To obtain this goal, three generations of application-specific integrated circuit of increased complexity and improved functionality has been designed and fabricated in deep sub-micron CMOS technology. This implementation has allowed manufacturing a monolithic device, which realizes, at the same time, the pixelized charge-collecting electrode and the amplifying, shaping and charge measuring front-end electronics of a GPD. A big step forward in terms of size and performances has been obtained in the last version of the 0.18 micron CMOS analog chip, where over a large active area of 15x15mm<sup>2</sup> a very high channel density (470 pixels/mm<sup>2</sup>) has been reached. On the top metal layer of the chip, 105,600 hexagonal pixels at 50 micron pitch have been patterned. The chip has customizable self-trigger capability and includes a signal pre-processing function for the automatic localization of the event coordinates. In this way, by limiting the output signal to only those pixels belonging to the region of interest, it is possible to reduce significantly the read-out time and data volume. In-depth tests performed on a GPD built up by coupling this device to a fine pitch (50 micron) gas electron multiplier or microchannel plates are reported. Matching of the gas amplification and read-out pitch has let to obtain optimal results. A possible use of this detector for X-ray polarimetry of astronomical sources and other imaging applications are discussed. Results from test of a fourth generation very large area ASIC working in counting mode will also be presented for the first time.

**Primary author:** BELLAZZINI, Ronaldo (INFN Pisa)**Presenter:** BELLAZZINI, Ronaldo (INFN Pisa)**Session Classification:** Gas Pixel Detectors**Track Classification:** Gas Pixel Detectors

Contribution ID: 17

Type: **Keynote talk**

## Advances in Position Sensitive Detectors for PET applications

*Thursday, 4 September 2008 16:10 (40 minutes)*

In 1985 the introduction of the block detector by Mike Casey and Ronald Nutt, changed the world of nuclear imaging. This invention has made possible high-resolution PET tomographs at a much-reduced cost. Almost all dedicated tomographs built since 1985 have used some forms of the block detector. In the last twenty years most of the additional improvement in PET technique was due to the introduction of new scintillating materials such as LSO and by the development of more powerful electronics and computing technologies. In the same years, Hamamatsu introduced the first large area position sensitive photomultiplier. The application of such technology opened new possibilities for the construction of dedicated high resolution PET apparatus in new emerging fields such as molecular medicine, gene therapy, breast cancer imaging and combined modalities. Since then, a wide range of new position sensitive photodetectors has been developed and used for PET applications: multi anode PMT's, Avalanche Photodiodes, Hybrid Photodiodes and, recently, Silicon Photomultipliers. Now some of these technologies are ready for the big step in the field of clinical PET replacing the original block detectors.

A brief historical review of the development of PET detectors and the recent advances are reported here. This paper also presents an overview of the near-future perspectives for PET and PET-MRI scanners with a special attention to the development of SiPMs and SiPM matrices.

**Primary author:** DEL GUERRA, Alberto

**Presenter:** DEL GUERRA, Alberto

**Session Classification:** PET applications

**Track Classification:** PET applications

Contribution ID: 18

Type: **Keynote talk**

## Pixel Detectors for Charged Particles

*Friday, 5 September 2008 09:00 (40 minutes)*

Pixel Detectors as the current technology of choice for the innermost vertex detection have now reached a stage where large detectors have been built for the LHC experiments and a new era of developments, both for hybrid and for monolithic and semi-monolithic pixel detectors is in full swing. This is largely driven by the requirements of the Super-LHC and by collider experiments which plan to use monolithic pixel detectors for the first time such as STAR at RHIC and Super-BELLE. The talk will give an overview over current developments on hybrid pixel detectors as well as on so-called active pixel detectors for particle tracking and vertexing including MAPS and DEPFET pixels.

**Primary author:** WERMES, Norbert (Physikalisches Institut)

**Presenter:** WERMES, Norbert (Physikalisches Institut)

**Session Classification:** Pixel Detectors for Charged Particles

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: **19**

Type: **Oral Contribution**

## **Micromegas tracker project for CLAS12**

*Tuesday, 2 September 2008 09:40 (20 minutes)*

Micromegas detectors on bulk are used in a new design of the central tracker for the future CLAS12 spectrometer in Hall B at Jefferson Lab. Performances, mechanical designs and behaviour in magnetic field are shown.

**Primary author:** BALL, Jacques (DAPNIA)

**Presenter:** BALL, Jacques (DAPNIA)

**Session Classification:** Applications in Nuclear Physics

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 20

Type: **Oral Contribution**

## Monolithic Pixel Sensors in 0.15um Fully Depleted SOI Technology

*Friday, 5 September 2008 09:40 (20 minutes)*

A monolithic pixel sensor has been design and fabricated in a novel deep-submicron 0.15 micron Silicon-On-Insulator (SOI) CMOS technology. This combines a thin layer of CMOS electronics isolated from a high-resistivity silicon substrate that can be depleted as in standard reversely-biased silicon detectors. The first prototype chip features arrays of analog and digital pixels of 10 micrometer pitch. Results from extensive testing performed with focused infrared lasers and high-energy particle beams are presented. The radiation hardness of the process has been characterised with low energy protons and neutrons.

The design of a new prototype will be discussed in relation to its potential applications in high-energy physics, electron microscopy and beam monitoring.

**Primary author:** Dr CONTARATO, Devis (Lawrence Berkeley National Laboratory)

**Presenter:** Dr CONTARATO, Devis (Lawrence Berkeley National Laboratory)

**Session Classification:** Pixel Detectors for Charged Particles

**Track Classification:** Pixel Detectors for Charged Particles



Contribution ID: 21

Type: **Poster**

## Positron spectrometer of MEG experiment at PSI

*Wednesday, 3 September 2008 15:10 (20 minutes)*

A new type of positron spectrometer for the MEG experiment has been developed at the Paul Scherrer Institute (PSI). The main goal of the experiment is a search for a lepton flavor violating decay  $\mu^+ \rightarrow e^+ \gamma$  with a sensitivity of  $10^{-13}$  in branching ratio in order to check the predictions of the supersymmetric extensions of the standard model. Measurements of the reactions beyond the standard model require specially designed detectors. The MEG positron spectrometer consists of a special superconducting solenoidal magnet and an ultimate low-mass drift chamber system. Recently, few commissioning experiments were performed. The spectrometer design and the first results of the commissioning runs will be presented.

**Primary author:** Prof. KISELEV, Oleg

**Presenter:** Prof. KISELEV, Oleg

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 22

Type: **Oral Contribution**

## Improved spatial resolution analysis of micron resolution silicon pixel detectors based on beam and laser tests

*Friday, 5 September 2008 10:00 (20 minutes)*

A new generation of track detectors for high energy physics are being designed for track recognition with submicron precision. Pixel detectors with micron resolution are a basic pre-requisite of such designs. With such precise detectors, however, the determination of spatial resolution becomes complicated because both multiple scattering and intrinsic detector errors contribute equally significantly to tracking errors.

This note is based on laser tests using pulsed 682 nm laser light and on data of DEPFET beam tests at CERN in 2006 and 2007. We used a new method to separate the contributions of intrinsic resolution, multiple scattering and track uncertainty to impact point prediction error, and used it in track analysis of beam tests. We compared several methods of impact point prediction correction (eta-correction) based either on beam test tracks or on laser matrix scans for a range of laser pulse energies. We show about 20% improvement in the resolutions calculated from the data of two DEPFET beam tests with different detector setup. We also show that eta-correction derived from laser tests can be applied in tracking.

**Primary author:** Dr KODYS, Peter (Charles University)

**Presenter:** Dr KODYS, Peter (Charles University)

**Session Classification:** Pixel Detectors for Charged Particles

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 23

Type: **Oral Contribution**

## The effect of protons on the performance of swept-charge devices

*Wednesday, 3 September 2008 13:50 (20 minutes)*

The e2v technologies CCD54, or swept-charge device (SCD) has been extensively radiation tested for use in the Chandrayaan-1 X-ray Spectrometer (C1XS) instrument, to be launched as part of the Indian Space Research Organisation (ISRO) Chandrayaan-1 payload in 2008. The principle use of the SCD is in X-ray fluorescence (XRF) applications, the device providing a relatively large collecting area of 1.1 cm<sup>2</sup>, and achieving near Fano-limited spectroscopy at -150C, a temperature that is easily obtained using a thermoelectric cooler (TEC). This paper describes the structure and operation of the SCD and details the methodology and results obtained from two proton irradiation studies carried out in 2006 and 2008 respectively, to quantify the effects of proton irradiation on the operational characteristics of the device. The analysis concentrates on the degradation of the measured FWHM of various elemental lines and quantifies the effects of proton fluence on the observed XRF spectra from mineralogical target samples.

**Primary author:** Prof. SMITH, David

**Presenter:** Prof. SMITH, David

**Session Classification:** Applications in Space Science

**Track Classification:** Applications in Space Science

Contribution ID: 24

Type: **Oral Contribution**

## **Fabrication and simulation of Novel Ultra Thin 3D Silicon Detector - Plasma Diagnostics**

*Wednesday, 3 September 2008 10:20 (20 minutes)*

A novel ultra thin silicon detector called U3DTHIN has been designed and built for applications that range from neutral particle analyzers (NPA) used in Corpuscular Diagnostics of High Temperature Plasma to very low X-Ray spectroscopy. The main purpose of this detector is to provide a state-of-the-art solution for the upgrade of the current detector system of the NPAs at JET and also to pave the road for the future detection systems of the ITER experimental reactor. Currently the NPAs are using very thin scintillator - photomultiplier tube, and their main drawbacks are poor energy resolution, intrinsic scintillator nonlinearity, and relative low count rate capability and finally poor signal-to-background discrimination for the low energy channels. The proposed new U3DTHIN detector is based on very thin sensitive substrate which will provide nearly 100% detection efficiency for ions and at the same time very low sensitivity for the neutron and gamma background

**Primary author:** Dr PELLEGRINI, Giulio (Centro Nacional de Microelectronica CNM-IMB-CSIC)

**Presenter:** Dr PELLEGRINI, Giulio (Centro Nacional de Microelectronica CNM-IMB-CSIC)

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 25

Type: **Poster**

## Development of new Atlas Pixel front-end IC for upgraded LHC luminosity

*Friday, 5 September 2008 10:40 (20 minutes)*

A new pixel Front-End (FE) IC is being developed in a 130nm technology for use in the upgraded Atlas pixel detector. The new pixel FE will be made of smaller pixels (50x250/200um vs. 50x400um for the present FE, FE-I3), a much improved active area over inactive area ratio, and a new analog pixel chain tuned for low power and new detector input capacitance. The higher luminosity for which this IC is tuned implies a complete redefinition of the digital architecture logic, which will not be based on End-of-Column data buffering but on local pixel logic and local pixel data storage. An overview of the new FE will be given with particular emphasis on the new digital logic architecture and possible architecture variations.

**Primary author:** Dr BARBERO, Marlon (Physikalisches Institute, Universitaet Bonn)

**Presenter:** Dr BARBERO, Marlon (Physikalisches Institute, Universitaet Bonn)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 26

Type: **Oral Contribution**

## Studies on Charge Collection Efficiencies for Planar Silicon Detectors after Doses up to $10^{15}$ neq/cm<sup>2</sup>

*Thursday, 4 September 2008 10:20 (20 minutes)*

Planar, segmented silicon sensors are used for the tracker and vertex detectors for high energy physics experiments at the Large Hadron Collider (LHC) because of their unsurpassed performance in terms of granularity, resolution and speed while offering relatively low mass. The planned luminosity upgrade of the Large Hadron Collider at CERN (Super-LHC, sLHC) will provide a challenging environment for these silicon tracking and vertexing detector systems. For the regions where silicon micro-strip detectors are envisaged in the sLHC ATLAS experimental upgrade, the expected particle fluence at the innermost microstrip layer is up to  $1 \times 10^{15}$  1 MeV neutron equivalent particles (neq) per square centimetre over the anticipated 5 year lifespan of the experiment, making the radiation hardening of the silicon detectors more important than ever.

We present studies of the charge collection efficiencies of various readout geometries (p+ strip in n-bulk, n+ strip in n-bulk, and n+ strip in p-bulk) as well as substrate types (float zone or magnetic Czochralski) after neutron irradiation up to  $1 \times 10^{15}$  neq per square centimetre. The charge collection efficiency measurements have been carried out using 128 channel analogue, high-speed (40MHz) electronics and a Strontium electron source. These measurements provide a reference of the expected collected charge by segmented devices at these extreme doses and give input to the design of the readout electronics necessary for the various micro-strip tracking subsystems planned to be used at the Super-LHC.

**Primary author:** Dr AFFOLDER, Anthony (University of Liverpool)

**Co-author:** ALLPORT, Phil (U. of Liverpool)

**Presenter:** ALLPORT, Phil (U. of Liverpool)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 27

Type: **Oral Contribution**

## In search of exotic events for positron emission tomography: a GAMMASPHERE experiment

*Thursday, 4 September 2008 17:30 (20 minutes)*

THE GAMMASPHERE is a unique facility for gamma-ray spectroscopy. The spherical array of 110 Compton-suppressed high-purity germanium (HPGe) detectors features a powerful combination of high sensitivity, resolution, granularity and efficiency. Many quantities previously not measurable became possible; breakthroughs continue to emerge across the fields of nuclear physics, particle physics and astrophysics. A GAMMASPHERE experiment to study rare events for positron emission tomography (PET) is an unprecedented luxury. This is true not only in terms of the solid angle and the gamma-ray detection characteristics, but also in terms of the amount of data that may be collected. The GAMMASPHERE provides multi-dimensional data hit-by-hit. We report our experiment carried out at the Argonne National Laboratory. Instead of the beam lines used for nuclear and particle physics, we used fluorine-18 in the form of fluoro-2-deoxyglucose (FDG, the most commonly used PET agent) as the radiation source. The experiment was repeated with biological samples of varying oxygen concentrations. We read the output file byte-by-byte without the use of sorting or analysis software, so that each step of the data processing is completely transparent. We analyse the data hit-by-hit; no hit is dismissed or filtered out unexamined. We present the multivariate correlation between various parameters (e.g. energy, time and angular correlation) as well as the breakdown of hit counts into various components (e.g. the number and the location of Compton-suppressed hits per germanium hit). We demonstrate the rare events (such as annihilations emitting gammas which are not colinear, not 511 keV and even not in pairs) which potentially revolutionise PET in terms of image reconstruction and molecular imaging.

**Primary author:** Dr CHIN, Mary**Presenter:** Dr CHIN, Mary**Session Classification:** PET applications**Track Classification:** PET applications

Contribution ID: 28

Type: **Oral Contribution**

## A prototype X-ray imaging system using pixelated energy resolving detectors

*Wednesday, 3 September 2008 10:00 (20 minutes)*

A prototype X-ray imaging system, using the principle of tomographic energy dispersive diffraction imaging (TEDDI) has been developed at the University of Manchester's School of Materials. The non-destructive 3D imaging system makes use of a state of the art collimator array and a pixelated Si energy resolving detector. A proof of concept for the system has successfully been carried out using metal, polymer and organic samples being exposed to a white X-ray beam from a synchrotron source. The new rapid TEDDI system is limited to thin, low density materials due to the low stopping power of Si at higher X-ray energies. In this presentation the results of substituting Si for CdZnTe as the active detection element and resulting limitations to the key parameters of energy resolution and count rate, for the detectors will be presented. A new ASIC and detector system for the rapid TEDDI measurements has been designed using our initial findings. This design will also be discussed.

**Primary author:** Prof. HANSSON, Conny

**Presenter:** Prof. HANSSON, Conny

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources



Contribution ID: 30

Type: **Oral Contribution**

## **Position Sensitive Scintillator Based Detector Improvements by Means of an Integrated Front-End**

*Tuesday, 2 September 2008 12:30 (20 minutes)*

PESIC is an integrated front-end for multianode photomultiplier based nuclear imaging devices. Its architecture has been designed to improve time behavior and increase spatial resolution. Its preamplifying stage introduces two main benefits: digitally programmable gain adjustment for every photomultiplier output, and isolation from other front-end electronics by means of current buffers. This last feature allows to use different types of photomultipliers such as SiPM and optimizes front-end deadtime, reducing impact position dependent output delay. PESIC includes an indirect measurement of the depth of interaction of the gamma ray inside the scintillator crystal, based on the width of its light distribution. Test measurements have been carried out in an experimental dual detector PET setup in order to quantify improvements due to front-end integration and detector calibration.

**Primary author:** Prof. HERRERO-BOSCH, Vicente

**Presenter:** Prof. HERRERO-BOSCH, Vicente

**Session Classification:** Applications in Nuclear Medicine and Radiology

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 31

Type: **Oral Contribution**

## **Avalanche photodiodes and Vacuum Phototriodes for the Electromagnetic Calorimeter of the CMS experiment at the Large Hadron Collider**

*Wednesday, 3 September 2008 17:10 (20 minutes)*

The Electromagnetic Calorimeter for the Compact Muon Solenoid (CMS) experiment at the CERN Large Hadron Collider (LHC) has lead tungstate crystals as the active medium. The photodetectors used to detect the scintillation light must be fast, sensitive, radiation-hard, and operate with significant internal gain in a 4T magnetic field for many years. CMS developed two different technologies to satisfy these requirements. In the central subsystem of the electromagnetic calorimeter 5x5 mm<sup>2</sup> silicon avalanche photodiodes (APD) are used. In the forward/backward regions, where the radiation levels are highest, single-gain-stage, photomultipliers (vacuum phototriodes (VPT)) are deployed. The design and performance characteristics of the custom-designed APDs and VPT are described, the techniques used to ensure radiation resistance and quality assurance of over one hundred thousand individual photodetectors are discussed, and the performance of the overall calorimeter is presented.

**Primary author:** HOBSON, Peter (Detector Development Group)

**Presenter:** HOBSON, Peter (Detector Development Group)

**Session Classification:** Novel Photon Detection Systems

**Track Classification:** Novel Photon Detection Systems

Contribution ID: 32

Type: **Oral Contribution**

## **Performance of a multi-anode photomultiplier employing a ultra bi-alkali photo cathode and ragged dynodes**

*Wednesday, 3 September 2008 14:10 (20 minutes)*

We report on the performance test of a multi-anode photomultiplier (MAPMT) R8900-M16-UBA newly developed by Hamamatsu Photonics K.K. A great advantage of R8900 series is a highly sensitive surface (> 80 % of physical area), but the quantum efficiency (QE) was relatively low (~ 20 %). In this paper, we have made two substantial changes on R8900-M16 : (1) to improve the QE to 40 % level, by employing a ultra bi-alkali (UBA) photo-cathode, and (2) to construct a ragged dynode which endure a vibration for future use in space. We measured each pixel signals at single photo-electron level and signals of scintillation photons using a 16-pixel plastic scintillator array. Thanks to high QE, good energy resolution of 29.9% (FWHM) was obtained for 59.5keV gamma-rays. Tolerance to the vibration in the possible launching vehicles will be also discussed.

**Primary author:** Mr TOIZUMI, Takahito**Presenter:** Mr TOIZUMI, Takahito**Session Classification:** Applications in Space Science**Track Classification:** Applications in Space Science

Contribution ID: 33

Type: **Oral Contribution**

## Photon detection with CMOS sensors for fast imaging

*Tuesday, 2 September 2008 16:50 (20 minutes)*

CMOS sensors are developed for high energy physics. They offer a unique optimization with respect to granularity, thickness, readout speed, radiation tolerance and power consumption. We focus here on photon imaging.

After a presentation of the general achievements of the MIMOSA sensors, we discuss the sensor ability to detect X rays of a few keV. We then turn to the back-thinned version of CMOS sensors associated with a photocathode. This new hybrid photo-detector, called EBCMOS, provides single visible photon counting and positioning with high resolution at large frame rates. Results obtained with the first EBCMOS produced in 2007 are shown and its first operations in fluorescence microscopy for biology reported. We conclude on the current developments to reach 1000 frames per second and beyond.

**Primary author:** BAUDOT, Jerome (Institut de Recherches Subatomiques (IReS))

**Presenter:** BAUDOT, Jerome (Institut de Recherches Subatomiques (IReS))

**Session Classification:** Position Sensitive Detectors for Biology

**Track Classification:** Position Sensitive Detectors for Biology

Contribution ID: 34

Type: **Oral Contribution**

## Active pixel sensors in nuclear medicine imaging

*Tuesday, 2 September 2008 14:30 (20 minutes)*

Three different Active Pixel Sensors provided through the MI-3 collaboration have been tested to assess their application to Nuclear Medicine Imaging. When coupled to a phosphor such as CsI(Tl) these sensors have the potential for high resolution imaging of radiotracers such as Tc-99m. The work carried out so far shows that the noise levels in the APS sensors needs to be as low as possible so that the signal from low energy gamma rays can be detected. Although the present level of noise is relatively high (between 25 electrons and ~100 electrons per pixel) the major component is fixed pattern in nature and can be removed from images. A simple method has been developed to differentiate between fixed pattern noise and statistical noise and this has been applied to data acquired with the sensors. So far images of simple structures show the potential for this device to become part of a larger system for imaging with sub-mm spatial resolution. Such a device would be useful for imaging small tumours and heart defects using appropriate radiotracers.

**Primary author:** Prof. OTT, Robert (Institute of Cancer Research)

**Presenter:** Prof. OTT, Robert (Institute of Cancer Research)

**Session Classification:** Applications in Nuclear Medicine and Radiology

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 35

Type: **Oral Contribution**

## **Image-transfer properties of a microCT system based on a flat panel detector**

*Tuesday, 2 September 2008 13:50 (20 minutes)*

A computed microtomography system (microCT) based on a CMOS flat panel detector (FPD) has been recently developed at Instituto de Fisica, UNAM, and is currently being characterised. The initial tests include the measurement of X-ray spectra using a CdTe detector, and the determination of the image transfer characteristics of the flat panel detector, such as linearity of response, MTF, noise and DQE. The alignment of the system is carried out with a specially build phantom using the method proposed by Noo et al. for cone beam irradiation geometry. Tomographic image reconstruction is performed with in-house developed programs based on the Feldkamp algorithm, and calibration in Hounsfield Units (HU) is carried out by means of a tissue-equivalent phantom. Finally, the dose performance of the system has been evaluated using TLD-100 chips and EBT GafChromic film, and the results have been compared with Monte Carlo simulations. In this work an overview of the main system characteristics is presented, with an emphasis on the image transfer characteristics of the flat panel detector.

**Primary author:** Dr MARTINEZ-DAVALOS

**Presenter:** Dr MARTINEZ-DAVALOS

**Session Classification:** Applications in Nuclear Medicine and Radiology

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 36

Type: **Oral Contribution**

## A new design of MPGD: Micro-Mesh Micro-Pixel Chamber

*Monday, 1 September 2008 11:30 (20 minutes)*

A novel MPGD “Micro-Mesh Micro-Pixel Chamber (M<sup>3</sup>-PIC) has been developed for particle imaging and/or TPC readout. The M<sup>3</sup>-PIC consists of a Micropixel chamber (u-PIC) and a thin micro mesh film. A point-like electric field is formed around the anode electrode which provides a higher gas gain and more stable operation than existing MPGDs. In addition, ion back flow (IBF) into the detection volume is strongly suppressed. A prototype of this detector (of size 3cm X 3cm) has been manufactured and successfully operated. Stable operation with a gas gain of more than  $5 \times 10^4$  was achieved using an Ar:Ethane = 50:50 gas mixture, and the measured IBF rate was less than 1%.

**Primary author:** OCHI, Atsuhiko (Department of Physics)

**Presenter:** OCHI, Atsuhiko (Department of Physics)

**Session Classification:** Novel Gas-based Detection Techniques

**Track Classification:** Novel Gas-based Detection Techniques

Contribution ID: 37

Type: **Oral Contribution**

## An investigation of the position resolution of the HOTWAX detector

*Monday, 1 September 2008 11:50 (20 minutes)*

The HOTWAXS detector has been available for use by the scientific community at the Daresbury SRS for the last 18 months on stations 9.3 and 2.1. A second system has also recently been commissioned on station I22 of the Diamond light source and is in routine use. The detector is based on Microstrip Gas Chamber (MSGC) technology and offers high counting rate, parallax free, photon counting detection with 512 independently instrumented position sensitive channels. The detector was designed to be used in the combined studies of X-ray absorption fine structure and X-ray diffraction (XAFS/XRD), and also in the technique of small angle and wide angle X-ray scattering (SAXS/WAXS). The energy range covered by stations I22 and 9.3 are very similar and vary from 6 to 30keV. The routine operation of the detectors is generally about 8keV using an Ar:DME gas mixture. This report demonstrates that in the higher energy range very significant gains in both detection efficiency and position (angular) resolution are achieved by moving to a Xenon based gas mixture.

**Primary author:** Dr DUXBURY, Dominic (RAL, STFC)

**Presenter:** Dr DUXBURY, Dominic (RAL, STFC)

**Session Classification:** Novel Gas-based Detection Techniques

**Track Classification:** Novel Gas-based Detection Techniques



Contribution ID: 38

Type: **Oral Contribution**

## Silicon Carbide X-ray Detectors for Planetary Exploration

*Wednesday, 3 September 2008 14:30 (20 minutes)*

Planetary exploration places high demands on instrumentation and presents some of the harshest operating environments including extreme thermal conditions, high radiation tolerance and low mass and power constraints. We present data on a novel detector, the Semi-Transparent SiC Schottky Diode (STSSD), which shows promising energy resolution (at 5.9 keV it was 1.5 keV Full Width at Half Maximum) at room temperature and good radiation tolerance for proton irradiation ( $\sim 10^{13}$  cm<sup>-2</sup>, energy  $\sim 50$  MeV). Future development of SiC detectors will lead to imaging spectroscopic arrays capable of meeting the stringent demands of future planetary exploration missions. We discuss the detector requirements necessary for use in the environment likely to be encountered in a mission to the Jovian system.

**Primary author:** Dr LEES, John

**Presenter:** Dr LEES, John

**Session Classification:** Applications in Space Science

**Track Classification:** Applications in Space Science

Contribution ID: 39

Type: **Oral Contribution**

## New micromegas detectors in the CAST experiment

*Thursday, 4 September 2008 14:10 (20 minutes)*

A low background Micromegas detector was operating at the sunrise side of the CAST (CERN Axion Solar Telescope) experiment during the first phase of the experiment (2002-2004). This detector, constructed of low radioactivity materials, operated efficiently and achieved a low background level of around  $5 \times 10^{-5}$  counts/keV/cm<sup>2</sup>/s in the 2-4 keV region. This performance was accomplished by exploiting the spatial and energy resolution of the detector as well as the time information contained in the pulse shape of the events. During the second phase of the experiment, the detector at the sunrise was replaced and upgraded by including a shielding. Moreover the old TPC covering the sunset side of the experiment was replaced by two new Micromegas detectors. These detectors belong to the newest generation of Micromegas detectors: 'bulk' and 'microbulk'. Performances and advantages will be presented.

**Primary authors:** Dr FERRER RIBAS, Esther (DAPNIA, Saclay); JAVIER, Galan Lacarra (Instituto de Fisica Nuclear y Altas Energias - Facultad de Cienc)

**Presenter:** JAVIER, Galan Lacarra (Instituto de Fisica Nuclear y Altas Energias - Facultad de Cienc)

**Session Classification:** Gas Pixel Detectors

**Track Classification:** Gas Pixel Detectors

Contribution ID: 40

Type: **Oral Contribution**

## Generation of Deep N-well CMOS MAPS with In-Pixel Sparsification for the ILC Vertex Detector

*Friday, 5 September 2008 10:20 (20 minutes)*

This work aims at discussing the design criteria and the characterization results relevant to a novel kind of monolithic active pixel sensors (MAPS) in deep submicron CMOS technology (130nm minimum feature size) for vertexing applications at the ILC. Compared to other CMOS MAPS, such devices implement pixel-level data sparsification and time stamping, with similar functionalities as in hybrid pixel sensors. The deep n-well (DNW) available in this CMOS generation is used to collect the charge released in the substrate, and pixel signal processing is performed by a classical optimum amplifying stage for capacitive detectors. This approach has been validated by the first prototype chip (SDR0) containing different test structures of 25x25um<sup>2</sup> pixels where both analog and digital functions have been integrated inside the elementary cell. A laser source has been used for the experimental characterization of the device properties in terms of charge diffusion among pixels. In the final paper, the experimental characterization of the prototype chip, including the calibration with soft X-rays (55Fe) and the response to beta-rays (90Sr), will be presented.

**Primary author:** Dr TRAVERSI, Gianluca (University of Bergamo)

**Presenter:** Dr TRAVERSI, Gianluca (University of Bergamo)

**Session Classification:** Pixel Detectors for Charged Particles

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 41

Type: **Oral Contribution**

## **DM-TPC: a TPC with optical readout for directional detection of dark matter**

*Monday, 1 September 2008 17:00 (20 minutes)*

We developed a TPC with optical readout with the goal of detecting the sense and direction of the elastic recoils generated by Dark Matter interactions. The detector, filled with CF<sub>4</sub> gas at low pressure, is equipped with a mesh-based amplification region that allows for a 2D imaging of the recoils in a CCD camera. The third coordinate of the recoil is provided by PMTs. The sense of the direction is determined by measuring the energy loss along the recoil track. The performance of this detector has been measured using alpha particles, low-energy neutrons, and x-rays. In particular, head-tail discrimination has been demonstrated for nuclear recoils down to  $\sim 100$  keV. The enhanced sensitivity to Dark Matter due to the directional measurement allows this detector to improve on the present limits on spin-dependent interactions with just a few kg-year of exposure.

**Primary author:** Prof. WELLENSTEIN, Herman

**Presenter:** Prof. WELLENSTEIN, Herman

**Session Classification:** Detectors for Astrophysics and Astro-Particle Physics

**Track Classification:** Detectors for Astrophysics and Astro-Particle Physics

Contribution ID: 42

Type: **Oral Contribution**

## Boron imaging with a microstrip silicon detector for application in BNCT

*Tuesday, 2 September 2008 14:10 (20 minutes)*

Boron Neutron Capture Therapy (BNCT) is a radiotherapeutic technique exploiting the alpha particles produced after the irradiation of the isotope  $^{10}\text{B}$  with thermal neutrons in the capture reaction  $^{10}\text{B}(n,\alpha)^7\text{Li}$ . It is used to treat tumours that for their features (radioresistance, extension, localization near vital organs) cannot be treated through conventional photon-beams radiotherapy. One of the main limitations of this technique is the lack of specificity (i.e. the ability of localizing in tumour cells, saving the healthy tissues) of the compounds used to carry the isotope  $^{10}\text{B}$  in the organs to be treated.

This work, developed in the framework of the INFN PhoNeS project, describes the possibility of boron imaging performed exploiting the neutrons photoproduced by a Linac (the Clinac 2100C/D of the S. Anna Hospital Radiotherapy Unit in Como, Italy) and detecting the alphas with a non-depleted microstrip silicon detector: the result is a 1D scan of boron concentration. Several boron doped samples have been analyzed, from solutions of  $\text{H}_3\text{BO}_3$  (reaching a minimum detectable amount of 25ng of  $^{10}\text{B}$  to biological samples of urine containing BPA and BSH (the two molecules currently used for the clinical trials in BNCT) and  $^{10}\text{BPA}$ -Fructose complex perfused human lung samples. Further measurements are under way to calibrate the system, in order to obtain an absolute value of boron concentration.

**Primary author:** Mr MATTERA, Andrea

**Presenter:** Mr MATTERA, Andrea

**Session Classification:** Applications in Nuclear Medicine and Radiology

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 43

Type: **Oral Contribution**

## Synchrotron x-ray applications of pixel/strip detectors at Diamond

*Wednesday, 3 September 2008 09:40 (20 minutes)*

A wide range of area and linear detectors have been commissioned on the synchrotron X-ray beamlines operating at the Diamond Light Source in UK. In addition to mature technologies such as Image-Plates, CCD/scintillator detectors, Multi-Wire and Micro-Strip Gas detectors, more recent detectors based on semiconductor pixel/strip sensors coupled to CMOS read-out chips are also in use for routine synchrotron X-ray diffraction and scattering experiments. The performance of several commercial and developmental pixel/strip detectors for synchrotron studies are discussed with emphasis on the image quality achieved with these devices. Examples of pixel/strip detector applications on Diamond Light Source X-ray beamlines as well as considerations on detector calibration and image correction are reported.

**Primary author:** Dr MARCHAL, Julien

**Presenter:** Dr MARCHAL, Julien

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 44

Type: **Oral Contribution**

## Development of large-area reverse-type APD arrays for high-resolution medical imaging

*Thursday, 4 September 2008 16:50 (20 minutes)*

Avalanche photodiode (APD) offers an advantage in weak scintillation detection, fast time response, as well as magnetic field insensitivity. We have developed large-area APD arrays with Hamamatsu photonics K.K, specifically designed for high resolution positron emission tomography (PET). Each device has a monolithic 16x16 (or 8x8) pixels structures with an active area of 1.0 (or 4.0) mm<sup>2</sup> for each pixel. We confirm excellent gain uniformity (< 10%), low dark-noise (< 0.3 nA) measured at room temperature. The energy resolution of 7.2 % (FWHM) was obtained for direct detection of 5.9 keV X-rays, while 10.2 % (FWHM) for 662 keV gamma-rays when coupling with LYSO matrix. An excellent time resolution of 102 ps (FWHM) was obtained for 16 keV X-ray beam. These results suggest these APD arrays can be a promising device for future applications in nuclear medicine.

**Primary author:** Dr KATAOKA, Jun

**Presenter:** Dr KATAOKA, Jun

**Session Classification:** PET applications

**Track Classification:** PET applications

Contribution ID: 45

Type: **Oral Contribution**

## Development of a low-noise analog front-end ASIC for APD-PET detectors

*Thursday, 4 September 2008 17:10 (20 minutes)*

We report on the development of the front-end ASIC for high spatial resolution PET detectors with time-of-flight capability based on LYSO scintillator arrays coupled with position-sensitive avalanche photodiode (APD) arrays. The ASIC is designed on the basis of the Open-IP LSI project led by JAXA and realized in TSMC 0.35um CMOS technology. It is composed 8 channels of charge sensitive amplifier, band-pass filters, differentiators, energy and timing discriminators, and 2 channels of time-to-amplitude converters. As a result, the energy resolution is 9.7% (FWHM) at 511 keV, and a time resolution is below 970 ps. We will also report on the current status of developing 2nd version ASIC which is designed to have 32 channels analog circuits with improved time resolution.

**Primary author:** Mr KOIZUMI, Makoto

**Presenter:** Mr KOIZUMI, Makoto

**Session Classification:** PET applications

**Track Classification:** PET applications



Contribution ID: 46

Type: **Oral Contribution**

## Characterisation of a pixellated CsI detector for gamma-ray imaging

*Tuesday, 2 September 2008 10:00 (20 minutes)*

The Distinguish collaboration is developing a technique capable of detecting and imaging hidden illicit substances such as explosives or narcotics in luggage and vehicles in transit [1]. To this end there is a requirement for a detection technique that is highly sensitive and highly specific. Pulsed Fast Neutron Analysis (PFNA) techniques [2] are used to stimulate the emission of characteristic gamma-rays, leading to the determination of the concentrations of the light elements (Oxygen –  $E_g = 6.13\text{MeV}$ , Carbon –  $E_g = 4.43\text{MeV}$ ) that are normally used as primary components of explosive materials. This work is based on the Compton Camera principle [3] which aims to produce a 3D image of sources located in space. Compton Camera measurements are to be undertaken using a planar High purity Germanium (Ge) detector for scattering and an 8 x 8 pixel Caesium Iodide (CsI) detector as an absorber that is coupled to a Hamamatsu H8500 multianode. The CsI has been scanned to measure and characterise its performance. Detector characterisation allows quantification of the position dependant response of such a device. Principles of the experiment, testing procedures and some initial Ge/CsI Compton Camera images will be presented.

[1] M. Farahmand et al. "Detection of explosive substances by tomographic inspection using neutron and gamma-ray spectroscopy", NIMB 261 (2007) 396-400

[2] Gozani, T., "Novel applications of fast neutron interrogation methods", Nucl. Instr. and Meth. A. 353 (1994) 635

[3] D. B. Everett, J. S. Fleming, R. W. Todd, and J. M. Nightingale, "Gamma-radiation imaging system based on the Compton effect", Proc. ZEE, Vol. 124, pp. 995-1000, 1977.

**Primary author:** Mr JONES, Martin

**Presenter:** Mr JONES, Martin

**Session Classification:** Applications in Nuclear Physics

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 47

Type: **Oral Contribution**

## **Design construction & characterisation of a benchtop microPET system based on LYSO crystal arrays & Hamamatsu H8500**

*Thursday, 4 September 2008 17:50 (20 minutes)*

A microPET system for small animal studies is currently being developed at Instituto de Fisica, UNAM. The main goal of this project is to build a cost-effective benchtop system that could be suitable for research purposes. The basic design uses off-the-shelf components and is being assembled using in-house built readout circuits and NIM electronics. In this work we are presenting the initial tests of the first detection modules that have been assembled. The modules are based on pixelated scintillator LYSO crystal arrays coupled to position sensitive photomultiplier tubes, with a resistive chain readout system. Pulse conditioning is performed with nuclear instrumentation modules, and its digitization is performed with a fast analog-to-digital data acquisition board. The uniformity, cross-talk and aperture function of the photomultipliers have been measured. The modules are able to identify individual crystals (out of 400) with a 4 to 1 peak-to-valley ratio. The measured energy resolution of  $^{22}\text{Na}$  spectra in individual crystals are between 7 and 15%, the dead time of the system is between 17 and 42  $\mu\text{s}$  depending on the source volume, and the resolving time is 1.16 +/- 0.01 ns. The detection modules were used to obtain the first tomographic images of a 30 g mouse with  $^{18}\text{F}$  sodium fluoride. The design and characterization of the system includes Monte Carlo simulations of the detectors.

**Primary author:** Dr RODRIGUEZ-VILLAFUERTE, Mercedes

**Presenter:** Dr RODRIGUEZ-VILLAFUERTE, Mercedes

**Session Classification:** PET applications

**Track Classification:** PET applications

Contribution ID: 48

Type: **Oral Contribution**

## The multidimensional integrated intelligent imaging project (M-I3)

*Wednesday, 3 September 2008 17:30 (20 minutes)*

M-I3 is a consortium of eleven universities and research laboratories whose mission is to develop complementary metal-oxide semiconductor (CMOS) active pixel sensors (APS) and to apply these sensors to a range of imaging challenges. A range of sensors has been developed: OPIC - designed for in-pixel intelligence; FPN - designed to develop novel techniques for reducing fixed pattern noise; HDR - designed to develop novel techniques for increasing dynamic range; Vanilla - with digital and analogue modes and regions of interest, which has also been backthinned; LAS - a novel stitched large area sensor; and eLeNA - which develops a ranges of low noise pixels. Applications being developed include: autoradiography, a gamma camera system, radiotherapy verification, tissue diffraction imaging, X-ray phase-contrast imaging DNA sequencing, electron microscopy.

**Primary author:** Dr EVANS, Phil

**Presenter:** Dr EVANS, Phil

**Session Classification:** Novel Photon Detection Systems

**Track Classification:** Novel Photon Detection Systems

Contribution ID: 49

Type: **Oral Contribution**

## TCT & test beam results of irradiated magnetic Czochralski silicon (MCz-Si) detectors

*Thursday, 4 September 2008 11:10 (20 minutes)*

Pad and strip detectors processed on high resistivity n-type magnetic Czochralski silicon were irradiated to several different fluences with protons. The pad detectors were characterized with Transient Current Technique (TCT) and the full-size strip detectors with a reference beam telescope and 225 GeV muon beam. The TCT measurements indicate a double junction structure and space charge sign inversion in MCz-Si detectors after  $5 \times 10^{14}$  neq/cm<sup>2</sup> fluence. In the beam test a S/N of 41 was measured for a non-irradiated MCz-Si sensor, S/N of 25 for a sensor irradiated with  $1 \times 10^{14}$  1 MeV neq/cm<sup>2</sup>, and a S/N of 19 for a sensor irradiated with  $5 \times 10^{14}$  1 MeV neq/cm<sup>2</sup>.

**Primary author:** Dr LUUKKA, Panja-Riina (Helsinki Institute of Physics HIP)

**Presenter:** Dr LUUKKA, Panja-Riina (Helsinki Institute of Physics HIP)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 50

Type: **Oral Contribution**

## The Atlas SCT: Commissioning experience and SLHC Upgrade

*Thursday, 4 September 2008 09:40 (20 minutes)*

The ATLAS SemiConductor Tracker (SCT) has been installed, and fully connected to electrical, optical and cooling services. Commissioning has been performed both with calibration data and cosmic ray events. The cosmics were used to align the detector, measure the hit efficiency and set the timing. The SCT is now ready to take data when the LHC turns on this autumn. At the same time, it is clear that the present ATLAS tracker will need to be renewed for projected luminosity upgrade of the LHC, the SLHC. This is mainly driven by occupancy and radiation hardness issues. The new tracker will likely be entirely made of silicon, with the space of the present SCT largely taken up by detectors with much shorter strips. Several large-scale R&D projects on the sensors and module concepts for this upgrade are running, including sensor and module prototyping. We will report upon the commissioning experience from the SCT, use it to extract valuable lessons for future silicon tracker projects, and give an up-to-date overview of the status and results of the R&D efforts for the ATLAS tracker upgrade.

**Primary author:** MITREVSKI, Jovan (Santa Cruz Inst. for Particle Phys. (SCIPP) - Univ. of California)

**Presenter:** MITREVSKI, Jovan (Santa Cruz Inst. for Particle Phys. (SCIPP) - Univ. of California)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 51

Type: **Oral Contribution**

## 3D detectors

*Thursday, 4 September 2008 11:30 (20 minutes)*

The luminosity upgrade of the LHC to the SLHC will mean a massive increase in radiation levels for the tracking detectors close to the interaction point. The development of ultra-radiation hard silicon detectors is required for the innermost tracking layers. One option for radiation-hard silicon sensors is the 3D technology, where columnar electrodes are etched deep into the silicon bulk. This means a short charge collection distance (counteracting radiation-induced charge trapping), and reduces the depletion voltage compared to planar sensor designs. We have developed and obtained 3D sensors from several sources, and will report on the designs and processing of the sensors. A large number of 3D sensors were studied in probe-station measurements. Several sensors, in particular 3D strip designs, have been connected to LHC-speed readout electronics, and were then tested with an IR-laser system, with a Sr90-beta-source setup and in a test beam at CERN. We will describe the results from these measurements, and draw conclusions on the maturity of the 3D technology as well as the feasibility to use it for SLHC tracking applications.

**Primary author:** PARZEFALL, Ulrich (Fakultaet fuer Physik)

**Presenter:** PARZEFALL, Ulrich (Fakultaet fuer Physik)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 52

Type: **Oral Contribution**

## Characterization of a 1-D perforated diode neutron detector array

*Wednesday, 3 September 2008 11:10 (20 minutes)*

Performance of a 4 cm long 32 pixel perforated diode neutron detector array is compared to an identical array of thin-film coated diodes. The perforated neutron detector design has been adapted to a 1-D pixel array capable of 120 micrometer spatial resolution and counting efficiency greater than 15%. Deep vertical trenches filled with  $^6\text{LiF}$  provide outstanding improvement in efficiency over thin-film coated diode designs limited to only 4.5%. The entire system including custom read-out electronics and user interface software is a result of collaborative efforts between Kansas State University, the University of Tennessee, and Oak Ridge National Laboratory. This work marks the final progressive step before a much larger array of 1024 pixels spanning across 10 cm will be constructed by tiling a 64 pixel sensor specifically for use in small-angle neutron scattering experiments at the Spallation Neutron Source of Oak Ridge National Laboratory.

**Primary author:** Mr MCNEIL, Walter

**Presenter:** Mr MCNEIL, Walter

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 53

Type: **Oral Contribution**

## Imaging performances of the DRAGO gamma camera

*Monday, 1 September 2008 18:00 (20 minutes)*

In this work, we present the results of the experimental characterization of the DRAGO gamma camera, developed within an Italian INFN project. This camera, based on the Anger camera topology, is based on a monolithic array of 77 Silicon Drift Detectors (SDDs), with an active area of 6.7 cm<sup>2</sup>, coupled to a single CsI(Tl) scintillator crystal, 5mm thick. The use of an array of SDDs allows to achieve a high quantum efficiency with respect to photomultiplier tubes and a very low electronics noise compared with respect to other conventional silicon photodetectors. The performances achieved in gamma-ray imaging using this camera are reported in this work. When imaging a 0.2mm collimated Co-57 source (122keV) a spatial resolution ranging between 0.25mm to 0.5mm has been measured. The depth-of-interaction capability of the detector, thanks also to a maximum likelihood reconstruction algorithm, has been also investigated by imaging a collimated beam tilted to an angle of 45° with respect to the scintillator surface.

**Primary author:** Prof. FIORINI, Carlo (Politecnico di Milano and INFN Italy)

**Presenter:** Prof. FIORINI, Carlo (Politecnico di Milano and INFN Italy)

**Session Classification:** Detectors for Astrophysics and Astro-Particle Physics

**Track Classification:** Detectors for Astrophysics and Astro-Particle Physics



Contribution ID: 54

Type: **Oral Contribution**

## The CMS pixel detector

*Friday, 5 September 2008 11:30 (20 minutes)*

The CMS Pixel Detector consists of three barrel layers closed by two forward/backward disks on each side of the interaction region, and provides a crucial contribution to pattern recognition, primary and secondary vertices reconstruction, as well as heavy flavour tagging. The sensors are n-on-n, with n+ implants on n bulk silicon, and a cell size of 100x150  $\mu\text{m}^2$ . The Lorentz drift of electrons inside the magnetic field of 4 T leads to charge spreading of the order of 150  $\mu\text{m}$  for unirradiated sensors of 300  $\mu\text{m}$  thickness in the barrel, therefore the charge is collected typically on more than one pixel. In the forward disks charge sharing is obtained by tilting the sensors by 20 in a turbine-like geometry. A novel technique is presented for the reconstruction and simulation of pixel hits. The technique requires a priori knowledge of the track angle, which makes it suitable for the second pass in a two-pass reconstruction algorithm. It was originally developed to optimally estimate the coordinates of hits after the detector has been damaged by radiation, but it turns out to have superior performance also before irradiation.

**Primary author:** Dr BLEKMAN, Freya (Cornell University)

**Presenter:** Dr BLEKMAN, Freya (Cornell University)

**Session Classification:** Pixel Detectors for Charged Particles

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 55

Type: **Oral Contribution**

## First Testbeam Results from the ISIS1 Detector

*Friday, 5 September 2008 12:10 (20 minutes)*

The ISIS (In-Situ charge storage Imaging Sensor) is a monolithic active pixel sensor with memory cells in each pixel. The memory cells are implemented as a CCD register. The device is a “burst camera” with charge being clocked simultaneously into the registers in each pixel. This makes the ISIS an excellent sensor for the ILC vertex detector for various reasons. The sensors can be made very thin while still retaining a high S/N ratio. The charge liberated by the passage of a particle is stored in potential wells inside the pixel and not amplified and sampled except outside the bunch-train, making the device less sensitive to EMI. The ISIS1 is a proof-of-principle ISIS device. In October 2007 we performed tests at the DESY e- beam-line with a telescope consisting of 5 ISIS1 sensors. The first test-beam results including S/N and position resolution will be shown.

**Primary author:** Dr CUSSANS, David (University of Bristol)

**Presenter:** Dr CUSSANS, David (University of Bristol)

**Session Classification:** Pixel Detectors for Charged Particles

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 56

Type: **Oral Contribution**

## Position sensitivity of the proposed segmented germanium detectors for the DESPEC project

*Tuesday, 2 September 2008 10:20 (20 minutes)*

The DESPEC HPGe array is a part of the NuSTAR project at FAIR, Germany. It is aimed at the spectroscopy of the decaying exotic nuclei stopped in the micro-strip silicon implantation detector AIDA. Segmented gamma-ray tracking detectors are proposed for this array in order to maximize detection efficiency and background suppression when searching for very rare events. Two types of detector modules – stacks of 3 16-fold segmented planar crystals and 12- and 16-fold segmented clover detectors – have been investigated and compared from the point of view of the achievable position resolution using pulse shape analysis (PSA). To this end, detector signals from realistic gamma-ray interactions have been calculated. These signals were treated by PSA in order to reconstruct the photon interaction locations. Comparing the initial interaction locations to the reconstructed ones, it was found the the double-sided strip planar detector yielded position reconstruction errors at least a factor 2 lower than the other detectors considered.

**Primary author:** Mr KHAPLANOV, Anton

**Presenter:** Mr KHAPLANOV, Anton

**Session Classification:** Applications in Nuclear Physics

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 57

Type: **Poster**

## A semiconductor compton camera system in SPECT mode

*Thursday, 4 September 2008 15:10 (20 minutes)*

This work describes the development of a dual layer Compton camera [1] to produce a 3D source image with a greater sensitivity than the mechanical collimation technique [2], presently used for SPECT (Single Photon Emission Computed Tomography) in medicine. The imaging of low energies is of particular importance as the current isotope of choice for SPECT in medicine is  $^{99m}\text{Tc}$ , emitting photons of 140 keV. The Compton camera technique requires good energy resolution and position sensitivity. Segmented semiconductor detectors were selected as they provide excellent energy resolution and with the application of Pulse Shape Analysis (PSA) [3], the ability to determine the position of interaction beyond that of the detectors segmentation. An initial system of two HPGe planar detectors, (active volume of each crystal is  $60 \times 60 \times 20\text{mm}^3$ ), resulted in a poor low energy imaging efficiency due to the crystal thickness. To overcome this, the front HPGe detector was replaced with a 0.5mm thick double sided silicon strip detector aiming to maximise the fraction of incident gamma rays scattering into the rear detector. Details of the characterisation measurements of the Silicon and Germanium detectors will be presented. Preliminary imaging results will be shown for the new Silicon/Germanium system and the previous Germanium/Germanium system [4], together with experimental details and efficiency comparison of both camera setups.

### References

- [1] M. Singh & D. Doria - An electrically collimated gamma camera for single photon emission computed tomography, *Med Phys.*, vol. 10 pp. 421-427, 1983
- [2] H. Anger. A new instrument for mapping gamma-ray emitters. *Biology and Medicine Quarterly Report UCRL*, 1957, 3653: 38. (University of California Radiation Laboratory, Berkeley)
- [3] K. Vetter, *NIM A* 452 (2000) 223
- [4] J. Gillam, School of Physics & Materials Engineering, Monash University, Australia

**Primary author:** Mr GRINT, Alexander

**Presenter:** Mr GRINT, Alexander

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 58

Type: **Oral Contribution**

## **X-ray detectors for Astronomy and Space Applications**

*Monday, 1 September 2008 17:40 (20 minutes)*

**Primary author:** Prof. HOLLAND, Andrew

**Presenter:** Prof. HOLLAND, Andrew

**Session Classification:** Detectors for Astrophysics and Astro-Particle Physics

**Track Classification:** Detectors for Astrophysics and Astro-Particle Physics

Contribution ID: 59

Type: **Poster**

## The GEM-based Neutron detector

*Tuesday, 2 September 2008 15:10 (20 minutes)*

The development and testing of a large area high count rate position-sensitive neutron detector based on Gas Electron Multiplier (GEM) is reported. With the use of  $^3\text{He}:\text{CF}_4$  gas mixture at atmospheric pressure, the detector is anticipated to have ~50% efficiency for cold neutrons, 5-10 mm spatial resolution, and to handle up to  $10^6 \text{ cm}^{-2}\text{s}^{-1}$  count rates, sufficient for intended applications with thermal and cold neutrons at IUCF Low Energy Neutron Source. A  $10 \times 10 \text{ cm}^2$  prototype detector with a cascaded triple-GEM structure and two-dimensional crossed-strip readout electrode giving a  $4 \times 4 \text{ mm}^2$  readout pixel size has been fabricated using industrially produced GEM foils and readout PCB. The prototype detector has been tested with electron and X-ray sources and demonstrated spatial resolution of 4 mm (single pixel). Tests of the prototype with neutron sources are on the way. This work has been supported by the National Science Foundation (under grants DMR-0220560 and DMR-0320627) and the 21st Century Science and Technology Fund of Indiana (Indiana University).

**Primary author:** Dr KLYACHKO, Alexadner

**Presenter:** Dr KLYACHKO, Alexadner

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Gas-based Detection Techniques

Contribution ID: **60**Type: **Poster**

## First particle results for the HEPAPS4 characterisation

*Wednesday, 3 September 2008 15:10 (20 minutes)*

Monolithic Active Pixel Sensors (MAPS) form a set of new detector technologies currently under study as possible vertex and tracking sensors to be used in future high energy physics (HEP) experiments. The most active research is being carried out as part of R&D for future e+e- colliders while such devices are also a possibility for vertexing at a neutrino factory near detector. Here presented are preliminary results for particle detection using the HEPAPS4 chip. The HEPAPS4 chip is a large area sensor of standard 3 CMOS type specifically designed for charged particle detection. This paper will report on the response of this device to charged particles from a 6GeV e-testbeam and a beta source. Presented are S/N and cluster size data with preliminary studies of telescope correlations.

**Primary author:** Mr LAING, Andrew

**Presenter:** Mr LAING, Andrew

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 61

Type: **Poster**

## Detection efficiency spatial and timing resolution of thermal and cold neutron counting MCP detectors

*Friday, 5 September 2008 10:40 (20 minutes)*

Neutron counting detectors with boron or gadolinium doped microchannel plates (MCPs) proved to have very high detection efficiency, spatial and temporal resolution and have very low read-out noise. In this paper we present the results of both theoretical predictions and experimental evaluations of detection efficiency and spatial resolution measured at cold and thermal neutron beamlines. The quantum detection efficiency of not fully optimized detector was measured to be 45% and 14% for the cold and thermal beamlines, respectively. The experiments also demonstrate that the spatial resolution can be as high as sub-15  $\mu\text{m}$  - highest achievable with the particular MCP pore dimension used in the experiment, although more electronics development is required in order to increase the counting rate capabilities of those 15  $\mu\text{m}$  resolution devices. The timing accuracy of neutron detection is on the scale of few  $\mu\text{s}$  and is limited by the neutron absorption depth in the detector. The good agreement between the predicted and measured performance allows the optimization of the detector parameters in order to achieve the highest spatial resolution and detection efficiency in the future devices.

**Primary author:** Dr TREMSIN, Anton

**Presenter:** Dr TREMSIN, Anton

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources



Contribution ID: 62

Type: **Poster**

## Application of Pulse Shape analysis to In-Beam EXOGAM data

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The aim of this work has been to investigate the performance of digital pulse shape analysis (PSA) [1] applied to improve the position resolution of EXOGAM [2] high purity Germanium (HPGe) clover detectors. Unlike arrays currently under development such as AGATA [3] and GRETA [4], EXOGAM was not designed for the implementation of PSA and as such is less suitable; however any improvement in performance that can be obtained will be of interest to the large number of nuclear physicists who continually use the array to collect experimental data. Pulse shape analysis is the process of gaining information about the position of an interaction in a detector by analysing the shape of the charge pulses produced. Two different PSA techniques have been used in this work, Image Charge Asymmetry (ICA) [5] and Risetime [6] analysis. The intrinsic position resolution of a segment in the detector is 14.5mm, with PSA the resolution varies from around 10mm in the most sensitive regions to around 12.5mm in less sensitive regions.

[1] R.M. Lieder et al. Nuc. Phys. A 682 (2001) 279c-285c.

[2] Characterisation of an EXOGAM clover germanium detector, Sebastien Alexandre Adrien Gros.

[3] D. Bazzacco, Nuc. Phys. A 746 (2004) 248c-254c.

[4] M.A. Deleplanque et al., NIM A430 (1999) 292-310.

[5] L.C. Milailescu and B. Cedarwall, NIM A550 (2005) 278-291.

[6] Th. Kroll et al. NIM A371 (1996) 489-496.

**Primary author:** Mr UNSWORTH, Carl

**Presenter:** Mr UNSWORTH, Carl

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 63

Type: **Oral Contribution**

## **Detectors for X-Ray Coherent Diffractive Imaging**

*Wednesday, 3 September 2008 11:50 (20 minutes)*

This paper presents the results of a trade study which looks at current and future requirements for detectors in coherent x-ray diffractive imaging. Several technologies are assessed against criteria, and observations about the challenges to soft x-ray detector science are discussed.

**Primary author:** Dr HALL, Christopher

**Presenter:** Dr HALL, Christopher

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 64

Type: **Poster**

## The prototype of the MICE Electron Muon Ranger: design, construction and test

*Wednesday, 3 September 2008 15:10 (20 minutes)*

MICE (Muon Ionization Cooling Experiment) and its goal to demonstrate the feasibility of ionization cooling represent the first step towards a neutrino factory. Muons in MICE are produced by pions which derive from the interaction of protons with a target. Being muons short lived particles, a special cooling procedure has to be developed, able to reduce quickly the emittance. MICE intends to measure the emittance value with a 0.1% accuracy before and after the cooling element; thus a detector able to reconstruct and identify individual particles is required. The presence of electrons due to the muons decay introduces a systematic error on the emittance and cooling measurements. For this reason a particle identification system is being developed based on a totally active scintillator tracker/calorimeter (EMR, Electron Muon Ranger). The detector consists of 50 planes of extruded scintillator bars 1m long and with a section of  $1.5 \times 1.9 \text{ cm}^2$ ; the bars are readout with 0.8mm WLS fibers coupled to multinode photomultipliers. The readout segmentation will be chosen accordingly to the rate (600 of good muons per 1ms spill every 1s). This paper describes the design, construction and test with cosmic rays of the first small size prototype of the EMR with full analog readout, consisting of 4x and 4y layers with 10 bars each with the final section and a length of 19cm.

**Primary author:** Ms LIETTI, Daniela

**Presenter:** Ms LIETTI, Daniela

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 65

Type: **Poster**

## Quantifying the limitations of small animal high-purity germanium PET based on Geant4 simulations

*Thursday, 4 September 2008 15:10 (20 minutes)*

The application of position sensitive semiconductor detectors in medical imaging is a field of global research interest. The Monte-Carlo simulation toolkit GEANT4 [1] was employed to better the understanding of detailed  $\gamma$ -ray interactions within the small animal Positron Emission Tomography (PET) imaging system, SmartPET [2]. The two SmartPET detectors [3] are planar, orthogonally segmented, high-purity germanium strip detectors which are mounted in a rotating gantry and operated in coincidence to perform positron emission tomography. This system has shown promising results in the field of PET [4] and Compton camera imaging [5]. Images for a selection of single and multiple point, line and phantom sources were successfully reconstructed using both a filtered back-projection [6] and an iterative reconstruction algorithm [6]. Techniques developed based on these data will be presented which allow inclusion of multiple interaction events into the image reconstruction, providing a strong argument for semiconductor PET. The simulated data were exploited as an alternative route to a reconstructed image allowing full quantification of the image distortions introduced in each phase of the data reconstruction. Quantifying the contribution of uncertainty in all system components from detector to reconstruction algorithm allows the areas in need of most attention on the SmartPET project and semiconductor PET to be addressed. The results shall be discussed in this contribution.

[1] <http://geant4.web.cern.ch/geant4/>

[2] A.J. Boston et al., An overview of the SmartPET project: Progress Report, oral contribution, Argonne National Laboratory, Chicago, USA (2006), <http://ns.ph.liv.ac.uk/~ajb/public/presentations/smartpet-overview-anl-may-2006.pdf>

[3] H.C. Boston et al., Nucl. Instr. and Meth. A (2007), doi:10.1016/j.nima.2007.04.017

[4] R.J. Cooper et al. in preparation for submission (2008)

[5] J.E. Gillam et al. Nucl. Instr. and Meth. A Vol 579 pp 76-79 (2007)

[6] A.R. Mather, PhD Thesis, Evaluation of the Planar Germanium SmartPET system for use in Positron Emission Tomography, University of Liverpool (2007)

**Primary author:** Mr OXLEY, David

**Presenter:** Mr OXLEY, David

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications

Contribution ID: 66

Type: **Poster**

## Reduction of multiple triggering in counting detectors

*Friday, 5 September 2008 10:40 (20 minutes)*

In detectors utilising microchannel plates as an amplification stage, there is a degree of charge cloud spreading within the microchannel plate stack and also between the microchannel plate stack and the readout device. This charge cloud spreading results multiple triggering within event counting detectors, leading to degradation of spatial resolution and statistical noise on the resultant spectrum. We present a scheme for reducing such multiple triggering based on a first-past-the-post voting circuit interposed between the charge amplifier/discriminators and the counters in an event counting detector.

**Primary author:** Dr LANGSTAFF, Dave (University of Wales, Aberystwyth)

**Presenter:** Dr LANGSTAFF, Dave (University of Wales, Aberystwyth)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 67

Type: **Poster**

## The Trigger system of the Alice Muon Spectrometer at LHC

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The forward muon spectrometer of the ALICE experiment aims at investigating the properties of strongly interacting matter at the extreme energy density reached in heavy ion collisions at LHC. The trigger system of the spectrometer consists of four planes of RPC (Resistive Plate Chamber) detectors operated in streamer mode, 21k front-end channels and fast-decision electronics, covering an area of 140 m<sup>2</sup>. It is designed to reconstruct (muon) tracks, in a large background environment, for providing a fast trigger signal. Indeed, a trigger decision is delivered each 25 ns (40 MHz) with a total latency of 800 ns. The hit position on the RPC is measured in two orthogonal dimensions with an accuracy of the order of 1 cm. Selected aspects of the design and of the installation, which has lasted from 2006 to 2007, of such a large device will be discussed. The performances, of both detectors and electronics, measured with dedicated test tools and cosmic rays during the commissioning runs carried out in the first half of year 2008 will be presented.

**Primary author:** DUPIEUX, Pascal (Laboratoire de Physique Corpusculaire (LPC))

**Presenter:** DUPIEUX, Pascal (Laboratoire de Physique Corpusculaire (LPC))

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 68

Type: **Poster**

## Modelling a Hybrid Pixel Detector for Coherent X-ray Diffractive Imaging

*Friday, 5 September 2008 10:40 (20 minutes)*

The emerging interest in coherent x-ray diffractive imaging (CXDI) is placing particular demands on position sensitive x-ray detectors. The technique typically requires a high efficiency, highly pixellated detector with a large dynamic range. CXDI is a good example of where hybrid pixel detectors will be a very competitive technology. The detector development group at the Monash Centre for Synchrotron Science are developing a hybrid pixel detector aimed at medical imaging. With some adaptation we believe it will be suitable for a CXDI detector. A Monte Carlo model of a silicon detector layer over an ASIC has been developed to allow exploration of this possibility. We report on the results of modelling low energy x-ray (0.5 to 5 keV) interactions in the proposed device.

**Primary author:** Mr CURWOOD, Evan

**Presenter:** Mr CURWOOD, Evan

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 69

Type: **Poster**

## Sensor concepts for future hybrid pixel detectors

*Wednesday, 3 September 2008 15:10 (20 minutes)*

Hybrid pixel detectors which will be operated in experiments after the luminosity upgrade of LHC, have to survive very high radiation doses up to  $10^{16}$   $1\text{ MeV } n_{eq}$  per  $\text{cm}^2$ . Therefore, new sensor concepts exceeding the radiation tolerance of the currently used DOFZ planar n-in-n silicon sensors are under investigation. Among them are 3D active edge silicon detectors, single crystal or polycrystalline chemical vapor deposition (CVD) diamonds or n-in-p planar processed silicon detectors on MCz or EPI p-type bulk material. These sensor concepts will be presented and their prospects will be discussed using the experience gained with prototype devices which were bump bonded to ATLAS pixel front-end electronics. Recent results coming from lab measurements or test beams will be shown.

**Primary author:** HUEGGING, Fabian Georg (Unknown)

**Presenter:** HUEGGING, Fabian Georg (Unknown)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics



Contribution ID: 70

Type: **Poster**

## CF4-filled micropattern detector aiming neutron imaging

*Tuesday, 2 September 2008 15:10 (20 minutes)*

The Micro Hole & Strip Plate (MHSP) operating in a CF<sub>4</sub> atmosphere aiming neutron imaging will be presented. Recent results of the MHSP operation in pure xenon have shown position resolutions of around 300 μm and gas gains well above 10<sup>4</sup> for tetrafluoromethane (CF<sub>4</sub>) at atmospheric pressure. CF<sub>4</sub> combined with <sup>3</sup>He is generally known as an efficient gas for proton and tritium stopping, produced in the nuclear reaction <sup>3</sup>He(n,p)T, as well as a low sensitive gamma medium. Using resistive lines for charge division deposited perpendicularly on each side of the MHSP, it is possible to determine where the nuclear reaction took place and to obtain the neutron image. Systematic studies of the position resolution and gas gain as a function of the CF<sub>4</sub> pressure up to 2.6 bar will be presented.

**Primary author:** Mr NATAL DA LUZ, Hugo

**Presenter:** Mr NATAL DA LUZ, Hugo

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Gas Pixel Detectors

Contribution ID: 71

Type: **Poster**

## Degradation of high resistivity FZ and Magnetic CZ N-type Silicon detectors subjected to 2-MeV Electron Irradiation

*Wednesday, 3 September 2008 15:10 (20 minutes)*

Particle tracking detectors made on high resistivity (HR) float zone (FZ) silicon are widely used in high energy physics experiments. Results from the CERN RD48 and RD50 collaborations have shown that diffusion oxygenated FZ (DOFZ) silicon can better withstand the high hadron fluences expected for 10 years operation of the Large Hadron Collider at CERN. Recently, new semiconductor industry interests and developments have enabled the production of magnetic Czochralski (MCZ) Si wafers with sufficiently HR and with a well-controlled high concentration of interstitial oxygen. In order to shed some further light on the behavior of the HR MCZ n-type material under electron irradiation, we investigate here the effects of 2 MeV electron irradiation, up to a fluence of  $5 \times 10^{16} \text{ e/cm}^2$ , on the electrical and carrier lifetime properties of p-on-n silicon diodes fabricated on different substrate materials, including high resistivity (HR) standard and oxygenated float zone, as well as HR magnetic Czochralski silicon. A progressive degradation of the characteristics is observed for all devices, pointing to a generation of bulk damage. Interestingly, a significant increase of the effective donor concentration is observed after the highest fluences for all materials. This degradation in the electrical properties should be taken into account for the use of these HR Si materials under high energy electron environments.

**Primary author:** Dr RAFI, Joan Marc**Presenter:** Dr RAFI, Joan Marc**Session Classification:** Poster Session 2 - PPE & Nuclear**Track Classification:** Applications in Particle Physics

Contribution ID: 72

Type: **Poster**

## **Analysis of time resolution in a dual head LSO+PSPMT PET system using low pass filter interpolation and DCFD techniques**

*Thursday, 4 September 2008 15:10 (20 minutes)*

A digital procedure is proposed in this work to improve time resolution in PET systems based in a low-pass filter interpolation plus a Digital Constant Fraction Discriminator (DCFD). It is analyzed the best way to implement this algorithm applied to our dual head PET system. Our detector uses two continuous LSO crystals each with a position sensitive PMT. Detector signals are adapted using an analog front-end to be processed in a digital acquisition board. A test bench has been developed to simulate the electronics and digital algorithms using Matlab. Results show that electronic noise and other undesired effects affect severally to the timing resolution. Interpolated DCFD has better results than not interpolated DCFD. For high errors, differences are reduced. An optimum DCFD delay selection also improves time resolution.

**Primary author:** Mr MONZO, Jose M**Presenter:** Mr MONZO, Jose M**Session Classification:** Poster Session 3 - Medical, PET and Biological**Track Classification:** PET applications

Contribution ID: 74

Type: **Poster**

## **Preliminary Monto carlo study of 18-FDG SPECT Imaging with a LaBr<sub>3</sub>@Ce Gamma Camera**

*Thursday, 4 September 2008 15:10 (20 minutes)*

The utility of 18F-deoxyglucose (18-FDG) in cardiology, oncology, and neurology has generated great interest in a more economical ways of imaging 18FDG than conventional PET scanners. The main thrust of this work is to investigate the potential use of LaBr<sub>3</sub>:Ce materials in a low-cost FDG-SPECT system compared to NaI(Tl) using GATE Monte Carlo simulation.. System performance at 140 keV and 511 keV was assessed using energy spectra, system sensitivity, intrinsic spatial resolution and count rate performance. The intrinsic spatial resolution results demonstrated the superiority of LaBr<sub>3</sub>:Ce crystals with respect to NaI(Tl) (e.g. 2.4 mm vs. 3.6 mm at 511 keV) . Comparison of the LaBr<sub>3</sub>:Ce and NaI(Tl) crystal-based systems showed 4.5% and 8.9% higher system sensitivity for the LaBr<sub>3</sub>:Ce at 140 keV and 511 keV, respectively. The LaBr<sub>3</sub>:Ce scintillator significantly improves intrinsic count rate performance due to its fast decay time with respect to the NaI(Tl). In conclusion, because LaBr<sub>3</sub>:Ce crystal combines excellent intrinsic count rate performance with slightly increased system sensitivity, it has the potential to be used for FDG-SPECT systems.

**Primary author:** Mr ALZIMAMI, Khalid

**Presenter:** Mr ALZIMAMI, Khalid

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 75

Type: **Poster**

## Simple parallel to serial stream converter for Active Pixel Sensor readout for experiment STAR

*Wednesday, 3 September 2008 15:10 (20 minutes)*

This paper will describe a new electronic module for conversion of parallel data flow to serial stream in USB2 full handshake mode (named in this paper as converter). The converter is used for investigation of active pixel sensors in NPI of ASCR and in LBL APS group. Readout DAQ software can be run on Win XP OS and Linux OS using this converter. GUI example for DAQ was prepared in Lab Windows and Lab View. The module was designed using virtual periphery concept and it can be easy adapted for many similar tasks for parallel to serial data stream conversion.

**Primary author:** KUSHPIL, Vasilii (Academy of Sciences of the Czech Republic (ASCR))

**Presenter:** KUSHPIL, Vasilii (Academy of Sciences of the Czech Republic (ASCR))

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 76

Type: **Poster**

## Optimisation of a Dual Head Semiconductor Compton Camera using Geant4

*Thursday, 4 September 2008 15:10 (20 minutes)*

Conventional gamma -camera systems utilise mechanical collimation to provide information on the position of an incident gamma-ray photon. Systems that use electronic collimation utilising Compton Image reconstruction techniques have the opportunity to offer huge improvements in detection sensitivity. Such systems have been previously limited by the relatively poor energy resolution of the detector material used in the camera. The University Of Liverpool Department Of Physics have been evaluating position sensitive High Purity germanium (HPGe) detector systems as part of a Single Photon Emission Computed Tomography (SPECT) gamma Compton Camera system. Data has been acquired from the SmartPET detectors, operated in Compton Camera mode. These orthogonally segmented planar detectors are designed for the energy range of small animal PET imaging [1]. The minimum in the energy range of the current system is 244keV [2] due to the 20mm thickness of the first scatter detector. This thickness of germanium causes a large proportion of gammas with energy less than 244keV to be completely absorbed in the detector, rather than scatter through it. Results are presented on the outcome of a Geant4 [3] simulation designed to optimise the geometry of a new germanium Compton Camera system for the energy range of medical applications.

[1] R.J. Cooper et al., Nuclear Instruments and Methods in Physics Research A 579 (2007) [2] H.C. Boston et al., IEEE Nuclear Science Symposium Conference Record (2006) [3] S. Agostinelli, Nuclear Instruments and Methods in Physics Research A 506 (2003) 250-303

**Primary author:** Ms HARKNESS, Laura

**Presenter:** Ms HARKNESS, Laura

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications

Contribution ID: 77

Type: **Oral Contribution**

## HEXITEC ASIC - a Pixellated Readout Chip for CZT Detectors

*Monday, 1 September 2008 15:30 (20 minutes)*

HEXITEC is a collaborative project with the aim of developing a new range of detectors for high energy X-ray imaging. High energy X-ray imaging has major advantages over current lower energy imaging for the life and physical sciences including improved phase contrast images on larger, higher density samples and with lower accumulated doses. However, at these energies conventional silicon based devices cannot be used, hence the requirement for a new range of high Z detector materials. Underpinning the HEXITEC programme are the development of a pixellated Cadmium Zinc Telluride (CZT) detectors, and a pixellated readout ASIC which will be bump-bonded to the detector. The HEXITEC ASIC is required to have low noise (20 electrons rms) and tolerate detector leakage currents. A prototype 20x20 pixel ASIC has been developed and is being manufactured. A description will be given of the design of the ASIC together with initial test results.

**Primary author:** JONES, Lawrence (STFC Rutherford Appleton Laboratory)

**Presenter:** JONES, Lawrence (STFC Rutherford Appleton Laboratory)

**Session Classification:** Applications in Astronomy and Astrophysics

**Track Classification:** Applications in Astronomy and Astrophysics

Contribution ID: 78

Type: **Poster**

## Imaging with pixellated CdZnTe detectors for use in a Portable Gamma-Ray Spectrometer (PorGamrayS)

*Thursday, 4 September 2008 15:10 (20 minutes)*

The PorGamRayS project is developing a proof of principle Portable Gamma Ray Spectrometer to perform Compton imaging in the energy range from 60keV to 2.0MeV. This novel detection system will be used for the remote imaging of the radiation field in a wide range of industrial and environmental applications. It will be constructed from a stack of room temperature semiconductors that will consist of two scatter detectors and five absorber detectors. The five absorbers will be constructed from Cadmium Zinc Telluride (CdZnTe). A series of scans with a 1mm collimated beam of 122keV gamma-rays, from a 0.2GBq  $^{57}\text{Co}$  source, has been performed on a selection of these detectors. This has enabled their position dependent response to be investigated. Each detector is bonded to a daughter board that also incorporates the read out electronics consisting of a multi-channel Application Specific Integrated Circuit (ASIC). Two ASICs have been tested for the project and their performances have been assessed. Three detectors have been arranged in a Compton camera configuration and a variety of sources have been imaged. The results from the detector scans, ASIC tests and source reconstructions will be presented.

**Primary author:** Mr DIMMOCK, Matthew

**Presenter:** Mr DIMMOCK, Matthew

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** Applications in Nuclear Medicine and Radiology



Contribution ID: 79

Type: **Poster**

## **A High Speed PC-Based Data Acquisition & Control System for Positron Imaging**

*Thursday, 4 September 2008 15:10 (20 minutes)*

A high speed PC-based data acquisition system for use with positron imaging systems (e.g. ECAT scanners designed by CTI / Siemens) is presented. This system replaces old dedicated hardware with a compact, flexible device with the same functionality and superior performance. Data acquisition rates of up to 80 MBytes per second allow coincidence data to be saved to disk for real-time analysis or post processing. The system supports the storage of time information with resolution of a half millisecond and remote trigger data support. Control of the detector system is provided by high-level software running on the same computer. A modular positron camera with a flexible geometry suitable for performing Positron Emission Particle Tracking (PEPT) studies on a wide range of applications has been constructed. This camera relies on the new data acquisition system for control, data capture and storage, and real time analysis of event data.

**Primary author:** Mr LEADBEATER, Thomas

**Presenter:** Mr LEADBEATER, Thomas

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications

Contribution ID: 80

Type: **Oral Contribution**

## Performance of an AGATA prototype detector estimated by Compton-imaging techniques

*Tuesday, 2 September 2008 11:30 (20 minutes)*

High-resolution  $\gamma$ -ray spectroscopy is one of the most powerful and sensitive tools to investigate Nuclear Structure. However, it is apparent that the present generation devices are not suited to the expected experimental conditions at the planned and under construction radioactive ion beam facilities. Devices with higher efficiency and sensitivity should be developed. The solution which has been proposed since the mid-nineties relies on the possibility to determine the position and the energy deposition of the individual interaction points of a photon within a germanium crystal, and on the capability to reconstruct the photon scattering sequence through powerful data analysis algorithms. The estimation of the performance obtainable in experimental conditions was done by two ways: using an in-beam experiment, extracting the information from the Doppler correction capabilities, and using Compton imaging technique, extracting the information from the quality of the produced images of the radioactive sources.

**Primary author:** Dr RECCHIA, Francesco**Presenter:** Dr RECCHIA, Francesco**Session Classification:** Applications in Nuclear Physics**Track Classification:** Applications in Nuclear Physics

Contribution ID: **81**Type: **Poster**

## Characterisation of HEPAPS4 - a family of CMOS active pixel sensors for charged particle detection

*Friday, 5 September 2008 10:40 (20 minutes)*

Monolithic active pixel sensor technology is a relatively inexpensive and reliable alternative to that of CCDs. Potential scientific applications of these devices include charged particle detection, indirect X-ray imaging and indirect neutron detection. This paper will report on the characterisation of three different sensor variants from the HEPAPS4 family. The sensors have identical 3MOS design but differ by the implementation of the photosensitive element. They have an array of 1024 x 384 pixels of 15 x 15  $\mu\text{m}^2$  with 20  $\mu\text{m}$  epi-layer. Photonic methods are used to measure conversion gain, linearity, signal to noise ration, dynamic range and pixel-to-pixel uniformity. In the noise analysis different contributing components such as reset noise, dark current and read noise are identified.

**Primary author:** Mr MANEUSKI, Dzmitry**Presenter:** Mr MANEUSKI, Dzmitry**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 82

Type: **Poster**

## Position sensitive detectors of the detector group at Jülich

*Friday, 5 September 2008 10:40 (20 minutes)*

The detector group of the Central Institute of Electronics at the Forschungszentrum Jülich GmbH was founded in 1968. First developments aimed at a detector system with a position sensitive BF<sub>3</sub> proportional counter for small angle neutron scattering, which was later used at a beamline of the research reactor FRJ2. At the end of the 70's first measurements were carried out with photomultiplier (PMT) based detector systems together with a LiI crystal from Harshaw. Based on this experience we started with the spectrum of position sensitive neutron scintillation detectors, which have been developed and designed in our institute during the last three decades comprising several high resolution linear and two dimensional detectors. The general design of those detectors is based on a modified Anger principle using an array of PMTs and a 1mm <sup>6</sup>Li glass scintillator. The sensitive detector area varies on the type of the PMTs used and is related to the spatial resolution of the detector type. The neutron sensitivity at 1  $\mu$  is about 65% and the rest gamma sensitivity is less than 10<sup>-4</sup> with a maximum count rate up to 500kHz depending on the used detector system.

**Primary author:** Mr ENGELS, Ralf

**Presenter:** Mr ENGELS, Ralf

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: **83**Type: **Poster**

## **FinnCRack a cosmic muon telescope for detector studies**

*Wednesday, 3 September 2008 15:10 (20 minutes)*

We present a cosmic rack, the FinnCRack. This device is a silicon strip detector based telescope that measures tracks of cosmic particles. FinnCRack is constructed using components of the Tracker Outer Barrel (TOB) of the CMS experiment at the CERN LHC. The FinnCRack provides temperature and humidity control. The data is analyzed using the official CMS analysis software package, CMSSW. The setup in FinnCRack has been designed to allow insertion of detectors to be tested into the middle of the device and integration of those detectors to the data acquisition. The setup can be used as a reference tracker in detector studies. The surface area in which reference is produced is approx. 1000cm<sup>2</sup>

**Primary author:** MAENPAA, Teppo (Helsinki Institute of Physics)

**Presenter:** MAENPAA, Teppo (Helsinki Institute of Physics)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 84

Type: **Poster**

## **Design and Operation of a 2d thin film semiconductor neutron detector for use as a beamport monitor**

*Friday, 5 September 2008 10:40 (20 minutes)*

Silicon based diodes coated with a thin film of neutron reactive materials have been shown to produce excellent low efficiency neutron detectors. This work employs the same technology, but groups 25 equally sized and spaced diodes on a single 29 mm by 29 mm chip. The 5x5 chips have been fabricated and coated with a thin film of  ${}^6\text{LiF}$  for use as a low efficiency neutron beam monitor. The 5x5 neutron detector array is coupled to an array of pre amplifiers allowing the response to be interpreted using a LabVIEW FPGA. The 5x5 array has been characterized in a diffracted neutron beam. This work is part of on-going research to develop various designs of high and low efficient semiconductor neutron detectors.

**Primary author:** Mr UNRUH, Troy

**Presenter:** Mr UNRUH, Troy

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 85

Type: **Poster**

## Delay-Line Readout Method Research

*Wednesday, 3 September 2008 15:10 (20 minutes)*

Delay-Line readout method is suitable for GEM detector in low-rate environment. According to the electric circuit model of delay-line and the output signal of GEM detector, we construct a full simulation model of delay-line readout system, containing delay-line readout PCB, Amplifier, Constant-fraction discriminator and Time-Digital converter. Three kinds of delay-lines, with the per cell time delay of 300ps, 600ps and 800ps in ideal condition, are selected. The corresponding test results are 360.8ps/cell, 458.6ps/cell and 654.7ps/cell in real case. The difference between experiments and design show that the affection of parasitical parameters of PCB route must be considered. By using the software of 2D Extractor (Ansoft Corporation), the time delay of the PCB route is calculated and a new electric circuit model of our delay-line PCB is developed. The simulation results of the new model are 353.1ps/cell, 454.9ps/cell and 656.8ps/cell, which are in good agreement with experiment. A GEM detector with 150um width readout stripes in 400um pitch, coupled with the Delay-line readout PCB (360.8ps/cell), is tested with an 8keV X-ray source. The position resolution of 240um is obtained.

**Primary author:** Dr ZHOU, Yi**Presenter:** Dr ZHOU, Yi**Session Classification:** Poster Session 2 - PPE & Nuclear**Track Classification:** Applications in Nuclear Physics

Contribution ID: 86

Type: **Poster**

## Hybrid Photon Detectors for the LHCb RICH: performance and operational experience

*Tuesday, 2 September 2008 15:10 (20 minutes)*

Pion/kaon discrimination in the LHCb experiment will be provided by two Ring Imaging Cherenkov (RICH) counters. These use arrays of 484 Hybrid Photon Detectors (HPDs) to detect the Cherenkov photons emitted by charged particles traversing the RICH. The HPD consists of a vacuum tube with a multi-alkali S20 photocathode deposited on the inside surface of a quartz entrance window, with the photoelectrons accelerated by a 20 kV voltage onto an anode consisting of an 8192 channel pixel silicon sensor. This paper will describe the results from comprehensive quality assurance tests on the 550 HPDs manufactured for LHCb. Furthermore, two extended measurements carried out on a sample of tubes will be described. One measurement determines the efficiency of the HPD pixel chip by measuring the summed analogue response from the backplane of the silicon sensor, and the other determines the quantum efficiency of the photocathode. Finally the operational experience gained during the installation and commissioning of the HPDs in the RICHs, and the current status there of the HPDs, will be detailed.

**Primary author:** CARSON, Laurence (Unknown)

**Presenter:** CARSON, Laurence (Unknown)

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Photon Detection Systems



Contribution ID: 87

Type: **Oral Contribution**

## First results of the PixelGEM central tracking system of COMPASS

*Thursday, 4 September 2008 14:30 (20 minutes)*

For its physics program with a high-intensity hadron beam of  $2 \times 10^7$  particles per second, the COMPASS experiment at CERN requires tracking of charged particles scattered by very small angles with respect to the incident beam direction. While good resolution in time and space is mandatory, the challenge is imposed by the high beam intensity, requiring radiation-hard detectors which add very little material to the beam path in order to minimize secondary interactions. To this end, a set of five triple-GEM detectors with  $1 \times 1 \text{ mm}^2$  pixels in the beam region and 2-D strips with a pitch of 400 micrometer in the periphery is currently being installed in the COMPASS spectrometer. First results of the performance of the full PixelGEM central tracking system in the COMPASS 2008 hadron beam run will be presented.

**Primary author:** HAAS, Florian (Technische Universitat Munchen)

**Presenter:** HAAS, Florian (Technische Universitat Munchen)

**Session Classification:** Gas Pixel Detectors

**Track Classification:** Gas Pixel Detectors

Contribution ID: 89

Type: **Poster**

## Improving Quantum Efficiency and Spectral Resolution of a CCD: Investigating Angle of X-ray Incidence

*Tuesday, 2 September 2008 15:10 (20 minutes)*

Improving the quantum efficiency (QE) and spectral resolution of X-ray sensitive charge-coupled devices (CCDs) for astronomy and planetary science applications is the primary focus of this work. These improvements are aimed at broadening the energy response of the detectors from 0.2 keV to >15 keV). Extending a the high energy response of a MOS (metal-oxide semiconductor) CCD can be achieved by increasing the depletion depth. High resistivity silicon, high dopant concentrations and high substrate voltages can all improve the high energy QE. A greater depletion depth results in a smaller number of registered multi-pixel events and, as such, also leads to an improvement in energy resolution for non-isolated event spectra. A third method of improving the QE of a CCD at higher X-ray energy is to increase the angle of incidence. An X-ray entering a sensor at a shallow angle travels through a greater region of depleted silicon and is therefore much more likely to interact in the depletion region. This study outlines the most recent work carried out at the University of Leicester focused on investigating the effect of changing the incidence angle of X-rays interacting with a CCD. A Monte Carlo model has been developed and used to investigate the effect of tilting a CCD on the quantum efficiency, energy resolution and multi-pixel event distribution as a function of angle. Experimental verification of the model is also presented.

**Primary author:** Mr BROWN, Craig

**Presenter:** Mr BROWN, Craig

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Applications in Space Science

Contribution ID: 90

Type: **Poster**

## **Large Active Rejection Detectors measuring ionization and heat simultaneously for the Edelweiss collaboration**

*Tuesday, 2 September 2008 15:10 (20 minutes)*

For events produced by betas, X and gammas rays underneath the surface of ionization and heat detectors, the collection of free charge carriers is poor. This is a strong limiting factor for Dark Matter research as WIMPs. For such events, electron recoils can indeed mimic nuclear recoils which generated by WIMPs. The solution is to localize of the interaction. This is the reason position sensitive detectors are developed for Edelweiss experiment.

In this paper we present the design of the two possible solutions of large active rejection detectors, and we report the result of the first data taking in the Frejus Underground Labs (LSM) in the Edelweiss-2 experiment with these detectors.

**Primary author:** Mr NAVICK, Xavier Francois

**Presenter:** Mr NAVICK, Xavier Francois

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Detectors for Astrophysics and Astro-Particle Physics

Contribution ID: 91

Type: **Poster**

## The use of automatic scale selection to improve the spatial and spectral resolution of a scintillator-coupled EMCCD

*Tuesday, 2 September 2008 15:10 (20 minutes)*

The technology behind the Electron-Multiplying Charge Coupled Device (EMCCD) was successfully exploited by e2v technologies in the late 1990s. Since then, many uses have been found for these low light level (L3) devices including surveillance and many scientific applications. The EMCCD increases or “multiplies” the charge signal by the phenomenon of impact ionisation (or avalanche multiplication) allowing the detection of low signal events of only a few photons. When coupled with a scintillator, this low light capability can be used to image photon flashes from individual X-ray interaction events. The combination of depth of interaction effects in the scintillator, shot noise on the signal and the multiplication noise factor lead to large variations in the profile of the detected signal from a constant energy X-ray source. This variation leads to poor spectral performance and can have adverse effects on the centering techniques used in photon-counting imagers. The concept of scale-space is similar in many ways to the Fourier or Wavelet Transforms. Automatic scale selection can be implemented through the scale-space transform as a method of fitting a known profile to the observed photon flash. The process is examined here in the context of the photon-counting EMCCD detector and the results obtained in both simulated and experimental data compared. Through the analysis of the fitting process and the results achieved, the implications on imaging performance and spectral resolution are discussed.

**Primary author:** Mr HALL, David

**Presenter:** Mr HALL, David

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Photon Detection Systems

Contribution ID: 92

Type: **Poster**

## Cellular Automaton Based Position Sensitive Detector Equalization

*Tuesday, 2 September 2008 15:10 (20 minutes)*

Indirect position detectors based on scintillator crystals don't have a spacial uniformity in their response. This happens due to crystal irregularities and gain differences between the photomultiplier anodes. In order to solve this, PESIC, an integrated front-end for multianode photomultiplier based nuclear imaging devices was created. One of its main features is the digitally programmable gain adjustment for every photomultiplier output.

On another front, Cellular Automata have been proved to be a useful method to create models of certain dynamic systems. In this paper we introduce a Cellular Automaton which emulates the behavior of the scintillator crystal and the photomultiplier. Thanks to this model we can make an automatic energy-based calibration of the crystal and the photomultiplier by configuring the Cellular Automaton with experimental results and making it evolve up to an stables tate. This can be useful for make a pre-calibration of the detector before to make a calibration of the full system.

**Primary author:** Mr FERRANDO, Nestor

**Presenter:** Mr FERRANDO, Nestor

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Photon Detection Systems

Contribution ID: 95

Type: **Poster**

## Maximum likelihood positioning for gamma ray imaging detectors with depth of interactions measurement

*Thursday, 4 September 2008 15:10 (20 minutes)*

The center of gravity algorithm leads to strong artifacts for gamma-ray imaging detectors that are based on monolithic scintillation crystals and position sensitive photo-detectors. This is a consequence of using the centroids as position estimates. The charge division circuits which are used to compute the centroids can also be used to compute the standard deviation of the scintillation light distribution. We studied the feasibility of maximum likelihood estimation for computing the true gamma ray photo conversion position from the centroids and the standard deviation of the light distribution. We used an analytic model for the scintillation light distribution based on the inverse square law for predicting the light response function of the scintillation detector and used this model together with maximum likelihood estimation to reconstruct the true impact positions from simulated photo-conversion events. Preliminary results were obtained with Monte Carlo simulation. These results suggest that the maximum likelihood positioning is feasible and partially removes the strong artifacts of the center of gravity algorithm. We also show that the method produces good estimates for the depth of interaction.

**Primary author:** Dr LERCHE, Christoph Werner (Universidad Politecnica de Valencia, Spain)

**Presenter:** Dr LERCHE, Christoph Werner (Universidad Politecnica de Valencia, Spain)

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications

Contribution ID: 96

Type: **Poster**

## A 4096-pixel MAPS device with on-chip data sparsification

*Friday, 5 September 2008 10:40 (20 minutes)*

A prototype of a mixed-mode ASIC built up of a fast readout architecture that interfaces with a matrix of 4096 Monolithic Active Pixel Sensor (MAPS), via STM 130nm CMOS technology, was fabricated. Square groups of 16 pixels form a macro-pixel (MP). Each MP can be latched via single pixels (50 by 50 micron) and a time-stamp is associated with the frozen condition. The readout architecture is parallel and could overcome the readout speed limit of big matrixes. As the output port can only accept one-hit information at a time, an internal queuing system has been provided to face local high hit-rates. The ASIC can be connected to an actual full-custom matrix of MAPS or to a digital matrix emulator composed of standard cells, for testing facilities. For both operating modes a slow-control phase is required to load the chip configuration via mask bits to select which MPs are to be read and which are not, for example in case they are too noisy or burned up. Previous versions of similar ASICs were designed and properly tested. The work is aimed at improving the design of MAPS detector with an on-chip fast sparsification system, for particle tracking, to match the requirements of future high-energy physics experiments. The readout architecture implemented is data driven extending the flexibility of the system to be also used in first level triggers on tracks in vertex detectors. Preliminary simulations and tests prove that the readout system can cope with an average hit rate up to 100 MHz/cm<sup>2</sup> if a master clock of 80 MHz is used, while maintaining an overall efficiency over 99%.

**Primary author:** Dr GABRIELLI, Alessandro (Dipartimento di Fisica Università di Bologna)

**Presenter:** Dr GABRIELLI, Alessandro (Dipartimento di Fisica Università di Bologna)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 98

Type: **Oral Contribution**

## The role of position sensing in adaptive optics

*Monday, 1 September 2008 14:30 (20 minutes)*

Adaptive Optics systems measure and correct dynamic optical distortions, often atmospheric turbulence, to improve overall system performance. Such systems have grown from their astronomical inception in 1953 to cover many fields including ophthalmology, high power lasers, communication, optical storage and astronomy.

There are many different systems but common to all is the need to measure optical distortions. often at high spatial resolutions and kilohertz rates. Various forms of optics such as the Shack-Hartmann sensor are used to develop optical turbulence into patterns of moving light that may be sensed and processed to drive the corrective mirrors.

Initially vidicon CRT technology was used, being replaced by many forms of position sensing detectors including QPDs, APDs, fibre coupled PMT arrays and MCP devices. Modern astronomical systems are converging on the use of CCD sensors often with on-chip electron multiplying gain, driven by the need for high framerate and spatial resolution at extremely low light levels, while CMOS sensors hold promise for higher light level applications. In this talk an overview of sensors in modern adaptive optics, looking at the benefits of moving to image sensors , and what further development may occur.

**Primary author:** Dr SAUNTER, Christopher (University of Durham)

**Co-author:** Dr LOVE, Gordon (University of Durham)

**Presenter:** Dr SAUNTER, Christopher (University of Durham)

**Session Classification:** Applications in Astronomy and Astrophysics

**Track Classification:** Applications in Astronomy and Astrophysics



Contribution ID: 99

Type: **Poster**

## Optical & Electrical Characterization of a backthinned CMOS Active Pixel Sensor

*Tuesday, 2 September 2008 15:10 (20 minutes)*

This work will report on the first work on the characterisation of a backthinned Vanilla - a 512x512 (25um squared) active pixel sensor. For some time, it has been predicted that the removal of the supporting substrate section of the sensor to allow detection via direct backside illumination would result in many potential benefits to applications in fields such as particle physics (lower mass) and biomedical science (enhanced UV detection). However, whilst common practice in CCDs, such backthinning techniques have been rarely used on Active Pixel Sensors. In this work, on wafer Vanilla sensors were backthinned (by E2V) to within a few microns into the epi-layer. Characterisation of the detectors was carried out through the analysis of Photon Transfer Curves to yield a measurement of full well capacity, noise levels, gain constants and linearity. Spectral characterisation of the sensors was also performed in the Visible and UV regions. A full comparison against non backthinned front illuminated Vanilla sensors is included.

**Primary author:** Dr BLUE, Andrew (University of Glasgow)

**Presenter:** Dr BLUE, Andrew (University of Glasgow)

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Photon Detection Systems

Contribution ID: **100**Type: **Poster**

## Characterization of double-sided 3D Medipix 2 detectors

*Friday, 5 September 2008 10:40 (20 minutes)*

3D detectors are photodiode detectors with n- and p-type electrode columns passing through a silicon substrate. Using this structure, the spacing between electrodes can be made much smaller than the substrate thickness, greatly reducing the collection time and operating voltage of the sensor. The structure should also reduce charge sharing between adjacent pixels, improving the image quality. A variation of the 3D design is the 'double sided' configuration, where neither set of electrodes passes through the full substrate thickness. A set of double-sided 3D detectors with full Medipix2 geometry have been fabricated, bump bonded to readout chips, and connected to the USB interface for Medipix detectors developed by IEAP-CTU (Prague). The sensors have been tested using different radioactive sources and the results have been compared to those of a standard planar detector.

**Primary author:** Dr FLETA, Celeste (University of Glasgow)

**Presenter:** Dr FLETA, Celeste (University of Glasgow)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Pixel Detectors for Charged Particles

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

## Performance results from the first ZEPLIN-III science run

*Monday, 1 September 2008 17:20 (20 minutes)*

ZEPLIN-III is a position-sensitive liquid xenon time projection chamber which is currently collecting data in a deep underground laboratory at Boulby in North Yorkshire, UK. It's science goal is the direct detection of Galactic dark matter particles and it is specifically designed to be sensitive to neutralinos predicted by supersymmetry. We will present results on instrument performance including energy resolution, position reconstruction and particle species identification.

**Primary author:** ARAUJO, Henrique (Unknown)

**Presenter:** ARAUJO, Henrique (Unknown)

**Session Classification:** Detectors for Astrophysics and Astro-Particle Physics

**Track Classification:** Detectors for Astrophysics and Astro-Particle Physics

Contribution ID: 102

Type: **Oral Contribution**

## Electron multiplication CCDs for astronomical applications

*Monday, 1 September 2008 14:50 (20 minutes)*

Electron multiplication CCDs have been commercially available for the last few years but have yet to make wide impact in the astronomical community. They have specifically been designed to use an avalanche gain process during the serial charge transfer to give sub-electron read out noise. In all other respects they are identical to the very latest generation of CCDs. They have been used with good success in 'lucky' imaging, for adaptive optics systems and also in high speed faint object spectroscopy science programs. The sub electron read noise makes them an obvious choice for any observation which is normally detector noise limited. We will present a detailed summary of the typical performance and characteristics of these devices and compare and contrast their performance against standard low noise astronomical CCDs. We will also present modelled and real data for these detectors with particular regard to some of their lesser know issues such as clock induced charge. Finally we will present results from real world astronomical testing which shows the superior performance of these devices.

**Primary author:** Dr DEREK, Ives**Presenter:** Dr DEREK, Ives**Session Classification:** Applications in Astronomy and Astrophysics**Track Classification:** Applications in Astronomy and Astrophysics

Contribution ID: 103

Type: **Oral Contribution**

## Photon counting microstrip detector for time resolved powder diffraction experiments

*Friday, 5 September 2008 11:50 (20 minutes)*

The MYTHEN detector is a silicon microstrip detector with single photon counting readout developed for powder diffraction experiments at the Swiss Light Source. A one dimensional 30k channels system covering 120 degrees has been installed at the Material Science beamline and is being used for users operation since the end of 2007. Due to its massively parallel detection of X-rays and fast readout, it is optimized for time-resolved or dose-critical measurements that can be performed in fractions of a second on the whole angular range. The intensity of the synchrotron radiation source can be exploited thanks to the high counting rate capability. Promising results have been obtained also for other synchrotron radiation applications like imaging and pump and probe experiments. The detector characteristics will be described in detail and its outstanding performances will be shown.

**Primary author:** Dr BERGAMASCHI, Anna**Presenter:** Dr BERGAMASCHI, Anna**Session Classification:** Pixel Detectors for Charged Particles**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 104

Type: **Poster**

## Low-afterglow CsI:Tl microcolumnar films for small animal high-speed microCT

*Thursday, 4 September 2008 15:10 (20 minutes)*

Dedicated high-speed microCT systems are being developed for noninvasive screening of small animals. Such systems require scintillators with high spatial resolution, high light yield, and minimal persistence to ensure ghost free imaging. Unfortunately however, afterglow associated with the microcolumnar CsI:Tl scintillator screens used in current high speed systems introduce image lag, leading to substantial artifacts in reconstructed images, especially when the detector is operated at several hundreds of frames per second. At RMD, we have discovered that the addition of a second dopant, Eu<sup>2+</sup>, to the CsI:Tl crystals, suppress the afterglow by as much as a factor of 20 at 2 ms after a short excitation pulse of 20 ns, and by as much as a factor of 15 at 2 ms after a long excitation pulse of 100 ms. Our observations, supported by theoretical modeling, indicate that Eu<sup>2+</sup> ions introduce deep electron traps that alter the decay kinetics of the material, making it suitable for many high-speed imaging applications. Here we report on the fabrication and characterization of microcolumnar CsI:Tl,Eu films to examine if the afterglow properties of CsI:Tl,Eu crystals are preserved in the films as well. Preliminary results indicate that the co-doped microcolumnar films show a factor of 3 improvement in the afterglow compared to the standard CsI:Tl films. The effects of the codopant on the performance of the newly fabricated microcolumnar films, and their suitability for high-speed microCT will be discussed in the paper.

**Primary author:** Dr SINGH, Bipin**Presenter:** Dr SINGH, Bipin**Session Classification:** Poster Session 3 - Medical, PET and Biological**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: **105**Type: **Poster**

## Status of the CMS Silicon Strip Tracker and commissioning results

*Wednesday, 3 September 2008 15:10 (20 minutes)*

With a total area of more than 200 square meters, about 15000 silicon modules, and nearly 10 million readout channels, the CMS Silicon Strip Tracker is by far the largest silicon strip detector ever built. Together with the pixel detector, it measures the momentum of charged particles, and plays a major role in lepton identification and heavy quark tagging. The detector has been integrated and commissioned in a dedicated assembly hall on the surface, prior to the installation in CMS; up to 15% of the silicon modules have been operated simultaneously, at different temperatures, including the nominal temperature of -10C. Several million cosmic muon tracks have been recorded using a dedicated trigger system. The achievements of this commissioning phase are discussed in detail, including: development of operation procedures, data acquisition and detector control software; evaluation of the intrinsic detector performance, refinement of the tracker reconstruction and alignment software. The Tracker has been subsequently installed in the pit, and will be taking data with CMS at the time of the conference.

**Primary author:** ANGHEL, Ioana Maria (University of Illinois at Chicago)

**Presenter:** ANGHEL, Ioana Maria (University of Illinois at Chicago)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 106

Type: **Poster**

## **Feasibility study of high sensitive LaBr<sub>3</sub> PET scanner based on the DOI-dependent extended-energy window**

*Thursday, 4 September 2008 15:10 (20 minutes)*

Conventionally, PET scanners are used for the scintillator has high effective atomic number. Recently, novel scintillators like LaBr<sub>3</sub> have excellent timing and energy resolutions were developed. LaBr<sub>3</sub> has high performance for the PET scanner, but effective atomic number is lower than LSO. On the other hand, we developed the scatter reduction method using depth-of-interaction (DOI) information and energy information for high sensitivity. Sensitivity of the PET scanner with LaBr<sub>3</sub> can be improved using this method. In this work, our method is applied to the whole-body DOI-PET scanner with the LSO/LaBr<sub>3</sub> phoswich detector using GATE . From simulation results, the number of true coincidences can be increased while keeping low scatter and low random coincidences by using the DEEW method. NECR can be improved by 20-60 % for the whole-body DOI-PET scanner. Using the DEEW method, sensitivity of the PET scanner with low effective atomic number can be improved.

**Primary author:** Dr YOSHIDA, Eiji (National Institute of Radiological Sciences)

**Presenter:** Dr YOSHIDA, Eiji (National Institute of Radiological Sciences)

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications



Contribution ID: 107

Type: **Oral Contribution**

## Advances in the photodetection technologies for Cherenkov imaging applications

*Wednesday, 3 September 2008 16:50 (20 minutes)*

The impressive development of novel photodetectors for Cherenkov imaging devices has allowed to achieve the very demanding hadron identification performance required to study CP violation in B meson decays and to assure a successful operation in the very harsh environment produced by colliding lead nuclei head-on at the unprecedented energies of the LHC collider. However, the design of the forthcoming generation of Cherenkov imaging detectors will have to adapt to the more exacting conditions at future accelerators entailing the capability to stand very high event rates and radiation doses. These challenges ahead require new ideas in photodetection technologies.

**Primary author:** Dr NAPPI, Eugenio (INFN Sezione di Bari)

**Presenter:** Dr NAPPI, Eugenio (INFN Sezione di Bari)

**Session Classification:** Novel Photon Detection Systems

**Track Classification:** Novel Photon Detection Systems

Contribution ID: **109**Type: **Oral Contribution**

## CMS Tracker upgrade issues and plans

*Thursday, 4 September 2008 10:00 (20 minutes)*

The LHC accelerator complex will undergo a program of consolidation and upgrade of various components, with goal of exceeding a peak luminosity of 1034 (original design figure) around the year 2013, to eventually reach values close to 1035. Such luminosity upgrade poses new challenges to the detector operation, both in terms of instantaneous and integrated rates. In CMS the systems that have been identified to need substantial upgrade are the tracker and the level 1 trigger (other aspects are under study). The tracking system needs higher readout granularity and higher radiation tolerance, while moderating power dissipation and material budget, which are already limiting the performance of the present detector. The trigger system needs to include tracking information at the level 1, to maintain an acceptable rate without losing efficiency on physics channels, which ultimately results in further challenges for the design of a new tracker detector and its readout architecture.

We give an overview of the options under study to design a tracker that can cope with the enhanced requirements for what concerns choices of silicon sensors, readout architecture, powering schemes, cooling technologies, detector layouts.

**Primary author:** DIERLAMM, Alexander (University of Karlsruhe)

**Presenter:** DIERLAMM, Alexander (University of Karlsruhe)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: **110**Type: **Poster**

## Image Charge Multi-Role and Function Detectors

*Tuesday, 2 September 2008 15:10 (20 minutes)*

The Image-Charge technique used with image tubes provides several operational and practical benefits by serving to isolate the electronic image readout from the detector. The simple dielectric interface between detector and readout provides vacuum isolation and no vacuum electrical feed-throughs are required. Since the readout is mechanically separate from the detector, an image tube of generic design can be simply optimised for various applications by attaching it to different readout devices and electronics. We present imaging performance results using a single image tube with a variety of readout devices suited to differing applications: a) A four electrode charge division tetra wedge anode, optimised for best spatial resolution in photon counting mode. b) A cross delay-line anode, enabling higher count rate, and the possibility of discriminating near co-incident events, and an event timing resolution of better than 1 nanosecond. c) A multi-anode readout connected, either to multi channel oscilloscope for analogue measurements of fast optical pulses, or alternately, to a multi-channel time correlated single photon counting (TCSPC) card.

**Primary author:** Dr MILNES, James**Presenter:** Dr MILNES, James**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors**Track Classification:** Novel Photon Detection Systems

Contribution ID: 111

Type: **Oral Contribution**

## Position Sensitive Electron Detection for TEM with column parallel CCD

*Tuesday, 2 September 2008 17:10 (20 minutes)*

A number of electron detectors for transmission electron microscopes (TEM) are being developed to overcome limitations of existing imaging cameras, i.e. poor modulation transfer, low efficiency, slow frame rate and limited dynamic range. A variety of new detection modes is being considered with these new detectors, but which will provide optimum performance? This work presents beam tests performed with a fast column parallel CCD detector developed by the Linear Collider Flavour Identification for particle detection at the ILC and uses custom data analysis to reproduce and compare three modes of operation: integrating imaging camera, binary active pixel sensor and position sensitive electron detection. These tests demonstrate that best performance is obtained with position sensitive detection, where filtering can be employed to remove clusters of large lateral displacement.

### Summary

Slides not uploaded at authors request - AP 2008/09/02

**Primary author:** Dr MOLDOVAN, Grigore

**Presenter:** Dr MOLDOVAN, Grigore

**Session Classification:** Position Sensitive Detectors for Biology

**Track Classification:** Position Sensitive Detectors for Biology

Contribution ID: 112

Type: **Poster**

## **Profile monitors for pulsed antiproton beams used by the ASACUSA experiemnt at Cern's antiproton decelerator**

*Friday, 5 September 2008 10:40 (20 minutes)*

Several types of profile monitors used to measure the spatial and temporal profiles of pulsed antiproton beams at the Antiproton Decelerator (AD) facility of CERN is described. These include a highly sensitive, secondary electron emission chamber, a parallel plate ionization chamber, and a Lucite Cherenkov counter. These monitors were recently used in laser spectroscopy experiments of antiprotonic helium atoms.

**Primary author:** Dr HORI, Masaki

**Presenter:** Dr HORI, Masaki

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 113

Type: **Poster**

## Reborn quadrant anode image sensor

*Tuesday, 2 September 2008 15:10 (20 minutes)*

We describe position and time sensitive photon counting microchannel plate detector with improved quadrant anode readout system. The technique relies on a combination of the four planar elements pattern and an additional fifth electrode. The charge cloud induced by the event is split between the electrodes. The measured charge values uniquely define the position of the initial event. Quadrant anode has been first published in 1976 by Lampton and Malina. This anode type was undeservedly forgotten and its potential has been hardly underestimated. Presented approach extends the working spatial range to the whole sensitive area of the microchannel plate surface and demonstrates good linearity over the field of view. The resulting spatial resolution is better than 50 microns over the whole field of view in combination with less than 130 picoseconds temporal resolution for 25 mm detector diameter at count rates up to one million events per second.

**Primary author:** Mr PROKAZOV, Yury

**Presenter:** Mr PROKAZOV, Yury

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Photon Detection Systems

Contribution ID: 114

Type: **Oral Contribution**

## The GLAST Large Area Telescope

*Wednesday, 3 September 2008 14:50 (20 minutes)*

The Gamma-ray Large Area Space Telescope (GLAST) is a next generation high-energy gamma-ray observatory designed to explore the sky over more than four energy decades (20 MeV–300 GeV) with unprecedented sensitivity and resolution. The Large Area Telescope (LAT), the main instrument on board GLAST, is a pair conversion telescope designed and built exploiting the state of the art in high-energy physics detector technology; a significant fraction of the advance in sensitivity (roughly a factor of 30) over the predecessor CGRO-EGRET instrument, is in fact accomplished by means of the largest and by far most complex (70 square meters of Silicon Strip Detectors for a total of almost 1 million of channels) Silicon Tracker ever built for a space mission. With the launch date now firmly established for the beginning of June 2008, this is a particularly exciting moment for the whole collaboration. The first two months of operation will be devoted to a carefully planned calibration activity, which will prepare the instrument for the real science data taking phase, continuing over the following 5–10 years. The operation experiences, as well as the highlights from this initial on-orbit verification phase, will be presented in this talk.

**Primary author:** Dr BALDINI, Luca**Presenter:** Dr BALDINI, Luca**Session Classification:** Applications in Space Science**Track Classification:** Applications in Space Science

Contribution ID: 115

Type: **Poster**

## High-Precision Position Estimation in PET using Artificial Neural Networks

*Thursday, 4 September 2008 15:10 (20 minutes)*

Traditionally, the most popular technique to predict the impact position of gamma photons on a PET detector has been Anger's logic. However, it introduces nonlinearities that compress the light distribution, reducing the useful field of view and the spatial resolution, especially at the edges of the crystal scintillator. In this work we make use of neural networks to address a bias-corrected position estimation from real stimulus obtained from a 2D PET system setup. The preprocessing and data acquisition were performed by separate custom boards, especially designed for this application. The results show that neural networks yield a more uniform field of view while improving the systematic error and the spatial resolution. Therefore, they stand as better performing and readily available alternative to classic positioning methods.

**Primary author:** MATEO, Fernando (Universidad Politécnic de Valencia)

**Presenter:** MATEO, Fernando (Universidad Politécnic de Valencia)

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications



Contribution ID: **116**

Type: **Poster**

## **Recent results on the performance of irradiated LHCb VELO detectors**

*Wednesday, 3 September 2008 15:10 (20 minutes)*

New results on the performance of n+n and n+p LHCb VELO sensors are presented. Special attention is given to the study of systematic biases in reconstructed cluster positions due to irradiation, and their potential impact on LHC physics.

**Primary author:** BOWCOCK, Themis (Department of Physics)

**Presenter:** BOWCOCK, Themis (Department of Physics)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 117

Type: **Oral Contribution**

## Instrumentation for sub-mm astronomy

*Monday, 1 September 2008 15:10 (20 minutes)*

Sub-mm astronomy has seen an explosive growth in recent years. This has been driven by improvements in detector technology, and in particular the move from single pixel instruments to ones containing arrays of hundreds and even thousands of pixels. Sub-mm detectors are different from those used in astronomy at most other wavelengths in that they are not produced commercially. Instead, research, development and construction is carried out in universities and government laboratories. We are also at an interesting point in that several competing detector technologies are under development and it is not yet clear which will be used in future instruments. I will discuss current instruments as well as the issues facing us in developing the next generation of instruments, operating both on the ground and from space.

**Primary author:** Dr WOODCRAFT, Adam**Presenter:** Dr WOODCRAFT, Adam**Session Classification:** Applications in Astronomy and Astrophysics**Track Classification:** Applications in Astronomy and Astrophysics

Contribution ID: 118

Type: **Poster**

## The Detective Quantum Efficiency of Electron Area Detectors

*Thursday, 4 September 2008 15:10 (20 minutes)*

Recent progress in detector design has created the need for a careful side-by-side comparison of the modulation transfer function (MTF) and resolution-dependent detective quantum efficiency (DQE) of existing electron detectors, including film, with detectors based on new technology. We will present the results of measurements of the MTF and DQE of several detectors at 120 and 300ke. MTF and DQE measurements for 300 keV electrons will be presented for three detectors, viz. film, CCD and MAPS and Medipix2 at 120 keV. Computer simulations have also been carried out, showing good agreement with the experimental results. We will conclude that the DQE to be expected from direct detection by back-thinned CMOS designs is likely to be equal to or better than film at 300 keV.

**Primary author:** Dr FARUQI, Wasi

**Presenter:** Dr FARUQI, Wasi

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** Position Sensitive Detectors for Biology

Contribution ID: **119**Type: **Poster**

## Sensor R&D for CMS Tracker upgrade

*Wednesday, 3 September 2008 15:10 (20 minutes)*

For the luminosity upgrade of the LHC, CMS is starting ambitious and diversified sensor research and development projects. The increased particle fluence implies more stringent requirements on the radiation hardness; the increased occupancy requires higher granularity; the need of moderating the material budget while increasing the number of readout channels suggests the use of thinner detectors. Different silicon bulk materials and detector concepts are investigated. Two 6-inch multi-project wafers with two different companies are in the planning, containing dedicated strip, short strip and pixel structures; the materials under investigation are floatzone n-type, floatzone p-type, Magnetic Czochralski n- and p-type, with different thicknesses. Other projects are studying n- and p-type epitaxial structures, as well as non-planar methods like Silicon-On-Insulator and 3D structures. In parallel with the research on the sensors, different connection concepts are evaluated, especially relevant for the short strip detectors.

**Primary author:** Dr KOYBASI, Ozhan**Presenter:** Dr KOYBASI, Ozhan**Session Classification:** Poster Session 2 - PPE & Nuclear**Track Classification:** Applications in Particle Physics

Contribution ID: 120

Type: **Poster**

## The CMS Tracker Detector Control System

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The CMS Silicon Strip Tracker is by far the largest detector ever built in this technology, with an active surface of of 206 m<sup>2</sup>, 9648128 readout channels on 75376 APV front-end chips, 15232 silicon modules, built out of 24328 sensors. The Tracker Control System (TCS) is a distributed control software to operate ~2000 power supplies for the silicon modules of the CMS Tracker and monitor its environmental sensors. The TCS receives information from about 103 environmental probes (temperature and humidity sensors) located inside the detector volume and driven through the Programmable Logic Controllers of the Tracker Safety System (TSS), 105 parameters read out via the data acquisition system from dedicated chips in the front-end electronics, and 105 parameters from the power supply modules. Such information is monitored, evaluated and correlated with the detector layout; actions are taken under specific conditions; the system includes 10 PCs and 10 PLCs that are continuously running the necessary control and safety routines. The DCS is a fundamental tool for the Tracker operation and its safety; the first operation experience will be presented at the conference.

**Primary author:** SHAH, Yousaf**Presenter:** SHAH, Yousaf**Session Classification:** Poster Session 2 - PPE & Nuclear**Track Classification:** Applications in Particle Physics

Contribution ID: **121**Type: **Poster**

## Commissioning of the atlas pixel detector

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The Pixel Detector is a key component of the inner tracking detector of ATLAS, constructed to allow precision tracking of charged particles and vertexing. The ATLAS pixel detector system contains approximately 80 million channels and 1744 detector modules, has been already installed in its final position inside ATLAS and is ready for the first beams of the Large Hadron Collider at CERN. The detector is being commissioned with cosmic rays. The overall status of the detector will be presented, emphasizing its performance measured during commissioning and early operation.

**Primary author:** GOLLING, Tobias (LBNL)**Presenter:** GOLLING, Tobias (LBNL)**Session Classification:** Poster Session 2 - PPE & Nuclear**Track Classification:** Applications in Particle Physics

Contribution ID: 122

Type: **Poster**

## Electrical properties of the sensitive side in Si edgeless strip detectors developed for TOTEM Experiment

*Wednesday, 3 September 2008 15:10 (20 minutes)*

Microstrip edgeless silicon detectors have been successfully produced and tested. These detectors are fabricated with standard planar technology, reach full sensitivity in 50  $\mu\text{m}$  from the cut edge and can operate with high bias at room temperature. These detectors employ a newly conceived terminating structure, which, although is extremely reduced with respect to the conventional ones, still prevents the breakdown and the surface current injection at high bias. Moreover they are fully efficient up to a fluence of about  $1.5 \times 10^{14}$  p  $\text{cm}^{-2}$ , if operated with moderate cooling. The mass production of these detectors for the TOTEM Experiment has been successfully completed. Their installation in the Roman Pots is ongoing and will allow the TOTEM Experiment to detect leading protons at  $10^\circ$  from the beam at the LHC.

**Primary author:** Dr VERBITSKAYA, Elena

**Presenter:** Dr VERBITSKAYA, Elena

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 123

Type: **Poster**

## **GASTONE a new ASIC for the cylindrical GEM Inner Tracker of KLOE experiment at DAFNE**

*Tuesday, 2 September 2008 15:10 (20 minutes)*

A mixed analog-digital ASIC prototype named GASTONE (GEM Amplifier Shaper Tracking ON Events) designed in the CMOS AMS 0.35um technology has been developed to specifically readout the cylindrical GEM inner tracking detector built as improvement of the KLOE apparatus at the e+e- DAFNE collider. The analog part of the ASIC is characterized by a very low power dissipation of 1.32 mW/channel for our specific application and by an equivalent input noise charge (ENC) of 1200 e- + 45 e-/pF achieved for a supply current of 100 uA in the input transistor. A prototype with only 16 readout channels has been developed whereas a final version will implement a total of 64 channels for the final detector readout. The results of the measurements obtained on a cylindrical mono-dimensional GEM prototype by using cosmic muons and a proton beam test performed at CERN instrumented with GASTONE device, will be shown.

**Primary authors:** Dr RANIERI, Antonio (INFN Bari); LODDO, Flavio (Univ. + INFN)

**Presenter:** Dr RANIERI, Antonio (INFN Bari)

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Gas-based Detection Techniques



Contribution ID: 124

Type: **Oral Contribution**

## High spatial resolution probes for neurobiology applications

*Tuesday, 2 September 2008 17:30 (20 minutes)*

Position-sensitive biological neural networks, such as the brain and retina, require position-sensitive detection methods to identify, map and study their behaviour. Traditionally, planar microelectrodes have been employed to record the cells electrical activity, with device limitations arising from the electrodes 2-D nature. Described here is the development and characterisation of an array of electrically conductive micro-needles aimed at addressing the limitations of planar electrodes. The capability of this array to penetrate neural tissue improves the electrode-cell electrical interface and allows more complicated, 3-D networks of neurons, such as in the brain, to be studied. State-of-the-art semiconductor fabrication techniques were used to etch, passivate, conformally metal coat and fill high aspect ratio holes in silicon. These are subsequently transformed in to needles with conductive tips. This process has enabled the fabrication of arrays of unprecedented dimensions: 61 hexagonally close-packed electrodes, up to 150um tall, with 60um spacing. Electroplating the tungsten tips with platinum ensures suitable impedance values (~300 kOhm at 1 kHz) for the recording of neuronal signals. Without compromising spatial resolution of the neuronal recordings, this array adds a new and exciting dimension to the study of biological neural networks.

**Primary author:** Dr GUNNING, Deborah (The University of Glasgow)

**Presenter:** Dr GUNNING, Deborah (The University of Glasgow)

**Session Classification:** Position Sensitive Detectors for Biology

**Track Classification:** Position Sensitive Detectors for Biology

Contribution ID: 125

Type: **Oral Contribution**

## A new generation of GEM detectors and their applications

*Monday, 1 September 2008 12:10 (20 minutes)*

We have developed a new generation of GEM-like detectors with double layered electrodes instead of commonly used metallic ones: with an inner layer consisting of thin metallic strips and an outer layer made of resistive grid manufactured by a screen printing technology. By measuring signals induced by avalanches on the inner strips one can obtain 2-D information about the position of the avalanches. The resistive grid makes the detector intrinsically spark protected: in the case of sparks the resistive layer restricts their current and thus the destructive power. The new detectors have several other advantages: they operate at ten times higher gains than conventional GEMs, have compact planar geometries, can operate in electronegative gases and so on, and this is why we believe that they will find a wide range of applications. As examples we will describe results of some experiments demonstrating that new GEMs can be used in RICH and for the readout of noble liquid TPCs.

**Primary author:** PESKOV, Vladimir (Pole Universitaire Leonardo de Vinci)

**Presenter:** PESKOV, Vladimir (Pole Universitaire Leonardo de Vinci)

**Session Classification:** Novel Gas-based Detection Techniques

**Track Classification:** Novel Gas-based Detection Techniques

Contribution ID: 127

Type: **Oral Contribution**

## Planar Edgeless Silicon Detectors for the TOTEM Experiment

*Thursday, 4 September 2008 12:10 (20 minutes)*

Microstrip edgeless silicon detectors have been successfully produced and tested. These detectors are fabricated with standard planar technology, reach full sensitivity in 50  $\mu\text{m}$  from the cut edge and can operate with high bias at room temperature.

These detectors employ a newly conceived terminating structure, which, although is extremely reduced with respect to the conventional ones, still prevents the breakdown and the surface current injection at high bias. Moreover they are fully efficient up to a fluence of about  $1.5 \times 10^{14}$  p  $\text{cm}^{-2}$ , if operated with moderate cooling.

The mass production of these detectors for the TOTEM Experiment has been successfully completed. Their installation in the Roman Pots is ongoing and will allow the TOTEM Experiment to detect leading protons at  $10\sigma$  from the beam at the LHC.

**Primary author:** Dr RUGGIERO, Gennaro (CERN)

**Presenter:** Dr RUGGIERO, Gennaro (CERN)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 128

Type: **Oral Contribution**

## Positron emission particle tracking using a modular positron camera

*Thursday, 4 September 2008 18:10 (20 minutes)*

The technique of positron emission particle tracking (PEPT), developed at Birmingham in the early 1990s, enables a radioactively-labelled tracer particle to be accurately tracked as it moves between the detectors of a positron camera. In 1999 the original Birmingham positron camera, which consisted of a pair of MWPCs, was replaced by a system comprising two NaI(Tl) gamma camera heads operating in coincidence. This system has been successfully used for PEPT studies of a wide range of granular and fluid flow processes. More recently a modular positron camera has been developed using a number of the BGO block detectors from standard PET scanners (CTI ECAT 930 and 950 series). This camera has flexible geometry, is transportable, and is capable of delivering high data rates. This paper presents initial experience of its use in a range of geometries and applications.

**Primary author:** Dr PARKER, David (University of Birmingham)

**Presenter:** Dr PARKER, David (University of Birmingham)

**Session Classification:** PET applications

**Track Classification:** PET applications

Contribution ID: 129

Type: **Oral Contribution**

## Development of multi-tubes detectors at the ILL

*Monday, 1 September 2008 12:30 (20 minutes)*

The construction of bidimensional tube-array detectors at the ILL, in particular the one for the SANS instrument D22, allowed to develop a purpose-built charge division electronics and to explore others structures having similar detection principles. One of these is the so-called Multitube in which, instead of having independent position sensitive tubes held together by a mechanical support, the stainless steel tubes are welded on both ends to 2 common flanges, sharing the same gas volume. Several of these detectors have been built and installed; the instrument IN5 at the ILL will soon be equipped with 12 multitube modules of 32 tubes each, covering a total sensitive area of about 30 m<sup>2</sup>. Another development is the Monobloc Multitube, made out of a single Aluminum bloc, with channels machined by wire-cut EDM; the channels can have almost any shape, the front window can be a few mm thick and the separation walls between channels can be as thin as 0.5 mm. The first of these detectors will be installed on the new reflectometer FIGARO at the ILL, and 2 more will be fabricated, one for the modernization of D17 and another one for the construction of the SANS instrument D33.

**Primary author:** Dr MANZIN, Guiliana**Presenter:** Dr MANZIN, Guiliana**Session Classification:** Novel Gas-based Detection Techniques**Track Classification:** Novel Gas-based Detection Techniques

Contribution ID: 130

Type: **Oral Contribution**

## **Radiation Hardness Studies of Polycrystalline & Single-crystal Chemical Vapor Deposition Diamond for High Luminosity Tracking Detectors**

*Thursday, 4 September 2008 11:50 (20 minutes)*

With the commissioning of the LHC expected in 2008, and the LHC upgrades expected in 2012, ATLAS and CMS are planning for detector upgrades which require radiation hard technologies. Chemical Vapor Deposition (CVD) diamond has been used extensively in beam conditions monitors as the innermost detectors in the highest radiation areas of BaBar, Belle and CDF and is now planned for all LHC experiments. This material is now being discussed as an alternate sensor material for use very close to the interaction region of the super LHC where the most extreme radiation conditions will exist. Recently the RD42 collaboration constructed, irradiated and tested polycrystalline and single-crystal chemical vapor deposition diamond detectors to the highest fluences available. In this paper we present beam test results of chemical vapor deposition diamond up to fluences of  $1.8 \times 10^{16}$  protons/cm<sup>2</sup> which shows that both polycrystalline and single-crystal chemical vapor deposition diamonds follow a single damage curve allowing one to extrapolate their performance as a function of dose. We will also present the beam test results of irradiated diamond strip detectors which function quite well after a fluence of  $1.5 \times 10^{15}$  p/cm<sup>2</sup>.

**Primary author:** KAGAN, Harris (Ohio State University)

**Presenter:** KAGAN, Harris (Ohio State University)

**Session Classification:** Applications in Particle Physics

**Track Classification:** Applications in Particle Physics

Contribution ID: 131

Type: **Oral Contribution**

## A novel large-volume spherical detector with proportional amplification read-out

*Thursday, 4 September 2008 14:50 (20 minutes)*

A new type of radiation detector based in the spherical geometry is presented. The detector consists of large spherical gas volume with central electrode and radial electric field. Charges deposited in the drift volume are drifting to the central sensor where are amplified and collected. We introduce a new spherical proportional sensor located at the center of curvature acting as a proportional amplification structure. It allows to reach high gas gains and operates from low to high gas pressure. Signal development and the absolute amplitude of the response are consistent with predictions. Sub-keV energy threshold with good energy resolution is achieved. This simple and robust structure allows to read large volumes with a single read-out channel. The detector performance presently achieved is already dose to fulfill the demands of many challenging projects from low energy neutrino physics to dark matter detection with applications in neutron, alpha, gamma spectroscopy.

**Primary author:** GIOMATARIS, Ioanis (Centre d'Etudes de Saclay (CEA-Saclay))

**Presenter:** GIOMATARIS, Ioanis (Centre d'Etudes de Saclay (CEA-Saclay))

**Session Classification:** Gas Pixel Detectors

**Track Classification:** Gas Pixel Detectors

Contribution ID: 132

Type: **Oral Contribution**

## **A high throughput, multi-channel photon counting detector with picosecond timing**

*Wednesday, 3 September 2008 17:50 (20 minutes)*

High throughput photon counting with high time resolution is a niche application area where vacuum tube technologies can still outperform solid state devices. Applications in the life sciences will benefit greatly from performance enhancements both in event timing accuracy and detector throughput. The goal of the HiContent project is to develop a detector system specifically designed for optical proteomics, capable of high content (multi-parametric) analysis at high throughput. The detector combines multi-channel, high time resolution photon counting in a single miniaturized detector system with integrated multi-channel ASIC electronics with up to 1024 parallel counting channels and 20 picosecond time resolution. We describe the detector design and discuss the current status of the HiContent project and present the results from a 64 channel prototype system.

**Primary author:** Dr LAPINGTON, Jon (University of Leicester)

**Presenter:** Dr LAPINGTON, Jon (University of Leicester)

**Session Classification:** Novel Photon Detection Systems

**Track Classification:** Novel Photon Detection Systems



Contribution ID: 133

Type: **Oral Contribution**

## Image-guided radiotherapy using active pixel technology

*Tuesday, 2 September 2008 14:50 (20 minutes)*

The intelligence, read-out speed, radiation hardness and large size of CMOS active pixel sensors (APS) gives them a potential advantage over current radiotherapy verification systems. This work investigates the feasibility of using an APS to image the megavoltage treatment beam produced by a linear accelerator, and demonstrates the logic which may be used to evaluate treatment and track motion. A CMOS APS was incorporated into an imaging system, and anatomical imaging, resolution and contrast were evaluated. Two algorithms were used to determine the field-area, delivered dose and the position of collimator leaves in an intensity-modulated radiotherapy treatment. Results agreed with the prescription to within a single frame for dose delivery, and 0.03 cm for the position of collimator leaves. Such a system therefore shows potential for online verification.

**Primary author:** OSMOND, John**Presenter:** OSMOND, John**Session Classification:** Applications in Nuclear Medicine and Radiology**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 134

Type: **Poster**

## Comparison of the data obtained by PEPT technique for stationary and rotating particle on two detectors

*Thursday, 4 September 2008 15:10 (20 minutes)*

The technique of positron emission particle tracking (PEPT) was developed at the Birmingham University and has proved an extremely powerful tool for studying flow processes inside real laboratory-scale process equipment. In PEPT, a single radioactively-labelled tracer particle is tracked by detecting simultaneously. Routine studies use the ADAC Forte positron camera consisting of two planar gamma camera heads each containing a crystal of sodium iodide 50\*40 cm<sup>2</sup> and 16 cm thick operated in coincidence. Recently the University of Birmingham has acquired the ECAT scanner consists of 32 detector buckets. Each bucket comprises 4 bismuth germanate crystals each subdivided into an 8x4 array of small detecting elements, so that in total the scanner consists of 8 rings each of 512 elements. This paper presents the initial comparison between the ADAC and ECAT scanner data obtained from the PEPT algorithm. For the stationary point source, the precision in location will be approximately 10 times better than obtained with the ADAC camera. Fast moving particles with speed of 2 m/s can be located with an accuracy of 2mm while the corresponding value is found 0.6mm for ADAC camera. Since for PEPT 3D operation is better and the septa couldn't easily be removed from the ECAT 931 gantry so it is suggested that the configuration of the detector to be changed into a new frame.

**Primary author:** Dr SADRMOMTAZ, Alireza

**Presenter:** Dr SADRMOMTAZ, Alireza

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications

Contribution ID: 135

Type: **Poster**

## Radiation detection and readout based on the latchup effect

*Friday, 5 September 2008 10:40 (20 minutes)*

An innovative circuit topology for solid-state pixel detectors based on latch up effect is described. This effect, normally considered detrimental in CMOS devices when triggered by SEU or external radiation, is exploited in solid state electronic switches (e.g. thyristor and SCRs). Here it is proposed to use this effect as part of a building block for low power, low noise, fast and much simplified particle and radiation detection. The latch up effect is based on a positive feedback triggered in a loop of active devices by an injected charge. Following latch up, the circuit retains its final state until reset and the next cycle of readout is started. A detector prototype with sensitivity of approximately 1pC based upon commercial components was built and tested confirming the working principle. A new prototype with increased charge sensitivity is currently being investigated in a commercial deep-submicron CMOS technology. A further improvement with the possibility of accurately selecting the threshold of ignition is currently being investigated. It is based on commercially available MOS transistors, routinely used as building blocks for digital memory cells (i.e. EPROM or FLASH). A prototype using commercial components is being built to validate the concept and to understand the limitations. Simulations and measurements results will be presented. This approach in principle could greatly simplify the readout of particle and radiation detectors, as most of the standard blocks, like charge amplifier, buffers or comparator, are implemented using fewer programmable devices.

**Primary author:** Dr VILLANI, Giulio (Rutherford Appleton Laboratory)

**Presenter:** Dr VILLANI, Giulio (Rutherford Appleton Laboratory)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 137

Type: **Poster**

## **Wavelength shifting fibre neutron image detector with a fibre optic taper for a high spatial resolution**

*Thursday, 4 September 2008 15:10 (20 minutes)*

An effective pixel size of a two-dimensional wavelength shifting fibre (WLSF) neutron image detector was improved from 0.5 mm down to 0.17 mm with implementing a fibre optic taper (FOT). The main part of the prototype detector consisted with a thin ZnS/6LiF screen, the FOT, and the crossed WLSF ribbons for x and y coordinate. The WLSF image detector had 16 x 16 fibre channels and the light signals in each fibre were read out individually. The FOT that was made out of fine glass fibres with a taper ratio of 3.1 was implemented in between a scintillator screen and the WLS fibres, which worked as an image magnifier. The original detector that equipped with a scintillator screen without a FOT exhibited a spatial resolution of around 0.8 mm. The spatial resolution of this detector was dominated with a light disperse in the screen and the side length of a fibre of 0.5 mm. The prototype detector equipped with the FOT measured a narrow neutron beam with a finer pixel size whilst the same WLSF were used for readout. This result indicated a possibility to improve the effective pixel size / spatial resolution with a FOT device. This kind of detector would be quite unique and useful for energy-selective neutron radiography at a pulsed neutron source because of its neutron counting capability.

**Primary author:** Dr NAKAMURA, Tatsuya

**Presenter:** Dr NAKAMURA, Tatsuya

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 138

Type: **Poster**

## **CMS Tracker alignment strategy and first results obtained from cosmic muon tracks**

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The all-silicon design of the CMS Tracker poses new challenges in aligning the system with more than 15000 independent modules. For optimal track-parameter resolution, the position and orientation of its modules need to be determined with a precision of better than few dozens of micrometers. Starting with the survey measurements and corrections provided by the hardware alignment system, we can achieve the ultimate precision with data from the silicon modules traversed in-situ by charged particles. Several implementations of statistical algorithms allow us to solve the optimization problem with the required accuracy in manageable time. We describe survey measurements and experience with the hardware alignment system. We discuss selection of data samples used for track based alignment and present results from Monte-Carlo studies. First CMS Tracker alignment analysis results with cosmic track data will be given.

**Primary author:** OLZEM, Jan (I. Physikalisches Institut (B))

**Presenter:** OLZEM, Jan (I. Physikalisches Institut (B))

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 139

Type: **Oral Contribution**

## **Gamma-ray tracking and background suppression in the planned germanium array of DESPEC: a comparative analysis**

*Tuesday, 2 September 2008 11:10 (20 minutes)*

Novel techniques of gamma-ray tracking and imaging are employed for the new generation of nuclear gamma-ray spectrometers. As a prominent example of this approach the advanced gamma tracking array AGATA will soon start operating in its prototype version. Another large gamma-tracking array is currently being designed for the needs of the DESPEC NUSTAR collaboration. It should cover all types of decay studies with implanted radioactive beams. In order to push the limits of the gamma-ray spectroscopy to the domain of the exotic nuclei close to the borderlines of stability, low count rates and high backgrounds should be considered. For this purpose a new gamma-ray tracking algorithm TANGO was developed featuring identification of the photon escape events which allows achieving high Peak/Total values. Imaging capabilities of the array will be exploited in order to correlate the decay photons with the implantation positions, thus allowing photon tagging, and ambient gamma-ray background suppression. Segmented HPGe planar and coaxial detectors are considered for the physical realization of the array. A comprehensive analysis of the tracking and background suppression capabilities will be presented along with a comparison between different proposed configurations.

**Primary author:** Dr TASHENOV, Stanislav (KTH, Royal institute of technology)

**Co-author:** Mr KHAPLANOV, Anton

**Presenter:** Mr KHAPLANOV, Anton

**Session Classification:** Applications in Nuclear Physics

**Track Classification:** Applications in Nuclear Physics

Contribution ID: 140

Type: **Poster**

## Time-Resolved Neutron Imaging System Using a High-Frame-Rate CMOS Camera for TOF Neutron Radiography

*Friday, 5 September 2008 10:40 (20 minutes)*

An effective pixel size of a two-dimensional wavelength shifting fibre (WLSF) neutron image detector was improved from 0.5 mm down to 0.17 mm with implementing a fibre optic taper (FOT). The main part of the prototype detector consisted with a thin ZnS/6LiF screen, the FOT, and the crossed WLSF ribbons for x and y coordinate. The WLSF image detector had 16 x 16 fibre channels and the light signals in each fibre were read out individually. The FOT that was made out of fine glass fibres with a taper ratio of 3.1 was implemented in between a scintillator screen and the WLS fibres, which worked as an image magnifier. The original detector that equipped with a scintillator screen without a FOT exhibited a spatial resolution of around 0.8 mm. The spatial resolution of this detector was dominated with a light disperse in the screen and the side length of a fibre of 0.5 mm. The prototype detector equipped with the FOT measured a narrow neutron beam with a finer pixel size whilst the same WLSF were used for readout. This result indicated a possibility to improve the effective pixel size / spatial resolution with a FOT device. This kind of detector would be quite unique and useful for energy-selective neutron radiography at a pulsed neutron source because of its neutron counting capability.

**Primary author:** NAKAMURA, Tatsuya (Japan Atomic Energy Agency)

**Presenter:** NAKAMURA, Tatsuya (Japan Atomic Energy Agency)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 141

Type: **Poster**

## Laser and Beta source setup characterization of 3D-DDTC detectors fabricated at FBK-irst

*Wednesday, 3 September 2008 15:10 (20 minutes)*

Double-sided Double-Type Column 3D detectors (3D-DDTC) have been fabricated at Fondazione Bruno Kessler (former IRST). These sensors have columnar electrodes etched perpendicularly to the wafer surface from both sides and not fully penetrating into the substrate, so that the fabrication process is simpler than for standard 3D detectors. Compared to the previously developed 3D Single-Type-Column detectors, these new detectors are expected to yield shorter charge collection time and higher radiation hardness, as also predicted by TCAD simulations. The electrical characteristics of the first prototypes (p-on-n with non optimized column depth ) are promising: very low leakage currents, in the order of 0.1pA/column, lateral depletion voltage at about 0.5V and full depletion voltage just below 3V. We will report on the latest results from the functional characterization of strip sensors connected to ATLAS SCT ABCD3T chips running at 40MHz. The sensors are stimulated with infrared LASER pulses having a spot size of few microns, so as to investigate the signal variation as a function of the laser injection point. Moreover, also a Sr90 Beta source setup will be used to perform Charge Collection and Efficiency measurements.

**Primary author:** ZOBOLI, Andrea (Universita degli Studi di Trento)

**Presenter:** ZOBOLI, Andrea (Universita degli Studi di Trento)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics



Contribution ID: 142

Type: **Poster**

## The RICH system of the LHCb experiment: status and performance

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The LHCb experiment is an experiment that will search for new physics in CP violation from heavy flavour decays at the LHC at CERN. Particle identification (pion, kaon and proton discrimination), a crucial requirement of the physics goals of the experiment, will be provided by two Ring Imaging Cherenkov (RICH) detectors. The upstream RICH1 detector incorporates two radiators, aerogel and C4F10 gas, while the downstream RICH2 contains CF4 gas. Combined, they provide particle identification coverage over a momentum range between 1 and 100 GeV/c. RICH1 contains a system of novel low-mass carbon-fibre spherical mirrors and flat glass mirrors to focus the Cherenkov light onto arrays of 196 Hybrid Photon Detectors (HPDs). The RICH2 detector contains glass spherical and flat mirrors to focus the Cherenkov light onto arrays of 288 HPDs. Magnetic calibration systems in both RICHes measure and correct for the distortion of the ring-images in the HPDs from the residual magnetic field, up to 2.5mT, from the LHCb dipole magnet.

This paper will describe the features of the two RICH detectors that are currently installed in LHCb, as well as the novel technologies. The status of the commissioning of the detectors will be given, the calibration and alignment techniques and the results from a beam test carried out with the final detector components and readout system. Finally, the anticipated particle identification performance of the RICH detectors from comprehensive Monte Carlo simulations will be presented. A technique to calibrate the particle identification performance of the RICH system with data using  $D^*$  decays will also be described.

**Primary author:** PICKFORD, Andrew (University of Glasgow)

**Presenter:** PICKFORD, Andrew (University of Glasgow)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 143

Type: **Poster**

## Precise measurement of the very rare decay

$$K^+ \rightarrow \pi^+ \nu \bar{\nu}$$

*Wednesday, 3 September 2008 15:10 (20 minutes)*

The P326 proposal of a new experiment NA62 aiming to perform precise measurement of the very rare kaon decay  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  branching ratio at CERN is described. About 80  $K^+ \rightarrow \pi^+ \nu \bar{\nu}$  events with 10% of background is planned to obtain in two years of data taking. To reconstruct charged pion tracks with high efficiency and high resolution a single magnet spectrometer based on straw tubes and working in vacuum should be design and produce. The current status of R&D of this detector and results of its prototype testing are discussed.

**Primary author:** MOVCHAN, Sergei (Joint Institute for Nuclear Research (JINR))

**Presenter:** MOVCHAN, Sergei (Joint Institute for Nuclear Research (JINR))

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 145

Type: **Poster**

## The X-ray quantum efficiency measurement of a high resistivity CCD

*Tuesday, 2 September 2008 15:10 (20 minutes)*

The CCD247 is the 2nd generation of high resistivity device to be manufactured in e2v technologies plc development programme. Intended for infrared astronomy, the latest devices are fabricated on high resistivity (~8 kΩcm) bulk silicon, allowing for a greater device thickness whilst maintaining full depletion when 'thinned' to a thickness of 150 μm. In the case of the front illuminated variant, depletion of up to 300 μm is achievable by applying a gate to substrate potential of up to 120 V, whilst retaining adequate spectral performance. The increased depletion of high resistivity CCDs greatly improves the quantum efficiency (QE) for incident X-ray photons of energies above 4 keV, making such a device beneficial in future X-ray astronomy missions and other applications. The X-ray QE of a CCD is the percentage of incident photons that are converted into electron-hole pairs and sampled by the device. This is practically measured for a range of incident photon energies to determine the X-ray sensitivity of the CCD by comparing the flux measured by the CCD at specific energies to that of a calibrated reference detector illuminated by the same source. The relative difference between the flux measured by the CCD and the calibrated detector is used to ascertain the absolute X-ray CCD QE. Here we describe the experimental setup and present results of X-ray QE measurements taken in the energy range 2 keV to 20 keV for a front illuminated CCD247.

**Primary author:** Mr MURRAY, Neil

**Presenter:** Mr MURRAY, Neil

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Applications in Space Science

Contribution ID: 146

Type: **Poster**

## **Scintillation characteristics and imaging performance of CsI:Tl thin films for X-ray imaging applications**

*Tuesday, 2 September 2008 15:10 (20 minutes)*

We have manufactured thallium doped cesium iodide (CsI:Tl) scintillator thin films by the thermal deposition method. The scintillation characteristics of the CsI:Tl thin films was studied by the X-ray induced luminescence and photoluminescence(PL) for different Tl doping concentrations between 0.1~10.0mol%. The wavelength of the main emission peak was about 550nm for both studies, but the light intensity dropped and the emission peak shifted toward the long wavelength for higher Tl concentration in X-ray luminescence case. X-ray diffraction (XRD) and scanning electron microscopy (SEM) for observation of structural properties was used to investigate the relationship between the microstructure affected by the evaporation condition and post-heat treatment, and the scintillation properties of samples. The imaging performance of the various CsI:Tl films fabricated will be also evaluated by X-ray radiographic test after coupling to a CCD sensor.

**Primary author:** Dr KYUNG CHA, Bo

**Presenter:** Dr KYUNG CHA, Bo

**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors

**Track Classification:** Novel Photon Detection Systems

Contribution ID: 147

Type: **Poster**

## Design and Fabrication of PDE enhanced SiPM with Micro-lens

*Thursday, 4 September 2008 15:10 (20 minutes)*

An SiPM is a good candidate for PET-MRI systems to overcome problems of conventional PMTs. In this paper, a virtual guard ring and wafer trench in SiPM active areas were adopted to prevent the premature breakdown in the curvature junction. N<sup>+</sup>/p<sup>-</sup>/p/π/p<sup>+</sup> doping structure was simulated and designed to improve avalanche trigger probability. In order to improve the fill factor in small sized micro-cells in an SiPM pixel, layout was designed with high sheet resistance poly-silicon quenching resistor, and a micro-lens, to maximize light collection efficiency, was accurately modeled. SiPM fabrication is now in progress. PDE, the dark count, the timing resolution, and the gamma-ray energy resolution with a scintillation crystal will be measured. Other experiments in order to compare the performance of different structured SiPMs will be done.

**Primary author:** LEE, Chae hun (KAIST)

**Presenter:** LEE, Chae hun (KAIST)

**Session Classification:** Poster Session 3 - Medical, PET and Biological

**Track Classification:** PET applications

Contribution ID: 148

Type: **Poster**

## **Performance evaluation for pinhole collimators of small gamma camera by MTF and NNPS Analysis; Monte Carlo simulation st**

*Thursday, 4 September 2008 15:10 (20 minutes)*

Presently the gamma camera system is widely used in various medical diagnostic, industrial and environmental fields. Hence, the quantitative and effective evaluation of its imaging performance is essential for design and quality assurance. The NEMA standards for gamma camera evaluation are insufficient to perform sensitive evaluation. In this study, MTF(modulation transfer function), NNPS(normalized noise power spectrum) will be suggested to evaluate gamma camera performance with changeable pinhole collimators using Monte Carlo simulation. We simulated the system with a cylinder and a disk source, and seven different pinhole collimators from 1mm- to 4mm-diameter pinhole with lead. The MTF and NNPS data were obtained from output images and were compared with FWHM, sensitivity and differential uniformity. In the result, we found that MTF and NNPS are effective and novel standards to evaluate imaging performance of gamma cameras instead of conventional NEMA standards.

**Primary author:** Mr CHO, Gyuseong**Presenter:** Mr CHO, Gyuseong**Session Classification:** Poster Session 3 - Medical, PET and Biological**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 149

Type: **Poster**

## **K-edge subtraction using an energy sensitive PSD**

*Thursday, 4 September 2008 15:10 (20 minutes)*

Digital Subtraction Angiography is an important technique used to image arterial blood flow using an introduced contrast agent. A mask image (using no contrast agent) is initially acquired which is subtracted from subsequent images after introduction of the contrast agent, resulting in images of the only the agent used. However, given a detector that measures position and energy rather than the currently used integrating devices it is possible to use the K-edge in the absorption spectra of the contrast agent to conduct equivalent imaging. This study demonstrates this imaging possibility using a simulated data model and explores its limits under a number of initial conditions of assumed spatial and spectral resolution. The effects on the final image of different methods of image subtraction and pre-processing are also explored. It is found that a K-edge subtraction image retains equivalent properties as DSA for angiography contrast imaging.

**Primary author:** Dr HALL, Christopher**Presenter:** Dr HALL, Christopher**Session Classification:** Poster Session 3 - Medical, PET and Biological**Track Classification:** Applications in Nuclear Medicine and Radiology

Contribution ID: 150

Type: **Poster**

## **Plastic Scintillator-based Radiation Detector for Mobile Radiation Detection System against Nuclear/Radiological Terror**

*Friday, 5 September 2008 10:40 (20 minutes)*

In these days, the threats relating to nuclear and radioactive materials have become a matter of internationally increased grave concern. The mobile radiation detection system has employed a NaI-based radiation detector to monitor in-transit nuclear material. In the design of a radiation detector for prevention of illicit trafficking of nuclear and radioactive materials, the trade-off should be carefully optimized between performance and cost to achieve cost-effective inspection system. The cost-effective mobile radiation detection system based on plastic scintillation material is introduced in this paper. This paper also deals with six energy windowing approach to discriminate any targeted materials (SNM, radioactive source) from nationally occurring radioactive material (NORM). For energy windowing approach, placement of each energy window boundary and its statistical ratio are characterized by using MCNPX. The theoretical results are corrected with systematic noise obtained through experiment. Finally, this paper demonstrates how the mobile radiation detection system succeeds in detecting the targeted materials and discriminating them from NORM.

**Primary author:** KWAK, Sung-Woo (KINAC)

**Presenter:** KWAK, Sung-Woo (KINAC)

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources



Contribution ID: 151

Type: **Poster**

## Hybrid charge preamplifiers - design methodology & performance limits

*Tuesday, 2 September 2008 15:10 (20 minutes)*

The hybrid charge amplifiers have been around for some time and it seems they are approaching their technological maturity, but not the extinction yet. In this paper the design methodology is formalized and key design constraints are defined and discussed. Further, considering that components used in such preamplifiers are also reaching their technological maturity, it is possible to predict performance limits with high degree of accuracy. Design of pulse shapers is also covered, mainly focusing on translation of the key performance requirements into parameters needed for formal design of active electronics filters. Most of the existing literature separately deals with the performance and the design issues, while our objective is to merge those two processes in a single practical method. We would also point to some key similarities and differences between hybrid and ASIC design approaches.

**Primary author:** Dr PANJKOVIC, Goran**Presenter:** Dr PANJKOVIC, Goran**Session Classification:** Poster Session 1 - Astrophysics, Space, Gaseous and Novel Photon detectors**Track Classification:** Novel Photon Detection Systems

Contribution ID: 152

Type: **Poster**

## The EUDET High Resolution Pixel Telescope

*Wednesday, 3 September 2008 15:10 (20 minutes)*

A high resolution ( $\sigma < 3\mu\text{m}$ ) beam telescope based on monolithic active pixel sensors is being developed within the EUDET collaboration. EUDET is a coordinated detector R&D programme for a future international linear collider providing test beam infrastructure to detector R&D groups. The telescope consists of six sensor planes with a pixel pitch of  $30\mu\text{m}$  and can be operated inside a solenoidal magnetic field of up to 1.2T. In the last year the demonstrator telescope was tested and used by different groups at test beams at CERN and DESY. In this presentation the high resolution beam telescope based on pixel sensors will be described. Design aspects to ease users interfacing to the general purpose mechanical setup and the data acquisition will be explained. Also a modular analysis package has been developed and used to analyse the data. Users can integrate at different levels of the analysis chain. In summer 2008 the demonstrator version of the telescope will be used by five different users (CALICE, DEPFET, MimoRoma, ISIS, SiLC). In this presentation the performance of the telescope in the different test beam will be summarised and the results will be discussed. The audience will learn how to apply for the use of this telescope and which tools are ready for the community.

**Primary author:** Mr ROLOFF, Philipp (Deutsches Elektronen-Synchrotron (DESY))

**Presenter:** Mr ROLOFF, Philipp (Deutsches Elektronen-Synchrotron (DESY))

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics

Contribution ID: 153

Type: **Oral Contribution**

## Progress on the Aberystwyth Electron Counting Array

*Wednesday, 3 September 2008 11:30 (20 minutes)*

We report on progress made on the Aberystwyth University Electron Counting Detector array since the last PSD conference. A new detector with 1,536 pixels across an active area of 38mm x 5mm is presented. Also presented are applications of the existing detector in photoelectron spectroscopy, showing how the improvement in detection technology enables fresh insights into the fabrication of semiconductor device structures. Examples presented are metal contact formation in diamond and the growth of organic thin film layers on conventional inorganic semiconductors.

**Primary author:** Dr LANGSTAFF, Dave (University of Wales, Aberystwyth)

**Presenter:** Dr LANGSTAFF, Dave (University of Wales, Aberystwyth)

**Session Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

**Track Classification:** Detectors for Synchrotron Radiation and Spallation Neutron Sources

Contribution ID: 154

Type: **Keynote talk**

## A word of welcome

*Monday, 1 September 2008 10:20 (15 minutes)*

**Primary author:** Prof. RUSSELL KCB, DL, FRSE, Muir (The University of Glasgow)

**Presenter:** Prof. RUSSELL KCB, DL, FRSE, Muir (The University of Glasgow)

**Session Classification:** Opening speeches and welcome

**Track Classification:** Opening speeches and welcome

Contribution ID: 155

Type: **Poster**

## **eLeNA: A Parametric CMOS Active Pixel Sensor for the evaluation of noise reduction architectures**

*Friday, 5 September 2008 10:40 (20 minutes)*

We present a parametric CMOS Active Pixel Sensor for the evaluation of noise reduction architectures. The sensor is called e-Le-NA, which stands for Low Noise Active pixel sensor. It consists of fourteen different arrays for characterising and investigating method to reduce the noise in an image sensor. In a MAPS, the dominant source of noise is the reset noise. A conventional technique is to apply a Correlated Doubling Sampling (CDS). For MAPS, other techniques are also envisaged, based on performing the reset in an actively controlled way, hence their collective name as 'active reset'. This sensor includes architectures for both CDS and active reset. The goal is to achieve sub 10 e- rms and we will present preliminary results. The sensor was designed and manufactured in the novel 0.18  $\mu\text{m}$  CMOS Image Sensor process INMAPS, which includes a special deep P-well module for enhanced imaging performance and was developed by RAL. The sensor has 512 x 448 pixels at 15  $\mu\text{m}$  pitch, the die is 8 mm x 9.1 mm and it was manufactured with two epitaxial layer thicknesses, of 5 and 12  $\mu\text{m}$ .

**Primary author:** Dr ANAXAGORAS, Thalís

**Presenter:** Dr ANAXAGORAS, Thalís

**Session Classification:** Poster Session 4 - Synchrotron Detectors and Pixel Detectors

**Track Classification:** Pixel Detectors for Charged Particles

Contribution ID: 156

Type: **Oral Contribution**

## **Special Announcement - First tracks reconstructed from LHC beam in the LHCb VELO.**

*Monday, 1 September 2008 10:35 (15 minutes)*

At 17:30 on Friday 22nd August LHCb reconstructed in its Vertex Locator (VELO) the first particles from interactions of the LHC beam. The observation was made during an LHC synchronization test. This test collided the proton beam with an absorber 200m from LHCb. The resulting particles from the very first event were reconstructed in the LHCb VELO.

**Primary author:** PARKES, Chris (Department of Physics and Astronomy)

**Presenter:** PARKES, Chris (Department of Physics and Astronomy)

**Session Classification:** Opening speeches and welcome

**Track Classification:** Opening speeches and welcome

Contribution ID: 157

Type: **Oral Contribution**

## Conference Summary

*Friday, 5 September 2008 12:30 (20 minutes)*

**Primary author:** Prof. ALLPORT, Phil (U. of Liverpool)

**Presenter:** Prof. ALLPORT, Phil (U. of Liverpool)

**Session Classification:** Summary and closing remarks

**Track Classification:** Summary and closing remarks

Contribution ID: 158

Type: **Poster**

## Development of linseed oil-free Bakelite Resistive Plate Chambers

*Wednesday, 3 September 2008 15:10 (20 minutes)*

In this paper we would like to present a comparative study of the Resistive Plate Chambers (RPC) made of different grades of Bakelite paper laminates, produced and commercially available in India. The chambers, operated in the streamer mode using argon, tetrafluoroethane and isobutene in 34:59:7 mixing ratio, are tested for the efficiency and stability with cosmic rays. A particular grade of Bakelite (P-120, NEMA LI-1989 Grade XXX), used for high voltage insulation in humid conditions, was found to give satisfactory performance with stable efficiency of >96% continuously for a long period. In the first set of detectors made with such Bakelite, a thin coating of silicone fluid on the inner surfaces of the Bakelite was found to be necessary for operation of the detector. However, very recently RPCs made with the same grade of Bakelite but having very fine surface finish, are found to give equivalent performance even without any coating inside. Results of the surface profile studies of the Bakelite and the timing properties & cross-talk of such detectors will also be presented.

**Primary author:** Prof. SUDEB, Bhattacharya (Saha Institute of Nuclear Physics, Kolkata, India)

**Presenter:** Prof. SUDEB, Bhattacharya (Saha Institute of Nuclear Physics, Kolkata, India)

**Session Classification:** Poster Session 2 - PPE & Nuclear

**Track Classification:** Applications in Particle Physics



Contribution ID: **159**

Type: **not specified**

## **test talk**

**Primary author:** BATES, Richard (Department of Physics and Astronomy)

**Presenter:** BATES, Richard (Department of Physics and Astronomy)

**Track Classification:** Summary and closing remarks