7th Trento Workshop on Advanced Radiation Detectors (3D and p-type)

Report of Contributions

Contribution ID: **0** Type: **not specified**

Analysis of Edge and Surface TCTs for Irradiated 3D Silicon Strip Detectors.

Thursday, 1 March 2012 15:20 (25 minutes)

We performed edge and surface TCT measurements of a double sided 3D silicon strip detector at the Jozef Stefan Institute. Double sided 3D devices are a useful counterpart to traditional planar devices. The TCT techniques allow the electric fields in 3D devices to be probed in a way not possible before.

The strip detectors had a substrate thickness of 300 micrometers and a strip pitch of 80 micrometers. The columns, that formed the electrodes, had a diameter of 10 micrometers, and were 250 micrometers deep. The junction electrodes were connected together to form the strips with 20 micrometer wide Aluminium metalisation. The Ohmic electrodes were all connected together on the backside of the device with a uniform contact. The detectors were tested both prior to irradiation and after irradiating to 5 x 10ˆ15 N/cmˆ2. Studies were performed into the effect of varying bias voltage and also the effect of annealing on the irradiated sample. An IR laser (1020 nm for surface, 1060 nm for edge) was used to scan the devices with a FWHM of 8 micrometers. This allowed scans with a resolution of 2.5 micrometers to be performed. The irradiation and edge polishing were completed at the Jozef Stefan Institute in Ljubljana.

The TCT experiment was undertaken in an atmosphere of dry air, with the irradiated samples held at a temperature of -20C. Annealing was achieved insitue by warming to 60C for intervals of 20, 40, 100, 300 and 600 minutes.

The collected charge as a function of position and electric field was obtained for both per and post irradiated devices and after annealing. The rise and fall times of the signal waveforms are compared for different bias voltages and positions. This gives information on the origin of the induced signal, that is the portion from electron or hole motion. The results are compared to simulation.

Primary author: STEWART, Graeme Douglas (University of Glasgow)

Co-authors: PELLEGRINI, Giulio (Universidad de Valencia (ES)); KRAMBERGER, Gregor (Jozef Stefan Institute (SI)); MILOVANOVIC, Marko (Jozef Stefan Institute, Ljubljana); BATES, Richard (University of Glasgow (GB))

Presenter: STEWART, Graeme Douglas (University of Glasgow)

Session Classification: 3D Detectors

Contribution ID: **1** Type: **not specified**

Progress with 3D detectord for the IBL

Wednesday, 29 February 2012 14:30 (25 minutes)

this talk will report an overview on the developement of 3D silicon sensors for the ATLAS IBL. The experience of qualifying, producing and testing 3D sensors compatible with the FE-I4 pixel readout electronic chip will be discussed together with an indication of the future perspectives on the use of micromachining in radiation detection.

Primary author: Dr DA VIA, Cinzia (University of Manchester (GB))

Presenter: Dr DA VIA, Cinzia (University of Manchester (GB))

Session Classification: Running experiments and upgrades

Contribution ID: **2** Type: **not specified**

Characterization of Silicon n-in-p Pixel Sensors for future ATLAS Upgrades

Wednesday, 29 February 2012 15:45 (25 minutes)

The n-in-p silicon technology is a promising candidate for the foreseen upgrade steps of the ATLAS Pixel Detector towards HL-LHC. Due to the radiation hardness and cost effectiveness of this technology, it permits to increase the area covered by pixel detectors.
Characterization and performance results of n-in-p planar pixel sensors produced by CiS (Germany) connected via bump bonding to the ATLAS readout chip FE-I3 will be presented.
The analysis of these devices has been performed before and after irradiation up to a fluence of 1E16 n_eq/cmˆ2. Charge collection and tracking efficiency studies indicate the functioning of this technology up to this particle fluence. An overview of the on-going pixel production at CiS for sensors compatible with the new ATLAS readout chip FE-I4 will be included.

Primary authors: LA ROSA, Alessandro (Universite de Geneve (CH)); MACCHIOLO, Anna (Max--Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); GALLRAPP, Christian (CERN); PERNEGGER, Heinz (CERN); WEIGELL, Philipp (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D); RICHTER, Rainer (M); Dr NISIUS, Richard (Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) (D)

Presenter: GALLRAPP, Christian (CERN)

Session Classification: Planar Detectors

Contribution ID: **3** Type: **not specified**

Double-Sided 3D Silicon Detectors for the High-Luminosity LHC

Wednesday, 29 February 2012 17:10 (25 minutes)

For the ATLAS upgrade, the inner pixel layers will have to withstand fluences of up to 2E16 1MeV neq/cmˆ2. 3D detectors have been shown to be very radiation tolerant, and have been proposed as an option for the inner pixel layers for the ATLAS upgrade. This work presents studies done on double sided 3D strip detectors. Charge collection and noise measurements are presented before and after irradiation. Charge multiplication in 3D sensors is also investigated.

Primary author: BETANCOURT, Christopher (Freiburg University)

Co-author: Dr KOHLER, Michael (University of Freiburg)

Presenter: BETANCOURT, Christopher (Freiburg University)

Session Classification: 3D Detectors

Contribution ID: **4** Type: **not specified**

Comparison of n & p-type silicon modules at LHCb VELO

Wednesday, 29 February 2012 11:10 (25 minutes)

The VELO is the silicon detector surrounding the LHCb interaction point. The sensors have an inner radius of only 7mm from the LHC beam and an outer radius of 42 mm. Consequently the sensors receive a large and non-uniform radiation dose. A dose of 0.5 x 10ˆ13 1 MeV neutron equivalents /cmˆ2 per fbˆ-1 of data is predicted at the tip of the sensors. The sensors are fabricated from oxygenated n-on-n silicon with one module made from n-on-p silicon, the only n-on-p module operated at the LHC.

LHCb is a dedicated experiment to study new physics in the decays of beauty and charm hadrons at the Large Hadron Collider (LHC) at CERN. The beauty and charm hadrons are identified through their flight distance in the Vertex Locator (VELO), and hence the detector is critical for both the trigger and offline physics analyses. The VELO is the highest resolution vertex detector at the LHC.
The radiation damage is monitored by three studies: 1) the currents drawn as a function of temperature and voltage 2) studying the noise versus voltage behaviour and 3) charge collection efficiency, studied with tracks from proton-proton collisions, as a function of voltage. The results of all three studies are presented. Clear differences in behaviour, as expected, are observed between n-on-n and n-on-p sensors. Type inversion is observed in the n-in-n sensors. The p-type sensors depletion voltage first reduced and is now increasing. Radiation induced charge loss due to the second metal layer on the sensors is also observed and will be discussed.

Primary author: PARKES, Chris (University of Manchester (GB))

Presenters: PARKES, Chris (University of Manchester (GB)); HUTCHCROFT, David (University of Liverpool (GB))

Session Classification: Running experiments and upgrades

Contribution ID: **5** Type: **not specified**

Surface effects in double-sided silicon 3D sensors fabricated at FBK

Wednesday, 29 February 2012 17:35 (25 minutes)

Surface effects were found to significantly affect the electrical characteristics of double-sided 3D detectors fabricated at FBK.
With reference to 3D test diodes, we have studied the layout dependence of some critical parameters such as leakage current, breakdown voltage and capacitance both experimentally and with the aid of TCAD simulations.
Simulations are found to accurately reproduce the device characteristics, thus explaining the basic mechanisms governing
the electrical behavior and providing useful hints for layout optimization.

Primary authors: Prof. DALLA BETTA, Gian-Franco (INFN and University of Trento); Dr POVOLI, Marco (University of Trento and INFN)

Co-authors: Dr BAGOLINI, Alvise (FBK); Dr VIANELLO, Elisa (FBK); Dr MATTEDI, Francesca (FBK); GIACOMINI, Gabriele (Fondazione Bruno Kessler); BOSCARDIN, Maurizio (FBK Trento); ZORZI, Nicola (Fondazione Bruno Kessler - FBK)

Presenter: Prof. DALLA BETTA, Gian-Franco (INFN and University of Trento)

Session Classification: 3D Detectors

Contribution ID: **6** Type: **not specified**

Status report on the 3D sensor development @FBK

Wednesday, 29 February 2012 16:45 (25 minutes)

We report on the main technological issues related to the optimization of double side 3D detectors for the first production for ATLAS IBL at FBK (Trento, Italy). With respect to the previous versions of this technology we have strongly improved the main electrical properties (i.e. leakage current and breakdown voltage), the yield and the reproducibility. Selected results from the electrical characterization of the processed wafers are reported.

Primary author: BOSCARDIN, Maurizio (fbk)

Presenter: BOSCARDIN, Maurizio (fbk)

Session Classification: 3D Detectors

Contribution ID: **7** Type: **not specified**

ATLAS Silicon Microstrip Tracker Operation and Performance

Wednesday, 29 February 2012 09:30 (25 minutes)

The Semi-Conductor Tracker (SCT) is a silicon strip detector and one of the key precision tracking devices in the Inner Detector of the ATLAS experiment at CERN LHC.
The SCT is constructed of 4088 silicon detector modules for a total of 6.3 million strips. Each module is designed, constructed and tested to operate as a stand-alone unit, mechanically, electrically, optically and thermally. The modules are mounted into two types of structures: one barrel (4 cylinders) and two end-cap systems (9 disks on each end of the barrel).
The SCT silicon micro-strip sensors are processed in the planar p-in-n technology. The signals from the strips are processed in the front-end ASICS ABCD3TA, working in the binary readout mode. Data is transferred to the off-detector readout electronics via optical fibers.
The completed SCT has been installed inside the ATLAS experimental cavern since 2007 and has been operational since then. Calibration data has been taken regularly and analyzed to determine the noise performance of the system. Extensive commissioning with cosmic ray events has been performed both with and without magnetic field. The sensor behavior in the 2 Tesla solenoid magnetic field was studied by measurements of the Lorentz angle. We find 99.3% of the SCT modules are operational, noise occupancy and hit efficiency exceed the design specifications; the alignment is very close to the ideal to allow on-line track reconstruction and invariant mass determination.
In the talk the current status of the SCT will be reviewed. We will report on the operation of the detector including an overview of the issues we encountered and the observation of significant increases in leakage currents (as expected) from bulk damage due to non-ionising radiation. The main emphasis will be given to the tracking performance of the SCT and the data quality during the many months of data taking (the LHC delivered 47pb-1 in 2010 and 5.6fb-1 in 2011 of proton-proton collision data at 7 TeV, and two times one-month periods of heavy ion collisions). The SCT has been fully operational throughout all data taking periods. It delivered high quality tracking data for 99.9% (2010) and 99.6% (2011) of the delivered luminosity.
The SCT running experience will then be used to extract valuable lessons for future silicon strip detector projects.

Summary

see abstract

Primary author: JOHANSSON, Per Daniel Conny (University of Sheffield (GB))

Presenter: JOHANSSON, Per Daniel Conny (University of Sheffield (GB))

Session Classification: Running experiments and upgrades

Contribution ID: **8** Type: **not specified**

Status and Applications of the GridPix and Gossip gaseous tracking detectors

Since Dec 2011, GridPix chips (TimePix + Protection Layer + InGrid) can
be produced commercially for a reasonable price.
New applications of GridPix trackers are presented: a LVL1 trigger for the LHC experiments, and new TPCs.

Primary author: VAN DER GRAAF, Harry (NIKHEF (NL))

Presenter: VAN DER GRAAF, Harry (NIKHEF (NL))

Contribution ID: **10** Type: **not specified**

The Trixy Tracking detector

We propose a new tracker which is based on the electron multiplier of the Tipsy single soft photon detector.

The electron multiplier consists of a stack of transmissive dynodes, placed on top of a pixel chip. Above this, an Electron Emission Membrane is placed, which has the property to emit, with a high probability, at least one electron at the point of passage of a MIP crossing the membrane. This electron is focused onto the first dynode, associated to a pixel. After multiplication in 5 - 7 dynode stages, the avalanche is detected by the pixel circuitry.

Summary

We propose a radically new and generic type of detector for photons, electrons and energetic charged particles: a stacked set of curved miniature dynodes in vacuum, created through MicroMechanical Electronic Systems (MEMS) fabrication techniques on top of a state-of-the-art CMOS pixel chip. This combination in itself is an extremely efficient electron detector. By capping the system with a traditional photocathode, a highly sensitive timed photon counter can be realized, outperforming all existing photon detectors. By capping it with an Electron Emission Membrane, a timed particle tracking detector is realized with a time resolution far superior to current particle detectors.

The core innovation, i.e., the stacked curved dynodes on top of a pixel chip, will revolutionize electron detection in solid-state, atomic and molecular physics experiments. As a photon detector, it will have pico-second time resolution, much better than classical photomultipliers, at low noise. This will have impact on the field of medical imaging, optical communication, night-vision equipment and even 3D image recording by measuring the time-of flight of photons from a flashlight. As a particle detector, it will allow faster and higher-resolution measurements of the trajectories of fast charged particles, essential in modern particle physics experiments. Its time resolution is three orders of magnitude better than state-of-the-art Si planar detectors, opening new horizons for (vertex) tracking, time-of-flight spectrometers, track pattern recognition and trigger detectors.

The realization of this detector concept requires high-risk/high-impact developments in the area of (1) fundamental understanding of electron emission, (2) the MEMS-based fabrication of novel curved transmission dynodes and (3) high-efficiency Electron Emission Membranes.

Primary author: VAN DER GRAAF, Harry (NIKHEF (NL))

Presenter: VAN DER GRAAF, Harry (NIKHEF (NL))

Contribution ID: **11** Type: **not specified**

Development of novel KEK/HPK n(+)-in-p silicon sensors and evaluation of performance after irradiation

Wednesday, 29 February 2012 15:20 (25 minutes)

We have been developing highly radiation-tolerant n(+)-in-p silicon planar pixel and microsrip sensors for use in the high-luminosity LHC. Novel n(+)-in-p pixel sensors were made using a combinations of the bias structure of punch-through or polysilicon resistor, the isolation structure of p-stop or p-spray, and the thickness of 320 μm or 150 μm.
The strip sensors and associated test structures were made of the polysilicon resistor and the p-stop isolation structures.
The strip sensors and test structures were irradiated using 70 MeV protons to particle fluences of 5x10ˆ12 to 1x10ˆ15 , and the pixel sensors using 23 MeV protons to 2x10ˆ15 1-MeV neq/cmˆ2.
In evaluating the performance of the irradiated sensors, we have observed a number of effect that we would like to understand: (1) decreased efficiency under the bias rail, (2) increased onset voltage in the punch-through protection structures, (3) decreased potential of the p-stop implant between the n(+) strips,(4) decreased active area in the strip end, etc.
We discuss the common source that may have caused the above observations.

Primary author: UNNO, Yoshinobu (High Energy Accelerator Research Organization (JP))

Presenter: UNNO, Yoshinobu (High Energy Accelerator Research Organization (JP))

Session Classification: Planar Detectors

Contribution ID: **12** Type: **not specified**

Results on a beam test of n-in-p silicon strip sensors before and after irradiation

Thursday, 1 March 2012 09:30 (25 minutes)

We have executed a beam test of n-in-p silicon strip sensors aimed for the High Luminosity LHC(HL-LHC) upgrade of the ATLAS SCT(Semi-Conductor Tracker), in Dec. 2011 at Reseach Center for Nuclear Physics (RCNP). The data acquistion system was made of (1) the ABCN chip with a new readout system using an universal read-out board called "SEABAS" and (2) a beam defining telescope with VME readout modules. The telescope defined the beam position of 392 MeV protons with a spacial resolution of approximately 10 μm. The new sensors were irradiated using 70 MeV protons at Cyclotron and Radioisotope Center (CYRIC) to 1x10^12 to 1x10^15 n_eq/cm^2. The muti-hit ratio, the charge collection capability, the sensitive region on the strip end around the PTP structure, of the non-irradiated and irradiated new sensors were compared. In the non-irradiated sensor, the sensitive region on the strip end reached to the bias rail, while in the irradiated to the 10^15 n_eq/cm^2 sensor reached only to strip end.

Primary author: KISHIDA, Takuya (Tokyo Institute of Technology (JP))

Co-authors: NAKANO, Itsuo (Okayama University (JP)); TOJO, Junji (Kyushu University (JP)); HARA, Kazuhiko (University of Tsukuba (JP)); HANAGAKI, Kazunori (Osaka University (JP)); Prof. YORITA, Kohei (Waseda University (JP)); NAGAI, Koichi (University of Tsukuba (JP)); KIMURA, Naoki (Waseda University (JP)); JINNOUCHI, Osamu (Tokyo Institute of Technology (JP)); TERADA, Susumu (High Energy Accelerator Research Organization (JP)); KONDO, Taka (High Energy Accelerator Res. Organ. (KEK)); KUBOTA, Tomonori (Tokyo Institute of Technology (JP)); IKEGAMI, Yoichi (High Energy Accelerator Research Organization (JP)); UNNO, Yoshinobu (High Energy Accelerator Research Organization (JP)); TAKUBO, Yosuke (High Energy Accelerator Research Organization (JP))

Presenter: KISHIDA, Takuya (Tokyo Institute of Technology (JP))

Session Classification: Planar Detectors

Contribution ID: **13** Type: **not specified**

Development of n-in-p planar pixel sensors with active edge for the ATLAS High-Luminosity Upgrade

Thursday, 1 March 2012 16:15 (25 minutes)

The foreseen luminosity-upgrades for the LHC pose severe constraints on the future ATLAS silicon tracker. The innermost layer of the new pixel system will have to withstand a total integrated fluence in excess of 1x10ˆ16 neq/cm2. Moreover, there are geometrical requirements that pose stringent limits on the layout of the new pixel modules, both in terms of thickness and of insensitive-region size.
We report here on the development of radiation-hard n-in-p planar pixel sensors, compatible with FE-I4 readout chip, with small insensitive region at the edge; these devices are targeted at the innermost layers of the future ATLAS tracker.
The reduction in inactive area will be achieved thanks to heavily doped trenches at the detector edge, the ‘’active edge" paradigm.
The sensors are being fabricated at FBK (Trento, Italy) in collaboration with LPNHE (Paris, France).
In the following the active edge process will be highlighted. We will also describe the sensors we want to produce with this first submission and we present first TCAD simulation results for these devices.

Primary authors: LA ROSA, Alessandro (Universite de Geneve (CH)); GIACOMINI, Gabriele (Fondazione Bruno Kessler); CALDERINI, Giovanni (Univ. P. et Marie Curie (Paris VI) (FR)); MARCHIORI, Giovanni (Univ. P. et Marie Curie (Paris VI) (FR)); CHAUVEAU, Jacques (Universites de Paris VI et VII); BOSISIO, Luciano (Universita e INFN (IT)); BOMBEN, Marco (Univ. P. et Marie Curie (Paris VI) (FR)); BOSCARDIN, Maurizio (FBK Trento); ZORZI, Nicola (Fondazione Bruno Kessler - FBK); BAGOLINI, alvise (FBK, Trento)

Presenter: GIACOMINI, Gabriele (Fondazione Bruno Kessler)

Session Classification: Slim/Active edges

Contribution ID: **14** Type: **not specified**

Probe and Scanning System for 3D Response Mapping of Pixelated Semiconductor Detector with X-rays and the Timepix Read-out

Friday, 2 March 2012 12:10 (25 minutes)

The development of new radiation detectors of different semiconductor materials (Si, CdTe, GaAs, …) brings the necessity to test and evaluate their response and detection performance such as the spatial homogeneity and local charge collection efficiency. Similarly, such testing is desired as well in order to evaluate the extent of radiation damage in detectors. We built a detector scanning system allowing direct measurement of 3D distribution of basic sensor characteristic such as charge collection efficiency, charge diffusion etc. The principle of this system is based on the use of a highly collimated parallel X-ray beam with a perfect line profile. The beam is sent onto the pixelated sensor at a low angle, which allows determining, for a given angle and detector position, the depth of interaction for each pixel. Shifting the detector along the axis perpendicular to the plane of the beam we can obtain a 3D map of the detector response. Per-pixel signal read-out from the pixelated detector can be done by usage of the hybrid semiconductor device Timepix which allows per-pixel energy measurement. The Timepix chip contains an array of 256 × 256 square pixels (total over 65 k pixels) with pitch size 55 μm. Our method allows probing and scanning the charge collection at different depths across the pixelated sensor. Moreover, it allows determining the effect of radiation damage at μm scale. All these effects can be studied as well in the dependence on various detector parameters such as the sensor bias voltage or temperature. Results with specific detector materials will be presented.

Primary author: JAKUBEK, Jan (aInstitute of Experimental and Applied Physics, Czech Technical University in Prague (Horska 3a/22, CZ 12800 Prague 2, Czech Republic))

Presenter: JAKUBEK, Jan (aInstitute of Experimental and Applied Physics, Czech Technical University in Prague (Horska 3a/22, CZ 12800 Prague 2, Czech Republic))

Session Classification: Applications and other technologies

Contribution ID: **15** Type: **not specified**

Planar n+-in-n pixel sensors for the ATLAS IBL upgrade

Wednesday, 29 February 2012 12:00 (25 minutes)

ATLAS plans a first major upgrade of its pixel detector on the path to HL-LHC in form of the IBL: The insertion of a 4th pixel layer (Insertable B-Layer) is currently being prepared for 2013. This will enable the ATLAS tracker to cope with an increase of LHC's peak luminosity to about 3E34 cm-2 s-1 which requires a radiation hardness of the sensors of up to 5E15 n_eq cm-2.

As part of their qualification process planar sensors were irradiated up to the IBL end of life fluence of 5E15 n_eq cm-2 using low energy protons and reactor neutrons. Their performance was evaluated in lab based measurements and dedicated test beam campaigns. Results from these measurements will be presented.

Due to the unprecedentedly small mean sensor radius of only 3.2 mm from the beam, most of the IBL modules are mounted at fairly steep angles with respect to the eta coordinate which leads to large cluster sizes in z. To investigate the effect of this peculiarity, test beam measurements were performed at angles equivalent to realistic sensor positions close to the beampipe at eta=2.5. The status of testbeam reconstruction and analysis will be presented and a first estimate will be given on the prospects of studying the active zone in highly irradiated sensors with high-eta/grazing angle measurements.

An production progress report of the sensors for the IBL will be given as well.

Primary authors: Mr RUMMLER, Andre (Technische Universitaet Dortmund (DE)); MUENSTERMANN, Daniel (CERN)

Presenter: MUENSTERMANN, Daniel (CERN)

Session Classification: Running experiments and upgrades

Contribution ID: **16** Type: **not specified**

Measurements of highly irradiated ATLAS n+-in-n planar pixel sensors

Thursday, 1 March 2012 11:35 (25 minutes)

ATLAS plans a full replacement of its inner tracker after the end of this decade to cope with luminosities of up to 10E35
cm-2 s-1 at HLLHC. Here, the innermost pixel layer will have to withstand a radiation damage of 2E16 n_eq cm-2.

During the last three years lab characterisation of n+-in-n sensors highly irradiated with neutrons and protons as well as several test beam campaigns were conducted, using irradiated and unirradiated readout electronics. Results of these measurements will be presented.

A new dedicated test structure (fanout) for measurements of pixel detectors with exchangeable readout electronics will be introduced and first tests will be shown as well.

Some time ago it was demonstrated on strip sensors that beyond 2E15 n_eq cm-2 the conventional models are not sufficient to explain their beviour. Highly irradiated silicon pixel sensors show clearly similar effects. In order to clarify this matter interesting results could be gained with test beam measurements at very steep angles. First ideas and progress will be presented.

Primary author: Mr RUMMLER, Andre (Technische Universitaet Dortmund (DE))

Presenter: Mr RUMMLER, Andre (Technische Universitaet Dortmund (DE))

Session Classification: Planar Detectors

Contribution ID: **17** Type: **not specified**

Overview of the ATLAS Insertable B-Layer (IBL) Project

Wednesday, 29 February 2012 11:35 (25 minutes)

The upgrades for the ATLAS Pixel Detector will be staged in preparation for high luminosity LHC. The first upgrade for the Pixel Detector will be the construction of a new pixel layer which will be installed during the first shutdown of the LHC machine, foreseen in 2013-14. The new detector, called the Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new, smaller radius beam-pipe at a radius of 3.3 cm. The IBL will require the development of several new technologies to cope with increased radiation and pixel occupancy and also to improve the physics performance through reduction of the pixel size and a more stringent material budget. Two different and promising silicon sensor technologies, planar n-in-n and 3D, are currently under investigation for the IBL. An overview of the IBL project, of the module design and the qualification for these sensor technologies with particular emphasis on irradiation and beam tests will be presented.

Summary

The upgrades for the ATLAS Pixel Detector will be staged in preparation for high luminosity LHC. The first upgrade for the Pixel Detector will be the construction of a new pixel layer which will be installed during the first shutdown of the LHC machine, foreseen in 2013-14. The new detector, called the Insertable B-layer (IBL), will be installed between the existing Pixel Detector and a new, smaller radius beam-pipe at a radius of 3.3 cm. The IBL will require the development of several new technologies to cope with increased radiation and pixel occupancy and also to improve the physics performance through reduction of the pixel size and a more stringent material budget. Two different and promising silicon sensor technologies, planar n-in-n and 3D, are currently under investigation for the IBL. An overview of the IBL project, of the module design and the qualification for these sensor technologies with particular emphasis on irradiation and beam tests will be presented.

Primary author: GALLRAPP, Christian (Technische Universitaet Berlin (DE))

Presenter: GALLRAPP, Christian (Technische Universitaet Berlin (DE))

Session Classification: Running experiments and upgrades

Contribution ID: **18** Type: **not specified**

Radiation-hard active sensors in 180 nm HV CMOS technology

Thursday, 1 March 2012 12:25 (25 minutes)

While CMOS processes are cost-efficient and commercially available, they have not yet been used to produce radiation-hard sensors. So-called HV CMOS processes combine a slightly higher resistivity p-type substrate with deep n-wells and allow the combination of a drift-based electron-collecting sensor with active cuircit components while keeping a fill factor of 100%. Achievable depletion depths are in the order of 10-20 um.

The presentation will introduce the concept, present preliminary results obtained with first test chips and summarize the sensor design of a combined active strip/pixel sensor chip which was submitted in November and will be available for testing by end of March.

Summary

While CMOS processes are cost-efficient and commercially available, they have not yet been used to produce radiation-hard sensors. So-called HV CMOS processes combine a slightly higher resistivity p-type substrate with deep n-wells and allow the combination of a drift-based electron-collecting sensor with active cuircit components. Achievable depletion depths are in the order of 10-20 um.

This allows for novel sensor concepts such as having the first amplifier (and more electronics if desired) directly in a (very small) pixel sensor cell. Due to the low input capacitance of the small pixel, the noise contribution is very small and the signal-to-noise ratio is superb in spite of the rather shallow depletion zone and signal. These small pixel cells can then combined to form virtual strips or larger pixels which match already existing readout electronics chips, e.g. Beetle or FE-I4. Analogue hit encoding can yield improved resolution compared to the readout-chip pitch.

The presentation will introduce the concept, present preliminary results obtained with first test chips and summarize the sensor design of a combined active strip/pixel sensor chip which was submitted in November and will be available for testing by end of March.

In addition, an outlook will be given on the prospects and possible benefits of going to even smaller CMOS feature sizes. Furthermore, advantages and drawbacks of active CMOS sensors will be compared to drift-based CMOS MAPS concepts.

Primary author: MUENSTERMANN, Daniel (CERN)

Co-author: Dr PERIC, Ivan (Ruprecht-Karls-Universitaet Heidelberg (DE))

Presenter: MUENSTERMANN, Daniel (CERN)

Session Classification: Planar Detectors

Contribution ID: **19** Type: **not specified**

Overview of the 3D Pixel sensors: recents laboratory measurements for the ATLAS Insertable B-Layer (IBL)

Thursday, 1 March 2012 14:55 (25 minutes)

3D Silicon Pixel sensors fabricated at FBK-irst and at CNM with Double-side Double Type Column approach with full pass through columns electrodes have been irradiated and tested in laboratory. We will present an overview of the recent results from laboratory tests obtained with devices non irradiated and irradiated with protons up to 5x10ˆ15 neq/cmˆ2

Primary author: MICELLI, Andrea (Universita degli Studi di Udine (IT))

Presenter: MICELLI, Andrea (Universita degli Studi di Udine (IT))

Session Classification: 3D Detectors

Contribution ID: **21** Type: **not specified**

LHC-B Velo operation

Wednesday, 29 February 2012 09:55 (25 minutes)

Primary author: JANS, Eddy (NIKHEF)

Presenter: JANS, Eddy (NIKHEF)

Session Classification: Running experiments and upgrades

Contribution ID: **22** Type: **not specified**

Welcome

Wednesday, 29 February 2012 09:15 (10 minutes)

Session Classification: Registration and welcome

Contribution ID: **23** Type: **not specified**

Practical information

Wednesday, 29 February 2012 09:25 (5 minutes)

Presenter: KRAMBERGER, Gregor (Jozef Stefan Institute (SI))

Session Classification: Registration and welcome

Contribution ID: **24** Type: **not specified**

CMS pixel operation and upgrade plans

Wednesday, 29 February 2012 14:55 (25 minutes)

The CMS experiment is equipped with a 3 layer pixel detector for track seeding and vertexing. The talk gives a short description of the detector and its performance. During 2011 first radiation induced changes of the modules became noticable. This concerns the leakage current of the sensors, and the full depletion voltage, but also some parameters of the readout electronics.

It is planned to replace the CMS pixel detector by a new 4 ayer system in 2017. The motivation and a short description of the upgraded detector is also given.

Presenter: ROHE, Tilman (Paul Scherrer Institut (CH))

Session Classification: Running experiments and upgrades

Contribution ID: **25** Type: **not specified**

Diamond Sensor Based Systems in CMS

Friday, 2 March 2012 11:20 (25 minutes)

I will describe the systems in CMS that are based on the use of diamond sensors. These include the Beam Conditions Monitor that is part of the CMS safety system and the Pixel Luminosity Telescope a dedicated luminosity monitor that has recently been installed for a pilot run this year. I will briefly describe each system, show the latest data, and conclude with plans for the upcoming run and for the long shutdown

Primary author: HITS, Dmitry (Rutgers, State Univ. of New Jersey (US))

Presenter: HITS, Dmitry (Rutgers, State Univ. of New Jersey (US))

Session Classification: Applications and other technologies

Contribution ID: **26** Type: **not specified**

Status production of 3D at CNM

Thursday, 1 March 2012 14:30 (25 minutes)

Silicon detectors with cylindrical electrodes (so called 3D detectors) offer advantages over standard planar photodiodes as more radiation hard radiation sensors. 3D detectors with the double sided geometry have been fabricated at IMB-CNM clean room facilities. The layouts will fit the new pixelated readout chip FE-I4 developed by Atlas collaboration.
The technology and the electrical measurements of new 3D detectors fabricated in silicon substrates 230um thick for the future Insertable b-layer (IBL) of the Atlas experiment. The technological steps necessary for the fabrication of this double side 3D detectors are presented. We have performed detailed simulations including technological and electrical behaviour. By these simulations the optimum parameters for the design and fabrication of these devices have been found. With this information a new mask set has been designed which includes different detector geometries. The first detectors fabricated in the clean room facilities of CNM-IMB in Barcelona are presented together with the preliminary electrical measurements showing full depletion voltage of 5 V and leakage current on the order of nano amperes at room temperature.

Primary author: PELLEGRINI, Giulio (Universidad de Valencia (ES))

Presenter: PELLEGRINI, Giulio (Universidad de Valencia (ES))

Session Classification: 3D Detectors

Contribution ID: **27** Type: **not specified**

Edge-TCT studies of heavily irradiated strip detectors

Thursday, 1 March 2012 09:55 (25 minutes)

Effects of long term annealing on charge collection properties of miniature p-type micro-strip detectors, 300 and 150 µm in thickness, irradiated to fluences of 1016 and 5•1015 neq/cm2 with reactor neutrons respectively, were examined by using the Transient Current Technique with Edge-on laser injection (Edge-TCT). The detectors were annealed at 60°C in steps to an accumulated time of 10240 min and 20480 min respectively. Large increase of measured charge was observed even at low bias voltages at late annealing stages. Long term annealing causes build up of negative space charge at the n+-p junction, which is located near the strips, consequently resulting in very high electric fields, sufficient for initiating the process of impact ionization, leading to charge multiplication. The increase of charge collection is correlated with the increase of leakage current.

Presenter: MILOVANOVIC, Marko (Jozef Stefan Institute, Ljubljana)

Session Classification: Planar Detectors

Contribution ID: **28** Type: **not specified**

Survey of Edge-TCT studies at CERN

Thursday, 1 March 2012 10:20 (25 minutes)

A survey of recent activities concerning the edge-TCT measurements and analysis at CERN will be presented. The first part of the talk is focused on annealing study of FZ and MCz strip detectors irradiated with 24GeV/c protons to fluence of 1e16p/cm2. In the second part of this talk two methods are proposed to extract the trapping time profiles from edge-TCT measurements. The first method is based on comparison of calculated signals with the measured ones, while the second method involves comparison of measured and calculated efficiency profiles. An example of first method at work was already presented at 19th RD50 workshop, thus an example for the second method is given here. The work is still under the development, however problems and future plans will be addressed in this talk.

Presenter: DOLENC KITTELMANN, Irena (CERN)

Session Classification: Planar Detectors

Contribution ID: **29** Type: **not specified**

Update on charge collection measurements with SCT128 chip in Ljubljana

Thursday, 1 March 2012 11:10 (25 minutes)

In the presentation the results of charge collection measurements with SCT128 chip with HPK mini-strip detector will be shown. First the results with sensor irradiated with pions at PSI and later with neutrons in Ljubljana will be presented. In the second part of the talk the measurements of changes of collected charge and detector current with time will be shown. The detector irradiated with pions was biased for several hours during which CCE measurements were repeated.

Presenter: MANDIC, Igor (Jozef Stefan Institute (SI))

Session Classification: Planar Detectors

Contribution ID: **30** Type: **not specified**

Trench detectors for enhanced charge multiplication

Thursday, 1 March 2012 12:00 (25 minutes)

Presenter: CASSE, Gianluigi (University of Liverpool (GB))

Session Classification: Planar Detectors

Contribution ID: **31** Type: **not specified**

Progress on Scribe-Cleave-Passivate (SCP) Slim Edge Technology

Thursday, 1 March 2012 16:40 (35 minutes)

Presenter: FADEEV, Vitaliy (Lawrence Berkeley National Laboratory (LBNL))

Session Classification: Slim/Active edges

Contribution ID: **32** Type: **not specified**

The Diamond Beam Monitor for Luminosity Upgrade of ATLAS

Friday, 2 March 2012 11:45 (25 minutes)

Luminosity monitors, beam monitors and tracking detectors of the experiments at the Large Hadron Collider and their upgrades must be able to operate in radiation environments several orders of magnitude harsher than those of any current detector. We have observed in ATLAS that as the environment becomes harsher detectors not segmented, either spatially or in time, have difficulty handling the separation of signal from background. Once the charged particle multiplicity reaches the point where all segments of these detectors have a high probability of having a hit in every bunch crossing their sensitivity quickly vanishes. This is already happening in ATLAS to the MBTS luminosity counters that will be removed in the 2011 year-end shutdown and LUCID luminosity counters. Chemical Vapour Deposition (CVD) diamond has a number of properties that make it an attractive alternative for high energy physics detector applications. Its large band-gap (5.5 eV) and large displacement energy (42 eV/atom) make it a material that is inherently radiation tolerant with very low leakage currents and high thermal conductivity. CVD diamond is being investigated by the RD42 Collaboration for use very close to LHC interaction regions, where the most extreme radiation conditions are found. The ATLAS Diamond Beam Monitor project (DBM) is a highly spatially segmented diamond-based luminosity monitor to measure bunch-by-bunch luminosity in ATLAS. The DBM will complement the highly time-segmented ATLAS BCM so that when the other ATLAS luminosity monitors (MTBS and LUCID) have difficulty functioning the ATLAS luminosity measurement which is a key to most precision measurement is not compromised. The DBM will provide three orders of magnitude higher spatial segmentation (relative to the single BCM pads) at the expense of lower (25 ns vs 2 ns) time resolution. However these two systems will complement one another in our characterisation of the beam backgrounds. The BCM will still use its exquisite timing resolution to localise beam background sources up (or down) stream of ATLAS, while the DBM will provide additional spatial information about the source(s) of background. To accomplish these goals, the DBM architecture is four 3-layer telescopes on each side of the interaction point with each layer having the size of one FE-I4 module, namely 20mm x 16.8mm active area. The first and last layers of the telescope are offset so that particles from both the ATLAS interaction point and beam halo background can be tracked. The results from protoype detectors and status of the project will be presented.

Presenter: GORISEK, Andrej (Jozef Stefan Institute (SI))

Session Classification: Applications and other technologies

Contribution ID: **33** Type: **not specified**

Status and performance of the ATLAS Pixel Detector

Wednesday, 29 February 2012 10:20 (25 minutes)

Presenter: GIBSON, Stephen (CERN)

Session Classification: Running experiments and upgrades

Contribution ID: **34** Type: **not specified**

Registration

Wednesday, 29 February 2012 08:30 (45 minutes)

Session Classification: Registration and welcome