The 30th International Workshop on Vertex Detectors

Report of Contributions

https://indico.global/e/1721

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

Welcome

Monday 27 September 2021 12:00 (10 minutes)

Presenter: BORTOLETTO, Daniela (University of Oxford (GB))

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

Radiation hardness of the ITkPixV1 and RD53A chips

Tuesday 28 September 2021 15:00 (15 minutes)

The ITkPixV1 chip is the pre-production pixel readout chip for the Phase-2 Upgrade of the ATLAS experiment at the HL-LHC. The harsh environment of HL-LHC, including a peak luminosity of 5x10ˆ34cm-2s-1 and an estimated total ionising dose (TID) of 1 Grad throughout its lifetime is placing strong requirements on the radiation tolerance of the chip. This contribution outlines investigations into the radiation tolerance of ITkPixV1. The impact of TID damage to the digital and analog front-end up to total doses of 1 Grad (at dose rate 4 Mrad/h) is reported.

Author: MIRONOVA, Maria (University of Oxford (GB))

Presenter: MIRONOVA, Maria (University of Oxford (GB))

Session Classification: YSF talks

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

Simulation of the Belle II Silicon Vertex Detector

Monday 27 September 2021 15:40 (15 minutes)

Belle II is the next generation B Factory experiment operating at the SuperKEKB accelerator complex at KEK in Tsukuba, Japan. It is expected to collect 50 ab-1 of data, with a target instantaneous luminosity of $6.5 \times 10^{35}\mathrm{cm}^{-2}\mathrm{s}^{-1}$, which is about 30 times larger than its predecessor.

The Silicon Vertex Detector (SVD) consists of four layers of double-sided silicon strip detectors (DSSDs) and is a part of the newly designed innermost tracking device of Belle II. Located in close vicinity of the interaction point, it plays a crucial role in track position and hit time determination, as well as contributing to slow particle identification through specific dE/dx measurements.

In view of the ever increasing Belle II data sample, accurate simulation of the detector is growing in importance. Belle II software implements a simplified signal formation model in the SVD simulation. It is based on charge sharing among strips based on coupling capacitances, with coefficients initially tuned with test beam data. With first data from collisions in Belle II we observed a good match between data and MC for cluster charge and signal to noise ratio distributions, while some disagreement in terms of cluster size and strip time distributions was found. In this talk we will summarize our effort to improve detector simulation and present the achieved results. A data-driven method allows a better parametrization of the charge sharing model, yielding a significant improvement of data-simulation agreement in cluster size distribution. Furthermore, by refining the simulation of coupling effects, we are able to model the strip time distribution more accurately.

Author: KALETA, Mateusz (Institute of Nuclear Physics Polish Academy of Sciences)

Presenter: KALETA, Mateusz (Institute of Nuclear Physics Polish Academy of Sciences)

Session Classification: YSF talks

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

A silicon pre-shower detector to enable di-photon measurement in the FASER experiment at CERN.

Tuesday 28 September 2021 15:15 (15 minutes)

The FASER experiment at CERN takes advantage of the enormous flux of hadrons produced at zero-angle at the ATLAS interaction point to perform the first search for low-mass, Long Lived Particles (LLPs) at the LHC.
The present design of the experiment is optimised to measure LLPs decaying into two charged leptons. To extend the discovery potential of the experiment to neutral particles in the final state, a tungsten-silicon pre-shower detector is under construction to enable the discrimination of two photons with O(TeV) energies and separation down to 200 μm.
The new pre-shower will be made of interleaved layers of tungsten absorbers and monolithic silicon pixel sensors in SiGe BiCMOS. The detector ASIC will have hexagonal pixels of 65 μm side, an extended dynamic range for the charge measurement and capability to store the charge information for hundreds of pixels per event with very limited dead area.
A summary of the project, including simulation results and a description of the monolithic ASIC will be presented.

Authors: SFYRLA, Anna (Universite de Geneve (CH)); PAOLOZZI, Lorenzo (CERN); PICARDI, Antonio (Universite de Geneve (CH)); PANDINI, Carlo Enrico (University of Geneva); MAGLIOCCA, Chiara (Universite de Geneve (CH)); RIZZI, Chiara (University of Geneva); SULTAN, D M S (Universita degli Studi di Trento and INFN (IT)); FERRERE, Didier (Universite de Geneve (CH)); MARTINELLI, Fulvio (EPFL - Ecole Polytechnique Federale Lausanne (CH)); IACOBUCCI, Giuseppe (Universite de Geneve (CH)); PERIC, Ivan (KIT - Karlsruhe Institute of Technology (DE)); MUNKER, Magdalena (CERN); NESSI, Marzio (CERN); VICENTE BARRETO PINTO, Mateus (Universite de Geneve (CH)); MILANESIO, Matteo (Universite de Geneve (CH)); TARANNUM, Noshin (Universite de Geneve (CH)); VALERIO, Pierpaolo (CERN); KOTITSA, Rafaella Eleni (Universite de Geneve (CH)); CARDARELLI, Roberto (INFN e Universita Roma Tor Vergata (IT)); CARDELLA, Roberto (Universite de Geneve (CH)); GONZALEZ SEVILLA, Sergio (Universite de Geneve (CH)); DEBIEUX, Stephane (Universite de Geneve (CH)); MORETTI, Theo (Universite de Geneve (CH)); GURIMSKAYA, Yana (Universite de Geneve (CH)); FAVRE, Yannick (Universite de Geneve (CH))

Presenter: PAOLOZZI, Lorenzo (CERN)

Session Classification: YSF talks

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

Analysis of test beam data with bent MAPS sensors for the ALICE upgrade

Tuesday 28 September 2021 15:30 (15 minutes)

The ALICE upgrade planned for the LHC Long Shutdown 3 aims to replace the three innermost of the current Inner Tracking System (ITS) with a new silicon detector based on wafer-scale, ultra-thin, truly cylindrical Monolithic Active Pixel Sensors built with 65 nm technology (ITS3).
The ITS3 will reach unprecedented tracking and vertexing performance, thanks to its ultra-low material budget.
The R&D programme to characterize the effect of the bending on the 50µm-thick ALPIDE sensors for the ALICE ITS3 project is currently underway.
Since 2019 several test beam campaigns were conducted to characterize the behaviour of the bent sensors.
In this contribution, we report on the outcome of the in-beam test of bent ALPIDE sensors showing how the results compare to the non-bent sensors.
The analysis details will be presented.
In particular, the effect of the bending on the detector efficiency and resolution will be discussed.

Author: JACAZIO, Nicolo (CERN)

Presenter: JACAZIO, Nicolo (CERN)

Session Classification: YSF talks

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

MONOLITH –picosecond time stamping in fully monolithic highly-granular pixel sensors

Thursday 30 September 2021 15:55 (15 minutes)

The aim of the MONOLITH H2020 ERC Advanced project is to develop fully monolithic highly granular pixel sensors with picosecond time stamping capabilities. To reach a picosecond precise sensor response, a thin gain layer has been implemented deep inside a high-resistivity epitaxial layer. By moving the gain layer away from the pixel implantation, the pixel size can be reduced down to 50 μm, allowing to simultaneously reach a high spatial precision. Making use of a SiGe BiCMOS 130 nm process technology, a fast and low noise frontend response has been realised. 3D TCAD simulations have been developed for a detailed insight and understanding of the sensor and have been used to optimise the gain layer and epitaxial layer doping levels as well as the pixel edge structures. Several prototypes with different doping levels and different complexity of in-pixel circuitry have been produced in this technology to investigate and optimise their performance in terms of e.g. sensor gain and time stamping capability. Laboratory and test-beam measurements have been made, with a focus on sensor gain, detection efficiency and time resolution.
This talk will introduce the MONOLITH project and summarise the main measurement and simulation results.

Authors: PICARDI, Antonio (Universite de Geneve (CH)); MUNKER, Magdalena (CERN); MAGLIOCCA, Chiara (Universite de Geneve (CH)); FERRERE, Didier (Universite de Geneve (CH)); MARTINELLI, Fulvio (EPFL - Ecole Polytechnique Federale Lausanne (CH)); IACOBUCCI, Giuseppe (Universite de Geneve (CH)); RUECKER, Holger (ihp-microelectronics); PAOLOZZI, Lorenzo (CERN); NESSI, Marzio (CERN); VICENTE BARRETO PINTO, Mateus (Universite de Geneve (CH)); MILANESIO, Matteo (Universite de Geneve (CH)); VALERIO, Pierpaolo (CERN); KOTITSA, Rafaella Eleni (Universite de Geneve (CH)); CARDARELLI, Roberto (INFN e Universita Roma Tor Vergata (IT)); CARDELLA, Roberto (Universite de Geneve (CH)); GONZALEZ SEVILLA, Sergio (Universite de Geneve (CH)); MORETTI, Theo (Universite de Geneve (CH)); GURIMSKAYA, Yana (CERN)

Presenter: MUNKER, Magdalena (CERN)

Session Classification: YSF talks

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

The 100µPET project: an ultra high resolution small-animal PET scanner

Tuesday 28 September 2021 15:45 (15 minutes)

Recent developments in semiconductor pixel detectors allow for a new generation of positron-emission tomography (PET) scanners that, in combination with advanced image reconstruction algorithms, will allow for a few hundred micron spatial resolutions. Such novel scanners will pioneer ultra-high resolution molecular-imaging, a field that is expected to have an enormous impact in several medical domains, neurology among others. The University of Geneva, the Hôpitaux Universitaires de Genève and the École Polytechnique Fédérale de Lausanne have launched the 100µPET project that aims to produce a small-animal PET scanner with ultra-high resolution. This prototype, that will use a stack of 60 monolithic silicon pixel sensors as detection medium, will provide volumetric spatial resolution one order of magnitude better than today's best operating PET scanners. The R&D on the optimisation of the monolithic pixel ASIC, the readout system and the mechanics, as well as the simulation of the scanner performance, will be presented.

Author: VICENTE BARRETO PINTO, Mateus (Universite de Geneve (CH))

Co-authors: IACOBUCCI, Giuseppe (Universite de Geneve (CH)); PAOLOZZI, Lorenzo (CERN); FERRERE, Didier (Universite de Geneve (CH)); PANDINI, Carlo Enrico (University of Geneva); CADOUX, Frank Raphael (Universite de Geneve (CH)); VALERIO, Pierpaolo (CERN)

Presenter: VICENTE BARRETO PINTO, Mateus (Universite de Geneve (CH))

Session Classification: YSF talks

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

Measurement of the cluster position resolution of the Belle II Silicon Vertex Detector

Monday 27 September 2021 15:25 (15 minutes)

The Silicon Vertex Detector (SVD), with its four double-sided silicon strip sensor layers, is one of the two vertex sub-detectors of Belle II operating at SuperKEKB collider (KEK, Japan). Since 2019 and the start of the data taking, the SVD has demonstrated a reliable and highly efficient operation, even running in an environment with harsh beam backgrounds that are induced by the world's highest instantaneous luminosity.
Beside providing particle identification information, the SVD is used to reconstruct tracks in order to determine the position of decay vertices with high accuracy. While the SVD performance is already very good and allows an efficient track reconstruction, there is still some room for improvements of the cluster position reconstruction.
In order to provide the best quality track reconstruction with an efficient pattern recognition and track fit, and to correctly propagate the uncertainty on the hit's position to the track parameters, it is crucial to precisely estimate the resolution of the cluster position measurement. Several methods for estimating the position resolution directly from the data will be discussed. They involve various ways to select data, comparing reconstructed hits with track extrapolation all over the detector, or exploiting regions where two detection ladders overlap in order to compare two reconstructed hits. Various statistical treatments to extract a single and robust resolution number were also investigated: truncated mean and mean absolute deviation. The behaviour of each method is studied comparatively with simulated and real data and the performance is compared to that obtained on the first Belle II data. Finally, possible future improvements of the cluster position resolution will be discussed.

Author: LEBOUCHER, Robin (CNRS)

Presenter: LEBOUCHER, Robin (CNRS)

Session Classification: YSF talks

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

Operational experience of the CMS Tracker

This presentation describes the operational experiences and challenges with the CMS Tracker running under conditions, which are beyond the designed instantaneous luminosity. The evolution of detector parameters will also be discussed.

Author: Dr CMS EXPERIMENT , Young Scientist (CMS Experiment)

Presenter: Dr CMS EXPERIMENT , Young Scientist (CMS Experiment)

Session Classification: YSF talks

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

Exploring Track Trigger Parameters for Exotic and Long-Lived Particle Searches

Monday 27 September 2021 15:55 (15 minutes)

CERN's ATLAS and CMS experiments were designed with prompt and standard model particles in mind. The track-trigger upgrades planned for the High Luminosity LHC open up the possibility to trigger on long-lived and unconventional signatures directly. To maximize sensitivity for these challenging signatures, we study the efficiency of hypothetical hardware level track triggering algorithms. We look to find the collection of track trigger parameters best suiting a wide range of signatures of LLP and exotic models. In this talk, we explore the results for models with displaced jets and leptons, heavy stable charged particles, and soft-unclustered energy patterns.

Author: NELSON, Jessica Nicole (Brown University (US))

Co-authors: HOLMES, Tova Ray (University of Tennessee (US)); PACHAL, Katherine (Duke University (US)); DI PETRILLO, Karri Folan (Fermi National Accelerator Lab. (US)); FARR, Jesse Nicole (University of Tennessee (US)); GUO, Christopher (Fermi National Accelerator Lab. (US))

Presenter: NELSON, Jessica Nicole (Brown University (US))

Session Classification: YSF talks

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

Experience with the ATLAS Inner Detector

Monday 27 September 2021 12:10 (30 minutes)

Presenter: MORINAGA, Masahiro (University of Tokyo (JP))

Session Classification: Current experiments

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

Experience with the CMS Inner Detector - YSF talk

Monday 27 September 2021 12:40 (15 minutes)

Presenter: HABIBULLAH, Redwan Md (Florida State University (US))

Session Classification: Current experiments

Contribution ID: **20** Type: **not specified**

Timing detectors for CMS

Thursday 30 September 2021 12:30 (30 minutes)

Presenter: FERRERO, Marco (Universita e INFN Torino (IT))

Session Classification: Timing Detectors

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

Overview of timing detector development at BNL/HPK/KEK/Tsukuba

Thursday 30 September 2021 13:45 (30 minutes)

Presenter: NAKAMURA, Koji (High Energy Accelerator Research Organization (JP))

Session Classification: Timing Detectors

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

ARCADIA: technology platform and system-grade demonstrator architecture

Wednesday 29 September 2021 16:00 (30 minutes)

Presenter: PATERNO, Andrea (Universita e INFN Torino (IT))

Session Classification: Monolithic detectors

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

Progress on SOI Pixel Sensors

Wednesday 29 September 2021 12:30 (30 minutes)

Presenter: MIYOSHI, Toshinobu (KEK)

Session Classification: Monolithic detectors

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

Progress in DMAPS (Monopix)

Wednesday 29 September 2021 13:45 (30 minutes)

Presenter: DINGFELDER, Jochen Christian (University of Bonn (DE))

Session Classification: Monolithic detectors

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

Monolithic sensors for the Mu3e experiment

Wednesday 29 September 2021 14:15 (30 minutes)

Presenter: VIGANI, Luigi (Ruprecht Karls Universitaet Heidelberg (DE))

Session Classification: Monolithic detectors

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

The ATLAS tracker system for HL-LHC

Tuesday 28 September 2021 12:00 (30 minutes)

Presenter: CALDERINI, Giovanni (Centre National de la Recherche Scientifique (FR))

Session Classification: Upgrades

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

The Phase-2 Upgrade of the CMS Inner Tracker

Tuesday 28 September 2021 12:30 (30 minutes)

Presenter: BARTEK, Rachel (Catholic University of America)

Session Classification: Upgrades

Contribution ID: **35** Type: **not specified**

Upgrade of the BELLE II Inner Detector

Tuesday 28 September 2021 14:15 (30 minutes)

Presenter: KATSURO, Nakamura (KEK)

Session Classification: Upgrades

Contribution ID: **38** Type: **not specified**

Development of bent silicon vertex detectors for ALICE in the LHC Run 4

Tuesday 28 September 2021 13:45 (30 minutes)

Presenter: BUCKLAND, Matthew Daniel (University of Liverpool (GB))

Session Classification: Upgrades

Contribution ID: **42** Type: **not specified**

Operational experience of the BELLE II pixel detector

Monday 27 September 2021 13:40 (30 minutes)

Presenters: WANG, Boqun (DESY); WANG, Boqun (MPI for Physics, Munich, Germany)

Session Classification: Current experiments

Contribution ID: **43** Type: **not specified**

Operational experience of the BELLE II Silicon Vertex Detector

Monday 27 September 2021 12:55 (30 minutes)

Presenter: UEMATSU, Yuma (The University of Tokyo)

Session Classification: Current experiments

Contribution ID: **48** Type: **not specified**

LGAD Development for the LHC's High-Luminosity Upgrade at Teledyne e2v

Thursday 30 September 2021 16:10 (15 minutes)

The need for 4D tracking and Ultra-Fast Silicon Detectors is a result of the expected pile-up at the High-Luminosity LHC General-Purpose Detectors. To fully reconstruct events along the beam line where post-collision reconstruction with 3D detectors is insufficient, timing information is added to the spatial measurements to disentangle overlapping events. Track timing resolution of the order of tens of picoseconds is required to sufficiently resolve individual vertices.

As a part of a collaboration with commercial silicon foundry Teledyne e2v, the University of Oxford, University of Birmingham, Rutherford Appleton Laboratory and Open University are developing and testing new Low Gain Avalanche Detectors (LGADs). The project is aimed at developing Ultra Fast Silicon Detectors with properties suitable for use in the ATLAS High Granularity Timing Detector (HGTD). The simulation and production of the first batch of 22 six-inch wafers, featuring 50 μm thick high-resistivity epitaxial layers and different gain layer implants, has been completed successfully.

We will present the results of TCAD simulations, followed by leakage current (IV) and capacitance (CV) measurements for LGAD devices of sizes ranging from 1 mm to 4 mm, including comparisons to PiN diodes where the gain layer is absent. Gain measurements using laser injection on both LGAD and PiN devices will also be shown. Furthermore, we will present results and observations from laser wafer dicing and post-dicing thermal annealing.

Author: GAZI, Martin (University of Oxford)

Co-authors: ALLPORT, Philip Patrick (University of Birmingham (UK)); BORTOLETTO, Daniela (University of Oxford (GB)); GONELLA, Laura (University of Birmingham (UK)); HYNDS, Daniel (University of Oxford (GB)); JORDAN, Douglas (Teledyne e2v); KOPSALIS, Ioannis (University of Birmingham (GB)); MCMAHON, Stephen (Science and Technology Facilities Council STFC (GB)); MULVEY, Jonathan (University of Birmingham); PLACKETT, Richard (University of Oxford (GB)); STEFANOV, Konstantin (University of Oxford (GB)); VILLANI, Enrico Giulio (STFC - Science & Technology Facilities Council (GB))

Presenter: GAZI, Martin (University of Oxford)

Session Classification: YSF talks

Contribution ID: **49** Type: **not specified**

The Phase-2 Upgrade of the CMS Outer Tracker

Tuesday 28 September 2021 13:00 (30 minutes)

Presenter: NASH, Kevin Connor (Rutgers State Univ. of New Jersey (US))

Session Classification: Upgrades

Contribution ID: **51** Type: **not specified**

MAPS for the Upstream Tracker at LHCb Upgrade II

Wednesday 29 September 2021 13:00 (30 minutes)

Presenter: LI, Yiming (Institute of High Energy Physics, Chinese Academy of Sciences (CN))

Session Classification: Monolithic detectors

Contribution ID: **52** Type: **not specified**

MALTA monolithic Pixel sensors in TowerJazz 180 nm technology

Wednesday 29 September 2021 15:00 (30 minutes)

Presenter: SOLANS SANCHEZ, Carlos (CERN)

Session Classification: Monolithic detectors

Contribution ID: **53** Type: **not specified**

Timing detectors for ATLAS

Thursday 30 September 2021 12:00 (30 minutes)

Presenter: CASADO LECHUGA, Pilar (The Barcelona Institute of Science and Technology (BIST) (ES))

Session Classification: Timing Detectors

Contribution ID: **54** Type: **not specified**

Status of the TimeSPOT project

Thursday 30 September 2021 15:25 (30 minutes)

Presenter: LAI, Adriano (Universita e INFN, Cagliari (IT))

Session Classification: Timing Detectors

Contribution ID: **56** Type: **not specified**

Tracking for LHCb Run3 - VELO detector construction and the Silicon Upstream Tracker

Monday 27 September 2021 14:10 (30 minutes)

Presenter: KOSTIUK, Igor (Nikhef National institute for subatomic physics (NL))

Session Classification: Current experiments

Contribution ID: **57** Type: **not specified**

Upgrade of the ALICE ITS detector

Monday 27 September 2021 14:40 (30 minutes)

Presenter: REIDT, Felix (CERN)

Session Classification: Current experiments

Contribution ID: **58** Type: **not specified**

SiPM for Physics

Wednesday 29 September 2021 12:00 (30 minutes)

Presenter: MAZZI, Alberto (Center for Materials and Microsystems, Fondazione Bruno Kessler, Trento, Italy)

Session Classification: Monolithic detectors

Contribution ID: **59** Type: **not specified**

Development of LGADs and 3D detectors at FBK

Thursday 30 September 2021 14:15 (30 minutes)

Presenters: PATERNOSTER, Giovanni (FBK - Fondazione Bruno Kessler (IT)); PATERNOSTER, Giovanni (Fondazione Bruno Kessler); PATERNOSTER, Giovanni (Fondazione Bruno KEssler)

Session Classification: Timing Detectors

Contribution ID: **60** Type: **not specified**

A pixel detector with Timing for LHCb Upgrade 2

Thursday 30 September 2021 13:00 (30 minutes)

Presenter: JURIK, Nathan Philip (CERN)

Session Classification: Timing Detectors

Contribution ID: **61** Type: **not specified**

LGAD developments within the RD50 collaboration

Thursday 30 September 2021 14:55 (30 minutes)

Presenter: MOFFAT, Neil (Consejo Superior de Investigaciones Cientificas (CSIC) (ES))

Session Classification: Timing Detectors

Contribution ID: **62** Type: **not specified**

Development of HVCMOS sensors within the RD50 collaboration

Wednesday 29 September 2021 15:30 (30 minutes)

Presenter: VILELLA FIGUERAS, Eva (University of Liverpool (GB))

Session Classification: Monolithic detectors