HK 27: Instrumentation VI

Time: Tuesday 17:30–19:00 Location: HBR 19: C 1

Group Report HK 27.1 Tue 17:30 HBR 19: C 1

The $\overline{\text{P}}$ANDA Luminosity Detector — •René Hagdorn[1], Niels Boelger[1], Stephan Bökelmann[1], Achim Denig[2], Florian Feldbauer[1], Miriam Fritsch[1], Roman Klasen[1], Heinrich Leithoff[2], Jinxin Li[1], Stephan Maldaner[1], Christof Motzko[3], Jannik Petersen[2], and Gerhard Reicherz[1] for the PANDA-Collaboration — [1]Ruhr-Universität Bochum — [2]Johannes-Gutenberg-Universität Mainz — [3]Helmholtz-Institut Mainz

The $\overline{\text{P}}$ANDA experiment is primarily focused on hadron spectroscopy. It will be situated at the FAIR accelerator complex, currently under construction in Darmstadt. In order to determine the cross sections of occurring processes a precise knowledge of the luminosity is crucial. The luminosity will be measured with the Luminosity Detector. This detector is a tracking detector, which provides the angular distribution of the tracks of elastically scattered antiprotons at small scattering angles. This way, a precision of $< 5\,\%$ for the absolute time-integrated luminosity can be reached.

The detector consists of four layers of silicon pixel sensors (HV-MAPS) which combine the sensitive detection area and the readout electronics on the same chip. The sensors are glued to both sides of CVD-diamond carriers and mounted to a movable holding structure. To prevent disturbances of the primary beam the whole setup is operated in vacuum, introducing the need of an active cooling system.

The concept of the luminosity determination at $\overline{\text{P}}$ANDA is explained and the detector components including the sensor modules, cooling system, vacuum control, and data acquisition system are presented.

HK 27.2 Tue 18:00 HBR 19: C 1

Simulation and analysis of pixel cluster shapes in the ALPIDE monolithic active pixel sensor — •Fabian Königstein for the ALICE Germany-Collaboration — Physikalisches Institut Heidelberg, Germany

The ALPIDE chip, a CMOS Monolithic Active Pixel Sensor (MAPS), is the key component of the currently operating ALICE inner tracking system (ITS2). The ITS2 features good spatial resolution and detection efficiency, excelling at reconstruction of primary and secondary vertices, as well as detection of low momentum particles. ALPIDE is a digital sensor, meaning that only binary information is recorded about the passing of a particle: either a pixel records sufficient ionization charge or not. No information about the mass or energy or velocity of the particle is available. The possibility of involving the ITS2 deeper in particle identification, improving the overall performance is investigated. In this work I explore the possibility of using groups of pixels which recorded a hit, a so called pixel cluster, for rudimentary particle identification. For this, I utilize a simple theoretical model to simulate the charge diffusion and drift in ALPIDE sensors and to understand how they affect the pixel cluster properties. The model is tuned to data recorded during ALPIDE beam test campaigns. Additionally, data for different particle species is compared to the corresponding simulation result to verify the simple model.

HK 27.3 Tue 18:15 HBR 19: C 1

Simulations for the MIMOSIS-1 CMOS Monolithic Active Pixel Sensor — •Hasan Darwish for the CBM-MVD-Collaboration — Goethe University Frankfurt

MIMOSIS is a CMOS Monolithic Active Pixel Sensor designed to be used for the Micro Vertex Detector (MVD) of the future CBM experiment at FAIR in Darmstadt. The 50 um thick sensor featuring 1024 x 504 pixels with a pitch of 27 x 30 um will have to combine a spatial resolution of ~ 5 um with a time resolution of 5 us and provide a peak rate capability of 80 MHz/cm^2. Simulations have been done for the first prototype, MIMOSIS-1, using Allpix-squared simulation software. The simulations aim to reproduce the findings obtained in the sensor beam tests at DESY, COSY and CERN. The simulations as well as the reference data will be presented. *This work has been supported by BMBF (05P21RFFC2), HFHF, GSI, HGS-HIRe and Tangerine.

HK 27.4 Tue 18:30 HBR 19: C 1

Shower Shape Studies with EPICAL-2 — •Jan Schöngarth — Institut für Kernphysik, Goethe Universität Frankfurt

The EPICAL-2 detector has been designed and constructed within the endeavour to develop a novel electromagnetic calorimeter based on a SiW sampling design using silicon pixel sensors with binary readout. The R&D is performed in the context of the proposed Forward Calorimeter upgrade within the CERN-ALICE experiment and is strongly related to proton CT imaging studies as well as applicable to future collider projects.

EPICAL-2 consists of alternating W absorber and Si sensor layers employing the ALPIDE sensor developed for the ALICE-ITS upgrade. It has a total thickness of 20 radiation lengths, an area of 30 mm * 30 mm, and 25 million pixels of size $\sim 30 * 30\ \mu\text{m}^2$. EPICAL-2 has been successfully tested with cosmic muons as well as in test-beam campaigns at DESY and CERN-SPS. Monte Carlo simulations have been performed using Allpix^2, a generic simulation framework for semiconductor detectors.

In this talk, an overview of the detector response in data and simulation, using different energy proxies, namely the number of pixel hits, clusters or charged shower particles per event, is given. In addition, a study of the electromagnetic shower shape including a 2D-parametrization of lateral density profiles is presented.

Supported by BMBF and the Helmholtz Association.

HK 27.5 Tue 18:45 HBR 19: C 1

First experimental time-of-flight based proton radiography — •Felix Ulrich-Pur[1], Thomas Bergauer[2], Tetyana Galatyuk[1,3,4], Albert Hirtl[5], Vadym Kedych[3], Yevhen Kozymka[3], Wilhelm Krüger[3], Sergey Linev[1], Jan Michel[1], Jerzy Pietraszko[1], Adrian Rost[6], Christian Joachim Schmidt[1], Michael Träger[1], and Michael Traxler[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [2]Austrian Academy of Sciences, Institute of High Energy Physics — [3]Technische Universität Darmstadt — [4]Helmholtz Forschungsakademie Hessen für FAIR — [5]TU Wien, Atominstitut — [6]FAIR Facility for Antiproton and Ion Research in Europe GmbH

Low Gain Avalanche Detectors (LGADs) are silicon-based detectors especially designed for high luminosity environments. Due to their excellent 4D-tracking properties, LGADs allow single particle tracking with high spatial and time precision even at high track densities.
One application that could particularly benefit from this high rate capability is ion computed tomography (iCT), an imaging modality aiming at the improvement of treatment planning quality in ion beam therapy. Building an iCT system based on LGADs, would not only help to address the rate limitations of current iCT prototype scanners, but it would also allow to integrate time-of-flight measurements into the imaging process itself, also referred to as TOF-iCT.
In this contribution, we will present our development efforts towards a TOF-iCT system based on LGADs and show the first experimental TOF-based proton radiography recorded at MedAustron.