HK 43: Instrumentation IX

Time: Thursday 14:00–15:30 Location: SR Exp1A Chemie

Group Report HK 43.1 Thu 14:00 SR Exp1A Chemie
Material budget imaging for mockup samples of the ALICE ITS3 with an electron beam — •Simon Gross-Bölting for the ALICE Germany-Collaboration — Physikalisches Institut, Heidelberg, Deutschland

During the Long Shutdown 3, ALICE will replace the inner barrel of its ITS2 detector with the ITS3, which features curved, ultra-thin silicon sensors supported by ultra-light carbon foam. The ITS3 aims for an average material budget of 0.09% in its first layer within a pseudorapidity range $|\eta| < 1$.

To study scattering caused by the carbon foam, a mockup was tested using an electron scattering telescope optimized for angular resolution. Scattering angle distributions were analyzed by fitting the inner 98% with a Gaussian, and the material budget was inferred using the Highland formula. Position-based momentum calculations, accounting for momentum gradients in the test beam, enhanced accuracy and eliminated the need for a scaling factor, enabling the creation of a two dimensional material budget map.

The measured material budget for the "half-ring" matched theoretical predictions, while deviations in the "longeron" were linked to excess glue, later confirmed by CT scans.

HK 43.2 Thu 14:30 SR Exp1A Chemie
Performance studies with the novel MIMOSIS-2.1 Sensor* — •Benedict Arnoldi-Meadows for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

The cmos Monolithic Active Pixel Sensor mimosis will be used as sensor technology for the Micro Vertex Detector (mvd) of the cbm experiment at fair in Darmstadt. It is currently in a R & D phase with mimosis-2.1 being its latest prototype, featuring likely fully depleted ac-coupled pixels with in total four sensing element designs, which were evaluated for their detection performance. These designs differ in the thickness of $25\,\mu$m and $50\,\mu$m and the doping in the epitaxy. The sensors under test feature numerous elements of the final sensor, *e.g.*, the full data rate capability of the final sensor by 8×320 MHz links with the mimosis data format which clusters neighboring fired pixels on the envisaged $\sim 4.25\,\mathrm{cm}^2$ large pixel matrix with 1024×504 pixels, each with an individual pitch of $\sim 27 \times 30\,\mu\mathrm{m}^2$.

The results of first sensor performance studies at dedicated test-beam facilities (desy, cern) will be presented.

*This work has been supported by bmbf (05P21RFFC2), gsi, Eurizon, hgs-hire, and hfhf.

HK 43.3 Thu 14:45 SR Exp1A Chemie
Status of the Readout of the CBM Micro Vertex Detector — •Benedikt Gutsche for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt, Germany

The Compressed Baryonic Matter (CBM) Experiment will be one of the main experiments at the future FAIR facility. Its Micro Vertex Detector (MVD) will be composed of four sensor planes in vacuum and will be equipped with Monolithic Active Pixel Sensors (MIMOSIS). The sensor is being developed by IPHC Strasbourg and will run with a peak rate capability of 80 MHz/cm^2. The detector will be read out by GBTx's and PCIe based FPGA boards. The data is there to be processed and included into the common readout stream of the experiment. This contribution reports the progress regarding the GBTx configuration, HDL development, and lab testing. A smaller mini-MVD setup exists at GSI and results from the beam tests in Februray will be shown, as well as an outlook into the next steps and goals for the upcoming beam time in May/2025.

HK 43.4 Thu 15:00 SR Exp1A Chemie
Test-beam measurements with a babyMOSS beam telescope — •Alexander Rachev for the ALICE Germany-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — Forschungs- und Technologiezentrum Detektorphysik, Universität Bonn

ALICE 3 is a novel, next-generation heavy-ion experiment at the LHC that is planned to be installed during the Long Shutdown 4. In the new detector, charged-particle tracking will be performed entirely by monolithic active pixel sensors (MAPS) based on 65nm CMOS technology. For the outer tracking alone an area of 45 m^2 needs to be covered, which requires extensive R&D on sensors, mechanics and cooling, as well as cooperation with industry.

In order to quantify the characteristics of new sensors, e.g. the spatial resolution, a reliable beam telescope is indispensible. A beam telescope is an arrangement of detectors used to track particles, providing a reference for the Device under Test (DUT) in a particle (test-)beam. Sensors that are currently being investigated for the upcoming inner tracker upgrade form the starting point for developments of the outer tracker. One of these sensors is the babyMOSS which is being used to construct a beam telescope for future characterizations and to understand the behavior of the newly developed MAPS.

In this talk I will present the setup of a babyMOSS beam telescope and show analysis results of testbeam data. Supported by BMBF.

HK 43.5 Thu 15:15 SR Exp1A Chemie
Impact of gap size modifications on the performance of a 65 nm CMOS technology Monolithic Stitched Sensor towards the future ALICE ITS3 — •Anouk Kaiser for the ALICE Germany-Collaboration — Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany

The Monolithic Stitched Sensor (MOSS) is a wafer-scale, pixel sensor prototype designed to investigate stitching techniques, evaluate achievable yield, and serve as a proof of concept for the ALICE Inner Tracking System 3 (ITS3) upgrade. The $50\,\mu$m thin sensor achieves full depletion at low reverse bias voltages through a deep n-type implant blanket extending beneath the collection diode. To improve charge collection efficiency at pixel boundaries, the design incorporates gaps of this implant between pixels in order to enhance lateral electric fields. The drift-based charge collection mechanism reduces the cluster size, making single-pixel hits the most common outcome.

This presentation will explain the analysis, using particles from a testbeam to determine performance parameters of the chip, namely the detection efficiency and the position resolution. It will examine the role of charge sharing at pixel boundaries, its effect on cluster size, and the resulting impact on position resolution. A key part of this study is comparing how two different gap sizes perform and understanding their role in shaping these results.