HK 58: Instrumentation XIII

Time: Thursday 17:30–19:00 Location: SR Exp1A Chemie

Group Report HK 58.1 Thu 17:30 SR Exp1A Chemie

The Silicon Tracking System of the CBM experiment: recent progress of the series production and performance in beam experiments — •Dairon Rodriguez Garces for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

The Compressed Baryonic Matter (CBM) experiment, cornerstone of the Facility for Antiproton and Ion Research (FAIR), focuses on exploring the properties of dense matter under extreme conditions. A key component of CBM is the Silicon Tracking System (STS), the central detector for tracking and momentum measurement of charged particles, designed to measure up to 1000 charged particles in nucleus-nucleus collisions at interaction rate up to 10 MHz, with a free streaming readout. It consists of 8 tracking stations equipped with 876 double sided silicon sensor modules mounted on low-mass carbon fiber ladders.

This report provides an overview of the recent progress in view of the realization of the STS detector: series module and ladder production, including detailed test and characterization of all individual components. It presents insights from beam operation with prototypes installed in the mini-CBM detector at SIS18 and in the E16 experiment at J-PARC, highlighting the capabilities of the detector under realistic conditions.

HK 58.2 Thu 18:00 SR Exp1A Chemie

Performance of hit, track, and vertex reconstruction of the Silicon Tracking System of the CBM experiment — •Dario Alberto Ramirez Zaldivar for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The Compressed Baryonic Matter (CBM) experiment is one of the experimental pillars at the Facility for Antiproton and Ion Research (FAIR). The Silicon Tracking System (STS) is the core detector for track reconstruction and momentum measurement. It comprises approximately 900 double-sided silicon strip sensors with 1024 strips per side, arranged in 8 tracking stations in a magnetic field of 1 Tm.

The mCBM setup at SIS18/GSI (mCBM@SIS18) is a small-scale precursor of the full CBM experiment. It consists of pre-series productions of all major detector subsystems, aiming to verify CBM's free-streaming readout electronics, data transport, and online reconstruction. The mini-STS (mSTS) setup consists of 12 sensors arranged in 3 stations and no magnetic field.

Heavy ion collisions in the $1-2$ $AGeV/c$ range were measured with an average collision rate $of 500$ kHz. The primary and secondary vertexes are reconstructed. Hit reconstruction efficiency is estimated using correlations with downstream detectors. This contribution will present the performance of hit, track, and vertex reconstruction from measurements of heavy ion collisions.

HK 58.3 Thu 18:15 SR Exp1A Chemie

LGAD Technology for Precise Reaction Time Measurement in Heavy-Ion Experiments, Medical Applications and Detector Diagnostics — •Yevhen Kozymka[3], Thomas Bergauer[2], Tetyana Galatyuk[1,3,4], Albert Hirtl[5], Matthias Kausel[5,6], Mladen Kis[1], Barbara Knäusl[7], Wilhelm Krüger[3], Sergey Linev[1], Jan Michel[1], Jerzy Pietraszko[1], Christian Joachim Schmidt[1], Michael Träger[1], Michael Traxler[1], Felix Ulrich-Pur[1], Matteo Centis Vignali[8], and Ashish Bisht[8] — [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]EBG MedAustron — [7]Medical University of Vienna, Department of Radiation Oncology — [8]Fondazione Bruno Kessler, Centre of Materials and Microsystems

The development of LGAD technology for charged particle detection is currently experiencing significant growth and demonstrating great performance in applications such as reaction time measurement, beam monitoring and ion CT thanks to its excellent timing properties. Preliminary measurements conducted with He and C ions have shown very promising results and great potential for heavy ion applications.

This presentation will focus on the results achieved using LGAD detectors for measuring the time-of-flight of protons as well as He and C ions conducted at the MedAustron institute, and will also showcase an example of using these sensors to diagnose radiation damage in a pcCVD diamond sensor.

HK 58.4 Thu 18:30 SR Exp1A Chemie

Commissioning of a telescope with babyMOSS reference layers for the testing of MAPS chips for ALICE — •Georgios Mantzaridis for the ALICE Germany-Collaboration — Technische Universität München, München, Germany

Monolithic Active Pixel Sensors (MAPS) provide the basis for the next generation of tracking and vertex detectors for the ALICE experiment at CERN. Both the next upgrade of the inner tracking system, ITS3, and the upcoming Outer Tracker for the planned ALICE3 detector will employ this technology. For that, the ALICE Collaboration is developing new sensor prototypes for which an extensive R&D program is conducted to assess the performance and operating parameters. For this purpose, we constructed a testbeam telescope at TUM. It uses six babyMOSS chips as reference planes in addition to the device under test (DUT). This contribution presents the commissioning of the telescope using the 3.2 GeV/c electron beam of the ELSA facility in Bonn. An analogue prototype test structure (APTS) is used as the DUT of which the spatial resolution and efficiency have been measured. This testbeam serves also as a preparation for testing larger pitch APTS, which are prototype sensors for the ALICE3 Outer Tracker and will be available next summer.

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HK 58.5 Thu 18:45 SR Exp1A Chemie

Readout and Slow Control for Test Detectors — •Tim Molzberger — Physikalisches Institut Albert-Ludwigs Universität, Freiburg im Breisgau, Deutschland

We present the latest developments for the readout and the slow control for test detectors. The readout features silicon photomultipliers for photodetection, coupled with application-specific integrated circuits (ASICs) for signal processing. The ASICs amplify and shape the signals, outputting a digital signal for each channel, along with two sums of the analog signals at different gain levels. A set of sampling ADCs digitizes the summed signals, while a separate set of threshold ADCs extracts timing information from the digital signals. The slow control system configures and monitors both the ADCs and ASICs through a group of controller boards. These boards also supply power to the readout system and maintain consistent gain across all photodetectors over a wide temperature range by employing a feedback loop.