HK 28: Instrumentation VIII

Time: Friday 14:00–15:45 Location: H2

Group Report HK 28.1 Fri 14:00 H2

Status of the CBM-MVD* — •Michael Deveaux for the CBM-MVD-Collaboration — GSI Darmstadt

The Compressed Baryonic Matter Experiment (CBM) is one of the core experiments of the future FAIR facility. It will explore the phase diagram of strongly interacting matter in the regime of high net baryon densities. Its Micro Vertex Detector (MVD) will contribute to the secondary vertex determination on a 10 μm scale, background rejection in di-electron spectroscopy and reconstruction of weak decays of multi-strange baryons. The detector comprises four stations placed next to the target in vacuum. The stations will be populated with 50 μm thin, highly-granular dedicated Monolithic Active Pixel Sensors (called "MIMOSIS"), which are being developed aiming at a spatial precision in the order of ~ 5 μm, a readout speed of less than 5 μs/frame, a radiation tolerance of $\sim 7 \times 10^{13}$ n_{eq}/cm^2 and 5 MRad. This contribution will summarize the status of activities towards constructing the MVD, that involve in particular the commissioning and beam tests of the first full size sensor prototype MIMOSIS-1 carried out in partnership with IPHC-Strasbourg.

*This work has been supported by BMBF (05P19RFFC1), GSI, HFHF and CREMLINplus.

HK 28.2 Fri 14:30 H2

Test beam performance of a digital pixel calorimeter — •Tim Sebastian Rogoschinski — Institut für Kernphysik, Goethe-Universität Frankfurt

A prototype of a digital pixel electromagnetic calorimeter, EPICAL-2, has been designed and constructed. It consists of alternating W absorber and Si sensor layers, with a total thickness of 20 radiation lengths, an area of 30 mm × 30 mm, and 25 million pixels. The design is the next step in pixel calorimetry, building on and refining a previous prototype using MIMOSA sensors [1]. The new EPICAL-2 detector employs the ALPIDE sensors developed for the ALICE ITS upgrade. This R&D is performed in the context of the proposed Forward Calorimeter upgrade for ALICE, but it also serves the general understanding of a fully digital calorimeter. The Allpix2 framework [2] was used to perform MC simulations of the detector response and shower evolution in EPICAL-2. We will report on first results on calibration from cosmic muons and on the calorimeter performance measured with the DESY electron beam. The prototype shows good energy resolution and linearity, comparable with those of a SiW calorimeter with analog readout. Electron test beam results can be reproduced by simulation.

[1] JINST13 (2018) P01014
[2] NIM A901 (2018) 164-172

HK 28.3 Fri 14:45 H2

Simulation of collision fragments impinging the CBM-MVD* — •Hasan Darwish for the CBM-MVD-Collaboration — Goethe University Frankfurt am Main

The Micro Vertex Detector (MVD) of the CBM experiment will be located close to the target. Consequently, it will be exposed to a dense flux of charged particles from different origins. With respect to the radiation hardness of the sensor, one major question is whether the CMOS Monolithic Active Pixel Sensors of the MVD will be exposed to harmful impacts of nuclear fragments coming from the target, which can potentially lead to a significant damage. We present studies based on GEANT invoking two different models simulating the production of nuclear fragments from relativistic heavy ion collisions. The simulation results and their impact on the requirements for the MVD will be discussed.

*This work has been supported by BMBF (05P19RFFC1), GSI, HFHF and CREMLINplus.

HK 28.4 Fri 15:00 H2

First Observations from Mimosis-1 Single Event Upset Beam Tests.* — •Benedict Arnoldi-Meadows for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt am Main

Mimosis-1 is the first full-sized prototype for the final cmos Monolithic Active Pixel Sensor to be used in the cbm Micro Vertex Detector (mvd). In the mvd, the sensors will be placed in close proximity to the beam and thus be exposed to $\sim 1\,\mathrm{kHz/cm^2}$ heavy ions from the beam halo. Moreover, in the event of a failing dipole, the beam will be displaced and may hit sensors.

Two beam tests with mimosis-1 were conducted to determine single event effects induced by $\sim 1\,A$ GeV heavy ions. First and preliminary results from the ongoing analysis of the tests will be presented.

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HK 28.5 Fri 15:15 H2

Radiation damage and annealing studies of $PbWO_4$ scintillation crystals for the $\overline{P}$ANDA-EMC — •Pavel Orsich[1], Valery Dormenev[1], Markus W. H. Moritz[1], Hans-Georg Zaunick[1], Kai-Thomas Brinkmann[1], and Mikhail Korjik[2] — [1]II. Physikalisches Institut, Justus-Liebig-Universität, Gießen — [2]Institute for Nuclear Problems, Minsk, Belarus

Lead tungstate scintillation crystals – PbWO 4 (PWO-II) – will be used in the Electromagnetic Calorimeter (EMC) of the high energy physics experiment $\overline{P}$ANDA at the high-luminosity accelerator facility FAIR (Darmstadt). During the operation of the experiment a degradation of the optical transmission of these crystals will occur due to creation of color centers via radiation damage and as a consequence this leads to the deterioration of the energy resolution of the calorimeter. In order to partially reverse this radiation damage the phenomenon of the stimulated recovery in scintillation crystals have been investigated via illumination by visible and infrared light.

A model of the radiation-induced absorption and its recovery in lead tungstate crystals will be presented. The mechanisms of the radiation damage under γ-radiation and the recovery under light will be discussed.

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HK 28.6 Fri 15:30 H2

Radiation dose simulation for FAIR phase-0 experiment at MAMI — •Alexander Greiner[1], Frank Maas[1,2,3], Oliver Noll[1], Sahra Wolff[1], Luigi Capozza[1], Julian Moik[1], David Rodriguez Pineiro[1], Samet Katilmis[1], Alaa Dbeyssi[1], Peter-Bernd Otte[1], and Dong Liu[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Germany — [2]Institute of Nuclear Physics, Johannes Gutenberg University, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

A complex detector system is being developed for the PANDA experiment at the FAIR accelerator facility in Darmstadt.
The group in Mainz is constructing the backward end cap (BWEC) of the PANDA electromagnetic calorimeter, which will be used at the MAMI electron accelerator for a FAIR/Phase0 experiment at Mainz to measure the electromagnetic transition form factor of the $\pi^0 \to \gamma\gamma$ transition.
In order to check whether the planned set-up of the BWEC can withstand the radiation exposure of the experiment without impairing the data acquisition through malfunctions, GEANT4 simulations of the experimental setup were carried out to record the radiation exposure of the entire experimental setup and individual important components. This presentation will explain how the simulations were carried out. We will present the results of the estimated radiation exposure and compare these estimates with various radiation resistance measurements of some components from the R&D phase.