HK 64: Instrumentation XVI

Time: Thursday 15:45–17:15 Location: HBR 19: C 2

Group Report HK 64.1 Thu 15:45 HBR 19: C 2

Space-point distortion calibrations for the ALICE TPC in LHC Run 3 — •Matthias Kleiner for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The Time Projection Chamber (TPC) in the ALICE experiment at the CERN LHC provides excellent tracking and particle identification capabilities. In order to cope with the high interaction rates of up to 50 kHz in Pb–Pb collisions during Run 3, the Multi-Wire Proportional Chambers (MWPCs) in the TPC were replaced by stacks of four Gas Electron Multiplier (GEM) foils to allow for continuous data acquisition. Despite the intrinsic ion-blocking properties of the 4-GEM system, a residual amount of ions produced during the electron amplification drifts into the active volume of the TPC, leading to space-charge distortions of the nominal drift field. Various further effects, such as fluctuations in the interaction rate or the decay of the LHC beam, cause time dependent variations of the distortions due to space-charge. Additional detector effects cause static and time dependent space-point distortions. These space-point distortions have to be corrected to preserve the intrinsic tracking precision of the TPC.

In this talk, an overview of observed space-point distortions and time dependent distortions in the ALICE TPC in Run 3 will be presented, along with procedures developed for the calibration of the space-point distortions.

Supported by BMBF and the Helmholtz Association

HK 64.2 Thu 16:15 HBR 19: C 2

Gain Calibration of the ALICE TPC with a Krypton source — •Ankur Yadav, Philip Hauer, and Bernhard Ketzer for the ALICE Germany-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

The ALICE Time Projection Chamber (TPC) was upgraded with a Gas Electron Multiplier (GEM)-based amplification system and continuous readout for Run 3 of the LHC. After the first successful Pb-Pb data taking in 2023, the TPC took several measurements by injecting the meta-stable radioactive isotope Kr-83m into the gas volume in order to calibrate the gain of each pad. In addition to the nominal settings used for physics data taking, several other combinations of electric fields in the quadruple-GEM stack were tested.

The recorded data was used to extract the pad-by-pad gain maps for the calibration of the TPC. In addition, the MC methods provided by the ALICE O^2 toolkit were used to simulate the decays of Kr-83m in the ALICE TPC.

This talk will present the comparison between the results for the different field settings as well as compare the results of the simulation with the data measured by the ALICE TPC.

Supported by BMBF.

HK 64.3 Thu 16:30 HBR 19: C 2

Investigation of gain homogeneity of new GEM tracking detectors for AMBER — •Paul Clemens[1], Jan Paschek[1], Bernhard Ketzer[1], and Karl Flöthner[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]GDD, CERN, Geneva, Switzerland

AMBER is a new fixed-target experiment at CERN's SPS, designed to investigate fundamental properties of hadrons. In the next years, measurement campaigns are planned which aim to measure the proton charge radius, antiproton production cross sections and Drell-Yan processes. In the predecessor experiment, Gas Electron Multiplier (GEM)-based detectors have been used since 2001 for precise tracking close to the beam. The requirements of the new measurements planned for AMBER, free-streaming readout and higher rate capability for strips in the central region, demand an upgrade of the existing COMPASS GEM tracking system. During the commissioning phase of new 30×30 cm^2 triple-GEM tracking detectors, a significantly higher gain was measured at a certain position in the detector, compared to the rest of the active area. This „hot spot“ appeared in all new detectors in the lab and at a test beam at the SPS. Large inhomogeneities in the gain distribution can potentially lead to discharges, threatening stable operation of the detector or even damaging it, or to inefficiencies in lower gain regions. In this talk, I will present systematic investigations towards the cause of this effect and discuss possible solutions.

HK 64.4 Thu 16:45 HBR 19: C 2

A Stabilized Voltage Divider for HV-Supply of GEM Detectors — •Jakob Krauss[1], Philip Hauer[1], Christian Honisch[1], Karl Flöthner[1,2], Matiss Wolter[1], and Bernhard Ketzer[1] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Germany — [2]CERN, Geneva, Switzerland

Gas Electron Multipliers (GEMs) are a common amplification stage in gaseous detectors. A high electric field is created inside micro-patterned holes to produce charge amplification. When used in high-rate environments, such as AMBER, the charges produced inside the detector lead to non-negligible currents between the electrodes. This imposes more stringent requirements on the stability of the high-voltage supply, as the gain is highly sensitive to the applied potentials.

The commonly used Passive Voltage Divider (PVD), is a cascade of resistors to set the potentials and limit the currents. With this design, any significant current will inevitably cause a change of potential. In contrast, the newly developed Stabilized Voltage Divider (SVD) employs a common-drain circuit, that provides currents with minimal voltage drop. The SVD also provides active current limiters for all GEM electrodes, effectively mitigating continuous discharges.

The talk will cover the principle of the SVD and a comparison with the PVD in simulation and in a detector setup under strong irradiation.

HK 64.5 Thu 17:00 HBR 19: C 2

Photon Reconstruction with ALICE's TPC in Run 3 — •Felix Schlepper for the ALICE Germany-Collaboration — Physikalisches Institut Heidelberg

In the upcoming ALICE Run 3 at CERN's LHC, the reconstruction of photons faces significant hurdles due to unconstrained tracks within the Time Projection Chamber (TPC) in continuous readout-mode. Due to their unconstrained nature these tracks produce large combinatorics, which is computationally very challenging. This talk delves into the challenges and solutions to reduce these combinatorics in the secondary vertexing and allow ALICE to reconstruct the vast majority of Photons.