HK 3: Instrumentation II

Time: Monday 16:30–18:00 Location: SCH/A.101

Group Report HK 3.1 Mon 16:30 SCH/A.101

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) is the main tracking and particle identification detector of the ALICE experiment at the CERN LHC. 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) 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-point distortions of the nominal drift field. Various effects, such as variations in the number of collisions for a given time interval, cause fluctuations of the distortions due to space-charge on very short time scales. Additional effects such as charging up of the GEM frames contribute to the space-point distortions. The average space-point distortions as well as the fluctuations have to be corrected to preserve the intrinsic tracking precision of the TPC.

In this talk, an overview about space-point distortions and distortion fluctuations 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 3.2 Mon 17:00 SCH/A.101

First tests of the time projection chamber and the trigger barrel of the PUMA experiment — Alexandre Obertelli[1,2], •Clara Klink[1,2], Sabrina Zacarias[2], Christina Xanthopoulou[2], Francois Butin[1], Frank Wienholtz[2], and Emmanuel Pollacco[3] — [1]CERN, Genève, Switzerland — [2]TU Darmstadt, Darmstadt, Germany — [3]CEA-IRFU, Paris-Saclay, France

The antiProton Unstable Matter Annihilation (PUMA) experiment plans on using antiprotons as probe for the nucleonic composition in the tail of the nuclear density distribution for stable and exotic nuclei. Antiprotons annihilate with the nucleons on the nucleus' surface: the combined charge of the annihilation products will reveal the neutron-to-proton content at the nuclear surface. This allows to investigate quantum phenomena like Halo nuclei and neutron skins. The products of the annihilation will be detected in a time projection chamber surrounded by a plastic-scintillator trigger barrel. In this talk, the working principle of the PUMA detection system will be explained, as well as the data acquisition system. The results of first tests with the system will be presented.

HK 3.3 Mon 17:15 SCH/A.101

Low Material TPC construction — •David Markus for the MAGIX-Collaboration — Institute of Nuclear Physics, JGU Mainz

The MAinz Gas Injection Target EXperiment MAGIX, currently under construction in Mainz, together with the Mainz Energy-Recovering Superconducting Accelerator MESA, will perform electron scattering measurements on various gases, provided by a gas jet target. With an intended luminosity of 10^{35} cm^{-2} s^{-1} at 105 MeV, MAGIX is capable of servicing a wide variety of phyiscal objectives, including dark sector searches, investigations into few body systems and nuclear astrophysics.

The scattered particles will be measured with two identical high resolution magnetic spectrometers. In their focal plane a short drift GEM-based Time Projection Chamber is placed to serve as tracking detector. The active area of the TPC is 768x192x140mm. The setup of the experiment, from the internal gas jet target to the TPC, is designed to limit the interaction of scattered particles before their detection, such that the only seperator of TPC gas volume and interaction point is single kapton foil entry window. To assure that the desired precision can be achieved, a space saving calibration system using UV-LEDs has been designed. Plastic scintillators mounted after the capton foil exit window serve as a trigger veto system.

The low material TPC contruction and calibration system will be the focus of this talk.

HK 3.4 Mon 17:30 SCH/A.101

The MAGIX StarryNight calibration system — •Daniel Steger for the MAGIX-Collaboration — Institute of Nuclear Physics, JGU Mainz

The MESA accelerator will host the MAGIX experiment, which is based on the scattering of an electron beam on a gas jet target. This enables scattering on gases like hydrogen while minimizing interaction with any other materials allowing us to perform high precision experiments. The measurement of the scattered particles is done by two magnetic spectrometers using a GEM based TPC to track the particles. To achieve the precision desired an independent system to calibrate the TPC is necessary. A prototype of such a system has been designed, utilizing LEDs with a wavelength of 275 nm that are operated in pulses above the cathode of the active volume of the TPC. Furthermore the cathode of the TPC has been replaced with aluminium based photon-electron-converter boards.

In this contribution the setup and development of this calibration system will be presented.

HK 3.5 Mon 17:45 SCH/A.101

Quality Control for the ALICE TPC — •Berkin Ulukutlu for the ALICE Germany-Collaboration — Technische Universität München, Munich, Germany

The ALICE TPC (Time Projection Chamber) detector at the LHC has recently been upgraded to handle higher interaction rates with a continuous readout mode. This upgrade includes a new readout system using GEMs for amplification, custom front-end electronics, and new reconstruction software. To monitor this essentially new detector's performance and assure its reliability under extreme operating conditions, a Quality Control framework has been developed. This framework provides tools for monitoring the TPC in real-time at both the hardware and physics observable levels, such as particle identification performance. The QC systems also include automated checks for alerting detector experts in case of any issues. However, pinpointing the source of issues in such a complex system is not easy. To assist with this, QC tools specifically designed for expert use are being developed, offering a direct and interactive interface to TPC observables in contrast to the predefined histograms and projections used in synchronous monitoring. In this talk, we will provide an overview of the TPC QC project, highlighting the challenges and the tools developed to address them.