HK 52: Accelerators and Instrumentation I

Time: Wednesday 14:00–16:00 Location: H-ZO 80

Group Report HK 52.1 We 14:00 H-ZO 80

Development of a high-rate TPC based on GEM amplification — •Bernhard Ketzer for the GEM-TPC-Collaboration — Technische Universität München, Physik Department, James-Franck-Straße, D-85748 Garching, Germany

Future experiments at high-luminosity machines such as PANDA, an antiproton-proton annihilation experiment at FAIR, require high-resolution tracking detectors with good momentum resolution, which at the same time have a very small material budget in order to minimize secondary interactions. A TPC ideally fulfills these requirements, and in addition contributes to particle identification via the measurement of the specific energy loss. The high interaction rate at these machines, however, requires to run the TPC in a continuous mode, i.e. without a gating grid. Therefore GEM foils are used to limit the backflow of ions from the multiplication into drift region. A small triple GEM-TPC has been built and tested using cosmic muons as well as electrons from ELSA, Bonn. First results from these tests will be shown, which provide a valuable cross-check for Monte Carlo simulations of the performance of a TPC in PANDA. These simulations indeed indicate that the challenges of field distortions and event mixing can be overcome. Currently, a larger prototype TPC with a driftlength of 60 cm and a diameter of 30 cm is being built. This chamber is expected to be tested both in the FOPI experiment at GSI and at ELSA in the near future. The design and the present status of this prototype will be discussed.

This work is supported by the BMBF, the DFG cluster of excellence *Universe*, the MLL München, and the EU 6th Framework Program.

HK 52.2 We 14:30 H-ZO 80

New developments for the GEM-based TPC for PANDA — •Maxence Vandenbroucke for the GEM-TPC-Collaboration — Technische Universität München E18, Garching, Germany

The PANDA experiment is an internal target experiment at the High Energy Storage Ring (HESR) at the new Facility for Antiproton and Ion Research (FAIR) at Darmstadt. A TPC is proposed as the central tracker due to its good position and momentum resolution, its low material budget, and its particle identification capabilities via ionization measurements. The continuous nature of the antiproton beam makes the use of a traditional ion gate impractical and hence GEM foils are used for gas amplification, due to their intrinsic ion back flow suppression properties. A small prototype of this GEM-TPC (diameter 200mm, drift length 77mm) has been built and characterized with cosmic muons using a rectangular pad readout structure. The chamber has recently been upgraded with a new readout plane with hexagonal pads, and new front end electronics, based on the AFTER ASIC. The performance of the detector is expected to improve significantly and is currently being studied at a beam test at the ELSA accelerator at Bonn. Preliminary results will be presented in this talk.

HK 52.3 We 14:45 H-ZO 80

The status of the FOPI GEM-TPC * a precursor prototype for the PANDA-TPC — •Bernd Voss for the GEM-TPC-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

In 2007 the construction and building of a medium volume (Ø300mm x 650mm) Time Projection Chamber (TPC) based on Gaseous Electron Multipliers (GEM) as amplification stages has been started. The detector is foreseen to be integrated in several experiments e.g. at ELSA/Bonn as well as at FOPI/GSI. It serves as a precursor prototype for an even larger TPC (Ø840mm x 1500mm) to be incorporated in PANDA/FAIR as a central tracking device which will be built in the frame-work of a joint venture project of twelve institutions in Europe. The general design of the detector as well the current status of assembly and testing will be presented.

HK 52.4 We 15:00 H-ZO 80

Tracking upgrade of the Crystal Barrel experiment at ELSA — •Alexander Winnebeck for the GEM-TPC-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, D-53115 Bonn

Double polarization photo-production experiments are performed with the Crystal Barrel experiment at ELSA in Bonn. The experimental set-up is dominated by an electromagnetic calorimeter, which is well suited for the investigation of multi-photon final states.

Detecting charged particles extends the capability of the set-up, and opens the field of charged and semi-charged reactions. An ideal detector for this task is a TPC, because it detects charged particles, determines their sign of charge and the transverse momentum, when a magnetic field is present. Combining this with the measured dE/dx allows particle identification for momenta up to ≈ 1 GeV/c.

Therefore a TPC is developed for the Crystal Barrel experiment. At first, a prototype chamber was tested in order to study resolution and further properties using an electron beam at ELSA. For these measurements a tracking test bench was set up with silicon strip detectors and planar GEM trackers.

First results of a test beam time will be presented.

HK 52.5 We 15:15 H-ZO 80

The PixelGEM Tracking System for the COMPASS Experiment — Heinz Angerer, Alexander Austregesilo, Florian Haas, Bernhard Ketzer, Igor Konorov, Markus Krämer, Alexander Mann, Thiemo Nagel, Stephan Paul, Florian Schneider, and •Sebastian Uhl — Technische Universität München, Physik Department E18, 85748 Garching

For the COMPASS experiment at CERN a gas electron multiplier (GEM) detector with a novel readout type has been developed. With its combined pixel and strip structure it should provide precise spatial information for the tracking of charged particles and still stand the high intensities of muon and hadron beams with a particle rate of more than $2 \cdot 10^5 / \left(\mathrm{mm}^2\,\mathrm{s}\right)$. The low material budget of these detectors was an essential part in reducing the amount of multiple scattering and secondary interactions in the hadron beam used in the year 2008. Five detectors have been successfully set up in the COMPASS spectrometer. We will present results in hadron beams of low $(3.5 \cdot 10^3\ \pi^- / \left(\mathrm{mm}^2\,\mathrm{s}\right))$ and high $(2 \cdot 10^4\ \pi^- / \left(\mathrm{mm}^2\,\mathrm{s}\right))$ intensities.

This work is supported by the Maier-Leibnitz-Labor der LMU und TU München and the DFG Cluster of Excellence "Origin and Structure of the Universe"(Exc153).

HK 52.6 We 15:30 H-ZO 80

Calibration of the Straw-Tube-Tracker for COSY-TOF — •Pierre Voigtländer, James Ritman, Matthias Röder, and Peter Wintz for the COSY-TOF-Collaboration — Institut für Kernphysik I, Forschungzentrum Jülich GmbH, 52425 Jülich, Germany

The Straw-Tube-Tracker (STT) is a new detector for the time of flight spectrometer COSY-TOF with 3120 single straw tubes arranged in 15 double-layers. The straw tubes are filled with a gas mixture of Ar/CO_2 (90%/10%) at an absolute pressure of 1.2 bar. During a commissioning beam time in August 2008 we used a 3.1 GeV/c proton beam on a proton target to study the $pp \to pp$ and $pp \to d\pi^+$ reactions for calibration of the STT detector. In a first step the isochrone-time-relation was determined by the drift time spectra of the single straws. Using this information the trajectories of reaction particles were reconstructed and the position of the individual straw tubes was determined by iterative fitting. The calibration results were compared with simulations of single straws, using the Garfield package. The obtained spatial resolution and efficiency of the STT will be presented.
Supported in part by BMBF and FZ-Jülich.

HK 52.7 We 15:45 H-ZO 80

Commissioning of the Vacuum Straw Tracker for the COSY-TOF Spectrometer — •Matthias Röder, James Ritman, Pierre Voigtländer, and Peter Wintz for the COSY-TOF-Collaboration — Institut für Kernphysik I, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

The Straw-Tracker at COSY-TOF is a system of 3120 Straws arranged in 30 layers. These are operated at 1.2 bar driftgas pressure in the TOF vacuum so that they are self-supporting, despite their mylar wrapping being only 30 μm thick. As a result the total radiation length amounts to only 1 %. The operation with 1500 V anode voltage in medium vacuum at $\approx 5 \cdot 10^{-3}$ mbar imposes stringent demands on detector design and handling.

In this talk the system is introduced and it is reported on the commissioning during the year 2008. The emphasis is placed on vacuum operation and results on the efficiency and resolution under experiment

conditions.

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