HK 61: Instrumentation XVIII

Zeit: Donnerstag 16:30–18:30 Raum: S1/01 A2

Gruppenbericht HK 61.1 Do 16:30 S1/01 A2

MAGIX: progressing towards a new experiment — •Sabato Stefano Caiazza for the Magix/MESA-Collaboration — Institut für Kernphysik - JGU, Mainz, Deutschland

In the next years, the Institut für Kernphysik at the Johannes Gutenberg-Universität Mainz, will build a new high-intensity accelerator for low-energy polarized electron beams. The MAGIX experiment will be one of the two exploiting this new machine. This experiment is designed to perform high precision measurement on the intense beam provided by the accelerator with polarized an unpolarized gas targets. This report will present an overview of the experiment and of its objectives, focussing on the development of the first prototypes of the experimental components and the first simulations of the experimental performances with an outlook on the future perspectives.

HK 61.2 Do 17:00 S1/01 A2

Entwicklung großflächiger mikrostrukturierter Gasdetektoren für MAGIX — •Pepe Gülker für die Magix/MESA-Kollaboration — Institut für Kernphysik, Mainz

Das geplante MAGIX-Experiment wird im energierückgewinnenden Bogen des zukünftigen MESA-Beschleunigers stehen und von diesem mit einem Elektronenstrahl (105 MeV | bis zu 10 mA) versorgt werden. In der Fokalebene der hochauflösenden Spektrometer (TARDIS) sollen MPGDs genutzt werden, die speziell für diese Anwendung zu entwickeln sind. Aufgrund der niedrigen Energien muß die effektive Strahlungslänge der Detektoren auf ein Minimum reduziert werden um unerwünschte Effekte, wie Vielfachstreuung zu reduzieren. Die hiermit zusammenhängenden Herausforderungen im Bezug auf die Optimierung der Effizienz und des räumlichen Auflösungsvermögens stehen im Mittelpunkt der Entwicklung. In diesem Vortrag werden die ersten Ergebnisse verschiedener Prototypen, so wie die ersten Tests mit einer dünnen Kapton basierten Auslesestruktur vorgestellt.

HK 61.3 Do 17:15 S1/01 A2

Filtering of common mode effect baseline shift on GEM-based detectors — •Konstantin Münning[1], Bernhard Ketzer[1], Markus Ball[1], Christian Lippmann[2], Arild Velure[3], and Bruno Cavalcante de Souza Sanches[4] for the ALICE-Collaboration — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany — [2]GSI - Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]University of Bergen, Department of Physics & Technology — [4]Universidade de Sao Paulo, Instituto de Fisica

Future upgrades of accelerator-based particle physics experiments aim at drastically increased event rates and challenge both detector and readout performance. At high count rates in particle detectors effects like signal pileup, baseline shift and fluctuations become important.

Large size GEM detectors as envisaged e.g. for the ongoing ALICE TPC upgrade have the advantage of delivering a fast signal without ion tail in comparison to wire chambers but the large capacitive coupling between channels via the GEM electrode facing the readout pads leads to significant baseline shift and fluctuations (common mode effect).

The talk is presenting the work on improving the stability of current baseline correction filters and introducing new filters and new data output modes in the read out electronics. The implementation in the SAMPA MPW2 chip to be used at ALICE and other experiments, which has now reached prototype production stage, is being introduced.

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Performance studies with the quadruple GEM detectors for the ALICE TPC upgrade — Piotr Gasik and •Andreas Mathis for the ALICE-Collaboration — TU München, Physik Department E62, Excellence Cluster 'Universe', D-85748 Garching, Germany

The ALICE Collaboration is planning a major upgrade of its central barrel detectors to be able to cope with the increased LHC luminosity beyond 2019. In order to record at an increased interaction rate of 50 kHz in Pb–Pb collisions, the TPC will be operated in an ungated mode with continuous readout. This demands for a replacement of the currently used gated MWPC (Multi-Wire Proportional Chamber) by GEM-based (Gas Electron Multiplier) readout chambers, while retaining the performance in particular in terms of particle identification capabilities via the measurement of the specific energy loss.

The present baseline solution for the TPC upgrade consists of a stack of four large-size GEM foils as amplification stage. An extensive R&D program with small detector prototypes has yielded a specific voltage configuration fulfilling the design specifications in terms of ion backflow suppression, gain stability, energy and $\mathrm{d}E/\mathrm{d}x$ resolution and stability against discharges. Moreover, large-size prototypes have been built in order to validate the production techniques and the performance with respect to operational stability against electric discharges and $\mathrm{d}E/\mathrm{d}x$ resolution both with beams and radioactive sources.

This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe' and BmBf Verbundsprojekt ALICE at HIG rate 05P15WOCA1.

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Ion backflow and energy resolution in quadruple GEM stack for the ALICE TPC upgrade — •Michael Jung, Rainer Renfordt, and Harald Appelshäuser for the ALICE-Collaboration — Institut für Kernphysik Frankfurt, Goethe-Universität Frankfurt, Germany

After the upgrade of the LHC at CERN the interaction rate of Pb–Pb collisions in RUN3 will be about 50 kHz. Therefore the Time Projection Chamber (TPC) of the ALICE experiment will be upgraded with quadruple stacks of Gas Electron Multipliers (GEMs), to provide operation in continuous mode. A test detector with a quadruple GEM stack has been set up in Frankfurt to investigate the behaviour of GEMs with emphasis on ion backflow (IBF) and energy resolution by varying GEM voltages, transfer fields between GEMs and the pitch between the GEM holes. Furthermore the electron transport properties of GEM foils were studied for different GEM hole pitches.

HK 61.6 Do 18:00 S1/01 A2

Measurement of ion mobility in Argon and Neon based gas mixtures — •Alexander Deisting for the ALICE-Collaboration — Research Division and EMMI, GSI Helmholtzzentrum für Schwerionenforschung — Physikalisches Institut, Universität Heidelberg

Gaseous drift chambers are currently operated at different experiments. In addition such detectors are foreseen for new experiments or upgrades of existing experiments. The performance of detectors with gas as detection medium strongly depends on the parameters of the gas used. One of these is the ion mobility μ, relating the velocity of drifting ions to the applied drift field. If the ion mobility is known it is e.g. possible to estimate the time development of space charges created by ions drifting through the gas volume of the detector and to correct for them.

To measure μ a dedicated gaseous detector was built. It features a gas amplification stage using a stack of three Gas Electron Multiplier (GEM) foils. In parallel to the GEM stack a mesh is mounted, which serves as drift cathode. For the measurement this detector is irradiated with an ionising source. The primary ionisation charges are then amplified by the GEM stack and a signal at the pad plane can be measured. In addition the ions produced during the amplification process will drift towards the mesh and induce a signal there. From the time difference between these signals, the ion mobility can be calculated.

With this setup the ion mobility in several Argon and Neon based gas mixtures was measured. The influence of O_2 and H_2O contamination on the mobility was studied as well.

HK 61.7 Do 18:15 S1/01 A2

A Photoelectric Effect based Field Calibration System for the Time Projection Chamber at the CBELSA/TAPS Experiment — •Dimitri Schaab, Markus Ball, Reinhard Beck, and Bernhard Ketzer for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Deutschland

One challenge of gaseous track detectors, such as the Time Projection Chamber (TPC), is the calibration of the electric field inside the sensitive volume. This is crucial since deviations from a perfectly homogeneous drift field deteriorates the performance of the TPC. Reasons for these deviations are, on the one hand, static imperfections of the detector structure and, on the other hand, dynamic changes of the space charge inside the sensitive volume. The dynamic space charge

distortions are collision rate dependent and mainly related to the unwanted ion backflow from the amplification region near the readout plane. For the CBELSA TPC, a calibration system is planned which is based on the T2K calibration system. Here, electrons are released via the photoelectric effect at well-known positions on the cathode, which then drift towards the readout plane and show the integrated spatial distortions.
The concept of the calibration system as well as first results of a small prototype will be presented.
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