T 43: Gasgefüllte Detektoren 2 (gemeinsam mit HK)

Zeit: Dienstag 11:00–12:30 Raum: F 102

T 43.1 Di 11:00 F 102

The tracking system for NA64 at CERN SPS — •Michael Hösgen, NA64 Collaboration, and Bernhard Ketzer — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Deutschland

NA64 is a new experiment at CERN SPS, which conducts a direct search for invisible decays of sub-GeV dark photons (A'). The A' might be produced by 100 GeV electrons incident on an active target Electromagnetic Calorimeter (ECAL) in the reaction $e^-Z \rightarrow e^-ZA'$ via kinetic mixing with photons. The A's supposedly decay invisibly into dark matter particles resulting in a large amount of missing energy.

To verify the momentum of the incident electrons and to clean-up the event sample, tracking of the electrons is crucial for this experiment. The tracking system utilises four Micromegas (MM) and two Gas Electron Multiplier (GEM) detectors. The GEM detectors used in the tracking system have three $10 \times 10\,(cm)^2$ standard GEM foils and a two layer strip readout resulting in 256 channels per plane. As conversion gas an Ar/CO2 (70/30) mixture is used. Tracks will be reconstructed using the tracking framework GENFIT II.

In this talk the performance of the tracking system, especially the GEMs, will be presented. I will also show new limits on the $\gamma - A'$ mixing deduced from a first run in 2016.

T 43.2 Di 11:15 F 102

Entwicklung und Beamtestergebnisse eines GEM-basierten TPC-Auslesesystems — •Paul Malek für die LCTPC-Deutschland-Kollaboration — Deutsches Elektronen-Synchrotron DESY — Universität Hamburg, Institut für Experimentalphysik

Für den *International Large Detector* (ILD) am geplanten *International Linear Collider* (ILC) ist eine Zeitprojektionskammer (*Time Projection Chamber*, TPC) als zentraler Spurdetektor geplant. Um die nötige Spurauflösung zu erreichen, ist ein Gasverstärkungs- und Auslesesystem mit mikrostrukturierten Gasdetektoren (*Micro Pattern Gaseous Detectors*, MPGD) vorgesehen. Eine der untersuchten Möglichkeiten für die Gasverstärkung und Detektion sind Gas-Electron-Multiplier (GEM).

In dem Beitrag wird ein GEM Modul vorgestellt, dass mit Hilfe von Keramikstrukturen eine sehr grosse Abdeckung der Fläche erreicht, bei gleichzeitiger Minimierung des Materials. Durch Entwicklung von geeigneten Prozeduren und Werkzeugen zur Produktion konnten die Parameter des Module wie Flachheit und Stabilität deutlich verbessert werden. Ergebnisse umfangreicher Messungen im DESY Teststrahl werden vorgestellt. Der Einfluss der besseren Modul Parameter auf Auflösung und insbesondere für die Messung des spezifischen Energieverlustes, dE/dx, werden diskutiert.

T 43.3 Di 11:30 F 102

Study of electrostatic charge-up phenomena in Gas Electron Multipliers — •Philip Hauer, Steffen Urban, Markus Ball, and Bernhard Ketzer — Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, DE

Gas Electron Multipliers (GEM) are widely used as amplification stage in gaseous detectors exposed to high rates, e.g. in the Time Projection Chamber of the ALICE (A Large Ion Collider Experiment) experiment after its upgrade. The GEM consists of a polyimide foil which is coated by two thin copper layers. GEM have a high density of holes, where charges are multiplied if suitable voltages are applied. One critical property is the electrostatic charge-up of GEM. It occurs when the trajectories of drifting ions or electrons end on the polyimide surface. Since polyimide is a very good insulator, the charge remains there. The charge-up influences key properties of the GEM, e.g. the gain.

The characteristics of the charge-up process are studied in simulations. The electrostatic environment is calculated with a finite-element method. Afterwards, the movement of single particles in the electrostatic environment is simulated. The possibility to study the behaviour of single charges gives insight on the charge-up process. Furthermore, the simulated properties are cross-checked with measurements. Results of the measurements and simulations of the charge-up effect will be presented. Additionally, the influence of different parameters, e.g. the rate of incoming radiation, on the time constant of the charge-up process will be discussed.

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T 43.4 Di 11:45 F 102

Status of the Digitization for the Upgraded ALICE GEM-TPC — •Andreas Mathis[1] and Jens Wiechula[2] for the ALICE-Collaboration — [1]TU München, Physik Department E62, Excellence Cluster 'Universe', Garching — [2]Institut für Kernphysik, Goethe-Universität, Frankfurt am Main

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 up to 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 employed gated Multi-Wire Proportional Chambers 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 increase in interaction rate and the requirements of a triggerless, continuous readout demand for significant modifications of the front-end cards, the computing system and the corresponding calibration, reconstruction and simulation framework. In particular, the upgraded readout scheme of the TPC with GEMs requires a complete re-design of the digitization, which includes a detailed simulation of the detector response after electron amplification in a stack of four GEM-foils.

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T 43.5 Di 12:00 F 102

Discharge studies with a double GEM setup — •Alexandra Datz[1,2] and Alexander Deisting[1,2] for the ALICE-Collaboration — [1]GSI, Darmstadt — [2]Physikalisches Institut, Heidelberg

The interaction rate of lead-lead collisions at the LHC will increase to 50 kHz during run 3. Hence an upgrade of the readout chambers of the Time Projection Chamber (TPC) of ALICE is necessary. New readout chambers equipped with stacks of four Gas Electron Multipliers (GEMs) have been developed. These allow for a continuous readout and preserve the momentum and dE/dx resolution of the current TPC. However, the new chambers have a higher risk to be damaged during a discharge than the current wire chambers. It has been confirmed at beam tests that the high voltage (HV) settings of the GEM stacks have a sufficiently low discharge probability. In order to understand the discharge mechanism and to further minimize the discharge probability, studies with small detectors have been carried out and will be presented here.

Our detector consists of two GEMs (10x10cm^2), a drift cathode and a readout plane. Discharges are triggered intentionally by increasing the voltage of one of the GEMs and releasing alpha particles in the gas (Ar-CO2 90-10). The potentials on the GEM sides and the signal at the readout plane are recorded to study the influence of different parameters, such as different resistors in the HV supply lines for the GEMs, on the discharge behavior. Results on secondary discharge probabilities are also shown.

T 43.6 Di 12:15 F 102

GEM discharge protection with a resistive copper oxide layer — •Oleksiy Fedorchuk for the LCTPC-Deutschland-Collaboration — Deutsches Elektronen-Synchrotron, Hamburg, Deutschland

For the International Large Detector (ILD) at the planned International Linear Collider (ILC) a Time Projection Chamber (TPC) is foreseen as the main tracking detector. The gas amplification will be done by Micro Pattern Gaseous Detectors (MPGD). One option is to use Gas Electron Multipliers (GEM).While the applicability of GEMs for the gas amplification in a TPC readout has been shown, the focus of the current research is to study the discharge processes and improve the long term high voltage stability of the readout modules. This is a crucial requirement for the operation in the final ILD TPC.

The main focus of the research presented in this talk is on studies of the discharge stability and operational features of large area 22×18cm^2 GEM foils. A novel treatment of the GEM foils by applying a resistive layer of copper oxide will be presented. The impact of this treatment on the high voltage stability and the GEM performance will be discussed. First results from using these GEMs in a prototype TPC will be presented.