HK 50: Instrumentation XV

Zeit: Donnerstag 14:00–15:45 Raum: Audimax H1

Gruppenbericht HK 50.1 Do 14:00 Audimax H1

Upgrade of the ALICE TPC — •Robert Münzer for the ALICE-Collaboration — Institut für Kernphysik - Goethe Universität, Frankfurt, Germany — CERN, Geneva, Germany

During the long shutdown 2 (LS2) of the LHC in 2019-2020, the ALICE TPC will be upgraded to be able to take data at the increased luminosity expected for Run 3. During LS2, the present multi-wire proportional chambers (MWPC) will be replaced by chambers based on Gas Electron Multiplier (GEM) technology, keeping the spatial and energy resolution of the present TPC. This allows to overcome the intrinsic rate limitation imposed by the necessity of a gating grid for MWPC-based readout and reading out continuously at Pb-Pb interaction rates up to 50 kHz at limited space-charge distortions.
The use of GEM technology together with the continuous readout mode requirement asked for a complete re-design of the readout electronics. Furthermore, an advanced high-voltage power supply concept is required, based on so-called cascaded power supply modules.
After an extensive R&D program, carried out during the last years, the mass production of the 80 quadruple-GEM readout chambers has been started in 2017. To ensure an adequate performance of the new chambers, an advanced quality assurance and testing procedures across various construction institutes was established.
In this presentation, the recent status of the ongoing activities will be presented.
This work is supported by BMBF and HGF

HK 50.2 Do 14:30 Audimax H1

Application of micron-size plasma for precision measurement of gas parameters in resistive plate chambers and drift detectors with an unique laser-driven test facility — •Xingming Fan[1], Lothar Naumann[1], Mathias Siebold[1], Daniel Stach[1], Christian Wendisch[2], and Michael Wiebusch[3] — [1]Institut für Strahlenphysik, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Institut für Kernphysik, Goethe-Universität, Frankfurt, , Germany

A high precision Laser-driven detector test facility has been developed at Helmholtz-Zentrum Dresden-Rossendorf. Primary ionizaion with well-defined position, start time and electron number is created in special designed gas detector samples.

Experiments on samples of Resistive Plate Chamber (RPC) with varies gap widths is operated. Precise value of Townsend coefficient and electron drift velocity is obtained on different filed strengths. Comparison between our results and other works has shown disagreement in 100 kV/cm field, but comparible parameters in 50 kV/cm field.

Mini Drift Chamber (MDC) sample is designed representing the MDC detector with complex and inhomogeneous field design in HADES experiment. A very precise 2D and 3D drift velocity distribution is obtained for Ar/CO_2 filled MDC. An individual drift tube sample allows the comparison of gas parameters, the estimation of the multiphoton ionization coefficient and the Debye length of ionization at laser focus.

HK 50.3 Do 14:45 Audimax H1

Ar-CF_4 mixtures as counting gas for fission fragments — •Marius Peck[1], Joachim Enders[1], Alf Göök[2], Franz-Josef Hambsch[2], and Stephan Oberstedt[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]European Commission, JRC-IRMM, Geel, Belgium

The use of ionization chambers (IC) for the study of charged particles relies on the accurate determination of the energy deposition in the gas. One of the major issues related to accurate energy determination is the so-called pulse height defect (PHD). The term is used to summarize effects that cause a non-linear response of the pulse height to highly ionizing particles, such as fission fragments. To our knowledge, the only gas for which the PHD has been directly measured with ions of known energies is P-10 ($90\%Ar + 10\%CH_4$) [1]. However, evidence exists [2] that these results can be directly applied to pure CF_4. While pure CF_4 has disadvantages due to the very high stopping power, mixing Ar and CF_4 would be more applicable for typical set-ups employed for detecting fission fragments. However for $Ar + CF_4$ mixtures not much is known in terms of electron mobility and PHD. Hence, counting gas properties in different mixtures of $Ar + CF_4$ have been studied using a twin Frisch-grid IC. The PHD in the different gas mixtures has been determined relative to the reference gas P-10 using the well-known ^{252}Cf(sf) decay.

[1] Budtz-Jørgensen, Nucl. Instr. Meth. Phys. Res, Vol. 258, 1987.
[2] Tovesson, J NUCL SCI TECHNOL, Supplement 2, 2002.
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HK 50.4 Do 15:00 Audimax H1

Optimization of the HV scheme for GEM-based detectors — •Lukas Lautner for the ALICE-Collaboration — TU München, Physik Department E62, Excellence Cluster 'Universe', Garching

Gas Electron Multiplier (GEM) - based detectors are widely used in many experiments (COMPASS, LHCb, TOTEM) and future upgrades (ALICE, CMS, sPHENIX). Electrical discharges that may occur during operation of those detectors are possibly harmful to hardware and electronics and can damage it permanently in form of increased leakage currents or electric short circuits that render the detector effectively blind. Initital discharges, caused by high charge densities obtained in a single GEM hole may trigger a secondary discharge between two GEMs in a stack or between the last GEM and the readout anode. The latter is especially dangerous - as the front-end electronics can be severely affected by high energy released in a discharge event. The behaviour of the electric field in the gap between GEM foils or a GEM foil and the readout anode after an initial spark cannot explain the appearance of the secondary discharges which nature is still not fully understood. However the thorough optimization of the HV scheme, in terms of its RC characteristics, allows to minimize the propagation probability. A set of recommendations has been compiled which will be employed in the optimization procedure for the HV scheme of the upcoming ALICE TPC Upgrade.

This research was supported by BMBF, HGF and the DFG cluster of excellence 'Origin and Structure of the Universe'.

HK 50.5 Do 15:15 Audimax H1

Long-term efficiency analysis of GEM detectors at the COMPASS experiment — •Elizaveta Fotina, Mathias Wagner, Rocio Reyes Ramos, Mikhail Mikhasenko, and Bernhard Ketzer for the COMPASS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Detectors based on the Gas Electron Multiplier (GEM) are the backbone of the inner tracking system of the COMPASS experiment at CERN. They provide high position resolutions of the order of 70 μm even at very high particle rates close to the beam. The detectors have been built in 2001-2002 and have been used continuously since then. The data taken with COMPASS until now provide a unique basis to investigate the long-term performance of these detectors in high-intensity muon and hadron beams. As a first step, we investigate the 2D efficiencies of all 22 detector planes, extracted from physics runs and compare the results for different years, using data from the 2008 hadron run and from the 2015 Drell-Yan run, and discuss the observed effects. Supported by BMBF.

HK 50.6 Do 15:30 Audimax H1

Understanding leakage current of GEMs - quality assurance of GEM foils for the ALICE TPC upgrade — •Pascal Becht for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The scheduled upgrade of the LHC at CERN, which will result in a higher luminosity and thus a higher heavy-ion interaction rate, made an upgrade of the ALICE experiment's Time Projection Chamber (TPC) mandatory. During the long shutdown 2 (2019 - 2020) the current Multiwire Proportional Chamber (MWPC) readout will be replaced by Gas Electron Multiplier (GEM) based readout chambers, which are able to provide a continuous readout at rates up to 50 kHz in Pb-Pb collisions.

For that reason the chamber production has already started and makes progress. There an indispensable issue is the extensive quality assurance (QA) done on the GEM foils before they finally get assembled in the chambers. One parameter to quantify the foil's quality is the *leakage current* through the foil.

This talk will present the procedure of leakage current tests, done at GSI. Furthermore, the investigation of determining factors of the leakage current through a GEM foil, such as area, pitch size and the hole size, will be discussed.