HK 18: Instrumentation V

Time: Tuesday 15:45–17:15 Location: HBR 19: C 5a

HK 18.1 Tue 15:45 HBR 19: C 5a

Improving the Quality Assurance of MPGDs with a Spark Detection System — •Tim Schüttler[1,2], Philip Hauer[1,2], and Bernhard Ketzer[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]Forschungs- und Technologie-Zentrum Detektorphysik, Universität Bonn

Gas Electron Multipliers (GEMs) play a crucial role as amplification stages in modern gaseous detectors. GEM foils consist of a polyimide substrate coated with copper on both sides. Microscopic holes are etched into the structure using a photolithographic process.

The precision of the etching process is sensitive to various factors such as chemical concentration/temperature or treatment duration, leading to potential irregularities in the resulting GEM which can have undesirable effects during detector operation. Since we are about to establish a GEM production in Bonn for small-sized GEMs, a rigorous and reliable quality assurance of the produced foils is indispensible.

To ensure the quality of the 10×10 cm^2 GEMs commonly used for testing purposes, a small-scale versatile Spark Detection System (SDS) was developed. It allows one to apply high voltage to the GEM foil while a built-in camera monitors electric discharges within the holes. Simultaneously, the leakage current flowing through the polyimide is measured, providing valuable insights into the GEM's overall quality.

In this talk, I will explain the SDS design and address challenges encountered with leakage currents inside the system. Sample measurements will be presented to illustrate the system's effectiveness, and the efficiency as well as possible optimization options are discussed.

HK 18.2 Tue 16:00 HBR 19: C 5a

Optimizations of the specific energy loss measurement and data to Monte Carlo matching for the ALICE TPC in Run 3 — •Tuba Gündem — Institut für Kernphysik, Goethe-Universität Frankfurt

The Time Projection Chamber (TPC) is the primary detector for tracking and Particle Identification (PID) in the ALICE experiment. PID is achieved through the reconstruction of particle momentum and specific energy loss (dE/dx). The dE/dx for a given track is calculated using the clusters associated with the track. However, challenges arise in the form of potential loss of TPC clusters, caused by different factors such as falling below the zero suppression threshold applied in the front-end electronics.

In this talk, various strategies for dealing with subthreshold clusters and cluster acceptance effects, offering new possibilities for optimizing the dE/dx calculation will be presented. Furthermore, the impact of space-charge distortion on dE/dx will be discussed. In addition, a method for improving the matching of simulated dE/dx with reconstructed dE/dx in data will be shown.

HK 18.3 Tue 16:15 HBR 19: C 5a

TPC cluster shape analysis — •Janis Noah Jäger for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

An important aspect of the latest ALICE upgrade is the upgrade of the Time Projection Chamber (TPC). The TPC is the main tracking and particle identification device in ALICE. By replacing the Multi-Wire Proportional Chambers (MWPC) with stacks of four Gas Electron Multiplier (GEM) foils, a continuous readout of the TPC is achieved. The modification also required a major upgrade of the entire readout chain, from the front-end cards, via data acquisition and distribution, up to online reconstruction and data compression. Furthermore, the complete reconstruction and calibration software was rewritten, including the TPC cluster finding algorithm.

This talk discusses the analysis of cluster shapes as a function of different track properties and compares it with Monte Carlo simulations. Properties such as track angles can lead to a broadening of the cluster. Effects such as diffusion also play an important role in the shape of the cluster.

HK 18.4 Tue 16:30 HBR 19: C 5a

Current Status of the GEM Production at the FTD in Bonn — •Philip Hauer[1,2], Markus Ball[2], Dmitri Schaab[2], Yevgen Bilevych[2], and Bernhard Ketzer[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]Forschungs- und Technologie-Zentrum Detektorphysik, Universität Bonn

Gas Electron Multipliers (GEMs) are widely used as an amplification stage in gaseous detectors. They consist of a 50 μm thick polyimide foil which is cladded on both sides by 5 μm copper. In a photolithographic process, microscopic holes (for standard GEM foils: diameter: 70 μm, pitch: 140 μm) are etched into this structure. Up to now, GEM foils are only produced at the PCB workshop at CERN.

The new Research and Technology Center for Detector Physics (FTD) in Bonn has recently commissioned commissioned new infrastructure facilitating the production of micropatterned structures like GEMs. This infrastructure includes several wet benches, a dry film laminator, an exposition machine and a mask-less aligner. With these machines, we have successfully produced an initial functional standard GEM. In the future, our research agenda includes the exploration of GEMs with different geometries as well as the production of other micropattern structures, e.g. InGrids.

In this talk, I will go through the individual steps for the GEM production and how they are performed in Bonn. First measurement results will be presented, as well as our plans for the future.

HK 18.5 Tue 16:45 HBR 19: C 5a

Investigating Diamond-like carbon (DLC) photocathodes for THGEM-based multi-channel photodetectors — •Anil Berkay Adigüzel, Leonardo Bugia, Berkin Ulukutlu, and Thomas Klemenz — Technische Universität München, Munich, Germany

In physics research, photon detection is vital, but current methods like Photomultiplier tubes and Silicon Photomultipliers are costly. Micro-Pattern-Gas-Detector (MPGD) photon detectors offer a cheaper alternative but struggle with visible spectrum photons due to limited stable photocathode materials. This study introduces a specialized multi-pad THGEM detector for assessing various photocathodes using diverse light sources. With 64 readout channels, it enables accurate background estimation and uniformity assessment of photocathodes. Initial validation involved measuring CsI in the VUV range, confirming expected efficiency. Diamond-Like Carbon (DLC) photocathodes, though less efficient than CsI, show higher resilience to gas-related aging, making them a potential choice when paired with a high-gain amplification structure. This research is funded by the DFG Sachmittel FA 898/5-1

HK 18.6 Tue 17:00 HBR 19: C 5a

A versatile trigger-less readout for MPGD tracking systems — •Karl Jonathan Flöthner[1,2], Florian Brunbauer[1], Francisco García[3], Djunes Janssens[1], Bernhard Ketzer[2], Marta Lisowska[1], Michael Lupberger[2], Hans Muller[1,2], Eraldo Oliveri[1], Giorgio Orlandini[1], Dorothea Pfeiffer[4], Leszek Ropelewski[1], Jerome Samarati[4], Fabio Sauli[1], Lucian Scharenberg[1], Miranda van Stenis[1], Rob Veenhof[1], August Brask[5], and Michael Heiss[6] — [1]CERN, Geneva, Switzerland — [2]University of Bonn, Germany — [3]HIP, Helsinki, Finland — [4]ESS, Lund, Sweden — [5]Aarhus University, Denmark — [6]PSI, Villingen, Switzerland

The beam telescope of the RD51 collaboration at CERN consists of several triple-GEM detectors, each with an active area of 10x10 cm^2, and additional scintillators to generate a trigger signal for the timing of events. The detectors are equipped with the new VMM3a ASIC coupled to the Scalable Readout System (SRS). In this configuration, the system can provide a rate capability of the order of a few MHz, spatial resolutions in the order of 50 μm and time resolutions in the nanosecond regime. During the RD51 test-beam campaigns in 2023 the system has been improved in terms of powering and noise. The telescope provided data to different groups with different detector technologies (e.g. GEM-TPC, 30×30 cm^2 AMBER prototype, MPGD DHCAL). The talk will discuss the improvements of the system and present results of different detectors under test. This work has been sponsored by the Wolfgang Gentner Programme of the BMBF (grant no. 13E18CHA).