HK 45: Instrumentation XIII

Time: Wednesday 17:30–19:00 Location: SCH/A.101

HK 45.1 Wed 17:30 SCH/A.101

Photon Detection with THGEMs — •Thomas Klemenz[1], Laura Fabbietti[1], Piotr Gasik[2], Roman Gernhäuser[1], and Berkin Ulukutlu[1] — [1]Techinsche Universität München, Garching, Germany — [2]FAIR/GSI GmbH, Darmstadt, Germany

Traditional devices for photon detection like the Photomultiplier Tube or more recent technologies such as Silicon Photomultipliers are not easily scalable and rather cost-intensive.. Therefore, especially with large area experiments in mind it is exciting to investigate new ways of detecting photons. In this project we are taking the approach of combining a photosensitive material with a Thick GEM (THGEM) to produce a gaseous photon detector. THGEMs are robust, low-cost devices, which can be easily implemented in large area applications. One side of the THGEM is coated with a photosensitive material and placed within an electrical field. Photons captured by the active surface lead to a release of electrons which drift into the THGEM hole where they undergo avalanche multiplication due to strong electric fields applied. Below the THGEM an anode is reading out the amplified electron signal. Depending on the gain of the THGEM this could enable single photon detection. We want to study the potential of this approach while trying different photosensitive materials. Ultimately, we aim to measure visible wavelength photons and to provide a low-cost, large area solution for neutrino observation in water and ice environments. In the talk the current status of the project is discussed.

This work is funded by the BMBF Verbundforschung (05P21WOCA1 ALICE) and the DFG Sachmittel FA 898/5-1.

HK 45.2 Wed 17:45 SCH/A.101

The novel XYU-Readout for ambiguity-reduced tracking — •Karl Jonathan Flöthner[1,2], Florian Brunbauer[1], Serge Ferry[1], Francisco García[3], Djunes Janssens[1], Bernhard Ketzer[2], Marta Lisowska[1], Hans Muller[1], Rui de Oliveira[1], 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], Antonija Utrobicic[1], and Rob Veenhof[1] — [1]CERN, Geneva, Switzerland — [2]University of Bonn, Germany — [3]HIP, Helsinki, Finland — [4]ESS, Lund, Sweden

Signals generated in gaseous detectors such as GEM-based detectors are often read out by strips providing one or two coordinates of a track. Such a strip-based readout (R/O) often suffers from ambiguities. For particle tracks, these are usually removed by pattern recognition. For the detection of photons, e.g. in a RICH detector, however, they have to be removed in a single detector. Solutions for this problem on the detector level are additional information about the signal amplitude, or a pixelated readout. The latter, however, results in a huge increase in the number of electronic channels and the material budget. Therefore, the XYU-R/O was proposed as a three-coordinate strip-readout. The fact that no vias are needed inside the active area is a novelty of the design and important for a reliable and simple production. The talk will cover results from X-ray measurements and will be complemented by test beam data from October 2022.

HK 45.3 Wed 18:00 SCH/A.101

Stabilized voltage divider for GEM detectors — •Oliver Adam, Philip Hauer, Christian Honisch, Dimitri Schaab, Dominik Schüchter, Marco Vogt, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Multi-GEM detectors often use the simple principle of classic voltage dividers to supply their electrodes with high voltages. The problem with that kind of voltage supply (passive voltage divider) is that the voltages change when additional currents are produced inside the detector at high irradiation rates, which are taken up by the electrodes. In addition, the effect of occasional sparks inside the detector is traditionally minimized using high-ohmic bias resistors, which again modify the electrode potentials in case of non-negligible currents. Using active components (source follower) instead of passive resistors offers away to overcome these drawbacks. The resistor chain is stabilized with a transistor chain and has an active current limit. Simulations support these considerations. In measurements with X-ray and radioactive sources, we investigate the gain stability at high rates and the stability against discharges. This talk will cover the working principle of the stabilized voltage divider. Furthermore the results of simulations and measurements will be discussed.

HK 45.4 Wed 18:15 SCH/A.101

Studying the Impact of Humidity on the Performance of MPGDs — •Henrik Fribert[1], Piotr Gasik[2], Berkin Ulukutlu[1], and Laura Fabbietti[1] — [1]Technische Universität München, Garching, Germany — [2]FAIR/GSI GmbH, Darmstadt, Germany

MPGDs (Micro-Pattern Gaseous Detectors) are gaseous detectors used in high-energy physics experiments like ALICE or ATLAS at the LHC. Despite 30 years long experience in the production and successful operation of this type of detector, the effect of water contamination of the gas composition on their performance is still a subject of debate. We contribute to this topic with systematic studies using several MPGDs (GEMs, THGEMs, and Micromegas) operated with an Ar-CO2 mixture and introducing water content in a range of 0-5000 ppmV. Detector performance is evaluated while varying the humidity level for each type of MPGD under study. The water is introduced to the detector vessel by incorporating a water-filled bubbler into the gas system, through which gas can be flushed at different rates. It is observed that the presence of increased humidity does not degrade any of the studied performance criteria. On the contrary, our measurements suggest an improvement in discharge stability with increasing humidity levels, at the highest gains and fields. We conclude, that adding a small amount of water to the gas mixture may be beneficial for the stable operation of an MPGD. This work is funded by the BMBF Verbundforschung (05P21WOCA1 ALICE) and the DFG Sachmittel FA 898/5-1.

HK 45.5 Wed 18:30 SCH/A.101

Investigations on the Signal-to-Noise Ratio of the VMM Readout Chip with a GEM Detector — •Virginia Klapper[1], Karl Flöthner[1,3], Pascal Henkel[1], Michael Lupberger[1,2], and Bernhard Ketzer[1] — [1]Universität Bonn, Helmholtz- Institut für Strahlen- und Kernphysik, Bonn, Germany — [2]Universität Bonn, Physikalisches Institut, Bonn, Germany — [3]CERN, Geneva, Switzerland

Dedicated readout chips are required to collect, preamplify and further process the data generated by microstructured particle detectors. The VMM is an ASIC that was developed for the ATLAS New Small Wheel upgrade. It operates in a self-triggered mode, thus not requiring an external trigger signal for data readout, which gives much more flexibility for complex selection criteria in the high-level software trigger. This chip is a candidate to read out novel high-rate GEM detectors at the AMBER experiment at the CERN SPS. We are in particular interested in the Signal-to-Noise Ratio (SNR) and how it compares to the APV25 chip that has been used for GEM readout at COMPASS.

This presentation focuses on a setup to measure the SNR with cosmic muons. A GEM detector read out by VMM chips is sandwiched between two scintillators with photomultipliers. The coincidence signal is injected into a trigger board connected to a separate VMM frontend board. This way, the triggers are timestamped as belonging to data from the detector.

This contribution presents the SNR measurements for a variety of parameters like different gas gains or VMM thresholds.

HK 45.6 Wed 18:45 SCH/A.101

Data analysis of a GEM detector with VMM3a readout at the AMBER pilot run — •Pascal Henkel[1], Karl Jonathan Flöthner[3,1], Virginia Klapper[1], Michael Lupberger[1,2], and Bernhard Ketzer[1] — [1]Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany — [2]Universität Bonn, Physikalisches Institut, Bonn, Germany — [3]CERN, Geneva, Switzerland

In its first phase, the AMBER experiment at CERN SPS plans, among others, a measurement of the proton form factor at small Q2, using high-energy muon-proton elastic scattering. During a pilot run in October 2021 a GEM-based planar tracking prototype detector took data using the self-triggered VMM3a ASIC as readout chip. The purpose was a first test of the prototype detector in a high muon rate environment and in various configurations of the chip. The time-stamped VMM data has to be combined with the triggered data from the COM-

PASS spectrometer and other detectors in the pilot run setup. For synchronization, COMPASS trigger signals where injected into a dedicated VMM chip, such that they were timestamped.

In the ongoing analysis the obtained data is brought into temporal match with the external trigger which will make it possible to reconstruct particle tracks from the triggered detectors and correlate them with the signals measured by the prototype detector. The results should give insights that help optimizing the chip configurations in order to evaluate in future measurements how the VMM3a performs in comparison to the APV25 readout chip for COMPASS GEMs.