HK 16: Instrumentation VI

Time: Monday 16:00–17:30 Location: HK-H5

HK 16.1 Mon 16:00 HK-H5

Beam measurements with the RD51 beam telescope using the VMM3a and SRS — •Karl Jonathan Flöthner[1,2], Lucian Scharenberg[1,2], Daniel Petri Sorvisto[4], Eraldo Oliveri[1], Francisco Fuentes[3], and Bernhard Ketzer[2] — [1]CERN — [2]Univ. of Bonn (DE) — [3]Helsinki Institute of Physics — [4]Univ. of Aalto (FI)

RD51 is an international research and development collaboration at CERN with focus on advanced gas-avalanche detector technologies and associated electronic-readout systems. For testbeam campaigns the RD51 collaboration provides a GEM-based beam telescope for detector studies. It consists of several triple-GEM detectors with an active area of 10x10 cm^2 and additional scintillators to generate a trigger signal for the start of events. During the last year the telescope was equipped with the new VMM3a ASIC coupled to the Scalable Readout System (SRS). In this configuration the system can provide a MHz counting rate-capability, spatial resolutions in the order of 50 μm (COMPASS like triple-GEM detector) and time resolutions in the 10-ns regime (VMM capable of few ns). The new setup was tested in the laboratory and during two testbeam campaigns (July/October 2021). The system contains five GEM-detectors and a total of 42 VMMs (2688 channels). During the last beam campaign, the telescope has been used to investigate different fine-pitch GEM foils to understand the impact on spatial resolution with MIPs. The talk will discuss some challenges of the system and present first results of the last testbeam data, focussing on the performance of the fine-pitch GEM.
Supported by BMBF.

HK 16.2 Mon 16:15 HK-H5

New GEM detectors for AMBER — •Jan Paschek[1], Karl Flöthner[3], Markus Ball[1], Michael Hösgen[1], Michael Lupberger[1,2], and Bernhard Ketzer[1] — [1]Helmholtz-Institut für Strahlen- und Kernphysik der Universität Bonn, Bonn, Germany — [2]Physikalisches Institut der Universität Bonn, Bonn, Germany — [3]CERN GDD, Meyrin, Schweiz

Phase II of the COmmon Muon Proton Apparatus for Structure and Spectroscopy (COMPASS) is planned to be finished in 2022 by measuring the transverse-momentum dependent PDFs in deep inelastic scattering of muons on a deuterium target.
Using the COMPASS spectrometer a new proposal for a future QCD facility at the M2 beamline of the SPS accelaror, at CERN has been accepted. Running under the name AMBER, the physics program includes a measurement of the proton radius in elastic muon-proton scattering. The GEM stations are mandatory for scattered muon tracking. With a low material budget, high efficiency ($> 97\%$) and a good spatial resolution (around 70μm) the triple GEM detectors are an ideal tracking system. Combined with further detectors and a magnetic field, the momentum of scattered muons can be determined.
However, the existing GEM detectors have to be replaced as they cannot cope with the anticipated beam rates and have suffered from 20 years of operation COMPASS. A new detector layout was developed. In this contribution, first test results as well as the quality assurance procedure for detector construction will be presented.

HK 16.3 Mon 16:30 HK-H5

Impact of the gas choice and the geometry on the breakdown limit in (TH)GEM-based detectors — •Lukas Lautner[1,2], Piotr Gasik[3], Andreas Mathis[1], Laura Fabbietti[1], Tobias Waldmann[1], Berkin Ulukutlu[1], and Thomas Klemenz[1] — [1]Physik Department, Technische Universität München — [2]CERN — [3]GSI - Helmholtzzentrum fur Schwerionenforschung GmbH

In this study we investigate the intrinsic stability limits of Gas Electron Multiplier (GEM) and Thick GEM detectors upon irradiation with alpha particles. The measurements are performed in Ar- and Ne- based mixtures with different CO_2 content to study the influence of the gas on discharge probability and critical charge limits. The latter are obtained by comparing the experimental data to results obtained within a Geant4 simulation framework. The measurements provide a direct comparison between GEMs and THGEMs and allow us to evaluate the influence of geometrical parameters, such as hole size, pitch and (TH)GEM thickness, on the stability of a structure and the resulting critical charge value. We observe that the breakdown limit is strongly dependent on the gas, and that the amount of quencher in the mixture does not necessarily correlate with higher stability. The outcome of these studies is of particular interest for currently running or planned photon and hadron-blind detectors based on THGEM technology as well as cryogenic applications.

HK 16.4 Mon 16:45 HK-H5

Charge density breakdown limits in Micromegas structures — •Tobias Waldmann[1], Berkin Ulukutlu[1], Piotr Gasik[2], Laura Fabbietti[1], Thomas Klemenz[1], and Lukas Lautner[1] — [1]Technische Universität München — [2]GSI Helmholtzzentrum

Micro Mesh Gaseous Structures (Micromegas) are detectors implemented in a wide range of modern particle physics experiments. Among their major advantages are high achievable gains, good energy resolution and intrinsic ion backflow suppression. However, a major limiting factor to the performance is the formation of electrical discharges inside the amplification region, which can eventually blind or permanently damage the involved detector components. Therefore, the limits of safe operation of such detectors need to be studied in detail. In our studies we investigated the discharge stability of Micromegas with respect to different mesh geometries and gas mixtures. As in previous studies with GEMs and THGEMs, the measurements show clear evidence for charge density being a driving factor in the discharge formation process in Micromegas. This is observed through a dependence on the used gas mixture, where Neon-based mixtures with low CO2 content yield the best stability against the development of discharges. The results provide further constraints and limits for the safe operation of Micromegas-based detectors, opening up new possibilities for their optimization.

HK 16.5 Mon 17:00 HK-H5

A Pulsed Drift Tube for 100keV Antiprotons — •Jonas Fischer, Alexandre Obertelli, and Frank Wienholtz — IKP TU Darmstadt, Deutschland

The PUMA collaboration aims at trapping, storing and transporting 10^9 antiprotons in a cryogenic penning trap. To achieve this, antiprotons from ELENA need to be decelerated from 100keV to 4keV in a first step. To minimise losses in the deceleration process, a Pulsed Drift Tube (PDT) was installed at LNE51 at CERN. A good vacuum of below 10^{-10} mbar is necessary to avoid the annihilation of the antiprotons with residual gas molecules. This, and the high voltage, pose strict restrains on the design and operation of the pulsed drift tube. In this talk I will give an overview over the pulsed drift tube designed for PUMA.

HK 16.6 Mon 17:15 HK-H5

Testing Low's theorem with the Forward Conversion Tracker of ALICE 3 — •Martin Völkl for the ALICE-Collaboration — Universität Heidelberg

Soft theorems play a fundamental role in the development of quantum field theory. In scattering processes the production of soft photons diverges in the infrared in a controlled manner. Low's theorem relates the production cross section of a process with and without additional soft photon emission by a simple formula without dependence on the details of the process. However, this simple and fundamental prediction was found to strongly underestimate measured soft photon production in hadronic processes for previous experiments.

With this contribution we discuss the prospects of measuring and investigating this effect with the future ALICE 3 experiment using the proposed Forward Conversion Tracker (FCT). This detector can measure photons from collisions at LHC energies down to very low photon momenta. The resulting measured photons can then be related to the information about the hadronic event measured with ALICE 3. This allows exploration of the apparent discrepancy between calculations and experiment which would significantly impact our fundamental understanding of quantum field theories.