T 95: Gaseous Detectors III

Time: Friday 9:00–10:30 Location: KH 01.014

T 95.1 Fri 9:00 KH 01.014

Background Studies at the SHiP Spectrometer Straw Tracker — •Hannah Limberg, Caren Hagner, Daniel Bick, Wei-Chieh Lee, and Walter Schmidt-Parzefall — Institute of Experimental Physics, University of Hamburg, Hamburg, Germany

SHiP (Search for Hidden Particles) is a general-purpose beam-dump experiment currently in preparation at the CERN SPS. The experiment is designed to explore physics beyond the Standard Model by searching for feebly interacting particles (FIPs), which are predicted by several theoretical models of the hidden sector. When the high-intensity proton beam from the SPS hits a thick target, the collisions can potentially create hidden particles. These particles enter a 50 m decay volume and decay into Standard Model particles. They are detected by the spectrometer straw tracker located behind the decay volume. While only moderate particle rates from the target are expected, backgrounds from secondary interactions, for example in the tracker frames, will contribute significantly to the total number of hits in the spectrometer. The influence of background and its impact on the detection efficiency are investigated through simulation studies. The results will be presented in this talk.

T 95.2 Fri 9:15 KH 01.014

Implementation of 2nd coordinate measurement for 3D tracking with Drift Tube Chambers — •Nick Meier, Julia Okfen, and Oliver Kortner — Max-Planck-Institute for Physics, Garching, Germany

This work investigates the implementation of a second coordinate measurement in drift-tube detectors to enable full 3D hit reconstruction in drift tube chambers. Two concepts are studied: the Twin-Tube configuration, where signals are looped through paired tubes, and a Double-Sided Readout with independent readout on both ends. For ATLAS muon drift-tube (MDT) chambers, measurements of signal propagation and attenuation allow reconstruction of the hit position along the wire. Using the signal propagation delay measurement, a second coordinate resolution of approximately 200 mm is achieved at various tube lengths. A second-coordinate measurement efficiency exceeding 96% can be achieved under HL-LHC background conditions. For small diameter muon drift-tube (sMDT) chambers, resolutions between 100-140 mm are obtained at the different positions along the tube, reaching 95 mm for a 100 GeV muon beam and 52 mm when combining the information of four tubes. The utilization of the second coordinate for the rejection of γ background hits in track reconstruction will also be discussed in the presentation. Overall, the results demonstrate that a second coordinate can be integrated into gaseous drift-tube detectors with high efficiency, providing a promising option for future high γ background rates as expected for the muon systems at the HL-LHC and the FCC.

T 95.3 Fri 9:30 KH 01.014

Testbeam Performance of 20x20 cm^2 triple GEM Detector — •Nick Schneider, Otmar Biebel, Valerio D'Amico, Ralf Hertenberger, Eshita Kumar, Lilla Schneider, Chrysostomos Valderanis, and Fabian Voggel — LMU Munich

Micro-Pattern Gaseous Detectors are heavily used for the detection of charged particles with excellent temporal and spatial resolution. The investigated detector is a triple-GEM detector with a size of 20x20 cm^2. Additionally the GEM-foils are split into 4 sectors on the top sides to reduce the capacity in case of a violent discharge, making it less likely for the foils to be damaged in such an event. While testing the detector in the lab with a ^{55}Fe source a charge-up effect was noticed. To further investigate this effect and determine efficiency and resolution of this detector it is tested in a 120 GeV muon testbeam at CERN and a high-rate ≈3 GeV electron testbeam at ELSA (University of Bonn). For the muon testbeam additional tracking detectors are used to determine the efficiency and the resolution of detector under test. Due to multiple scattering, it is very difficult to track the particles in the electron testbeam. Consequently, the high electron flux of this beam is used to further investigate high-rate and charge-up effects. Some of the results of these testbeams will be presented.

T 95.4 Fri 9:45 KH 01.014

Rate characteristics of triple GEM detectors with results from the ELSA testbeam measurements — Erik Ehlert, Kerstin Hoepfner, Stella Israel, •Daniel Klee, Markus Merschmeyer, Alexander Schmidt, and Shawn Zaleski — III. Physikalisches Institut, RWTH Aachen University, Aachen, Germany

Gas electron multipliers (GEM detectors) are often used in challenging conditions. For example in the CMS experiment the new ME0 detector will see particle-fluxes of up to 150 kHz/cm^2. For a muon detector it is not trivial to cope with such high rates. GEM detectors are particularly well suited for this environment because of their high rate capability and good spatial resolution. This talk will present results on studies of operating a GEM detector at high and highest rates. In particular, we present the influence of boundary conditions, such as variation of protection resistors. Besides measuring the rate capability of a triple GEM test detector with an X-Ray source, the presented results also include measurements recorded at the Elektronen-Stretcher-Anlage (ELSA) in Bonn. Here we were able to reach even higher rates, pushing the GEM detector to its limits.

T 95.5 Fri 10:00 KH 01.014

BASTARD: A GEM based neutron detector with VMM readout — •Jan Glowacz[1], Thomas Block[1], Klaus Desch[1], Saime Gürbuz[1], Jochen Kaminski[1], and Markus Köhli[2,3] — [1]University of Bonn — [2]Heidelberg University — [3]StyX Neutronica GmbH

In the neutron science community the high price of helium-3 pushes the use of solid neutron converters like boron or gadolinium in detectors. The boron based multi stage tracking detector (BASTARD) is such a detector with focus on high spatial resolution and high readout rates. It is a multi-layer gaseous detector, where a boron coated cathode is used to convert neutrons into helium and lithium ions. A GEM-like gas amplification stage is used to detect the ions. The readout is implemented using VMM3a hybrids and the DRD1 Scalable Readout System. A prototype detector with an active area of 10cm x 10cm is currently under development. We present our first results form tests with the prototype.

T 95.6 Fri 10:15 KH 01.014

A Time-Projection-Chamber for Neutron Science — •Thomas Block[1], Klaus Desch[1], Jochen Kaminski[1], Markus Köhli[2,3], Saime Gürbüz[1], Jan Glowacz[1], and Can Cetinkaya[1] — [1]Physikalisches Institut, Rheinische Friedrich-Wilhelms Universität Bonn — [2]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg — [3]StyX Neutronica GmbH, Mannheim

Due to the increased price of helium-3, alternative approaches for detectors in neutron science are highly demanded. This work combines the concept of a time projection chamber (TPC) with a boron-coated scintillator and optical guides. The GridPix-based readout with high granularity and high time resolution makes it a suitable candidate for imaging instruments and mid-rate scattering experiments. The enriched boron absorbs incoming thermal neutrons and decays into an alpha particle and a lithium ion. One ion enters the drift volume of the TPC and creates a trace of electron-ion pairs, which subsequently is projected onto the readout. The other ion of the same decay, which is emitted in the opposite direction, creates photons in the scintillator layer, which is used to trigger the readout. The light is coupled via an optical guide to a FPGA-controlled silicon photomultiplier trigger board. This timing information is necessary to reconstruct the three-dimensional ionisation track and hence the point of neutron conversion. We present the detector concept, its current stage of development and first measurements.