T 39: Gaseous Detectors 2

Time: Tuesday 16:15–18:15 Location: T-H24

T 39.1 Tue 16:15 T-H24

Development of gas and high voltage systems for a small-strip Thin Gap Chamber quadruplet — •José Antonio Fernández Pretel, Ksenia Solovieva, Bernhard Pfeifer, Jürgen Tobias, Patrick Scholer, Ulrich Landgraf, and Vladislavs Plesanovs — Albert-Ludwigs Universität Freiburg

In the ATLAS detector, a good performance of the trigger and tracking systems is needed to ensure its physics program. For this purpose, the end-cap muon system has been upgraded by installing the so-called New Small Wheel. The small-strip Thin Gap Chambers (or sTGCs for short, one of its main technologies) are multi-wire proportional counters running with a working mixture of CO_2:n-pentane (55:45) and a high voltage about 3kV for signal amplification. For the test setup being designed in Freiburg, a gas and high voltage systems are needed to run sTGCs, whose optimal operation needs to be guaranteed in real time via monitoring. In this presentation, the mixing, delivery and storage components of the gas system, the high-voltage and monitoring systems to run sTGCs in Freiburg are discussed.

T 39.2 Tue 16:30 T-H24

Cosmic Test Stand Studies with a small-strip Thin Gap Chamber quadruplet — •Ksenia Solovieva, Jose Antonio Fernandez Pretel, Patrick Scholer, Vladislavs Plesanovs, and Ulrich Landgraf — Albert-Ludwigs University, Freiburg

The small-strip Thin Gap Chamber (sTGC) technology is being implemented in the New Small Wheel upgrade of ATLAS for improved triggering and tracking in a higher particle rate environment. The sTGC detector readout includes a pad segmentation, which plays a key role in the trigger chain. For the purpose of investigating readout and trigger parameters, a quadruplet was set up in a cosmic muon test stand in Freiburg and read out with the final ATLAS NSW readout system and the final gas mixture. Another quadruplet was also tested in the gamma irradiation facility (GIF++) at CERN with a muon beam. The results of this study will be used for comparison with the results from the local setup. This presentation discusses the goals and challenges of the dedicated setup, as well as presenting the prospective results.

T 39.3 Tue 16:45 T-H24

Study of the Position Resolution of Large Scale Micromegas Detectors — •Vladislavs Plesanovs, Patrick Scholer, Ulrich Landgraf, and Gregor Herten — University of Freiburg

During the current Long Shutdown 2 (LS2), the ATLAS muon spectrometer will receive an upgrade with the New Small Wheels (NSW), which consist of two new technologies, the sTGC detector (trigger) and the Micromegas detector (tracking).

The performance parameters of the Micromegas detectors, such as efficiency, gain, and position resolution, have been studied in the past with cosmic muons and test beams. In a recent study using cosmic muons, which forms the basis for this presentation, an attempt was made to improve the position resolution using a charge-weighted mean time correction.

T 39.4 Tue 17:00 T-H24

Clock phase calibration of the readout controller of the NSW — •Jonas Roemer[1], Anne Fortman[2], Michelle Solis[3], and Jared Sturdy[1] — [1]Department of Physics and Astronomy, University of California, Irvine — [2]Harvard University — [3]University of Arizona

ATLAS introduces a new muon detector system for the upcoming Run 3 of the LHC: The New Small Wheel (NSW). The NSW features two detector technologies, the Micromegas and the small Thin Gap Chambers. The front-end boards of both technologies use the same readout controller ASIC (ROC). The purpose of the ROC is, among other things, to receive and route trigger, timing and control (TTC) signals, and to collect the channel hit data and transmit it to the readout system.

The ROC samples the TTC stream with a configurable 40 MHz clock. The phase of this clock must be calibrated to interpret the TTC words correctly. Furthermore, the ROC has two 160 MHz clocks for internal functionality and for sampling the hit data from the VMMs. Both must be calibrated relative to each other.

This talk outlines the electronics architecture and calibration procedure and presents the results.

T 39.5 Tue 17:15 T-H24

Gas Monitoring Chambers for the T2K Near Detector Upgrade — Philip Hamacher-Baumann, Ines Hannen, Leon Mans, Thomas Radermacher, Stefan Roth, David Smyczek, and •Nick Thamm — RWTH Aachen University - Physics Institute III B, Aachen, Germany

Measurements from the Tokai to Kamioka (T2K) long baseline neutrino oscillation experiment have shown first indications for CP violation in the leptonic sector. To improve these results, a part of the near detector (ND280) of T2K will be replaced by a 3D fine-grained scintillator tracker acting as target (SFGD), two high-angle time projection chambers (HA-TPCs) and a time-of-flight system (TOF). The Aachen group is developing and constructing new gas monitoring chambers for the existing and new TPC systems to be installed in 2023. These chambers are dedicated to the continuous calibration and monitoring of the TPC drift gas properties. This talk gives an overview of the design, simulation, comissioning and series production of the new gas monitoring system.

T 39.6 Tue 17:30 T-H24

Electronics of the New T2K Gas Monitoring Chambers — Philip Hamacher-Baumann, Thomas Radermacher, Stefan Roth, •David Smyczek, and Nick Thamm — RWTH Aachen University - Physics Institute III B, Aachen, Germany

A pair of High Angle Time Projection Chambers (HATs) will be installed during the upgrade of the T2K near detector ND280. For the calibration of the new HATs the gas parameters will be continuously monitored. For this task, new Gas Monitoring Chambers (GMCs) are developed by the Aachen group and currently under construction. The electronics of the GMC consist of a preamplifier for the anode signals, a triggering system using SiPMs, a data acquisition system using VME waveform digitizers and a slow control logging parameters like pressure and temperature. The design and the commissioning of the electronics system will be presented.

T 39.7 Tue 17:45 T-H24

Hydrogen-rich Gases for High Pressure Time Projection Chambers at Neutrino Beamlines — •Philip Hamacher-Baumann, Thomas Radermacher, Stefan Roth, and Nick Thamm — Physics Institute III B, Aachen, Germany

DUNE's near detector complex foresees a magnetized high-pressure gaseous time projection chamber (HPgTPC) as part of its detector suite. The gaseous active volume boasts a very low detection threshold with high particle-identification power and large acceptance for tracking. Especially interactions on the gas itself in the high intensity neutrino beam will be collected with an unmatched rate. For design and development of a pressurized TPC, it is essential to quantify and validate electron drift parameters, to predict performance of the final detector, e.g. HPgTPC. This presentation investigates how electron drift parameters of drift gas mixtures perform at higher than atmospheric pressures. Additionally, a study of hydrogen-rich Argon:Methane gas mixtures for consideration in HPgTPC is presented using measurements from a test chamber.

T 39.8 Tue 18:00 T-H24

Boron-based neutron Time Projection Chamber — •Divya Pal[1], Jochen Kaminski[1], Micheal Lupberger[1], Markus Köhli[1,2], Klaus Desch[1], Markus Gruber[1], Saime Gürbuz[1], and Laura Rodriguez Gómez[1] — [1]Physikalisches Institut, Universität Bonn — [2]Physikalisches Institut, Universität Heidelberg

Thermal neutron detection is crucial in various areas ranging from fundamental physics research to national security, crystallography and medicine. Tradionally, thermal neutron detectors use Helium-3 filled proportional counters. However, due to the supply shortage of Helium-3, leading to a rapid increase in its price, alternative detectors are sought.

In Bonn, the BOron DEtector with Light and Ionization Reconstruction (BODELAIRE) is being developed to provide high spatial and time resolution in thermal neutron detection. The BODELAIRE is based on the principle of a Time Projection Chamber (TPC) with thin layers of Boron-10 neutron converters placed perpendicular to a GridPix readout which will have Timepix3 as ASIC. The trigger is placed along the field cage, consisting of multiple layers: Boron, scintillator and light readout. Thus, the working principle is that the conversion of the neutron with Boron-10 gives two tracks, one giving a trigger signal in the scintillator while the other leaves a track in the gas volume.

The concept and current development status of the BODELAIRE will be presented.