T 116: Detectors 11 (gas detectors)

Time: Friday 9:00–10:30 Location: Geb. 30.23: 2/17

T 116.1 Fri 9:00 Geb. 30.23: 2/17

BODELAIRE: A TPC for Neutron Science — Klaus Desch[1], Jochen Kaminski[1], •Thomas Block[1], Michael Lupberger[1,2], Markus Köhli[3], Saime Gürbuz[1], Markus Gruber[1], and Laura Rodriguez Gómez[1] — [1]Physikalisches Institut, Univeristät Bonn — [2]HISKP, Universität Bonn — [3]Physikalisches Institut, Univeristät Heidelberg

An increase in demand and the resulting price increase of Helium-3 has sparked the development of alternative kinds of neutron detectors for various applications in neutron science.

The Boron Detector with Light and Ionisation Reconstruction (BODELAIRE) is a detector, which combines the concept of a time projection chamber (TPC) with a highly granular readout with high time resolution and a boronated glass window for neutron conversion. Boron absorbs incoming neutrons and decays into an alpha particle and a Lithium ion. One of the ions enters the drift volume of the TPC and creates a trace of electron-ion pairs, which the readout detects. The other ion emitted in opposite direction is used to start the readout with the help of a scintillator inside the glass vessel. The light created in the scintillator is coupled to a trigger board via wavelength shifting fibers to generate a start signal in silicon photomultiplier-based electronics. The trigger system is FPGA-controlled, which the user can interface with to set signal thresholds.

In this talk I will present the detector concept and its current status of development.

T 116.2 Fri 9:15 Geb. 30.23: 2/17

Cosmic Muon Tracking with Micromegas Detectors and Neutron Source Characterisation — •Eshita Kumar, Otmar Biebel, Valerio D'Amico, Stefanie Götz, Ralf Hertenberger, Roman Lorenz, Katrin Penski, Nick Schneider, Chrysostomos Valderanis, and Fabian Vogel — LMU München

MICRO MEsh GAseous Structure (Micromegas) detectors are Micro-Pattern Gaseous Detectors (MPGDs) that have high rate capability due to the fast evacuation of positive ions and excellent spatial resolution due to a small-scale readout strip pitch. To test the performance and resilience of such detectors in detecting cosmic muons under high background, a $2\,\mathrm{m}^2$ Micromegas detector with four layers was irradiated by a 10 GBq Americium-Beryllium neutron source for a period of three years. The analysis performed on these measurements without background radiation and the final results obtained on the efficiency of the detectors in tracking cosmic muons after long-term irradiation will be discussed. Furthermore, an intensive study on the characteristics of the neutron source used was carried out: measurements with a shielding material of varying thicknesses placed in front of the source were used to disentangle the detector response for gamma and neutron radiation. A Germanium detector was used in order to determine the intensity of gammas produced by the source. Following this, a Geant4 simulation was performed to determine the interaction probability from the background radiation. A comparison of the analysis of the detector output to the simulation results for the final charge obtained from the gammas and the neutrons will be shown.

T 116.3 Fri 9:30 Geb. 30.23: 2/17

Long term irradiation studies of ATLAS Micromegas detectors at the CERN GIF++ facility — •Valerio D'Amico, Stefanie Goetz, Ralf Hertenberger, Eshita Kumar, Roman Lorentz, Katrin Penski, Nick Schneider, Chysostomos Valderanis, Fabian Vogel, and Otmar Biebel — Ludwig-Maximilians-Universität München

The ATLAS muon spectrometer will face an increase of particle rate consequently of the larger instantaneous luminosity for the HL-LHC phase, expected to reach 7.5×10^{34} cm^{-2}s^{-1}. The New Small Wheel of the ATLAS muon spectrometer end-cap is equipped with small-strip Thin Gap Chambers and Micromegas (MM), able to provide good tracking and trigger performances in this dense environment. MM detectors are operated with Ar : CO_2 : iC_4H_{10} 93:5:2 vol% ternary gas mixture, providing a good HV stability and a large pulse height, useful for inclined track reconstruction. Due to the hydrocarbon content in the mixture, an extensive aging campaign is ongoing at the Gamma Irradiation Facility (GIF++) at CERN on MM production detectors, where they are long term exposed to a 11.6 TBq ^{137}Cs γ-source, accumulating so far a charge equivalent to several years of HL-LHC operations. Amplification gain, tracking position and time resolution using 80 GeV muon beam were studied to test the detector stability during irradiation. This contribution will describe the results obtained from the above studies, showing the good response of the detector after several 'HL-LHC equivalent' years of irradiation, demonstrating the robustness of ATLAS MM detectors under intense particle rates.

T 116.4 Fri 9:45 Geb. 30.23: 2/17

Upgrading the CMS muon end cap for the high luminosity LHC using GEM chambers — •Shawn Zaleski, Thomas Hebbeker, Kerstin Hoepfner, and Francesco Ivone — III. Physikalisches Institut, RWTH University, Aachen

The first set of gas electron multiplier (GEM) chambers was installed in the Compact Muon Solenoid (CMS) end cap of the muon system during long shutdown 2 (LS2) in 2021 and 2022. These GEM chambers comprise the so-called GE1/1 subsystem. The GE1/1 system compliments the cathode strip chamber (CSC) system in an effort to improve the transverse momentum measurement of muons traversing the CMS end caps. The GE1/1 system has been participating in data taking within CMS since the start of Run 3 in 2022. Several performance studies have been performed in this time and a procedure for certifying GEM data has been developed. Additional extensions to the GEM system are foreseen. These extensions will extend the measurement acceptance of the muon system in pseudorapidity from 2.4 to 2.8.

T 116.5 Fri 10:00 Geb. 30.23: 2/17

Production of thin-gap Resistive Plate Chambers for the Phase-2 Upgrade of the ATLAS muon spectrometer — Nayana Bangaru, •Francesco Fallavollita, Oliver Kortner, Hubert Kroha, Giorgia Proto, Daniel Soyk, Timur Turkovic, and Elena Voevodina — Max Planck Institut für Physik - Werner Heisenberg Institute, München, Germany

The present ATLAS RPC system will undergo a major upgrade for the HL-LHC program, consisting in three additional full coverage layers of new generation thin-gap RPC trigger chambers, to be installed in the inner barrel region of the Atlas Muon Spectrometer. The Max Planck Institute for Physics (MPI) has established RPC production procedures compliant with industrial requirements and is in the process of certifying several companies for the future RPC series production for the ATLAS upgrade for HL-LHC and beyond. In order to certify the new manufacturers, several $40\times50\,cm^2$ small-size detector prototypes have been built by them. Their performance have been studied in laboratory tests and at CERN Gamma Irradiation Facility (GIF++). Several full-scale prototypes are currently under construction and qualification at the external manufacturers and at MPI. The prototypes will undergo long-term irradiation for half a year in the CERN GIF++ facility in order to qualify the components and production procedures with respect to longevity. The core of the project is presented, together with a description about the technology transfer, the RPC prototype production and certification at the selected companies, as well as their performance and stability measurements at CERN GIF++ facility.

T 116.6 Fri 10:15 Geb. 30.23: 2/17

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 has been implemented in the New Small Wheel upgrade of ATLAS for improved triggering and tracking in a higher particle rate environment. For the purpose of investigating analog signal shapes and gas 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. With the unique opportunity of this setup to study analog signals before digitisation and to closely monitor various properties of the gas and HV, it lends itself to studies of the properties of the sTGC gas mixture and analog signal shapes. This presentation discusses the goals and challenges of the dedicated setup, as well as comparing results to simulation in Garfield++.