T 23: Gas-Detectors / Muon MDT

Time: Monday 16:30–18:00 Location: WIL/A120

T 23.1 Mon 16:30 WIL/A120

Production and testing of Resistive Plate Chambers (RPCs) — •Timur Turkovic, Oliver Kortner, Daniel Soyk, and Hubert Kroha — Max Planck Institut für Physik

Resistive plate chambers (RPCs) with electrodes of high-pressure phenolic laminate (HPL) and small gas gap widths down to 1 mm provide a relatively low cost detector for large area tracking in ATLAS, that still grants high rate capability and fast response with an excellent time resolution of better than 500 ps. They can be operated up to γ background count rates of 10 kHz/cm2, which is five times the maximum rate these RPCs will encounter in the innermost layer of the barrel muon spectrometer of the ATLAS detector, where they will be installed in the phase-II upgrade for the HL-LHC operation. Production procedures that were previously developed in the lab have been transferred to several companies of which each produced first test samples. The quality of these samples was tested by measuring the voltage-current curves and the muon detection efficiency with cosmic muons.

T 23.2 Mon 16:45 WIL/A120

Study of the muon detection efficiency of thin-gap RPCs — •Nayana Bangaru, Oliver Kortner, Hubert Kroha, and Timur Turkovic — MPI für Physik, München, Deutschland

Resistive plate chambers (RPC) with small gaps between electrodes of high-pressure phenolic laminate offer excellent time resolution of better than 500 ps and cm position resolution . Thin-gap RPCs with a gas gap of 1 mm will be used for the phase II upgrade of the ATLAS muon spectrometer. The muon hit positions will computed from he signals induced on 30 mm wide pick-up strips. In order to obtain a muon detection efficiency >99%, very sensitvie amplifiers have to be used. We studied the dependence of the muon detection efficiency of thin-gap RPCs on the applied operating voltage with two different amplifier options: the ATLAS thin-gap RPCs and an alternative circuit using commercial high-performance transimpedance amplifiers from Texas Instruments. In this contribution we will introduce the two amplifiers and present the results of our efficiency measurements

T 23.3 Mon 17:00 WIL/A120

Finding eco-friendly alternatives for highly potent greenhouse gases in drift chambers — •Ines Hannen, Thomas Radermacher, Stefan Roth, David Smyczek, and Nick Thamm — RWTH Aachen University - Physics Institute III B, Aachen, Germany

Climate change poses an immense challenge to mankind. Drift chambers used in high-energy physics are often filled with highly potent greenhouse gases. To find an alternative to these, simulations on drift gas properties and energy deposition are performed. Important drift gas parameters, simulations and criteria to find eco-friendly alternatives are presented. The focus lies on Argon based drift gases as used for example in the time projection chambers of the T2K experiment.

T 23.4 Mon 17:15 WIL/A120

Quality Control in the Construction of new small-diameter Muon Drift Tube (sMDT) Chambers for the ATLAS Muon Spectrometer at the HL-LHC — •Daniel Buchin, Alice Reed, Marian Rendel, Patrick Rieck, Elena Voevodina, Oliver Kortner, and Hubert Kroha — Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München

In order to improve the muon trigger efficiency and the rate capability of the ATLAS muon detectors for operation at the high luminosity upgrade of the Large Hadron Collider (HL-LHC), the Monitored Drift Tube (MDT) tracking chambers in the inner barrel layer of the ATLAS Muon Spectrometer will be replaced by small-diameter Muon Drift Tube (sMDT) chambers integrated with new thin-gap RPC trigger chambers.

The sMDT chambers are in serial production since January 2021. The serial production involves a stringent quality control program to assure the reliability and high mechanical precision of the chambers. In the talk, this program will be presented. It includes tests of the individual drift tubes and several mechanical measurements on the sMDT chambers. Also, the dedicated quality control database and monitoring web interface will be discussed.

T 23.5 Mon 17:30 WIL/A120

Construction of new small-diameter Monitored Drift Tube (sMDT) chambers for the HL-LHC upgrade of the ATLAS Muonspectrometer — •Alice Reed, Daniel Buchin, Marian Rendel, Patrick Rieck, Elena Voevodina, Oliver Kortner, and Hubert Kroha — Max Planck Institut für Physik (Werner-Heisenberg-Institut), München

In order to improve the muon trigger efficiency and the rate capability of the ATLAS muon detectors for operation at the high-luminosity upgrade of the Large Hadron Collider (HL-LHC), the Monitored Drift Tube (MDT) chambers in the inner barrel layer of the ATLAS Muon Spectrometer will be replaced by small-diameter Muon Drift Tube (sMDT) chambers integrated with new thin-gap RPC trigger chambers. The sMDT chambers fit, together with the RPCs, into the very tight available space and provide an order of magnitude higher background rate capability compared to the current detectors.

The sMDT chambers have been in serial production since January 2021. In this talk, the steps for the drift tube production and chamber construction will be presented, followed by a discussion of the cosmic muon tests used for the final chamber certification.

T 23.6 Mon 17:45 WIL/A120

Impact of environmental pressure and temperature variations on triple-GEM detector gas gain — •Francesco Ivone, Thomas Hebbeker, Kerstin Hoepfner, Giovanni Mocellin, and Shawn Zaleski — III. Physikalisches Institut A, RWTH Aachen University

The GEM (Gas Electron Multiplier) technology has been widely adopted for muon detection in high energy physics experiments, for both tracking and triggering, as well as in other application areas.

The GEM gas electron amplification factor depends on the gas properties: mainly the mixture, the temperature and the pressure. While the gas mixture is finely controllable, the gas temperature and pressure are influenced by the fluctuations of the environmental parameters. Correcting for such variations is therefore crucial to maintain stable operating conditions or to compare performance measured in different conditions. In this contribution we describe the dependence of triple-GEM gas gain on temperature and pressure for three different gas mixtures. The study is based on experimental data, supported by simulations.