T 62: Myondetektoren

Zeit: Mittwoch 16:30–18:35 Raum: Z6 - SR 2.002

Gruppenbericht T 62.1 Mi 16:30 Z6 - SR 2.002

CMS muon chambers - status and upgrade — Thomas Hebbeker, Carsten Heidemann, Kerstin Hoepfner, Markus Merschmeyer, and •Daniel Teyssier — III. Physikalisches Institut A, RWTH Aachen University

The CMS muon system uses three different technologies to trigger, identify muons and measure their momentum. Even after 10 years of operation the performance is very high. The Drift Tube (DT) chambers located in the barrel show a very good behavior and have a coverage up to $\eta = 1.2$. The Cathode Strip Chambers (CSC) are able to work in an inhomogeneous B field environment and cover the endcaps region up to $\eta = 2.4$. In addition the Resistive Plate Chambers (RPC) are present in both barrel and endcaps, in order to give a better time resolution. The living channels fraction for all these detectors is still very high at the end of 2017 and the redundancy of the system allows a very good muon identification efficiency.

The HL (High Lumi)-LHC program is challenging for the muon system, as it will compel to deal with new background and rate conditions. The electronics of all three DT, CSC and RPC systems will be modified. Some new Gas Electron Multiplier (GEM) and RPC detectors will be installed to extend the current coverage up to $\eta = 2.8$ and also to reinforce the redundancy in the forward region. Several tests of longevity are on-going to qualify the new components.

This talk will present the status of the current muon system and the capacity to improve and extend the system for HL-LHC.

T 62.2 Mi 16:50 Z6 - SR 2.002

CMS DT muon chambers upgrade — •Carsten Heidemann, Thomas Hebbeker, Markus Merschmeyer, and Daniel Teyssier — III. Physikalisches Institut A RWTH Aachen University, Aachen

The CMS Drift Tubes (DT) muon chambers in the barrel will cope with higher pile-up as well as higher background conditions in the next High Luminosity (HL) LHC program. The failure rate of the detector itself is very low and there is no need to replace the chambers themselves for HL-LHC. The increased trigger rates and the radiation environment requires an exchange of the frontend electronics mounted on the chambers. A new mini crate (MiC2) is currently designed to replace the old electronics and move the level-1 trigger functionality to the better accessible service cavern. The longevity studies of the chambers are ongoing using the Gamma Irradiation Facility (GIF++) to re-enact the conditions of three times the HL-LHC equivalent dose.

T 62.3 Mi 17:05 Z6 - SR 2.002

Bau von small-diameter Muon Drift Tube (sMDT)-Kammern für das ATLAS-Myonspektrometer — •Verena Walbrecht, Korbinian Schmidt-Sommerfeld, Patrick Rieck, Oliver Kortner und Hubert Kroha — Max-Planck-Institut für Physik, München

Im zweiten Long Shutdown des Large Hadron Colliders, 2019-2020, werden die Monitored Drift Tube (MDT)-Kammern an den Enden der inneren Barrellage durch 16 neue small-diameter Muon Drift Tube (sMDT)-Kammern mit dem halben Rohrdurchmesser ersetzt, die mit neuen thin-gap RPC-Triggerkammern integriert sind. Die Kammerproduktion hat im Januar 2018 begonnen und soll bis Dezember des Jahres abgeschlossen sein. Wie bei den MDT-Kammern muss auch beim Bau der sMDT-Kammern eine hohe Positioniergenauigkeit der Zähldrähte von mindestens 0.02 mm erreicht werden.
In dem Vortrag wird über die Driftrohrproduktion, die Montage und Vermessung der Kammern und deren mechanische und elektrische Eigenschaften berichtet.

T 62.4 Mi 17:20 Z6 - SR 2.002

High rate studies of the ATLAS MDT chambers in LHC Run-2 — •Nicolas Köhler, Oliver Kortner, Hubert Kroha, and Robert Richter — Max Planck Institut für Physik

In 2017, the Large Hadron Collider for the first time delivered instantaneous luminosities near $2 \cdot 10^{34}\,\mathrm{cm^{-2}s^{-1}}$, twice the design luminosity. Under the so far highest neutron and γ background fluences in the ATLAS muon spectrometer at this luminosity, the high counting rate behaviour of the ATLAS precision muon tracking chambers, the Monitored Drift Tube (MDT) chambers , has been studied, especially in the inner endcap layer where the background rates are highest. The data are used to obtain new estimates of the limitations for the operation of the chambers under realistic conditions.

T 62.5 Mi 17:35 Z6 - SR 2.002

Quality control of GEM detectors for the Upgrade of the CMS Muon Forward system — •Giovanni Mocellin, Henning Keller, Kerstin Hoepfner, and Thomas Hebbeker — III. Physikalisches Institut A, RWTH Aachen University, Germany

With the increase of the instantaneous luminosity delivered to the experiments by the LHC accelerator, reaching a value of $5\times10^{34}\,\mathrm{cm^{-2}s^{-1}}$ after the Long Shutdown 3 in 2025, the detectors have to be upgraded to improve the performance and to sustain higher particle fluxes. The forward regions, corresponding to the endcaps of the detectors, are the most affected parts. In the CMS experiment, to cope with the higher event rates and larger radiation doses, triple-layer Gas Electron Multipliers (GEM) will be installed in the Muon Endcaps. For the first time, such detectors will have large sizes of the order of 1-2 $\mathrm{m^2}$, thus high requirements on the uniformity across the detector are needed. Triple-GEM chambers will complement the existing Cathode Strip Chambers, leading to a better identification of the muon tracks and a reduction of the trigger rate due to the suppression of fake candidates. In addition, the forward coverage will be further extended. Before the final installation in the CMS detector, to test their integrity, quality and performance, the GEM chambers undergo eight Quality Control tests (QC1-QC8). One of the sites in which these operations are performed is Aachen. This talk gives an introduction to GEM detectors and presents results of the performance tests.

T 62.6 Mi 17:50 Z6 - SR 2.002

Effects of humidity on the gas gain in MicroMegas detectors — •Thorwald Klapdor-Kleingrothaus, Stephanie Zimmermann, and Ulrich Landgraf — Universität Freiburg

The Micro-Mesh-Gaseous Detectors (MicroMegas) are planar and high-rate capable detectors with a very good spatial resolution. In the recent years, the MM technology was intensively studied in view of replacing the innermost station of the ATLAS endcap muon spectrometer. The new detector assembly is known as the New Small Wheel (NSW) Upgrade and will be installed in the next long LHC shutdown in 2019/20. The NSW will use the MicroMegas technology as well as small strip-Thin-Gap-Chambers (sTGC) for triggering and track reconstruction. In this context, small MicroMegas prototypes (10x10cm) were developed to study their performance and their behavior. The presented work uses a cosmic muon test setup with two of these prototypes in combination with a scalable readout system. Influences on the detector performance caused by variations in the pressure of the operation gas or by changes in the humidity at the low ppm level are investigated. These parameters will affect the later design of detector-slow-control system at the NSW in ATLAS. The results of the first measurements and corresponding simulation studies are presented.

T 62.7 Mi 18:05 Z6 - SR 2.002

Measurement of Position Inaccuracies in Large Micromegas Chambers — •Patrick Scholer, Ulrich Landgraf, and Stefanie Zimmermann — Universität Freiburg

In the next long shutdown of the LHC in 2019/20, the innermost part of the end cap Muon Spectrometer of the ATLAS detector will be replaced. The new system is called New Small Wheel (NSW). It will use Micro Mesh Gaseous Detectors (Micromegas, MM) and small-strip Thin Gap Chambers (sTGCs) as its detector technologies; both providing a high spatial resolution achieved by a strip like segmented read-out structure.

The mechanical production tolerances on the strip alignment have a direct impact on the spatial resolution of the detector. In order to guarantee the tight requirements, a high precision optical measurement tool was developed allowing for measurements of the strip pattern and geometry over the large dimensions of the NSW PCBs of up to 2 m. It is based on a camera and a telecentric objective joined to a coordinate measurement machine. Specific optical object detection libraries were developed to allow for multiple object detection. The system reaches a precision of 30 μm within a spatial measurement range of 6.5 m x 1.4 m.

In this talk, the setup of the measurement system is discussed and first measurement results are presented.

T 62.8 Mi 18:20 Z6 - SR 2.002

Investigation of square meter sized Micromegas Quadruplets with Cosmic Muons — •Maximilian Herrmann, Otmar Biebel, Bernhard Flierl, Ralf Hertenberger, Felix Klitzner, Philipp Lösel, Ralph Müller, and Chrysostomos Valderanis — LMU München

Square meter sized Micromegas quadruplets will be used in collision experiments for muon tracking. The Cosmic Ray Test Facility (CRF) in Garching is well suited for the investigation of these detectors with cosmic muons. The CRF consists of two Monitored Drift Tube Chambers (MDTs) for precise tracking in one dimension. A trigger and a coarse segmentation in the direction along the tubes is achieved via a scintillator hodoscope. A quadruplet with an active area of about 2 m^2 fits well in the 9 m^2 active area of the CRF and can be investigated with tracks inclined between $\pm$ 30 degrees to the zenith angle.
We present results for the performance of Micromegas quadruplets based on measurements done in the CRF. Geometrical properties of the segmented readout anodes are reconstructed from the deviations to track predictions of the MDTs. The position resolution is investigated to estimate the track prediction accuracy. Homogeneity in pulse height and efficiency will be discussed.