T 117: Myondetektoren 2

Zeit: Donnerstag 16:45–18:35 Raum: VSH 06

Gruppenbericht T 117.1 Do 16:45 VSH 06

Construction and Quality Assurance of Large Area Resistive Strip Micromegas for the Upgrade of the ATLAS Muon Spectrometer — •Ralf Hertenberger[1], Otmar Biebel[1], Bernhard Flierl[1], Maximilian Herrmann[1], Felix Klitzner[1], Philipp Lösel[1], Ralph Müller[1], Chrysostomos Valderanis[1], and Andre Zibell[2] — [1]LMU München — [2]JMU Würzburg

To cope with the increasing luminosity of LHC intrinsically high-rate capable resistive strip Micromegas detectors of 2-3 m^2 size will replace in 2019 the present tracking detectors of the innermost stations of the ATLAS muon endcap system.

In order to retain 15% transverse momentum resolution for 1 TeV muons, a challenging mechanical precision is required for each of the eight planes of the assembled double-quadruplets, with an alignment of the readout strips at the level of 30 μm along the precision coordinate and 80 μm perpendicular to the plane and with a single plane spatial resolution better than 100 μm at a rate capability up to 15 kHz/cm^2.

Several PCB boards with micro readout strips need to be joined and precisely aligned to form a full readout plane. The precision in the alignment is reached either with precision mechanical holes or by optical masks, both referenced to the readout strips. Methods to confirm the precision of components and assembly are based on precise optical devices and X-ray or cosmic muon investigations.

We will report on the construction procedures for Micromegas quadruplets, on results from quality control, on assembly and calibration methods.

T 117.2 Do 17:05 VSH 06

Printing high ohmic resistors for two-dimensional Floating Strip Micromegas Detectors — •Isabel Frank[1], Otmar Biebel[1], Bernhard Flierl[1], Maximilian Herrmann[1], Ralf Hertenberger[1], Felix Klitzner[1], Philipp Lösel[1], Ralph Müller[1], Chrysostomos Valderanis[1], and André Zibell[2] — [1]LMU München, Germany — [2]JMU Würzburg, Germany

Micromegas detectors are gaseous high-rate capable particle detectors with excellent spatial and temporal resolution. Single particle tracking is possible for particle fluxes up to 7 MHz/cm^2. Different to the standard Micromegas design, floating strip Micromegas use anode strips which are on a floating electrical potential due to high ohmic contact to the HV supply. The charge signal is coupled to readout strips which are separated by a thin kapton layer from the floating anode strips. A two-dimensional floating strip Micromegas detector was built with an active area of 19.2 x 19.2 cm^2 and adjustable drift region hight. The floating strips require individual high ohmic contact to high voltage. We present a method to connect reliably the floating strips individually to common high voltage using high atomic polymer resistive paste with a screen printing method. Results from characterizing measurements of the resistances and from tests of the detector using 5.9 keV photons from a ^{55}Fe source are presented.

T 117.3 Do 17:20 VSH 06

Grossflaechige Mikrogitter für ATLAS Micromegas Detektoren — •Andre Zibell und Raimund Ströhmer — Julius-Maximilians-Universität Würzburg

Im Zuge der zweiten langen Wartungspause des LHC Beschleunigers 2019/2020 werden die 'Small Wheel' Myonkammern des ATLAS Detektors unter anderem gegen grossflächige und hochratenfeste Micromegas Detektoren ausgetauscht. Die Gesamtmenge dieser Detektoren ist in vier unterschiedliche Modultypen aufgeteilt, deren Serienproduktion 2017 beginnt.

Eine der Schlüsselkomponenten dieser Detektortechnologie sind vollflächige Edelstahl-Mikrogitter. Am Standort Würzburg werden für einen der vier Modultypen die 128 nötigen, je etwa 3 Quadratmeter grossen Mikrogitter auf Transferrahmen gespannt, und im Anschluss auf die Detektormodule umgeklebt.

Es werden die Entwicklung und der Aufbau der nötigen Infrastruktur vorgestellt, sowie die Ergebnisse der Modul0- und frühen Serienproduktion hinsichtlich Homogenität der mechanischen Spannung, Stabilität, Verfahren und Ausbeute präsentiert. Die von ATLAS vorgegebenen Anforderungen wurden bereits bei den ersten Testgittern erfüllt.

T 117.4 Do 17:35 VSH 06

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, MM) 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 in the next long LHC shutdown in 2019/20 by a new detector assembly known as the New Small Wheel (NSW) Upgrade. The two New Small Wheels will use the MicroMegas technology as well as sTGC's 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 impact the later design of detector slow control system at the New Small Wheel in ATLAS. The results of the first measurements and corresponding simulation studies are presented.

T 117.5 Do 17:50 VSH 06

Characterization tests of Micromegas with elongated pillars — •Ourania Sidiropoulou — CERN and University of Wuerzburg

Micromegas are micro-pattern gaseous detectors which are more and more widely used in physics experiments. Micromegas are parallel-plate chambers where the amplification region is separated from the conversion region by a thin metallic micro-mesh. The width of the amplification region is defined by regularly spaced insulating pillars.

The pillars are made by photo-lithography from a uniform layer of photoimageable coverlay; its thickness defines the amplification gap. Since pillars produce a dead area and a perturbation of the electric field in the region nearby, the design of the pillar pattern is an important parameter. Moreover it has been observed that the attachment of small pillars to the anode plane of the detector is a critical factor for industrially produced large-size anode boards.

In this talk, a resistive micromegas detector built with a new pillar pattern with elongated shapes with length between few mm up to 10 cm will be presented. The detector features readout strips with a width of 250 μm and a pitch of 400 μm. The pillars extend in the direction orthogonal to the readout strips and are 200 μm wide. The larger surface of the pillars allows for a better adhesion to the readout structure and a more uniform amplification gap.

After the motivation of the new proposed structure, the presentation focuses on the characterization of the detector. Results on gain measurements, electron mesh transparency, ion back-flow, efficiency, spatial resolution and tracking performance are presented.

T 117.6 Do 18:05 VSH 06

Studies on Discharge Behaviour in Thick-GEMs — •Bernhard Flierl[1], Otmar Biebel[1], Theo Goldfuss[1], Ralf Hertenberger[1], Phillipp Lösel[1], and Andre Zibell[2] — [1]Ludwig-Maximilians-Universität München — [2]Julius-Maximilians-Universität Würzburg

Gaseous Electron Multipliers (GEMs) have shown great performance in different applications. Their intrinsic high rate capability might be lowered in hostile environment, where strongly ionizing particles occur simultaneously to minimum ionizing particles to be detected. Very high charge deposition creates discharges, which are in general harmless for the GEM, but create dead time until the initial voltages are recreated. Here the discharge characteristics of Thick-GEMs made from 1 mm PCB-Material and 35 μm copper cladding in contrast to standard GEMs of 50 μm Kapton with 5 μm copper cladding is studied and different approaches of discharge prevention are discussed. An optical read-out is used to locate and count artificially induced discharges, which lead to a visible spark. We present results of characterization with different drift gases by measurements with cosmic muons and an α-source in order to trigger discharges by high local energy deposition of 5.5 MeV. The main focus is on the minimization of the effects of a discharge, e.g minimization of voltage drop on the GEM-electrodes and dead time after a discharge.

T 117.7 Do 18:20 VSH 06

Precision Studies with Resistive Strip Micromegas and their Dependence on Detector Size — •Philipp Lösel[1], Otmar Biebel[1], Bernhard Flierl[1], Maximilian Herrmann[1], Ralf Hertenberger[1], Felix Klitzner[1], Ralph Müller[1], and Andre Zibell[2] — [1]LMU München, Germany — [2]JMU Würzburg, Germany

Currently square-meter sized Micromegas are of big interest for many particle physics experiments. Smaller Micromegas are used often as reference detectors for testbeam setups. They have been intensively investigated in particle beams under background irradiation and with cosmic muons. Micromegas have excellent spatial resolution below 100 μm for perpendicular incident of the traversing particle. Additionally Micromegas allow for angle reconstruction in a single plane with an angular resolution of up to 2° depending on the drift field. The achievable resolution is limited for measurements with cosmic muons due to increased multiple scattering at lower energies.

We will present a comparison of the spatial resolution, angular resolution, efficiency and signal shape effects of square-meter sized resistive strip Micromegas in comparison with $(10 \times 10)\,\mathrm{cm}^2$ versions in particle beams as well as in measurements with cosmic muons. The Micromegas were exposed to 120 GeV pions at the H6 beam-line at SPS/CERN, where the test Micromegas were investigated in a telescope, consisting of four reference Micromegas. Measurements with cosmic muons were performed in the Cosmic Ray Facility at LMU Munich with two high precision Monitored Drift Tube chambers for reference tracking and three small Micromegas for comparison.