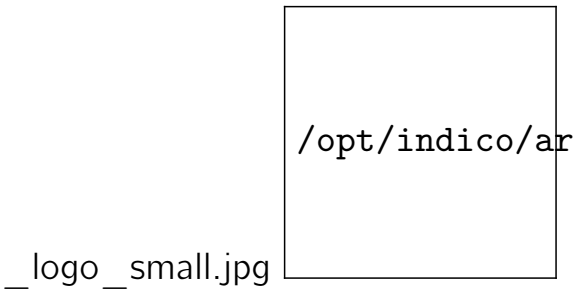

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Precise Calibration of Large Area Micromegas Detectors Using Cosmic Rays

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Content

Currently m^2-sized micropattern detectors with spatial resolution better than 100 μm and online trigger capability are of big interest for many experiments. Large size in combination with superb spatial resolution and trigger capability implicates that the construction of these detectors is highly sophisticated and imposes strict mechanical tolerances. We developed a method to survey assembled and working detectors on potential deviations of the micro pattern readout structures from design value as well as deformations of the whole detector, using cosmic muons in a tracking facility.
The LMU Cosmic Ray Facility consists of two 8 m^2 ATLAS Monitored Drift Tube chambers (MDT) for precision muon reference tracking and two segmented trigger hodoscopes with sub-ns time-resolution and additional 10 cm position information along the wires of the MDTs. It provides information on homogeneity in efficiency and pulse height of one or several micropattern detectors installed in between the MDTs. With an angular acceptance of $-30°$ to $+30°$ the comparison of the reference muon tracking with centroidal position determination or time projection chamber like track reconstruction in the micropattern detector allows for calibration in three dimensions.
We present results of a m^2-sized one-dimensional resistive strip Micromegas detector consisting of two readout boards with in total 2048 strips, read out by 16 APV25 front-end boards. This 16-fold segmentation along the precision direction in combination with a 10-fold segmentation in orthogonal direction by the resolution of the trigger hodoscope, allows for very detailed analysis of the 1 m^2 detector under study by subdivision into 160 partitions, each being analyzed separately.
We are able to disentangle deviations from the readout strip straightness and global deformation due to the small overpressure caused by the Ar:CO_2 gas flux.
We introduce the alignment and calibration procedure, report on homogeneity in efficiency and pulse height and present results on deformation and performance of the m^2-sized Micromegas.

Summary

We present analysis methods for the calibration of large area Micromegas detectors using a test facility with cosmic muons.

Primary author(s) : Mr. HERRMANN, Maximilian (LMU Munich)

Presenter(s) : Mr. HERRMANN, Maximilian (LMU Munich)

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