Performance and Calibration of a 2m² SM2 Micromegas Detector for the ATLAS Muon Spectrometer Upgrade

The steadily increasing luminosity of LHC requires an upgrade to high rate and high resolution capable detector technology for the inner end cap of the muon spectrometer of the ATLAS experiment. For precision tracking 4 types of 2 and 3 m² large micromegas quadruplets will provide 8 consecutive active layers, each with 100 µm spatial resolution per individual plane.

120 GeV SPS muon and pion data from Aug. 2017, taken with the SM2 2 m² quadruplet prototype, show spatial resolutions of 80 µm for perpendicular particle incident using charge weighted position reconstruction. An analysis using additional drift-time information gives similar good resolution also for inclined tracks.

The full active area of the SM2 prototype quadruplet has been calibrated in the Munich Cosmic Ray Facility. A segmentation of the active area into 55x100 mm² partitions enabled a detailed full area analysis of local detector properties, as geometrical quality, efficiency and pulse height.

Pulse Height and Efficiency for Local Beam Spots

Spatial Resolution Using Charge Weighted Position Reconstruction

Improved Track Reconstruction Using Also the Drift Time Information