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Resistive Micromegas for the Muon Spectrometer Upgrade of the ATLAS Experiment (12' + 3')

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Large size resistive Micromegas detectors will be employed for the first time in high-energy physics experiments for the Muon Spectrometer upgrade of the ATLAS experiment at CERN. The current innermost stations of the muon endcap system, the Small Wheel, will be upgraded for LHC Run3 and for HL-LHC to retain the good precision tracking and trigger capabilities in the high background environment expected with the upcoming luminosity increase of the LHC.
Along with the small-strip Thin Gap Chambers (sTGC) the "New Small Wheel"will be equipped with eight layers of Micromegas (MM) detectors arranged in multilayers of two quadruplets, for a total of about 1200 m^2 detection planes. All quadruplets have trapezoidal shapes with surface areas between 2 and 3 m^2. The Micromegas system will provide both trigger and tracking capabilities.
In order to achieve a 15% transverse momentum resolution for 1 TeV muons, a challenging mechanical precision is required in the construction of each plane of the assembled modules, with an alignment of the readout elements (the strips) at the level of 30 μm along the precision coordinate and 80 μm perpendicular to the plane. Each Micromegas plane must achieve a spatial resolution better than 100 μm independent of the track incidence angle and operate in an inhomogeneous magnetic field (B < 0.3 T), with a rate capability up to ˜15 kHz/cm^2
In the recent years, the achievement of the required performance has been demonstrated with dedicated testbeams performed on small (10×10 cm^2) and medium size (1×0.5 m^2) resistive Micromegas detectors.
In the next months the first full size prototypes (modules-0) will be completed and will be subjected to a thorough validation phase.
After a brief review of the performance studies of small prototypes, demonstrating the excellent characteristics of the detectors, the Modules-0 construction procedures will be reviewed along with the results of the validation tests obtained with X-rays, cosmic ray tracks and with high-energy particle beams.

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