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Resistive Micromegas for the Muon Spectrometer Upgrade of the ATLAS Experiment

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Large size multilayer resistive Micromegas detectors will be employed for the Muon Spectrometer upgrade of the ATLAS experiment at CERN. The current innermost stations of the muon endcap system, the 10 m diameter Small Wheel, will be upgraded in the 2019-2020 long shutdown of 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 m2 detection planes. All quadruplets have trapezoidal shapes with surface areas between 2 and 3 m2. 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 for each plane of the assembled modules, with an alignment of the readout elements (strips with ˜450 um pitch) 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/cm2.

In May 2017, all four types full size prototypes (modules-0) will be completed and will be subjected to a thorough validation phase.

The Modules-0 construction procedures will be reviewed along with the results of the quality controls results during constructions and the final validation tests obtained with X-rays, cosmic tracks and with high-energy particle beams at CERN.

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