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Status of the art of the Resistive Micromegas for the Upgrade of the ATLAS Detector

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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 end-cap system, two 10 m diameter wheels, will be upgraded in the 2019-2020 long shut-down 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. The new detector system will be equipped with eight layers of Micromegas (MM) detectors arranged in multi-layers 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 readout elements consist of 300 μm wide strips with a pitch of ~450 μm for a total of 2.1 M readout channels. The Micromegas system will provide both trigger and tracking capabilities, a 15% transverse-momentum resolution for 1 TeV muons and a spatial resolution better than 100 μm independent of the track incidence angle. It will operate in an inhomogeneous magnetic field ($B < 0.3$ T), with a rate capability of up to ~15 kHz/cm². In May 2016 the first full size prototype (Module-0) has been completed by the INFN consortium and studied on a dedicated test beam at Cern. Further tests included mechanical studies for the detector assembly in the wheel and performances under deformation, as well as ongoing tests on high-voltage stability and cosmic rays. The status of the art of the Micromegas construction, as a part of the NSW project, will be reviewed, along with the studied performance on the first Module-0.

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