

Upgrade of the ATLAS Muon Spectrometer Thin Gap Chambers and their electronics for the HL-LHC phase

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The instantaneous luminosity of the LHC will be increased by almost an order of magnitude with respect to the design value by undergoing an extensive upgrade program for the High-Luminosity LHC (HL-LHC). Many upgrades are foreseen for the thin gap chambers (TGC) of the ATLAS Muon System. A Phase-I upgrade project is the replacement of the present first station in the forward regions with the New Small Wheels (NSWs). Along with Micromegas, the NSWs are equipped with 8 layers of small-strip thin gap chambers (sTGC) arranged in multilayers of two quadruplets, for a total active surface of more than 2500 m². The spatial resolution has to be better than 100 μm per sTGC plane to allow the trigger track segments to be reconstructed with an angular resolution of 1 mrad. At Phase-II, the TGC at larger radius from the beam line than the NSW will also be replaced with triplet chambers with finer granularity. Another Phase-II upgrade project is the replacement of the TGC trigger and readout electronics. The first prototype of the frontend board has been developed and tested at the CERN SPS with functions required for the HL-LHC including data transfer of 256 channels at 16 Gbps. The new trigger algorithm has been validated with data, and was found to reduce the event rate by 30% while increasing the efficiency by a few percent. The design, performance and status of the ATLAS TGC upgrade projects will be discussed, along with results from tests of the chambers or prototypes with beams.

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