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Update ATLAS L1 Muon Trigger with sTGC: Design and Performance

It is necessary to update the ATLAS forward Level 1 (L1) muon trigger for the super LHC (sLHC) with luminosity of $7.0 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ for suppressing fake and prompt muon from heavy quarks. The small-strip Thin Gap Chambers (sTGC) is selected as primary trigger detector for updating the ATLAS New Small Wheel(NSW). The goal is to control the L1 muon trigger rate below 25KHz . This is realized by a two-step trigger system: the ultra-fast pad-trigger system to define the regions of interest with selected muon candidates which enable the accurate muon track measurement with 1mrad angular precision from sTGC strips, where trigger data is transmitted with multi-GBit/s fast trigger data serializer (TDS).

The new, sTGC-based, L1 muon trigger system will be reviewed. Detailed description of the readout system as well as dedicated simulation studies will be presented. The former includes the actual chamber and readout electronics design, while the latter includes a simulation of the response of the detector and the readout electronics. The studies show that the pad-trigger system has almost 100% efficiency and angular resolution of muon track measurement from sTGC strips is better than 1mrad with trigger efficiency around 93%. Finally, the expected system performance under the harsh sLHC conditions will be presented with estimated the fake muon track rate from sTGC trigger detector.

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