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Precision Tracking with small-strip Thin Gap Chamber (sTGC): from Test Beam to ATLAS NSW Upgrade

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The super-LHC (sLHC) is expected to operate with a luminosity of 7x1034 cm-2s-1 after the forthcoming luminosity upgrade which will increase by approximately a factor five, both the physics event rate and the beam background. It is essential to update the present inner most Muon Spectrometer components in the forward region to cope with these high rates. The small-strip Thin Gap Chambers (sTGC) has been chosen to provide both a fast trigger and high precision muon tracking for the ATLAS New Small Wheel (NSW).
Developments of sTGC detector have been carried out over the past years, different chambers have been tested with cosmic rays, in test beam and under different irradiations. Large prototypes (1.2 x 0.8 m2) containing four gas gaps, each gap providing pads, strips and wires, yielded a position resolution better than 70μm at perpendicular incidence angle and less than 130μm for 30 degrees incidence angle. The results have been repeated with different front-end electronics and have been confirmed during a combined TGC-sMDT test beam where sMDT provided precision tracking. The detectors have been shown to withstand a high total irradiation dose equivalent to 6 Coulomb/cm of wire. The tests of a new electronic chain (including the new VMM chip under development by BNL) have also been realized. The results of these various tests are presented.
The new, 8 layer sTGC and 8 layer MM (MicroMegas) based, ATLAS New Small Wheel (NSW) muon detector under high beam background will be reviewed and dedicated simulation studies will be presented. The simulation includes the response of the detector and the readout electronics. These studies show that the 8 layer sTGC detector provides robust precision tracking with high efficiency, where the expected muon PT resolution is around 10% for muons with 1TeV transverse momentum.

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