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# Small-Strip Thin Gap Chambers for the Muon Spectrometer Upgrade of the ATLAS Experiment

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For the forthcoming upgrade to the LHC, the first station of the ATLAS muon end-cap system needs to be replaced in 2018 and 2019 to retain the good precision tracking and trigger capabilities in the high background environment expected with the upcoming luminosity increase. In particular, the precision reconstruction of tracks requires a spatial resolution of about 100 um, and the Level-1 trigger track segments have to be reconstructed with an angular resolution of 1 mrad. The single sTGC planes of a quadruplet consists of an anode layer of 50um gold plated tungsten wire sandwiched between two resistive cathode layers. In order to benefit of the very good position resolution of the detectors, the position of each strip must be known with an accuracy of 40 μm along the precision coordinate and 80 um along the beam. The mechanical precision is a key point and must be controlled and monitored all along the process of construction and integration. A full size sTGC quadruplet has been constructed and equipped with the first prototype of dedicated front-end electronics. The performance of the sTGC quadruplet has been evaluated in test beams at Fermilab (May 2014) and CERN (October 2014), where the spatial resolution and trigger efficiencies were measured. We will present results obtained from the test beams and discuss the construction of a full size (~1x1m) sTGC quadruplet prototype.

## Collaboration

ATLAS Muon Collaboration

## Summary

For the forthcoming Phase-I upgrade to the LHC (2018/19), the first station of the ATLAS muon end-cap system, Small Wheel, needs to be replaced. The New Small Wheel (NSW) will have to operate in a high background radiation region while reconstructing muon tracks with high precision and providing information for the Level-1 trigger. In particular, the precision reconstruction of tracks requires a spatial resolution of about 100 μm, and the Level-1 trigger track segments have to be reconstructed with an angular resolution of approximately 1 mrad. The NSWs consist of eight layers each of Micromegas and small-strip Thin Gap Chambers (sTGC), both providing trigger and tracking capabilities.

The single sTGC planes of a quadruplet consists of an anode layer of 50μm gold plated tungsten wire sandwiched between two resistive cathode layers. Behind one of the resistive cathode layers, a PCB with precise machined strips (thus the name sTGC) spaced every 3.2mm allows to achieve a position resolution that ranges from 70 to 150μm, depending on the incident particle angle. Behind the second cathode, a PCB containing an arrangement of pads allows for a fast coincidence trigger between successive sTGC layers to tag the passage of a track and to readout only the corresponding strips. To be able to profit from the high accuracy of each of the sTGC planes for trigger purposes, their relative geometrical position between planes has to be controlled to a precision of about 40μm in their parallelism, as well (due to the various incident angles), to within a precision of 80μm in the relative distance between the planes to achieve the overall angular resolution of 1mrad. A full size sTGC quadruplet has been constructed and equipped with the first prototype of dedicated front-end electronics. The performance of the sTGC quadruplet has been evaluated in test beams at Fermilab (May 2014) and CERN (October 2014), where the spatial resolution and trigger efficiencies were measured. We will present results obtained from the test beams and discuss the construction of a full size (~1x1m) sTGC quadruplet prototype.

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