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Test beam and performance study of ATLAS New Small Wheel small-strip Thin Gap Chamber

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The Large Hadron Collider is expected to reach an instantaneous luminosity of $5-7.5\times10^{34}cm^{-2}s^{-1}$ towards high-luminosity runs in the future. The ATLAS Phase-I upgrade plans to replace the present innermost station of Muon Spectrometer in the forward region, Small Wheels, with the New Small Wheel (NSW) detector system in order to improve Level-1 muon trigger selectivity and maintain good muon tracking capability under high background rate. The NSW features two gaseous detector technologies, Micro Mesh Gaseous Structures (MM) and small-strip Thin Gap Chambers (sTGC), with 2.4 million readout channels and a total surface area of more than $2,500m^2$. Both detectors have trigger and precision tracking capabilities.
The new Gamma Irradiation Facility (GIF++) located at the H4 beam line of SPS at CERN is a unique place where high energy muon and pion beams are combined with a 14TBq ^{137}Cesium source to test the detector tracking ability in a high background rate environment. One fully integrated sTGC quadruplet was tested at GIF++ in a muon beam during Oct-Nov 2021. This is the first time a test beam is performed on the sTGC with final version electronics and using the final DAQ (data acquisition) system. In this talk we present the test beam setup and performance results, namely efficiency and resolution at different track inclination and photon background rates. Studies of the impact of different electronics configuration will also be presented.

Career stage

Graduate student

Author: YE, Xinmeng (University of Michigan (US) / University of Science and Technology of China (CN))

Presenter: YE, Xinmeng (University of Michigan (US) / University of Science and Technology of China (CN))

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