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ATLAS Muon Thin Gap Chamber technology for a detector at the ILC

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The largest phase-1 upgrade project for the ATLAS Muon System at Large Hadron Collider (LHC) is the replacement of the present first station in the forward regions with the New Small Wheels (NSWs). The NSWs consist of two detector technologies: Large size multi-gap resistive strips Micromegas (MM) and small-strip Thin-Gap Chamber (sTGC). The sTGC modules are called "trigger chambers"and Micromegas modules "precision chambers"despite having comparable tracking and trigger performances. The MM chambers are ionization-based Micro-Pattern Gaseous Detectors (MPGD) made up of parallel plates, having a thin amplification region separated from the conversion region via a thin metallic mesh. They will be mainly used as precision tracking detectors with a high spatial resolution, efficiency better than 95% per single plane, in a highly irradiated environment of the ATLAS experiment. Along with the MM, the NSWs will be equipped with eight layers of sTGC chambers arranged in multilayers of two quadruplets, for a total active surface of more than 2500m2. To achieve the good precision tracking and trigger capabilities in the high background environment of the high-luminosity LHC, each sTGC plane must have a spatial resolution better than 100μm to allow the Level-1 trigger track segments to be reconstructed with an angular resolution of approximately 1mrad. The frontend electronics are implemented in about 2000 boards including the 4 custom-designed ASICs capable of driving trigger and tracking primitives to the backend trigger processor and readout system. The readout data flow is designed through a high-throughput network approach and fast-timing. The large number of readout channels, short time available to prepare and transmit trigger data, large volume of output data, harsh radiation environment, and the need of low power consumption all impose great challenges on the system design, integration and commissioning. In this talk, the design, construction, performance and status of the ATLAS NSW upgrade project will be discussed. The timing structure of the proton beams of the LHC and of the electron-positron beams proposed for the International Linear Collider (ILC) are quite different, but the NSW detector technologies can be adapted as a powerful timing detector for precise muon tracking of high-multiplicity events at future electron-positron colliders. Concepts and ideas on how ATLAS muon gaseous chamber technology can be adapted for a detector at the ILC will be summarized. Generic characteristics of MM and sTGC will be provided for pattern recognition at the ILC.

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