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Simulation of the ATLAS New Small Wheel (NSW) System

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The instantaneous luminosity of the Large Hadron Collider (LHC) at CERN will be increased up to a factor of five with respect to the present design value by undergoing an extensive upgrade program over the coming decade. In order to benefit from the expected high luminosity performance that will be provided by the Phase-1 upgraded LHC, the first station of the ATLAS muon end-cap Small Wheel system will need to be replaced by a New Small Wheel (NSW) detector. The NSW is going to be installed in the ATLAS detector in the forward region of $1.3 < |\eta| < 2.7$ during the second long LHC shutdown. The NSW will have to operate in a high background radiation region, while reconstructing muon tracks with high precision as well as furnishing information for the Level-1 trigger. A detailed study of the final design and validation of the readout electronics for a set of precision tracking (Micromegas) and trigger chambers (small-strip Thin Gap Chambers or sTGC) that are able to work at high rates with excellent real-time spatial and temporal resolution will be presented. The simulation of the entire NSW system integrated in the common ATLAS trigger simulation and reconstruction chain is a necessary part of the performed Monte Carlo (MC) studies. A dedicated parametric digitization model based on the exhaustive standalone MC studies and experimental test beam results has been developed over the years to simulate the response of the NSW system. The simulated digital readout signals are used to build the cluster hits and reconstructed track-segments in the detector planes at both the trigger and off-line reconstruction levels. They have been included in the common ATLAS muon trigger and reconstruction algorithms. This contribution will summarize the developed simulation model and the importance of the NSW system for the improvement of the muon reconstruction efficiency and muon identification.

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