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Upgrade of the first-level muon trigger for the ATLAS experiment at the HL-LHC

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The HL-LHC upgrade will not only significantly increase the collider's physics reach, but also pose challenging requirements on the performance of the detector. To exploit its full physics potential, more selective hardware triggers are required. At the ATLAS experiment, a huge gain in the selectivity of the first-level muon trigger will be accomplished by incorporating the data of the precision tracking muon drift-tube (MDT) chambers into the trigger decision in addition to the fast RPC and TGC trigger chambers. For this purpose, the Sector Logic system processing data from the trigger chambers will be complemented by the novel MDT trigger processor (MDTTP) boards.

The front-end electronics of the muon system will be replaced to cope with the expected increased rates and latencies, streaming all hit data continuously to back-end trigger electronics over high-speed optical links. The hits of the fast trigger chambers will be processed by the Sector Logic to determine the bunch-crossing in which a muon has been created and a region of interest in which the muon is detected. This coarse position information is then used as a seed for the reconstruction of the muon trajectory from the spatially precise MDT hits by the MDTTP. Based on this, the final muon trigger decision is taken. The achieved online muon transverse momentum resolution leads to a sharp trigger turn-on curve and to very low fake triggers.

Preliminary designs for the new trigger processors exist. A prototype of the MDTTP ATCA blade is in production. It consists of two coplanar printed circuit boards, the Service Module providing the basic infrastructure and the Command Module incorporating a high-performance FPGA for data processing. The presentation will describe the new ATLAS first-level muon trigger architecture, the MDT trigger processor blade and the firmware running on it.

Collaboration

The ATLAS Collaboration

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