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The new Muon-to-Central-Trigger-Processor Interface at ATLAS

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The ATLAS trigger system includes a Level-1 (L1) trigger based on custom electronics and firmware, and a high level trigger based on off-the-shelf hardware and processing software. The L1 trigger system uses information from the calorimeters and from the muon trigger detectors, consisting of Resistive Plate Chambers in the barrel, and of Thin-Gap Chambers, small-strip Thin-Gap Chambers and MicroMegas in the endcaps. Once information from all muon trigger sectors has been received, trigger candidate multiplicities are calculated by the Muon-to-Central Trigger-Processor Interface (MUCTPI). In the next stage, muon multiplicity information is sent to the Central-Trigger Processor (CTP) and trigger objects are sent to the topological trigger. The CTP combines the information received from the MUCTPI with the trigger information from the calorimeters and the topological trigger, and takes the L1 trigger decision. As part of the upgrade of the ATLAS L1 trigger system for Run-3 of the Large Hadron Collider (LHC), a new MUCTPI has been designed and commissioned. The upgrade includes a replacement of 18 VME boards by a single ATCA board based on three high-end FPGAs and one System-on-Chip (SoC), with the sector-logic input data received on 208 optical links. Two FPGAs are used as Muon Sector Processors (MSPs), one MSP for each side of the ATLAS detector, and one FPGA used as Trigger and Readout Processor (TRP). The MSPs receive trigger information from the 208 muon trigger sectors, conduct overlap handling to flag/remove duplicate muon candidates, calculate the transverse momentum threshold multiplicities and send trigger objects to the topological trigger system. The TRP combines the trigger information, and sends trigger multiplicities to the CTP and trigger data to the Data Acquisition (DAQ) system. The DAQ Run-Control software for configuration, control and monitoring of the MUCTPI runs directly on the SoC. We discuss the commissioning and integration of the new MUCTPI used in ATLAS from the beginning of Run-3. In particular, we describe monitoring tools which have been developed for the commissioning and operation of the new MUCTPI, and challenges which had to be overcome to integrate the system in the experiment. Furthermore, we report the performance of the MUCTPI at the beginning of Run-3 of the LHC.

In-person participation

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