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Topology in the future ATLAS Level-1 Trigger

ATLAS is an experiment on the Large Hadron Collider (LHC), located at the European Organization for Nuclear Research (CERN) in Switzerland. By 2015 the LHC instantaneous luminosity will be increased from 10^{34} up to $3 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$. This places stringent operational and physical requirements on the ATLAS Trigger in order to reduce the 40MHz collision rate to a manageable event storage rate of 1kHz while at the same time, selecting those events that contain interesting physics events.

The Level-1 Trigger is the first rate-reducing step in the ATLAS Trigger, with an output rate of 100kHz and decision latency of less than $2.5\mu\text{s}$. It is composed of the Calorimeter Trigger, the Muon Trigger, and the Central Trigger Processor (CTP). In 2014, there will be a new electronics module: the Topological Processor (L1Topo).

The L1Topo will make it possible, for the first time, to use detailed information from subdetectors in a single Level-1 module. This allows the determination of angles between jets and/or leptons, or even more complex observables as the invariant mass. This requires L1Topo to receive on a single module a total bandwidth of about 1Tb/s and process the data within 100 ns. In order to provide this new information to the L1Topo, L1Calo Common Merging Modules (CMX) are upgraded and for the L1Muon system a specific interface MUCTPI2L1topo has been design and built. The CTP will be upgraded as well to accept a larger number of trigger inputs.

The talk focuses on the relevant upgrades of the Level-1 trigger with focus on the high density design characteristic of L1Topo.

Primary author: KAHRA, Christian (Johannes-Gutenberg-Universitaet Mainz (DE))

Presenter: KAHRA, Christian (Johannes-Gutenberg-Universitaet Mainz (DE))

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