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A new highly selective first level ATLAS muon trigger with MDT chamber data for HL-LHC

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Highly selective first level triggers are essential for the physics programme of the ATLAS experiment at the HL-LHC where the instantaneous luminosity will exceed the LHC Run 1 instantaneous luminosity by almost an order of magnitude. The ATLAS first level muon trigger rate is dominated by low momentum muons, selected due to the moderate momentum resolution of the resistive plate and thin gap trigger chambers. This limitation can be overcome by including the data of the precision muon drift tube chambers in the first level trigger decision. This requires the implementation of a fast MDT read-out chain and a fast MDT track reconstruction. A demonstrator of the fast read-out chain was successfully tested under HL-LHC operating conditions at CERN's Gamma
Irradiation Facility. The test results showed that the data provided by the demonstrator can be processed with a fast track reconstruction algorithm on an ARM CPU within the $6{\sim}\mu$s latency of the first level ATLAS trigger anticipated for the HL-LHC. The algorithm was also applied to ATLAS LHC run I data to prove under realistic operating conditions that first level single muon trigger rates as small as the high level trigger rates can be achieved with the new MDT based muon trigger.

Collaboration

ATLAS Muon Collaboration

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