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The new Global Muon Trigger of the CMS experiment

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For the 2016 physics data runs the L1 trigger system of the CMS experiment is undergoing a major upgrade to cope with the increasing instantaneous luminosity of the CERN LHC whilst maintaining a high event selection efficiency for the CMS physics program.

Most subsystem specific trigger processor boards are being exchanged with powerful general purpose processor boards, conforming to the MicroTCA standard, whose tasks are performed by firmware on an FPGA of the Xilinx Virtex 7 family.
Furthermore, the muon trigger system is undergoing change from a subsystem centred approach, where each of the three muon detector systems provides muon candidates to the global muon trigger, to a region based system, where muon track finders combine information from the subsystems to generate muon candidates in three detector regions that are then sent to the upgraded global muon trigger.

The upgraded global muon trigger receives up to 108 muons from the sector processors of the muon track finders in the barrel, overlap, and endcap detector regions. The muons are sorted and duplicates are identified for removal in two steps. The first step treats muons from different sector processors of a track finder in one detector region. Muons from track finders in different detector regions are compared in the second step. With energy sums from the calorimeter trigger an isolation variable is calculated and added to each muon, before the best eight are sent to the upgraded global trigger where the final trigger decision is taken. The upgraded global muon trigger algorithm is implemented on one of the general purpose processor boards that uses about 70 optical links at 10 Gb/s to receive the input data from the muon track finders and the calorimeter energy sums, and to send the selected muon candidates to the upgraded global trigger.

The design of the upgraded global muon trigger in the context of the CMS L1 trigger upgrade, and experience from commissioning and data taking with the new system are presented here within.

Primary authors: MEIJERS, Frans (CERN); REIS, Thomas (CERN)

Presenter: REIS, Thomas (CERN)

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