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Performance of muon-based triggers at the CMS High Level Trigger

The trigger systems of LHC detectors play a fundamental role in defining the physics capabilities of the experiments. A reduction of several orders of magnitude in the rate of collected events, with respect to the proton-proton bunch crossing rate generated by the LHC, is mandatory to cope with the limits imposed by the readout and storage systems limits. An accurate and efficient online selection mechanism is thus required to fulfill the task keeping maximal the acceptance to physics signals. The CMS experiment operates using a two-level trigger system. Firstly a Level-1 Trigger (L1T) system, implemented using custom-designed electronics, is designed to reduce the event rate to a limit compatible to the CMS Data Acquisition (DAQ) capabilities. A High Level Trigger System (HLT) follows, aimed at further reducing the rate of collected events finally stored for analysis purposes. The latter consists of a streamlined version of the CMS offline reconstruction software and operates on a computer farm. It runs algorithms optimized to make a trade-off between computational complexity, rate reduction and high selection efficiency. With the computing power available in 2012 the maximum reconstruction time at HLT was about 200 ms per event, at the nominal L1T rate of 100 kHz. An efficient selection of muons at HLT, as well as an accurate measurement of their properties, such as transverse momentum and isolation, is fundamental for the CMS physics programme. The performance of the muon HLT for single and double muon triggers achieved in Run I will be presented. Results from new developments, aimed at improving the performance of the algorithms for the harsher scenarios of collisions per event (pile-up) and luminosity expected for Run II will also be discussed.

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