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Performance of Tracking, b-tagging and Jet/MET reconstruction at the CMS High Level Trigger

The trigger systems of the LHC detectors play a crucial role in determining the physics capabilities of experiments. In 2015, the center-of-mass energy of proton-proton collisions will reach 13 TeV up to an unprecedented luminosity of 1e34 cm-2s-1. A reduction of several orders of magnitude of the event rate is needed to reach values compatible with detector readout, offline storage and analysis capabilities. The CMS experiment has been designed with a two-level trigger system: the Level-1 Trigger (L1T), implemented on custom-designed electronics, and the High Level Trigger (HLT), a streamlined version of the offline reconstruction software running on a computer farm. A software trigger system requires a trade-off between the complexity of the algorithms, the sustainable output rate, and the selection efficiency. With the computing power available during the 2012 data taking the maximum reconstruction time at HLT was about 200 ms per event, at the nominal L1T rate of 100 kHz. Tracking algorithms are widely used in the HLT in the object reconstruction through particle-flow techniques as well as in the identification of b-jets and lepton isolation. Reconstructed tracks are also used to distinguish the primary vertex, which identifies the hard interaction process, from the pileup ones. This task is particularly important in the LHC environment given the large number of interactions per bunch crossing: on average 25 in 2012, and expected to be around 40 in Run II with a large contribution from out-of-time particles. In order to cope with tougher conditions the tracking and vertexing techniques used in 2012 have been largely improved in terms of timing and efficiency in order to keep the physics reach at the level of Run-I conditions. We will present the performance of these newly developed algorithms, discussing their impact on the b-tagging performances as well as on the jet and met reconstruction.

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