

The CMS Level-1 Trigger system for the LHC Run II

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During the second run of operation, the LHC delivers proton-proton collisions at a centre-of-mass energy of 13 TeV with a peak instantaneous luminosity of $1.5 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ in 2016, almost double the peak luminosity reached during

Run-1 and far larger than the design value. To maintain acceptance for proton and heavy ion collision events of interest without exceeding the 100 kHz limit, the CMS Level-1 (L1) trigger has been being upgraded. The upgraded system makes use of new Xilinx Virtex-7 based AMC cards from the microTCA technology. The L1 calorimeter trigger, which finds electrons, photons, tau leptons, jet candidates and computes energy sums has been upgraded implementing isolation requirement, multivariate regression, and pile-up mitigation techniques in order to reach acceptable performance. The CMS muon detector was designed for preserving the complementarity and redundancy of three separate muon detection systems, Cathode Strip Chambers (CSC), Drift Tubes (DT) and Resistive Plate Chambers (RPC), until they were combined at the input to the Global Trigger. The upgrade of the muon trigger aimed at exploiting the redundancy of the three muon detection systems earlier in the trigger processing chain in order to obtain a high-performance trigger with higher efficiency and better rate reduction, implementing pattern recognition and MVA (Boosted Decision Tree) regression techniques directly in the trigger boards. In addition, the new global trigger is capable of evaluating complex selection algorithms such as those involving the invariant mass of trigger objects. The talk will cover the technological aspects of the Run II calorimeter trigger system. Results of its performance during the 2016 collisions of the LHC will be presented along with 2017 optimization for more intense conditions foreseen.

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