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The CMS Electron and Photon Trigger for the LHC Run 2

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The CMS experiment implements a sophisticated two-level triggering system composed of Level-1, instrumented by custom-design hardware boards, and a software High-Level-Trigger. A new Level-1 trigger architecture with improved performance is now being used to maintain the thresholds that were used in LHC Run1 for the more challenging luminosity conditions experienced during Run2. The upgrades to the calorimetry trigger will be described along with performance data. The algorithms for the selection of final states with electrons and photons, both for precision measurements and for searches of new physics beyond the Standard Model, will be described.

Summary

The Compact Muon Solenoid (CMS) experiment implements a sophisticated two-level triggering system composed of the Level-1, instrumented by custom-design hardware boards, and a software High-Level-Trigger.

During Run 2, the LHC has increased its centre-of-mass energy to 13 TeV and will progressively reach an instantaneous luminosity of $2\times\ 10^{34}\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$.

In order to guarantee a successful and ambitious physics programme the CMS Trigger and Data acquisition (DAQ) system has been upgraded.

A new Level-1 trigger architecture with improved performance is now being used and a novel concept for the L1 calorimeter trigger is introduced: the Time Multiplexed Trigger (TMT). In this design, which is similar to the CMS DAQ or HLT architecture, nine main processors receive each all of the calorimeter data from an entire event provided by 18 preprocessors. The advantage of the TMT architecture is that a global view and full granularity of the calorimeters can be exploited by sophisticated algorithms. The goal is to maintain the current thresholds for calorimeter objects and improve the triggering efficiency.
The introduction of new triggers based on the combination of calorimeter objects is also foreseen.

The performance of these algorithms will be presented, both in terms of efficiency and rate reduction using the proton collision data collected in 2016. The challenging aspect of the pile-up mitigation will be addressed along with the rejection of anomalous signals (spikes) in the APDs.

The impact of the improved selections on benchmark physics with electrons and photons in the final states will be discussed using as examples precision measurements of the Higgs boson properties and searches for new physics beyond the Standard Model.

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