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New CMS Trigger Strategies for the Run 3 of the LHC

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The Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) features a sophisticated two-level triggering system composed of the Level 1 (L1), instrumented by custom-design hardware boards, and the High-Level Trigger (HLT), a software based trigger based on the complete event information and full detector resolution. The CMS L1 Trigger relies on separate calorimeter and muon trigger systems that provide jet, e/γ, τ, and muon candidates along with calculations of energy sums to the Global Trigger, where selections are made based on the candidate kinematics. During its second run of operation, the L1 trigger hardware was entirely upgraded to handle proton-proton collisions at a center-of-mass energy of 13.6 TeV with a peak instantaneous luminosity of $2.2 \cdot 10^{34} cm^{-2} s^{-1}$, more than double the design luminosity for the machine. For the Run 3 of the LHC, an optimized and expanded Level-1 and HLT trigger physics menu has been developed to meet the requirements of the ambitious CMS physics program. A wide range of measurements and searches will profit from the new features and strategies implemented in the trigger system. Dedicated variables and non-standard trigger techniques targeting Long Lived Particles searches and other unconventional physics signatures have been developed. Moreover, the implementation of new kinematic computations at the trigger level will improve b-physics measurements and resonance searches. This talk will present these new features along with their performance measured in Run 3 of the LHC.

Collaboration / Activity

CMS

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