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Design and performance of the upgrade of the CMS L1 muon trigger

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After the Long Shutdown 1 LHC will run at a center of mass energy of 13TeV, providing CMS with proton collisions at an expected rate which is almost double the LHC design goal of 10^{34} cm⁻²s⁻¹, and almost three times the peak luminosity reached during Run1 of $7.7 \cdot 10^{33}$ cm⁻²s⁻¹. The higher luminosity and center of mass energy of LHC will raise the Level 1 (L1) muon trigger rate by almost a factor six for a given muon pt threshold. It is therefore necessary to increase the muon transverse momentum threshold to keep the trigger rate under 100 kHz, maximum sustainable rate for the CMS detectors. An increase of the L1 trigger thresholds implies a lowering of the efficiency in detecting signals from new physics and consequently a delay in possible discoveries. The CMS muon trigger will be completely upgraded using custom designed AMC boards, with more powerful FPGAs and larger memories. The upgraded CMS trigger muon system will implement pattern recognition and MVA (Boosted Decision Tree) regression techniques in the trigger boards for muon pt assignment, drastically reducing the trigger rate and improving the trigger efficiency. The upgraded system design will exploit the redundancy of the CMS muon detectors at a very early stage merging different muon detector information already at L1. The pileup subtracted information from the upgraded calorimeter trigger will allow to require isolated muons already at L1. The upgrade trigger is also designed to include inputs from GEM, the phase 2 muon detector upgrade, in particular in the very high rapidity region. In this presentation the upgraded CMS L1 muon trigger is described and its expected performance presented.

Collaboration

CMS

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