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The CMS Level 1 Triggersystem - functionality and performance

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We describe the functionality of the hardware based CMS L1 trigger system, which uses special trigger data from our Muon system, the Electromagnetic and Hadronic calorimeters for triggering on jets, electron/gammas and muons, total transverse and missing energy. With these "triggerobjects" complex algorithms can be built, which run simultaneously in the hardware, can be grouped together and masked on demand and are easily changeable by adapting the firmware via a GUI. Technical triggers care for clean collisions, whereas physics triggers are set up to catch interesting physics channels. The available trigger decision (latency) time is designed for 3.2 microseconds, after which via the DAQ the detector data are read out for further processing, reconstruction and filtering (High Level trigger HLT) online in a computerfarm. In addition a central trigger steering and controlling system allows to control the trigger components. The hardware trigger decisions are checked via software during event processing. We show our experience with this flexible and adaptive system in cosmic runs and the tuning, performance and efficiency with collision data of the LHC.

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