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The LHCb trigger and its upgrade

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The current LHCb trigger system consists of a hardware level, which reduces the LHC bunch-crossing rate of 30 MHz to 1 MHz, at which the entire detector is read out. In a second level, implemented in a farm of 20k parallel-processing CPUs, the event rate is reduced to 12.5 kHz.

In the High Level Trigger, events are buffered locally on the farm nodes, which gives time to perform run-by-run detector calibrations. These allow publication quality reconstruction to be run in the trigger system, as demonstrated by the first LHCb analyses performed and published solely on trigger data. Special attention is given to the use of multivariate analyses in the High Level Trigger and their importance in controlling the output rate.

The LHCb experiment plans a major upgrade of the detector and DAQ system in the LHC shutdown of 2018. In this upgrade, a purely software based trigger system is being developed, which will have to process the full 30 MHz of inelastic collisions delivered by the LHC.

We review the performance of the LHCb trigger system during Run II of the LHC, focusing on the High Level Trigger. The upgrade trigger system will also be discussed.

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