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The LHCb Trigger Architecture beyond LS1

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The LHCb experiment is a spectrometer dedicated to the study of heavy flavor at the LHC. The rate of proton-proton collisions at the LHC is 15 MHz, but resource limitations mean that only 5 kHz can be written to storage for offline analytsis. For this reason the LHCb data acquisition system – trigger – plays a key role in selecting signal events and rejecting background. In contrast to previous experiments at hadron colliders like for example CDF or D0, the bulk of the LHCb trigger is implemented in software and deployed on a farm of 20k parallel processing nodes. This system, called the High Level Trigger (HLT) is responsible for reducing the rate from the maximum at which the detector can be read out, 1.1 MHz, to the 5 kHz which can be processed offline,and has 20 ms in which to process and accept/reject each event. In order to minimize systematic uncertainties, the HLT was designed from the outset to reuse the offline reconstruction and selection code. During the long shutdown it is proposed to extend this principle and enable the HLT to access offline quality detector alignment and calibration, by buffering events on the HLT nodes for long enough for this alignment and calibration to be performed and fed into the HLT algorithms. This will in turn allow the HLT selections to be tightened and hence will significantly increase the purity of the data being written for offline analysis. This contribution describes the proposed architecture of the HLT beyond LS1 and the technical challenges of implementing a real-time detector alignment and calibration in the LHC environment.

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