

LHCb High Level Trigger design issues for post Long Stop 1 running

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The LHCb High Level Trigger uses two stages of software running on an Event Filter Farm (EFF) to select events for offline reconstruction and analysis. In LHC runs 1 & 2 the first stage (Hlt1) processes approximately 1 MHz of events accepted by a hardware trigger. In 2012, the second stage (Hlt2) wrote 5 kHz to permanent storage for later processing. Following the LHC's Long Stop 1, the machine energy will increase from 8 TeV in the center-of-mass to 13 TeV. The cross sections for beauty and charm are expected to grow proportionately. We plan to increase the Hlt2 output to 12.5 kHz, ~10 kHz for offline processing and ~ 2.5 kHz ready for immediate analysis. By increasing the absolute computing power of the EFF, buffering data for processing between machine fills, and improving algorithms, we should be able to significantly increase the efficiency for signal while improving signal-to-background ratios. Hlt1 will use a boosted decision tree to increase efficiency at that stage. We will determine calibration and alignment constants between Hlt1 and Hlt2, allowing Hlt2 to use reconstruction very close to that used offline, including RICH and calorimetric information. Post Long Stop 2 we will read out the front-end electronics at 40 MHz and move to a full software trigger while operating at higher luminosity. The implications for increasing charm yields are emphasized.

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