

Online Measurement of LHC Beam Parameters with the ATLAS High Level Trigger

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We present an online measurement of the LHC beam parameters in ATLAS using the High Level Trigger (HLT). When a significant change is detected in the measured beamspot, it is distributed to the HLT. There, trigger algorithms like b-tagging which calculate impact parameters or decay lengths benefit from a precise, up-to-date set of beamspot parameters. Additionally, online feedback is sent to the LHC operators in real time. The measurement is performed by an algorithm running on the Level 2 trigger farm, leveraging the high rate of usable events. Dedicated algorithms perform a full scan of the silicon detector to reconstruct event vertices from registered tracks. The distribution of these vertices is aggregated across the farm and their shape is extracted through fits every 60 seconds to determine the beamspot position, size, and tilt. The reconstructed beam values are corrected for detector resolution effects, measured in situ using the separation of vertices whose tracks have been split into two collections. Furthermore, measurements for individual bunch crossings have allowed for studies of single-bunch distributions as well as the behavior of bunch trains. This talk will cover the constraints imposed by the online environment and describe how these measurements are accomplished with the given resources. The algorithm tasks must be completed within the time constraints of the Level 2 trigger, with limited CPU and bandwidth allocations. This places an emphasis on efficient algorithm design and the minimization of data requests.

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