Contribution ID: **322**   Type: **Talk**

Downstream tracking and vertexing at the first stage of the LHCb trigger

Tuesday 22 October 2024 16:15 (18 minutes)

A new algorithm, called "Downstream", has been developed and implemented at LHCb, which is able to reconstruct and select very displaced vertices in real time at the first level of the trigger (HLT1). It makes use of the Upstream Tracker (UT) and the Scintillator Fiber detector (SciFI) of LHCb and it is executed on GPUs inside the Allen framework. In addition to an optimized strategy, it utilizes a Neural Network (NN) implementation to increase the track efficiency and reduce the ghost rates, with very high throughput and limited time budget. Besides serving to reconstruct Ks and Lambda vertices to calibrate and align the detectors, the Downstream algorithm and the associated two-track vertexing will largely increase the LHCb physics potential for detecting long-lived particles during the Run3.

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Session Classification: Parallel (Track 2)

Track Classification: Track 2 - Online and real-time computing