Contribution ID: **276**   Type: **Poster**

Commissioning of the Upstream Tracker for the LHCb Upgrade

Monday, 27 May 2024 15:58 (1 minute)

The LHCb detector has undergone a major upgrade that will enable the experiment to acquire data with an all-software trigger, made possible by front-end readout in real-time and the capabilities of performing the data selection algorithm while the data are acquired. Almost all the detector subsystems have been replaced by new designs mandated by the processing speed requirements to achieve this goal. At the heart of the real-time analysis is a fast and efficient track reconstruction, without spurious tracks composed of segments associated with hits from different charged particles. The Upstream Tracker (UT), a 4-plane silicon microstrip detector in front of the dipole magnet, is crucial to the charged particle trajectory reconstruction. The UT also provides a momentum measurement, as it is located in a magnet fringe field and aids the reconstruction of long-lived particles.

The UT comprises about 1000 sensors of four different designs and about 4000 dedicated front-end ASICs (SALT chips), performing analog processing, digitization, common-mode subtraction, and zero-suppression. Communications with the DAQ system are coordinated by a set of data control boards that also provide the optical interface between front-end ASICs and data acquisition boards. Four firmware algorithms are needed to process the UT data in the TELL40 readout boards because of the different data rates to be dealt with.

The UT was installed in LHCb in early 2023. The first year of commissioning was challenging for data synchronization issues related to specific properties of the GBTx chip. We report the lessons learned during the early commissioning phase and the upcoming run when the UT performance with beams will be studied. In particular, we focus our report on the steps taken to ensure that the excellent performance of the various detector components is maintained in the experiment environment and at the high rates expected.

Collaboration

LHCb

Role of Submitter

The presenter will be selected later by the Collaboration

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Session Classification: Integration and Detector Systems - Poster session

Track Classification: T8 - Integration and Detector Systems