



Contribution ID: 215

Type: Talk

An online data processing system for the CMS Level-1 Trigger data scouting demonstrator

Thursday 24 October 2024 16:33 (18 minutes)

The CMS Level-1 Trigger Data Scouting (L1DS) introduces a novel approach within the CMS Level-1 Trigger (L1T), enabling the acquisition and processing of L1T primitives at the 40 MHz LHC bunch-crossing (BX) rate. The target for this system is the CMS Phase-2 Upgrade for the High Luminosity phase of LHC, harnessing the improved Phase-2 L1T design, where tracker and high-granularity calorimeter data will be available for the first time. Currently, a L1DS demonstrator is operating during LHC Run3, collecting data from the CMS L1T system. This contribution focuses on the online processing system of the Run3 scouting demonstrator, introduced for the first time in the beginning of 2024. Its function is to aggregate data fragments from all scouting sources (event building), perform online analysis/selection, and generate datasets for offline analysis. Contrary to the standard CMS data-taking, data fragments and processing are based on the LHC orbit, rather than individual events per BX. This allows the system to work at a constant rate of about 11kHz, while opening the possibility of exploring multi-BX correlations. An overview of the L1DS system will be provided, including its architecture, performance, and first results.

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Session Classification: Parallel (Track 2)

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