

Design and perspectives of the CMS Level-1 trigger Data Scouting system

venerdì 31 maggio 2024 08:34 (1 minuto)

The CMS detector will undergo a significant upgrade to cope with the HL-LHC instantaneous luminosity and average number of proton-proton collisions per bunch crossing. The Phase-2 CMS detector will be equipped with a new Level-1 (L1) trigger system that will have access to an unprecedented level of information. Advanced reconstruction algorithms will be deployed directly on the L1 FPGA-based processors, producing reconstructed physics primitives of quasi-offline quality. The latter will be collected and processed by the Level-1 trigger Data Scouting (L1DS) system at the full bunch crossing rate. Besides providing vast amounts of data for L1 and detector monitoring, the L1DS will perform quasi-online analysis in a heterogeneous computing farm: the study of signatures too common to fit within the L1 acceptance budget, or orthogonal to the standard physics trigger selection strategies, is expected to greatly benefit from this approach. An L1DS prototype system has been set up to operate in the current LHC Run-3, with the main goal of demonstrating the basic principle and shape the development of the Phase-2 system. The Run-3 L1DS receives trigger primitives from the Global Muon and Calorimeter Trigger, the Global Trigger decision bits and the muon segments from the Barrel Muon Track Finder. FPGA boards acquire and aggregate the synchronous trigger data streams and perform basic data reduction, before sending the trigger primitives to a set of computing nodes through 100Gbps Ethernet connections running a simplified firmware version of the TCP/IP protocol. An Intel TBB-based DAQ software receives the TCP/IP streams and applies further processing before the ingestion of the data into a cluster of servers running the CMS reconstruction framework. The output of the processing step are L1DS data sets in Analysis Object Data format. This contribution presents the Run-3 L1DS demonstrator architecture and recent physics results extracted from the collected data.

Collaboration

CMS Collaboration

Role of Submitter

The presenter will be selected later by the Collaboration

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Classifica Sessioni: Electronics and On-Detector Processing - Poster session

Classificazione della track: T7 - Electronics and On-Detector Processing