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The Level 1 Scouting system of the CMS experiment

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A novel data collection system, known as Level-1 (L1) Scouting, is being introduced as part of the L1 trigger of the CMS experiment at the CERN Large Hadron Collider. The L1 trigger of CMS, implemented in FPGA-based hardware, selects events at 100 kHz for full read-out, within a short 3 microsecond latency window. The L1 Scouting system collects and stores the reconstructed particle primitives and intermediate information of the L1 trigger processing chain, at the full 40 MHz bunch crossing rate. This system will provide vast amounts of data for detector diagnostics, luminosity measurements, and the study of otherwise inaccessible signatures, either too common to fit in the L1 accept budget, or with requirements orthogonal to the standard physics triggers. Demonstrator systems consisting of PCIe-based FPGA stream-processing boards and associated host PCs have been deployed at CMS to capture data from both the Global Muon Trigger (GMT), and Calorimeter Trigger sub-systems. In addition, a neural-network based re-calibration and fake identification engine has been developed using the Micron Deep Learning Accelerator (MDLA) FPGA framework. An overview of the new system, and the first results from 2022 data taking will be shown. Plans and development progress towards the continued expansion of the L1 Scouting system throughout LHC Run 3, and for Phase II of CMS at the High Luminosity LHC, will also be presented.

Significance

First results with LHC Run 3 data taking, with a new and novel data collection system (L1 scouting).

References

Experiment context, if any

CMS

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