Design of the CMS High Granularity Calorimeter trigger primitive generator system

Poster to be given at IPRD2023: 16th Topical Seminar on Innovative Particle and Radiation Detectors, 25-29 Sep 2023, Siena (Italy) The poster is selected (cms speaker).

Abstract

The CMS collaboration has chosen a novel high granularity calorimeter (HGCAL) to instrument the endcap regions as part of its upgrade for the high luminosity LHC. The HGCAL will have fine segmentation in both the transverse and longitudinal directions and will be the first such calorimeter specifically optimised for particle flow reconstruction to operate at a colliding-beam experiment. The calorimeter data will be part of the Level 1 trigger of the CMS experiment and, together with tracking information, will allow particle-flow techniques to be used in this first level trigger. The Level 1 trigger has tight constraints on latency and rate and will be implemented in hardware. The high granularity leads to about six million readout channels in total, that are concentrated in one million trigger cells, sampled at 40 MHz for the Level 1 trigger. This presents a significant challenge in terms of data manipulation and data processing for the trigger system as the trigger data volumes will be an order of magnitude above those currently handled in CMS. In addition, the high luminosity will result in an average of up to 200 interactions per bunch crossing that yield a huge background rate in the forward region that will need to be efficiently rejected by the trigger algorithms. Furthermore, reconstruction of the three-dimensional particle clusters to be used for particle flow in events with high hit rates is also a complex computational problem for the trigger. The status of the HGCAL trigger architecture and design, as well as the algorithms developed in order to tackle these major issues, will be presented.

Speakers

Isaac Telford Ehle (LLR, Ecole Polytech., IN2P3-CNRS) [Submitted abstract]