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CMS ECAL Electronics Developments for HL-LHC

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The High Luminosity LHC (HL-LHC) will provide unprecedented instantaneous and integrated luminosity. The CMS electromagnetic calorimeter (ECAL) will face a challenging environment at the HL-LHC: higher event pileup, higher radiation levels for the crystals and photodetectors, and a higher rate of anomalous signals from the APDs. To mitigate these challenges and maintain the excellent physics performance of the detector, a redesign of the ECAL electronics is planned, including an increase in trigger rate and latency.

Summary

Even after 3000fb⁻¹, the lead tungstate crystals forming the barrel part of the CMS ECAL will still perform well. The APDs have recently been exposed to the levels of radiation expected at the end of HL-LHC. Although operational, there will be some increase in noise due to radiation-induced dark-currents. Triggering on electromagnetic objects with ~140 pileup events necessitates a change of the front-end electronics. New developments in high-speed optical links will allow single-crystal readout at 40 MHz to upgraded off-detector processors, allowing maximum flexibility and enhanced triggering possibilities. The very-front-end system will also be upgraded, to provide improved rejection of anomalous signals in the APDs as well as to mitigate the increase in APD noise. We are also considering lowering the ECAL barrel operating temperature from 18 degrees C to about 8-10 degrees C, in order to increase the scintillation light output and reduce the APD dark current.

We will present limits to the present system and a description of the new architecture, along with the R&D involved in developing the new system.

Author: HANSEN, Magnus (CERN)

Presenter: HANSEN, Magnus (CERN)

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