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First large volume characterization of the QIE10/11 custom front-end integrated circuits

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The CMS experiment at the CERN Large Hadron Collider will upgrade the photon detection and readout systems of its barrel and endcap hadron calorimeters (HCAL) through the second long shutdown of the LHC in 2018. A central feature of this upgrade is the development of two new versions of the QIE (Charge Integrator and Encoder), a Fermilab-designed custom ASIC for measurement of charge from detectors in high-rate environments. For the first time, the characteristics and performance of the new QIE and their related chip-to-chip variations as measured in a sample of 20,000 chips is described.

Summary

The CMS experiment at the CERN Large Hadron Collider (LHC) will upgrade the photon detection and readout systems of its barrel and endcap hadron calorimeters (HCAL) through the second long shutdown of the LHC in 2018. A central feature of this upgrade is the development of two new versions of the QIE (Charge Integrator and Encoder), a Fermilab-designed custom ASIC for measurement of charge from detectors in high-rate environments. These most recent additions to the QIE family feature 17-bits of dynamic range with 1% digitization precision for high charge and a time-to-digital converter (TDC) with half nanosecond resolution all with 16 bits of readout per bunch crossing. For the first time, the CMS experiment has produced and characterized in great detail a large volume of chips. The characteristics and performance of the new QIE and their related chip-to-chip variations as measured in a sample of 20,000 chips is described.

Primary author: HARE, Daryl (Fermi National Accelerator Lab. (US))

Presenter: HARE, Daryl (Fermi National Accelerator Lab. (US))

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