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New method of out-of-time energy subtraction for the CMS hadronic calorimeter

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The CMS hadronic calorimeter employs plastic-scintillator-based sampling calorimeters in the barrel and endcap (HBHE). In Run 2, the LHC operates at 13 TeV center of mass energy with up to 50 simultaneous collisions per bunch crossing (pileup) and a 25 ns bunch spacing. The HBHE scintillator light pulse is only 60% contained in a 25 ns window, resulting in significant pulse overlap for consecutive events (referred to as 'out-of-time pileup').

This talk presents a novel algorithm that will be used in 2018 for subtracting out-of-time pileup in HBHE both online in the software trigger and offline. The algorithm includes methods for both the barrel with hybrid photodiode photosensors and QIE8 digitizers, and the endcap with silicon photomultipliers and QIE11 digitizers, including the challenging charge-dependent pulse shaping effects of the QIEs. The on-detector pulse shape measurement method and results are also shown.

The new algorithm is 5-10 times faster than the previous one, and for the first time CMS will use the offline method at the trigger level. This and other changes improve missing transverse energy (MET) resolution by 50% at 25 pileup. The impact of out-of-time pileup subtraction on jet and MET reconstruction are also presented.

Secondary topics

Applications

Experience with current calorimeter at the energy frontier

Primary topic

Simulation and algorithms

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