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First results from CMS SiPM-based hadronic endcap calorimeter

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The CMS hadronic calorimeter employs a plastic-scintillator-based endcap detector. In early 2017, a 20° wedge of the endcap was upgraded with silicon photomultipliers (SiPMs) and readout electronics based on the QIE11 digitizer. Based on the excellent experience with this 20° pilot system in 2017, the entire endcap detector was upgraded with SiPMs in early 2018. We report on the first ever operation of SiPMs in a high-rate collider detector. We show results for both the 20° pilot system and the fully upgraded detector (with first 2018 collisions).

We compare SiPM performance to that of the previous hybrid photodiode / QIE8-based readout and describe how the factor three improvement in photon-detection efficiency, increased longitudinal segmentation, and improved response stability allow for mitigation of scintillator radiation damage and simplified calibration. We report in situ measurements of radiation-induced SiPM dark current. Overall, we show that the upgraded SiPM-based system allows more than 50% improvement in radiation-induced response degradation.

Secondary topics

Front-end readout - Silicon photomultipliers

Applications

Experience with current calorimeter at the energy frontier

Primary topic

Scintillators

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