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Construction and first beam-tests of silicon-tungsten prototype modules for the CMS High Granularity Calorimeter for HL-LHC

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The High Granularity Calorimeter (HGCAL) is the technology choice of the CMS collaboration for the endcap calorimetry upgrade planned to cope with the harsh radiation and pileup environment at the High Luminosity-LHC. The HGCAL is realized as a sampling calorimeter, including an electromagnetic compartment comprising 28 layers of silicon pad detectors with pad areas of 0.5 —1.0 cm^2 interspersed with absorbers. Prototype modules, based on hexagonal silicon pad sensors, with 128 channels, have been constructed and tested in beams at FNAL and at CERN. The modules include many of the features required for this challenging detector, including a PCB glued directly to the sensor, using through-hole wire-bonding for signal readout and ˜5mm spacing between layers –including the front-end electronics and all services. Tests in 2016 have used an existing front-end chip - Skiroc2 (designed for the CALICE experiment for ILC). We present results from first tests of these modules both in the laboratory and with beams of electrons, pions and protons, including noise performance, calibration with mips, electron energy resolution and precision-timing measurements.

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