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Beam-test evaluation of the precision timing capabilities of a CMS HGCAL prototype

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The existing CMS endcap calorimeters will be replaced with a High Granularity Calorimeter (HGCAL) for operation at the High-Luminosity (HL) LHC. Radiation hardness and excellent physics performance will be achieved by utilising silicon pad sensors and SiPM-on-scintillator tiles with high transverse and longitudinal segmentation. One of the major challenges of the HL-LHC will be the high pileup environment, with interaction vertices spread not only in position, but also in time. In order to efficiently reject particles originating from pileup, precision timing information of the order of 30 ps will be of great benefit. In order to meet such performance goals, the HGCAL will provide timing measurements for individual hits with signals above 12 fC (equivalent to 3-10 MIPs), such that clusters resulting from particles with pT > 5 GeV should have a timing resolution better than 30ps.

In order to assess the technical feasibility and physics performance of such a design, beam tests were performed with a prototype of HGCAL silicon modules at the CERN SPS. We present the detector and DAQ components related to the precision timing evaluation, as well as calibration techniques and preliminary results on the timing performance.

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