

The CMS Phase-2 high-granularity 5D calorimeter

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The CMS high-granularity endcap calorimeter (HGCAL) is a challenging detector that brings together tracking and calorimetry, silicon and scintillators, as well as linear collider detector concepts, to meet the harsh radiation and pileup environment of the High Luminosity LHC Phase (Phase 2) in the forward region and exploit challenging signatures such as VBF/VBS production. The HGCAL features unprecedented transverse and longitudinal segmentation in both its electromagnetic (ECAL) and hadronic (HCAL) compartments. This information allows to resolve the fine structure of showers, playing to the strengths of particle-flow reconstruction, and allowing to enhance pileup rejection and particle identification, while still achieving good energy resolution. The ECAL and a large fraction of HCAL will be based on hexagonal silicon sensors of $0.5 - 1 \text{ cm}^2$ cell size. The remainder of the HCAL will be based on highly-segmented scintillators read out by silicon photo-multipliers (SiPM). The intrinsic high-precision timing capabilities of the silicon sensors add a further measurement dimension, critical in event reconstruction, especially for pileup rejection. This presentation will overview the HGCAL project, covering the physics motivation, engineering design, readout and trigger concepts, performance (simulated and from beam tests), as well as ways in which the 5D information content may be exploited by cutting-edge machine learning techniques to enhance the overall physics performance of the forward region.

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