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The CMS ECAL Upgrade for Precision Crystal Calorimetry at the HL-LHC

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The electromagnetic calorimeter (ECAL) of the Compact Muon Solenoid Experiment (CMS) is operating at the Large Hadron Collider (LHC) in 2016 with proton-proton collisions at 13 TeV center-of-mass energy and at a bunch spacing of 25 ns. Challenging running conditions for CMS are expected after the High-Luminosity upgrade of the LHC (HL-LHC). We review the design and R&D studies for the CMS ECAL crystal calorimeter upgrade and present first test beam studies. Particular challenges at HL-LHC are the harsh radiation environment, the increasing data rates and the extreme level of pile-up events, with up to 200 simultaneous proton-proton collisions. We present test beam results of hadron irradiated PbWO crystals up to fluences expected at the HL-LHC. We also report on the R&D for the new readout and trigger electronics, which must be upgraded due to the increased trigger and latency requirements at the HL-LHC.

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