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## The CMS ECAL upgrade for precision timing measurements at the High-Luminosity LHC

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The High Luminosity upgrade of the LHC (HL-LHC) at CERN will provide unprecedented instantaneous and integrated luminosities of around  $5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  and 3000/fb, respectively. An average of 140 to 200 collisions per bunch-crossing (pileup) is expected. In the barrel region of the Compact Muon Solenoid (CMS) electromagnetic calorimeter (ECAL), the lead tungstate crystals and avalanche photodiodes (APDs) will continue to perform well, while the entire readout and trigger electronics will be replaced. The noise increase in the APDs, due to radiation-induced dark current, will be mitigated by reducing the ECAL operating temperature. The trigger decision will be moved off-detector and performed by powerful and flexible FPGA processors.

The upgraded ECAL will greatly improve the time resolution for photons and electrons with energies above 10 GeV. Together with the introduction of a new timing detector designed to perform measurements with a resolution of a few tens of picoseconds for minimum ionizing particles, the CMS detector will be able to precisely reconstruct the primary interaction vertex under the described pileup conditions.

We present the status of the ECAL barrel upgrade, including time resolution results from beam tests conducted during 2018 and 2021 at the CERN SPS.

### In-person participation

Yes

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