

Scintillator performance at low dose rates and low temperatures for the CMS High Granularity Calorimeter for HL-LHC

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The High Luminosity LHC (HL-LHC) will integrate 10 times more luminosity than the LHC, posing significant challenges for radiation tolerance, especially for forward calorimetry, and hallmarks the issue for future colliders. As part of its HL-LHC upgrade program, the CMS collaboration is designing a High Granularity Calorimeter to replace the existing endcap calorimeters. The upgrade includes both electromagnetic and hadronic compartments, with the latter using a mixture of silicon sensors (in the highest radiation regions at high pseudorapidity) and scintillator as its active components. The scintillator will nevertheless receive large doses accumulated at low dose-rates, and will have to operate at low temperature - around -30 degrees Celsius. We discuss measurements of scintillator radiation-hardness, from in-situ measurements from the current CMS endcap calorimeters, from measurements taken in the collision hall using a special test setup, and measurements at low temperature and low dose-rate at gamma sources. We also discuss studies using a silicon photomultiplier (SiPM) placed directly on the scintillator for readout, instead of the use of more-conventional embedded wavelength-shifting fibres leading to SiPms.

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