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Test beam characterization of sensor prototypes for the CMS MTD barrel timing layer

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The Compact Muon Solenoid (CMS) detector at the CERN Large Hadron Collider (LHC) is undergoing an extensive upgrade program to prepare for the challenging conditions of the High-Luminosity LHC (HL-LHC). A new timing detector in CMS will measure minimum ionizing particles (MIPs) with a time resolution of 30-40 ps for MIP signals at a rate of 2.5 Mhit/s per channel at the beginning of HL-LHC operation. The precision time information from this MIP Timing Detector (MTD) will be used to reduce the effects of the high levels of pileup expected at the HL-LHC, bringing new capabilities to the CMS detector. The central barrel part of the MTD detector, the Barrel Timing Layer (BTL), will be based on LYSO:Ce crystals read out with silicon photomultipliers (SiPMs). The BTL will use elongated crystal bars, read out by a SiPM on each end of the crystal, to maximize detector performance within the constraints of space, cost, and channel count. This geometry enables covering large surfaces with a minimal active area of the photodetectors, thus reducing noise and power consumption. We will present an overview of the MTD BTL design and recent results on the characterisation of BTL sensor prototypes with beams of high energy particles.

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