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Low Gain Avalanche Diodes for Precision Timing in the CMS Endcap

The Compact Muon Solenoid (CMS) detector at the CERN Large Hadron Collider (LHC) is undergoing an extensive Phase II upgrade program to prepare for the challenging conditions of the High-Luminosity LHC (HL-LHC). In particular, precision timing can offset the performance degradation due to event pileup at the HL-LHC, recovering the purity of vertices of current LHC conditions. As such, a new timing layer will be introduced to measure minimum ionizing particles (MIPs) with a time resolution of ~ 30 ps. The endcap region of this MIP Timing Detector (MTD) will be instrumented with a hermetic, single layer of silicon low gain avalanche detectors (LGADs), covering the high radiation pseudo-rapidity region between $|\eta|=1.6$ to 3.0. Radiation tolerance studies of the LGADs indicate promising performances of 30 and 50 ps at fluences corresponding to $|\eta|=2.5$ and 3.0, respectively. In addition, the LGADs have intrinsic gain, which enhances the MIP signal and provides adequate signal-to-noise for good timing precision. We present the status of the R&D for the LGADs for the endcap region of the MTD and report on recent test beam results.

Secondary topics

Applications

Primary topic

Crystals

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