

Low Gain Avalanche Detectors for Precision Timing in the CMS MTD Endcap Timing Layer

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The MIP Timing Detector (MTD) of the Compact Muon Solenoid (CMS) is designed to provide precision timing information (with resolution of ~ 40 ps per layer) for charged particles, with hermetic coverage up to a pseudo-rapidity of $|\eta|=3$. This upgrade will reduce the effects of pile-up expected under the High-Luminosity LHC running conditions and brings new and unique capabilities to the CMS detector. The time information assigned to each track will enable the use of 4D reconstruction algorithms and will further discriminate in the time domain interaction vertices within the same bunch crossing to recover the track purity of vertices in current LHC conditions. The endcap region of the MTD, called the Endcap Timing Layer (ETL) will be instrumented with silicon-based low gain avalanche detectors (LGADs), covering the high radiation pseudo-rapidity region between $|\eta|=1.6$ and 3.0 . Each endcap will be instrumented with a two-disk system of LGADs, read out by Endcap Timing Readout Chips (ETROCs), being designed for precision timing measurements. We will present an overview of the MTD ETL design, which is detailed in the MTD technical design report. We will also present the R&D and test beam studies that were integral for achieving the ETL design, characterization of the LGAD sensors, as well as recent progress on the development of the ETROC readout electronics.