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System testing of the CMS Endcap MIP Timing Layer

The high luminosity phase of the LHC (HL-LHC) opens up new windows for exciting discoveries but also brings about new challenges due to the high pileup environment of approximately 200 simultaneous interactions per collision. Precise measurements of track and vertex timing can efficiently mitigate these pileup effects. Therefore, the CMS detector will be upgraded with a MIP timing detector (MTD) capable of providing ultra-fast timing information of trajectories of charged particles. With a time resolution of below 50ps per hit the MTD will be a key ingredient to discover new physics at the HL-LHC. The endcap region of the MTD (1.6 < $|\eta|$< 3.0) has to endure high fluences, motivating the use of thin radiation tolerant silicon sensors with fast charge collection. Tests and developments of these low gain avalanche diodes (LGADs) by CMS together with manufacturers have resulted in a robust design of 16x16 pixel sensors. A custom readout chip for ETL sensors (ETROC) containing clock trees, preamplifier, discriminator, and TDC is being developed in parallel. Several testing campaigns were carried out in the last year, from test beams to characterize the performance of the ETROC2 prototypes together with bump bonded LGAD sensors to first slice tests of the system, including front end electronics and back end prototypes. This poster presents the developments and progress made for the ETL detector in this context.

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