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Low-Gain Avalanche Diodes for the CMS Endcap Timing Layer

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In order to cope with the demanding running conditions of the HL-LHC and to bring new and unique capabilities to the experiment, the Compact Muon Solenoid (CMS) detector will undergo a major upgrade. One novelty will be the introduction of a new MIP timing detector (MTD), which will allow the measurement of the time of charged particles with a resolution of 30-40 ps. The MTD will enable the use of 4D reconstruction algorithms and allow to discriminate, in the time domain, interaction vertexes within the same bunch crossing . To obtain the needed time resolution, the MTD component covering the 1.6 < |eta| < 3 region, also known as the Endcap Timing Layer (ETL), will exploit a new silicon-based technology, Low-Gain Avalanche Diodes (LGADs), read out by a custom-made ASIC called ETROC. LGAD devices feature an intrinsic gain of 10–30, provided by a highly doped implant, which allows to overcome the electronic'noise and to achieve a low-jitter fast-rising signal that enables precision timing reconstruction for MIPs. Moreover, these sensors are also designed to be radiation tolerant and thus can maintain almost unchanged performances up to the end of the HL-LHC physics program.
This poster will provide an overview of the ETL LGADs and of the measurements performed on the latest LGADs prototypes to validate the sensor design. including the performance evolution as a function of the received radiation level. Radiation hardness of these novel detectors will be described in detail. Particular attention will also be given to the description of the recent beam tests of LGADs connected to the latest version of the ETROC chip, aimed at validating its design and functionalities.

Collaboration

CMS

Role of Submitter

I am the presenter

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