

Performance of Highly Irradiated SiPMs Coupled to LYSO:Ce Crystals for the CMS MTD Barrel Timing Layer

The MIP Timing Detector is a new detector developed for the CMS upgrade for the High Luminosity LHC era. The detector will bring the capability of measuring precisely the production time of particles generated in proton-proton collisions. In particular, the MTD will allow for the disentangling of the estimated 200 nearly simultaneous pileup vertices that occur in the interaction diamond at each bunch crossing during high luminosity operation. The central Barrel Timing Layer of this detector will consist of an array of LYSO:Ce crystals coupled to SiPMs able to provide unprecedented time resolution under such conditions (30 ps). One of the important challenges that the detector will face is to keep its good performance (< 60 ps) during the lifetime of the experiment. It has been shown that the performance of SiPMs is affected when they are exposed to high levels of radiation. In order to quantify the impact of radiation on our prototype, we irradiated three pairs of SiPMs to different levels of 1 MeV neutron equivalent fluence comparable to those expected at the end of life conditions. We report on the preliminary performance results of time resolution measured in the laboratory and with the test beam of our detector prototype.

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