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Radiation hardness study of Silicon Detectors for the CMS High Granularity Calorimeter (HGCAL)

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The CMS collaboration is planning to upgrade the forward calorimeters as these will not be sufficiently performant with the expected HL-LHC (High Luminosity LHC) conditions. The High Granularity Calorimeter (HGC) is the technology choice of the CMS collaboration for this upgrade. It is realized as a sampling calorimeter with layers of silicon detectors that feature very high longitudinal and lateral granularities, and a coarser segmentation backing hadronic calorimeter based on scintillators as active material. The sensors are realized as pad detectors of size in the order of 1 cm2 with an active thickness between 100μm and 300μm depending on the position respectively the expected radiation levels. For an integrated luminosity of 3000 fb − 1 and in the region η ~ 3, the electromagnetic calorimetry near shower max will sustain integrated doses of 1.5 MGy (150 Mrads) and neutron fluences of 10 16 n/cm 2 . Integrated doses at the location of the front layers of the existing HE are expected to reach 300 kGy (30 Mrads). After the first results on neutron irradiation of 300μm, 200μm and 100μm n-on-p and p-on-n devices that have been irradiated to fluences up to 1.5E16 n/cm2 at JSI Triga reactor in Ljubljana, Slovenia. We present the latest results in terms of radiation hardness of these pad detectors as obtained with CV, IV, TCT and beta-CCE measurements.

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