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Testbeam and laboratory characterization of 3D CMS pixel sensors MAYUR BUBNA, ALEX KRZWYDA, ENVER ALAGOZ, DANIELA BORTOLETTO, Purdue University — Future generations of colliders, like High Luminosity Large Hadron Collider (HL-LHC) at CERN will deliver much higher radiation doses to the particle detectors, specifically those closer to the beam line. Inner tracker detectors will be the most affected part, causing increased occupancy and radiation damage to Silicon detectors. Planar Silicon sensors have not shown enough radiation hardness for the innermost layers where the radiation doses can reach values around 10^{16} neq/cm^2. As a possible replacement of planar pixel sensors, 3D Silicon technology is under consideration as they show higher radiation hardness, and efficiencies comparable to planar sensors. Several 3D CMS pixel designs were fabricated at FBK, CNM, and SINTEF. They were bump bonded to the CMS pixel readout chip and characterized in the laboratory using radioactive source (Sr90), and at Fermilab MTEST beam test facility. Sensors were also irradiated with 800 MeV protons at Los Alamos National Lab to study post-irradiation behavior. In addition, several diodes and test structures from FBK were studied before and after irradiation. We report the laboratory and testbeam measurement results for the irradiated 3D devices.

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