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Study of the readout chip and silicon sensor degradation for the CMS pixel upgrade

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Hybrid silicon pixel detectors are currently used in the innermost tracking system of the Compact Muon Solenoid (CMS) experiment. Radiation tolerance up to fluences expected for a few years of running of Large Hadron Collider (LHC) has already been proved, although some degradation of the part of the silicon detector closer to the interaction point is expected. During the LHC upgrade phases, the level of dose foreseen for the silicon pixel detector will be much higher. To face this aspect, dedicated irradiation tests with fluences above $\mathcal{O}(10^{21}) \text{ n}_{\text{eq}}/\text{cm}^2$ have been performed on the silicon sensor and readout chip. Changes in the operation of the sensor and readout chip as a function of the fluence are presented. The charge collection efficiency has been studied: partial recovery of the detector efficiency can be achieved by operating the detectors in a controlled environment and at higher bias voltage.

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