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# Low dose gamma irradiation study of ATLAS ITk MD8 diodes and miniature strip sensors

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Silicon strip detectors developed for the Inner Tracker (ITk) of the ATLAS experiment will operate in a harsh radiation environment of the HL-LHC accelerator. The ITk is thus designed to endure a total fluence of 1.6×1015 1 MeV neq/cm2 and a total ionizing dose (TID) of 66 Mrad in the strip detector region. A radiation-hard $n^+$-in-p technology is implemented in the ITk strip sensors. To achieve the required radiation hardness, extensive irradiation studies were conducted during sensor development, primarily performed up to the maximal expected total fluence and TID to ensure the end-of-life operations. These studies included irradiations of sensors with various particle types and energies, including the 60Co gamma rays. Our previous results obtained for gamma irradiated diodes and strip sensors indicate a linear increase of bulk current with TID, while a surface current saturates at the lowest TID levels checked, preventing a determination of the exact TID for which the observed saturation occurs.
This contribution presents the results coming from irradiations by 60Co gamma rays to multiple low TIDs, ranging from 0.5 to 100 krad. The detailed study of total, bulk, and surface currents of miniature strip sensors and diodes explores an unknown dependence of surface current on the TID, temperature and annealing. Additionally, the effect of the p-stop implant between the guard ring and the bias ring of measured samples will be discussed, which reveals the characteristics of the surface current, in the central region of the miniature sensors and in the edge region of the diode. The observations are relevant for the initial operations of the new tracker.

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