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Simulations of Hadron Irradiated n+p- Si Strip Sensors Incorporating Bulk and Surface Damage

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The future upgrade of LHC to the SLHC, with the goal for over an order of magnitude higher luminosity (> 1035 cm -2 s -1) and over 4 times more integrated luminosity (3000fb-1) have posed challenges to develop the extreme radiation hard Si sensors. To address the problem, extensive measurements and simulations studies aimed for ATLAS and CMS tracker requirements have been initiated which are investigating different designs, materials and polarity for Si microstrip sensors. Si sensors installed in the tracker region are exposed to both charged and neutral radiation, undergo both surface damage and bulk damage. Most of the efforts to simulate the radiation effects on Si sensors in the past concentrated either studying surface damage or the bulk damage model only. However, in Si sensors degrading effects due to both take place simultaneously. In the present work, extensive simulations have been carried out for the p-type of Si microstrip sensors incorporating both surface and bulk damage together. The surface damage is incorporated using different amount of surface oxide charge density between interface of Si and SiO2 while bulk damage is included by a new trap model. Simulations of various properties of Si strip sensors, like Interstrip Resistance (Rint) and Interstrip Capacitance (Cint) have been carried out and compared against the measurements on sensors. The results are in agreement and help to understand the underlying physics of radiation damage to some extent. Further, the simulations for different p-stop designs are presented and regions of critical field are investigated to propose possible design for future detectors.

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