Study of Bulk Radiation Damage Effects in P-Fz Si Microstrip Detector for FCC Experiment

Deepali1, Ajay Kumar Srivastava1\*

1Department of Physics, University Institute of Sciences, Chandigarh University, Gharuan, Mohali, Punjab, India.

1\*Corresponding author: kumar.uis@cumail.in

**Abstract**. One significant barrier to the use of silicon detector in high energy physics is radiation damage. In recent years, so many efforts have been made to improve the tolerance of detector, which is to be used in high energy experiments as the reference Future circular collider (FCC) at CERN is planned. Due to its greater Charge Collecting Efficiency, p-type detectors were found to be a suitable device within the CERN RD50 collaboration   for the HL-LHC and FCC experiments. Here, we have developed the CU Penta Trap microscopic radiation damage model for the p-type Fz Si detector, that can be used to simulate the effects of radiation damage in the heavily irradiated n in p Fz-Silicon microstrip detectors. In order to reproduce the experimental data using SRH modelling on full depletion voltage and leakage current at 223K , the radiation damage parameters were tuned well. At very high FCC fluence order of $1×10^{17}n\_{eq}cm^{-2}$, it can cause very high leakage current, more than 1000V full depletion voltage and CCE degradation occurs in the detector.

References:

1. Sato K, Hara K, Onaru K, Harada D, Wada S, Ikegami Y and Hanagaki K. 2020 *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, **982,** 164507**.**
2. Srivastava A K, Saini N, Chatterjee P, Michael T and Patyal S 2023 *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, **16**8031**.**
3. Schwandt, J., Fretwurst, E., Garutti, E., Klanner, R., Scharf, C., & Steinbrueck, G. (2018, November). A new model for the TCAD simulation of the silicon damage by high fluence proton irradiation. In *2018 IEEE Nuclear Science Symposium and Medical Imaging Conference Proceedings (NSS/MIC)* (pp. 1-3). IEEE.