Characteristics of thin p-MCz Si microstrip detector Irradiated up to a mixed fluence of 1017 neq,/cm2 for the FCC

Shilpa Patyala, Ajay K. Srivastavaa.[[1]](#footnote-2)\*

aDepartment of Physics, University Institute of Sciences, Chandigarh University,

 Gharuan-Mohali, Punjab, 140413, India.

 *\*E-mail*: kumar.uis@cumail.in

**Abstract.** Silicon microstrip detectors can be used for the precise particle tracking in the inner tracking region of the detector used in the future high luminosity collider experiment. In the future experiments, hadron collider provides higher luminosities on the strip detector, and therefore, a detector requires very high radiation hardness. Within CERNRD50collaboration, MCz Si is identified as a prime radiation hard material for the fabrication of the p-Si microstrip detector. In this paper, we have used the experimentally verified four level deep-trap mixed irradiation model for p-MCz Si to investigate the effect of heavy irradiations up to a mixed fluence of 1017n eq./cm2 on the full depletion voltage, leakage current, and charge collection efficiency using SRH and CCE modelling.

The changes in the characteristics were evaluated, and effect of the traps on the macroscopic performance of the detectors and possible improvement in the design and semiconductor technology of the p-Mcz silicon microstrip detector

References:

1. Dierlamm, A., & CMS Tracker Collaboration 2019 *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 924 **256-261.**
2. Moll M. 2018 Displacement damage in silicon detectors for high energy physics. *IEEE Transactions on Nuclear Science* 65(**8**) 1561-1582.
3. CMS collaboration CMS-DP-2015-02.
4. Kramberger G, V Cindro, I Dolenc, I Mandic, M Mikuz and M Zavrtanik. 2009 *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*  609 **2-3** 142-148.
5. Patyal S, Saini N, Kaur B, Chatterjee P and Srivastava A. K. 2022 *Journal of Instrumentation*, 17***(*09)** C09023.
6. Srivastava A. K, Fretwurst D, E Klanner, R and Steinbrück G. 2009 Numerical modelling of Si sensors for HEP experiments and XFEL*.Proceedings of science* Vol. 30.
7. Srivastava A. K 2019 *Si Detectors and Characterization for HEP and Photon ScienceExperiment: How to Design Detectors using TCAD Device Simulation* Springer Nature Switzerland AG Switzerland ISBN:978-3-030-19530-4.
8. Maksimow M, 2009 Thesis.
9. 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**.**
10. Hara K, Allport P P, Baca M, Broughton J, Chisholm A, Nikolopoulos K, Pyatt S Thomas, J P Wilson, A Kierstead and Kuczewski P 2016 *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 831 **181-188**.
11. 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**.**
12. Passeri D, Moscatelli F, Morozzi A, and Bilei G 2016 *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, 824, **443-445.**
1. [↑](#footnote-ref-2)