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Investigation of Mixed Bulk Radiation Damage Effects in p-MCz Thin Silicon Microstrip Detector for Phase 2 Upgrade of the new CMS Tracker Detector at HL-LHC

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A lot of R & D work is carried out in the CERN RD50 Collaboration to find out the best material for the Si detectors that can be used in the harsh radiation environment of HL-LHC, n and p-MCz Si was identified as one of the prime candidates as a material for n in p strip detector that can be chosen for the phase 2 upgrade plan of the new Compact Muon Solenoid tracker detector in 2026.
For the very first time, an advanced four level deep-trap mixed irradiation model for p-MCz Si is proposed by the comparison of experimental data on the full depletion voltage and leakage current to the Shockley Read Hall recombination (SRH) statistics results on the mixed irradiated p-MCz Si PAD detector.
In this work, we have determined the effective introduction rate ηeff of shallower donor deep trap E30 K using SRH theory calculations for exp. Neff and that can be shown the behaviour of space charges and electric field distribution in the p-MCz Si strip detector and compared its value with the ηeff of shallower donor deep trap E30 K in the n-MCz Si microstrip detector.
Prediction uncertainty in the p-MCz Si radiation damage mixed irradiation model considered in the full depletion voltage and leakage current. A very good agreement is observed in the experimental and SRH results. This p-MCz Si radiation damage model is used to extrapolate the value of the full depletion voltage at different mixed (proton + neutron) higher irradiation fluences for the thin p-MCz Si microstrip detector.

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