Modeling of Radiation Damage Effects in Silicon Detectors at High Fluences HL LHC with Sentaurus TCAD

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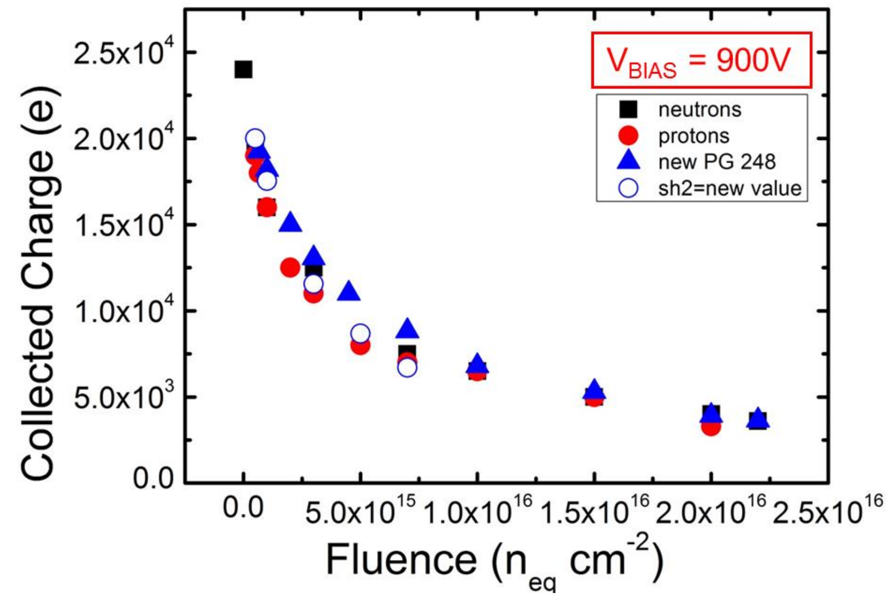
- ✓ Goal: extend the predictive capabilities of a past TCAD radiation damage modelling to HF HL-LHC radiation damage levels (e.g. fluences > 2.0×10^{16} cm^{-2} 1 MeV neutrons).
- ✓ Bulk deep-level and oxide/interface trap states.
- ✓ Keep low the number of traps (e.g. fitting parameters).
- ✓ New effects (e.g. charge multiplication <- avalanche effects).
- ✓ Physically grounded approach, no over-specific modelling.
- ✓ Capture cross-section variations (σ_n, σ_p), keeping the same (already characterized) defects: energy levels, introduction rates, …
- ✓ Static and transient (e.g. charge collection) behaviour modelling @Φ, @T, @V_{bias}, … (device independent).

- ✓ Simulations vs. measurements.
- ✓ Charge collection as a function of radiation fluences at T=248K, V_{BIAS}=900V [1].

[1] Affolder et al., NIM A, Vol. 623 (2010).



- ✓ Interstrip resistance as a function of bias voltage at different radiation fluences.
- ✓ Effect of the acceptor Si/SiO_2 trap state – accumulation layer modulation.