

Irradiation study of COFFEE2 chips

This work presents the first irradiation assessment of a pixel sensor prototype (COFFEE2) fabricated in the 55nm HV-CMOS process, targeted for the high-radiation environment of the LHCb Upgrade II. The study focuses on the KIT array within COFFEE2, which features a complete readout system. Protons were used to irradiate chips to fluences up to $1 \times 10^{14} \text{ n_eq/cm}^2$ at room temperature and $7 \times 10^{14} \text{ n_eq/cm}^2$ at -28°C . Post-irradiation measurements show a manageable increase in leakage current. The chip remained functional with high hit efficiency even at $10^{14} \text{ n_eq/cm}^2$, though a reduction in pixel response uniformity was observed. Higher depletion bias was found to mitigate performance loss. The results demonstrate the strong radiation tolerance of the 55nm HV-CMOS technology, validating its promise for future particle tracking detectors requiring micrometer spatial resolution and nanosecond timing.

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