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The effective bandgap and current related damage rate of highly irradiated silicon sensors

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The reverse current of irradiated silicon sensors has a strong influence on the signal-to-noise-ratio of a detector and leads to significant heat dissipation within the detector. Thus knowledge of the expected reverse current is crucial for detector design and operation.
The dependence of the reverse current on temperature and irradiation fluence is parameterized by the effective bandgap Eeff and the current related damage rate α.
These two quantities were obtained by measurements of the reverse current at temperatures of -32℃, -27℃ and -23℃ in a cold setup using a freezer and peltier. For this study planar n-in-p silicon strip detectors manufactured by Hamamatsu Photonics and Micron Technology irradiated with fluences ranging from 2x1014 to 2x1016 neq/cm2 were used.

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