

Charge collection measurements of proton irradiated Magnetic Czochralski n-on-p silicon detectors

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Abstract

N-on-p silicon single pad detectors processed on high resistivity magnetic Czochralski Si have been characterized as particle detectors. Charge collection efficiency (CCE) tests have been performed with β -particles from a Sr^{90} source with an Amptek circuit characterized by a shaping time of $2\mu\text{s}$, measurements have been carried out at -30°C . The detectors have been irradiated with 26MeV protons up to fluence in the range 4×10^{13} - $7 \times 10^{14} \text{ cm}^{-2}$ (1MeV neutron equivalent fluences). Various annealing steps (0-252 min at 80°C) have been studied. In non-irradiated samples a 100% CCE is observed with full depletion voltages in agreement with those determined by capacitance-voltage (CV) measurements, if the contribution of diffusion is kept into account. CV and CCE profiles and full depletion voltage values are in good agreement at different annealing steps up to the fluence of $1.36 \times 10^{14} \text{ cm}^{-2}$. A 100% CCE saturation is achieved up to the fluence of $2.7 \times 10^{14} \text{ cm}^{-2}$, and a 90-96% CCE is measured at the highest fluences tested (2.7 - $6.8 \times 10^{14} \text{ cm}^{-2}$) when a bias beyond full depletion (700V) is applied.