P-type Modified Electrode Germanium Detector Impurity Profiles

JEREMY KEPHART, Pacific Northwest National Laboratory — Germanium detectors with unprecedented capabilities are needed for detecting ultra-rare events in future neutrinoless double-beta decay experiments, searches for dark matter, environmental monitoring programs, national security applications, and potentially neutrino astrophysics. An ideal detector would combine ultra-low background capabilities, minimal electronic instrumentation, extremely low energy threshold, and the ability to perform event reconstruction to determine the interaction type or the spatial distribution of ionization following an interaction. A germanium detector with a special, very low capacitance, contact geometry and presumably a deliberately contrived impurity profile could provide all these capabilities. We present an analysis of the detector impurity concentration profiles and their impact on the depletion voltage, capacitance and charge collection times for such detectors.

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