Single carrier sensing techniques in compound semiconductor detectors

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For conventional radiation detectors fabricated from compound semi-conductors, the wide disparity between the transport properties of the electron and holes, means that detector performances are limited by the carrier with the poorest mobility-lifetime product ($\mu\tau$). Finite drift lengths introduce an energy dependent depth term into the charge collection process, which effectively limit maximum detector thicknesses to a few mm for spectroscopy applications. Since mobility is a fundamental material property, the only practical way of improving $\mu\tau$ products is to increase carrier lifetimes, which in turn, depends greatly on detector material quality and stoichiometry. Until the particular traps/defect(s) can be identified and corrected, single carrier pulse processing (*e.g.*, rise time compensation) or sensing techniques (*e.g.*, hemispherical geometries, co-planar grids) offer the only practical means of obviating the problem - albeit at the expense of detection efficiency. In this paper we review carrier collection in compound semiconductor radiation detectors and examine various approaches to single carrier correction and collection techniques.