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1 Pulse-height loss in the signal readout circuit of compound semiconductor 2 detectors

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7 Abstract

8 Compound semiconductor detectors such as CdTe, CdZnTe, HgI₂ and TlBr are known to
9 exhibit large variations in their charge collection times. This paper considers the effect of
10 such variations on the measurement of induced charge pulses by using resistive feedback
11 charge-sensitive preamplifiers. It is shown that, due to the finite decay-time constant of the
12 preamplifiers, the capacitive decay during the signal readout leads to a variable deficit in the
13 measurement of ballistic signals and a digital pulse processing method is employed to
14 correct for it. The method is experimentally examined by using sampled pulses from a TlBr
15 detector coupled to a charge-sensitive preamplifier with 150 μ s of decay-time constant and
16 20 % improvement in the energy resolution of the detector at 662 keV is achieved. The
17 implications of the capacitive decay on the correction of charge-trapping effect by using
18 depth-sensing technique are also considered.

19 Keywords: Compound semiconductor detectors; Pulse-height loss; Ballistic deficit effect;
20 Signal readout; Digital signal processing;

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