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Relationship between Real Charges and Image Charges from the Planar smartPET Detector and the Advantages of Wavelet Analysis

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The smartPET project is an attempt to use high purity germanium detectors for use in positron emission tomography (PET). The current spatial resolution of PET using BGO and LSO detectors is ˜5mm, and the smartPET project aims to improve spatial resolution to 1mm. Two planar Germanium detectors with dimensions of will be used in coincidence; these detectors are pixelated by means of strip contacts.

By utilising a strip spacing and Pulse Shape Analysis (PSA) it's theoretically possible to achieve a spatial resolution. Pulses arising from direct gamma absorption in particular strips are accompanied by image charges in adjacent strips. The shape of these image charges is dictated by the position of photon interaction in relation to these adjacent strips; the closer to the adjacent strip the larger the image charge. The amplitude relationship between image charge and real charge is empirically known to be ˜40% (at maximum), presenting the problem of detecting low amplitude image charges in noise.

Current work will quantify the ratio of image charge to real charge and wavelet analysis will be implemented to de-noise signals. Early results of wavelet analysis appear to be very promising, with significant (almost total) noise reduction and identification of ˜6keV pulses in signals with ˜6keV noise. The results from previous work and current work will be discussed.

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