AbstractID: 3813 Title: Characterization of a Novel Dual-Panel PET Scanner for Use in Small Animal Imaging

Purpose: Characterization of a novel dual-panel PET scanner for use in small animal imaging.

Method and Materials: A prototype PET system comprised of two non-rotating HRRT panel detectors – each possessing a single-layer 72 x 104 array of 2.1mm x 2.1mm x 7.5mm LSO crystals – was evaluated for its suitability in small animal imaging. Resolution measurements were made by translating a 190mm long, 3mm diameter 21.5MBq ⁶⁸Ge line-source across various planes parallel to the detector's face, while sensitivity measurements were made in a similar fashion but using a 0.5mm diameter 65KBq ⁶⁸Ge point-source. To emulate small animal imaging, a mouse phantom was constructed from an 11.25mm length of 25.4mm diameter polycarbonate rod that contained a 3.5mm diameter hole – radially offset by 6.7mm and parallel to the rod's central axis – to accommodate either the ⁶⁸Ge line-source or ¹⁸FDG samples.

Results: Activity-independent scattered fractions were estimated by inserting the ⁶⁸Ge line-source into the mouse phantom, averaging counts in each crystal column parallel to the line-source, and second-order polynomial fitting the resulting projection data after excluding its central peak. Noise Equivalent Count Rates (NECRs) were then derived for various energy windows and ¹⁸FDG activities in the mouse phantom, to quantify scanner performance. Preliminary image reconstructions, performed using a 50-iteration Expectation Maximization algorithm, demonstrated reconstruction resolutions of ~1.6mm. Sensitivity measurements exhibited significant dependence upon energy window selection; with the 250-750keV energy window resulting in both the highest absolute sensitivity (6.8%) and the highest NECR (142kcps at 1.25MBq/cc).

Conclusion: Although the measured sensitivity's energy dependence suggests additional energy calibrations are needed, preliminary data show both device sensitivity and resolution to be comparable to or better than that of current commercial systems. Moreover the dual-panel scanner's simple fixed geometry and large field-of-view are especially well suited for whole-body imaging and concurrent imaging of multiple animals.