AbstractID: 7164 Title: Measuring the Quantitative Accuracy of Clinical Dynamic and Whole Body PET/CT Protocols via Imaged Reference Sources

Purpose: Accurate quantification is paramount when using PET imaging to gauge response to treatments or optimize biologically prescribed doses. This study examines the quantitative accuracy of PET protocols by analyzing external reference sources scanned concurrently with patients in dynamic and whole body scans.

Method and Materials: Canine and human patients were scanned using dynamic or whole body protocols on a GE Discovery LS PET/CT. In each scan a 50 ml reference vial containing a known amount of radioactive ^{64}Cu or ^{18}F was placed on the couch edge, in the scanner's field of view. Reference activity concentrations ranged from 20-300 kBq/ml. Dynamic scans consisted of 10, 30, 60, and 600 second frames while whole body scans used 8-10 minute bed positions. CT images were used to define two regions of interest for each reference source: (1) an inner cylindrical contour (ROI_{inner}) of 6-8 mm for activity concentration and, (2) a contour with a 5 mm margin surrounding the source (ROI_{total}) for total activity.

Results: A systematic bias was observed in both reference activity concentration and total reference activity for whole body and dynamic scanning protocols. ROI_{total} provided total activity measurements an average of 8 ± 3% lower than dose calibrator measurements in whole body scans. Dynamic scans imaged total reference activity approximately 4% lower for hotter sources in dynamic scans. Both contours showed reproducibility to within 2% when repeating scans with the same reference. Over the course of six months references held a standard deviation of 3%.

Conclusion: This study provided a quantitative assessment of our clinical scanning protocols and provided error estimates for the uptake in clinical patients based on reference sources. A bias was discovered prompting further cross-calibration with the dose calibrator. Further error reduction and quantification study using longer lived nuclides will continue to be clinically investigated.