AbstractID: 8248 Title: Accuracy and reproducibility of tumor position during prolonged and multi-modality animal imaging studies

Purpose: Dedicated small-animal imaging devices are being used more frequently for translational molecular imaging studies. However, few studies have investigated the magnitude of animal motion during extended dynamic imaging studies or the precision of animal repositioning in multi-modality and/or serial imaging protocols. The objective of this work was to determine the positional accuracy and precision with which tumors in situ can be reliably and reproducibly imaged on dedicated small-animal imaging equipment.

Method and Materials: A custom rodent animal cradle with a stereotactic template served to define a coordinate system and to facilitate rigid-body image registration. Attached to the template were fiduciary markers containing PET tracer and MRI and CT contrast media for visualization on the respective scanners. To quantify animal tumor motion during imaging protocols, "gold standard" point markers were inserted into tumors grown on the hind limb of nude rats. Three types of imaging examination were performed with the animals continuously anesthetized and immobilized: (i) single-modality imaging (microPET and MRI) in which the animals remained in the same scanner continuously for 2 hours, (ii) multi-modality imaging studies in which the animals were transported from a microPET to an MR scanner located in another building, and (iii) serial microPET scans in which the animals were removed from the scanner, then re-positioned and scanned.

Results: The animal tumor moved by less than 0.2–0.3 mm over two-hour microPET or MR imaging sessions. Transporting the animal between instruments introduced additional error of ~0.2 mm. In serial animal imaging studies, in which the animal was returned to its cage and subsequently re-positioned, reproducibility within ~0.8 mm could be obtained.

Conclusion: To our knowledge, this is the first study systematically and rigorously evaluating the accuracy and precision with which tumors can be repeatedly imaged in small-animal imaging devices.