

AbstractID: 3025 Title: 2.Experimental Method Development for Direct Dosimetry of Permanent Prostate Brachytherapy Implants

Purpose: To ascertain if PET DICOM data can be used for the quantitative description of dose distribution in support of direct prostate seed dosimetry.

Method and Materials: Simulated brachytherapy seeds were constructed containing trace amounts of a positron emitter F-18, such that all annihilation events took place in the encapsulation wall. An acrylic prostate phantom containing these seeds was imaged with a GE Discovery PET/CT scanner. The PET scan data was used as source in the input for Monte Carlo calculation of dose distribution due to the F-18. This dose distribution was then compared to computations wherein the source was restricted to the encapsulation wall. This was done to determine if the measured data could be used to accurately compute the annihilation dose, which in turn could be used to compute the therapeutic dose due to known seed activity.

Results: Examination of the dose distributions indicates a close agreement between the measured data and theoretical computational experiments for certain cases. We found that 2D acquisition with default reconstruction resulted in a maximum difference in transaxial dose distribution of 15% in a single voxel and a mean difference of 4% for the remaining voxels. The mean discrepancy between the ideal and PET based computations are within or close to calculation error of 2% to 4%. These results do not reflect any optimized acquisition protocol that can further reduce the observed differences.

Conclusions: This work indicates there is potential for using PET data for the proposed link between the therapeutic brachytherapy dose and the dose due to a trace amount of encapsulated positron emitter developed by Sajo and Williams. Without needing seed location information, clinical implementation of this method could significantly reduce the time needed for post-implant evaluation, and several of the uncertainties and limitations inherent in current prostate brachytherapy dosimetry.