AbstractID: 3616 Title: Progress Towards a MicroRT Small Animal Conformal Irradiator

Purpose: Newly developed small animal imaging devices, like micro computed tomography (microCT), micro positron emission tomography (microPET), and micro magnetic resonance (microMR), have stimulated development of small radiation therapy devices - microRTs. A conformal small animal irradiator will provide customized dose distributions that enable the investigator to limit confounding side effects and obtain more quantitative response results.

Method and Materials: The first step towards designing the microRT irradiator was to perform Monte Carlo simulations to aid in optimization of the proposed design. The proposed irradiator uses a high activity ^{192}Ir source that is a relatively small (*3mm* long and *3mm* in diameter) cylinder. The BEAMnrc Monte-Carlo code for was utilized to model the dose distribution for three source-to-target distances: *60mm*, *70mm* and *80mm*, and five circular field sizes: *5mm*, *7.5mm*, *10mm*, *12.5mm* and *15mm*. Finally, dose to a $50 \times 50 \times 50mm^3$ water phantom with $1 \times 1 \times 1mm^3$ voxel spacing was computed. To provide rapid dose calculations for treatment planning, a parametric dose model was developed and fit to the Monte Carlo data.

Results: The simulated radiation beams were determined to be radially symmetric, so a radially symmetric parametric form was selected for the dose model. The depth dose distribution was dominated by the inverse square law and the beam profile and depth-dose fits were excellent. The parameters varied smoothly as a function of depth, source-to-surface distance, and field size, allowing interpolation for non-simulated geometries.

Conclusions: Preliminary results of Monte-Carlo simulations demonstrated that the parametric fit to the dose distribution of a ^{192}Ir microRT device provides good agreement with Monte Carlo predictions.