AbstractID: 1682 Title: Dosimetric properties of a microRT small animal irradiator

Oncologic imaging is undergoing revolutionary changes through the use of small animal molecular imaging. A variety of imaging devices have been designed and manufactured for this purpose. MicroCT, microPET, and microMR are being used to evaluate molecular structure, function, and physiologic processes for malignancies and normal structures. This work has the potential to profoundly impact radiation therapy practice. In an effort to capitalize on the imaging research, a teletherapy microRT (radiation therapy) device based on a high-activity ^{192}Ir source has been recently proposed. The device will be used to deliver conformal radiation therapy to small animals (mice and rats). The initial development uses a commercial high-dose-rate (HDR) remote afterloader with custom-fabricated Tungsten collimators. The dose rate, beam profile uniformity, source misalignment effects, and optimal source orientation were measured. Monte-Carlo simulations were used to support the measurements and to estimate percent depth-dose characteristics of the proposed device. For a 10Ci, or more, ^{192}Ir source a 100cGy/min dose rate in a mouse at 1.5cm depth for a 1.5cm diameter circular field is achievable. With the source oriented perpendicular to the beam central axis, dose profiles have only minor asymmetries, while a parallel orientation delivers unacceptable dosimetric inhomogeneities due to oblique filtration through the source. Source misalignments greater than ±1.5mm introduce significant variations in dose profiles. Monte-Carlo simulations demonstrated that depth-dose properties of a microRT device comparable to scaled human conformal therapy using megavoltage beams can be achieved with high-activity sources and increased treatment distances. Commercial HDR-sources could be used for certain applications