AbstractID: 3819 Title: Advanced Irradiator for the Small Animal Conformal Treatment

Purpose: Conformal irradiation of small animals represents an emerging research tool in the field of radiation oncology. Our institution is developing a treatment system for the small animal RT based on the ^{192}Ir radioactive source. Extensive Monte Carlo simulations were performed for the simple irradiator geometries with a single radioactive source and simple collimator apertures. In order to compensate for the severe inverse square law effects a series of simulations were performed involving 256 ^{192}Ir sources arranged in 16x16 planar matrix.

Method and Materials: Simulations were performed using customized BEAMnrc code. The simulated geometry consisted of the source matrix positioned at the entrance of a meshed collimator. The collimator was a 2 cm thick tungsten slab with 256 (1x1 mm^2) square holes arranged to match the source matrix. The wall thickness between the adjacent holes was 1 mm. The final collimation element was a set of 2 cm thick tungsten leafs effectively enabling the choice of matrix elements included in the output beam. Dose distributions were scored in a 5x5x5 cm^3 water phantom with 1 mm^3 voxel-size.

Results: The obtained dose distributions exhibit significantly less dose fall off vs. depth when compared to the single source geometry. The radial dose distribution and the size of the penumbra are comparable with the single source geometry but the angle of divergence is much smaller particularly for the higher irradiation field sizes.

Conclusion: The novel design of the Ir192 irradiator has been tested via Monte Carlo simulations and exhibits significant improvements over simple geometries. Achievable depth dose curves and the small divergence of the beam promise much better conformal delivery. The design allows for IMRT-like treatment planning and is a strong candidate for an actual experimental realization.