

AbstractID: 14080 Title: Dosimetric characterization of an accessory designed to irradiate rodents using the Gamma Knife Perfexion treatment system (PFX).

Purpose: Dosimetric characterization of an accessory designed to irradiate rodents using the Gamma Knife Perfexion treatment system (PFX).

Methods and Materials: A rodent holder assembly was designed to be compatible with the PFX for the irradiation of up to 6 anesthetized, immobilized mice in one session. The holder design includes modular plastic construction materials compatible with MR and CT image guidance. Rodent positions are aligned to the holder assembly through sighting of external features on each animal and are targeted using the stereotactic coordinate system of the PFX and the Leksell GammaPlan planning system (LGP). Currently, GammaPlan versions cannot easily model the mice on the rodent holder assembly. Co-60 dose rates and isodose distributions for various radiation beam configurations and depths were determined using EBT radiochromic film and micro-LiF TLDs in rodent-sized polystyrene phantoms mounted on the assembly. Published tissue air ratios were spot-checked using TPRs obtained in a special step-wise tapered polystyrene phantom.

Results: The measured dose rates using film agreed to within 7% of expected values computed from published TAR and Elekta output data. Dose rates are about 55-60% greater compared to Elekta 16cm sphere calibration. Maximum dose rates scale with the number of unblocked sources. Film dosimetry shows that the 4mm collimator irradiates an ellipsoidal volume with approximately a 3 mm diameter at the 90% isodose. Isodose distributions can be shaped by blocking sectors 3 and 7 to avoid specific rodent anatomy and the adjacent rodent positions on the holder assembly.

Conclusion: Deviations from published data can be explained to result from attenuation of the dose rates by the rodent holder. Our dosimetric data supports the use of PFX for multiple-rodent irradiation. The system can be used to determine response of rodent brain tissue and tumors to radiation and the effect of molecular radiation modifiers.