AbstractID: 8917 Title: Dosimetry of a Novel MicroCT/RT System for Small Animal Conformal Radiotherapy

Purpose:
To measure the absorbed dose to the surface of water at the isocenter of a custom microCT system for small animal conformal radiotherapy. Percentage depth dose curves and backscatter factors for field sizes smaller than 2 cm were also investigated.

Method and Materials:
The dose rate at the surface of water at the isocenter (35.4 cm) of the GE microCT was measured using the in-air method proposed in the AAPM protocol TG-61. The half value layer (HVL) of the X-ray beam was measured using an ion chamber and calculated using Monte Carlo simulation. Ion chamber measurements were taken using 6 cm field size diameter. PDD curves and dose rate for field diameters of 2, 1, 0.5 and 0.1 cm were investigated using Gafchromic EBT film. Backscatter factors were calculated via Monte Carlo simulation.

Results:
The HVL of the beam was measured as 5.6 mmAl suggesting average photon energy of 46 keV. The dose rate at the surface of water at the isocenter of the microCT is $D_{(iso,\ d=0,\ 6cm)}$ = 2.1 Gy/min. The beam is attenuated to 50% at 3 cm depth in water for 1 cm field size and at 2.4 cm depth for 0.1 cm field size. The calculated backscatter factors for field sizes larger than 1 cm agree with those tabulated in AAPM protocol TG-61 within 1%, and for field sizes smaller than 1 cm agree with those extrapolated from TG-61 tables within 3%.

Conclusion:
The dose rate at the isocenter of the microCT is high enough to deliver therapeutic radiation doses to mice in reasonable irradiation times. The beam has enough penetration power to irradiate tumors inside mouse bodies. This microCT is therefore capable of performing 3-D conformal radiotherapy in mice using radiation fields as small as 1 mm in diameter.