AbstractID: 5317 Title: The Small-Animal Radiation Research Platform (SARRP): commissioning a 225 kVp “small-field” x-ray source for Monte Carlo-based treatment planning

Purpose:
To characterize the dosimetry of a small-field 225 kVp x-ray source and demonstrate the feasibility of the Pinnacle *Monte Carlo Dose Computation* engine (v7.9t alpha release) for treatment planning in the context of small-animal radiation therapy.

Method and Materials:
The 225 kVp therapeutic x-rays for the Small-Animal Radiation Research Platform (SARRP) are produced by a GE 225 x-ray tube (spot size 3 mm; Al filtration 4 mm). A simple small-field collimation system was constructed; for commissioning purposes we machined a set of brass cutouts which define field sizes of 3x3, 5x5, 10x10, 30x30 and 60x60 mm^2 at the nominal SARRP source-to-axis distance of 33.5 cm. The x-ray beams were characterized by irradiating Gafchromic EBT film in water. The film plane was oriented parallel to the central beam axis (z); measurements were made in the x-z and y-z planes for all field sizes. Dosimetric data were extracted from the films using a commercial flat-bed document scanner. Profiles and percent depth-dose (PDD) curves for depths from 0-9 cm (SSD = 33.5 cm) were imported into our research planning software for comparison with simulated data.

Results:
Preliminary simulated profiles for the 60x60 mm^2 cutout deviate, on average, by 1.7% and 2.8% in the high-dose region (90% or greater) for depths of 0.5 and 3 cm, respectively. Average PDD discrepancies for depths from 0-3 cm and 3-6 cm are 4.3% and 18.4% for the 60x60 mm^2 cutout, respectively, and 6.6% and 29.2% for the 5x5 mm^2 cutout.

Conclusion:
These encouraging results identify the feasibility of using this planning system. Pinnacle supports the finer resolution required for modeling the small fields. Future development will involve incorporation of a measured photon energy spectrum. For purposes of comparison and validation, we will also incorporate an independently-generated photon phase-space file for the simulated x-rays.