AbstractID: 11083 Title: Investigation of effects of treatment planning variables on small animal therapy dose distributions

Purpose: Methods used for small animal radiation treatment have yet to achieve the same dose targeting as in clinical radiation therapy. Toward understanding how to better plan small animal radiation, we characterized dose distributions of conformal radiotherapy of small animals in a microCT scanner with a variable aperture collimator. **Method and Materials:** Dose distributions were simulated on a cylindrical solid water phantom (radius 2.5mm, resolution 195μm) using a Monte Carlo algorithm. Phase-space files for collimator widths of 1-10mm were generated using BEAMnrc software, and dose distributions were generated in DOSXYZ for centered spherical targets with radii of 1, 2, 5, and 10mm; 2mm spherical targets offset by 10%, 20%, 30%, and 40% of the phantom diameter; and asymmetric elliptical targets of 2x4x2mm, 2x6x2mm, and 2x8x2mm. For each target, treatment plans included evenly-space, matched-isocenter beams ranging in number from 5-100, with multiple beam widths allowed for asymmetric targets. Dose distributions were analyzed in RT_Image. **Results:** For centered, symmetric targets, the number of beams required to achieve a smooth dose-volume histogram decreased with target size; for a 1mm target, no significant increase in smoothness was achieved with beam numbers beyond 60; for a 2mm target, beyond 60; for a 5mm target, beyond 50; and for a 10mm target, beyond 40. Dose distributions for non-centered, symmetric targets did not exhibit any significant loss of conformality with increasing offset from the phantom center, indicating sufficient beam penetration through the phantom for targeting superficial targets from all angles. Even with variable collimator widths, targeting of asymmetric targets was found to have less conformality than that of spherical targets. **Conclusion:** This method of generating and analyzing dose distributions provides a quantitative method for developing practical guidelines for small animal radiotherapy treatment planning. Future work should address methods to improve conformality in asymmetric targets.