AbstractID: 11509 Title: An Open Source Software Tool for Treatment Planning for Small Animal Conformal Radiotherapy

Purpose: A treatment planning environment for a novel microCT-based small animal conformal radiotherapy system has been developed. Built on the RT_Image open source package, the software allows planning based on CT data as well as other coregistered image types, and is integrated with a Monte Carlo dose calculation system. **Method and Materials:** The core RT_Image application allows display, registration, and region-of-interest (ROI) analysis of a variety of image types. A set of tools for defining beams was added to this application, matching the specifications of a microCT radiotherapy unit with a variable-aperture collimator. Beams can be added and configured manually, or can be set to conform to a 3D region of interest. Beam commissioning tissue maximum ratio (TMR) data for the system was incorporated into the application to allow isocenter dose estimation based on its depth. In addition, the software was configured to allow creation of phantom and input files for an EGSnrc Monte Carlo dose calculation engine. The 3ddose files generated by this separate software can then be imported into RT_Image for analysis. **Results:** Pseudocircular beams of arbitrary geometries can be simulated and viewed from arbitrary directions in RT_Image. Calculation of isocenter depth in tissue is done automatically within 1 second per beam, allowing estimation of isocenter dose using the included TMR data. The interfaces for creating EGSnrc phantom and input files allow flexible specification of phantom materials, Hounsfield and density lookup tables, and simulation parameters. Imported Monte Carlo dose simulations can be analyzed using ROI and dose volume histogram (DVH) techniques, and agree with TMR dose calculations to within 10% at isocenter. **Conclusion:** An open source tool for planning and simulating small animal radiation treatments has been constructed. Future development of this package will include inverse planning algorithms and control of the microCT hardware to deliver treatments.