AbstractID: 11059 Title: The influence of material assignment on Monte Carlo dose calculations for kilovoltage small animal radiotherapy

Purpose: To investigate the sensitivity of tissue assignment for Monte Carlo (MC) dose calculations using a kilovoltage beam for small animal radiotherapy, and to test the feasibility of dual energy microCT (DEmCT) imaging for material determination. **Method and Materials**: MC dose calculations for 34 ICRU-44 tissue types were performed in the EGSnrc/DOSXYZnrc code, using a 120kVp x-ray beam. Each tissue type was modeled as a 5mm diameter spherical inhomogeneity in a soft tissue cylindrical phantom and a treatment plan with five 5mm diameter isocentric beams was simulated. The mean absorbed dose as a function of tissue density (ρ) and atomic number (Z) was studied. Two phantoms with five known materials were scanned with 70kVp and 120kVp beams and the ρ and Z of these materials were extracted. DEmCT tissue segmentation was also applied on 70kVp and 120kVp CT images of a euthanized mouse. **Results:** The MC simulations demonstrate that inaccurate tissue segmentation can result in large dose calculation errors, up to 40% if adipose is assigned as soft tissue. The MC simulations also show a strong correlation between the Z of a tissue and the dose to the tissue. Preliminary results indicate that DEmCT material extraction using a microCT scanner is feasible; the mean error on the ρ and Z extraction of the five materials was 2.5% and 3.4%, respectively. The mouse DEmCT extracted tissues follow the data of ICRU-44 tissues. **Conclusions:** It was demonstrated that tissue segmentation is one of the key steps in Monte Carlo treatment planning for small animal radiotherapy using a microCT scanner. Preliminary results indicate that dual energy microCT extraction has the potential to increase the accuracy of the conventional tissue segmentation scheme.