AbstractID: 13571 Title: Stopping Power for Tissue Equivalent Materials and Hounsfield Numbers for Proton Radiation Treatment Planning: Calculation and Measurements

Purpose: To generate a proton stopping power calibration curve from tissue equivalent materials combined with Hounsfield Unit (HU) values measured by an in house CT scanner for use in proton treatment planning. **Method and Materials**: Tissue equivalent phantom materials (Gammex Model 467) used for CT calibration were placed at the center of a water tank (40x30x30 cm^3) and scanned with the CT scanner to measure their HU values. Image reconstruction was done with 5 mm slice thickness. In addition, the tissue equivalent phantom material relative stopping powers were measured with 197.1 MeV protons whose defining range was 18.28 cm. Ten phantom materials were individually placed in front of a water tank. A PPCO5 parallel plate chamber was used to measure pristine Bragg peaks in water. **Results:** A stoichiometric calibration method was used to characterize the CT scanner by fitting the measured HU values to the equation $HU = \rho_e^{rel} (A\ Z^{3.86} + B\ Z^{1.86} + C)$. Parameters A, B, and C are specific to the CT scanner used in this measurement and they correspond to photoelectric, Rayleigh and Compton cross sections. These fit parameters were used to calculate the HU values for the tissues whose compositions are listed in ICRP (1975). In addition, proton relative stopping powers for these materials were calculated by the Bethe-Bloch formula. The relative stopping power for each phantom material was also measured from the difference of the pulled back Bragg peak compared to that of water, and the results were compared. **Conclusion:** A stopping power versus HU value calibration curve for the proton treatment planning system was generated.