# AbstractID: 13847 Title: Tissue composition effect in proton dose calculation based on human antomical model

**Purpose:** We performed a study to investigate the tissue composition effect on proton dose distribution. Dose calculation was performed based on a human anatomical model, and compared with that based on stopping power.

**Method and Materials:** Currently, most proton treatment planning systems (TPS) employ a stopping-power-based dose algorithm for proton dose calculation, which do not model the tissue composition effect well due to the complicity of human anatomy. To overcome the limitation of general TPSs, Monte Carlo methods provide a feasible and accurate dose calculation as they take into account detailed material properties, including tissue density and tissue composition. Monte Carlo simulation calculates the dose for each small volume (voxel) after a patient is converted to a model consisting of a huge amount of tissue voxels. To obtain an accurate human anatomical model, the data set from the Nation Library of Medicine's Visible Human Project has been adapted in this study. A patient (actually a cadaver) was segmented with anatomical detailed materials assigned for each slice. Dose distribution and dose volume histogram were calculated using both MC simulations based on the anatomy models and TPS calculation, and compared with each other.

**Results:** Dose volume history for planning tumor volume (PTV), Brain, Pituitary and Chiasm were used for evaluating the effect of tissue composition. The mean dose difference for PTV was 2.3% for the cadaver-based MC simulation and TPS calculation. The mean dose differences for Brain, Pituitary and Chiasm were between 1.0% and 1.5%.

**Conclusion:** Proton radiation dose was calculated and closely compared using MC simulation and TPS calculation. It is found that human tissue composition contributes on proton radiation dose calculation to some level. Further study is needed to determine whether the effect of tissue composition on proton dose calculation is clinically significant.