AbstractID: 7641 Title: Cone Beam CT Number Correction Method for Accurate EBRT Dose Calculations

Purpose: Benchmark a method for correcting CBCT Hounsfield numbers in support of accurate dose calculations.

Method and Materials: Cone beam CT (CBCT) and Fan Beam CT (FBCT) scans of three phantoms: Head, Thorax and large solid water cylindrical 'pelvic' phantom are acquired under identical setup conditions. CBCT images are then modified by a step-function correction method, descretizing the Hounsfield units to five discrete CT numbers for the thorax, three discrete CT numbers for HN and Pelvic anatomies. The groups include the three main ranges of 0 HU for gas/air, 1000 HU for water/muscle and 2000 HU for bone. The FBCT, CBCT and corrected CBCT scans for each body site surrogate (HN, lung and pelvis) are used to compute EBRT plans consisting of an IMRT HN, SBRT lung and a prostate IMRT plan, respectively. The CBCT and corrected CBCT plans are paired with the corresponding FBCT-based plans to perform comparisons using dose difference analyses, DTA analyses and gamma-analyses. The criteria used are 0.2cm for DTA, 2.0% of maximum dose for dose difference and 1.0 for gamma.

Results: Compared with raw CBCT-based plan, this correction method reduces gamma by about 0.2, reduces DTA by about 0.1 cm and reduces dose difference by about 1% for lung and pelvis. The passing rate of gamma, DTA and dose difference also improved significantly. For HN, with and without correction both give excellent results, which may be due to the fact that the HU numbers or raw CBCT is much closer to those of FBCT for HN than those for lung and pelvis.

Conclusion: The HU correction method presented herein effectively improves the accuracy of dose calculation for CBCT-based treatment plan, supporting CBCT as a viable imaging modality for accurate EBRT dose calculations.