AbstractID: 11782 Title: Dose Perturbation Due To High Z Artifacts in IMRT Planning

Purpose: Presence of high-Z implants inside the patient causes streaking artifacts in the kVCT (kilovoltage computed tomography) scan. The purpose of this study is to evaluate the variation in the computed dose distribution due to these artifacts in kVCT scans as compared with megavoltage (MV)CT, and also to determine a suitable scanning and planning protocol in such situations.

Methods and Materials: High-Z materials produce more artifacts in kVCT images than MVCT images (using Tomotherapy). To quantify the difference in dose distributions due to these artifacts, dose is computed using both datasets for the same plan. Pinnacle 8.1u was used for this study, which provided the option of using different datasets for the same plan. With plan parameters being the same, we derive the variation in dose attributed to the high-Z artifacts. For this study, two sites with high Z implants were selected – a prostate with hip prostheses (HP) and a breast with a silicon breast expander. For example, the average density of the HP object is 3.55g/cc. KVCT and MVCT scans were obtained for both patients. The dose distributions on both datasets were evaluated using isodose and DVH (dose-volume histogram) parameters typically used by the physician for plan evaluation.

Results: For the prostate plan, PTV coverage for kVCT and MVCT datasets were 98.95% and 93.57% respectively for a 100% prescription. For the breast plan, the respective values were 97.40% and 94.36%.

Conclusion: A comparison of the PTVs calculated for both the kVCT and MVCT plans in the presence of high-Z materials shows that dose computed based on the kVCT dataset underestimates doses by ~3% in the presence of hip prosthesis, and 4.6% when a silicon breast expander is present. Our preliminary studies show that MVCT provides relatively realistic dose estimate in the presence of high-Z materials.