AbstractID: 5807 Title: Extended Range CT-value Analysis in Megavoltage CT Imaging and Therapy

Purpose: To investigate uses of megavoltage CT (MVCT) scans for high-Z materials, such as prosthetics, and Fletcher-Suit applicators. The image quality of kilovoltage CT (kVCT) scans is not clinically useful due to substantial artifacts. We investigated the relationship between MVCT derived "Hounsfield" units (HU) and electron density. Knowing this, we used MVCT scans to the treatment planning process. Then we evaluated the expected dose represented on the plan to actual measured dose taking MVCT derived inhomogeneities into account. **Method and Materials**: A Siemens 120 kVp CT scanner and 3.5 MeV Tomotherapy unit were used to scan a "Cheese" phantom containing 16 plugs whose relative electron density varied from 0.292 to 8.086. The 3-4 mm slice thickness images were transferred to Eclipse planning station to obtain mean HU. Tomotherapy treatment plans with field width of 2.5 cm, pitch 0.25, and modulation factor 2.5, were completed utilizing extended range HU-density tables and designed to deliver 2 Gy per fraction to a planning target volume (PTV). An A1SL ion chamber was used for absolute dose measurement, while EDR2 film for evaluation of dose profiles. **Results**: High-energy MVCT images compared to the kVCT showed much-reduced artifact. For unit density and low-Z materials (tissue equivalent), delivered dose was within 1% of kVCT-image based plans and within 1.6% of MVCT based plans. kVCT images could not be used for extracting HU in high-Z material due to saturation in CT numbers. For high-Z materials, HU were extracted from the MVCT image set. MVCT-based plans were within 0.6%-5.3% of the target dose depending on the high-Z material orientation and location compared to the PTV. **Conclusion**: We show that MVCT-based treatment plans containing high-Z material can be done accurately. We are exploring clinical applications of this study for patients with prostheses, and intracavitary radiotherapy.