AbstractID: 11048 Title: Dosimetric impact of imaging artifacts from kVCT and MVCT in the presence of metallic prostheses

Purpose: To determine the most acceptable dose distribution for patients with metallic implants by quantifying the dosimetric impact of metal-induced CT artifacts from two different imaging techniques (traditional kVCT and Tomotherapy MVCT) on optimization-based treatment planning.

Method and Materials: Six prostheses of varying composition and design were scanned in a 54 x 35.5 x 30 cm water tank using a 4 slice GE Discovery LS CT scanner and a Tomotherapy Hi-ART megavoltage CT system. Corresponding image value to density tables (IVDTs) were created for each CT type. Four spherical regions of interest (ROIs) were created: a PTV at isocenter, and Regions 1-3 at 6 cm, 10 cm and 10 cm from isocenter, respectively. Both the kVCT and MVCT data sets were used to optimize 5-field IMRT plans using Pinnacle's IMRT optimizer and Tomotherapy's treatment planning software. 60 Gy was delivered to the PTV. For each planning system, the chosen machine parameters, beam arrangements and number of optimization iterations were kept the same for all plans. Beam arrangements were chosen to avoid the prostheses.

Results: Point doses to the center of the ROIs varied significantly between kVCT and MVCT image-based plans. The Tomotherapy planning system reported higher doses for the MVCT plans than the corresponding kVCT plans, except for the points located in Region 1. The maximum difference in reported dose to Region 1 between scan types was 4.1 Gy for Tomotherapy and 1.5 Gy for Pinnacle. The maximum dose difference elsewhere was 0.8 Gy for Tomotherapy and 1.76 Gy for Pinnacle.

Conclusion: Metal artifacts significantly affect the beam shape, weighting and resulting dose distribution in the two optimization algorithms. Megavoltage scans are recommended for dose calculation, since the quantity and severity of metal-induced artifacts are minimized and the dose to regions at risk near the PTV is in general reduced.