AbstractID: 7780 Title: Dosimetric effects of image quality in a TomoTherapy MVCT dataset

Purpose: To evaluate the dosimetric effects of image noise and detector alignment artifacts in TomoTherapy MVCT datasets.

Method and Materials: MVCT images of CT quality assurance water phantoms were obtained on a TomoTherapy HI-ART treatment system. Images were used as input to a commercial treatment planning system (Philips Pinnacle^3) which allowed for adjustment of voxel densities within contoured structures. The entire phantom was contoured to override the densities determined from the MVCT to the known physical densities within the phantom. Heterogeneous treatment plans using static and rotational beams were performed on both the raw images and the images with density corrections. Dose differences between the two sets of plans were analyzed to determine the magnitude of discrepancies between the datasets.

Results: Average MVCT densities of regions distant from the central region of the phantom showed densities with in 2% of densities of water. The central region which is aligned with the TomoTherapy central axis showed an average density as greater than water by 5% due to a detector alignment artifact. For both the static and rotational beams, the isodoses distributions for the two sets of plans were very similar. In general, rotational plans demonstrated less error than static relative to the prescription point placed at the phantom center. More detailed information was obtained with dose difference displays which demonstrate relative errors proportional to the delivered dose in phantom. The maximum error observed throughout the datasets was found to be small (<1%).

Conclusion: Dosimetric differences resulting from image noise and artifacts were found to be insignificant. These results may be beneficial in the determination appropriate action limits for routine MVCT QA.

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