

AbstractID: 9099 Title: Evaluation of Elekta cone beam CT with bowtie filter for treatment planning

Purpose: To evaluate the depth and spatial consistency of Elekta cone beam CT (CBCT) number with and without bowtie filter and explore the feasibility of treatment planning using CBCT images with heterogeneity correction.

Methods and Materials: A Gammex tissue phantom was scanned on an Elekta XVI cone beam CT with and without bowtie filter. CBCT numbers of each insert rod in images obtained with or without a 1-cm bolus were measured. Hounsfield units (HU) of the insert rods were measured on a helical CT scanner. Conversions of CBCT number and HU to electron density (CBCT-ED and CT-ED) were generated. Single field treatment plans were created with heterogeneity correction in XIO treatment planning system, where the CBCT-ED or CT-ED conversions obtained without the bolus were used for unbolused and bolused plans with and without bowtie filter.

Results: CBCT numbers changed when the bolus was applied, with and without bowtie filter. The changes were smaller for the bowtie filter scans: the average changes were 83 and 128 CBCT number for scans with and without bowtie filter, respectively. CBCT numbers of the same material (e.g., solid water inserts) measured at different locations in the phantom were different: a maximum difference of 113 CBCT number was observed in the scan with the bolus and without the bowtie filter. With heterogeneity correction, the dose differences (maximums) between CT and CBCT non-bolused plans were 3.8% and 4.4% due to irregularity of the CBCT-ED points, for cases with and without bowtie filter, respectively. The differences between bolused plans were 4.5% and 12.0%, respectively.

Conclusion: CBCT numbers were found to be measurement-position dependent within the phantom and varied when a bolus was applied. The bowtie filter improved the CBCT number consistency. However, dose difference is still significant.