AbstractID: 5718 Title: Quantitative evaluation of cone beam CT data used for treatment planning

Purpose: To quantitatively evaluate the consistency of cone beam CT (CBCT) data and the deviation from helical CT if used for calculating dose to heterogeneous material.

Methods and Materials: A Gammex RMI 467 tissue characterization phantom was used to generate CT numbers for both the Elekta XVI CBCT and the Picker 5000CT. For both devices, the RMI phantom was positioned using the manufacturer's recommendations. Hounsfield numbers (HU) were obtained using a default window and level and a ROI of 1cm diameter over the center of the rod (insert). The numbers were recorded and a HU vs. electron density correction curve was generated. For the cone beam portion, we used the Elekta XVI CBCT with M10 collimator and no filter. CBCT data, conventional CT data and correction curves were transferred to our CMS XIO treatment planning system. To verify the consistency of CBCT numbers, we added a 1cm of bolus to the phantom and repeated the procedure. A single field treatment plan was generated with heterogeneity and non heterogeneity corrections for CBCT and CT datasets, and for nonbolused and bolused geometries. The Gammex phantom tissue equivalent rods were modified to accept TLD for measurement verification.

Results: Calculated doses for treatment plans generated without heterogeneity correction for data sets from CT and CBCT agreed within ~1%. CBCT numbers for the same insert differed with a small change in setup (ie. adding 1cm bolus). When heterogeneity correction was turned on, a difference of 14% was found between CT and CBCT nonbolused plans. TLD measured doses agreed with those from the calculated CT set.

Conclusion: Without heterogeneity correction, the dose calculation with CT and CBCT has excellent agreement suggesting a consistency in contour acquisition. One has to be extremely cautious in using CBCT data for heterogeneity corrections since significant error can occur.