

AbstractID: 4896 Title: Evaluation of kv CBCT-based Dose Verification

Purpose: To evaluate the accuracy of using kilovolt cone-beam CT (CBCT) for dose calculation and investigate the feasibility of using kv CBCT for patient dose verification.

Method and Materials: A solid water phantom and phantoms consisting of a stack of polystyrene slabs with three types of 3cm inserts (the same polystyrene material, lung- and bone-equivalent material) were used to evaluate the accuracy of CBCT-based dose calculation. Planning CT (GE Discovery-ST) and CBCT (Varian Trilogy) images of each of the phantoms were acquired. In each case, single-beam plan with a variety of field sizes and 5-beam IMRT treatment plans were prepared based on both planning CT and CBCT images. In addition, the optimized fluence maps from the CT-based IMRT plan were used recomputed the dose on the CBCT phantom images and the results were compared with that of the original treatment plan based on CT. Point dose and film measurements were also carried out and compared. The same comparison also was performed for a prostate patient and a head-and-neck patient.

Results: The recalculated dose distribution based on the CBCT and the intended fluence maps from the treatment plan agreed each to less than 3% for the homogeneous solid water or polystyrene phantoms. A similar level of agreement was found between the calculations and point dose measurements. For inhomogeneous phantoms, the discrepancy between the two sets of calculations depended on the spatial location, which ranges from 1% to 6%. The comparison of DVH curves suggested the same. When compared with measurements, a larger discrepancy was observed between the CBCT-based calculations and measured doses.

Conclusion: Our data suggest that, at present, the image quality of the CBCT is not satisfactory for accurate dose verification, and the Hounsfield number should be corrected before CBCT images can be utilized for dose verification.