AbstractID: 5004 Title: Clinical implementation of cone-beam CT for image-guided radiation therapy

Purpose:

A linear accelerator equipped with cone-beam CT (CBCT) was commissioned for image-guided radiation therapy in an IMPAC's Multi-Access environment. The purpose of this work is to report our experience of clinical implementation of CBCT in a multi-vendor environment.

Method and Materials:

The mechanical accuracy of the system was tested using a stereotactic method to verify the imaging isocenter congruent with the therapy isocenter of the accelerator (Trilogy, Varian). Image qualities, including the high contrast resolution (HCR) and low contrast resolution (LCR), were evaluated and compared with the conventional CT (Catphan 600). Imaging doses were measured using TLDs in several anthropomorphic phantoms for the intended treatment sites (head, chest, and pelvis). There are connectivity issues with current vendor provided software, the clinical implementation of CBCT relies on in-house CT-assisted targeting (CAT) software, which is used for aligning CBCT images to the planning CT to determine daily setup shifts. The alignment uncertainties and its dependence on imaging dose were verified in phantom with various known couch shifts.

Results:

The imaging isocenter was found to within 1 mm of the therapy isocenter. The CBCT HCR is similar to the conventional CT, approximately 6~7 lp/cm, while the LCR is inferior. The CBCT LCR with bow-tie appears better than without. With bow-tie, the average imaging doses using built-in protocols were 7.1, 6.7 and 4.3 cGy in head, chest, and pelvis phantoms, respectively; without bow-tie, doses were 5.4 and 2.4 cGy for head and pelvic phantoms. Workflow was implemented to use the in-house CAT software with vendor supplied CBCT acquisition software. The CAT software can predict overall sub-millimeter accuracy in a phantom experiment with many known couch shifts.

Conclusion:

We have successfully implemented CBCT for clinical use. Major challenges included various component testing, connectivity, and in-house software implementations.