AbstractID: 13240 Title: Phantom Study of CBCT setup accuracy in stereotactic body radiation therapy for lung cancer treatment

Purpose: To evaluate the accuracy of cone beam computed tomography (CBCT) guided positioning in the case of motion patterns associated with regular and irregular breathing for lung cancer stereotactic body radiation therapy (SBRT).

Methods and Materials: Five irregular motion patterns have been used in phantom-simulated cases using a solid ball to create four-dimensional (4D) CT datasets. Images are transferred to the Pinnacle Planning System 8.0m (Phillips) where a planning treatment volume (PTV) is constructed for planning. Subsequently the same phantom simulated cases are imaged with a CBCT (Elekta XVI) in volumetric reconstruction mode. Images defining the PTV using CBCT are compared with PTV determined from 4DCT images. Breathing motion patterns used in these phantom studies were from actual patients' data taken at random. For comparisons regular breathing motion data have been also used for reference in PTV matching derived from 4DCT and CBCT. The actual time dependant target position was known in each phantom-simulated case from the driver files associated with the motion generator.

Results For regular motion, CBCT exhibited up to 2mm shift between 4DCT derived PTV and CBCT defined PTV. For irregular motion, the CBCT derived PTV exhibited up to3.7mm shift relative to 4DCT derived PTV. However, we found that neither the 4DCT nor the CBCT accurately reflect of the actual PTV motion and geometry (up to 4.9mm) derived from known target dimensions and knowledge of motion data. Dosimetric impact of this error will be reported.

Conclusions The setup of target for SBRT treatment of lung tumor based on CBCT derived PTV is consistent with treatment plan based on 4DCT. This clinically positive result is not based, however, on accurate representation of clinically used PTV with true geometrical representation of PTV target derived from known target dimensions and known pattern of target motion in the phantom.