

AbstractID: 13743 Title: Can four dimensional cone beam computed tomography (4DCBCT) improve the patient setup for stereotactic body radiation therapy

Purpose: To assess the precision of 4DCBCT in patient setup for stereotactic body radiation therapy of lung cancer.

Methods and Materials: Eight cases of breathing motion patterns are imposed on phantom imitating the tumor motion in the lung. These simulated phantom motions are scanned by 4DCT. PTV volumes are defined from 4DCT images. At Elekta SynergyS, 3DCBCT images are acquired for phantom reproducing same motions at 4DCT. 3DCBCT data are transferred to XVI 1.51b and reconstructed into 4DCBCT. 4DCBCT images are imported into Pinnacle 8.1y. AVG and MIP images from 4DCBCT data are comparing with 4DCT. Matching are performed between AVG and MIP from 4DCBCT and 4DCT to set standards for accurate 4DCBCT derived irregularly target placement at treatment unit for case of irregular breathing motions for SBRT therapy of the lung. PTV location in laboratory frame of reference derived from known geometry of the phantom and known motion of the target is compared to PTV localization at same reference as derived from 4DCT and 4DCBCT.

Results: Images from 4DCBCT for patient setup shows noticeable difference with setup based on standard 3DCBCT. We found up to 5mm difference between 3DCBCT based setup and 4DCBCT setup in case when irregular breathing pattern with over 20 mm range. When comparing static marker location to the tumor location defined by phantom dimensions and phantom motion with respect to PTV location derived from 4DCBCT, we found the center of PTV dislocation relative to its true center up to 4mm. Dosimetric impact of this error will be reported.

Conclusions: 4DCBCT is not likely to improve the accuracy of patient positioning relative to 3DCBCT unless considerably slower gantry rotation is used to increase sampling of images needed for 4D binning.