AbstractID: 13789 Title: An Investigation on the Acquisition and Modification of Cone-Beam Computed Tomography Images for Head and Neck Cancer

Purpose: To determine the optimal parameters in the acquisition of cone-beam computed tomography (CBCT) for good image quality and to modify the CT numbers for accurate dose calculation in head and neck cancer.

Method and Materials: Systems of fan-beam CT (FBCT) and CBCT were used to acquire images. A program was developed to establish the averaged CT numbers for different materials, and plot them as a function of density. CT numbers of CBCT were modified to match those of FBCT. The modified CBCT images were used for dose calculation. Three CT phantoms were scanned by FBCT and CBCT for image uniformity, spatial resolution, CT numbers, and for comparing doses from orthogonal beams. A Rando phantom was scanned for head and neck regions by both FBCT and CBCT, and planned with intensity modulated radiation therapy (IMRT). In addition, the CBCT images at the first and sixth weeks of radiotherapy of a nasopharyngeal cancer patient treated with an IMRT plan were calculated for dose comparison.

Results: With 360°acquisition of CBCT images, and high-resolution reconstruction, the uniformity of CT number distribution was improved and the otherwise large variations of CT numbers for background and high-density materials were reduced significantly. The dose difference between FBCT and CBCT was <2% in CT phantoms. In both the Rando phantom and the patient, the dose-volume histograms were similar between FBCT and CBCT. The corresponding isodose curves covering □90% of the

prescribed dose on FBCT and CBCT were within 2 mm. The dosimetric difference on CBCT images between the first and sixth weeks were more from the setup errors due to body weight loss.

Conclusion: The protocol developed for CBCT acquisition and modification produced good quality images which can be used in dose calculation for re-planning purposes.