

AbstractID: 5279 Title: Quantitative evaluation of cone beam digital tomosynthesis (CBDT) for Image-Guided Radiation Therapy

Purpose: Cone beam digital tomosynthesis (CBDT) is a new imaging technique proposed by us recently as a rapid approach for creating cross sectional images of a patient in the radiotherapy treatment room. Similar to the cone beam computed tomography (CBCT) approach, the CBDT uses an X-ray source and an X-ray detector on a Linac to acquire projection data by rotation around the patient. Unlike CBCT, CBDT utilizes partial scans, typically in the range of 20-60 degrees of gantry arc. The purposes of this work are (1) to evaluate quantitatively the image quality of CBDT in terms of signal-to-noise ratio and spatial resolution; (2) to demonstrate that we can use CBDT to image soft tissue targets, e.g., the prostate.

Method and Materials: An experimental CBDT system has been built on a Linac with a recently developed flat-panel detector. A number of phantoms including a spatial resolution phantom, two contrast-detail phantoms and a custom-made anthropomorphic pelvic phantom (CIRS Inc.) were used in the evaluation. CBDT phantom images have been generated and analyzed for different degrees of gantry arc and compared to those from CBCT.

Results: Quantitative results on signal-to-noise ratio and spatial resolution have been obtained for different degrees of gantry arc. Compared to CBCT, CBDT has a worse spatial resolution in the direction perpendicular to the planes of reconstruction but a better resolution in the parallel direction. The image quality of CBDT is acceptable in the planes most relevant to the treatment. It has been shown that the prostate is visible on CBDT reconstructed images of the pelvic phantom.

Conclusion: This work indicates that the CBDT approach can be a viable and rapid tomographical imaging technique for treatment verification in radiotherapy.

Conflict of Interest: This work was partially supported by Siemens Medical Solutions, Inc.