AbstractID: 4467 Title: Assessment of four-dimensional CT image acquisition quality

The purpose of the present work is to develop and validate a series of tests to assess the quality of four-dimensional (4D) computed tomography (CT) imaging as applied to radiation treatment planning. Using a commercial motion phantom and two programmable moving platforms with a CT phantom, we acquired 4D CT datasets on two commercial multislice helical CT scanners using different approaches to 4D CT image reconstruction. 4D CT image data sets were obtained as the platform moves in different patterns designed to simulate various breathing patterns. Known inserts were contoured and statistics were generated to evaluate properties important to radiation therapy, namely phase-binning accuracy, geometric accuracy, volume accuracy, and CT number accuracy. Phase-binning accuracy varied by as much as 5% for a 4D procedure in which images were reconstructed, then binned, but exhibited no variation for a 4D procedure in which projections were binned prior to reconstruction. Geometric distortion was found to be small as was volume error. Partial volume effects in the direction perpendicular to the axial planes of reconstruction affected volume accuracy, however. CT numbers were reproduced accurately, but 4D images exhibited significantly more noise than static CT images. Characterization of such properties can be used to better understand and optimize the various parameters that affect 4D CT image acquisition.