AbstractID: 11536 Title: Geometric Calibration of a Dual Cone Beam CT System with Large Flat Panel Detectors

Purpose: To assess errors in a simple visual alignment of a dual large-flat-panel, cone-beam-CT (CBCT) system, and to obtain misalignment parameters that can be incorporated into image reconstruction for accurate target localization in image-guided radiation therapy (IGRT).

Method and Materials: A dual CBCT system with large flat panels has been developed. Two tube-detector sets are put in the orthogonal position on one optical bench. The designed source-to-detector distances (SDDs) and source-to-isocenter distances (SIDs) are 150 cm, and 100 cm, respectively. The detectors are 40 x 30cm 194μm-pixel Varian Paxscan 4030CB flat panels. A ball bearing phantom was scanned with the system. The centroids of the ball bearing projections were measured on both detectors, and geometrical misalignments were calculated firstly for each tube/detector subsystem. Then misalignments between the two subsystems were determined.

Results: The effects of out-of-plane tilt and skew on the image quality are very limited and have been ignored in our calibration. Calculated in-plane rotations for both detectors were found to be small. Horizontal and vertical shifts off the detector center were 0.06 and 0.02 cm for subsystem I, and 0.2 and 0.02 cm for subsystem II, respectively. Calculated SDDs and SIDs differed from designed values by 0.5 and 0.2 cm for subsystem I, and 0.2 and 0.5 cm for subsystem II. The vertical shift between the two subsystems was 0.12 cm, and the angle between them was 87.6 degrees.

Conclusion: The measurements show misalignments that are sufficient to warrant further mechanical adjustment and/or modeling of misalignment within image reconstruction. Notably the more substantial misalignments include those between the two subsystems.

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