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X-ray Sensor Application for Geometric Calibration and Imaging Acquisition in Cone-Beam Computed Tomography System

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This paper presents how a large area thin film transistor (TFT) x-ray imaging sensor has been applied to calibrate the gantry geometry and acquire x-ray projection images in cone-beam computed tomography (CBCT) system. A cone-beam x-ray tube and TFT imaging sensor could enable imaging of entire organ in one axial acquisition using one rotation of the gantry. The gantry motion could measure, analyze, and calibrate using projection images of five pin-hole phantoms during gantry rotation. The gantry rotation error was calculated by using the difference between reference point and each rotation point after edge detection in the 2D projection image. After gantry calibration, we acquired the projection images from CBCT system for three dimensional (3D) reconstructions. The projection images for the geometric parameters and 3D reconstruction are 361 (30 frame per seconds (fps) × 12 sec per rotation (spr)) with 1o intervals from the same procedures. In this work, amorphous silicon (a-Si) TFT x-ray imaging sensor (PaxScan 4030CB, Varian inc.) having a 397 × 298 mm2 active area with 194 (388) μm pixel pitch and 2048 × 1536 (1024 × 768) pixels in full (2 by 2 binning) mode is applied. 3D reconstruction method for CBCT system uses Feldkamp, Davis, and Kress (FDK) algorithm providing fast reconstructed results.

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