AbstractID: 8699 Title: First implementation of high-resolution dual-detector Region-of-Interest Cone-Beam Computed Tomography (ROI-CBCT) for a rotating C-arm gantry system

Purpose: Region-of-interest cone-beam computed tomography (ROI-CBCT) has the potential to reduce integral dose while providing higher-resolution data in the ROI. Previous work used rotating object geometries. We have implemented an ROI-CBCT system on a clinical rotating C-arm gantry system and have developed methods for combining high-resolution projection data within the ROI and low-resolution, low-dose data outside the ROI.

Method and Materials: High-resolution ROI projection data were acquired of a coronary stent placed in a rabbit using a custom-made, high-sensitivity, microangiographic-fluoroscope (HSMAF) detector (35 micron pixels), attached to the C-arm of a clinical fluoroscopic gantry. Full field-of-view (FFOV), low-resolution data were acquired at the same dose as the HSMAF (standard-dose) and at a lower dose using a commercial flat-panel detector (FPD) (194 micron pixels). HSMAF data were spatially registered with FPD data using cross-correlation techniques. The lower-dose FPD pixel values were matched to the HSMAF values using linear regression. During reconstruction, HSMAF data were used within the ROI, while corrected lower-dose FPD data were used outside the ROI. Reconstructions were performed with HSMAF/lower-dose-FPD and standard-dose-FPD data using geometric calibration data, Parker weights, a Shepp-Logan filter, and a Feldkamp algorithm, generating 512 x 512 x 512 volumes (25 micron voxels).

Results: The dual-detector ROI-CBCT reconstruction exhibits greater detail than that of the FPD alone. The full-width-at-half-maxima of line profiles of stent struts (100 micron diameter) are approximately 150 and 290 microns for the dual-detector and FPD data, respectively. No truncation artifacts are visible. The integral dose of the dual-detector system is 54% that of the standard-dose FPD for this experiment.

Conclusion: High-resolution 3D images of stents implanted in a rabbit are successfully obtained using a new rotating-gantry dual-detector ROI-CBCT system. Resolution is significantly higher and integral dose is lower with ROI-CBCT compared to the standard FPD approach.

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