AbstractID: 8554 Title: Effect of Geometric Unsharpness on the Reconstructed Image in Region of Interest (ROI) µCT

Purpose: To demonstrate the effects of variation of focal-spot size and magnification on the spatial resolution of reconstructed images of a micro-computed tomography (µCT) system which is attached to a standard angiographic C-arm gantry to enable Region-of-Interest cone-beam CT (ROI-CBCT).

Method and Materials: High-resolution ROI projection data of a vascular phantom were acquired using a new high-sensitivity, microangiographic fluoroscope (HSMAF) detector (35 µm pixels), which was attached to the C-arm gantry and able to be positioned in front of a standard full field-of-view, low-resolution commercial flat-panel detector (FPD) (194 µm pixels). The HSMAF consists of a CsI phosphor viewed by a 4-cm diameter light image-intensifier with large variable dynamic range whose output is coupled via a fiber-optic taper to a CCD camera. The test objects in the vascular phantom were a stent (100 micron struts) inside of a catheter in a cylindrical water bath. The phantom was placed on a portable test platform (PTP) enabling CBCT image acquisition by the HSMAF every 1°. Six µCT runs were performed using two focal-spot sizes (0.3 and 0.6 mm) and three magnification factors (1.15, 1.29, and 1.48). Profiles were extracted from the reconstructed struts, and the full width half-maximum (FWHM) were measured.

Results: The reconstructed data show that using the optimal configuration (smallest magnification with small focal spot) compared to the worst configuration (largest magnification and the large focal spot) resulted in a 47% reduction in the FWHM in the object plane (175 µm versus 375 µm).

Conclusion: Micro-CBCT can provide more accurate visualization of fine device features; however, geometric unsharpness and/or large focal spots can substantially degrade resolution reducing the quality of the µCBCT reconstructions.

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