AbstractID: 8714 Title: Automatic registration technique for rotating-gantry dual-detector Region-of-Interest Cone-Beam Computed Tomography (ROI-CBCT)

Purpose: Dual-detector region-of-interest cone-beam computed tomography (ROI-CBCT) can provide high-resolution data within the ROI while reducing integral dose by using low-resolution data outside the ROI to overcome truncation artifacts. However, when using C-arm rotating gantry systems, mechanical instabilities can cause the two detector systems to move relative to one another, resulting in artifacts in the reconstruction. Thus, to provide seamless reconstructions of dual-detector data, we have developed an automated method to register the two sets of detector data.

Method and Materials: High-resolution data were acquired using a custom-made high-sensitivity microangiographic fluoroscope (HSMAF) detector (35 microns pixels), attached to the C-arm using a custom-made support. Low-resolution data were acquired using a standard flat-panel detector (FPD) (194 micron pixels). FPD data were acquired at lower dose than the HSMAF data. Prior to pixel registration, FPD data were interpolated to match the pixel size and geometric magnification of the HSMAF data. Cross correlation technique was employed to align the HSMAF data with the FPD data. The pixel values of the FPD images were then increased to match the level of those of the HSMAF using parameters computed from linear regression of corresponding values. These steps were repeated for each projection.

Results: The average correlation coefficient is approximately 97% after registration compared to 65% prior to registration. Horizontal translation ranges from –100 to –96 pixels and vertical translation ranged from –59 to 71 pixels and varied uniformly with angle. Reconstructions with the dual-detector systems are of high quality and no artifacts could be seen.

Conclusion: The new registration technique gives well-matched images. This technique effectively corrects for any mechanical variabilities between the two runs. This technique is a crucial step for dual detector ROI-CBCT which minimizes artifacts due to misregistered projections would give rise to artifacts when reconstructed.

(Support: NIH-Grants R01-NS43924, R01-EB002873, Toshiba-Medical-Systems-Corporation)