AbstractID: 1642 Title: Geometric calibration of micro-cone-beam CT system

A micro-cone-beam computed tomography (micro-CT) system can produce high-resolution 3D data, but the acquisition geometry must be calibrated with regard to the center of rotation and possible shift due to translation to minimize reconstruction artifacts. Investigators have used calibration methods with dedicated calibration phantoms. We have developed techniques for calibrating the cone-beam CT images using the images themselves without the use of calibration objects.

Projection images of stented/stenosed vessel phantoms were acquired using our micro-CT system. Flat and dark field correction and logarithmic conversion were performed. Exposure variations due to variations in x-ray tube output were determined using unattenuated regions in the projection images. To determine the axis of rotation, we registered antiposed images using cross correlation techniques. Anti-posed projection images are equivalent to within a reflection about the rotation axis, statistical variations, differences in beam hardening and magnification. The center of rotation was determined for each plane perpendicular to the axis of rotation. Trans-axial translations were corrected by detecting discontinuities in the centroid of the sinogram using a derivative technique and shifting the image appropriately.

The shifts in the axis of rotation and translation were determined to an accuracy of 2 and 4 pixels (1 pixel = 43 microns), respectively, resulting in substantial artifact reduction. These techniques provide a method for calibrating the micro-CT system using the images themselves without the use of a calibration object. (Supported by NIH Grants R01NS38746, R01HL52567, R01EB002916, R01EB002873, Toshiba Corporation and Guidant Corporation).