AbstractID: 1939 Title: 3-D Point spread functions in simulated Cone Beam CT imaging- effects of detector blurring

Objective: 3-D Point Spread Functions (PSFs) in Cone Beam CT (CBCT) images reconstructed from simulated projection data are computed and used to quantify and characterize the effects of detector blurring

Method: CBCT imaging was simulated on a 24 2.4 GHz dual-Xeon PC cluster. Selected points in the reconstructed image space were projected onto the detector, sampled and then blurred with a Gaussian function representing detector blurring. Images were reconstructed using the Feldkemp algorithm with 45 CPUs each processing 10 projection views. The processed data were then forwarded back to the master node to combine into the reconstructed images. PSFs were plotted and analyzed to study their dependence on the pixel/voxel sizes, image acquisition and reconstruction geometries, number of projection views, detector blurring function. The feasibility to use PSFs to predict blurring of the reconstructed images by convolving the object with the PSFs was studied.

Results: In absence of detector blurring, the PSFs have a Full Widths Half Maximum (FWHMs) of ~2 pixels. With detector blurring added, the FWHMs of the PSFs were determined mainly by the FWHM of the blurring function. Images reconstructed from blurred projection data were compared and found to be identical to the object convolved with the PSFs. Detector blurring was also found to cause underestimation of the attenuation coefficients with the extent depending on the object size and the FWHM of the blurring function.

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