

AbstractID: 3928 Title: A Volume-of-Interest (VOI) scanning technique for cone beam breast CT

Purpose: To demonstrate that high quality cone beam CT images can be generated within the volume-of-interest (VOI) and to investigate the dose saving with the VOI scanning technique.

Method and Materials: The VOI scanning technique was investigated using both computer simulation and imaging experiments. To implement the VOI scanning technique, an additional filter is inserted between the x-ray source and the breast. The filter has a circular or rectangular opening to deliver a higher level x-ray exposure to a selected spherical or cylindrical VOI and a lower level exposure to the region outside the VOI. To prepare for reconstruction, a non-uniform reference image acquired with the VOI filter in but with the object out is used to normalize the projection images and measure the object attenuation only. Since the non-uniform attenuation by the VOI filter is modulating both the reference and projection images, it cancels out in the computed transmittance image. Regular Feldkamp filtered backprojection technique is used to reconstruct the 3-D images. Dose saving factor was estimated by tallying x-rays going through the VOI, thus delivered at high dose level, and dividing the result by the total number of x-rays backprojected to an image voxel.

Results: Images from both simulation and experimental studies show that during VOI scanning, an exposure reduced by a factor of up to 50 can be delivered to areas outside the VOI without compromising on the accuracy of image reconstruction, allowing for a small VOI in the breast to be imaged with more clarity or lower dose to the rest of the breast. However, dose saving becomes less significant when the distance between the voxel and the VOI decreases.

(This work was supported in part by a research grant CA104759 from the NCI and a research grant EB-00117 from the NIBIB)