AbstractID: 8789 Title: Comparison of breast-centered and Volume-of-Interest (VOI)-centered VOI cone beam CT techniques – dose and scatter considerations with Monte Carlo simulation

Purpose:
To evaluate and compare dose saving and scatter reduction properties of VOI-centered and breast-centered approaches to VOI cone beam CT with Monte Carlo simulation.

Method and Materials:
To implement the VOI scanning technique, a mask with an opening is inserted between the x-ray source and the patient to deliver higher exposures inside the VOI and lower exposures outside the VOI during the scan. There are two approaches to implement this technique. One is to center the breast with the rotation axis and move the VOI mask to track the VOI. The other is to center the VOI with the rotation axis, thus keeping the VOI mask fixed during the scan. A cylindrical breast model with a VOI close to the breast boundary was constructed to evaluate and compare the two approaches with Geant4 based Monte Carlo simulation. Dose distribution in the breast and scatter-to-primary ratios (SPRs) at the detector input were evaluated and compared to those estimated for full field cone beam CT.

Results:
Both VOI scanning techniques significantly reduce the radiation doses and scatter intensities both inside and outside the VOI. However, dose saving with the breast-centered approach was approximately twice as much as that with the VOI-centered approach both inside and outside the VOI. SPRs inside the VOI were similar for the two approaches and varied little with rotation degree.

Conclusion:
The breast-centered scan appears to be the preferred approach to VOI cone beam CT because it resulted in substantially better dose saving while similar scatter reduction as compared to the VOI centered approach. Effort to implement this technique is underway to demonstrate this technique and to validate the simulation results.

Acknowledgement:
This work was supported in part by grants CA104759 and CA124585 from NIH-NCI, a grant EB00117 from NIH-NIBIB, and a subcontract from NIST-ATP.