AbstractID: 6620 Title: Dose saving and scatter reduction in Volume-of-Interest (VOI) cone beam CT- a Monte Carlo simulation study with Geant4

Purpose:
To estimate and study the dose saving and scatter reduction properties of the VOI cone beam CT technique.

Method and Materials:
To implement the VOI scanning technique, a filter with a circular or rectangular opening is inserted between the x-ray source and the patient to deliver a higher level x-ray exposure inside the VOI and a lower exposure level outside the VOI in acquiring the projection images. This technique is expected to result in higher image quality inside the VOI with lower entire patient dose and significantly lowered scatter-to-primary ratios (SPRs) within the VOI. Modeling the patient as a cylinder of soft tissue, we have developed Monte Carlo simulation programs based on the Geant4 package to estimate the dose to the patient and the SPRs at the detector input. Simulation was performed at selected locations to estimate the variation of the dose level and SPRs from inside to the outside of the VOI. Simulation was also performed to estimate the reduction of the dose levels and SPRs with the VOI scanning technique as compared to full field cone beam CT.

Results:
Our simulation results show that with the exposure level reduced by the VOI filter, dose levels for the entire scan were significantly reduced both inside and outside the VOI. Scatter intensities at the detector input were also shown to decrease significantly both inside and outside the VOI in the projection images.

Conclusion:
Our simulation study successively demonstrated the ability of the VOI scanning technique to reduce patient dose and x-ray scatter for improved image quality.

Acknowledgement: