AbstractID: 8926 Title: A new X-ray scatter estimation and correction method for kilo-voltage cone beam CT assisted by Multislice CT scans

Purpose: To estimate and correct for the x-ray scatter on the flat panel detector on kV cone beam CT (CBCT) image acquisition, assisted by the original 3D volumetric image set acquired using multislice (MS) CT scanner.

Methods and materials: Flood field from the CBCT flat panel detector is stored on the On Board Imager (OBI) workstation. Using the flood field together with the image acquired from MSCT scanner (GE LightSpeed PET/CT) prior to any treatment, the scatter-free cone beam projection at each projection angle is estimated. Subtracting this estimated scatter-free projection data from the cone beam CT projection at the same angle gives us the x-ray scatter fluence plus uncertainties due to patient positioning and organ motion. Note that scatter has majority of low frequency components with high magnitude and patient positioning and organ motion has mainly high frequency components with very small magnitude. The calculated fluence is smoothed out using a low pass filter for eliminating high frequency signals to get pure scatter fluence. For the rest of CBCT scans during treatment, subtracting the estimated scatter fluence from CBCT projections in each scan yields an estimate of scatter-free projections for image reconstruction. Simulations were performed on mathematical phantoms. Scatter and organ motion were introduced into the projections. After applying the above algorithm, the images were reconstructed using FDK algorithm. These images were compared to the uncorrected images and percentage decrease in variance in the images was tabulated. Image quality at various aspects was analyzed.

Results and conclusions: Filtering techniques are sufficient to extract the low-frequency components from the subtracted signal to estimate the scatter fluence. This scatter correction strategy is patient specific and provides considerable improvements in image quality, especially for correcting the cupping artifact.