

AbstractID: 5545 Title: Minimizing scatter artifact in cone-beam CT reconstruction using both kilovoltage and megavoltage beams

Purpose:

To study the effect of imaging orientations on image quality of aggregated conebeam CT and to develop a strategy to minimize scatter artifact.

Method and Materials:

Orthogonal kilovoltage (kV) and megavoltage (MV) beam projections were acquired and used to reconstruct kV/MV aggregated CT images. With a 15-degree fan-beam angle, only 105-degree gantry rotations needed to obtain a minimal scan coverage. Besides its short scanning time, the new scan technique has the advantage of getting high soft-tissue contrast from kV beams and low scatter artifacts from MV beams. The kV and MV projection images were obtained by using a kV on-board imager and MV portal imager mounted orthogonally on a Varian-21EX LINAC. A linear model was established to fit the kV and MV attenuation values over the 15-degree overlap region. MV projections were then converted into kV-equivalent ones.

Aggregated CT images were reconstructed from both kV and converted MV projections jointly, using the filter-back projection method.

Results:

Using 8 different kV/MV orientations, we reconstructed 16 aggregated CT images for two phantoms, eight for each one. Each image was registered to its corresponding simulator-CT image from a GE LightSpeed-RT simulator. The reconstructed images show good contrast for both bones and soft-tissue. However some of them have relatively severe scatter artifacts. We calculated the normalized mutual information (NMI) between the aggregated CT and simulator CT images. The NMI exhibits a sinusoidal oscillation when plotted against the gantry start angle. The two maximums correspond to the two imaging orientations with kV (or MV) beams through the thinner (or thicker) side views of the phantoms, indicating that scatter from kV beams has more impact on image quality than MV beams.

Conclusion:

A strategy has been developed to determine the optimal imaging orientation for aggregated kV/MV CBCT.