AbstractID: 3875 Title: Local tomography using adapted Feldkamp and Expectation Maximization Algorithms

Purpose: There has been much interest utilizing megavoltage CT to verify patient positioning in conformal radiation therapy. Local tomography methods have been proposed for reconstructing tumor volumes. In this work, we use simulated and experimental phantom projection data to investigate and compare 3D local tomography approaches based on the Feldkamp-Davis-Kress (FDK) and Expectation Maximization (EM) reconstruction algorithms.

Method and Materials: We have implemented numerically local tomography versions of the EM and FDK reconstruction algorithms. An ensemble of numerical phantoms was created that contained structures of varying size and contrast. Multiple noisy simulated data sets were computed. Untruncated experimental projection data corresponding to a head and torso phantom were also acquired. From these data sets, truncated data were created by keeping only subsets of the complete data. 3D images of the tumor volumes were reconstructed by use of the local FDK and EM algorithms. The reconstructed images were assessed visually to determine if the boundaries and interfaces within the tumor volume were reconstructed accurately. The contrast of the reconstructed boundary information was quantified.

Results: For the low-noise data sets that contained a large number of uniformly spaced projections, the local FDK algorithm produces images that had better boundary contrast than those produced by the EM algorithm. However, the EM algorithm reconstructed images with reduced artifact levels when the projections contained high noise levels and were few in number.

Conclusion: In many applications of MV CT, the number of truncated projections is limited. In these cases, the EM is more appropriate than the FDK algorithm for reconstructing geometric information regarding the tumor volume. However, the local FDK algorithm is better suited for reconstructing low contrast boundaries when the number of acquired projections is sufficient.

Conflict of Interest (only if applicable):