AbstractID: 3789 Title: Megavoltage CT Image Characterization, Quality, and Enhancement

Purpose:
The use of Image-Guided Radiation Therapy (IGRT) has increased dramatically over the past five years. The purpose of this work was to evaluate quality of Megavoltage CT (MVCT) image and to develop methods for image enhancement.

Method and Materials:
The accuracy of MVCT imaging was measured using repeat imaging of an anthropomorphic head phantom in a known geometry. A technique for improving Image quality was developed using stable iterative deconvolution technique that utilizes that obtains an estimated inverse linear filter for a given instrumental response function or point spread function.

The investigators also developed a technique for reconstructing 4D MVCT images. Image data was collected axially with the couch stationary during the imaging of each slice. The detector data was over-sampled to capture different phases of respiration. The data corresponding to each projection was then re-binned data and reconstructed for each phase of the respiration cycle

Results:
The Tomotherapy image-guidance software yielded total imaging system errors of ±0.6 mm, ±0.5 mm, and ±0.6 mm with the automatic image fusion algorithm set to “Bone”, “Bone and Soft Tissue”, and “Full-Image” respectively. Deconvolution image enhancement was performed on MVCT images of a prostate patient sharpened high contrast landmark. This increased the contrast resolution of bone, bowel gas, and soft tissue. 4D image reconstruction was also used to eliminate motion artifices from motion phantom.

Conclusion:
The MVCT images acquired on a helical tomotherapy delivery system have the positional accuracy to position the dose distributions to within 1-mm of the desired position using the current clinical system. Deconvolution image enhancement has been used to improved superior-inferior contrast resolution, and respiration artifacts have been corrected with retrospective 4D image reconstruction.

Conflict of Interest:
Research supported by TomoTherapy, Inc.