

AbstractID: 2902 Title: Slice based image guidance with tomotherapy

Purpose: To improve the temporal resolution of image guided radiation therapy with slice based CT images from treatment beams of tomotherapy. In slice based image guidance (SBIG), the patient position would be monitored nearly concurrently at the time treatment.

Methods and Materials: The experiment was performed on a benchtop tomotherapy (BT) and on a regular TomoTherapy Hi.Art 2.0 (TH2). BT consists of a 6MV source, a kV source, a standard CT detector and an actuator. A Rando phantom was scanned by BT with two different dose levels of 1 cGy and 0.1 cGy and a ROI was contoured on the lower dose image. The treatment beams that delivered conformal dose to the ROI were used to filter the sinogram of the higher dose scan. Based on multi-resolution analysis, the incomplete filtered sinogram was locally reconstructed to obtain ROI, which was fused back to lower dose image. A similar process was repeated with lung phantom on the TH2 with MLC modulation. The number of projections for BT is 600/rotation and for TH2 is 51/rotation.

Results: Images reconstructed from the conformal beams on BT shows that without additional beams, the ROI can be reconstructed with good quality. Fine structures with width of 2-4 mm are clear. The MLC reproducibility is higher than 99.97% but the ROI image from TH2 was degraded by severe artifacts.

Conclusion: The fusion image from BT suggests that a positioning accuracy of 2mm is achievable. The SBIG image from TH2 shows substantial artifacts, which mainly because that the number of projections are too few and the scatters from the multi-leaf collimator. The first problem can be solved by using pulses instead of the 51 angles from optimization. The second problem would require a modified optimization by adding conformal beams without MLC modulation.