

AbstractID: 13043 Title: Influence of Dose Grid Resolution in Cumulative Dose Computation for 4D Inverse Planning

Purpose: To perform a 4D inverse planning optimization, 4D dose accumulation to each organ subvolume is essential. The dose grid resolution applied in the numerical dose calculation could be sensitive to the final treatment plan due to the interpolation and re-sampling of the displacement and planning dose distribution. This study is to evaluate the sensitivity of two typical dose resolutions in computing cumulative dose for 4D inverse planning.

Method and Materials: Two dose grid settings for cumulative dose computation were evaluated. One was set same as the planning dose grid with 4mm resolution. The other was chosen such that each cumulative dose grid voxel was exactly coincided with an image pixel to match the resolution of deformable displacement. Results from the second setting were set as baseline in evaluation. Two 4D inverse plans for lung cancer patients (phases: 10 and 8; tumor volume: 6.0cc and 7.1cc; tumor motion excursion: 1.9cm and 2.9cm) and one 4D adaptive plan for Head Neck cancer patient (9 daily images, CTV volume 258cc) were used in evaluation. The cumulative dose discrepancy between the two settings was evaluated for optimization step and final dose calculation. A single mean image was used in Pinnacle³ for dose calculation purpose during optimization. However, the dose was re-calculated based on each phase image for accumulation.

Results: The difference for the maximum dose and Equivalent Uniform Dose are less than 1.0% for all the cases. The difference for the minimum dose was 2.5%, -0.4% and -3.0% in the final dose calculation, while 1.3%, -0.6% and -2.9% during planning optimization for the three plans respectively.

Conclusion: Using 4mm resolution in cumulative dose computation may cause 3% discrepancy. It is recommended to use image pixel resolution for the calculation of cumulative dose in 4D inverse planning.

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