AbstractID: 5348 Title: Investigation of Simple IMRT Delivery to Stage I Lung Cancer Patients with Significant Respiratory Motion Using Respiratory Gated CT Scans

Purpose: To investigate the use of IMRT for the treatment of stage I lung cancer associated with significant respiratory motion using 4DCT data.

Method and Materials: A 4DCT scan - covering a full respiratory cycle in 10 phases - of a patient with a 1.8 cm diameter lung cancer was used to design several static step-and-shoot IMRT plans. Three plans were designed: two using snapshots of the tumor (mid-inhale, full-exhale), one using the superposition of all phases. Because of the significant tumor motion (maximum excursion of 2.5 cm) the effect of different margins around the CTV were studied. To reduce interplay between the MLC movement and respiratory motion in an ungated delivery, the number of intensity-levels was minimized while maintaining coverage to the PTV and minimizing dose to OARs.

Results: In this case-study five-field IMRT plans were generated using 18 MV photons delivering a total dose of 66 Gy in 33 fractions to the PTV. Plans based on snapshot scans of the lung only resulted in full coverage, if large margins (3 cm) were incorporated. All plans based on superimposed scans achieved full coverage, while allowing tight margins and minimizing the dosage to OARs. A small number of intensity-levels (3-5 per beam) were sufficient for PTV coverage, thereby reducing the risk of unwanted interplay effects between MLC movement and respiratory motion.

Conclusion: Using snapshot free-breathing CT scans for treatment planning can lead to geometrical misses and underdosage of the target volume unless large PTV margins are applied at the expense of increased dose to OARs. Taking the superimposed CT scans of all respiratory phases for treatment planning ensures the full coverage of the tumor volume, without increasing dose to OARs. For this case-study only a small number of segments were needed, allowing the application of IMRT despite significant tumor motion.