AbstractID: 2923 Title: Impact of Respiratory Motion on Dose Distributions and DVHs of Thoracic Structures – Evaluation Using 4DCT

Purpose: Respiratory motion may have effect on dose distributions and DVHs of thoracic organs and tumors themselves. The purposes of this work are to determine (1) changes of doses and DVHs with respiration; (2) actual doses delivered to these structures upon completion of one treatment fraction.

Method and Materials: Ten non-small-cell lung cancer cases were selected, all had free-breathing fast CT and 4DCT scans during normal breathing. These cases had acceptable breathing regularity and 4DCT image quality, sufficient motion of tumor and lung, and inclusion of entire lung. All cases were treated with 3D (8 cases) or IMRT (2 cases) techniques. Lung volumes were outlined on all respiratory phases consistently using a single CT-number threshold. Dose distributions were re-calculated for all phases, with DVHs obtained for each structure on all respiratory phases. For cases with significant changes of lung DVHs, deformable image registration was used to calculate total cumulative dose distribution combining all phases.

Results: The overall dose distributions were rather insensitive to respiration for both 3D and IMRT beams except extreme cases with diaphragm moved in/out of beams. Thus, change of DVH for static structures (e.g. cord) was often insignificant. Large changes of lung DVHs were observed only for half of the cases, the degree of which was affected by tumor location and volume, and lung motion. Changes of PTV and heart DVHs were mainly caused by their translational movements. Use of free-breathing CT was inadequate to represent moving anatomies and could cause spurious results, whiles mid-inspiration CT provided the best estimate of average lung volume, mass, and dose distributions.

Conclusion: Though dose distributions did not change significantly with breathing for photon treatments, variations of DVHs for thoracic structures were more complex and had to be assessed for individual patients and structures.