AbstractID: 5110 Title: Tumor Motion Ranges Due to Respiration

Purpose: The purpose of this study is to develop a method to estimate the patient-specific clinical accuracy and safety of adaptive SBRT after treatment delivery. Respiratory motion phantoms rely on continuous knowledge of the in-vivo tumor position, which does not exist for the time needed for adaptive SBRT delivery. A first approximation is to study the tumor motion range as predicted by the adaptive SBRT delivery system during treatment and compare the motion range to published literature.

Method and Materials: The predicted tumor motion was analyzed for 48 patients with 52 tumors. The database contains 28 tumors in the lung, 4 hilar tumors, 9 pancreases, 2 each in liver and chestwall, and one each renal, retroperineal, and internal mammary nodes. The mean and variance of tumor motion amplitudes were calculated using MatLab. Normal distributions were fitted to a respiratory extrema amplitude histogram.

Results: The motion ranges for most sites agreed with the literature. The largest motion amplitudes of 12 to 28 mm were observed in the lower lung. Fluctuations about the average motion ranges are mostly small. 50% of tumors in the upper and middle lung and hilum could have been treated without adaptive SRS using 2 mm PTV margin. This would have reduced the risk to patients caused by fiducial placement. The extent of motion in the pancreas is smaller than cited in the literature.

Conclusion: We analyzed tumor respiratory motion ranges under free breathing during adaptive SBRT. Certain patient subgroups could have been treated with non-adaptive SBRT and therefore with reduced risk from fiducial placement, if the extent of the tumor motion could have been determined before treatment by 4D imaging. Tracking problems due to sub-optimal fiducial placement may lead to problems in tumor motion prediction, which can be discovered by our analysis method after the first treatment.