AbstractID: 9690 Title: Robust Optimization for Lung Treatment in the Presence of Dosimetric Errors

Purpose: Intensity modulated radio therapy (IMRT) has the ability to deliver highly conformal dose distributions to tumors of complex shape. Uncertainties, such as breathing motion, can substantially degrade the quality of an otherwise optimized treatment plan. Furthermore, the quality of robustly optimized plans significantly depend on how well the underlying dose calculation matches the actual delivered dose to the treated organ.

Method and Materials: We present two planing concepts for IMRT using robust optimization techniques. The first concept relies on pencil beam based calculation of the delivered dose. The second method employs Monte Carlo dose calculation. The robust optimization techniques seeks to minimize the expectation value of the deviation of the delivered and prescribed dose with an uncertainty model relying on several random variables.

Results: When comparing the deposited dose of one pencil beam using Monte Carlo calculations of up to 10^7 particles to dose calculations using pencil beam based algorithms, we observe a significant laterally scattered dose that is not capture with simple pencil beam algorithms, amounting to up to 30%. Furthermore, a comparison of the dose before and after sequencing reveals errors of up to 5%. We developed a novel robust optimization algorithm that provides optimized IMRT plans which are inherently robust against dosimetric errors.

Conclusion: If the treated structure does not reveal significant inhomogeneities, using a computationally less expensive pencil beam calculation can allow for other ways treatment optimizations, such as beam-angle optimization, that are otherwise not accessible without extensive approximations.