AbstractID: 3408 Title: First Evaluation of a new multicriteria optimization tool - Investigation of Pareto-surfaces for IMRT prostate plans

Purpose: The aim of this paper is a first evaluation of the performance of a new multi-criteria optimization (MCO) tool developed for IMRT treatment planning
Method and Materials: The new MCO-tool computes a set of Pareto-optimal plans by simultaneously minimizing dose indicators for tumor targets and considered organs at risk. For the tumor, the dose homogeneity in the target is maximized for a given, prescribed mean dose while relative deviations to upper equivalent uniform dose (EUD) limits are minimized for organs at risk. The exploration of the solution space is done with a visual navigation tool, which provides control bars for each defined dose indicator. The navigation tool uses real-time interpolation to allow a smooth transition between the pre-computed plans. As a clinical example we consider a simplified prostate case where the only structures to be optimized are the PTV, rectum and bladder. The complete database of plans is visualized using EUD-values of the organs at risk and the standard deviation of the target dose as axes. This approximation of the 3D-Pareto-surface is then examined. The sensitivity of the navigation process on the individual dose indicators is analyzed in terms of the gradients on the Pareto-surface. Moreover, effects of rescaling the target dose homogeneity in terms of TCP-values are analyzed.
Results: The database provided by the MCO optimization for the simplified prostate case can indeed be presented as a 3D-Pareto-surface.The sensitivity of the navigation process is well reflected by the respective gradient on the Pareto-surface. The rescaling of the target dose homogeneity in terms of TCP values allows studying the sensitivity of the Pareto-surface in terms of the assumed radio-sensitivity of the tumor.
Conclusion: A first evaluation of a new MCO-tool has been successfully completed for a simplified prostate case with 3 mutually conflicting optimization criteria.