

AbstractID: 3943 Title: Biological optimization of fractionated IMRT using fraction groups

Purpose: To describe software for biological optimization of fractionated IMRT where the fluence profiles are not restricted to be identical for all fractions and to investigate the impact of fractionated time-dependent response functions on the optimization result.

Method and Materials: If the fluence profiles of all beams in every fraction are optimized the number of variables is proportional to the number of fractions. Each new fraction consumes memory and slows down the optimization. In order to reduce the number of variables similar fractions are assigned to the same fraction group. The same fluence profile is delivered for every fraction in a fraction group. To test the method the Poisson-LQ model is extended with a time-dependent bi-exponential repair model.

Results: In all tests the NTCP was minimized while the TCP was kept constant. If the time between consecutive fractions is long enough to cause complete repair there is not much gain in optimizing several fraction groups. In the case of incomplete repair, the NTCP was reduced by assigning Monday morning and Friday afternoon to a second fraction group. Adding more fraction groups did not improve the response significantly.

Conclusion: The use of fraction groups enables an efficient implementation of IMRT-optimization of a fractionated treatment and makes it possible to study time-dependent biological models. In the case of Poisson-LQ with repair, two fraction groups can improve the biological response. This is only true in the case of incomplete repair and the impact of the fractionation depends on the repair half times.

Conflict of Interest: Some of the authors are employees and some are stock owners of the submitting company.