AbstractID: 5090 Title: Relationship of EDU-based and dose-based plan optimization

Purpose: The essence of inverse planning is how to rank objectively the competitive treatment plans. The purpose of this work is to show the equivalence of recently introduced EUD-based and the conventional dose-based objective function and to setup a unified framework in the dose domain for IMRT inverse planning.

Methods: The dose-based objective function such as the quadratic function treats each voxel within a structure equally, whereas the EUD-based objective function aims to take into account of dose-volume effect when ranking the candidate plans. For the conventional approach to accomplish what an EUD method does, we partially "break" the implicit constraint that a structure is a mathematically uniform entity with all voxels having the same identity and assign each voxel a voxel-specific ranking (or penalty scheme). Algorithmically, this is accomplished by assigning a voxel-specific importance or a voxel specific prescription dose. The seemingly insolvable task of determining a large number of voxel-specific importance/prescription is dealt by heuristically relating them to the actual local doses. We show that this strategy is a more general ranking scheme, which can not only model the volumetric behavior but also the higher order factors beyond the dose-volume effect. EUD and other dose-volume formalisms represent special cases of the general framework.

Results: A unified inverse planning framework is established for inverse planning. By assigning higher importance to the voxels within the target volume but close to the margin with a critical structure, while simultaneously assigning higher importance to the voxels within the critical structure close to the target volume, the dose to the target volume is dramatically improved in comparison with the conventional approaches.

Conclusions: The EUD-based approach can be reformulated into the realm of conventional dose-based formalism without using biological parameters. The formalism allows us to design IMRT plans that would otherwise be unattainable.