AbstractID: 1760 Title: Intuitive Multicriteria IMRT Optimization Using a Lexicographic Approach

The process of IMRT optimization often involves making clinical decisions based on tradeoffs among multiple objectives. Such tradeoffs exist not only for structures having competing objectives (e.g., minimize under-dose of the treatment targets and over-dose of the organs at risk), but also for those having similar objectives (e.g., minimize dose to the normal tissue and to the critical organs). When the number of structures involved in an IMRT plan becomes large, it is often challenging to articulate clinicians' preferences on optimization objectives in an intuitive and quantitative manner with a conventional weighted-sum approach. Therefore, addressing this challenge, a multi-criteria programming concept called *Lexicographic ordering* (preemptive approach) has been implemented for non-linear objectives such as DVH constraints, and its performance has been evaluated for various clinical cases. In this method, clinical objectives are categorized into several priorities or levels. Optimization is performed for each level in order of priority while keeping the previously optimized results constrained. As a result, the feasible solution region is gradually reduced as the method progresses until an optimal solution is found. Non-linear objectives and constraints are explicitly handled by *Sequential Quadratic Programming* and good convergence was achieved with stable Jacobian calculations at a machine-precision level by *Automatic Differentiation* tools. Results indicate the Lexicographic method can facilitate the articulation of preference intuitively and produce both feasible and optimal results for IMRT cases.