

## AbstractID: 13158 Title: Making Controlled Tradeoffs Between Competing IMRT Goals using Lexicographic Ordering

**Purpose:** To use an intuitive multi-criteria optimization method called lexicographic ordering (LO) to facilitate controlled tradeoffs between competing objectives in IMRT and to show its utility in choosing between the competing factors of beam complexity and plan quality.

**Method and Materials:** The LO method optimizes plans according to priority levels with the goals in each prior level dominating the subsequent level. To create a reasonable set of candidate plans for a physician to navigate through, tradeoff scenarios are designed before optimization and then realized by relaxing achieved objectives in a baseline plan. To demonstrate this process, tradeoff scenarios between beam complexity and plan quality were designed by a radiation oncologist and applied to a prostate case. The first scenario applied smoothing as the final optimization priority to determine the intensity modulation reduction possible without affecting plan quality. Subsequent scenarios applied relevant concessions that were deemed acceptable to improve delivery efficiency. Smoothing was promoted by a diffusion-based method that penalizes modulation based on the sensitivity of the plan goals to each beamlet value.

**Results:** With minimal optimizer input, plans representing clinical tradeoff decisions were created during optimization. In a prostate case, 11 tradeoff scenarios between beam complexity and dosimetric quality were optimized. Smoothing as the final LO priority resulted in 15% MU reduction without sacrificing any clinical objectives. Tradeoffs in other priority levels resulted in MU reductions of up to 27%. For example, allowing a 2-4 Gy increase in normal tissue mean dose reduced MU by 21%.

**Conclusion:** The use of the multi-criteria LO method permitted controlled tradeoffs to be chosen between competing plan objectives before optimization. In an example, this allowed the construction of a manageable library of realistic plans to assist the physician in making an informed tradeoff decision between IMRT plan complexity and plan quality.

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