AbstractID: 9231 Title: An Efficient Approach To Volumetric Modulated Arc Therapy Optimization and Sequencing

**Purpose:** To develop and evaluate an efficient algorithm for inverse treatment planning of volumetric arc therapy (VMAT). **Materials and Methods:** VMAT plans were generated by first applying a direct machine parameter optimization algorithm from a research version of a commercial treatment planning system (Pinnacle 8.1v) to 18 beams spaced equidistantly at 20 degrees. At each beam angle, the number of segments was variable (typically 3 to 8) to match the intensity modulation fluence map. Low weight or small area segments were eliminated during optimization. The resulting segments were redistributed around the arc such that each individual segment was at a unique arc angle. Segments were sorted according to shape similarity in order to reduce leaf travel in between arc angle positions. To ensure accuracy of the final dose calculation, additional interpolated segments were generated, followed by a segment weight optimization to identify beam-off segments that would otherwise conflict with plan objectives. The approach was evaluated for six cases (three head-and-necks, two prostate, and one brain) with respect to treatment delivery time, and overall plan quality in comparison to step-and-shoot IMRT using a conventional number of static beams and identical objectives and constraints as in the VMAT case. **Results:** The dynamic arc plans consistently demonstrated target coverage and critical structure sparing comparable to step-and-shoot plans. For the head-and-neck cases, sparing of the brainstem and the spinal cord could be improved substantially. Treatment parameter optimization and dose calculation required 15 to 20 minutes on standard hardware. Estimated delivery times were between 1.5 and 4 minutes, which is mainly determined by the leaf trajectories, gantry speed and dose rate. **Conclusions:** A method for inverse planning for VMAT delivery was developed. The method produces treatment plans with high dosimetric quality and efficient delivery time with clinically feasible user time and effort.