AbstractID: 8387 Title: A system to dynamically balance dose sparing between critical structures in Intensity Modulated Radiation Therapy (IMRT)

Purpose: The IMRT treatment planning optimization process typically follows one, somewhat arbitrary, path, based on the manner in which the planner changes the optimization constraints/weights during planning. Thus, the planner usually never fully understands the trade-off in doses between structures and, thereby, can not optimally distribute critical structure dose sparing. We present a system that enables the planner to generate an optimally balanced plan in real-time by fully exploiting dose exchange between critical structures. **Methods and Materials:** The system uses pre-optimized fluences that are generated automatically. An initial baseline optimization is generated by "restricting" doses out of all critical structures equally. From this baseline, optimizations are generated for each critical structure further restricted, with all other critical structures completely relaxed to absorb excess dose (the optimizations explicitly respect target constraints) The fluences during the restricting process are stored, providing a history of the pathway taken by the optimization. A fast strategy is used to generate these optimizations prior to planning. At the time of planning, the system enables the planner to dynamically combine the pre-computed dose distributions corresponding to the extent that they would like each critical structure to be spared. The results are displayed in histogram-like form, allowing the planner to evaluate and dynamically balance critical structure dose sparing. **Results:** The system is illustrated for prostate and paranasal sinus cancer cases. In the prostate case, below a certain extent of rectal and bladder dose sparing, decreasing dose to one structure leads to increasing dose to the other structure. In the paranasal sinus cancer case, lowering the dose below the baseline optimization results in dose trade-off between the the left eye/optic nerve, chiasm, right optic nerve, and left/right temporal lobes. **Conclusion:** The system presented here enables maximized dose sparing by optimally balancing IMRT doses between critical structures in real-time.