# AbstractID: 7670 Title: A Distributed-Computing Framework using Nested Partitions for Beam-Angle Optimization in IMRT

**Purpose: Commercial IMRT treatment planning software currently solves the dose optimization (DO) problem, but does not consider additional variables, such as gantry, collimator, or couch angles. These parameters are generally specified by clinicians based on experience, and are often arbitrary and suboptimal. Including the additional variables in the treatment planning process increases the size of the combinatorial problem, and would require access to vast computational resources and novel optimization techniques. We have formed a collaboration with a leading academic supercomputer center and implemented the Nested Partitions (NP) algorithm, a versatile and efficient method, to produce IMRT plans which employ optimal beam angles.**

**Method and Materials: NP is a metaheuristic algorithm which is flexible enough to guide the search of a heuristic or deterministic dose optimization algorithm, and is well suited for implementation on distributed-computing platforms. We implemented the NP framework in conjunction with the dose-optimization algorithm employed in a commercial treatment planning system. We performed a study on a 5-field prostate case by executing the programs on four machines simultaneously, and evaluated the resulting treatment plans based on DVH constraints for the target and critical structures.**

**Results: After only three iterations of the NP algorithm, the resulting plan realized an improvement of 14% in a measure of beam-angle-sample quality over a clinical plan employing equi-spaced beams. Since each iteration was implemented simultaneously on multiple machines, a decrease in execution time by a factor of about 4 was observed.**

**Conclusion: Including additional variables, such as beam angles, in the IMRT optimization problem results in a vastly increased search space. However, our results indicate that the use of a distributed-computing platform combined with a powerful metaheuristic optimization algorithm can result in treatment plans which provide better target coverage and normal tissue sparing, and can be generated more efficiently than those currently produced.**