

AbstractID: 13146 Title: A Beam Angle Selection Algorithm for Particle Therapy

Purpose: To develop a beam angle selection algorithm for proton and ion beam therapy.

Materials and Methods: The goal of our optimization is to find beam arrangement that minimizes the number of violations of the following conditions: (1) Avoid placing beam spots next to the critical regions along the beam path. (2) Beam path should avoid going along the boundary of density inhomogeneities. (3) Beam path should avoid high Z, high density regions, which tend to have higher CT uncertainties. (4) Beam path should avoid going through critical targets whenever possible. Once an optimal beam angle configuration was found, the final plan was calculated using an in-house treatment planning system for beam spot weight calculation and final plan optimization.

Results: The algorithm was applied to a Head and Neck case. The results were compared with two non-optimized beam arrangements and the impact of set up uncertainties was also studied. We found that the proposed algorithm delivered a PTV coverage that was robust with respect to set up uncertainties. We also found that it improved significantly the levels of OAR sparing specially in the region of low and medium doses and that these results did not change significantly once set up uncertainties were taking into account.

Conclusions: A beam angle selection algorithm for proton and ion beam therapy was developed. The results showed that it could significantly improve the quality and the robustness of the treatment plans. It was also shown that even small beam angle variations might enhance the quality of a plan and that the use of BAO techniques is justified even for facilities with a fixed beam line where the treatments are coplanar.