AbstractID: 4981 Title: Energy and intensity-modulated radiation therapy using protons. To optimize or not to optimize?

Purpose: Development of a robust and time efficient 3D beam scanning technique in proton therapy opened up a possibility for utilizing particle beams for intensity-modulated radiation treatments. Just like for conventional inverse-planning using photons, an intensity-modulated technique for protons would also require performing time-consuming beamlet optimization calculations ultimately leading to laborious intensity-modulated beam delivery process. The purpose of this study is to show that with a "wise" choice of beam orientations, determined from the requirement that a given beam traverses as little volume of critical structures as possible, it is feasible to achieve superior patient dose distribution without resorting to time-consuming optimization procedure.

Method and Materials: Monte-Carlo calculations using track-repeating technique were used to perform comparative studies between proton plans that involve inverse optimization calculations and those that are based only on a forward planning. The energy modulation calculations that allow delivering constant dose distribution throughout the depth extent of the target were carried out in both delivery methods. Two clinical cases of lung and head-and-neck tumors were chosen to perform this study.

Results: We have inter-compared the dose distributions between intensity-modulated and forward based planning techniques for proton beams for two different clinical lesions. The distribution of isodose lines and DVH histograms for both methods suggest that with intelligent choice of the beam numbers and beam angles it is possible to generate patient dose distribution that is comparable to that obtained from the inverse treatment planning optimization.

Conclusions: Because of the possibility to modulate the dose in the depth dimension for proton beams, it is feasible to achieve superior dose distribution without resorting to time-consuming inverse planning. This suggests that the intensity modulated optimization calculations may not need to be employed for proton beam treatment planning.