AbstractID: 8957 Title: Energy thresholds in 180 degree arc delivery proton therapy

Purpose: To quantify the maximum initial proton kinetic energy necessary to treat a given percentage of patients with rotational proton therapy and to examine the impact of this energy threshold on the cost and feasibility of a compact, gantry-mounted proton accelerator treatment system. **Method and Materials:** One hundred randomized treatment plans from patients treated with IMRT were analyzed. The maximum radiological pathlength from the surface of the patient to the distal edge of the treatment volume was obtained for 180º continuous arc proton therapy and for 180º split arc proton therapy (two 90º arcs) using CT# histograms from the Pinnacle treatment planning system. In each case, the maximum energy necessary to treat a patient with protons was calculated using proton range tables for various media. In addition, Monte Carlo simulations were performed to quantify neutron production in the patient as a function of maximum initial proton energy. **Results:** The widely accepted value of 250 MeV needed to treat 100 percent of patients with protons was confirmed. However, it was shown that 90 percent of patients could be treated at 198 MeV, and 95 percent of patients could be treated at 207 MeV. Decreasing the maximum proton energy from 250 MeV to 200 MeV decreases the total neutron energy fluence created in the patient by a factor of 2.3. **Conclusions:** It is possible to significantly lower the requirements on the maximum energy of a compact proton accelerator if the ability to treat a small percentage of patients with rotational therapy is sacrificed. This decrease in maximum energy, along with the corresponding decrease in neutron production, could lower the cost and ease the engineering constraints on a compact proton accelerator treatment facility. **Conflict of Interest:** An author of this study has financial interest in Tomotherapy, Inc., which has licensed proton accelerator technology.