AbstractID: 13782 Title: Treatment time reduction for proton modulated scanning beams using a ridge filter

Purpose: Proton modulated beam scanning has the potential to significantly reduce dose to normal tissue, especially proximal to the target. However, the relatively long delivery time creates intrafractional motion uncertainty and limits the number of patients who could potentially benefit. To address this problem, a device that reduces the number of required energy layers by spreading the beam longitudinally has been designed. **Materials and Methods:** Using Geant4 code developed for scanning beam commissioning, a device was modeled within IBA's universal nozzle. Through Monte Carlo results, the shape, material, and location of the device were optimized for distal falloff preservation, dose uniformity, and minimized lateral spreading. Monte Carlo data was then used to commission a commercial treatment planning system. **Results:** The final design of the device resembled a bar ridge filter. The design is mostly air to preserve distal falloff. A low density plastic was selected for reduced neutron production and large-angle scatter compared to higher Z materials. The ridge filter was positioned at 50 cm from the isocenter for clinical feasibility, although lateral penumbra decreases at closer distances. Commissioning the test system showed calculated dose delivered to a sphere (d=1.5cm) with the device remained within 3% when compared to an unobstructed beam while the number of energy layers decreased from 14 to 5. Because time switching between energy layers is a major contribution to the overall time, this reduction could approximately double treatment speed. **Conclusion:** Through Monte Carlo simulations, a device has been designed that significantly reduces the number of energy levels required for modulated beam scanning. The device could potentially increase treatment speed, which would decrease intrafractional motion margins and expand the number of patients being treated.