

AbstractID: 5763 Title: Preliminary Radiological Characterization of an Active Proton Beam Spreading System for Therapeutic Use

Purpose: At most proton therapy centers, a clinically useable radiation field is delivered by means of a passive beam spreading system. However, at this proton therapy facility, an active proton beam spreading system has been installed in an isocentric gantry treatment room. Because there exists no standard acceptance test guidelines for an active proton beam delivery system, this presentation serves to report methods and preliminary results from the acceptance testing and early commissioning phase.

Method and Materials: Though passive spreading is the most common method of beam formation, the use of metal scatterers reduces the maximum beam range and results in a higher integral dose from concomitant scattered radiation. The active proton beam delivery methods, such as uniform scanning, have the potential of increased range and lower integral dose in comparison to passive spreading. Ionization chamber scans in a step-by-step mode in a scanning water phantom were used to acquire the bulk of the data.

Results: In the transverse plane perpendicular to the beam axis, the active beam delivery system is capable of delivering a field to within the clinical specification of $\pm 2.5\%$. In addition, the penumbra from the beam delivery system at 5 and 25 cm depth increase from 1.6mm to 10.0mm along the pristine Bragg peak. Along the longitudinal axis, the radiation field meets the range requirement. The SOBP causes a range deficit with the pristine peak of 0.25mm measured from 80-20% dose levels. Also, the SOBP extent flatness exceeds the clinical specification of $\pm 2.5\%$ and adjustable with a skewness parameter on the fly.

Conclusion: The active beam delivery system at this proton therapy facility is capable of delivering a therapeutically acceptable radiation beam. Furthermore, the active system represents a significant step enroute to the goal of intensity modulated proton therapy.