AbstractID: 13196 Title: Comparison of proton MLC with non-divergent brass and tungsten apertures

Purpose: To examine proton edge scattering effects from a tungsten MLC, specifically in comparison with proton edge effects using a non-divergent brass aperture. **Methods and Materials:** The standard for proton therapy beam shaping is a custom-cut, non-divergent aperture with thickness ~65mm. To make comparisons with tungsten MLC simulations, a Monte Carlo simulation model created with GEANT4 was run for non-divergent apertures made of tungsten and brass at thicknesses of 65, 75, and 85 mm. Simulations with each type of aperture were run for IBA's proton double-scattering options B1, B4, and B7 at 100 and 550 mm elevations with square field sizes of 15×15, 10×10, and 5×5 cm^2 and aperture-to-phantom air gaps of 1 and 4 cm. MLC simulations were verified with beam profile measurements using the same treatment parameters. **Results:** Dose profiles of proton beams have horns similar to dose profiles with X-ray beams, but they originate from protons scattering back into the field at the field edge. Using non-divergent tungsten and brass apertures, the size of the horns on dose profiles at the entrance of the simulated water phantom were found to follow the same trends as the leaf edge fields of the MLC. The profiles from the tungsten MLC fields were compared with the best case thickness (65 mm) for brass and tungsten apertures. MLC profiles have horns only along the axis of leaf travel due to MLC design, while the non-divergent apertures have equally large horns along both axes, as expected given the symmetry. Along the axis of leaf travel the horns resulting from edge scatter off of the MLC were approximately equal to or smaller than horns from edge scatter off of the non-divergent apertures. **Conclusions:** Proton dose profiles using a tungsten MLC have no worse edge-scattering effects than a non-divergent brass aperture.