AbstractID: 7673 Title: Therapeutic uniform scanning proton beam development and characterization: transverse results

Purpose:
Accepted now for human use is an active uniform scanning proton beam delivery system with dose layer stacking. This presentation reports specifically on the beam scanning portion of the system including transverse commissioning results.

Method and Materials:
The beam scanning provides field sizes of up to 20 and 30 cm diameter for proton range in water up to 27 cm and 20 cm, respectively. Several detectors were used for the proton field transverse characterization. They included a calibrated radiographic film/scanner system and a two dimensional 1020 multi-element ionization chamber array on 7.6 mm centers. Comparisons were made of beam quality properties between the new scanning system and a traditional passive beam spreading system employing foils scatterers and a rotating range modulator also in use at the facility.

Results:
Some care was required to optimize the scanning system with respect to beam flatness. This was due to the varying beam spot size within the delivery volume due to multiple Coulomb scattering. System commissioning results demonstrate the ability to produce clinically acceptable fields with respect to flatness, symmetry, and penumbra. All measured fields exhibited flatness within a tolerance of +/- 3% inside two transverse penumbral widths (80%/20%). The penumbra results demonstrate that the scanning system, although limited by a shorter source to axis distance compared to the passive system, has reduced penumbra in a 26 cm water range, 10 cm spread out Bragg peak beam, of about 0.7 mm at all depth positions. The differences, although noticeable, are relatively smaller when comparing in un-modulated beams.

Conclusion:
The development and characterization of a uniform proton beam scanning system has been completed and is indicated for therapeutic use. In addition the superfluous nature of scattering foils in the scanning system provided a useable 1-2.5 cm increase in water range at this facility.