AbstractID: 12580 Title: Extended Gamma Criteria in Proton Patient QA using MatrixX and MLIC

Purpose:
Proton patient QA requires measurement of output and verification of range compensator for the field specific spread-out Bragg peak. Matching dose profiles and depth dose between measurement and treatment planning is desirable.

Method and Materials:
A calibrated detector array can measure absolute output cGy/MU, verify field shape and detect range compensator errors. Multi-Layer-Ionization-Chamber (MLIC) can measure the field's percent depth dose (PDD) without compensator. IBA MatrixX and Omnipro IMRT are used to collect and analyze profiles on three planes per patient field. Dose planes at mid SOBP, distal 90% and 50% are chosen to verify cGy/MU and field shape, steep depth gradient around field edges and thickness accuracy of the compensator, respectively. The Gamma criteria of 3 mm/3% perpendicular to the beam path are extended to along the beam direction because of the steep proton distal dose gradient. MatrixX and MLIC results are compared with PPC05's in-water measurement regarding absolute output cGy/MU and PDD, respectively.

Results:
For ten patient fields, the outputs of MatrixX agree with PPC05 within 2%. Shorter range compensator thickness and milling defects are detected by the 2 mm criteria along the beam path. Gamma criteria of 3 mm/3% are met on more than 98% pixels of all depths for properly milled compensators of high energy beams. Penumbra mismatches cause failure of 3 mm/3% criteria at d90 and d50 for low energy beams. This is because Eclipse does not model compensator scattering, however, 98% pixels still pass 4 mm/4% criteria. MLIC agree with PPC05 measurements within 2 mm of distal 90% range and 2% of proximal 90% range of PDD. Lower surface dose (<2% difference on the first cm) was observed between MLIC and PPC05.

Conclusion:
Gamma criteria are extended for proton patient QA to quantitatively measure dose matching along and perpendicular to the beam direction.