AbstractID: 11535 Title: MU calculation for uniform scanning proton beam

Purpose: Accuracy in monitor unit (MU) calculation is critical for patient treatment which is measured in proton beam for each field that takes significant of beam time. An accurate, simple and time saving method is desired for MU calculation. Presented is a sector integration approach with constant correction for dose/MU calculation for any treatment in a uniform scanning proton beam.

Materials and methods: Dose measurements were made in a scanning proton beam with a parallel plate Markus ion-chamber in a water phantom. Two methods were adopted to measure the Dose/MU values: (i) varying beam energy and SOBP values with a fixed aperture radius (10cm) at the reference point and (ii) varying the beam energy and aperture radius with a fixed SOBP. These measured values were summarized into two tables. These two tables were used to calculate dose/MU for an energy and a SOBP using certain aperture radius by linear interpolation, which produced the initial results: $D(\text{energy, SOBP})_{10cm}$ and $D(\text{energy, radius})_{SOBP}$. The dose/MU value for any field size and shape is calculated using sector integration method with a piecewise correction based on these two values.

Results: Dose/MU values for total 412 beam fields without compensators were measured and calculated using the model above. The model parameters were derived from the measurements in 90 fields with varying shapes. These parameters were applied to compute the dose in the other 322 treatment fields. The difference between calculated and measured values in these 322 fields is -0.12%±1.36% for beam range in water <20 cm. The difference is smaller to -0.06%±0.74% for beam range >20cm.

Conclusion: An accurate, simple, and fast method for MU calculation in any proton treatment fields is introduced. The sector integration method derived from the actual measured data produced very small error when tested in 322 additional fields.