AbstractID: 7461 Title: Monitor Unit calculation in Eclipse Proton Therapy Treatment Planning

Purpose: To evaluate the Monitor Unit calculation algorithm in Eclipse proton therapy treatment planning.
Method and Materials: The Eclipse (Varian) treatment planning system is commissioned for eight double scattering options, i.e. eight range modulator and second-scatterer combinations. When supplying the commissioning beam data in cGy/MU, Eclipse calculates the Monitor Units delivering the prescribed dose. We compare this calculated output to measurements in water for fields of varying range and modulation width. The output variation with source-to-skin distance as well as with aperture size is investigated. To evaluate the effect of the range compensator and target inhomogeneities on the delivered dose, clinical plans are recalculated in a water phantom - both with and without range compensator – and the dose-per-MU in the normalization point is compared to measurement.
Results: Eclipse creates the spread-out Bragg peak by adding the individual pristine peaks according to their weight and position as defined in the user-supplied range-modulator wheel file. The observed output strongly depends on the range modulator wheel layout. By optimizing the file in combination with the user-supplied output for the pristine peaks a good agreement with the measured output is obtained. The agreement is best for small modulation width and worsens continuously with increasing modulation width, especially for the options with a higher range. The Eclipse dose decreases with source-to-skin distance as expected, but the measured decrease in output with aperture diameter is underestimated.
Conclusion: The accuracy of the Eclipse output calculation depends strongly on the accuracy of the beam data supplied. Optimizing the beam data to minimize the difference between planned and measured output typically leads to an agreement within ±5%.