AbstractID: 1078 Title: Monte Carlo for absolute clinical dosimetry, i.e. output factor calculation, in proton therapy.

The prescribed dose in radiation therapy has to be converted into machine monitor units (MU) for treatment. This is done for each patient field either by calibration measurements, by using algorithms based on idealized depth-dose curves, or by relying on empirical data. At the NPTC a MU corresponds to a fixed amount of charge collected in a segmented transmission ionization chamber in the treatment head. Using a detailed Monte Carlo model of the treatment head we are able to predict the dose delivered to the patient as a function of ionization chamber reading, thus using Monte Carlo for absolute proton dosimetry. To do so, the charge deposited in the ionization chamber is simulated. The Monte Carlo method has advantages over analytical monitor unit calculation algorithms in that it takes into account scattered radiation and provides a tool to study the influence of parts of the treatment head on the ionization chamber reading. Despite the fact that the Monte Carlo method may reduce the burden of time-consuming experimental verifications for each treatment field, it has the advantage compared to experimental methods to allow MU calculations at any position in the patient and not solely in water.

We show comparisons between the Monte Carlo simulation and experimental data. The results show a good agreement with measurements (<3%). Further, by analyzing the influence of scattering and the importance of different physical interactions, we discuss the necessary accuracy of the Monte Carlo calculation to be used clinically for MU calculations.