AbstractID: 10603 Title: Application of the simplified Monte Carlo algorithm to a clinical case for proton treatment planning

Purpose: We have developed a simplified Monte Carlo calculation (SMC) algorithm of dose distribution in proton therapy to improve the accuracy of dose calculations yet with a reasonable calculation time. We verified the new SMC by measurements, applied it to the clinical case, and compared the results with those by the conventional pencil beam algorithm (PBA). **Method and Materials:** The SMC takes into account the edge-scattering effects in an aperture and a range-compensating bolus ignored in the conventional pencil beam algorithm (PBA). In the SMC, since the dose in the human body is calculated using the measured dose distribution in water, the calculation time can be reduced compared with the full Monte Carlo method. To verify the accuracy of the SMC, the dose distribution formed by 235-MeV protons traversing a step-shaped bolus were measured with the PTW 2D-ARRAY detector. We applied the verified SMC to the clinical case and compared with the results obtained by the PBA. **Results:** While the new SMC reproduced well the measured dose distribution in water of protons traversing the step-shaped phantom, the PBA could not reproduce the hot spots due to the surface scattering effects of the aperture and the bolus. In the clinical case, while the high-dose parts at the entrance region and complex dose distributions have been found in the SMC, such dose structures have not been seen in the PBA. The calculation time of the SMC was 20 minutes for simulated 4 mega particles, the calculated voxels of 0.7 mega, the rms statistical error of 4.5%. **Conclusion:** We verified that the SMC method reproduced well the measured dose distributions with a reasonable calculation time. We applied it to the clinical case and found that a complex dose distribution predicted by the full Monte Carlo method also appears.