AbstractID: 1209 Title: Intensity-modulated proton therapy with a scanned beam: Study of the effects of the beam instability

Intensity-modulated proton therapy (IMPT) is a technique for radiation treatment of cancer, which allows one to deliver highly target-conformal dose distributions, and may eliminate the need for patient-specific hardware. IMPT treatments can be delivered by magnetically scanning a narrow proton pencil beam across the target volume, while both the scanning speed and the intensity of the beam are modulated. The aim of the current research is to determine technically optimal and clinically relevant specifications for the scanned beam delivery system, which is being developed in collaboration with Ion Beam Applications. Fluctuations and drift in the scanning and focusing magnet current may cause deviations in the instantaneous shape and size of the proton beam, as well as in the beam spot position in the iso-center plane. This will adversely affect the conformity between the delivered and planned doses. It is, therefore, important to determine the acceptable range of such deviations in the beam parameters. Using a simulation, we studied the effect of fluctuations in the beam position and size, and systematic beam drift on the delivered dose distributions. The effect was evaluated for realistic inhomogeneous IMPT fields, in terms of the RMS of the point dose discrepancy between planned and delivered distributions on the target. The results suggest that, in the region of interest, dose deviation RMS scales linearly with the fluctuation RMS. The fluctuations in the beam parameters should be kept below 10-15% of the beam size (σ), in order to keep the dose conformity within 5% of the prescription.