

AbstractID: 1467 Title: Monte Carlo-based modulated electron beam inverse treatment planning and delivery using an automated few-leaf electron collimator

Energy modulated electron therapy with conventional clinical accelerators has lagged behind photon IMRT despite its potential to achieve highly conformal distributions to superficial targets. One of the reasons for this is the absence of a practical, automated collimating device that allows for the flexible delivery of a series of variable field openings. Electron-specific multileaf collimators attached to the bottom of the applicator require the use of a large number of motors and suffer from being relatively bulky and impractical for head and neck sites. In this work we propose a custom-made “few-leaf” electron collimator (FLEC) that consists of four motor-driven blades (trimmer bars) at the end of the applicator. The device serves as an accessory to standard equipment and allows for the shaping of any irregular field by combination of rectangular beamlets. The use of limited-width trimmer bars in conjunction with backup collimation using the photon jaws allows the device to remain relatively compact. The characteristics of the FLEC were studied using a Monte Carlo model. Phantom dose distributions were optimized using a gradient-based inverse planning algorithm that uses a limited number of MC pre-generated, realistic phantom-specific kernels and user-specified dose-volume constraints. In-air scattering at the lowest energy leads to a slight increase in dose in peripheral areas of the field. In addition, field flatness could be improved by using a more elaborate leaf-end model. Despite these complications, by combining different electron energies, highly conformal distributions can be generated in superficial targets encased in organs at risk.