

AbstractID: 5370 Title: Construction and dosimetry of a prototype automated few-leaf electron collimator (FLEC) for delivery of energy-intensity modulated electron therapy

Purpose:

To design and implement an automated “few leaf electron collimator” (FLEC) used for energy modulated electron therapy (EMET) using Monte Carlo-based treatment planning. This study investigates the optimization of the physical design of the FLEC and provides preliminary validation results of comparison between Monte Carlo calculations and film measurements for complex intensity/energy modulated electron fields using a manual replica of the FLEC.

Methods and Materials:

The FLEC design was guided by Monte Carlo studies to optimize the physical configuration of the collimator leaves within the linear accelerator. To validate our Monte Carlo-based treatment planning system, we used a manual FLEC to acquire output of jaws collimated fields using ionization chamber and compared them with Monte Carlo calculation. Calculated two dimensional dose distributions were compared to film measurements obtained using energy-independent GafChromic® HS films. A gamma-index analysis quantifying the difference between calculation and measurements is discussed.

Results:

A prototype of the automated FLEC was constructed with 1.1 cm thick and 3 cm width copper leaves of. The field collimated by the FLEC is backed up by jaw openings following the FLEC projection that provides an optimum field quality. The compact design of the FLEC, including motors, encoders, switches, and necessary wiring, is suitable to be attached to a clinical electron applicator. Software was developed to facilitate remote control of the FLEC system. A comparison between Monte Carlo calculation and film measurements of complex intensity maps shows agreement within tolerated accuracy measures (3% for 3 mm) based on gamma index analysis.

Conclusions:

The results of this work confirm most of our design objectives and support the potential of using the prototype FLEC for modulated electron therapy delivery. QA procedures for the EMET treatment delivery using the FLEC integrated with the linear accelerator are being investigated.