Purpose:

To verify an add-on computer-controlled multileaf collimator (eMLC) device on a Varian linac capable of delivering accurate dose for energy-intensity modulated electron radiotherapy (MERT).

Methods:

The eMLC has 27 pairs of tungsten leaves (tongue and groove design to reduce intraleaf leakage) with 0.56 cm width and 2 cm thickness, providing a field size as large as 15 cm x 15 cm defined at 94 cm SSD. Measurements were done to determine the appropriate jaw setting for an eMLC shaped field, mainly to reduce the leaf leakage outside the eMLC shaped field. The phase space data were acquired by Monte Carlo (MC) simulations for electron beams of energies 6, 9, 12 and 15 MeV, respectively and used as an input source in MC dose calculations in a phantom. MC calculated PDDs and dose profiles were compared with measurements for large fields (e.g. 10 cm x 10 cm) and small fields (e.g. 3.4 cm x 3.4 cm). The eMLC leakage for various energies was measured both in-air and in phantom (at dmax) as a ratio of doses with the eMLC closed and completely open.

Results:

With the jaw position at 0.5 cm beyond the edge of the eMLC shaped field, it was showed to best eliminate the interleaf leakage, especially for high energies, e.g. 15 MeV. The average leaf leakage ranged from 0.3% (6 MeV) to 2.3% (15 MeV), which were consistent with lower in-phantom values than in-air values. MC calculated PDDs and dose profiles generally agreed with measurements to within 2 mm/2%.

Conclusions:

This eMLC device is capable of delivering energy and intensity modulated electron beams accurately with acceptable leaf leakage for advanced MERT treatment.