Purpose: Different designs of multileaf collimators (MLC) have been investigated for dose delivery for energy and intensity modulated electron radiotherapy (MERT). This work aims at verifying MERT dose delivery accuracy on clinical accelerators, Siemens Artiste and Varian Clinac iX, equipped with conventional photon multileaf collimators (pMLC).

Method and Materials: Expensive measurements and Monte Carlo (MC) simulations were performed to acquire the electron beam data for Monte Carlo-based MERT treatment planning. The calculated percentage depth dose (PDD) and dose profiles were benchmarked with measurements. Differences of electron beam characteristics for fields shaped by the Artiste and Clinac iX pMLC were examined, demonstrating their strengths and weaknesses in MERT dose delivery.

Results: MC simulated PDDs and dose profiles for electron energies, 6, 9, 12, 15 (Artiste) and 16 (Clinac iX) MeV with fields shaped by either applicators or MLCs agreed well (2%/2mm) with ion chamber measurements. For pMLC-shaped fields, no significant changes in PDDs were observed as SSD varied from 61 cm to 85 cm while the flatness and penumbra of dose profiles showed obvious deterioration as SSD increased. In comparison, the Clinac iX pMLC resulted in flatter electron beams with smaller penumbra than those collimated the Artiste pMLC most likely due to the differences of the pMLC locations.

Conclusions: Both Siemens Artiste and Varian Clinac iX are capable of delivering energy and intensity modulated electron dose distributions efficiently using their existing pMLC. The electron beam properties shaped by pMLCs were better suited for MERT at smaller SSDs (with smaller gaps between the pMLC and the patient surface). For the same SSD, the Clinac iX pMLC manifested superior beam flatness and penumbra compared to the Artiste pMLC.