

AbstractID: 9288 Title: Developing hardware and software tools for advanced mixed beam radiotherapy

**Purpose:** Intensity-modulated radiation therapy (IMRT) provides excellent lateral dose conformity while energy- and intensity-modulated electron therapy (MBRT) can spare distal critical structures for shallow targets. This work aims to combine IMRT and MERT for advanced mixed beam therapy (MBRT) of breast and head and neck cancers.

**Method and Materials:** We have acquired a motorized electron-specific multileaf collimator (eMLC) for accurate beam delivery for both conventional electron therapy and MERT. The eMLC is retractable to provide large apertures for efficient photon and electron beam delivery for MBRT. Extensive measurements were performed to verify dose distributions collimated by the eMLC and to validate MBRT treatment plans. Monte Carlo based dose calculation, treatment optimization and leaf sequencing algorithms were investigated for efficient and accurate beam delivery. This technique is being implemented clinically for scalp, head and neck, and breast treatment through pilot studies that are specially designed for dose escalation and hypofractionation.

**Results:** The eMLC provides similar electron beam characteristics to that obtained with a conventional electron applicator/cutout. The leakage is 1.8% for 16MeV electron beams and is less than 1% for other lower electron energies. A typical MERT has a 2-3 modulation-scaling factor, which results in a maximum 5% leakage dose that is similar to that from IMRT. The measurement results agreed with the planned dose distributions to 3%/3mm for both uniform and heterogeneous phantoms.

**Conclusion:** We have developed a MBRT system for the treatment of shallow targets that consists of hardware tools and software tools for accurate and efficient beam delivery. The technique is being implemented clinically for partial breast, scalp and head and neck treatments.