

AbstractID: 3094 Title: Use of Photon IMRT Fields to Sharpen the Penumbra of Electron Fields Shaped with Photon MLC

Purpose: Current electron beam therapy requires the production of custom lead cutouts in close proximity to the patient to minimize beam penumbra. This study investigated the use of a photon multi-leaf collimator (MLC) to collimate the electron beam and to improve its beam penumbra using photon IMRT fields.

Method and Materials: Beam parameters were first measured for 9 and 12 MeV electron beams shaped by a Millennium MLC from a Varian 2100CD linear accelerator. The data was used to commission electron MLC beams in a commercial treatment planning system (Theraplan Plus, Nucletron). A semi-empirical method of creating the photon IMRT fields to reduce the penumbra was developed. Film dosimetry was used to compare plan predictions with the measurements of the electron/photon beam delivery.

Results: We are able to model the MLC shaped electron beam with Theraplan plus reasonably well. By combining the penumbra reduction IMRT photons to the MLC shaped electron field, using Theraplan Plus, we obtained similar 50%-95% penumbra values compared to a cut-out shaped electron field alone, for several field sizes. Film dosimetry verified that the treatment field profile was similar to the Theraplan Plus prediction. This convenience of using the MLC to shape an electron beam does have significant drawbacks; as there is still a large increase in the lateral spread of the electron beam due to the increased source-to-surface distance. Secondly, the IMRT photon beam will add significantly to the dose at depth in the penumbra of the electron beam, which would have to be taken into account when irradiating near critical structures.

Conclusion: Electron beams can be conveniently collimated with photon MLC. The large beam penumbra for the electron MLC field can be reduced with IMRT photon fields to obtain dose profiles similar to those by cut-out shaped electron beams for the dose above 50%.