AbstractID: 7293 Title: Penumbra evaluation of the Synergy-S and Novalis micro-MLCs

Purpose:
To investigate the effect of variations in the field size, treatment depth, and treatment distance on penumbra at leaf-end and leaf-side of two micro-leaf collimators (μMLCs).

Method and Materials:
The penumbra characteristics of the Elekta's Synergy-S micro-leaf beam modulator with 4mm leave width and BrainLab's Novalis μMLC with 3mm leaf width at isocenter were investigated. Kodak EDR2 film was exposed to approximately 200cGy for a variety of build-up thicknesses (6MV photon beam, depth =1.5, 5, 10 and 15cm), field sizes ($3cm^2$–$10cm^2$), and treatment distances (90, 100, 105, 110, and 115cm SSD) for both square and circular fields. The penumbra information was expressed as 80% to 20% isodose distance.

Results:
Analysis of the measured penumbra revealed that BrainLab's μMLC had smaller effective penumbra (2.3mm–3.9mm at leaf-side and 2.4mm–4.4mm at leaf-end) as compared to that of Synergy-S (3mm–6mm at leaf-side and 4.3mm–7.8mm at leaf-end) for square fields, at 100cm SAD. The average difference of effective penumbras at leaf-side and at leaf-end was about 50% for the Synergy-S, while this difference was about 6% for BrainLab's μMLC. However, the effective penumbras for circular fields (3cm–9cm diameter) were comparable; ranging 4mm–7mm for the Synergy-S μMLC and 3mm–6mm for the BrainLab's system.

Discussion and Conclusions:
Both the BrainLab's and the Elekta's μMLCs produce comparable effective penumbras for typical treatment conditions. The Synergy-S does not use any adjustable jaw system. In this study, the adjustable jaws of BrainLab's μMLC were positioned at least 0.5cm behind the leaf-ends to eliminate their effect on penumbra. The variation of penumbra on leaf-end is significantly smaller for the BrainLab's μMLC. This difference could be due to several factors such as x-ray target to leaf distance, target's shape and size, or the exact leaf tip design; these issues are being investigated.