AbstractID: 5216 Title: Self-Correction of DMLC Delivery Errors Based On Feedback From on Flight Intensity Calculations

Purpose: To deliver DMLC intensity modulated therapy accurately in the presence of errors related to unaccounted target motion, improperly executed motions of leaves and imprecise control of beam intensity rate during delivery.

Method and Materials: The intensity delivered to each target point is calculated on-the-fly under the assumption of unidirectional leaf motion in the target frame of reference. The delivered intensity is then compared to the intended intensity. If a discrepancy arises, the leading leaf's trajectory is left unchanged and the following leaf's trajectory is modified to correct the error. Using the derived formulas, the following leaf is sped up or slowed down so that it efficiently corrects the error without unnecessarily compromising the delivered intensity to other points of the target. The formulas only consider the discrepancy between the delivered and intended intensity. They are not directly dependent on the actual and intended leaf positions as a function of time. This means that the leaves will not, in general, return to their originally planned trajectories. After correction is complete however, the correct intensity will be delivered to the rest of the target.

Results: Two representative examples of self-correction are shown. The first uses a static target, and shows how an intensity error due to an unintended leaf velocity can be corrected. The second shows a similar error, but instead uses a rigid moving target.

Conclusions: An algorithm is developed to modify the following leaf trajectory when a discrepancy between the delivered and intended intensity arises. The results show that it is feasible to correct some errors in DMLC delivery without interrupting delivery. The tolerance for errors can therefore be set much higher than current control algorithms. This should lead to considerably decreased number of beam interruptions at delivery.