Optimisation of the Intensity Map, in level and resolution, for the delivery of IMRT.

To deliver an IMRT treatment a continuous fluence profile, produced by an Inverse planning routine, is commonly divided into a fixed number of equal intensity levels a priori. In this study an algorithm was developed to optimise the number of unconstrained intensity levels required to deliver a single leaf pair (1-D) intensity profile.

Initially the number of intensity levels was determined by discretisation of the continuous intensity profile into M equally spaced bins; Bins of width 1 cm and intensity levels fixed at 10% increments were assumed.

In comparison the intensity levels were allowed to start at optimal values. The search criteria for these levels was minimisation of the error in the area under the unconstrained curve; It crudely reflects the error in delivered dose compared to the idealised (continuous fluence) case. Furthermore, the optimisation algorithm was employed to reduce the number of levels by appropriate combination of nearest value pairs. Finally, optimisation of the delivered profile was further investigated by allowing the bin widths to vary unevenly across the field.

An optimised leaf sequence was also computed to deliver these 1D profiles, however the final optimised intensity map can be ported to a generic leaf sequencing algorithm.

We have shown that it is practical to produce optimised intensity maps for the delivery of the IMRT plan whose levels are unconstrained in magnitude and number and whose resolution is patient specific.