AbstractID: 3333 Title: A generalized MLC segmentation algorithm for step-and-shoot IMRT with no tongue-and-groove error

Purpose: To develop an MLC segmentation algorithm for step-and-shoot IMRT that can segment intensity maps with large maximum intensity levels (e.g., ranging from 10 to 100) into the minimum number of MLC-segments in a fast computation time.

Method and Materials: We improved a previous MLC segmentation algorithm, called SLSNOTG, for step-and-shoot IMRT by Luan et al in AAPM'2004. Our new segmentation algorithm, called GSLSNOTG, has two improvements.
(1) It can segment intensity maps with large maximum intensity levels into the minimum number of MLC-segments without tongue-and-groove error. The key to this improvement is a new level reduction technique that can partition an intensity map into an optimal set of sub-intensity-maps without introducing any additional tongue-and-groove error. In contrast, the previous SLSNOTG algorithm was mainly designed to segment intensity maps with small maximum intensity levels, and may introduce more tongue-and-groove error when segmenting intensity maps of large maximum intensity levels (due to the level reduction schemes that it uses).
(2) Our new segmentation algorithm runs much faster than the previous SLSNOTG algorithm by pruning the sizes of the graphs used to model the intensity maps. This avoids using the slower k-link shortest path routine as in the SLSNOTG algorithm, and thus significantly reduces the computation time.

Results: Comparisons of our GSLSNOTG algorithm with the previous SLSNOTG algorithm and CORVUS 5.0 planning system demonstrated the advantages of the GSLSNOTG algorithm/software. For example, for an intensity map set of maximum intensity level 20, the GSLSNOTG algorithm computes 176 segments in less than 1.5 minutes. In comparison, CORVUS needs 382 segments, and the SLSNOTG algorithm runs in 10 minutes to compute a plan with the same number of segments with 2% tongue-and-groove error.

Conclusion: The new MLC segmentation algorithm GSLSNOTG can segment intensity maps of large maximum intensity levels in a fast computation time.