AbstractID: 13250 Title: Generalized Equivalent Field Size in IMRT

Purpose: To generalize the equivalent field size (EFS) for non-uniform fluence maps, to propose and verify a dose calculation method based on the generalized equivalent field size (GEFS).

Method and Materials: A parallel-beam dose table PDT(s,d) that consists of central axis dose (CAD) at various depths d of a water phantom for circular fields of various diameters s and can be obtained by the collapsed cone convolution/superposition (CCCS) method is used to define the phantom scatter S_p, $S_p(s)=PDT(s,d_{ref})/PDT(s_{ref},d_{ref})$, where s_{ref} and d_{ref} are the reference depth and reference diameter, respectively. S_p can be extended for arbitrary fluence maps by integrating fluence with respect to the phantom scatter with proper normalization. More precisely, the phantom scatter at a point c on the reference plane is $\int f(x)/f^*(c)dS_p(x-c)$, where $f^*(c)$ is the closest non-zero fluence to $f(c)$. For any given fluence map, GEFS of a point is defined to be the diameter of a circular field that has the same phantom scatter at the reference depth. Once GEFS is determined, we use PDT again to look up dose.

Results: GEFS is consistent with EFS for square fields. We tested the proposed dose calculation on various field shapes with uniform or non-uniform intensity. The resulting dose distributions are within 3%/3mm from those calculated by the CCCS approach except near the fluence edges in the buildup regions.

Conclusion: EFS is a useful tool for estimating dose of non-standard fields. However, its application is limited to uniform fluence maps. In this work, we extend the application to non-uniform fluence maps and propose a dose calculation method based on GEFS. The agreement between dose calculations based on GEFS and CCCS indicates that dose can be well approximated by scaling CAD along the radiation beam when the phantom scatter is estimated through GEFS.