AbstractID: 7864 Title: A Prototype Monte Carlo-based IMRT Treatment Planning Research System

We have constructed a prototype Monte Carlo-based IMRT treatment planning system. The system is implemented in C, C++, and the Matlab-based Computational Environment for Radiotherapy Research (CERR) (see abstract at this meeting). Motivating rationales include: (a) providing a customizable platform (CERR/Matlab) in which various IMRT planning approaches can be tested and analyzed, (b) providing a customizable environment with a rich set of visualization features which users can use to define IMRT test problems, (c) providing a system in which Monte Carlo generated beamlet dose distributions can be generated for researchers who wish to implement their own optimization algorithms, (d) to demonstrate basic methods for using stored Monte Carlo beamlet dose distributions, and (e) to facilitate published comparisons between optimization algorithms. CERR can read any AAPM/RTOG patient data (scan, structures) archive. Rectangular cross-section beamlets are computed using the VMC++ Monte Carlo engine. Beamlet dose distributions are stored in wavelet compressed format. Dose is not recalculated *ab initio* for each optimization iteration, but rather wavelet coefficients are summed in wavelet space and a single fast decompression is performed. The optimization algorithm is based on a non-linear integer programming approach with convex objective function and constraints. Objective function goals or constraints can be a combination of Equivalent Uniform Dose (EUD) terms, or strictly dosimetric terms such as quadratic deviation of dose or dose-volume constraints. Dose-volume constraints are handled using integer-programming techniques. This prototype system currently runs on PCs.

Supported by NCI grant R29 CA85181 and CMS, Inc.