

AbstractID: 11998 Title: Monte Carlo Treatment Planning: Implementation of Clinical Systems

Monte Carlo (MC) based treatment planning systems are already commercially available for both photon and electron beams and more users are implementing them in a clinical setting. Therefore it is important that strategies and paradigms for clinical commissioning and implementation of such systems be formulated and discussed. The purpose of commissioning tests for MC based treatment planning systems is not only to evaluate the accuracy of the system, but also to define the optimum calculation parameters, such as number of histories, calculation voxel size, etc., which will be applied in clinical use of the system. This in turn requires that medical physicists responsible for clinical implementation of such systems are well educated in principles of Monte Carlo algorithms.

We provide a brief review of AAPM Task Group Report No. 105 (Med. Phys. 34 (2007) 4818-4853), a document which outlines the important aspects of a MC-based dose calculation algorithm, from the basic aspects of the use of the MC method for radiation transport to the application of this approach in routine clinical photon and electron beam treatment planning. We also describe possible clinical implementation issues, including dose-to-medium vs. dose-to-water differences and give comparison of computation times for typical patient anatomies and calculation parameters.

Educational Objectives:

1. To provide an educational review of the physics of the MC method.
2. To discuss the factors associated with MC dose calculation within the patient-specific geometry, such as statistical uncertainties, approximations of the underlying physics model, CT-number to material density assignments, and reporting of dose-to-medium versus dose-to-water.
3. To briefly review the vendor transport codes currently used for clinical treatment planning.
4. To discuss the issues associated with experimental verification of MC algorithms.
5. To briefly review the potential clinical implications of MC calculated dose distributions.
6. To provide example timing comparisons of the major vendor MC codes in the clinical setting.