AbstractID: 9801 Title: Review of AAPM Task Group Report No. 105

A special class of Monte Carlo (MC)-based dose calculation codes optimized for photon and electron beams in patient-specific geometries has invigorated interest in the use of MC-based dose calculations for radiotherapy treatment planning. In general, this class of “second generation” codes, including VMC++, XVMC, and DPM, among others, employ electron-step algorithms that converge faster, i.e. fewer condensed-history steps are required for the same precision versus “first-generation” codes (such as EGS and MCNP). These advances, coupled with the use of sophisticated variance reduction techniques (e.g. directional bremsstrahlung splitting), have made it possible to perform MC-based photon beam dose calculations, in some instances, of the entire linear accelerator treatment head and patient-geometry, within minutes on a single processor. Consequently, several commercial vendors have released or are currently in the process of releasing MC algorithms for photon and/or electron beam treatment planning. With the impending availability of MC-based dose calculation algorithms for routine clinical treatment planning, it is important that strategies and paradigms for clinical commissioning and implementation of these systems be formulated and discussed. We provide a 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.

Educational Objectives:

1. To provide an educational review of the physics of the MC method including discussion of the approaches used for coupled photon and electron transport.
2. To review the methods used to improve the MC simulation efficiency.
3. To briefly review the vendor transport codes currently used for clinical treatment planning.
4. To describe the development of beam models for clinical treatment planning.
5. To discuss the factors associated with MC dose calculation within the patient-specific geometry, such as statistical uncertainties, CT-number to material density assignments, and reporting of dose-to-medium versus dose-to-water.
6. To discuss the issues associated with experimental verification of MC algorithms.
7. To briefly review the potential clinical implications of MC calculated dose distributions.
8. To provide example timing comparisons of the major vendor MC codes in the clinical setting.