AbstractID: 8120 Title: Clinical implementation of Monte Carlo methods for external photon beam therapy

The development of fast, accurate Monte Carlo (MC)-based codes has rejuvenated interest in the use of MC-based photon dose calculations in patient-specific geometries. In general, this class of “second generation” codes, including VMC++, XVMC, and DPM, among others, employ electron-step algorithms that converge faster, i.e. you are able to take fewer condensed-history steps for the same precision versus “first-generation” codes (such as MCNP and EGS). 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 (linac) treatment head and patient-geometry, within minutes on a single processor. With the impending availability of MC-based dose calculations for routine clinical treatment planning, it is important that strategies and paradigms for clinical commissioning and implementation of these systems be formulated and discussed.

The educational objectives of this lecture can be summarized as follows:

1. Understand the differences between “first” and “second-generation” MC-based photon beam dose algorithms and the methods (e.g. variance reduction techniques) used to render “second-generation” codes fast enough for routine treatment planning
2. Understand the methods used for characterization and beam modeling of the linac
3. Understand approaches for commissioning and experimental verification of MC-based photon beam dose calculation systems
4. Understand the basic issues associated with clinical implementation of MC-based photon dose calculation algorithms, as discussed in the AAPM Task Group Report No. 105