AbstractID: 4013 Title: Monte Carlo applications in conformal, IMRT and 4D clinical treatment planning: pitfalls and triumphs

Due to its ability to accurately model dose distributions for arbitrarily complex treatment delivery scenarios and patient geometries, it is highly probable that over the next few years the use of Monte Carlo in routine clinical planning will become substantially more widespread. Building on the discussion of the role of Monte Carlo in treatment head simulation (from the first course), this second Monte Carlo course will focus on patient planning applications. The goal of the course is to familiarize clinical medical physicists with the use of Monte Carlo in treatment planning, including advanced treatment techniques such as IMRT and motion compensated 4D treatment, and to discuss how Monte Carlo based planning differs from conventional algorithm based planning. We will demonstrate the utility of Monte Carlo with respect to improved dose calculation accuracy (versus conventional algorithms) in heterogeneous patient tissues, and illustrate how a properly benchmarked Monte Carlo system can play a unique role in the modeling of complex delivery procedures, such as IMRT. In particular, the ability to effectively model the dosimetric consequences of the detailed the multi-leaf collimator (MLC) geometry with Monte Carlo will be demonstrated. Finally, we will show how Monte Carlo can be applied to compensate for organ motion in 4D treatment planning without an increase in computation time. In addition to illustrating the role of Monte Carlo in complex treatment planning, an important focus of this course will be to provide guidance to clinical physicists on practical issues associated with the implementation, verification and clinical use of Monte Carlo systems.

Educational Objectives:

1. To familiarize clinical physicists with Monte Carlo applications for routine clinical treatment planning.
2. To understand the dosimetric influence of Monte Carlo in different anatomical sites and to become familiar with the potential clinical outcome benefits of Monte Carlo.
3. To understand some of the issues that clinical physicists face in the implementation and experimental verification of Monte Carlo treatment planning systems.
4. To understand the use, benefits and limitations of Monte Carlo for IMRT optimization and QA.
5. To become familiar with the role of Monte Carlo in motion compensated (4D) treatment planning.