With significant advances in computational technology, and the development of Monte Carlo (MC) algorithms optimized for radiotherapy class calculations, the use of MC in the routine clinical setting is quickly becoming a reality. In addition to affording significantly improved accuracy in heterogeneous patient tissues (such as the lung and head/neck) versus conventional algorithms in standard treatment planning, MC can play a unique role in the modeling of complex delivery procedures such as IMRT.

Despite the well-documented benefits of MC, there remain issues that are potentially hindering the acceptance of MC in the clinic. These include: (a) Source modeling for a given user's accelerator and the validation and testing required to commission an MC algorithm, (b) Clear indication of the dosimetric benefits of MC for various treatment sites and how these correlate to actual patient outcome, and (c) How physicists and physicians evaluate MC dose distributions and how they can potentially modify planning practices and dose prescriptions to accommodate the role of MC.

This symposium will be generally organized as follows: (1) **Introduction to the MC method**: how it works in the radiotherapy setting, types of algorithms, and limitations in the approximations used, (2) **Basic experimental validation**: limitations and potential improvements, **Commissioning and commercial implementation** of MC systems: issues of concern for clinical physicists, **Clinical evaluation of MC** in various anatomical sites, **Correlation of MC dose distributions with clinical outcome** in treatment planning of lung cancer, (3) **Application of MC in optimization and IMRT and clinical comparisons**: how MC is used in IMRT dose calculation including the time-dependent modeling of MLC's, the use of MC for IMRT QA, comparisons of clinical IMRT dose distributions, tradeoffs used in the various MC implementations and use of MC during IMRT optimization; (4) **MC in the clinic: a physician's perspective** of the value of MC based on experience with lung cancer treatment planning, the current RTOG standpoint on inhomogeneity corrections and MC; (5) **Discussion session to debate the issues of concern raised and to argue different perspectives** – this section is set out to be provocative – the aim is to raise questions important to clinical physicists in the development and commercial implementation of MC and to address clinical concerns.

Educational Objectives:

1. To understand the basics of MC and how it is applied in radiation treatment planning.
2. To understand some of the issues facing clinical physicists in the testing and commissioning of MC treatment planning systems.
3. To understand the dosimetric influence of MC in different anatomical sites and to become familiar with the potential clinical outcome benefits of MC for lung cancer planning.
4. To understand the use, benefits and limitations of MC for IMRT optimization and QA.
5. To understand the potential clinical changes in planning and dose prescription with MC from a clinician perspective, with particular emphasis on lung cancer treatment planning.