AbstractID: 8288 Title: Output factor in air and its impact on MU calculations

Output factor in air is most commonly called collimator scatter factor or headscatter factor. Measurements and analytical studies have shown that there are multiple components for output factor in air, in particular, photon head-scatter inside accelerator head, x-ray source obscuring effect, and monitor backscatter effect. Various sources of head-scatter, which include the flattening filter (and a wedge, if used), have been characterized. The availability of Monte Carlo simulation has provided a methodology to separate various components of the headscatter to interpret the measurement results. There has been some confusion regarding the miniphantom measurement technique that prevents widespread use of its measurement. Published data gave conflicting results on the effect of the dimension and materials of the miniphantom on the measured values of output factor in air. However, it is possible to find a safe subset of miniphantom specification (low Z and sufficient longitudinal and lateral dimension) to obtain a consistent value for output factor in air. The widespread use of IMRT has compelled the need to measure this quantity accurately, on and off the central axis, and inside and outside beam collimation. For some model (Monte-Carlo) based treatment-planning systems, miniphantom measurements provide part of the input data that is directly correlated to the total photon energy fluence produced by a linear accelerator. With the widespread use of MLC, it becomes necessary to determine the output factor in air for irregular fields. Different MLC configurations, depending on the manufacturers, pose quite different characteristics from the conventional collimators (the X and Y jaws). A methodology to parameterize the output factor becomes important. In addition, extensive data have been published in the literature to provide a guide on the magnitude of output factor in air for different types of clinical accelerators. Method has been proposed to QA measured output factors in air.

The objective of this course is to present a comprehensive review of the issues related to measurement and parameterization of output factors in air for photons from clinical linear accelerators. In particular, the impact of the output factor in air on MU calculation for different beam geometry and configuration is discussed.

Educational Objectives:

1. To discuss the various components that contribute to the output variation of a clinical linear accelerator and its impact on MU calculation for various beam geometry.
2. To review techniques of miniphantom measurements and the current understanding of the impact of material and geometry of miniphantom on output factor in air.
3. To understand various approaches to parameterize the head-scatter sources for determination of output factor in-air for square, rectangular, and irregular fields for both open and wedged beams.
4. To discuss output factor in air for offset fields and at off-axis points inside and outside of beam collimation.
5. To summarize the magnitude of output variation for different linear accelerators and propose QA methods for output factor in air.