

## Spectral measurements of a 6MV photon beam for finite-size pencil beam dose calculations

A kernel-based dose computation method with finite-size pencil beams (FSPBs) requires knowledge of the photon spectrum. Published methods of indirect spectral measurements using transmission measurements through beam attenuators use mathematical fits with a large number of parameters and constraints. In this study, we examine a simple strategy for fitting transmission data that models important physical characteristics of photon beams produced in clinical linear accelerators. The shape of an un-attenuated bremsstrahlung spectrum is known, varying linearly from a maximum at zero electron energy to a value of zero at the maximum energy of the accelerated electrons. This "ideal" spectrum is altered primarily by absorption of low energy photons by the flattening filter, causing the true spectrum to roll off to zero at low photon energies. The fitting equation models this behavior and has these advantages over previous methods: 1) the equation describes the shape of a bremsstrahlung spectrum based on physical expectations; 2) only three fit parameters are required with a single constraint. Results for a 6MV accelerator for central axis and off-axis beams show good agreement with the maximum, average and modal energies, as verified with known spectra. Previously published models, representations of beam fluence (energy fluence,  $dN/dE$ ), experimental methods, and the fitting process are discussed. Use of the measured spectrum is shown for a FSPB dose computation model, including the effects of off-axis beam-softening.