AbstractID: 1807 Title: Model-based methods for commissioning convolution/superposition codes for x-ray beams from linear accelerators

The existing convolution/superposition codes do not currently employ a "model-based" approach to linac commissioning. Since linac characteristics are derived iteratively from measured data, the beam modeler can potentially arrive at a non-unique combination of adjustable parameters to achieve a ``match" with measurement: e.g., (a) a large measured penumbra can be attributed to a large focal spot, although it may be largely due to collimator transmission, detector size and electron scatter; (b) measured far tails of transverse profiles may not completely resolve headscatter from phantom scatter and leakage; (c) the horns depends both on off-axis spectral softening and on incident fluence profile. To avoid modeling ambiguities, we propose a ``model-based" approach to commissioning. In a previous work, we described a convolution/superposition method that uses random sampling and propagation of photons and kernels. The Monte Carlo approach to superposition lends itself to commissioning methods that use the linac model from the EGS4/BEAM simulation, with the particle phasespace data scored just above the secondary collimator. In method-1, a particle is sampled directly from the phasespace file, propagated through the collimator system. In method-2, also applicable to polyenergetic convolution codes, a dual-source model is extracted from the phasespace data. Both methods make the beam commissioning simpler and more accurate by reducing the adjustable parameters to a single ``natural variable," i.e., the incident energy at the x-ray target. A self-consistent beam model is thus obtained, taking us a step closer to fully model-based dose calculation.