AbstractID: 4877 Title: Improved calculation of energy spectra from electron depth dose curves

Purpose:
Improve the precision of response functions, account for scatter in air, and significantly reduce the scatter component of the beam.

Methods and Materials:
(1) The electron depth dose measurements that are used as the reference are an open field (40cm x 40cm) without any applicator. (2) The vacuum in the space between source and phantom has been replaced with air, to account fully for in-air scatter. (3) The point source simulation with a set of small scoring regions around the central axis has been replaced by a 0.001 cm radius pencil beam simulation on a single 100 cm radius voxel. This is equivalent to a broad beam normally incident on the phantom with small scoring area. The resulting depth dose curves are corrected to a point source with an inverse square law correction. Ds(d) is the simulated dose at depth d in a 100 cm SSD setup. The corrected dose Dc(d) can be found with: Dc(d)=Ds(d)*10,000/(100+d)^2.

Results:
The electron depth dose curves simulated with a small pencil beam and large planar scoring regions agree well with those simulated with a point source and small regions after the inverse square law correction has been applied. The simulation times for the pencil beam calculations were shorter by orders of magnitude and the precision is much better.
Use of the large field with very low scatter from peripheral components and including the air scatter in the response functions provides for a more realistic estimate of the true spectrum. Otherwise the low energy component is overestimated.

Conclusions:
The three improvements of the unfolding procedure improve the accuracy of the electron spectra and require less simulation time.