AbstractID: 5734 Title: BrachyDose: A new fast Monte Carlo code for brachytherapy calculations

Purpose : To develop a fast Monte Carlo code based on EGSnrc for accurate dose calculation around brachytherapy sources.

Method and Materials: Sources and phantom geometries are modeled by using the Multi-geometry technique which allows various predefined geometry elements (eg, sources, applicators, catheters) a phantom geometry. Sources such as an HDR Ir-192 source and LDR I-125 or Pd-103 seed sources were modeled. One or more sources from a database can be duplicated many times and placed in arbitrary locations. Besides the above sources, BrachyDose can calculate dose around a miniature x-ray-tube source since it is based on EGSnrc. It also can use CT data in the phantom geometry.

Variance reduction techniques are applied to speed up computation time. Dose is calculated by scoring the collision kerma using a tracklength estimator. There is an option to reuse every photon which escapes from a seed as if it came from every seed in the implant with same direction relative to the seed itself.

Results : The speed of the BrachyDose calculation is specified by the time required to attain an average of 2\% statistics in the central region of an implant of 125 seeds spaced at 5 mm separation in a 1000 cm^3 cubic phantom. The time required scales roughly as the inverse of the volume of the voxels. On an 2.4 MHz CPU, the computation time is 510 s for 1 mm voxels. The DVHs for 1 mm voxels are significantly different from those in 2 mm voxels. Changing phantom material from water to prostate tissue causes the dose to vary by +/-5% vs dose to water, depending on distance from the seeds.

Conclusions: The Monte Carlo code developed is fast enough for routine clinical applications. Calculated dose values include inter-seed effects and other effects from tissue inhomogeneities.