AbstractID: 5533 Title: New BEAMnrc tools for photon and electron beam model analysis

Purpose: Accurate radiotherapy planning requires precise and adaptable beam models. A beam model must be able to reproduce the full range of output on a clinical accelerator if a 2%/2mm or better accuracy goal is to be met. Most beam models have not been able to consistently meet this goal. While beam models can be based largely on measurements, Monte Carlo calculations can also be useful for determining the needed parameters and the breadth of flexibility required. In particular, Monte Carlo calculations are critical for exploring the impact of asymmetries in the accelerator geometry. As part of an effort to develop flexible beam models meeting a 2%/2mm accuracy goal, we have developed new tools for use with BEAMnrc.

Method and Materials: A version of beamnrc.mortran incorporating a lateral shift for each component module has been designed, allowing the impact of laterally offsetting electron beam and accelerator elements to be evaluated. The point source model has also been modified to permit a non-normal beam angle to allow a sensitivity analysis to include an angular distribution at the focal spot with a tilted beam. In addition, we have developed a new component module RECT which includes a simple rectilinear phantom as part of BEAMnrc, removing the necessity of using DOSXYZnrc for simple geometries.

Results: By bypassing the need for a phase space file, RECT can facilitate high-statistic runs for large field configurations by eliminating restrictions on disk space. RECT can also take advantage of the homogeneity in a water phantom by allowing photon step sizes beyond individual voxel boundaries, speeding up the simulation.

Conclusion: The inclusion of lateral offsets in Monte Carlo beam models has been demonstrated to reproduce asymmetries of several percent in large electron fields, and is being used to study the 1-2% asymmetries found in clinical photon fields.