

The Discrete Ordinates Method (DOM) is a deterministic solution to the Boltzmann equation governing photon transport. DOM transport solutions are in principle as accurate as Monte Carlo photon-transport (MCPT) simulations but are potentially much faster, offering the prospect of using fundamental transport calculations as brachytherapy treatment planning tools. DOM calculations have been extensively benchmarked and used for neutron transport calculations but, to our knowledge, have never been applied to low energy, photon-emitting, point-like sources embedded in shallow penetration media characteristic of brachytherapy. In this study, we have evaluated the accuracy of the DANTSYS DOM code system for modeling the two-dimensional (2D) dose distribution around the microSelectron-HDR Ir-192 source. DANTSYS code estimates of the transverse-axis water kerma distribution from 0.1 mm to 7 cm distance and polar dose profiles at distances 0.25 cm, 1.0 cm, and 5.0 cm from the source center were compared to corresponding continuous-energy Monte Carlo calculations. A multigroup gamma cross section library with a fine energy grid was developed by the NJOY code system using the DLC-146 cross section library specifically for benchmarking DOM accuracy in brachytherapy applications. The root mean square error (RMS) of DANTSYS results in comparison to the MCPT ones is less than 2%, confirming that discrete ordinates transport solutions can accurately model brachytherapy source dose distributions in this energy range. Even with the fine energy group structure calculations presented here the DANTSYS gain in CPU time is tenfold. Supported by NIH Grant R01 CA46640.