

## AbstractID: 1402 Title: A Deterministic Dose Calculation Method with Analytic Ray Tracing for Brachytherapy Dose Calculations

A deterministic dose calculation method incorporating variably sized tetrahedral elements has been adapted for brachytherapy dose calculations with anisotropic linear sources. This method was evaluated for the dosimetry of the new microSelectron 1 mm pulsed dose rate (PDR)  $^{192}\text{Ir}$  source in water. The methods are based on the Attila radiation transport code\*, which solves the differential form of the linear Boltzmann transport equation for neutral and charged particles. The Attila computational mesh included 100,000 tetrahedral elements, which varied in size by a factor of over 3 million within the computational domain. Calculation parameters included 37 photon energy groups (CEPXS cross sections),  $P_2$  scattering order and  $S_{22}$  angular quadrature (528 angles solved). To mitigate ray effects caused by solving the transport equation on a finite number of angles, a novel analytic ray tracing method was applied to calculate the first collided source. Results were compared with calculations performed with the Monte Carlo code, MCNPX. An excellent agreement between Attila and MCNPX is obtained throughout clinically relevant distances. From a radial distance of 0.1 to 0.5 cm from the source, the RMS difference was 1.2%, with a maximum difference less than 2.5%. Between 0.5 and 3.0 cm from the source, the RMS difference was 0.7% with a maximum difference less than 2.5%. Between 3.0 and 10.0 cm from the source, the RMS difference was 0.92%, with a maximum difference less than 2.0%.

\*Wareing TA, *et. al* "Discontinuous Finite Element Sn Methods on Three-Dimensional Unstructured Grids", Nucl. Sci. Engr., V-138(2), 2001.