AbstractID: 11210 Title: A Highly Accurate, Rapid Dose Calculation Method Employing Direct Solution of Transport Equations

Purpose: ProACTive™, a new dose calculation method has been developed that provides accuracy comparable or exceeding Monte Carlo calculations with computational speed gains that may exceed two orders of magnitude.

Method and Materials: A transport simulation method has been developed fully utilizing computer memory and hierarchical pre-computation to produce high resolution, high quality dose computations for use in medical treatment planning. The advent of computers with Gigabytes of random access memory allows direct transport response coupling for distant finite surfaces and volumes. Coupling over large distances, with many angular finite groups minimizes ray-effects, providing consistent high accuracy dose computations through heterogeneous systems. This allows direct modeling of the forward peaked highly anisotropic scattering and transport of photons and electrons.

The discrete nature of these computations allow for reverse engineering of LINAC filters, and this is accomplished using minimal wide beam depth dose and one depth (typically 10 cm) profile data.

The method of invariant imbedding is employed to produce shape functions to speed computation of relatively low important scattered radiation.

ProACTive™ calculations have been compared to both measurement and published Monte Carlo calculations for number of homogenous and heterogeneous geometries, including interface regions.

Results: In homogenous, water equivalent geometries, agreement among ProACTive™, published Monte Carlo and measurement was excellent, typically within 1-2%. In heterogeneous geometries, similar results were obtained. On one processor ProACTive™ can run in minutes and is inherently parallelizable.

Conclusion: To obtain reasonable calculation speeds, variance reduction techniques are often employed in Monte Carlo calculations resulting in degradation of accuracy due to statistical artifacts. ProACTive™ uses finite angular and energy groups accounting for in-group spectral shifts during collision epochs, providing consistent high accuracy without inherent statistical fluctuations associated with Monte Carlo.

Conflict of Interest: Research Sponsored By Applied Computational Technologies, LLC