AbstractID: 2525 Title: RadSim, a program to simulate individual radiation interactions for teaching purposes

Purpose: To develop a computer program to simulate individual particle interactions in a visual way, as a teaching aid in radiotherapy physics.

Method and Materials: A program, RadSim, was developed using the RealBasic software development environment. A Graphical User Interface allows users to select individual interactions to be simulated for photons, electrons and positrons in the energy range encompassing radiation oncology (1 keV – several hundred MeV). The program is designed to operate in two modes. In the Manual mode a single interaction is performed. In the Simulated mode the user can run a short Monte Carlo simulation for a small number of particles. In the latter mode statistics on the interaction variables are displayed graphically. The program is made available in versions for the Windows, Linux and Mac operating systems, via free download from a website.

Results: The user can simulate the following types of interactions: for photons: Compton scatter, photo-electric effect with characteristic x-rays, Rayleigh scattering and pair-production, for electrons: inelastic nuclear scattering with Bremsstrahlung production, electron-electron scattering, for positrons: Bhabha scattering and annihilation. The Manual mode allows visual evaluation of kinematic equations. The user can initialize any combination of a minimally required set of interaction variables and the program evaluates the remaining variables, and displays the interaction visually showing incoming and outgoing particles. In the Simulated mode, the user can only change the kinetic variables of the initial particle. The final state of all particles involved is generated from a Monte Carlo simulation. The user defines the number of particles used in the simulation and frequency distributions are displayed during the simulation so that the user can watch the distributions grow.

Conclusion: The program RadSim enables virtual radiation experiments in the classroom and for self-learning and is found to be a useful addition to textbook teaching.