5. The Physics in the EGS4 Code System

EGS4 accounts for the following processes:

- Bremsstrahlung production (corrected at low energies to agree with ICRU-37 radiative stopping powers).
- Positron annihilation in flight and at rest (the annihilation quanta are followed to completion).
- Molière multiple scattering (*i.e.*, Coulomb scattering from nuclei). The reduced angle is sampled from a continuous (rather than discrete) distribution. This is done for arbitrary step sizes, selected randomly, provided that they are not so large, or so small, as to invalidate the theory.
- Møller (e^-e^-) and Bhabha (e^+e^-) scattering. Exact rather than asymptotic formulas are used.
- Continuous energy loss applied to charged particle tracks between discrete interactions.
  - Total stopping power consists of soft bremsstrahlung and collision loss terms.
  - Collision loss determined by the (restricted) Bethe-Bloch stopping power with Sternheimer treatment of the density effect.
- Pair production.
- Compton scattering.
- Coherent (Rayleigh) scattering may be modeled using an independent-atoms approximation (non-default option in EGS4).
- Photoelectric effect.
  - Neither fluorescent photons nor Auger electrons are produced or transported in the default version of subroutine `PHOTO`.
  - However, a version of `PHOTO` is available that allows for the production and transport of K-edge photons.

In addition to the above, the user can make changes to EGS4 by means of macro commands in the driver program, called the *User Code*. For example, macros have been written to change how bremsstrahlung and or photoelectric angles are sampled—*i.e.*, to override the way EGS4 handles this by default.