AbstractID: 9629 Title: Validation of PENELOPE code for X-ray photons transport with energy between 20 and 150 KeV in thin geometry

Purpose: PENEPOLE is a general Monte Carlos package for the simulation of coupled electron-photon transport. In this study, the simulation input parameters that control the transport algorithm have been optimized so that PENELOPE could properly describe X-rays interactions with thin materials in the energy range used in diagnostic radiology.

Method and Materials:

The PENELOPE code was validated through the simulation of the linear attenuation coefficient (μ) considering thin geometries and energies between 20 and 150 keV. The parameters associated with: threshold energy for local absorption (EABS); angular distribution (C1) and loss energy (C2) of charged particles and energy loss in collision (WCC) and radiation emission (WCR). The validation was performed by comparison of the simulated values and those presented in literature.

Results:

The differences between the values of μ obtained in this study and those presented in the literature were less than 1% for all the combinations of input parameters and in the whole range of energy used. It was found that the combination of input parameters has more influence on the results in the energy of 150 keV. For the range of energy considered in this study, the values of simulated μ were superior to those presented in the literature, except for the energy of 80 keV, for the acrylic, and 20 keV, for the aluminum.

Conclusion:

The value that should to be selected for each input parameter depends on the thickness and atomic number of the material and energy of the X-ray photons. Considering that variations of input parameters did not significantly changed the values of μ, as compared to those provided by literature, we concluded that the code PENELOPE correctly simulates the transport of particles in thin geometries and low X-rays energies, validating its use on studies of construction characteristics of ionization chambers used in diagnostic radiology.