Benchmarking the MCSHAPE3D code with 1D, 2D and 3D imaging experiments.

Jorge E. Fernandez\textsuperscript{1,2} and Viviana Scot\textsuperscript{1}

\textsuperscript{1} CNR/INFN and Laboratory of Montecuccolino-DIENCA, Alma Mater Studiorum University of Bologna, Italy
\textsuperscript{2} National Institute of Nuclear Physics (INFN)

MCSHAPE is a Monte Carlo code for the simulation of gamma and X-ray diffusion in matter which gives a general description of the evolution of the polarization state of the photons. The model is derived from the so called 'vector' transport equation [1]. The three-dimensional (3D) version of the code can accurately simulate the propagation of photons in heterogeneous media originating from either polarised (i.e., synchrotron) or unpolarised sources, such as X-ray tubes.

Photoelectric effect, Rayleigh and Compton scattering, the three most important interaction types for photons in the considered energy range (1-1000 keV), are included in the simulation. Recently the 3D version of the code MCSHAPE was presented. [2] The 3D extension of the code is based on a sample modeling using a 3D regular grid of cubic voxels. At each voxel, the local composition is specified by giving the number of chemical elements, their weight fractions, the atomic characteristics of each element, the total attenuation coefficient divided by the density and the total density. In this paper, the 3D extension of MCSHAPE was validated by simulating the output for 1D, 2D and 3D imaging experiments.