

Monte carlo simulation for electron-loss and photon-scattering  
corrections for parallel-plate free-air chambers

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The parallel-plate free-air ionization chambers are used for X-rays air-kerma rate standards at National Metrology Institute of Japan (NMIJ), National Institute of Advanced Industrial Science and Technology (AIST). The electron loss and scattering correction factors are needed for the evaluation of air-kerma rate from measured current. The electron loss correction factor ( $K_e$ ) is a correction of the charge loss by giving energy to the electrode part without a high-speed electron stopping in the air area where the charges are collected. The scattering correction factor ( $K_{sc}$ ) is for a correction of extra charges produced by scattered photon generated after an incidence photon is interactive. The electron-loss and photon-scattering correction factor for 3 different size parallel-plate free-air chambers are estimated by the EGS4 code. One is used as primary standards for absolute measurements of air kerma in beams of medium-energy X-rays and two are of low-energy X-rays. These correction factors are calculated for mono-energetic photons. It is obtained that electron-loss and photon-scattering correction factors depend on the chamber size, and especially, the photon-scattering correction value changes greatly depending on the size. The  $K_e$  and  $K_{sc}$  value for medium- and low-energy X-ray fields at AIST are estimated by averaging the energy deposition contributions over the X-ray spectrum. The overall uncertainty of the electron loss or scattering correction factor is evaluated to be 0.14%.