Tandem KAP Meters Calibration Parameters by Monte Carlo Simulation using Reference RQR Radiation Qualities

Ademar Potiens Jr., Nathalia Costa, Eduardo Correa, Lucas Santos, Vitor Vivolo, Marie Da Penha Potiens

Nuclear Energy Research Institute - National Nuclear Energy Commission (IPEN/CNEN-SP), São Paulo, Brazil

Abstract. The Kerma-area product quantity can be obtained by measurements carried out with a kerma-area product meter (KAP) with a plane-parallel transmission ionization chamber mounted on the X ray system. It is the integral of the air kerma over the area of the X ray beam in a plane perpendicular to the beam axis. This quantity has been important to establish the diagnostic reference levels (DRLs) all over the word. In this work the MCNP5 code was used to calculate the imparted energy in the air cavity of KAP meter and the spatial distribution of the air collision kerma in entrance plan of the KAP meter. From these data, the air kerma-area product (KAP) and the calibration coefficient for the KAP meter were calculated and compared with those obtained experimentally. The X-ray tube was easily modelled as well the complete tandem calibration set up was possible. The spectra of the diagnostic radiology RQR reference qualities measured were used as a source definition in the input card for the Monte Carlo simulation. The clinical KAP meter calibration coefficients were obtained experimentally and by Monte Carlo simulation. The differences between those values were about 2%, except for RQR 10 (5.45%). The uncertainties in Monte Carlo simulation were less than 0.5% in all cases and the FOM (Figure of Merit) was constant for a number of histories of 1 million.