AbstractID: 9641 Title: Monte Carlo calculation to determine tandem ionization chamber response to X-rays beam using PENELOPE

Purpose We used PENEPOLE code to determine the response of a special double-faced plane parallel ionization chamber to X-rays considering an energy range of 33 to 115 keV.

Methods and Materials We used a plane parallel ionization chamber with a double face, body in Lucite and entrance windows of Mylar (100 μm thick) and aluminum (5 μm thick). One face has an aluminum collecting electrode (A) and the other has a graphite collecting electrode (G), each one with 5 mm thick and 20 cm in diameter. The volumes are approximately 0.6 cm^3, filled with dry air (sea level). For this study, the X radiation qualities spectra were calculated using a software that is based on the work of Birch and Marshall. PENELOPE was used to calculate the energy response variation of the modeled tandem chamber. The cutoff energy for photon and electron absorption was assumed as 1 keV. The following parameters were used for all materials: an average angular deflection C1=0.05, a maximum average fractional loss between consecutive hard elastic events C2=0.05, a cutoff energy loss for hard inelastic collisions WCC=5 keV and a cutoff energy loss for hard bremsstrahlung emission WCR=1 keV. Measurements of the energy response variation of the tandem chamber were performed using the radiation qualities established by a standard laboratory. The source-detector distance was 50 cm and the diameter of circular field was 6.66 cm.

Result The differences between measured and calculated energy response variation are less than 7.0 % for the face A and less than 1.5 % for the face G of the tandem chamber.

Conclusion The results show that PENELOPE code allows a reliable methodology for design and analysis of ionization chambers over the range between 33 to 115 keV of X-ray beams.