

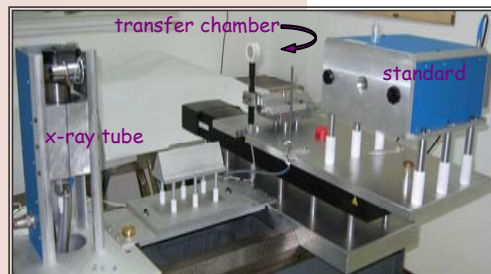
Reference radiation qualities for mammography at the BIPM

New reference radiation qualities for mammography

Generating potential / kV	25	28	30	35
Additional filtration	30 μm Mo			
HVL / mm Al	0.277	0.310	0.328	0.365
$K_{\text{air}} / \text{mGy s}^{-1}$	2.00			

Installation of a new x-ray tube with Mo-anode

- high-voltage generator, voltage stabilization and anode current measuring system shared with W-anode tube
- new cooling system installed for both tubes
- high precision translation table and motion control device installed for standard and transfer chamber



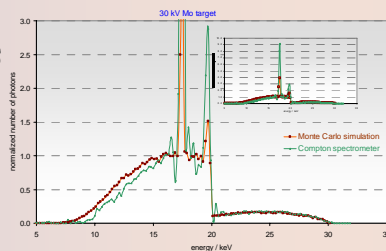
Characterization of the radiation field

- study of the radiation field with radiographic film (size, shape, orientation)
- design (size and position) of collimators to produce a 100 mm diameter field at the reference plane (600 mm)
- horizontal and vertical profiles measured using a thimble chamber

Spectra: measurements and simulations

Spectral measurements: Spectra were measured using the Compton scattering method. The scattered photons were detected at 90° with a low-energy pure germanium detector (LEGe) coupled to a multichannel analyser (MCA).

Spectral simulations: The transport of electrons and photons was performed using the Monte Carlo code PENELOPE [1]; the x-ray tube, collimators and filter were simulated using the geometry code PENGEO.



Design and construction of a new standard

The new standard is a parallel-plate free-air chamber (FAC) designed to be used up to 50 kV and to minimize the correction factors for the K_{air} determination.

Comparison with the existing standard: agreement at the level of 1×10^{-3}

Calculation of the FAC correction factors

Correction factors entering in the K_{air} determination were calculated using Monte Carlo techniques (PENELOPE code). For these calculations the chamber was simulated in detail using the PENELOPE geometry code PENGEO.

The results for monoenergetic photons were folded with measured and simulated spectra.

	25 kV	28 kV	30 kV	35 kV
electron loss k_e	1.0000	1.0000	1.0000	1.0000
photon scatter k_{sc}	0.9977	0.9977	0.9978	0.9978
fluorescence k_{fl}	0.9975	0.9976	0.9976	0.9977
bremsstrahlung production k_{br}	1.0000	0.9999	0.9999	0.9999
diaphragm correction k_{dia}	0.9996	0.9996	0.9995	0.9995

Reference

[1] Salvat, F., Fernandez-Varea, J.M., Acosta, E., Sempau, J., PENELOPE – A Code System for Monte Carlo Simulation of Electron and Photon Transport, NEA/NSC/DOC (2001)19 (ISBN 92-64-18475-9).