

Application of an extrapolation chamber in low X-rays as a reference system

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Extrapolation chambers are important metrological instruments for detection of beta radiation and low energy X-rays. These chambers are very useful, because they allow the determination of superficial doses through the variation of the air mass in their sensible volumes. In this work, two extrapolation chambers were tested in some standard qualities of X-ray beams, BIPM radiotherapy level. A commercial PTW extrapolation chamber model 23391 and a home-made extrapolation chamber designed and constructed at IPEN, for beta radiation, were studied in standard X radiation beams. The commercial chamber has a collecting electrode (40 mm diameter) and guard rings made of aluminum, and entrance window (0.025 mm thick) made of polyamide; the developed chamber presents a collecting electrode (30 mm diameter) and guard rings made of graphite, and entrance window (0,84 mg/cm² thick) made of aluminized polyethylene terephthalate. Both chambers were positioned at 50 and 100 cm from the X-ray system focus. A Keithley 6517a electrometer was utilized. The air kerma rates were determined using a PTW ionization chamber, model 23344, calibrated at the German primary laboratory Physikalisch-Technische Bundesanstalt (PTB). The main characteristics of both extrapolation chambers, as ion collection efficiency, saturation curve, polarity effect, repeatability, long time stability, linearity response, extrapolation curves and energy dependency were determined and compared. The results show that both chambers present adequate responses for the verified X-ray beam qualities, confirming preliminary studies realized with these detectors. In conclusion, both chambers are useful for accurate measurements in low energy X-ray beams.

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