ASSEMBLING AND STUDY OF A PLANE-PARALLEL IONIZATION CHAMBER IN LOW-ENERGY X-RAY QUALITIES FOR RADIOTHERAPY

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A plane-parallel ionization chamber, with a sensitive volume of 6.28cm^3, developed at the Calibration Laboratory of IPEN (LCI), was utilized to verify the possibility of its application in low-energy X-ray beam qualities for radiotherapy (T-qualities). This homemade chamber was manufactured using polymethyl methacrylate (PMMA) coated with graphite, and utilizing co-axial cables. This ionization chamber was connected to an electrometer, model UNIDOS E, *Physikalisch-Technische Werkstätten* (PTW), Germany, during all measurements. In order to evaluate the performance of this ionization chamber, some characterization tests were performed: short- and long-term stability, leakage current, saturation, ion collection efficiency, polarity effect, linearity of response and energy dependence. The stability tests were made using a ^{90}Sr + ^{90}Y check source device, PTW, model 8921, with nominal activity of 33MBq (1994). The other tests were undertaken using an industrial X-ray unit, Pantak Seifert, model ISOVOLT 160HS, that operates from 5kV to 160kV. The short- and long-term stability tests were performed using the check source that was positioned in a reproducible geometry using a special acrylic support. The saturation curve was obtained varying the applied voltage from -400 V to +400 V, in steps of 50V, using the charge collecting time of 20 s. This test was made for a low-energy X-ray beam quality for radiotherapy, T-50 (b), established at the Pantak equipment at LCI for calibration procedures, based on *Bureau International des Poids et Mesures* [BIPM, 2004]. From the saturation curve two other characteristics were analyzed: the polarity effect and the ion collection efficiency. These two tests were obtained using equations provided by the TRS-398 report [IAEA, 2000]. The leakage current of the ionization chamber was measured in time intervals of 20 minutes, before and after its irradiations, and all the results obtained were in agreement with the IEC 60731 standard. The linearity of response was verified utilizing the T-50 (b) radiation quality, and the ionization chamber was exposed to different air kerma rates. To evaluate the energy dependence of the chamber response the T-qualities were also utilized. All results were considered satisfactory, and values were obtained within those recommended internationally [IEC, 2011]; therefore, this homemade ionization chamber presents potential routine use in dosimetry of low-energy radiotherapy beams.

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