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INVESTIGATION OF THE APPLICABILITY OF A SPECIAL PARALLEL IONIZATION CHAMBER FOR X-RAY BEAM DOSIMETRY

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Ionization chambers are usually utilized as reference instruments in diagnostic radiology dosimetry and in quality assurance programs, mainly due to their high sensitivity and relatively constant response within a wide range of energy. Diagnostic X-rays are the greatest source of exposition to ionizing radiation of the population worldwide. Moreover, with the introduction of new techniques and equipment in medical imaging, it is possible to observe a rapid increase in the number of high dose X-ray examinations. In order to obtain accurate and lower-cost dosimeters for quality control assurance of medical X-ray facilities, the Calibration Laboratory of IPEN has recently designed a special ionization chamber, for dosimetry in diagnostic radiology beams. A preliminary characterization of this ionization chamber in low-energy radiotherapy beams was reported in another work by the same group. The ionization chamber presented in this work was manufactured utilizing PMMA coated with graphite, silver glue, and coaxial cables. The chamber collecting electrode has a diameter of 42.0 mm and thickness of 2.0 mm, while the chamber walls present a thickness of 2.0 mm. This ionization chamber has a sensitive volume of 6.3 cm^3. For the chamber characterization some tests were undertaken: short- and medium-term stabilities, saturation curve, ion collection efficiency, leakage current, linearity of response and energy dependence. The stability tests were made using a $^{90}Sr+^{90}Y$ check source device, and the other tests were undertaken using an industrial X-ray unit, Pantak/Seifert, model ISOVOLT 160HS, that operates from 5 kV to 160 kV. All results obtained in this work were considered satisfactory, and within the limits recommended by the International Electrotechnical Commission. Therefore, this homemade ionization chamber presents potential use for dosimetry of conventional diagnostic radiology beams.