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# Performance tests of a special ionization chamber for X-rays in mammography energy range

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## ABSTRACT

A special mammography homemade ionization chamber was developed to be applied for mammography energy range dosimetry. This chamber has a total sensitive volume of 6 cm<sup>3</sup> and is made of a PMMA body and graphite coated collecting electrode. Performance tests as saturation, ion collection efficiency, linearity of chamber response versus air kerma rate and energy dependence were determined. The results obtained with this special homemade ionization chamber are within the limits stated in international recommendations. This chamber can be used in quality control programs of mammography energy range. All measurements were carried out at the Calibration Laboratory of IPEN.

Keywords: ionization chamber, mammography, dosimetry.

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## 1. INTRODUCTION

The diagnostic effectiveness and reliability of a breast screening procedure depends on the quality control program of the mammography equipment, which involves an accurate dosimetry [1, 2]. For quality control in medical clinic X-ray equipment, ionization chambers are the reference detectors for the routine verification of the dosimetric parameters as air kerma rate [3]. So, this kind of

detector has to follow high quality control standards and be calibrated in well-known standard radiation fields. In this work, a special ionization chamber is presented for dosimetry in mammography beams. This ionization chamber was characterized with respect to the performance tests of saturation of ionization current.

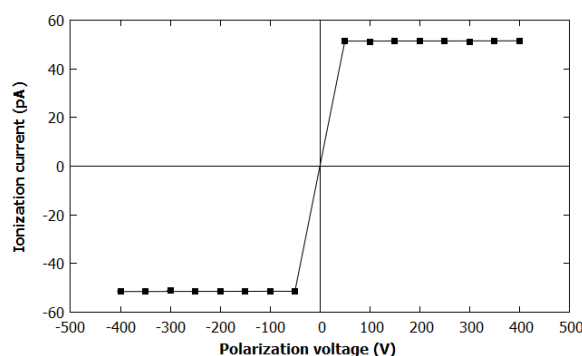
## 2. MATERIALS AND METHODS

The special ionization chamber has a total sensitive volume of  $6.0 \text{ cm}^3$  (two sensitive volumes of  $3.0 \text{ cm}^3$ ) and a distance of 4 mm between the inner electrodes. Ionization chambers with double sensitive volume have been developed for other beam radiation qualities [4,5], but not for mammography energy range yet. A PTW-Freiburg UNIDOS electrometer was utilized to polarize and to take the readings of the special ionization chamber. To perform the measurements, the ionization chamber was exposed to radiation beams from a Pantak Seifert Isovolt 160HS X-ray equipment. This irradiation system is located at the Calibration Laboratory (LCI) at IPEN.

## 3. RESULTS AND DISCUSSION

To perform the saturation test, the entrance window was located at the reference distance of 100 cm in relation to the X-ray reference point. The ionization chamber was irradiated in the WMV 28 radiation quality, and it was polarized with  $\pm 50 \text{ V}$  to  $\pm 300 \text{ V}$  in steps of  $\pm 50 \text{ V}$ . The saturation curve is shown in Figure 1. It can be seen that the ionization current is constant starting at  $\pm 50 \text{ V}$ , and it presents a symmetrical behavior when a change in the polarity signal occurs.

**Figure 1:** *The special ionization chamber saturation curve*



#### 4. CONCLUSION

The special ionization chamber was tested in standard mammography radiation fields established at LCI/IPEN. Through the saturation curve data it was possible to verify the polarity effect that was negligible for this ionization chamber in the polarization voltages utilized in this work.

#### 5. ACKNOWLEDGEMENTS

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