BETA CALIBRATION AND DOSIMETRY AT IPEN

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A commercial extrapolation chamber (PTW, Germany) was tested in different beta radiation fields and its properties investigated. Its usefullness for beta radiation calibration and dosimetry was demonstrated.

The Beta Secondary Standard setup of the IPEN calibration laboratory was utilized. This system, developed by the Physikalisch-Tecknische Bundesanstalt, Brunswick (Germany) and manufactured by Buchler & Co., consists of a source stand, a control unit with timer and four interchangeable beta sources: ^{90}Sr-^{90}Y (1850 and 74 MBq), ^{204}Tl (18.5 MBq) and ^{147}PM (518 MBq). A digital Keithley 616 electrometer was used for the ionization current detection. The variable volume ionization chamber of cylindrical form is provided with different collecting electrodes of tissue equivalent material and Mylar entrance windows of different thicknesses.

Measurements of the ionization current varying the chamber depth between 0.70 and 2.50mm were taken to obtain extrapolation curves for each source, using the 0.025 mm entrance window, 40mm diameter collecting electrode, at the calibration distances . The electric field was maintained constant at 10 V/mm. Calibration factors were determined and consequently the chamber energy dependence.

Varying the source-chamber distance, for ^{90}Sr - ^{90}Y and ^{204}Tl sources it was found that the response obeyed the inverse square law respectively in the intervals 11 to 80cm and 20 to 40 cm. In the case of ^{147}Pm radiation, the power function relationship presented a power of 4.85 between 11 and 25 cm.

With the aim of determining the linearity limit of an extrapolation curve, the camber depth was varied up to 25.00mm. This limit occurred at 3mm depth.

Calibration factors were determined using all beta sources of the setup, changing the chamber collecting electrodes (and the respective guard rings) between 10 and 40mm diameter. These factors depend strongly on the electrode area, because the electrode defines the chamber sensitive volume. With these results it is possible to choose the electrode according to the necessity, for high and low dose rate determinations.

Other experiences were also performed, referring to the influence of the flattening filters in the calibration factors, angular dependence and transmission factors determination. These results will also be presented, in comparison with other from the literature[1-4].

References:

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