MONTE CARLO SIMULATION OF β–γ COINCIDENCE SYSTEM USING PLASTIC SCINTILLATORS IN 4π GEOMETRY

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The Nuclear Metrology Laboratory (Laboratório de Metrologia Nuclear, LMN) at the IPEN-CNEN/SP has developed a $4\pi\beta(PS)-\gamma$ coincidence system for primary radionuclide standardization, which consists of a plastic scintillator in 4π geometry, for alpha and electron detection, coupled to a NaI(Tl) counter for gamma-ray detection [1]. With this system several radionuclides have been standardized applying the extrapolation technique.

On the other hand, the LMN has developed a Monte Carlo code called ESQUEMA [2] which simulates the behavior of this extrapolation curve by following all transitions in the decay scheme from the precursor nucleus to the ground state of the daughter nucleus, and considering the deposited energy for all detected radiation in both detectors. Therefore, it can reproduce the whole coincidence experiment accurately.

This code has already been applied to a conventional $4\pi\beta-\gamma$ coincidence system which consists of a proportional counter in 4π geometry, coupled to NaI(Tl) scintillation counters [2]. The purpose of the present work is to apply this code to the $4\pi\beta(PS)-\gamma$ coincidence system, for the cases of ^{60}Co and ^{133}Ba.

The deposited energy distribution for monoenergetic electrons and photons in 4π plastic scintillator and for monoenergetic photons in NaI(Tl) detector were calculated by means of code Penelope [3]. A least square fit between the experimental data and the Monte Carlo calculation has been performed in order to obtain the activity. This procedure is based on a realistic behavior of the extrapolation curve instead of the conventional approach, using polynomial fitting.

References

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