

GAMMA-SPECTROMETRY OF EXTENDED SOURCES FOR ANALYSING ENVIRONMENTAL SAMPLES

Measurements of the environmental activity concentration by gamma-ray spectrometers require the determination of the **full-energy-peak efficiency** η , as a function of photon energy over the region for which the detector is suitable. This can be done either **experimentally** or **by calculation**. For very simple cases (single gamma-transition, point-like source positioned far from a simple shaped detector, etc.) its determination is quite straightforward. In this case a unique $\eta(E_\gamma)$ function characterises the detection efficiency. However, if the decay scheme of the studied nucleus is more complex, cascade effects modify the detection efficiency. Similarly, the actual detection efficiency depends on the actual detection geometry e.g. (extended source), on the self-absorption occurring in the material of the source, and so on.

All these effects are generally treated as corrections or modifications of the simplest case values. These modifications are especially relevant when applied for large volume samples of environmental origin.

Corrections due to self-absorption and cascade coincidence phenomena can be accomplished by means of various theoretical, empirical and experimental procedures. This study attempts to summarise the state-of-the-art and offers an elaborate solution of Monte Carlo simulation by carefully tailoring its input to the actual problem.

The experimental determination of the detector efficiency with calibration sources is usually easier and more accurate than with calculations. However, there are cases when a measurement is just not possible either because no calibration sources are available, or they can not be prepared. In such a situation calculations (simulations) have to be used.

In this work calculations are made (applying GEANT MC) for experimental situations that were really performed. In order to achieve reliable results, these

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calculations should be validated. In this context validation means that calculations should be done for cases which can be made also experimentally, and the results of the calculations should be compared with the experimentally measured values. If this comparison is satisfactory, one can rely on the result of the calculations also in cases, when no direct experimental determination is possible.

The results of this comparison are presented and discussed in this work.

Part of this work has been performed in the Institute of Nuclear Techniques of Technical University Budapest (INT TUB), using a **HPGe** coaxial detector called (**POP-TOP**). Another part has been performed in Brunel University of West London, using **HPGe** low energy detector with **Be** window called (**LO_AX** detector), directly developed for low energy spectrometry.