CALCULATION OF THE RESPONSE FUNCTION OF A TRUE COAXIAL Ge(Li) DETECTOR TO AN EXTENDED GAMMA-RAY SOURCE

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The calculation of the Ge(Li) detector response to an extended gamma-radiation source, reported previously[1], was developed to allow for the detector efficiency dependence on source geometry. A response function was factored into a part δ which determines the directional intensity distribution of the radiation falling onto the detector face, and into the corresponding detector efficiency $\bar{\varepsilon}$ for the incoming radiation distribution:

$$n = N_o \cdot \bar{\varepsilon} \cdot \delta,$$

where n and N_o are the detected and emitted photon numbers, respectively.

In the case of an coaxial detector and a cylindrical radiation source, the factor δ, dependent on the detector and the source geometry and on the absorption of the emitted radiation in the source, can be reduced analytically to a form suitable for numerical calculation[1].

In order to obtain $\bar{\varepsilon}$, a semi-empirical method has been developed by using a matrix efficiency field for point sources distributed within the source volume. However, as the self-absorption in an extended source introduces changes in the incoming radiation field, there is also a dependence of $\bar{\varepsilon}$ on the absorption coefficient μ of the source material. This is approximately accounted for by introduction of the modified absorption coefficient μ' [2].

This approximation is found to be satisfactory by comparison of μ' and μ and by the experimental verification of the response function calculation with reference radiation sources.

1) E. Coffou, V. Knapp, T. Petković, A response of a coaxial Ge(Li) detector to the extended source of gamma radiation, Proc. of the XXIVth Conf. on Electr., Telec., Autom. and Engineering, IV (1980) 139, Priština, Yugoslavia

2) E. Coffou, V. Knapp, T. Petković, to be published