

2.6. Polarimetric efficiency of a planar Ge(Li) detector

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Application of a single Ge(Li) planar detector^{1,2)} to measurements of the degree of linear polarization of gamma rays has some advantages over the coincidence spectrometers: it is simple and reliable and the detection efficiency is relatively high. The main disadvantage is a lower polarimetric efficiency.

An Ortec Ge(Li) planar detector of $\phi 18 \times 3$ mm was used for measurements of linear polarization. Since the detector could not be rotated, a system was built by means of which the plane of polarization was rotated, other conditions being unchanged (see Fig.). To determine the polarimetric efficiency of the system for different gamma-ray energies, Compton scattering of 662 keV, 1173 and 1332 keV gamma rays was used. The degree of polarization of secondary Compton photons (P_C) obtained by scattering in graphite at a number of angles, was calculated. From the measured asymmetry of the counting rates $A = (N_1 - N_2)/(N_1 + N_2)$ the polarimetric efficiency $\varepsilon = A/P_C$ was calculated. N_1 and N_2 are the counting rates when the plane of polarization is parallel and perpendicular to the plane of the detector, respectively.

An approximate formula for the polarimetric efficiency has been derived

$$\varepsilon \approx F \cdot \frac{d\sigma_C(E, \Theta)}{d\Omega} \cdot P_C(E, \Theta) / \sigma_{tot}, \quad (1)$$

where $d\sigma_C/d\Omega$ and P_C are the differential cross section and the degree of linear polarization of photons of incident energy E when scattered by the Compton effect at an angle Θ , for which the product is maximum, σ_{tot} is the total cross section for the absorption of gamma rays and F a normalizing factor. A comparison of the results of measurements and of the calculated values of ε_{th} is given in the Table on the p. 16.

References

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2.7. Tests and calibration of a 3D system

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Multiparametric analysis of events has become a widely applied technique in complex experimental methods of investigation in nuclear physics. A three-dimensional (3D) system of $256 \times 256 \times 256$ channels (24 bit) with the provision for extension up to 36-bit recording of data has been built in the Department of Electronics in the Institute. It is used in connection to a double- or triple-input fast-slow electronic system. Coincident data are analyzed in three ADC-s and the channel numbers recorded on punched paper tape. The total number of channels