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JOINT INSTITUTE
FOR NUCLEAR RESEARCH

Preliminary results of measurements with a prototype setup for studying (investigation) the angular correlation of gamma quanta in reactions with neutrons

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P-even angular correlations

$$\sigma^{\pm} = \sigma_0\left(1 \pm P\mathbf{s}_n\mathbf{k}_n\right)$$

$$A(E) = \frac{2H_{ps}x_{1/2}}{E - E_s}\left(\frac{\Gamma_n^s}{\Gamma_n^p}\right)^{1/2}; \leftarrow \textit{Asymmetry}$$

$$x_{1/2} = \frac{\left(\Gamma_{n1/2}\right)^{1/2}}{\left(\Gamma_{n1/2} + \Gamma_{n3/2}\right)^{1/2}}; \qquad x_{3/2} = y; \qquad x^2 + y^2 = 1;$$

$$\sigma(\theta,\varphi) = \frac{\lambda\!\!\!^{-2}}{4}\left[a_0 + \sum_{k\neq 0}\left(a_k P_k(\cos\theta) + b_k P_y P_k^1(\theta,\varphi)\right)\right];$$

$$P_1(\cos\theta) = \cos\theta; \qquad P_2(\cos\theta) = (1/2)\left(3\cos^2\theta - 1\right);$$

H_{ps} – is the weak matrix element, E_s *and* Γ_n^s – *energy and widths of the s – resonance.*

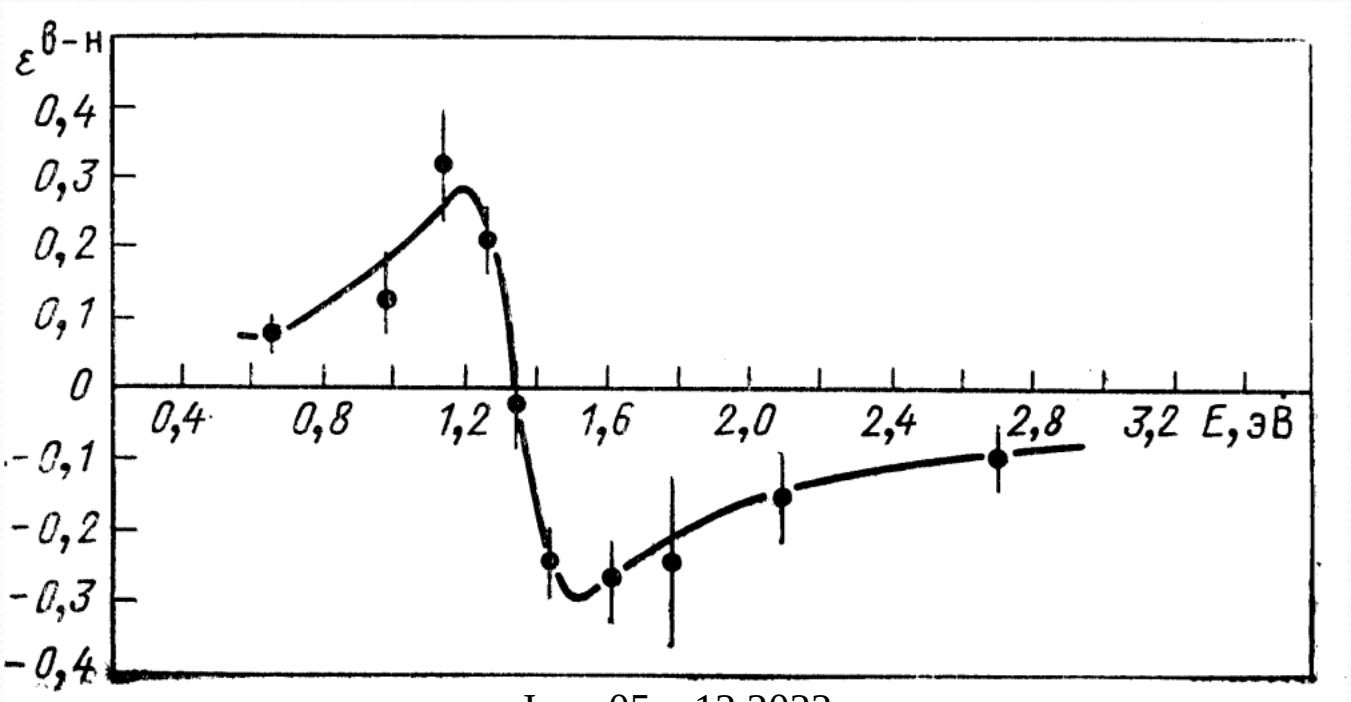
Γ_n^p – *widths of the p – resonance,* P_k – *Legendre polynomials.*

The effect of forward-backward asymmetry in an unpolarized neutron beam is expressed as follows:

$$\varepsilon^{f-b}(\theta)=\frac{\sigma(\theta)-\sigma(\pi-\theta)}{\sigma(\theta)+\sigma(\pi-\theta)}=\frac{a_1\cos\theta}{a_0+a_2P_2(\cos\theta)};$$

if

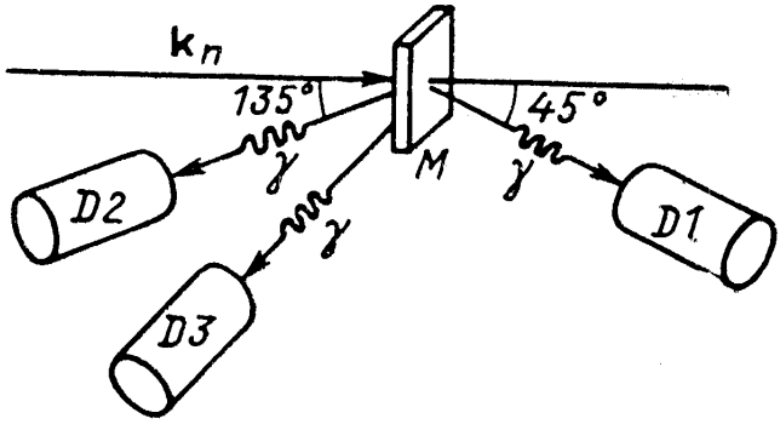
$$\varepsilon^{f-b}=\frac{\left(-x+y/2^{1/2}\right)4t_\theta\cos\theta(E/E_0)^{1/2}(E/E_0)/\Gamma}{\left[1-P_2(\cos\theta)\left(xy/2^{1/2}+y^2/4\right)\right]^{1/2}\left[4\Delta E^2/\Gamma^2+1+t_\theta^2E/E_0\right]}.$$

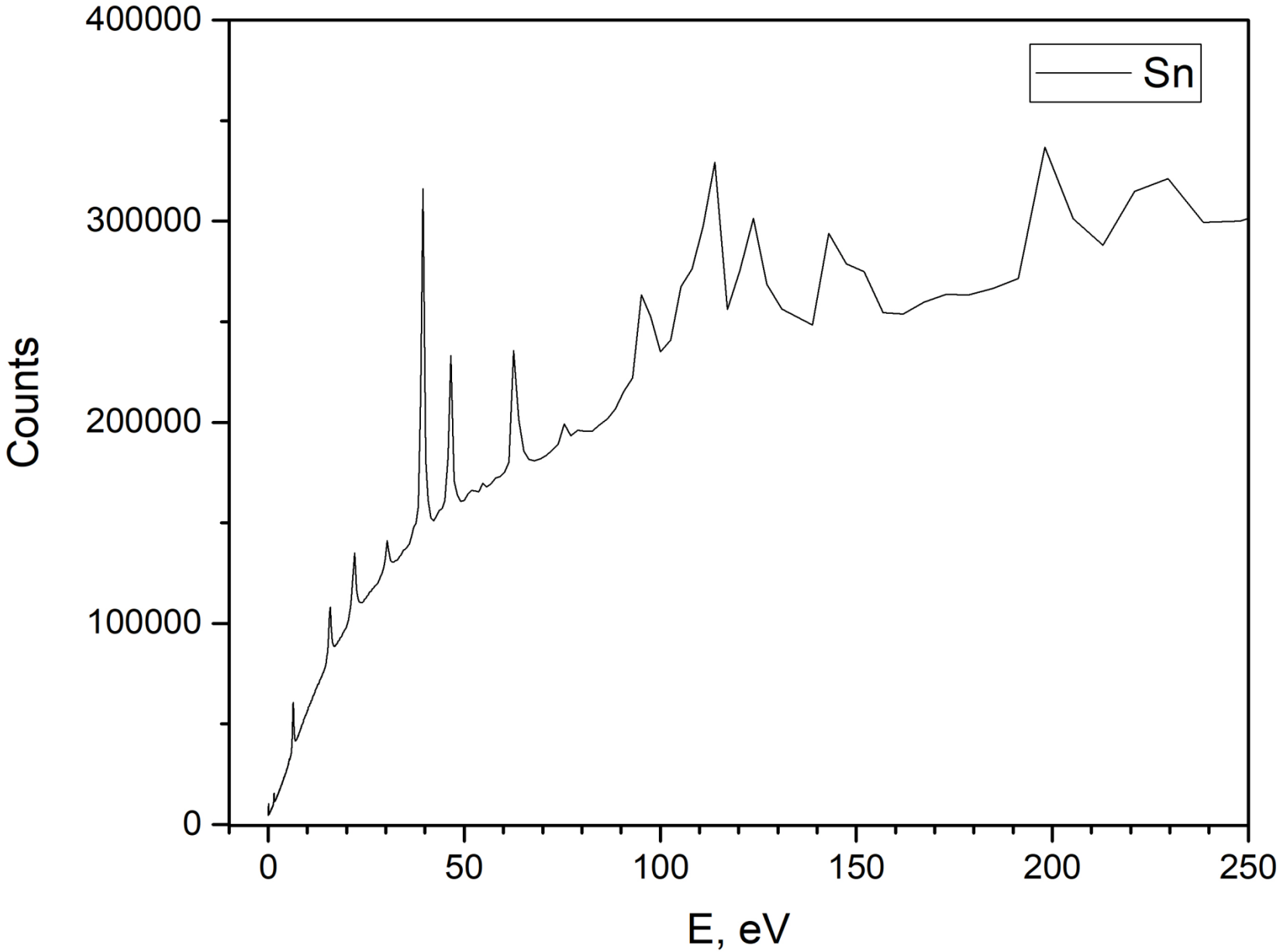


Parameters of a pulse source of resonance neutrons of IREN

Peak current (A)	2
Repetition rate (Hz)	25-50
Pulse width (ns)	100
Energy of electrons (MeV)	30
Beam power (kW)	0.5

A prototype setup





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Summary

The elemental and isotopic composition of the tin plate was determined. The plate consists of an admixture of tin, antimony and indium.

The measurements were carried out with 8 BGO detectors, tin was chosen as a sample. The time-of-flight spectra were measured. Due to the large background and impurities in the sample, it is impossible to determine the p-wave resonances of tin.

Future work

1. Determine the position and density of the neutron beam
2. Lay a neutron guide to reduce the background
3. Build shield for detectors

Nazarlarinizga Rakhmet

Thank you for your attention

Спасибо за внимание

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