

Thermal neutrons registration by two-channel spectrometric system based on uncooled silicon PIN detectors and metal gadolinium converter

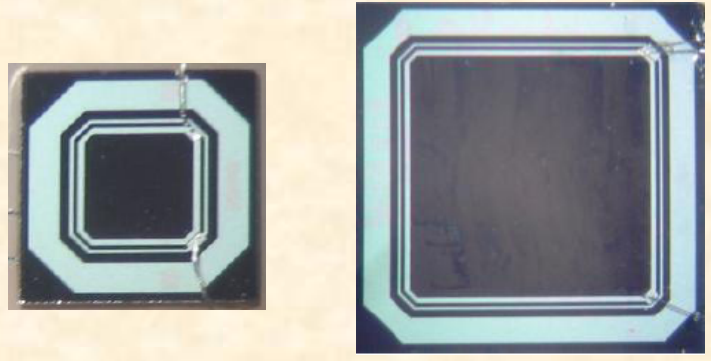
O.S. Deiev, V.N. Dubina, A.A. Kaplij, S.K. Kiprich, N.I. Maslov,
V.D. Ovchinnik, S.M. Potin, M.Y. Shulika, G.P. Vasil'ev, V.I. Yalovenko,

NSC KIPT, Kharkov, Ukraine

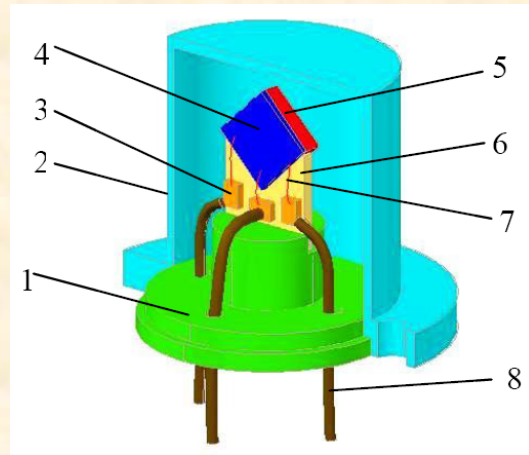
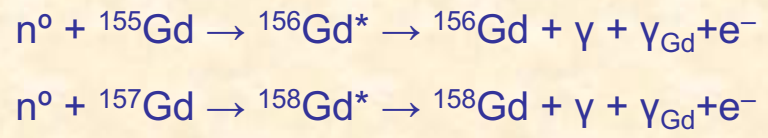
V. Sharyy,

IRFU, CEA-Saclay, France

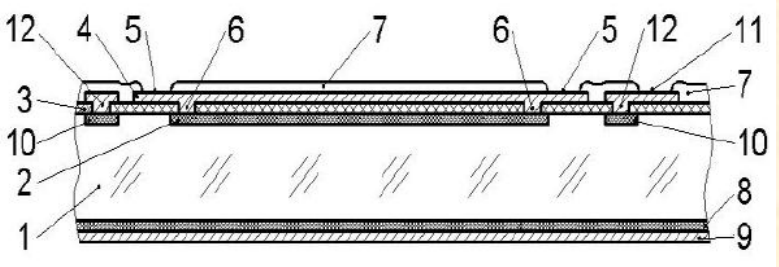
Thermal neutron registration with silicon detector and Gd converter



Planar silicon detectors (PSD) (left - active area 2x2 mm² and right - active area 5x5 mm²)

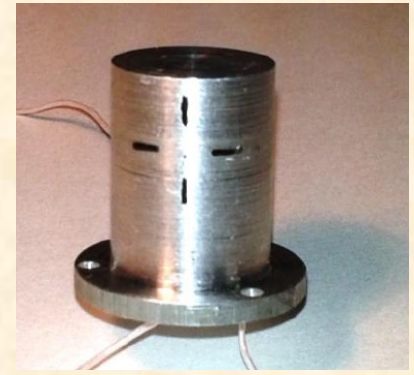


The base unit with mounted Si detector of 5x5 mm²



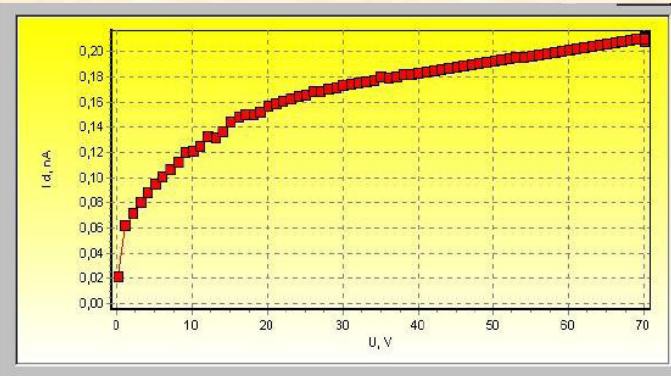
PSD structure: 1 - silicon wafer; 2 - doped layer of p/n junction; 3 - SiO₂ layer; 4 - Al contact layer; 5 - pad on the oxide layer; 6 - contact hole to p/n junction, 7 - protective oxide layer; 8 - ohmic contact n+ layer; 9 - Al back side contact layer; 10 - protective ring of p/n junction; 11 - guard ring of contact pad; 12 - contact hole to the guard ring p/n junction

Schematic of the sealed module for thermal neutrons detection: 1 - metal base; 2 - metal housing; 3 - an intermediate terminal; 4 - PSD; 5 - gadolinium converter; 6 - detector dielectric holder; 7 - aluminum wire jumper; 8 - external terminals



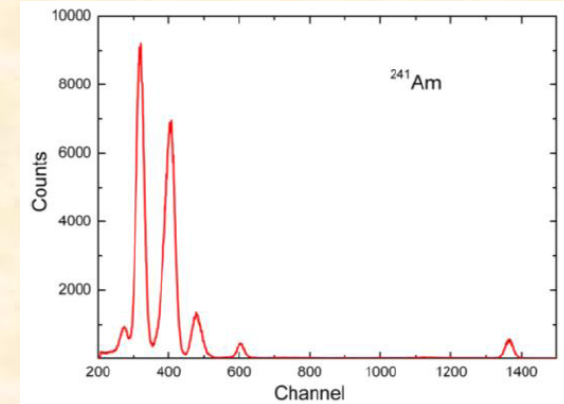
A sealed module in an aluminum housing

Thermal neutron registration with silicon detector and Gd converter

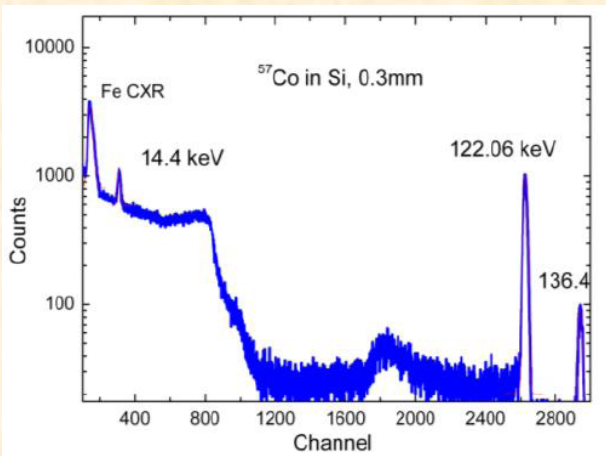


I-V characteristic of the detector active area (2×2 mm²)

γ-ray energy resolution:
 0.9 keV for 2×2 mm detector
 1.2 keV for 5×5 mm detector

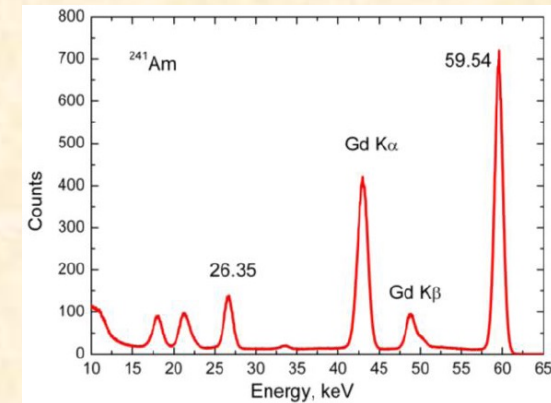


²⁴¹Am spectrum from detector sized 2×2 mm w/o Gd converter



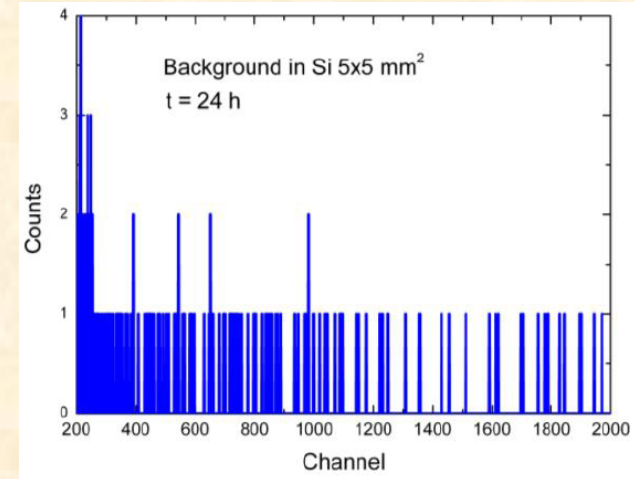
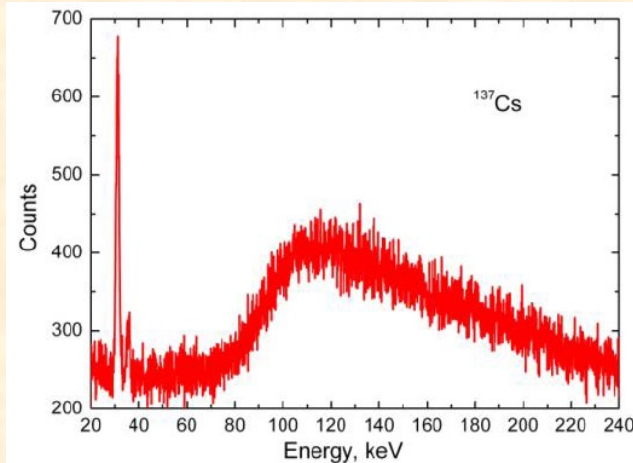
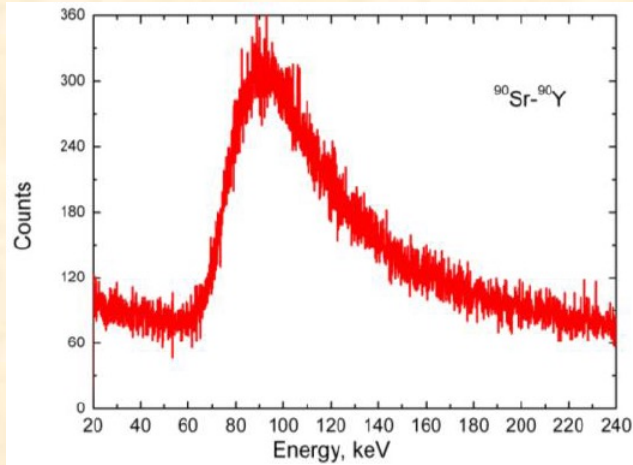
⁵⁷Co spectrum from detector sized 2×2 mm w/o Gd converter

The measured static characteristics of the detector module together with gamma-ray (²⁴¹Am, ⁵⁷Co) and electron emission spectra (⁹⁰Sr-⁹⁰Y and ¹³⁷Cs) have demonstrated the ability of the chosen design to **covers the energy range** of the conversion electrons and X-rays of nuclear reaction Gd (n, γ+e⁻) Gd .



²⁴¹Am spectrum from detector sized 5×5 mm with Gd converter

Thermal neutron registration with silicon detector and Gd converter



The background spectrum for $5 \times 5 \text{ mm}^2$ detector with gadolinium converter measured at the absence of the radiation source

Perspective aim:

The application of the double-channel measurement mode.

This can significantly improve the separation of neutron and gamma signals.

Electron spectra from e^- -sources $^{90}\text{Sr}-^{90}\text{Y}$ (above) and ^{137}Cs (below) for the detector size of $5 \times 5 \text{ mm}^2$.

Thank you for your attention

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