

Computer simulation of the plastic scintillator and HPGe detector in coincidence

D. Joković, R. Banjanac, A. Dragić, V. Udovičić, J. Puzović*, I. Aničin*

Institute of Physics, University of Belgrade, Serbia

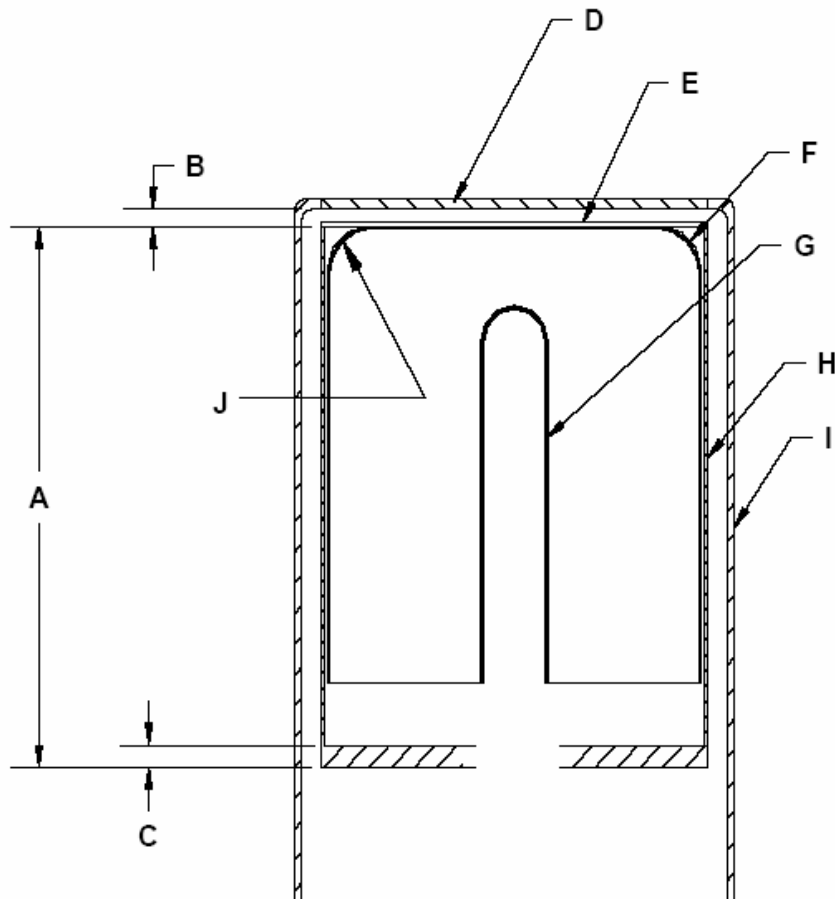
**Faculty of Physics, University of Belgrade, Serbia*

The HPGe detector

active volume: 148 cm³

rel. efficiency: 35 %

background count rate (40-3000 keV): 0.45 c/s



BASIC DETECTOR DIMENSIONS	
DETECTOR DIAMETER	58.5 mm
DETECTOR LENGTH	56.4 mm
DETECTOR END RADIUS (J)	8 mm, NOMINAL
HOLE DIAMETER	9 mm
HOLE DEPTH	42.9 mm
HOLE BOTTOM RADIUS	8 mm, NOMINAL

MISCELLANEOUS DETECTOR ASSEMBLY DIMENSIONS AND MATERIALS			
IDENTIFIER	DIMENSION	DESCRIPTION	MATERIAL(S)
A	94 mm	MOUNT CUP, LENGTH	COPPER
B	3 mm	END CAP TO CRYSTAL GAP	N.A.
C	3.2 mm	MOUNT CUP BASE	COPPER
D	1.5 mm	END CAP WINDOW	MAGNESIUM
E	0.03/0.03 mm	INSULATOR/SHEILD	MYLAR/ALUMINIZED MYLAR
F	300 microns	OUTSIDE CONTACT LAYER	LITHIUM
G	0.3 microns	HOLE CONTACT LAYER	BORON
H	0.76 mm	MOUNT CUP WALL	COPPER
I	1.5 mm	END CAP WALL	MAGNESIUM

The plastic scintillator

dimensions: 100cm x 100cm x 5cm

H/C ratio: 1.1

density: 1.032 g/cm³



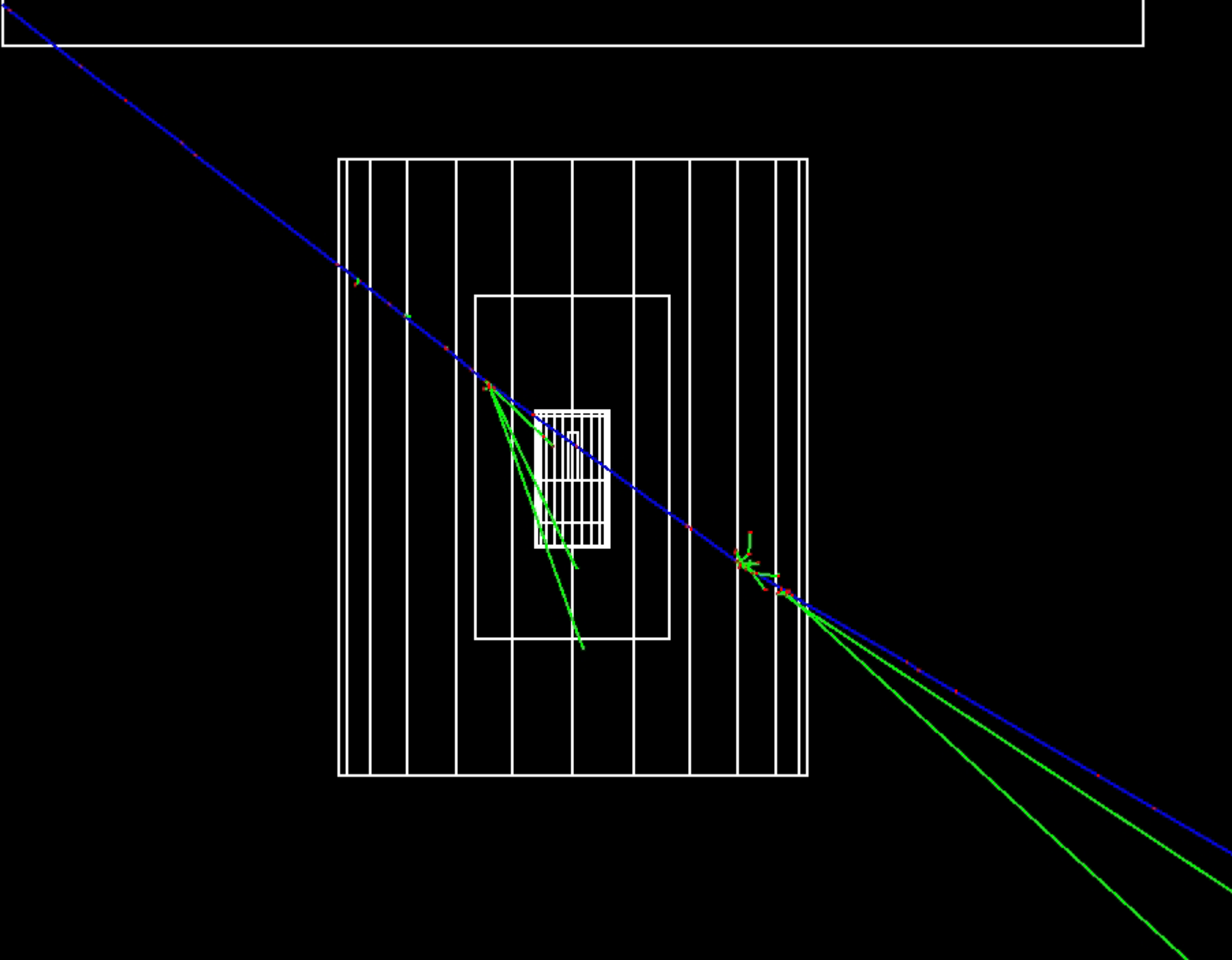
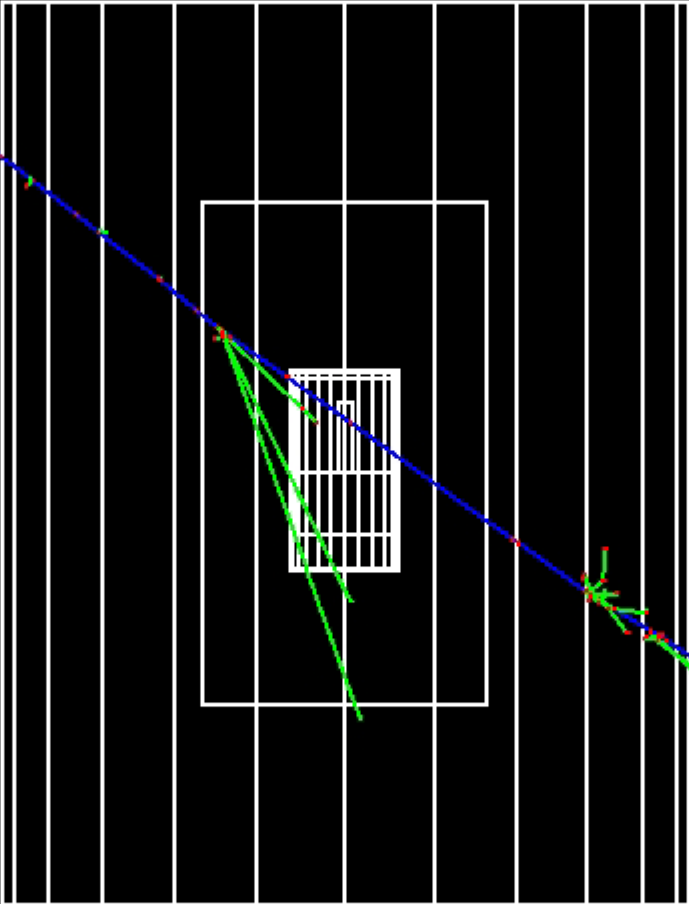
The simulation code

- Geant4 v.9.0
- QGSP physics list
- primary generation

$$j(\Theta, \varphi) = j_n \cos^n \Theta$$

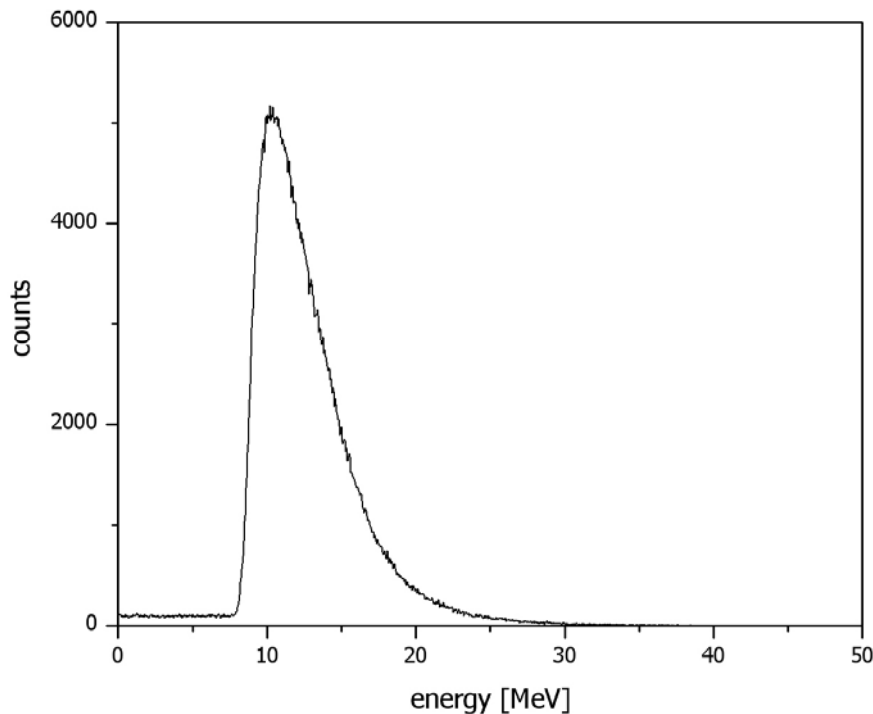
- $n=1.55$
- $J_h / J_v = 3.64$

$$\frac{dj_\mu(E_\mu, \cos \Theta)}{dE_\mu} \approx 0.14 E_\mu^{-2.7} \left(\frac{1}{1 + \frac{1.1 E_\mu \cos \Theta}{115 \text{ GeV}}} + \frac{0.054}{1 + \frac{1.1 E_\mu \cos \Theta}{850 \text{ GeV}}} \right)$$



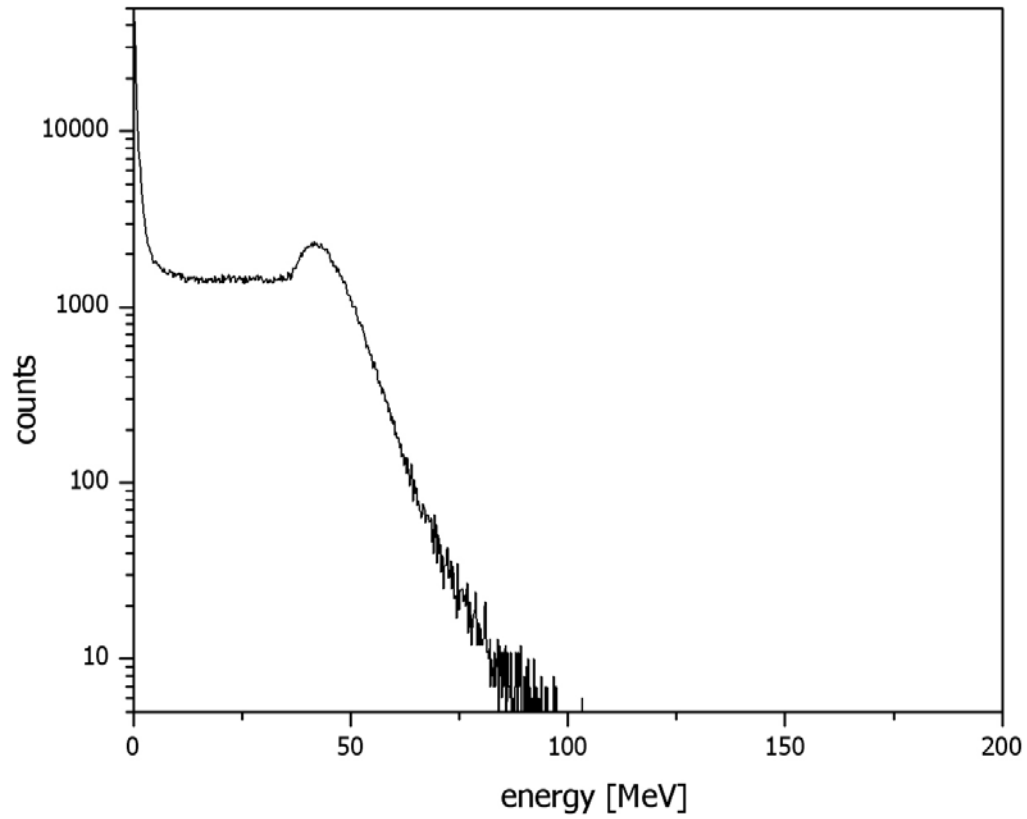
The results

- measured muon flux: $J_\mu = 4.5(2) \cdot 10^{-3} \text{ s}^{-1} \text{ cm}^{-2}$
- No. of simulated events: 10^8 ; live time: $2.1 \cdot 10^6 \text{ s}$ (24 days)
- 611235 recorded coincident events

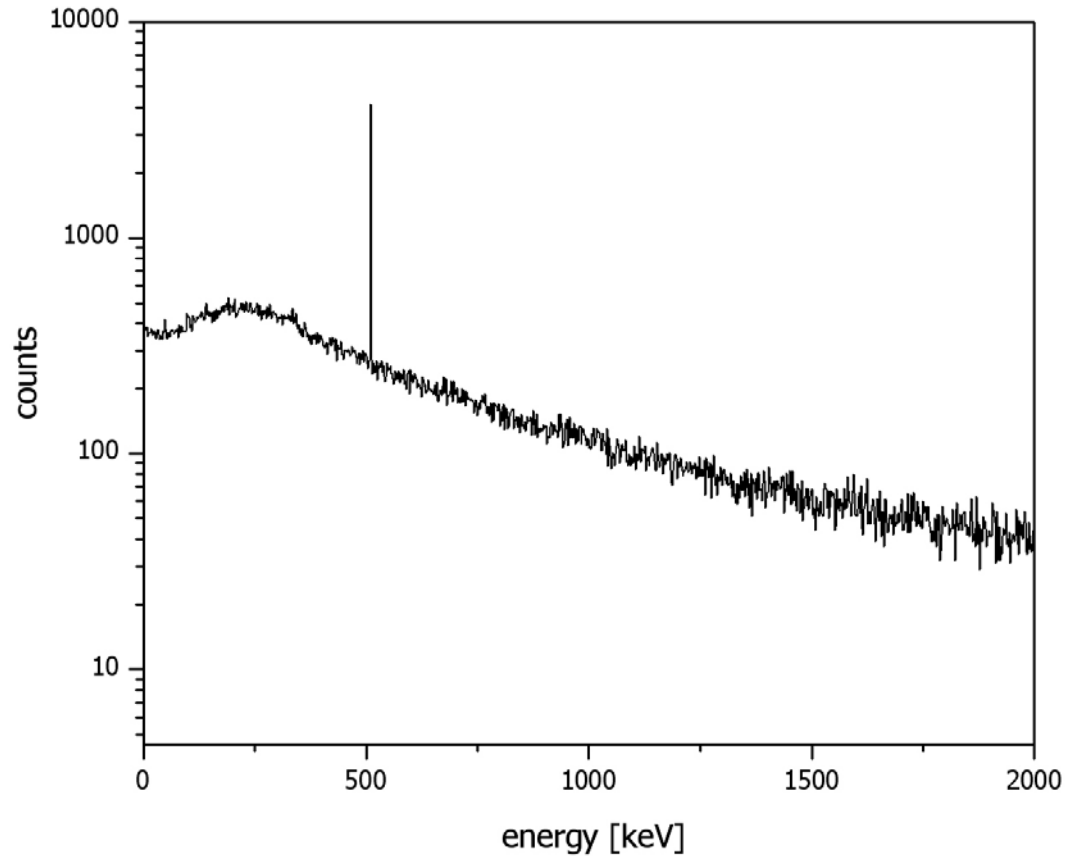


- coincident spectrum of the plastic scintillator

- coincident spectrum of the HPGe detector



- spectrum of the HPGe detector in interval 0-2000 keV



- integral count is 179793; count rate is 0.086 c/s
- annihilation peak count is ≈ 3900 ; its count rate is ≈ 0.0019 c/s