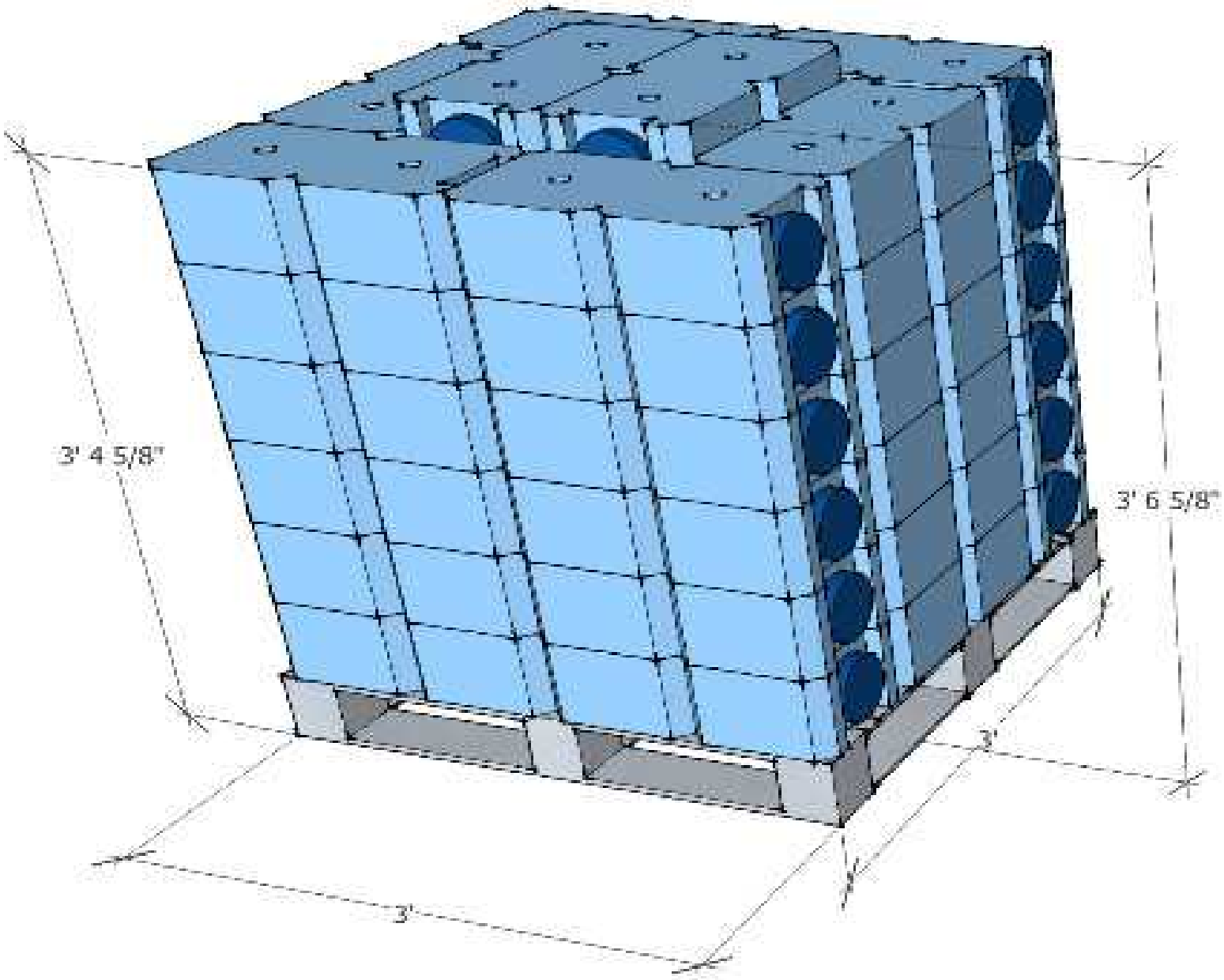
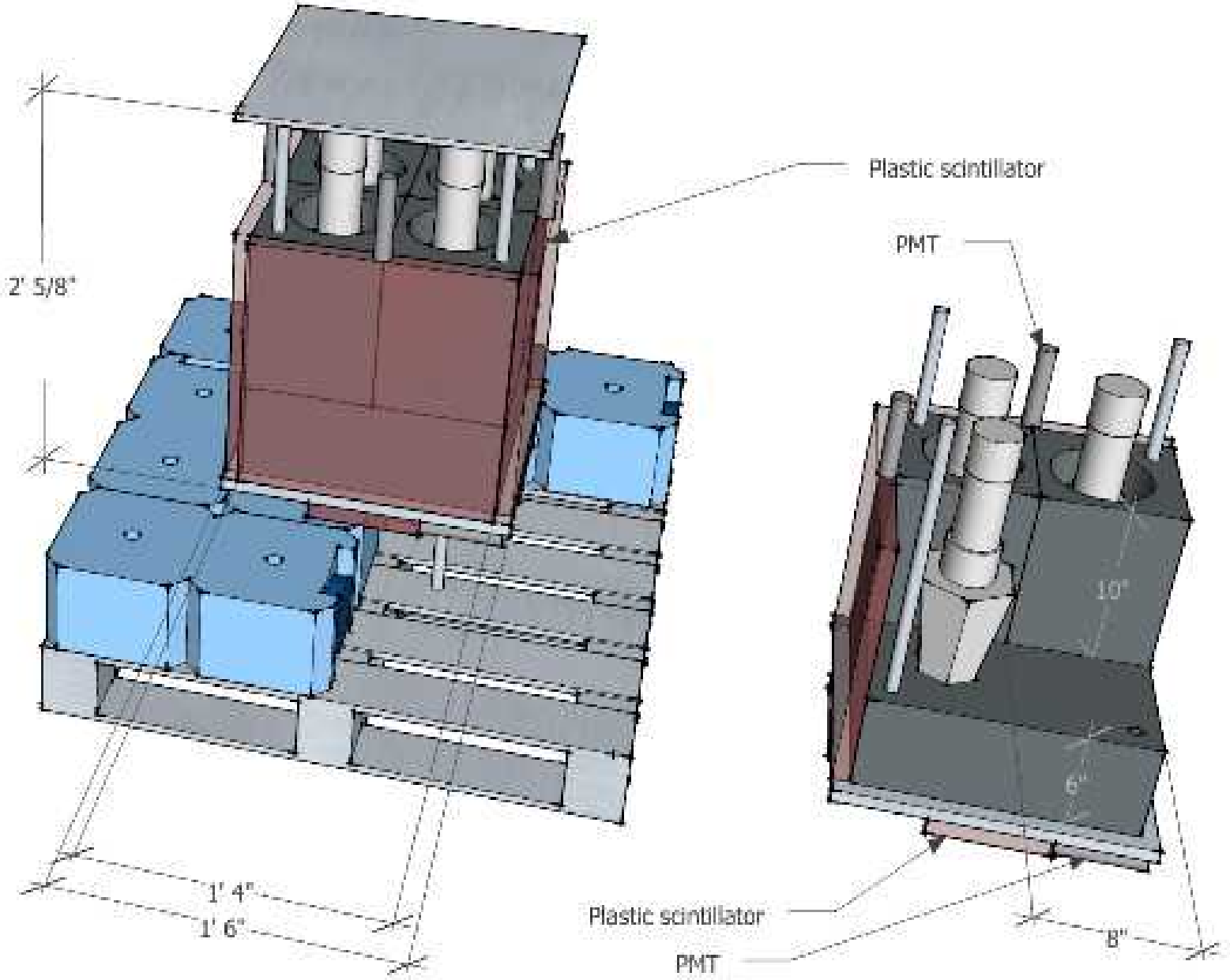
Comparison of CENNS detector results created with Geant4 and MCNP

Jan Patrick Adam
10/04/2014

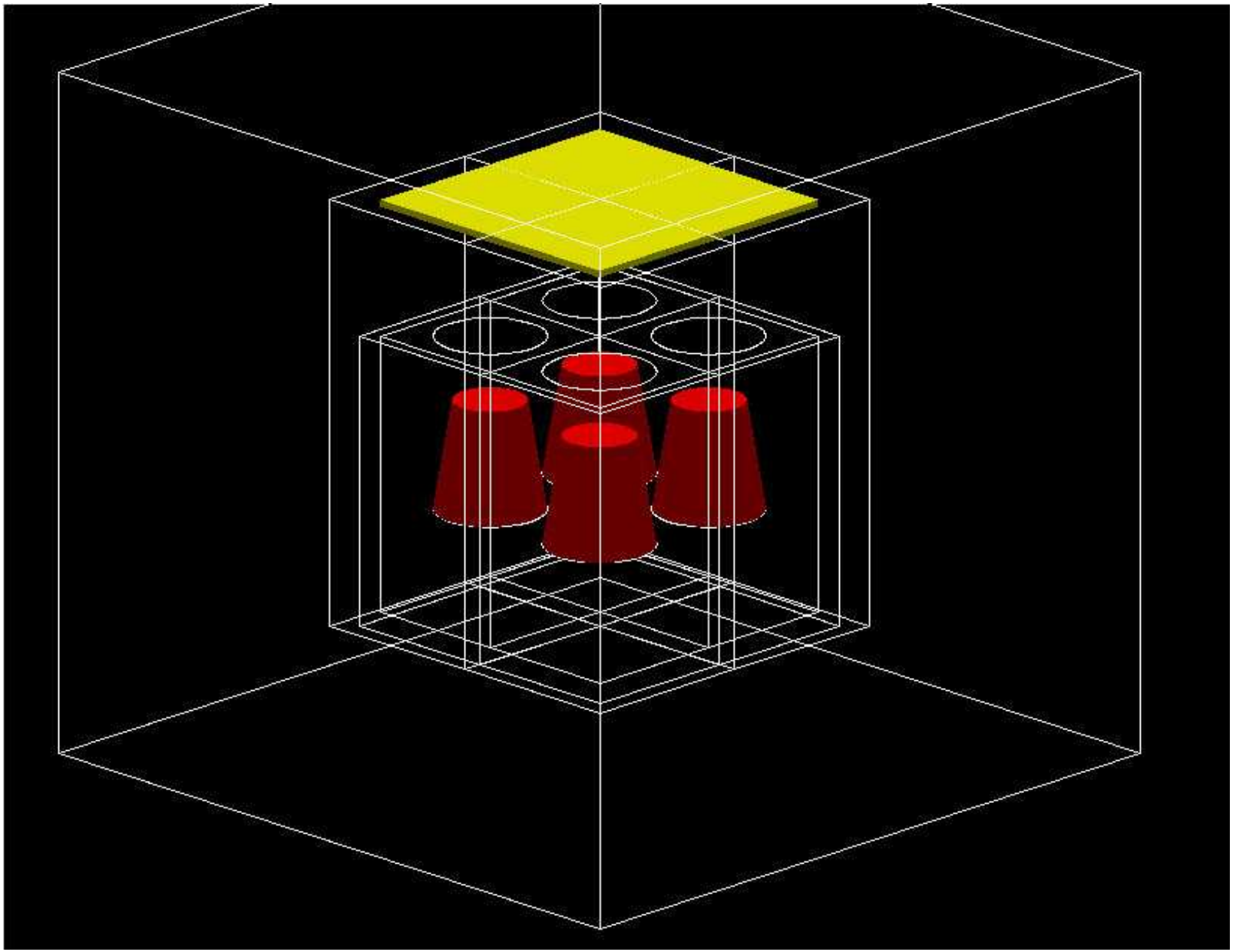
Detector Setup



Detector Setup



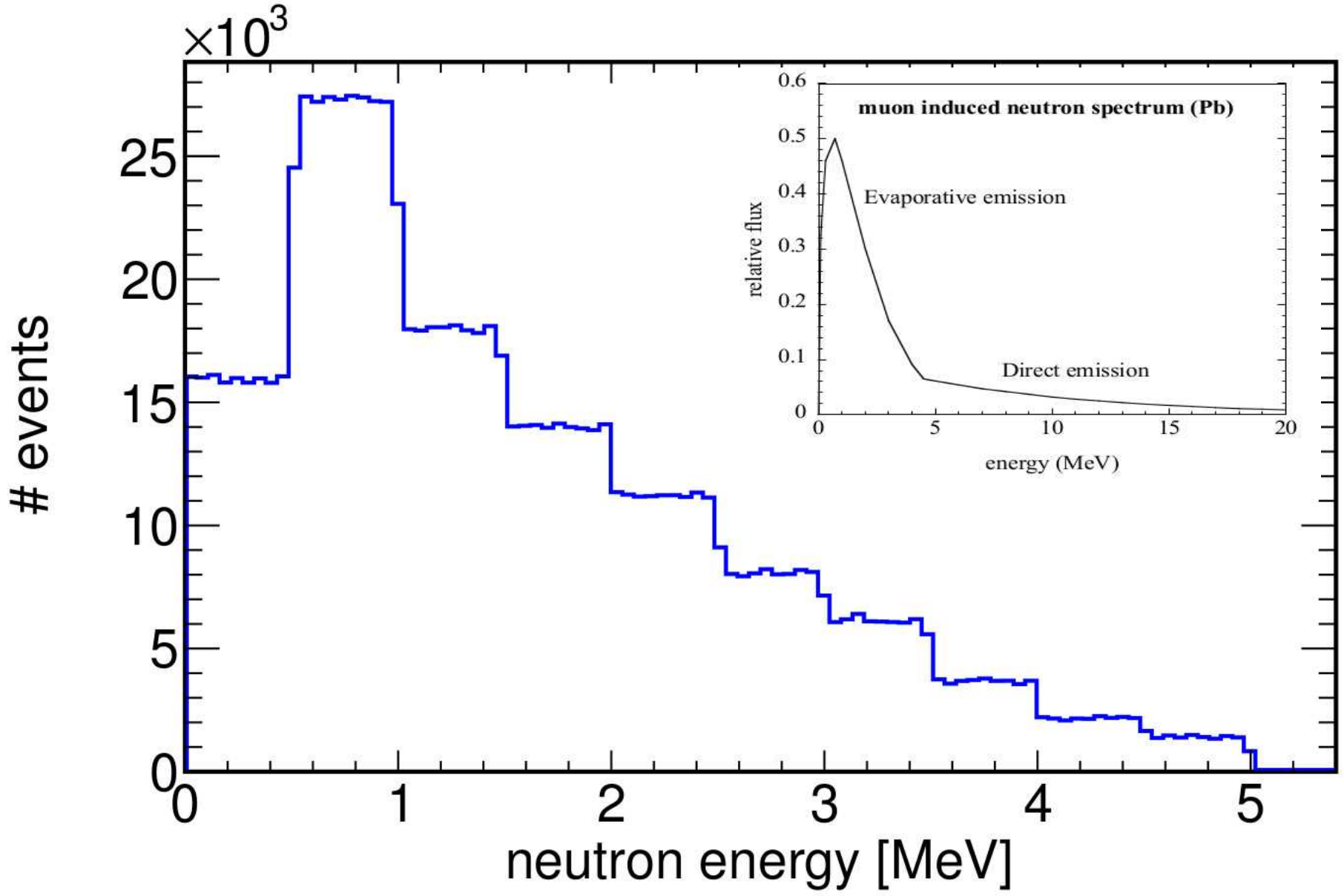
Detector Setup

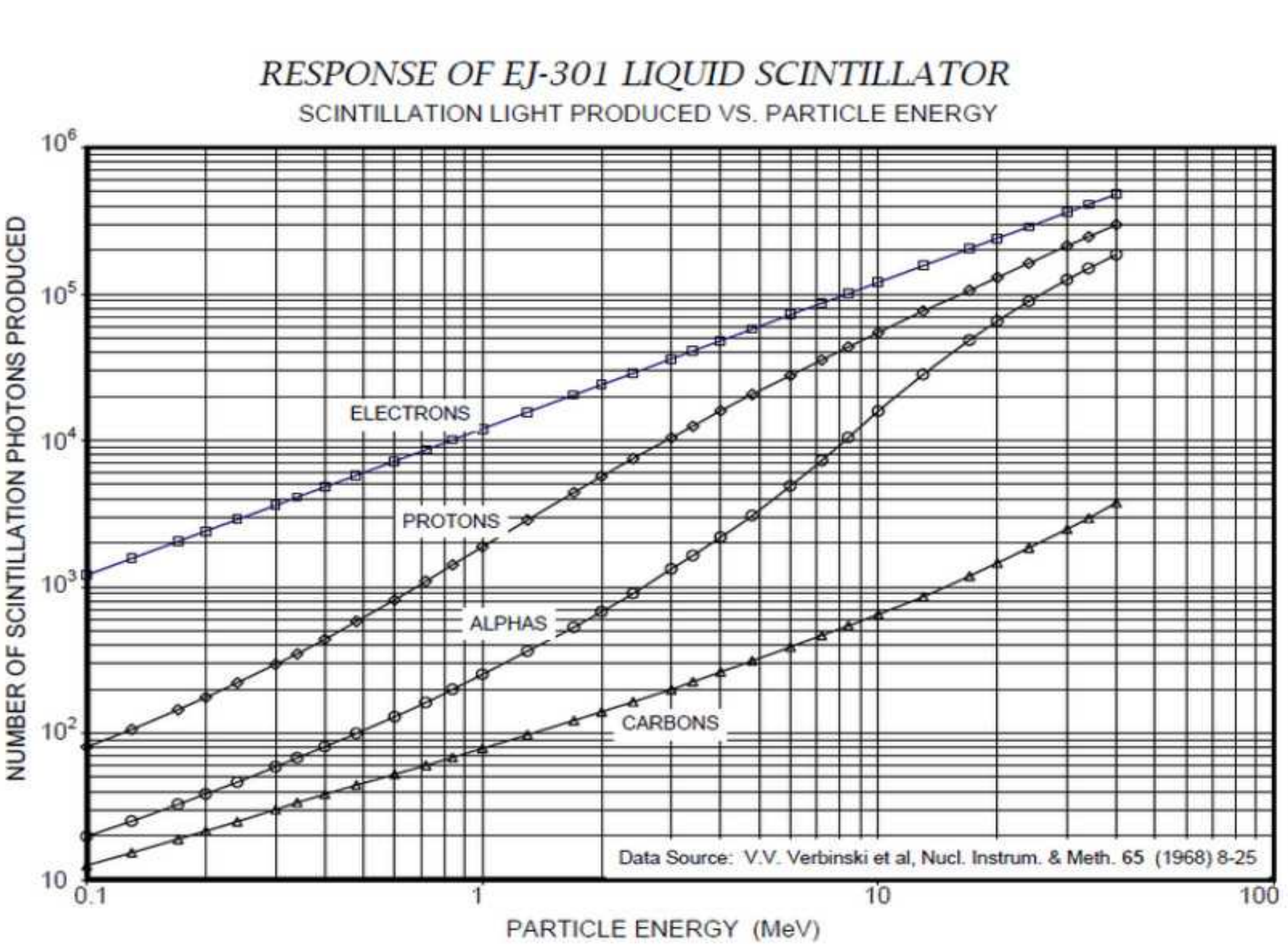


Materials

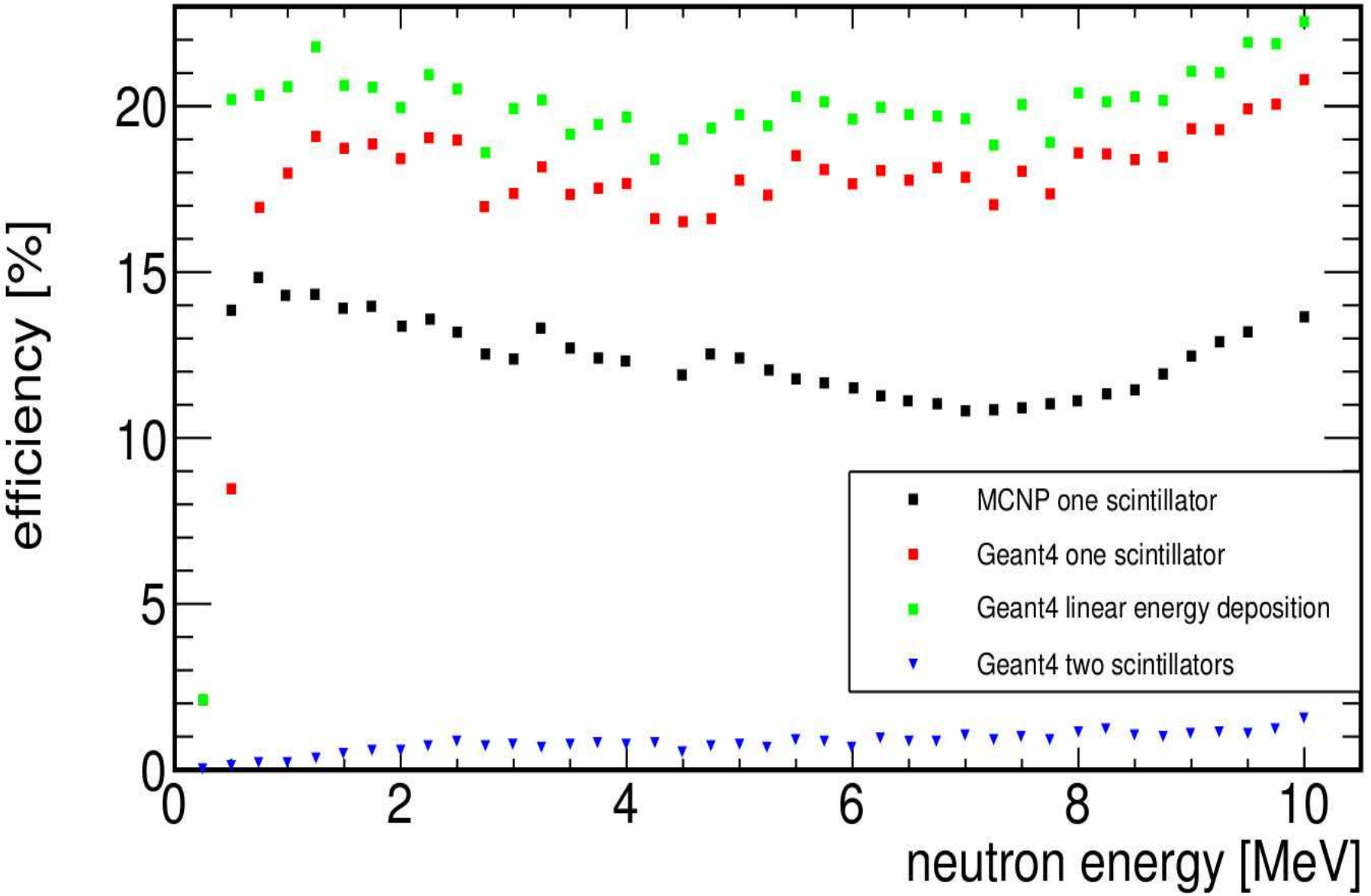
- Shielding in bricks: water (H_2O)
- Detector: lead (Pb)
- Scintillator: EJ-301 ($C_6H_4(CH_3)_2$)
- Shielding around lead: EJ-200 ($C_{10}H_{11}$)
- Shielding over lead: Al7075 (alloy)

Energy Distribution

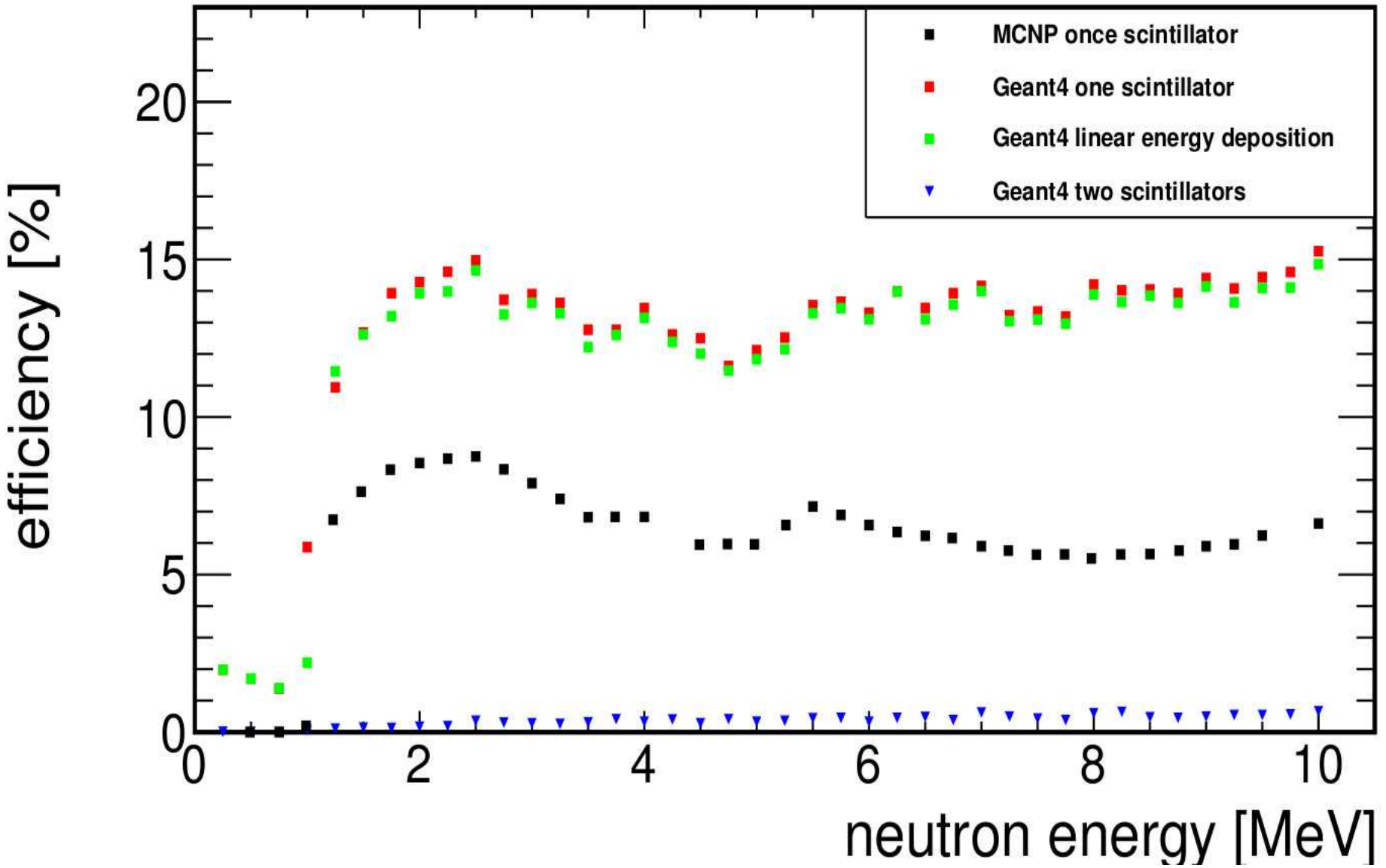



RESPONSE OF EJ-301 LIQUID SCINTILLATOR
SCINTILLATION LIGHT PRODUCED VS. PARTICLE ENERGY
NUMBER OF SCINTILLATION PHOTONS PRODUCED
10^6
10^5
10^4
10^3
10^2
10
ELECTRONS
PROTONS
ALPHAS
CARBONS
Data Source: V.V. Verbinski et al, Nucl. Instrum. & Meth. 65 (1968) 8-25
0.1
1
10
100
PARTICLE ENERGY (MeV)

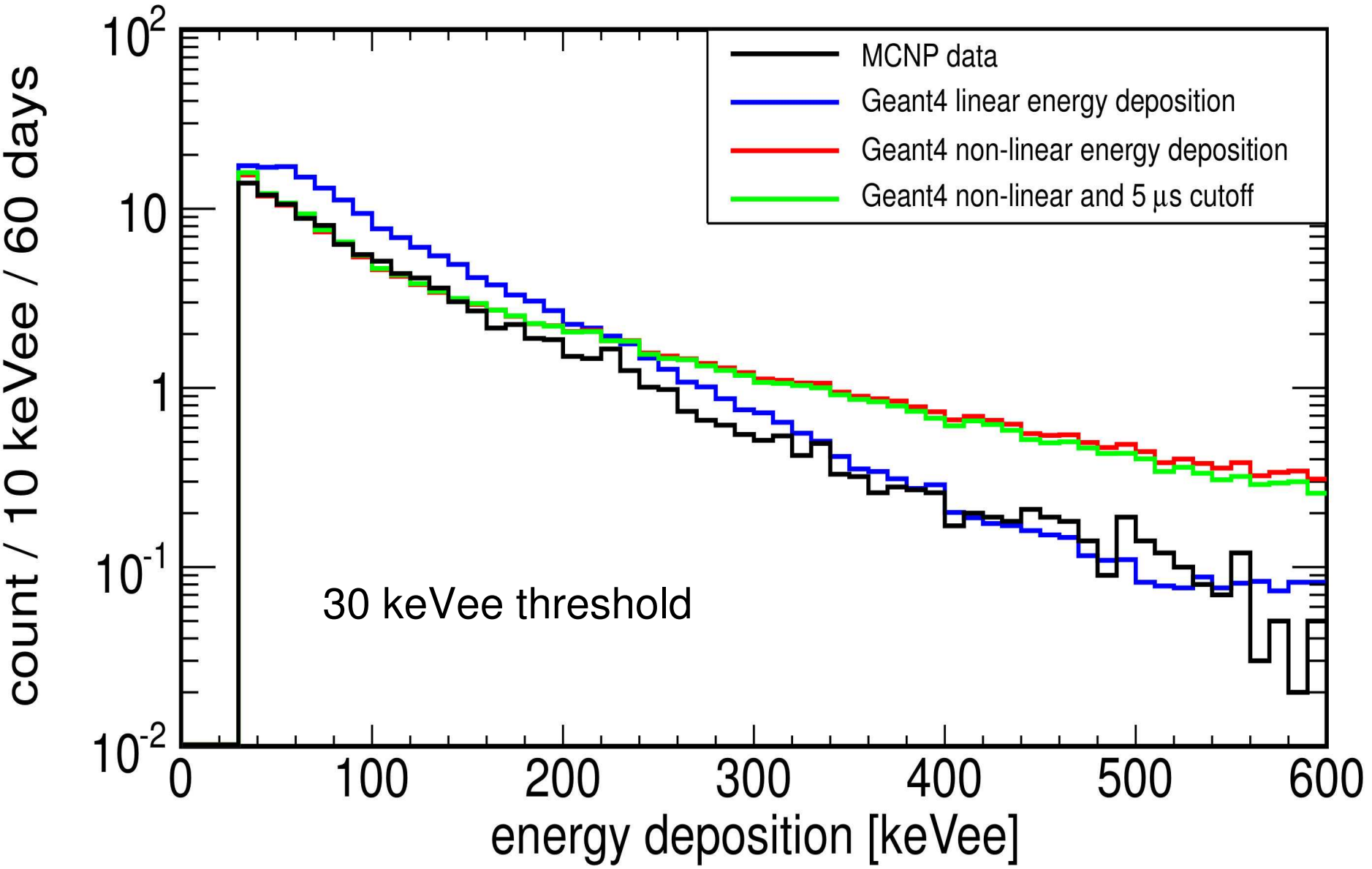
Efficiency


efficiency [%]
neutron energy [MeV]
0
5
10
15
20
0
2
4
6
8
10
MCNP one scintillator
Geant4 one scintillator
Geant4 linear energy deposition
Geant4 two scintillators

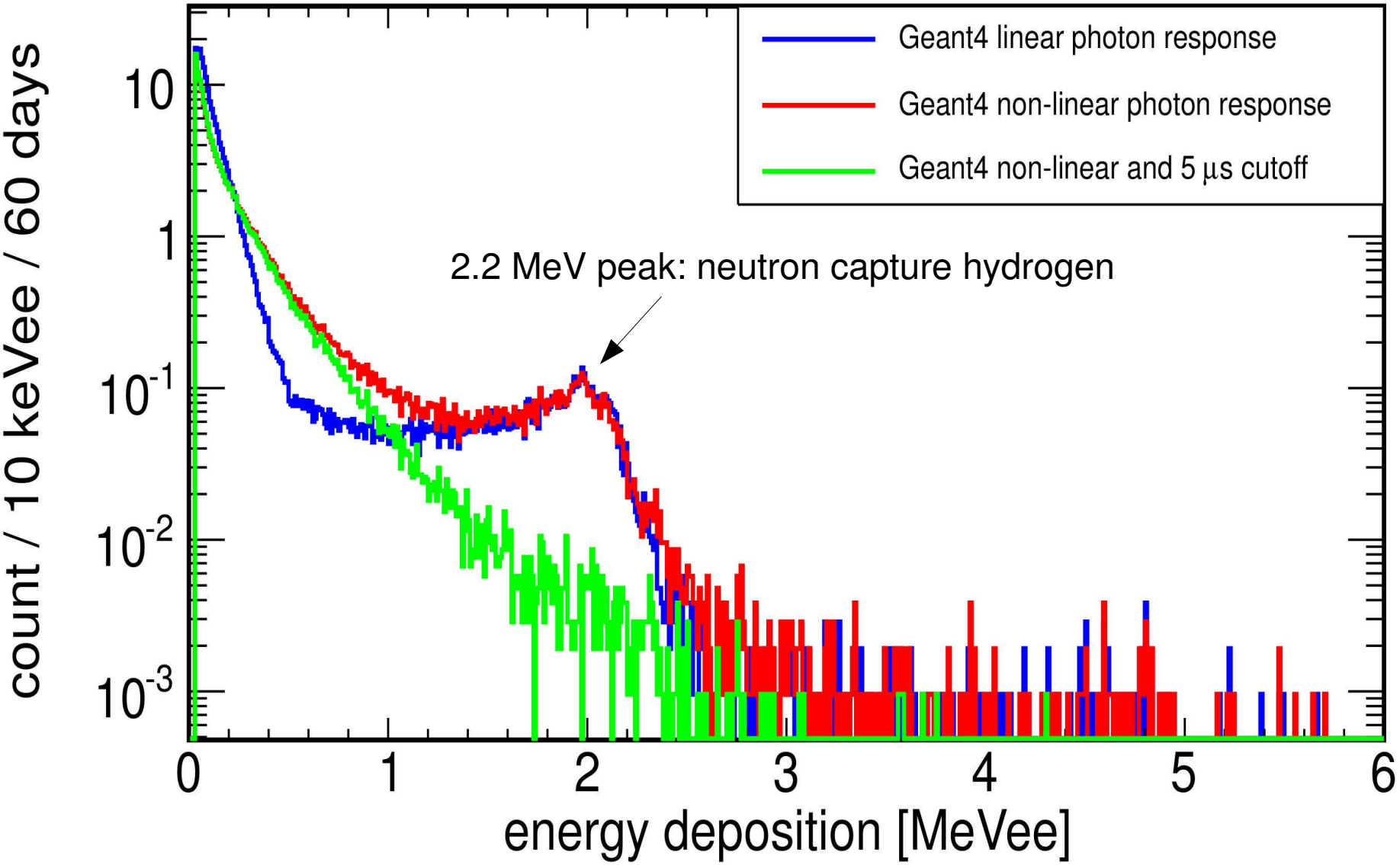
Efficiency


MCNP once scintillator
Geant4 one scintillator
Geant4 linear energy deposition
Geant4 two scintillators
efficiency [%]
neutron energy [MeV]
0
5
10
15
20
0
2
4
6
8
10

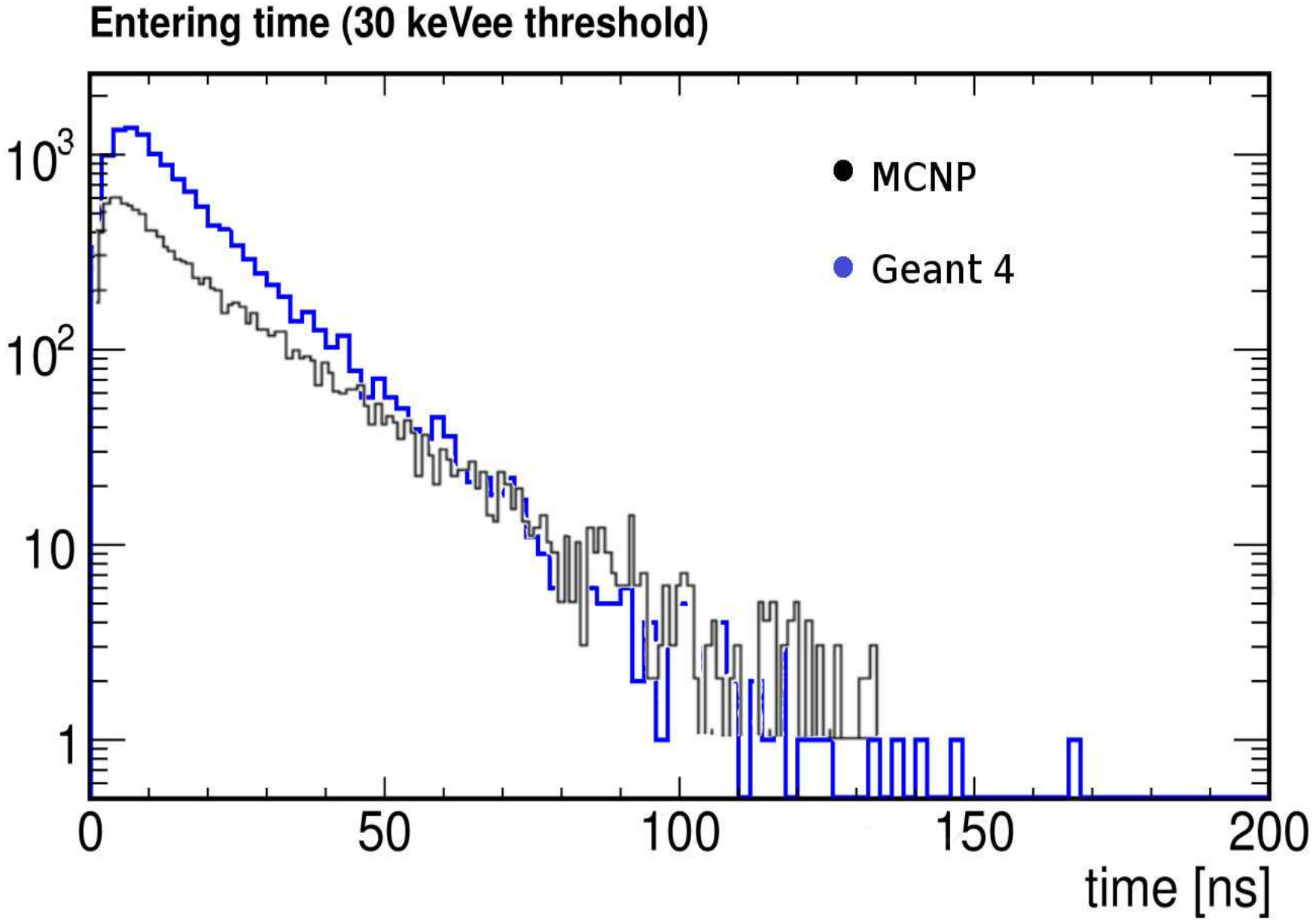
Energy Deposition



Energy Deposition



Timing


Entering time (30 keVee threshold)
MCNP
Geant 4
10^3
10^2
10
1
0
50
100
150
200
time [ns]

Comparison of CENNS detector results created with Geant4 and MCNP

Sources:

"A Design Document for the Neutrino-Induced Neutron Pile Concept"
P. S. Barbeau, J. I. Collar, Y. Efremenko, D. Hornback,
J. Newby, D. Reyna, G. C. Rich, K. Scholberg
August 6, 2014

Scintillator data:

http://www.eljentechnology.com/

Jan Patrick Adam
10/04/2014