

9th Collaboration Meeting of the BM@N Experiment at the
NICA Facility (13-16 September 2022)

Separation of photons and neutrons with prototype of HGN detector

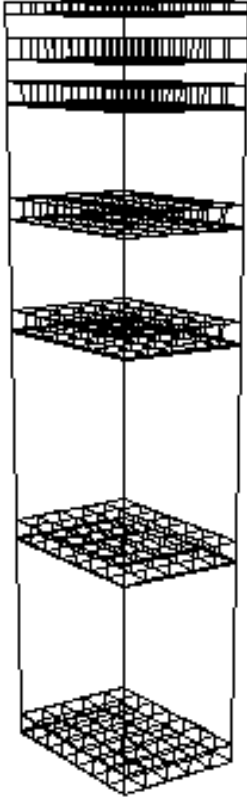
A.Stavinskiy, P. Alexeev, [N.Zhigareva](#)



- Neutrons are significant part of secondary particles
- Equation of state (EOS) depends on isotopic composition (n^0/p^+)
- For neutron identification need to reject them from charged particles (via veto-system) and from photons

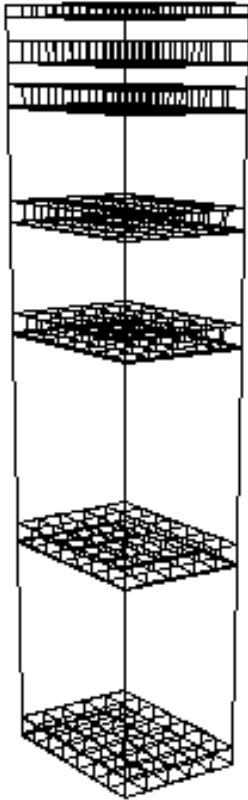
HGN-prototype setup

High Granularity Neutron detector



- There are 3 layers configuration were tested:
- 1st and 2nd with minimal layers amount (6 and 7) to elaboration of n^0/γ separation procedure
- 3rd with 14 layers to test the expectation properties of BMN neutron detector prototype

Layers in HGN-prototype



1st (6 layers): 7x scintillators + 6x Absorber (Cu) = 320mm(Cu)
+60mm(Scint)

rad.length = 23.45

nucl.length = 2.2

2nd (7 layers): 8x scintillators + 7x Absorber(2x Pb, 5x Cu) =
20mm(Pb)+290mm(Cu)+65mm(Scint)

rad.length = 25.35

nucl.length = 2.14

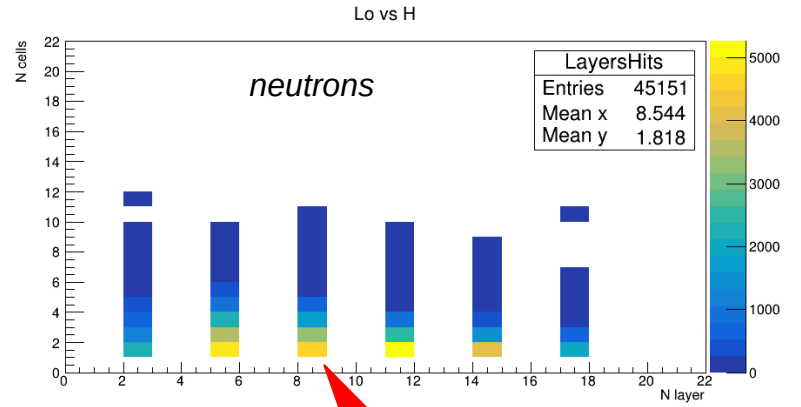
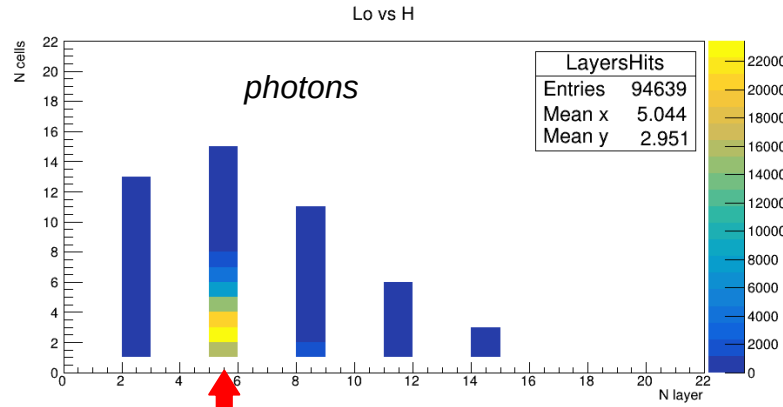
3rd (14layers): 15x scintillators +5x Absorber (Pb)+ 9x
Absorber(Cu) = 40mm(Pb)+270mm(Cu)+350mm(Scint)

rad.length = 30.8

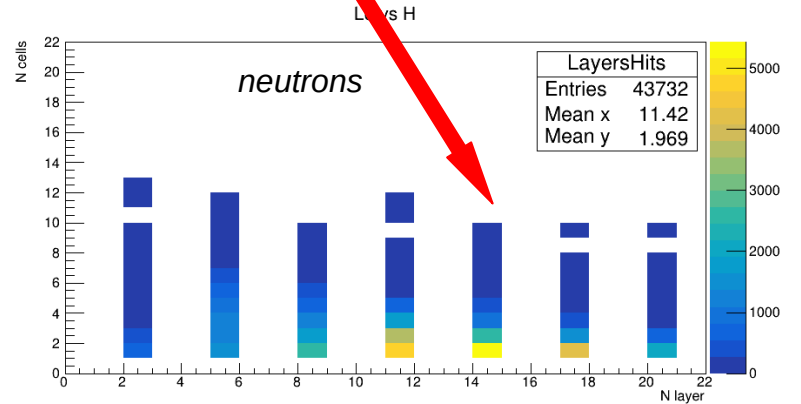
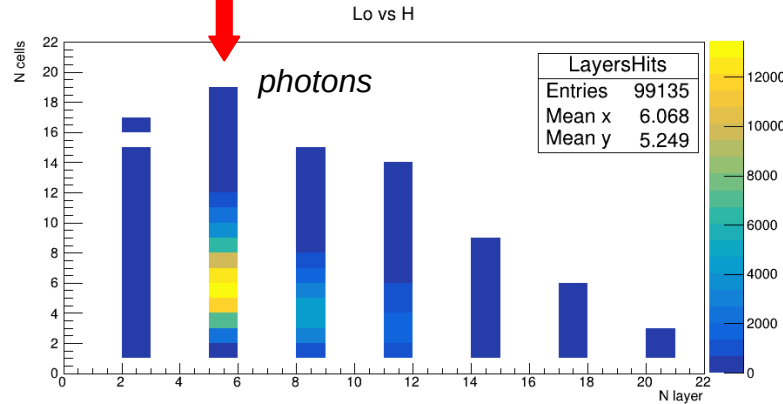
nucl.length = 2.83

1st hit vs layer, 0.5GeV

6 layers

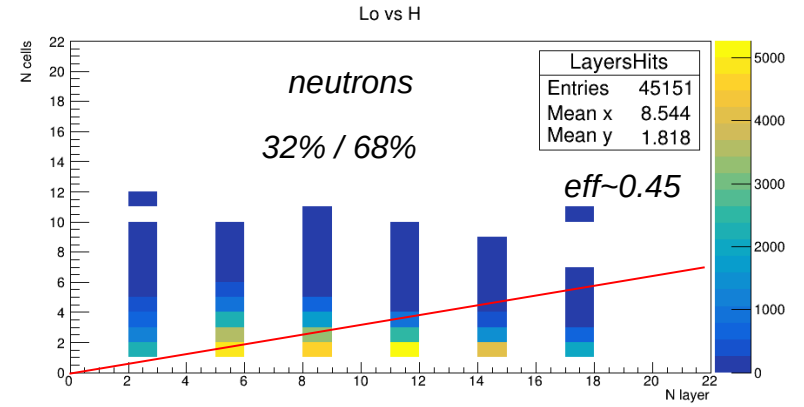
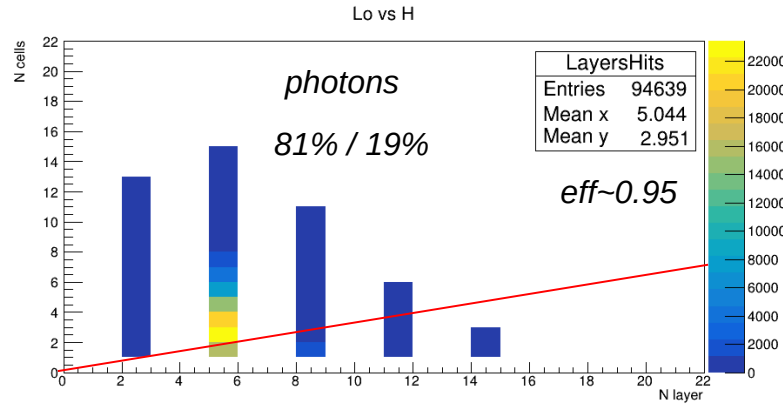


7 layers

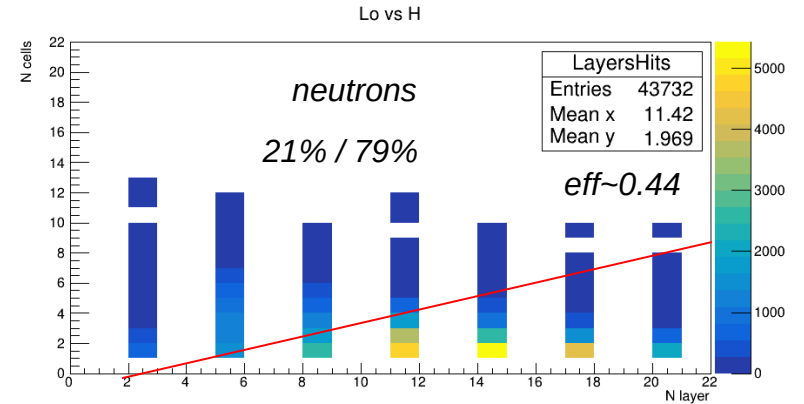
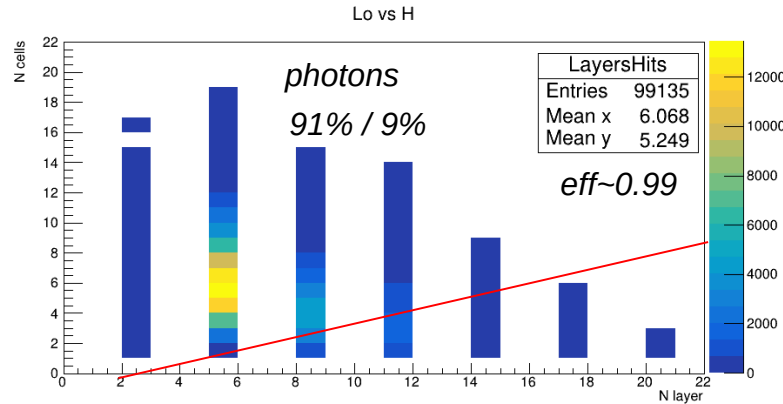


1st hit vs layer, 0.5GeV

6 layers

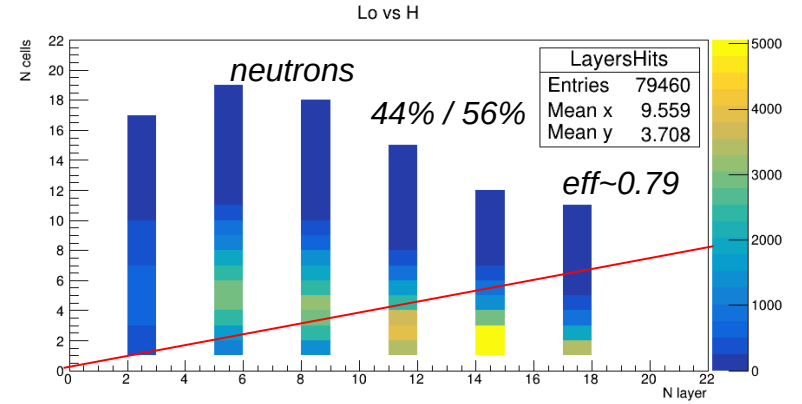
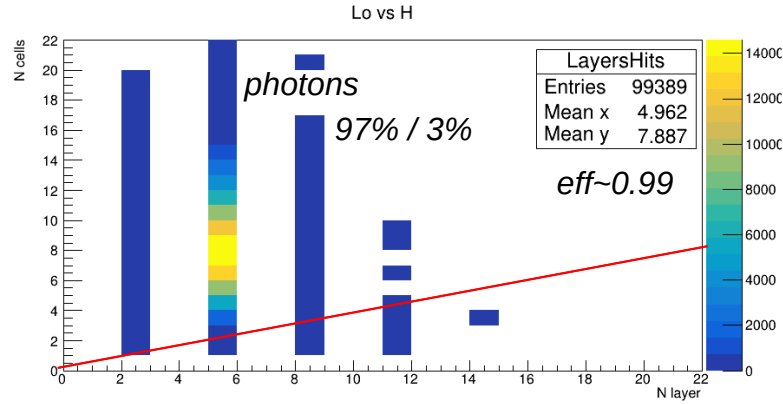


7 layers

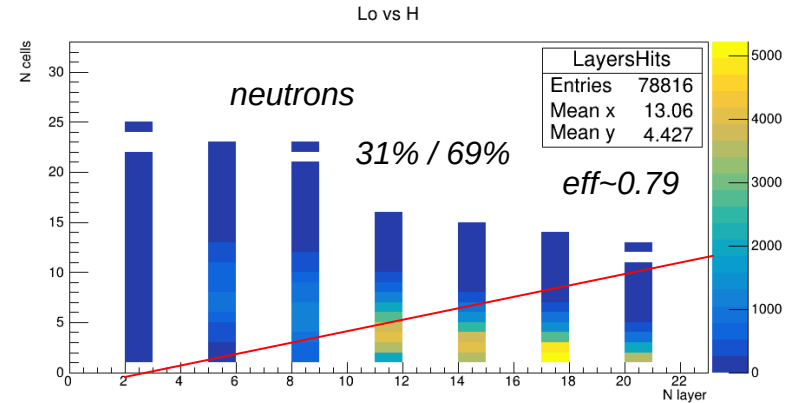
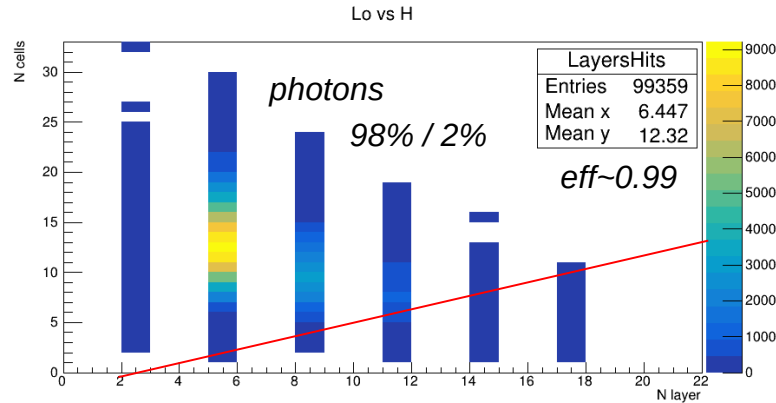


1st hit vs layer, 2.0GeV

6 layers



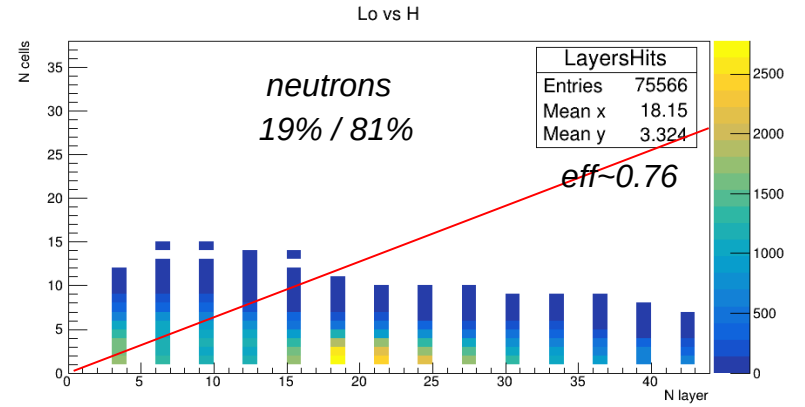
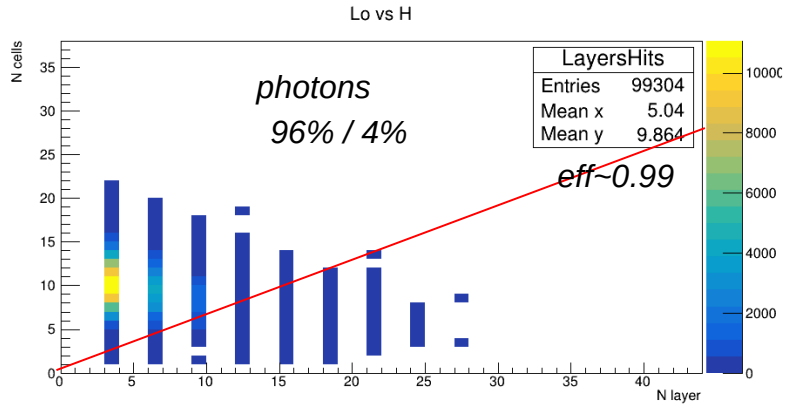
7 layers



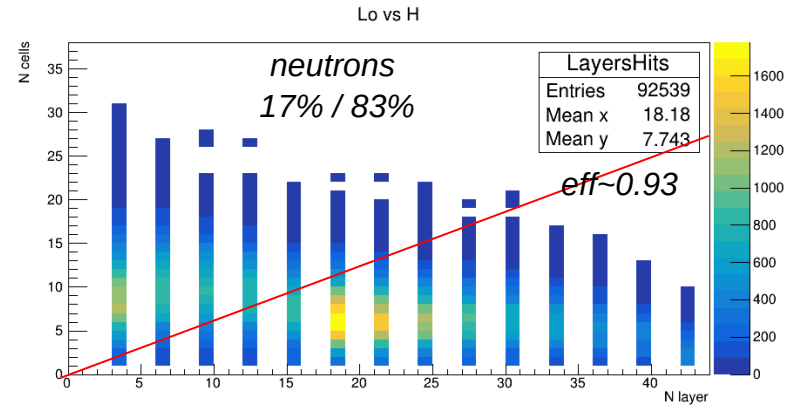
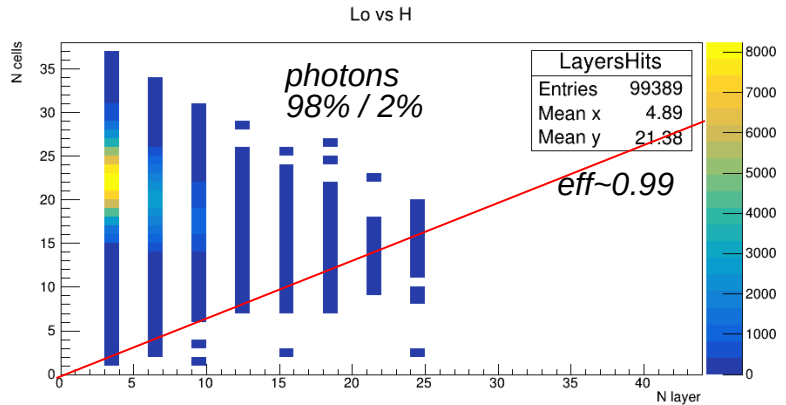
- Configurations with minimal amount of layers allows to do n^0/γ separation procedure
- 7-layers prototype is better then 6-layers one
- For more complicated background sources need to increase amount of layers → HGN prototype for BMN (“3rd configuration”)

1st hit vs layer, 3rd configuration

0.5GeV



2GeV



- *Neutrons are significant part of secondary particles, so n^0/γ separation procedure is needed*
- *A small amount of layers is enough to allow n^0/γ separation procedure*
- Photons and neutrons are differently located in prototype volume, and this is the way to separate neutral particles using some linear function

Thank you!