SPD collaboration meeting (3-6 October 2022)
VBLHEP, JINR, Dubna

Photon and neutron separation in ZDC prototype

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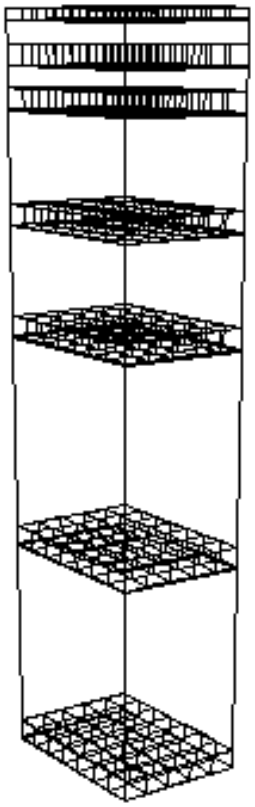
Motivation

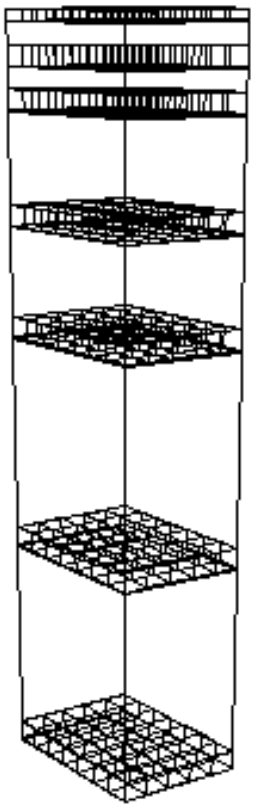
- Neutrons are significant part of secondary particles
- Equation of state (EOS) depends on isotopic composition (n^0/p^+)
- For neutron identification need to reject them from charged particles (via veto-system) and *from photons*
- Identification of spectators in d-d interactions

Prototype setups



- 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 propeties of prototype

Layers in 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)*

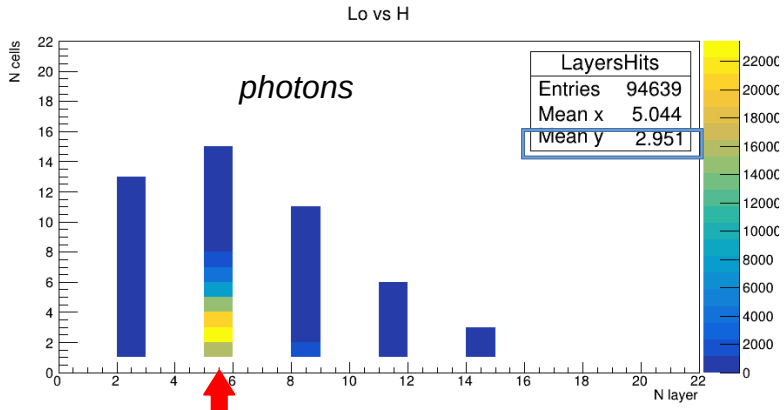
rad.length =30.8

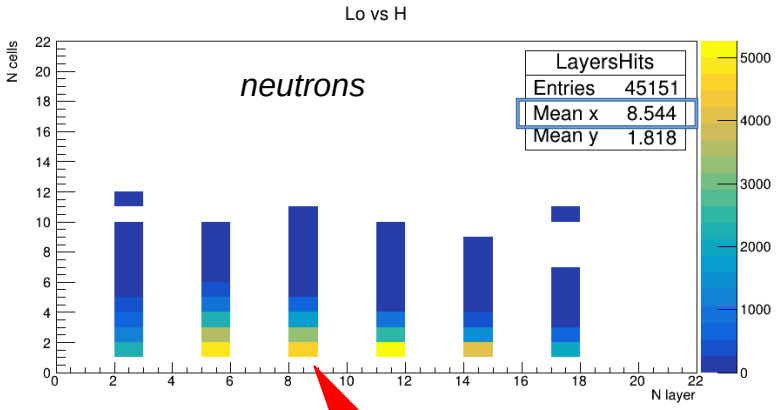
nucl.length = 2.83

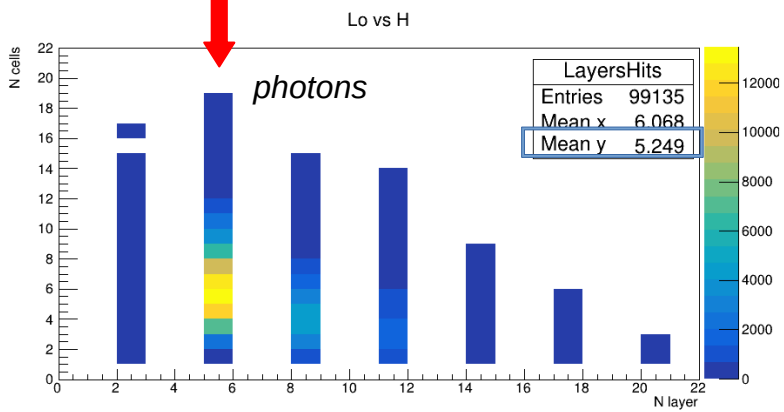
1st hit *vs* layer, 0.5*GeV*

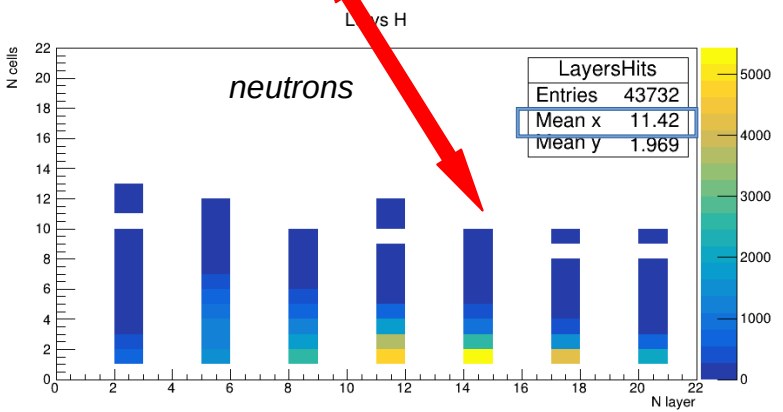
6 layers

7 layers



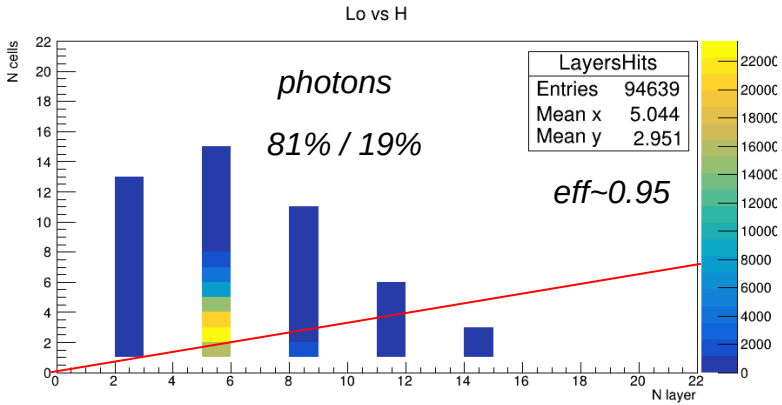


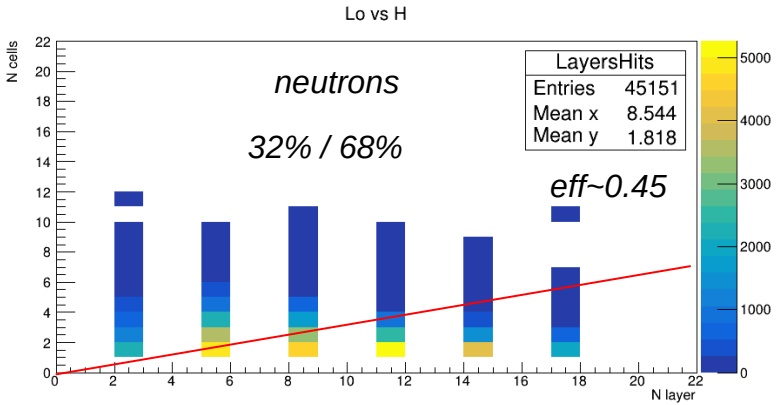




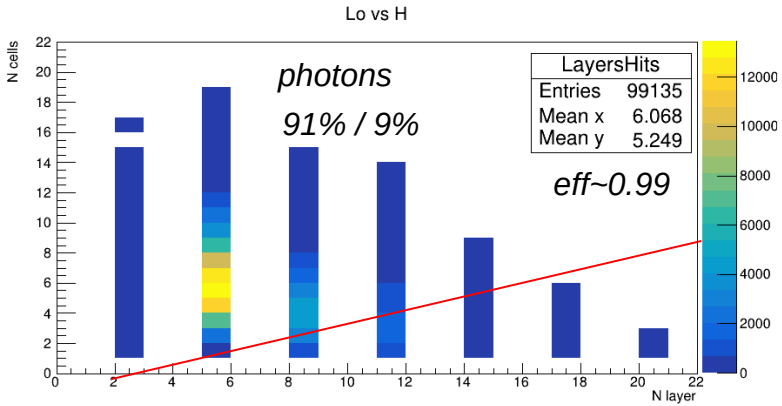
1st hit *vs* layer, 0.5*GeV*

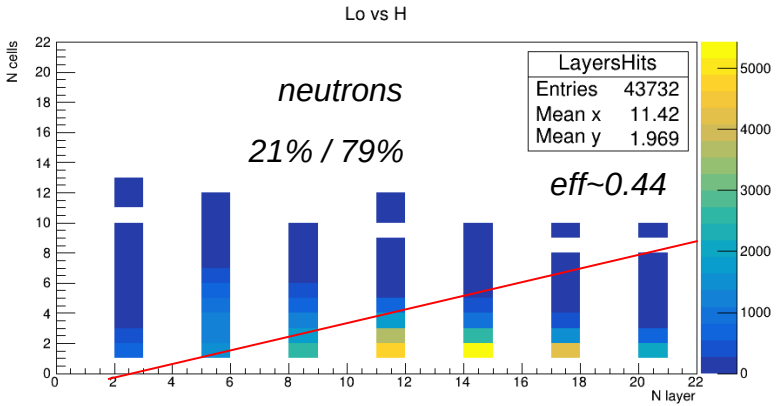
6 layers





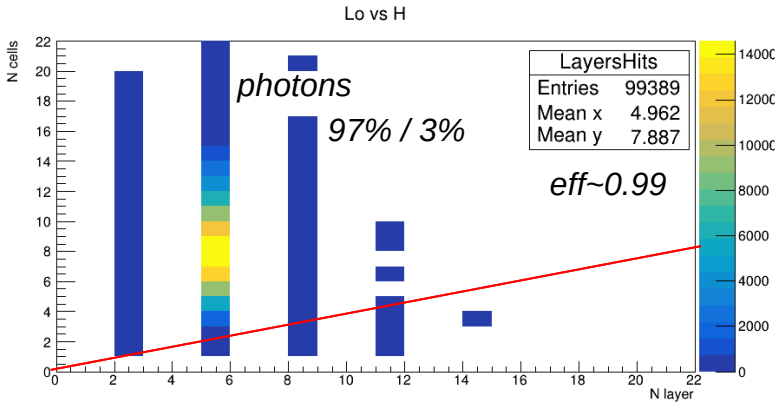
7 layers

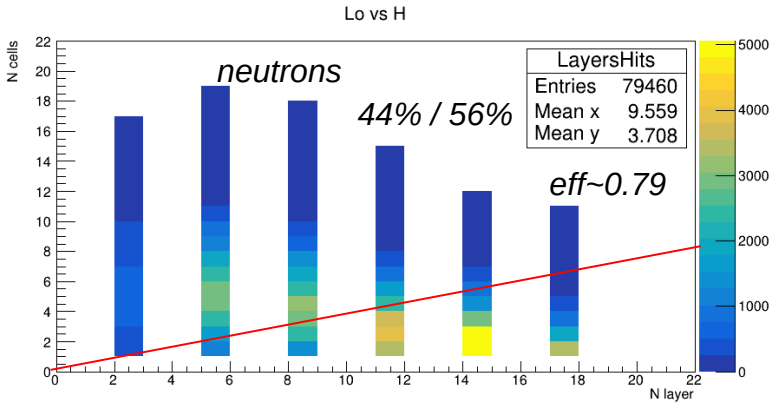




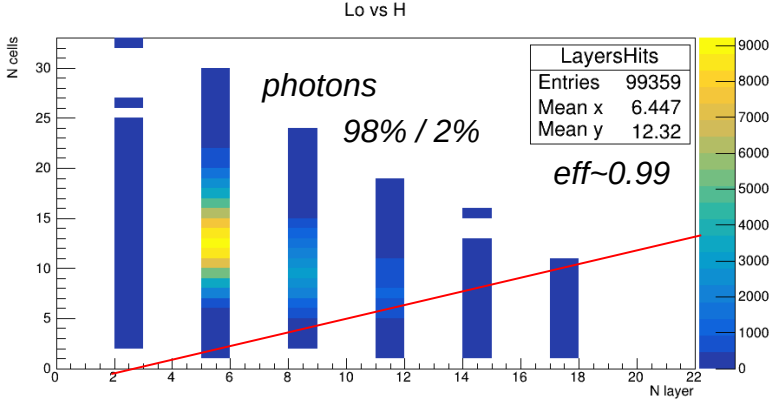
1st hit *vs* layer, 2.0*GeV*

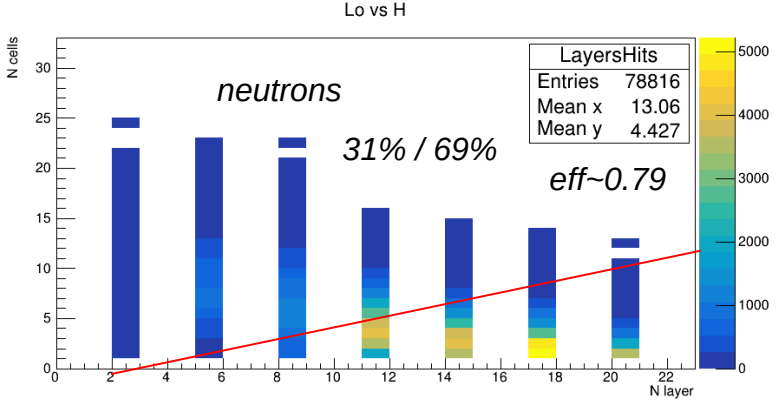
6 layers





7 layers

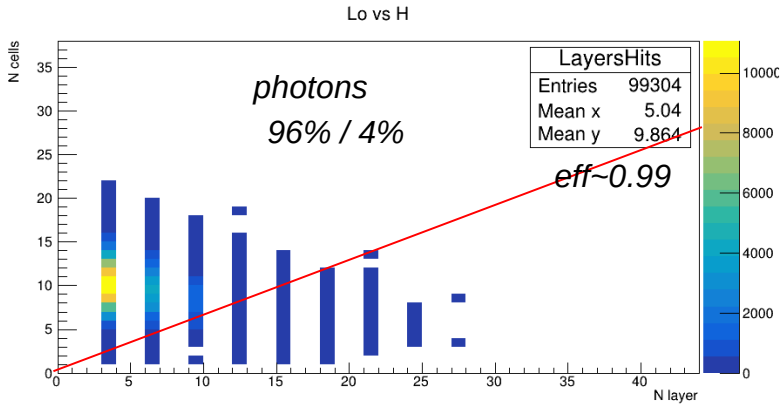


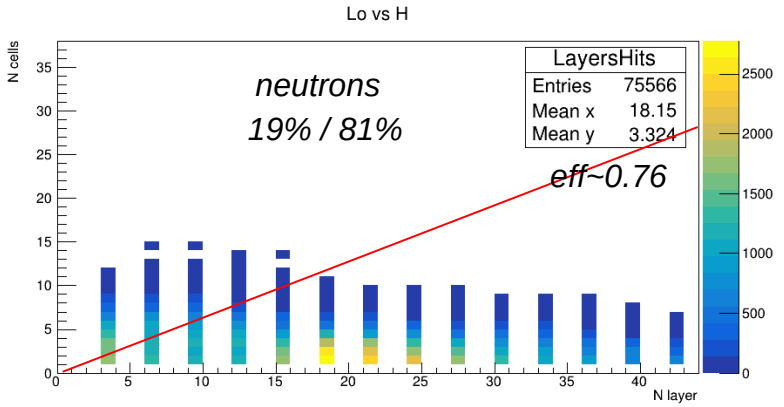


- Configurations with minimal amout of layers allows to do n^0/γ separation procedure
- 7-layers prototype is better then 6-layers one
- For more complicated background sources need to increase amount of layers

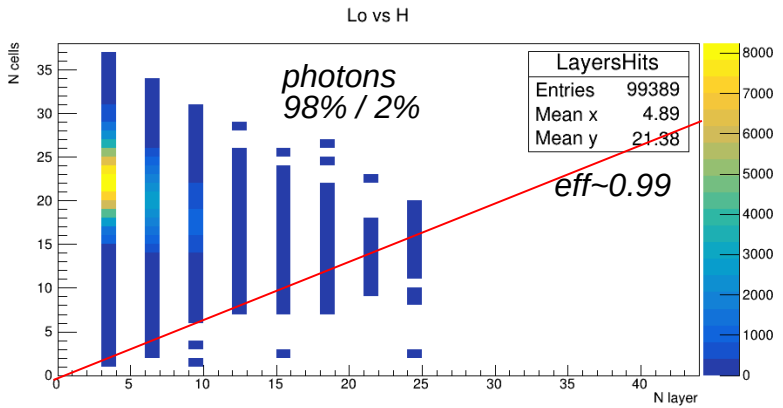
1st hit *vs* layer, 3rd configuration

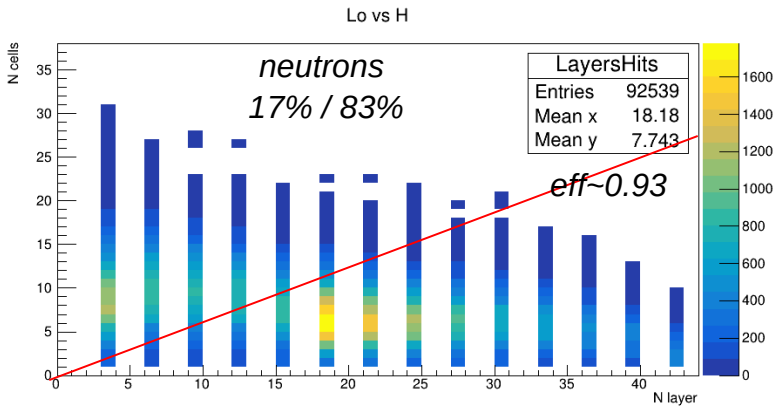
0.5GeV



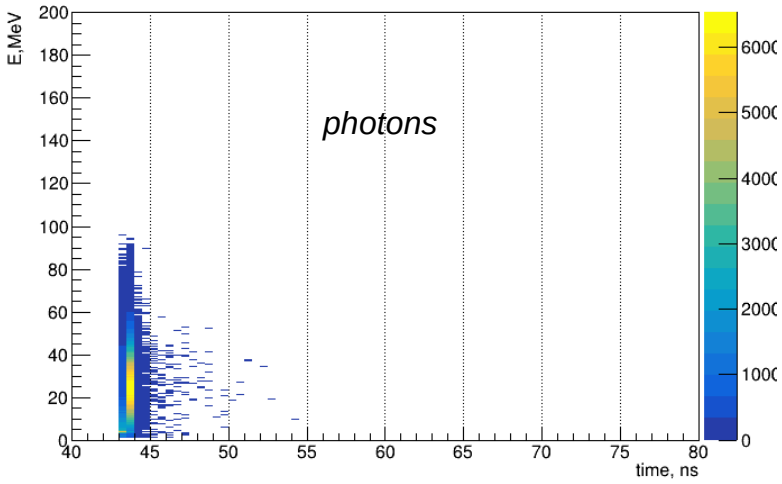


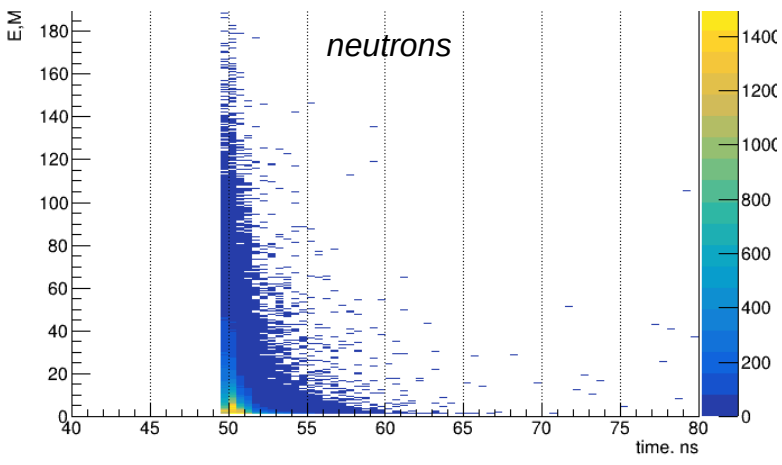
2GeV





Time vs Energy





← differences between photon- and neutron zones in long base (~13m)

Summary

- *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!