### **Simulation Geometry in GEANT4**

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### **Outline**

- **1** Brief Introduction
- 2 physcis and scoring
- 3 simulation output
- 4 summary

## **Priliminary Geometry Design**

- **1** scintillator cubes  $10 \times 10 \times 10$
- 2 flat film as neutron detector: 4layers
- 3 six light guide arrays
- 4 six PMT [SiPM] arrays



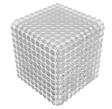
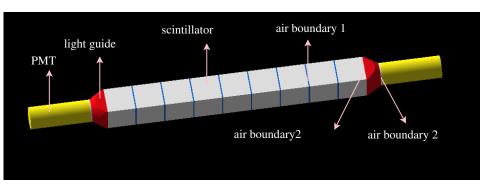




图: scintillator cube

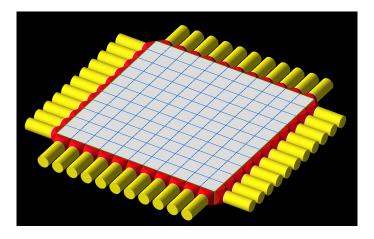
图: scintillator cube+light guide+PMT

The structure of one dimention detector:



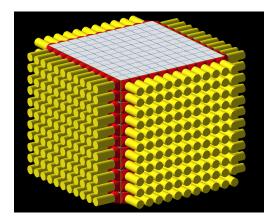
**\bigsilon**: Geometry structure: PMT-lightguide-scintillator-air boundary between [scintillators; scintillator and lightguide; lightguide and PMT cathode]

# **Details about the Geometry Set-up**

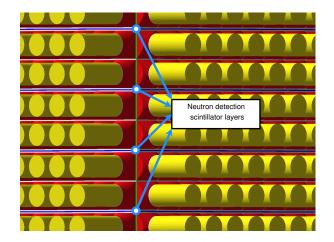


# **Details about the Geometry Set-up**

Not finished yet.



## **Details about the Geometry Set-up**



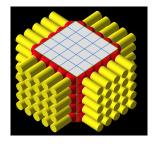
: neutron detection scintillator layers in the y direction.

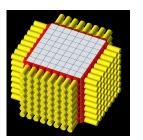
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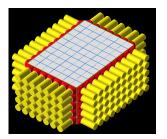
## flexiable size adjustment

Easy to change the full detector size according to experimental requirements.









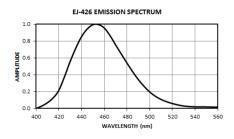
#### THERMAL NEUTRON DETECTOR

- the neutron detector EJ-426.
- flat white thin sheet, 6LiF: (ZnS:Ag)

#### detection princeple:

$$^{6}\text{Li} + ^{1}\text{n} \rightarrow ^{3}\text{H} + ^{4}\text{He} + 4.78\text{MeV}$$
 (1)

The resulting triton and alpha particle are detected by ZnS:Ag phosphor with the broad blue fluorescent spectrum.



DETECTION PROPERTIES				
Screen Type		EJ-426-0	EJ-426HD2	
<sup>6</sup> LiF:ZnS Mass Ratio		1:3	1:2	
<sup>6</sup> Li Density (atoms/cm <sup>3</sup> )		8.81 × 10 <sup>21</sup>	1.39 × 10 <sup>22</sup>	
Theoretical N™ Efficiency	0.32 mm thick	0.23	0.34	
	0.50 mm thick	0.34	0.48	

- choose the formula: EJ-426-0 or EJ-426HD2?
- 2 switch the thickness: 0.32mm or 0.5mm?
- 3 sheet size: 60mm × 60mm?
- 4 do we need backing material?

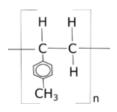
BACKING				
MATERIAL TYPE	DESCRIPTION	SUFFIX		
Aluminum Foil	50 μm thick foil	(none)		
	0.25 mm thick sheet	-PE		
Clear Polyester Sheet	Laminated between two 0.25 mm thick sheets	-PE2		
Aluminized Mylar	0.12 mm thick sheet	-AM		
Pure Aluminum	0.5mm thick plate	-PA		
High Reflective Aluminum	0.4mm thick plate	-A		

### next to be done

- detector construction.
  - add remain geometry [lightguides and PMTs].
  - attach correct material to each logical volume.
  - other components
- adjustment of physis list
  - about scitillator material and their optical properties
  - optical performance of lightguides
  - response of PMT [SiPM]
  - optical boundaries
- add different primary paticle sources
  - alter the particle type, position, momentum, energy etc.
  - use gps to control theparticle source
- sensitive detector and scoring
- more useractions for output and analyze.

## material of detector components

gamma scintillator:EJ-200
Base: Polyvinyl toluene formula: [CH2CH(C6H4CH3)]n



Density: 1.023 g/cm<sup>3</sup> Refraction Index: 1.58

Light Output: No change from -60 $^{\circ}$ C to 20 $^{\circ}$ C

thermal neutron scintillator:EJ-426HD2

<sup>6</sup>LiF: ZnS MassRatio1: 3

 $^6$ Li Density(atoms/cm $^3$ ): 8.81×10 $^{21}$ 

<sup>6</sup>Li enriched to minimum of 95 atom percent.

# material of detector components



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## sensitive detector



#### summary

- almost finish simple detector geometry.
- other parts of simulation program still in progress.