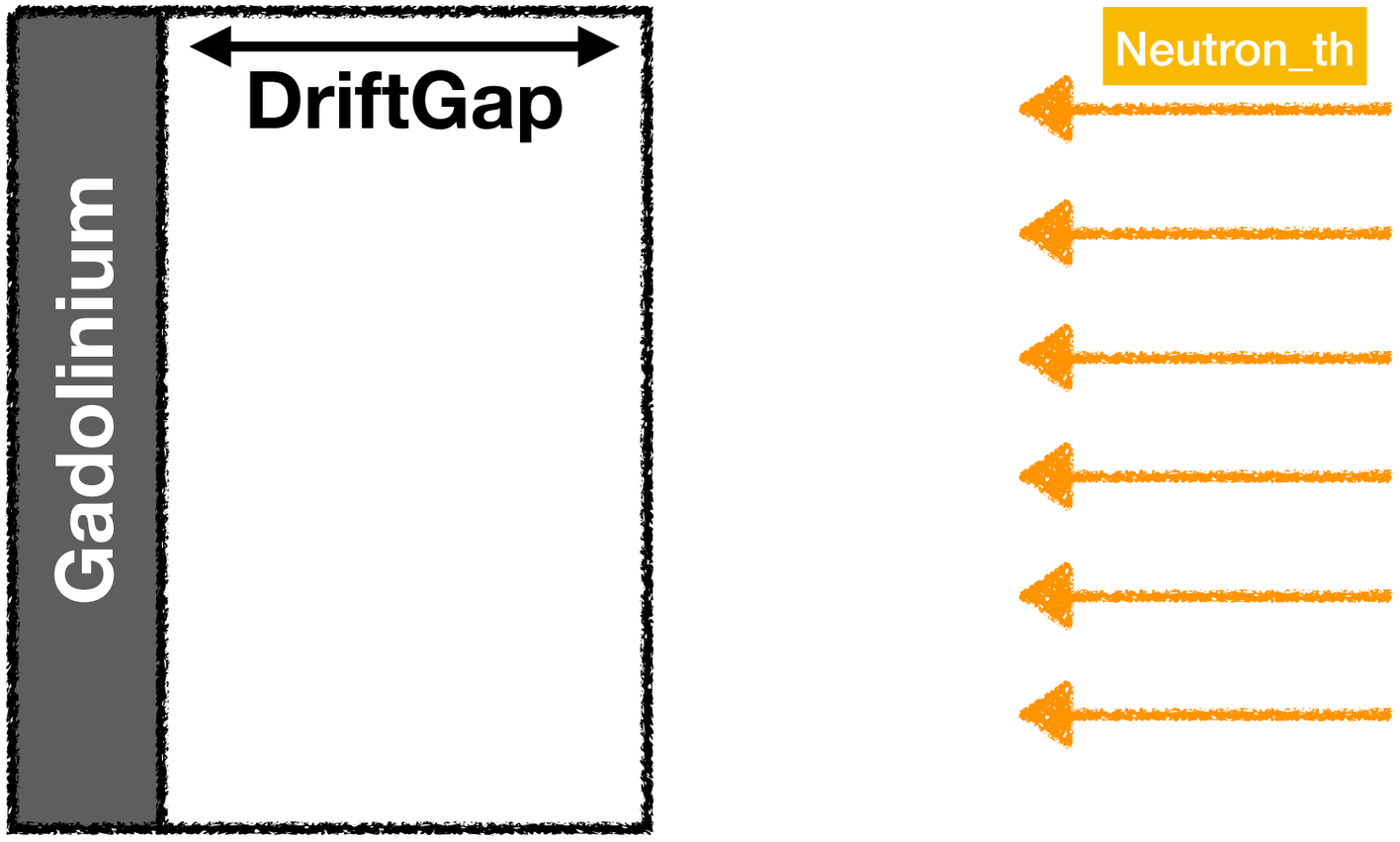
Cadmium & paraffin plate for thermal neutron shielding

Donghyun

- **Purpose : Simulate how thicker shielding material is needed**

※ **Simulate as simple as possible**

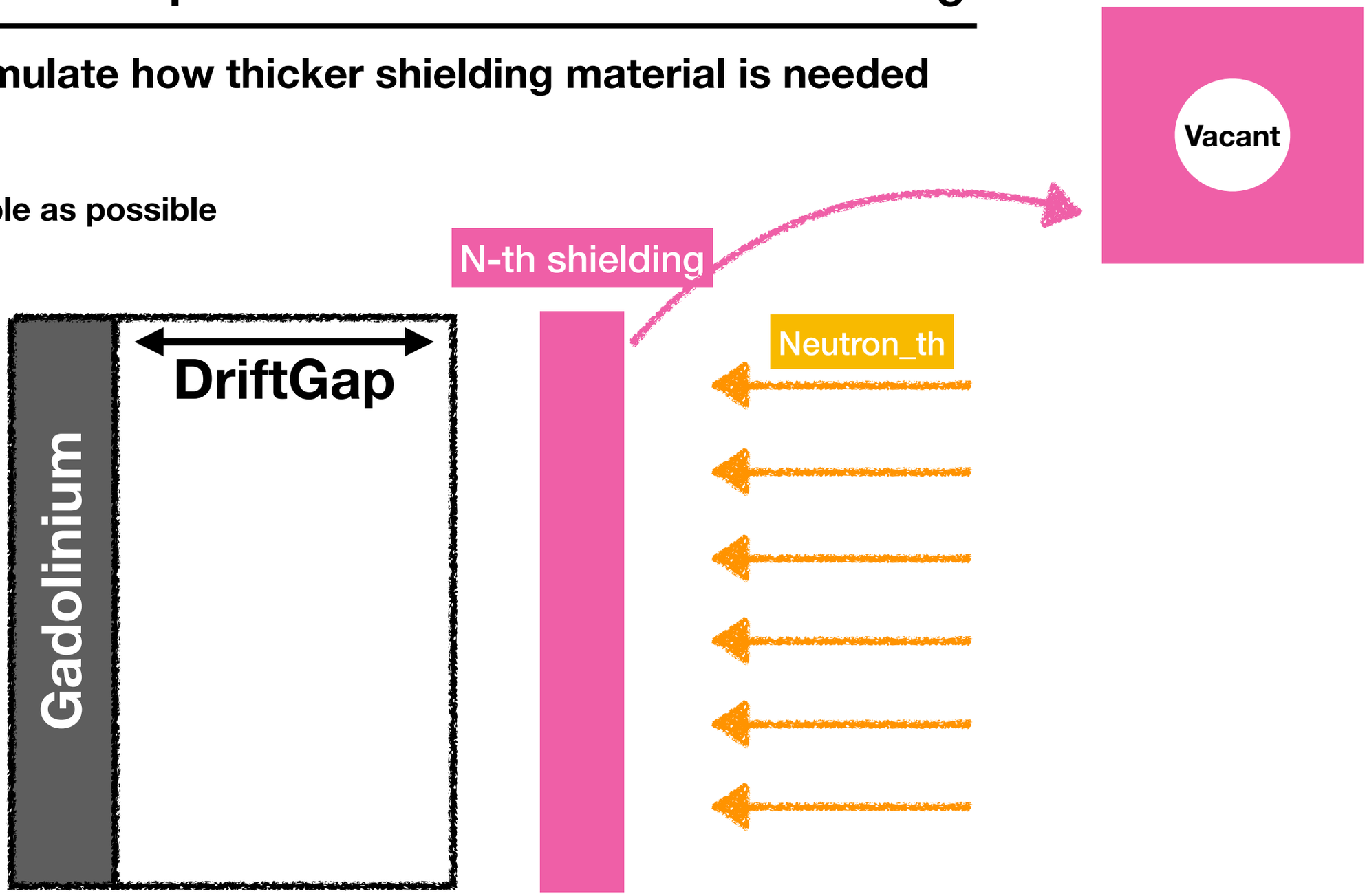


Last Experiment schematic

Cadmium & paraffin plate for thermal neutron shielding

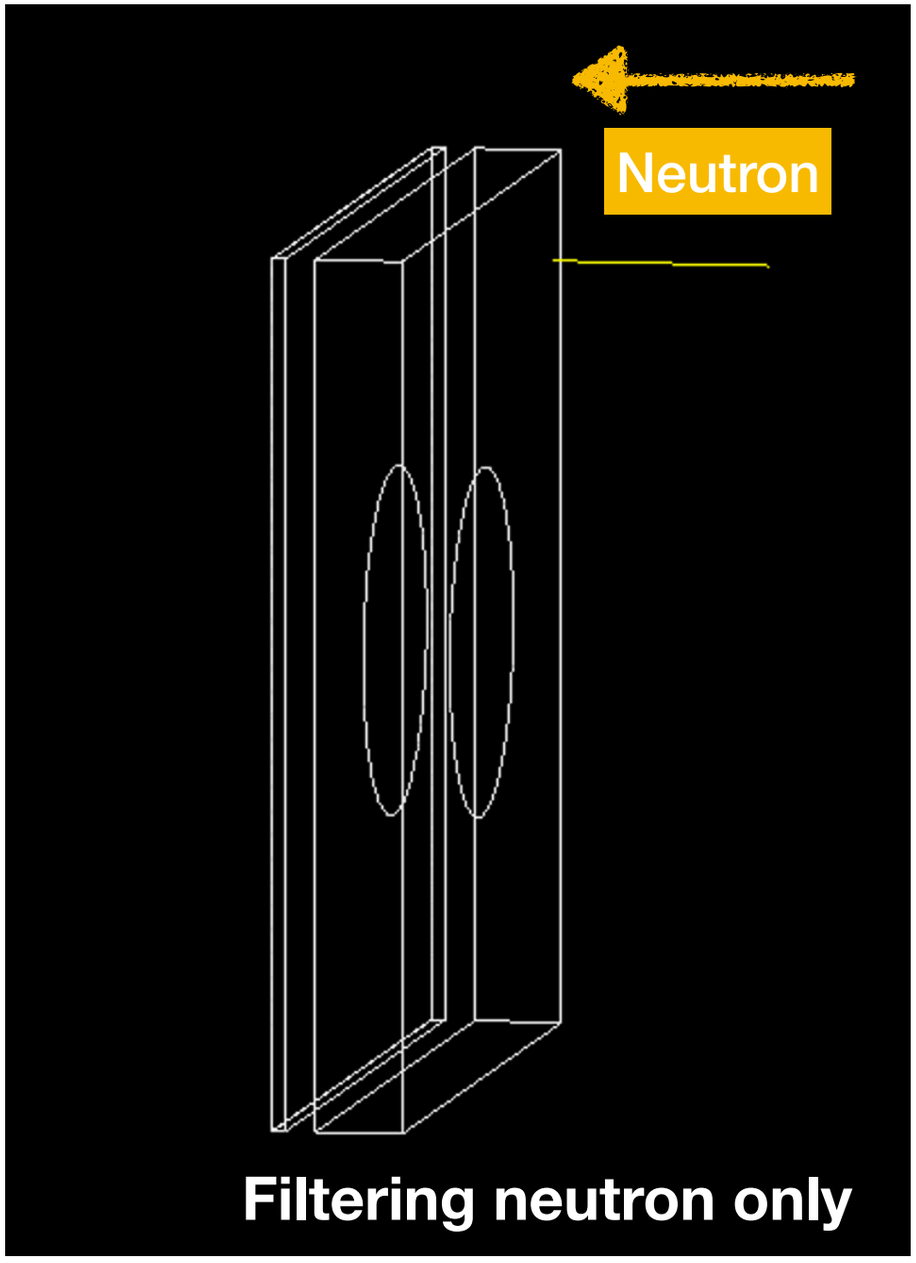
- **Purpose : Simulate how thicker shielding material is needed**

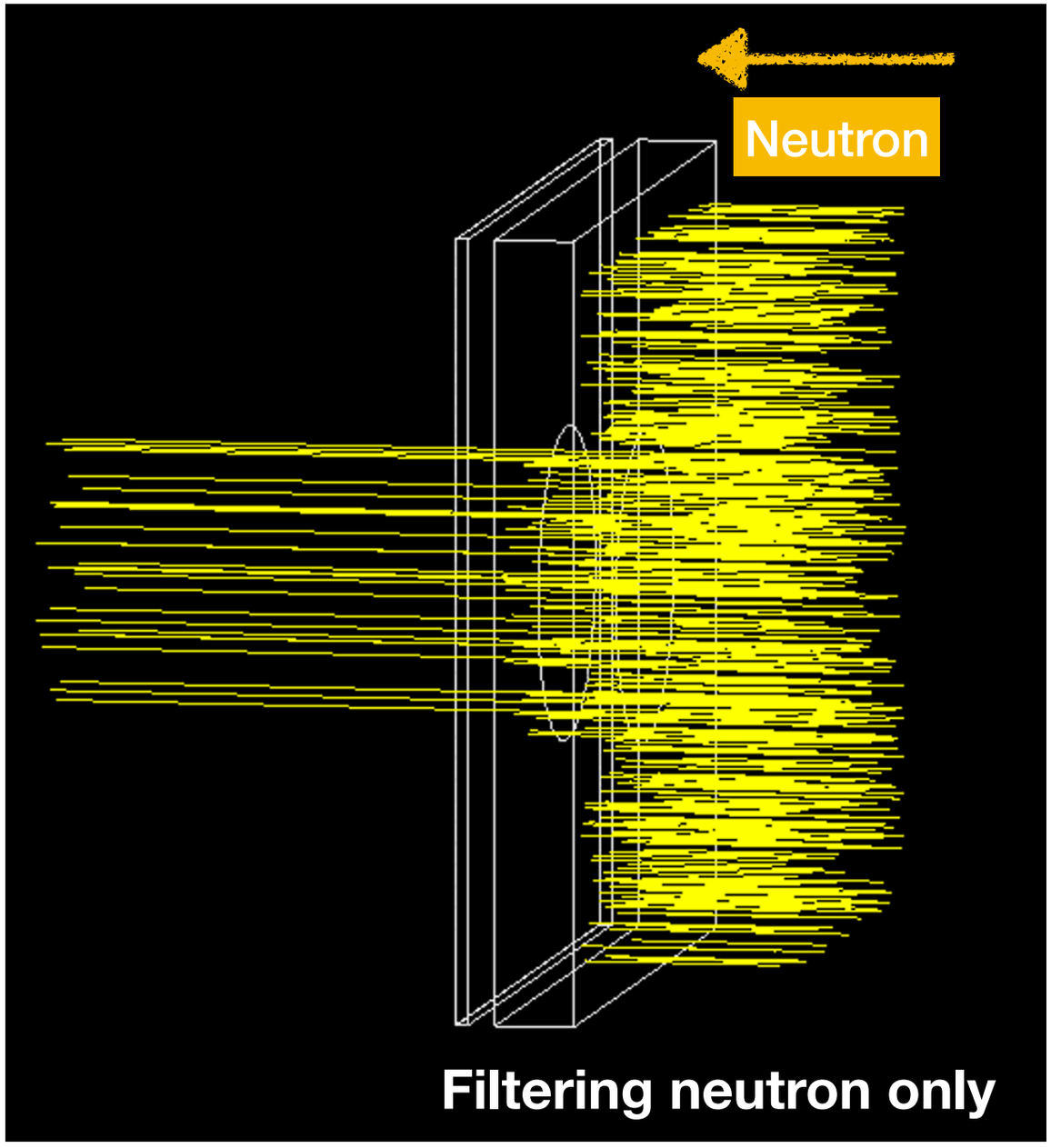
※ **Simulate as simple as possible**



This Experiment schematic

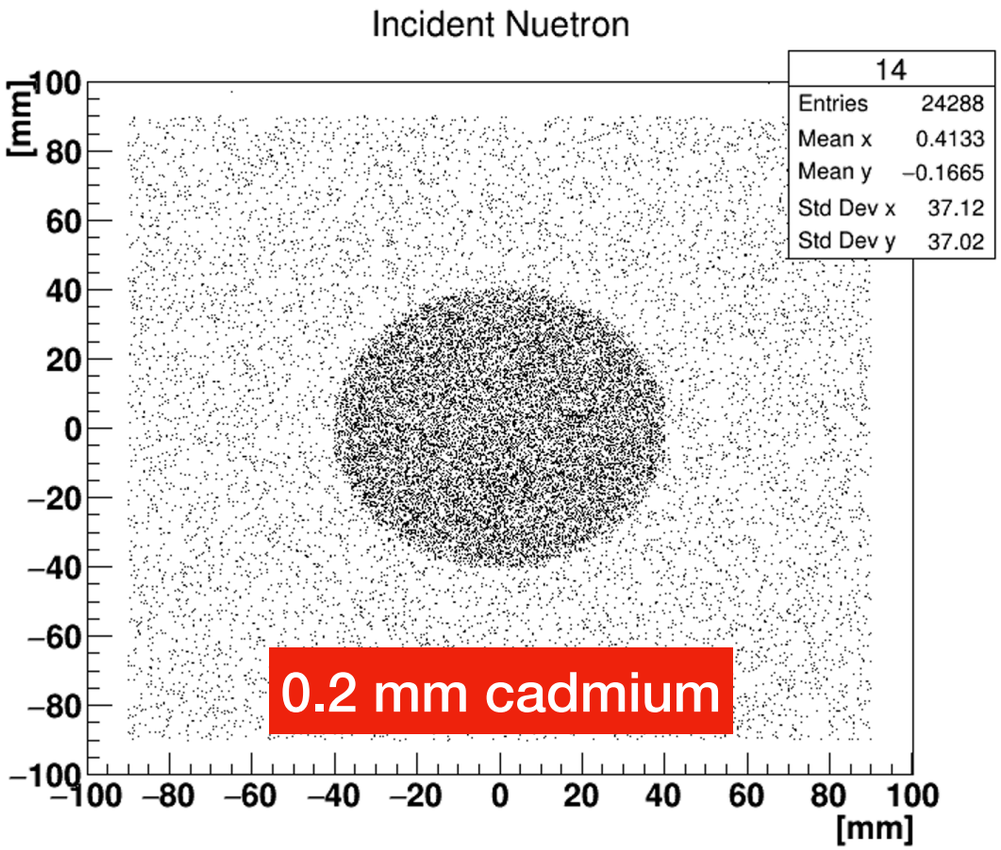
Cadmium & paraffin plate for thermal neutron shielding

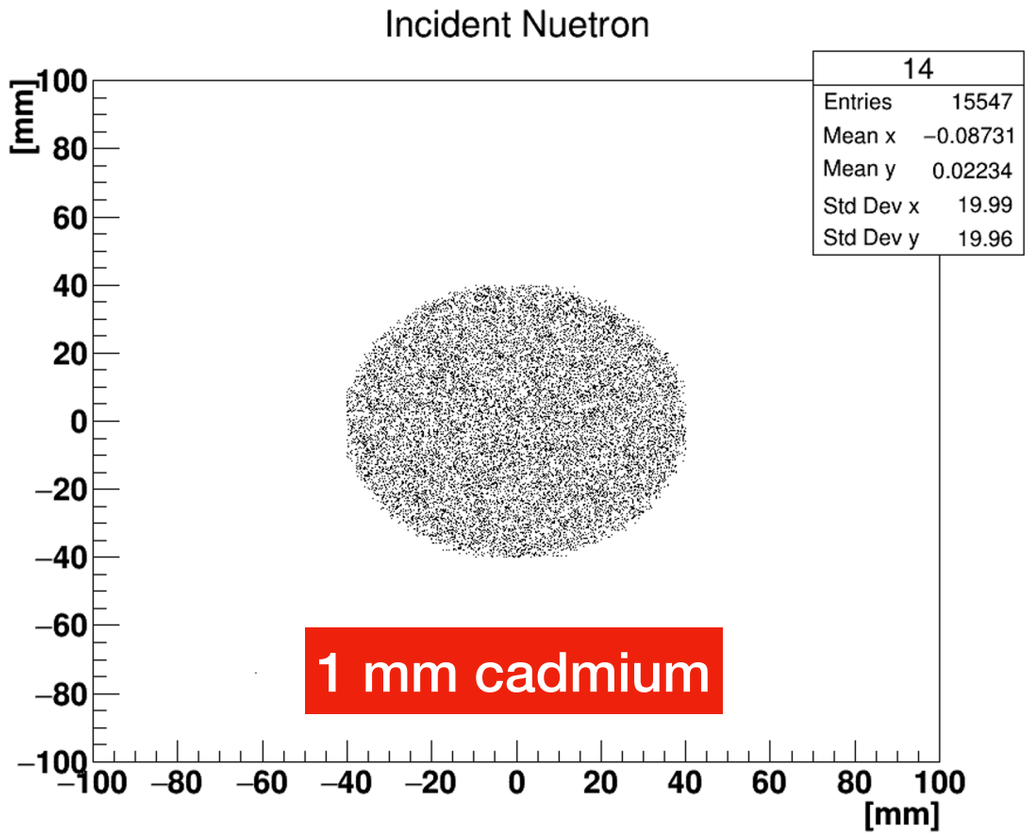


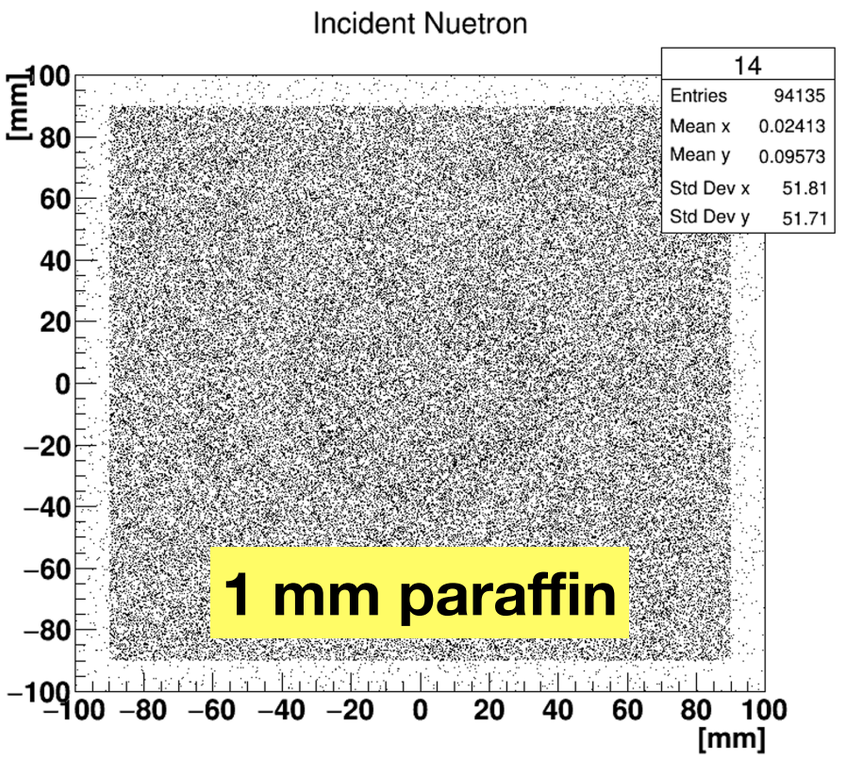


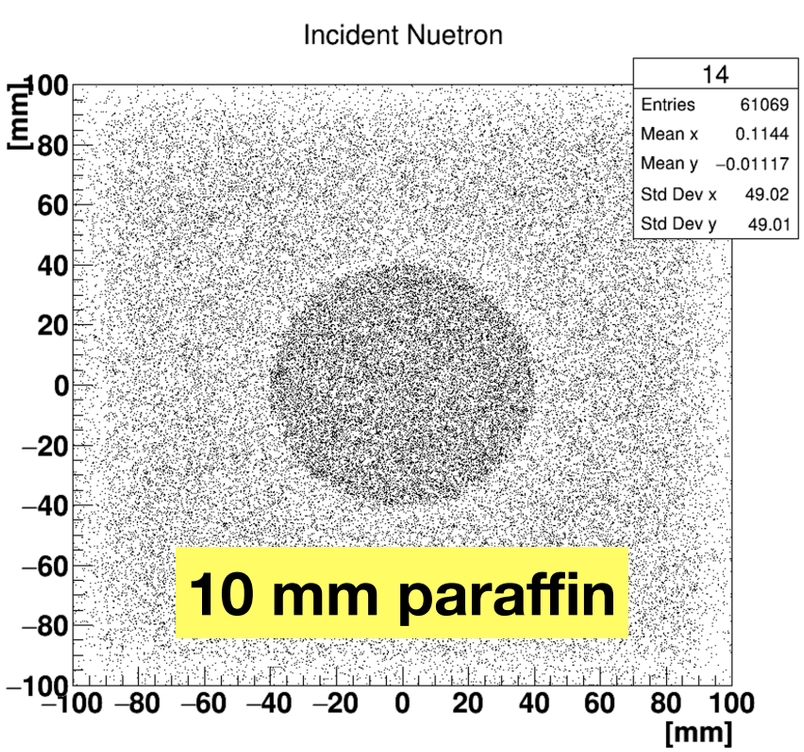
1. Length of plate : 20 cm * 20 cm
(G4box 선언 시 한 변의길이 입력하면 2배 되는걸 깜박, 그러나 이번 시뮬레이션에서 큰 상관 없음)
2. Hole diameter of shielding material : Length of plate * 0.4 = 8 cm
3. Particle Gun
    3.1 particle : neutron
    3.2 energy : 25 meV
    3.3 position : Length of plate * 0.9 범위 내에서 random

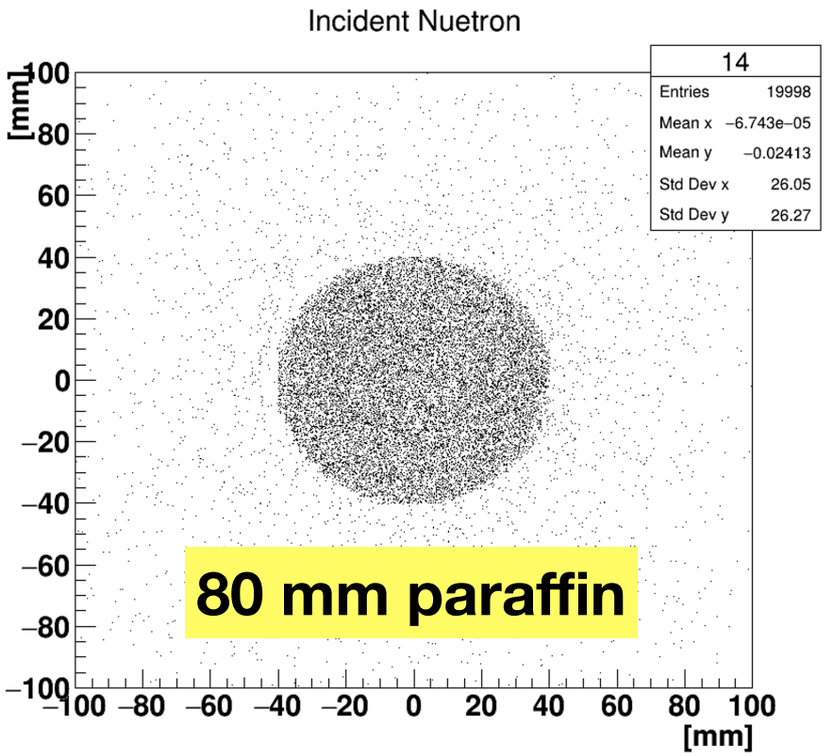
Cadmium & paraffin plate for thermal neutron shielding







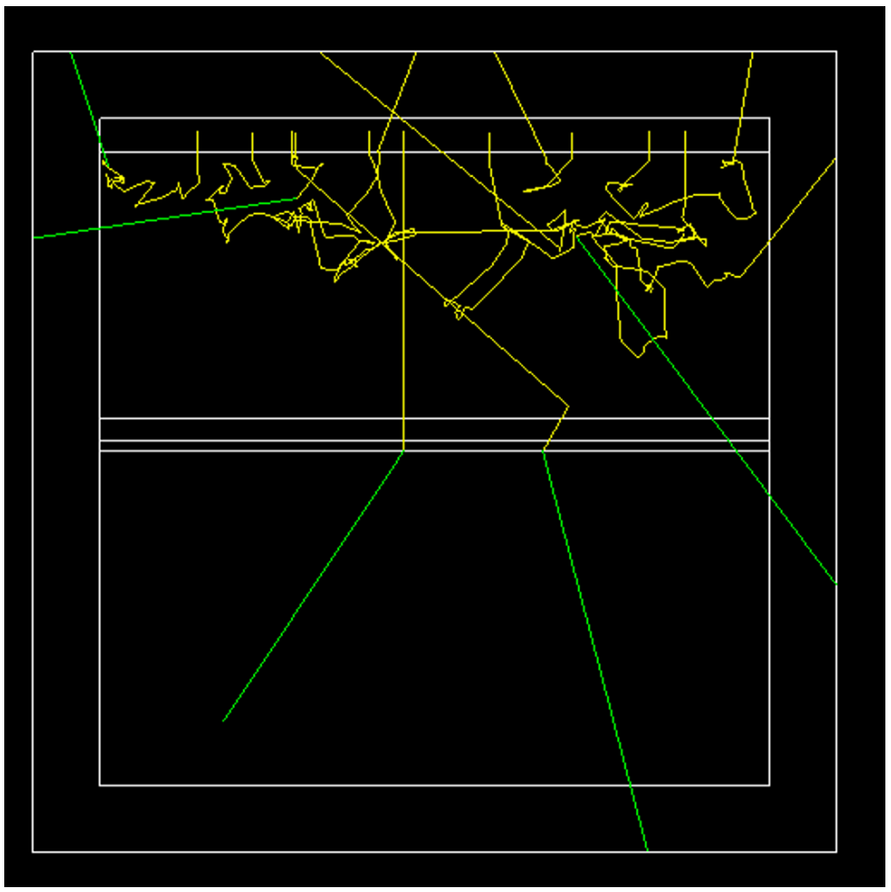


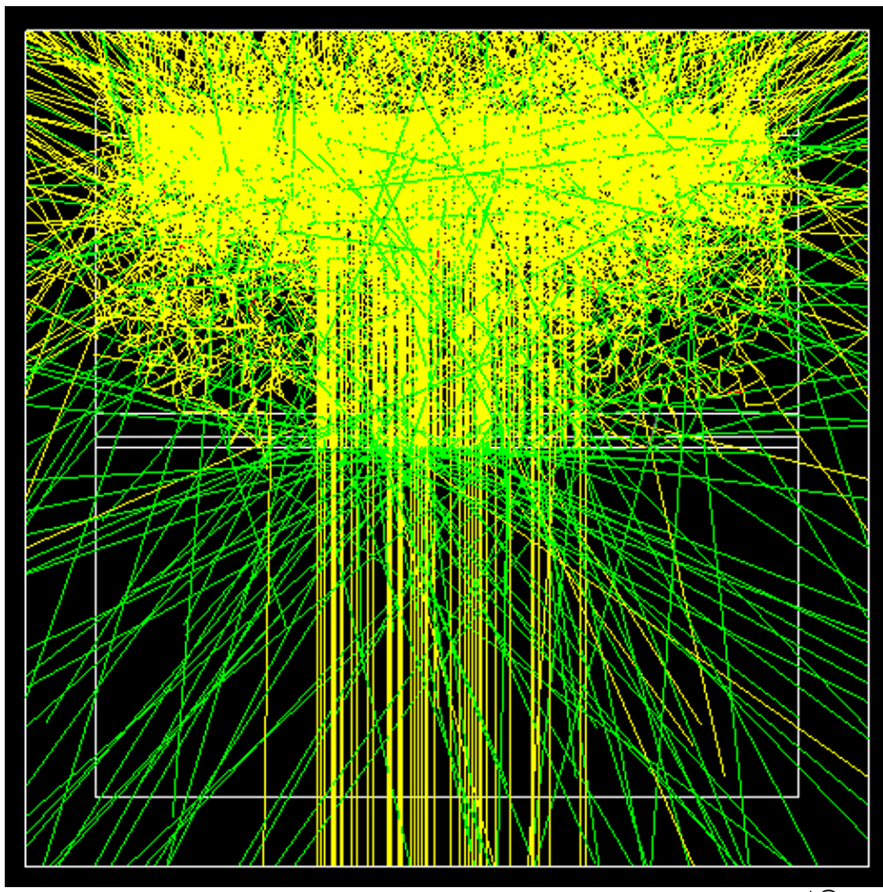


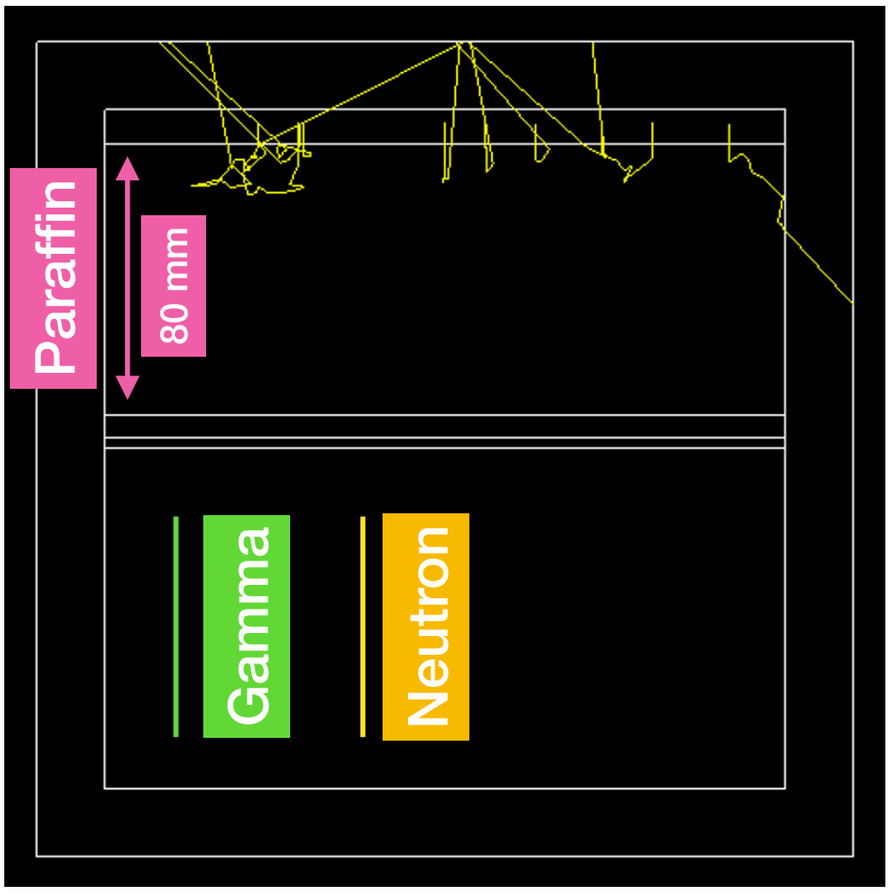
—> Cadmium for neutron shielding looks good but..

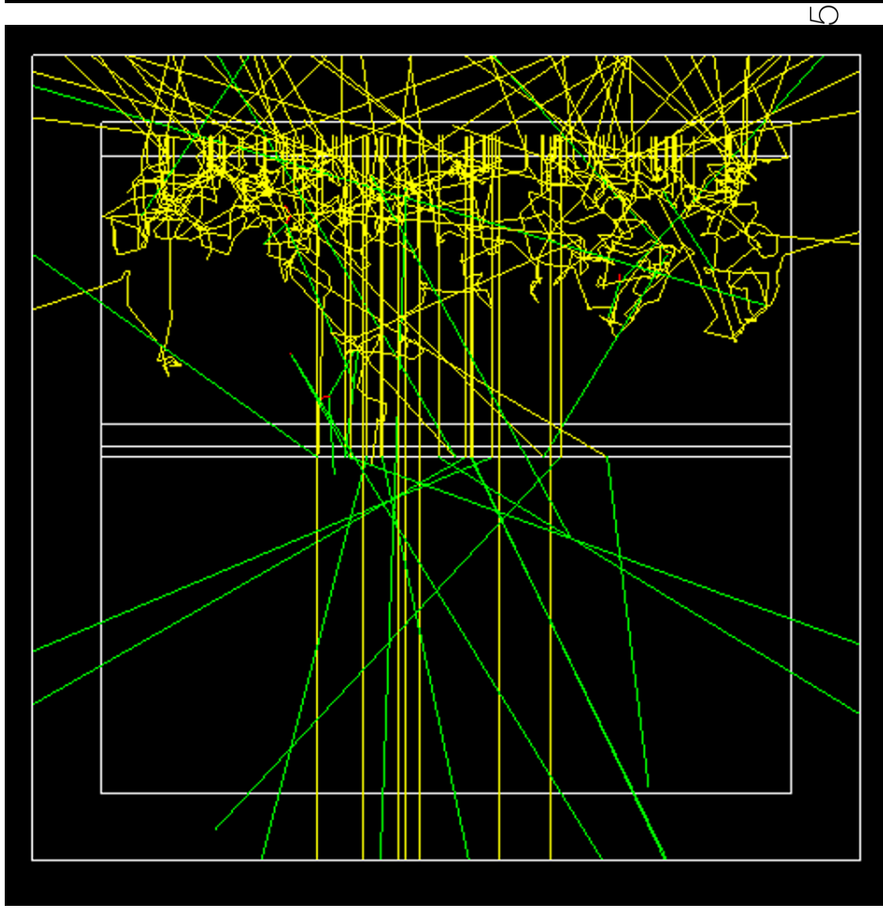
잘 안보이는데 얘는 가돌리늄 판에서 감마가 튀어나오는거고

Paraffin_beam on 10/100/1000

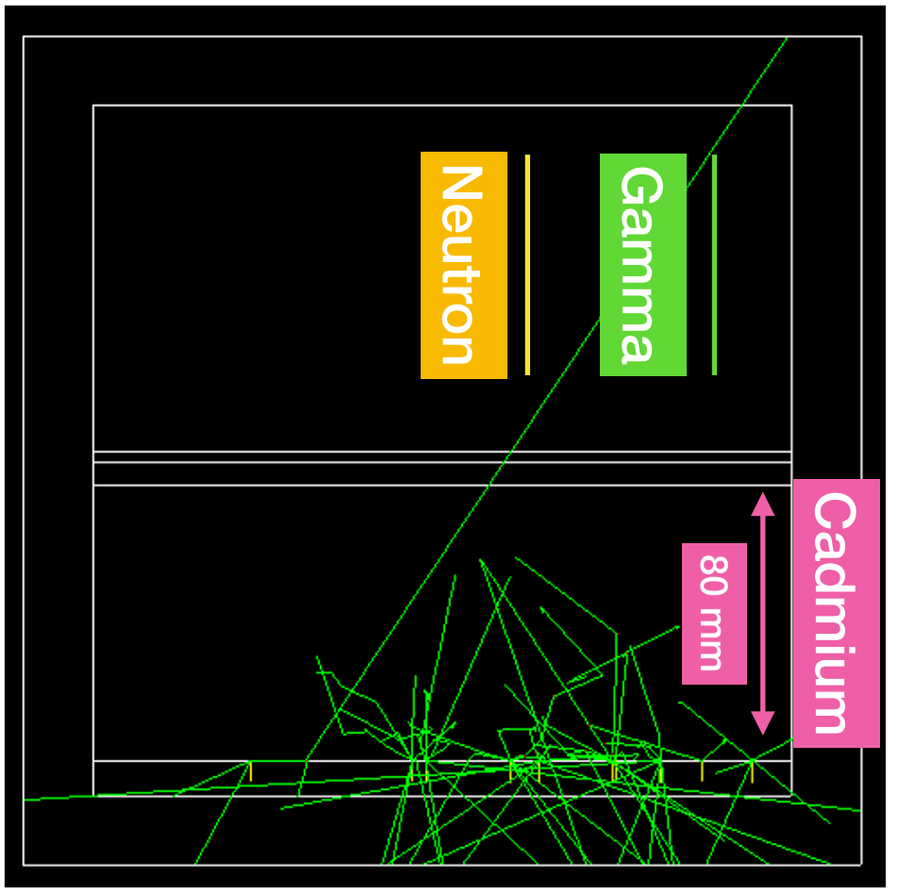


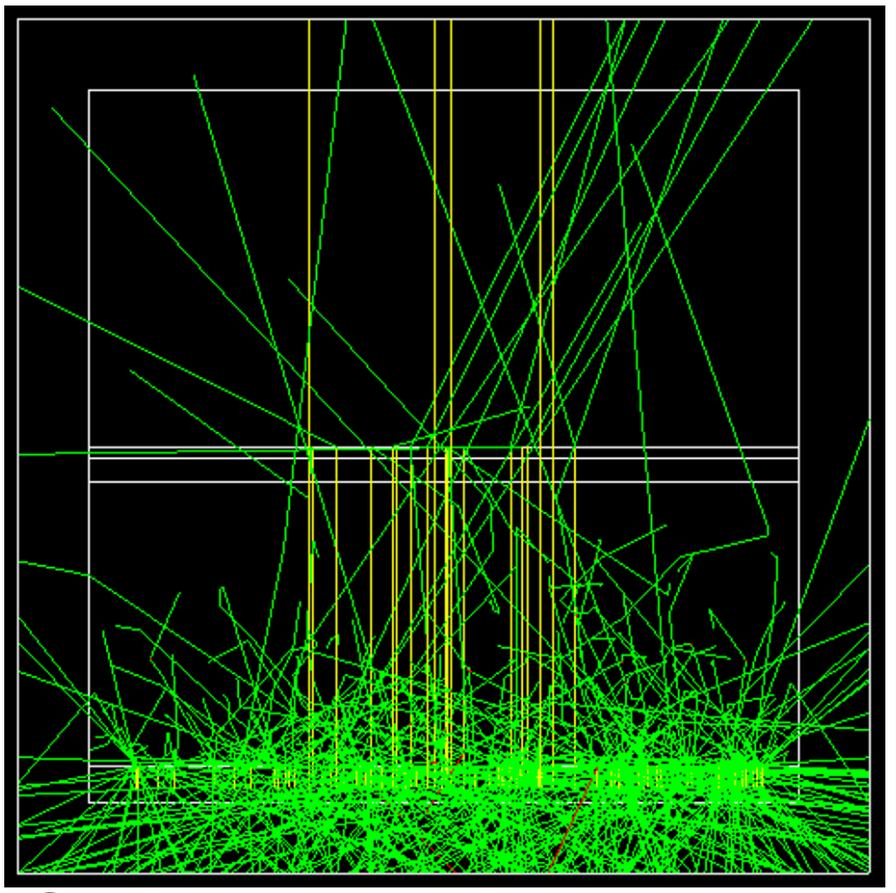


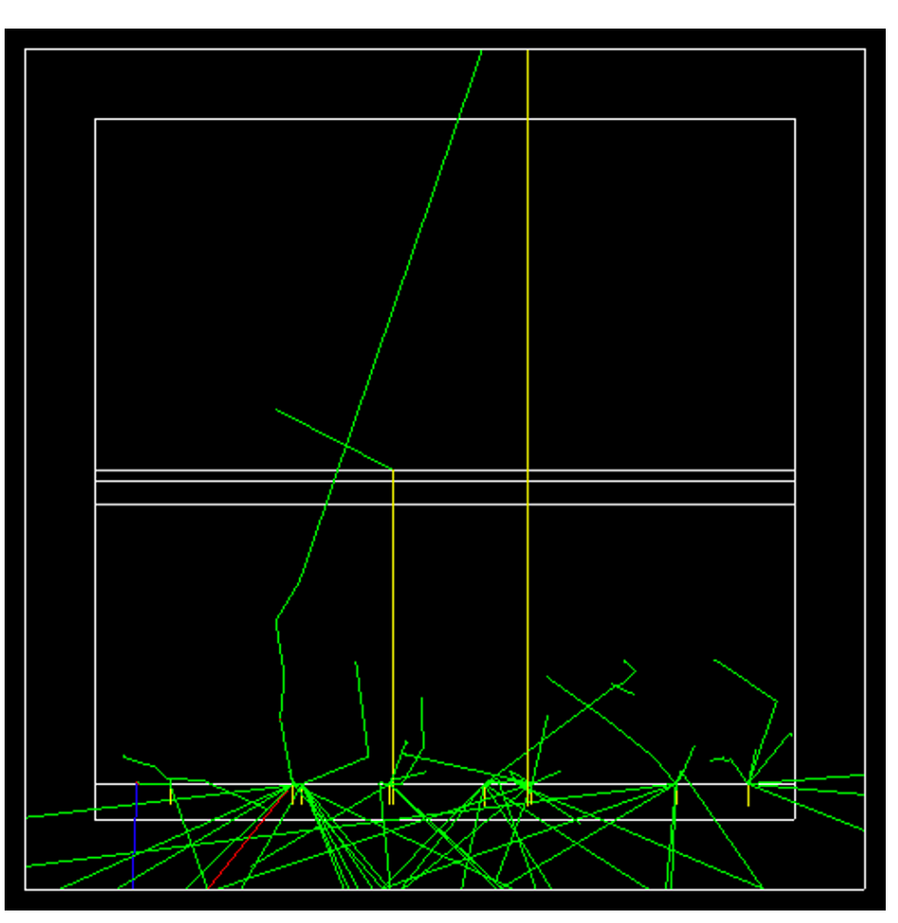


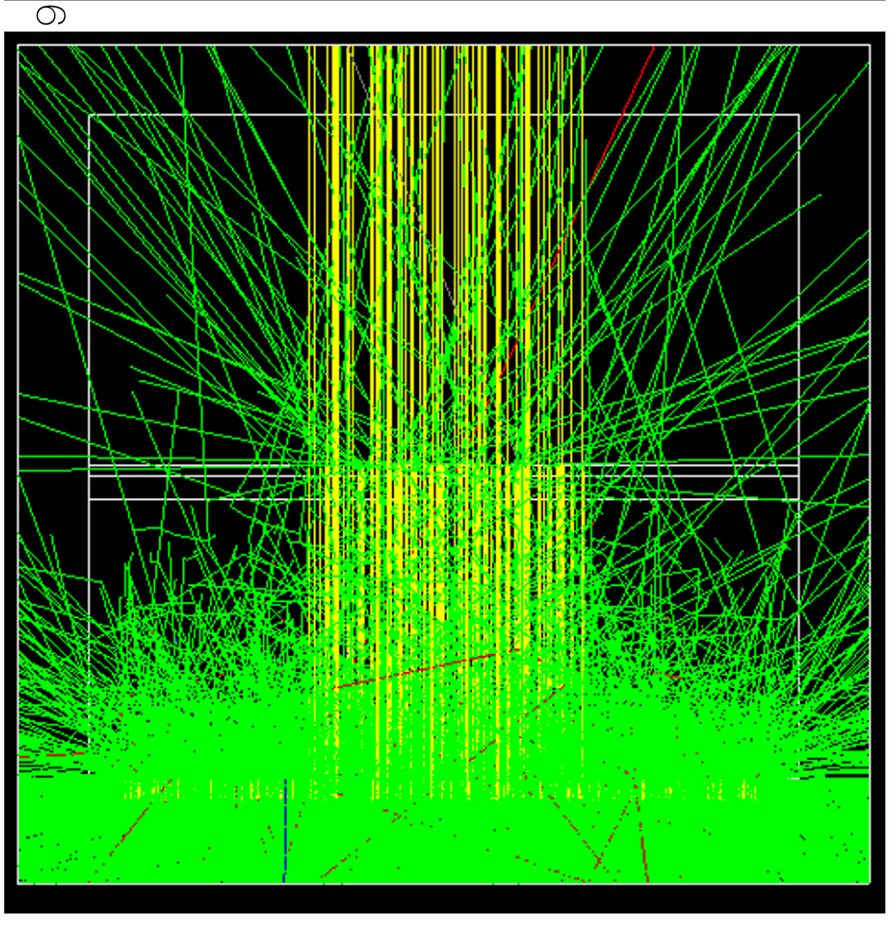


Cadmium_beam on 10/100/1000







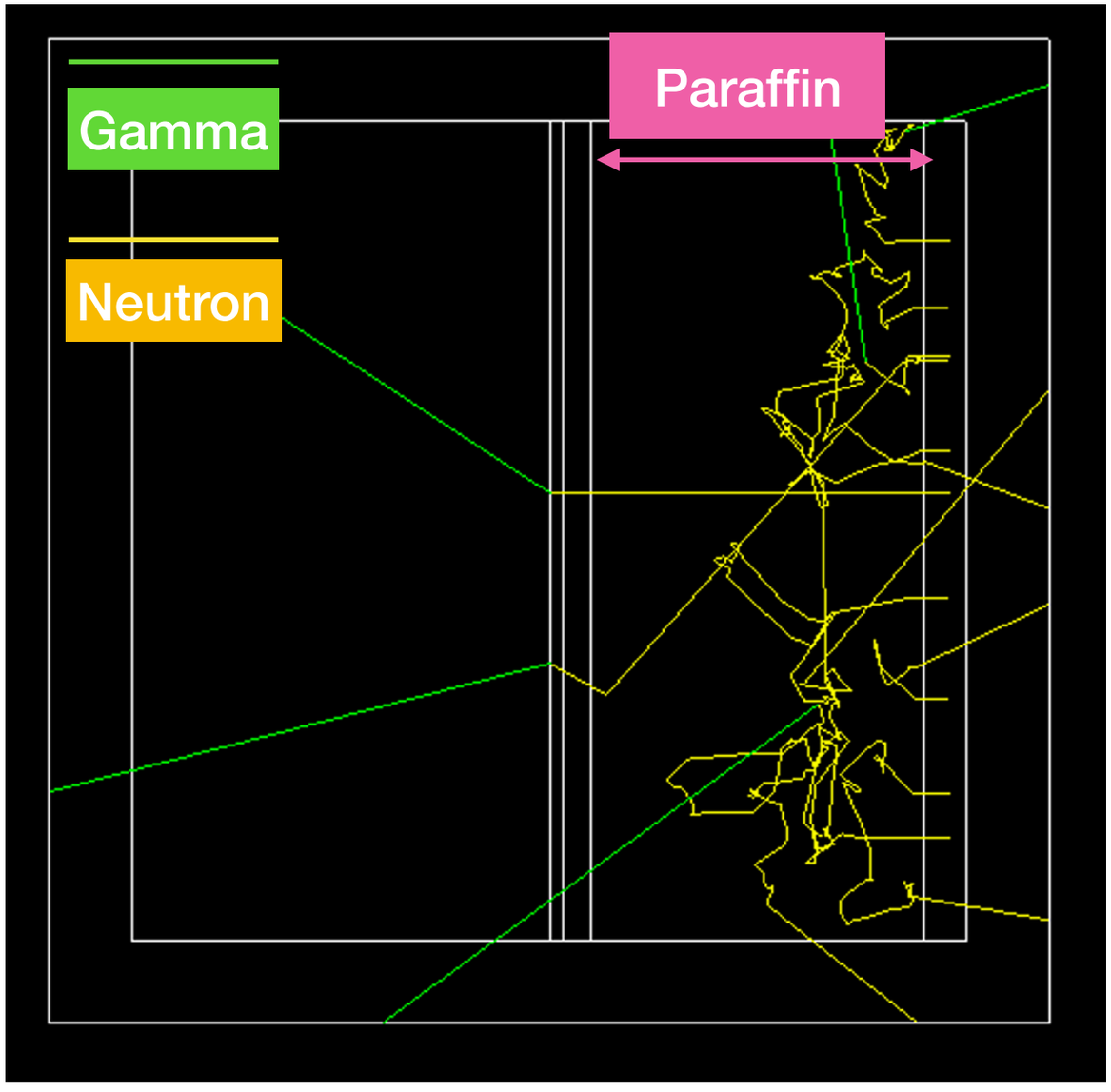


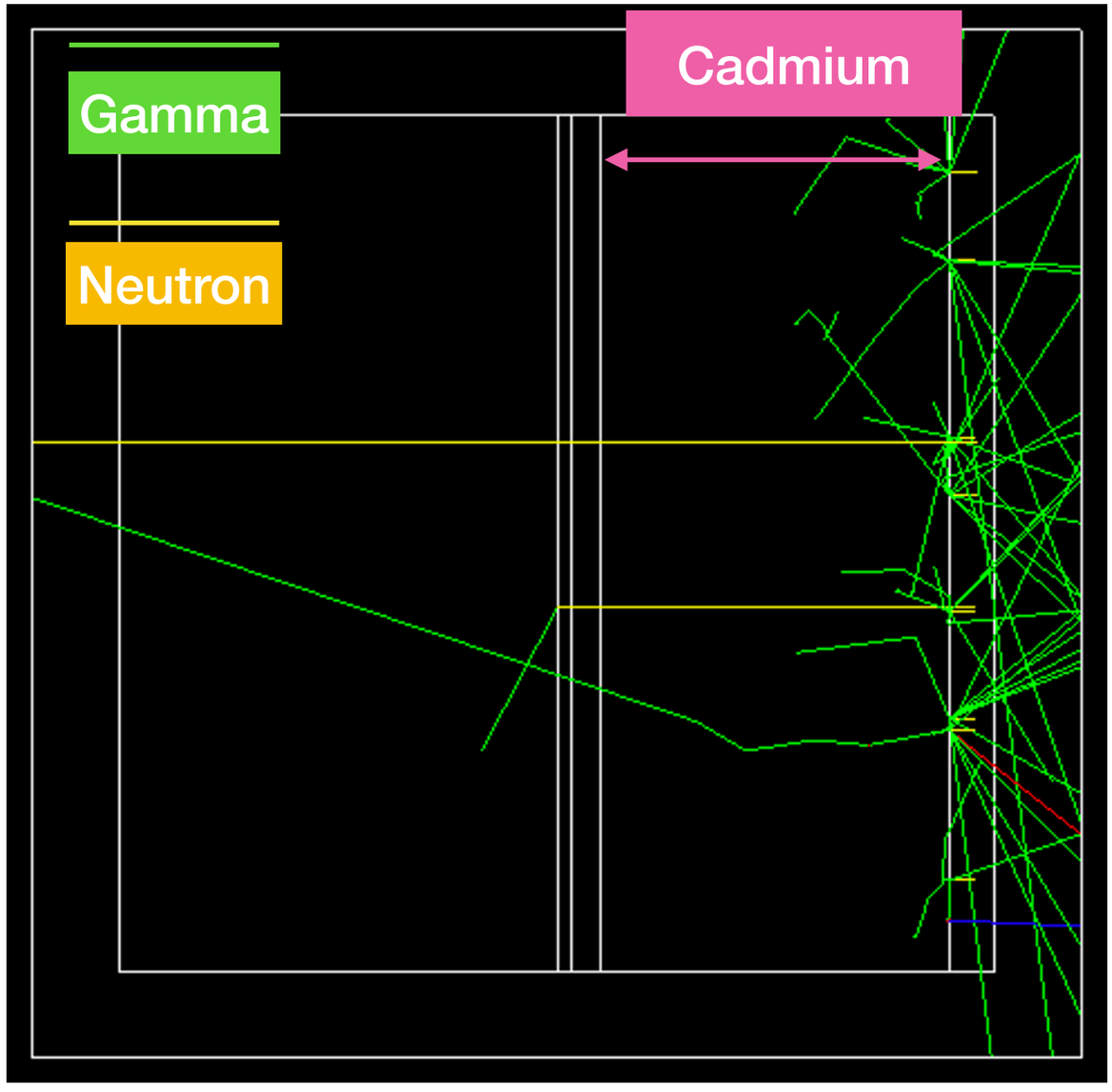
c)

b)

애는 카드뮴 표면에서 감마가 튀어나옵니다. (지배적인 반응만 말하자면..)

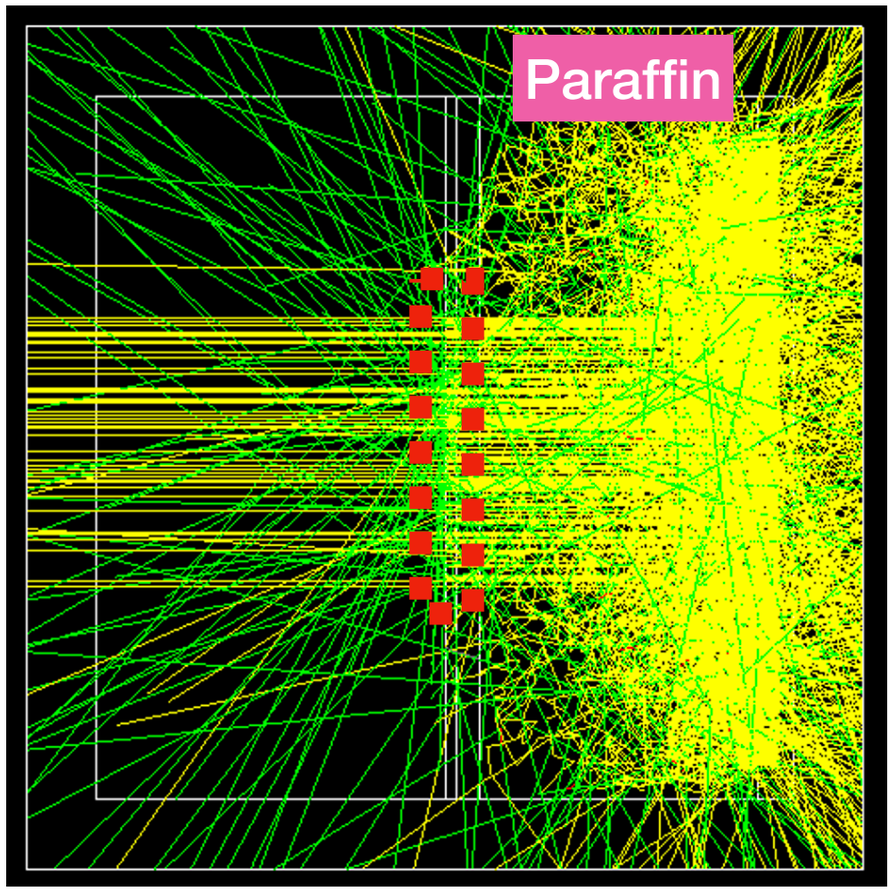
Paraffin&Cadmium

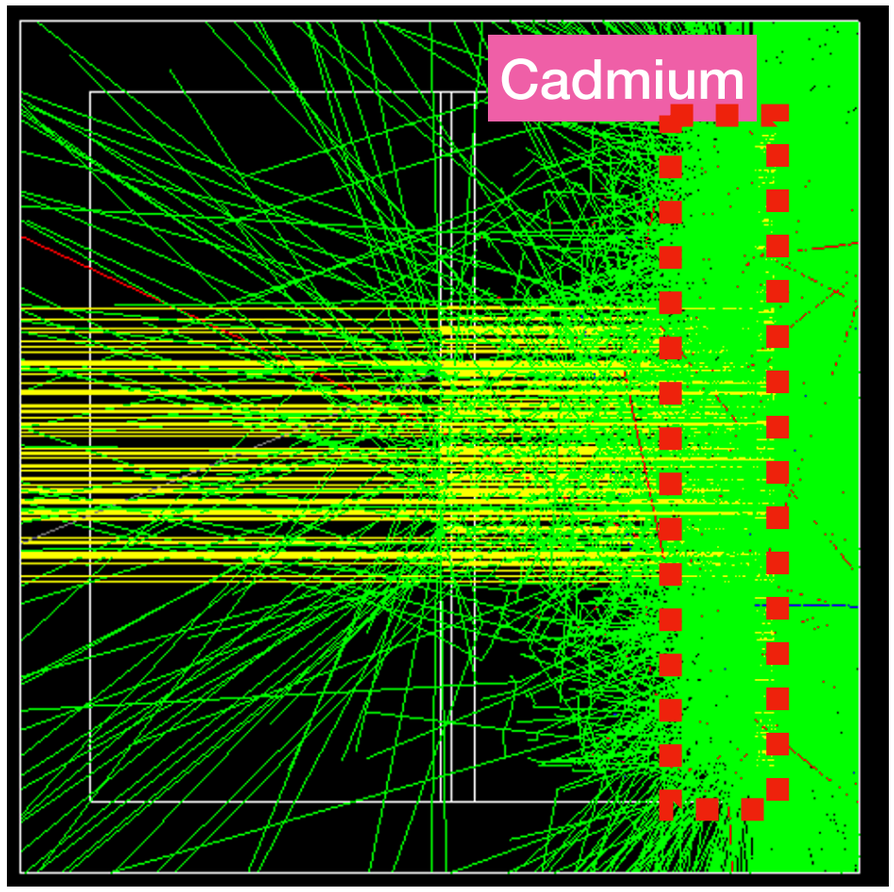




- First, we cannot use 80mm cadmium due to its price (and Cd is a toxic, it is not clear whether it can be purchased)
- Paraffin(C_nH_{2n+2}) -> hydrogen-rich -> suitable to stopping neutron
  - Left figure -> neutrons are absorbed in paraffin
- Cadmium -> good substance in view of shielding but -> high N_th cross-section substance -> not stopping neutron -> make many secondary gamma

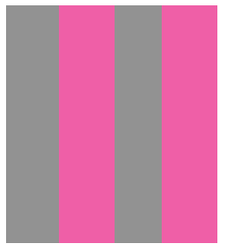
Paraffin&Cadmium _ 일단 현재까지의 요약..





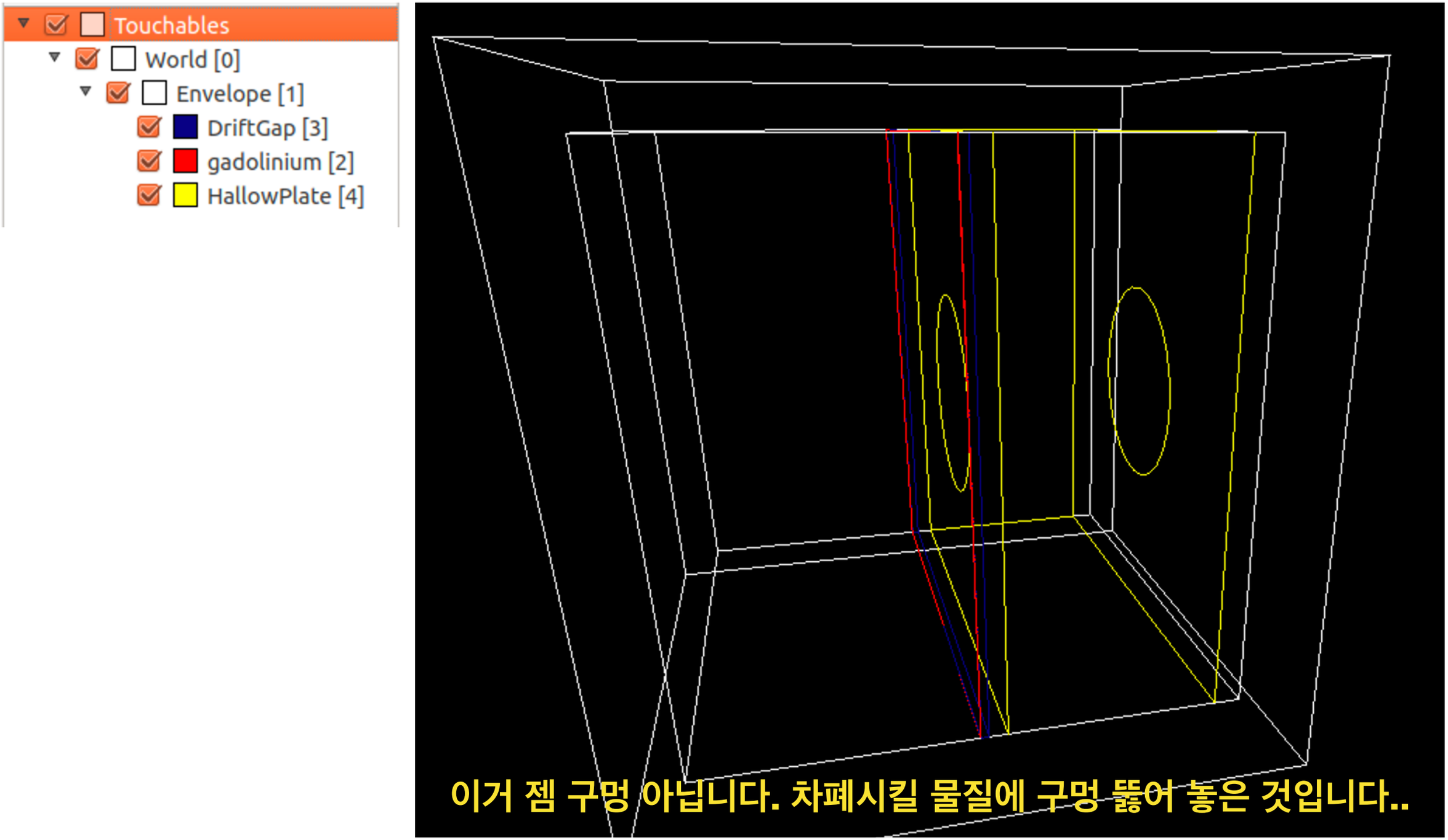
지금 카드뮴을 80mm 로 해놓아서
별 거 아닌 것 처럼 보이나,
실제로 카드뮴을 사용하게 되면
1~2mm 일텐데
그럼 카드뮴으로 부터의
secondary gamma 가
GEM의 active volume 을 뒤덮습니다.
카드뮴을 사용한다면, 감마의 에너지에
따라서 다르겠지만 밑 그림과 같이
카드뮴, 납을 번갈아가면서 배치하여
최대한 secondary gamma를 막는
것이 필요할 것 같습니다.

추가로 확인해 볼 것들은 다음 주에..



- If there is not enough space available when using GEM detector
  - Cadmium is good -> but it would be better to lay a layer of Cd + Pb layer
    - Now, we don’t know the exact E of gamma or something
  - More detail energy of gamma & generate process will be conducted next week
- If we don’t care space when using GEM detector
  - Paraffin is good
  - Also, more detail simulation will be conducted next week

Backup


Touchables
World [0]
Envelope [1]
DriftGap [3]
gadolinium [2]
HallowPlate [4]
이거 젬 구멍 아닙니다. 차폐시킬 물질에 구멍 뚫어 놓은 것입니다..

Cadmium_Process_Thickness

Cadmium 0.1 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=   2703            hadElastic=     13              nCapture=    5823
```

Cadmium 0.2 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=    822            hadElastic=     19              nCapture=    7554
```

Cadmium 0.5 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=     34            hadElastic=     21              nCapture=    8417
```

Cadmium 1 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=      2            hadElastic=     28              nCapture=    8472
```

Cadmium 2 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=      3            hadElastic=     21              nCapture=    8495
```

Paraffin_Process_Thickness

Paraffin 1 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=   8427           hadElastic=   2745           nCapture=     30
```

Paraffin 4 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=   8370           hadElastic=  13915           nCapture=    134
```

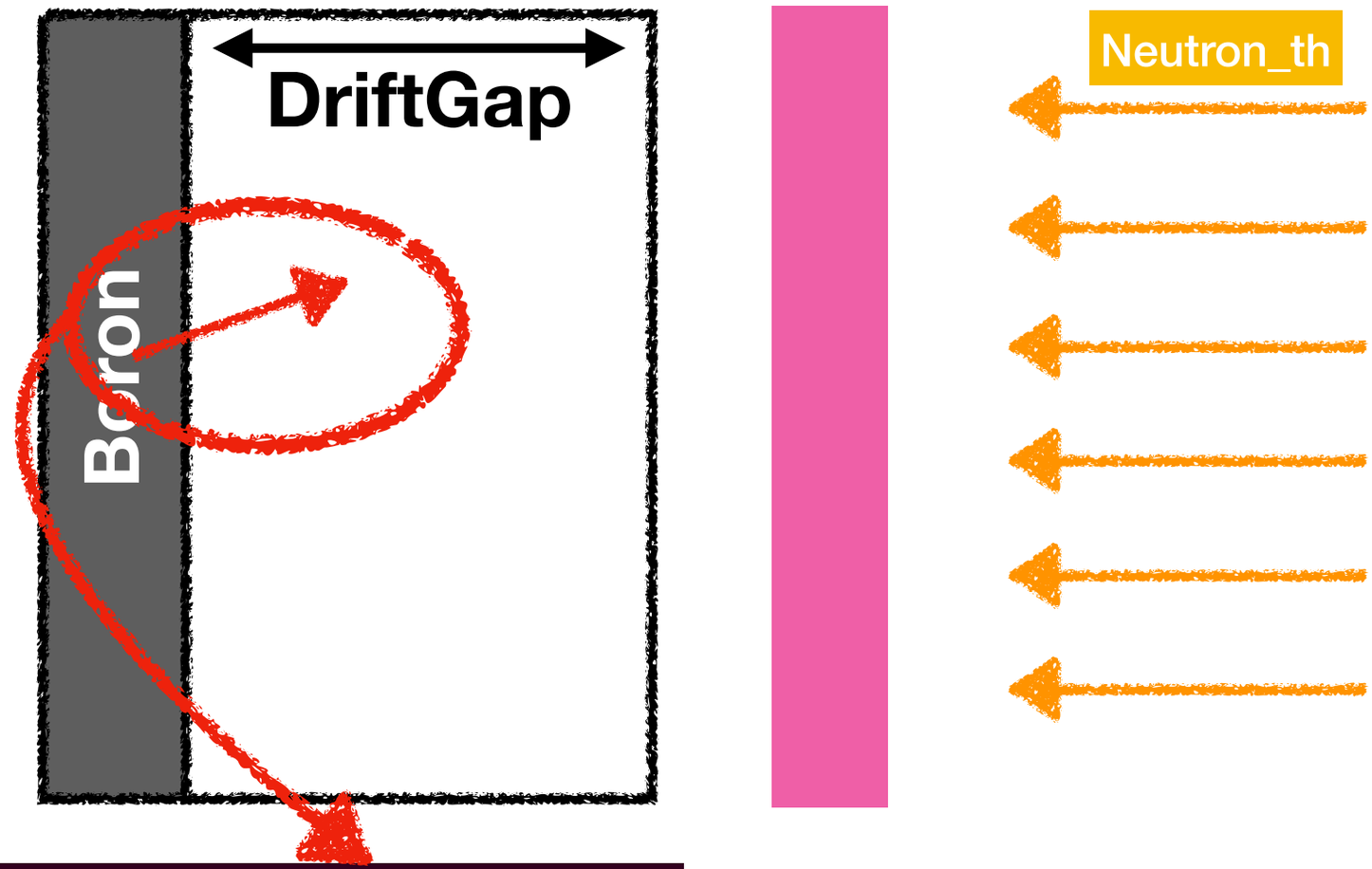
Paraffin 10 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=   8038           hadElastic=  39562           nCapture=    397
```

Paraffin 80 mm

```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=   7552           hadElastic= 169518           nCapture=   1654
```

시도중..




```
The run is 10000 neutron of 25 meV

Process calls frequency :
      Transportation=    849

List of generated particles:
           B11:        9  Emean =  711.04 eV    ( 9.2659 meV --> 6.3991 keV)
           Li7:     1328  Emean =  849.71 keV   ( 832.3 keV --> 1.014 MeV)
         alpha:     1328  Emean =  1.4895 MeV   ( 1.4718 MeV --> 1.777 MeV)
            e-:      780  Emean =   3.413 keV   ( 806.34 eV  --> 283.64 keV)
         gamma:     2278  Emean =     268 keV   ( 1.0019 keV --> 11.454 MeV)
```

특정 위치에서, 특정 입자 별 에너지 분포 코드 짜는 중입니다..