

GATE Simulation study

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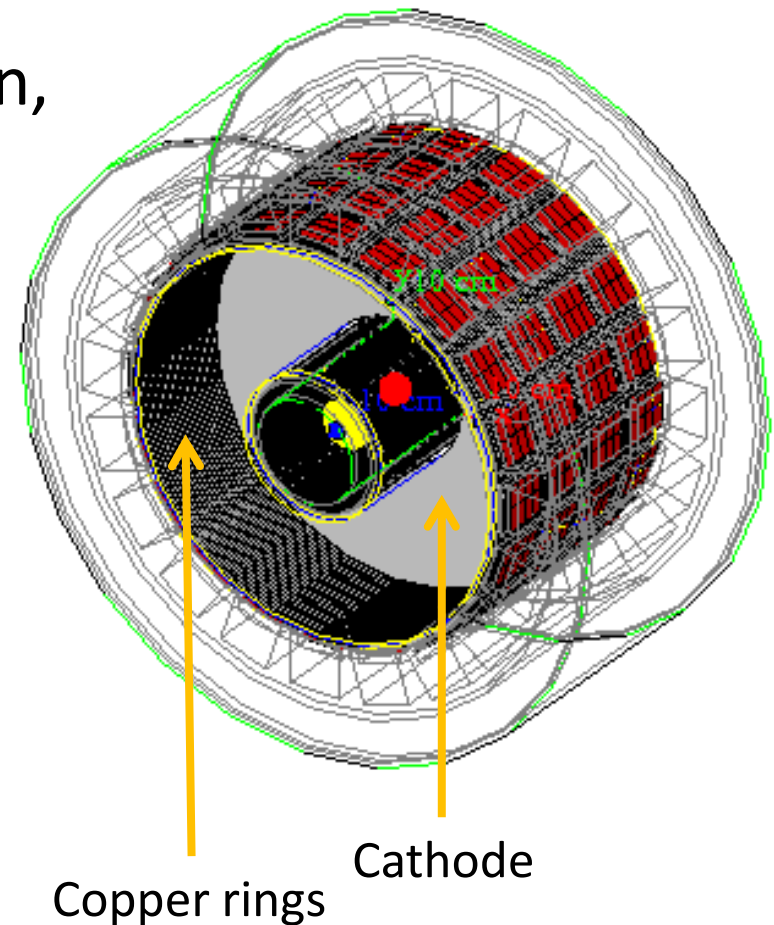
Contents

- GATE simulation
 - define the mesh cathode

GATE simulation

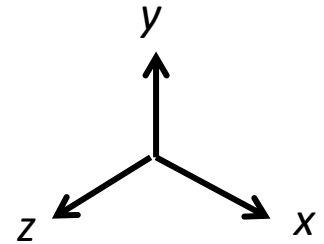
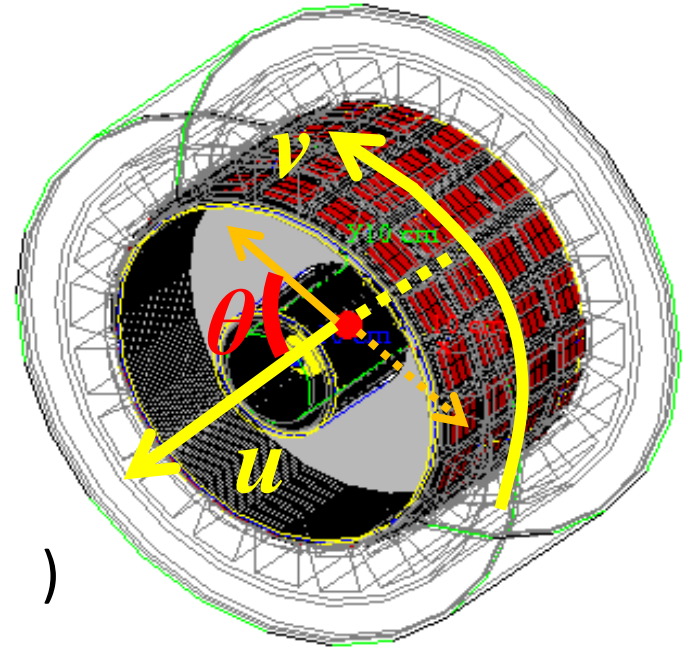
Detection efficiency for photon

- In order to improve the detection efficiency for photon, the study focus on the optimization of geometry, especially copper rings and cathode.
- Changed the aperture ratio of cathode and the shape of copper rings.



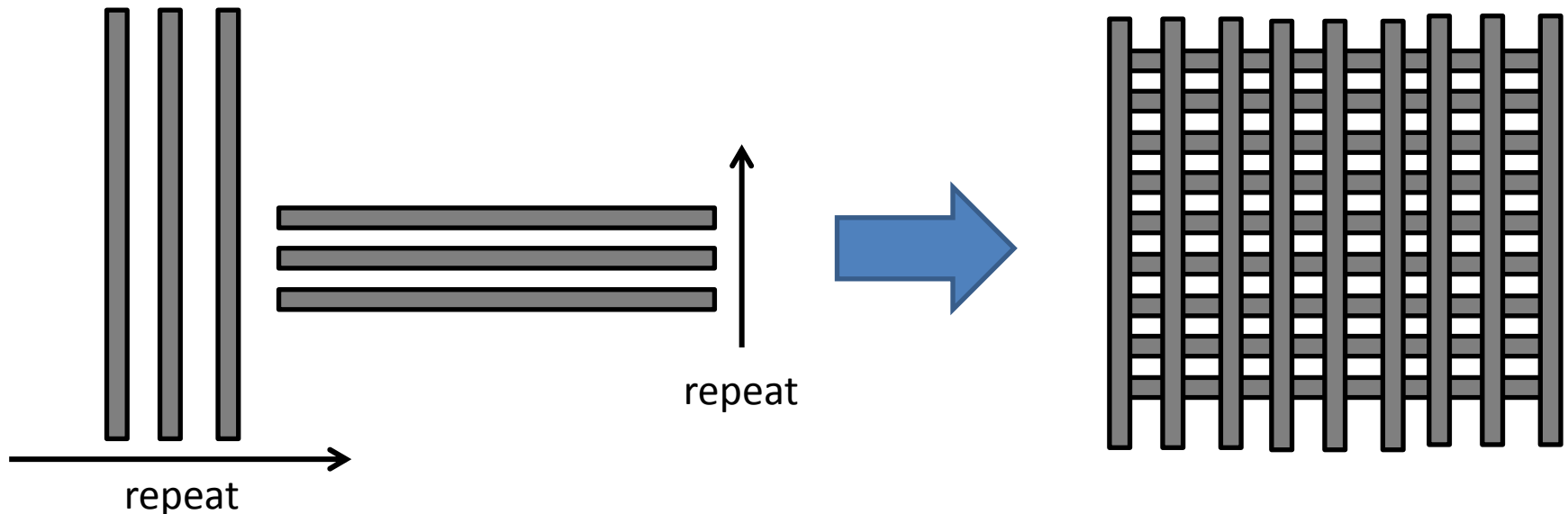
XEMIS2 geometry and source

- radial $7 < r < 19$ cm
- axial (z) Length = 2×12 cm
(divided by cathode)
- Electric Field in z direction 2 kV/cm
- Pad size : 3.175×3.175 mm²
- Source
 - Positron
 - Shape : sphere ($r = 1.0$ cm)
 - Direction : constant ($\theta = 60^\circ$, $\phi = 90^\circ$)
- Drift velocity : 2.3 mm/usec
- PMTs
 - 2inch : 4×20
(4.624×4.624 cm²)
(divide PhotoCathode by 2(v) and 4(u))



Mesh cathode

- In order to detect many more photons , aperture ratio of cathode should be optimized.
- Example
 - Aluminium wire : 1[mm] x 400[mm]
 - aperture ratio : 0.44
 - interval : 3[mm]



Mesh cathode

- GATE macro

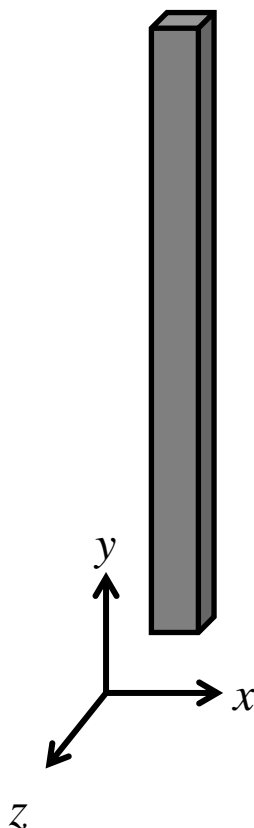
```
#####
# Mesh Cathode1      #
#####

/gate/xenon/daughters/name Cathode1
/gate/xenon/daughters/insert box
/gate/Cathode1/placement/setTranslation 0 0 0 cm
/gate/Cathode1/geometry/setXLength 1 mm
/gate/Cathode1/geometry/setYLength 400 mm
/gate/Cathode1/geometry/setZLength 0.5 mm
/gate/Cathode1/setMaterial Aluminium
/gate/Cathode1/vis/setColor gray
/gate/Cathode1/vis/setVisible 1

#####
# Mesh Cathode1 repeater  #
#####

/gate/Cathode1/repeaters/insert linear
/gate/Cathode1/linear/setRepeatNumber 140
/gate/Cathode1/linear/setRepeatVector 3 0 0 mm

#####
# Mesh Cathode2      #
```



```
/gate/Cathode1/linear/setRepeatVector 3 0 0 mm

#####
# Mesh Cathode2      #
#####

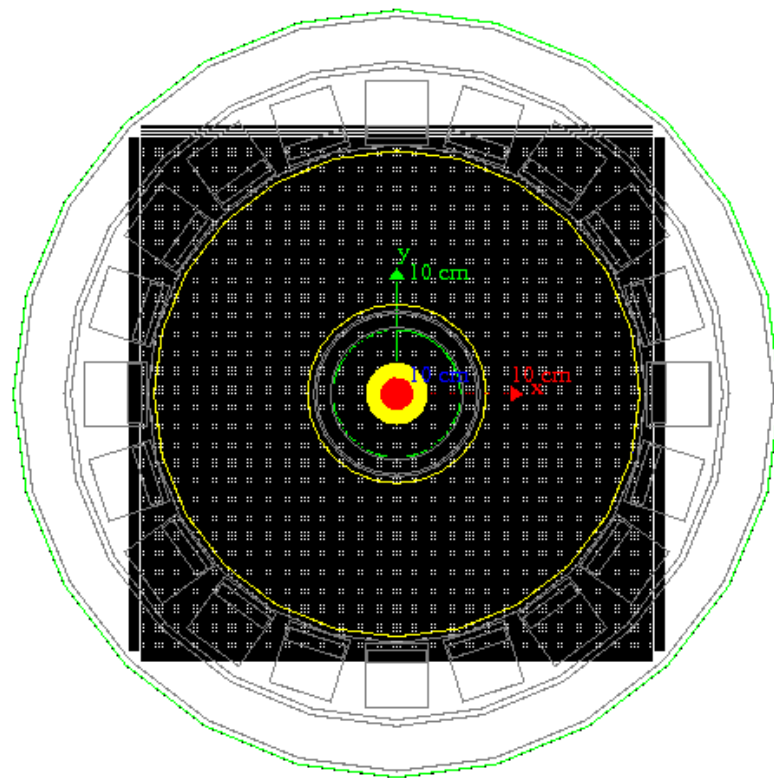
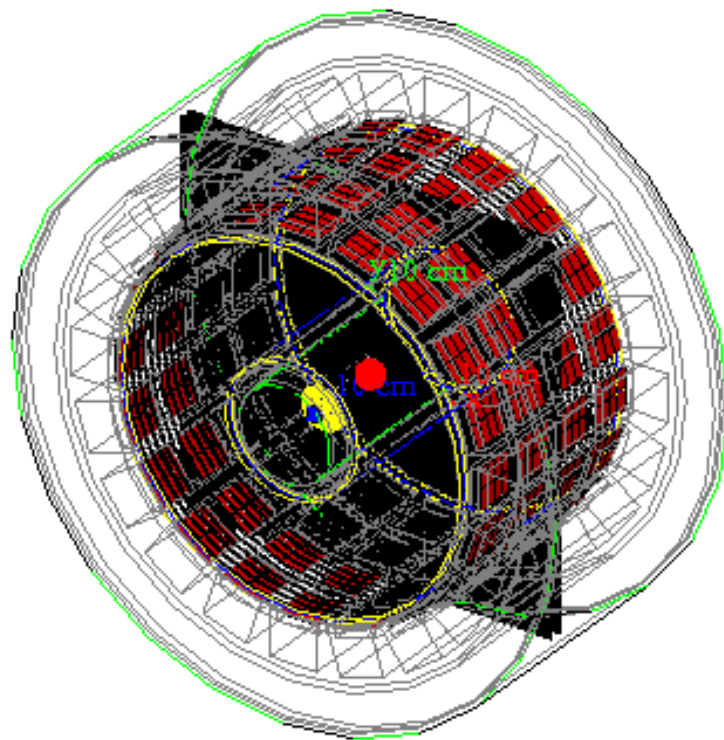
/gate/xenon/daughters/name Cathode2
/gate/xenon/daughters/insert box
/gate/Cathode2/placement/setTranslation 0 0 0 cm
/gate/Cathode2/geometry/setXLength 400 mm
/gate/Cathode2/geometry/setYLength 1 mm
/gate/Cathode2/geometry/setZLength 0.5 mm
/gate/Cathode2/setMaterial Aluminium
/gate/Cathode2/vis/setColor gray
/gate/Cathode2/vis/setVisible 1

#####
# Mesh Cathode2 repeater  #
#####

/gate/Cathode2/repeaters/insert linear
/gate/Cathode2/linear/setRepeatNumber 140
/gate/Cathode2/linear/setRepeatVector 0 3 0 mm
```

Mesh cathode

- GATE output



- It's not perfect, but it's enough for test of photon collection.

Next



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- Continue to improve the analysis program
 - Test the photon collection