GATE Simulation study

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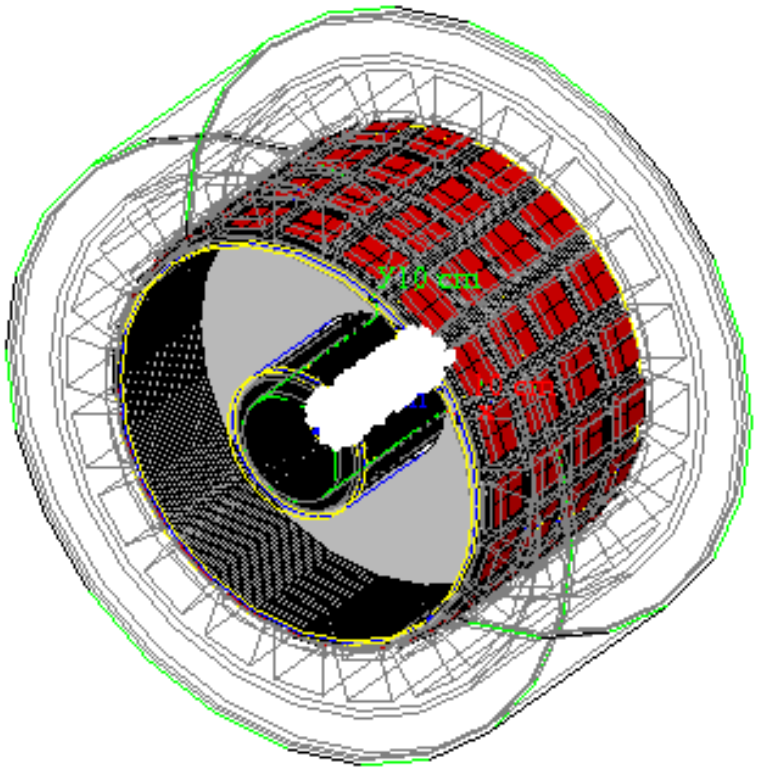
GATE simulation

Binary output

- Studied binary output of GATE output function for reducing file size
  - Output contents are same
  - File size is about 60%, comparing with ASCIIform.
    - Example (one of test run)
      - ASCIIform : 627 MB
      - Binary : 392 MB
      - ROOT : 138 MB

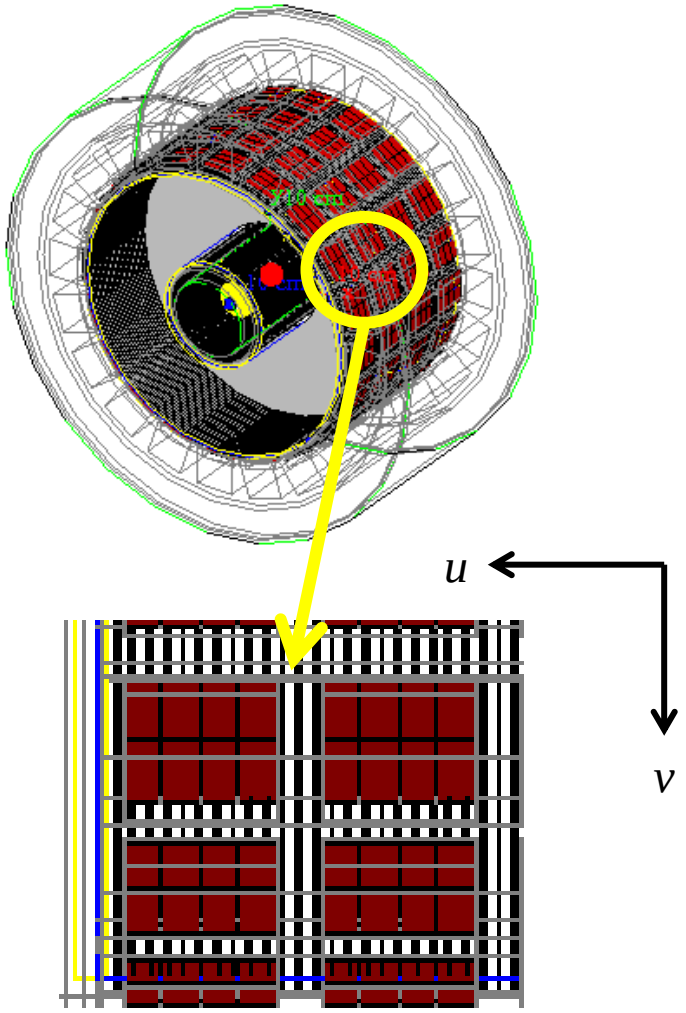
XEMIS2 Geometry

- 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 x 3.175 mm^2
- Source ^{44}Sc (β^+, γ : 1.157 MeV)
- Source position
  (cylinder : 0 < r < 2.5 cm -7.5 < z <7.5 cm)
- Drift velocity : 3 mm/usec
- PMTs
  - 2inch : 4 x 20
    (4.624 x 4.624 cm^2)
    (divide PhotoCathode by 4)



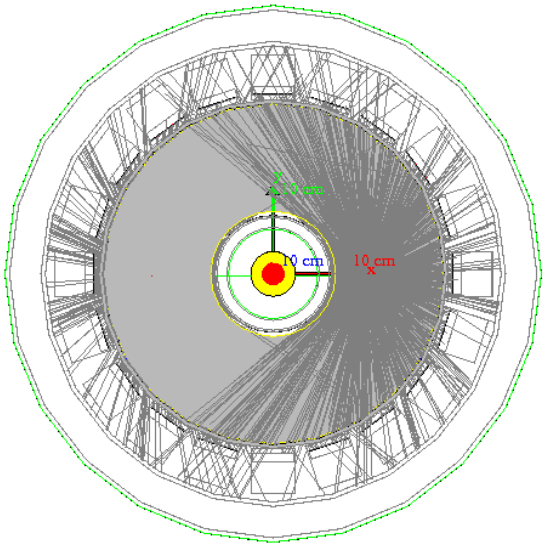
New geometry

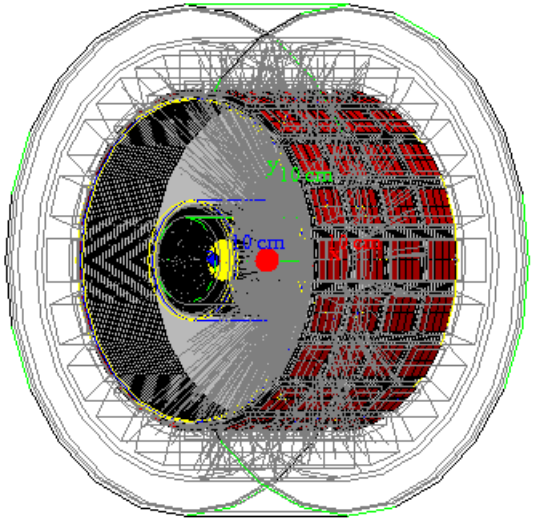
- Changed PhotoCathode for getting higher resolution
- Divided by 2 (v-direction) X 4 (u-direction)

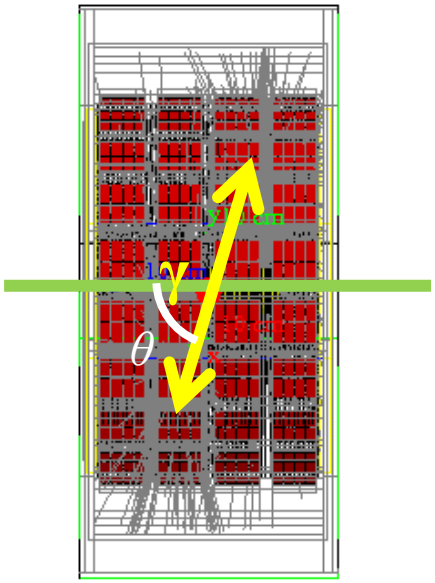


Change γ source option

- For the test of photon distribution
- Changed ^{44}Sc to only two γ (511 keV X 2)
- Direction is constant (φ : 0° , θ : 70°)



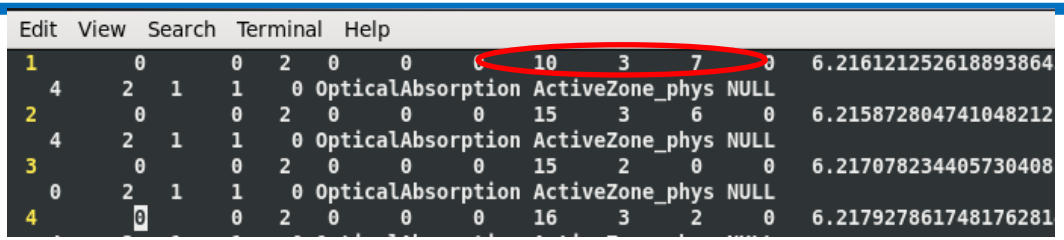




Viewer angle

Polar	: 0	
Azimuthial	: 0	
Polar	: 45	
Azimuthial	: 0	
Polar	: 90	
Azimuthial	: 90	

Getting u and v positions



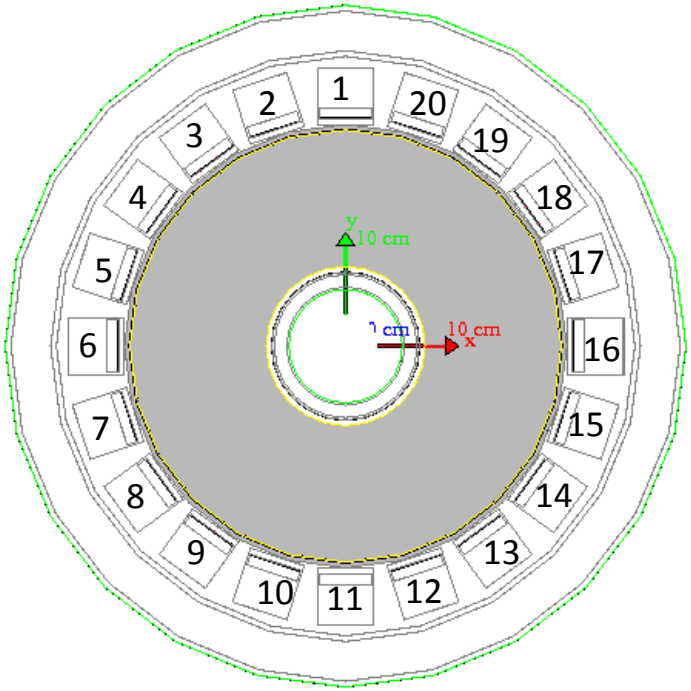
- Method
  - 1. get the entry of crystalID, submoduleID and module ID (next page) from ASCII form output
  - 2. generate the entry position from IDs

    (entry position corresponding to the IDs is prepared in advance)
  - 3. Get the number of entry in each position
  - 4. make arrays of posU(V)[i], posU(V)_count[i] and errors
  - 5. Graphed (TGraphErrors)

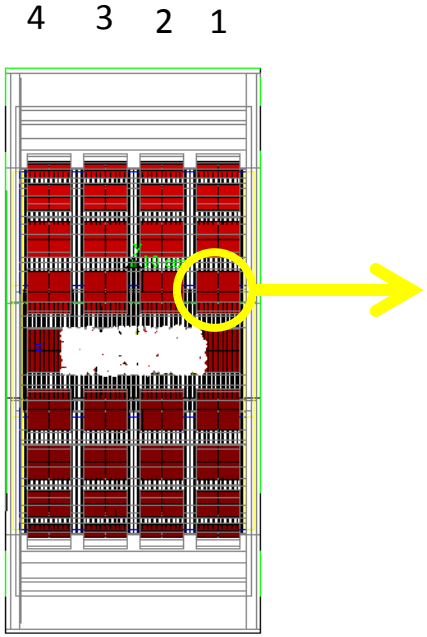
ID Position

- Three ID position

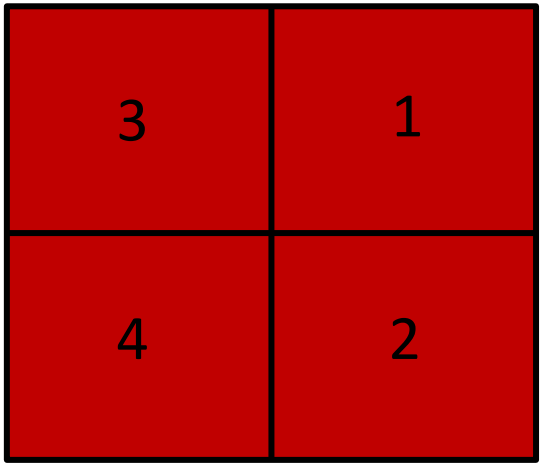
moduleID (PMTBox)



submoduleID (PMT)



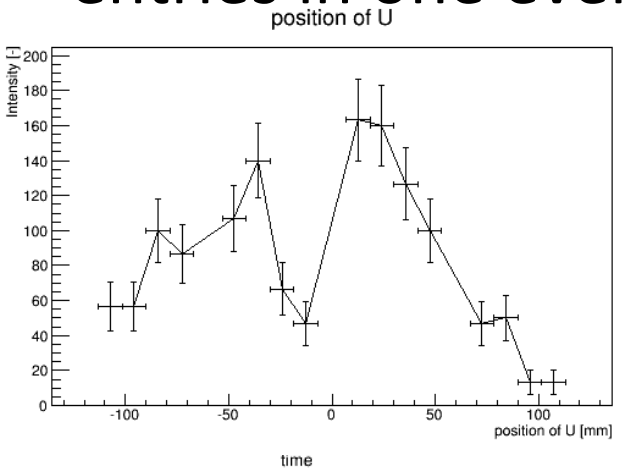
crystalID (PhotoCathode)

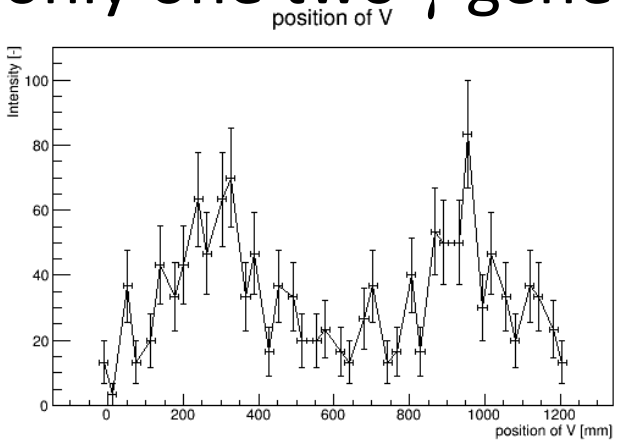


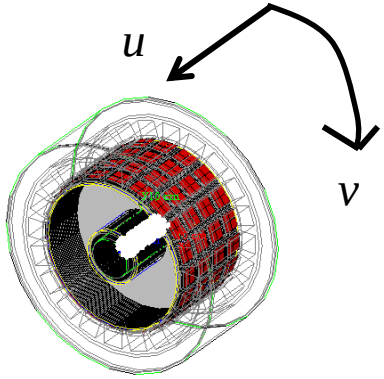
z ←

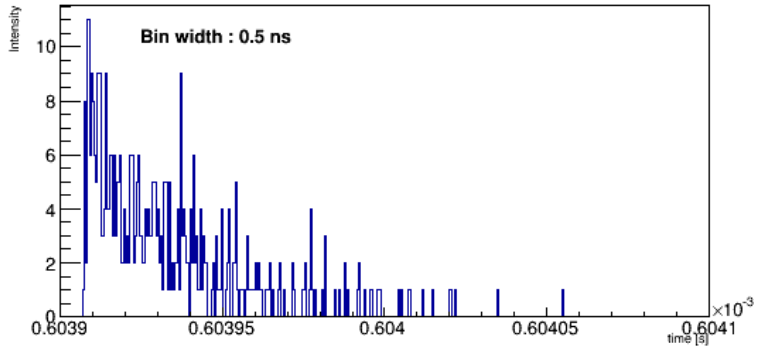
Getting u and v positions

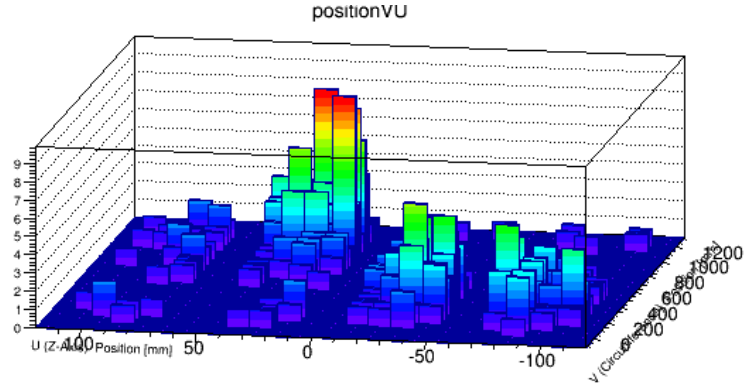
- Made time histogram for waveform
- Time histogram shows the timing of all photon entries in one event. (only one two γ generated)











Conclusion

- Changed PhotoCathode (2 X 2 ➔ 2 X 4) and γ source (^{44}Sc ➔ only two γ)
- Got the u and v position and made time histogram
  - Multi hit event was generated (compton scattering) ? -> confirm after
  - It is difficult to separate compton event from time histogram because it needs very high time resolution (~ 1 ns)

Next

- Study the algorithm for clustering
- Test the algorithm to the data which is introduced in previous slide