Edge Hill Problem

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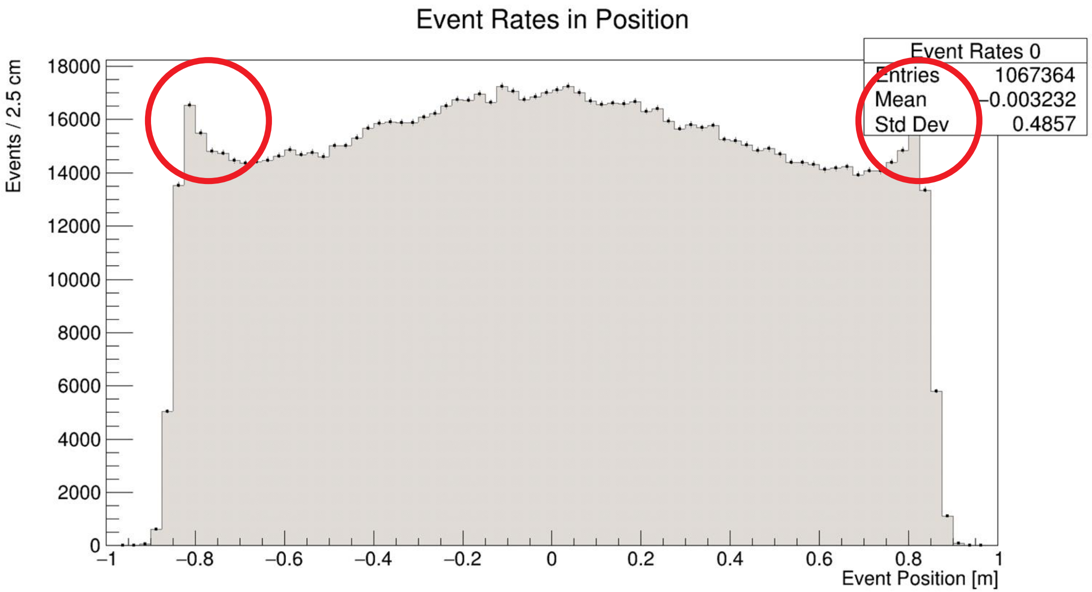
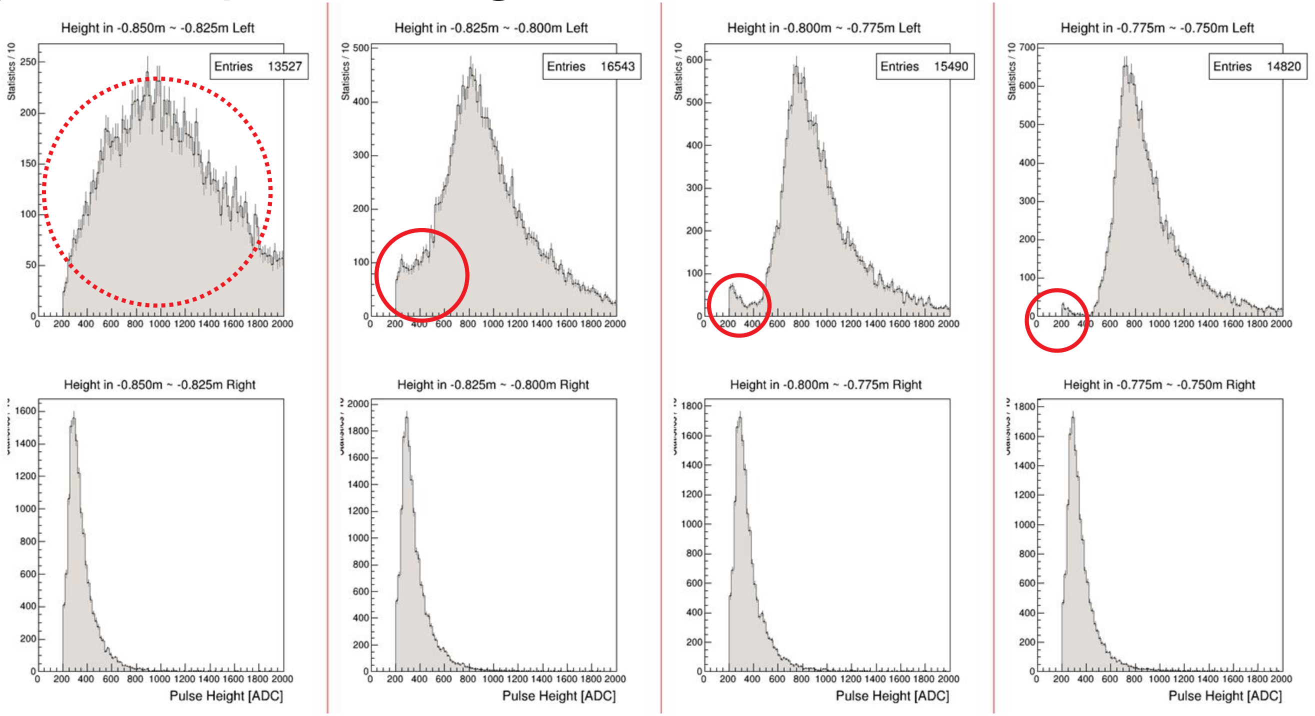
Motivation

- Running one plastic scintillator, lying down with threshold 200 ADCs, shows unnatural event rates at its edge.



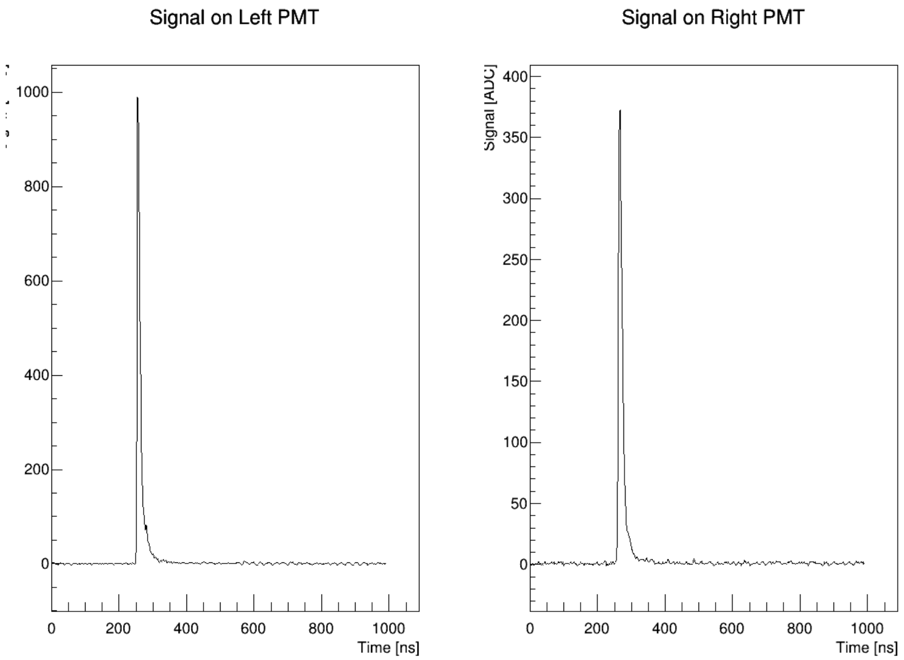
Motivation (cont’d)

- There is ‘something’ in the pulse height distribution near the PMT.



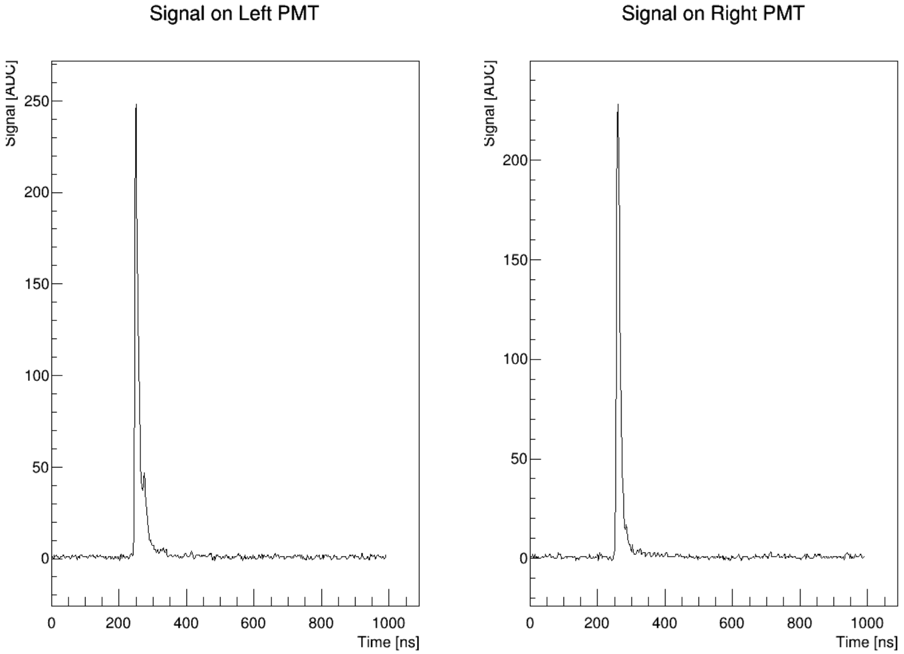
New Feature

- It is natural that the PMT near event point having larger signal than the signal on further PMT.
  - Due to attenuation
  - This example event is
  - Position: -77 cm (center is 0 cm.)
  - Left Height: **960** ADC
  - Right Height: 372 ADC



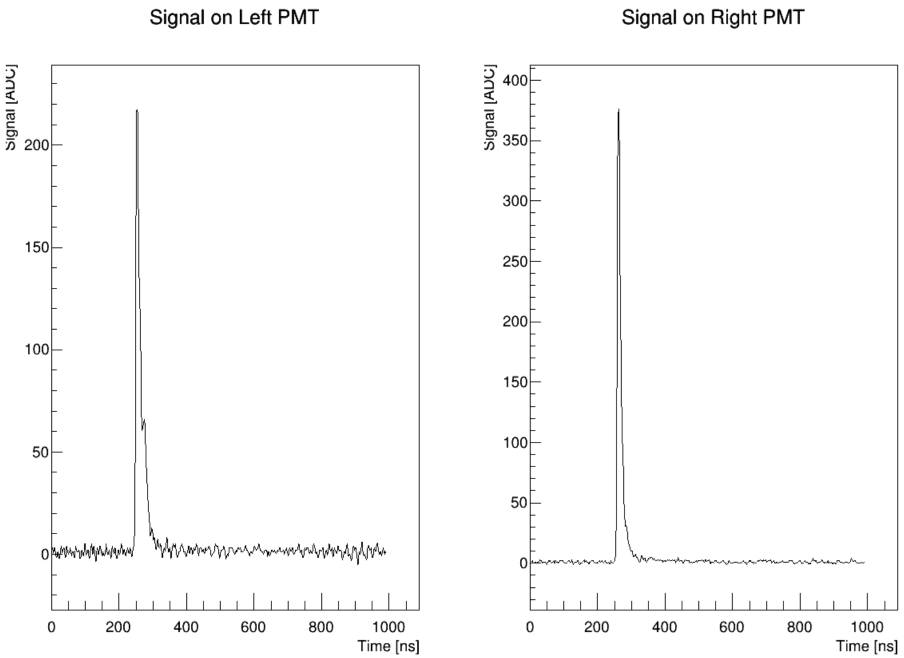
New Feature (cont'd)

- However, there were many 'unnatural' events.
  - This example event is
  - Position: -76 cm
  - Left Height: 246 ADC
  - Right Height: 226 ADC



New Feature (cont'd)

- However, there were many 'unnatural' events.
  - This example event is
  - Position: -75 cm
  - Left Height: 216 ADC
  - Right Height: **374** ADC
  - Further PMT gets stronger signal!

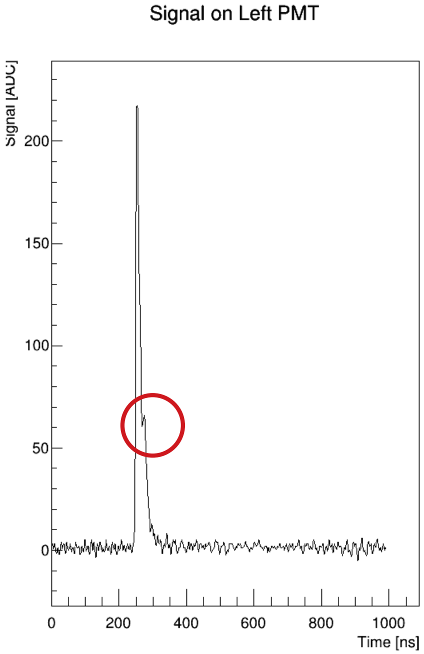


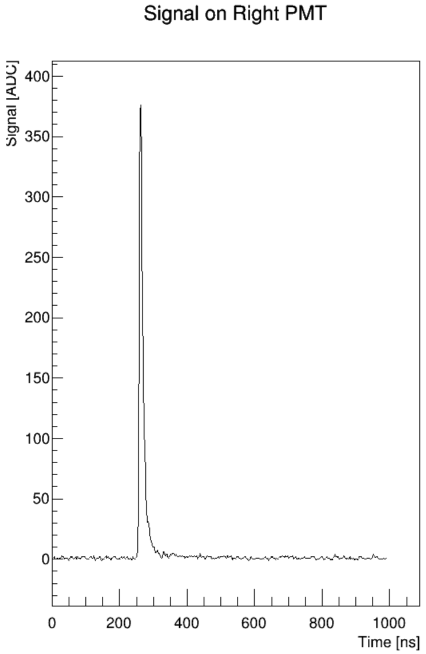
Properties of New Feature

- This phenomenon happens
  - Near a PMT. (rich in 5 cm, existent until 10 cm from PMT)
  - With relatively high secondary peak (reflection signal).

Properties of New Feature (cont'd)

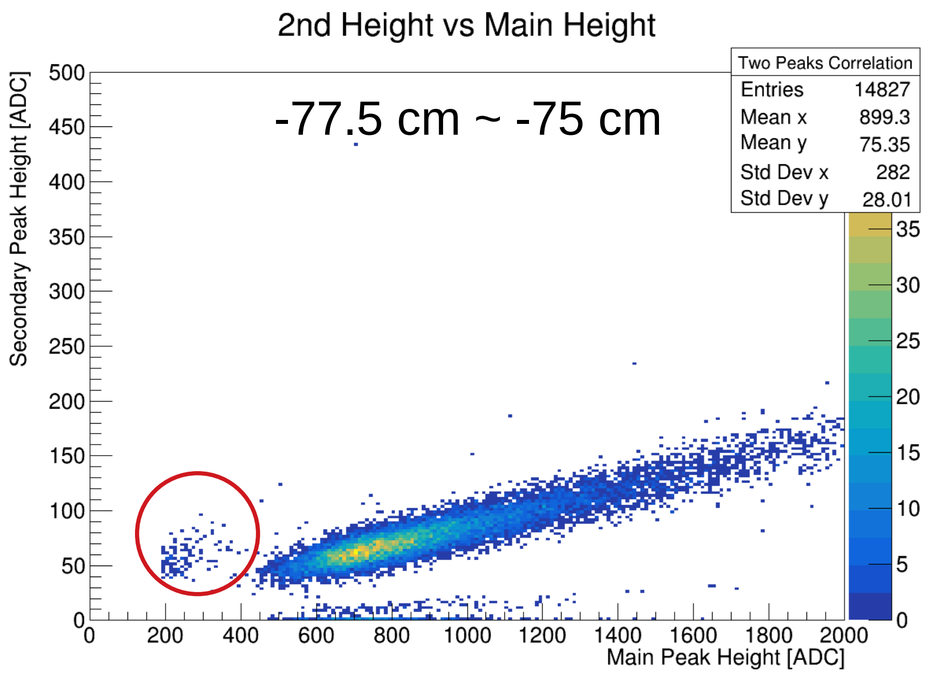
- Secondary peak (reflection signal) is relatively high.

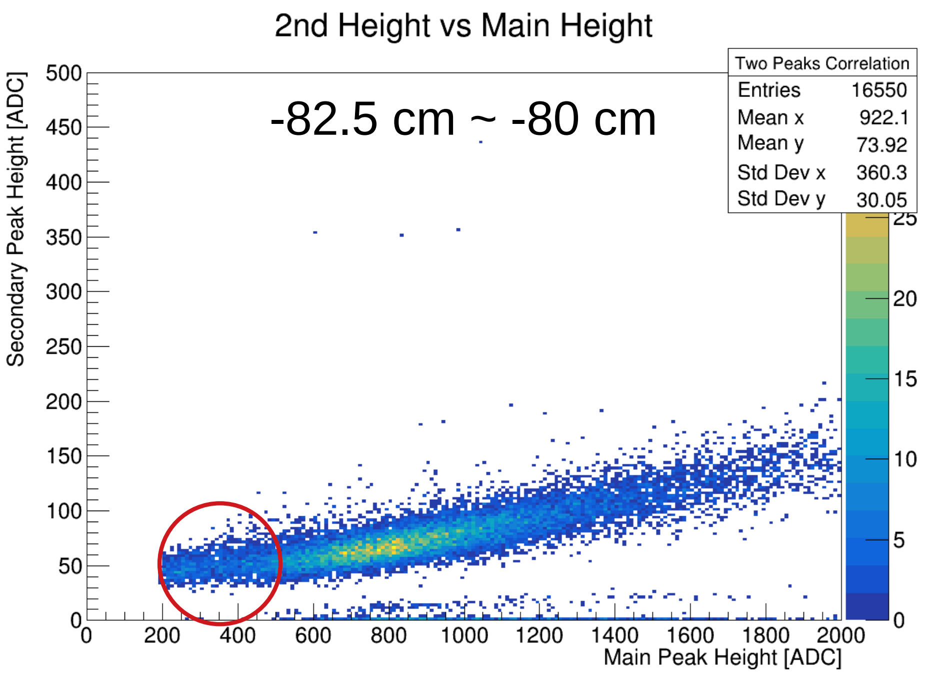




Properties of New Feature (cont'd)

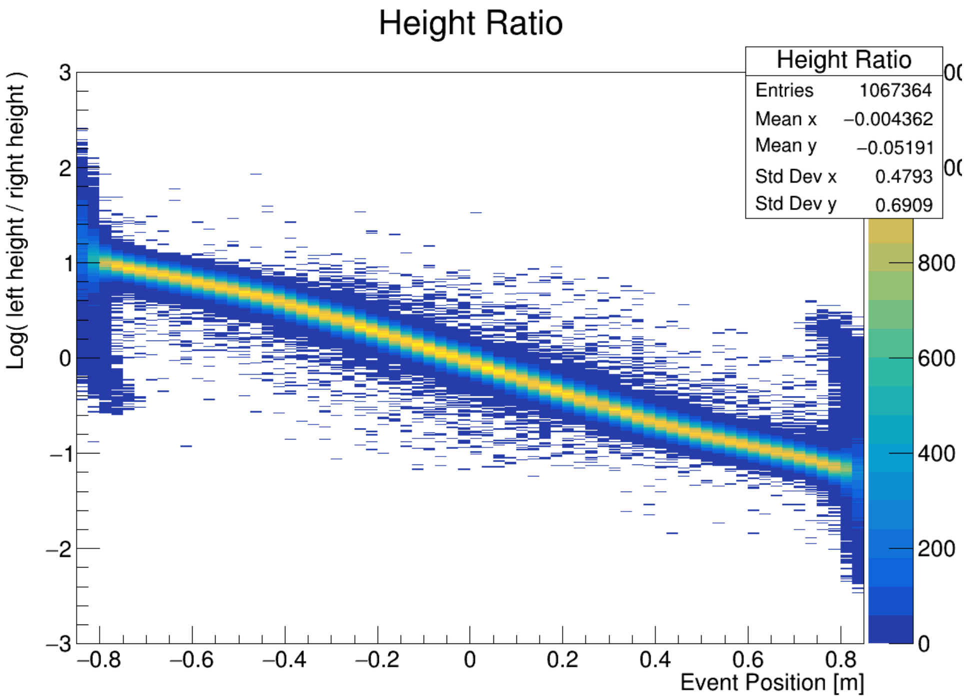
- Secondary peak (reflection signal) is relatively high.





Properties of New Feature (cont’d)

- Attenuation behavior is good except near edge.



Properties of New Feature (cont'd)

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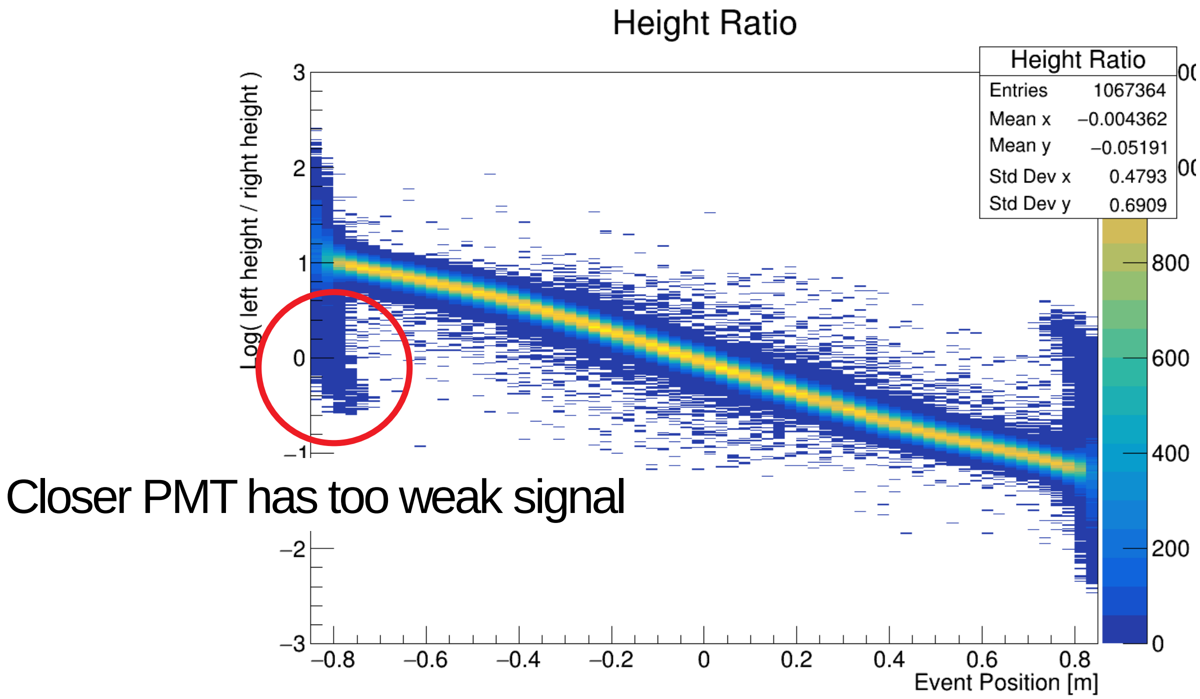
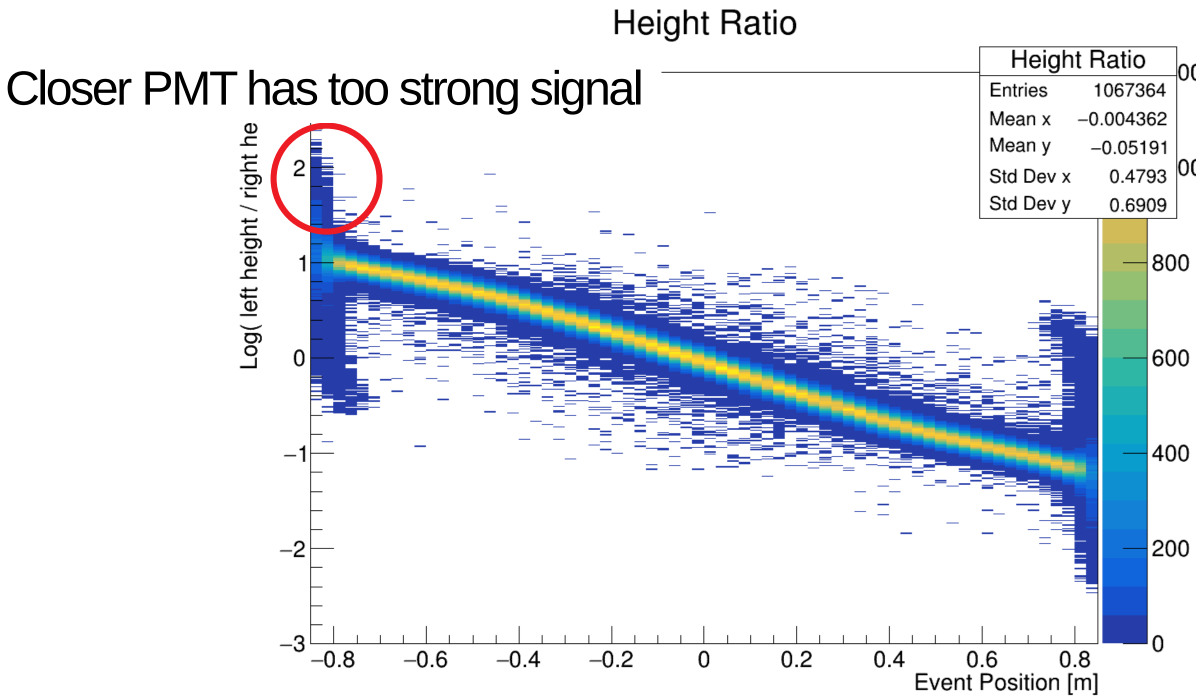


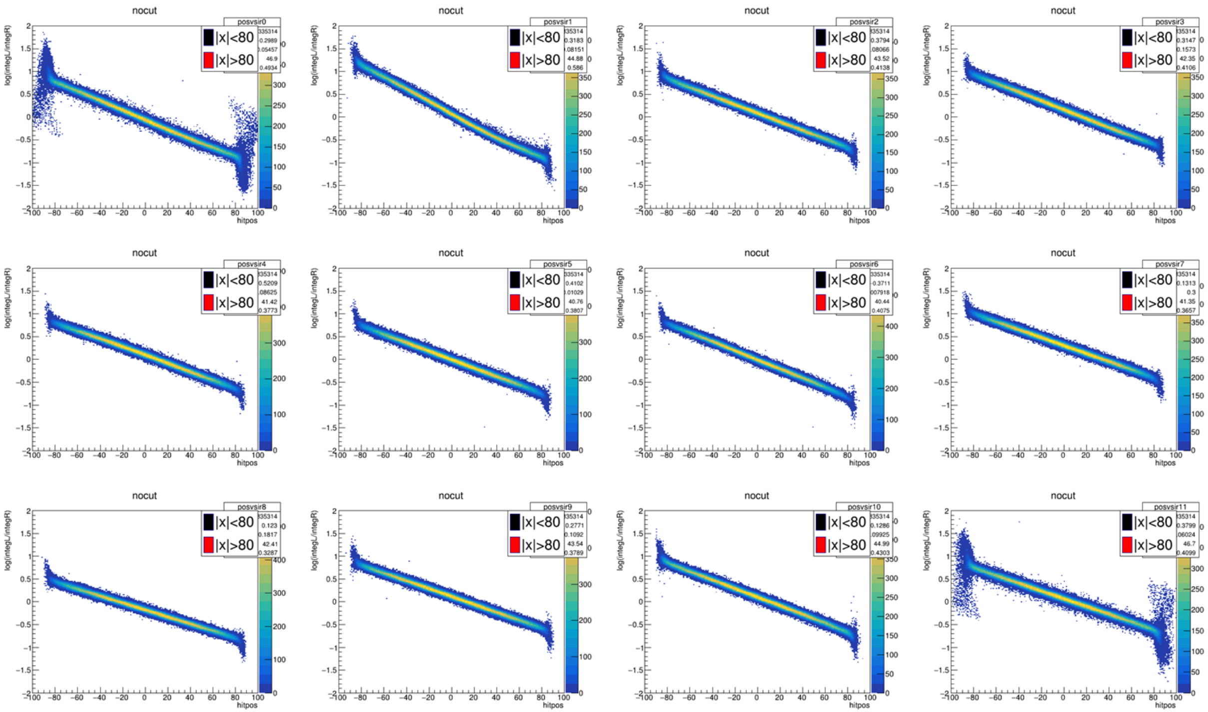
Properties of New Feature (cont'd)

- Attenuation behavior is good except near edge.



New Feature in CERN 12 Bars

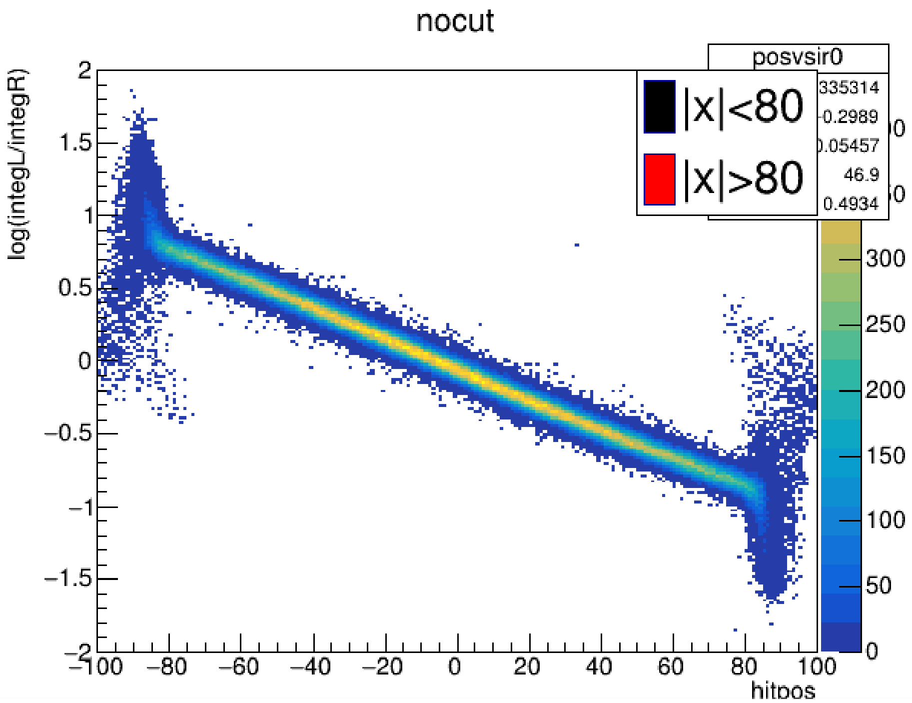
- Considering only 12 bars hits event
- Track fitted.
- Cut off chi/NDF > 1.5
- Position has determined properly..
- Also exist.



New Feature in CERN 12 Bars

- Also exist.
- Bars except 1st and last bars
  have less edge hit events.

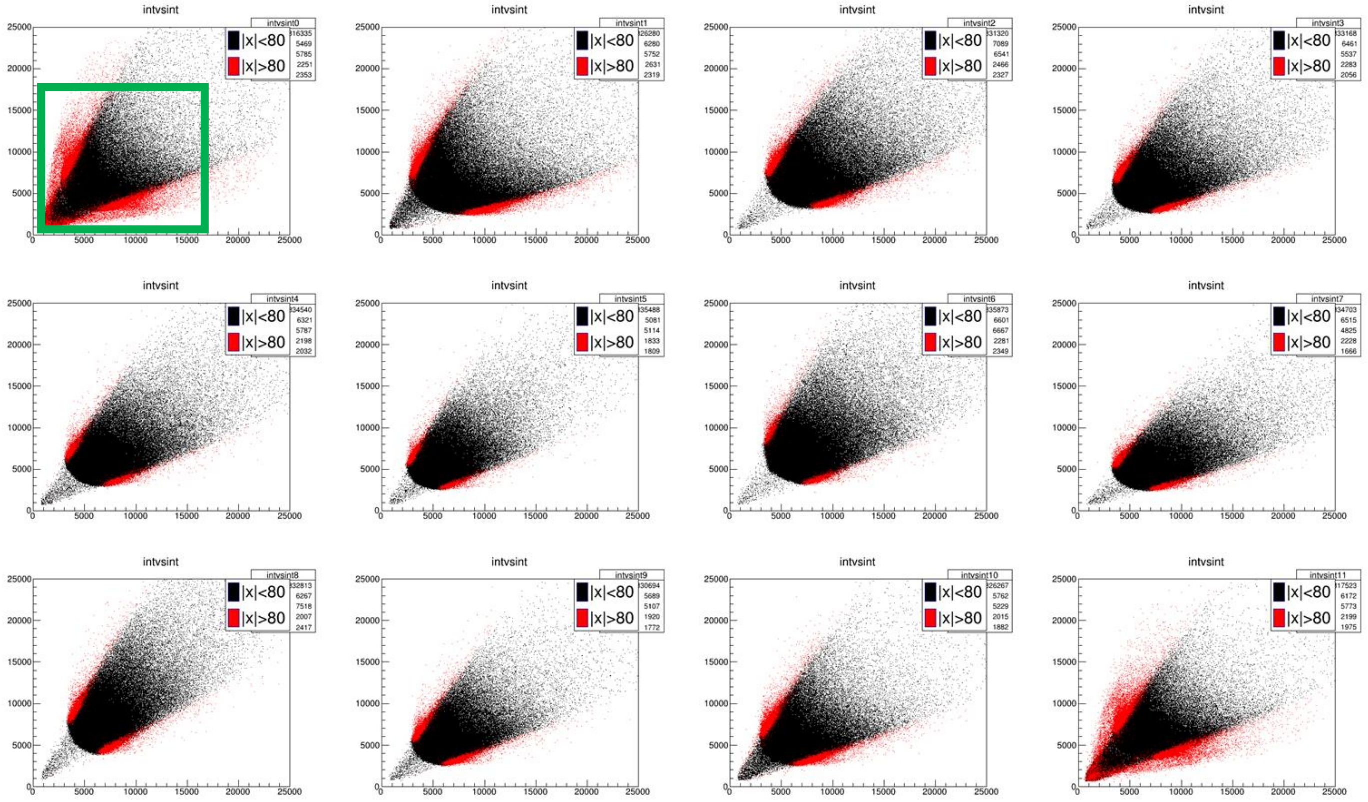
So, such behavior rates are small.



  - 1st bar.

New Feature in CERN 12 Bars

- To see energy dep.
- Left integ. vs right integ.

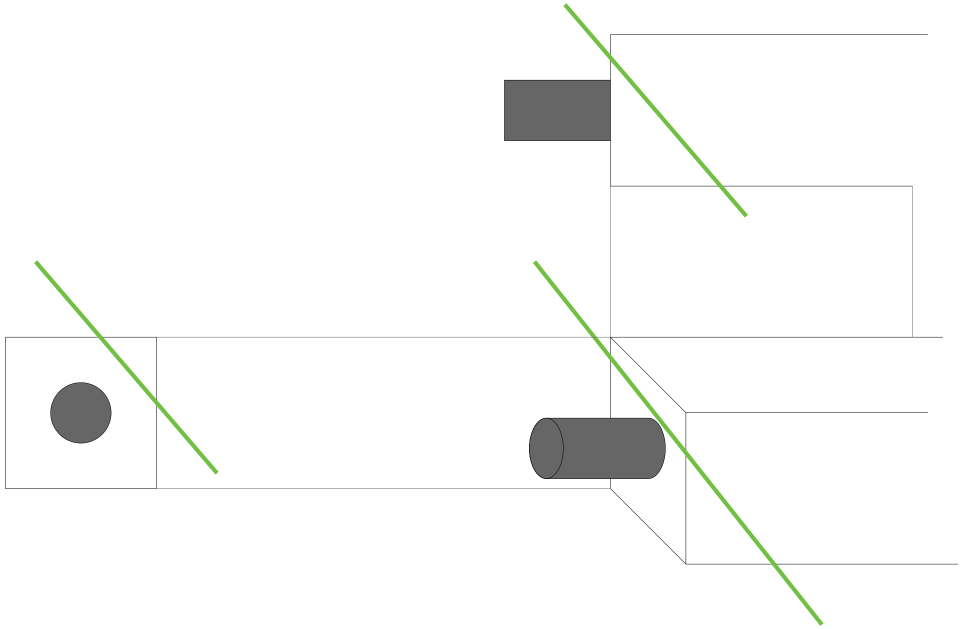


Scenario

- This new phenomenon can not be explained by new source.
  - ex. new particle, fluorescence, Cherenkov radiation, etc.
- There may be some geometrical complexity in the vicinity of PMT.

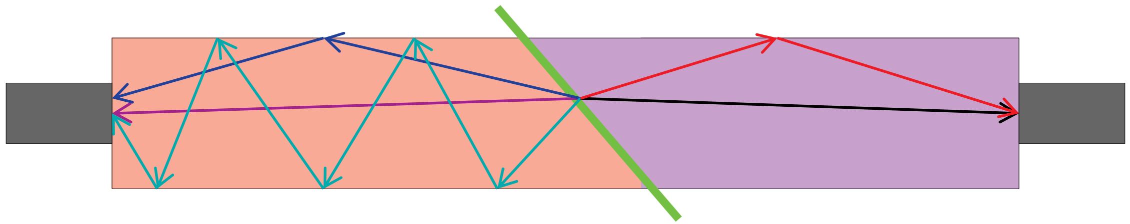
Geometrical Effect

- The most possible scenario is muon passing the side part of scintillator.



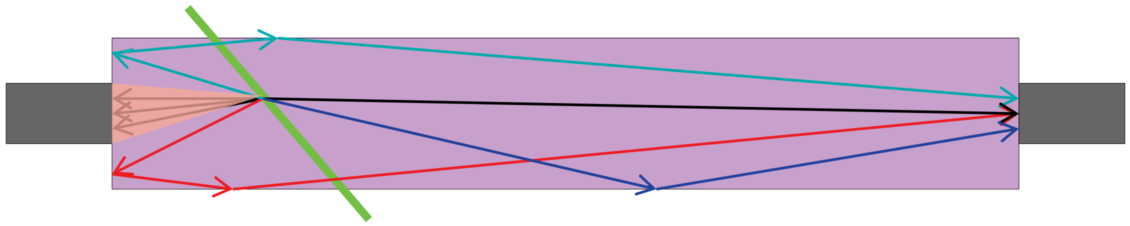
Geometrical Effect (cont'd)

- Normal events has about 2π solid angle to each PMTs.



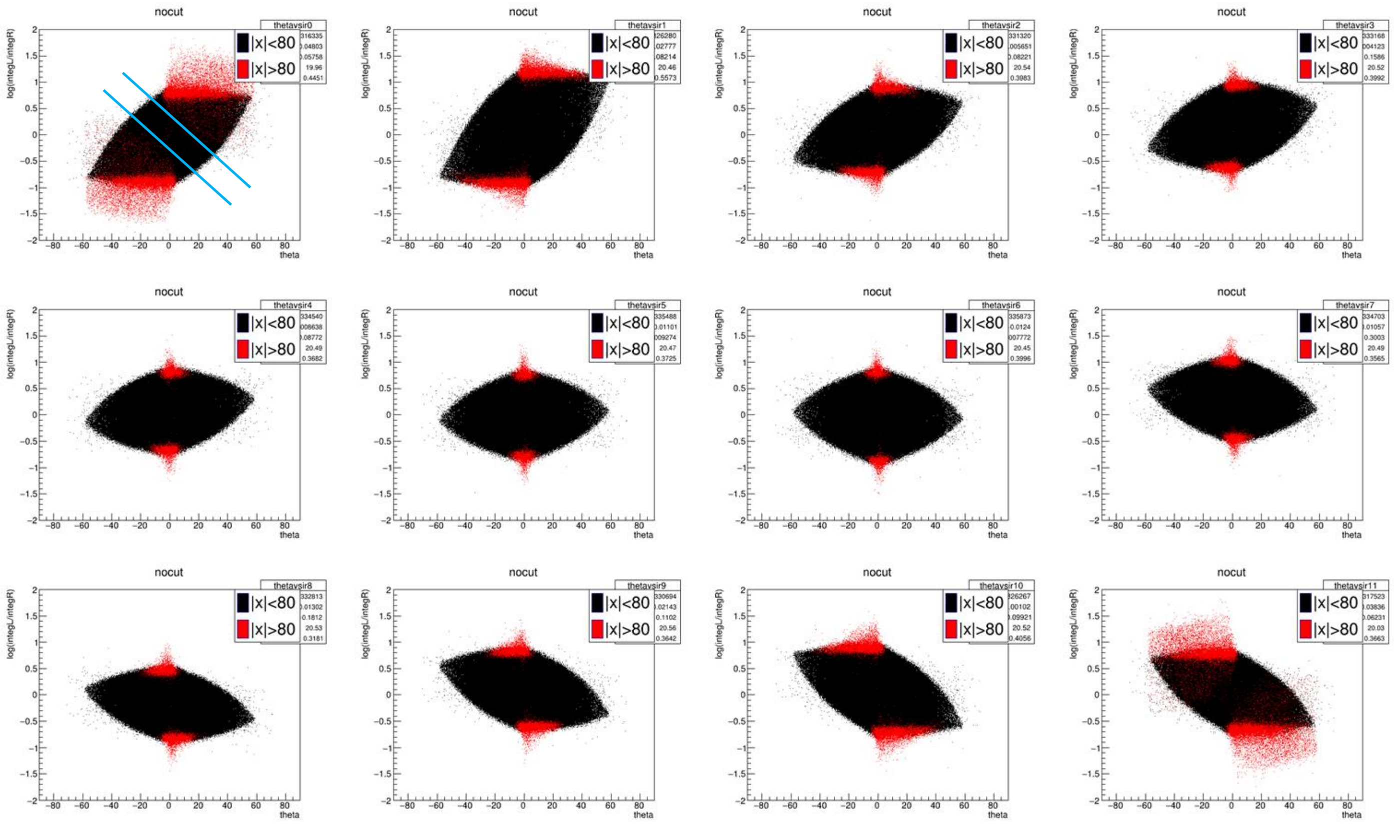
Geometrical Effect (cont’d)

- Sided events can have asymmetric solid angle to each PMTs.
- Perhaps this kind of events is the reason of hill at the edge.



Geom. In CERN

- To see angle dep.
- Angle vs log(intL/intR)

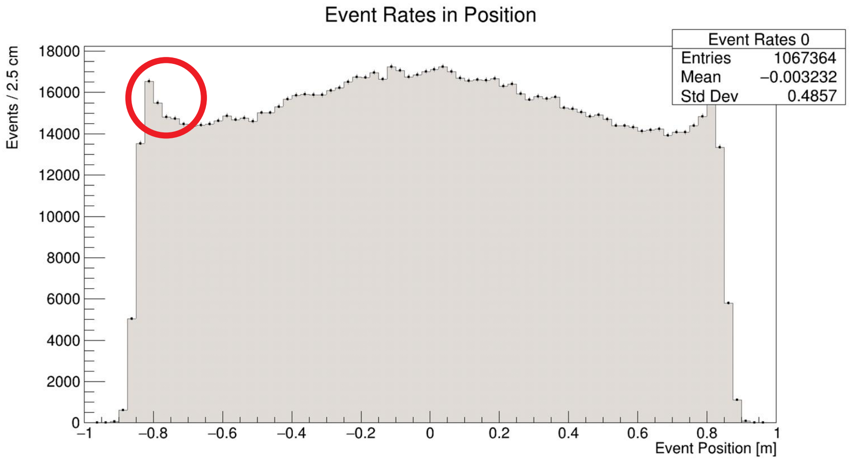


GEANT4 Simulation

- GEANT4 simulation considering geometrical effect shows a little aspect of ‘new feature’.
  - Not that satisfying yet.

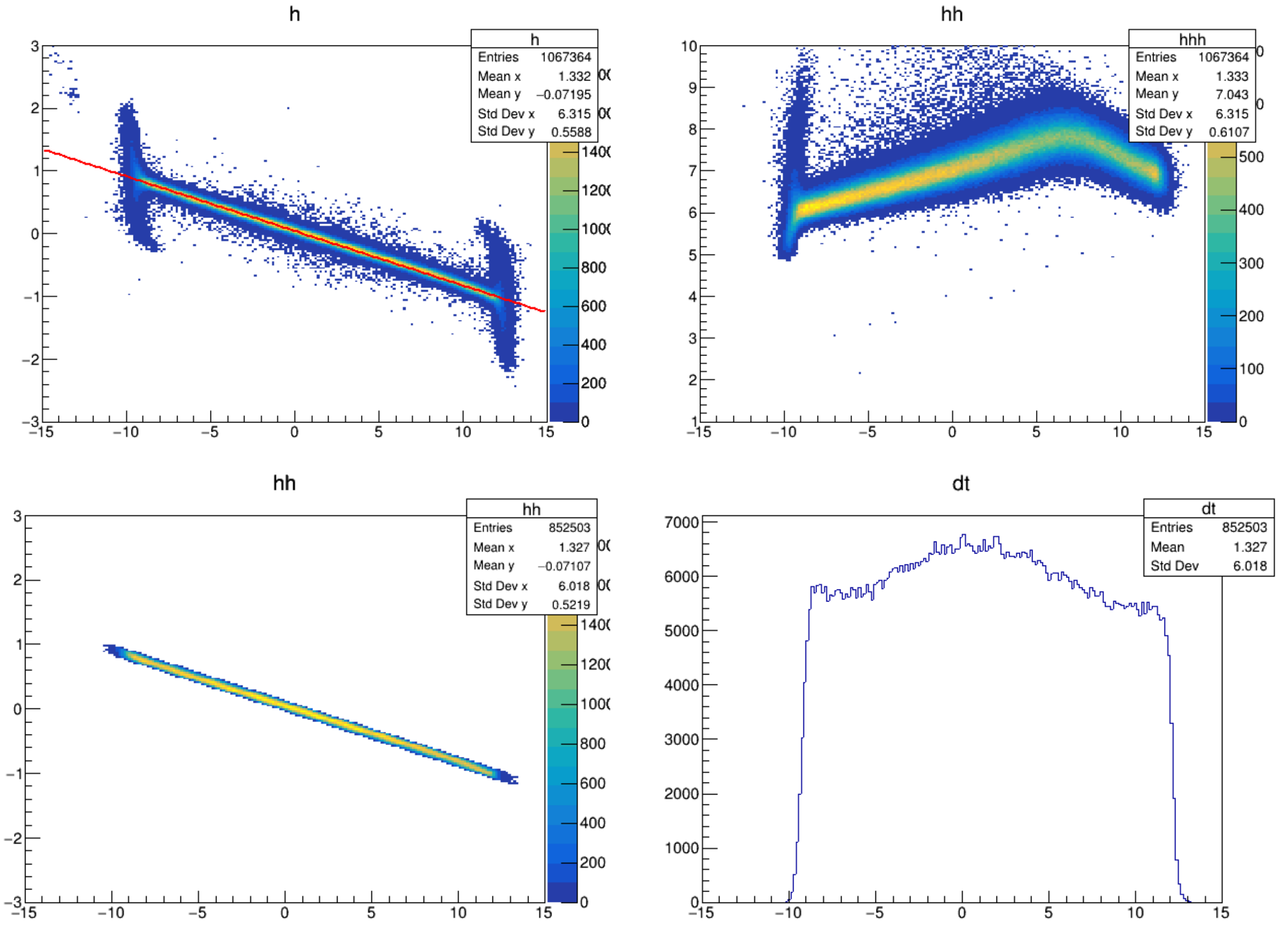
Event Rate

- About 5,000 events are in the hill.
  - ~ 0.5% of total events
- The order is consistent with Byeongyoon's calculation.
  - c.f. Byeongyoon's presentation
  - Would it be just a coincidence?
  - Not sure yet.



Event Rate

- Just cut off along a line
- Cut is applied to integ, but trigger is determined by heights.
- Edge hill has reduced to reasonable level.



How to Confirm?

- Detecting muon coming to one side.
  - More properties will be obtained from this experiment.
- Seungmok is studying GEANT4.

What Should We Do?

- Whatever the origin of edge hill is, it is clear that the signal near a PMT shows bad behavior.
- We should cut the events in the vicinity of PMT.

Cut How Much?

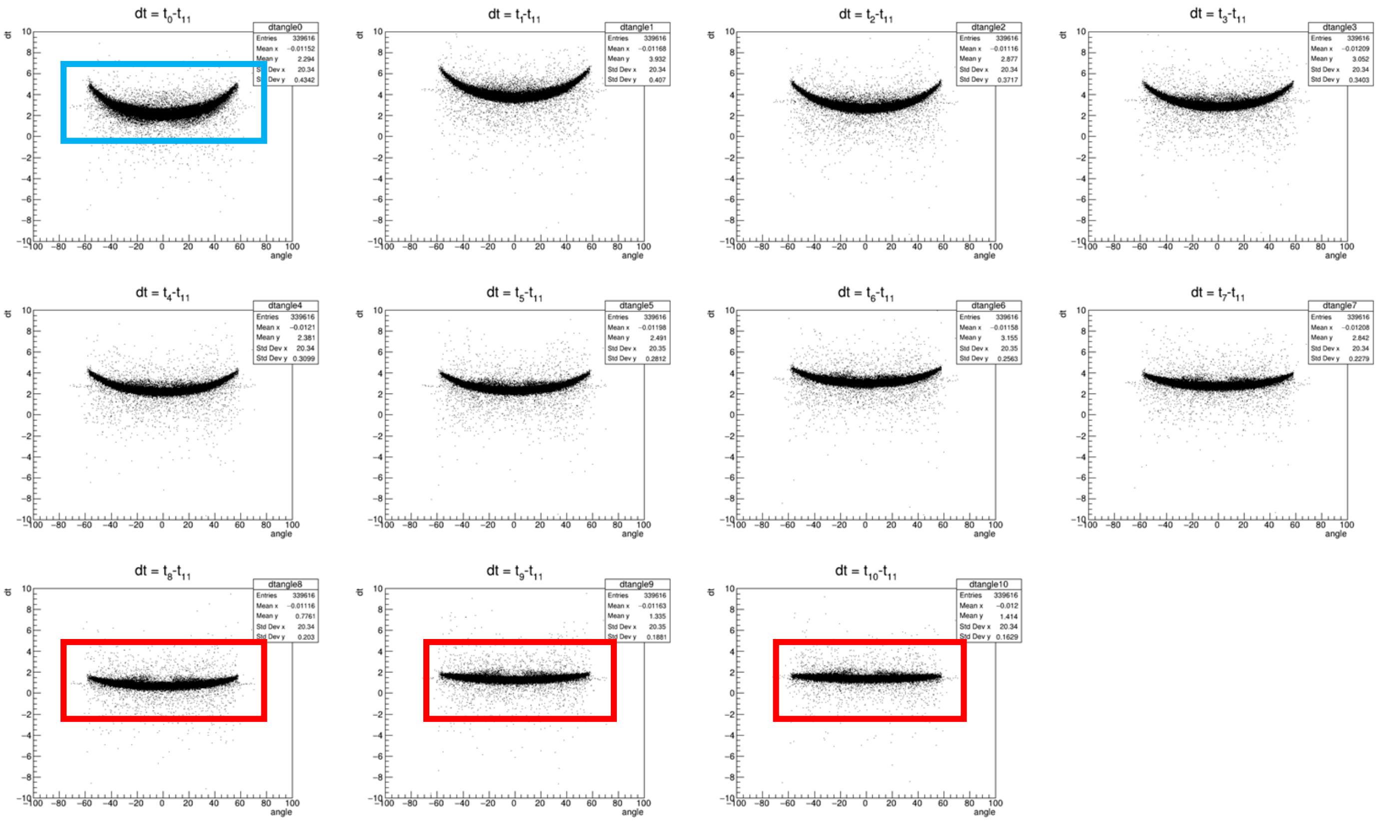
- 5 cm cut does improve the result.
  - 10 cm cut is also considerable.
- It may be able to optimize.
- But its optimization variables are ambiguous.

Cut How Much? (cont’d)

- No cut
- Angle vs

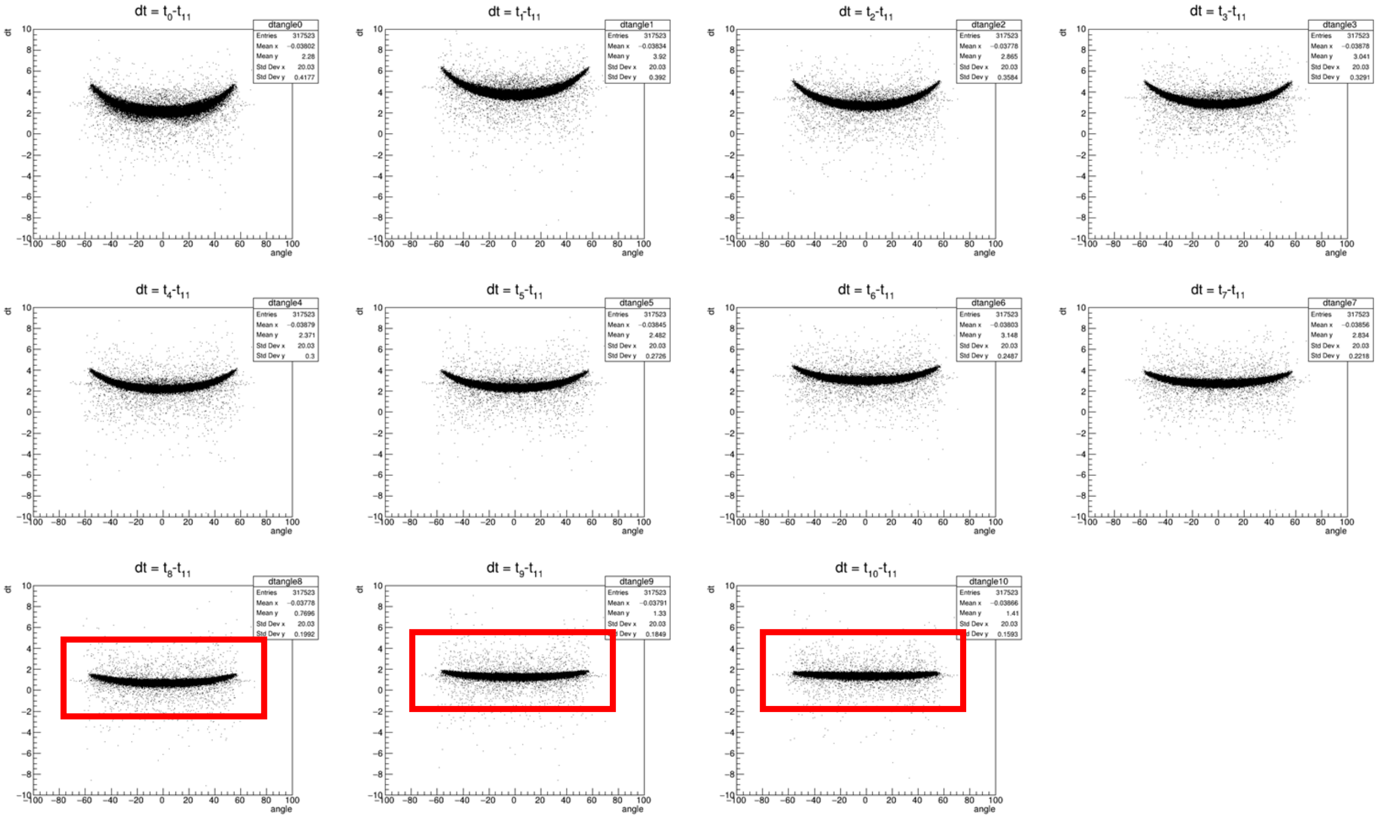
  t_i – t_11

  (i = 0,1,2,~)



Cut How Much? (cont'd)

- Cut on 11th bar
- Cut 5 cm



Cut How Much? (cont'd)

- Cut on others
- In the real exp, every bar has behavior similar to 1st and last bars.