



Modular Rich Detector Simulation Cherenkov Ring Radius obtained from Circular Hough Transform

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Outline

Obtain Cherenkov Ring Radius from simulation results using Circular Hough Transform.

1. Monte Carlo result

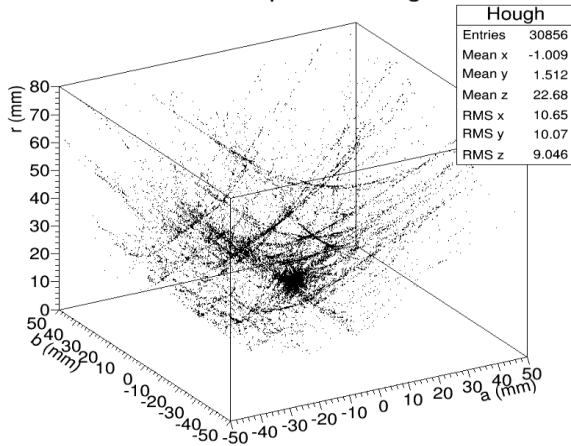
- Infinite pixel size
- Finite pixel size ($6 \times 6 \text{mm}^2$)

2. Simulation result



Ring Finder Algorithm Update

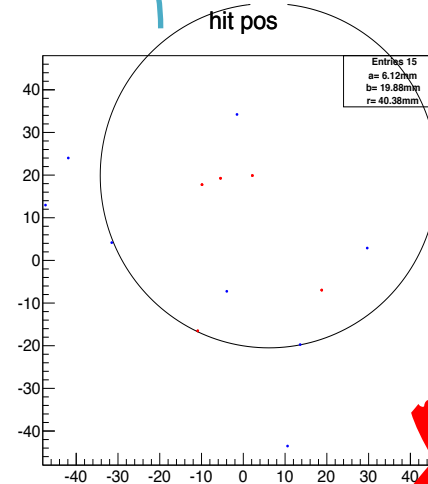
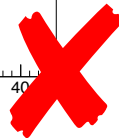
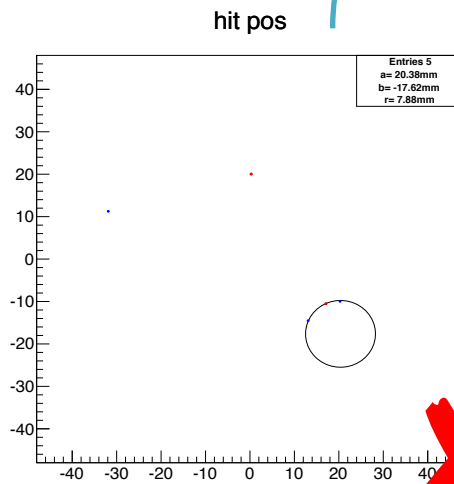
Info of all possible rings



When filling 3D (a,b,r) histogram

- Center position(a,b) cut:
 - If ($|a| > 3\text{mm}$ or $|b| > 3\text{mm}$) skip;

Not considered





Monte Carlo



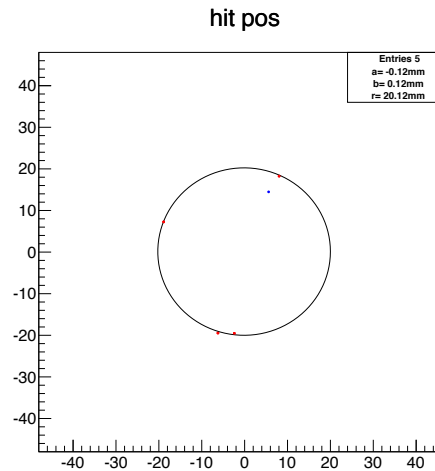
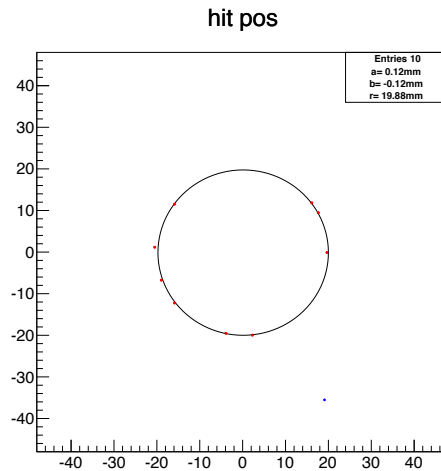
Monte Carlo

- 10,000 events
- Infinite pixel size / finite pixel size ($6 \times 6 \text{mm}^2$)
- In each events
 - Number of hits
 - Total number of Hit= $N_{\text{signal}} + N_{\text{noise}} < 15$
 - Ring radius
 - Radius = Gaussian distribution function
 - Mean of radius=20mm
 - Sigma of radius=0.1mm

Event by Event Display (**infinite** pixel)

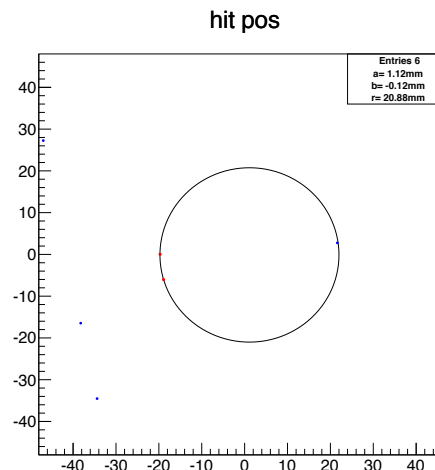
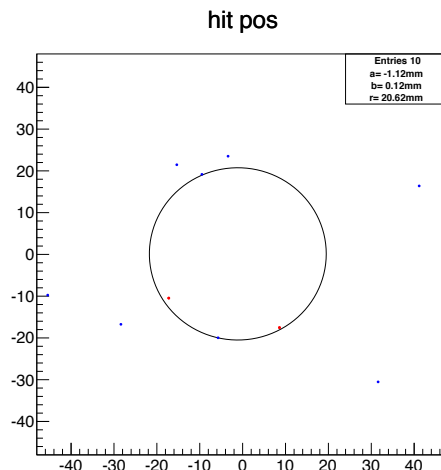


low noise



- **Signal**
- **noise**

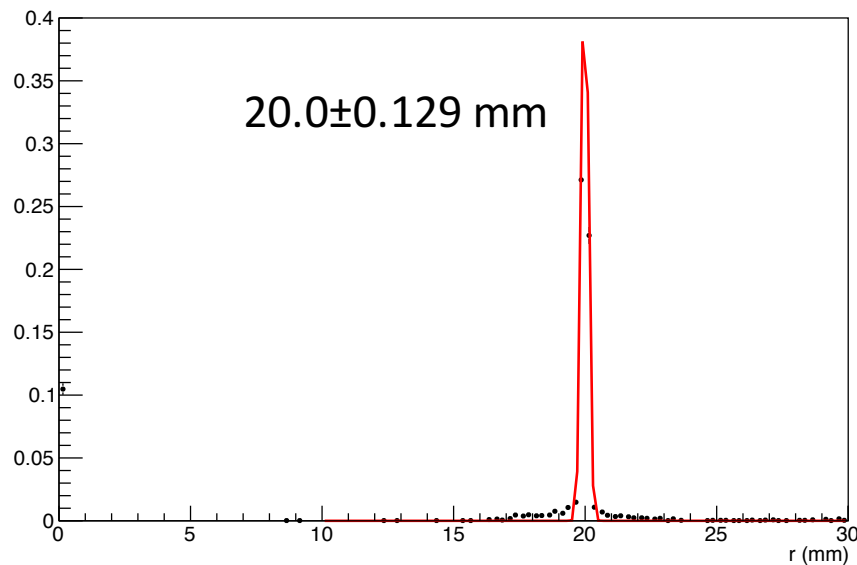
strong noise



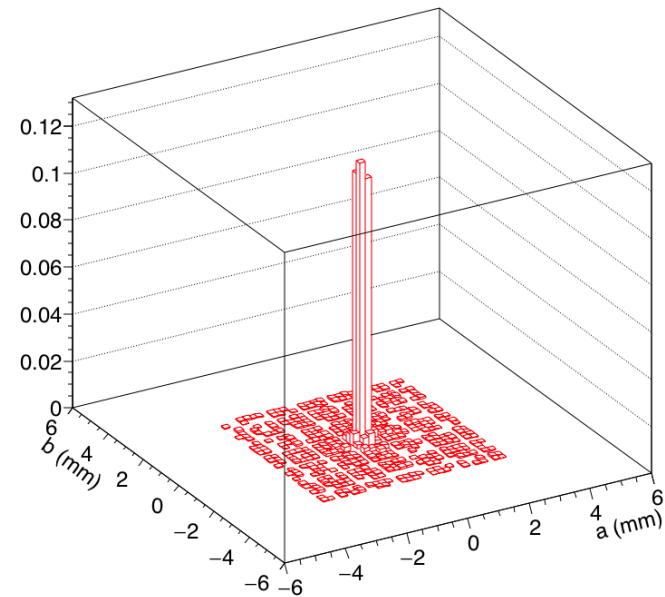


Radius (in each event) Distribution (**infinite** pixel)

Normalized Radius (each event) Distribution



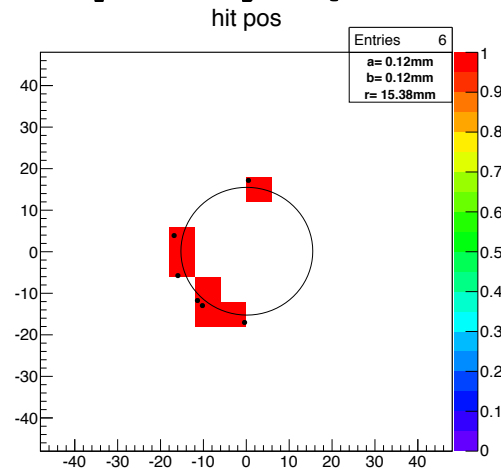
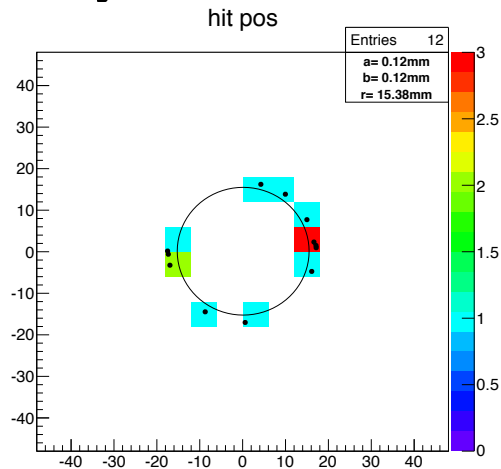
Normalized Center (a,b) Distribution





Event by Event Display (**finite** pixel)

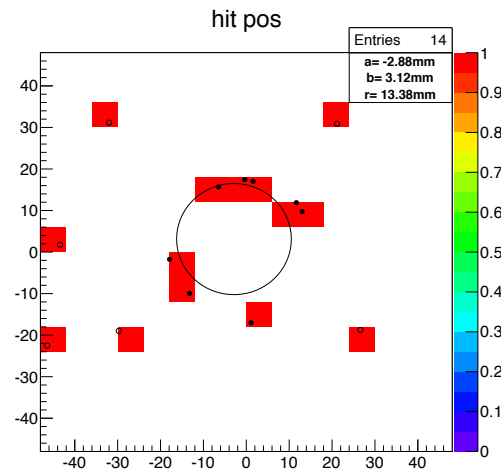
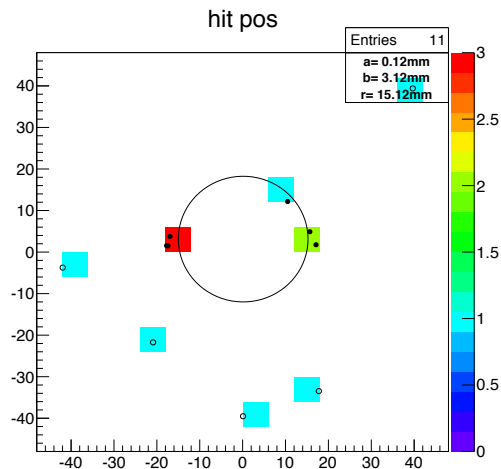
low noise



Fitted rings are generally smaller than the actual rings

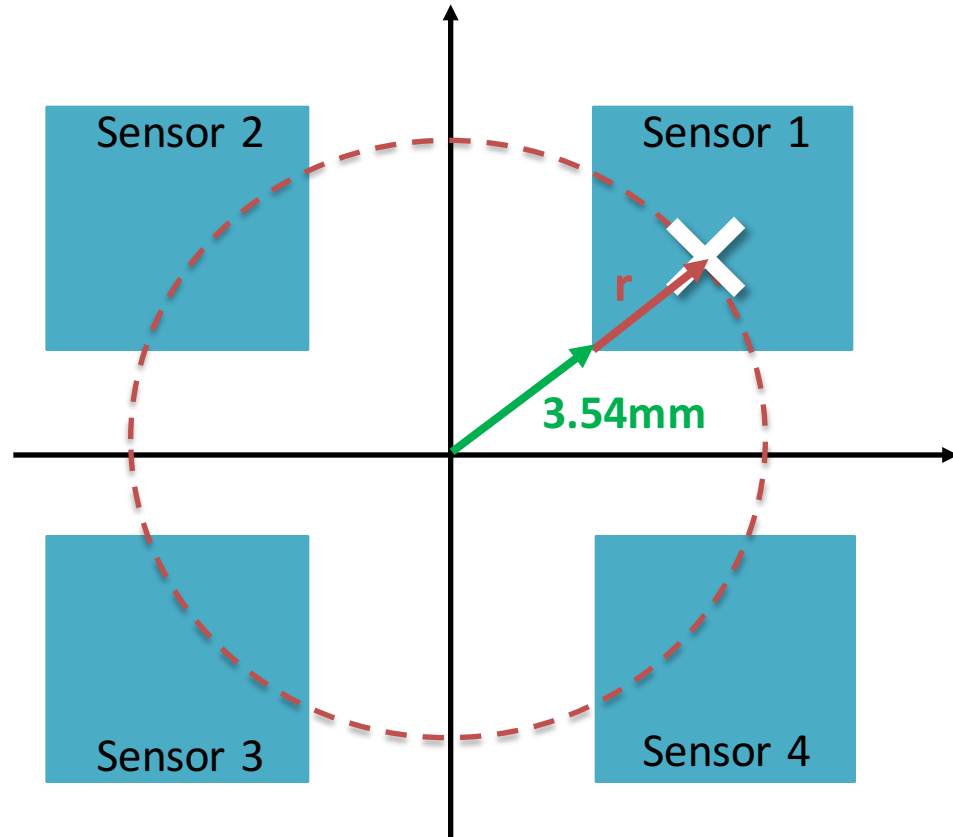
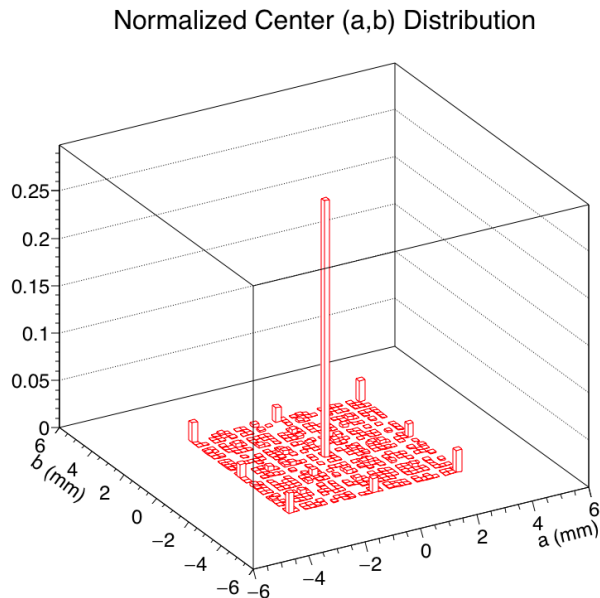
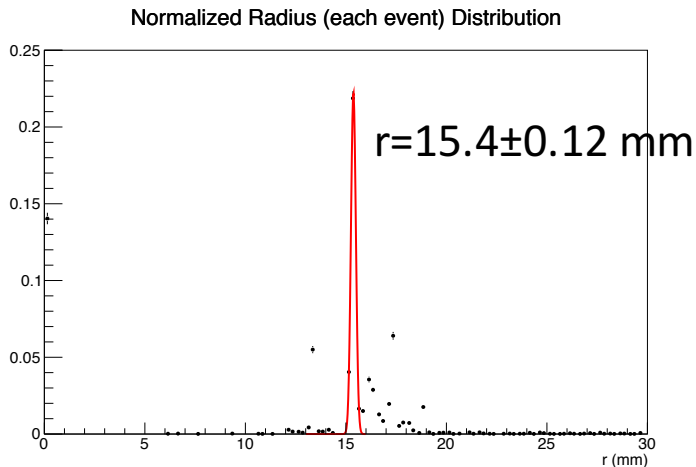
- Signal
- noise

loud noise



Fitted rings are close to the actual rings, even with loud noise

Radius (in each event) Distribution (**finite** pixel)



measured value of radius

$= r + 3.54$

$= 18.94 \text{ mm}$

Smaller than the actual value (20mm).
difference due to pixel size



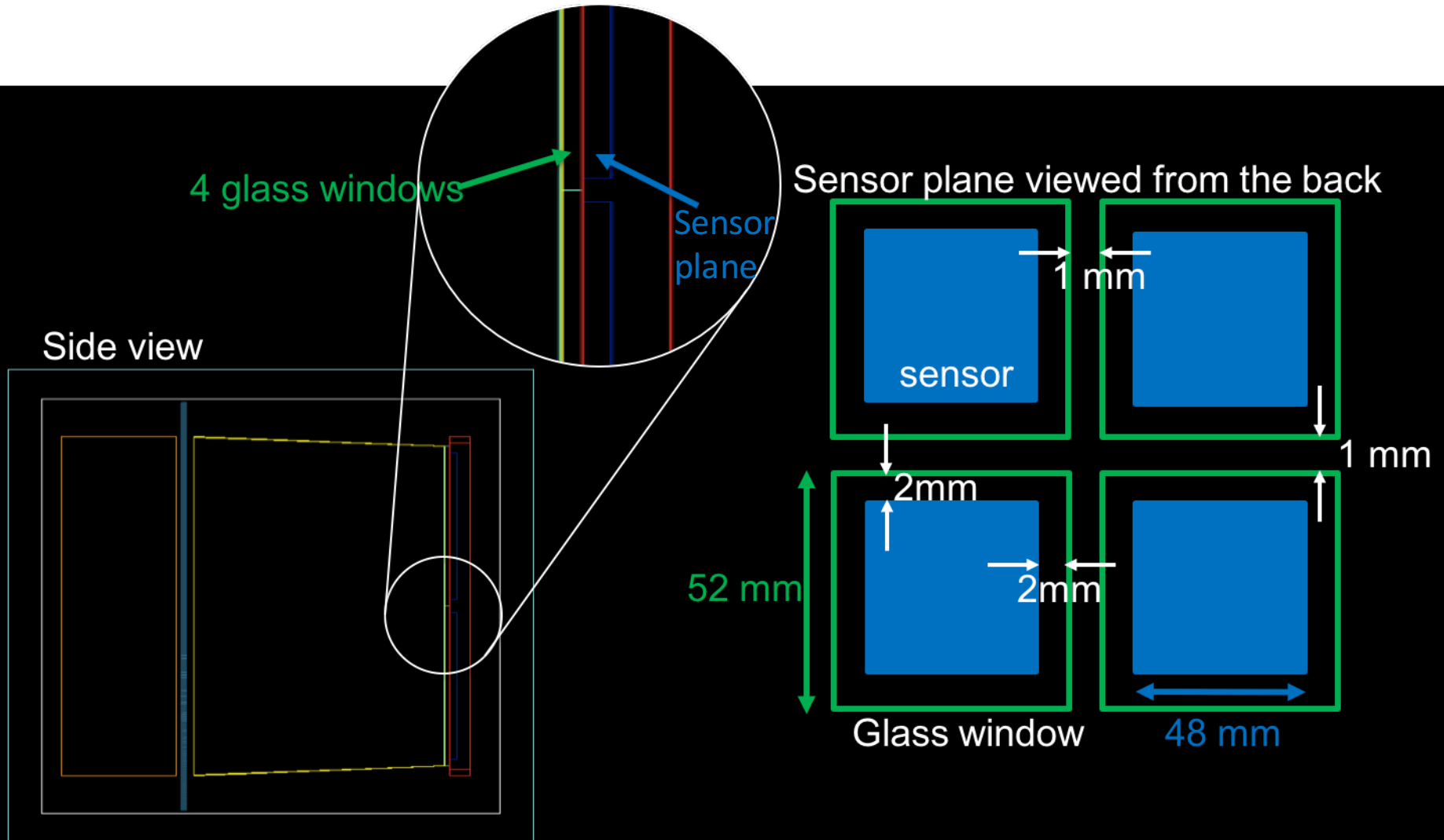
Simulation Result



Simulation Setup

- Beam
 - 120GeV proton
 - 1,000 events
 - Launched perpendicularly toward center of the detector
 - Beam diameter 1cm
- Detector
 - Aerogel gel: 3.3cm thick, $n=1.03$
 - Fresnel lens: $f=3$ inches
 - Sensor plane : at Fresnel lens focal plane, 1mm gap between glass windows (or 5mm between sensors)

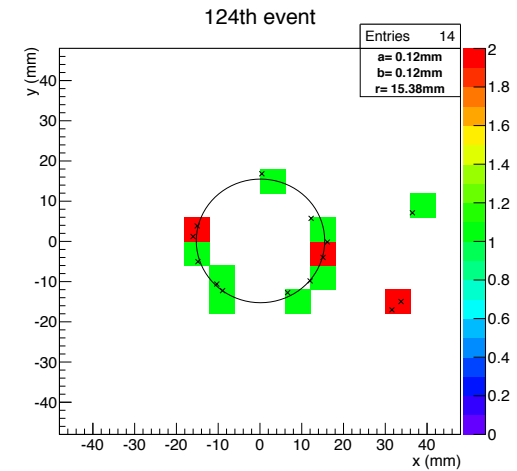
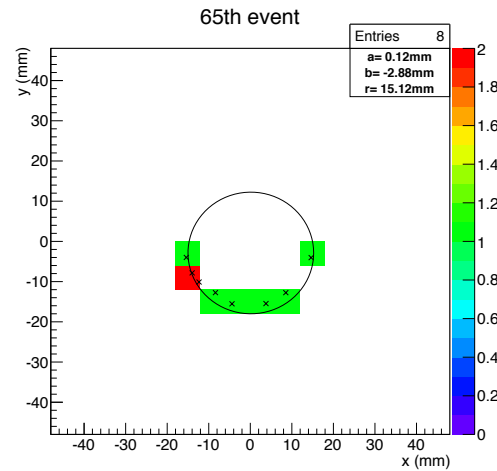
Detector Setup



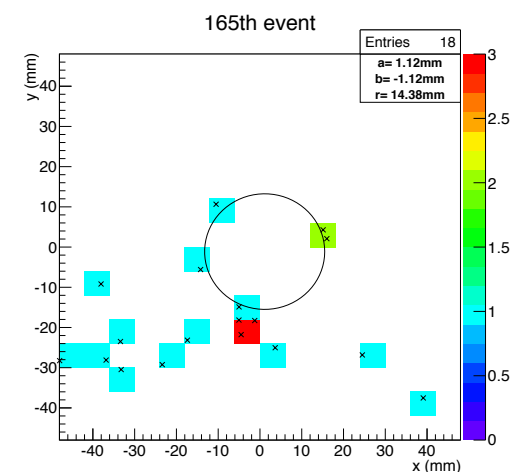
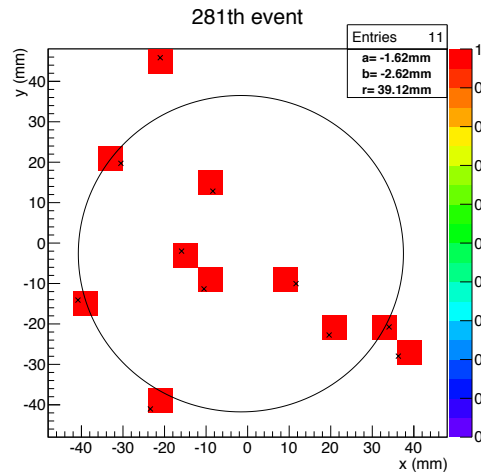


Event by Event Display

low background

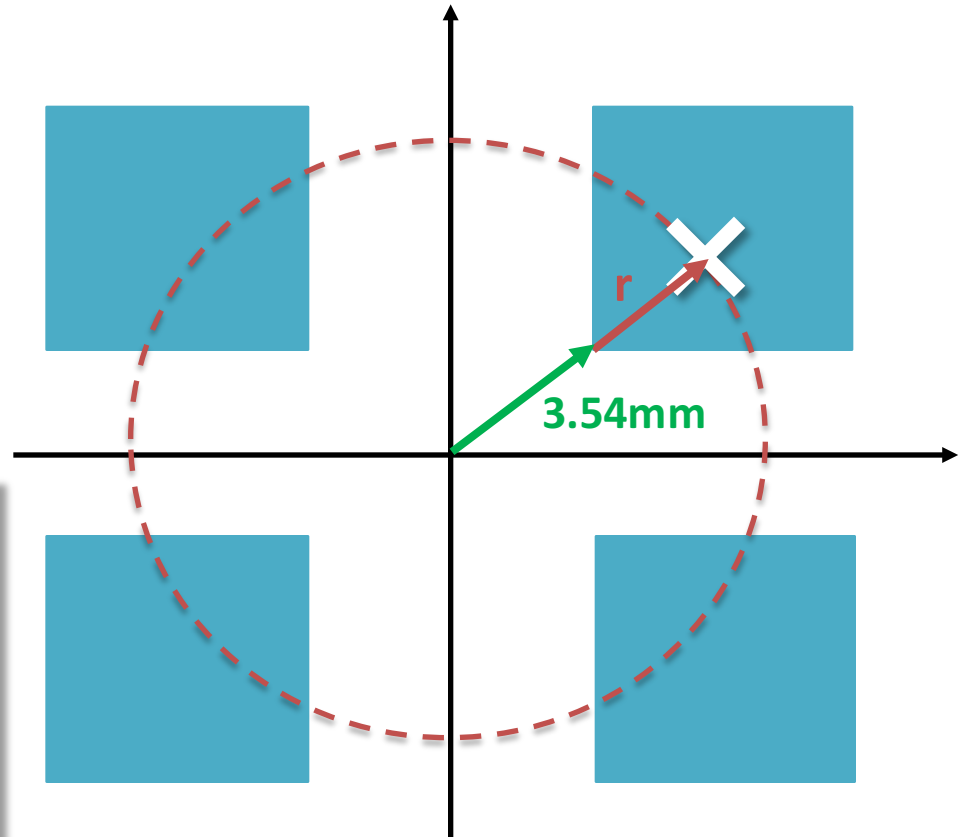
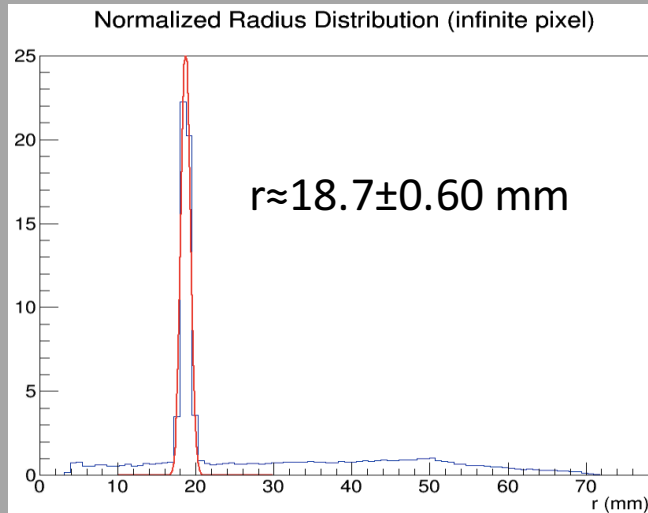
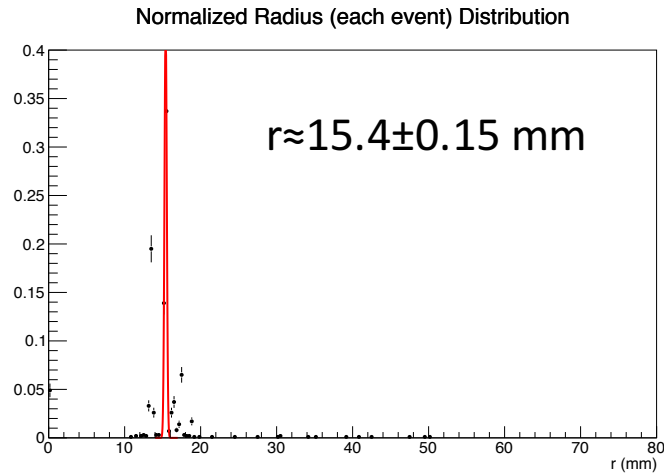


strong background





Radius (in each event) Distribution



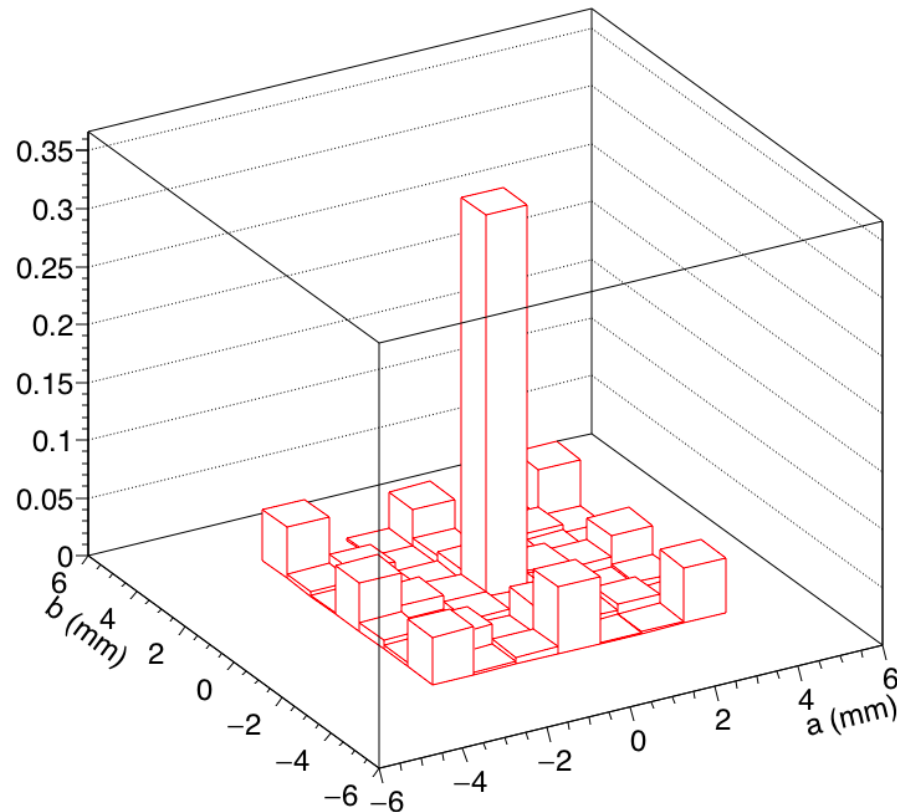
Actual measured value of radius
 $= r + 3.54$
 $= 18.94 \text{ mm}$

- Radius of each photon hit from simulation result.
- No Q.E. applied

Center Position (in each event) Distribution



Normalized Center (a,b) Distribution





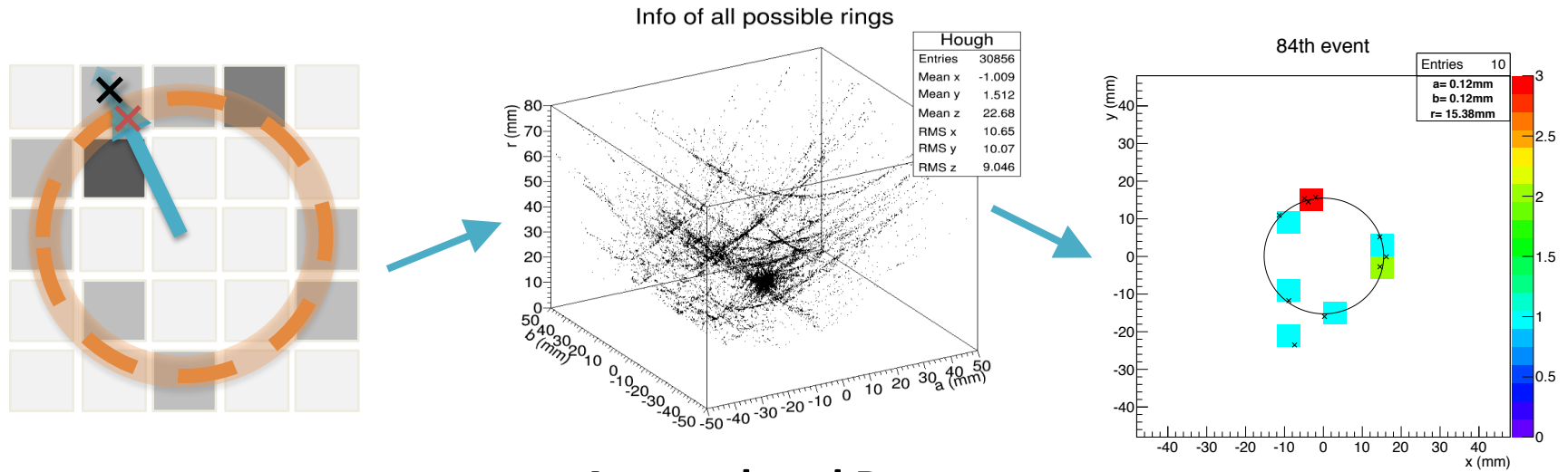
Summary

- Ring Finder Algorithm has be tested using Monte Carlo method
- Ring Finder Algorithm is implemented in simulation analyses

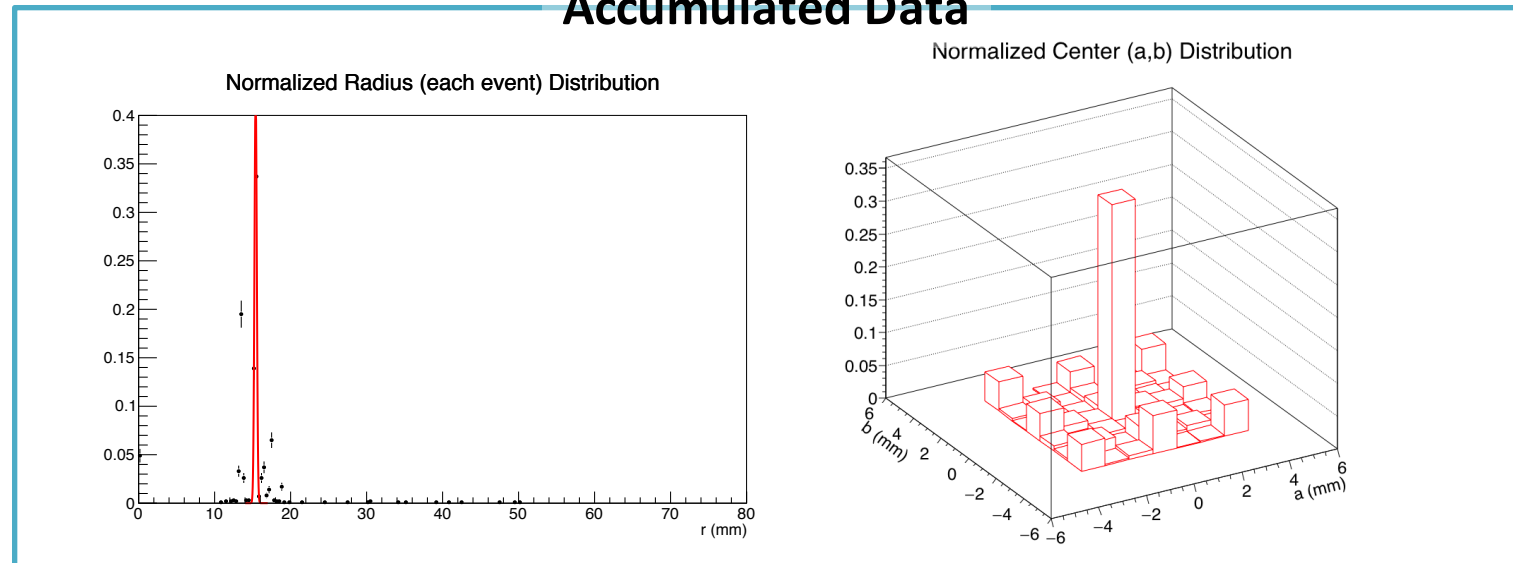


Back Up

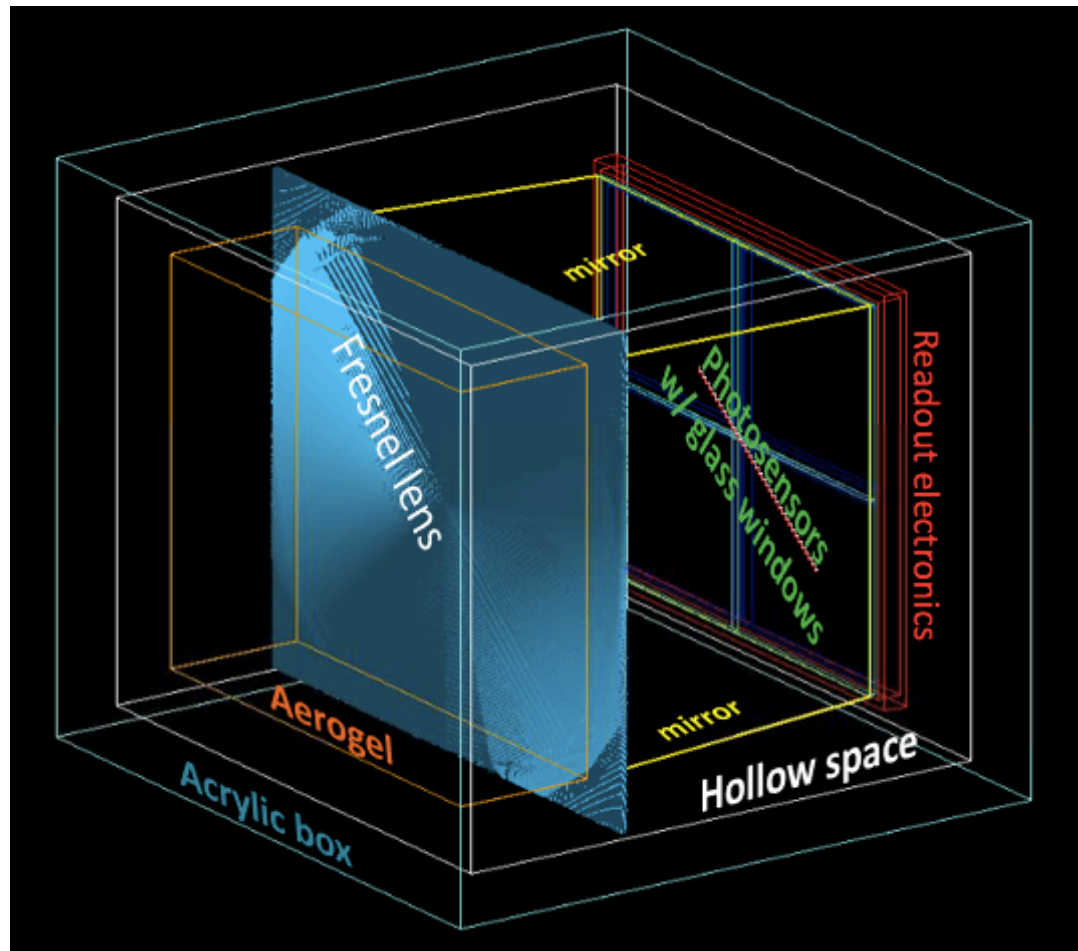
Ring Finder Analysis Procedure



Accumulated Data



Detector Setup



Detector Setup

