INTT efficiency study

2025/08/14 Takahiro Kikuchi

INTT efficiency with MVTX

- Currently I’m working on INTT efficiency with MVTX
- I did some study with Montecarlo and going to report it.

Overview

- INTT Efficiency of INTT Inner layer, requiring MVTX 3 layer and INTT Outer layer.
- $$\frac{(\text{MVTX 3 layer}+\text{INTT Outer})+\text{INTT Inner}}{(\text{MVTX 3 layer}+\text{INTT Outer})}$$

- Before using real data, I'm working on MDC2 Run26 (AuAu zero-field)
- Planning: p-p with magnet

Purpose of MC analysis

- Efficiency with real data can be broadly divided in two section.
- Total detected good track = (good tracks which are detectable) × (Tracking efficiency)
  - Good track: MVTX 3 layer + INTT Inner and Outer
- Because of dead area, there are some tracks which can't have INTT Inner cluster though they have that of MVTX, INTT Outer.

- Before using real data, counting the undetectable tracks and make sure the correspondence of these tracks and geometry.

About preliminary request

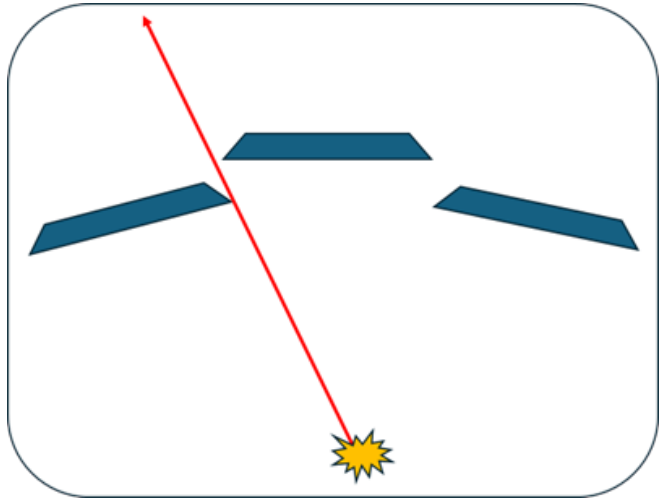
- I'd like to require preliminary of some plots for initial stage.
- For Montecarlo data, presentation in GM isn't needed, just the approval from Publication Board Chair.

- Unfortunately, I missed the announcement of SDCC maintenance and it didn't finish until I woke up today…
- But fortunately, I don't need GM approval.
- I couldn't prepare the final version of plots
- Maybe next week…

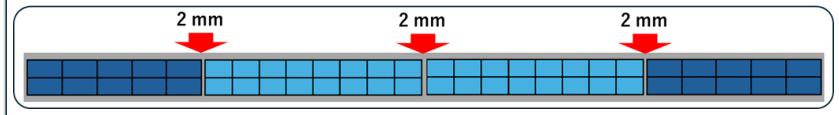
Undetectable tracks

- There are some group of undetectable tracks.

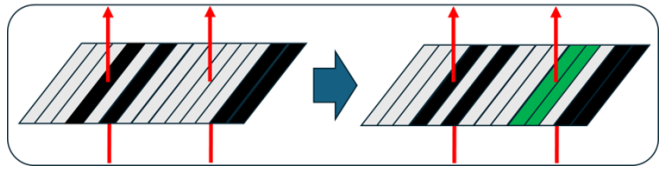
Passing through between the ladders



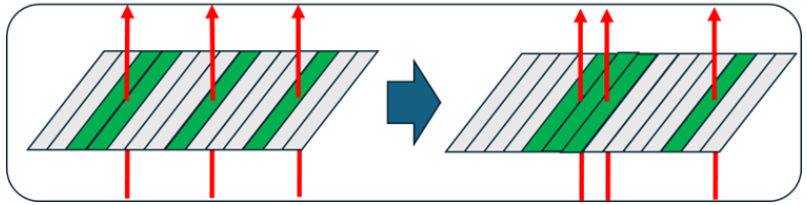
Dead area between type A, B



Dead channel

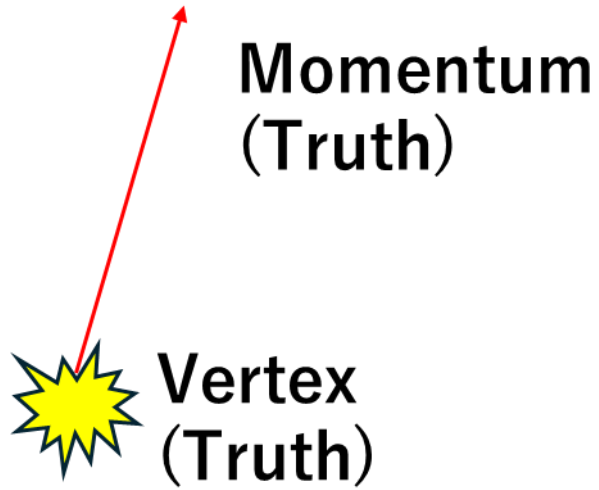


Cluster duplication



Track reconstruction

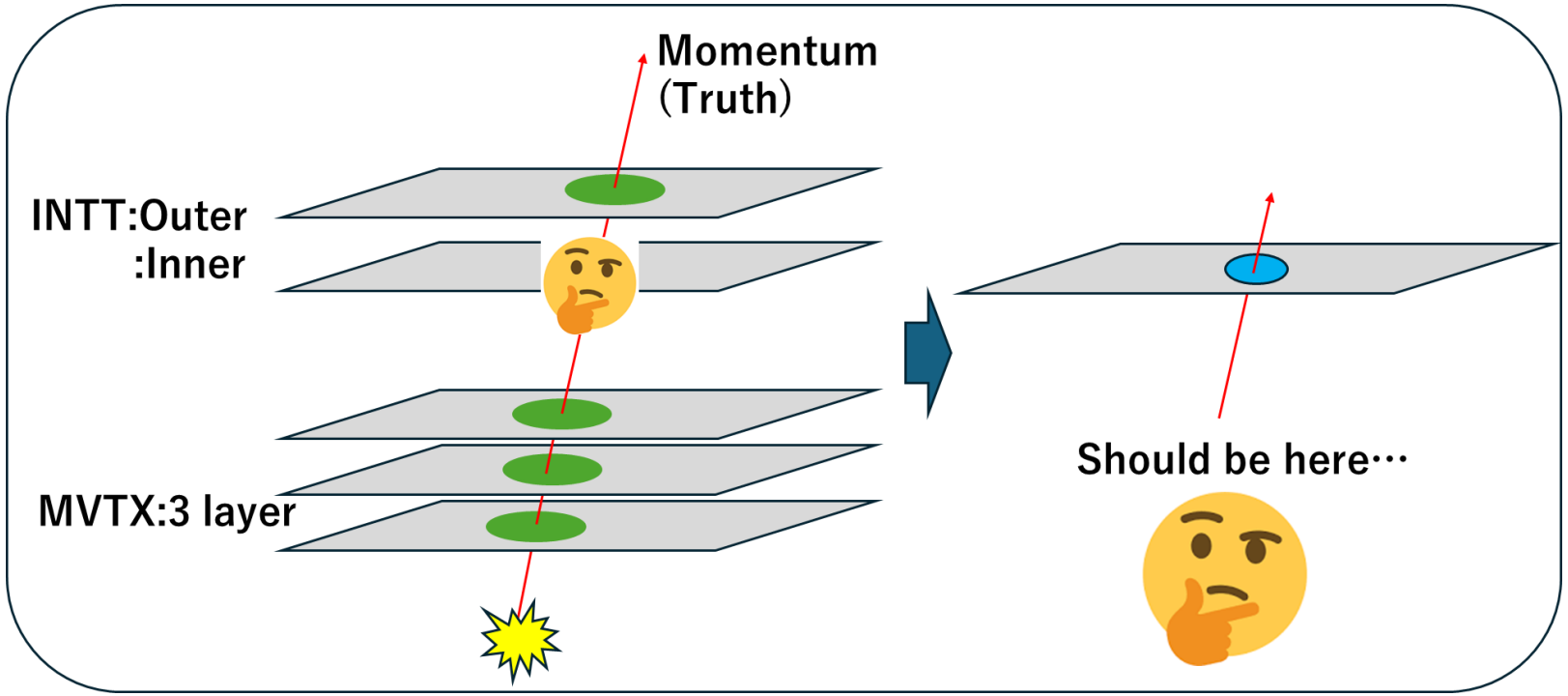
- Instead of silicon seeding, I used G4Truth information.
- With the vertex position and its momentum vector, I draw a track.



Calculating the crossing point

- With that track, I calculated the crossing point for each INTT Inner/Outer layer.

- INTT ladder geometry is from “ActsPlaneSurface”.



Calculating the crossing point

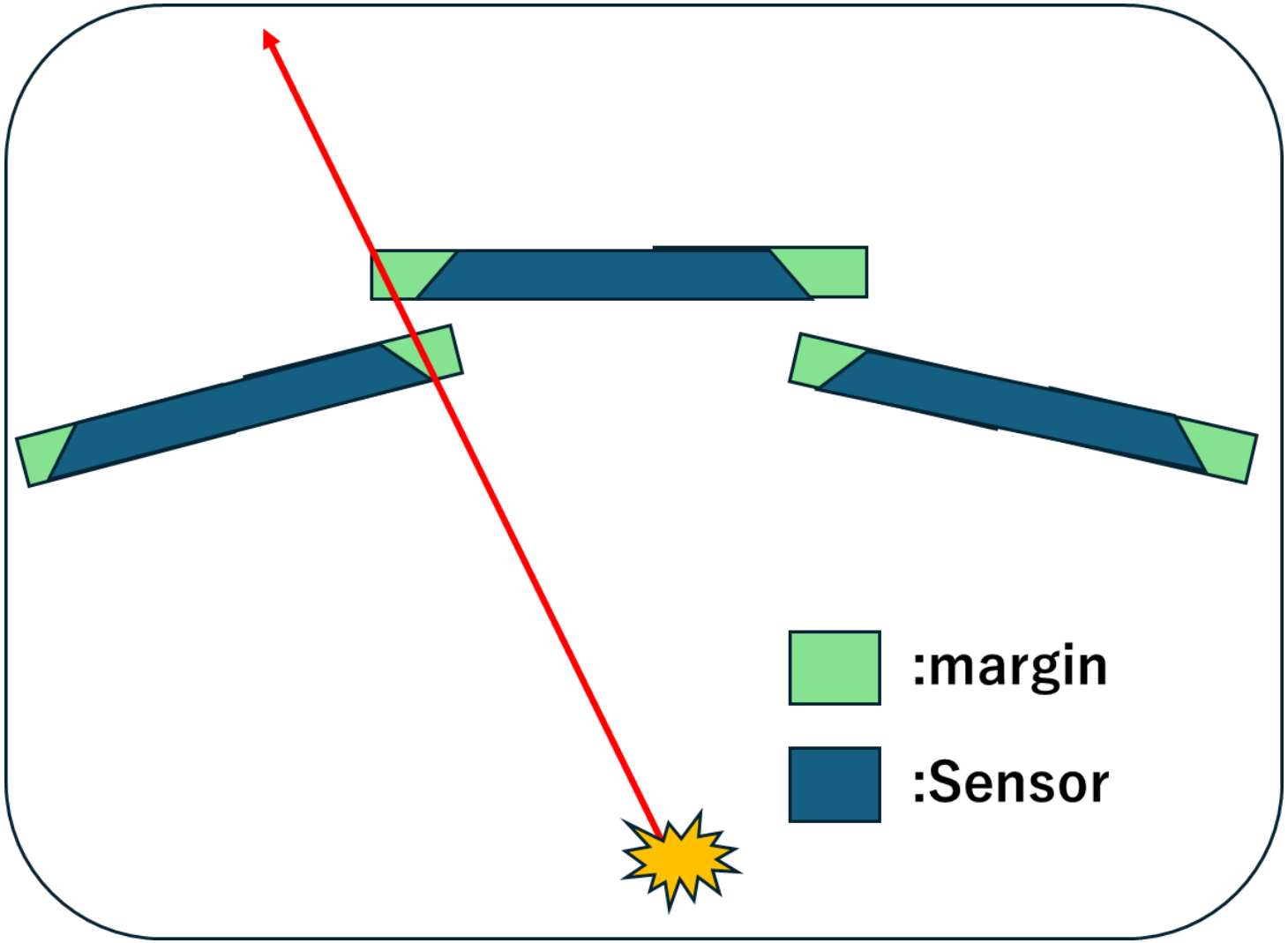
- “ActsPlaneSurface” has the center position and normal vector of each type A, B sensor group.
- To calculate the crossing point, I prepared a equation of a plane which reflect each ladders.

- If the distance between the crossing point and center of ladder is reasonable, I counted it as “crossed”.

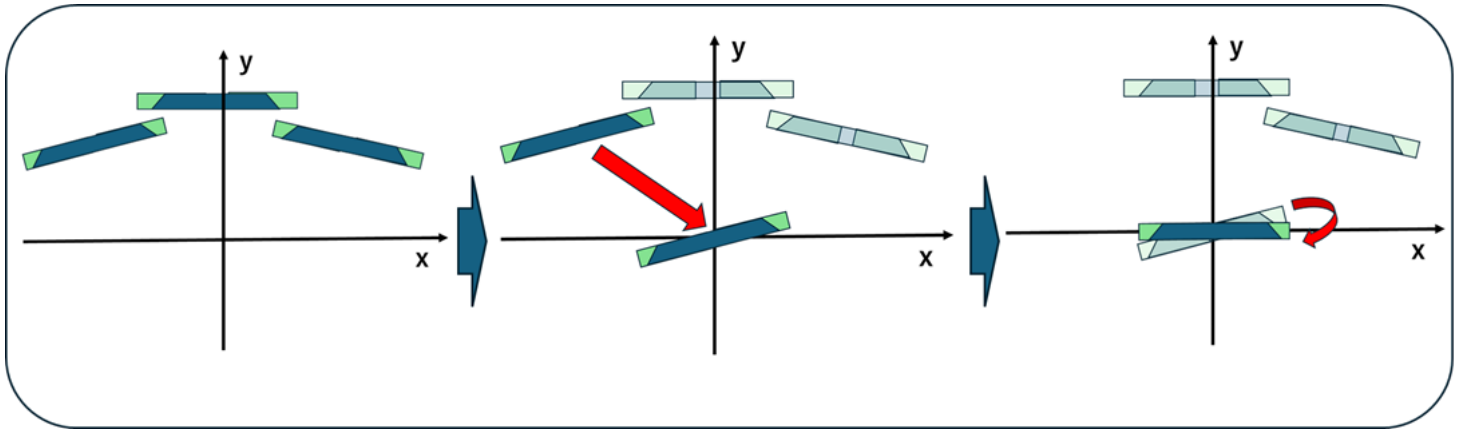
Distance from center of layer

- The width of INTT ladder in x,y plane is ±0.998 cm.

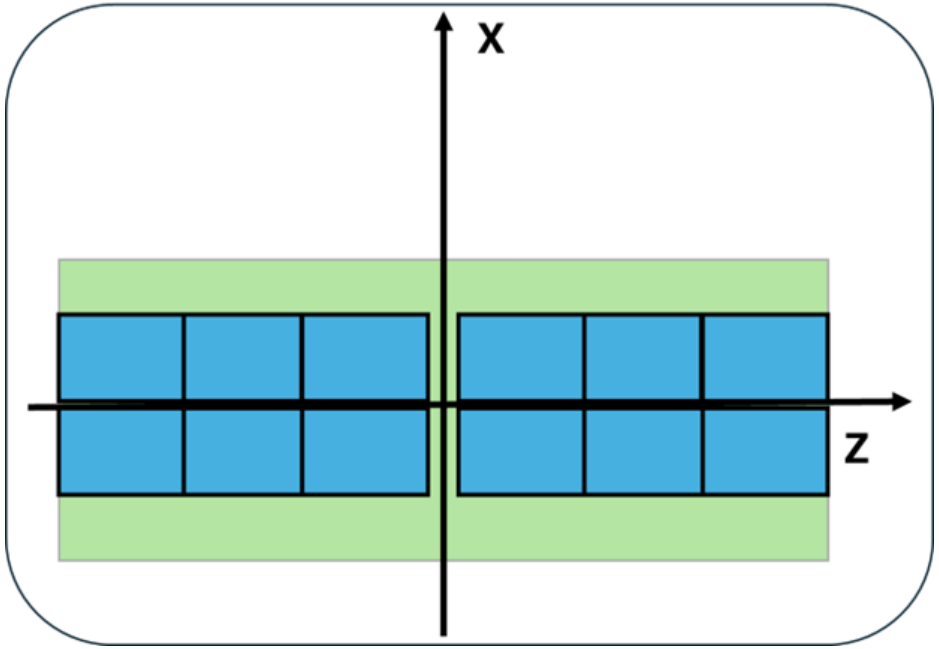
- To detect the passing through event, I added some margin around the ladder(+0.4 cm).



Global to local



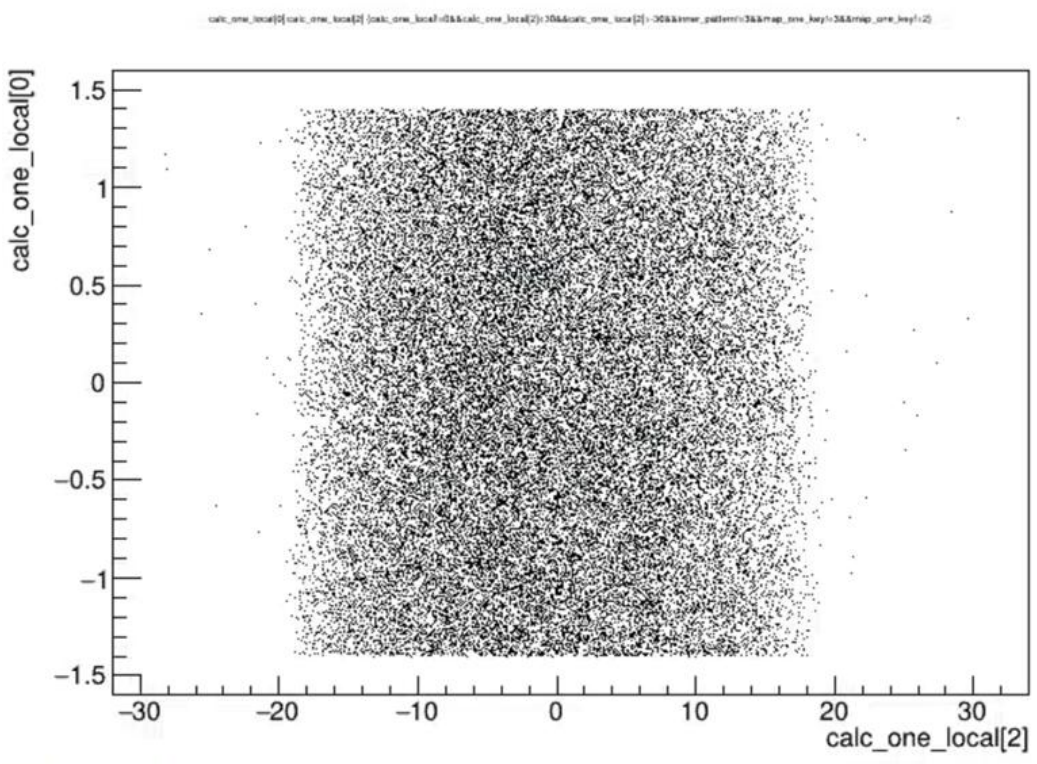
- To overdraw all ladders, change the coordination local from global.

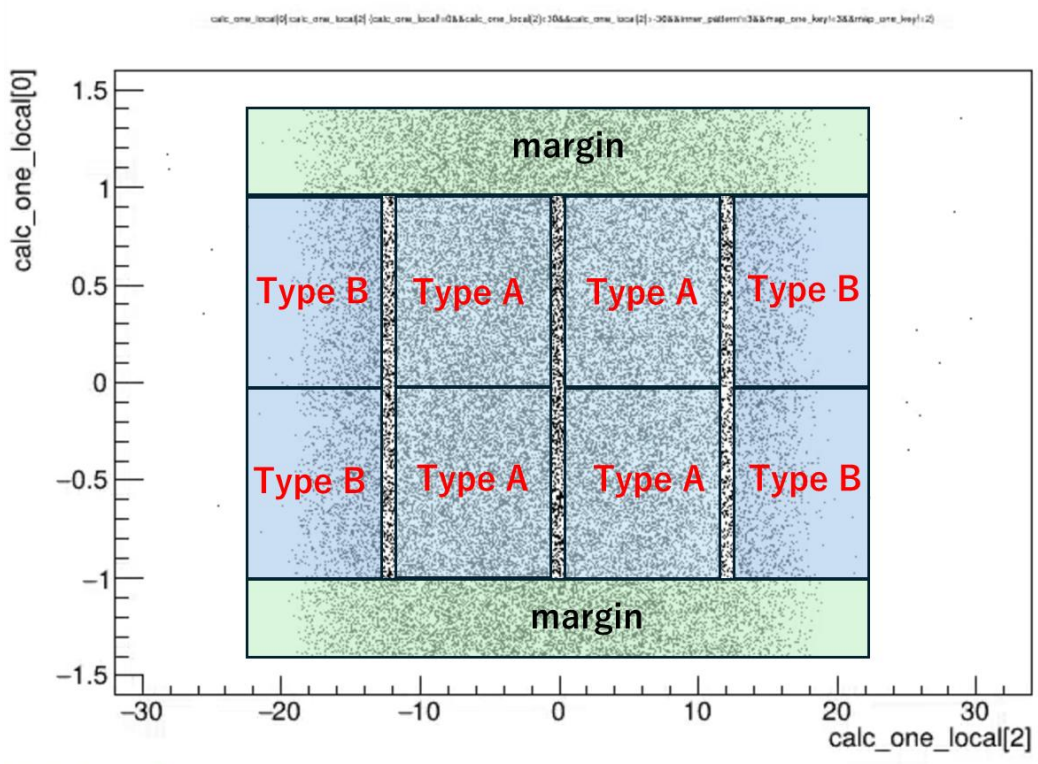


- Some of these calculation is based on CylinderGeomIntt/CylinderGeomInttHelper

The crossing point of all tracks

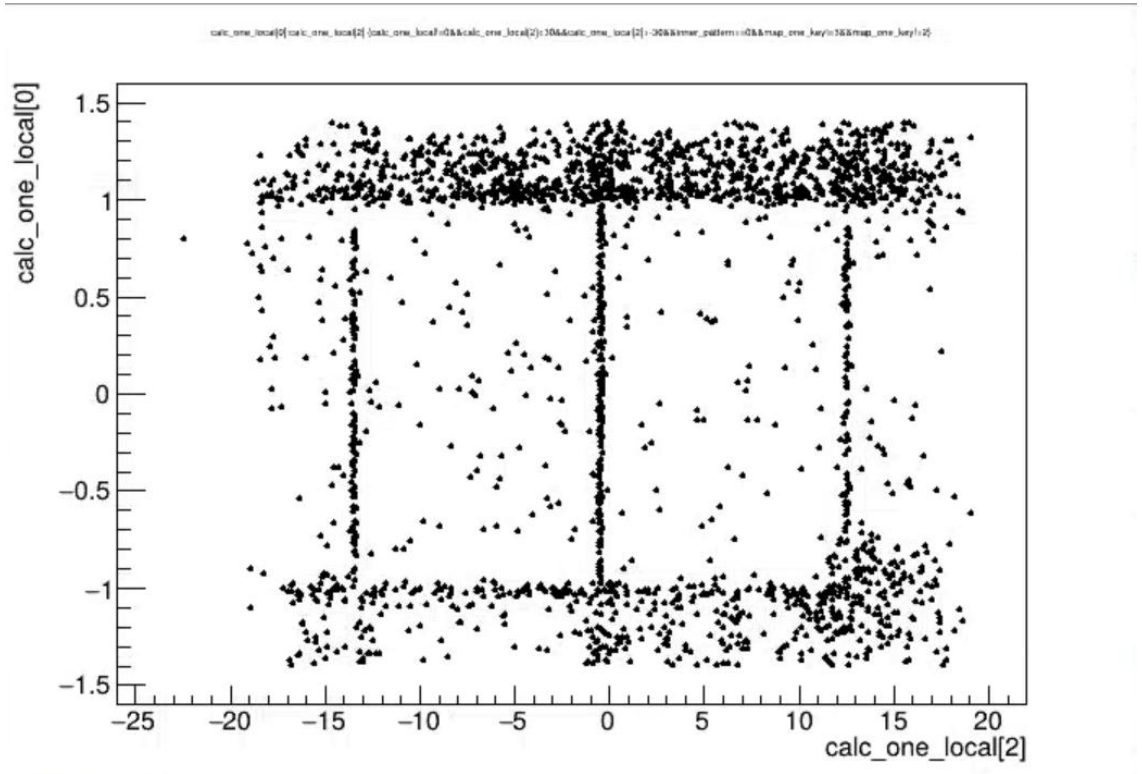
- Overdrawing all ladders.

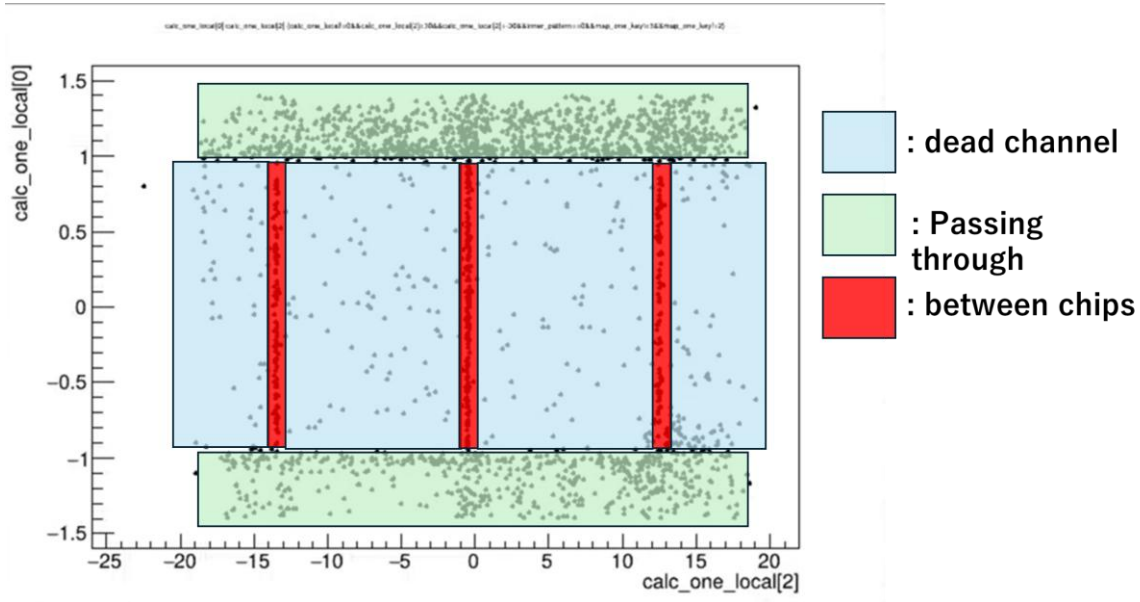




Crossing points of (no INTT Inner cluster) track

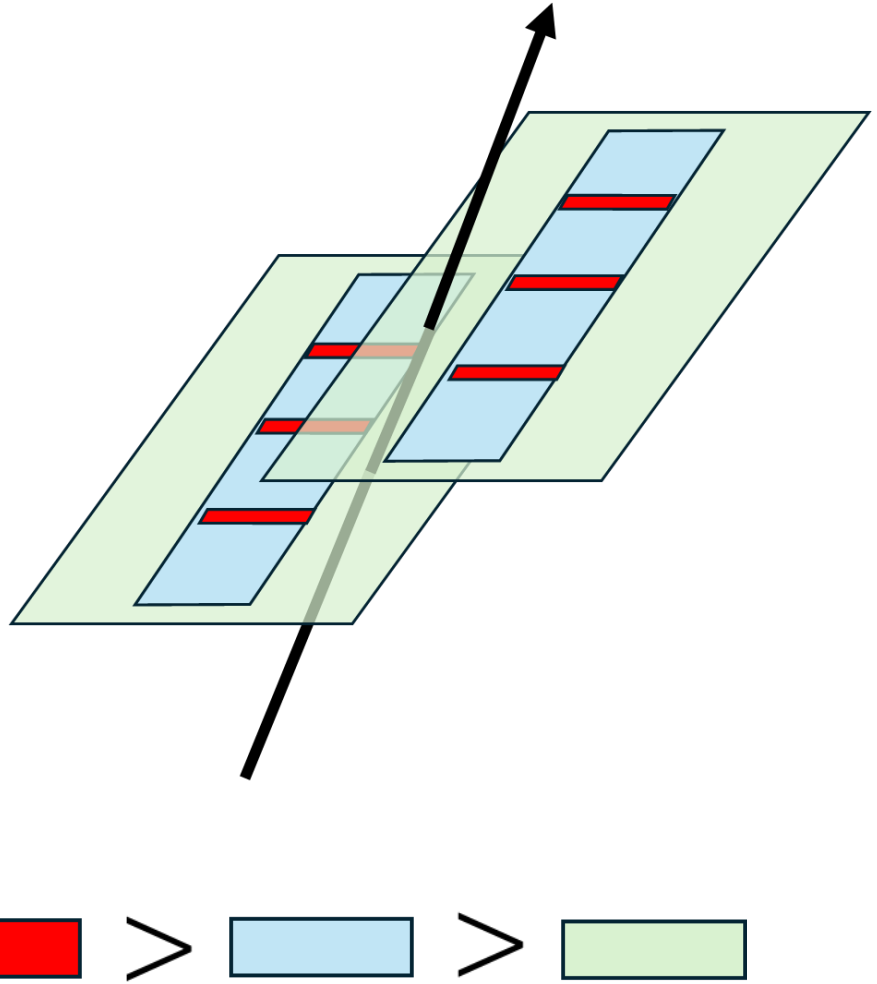
I classified the crossing point based on the geometry.





To avoid double counting

- Some tracks can have two crossing points.
- To avoid double counting, I set the priority for each classification.



Results

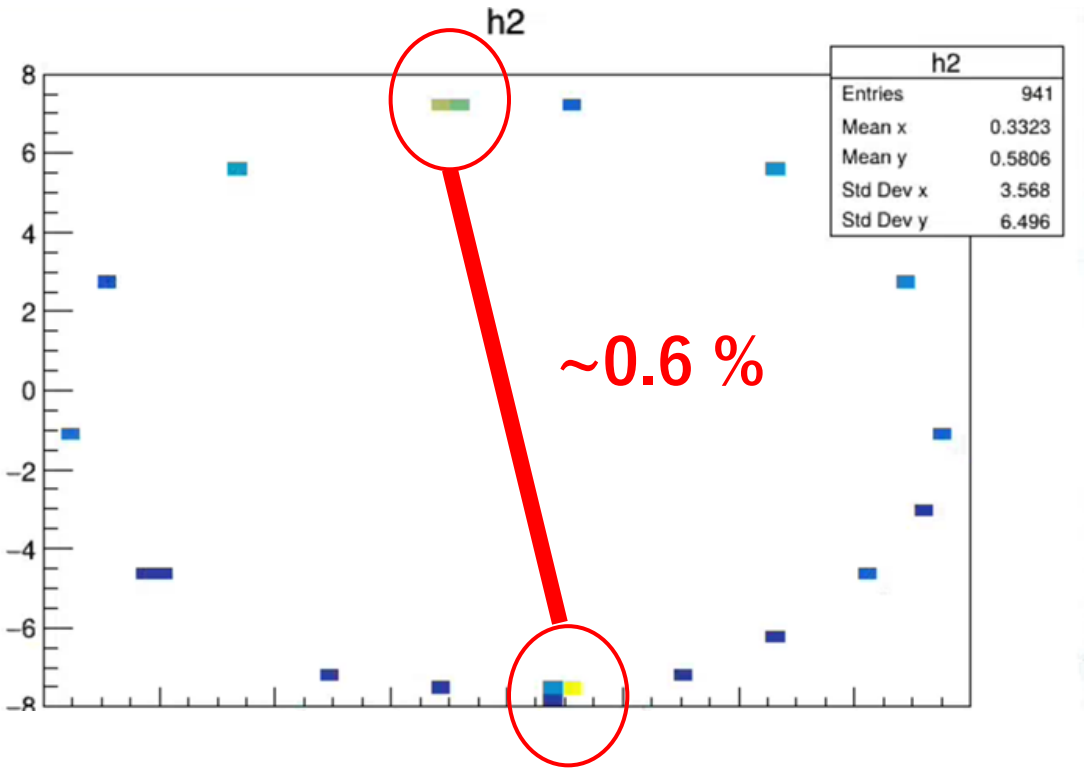
- Total tracks: 73307 (100 %)
- Detectable tracks: 66771 (91.1 %)

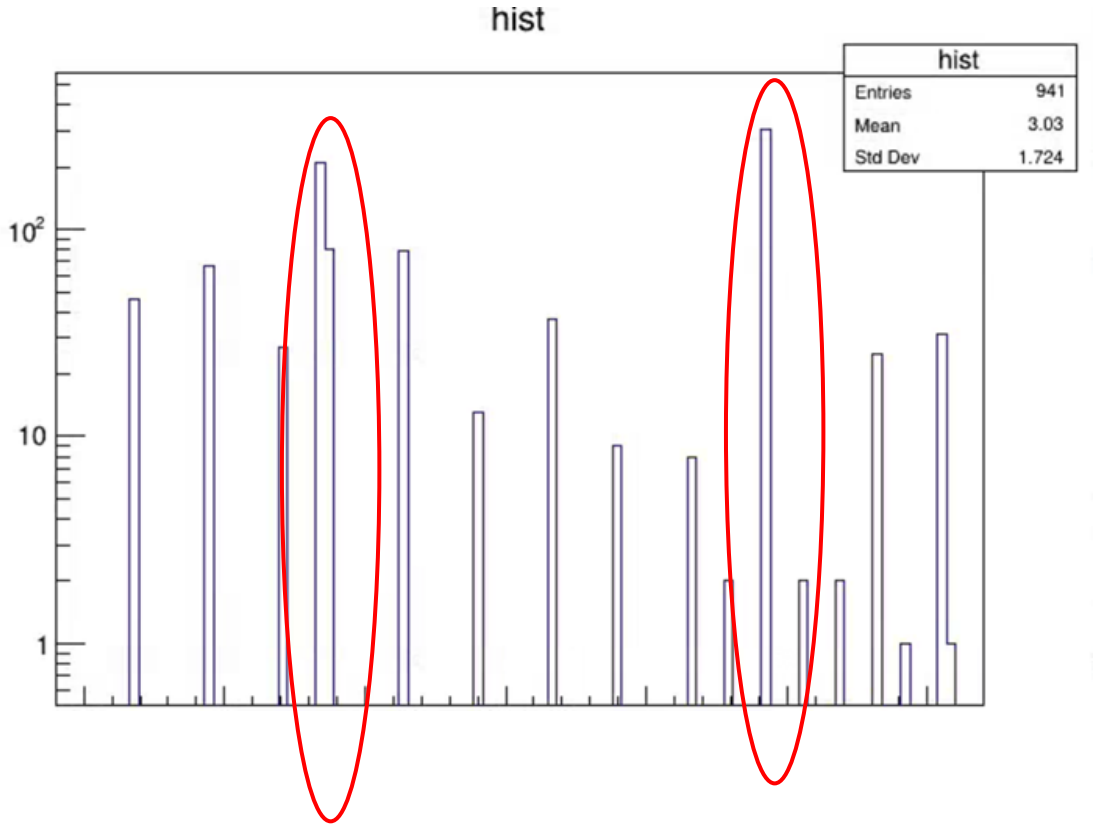
- Bad track (8.9 %)
  - Cluster duplication: 1639 (2.2 %)
  - Passing through: 947 (1.3 %)
  - Type A/B dead area: 794 (1.1 %)
  - Dead channel :3155 (4.3 %)
    - Without CDB masking (~0.9 % per ladder)…random dead channel is 1.03%

Passing through ratio

- From (x, y)=(0, 0) point, INTT Inner ladder have two non-overlap area.
- They are in the between of half barrel.
- The ratio of the non-overlap area is 0.6 %.
- And the tracks passing through these two area is 0.7 %

- There are some tracks even if they fully overlap.

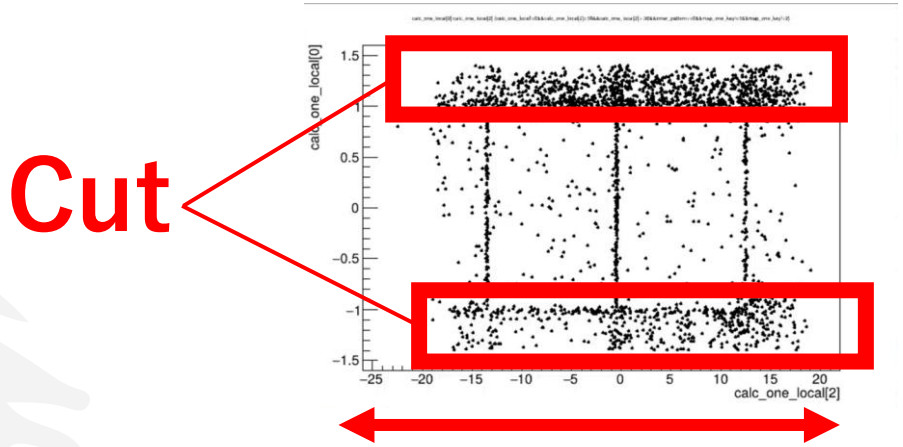


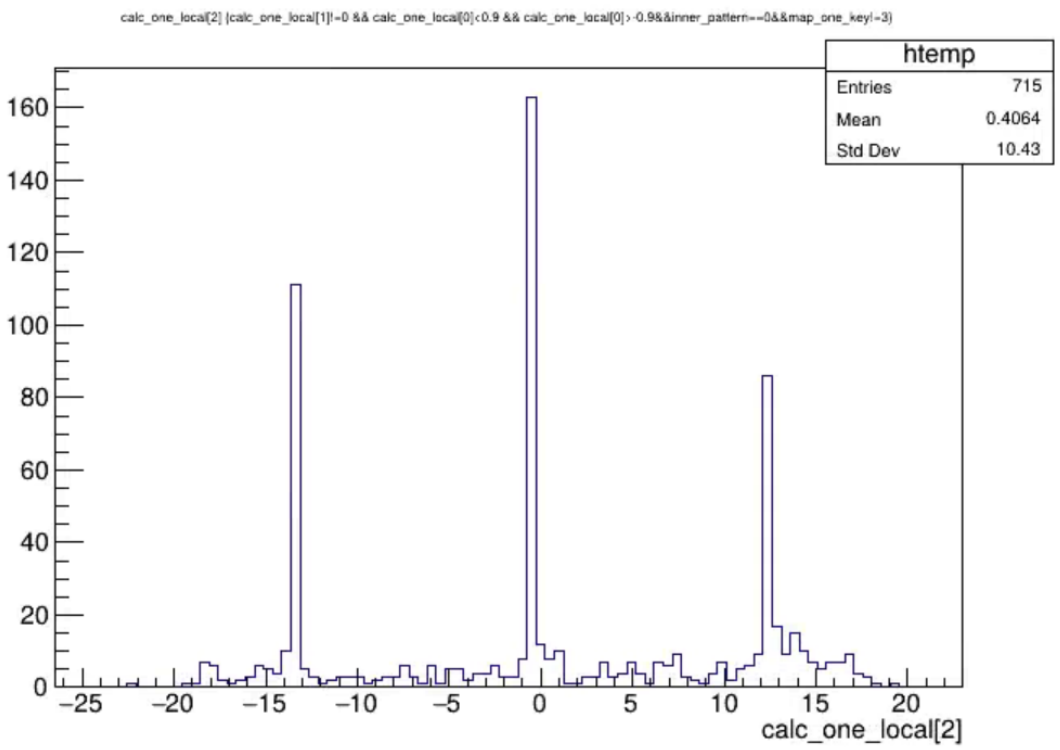


Preliminary request

- Failed cluster distribution with TH1D
- X axis is z (cm)

- I'll get more statistics until next week…





Planning preliminary request

- The right side plot
- I'll get more statistics until next week…