Muon ID and stopping power with different layer configurations

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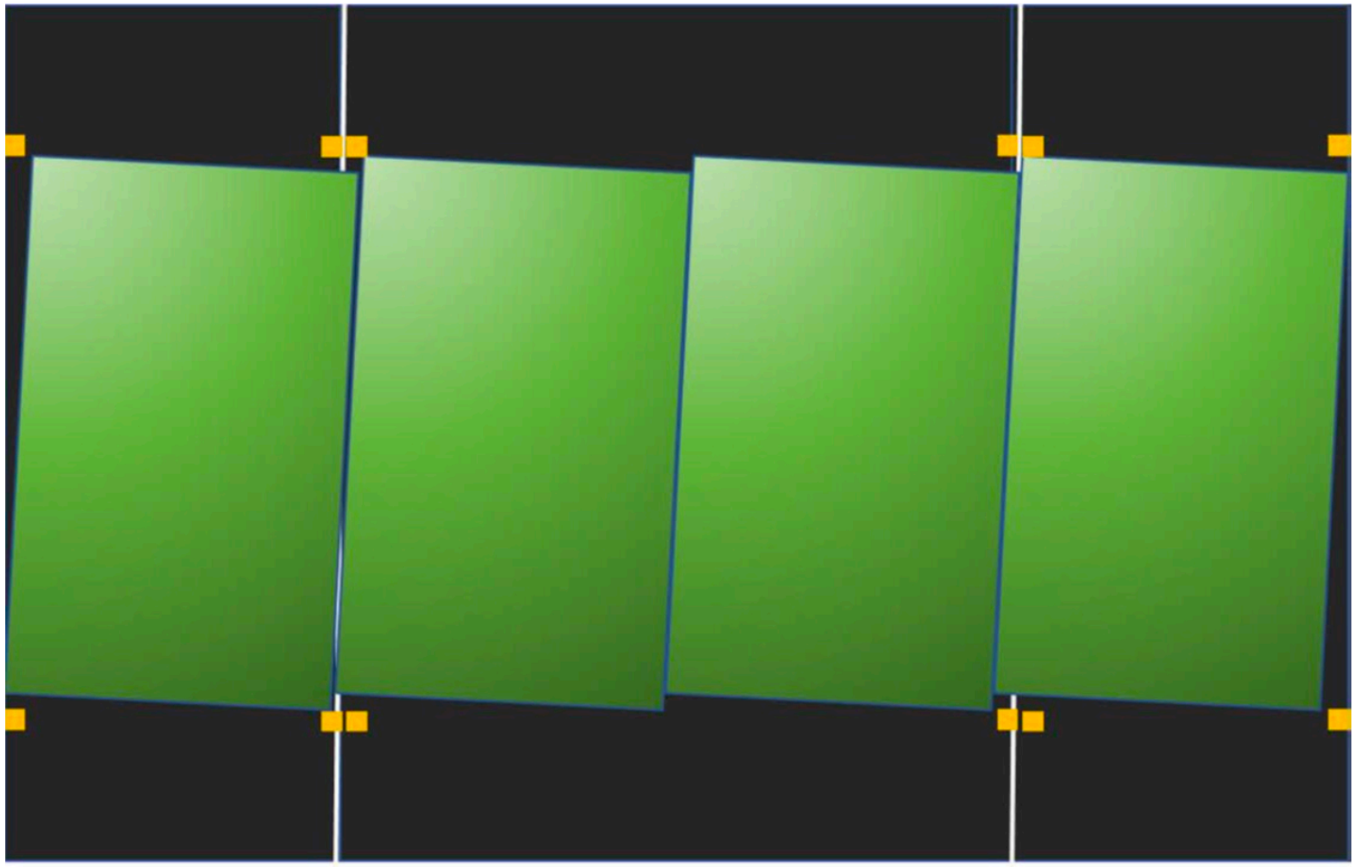
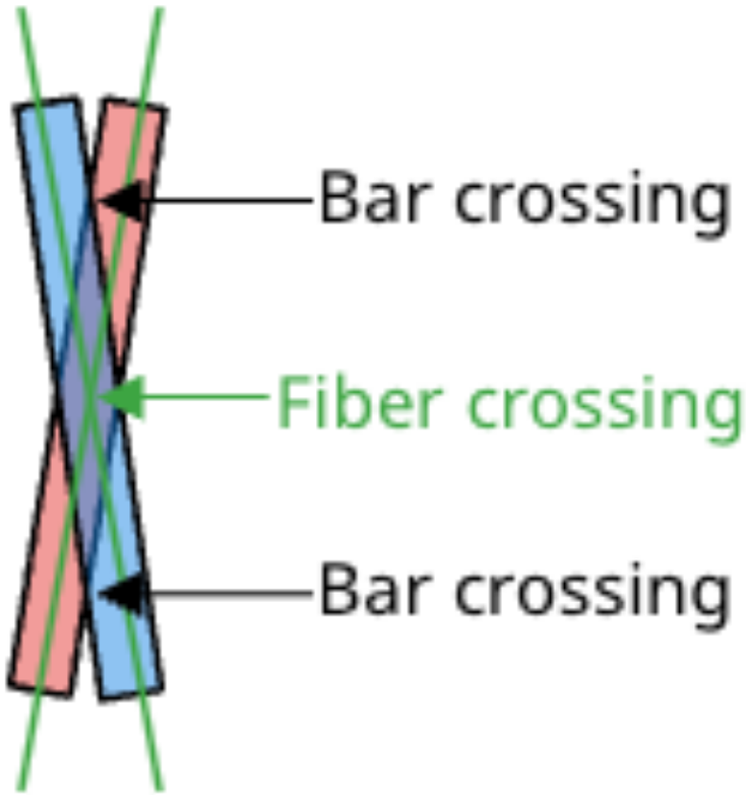
Nov. 12, 2024

TMS Meeting

Motivation

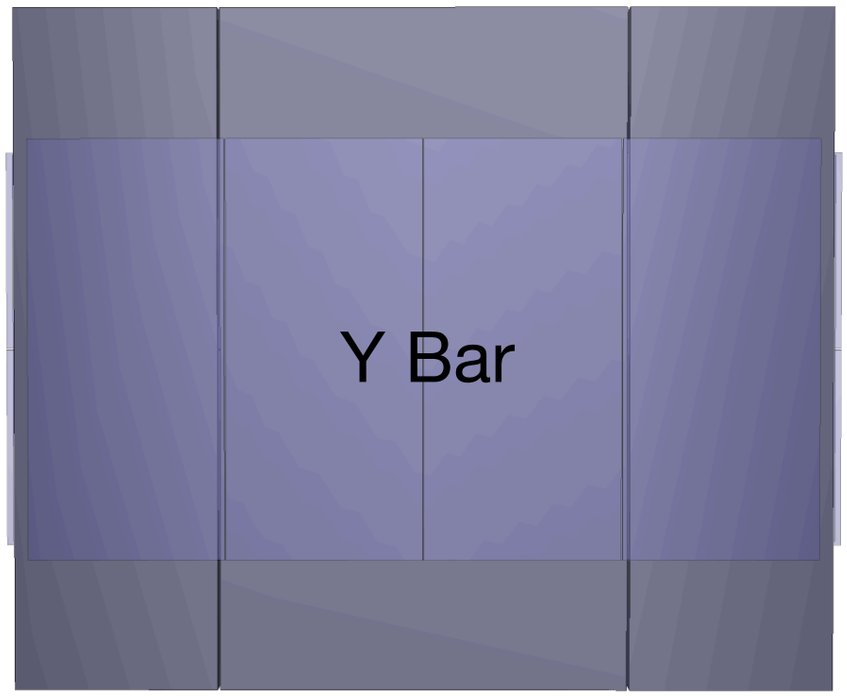
- In the initial design, the scintillator layers are rotated by 3 degrees.
- We can get the X position by averaging UV hits and the Y position by crossing the fiber.
- It has a trade-off, good for X positioning-> charge ID
  however, bad for Y positioning -> stopping & exiting muon.

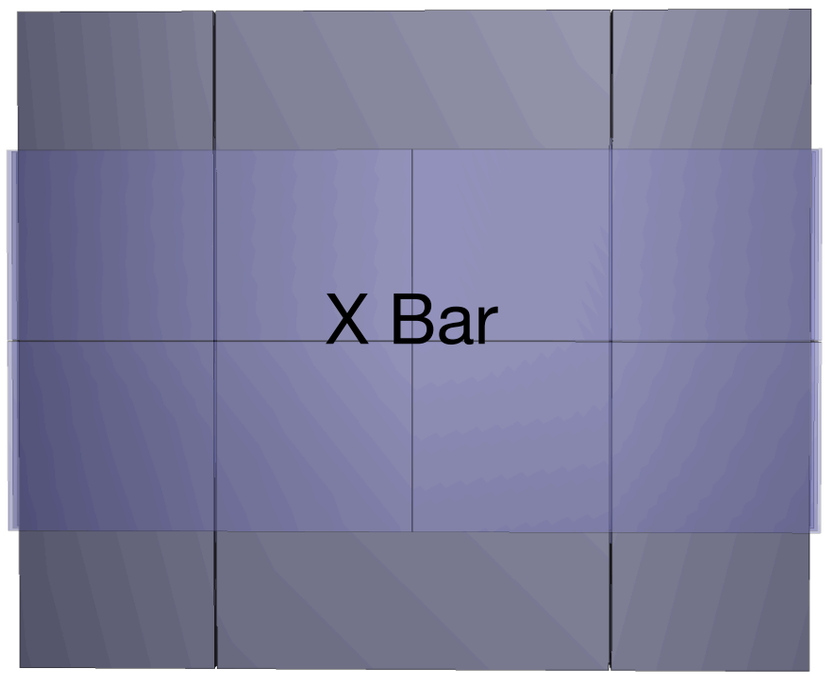




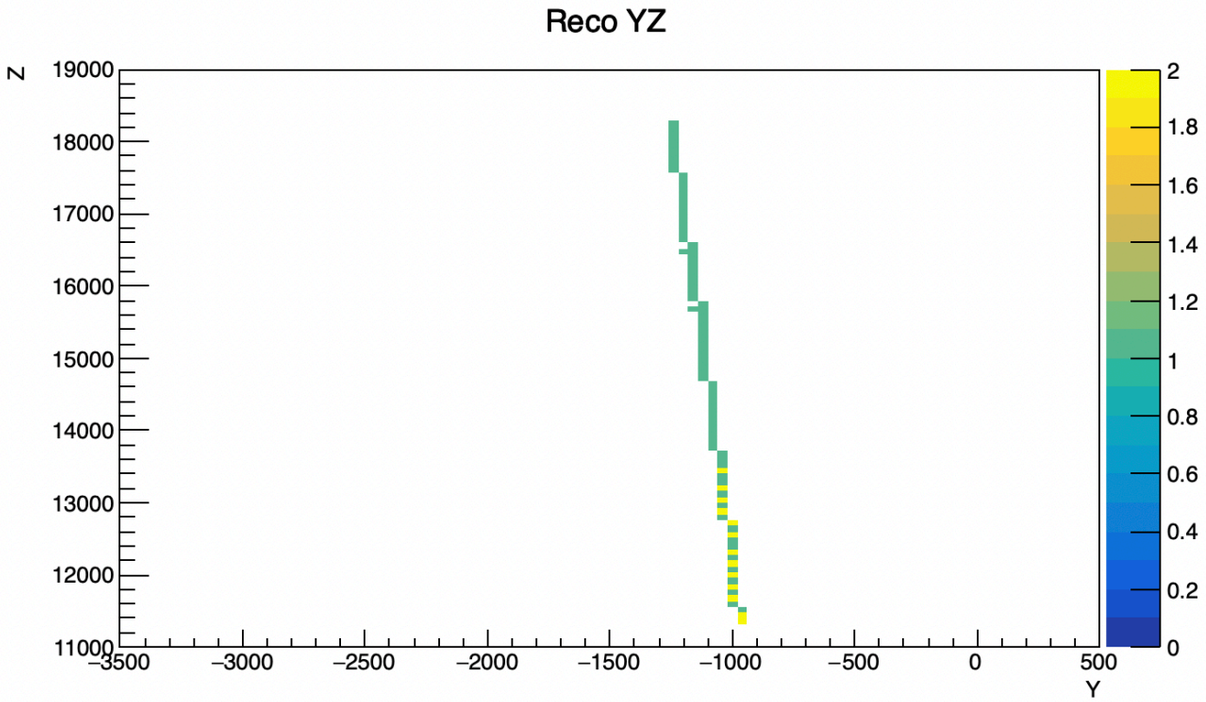
XY layer

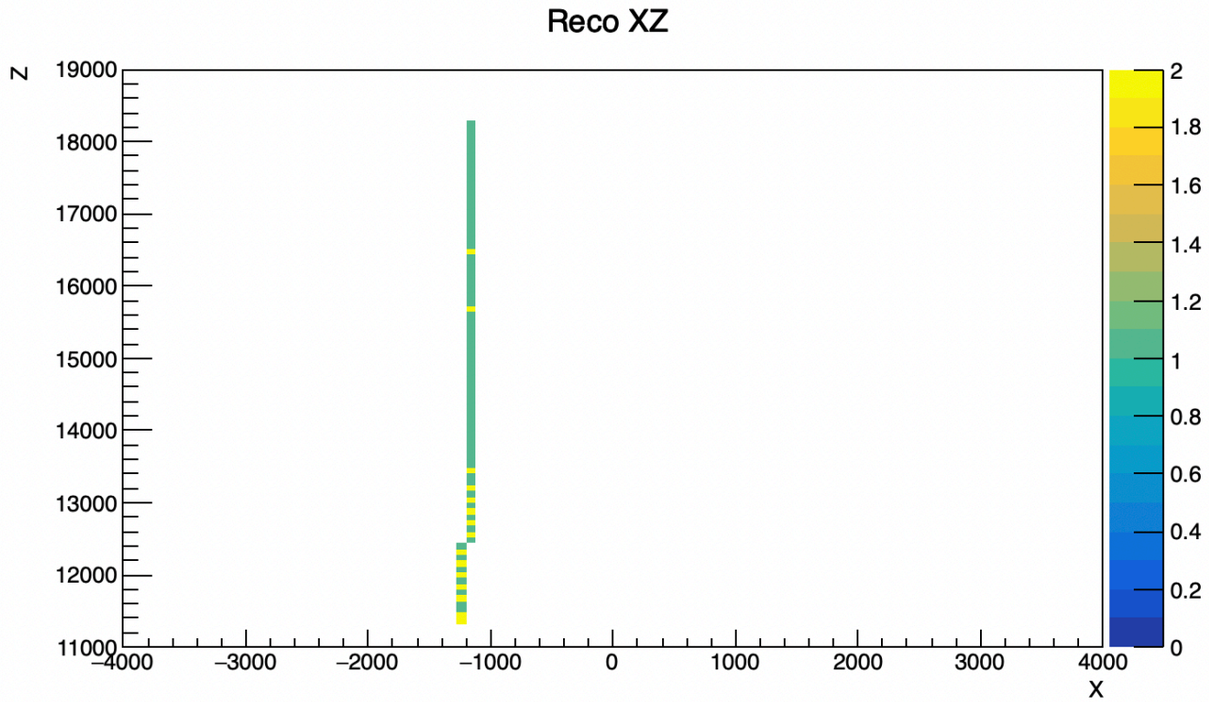
- There are many possible cases to design the orientation of bars. (ex. XY, one X layer after some Y layers, put X layer alternatively first 20 plates, and so on)
- In order to compare charge ID & stopping power between original design (UV) and these combination, Let's start with simplest one, XY.
- With only XY layer, we can just get X (Y) position from Y (X) bar.

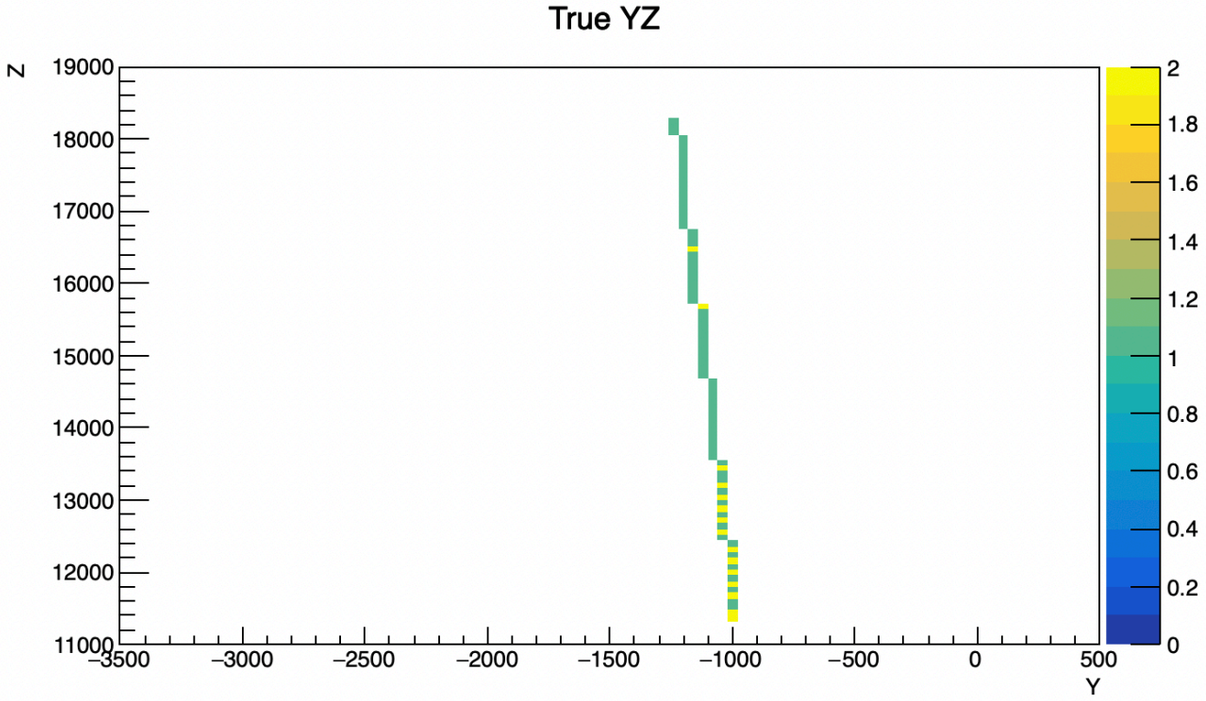


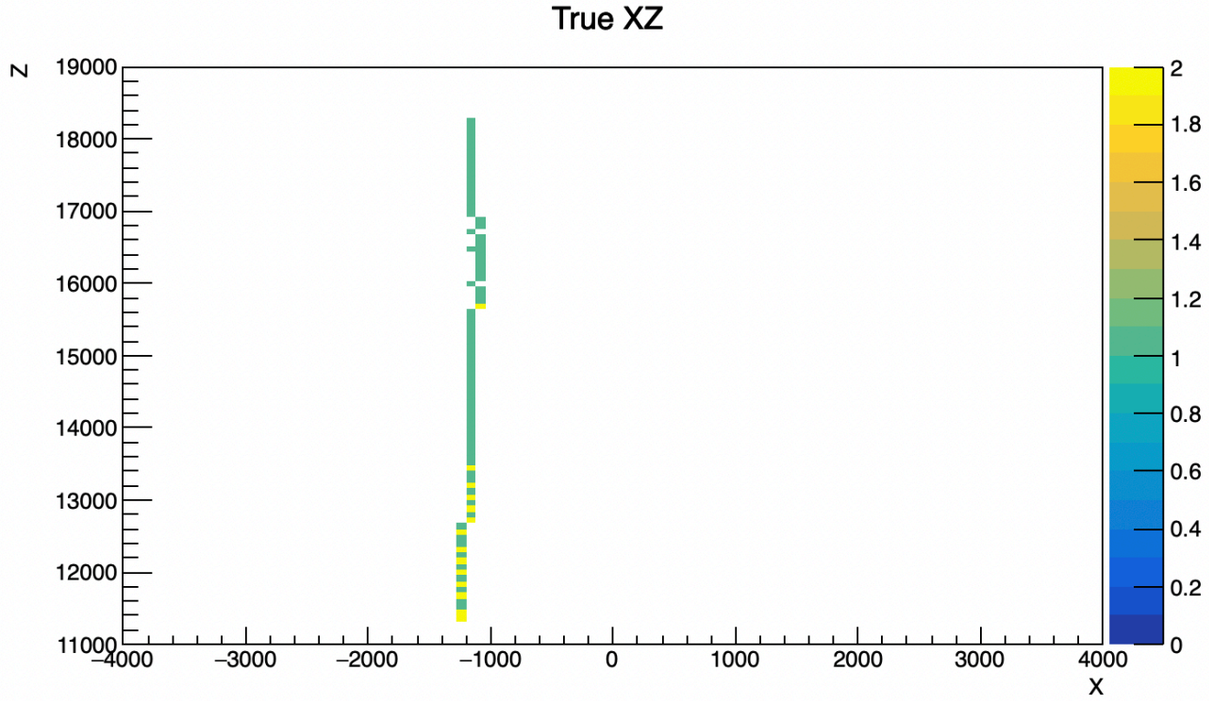


Event display

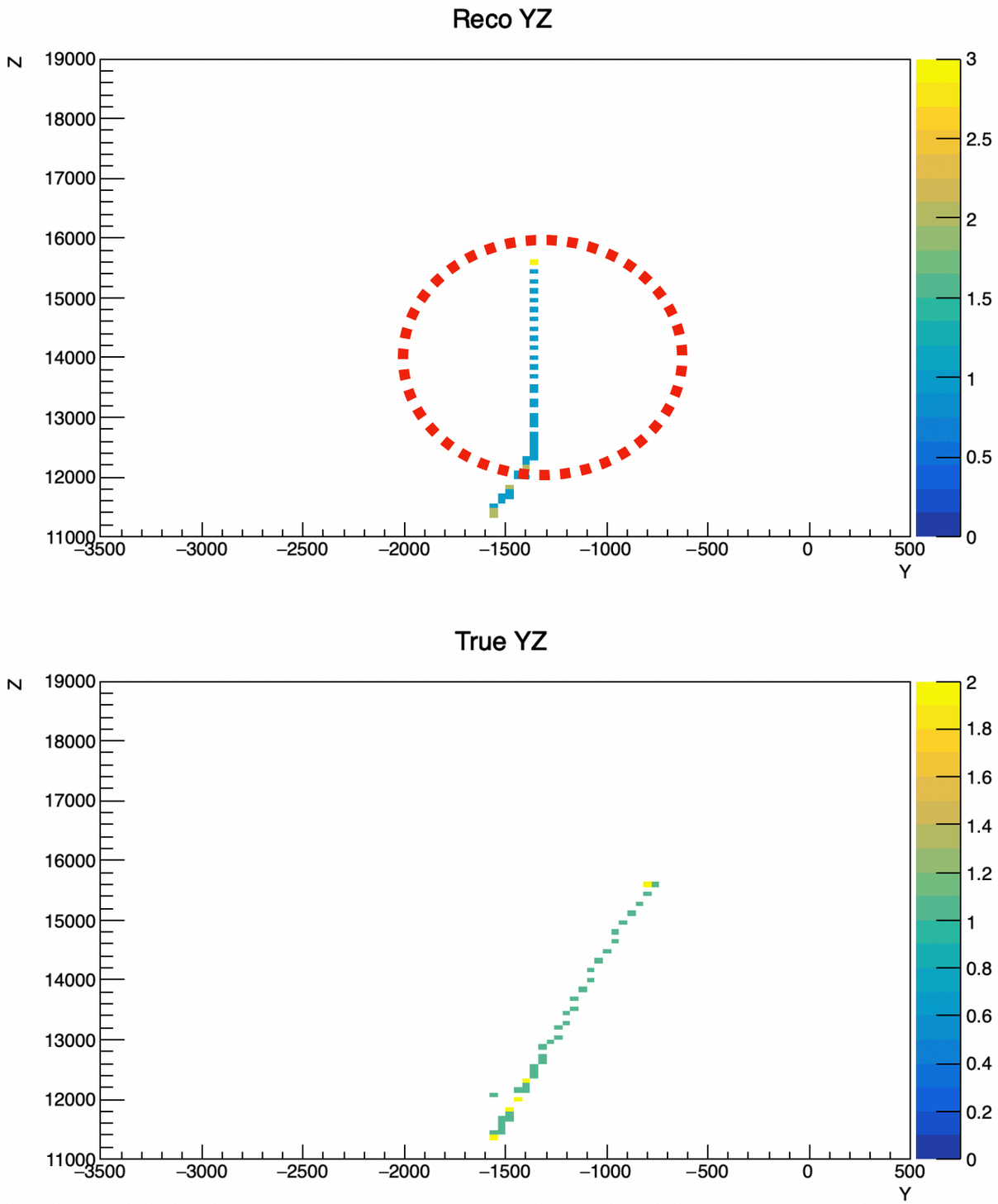


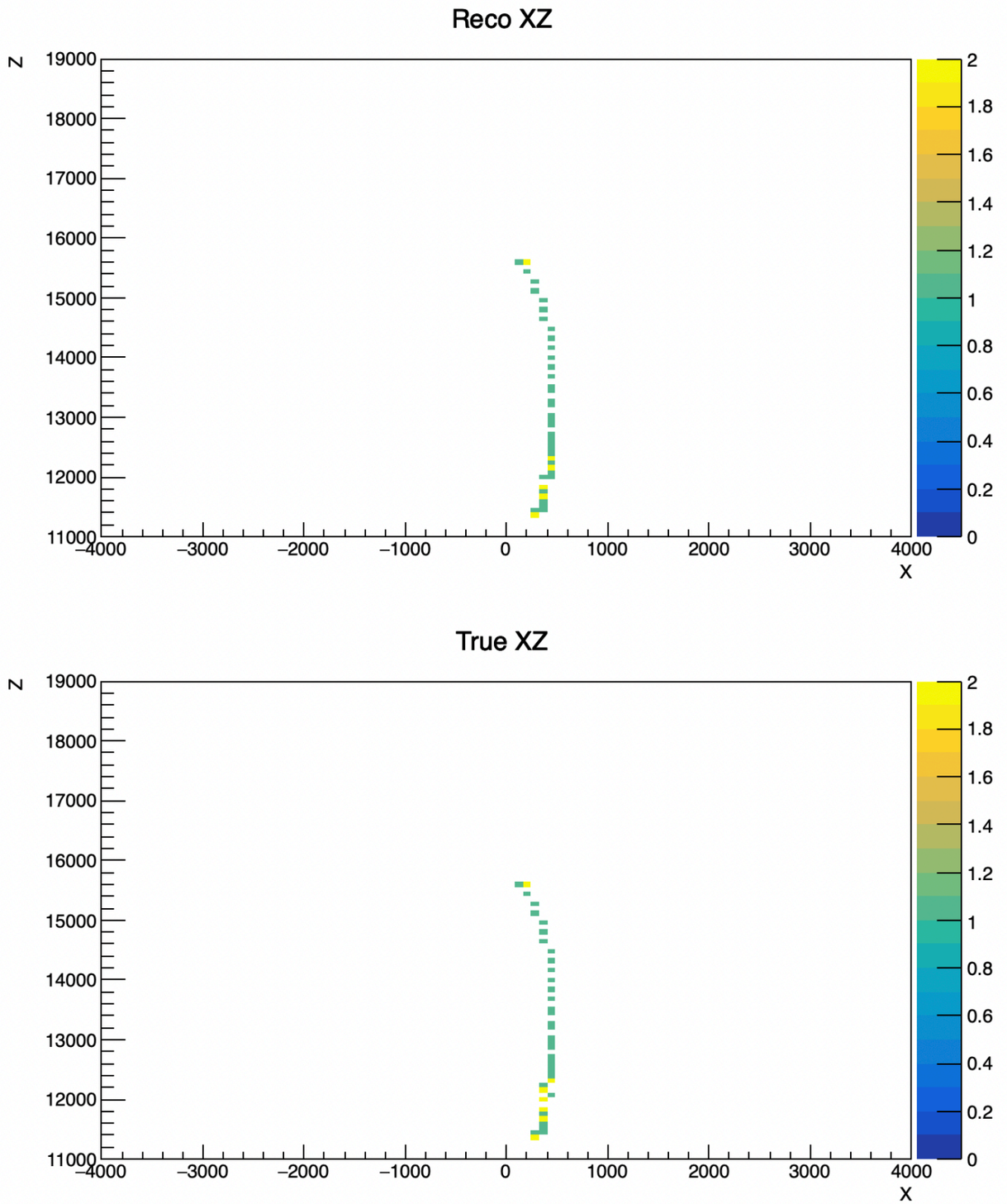






Event display

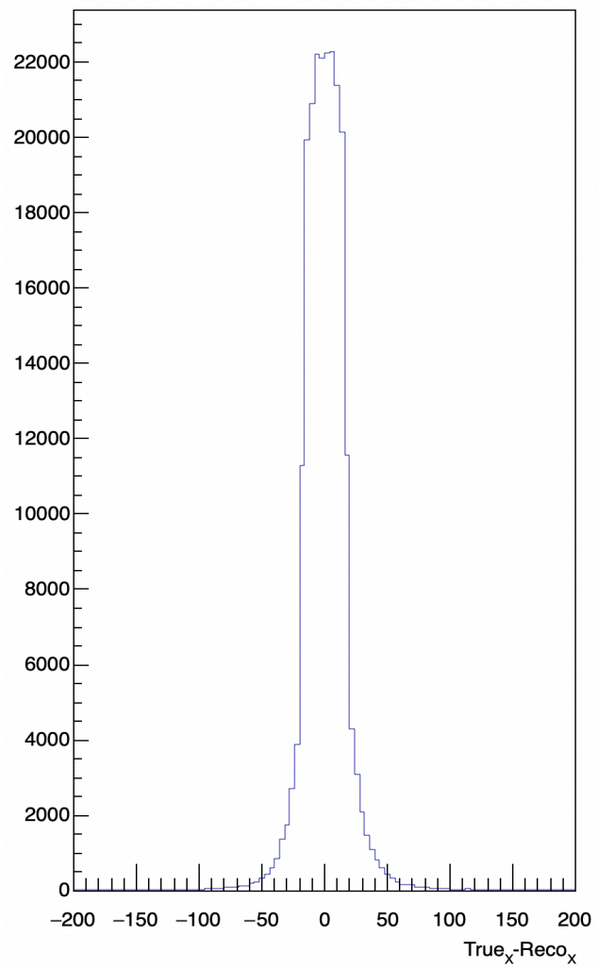


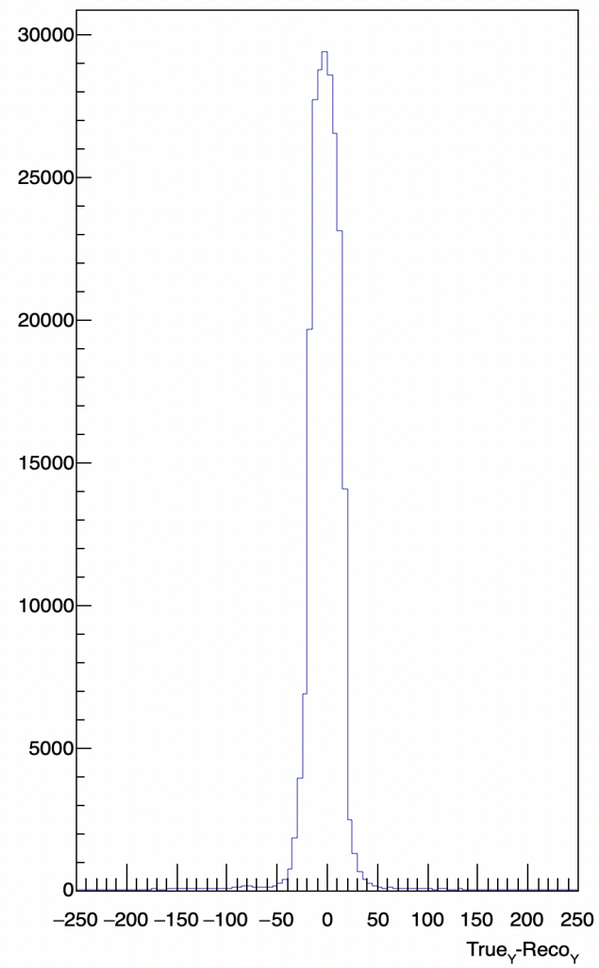


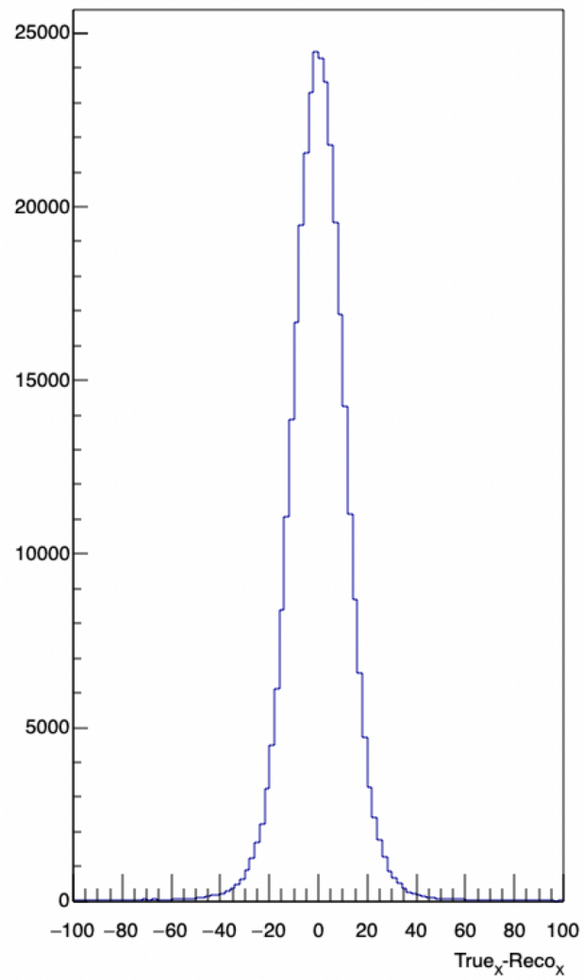
Track position

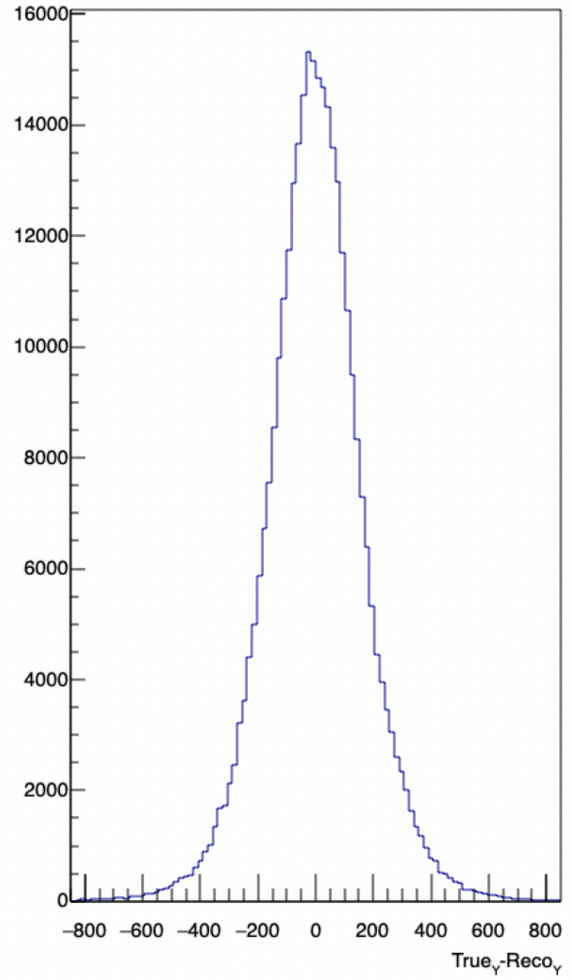
- Only consider the event with a single track and before the Kalman filter.
- Truth-Reco distribution of every point in the track.

XY layers, $\sigma_x = 86mm,\ \sigma_y = 77mm,$ UV layers, $\sigma_x = 14mm,\ \sigma_y = 184mm,$









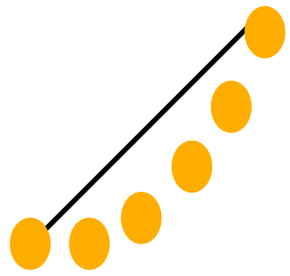
	Start X	Start Y	End X	End Y
XY	156.9 mm	66.2 mm	173.4 mm	171.8 mm
UV	20.9 mm	245.6 mm	33.7 mm	267.4mm

Charge ID & Stopping, exiting muon

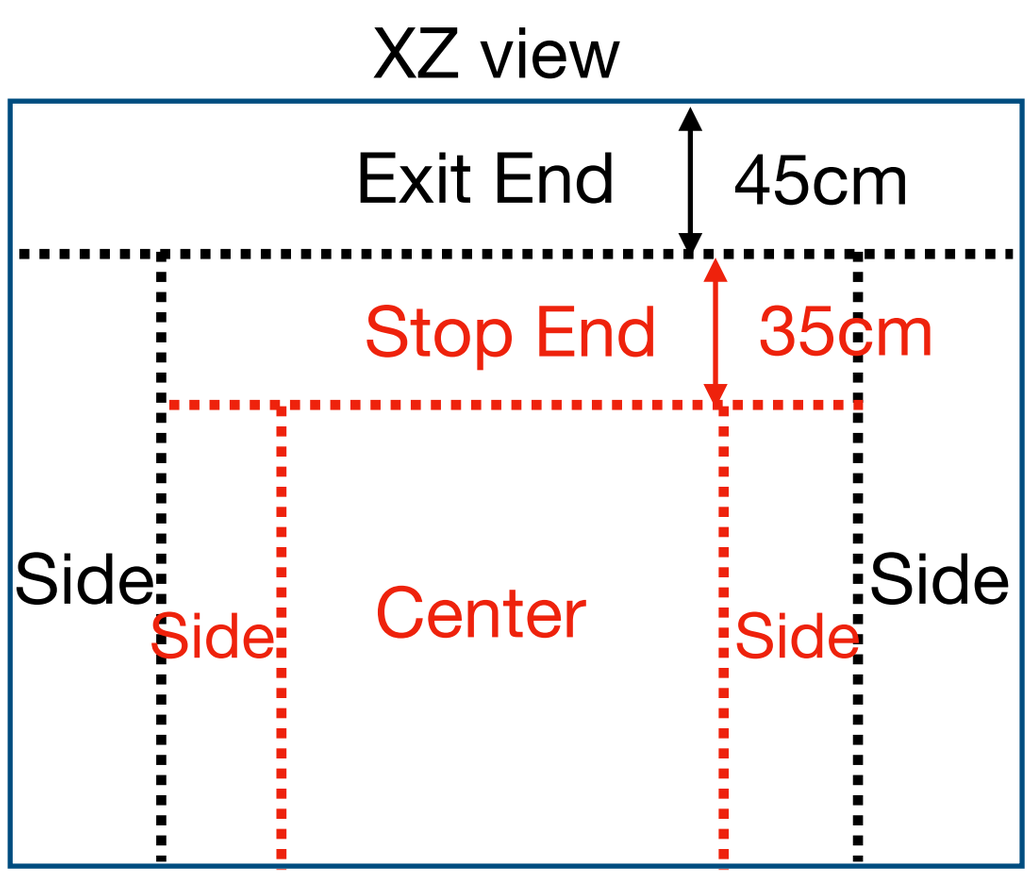
- Simply, charge ID can get by counting the number of hit one side of the line.

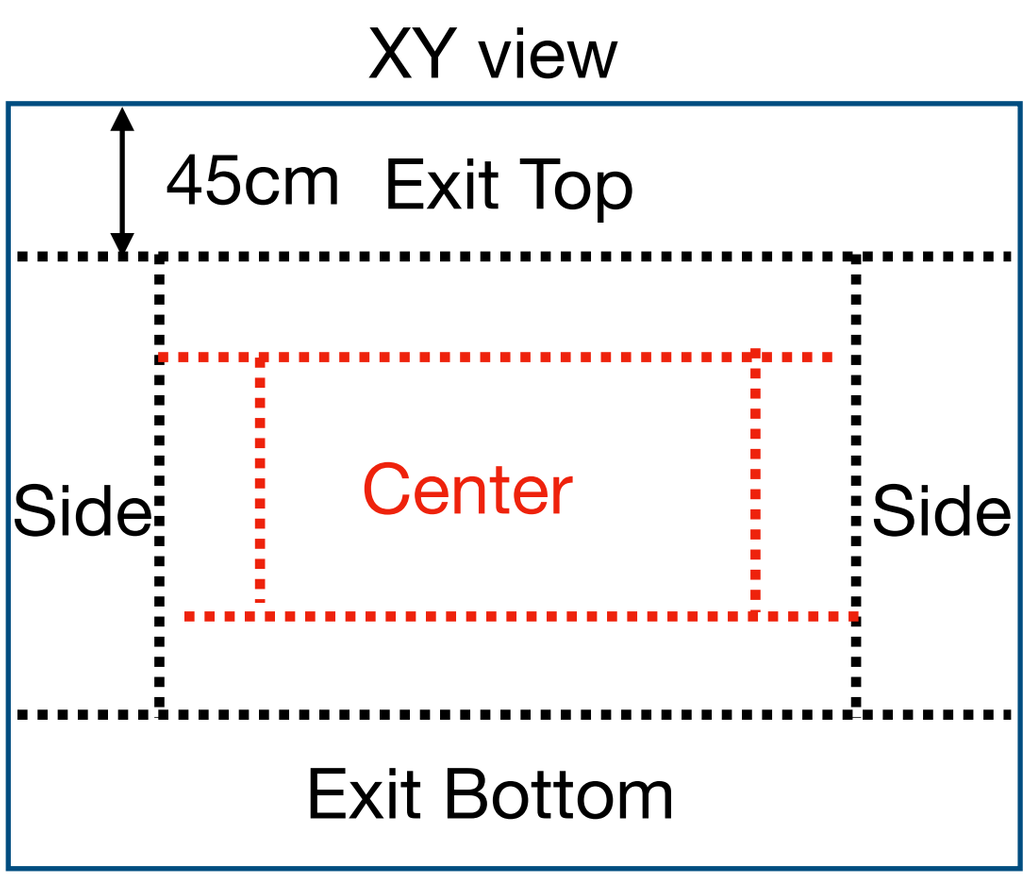
XY layer's Muon ID: (efficiency | purity): 0.93% | 0.99%

UV layer's Muon ID: (efficiency | purity): 0.94% | 0.99%



- For the stopping power, TMS is divided into 3 parts, side, top-bottom, and end by 45cm outer from the boundary.





Charge ID & Stopping, exiting muon

XY layer

Part	Accuracy	Stop_Effi	Exit_Effi	Stop Ratio	Exit Ratio	Total Ratio
Side	0.96	0.96	0.96	0.03	0.06	0.10
Top_bottom	0.95	0.96	0.94	0.13	0.17	0.30
End	1.00	0.96	1.00	0.01	0.21	0.22
Total	0.98	0.99	0.97			

UV layer

Part	Accuracy	Stop_Effi	Exit_Effi	Stop Ratio	Exit Ratio	Total Ratio
Side	0.96	0.90	0.97	0.03	0.10	0.13
Top_bottom	0.85	0.73	0.90	0.08	0.24	0.33
End	0.99	0.91	1.00	0.01	0.19	0.19
Total	0.93	0.90	0.94			

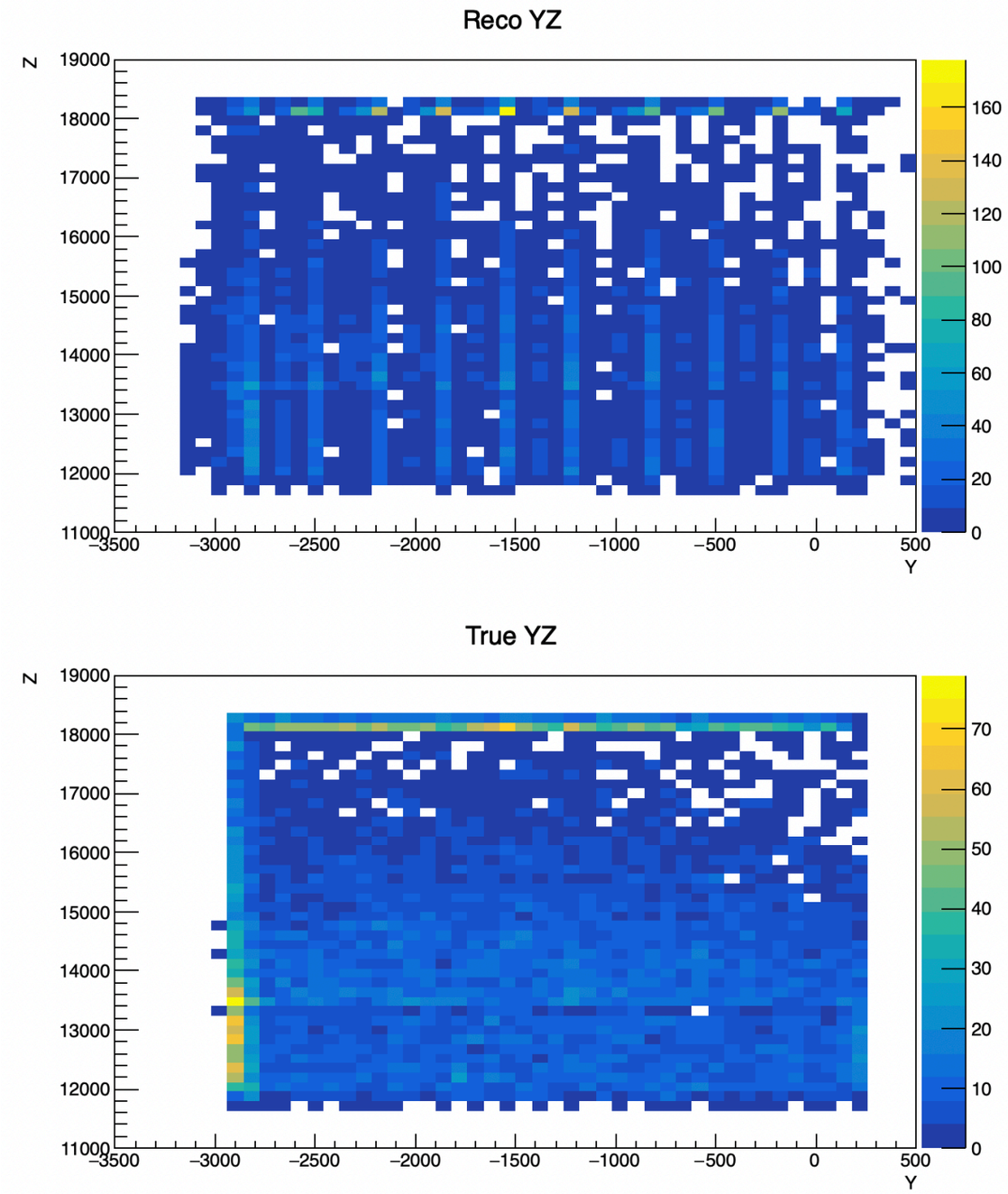
Accuracy = (True_Stop+True_Exit)/Total

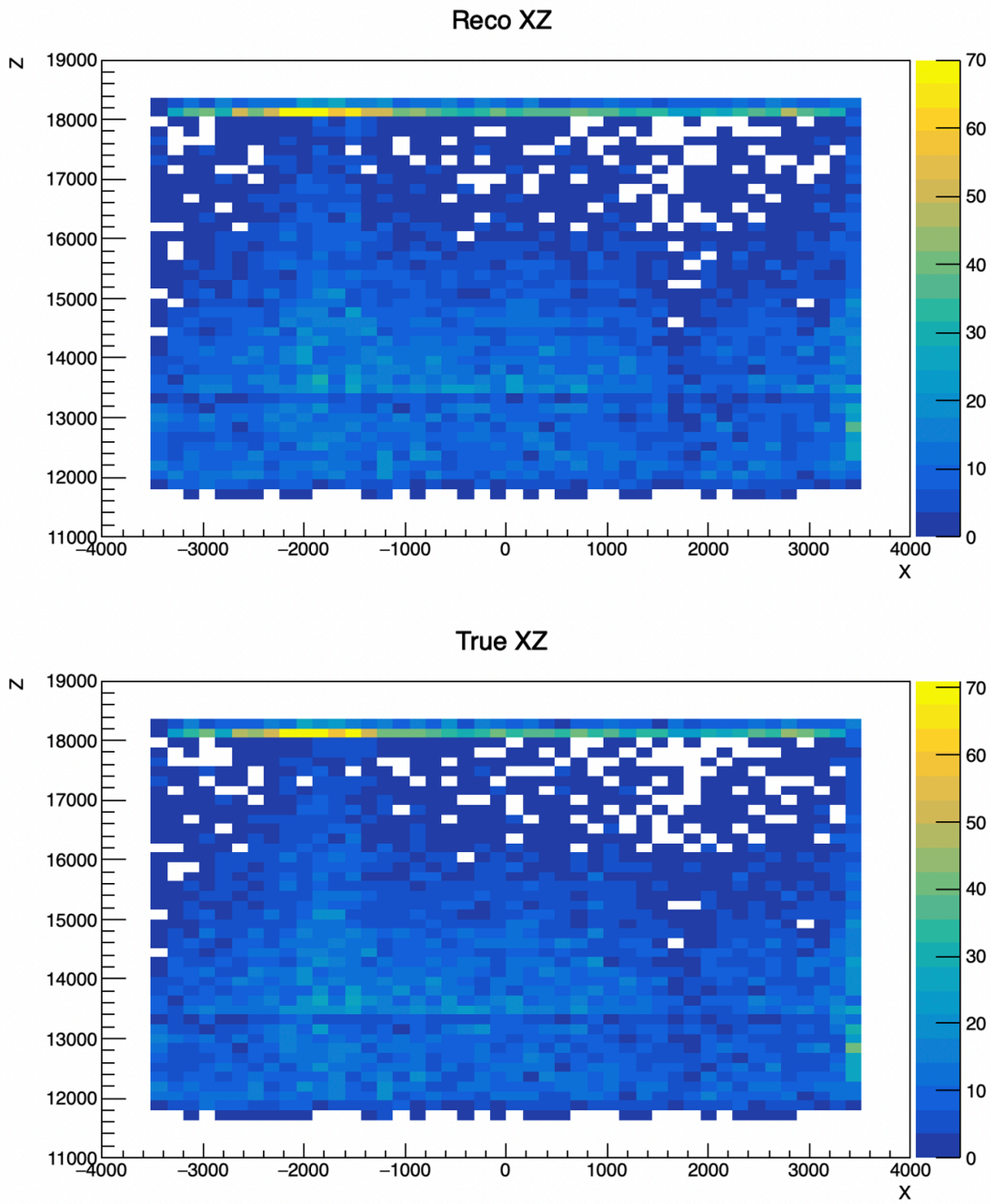
Stop (Exit) Efficiency = (True_Stop)/(True_Stop +False_Stop)

Note: These numbers somehow depend on the defined gap.

Some weird reco

- The end points from UV layers, the y potions are piled up at the edge of the y boundary whereas XY didn't show this.





Summary&Plan

- The Charge ID from the XY layer and UV layer are similar.
- The accuracy of stopping at the top and bottom edge is 95% for XY, but 85% for UV
- Check what makes these weird points and fix it.
- Why accuracy of stopping &exiting muon depends on the boundary.
- Do it again after applying the Kalman filter.