
Charge ID and stopping power with different layer configurations

Kiyoung Jung, Chris Marshall
(University of Rochester)

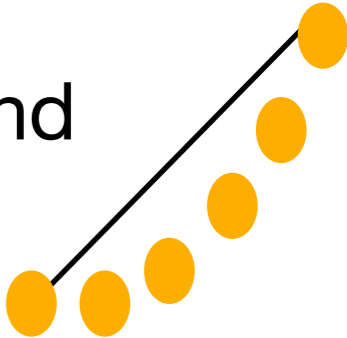


UNIVERSITY of
ROCHESTER

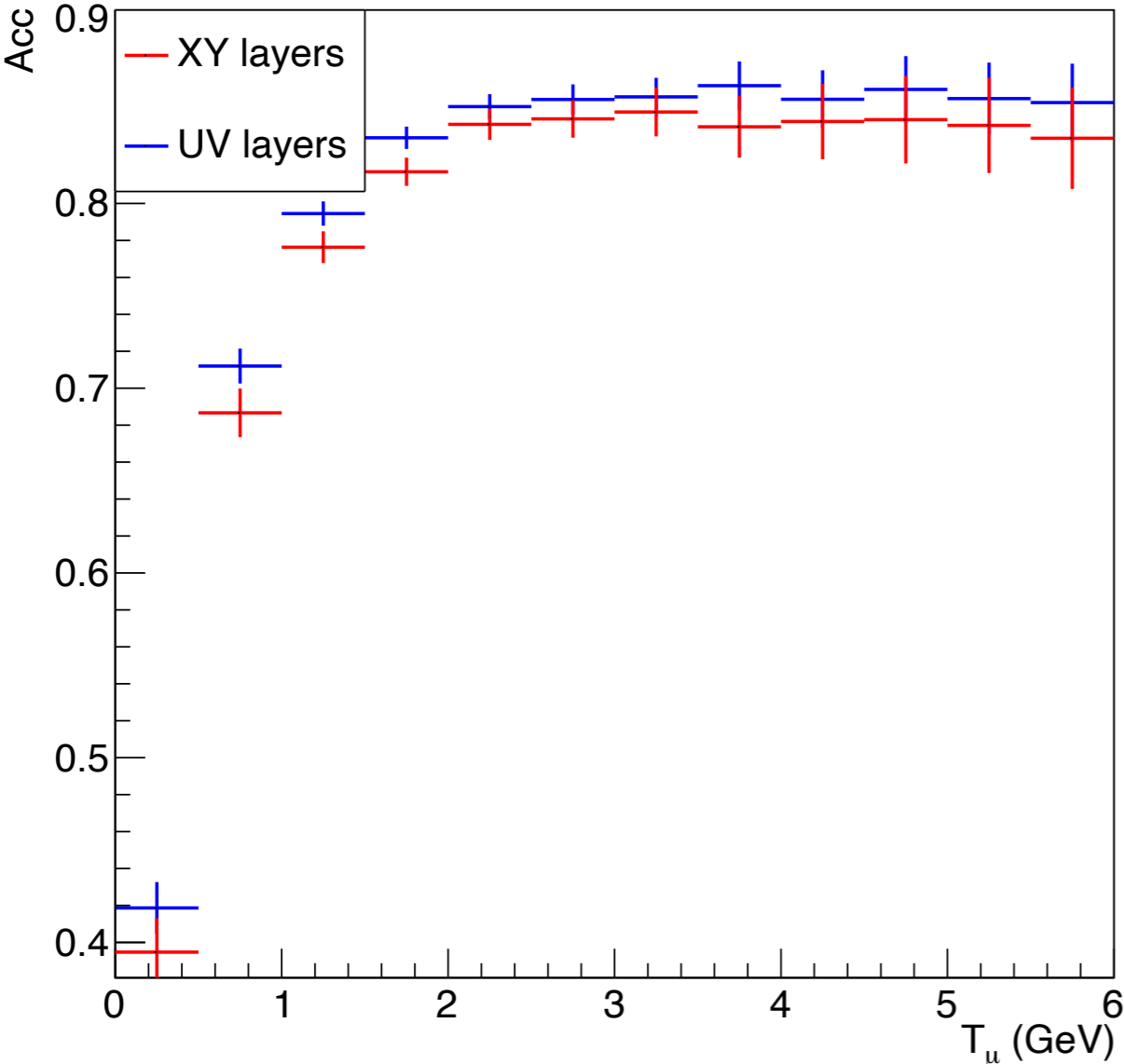
Dec. 3, 2024
TMS Meeting

Charge ID

- Compare the results between UV layers and XY layers.
- Select the event which has only one reconstructed track and $T_{\mu} < 6\text{GeV}$.



-> It has a difference, UV: 10%, XY: 6% of total events.



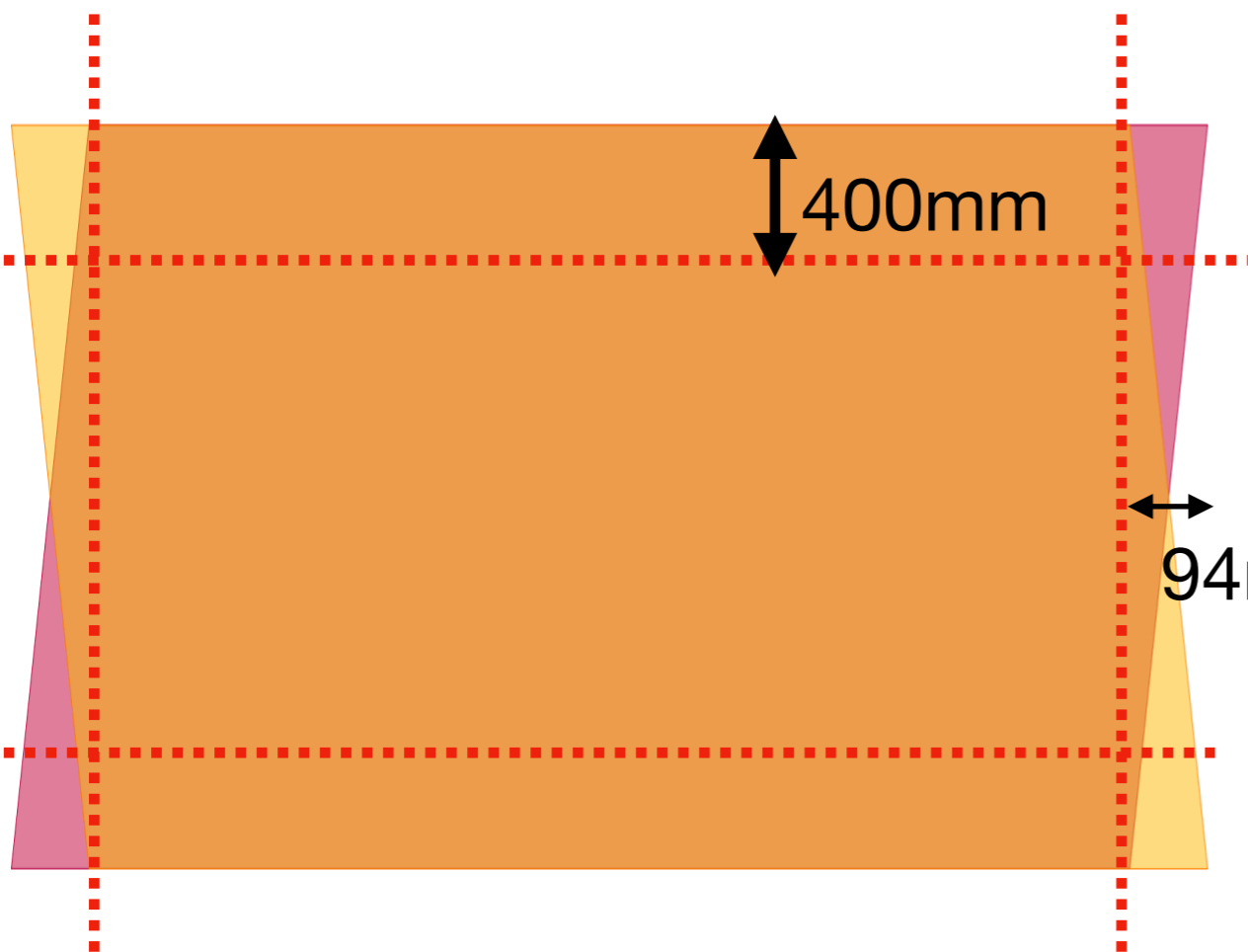
Total Accuracy
XY: 81.3%
UV: 82.4%

Stopping power

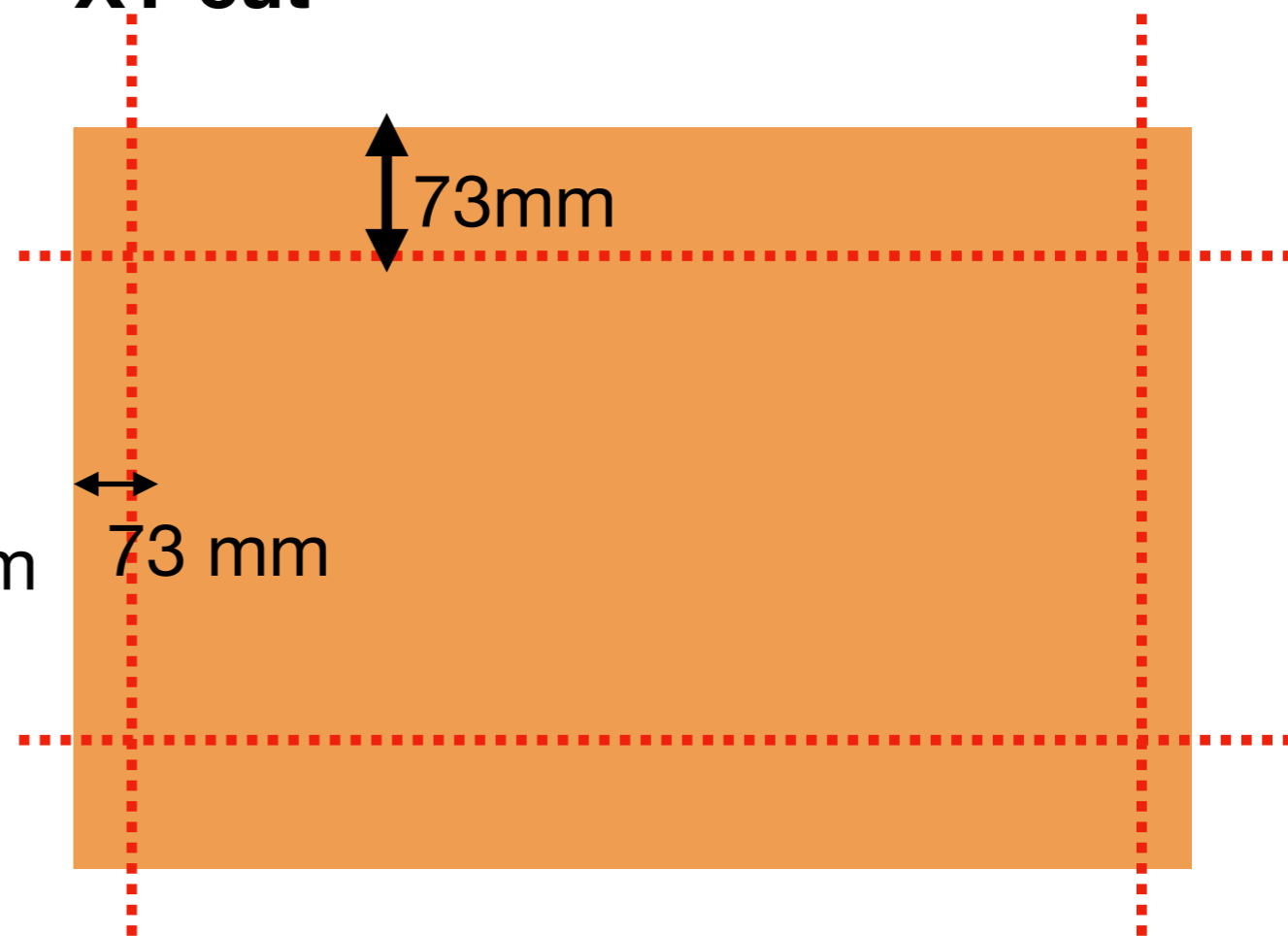
- Different volume cut was applied on the reconstructed hits:
- Z plane: approximately 2 plane far from the back $\sim 130\text{mm}$.
- Y plane: for XY, the width of two bars $\sim 73\text{mm}$, for UV, 400mm
- X plane: for XY, the width of two bars $\sim 73\text{mm}$, for UV, 94mm

Reconstructed hits are only consider within this volume cut, otherwise it exits!

UV cut

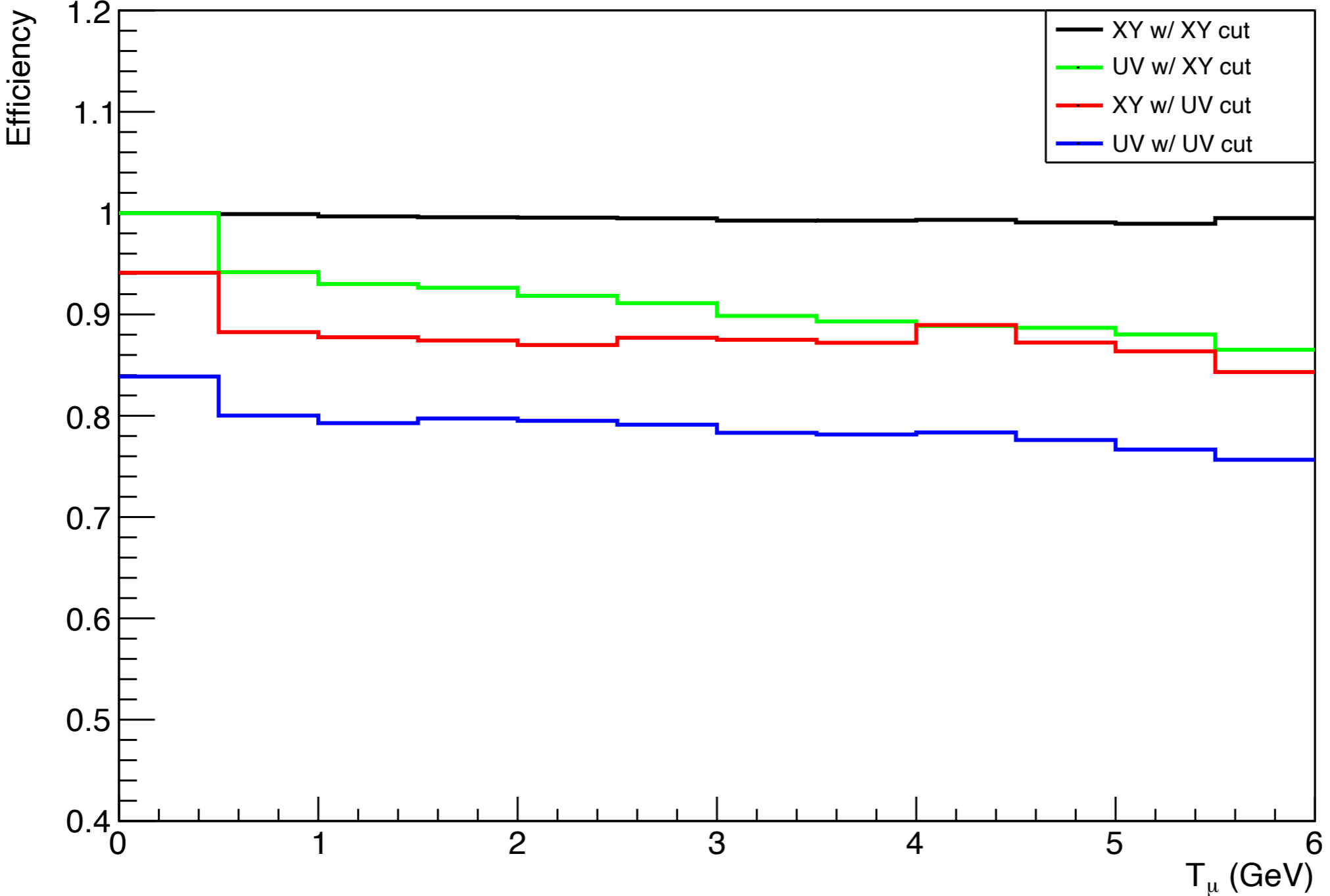


XY cut



Stopping power

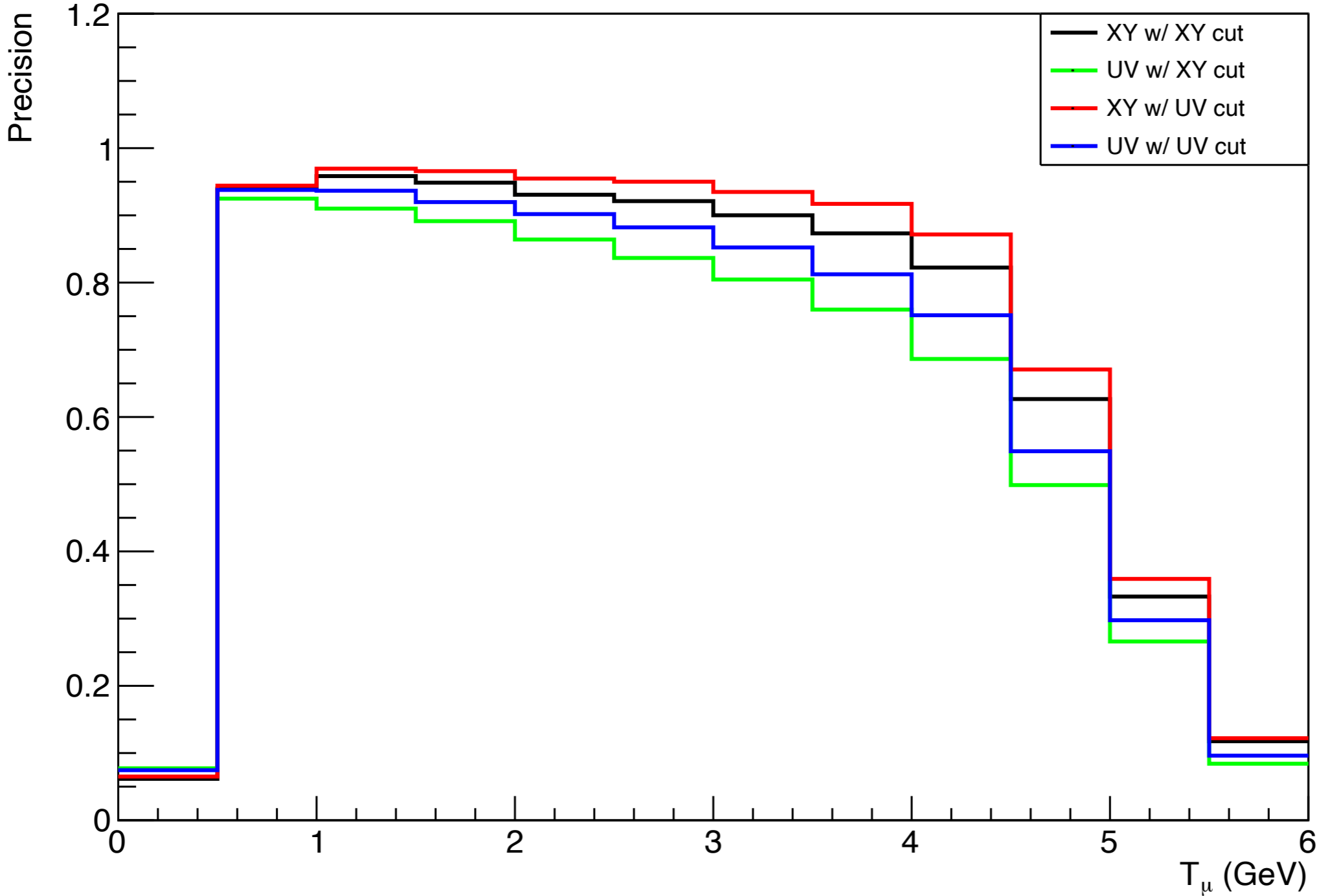
$$Effi = \frac{True\ stop}{True\ stop + False\ exit}$$



- As the volume cut gets tighter-> # of False exit get larger-> Efficiency is decreased.

Stopping power

$$Precision = \frac{True\ stop}{True\ stop + False\ stop}$$

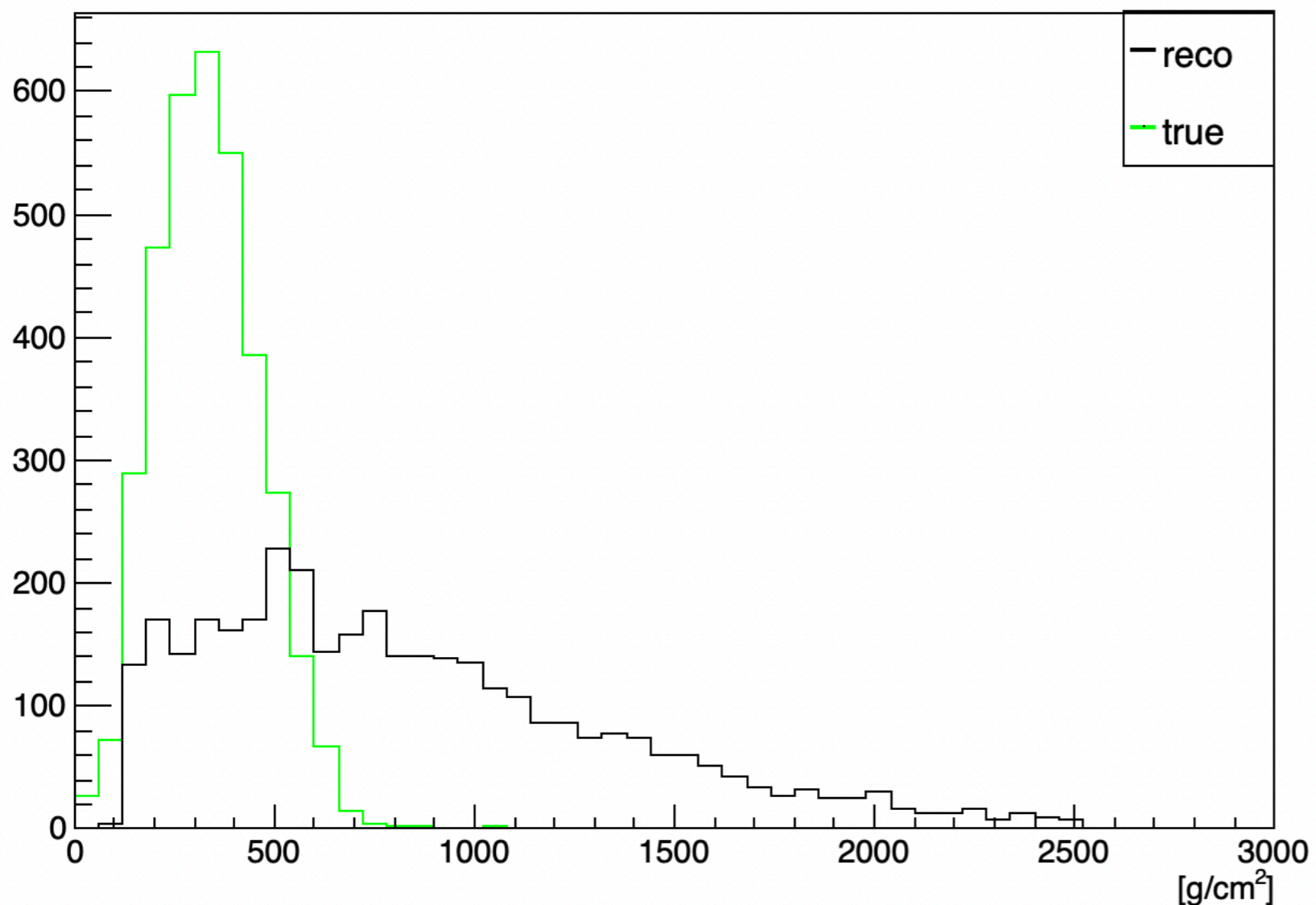


- In high energy muon, it is more likely to exit -> more false stop

Note> exit rate is also different after reconstruction, UV: 27%,XY:16%

Track Length

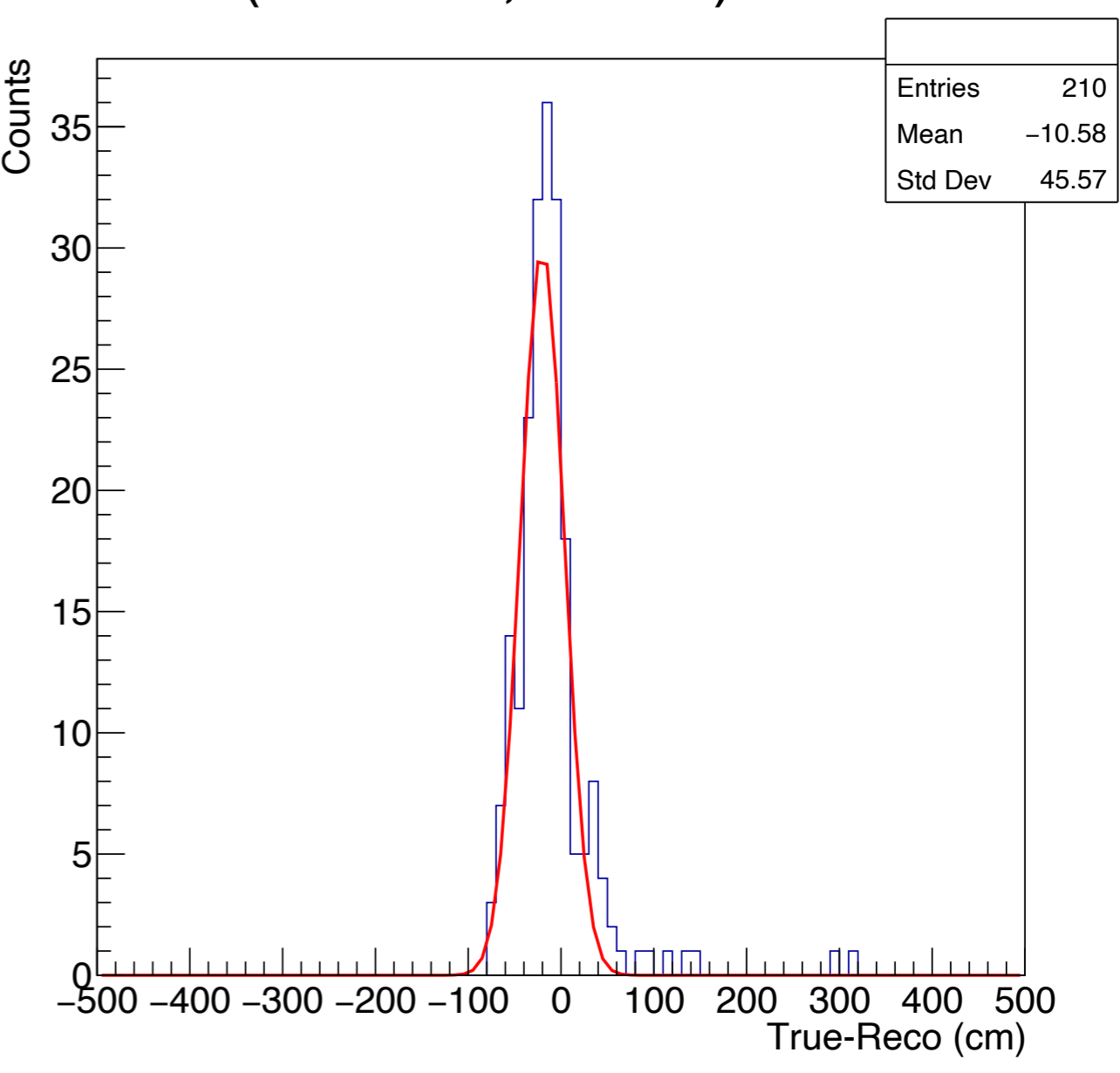
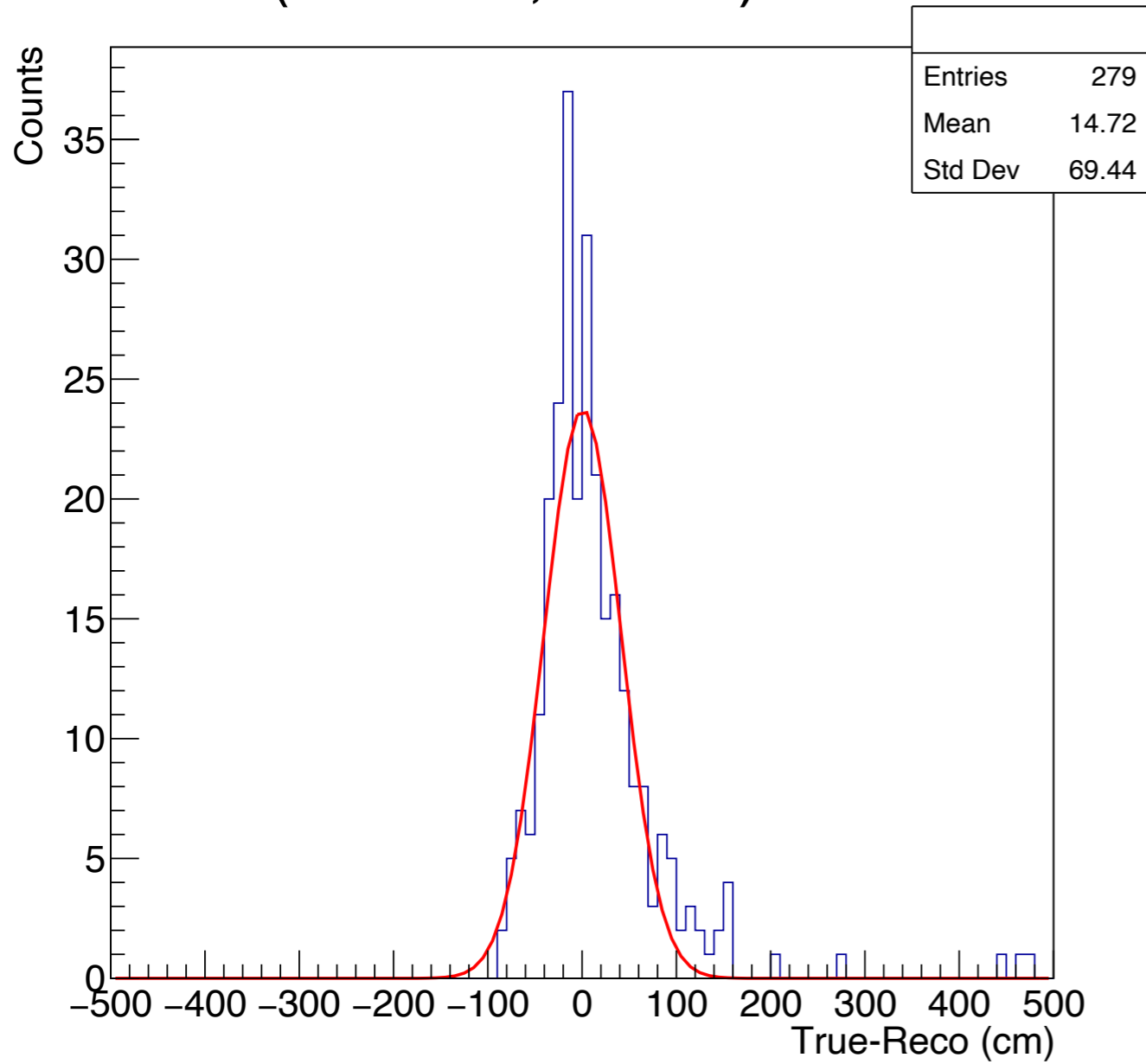
- Select only true-stopped events and earlier volume cut.
- Track length is defined as density*thickness (g/cm²) in the reconstruction.
- However, it doesn't seem like well-reconstructed.
- Therefore, just look at the length (cm) but ignore the Y position (2D).



Track Length

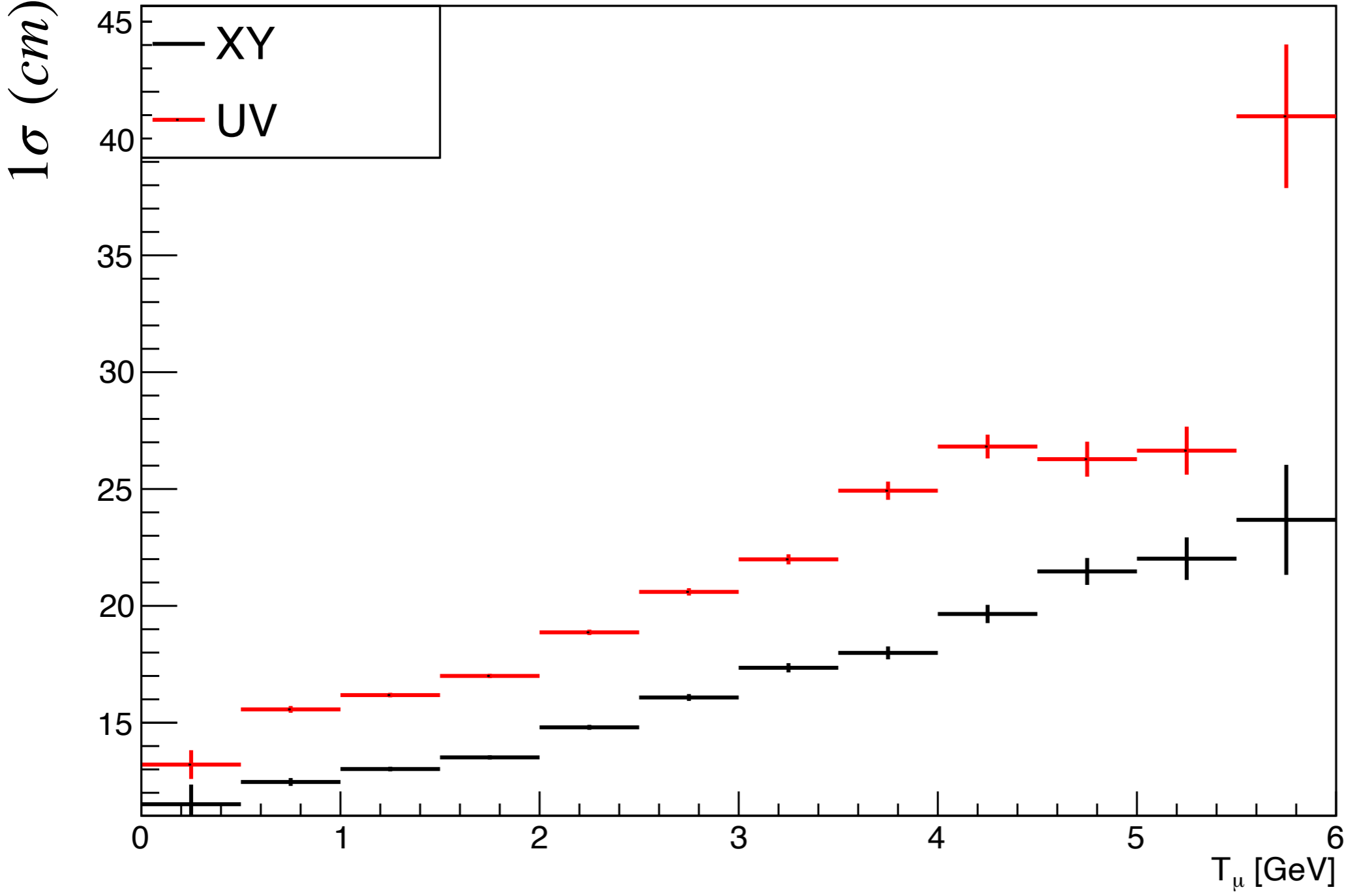
- UV (5.5 GeV, 6 GeV)

- XY (5.5 GeV, 6 GeV)

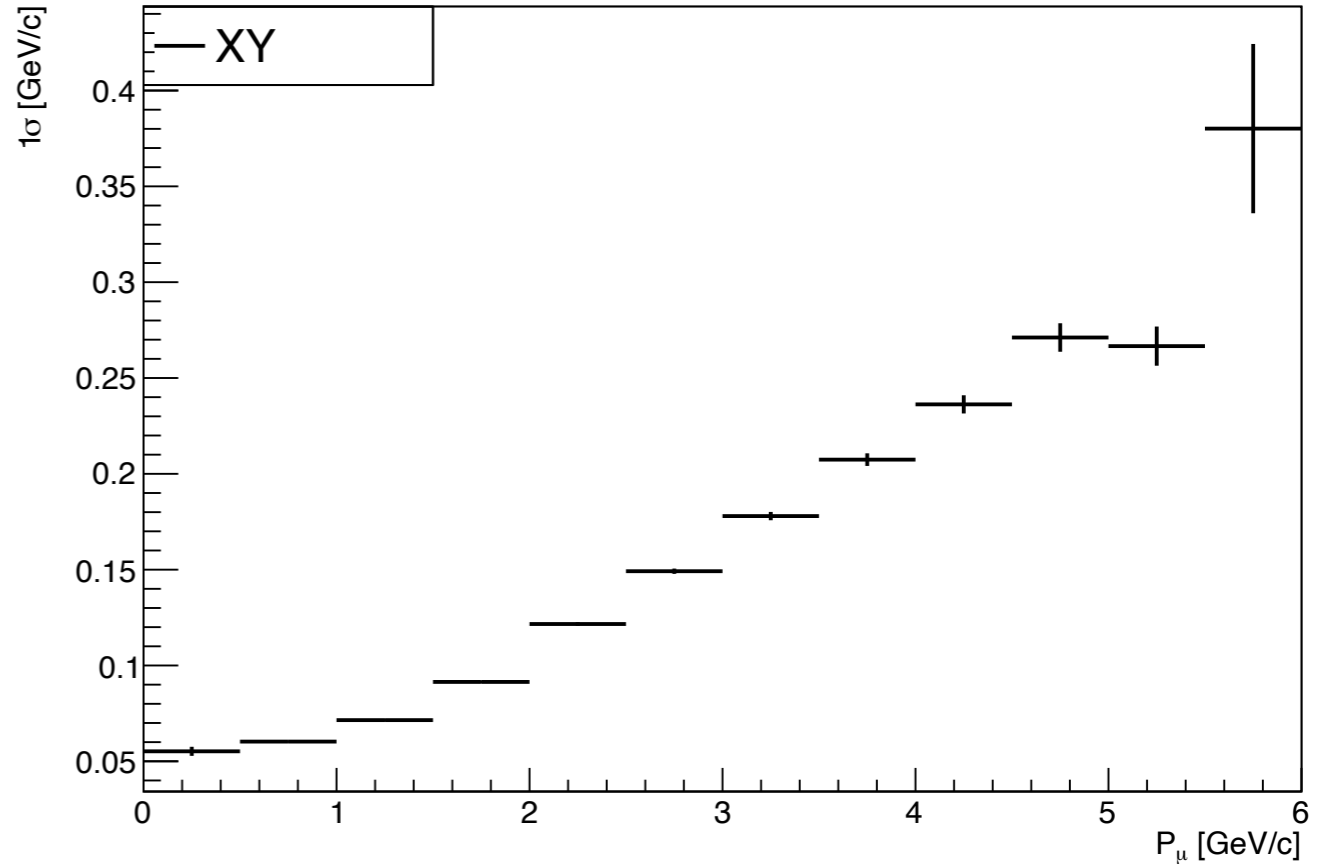
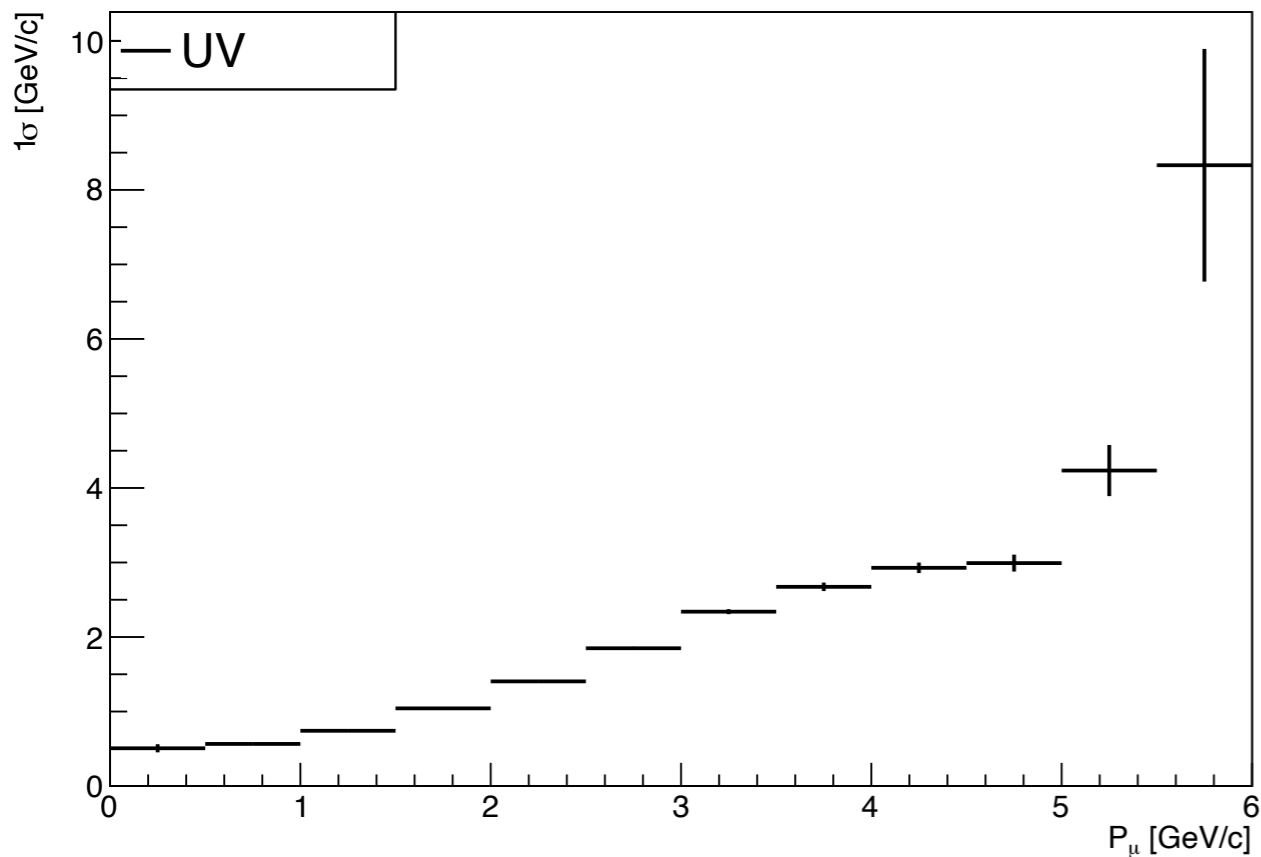


- Apply gaussian fit for each kinetic energy slice (0.5GeV) from 0 to 6 GeV

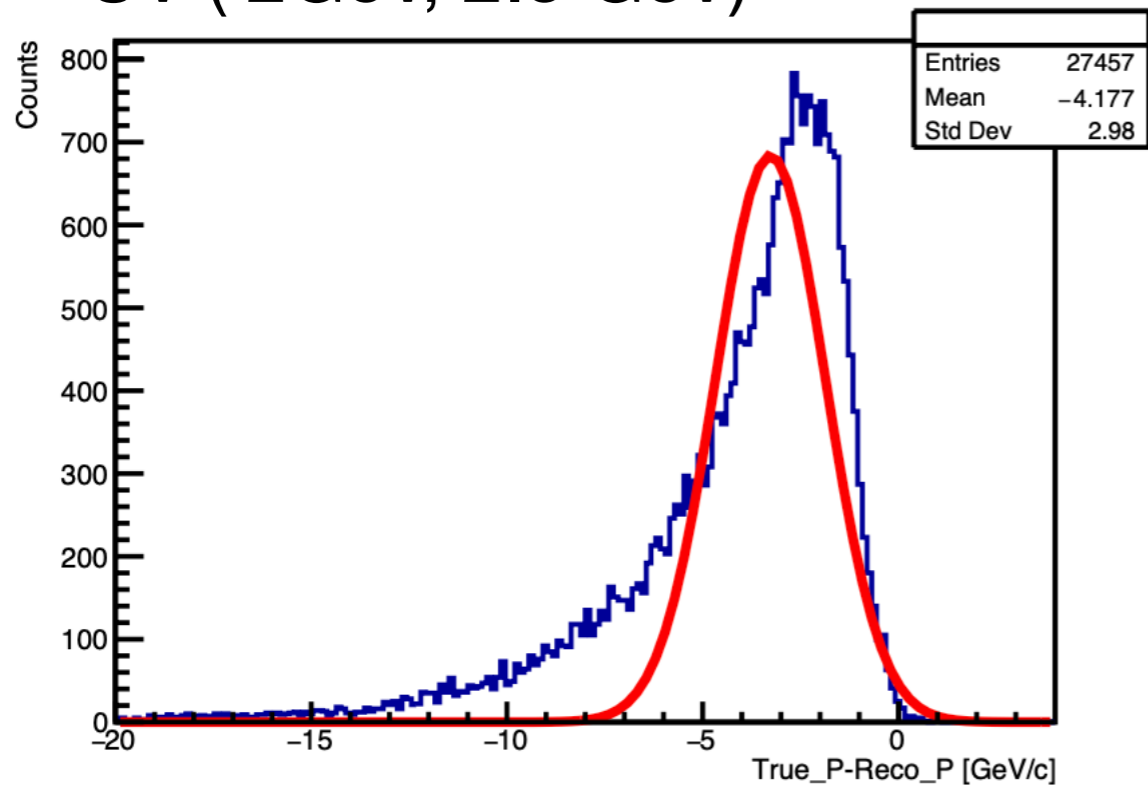
Track Length



Momentum from Kalman filter



- UV (2GeV, 2.5 GeV)



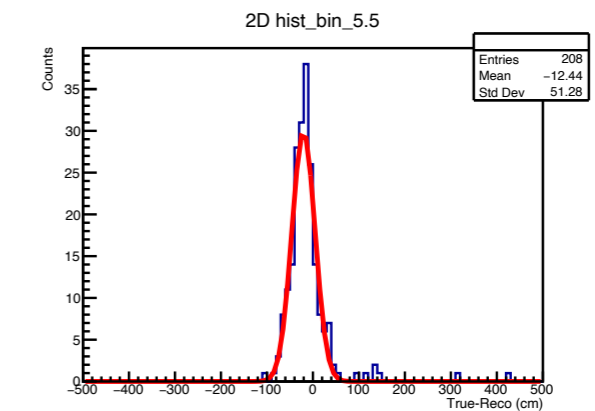
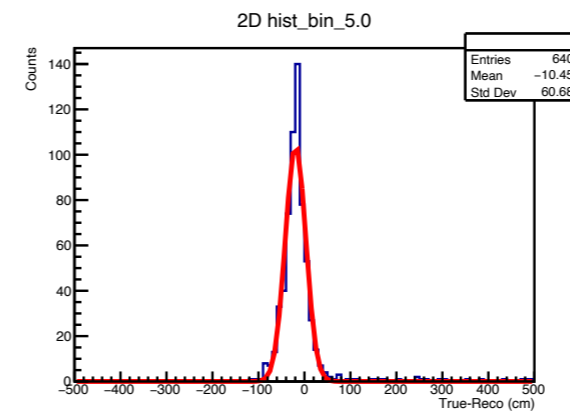
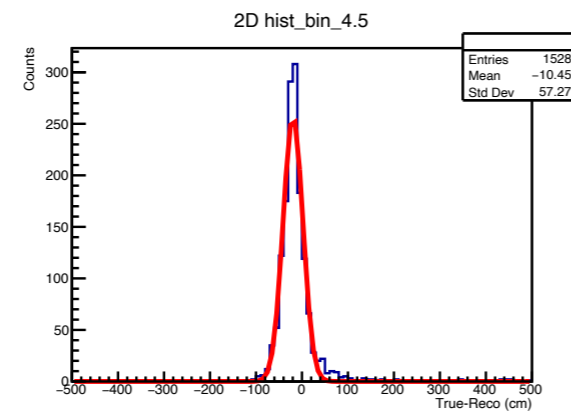
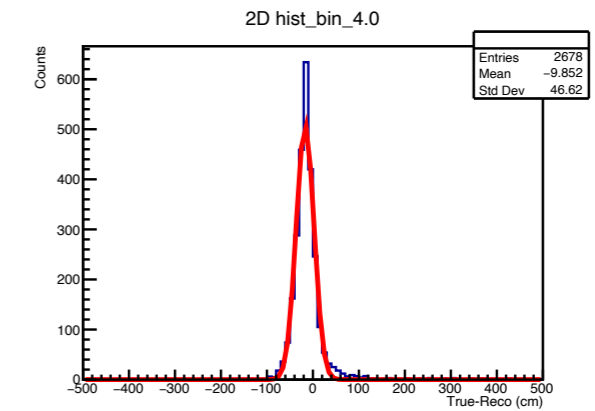
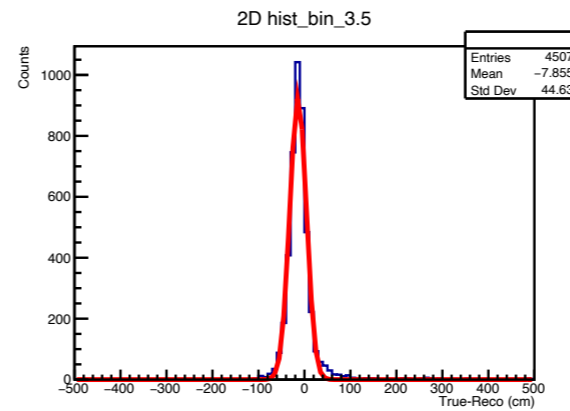
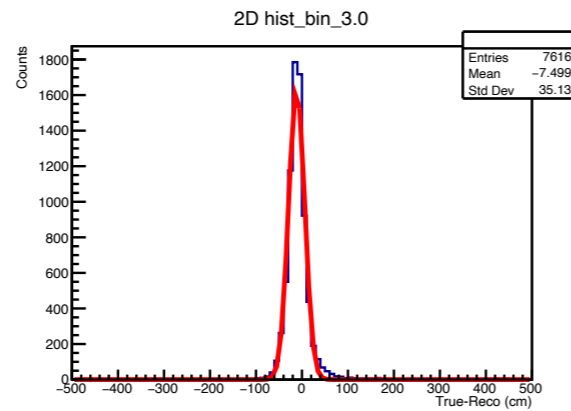
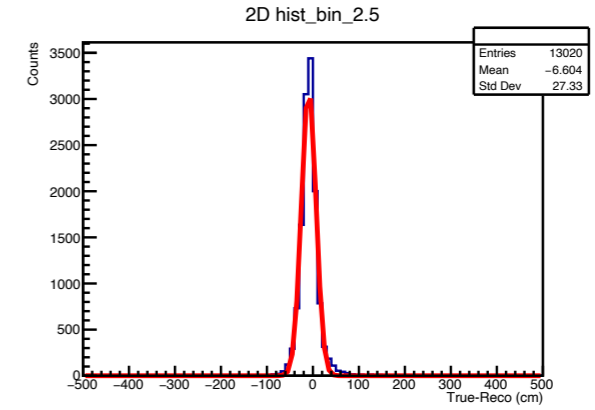
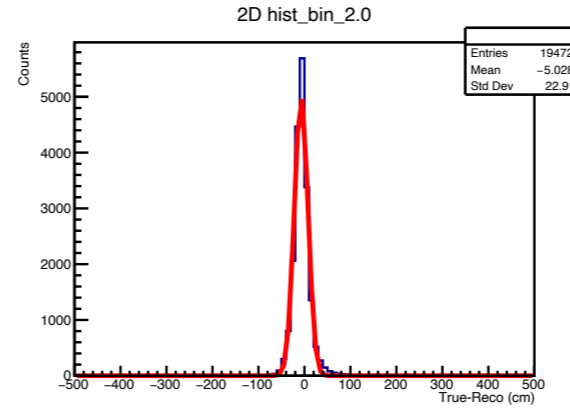
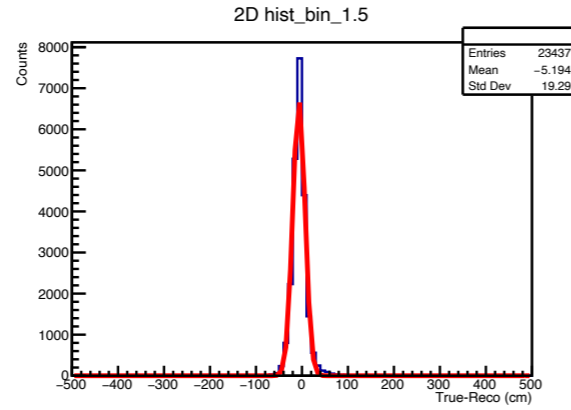
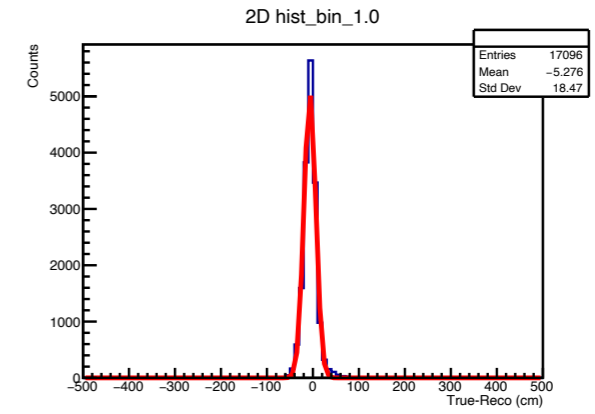
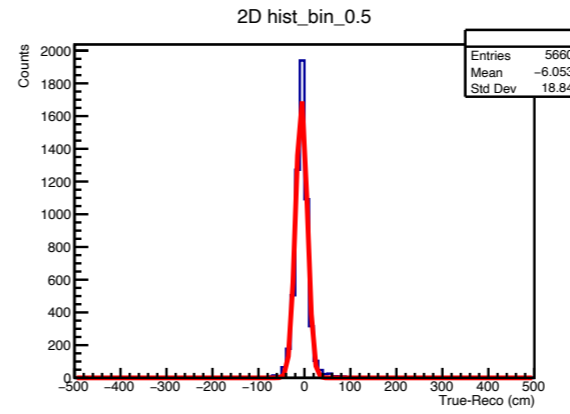
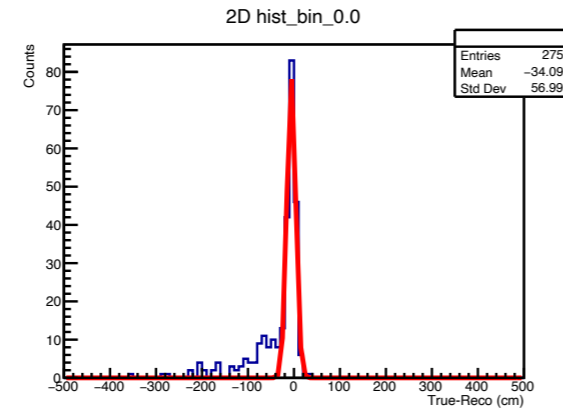
- Momentum from kalman filter doesn't work well for UV.
- The poor track length reconstruction in high energy affect on the momentum reconstruction.

Summary&Plan

- The Charge ID from UV layer is slightly better than it from XY layer.
- Stopping power is depend on the volume cut and XY layer is better than UY layer.
- Also, XY layer has better performance in reconstructed track length.
- Check the track length (density*thickness) and obtain the momentum from kalman filter again.

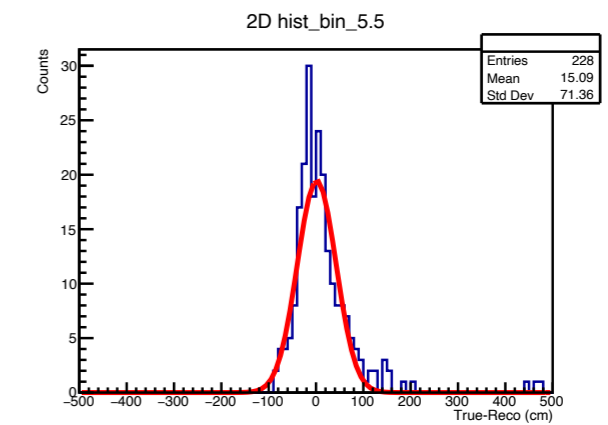
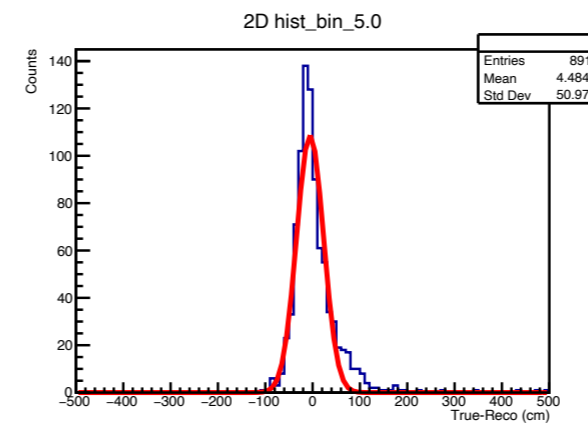
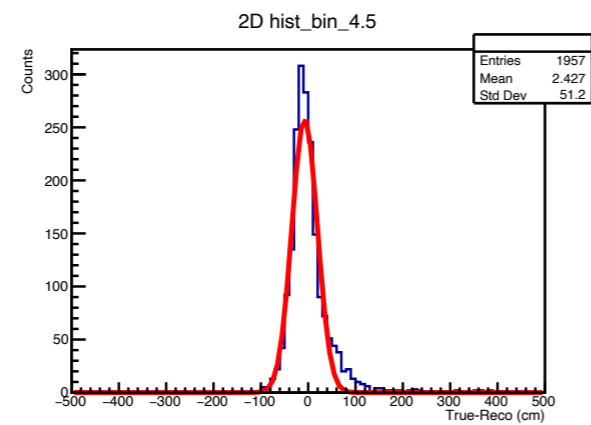
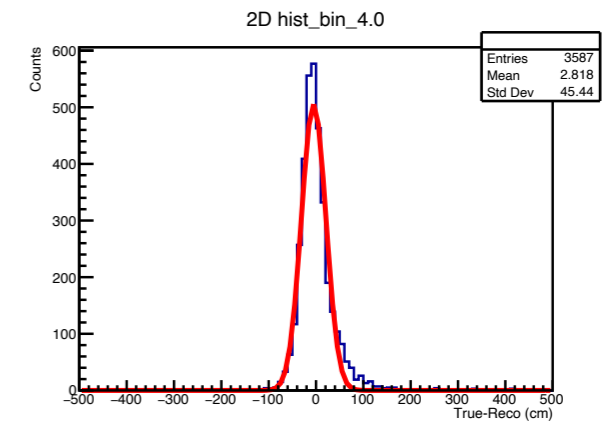
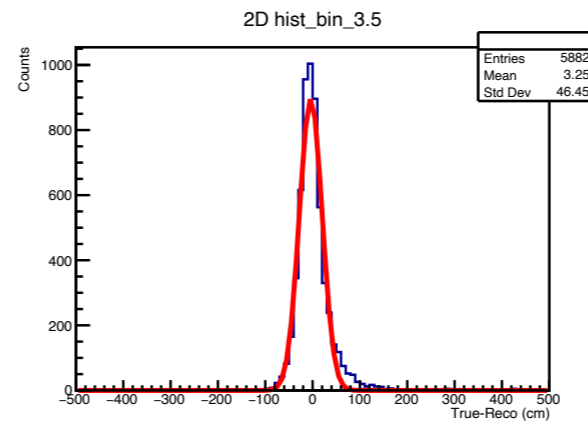
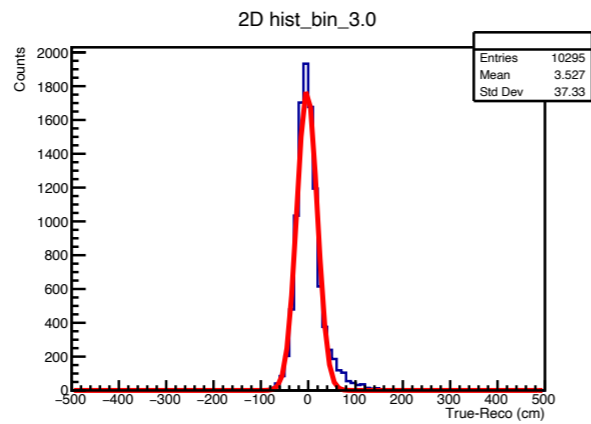
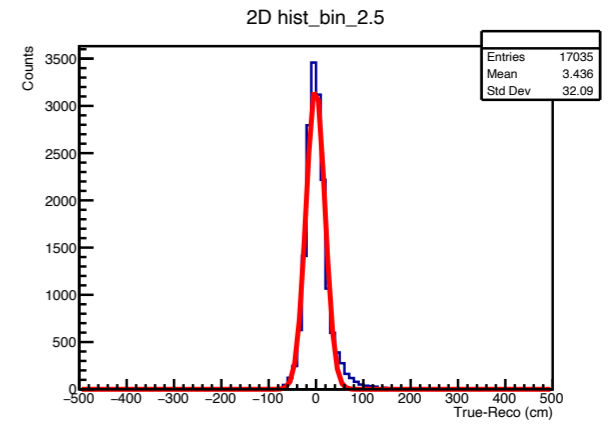
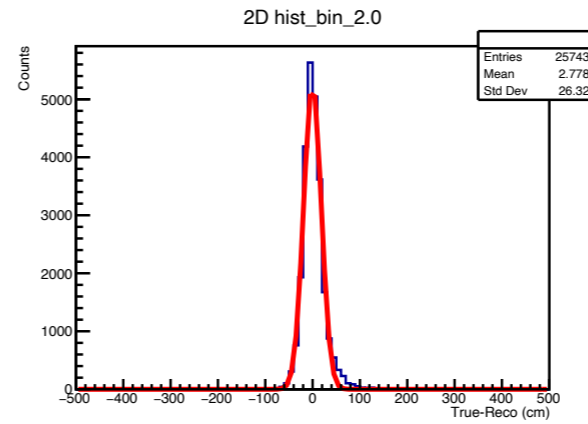
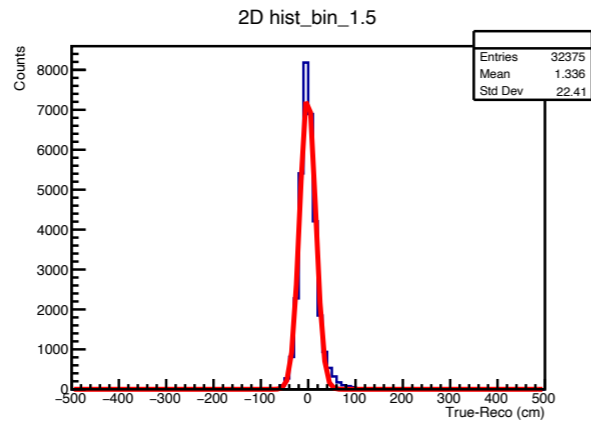
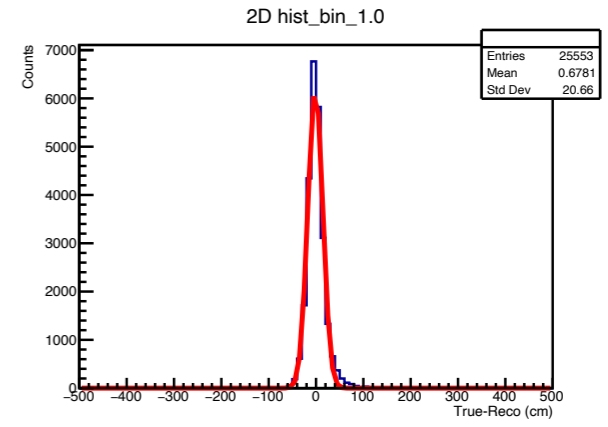
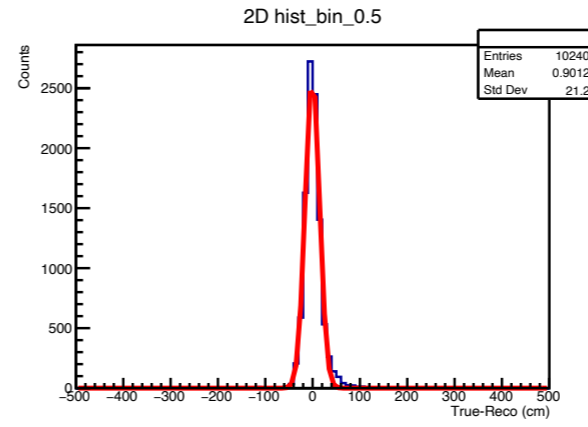
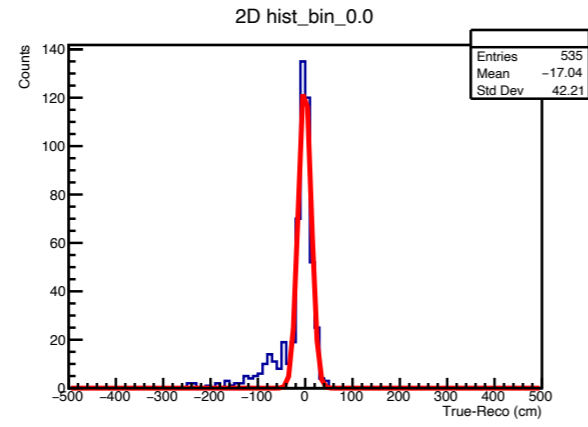
Backup

- XY layer



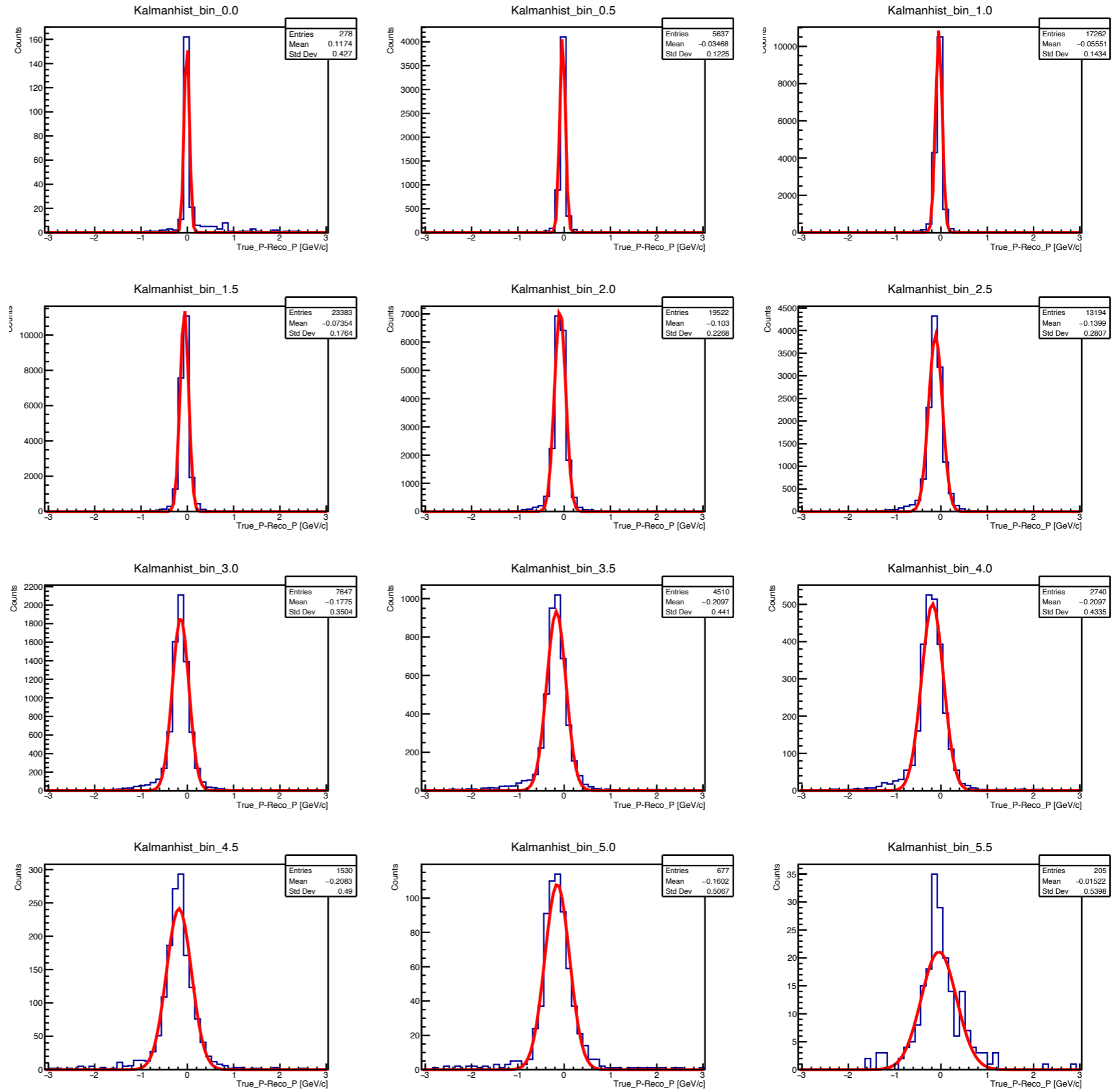
Backup

- UV layer



Backup

- XY layer with Kalman



Backup

- UV layer with Kalman

