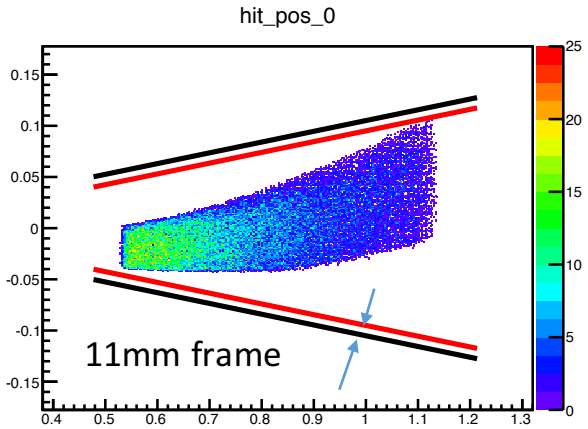
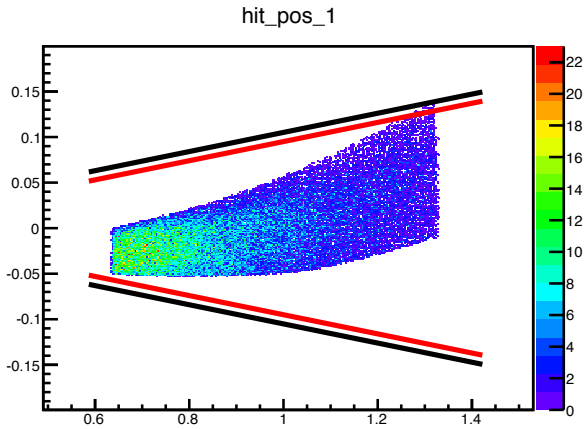
SoLID Tracking

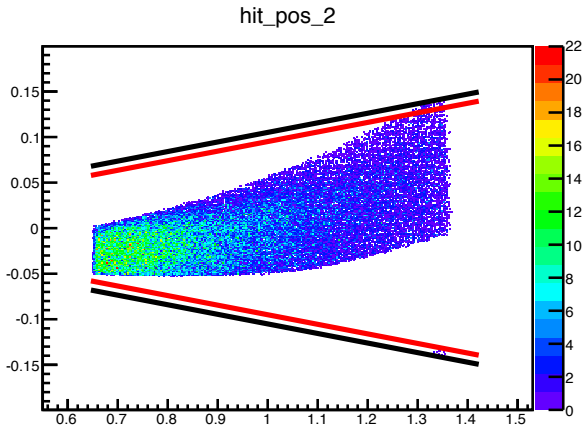
Weizhi Xiong

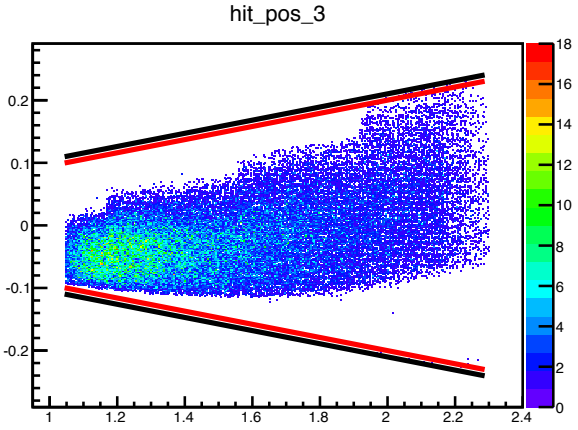
03/14/2017

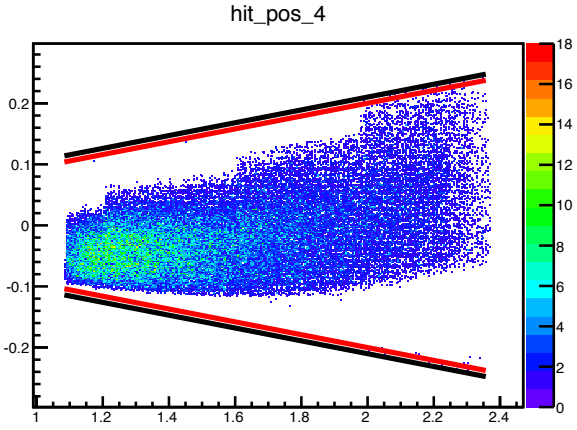
Triggered eDIS electron Position









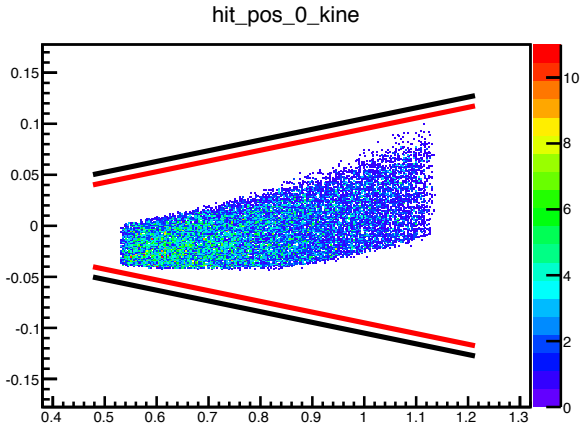


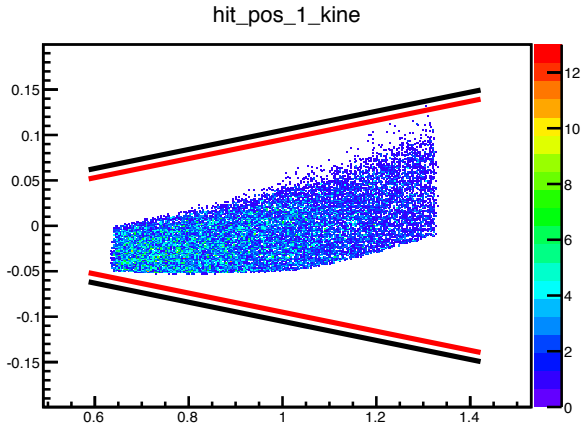
Trigger condition using info from EC:

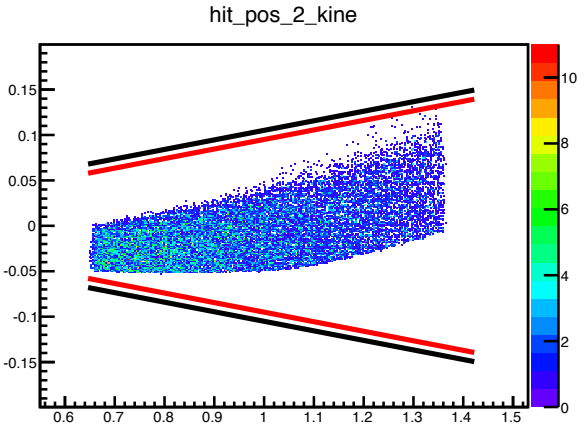
- 1.1 m< R <1.16 m : p > 3.8 GeV
- 1.16 m < R < 1.24 m : p > 3.5 GeV
- 1.24 m < R < 1.65 m : p > 2.5 GeV
- 1.65 m < R < 2.05 m : p > 2.0 GeV
- 2.05 m < R < 2.65 m : p > 1.5 GeV

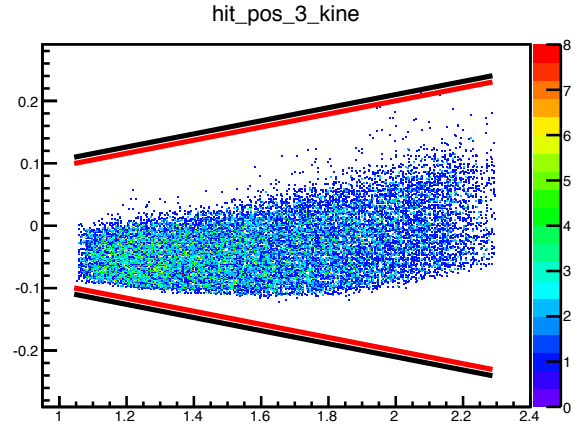
Hit position in chamber frame: x axis along the symmetric axis of the chamber

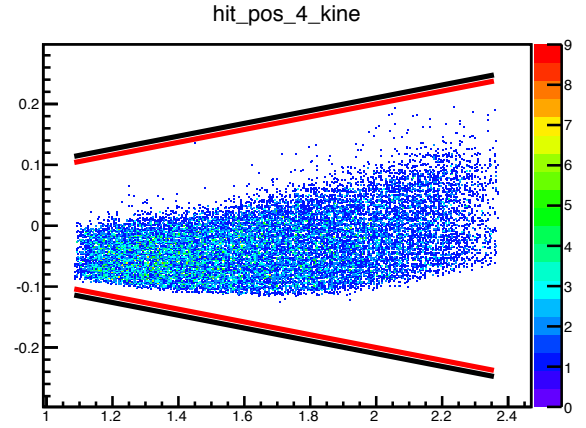
Triggered eDIS electron Position





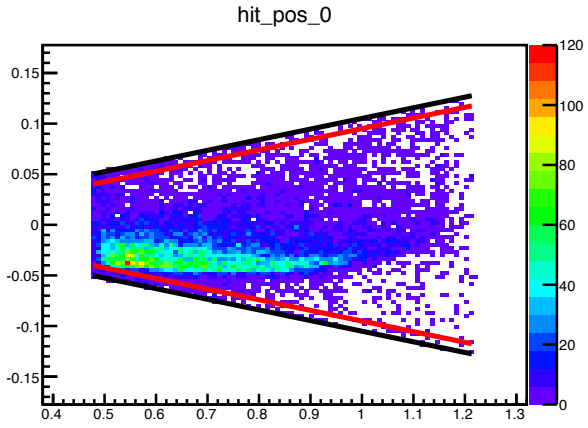


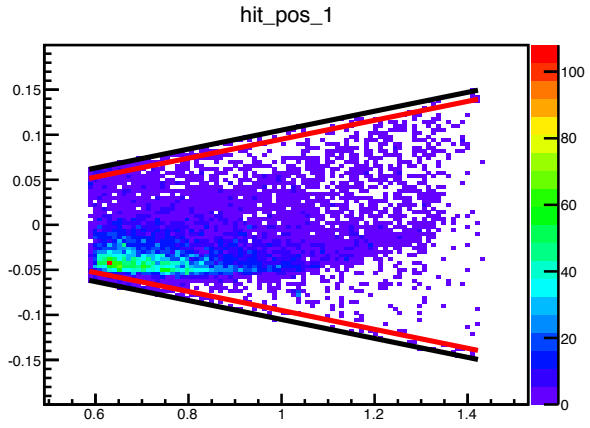


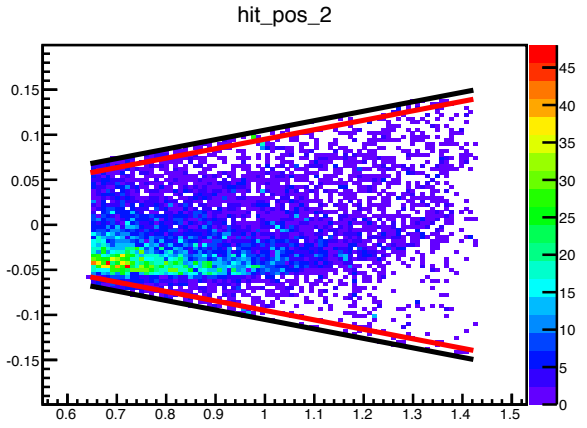


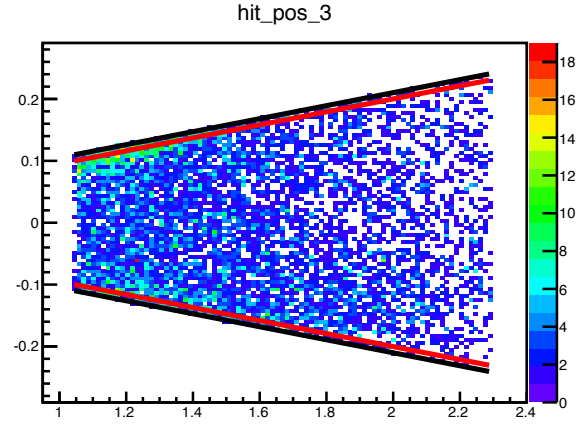
Trigger + kinematic cut of $Q^2 > 6$ GeV^2, W > 2 GeV and x > 0.55

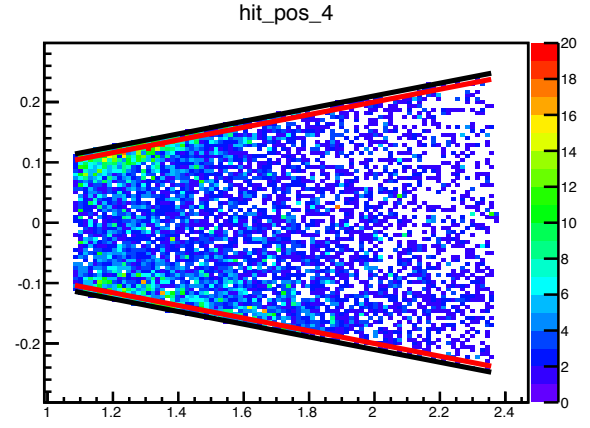
Background Hit Position







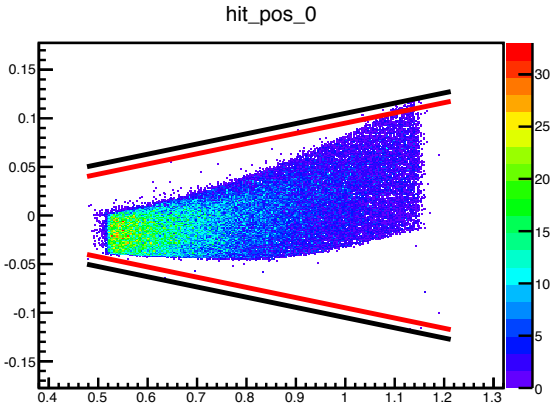


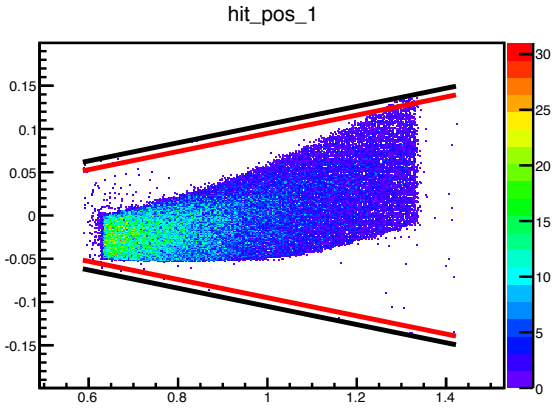


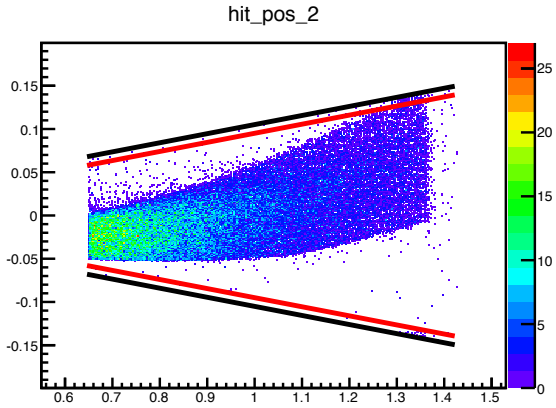
We can turn off the HV sector in many areas as the eDIS electrons only cover the central part of the chamber

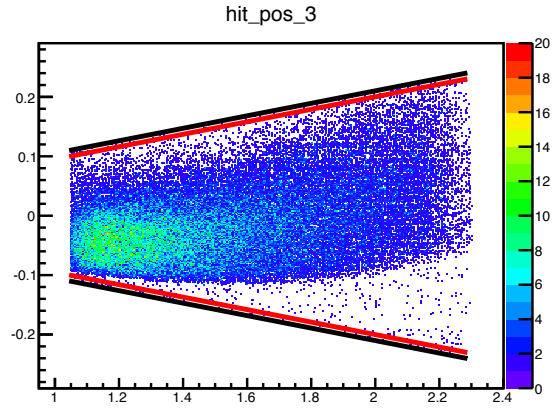
Also notice that the inner radii of the first two chambers are smaller than they need to be

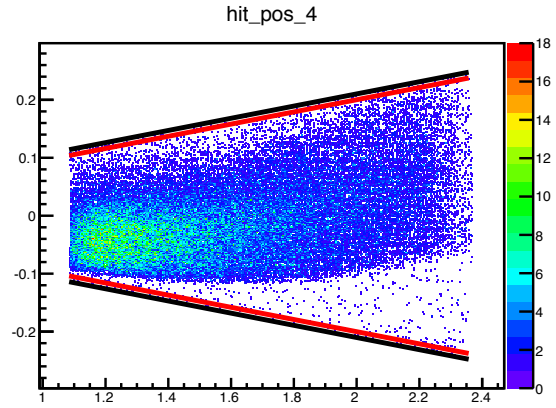
eDIS electron Position









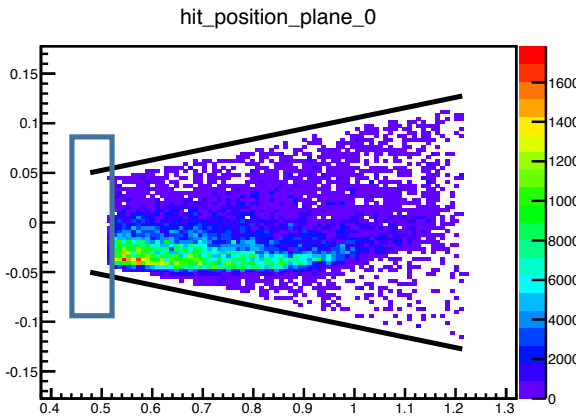


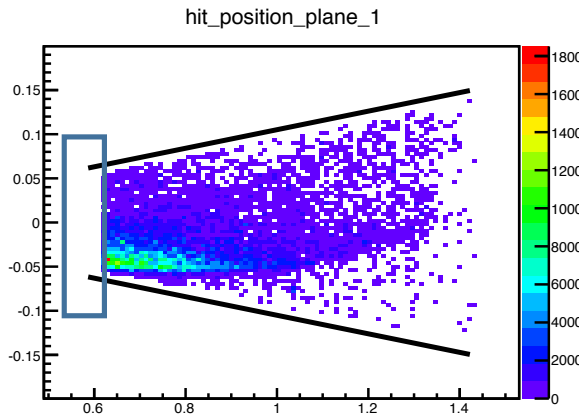
Hit position of all eDIS electron coming from the target, not trigger and kinematic cut, seems the inner radii of the first two trackers are still too small

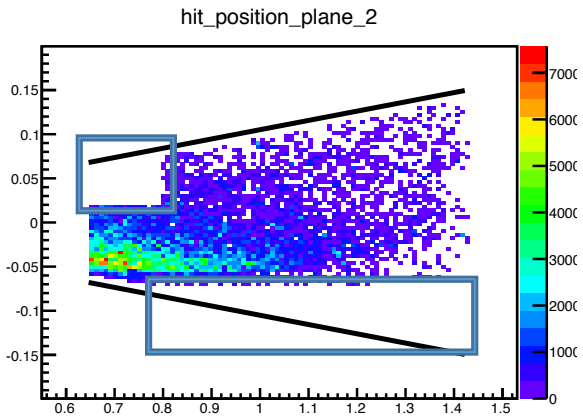
Turn off HV sector in Digitization

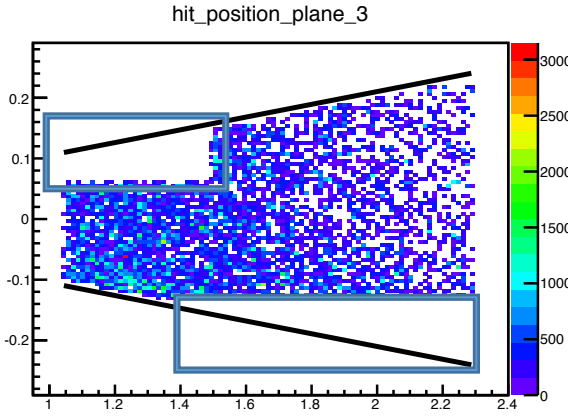
- Added a function in digitization (TSolGEMChamber class) to define areas that can be turned off
  - Currently only rectangles that are parallel to the symmetric axis of the chamber
  - Particles enter these areas will not produce ion pairs and thus no avalanche electrons and no signal on strip
  - Also removed hits landing on the frame of the chamber
    - Each readout plane will have ~56 strips less due to the two 11mm frames
    - # of strips for each readout plane: 578 | 687 | 687 | 1139 | 1175

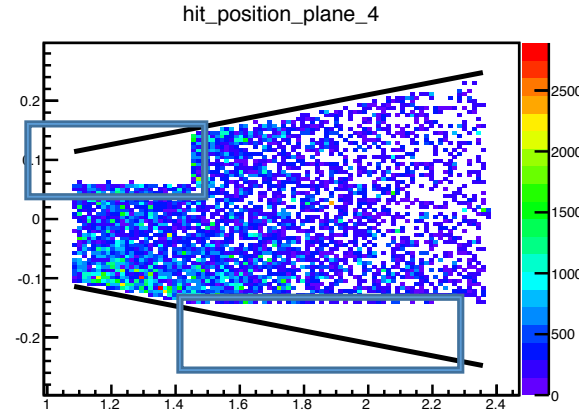
Background Hit Position









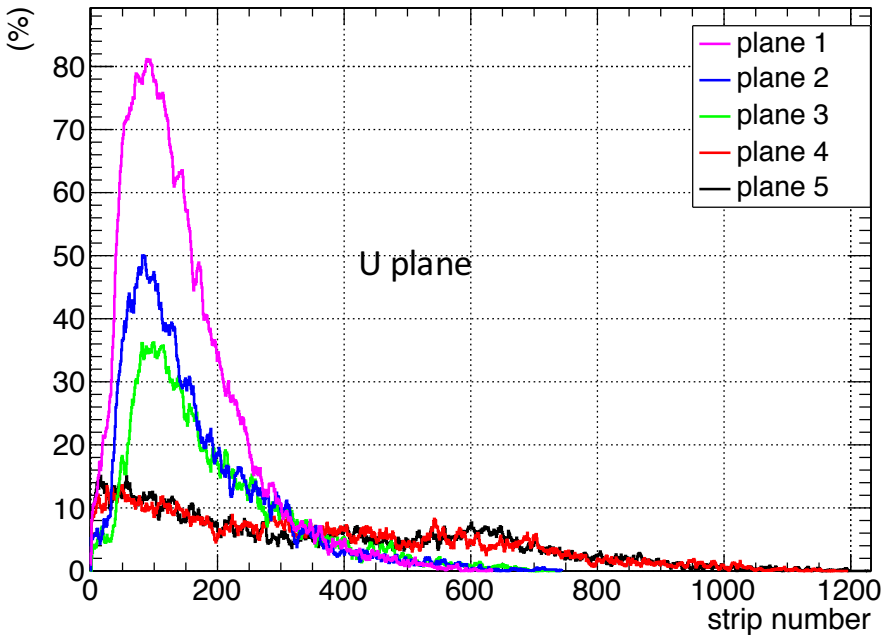


Removed about 10% of background hits on the first three trackers, and 33% of background hits on the last two GEMs

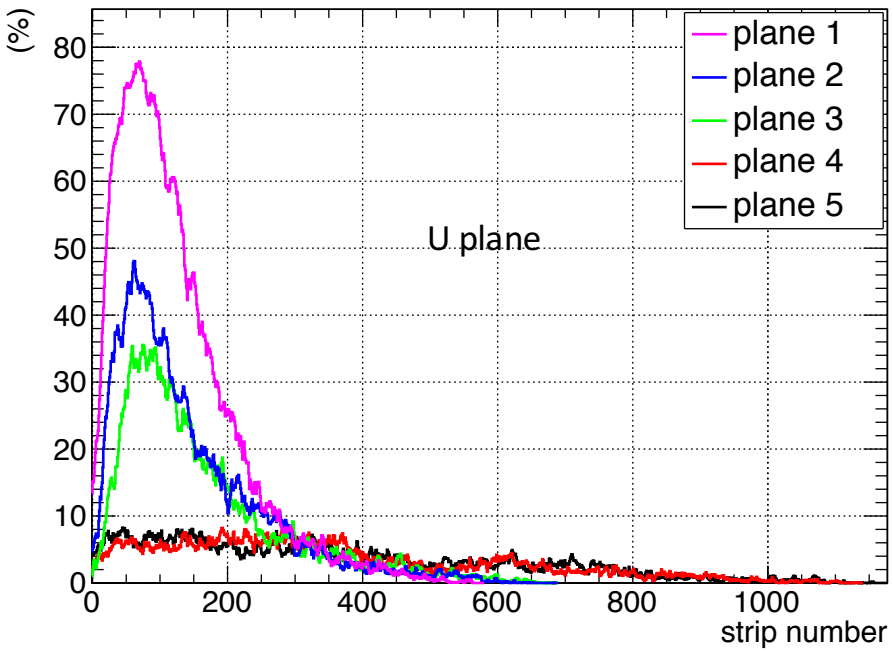
There are more areas can be turned off

Raw Occupancy Comparison

Before turn off HV sectors

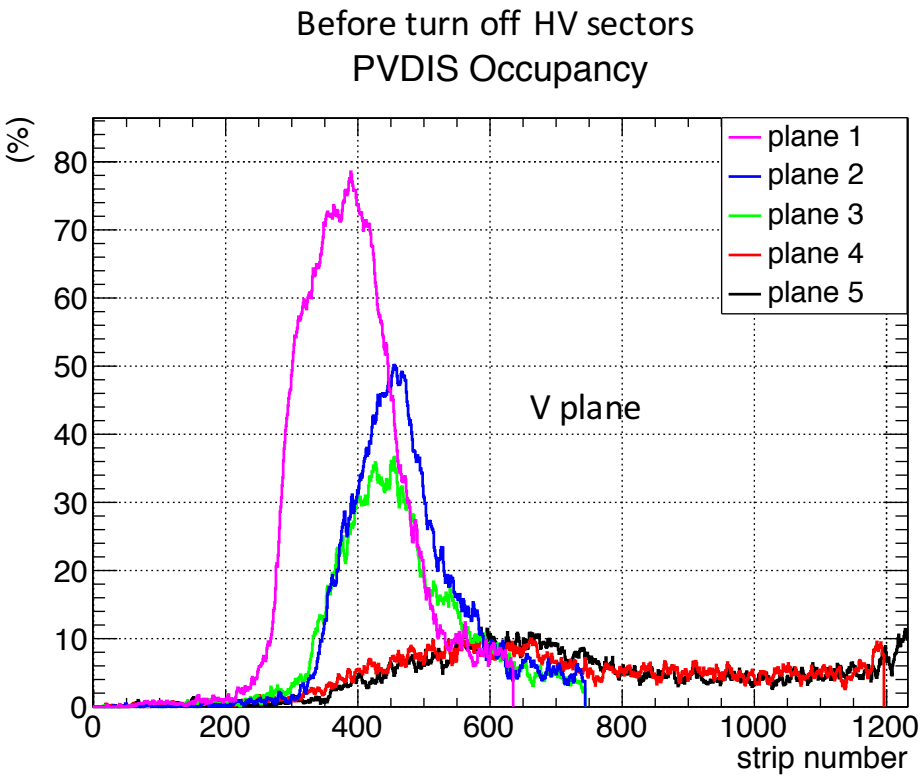


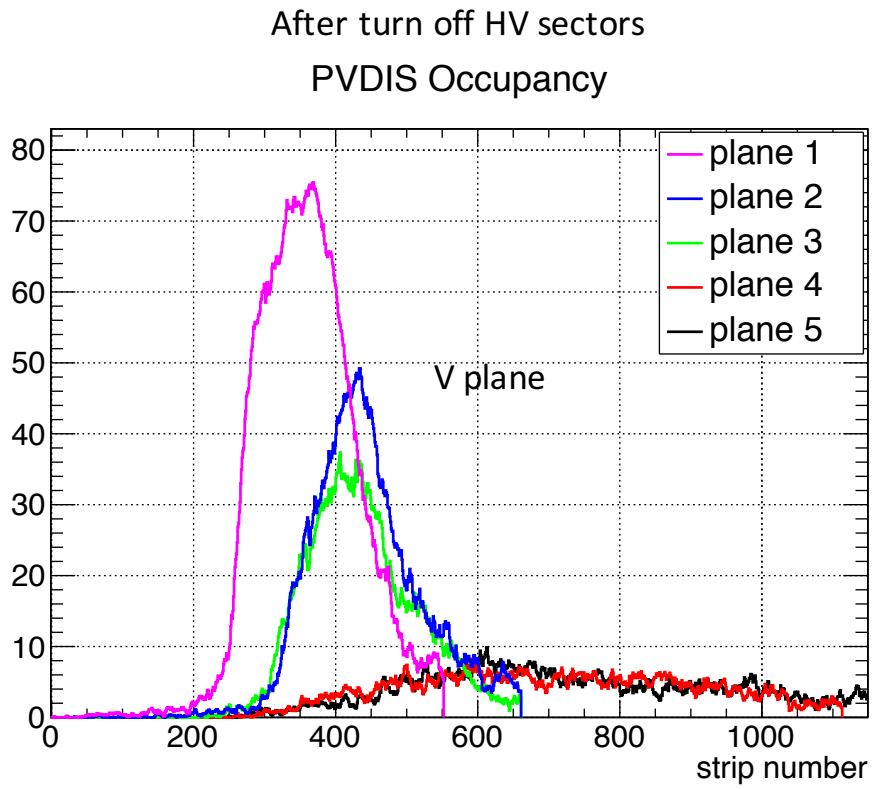
After turn off HV sectors



4 sigma cut of pedestal noise is applied in both cases

Raw Occupancy Comparison





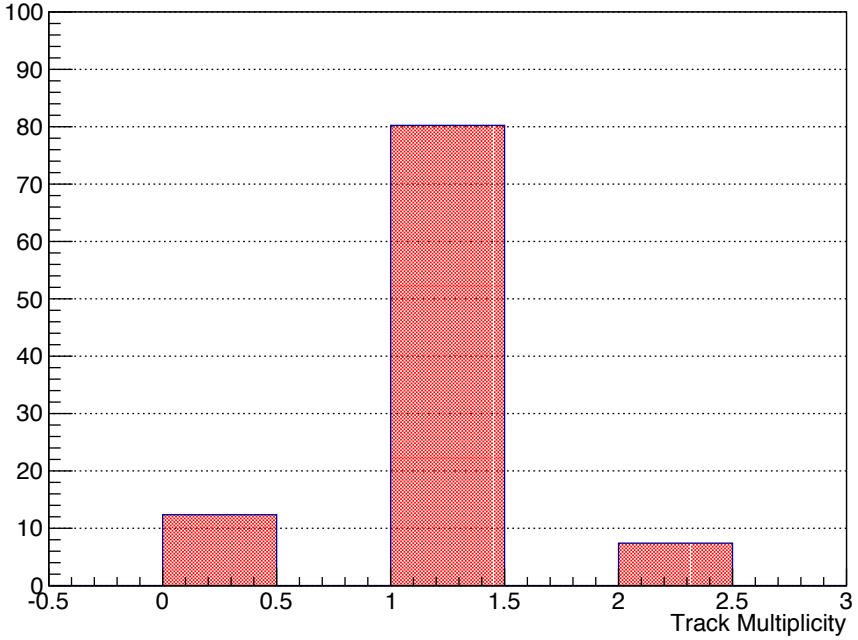
4 sigma cut of pedestal noise is applied in both cases

Tracking Efficiency and Accuracy

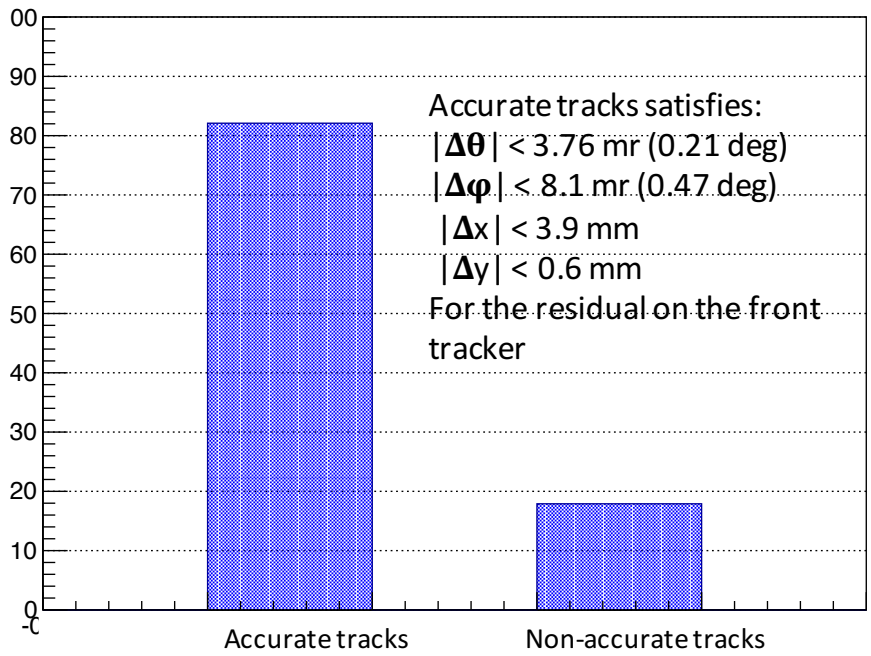
After turn off certain HV sectors

Kinematic cut: $Q^2 > 6\ GeV^2$, $W > 2\ GeV$ and $x > 0.55$

Efficiency



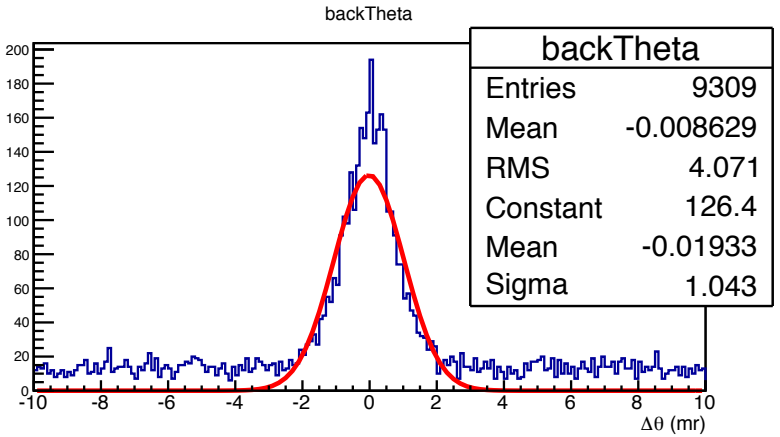
Accuracy

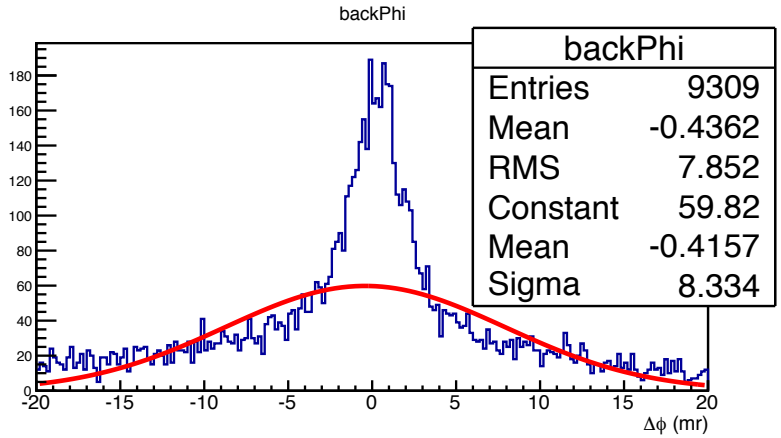


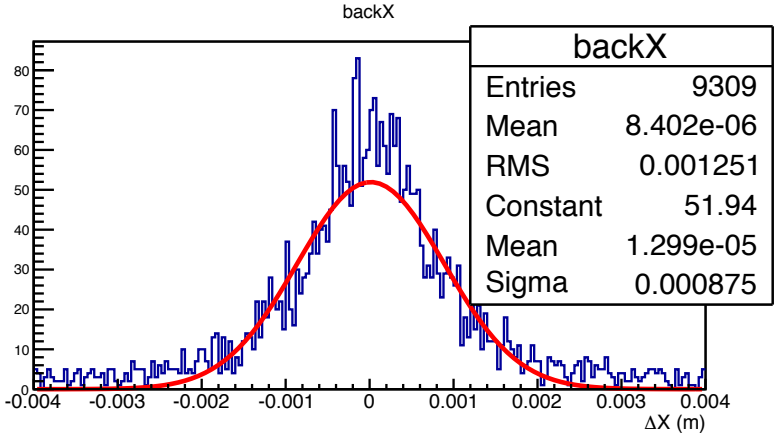
A 5% improvement on the tracking efficiency and 7% improvement on the accuracy can be achieved by turning off certain HV sectors

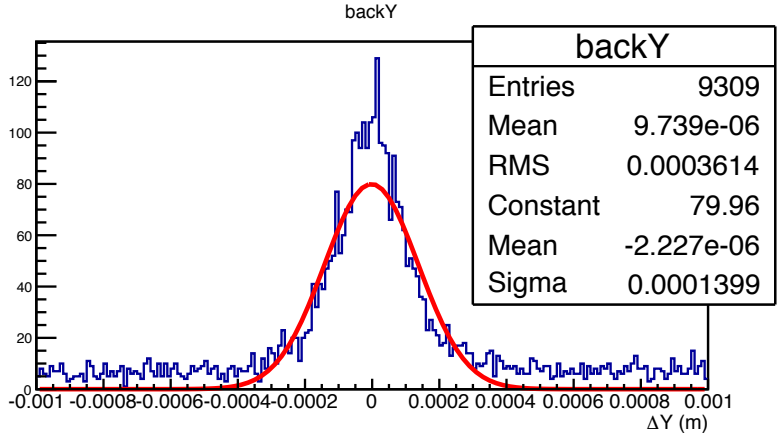
Multi-track Selection

Residual of all multi tracks on the front tracker



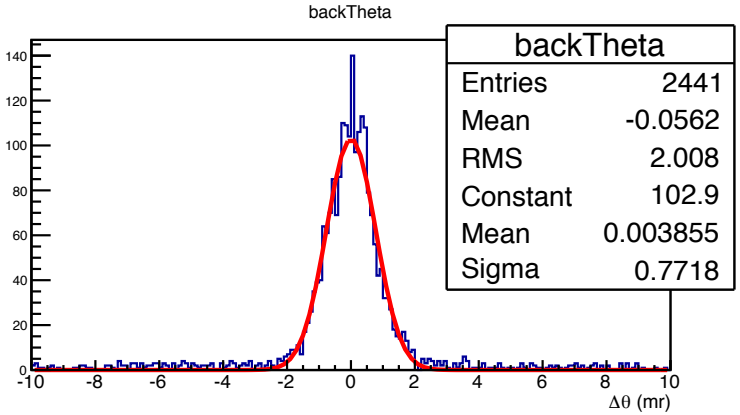


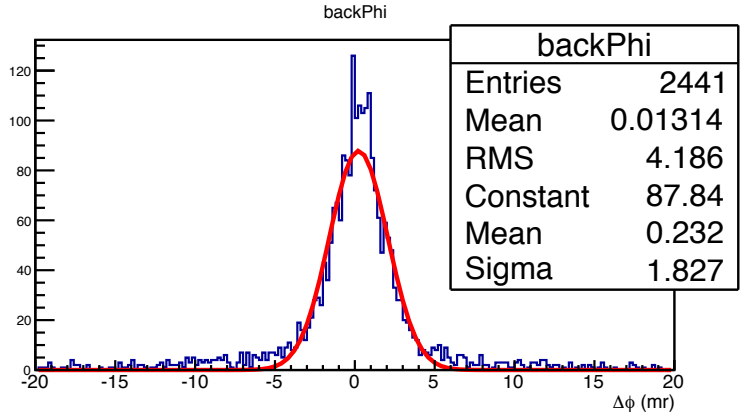


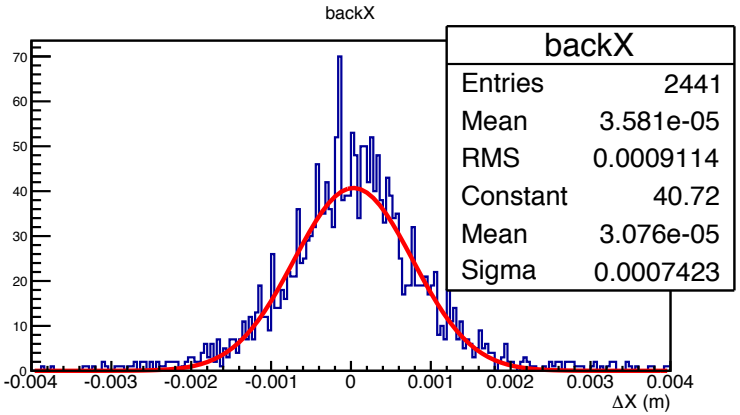


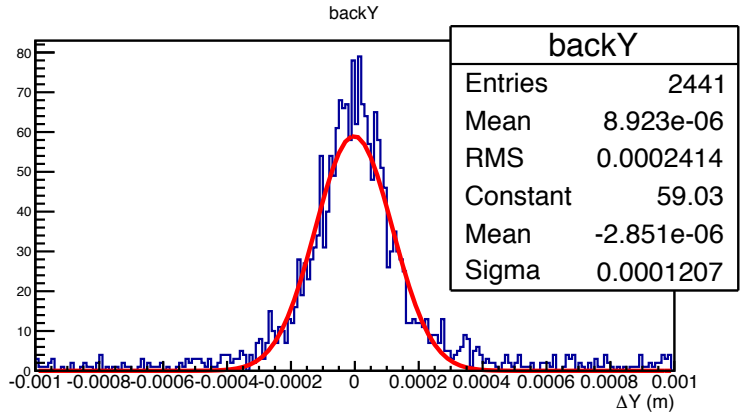
Multi-track Selection

After selecting 5 hits tracks and apply a chi2/NDF cut of < 8 on the multi tracks, if multiple tracks from the same event satisfy this, pick the one that has smaller chi2/NDF



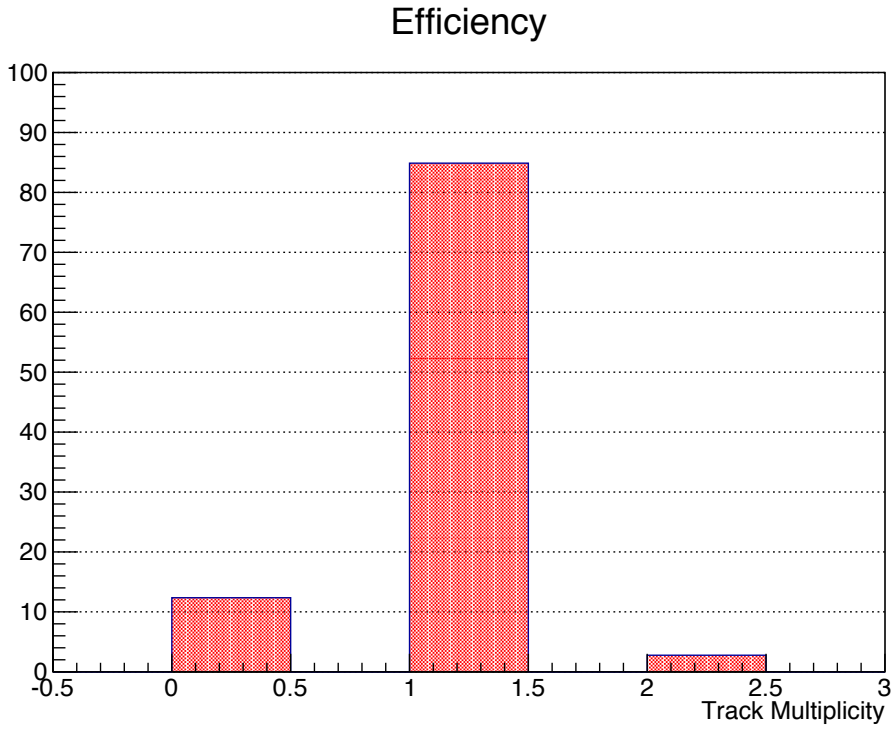


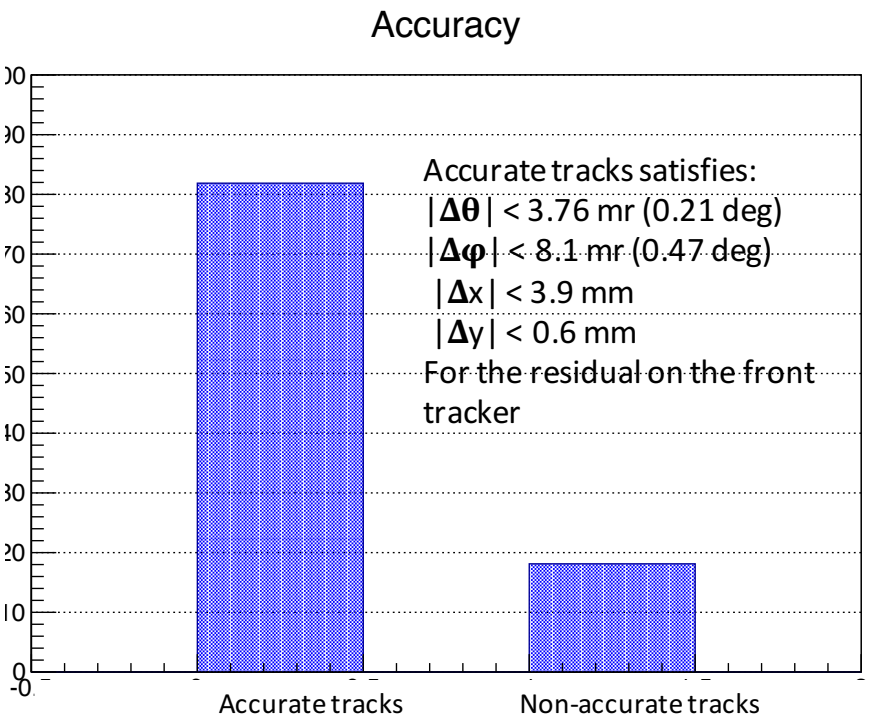




Tracking Efficiency and Accuracy

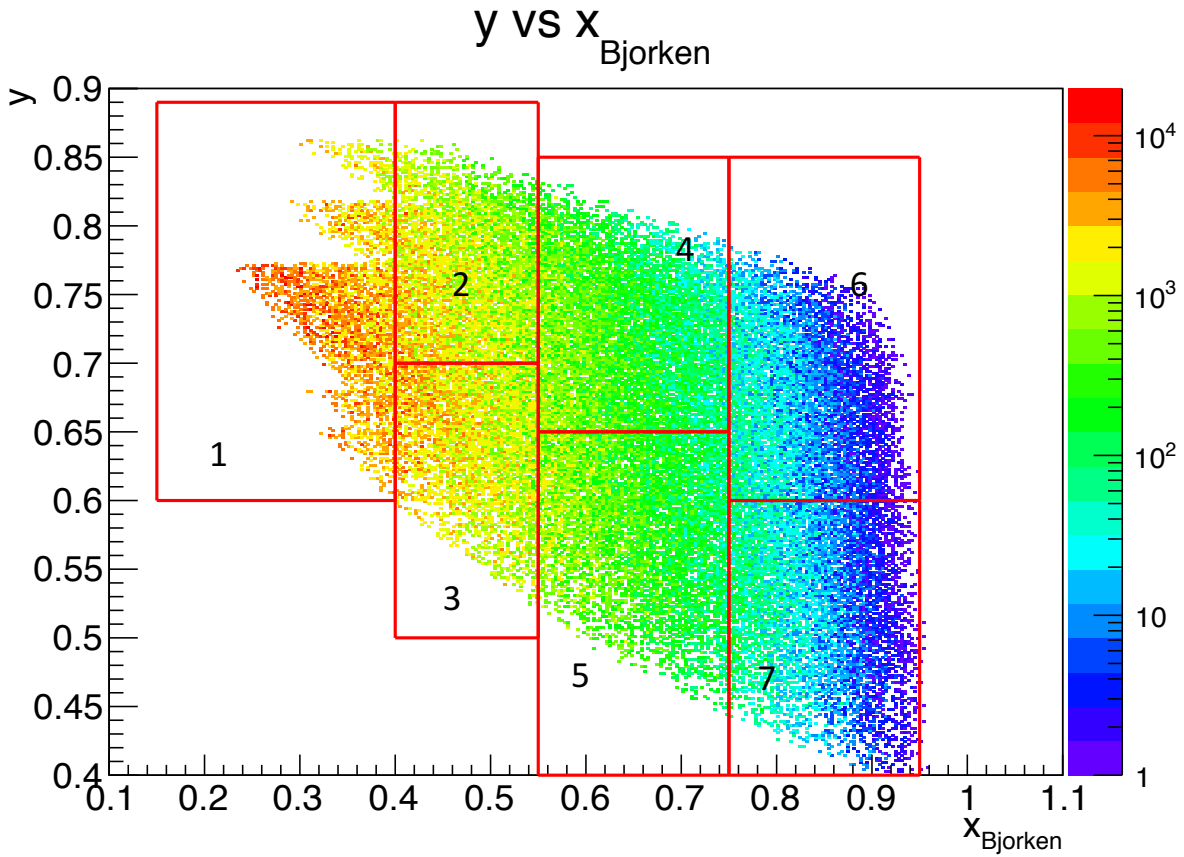
After turn off certain HV sectors and multi track selection
Kinematic cut: $Q^2 > 6\ GeV^2$, $W > 2$ GeV and $x > 0.55$





In %

	Efficiency	Accuracy
1	84.4	79.0
2	86.2	85.5
3	83.7	78.0
4	87.0	86.4
5	82.8	77.2
6	86.0	86.8
7	82.0	79.2



Efficiency contains tracks selected from multi-track events

Conclusion

- Might be able to get a few more % improvement by turning off more HV sectors
- Including 3 hit tracks can improve the efficiency for a few %, but they don't have a good accuracy
- Accuracy can be improved by removing wrong hits (in progress)

- Other major improvement might come from segmenting strip and major improvement on tracking algorithm