35 ton Sim/Reco/Analysis Meeting
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Thanks to Tom

**Measurement of t0 using APA crossing tracks (work in progress)**

Motivation

❏ The Photon detector system will provide the t0 timing of the events relative to the TPC.

❏ We are working on the measurement of deltat for the events which crosses the APA.

❏ Spatial separation(deltaX) between the positive (long drift) and negative(short drift) segment of a crossing track will give information to measure deltat.

❏ Angle between the two segments of a crossing track is also important parameter to measure.

Event selection

❏ We have started our analysis with AntiMuonCutEvents_LSU_dune35t sample because these are single muon event with t=0.

❏ At first, we have checked the starting and ending position of all the tracks.
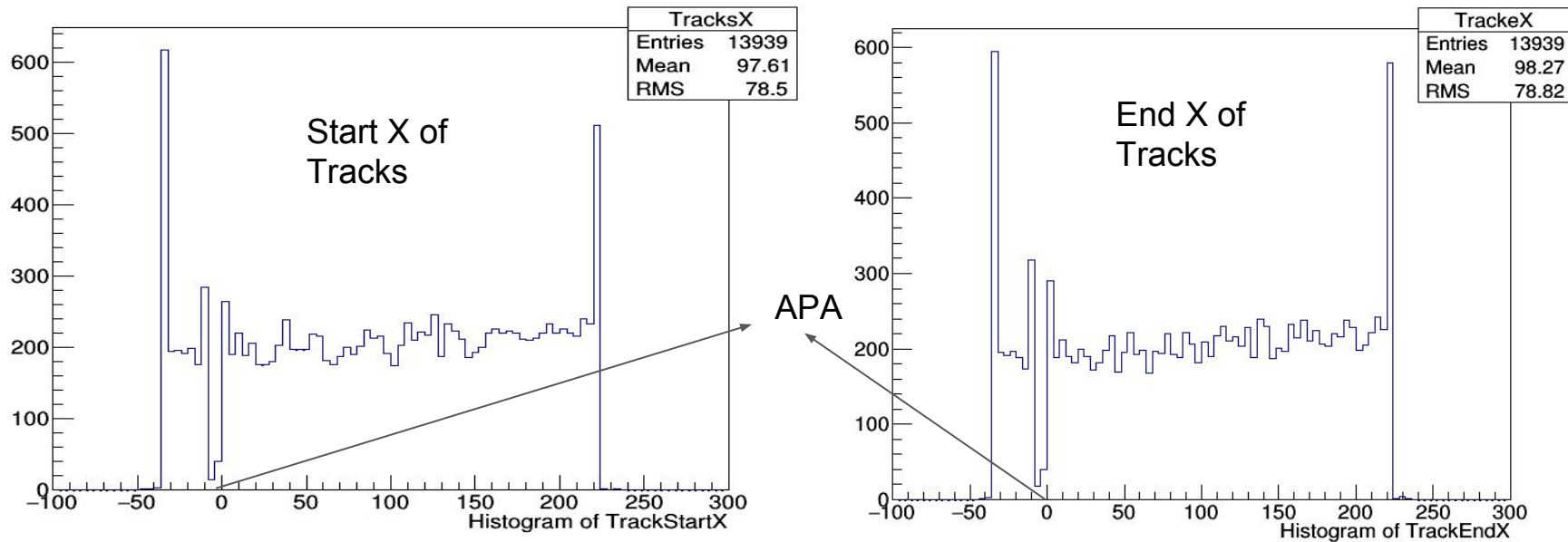
Track fitting and chisq

- ❏ We have selected tracks that crosses APA, we have splitted them into two segments along long and short drift.
- ❏ We have also selected the tracks which are only in the long drift, only in the short drift to check a good track.
- ❏ We have fitted the tracks using 3D line fit.
- ❏ The fitting method is

  X = p[0] +p[1] t

  Y = p[2] + p[3] t

  Z = t
- ❏ Chisq is divided with no of space points and is plotted for different cases.

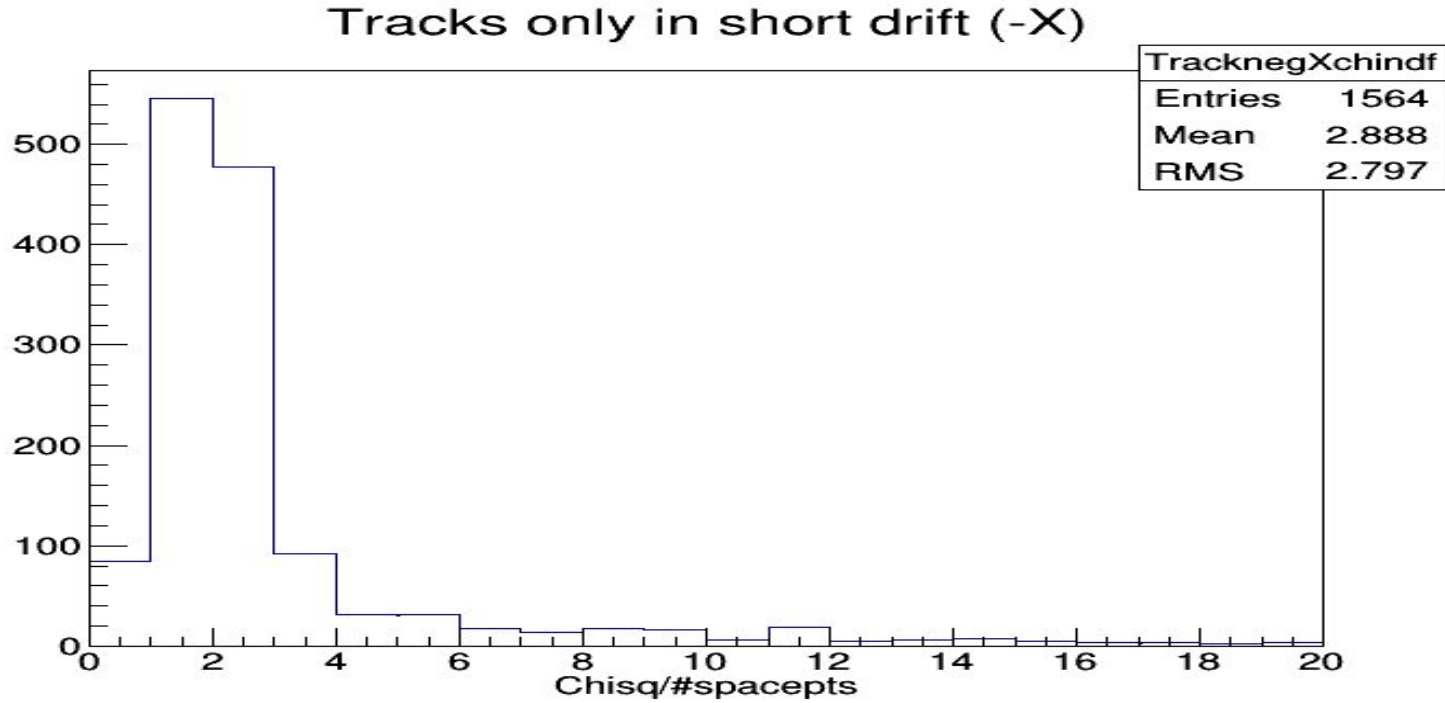short drift   APA   Long drift
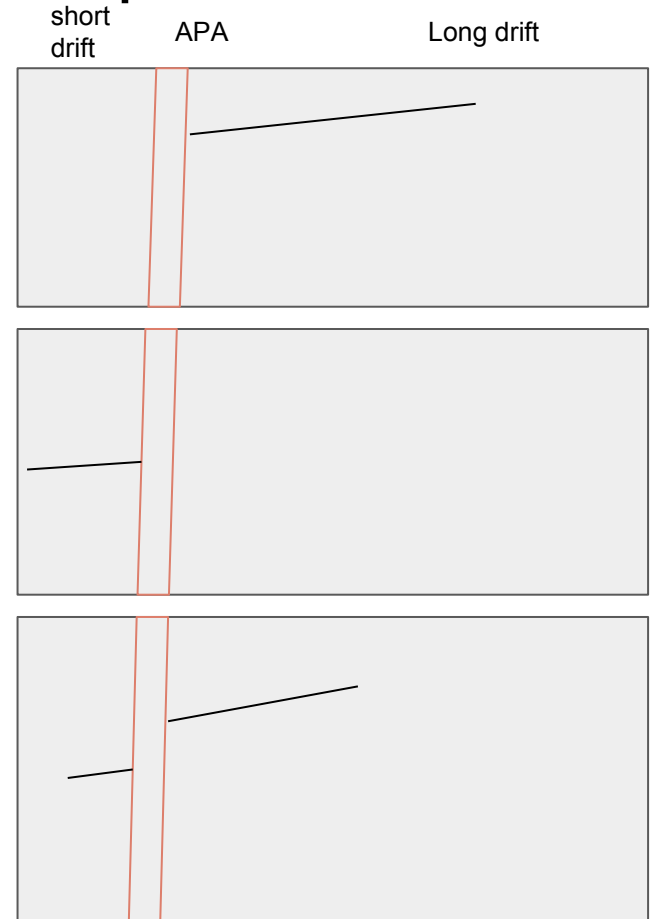
(Chisq/#spts) distribution(only in long drift)

Tracks only in long-drift (+X)

TrackposXchindf	
Entries	11673
Mean	2.715
RMS	2.683
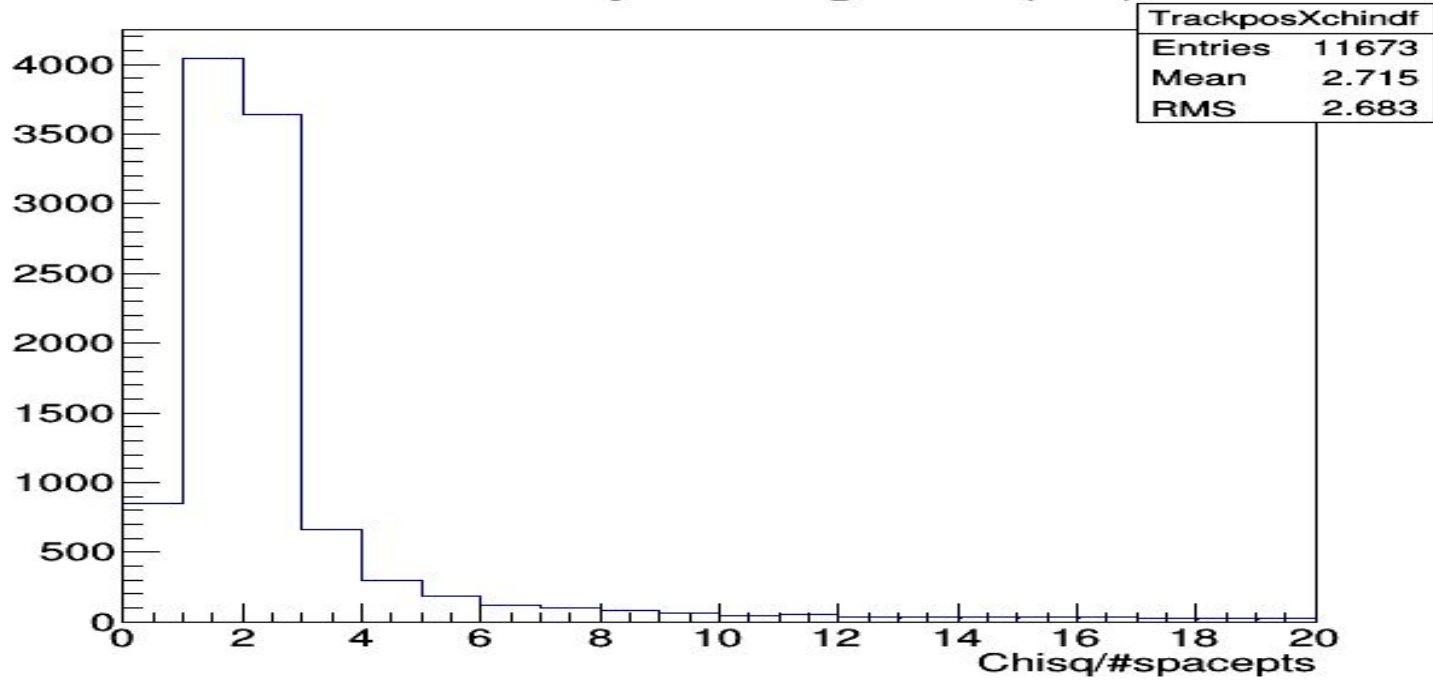
(Chisq/#spts) distribution(only in short drift)

Tracks only in short drift (-X)

TracknegXchindf	
Entries	1564
Mean	2.888
RMS	2.797

(Chisq/#spts)distribution (long drift of crossing track)

Long-drift segment of the crossed track

TrackstposXchindf	
Entries	702
Mean	3.524
RMS	3.613

Chisq/#spacepts
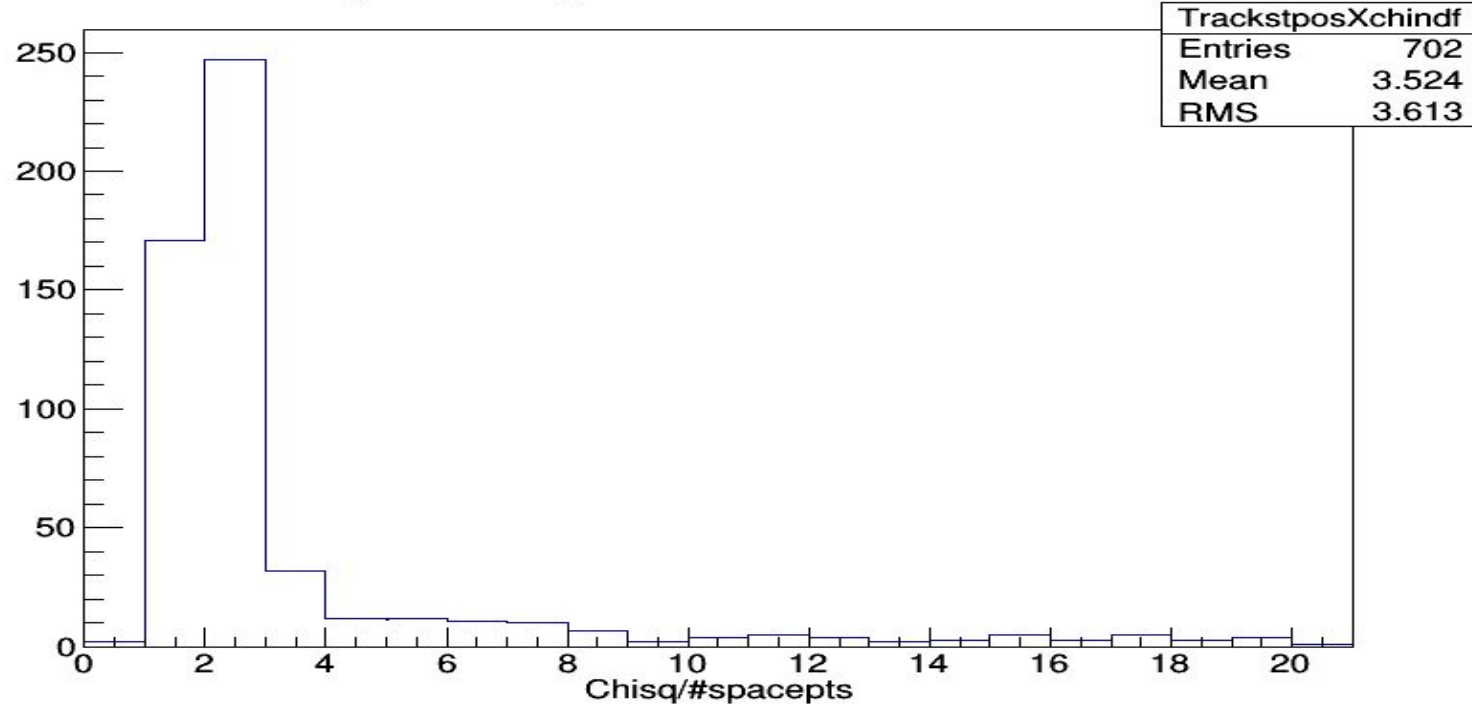
Chisq/#spts distribution(short drift of crossing track)

short-drift segment of the crossed track

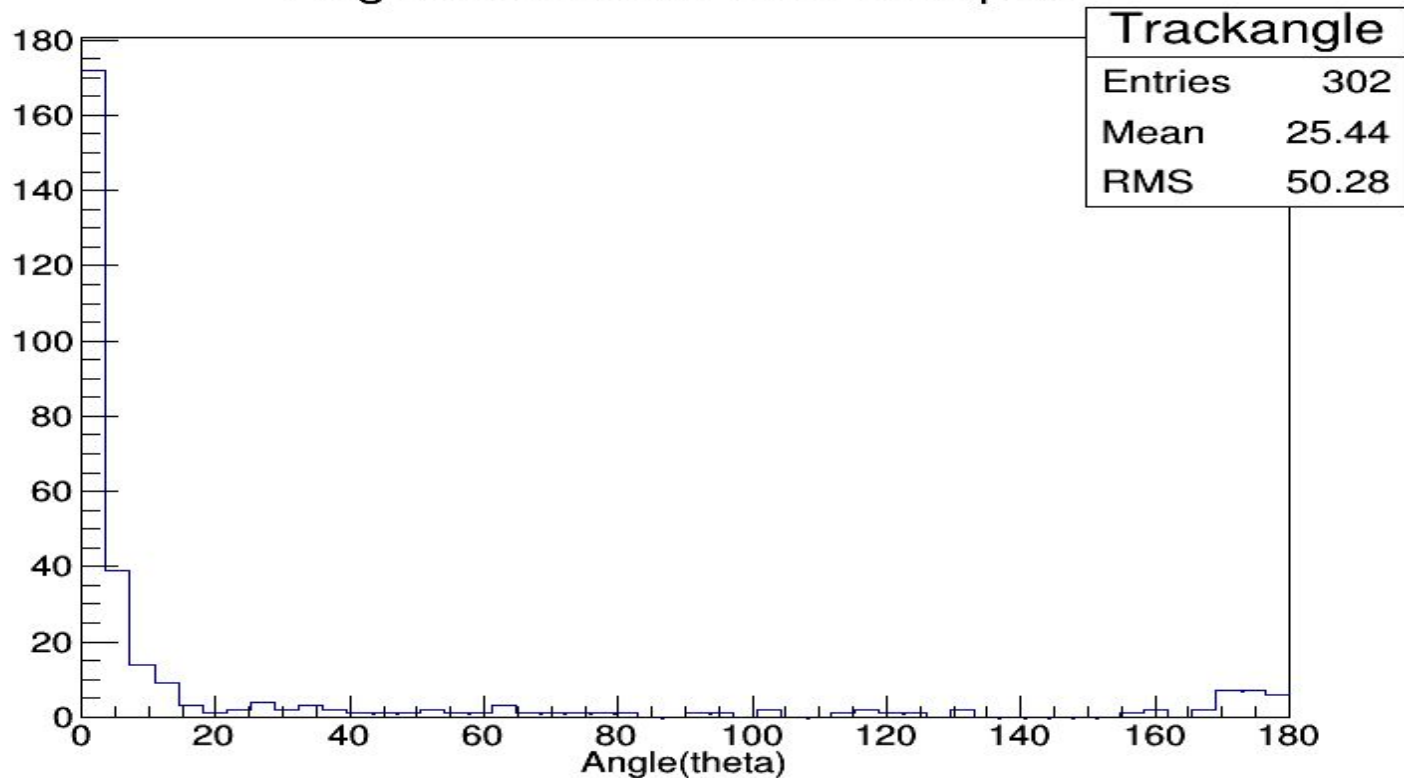| TrackstnegXchindf	
Entries	702
Mean	3.121
RMS	3.249

Chisq/#spacepts
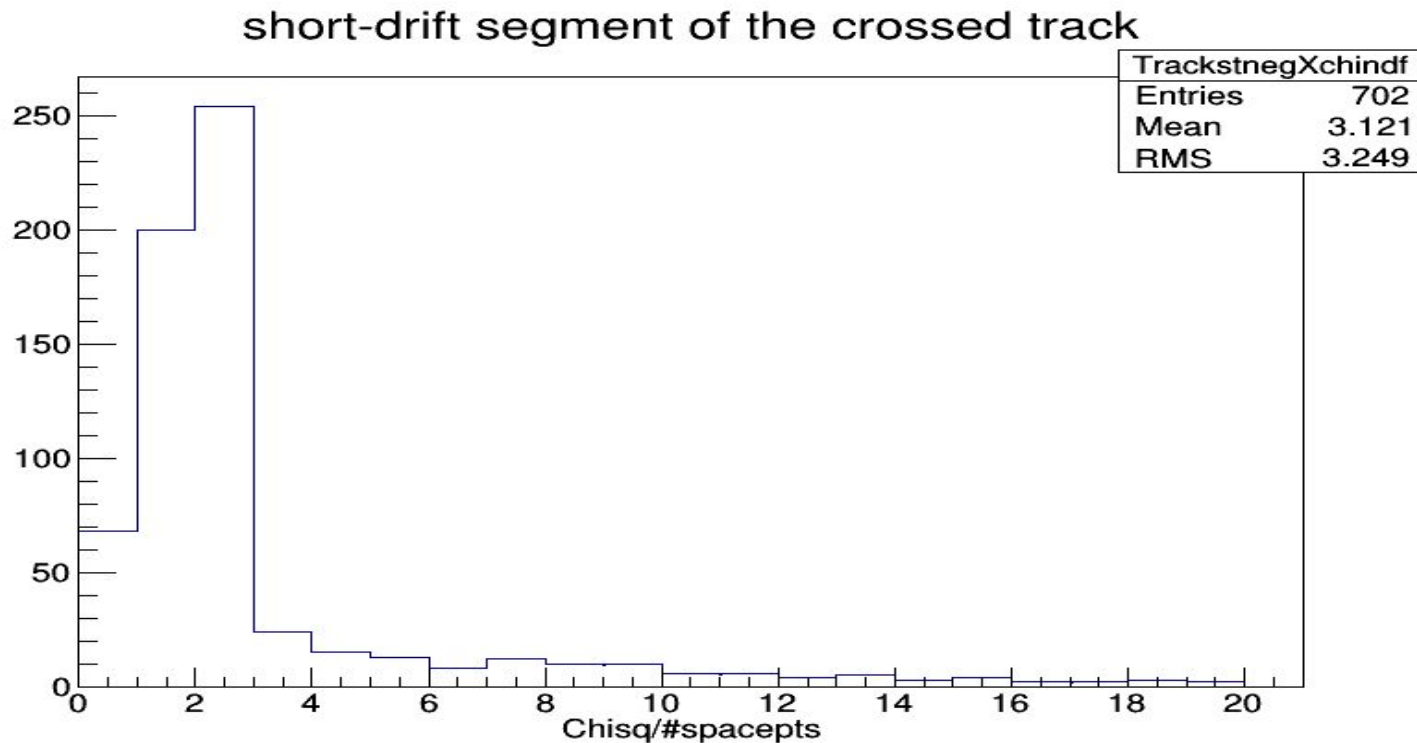
Angle between the two segments of crossing tracks

❏ Angle between the long and short drift part of a crossed track is defined as theta = acos(n1.n2);

❏ n -> unit vector of the segments of crossing track

Angle between pos and neg side of the splited track

Trackangle	
Entries	702
Mean	75.58
RMS	75.35

9
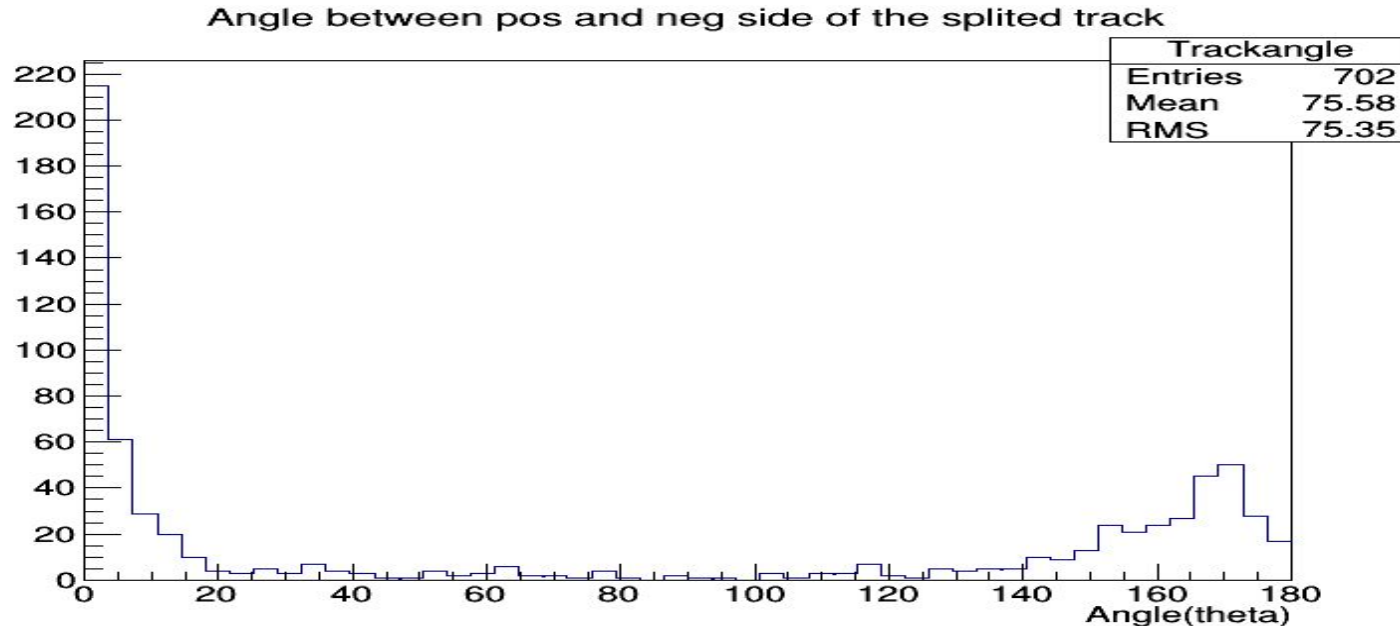
Angle distribution after (chisq/#spts <3) cut

Angle distribution after chisq cut

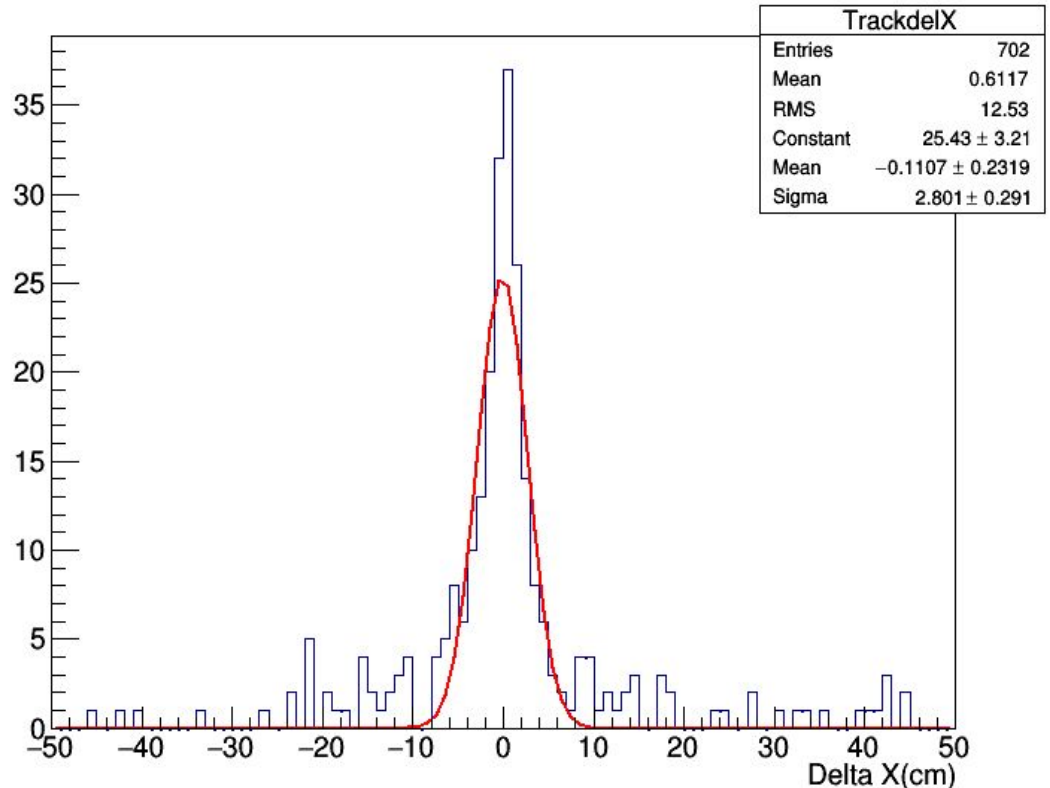| Trackangle	
Entries	302
Mean	25.44
RMS	50.28

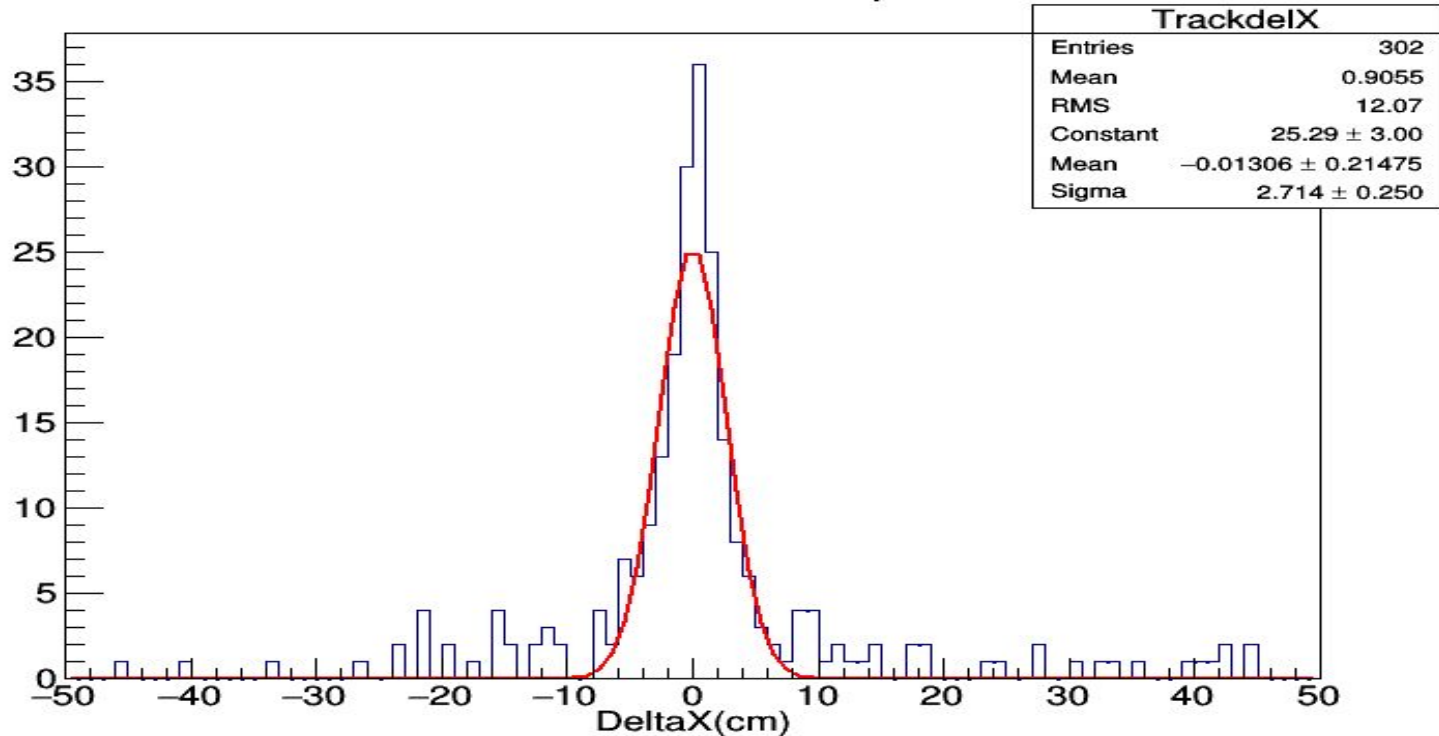# Delta X between two segments of crossing track

❏ An extra parameter in the fit dx is added each iteration for positive drift and is subtracted from negative drift points.

Delta X between pos and neg part of splited track

TrackdelX	
Entries	702
Mean	0.6117
RMS	12.53
Constant	25.43 ± 3.21
Mean	−0.1107 ± 0.2319
Sigma	2.801 ± 0.291

Delta X after (chisq/#spts <3)cut

Future plan

❏ We will now consider the flashtime from Photon detector and drift velocity and compare with the delta X.

❏ We will work on cry sample.

❏ We will have to improve event selection.

❏ We will also try to understand the unit vector of the segments of track along x, y,z, and angle with respect to electric field.