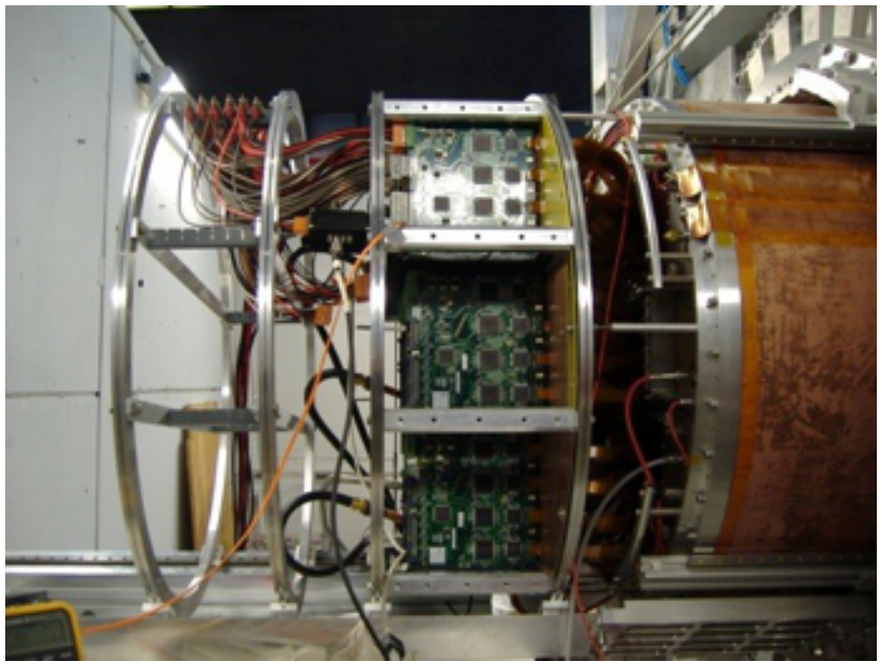
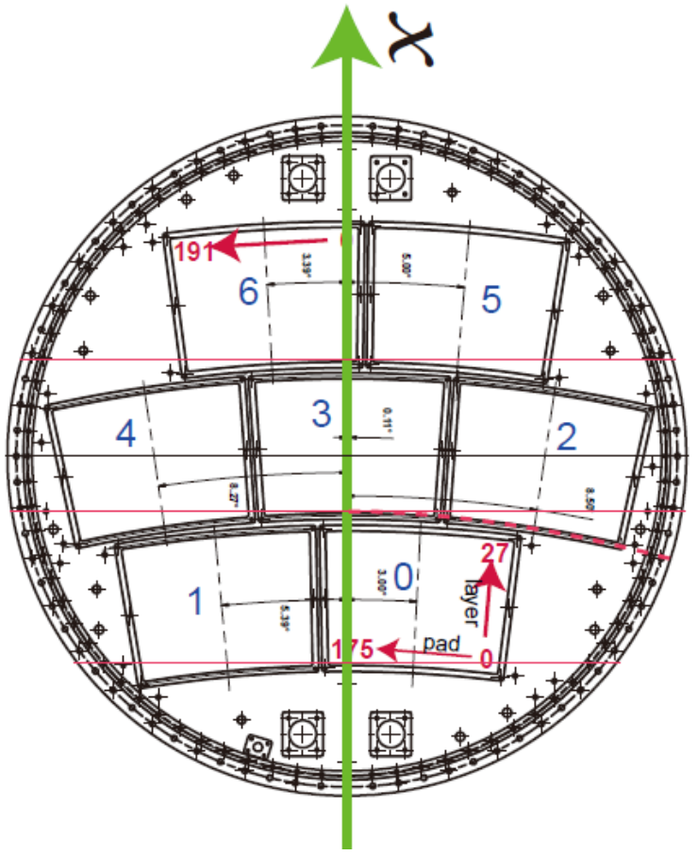
LP1 beam test data analysis by MarlinTPC

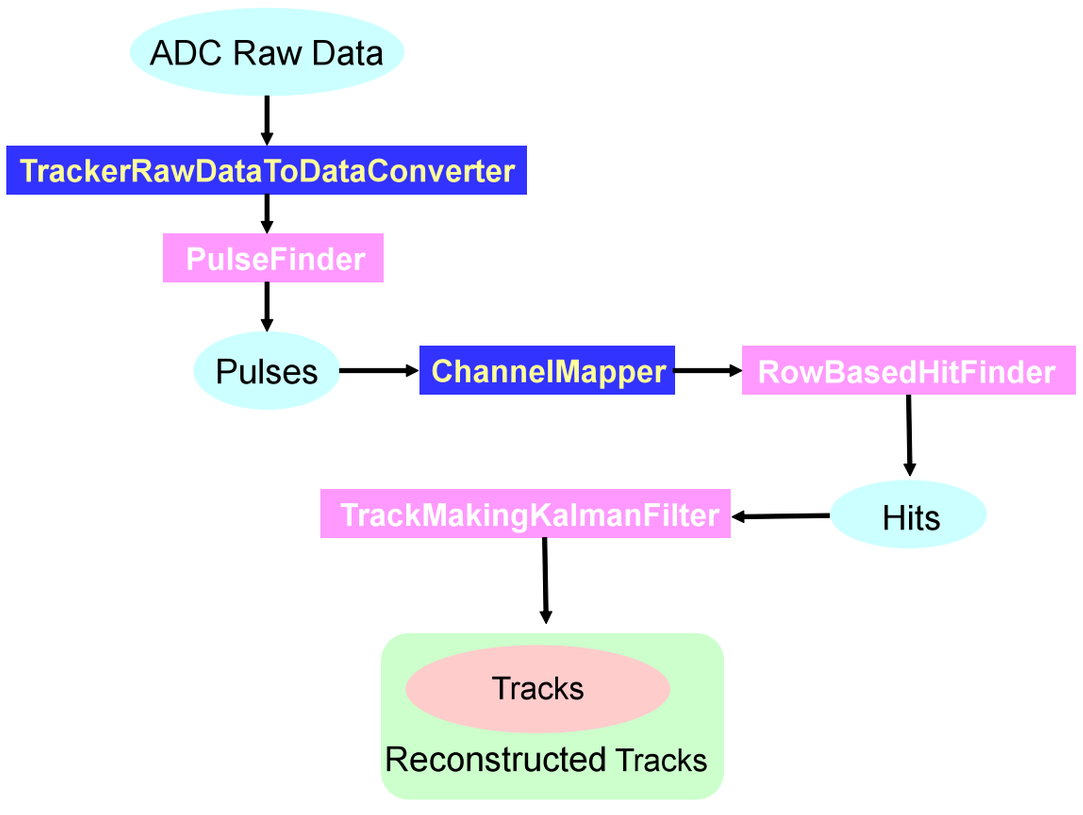
Li Bo

LP1 beam test and MarlinTPC



- LP1 beam test: Sep. 2010, at DESY;
- B field: 1T electron beam: 5GeV;
- drift distance: 5, 10, ..., 55cm;
- 3 modules were used.

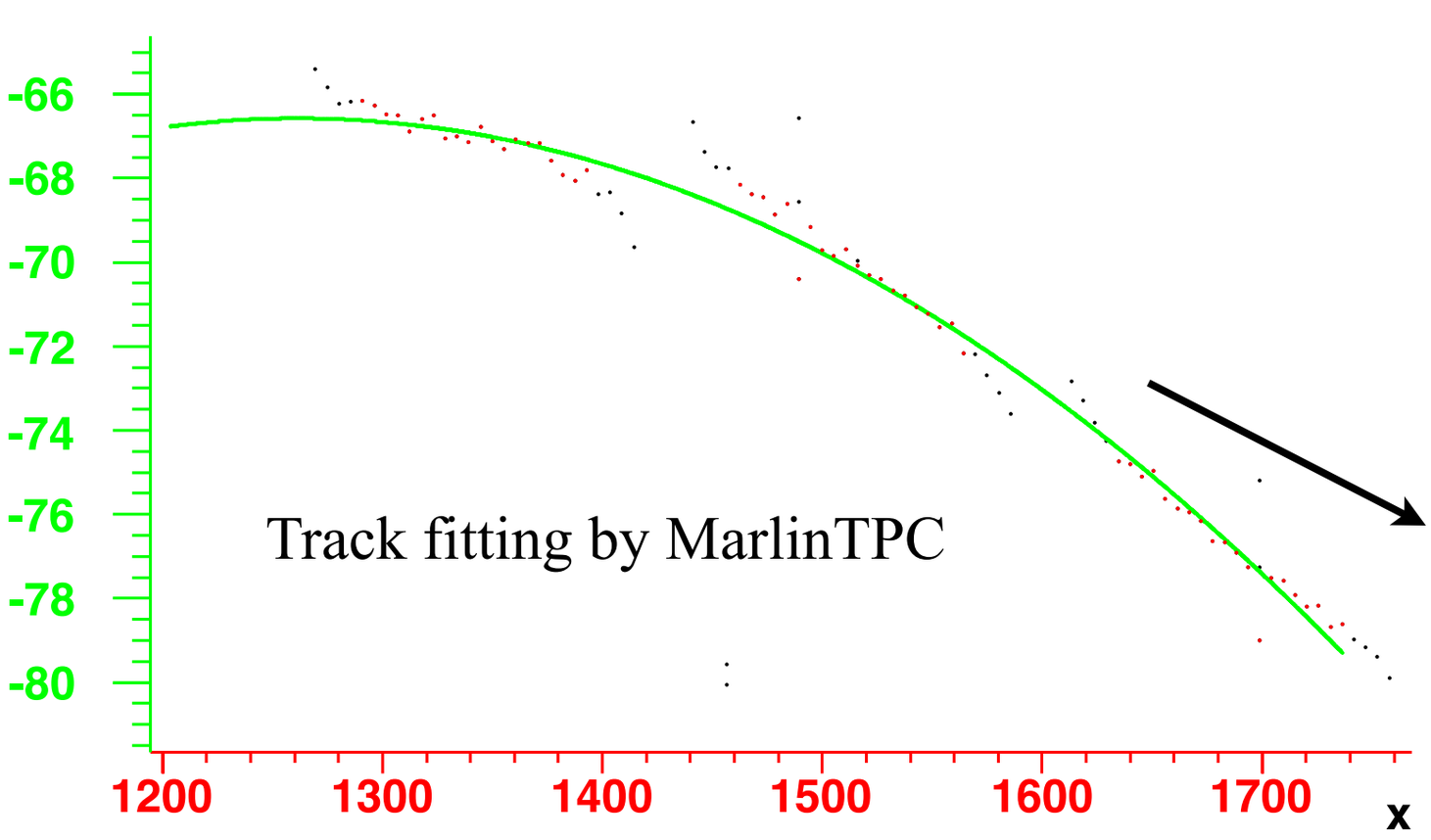




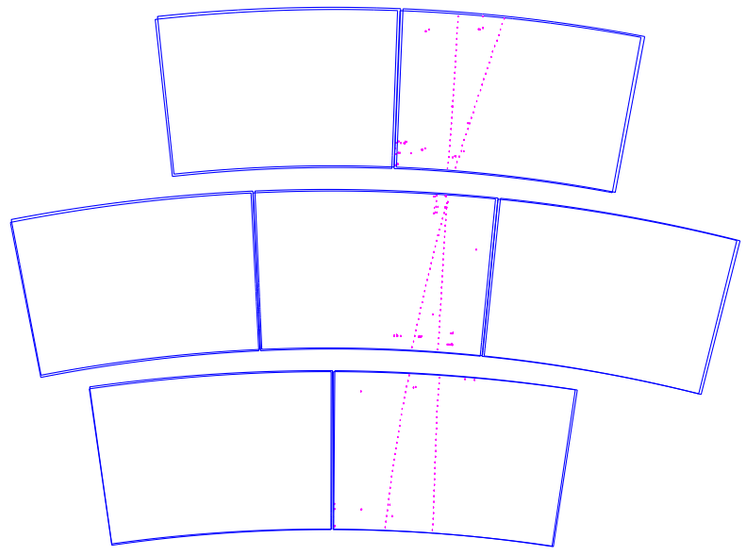
- MarlinTPC is as a tools for track reconstruction;
- The tracking algorithm is based on Kalman filter, and is tested by MC.

Track reconstruction

From the reconstructed tracks, we can see that:
- Detector has good tracking efficiency;
- Momenta of electrons are not the same;



Track fitting by MarlinTPC

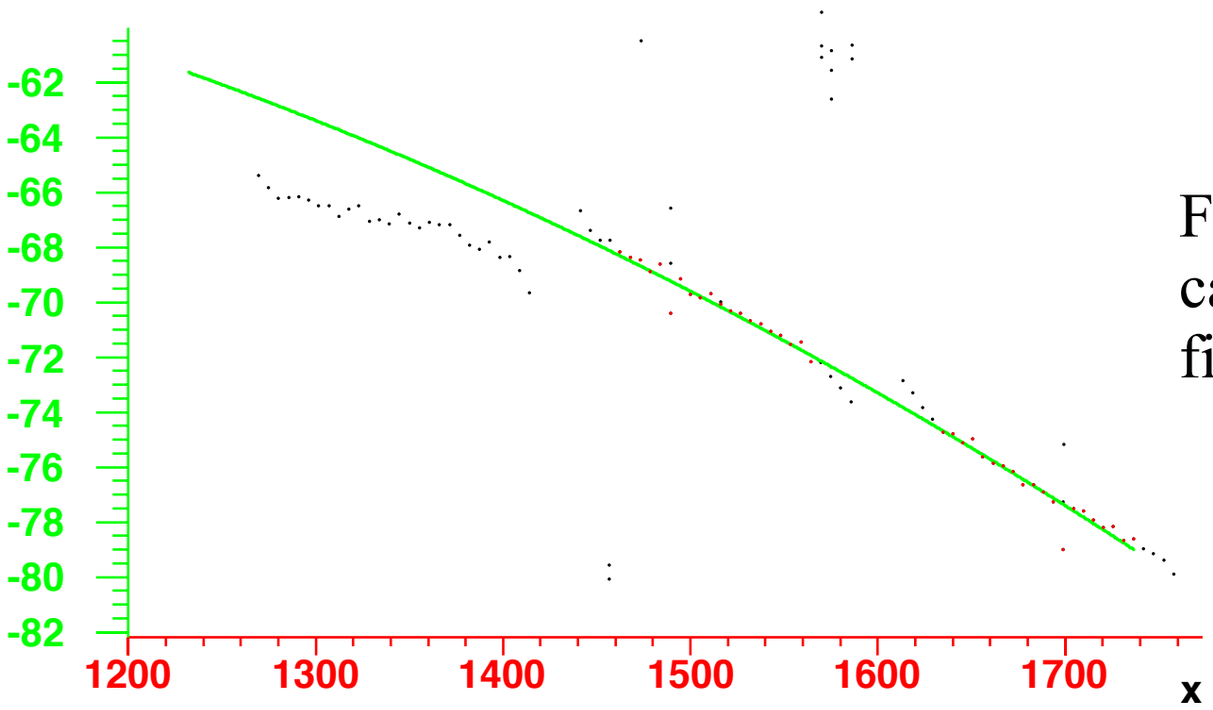


BBQ event display

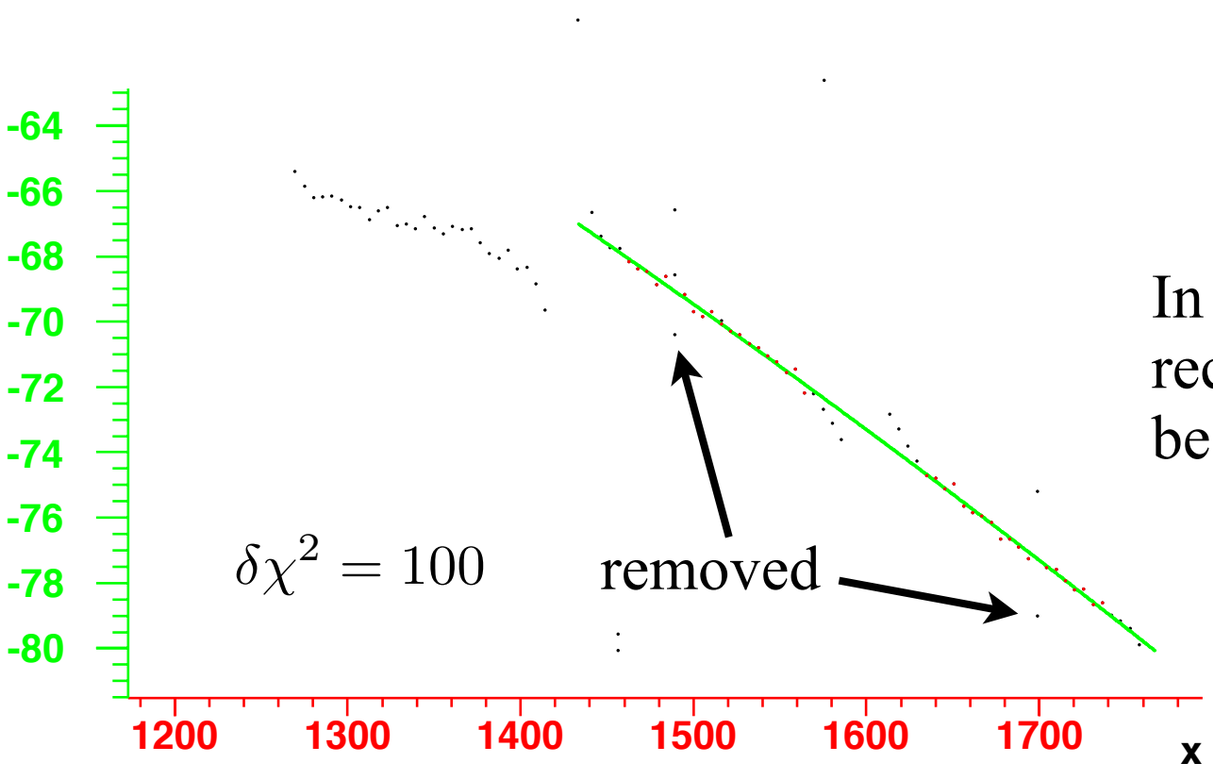
Distortion:
- The distortion at the boundary gives ‘S shape’ track in each module.
- ‘Misalignment’ between modules.

In order to take into account hits in 3 modules, a huge delta-chi2 is needed. It may affect the track quality.

Track reconstruction(cont.)



Fitting the track in module 3 and 5, we can see an obvious difference between the fitting line and track in module 0;

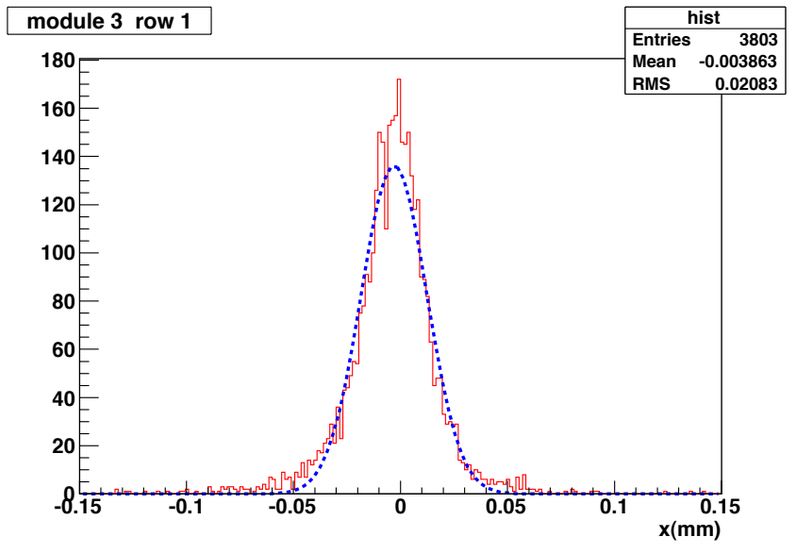


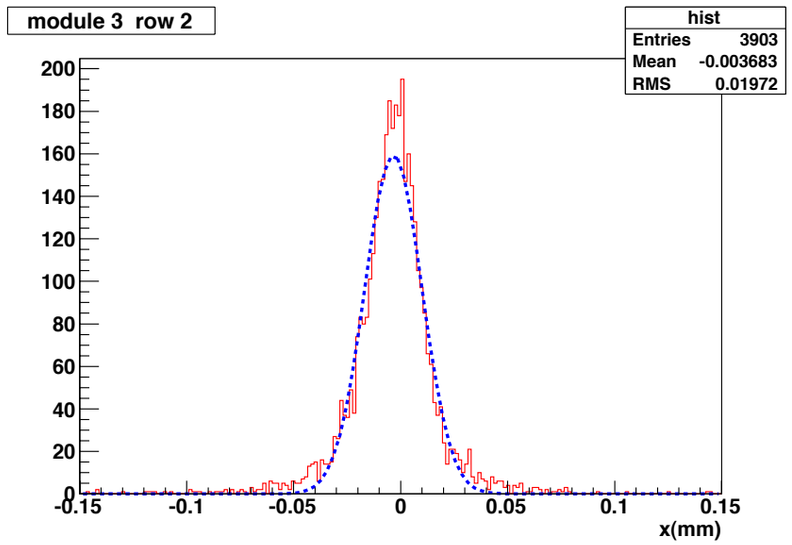
In this analysis, hits in module 3 and 5 are reconstructed. A proper delta-chi2 should be used.

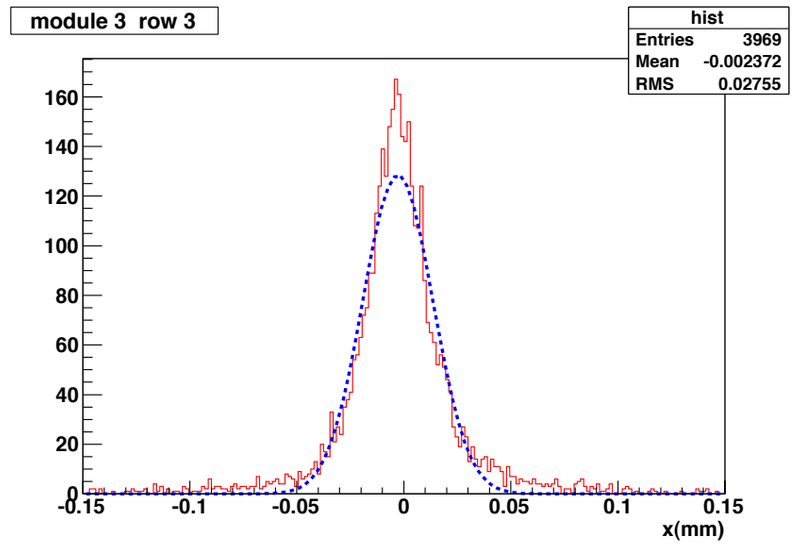
Residual

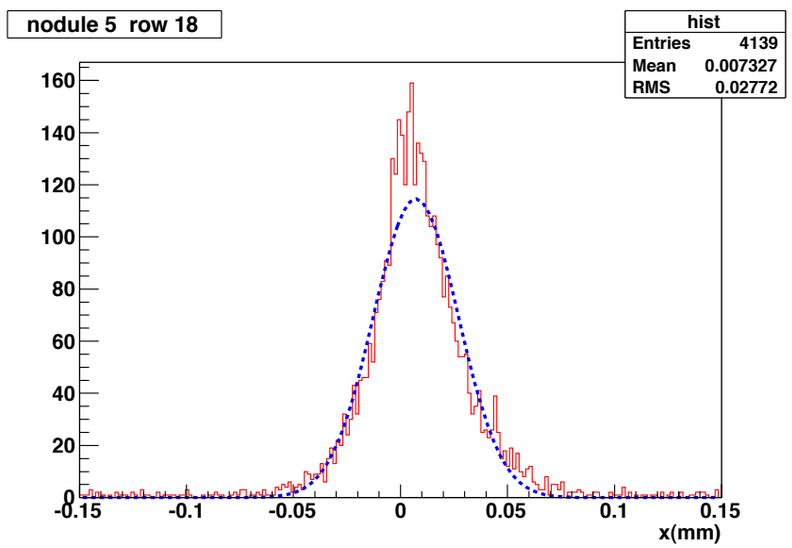
To get the position resolution of TPC, we need to plot the residual of each row:

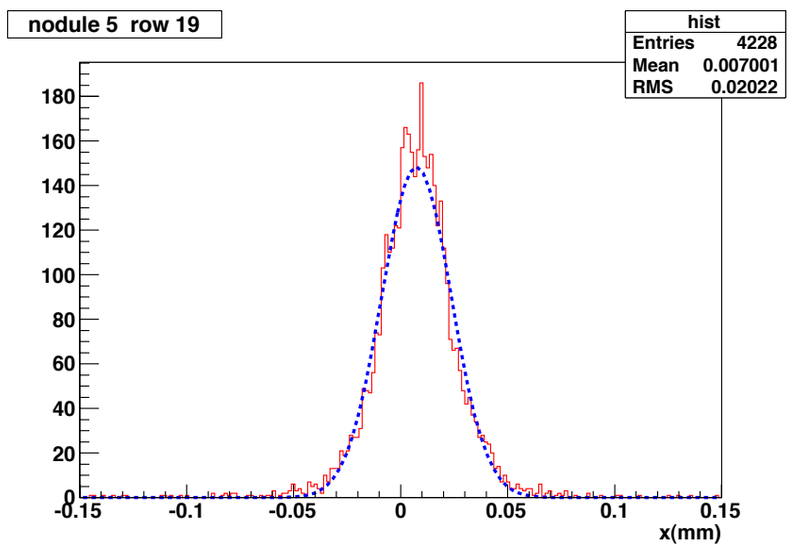
$$\text{residual} = x_{hit} - x_{track}$$

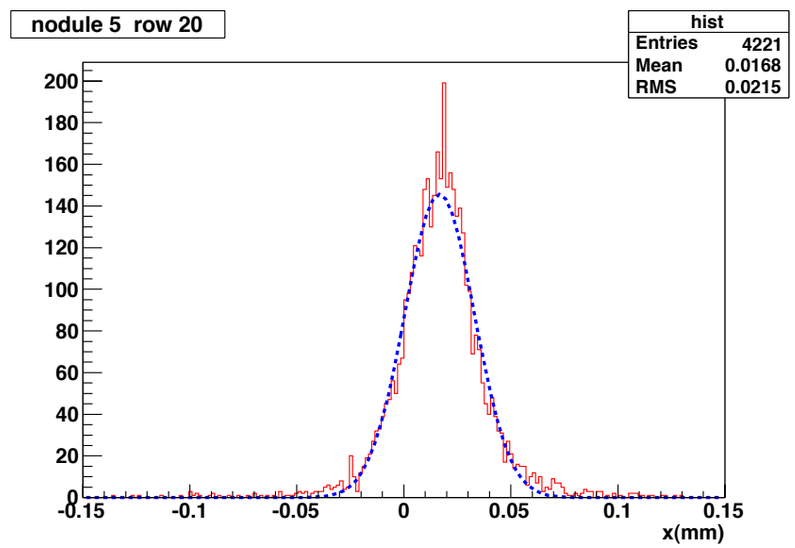








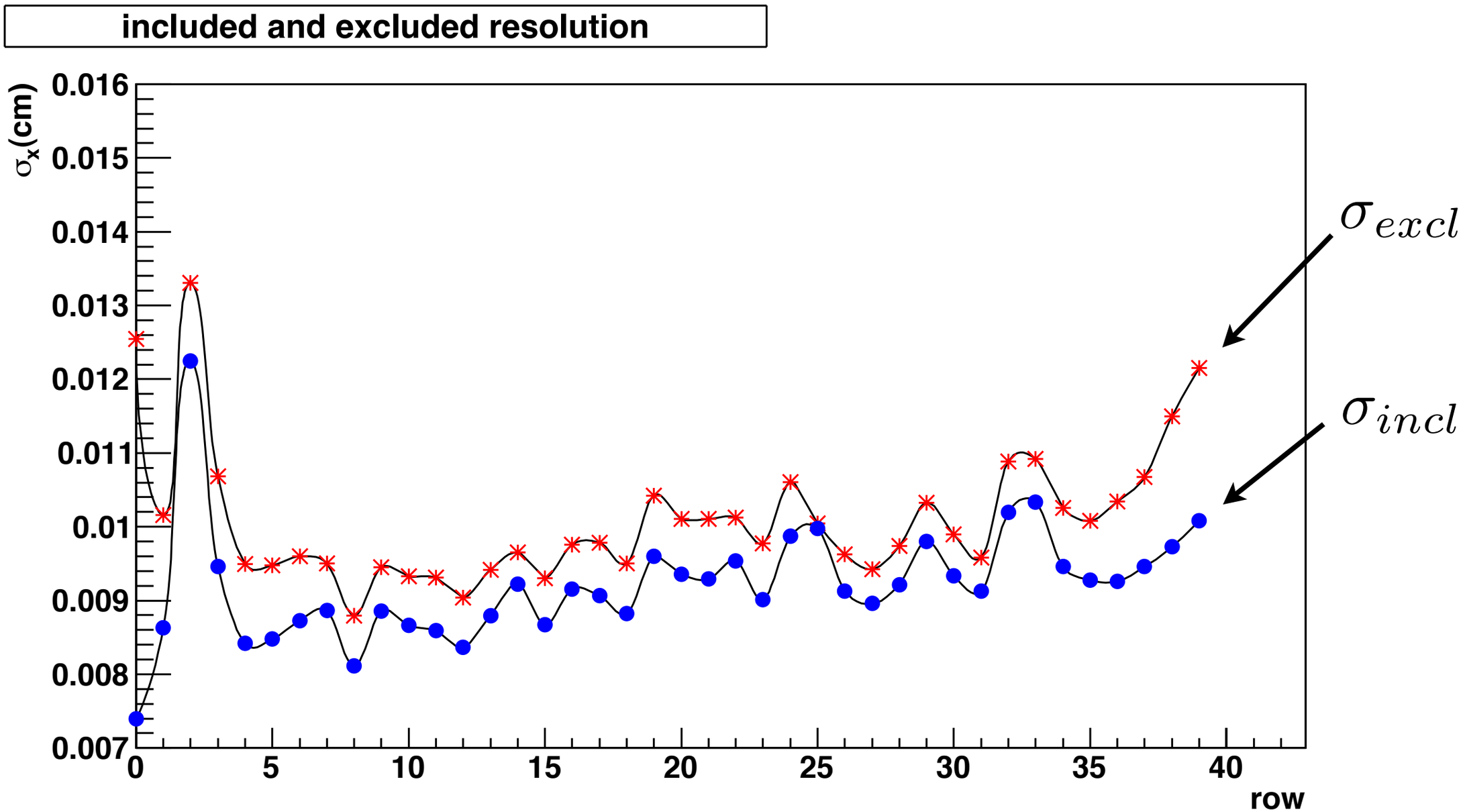




fitting will be improved...

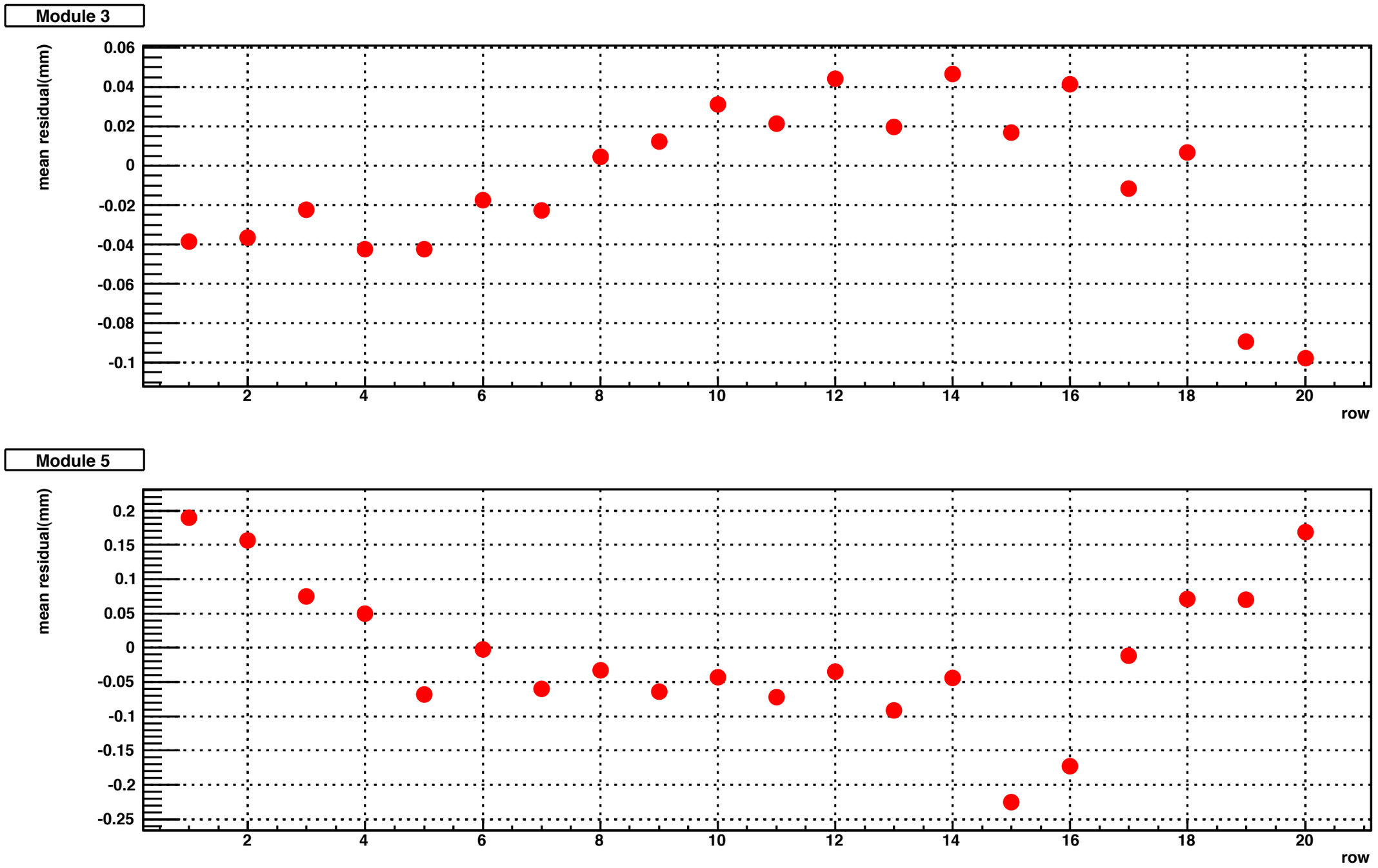
Resolution

- Position resolution is the sigma of residual;
- Because the track is unknown, there are two kinds of resolution:

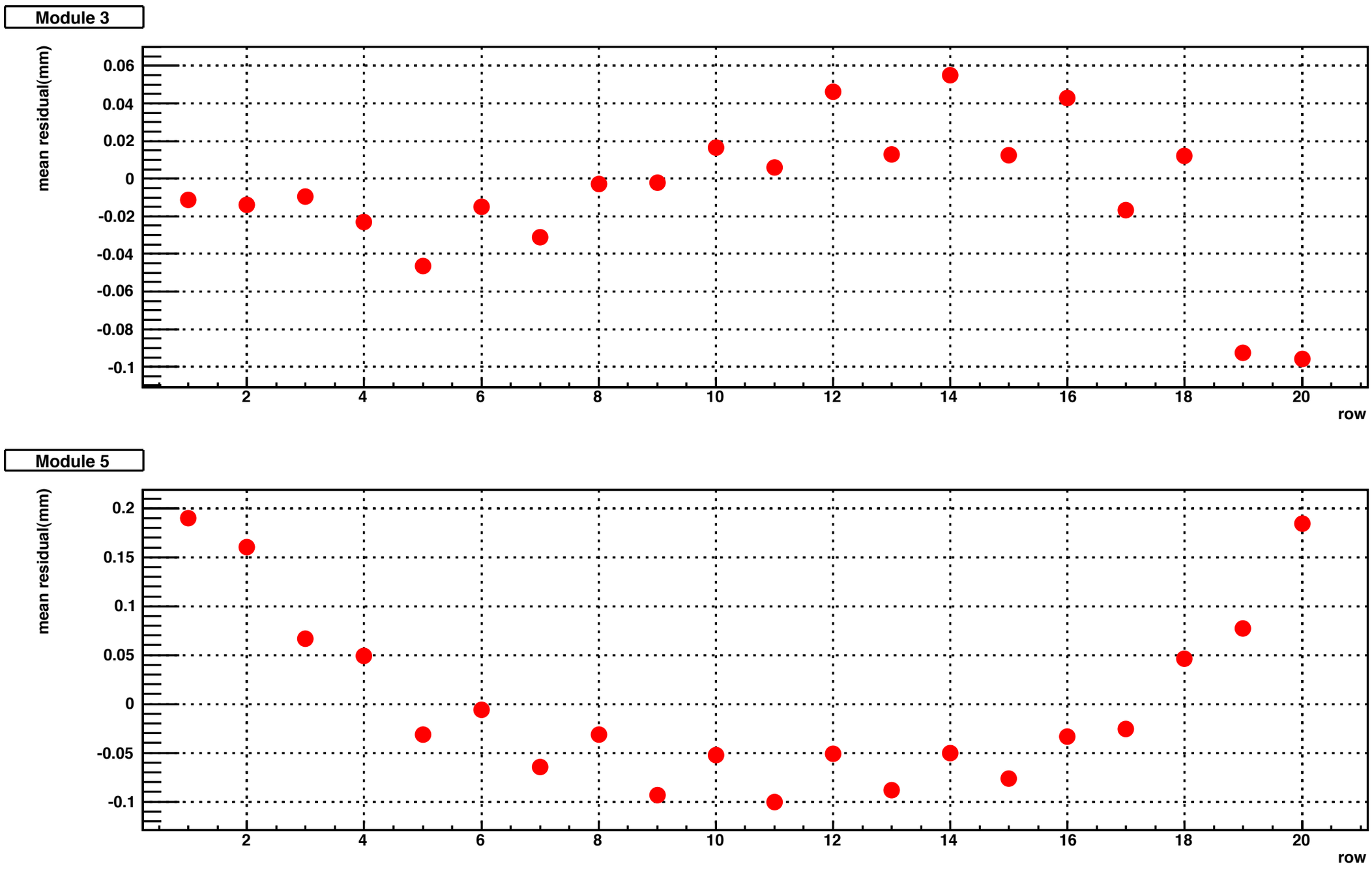


Distortion at 5cm

The mean of residual is the distortion:



Distortion at 50cm

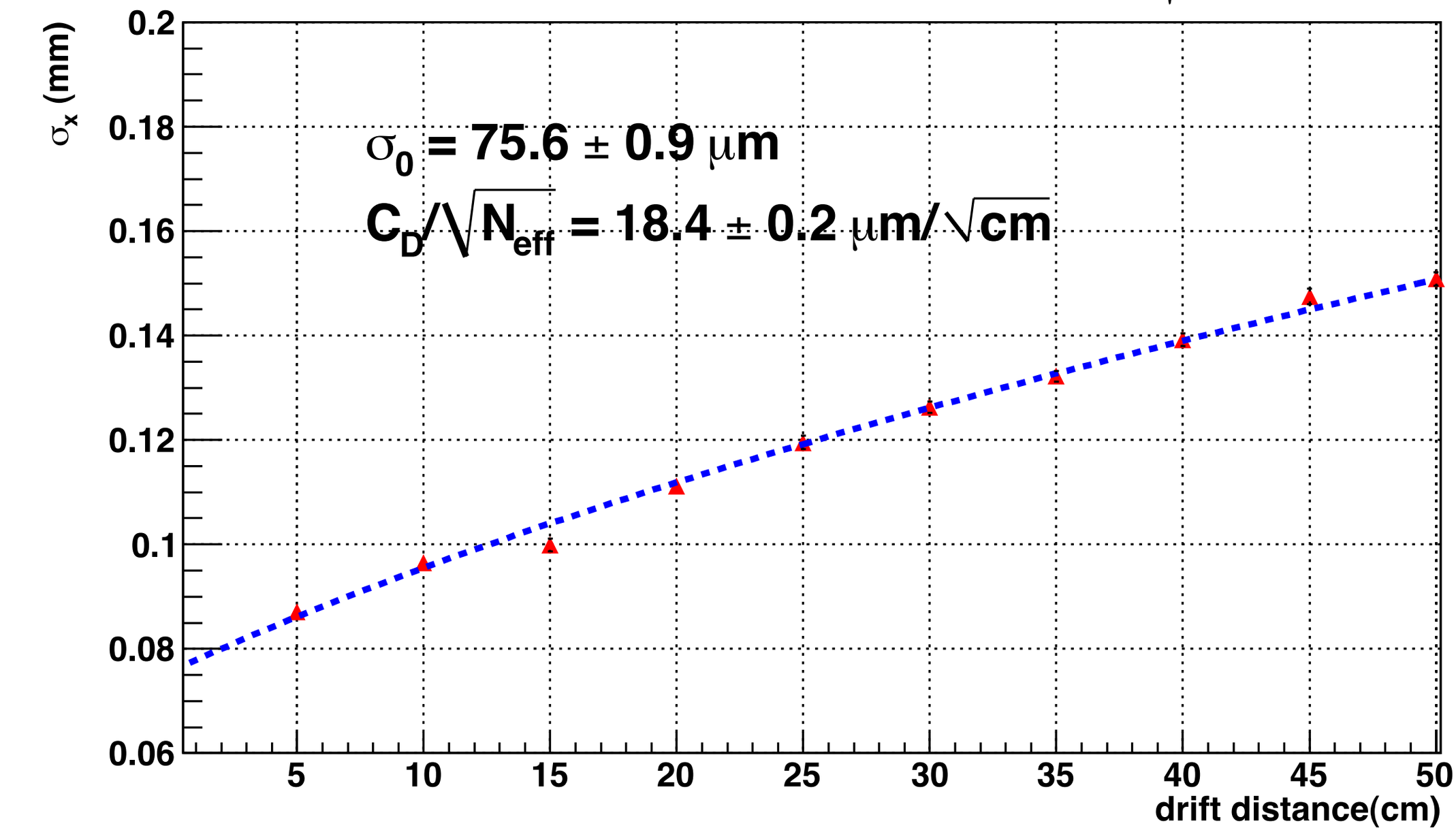


The distortion is not dependent drift distance significantly.

Resolution function

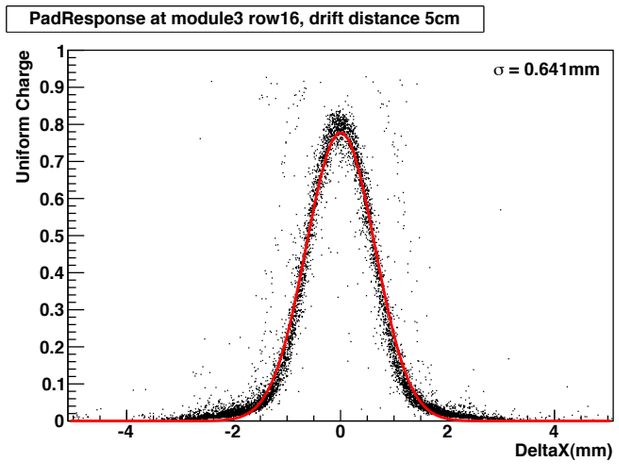
resolution-drift distance

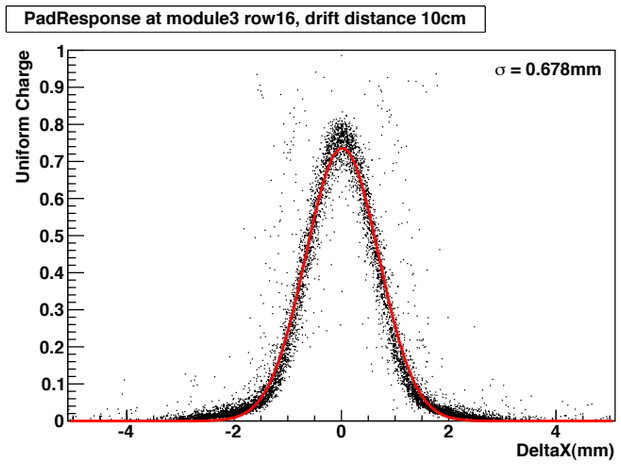
$$\sigma = \sqrt{\sigma_i \cdot \sigma_e} \qquad \sigma_x = \sqrt{\sigma_0 + \frac{C_D}{N_{eff}} z}$$

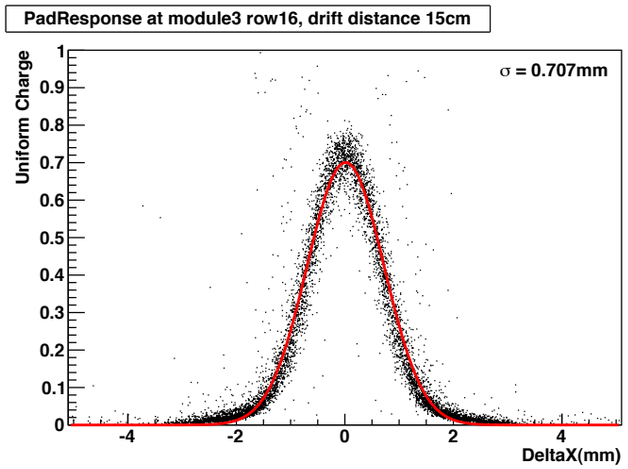


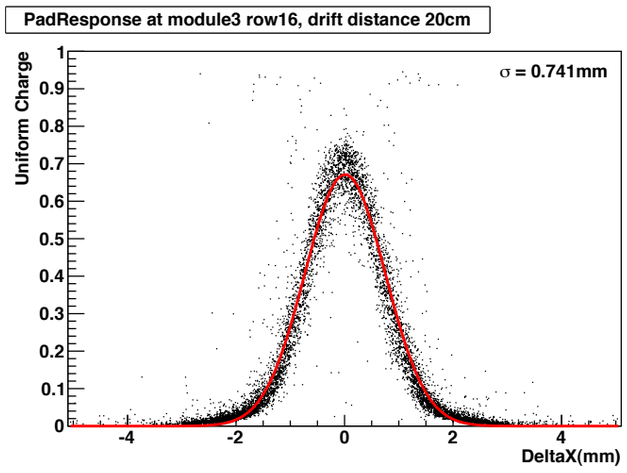
Pad response

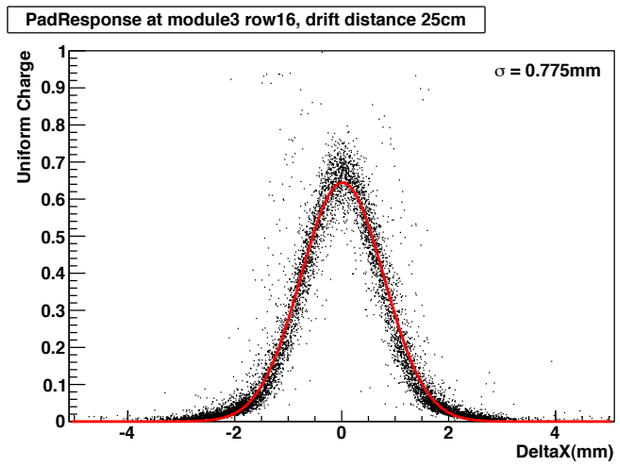
Pad response: $Q \sim (x_{puslecenter} - x_{track})$

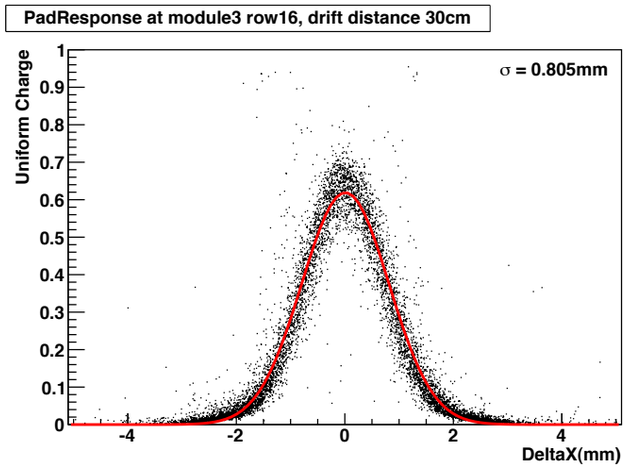


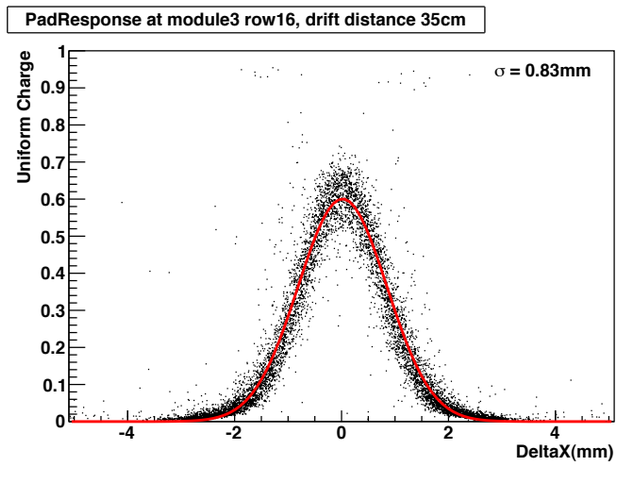


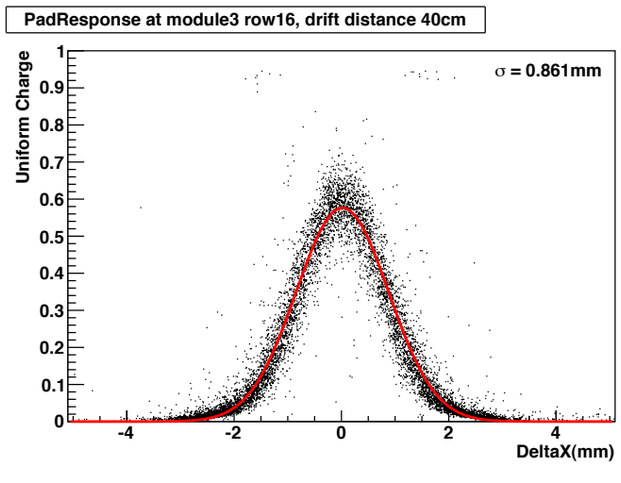


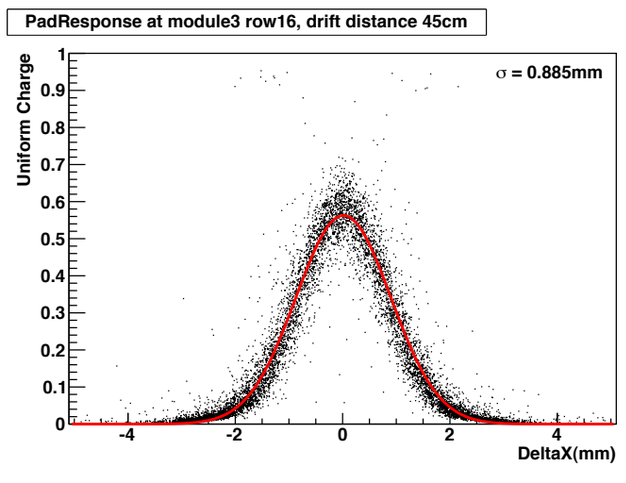




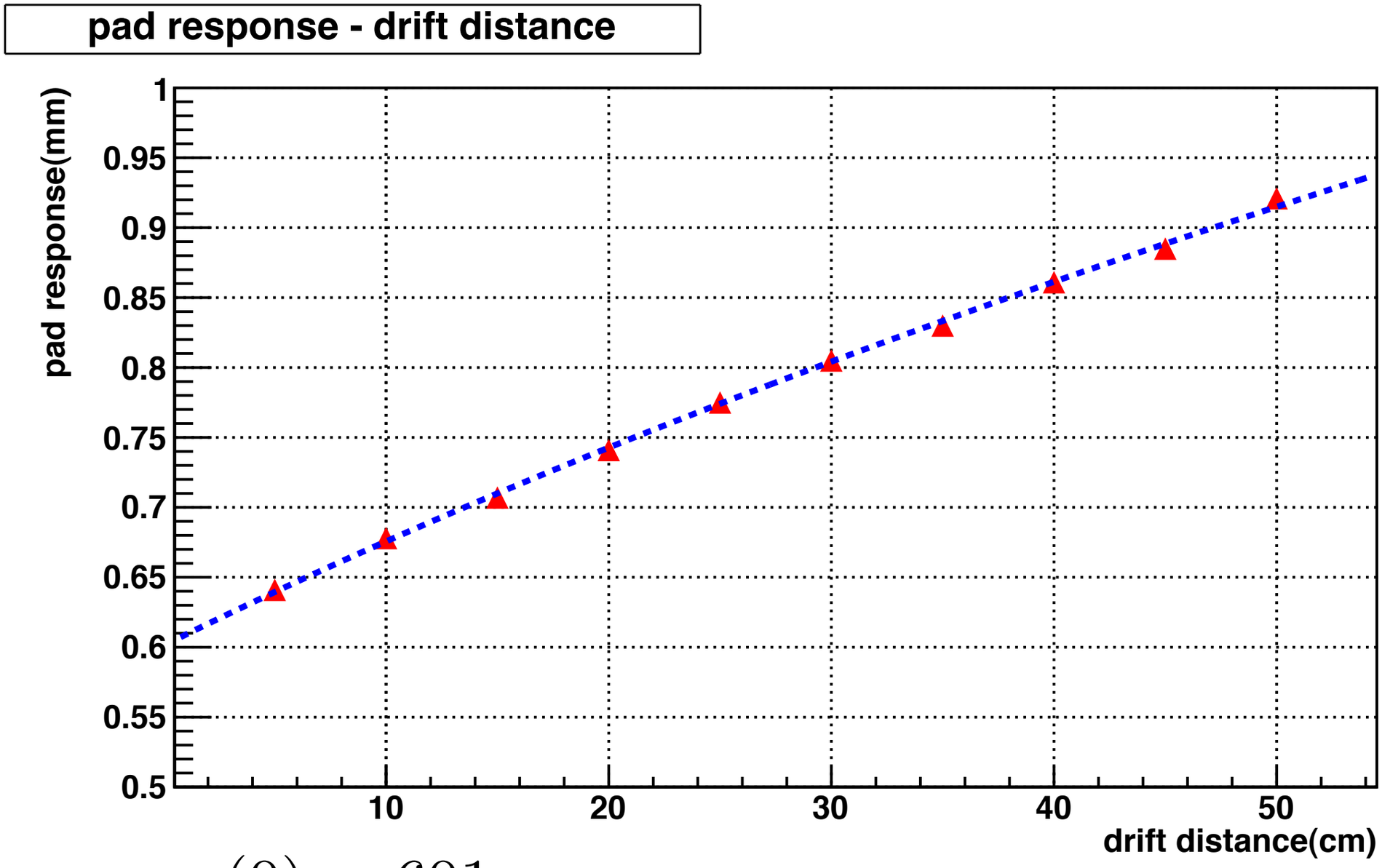








Pad response and drift distance



$$\sigma_{PR}(0) = 601\mu m$$

$$C_D = 97.5\mu m/\sqrt{cm}$$

Summary

- Now MarlinTPC can reconstruct tracks for LP1 beam test;
- Almost all information we need can be obtained from MarlinTPC;
- The preliminary result is consistent with that given by YokaRowMon;
- Future work is to check and improve the result.