Calibration algorithm and detector monitoring - TPC

Marian Ivanov

Outlook

- TPC calibration algorithm in HLT
- TPC QA

TPC calibration algorithm

- TPC calibration components based on the Raw data successfully integrated and used in the HLT framework (Pedestal, Pulser and Laser calibration)
  - Possibility to use the same – tested code in OFFLINE, DAQ and HLT
  - Input data - Interface – raw data - AliRawReader
- New TPC calibration components using tracks
  - Cluster error, shape fitting
  - Drift velocity monitoring, alignment
  - Gain calibration
  - Input data – Interface - AliTPCseed – array of clusters - space points

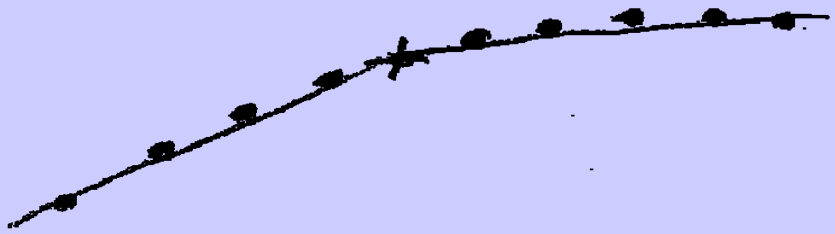
Track based calibration components

- AliTPCcalibTracks
  - Cluster error and shape parametrization
  - Raw cluster charge spectra
- AliTPCcalibTracksGain
  - Internal gain alignment
  - Charge Angular correction calibration
  - Sector gain equalization
- AliTPCcalibAlign + AliTPCcalibAlignment (Optional argument CE plane)
  - Sector alignment + QA histograms
- Status:
  - Offline - developed on MC – partially used (when enough statistic) on real cosmic data
  - HLT – to be interfaced

AliTPCcalibTracks analysis

FillResolutionHistoLocal(seed):

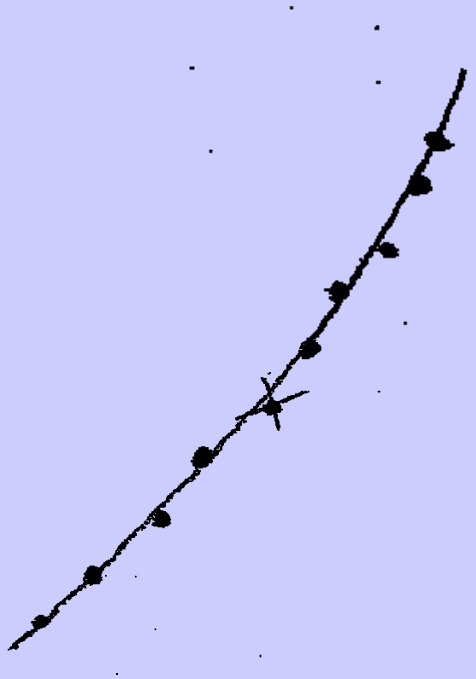
- Loops over all clusters of a given track
- For each cluster in a track a small tracklet is chosen
  (current cluster ±10 rows)
- This tracklet is fitted in Y and Z direction with two lines to determine the curvature
  (to ignore clusters
  on kinks)



AliTPCcalibTracks analysis

FillResolutionHistoLocal(seed):

- The tracklet is also fitted with a polynomial 2nd order in Y and Z direction
  - The difference between cluster and polynomial is stored as *delta* (σ) in one of the resolution histograms
  - Results of this analysis will be shown later on



AliTPCcalibTracks

- **Merge**(...) function is available to merge AliTPCcalibTracks objects from different PROOF-slaves
  - Necessary if the selector runs on PROOF to merge the objects coming from different PROOF-slaves
  - All the contained histograms are merged via their **Merge**(...) functions

Components

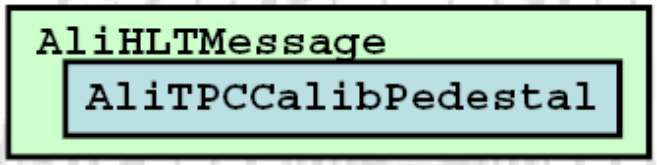
- Base Functionality:
  - Process(data)
  - Analyze()
- Component encapsulate data
  - Histograms, graphs, parameterization – Getters in the component

Calibration

- **General TPC calibration classes in cvs**
  - `AliTPCCalibPedestal`
  - `AliTPCCalibSignal`
- **Integrated into HLT Components**
  - `AliHLTTPCCalibPedestalComponent`
  - `AliHLTTPCCalibSignalComponent`
- **Included before AliRoot Release v4-5**

HLT – Calibration – Output

- **Calibration classes are shipped as ROOT TObjects → packed in AliHLTMessages (TMessage)**



- **3 Parallel output streams possible**
  - **FXS -> Collected by Offline Shuttle**
  - **TCP port -> HLT Online Monitoring**
    (was used during TPC Commissioning last week)
  - **DAQ via DataStream**

HLT – Components - Reminder

- **HLT Component = Wrapper to run in both**
  - **HLT Online Framework**
  - **HLT - AliRoot Offline**

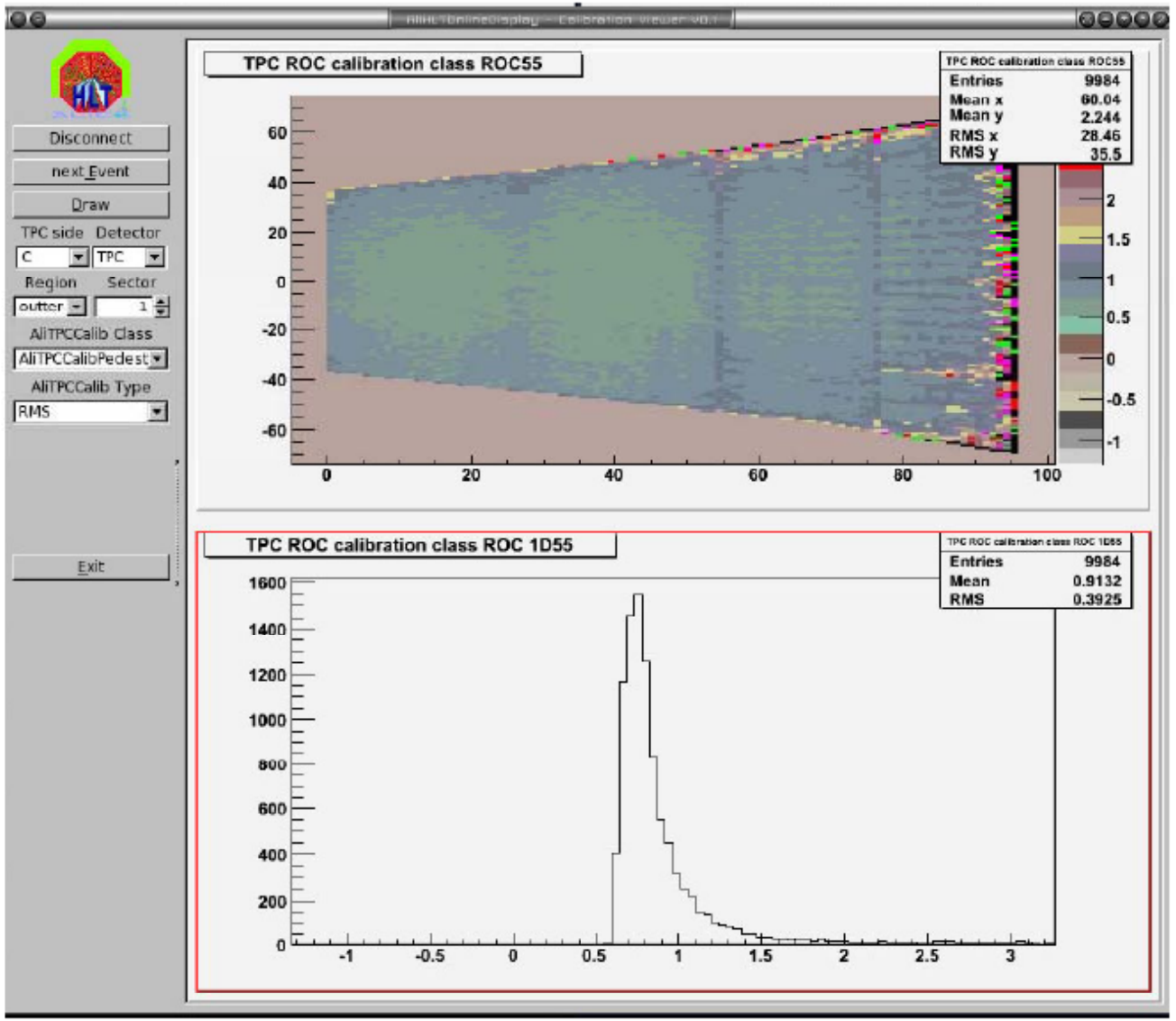
- **Some basic communication functions**
- **3 „worker" functions**
  - `DoInit()` → **Initialisation before run**
  - `DoEvent()` → **Called for every event**
  - `DoDeinit()` → **Deinitialisation after run**

Calibration in TPC Commissioning

- **Signal Calibration**
- **Pedestal Calibration**
- **All 8 Sectors (0,1,3,4,9,10,12,13)**
- **HLT Calibration Viewer**

- **AliEVE**
  - **2D view, 3D view**
  - **1D, 2D histograms**

HLT – Calibration Viewer



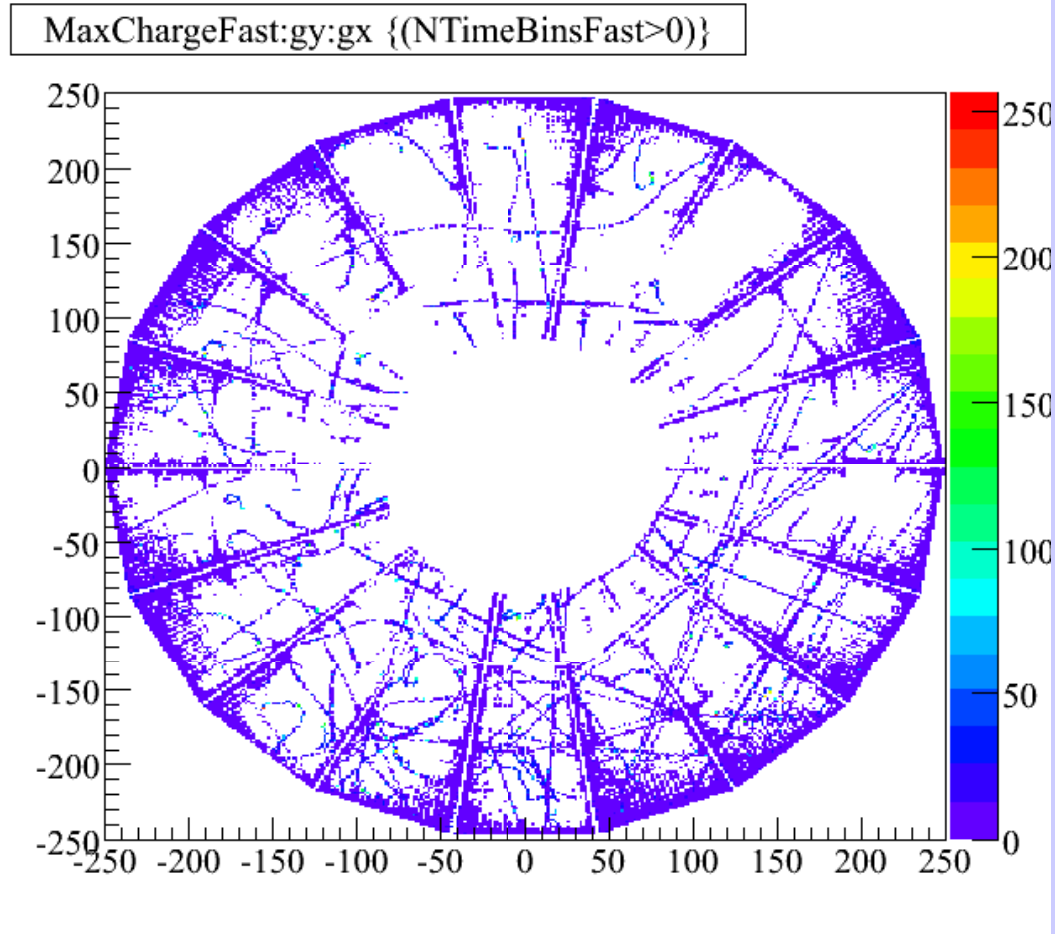
TPC QA

- The TPC (online) QA consist from two parts
  - Raw data monitoring e.g.
    - Amplitude spectra (1D, Profiles) ->require noise map + primitive calibration
    - Time dependence of mean Amplitude
  - Monitoring of calibration parameters
    - Check the detector behaviour
    - Check the calibration algorithm itself
    - The output of the calibration algorithm to be used in reconstruction, desirable no calibration reiteration needed

Quality assurance

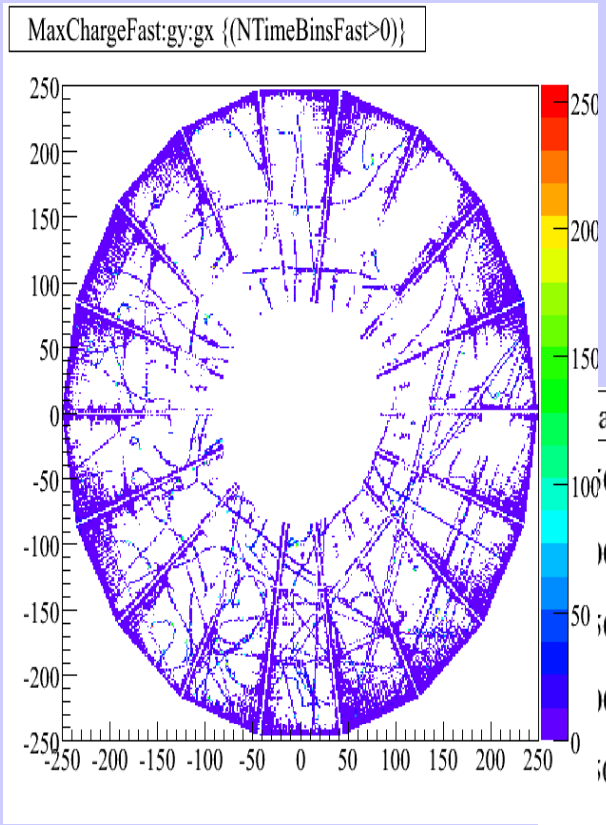
- Process:
  - Detect the problems - Define, what is the problem
  - What do we expect?
    - Defined in the TDR and in the PPR on the basis of simulation
  - Until which point the detector the information form the detector is reasonable?
    - How far we are from the expectation?
  - Define the limits of working conditions
  - Modify expectation
- TPC Strategy – Enable Expert mode of the QA just from the beginning.
  - Default histograms – views – configurable - generated by expert monitor
- More details about TPC QA -

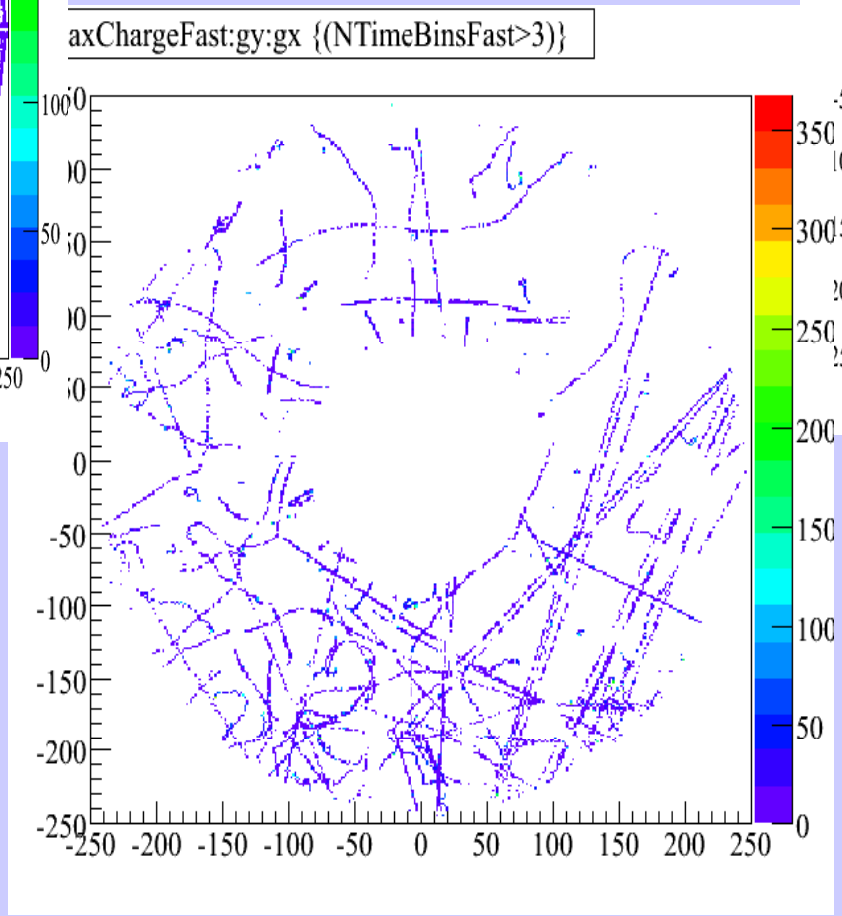
RAW data QA: Cosmic data from December run

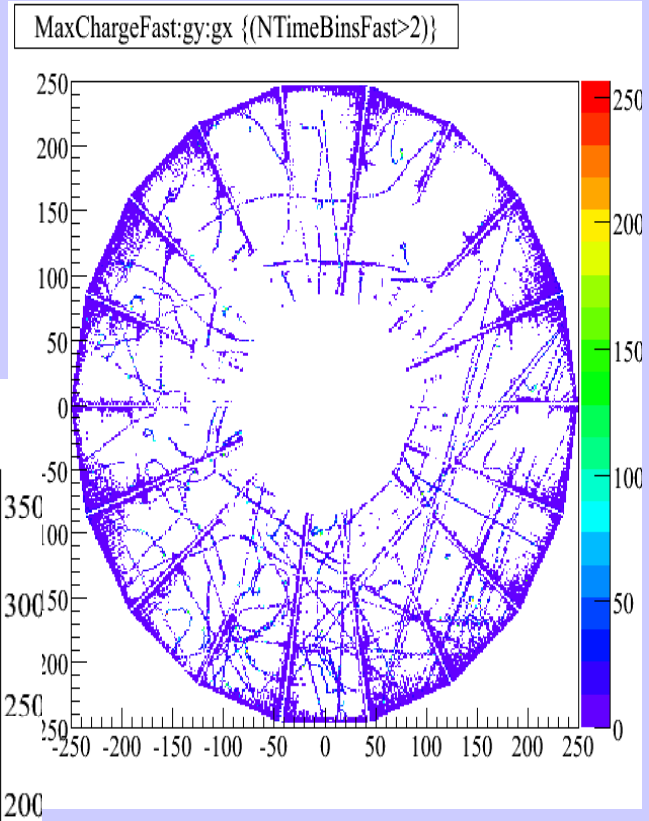


- Output can be viewed (and manipulated!) in TPC calibration browser online

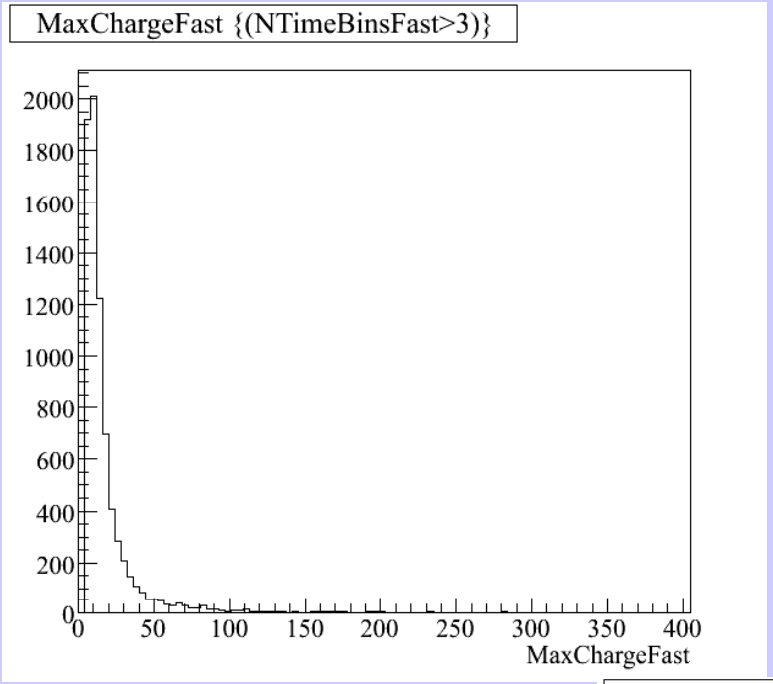
Qmax with cuts on mean time bins

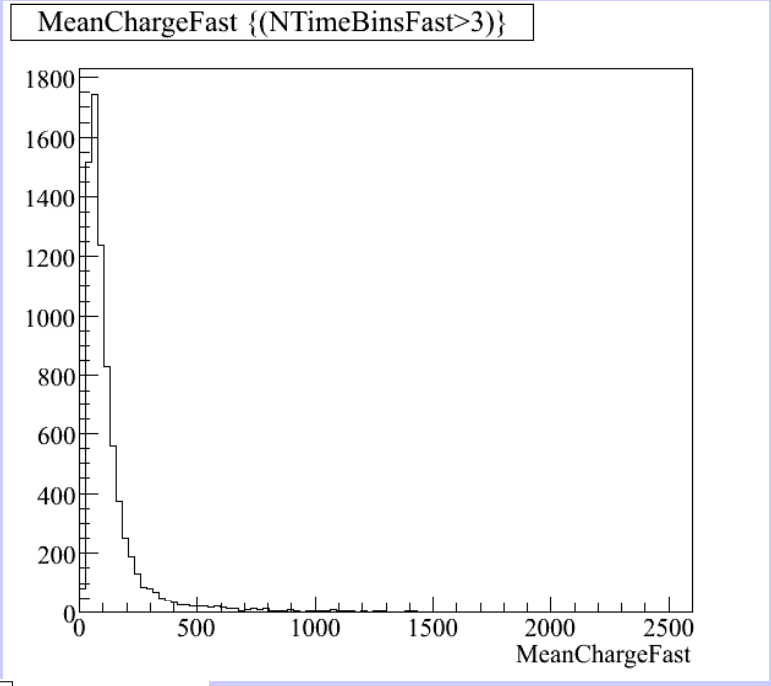


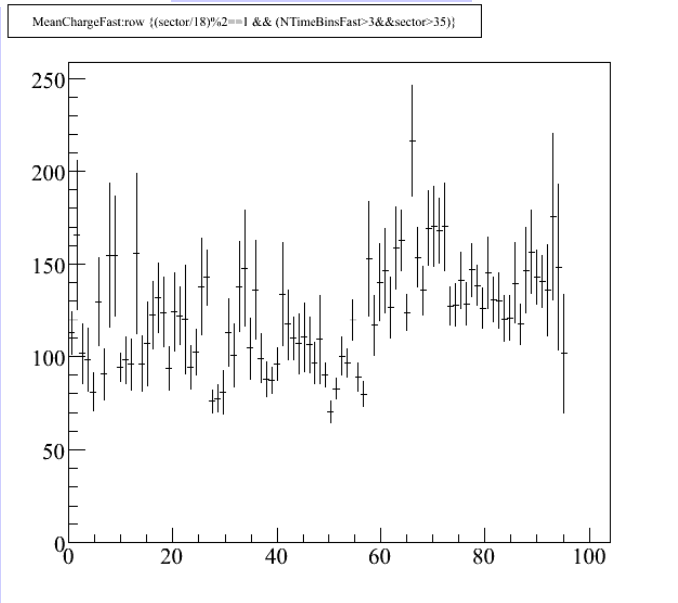




Q and Qmax plots with cuts



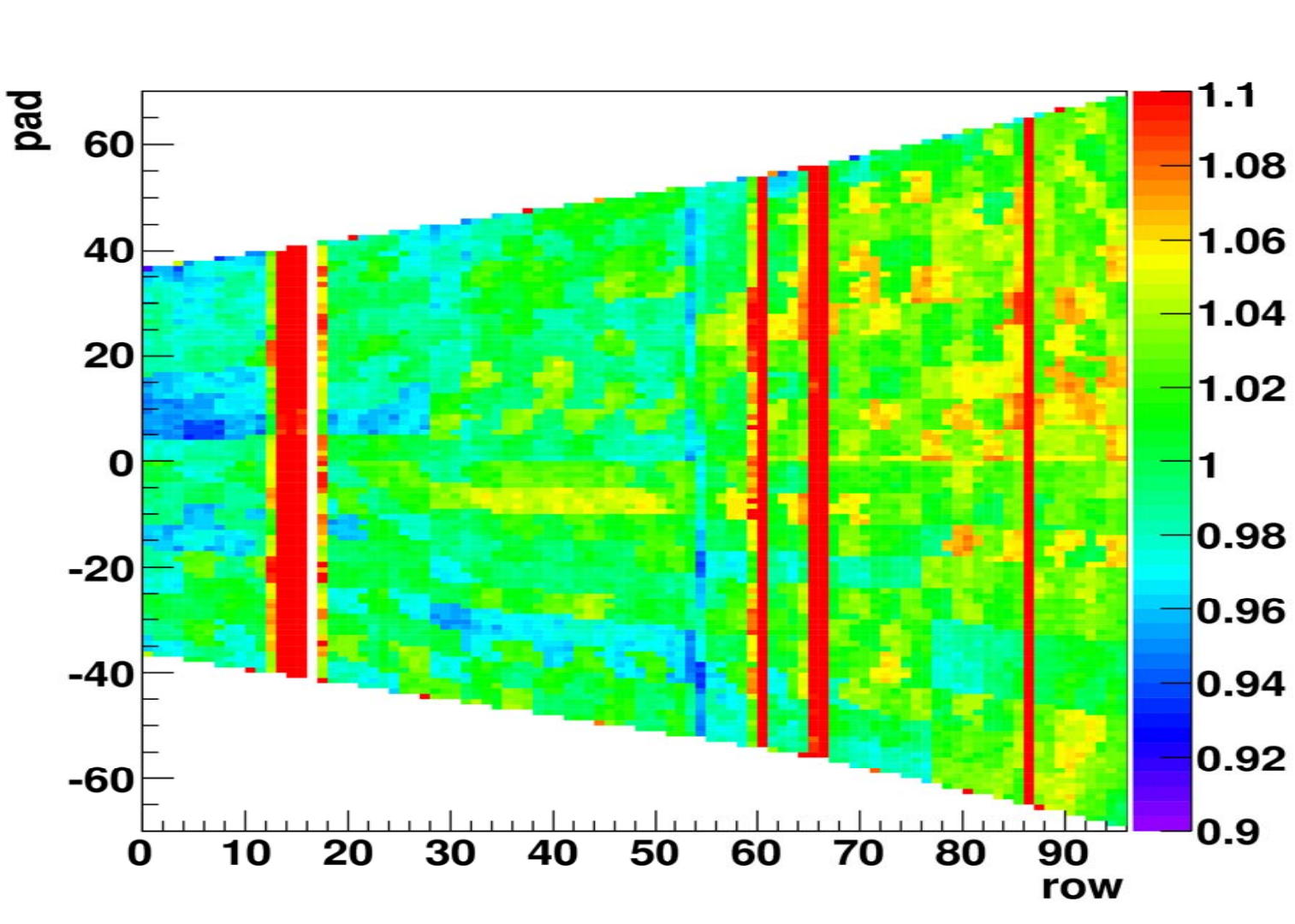




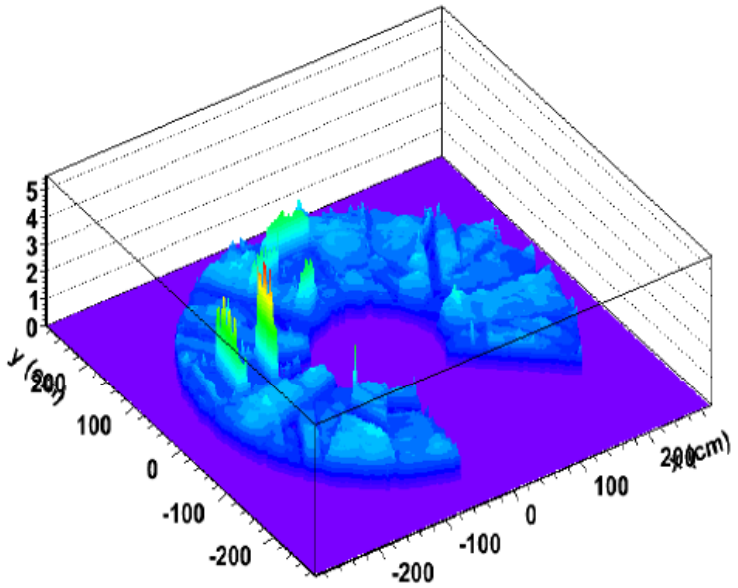
Quality assurance (DA)

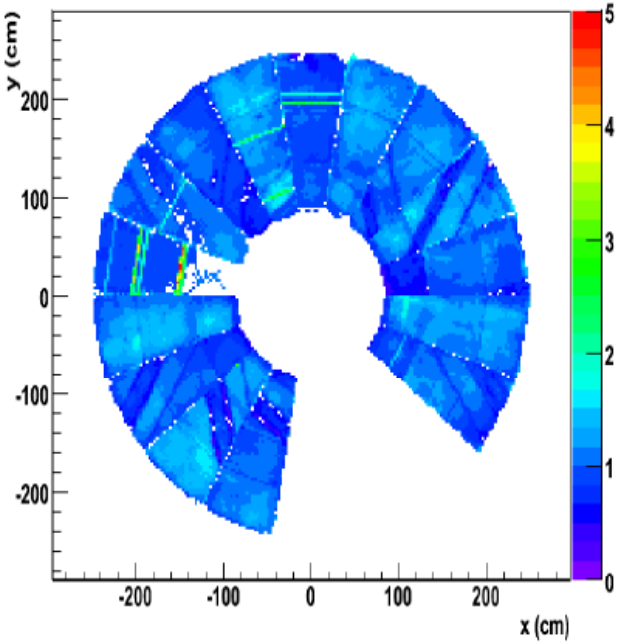
- Data quality monitoring based on statistical properties of data - Extracting in calibration procedure
- Low level – digit level:
  - Noise and pedestal calibration
  - Electronic gain calibration
  - Time 0 calibration
  - Laser calibration
- Direct answer
  - Number of dead channels
  - Percentage of suspicious channels
- Alarms:

Pulser Q measurement



Central electrode amplitude analysis





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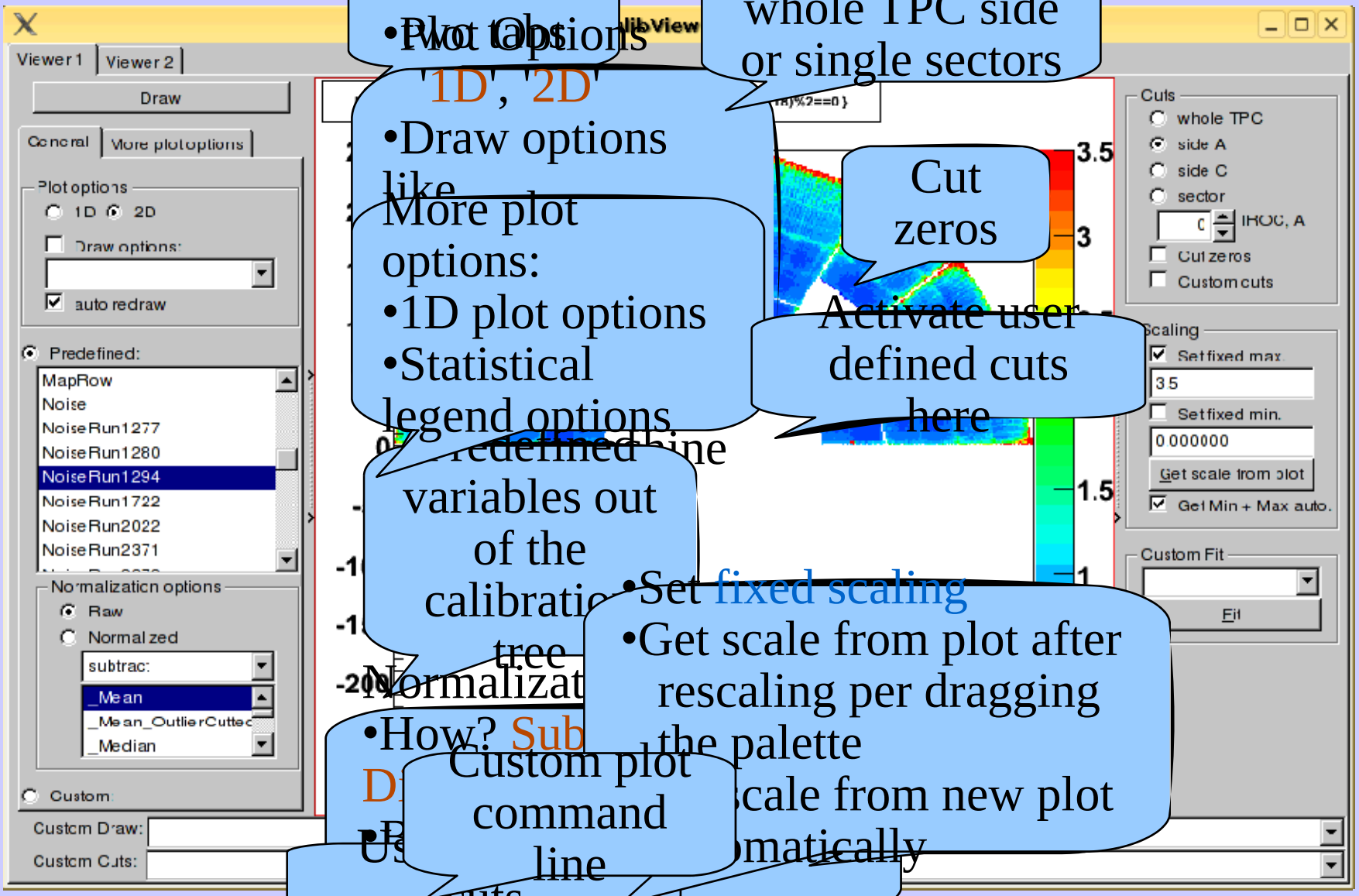
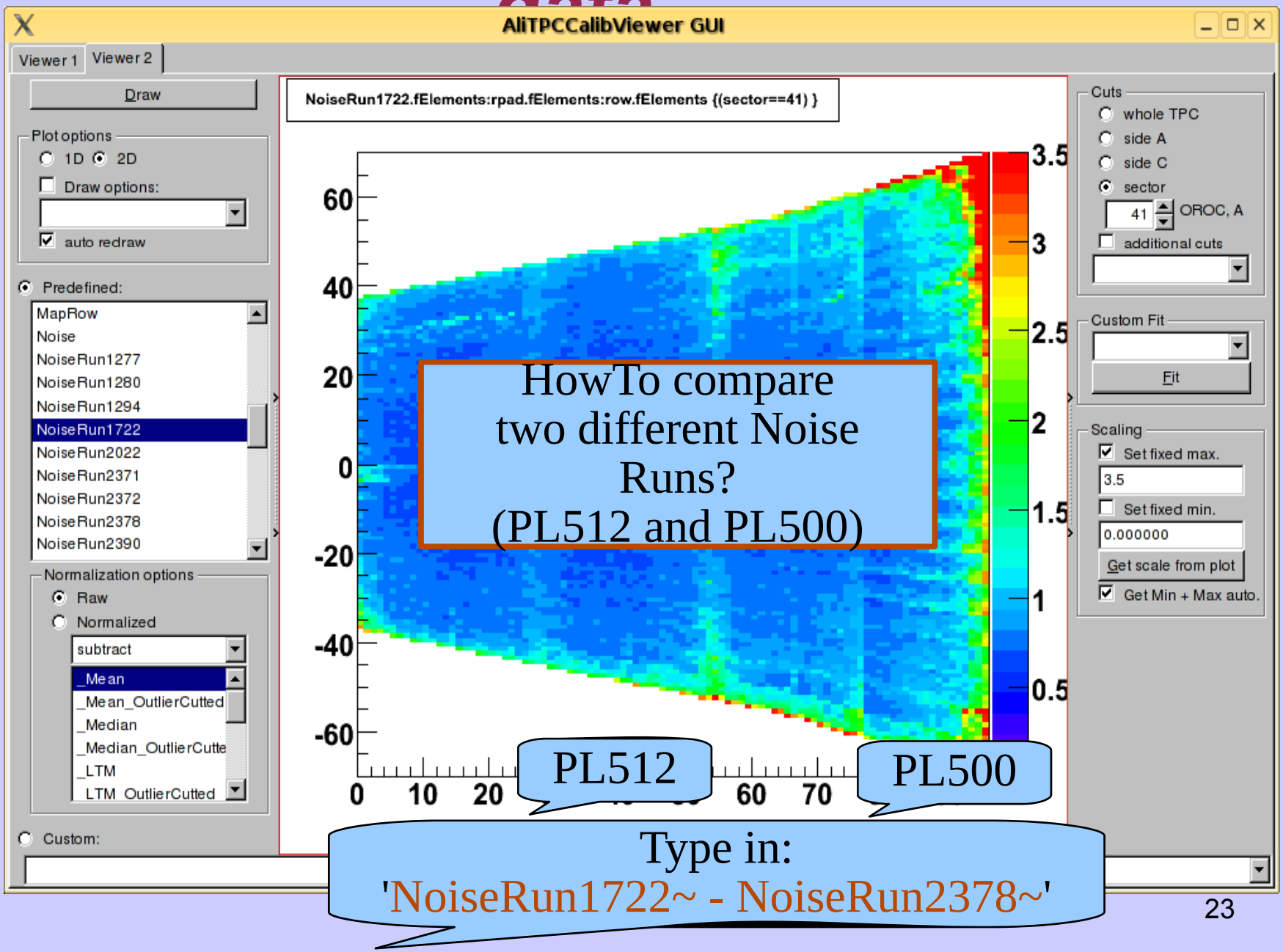
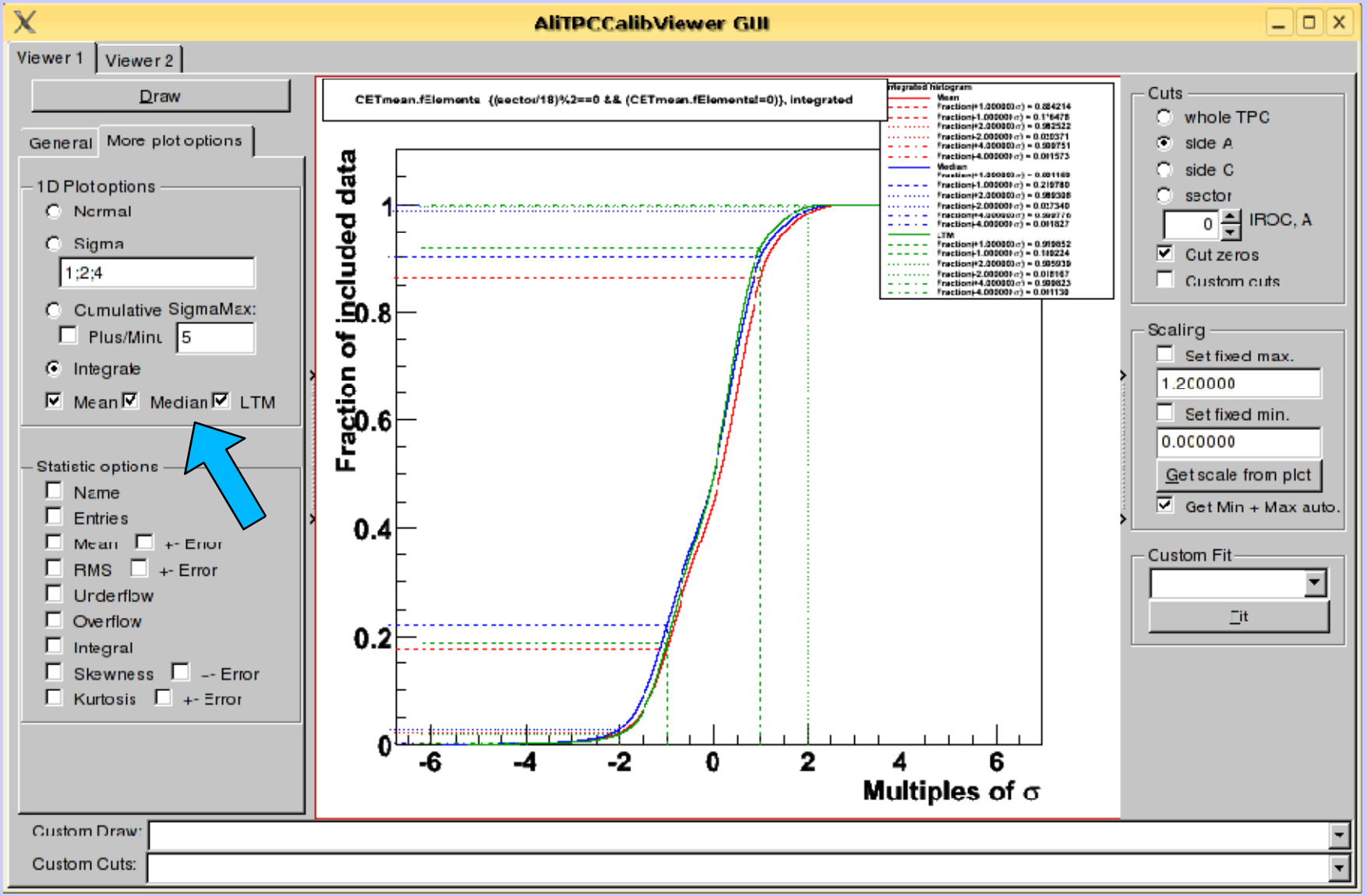
GUI in detail



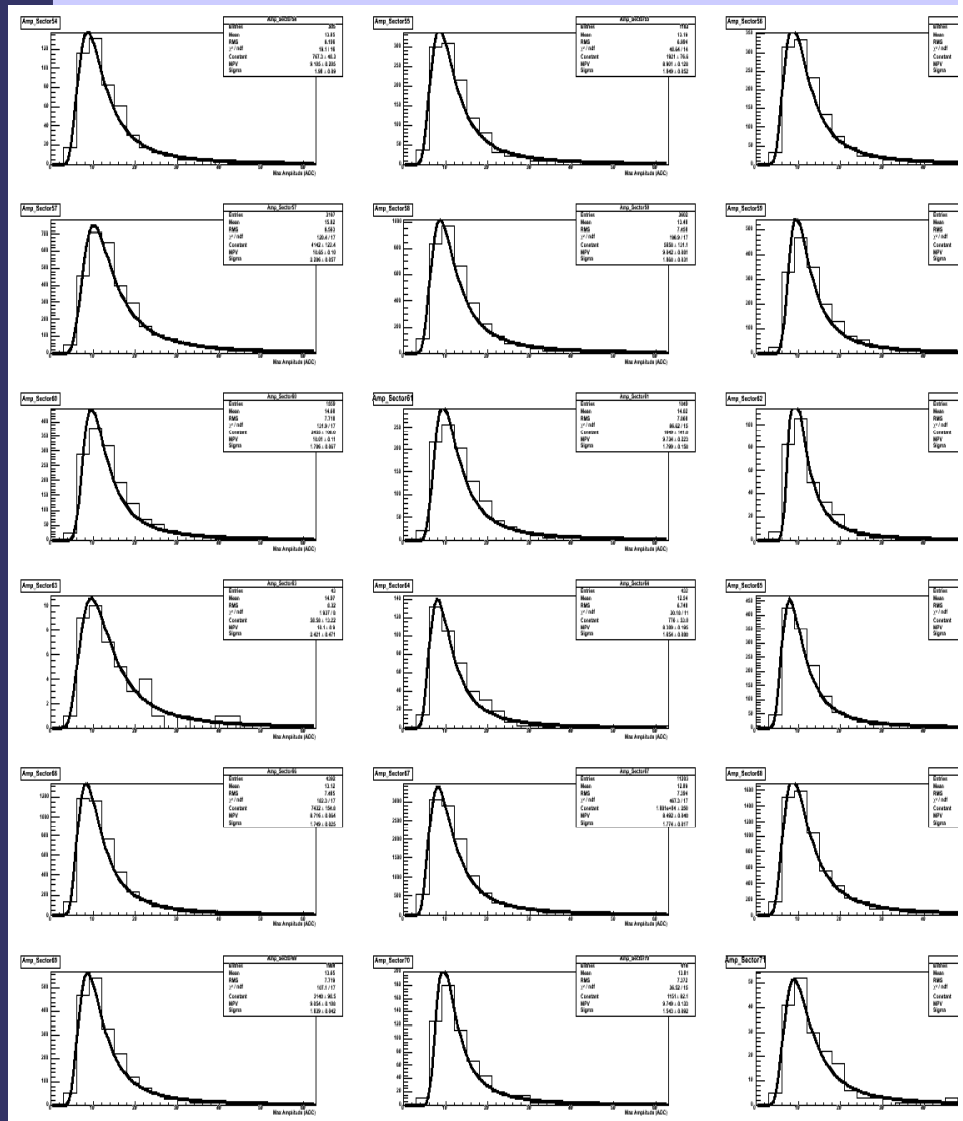
GUI demonstration – Comparison with refernce data

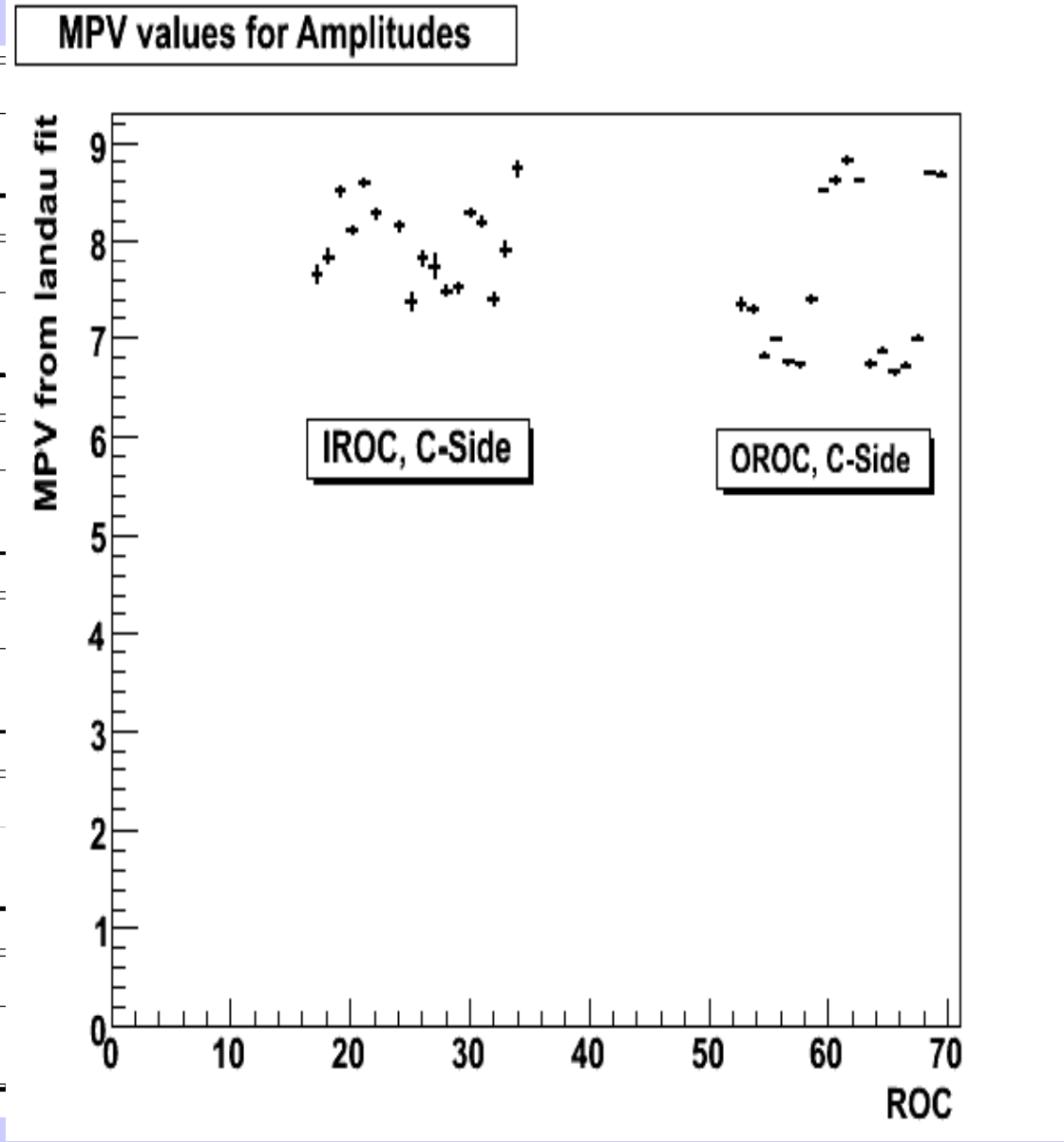


Statistic – cumulative function

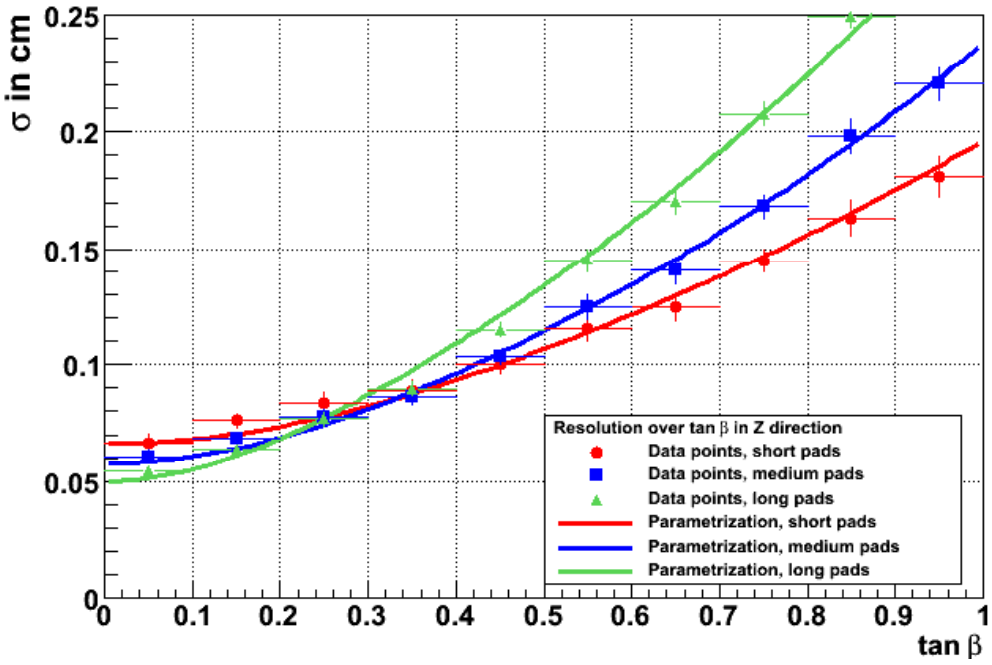


Monitoring using tracks

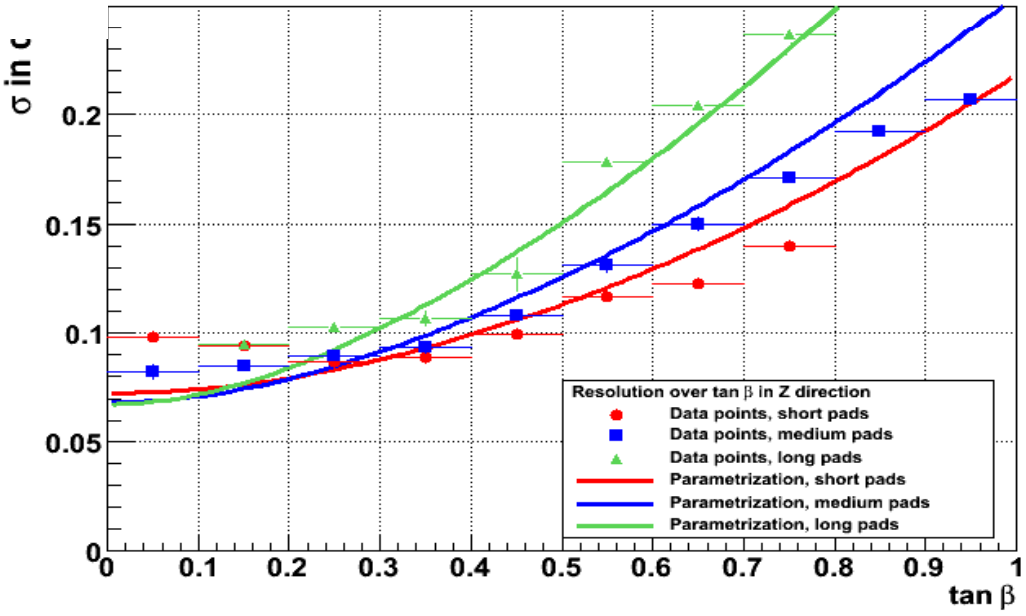




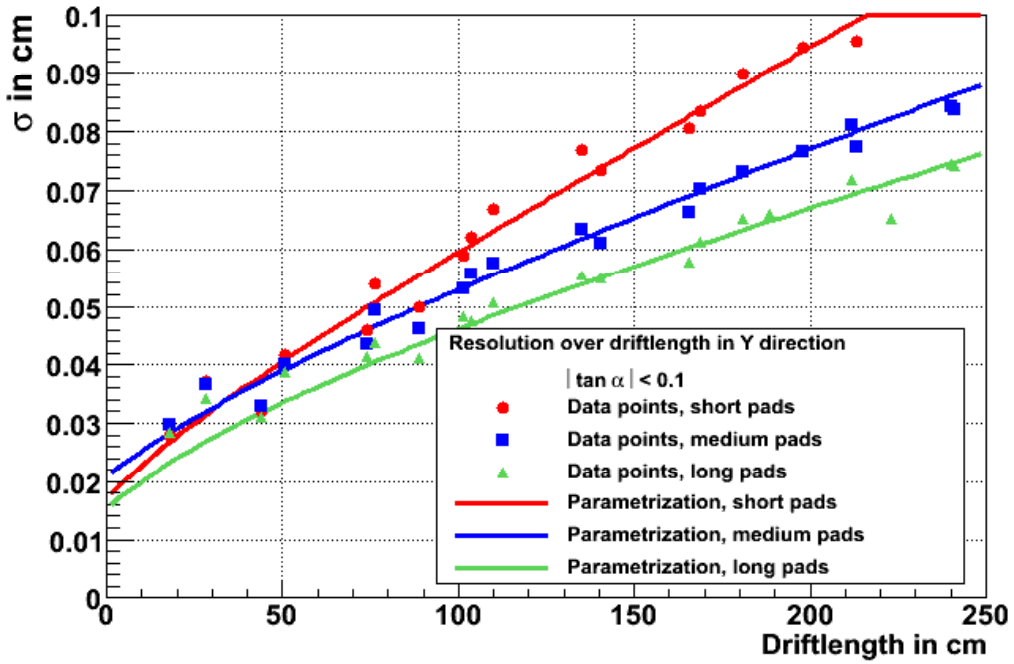
Cluster position resolution



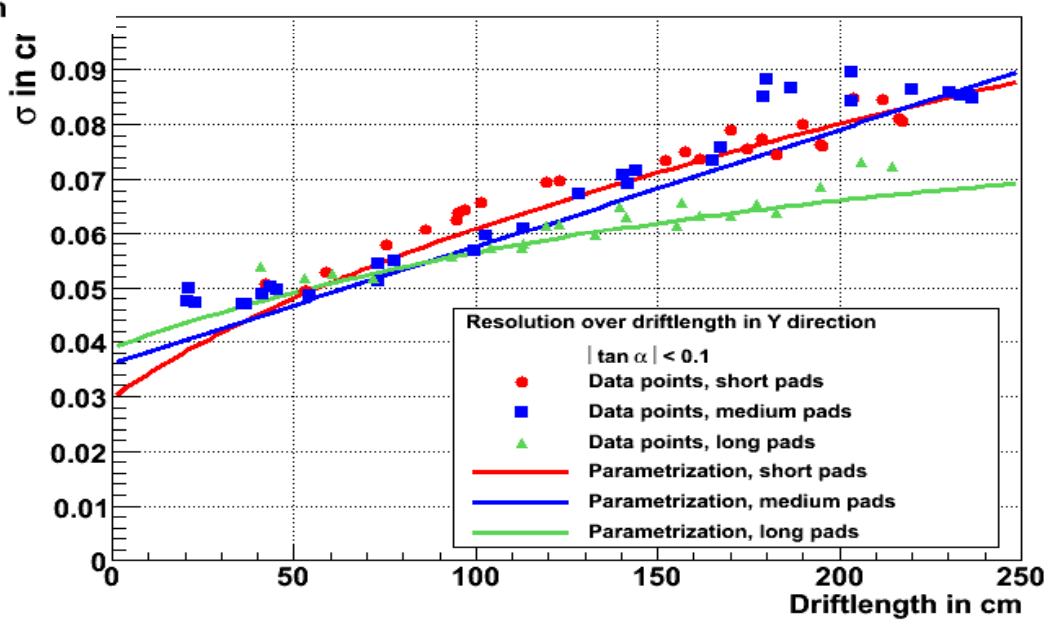
- Cluster position resolution as function of inclination angle
  - Left – MC data
  - Right – TPC test 2007 data



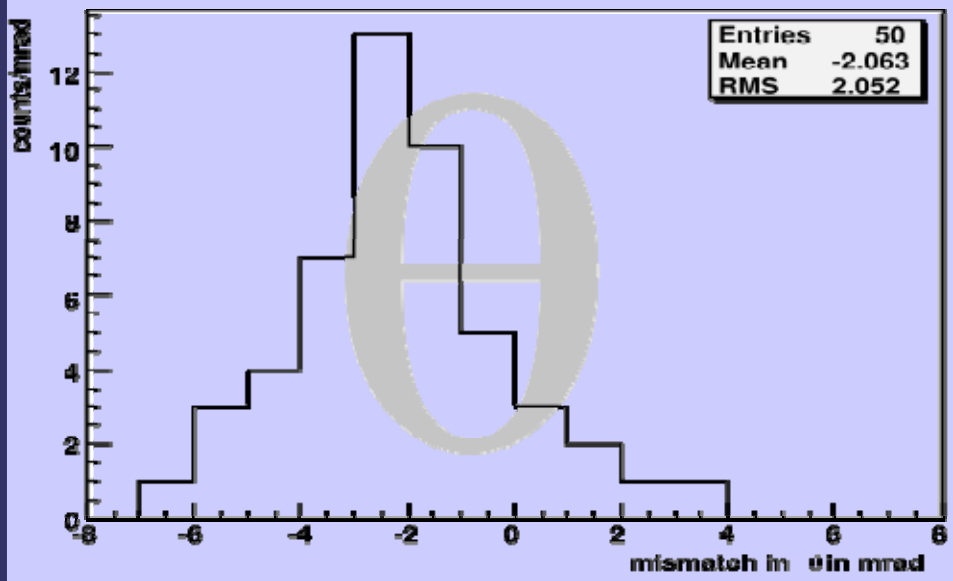
Cluster position resolution

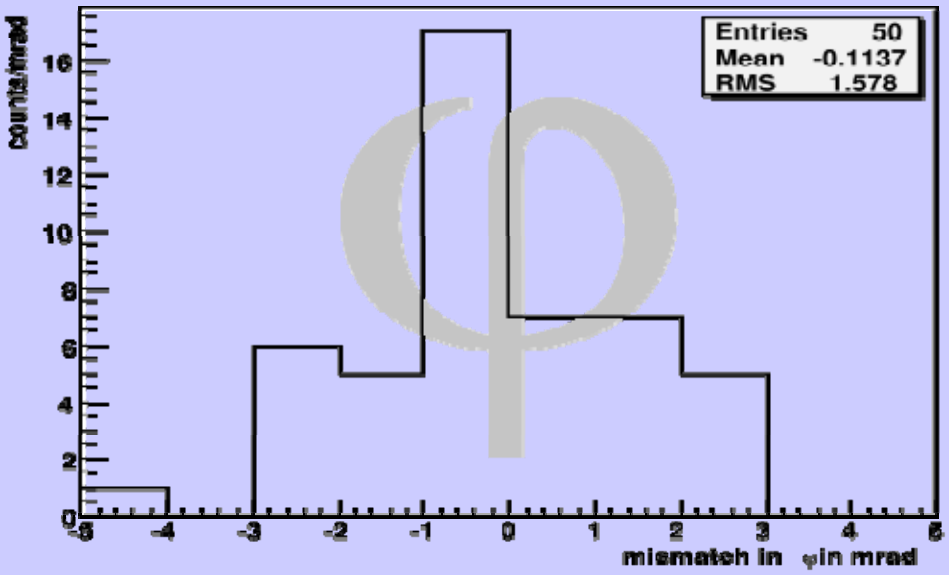


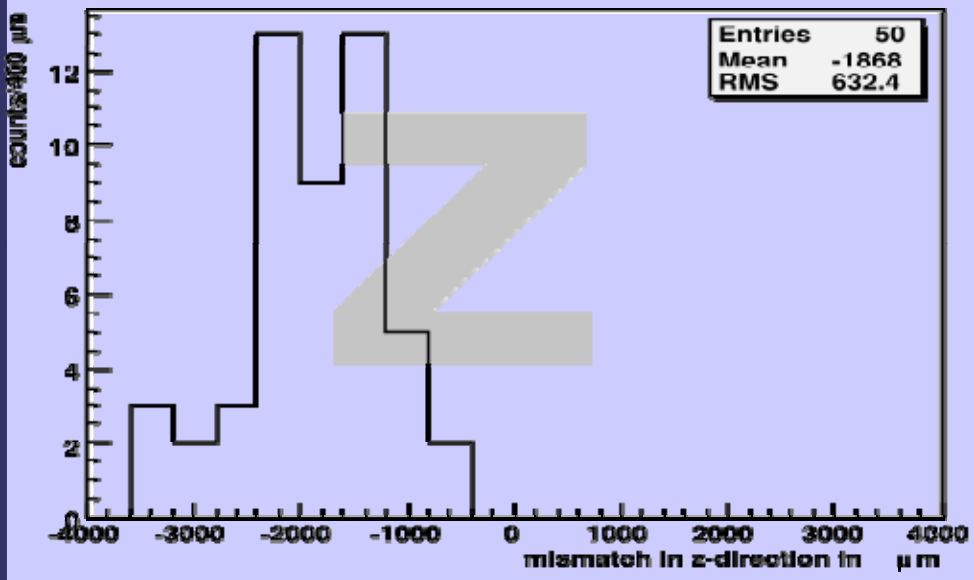
- Cluster position resolution as function of drift length
  - Left – MC data
  - Right – TPC test 2007 data

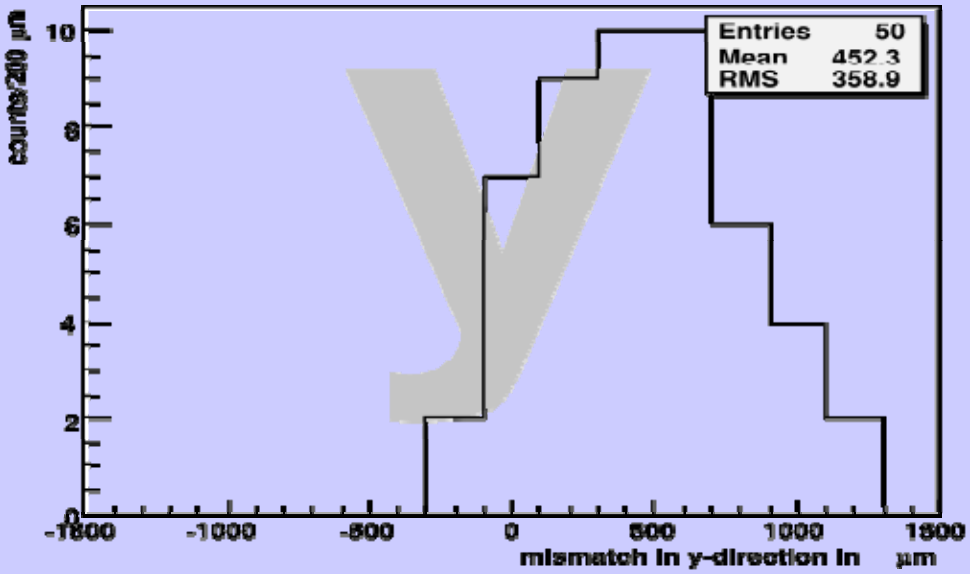


Alignment - Example









Alignment - Example