



Preliminary studies on the test-data from the IFR prototype

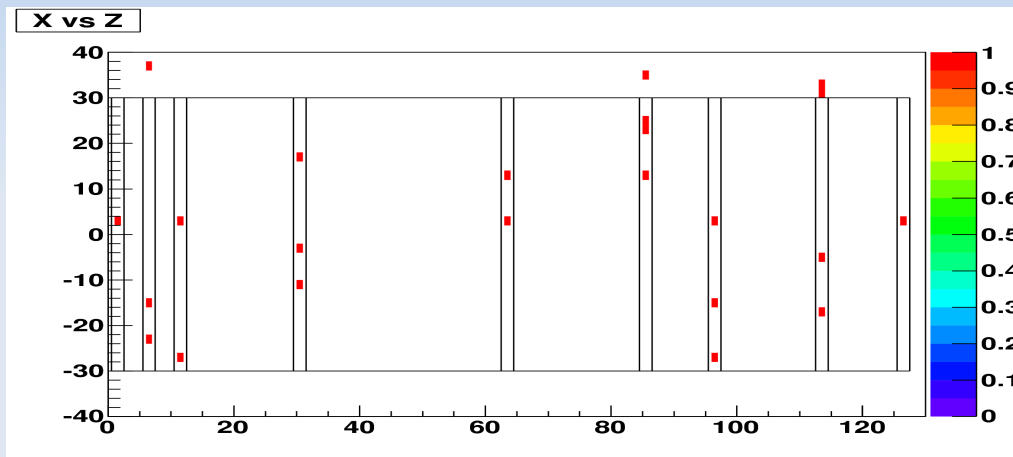


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13.09.2011

Data Set

- Test beam data – December 2010:

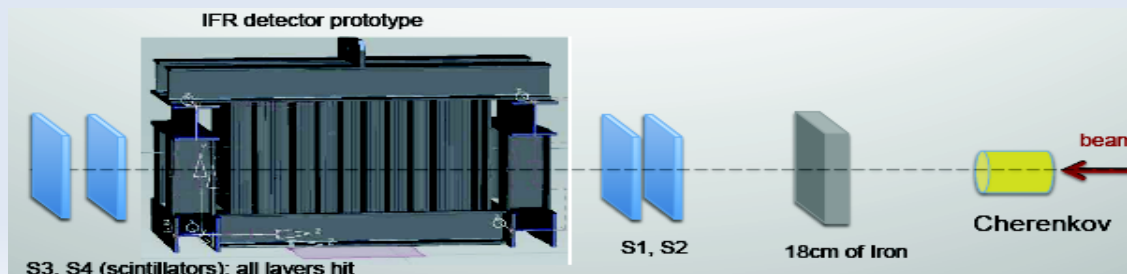
file: Er_PreprocessedEvents_160_6-12-2010_13-50-54.root



9818 events in total

- Selection of the muon-like tracks:

$\text{Tr_mu_Tight} > 0 \ \&\& \ \text{Tr_s3s4_Tight} > 0$



3175 events chosen

Data selection & errors

First selection of the readout information:

- **Odd layers:**

all BiRO information for **X,Y** coordinates

- **Even layers:**

X – position calculated from the time propagation measurement, read from both ends of the stripes (2 independent values)

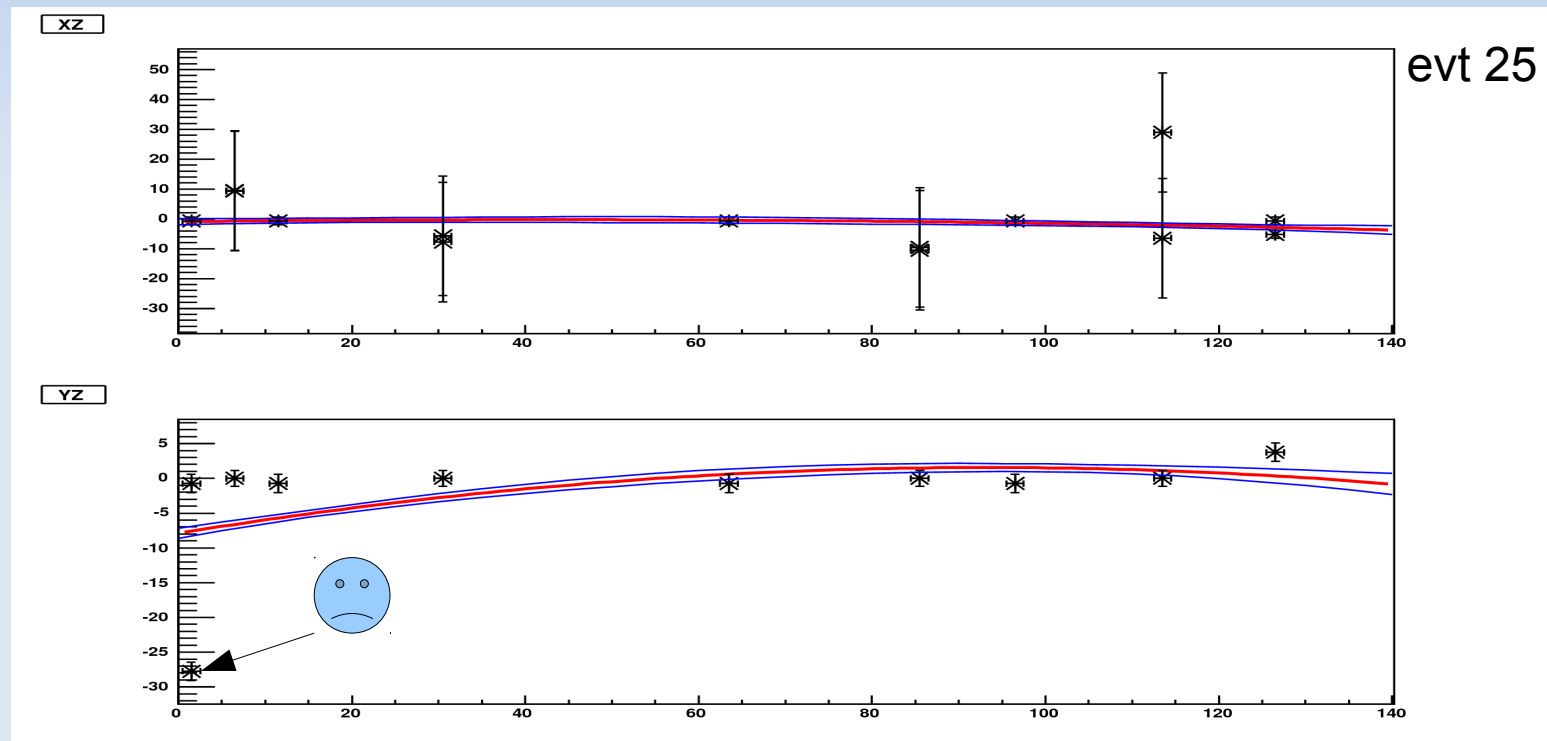
Y – BiRO information from only one side of the strip

Errors assignment:

- BiRO: $\Delta X, \Delta Y = \frac{d_{strip}}{\sqrt{12}}$, $\Delta Z = 1\text{cm}$
TDC-RO : $\Delta X = 20\text{ cm}$

Attempt to fit...

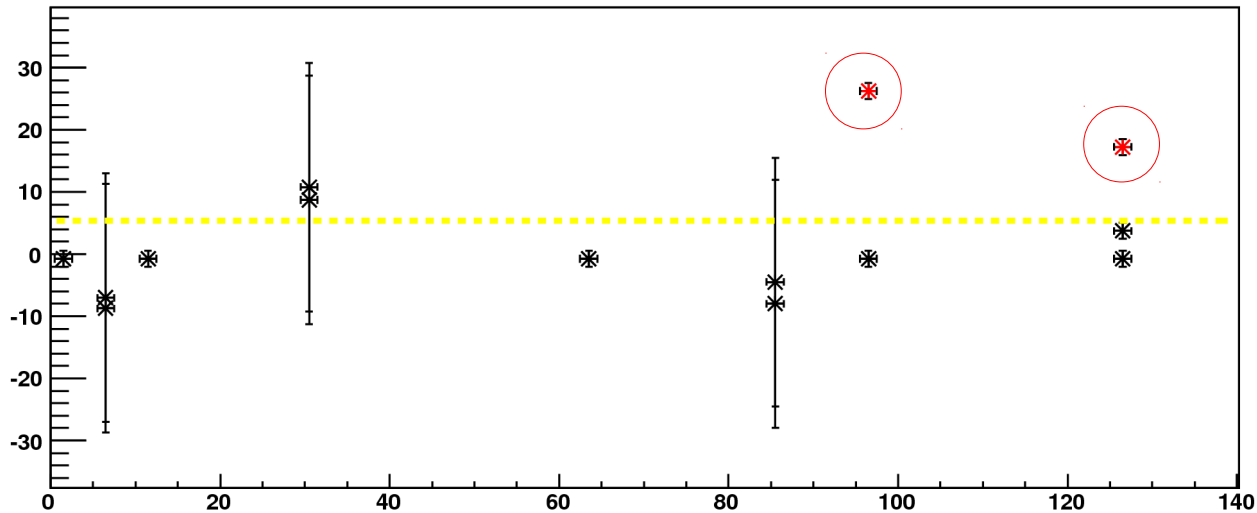
- Fit - 2nd order Polynomial function



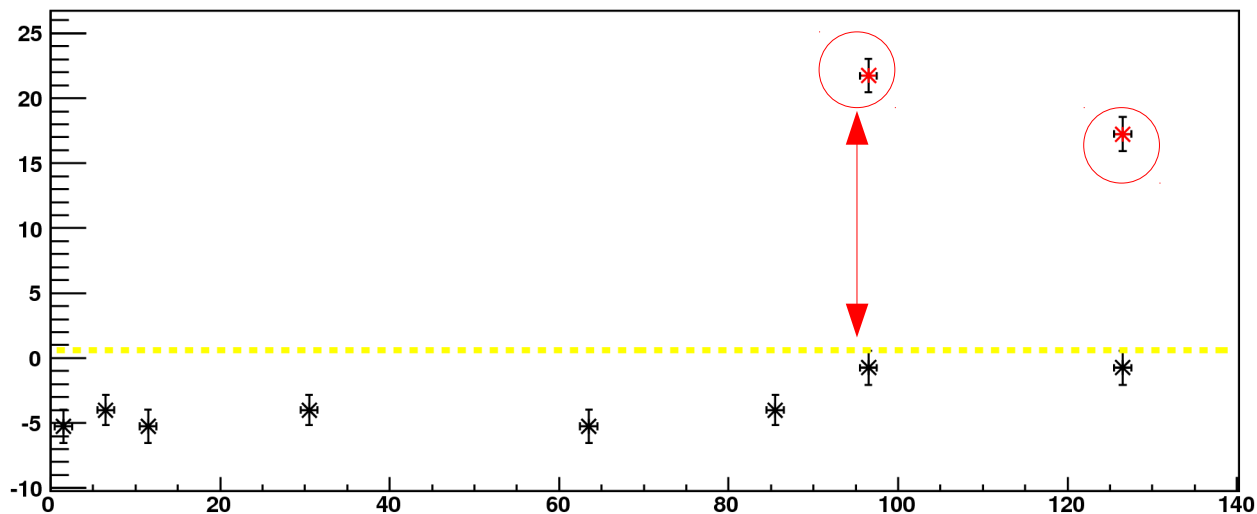
- Some background points disturbing the fit to the straight muon track

Noise Hits

28: XZ



28: YZ



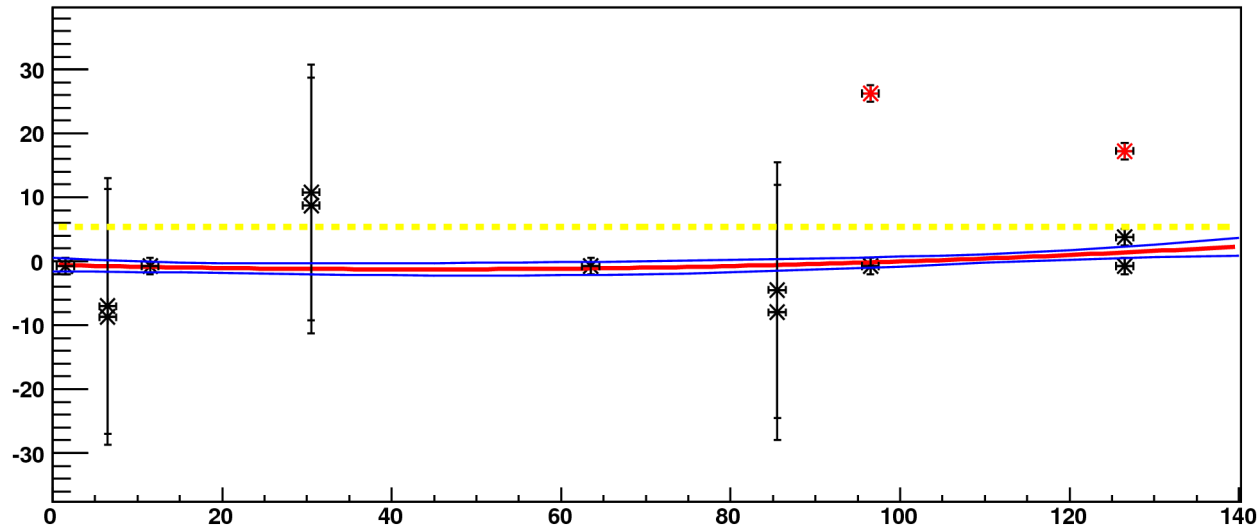
First idea:

rejecting
background
points
by their distance
from the **weighted
average**

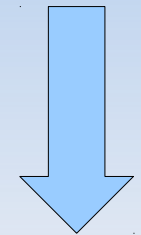
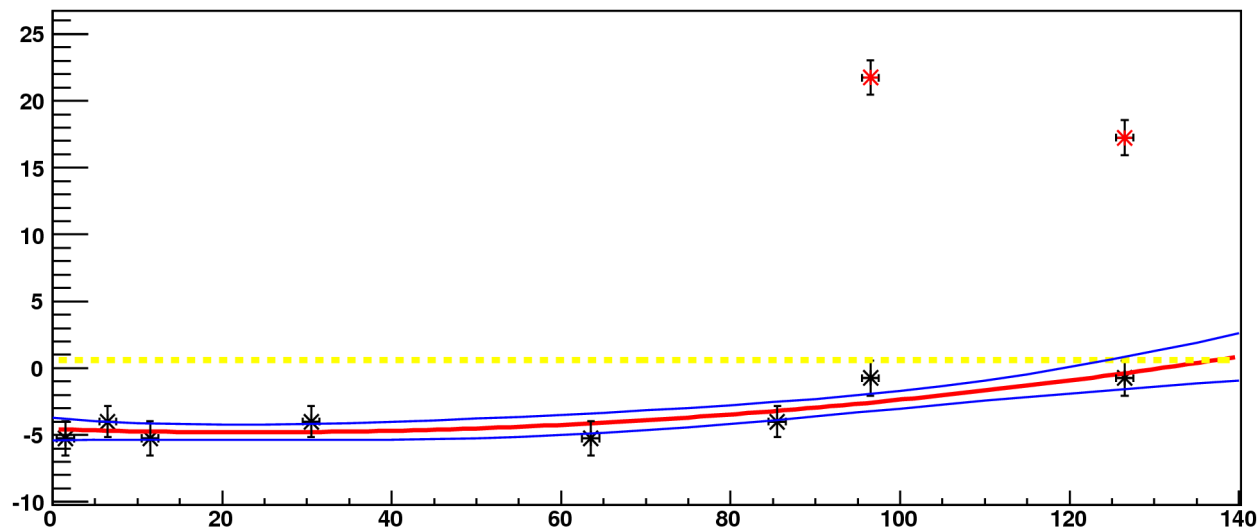
$$Av = \frac{\sum w_i X_i}{\sum w_i}, \quad w_i = \frac{1}{\Delta X_i^2}$$

Noise Hits - rejected

28: XZ



28: YZ

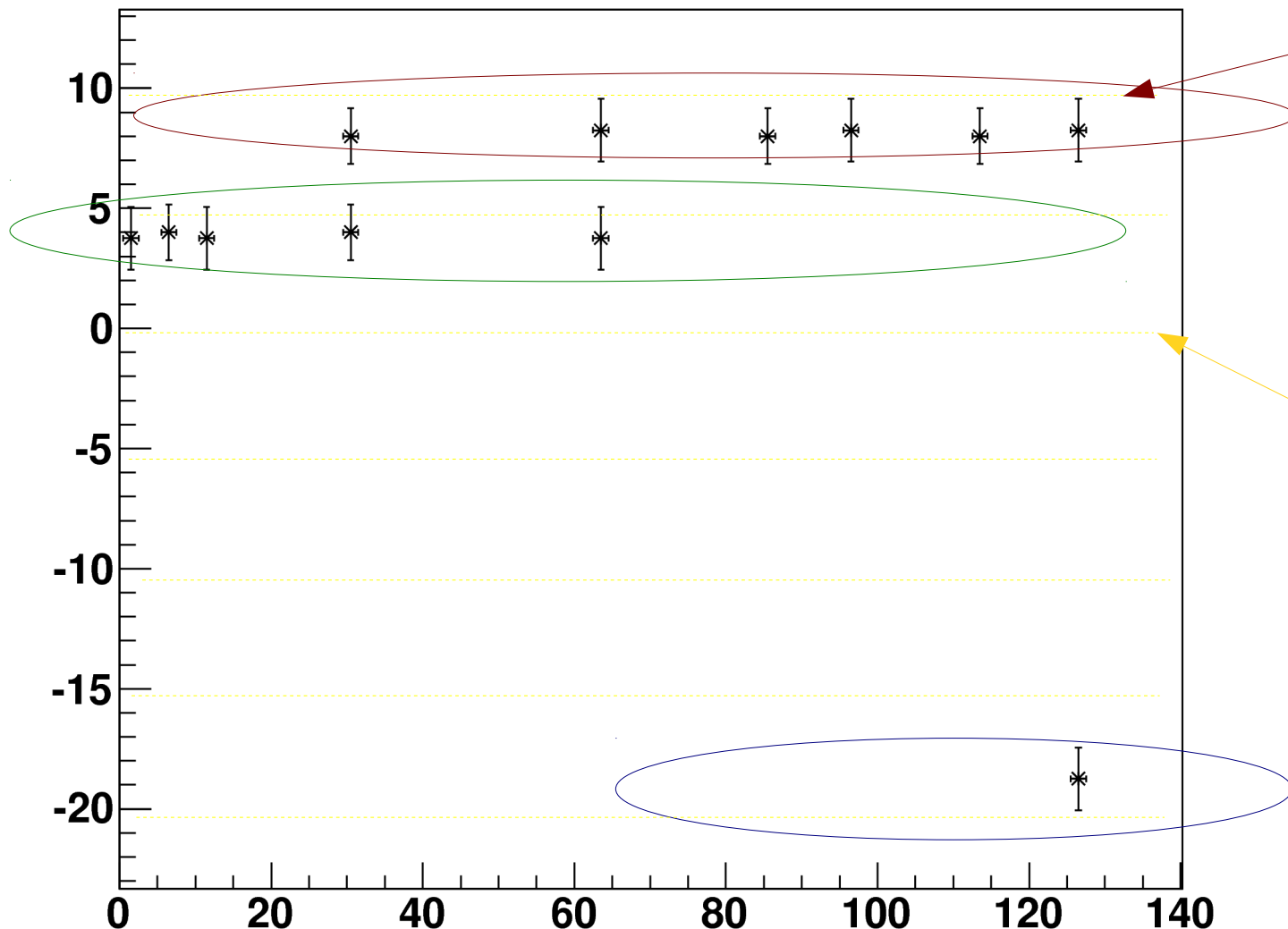


FIT

But...
Sometimes not ideal
solution!

Clustering algorithm YZ (1)

18: YZ



the biggest cluster –
good muon track

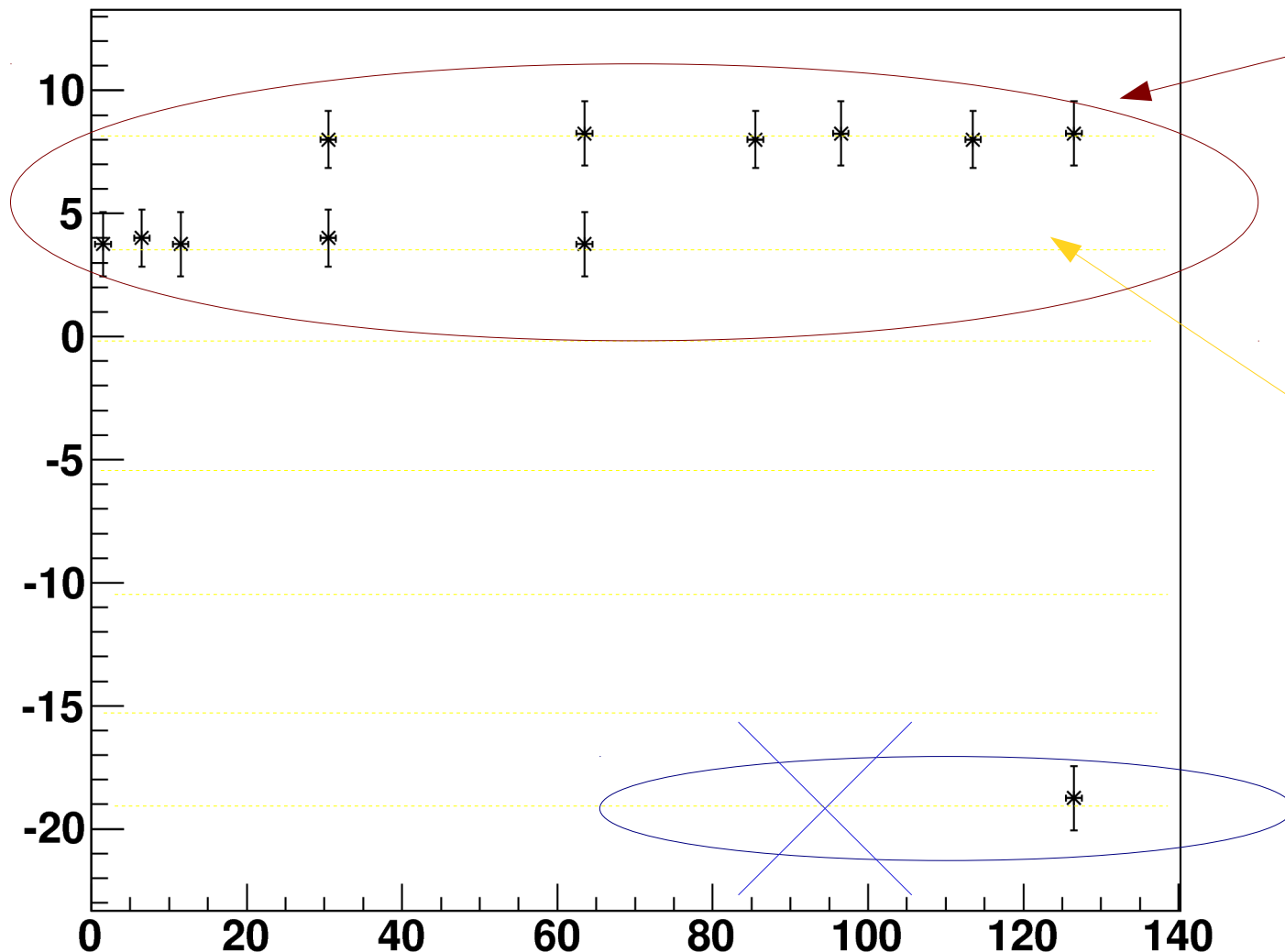
adjacent clusters:
 $d < 5.5$ cm
→ merge

Centroids -
initial positions

Points are assigned
to the closest centroid

Clustering algorithm YZ (2)

18: YZ



the biggest cluster –
good muon track

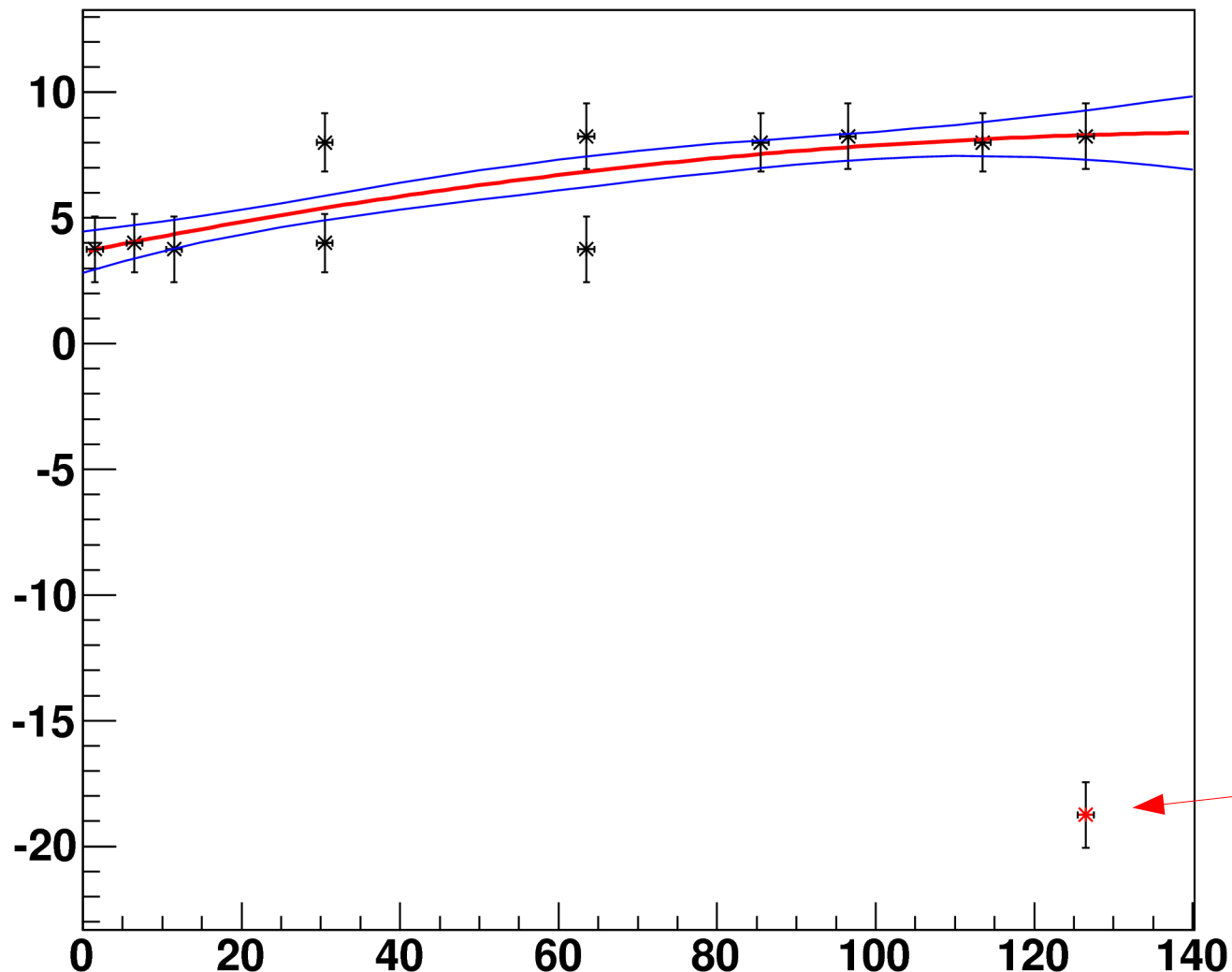


→ **merged**

Centroids -
positions
recalculated
in the next steps
according to
the assigned points

Clustering algorithm YZ (3)

18: YZ



FIT

Chi2 = 13.8842

NDf = 8

p0 = 3.64726

+/- 0.82045

p1 = 0.0638183

+/- 0.0343372

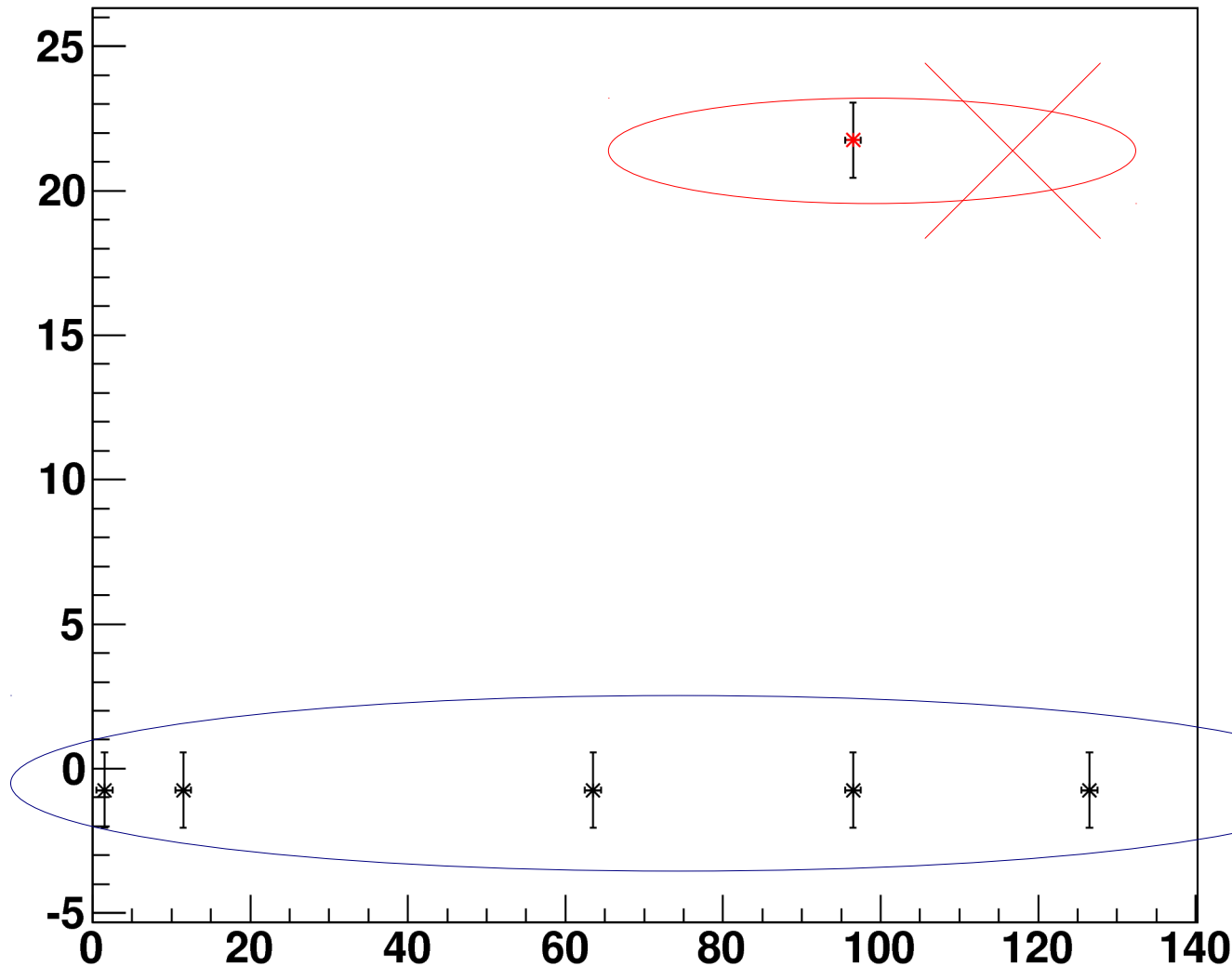
p2 = -0.000213982

+/- 0.0002709

REJECTED

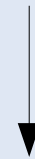
Clustering algorithm XZ (1)

9: XZ



1st step:

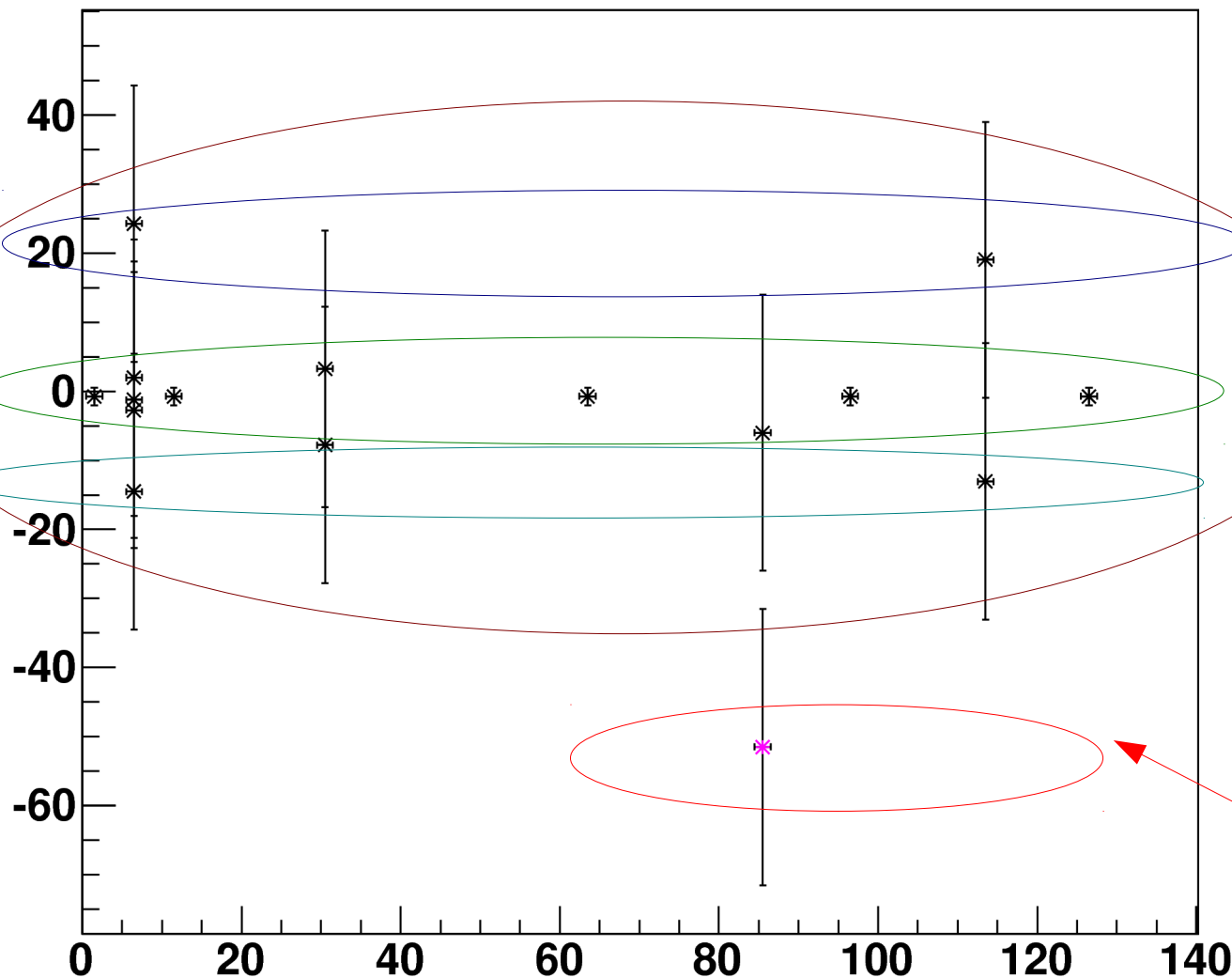
Rejecting only
BiRO bckg
points



Choosing
the reliable
BiRO track

Clustering algorithm XZ (2)

9: XZ



2nd step:

Including
TDC hits

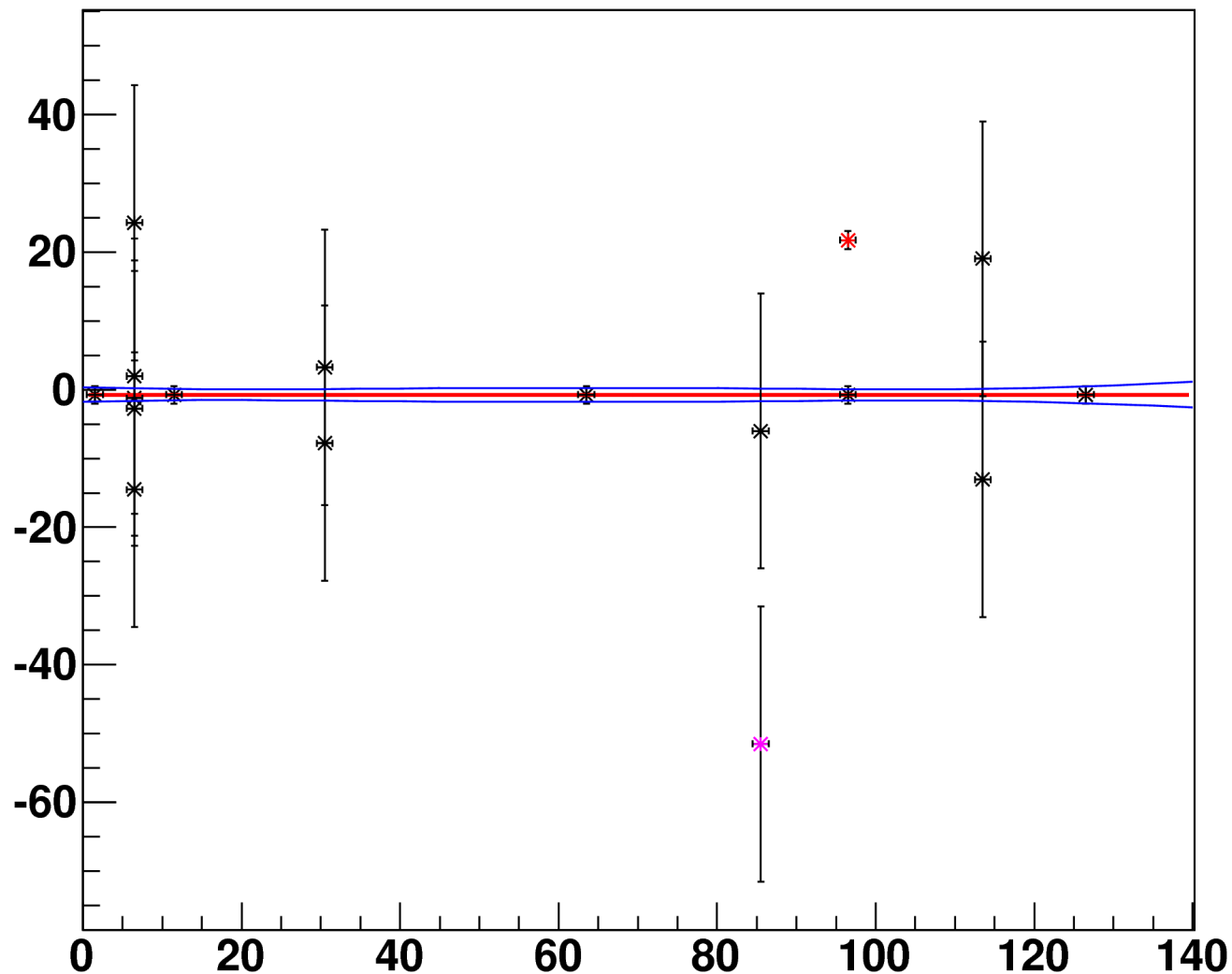
adjacent clusters:
 $d < 35$ cm
→ **merged**

Initial centroids –
every 20 cm

REJECTED

Clustering algorithm XZ (3)

9: XZ



FIT

Chi2 = 3.65793

NDf = 12

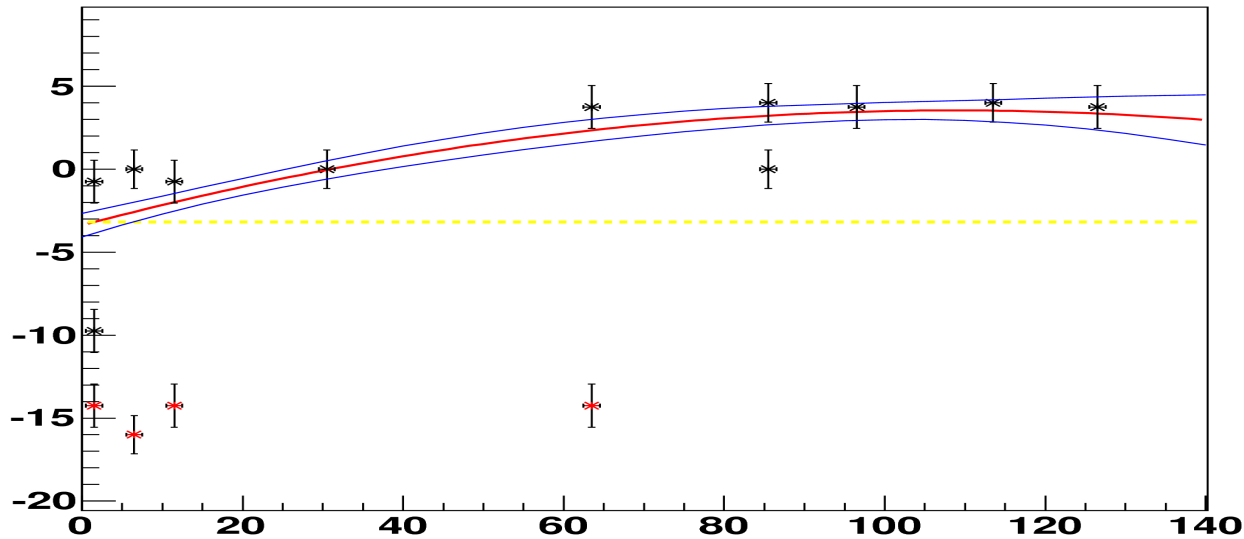
p0 = -0.723099
+/- 1.07129

p1 = -0.00114447
+/- 0.0476869

p2 = 8.58171e-06
+/- 0.000376575

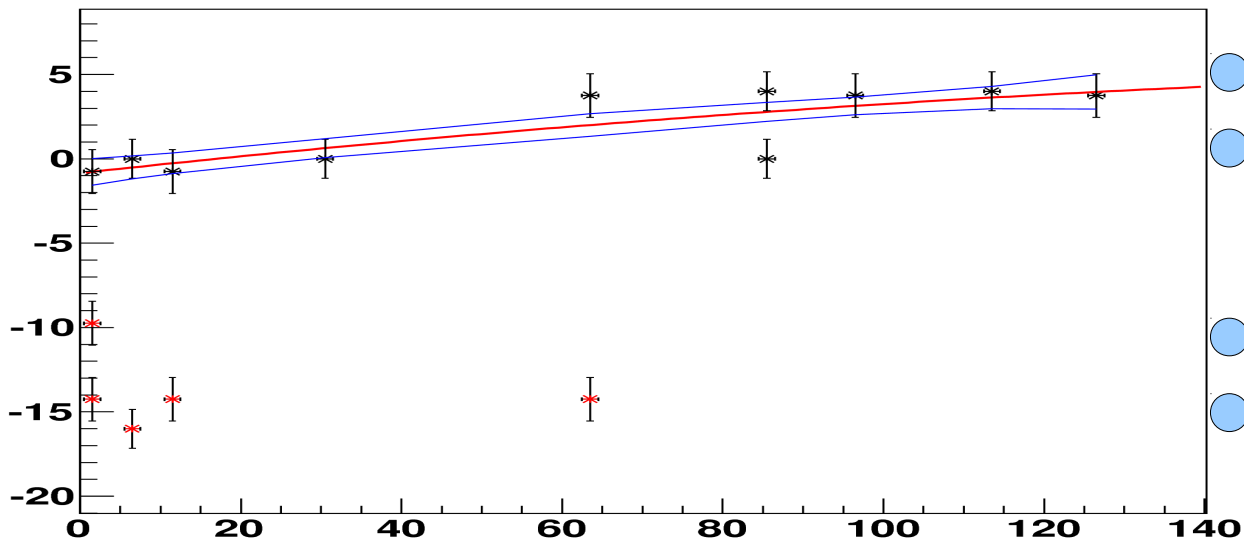
Weighted average VS Clustering

1583: YZ



The average is pulled down due to "low Y" noisy points
→ one of them is accepted

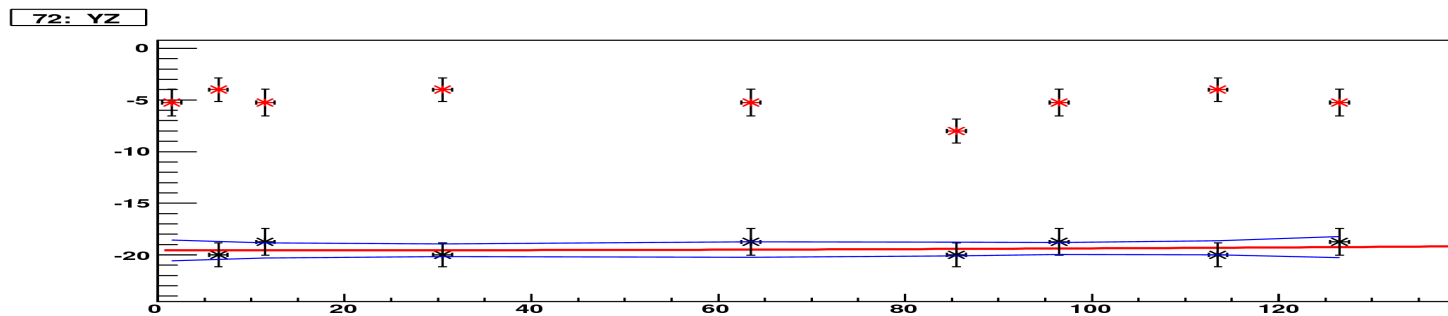
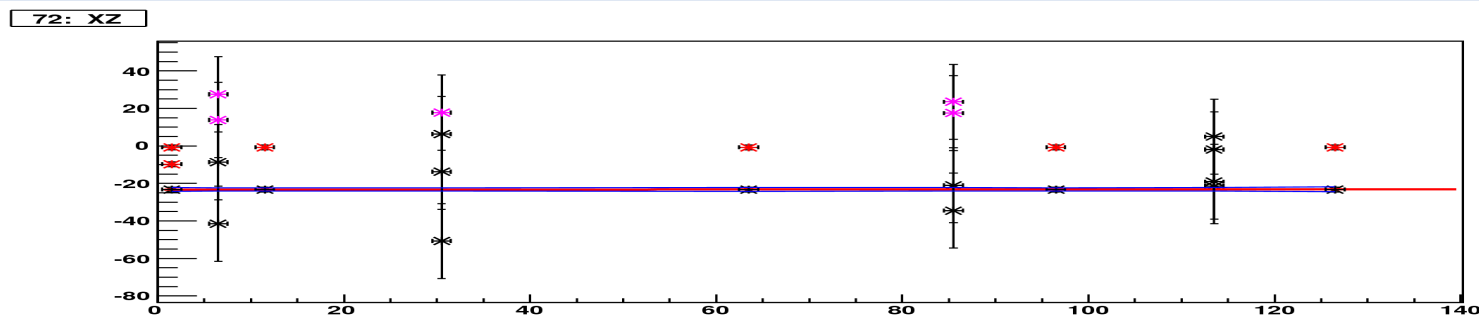
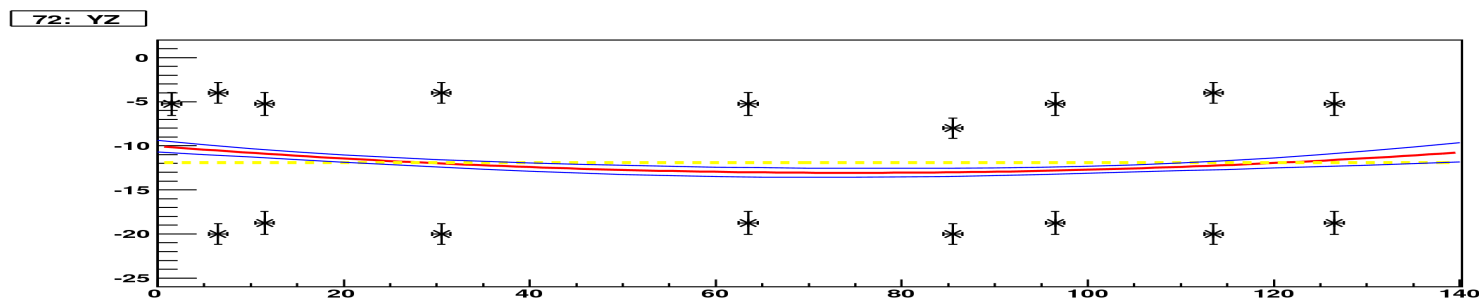
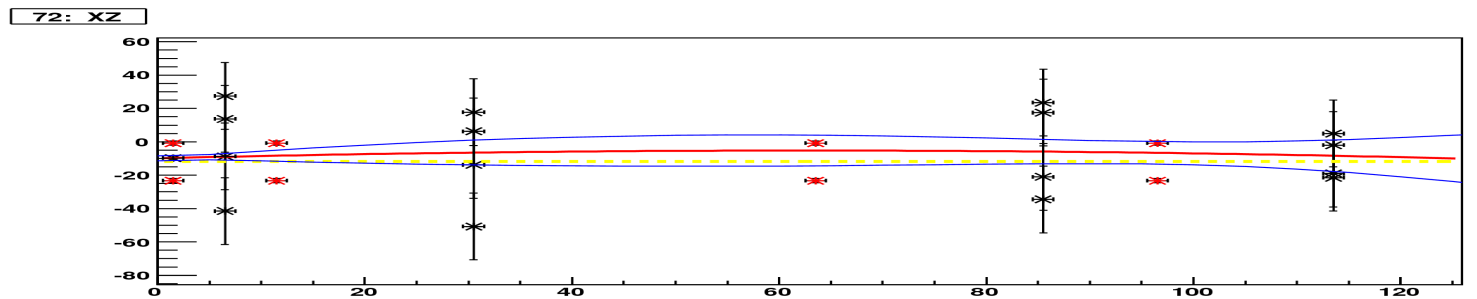
1583: YZ



Separate, distant clusters
→ better

**2530 muon-like events
processed
with this method
(5060 fits!)**

Two-muons events

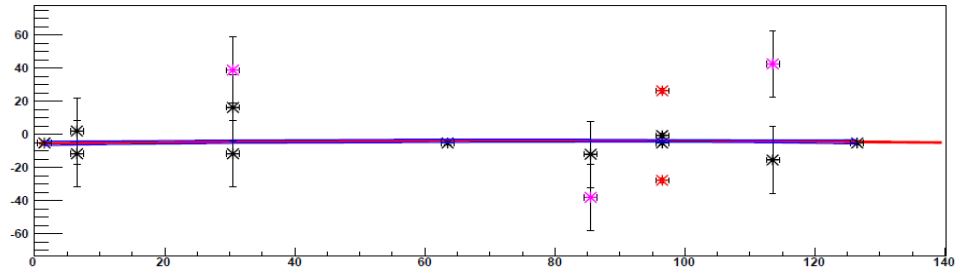


Weighted
Average

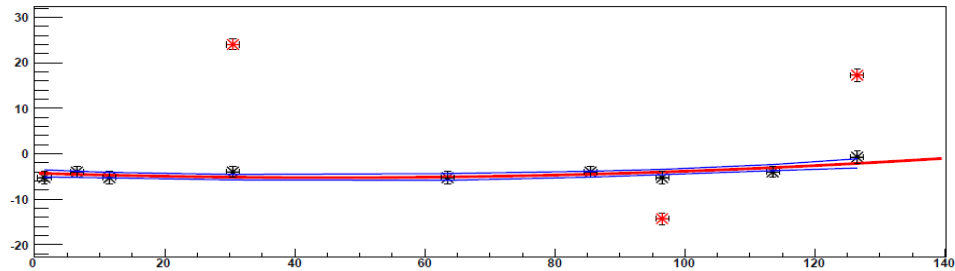
Clustering

some examples

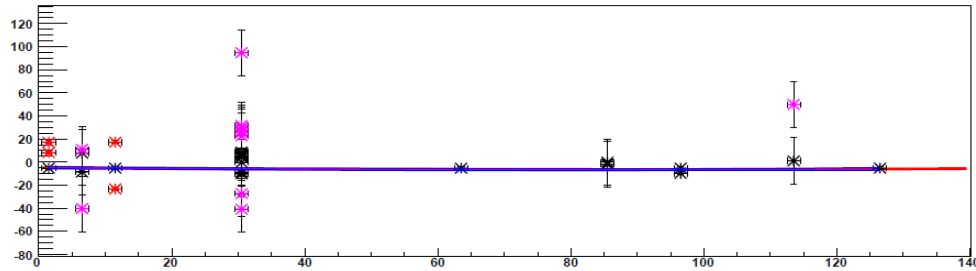
1710: XZ



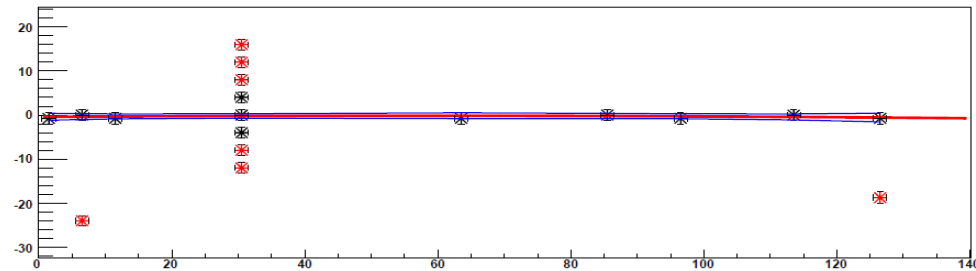
1710: YZ



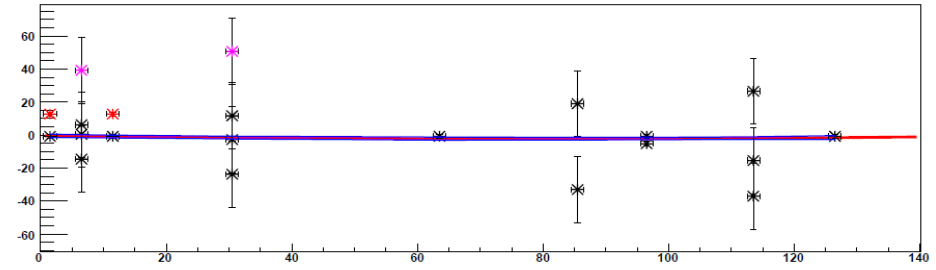
5927: XZ



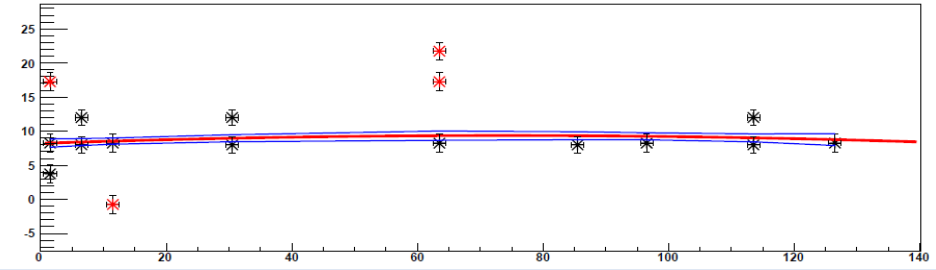
5927: YZ



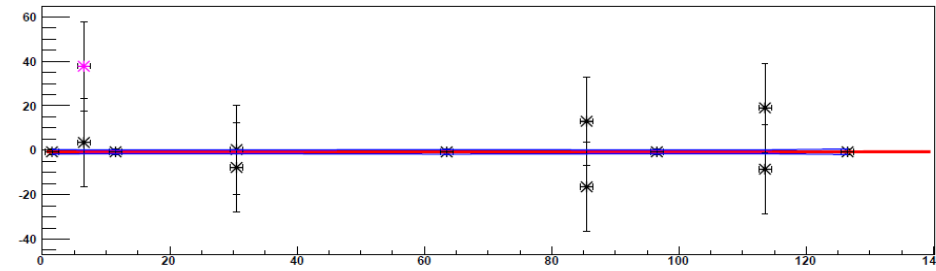
3977: XZ



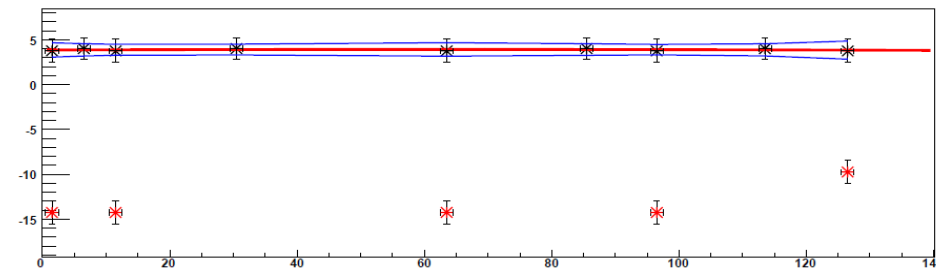
3977: YZ



6816: XZ

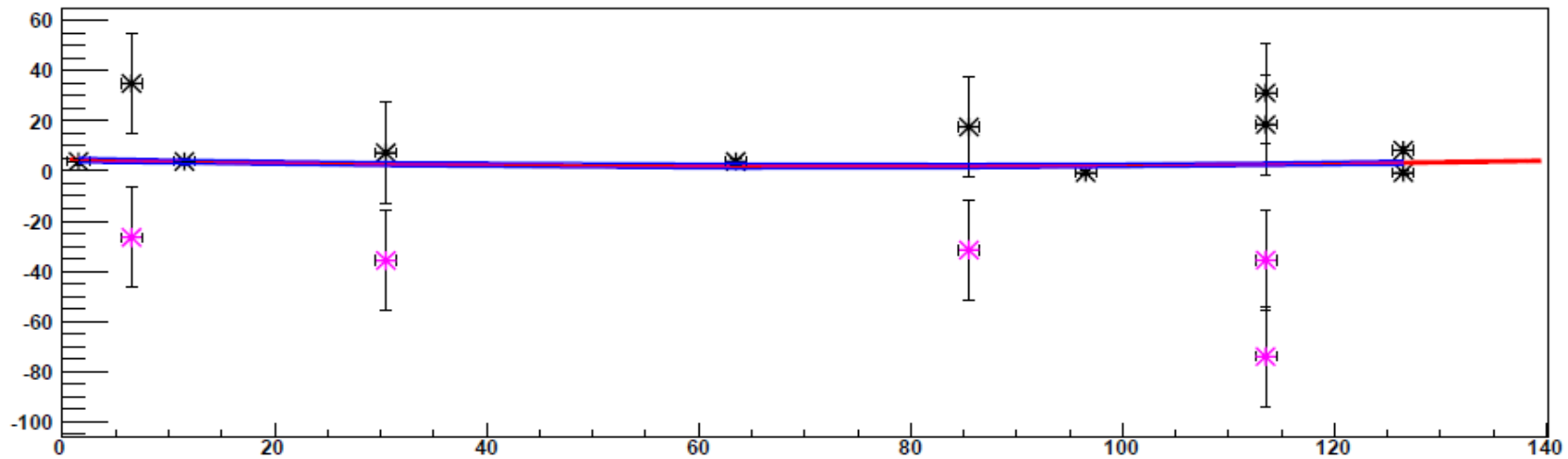


6816: YZ



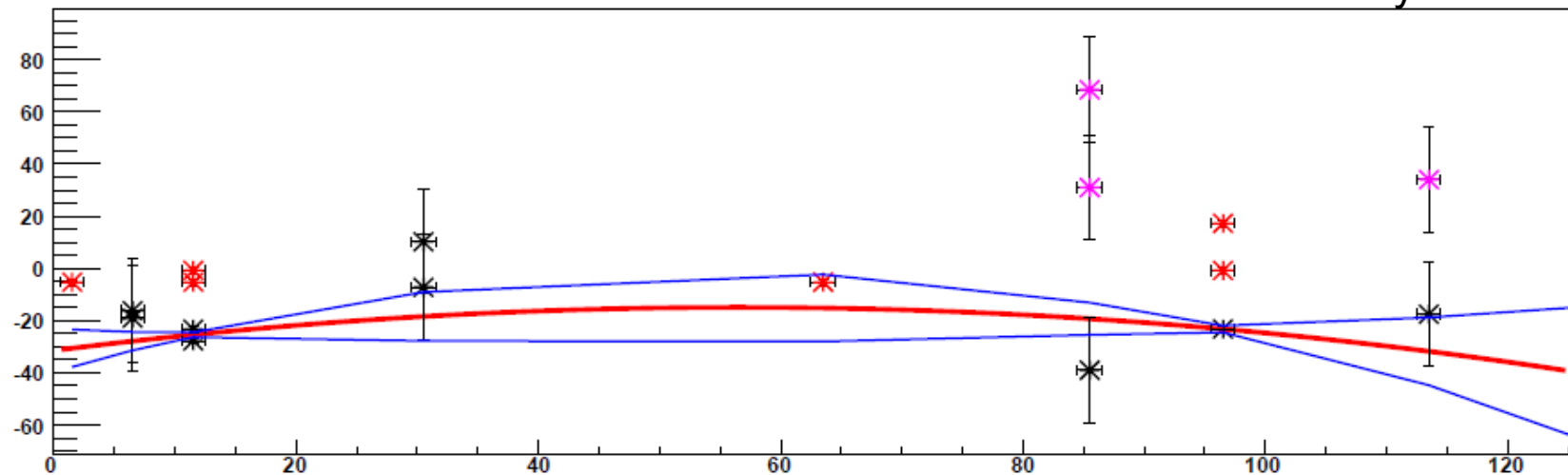
But sometimes...

351: XZ



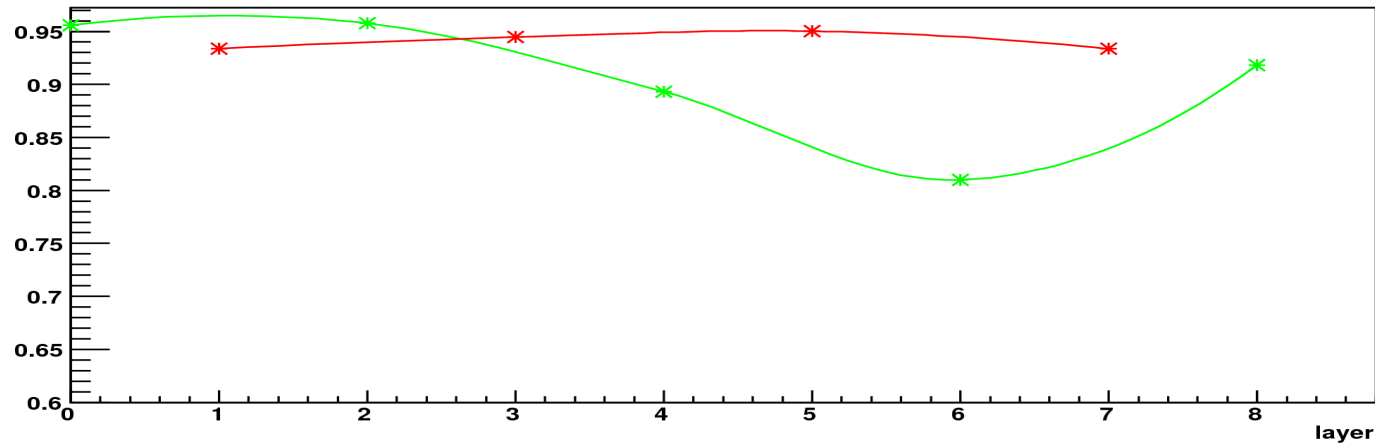
3282: XZ

extremely rare

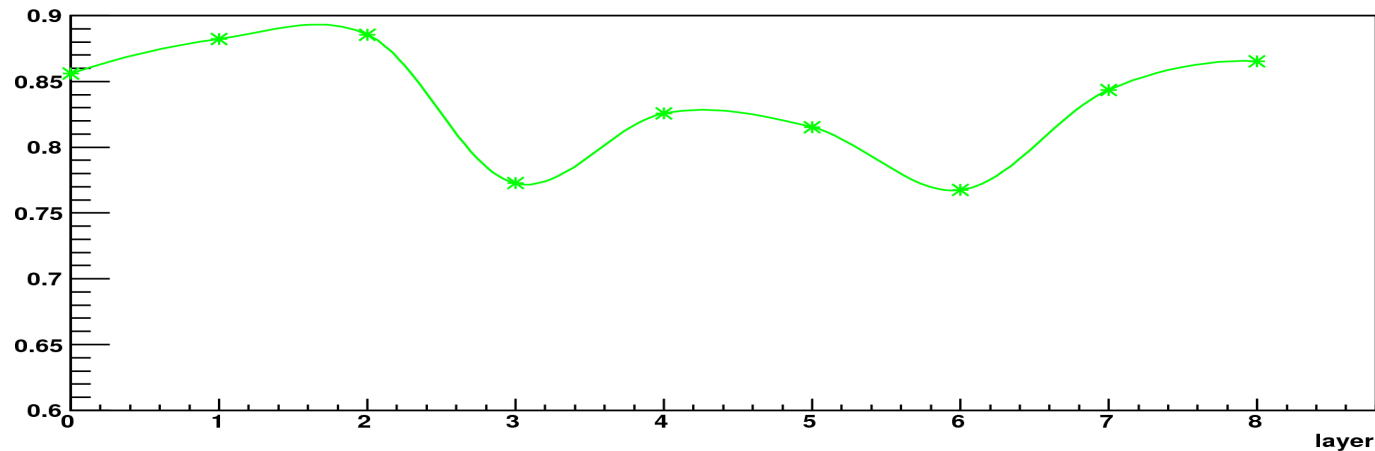



Preliminary efficiency calculations

efficiency XZ

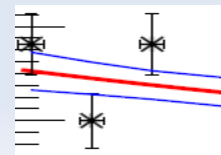


efficiency YZ



$$1\sigma = \sqrt{\left(\begin{array}{|c|} \hline \downarrow \\ \hline \end{array} \right)^2 + \left(\begin{array}{|c|} \hline \updownarrow \\ \hline \end{array} \right)^2}$$


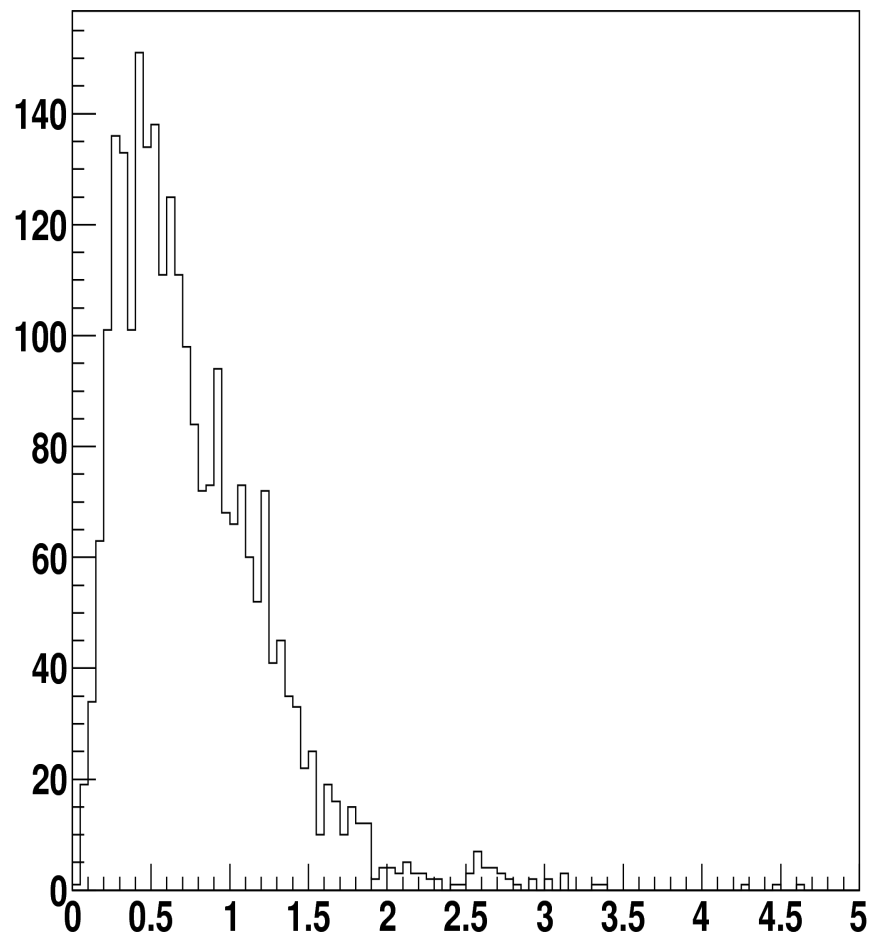
strict cut:



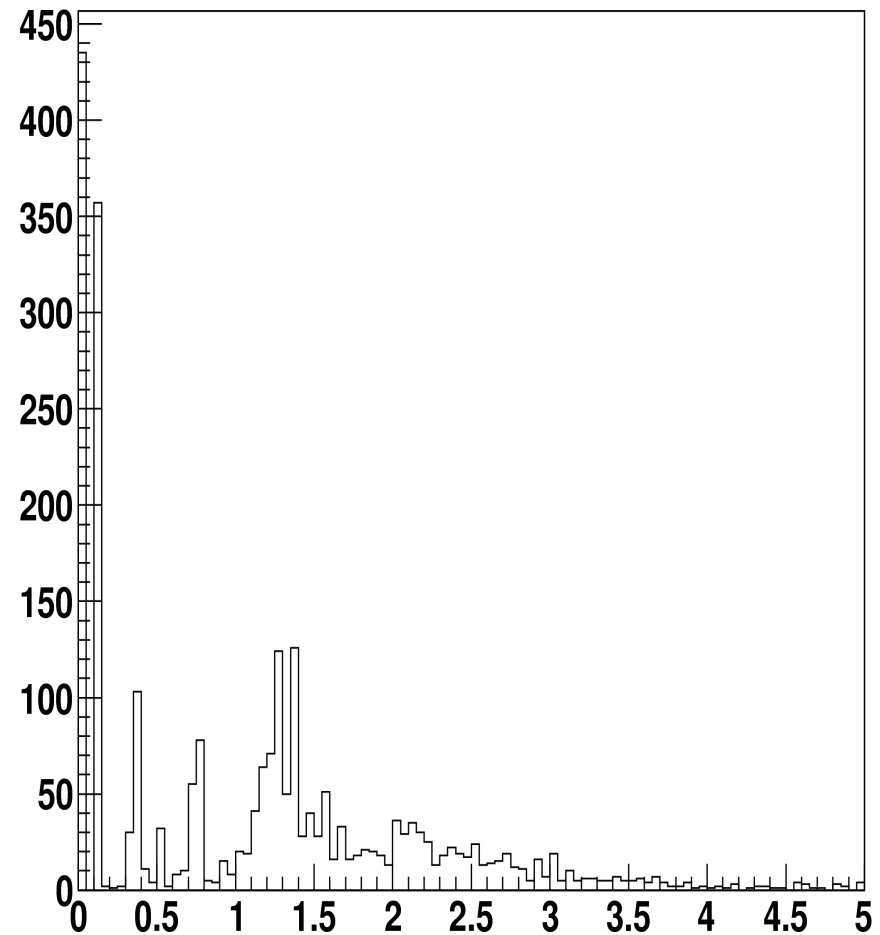
Bi-RO: 1σ
TDC-RO: 1.5σ

χ^2/ndof

Chi2/NDF XZ



Chi2/NDF YZ



Next steps

- Possible corrections to the current procedure...
- Alignment study – residual distribution of the hits
- Looking at new test data