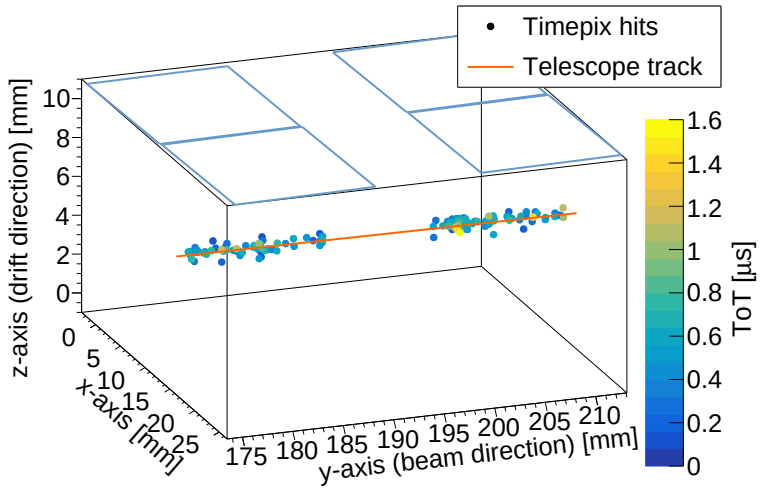


Update on quad beam test analysis

Kees Ligtenberg

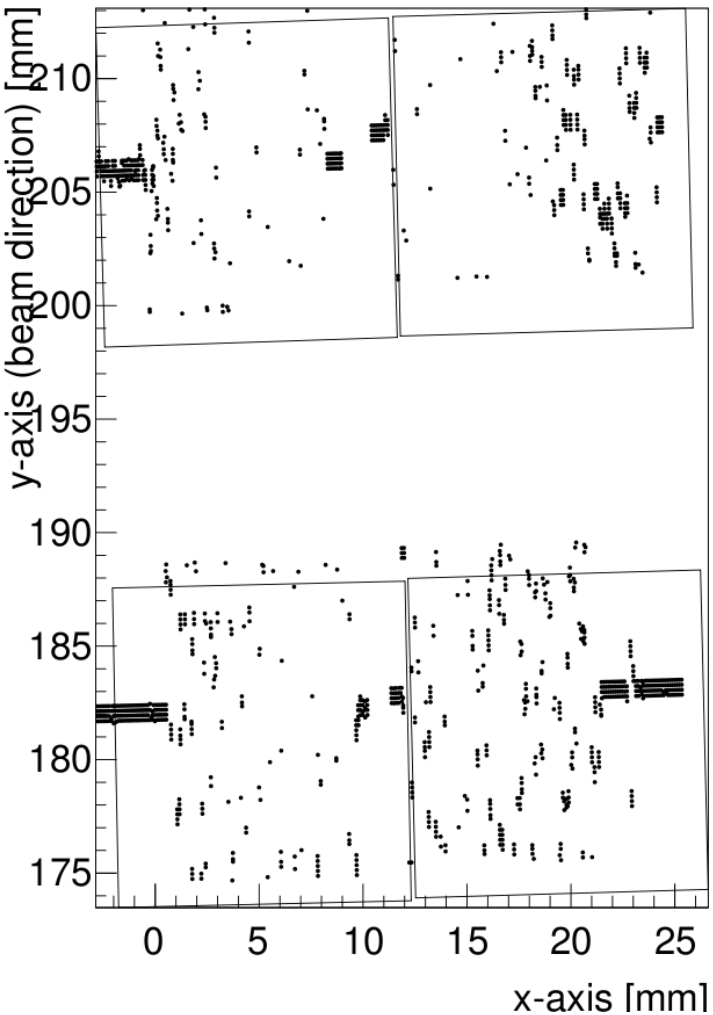
Lepcol meeting

May 9, 2019

Nikhef

In Testbeam data there also seem to be 'discharges'

From event displays a lot of very similar in a row:



I will try to figure out how many

Updated event/hit selection

Table: selection cuts. Overall selection efficiency 16%.

Telescope
Number of planes hits > 5 Reject outliers ($r_{x,z} < 50\,\mu m$) Slope difference between plane triplets < 1 mRad.
Timepix3 readout
First hit readout $< 5 \times 409.6\,\mu s$ Average hit readout $< 150 \times 409.6\,\mu s$ Max hit readout $< 200 \times 409.6\,\mu s$
Gridpix hit selection
$-500\,ns < t_{hit} - t_{trigger} < 500\,ns$ Hit ToT $> 0.15\,\mu s$ Reject outliers ($r_x < 2\sigma_x, r_z < 3\sigma_z$) Reject outliers ($r_x < 1.5\,mm, r_z < 2\,mm$)
Event Selection
$N_{hits} > 20$ $(N_{r_x<1.5mm} \;/\; N_{r_x<5mm}) > 0.8$ $x_{timepix} - x_{telescope} < 0.3\,mm$ $z_{timepix} - z_{telescope} < 0.3\,mm$

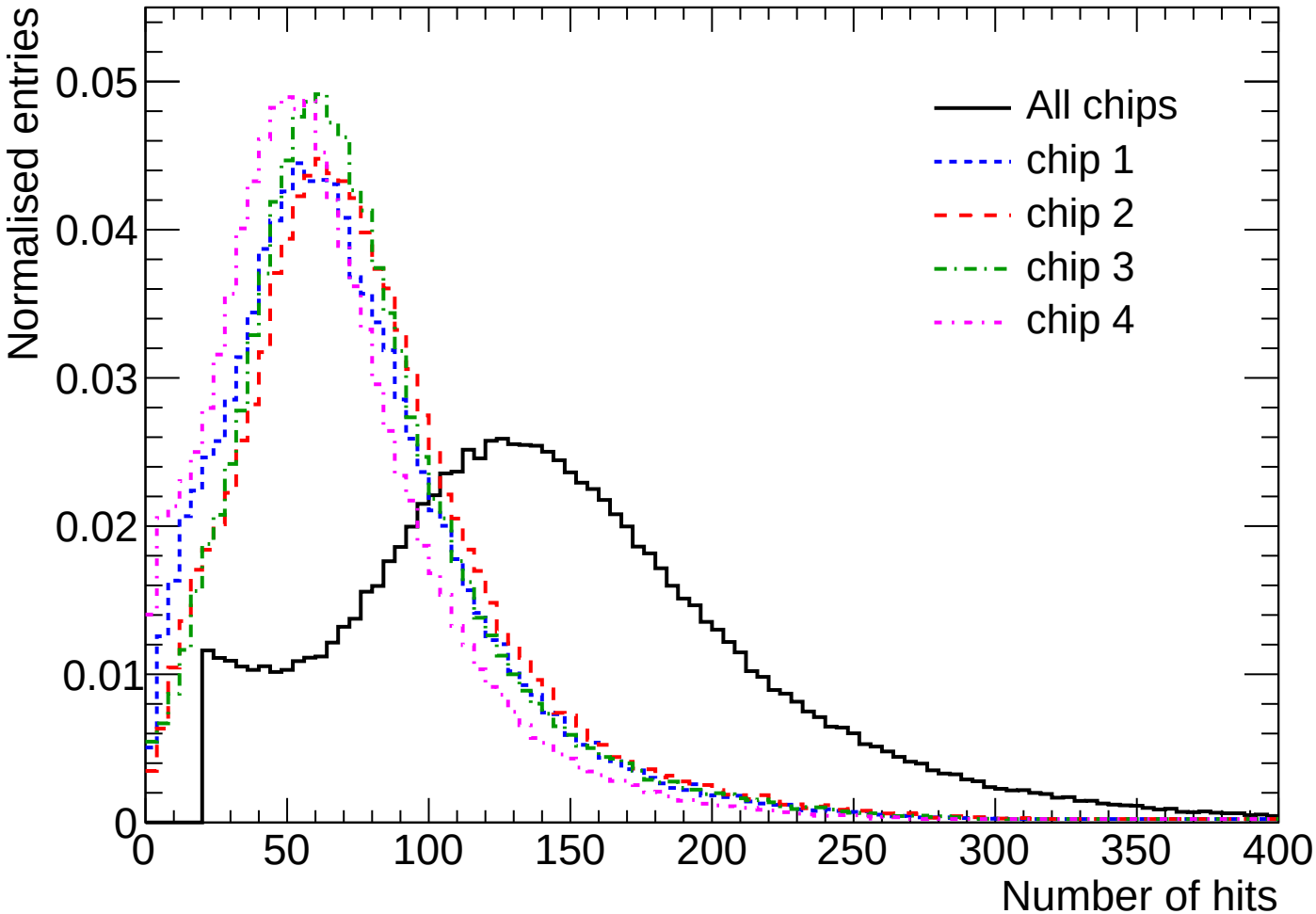
Nikhef

Run parameters

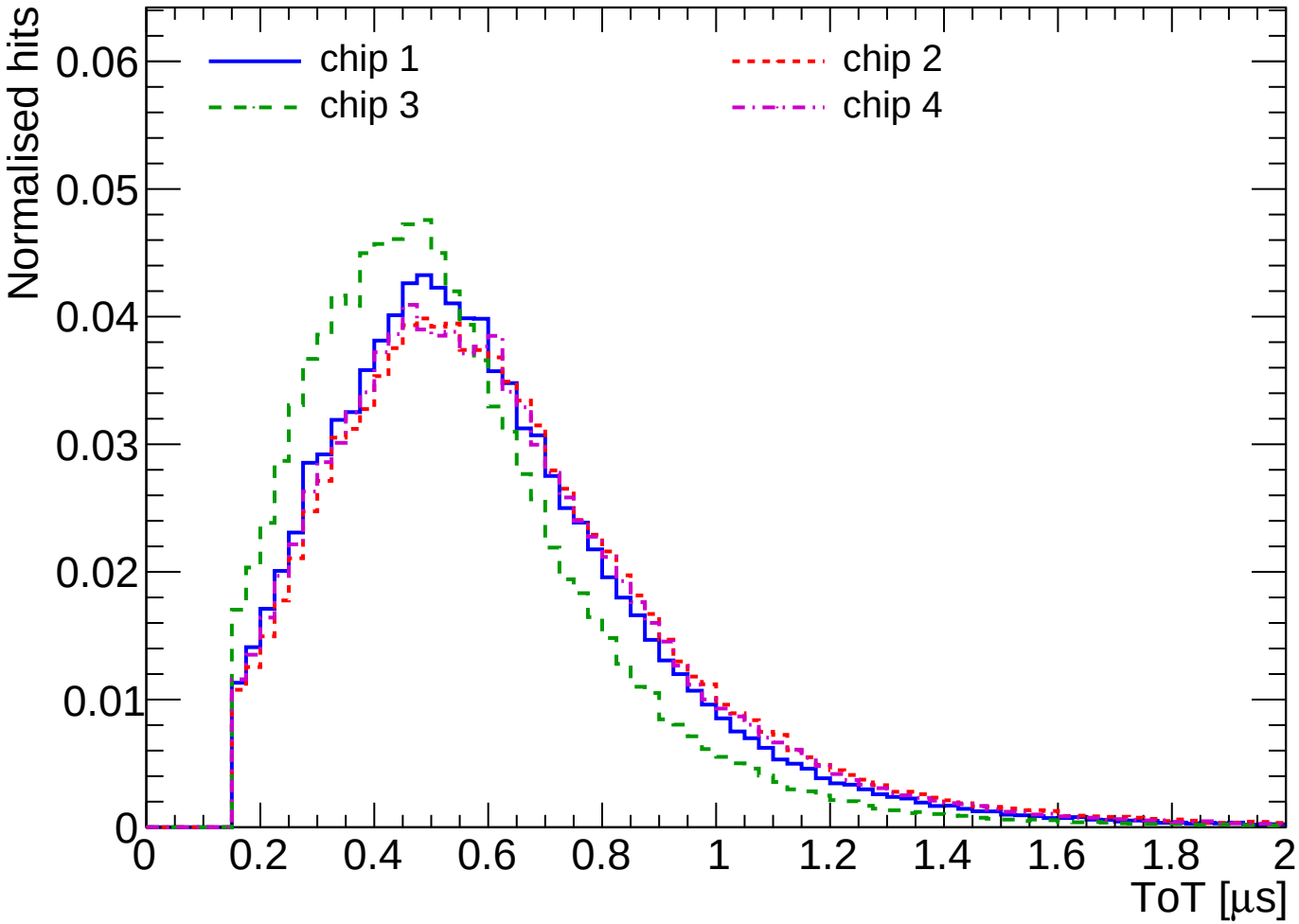
Runs duration	10 minutes
Triggers per run	2.2×10^6 triggers
V_{grid}	330 V
E_{drift}	400 V/cm
Threshold	550 e^-
Temperature	(300.5 ± 0.08) K
Pressure	1011 mBar
Oxygen concentration	814 ppm
Water vapor concentration	6000 ppm

Table: Parameters of the three analyzed runs. The error on the temperature and pressure indicates the spread during one run.

Number of hits

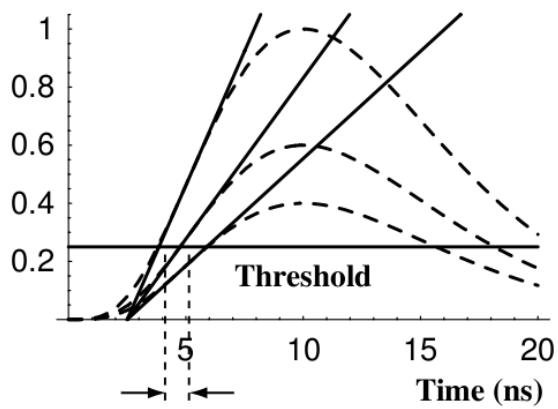


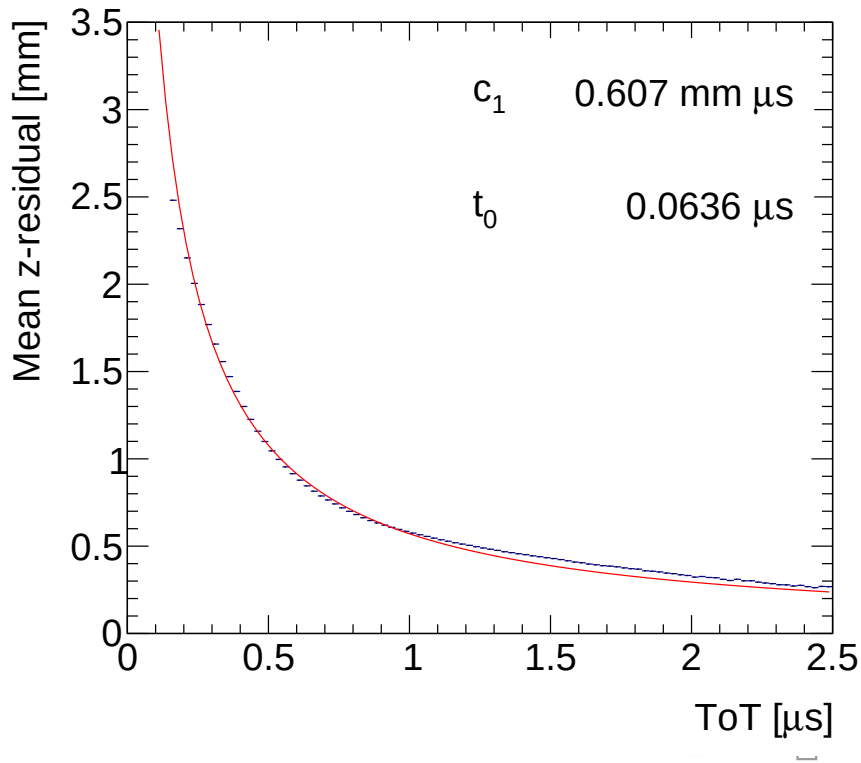
Time over threshold



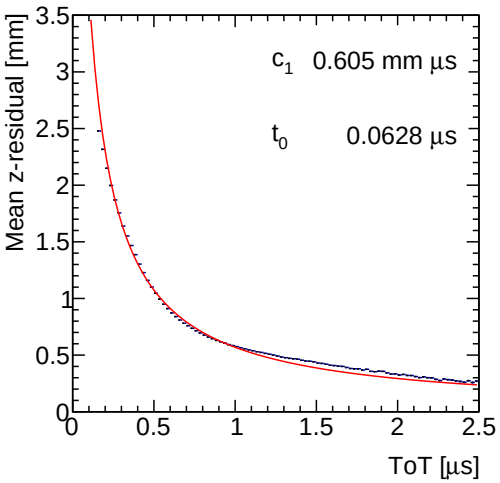
Time walk correction

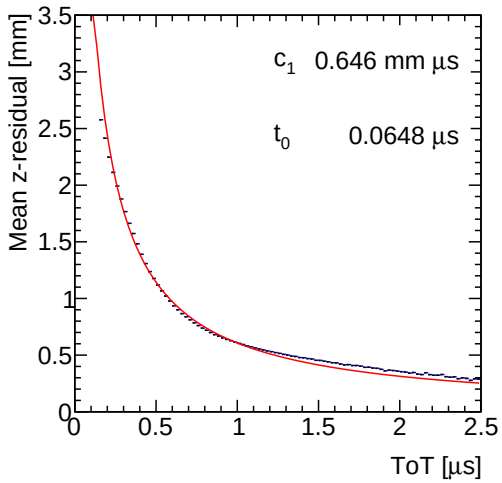
- Time walk occurs when the apparent time of arrival depends on the signal amplitude
- With Timepix3 the time walk can be corrected for using the Time over Threshold (ToT) as measure of signal strength:
  $\delta z_{\text{timewalk}} = \frac{c_1}{t_{\text{ToT}} + t_0} + z_0$

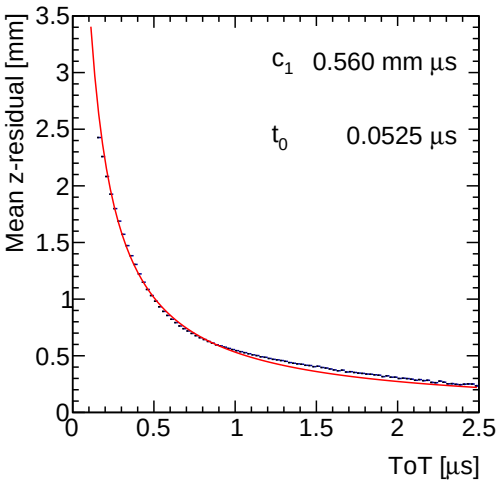


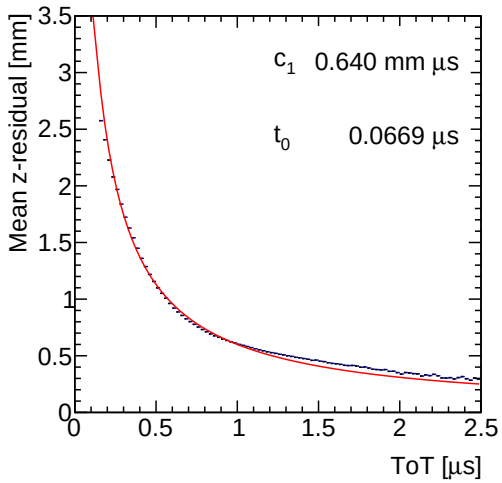


Time walk per chip

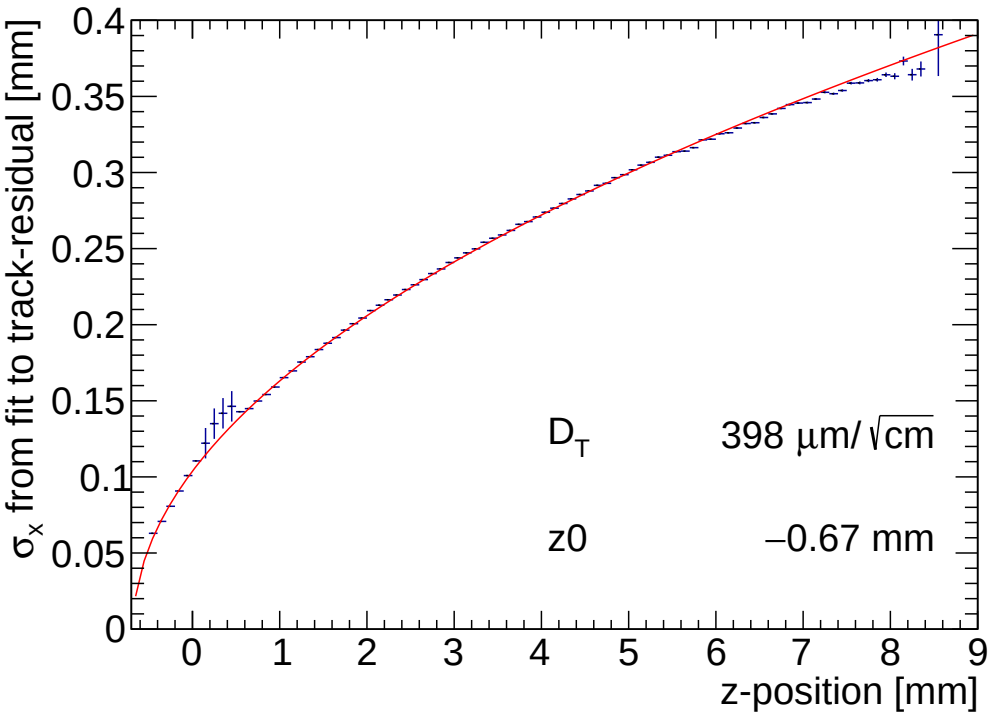








Diffusion in drift direction

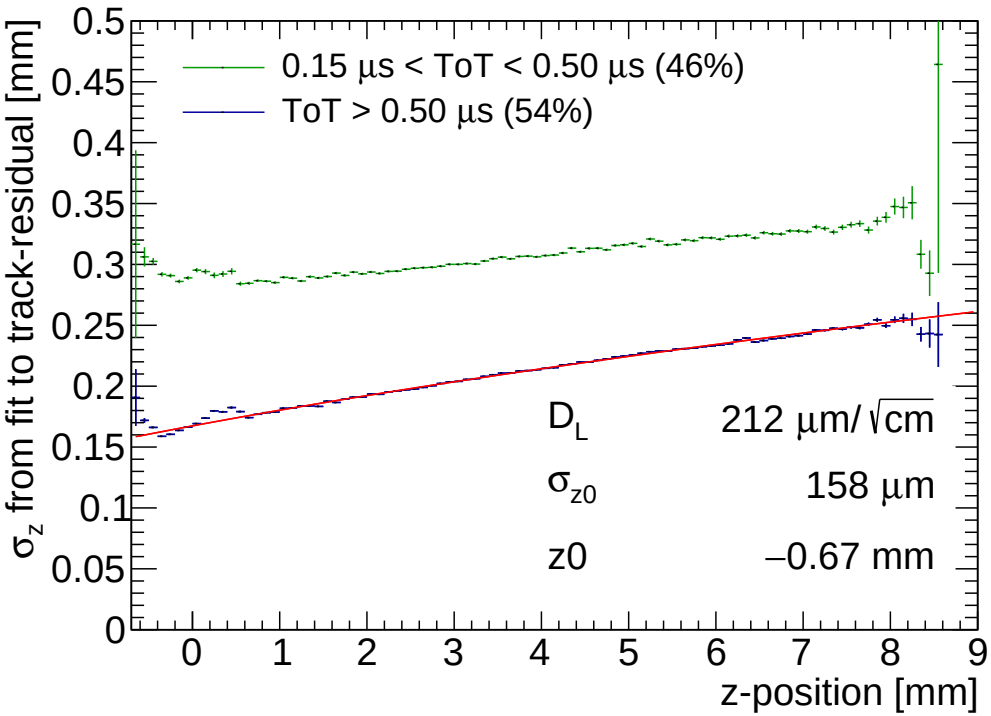


Residual as function of drift distance is fitted with

$$\sigma_x = \sqrt{\sigma_{x0}^2 + D_T^2(z - z_0)}$$

Points scattered on the guard have been given larger errors

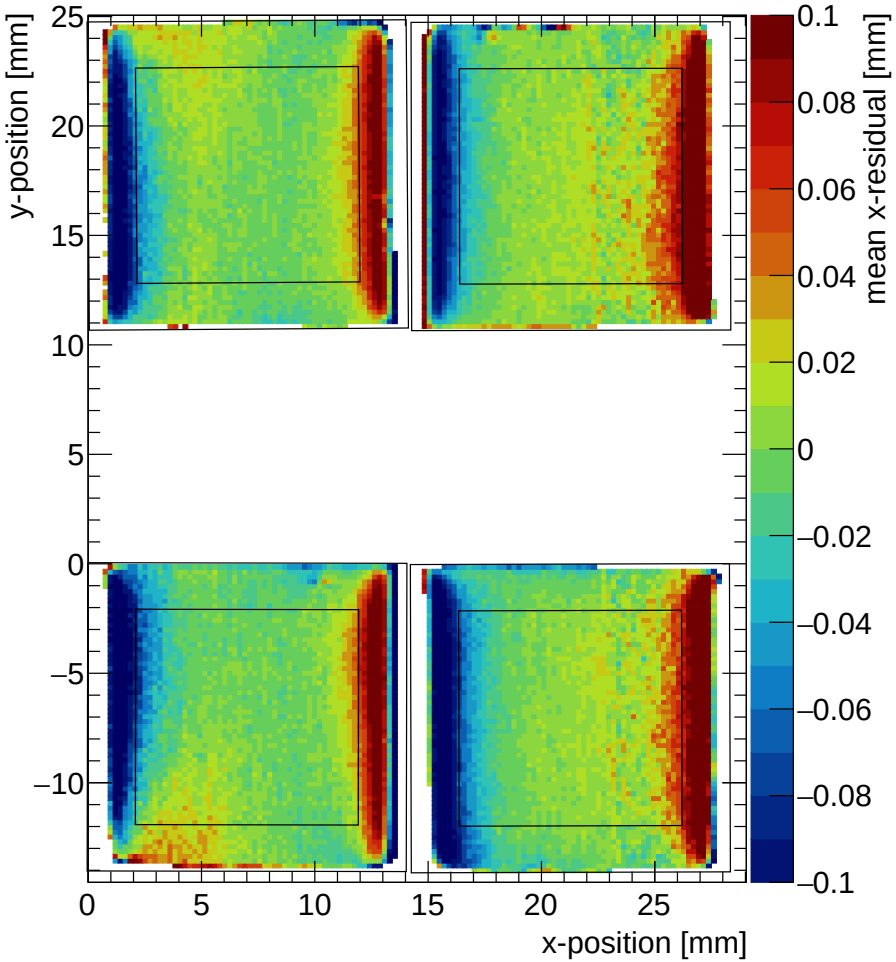
Longitudinal diffusion

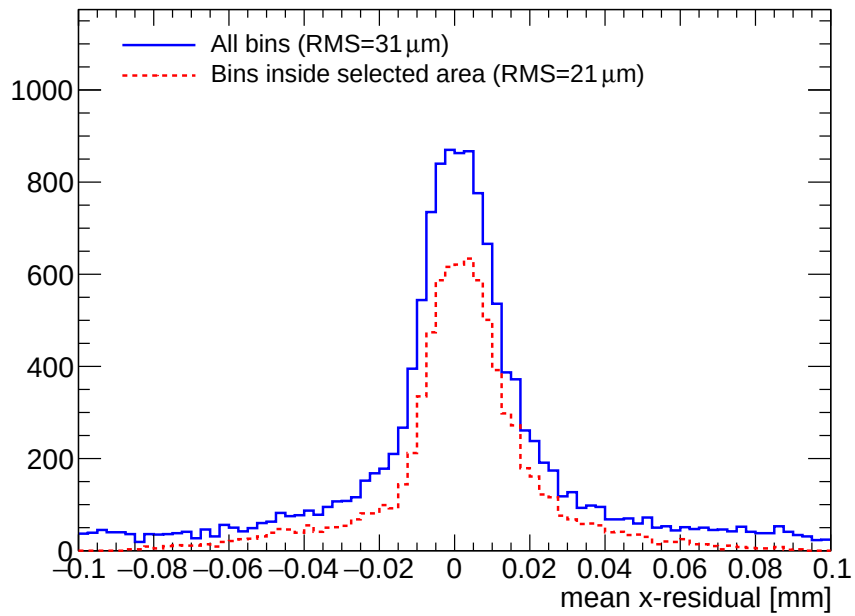


Residual as function of drift distance is fitted with

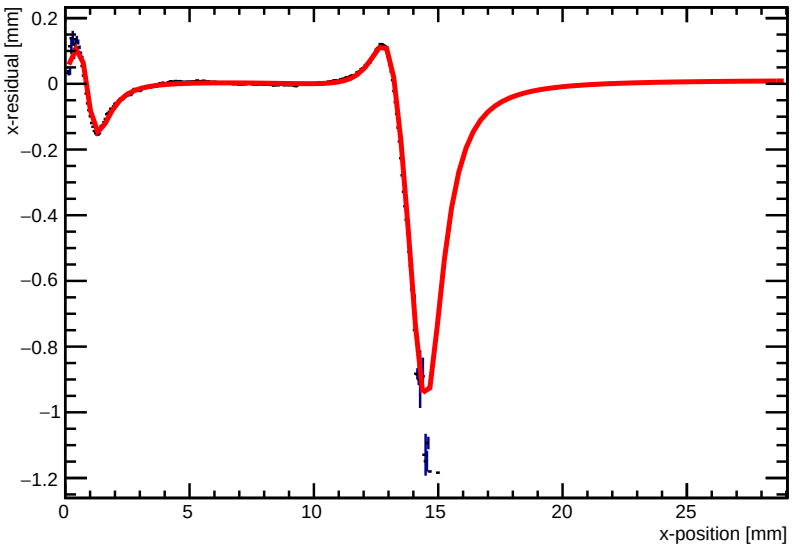
$$\sigma_z = \sqrt{\sigma_{z0}^2 + D_L^2(z - z_0)}$$

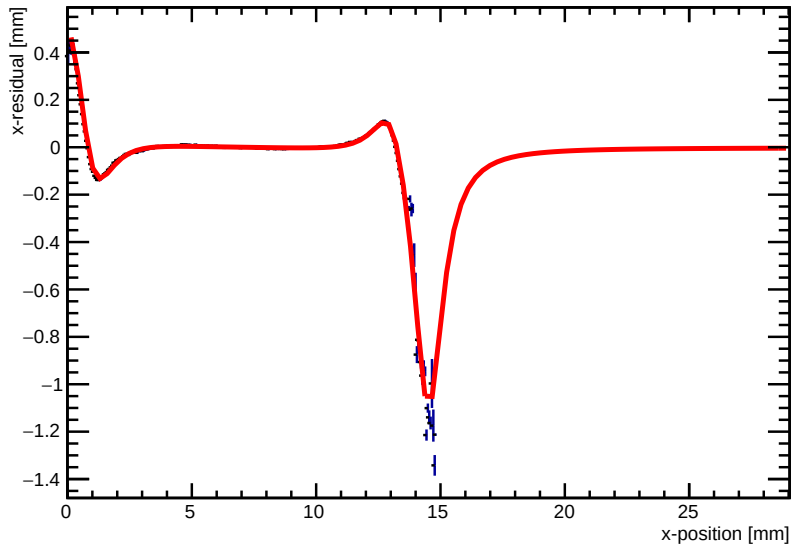
Deformation in pixel plane

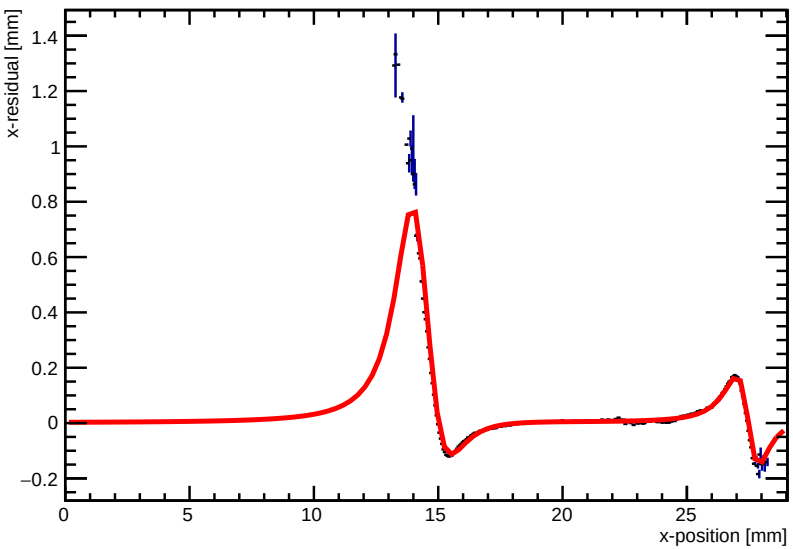


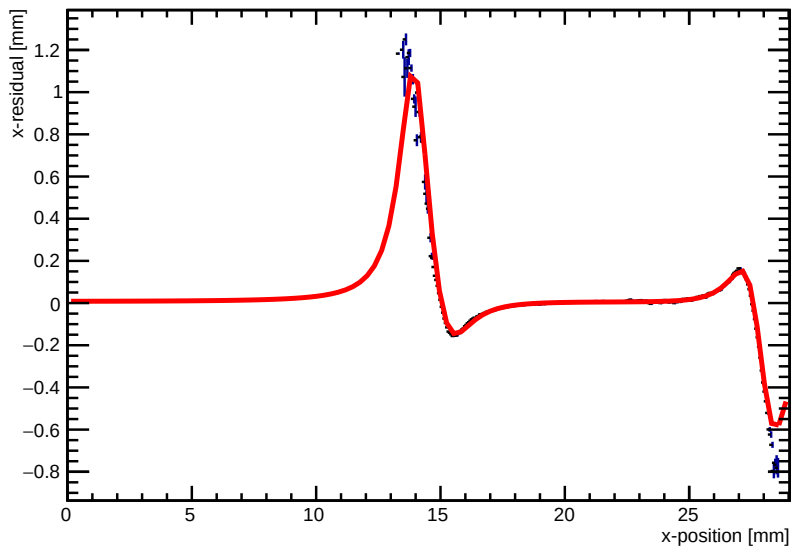


Correction of electric field deformations

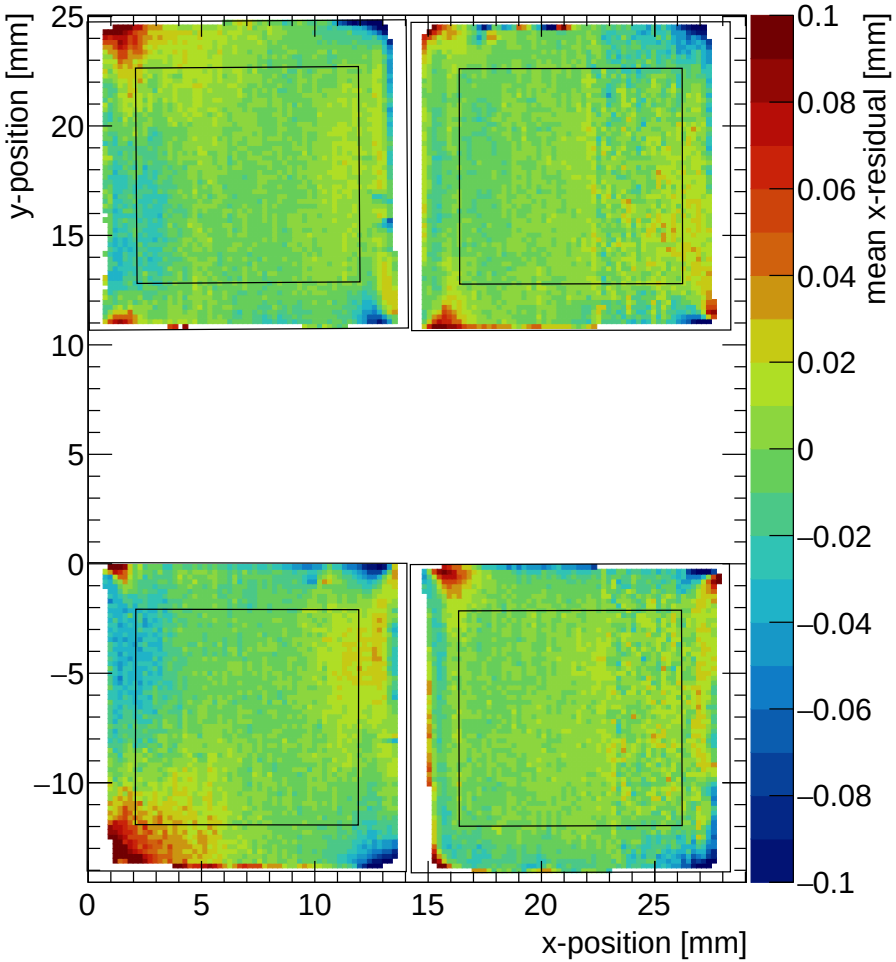


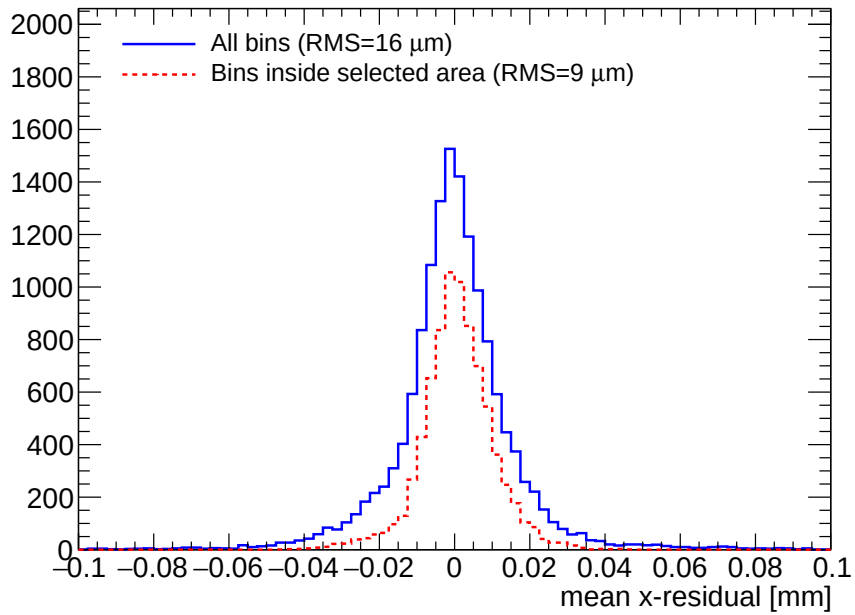






Corrected deformations in pixel plane





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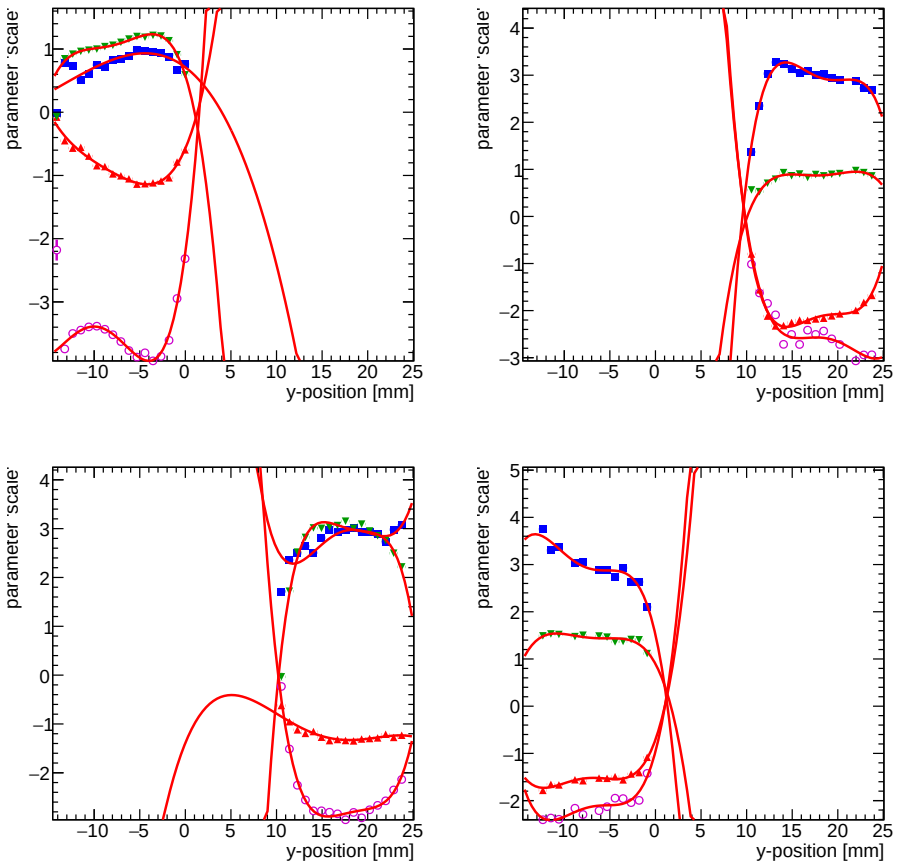
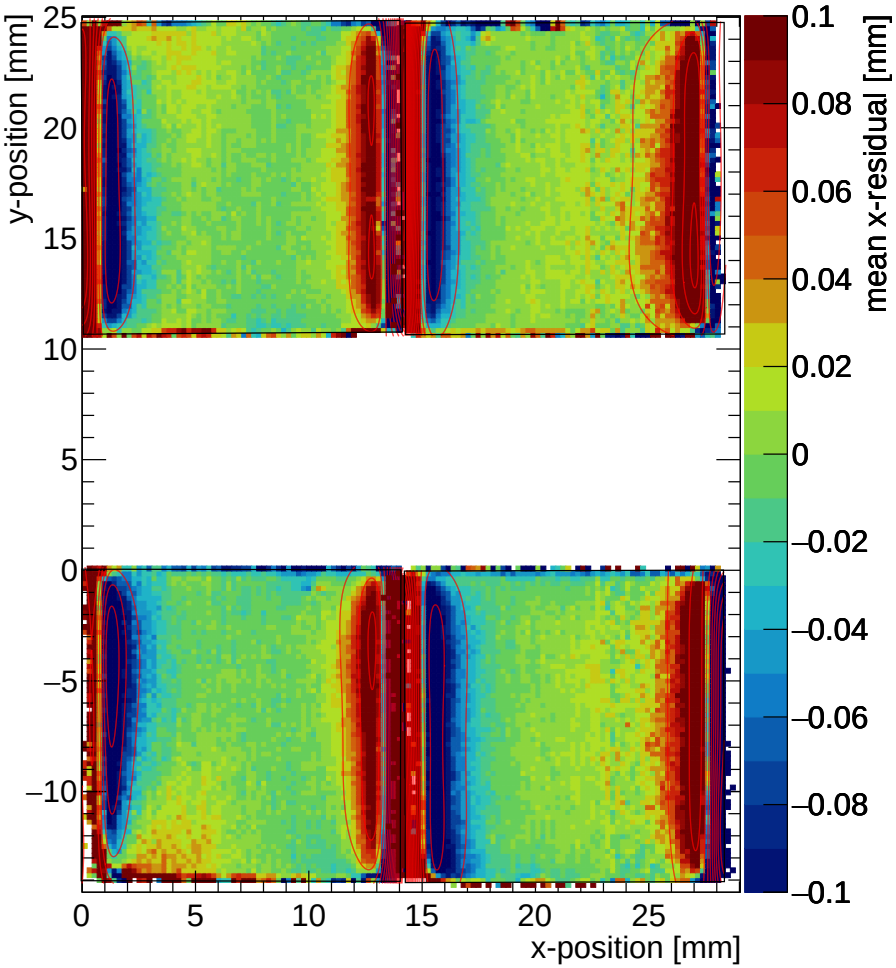
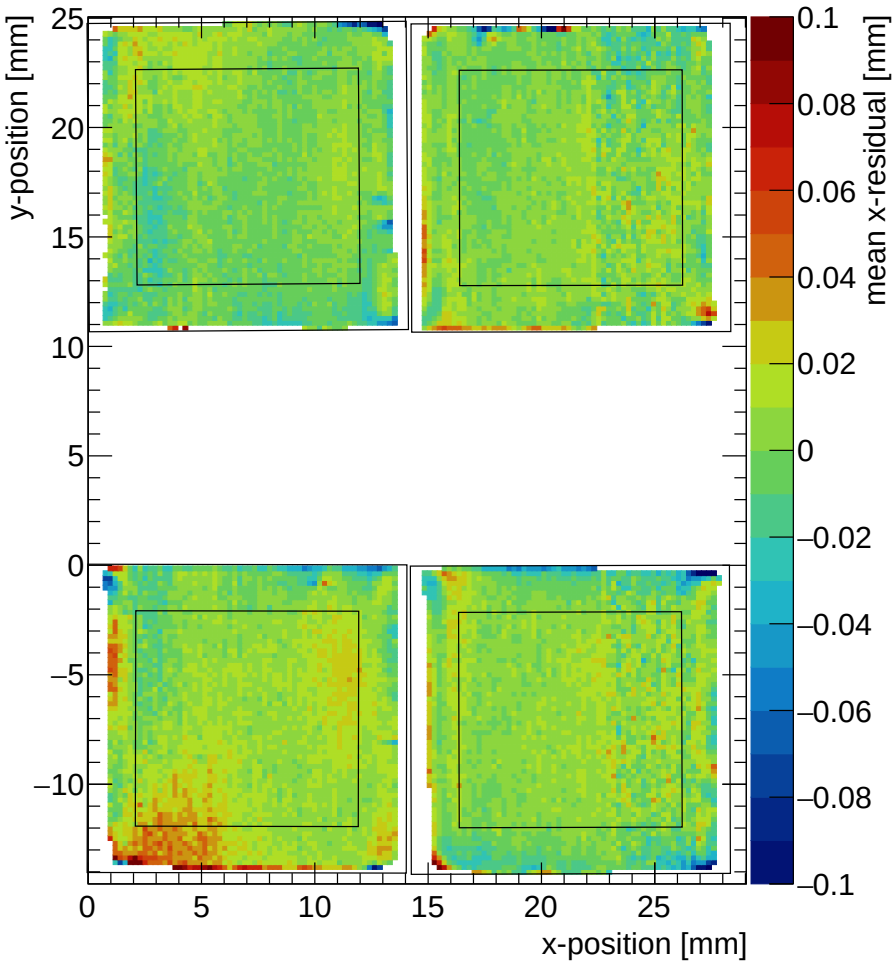
Correction of electric field deformations using y-dependence

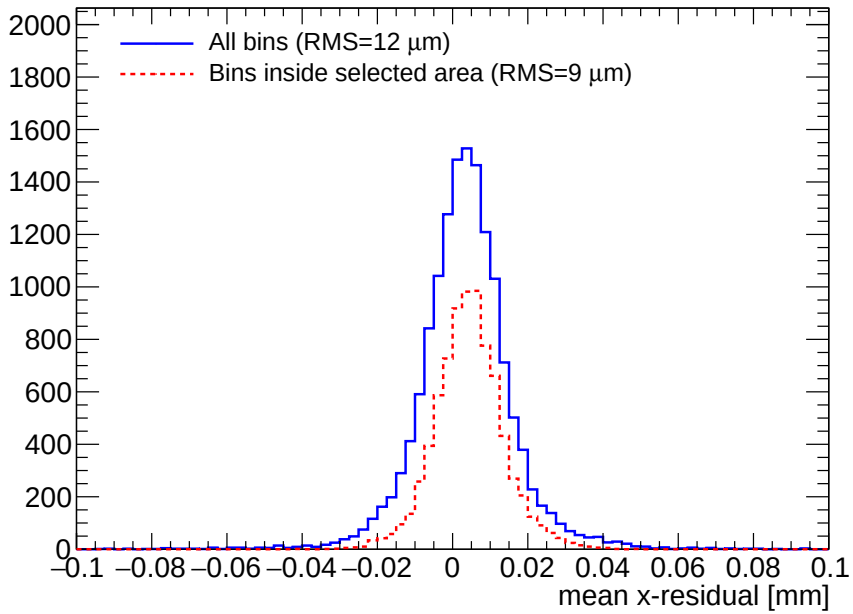


Deformation in pixel plane with contours of fitted slices



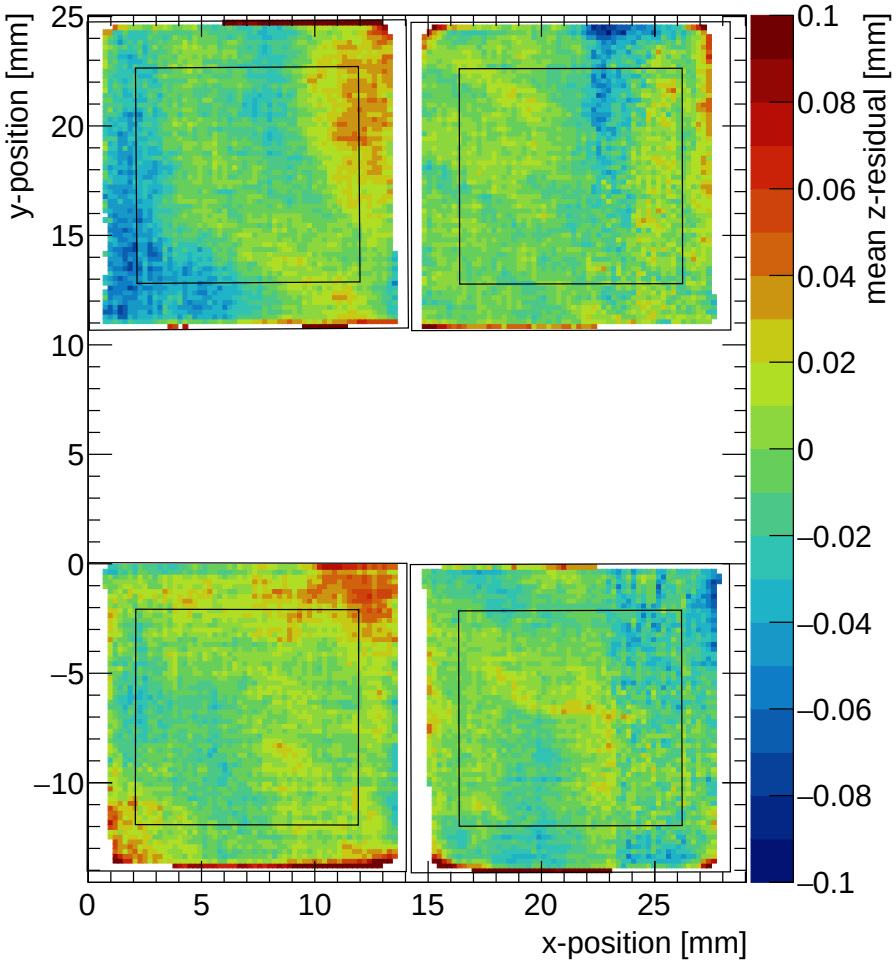
Deformation in pixel plane

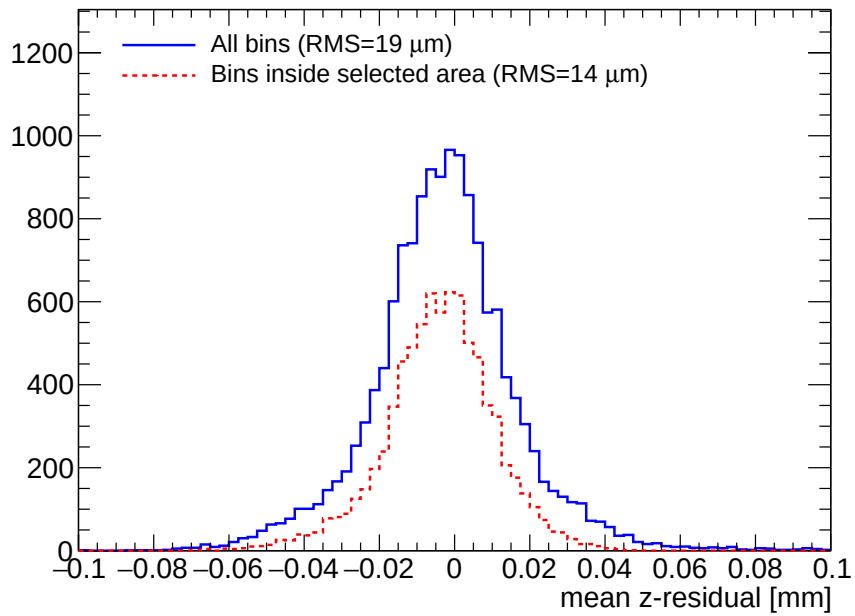




Introducing a y-coordinate dependence improves corners, but there is no difference for the central region

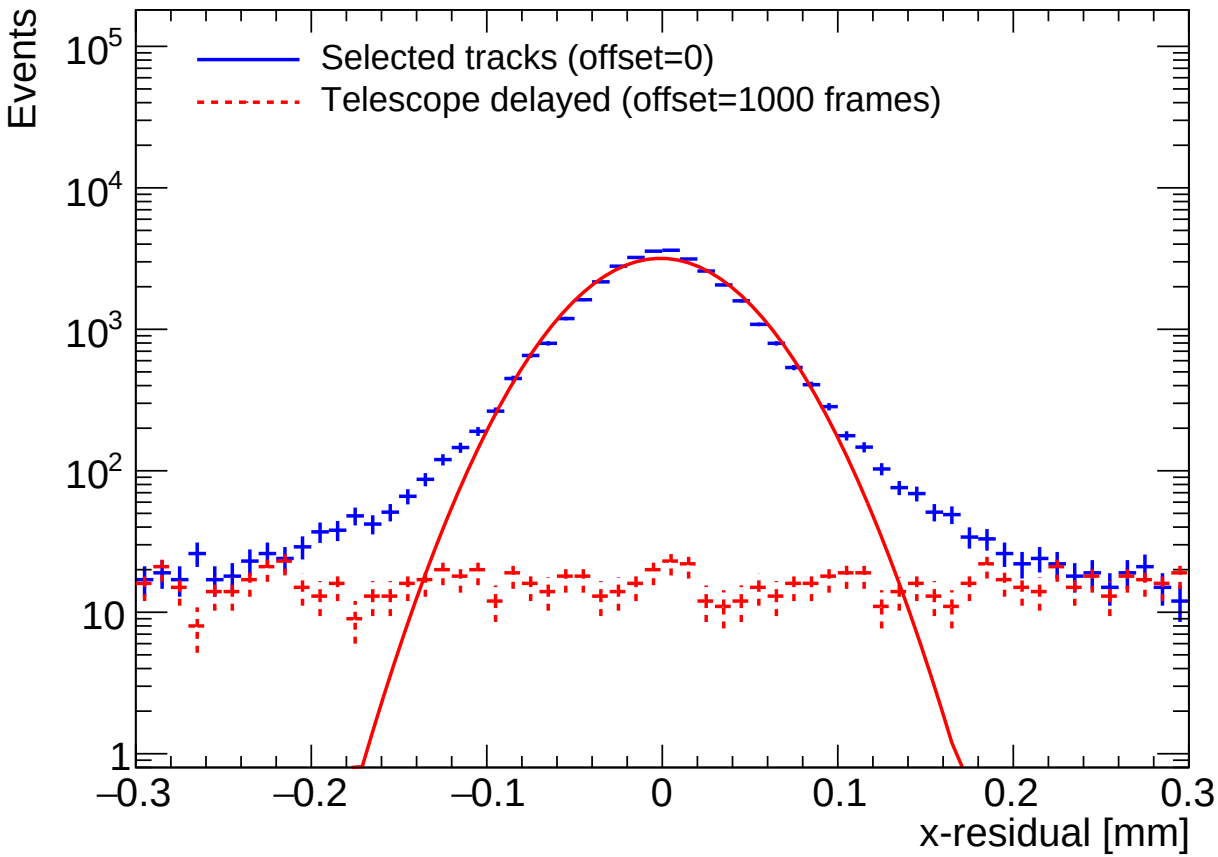
Deformation in drift direction





Distance to track of average of all hits

Residual of mean position of all quad hits to telescope track



Gaus fit σ is 42 µm

Background from coincidental tracks is approximetely 3%

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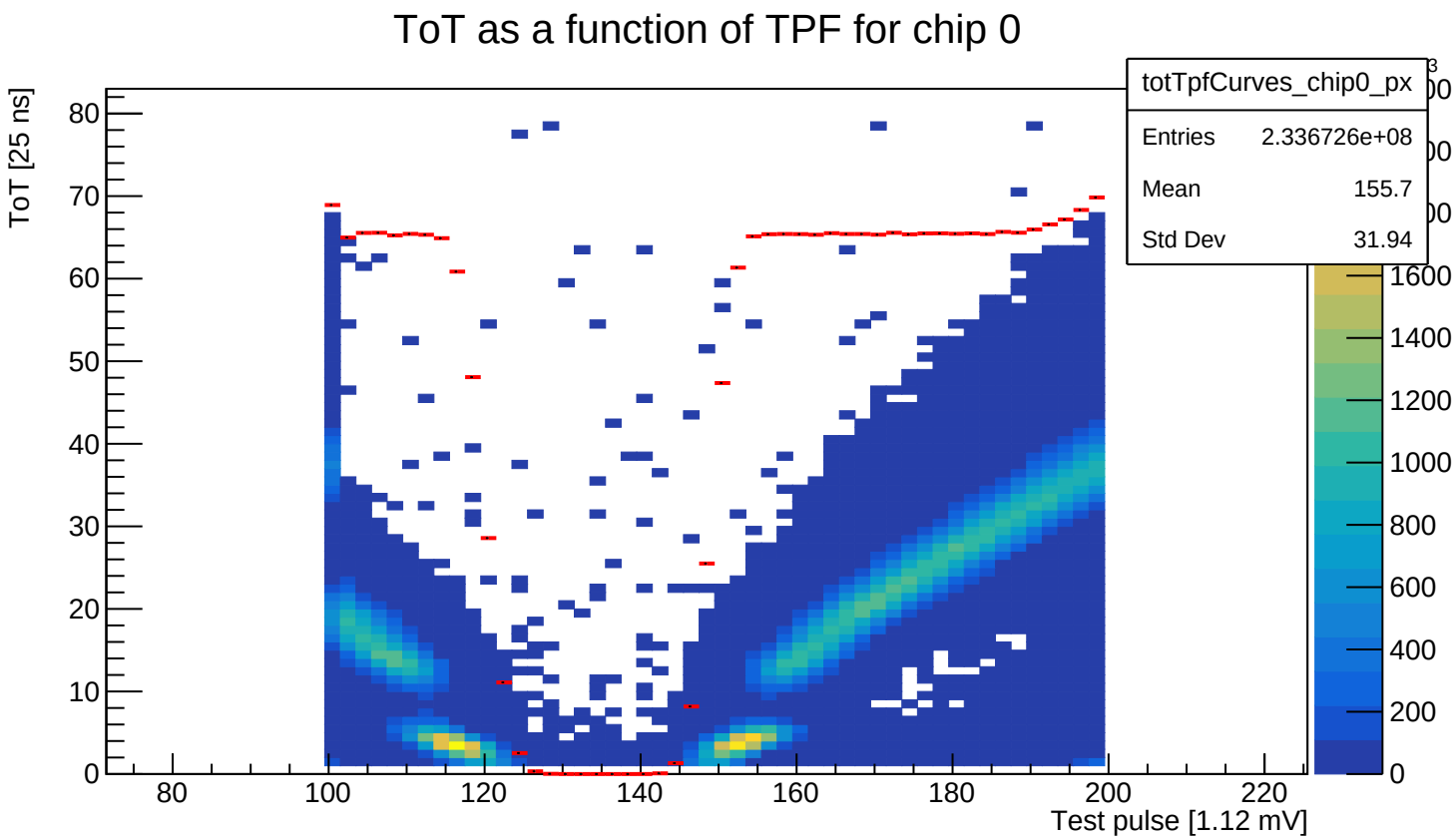
Charge-ToT callibration using test pulses



Strange gap around ToT = 7 [25 ns]
Threshold at 800e, red line is efficiency