

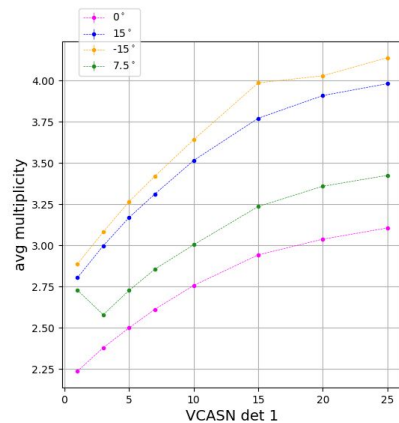
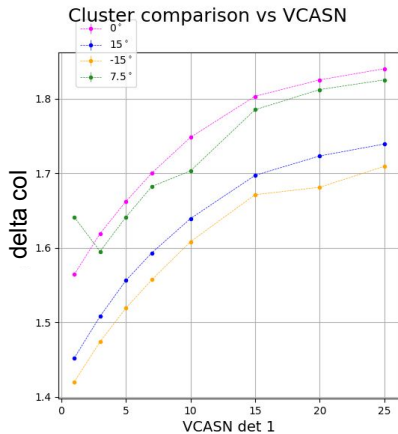
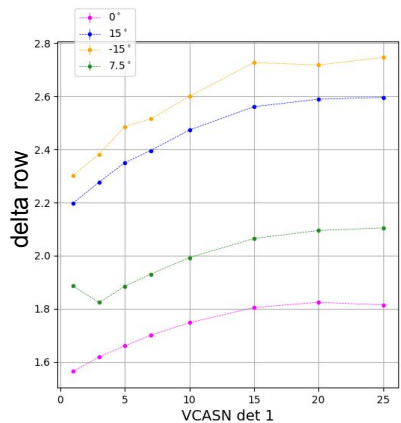
ARCADIA FNAL meeting

12-09-24

S.Ciarlantini, C. Pantouvakis, M. Rignanese, A. Zingaretti
INFN Sezione di Padova

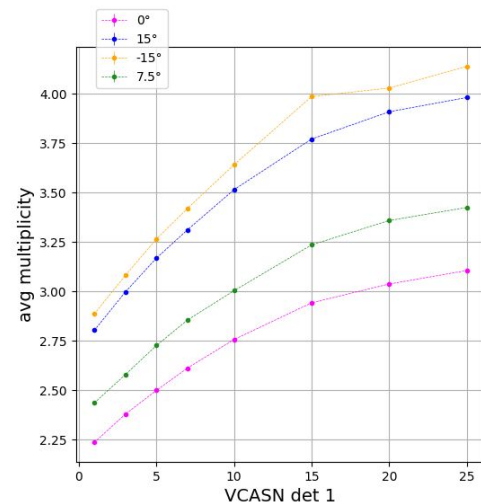
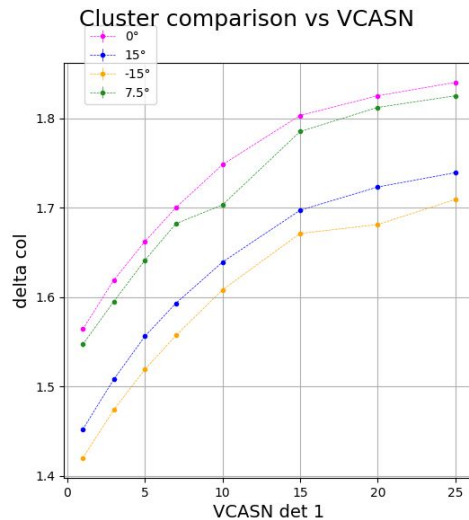
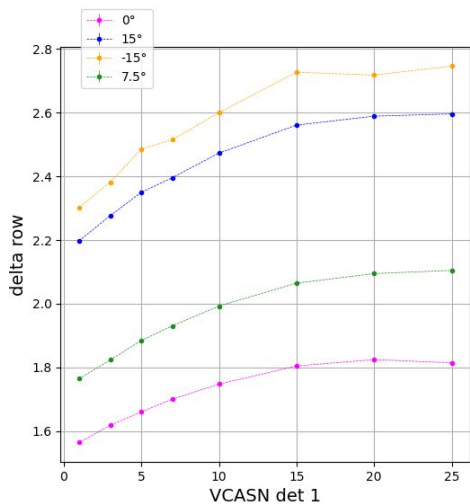


From previous meeting



run with VCASN = 1 was mistakenly recorded in our logbook, it was indeed a run with VCASN = 5

Correct plots



TB analysis: status

Assumptions done for the tracking:

- just time coincidence, NO spatial check of any kind
- consider events with just one clz per plane

What's new

Tracking

- Found and fixed some bugs in the analysis code
- Implemented three steps of alignment:
 - Preliminary alignment of detector 2 with respect to detector 0
 - Alignment of detector 1 (offset in xy) to have residual distributions centred in zero
 - Correction for tilt on xy for detector 1

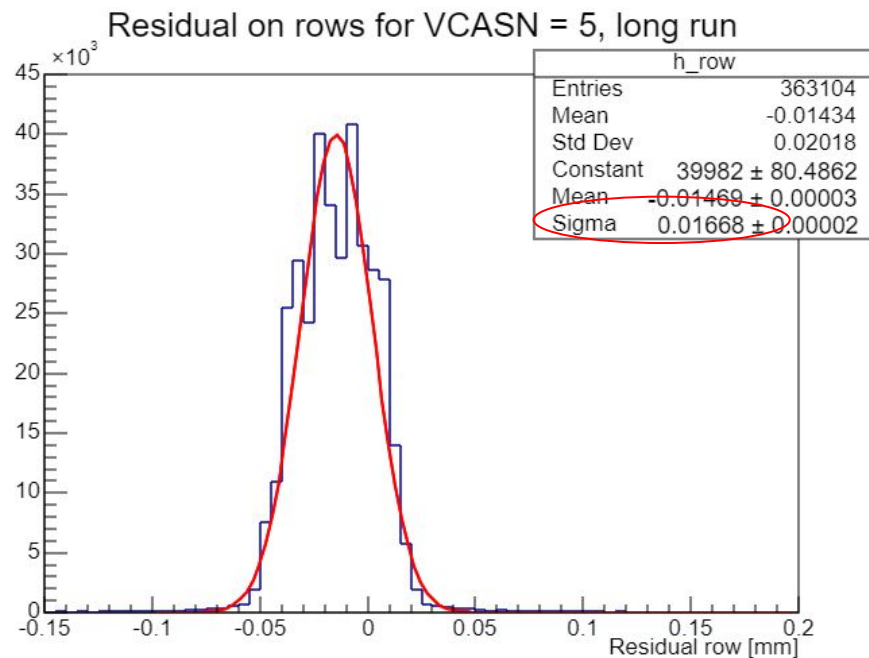
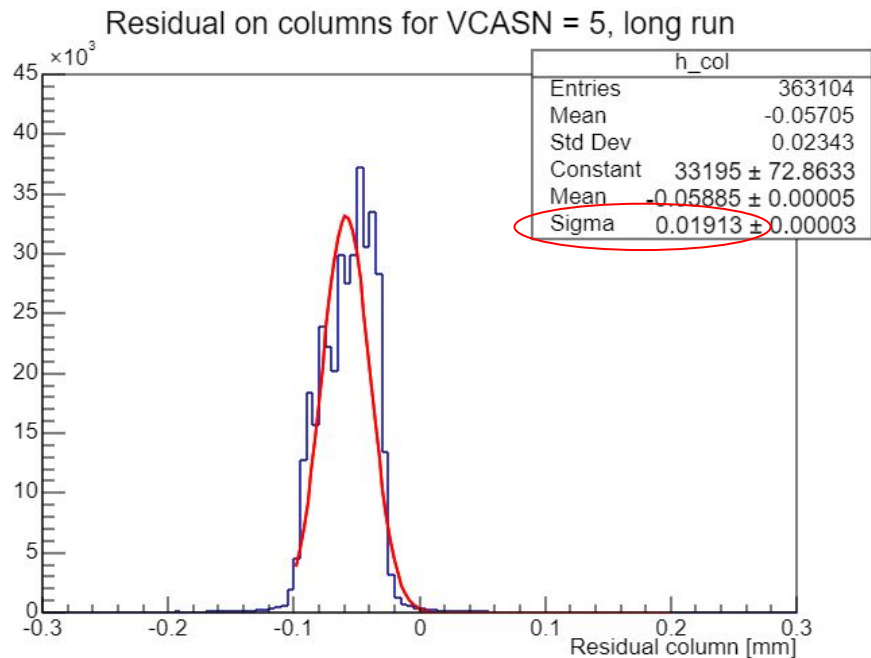
Efficiency

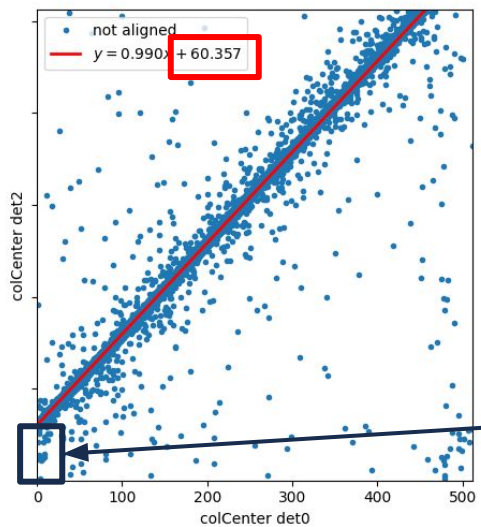
- Efficiency calculated as $\# \text{coincidences } 0-1-2 / \# \text{coincidences on det0-det2}$

Tracking - preliminary results: long default run

Step 0:
No alignment nor tilt correction

Long run (41 spills) with default configuration VCASN = (13,5,5); HV (-80, -90, -90) V

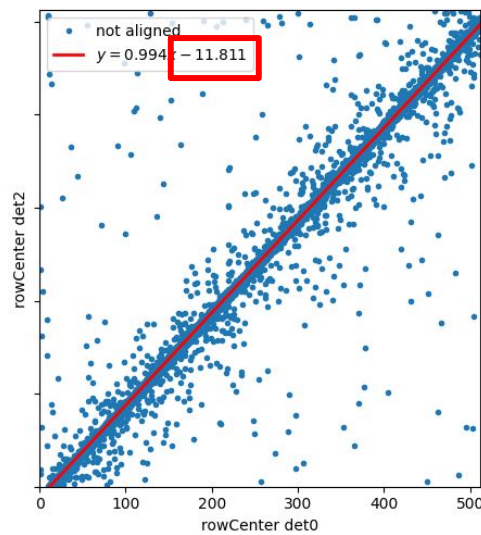
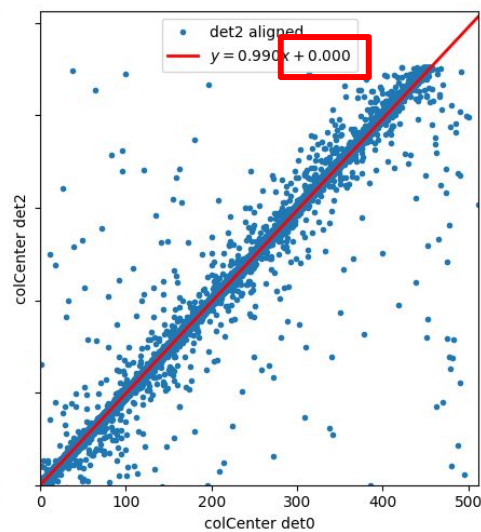




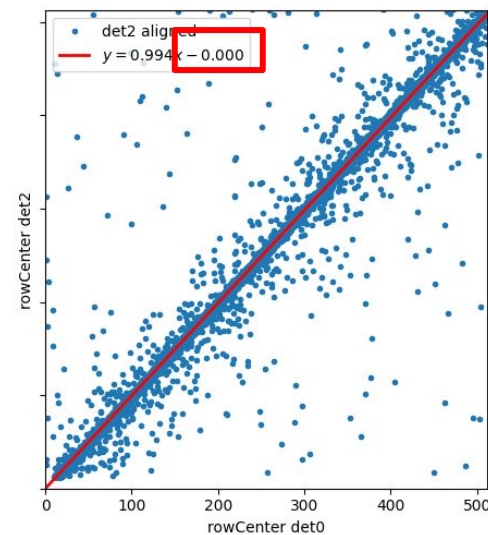
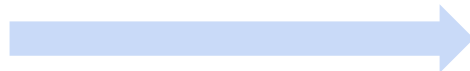
Step 1: prealignment of det 2 to det 0 from correlation plots

correlation plots
 det 0 - det 2

visible shift in particular
 along columns



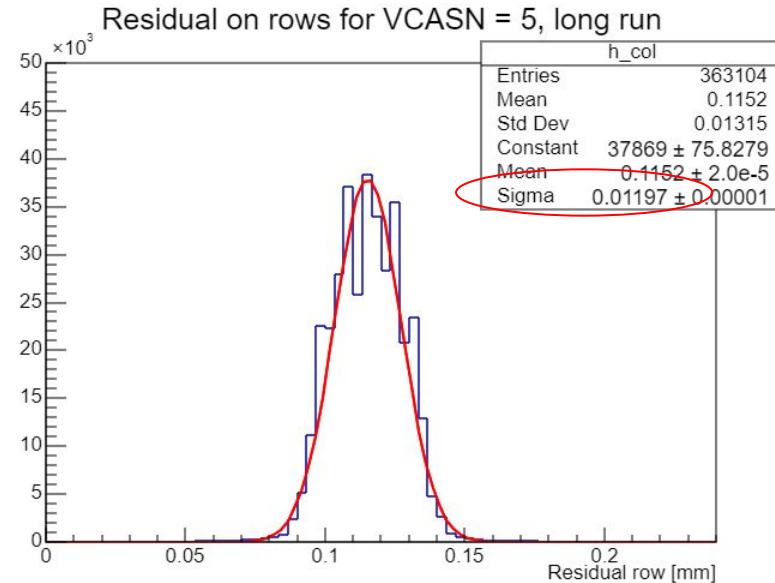
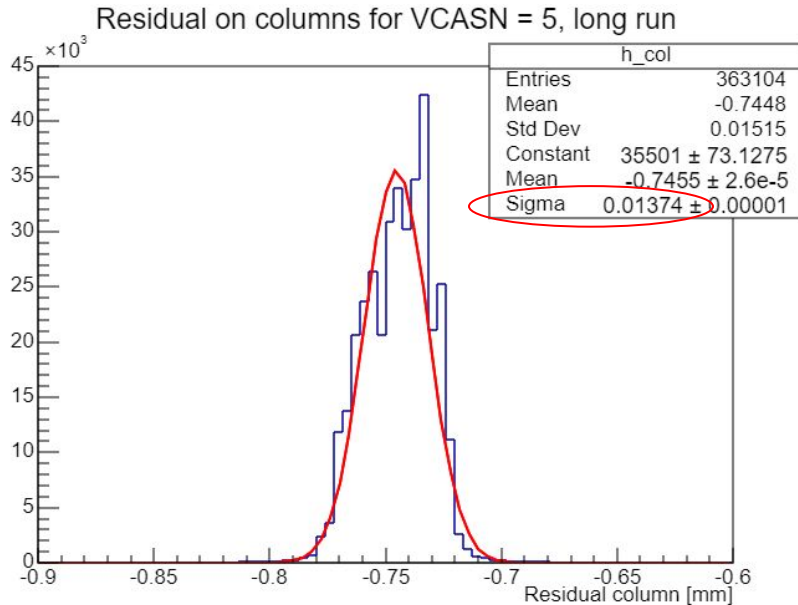
cluster center shifted by the
 intercepts of the fit



Alignment: residuals after preliminary alignment of det2

→ shifting rows and cols of det2 by the value of the intercept obtained from the fit of the correlation plot

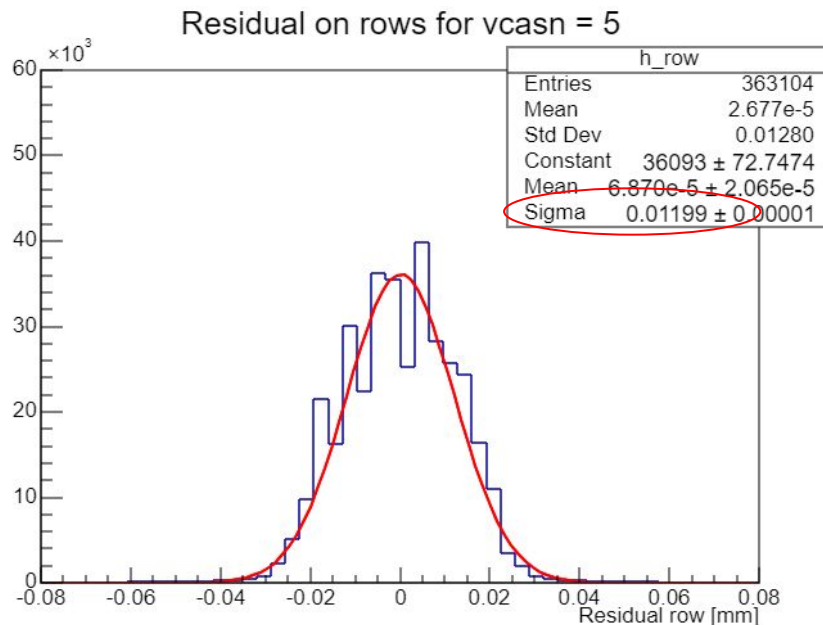
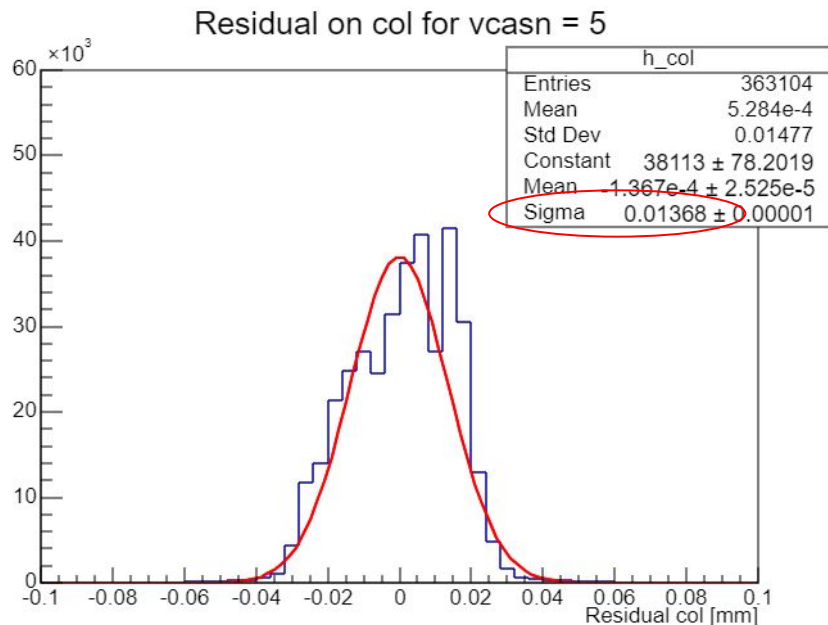
→ **Step 2:** use the mean obtained from the fit of the residuals to align det1



sigma value smaller respect to residual without det2 alignment (0.01913-0.01668 mm)

Alignment: residuals after alignment of det1

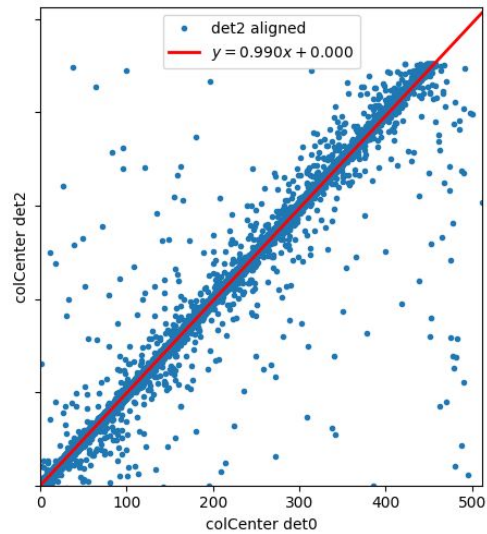
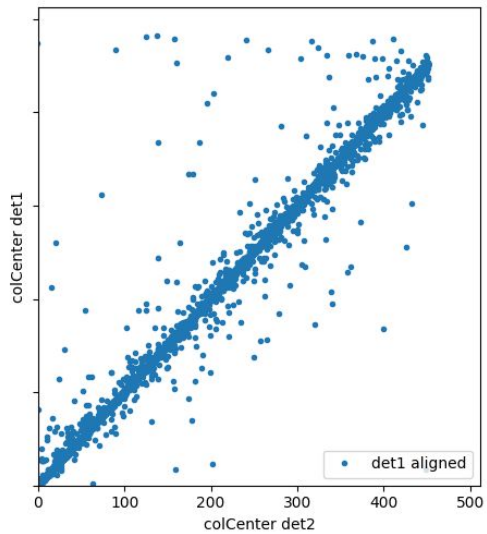
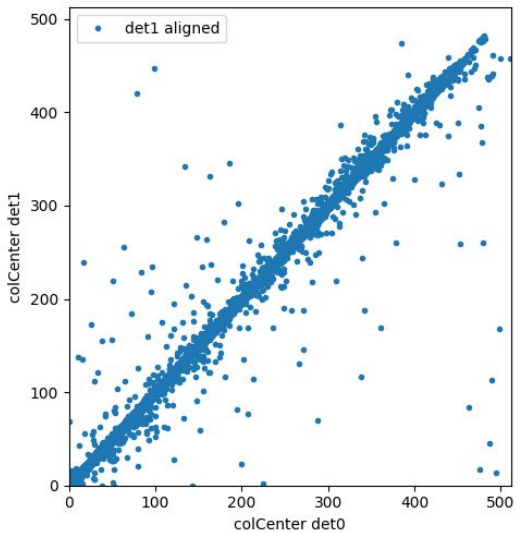
→ shifting rows and cols of det1 by the value obtained from the fit of the residuals obtained after the preliminary alignment of det2



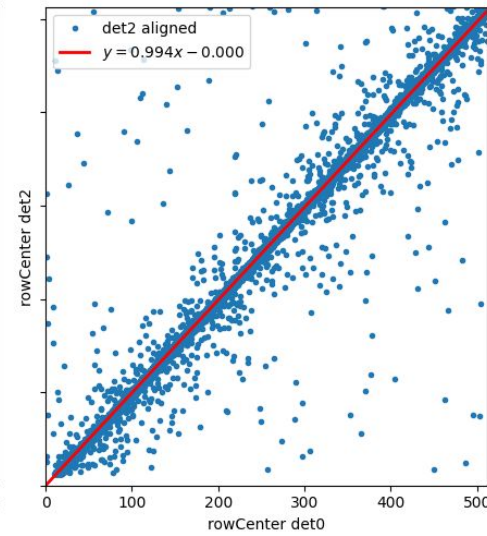
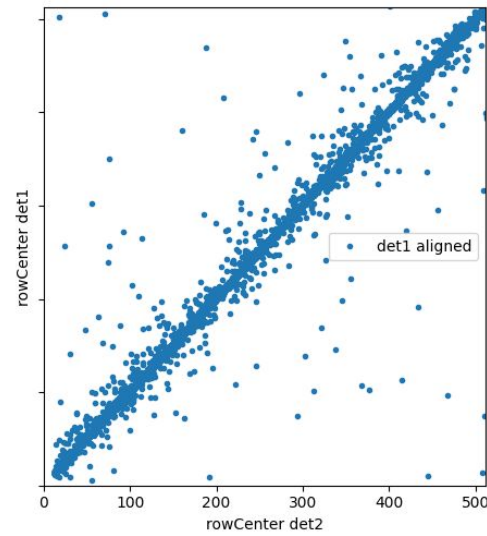
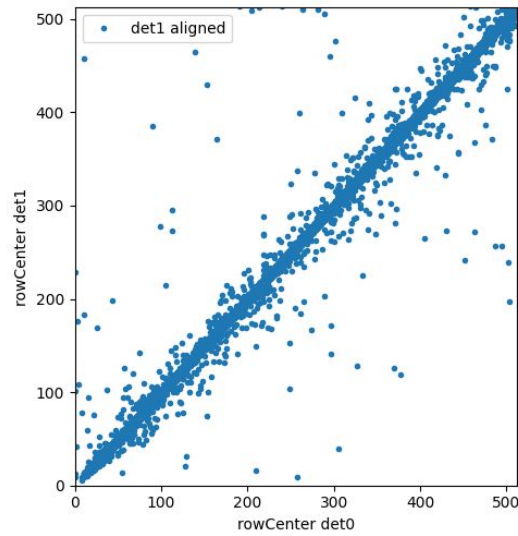
sigma value smaller respect to residual without det2 alignment (0.01913-0.01668 mm)

correlation plots

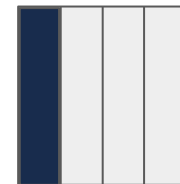
Col



Row



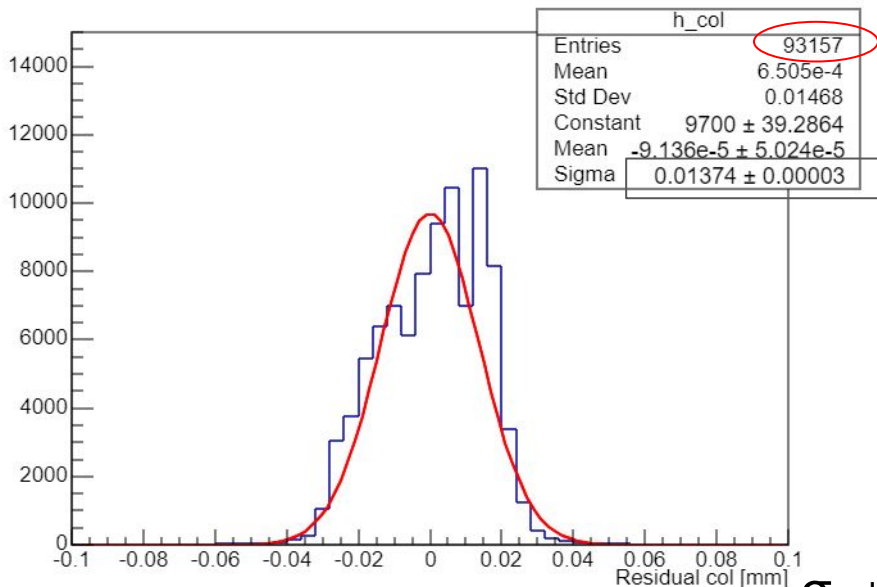
Residuals distribution for columns are wider and more asymmetrical → study of residuals in sub-regions of the pixel array to investigate this behaviour



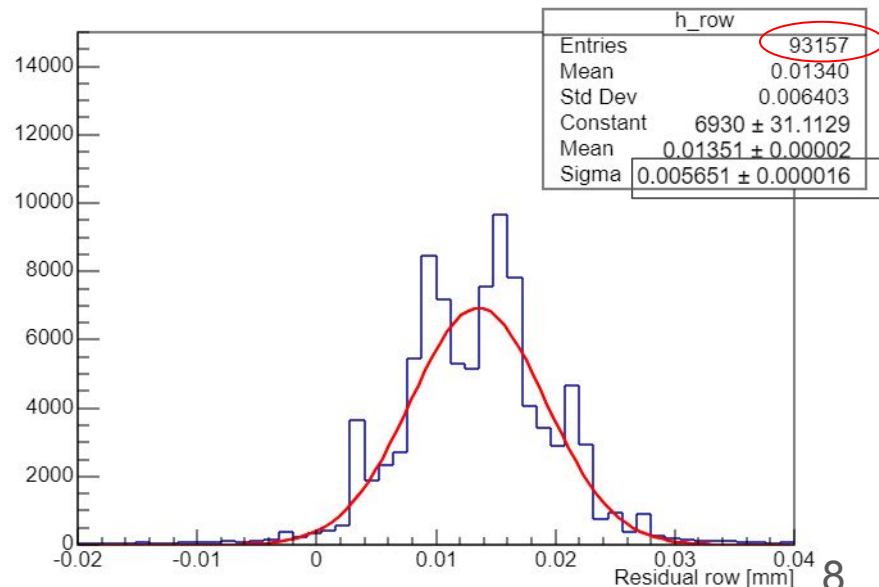
Residuals for sector [0,127]:

→ selecting only events in sector with col [0,127], row [0, 511]

Residual on col for vcasn = 5

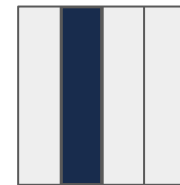


Residual on rows for vcasn = 5

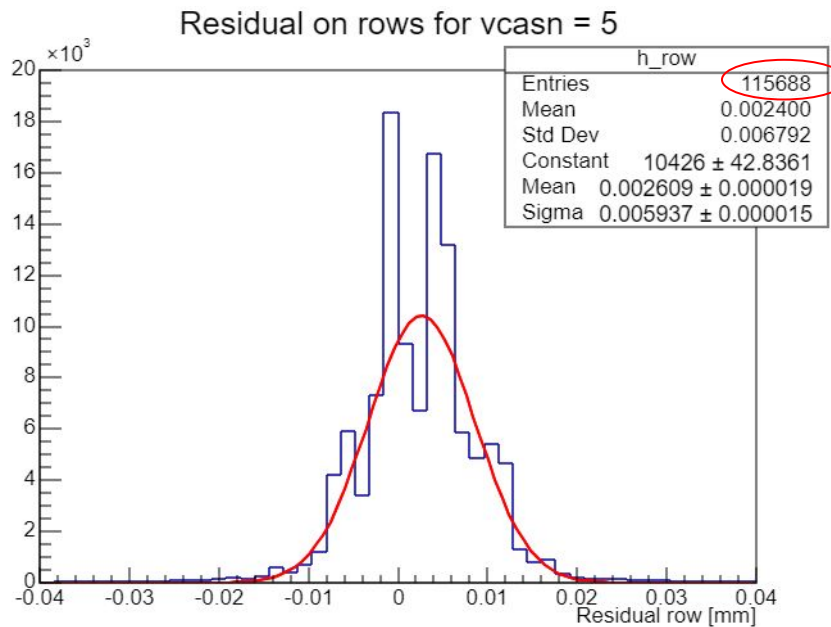
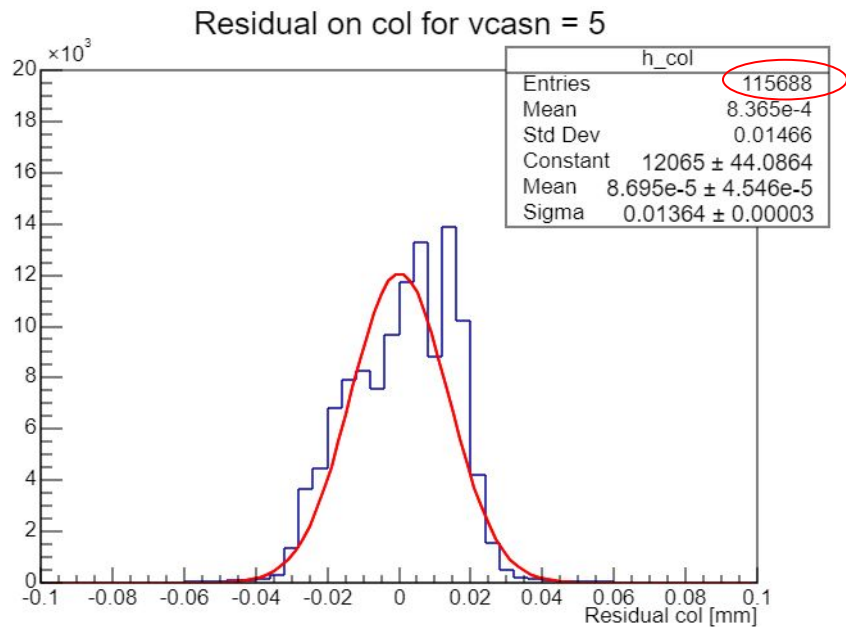


$\sigma_{col} \gg \sigma_{row}$

Residuals of sector [128, 255]:



→ selecting only events in sector with col [128, 255], row [0, 511]

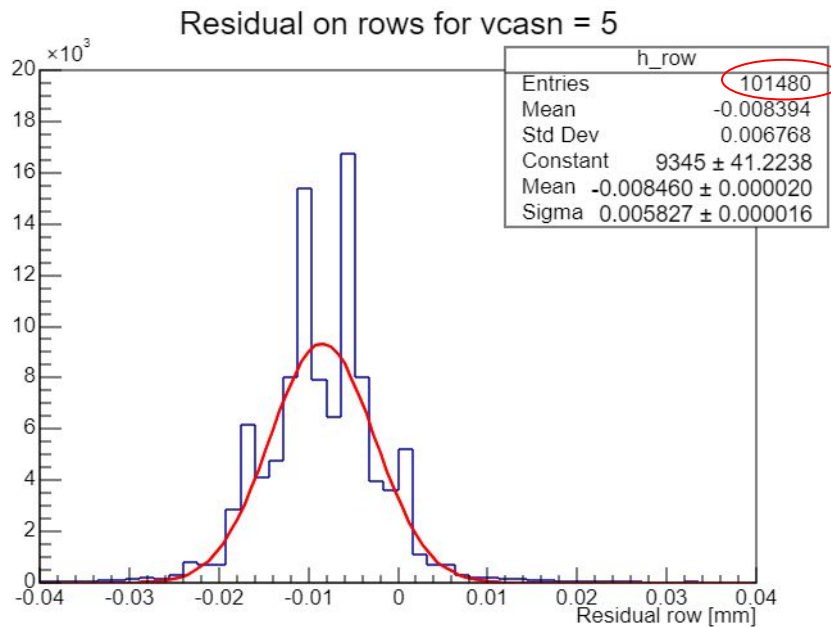
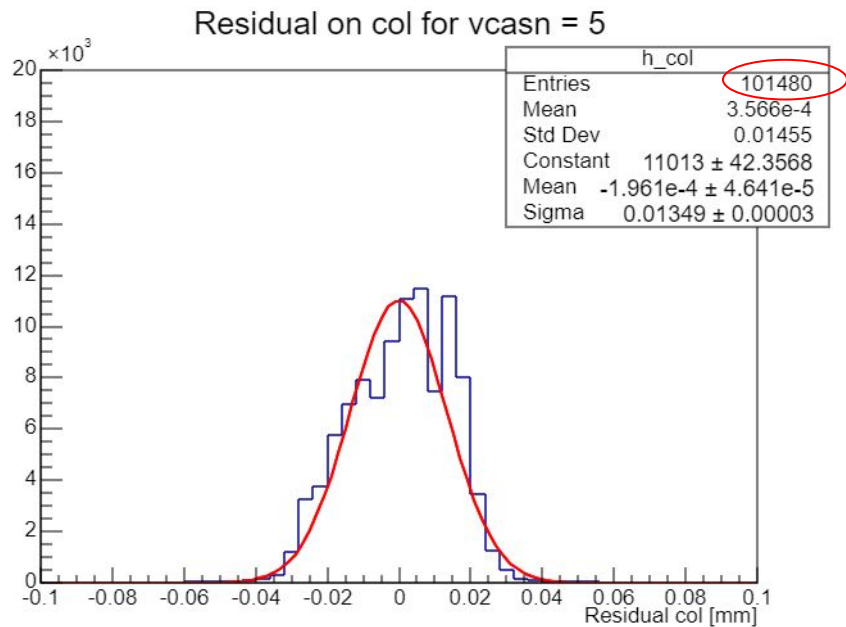


$\sigma_{col} \gg \sigma_{row}$

Residuals of sector [256, 383]:

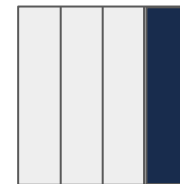


→ selecting only events in sector with col [256, 383], row [0, 511]



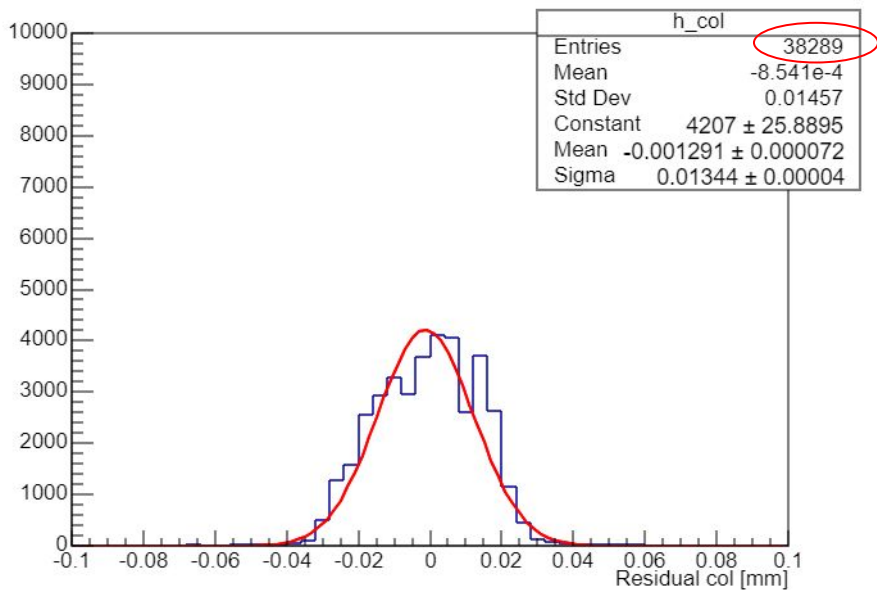
$\sigma_{\text{col}} \gg \sigma_{\text{row}}$

Residuals of sector [384, 511]:

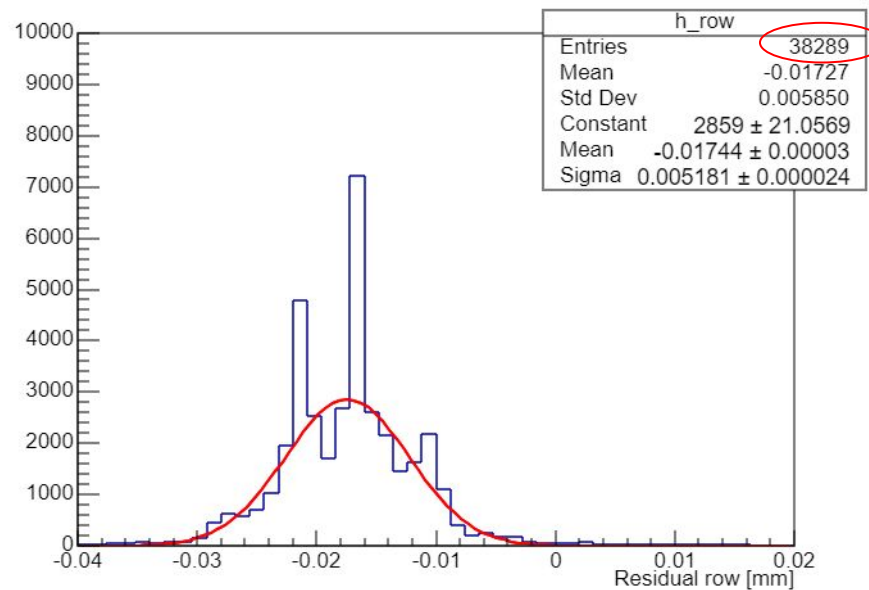


→ selecting only events in sector with col [384, 511], row [0, 511]

Residual on col for vcasn = 5

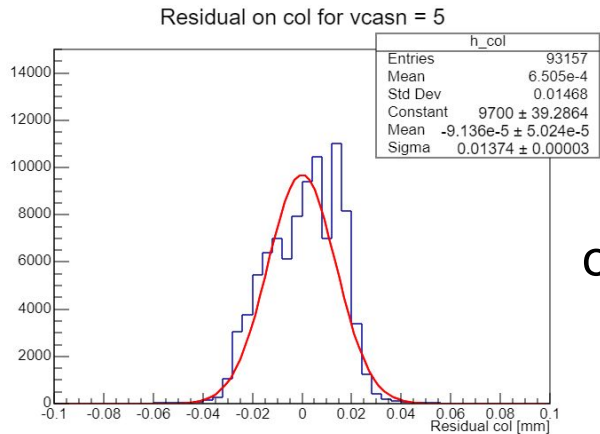
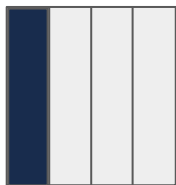


Residual on rows for vcasn = 5



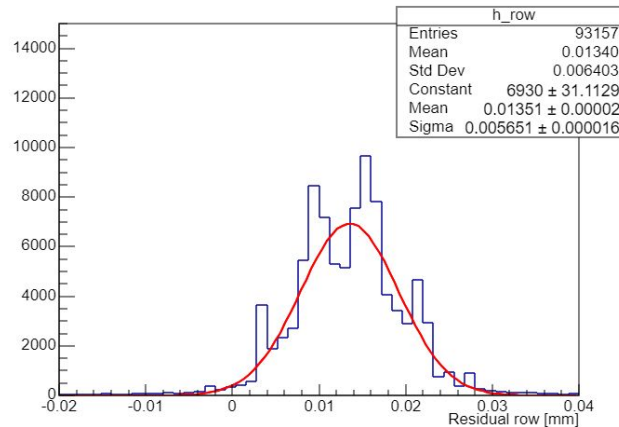
$\sigma_{col} \gg \sigma_{row}$

Cutting on columns: first sector

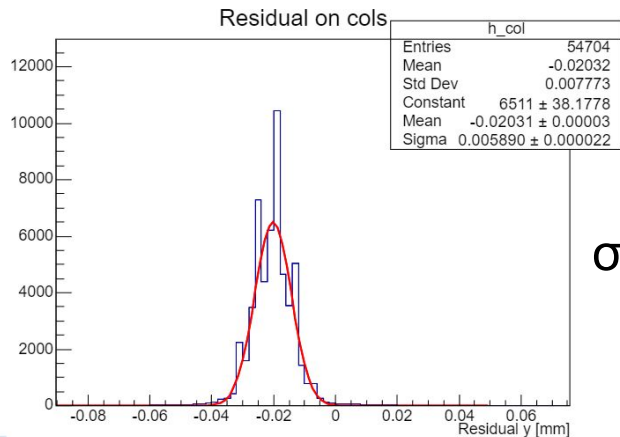
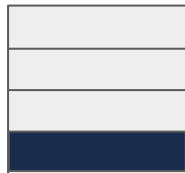


$\sigma_{col} \gg \sigma_{row}$

Residual on rows for vcasn = 5

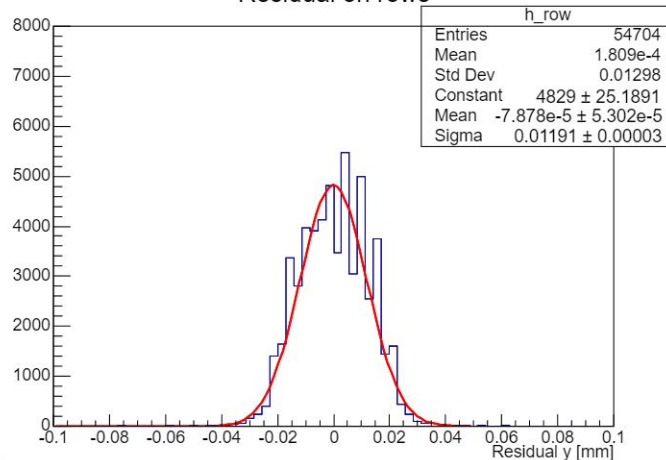


Cutting on rows: first sector



$\sigma_{row} \gg \sigma_{col}$

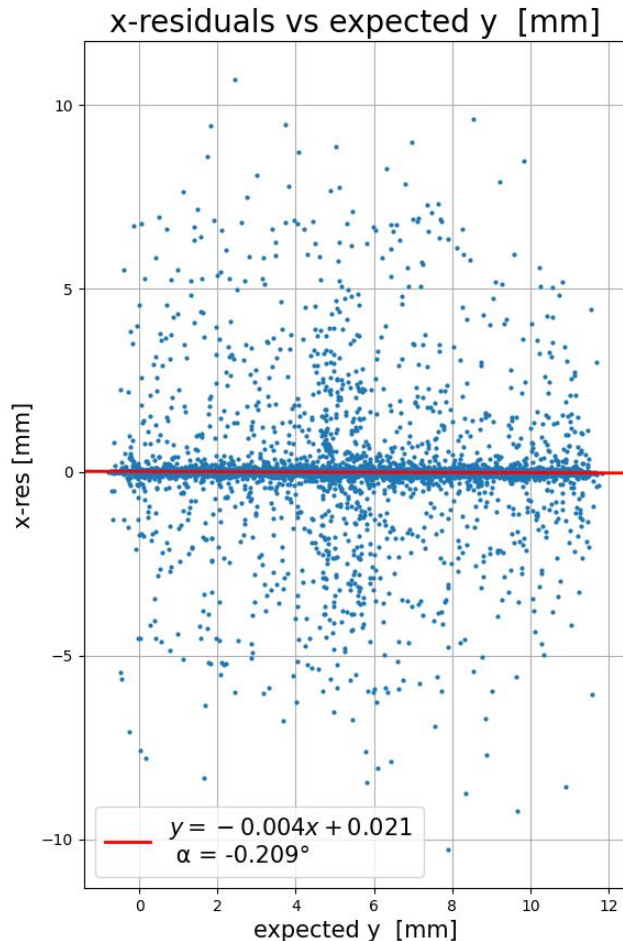
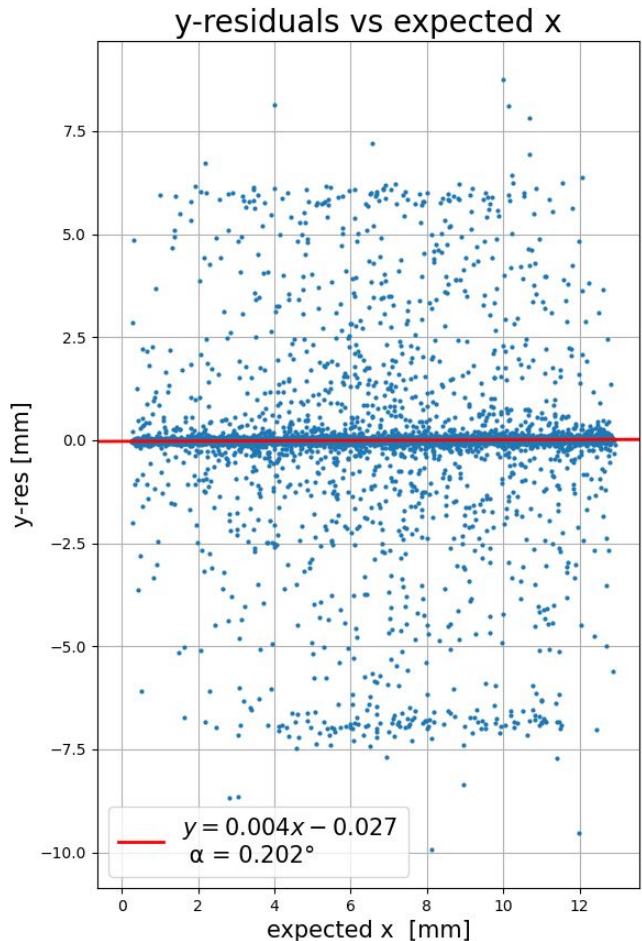
Residual on rows



Opposite behaviour → tilt on x-y

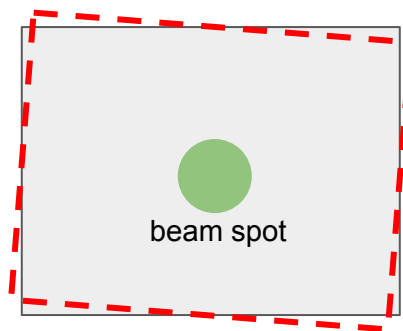
Middle Detector

Step 3:
x-y tilt correction



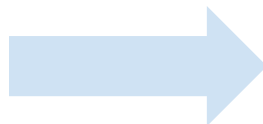
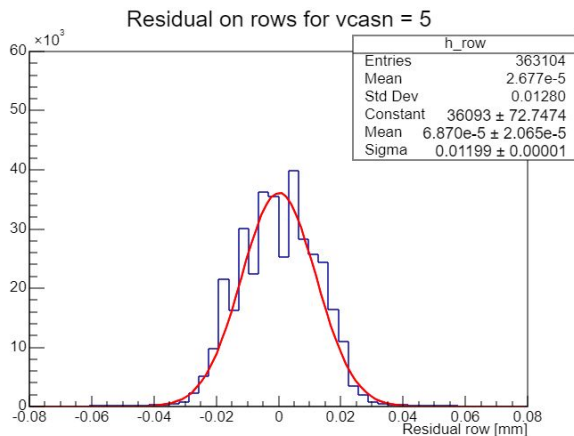
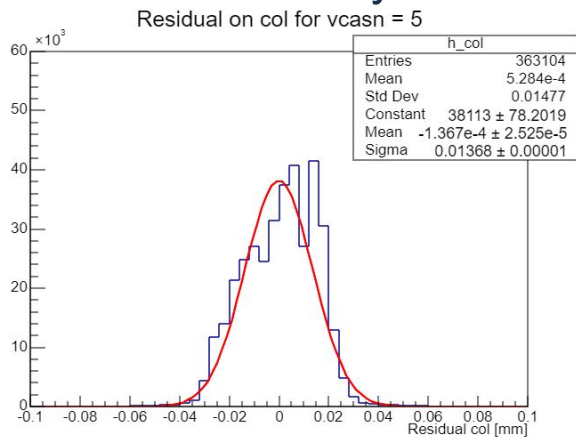
residuals after
det2 and det1
alignment

tilting angle of 0.202°

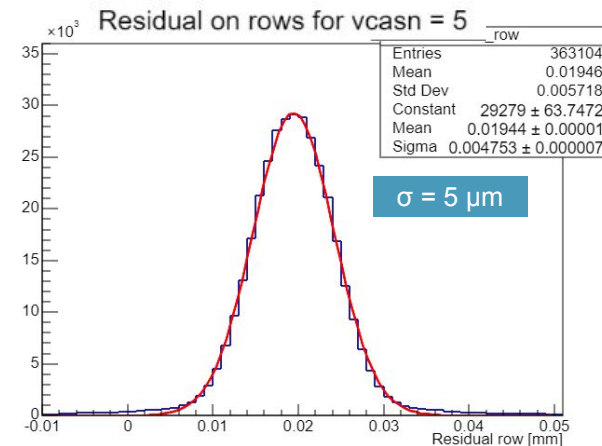
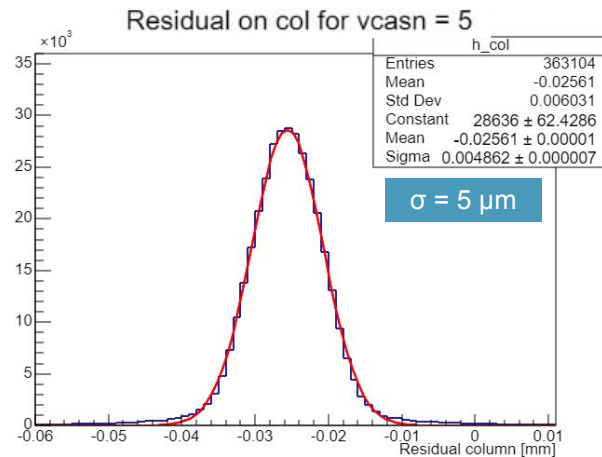


Before vs after tilt correction

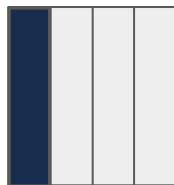
Residuals on full array



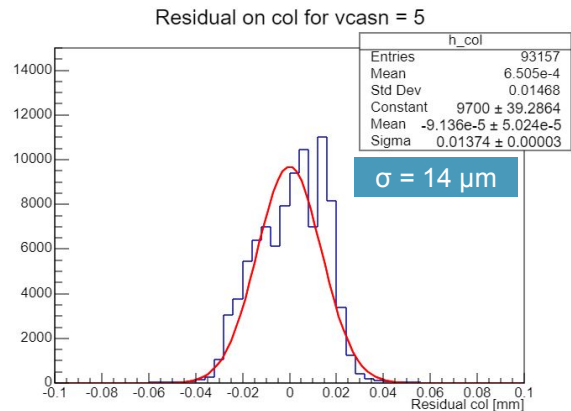
Step 3: x-y tilt correction



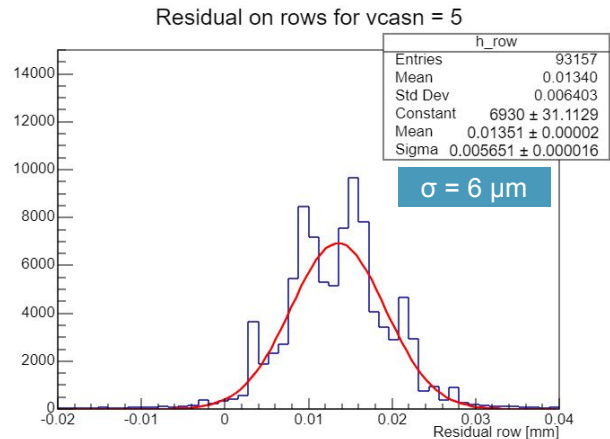
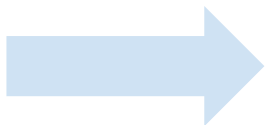
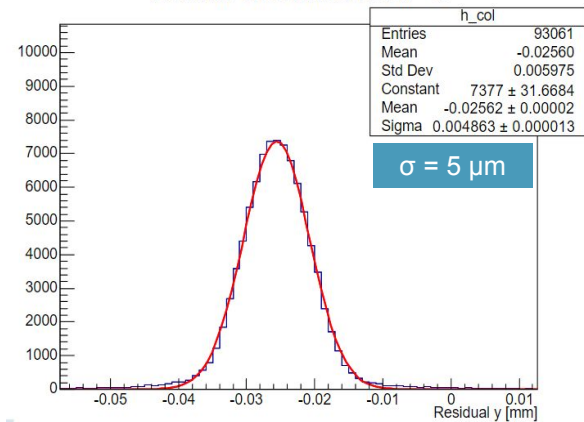
Before vs after tilt correction for residuals of sector [0,127]



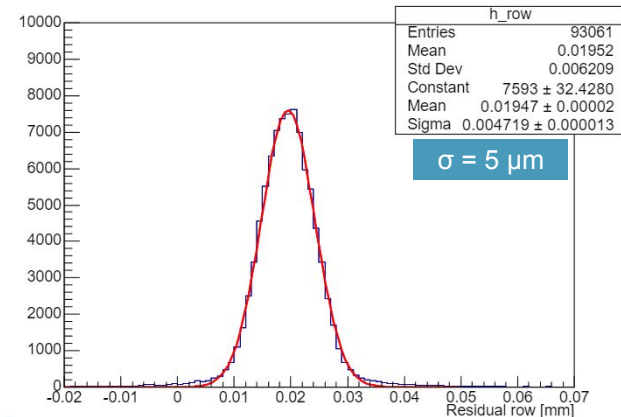
Step 3: x-y tilt correction



Residual on columns vcasn = 5

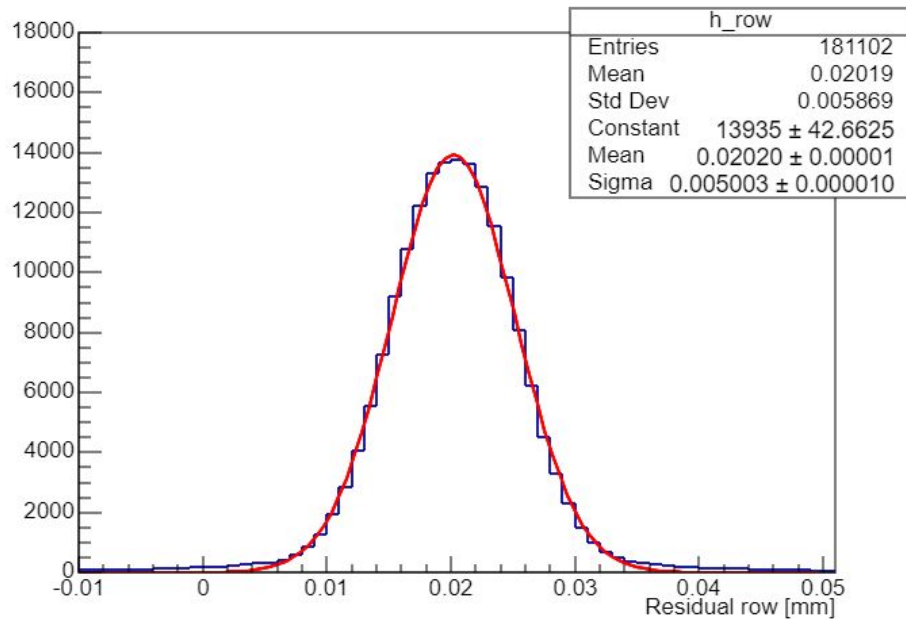


Residual on row vcasn = 5

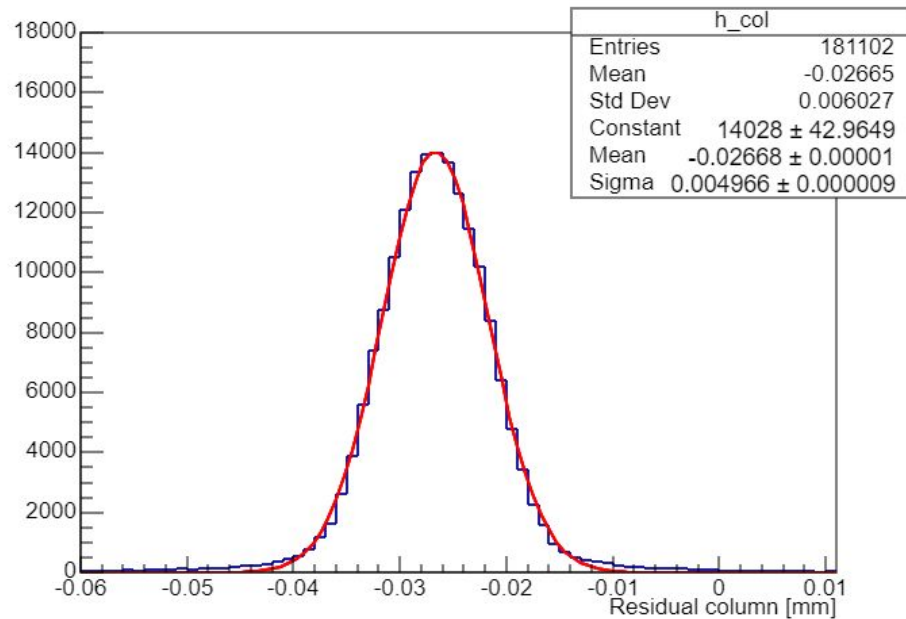


Residuals for VCASN = 1

Residual on rows for VCASN = 1

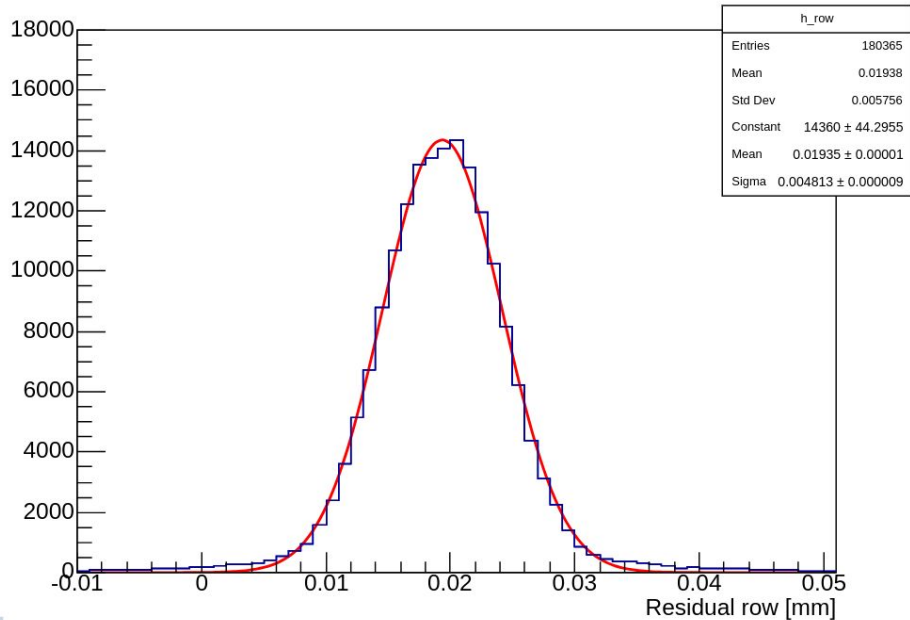


Residual on columns for VCASN = 1

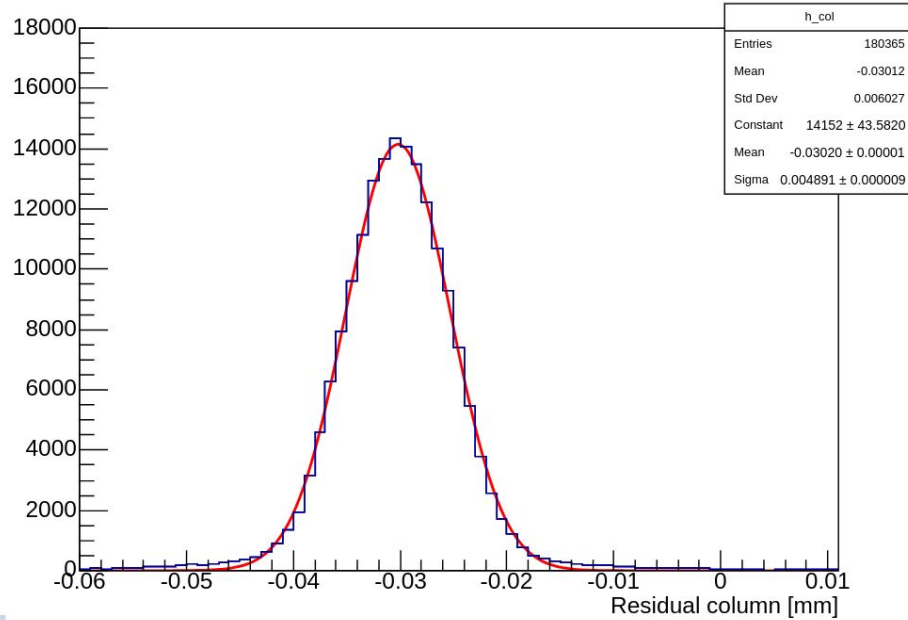


Residuals for VCASN = 3

Residual on rows for VCASN = 3

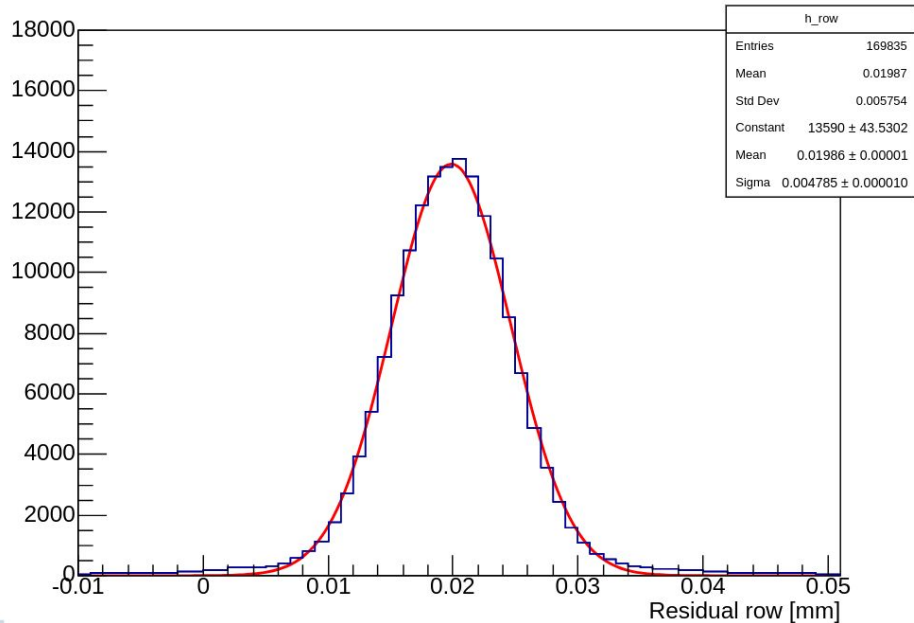


Residual on columns for VCASN = 3

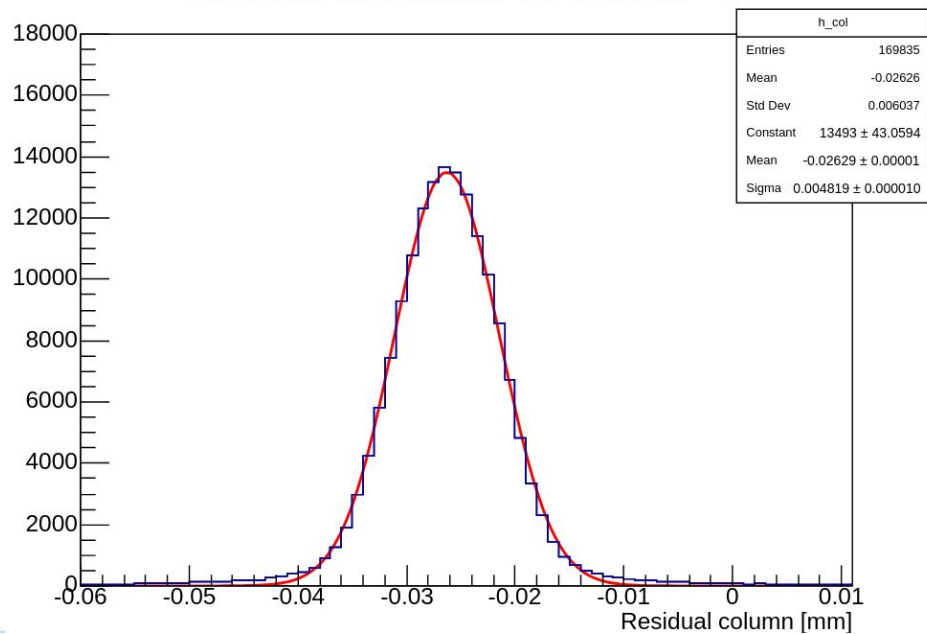


Residuals for VCASN = 7

Residual on rows for VCASN = 7

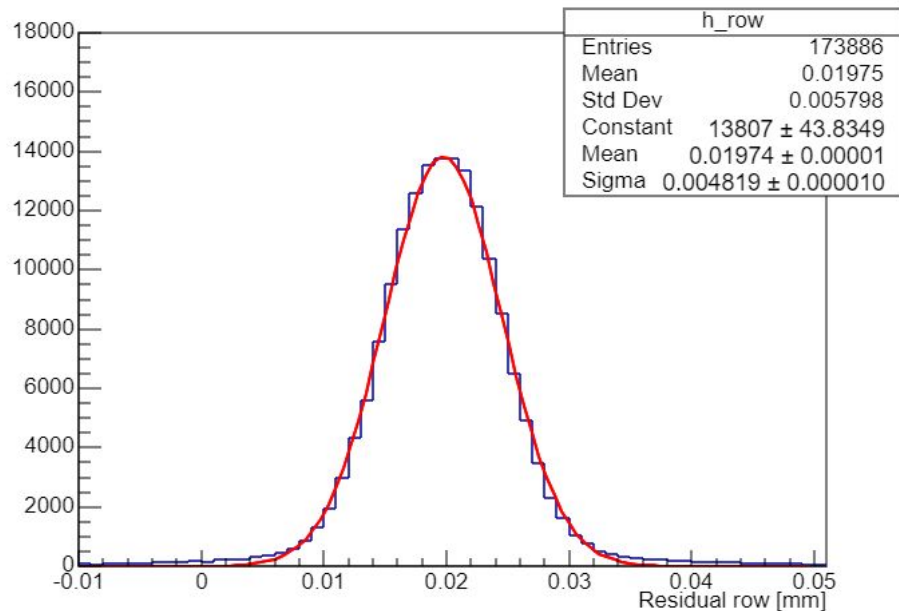


Residual on columns for VCASN = 7

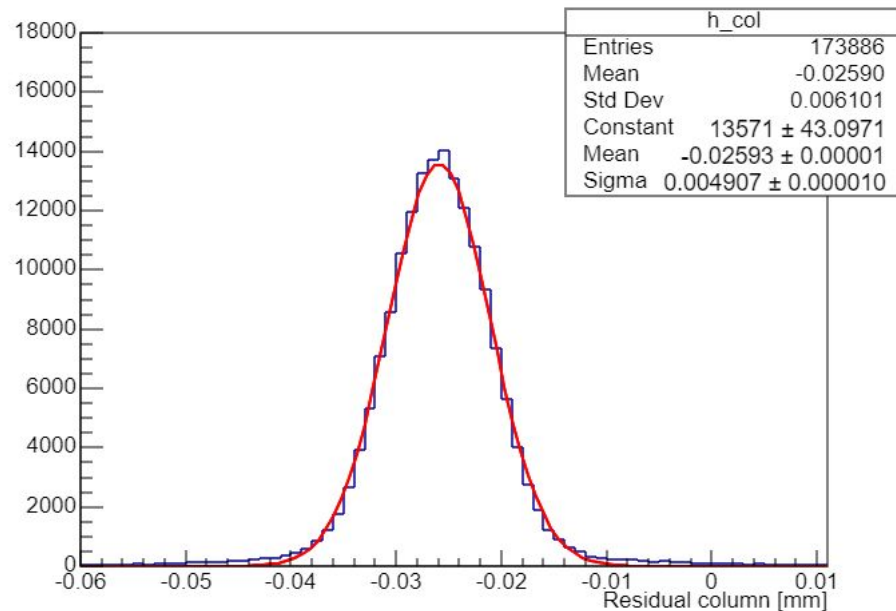


Residuals for VCASN = 10

Residual on rows for VCASN = 10

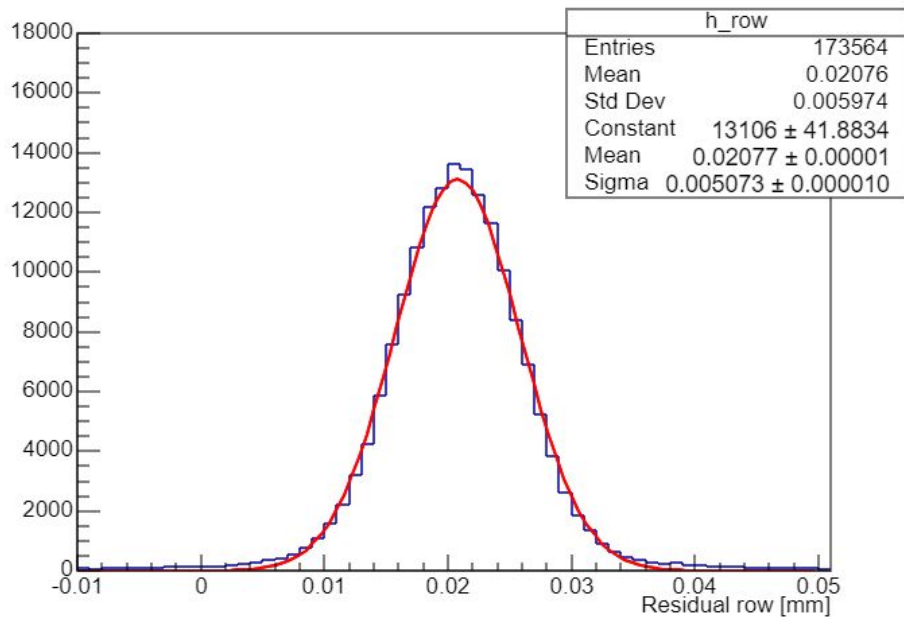


Residual on columns for VCASN = 10

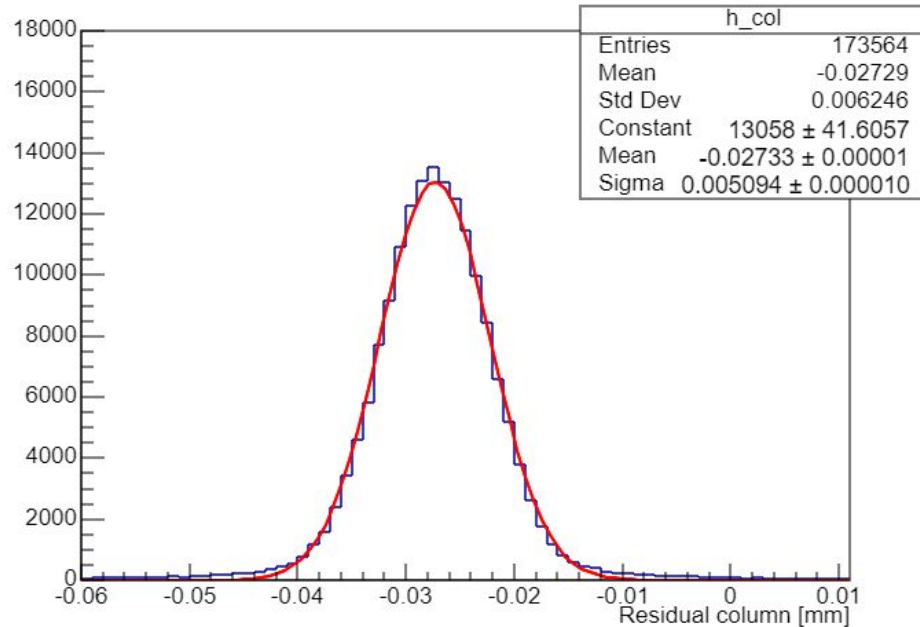


Residuals for VCASN = 15

Residual on rows for VCASN = 15

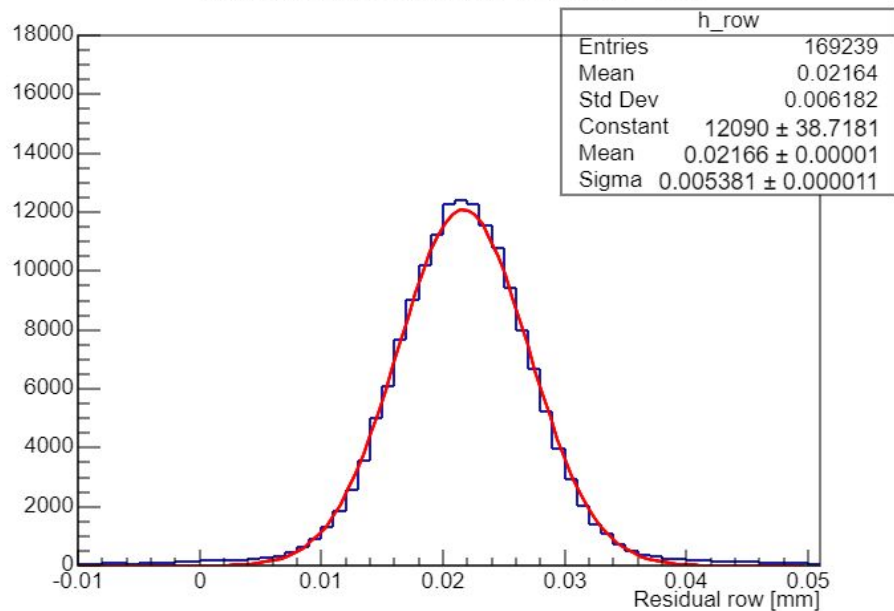


Residual on columns for VCASN = 15

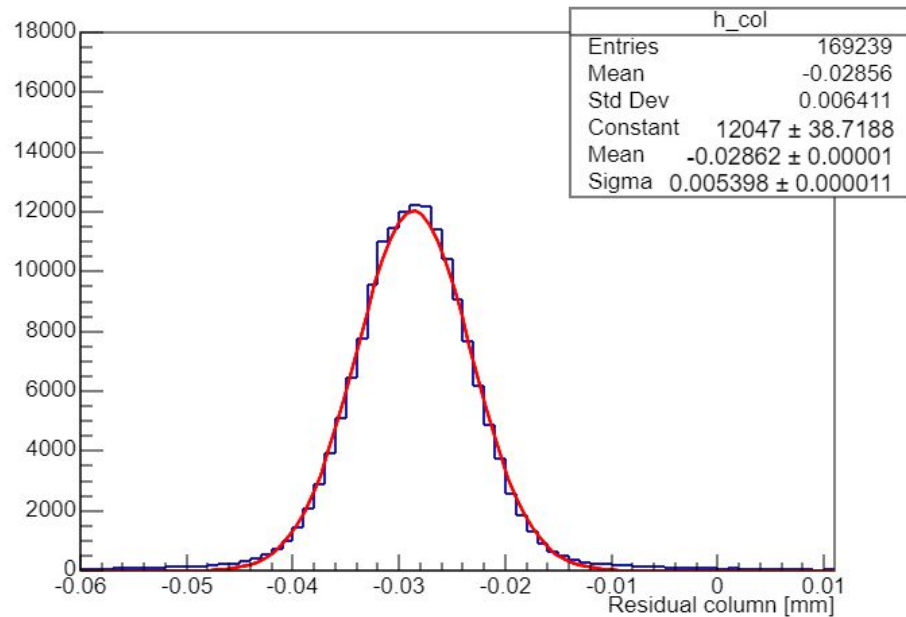


Residuals for VCASN = 20

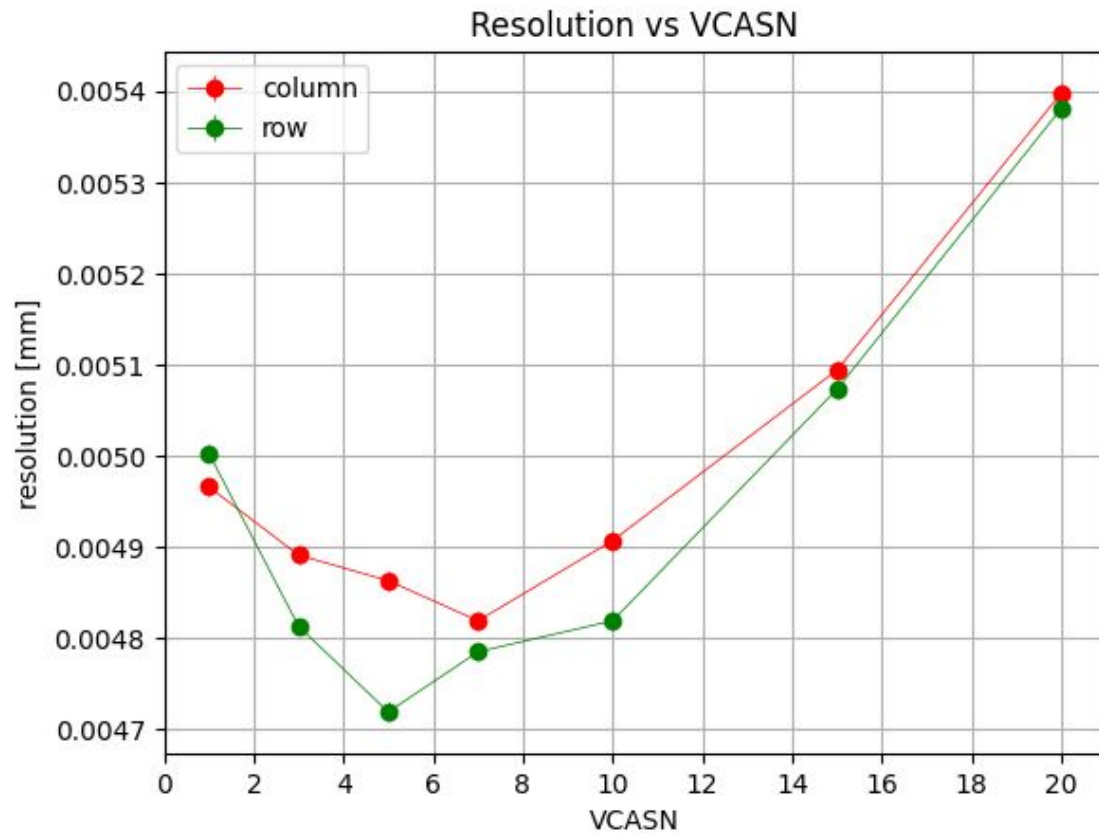
Residual on rows for VCASN = 20



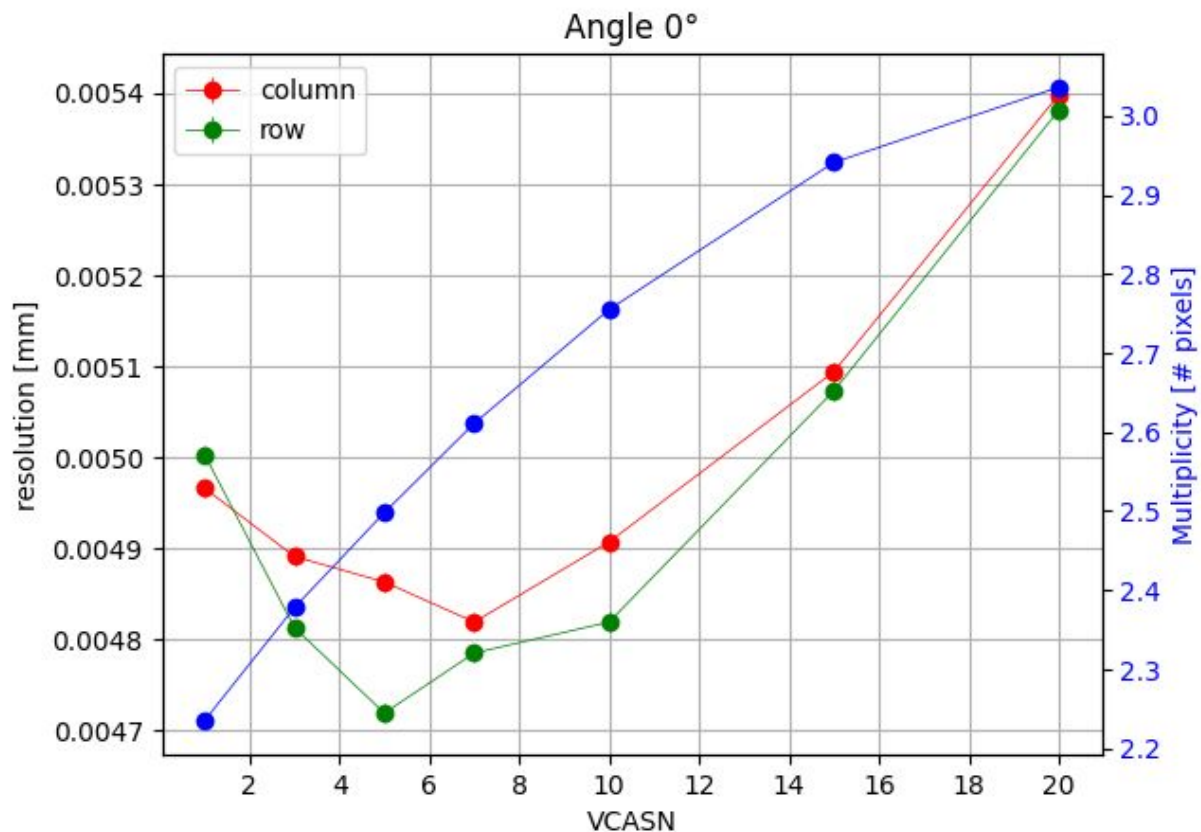
Residual on columns for VCASN = 20



Resolution vs threshold (VCASN)



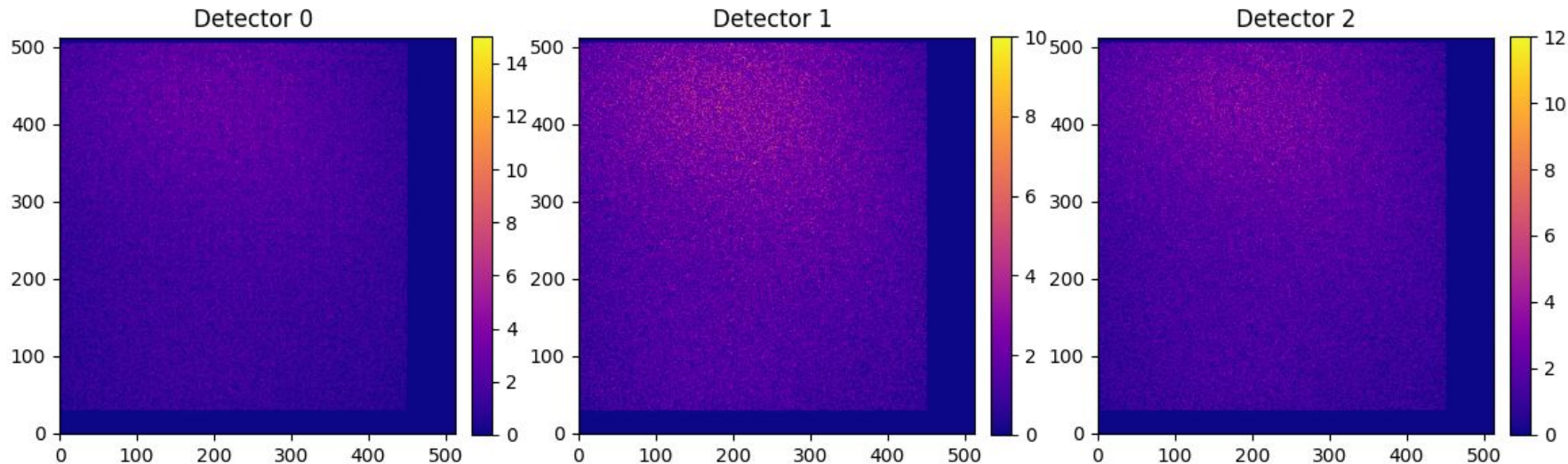
Resolution vs threshold (VCASN) and Multiplicity vs threshold (VCASN)



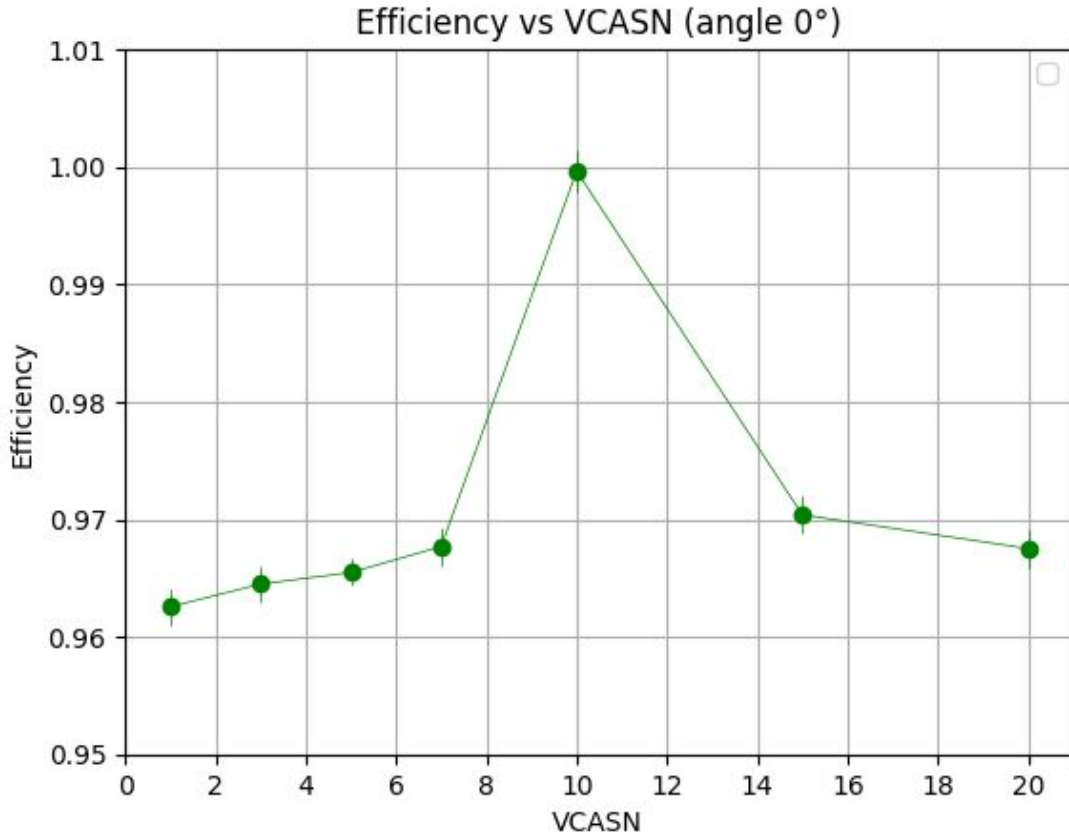
Preliminary study of efficiency

For efficiency estimation, proper cuts have been set to neglect regions excluded by alignment correction.

Hitmaps of detectors after cut (cut at $30 < \text{row} < 505$, $0 < \text{col} < 450$)



Preliminary study of efficiency: Efficiency vs VCASN



We estimate the efficiency as:

$$\frac{\# \text{ events with one clz per chip}}{\# \text{ events with one clz on external planes}}$$

Errors calculated considering poisson errors for num. and den. and then propagating.