ARCADIA FNAL meeting

31-07-24

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Clusterization algorithm: study of set time threshold at fixed spatial threshold

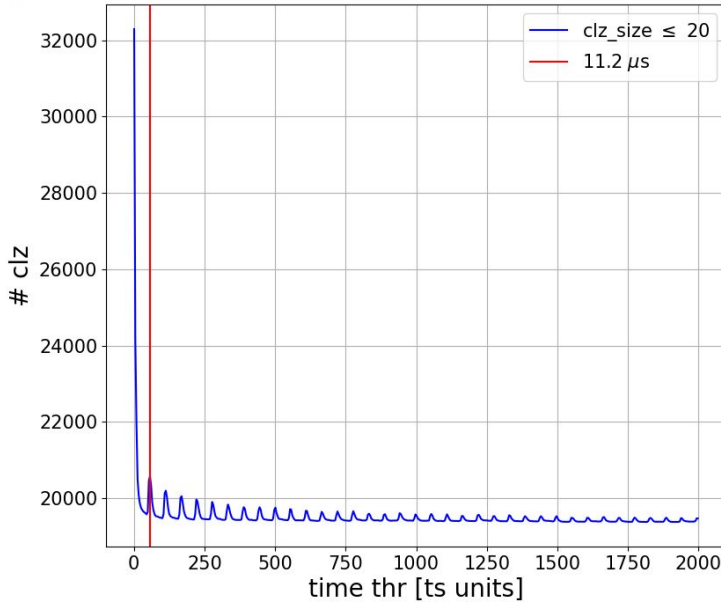Impact of time threshold for clusterization on #clusters and average multiplicity
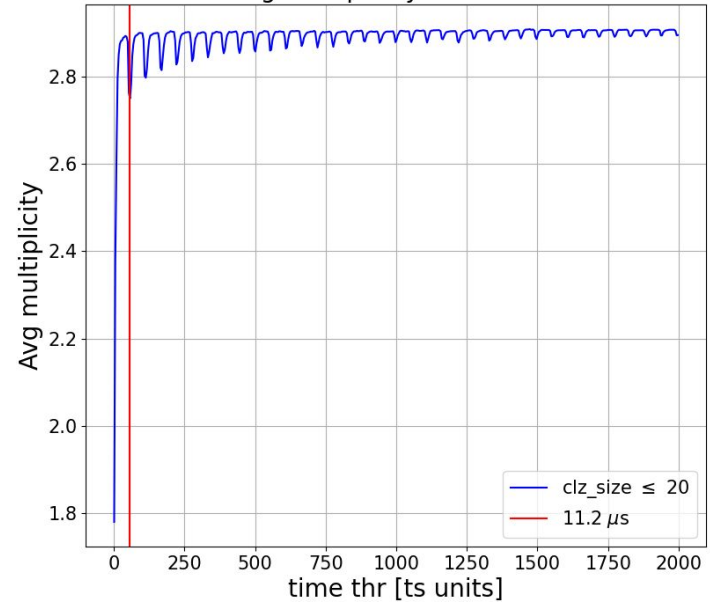Default configuration, run with 17 spills

7 batches length = 11.2 µs

Clusterization time threshold analysis (clz_lim = 2)

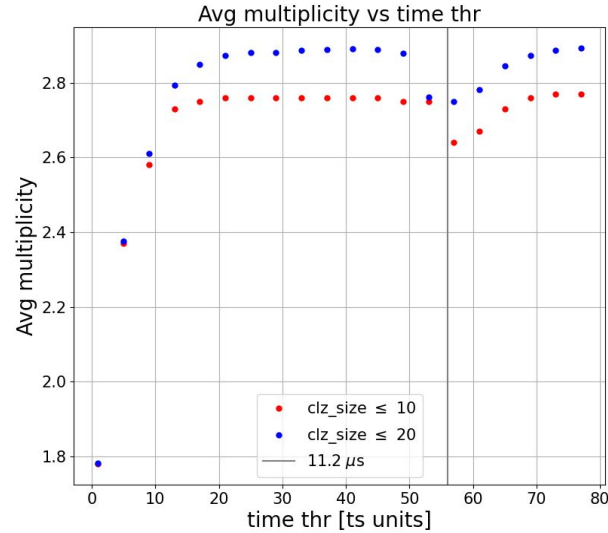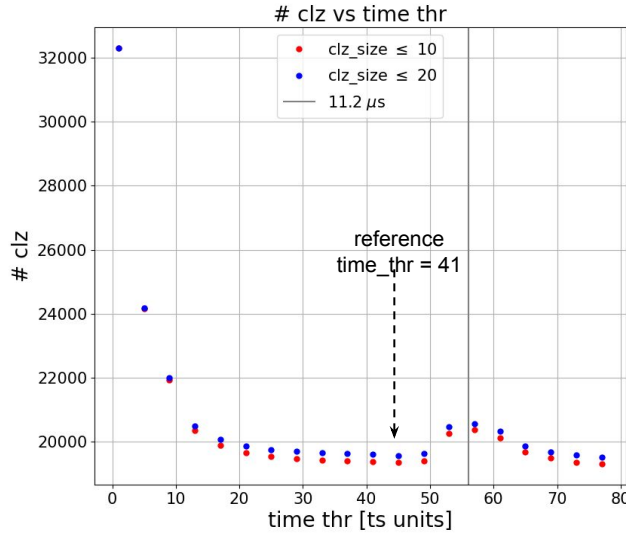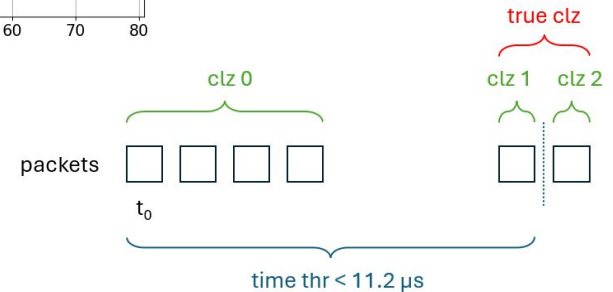# **Clusterization** algorithm: study of set time threshold at fixed spatial threshold

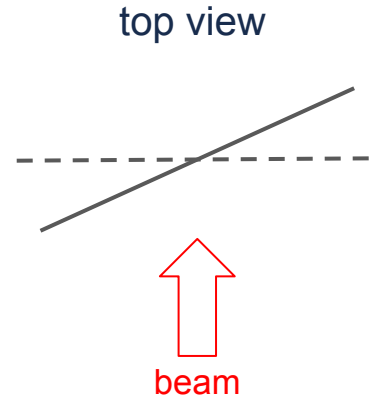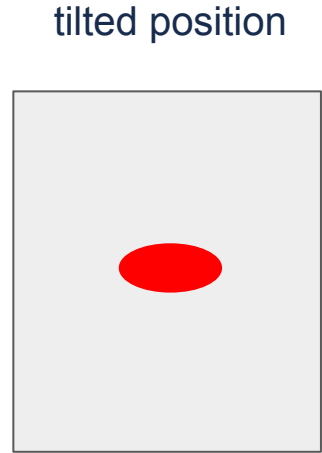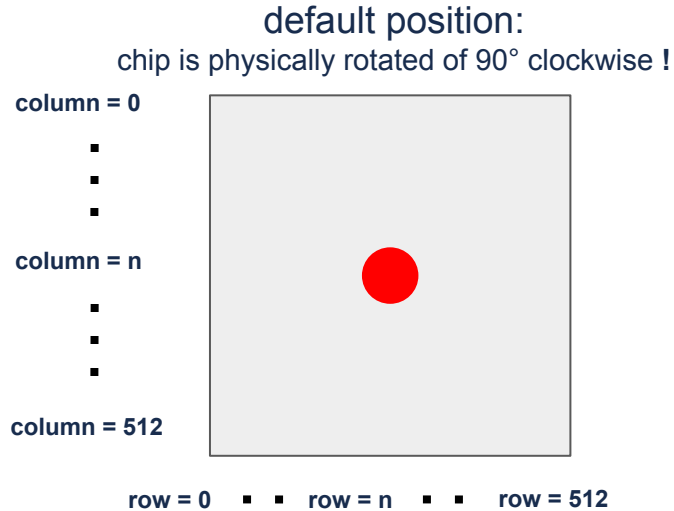Impact of time threshold for clusterization on #clusters and average multiplicity

→ #cluster increases when time_thr ~ k · 11.2 μs

Preliminary analysis on TB data: Angle scan

Chip orientation with respect to the beam:

default position:
chip is physically rotated of 90° clockwise **!**

tilted position

top view

column = 0
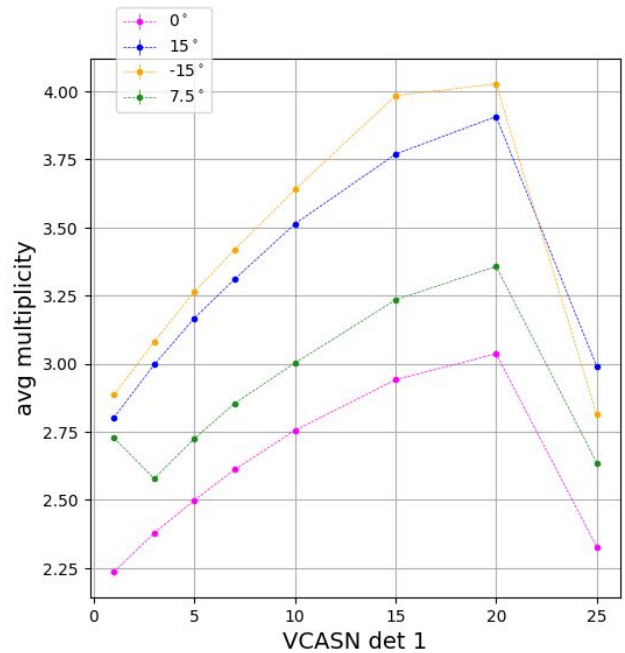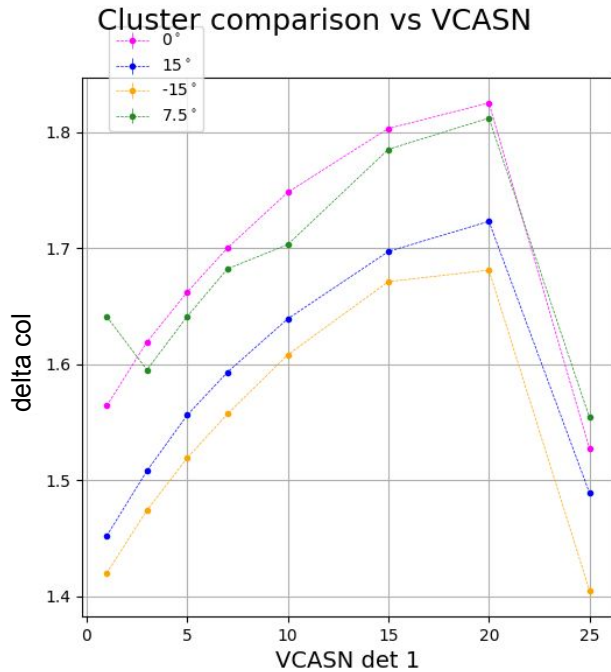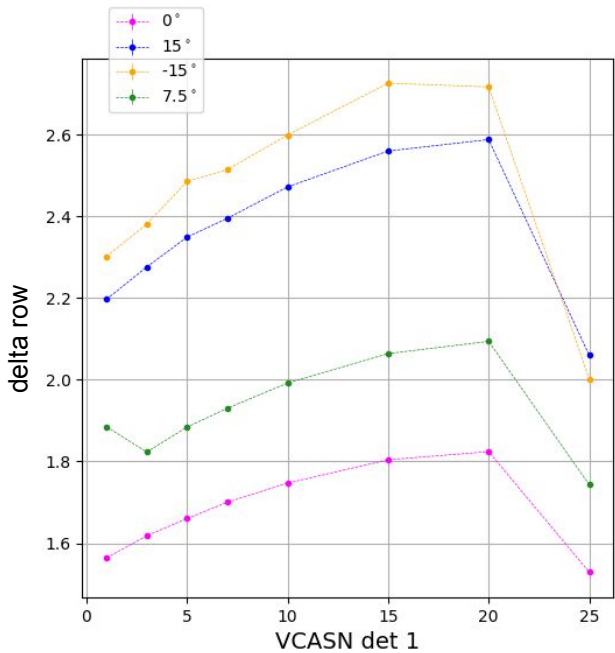
column = n

column = 512

row = 0   row = n   row = 512

beam

clz are expected to be symmetric

clz are expected to have delta_col > delta_row.
The effect is bigger as tilting angle increases

Preliminary analysis on TB data:
Cluster multiplicity vs VCASN

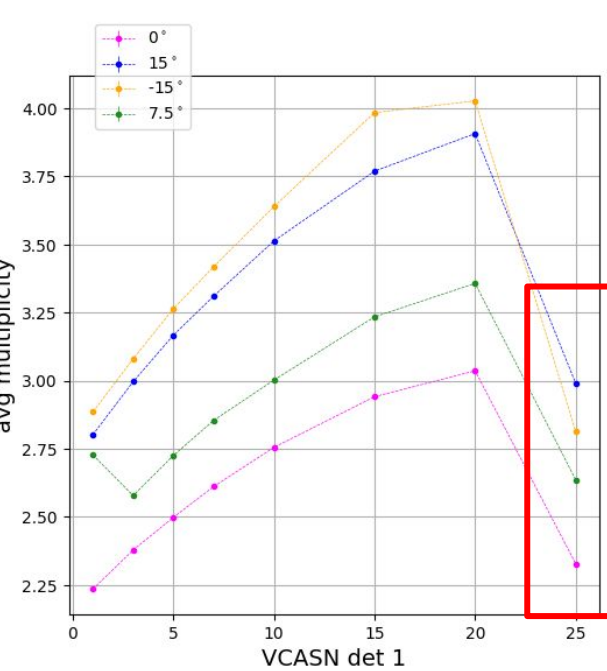# **Preliminary analysis on TB data:** Cluster multiplicity vs VCASN

Cluster comparison vs VCASN
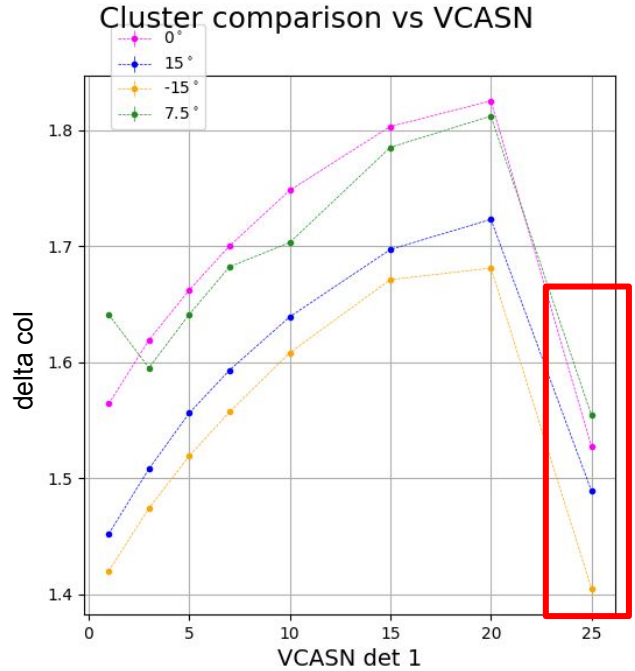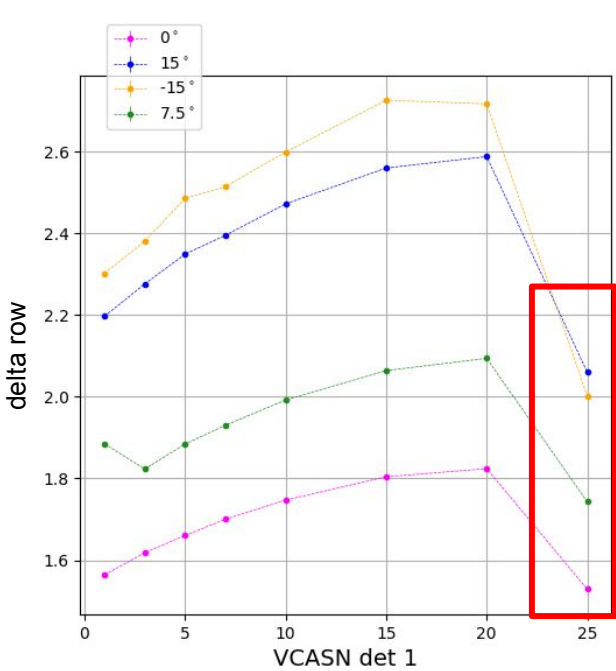
deg -15 data were taken in two different days

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

chip 1

Cluster comparison vs VCASN

Strange behaviour at VCASN = 25 → noisy pixels could affect clz dimensions and multiplicity
Try to eliminate noisy pixels

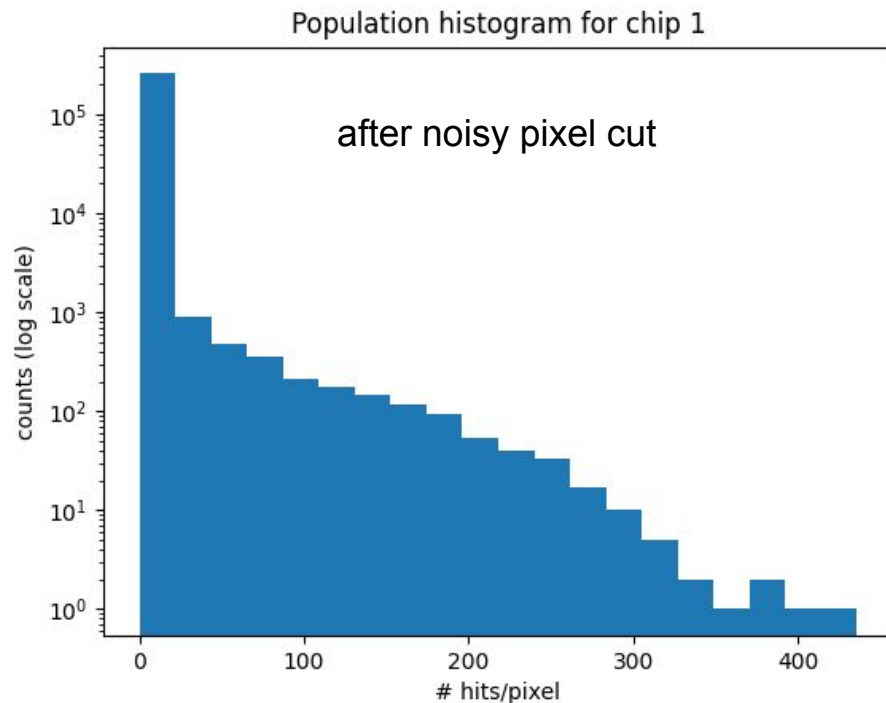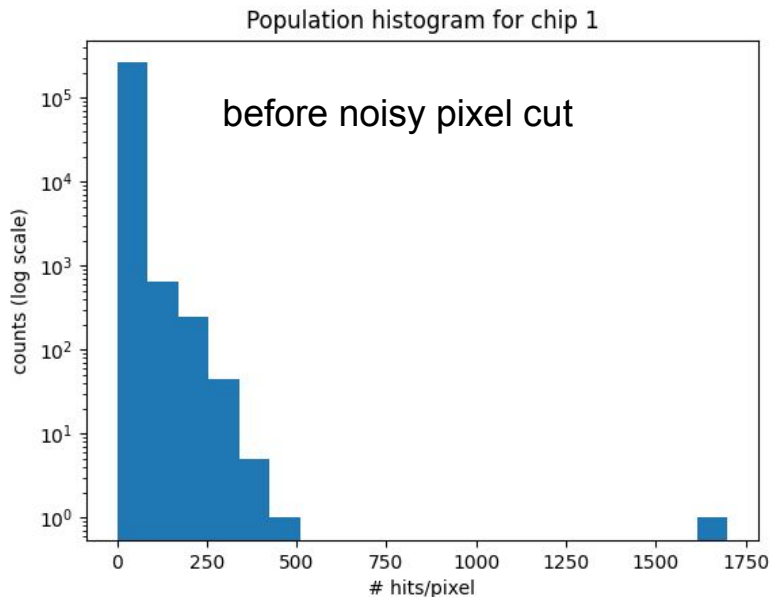ARCADIA

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chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

before noisy pixel cut

after noisy pixel cut

noisy pixels still present

threshold = 1500 hits/pixel

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Population histogram for chip 1

hits/pixel < 25: similar behaviour of chip0

long tail for #hits/pixel >25 due to band effect on rows

Population histogram for chip 0

Detector 1
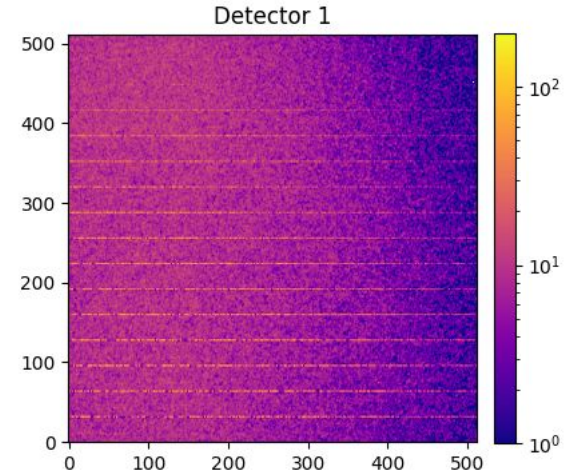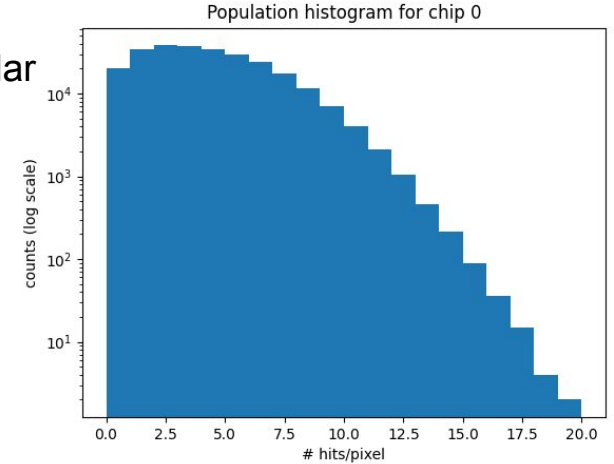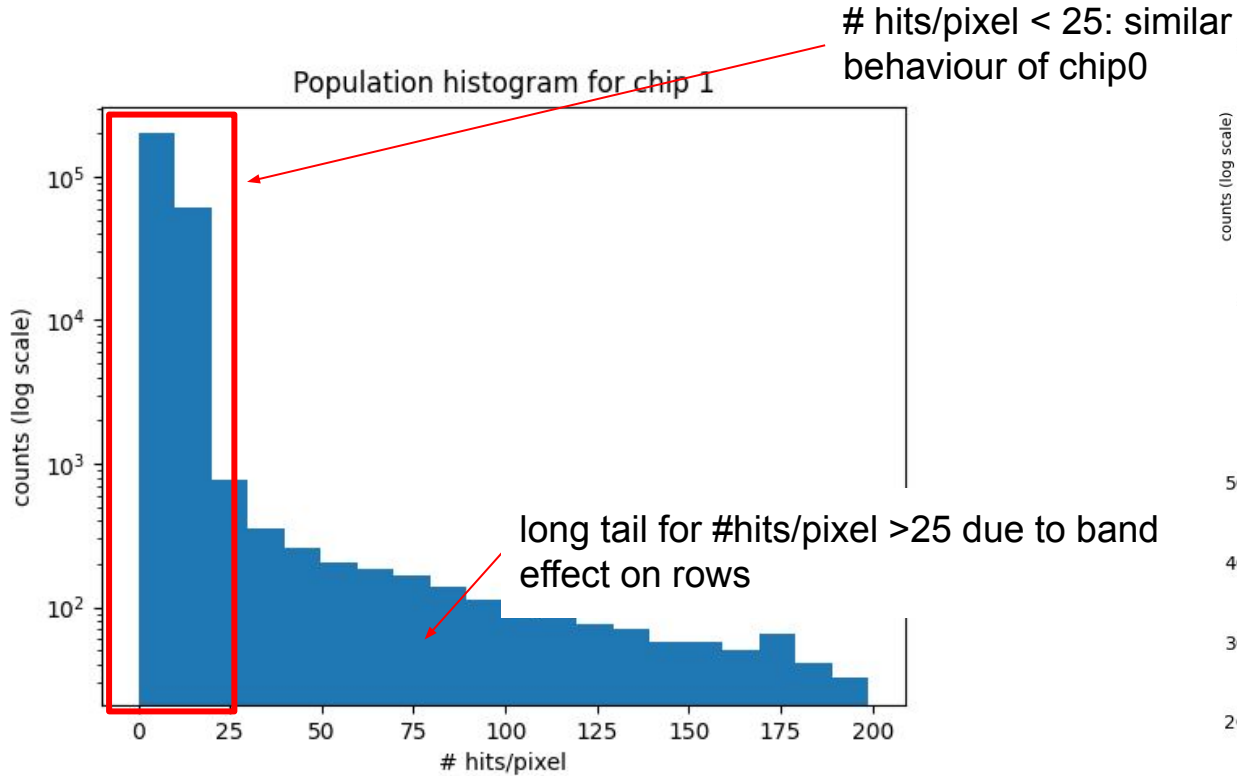
threshold = 200 hits/pixel

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Population histogram for chip 1
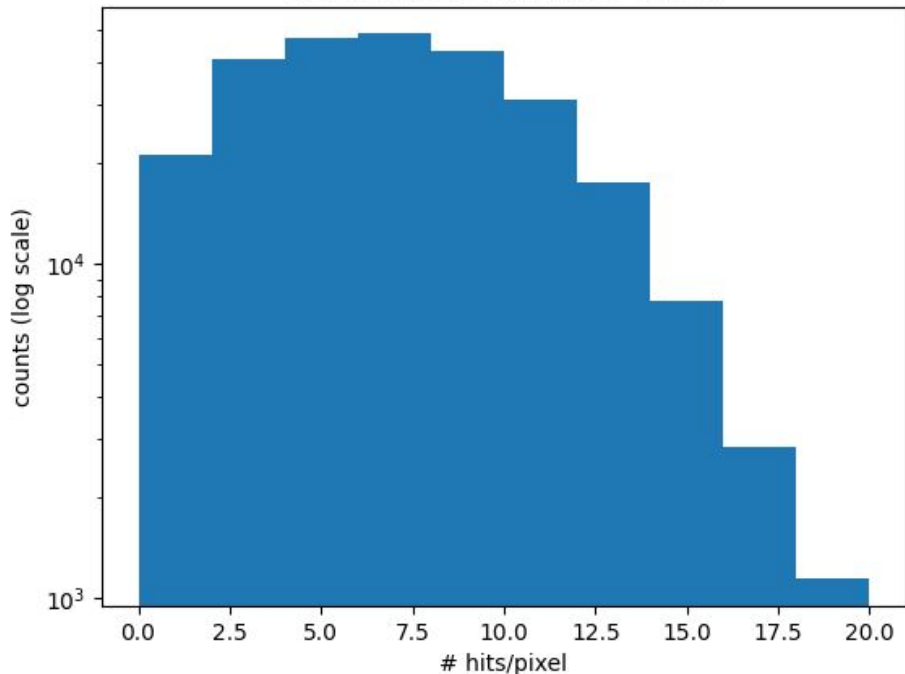
population det1 after noisy pixels cut

same behaviour
of chip0

Population histogram for chip 0

band effect on
rows reduced

Detector 1

threshold = 20 hits/pixel

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

chip 1

Without noisy pixel

Cluster comparison vs VCASN

VCASN = 1 @ +7.5° not following the behaviour
not clear why

chip 0: VCASN = 13; HV = -80V
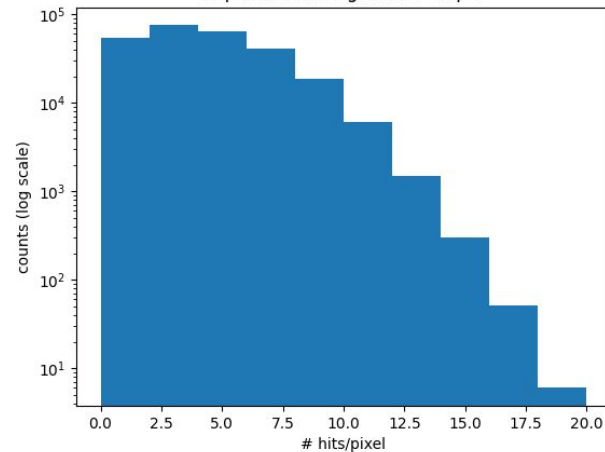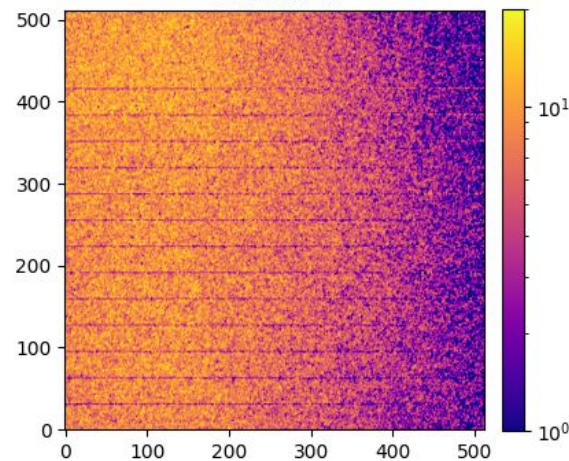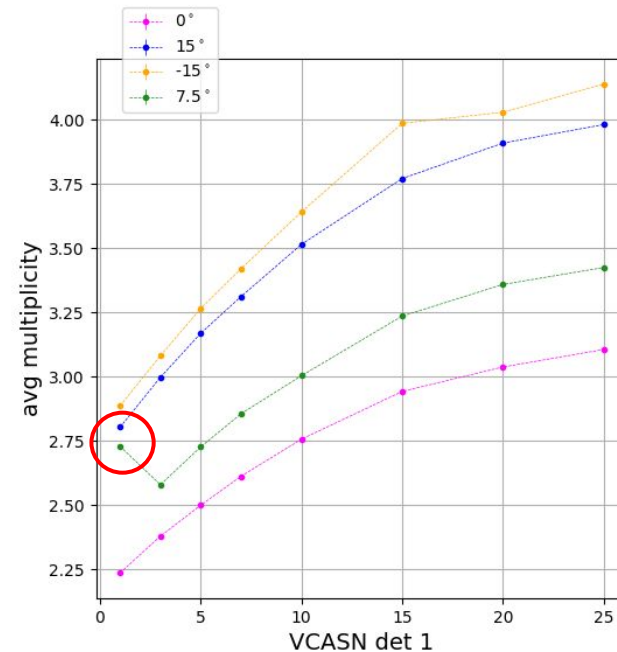chip 2: VCASN = 5; HV = -90V

chip 1: HV = -90V

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Without noisy pixel

Cluster comparison vs VCASN @ angle = 0°

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

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Preliminary analysis on TB data: Angle scan

Without noisy pixel

@ angle = 0°
clz dimensions are very
symmetric as expected

Cluster comparison vs VCASN @ angle = 0°

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

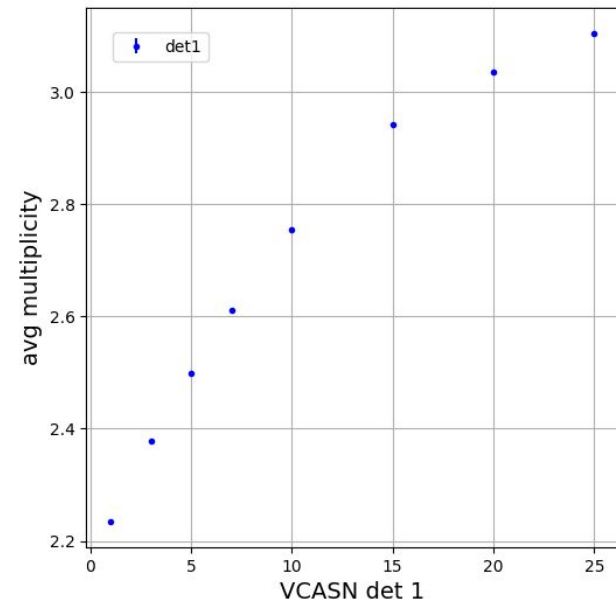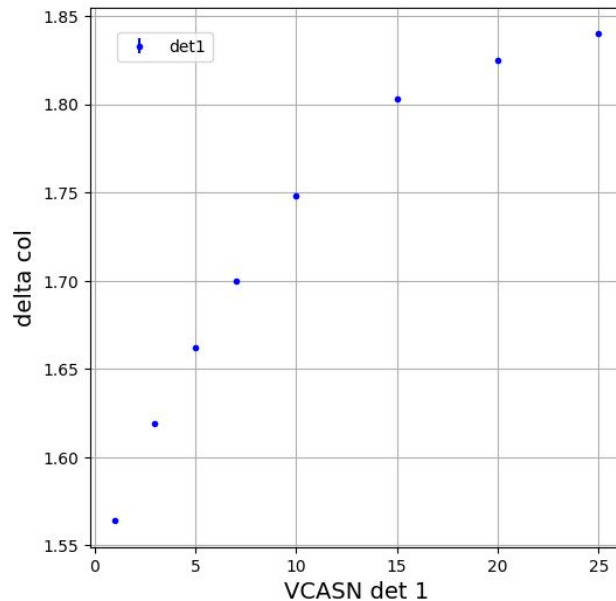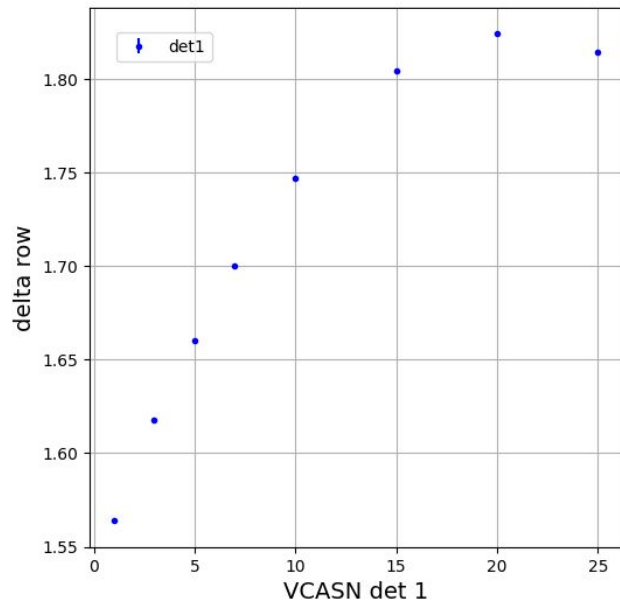Without noisy pixel

Cluster comparison vs VCASN @ angle = 15°

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Without noisy pixel

Cluster comparison vs VCASN @ angle = -15°

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

deg -15 data were taken in two different days

chip 1: HV = -90V

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Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Without noisy pixel

Cluster comparison vs VCASN @ angle = 7.5°

chip 0: VCASN = 13; HV = -80V
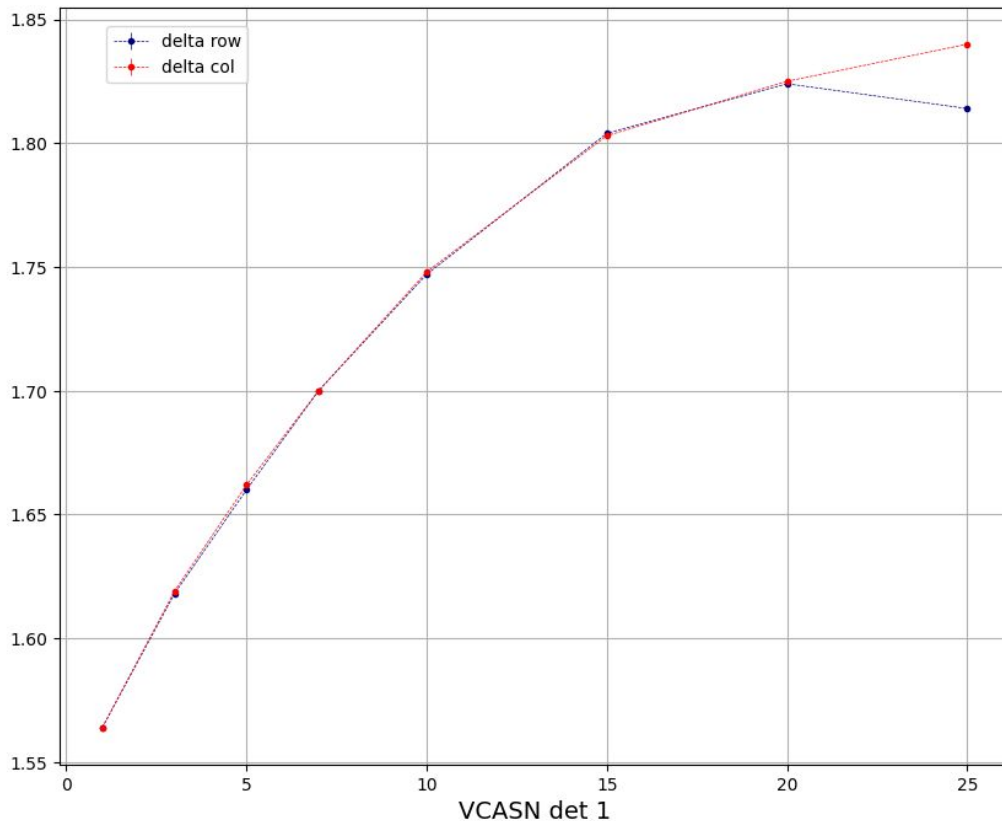chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

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Preliminary analysis on TB data:
Cluster multiplicity vs HV bias

Preliminary analysis on TB data: Cluster multiplicity vs HV bias

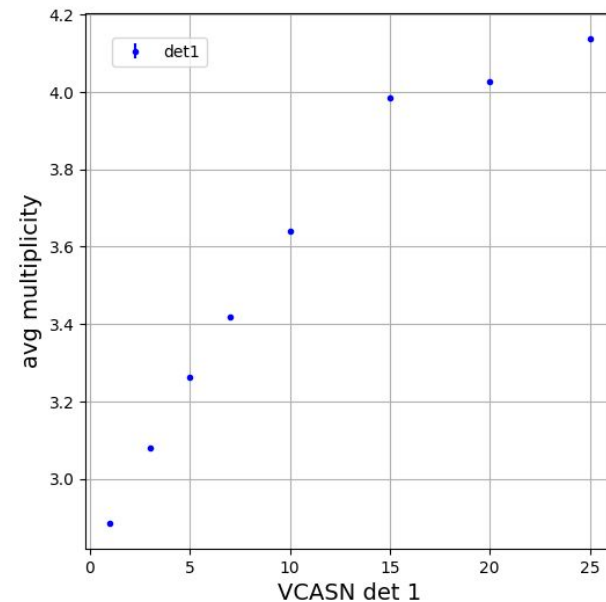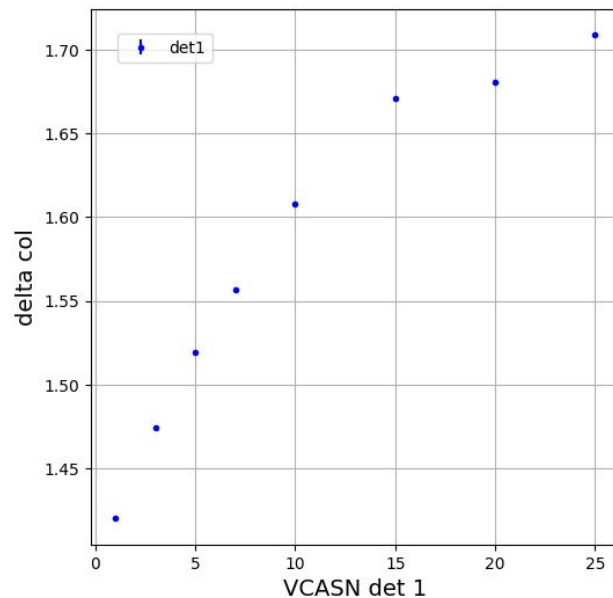chip 1: angle 0°

Cluster comparison vs HV bias @ angle = 0°
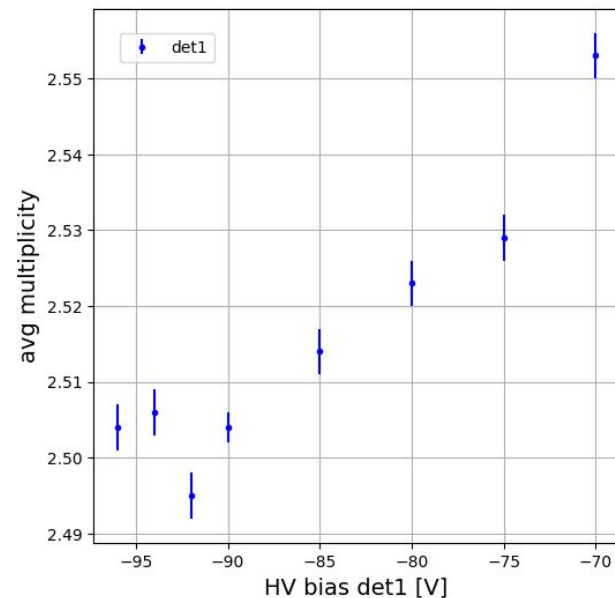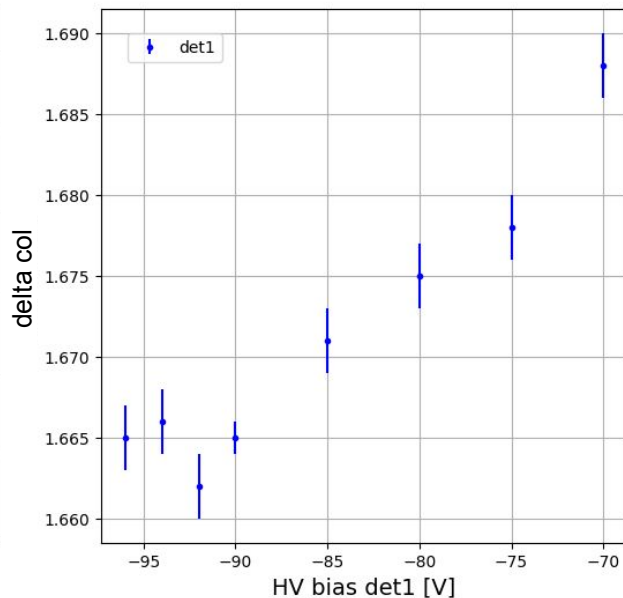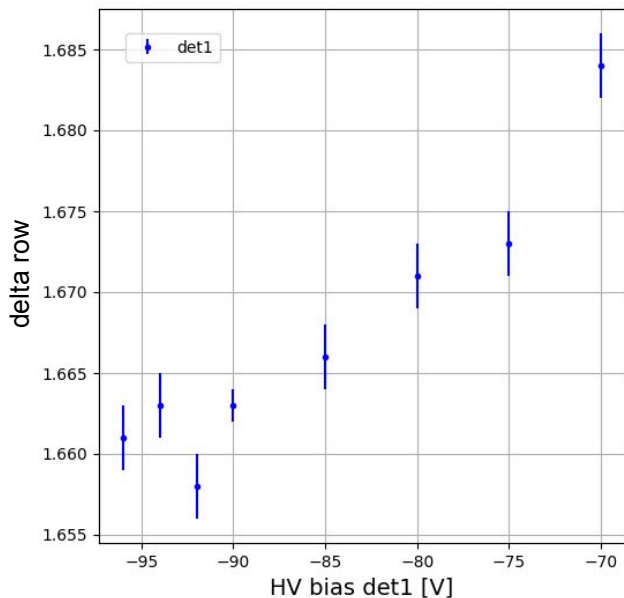
chip 0: VCASN = 13; HV = -90V
chip 2: VCASN = 5;   HV = -90V

chip 1: VCASN = 5

Preliminary analysis on TB data: Cluster multiplicity vs HV bias
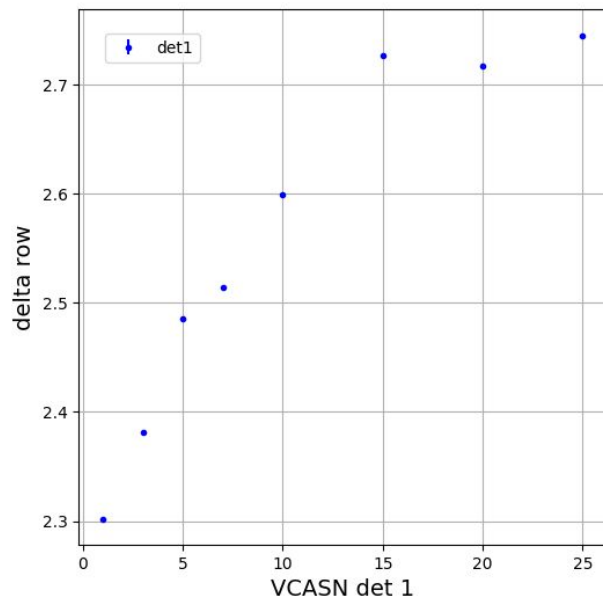
chip 1

Cluster comparison vs HV bias @ different angles
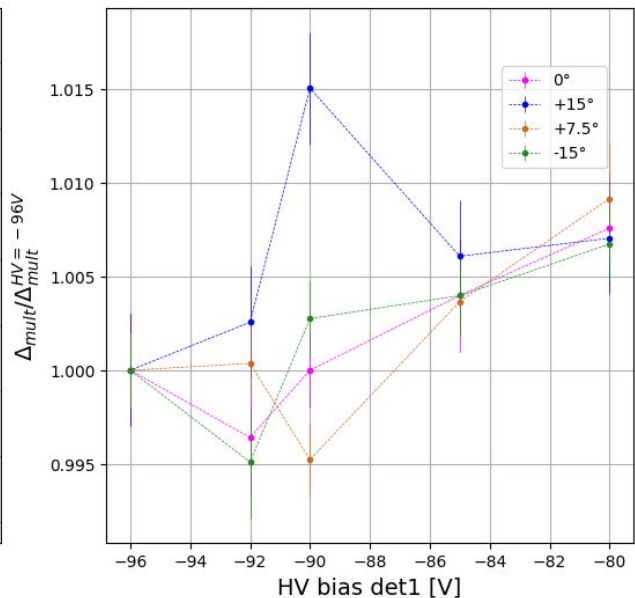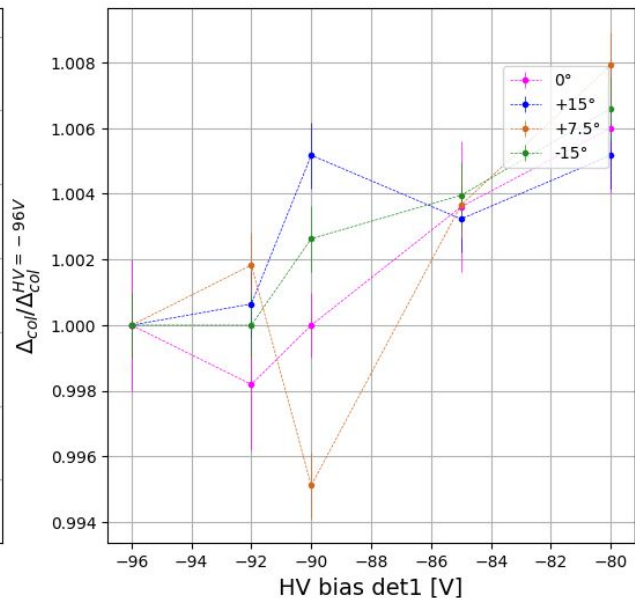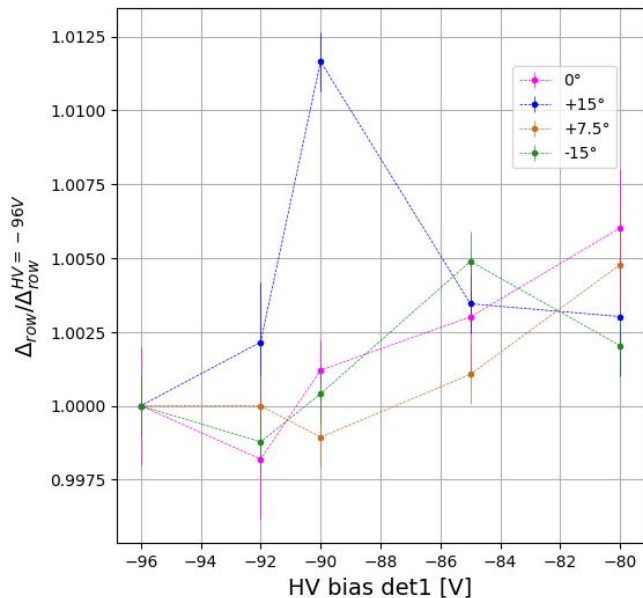
chip 0: VCASN = 13; HV = -90V
chip 2: VCASN = 5;   HV = -90V

chip 1: VCASN = 5

Preliminary analysis on TB data: Cluster multiplicity vs HV bias

Cluster comparison vs HV bias @ different angles

chip 0: VCASN = 13; HV = -90V
chip 2: VCASN = 5;   HV = -90V

chip 1: VCASN = 5

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Preliminary analysis on TB data:
Tracking

Preliminary analysis on TB data: Tracking

default run (03-04 july, angle 0°, 20 spills)

For det 0
total number of clz: 322986
total number of coincidences (only time coinc, tw = 41) 278145
coincidences with one clz: 178147

total time coinc / total number of clz = **86%**
coincidences with one clz / total number of coincidences = **64%**

Preliminary analysis on TB data: Tracking

default run (03-04 july, angle 0°, 20 spills)
one clz per coincidence per plane

no alignment

events outside 3 sigma on y = 3030 (1.7 %)
events outside 3 sigma on x = 2436 (1.4 %)
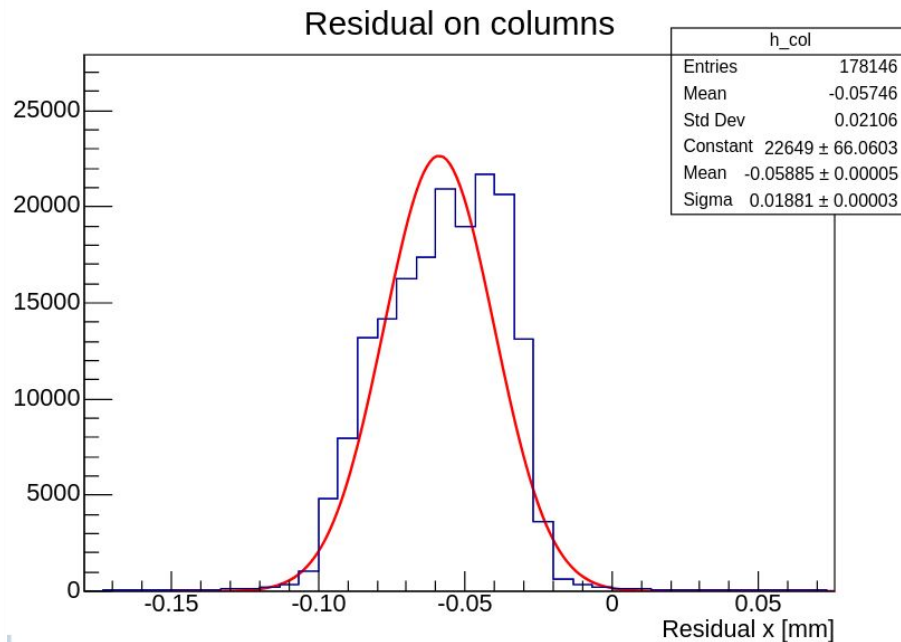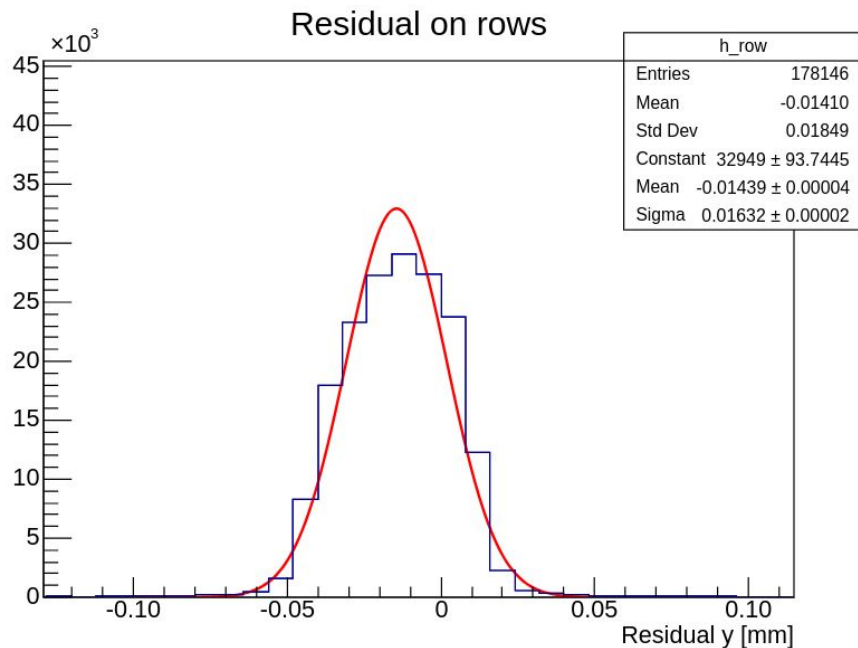
Preliminary analysis on TB data: Tracking

default run (03-04 july, angle 0°, 20 spills)
one clz per coincidence per plane

expected precision (pitch/sqrt(12))
0.025/sqrt(12) ≃ 0.0072mm

Residual on rows

h_row	
Entries	178146
Mean	-8.338e-4
Std Dev	0.01949
Constant	32645 ± 92.4251
Mean	-8.730e-4 ± 4.035e-5
Sigma	0.01641 ± 0.00002

Residual on columns

h_col	
Entries	178146
Mean	-0.002227
Std Dev	0.02082
Constant	22278 ± 65.2990
Mean	-0.003392 ± 0.000051
Sigma	0.01876 ± 0.00003

aligned

events outside 3 sigma on y = 3030 (1.7 %)
events outside 3 sigma on x = 2436 (1.4 %)

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Preliminary analysis on TB data: Tracking

with tw = 41

default run (03-04 july, angle 0°, 20 spills)
one clz per coincidence per plane, only first spill analyzed

with tw = 10
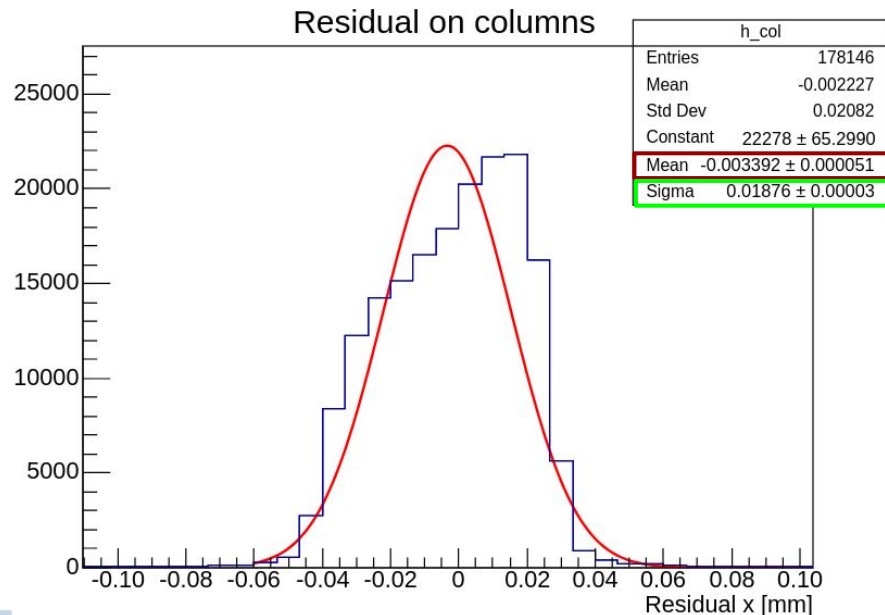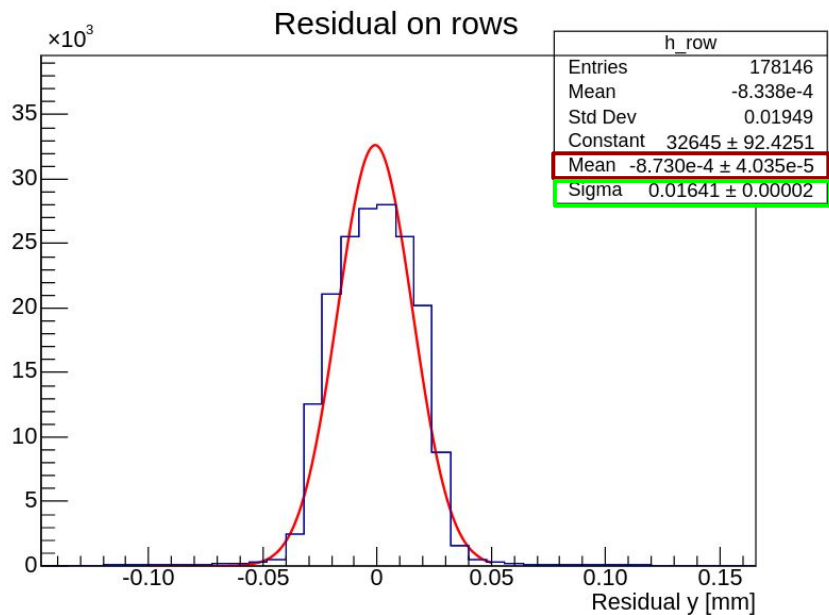

Residual on rows (tw = 10)

h_row	
Entries	8233
Mean	-0.01471
Std Dev	0.01958
Constant	1264 ± 16.6243
Mean	-0.01476 ± 0.00019
Sigma	0.01632 ± 0.00011

Residual on rows (tw = 41)

h_row	
Entries	8170
Mean	-0.01479
Std Dev	0.01970
Constant	1258 ± 16.5840
Mean	-0.01481 ± 0.00019
Sigma	0.01625 ± 0.00011

Residual on columns (tw = 10)

h_col	
Entries	8233
Mean	-0.05745
Std Dev	0.02132
Constant	893.9 ± 12.1
Mean	-0.05848 ± 0.00023
Sigma	0.01872 ± 0.00013

Residual on columns (tw = 41)

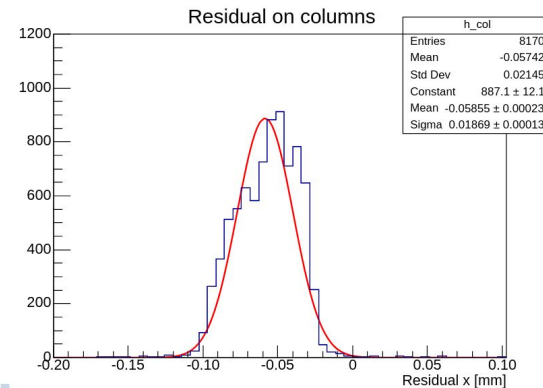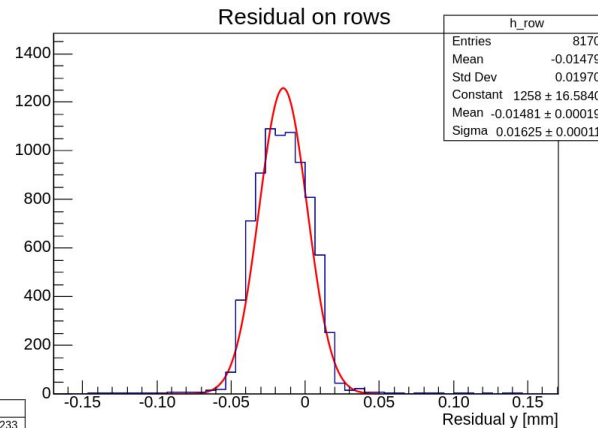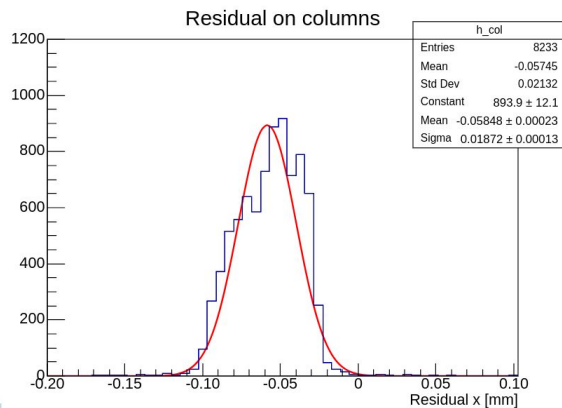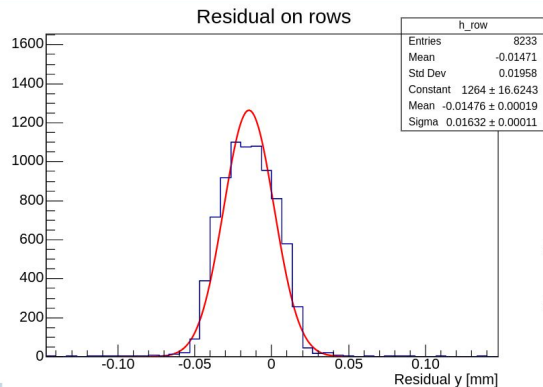| h_col	
Entries	8170
Mean	-0.05742
Std Dev	0.02145
Constant	887.1 ± 12.1
Mean	-0.05855 ± 0.00023
Sigma	0.01869 ± 0.00013

no alignment done

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Preliminary analysis on TB data: Tracking

default run (03-04 july, angle 0°, 20 spills)

total number of clz on det0 = 322986

total number of clz on det1 = 354945   total number of clz = 1042479

total number of clz on det2 = 364548

kinky clz found 8626 ⟶ **0.8%** of total clz
with 0.4 density thr.

number of clz with duplicated hit det0 = 39

number of clz with duplicated hit det1 = 2

number of clz with duplicated hit det2 = 45

Preliminary analysis on TB data: Tracking

default run (03-04 july, angle 0°, 20 spills)
20 spills analysis

Only time coincidence with tw = 41 ts units

Total sync found (at least one clz in each plane) = 278145

One cluster on external planes (0,2): 186001
One cluster per plane (0,1,2): 178147
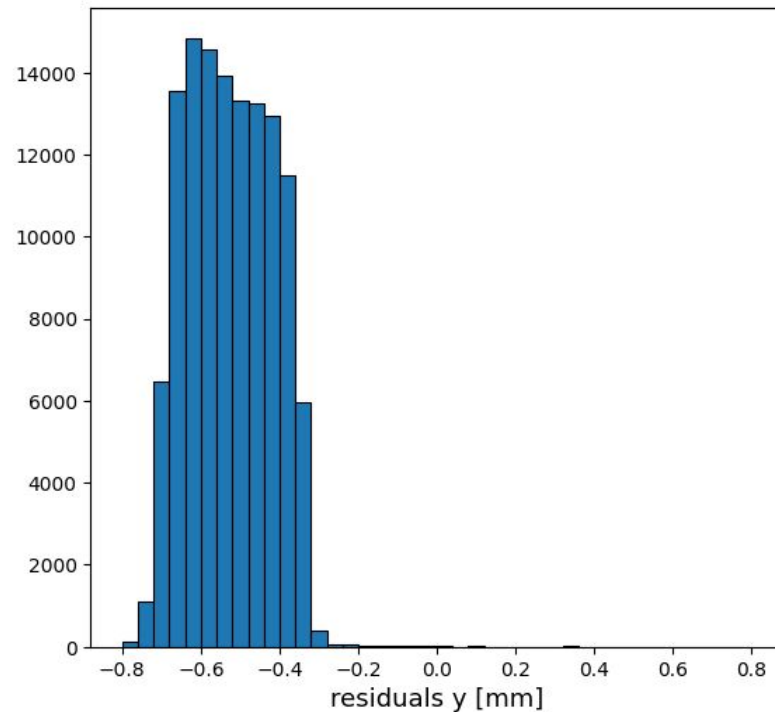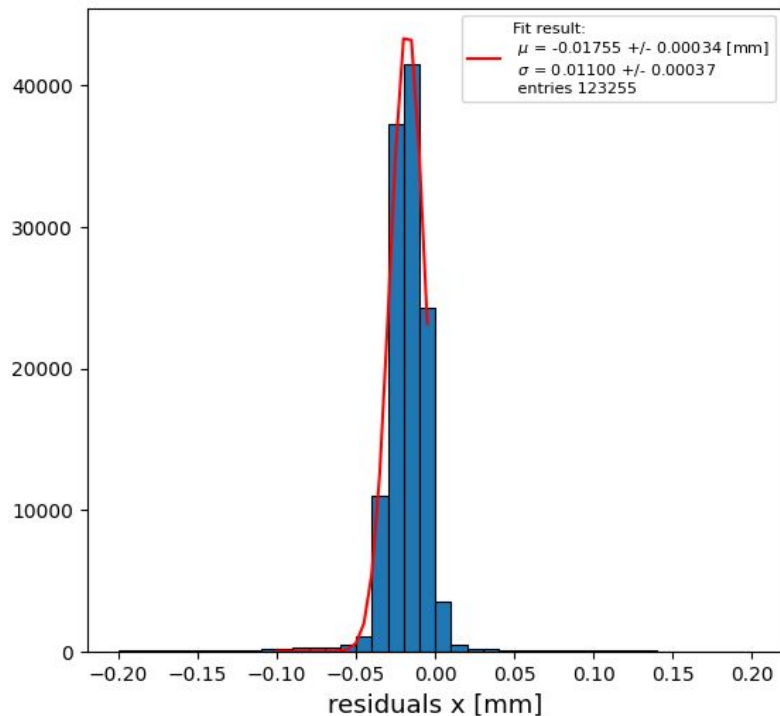**One cluster per plane (0,1,2) / one cluster per (0,2) = 95.8%**

No time coinc on 1 when 0 and 2 firing just one cluster: 1439
No cluster on plane (1) when cluster on (0,2) / one cluster per (0,2) = 0.7%

Preliminary analysis on TB data: Tracking

run 04-05 july, angle 15°, VCASN = 5, 16 spills
one clz per coincidence per plane

Residual plots

no alignment

Preliminary analysis on TB data: Tracking

run 04-05 july, angle 15°, VCASN = 5, 16 spills

number of clz on det0 = 273715

number of clz on det1 = 322895   total number of clz = 935271

number of clz on det2 = 338661

kinky clz found 8441 ⟶ **0.9%** of total clz
with 0.4 density thr.

number of clz with duplicated hit det0 = 40
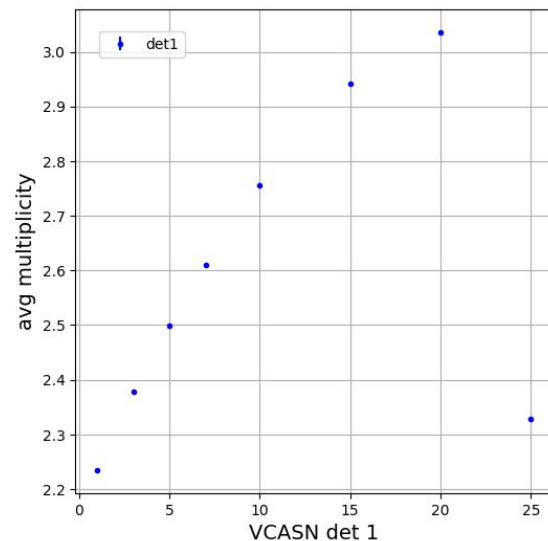
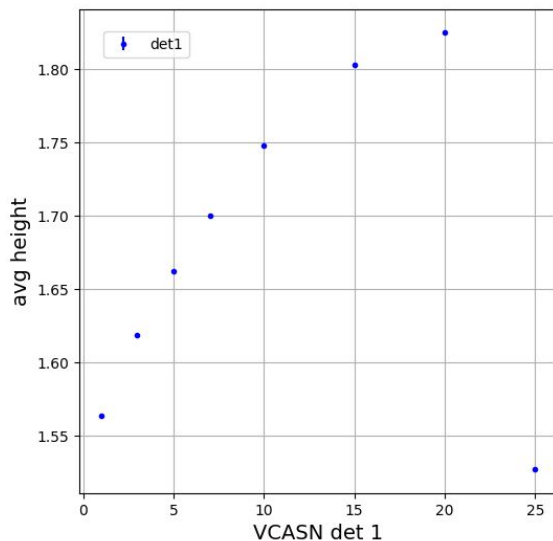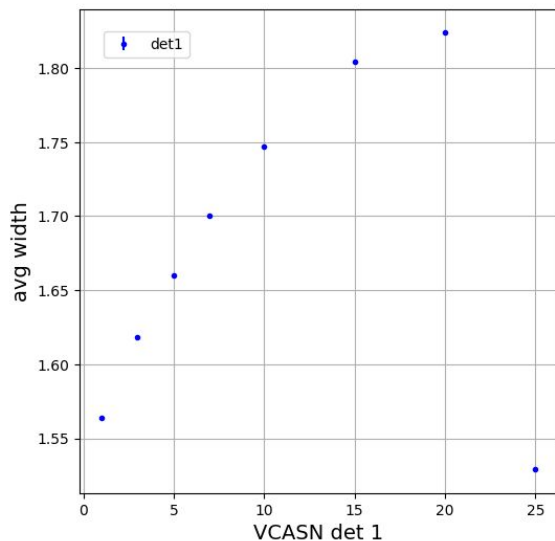number of clz with duplicated hit det1 = 3

number of clz with duplicated hit det2 = 37

BACKUP

Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Cluster comparison vs HV bias @ angle = 0°
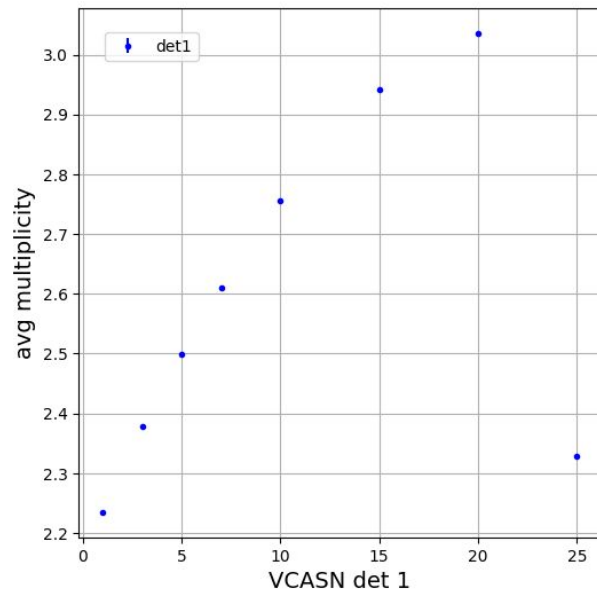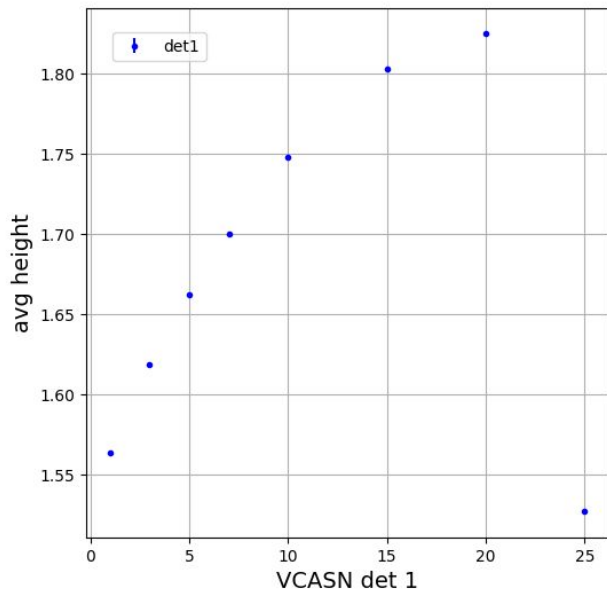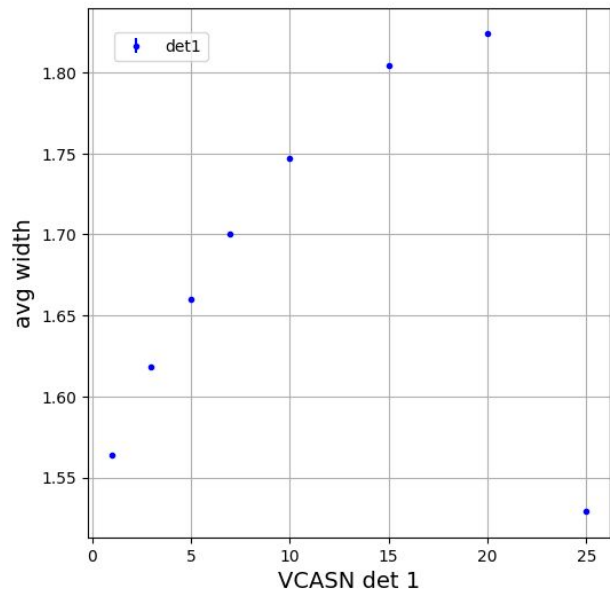
chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

Preliminary analysis on TB data: Angle scan

Cluster comparison vs HV bias @ angle = 0°

Preliminary analysis on TB data: Cluster multiplicity vs VCASN

Cluster comparison vs VCASN @ angle = 15°

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V
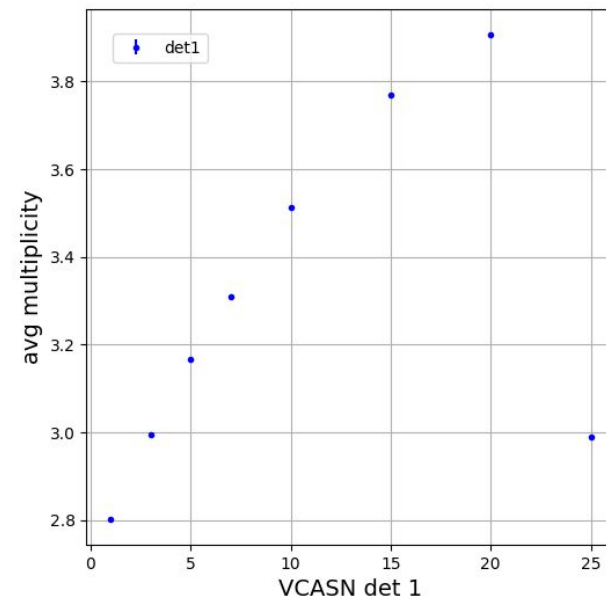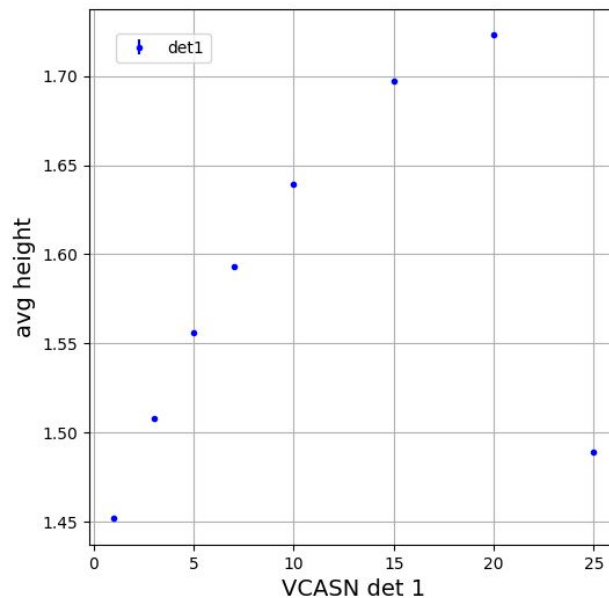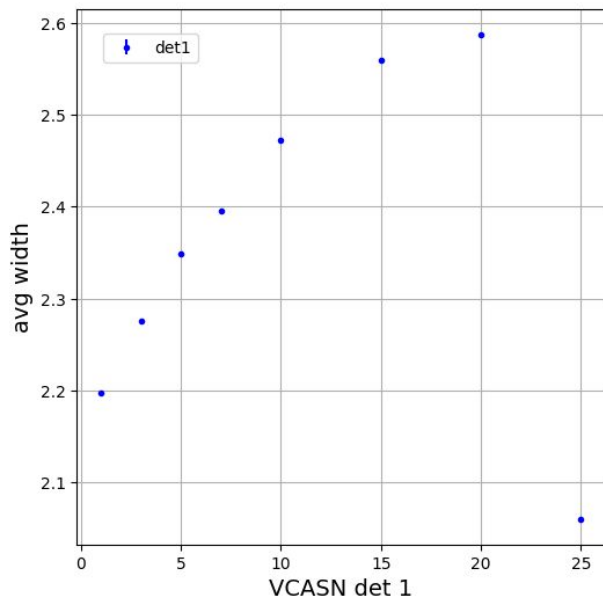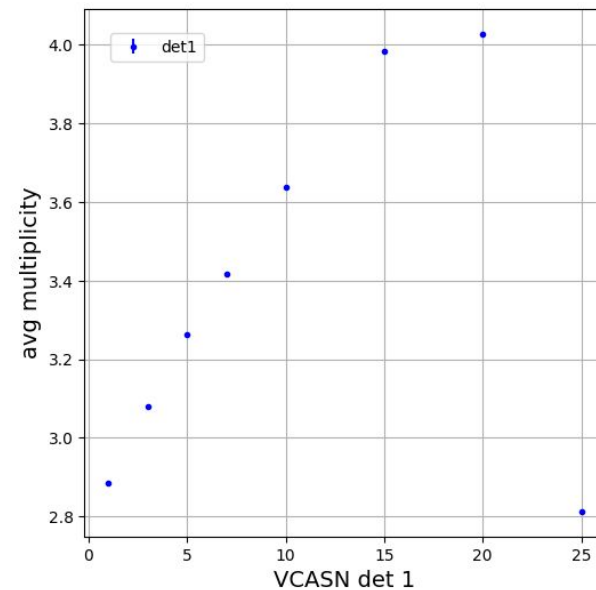
chip 1: HV = -90V

Preliminary analysis on TB data: Cluster multiplicity vs VCASN

chip 1: angle -15°
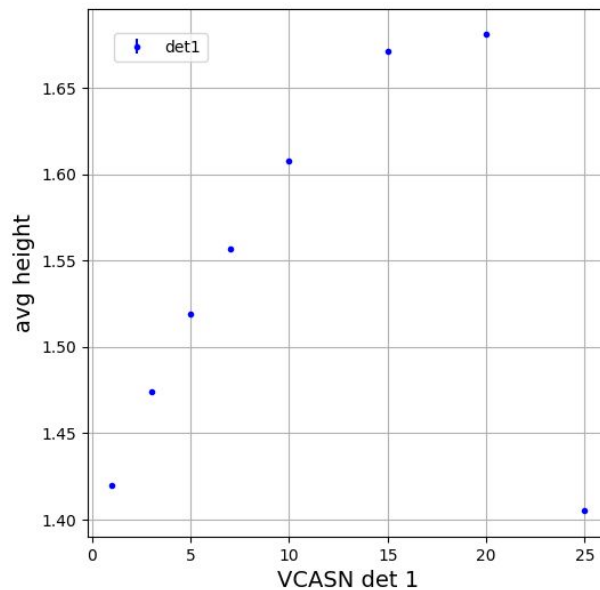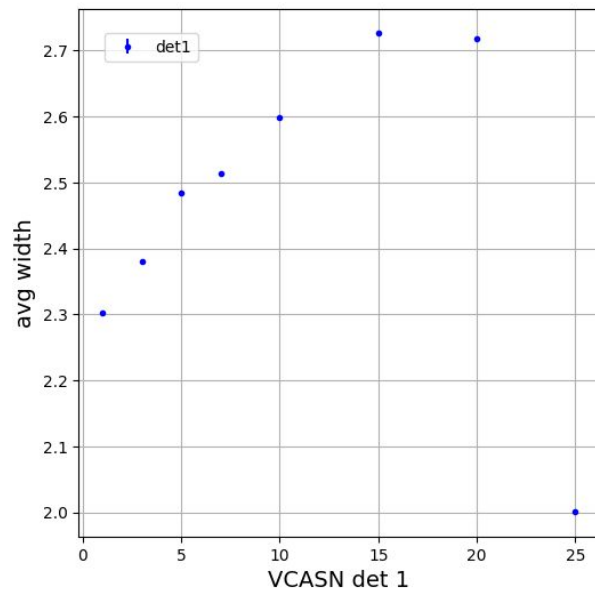
Cluster comparison vs VCASN @ angle = -15°

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V

Preliminary analysis on TB data: Cluster multiplicity vs VCASN

chip 1: angle 7.5°

Cluster comparison vs VCASN @ angle = 7.5°

chip 0: VCASN = 13; HV = -80V
chip 2: VCASN = 5;   HV = -90V

chip 1: HV = -90V