22nd INTERNATIONAL WORKSHOP ON DEPFET DETECTORS AND APPLICATIONS

STATUS UPDATE: PXD9 MODULE TESTING AT BONN

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W46_OF1

PREVIOUSLY CHARACTERISED AT MPP:

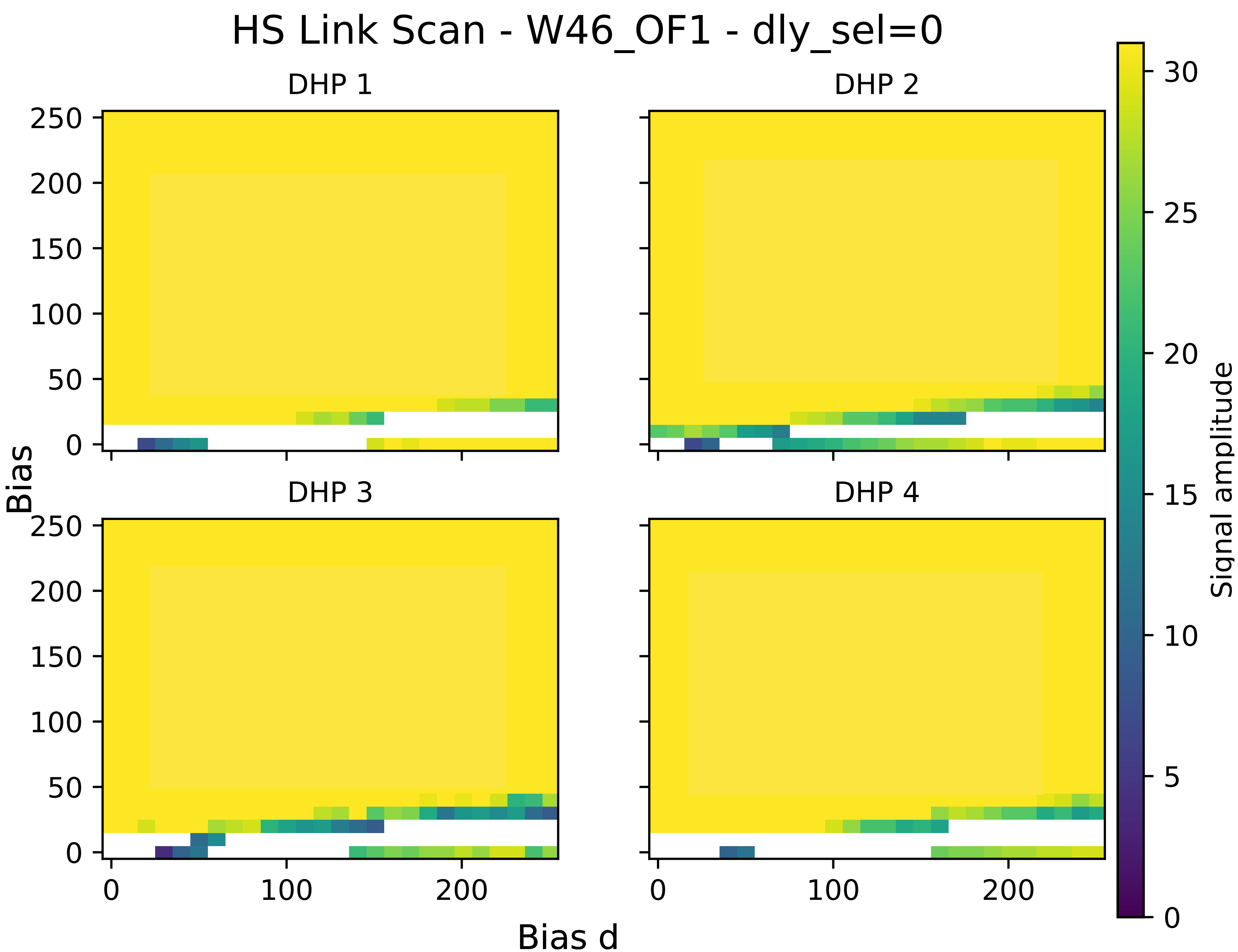
- HSL
- DELAY SCAN
- OFFSETS
- ADC SCAN

PROBLEMS WITH HSL4 STABILITY KEPT THEM FROM COMPLETING THE TESTS

SENT TO BONN FOR DEBUGGING.
MEASUREMENTS PERFORMED:

- HSL & DELAY SCANS
- ADC SCAN
- OFFSET CALIBRATION
- ^{90}Sr SOURCE SCAN

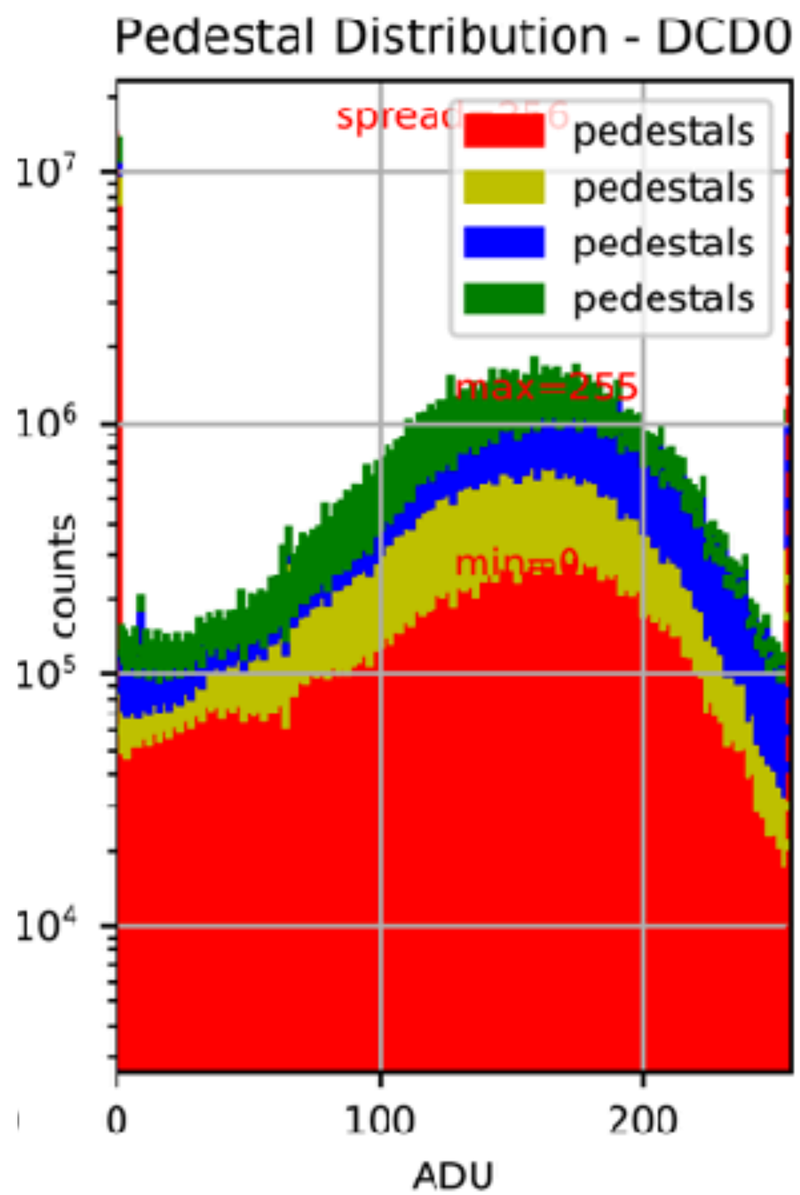
W46_OF1: HIGH SPEED LINKS



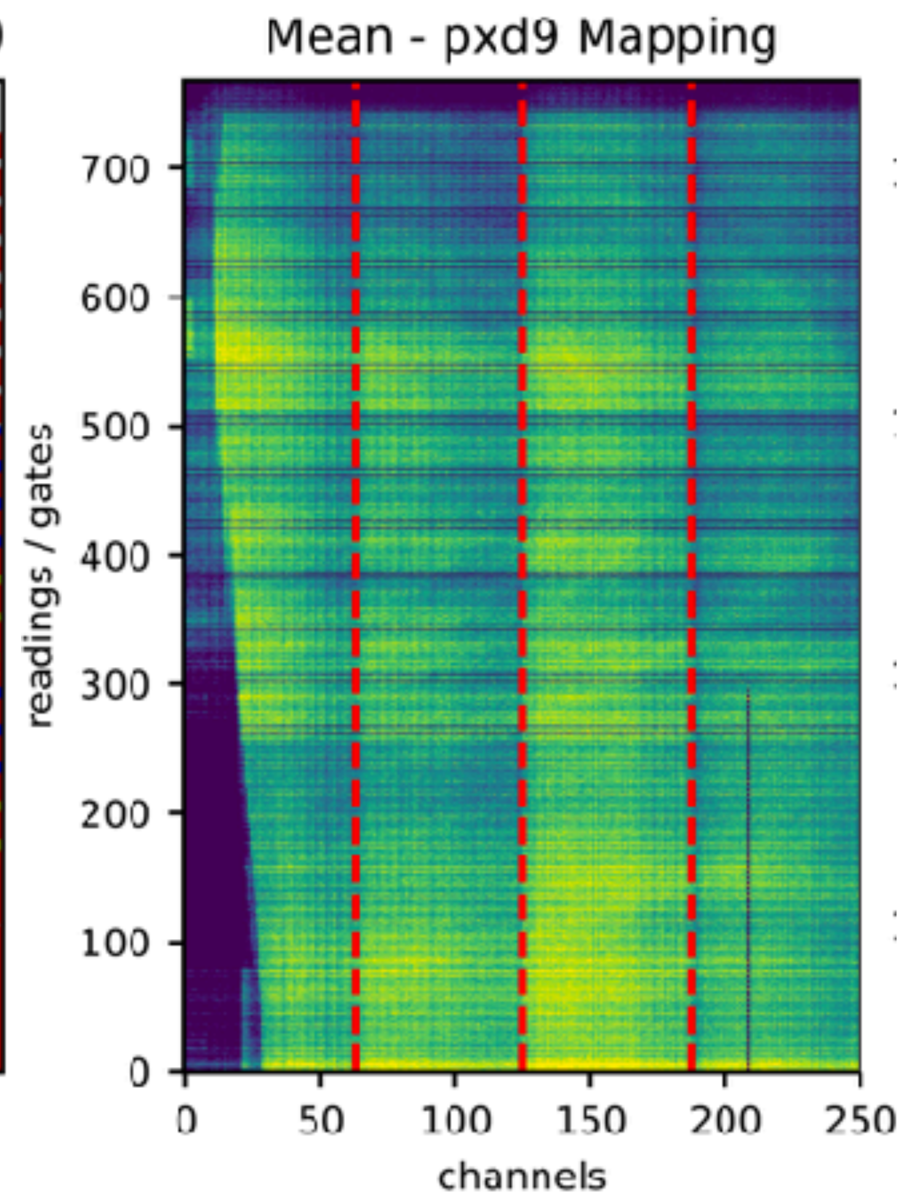
Standard bias=225, biasd=125, dly_sel=0 values were used. HSL were up and running stable over all our measurements. A delay optimisation was successfully performed.

W46_OF1: RAW PEDESTALS

gate-on* = -1.65 V



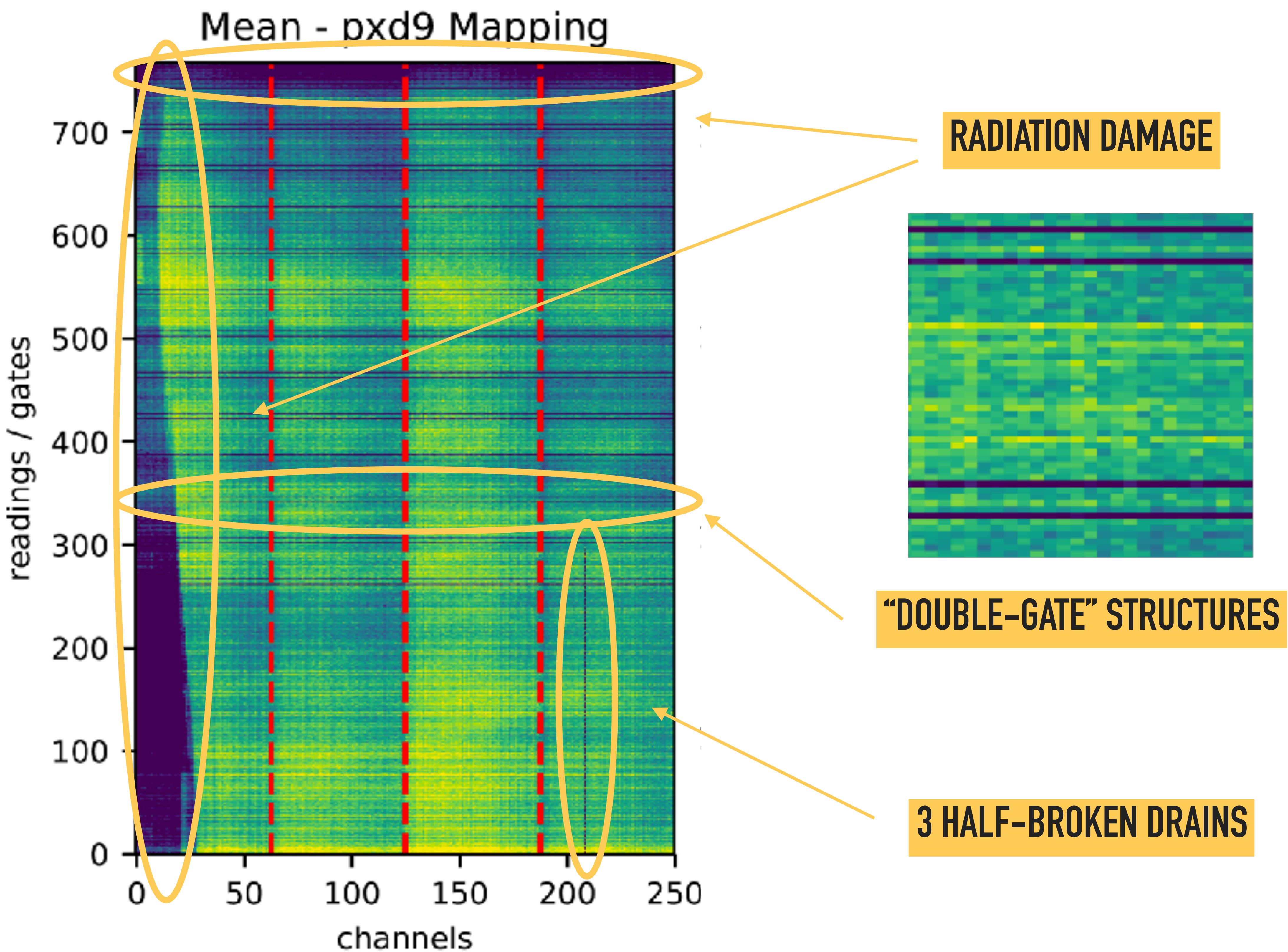
VNSubIn (DCD0) = 29



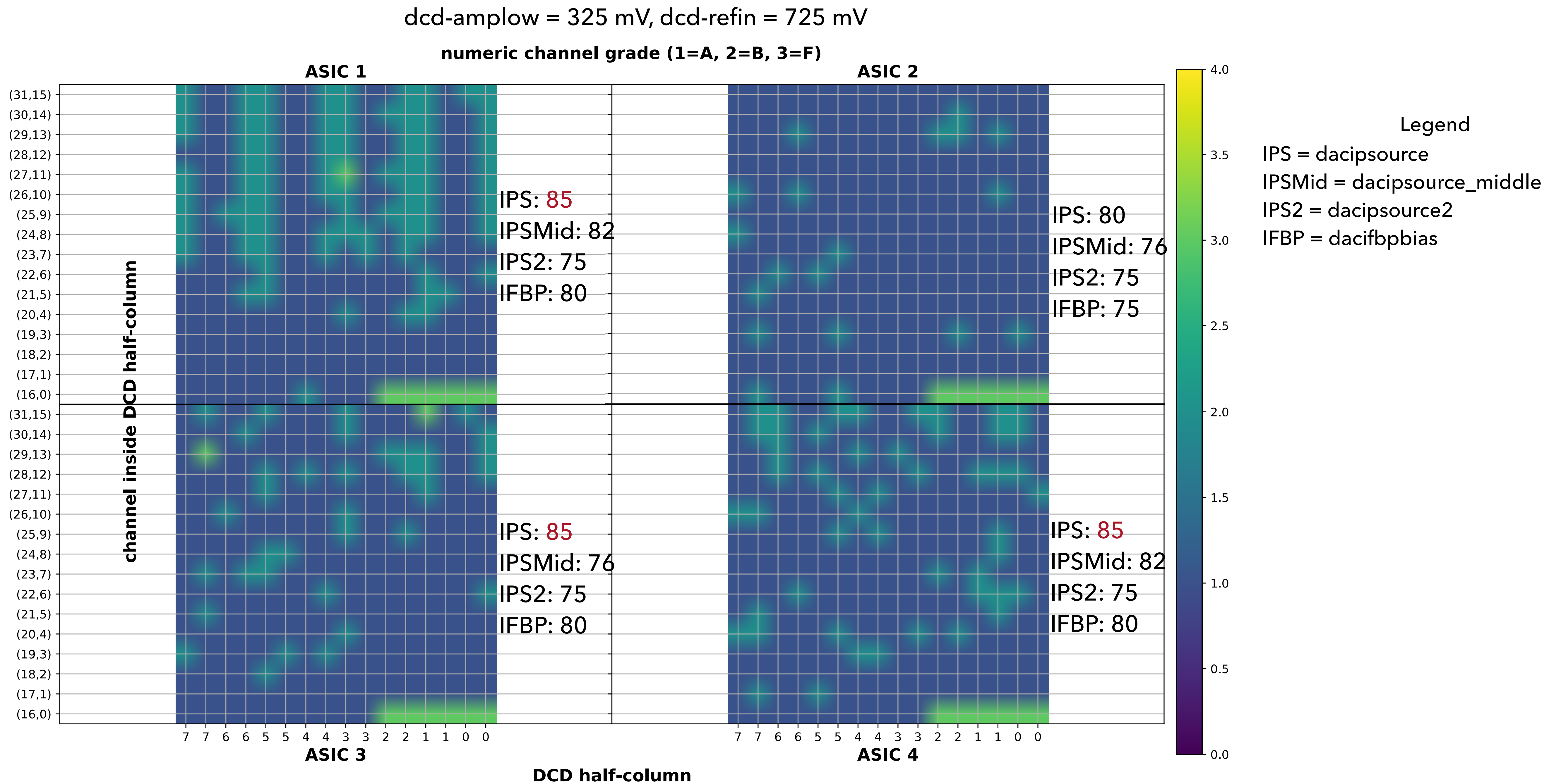
This module shows 3 interesting effects:

- radiation damage near the EOS and the balcony,
- 3 broken drains in DCD4,
- double gate structure with lower ADU values (4 and 34 healthy gates in between the weaker gates respectively).

W46_OF1: RAW PEDESTALS

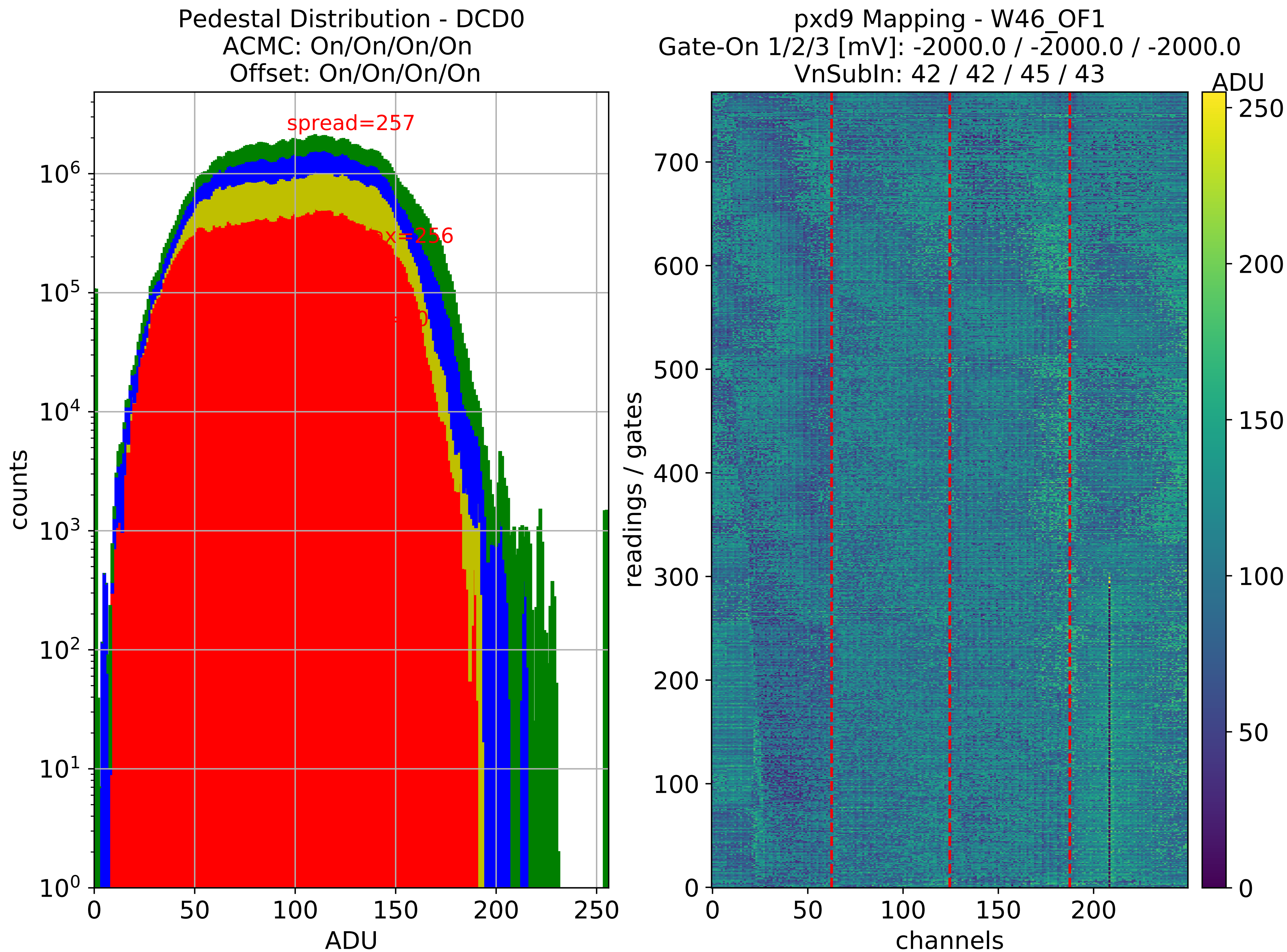


W46_OF1: ADC SCAN



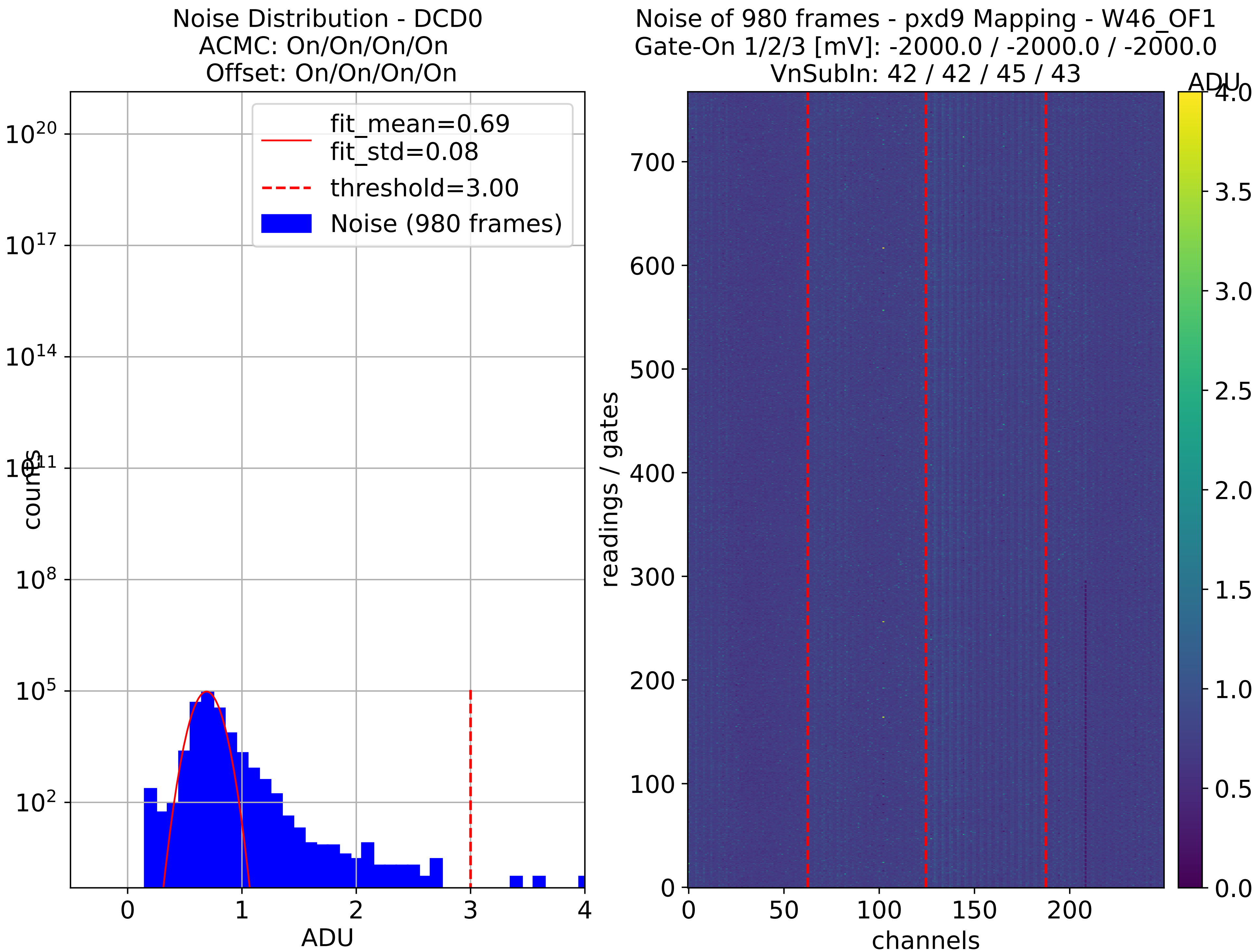
- We went for the ADC scan with the values proposed in the handbook.
- 2 ADC channels are graded as broken, all the other channels work fine.
- Some of the optimal values found were in the upper limit of the scan (in red).

W46_OF1: OFFSETS + ACMC (@ -2V GATE-ON)



The 2-bit DAC is used mostly to recover the weaker regions: those affected by the radiation, and the double gate structure.

W46_OF1: NOISE (@ -2V GATE-ON)



W46_OF1: ^{90}Sr SOURCE SCAN

Optimal
(less rings)

HV -74V

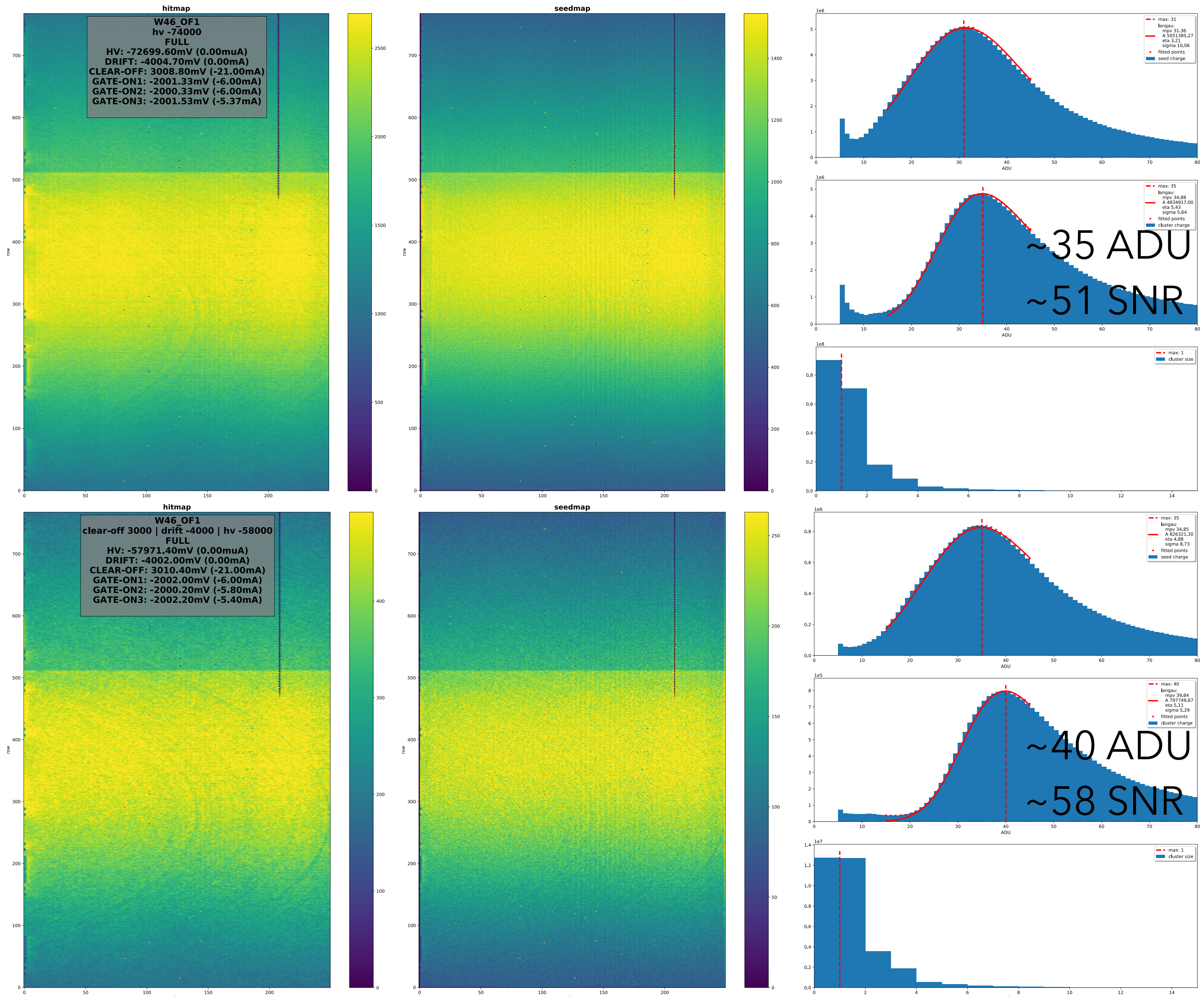
Drift -4V

Clear-off 3 V

Gate-on -2V

Optimal
(higher peak)

HV -58V



- Depending on how you define the optimal point (less rings or higher ADU peak in the cluster) we find different HV optimal value.
- Seems that for the higher HV we have more clusters with size 1. We might be losing some charge: maybe the neighbouring pixel doesn't have enough signal to pass the threshold.

W46_OF1 SUMMARY

- W46_OF1 was sent to Bonn for debugging as it showed problems with the HSL stability at MPP.
  - At Bonn the HSL were stable and the complete mass testing could be done.
- Measurements:
  - HSL: we used the standard values, which worked fine. Links were stable overnight.
  - Delay scan: typical anti diagonal results with a band of error-free communication. DCD-DHPT communication worked fine. See backup for details.
  - Raw pedestals: some radiation damage is appreciated near the EOS and the balcony, the “double-gate” structures are present, and 3 drain lines are half-broken.
  - ADC sweep: 3 channels were marked as failing, all the other channels worked fine after the optimisation.
  - Offsets: with the 2-bit DAC and ACMC all the matrix could be fitted in the dynamical range (except the 3 half-dead drain lines). Noise of 0.69 ADUs was recorded.
  - Source scan: we found two different optimal points depending if we tried to maximise SNR (SNR ~58) or we tried to get rid of the rings in the hitmaps (SNR ~51).
- Scores for the module according to the elog summary grading system: A for all measurements.

W46_OF2

PREVIOUSLY CHARACTERISED AT MPP:

- HSL
- DELAY SCAN
- OFFSETS

PROBLEMS WITH HSL3 STABILITY KEPT THEM FROM COMPLETING THE TESTS

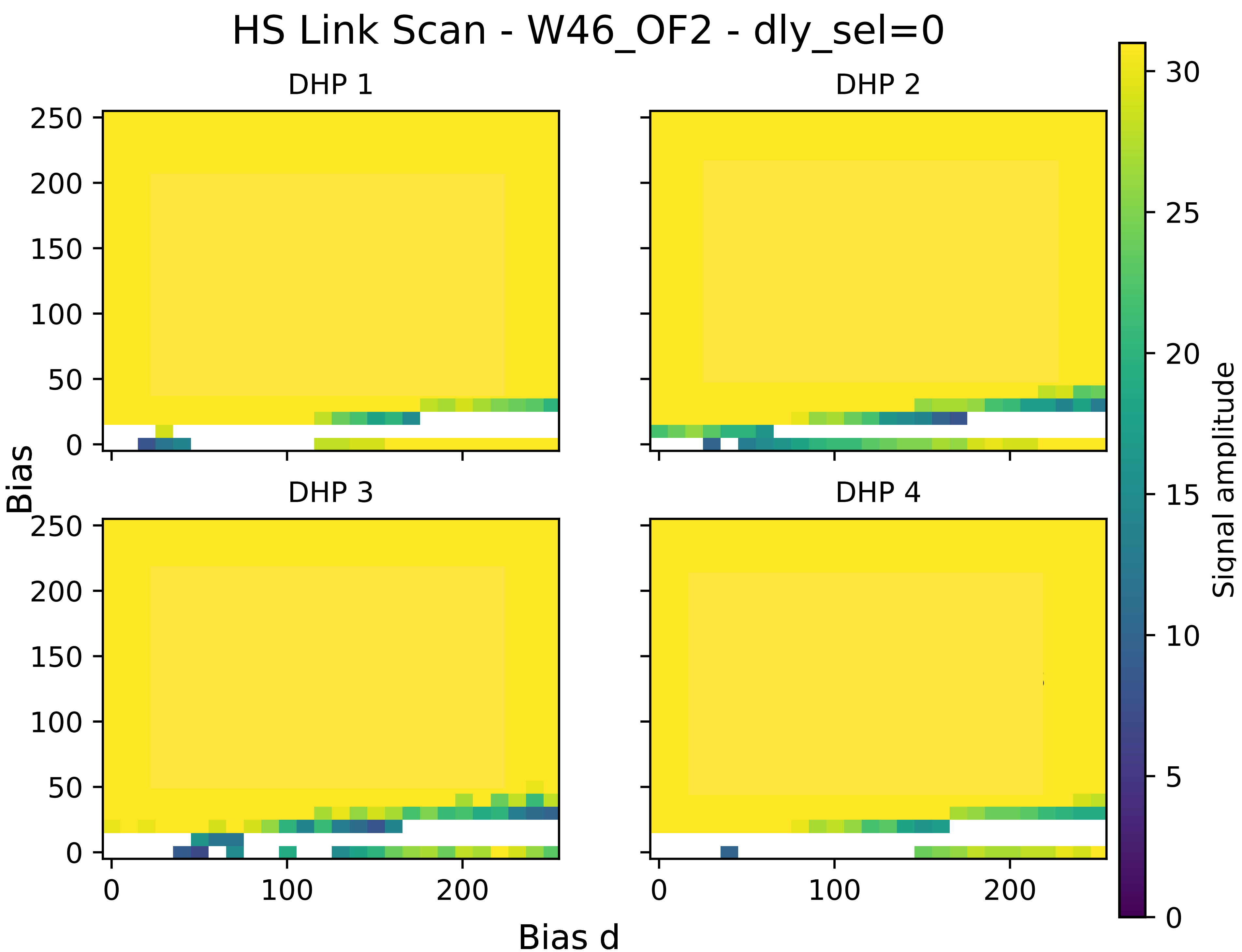
SENT TO BONN FOR DEBUGGING. MEASUREMENTS PERFORMED:

- HSL & DELAY SCANS

FOR 2 DIFFERENT DCD GAINS:

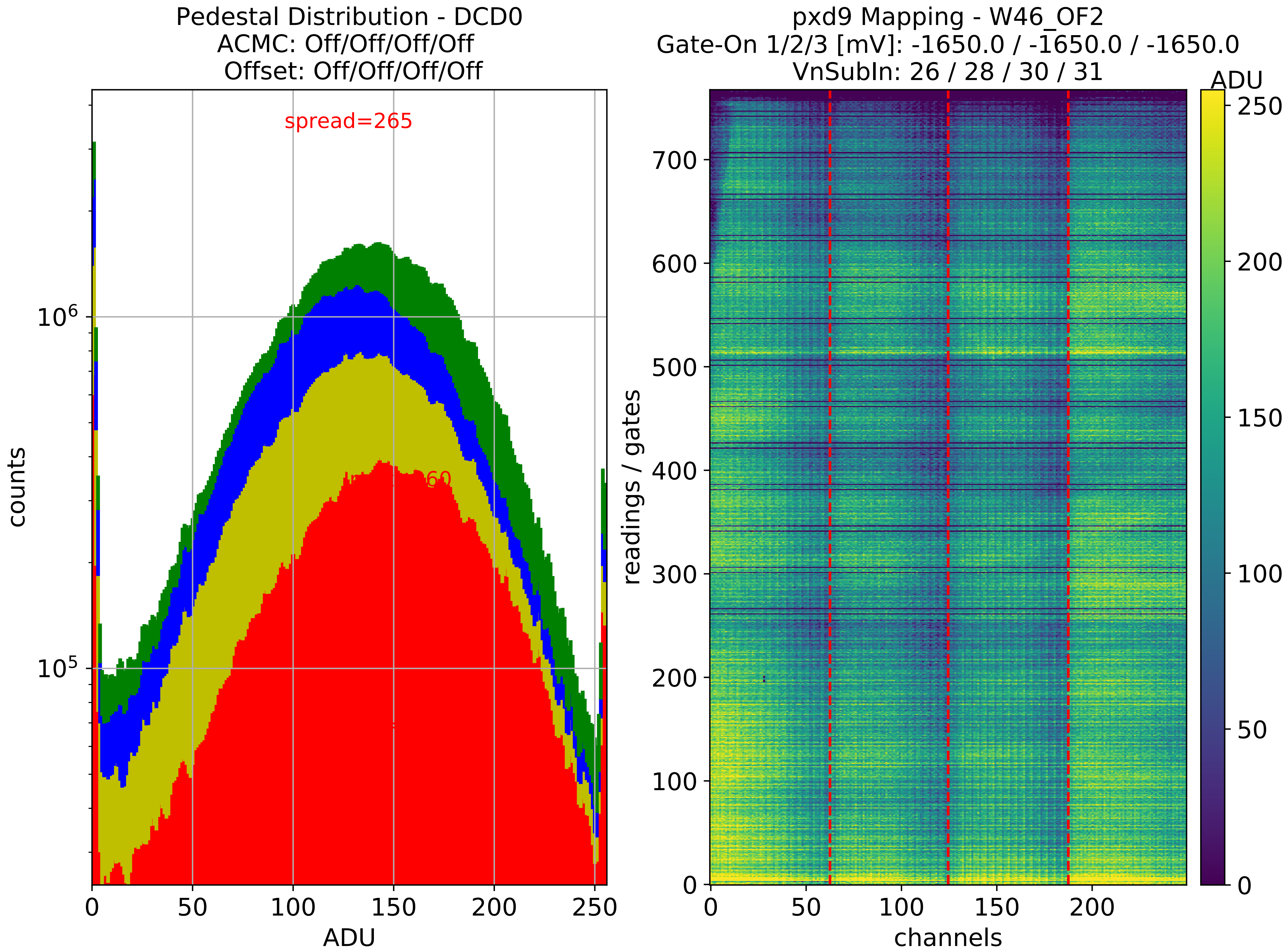
- EXTENDED ADC SCAN
- OFFSET CALIBRATION
- ^{90}Sr & ^{109}Cd SOURCE SCAN

W46_OF2: HIGH SPEED LINKS



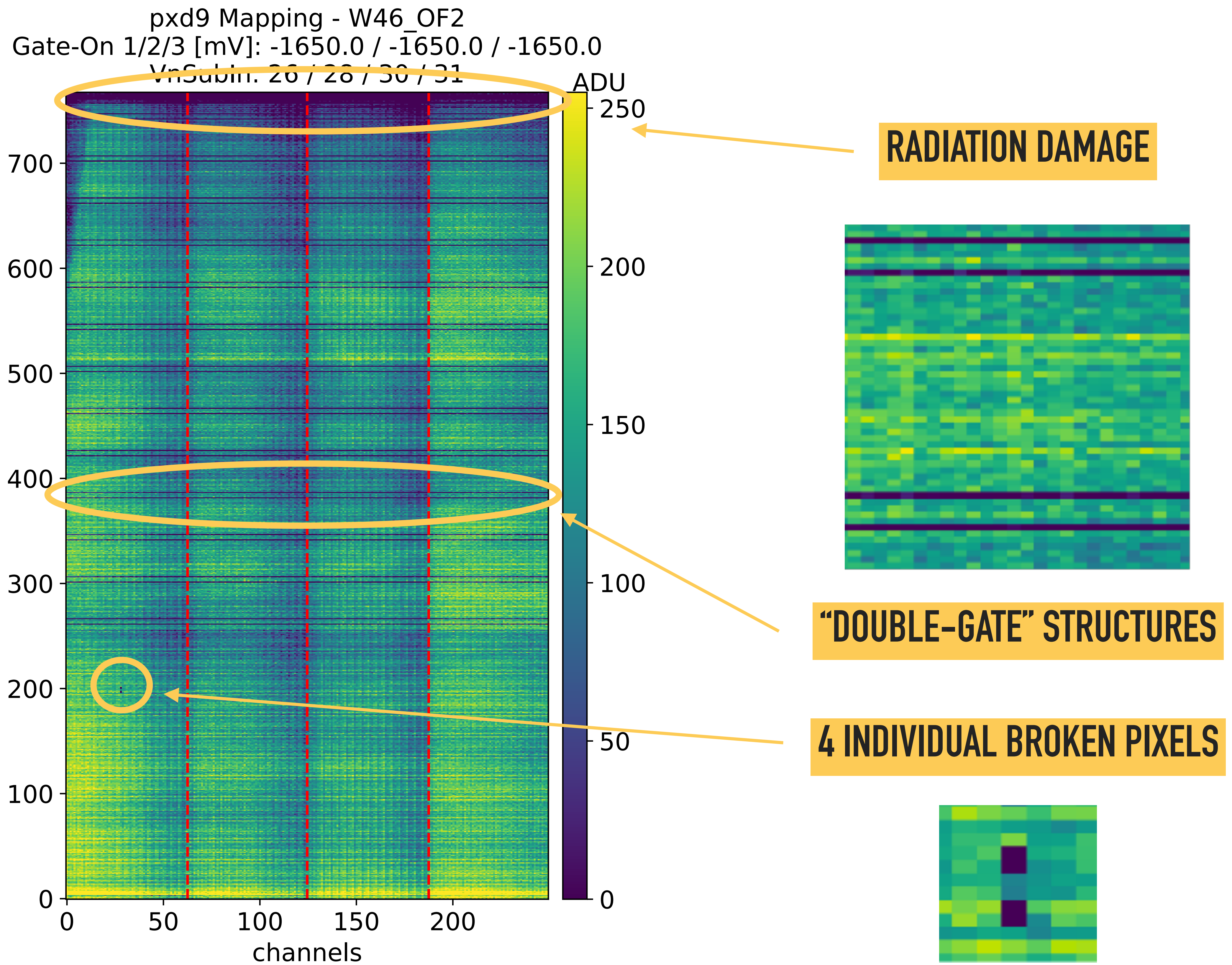
Standard bias=225, biasd=125, dly_sel=0 values were used. HSL were up and running stable over all our measurements. A delay optimisation was successfully performed.

W46_OF2: RAW PEDESTALS



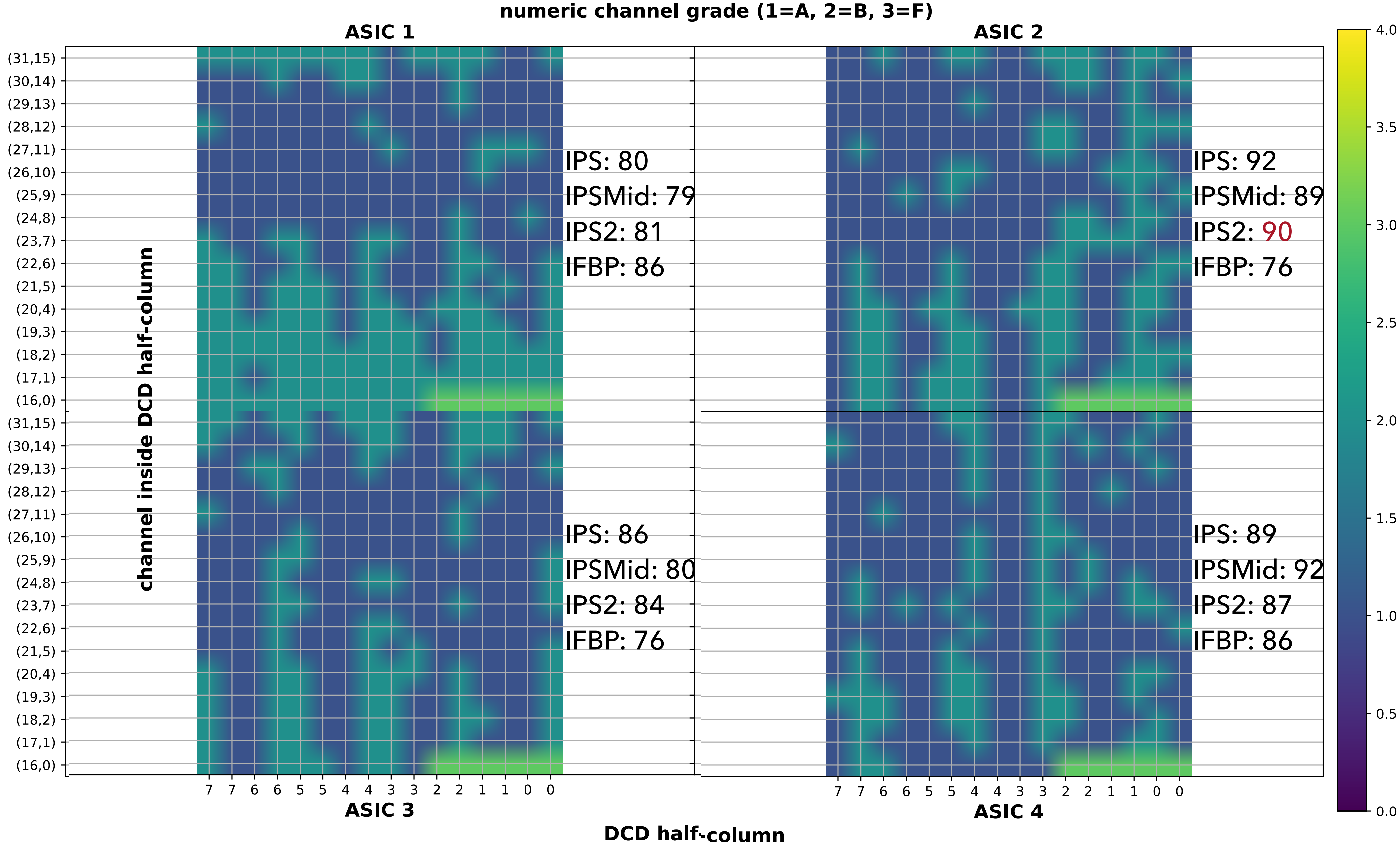
The radiation damage is mostly contained in the EOS. The same double gate structure observed in W46_OF1 is present. Also, 4 individual pixels are broken in DCD1.

W46_OF2: RAW PEDESTALS



W46_OF2: ADC SCAN

dcd-amplow = 200 mV, dcd-refin = 720 mV



Legend

IPS = dacipsource
IPSMid = dacipsource_middle
IPS2 = dacipsource2
IFBP = dacifbpbias

Extended scan:

dcd-refin
[675, 795; step=15]
dcd-amplow
[200, 440; step=15]
dacifbpbias
[60, 90; step=2]
dacipsource
[65,95; step=3]
dacipsource2
[60, 90; step=3]
dacipsource_middle
[65, 95; step=1]

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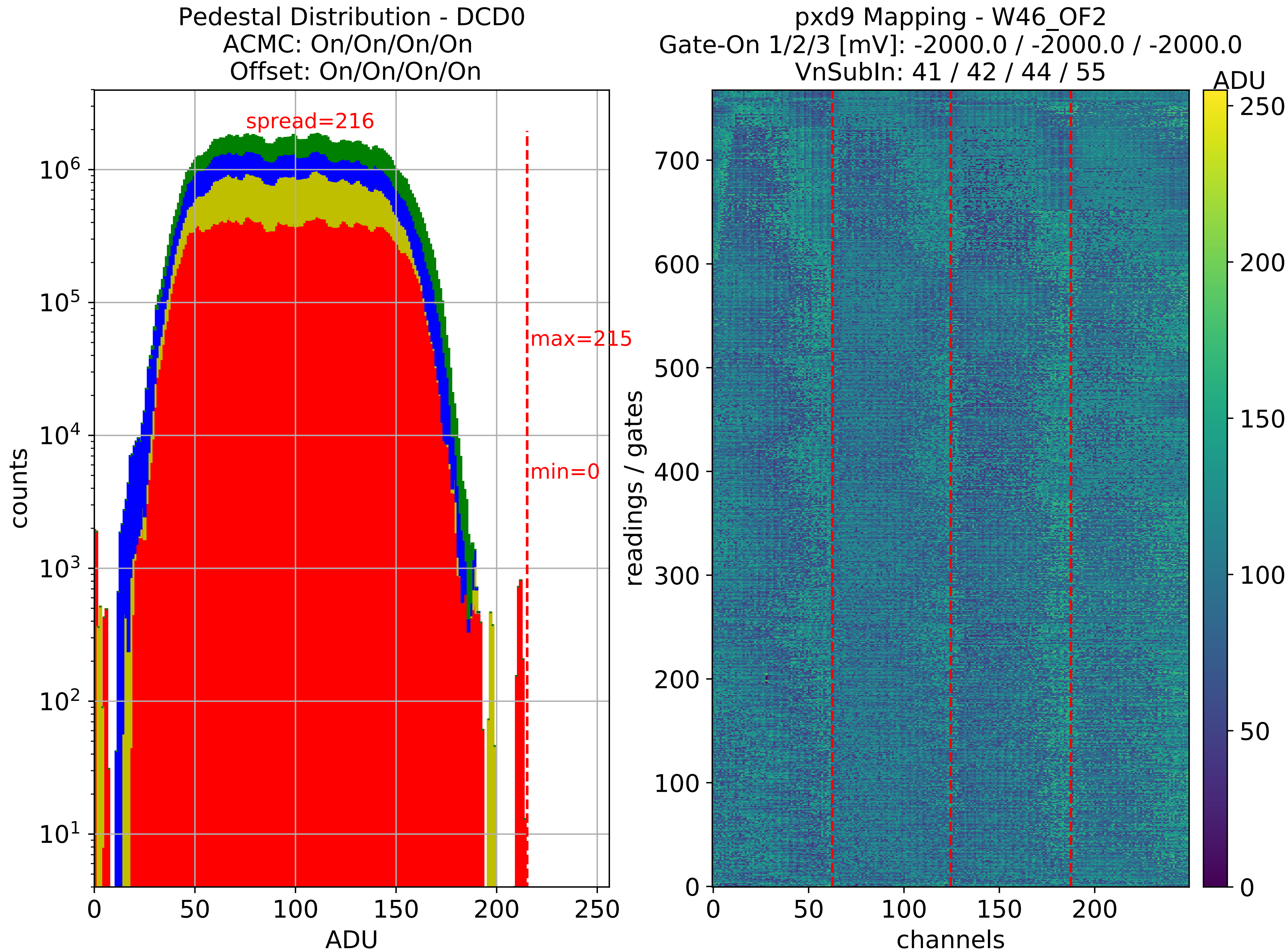
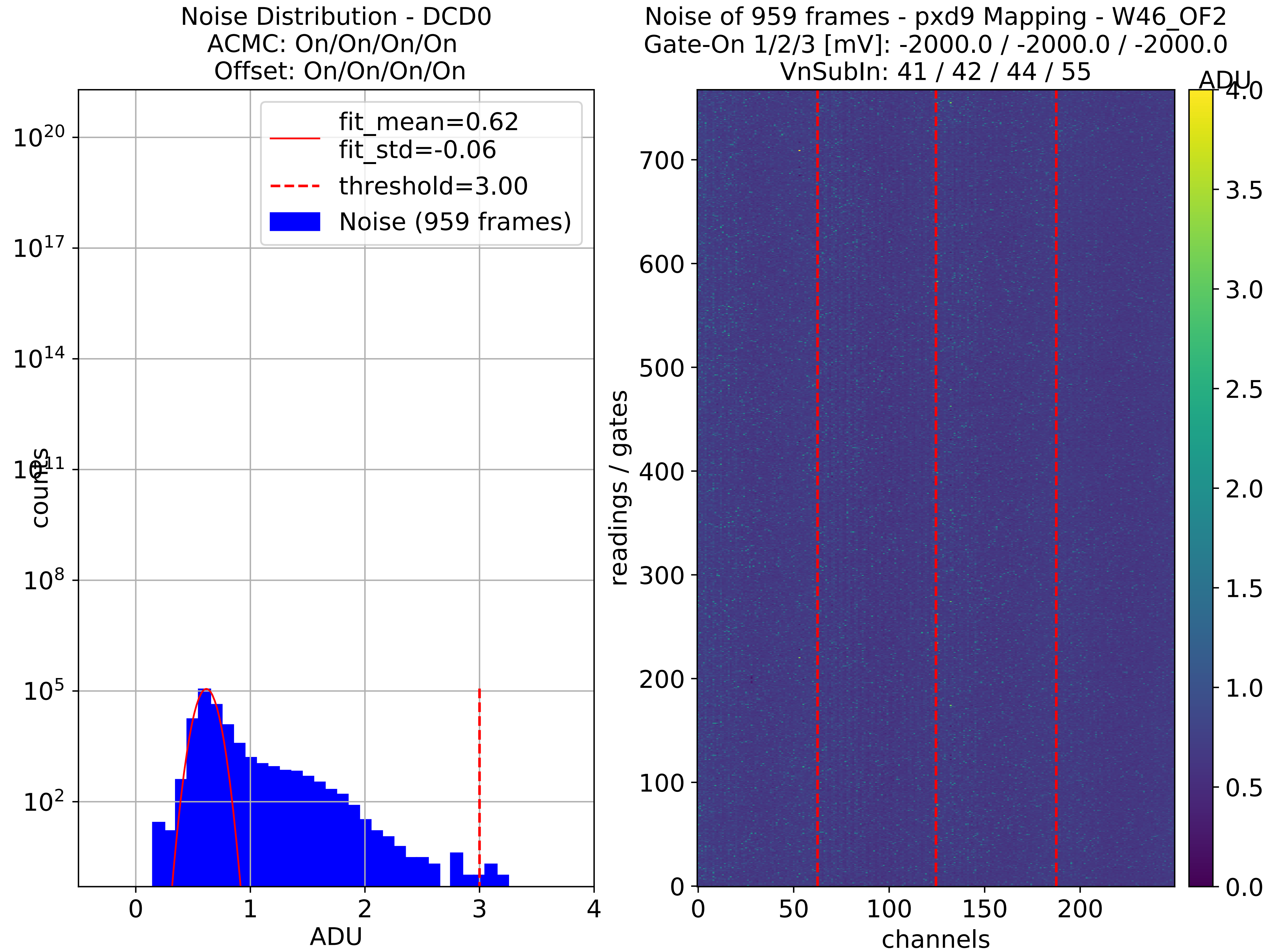
- We went for an extended ADC scan, as with W46_OF1 we were hitting some limits.
- All the channels are working fine. No broken channels found in the analysis.
- We found an unusually low dcd-amplow voltage to be the optimal point.

W46_OF2: OFFSETS + ACMC (@ -2V GATE-ON)



W46_OF2: NOISE (@ -2V GATE-ON, EN90)



W46_OF2: ^{109}Cd &^{90}Sr SOURCE SCAN

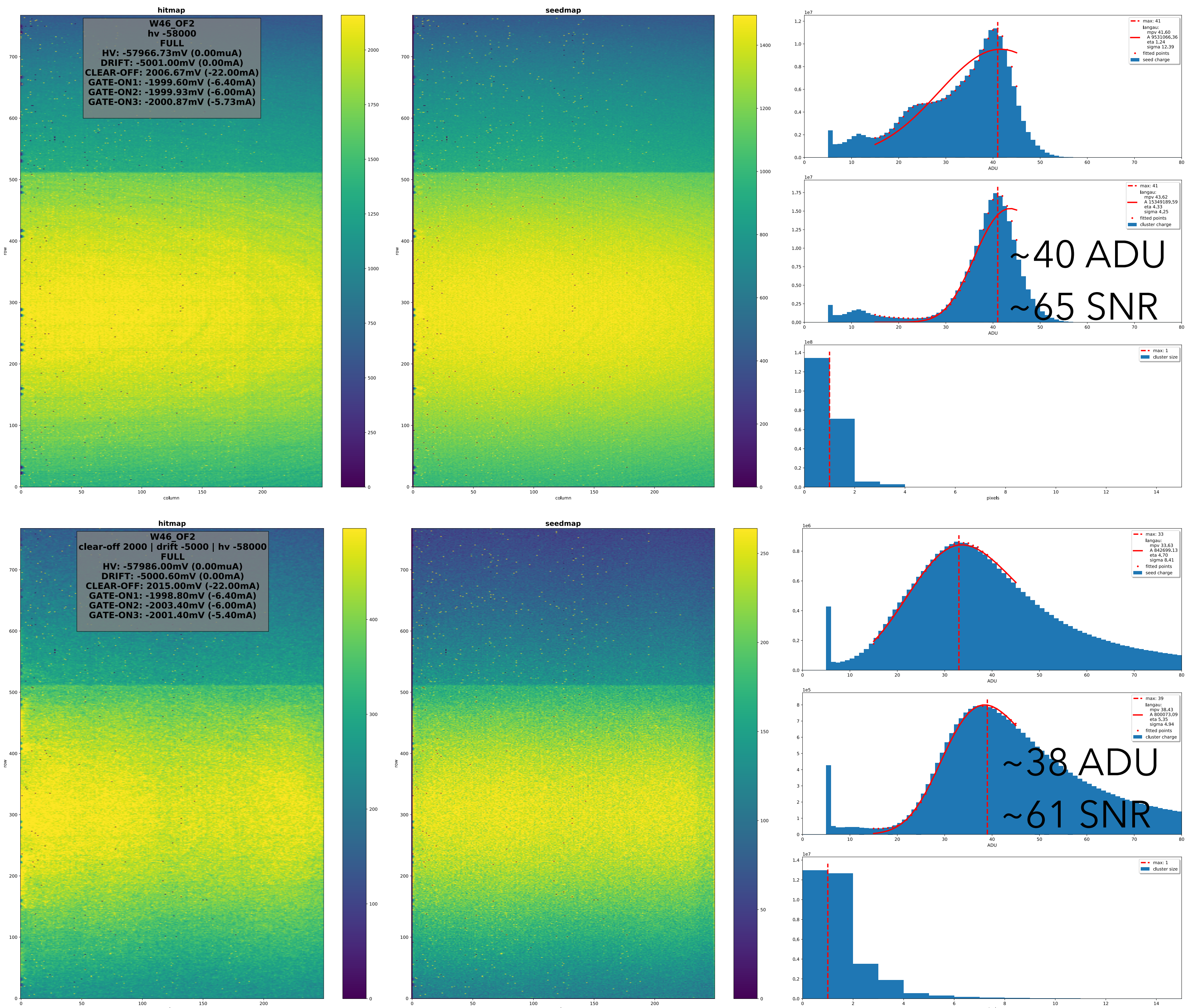
Optimal
(higher peak,
both sources,
~ringless)

HV -58V

Drift -5V

Clear-off 2 V

Gate-on -2V



The HV at which the peak is higher is clear and easy to spot. But for the minimisation of the rings it's a closer call; different values produce pictures that look approx. the same.

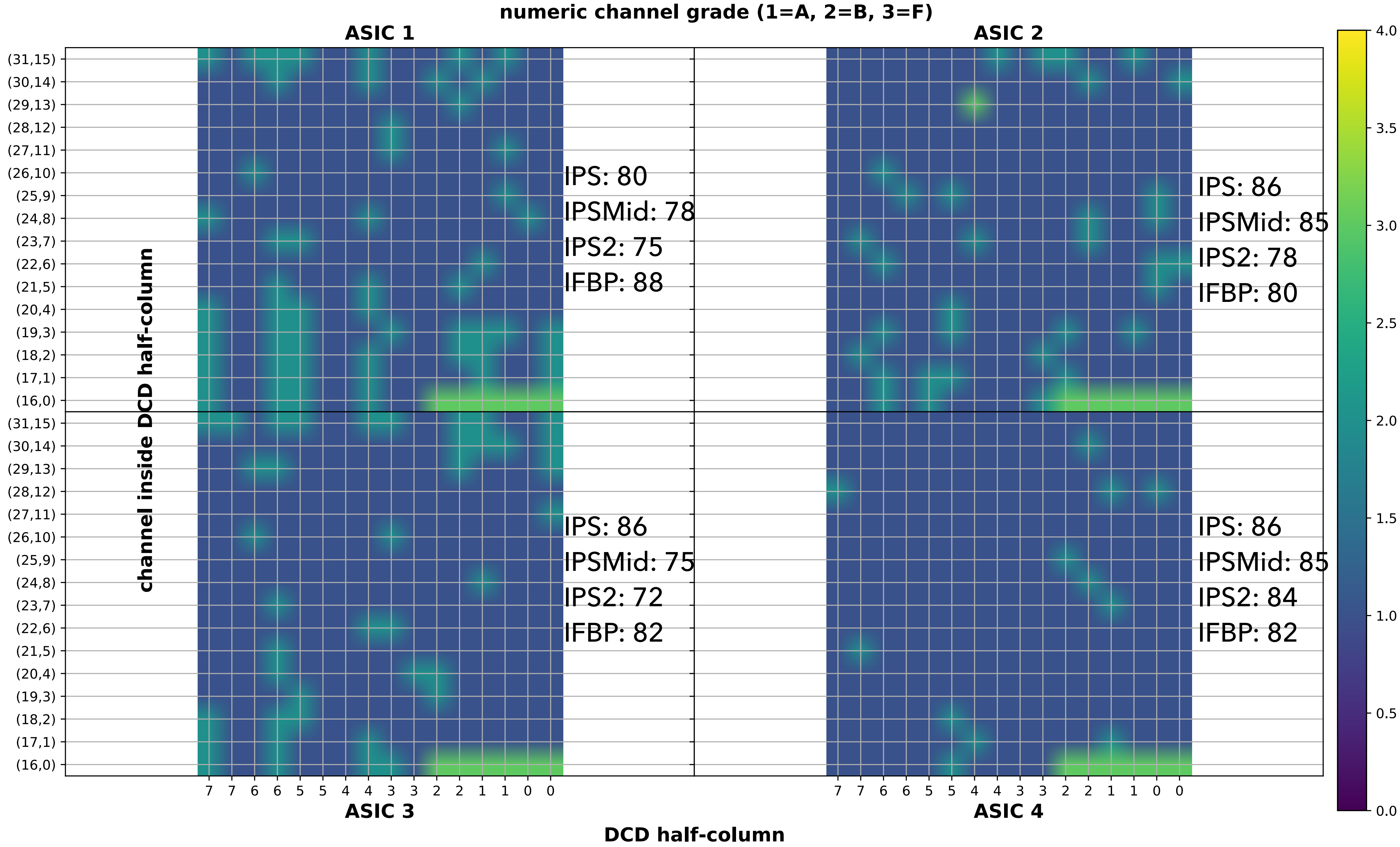
W46_OF2 SUMMARY

- W46_OF2 was sent to Bonn for debugging as it showed problems with the HSL stability at MPP.
  - At Bonn the HSL were stable and the complete mass testing could be done.
- Measurements:
  - HSL: we used the standard values, which worked fine. Links were stable overnight.
  - Delay scan: typical anti diagonal results with a band of error-free communication. DCD-DHPT communication worked fine. See backup for details.
  - Raw pedestals: some radiation damage is appreciated near the EOS, the “double-gate” structures are present, and 4 individual pixels are dead.
  - ADC sweep: all the DCD channels were working fine after the optimisation.
  - Offsets: with the 2-bit DAC and ACMC all the matrix could be fitted in the dynamical range (except the 4 dead pixels). Noise of 0.62 ADUs was recorded.
  - Source scan: both source scans yielded the same result, having an optimal point in which SNR is maximal (~60) and rings are the less apparent.
- Scores for the module according to the elog summary grading system: A for all measurements.

Lower gain (En60)

W46_OF2: ADC SCAN

dcd-amplow = 200 mV, dcd-refin = 690 mV

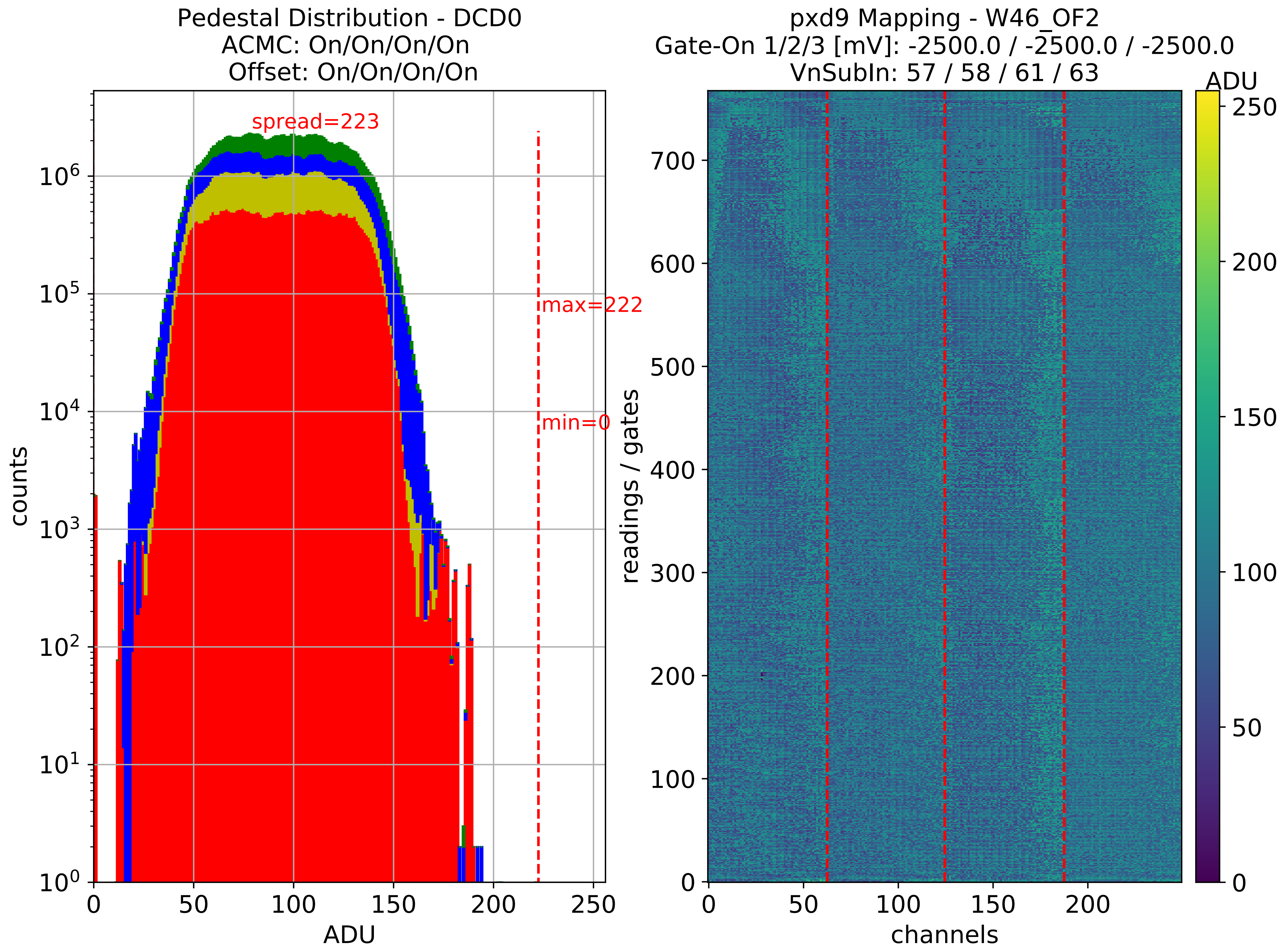


Legend
IPS = dacipsource
IPSMid = dacipsource_middle
IPS2 = dacipsource2
IFBP = dacifbpbias

Extended scan:
dcd-refin
[675, 795; step=15]
dcd-amplow
[200, 440; step=15]
dacifbpbias
[60, 90; step=2]
dacipsource
[65,95; step=3]
dacipsource2
[60, 90; step=3]
dacipsource_middle
[65, 95; step=1]

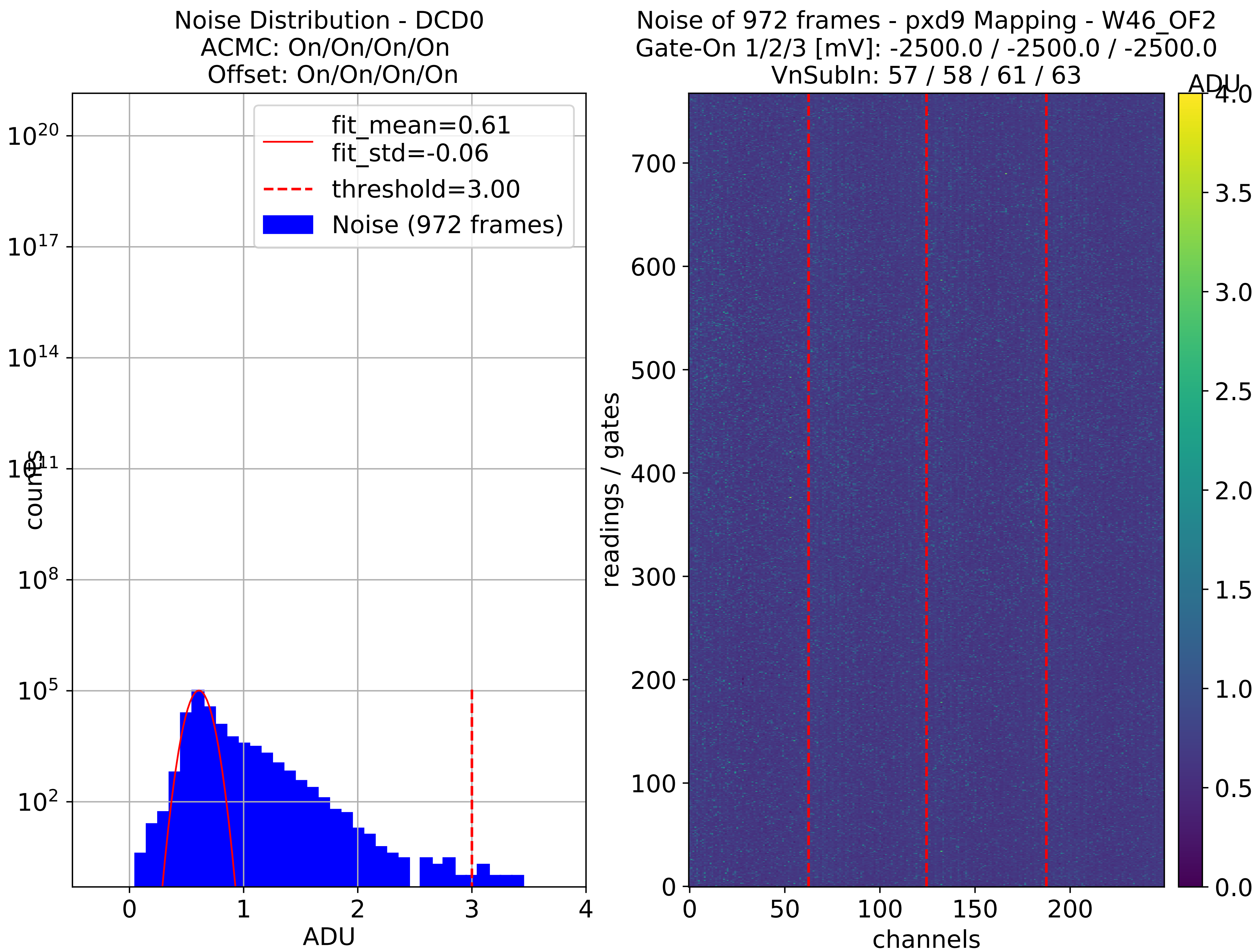
- Optimal points are in the same region as for the higher DCD gain.
- Surprisingly in this scan one of the channels was marked as broken.
- At this gain the unusually low dcd-amplow voltage is still the optimal point.

W46_OF2: OFFSETS + ACMC (@ -2.5V GATE-ON)



With the lower DCD gain we are able to reach -2.5V gate-on voltages and still have narrower pedestals than with En90 to accommodate for signal.

W46_OF2: NOISE (@ -2.5V GATE-ON, EN60)



W46_OF2: ^{109}Cd &^{90}Sr SOURCE SCAN

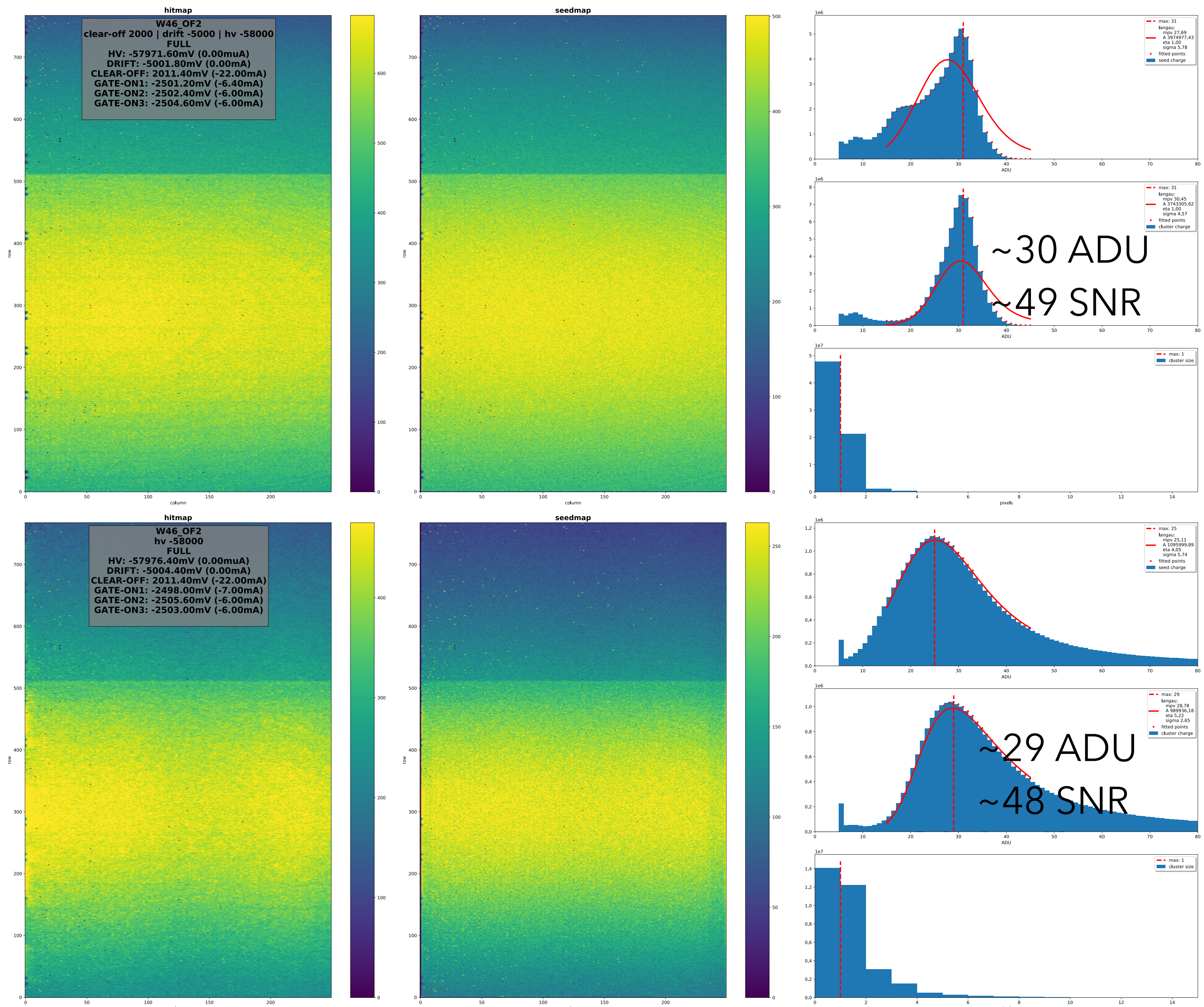
Optimal
(higher peak,
both sources,
~ringless)

HV -58V

Drift -5V

Clear-off 2 V

Gate-on -2V



The optimal parameters for this gain are compatible with the ones found for the higher gain.

SUMMARY

- W46_OF1 and W46_OF2 were sent to Bonn for debugging as they showed problems with the HSL stability at MPP.
  - At Bonn the HSL were stable for both modules and the complete mass testing could be done. Both modules resulted in grade A.
- Extended ADC scans for W46_OF2 have been performed, in two different gains (En90 and En60).
  - With the lower gain we are able to go to lower gate-on voltages
  - We sacrifice a bit of SNR (from ~60 to ~50) in exchange for more space in the pedestals for signal
  - We noticed that the grading of the ADCs depends strongly on the selected gate.
    - Two consecutive measurements with the same parameters can yield very different grading.

SUMMARY

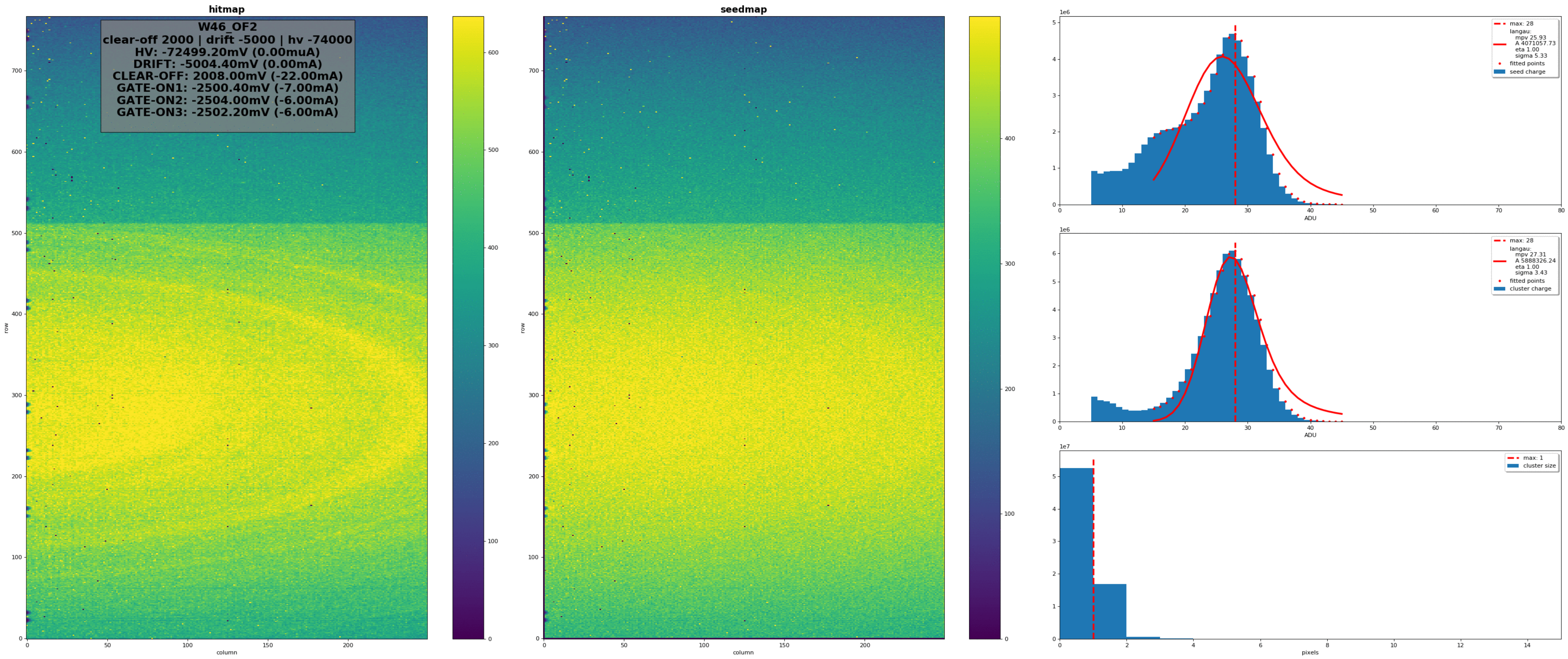
- The parameter optimisation for the source scan is mainly done by "eye"
  - In the case we are optimising to have the higher ADU peak there seems to be a systematic behaviour in which HV ~ -58V works best (see backup).
    - It looks more or less the same for different drift-clear-off combinations.
  - But if we are optimising for the clusters and hitmaps with less rings many (~6-10) parameter points give similar results.
    - W46_OF1: optimising for one or the other gives different optimal points.
    - W46_OF2: from the bunch of parameters points that lessens the ring patterns, there are points that also maximise the ADU peak.

THANKS FOR YOUR ATTENTION

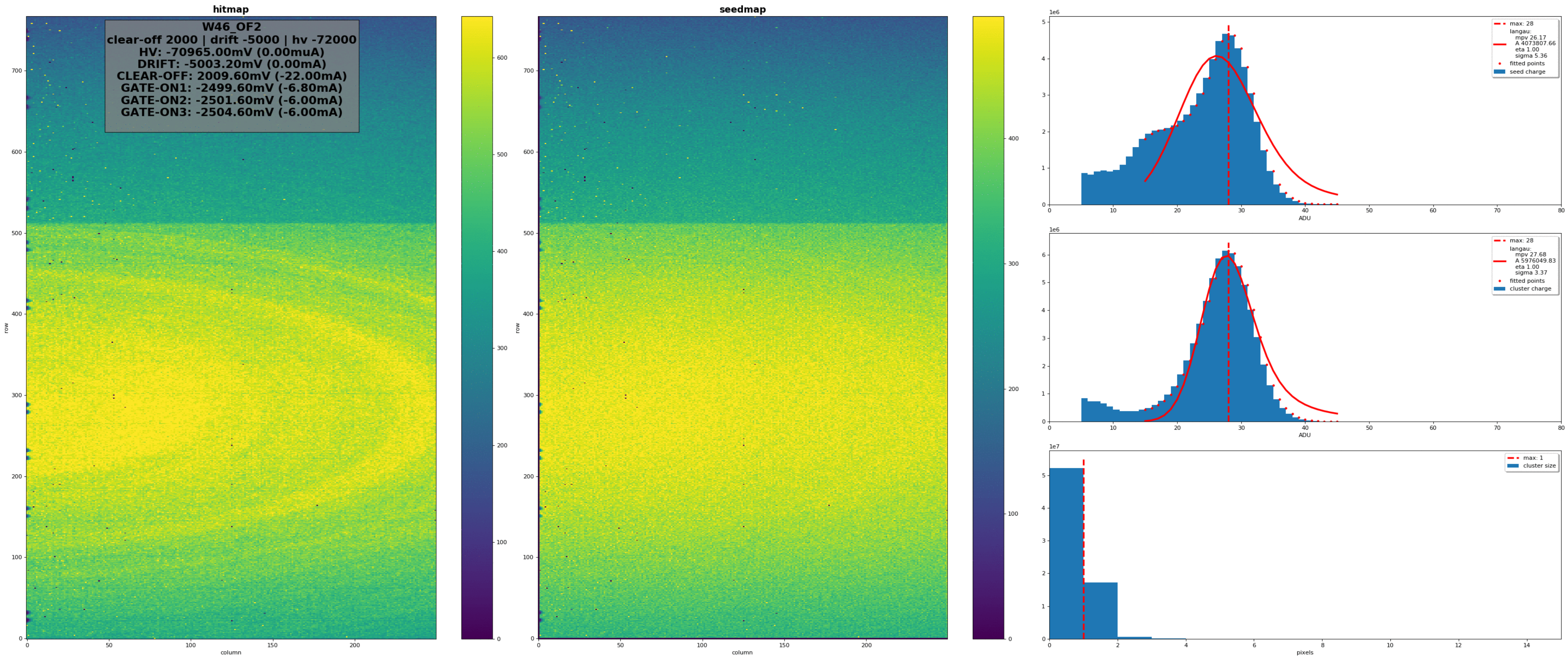
BACKUP

HV - Peak value interplay

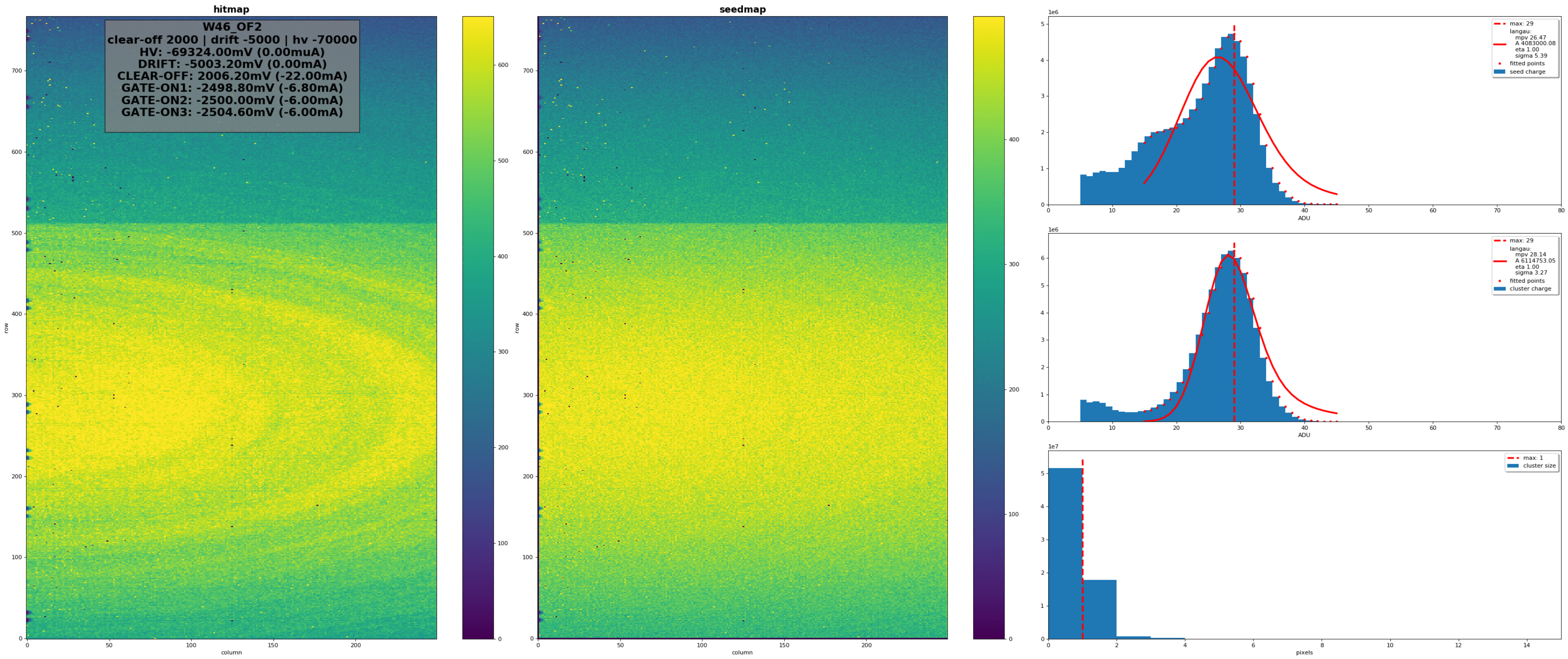
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



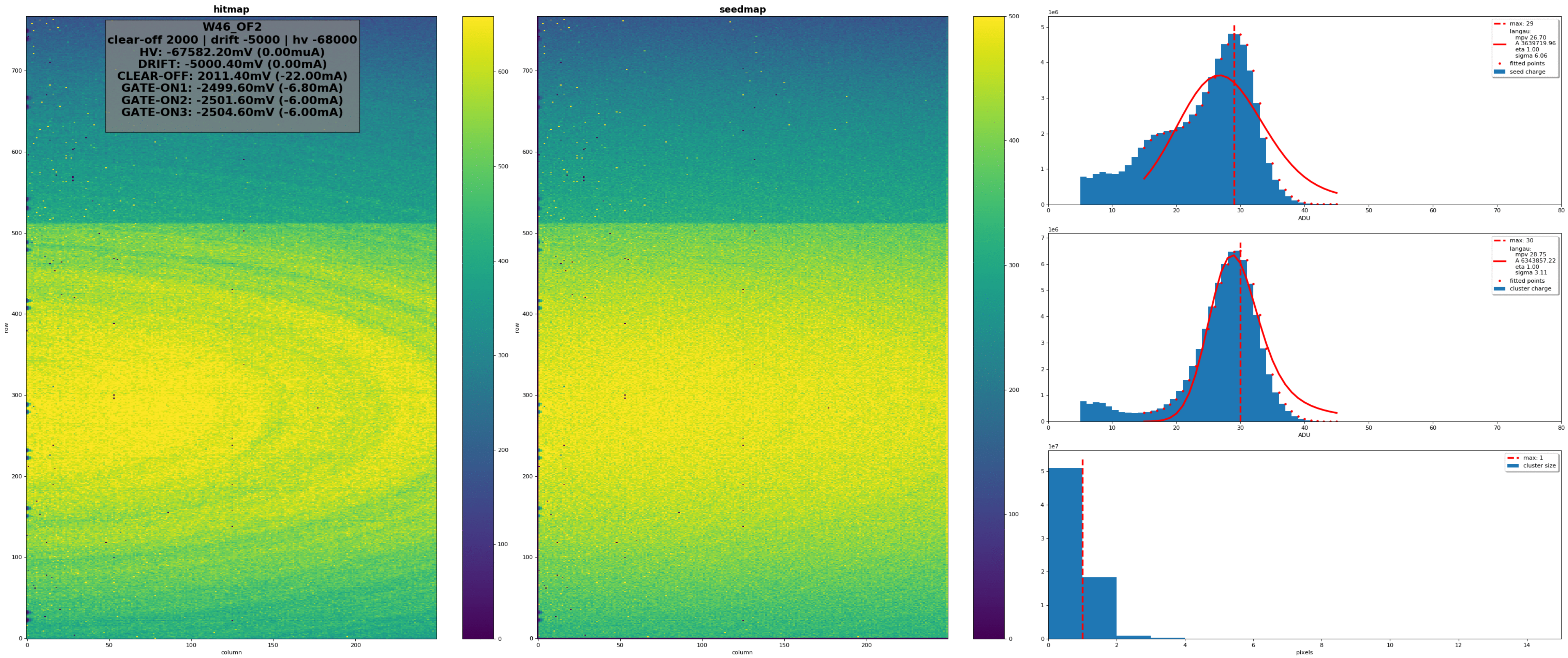
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



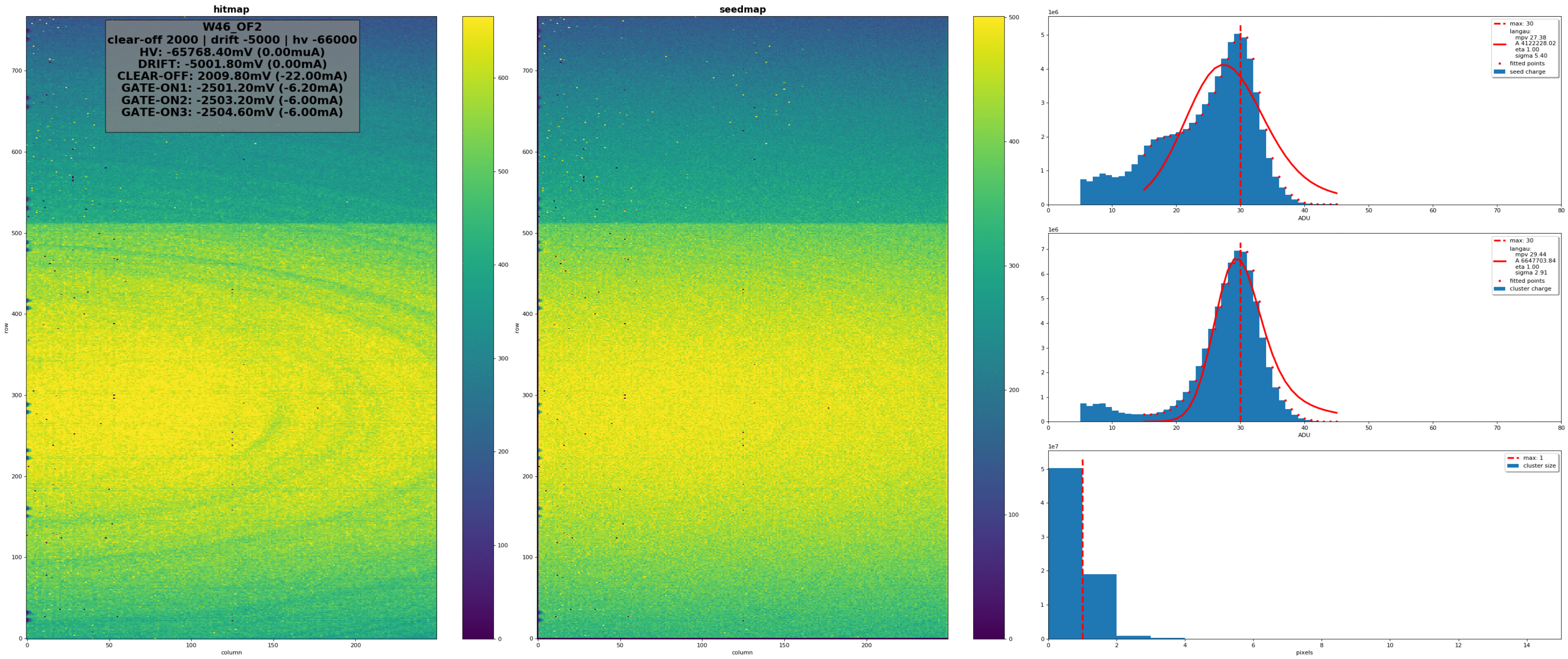
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



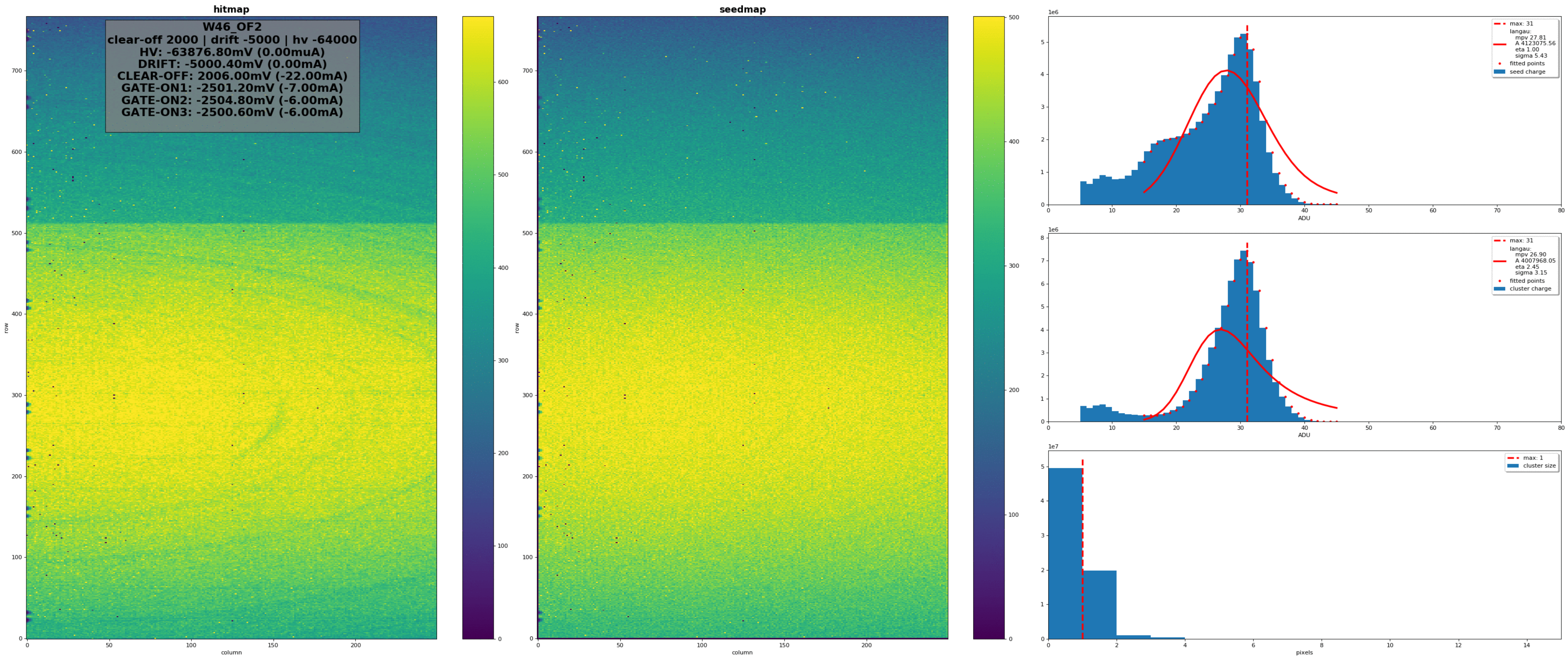
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



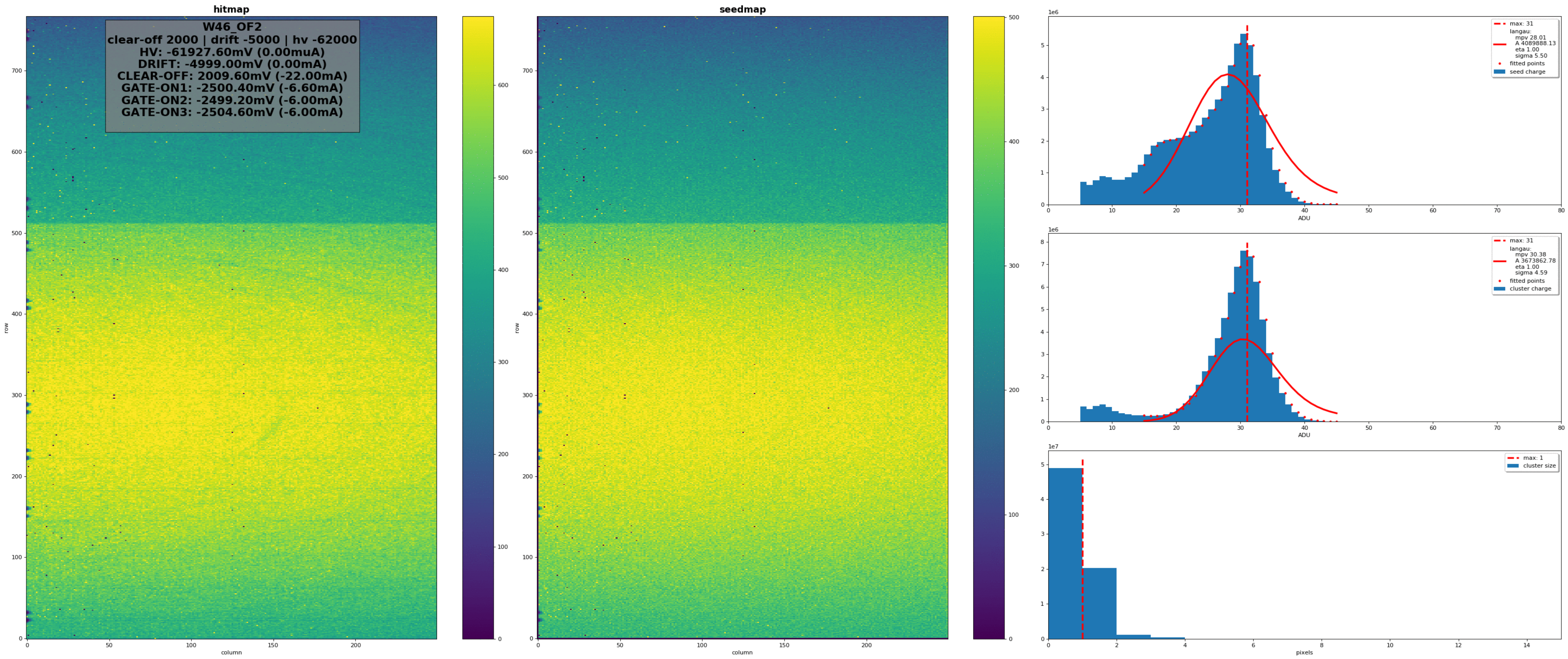
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



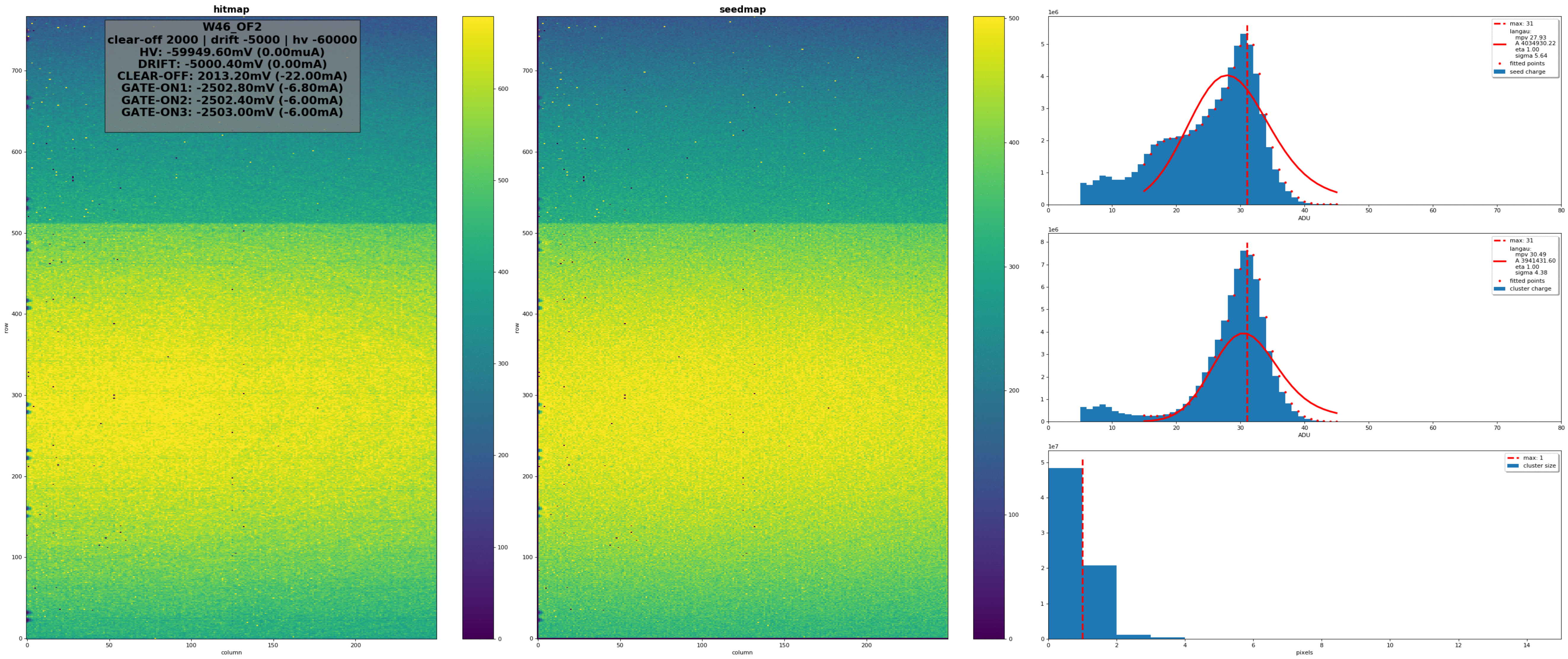
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



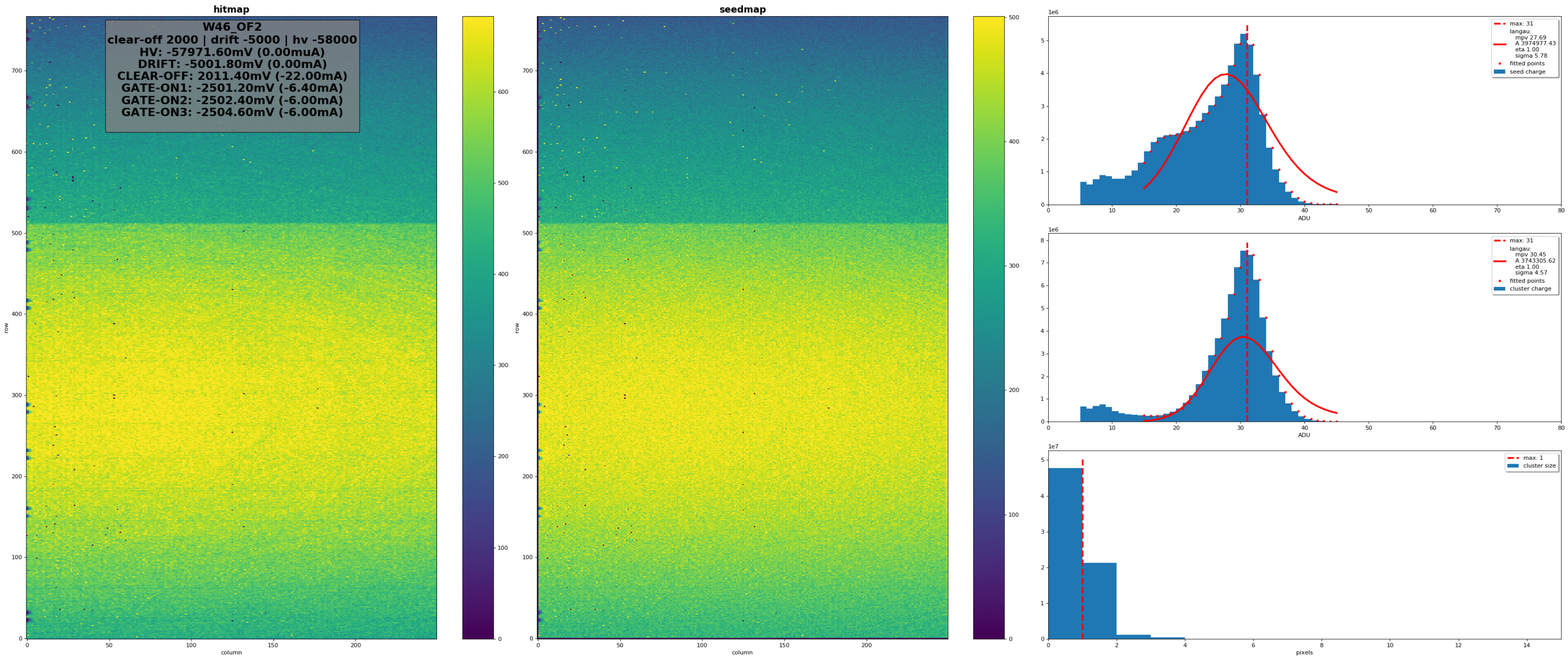
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



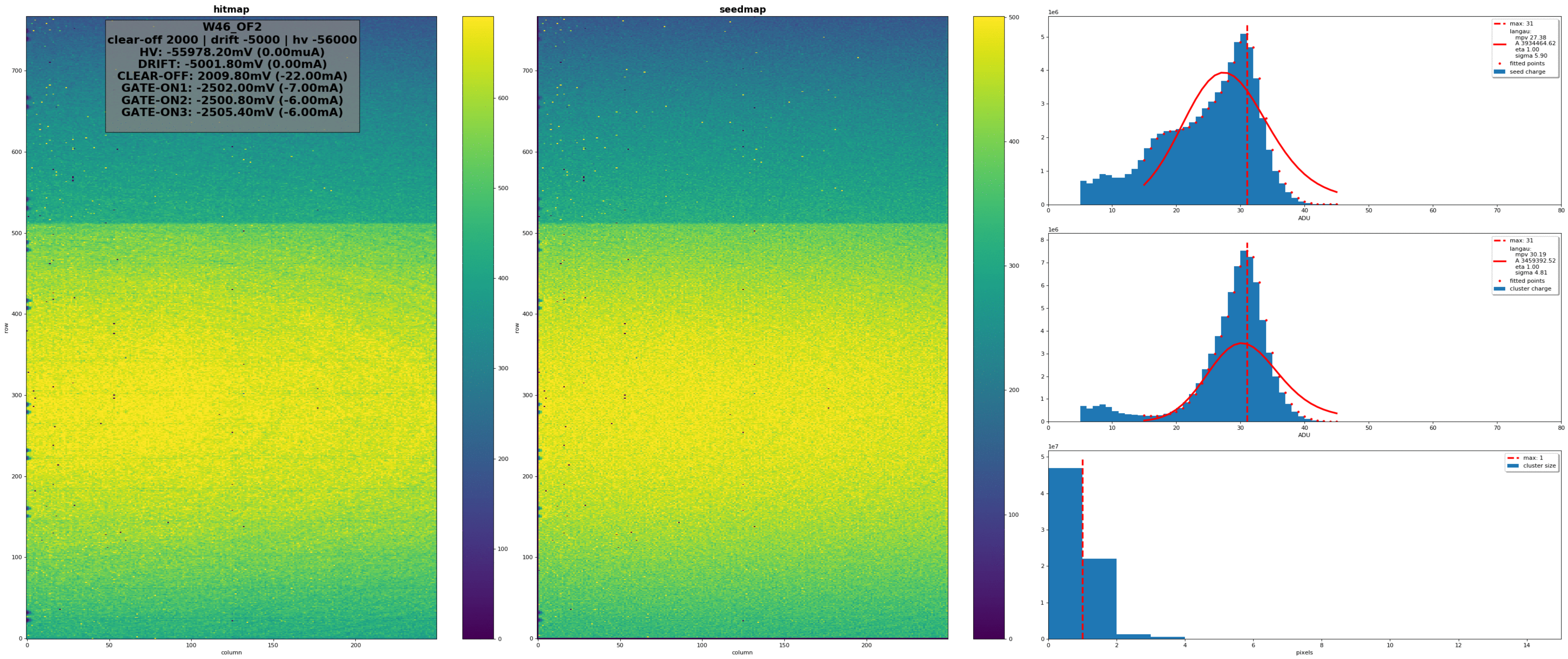
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



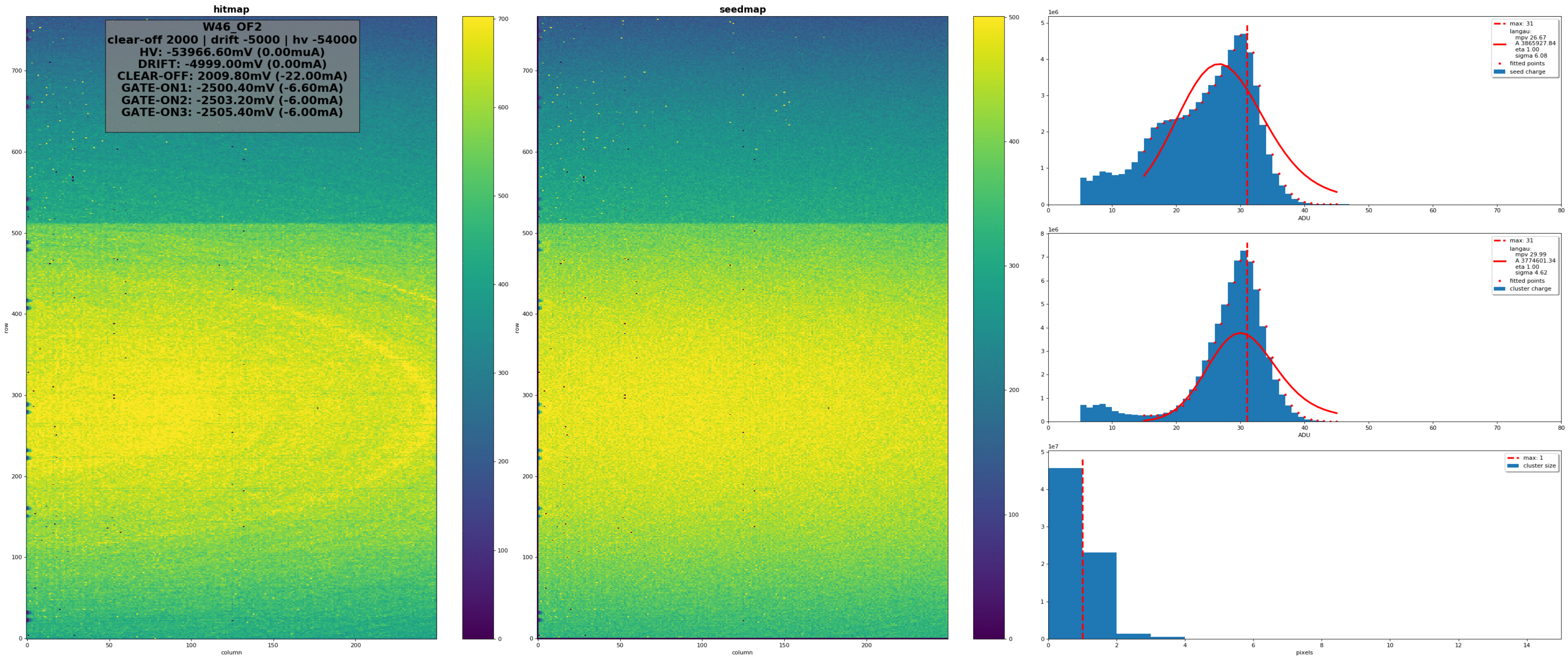
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V



W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V

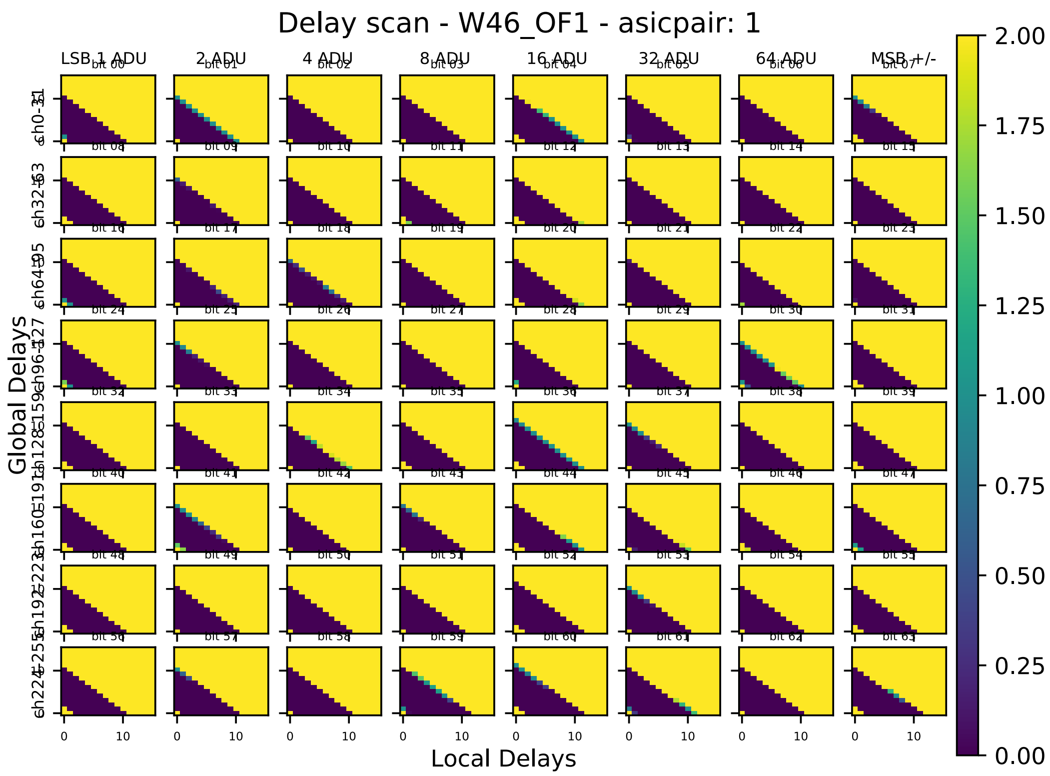


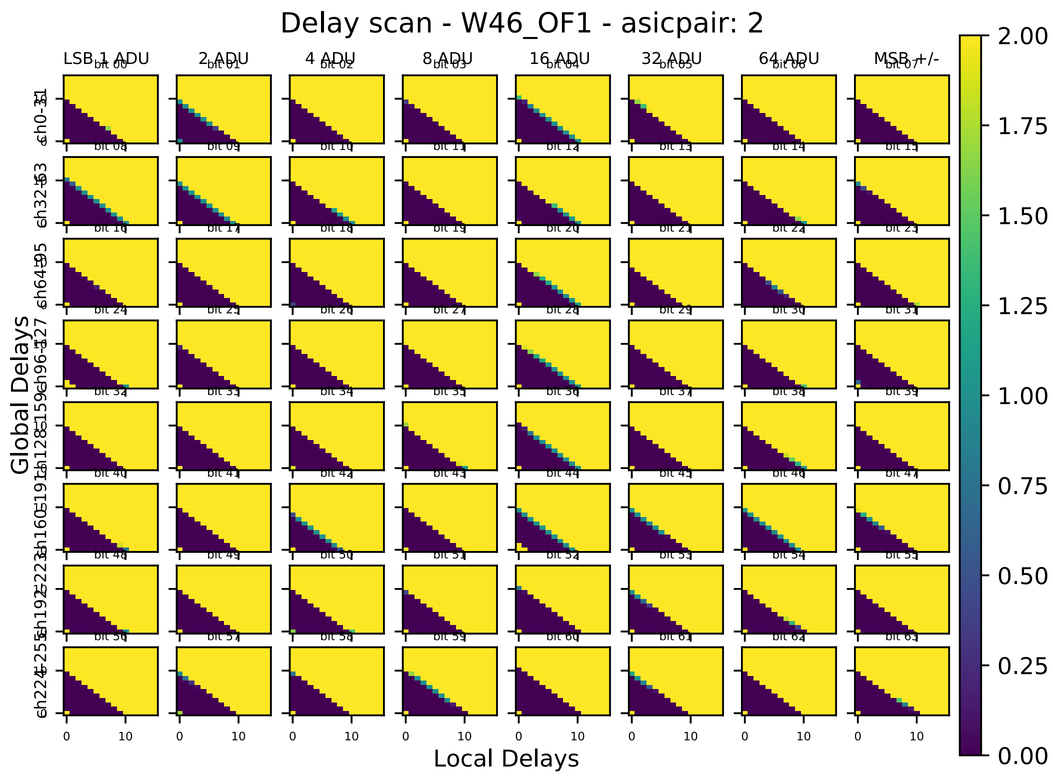
W46_OF2 (EN60): DRIFT -5V, CLEAR-OFF 2V

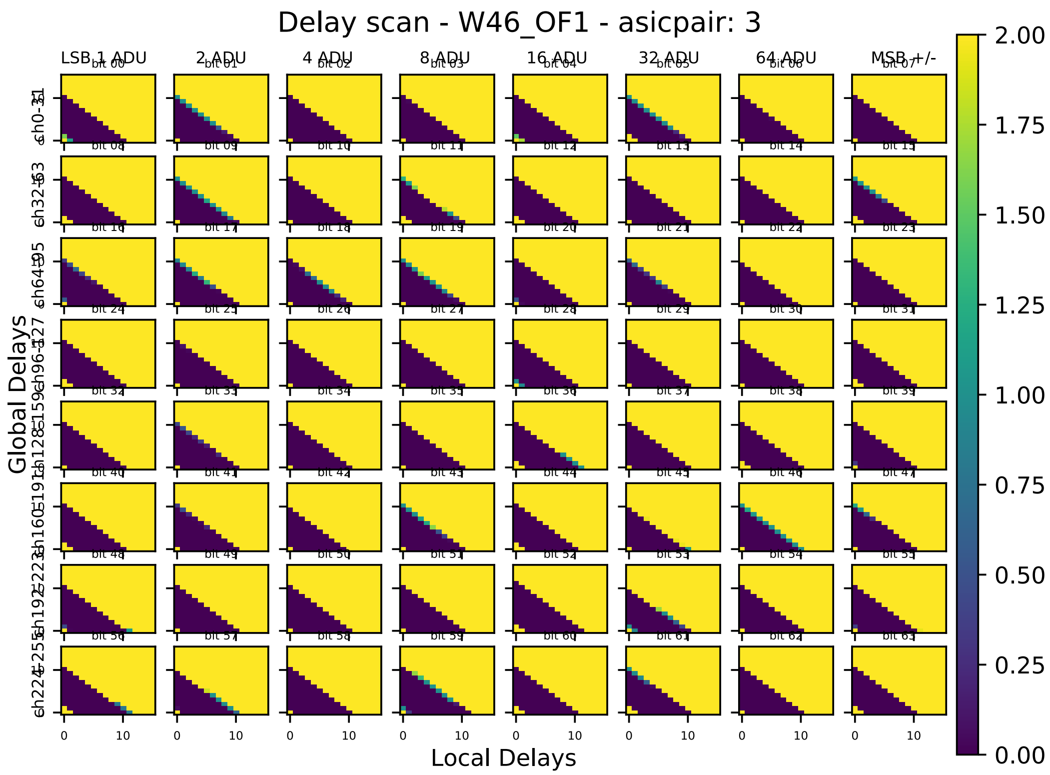


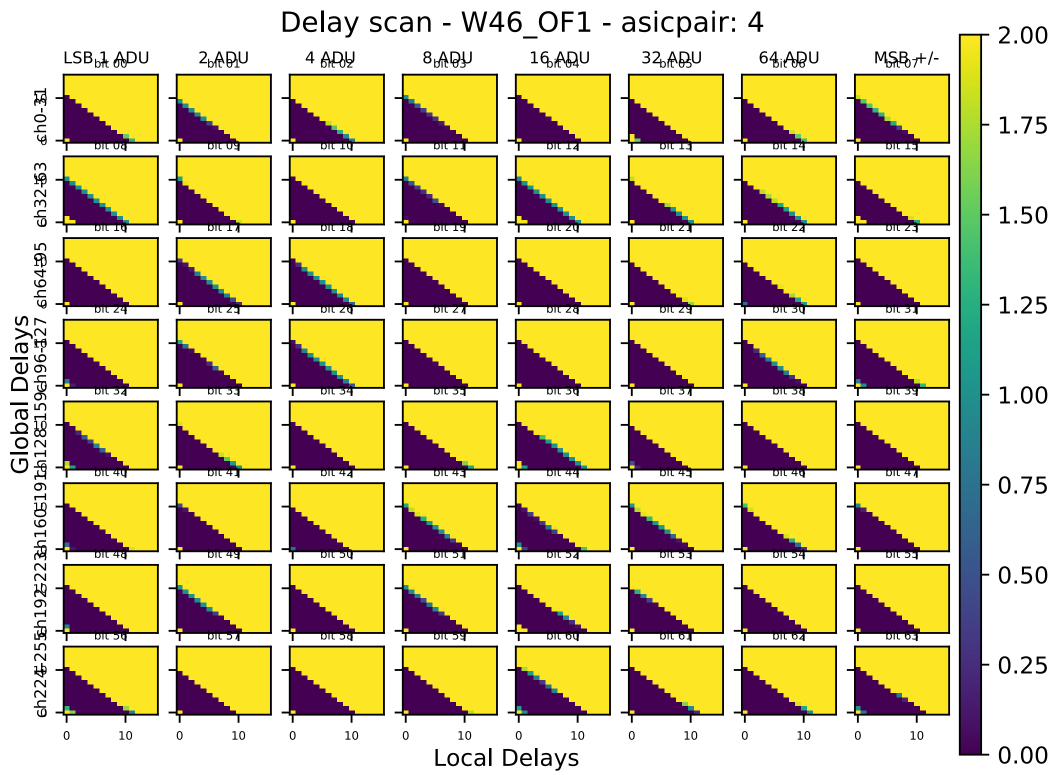
DCD delays results

W46_OF1: DCD DELAYS

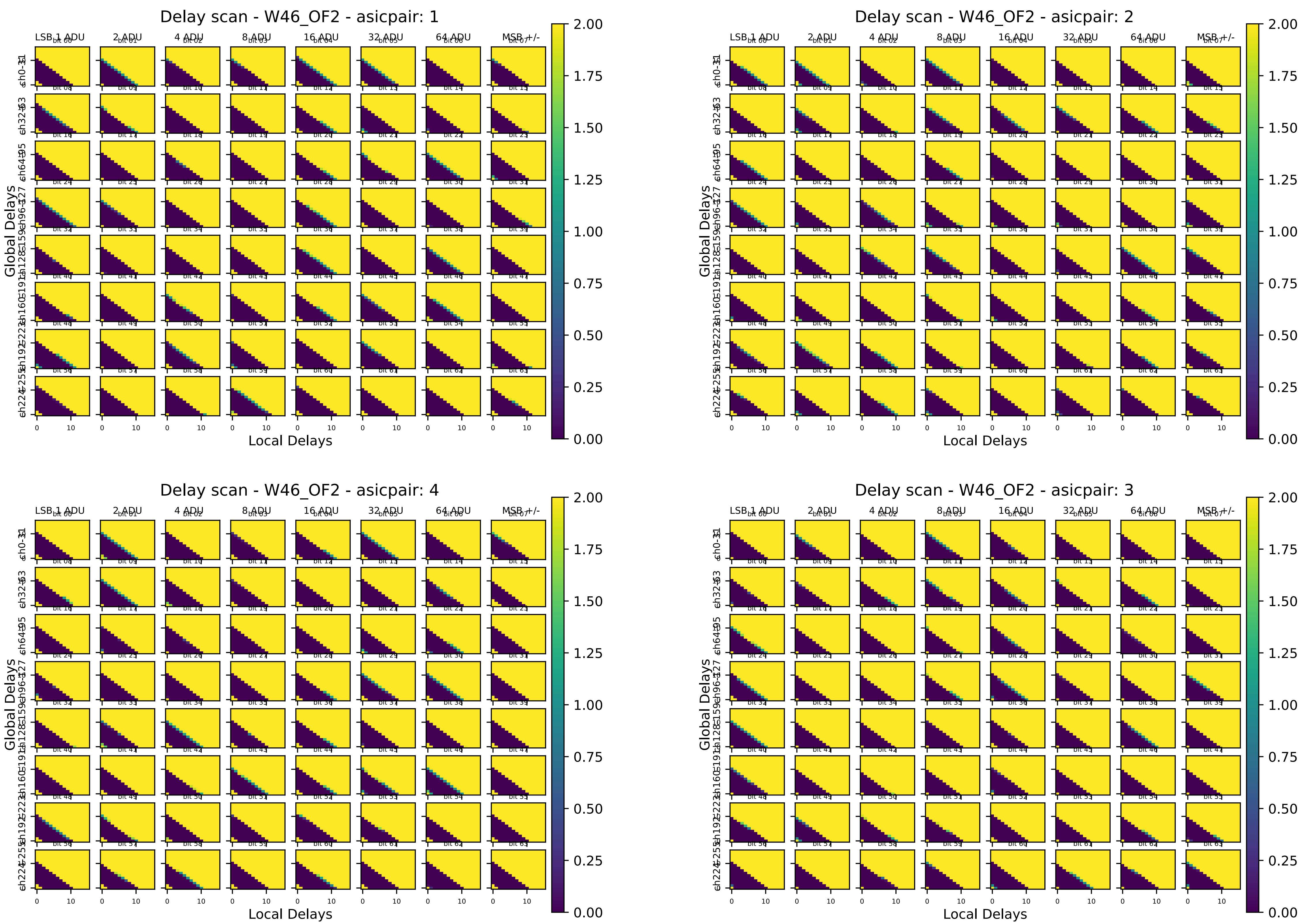








W46_OF2: DCD DELAYS



W46_OF1 ADC SCAN COMPARISON WITH MPP

W46_OF1: ADC SCAN