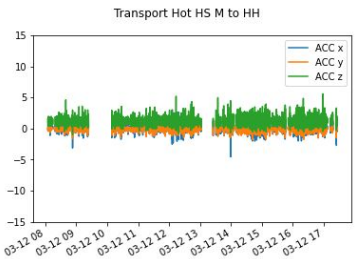
PXD Commissioning at DESY Experience P1

Transport MPP to HH

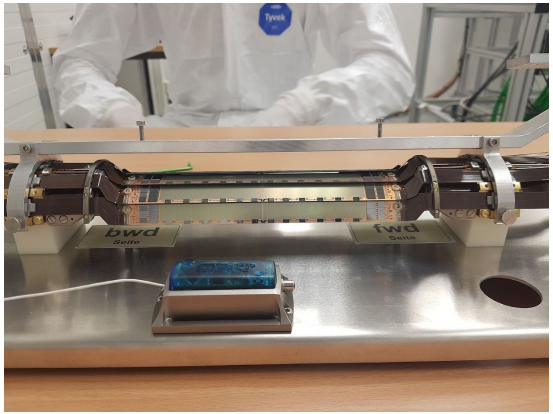
- A-team by car, kangoo, very slowly
- no (obvious mechanical) damages for dummy HS2
- still uncomfortable road conditions
  → use better rental next round



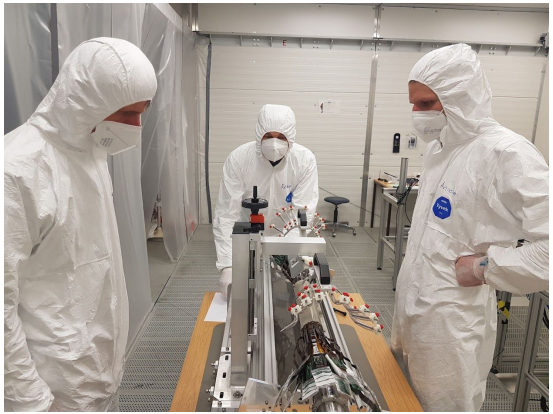
Mounting HS on dummy BP at DESY

- exercised by Reimer, Carsten, A-team following checklist → pictures
- procedure went smooth w/ issues
  - good to do w/ 4 people → might want to train additional expert

inspection (incl ladder screw tests)



mount to BP



install to setup and connect: CO2, N2, PPs

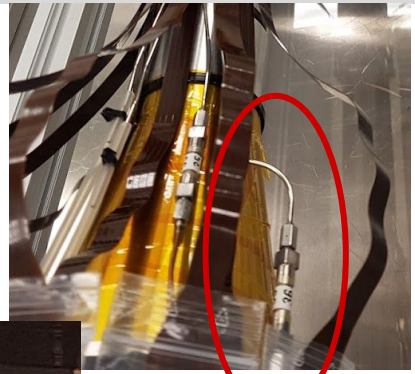
HS Mechanics: Issues (noticed) During Mounting

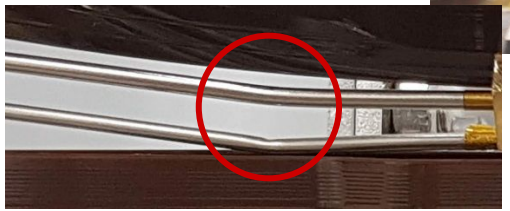
HS mechanics overall:

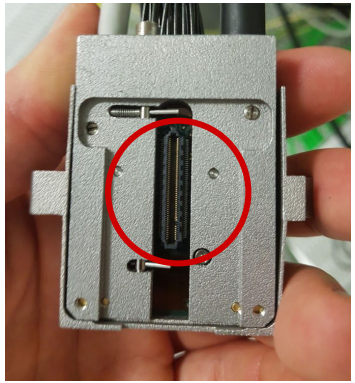
- HS looks very good: no brass vs SCBs angle, flat modules, so far no issue w/ opposite brass pieces, …
- mounting procedure went rather smooth
- some (O(2)) ladder screws loose

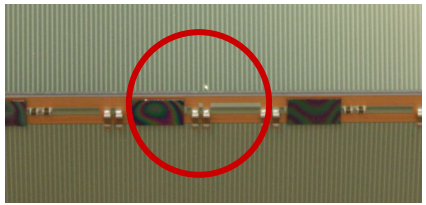
Issues:

- scratches on L1 Kaptons
  - origin not known, so far no visible impact on module performance
- pipe bending still not perfectly along BP and dents in pipes (interference w/ heavy metal? flow?)
  → to be re-check for second HS
  → re-bending difficult (preserve cross section, ensure no cracks)
- metal specs on matrices
  - could remove some at DESY, though not all
- PP connection damage
  - bent pins during plugging, luckily on female side
  - luckily unproblematic channel, still need to be even more careful









PXD Services

PCs:
- HW quite old (still using temporary testbeam setup from 2016?!)
- some limitations, pray “good enough” and survives till October
  - eg network hiccups, slow pedestal upload, cant run optical switch ioc, …
  - took some time to get archiver running stably

DHHs commissioning experience:
- configured / maintained with Stefans help (at DESY and remotely)
- some cards needed to be exchanged already (Stefan brough DHC30 replacement, used DHH20)
- needed (too) much time to get all stable links:
  - RTM issues, optical switch config, dirty fibers, poorly plugged fibers, unknown, …
  - need to streamline procedure for KEK (prepare configs, define debugging procedures in advance)

PSU commissioning experience
- have 11 PSUs at the moment: 10 for HS, 1 for testsetup
- unfortunately had one PSU break while connected on HS module
  - 67 had issues in past, seemed to work ok at DESY, now at LMU for debugging
- repaired unit 51 by DESY workshop (exchanged IC and NMOS on DCDC board)
- many HS_2p4 modules run in dcd-avdd current limit
  - implications on performance unknown, have to decide how best move forward w/ proposed fix

MARCO CO2 cooling experience
- ran smoothly until beginning of last weeks → then observed critical CO2 pump error
- setup down since, waiting for experts (holidays, sick) to investigate issue

PXD Commissioning

Config DB:

- manually adjusted from DHE → DHC setup by hand (including some “homogeneization”)
- some errors (multiple source entries per module)

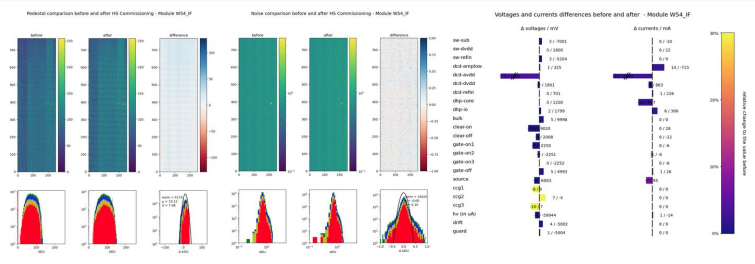
Hot DHP test:

- first powered all modules 1-by-1 w/ cooling → caught broken PP

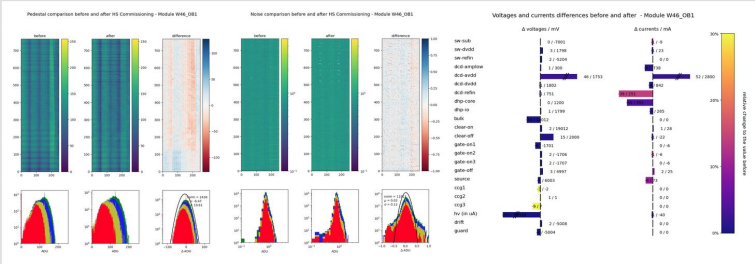
Initial commit comparison to MPP:

- cold DHP→STANDBY→PEAK power up 1-by-1
- comparison to MPP measurements cf
- some understood differences in pedestals and power consumption
  - different op temperature
  - different power supplies used
  - purposely different config (gain setting → will do differently for 2nd HS)
  - wrong config entry used at DESY
- one not understood difference
  - probably bad offsets in DESY config db?
  - fixed by offset calibration

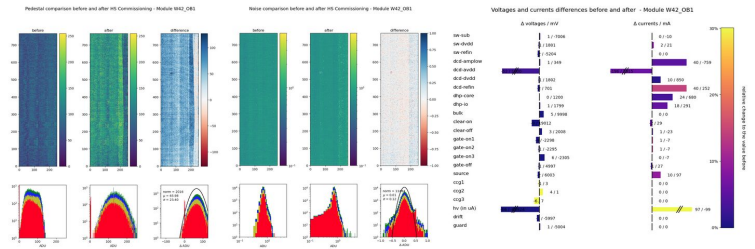
H1011: W54_IF



H2042: W46_OB1 (MPP used En60 branch, DESY En90)



H2052: W42_OB1 (difference not understood, consistent configs! Probably offsets issue?!)



Calibration Scans

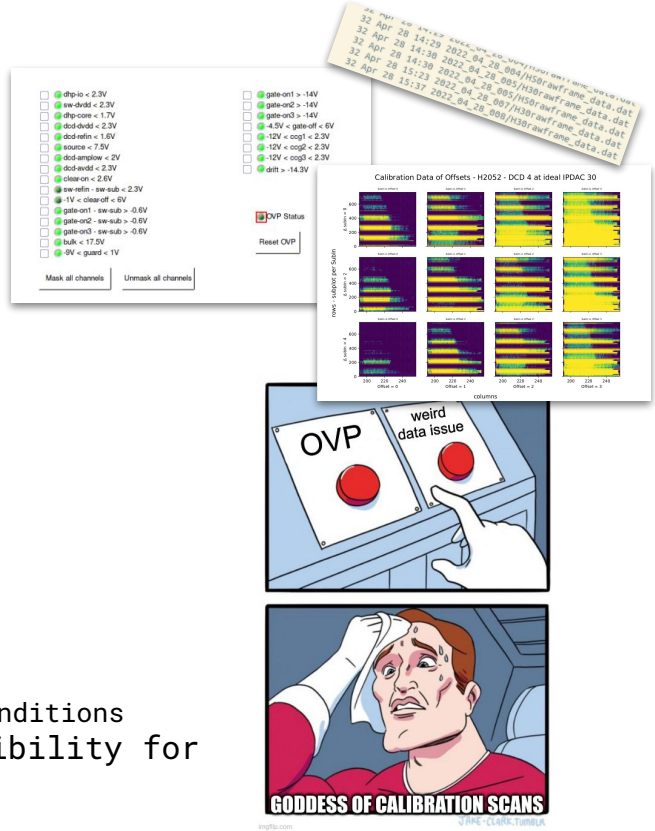
Goal (ideally):

- get high quality reference scans (incl temp dep and cross-talk)
- possibly recalibrate (eg offsets)
  - raw pedestals
  - offset calibration
  - hv-iv currents
  - depfet-iv currents
  - adc-curves
    (recalibration necessary for some HS_1p4 modules characterized at DESY)

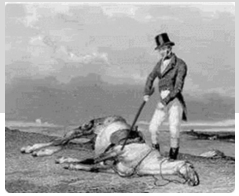
Not yet reached at DESY

- lack in person power/time and module/scan knowledge
  - many modules need special treatment
- lack in luck / measurement script robustness
  - many modules ⇒ higher chance of error (OVP, corrupt data)
  - complicated cooling & interlock ⇒ higher chance of errors

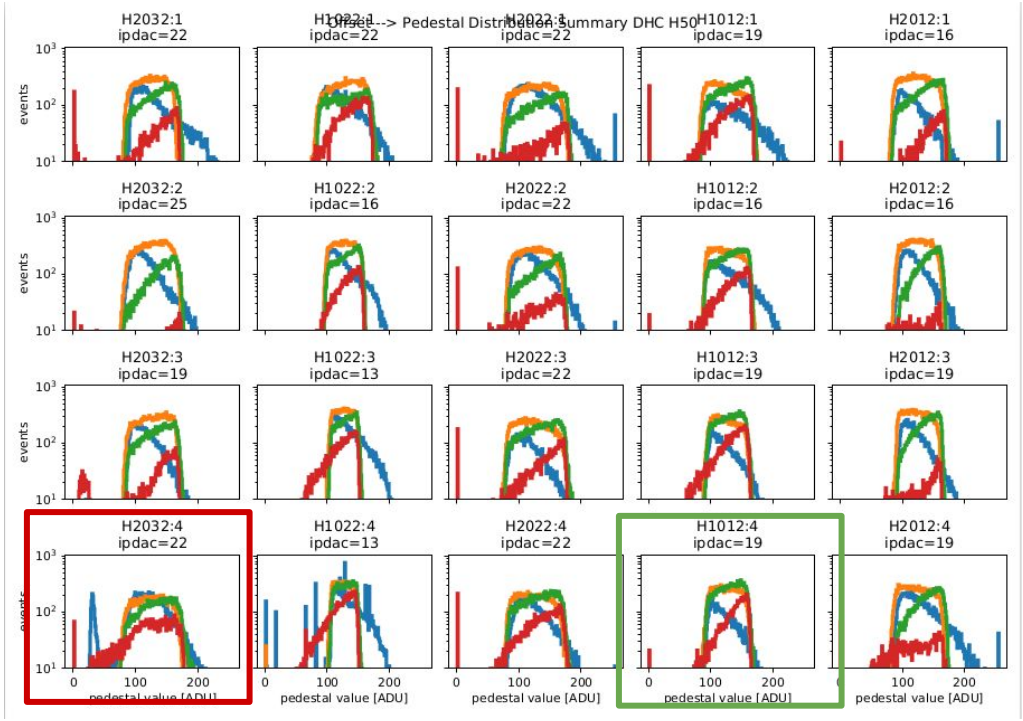
- may have impact on commissioning at KEK
  - less time but still may want reference measurements at final operation conditions
- IMO worth spending time also to gain/retain recalibration flexibility for irradiated modules (ADC scan, offsets, …)

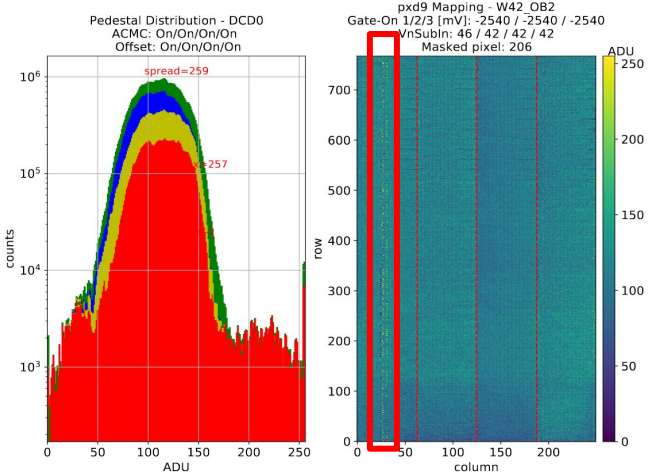


Offset (Re-)calibration

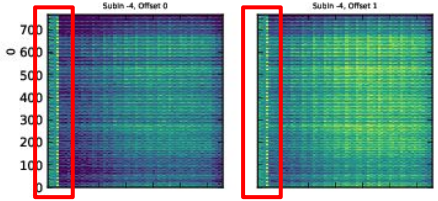


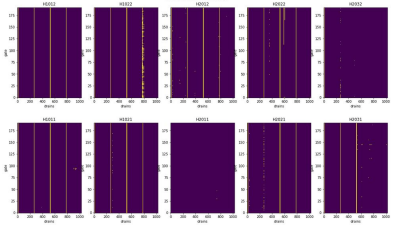
- aim to get good offsets (in particular for “old” modules)
- results mostly good but some bad
  - → algorithm still not handling dead drainlines & problematic offset lines well
  - → something strange w/ disconnected drainlines



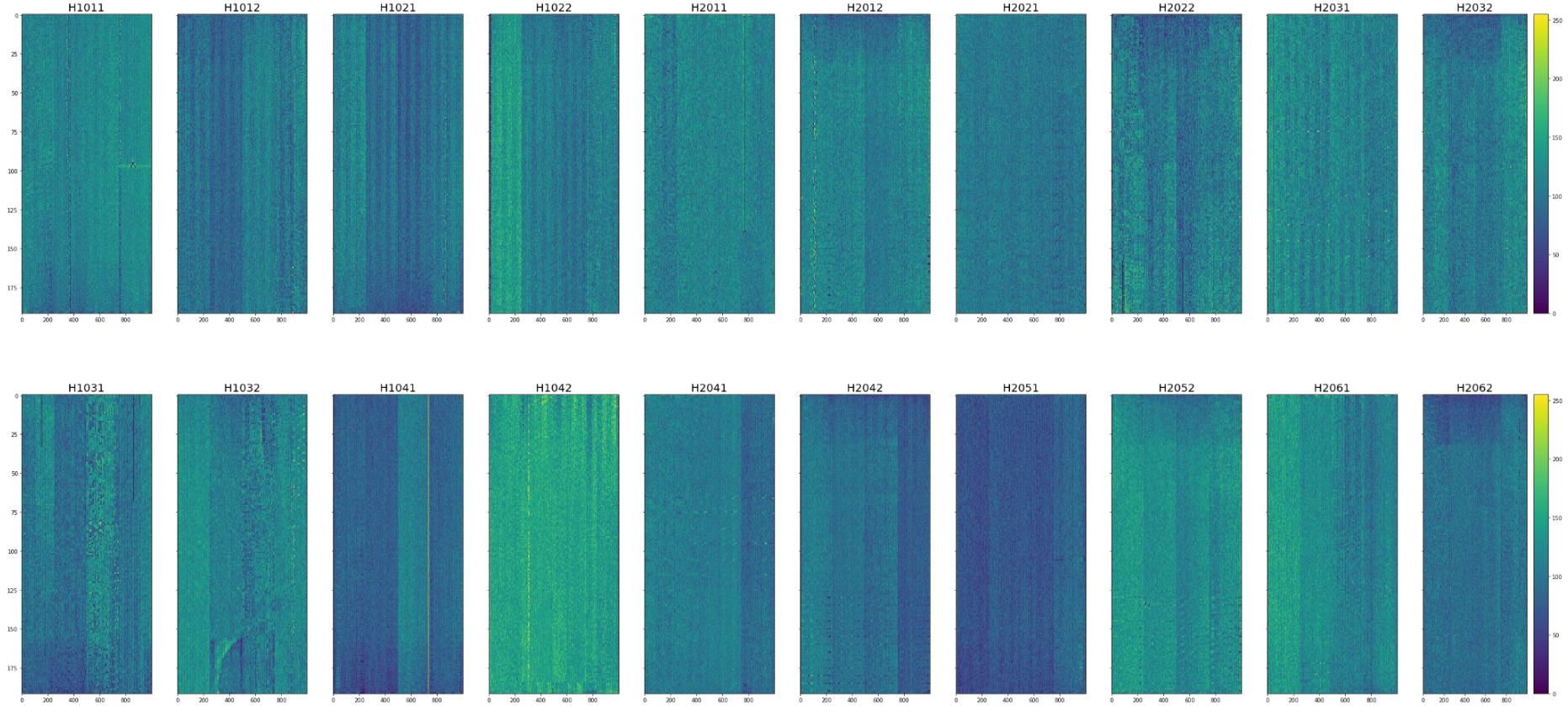


weird constant ADC values

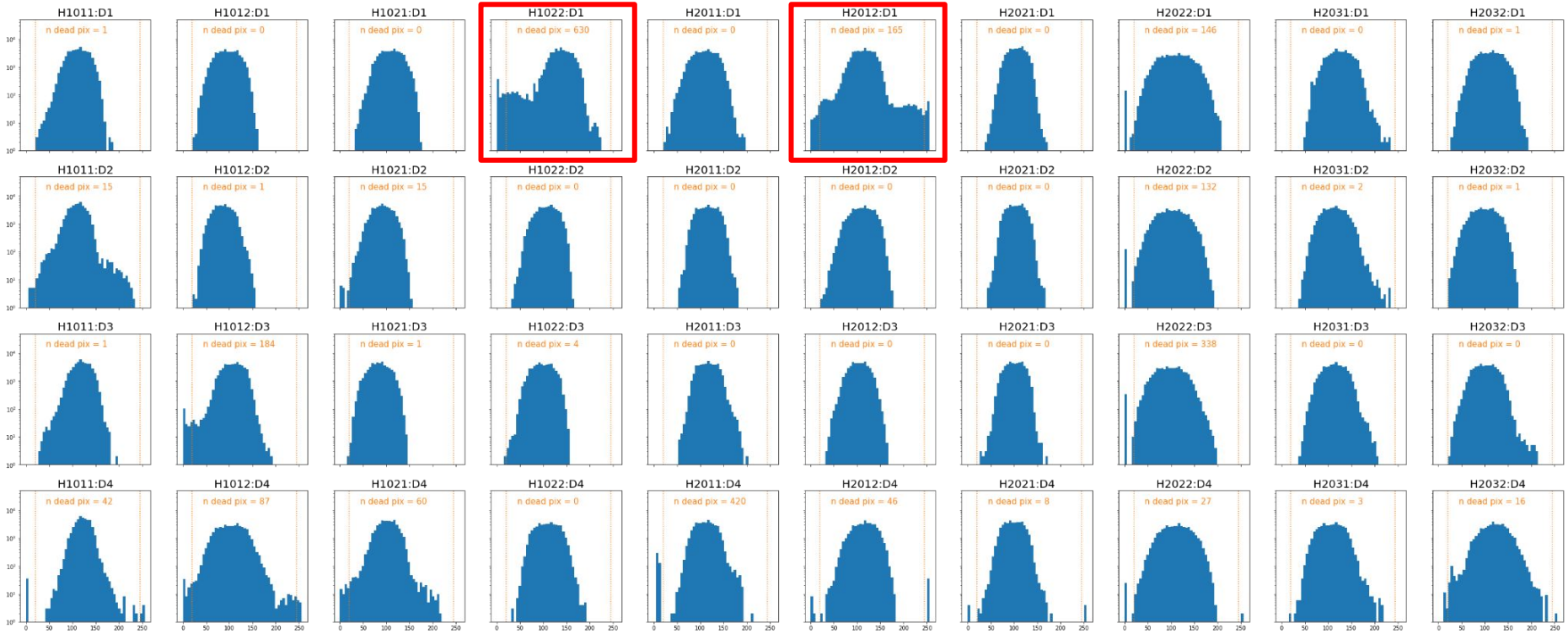




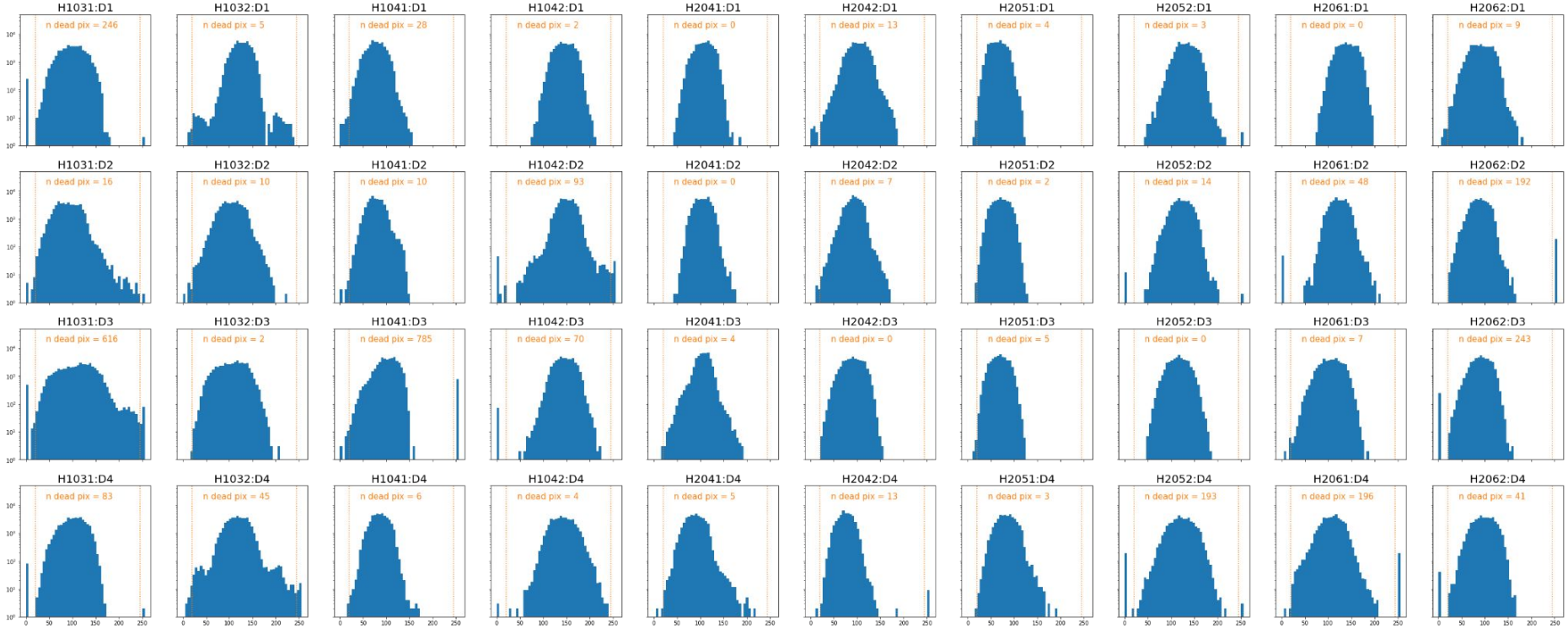
Pedestal Maps



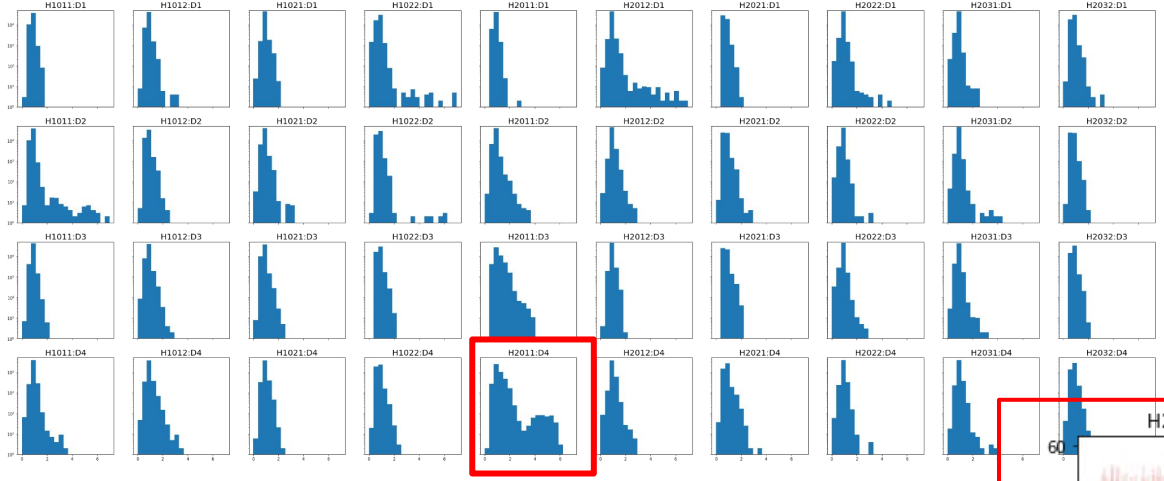
Pedestals Distributions HSa

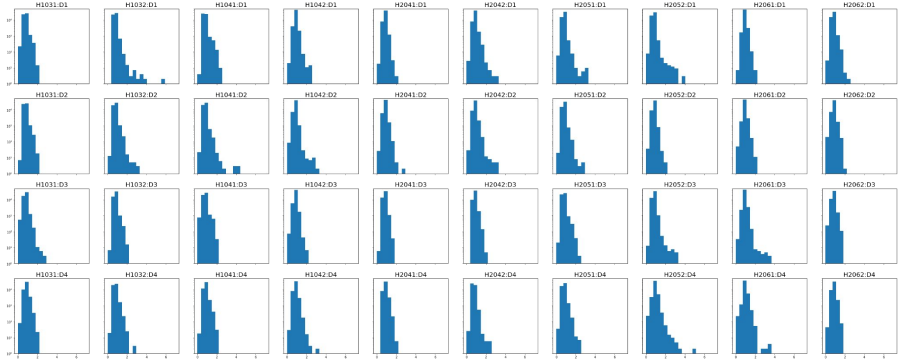


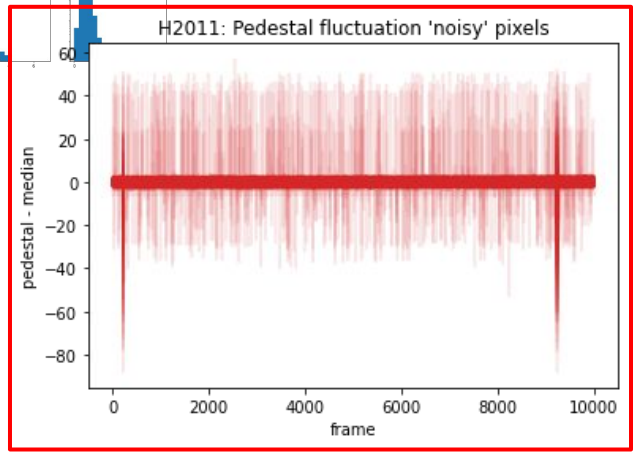
Pedestal Distributions HSb

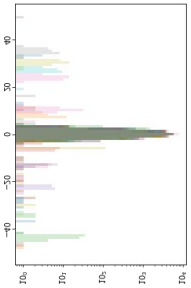


Pedestal Noise



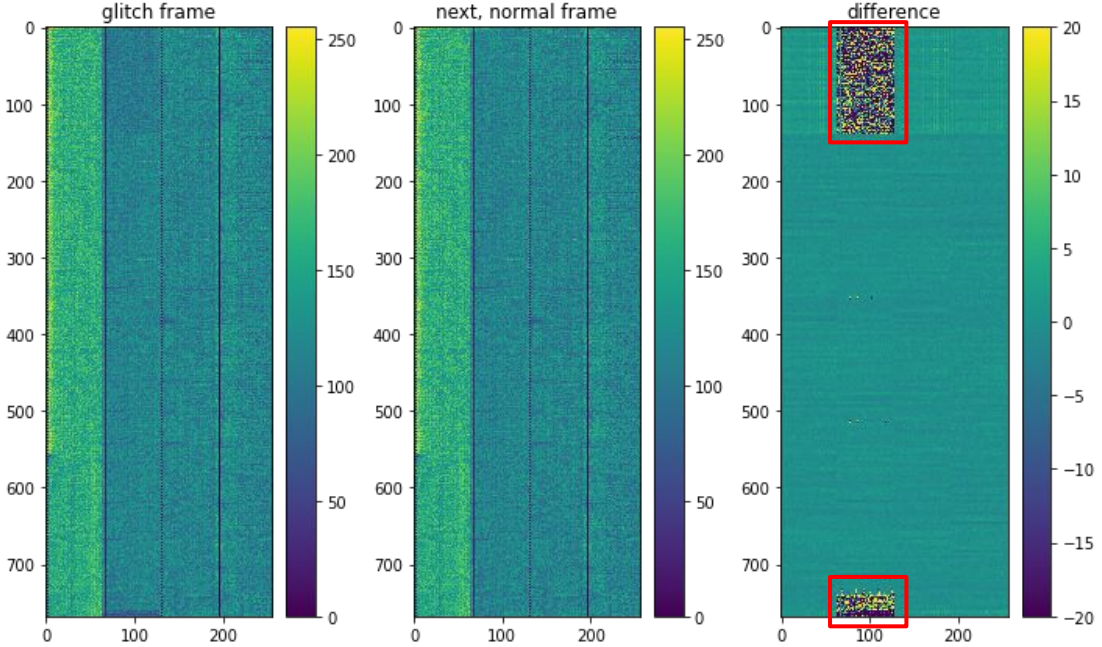




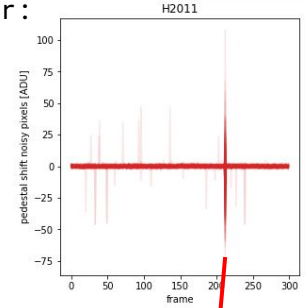


Special Needs Module H2011 / W45_OF1

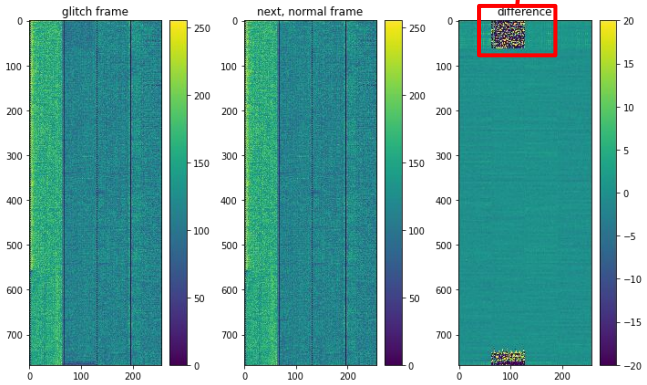
- Shows weird “glitchy” behaviour were pedestals of ASIC-pair 2 shift in some regions for individual gate
- issue not understood, dcd-avdd was particularly low for this module
- issue significantly mitigated by exchange of **DHE/DHI & PSU**
  - module mostly operational, further investigations pending



noise behaviour:
pixel wise and correlated pedestal jumps in both dirs



multiple glitch patterns?

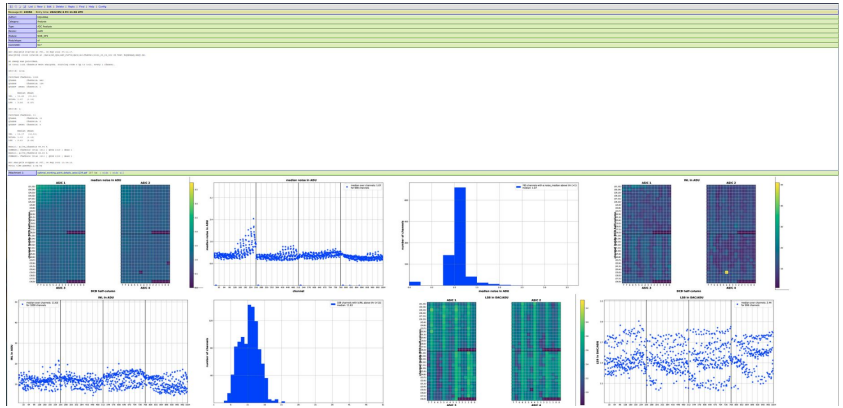


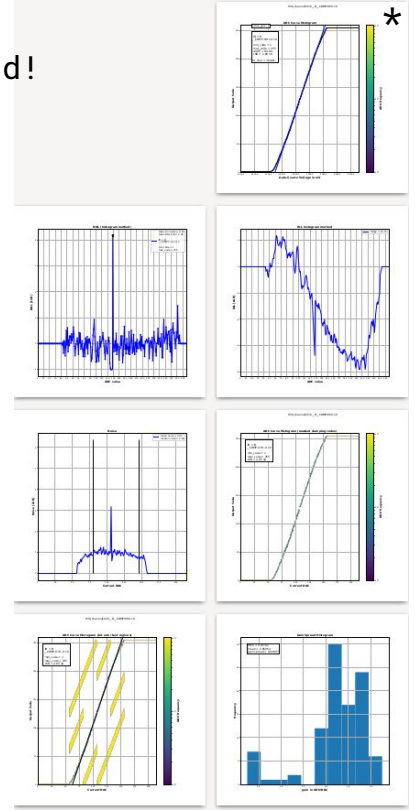
Advanced Calibrations

adc calibration

- might want to repeat as some DESY modules were not correctly characterized!
- possibly also study cross-talk or temperature dependence
- test scripts for KEK to study ageing behaviour
- despite further improvements to code, remains challenging:
  - module preconfiguration, good scan range for all modules
  - data issues (?!) and OVPs!
- so far: only working point measurement for HSa successful :(
  - in principle scripts work for multiple DHCs!

gradeA: 7231 / 10000
gradeB: 2740 / 10000
dead: 29 / 10000



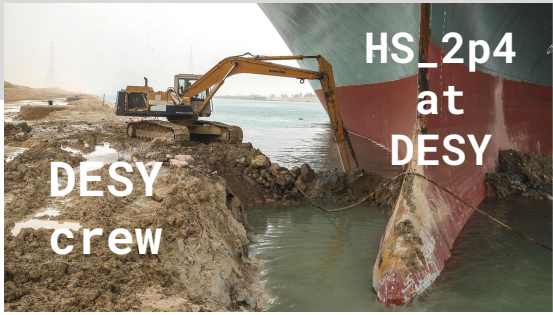


*sorry, Munira, but I gotta prove a point here

further calibrations

- depfet iv → not yet attempted
- source calibration → Anselm's talk

Summary



We're muddling through…

HS Mechanics:
- transport and mounting rather smooth w/ some headroom for 2nd HS

Commissioning:
- Would've wished for fewer problems and a bit more systematic approach
  - hopefully have learned for 2. HS and commissioning at KEK
  - will continue w/ hopefully more person power
  - could hide a bit behind delayed schedule
- Overall HS_2p4 modules seem as healthy as during characterization
  - sole exception H2011 / W45_OF1 which remains a mystery
    (still, as long as 2nd HS not ready, contemplating exchange futile)
- Will continue w/ some basic calibration scans and mostly source measurements
  - hope best starting state of HS and good knowledge of it will pay out in the long run

Source Setup Operation:
- mostly smooth from PXD and cooling perspective
- unfortunately still some misoperations that should be avoided
  (eg power on w/ light in setup → source current limit)
- unfortunately: recent MARCO issue remains to be investigated and fixed
  → issue could not be reproduced w/ engineers today
  → will try continue testing asap