

Module testing at Göttingen

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Overview

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 - Temperatures
 - Radiation Damage
 - DCD Parameter Optimization
 - Source Scans

Mass Testing in Göttingen

- one qualified PXD9 setup running (nearly) non-stop
- water chiller running at 15 – 18 °C
- using vacuum pump and plastic clamp for fixating modules
- temperature monitoring using utilityIOC (DHPT temperatures)
- using Sr90 beta source for source scans

Tested Modules

module	grade	comment
W37_OF1	gradeA	phase2 module
W40_IF	-	guinea pig module
W43_IB	gradeA	batch P3-2
W03_IB	gradeA	batch P3-2
W06_OB1	gradeB	batch P3-4
W08_OB2	gradeA	batch P3-4
W11_OF1	tbd	batch P3-4

- two more OF modules waiting

2nd PXD9 Setup in Göttingen

- setting up a 2nd PXD9 mass testing stand
 - missing items
 - vacuum pump (*ordered, expected this CW*)
 - production LMU-PS (*will be send by Stefan this CW*)
 - guinea pig module for qualifying (*brought by Botho*)
 - protective cover and light shield (*will be ready in time*)
- ETA: qualification within next week, mass testing starting CW 6
- ⇒ speedup will be $< 2\times$ (only one source, only one operator in February), but avoid dead times during changing modules, long scans, etc.

Observed Problems

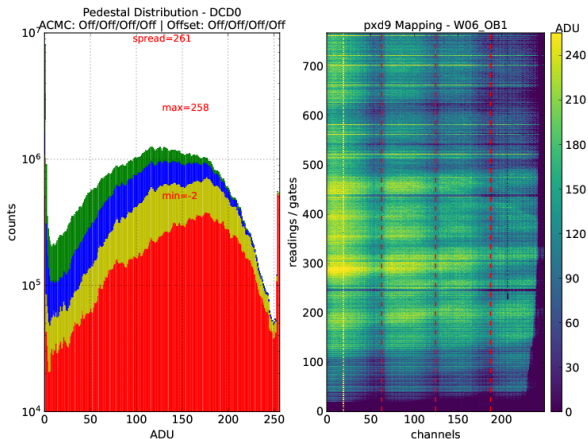
- HS link 4 instable in STANDBY, stable in PEAK
 - true for all modules tested so far
 - independent of module type and PP
 - PP desing issue, or rather back-end electronics related?
 - will cross check Infiniband cable and on 2nd setup
- cooling block congested
 - no water flow, no heat transportation
 - inlet/outlet scaled (*verkalkt*)
 - using regular tap water
 - use distilled water or appropriate coolant

DHPT Temperatures

module	range	Δ_{DHPTs}	comment
W37_OF1	?	?	no vacuum, no utilityIOC
W40_IF	55-60	1-3	no vacuum
W43_IB	45-50	2-4	DHP4 with strange readings
W03_IB	60-70	4-10	
W06_OB1	62-76	2-12	
W08_OB2	62-80	4-18	
W11_OF1	48-59	1-11	

- water chiller running at 15 – 18 °C
- as reported by Leo: absolute values not trustworthy

Radiation Damage



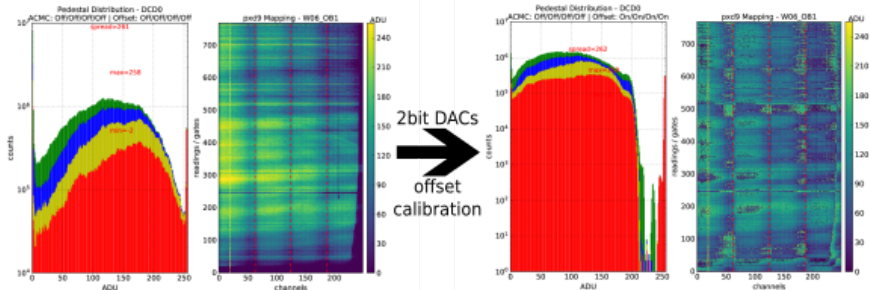
- pedestal inhomogeneity ("pedestal step") along DCDs and Switchers
- severity differs among modules (shown: W06_OB1)

Radiation Damage - Statistic

module	notable radiation damage visible in pedestals
W37_OF1	only light
W40_IF	
W43_IB	only light
W03_IB	only light
W06_OB1	X
W08_OB2	X
W11_OF1	X

- **proposed cause:** γ -irradiation of ASICs for checking bumps
- **result:** offset calibration used for "repair",
no pedestal spread reduction, power of offset calibration wasted

Radiation Damage - Offset Calibration



- give away pedestal compression power of offset calibration for "repairing" radiation damage

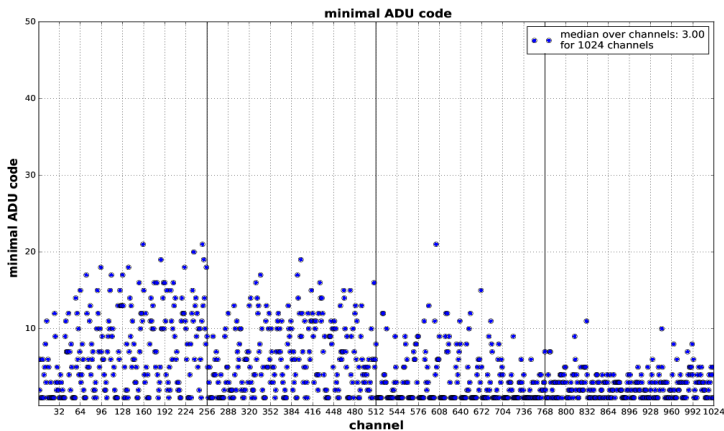
Overview Optimal DCD Settings

module	<i>IPSource</i>	<i>IPSMiddle</i>	<i>IPSource2</i>	<i>IFBPBias</i>	<i>AmpLow [mV]</i>	<i>Refln [mV]</i>	<i># dead channels</i>
W43_IB	75	72	65	80	250	750	(1)
W03_IB	75	72	60-70	65-80	400	725	0
W06_OB1	75	72-78	65	90	300	725	6
W08_OB2	70-75	70-74	60-70	70-80	300	675	(2)
W11_OF1	75	74-76	60-80	75-85	400	725	4

- numbers in (): due to strict cuts on number of detected long codes, still linear, full range curves
- up to 10 dead channels $\Rightarrow$ gradeA (99 % alive pixels)

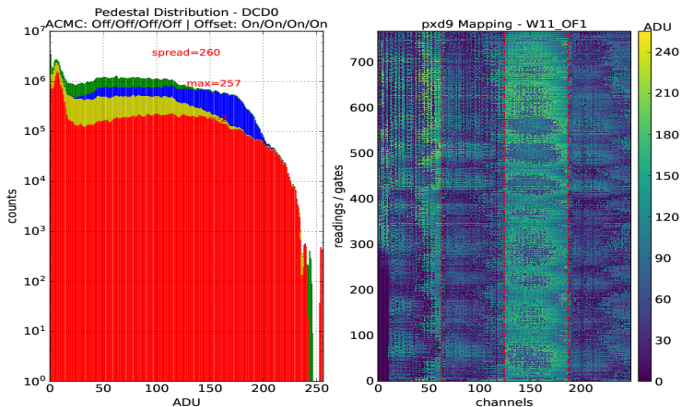
Synchronize ADC code_min and Pedestal Distribution

- DCD ADC optimization does not yield full 255 ADU code range for all channels (shown: W11_OF1)



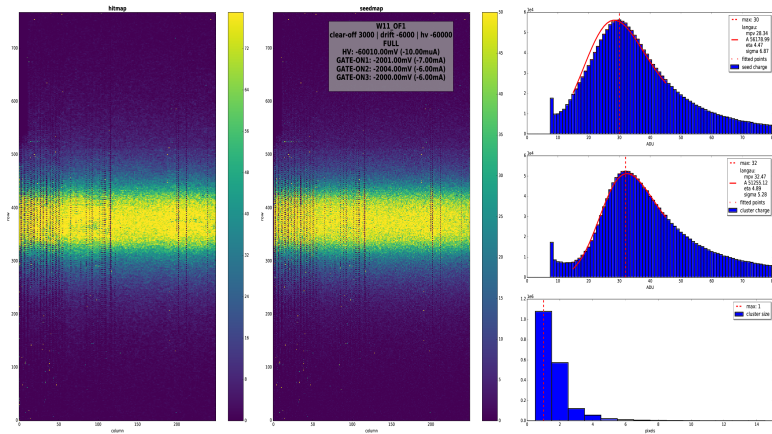
Synchronize ADC code_min and Pedestal Distribution II

- if pedestals are at low ADUs for these channels...



Synchronize ADC code_min and Pedestal Distribution III

- ... corresponding pixels will be dead

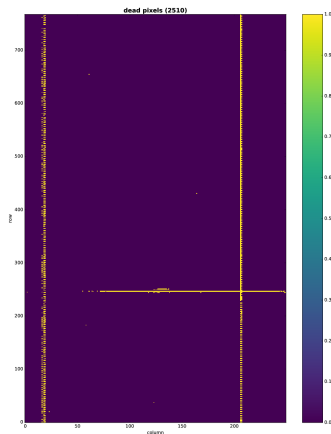


Masked Pixel Statistics

module	# masked pixels	% alive pixels	comment
W43_IB	≤ 2825	≥ 98.53	not fully illuminated broken drains and gate half broken drains
W03_IB	5	99.99	
W06_OB1	2510	98.69	
W08_OB2	697	99.64	
W11_OF1	tbd	tbd	

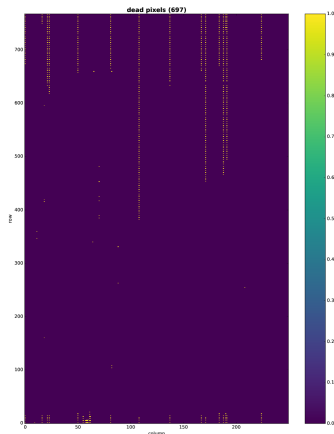
- gradeA: $\geq 99\%$ alive
- gradeB: $\geq 98\%$ alive
- a pixel is masked due to
 - high pedestal noise (> 3 ADU in 1000 frames),
 - high occupancy $> 0.05\%$, or
 - no hits (pixel is dead)

W06_OB1: masked pixels



- 2510 masked pixels on W06_OB1
- $\mathcal{O}(10)$ dead or half-dead drain lines, "hot" drain lines, 1 half dead gate

W08_OB2: masked pixels



- 697 masked pixels on W08_OB2
- $\mathcal{O}(10)$ half-dead drain lines

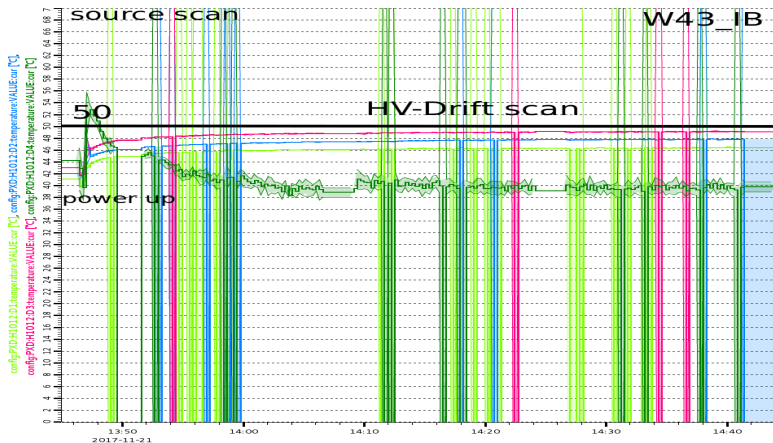
Overview Matrix Voltages

module	<i>HV [V]</i>	<i>drift [V]</i>	<i>clear-off [V]</i>	<i>gate-on [V]</i>
W43_IB	-70	-5	[5]	-2
W03_IB	-70	-5	[5]	-2
W06_OB1	-60	-6	3	-2
W08_OB2	-60	-5	3	-2.5
W11_OF1	-60	-6	3	-2

- not scanned voltage [5]
- optimum found "by eye" $\Leftrightarrow$ no visible rings

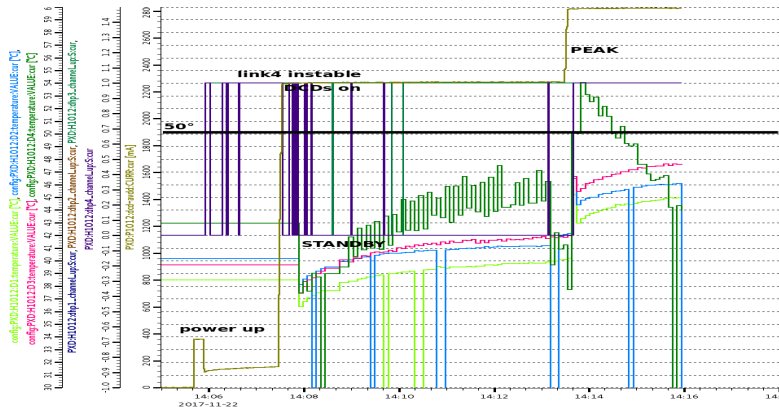
Backup

W43_IB: strange DHP temperature readings



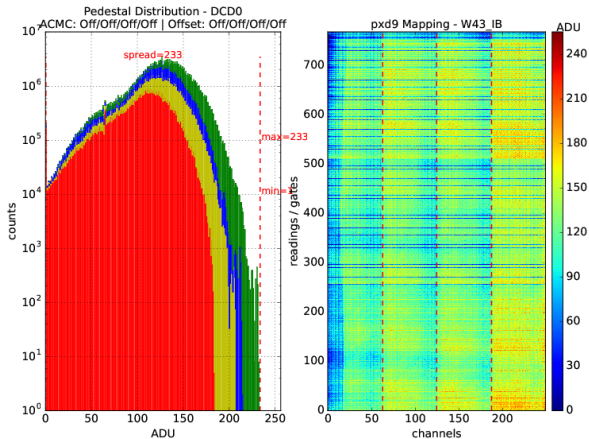
- strange DHP temperature readings on DHP4 on W43_IB

HS link 4 instability in STANDBY



- HS link 4 instable while in STANDBY
- observed on all modules (plot: W43_IB)
- all HS links stable in PEAK

Example of Light Radiation Damage



- light radiation damage, pedestals still in dynamic range (W43_IB)

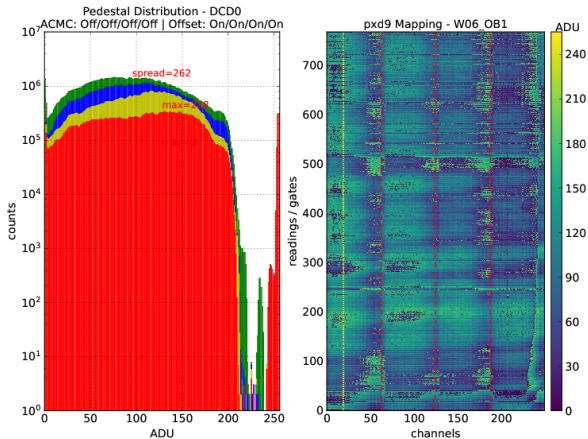
Overview Optimal DCD Settings - Detailed

module	DCD	IP_S	IP_{Sm}	IP_{S2}	$IFBPB$	$AL [mV]$	$RI [mV]$	$\# dc$
W43_IB	1	75	72	65	80	250	750	0
	2	75	72	65	80	250	750	0
	3	75	72	65	80	250	750	0
	4	75	72	65	80	250	750	0
W03_IB	1	75	72	60	75	400	725	0
	2	75	72	60	80	400	725	0
	3	75	72	70	75	400	725	0
	4	75	72	70	65	400	725	0
W06_OB1	1	75	76	65	90	300	725	0
	2	75	72	65	90	300	725	0
	3	75	78	65	90	300	725	0
	4	75	72	65	90	300	725	0

Overview Optimal DCD Settings - Detailed 2

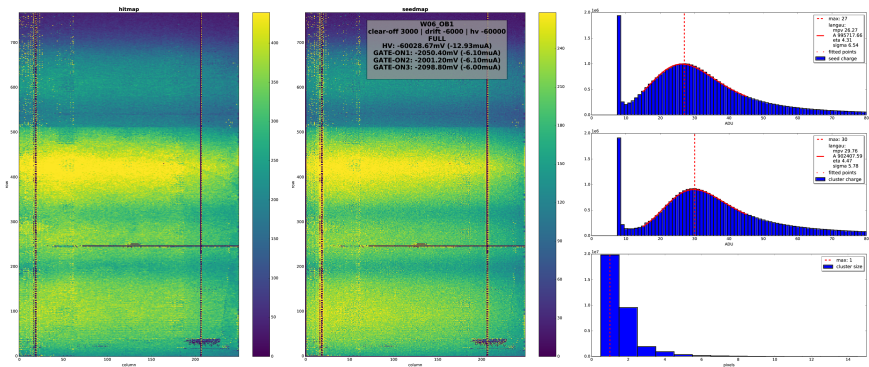
module	DCD	IP_S	IP_{Sm}	IP_{S2}	$IFBPB$	AL [mV]	RI [mV]	# dc
W08_OB2	1	70	72	60	80	300	675	0
	2	70	74	70	80	300	675	0
	3	75	70	65	70	300	675	0
	4	75	70	65	75	300	675	0
W11_OF1	1	75	76	60	85	400	725	0
	2	75	74	60	85	400	725	0
	3	75	76	80	75	400	725	0
	4	75	76	80	75	400	725	0

W06_OB1 - Pedestals

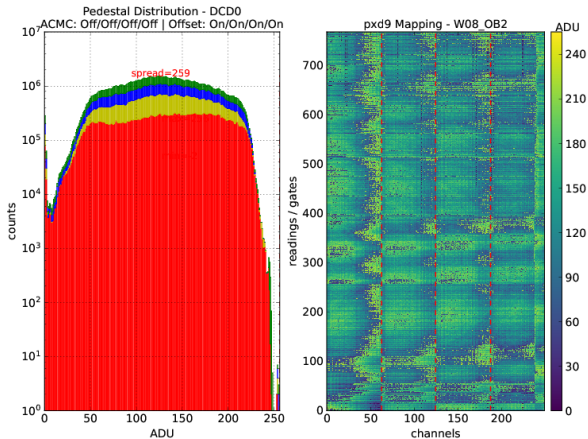


- pedestals with calibrated offsets (including rad. damage)

W06_OB1 - Hitmap

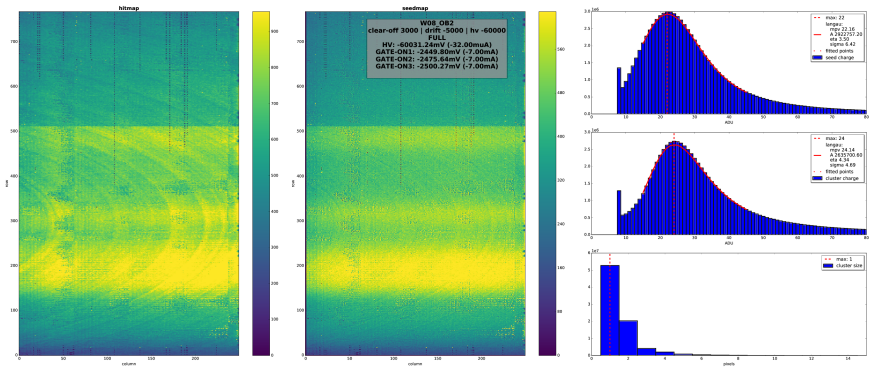


W08_OB2 - Pedestals

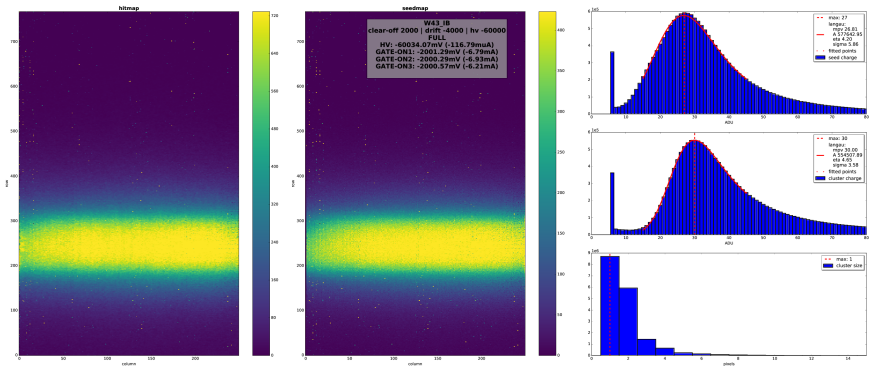


- pedestals with calibrated offsets (including rad. damage)

W08_OB2 - Hitmap



W42_IB - Hitmap



W42_IB - Dead Pixels

