

# Service Test @ DESY

PXD Workshop @ DESY  
08–10 October 2018

*Belle II*

# Service Test at DESY

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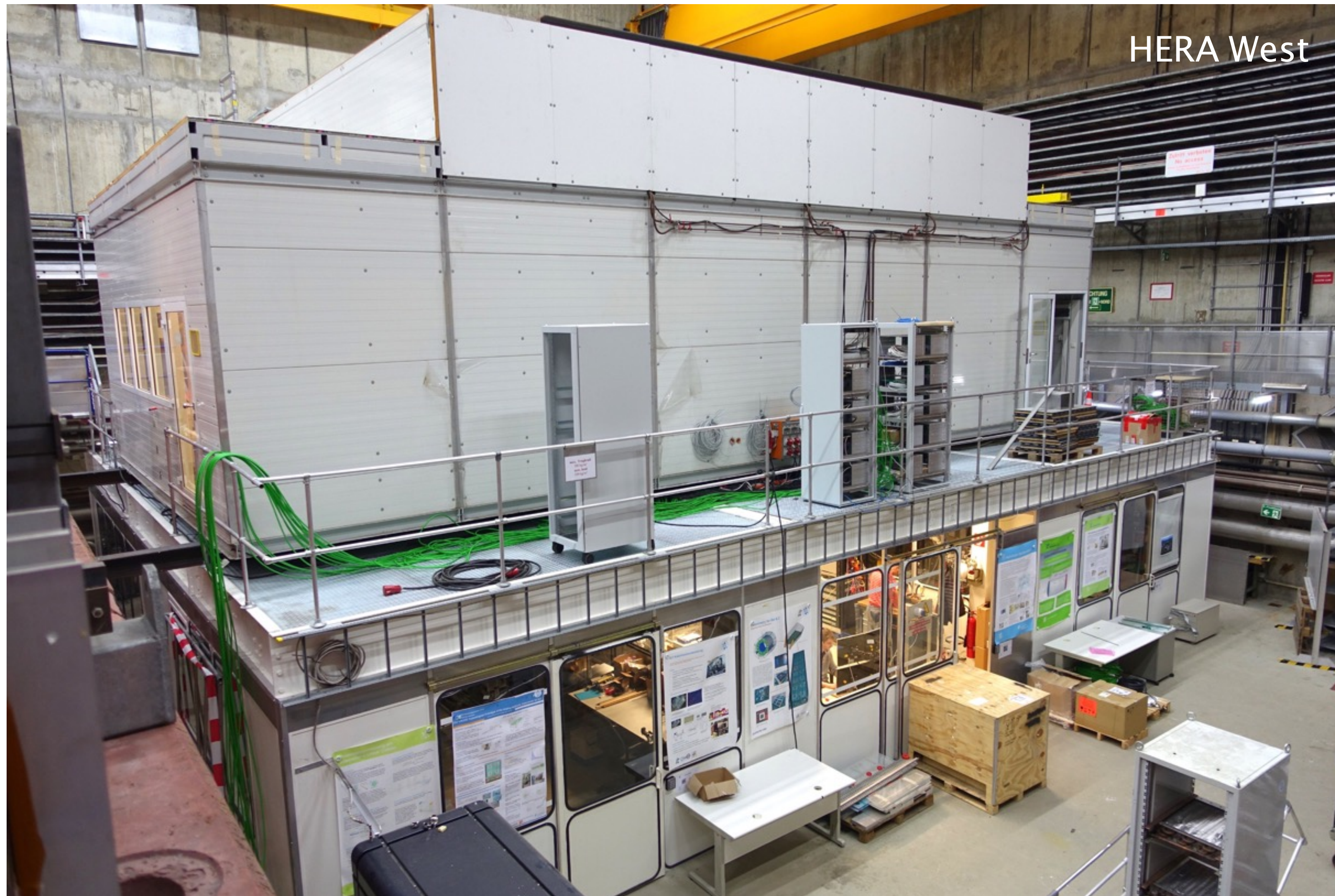
Systematic test of all final service components for PXD before connecting the final detector

Services which come to DESY are supposed to have passed some basic tests at manufacturer

→ First time operation with modules



# Test Setup





# Test Setup

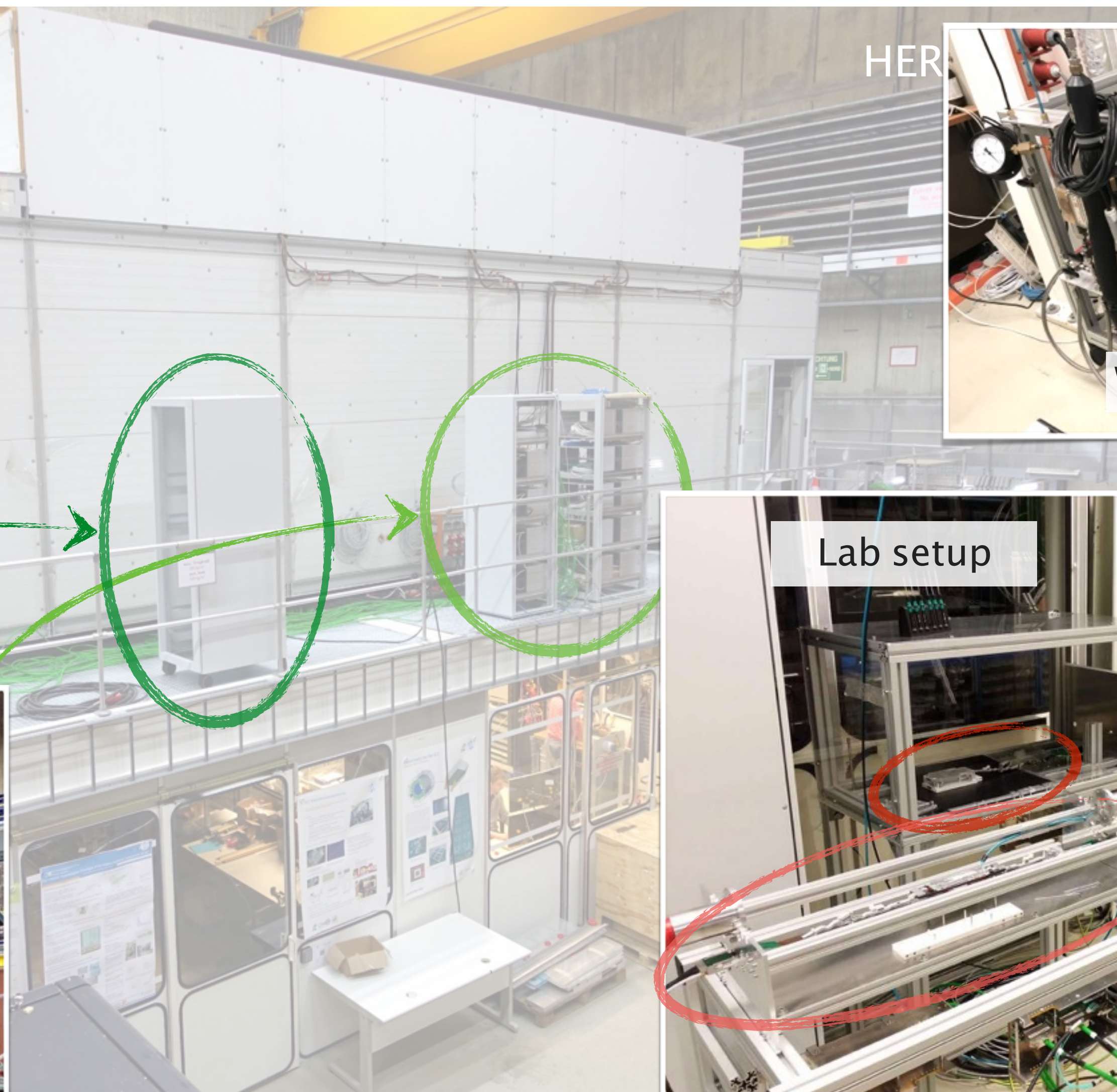
Cleanroom services tested in-situ



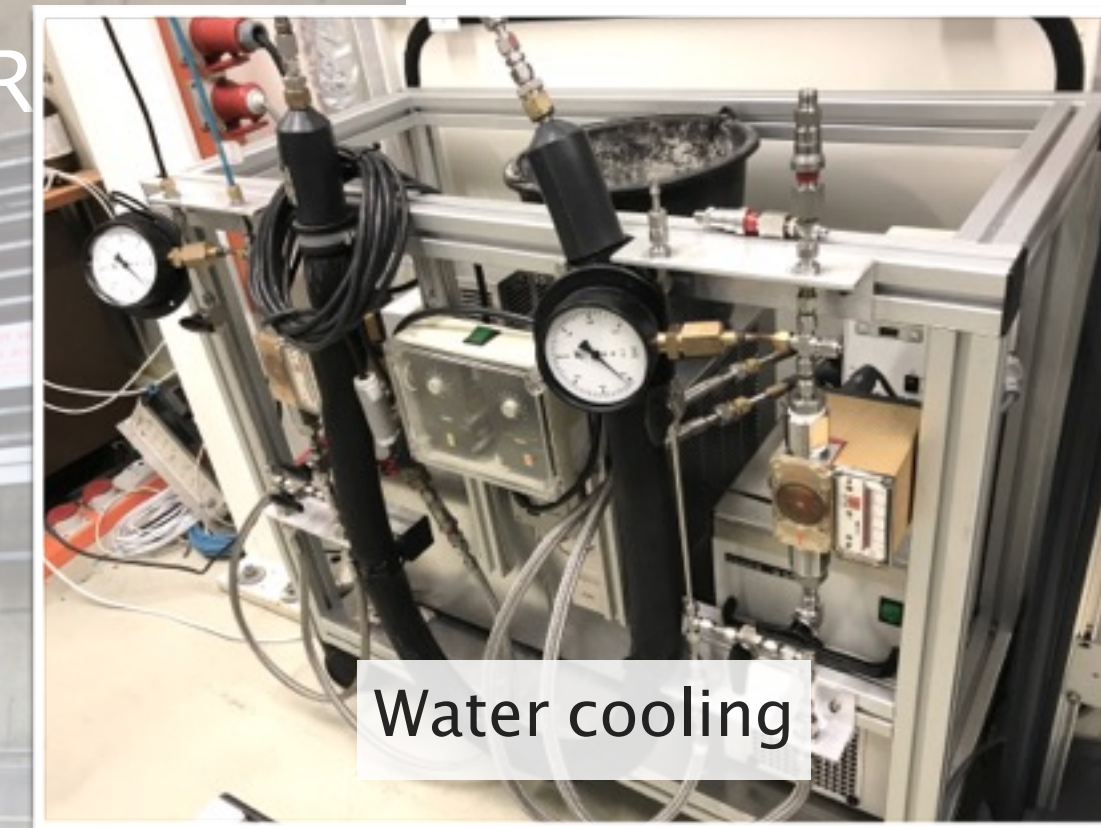
DHH



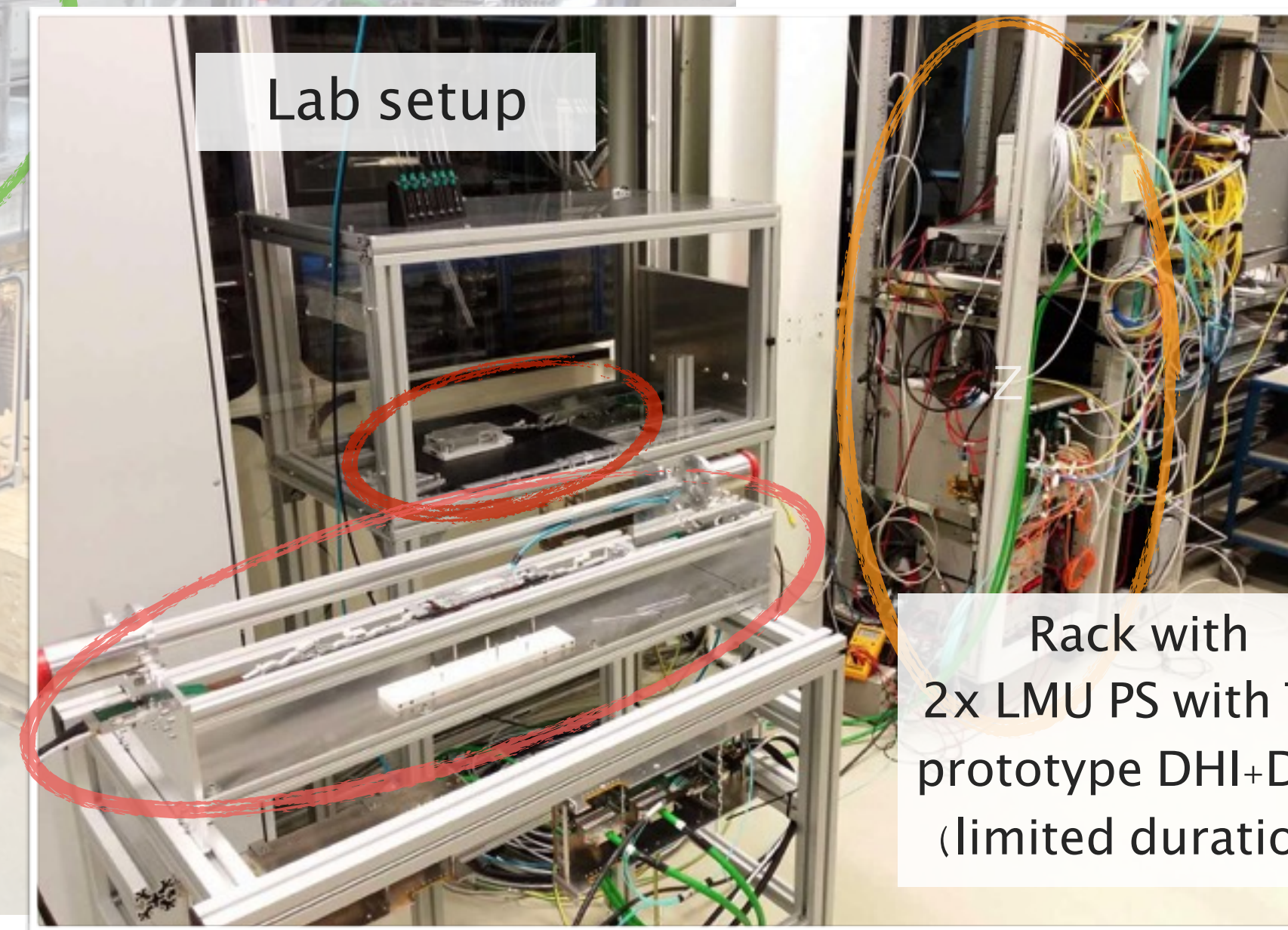
PS Rack



HERA



Water cooling



Lab setup

Rack with  
2x LMU PS with TTI  
prototype DHI+DHE  
(limited duration)



# Test Sequence

Basic module test to see that a service component functions (based on Mass Testing Handbook)

- ▶ Power on DHP's and establish JTAG connections and LINKS
- ▶ Power up to STANDBY & PEAK
- ▶ Monitor temperature and currents
- ▶ Measure Pedestal (not always)

**PXD:H2012** ☐ Use Config-Server Config Busy: ☒ Status: ☒ reset Finished temp measurement on DHPs [1, 2]

☒ DHP Channel Up  
☒ DHP Voltage ON  
☒ DHP PLL locked  
☒ DHC Channel Up  
☒ DHC PLL locked  
☒ GTX Synchronized

**DHP temps:** Manual Update  
66 °C 63 °C 60 °C 58 °C  
Auto Update Status: ☒  
Crit. Temp.: 85

**TLU Settings**  
Max bits: 33  
TS2TUDEL: 0  
TS2TADEL: 0  
Clock slow down factor: 5  
Use BUSY from script: ☐

**Statistics**  
DHP data counter: 589888.0  
DHP frame counter: 13  
DHP data rate: 0 Bps  
Trigger counter: 3  
Trigger rate: 0  
Missing triggers: 0  
Missing trigger rate: 0  
DHC data counter: 1180176.0  
DHC frame counter: 19  
DHC data rate: 0 Bps

**DHP Trigger Settings**  
Trigger width: 1529  
Trigger delay: 0  
FCK Length: 1536  
Timeout: 2000  
FCK strobe width: 1  
Invert Trigger: ☐

**Other settings**  
RXEQMIX: 3  
TCK Divider: 50  
use DHPT interface: ☒  
memory Dump: ☒  
Veto: ☒  
Read DHPT Frames: 0  
Batch read:

**ASIC settings**  
DHP1 Settings DCD1 Settings HS: ☒ disable SWITCHER1 Settings  
DHP2 Settings DCD2 Settings HS: ☒ disable SWITCHER2 Settings  
DHP3 Settings DCD3 Settings HS: ☒ disable SWITCHER3 Settings  
DHP4 Settings DCD4 Settings HS: ☒ disable SWITCHER4 Settings  
SWITCHER5 Settings

**Buttons:** Kill Driver Run Driver Kill Framereceiver Short RST Configure DHE Configure ASICS Reinitialize JTAG chain Long RST Chain initialized half/full rate Highspeed: p1p3 DHE ID: 35 Commit ID: 190 Select... Remapping: ☐ Automatic Startup Request DHE State: PEAK DHE Actual State: PEAK Entered State: PEAK. ☐ Skip DHP link check ☐ Skip pedestal upload ☐ Skip offset upload

**PXD PS Channel Overview Unit P2012** ☒ ENABLE ☐ DISABLE  Current State: **PEAK** Unit ID: 73

	min.	Set Current	max.	min.	Set Voltage	max.	Reg.	Voltage at Regulator	Voltage at Load	Current	
sw-sub	0 mA	50 mA	50 mA	-7100 mV	-7000 mV	0 mV	<input checked="" type="checkbox"/>	-7057 mV	-7004 mV	-10 mA	sw-sub
sw-dvdd	0 mA	30 mA	30 mA	0 mV	1800 mV	2000 mV	<input checked="" type="checkbox"/>	3164 mV	1800 mV	22 mA	sw-dvdd
sw-refin	0 mA	30 mA	30 mA	-7100 mV	-5200 mV	0 mV	<input checked="" type="checkbox"/>	-5223 mV	-5195 mV	0 mA	sw-refin
dcd-amplow	0 mA	1300 mA	1400 mA	0 mV	350 mV	500 mV	<input checked="" type="checkbox"/>	373 mV	325 mV	-1227 mA	dcd-amplow
dcd-avdd	0 mA	3000 mA	3000 mA	0 mV	1800 mV	2000 mV	<input checked="" type="checkbox"/>	5147 mV	1799 mV	2818 mA	dcd-avdd
dcd-dvdd	0 mA	940 mA	1000 mA	0 mV	1800 mV	2000 mV	<input checked="" type="checkbox"/>	3856 mV	1801 mV	842 mA	dcd-dvdd
dcd-refin	0 mA	1000 mA	1000 mA	0 mV	725 mV	1300 mV	<input checked="" type="checkbox"/>	2525 mV	725 mV	238 mA	dcd-refin
dhp-core	0 mA	730 mA	800 mA	0 mV	1200 mV	1640 mV	<input checked="" type="checkbox"/>	3343 mV	1200 mV	675 mA	dhp-core
dhp-io	0 mA	550 mA	550 mA	0 mV	1800 mV	2000 mV	<input checked="" type="checkbox"/>	3651 mV	1802 mV	273 mA	dhp-io
bulk	0 mA	10 mA	10 mA	0 mV	10000 mV	10000 mV	<input checked="" type="checkbox"/>	10006 mV	10009 mV	0 mA	bulk
clear-on	0 mA	30 mA	70 mA	0 mV	19000 mV	22000 mV	<input checked="" type="checkbox"/>	19117 mV	19009 mV	26 mA	clear-on
clear-off	0 mA	30 mA	40 mA	0 mV	4000 mV	20000 mV	<input checked="" type="checkbox"/>	3877 mV	4002 mV	-21 mA	clear-off
gate-on1	0 mA	15 mA	30 mA	-4000 mV	-2030 mV	5000 mV	<input checked="" type="checkbox"/>	-2090 mV	-2042 mV	-6 mA	gate-on1
gate-on2	0 mA	15 mA	30 mA	-4000 mV	-2000 mV	5000 mV	<input checked="" type="checkbox"/>	-2082 mV	-2004 mV	-6 mA	gate-on2
gate-on3	0 mA	15 mA	30 mA	-4000 mV	-2000 mV	5000 mV	<input checked="" type="checkbox"/>	-2081 mV	-2000 mV	-6 mA	gate-on3
gate-off	0 mA	30 mA	30 mA	0 mV	5000 mV	6000 mV	<input checked="" type="checkbox"/>	5150 mV	5001 mV	26 mA	gate-off
source	0 mA	120 mA	150 mA	0 mV	6000 mV	7000 mV	<input checked="" type="checkbox"/>	7316 mV	6000 mV	66 mA	source
cog1	0 mA	10 mA	10 mA	-5000 mV	0 mV	0 mV	<input checked="" type="checkbox"/>	1 mV	5 mV	0 mA	cog1
cog2	0 mA	10 mA	10 mA	-5000 mV	0 mV	0 mV	<input checked="" type="checkbox"/>	2 mV	0 mV	0 mA	cog2
cog3	0 mA	10 mA	10 mA	-5000 mV	0 mV	0 mV	<input checked="" type="checkbox"/>	3 mV	0 mV	0 mA	cog3
hv	0 uA	300 uA	10000 uA	-80000 mV	-60000 mV	0 mV	<input checked="" type="checkbox"/>	-65952 mV	-65999 mV	-101 uA	hv
drift	0 mA	10 mA	10 mA	-6000 mV	-3000 mV	0 mV	<input checked="" type="checkbox"/>	-3004 mV	-2995 mV	0 mA	drift
polycover	0 mA	0 mA	10 mA	0 mV	0 mV	0 mV	<input checked="" type="checkbox"/>	7 mV	8 mV	0 mA	polycover
guard	0 mA	10 mA	30 mA	-6000 mV	-5000 mV	0 mV	<input checked="" type="checkbox"/>	-5002 mV	-5005 mV	0 mA	guard

# Services from Final Production Tested @ DESY (1st batch)

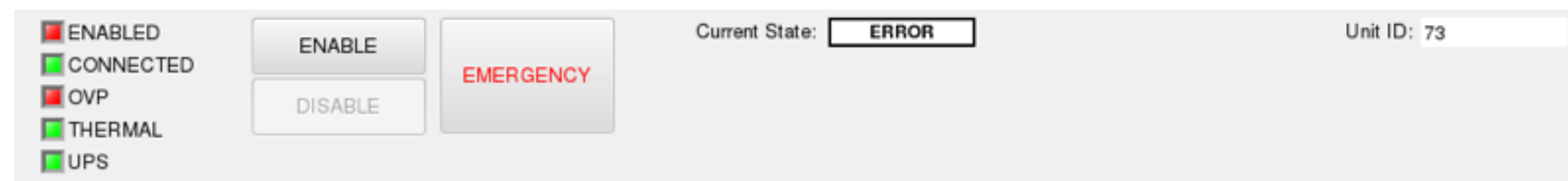
	total	tested	failed	min. requirement
Patch Panel	11xIF, 13xIB, 6xOF, 7xOB	5xIF, 13xIB, 2xOF, 7xOB	1xOF, 2xOB	pedestal
PCB	35	35	0	pedestal
LMU PS	35	35	0 (but some issues)	PEAK
PS cable	76	76	0	PEAK
Camera Link	58	55 (3 with issues)	0	LINKS
Optical Fibre [*]	16x8-pin, 17x12-pin	~5 x 8-pin ~5 x 12-pin	0	-

[\*] not all optical fibres were tested – considered quality trusted and harmless even if they fail

# Issues (?) with LMU PS, Dockbox PCB, Camera Links

## LMU PS: OVP issue ? (PS #73) – now at KEK

- ▶ OVP is triggered when powered  
(lab setup with TTI, firmware as of April, other PS were fine)
- ▶ Taken to LMU but issue not confirmed, and returned as is
- ▶ Worked fine with TDK Lambda primary PS (+ updated firmware)



## LMU PS: HV issue ? (PS #64) – now used at DESY

- ▶ HV showed high voltage & current at STANDBY
- ▶ Not reproducible, happened ~3 times out of many tries
- ▶ Similar behaviour observed once (?) with another PS  
→ resolved by restarting power up sequence IOC

normal  
abnormal

	-227 mV	-225 mV	-24 uA	hv
	-77925 mV	-78904 mV	-2109 uA	hv

## Dockbox PCB: floating voltages observed at KEK (2x PCB's, but not sure which ones)

- ▶ Worked fine with modules at DESY
- ▶ Similar voltage test was \_\_not\_\_ carried out at DESY
- ▶ Is this a real issue? Should it be always checked?
- ▶ **NEW INFO: one PCB was actually fine**

## Camera Link cables with “physical” issues

- ▶ One bent screw on the connector
- ▶ 2 cables with inconsistent labels on cable and connectors which side should be “Camera” and “Frame Grabber”
- ▶ No repair / further investigation as we had enough cables





# Issues with Patch Panels

## Problematic (?) patch panels & broken (?) modules (L2-FWD-12, L2-BWD-05, L2-BWD-08)

- ▶ Test modules (L2 ladder) showed abnormal behaviour when connected with these PP's
- ▶ Similar thing observed with two L2-BWD PP's and also with one L2-FWD PP → stopped testing with this ladder (more next slide)
- ▶ Three PP's sent to MPP (08.10), L2-FWD-12 now at KEK (09.05)
- ▶ Issues not fully understood
- ▶ **NEW INFO: the L2 ladder was known to be faulty, probably no problem with PP's**

## Lost JTAG connection (L1-FWD-10)

- ▶ Passed service test (May), used with 1st half-shell (June), but no JTAG at first attempt with 2nd half-shell (July)
- ▶ After swapping to another PP everything worked fine
- ▶ No further investigation done at DESY, and PP was returned to MPP (07.24)
  - apparently this was known with an earlier test but was not detected with later tests
- ▶ Now at KEK since Oct 2nd



# Test Modules

L1\_014 (W01\_IB, W45\_IF): March – June 2018 @DESY, now part of HS1p3

- ▶ First one to be used for service test, used to test cleanroom setup

L2\_024 (W44\_OB1, W12\_OF1): April – Aug 2018 @DESY, now at MPP, status unknown

- ▶ Last operation of OF in 29 March 2018 after ladder etching, OB in 12 March 2018 before ladder assembly
- ▶ OB showed abnormal behaviour (sw\_sub, sw\_refin, clear\_off) and OVP triggered while testing new Patch Panels, OF similar
- ▶ Sent to MPP, OB used for patch panel testing
- ▶ **NEW INFO: both modules were known to be faulty, observation at DESY was nothing new**

W05\_OB1: June – currently @DESY, going to Bonn for irradiation study

- ▶ Used frequently for service test & study of GM operation

W43\_IF: June (?) – currently @DESY, not operational

- ▶ Last confirmed working in May 2018 after a repair (see e-log & talk from Christian Koffmane)
- ▶ Problem from the first power-up @DESY: losing links and JTAG connection, often before reaching STANDBY
- ▶ After few tries, higher temperature observed (~60 C with DHP's on, ~85 C before losing JTAG towards STANDBY)
- ▶ Still at DESY, consult with Christian Koffmane today/tomorrow



# Summary

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A large fraction of services from final production tested at DESY

Few issues encountered – some of them are still not understood

Improvement for the future?

Next batch is partially here

- ▶ PS cables (80)
- ▶ Camera links (30 ? tbc)
- ▶ PCBs (7) for DAQ test setup