

PXD2 installation at KEK

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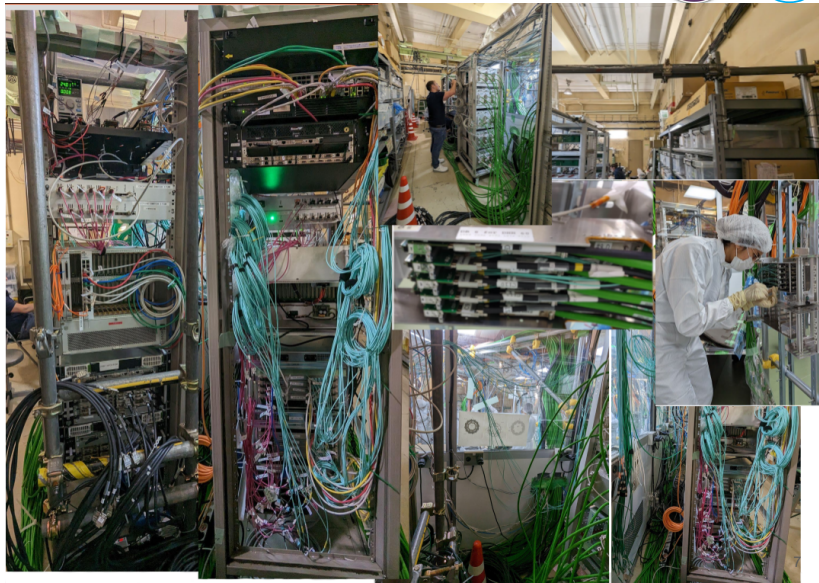


HELMHOLTZ

A lot of service work...

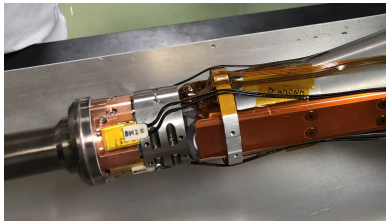
- DHH
- Power supplies
- Dock boxes
- Interlock system
- Environment monitoring
- Earthquake protection
- ...

→ Covered by other talks



Inspection of mounting blocks

- Installation of alignment bins
- Clearance check in critical regions
→ Problems with Diamond cables



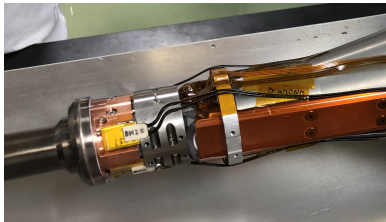
Preparation of PXD2 isolation to BP

- Kapton foil for isolation
- Holes for alignment bins and screws



Inspection of mounting blocks

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- Clearance check in critical regions
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Preparation of PXD2 isolation to BP

- Kapton foil for isolation
- Holes for alignment bins and screws

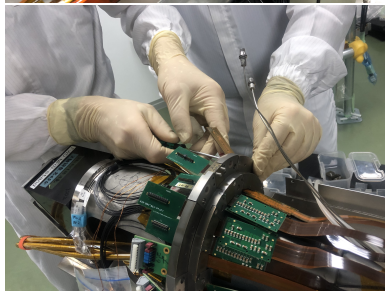
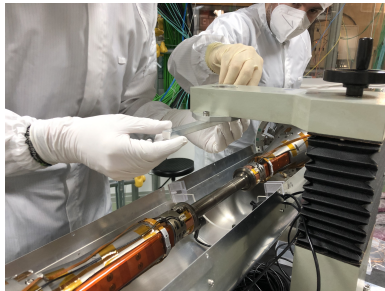


Preparation of mounting crane

- Adjustment with alignment bar

Dummy HS installation

- Test procedure
- Check Clearance
- Test isolation between HS and BP
- Test installation of heavy metal pieces (HMP) at end flange

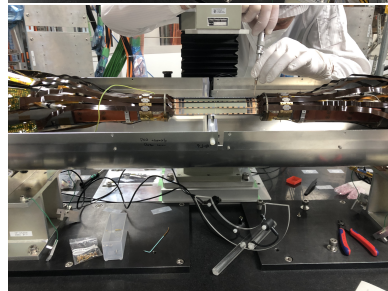
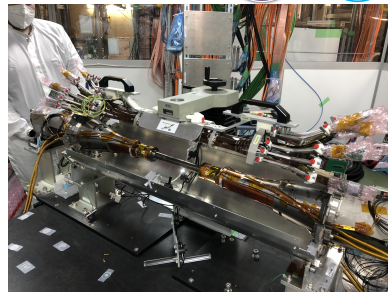
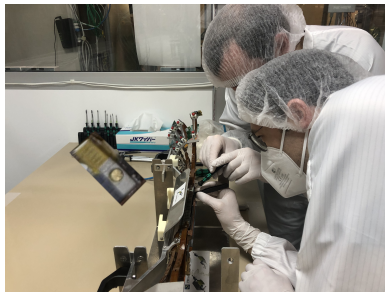


Preparation of HS

- Careful inspection of HS
- Replacement of grounding clamps
- Adjustment of screw torques (FWD: 10mNm BWD: 15mNm)
- Routing of grounding cable

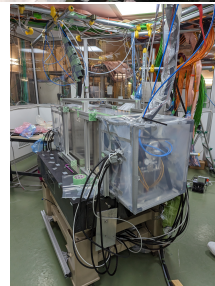
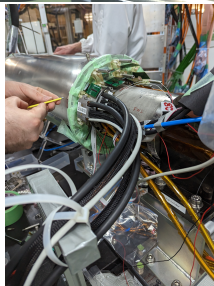
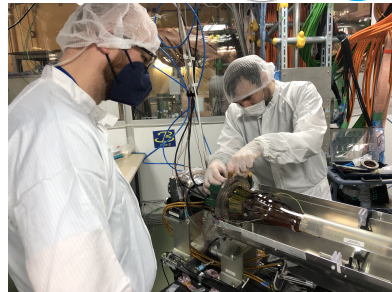
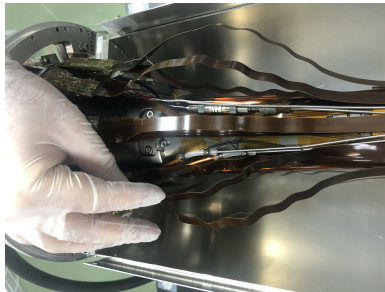
Installation of HS

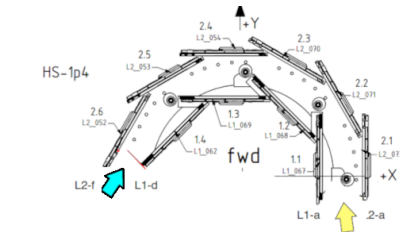
- Mounting of HS via crane
- Fixation of HS on BP with modified screws
→ Screws are isolated from HS



Connect HS to service and install sensors

- Connection of CO₂ and N₂ pipes
- Installation of heavy metal pieces
- Installation of Patch Panel (PP) fixation ring
- Connection of PP of edge ladders
- Installation of NTC and SHT sensors
- Setup of inner/outer dry volume





PXD2 Commissioning: Dry Volume

- [illegible]

Cooling

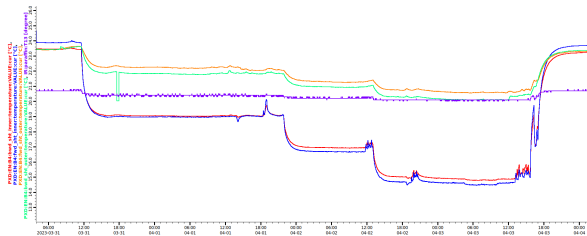
- RT \rightarrow 0°C \rightarrow -10°C \rightarrow -20°C \rightarrow RT
- Outer dry volume: decreased by $\approx 2.5^\circ\text{C}$
- Inner dry volume: decreased by $\approx 9^\circ\text{C}$
- Beampipe: decreased by $\approx 0.5^\circ\text{C}$

Module powering

- First single modules (FWD \rightarrow BWD)
- Power full Ladder, Power all four ladders

General observations

- No (tiny) bending observed during cool-down and warm-up of IBBelle ($< 20\mu\text{m}$)
- Small shift of ladders observed during cool-down/warm-up and when powering for longer time multiple modules ($< 110\mu\text{m}$)
- Shift is against initial bending direction for L1(2)-d ladders
 \rightarrow Strong hints that camera systems moves
- In general small bending during powering
 \rightarrow Most "extreme" case shown in the tables



Status	(μm)		
	L1-a	L2-a	tube
Off	0	0	0
PEAK	33	43	0
Long PEAK	88	109	60
Status	(μm)		
	L1-d	L2-f	tube
Off	0	0	0
PEAK	-1	-26	0
Long PEAK	43	17	45

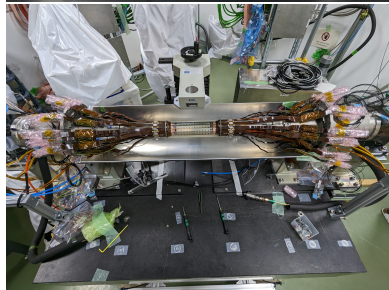
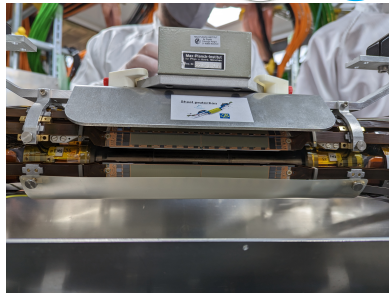
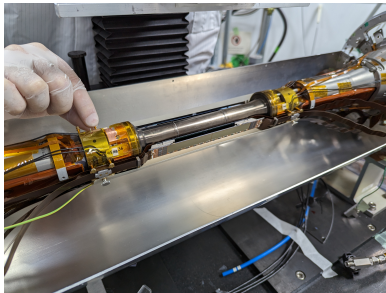
Preparation and installation of second hot HS



Preparation of HS
Installation of HS

- Edge ladders of both HS overlap

Connection of HS to cooling

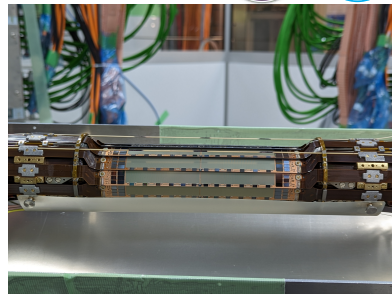
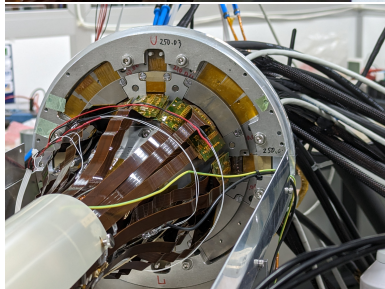


Installation of FOS fibers on one HS

- Removal of grounding ring and strain release clamps
- Installation of fibers with modified strain release clamps
- Installation of grounding ring

PP connections

- Installation of outer HMP
- Installation of PP fixation ring
- Installation of PP and tighten screws of HMP
 - ▶ From -Y to +Y
 - ▶ First L2 than L1
- Installation of inner HMP



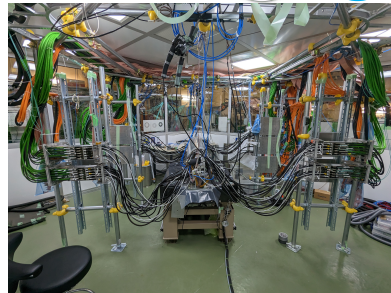
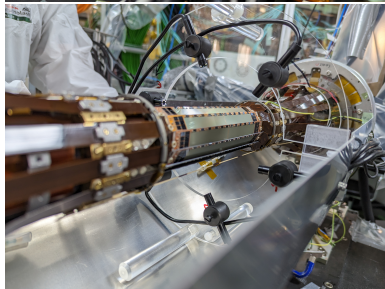
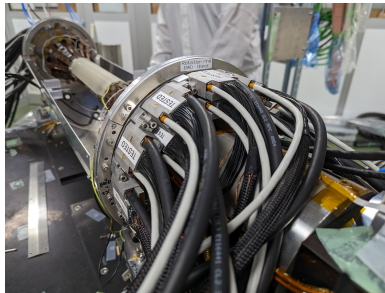
Installation of sensors

- NTC sensors for both HS

Installation of camera ring

- Observation of all L2 ladders
- No observation of L1

Setup of inner/outer dry volume



Three days of cooling run at -20C

- Power each ladder individually
- Power full FWD/BWD
- Power full PXD2

Goals

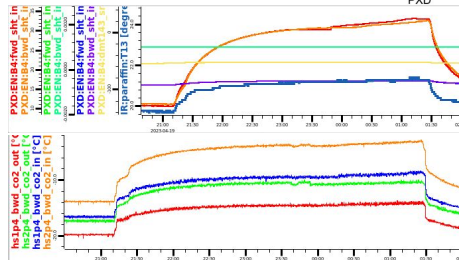
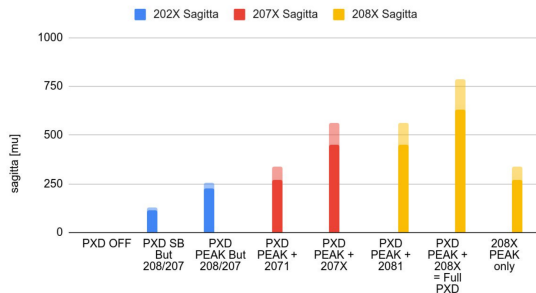
- Check of elec. behavior of modules
- Observation of ladder bending
- Observation of temperature behavior

Observation

- Some problems with service (power supplies)
- Strong bending for 208x and 207x
- Visible bending for 202x
- No significant bending for other ladders
- Temperature of BP rather stable
- Air temperatures strongly increasing

→ Goals reduce bending and temperatures

PXD2: Significantly Bent Ladders



Modification of N2 flow

- Two different input tubes per SCB (8x3 l/min)
- Increase of N2 flow reduces temperature
- N2 flow at SCB can be increased without bigger risk
- Carbon tube flow more critical

→ **Increase to 34 l/min (16 + 18 l/min)**

C02 temperature

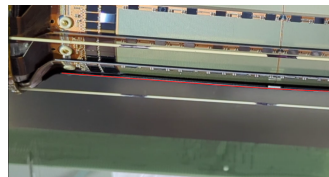
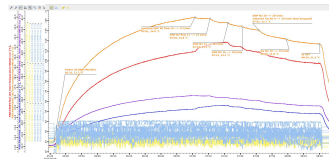
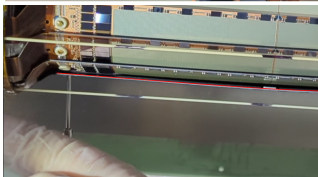
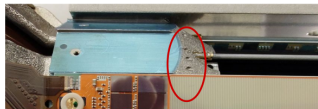
- Default temperature until now -20 °C
- IBBelle designed for -30 °C

→ **Decrease temperature to -25°C**

Screw torque

- FWD screw torque was reduced from 15 to 10 mNm
- Torque can be further reduced to 7.5 mNm without risk

→ **Reduce torque for 202x, 207x, 208x to 7.5 mNm**



Three days of cooling run at -25C

- Power each ladder individually
- Power full FWD/BWD
- Power full PXD2

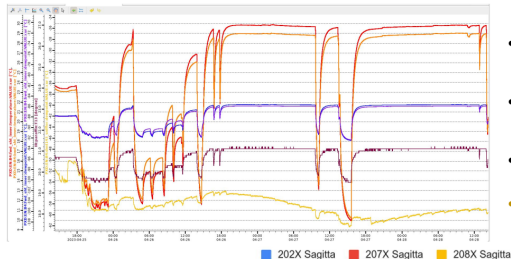
Goals

- Take source data
- Observation of ladder bending
- Observation of temperature behavior

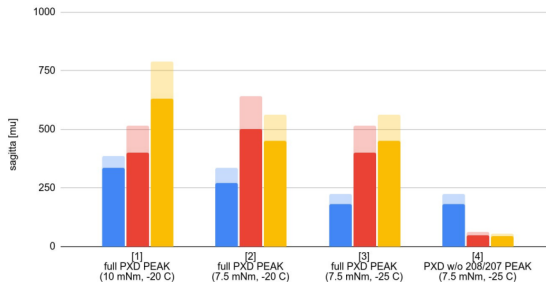
Observation

- All temperature stable and reasonable
- 208x and 207x still bending
- Visible bending for 202x
- Torque reduction seem to help slightly

Add. option: Turn off 207x and 208x



- air temperature inner DV ~30C
- dewpoint SHT 85 below sensitivity
- beampipe temperature ~21C
- dewpoint humidity sniffer ~ -60C



Thermal dummy L2 ladder bent with gradually increasing sagitta

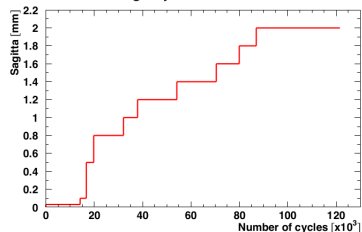
- ~ 4500 cycles at $\Delta 0.9$ mm
- ~ 2500 cycles at $\Delta 1.1$ mm
- >100 cycles at 1.8 mm
→ ladder developed two kinks

→ Thermal dummy ladder mechanically different

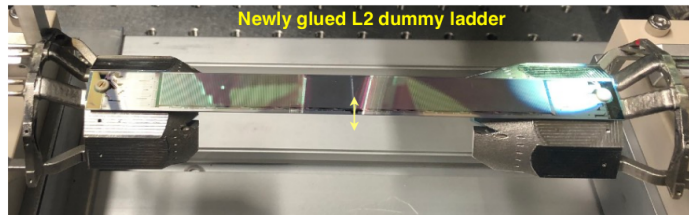
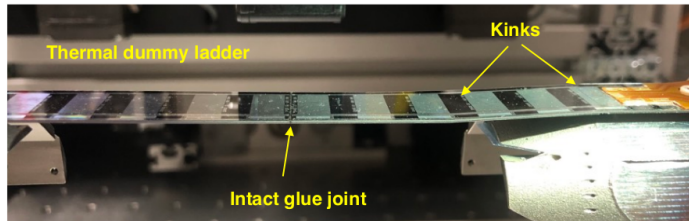
→ Both kinks at resistor lines

Repeat with recently glued L2 dummy ladder

L2 glue joint endurance test



After more than two months with more than 90k cycles with sagitta >1 mm → Ladder still intact





Up to know...

- Both HS successfully installed
- PXD2 is isolated from BP
- During first cooling runs temperature higher than expected
 - ▶ Modification of N2 flow and CO2 temp. stabilized temp.
- Bending for 2-3 ladder (207x, 208x and 202x) larger than wished
 - ▶ Bending up to 700 μm
 - ▶ Ladder at bending studies survived more than 90k cycles with more than 1mm bending
 - ▶ Even if ladder kinks no "breaking" expected
 - ▶ In worst case: Turn off 2-3 L2 ladders
- PXD1 was extracted and SVD removed

In the next weeks...

- SVD standalone commissioning
- Installation of two FOS fibers on PXD2
- Optimization of PXD2 grounding cable
- SVD attachment (week after B2GM)