Feasibility check of PXD mount

Current IR situation

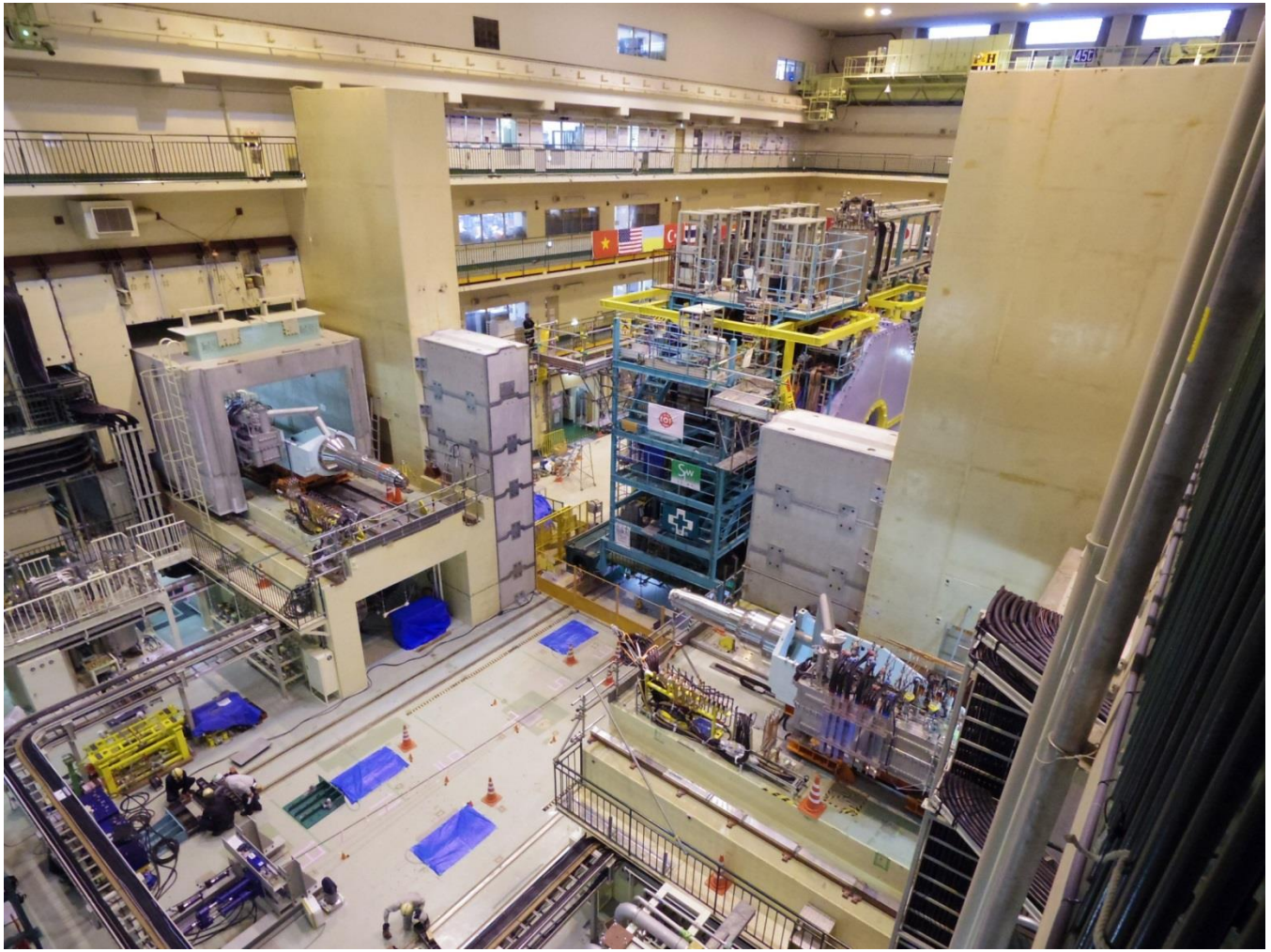
# KEK IR status

S. Tanaka(KEK)

SVD transportation test (B1->B4)
(will discuss in ladder mount review)

SVD ladder mount review in Feb.

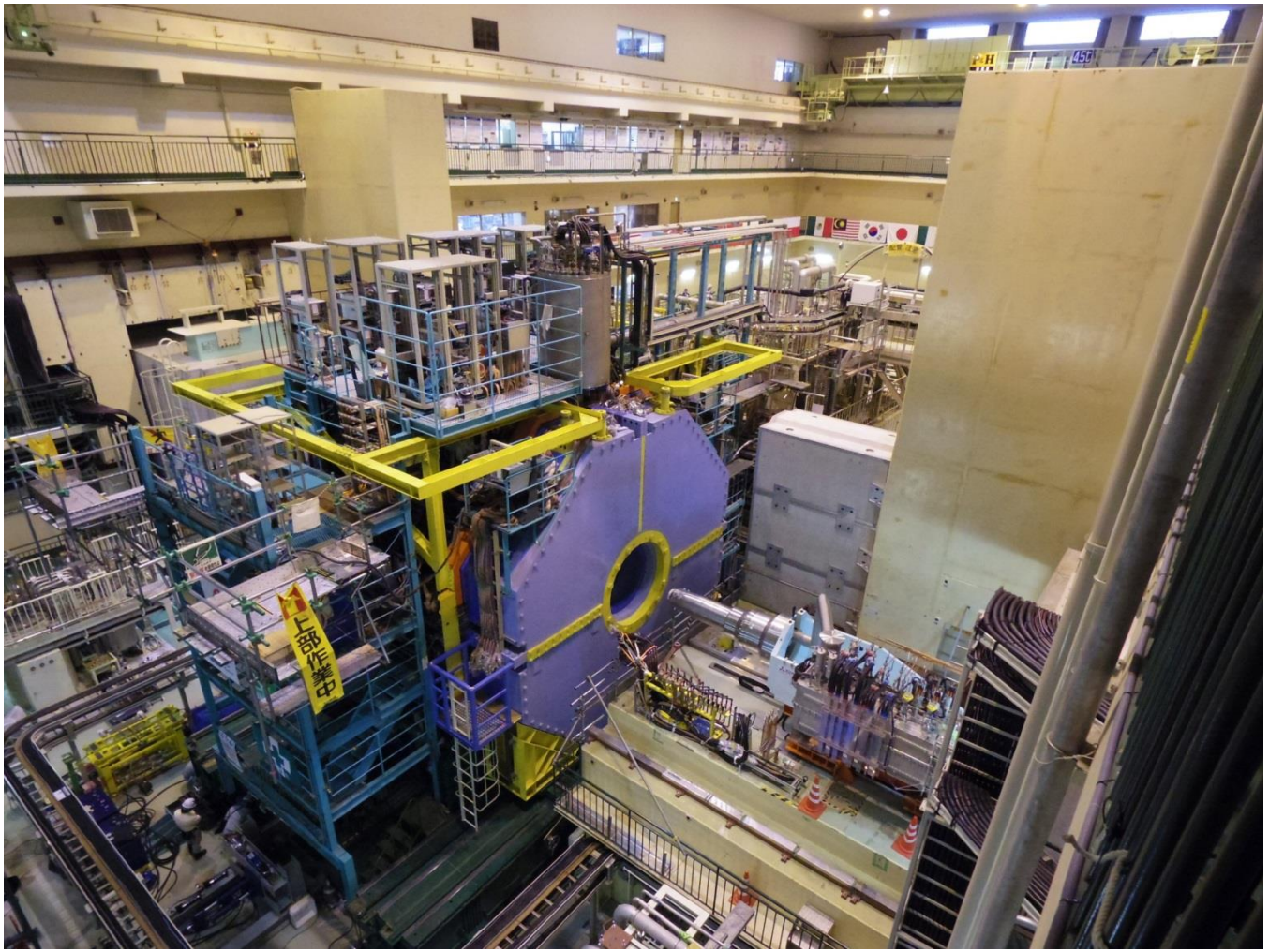
# Roll-in



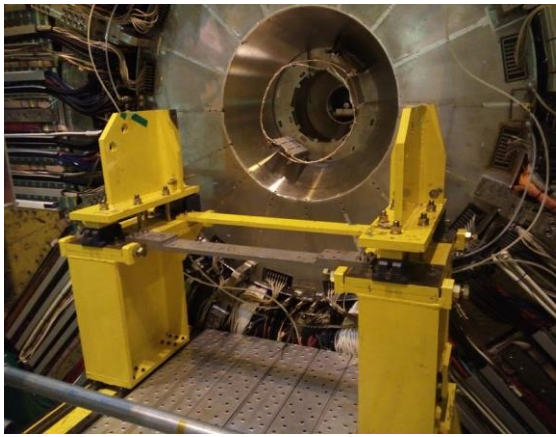
Belle II rolled-in to the beam line on April 11th, 2017
One of the biggest milestones in the construction phase
Live broadcasted by a video sharing website

KEK × niconico

# (Open End-yoke and) Insert QCS



# IR activities after Roll-in



- Apr. 24th-25th: Endcap stage assembly(BWD,FWD)
- 26th : Scaffolding setup
  - MPI: install setup,  DESY: B-mapper
- 27th : B-mapper Installation setup-> installation(1:00am)
- 28th : B-mapper Survey work

(1 day was tooo tight)

- 29th : BWD cable cage
- 30th : FWD cable cage
- May 1st-4th : B- sensor test, assembling QCS part, cabling
- 8th-9th : QCS installation
- 10th- : IBBelle restart preparation (MPI: CO2 group)
- 9th -: QCS piping/cabling/survey work
- 26th -: Belle solenoid ON
- 26th - : QCS excitation test

- Sep. 1st : disassembly of QCS pipes and moving to ARC side
  - FWD Endcap installation work will start
    - B-mapper dismantle work may be done after FWD endcap installation.

# Check list : VXD assembly -> Installation

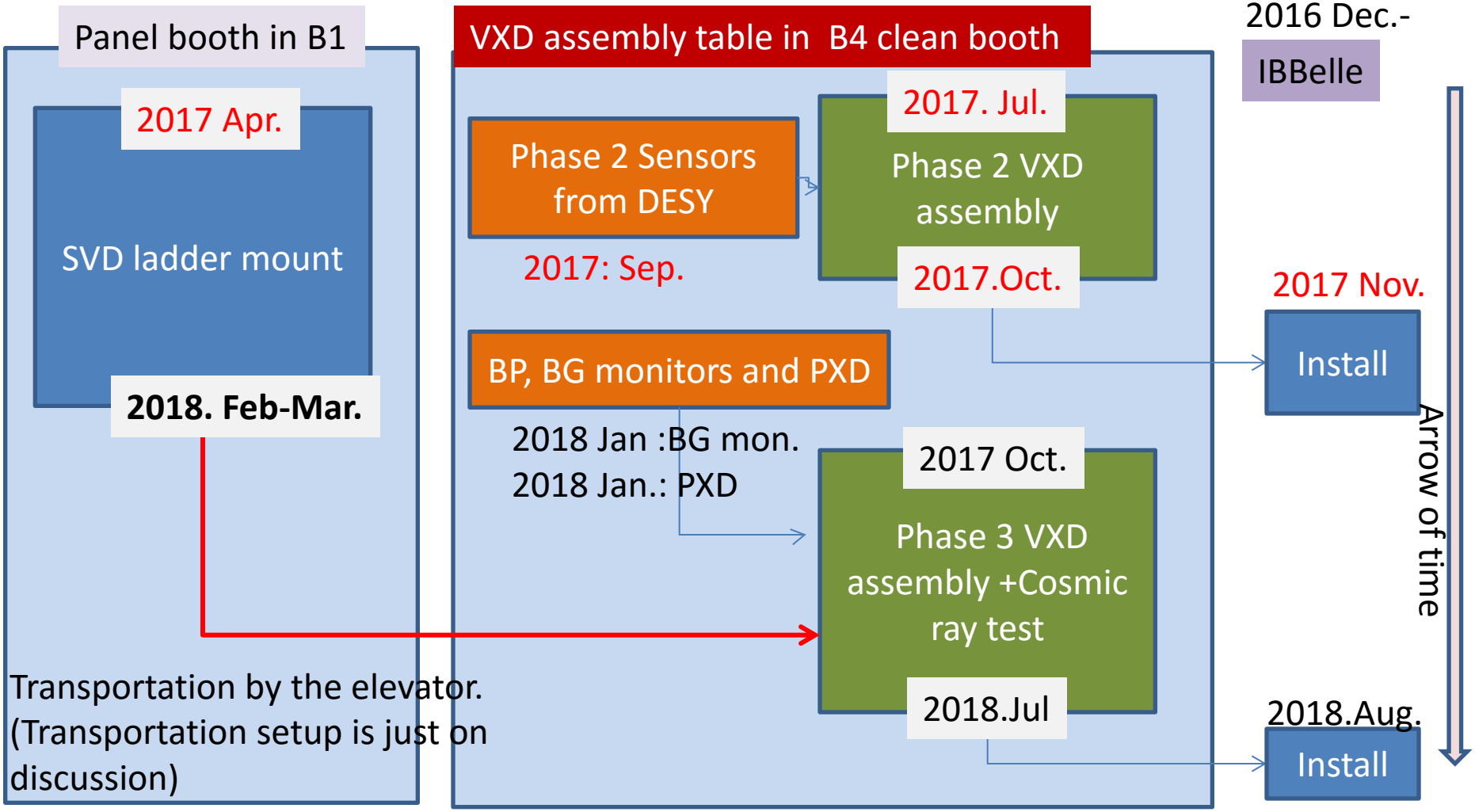
- BP + Shields assembly final check: Phase 2 finished, Phase 3 is on going (KEK)
- PXD mount: controlled by the Jigs (MPI+KEK)
- PXD/BEAST attachment : Confirmed on PERSY (DESY)
- Rotation with phase control: Confirmed on test assembly (KEK)
- Cabling/piping in the VXD volume: defined
- SVD structure transportation from B1 to B4: Should be confirmed in next B2GM
- SVD attachment: Clearance check between PXD and SVD
  - Phase 2 assembly is good chance to know the situation (it's difficult work on phase 3)
- Cable management after VXD completion (outside of VXD):
  - CO2 pipe connection to isolation block, PXD PP connection, cable cages (for transportation, after installation): A tentative plan was defined
- Installation ring attachment procedure: it can be confirmed on Phase 2 assembly
- Connection of the crane tool: OK
- Lifting up of VXD and put onto VXD cart: should be checked (not an issue)
- VXD cart move to B4 floor: OK
- VXD bring to installation setup: OK
- VXD installation: confirmed by test installation
- Service work between VXD and dock: (cable cages have installed now, but detailed service work steps should be defined)

Detailed assembly steps
Is documented

# VXD Assembly work management

Update(Draft):2017

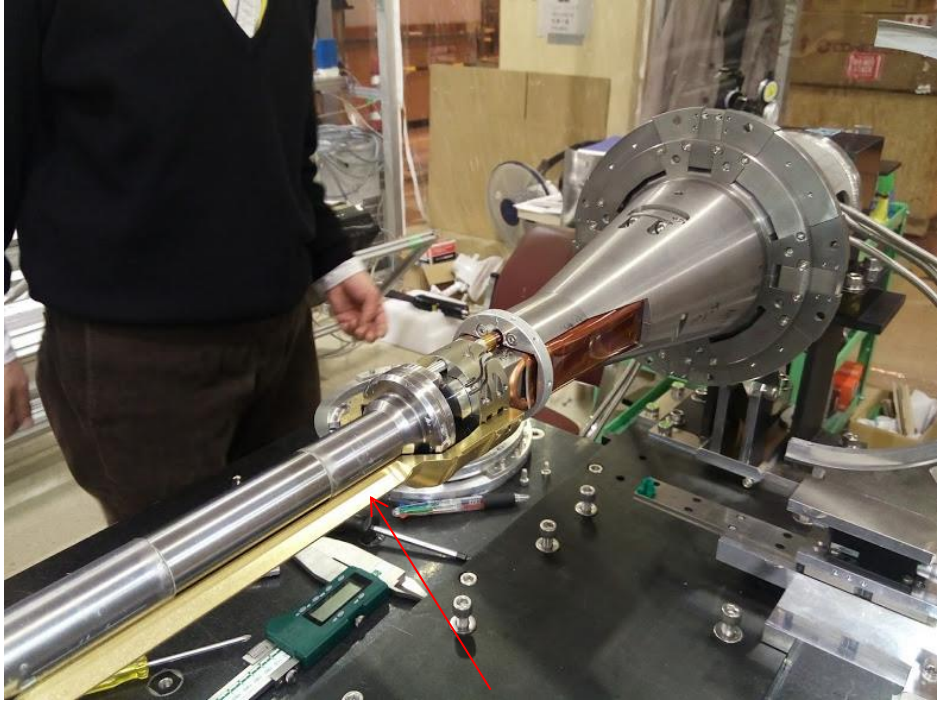
- We will assemble two sets of VXD system
  - VXD for BEAST phase II
  - VXD for physics run



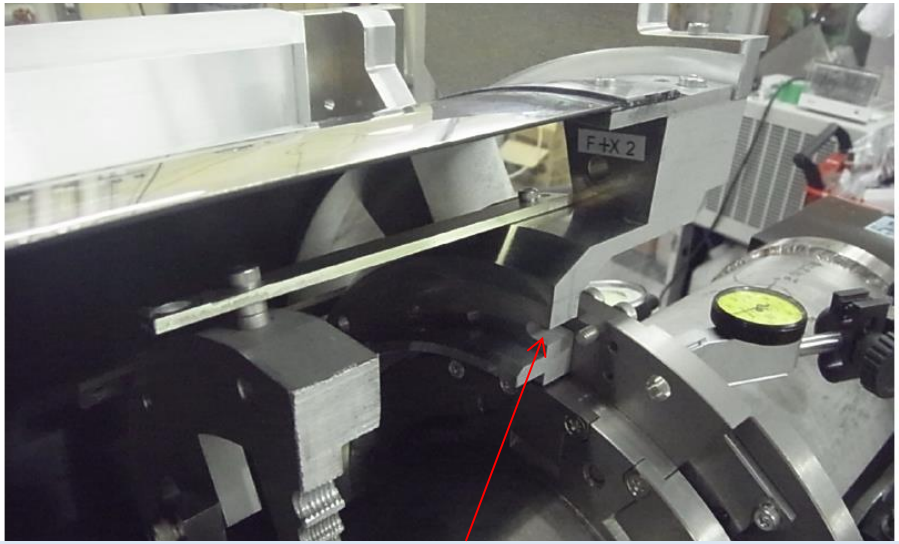
# VXD test assembly

- Beam pipe:
  - IP part: Be+Ti (same with final one)
  - Crotch part: SUS (Mock)
- Heavy metal shield (phase 2)
  - Fully installed
- End-flange (phase 2)
  - Phase2 End-flange is used
- Outer cover (phase 2)
  - CFRP glued with brackets
- SVD structure
  - No, but dummy load is installed

Checking of assembly procedure
And measuring mechanical deformation



PXD mount has confirmed by master jig

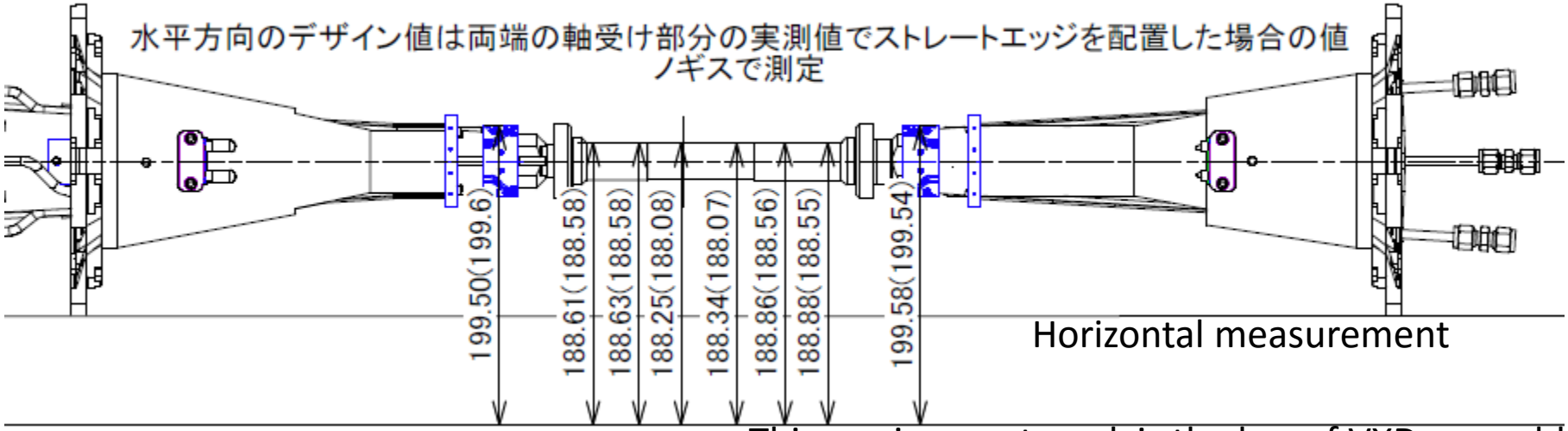



SVD connection: position is controlled by pins

# Survey result

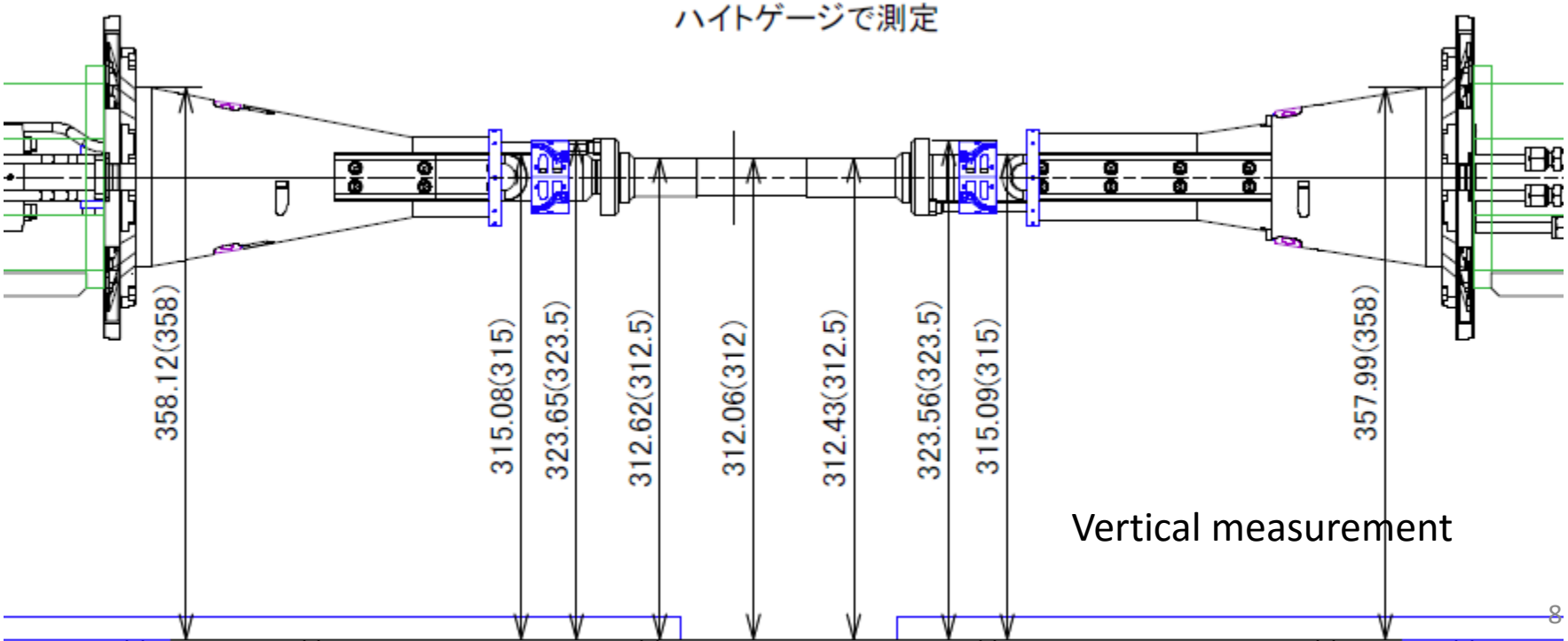
BP+HM

Measured value (Design)



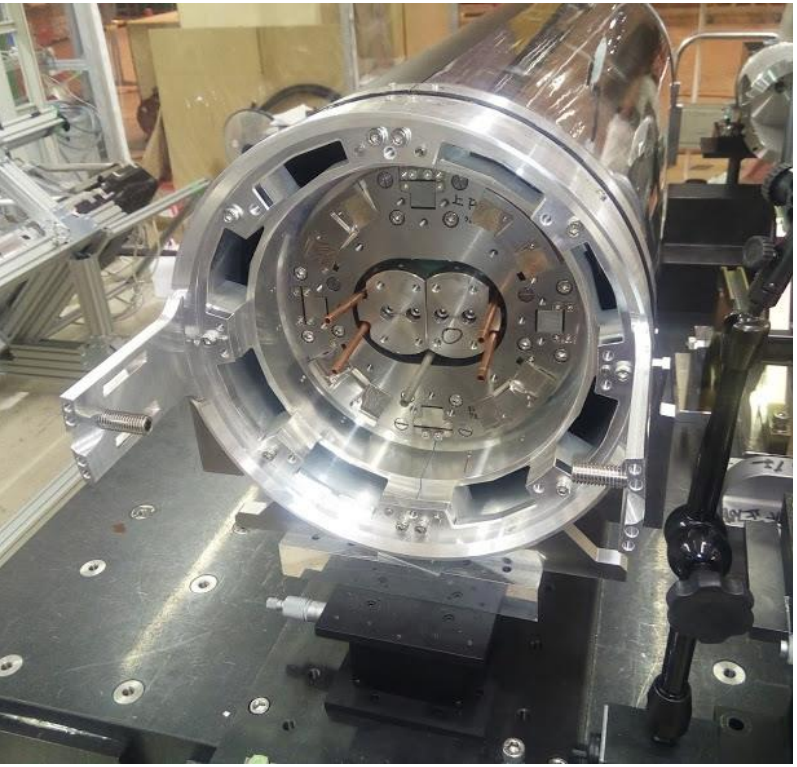

Horizontal measurement

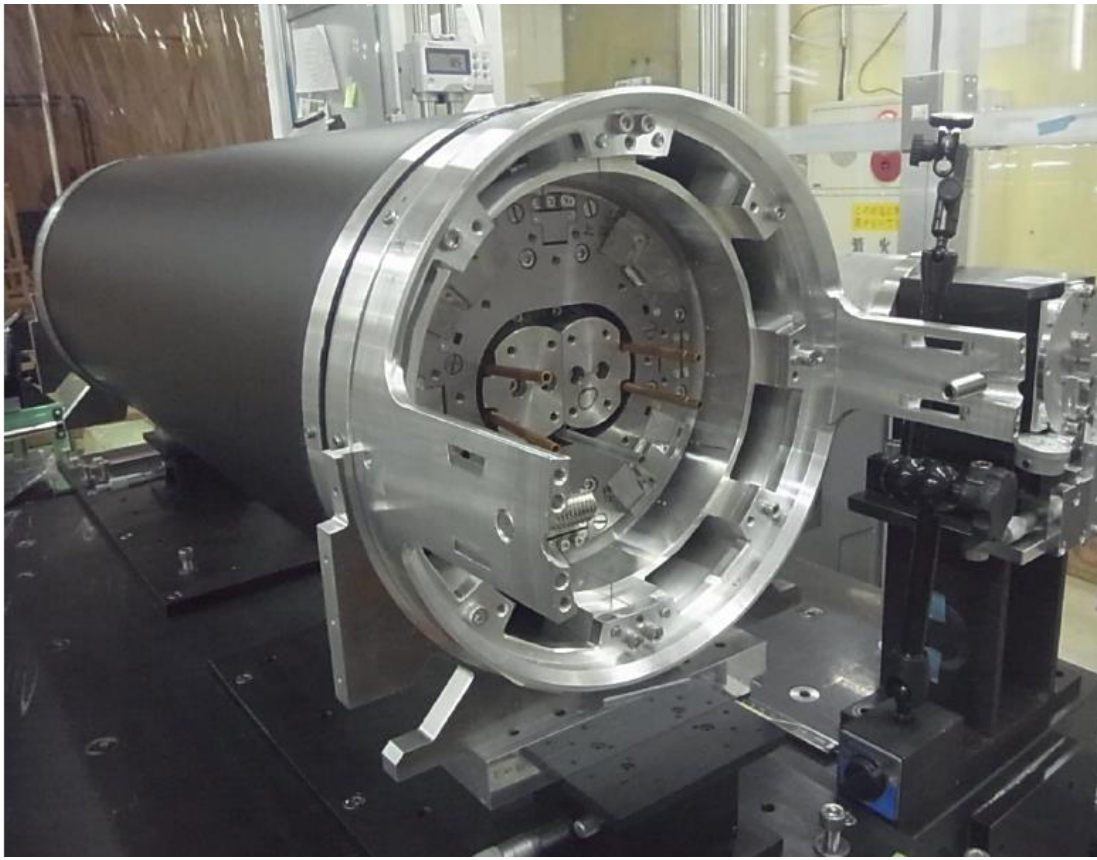
This arraignment work is the key of VXD assembly




Vertical measurement

# VXD test assembly until completion



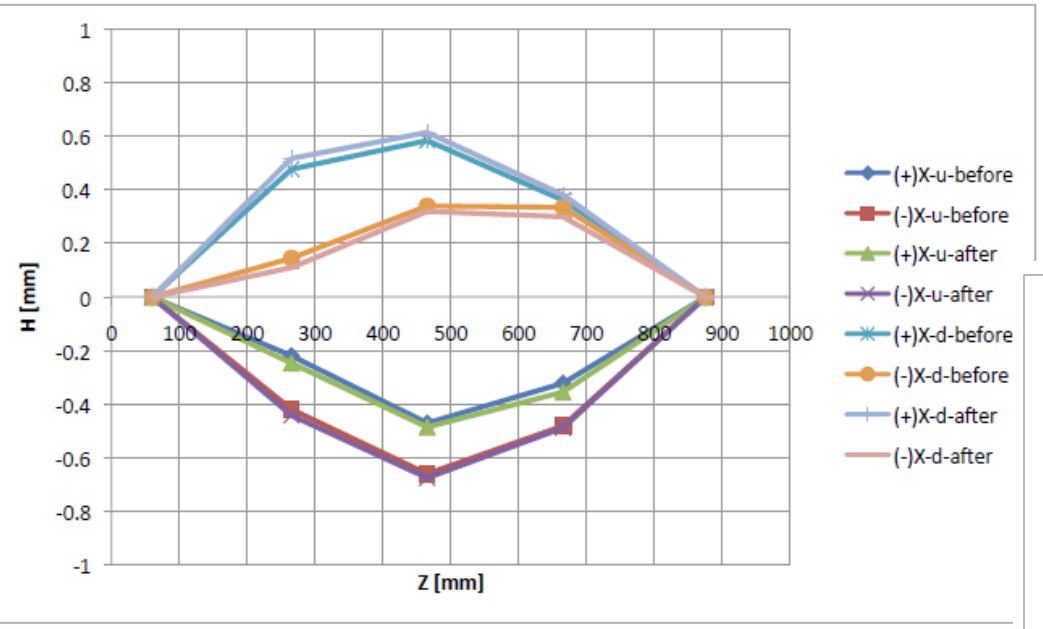


On connecting SVD half, HM flange position can be shifted by 300um to give clearance.  (pulling HM flange by control screw)

Almost all of procedure has been confirmed.

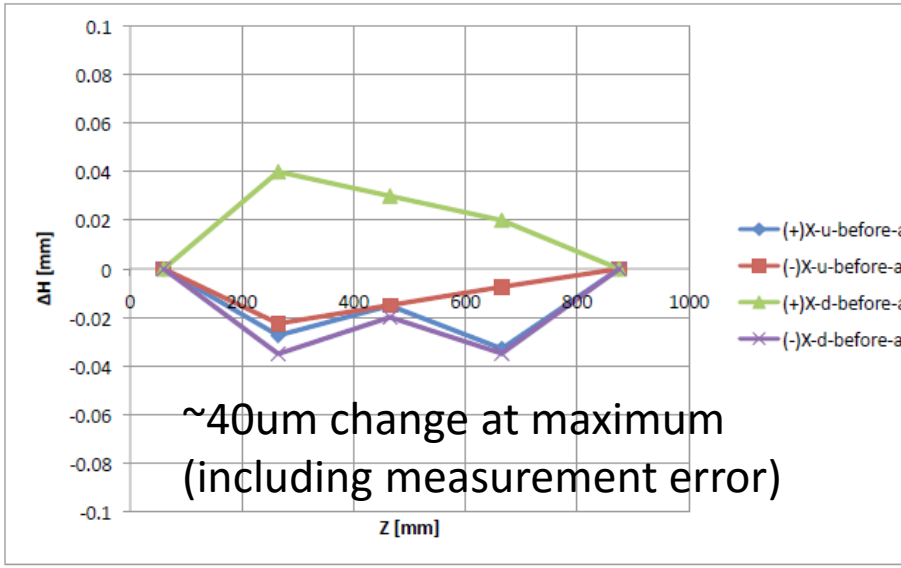
# Can CFRP keep VXD structure for 80kg load?

- Vertical value: radius difference from the design
  - Because CFRP is molded structure, there are some deformation.
- Horizontal: z position:
- Before is “before disassembly of support structure
- After is “after disassembly of support structure



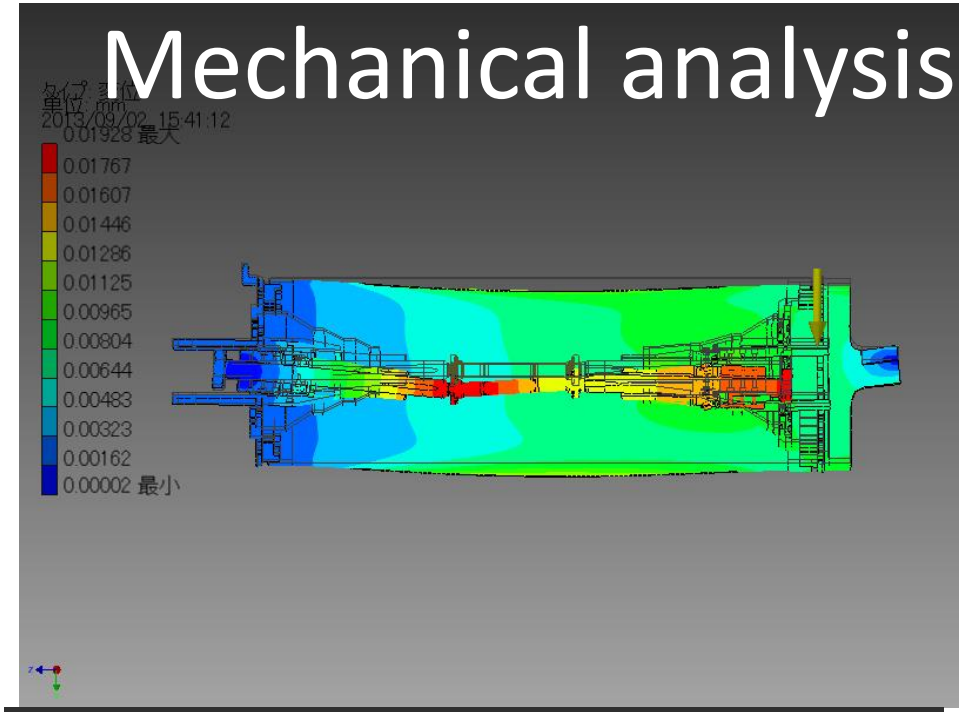

40um distortion after dismantle of mechanical support has observed

Before – After removing support




~40um change at maximum (including measurement error)

# Mechanical analysis

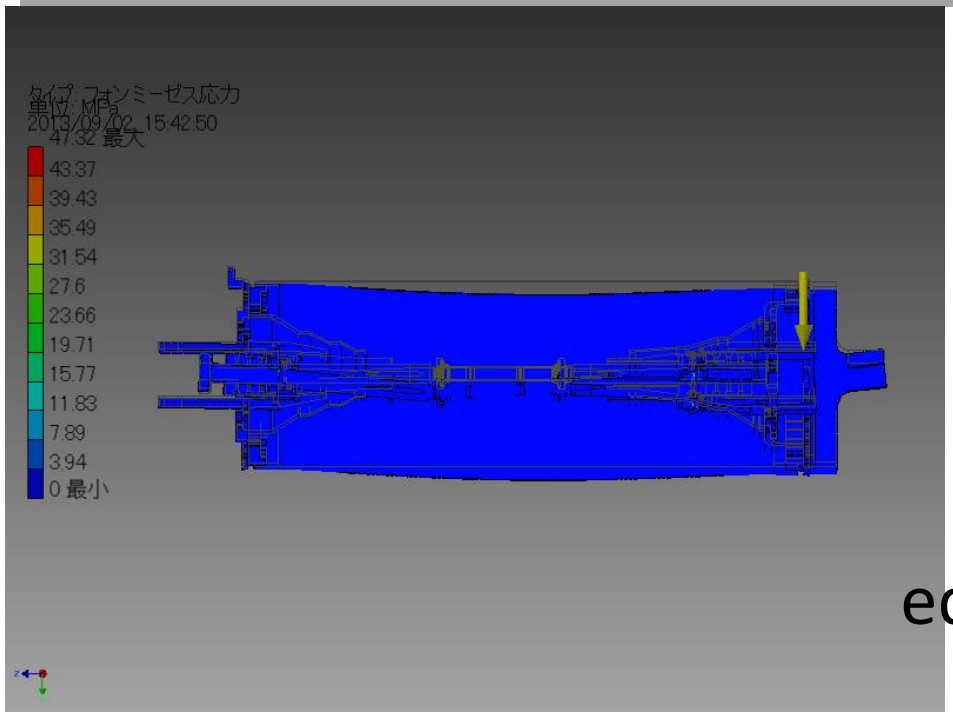



Backward point fixed

Deformation : MAX19.3µm

FEM analysis at VXD installed position

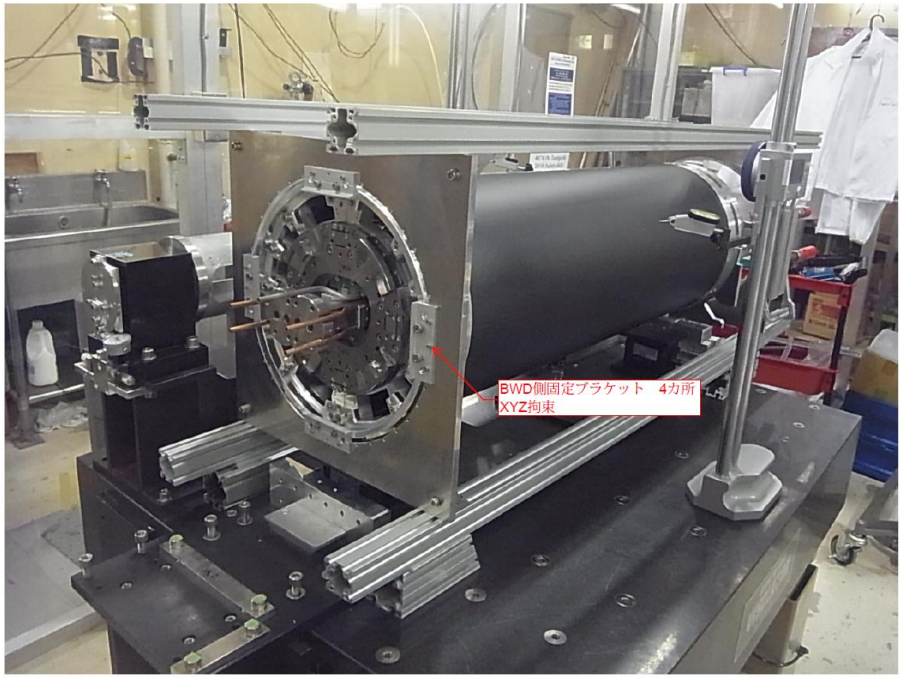
It is comparable with the measurement

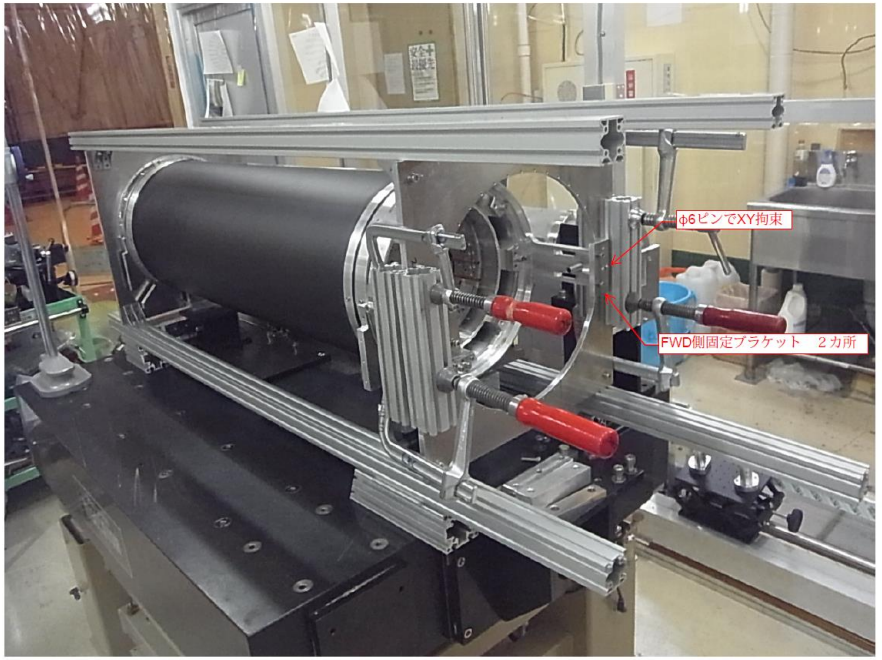



equivalent stress : MAX47MPa

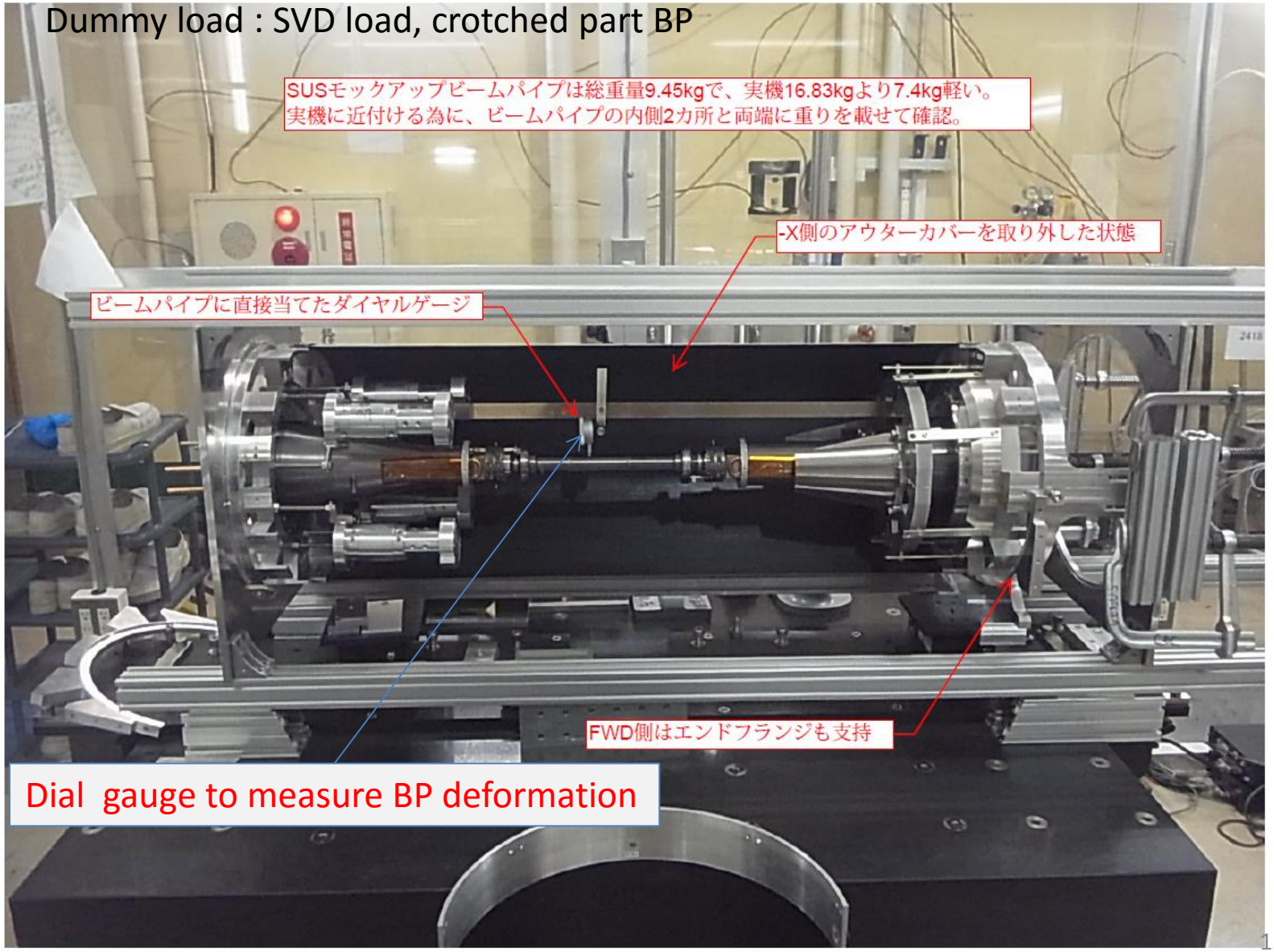
# Next step (VXD@ installed position)

- Fixing VXD to dummy CDC inner wall
  - Measuring deformation of VXD structure
    - Deformation of inside structure (in particular of Beam pipe) is most interesting point!



# Setup of dummy load

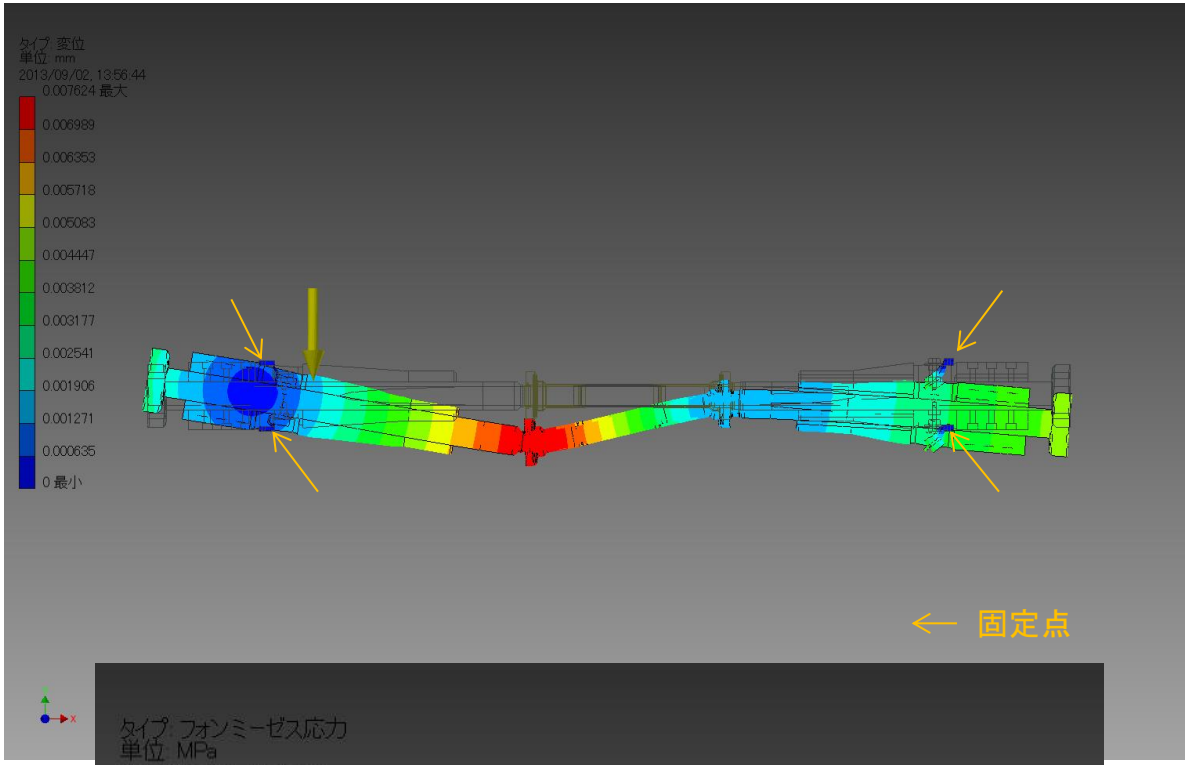



The dial meter is measuring relative space between Beam pipe and reference bar


Before putting dummy load
~450 um (as pedestal)

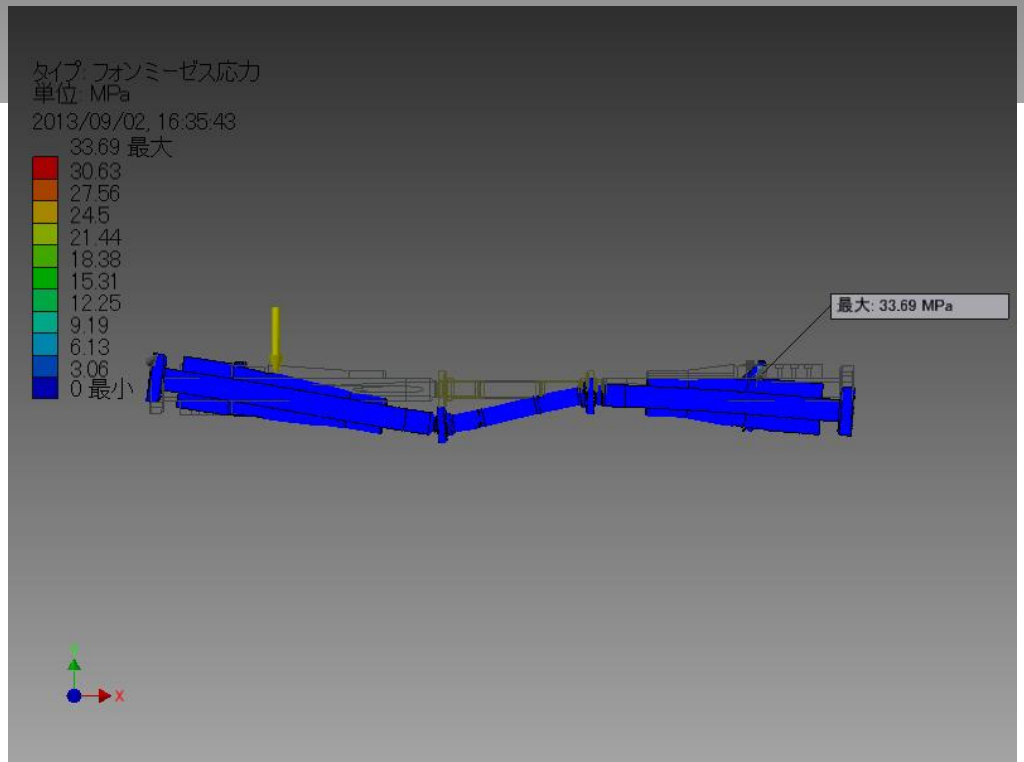
After putting dummy load
~450 um

No significant BP deformation was observed by putting additional 10kg dummy load (VXD is installed position)




FEM analysis:
BP+HM

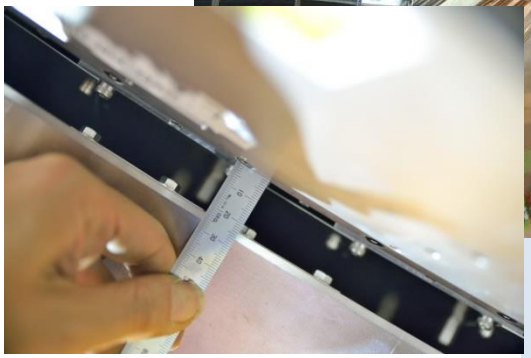
Deformation : MAX7.6μm




Equivalent stress : MAX33MPa

# Another updates


New vacuum pump for flex line has installed.

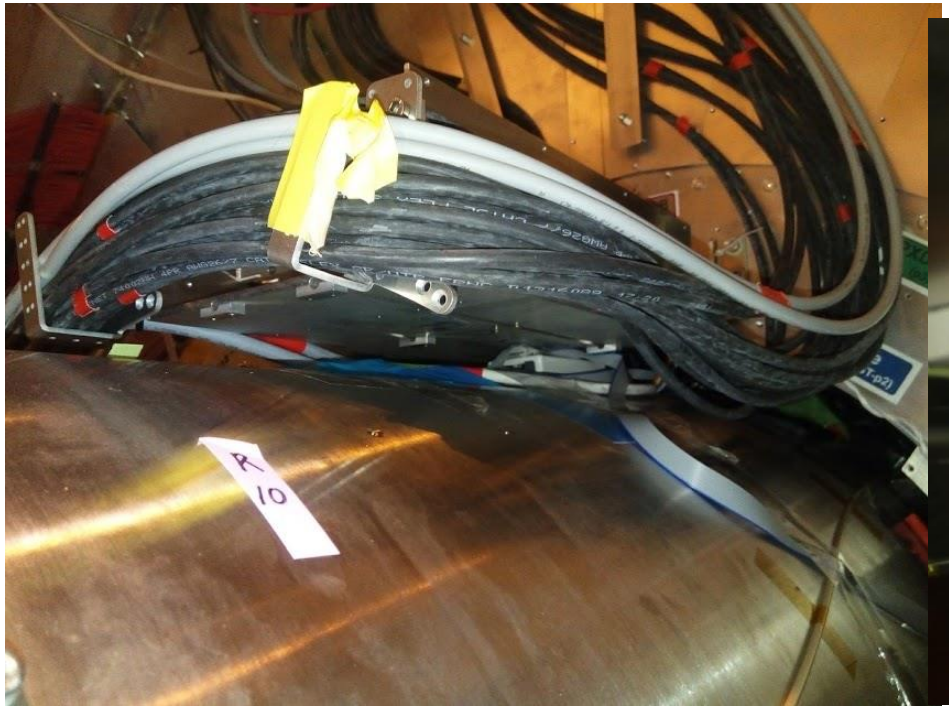


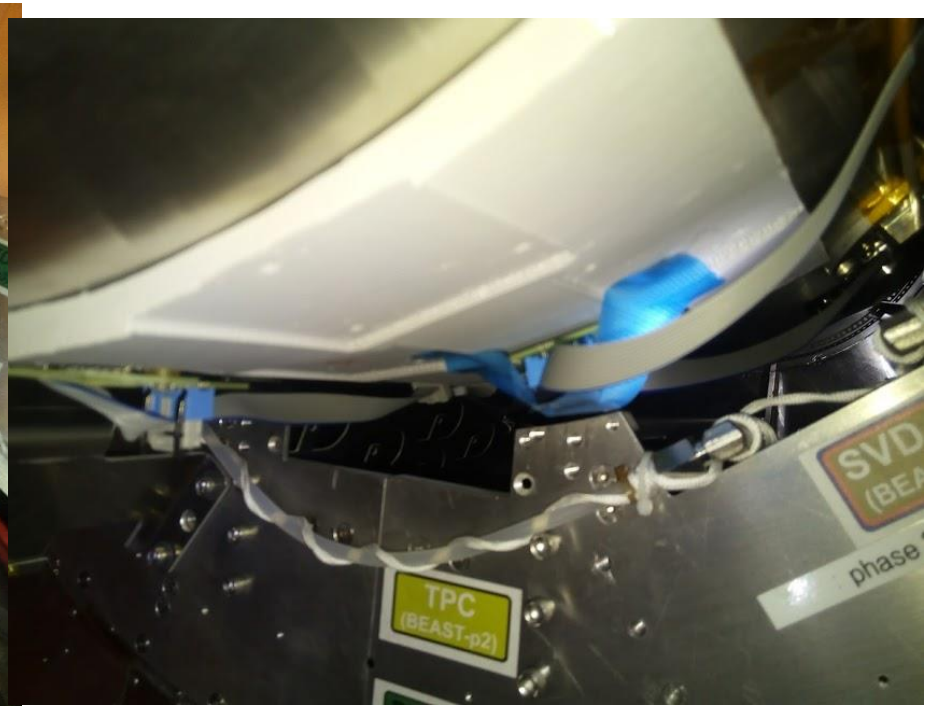
The screws on the CDC wall have replaced with thin type. (but BWD Endcap is not yet done)

- Paraffin cooling system for IP chamber
  - Pressure test of IP chamber (2 bar for Be part) has confirmed
  - Main circulating system is now in B4 floor
  - Piping work should finished soon (other than inside of Belle area)

# Conclusion

- Belle detector is now operation position
  - QCS system is also installed
- Magnetic field measurement is ongoing (until the end of Aug.)
- Phase 2 VXD mechanical assembly test has finished
  - Mechanical distortion was consistent with FEM analysis
  - 180 rotation with phase control was confirmed
  - Electrical isolation btw BP and HM: confirmed
  - Space issue of copper cooling pipe with HM: redesign and ordered
- Paraffin cooling (for BP) system preparation: ongoing
- Phase 3 VXD assembly test is ongoing
  - This setup will be kept during B2GM for the sensor integration discussion




- The space conflict between Docks and some B sensors.
  - B-sensor is not covered in Tscharlie's service design
    - All of service design have to be checked/reviewed by Tscharlie
  - Bending of dock has already expected if dock support ring is not connected
  - Up to now, there is no serious issue for phase 3 service design