

Status of VXD Installation

21st Internat. workshop on DEPFET detectors and applications
Schloss Ringberg / Germany, 29.05.2017



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Overview

- **Performed installation tests:**
 - **Nov. 2016: VXD dummy installation (1st test)**
 - **Apr./May 2017: B-field mapper installation (2nd test)**
- **Issues/critical points during installation tests**
 - **Adjustment of the new mounting tube**
 - **De-installation of the mounting tube system**
 - **Accessibility with on the BWD-side with closed ECL and dockboxes**
 - **Clearance for the VXD-brackets FWD**
 - **Installation of the CDC-Cable-Cages**
 - **Space for cable-installation in CDC-area FWD & BWD**
- **Improvements for installation equipment**
 - **Fixation of the VXD for phase2/3**
- **Survey and alignment of the Belle detector**

VXD dummy installation

Last year in **November 2016** was the **1st** VXD-test-installation with a **VXD-dummy** at the Belle II detector in **roll-out** position.

There were three different exercises planned:

- Set up the mounting tube system
- Normal installation
- Normal de-installation
- ~~Emergency de-installation~~

The exercises were performed by MPI-team:

Prof. Christian Kiesling, Andreas Wunderl, David Kittlinger

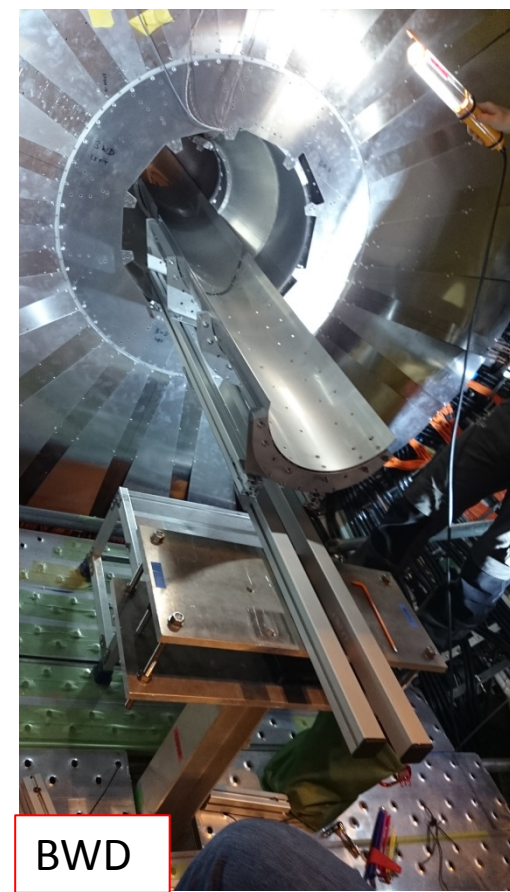
And supported by KEK-team:

Shuji Tanaka-san, Shoji Uno-san, Ichiro Adachi-san, Kohriki-san



VXD dummy installation

Insert mounting tube with a special roller support on the dockring – Setting up the mounting tube extension system -



B-field mapper installation

This year in **April/Mai 2017** was the **2nd** VXD-test-installation with a **B-field mapper** at the Belle II detector in **roll-in** position.

Issues from the Installation Nov. 2016 were removed!

There were different exercises planed:

- Set up the mounting tube system
- Normal De-& installation of the dummy
- Installation of the B-field mapper
- ~~Emergency de-installation~~
- ~~Lift the VXD on the MT with QCS restrition~~

The exercises were performed by MPI-team:

Christian Kiesling, Carsten Niebuhr, Szymon Bacher,
David Kittlinger

And supported by KEK-team:

Shuji Tanaka-san, Ichiro Adachi-san, Kohriki-san

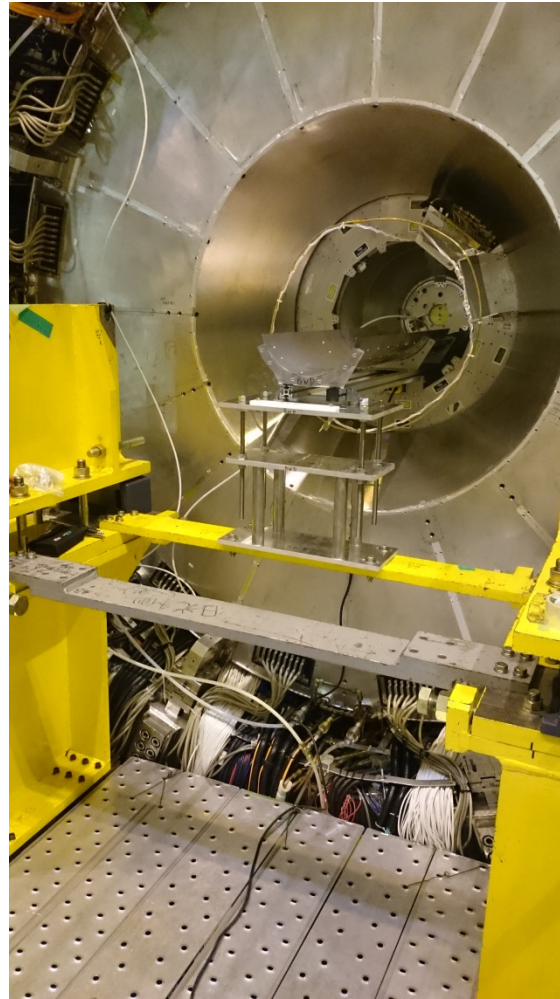


B-field mapper installation

Initial situation: New support trestles and columns and the QCS on FWD-side



FWD



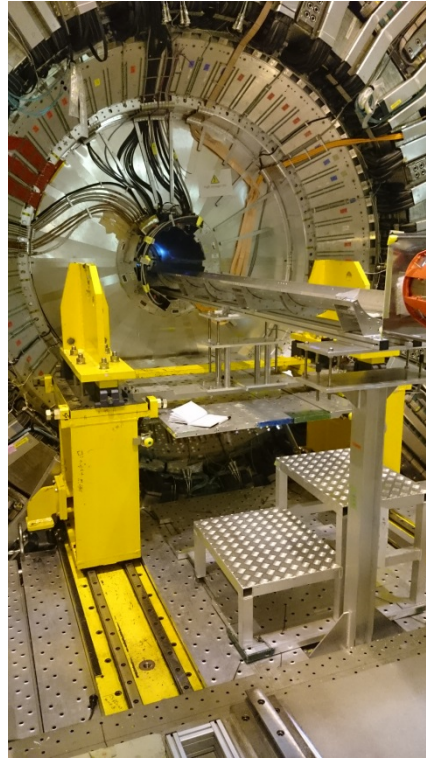
BWD

B-field mapper installation

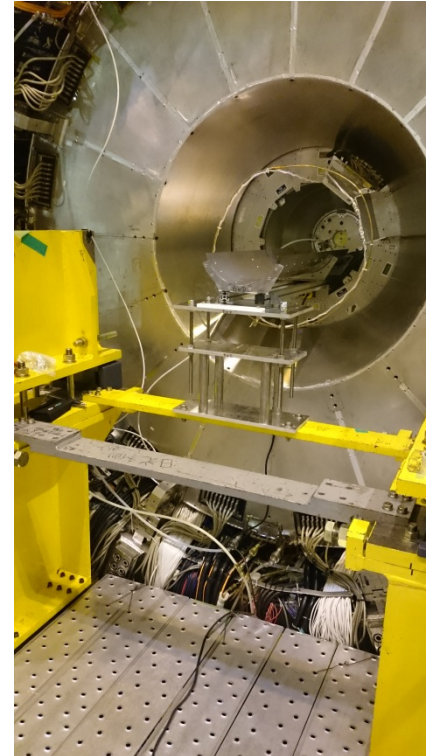
Installation of the new mounting tube system



Box with the
3 new mounting
tubes



FWD with mounting
tube system



BWD with mounting
tube system



New mounting
tube in the CDC

B-field mapper installation

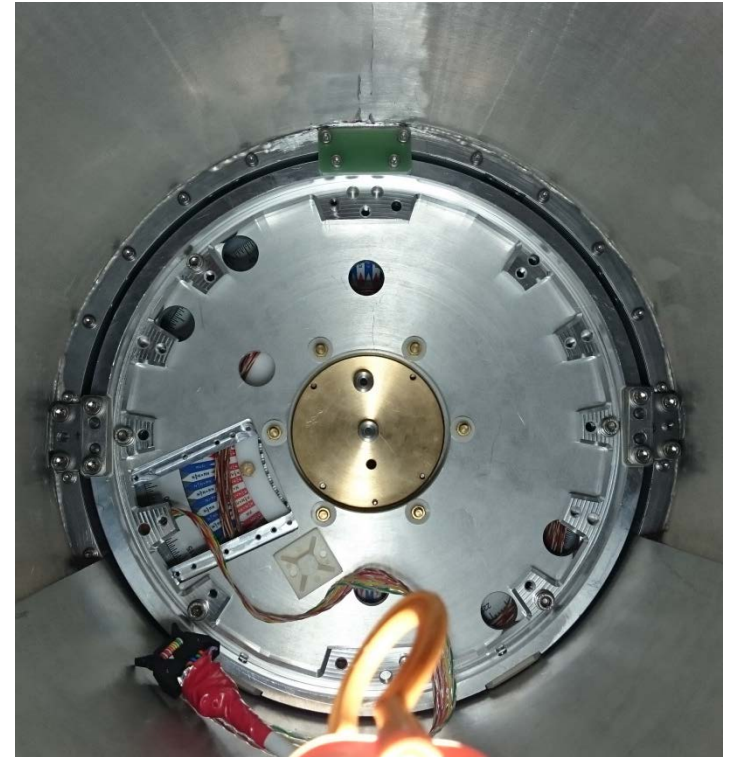
Installation of the B-field-mapper



B-field-mapper
before the
installation



Installed mapper
from the FWD-side

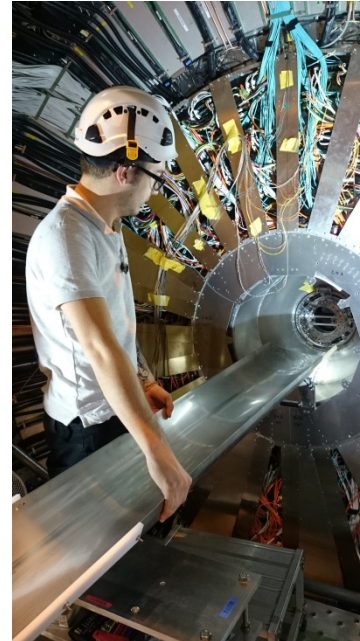


Installed mapper
from the BWD-side

VXD phase 2 installation

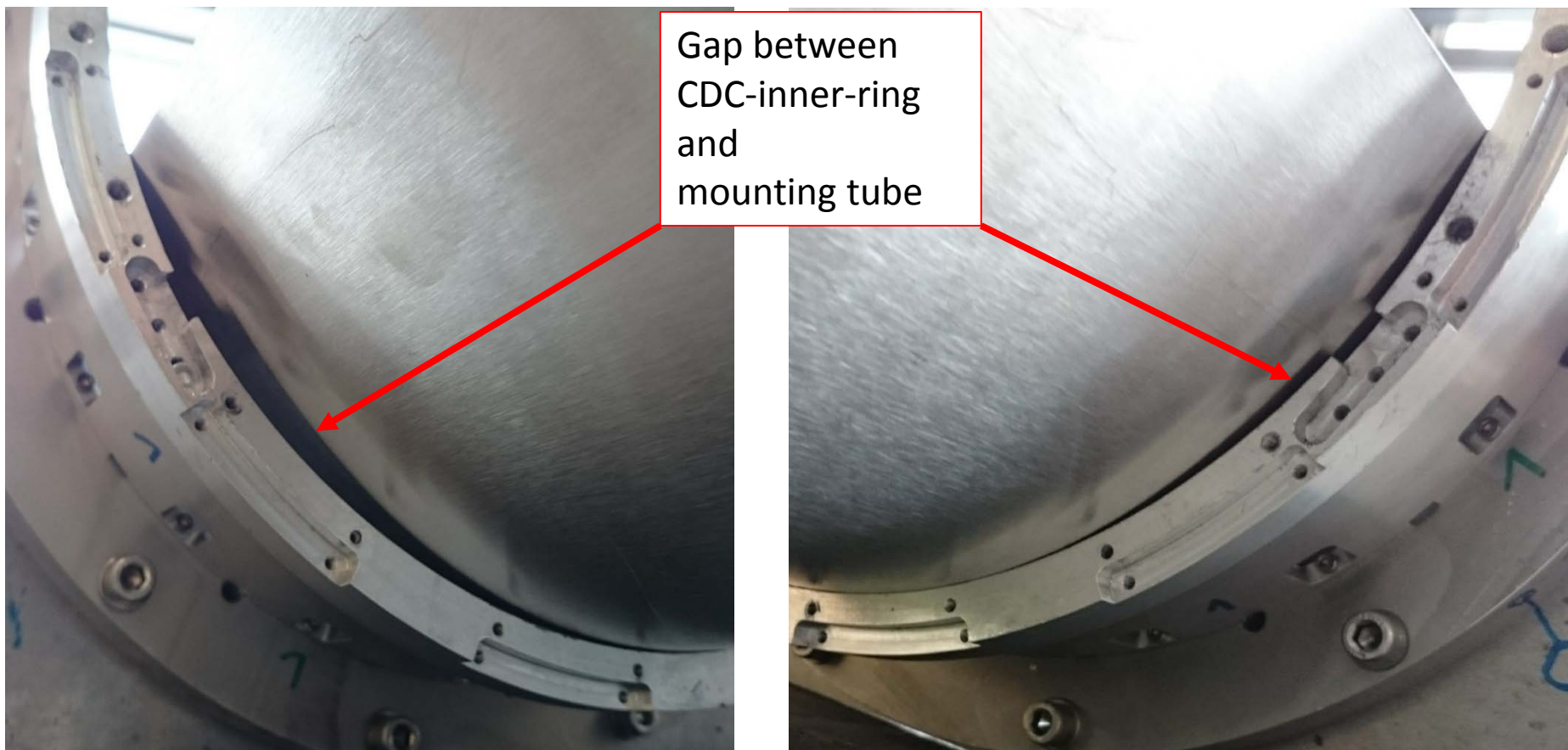
Tests to do with the VXD dummy before phase 2 installation:

- Lift the VXD incl. cable trays with the crane tool on the mounting tube with the restriction of the QCS (FWD) and the balustrade on top of the Belle detector
- Emergency de-installation from the BWD-side.



Improved Installation-Equipment

Issues with the shape of the „old“ mounting tube.



Improved Installation-Equipment



New mounting tubes made by German company RIME.

Manufacturing with myself on-site.

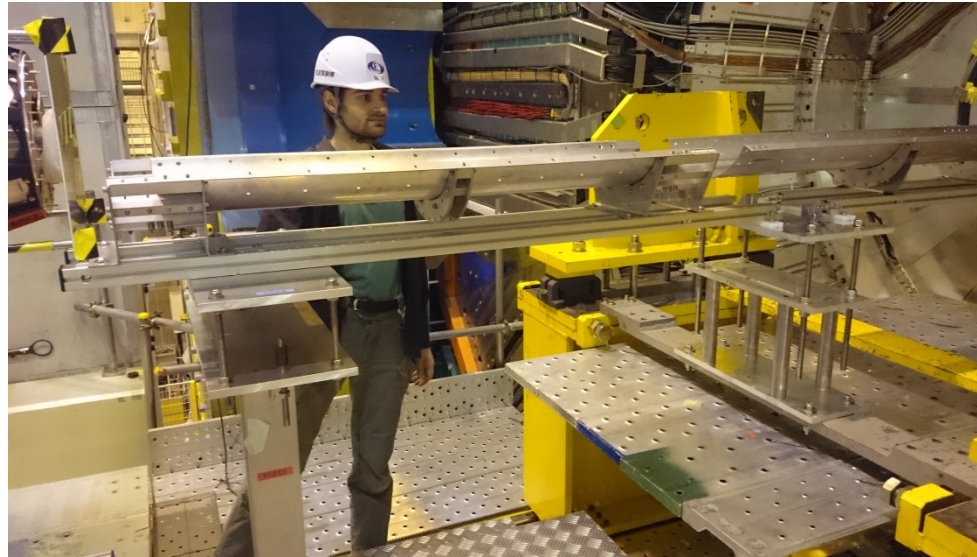
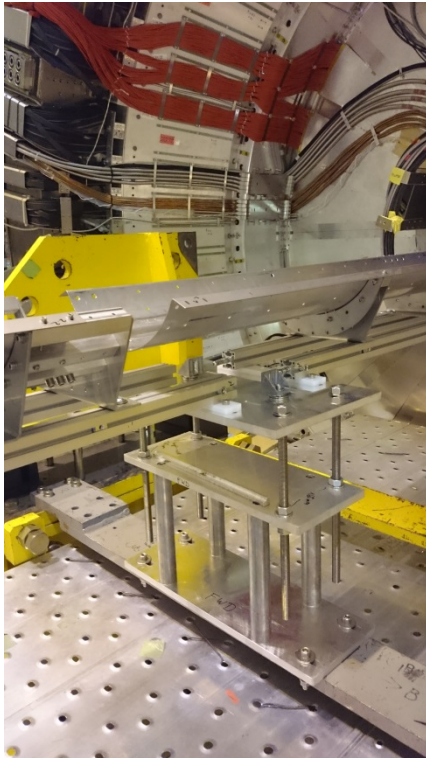
3 different variations were made.



4-roll-plate-bending- machine

De-Install. of the mounting tube system

Reason for splitting up the MT: Restriction through the QCS



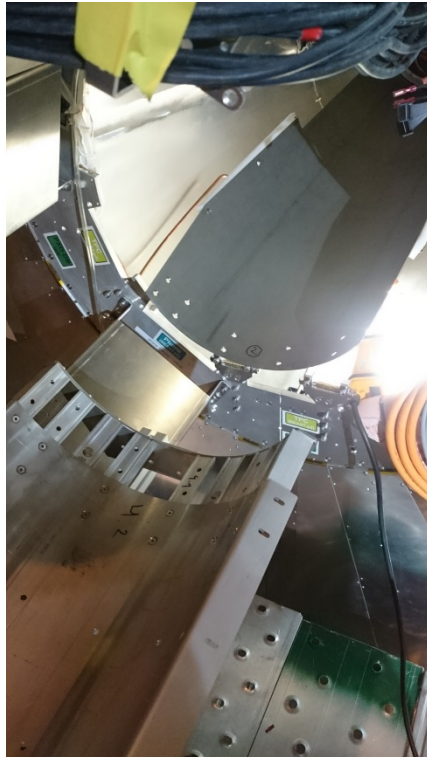
Remove the rear-unit.



First split the mounting-tube-extension FWD in 2 units.

Pull out the mounting tube till the end of the support to reach the screws.

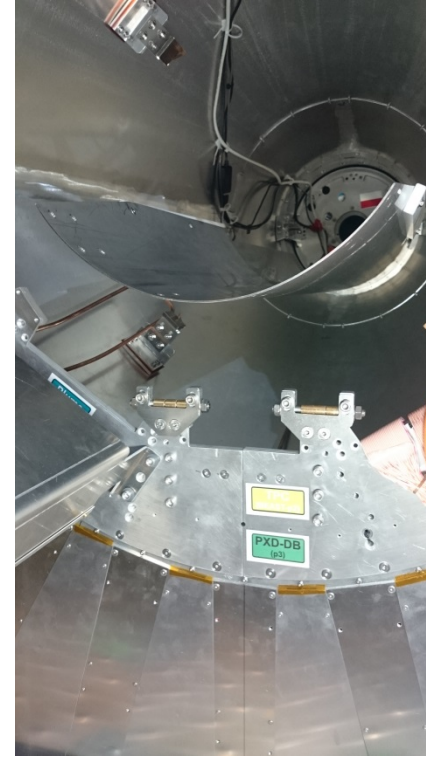
De-Install. of the mounting tube system



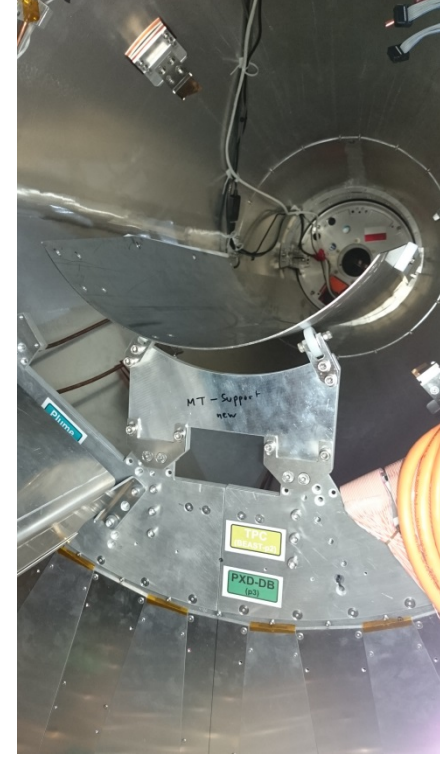
Disconnect the mounting-tube-extension from the mounting-tube and remove the front-unit.



The mounting tube will be still supported on the BWD-side



Change from mounting-tube-system-support...



... to mounting-tube-roller-support. Than pull out the mounting-tube.

Clearance for the VXD-brackets FWD



VXD-bracket
FWD-left



VXD-bracket
FWD-right



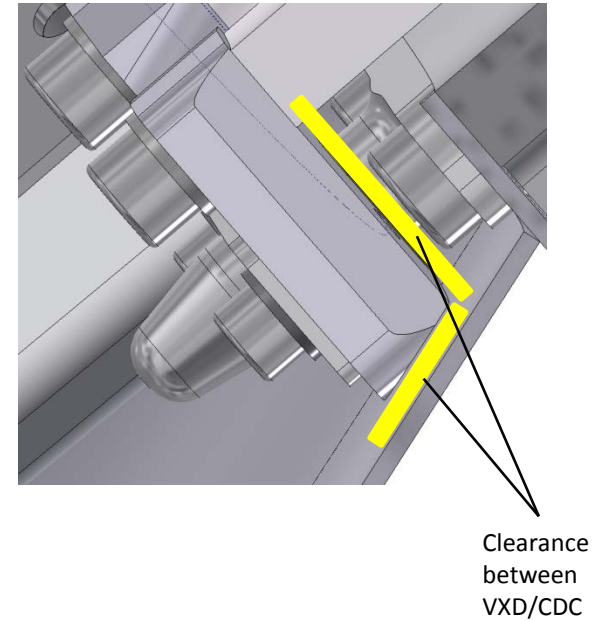
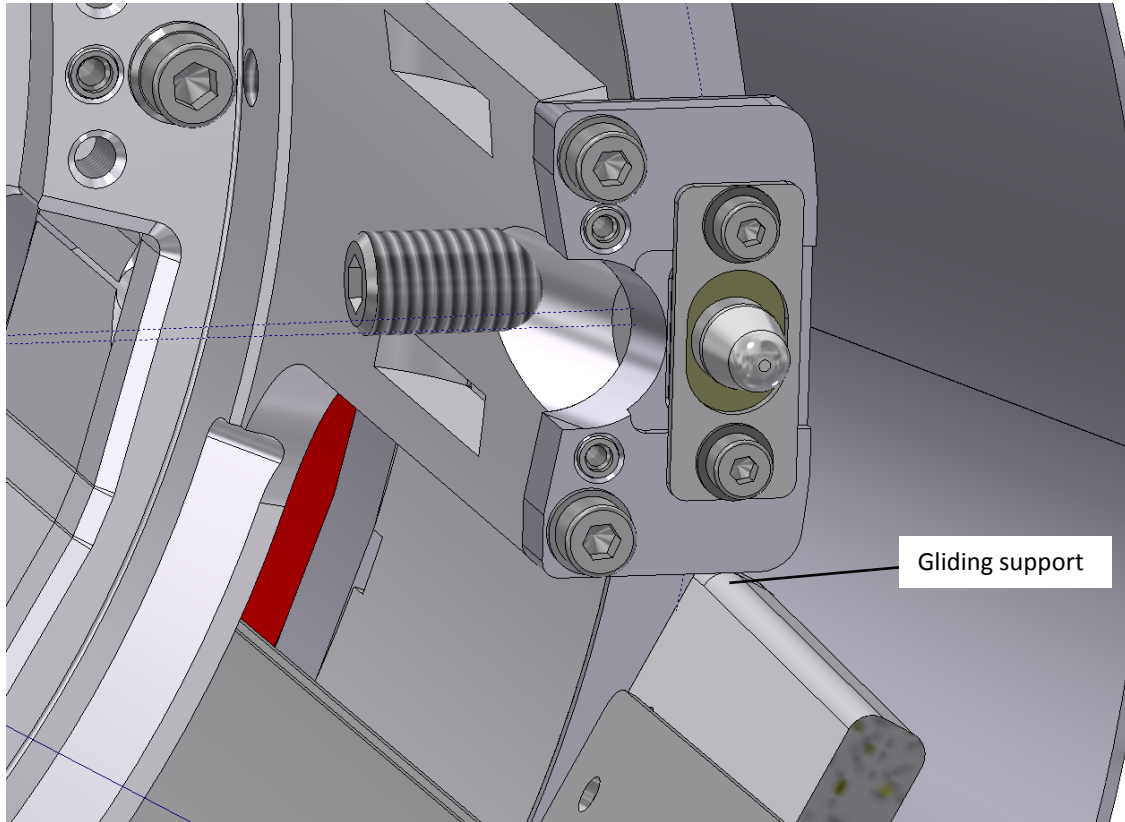
Clearance check
VXD-bracket
FWD-left



Clearance check
VXD-bracket
FWD-right

VXD-Bracket-FWD

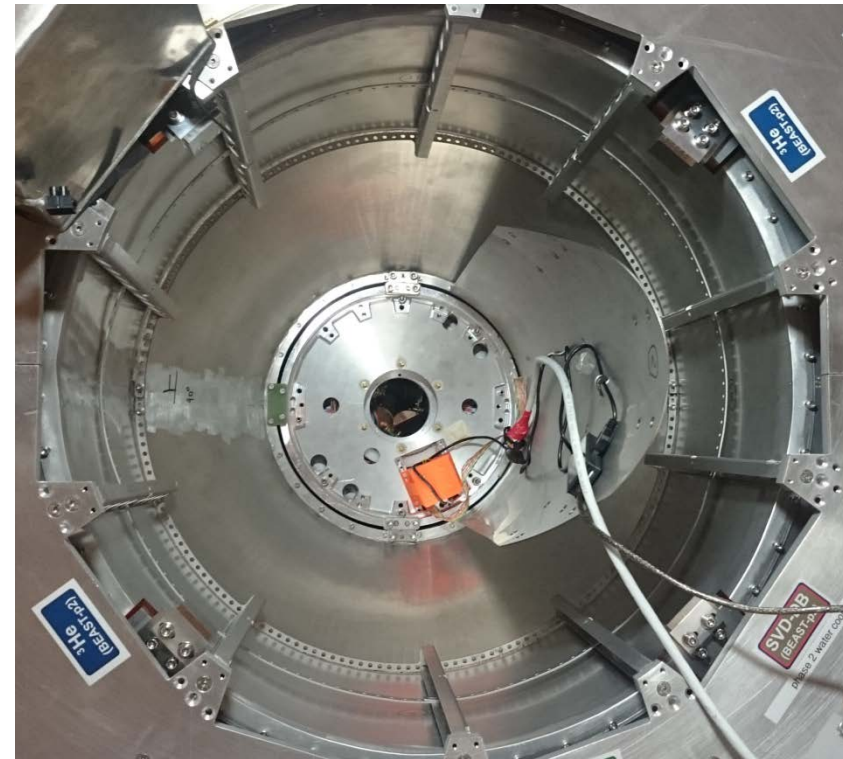
Surroundings in the installed situation



Installation of the CDC-Cable-Cages



CDC-Cable-Cage
FWD side



CDC-Cable-Cage
BWD side

Accessibility on the FWD-side



FWD: On the back



FWD: On the belly

FRESH AIR SUPPLY
is necessary!!!

Accessibility on the BWD-side

Dockboxes that block the space for the VXD-mapper-installation:

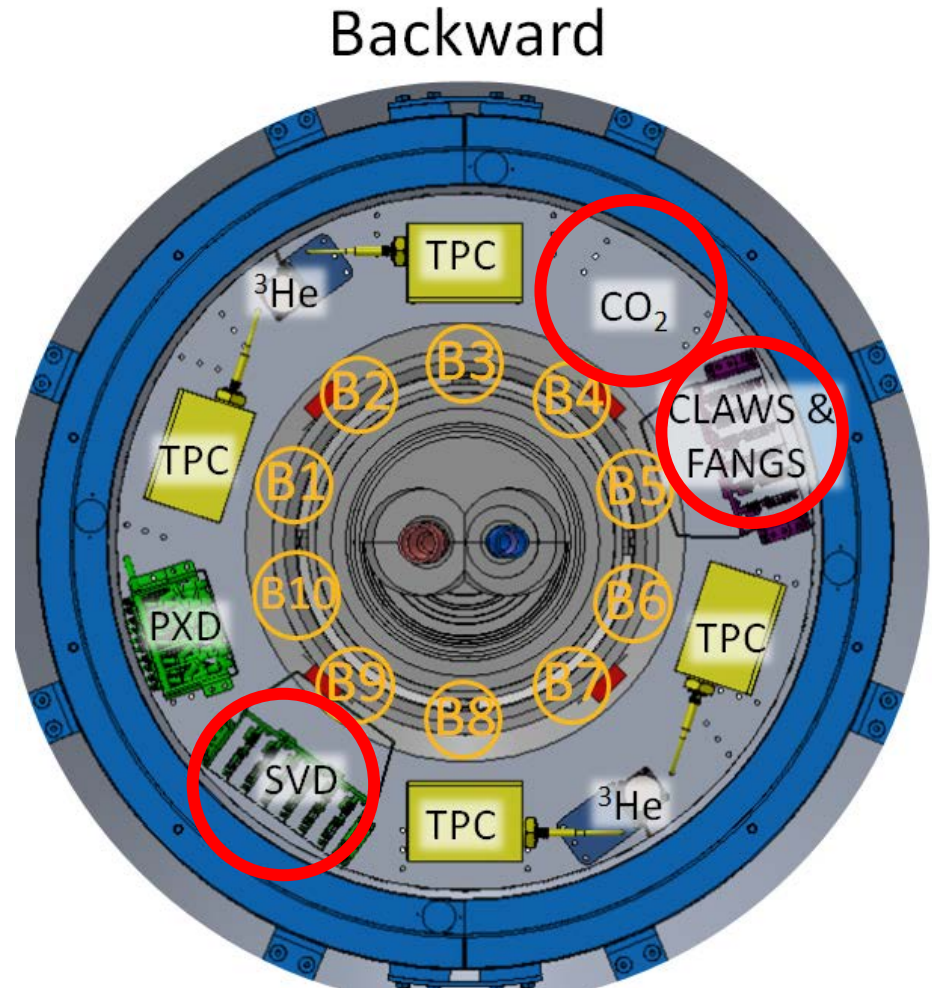
- CLAWS & FANGS
- CO₂
- SVD

(Shown in red circles!)

+ the ECL

Question:

Is the BWD-side of the VXD reachable?



Accessibility on the BWD-side



Reach to the brackets on the BWD-side through the dockboxes/ECL and...



... fix the brackets on the BWD-side.

Conclusion: The installation of the VXD-mapper **is possible** under the complicated conditions with ECL and dockboxes in our way. Cables and VXD can be reached by hand, if you stand in front of the ECL.

For more comfortable work I suggest a seat or the use of our installation panel.

But we definitely have no show-stoppers here!

Improved Installation-Equipment

Other improved equipment, that is at the MPI-workshop at the moment:

- VXD-brackets-FWD with adjustment possibilities in y-direction
- Lifting device BWD (milled out for more adjustment)
- Cable trays (reduced width on BWD-side)
- MT support with bushes on BWD (extended height)
- MT-reinforcement-unit on BWD (lowered version)



Fixation points...

... and degrees of freedom of the VXD to the CDC:



Pin fixation – constraint of x-y-direction



Compensation of tolerances/thermal expansions in x-direction – constraint of y-direction



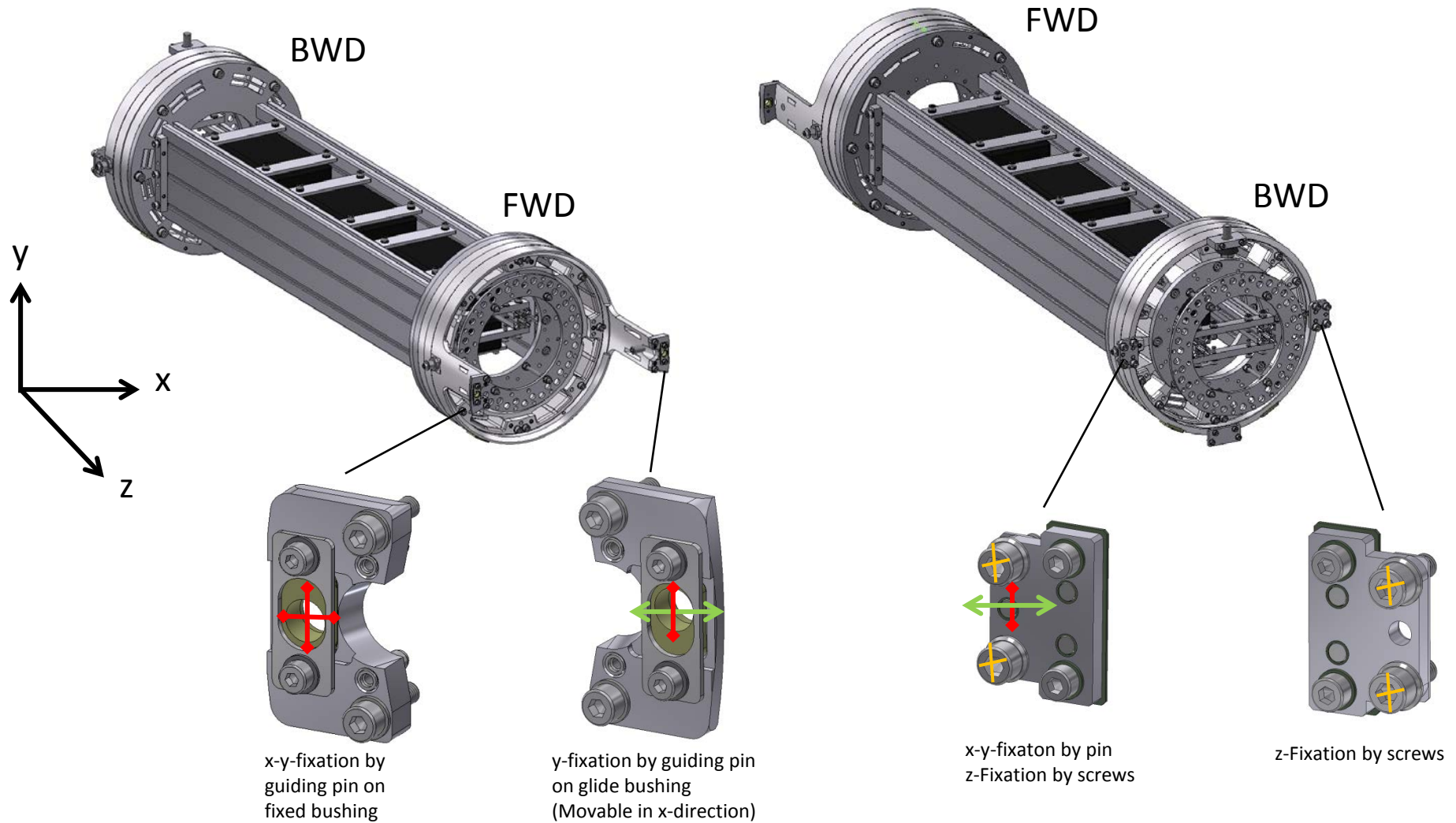
Compensation of thermal expansions in z-direction (in FWD-direction)



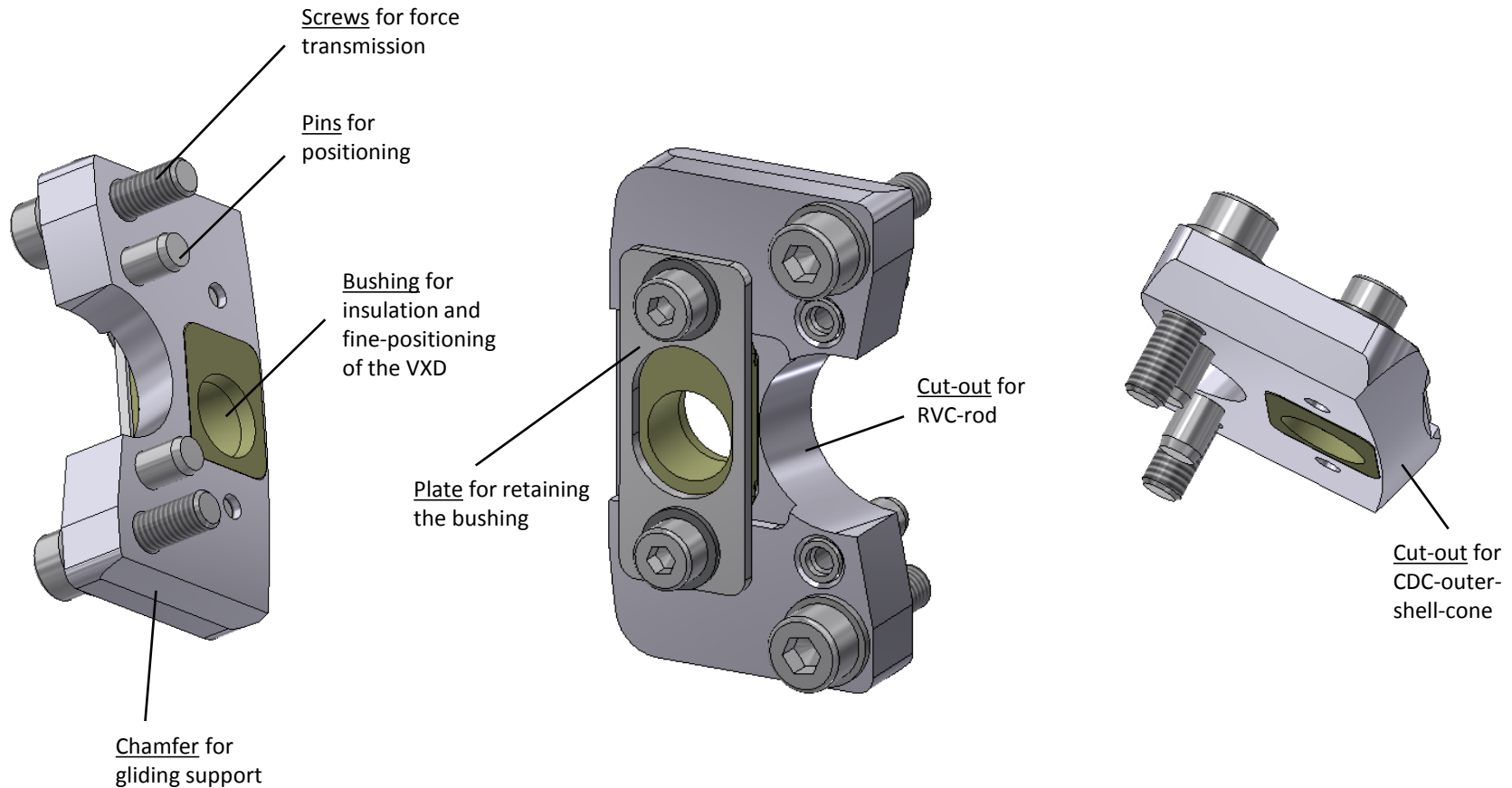
Fixation with screws – constraint of z-direction

Fixation points...

... and connection elements.

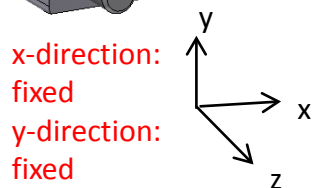
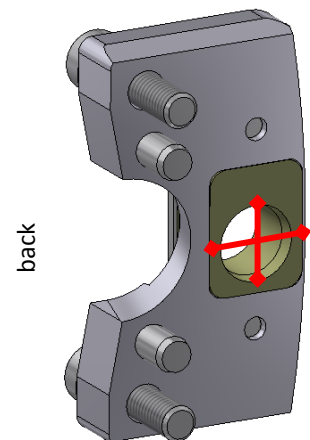
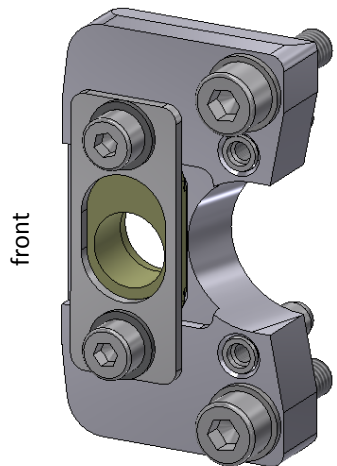


Features of the VXD-Bracket-FWD

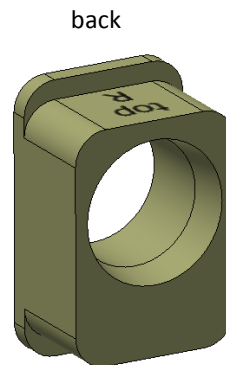
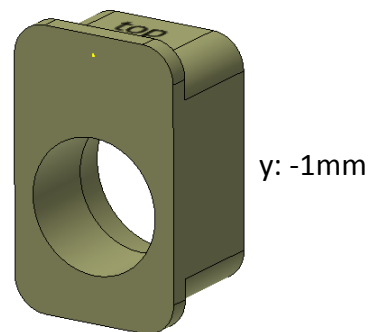
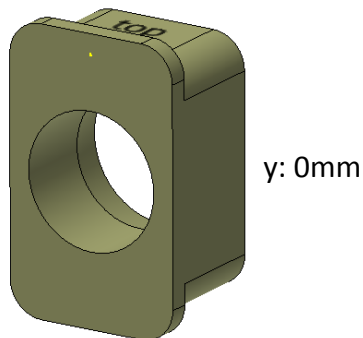
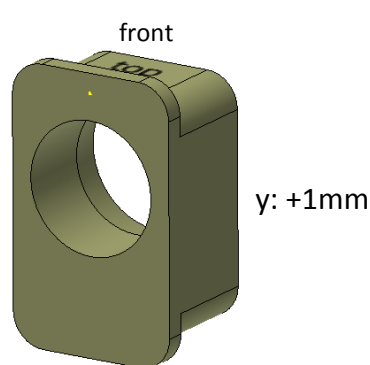


Compensation of the twist

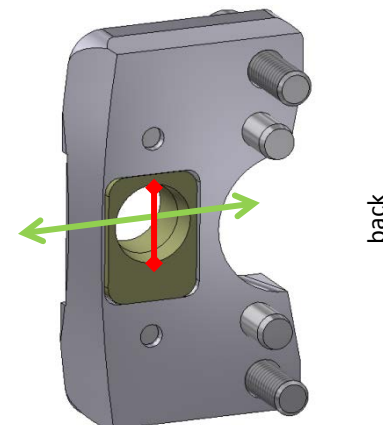
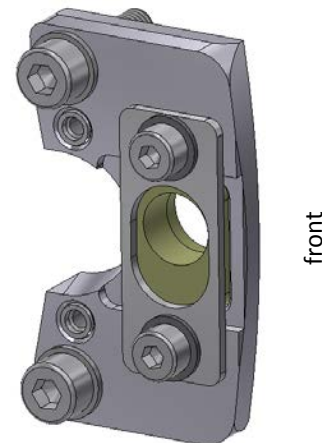
VXD-Bracket-FWD (left)



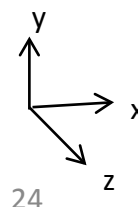
Bushing for twist-adaption



VXD-Bracket-FWD (right)



x-direction:
Clearance for compensation of
tolerances/thermal expansions
y-direction:
fixed

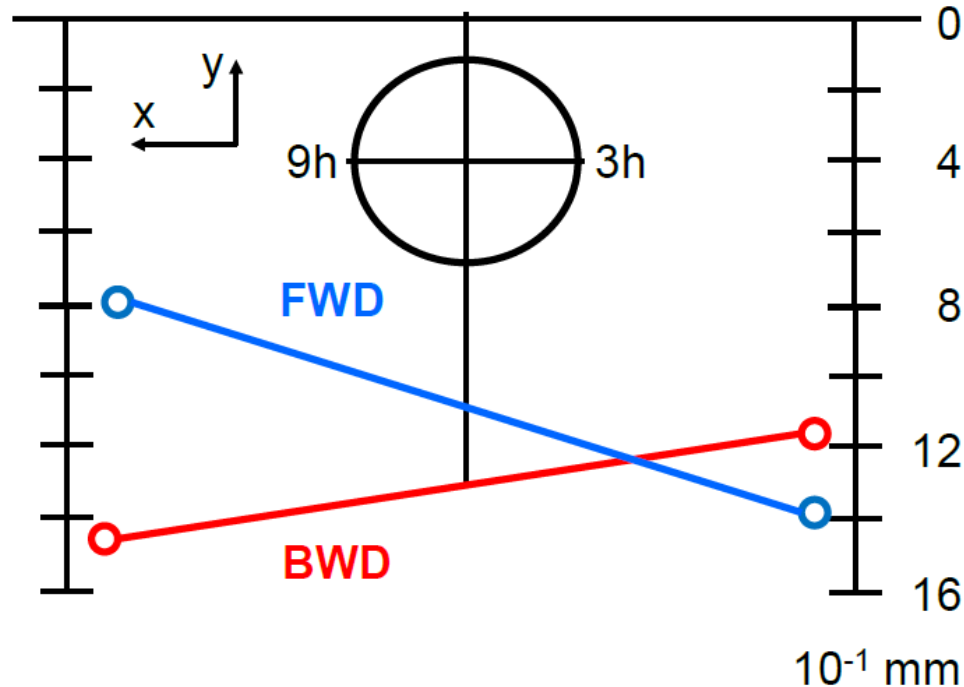


Alignment & survey

1st survey from November 2016 by Isamu Nakamura-san with total-station:

Isamu Nakamura took the measurements
BWD and FWD (thanks!)

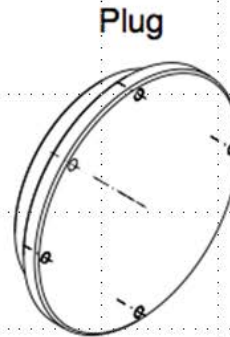
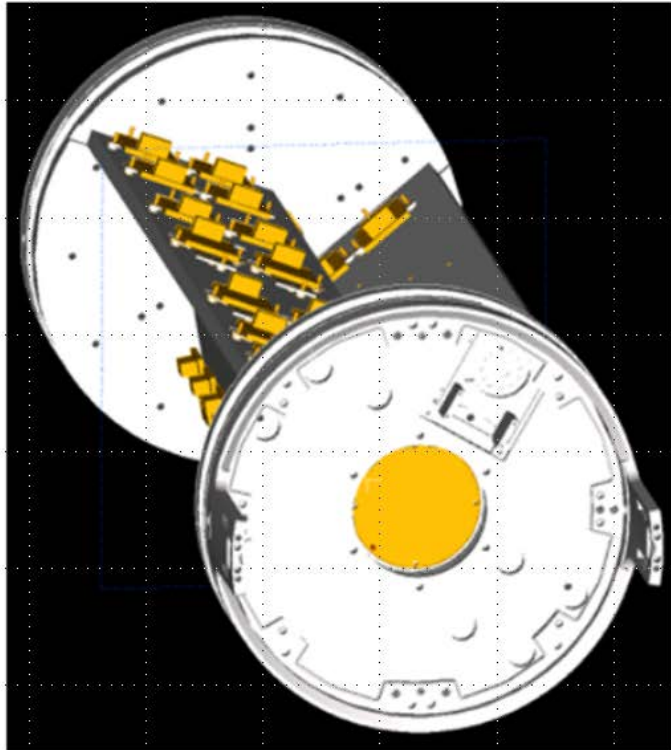
BWD CDC Inner		FWD CDC Inner	
3h	-0.16314 -0.00118	3h	0.16653 -0.00077
9h	0.16877 -0.00146	9h	-0.16489 -0.00138



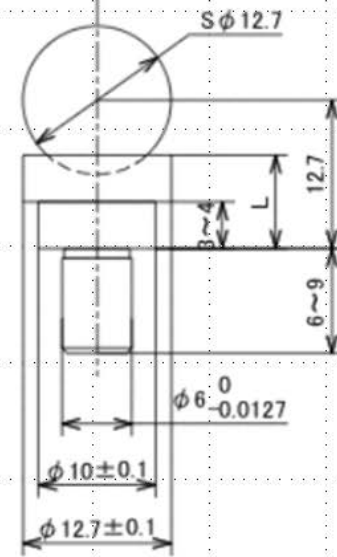
Alignment & survey

3rd survey from April 2017 by an external company with laser-tracker:

Fixation for Survey Target



0.5 inch reflector

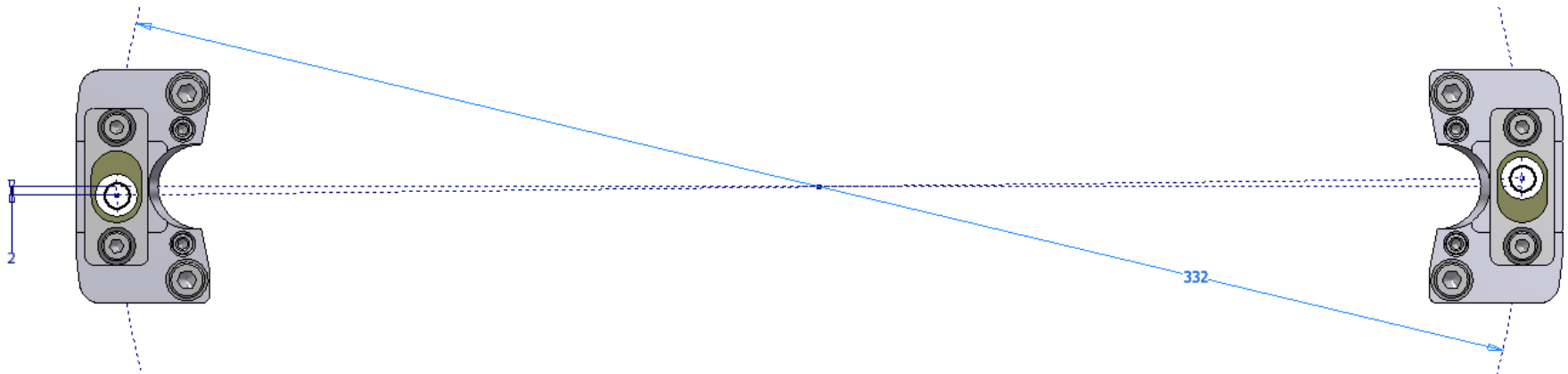


Holes for CCR target holder

- Track target position as function of rotation angle simultaneously from both sides
- determine position and orientation of mapper axis versus ϕ

Compensation of the twist...

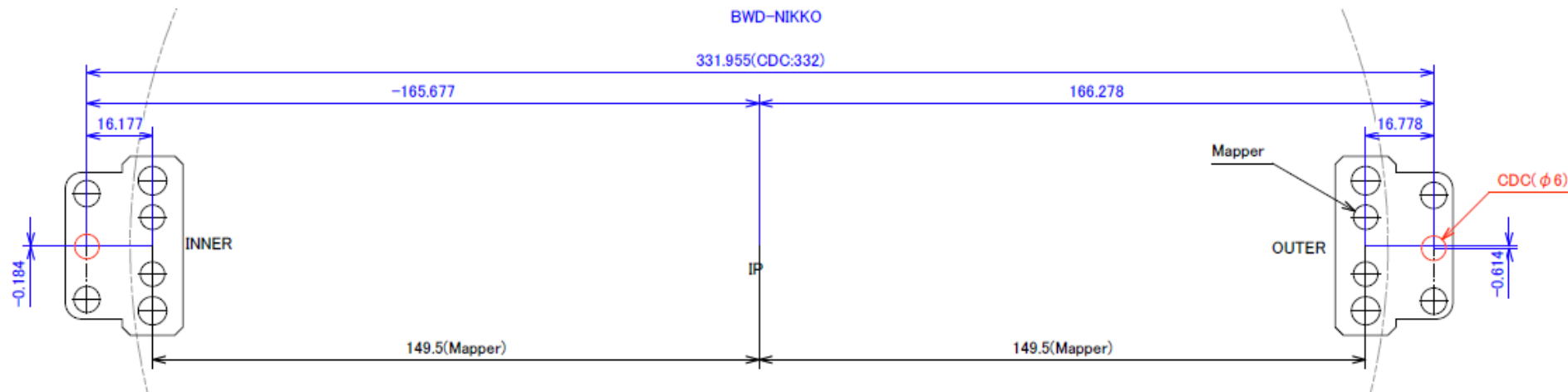
... between VXD and CDC for **FWD**



With the **new VXD-bracket-FWD system** it is possible to compensate a **twist of max. 1mm**, in pin-position ($d=332\text{mm}$), by only **re-producing the bushings**.
The bracket doesn't have to be renewed!

Compensation of the twist...

... between VXD and CDC for **BWD**



For the BWD-side, the brackets will be **manufactured new** with the pin-holes in the right-compensated position.

Summary

- **Performed installation tests**
- **Issues/critical points during installation tests**
- **Improvements for installation equipment**
- **Survey and alignment of the Belle detector**

Next

- **Manufacture new brackets for the FWD-side**
- **Installation of the VXD for phase 2**

Thank you for your attention!

Do you have any questions?



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