Interaction Region Construction towards Phase 2

21th KEKB Accelerator Review Committee
KEK, 13-15 June 2016

Ken-ichi Kanazawa
for
KEKB Vacuum Group
IR Technical Meeting Member
IR Installation Meeting Member
SVD/IR Mechanics Meeting Member

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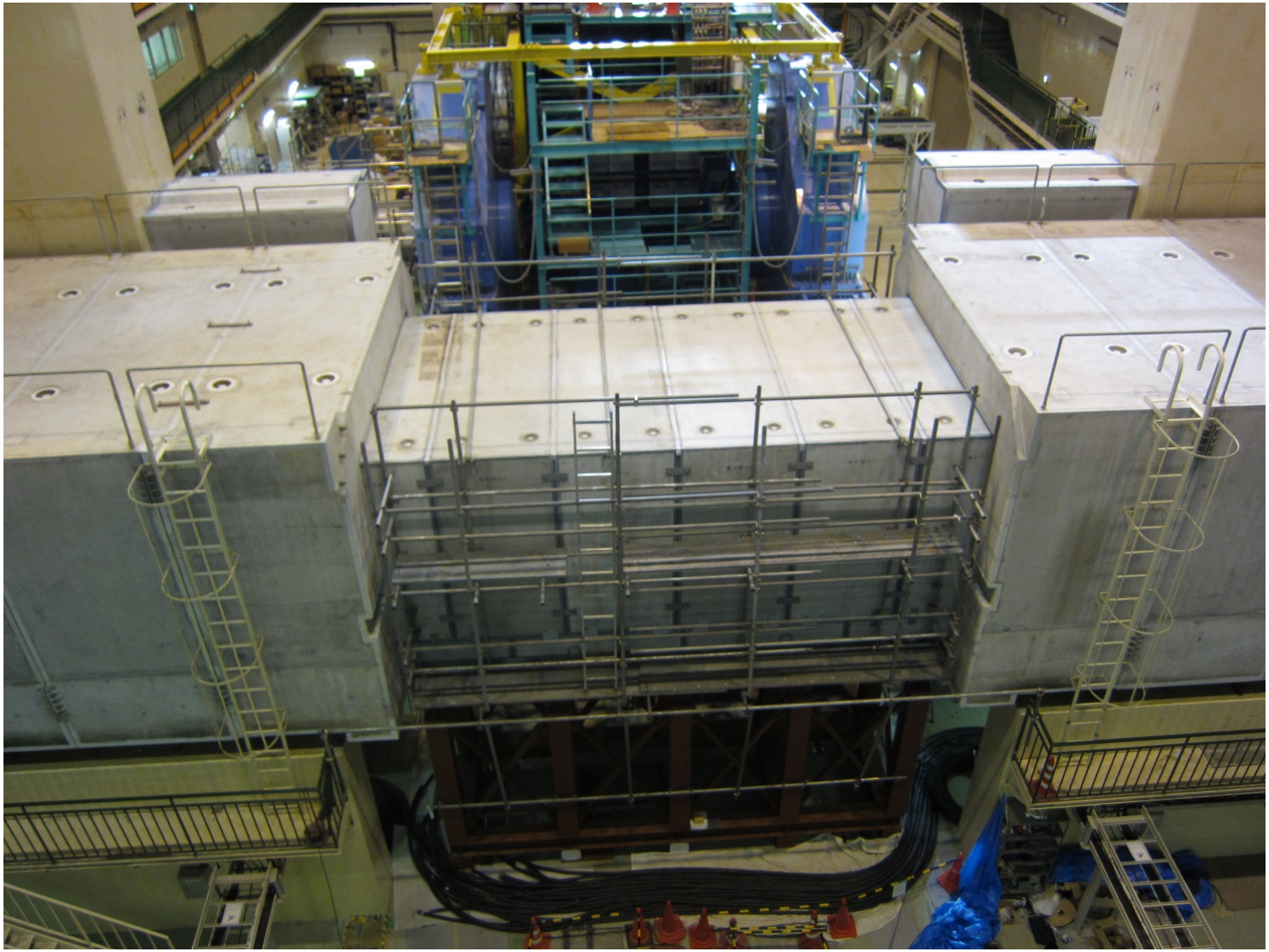
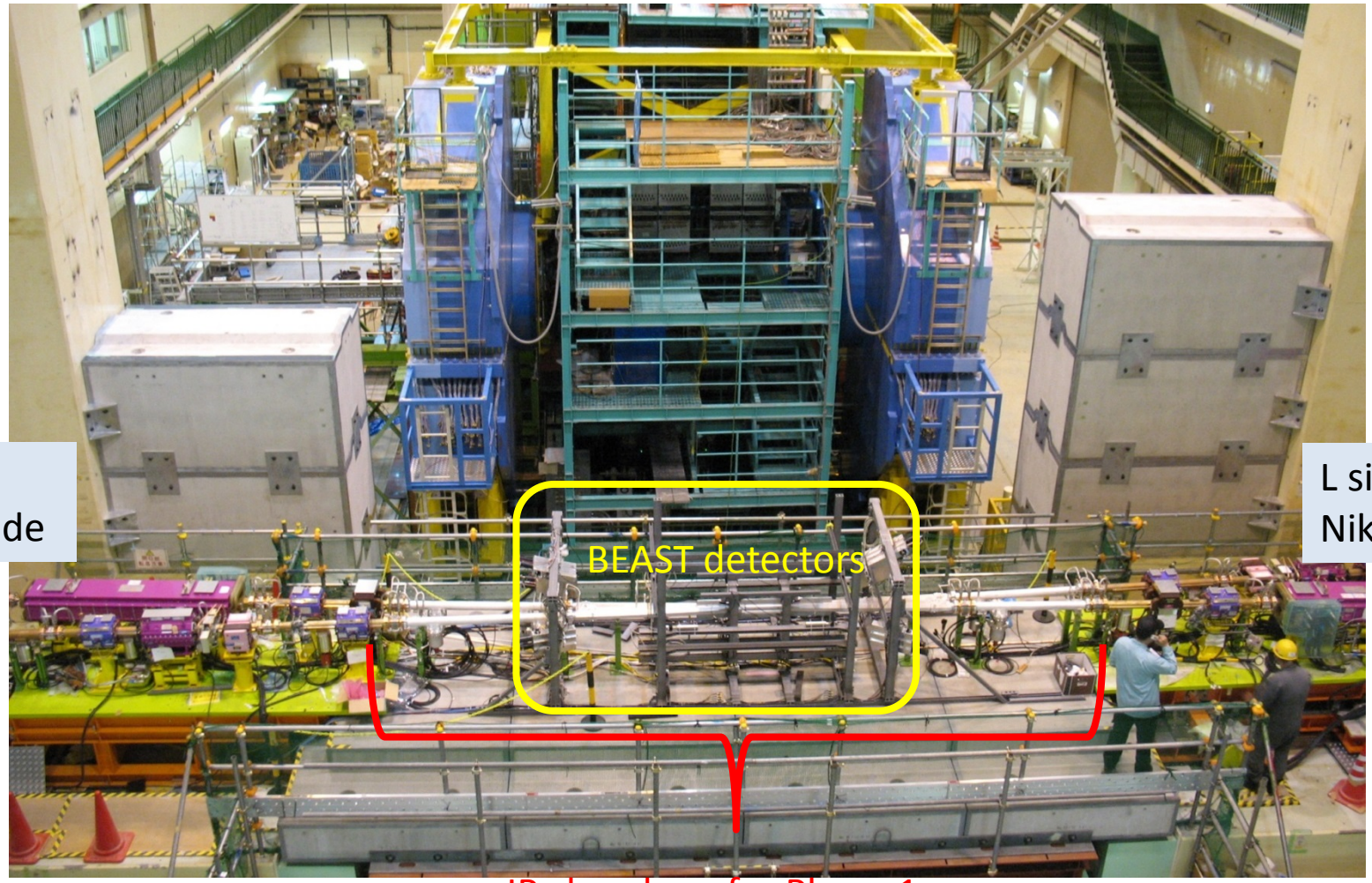
Outline from Phase 1 to Phase 2

Phase 1 IR with concrete shields



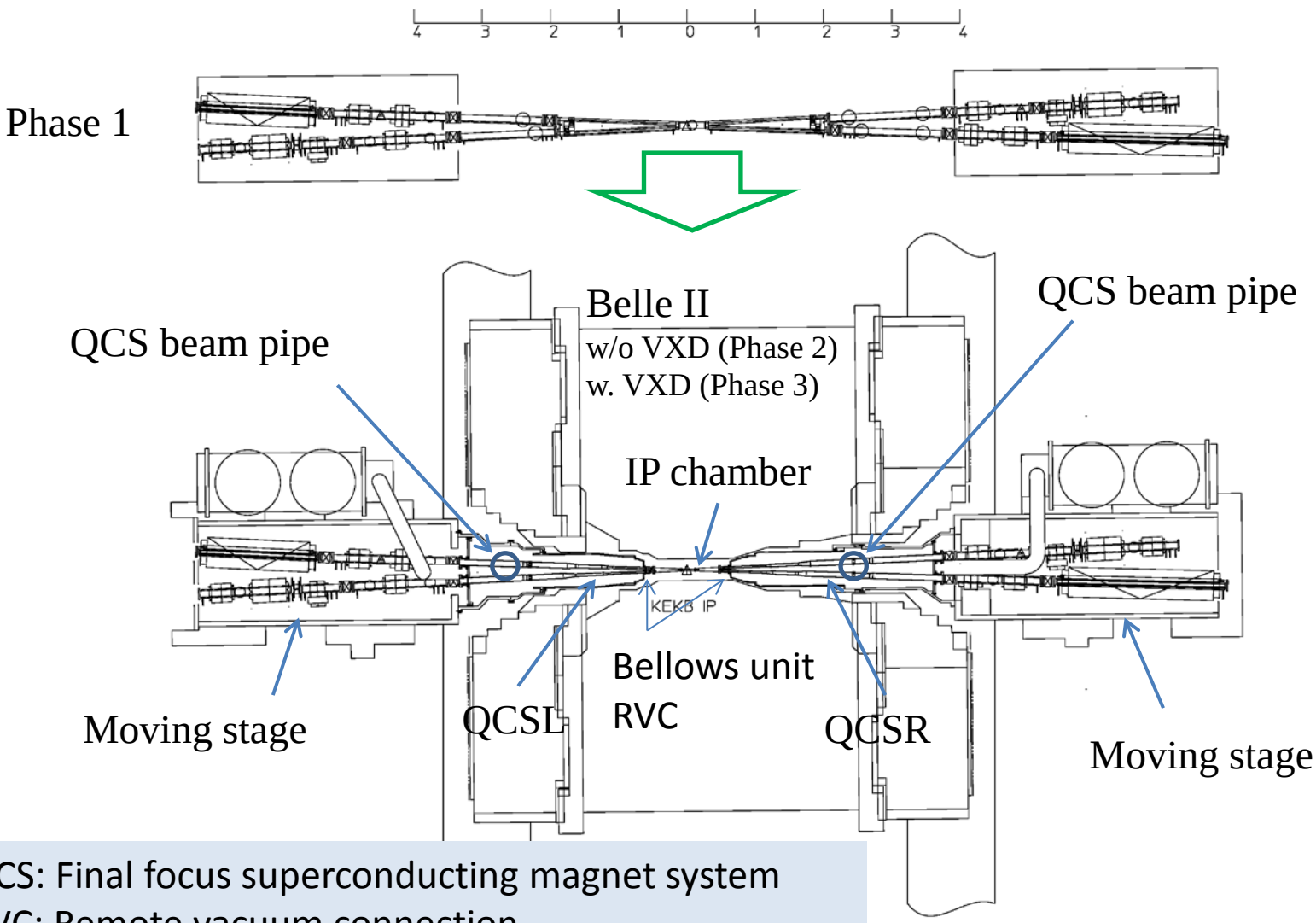
Outline from Phase 1 to Phase 2

Phase 1 IR without concrete shields

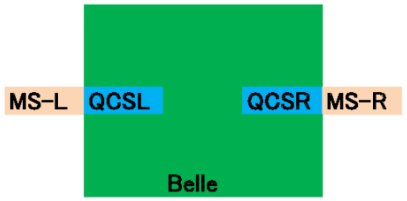


Outline from Phase 1 to Phase 2

Schematic drawing



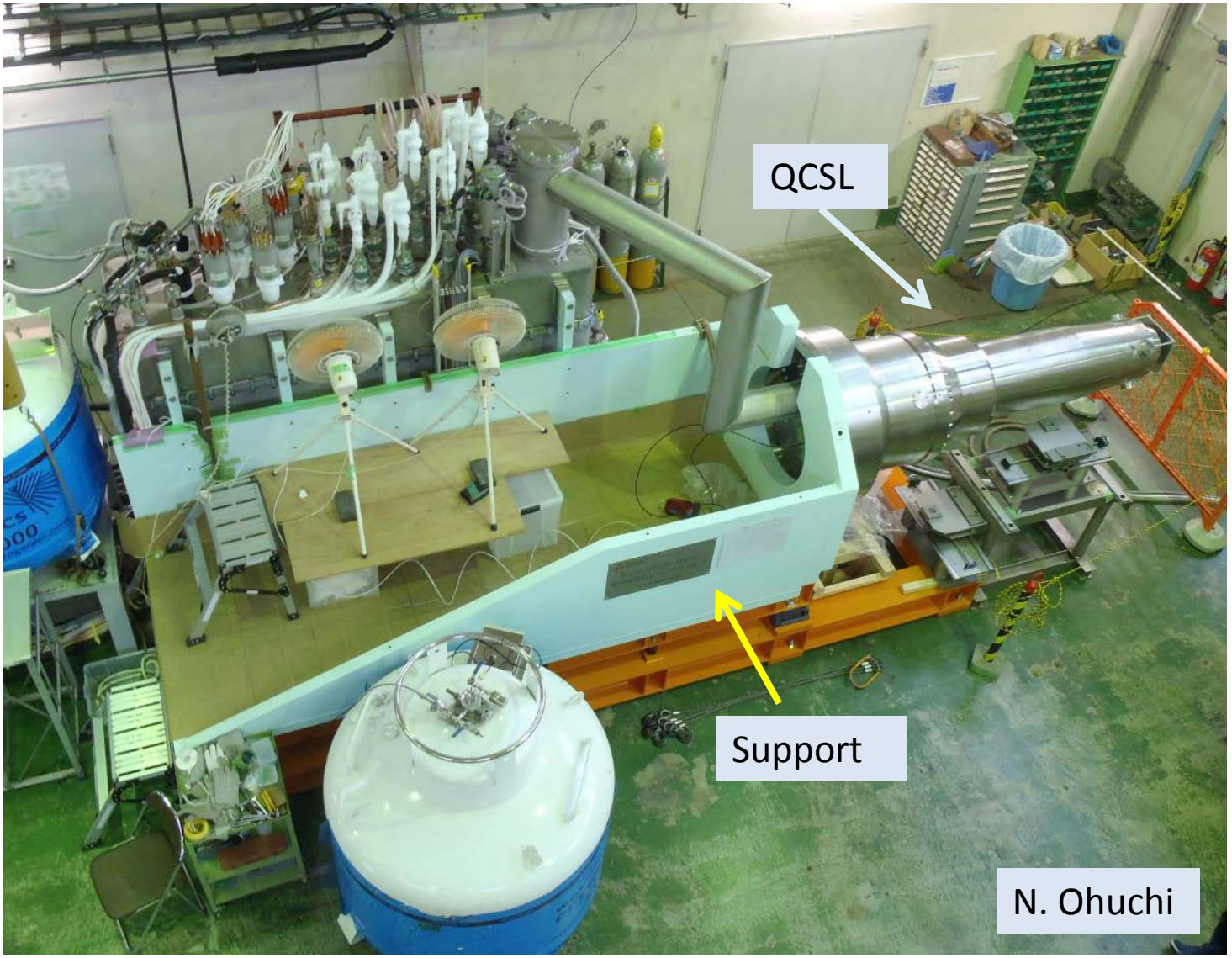
QCS: Final focus superconducting magnet system
RVC: Remote vacuum connection

2016	End of Jun – Jul	Magnets and beam pipes around IP are removed except the Moving Stage-L	
	1-Aug	QCSL installation	
	Aug – Oct	QCSL alignment MS-R installation	
	Nov	QCSL cooldown, QCSR installation	
	Nov	QCSR alignment	
	Dec	QCS move-out Belle roll-in	
2017	Jan	QCS move-in	
	Feb	QCSR cool down	
	Mar – Jun	QCSL cool down, Field measurement	
	Jul – Aug	QCS move-out BEAST II installation RVC installation QCS beam pipe installation	
	Sep – Oct	QCS move-in RVC connection Magnets and beam pipes return.	

Outline from Phase 1 to Phase 2

Phase 2 hardware

QCSL



Phase 2 hardware

Installation of the Moving Stage (L side)

Making a flat floor

Set base plates

Fill with mortar

Install Moving stage

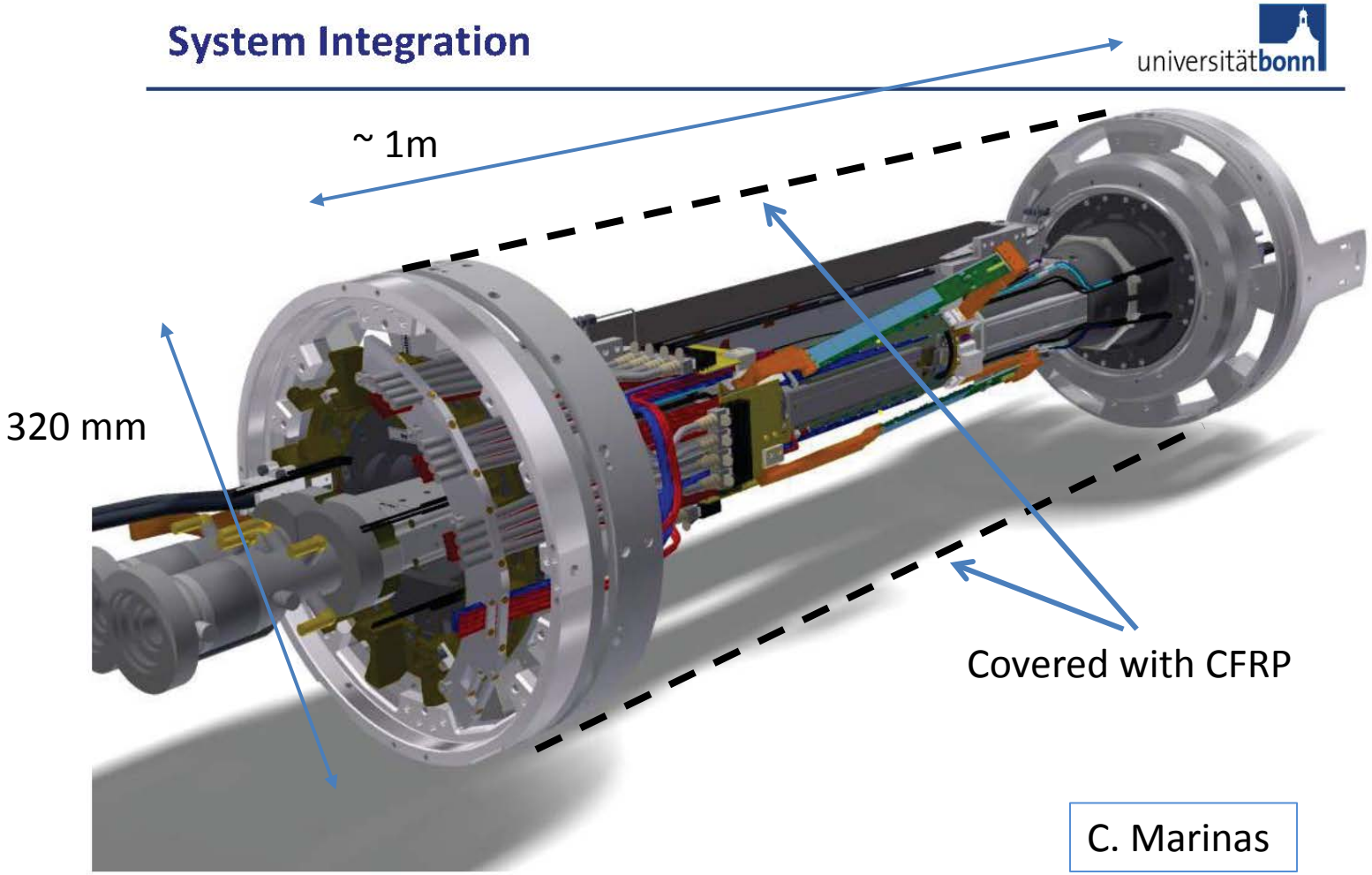
Setting linear guides

The moving stage for R side had already been fabricated. It will be installed at IR early September (2016), after floor work.

H. Yamaoka

Phase 2 hardware

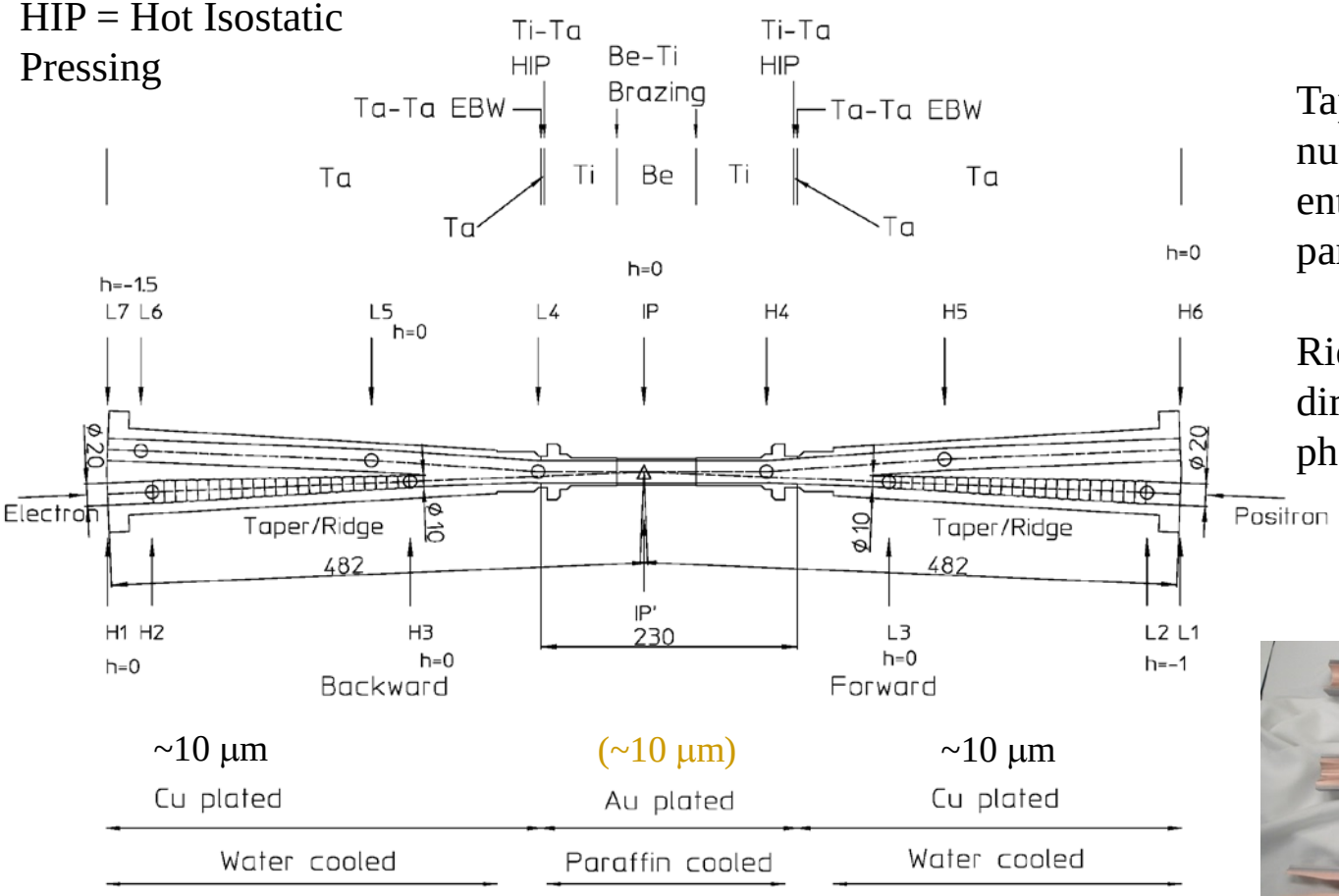
BEAST II



Phase 2 hardware

IP chamber: Design feature

HIP = Hot Isostatic Pressing

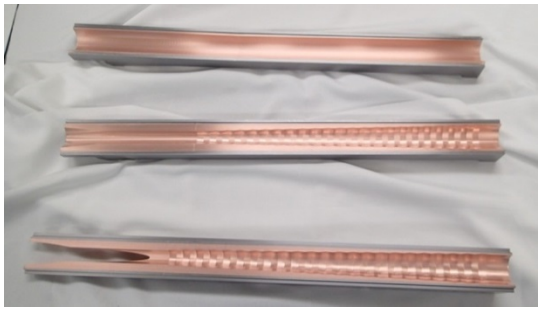


Only taper parts are exposed to direct synchrotron radiation from the last bend.

Taper: to reduce the number of photons entering into the central part

+

Ridges: to keep the direction of scattered photons away from Be



Negligible trap of HOM at the central part.

Phase 2 hardware

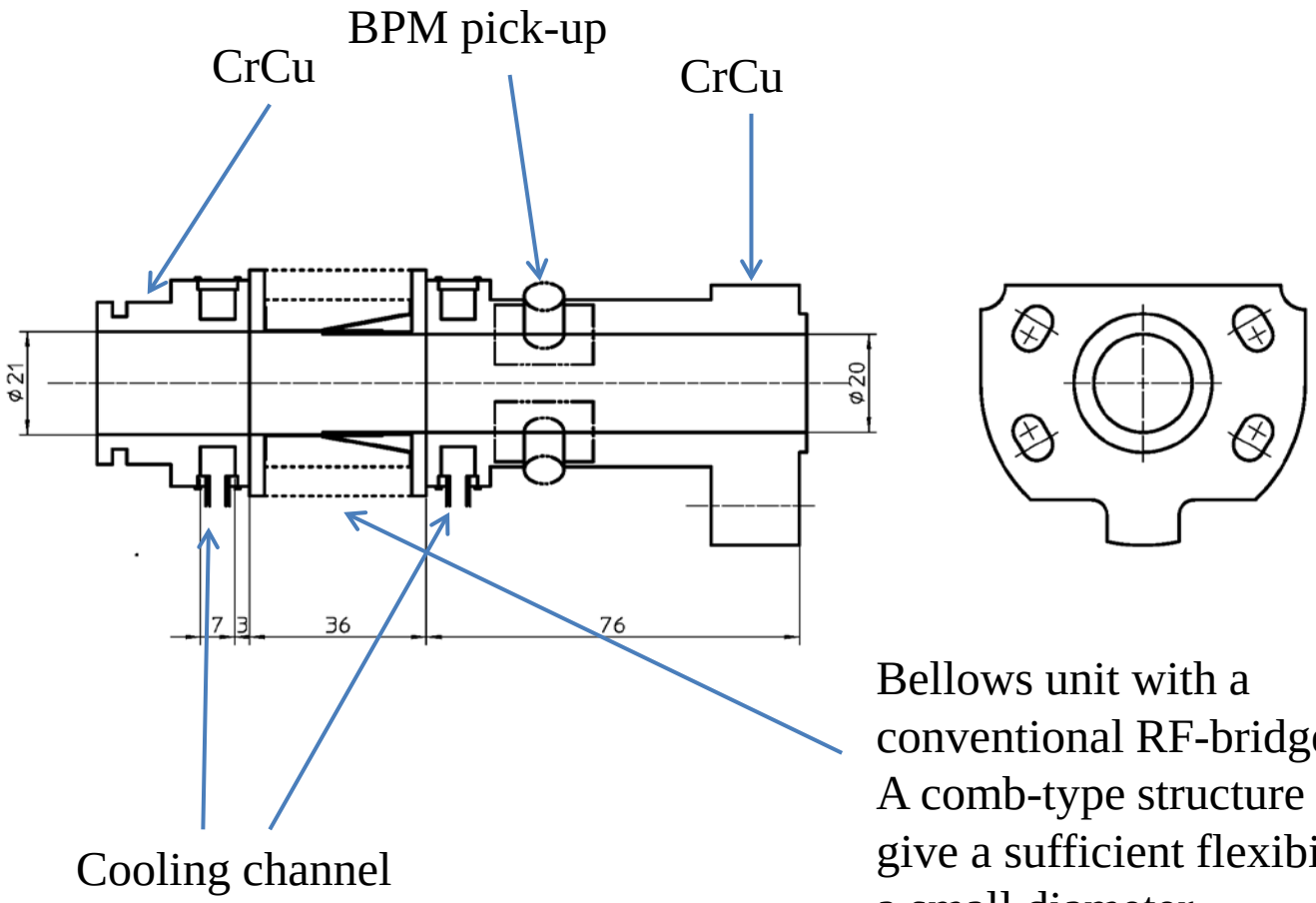
IP chamber

- The central straight part consists of double tube. Paraffin runs between them.
  - Outer Be: 0.4 mm thick
  - Inner Be: 0.6 mm thick
  - Gap: 1 mm

The IP chamber for Phase 2 is completed. The IP chamber for Phase 3 is needed before September 2017 when the assembly of VXD starts. Therefore, without feedback from Phase 2 experiences, the next chamber for Phase 3 must be fabricated.

Phase 2 hardware

Bellows unit between IP chamber and QCS



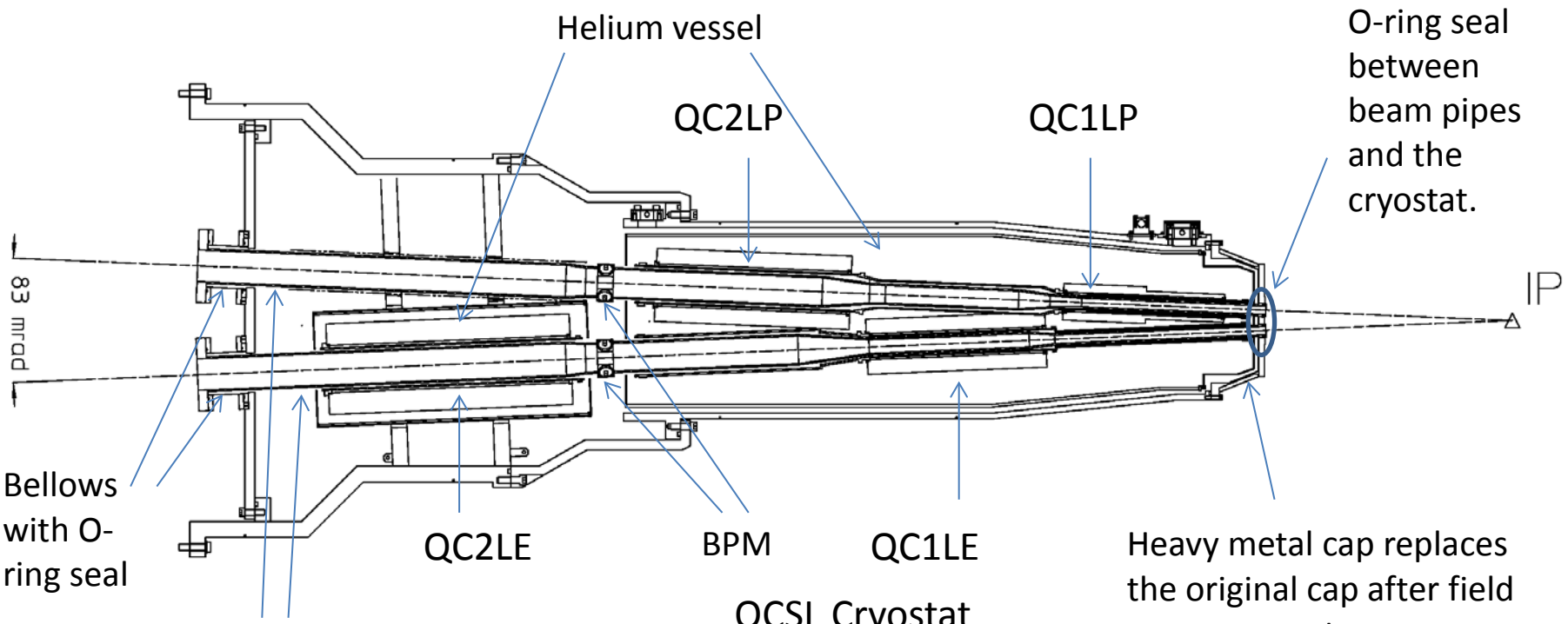
Bellows unit with a conventional RF-bridge.
A comb-type structure cannot give a sufficient flexibility for a small diameter.

This unit will be fabricated during 2016 Sep – 2017 May .

Phase 2 hardware

Beam pipes for QCS

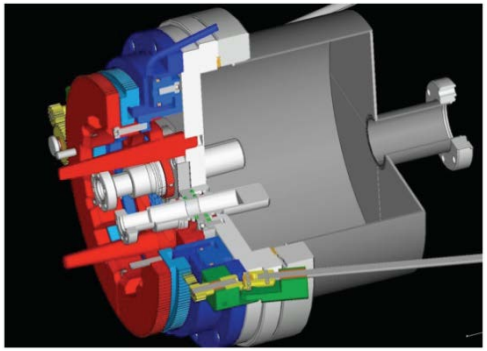
QCSL positron pipe was fabricated in FY 2015. Other three will be fabricated till June 2017.



Beam pipe with a 4 mm thick wall, and with water cooling channels therein.
Inside: Cu (+TiN) coated.

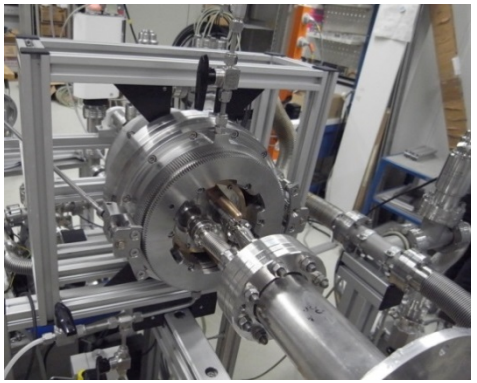
Phase 2 hardware

RVC

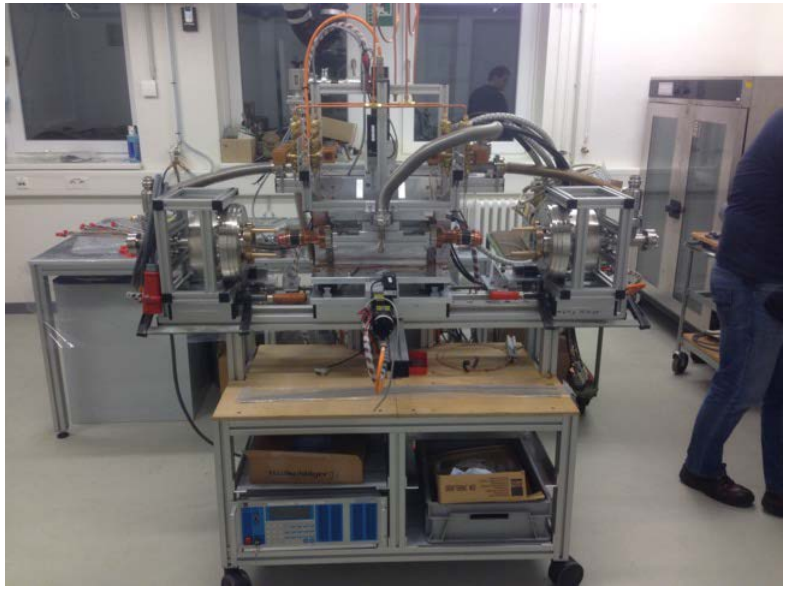


AIM with RVC was approved at 18th B2GM (18-21 June 2014).
Emergency procedure when RVC is stuck was agreed.

- Left-hand side: Make a space for hand access by removing some electronics of CDC, and detach RVC from QCSL.
- Right-hand side: Pull out VXD with QCSR.

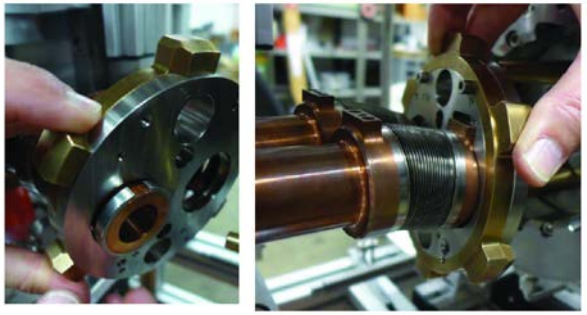


The first mock-up to valid the mechanism.



The second (~ final) product and their test mock-up.

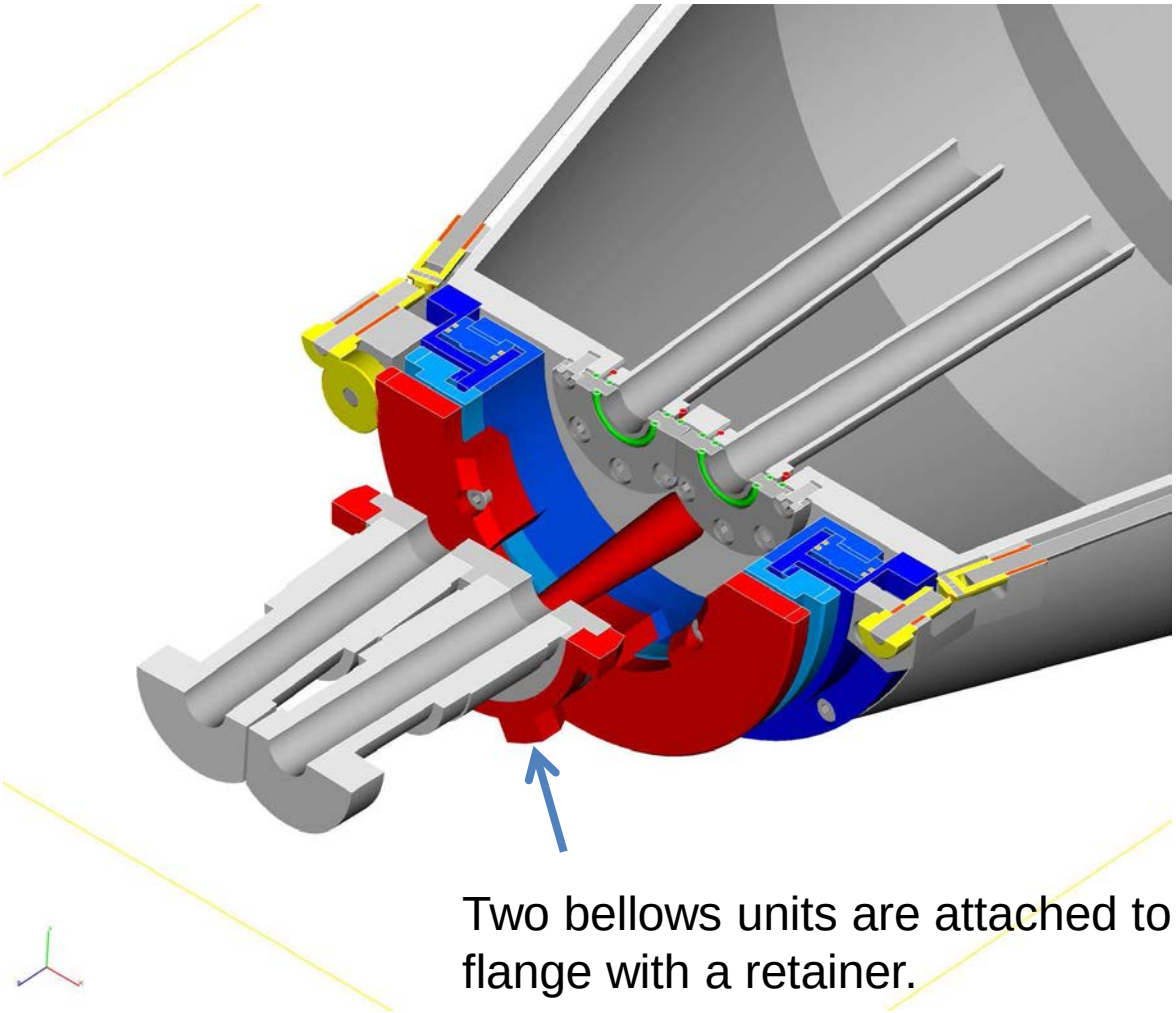
DESY



Pictures from the RVC-test-setup at DESY (Hamburg)

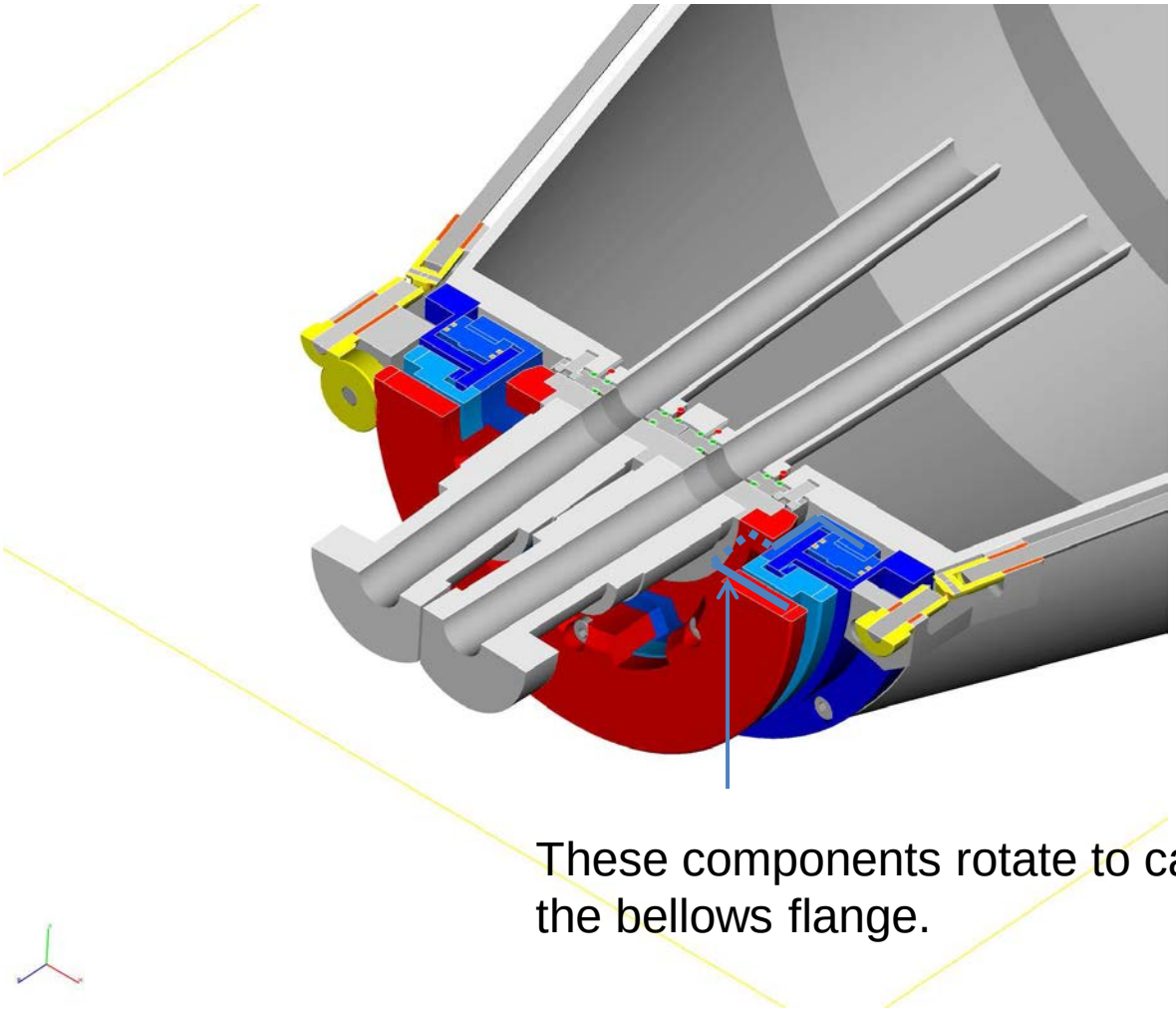
The following slides show how RVC works.

Picture 14 -19: How RVC works.



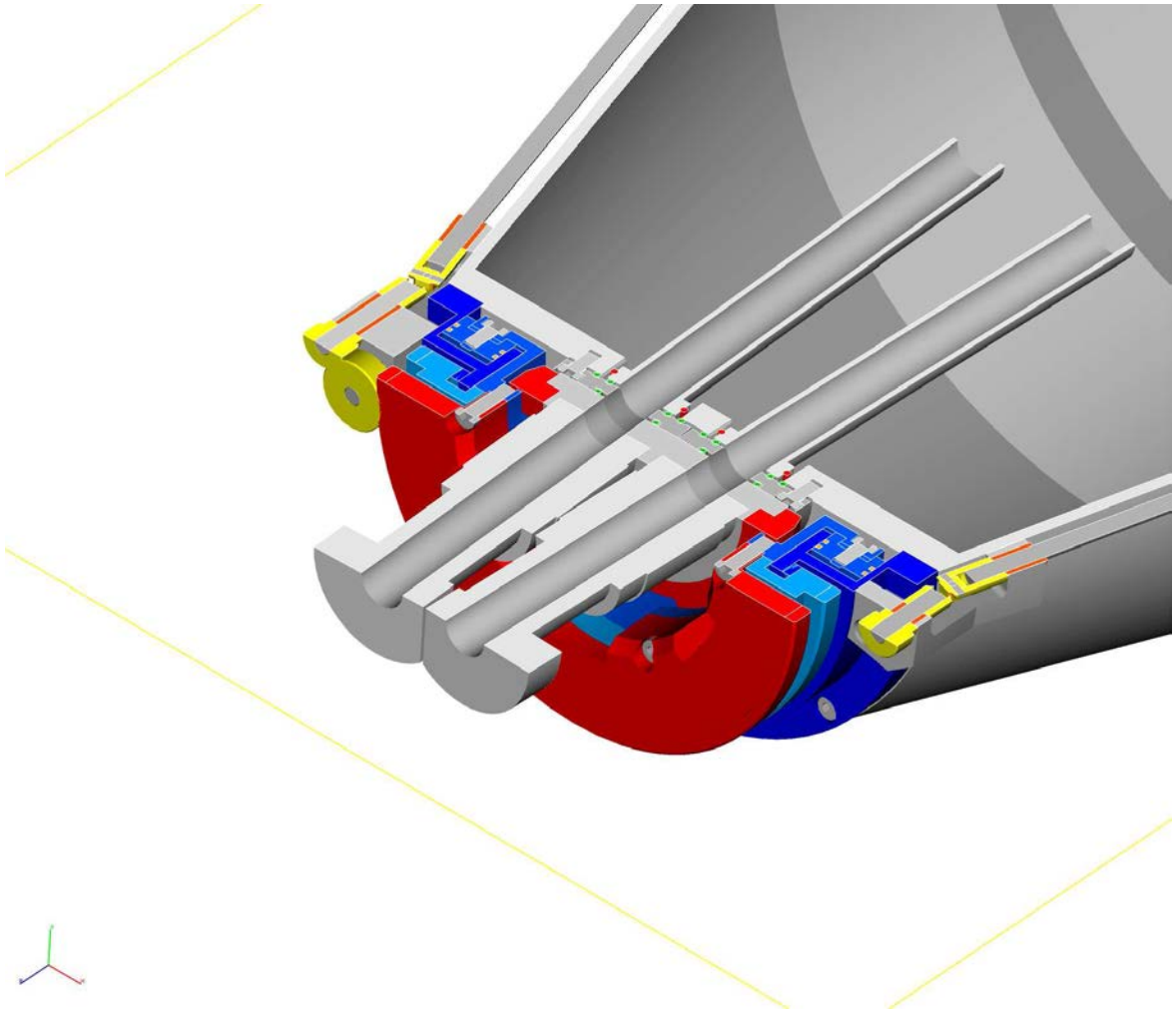
Two bellows units are attached to a single flange with a retainer.

Picture 15



These components rotate to catch the bellows flange.

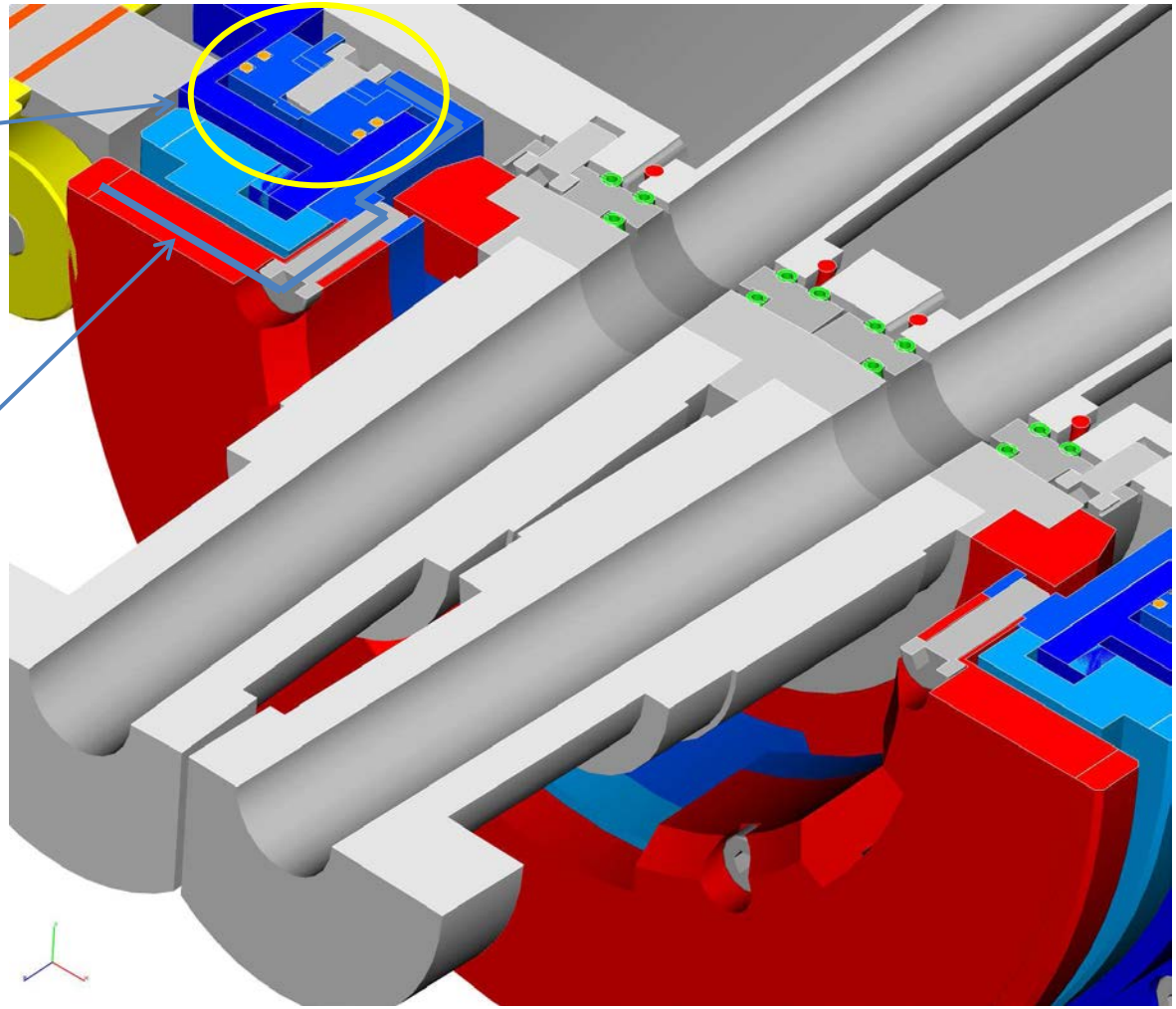
Picture 16



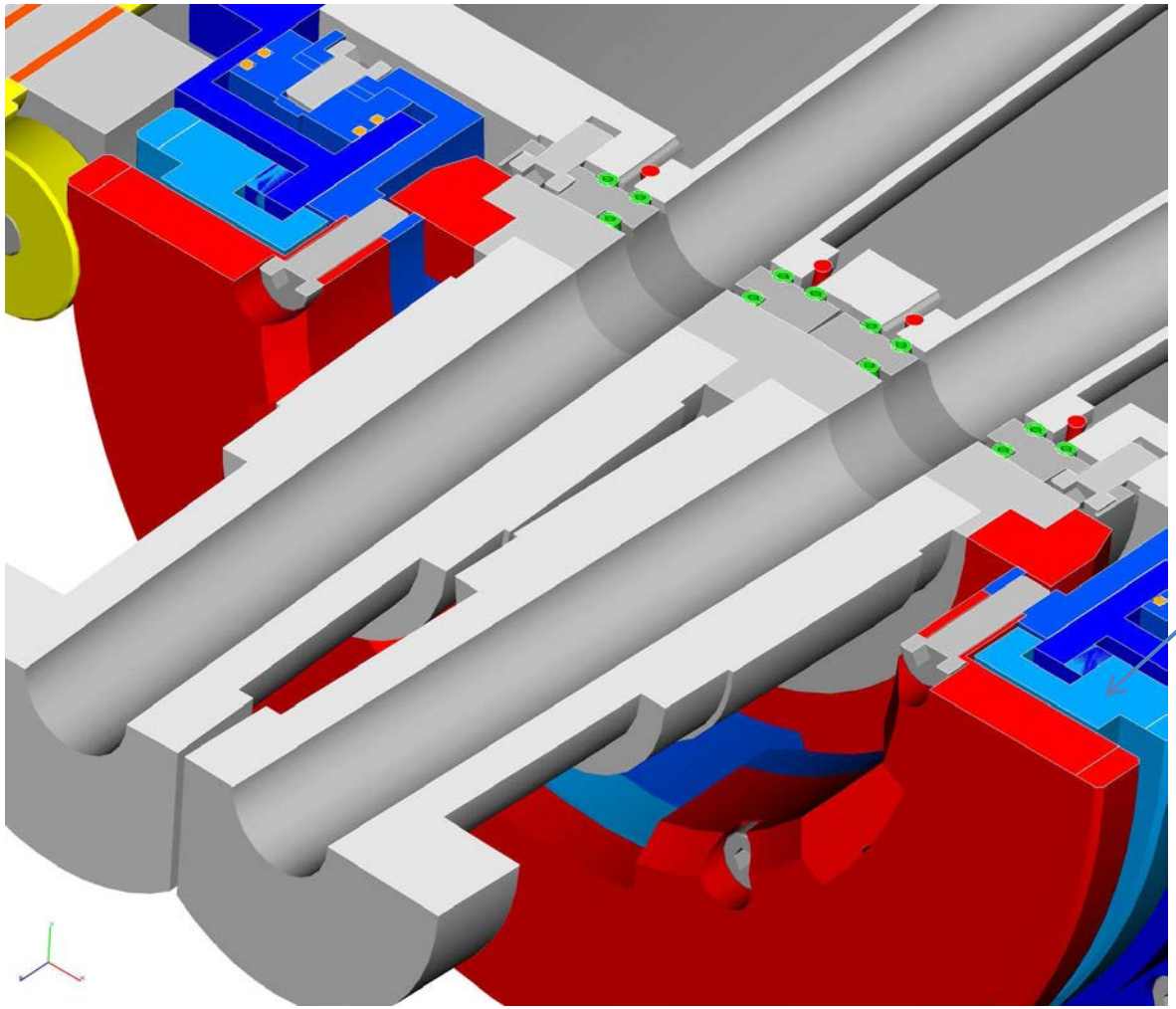
Picture 17

Cylinder for dry N_2 (about 50 bar)

These components shift to press the bellows flange to the cryostat.

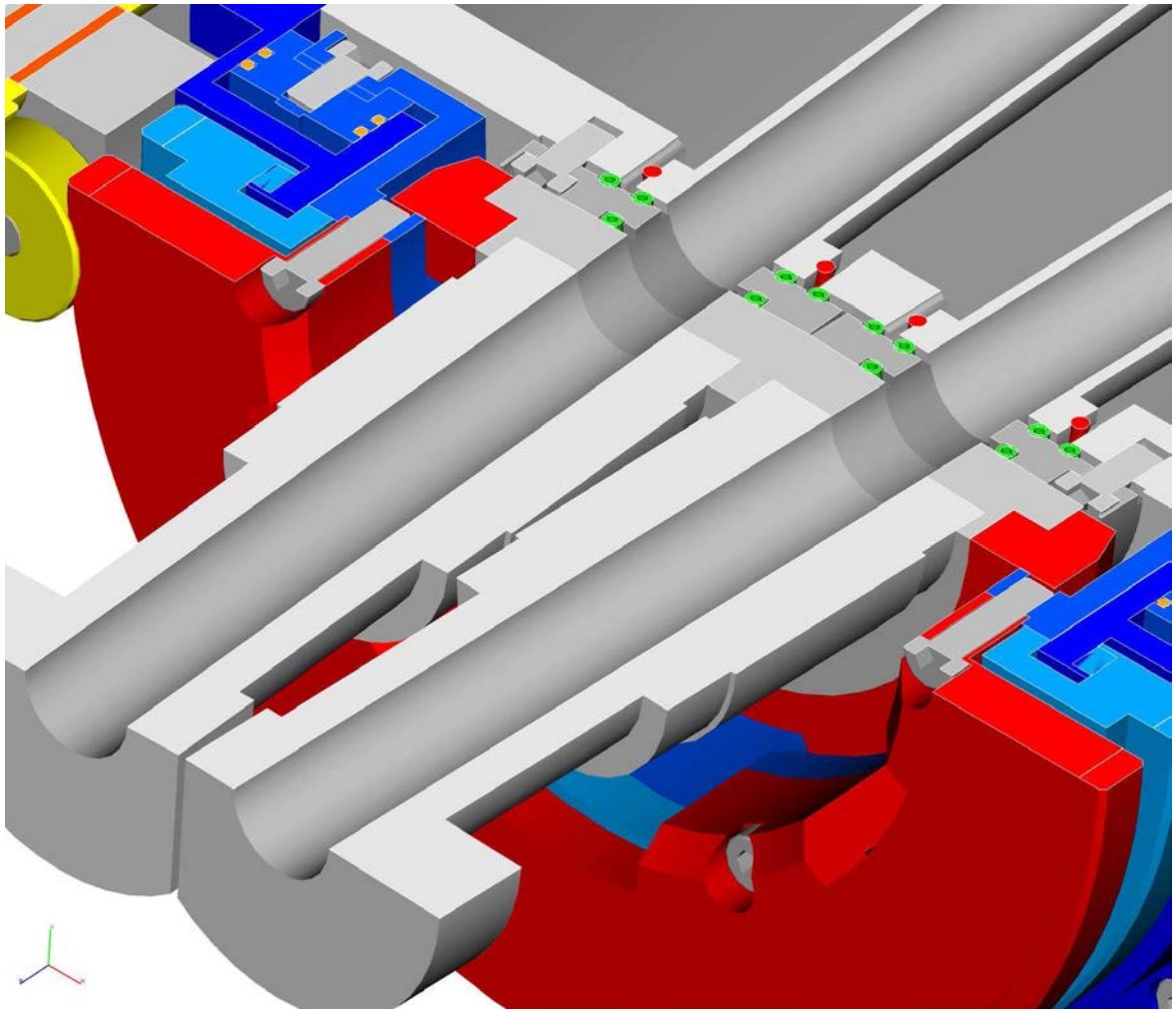


Picture 18



This large screw nut turns to lock the mechanism.

Picture 19



Phase 2 hardware

RVC: scheduling

2015 Now(February) (KEK Vacuum group and Belle-II group)

- Boundary conditions related to the QCS cryostat is nearly fixed.
- Space allocation around the right-hand side RVC is still under discussion. This will be discussed 8-9 May by Belle-II Members.

2015 June – December (KEK and DESY)

- Design of RVC (DESY) → Nearly complete (DESY)
- Design of the bellows unit (KEK/DESY) → Not finished (KEK)
- Design of the front cap of QCS (KEK/DESY) → Not finished (KEK)

2016 (DESY and KEK)

- Fabrication and Laboratory test of RVC (DESY) → In progress (DESY)
- Fabrication of the bellows unit (KEK/DESY) →2016 Sep – 2017 May (KEK)
- Fabrication of the front cap of QCS (KEK/DESY) →2016 Sep – 2017 May (KEK)

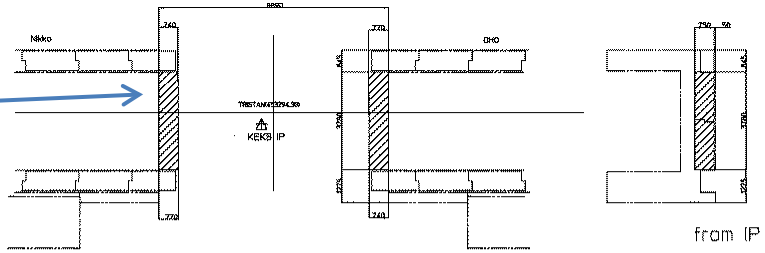
2017 March – April (before Phase 2)(KEK and DESY) → 2017 July

- Installation of RVC

Phase 2 hardware

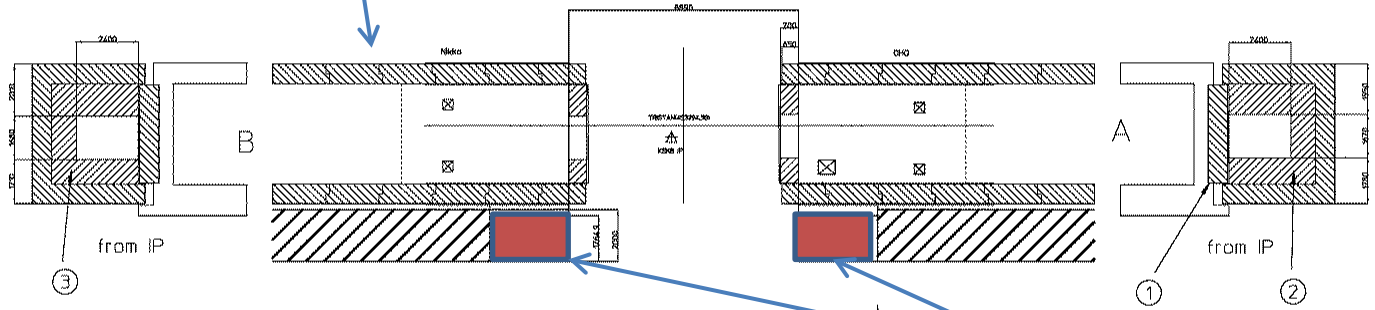
Concrete shield for Phase 2 and 3

Floor block



1. Floor block to fill a gap between the accelerator floor and the detector. This was set March 2014.

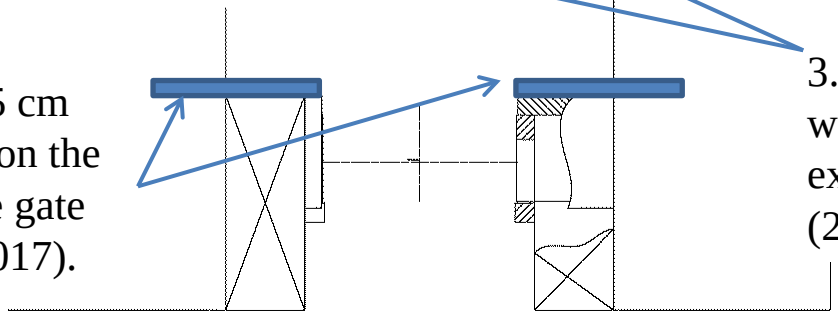
Gate shield



2. A concrete to reduce the front aperture of the gate shield. The frontend block of the gate shield will be modified to attach this concrete (2017).

3. Extension of the wall of the experimental hall (2015).

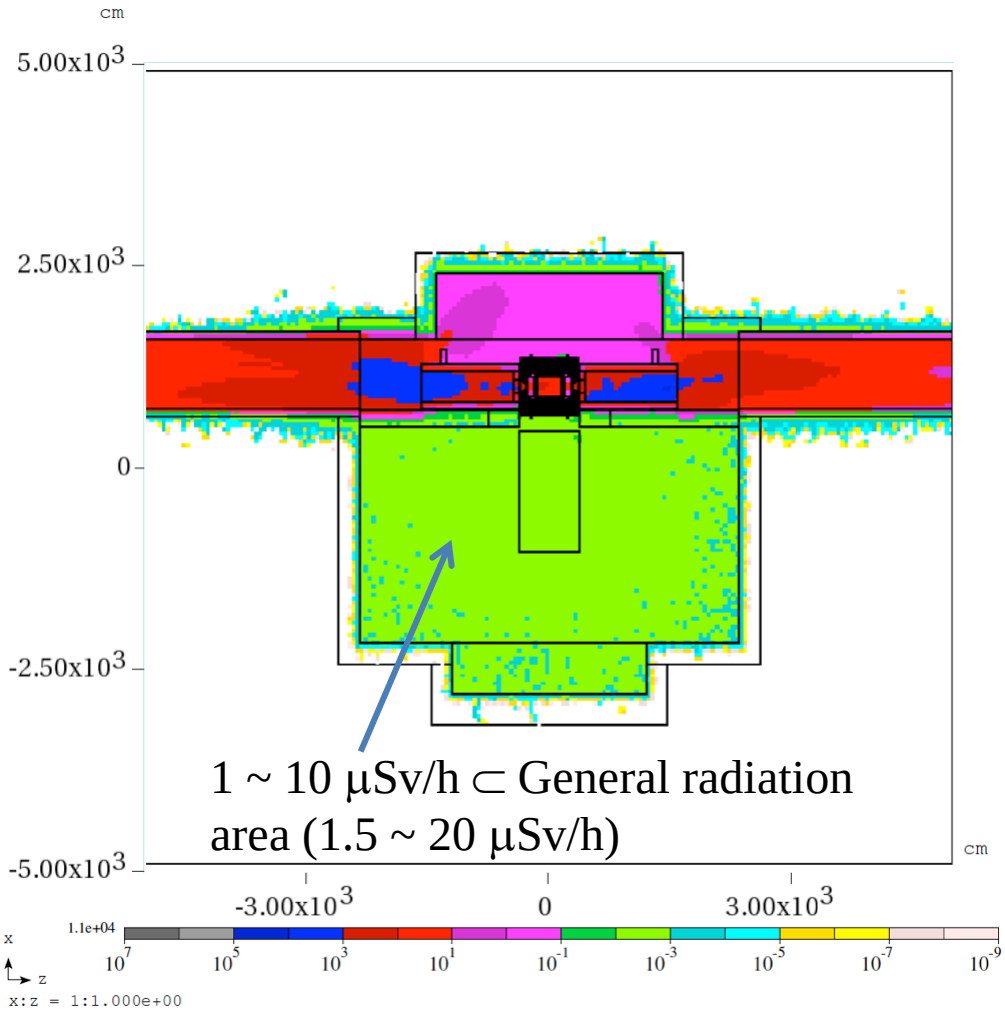
4. Add 45 cm concrete on the top of the gate shield (2017).



5. 80 cm thick concrete wall to cover the gap between the accelerator tunnel ceiling and the gate shield (2015).

Phase 2 hardware

MARS simulation



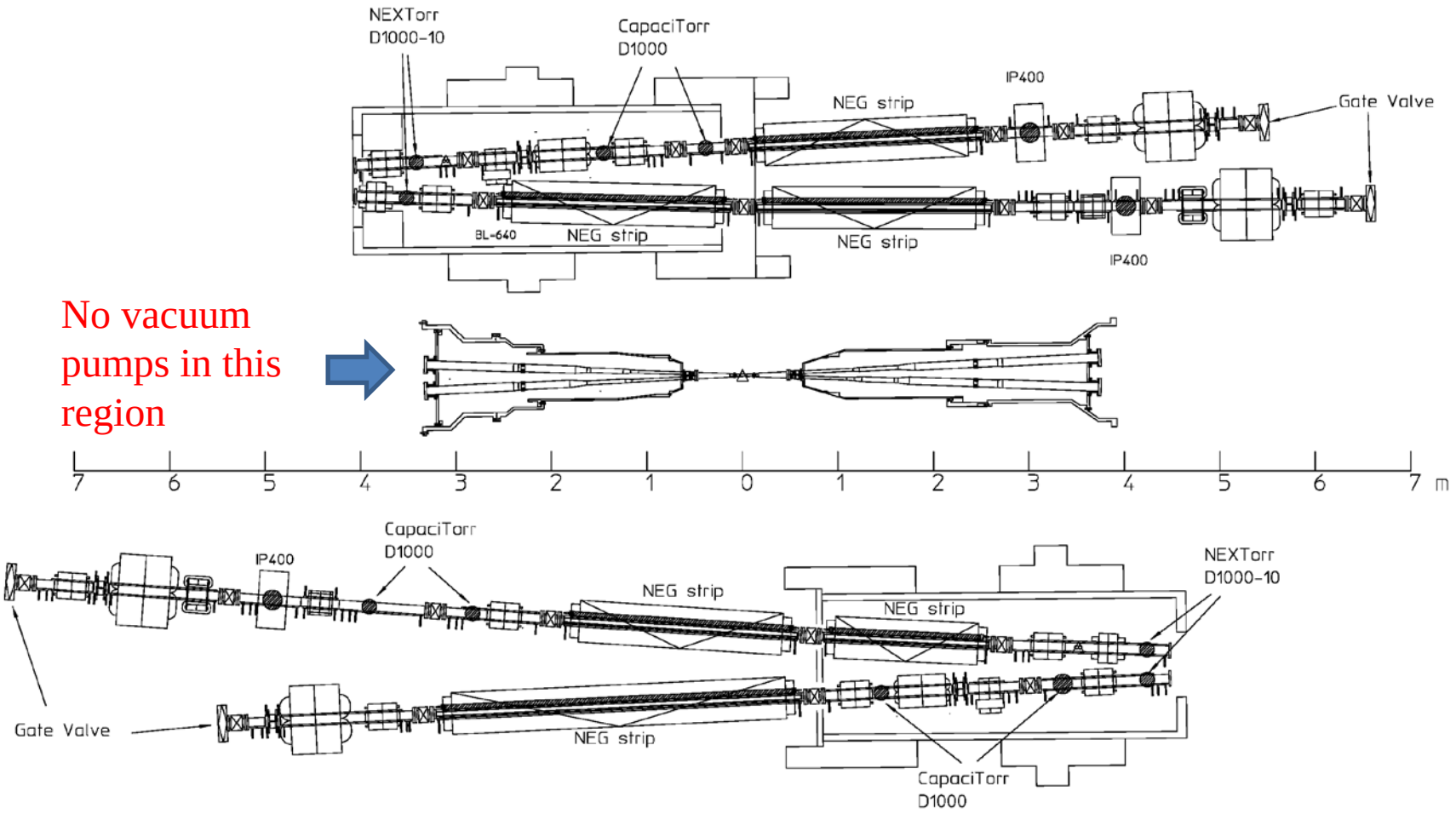
- Beam loss estimation: Y. Ohnishi, Y. Funakoshi
- Simulation: T. Sanami
- Condition: Full spec (Phase 3)

Requirement: Warning area (less than 1.5 μSv/h) during Phase 2

Since the target luminosity in Phase 2 is 1/80 of that in Phase 3, The requirement will be satisfied. If necessary, we will add a local shield around the radiation source.

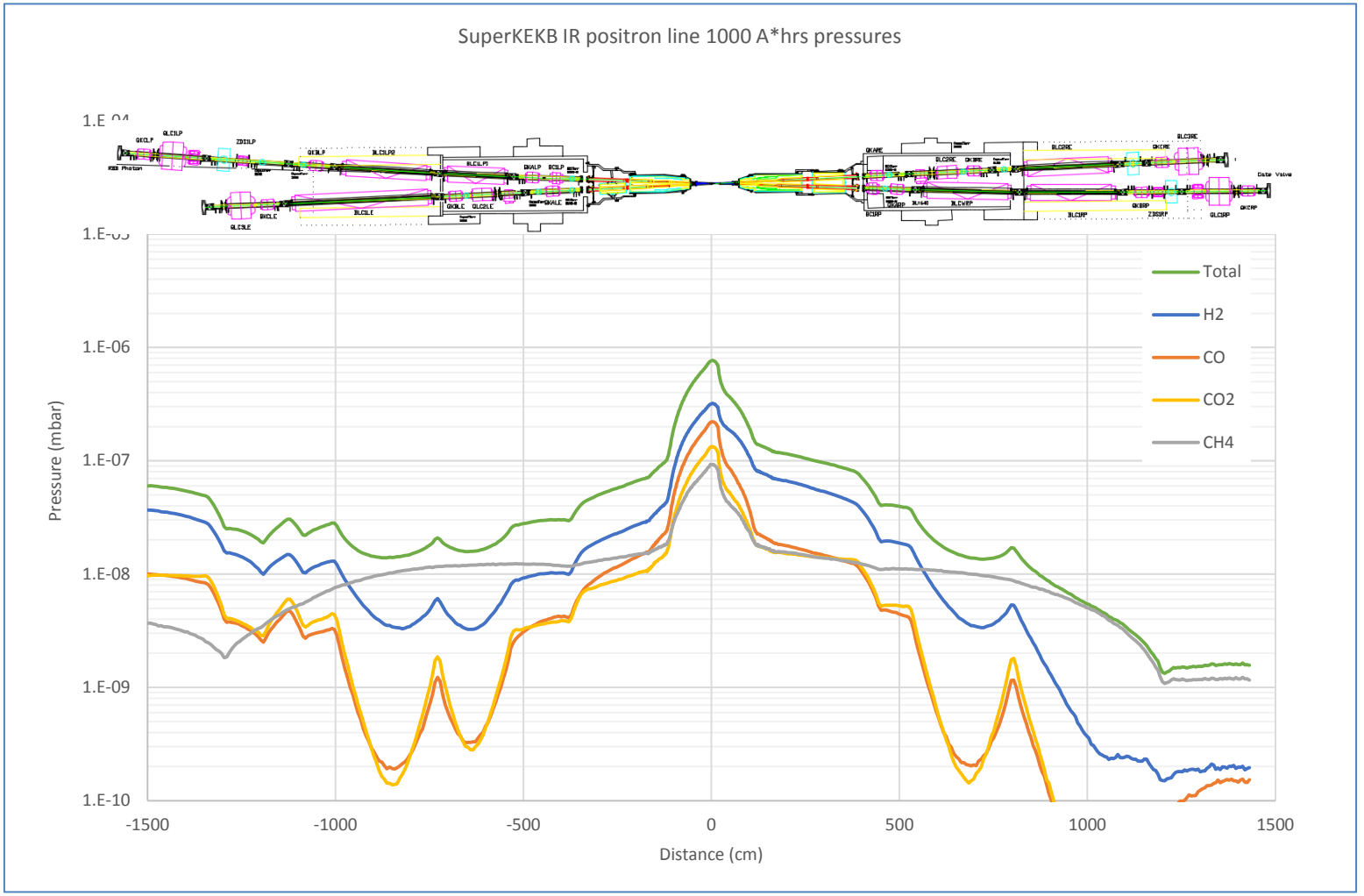
Issues relating to IR vacuum

Vacuum system of IR



Issues relating to IR vacuum

Pressure distribution



Thanks to J. Carter (ANL), M. Ady, R. Kersevan, and P. Chiggiato (CERN)

Pressure distribution

- With the simulation software MolFlow and SynRad, a pressure distribution around IP was estimated.
- The result is consistent with our previous rough estimation.
- Though the effect of this locally high pressure on the average pressure is not significant, a careful consideration on possible other effects is necessary.

Issues relating to IR vacuum

Electron cloud in QC1RP

- To evaluate the electron cloud density around IR is a recommendation at the last KEKB Accelerator Review Committee.
- J. A. Crittenden pointed out in the IPAC2015 paper (TUPTY081) that if photon scattering is considered, the number of synchrotron light photon incident on the QC1RP chamber is 30 times larger compared with the case of no photon scattering. This suggests a high electron cloud density in the QC1RP chamber. And combined with a large vertical beta-function in QC1RP, this local cloud may become a serious source of the beam blow-up. (TUPTY080)
- The cross check of this claim is not yet completed.
- The positron beam pipes for QCS cryostat will be TiN coated.
- Continuous effort to understand the electron cloud in the final focus magnets in necessary.

Summary

- Outline from Phase 1 to Phase 2 is explained.
- Hardware for Phase 2 is prepared according to the operational schedule.
- The IP chamber for Phase 2 is completed. However, the next chamber for Phase 3 must be prepared without feedback from Phase 2 experiences.
- The effect of a high pressure at IP and the electron cloud in QCS should be carefully studied.