QD0 Support from BDS tunnel
(L*=4.1m)

Motivations

(1) decoupling from the detector,

e.g. less vibration transfered from the detector

(2) separation between the detector and the accelerator elements,

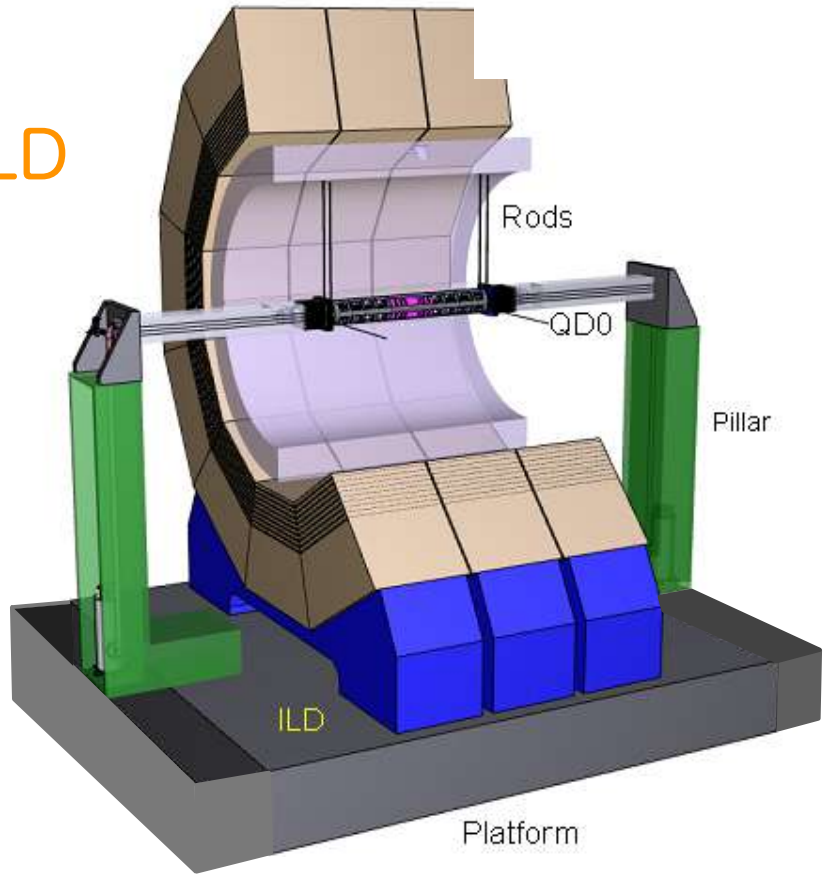
e.g. less alignment/repositioning issues after the push-pull operation/cycle

(3) in case of the QD0 pillar support in ILD, no endcap yoke splitting needed as shown in following slide, where the endcap yoke has to be split for service of inner sub-detectors

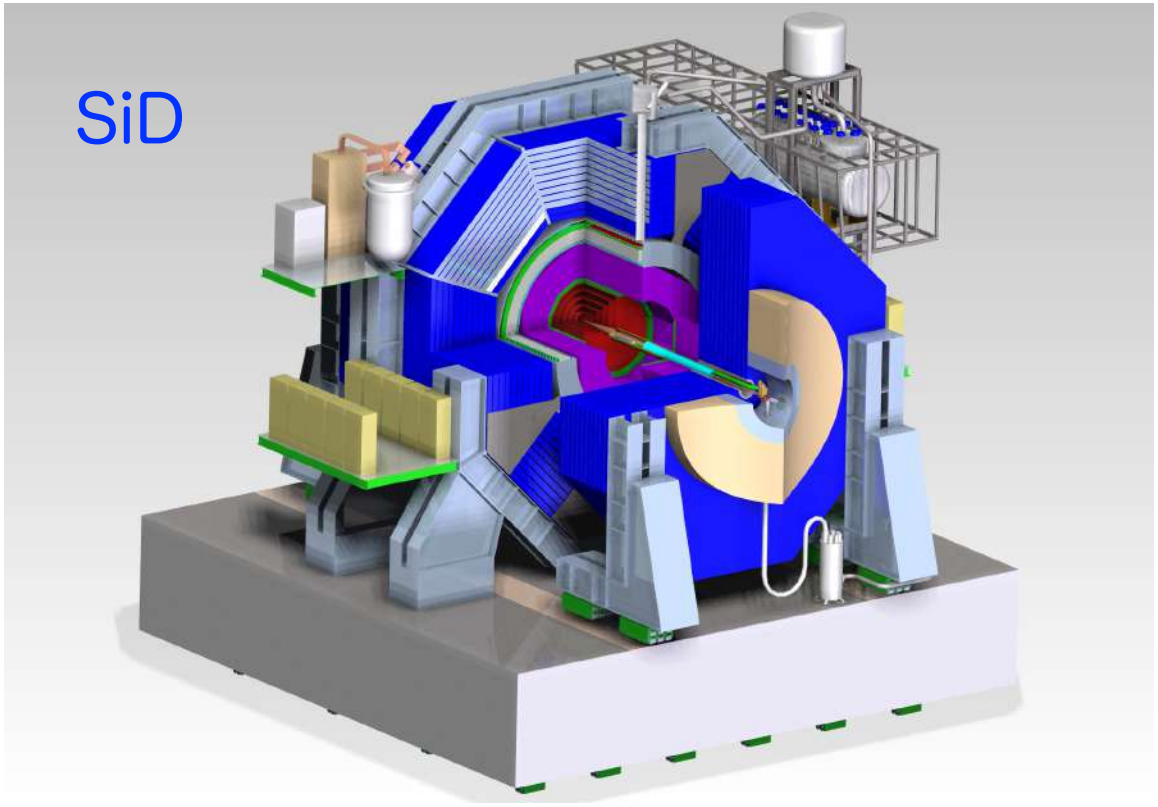
(4) no duplicated QD0 package for good cost performance

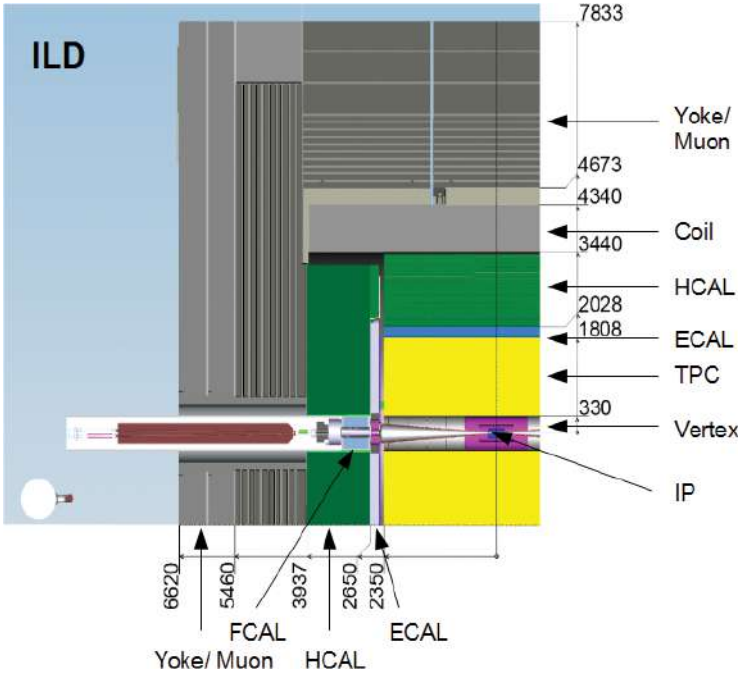
Toshiaki Tauchi (KEK), IDT-WG3 MDI Meeting, 27th January 2022

ILD

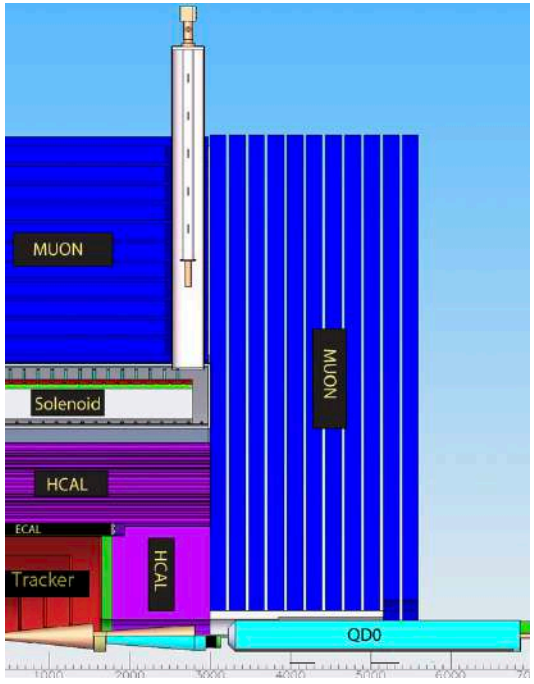


SiD





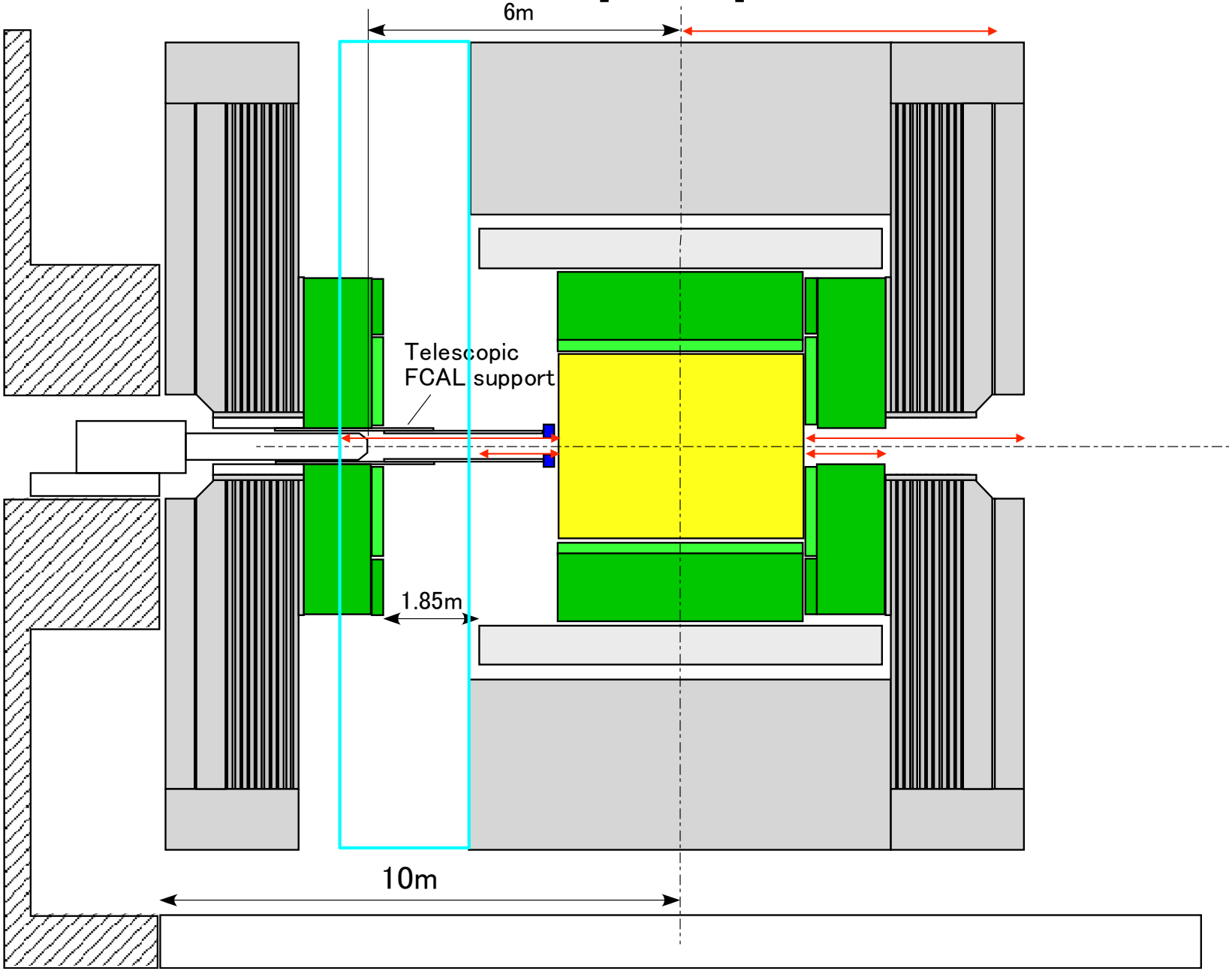
The QD0 magnets of ILD are supported by an external pillar that couples the magnet directly to the platform floor. In the barrel of the detector, the QD0 magnets are stabilised by a tie-rod system.



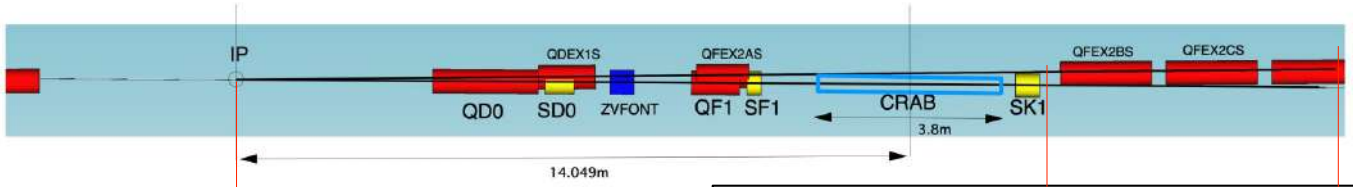
QD0, rests on a 5 d.o.f. magnetically insensitive mover system which in turn rests on cylindrical cutouts in the doors which are only marginally larger than the diameter of the QD0 cryostat.

LONGER L* OPTION

Endcap open



(1) 3.8m cantilever with a remote (dis)connection, RVC



L*=4.1m

L*(QF1)=9.5m

0.57x0.57x3.8m³, 0.05ᵗ :
0.41mm sag, 24.6Hz

0.58φx3.8m³, 0.05ᵗ :
0.59mm sag, 20.4Hz

ILD

SiD

7833

MUON

Solenoid

HCAL

ECAL

Tracker

IP

4,000

1,100

6620

5460

3937

2650

2350

FCAL

ECAL

Yoke/ Muon

HCAL

~3,800

~9,100

~2,280

~2,100

~2,100

~3,800

4,100

4,100

5,900

7,000

5,900

3,380

6,620

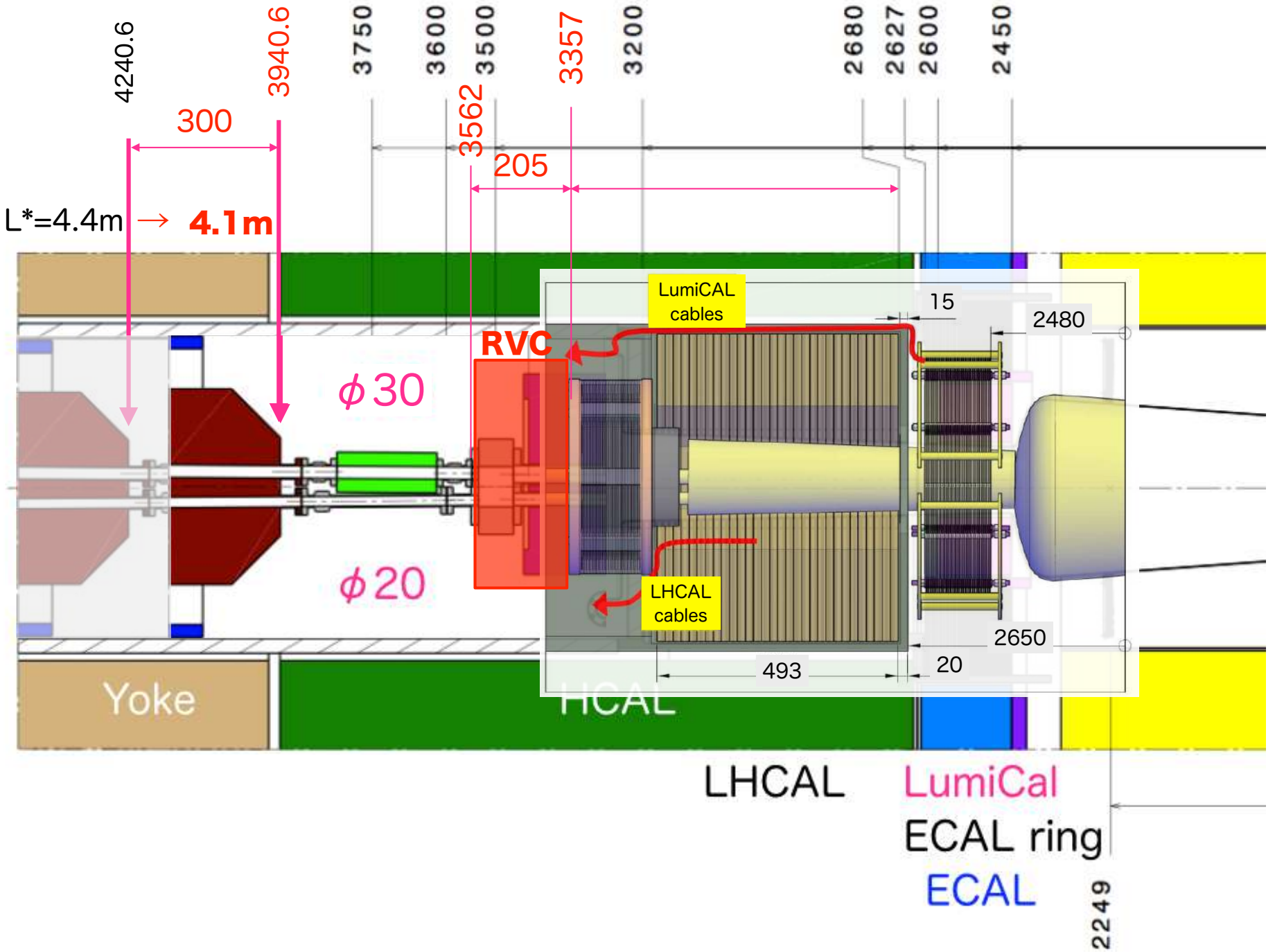
~5,620

~4,380

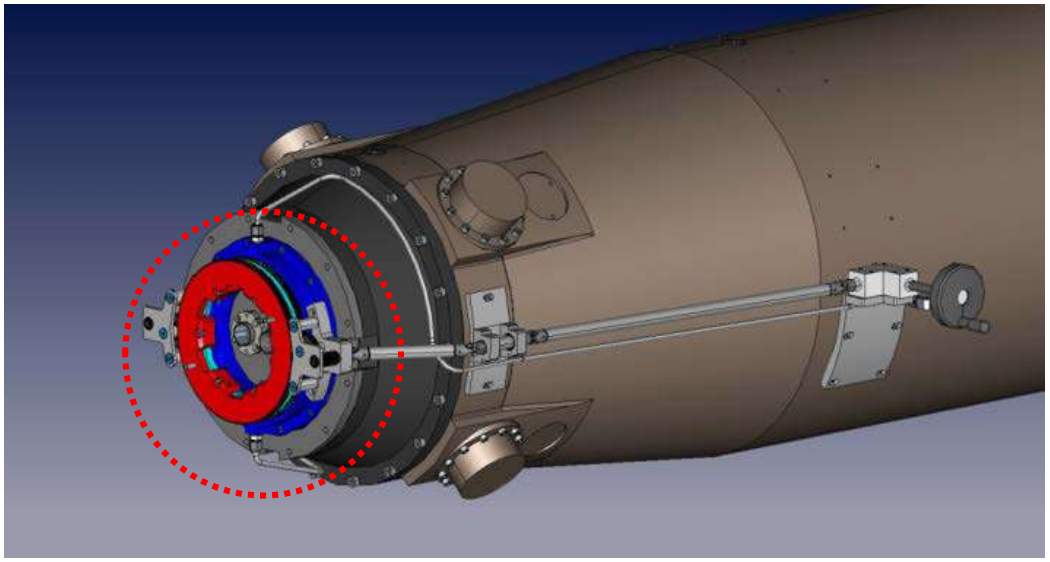
20,000

17,000

17,000


4240.6
3940.6
3750
3600
3500
3357
3200
2680
2627
2600
2450
300
3562
205
L*=4.4m → 4.1m
LumiCAL cables
15
2480
RVC
ϕ30
ϕ20
LHCAL cables
2650
493
20
Yoke
HCAL
LHCAL
LumiCal
ECAL ring
ECAL
2249

Remote Vacuum Connection (RVC)



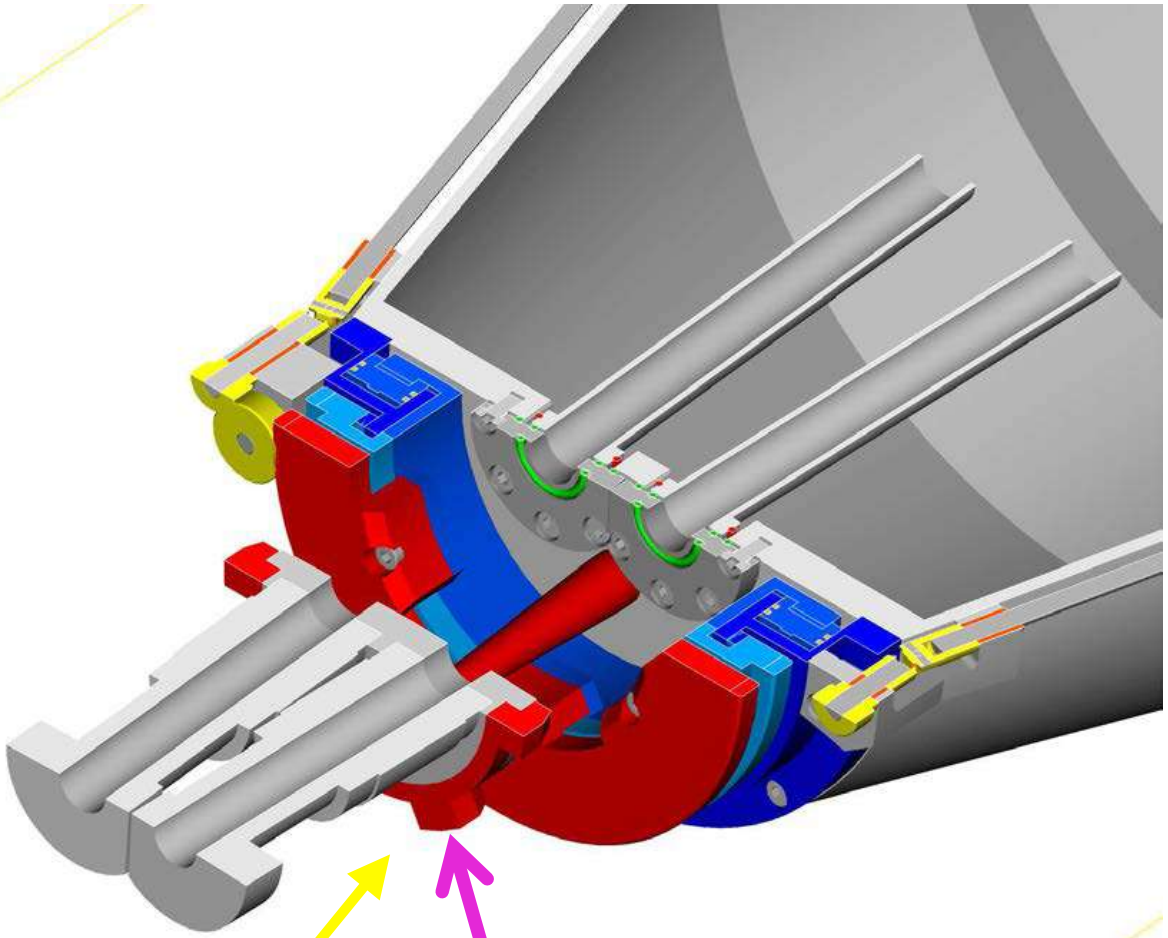
RVC is a mechanism introduced by Belle group to connect QCS beam pipes to BPM-bellows tubes by a remote manipulation.
RVC was designed and produced by DESY.

RVC on the new QCS head

Photo by DESY

How RVC works 1/6

BPM-bellows tubes (about 14 cm long)
set on a lock flange for RVC



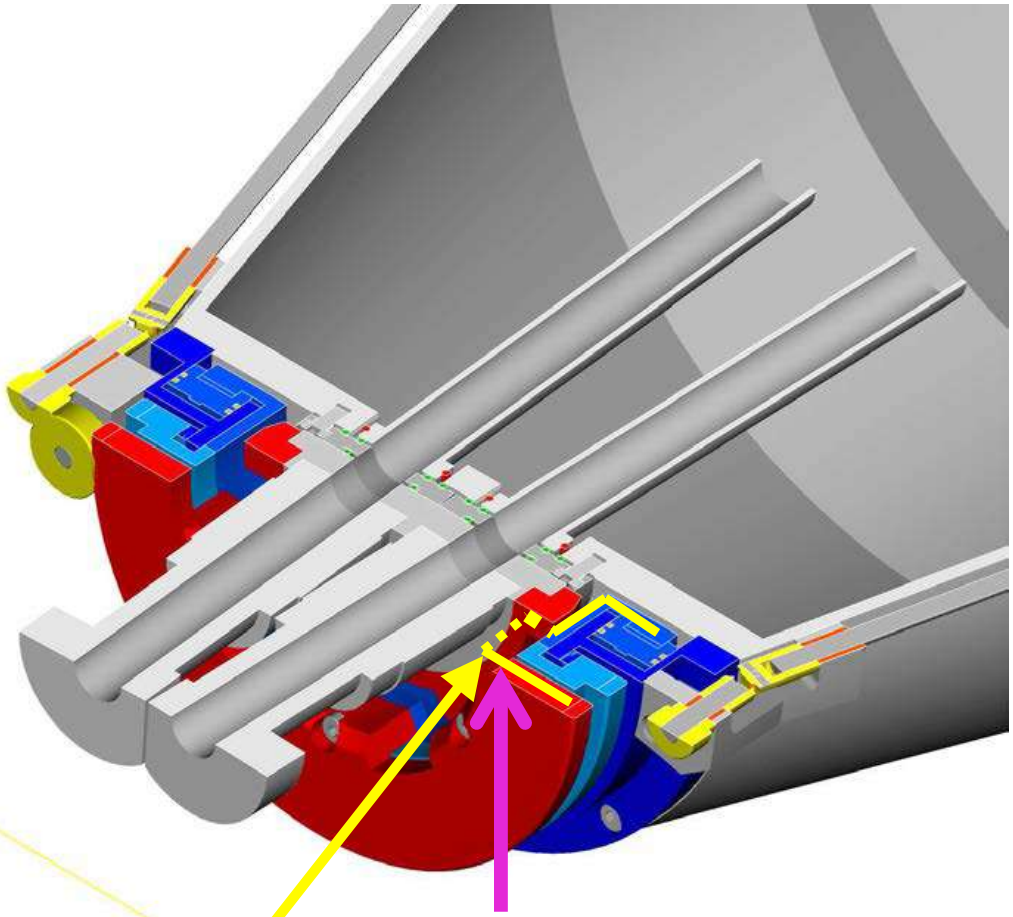
lock flange

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

Drawing by Karsten G.

How RVC works 2/6

BPM-bellows tubes (about 14 cm long)
set on a lock flange for RVC

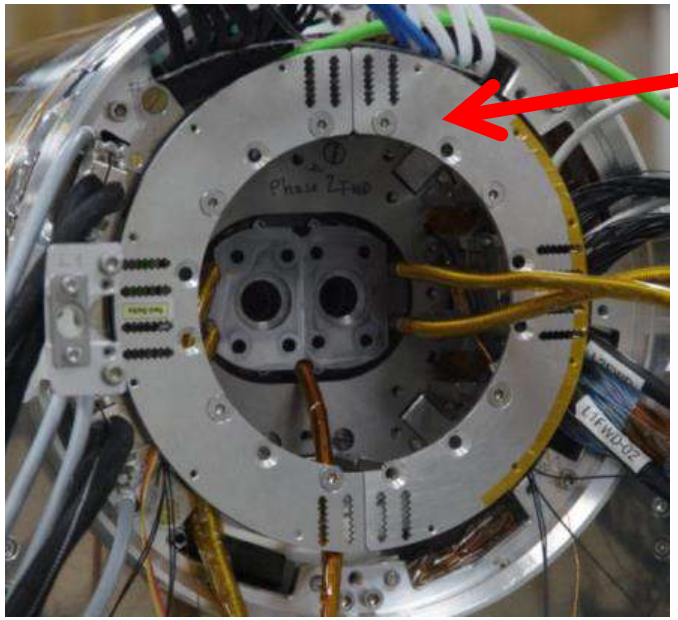


These components (red+blue) rotate to
catch the lock flange.

lock flange

Drawing by Karsten G.

Connecting BPM-bellows tube



Cable cage

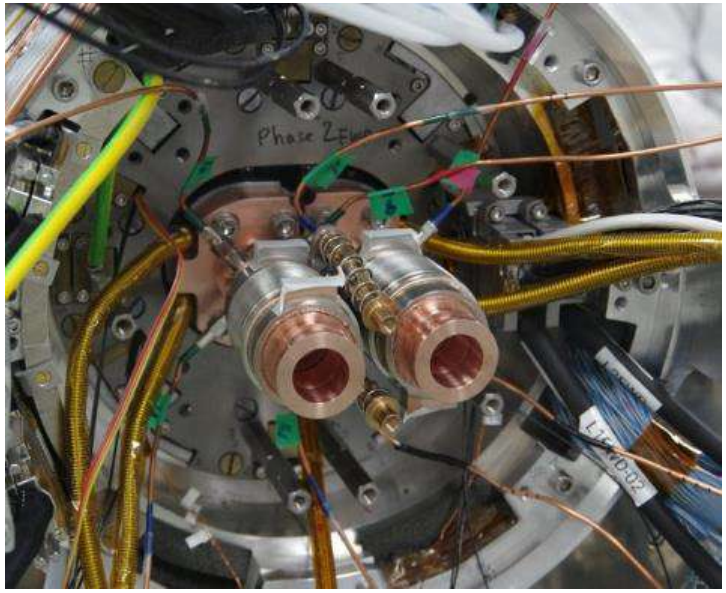
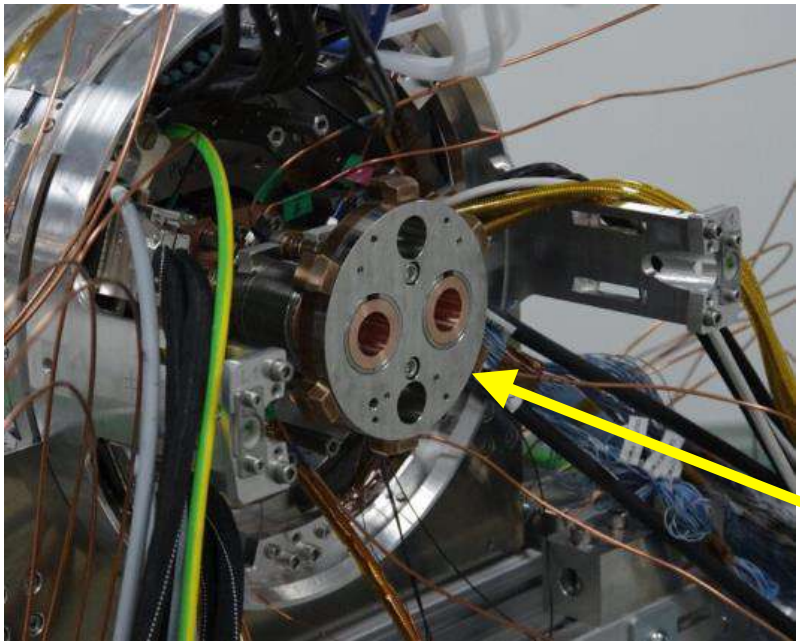


Photo by
M. Tobiyama



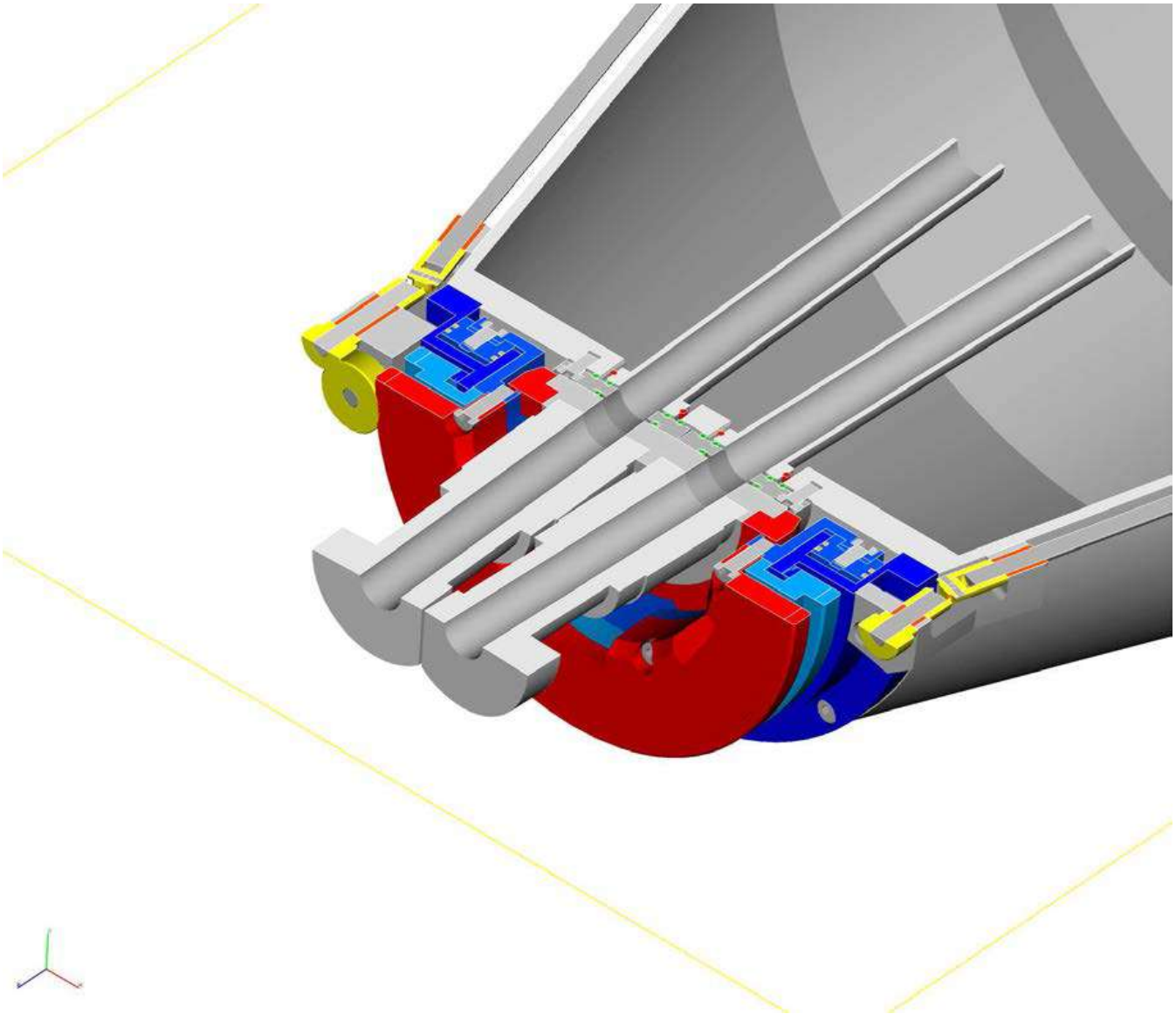
lock flange

FWD

The vacuum flanges of IP chamber is about 8 cm behind the cable cage.

The cable cage interfered with connecting work. It is temporally removed.

How RVC works 3/6

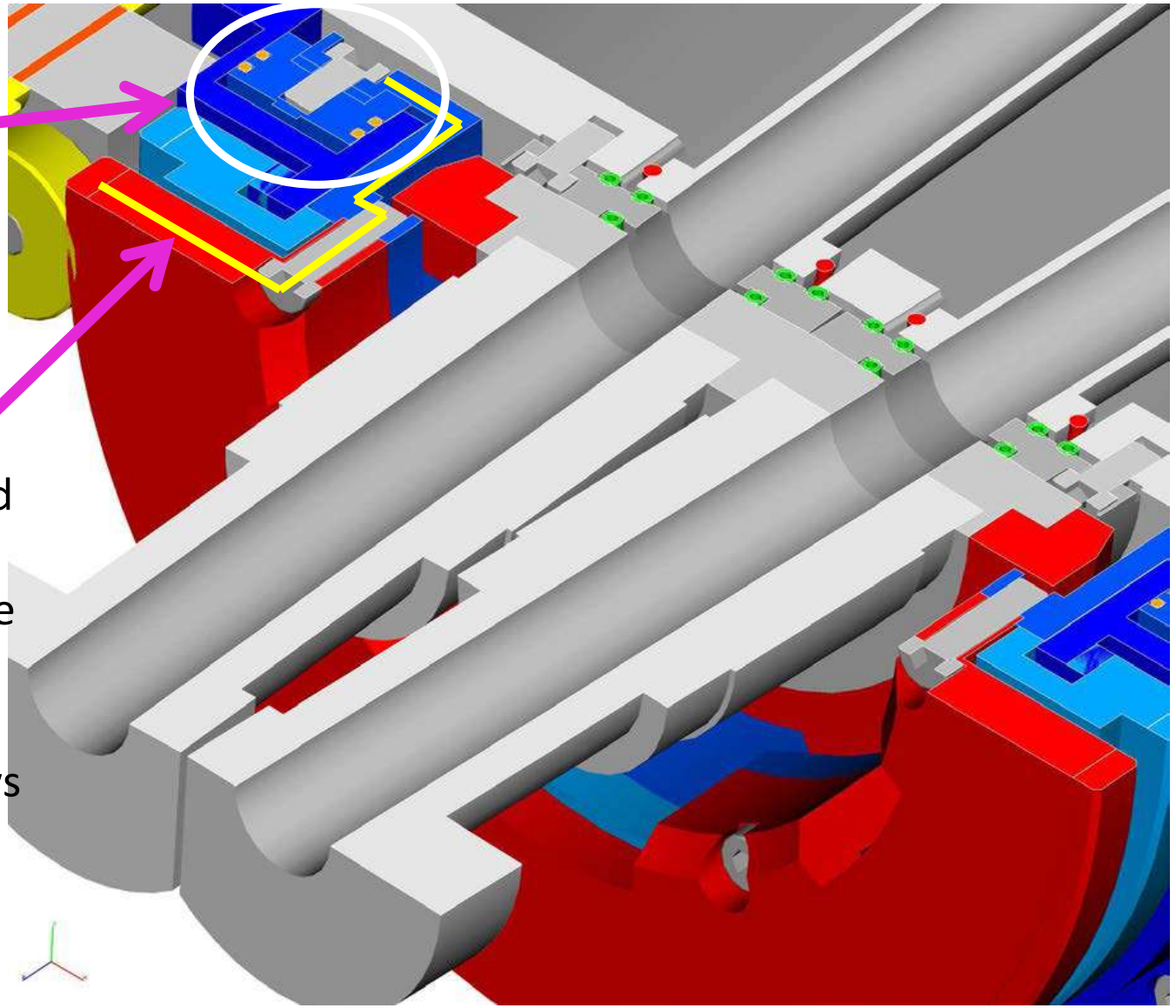


Drawing by Karsten G.

How RVC works 4/6

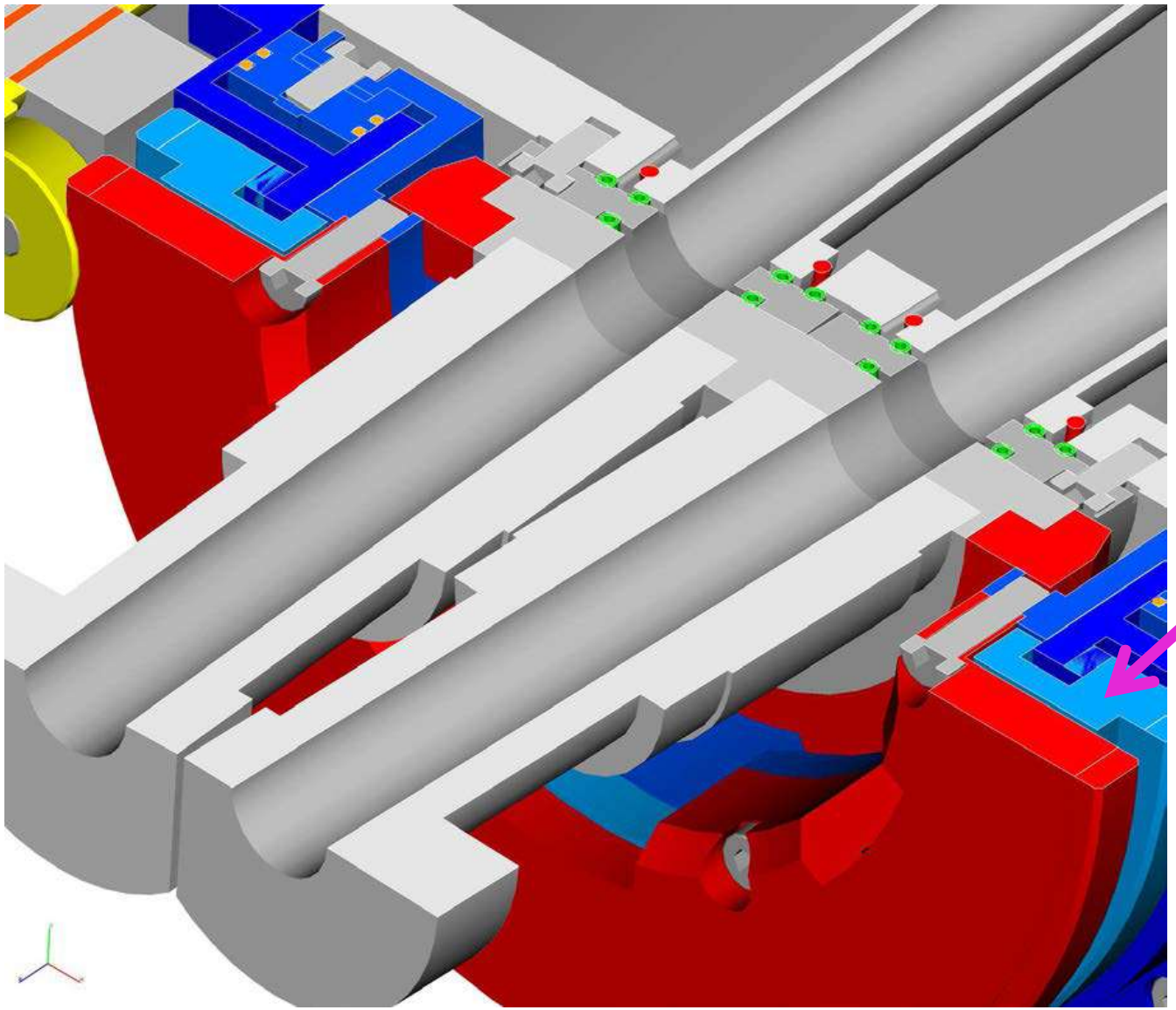
Cylinder for dry N_2 (about 50 bar)

These connected components connected to the piston in the cylinder, shift to press the bellows flange to the cryostat.



Drawing by Karsten G.

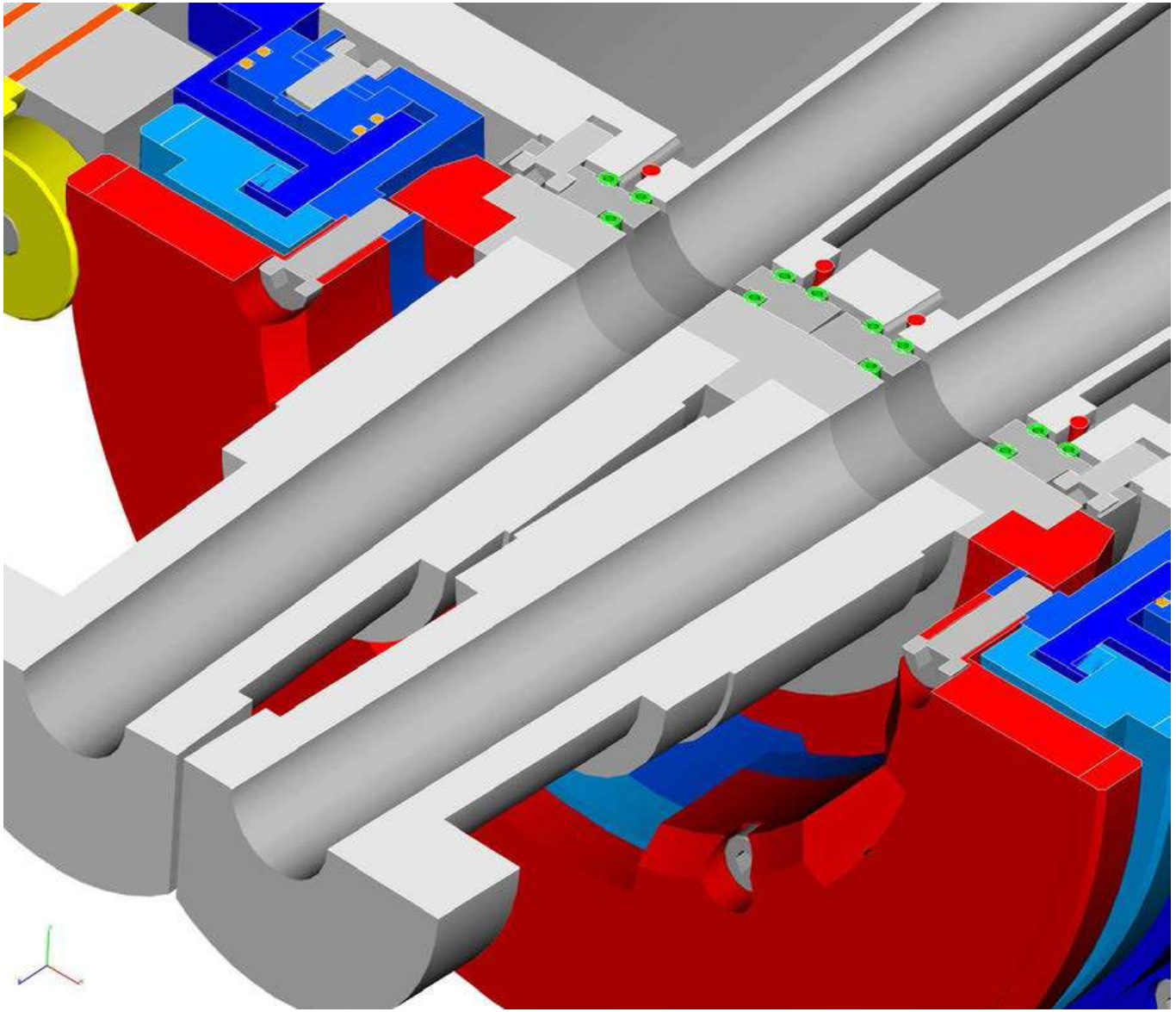
How RVC works 5/6



This large light blue screw nut turns to lock the mechanism.

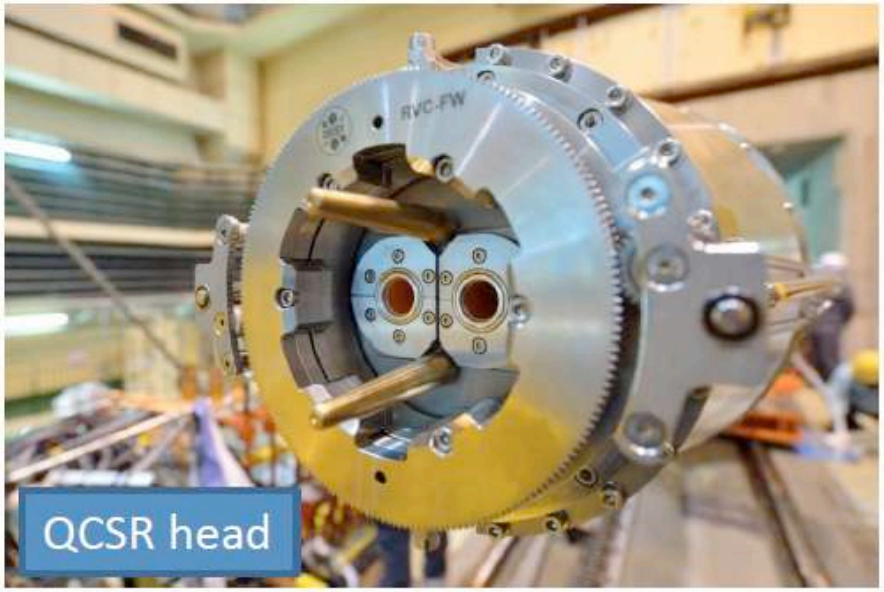
Drawing by Karsten G.

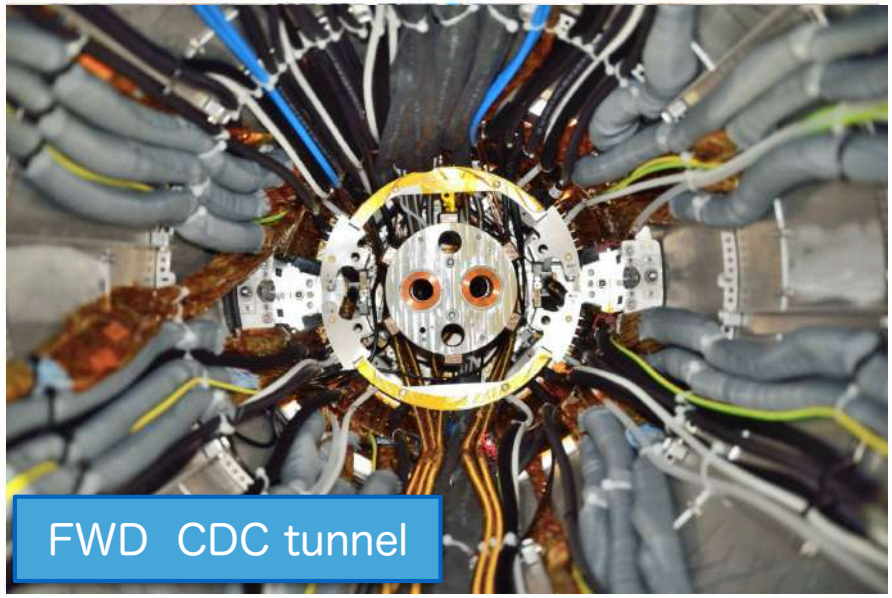
How RVC works 6/6

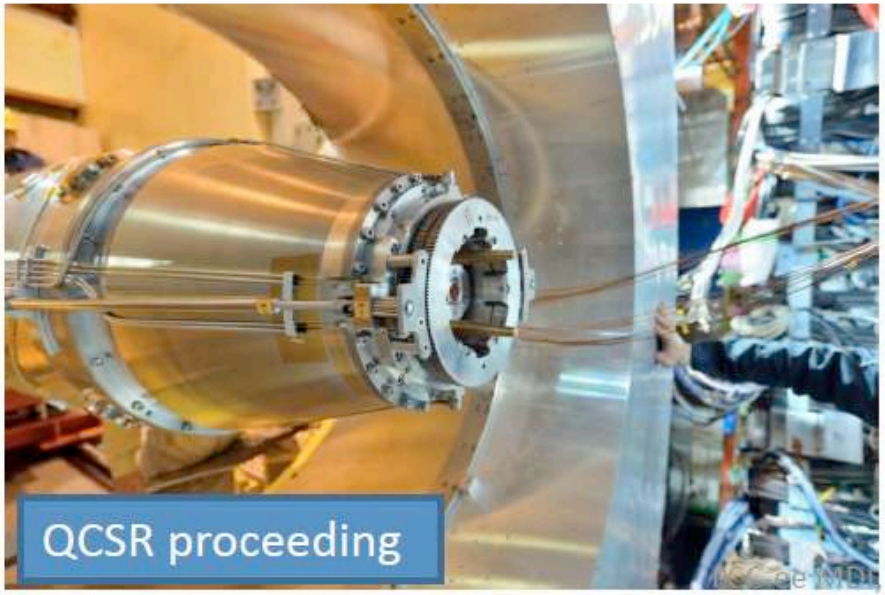


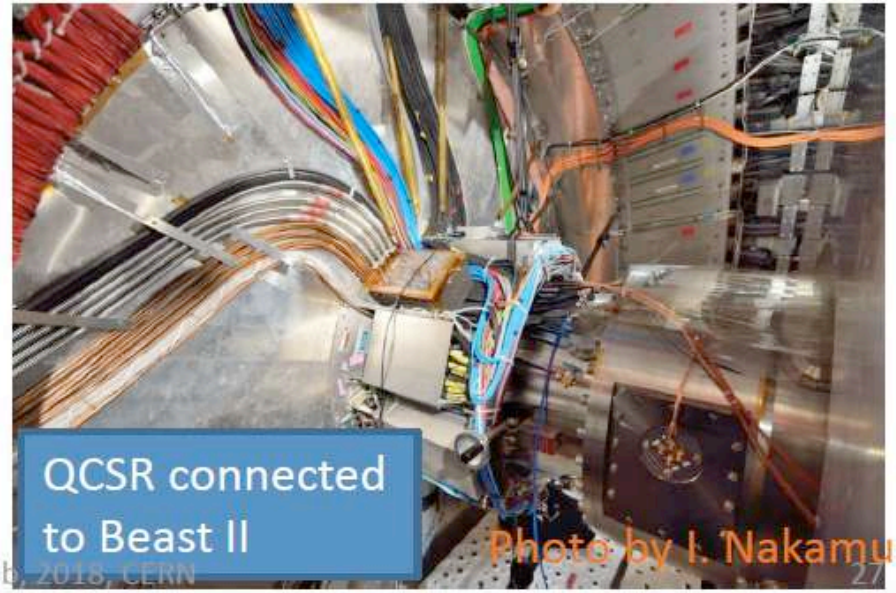
Drawing by Karsten G.

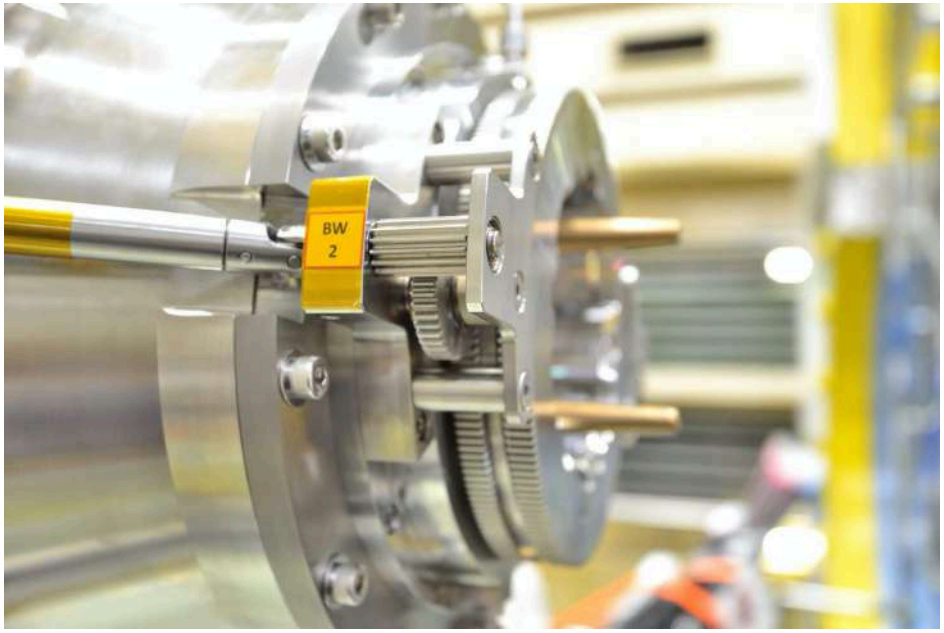
QCSR-Beast II connection (Jan. 9, 2018)

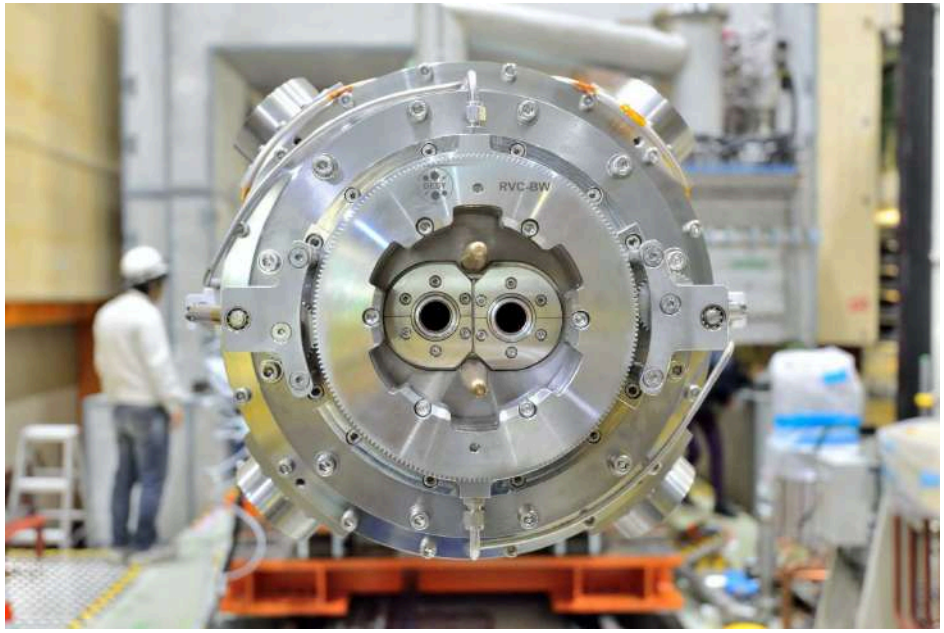


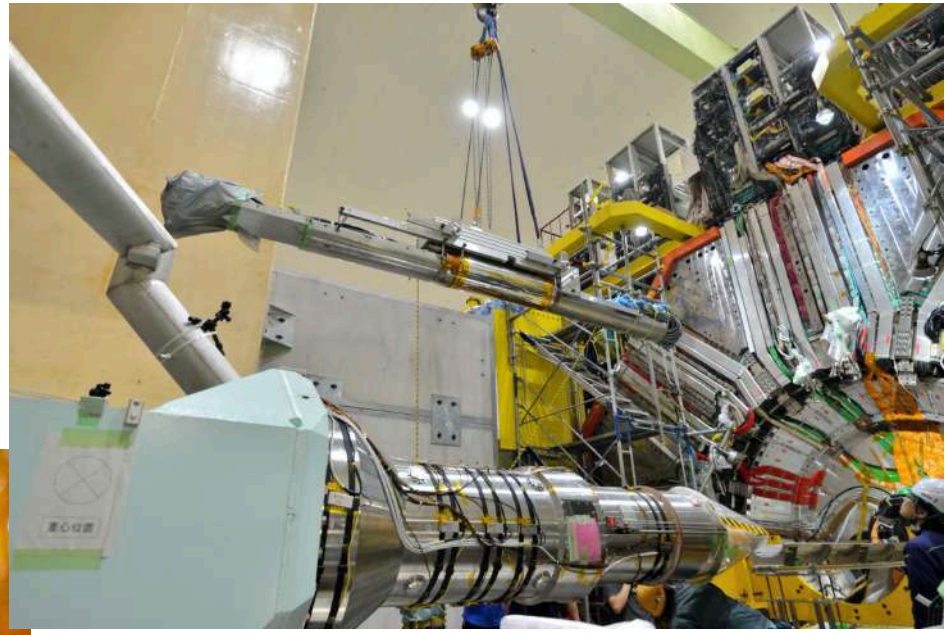




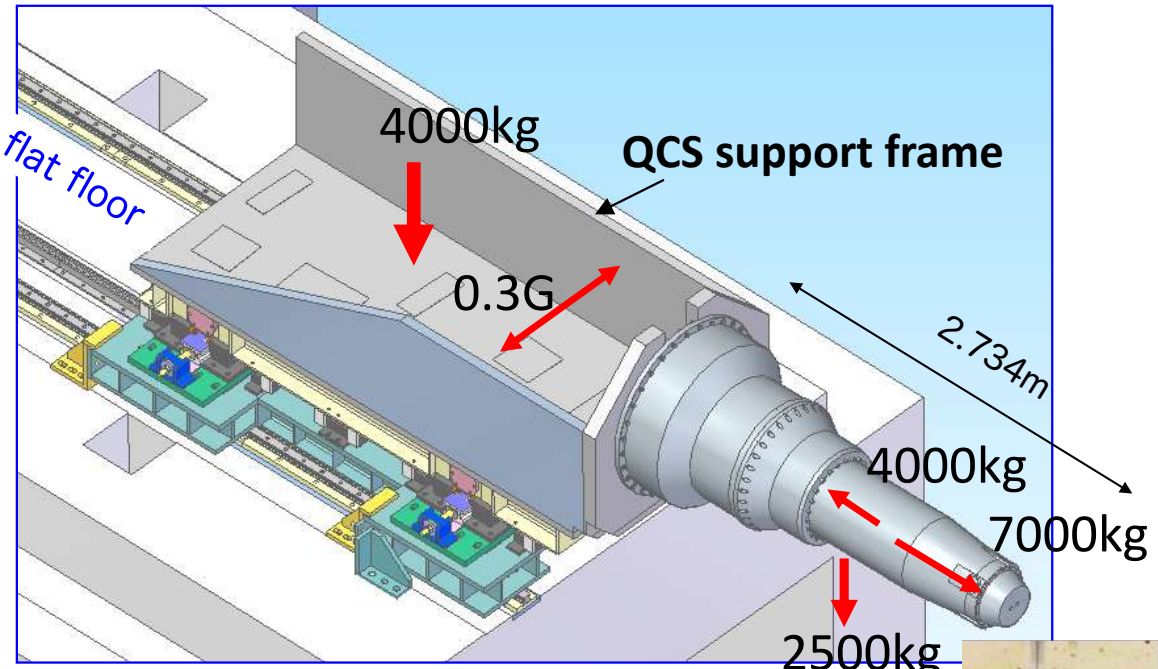


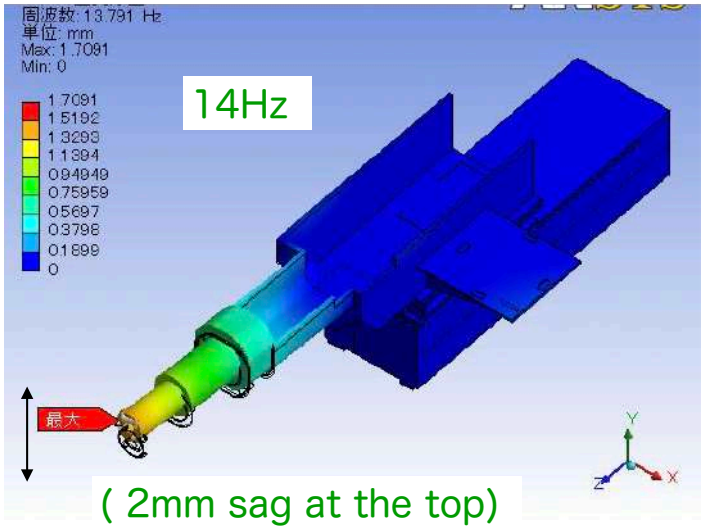

BW
2


RVC-BW



Mechanical design of the QCS Support at SuperKEKB





Load conditions (Vertical dir.)

Weight (QCS)： **2500kg**

Weight(Support Frame): **10000kg**

Weight of magnets: **4000kg**

Magnetic force(axial dir.)

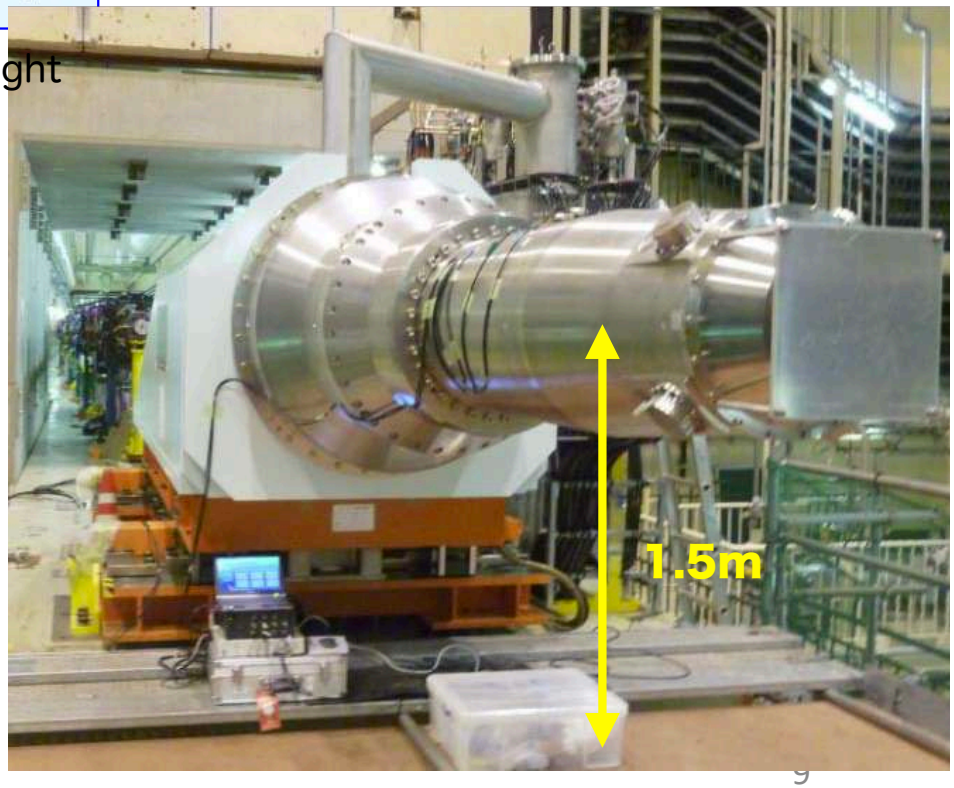
by the Bellell solenoid and the compensation sol.(ES)

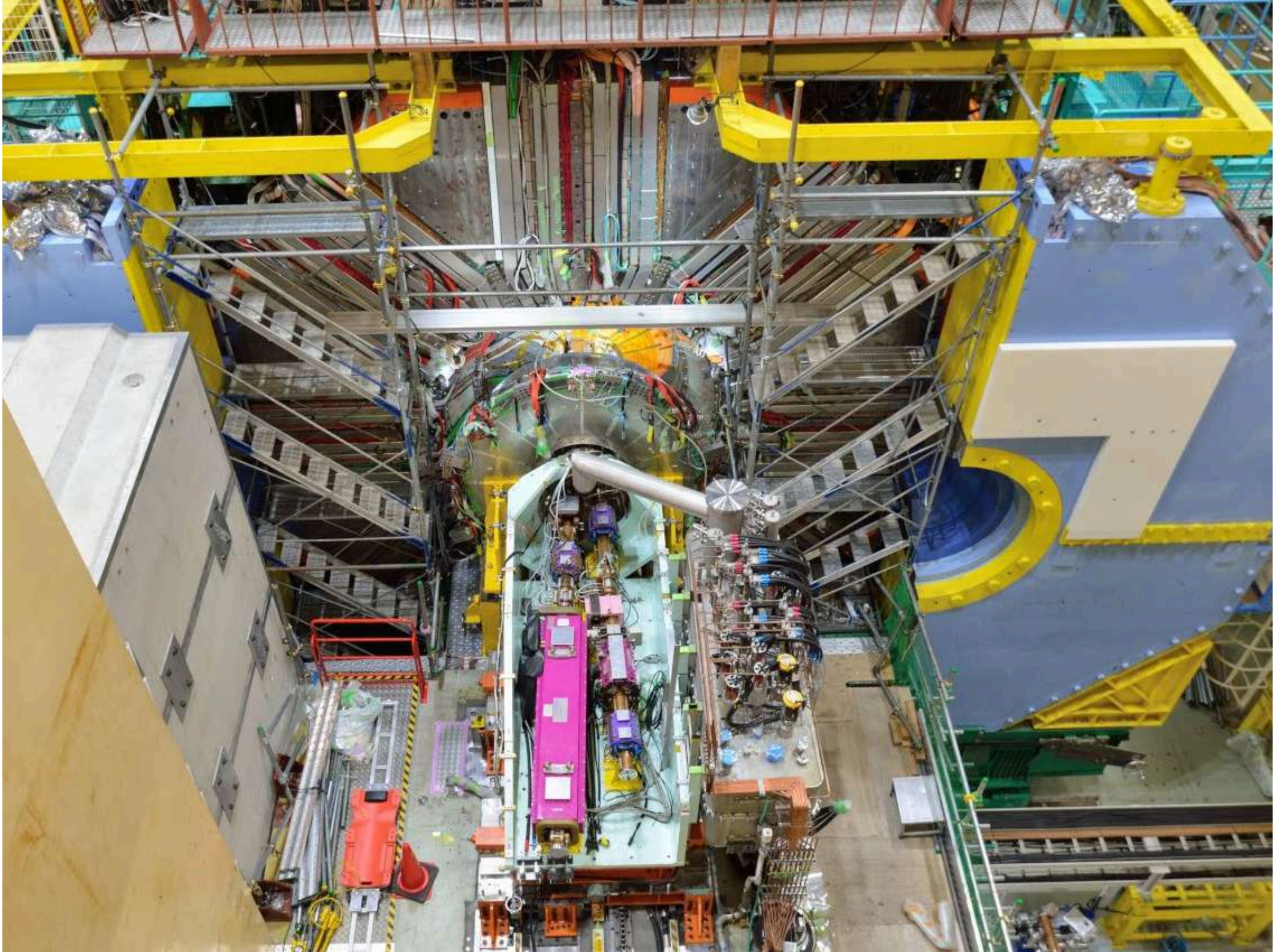
Inner direction： only Bellell **7000kg**

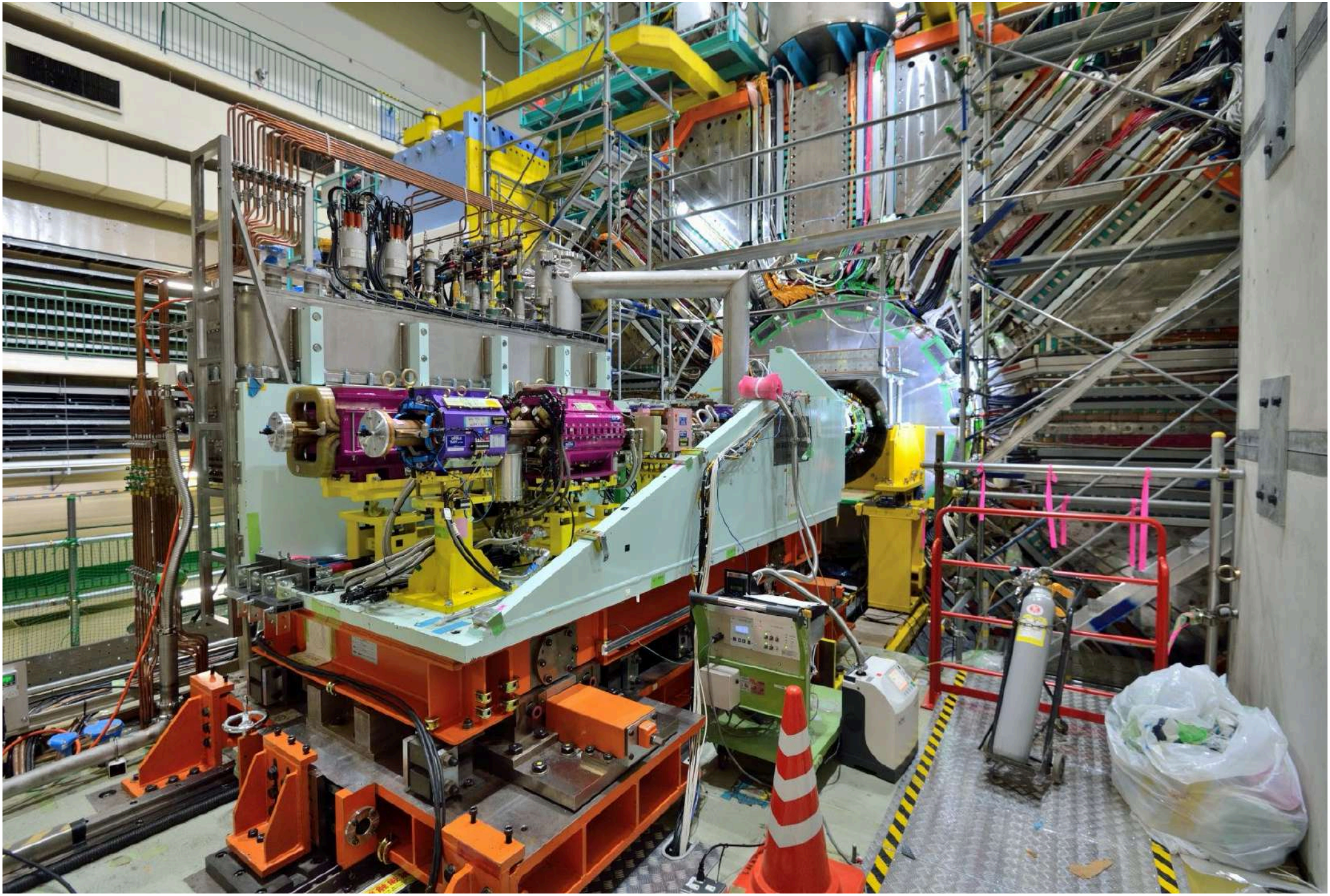
Outer direction: Bellell and ES **4000kg**

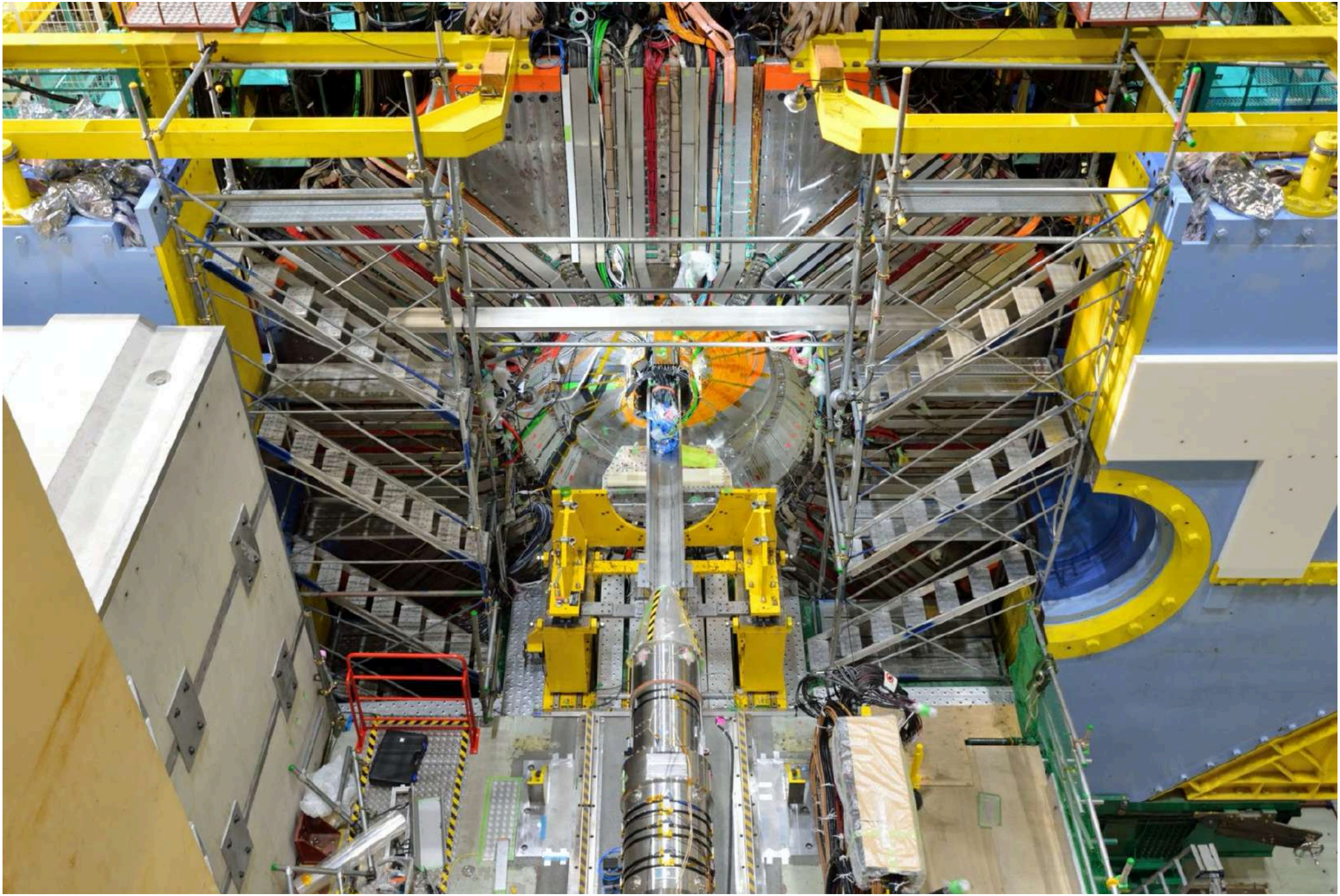
Seismic load

0.3G in the horizontal direction

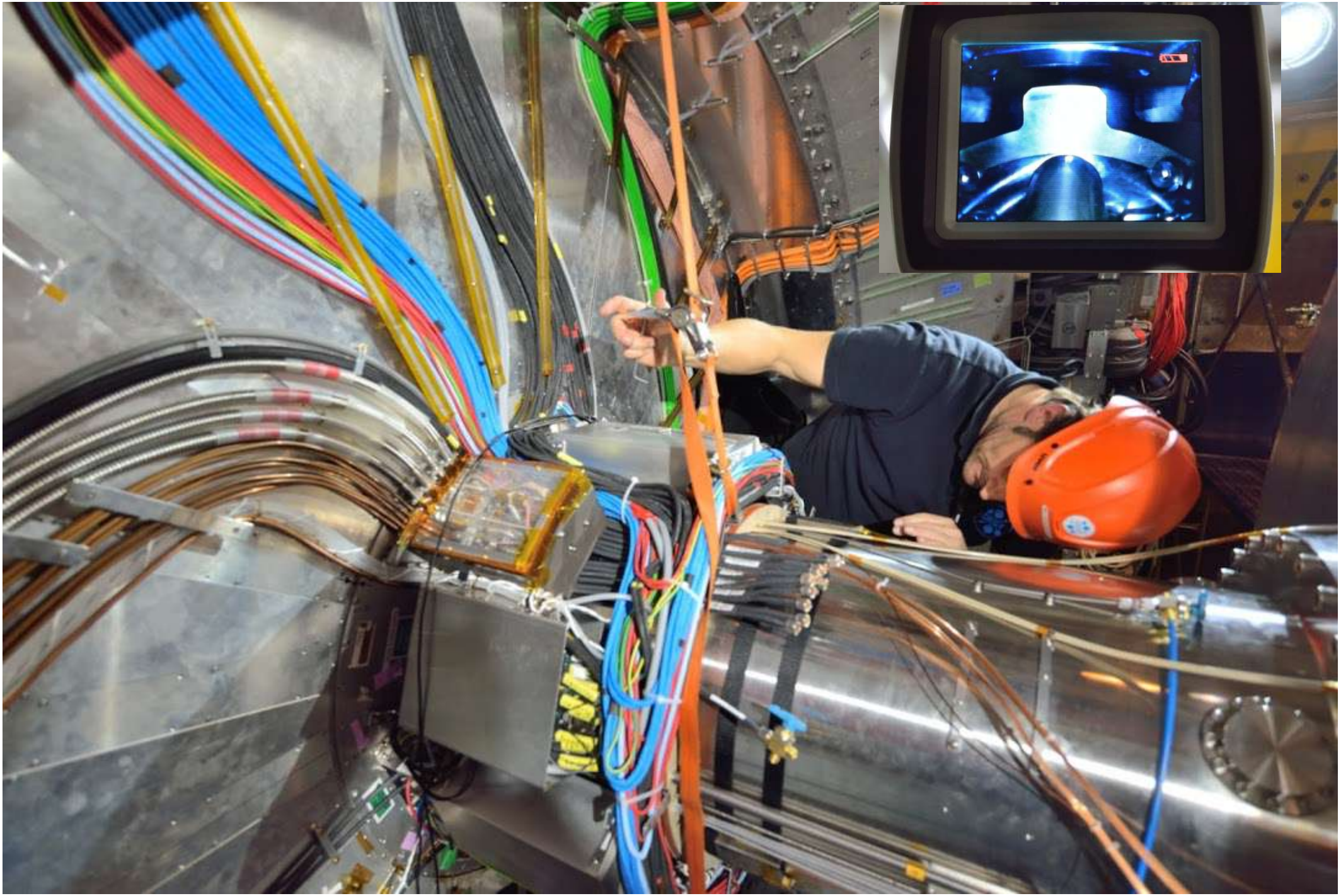




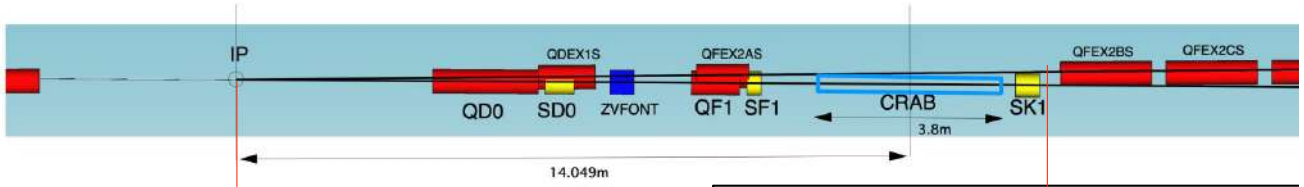





ARICH↑
ARICH↓
ARICH↑



(2) 5.9m cantilever with a manual (dis)connection

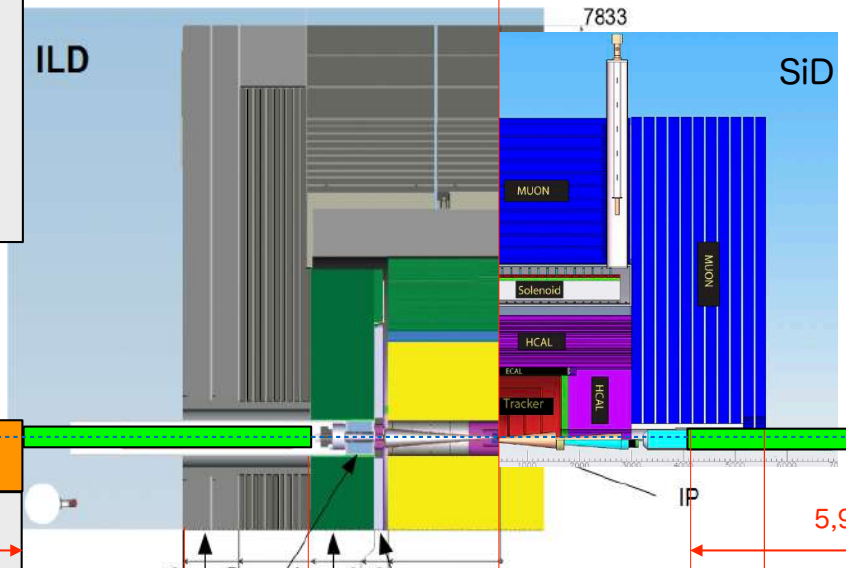


L*=4.1m

L*(QF1)=9.5m

0.57x0.57x5.9m³, 0.05ᵗ : 2mm sag, 11.2Hz

0.58ϕx5.9m³, 0.05ᵗ : 2.8mm sag, 9.4Hz



4,000

1,100

7,000

5,900

7,000

6620
5460
3937
2650
2350

FCAL
Yoke/ Muon
HCAL
ECAL

4,100

4,100

3,380

6,620

~5,620

~4,380

20,000

17,000

17,000

Possible study items in the ILC prelab are listed as follows;

(1) mechanical design of RVC,

if the length exceeds 205mm, the forward calorimeters should be relocated to make enough space foe the RVC

(2) engineering design of the cantilever system with girder carrying the magnets and the crab cavity including repositioning and alignment along the BDS beam line

(3) engineering design of the telescopic FCAL support

(4) ANSYS analysis with these engineering models to estimate the realistic stabilization of QD0 as much as possible

We also need agreeement for the same QD0 support sytem with the SiD group.

H.Yamaoka, 1/27,2000

Structure of JLC detector at B=3Tesla