

Possible benefit of longer L^* for detectors

2021/03/15

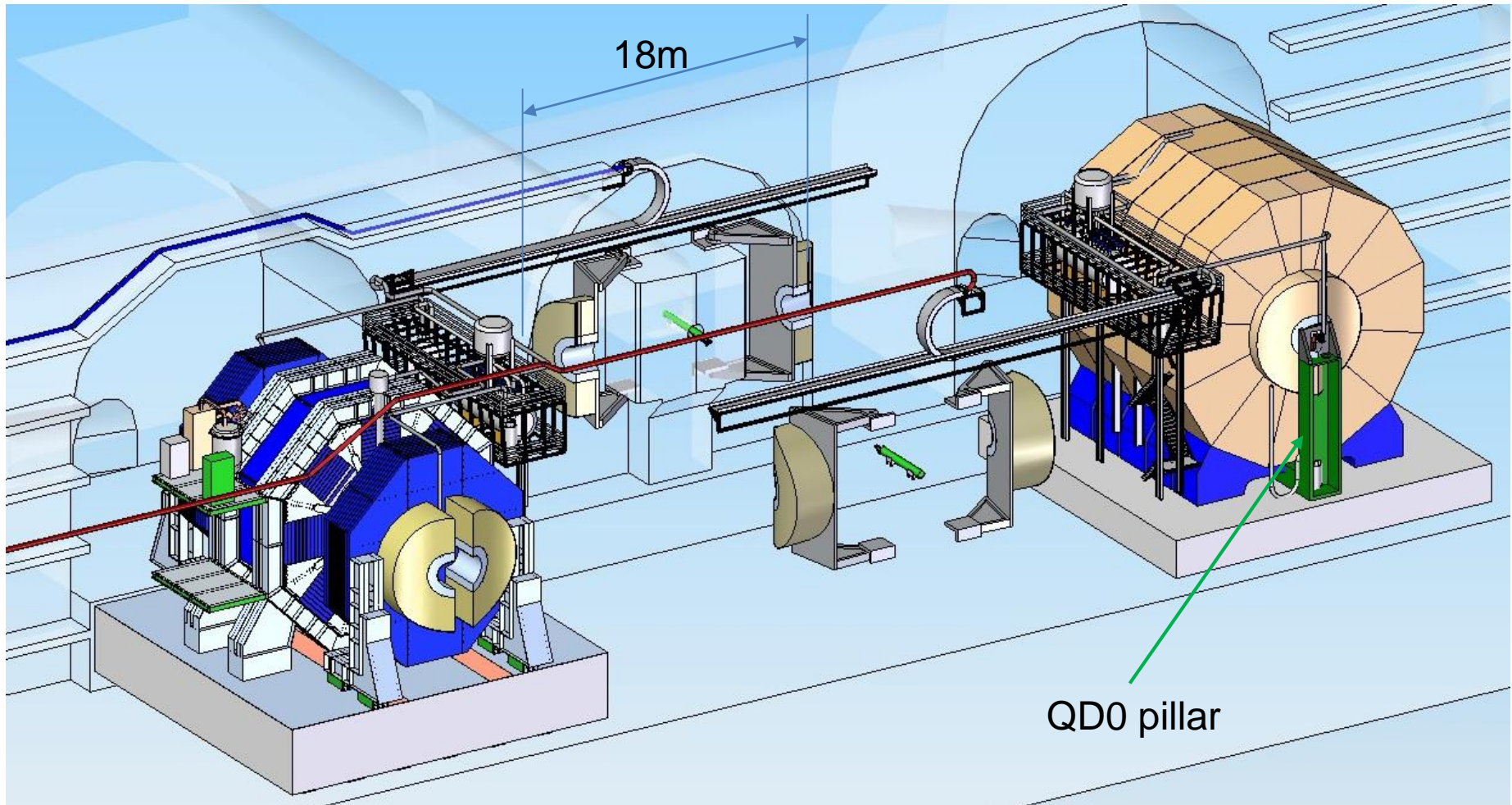
@LCWS2021

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QD0 support

- In the present design, QD0 is supported by QD0-support put on the platform (ILD), or by detector itself (SiD)
- No show-stopper is found so far, but there could be some possible risks
 - Vibration from detector
 - Position repeatability and time for machine tuning after push-pull operation
 - Difficulty in opening detector end-cap (ILD)

Original design

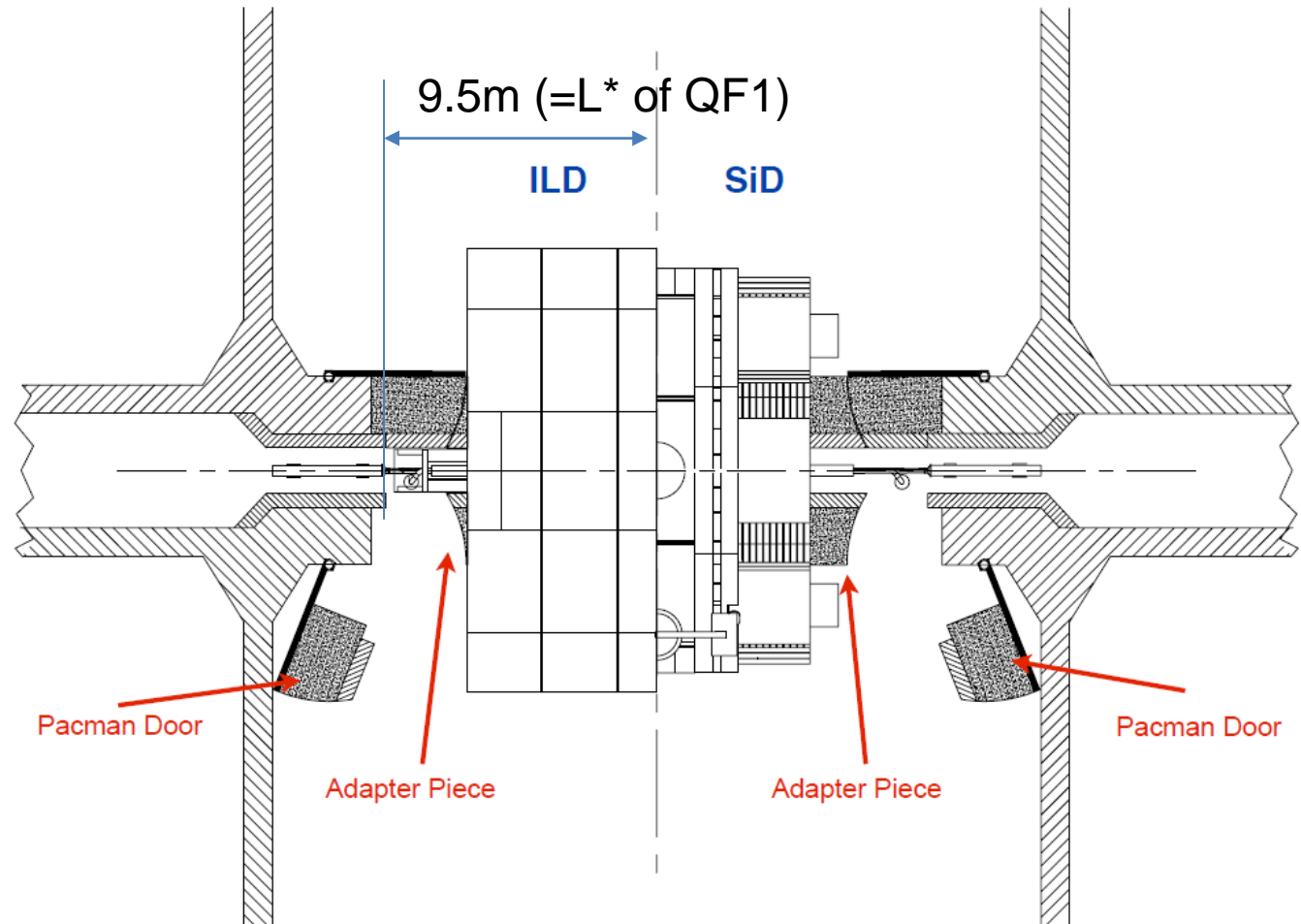


Original design

- TDR Vol.3, p146, Vol.4, p40

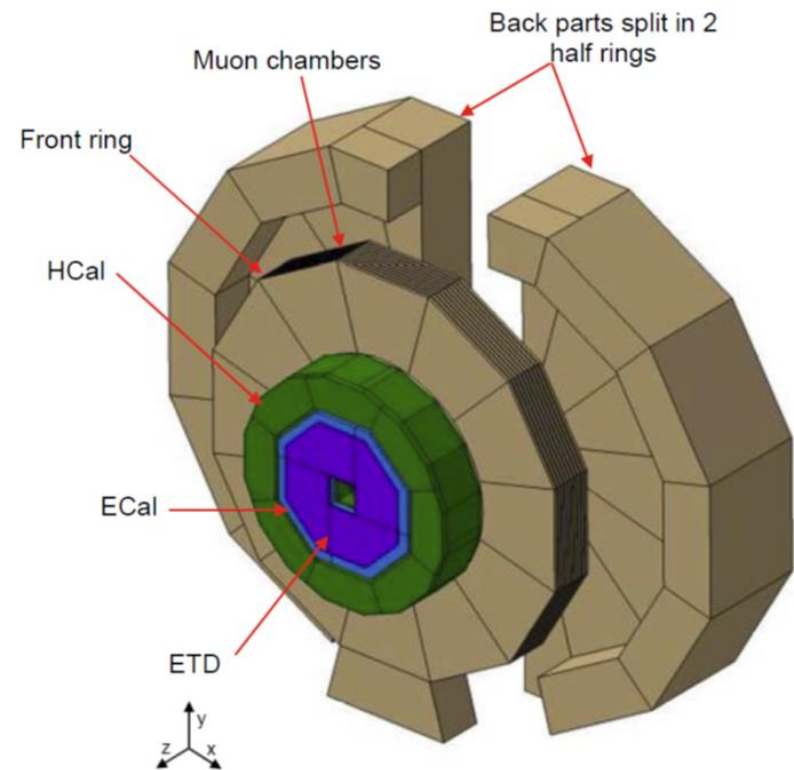
Figure 8.11

Design of the beamline shielding compatible with two detector of different size.



ILD Endcap opening

- Rear part of the endcap is split into two parts in order to clear the QD0 support pillar
 - [Klaus's talk at Mini-Workshop on 2019/2/28](#)
- This scheme could cause several difficulties
 - Space for support legs
 - Stability against earth quake
 - Lowering method using gantry crane
- QD0 support has to be movable to fully open the endcap at garage position



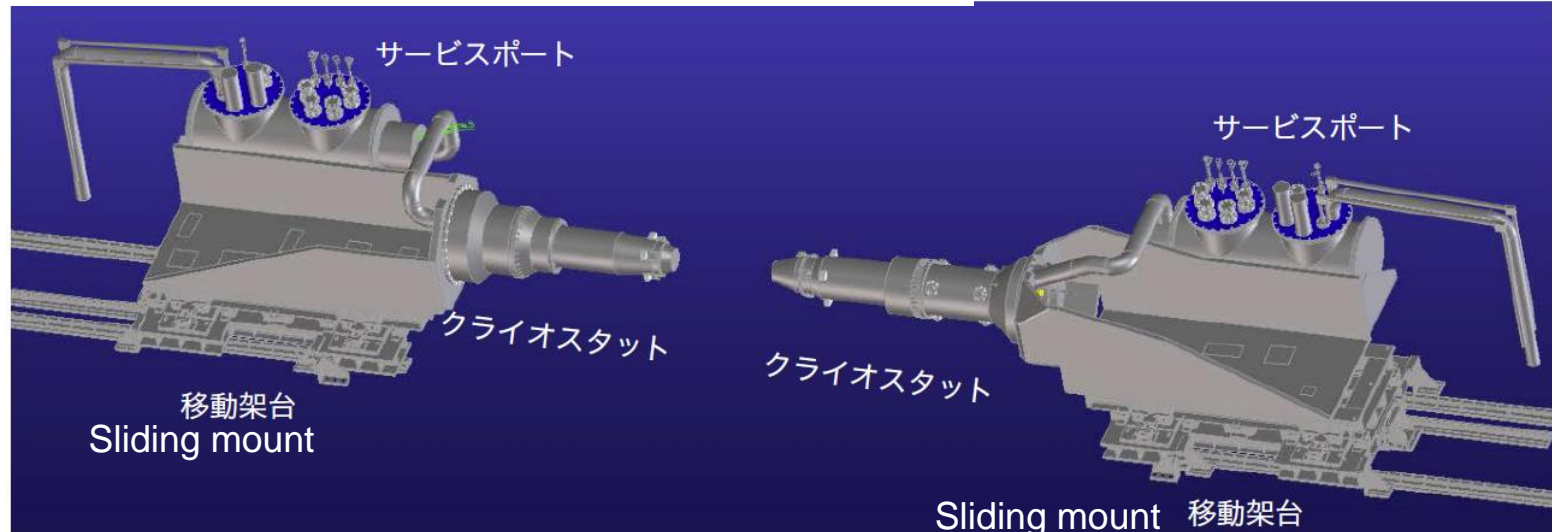
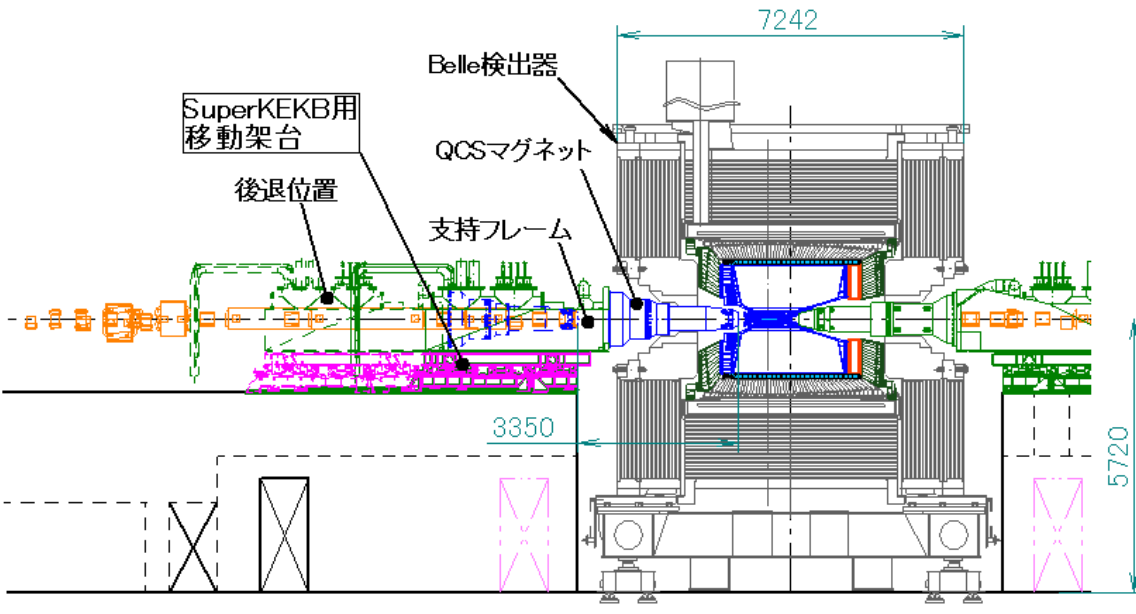
Longer L^* option

- Longer L^* option has been studied after TDR
 - Large L^* optics for ILC: Toshiyuki Okugi, AWLC2014
 - Longer L^* for ILC: Master Thesis by Fabien Plassard (Feb. 2015)
 - Longer L^* for CLIC 380: Doctor Thesis by Fabien Plassard (Jul. 2018)
- If $L^* > 6\text{m}$ is feasible, many engineering difficulties and risks will be reduced

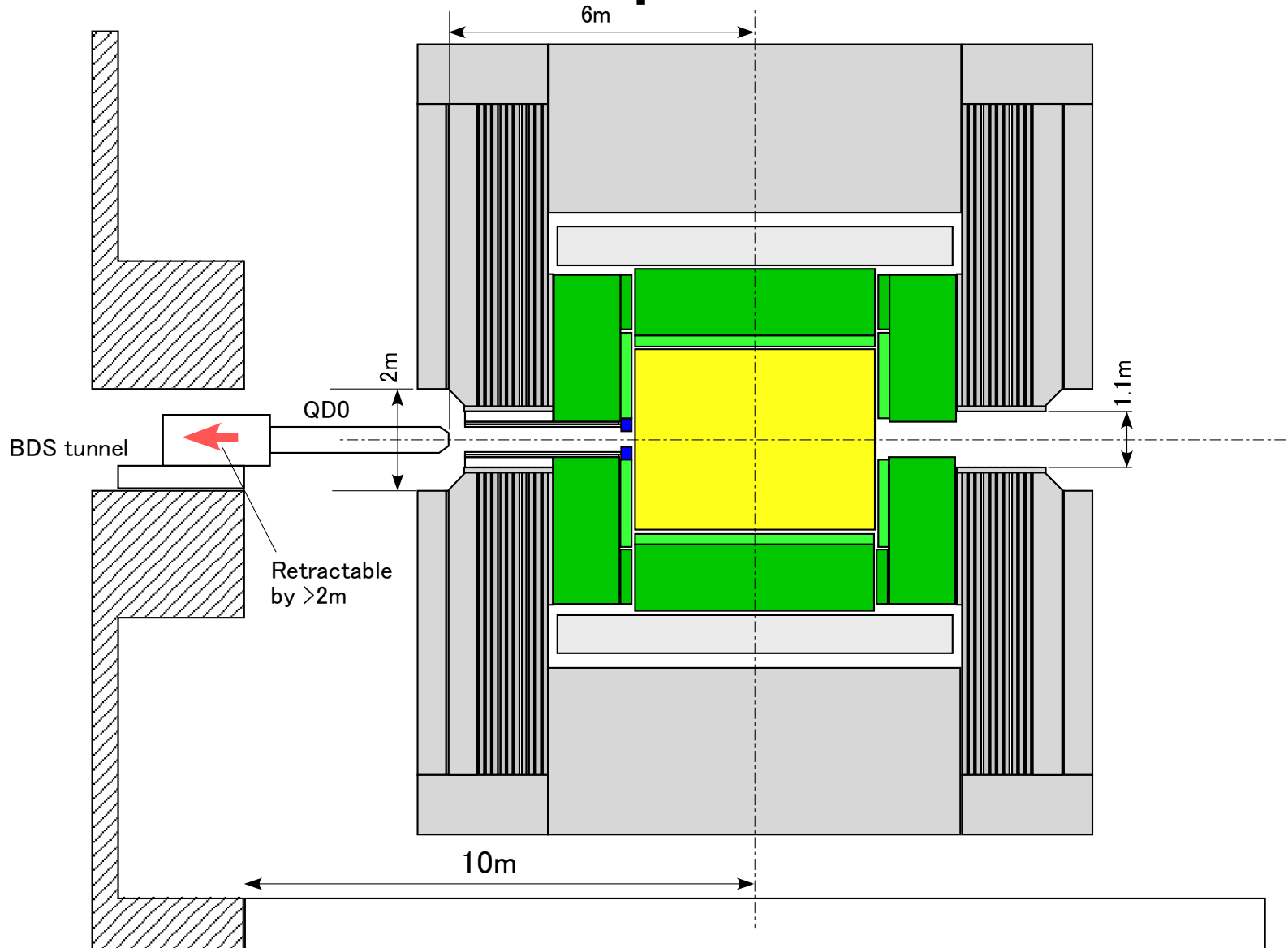
ILD @ $L^*=6\text{m}$

- QD0 can be supported from the BDS tunnel
 - We can get rid of QD0 pillar if $L^*=6\text{m}$
 - QD0 may have to be retractable like QSC of SuperKEKB
 - Much more stable than the support from the pillar on the platform
 - Much better position repeatability after push-pull
 - Pillar on the platform: $\sim 0.5\text{mm}$
 - Support from BDS tunnel: $10\sim 20\mu\text{m}$ (SuperKEKB)
 - Much faster machine tuning after push-pull
 - Only one pair of QD0 is necessary (3 pairs; for ILD, SiD, and machine study, are necessary for TDR design)
- ILD needs some modification
 - Cut the End-cap iron to make access to flanges at $Z\sim 6\text{m}$ possible, and/or remote vacuum connection (RVC) like SuperKEKB
 - FCAL support has to be re-considered (telescopic support?)
 - **No need for split endcap**

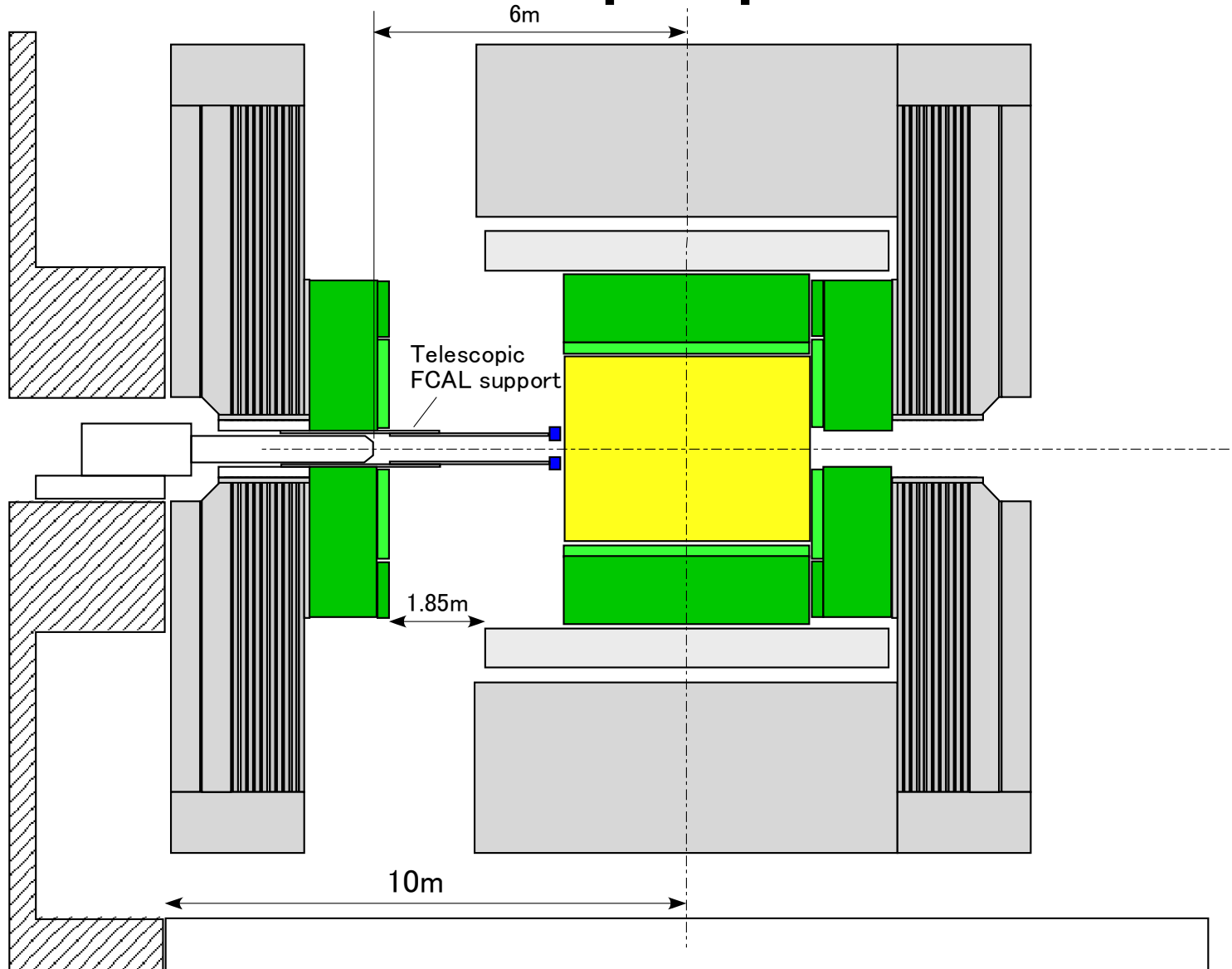
QCS of Super KEKB



Endcap closed



Endcap open



Another merit of longer L^*

- BeamCAL can be placed far from IP
 - → Weaker magnetic field at BCAL (and QD0 front surface) causes less back-scattering of pair background
 - → No need for AntiDID (?)
 - → Less cost, less construction period, and less risk
- Simulation study is necessary

Summary

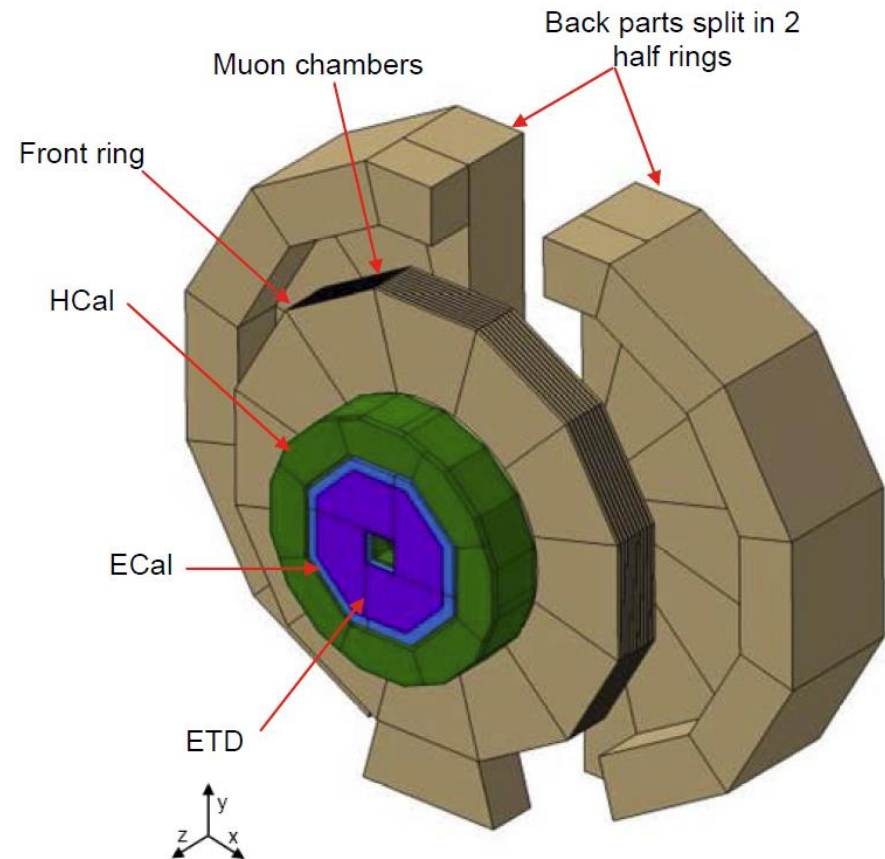
- QD0 support design in TDR has possible risks in stable and smooth operation of ILC, as well as difficulties in detector maintenance
- QD0 support from beam tunnel with longer L^* could solve these issues
- Longer L^* could also contribute to cost (and possibly construction time) reduction
- This option should be seriously studied during early phase of Pre-Lab period, both from the accelerator and detector point of view

BACKUP SLIDES

How to open ILD Endcap (1)

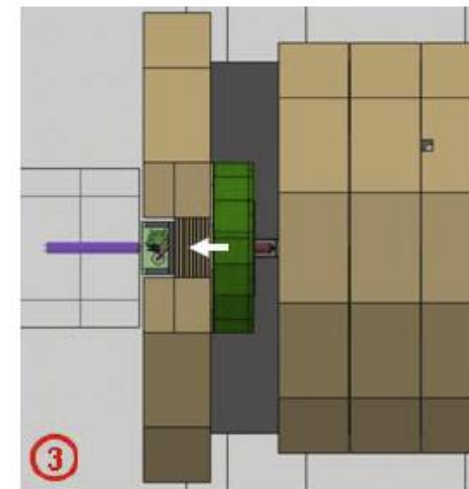
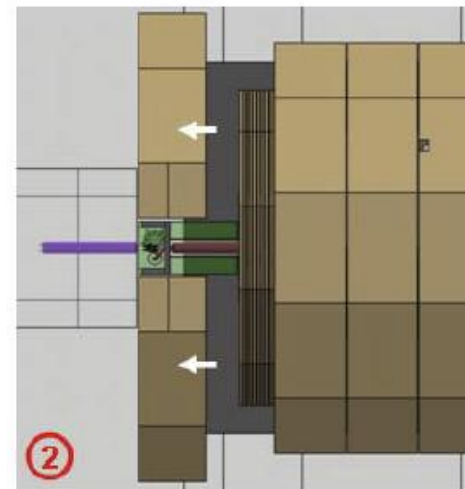
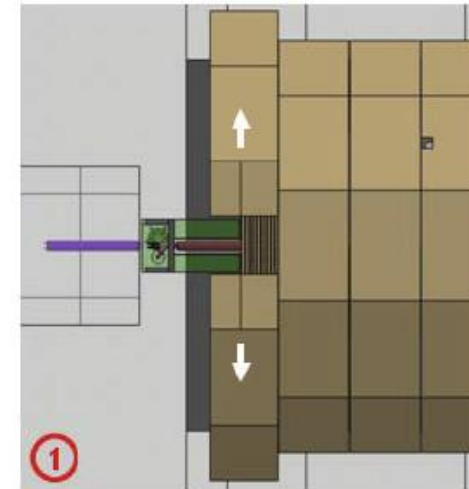
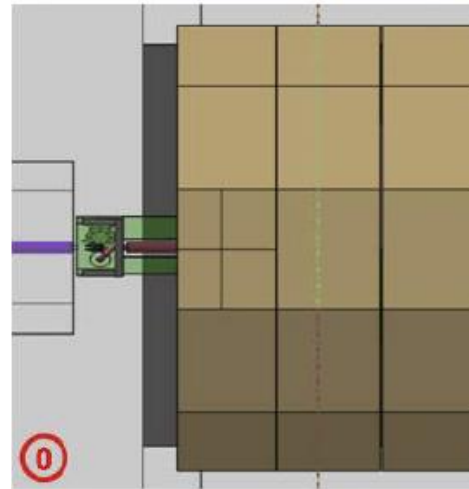
(Procedure to fully open the ILD endcap at garage position)

- Rear part of the End-cap is split into two parts to clear the QD0 pillar
 - [Klaus's talk at Mini-Workshop on 2019/2/28](#)



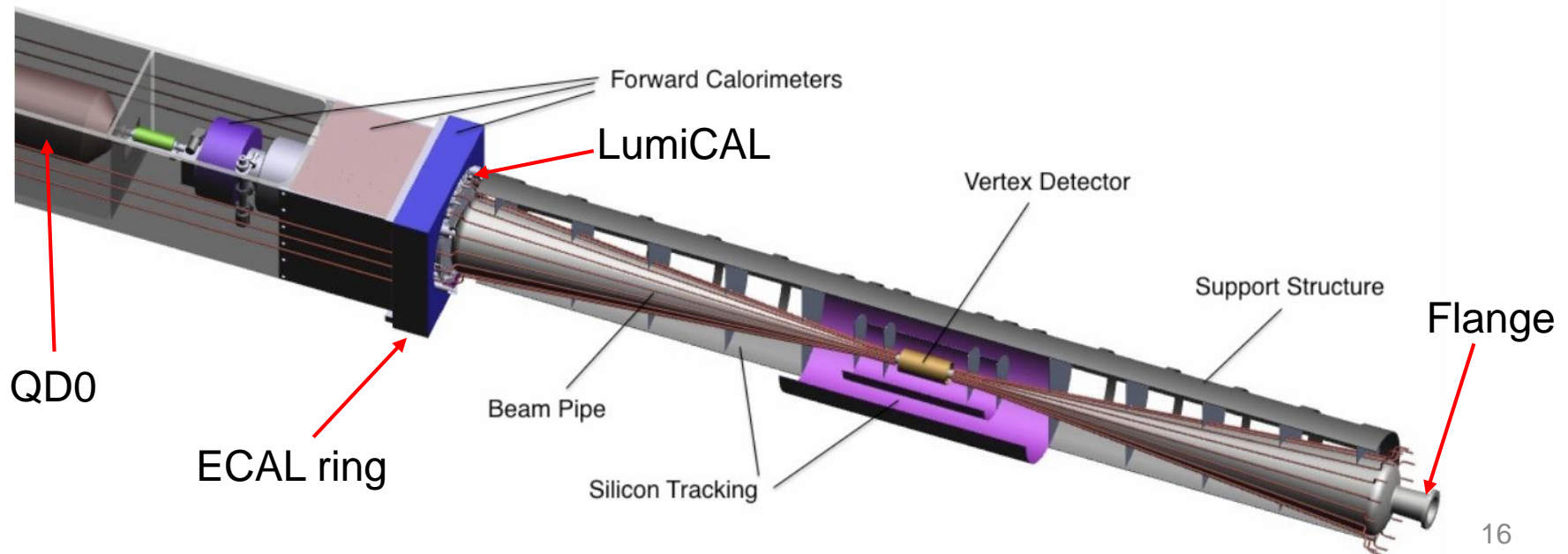
How to open ILD Endcap (2)

- About 1m gap between end-cap CAL and the barrel
- People get into the detector through the small gap

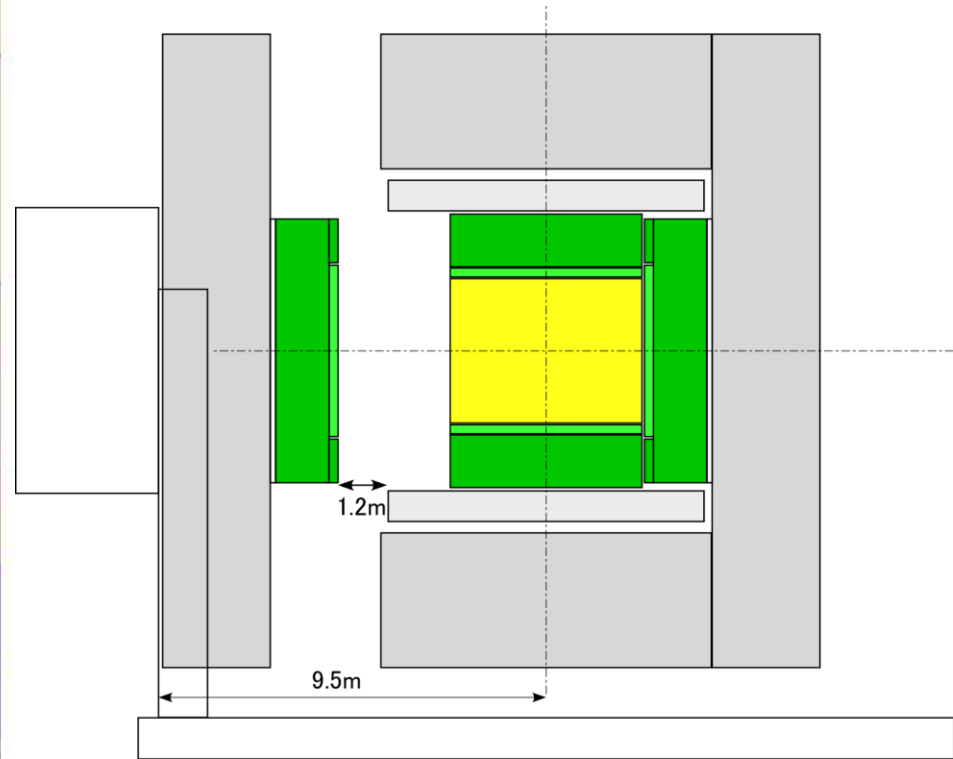
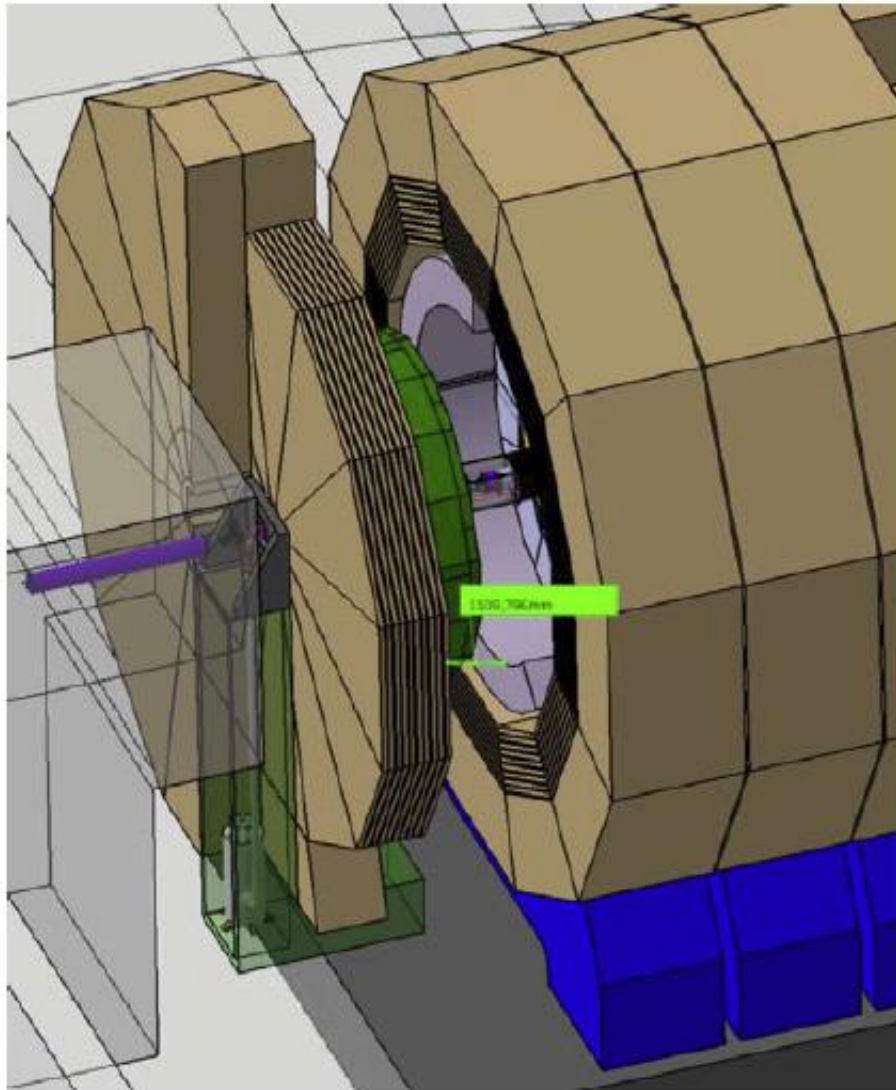


How to open ILD Endcap (3)

- Remove ECAL ring and LumiCAL
- Cut the beam pipe between QD0 support tube and Inner support tube
- Draw out the QD0 and FCALs together with the QD0 support
- Fully open the End-cap

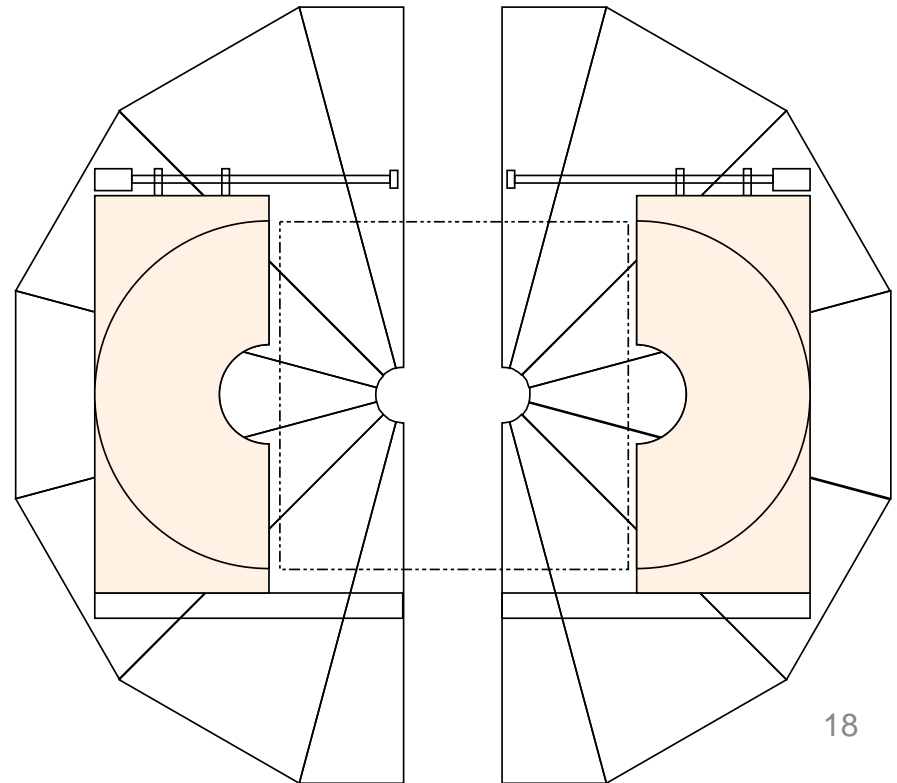
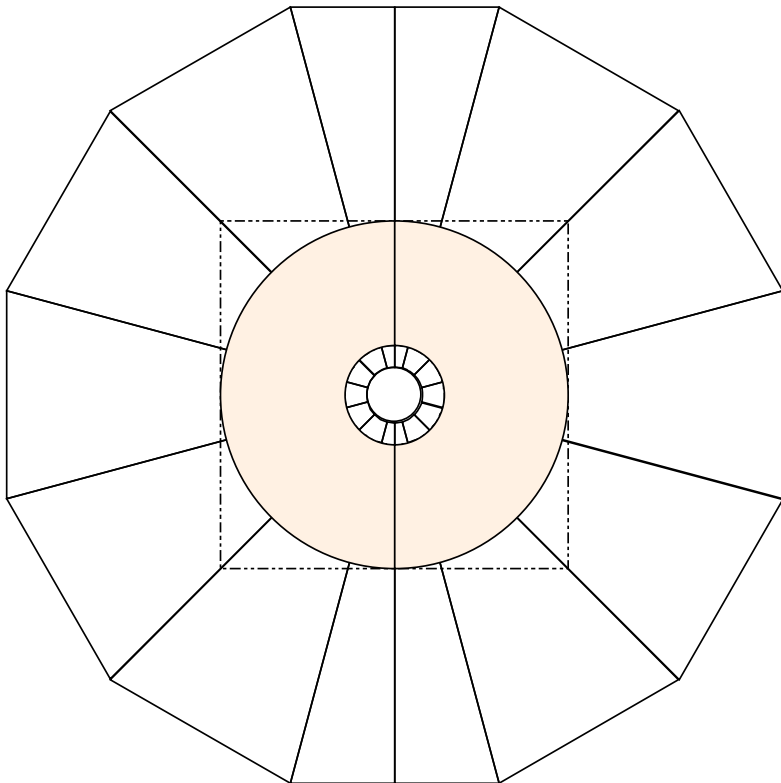


How to open ILD Endcap (4)



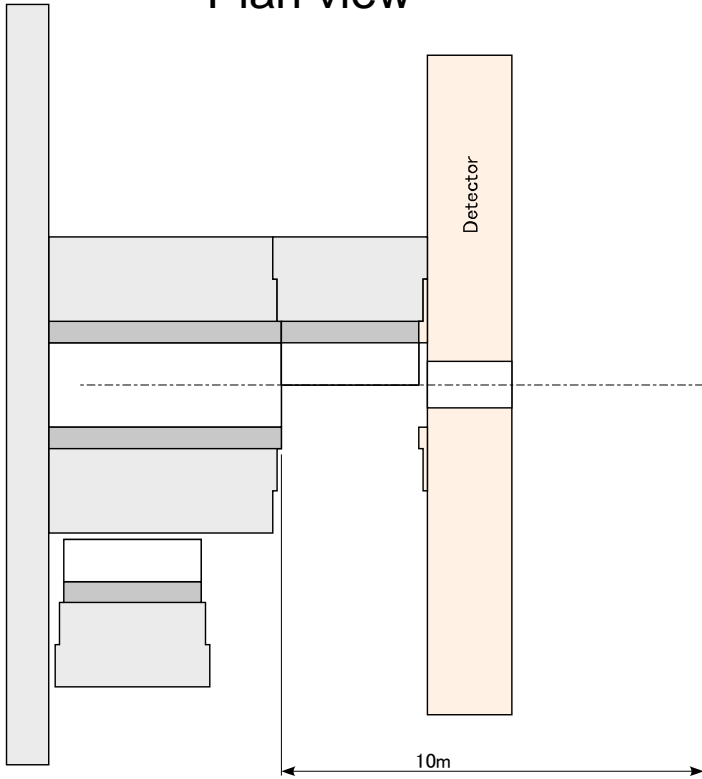
Problem (1)

- This procedure ignores the pac-man adapter (t~1.2m) on the detector, which hit the wall when we want to open the endcap **at beam position**
 - Solution 1: Movable adapter
 - Solution 2: Sliding pac-man instead of rotating pac-man

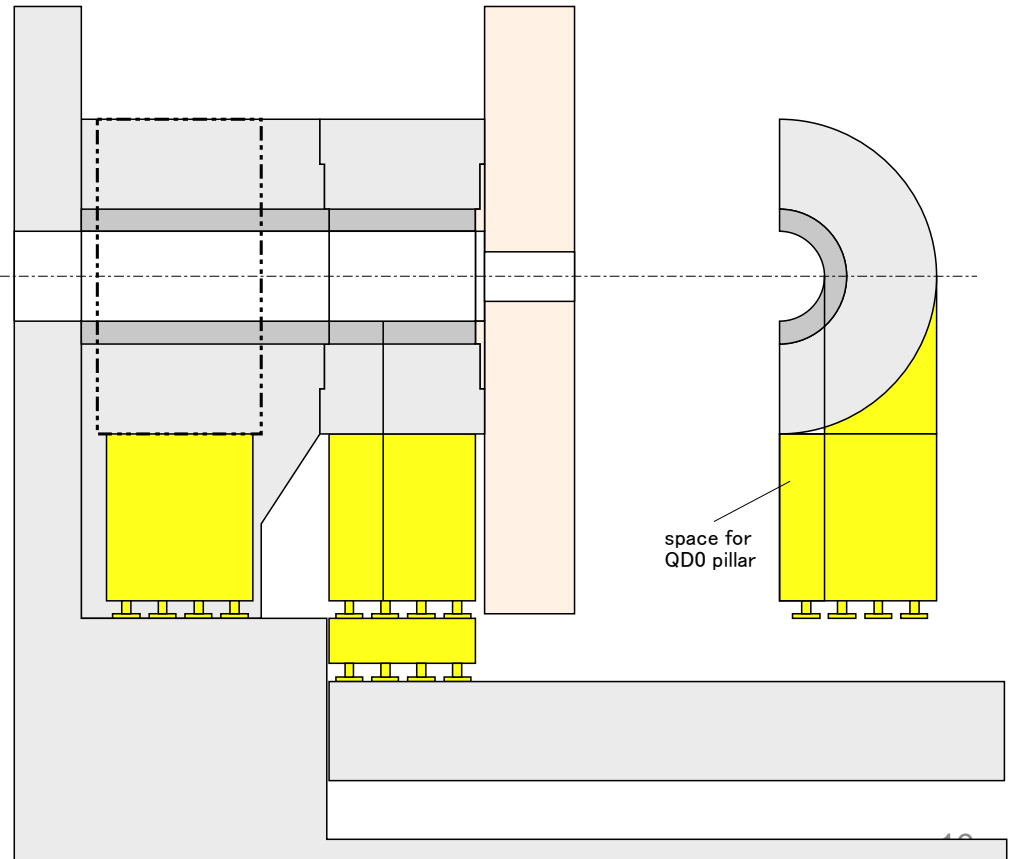


Sliding Pac-man

Plan view



Side view



Problem (2)

- Is splitting endcap realistic?
 - Space for support legs
 - Stability against earth quake
 - Lowering method using gantry crane

