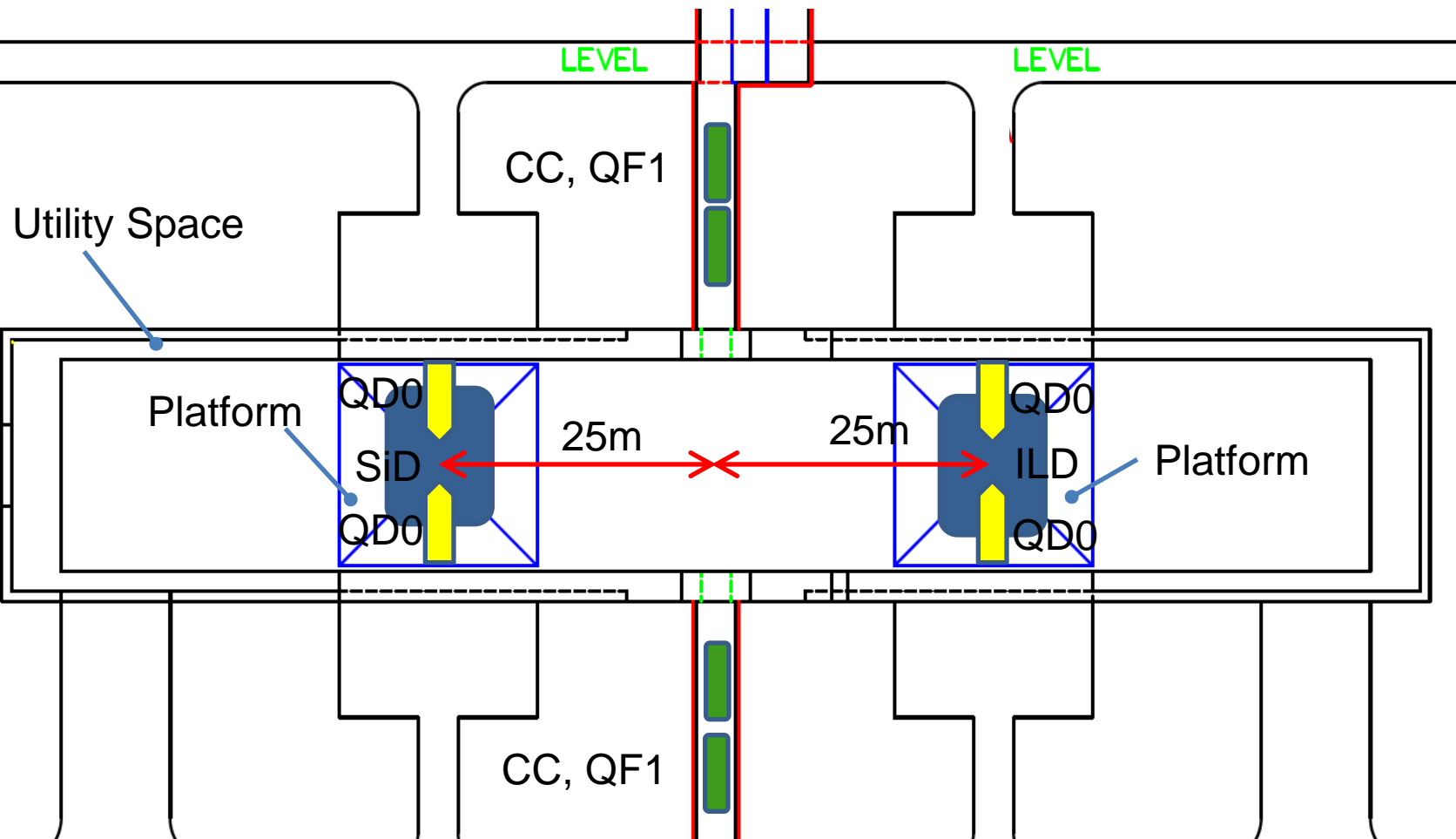


Physical relationship of Superconducting Equipment in the Japanese mountain site



CC, QF1: Stationary



QD0: QD0s are installed inside the detectors (push - pull operation)



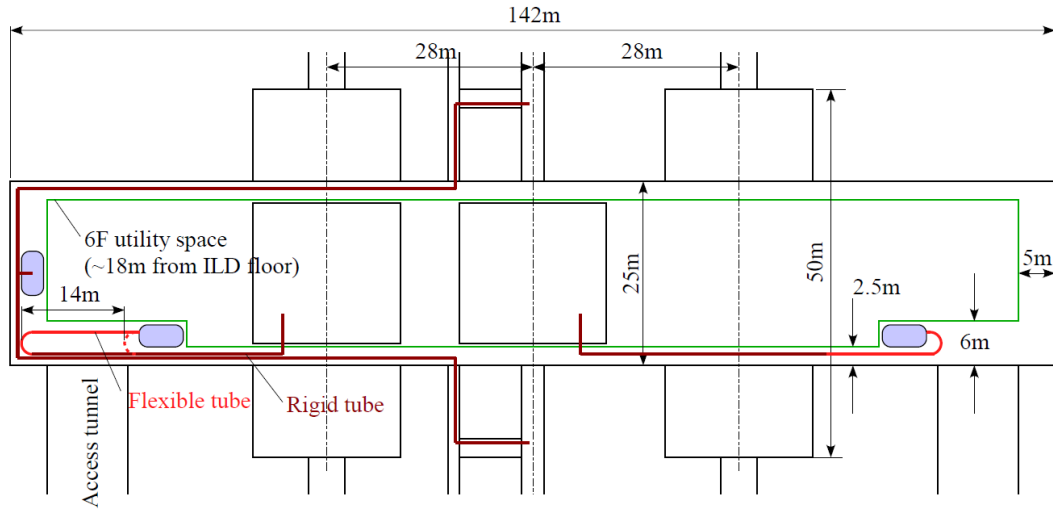
SiD, ILD; Push - pull operation

Size and Spec of Cold Boxes

- CB for SiD+QD0, 2.0 kW @4.2 K
 - Located on the detector
- CB for ILD+QD0, 2.0 kW @4.2 K
 - Located on the detector
- CB for QF1, Crab cavity, 2.0 kW @4.2 K
 - Located on the utility space (5F or 6F)

- Each cold box has following dimension and weight.
Diameter=2m, Length=6.7m, Height=3m, Weight ~ 5000 kg

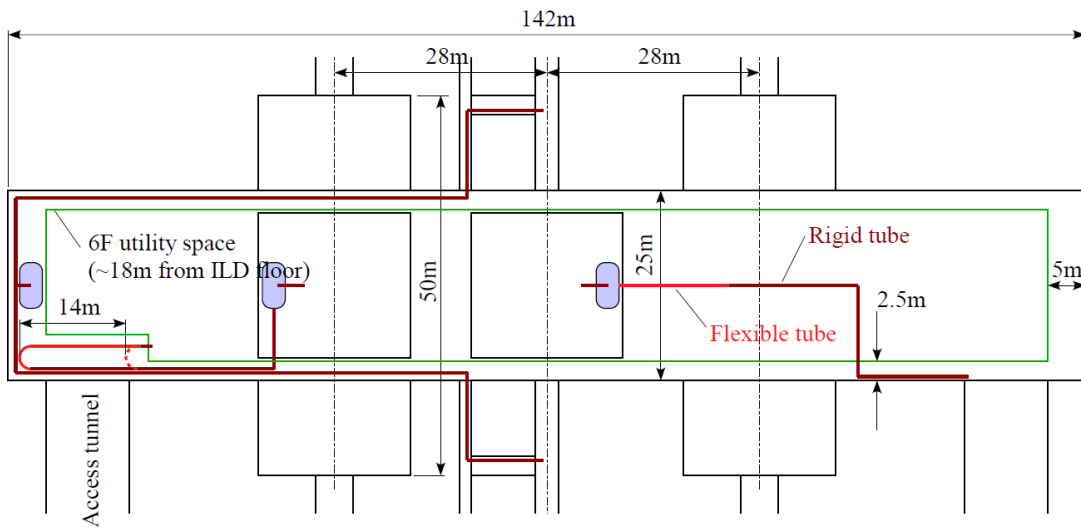
CBs on the side wall



- Cold Box protected by Mag.&Rad
- Easy Installation & Maintenance
- No Vibration
- More space available on the Platform

- Durability of the flexible transfer tube
- Heat load

CBs on the Detector



- Short TRT Line -> Heat Load

- Vibrations
- Space on the platform (+Infrastructures)
- Shielding from the fringe field
- Installation & Maintenance

Flexible Cryo-lines for Push-Pull

Req.s

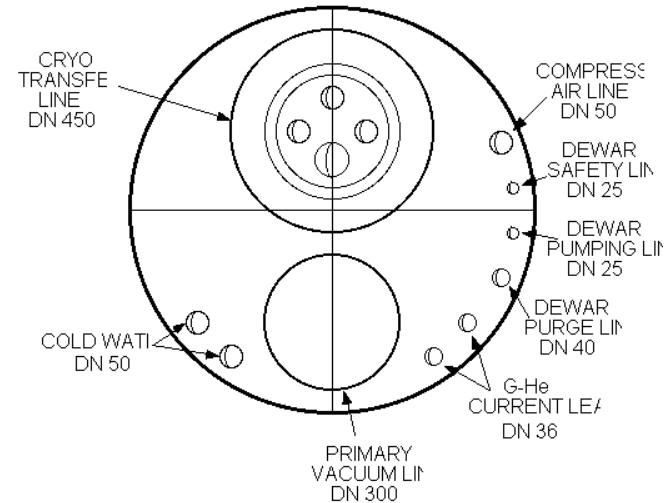
Length = 40 m (25 m flexible)

7 K Supply and return

70 K Shield

Vacuum Lines

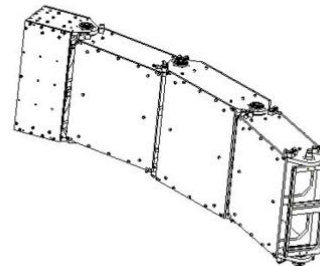
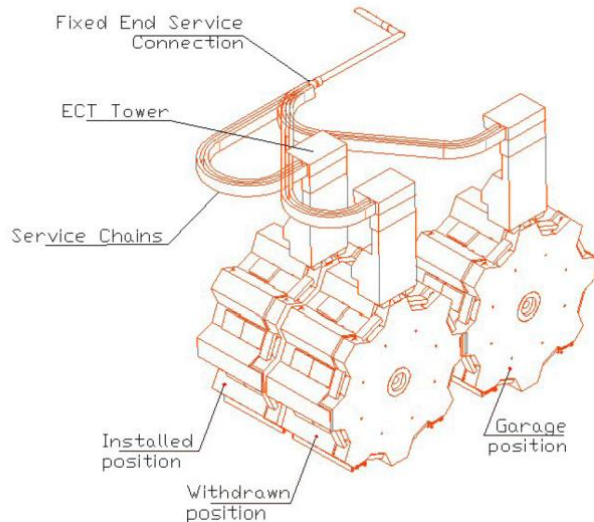
Off-the-shelf TRT Lines are limited in size (~1"ID), almost only single supply



CMS Integrated Transfer Line (Rigid)

Survey of Flexible Lines

End Cap (ATLAS) in 3 Different Positions



Link Box for flexible cryogenic lines with link sections ~ 622 mm

Information recollected by Wes...

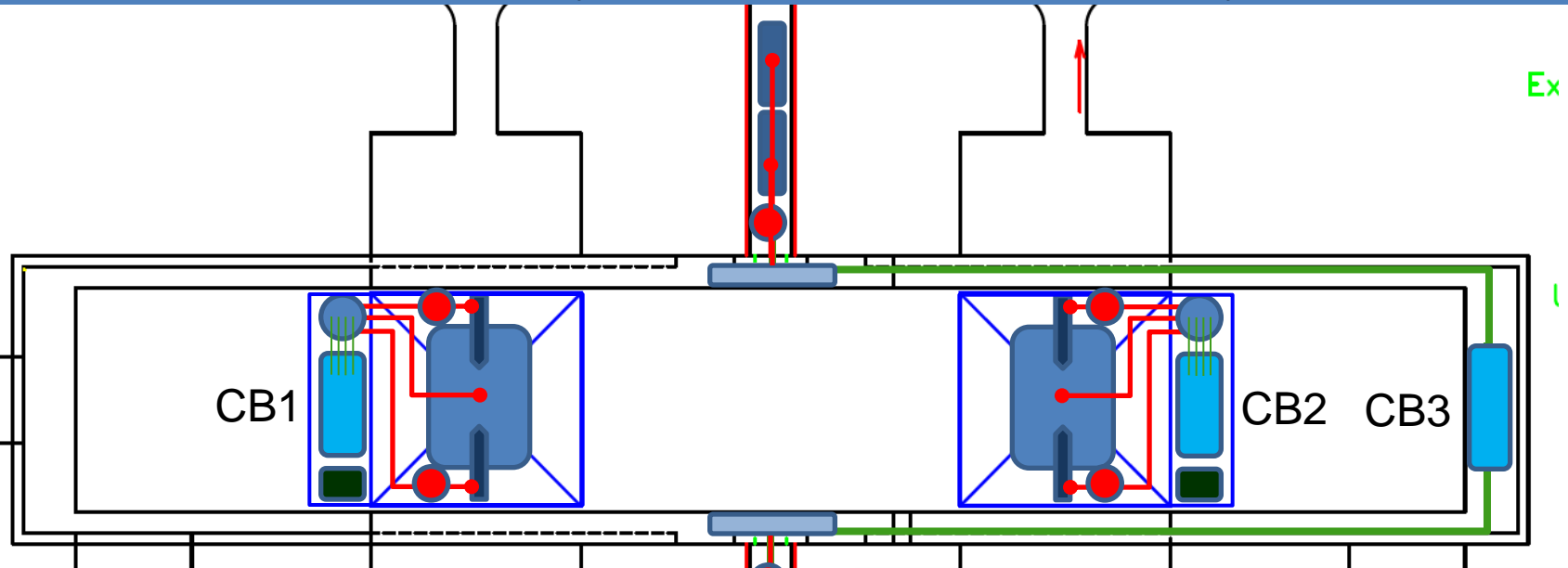
FNAL had no info.

JLAB did not have any direct info, but he thought that the heat load might involve a rather large diameter flex line because of the pressure drop of the return helium in the corrugated annular space. He suggest sending supercritical helium to the magnet and using a local JT valve.

Kabelmetal flex lines are now produced by NEXANS. They have some info showing bend radius (one time and several times) for various line diameter combinations.

Cryogenic Layout in the experimental hall

- ✓ CB3 and distribution boxes for CC and QF1 are installed on the 6F.
- ✓ CB1, 2, distribution boxes and PSs are installed on the each platform for detector
- ✓ Several numbers of ordinary flexible tubes have to be employed. (see P6 & P8)



● Distribution box for detector (4.2 K)

● Subcooler for 2.0K saturated Hell

■ Cold Boxes (CB1,2,3)

■ Distribution box (4.2 K)

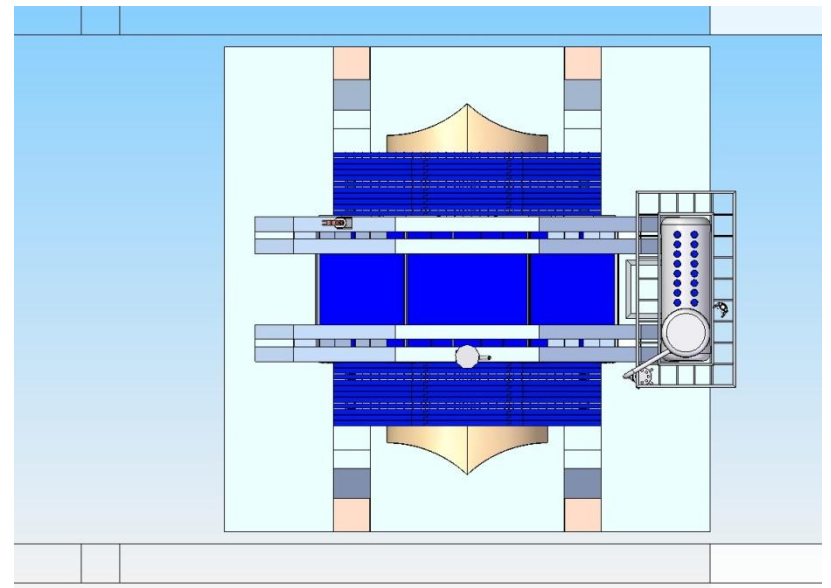
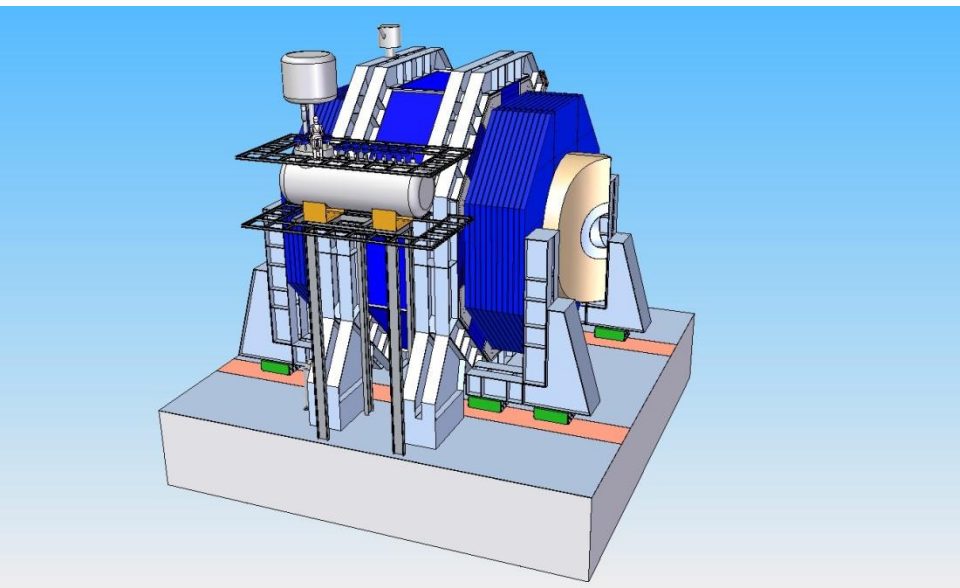
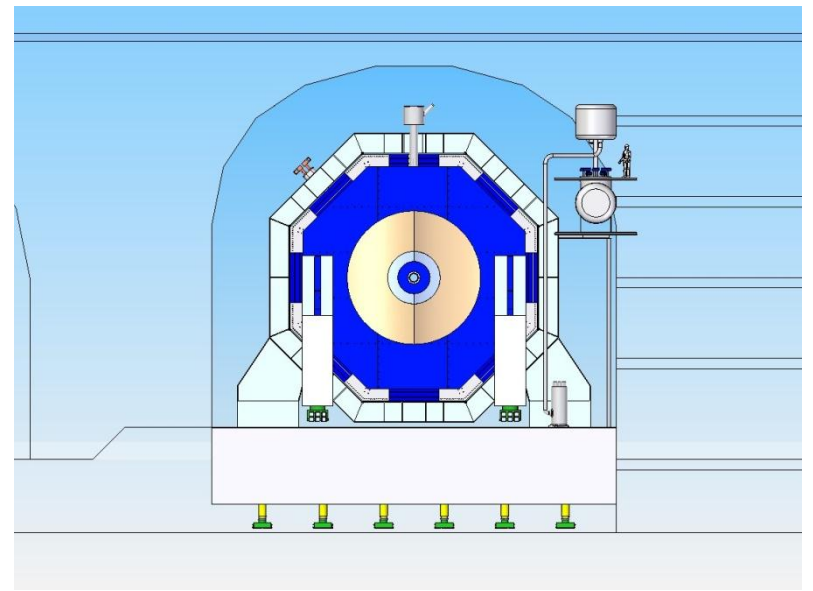
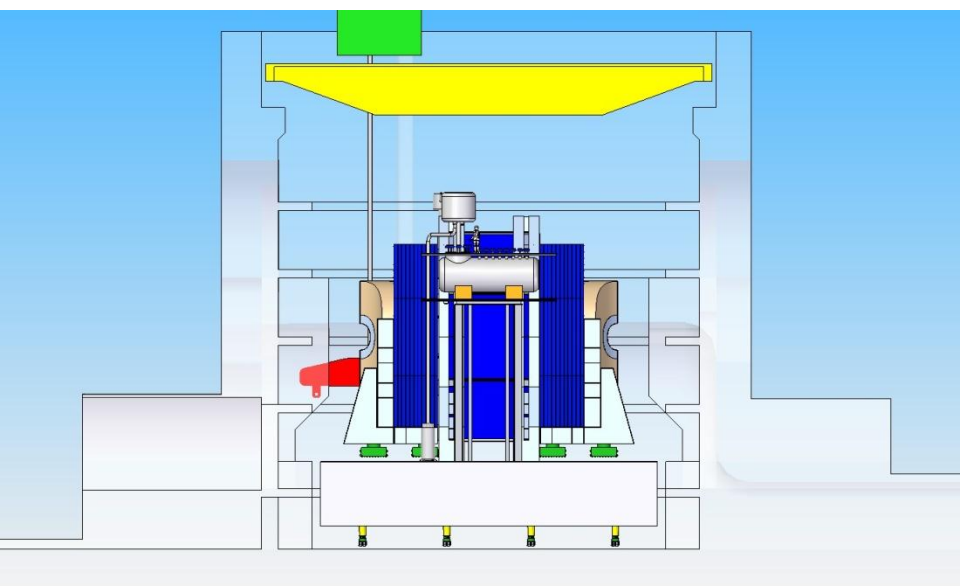
■ SiD, ILD, CC, QD0, QF1

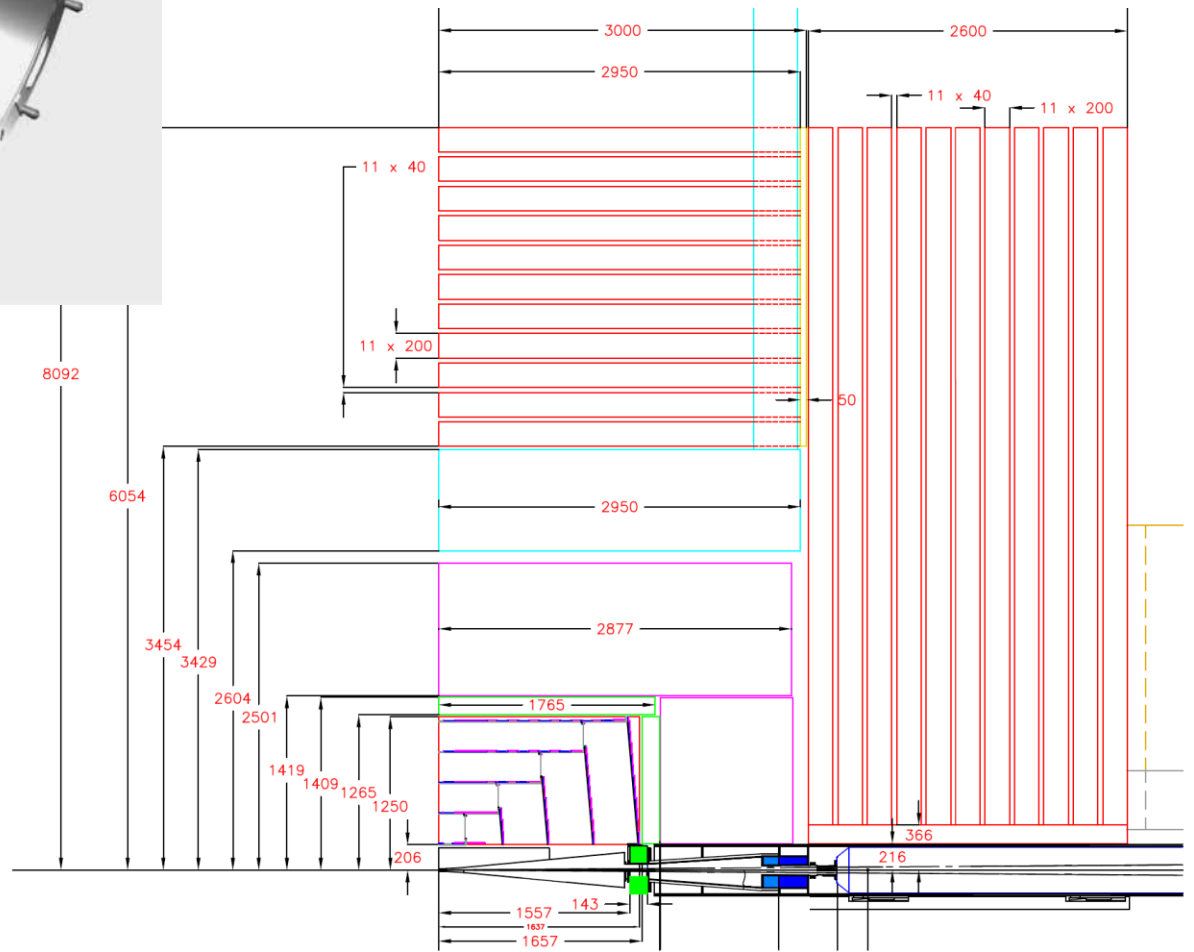
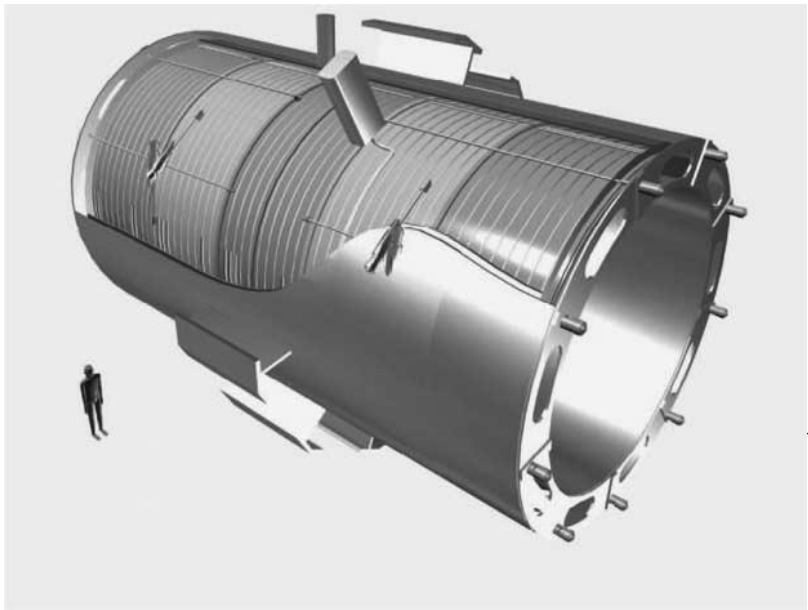
— Conventional TRT

— 7K Helium Gas Line

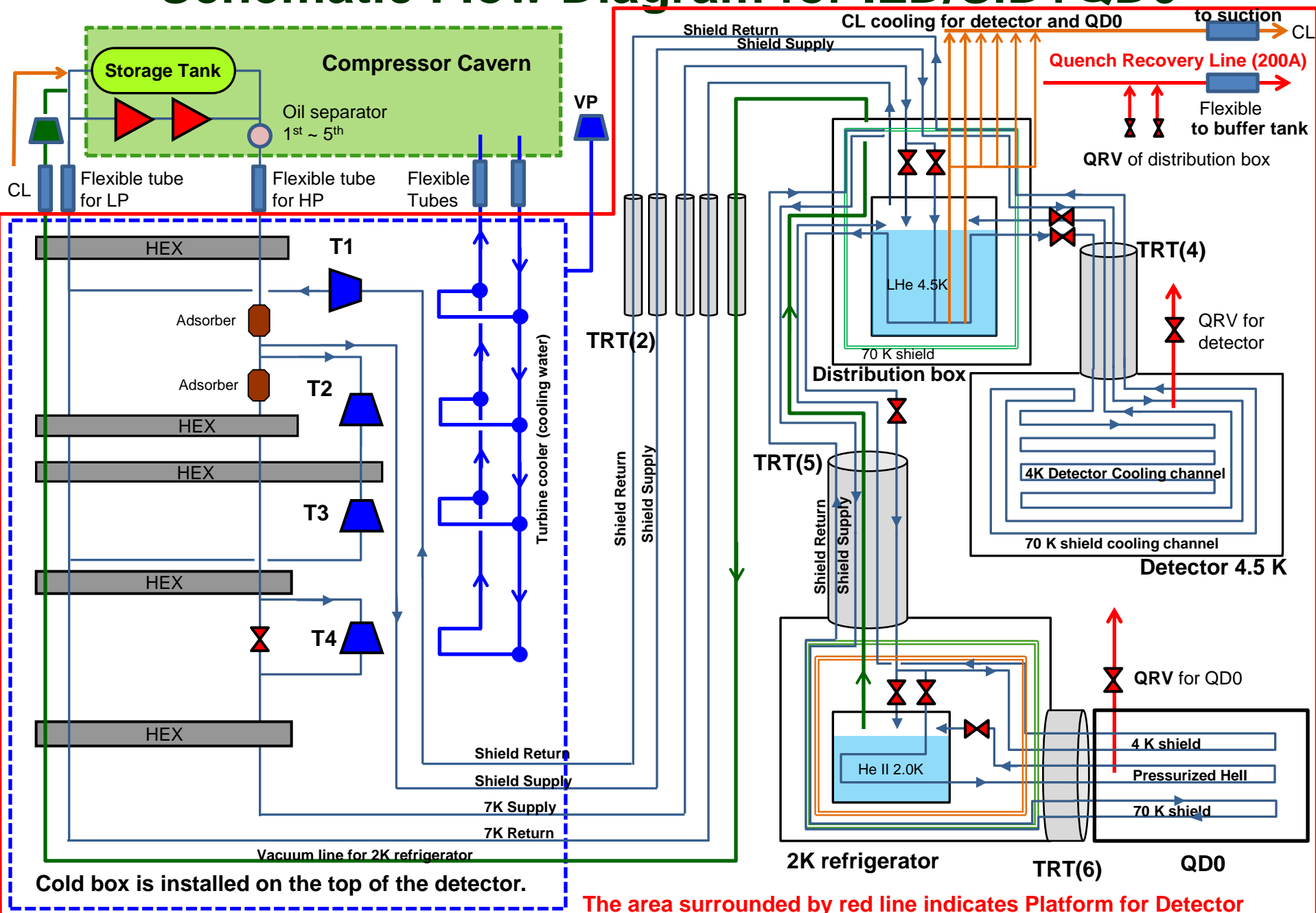
Installation location of cryogenic equipment

- On the each detector
 - One Cold box
 - One Distribution box for 4.5K
 - Two Distribution boxes for 2.0 K (QD0)
 - Power supply for Detector and QD0

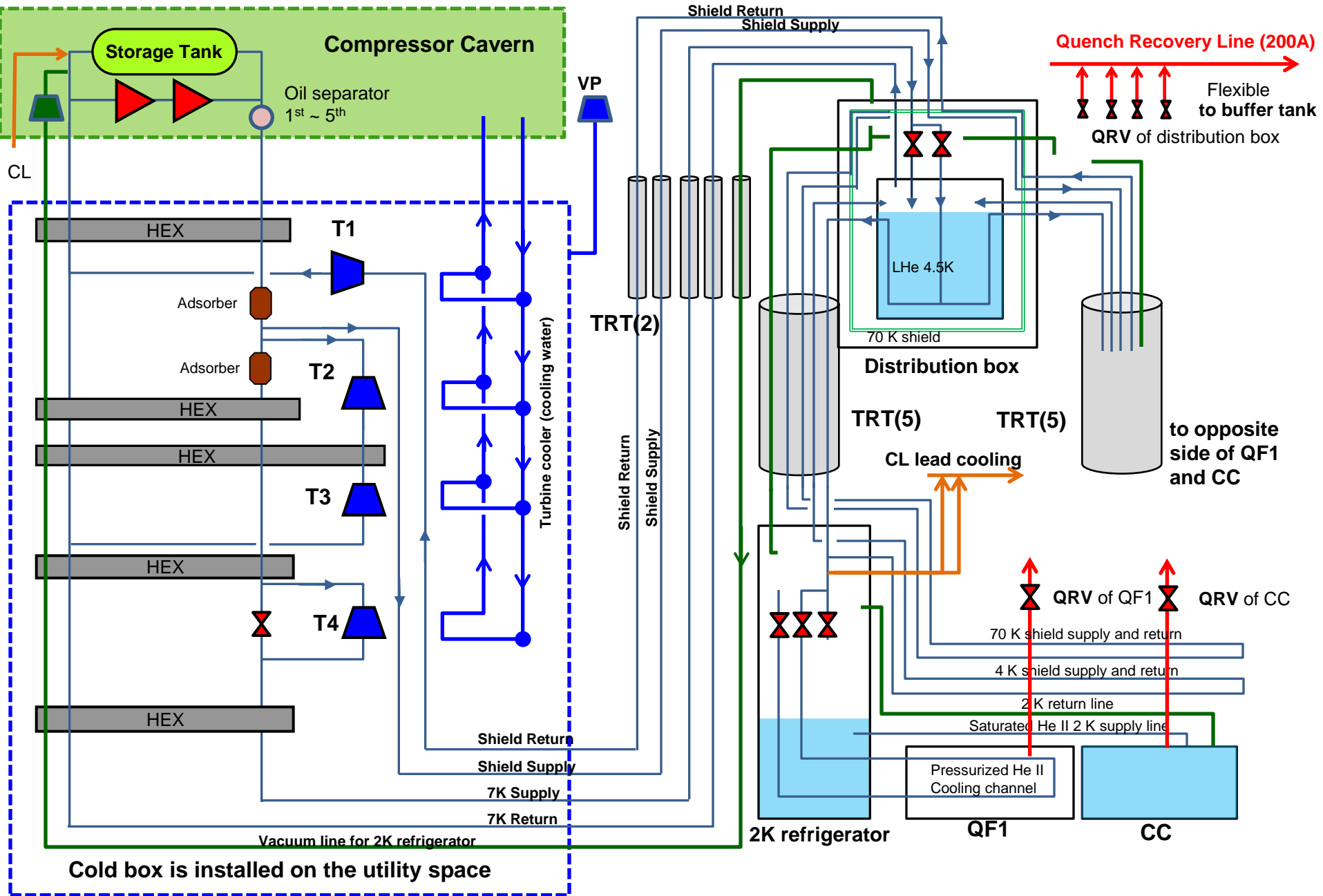




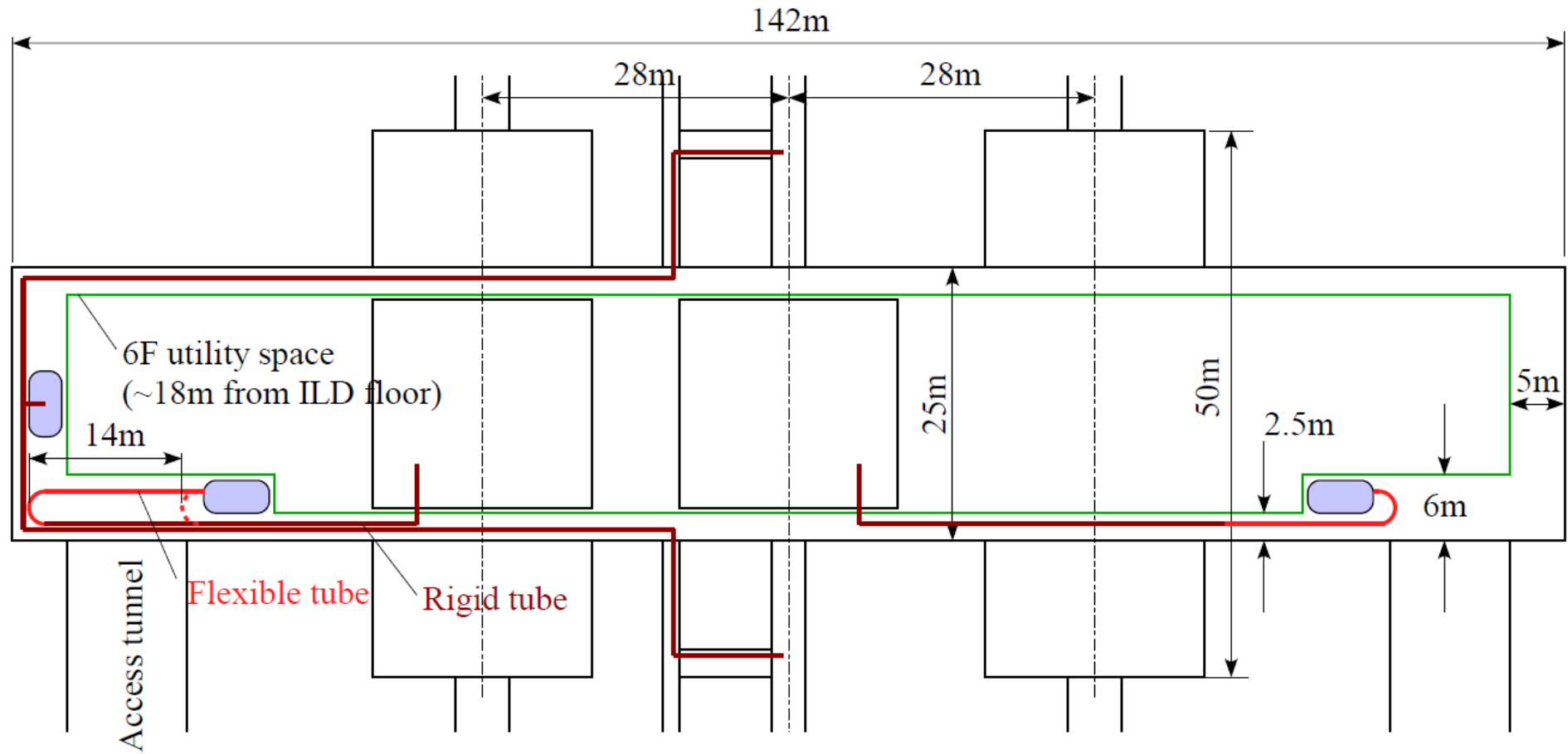
Schematic Flow Diagram for ILD/SiD+QD0



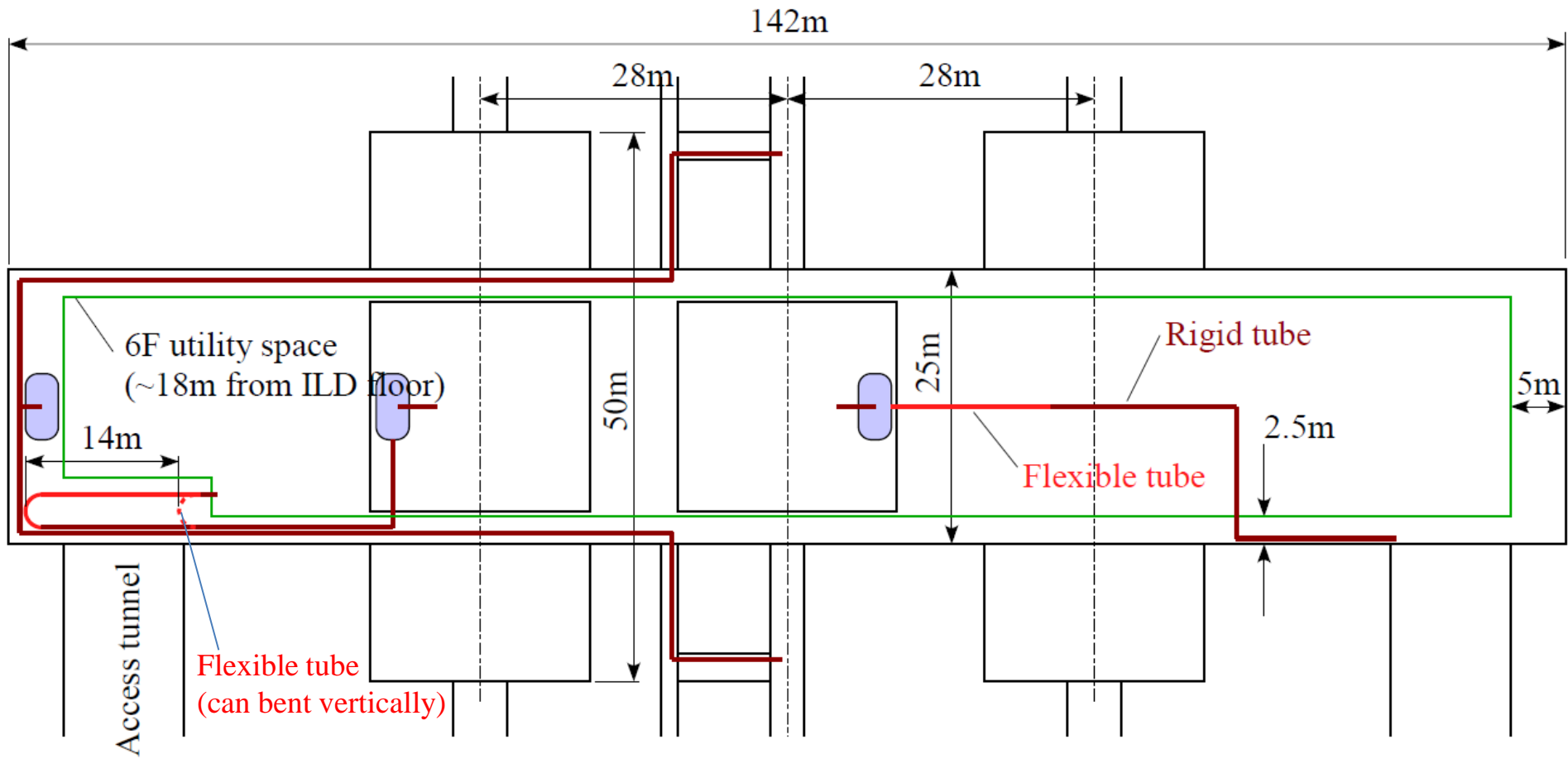
Schematic Flow Diagram for CC+QF1



Detector CBs on the side wall



Detector CBs on the platform



Baseline design

- 3 cold boxes; one for ILD+QD0s, one for SiD+QD0s, and one for QF1s and crab cavities
- There are two possibilities of the location of CBs for detectors
 - On the side wall
 - CB on 5F or 6F utility floor
 - 7K or 4K flexible transfer tube on 6F utility floor
 - CB and flexible transfer tube locate above the entrance of the access tunnel in order not to disturb the detector assembly
 - On the detector/platform
 - 300K high pressure flexible tube along the cable chain in the cable pit or on 6F utility floor (depends on the bending radius)
- Choice of the location of the CB is up to each detector group
- Capacity of the compressor for three CBs has to be defined before AD&I meeting

Ordinary Flexible Tube for each detector

Following ordinary single layer flexible tubes are adopted for pushpull operation per each detector.

	Diameter of Flex. tube	Number	Bending radius (mm)	References
Helium gas supply line	OD ~ 60.5mm	1	225 mm	Allowable pressure ~ 2.0 MPa
Helium gas return line	OD ~ 200 mm	1	750 mm	Allowable pressure ~ 2.0 MPa
Helium gas vacuum line	OD ~ 200 mm	1	750 mm	Allowable pressure ~ 0.2 MPa
Cooling water for turbine	OD ~ 30 mm	2	145 mm	Supply & Return
Quench relief line	OD ~ 128 mm	1	350 mm	Allowable pressure ~ 2.0 MPa
Return line for Current lead cooling	OD ~ 30 mm	1	180 mm	Allowable pressure ~ 2.0 MPa

Bending radius is the value of Tuf Omega Tube.