

# ILD Global Integration option for Mountain Regions

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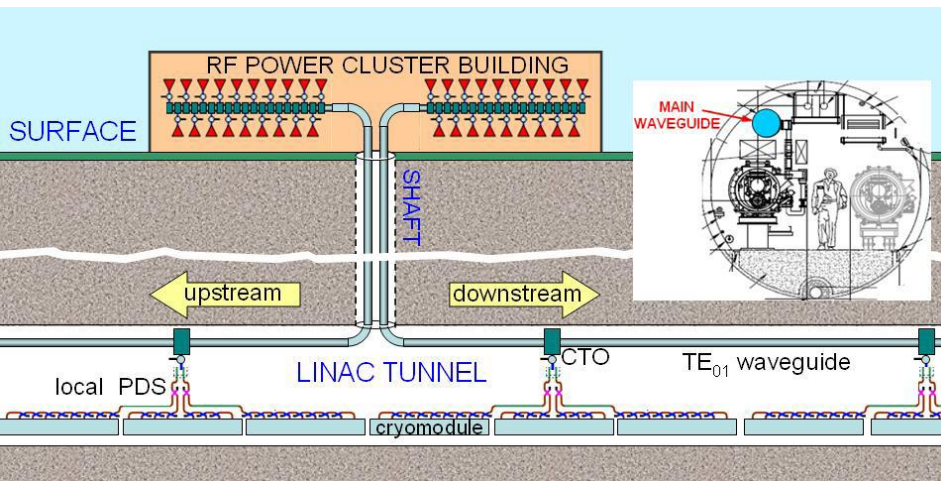
ILD Integration Workshop @DESY

# Study of CF in mountain regions

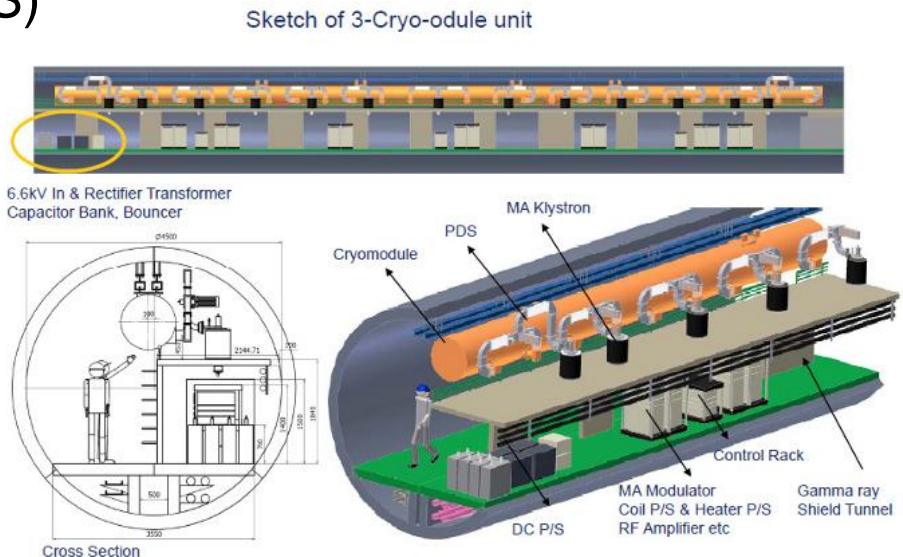
- Design study of conventional facilities (CF) in mountain regions is actively being done by KEK CFS group and AAA (Advanced Accelerator Associates Promoting Science and Technology) in Japan
- There was an International review on the Asian single tunnel design and the CF study in mountain regions (June 1-2)  
<http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=4613>
  - Review chair: Victor Kuchler (FNAL)
  - Positive review report
- Since CF design needs exp-hall design, we are now involved in this activity (since Apr.2010)

# ML Single tunnel configuration

- Single tunnel configuration of the main linac (ML) is the new baseline for cost reduction instead of two tunnel configuration in RDR
- Two options of single tunnel configuration
  - Klystron Cluster System (KCS)
  - Distributed RF System (DRFS)



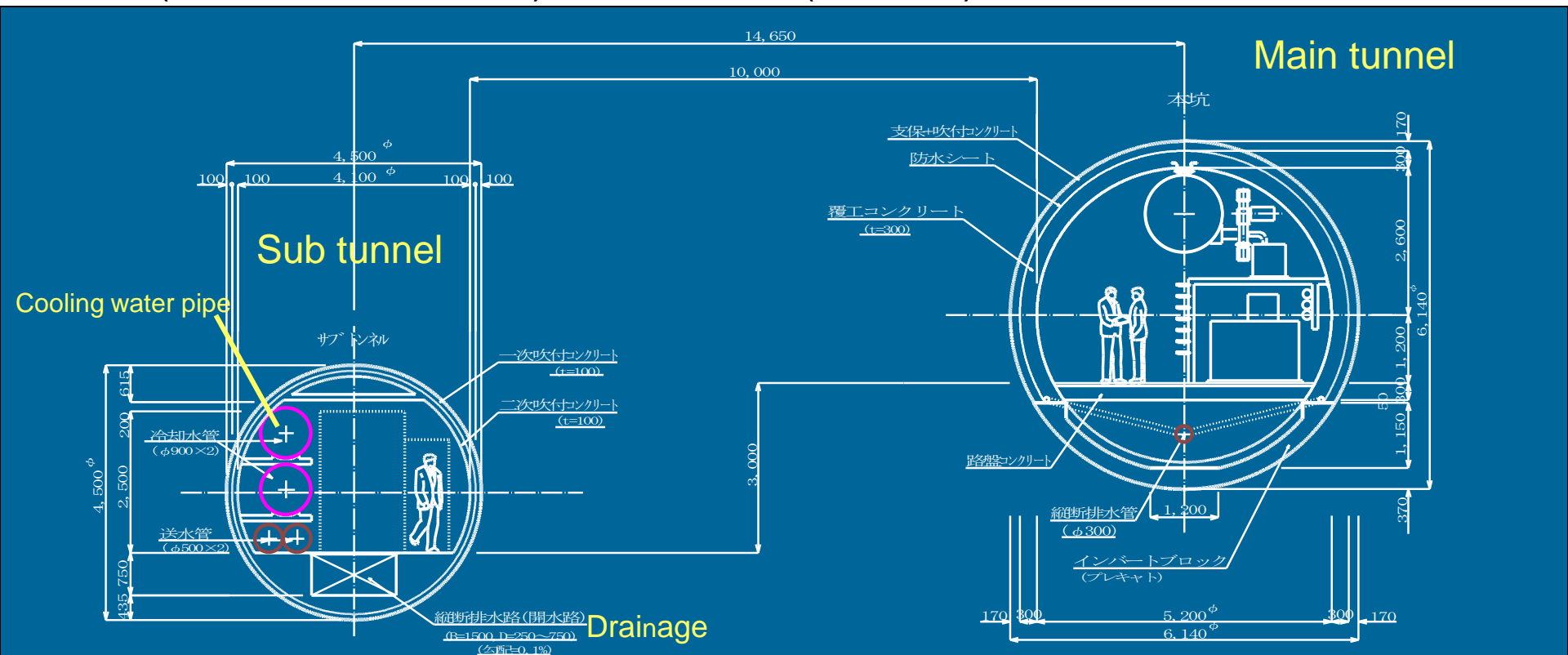
KCS



DRFS

# Asian single tunnel design

- KCS requires vertical shafts at every ~2.4km, which seems not suitable for mountain sites
- DRFS requires large-bore cooling water line along the ML tunnel
- ➔ Asian single tunnel design consists of a main tunnel for DRFS and a sub tunnel for cooling water/drainage of ground water/other services (no active elements) with several (inclined) access tunnels and shafts



# Exp-hall in mountain regions

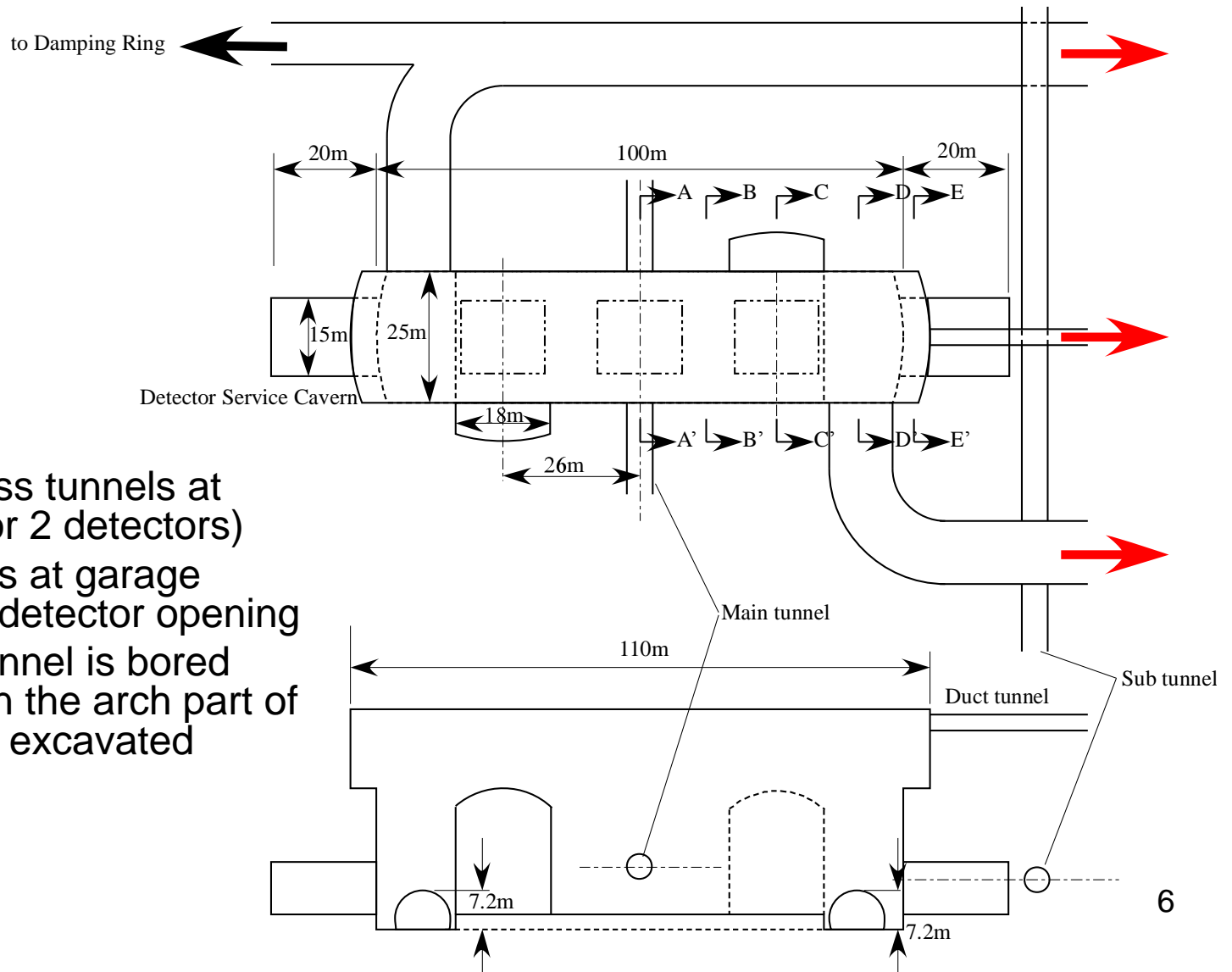
- At some candidate sites, depth of IP is  $d \gg 100\text{m}$
- By removing the requirement of  $d \leq 100\text{m}$ , degree of freedom of accelerator layout increases
- We should make environmental destruction as small as possible to realize the ILC project
  - CMS style assembly may require large area on ground surface in mountain area for assembly hall
  - Wide access roads to the assembly hall have to be constructed, which could also destroy the environment



- Exp-hall WITHOUT vertical shafts may be more suitable for some candidate sites in mountain region
- In that case, (inclined) access tunnels are used to carry detector/accelerator components into cavern/acc. tunnel
- We have just started to study on the exp-hall design and detector assembly method without vertical shaft

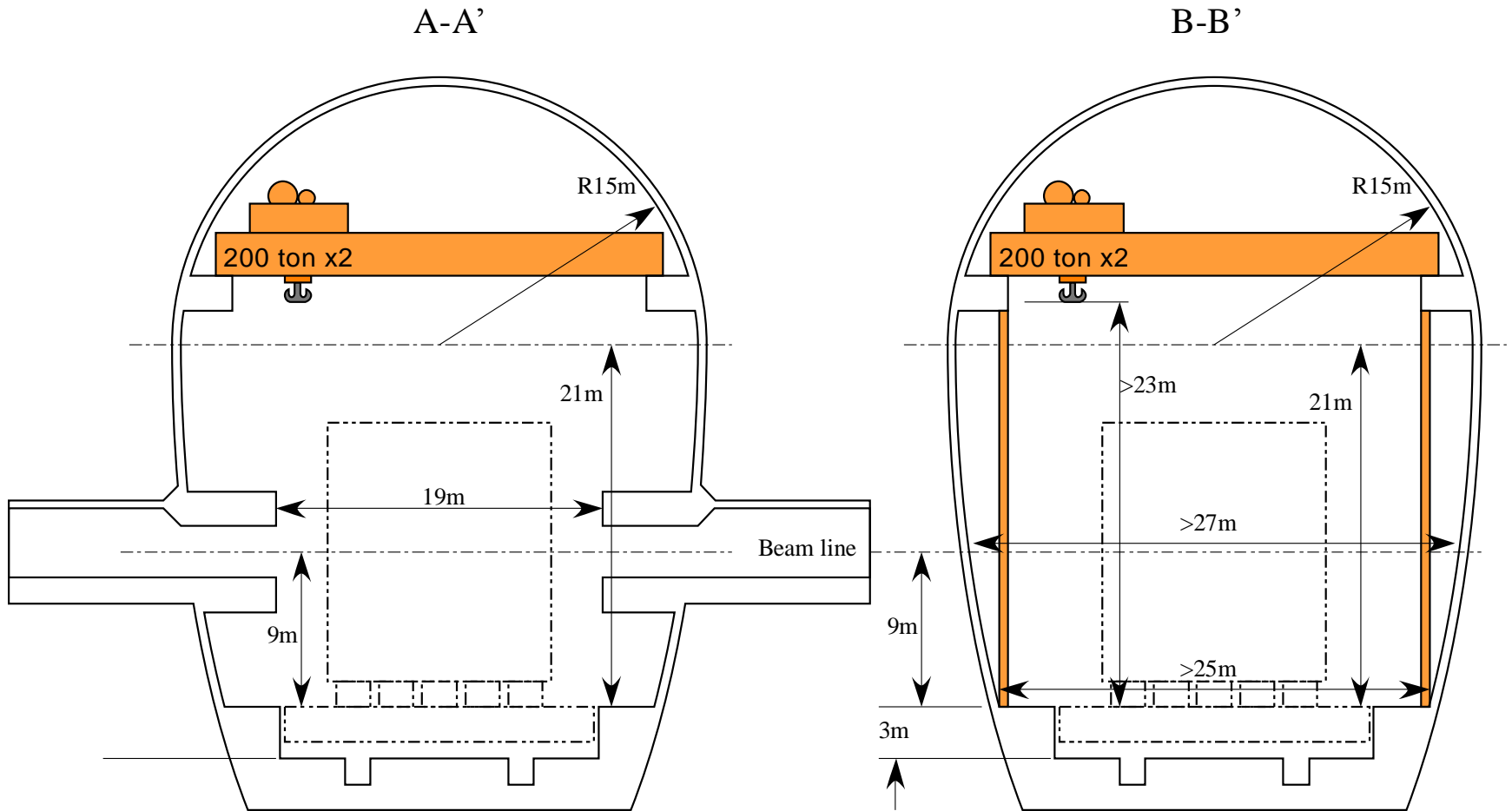
(n.b. It does not mean the CMS-style assembly using vertical shafts is excluded for all candidate sites in mountain regions)

# A possible design of exp-hall

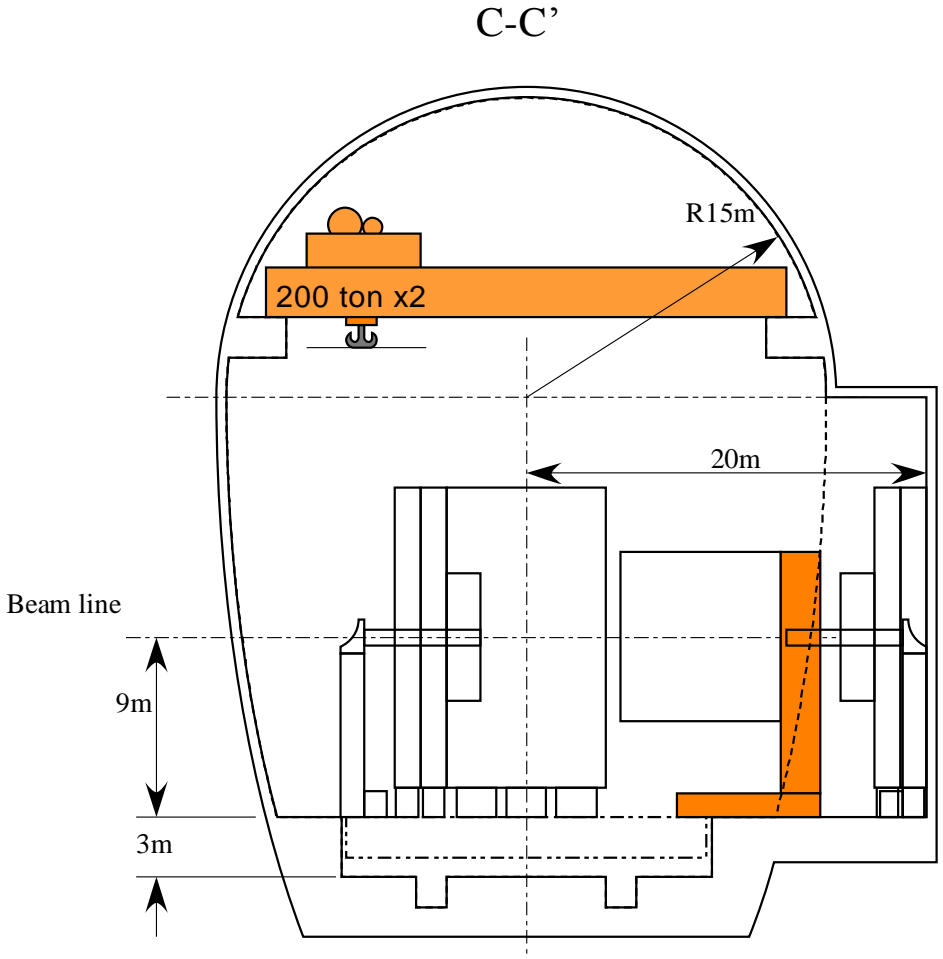


- Bottom access tunnels at both ends (for 2 detectors)
- Small alcoves at garage positions for detector opening
- Top (duct) tunnel is bored first, and then the arch part of the cavern is excavated

# A possible design of exp-hall

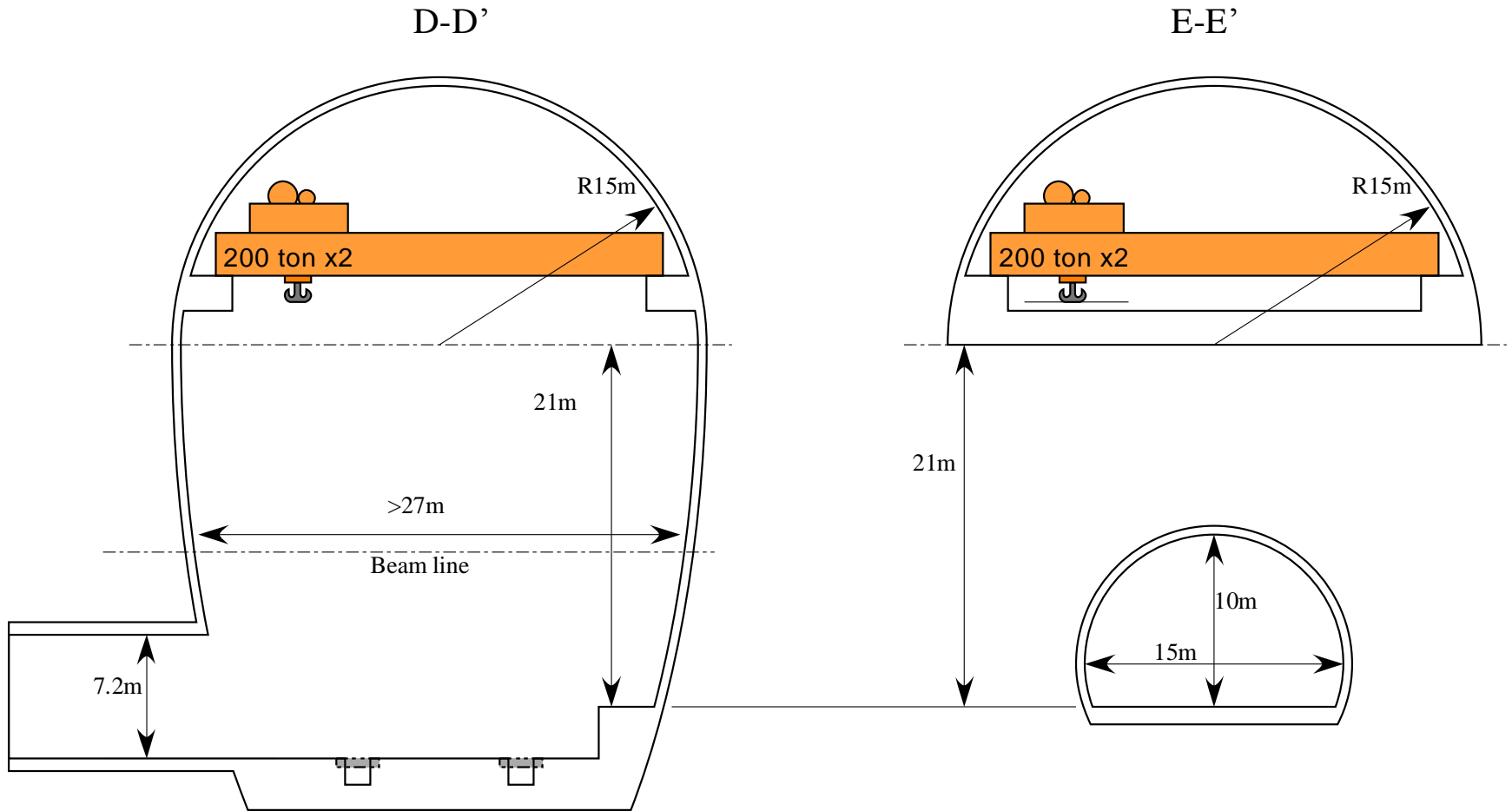


# A possible design of exp-hall

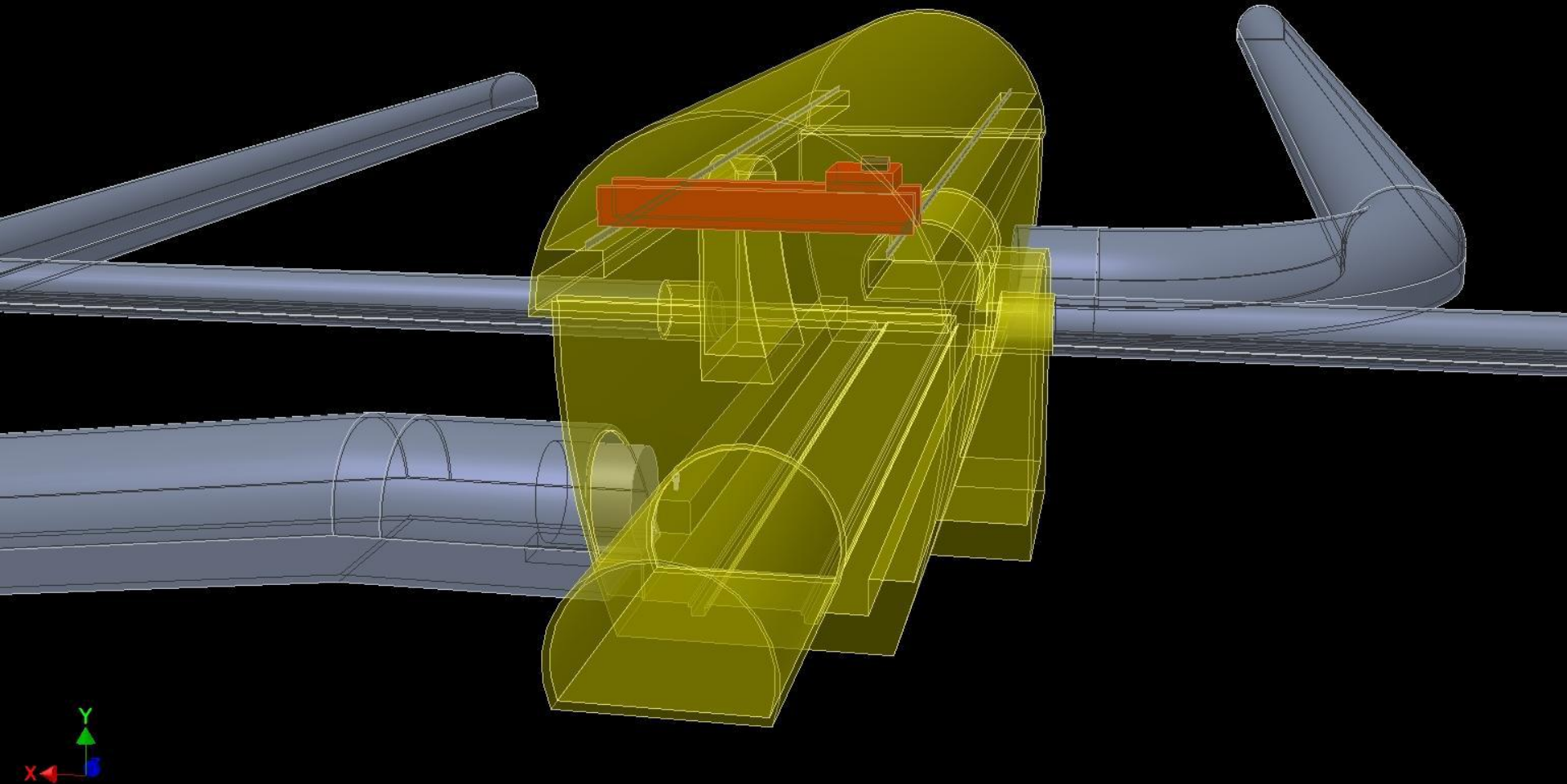




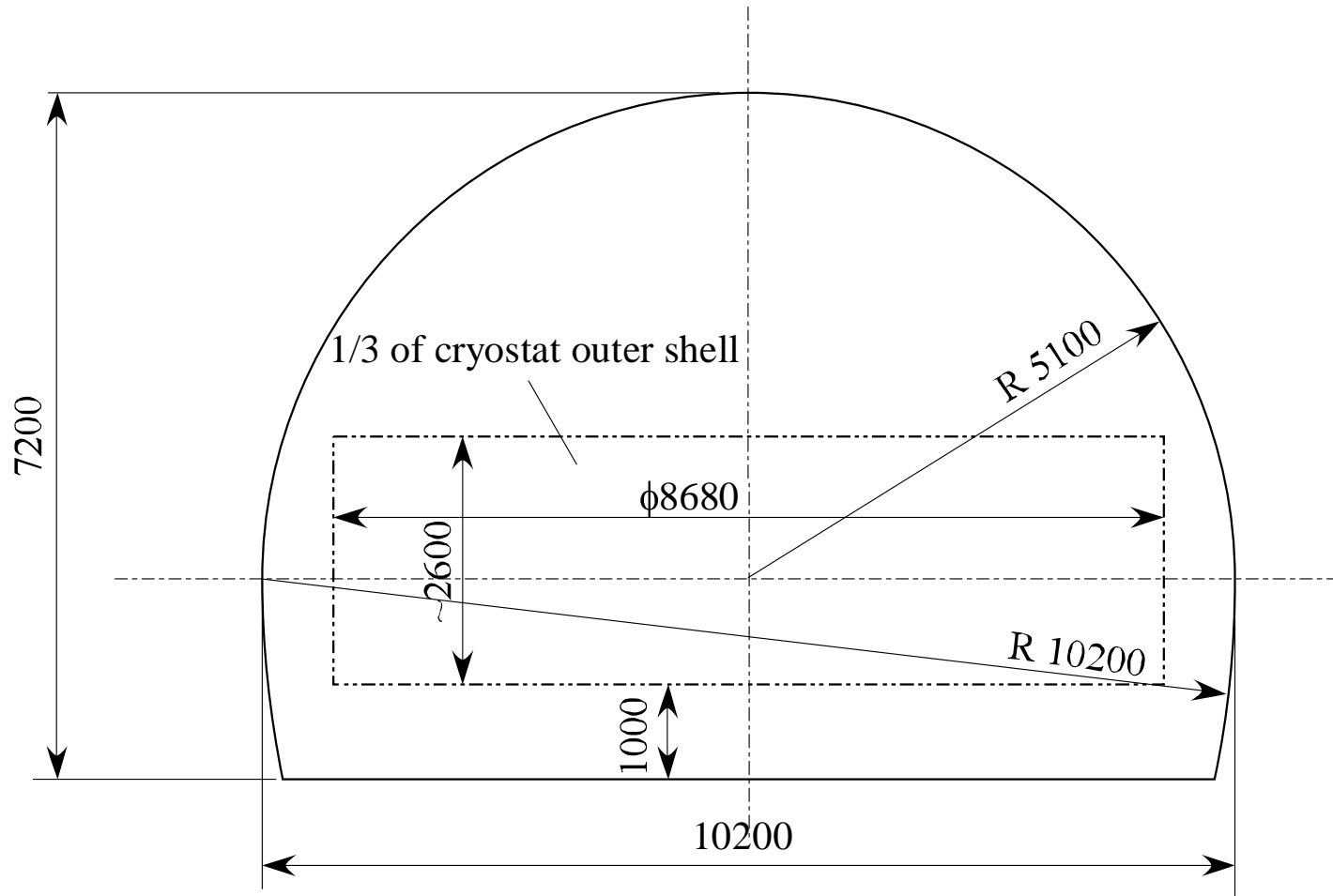
# A possible design of exp-hall



# 3D CAD



# Access tunnel



# Detector assembly

- Assembly hall locates at the entrance of access tunnel where wide flat surface exists and a wide road is available
- Detector would be assembled to relatively small pieces (<100ton) at the assembly hall, carried to the cavern through the access tunnel, and integrated to the large detector inside the cavern
  - Solenoid (example)
    - cable winding for 1/5 modules at the assembly hall
    - connected to the full solenoid at the cavern
- Barrel iron structure would be divided in  $\phi$  (and R) direction, rather than Z direction → non-CMS style
- Detailed study on the assembly method is necessary

# Construction period

- Construction period of an access tunnel ( $L \sim 1\text{km}$ ) is similar to that of a vertical shaft ( $d \sim 100\text{m}$ )
  - 1y (shaft/tunnel) + 2y (cavern) + 11m (inner structures) before start of detector installation
- There has been no serious estimation on the detector construction period for ILC
- Assembly of the iron yoke structure and the solenoid in the cavern would take  $\sim 1\text{y}$ , but it does not necessarily mean that non-CMS style assembly takes 1y more than CMS style assembly: Construction of sub-detectors could be the bottle neck

Realistic estimation of construction period of sub-detectors should be made

# Example of cavern

- Underground hydroelectric power plant in Japan (Kannagawa power plant)
- Cavern size: 51.4m(H)x33m(W)x215.9m(L) in hard sedimentary rocks
- Construction (excavation) period: 1y for arch, 1y for bench
- Depth: d~600m → Heavy components of generators were carried into the cavern through access tunnels



# Summary

- Collaborating with KEK CFS group, we have just started design study of experimental hall and assembly method of ILD assuming a cavern without vertical shaft for mountain region sites
- In this scheme (exp-hall without vertical shaft), CMS style assembly cannot be adopted, and new assembly procedure has to be studied
- We would like to get agreement of ILD to consider this scheme as a site-dependent option of ILD
- At CFS workshop at SLAC in Aug.2-3, I hope to discuss with SiD people on the possibility of SiD assembly scheme in shaft-less exp-hall