Status of the civil engineering design for the Kitakami site

Masanobu Miyahara

KEK Linear Collider Project Office

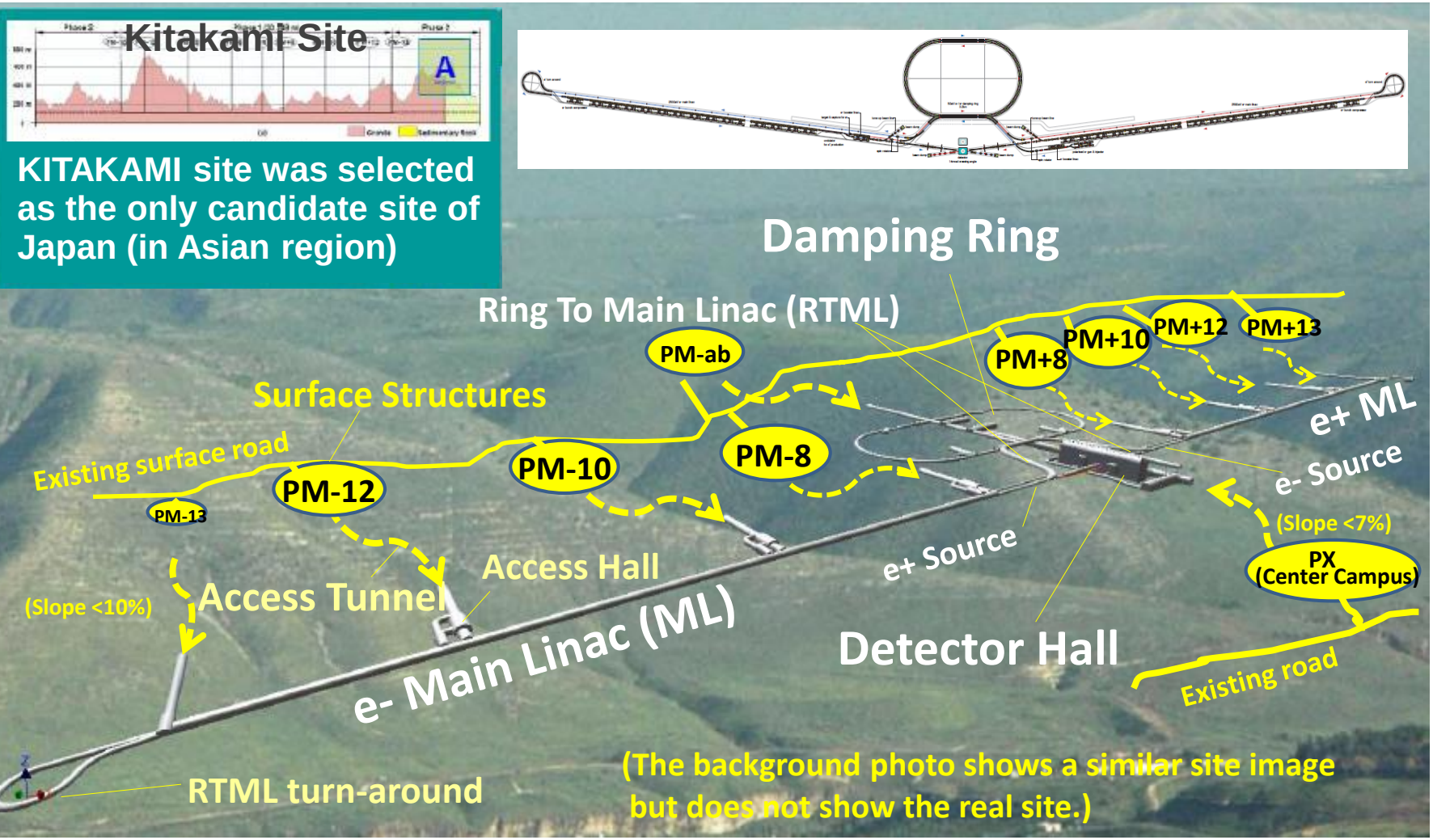
Contents

Status of Civil Engineering Design in the Asian mountainous site

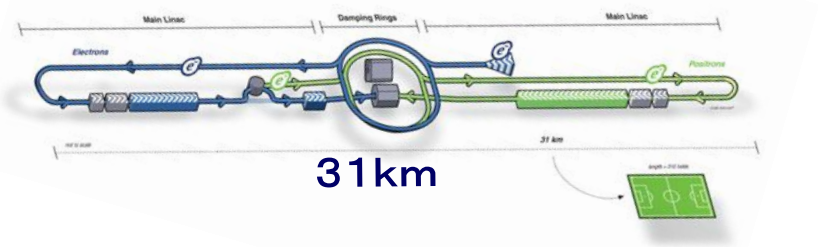
- **Accelerator Tunnel**
- **Detector Hall Cavern**

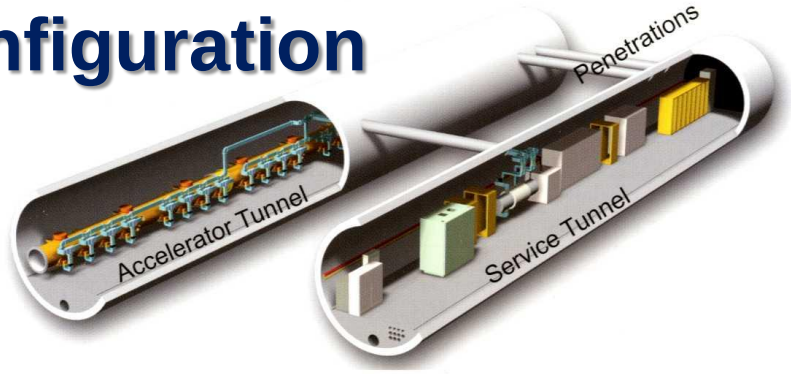
Accelerator tunnel in the mountain site

ILC Facility arrangement plan
in the mountain site

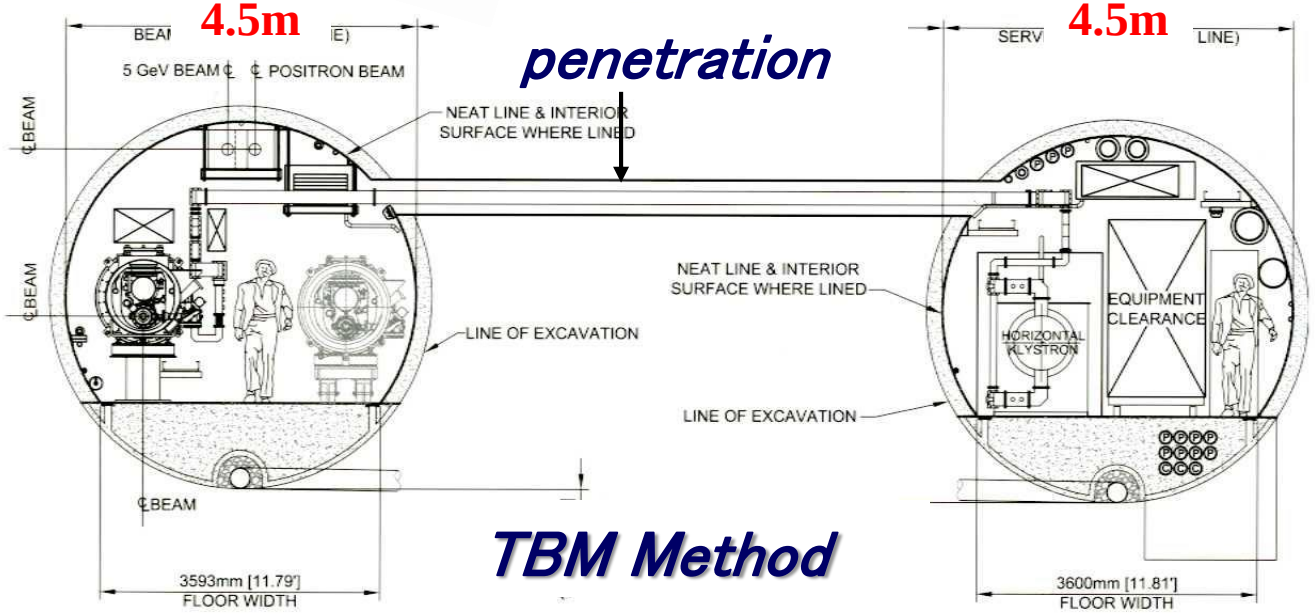


Main Linac Tunnel Configuration





Beam tunnel **Service tunnel**

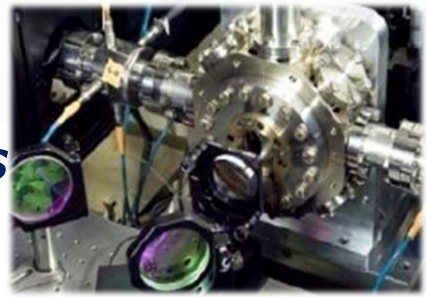


TBM Method

Schematic layout in TDR

IR & Detectors

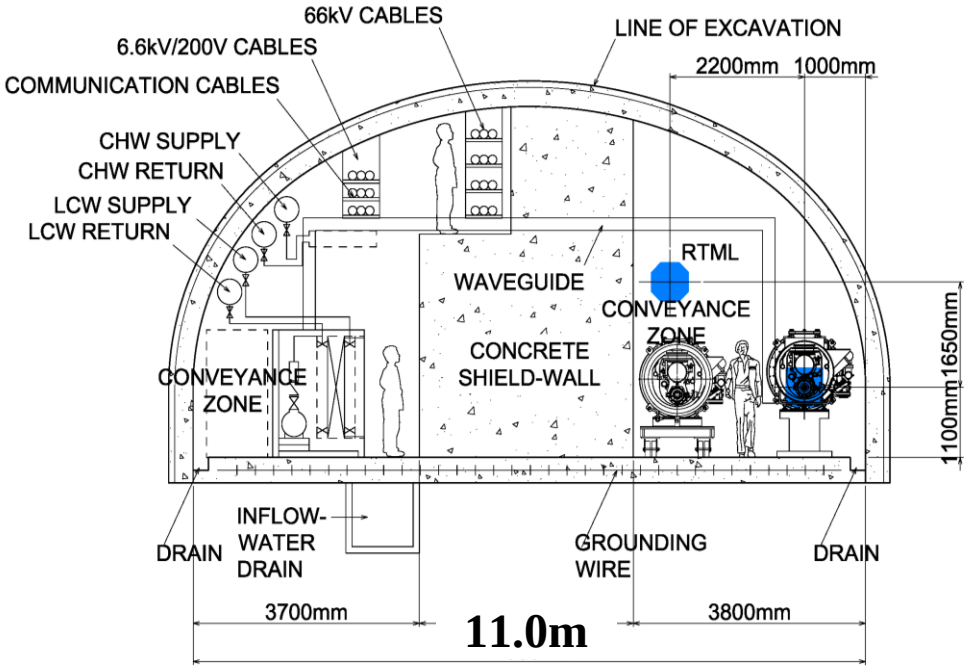
Fynal focus system

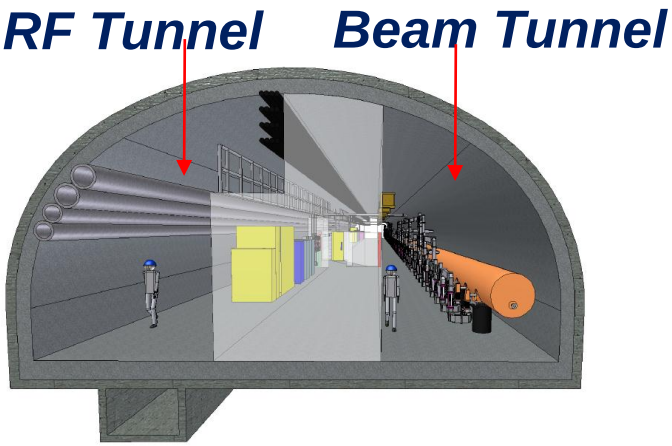


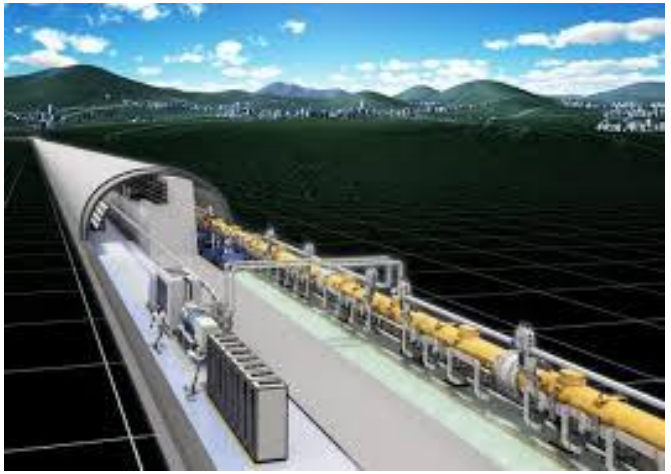
The tunnel standard section

In Japanese Single tunnel configuration

Main Linac cross section







Main Linac Tunnel

RF Power Source

Clystron

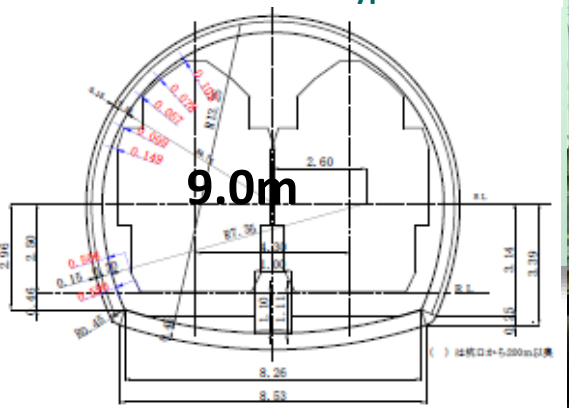
3.5m

Cryomodule

11.0m

Shinkansen-Tunnel

Double Truck type



Tunnel Length World Rankings

: Railway Tunnel
: Road Tunnel

Gotthard Base	57.1km
Seikan(青函)	53.4km
Channel(Euro)	49.4km
Lotschberg Base	34.6km
Hakkoda(八甲田)	26.4km
Iwate Ichinohe(一戸)	25.8km
Laerdals <road>	24.5km
Iiyama(飯山)	22.2km
Oshimizu(大清水)	22.2km
Simplon	19.8km

TUNNEL


Gotthard Base Tunnel


Seikan Tunnel

Euro Tunnel


Lotschverg Tunnel


Hakkoda Tunnel

Comparative Study of the Construction scale

ILC-Project study by KEK-CFS

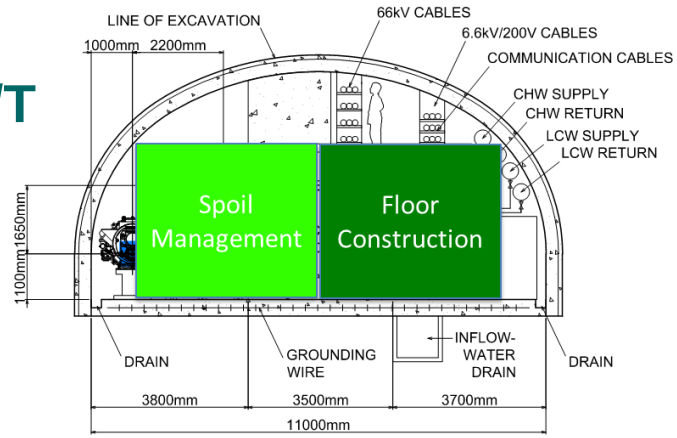
	LEP(LHC)	ILC
Number of Vertical Shaft (AT)	19, (6)	10
Total length of tunnel	32,600m 6,500m	35,000m (MLT)
Surface Buildings	70, (30)	-
Surface area of Buildings	59,000m^2 28,000m^2	80,000㎡
Volume of Excavation	1,100,000m^3 420,000m^3	2,610,000m^3
Volume of Concrete (underground)	230,000m^3 125,000m^3	820,000m^3

※ *LEP&LHC data are based on Offer by Mr. John Osborne (CERN)*

… Construction Schedule Study …

Precondition

- ☐ Construction Starts at the same time 10 A/T
- ☐ Construction in many District
- ☐ Parallel working of two groups in ML/T



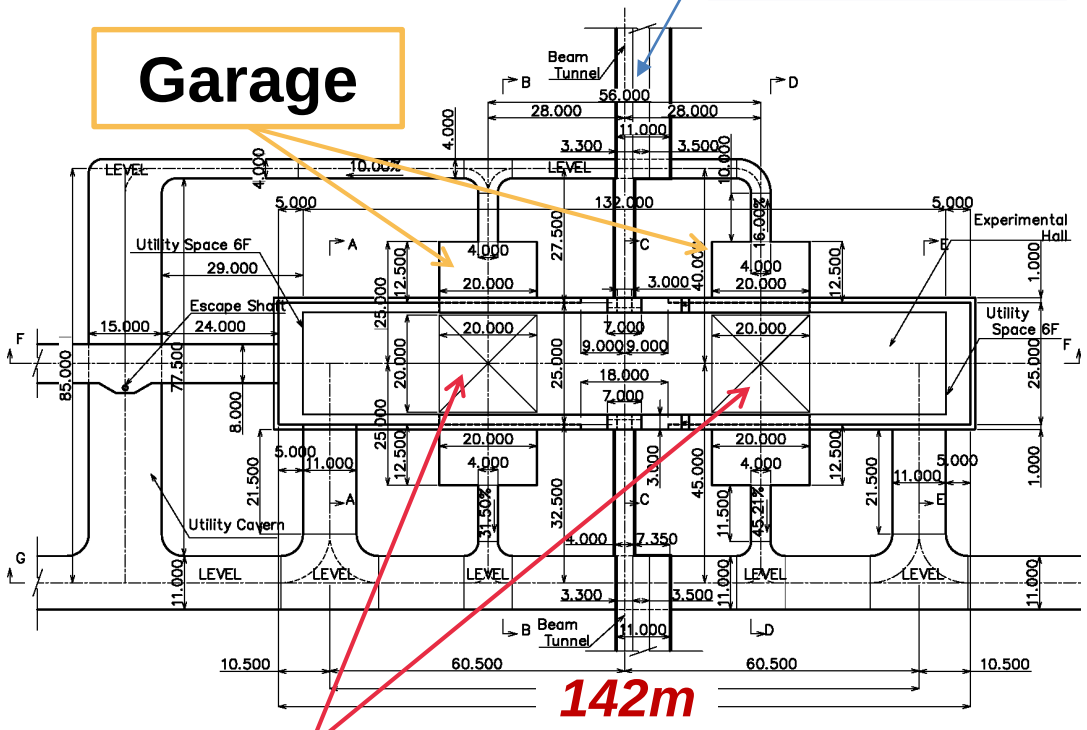
Drill & Blast → Mucking → Shotcrete → Rock Bolt → Steel Support

Detector Hall Cavern in the mountain site

..... Detector Hall Cavern .....

Main linac

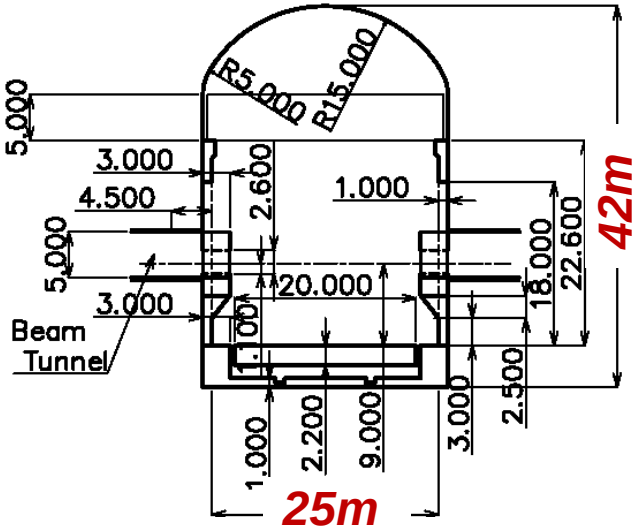
Garage



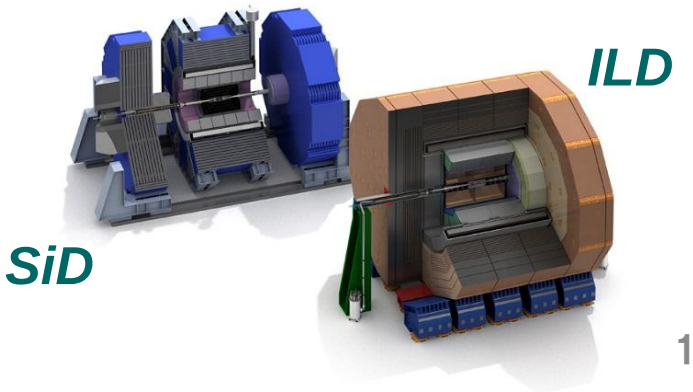
Assembling area

Detector Hall Plan

DH Cavern

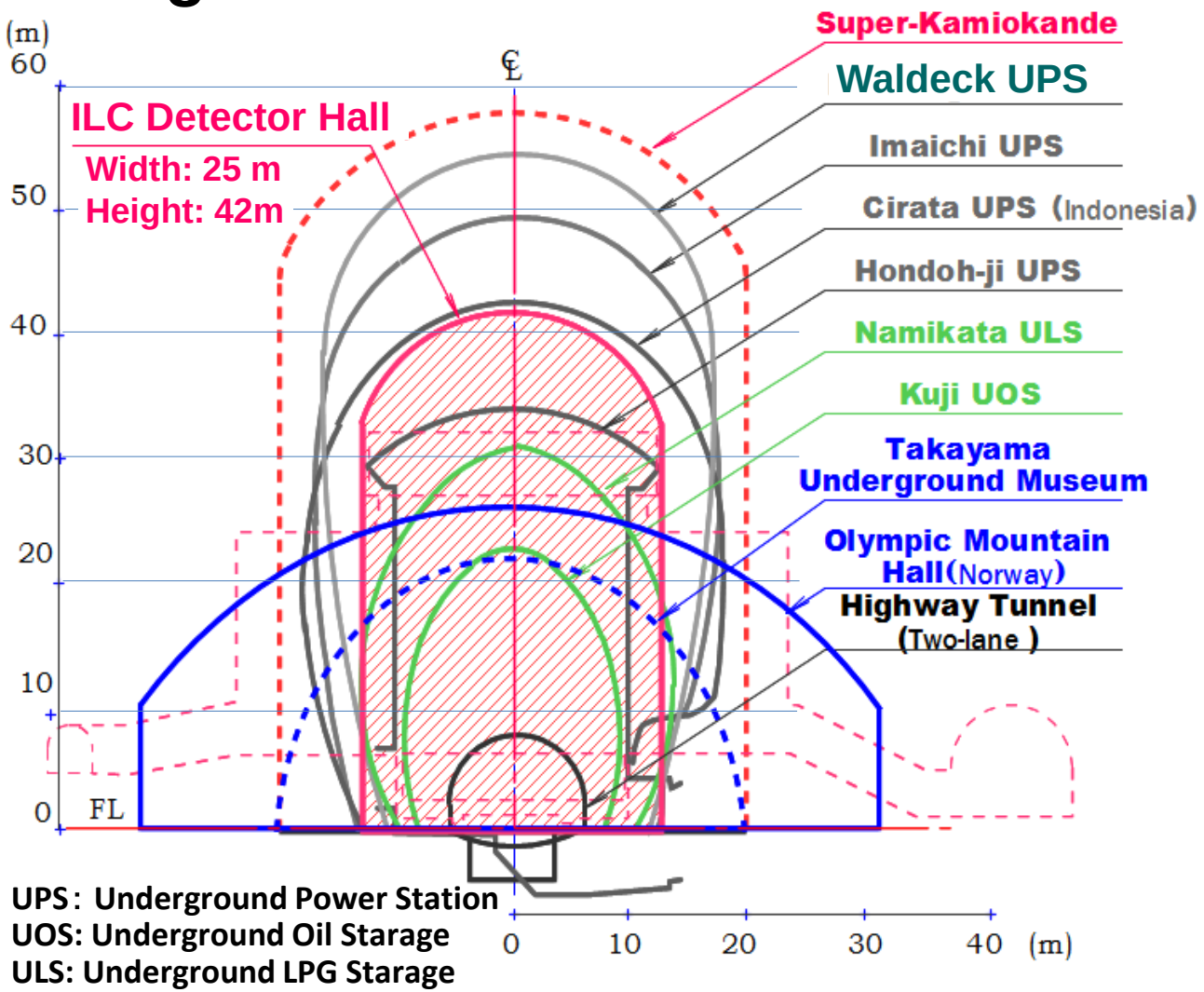


Cross Section



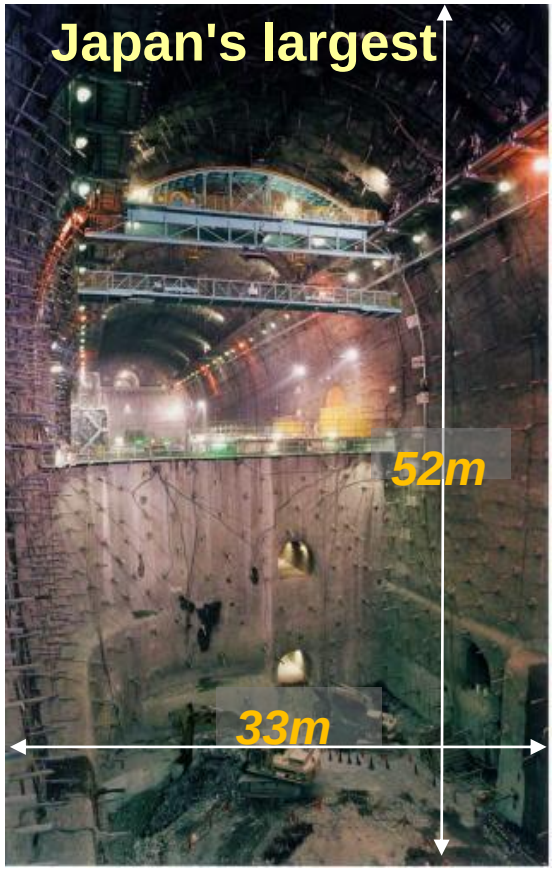
Comparison of Excavation Cross Section

Dimension of Underground Large Cavern in the world



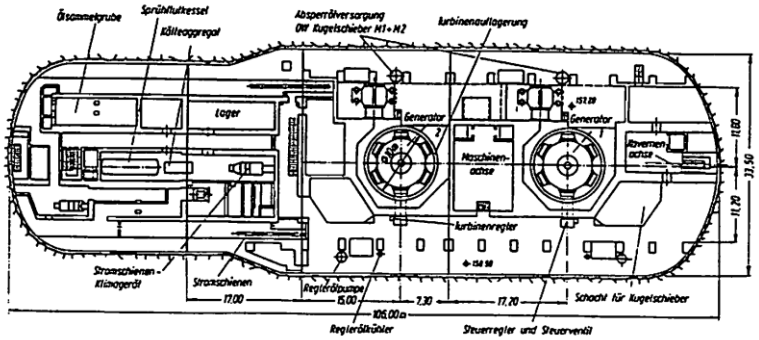
UPS : Underground Power Station
UOS: Underground Oil Starage
ULS: Underground LPG Starage

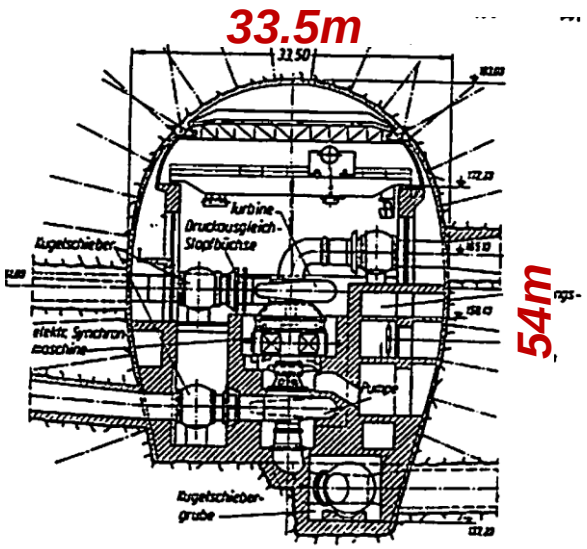
Underground Power Station



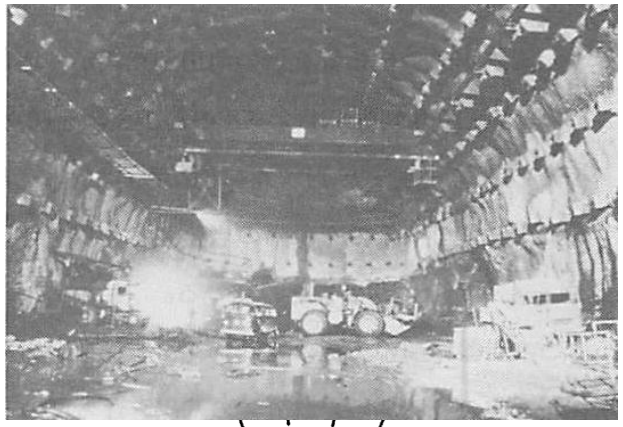
Waldeck-Ⅱ UPS

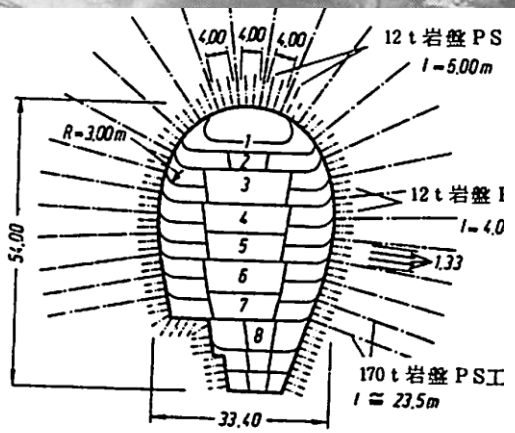
- Pumped-storage Hydroelectric Power Plant
- Waldeck-Ⅲ?: under construction? ⇒ total 920MW?





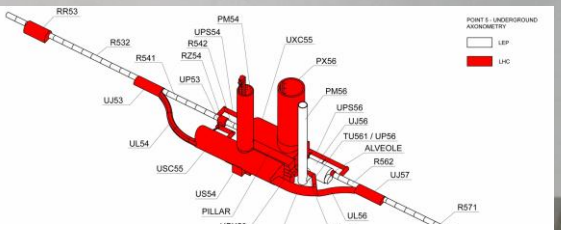
Waldeck-Ⅱ Construction



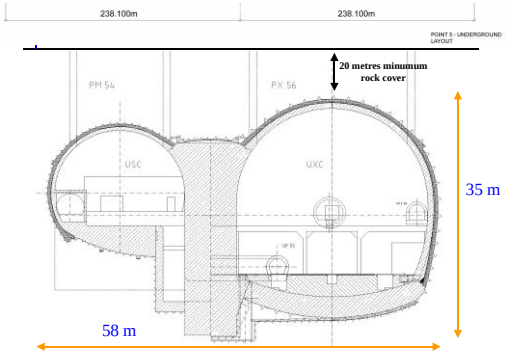


Bench-cut Excavation

CMS Cavern

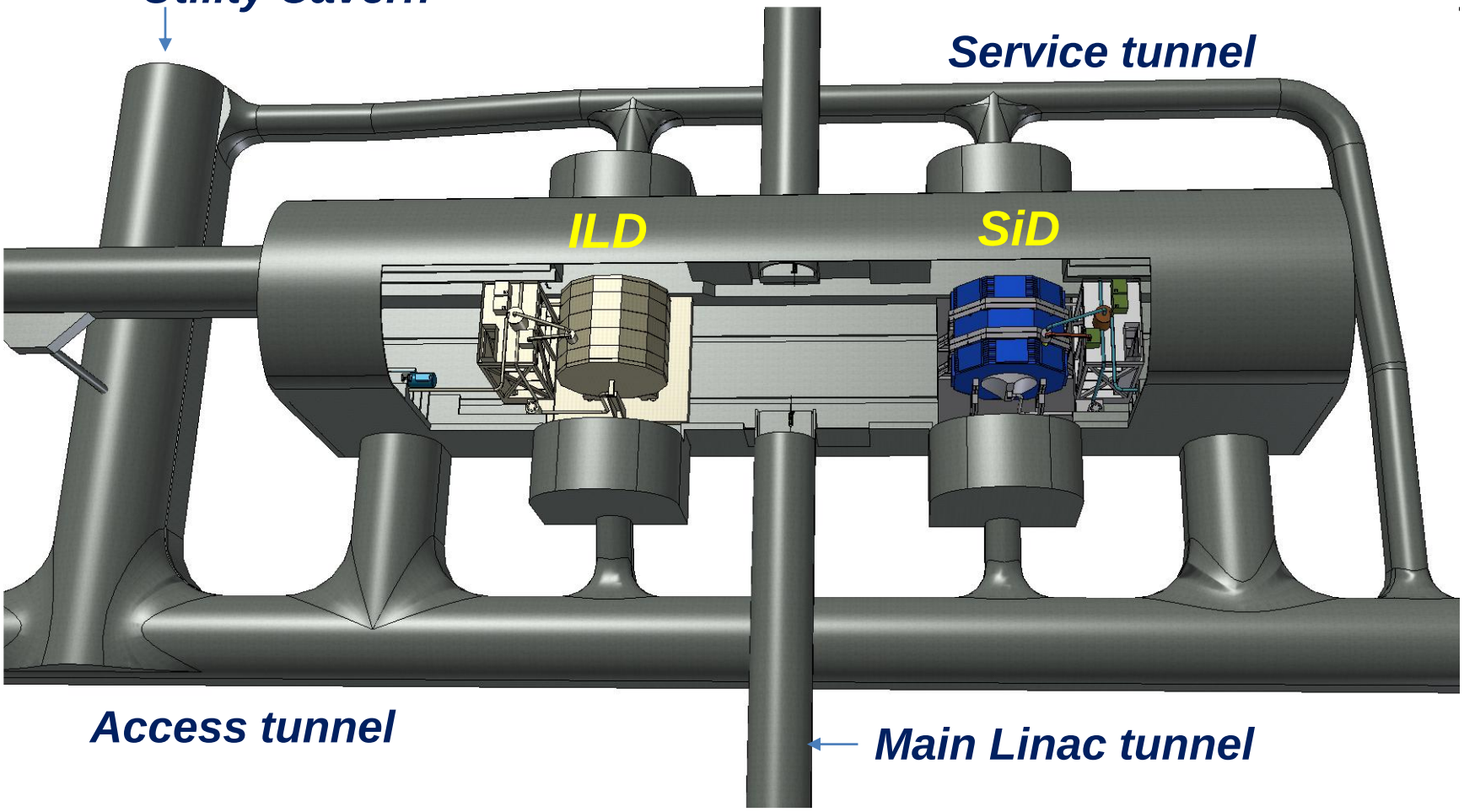


Section through Cavern Complex at point 5



CMS cavern 53m long, 27m wide by 25m high

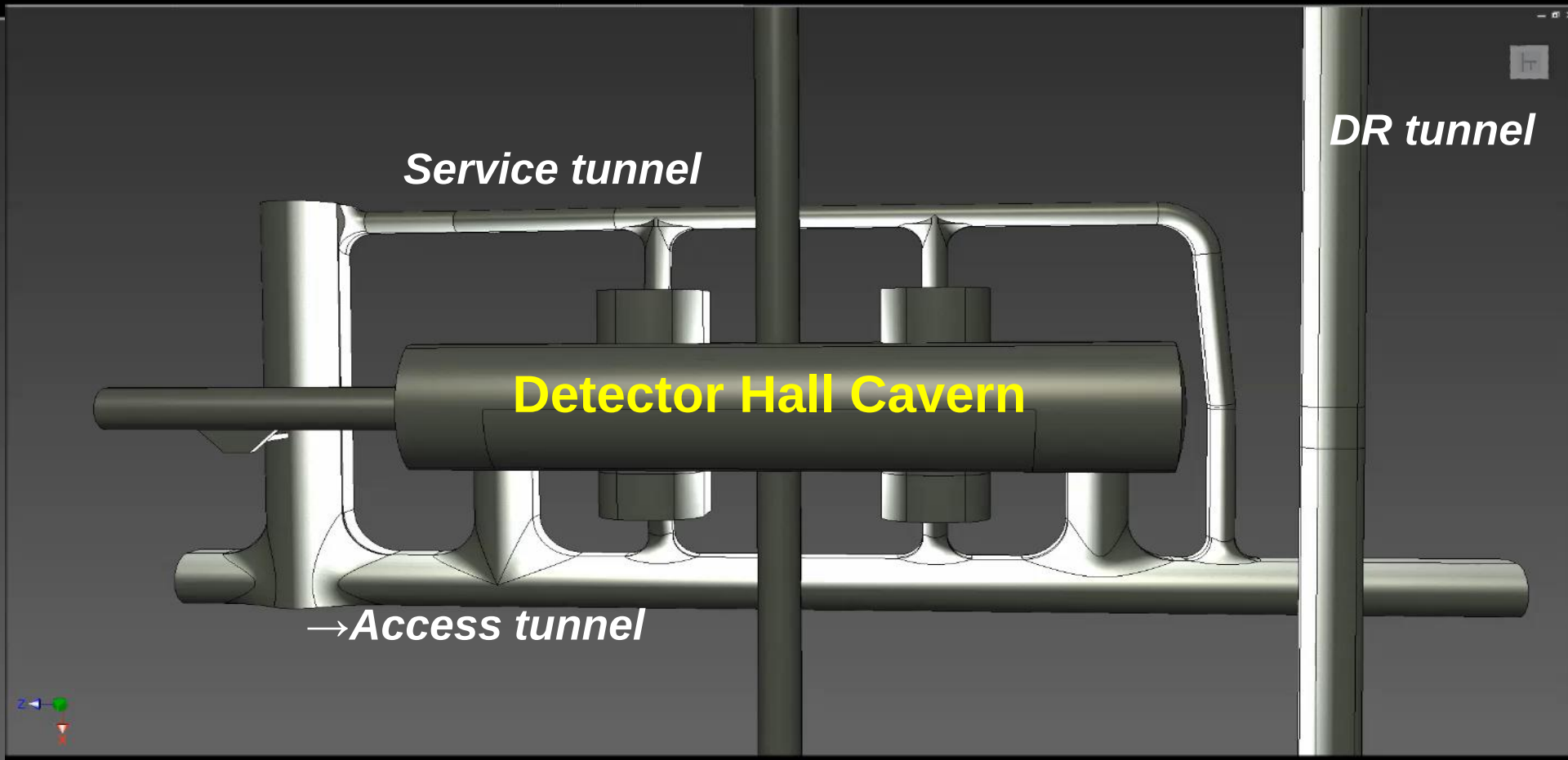
..... Detector Hall Cavern .....



..... Detector Hall Cavern .....

Image of the installation <Push-Pull>

ILD Install **SiD Install**



ML tunnel

Shinano-Ara

Study on Detector Hall access way in Kitakami site

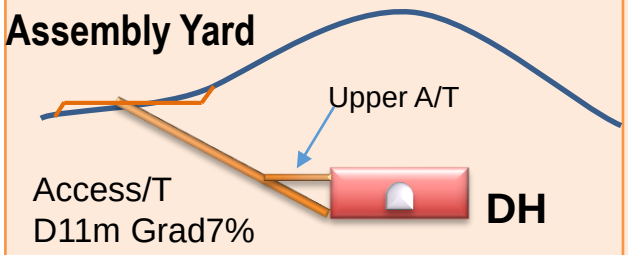
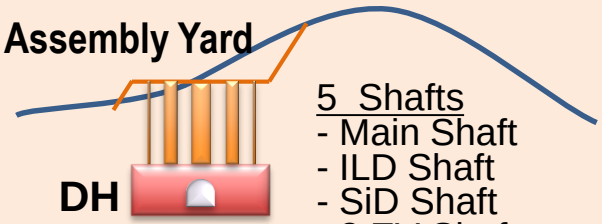
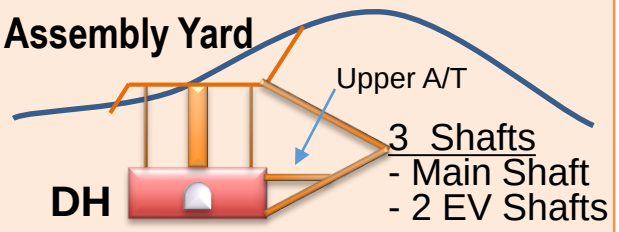
■ We are investigating about the Access way for Asian region Detector Hall.

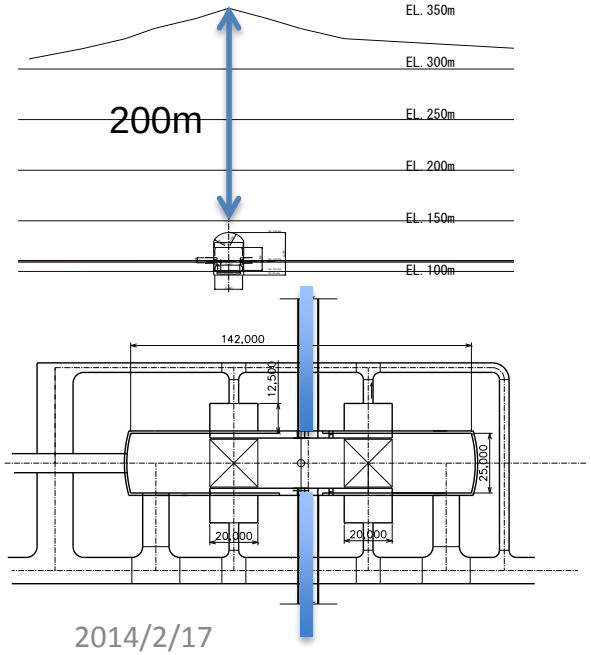
1.	Sloped Tunnel Access (based on TDR)
2.	Vertical Shafts Access (as like CMS)
3.	Tunnel & Shaft Access (New Scheme)

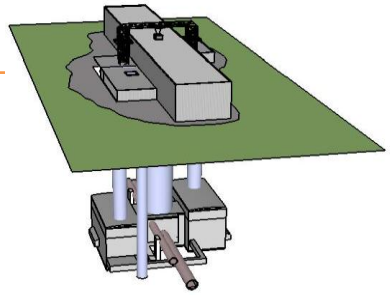
■ Main subjects for comparative study.

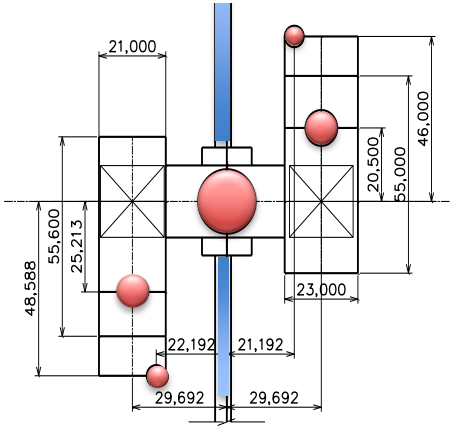
- Cost & Construction schedule
- Environmental Impact
- Safety Issue (Evacuation)
- Availability of Physical Experiments

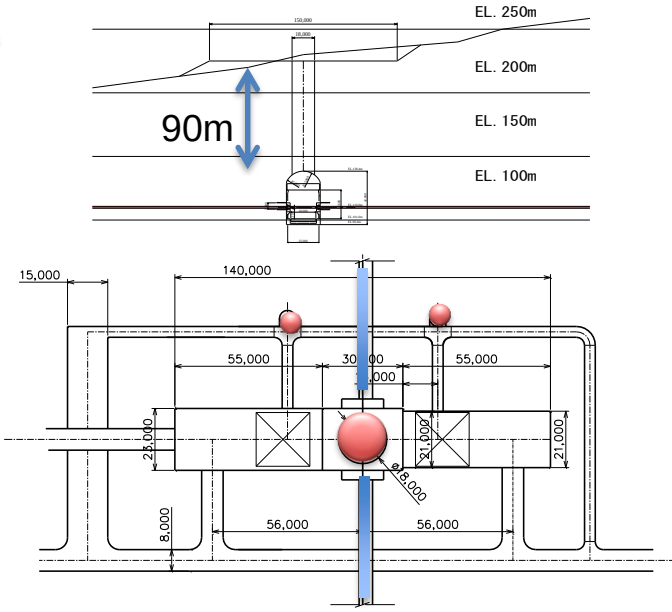
Comparison cases

Tunnel access	Shaft access	Tunnel & Shaft access
		
1 Access Tunnel (Large size)	5 Shafts	1 Access Tunnel (mid size) & 3 Shafts

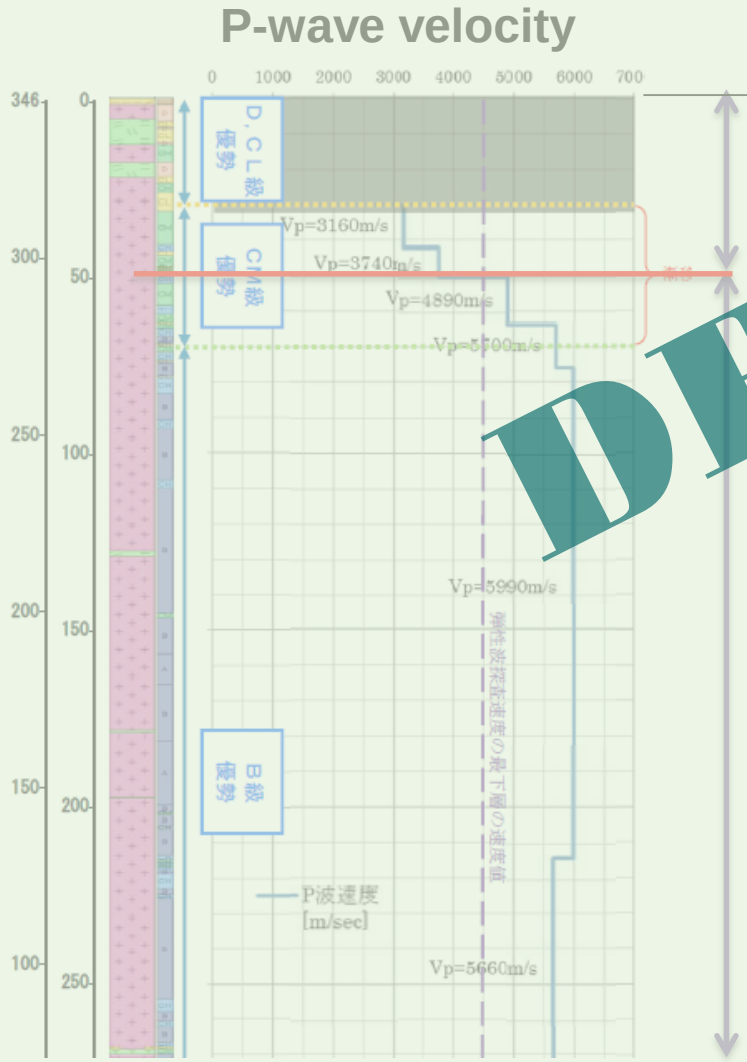








Geological condition and Detector depth



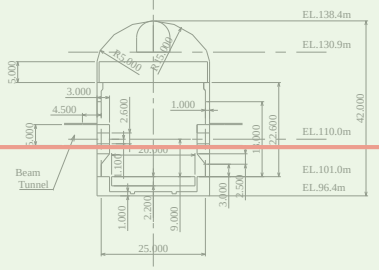
Ground surface EL.230

Soil
Weathered rock
50m depth

Assumed hard rock level EL.180m

Hard rock

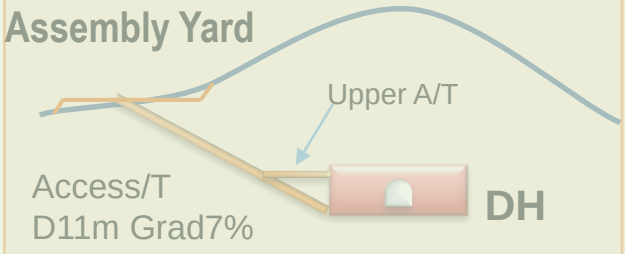
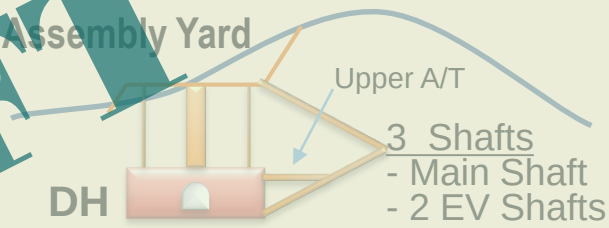
Minimum hard rock coverage 40m
equivalent to cavern height



Beam tunnel level EL.110m

- Geological condition is assumed referring to result of borehole investigation implemented at near mountain.
- Beam tunnel level of current plan is EL.110m.
- Geological condition will better if beam tunnel level deeper.

Comparison Study

Tunnel access	Shaft access	Tunnel & Shaft access
		
1 Access Tunnel (Large size)	5 Shafts	1 Access Tunnel (mid size) & 3 Shafts
Detector assembling is mainly **inside of Detector Hall**.	Detector assembling is mainly **on-ground**.	Detector assembling is mainly **on-ground**.
Location of DH & assembly yard can be selected individually.	Location must be satisfied on **ground social condition** and **geological condition**.	Location must be satisfied on **ground social condition** and **geological condition**.
All of personnel and machines must use **Vehicles** for entering and leaving.	All of personnel and machines must use **Winches** and **Elevators**.	**Both of Vehicle and Elevator** are available for entering and leaving.
Evacuation route is limited to DH **Access tunnel**.	Evacuation route is limited to **shaft way**.	Both of **Tunnel and shaft** are available for evacuation route.

- Cost & Schedule under study.

Summary

Subject for the next several years

- **Toward the Engineering Design**
  - Facility design depending on the KITAKAMI site
  - Consistency with the machine Layout & Installation
  - Planning of the Central Campus & Housing
- **Field Survey for the final design**
  - Environmental impact assessment
  - Topographical survey
  - Geological survey & Bedrock investigation

Thank you for listening