CFS Status

Update after LCWS2019

Civil Engineering

Evaluation subcommittee for ILC civil engineering facility in Tohoku (2019/7-2020/3)

- the Rock Mechanics Committee, the Japan Society of Civil Engineers -

Adequacy evaluation of civil design by a third party **from the viewpoint of rock dynamics for Kitakami candidate site**.

- Closed meeting because of the site-specific confidentiality.
- The committee was widely selected from Japanese universities, and S.Yamashita, T.Sanuki, S.Michizono and N.Terunuma had joined from ILC community.

The committee evaluated the design as valid based on the local geological information.

- It helps our explanation, how our cost evaluation on civil works obtained, to the people who worries about the big overruns of the civil cost when the site-specific design was applied.

In addition, following comments for the next stage were also noted.

- Survey and design of the ML tunnel under the streams, near entrance of access tunnel; i.e. weathered surface rocks
- Design of the transition from the vertical shaft to the DH cavern

The Evaluation Sub-Committee for ILC Civil Engineering facility in Tohoku concluded that the "Tohoku ILC Facility Plan" is technically feasible, and that the contents of the plan are appropriate.

Japan Society of Civil Engineers (JSCE) was commissioned by the Tohoku ILC Promotion Council to conduct a technical evaluation of the ILC design plan.

The activities of the Evaluation Sub-Committee for ILC Civil Engineering facility in Tohoku cover a wide range of topics covering the entire facility planning process: 1) ILC Plan Summary and Facility Plan Description, 2) Tohoku ILC Facility Plan Description, 3) Field survey in the site and identification of points to be noted, and 4) Summary of evaluation and points to be noted.

The Sub-Committee started the evaluation in mid-July 2019 and completed the work in February 2020. The features of this facility are that the total length of the main tunnel, in which beams runs, is as long as 20.5 km, and the main tunnel is to have five access tunnels (width 8 m, height 7.5 m, kamaboko-shaped) a large cavern (width 25 m, length 108 m ~ 133 m, height 42 m) for detectors.

Due to the large size of the facility and its underground location, there are various possible impacts. Therefore, to assess the adequacy of the content of the facility plan, it was necessary to examine it from a wide range of perspectives such as rock engineering, geotechnical engineering, hydrogeology, etc., and in the light of Japanese civil engineering technologies that have been used in the past to construct common tunnels and underground caverns.

Since the underground facilities will be constructed in underground rock with complex geological conditions, the following issues were discussed in this study: Investigation of the unique characteristics of the proposed construction site, Determination of the properties of the ground, rock and water by surface and underground exploration, Confirmation of the mechanical stability of the underground facilities, Checking the impact of the design on the constructability of the facilities, Planning with consideration of economic efficiency.

The Sub-Committee, consisting of leading experts in the field, conducted a careful and close evaluation based on the exchange of various opinions, and concluded that the "Tohoku ILC Facility Plan" is technically feasible from an expert's point of view, and that the contents of the plan are appropriate.

February 20, 2020
Japan Society of Civil Engineers, Committee on Rock Mechanics
Evaluation Sub-Committee for ILC Civil Engineering Facility in Tohoku
Chair Yuzo Ohnishi

English translation is in progress

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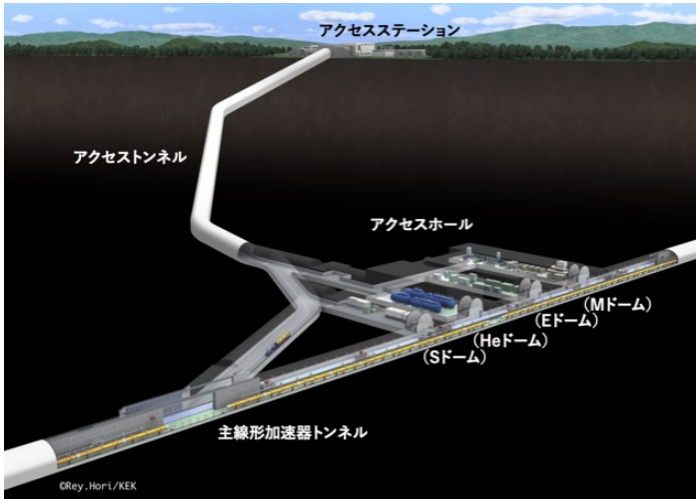
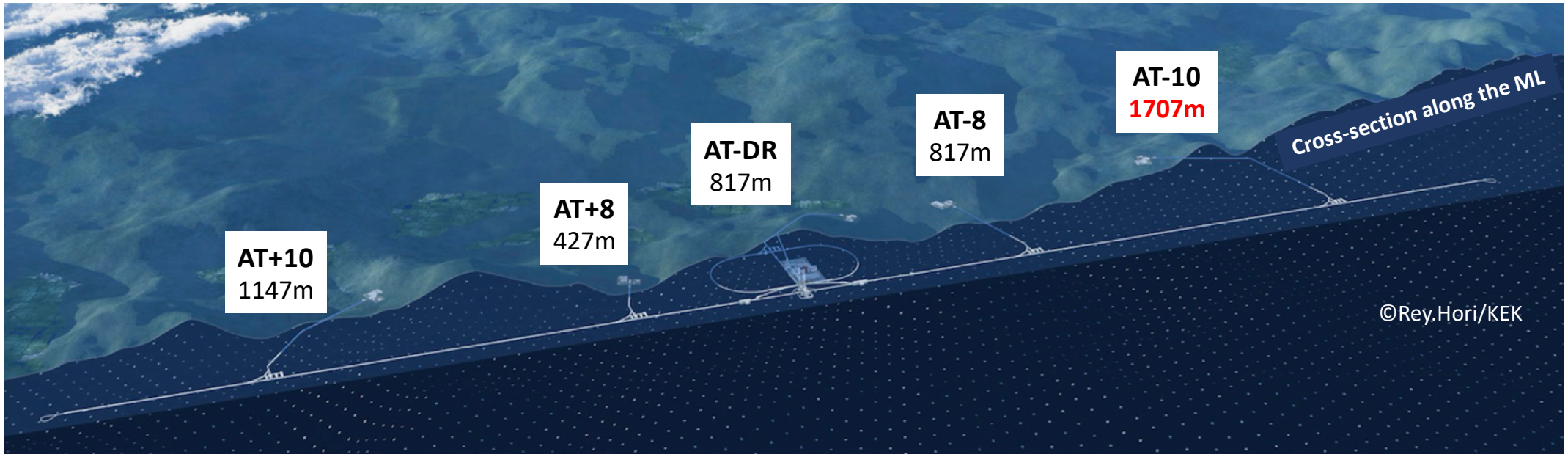
The schedule for civil works was also presented in the committee...

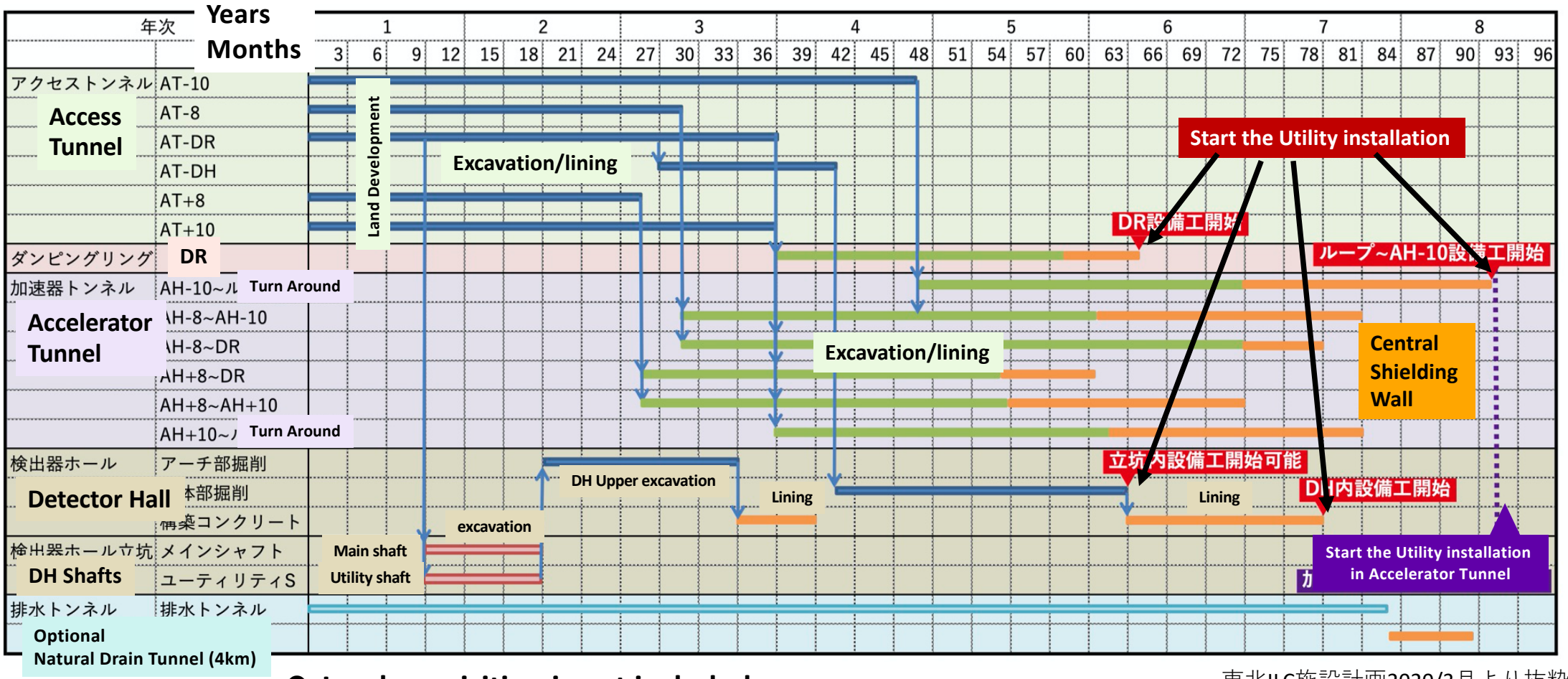
- The ILC is planning to be installed in the Kitakami Mountains at **an altitude of 110m**. The depth varies from 20m to 600m following the surface structure.
- The maximum slope of the access tunnel should be less than 10% to allow the transportation of equipment. Then the length of the access tunnel depends on the altitude of the access point.
- Minimum route of access tunnel was surveyed with the help of TOT.



- The length of the access tunnel varies from 400 m to **1,700 m**, while the TDR was 1,000 m.
- The longest access tunnel is AT-10, for the north end of the ILC, and **results 2.5 years longer civil works** than that of TDR.
- The mitigation of the civil work delay needs to be considered …



Tunnel Construction (civil work) Schedule



- **Land acquisition is not included.**
- **Just one long access tunnel (AT-10) will increase the overall construction period.**

東北ILC施設計画2020/3月より抜粋

Updates of CFS works in Japan

- KEK/Tohoku CFS Team
- AAA working group

An example of access tunnel arrangement:

It shows how large space is required for pipes and cables.

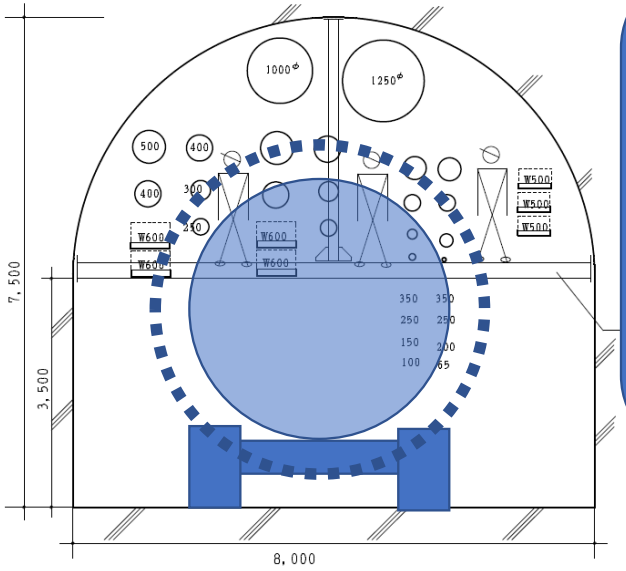
The actual layout must be determined by considering various backgrounds.

Proposal of pipes(He, Water and air), power cables arrangement in the access tunnel

This figure shows only the required space in access tunnel for cable and rack

This is not the actual installation plan

Classification		Name	Size	Quantity
Hellium plant	①	High Pressure line	300Φ	2
	②	Middle pressure line	500Φ	2
	③	Low presssure line	400Φ	2
	④	Negative pressure line	400Φ	2



アクセストンネル
収容配管等断面図

2016.11.16

Transport
Cold Box (diam. 4m)
Into access hall
In installation, repair(?)
and addition for future
extension of ILC

Required space for
- ✓ Piping
- ✓ Cable rack

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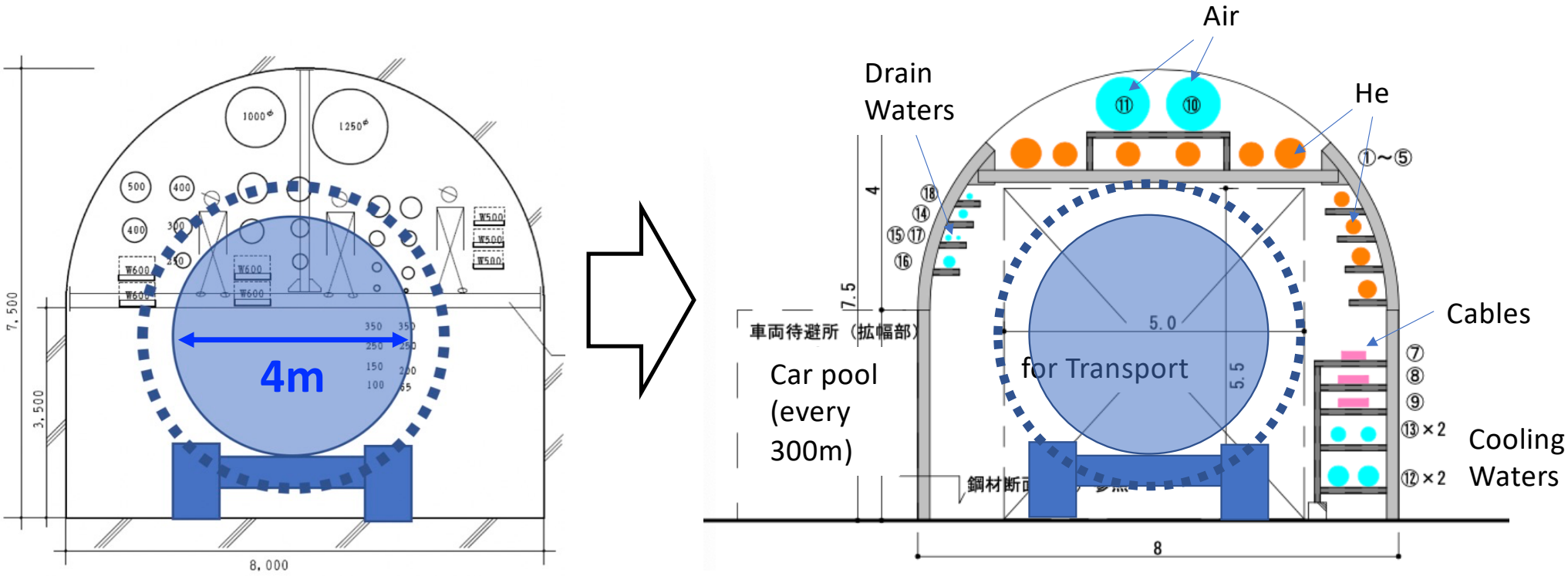
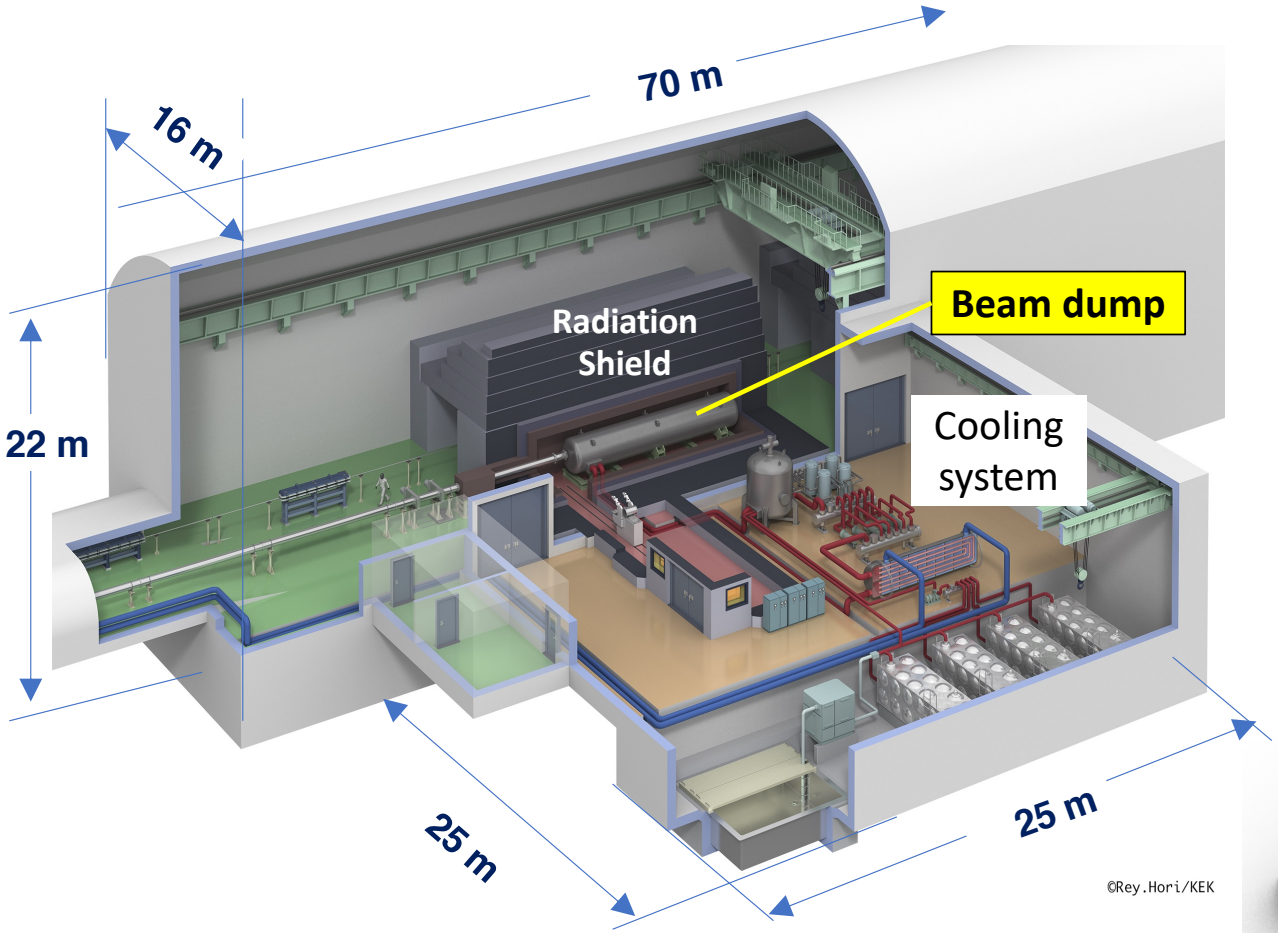
Update of access tunnel layout
by KEK/Tohoku CFS Team (2019/Dec)

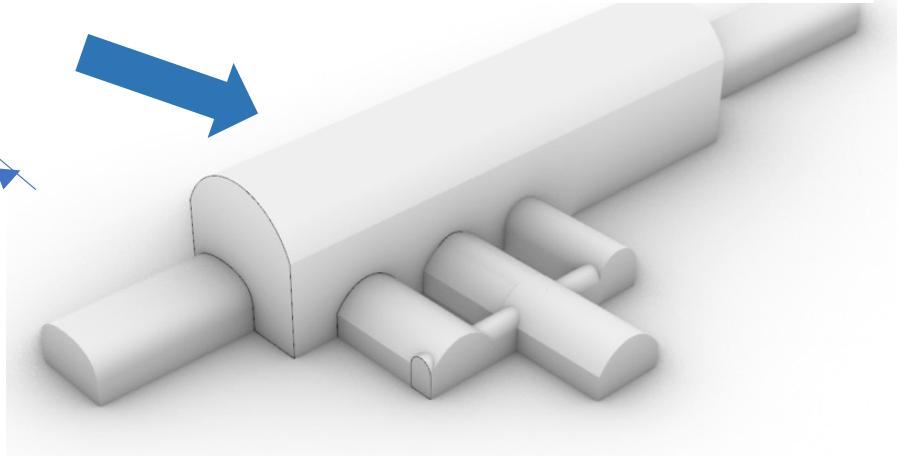


Main beam dump



- **Big cavern to install the 5m-thick shields.**
- Water dump capable for 18MW beam power (1TeV).

- **Optimization of cavern is ongoing with AAA.**
- Avoid big-flat utility cavern

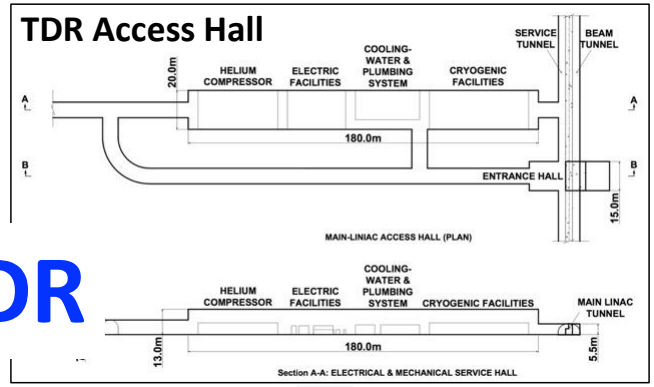


Appendix

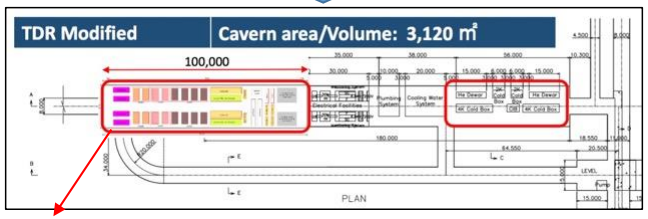
CFS design which changed from TDR

Already discussed in the CFS session of past LC workshops

TDR Access Hall

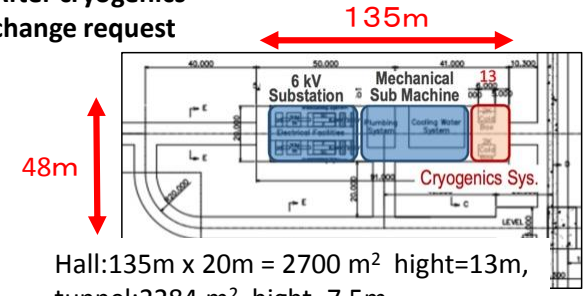


TDR



go to surface

After cryogenics change request



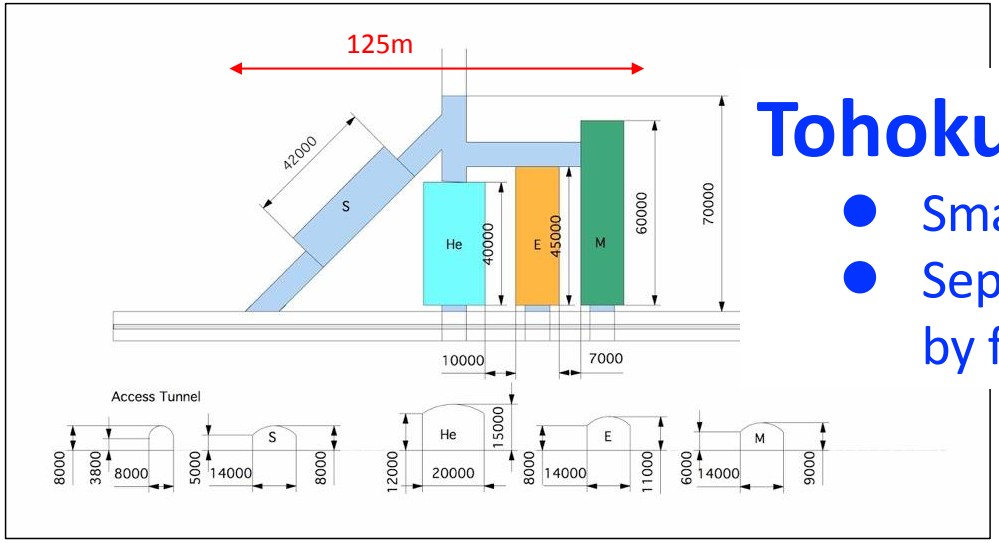
Hall:135m x 20m = 2700 m^2 hight=13m,
tunnel:2284 m^2 hight=7.5m
total area=4984 m^2 , volume=52230m^3

Proposal of New Access Hall shape for Main Linac

direct access of Electric, Water/Air, Helium to Main Linac Tunnel.
separate halls for electric, water, helium.
Keep enough connection room for cables, pipes, ducts, and helium trasfer lines.

Proposed Access Hall
to accommodate detail designed utilities

Hall:2858 m^2 tunnel: 904 m^2
total area=3762 m^2 total volume=38426m^3



Tohoku study

- Smaller volume
- Separate cavern by function

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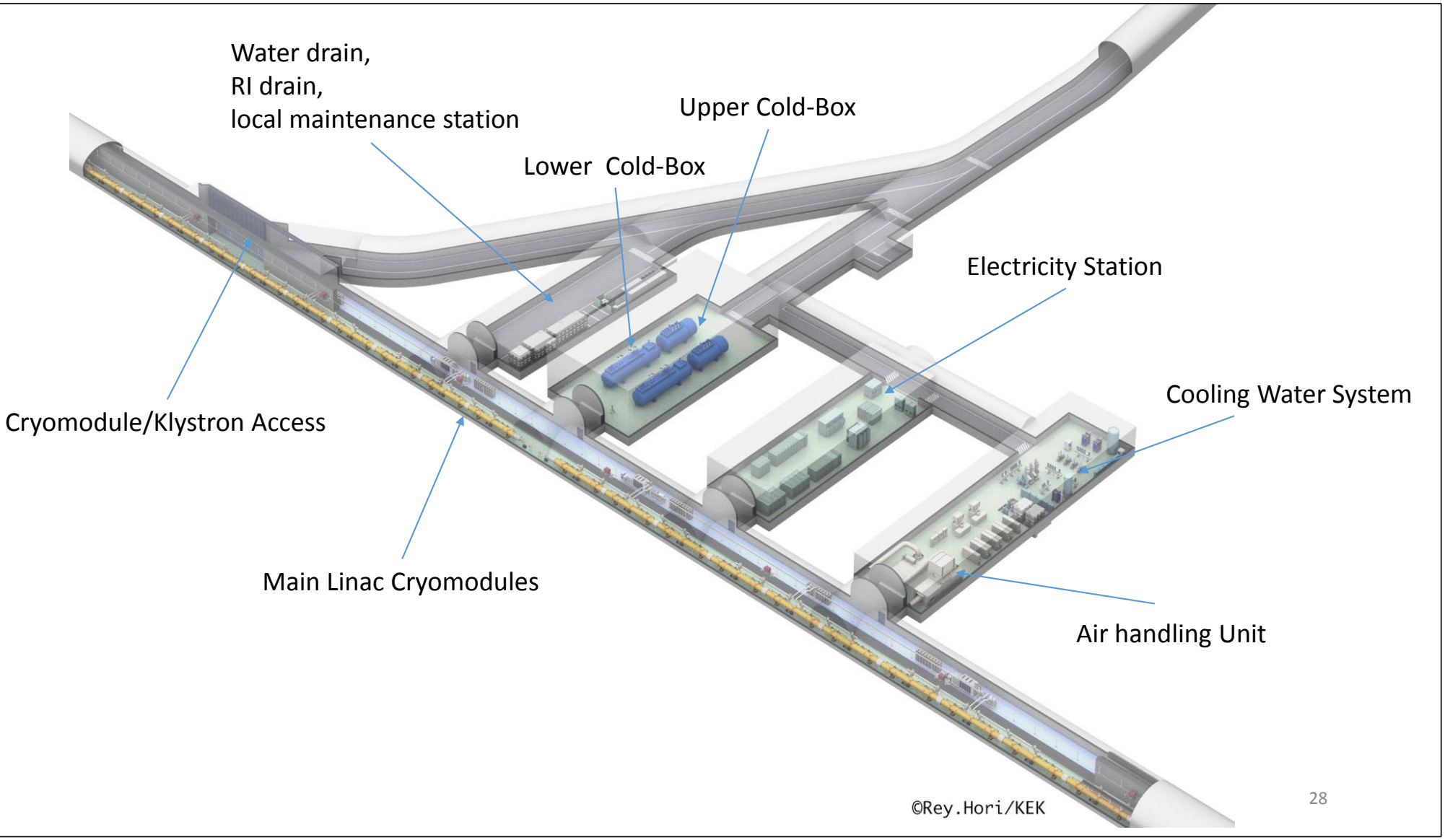
Water drain,
RI drain,
local maintenance station
Upper Cold-Box
Lower Cold-Box
Electricity Station
Cooling Water System
Cryomodule/Klystron Access
Main Linac Cryomodules
Air handling Unit
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