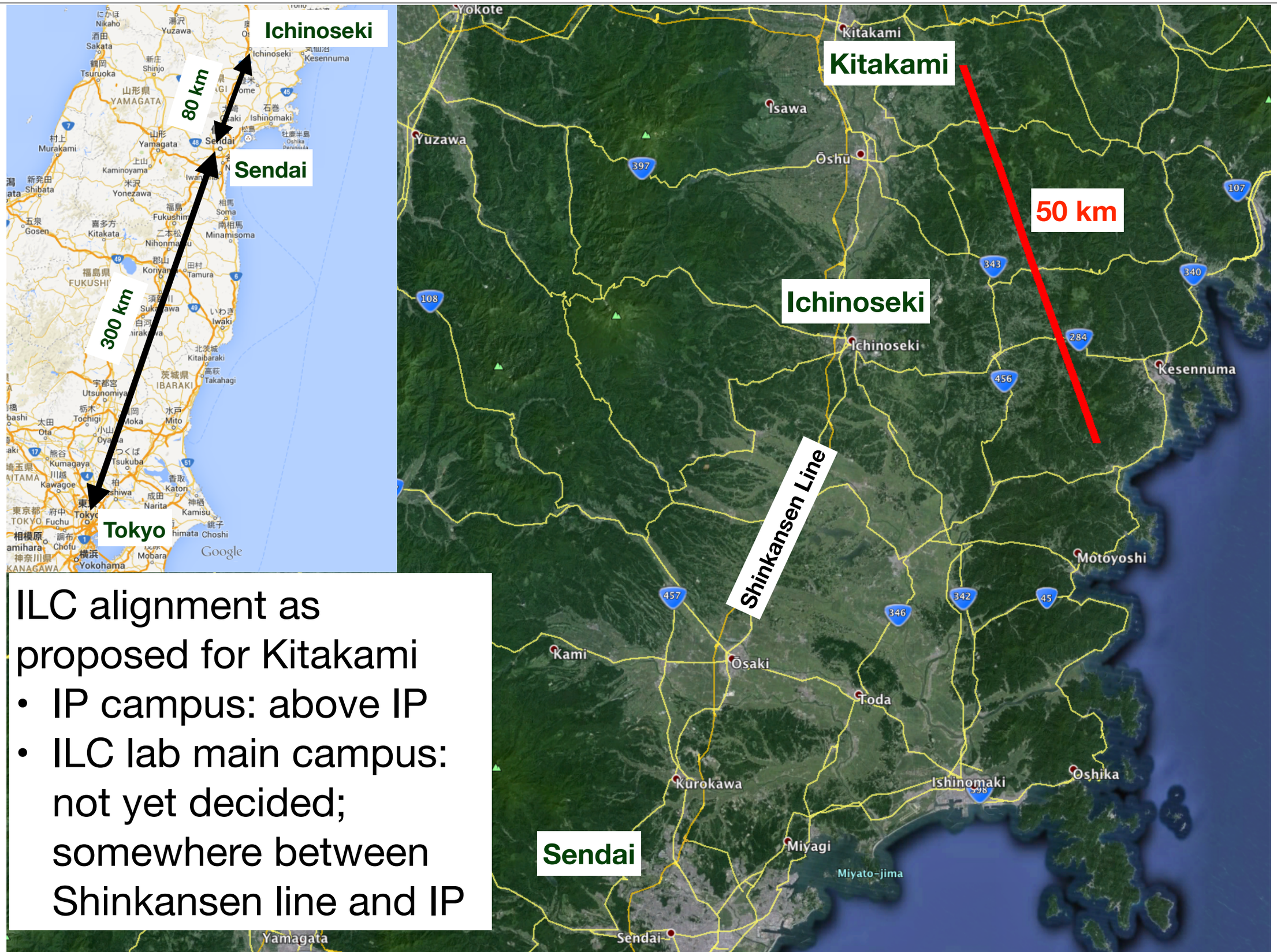
ILC Infrastructure and ILD Integration

Karsten Buesser

ILC@DESY Project Meeting
16.10.2015

Infrastructure Working Group

Location of ILC Lab Main Campus and IP Campus

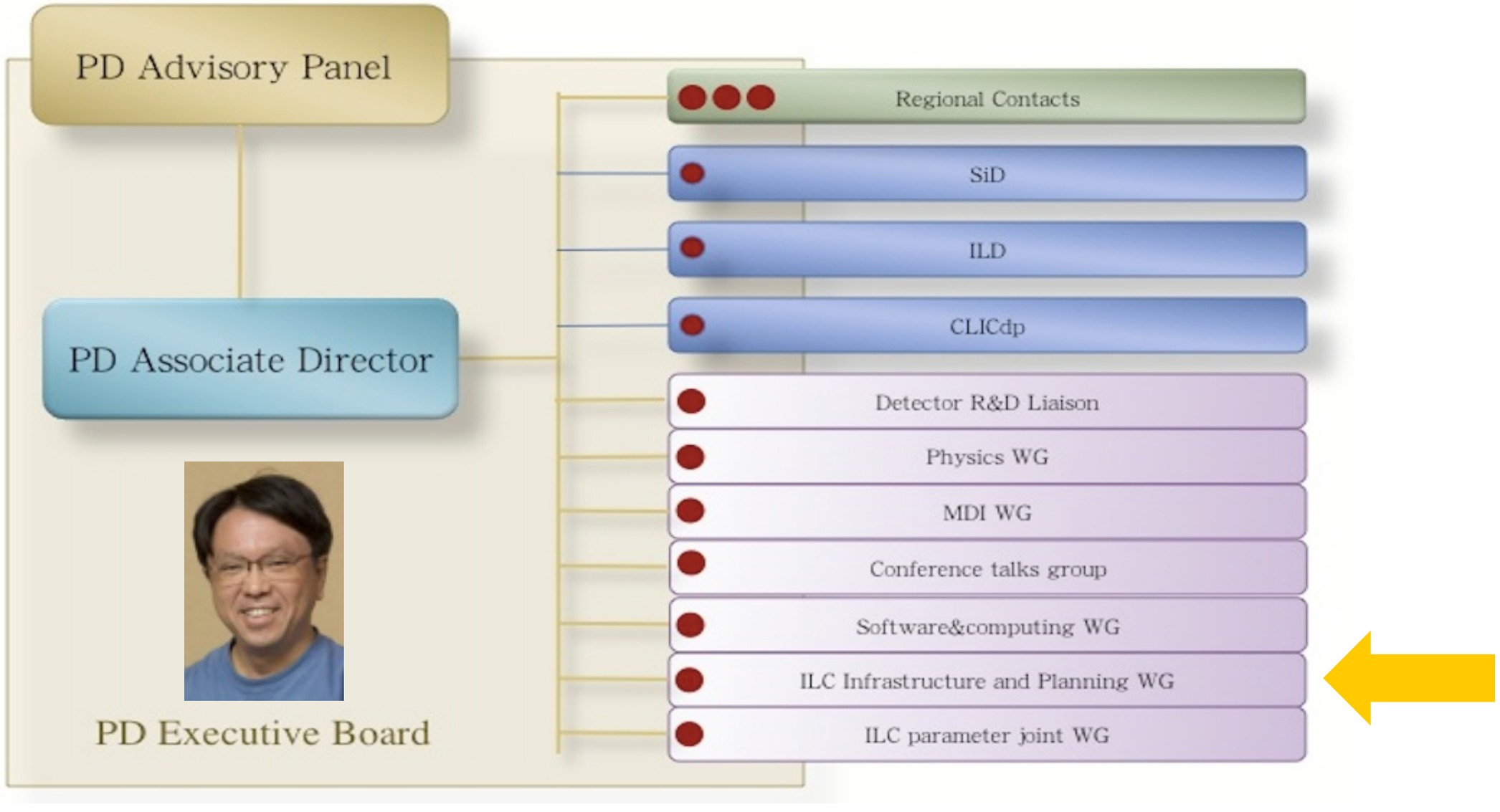


ILC alignment as proposed for Kitakami

- IP campus: above IP
- ILC lab main campus: not yet decided; somewhere between Shinkansen line and IP

Infrastructure and planning WG : Chair: Sakue Yamada

one of the Phvsics-Detector WGs. active since June 2014



Slide from Sakue Yamada

Members

ILD: K.Buesser, F. Simon/MC. Fouz,
SiD: M. Breidenbach, M. Stanitzki,
Local: K. Kawagoe, Y. Sugimoto,
Chair: S. Yamada

Given mandate

1: Study of the human and budgetary resource needs and their availability during construction and operation
2: The time profile of the resources and their reality to quire
3: The organizational structure to interact with the ILC laboratory

Slide from Sakue Yamada

Purposes

A: to provide inputs from the detector groups
to the Infrastructure design studies for the ILC lab,
and to the Governance discussions

B: to prepare answers to possible inquiry in the
expert sub-committee of the MEXT

The target date: February 2015.

Slide from Sakue Yamada

Possible types of the ILC lab

- Three types were considered first:

A: Very simple lab with minimum facilities

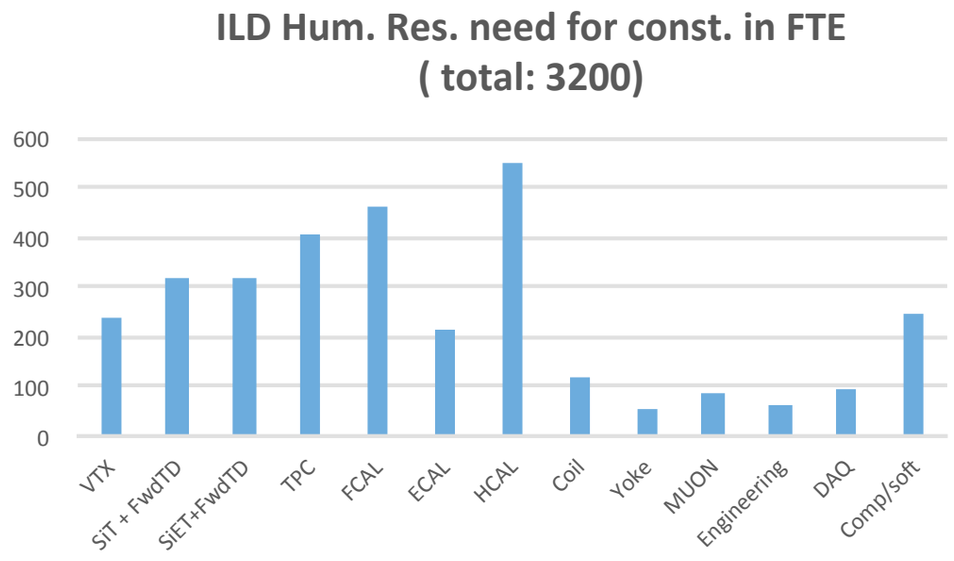
B: More facilities and services as seen in the existing labs but not complete. (flexible between A and C)

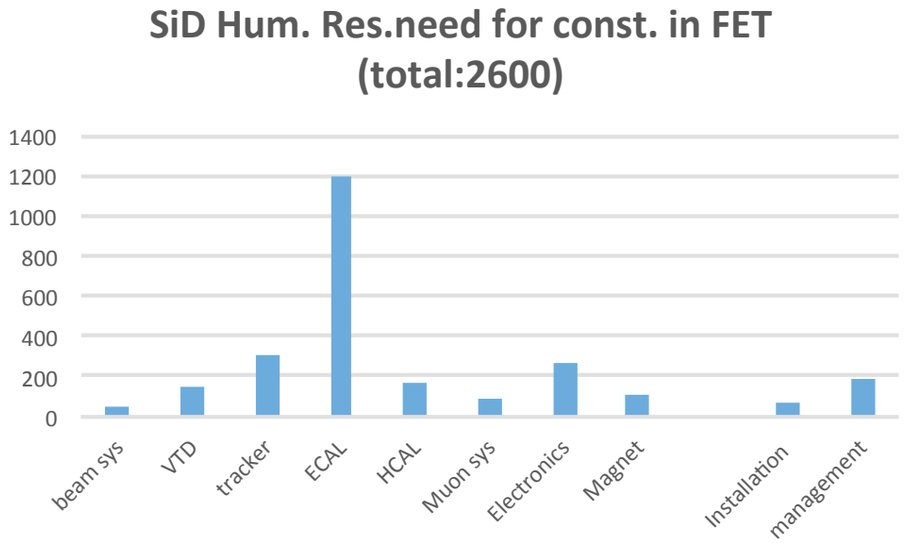
C: Fully complete lab with everything (like e.g. CERN)

We assumed that ILC lab may be a kind of type B.
As required services are compiled, the type may end up rather closer to C than A.

Slide from Sakue Yamada

Human resources for detector construction





- Both groups estimated the human power during the entire construction period (9 years) in FTE.

(only the sum for each component shown)

- They will be mostly paid by collaborating institutions around the world.

Total FTEs: ILD 3200, SiD 2600

The numbers include physicists, post-docs, engineers and technical personnel with about the same fraction, and a small number of administrational support.

Slide from Sakue Yamada

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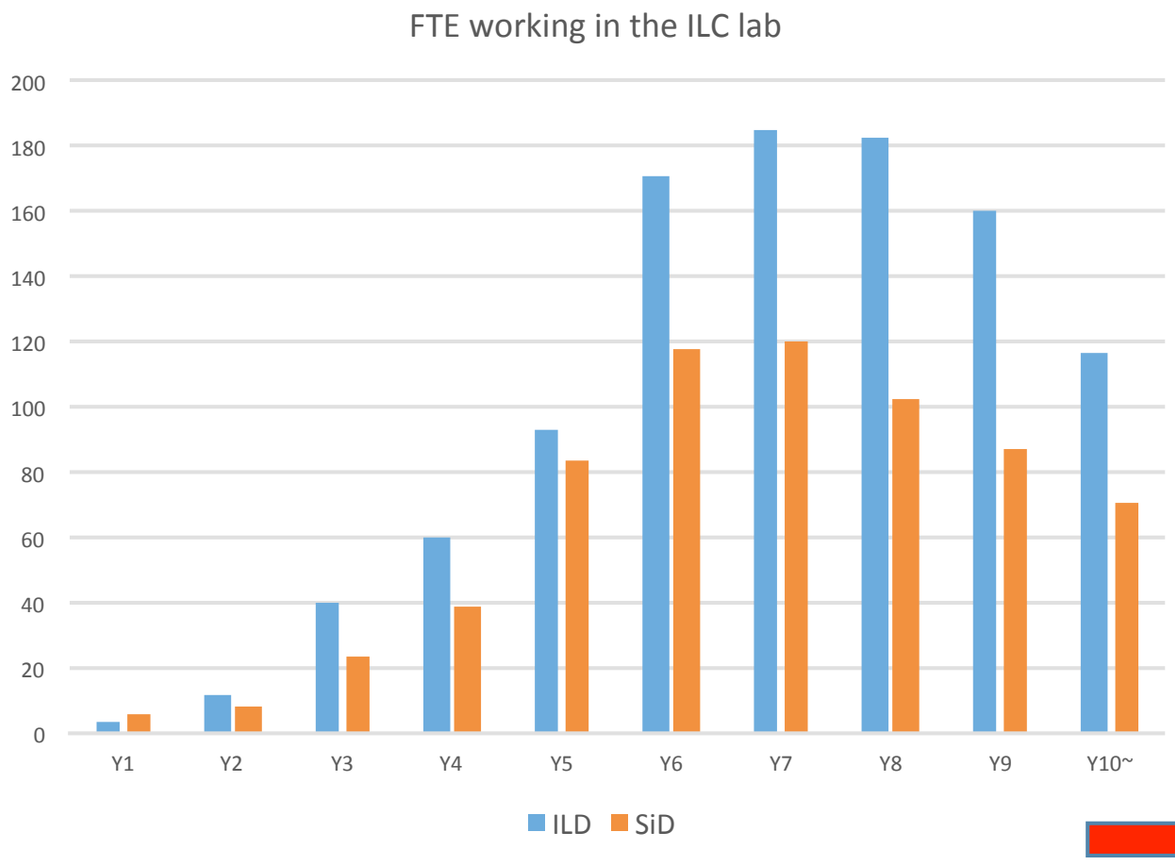
Slide from Sakue Yamada

People visiting/staying on site for construction and operation/maintenance



More people will be on site as time goes and peaks around 7th~8th year.
Total sum peaks ~300 FTEs.

The Y10 level remains for operation and maintenance.

A considerable part of them will be working at the IP region.
(**ILD: ~30~40%, SiD: 70~80%)**

The level remains the same for operation/maintenance

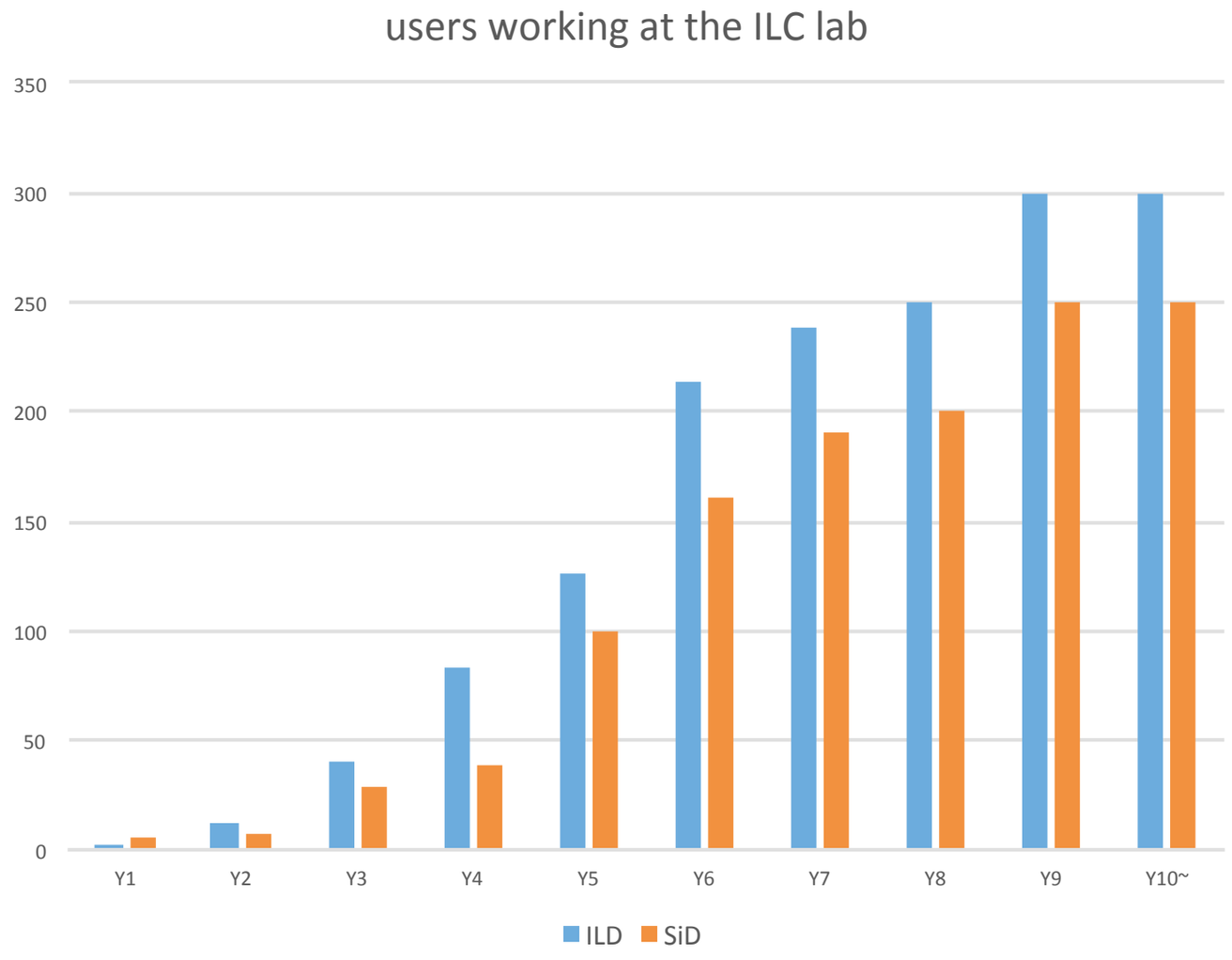
Slide from Sakue Yamada

The number of users on site

- There will be a big number of users from the time of commissioning through the physics run period.
- They start with a small number at Y1 but will reach in total (500~600)/year or more including physicists, post-docs and students.

Note: The numbers are in FTEs.

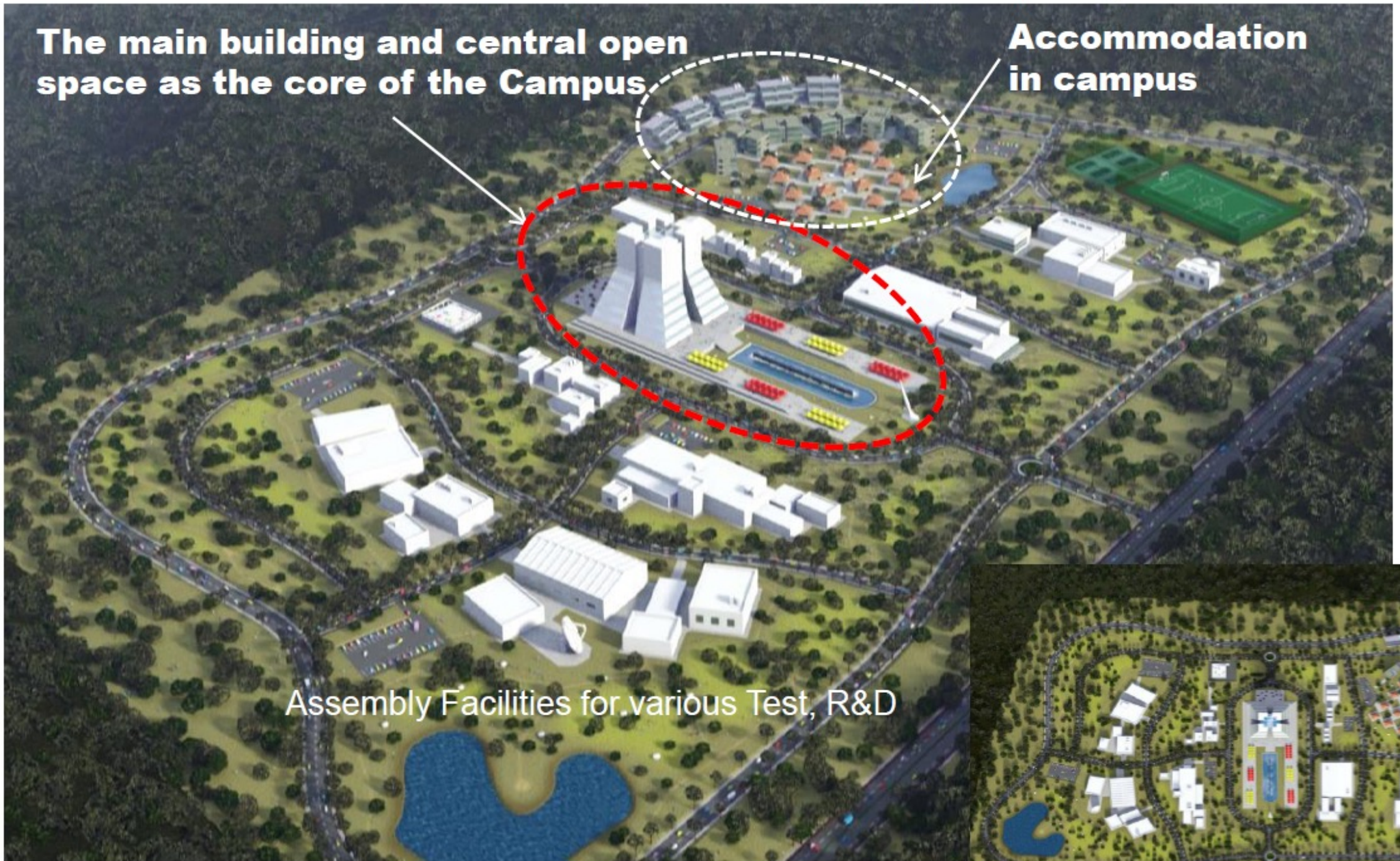
(They will peak e.g. during the collaboration meetings.)



Slide from Masanobu Miyahara

Central campus

Draft proposal plan for discussion

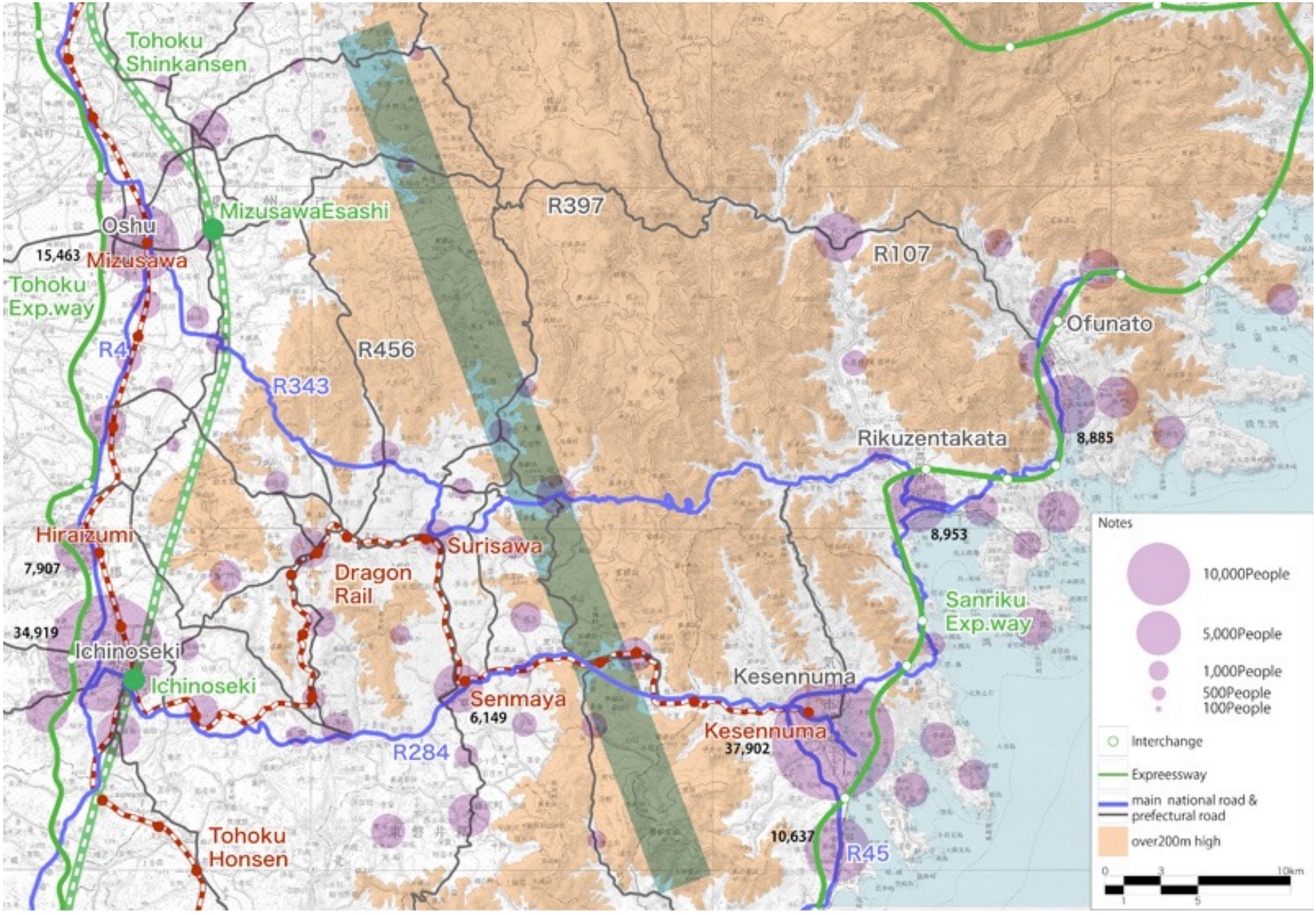


(M. Miyahara, AWLC14)

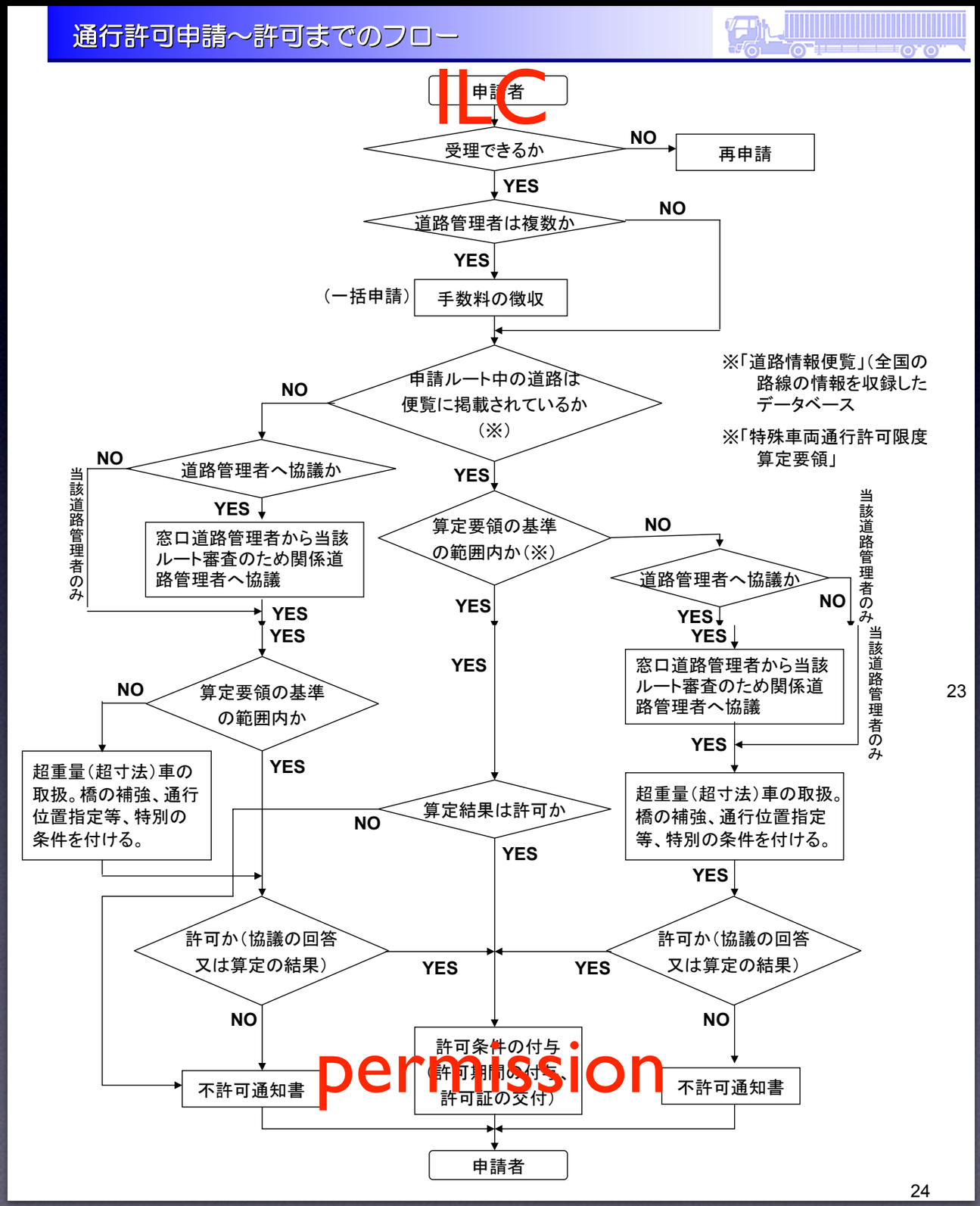
Transportation in Kitakami

KITAKAMI Site: Transportation

Slide from Tokiko Onuki



We have to get permission from the authorities.



Slide from Tomo Sanuki

Ministry of Land, Infrastructure, Transport and Tourism

General rule

total weight	trailer/ track	our package	daytime	night	Xpwy	paper work
25 ton	~10 ton	~15 ton	YES	YES	YES	0
44 ton	~20 ton	~24 ton	YES†/ NO	YES	NO	1
80 ton	~30 ton	~50 ton	NO	YES	NO	10

† Probably "YES", if our package fits into a standard container (W=2,438mm).

20kW Cold Box

- L17.0m x W4.4m x H4.7m
- 80 ton
- #10

Slide from Tomo Sanuki

LHC Cold Box

2015/10/05

- Found solutions.
- New loads are to be built.

Slide from Tomo Sanuki

Transportation Status

- The current transportation rules in Japan are rather strict
- At this time we cannot assume that reinforcements of bridges and streets are possible
  - this might change, when the project gets approval
  - but even then there might be boundary conditions given by nature

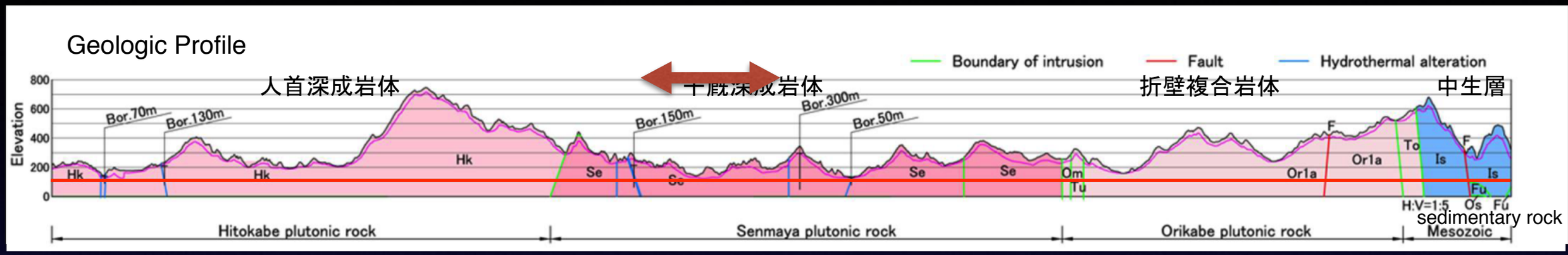
News from the Interaction Point

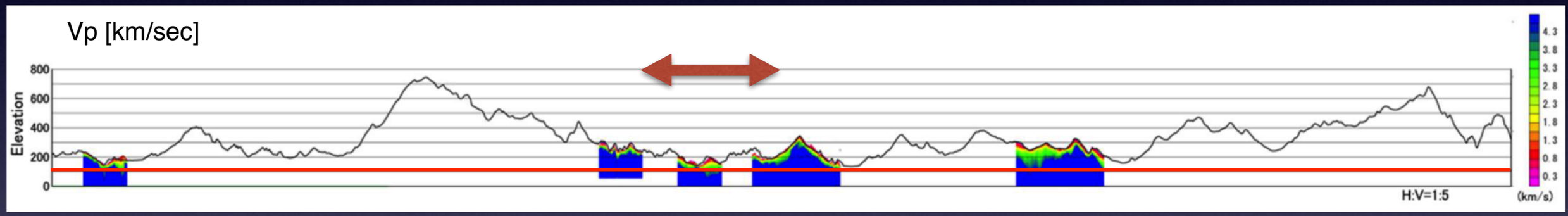
ALCW15@KEK

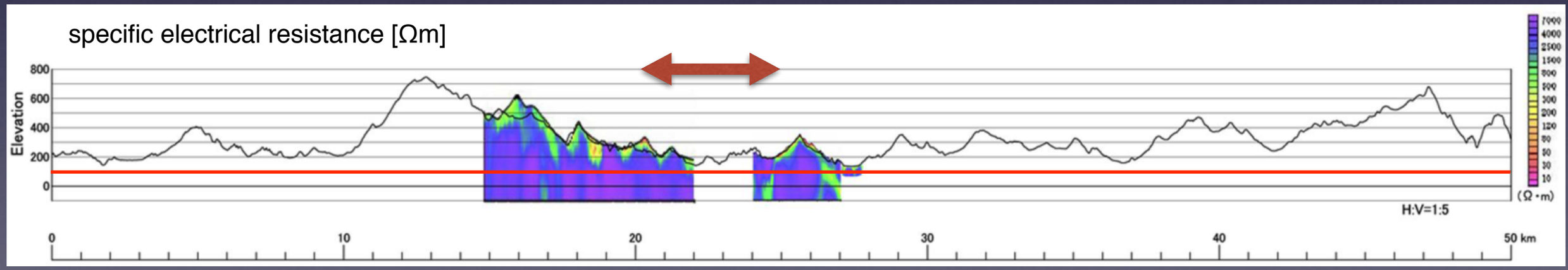
IP area for vertical access

North

South

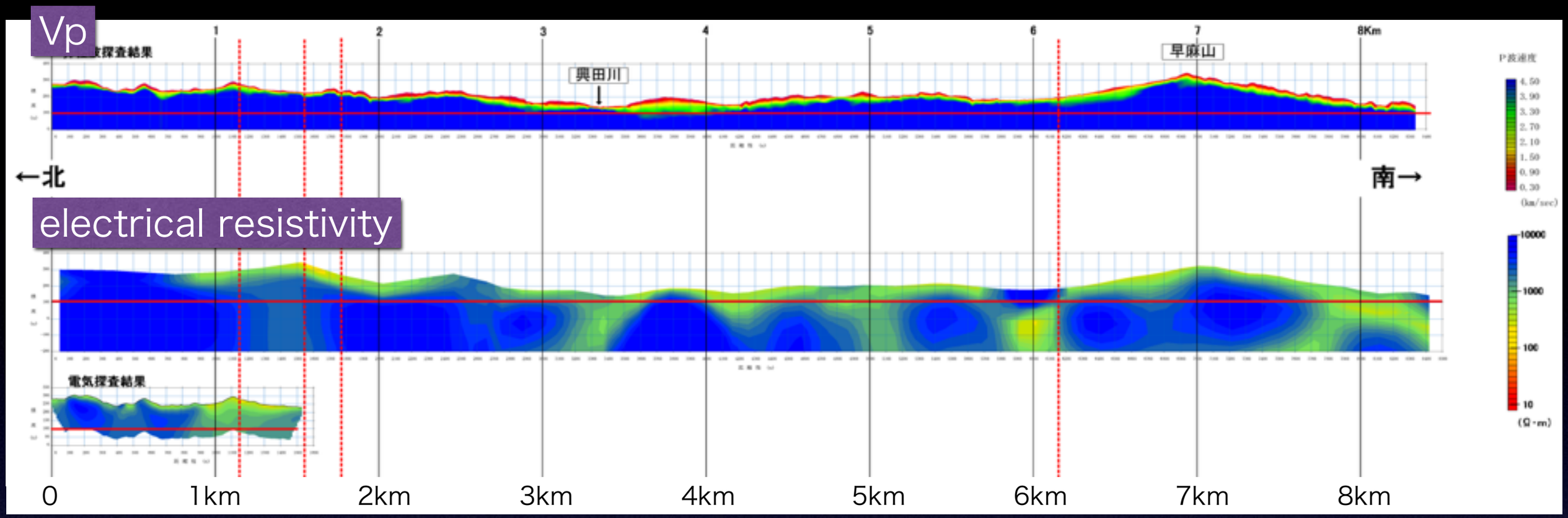






→ more detailed survey

Slide from Tomo Sanuki



- Our budget is limited. Only one boring.
- Have to demonstrate that a detector cavern with a vertical shaft is possible in Kitakami.

Slide from Tomo Sanuki

Vp / electrical resistivity

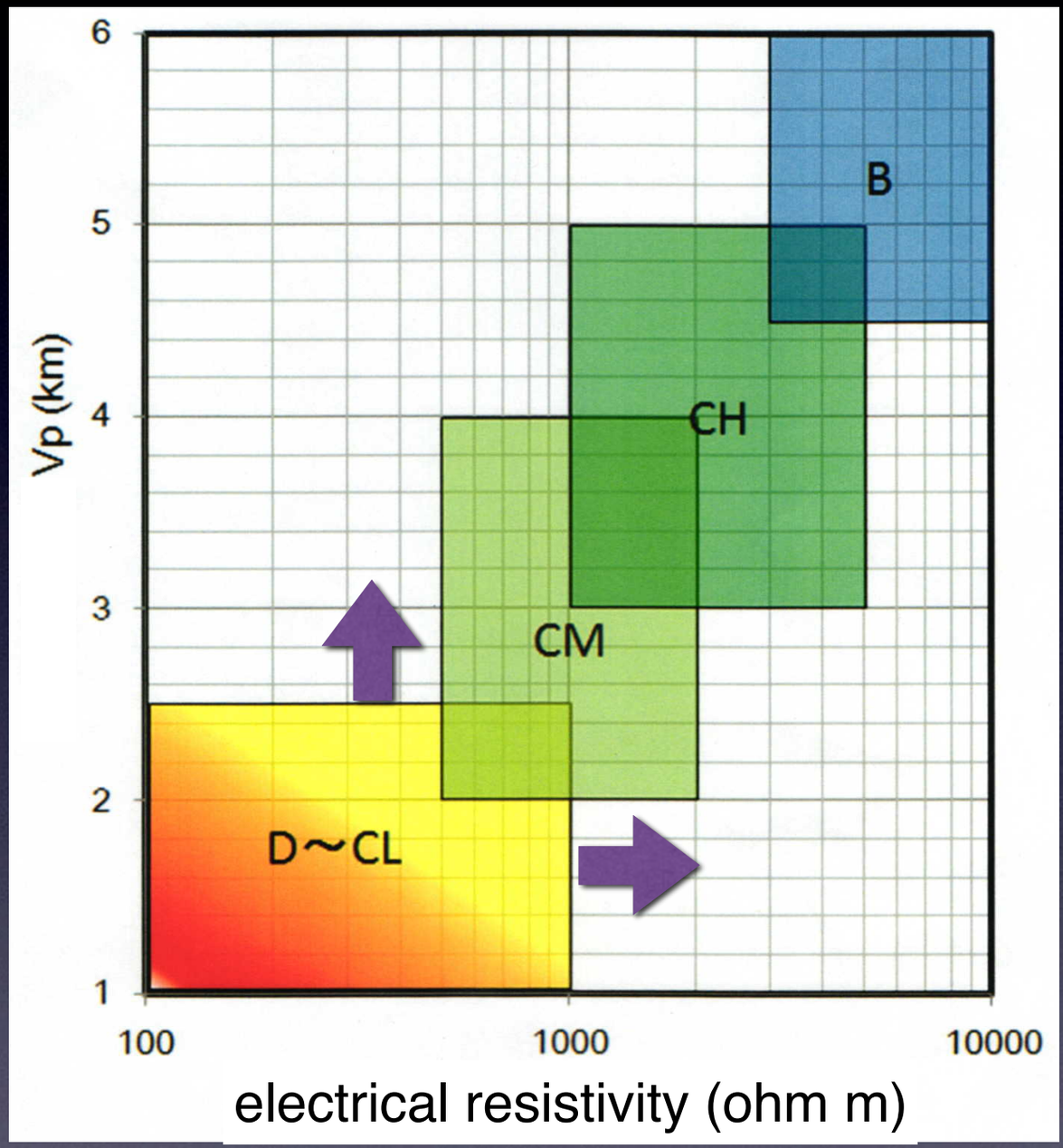
sample @ Mt. Hayama

B

CH

CM

CL



“better than CL” ==>>

“electrical resistivity > 1,000Ωm” & ”Vp>~2,500m/s”

Slide from Tomo Sanuki

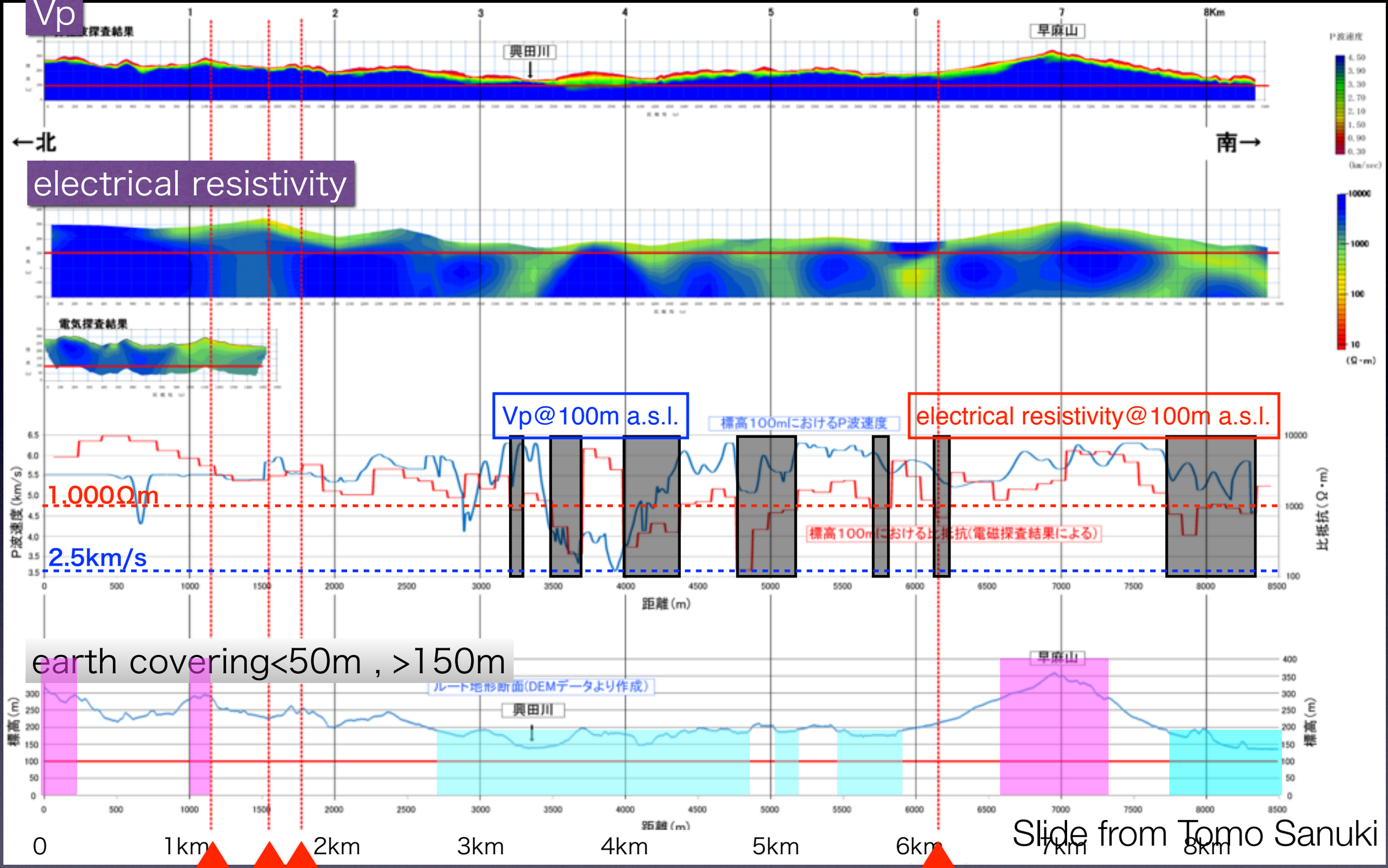
Vp

electrical resistivity

Vp@100m a.s.l.

electrical resistivity@100m a.s.l.

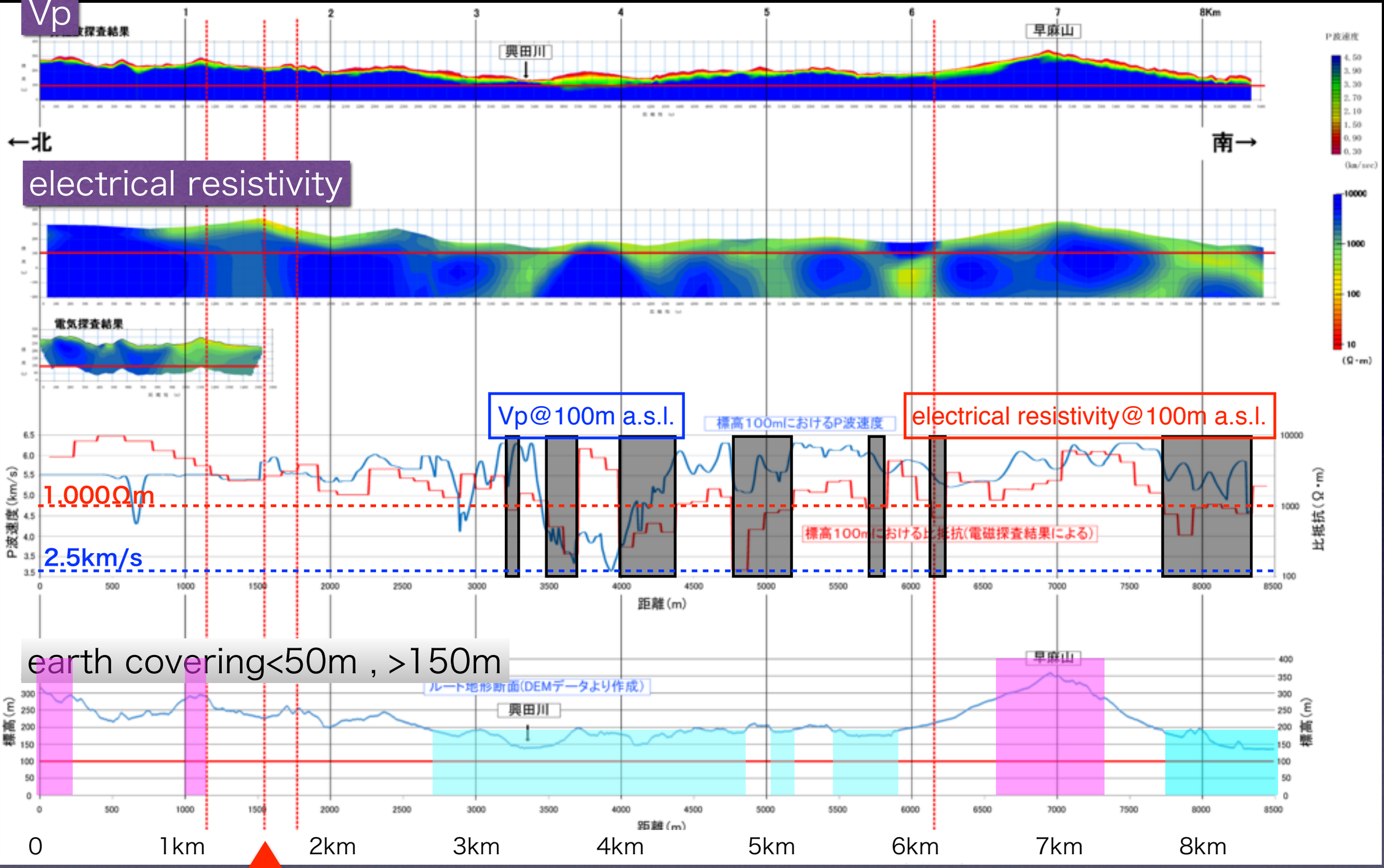
earth covering<50m , >150m



Slide from Tomo Sanuki

candidate IP, from the point of view of surface condition (topography, nearby roads, existing houses, land use, …)

Vp



I bet on this site.

Slide from Tomo Sanuki

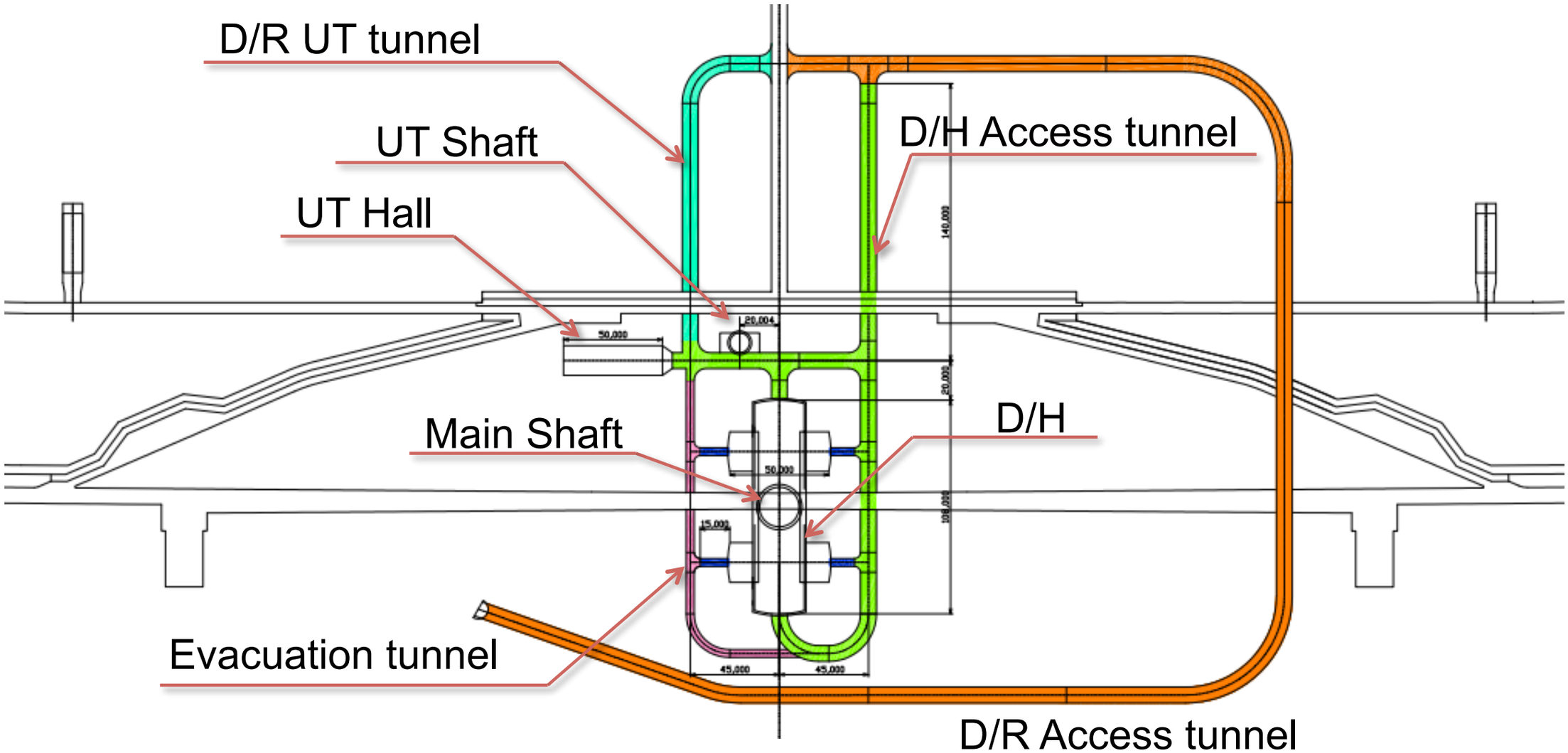
so far, so good

2015/10/05

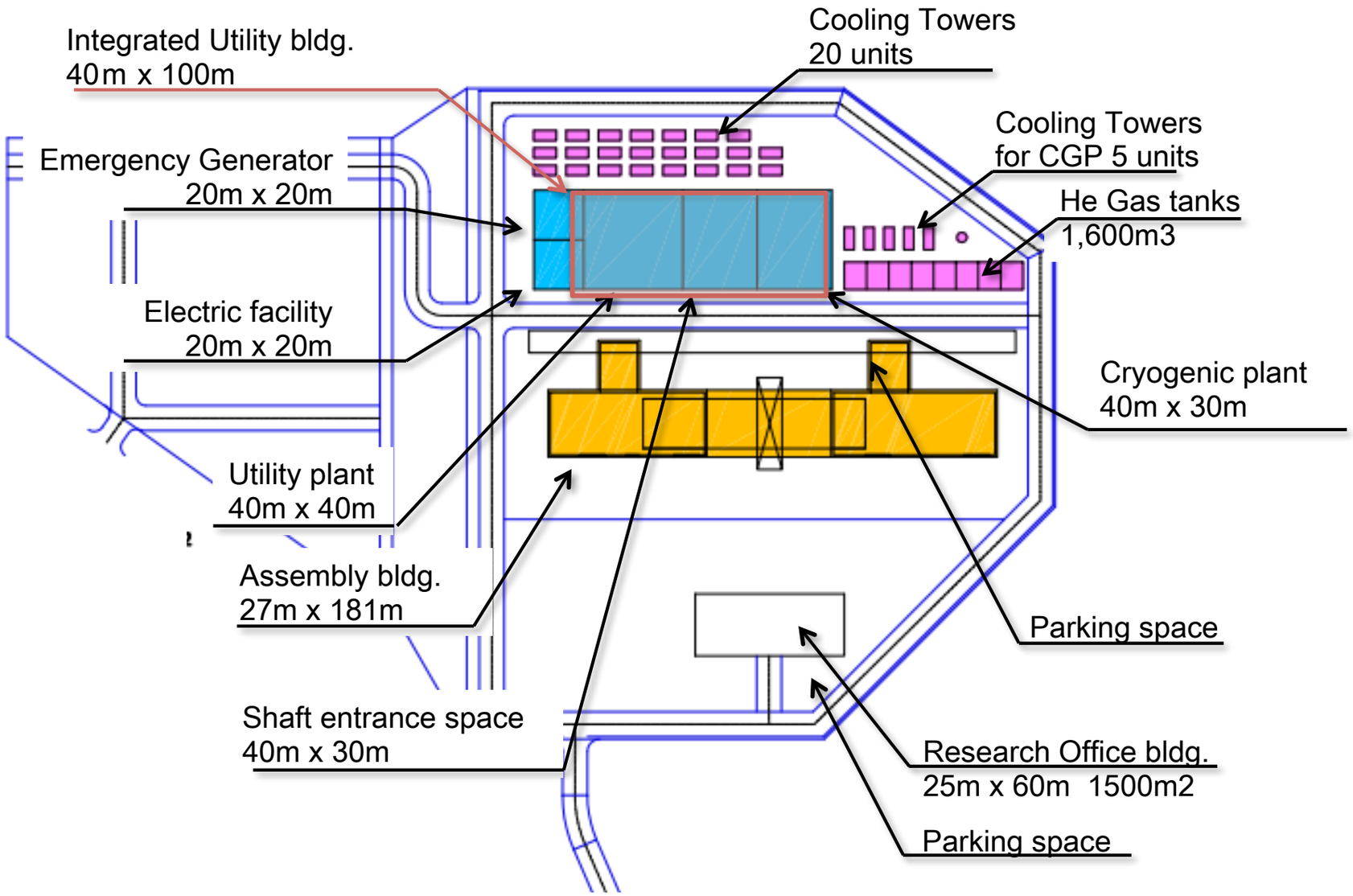
Slide from Tomo Sanuki

Buildings and Caverns

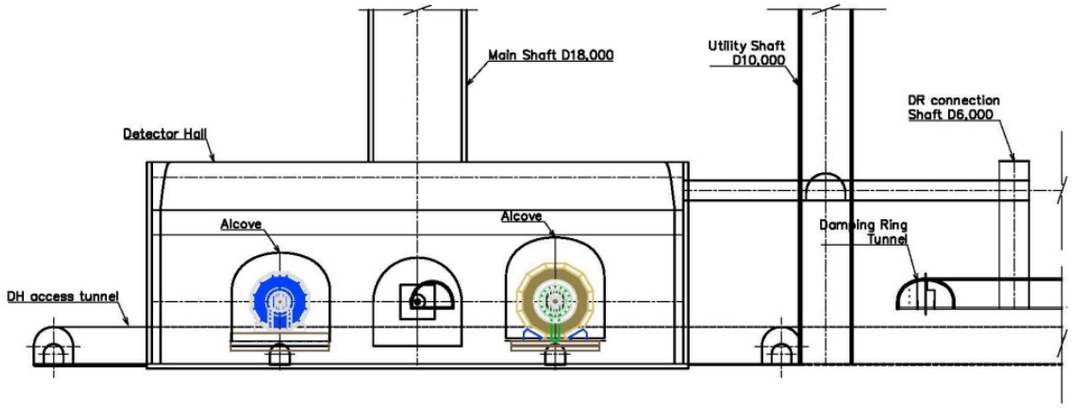
Underground Structure



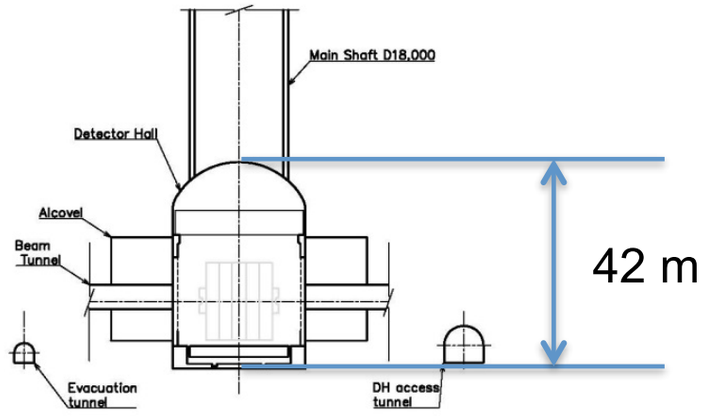
Surface ground Buildings and facilities

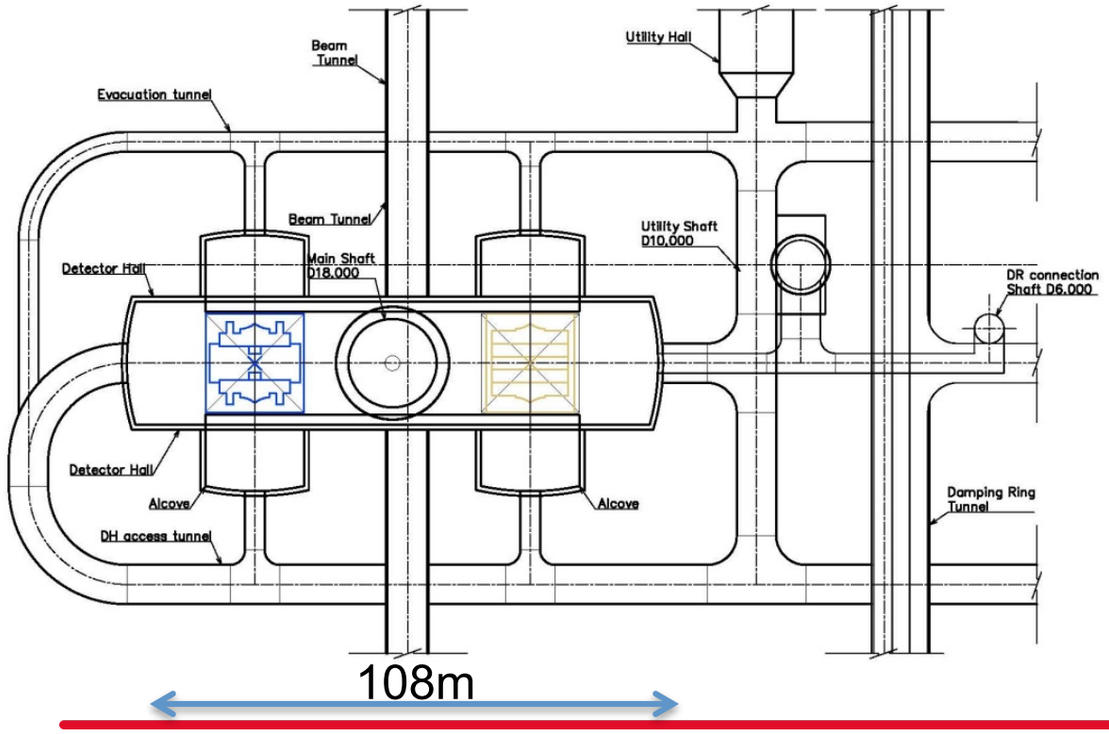


Current Design of Detector Hall



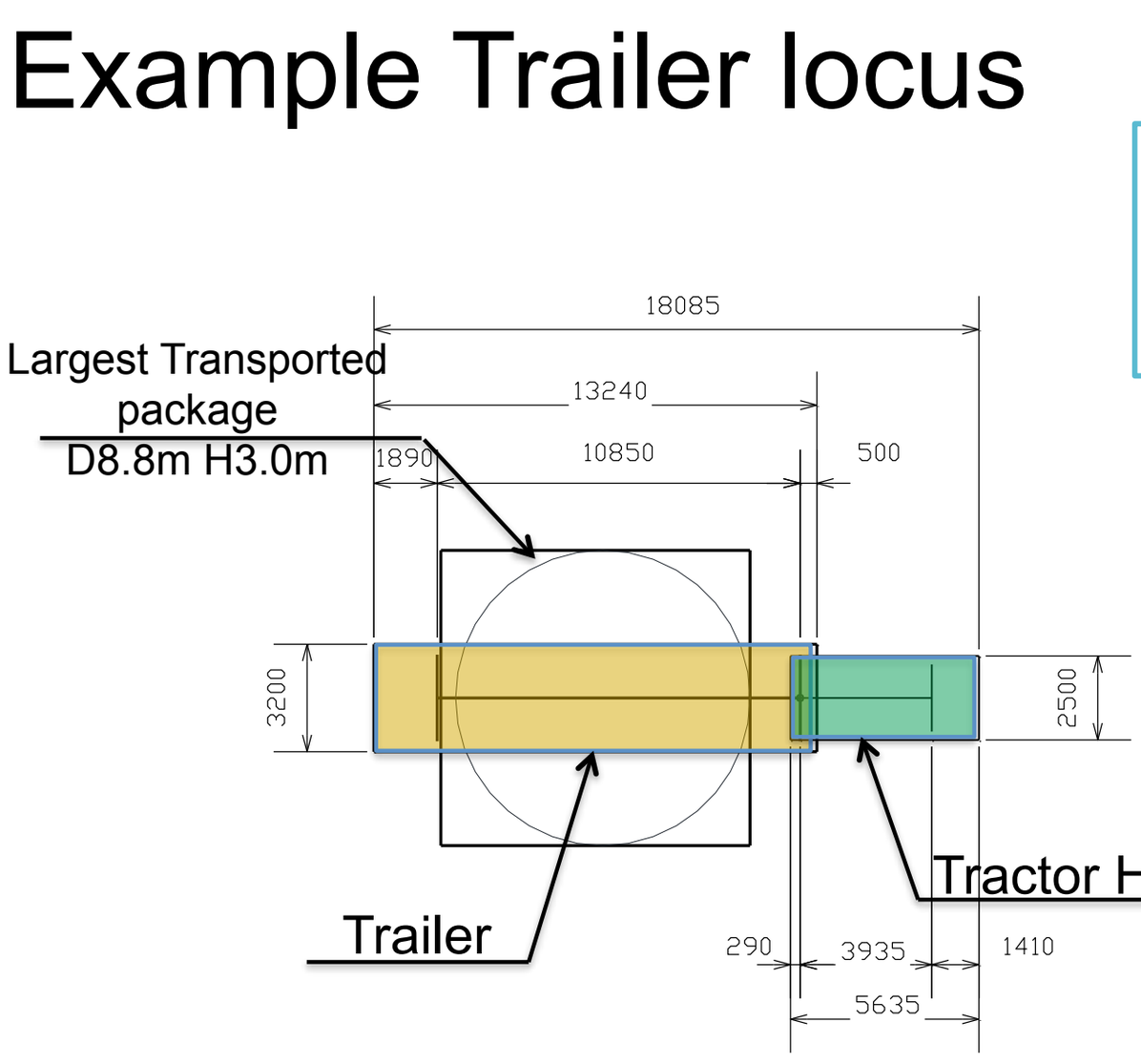
SiD side ILD side



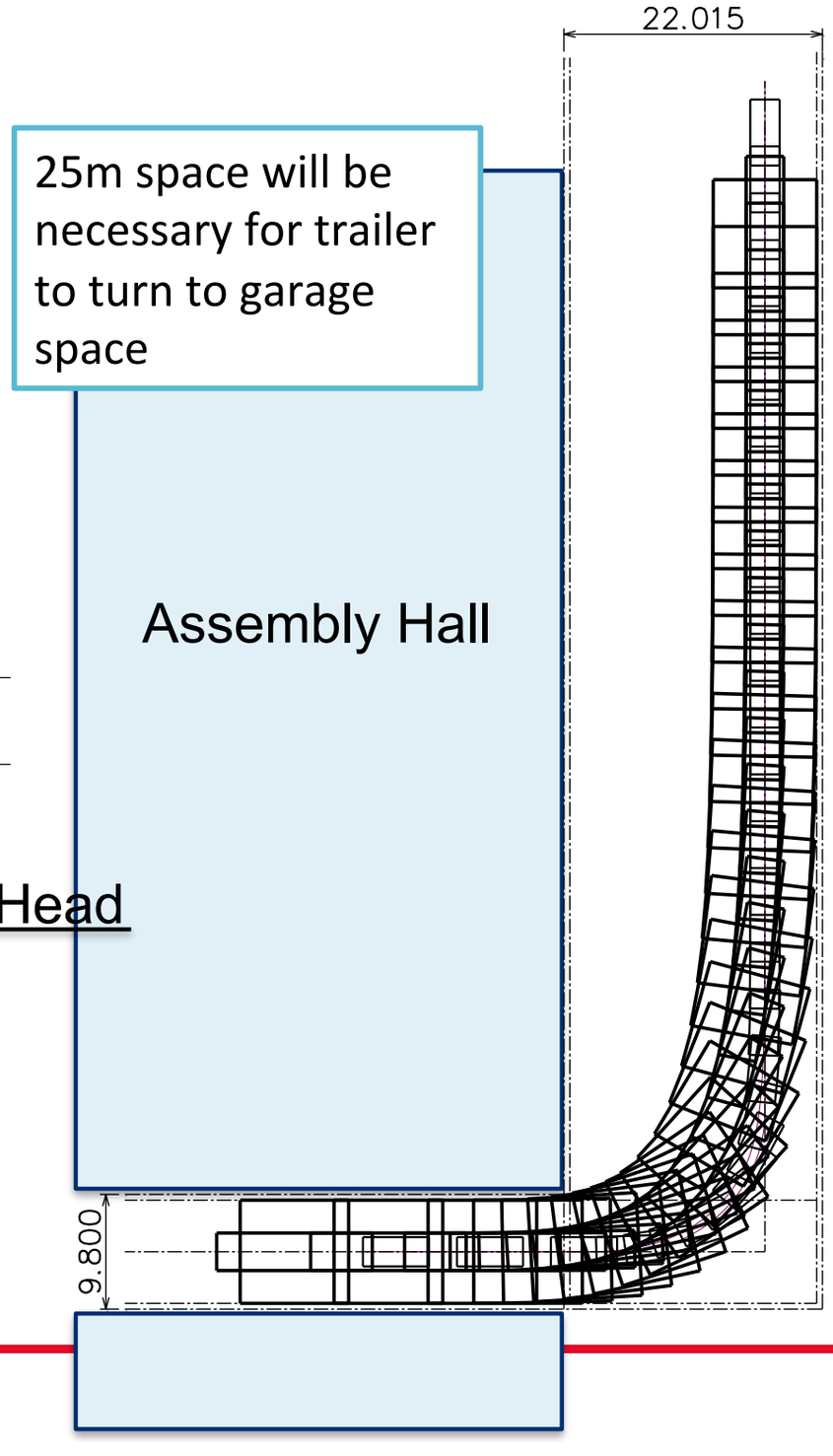


- Main shaft locates IR position.
- DH length : 108m.
- Utility lines are in UT shaft
- Personnel entrance way is elevator installed in UT shaft
- Access tunnels connect at the both end of DH

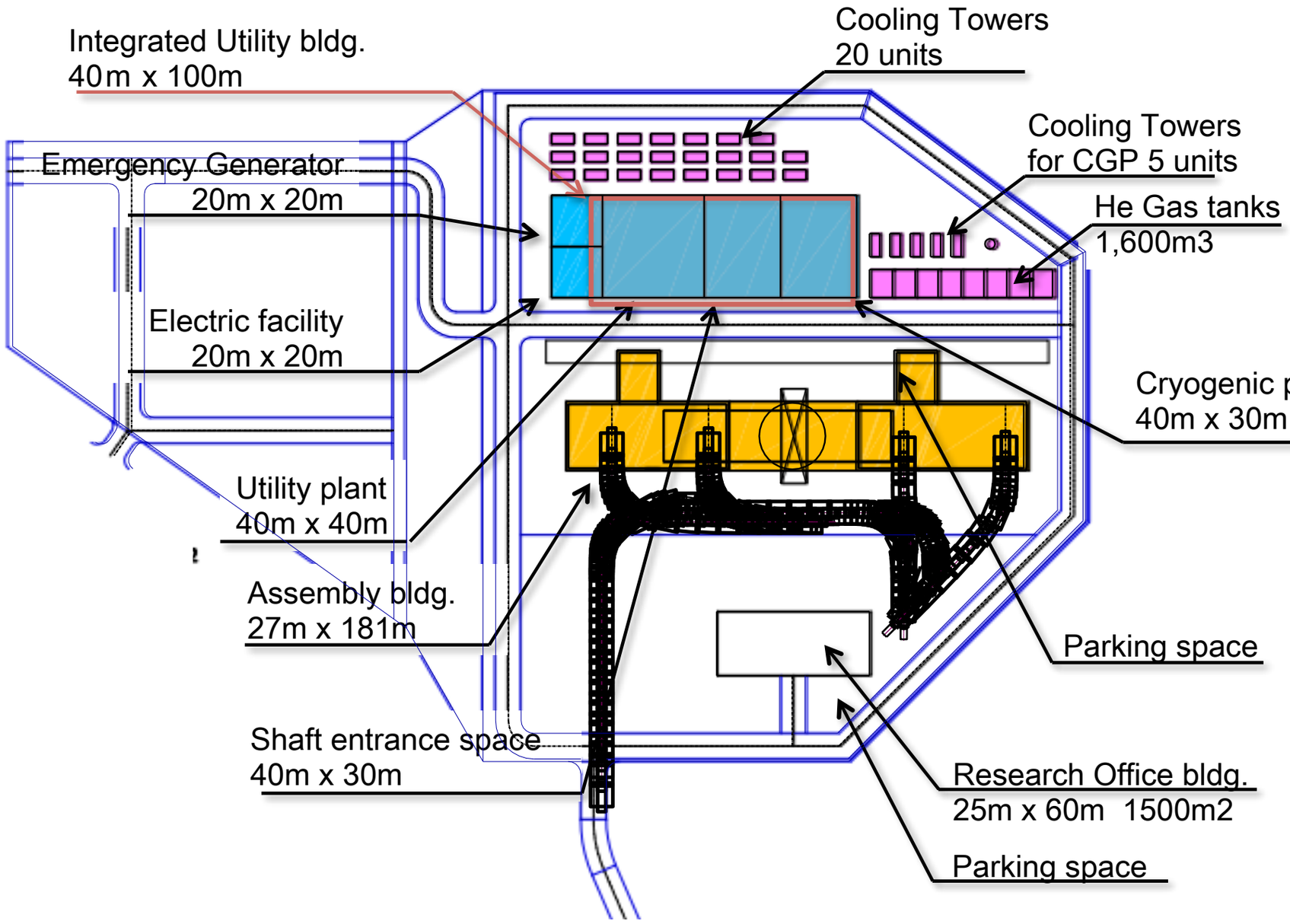
Example Trailer locus



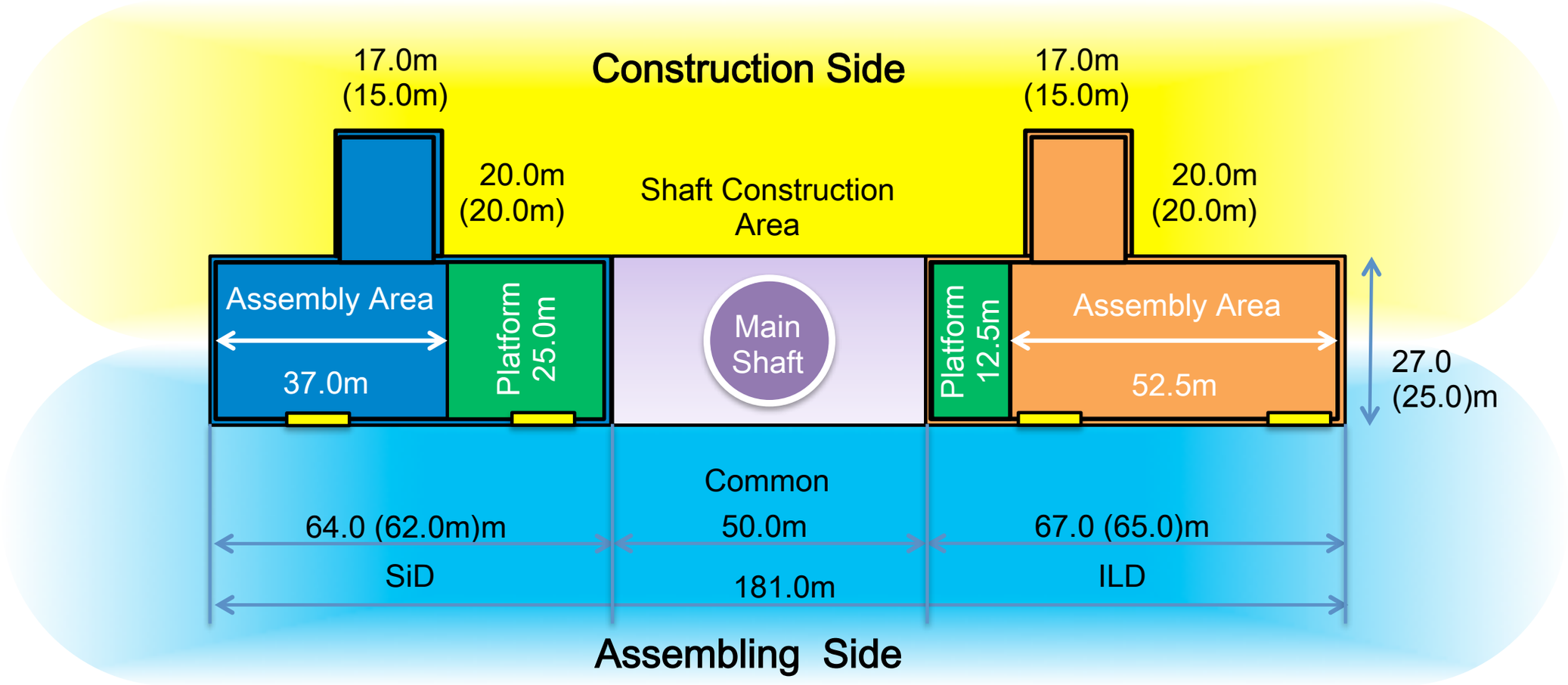
	Tractor Head	Trailer
Length	5.635m	13.240m
Width	2,500m	3,200m



Surface ground Buildings and facilities



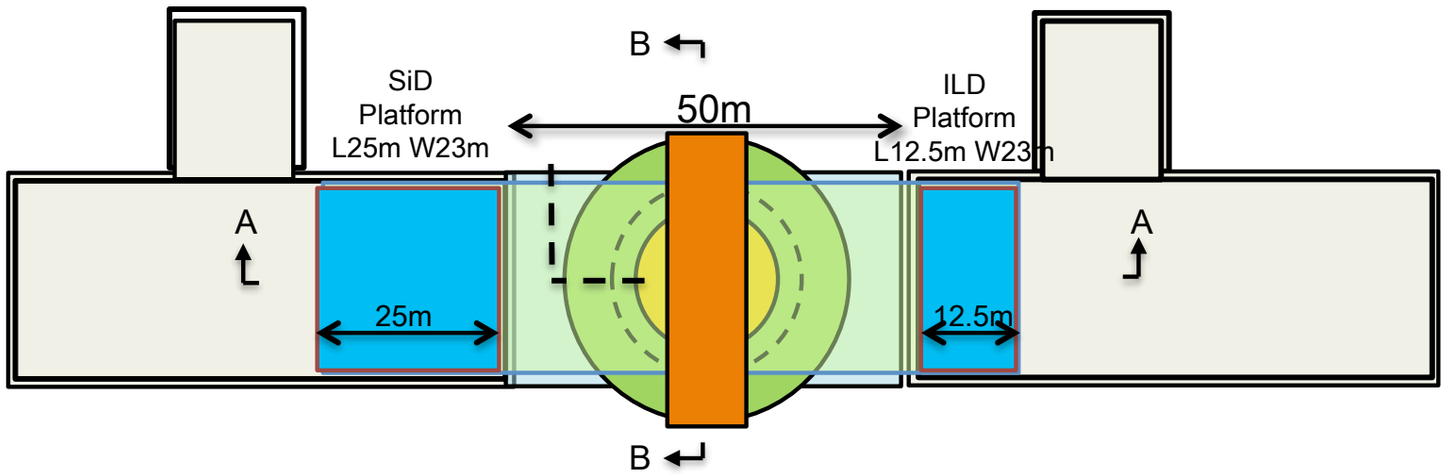
Assembly Hall

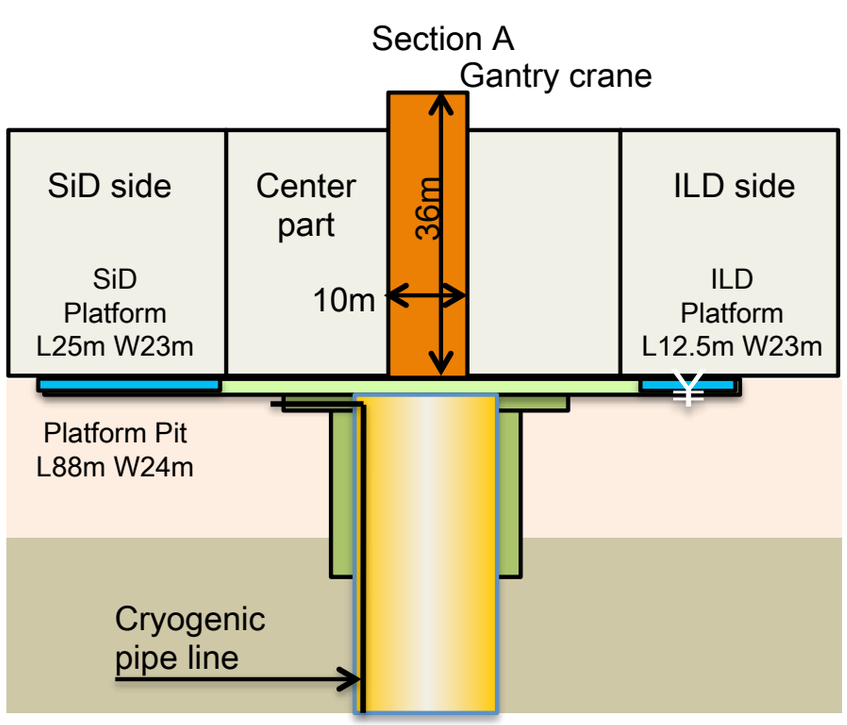


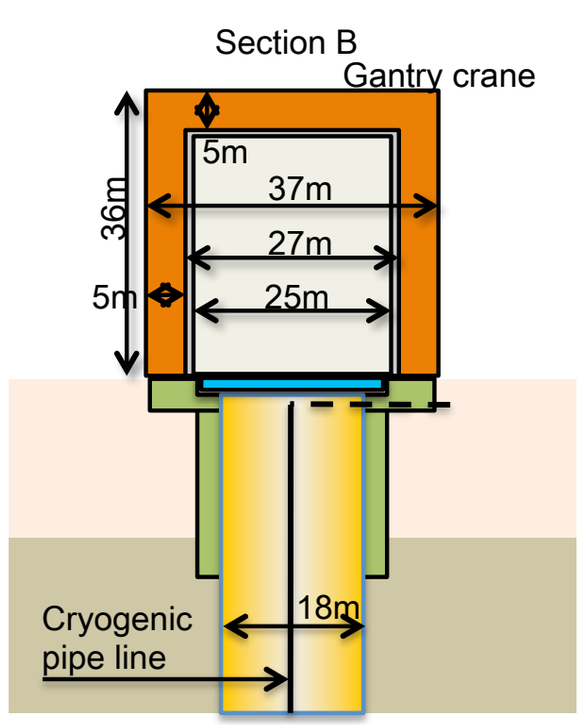
Two Garages for each Detector
Two Large Entrances for SiD
Two Large Entrances for ILD
All Large Entrances are at the same side

Outer space
ILD: L67.0m x w27.0m
SiD: L64.0m x w27.0m

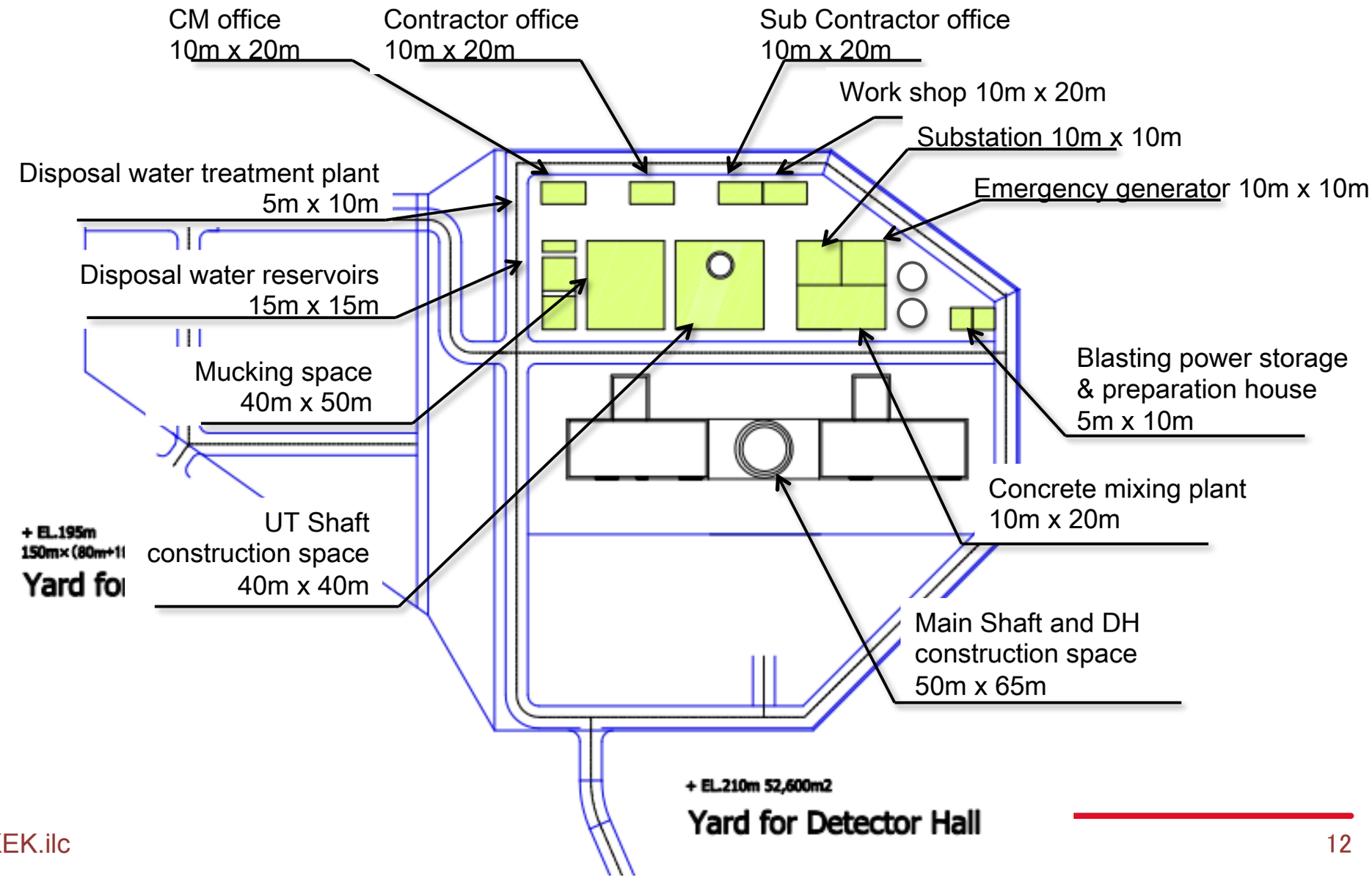
Vertical section around Main shaft







Construction facilities Arrangements

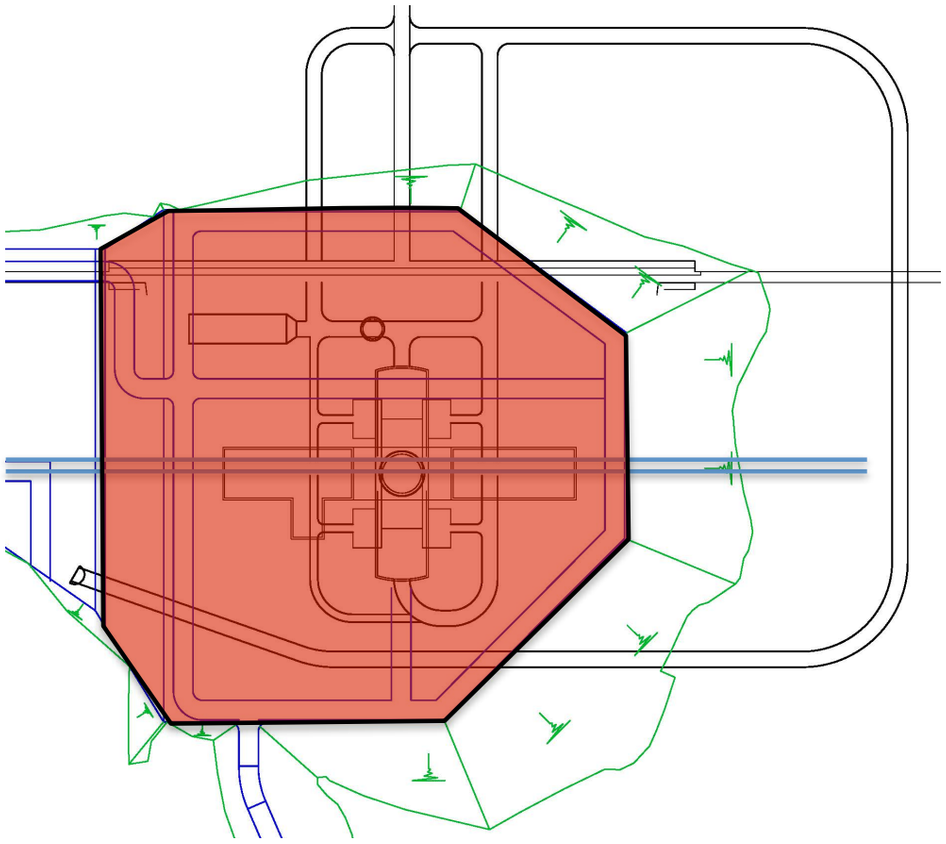


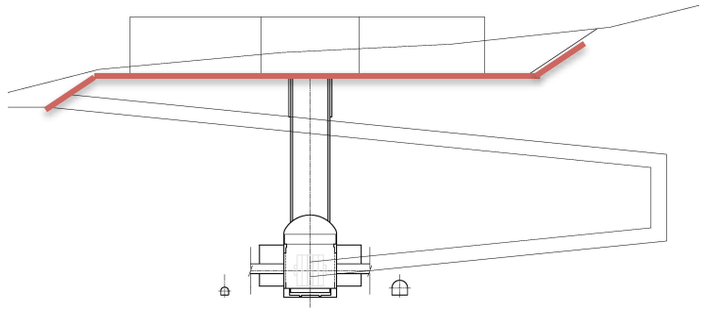
Major construction facilities

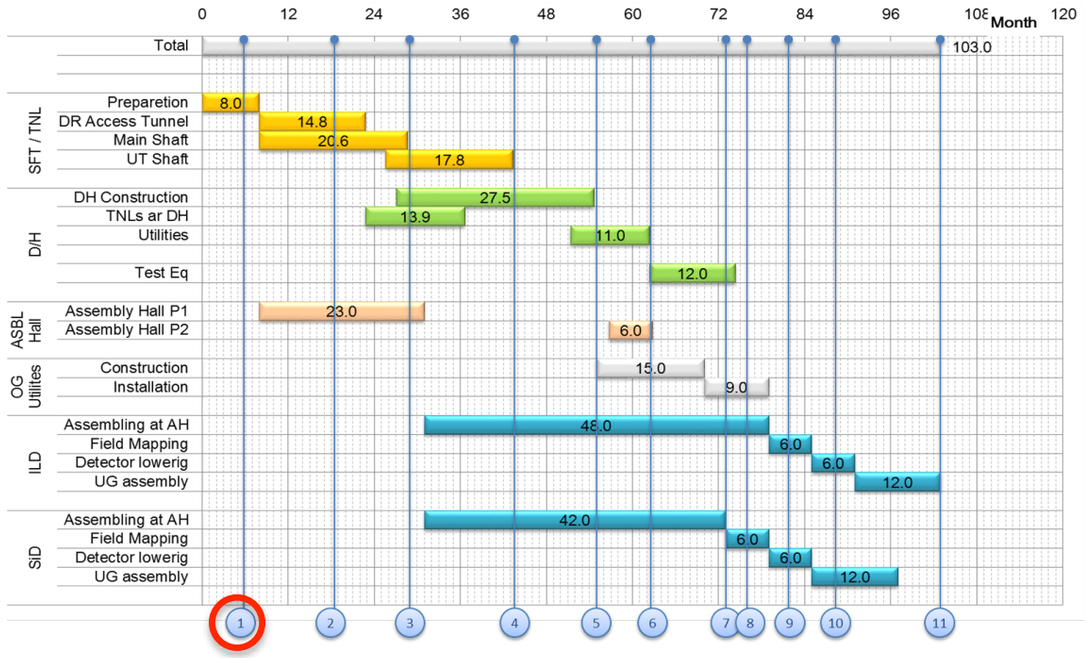
items	Contents
Main shaft and DH construction facility	Cranes, Elevator, Hanging deck, Mucking equipment Ventilation fans
Utility shaft construction facility	Cranes, Elevator, Hanging deck, Mucking equipment Ventilation fans
Disposal Water Treatment Facility	Disposal water treatment Sedimentation reservoirs
Blasting powder preparation and storage chamber	Preparation and management chamber Storage chamber
Concrete mixing plant	Mixing plant Aggregates stock silos Disposal water treatment facility
Power supply facility	High voltage transformer Emergency generator
Offices	CM Office
	Contractors Office
	Subcontractors Offices
Construction yd.	Material stock yard Mucking yard

Ground surface allocation according timeline

No.1 Preparation work



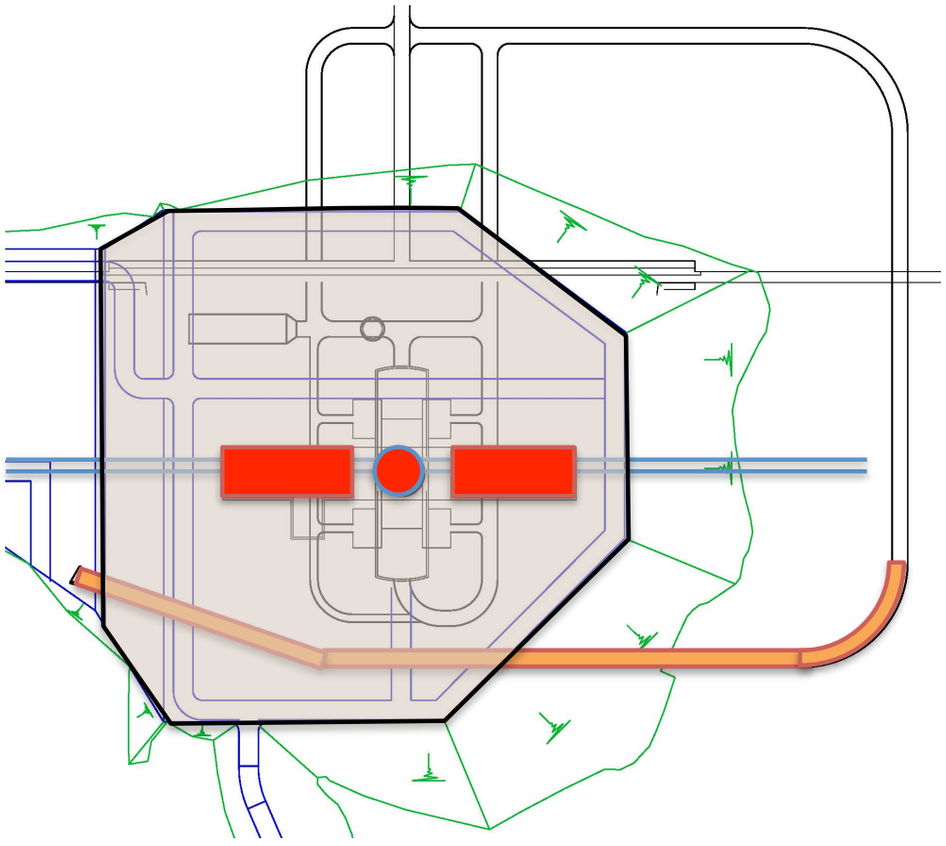


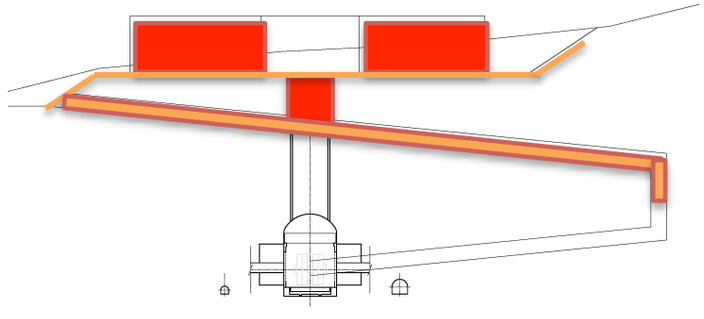


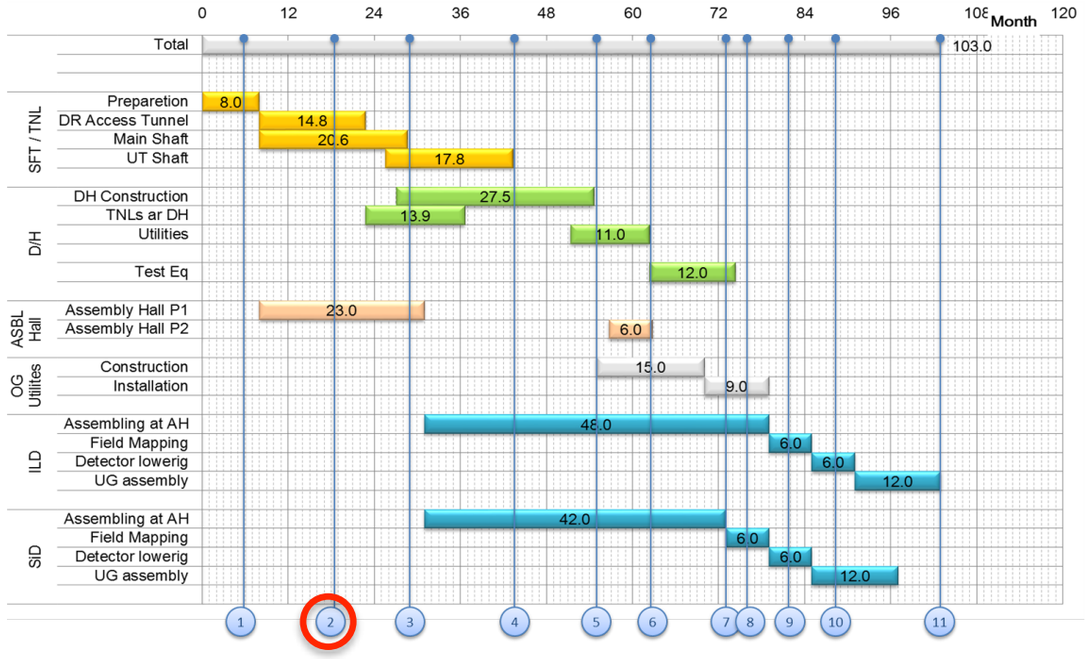
Notes
- Preparation work
- Assembly yard forming

Ground surface allocation according timeline

No.2 AsH, Shaft, A/T Construction





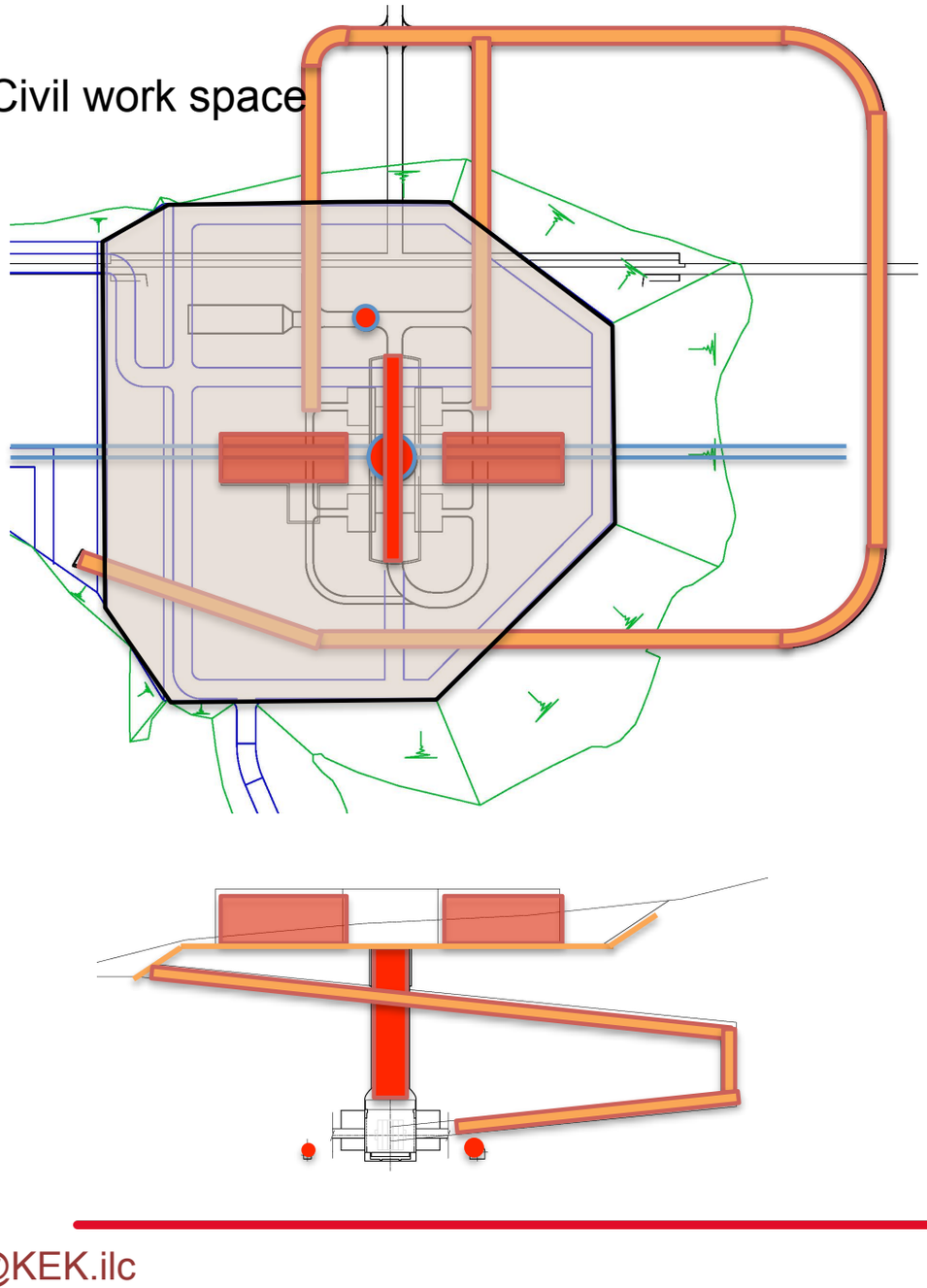


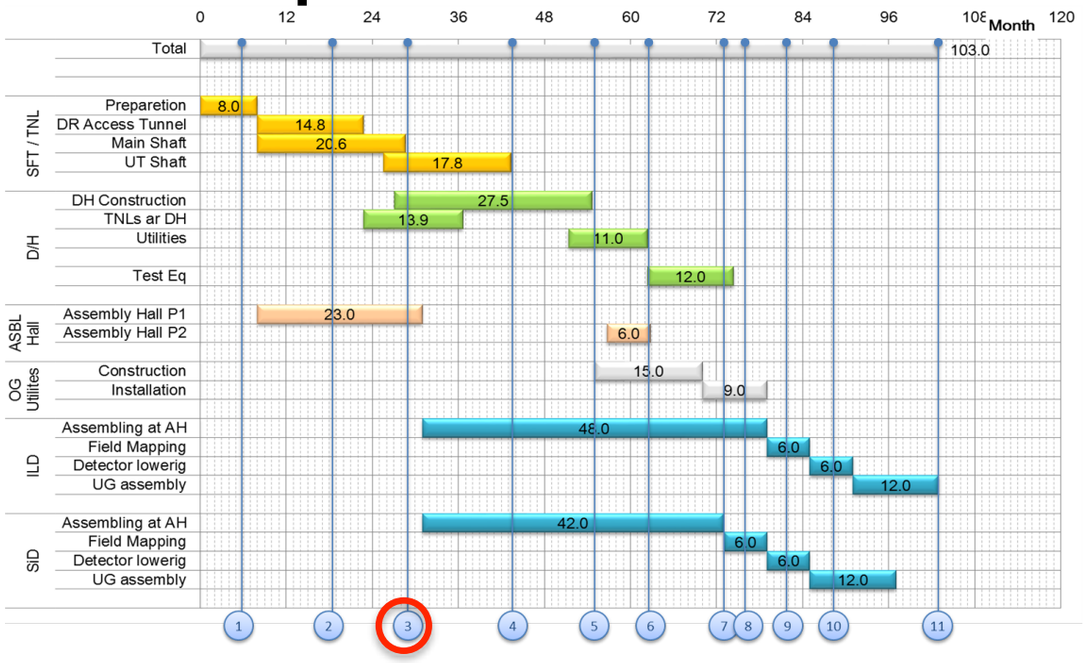
Notes

- Access tunnel excavation
- Main shaft construction
- Assembly hall 1 phase construction

Ground surface allocation according timeline

No.3 Main Shaft, AsH P1 completion

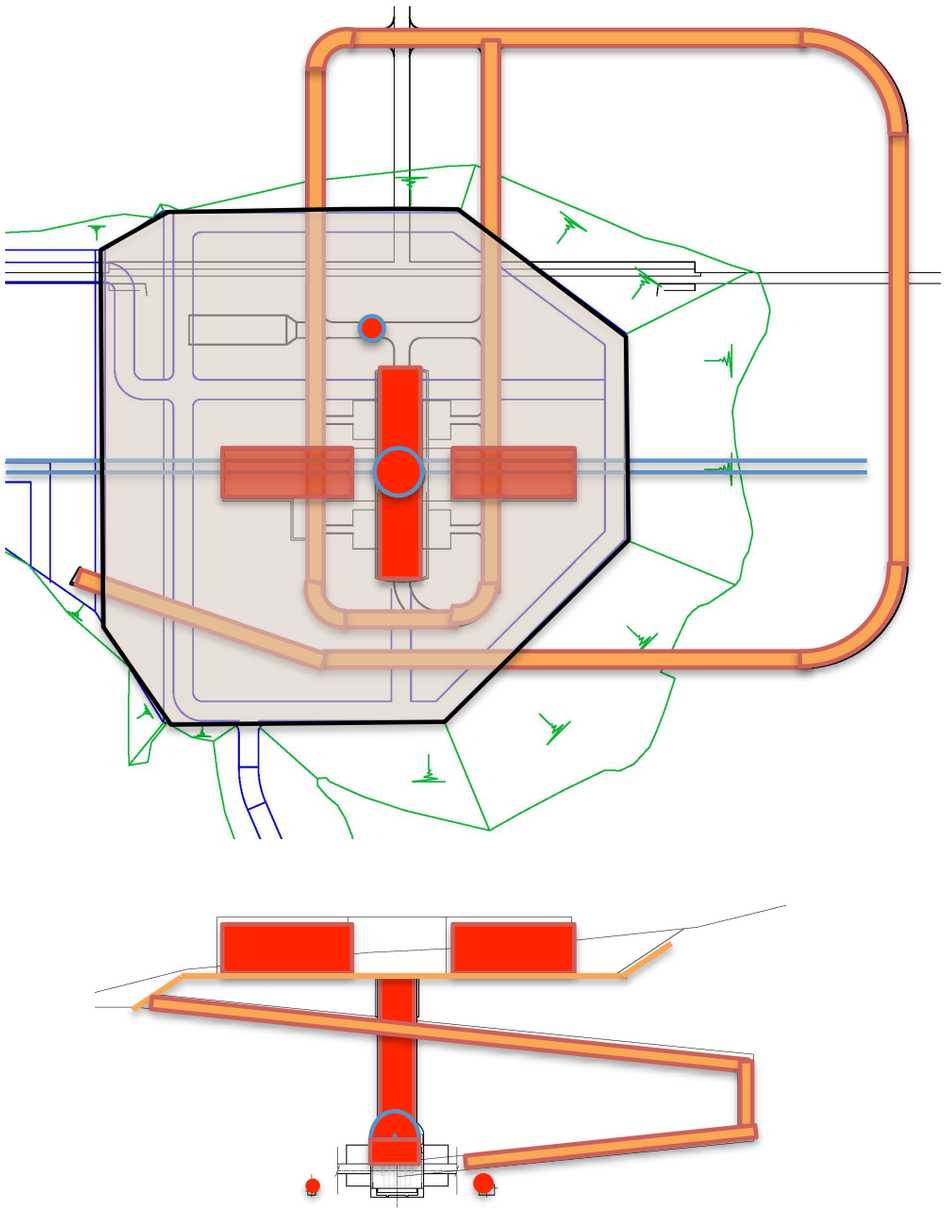


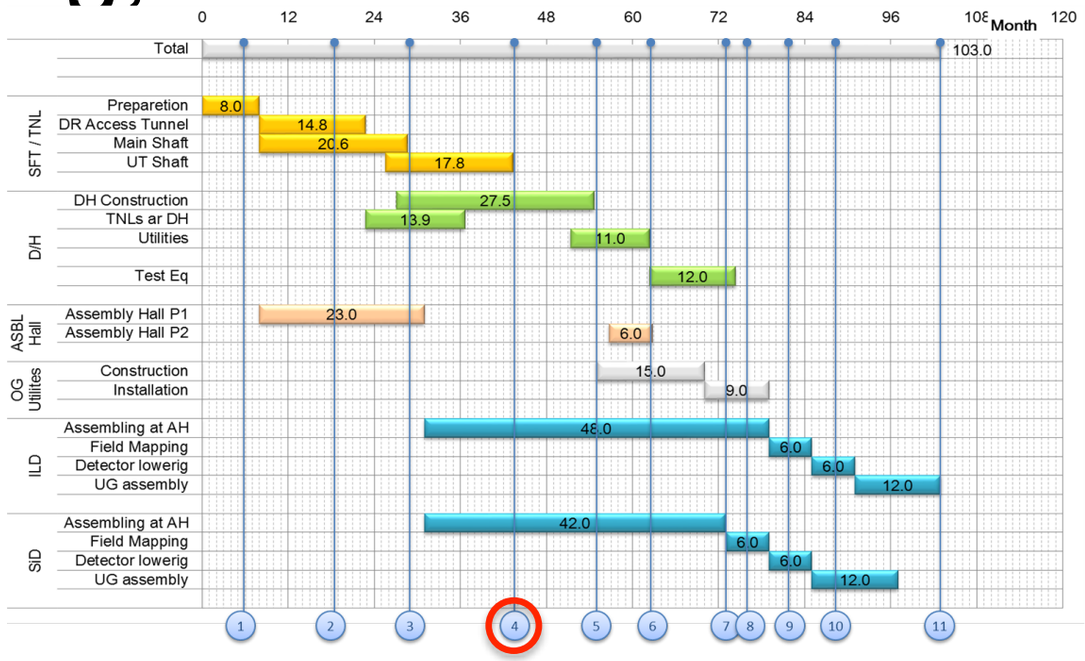


Notes
- UT shaft construction
- Main shaft completion
- Access tunnel excavation
- Detector hall excavation
- Assembly Hall almost completion

Ground surface allocation according timeline

No.4 Detector Assembling, DH construction





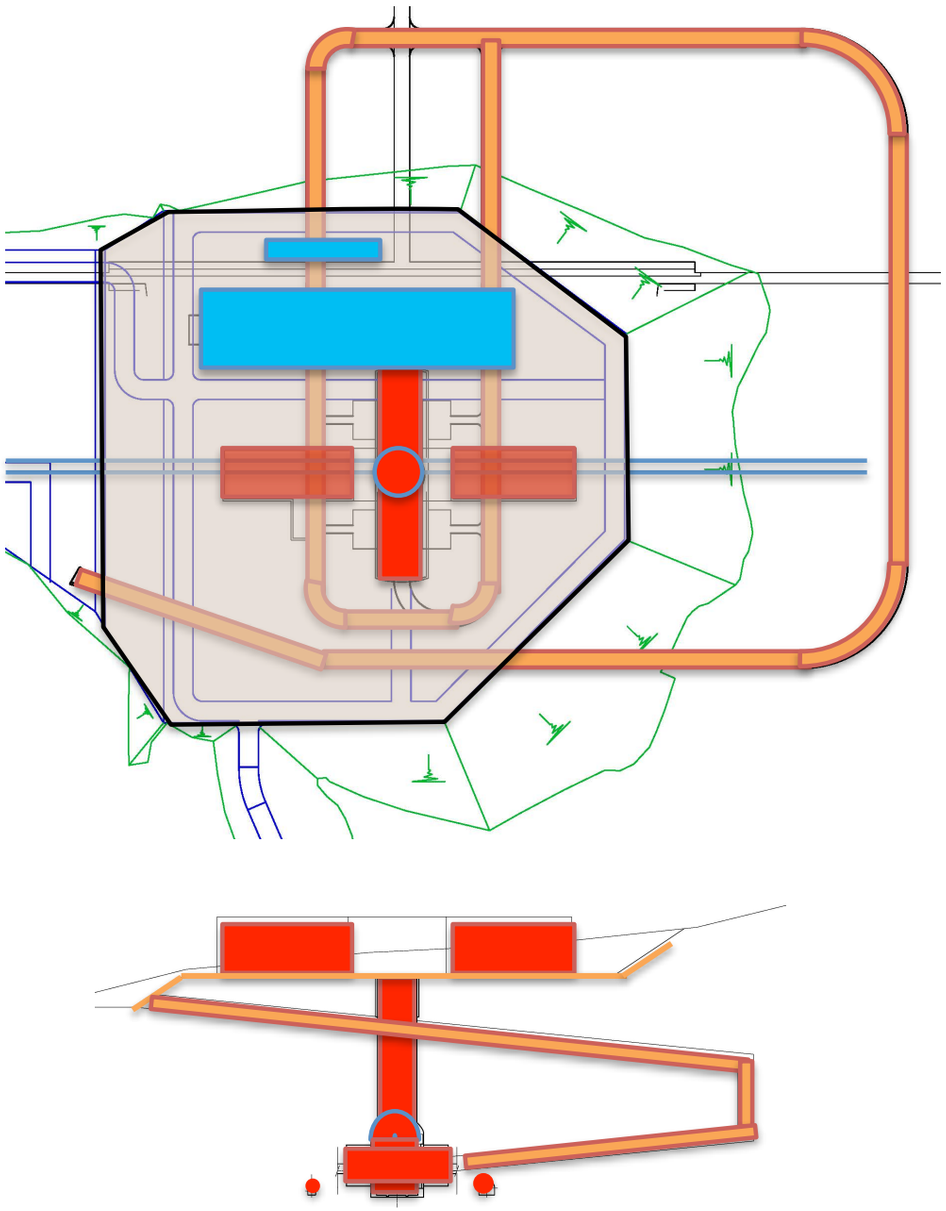
Notes

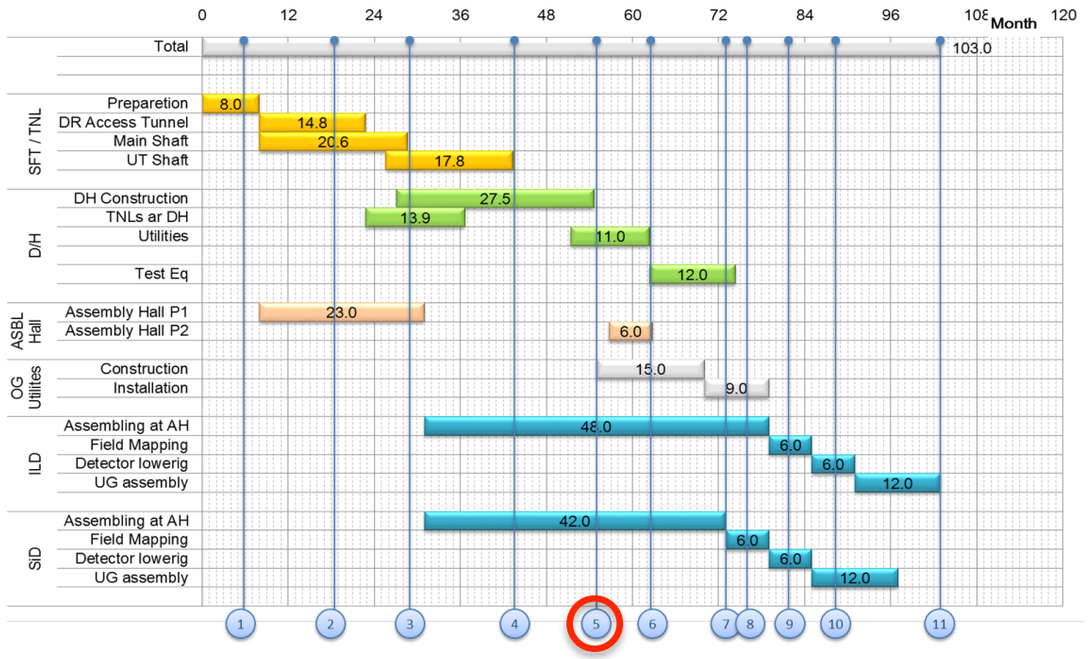
- UT shaft completion
- Detector hall construction
- Detector hall excavation

- Detectors assembling at AsH

Ground surface allocation according timeline

No.5 DH Ex. Completion





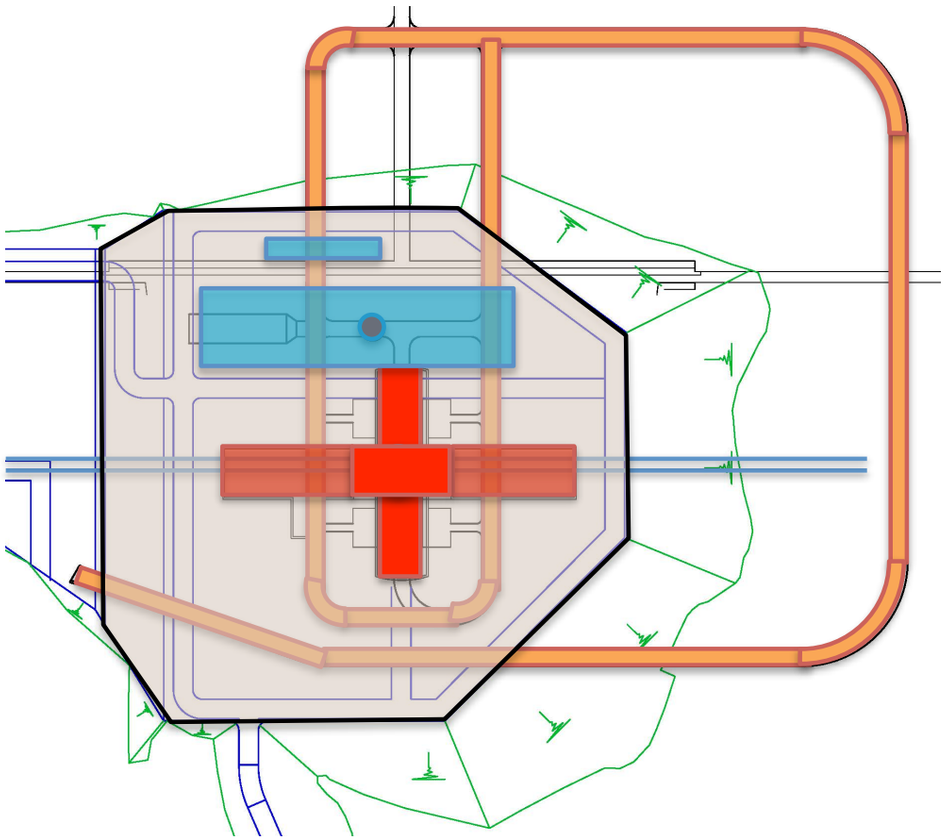
Notes

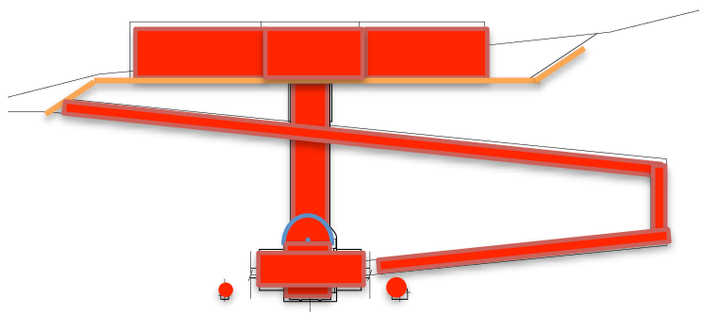
- Detector hall completion
- Utility facility construction
- On ground Service building construction

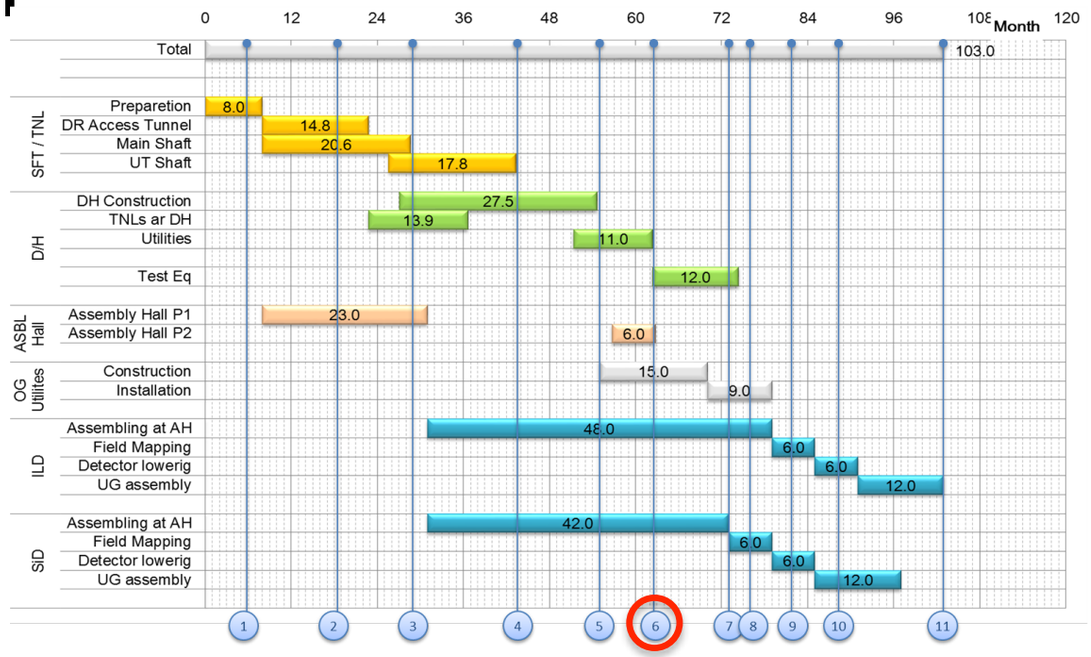
- Detectors assembling at AsH

Ground surface allocation according timeline

No.6 AsH Phase 2 completion







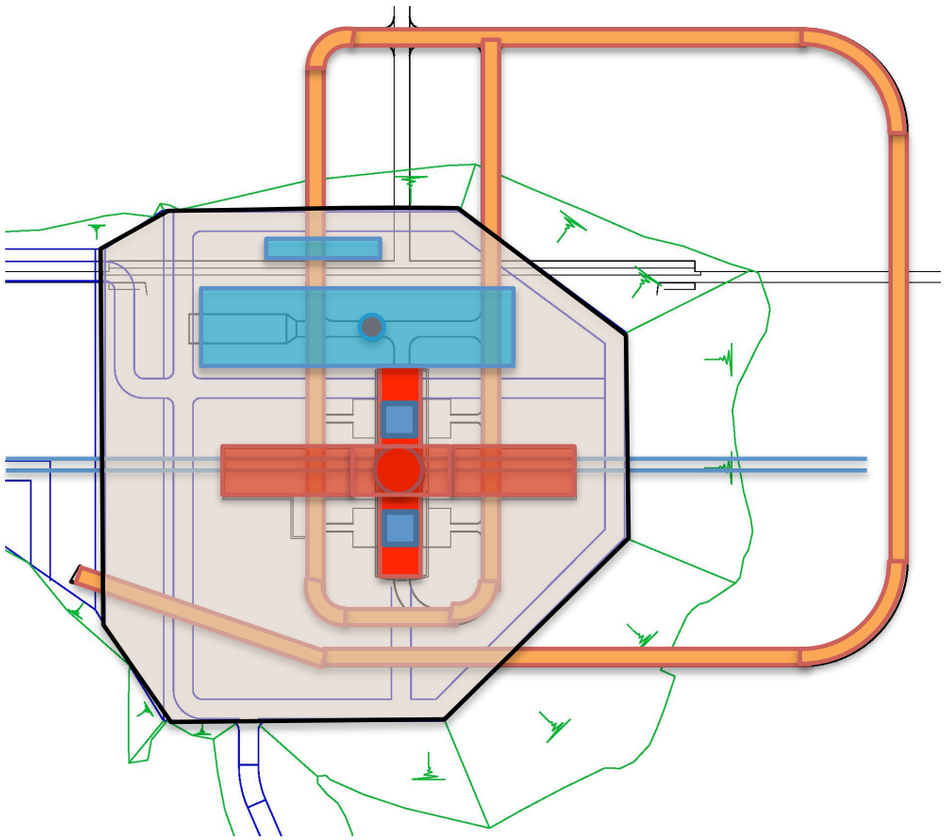
Notes

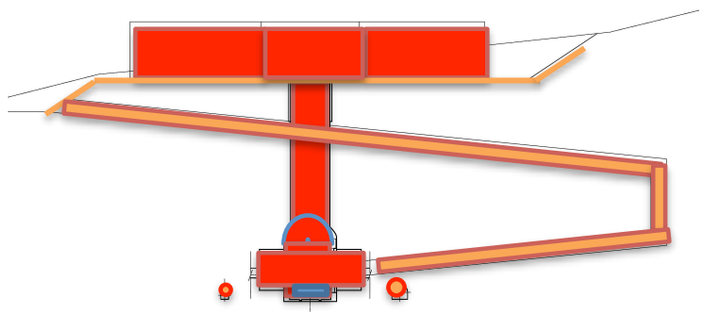
- Assembly hall 2nd phase construction

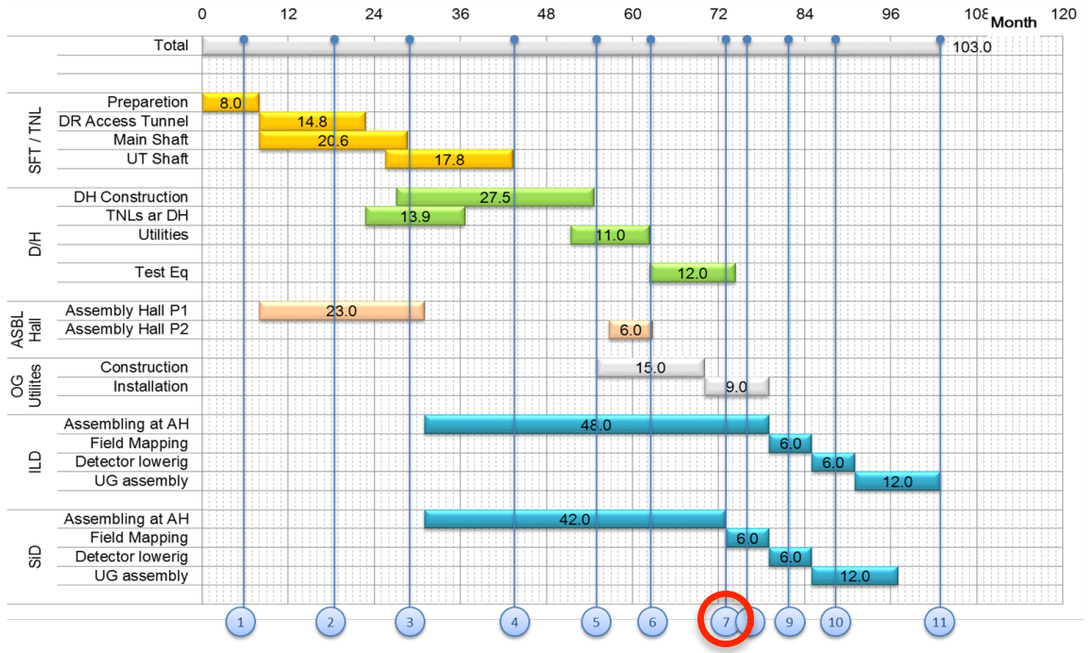
- Detectors assembling at AsH

Ground surface allocation according timeline

No.7 DH platform completion







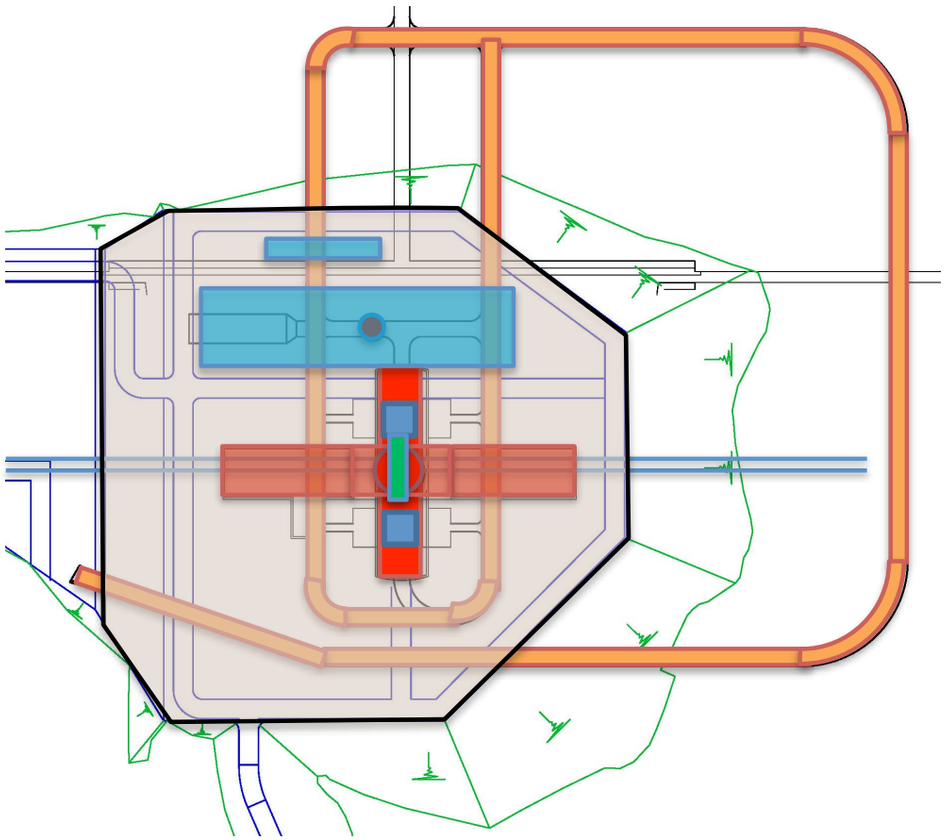
Notes

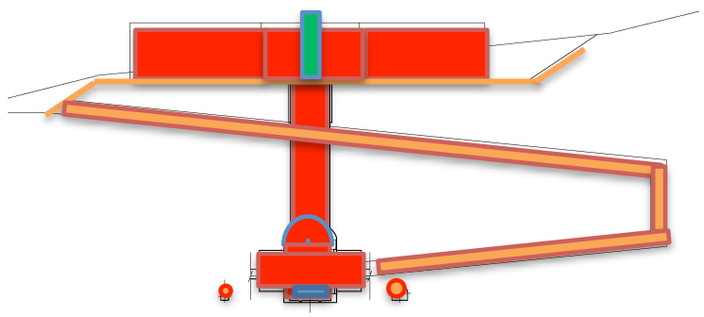
- Assembly hall 2nd phase construction

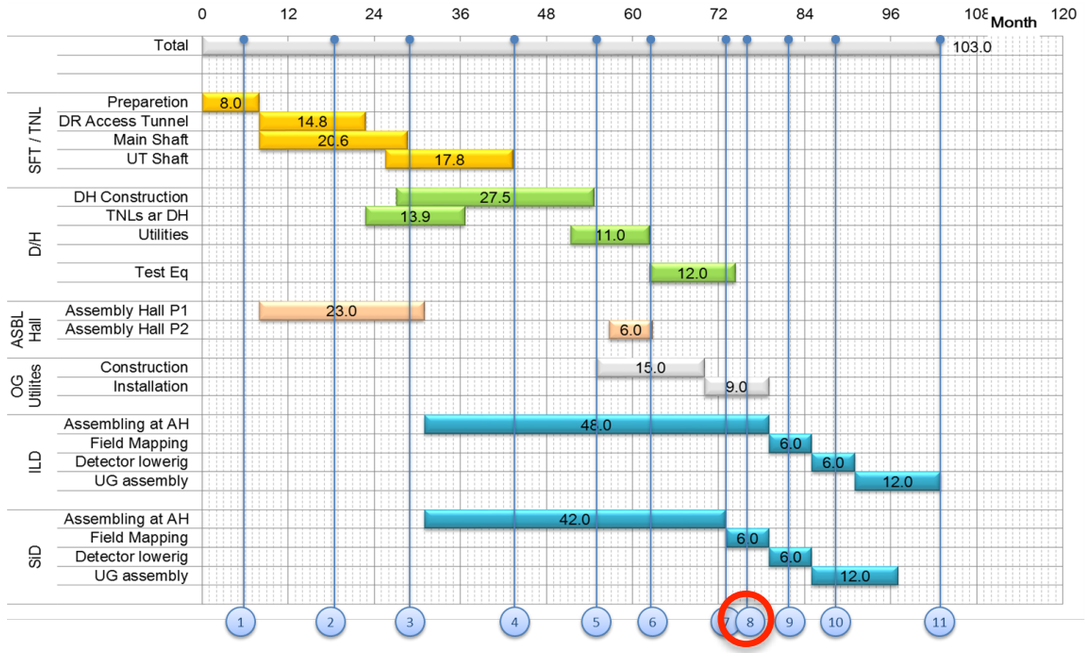
- Detectors assembling at AsH

Ground surface allocation according timeline

No.8 Gantry Crane installation







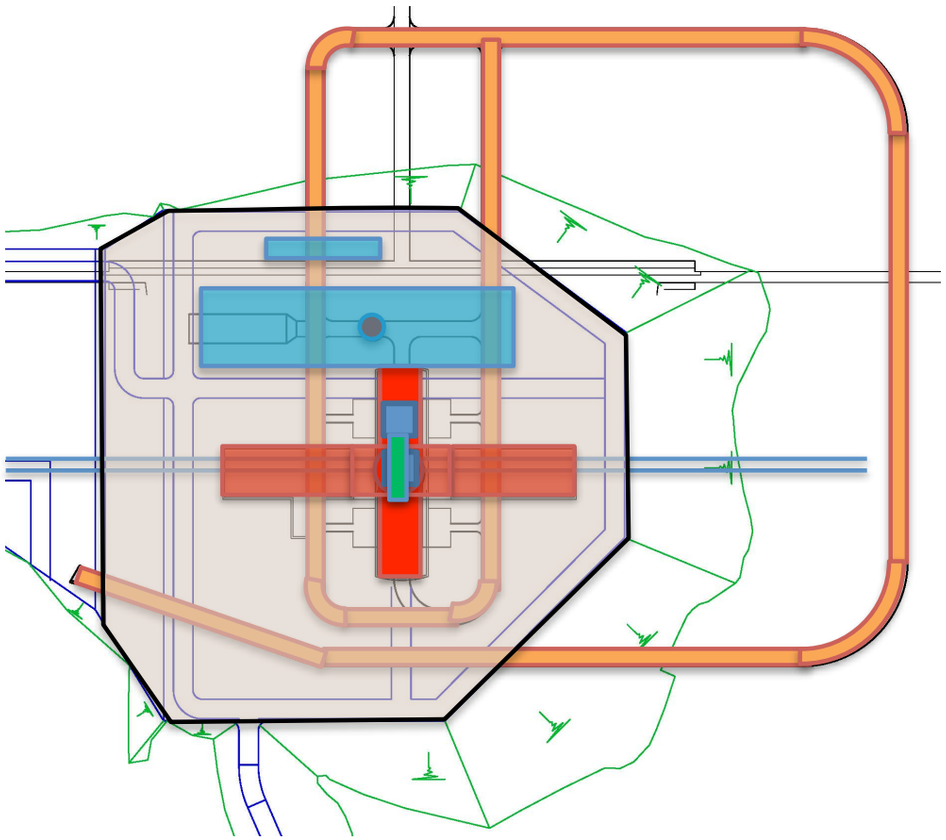
Notes

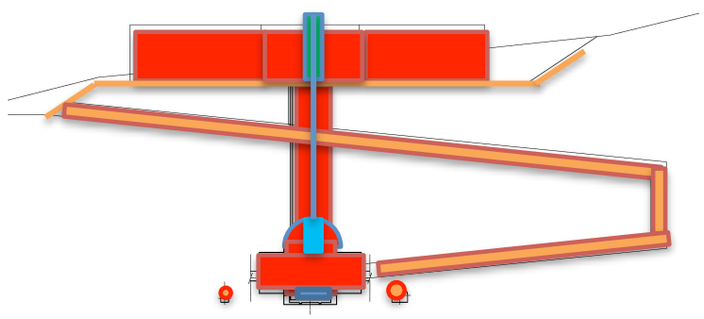
- Assembly hall 2nd phase completion
- Gantry crane installation

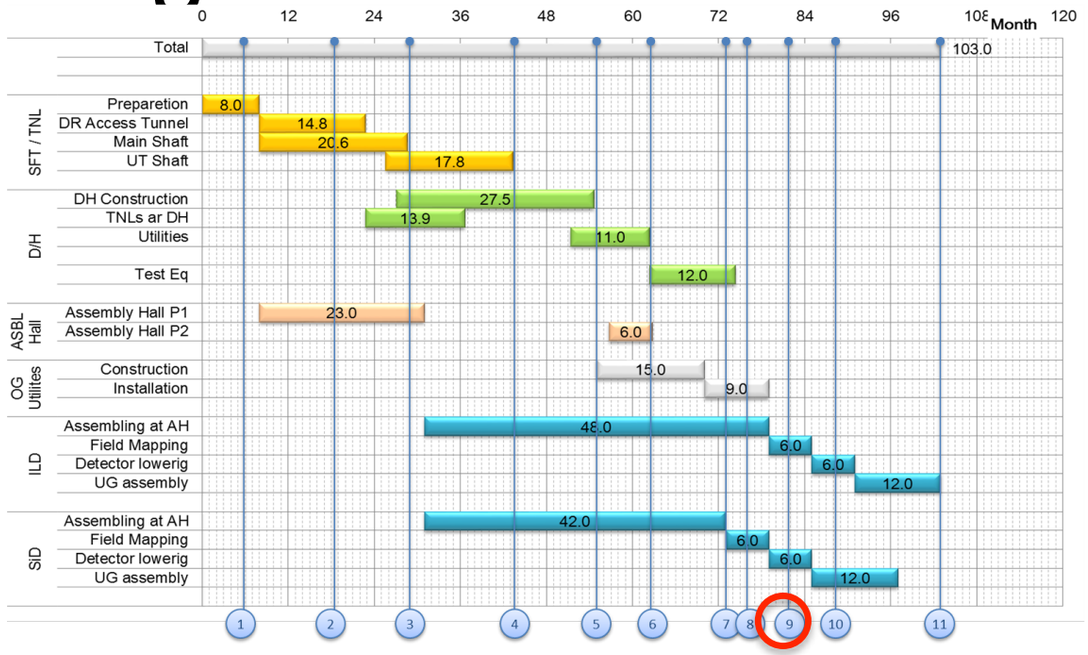
- Detectors field mapping at AsH

Ground surface allocation according timeline

No.9 SiD Detector Lowering



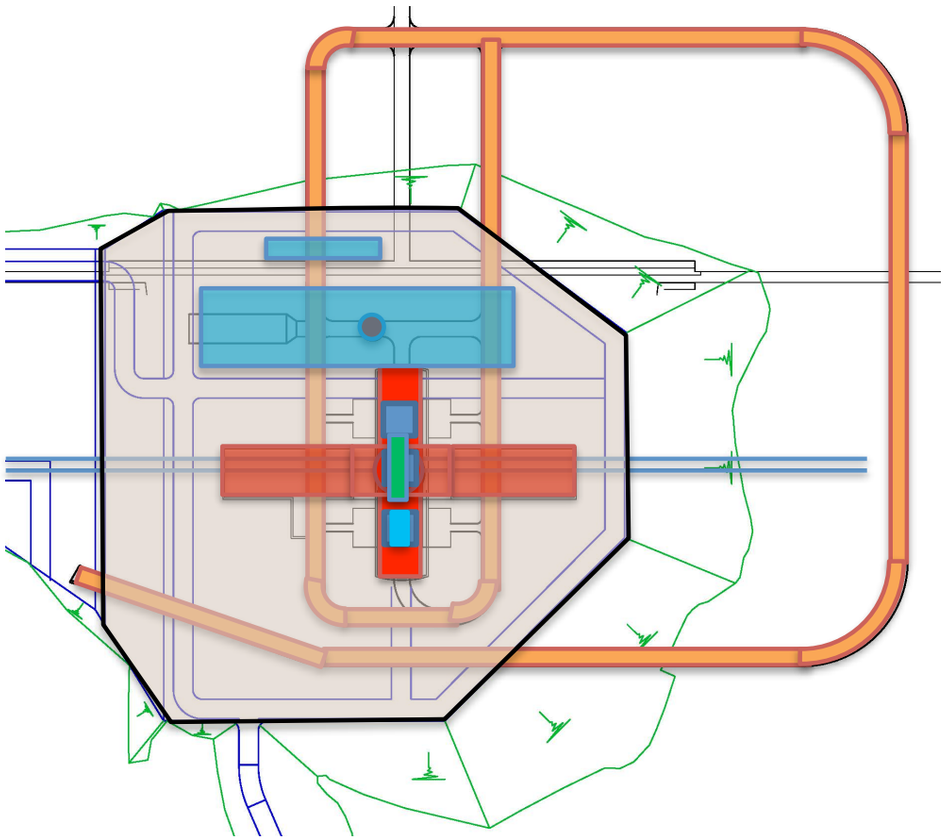


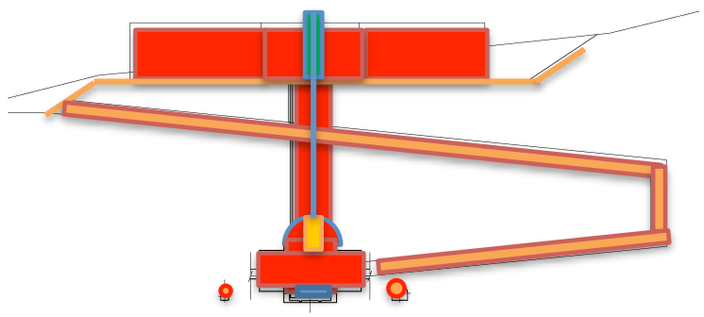


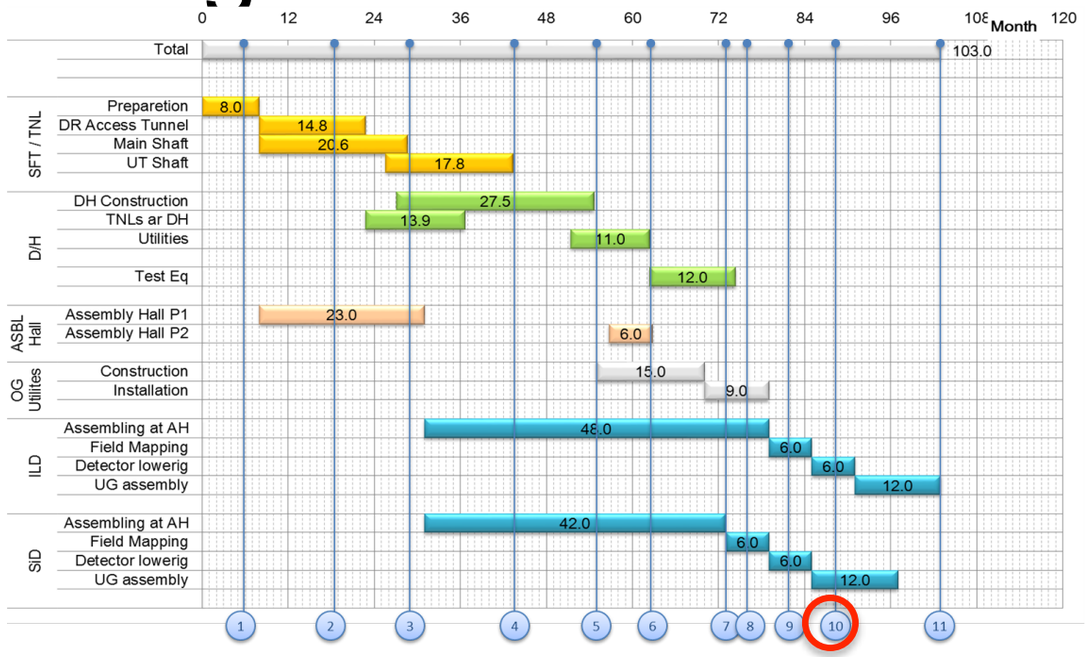
Notes
- SiD lowering

Ground surface allocation according timeline

No.10 ILD Detector Lowering



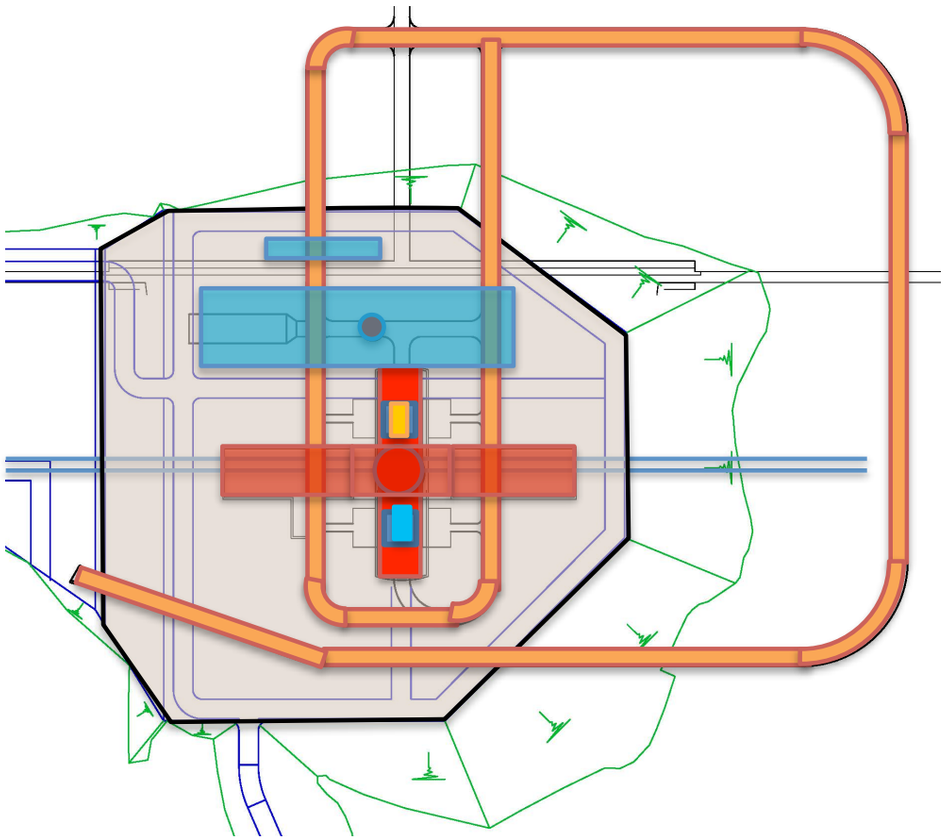


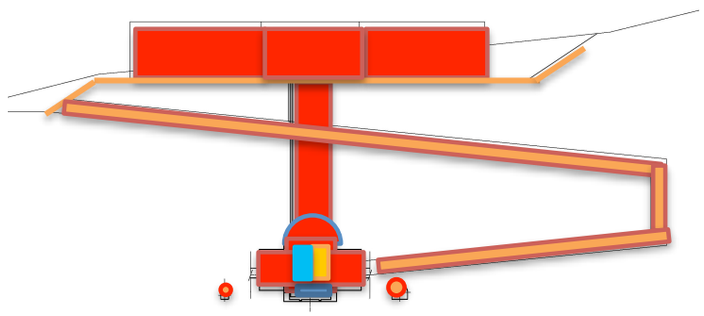


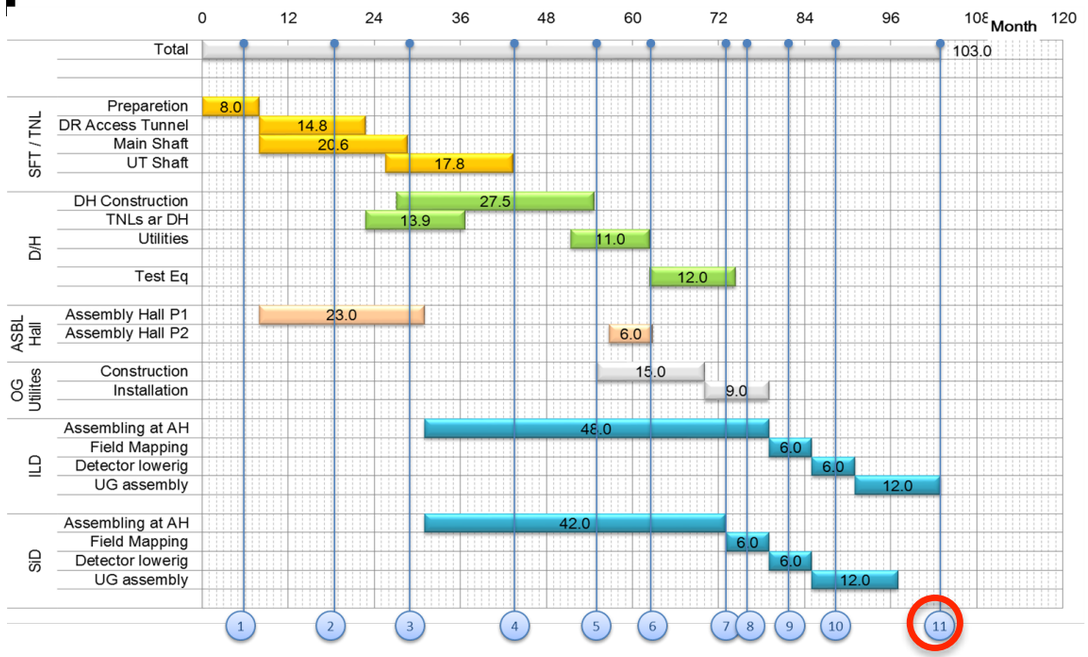
Notes
- ILD lowering

Ground surface allocation according timeline

No.11 Assembling Completion







Notes

How to Assemble ILD in Kitakami?

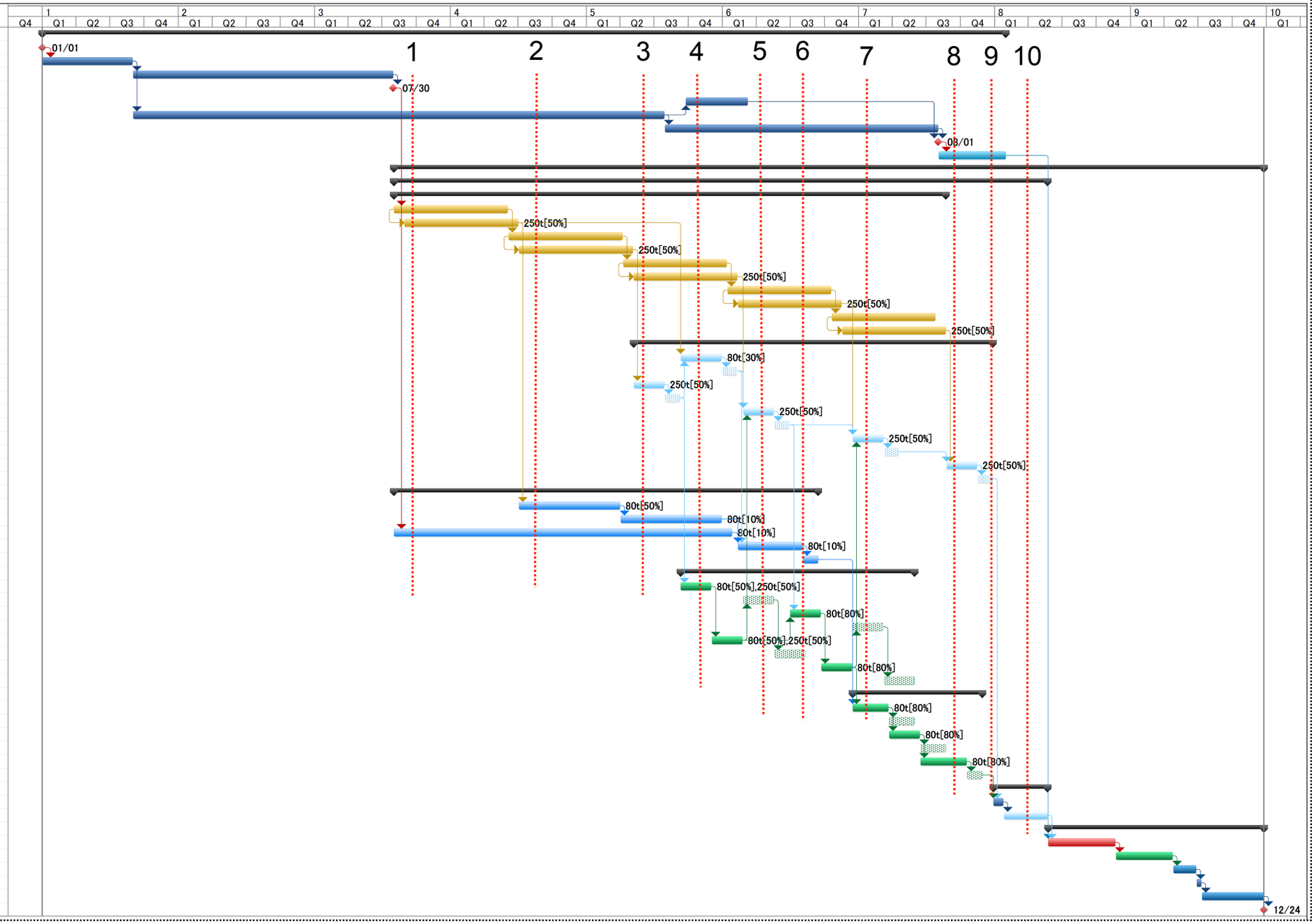
Assumption

- New timeline for CFS
  - Ground breaking (GB) 4 years after project approval
  - AH becomes ready ~2.5 years after GB
  - DH becomes ready ~6.5 yeas after GB
- Magnetic field measurement on surface after ECAL installation
- TPC and silicon inner trackers are installed after lowering the detector to DH
- AH is used only for iron yoke assembly, solenoid assembly, and installation of ECAL, HCAL, solenoid, and muon detector
- Assembly hall has a 250t crane and an 80t crane for ILD
- Installation period of each sub-detector is based on TDR

Slide from Yasuhiro Sugimoto

Gantt chart

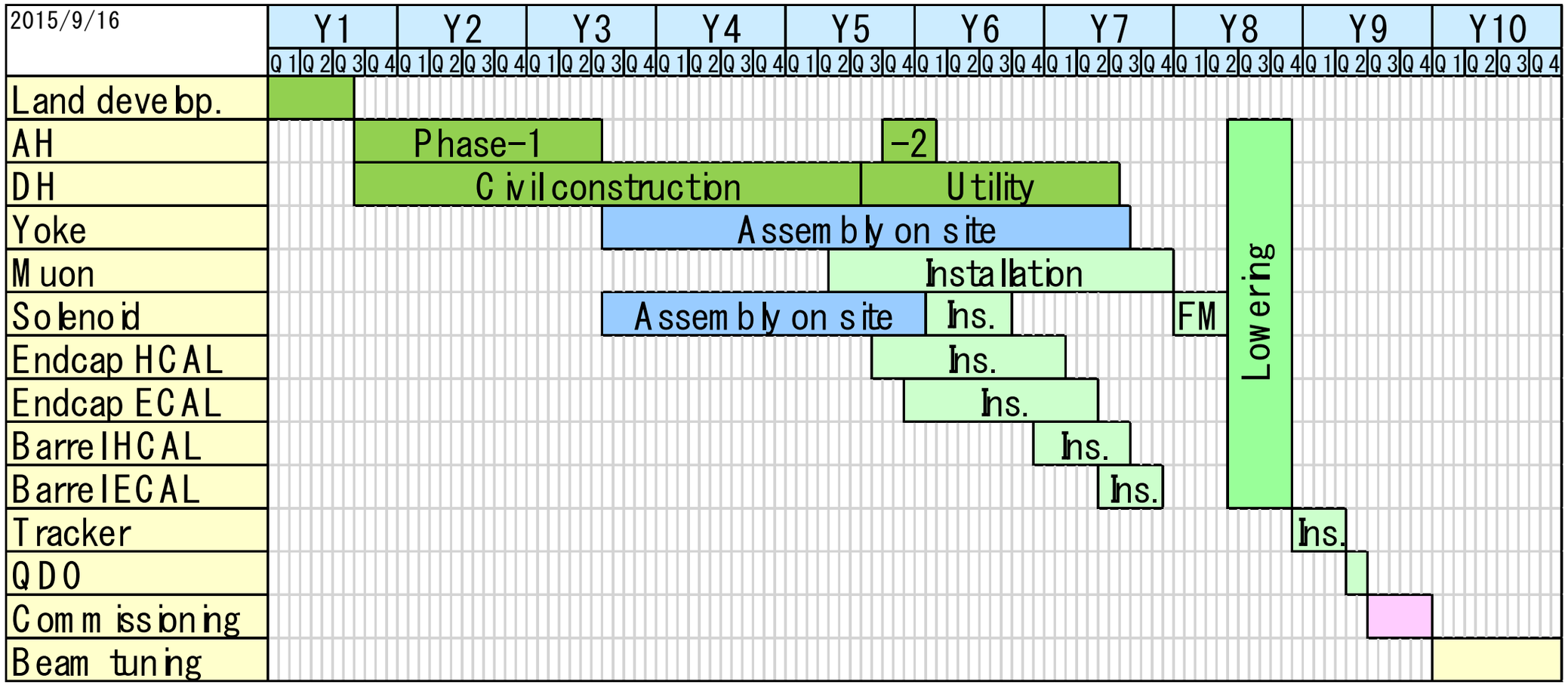
ID	タスク名
1	**Conventional Facilities**
2	Start of civil construction
3	Land development/common preparation
4	Assembly hall – Phase 1
5	AH ready for detector construction
6	AH – Phase 2
7	Detector hall/tunnel
8	Underground utilities
9	DH ready for detector lowering
10	SiD lowering
11	**ILD assembly in flat site**
12	**Surface assembly**
13	**Yoke assembly**
14	YB0 modules
15	YB0 ring
16	YE+ modules
17	YE+ ring
18	YE− modules
19	YE− ring
20	YB+ modules
21	YB+ ring
22	YB− modules
23	YB− ring
24	**Muon detector**
25	Muon detector YB0 install
26	Muon detector YB0 cabling
27	Muon detector YE+ install
28	Muon detector YE+ cabling
29	Muon detector YE− install
30	Muon detector YE− cabling
31	Muon detector YB+ install
32	Muon detector YB+ cabling
33	Muon detector YB− install
34	Muon detector YB− cabling
35	**Solenoid**
36	Outer Vacuum Tank construction
37	Inner Vacuum Tank construction
38	Coil construction
39	Coil/IVT/cryo installation
40	Coil test
41	**Endcap Calorimeters**
42	HCAL endcap+ install
43	HCAL endcap+ cabling
44	HCAL endcap− install
45	HCAL endcap− cabling
46	ECAL endcap+ install
47	ECAL endcap+ cabling
48	ECAL endcap− install
49	ECAL endcap− cabling
50	**Barrel Calorimeters**
51	HCAL barrel+ install
52	HCAL barrel+ cabling
53	HCAL barrel− install
54	HCAL barrel− cabling
55	ECAL barrel install
56	ECAL barrel cabling
57	**Magnet commissioning**
58	Close yoke
59	Field Mapping
60	**Underground assembly**
61	Lowering big parts
62	TPC/Inner detectors
63	QD0/piller
64	Close detector
65	Detector commissioning
66	Ready for commissioning with beam



Slide from Yasuhiro Sugimoto

Simplified table

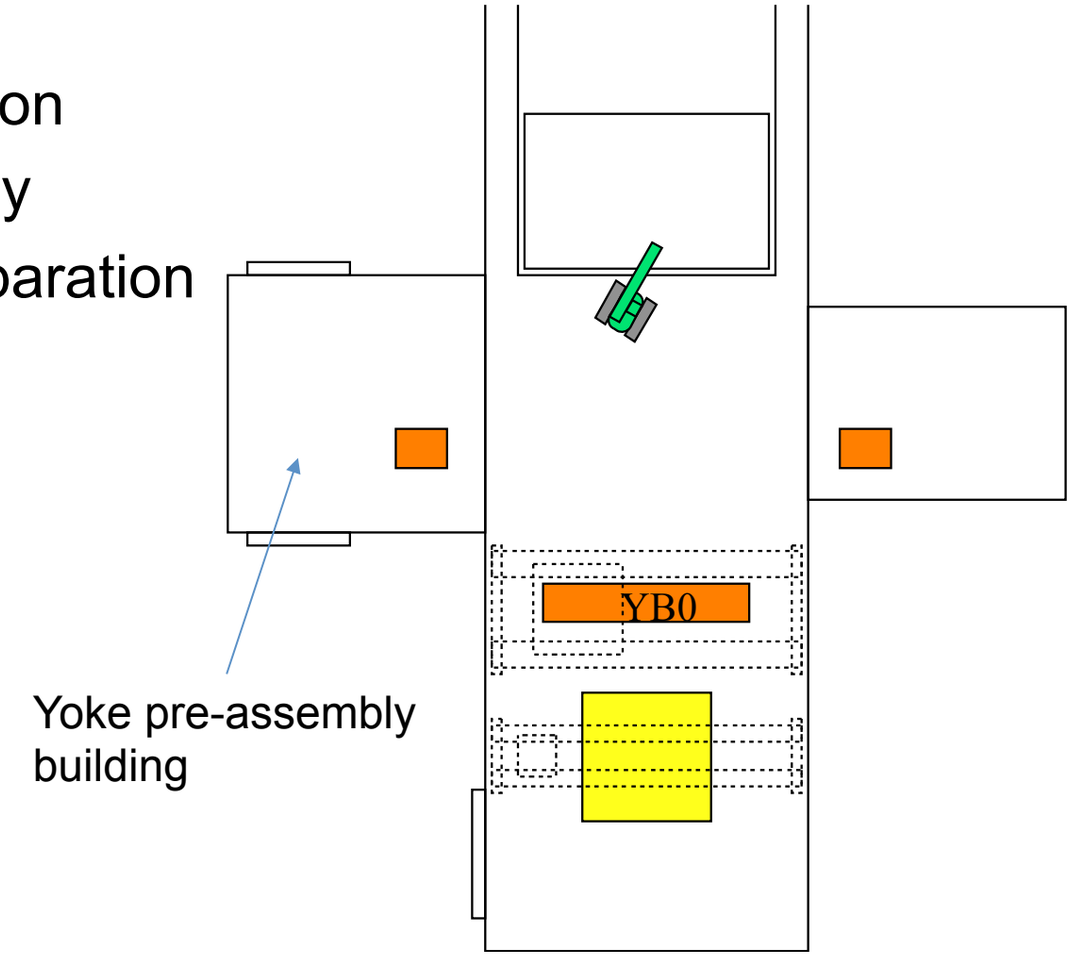
- Definition of T0 here is the beginning of the land development = Ground Breaking (consistent with CFS group)



Slide from Yasuhiro Sugimoto

Step 1

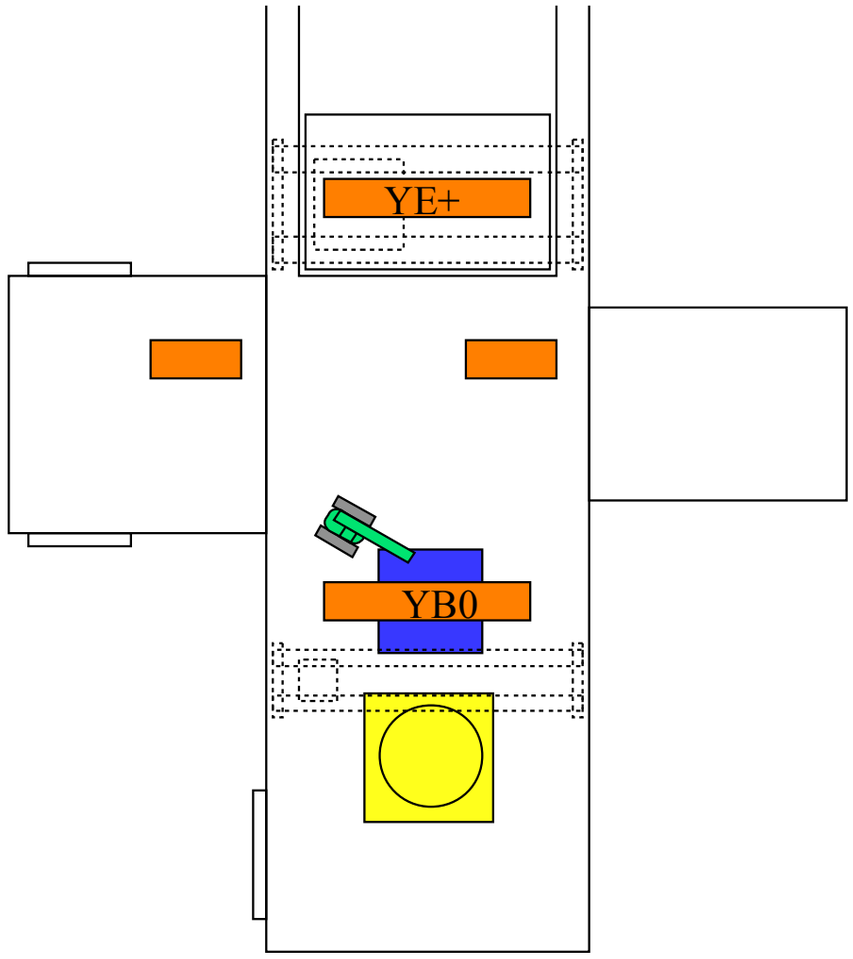
- Platform construction
- YB0 Yoke assembly
- Coil assembly preparation



Slide from Yasuhiro Sugimoto

Step 2

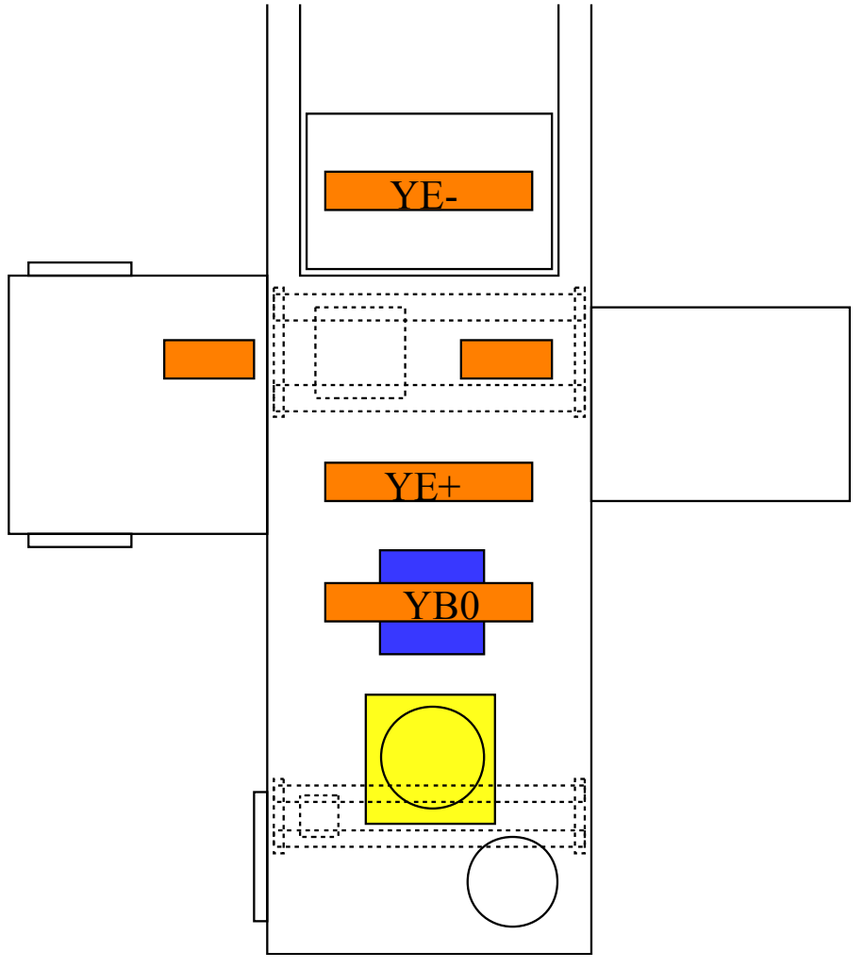
- YE+ Yoke assembly
- YB0 outer vacuum tank (OVT) assembly
- Coil assembly



Slide from Yasuhiro Sugimoto

Step 3

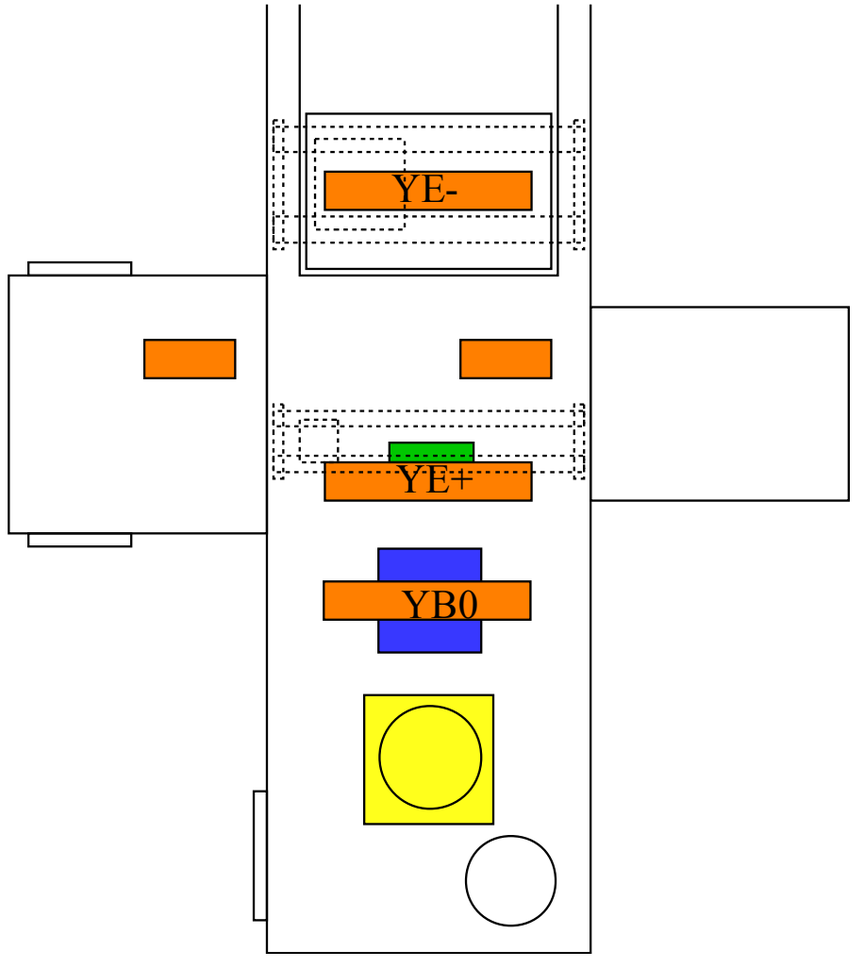
- YE- Yoke assembly
- YE+ Muon detector installation
- Inner vacuum tank (IVT), Coil assembly



Slide from Yasuhiro Sugimoto

Step 4

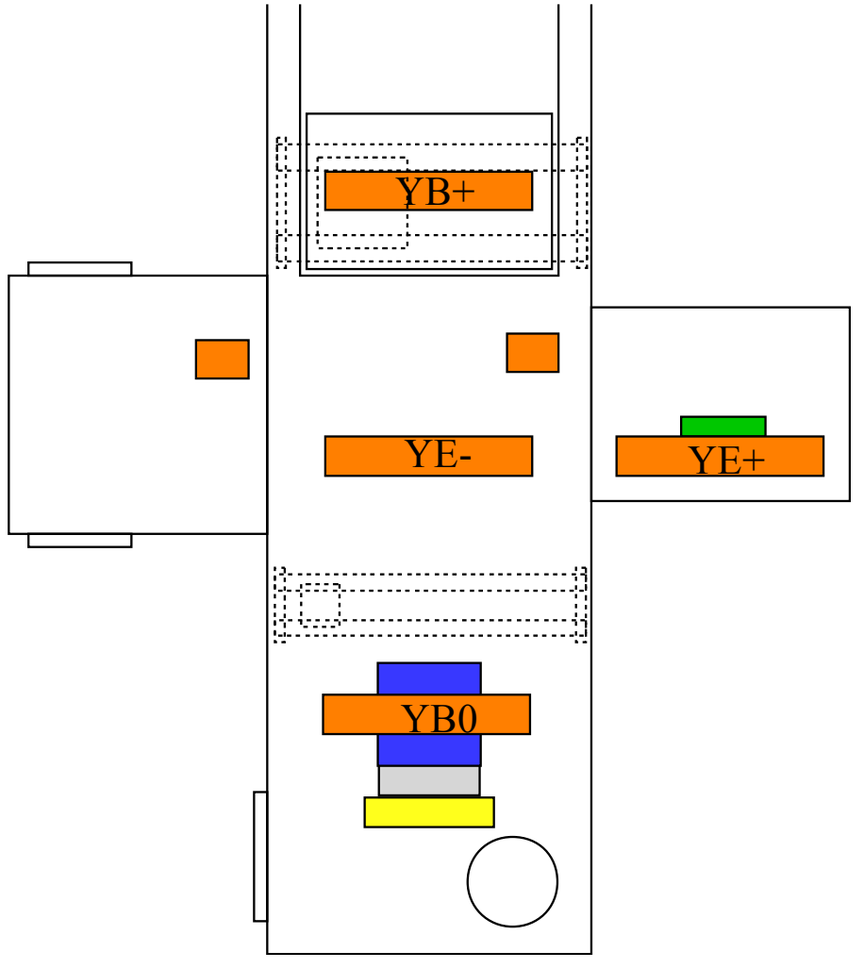
- YE- Yoke assembly
- YB0 Muon detector installation
- YE+ Calorimeter installation
- IVT, Coil assembly



Slide from Yasuhiro Sugimoto

Step 5

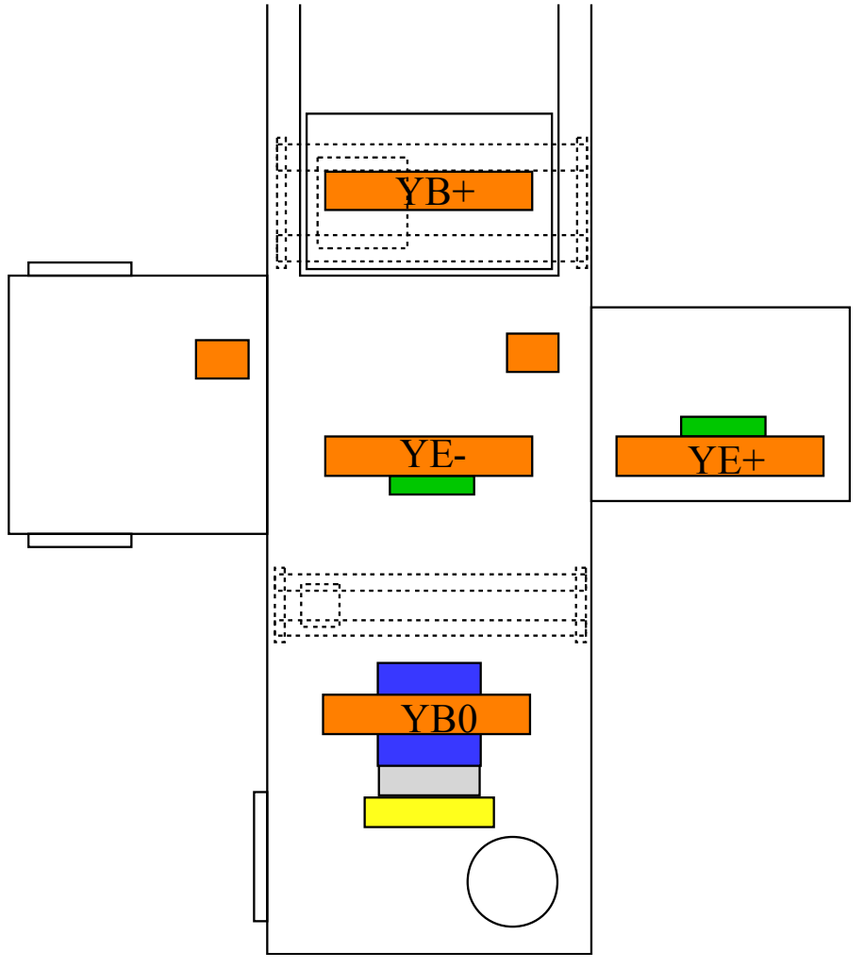
- YB+ Yoke assembly
- YE- Muon detector installation
- YE+ Calorimeter cabling
- Coil, IVT installation



Slide from Yasuhiro Sugimoto

Step 6

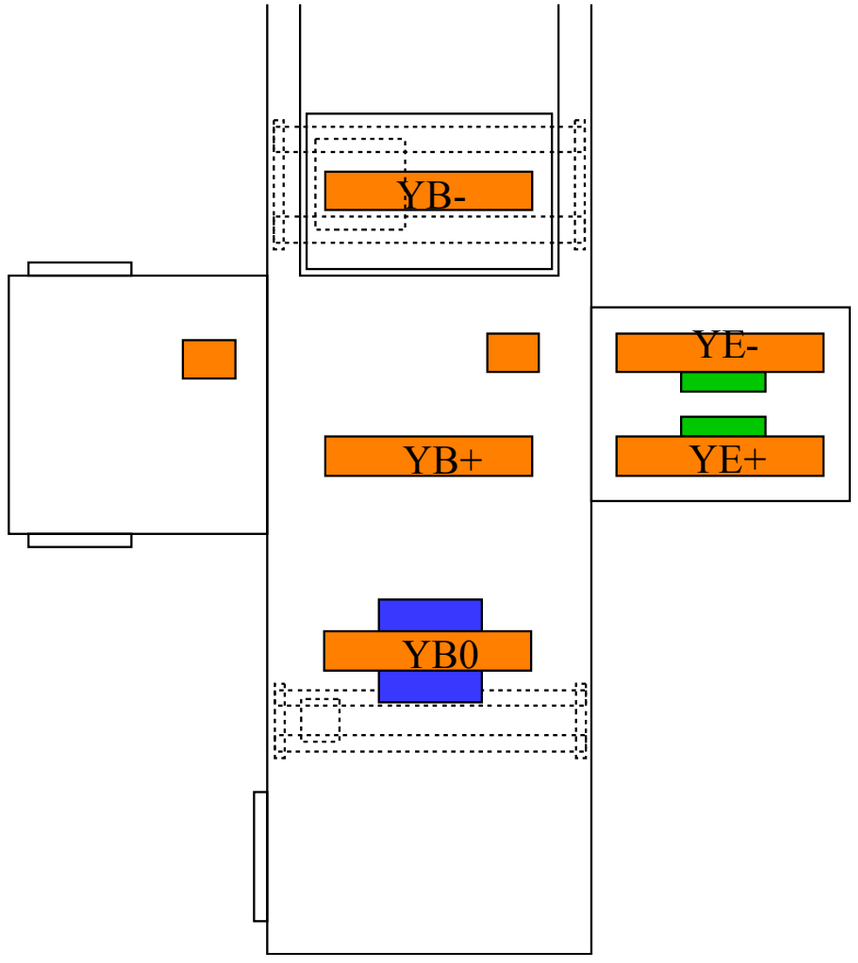
- YB+ Yoke assembly
- YE- Calorimeter installation
- Coil, IVT installation



Slide from Yasuhiro Sugimoto

Step 7

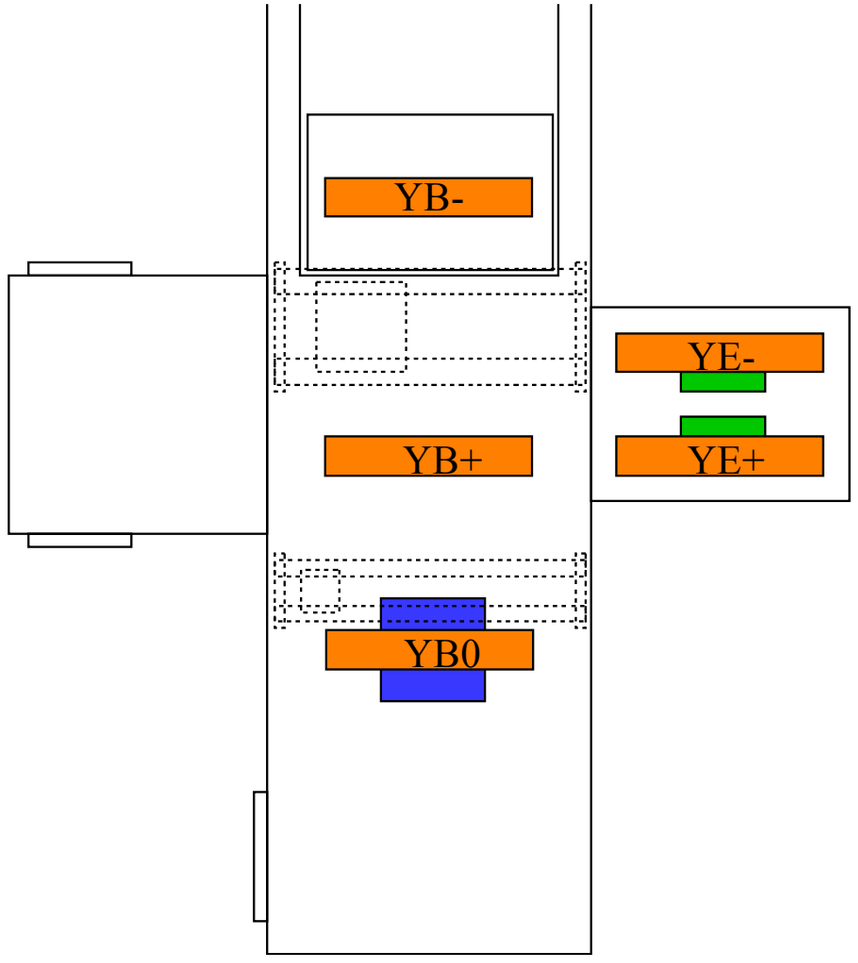
- YB- Yoke assembly
- YB+ Muon detector installation
- YE- Calorimeter cabling
- YB0 Calorimeter installation



Slide from Yasuhiro Sugimoto

Step 8

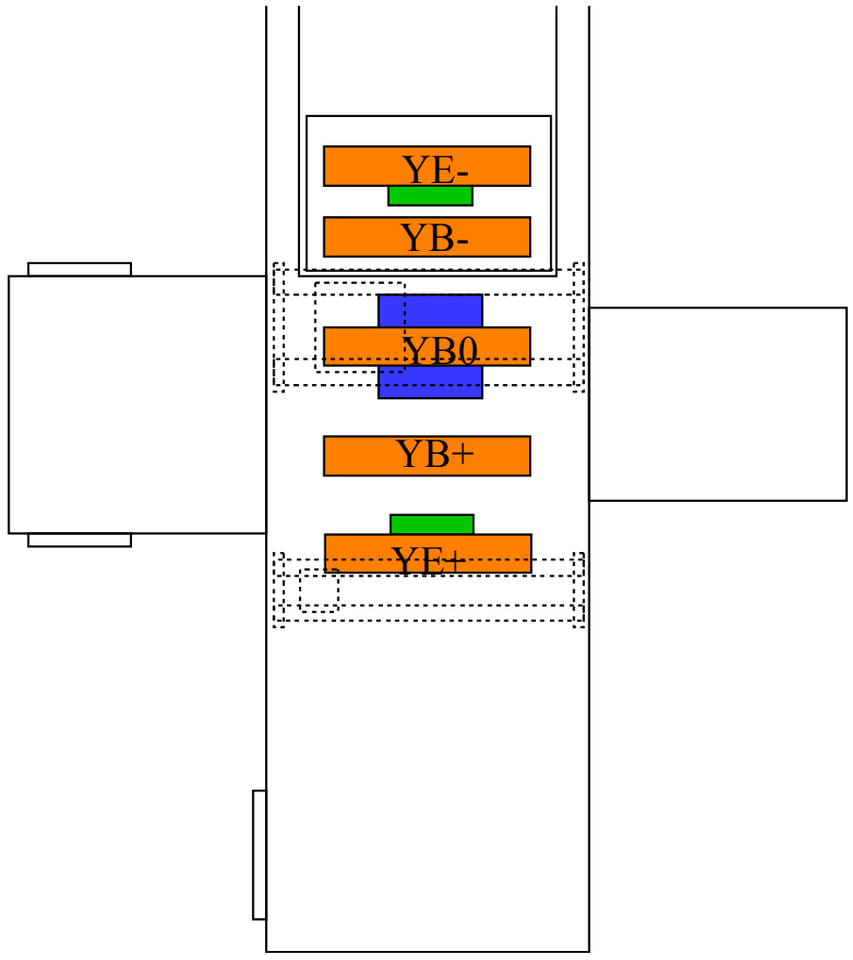
- YB- Muon detector installation
- YB0 Calorimeter installation



Slide from Yasuhiro Sugimoto

Step 9

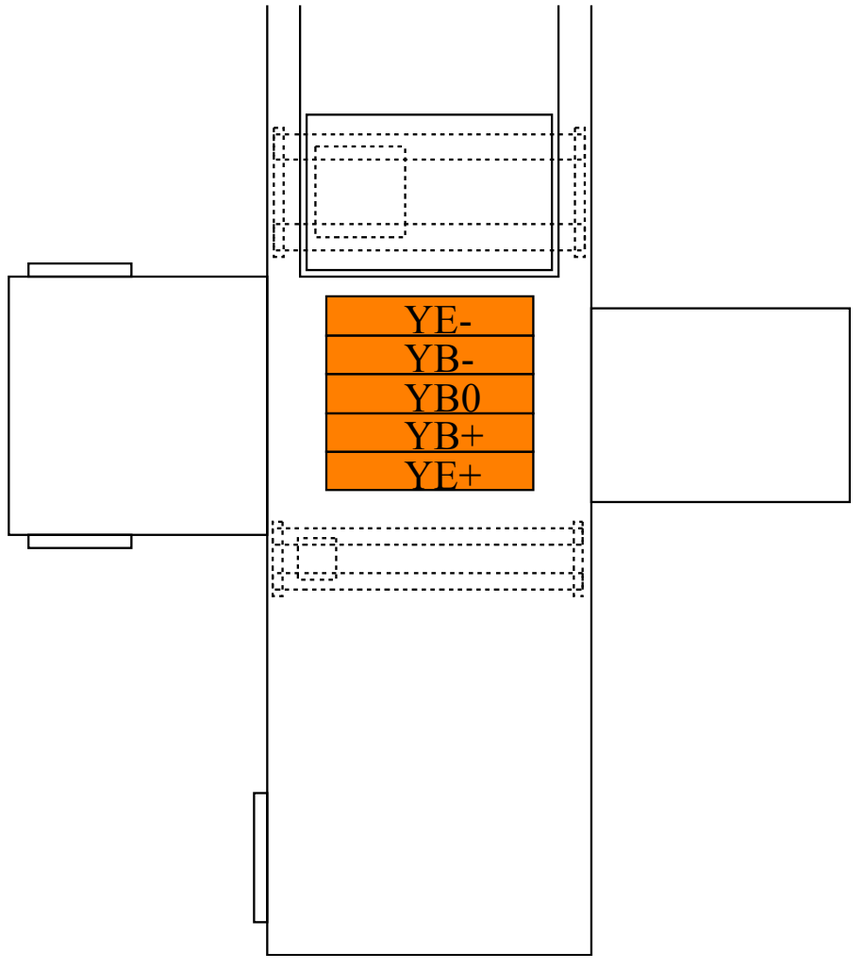
- YE-, YB-, YB0, YB+, YE+ shuffle the position



Slide from Yasuhiro Sugimoto

Step 10

- Close the detector
- Field mapping



Slide from Yasuhiro Sugimoto

Open questions

- Yoke
  - Size of yoke pre-assembly building: 20mx20m?
  - Capacity of the crane: 20t ?
- Muon detector
  - Location of module storage/test space: Central campus or IP campus? (Probably Central campus)
  - Size of the storage/test space (size for one sector (1/12) of a yoke ring would be enough)
- ECAL
  - Location of module storage/test space: Central campus or IP campus? (probably Central campus)
  - Reduction of the size (900m^2) possible? (Endcap and barrel in series)
- SDHCAL
  - Location of module storage/test space: Central campus or IP campus? (probably IP campus)
  - Reduction of the size (1200m^2) possible? (Endcap and barrel in series)
- AHCAL
  - Location of module storage/test space: Central campus or IP campus? (probably IP campus)

Slide from Yasuhiro Sugimoto

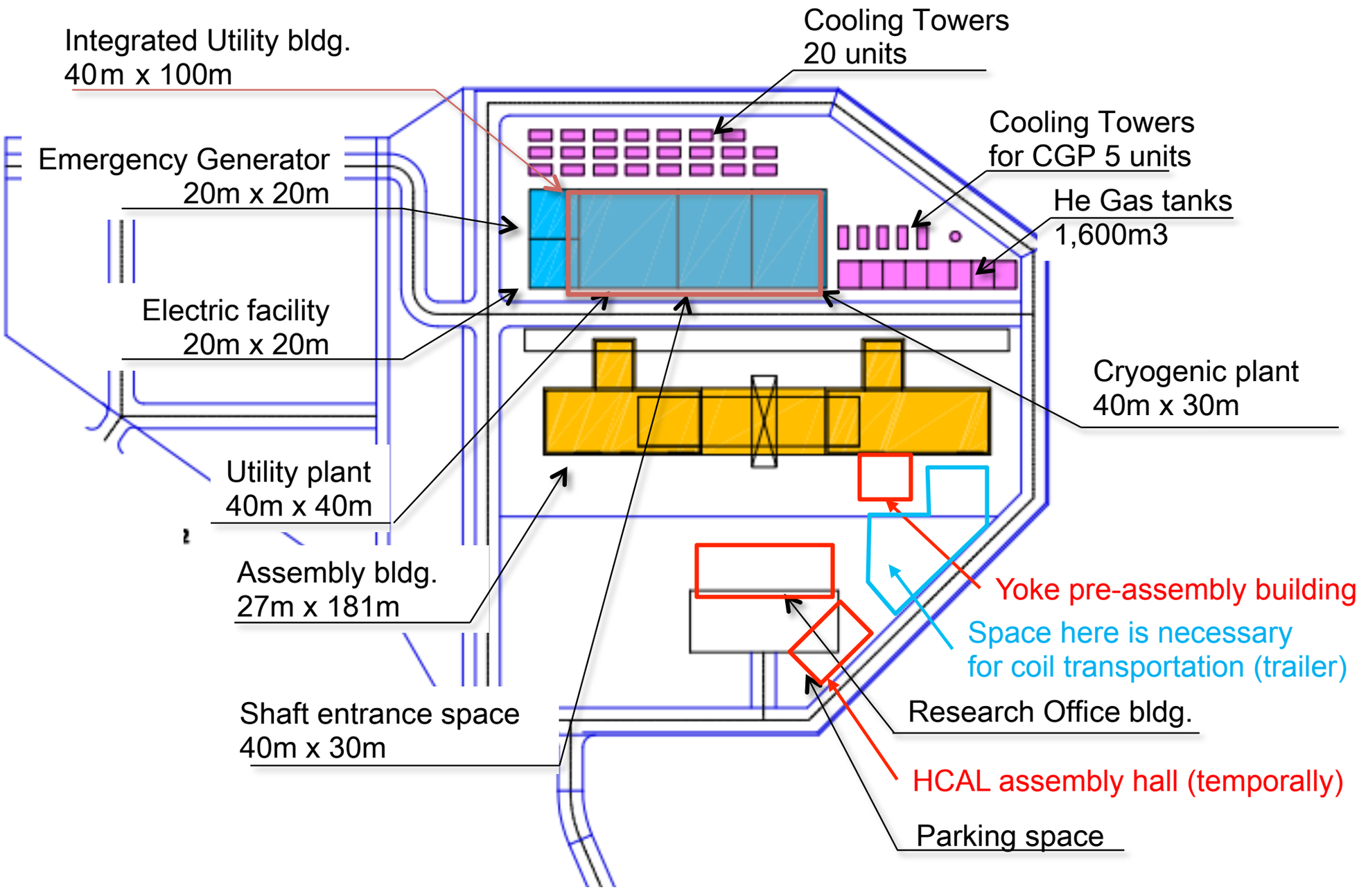
Proposal

- Fix space requirement for sub-detector assembly at IP campus
  - Iron yoke pre-assembly building (~400m^2?)
  - HCAL assembly building (~600m^2?)
  - (Control room and clean rooms for TPC and VTX/Si tracker can be located in the research office building)
  - If we can make agreement in this meeting, we would give the information to J-Power to update the IP campus design by LCWS2015

- Define ILD official timeline
  - Timeline on p15 as a starting point
  - Each sub-detector group can make “change request” to ILD technical coordination team

Slide from Yasuhiro Sugimoto

IP campus with 600m^2 HCAL-AH



Slide from Yasuhiro Sugimoto

What about the ILD subdetectors?
(selected examples)

AHCAL Assembly

Kitakami Side

or anywhere in any detector

HELMHOLTZ ASSOCIATION

DESY

Slide from Karsten Gadow

AHCAL Assembly

solution: all needed AHCAL parts fit into here

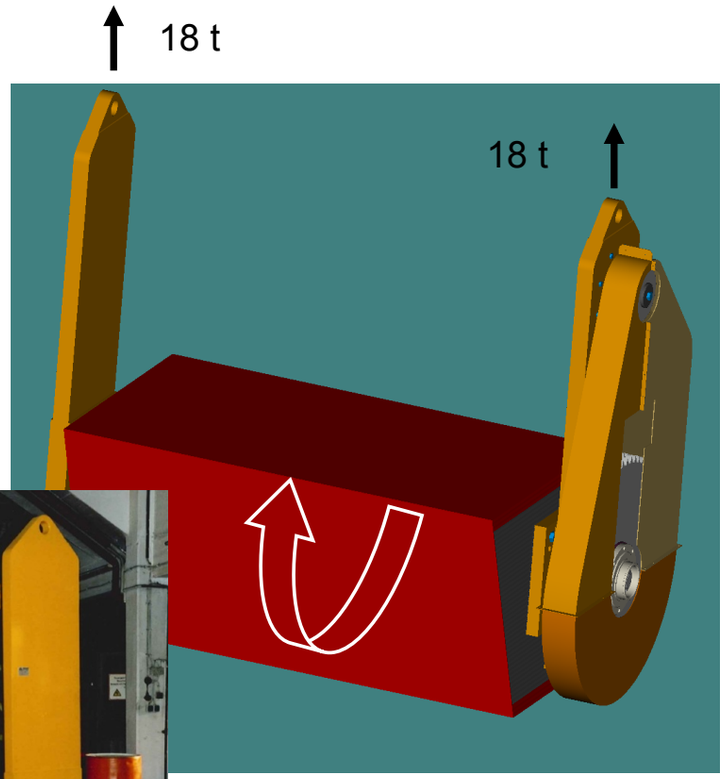
AUSSENMASSE		
Länge	mm	6058
	ft	19' 10 ½"
Breite	mm	2438
	ft	8'
Höhe	mm	2591
	ft	8' 6"

GEWICHT		
Tara	kg	2700
	pd	5950
Max. Zuladung	kg	27780
	pd	61250
Max. Bruttogewicht	kg	30480
	pd	67200

the container fits to standard transport systems as ships, railways, trucks and through tunnels…..

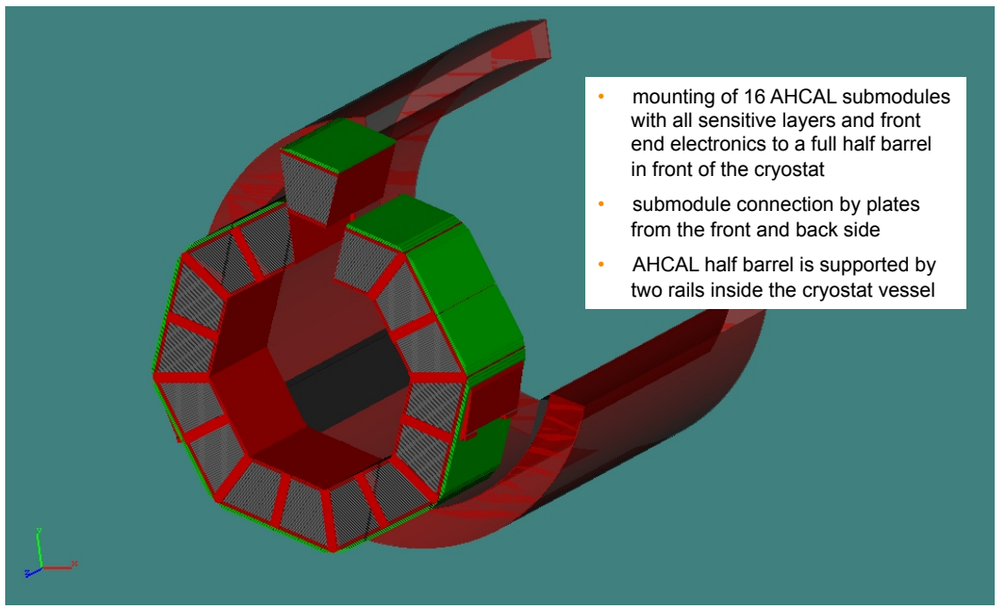
Slide from Karsten Gadow

AHCAL barrel integration tools



- lifting and turning tool for AHCAL barrel absorber submodules available
  - 2 x 18 t capacity
  - operation with 2 hooks (z angle adjustment)
  - precise motor controlled turning
  - design for adaptation for sub-modules with and without sensitive layers started
- mounting, support and insertion frame
  - insertion frame design ready
  - insertion frame support design depends on final yoke size and useable space
- push and pull tool available
  - must be modified to the rail distance and rail shap

AHCAL half barrel absorber installation
step 1



- mounting of 16 AHCAL submodules with all sensitive layers and front end electronics to a full half barrel in front of the cryostat
- submodule connection by plates from the front and back side
- AHCAL half barrel is supported by two rails inside the cryostat vessel

Slide from Karsten Gadow

AHCAL assembly in ILD
experimental site requirements

- experimental site must be reachable by standard trucks with 20“ containers and a payload of 20 t under convenient conditions (moderate slopes and curves)
- the AHCAL test hall must be passable with trucks like above
- the AHCAL test hall must be equipped with 2 x 20 t gantry cranes
- the two crane hooks must reach a distance of 2,5 m between each other and a height of 6 m over ground
- the operational area of the cranes for the AHCAL must be 10 m (crane bridge) x 20 m

  load area 4 x 8 m / AHCAL test area 6 x 8 m / AHCAL storage area 10 x 12 m
- the AHCAL test area must be air conditioned
- cooling water (16°C, 2 bar, 50 l/min) must be supplied to the AHCAL test area
- electrical power 4 x (3 phase x 400V / 50Hz, 32 A) must be supplied to the AHCAL test area
- workshop (5 m x 10 m with a height of 3,5 m) for sensitive layer repair directly at the AHCAL test area
- 4 offices with 20 m² directly at the AHCAL test area

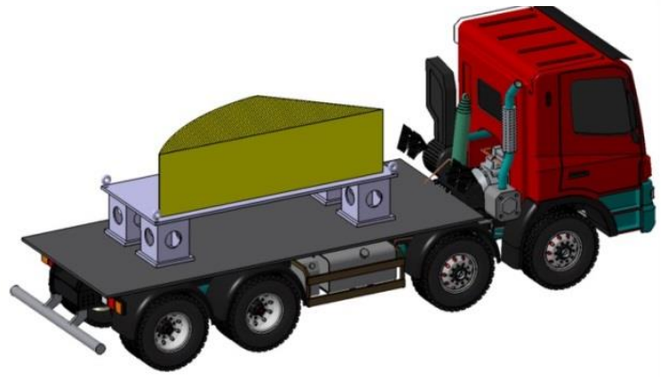
Slide from Karsten Gadow

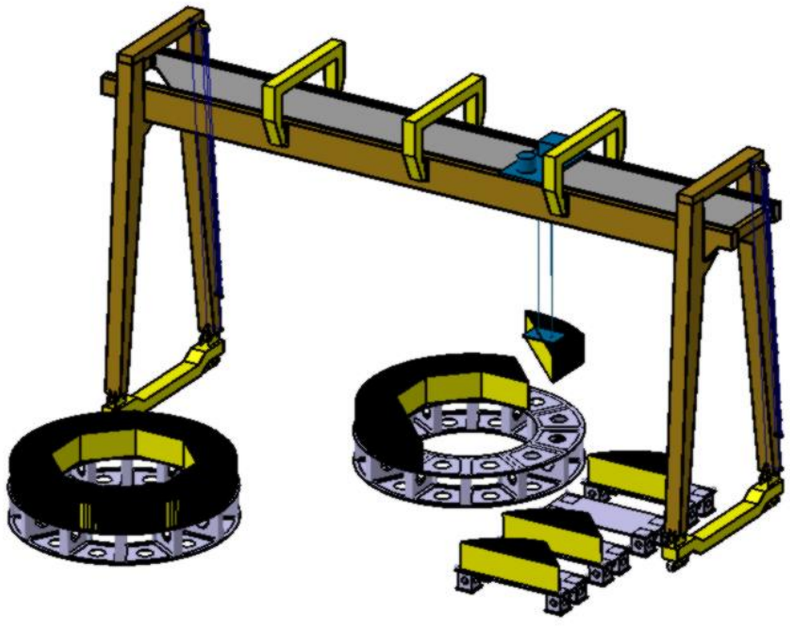
Barrel integration : scenario A

- Wheel Building in **Assembly Hall** : 8 modules x 5

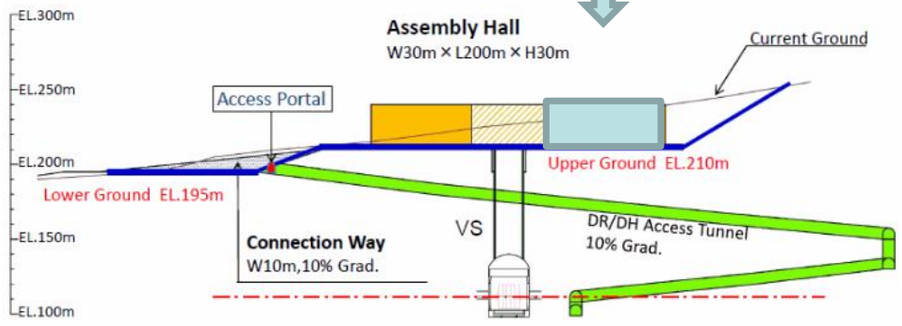
Transport to Assembly Hall with normal truck - ILD area

- **Step 1** : Wheel structure transport (8 travels) & assembly
- **Step 2** : Modules transport 40 travels with 11 t
- **Step 3 :** Modules assembly on the wheel structure with 100 t crane
  - 8 modules in position on specific tool & screwing/welding





Road to



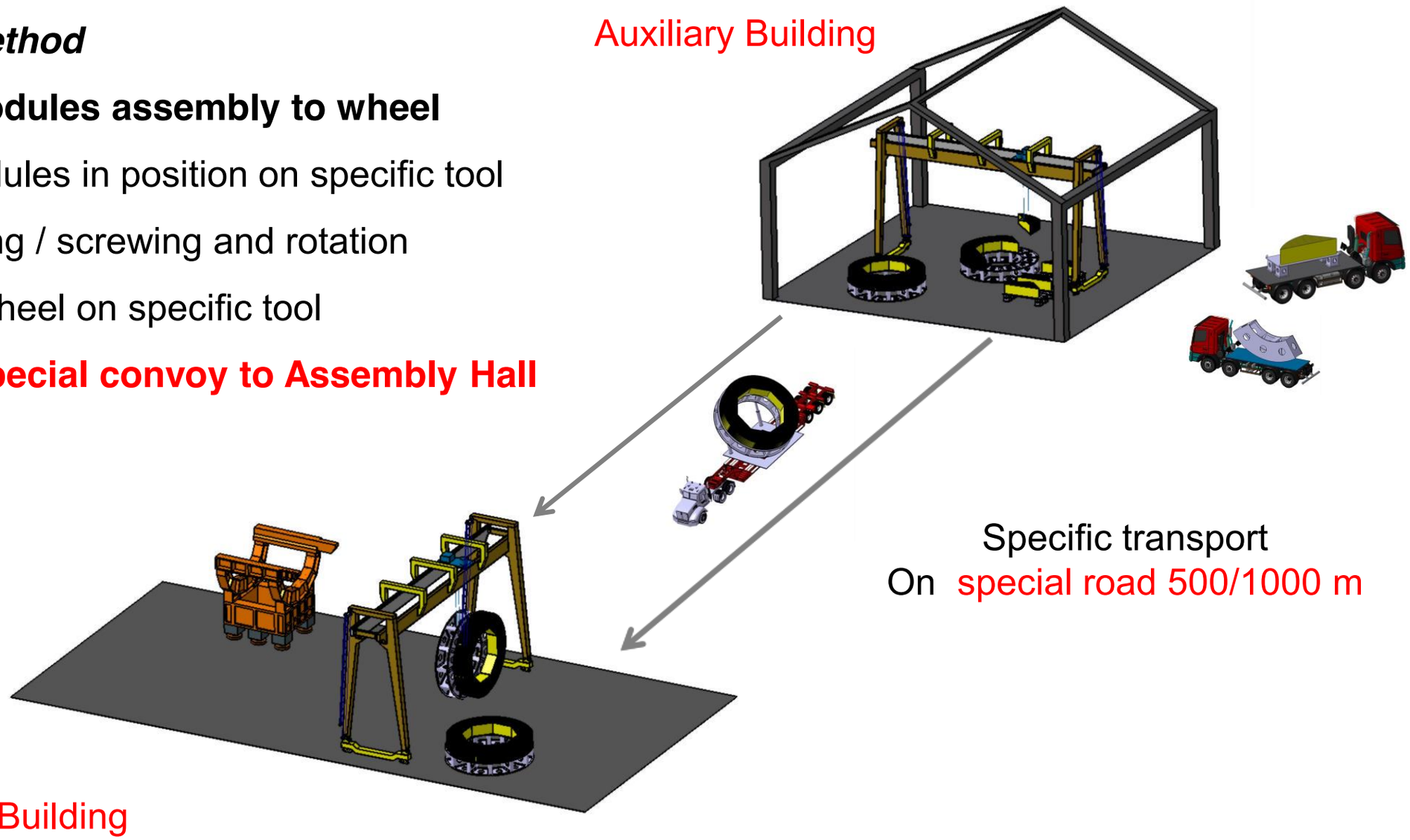
Longitudinal section

Slide from J.C. Ianigro

Wheel assembly in Auxiliary building : s

Building Method

- **Step 1 : Modules assembly to wheel**
  - 8 modules in position on specific tool
  - welding / screwing and rotation
- **Step 2 :** Wheel on specific tool
- **Step 3** : **Special convoy to Assembly Hall**



Slide from J.C. Ianigro

Barrel integration : scenario C

- Wheel assembly in Auxiliary building : 8 modules => 5 wheels

Building Method

•**Step 1 : Modules assembly to wheel**

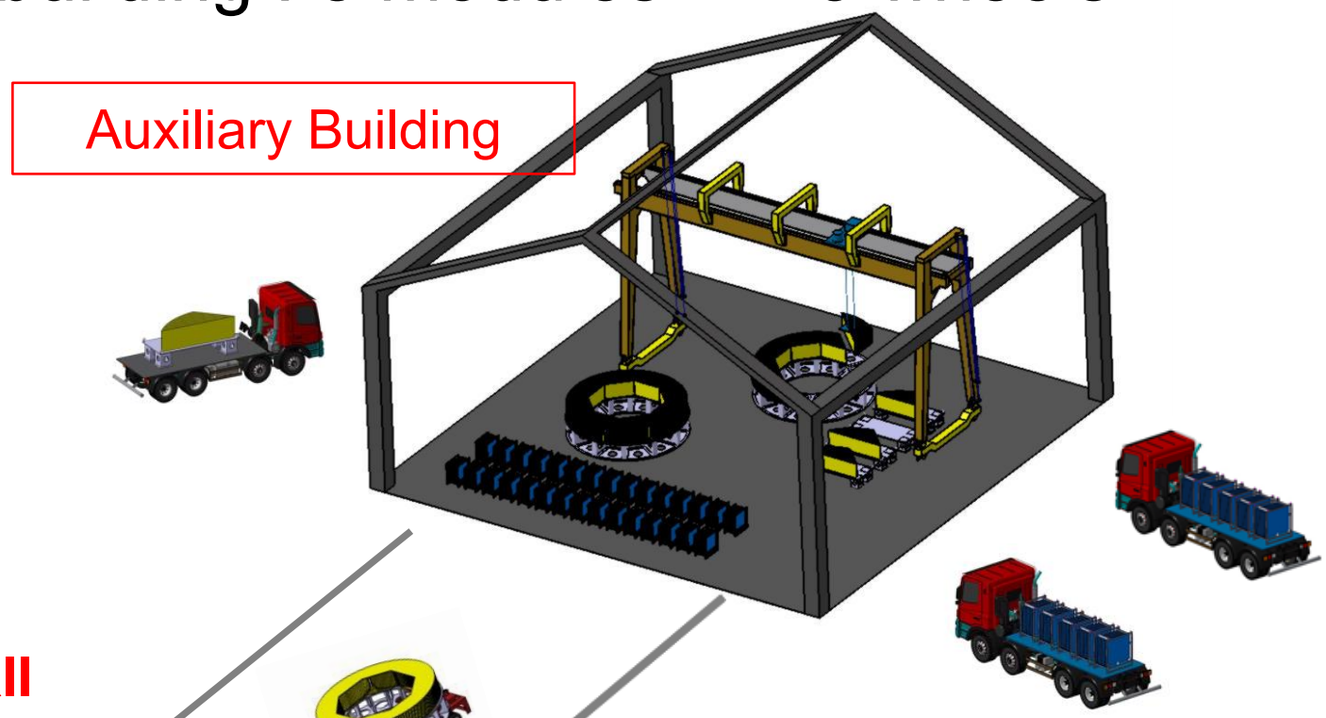
  • 8 modules in position on specific tool

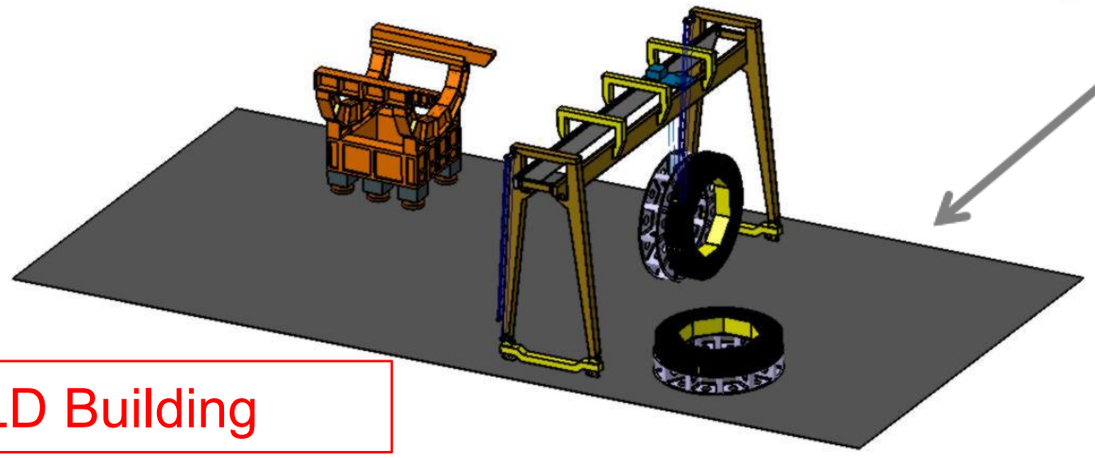
  • welding / screwing and rotation

• **Step 2 :** Wheel on specific tool

• **Step 3** : GRPC insertion and connected

• **Step 4** : **Special convoy to Assembly Hall with GRPC inside wheels – ready to be connected**





Specific Damper transport
On special road 500/1000 m

Slide from J.C. Ianigro

Back to Transportation

- Container vessel „MOL Comfort“, 8110 TEU, Mitsui O.S.K. Lines
- Line service LP1: Japan - Hong Kong - Singapore - Jeddah - Rotterdam - Hamburg - Southampton - Le Havre and back to Japan

„MOL Comfort“ 17.6.2013

- Indian Ocean between Singapore and Jeddah

„MOL Comfort“ Rear Part

- Salvage operation failed, sunk on June 27th.

„MOL Comfort“ Rear Part

- Salvage operation failed, sunk on June 27th.

„MOL Comfort“ Front Part

- Salvage operation failed, caught fire, sunk on July 11th

„MOL Comfort“ Front Part

- Salvage operation failed, caught fire, sunk on July 11th

„MOL Comfort“ Front Part

- Salvage operation failed, caught fire, sunk on July 11th

„MOL Comfort“ Front Part

- Salvage operation failed, caught fire, sunk on July 11th

A Toshiba klystron for the XFEL was on board of this ship….

Summary

- The planning for the layout and infrastructure at the Kitakami site is advancing
- Now is the time to provide input from ILD for this process
  - Area and space requirements
  - Infrastructure: power, cooling, computing, etc.
  - Special environments: clean rooms, etc.
- Need to understand better the dependencies on local conditions, e.g. transportation limits, on ILD assembly and maintenance philosophy
- We have a proposal for a central ILD installation plan
  - continue discussions and finalise a.s.a.p.
- Next integration/infrastructure meeting (besides Whistler)
  - March 2016 KEK
  - ECFA WS June 2016 Santander