Interaction Region Issues

Report from MDI/CFS Workshop

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ILD Workshop, Oshu City
09.09.2014

Change Control

ILC Change Control Process

- ILC Baseline Design as described in TDR is now under change control
- Design changes need to follow a defined process and need approval by LCC directorate

1. Proposing a design change

- Change Request (CR)
- Change Request Creater (CRC)
- Written document
- Submitted to Change Management Board (CMB)

2. Expert review

- Reviewed by CMB with additional experts as needed
- CMB defines the scope of the review
- Communication with all stakeholders
- Capture relevant documents

3. Decision

- Results with recommendation from (2) presented to ILC Director
- Written summary document
- ILC Director (in consultation with the CMB) makes final decision, or
- Decision is escalated to LCC directorate.

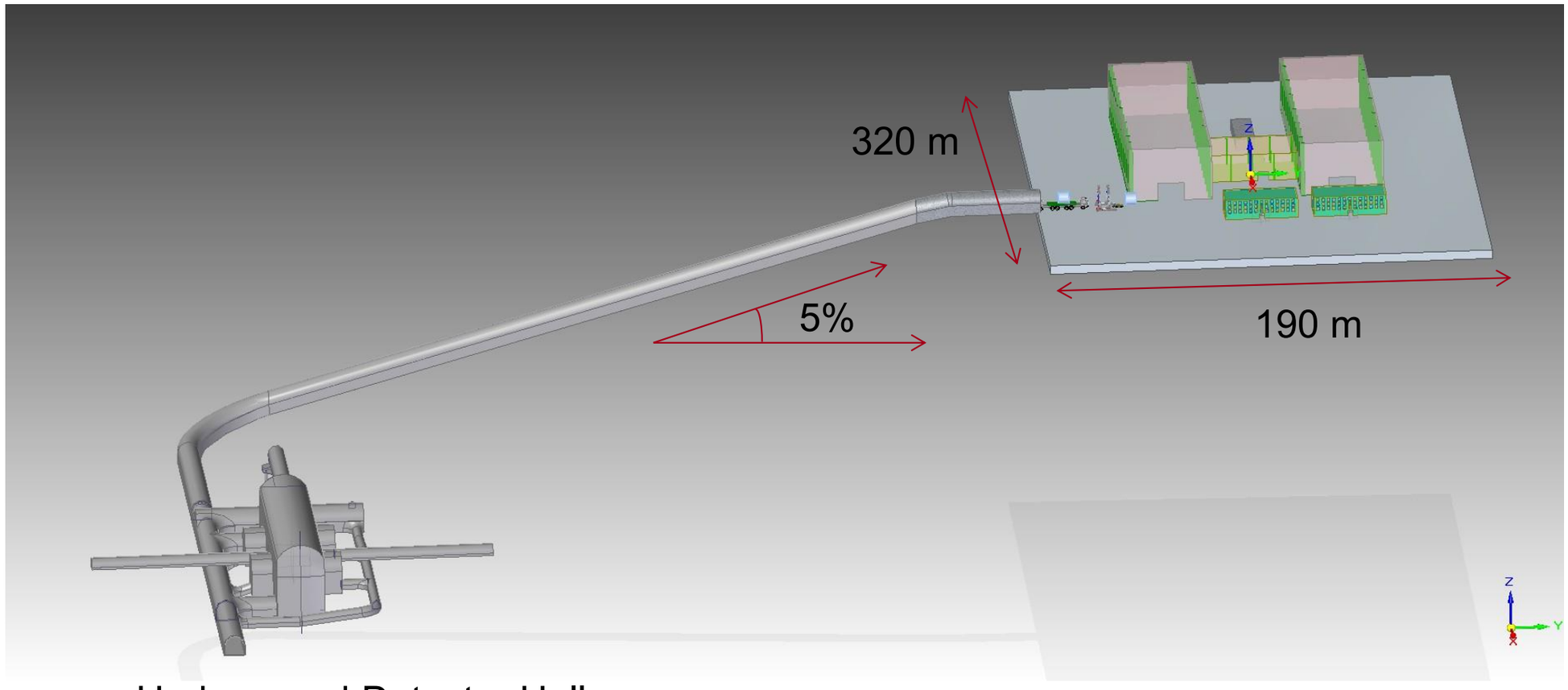
4. Updating TDD to reflect the change

- CMB identiifies team (and team leader) to implement change.
- Generate scope of work
- Develope implementation plan
- Release of updated TDD

The Interaction Region (proud home of ILD…)

Baseline Detector Hall Scenario (TDR)

- TDR assumed Japanese site would be very mountainous - no flat top area to place a surface installation atop the underground areas
- Access to underground areas via horizontal tunnel of ~1km length and up to 10% slope
- Detector installation mostly underground

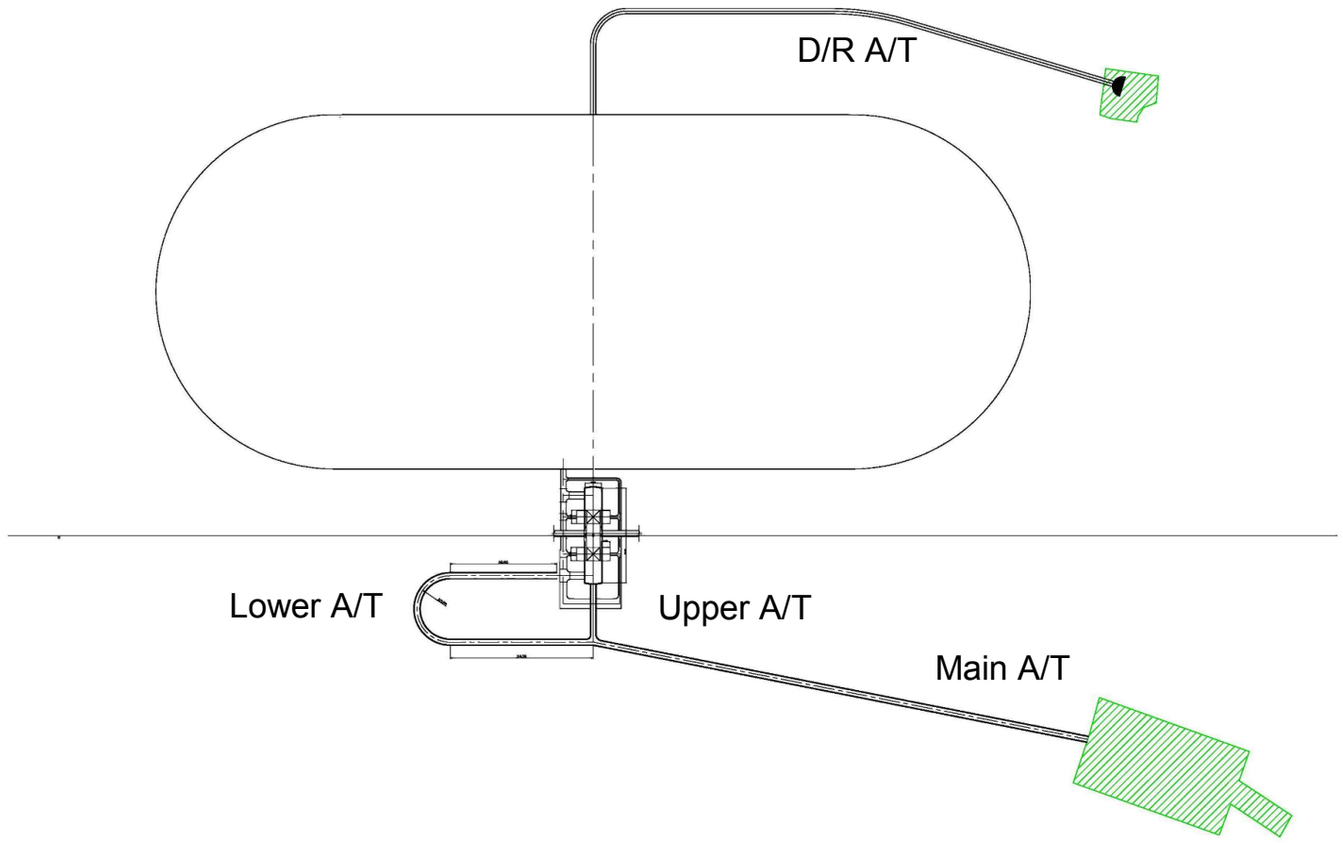


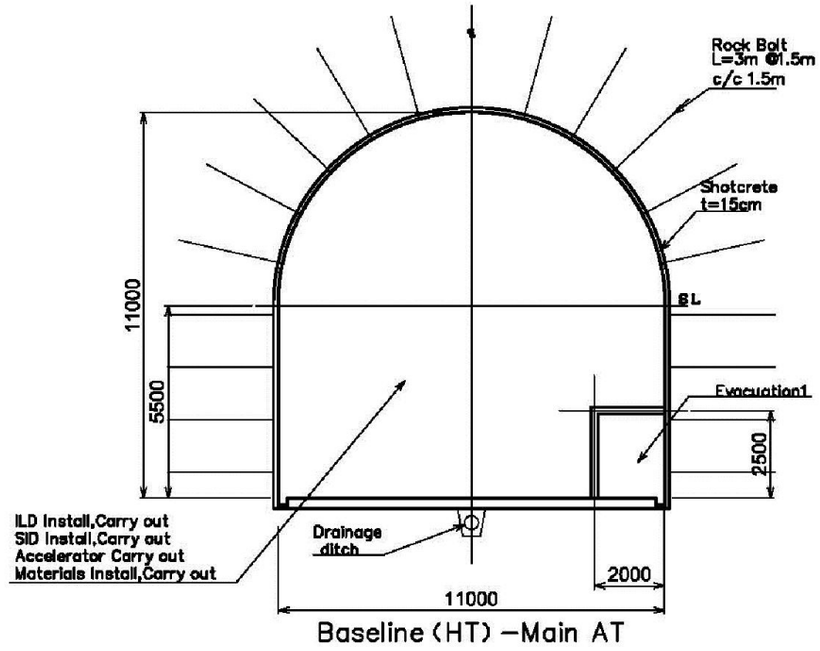
Undergound Detector Hall

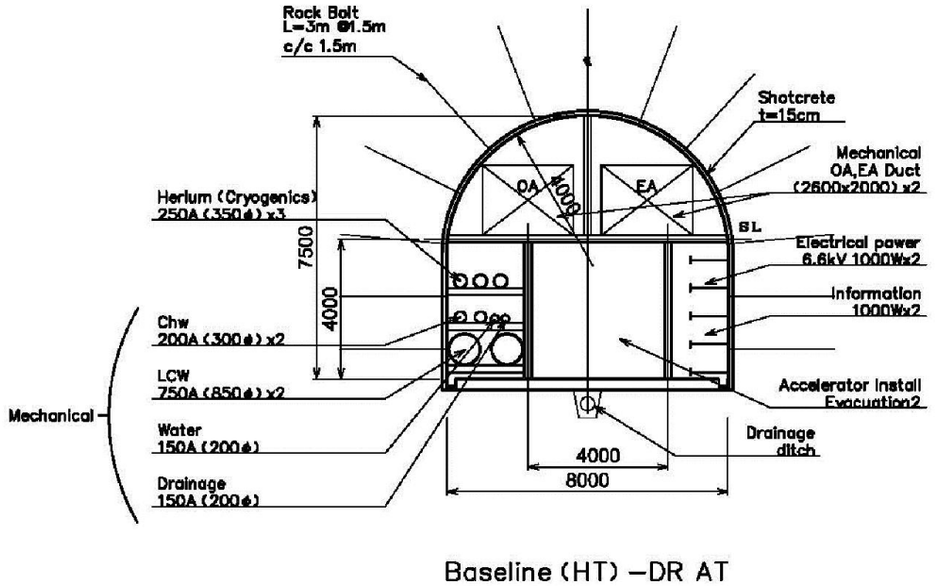
Baseline General layout

Tunnel access for D/H

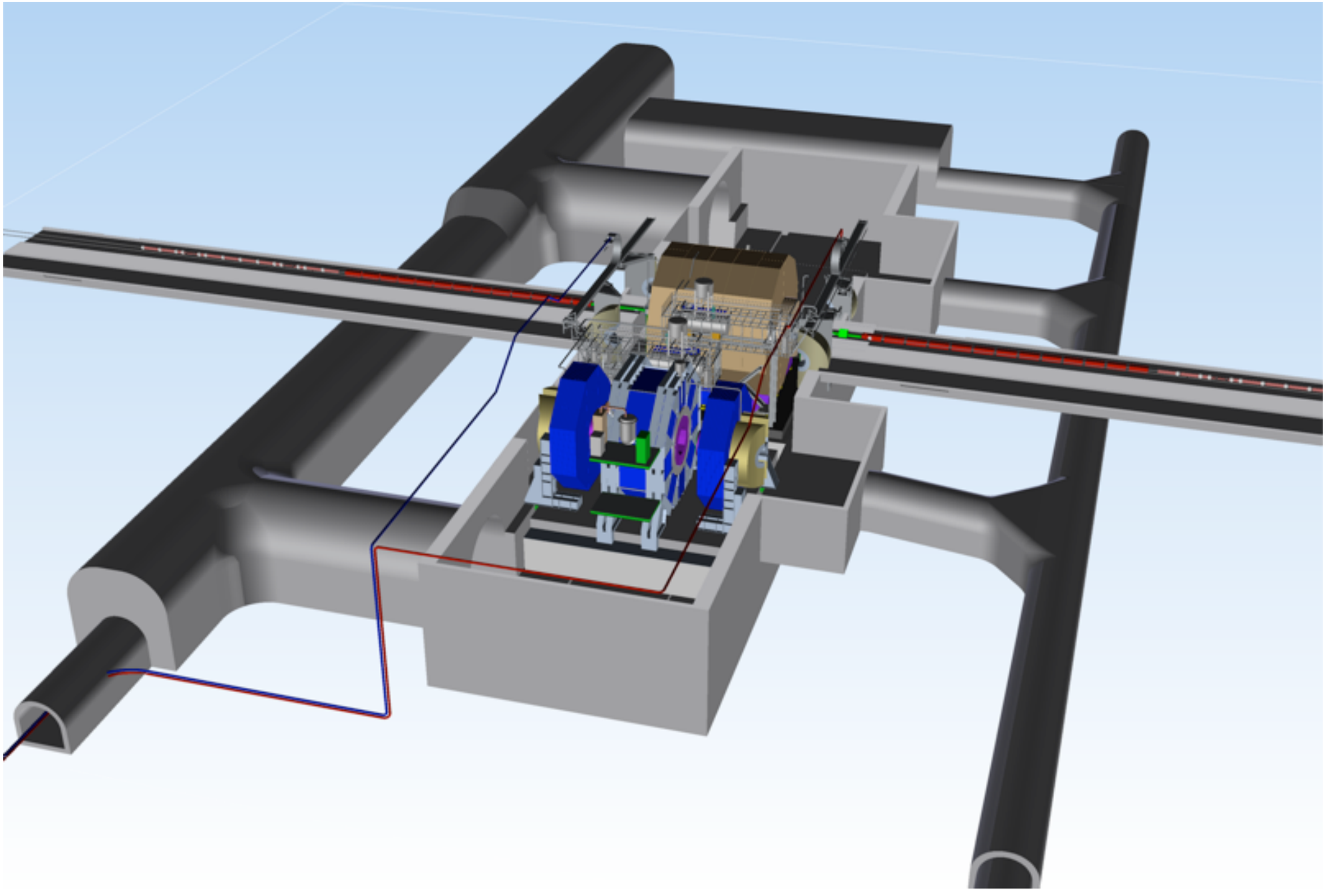
D/H access tunnels : D:11m , grad:7%
  Detectors assembling and access to D/H
D/R access tunnels : D:8m , grad:10%
  Accelerators transportation and utility lines for D/H and D/R





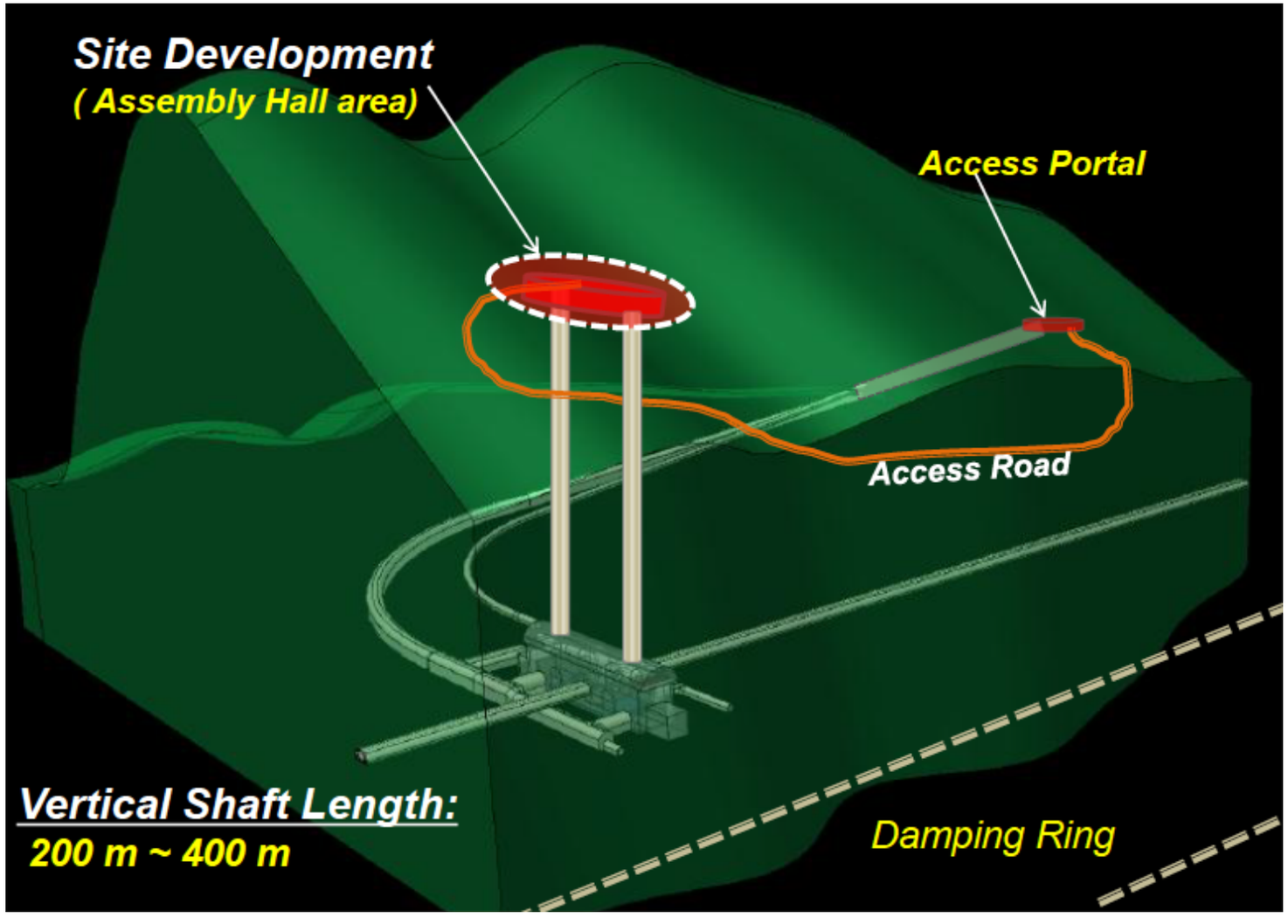


TDR Interaction Region



Kitakami Site

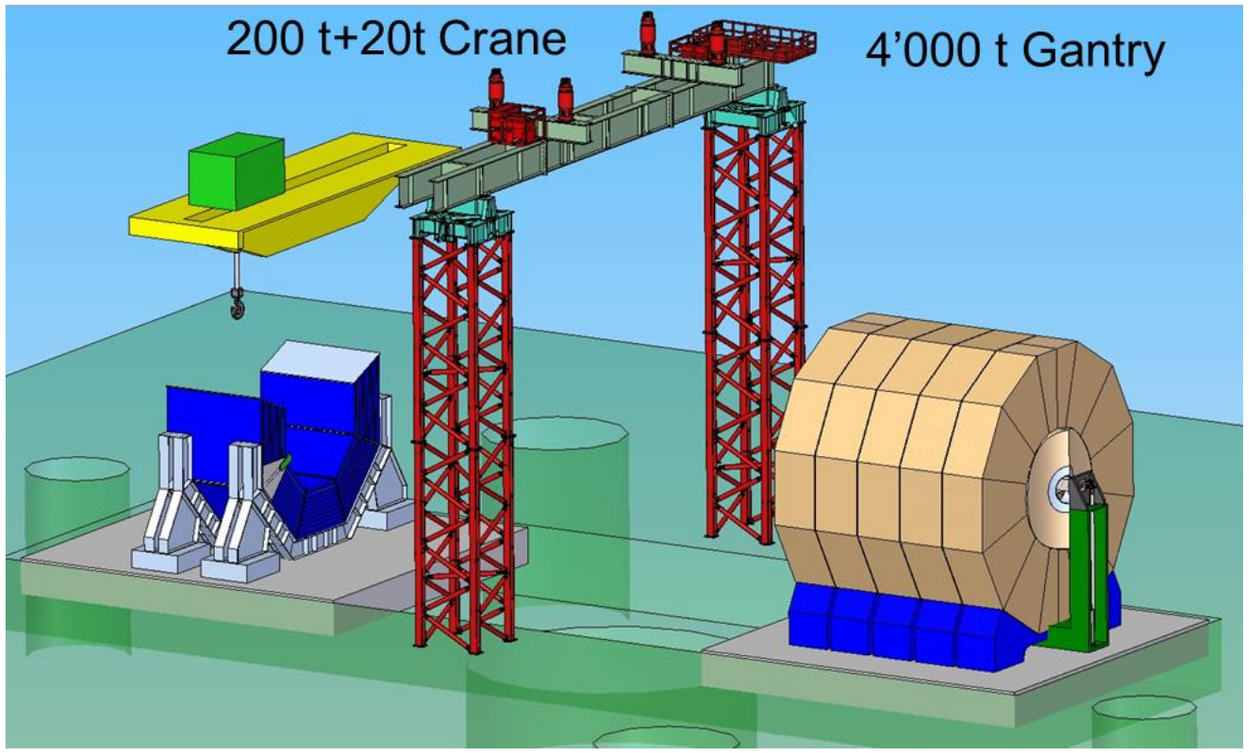
- Selected site in Kitakami has no steep mountains around the interaction area
- Vertical access to underground areas seems possible
- CFS and MDI groups started initiative at LCWS13 to look into this

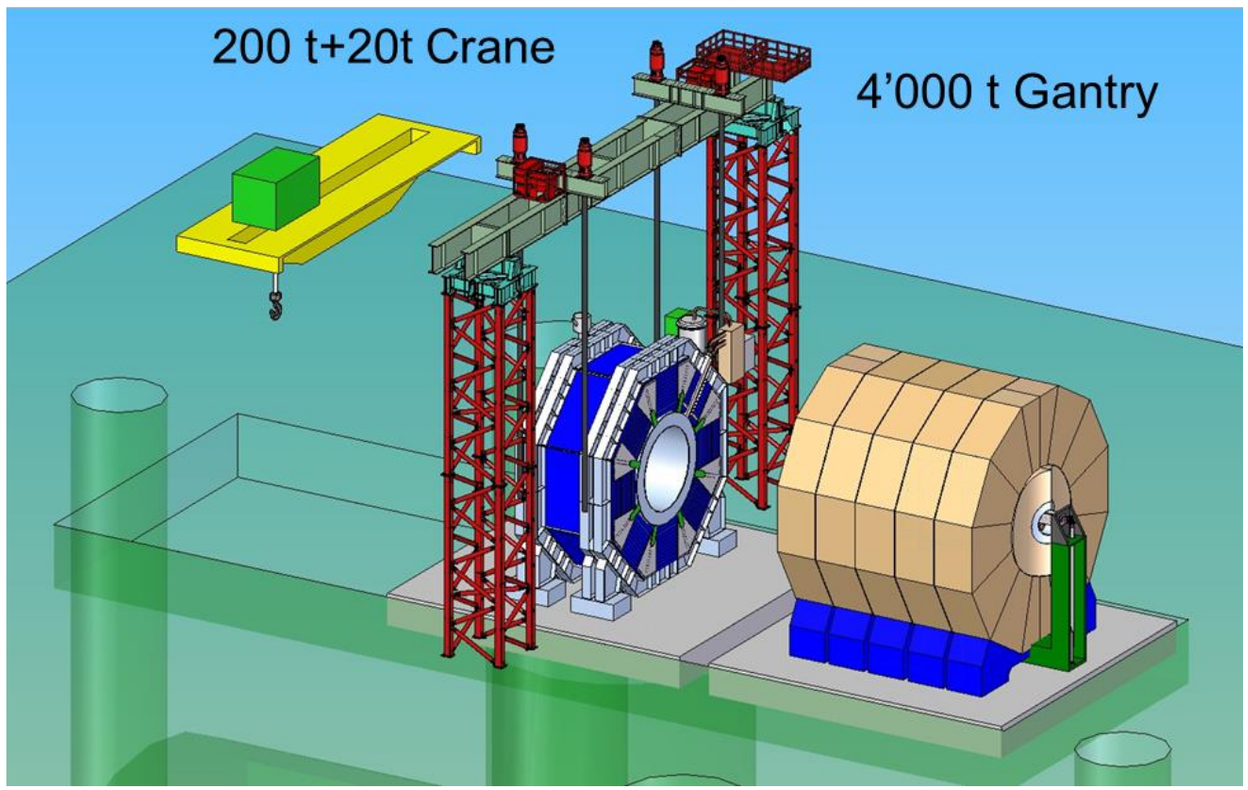


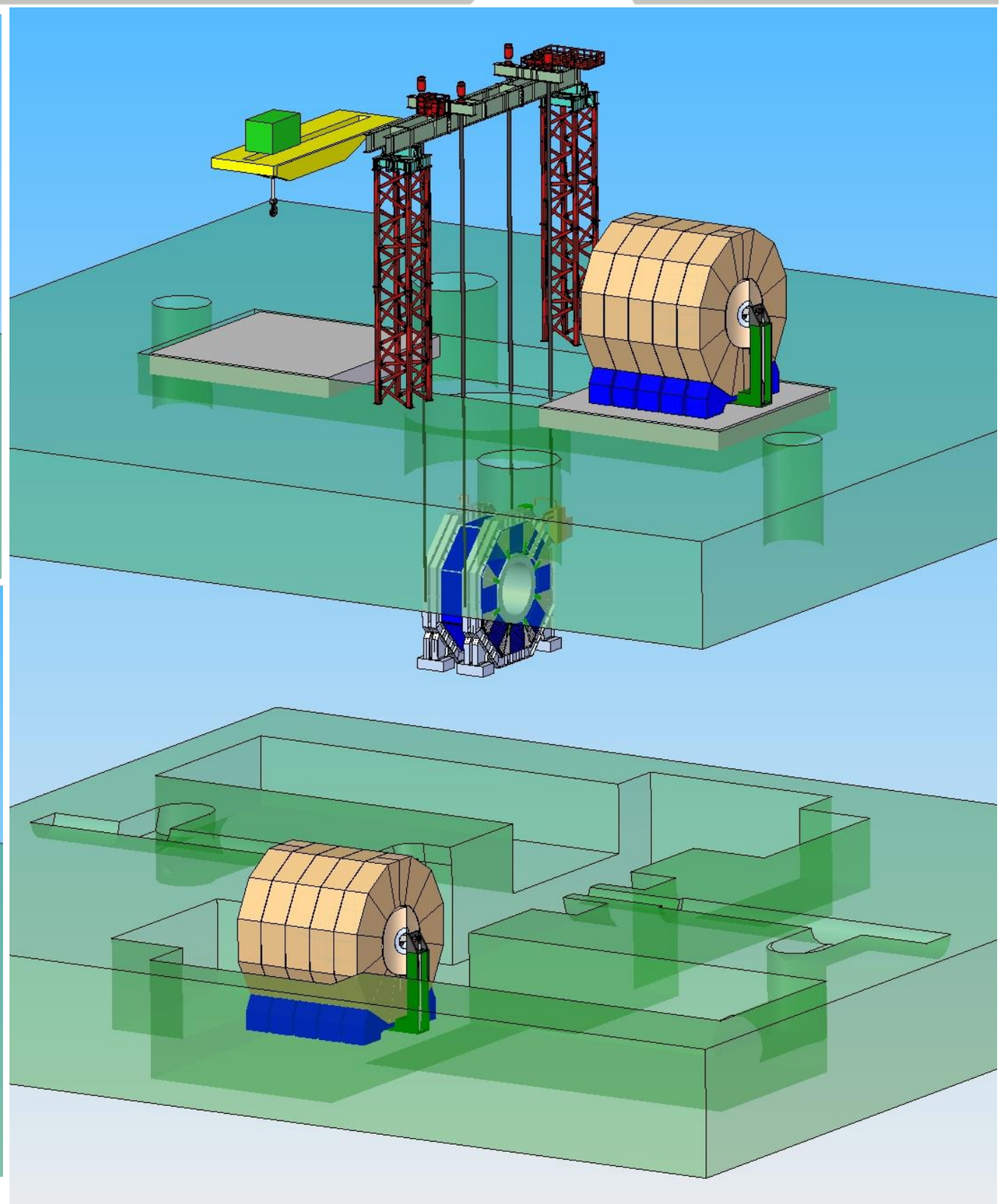
Option #1: Vertical shafts

M. Oriunno

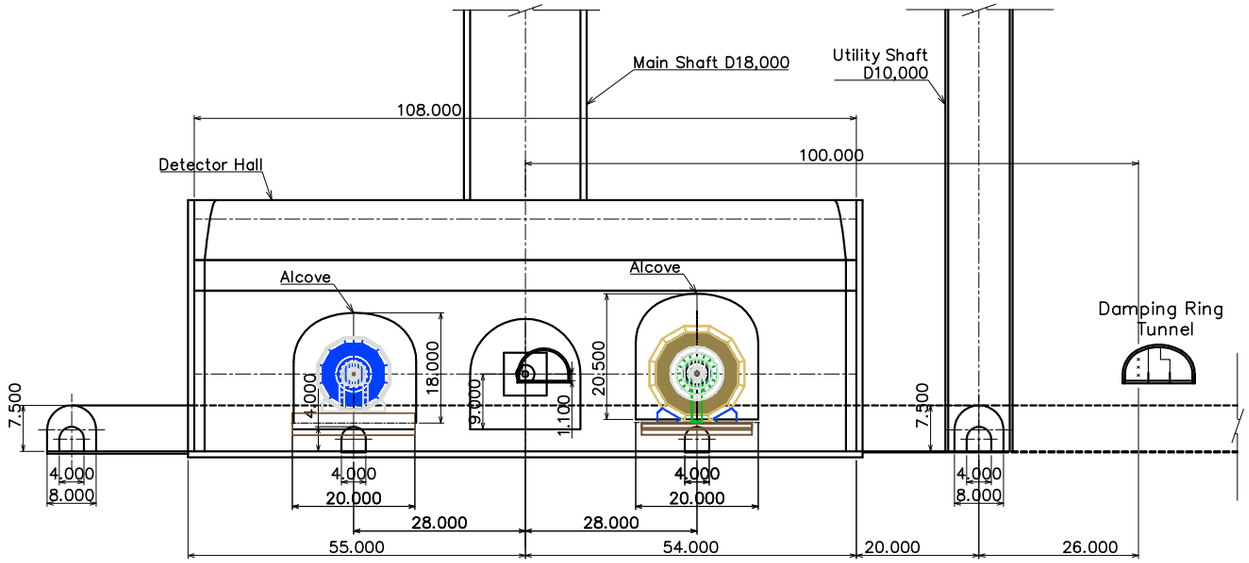
SLAC

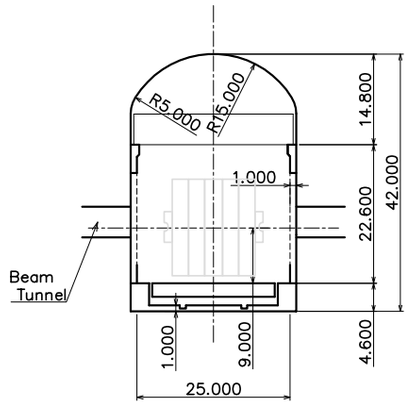


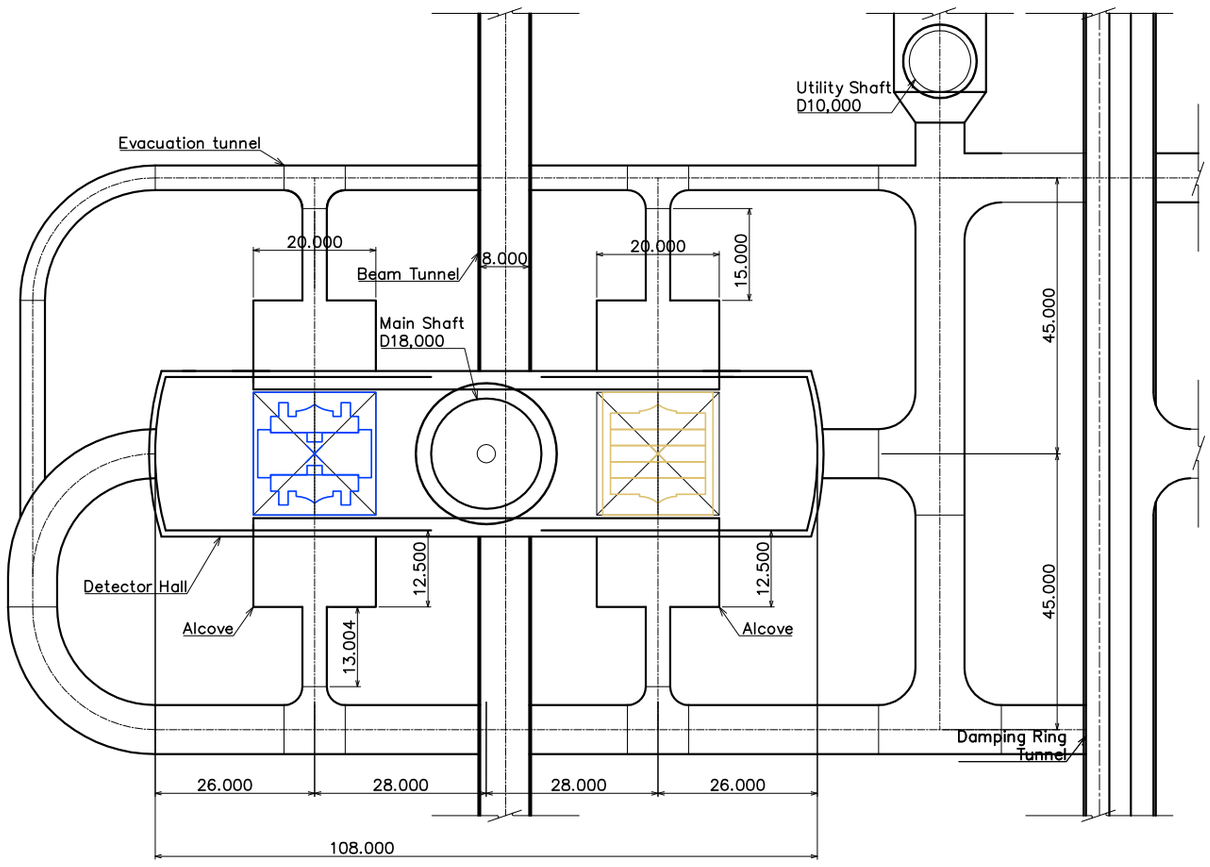




Y. Nishimoto







HYBRID-A'

0 50m

Liniar Colider Collaboration **ASIA REGION**	**CFS Detector Hall Access Study** **Hybrid Option**	KEK	**DRAWING NO.**	**REVISION**
			SCALE shown on drawing	**DATE 4 Sep 2014**

Cryogenic Configuration on Hybrid A'

Hybrid A' (All pipes for Helium and cooling water.)

cooling tower for IR compressors including DR.
volume flow rate = 1500L/min per 1 comp.
total volume flow rate = 6000 L/min (4 comps)

sub buffer tanks for comp

main buffer tank

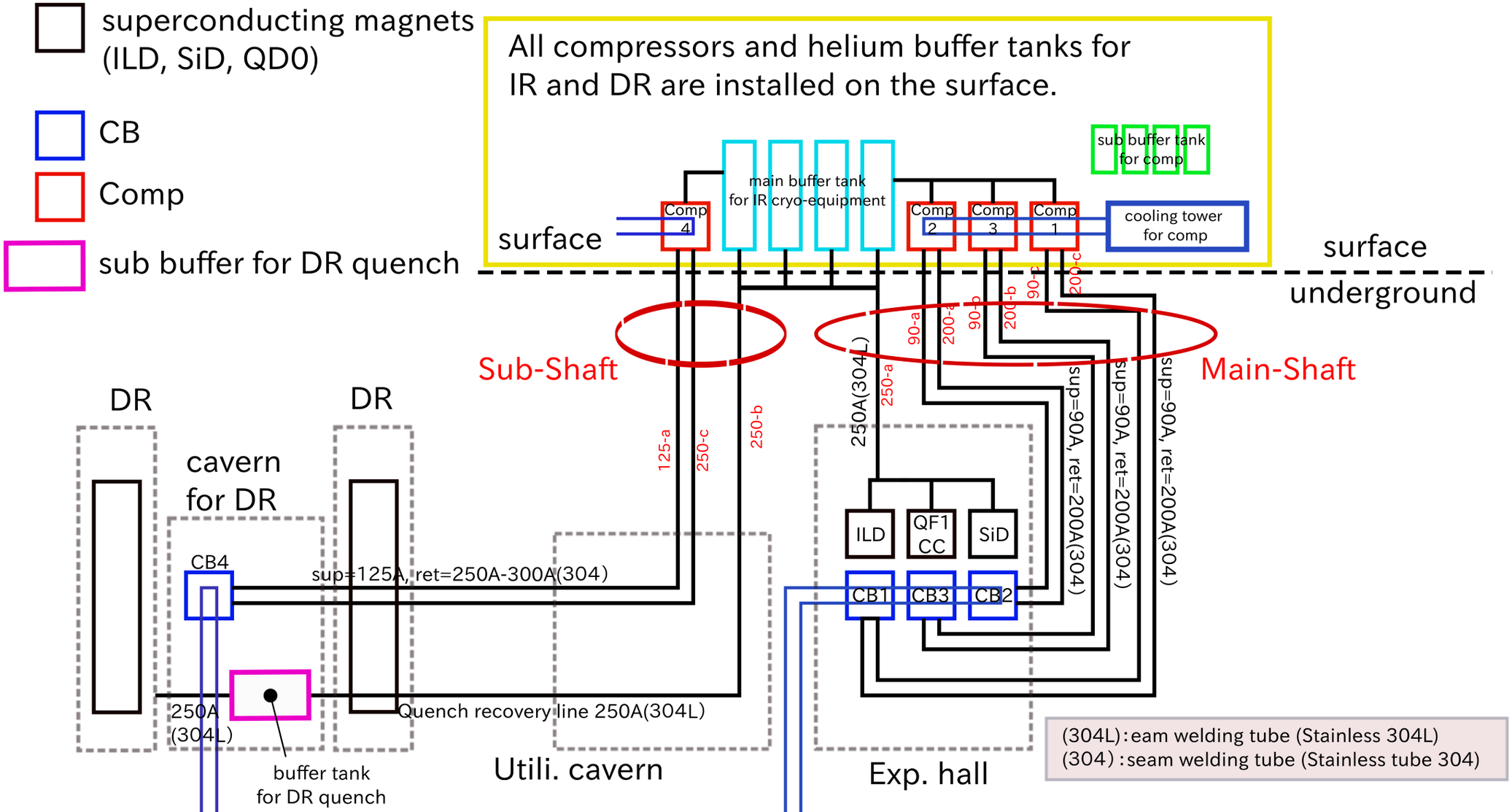
cooling towers

superconducting magnets (ILD, SiD, QD0)

CB

Comp

sub buffer for DR quench



(304L) : eam welding tube (Stainless 304L)
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cooling water for turbine is supplied from cooling water system located in the underground
100L/min per one CB.
Inlet temp = 31 deg.

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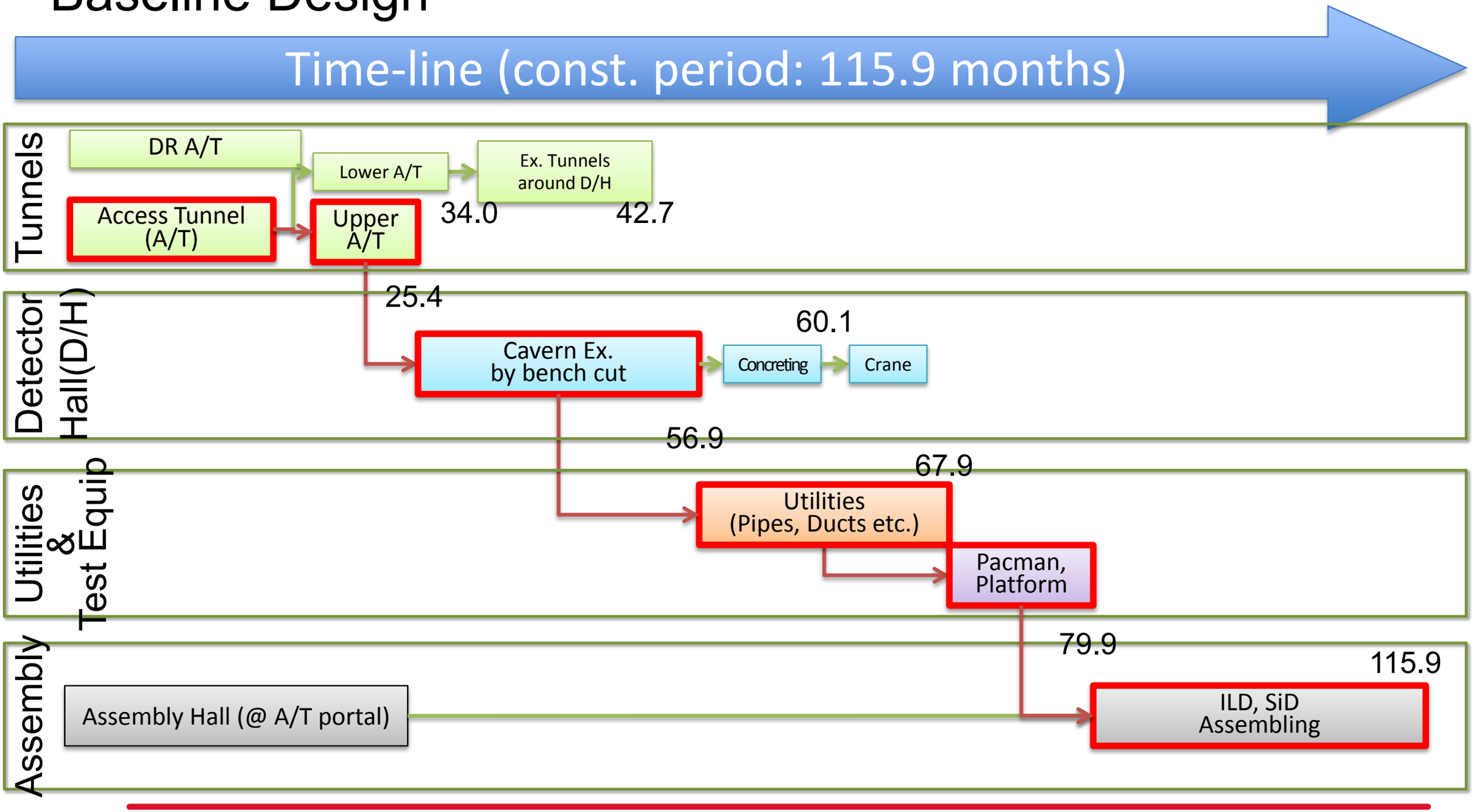
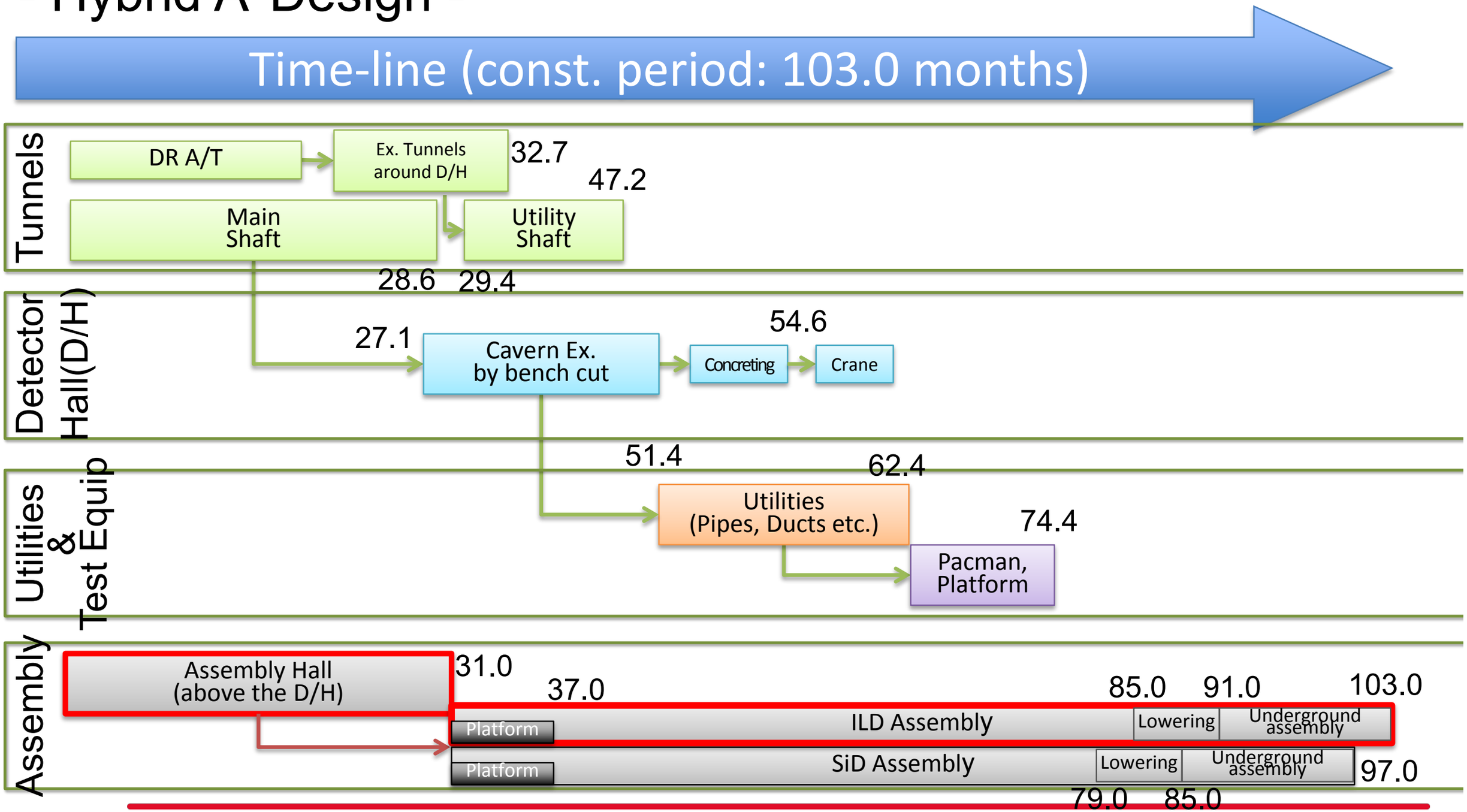
Outline of the Detector Hall (D/H) construction procedure - Baseline Design -



Outline of the Detector Hall (D/H) construction procedure - Hybrid A' Design -



Cost comparison between Baseline and Hybrid A’

- Sorry, confidential….
- Costs for both versions are equal within 5-10%
- Hybrid A’ is probably more developed (safety egress, etc.) but still cheaper:
  - less underground volume
  - shorter service paths (90m shaft vs 1km tunnel)

Surface Assembly Areas

M. Miyahara

Experiment Support Facilities

Consideration about the facilities required in order to support the experimental function

Facility examples other than the Assembly Hall

Function	Facility	Scale	Overview
Office-related	Research & Administration Building	-	On-site office for researchers, Technical staffs, Administrator
	Conference & Meeting	-	
Experiment-related	Control center	-	Experiment & Energy
	R&D facilities	-	
Safety-related	Radiation control	-	Disaster Prevention center
Cryogenics	Helium Compressor House	-	Liquid He Storage Tank
Transport	Parking facility	-	Garage, Parking lot

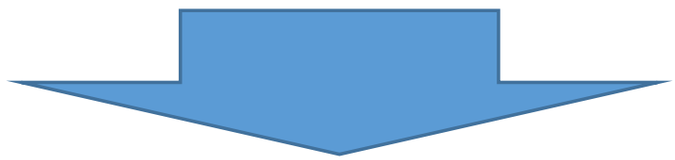
- *Notice; This table is only starting point for the near future discussion*

M. Miyahara

Other Surface Facilities

Consideration about the Facilities required in order to create the Research Environment with Amenity

- We should consider this area as a satellite campus if the central campus will be located in the distance



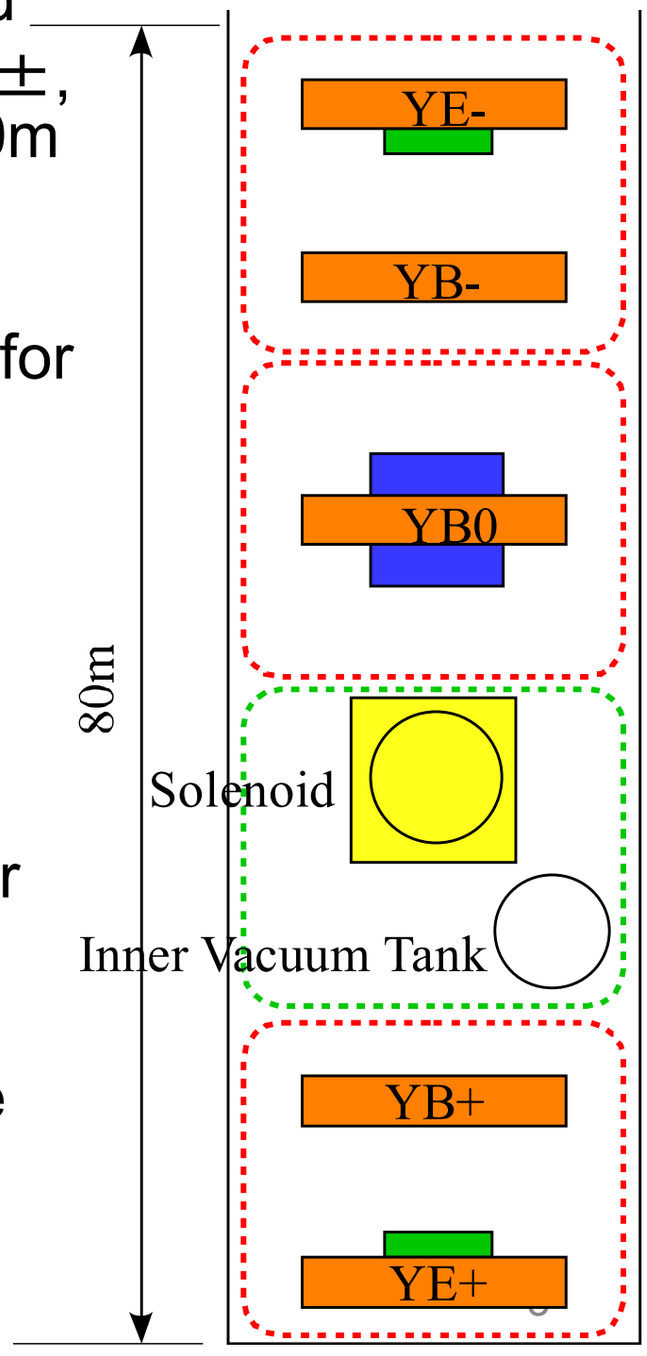
Should we consider whether the following surface facilities are necessity?

Category	Facility	Scale	Overview
Service & Welfare	Cafeteria	-	Dinning, Coffee lounge
	Shop	-	Foods & Drink, etc.
	Medical office	-	MD: Temporary? Nurse?
	Visitor lounge	-	Information, Public relations
Accommodation	Shot-term lodging	-	Need or not?
?	?	-	

- *Notice; This table is only starting point for the near future discussion*

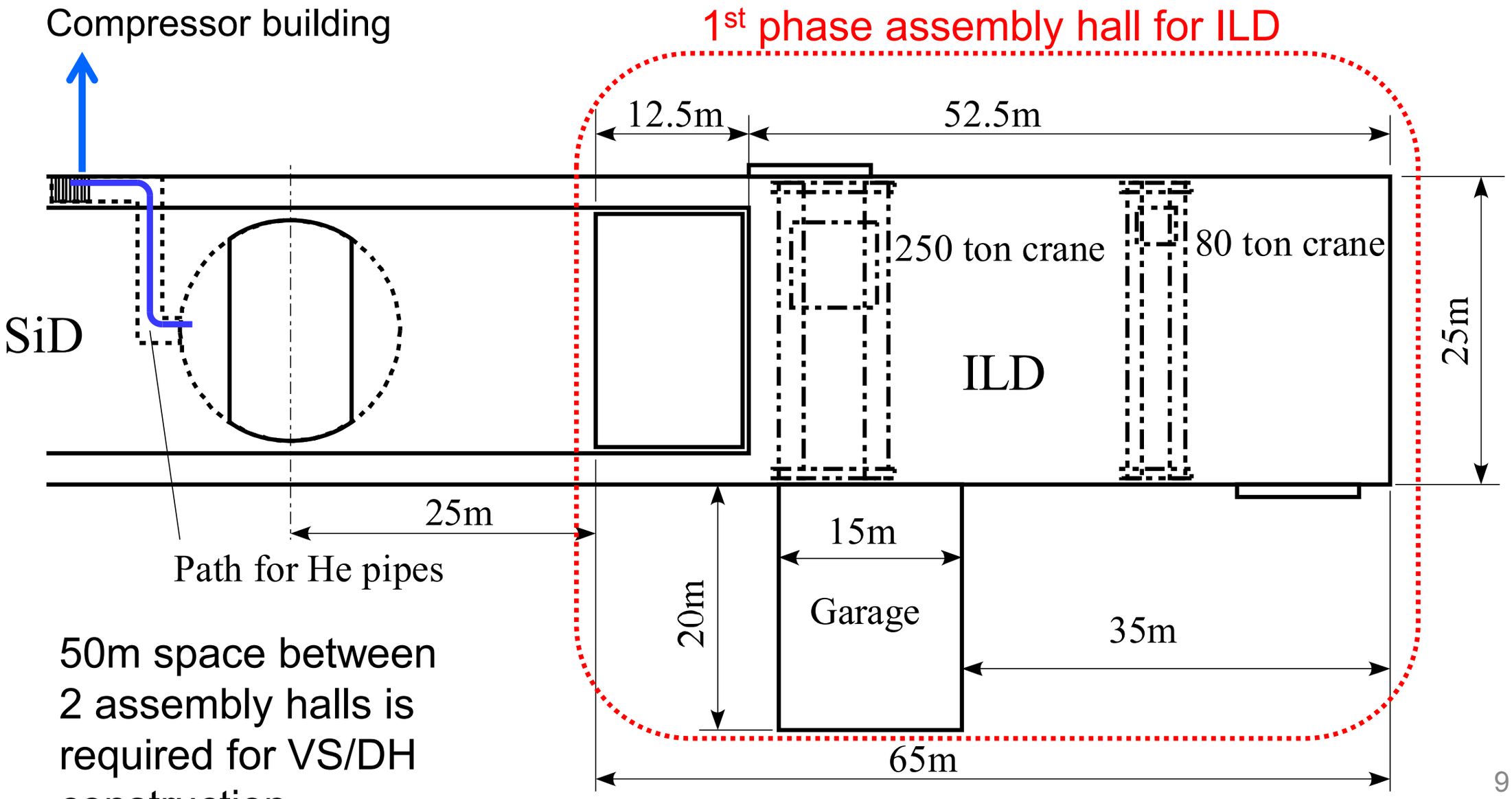
ILD requirement for AH

- Space
  - ILD needs assembly space for 5 yoke rings and solenoid
  - If we assume 25mx10m space for each of YE± and YB±, and 25x20m for YB0 and solenoid, respectively, 25mx80m space is necessary
- Crane
  - A 250 ton crane for yoke assembly and an 80 ton crane for solenoid/detector assembly and installation are needed
  - ~4000 ton gantry crane for detector lowering
- Hall height
  - 22.6m from the floor to crane rail, 6m from crane rail to ceiling, plus alpha for lights and fans on the ceiling
- Cryogenics
  - He gas pipes have to be connected from the compressor building for magnetic field mapping in AH
- Platform
  - ILD should have its own platform on surface to avoid the risk of delay of SiD construction



A possible design of AH

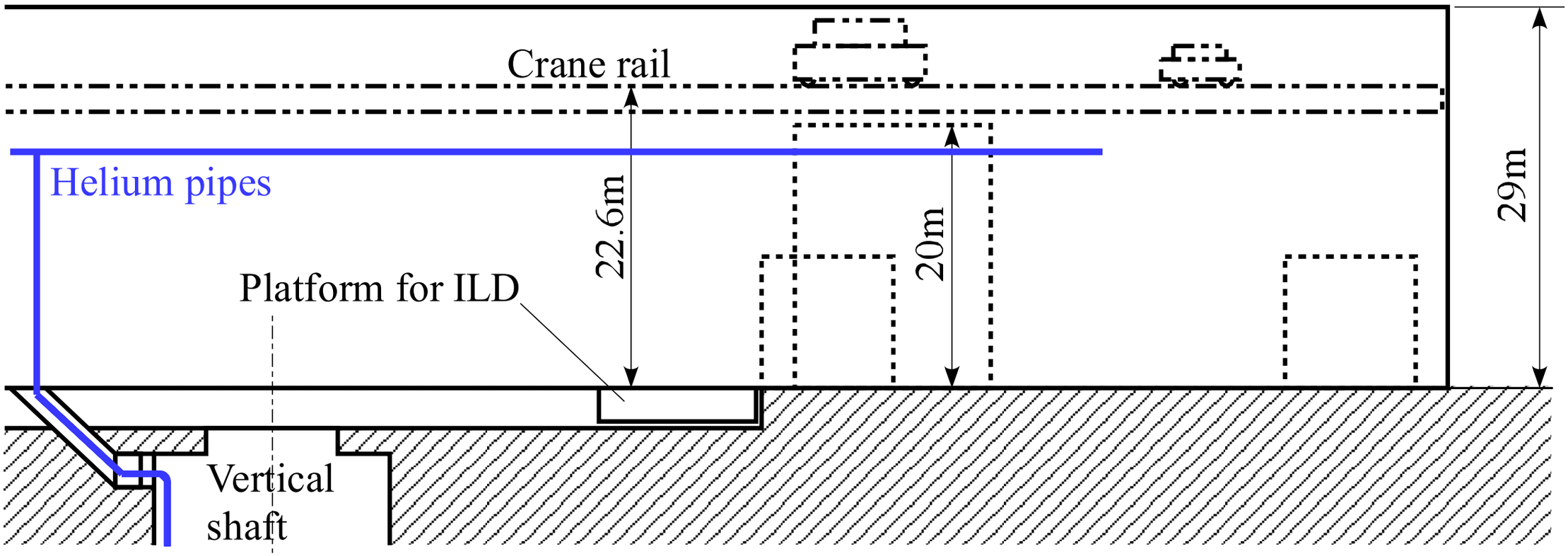
- Plan view



50m space between 2 assembly halls is required for VS/DH construction

A possible design of AH

- Side view



Way Forward

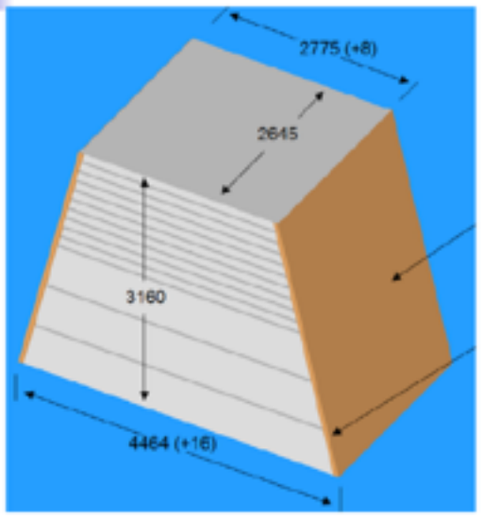
Timeline

- We have discussed alternative IR configurations since LCWS13 (Tokyo)
- Moving the ILC IR by ~700m to the north allows for a vertical shaft access
  - the new detector hall design allows for shorter assembly time at comparable cost
  - vertical shaft assembly decouples detector and machine assembly time lines better
- At MDI/CFS workshop all present (ILD, SiD, CFS, ILC Management) agreed that Hybrid A' should become the new ILC baseline version
- We will draft a change request to the TDR baseline in the following weeks
- Final submission at LCWS14 (Belgrade)

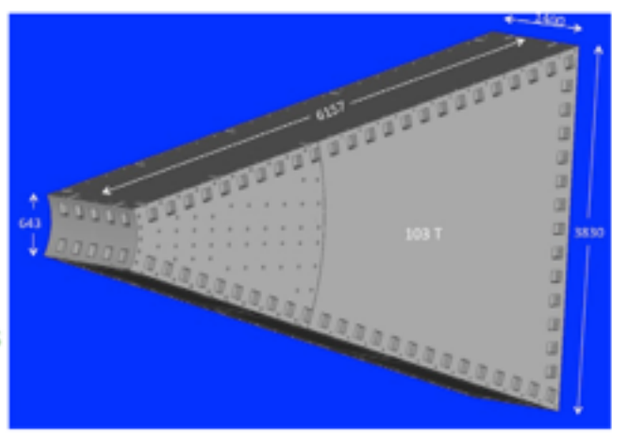
Transportation Issues

Segment Dimensions

U. Schneekloth



Barrel
- Weight ~210t 18 pieces
- Plus 18 slightly smaller pieces weight ~170t



Inner end-cap
- Weight ~100t 6 pieces
- Plus 6 slightly smaller

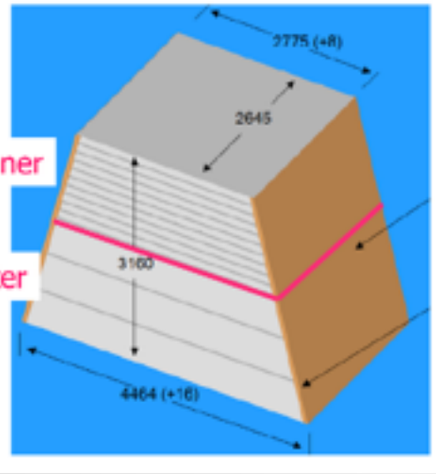
+ outer end-caps

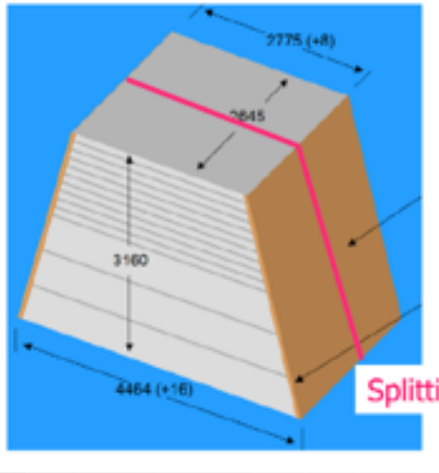
ILD Iron Yoke Transport

	number of pieces	weight (t)	max. dimensions (m x m x m)
Barrel			
large segments	18	210	4.5 x 2.65 x 3.2
small segments	18	170	3.9 x 2.65 x 3.2
End-cap			
inner large	12	120	6.1 x 3.9 x 1.5
inner small	12	100	5.9 x 3.8 x 1.5
inner rim	24	50	4.5 x 1.4 x 1.2
outer large	24	80	7.2 x 5.4 x 0.6
outer small	24	65	7.2 x 3.9 x 0.6
Barrel option			
large segments	36	105	4.5 x 1.3 x 3.2
small segments	36	85	4.5 x 1.3 x 3.2

Barrel Segment Dimensions

Could reduce segment size and weight
- Splitting into inner and outer segments
  - Need additional mounting/connection plates between inner and outer
  - Achieving tolerance during machining more difficult
- Splitting in z-direction
  - No problem with forces. Magnetic force acting in z-direction. Compressing wheels
  - Achieving tolerances easier





ILD

Professors for bridges at Tohoku U. says;

- Bridges are designed so that a 25ton-truck (5tons on the front wheels, 20tons on rear wheels) can pass them safely. (a safety factor=1.7)

- Since some of the existing bridges were built some decades ago, it is very difficult (almost impossible) to estimate physical property of the material used for them.

- Therefore, nobody can tell us the absolute maximum weight we can transport.

Boundary conditions

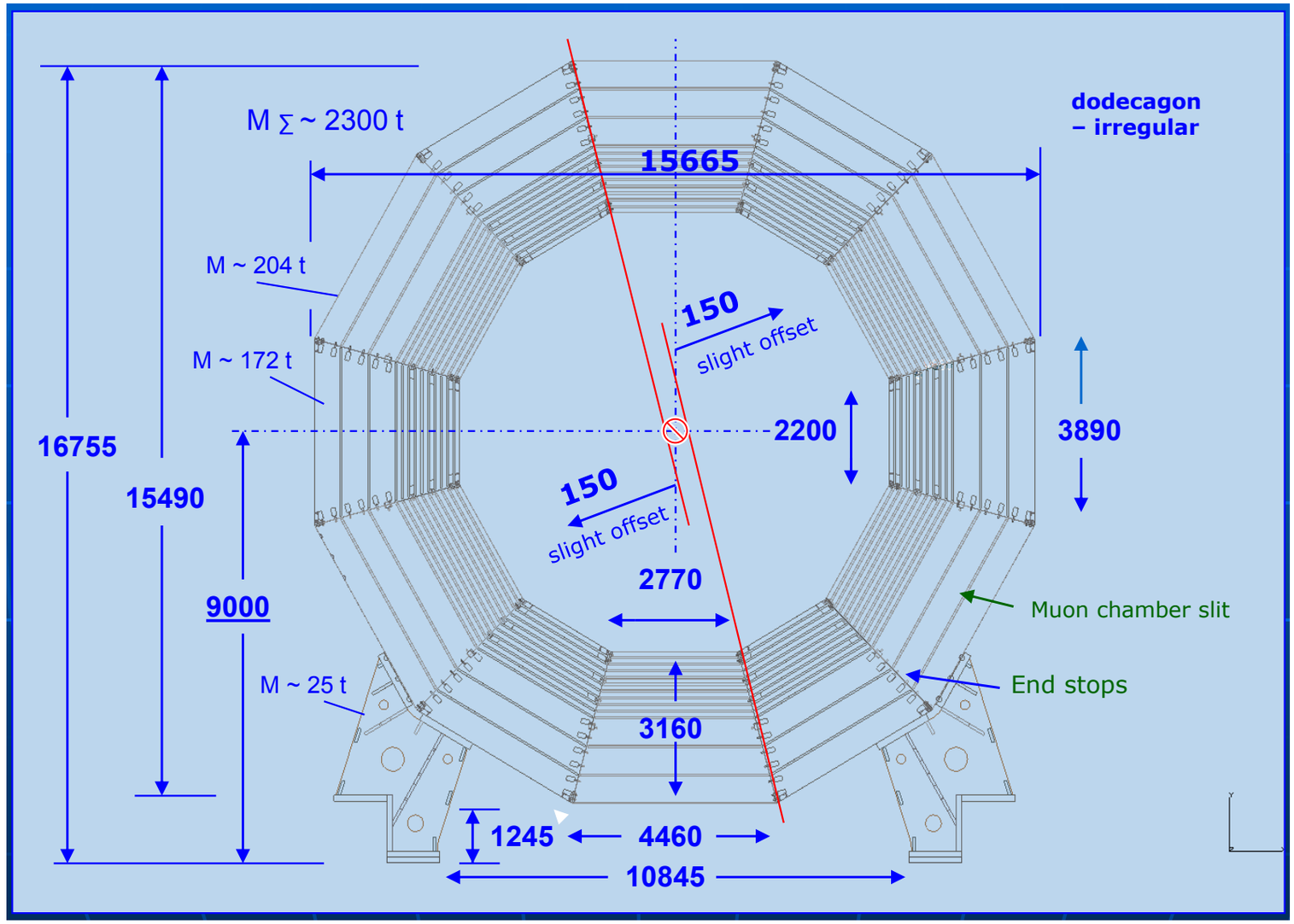
- If we will transport only a few heavy packages, 70 ton is a realistic number.

- We have to transport MANY heavy packages.
- ~50 ton would be a good number

- WG/TF in Tohoku will study transportation in more detail.

Consequences for ILD

- Some ILD parts are heavier than 50t:
  - Yoke
  - Coil modules
- Need an engineering re-design
- Need to study work to be done in assembly area at IR
- Not discussed: need to be have a detailed look into seismic issues



Summary

Conclusion

- Though not all of us might like it:
  - Push-pull is still there…. and there are still two detectors
  - If we stop to plan for that now, we might give up options too early
    - Things are literally blasted into granite soon…. at least site dependent cost estimates
    - Not to forget: IR costs are minuscule compared to the project cost
      - We have understood the engineering issues of push-pull well enough that no of the experts asked or involved have serious doubts
- We have found a design of the interaction region that complies with the site realities as well as the needs of SiD and ILD. And it is cheaper than the baseline….
  - But in the end, the geologic realities will decide
- Transportation is an issue; be prepared that your pet ILD part might not have a smooth ride towards the IR: slopes, snow, mass and size limits