

Detector Requirements for DH/AH

Karsten Buesser

Mini-Workshop on ILC Infrastructure and CFS for Physics and Detectors
30.09.2016

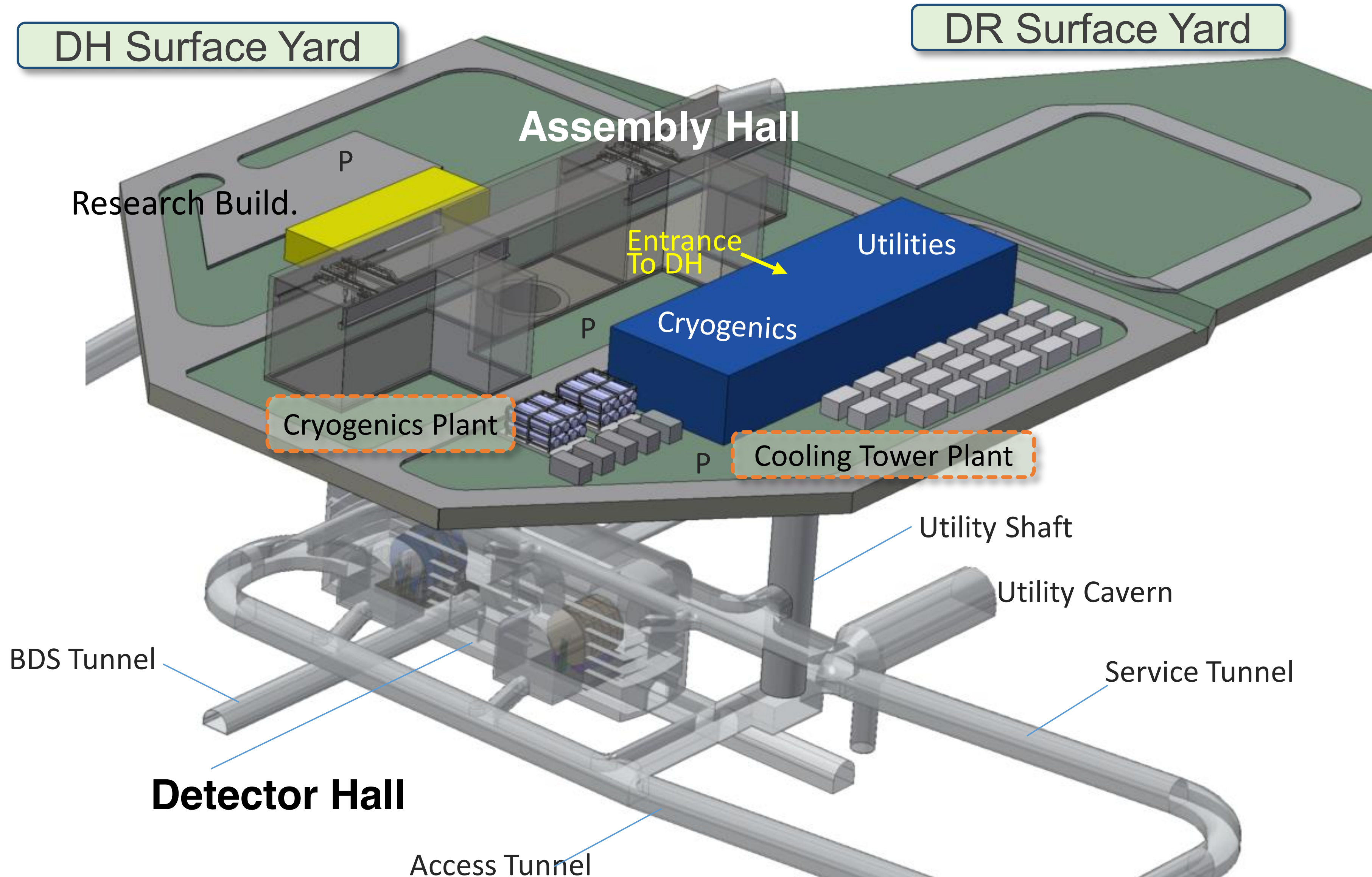
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Detector Hall and Assembly Hall Status

(as presented by M. Miyahara in March)

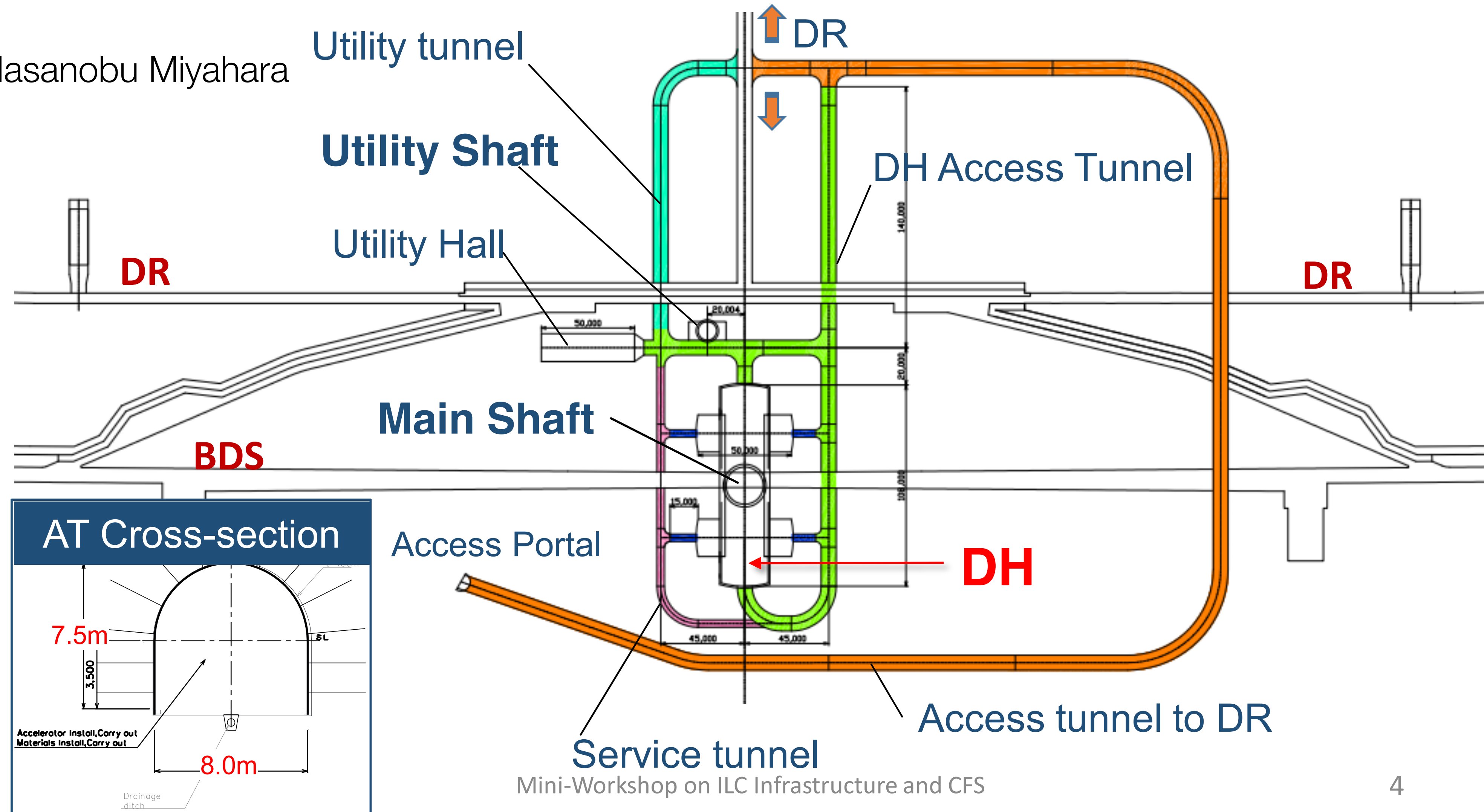
Overall Facilities of the DH Region



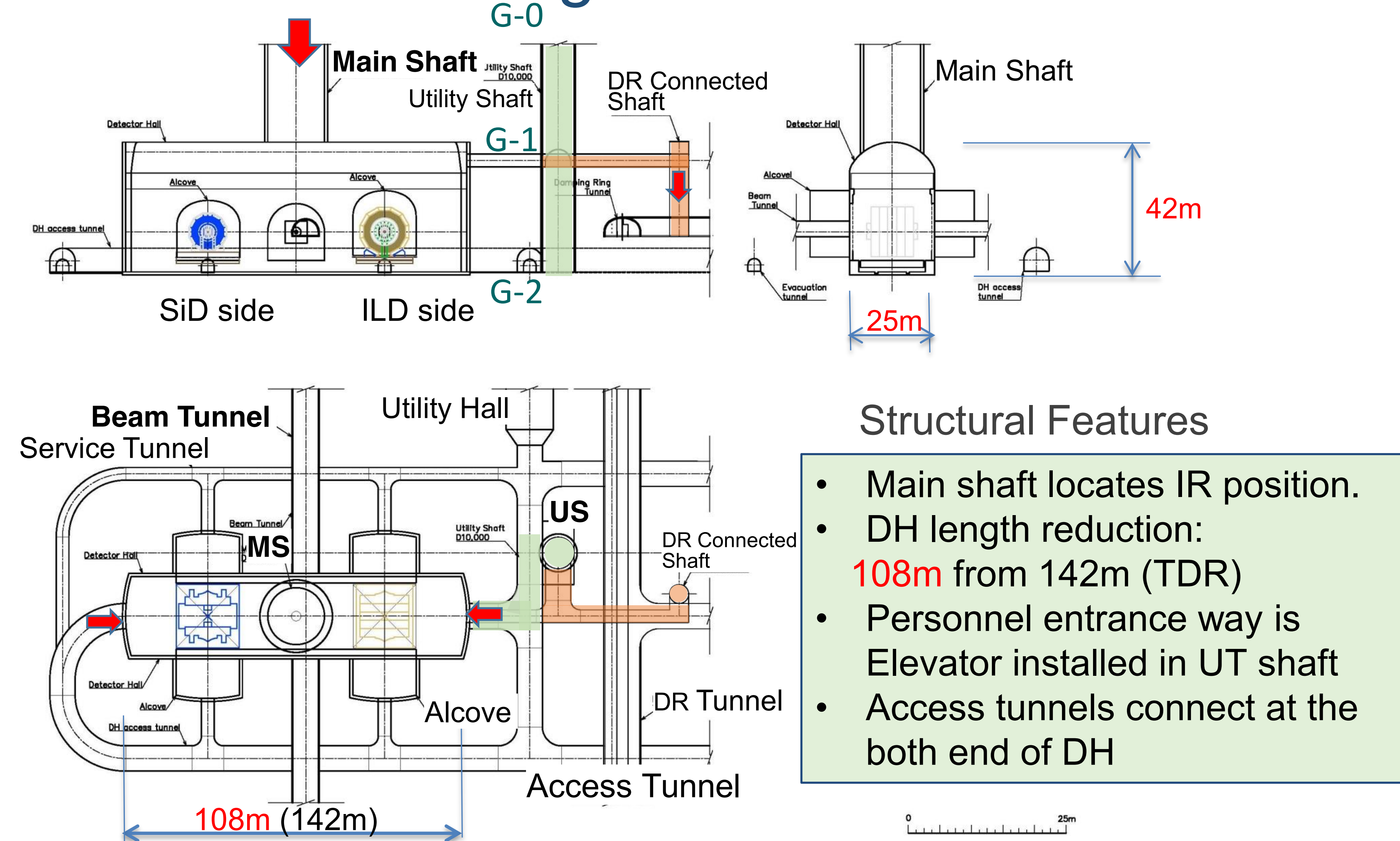
I Current Design of Detector Hall Region

Arrangement of the Underground Facilities

Slide from Masanobu Miyahara



Current Design of Detector Hall



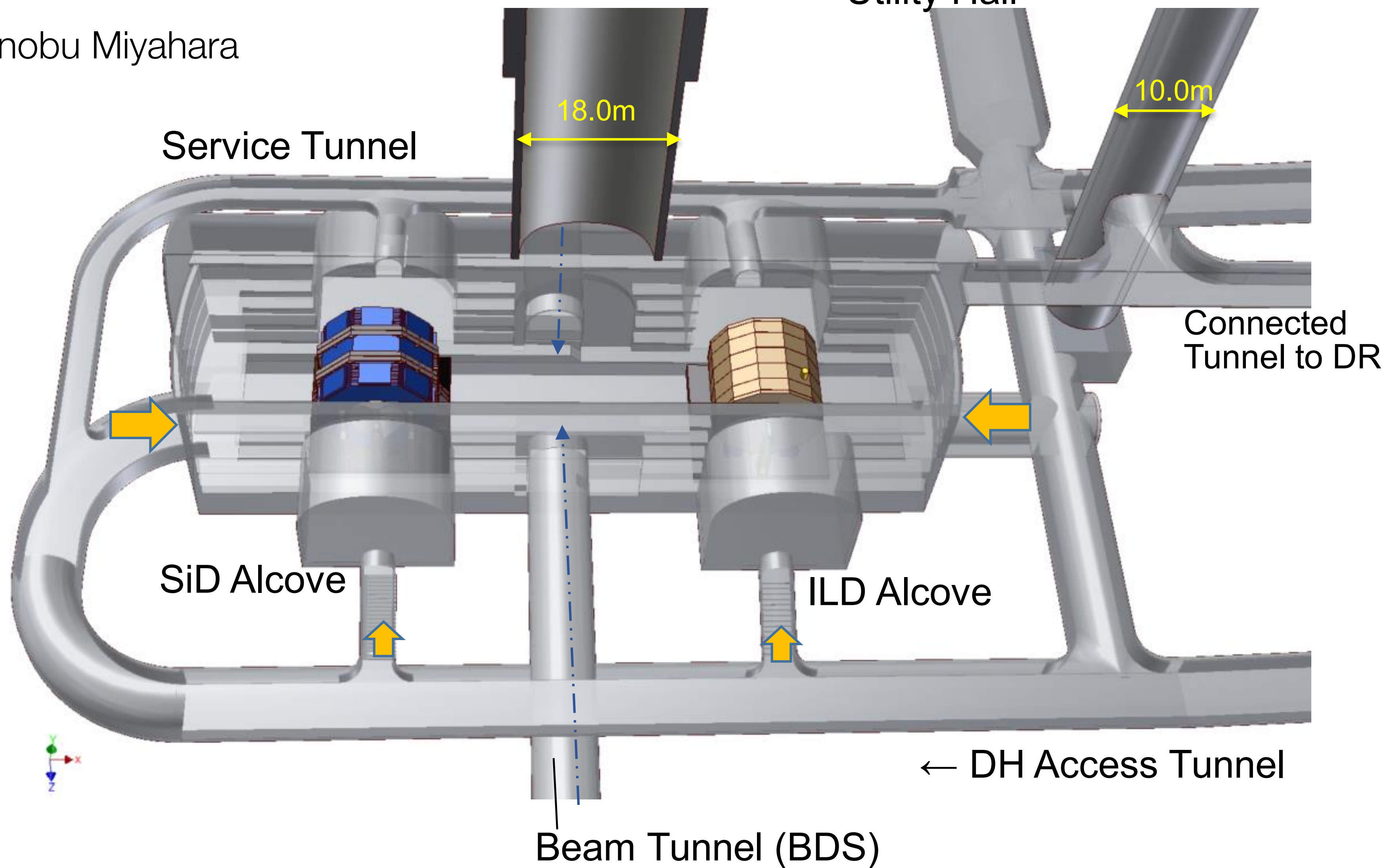
Detector Hall and two Vertical Shafts

Main Shaft

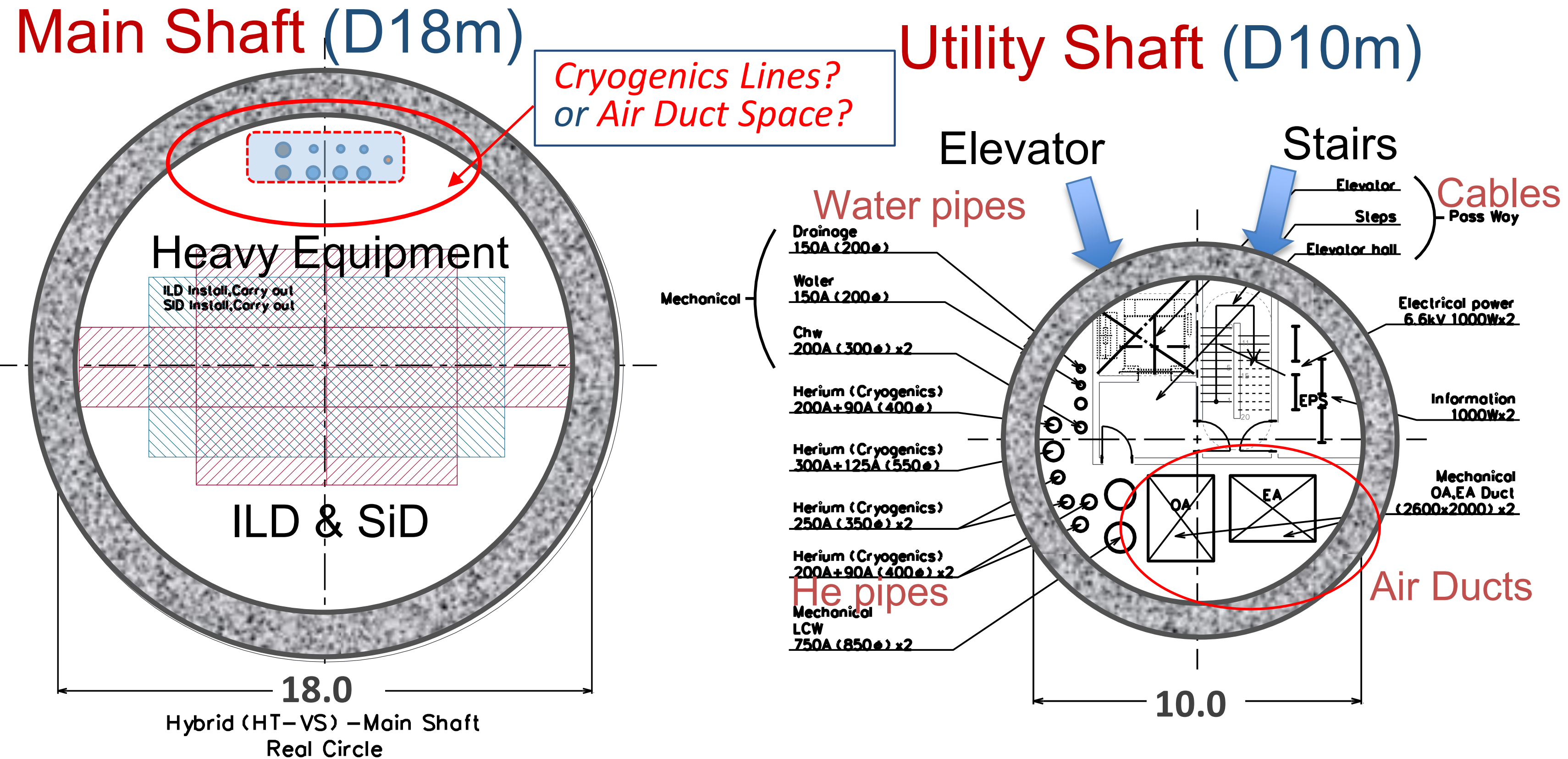
Utility Hall

Utility Shaft

Slide from Masanobu Miyahara



Two Vertical Shafts



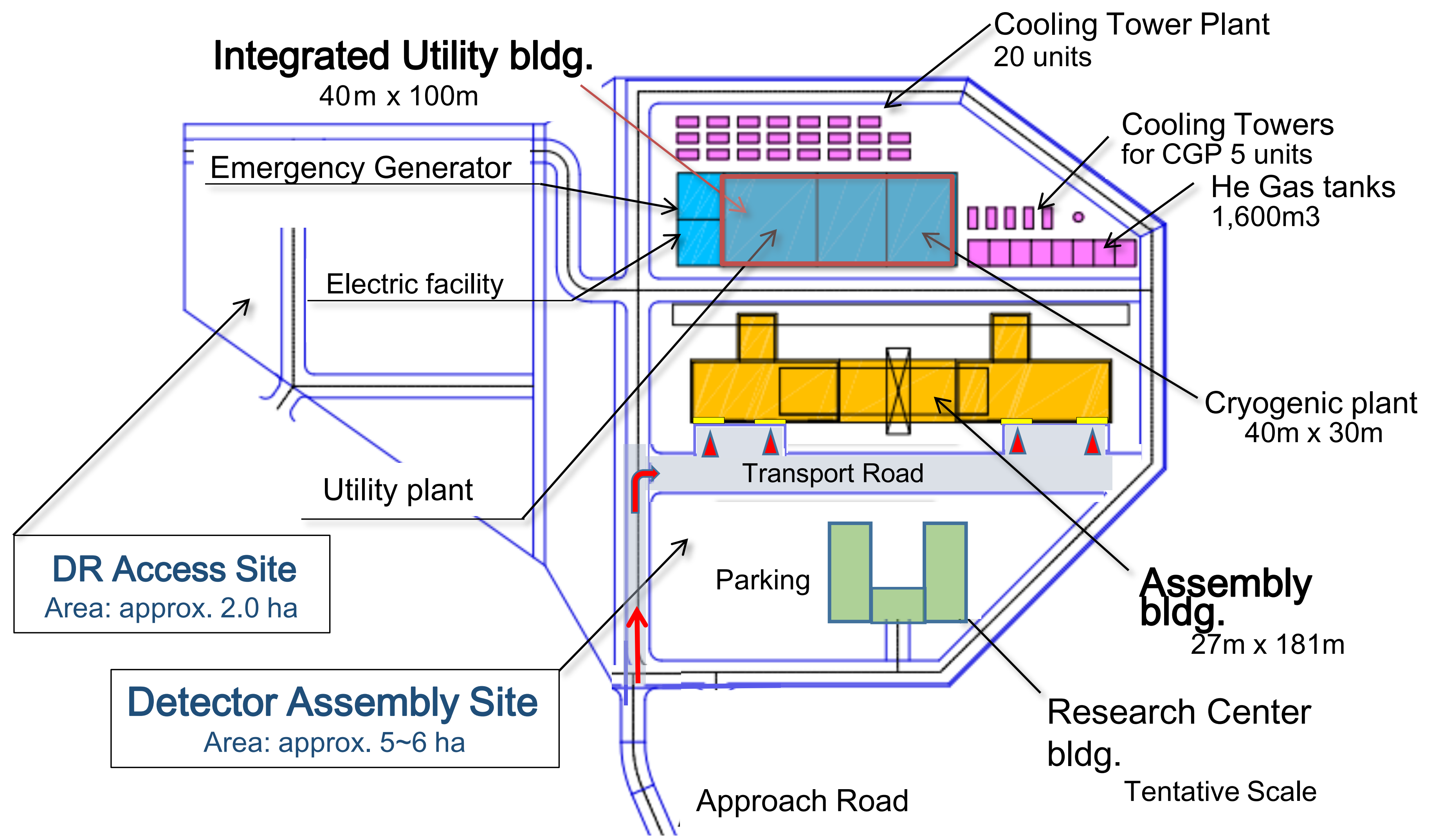
Main shaft D=18m

- Center of DH
- Detectors Installation by Gantry Crane

Utility shaft D=10m

- Utility lines: Pipes, ducts, cables
- Personnel access to Detector Hall by Elevator and Stairs

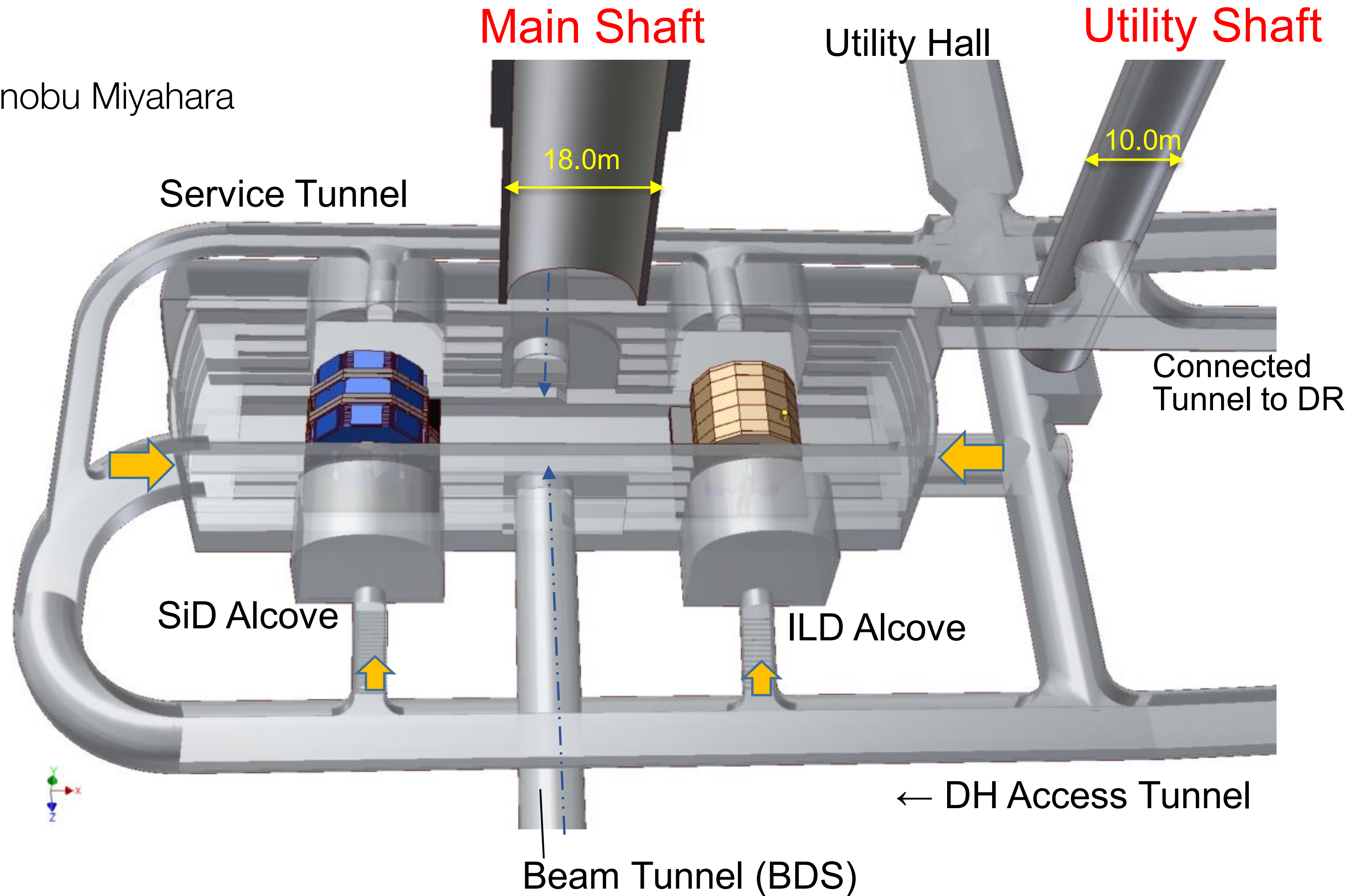
II Surface Yard and Facilities



Some Questions...

Detector Hall and two Vertical Shafts

Slide from Masanobu Miyahara



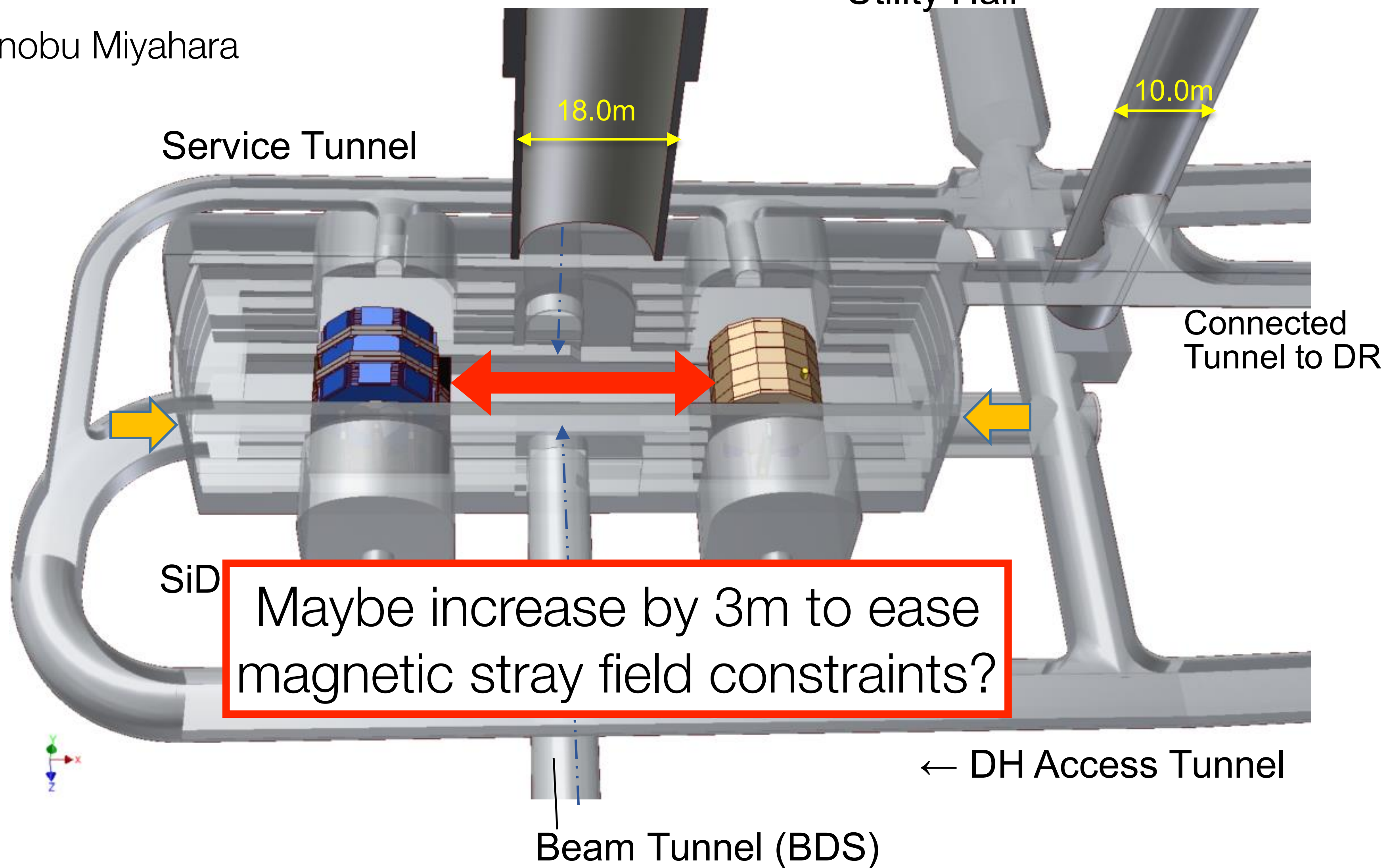
Detector Hall and two Vertical Shafts

Main Shaft

Utility Hall

Utility Shaft

Slide from Masanobu Miyahara



Review of Crane Specifications



- We have agreed on a list of crane specifications for the current AH/DH design

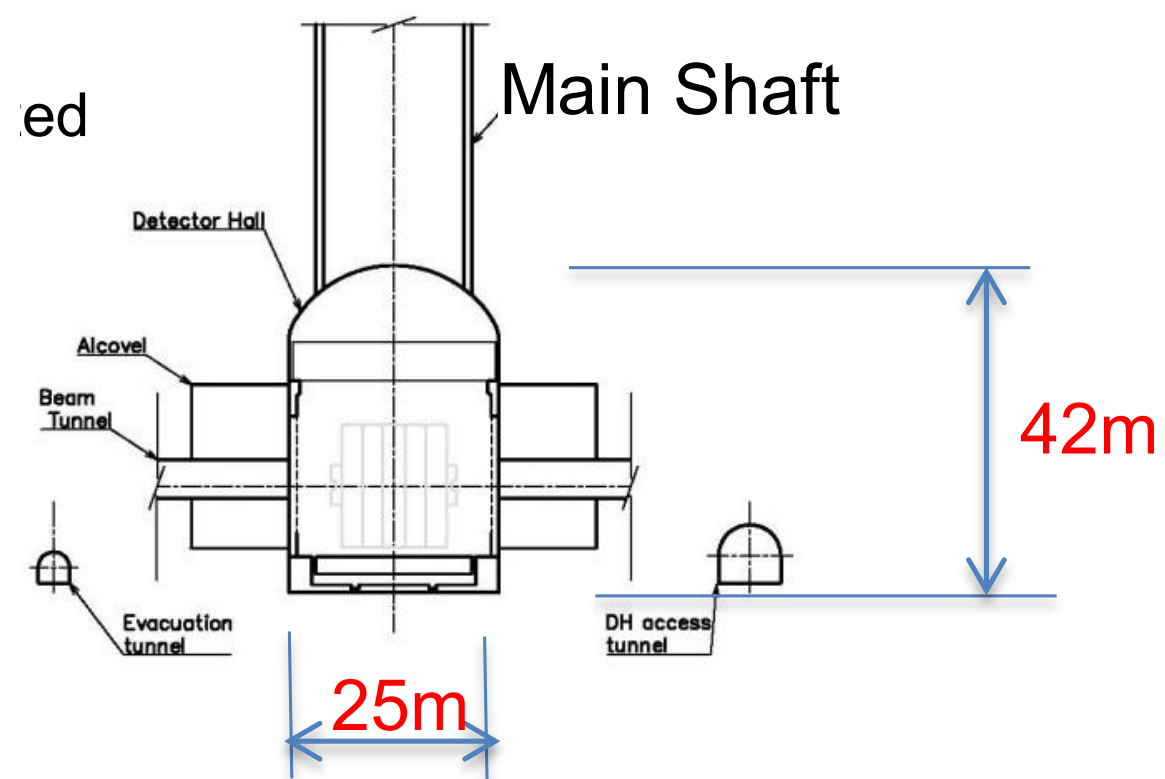
Permanent crane

Items	Specifications	Unit	Baseline	Hybrid-A'
DH Main/H Crane	250t S25m h35m	pcs	2	
	80t S25m h35m	pcs	2	
	40t S25m h35m	pcs		2
DH Alcove Hoist Crane	2.5t S25m h25m	pcs	4	4
Assembly Hall	250t S25m h35m	pcs	2	
	250t S25m h130m	pcs		2
	80t S25m h35m	pcs	2	2

- Need to review this in view of new ideas for assembly
- Check crane hook coverage

Crane Coverage

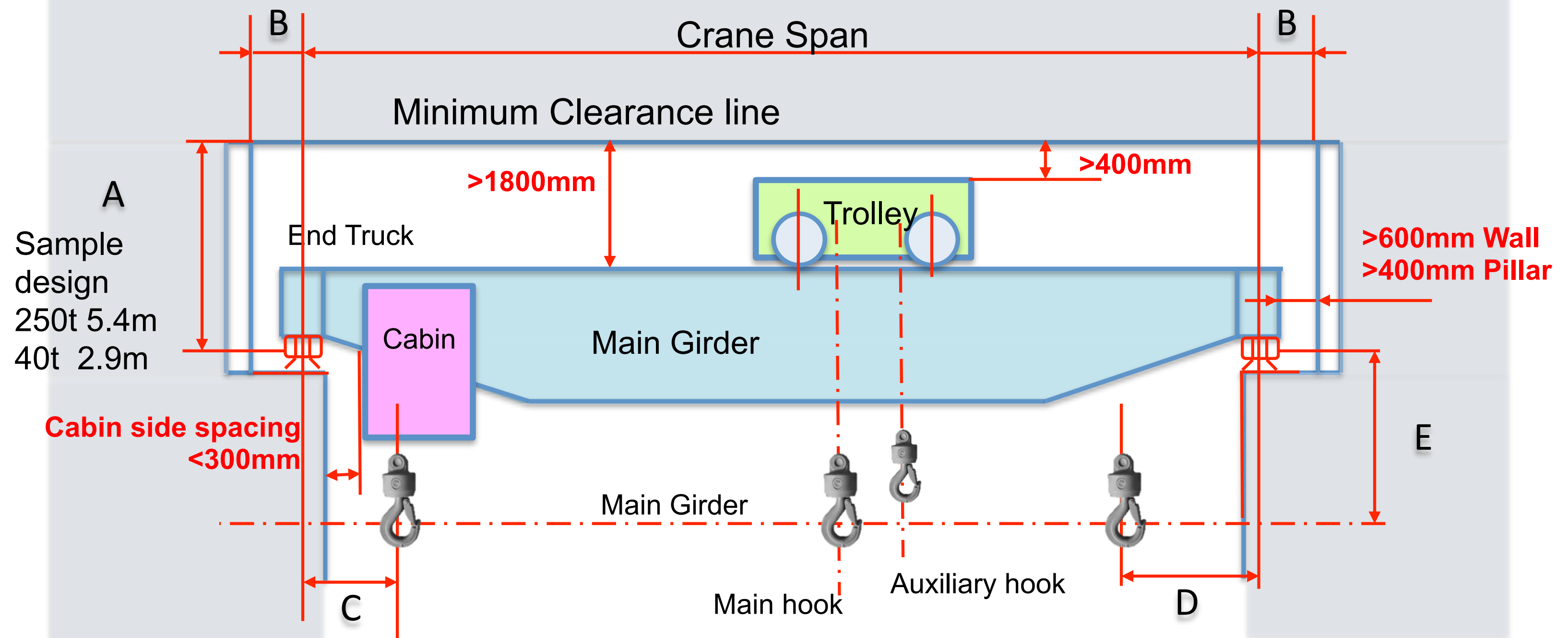
- Need to make a careful plan for the crane coverage in DH/AH
- How close to the vertical walls do we need access with main cranes?
- Design of service galleries?
- Arch design of DH still for 250t cranes



Over head traveling crane space

Y. Nishimoto

Red values are specified by crane regulation
Other values can be set by individual design

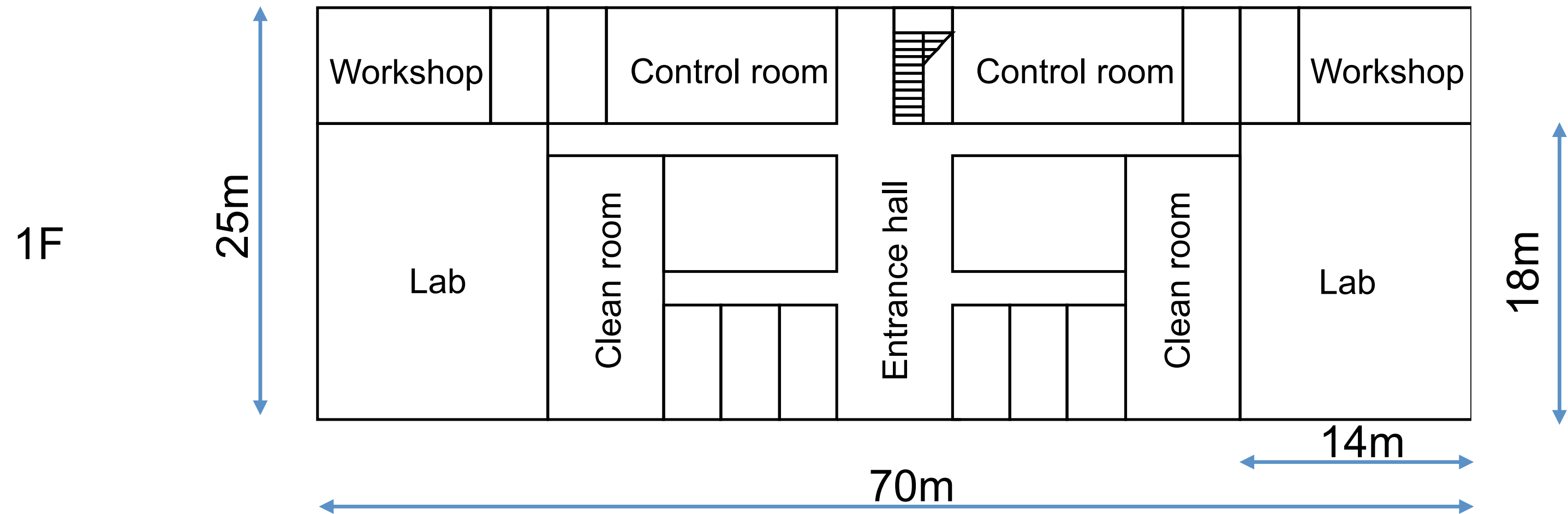


Research Office Building at IP Campus (proposal)

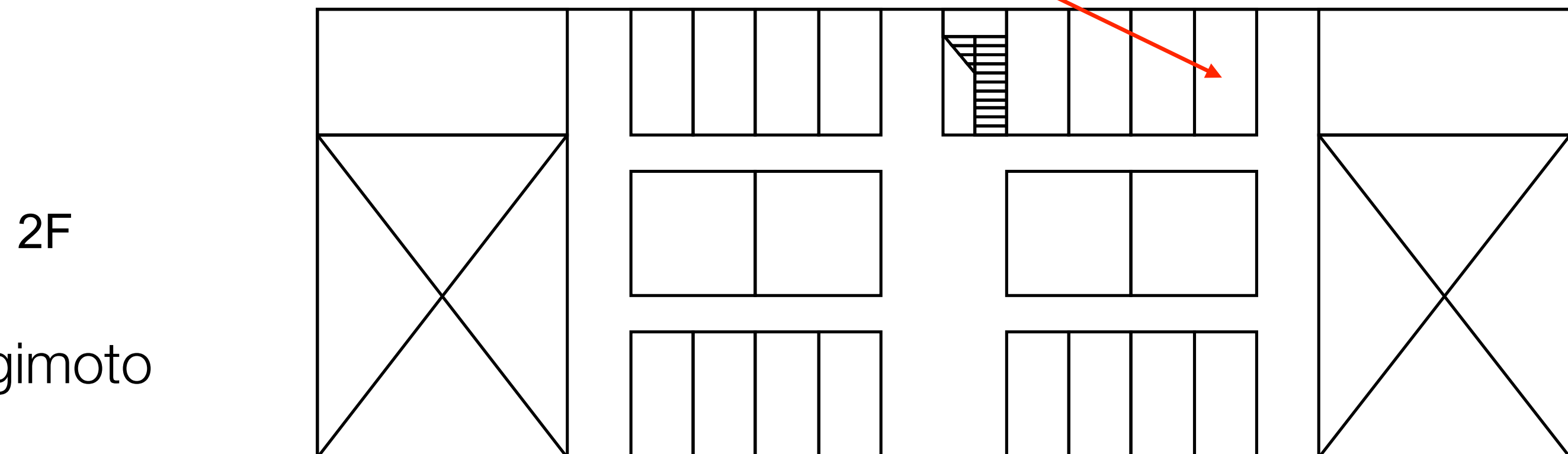
- Requirements for Research Office Building:

- Control rooms of experiments
- Meeting rooms
- Clean rooms (TPC, SI)
- Office Space
- Lab space with crane and gas equipment/ventilation

A possible design of ROB on IP campus



Office rooms for Si/TPC/DAQ (Office space for CAL groups in HCAL assembly hall)

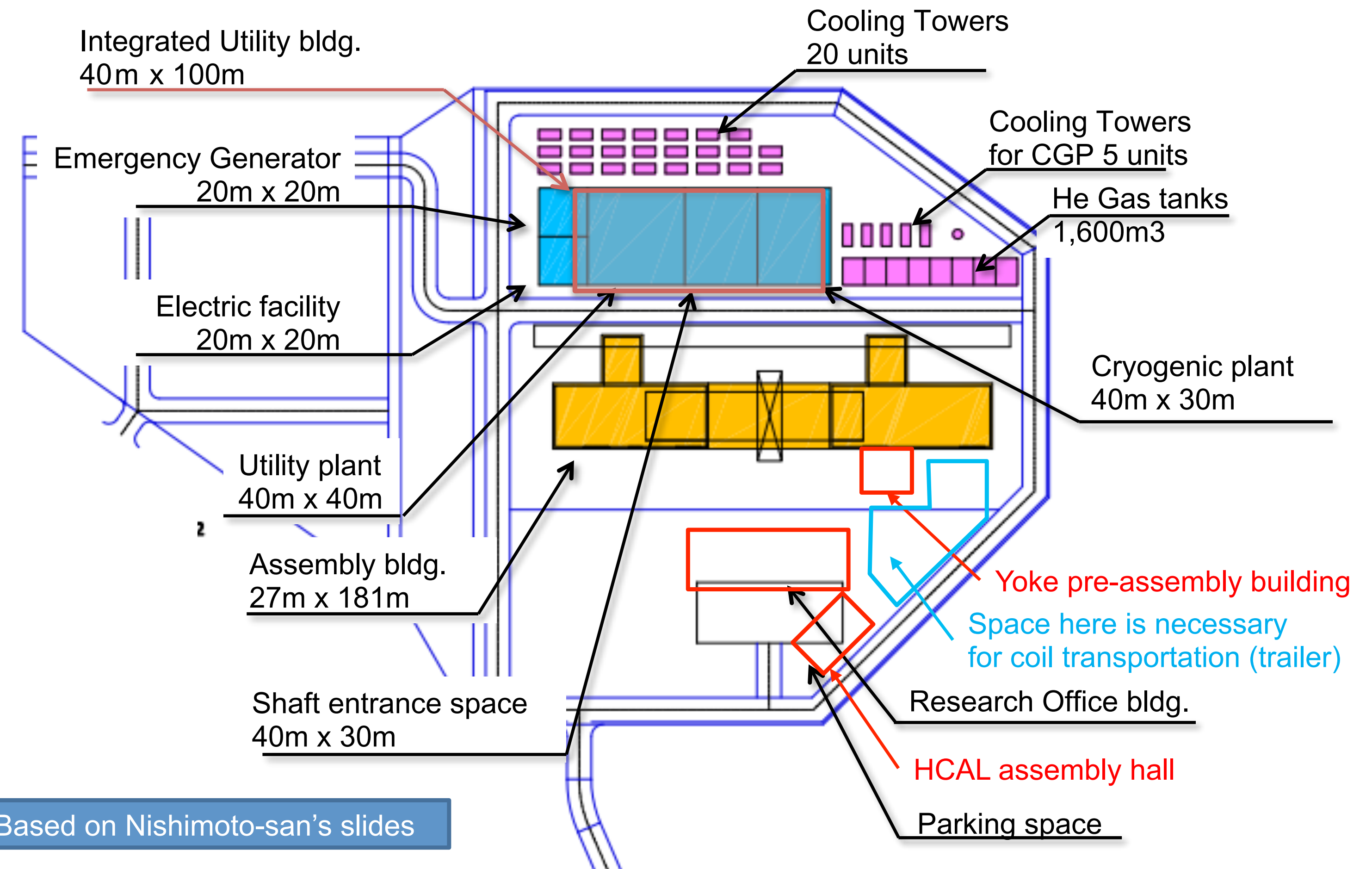


Slide from Yasuhiro Sugimoto

Detector Assembly Facilities at IP Campus (proposal)

- Need pre-assembly space for heavy detector elements
 - HCAL, Yoke
- Pre-assembly of yoke elements (welding, crane)
- Assembly of HCAL elements
 - e.g. DHCAL rings (<125t)
- Need to keep transportation routes in mind...

IP campus with 600m² HCAL-AH



Based on Nishimoto-san's slides

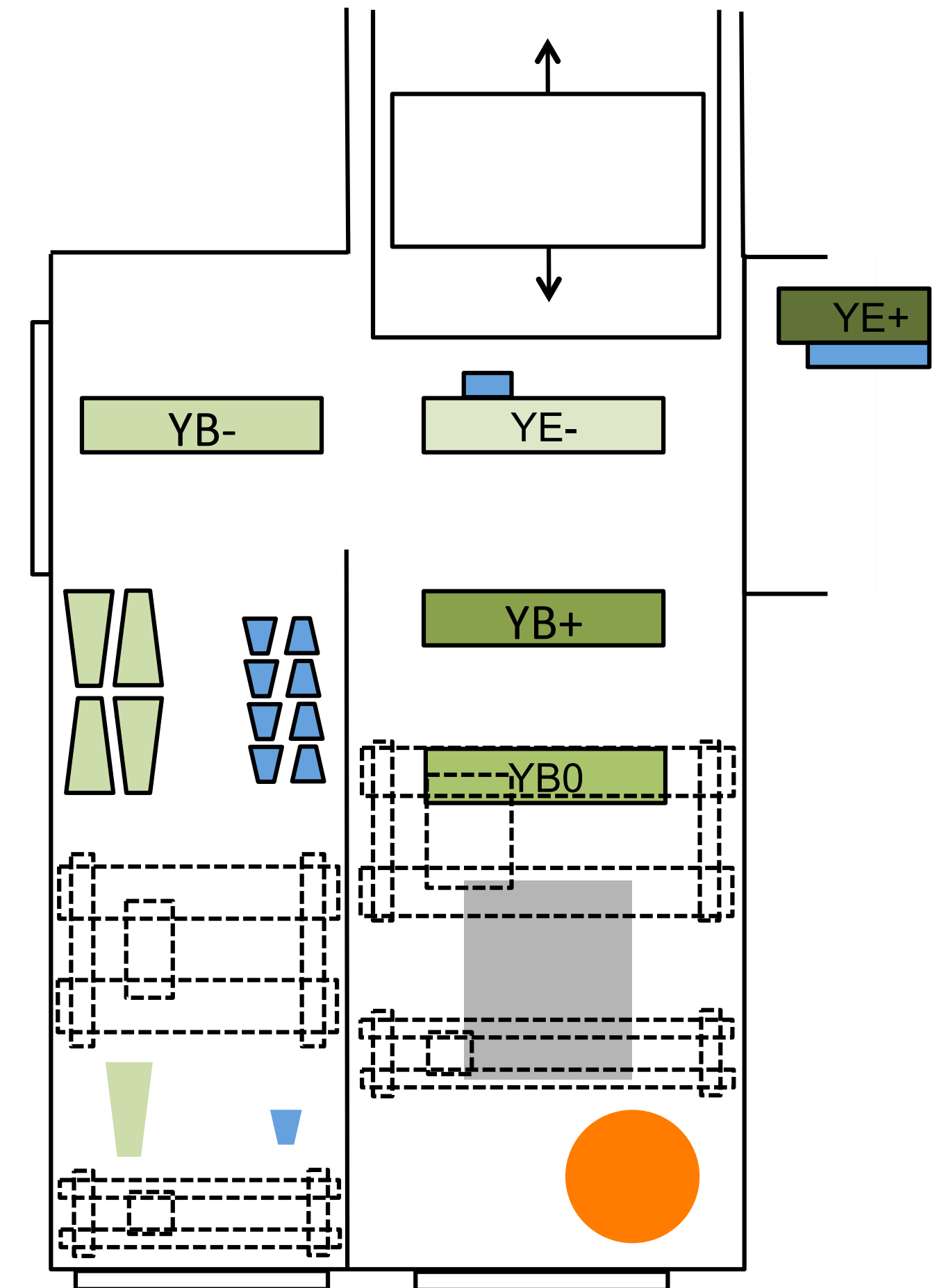
Slide from Yasuhiro Sugimoto

Assembly Study ILD (Work in Progress)

- Optimisation of ILD assembly is on-going work
- Biggest uncertainty:
 - where and how to build the coil
- Proposal: pre-assembly area for yoke and HCAL elements next to detector assembly hall
- Crane/movement capacities under study
- Could be temporary building

Integration Proposal

- > YB-: production + assembly
 - One production lane for about 6 months (12 modules)
 - In parallel: solenoid assembly
 - In parallel: finalisation of muon installation in YE+ and begin muon installation in YB0 (120 days)
- > HCAL production for endcaps
 - Mounting YE- HCAL
 - Start YB- yoke assembly once YE- HCAL is ready or assemble YB- wheel in garage



Technical Detector Services

- Not seriously discussed since 2009
- Needs to be adapted to current underground hall designs!

Primary services

Facility	Output	Users
Water chillers	Water at 6 - 10 deg C	HVAC Electronics racks cooling Detector specific cooling (chilled fluids in range -30 / +25 deg C)
High to medium voltage power transformers	18 kV / 400V AC tri-phase	Lifts, cranes, general services Cooling & HVAC stations Primary power to detector electronics
Diesel & UPS facility	Secured power for valuable systems	
He storage & compressor plants	High pressure He at room temperature	He liquifier
Gas & compressed-air plants	Gas mixtures Compressed-air	Detectors chambers Process control valves, moving systems, ...

Plants providing these services are usually located on surface, due to their dimensions and related risks.

- Not seriously discussed since 2009
- Needs to be adapted to current underground hall designs!

Secondary services

- Temperature-stable cooling water for sensitive detectors
- Low Voltage/High Voltage supply for front-end electronics
- Gas mixtures for drift-chambers
- UPS power for valuable electronics
- AC-DC power converters for superconducting coil(s)
- Cryogenics & Vacuum services

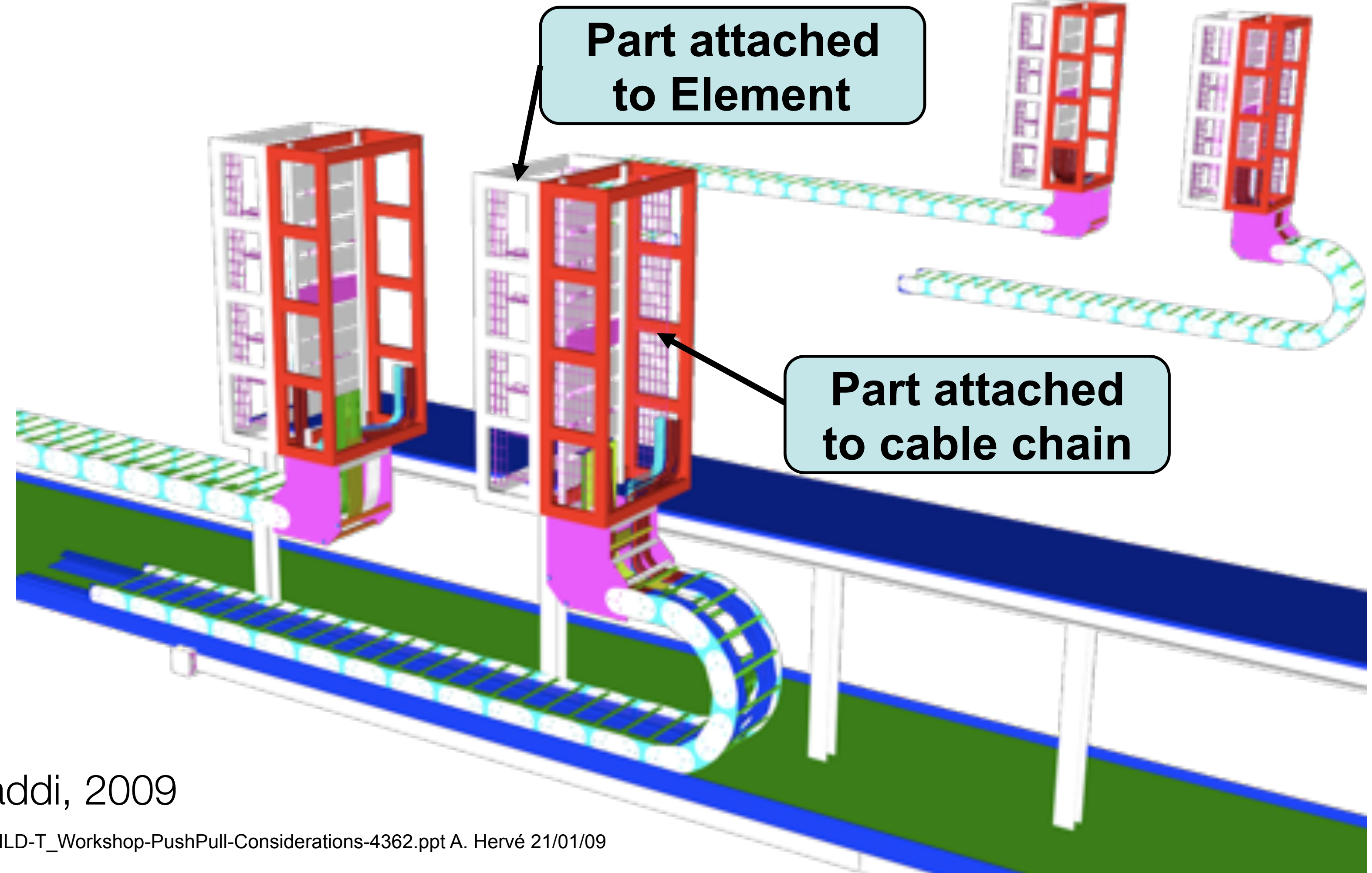
Secondary service plants need often to be close to the detector (low-voltage/high-current lines, cryogenics lines, etc) and they are located in the underground areas. Due to the push-pull design of the Interaction Region, these services are permanently connected and run into cable-chains toward the detector, regardless of their position in the Hall. To keep flexible pipes and cables in the chains within a reasonable length (< 50m), a service alcove for each detector is proposed at the main cavern ends.

Cable Chains and Detector Services

- Many services need to be attached to the movable detectors
- CMS design of cable chains has been adopted as conceptual design
- No study on this since 2009...



How cable chains are connected to pre-cabled Elements



Slide from Andrea Gaddi, 2009

Cable Chains and Detector Services

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How cable chains are connected to pre-cabled Elements



Part attached

On-board services

Some secondary services must be situated close to the detector as well, if the connection lines through the cable-chains is technically difficult or too expensive.

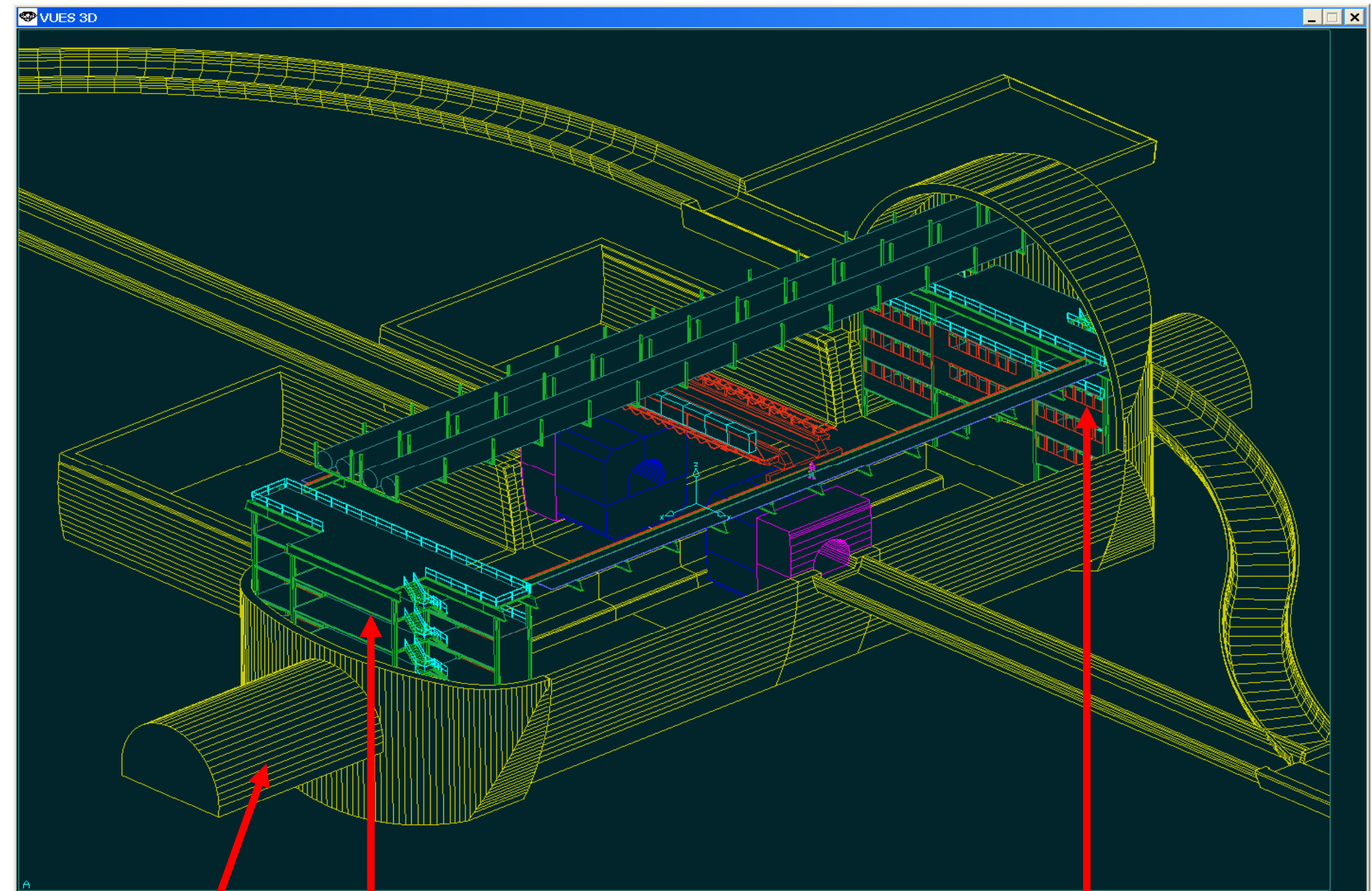
However this makes the size of the moving detector bigger with risks of inducing vibrations and electrical noise and should be limited to a few special utilities, in a push-pull scenario, where detectors move every month or so.

Slide from Andrea Gaddi, 2009



- Proposal in 2009:
- Service cavern at the end of the detector hall
 - NB: discussed for the old DH design (RDR)
- Idea for current design:
 - put services on service galleries around the underground hall
 - is this realistic? need a design!

Cavern space for infrastructures



Slide from Andrea Gaddi, 2009

Service alcove with light crane

No crane coverage. Only for light weight infrastructures (electronics racks)

Andrea Gaddi, CERN Physics
Dept.

- Possible list of underground detector service facility (2009)
- Needs an update
- Can this fit on the hall service galleries?

List of systems housed in the “service-block”

Detector facilities located into the service cavern (not exhaustive list...):

- Electrical room for transformers & switchboards: LV system, electronics racks, UPS
- Cryogenics & vacuum system for magnet: He liquefier, rough vacuum pumps, ...
- Electrical room for magnet power circuit: AC/DC power converter, breakers, ...
- Ventilation & air-treatment skids
- Cooling skids for detector circuits: heat-exchangers, pumps, controls
- Gas room for gas mixture distribution/regulation
- Laser room for detector calibration
- Safety room: radiation monitoring, smoke detection, fire-fighting, ...

Slide from Andrea Gaddi, 2009

Conclusion



- We are getting a better idea of the infrastructures that are needed for the detector assemblies
- We have to focus also on the underground services and distributions
 - No coherent plan for the current detector hall design
 - ILD did some studies in 2009, not followed up since then
 - partially because at that time it was too early, as many sub detector requirements were not known
 - Need to re-work the requirement lists in view of current understanding on read-out systems, etc:
 - power supplies, coolers, gas systems, safety, fire prevention, etc. etc.
- We need to adapt the planning to the possible new IP location!