

Detector Utilities

2018/10/25

Yasuhiro Sugimoto

@LCWS2018

Contents

- Gantry Crane
- Platform in Assembly Hall
- ILD Utility Survey

GANTRY CRANE

Discussion at SCJ committee

- Some of (sub-) committee members expressed doubt about feasibility of >4000t gantry crane (GC)
- I discussed with one of them when they visited KEK
 - I explained the structure of the GC (strand jacks), and showed some examples in Japan (3000t for Tokyo Sky Tree and 6000t for Kyocera Dome)
 - He understood the GC itself, but still has a doubt in the foundation (anti-seismic design)
- Actually, as far as I know, there is no study of the anti-seismic design of the GC in Japan → To be done quickly during the preparation phase

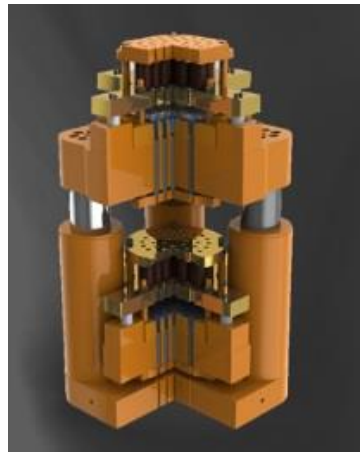
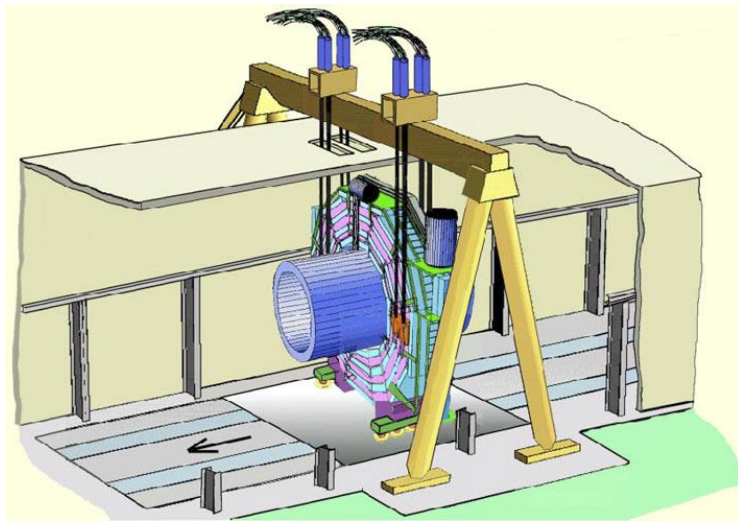
Discussion at SCJ committee

- Gantry Crane in their mind ?



Discussion at SCJ committee

- Gantry Crane in our mind



Strand Jack



Cost Issue

- Shin Michizono suggested to use 2000t GC instead of 4000t because the GC cost included in ILC cost estimation in Japan is only for 2000t (same as that for CMS)
- The cost of 4000t GC was estimated in Japan several years ago
 - VSL : ~X6 more expensive than CMS case
 - Taihei Dengyou : Slightly higher than VSL
- There are two choices
 - Accept 2000t and divide detectors more → Longer construction period, and many demerits
 - Detector groups share the cost (CMS paid ~2.4M CHF from the common fund)

ILD/SiD parameters

		Weight		Division		
		Yoke	Detector	4000t	2500t	2000t
ILD	Barrel	6900	1000	3	3* or 5	5*
	Endcap	3250x2		2	4	4
	Total			5	7	9
SiD	Barrel	3300	800	1	3	3
	Endcap	2200x2	250x2	2	2	4
	Total			3	5	7

* Detector installation in Detector Hall (underground)

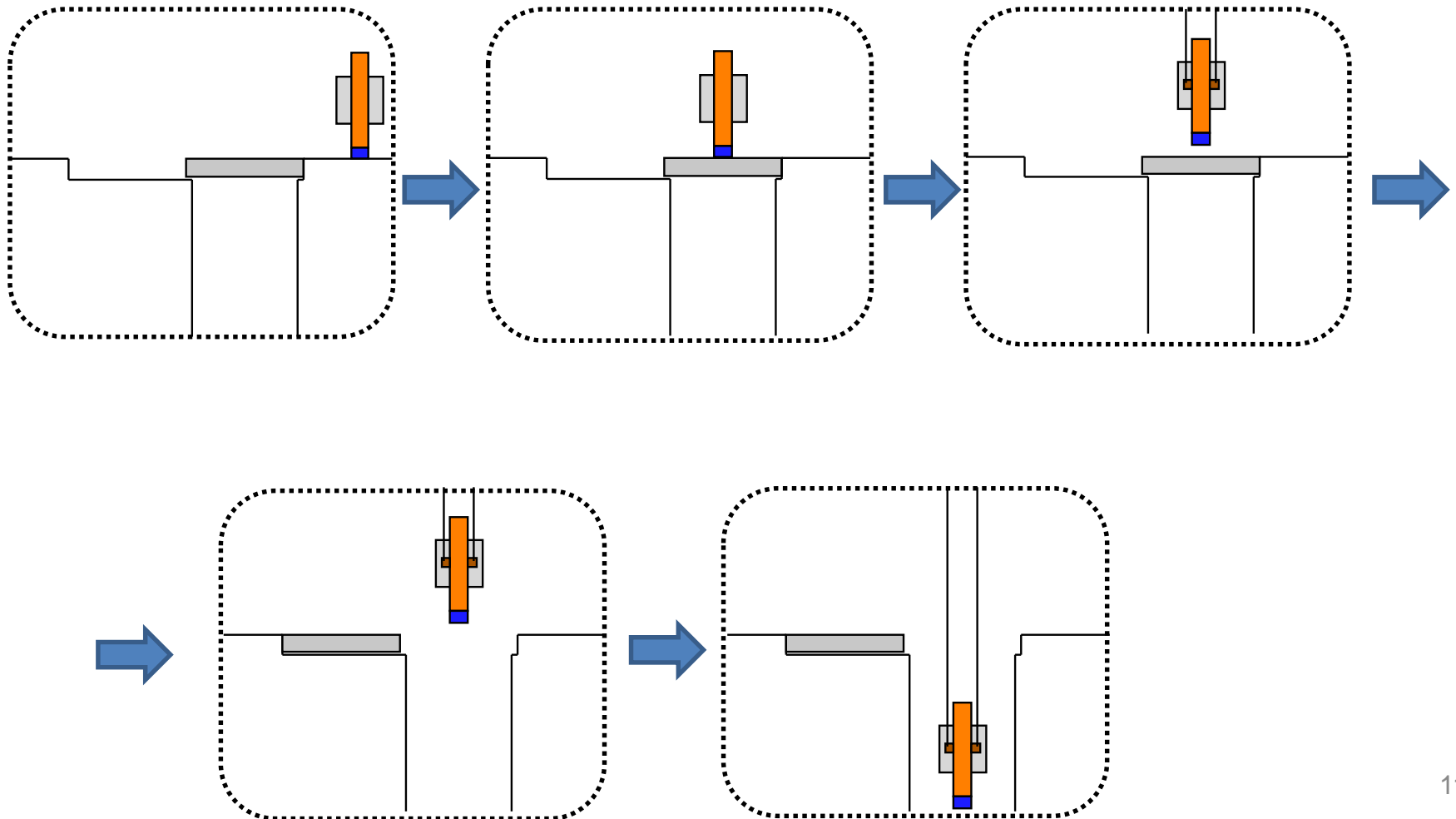
PLATFORM IN ASSEMBLY HALL

Detector lowering procedure

- In case of CMS, the platform in the assembly hall does not move with heavy detector component on it
- In present design of ILC detector assembly hall, each platform has to move with heavy load (>4000t) on it (total:6000t including self-weight) → High Risk
- In order to mitigate this risk, I would like to propose “Common Platform”
- This idea can be realized only if SiD (Barrel) can move in z-direction (along beam line) → Probably OK

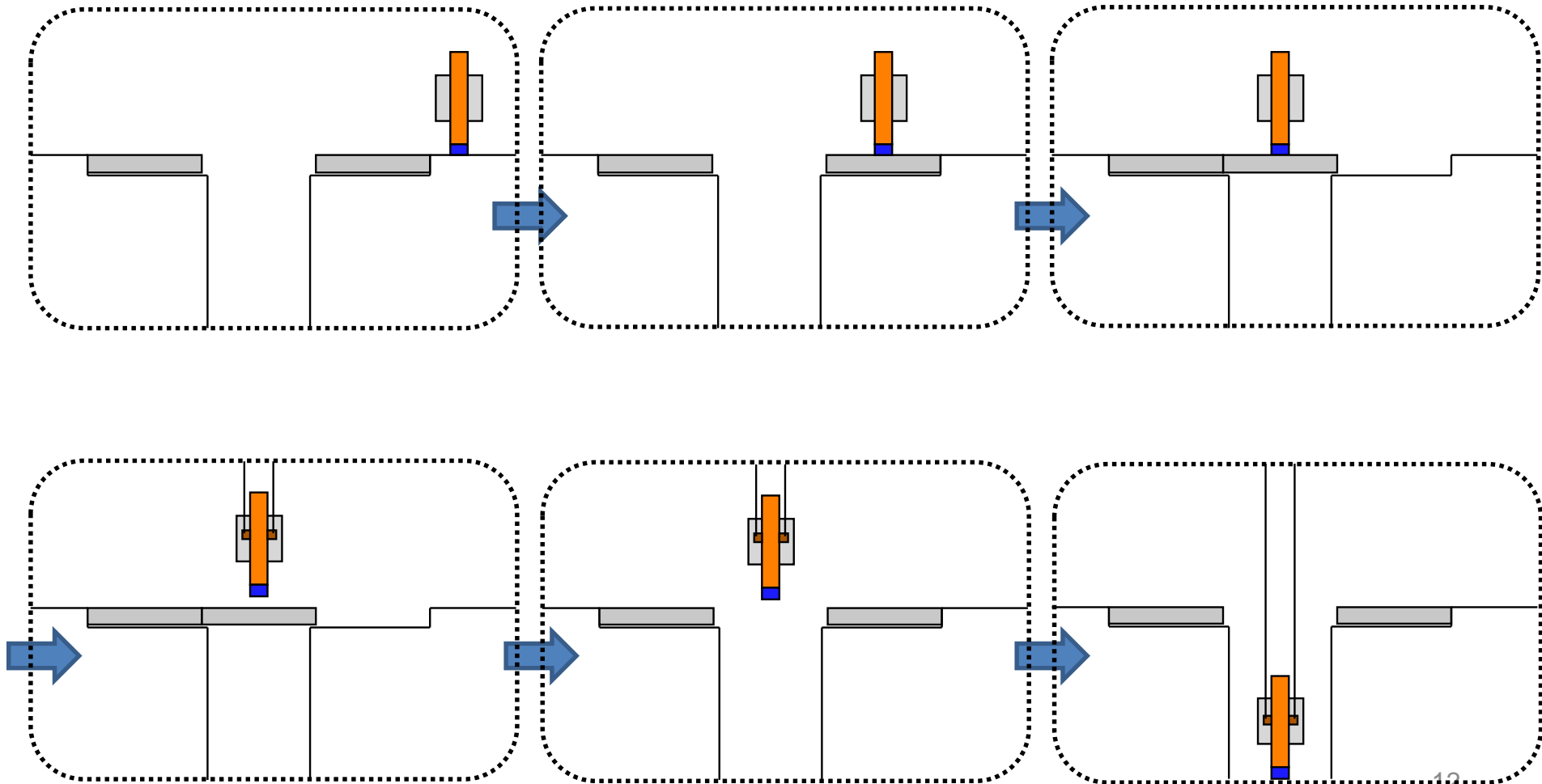
Detector lowering procedure

- CMS

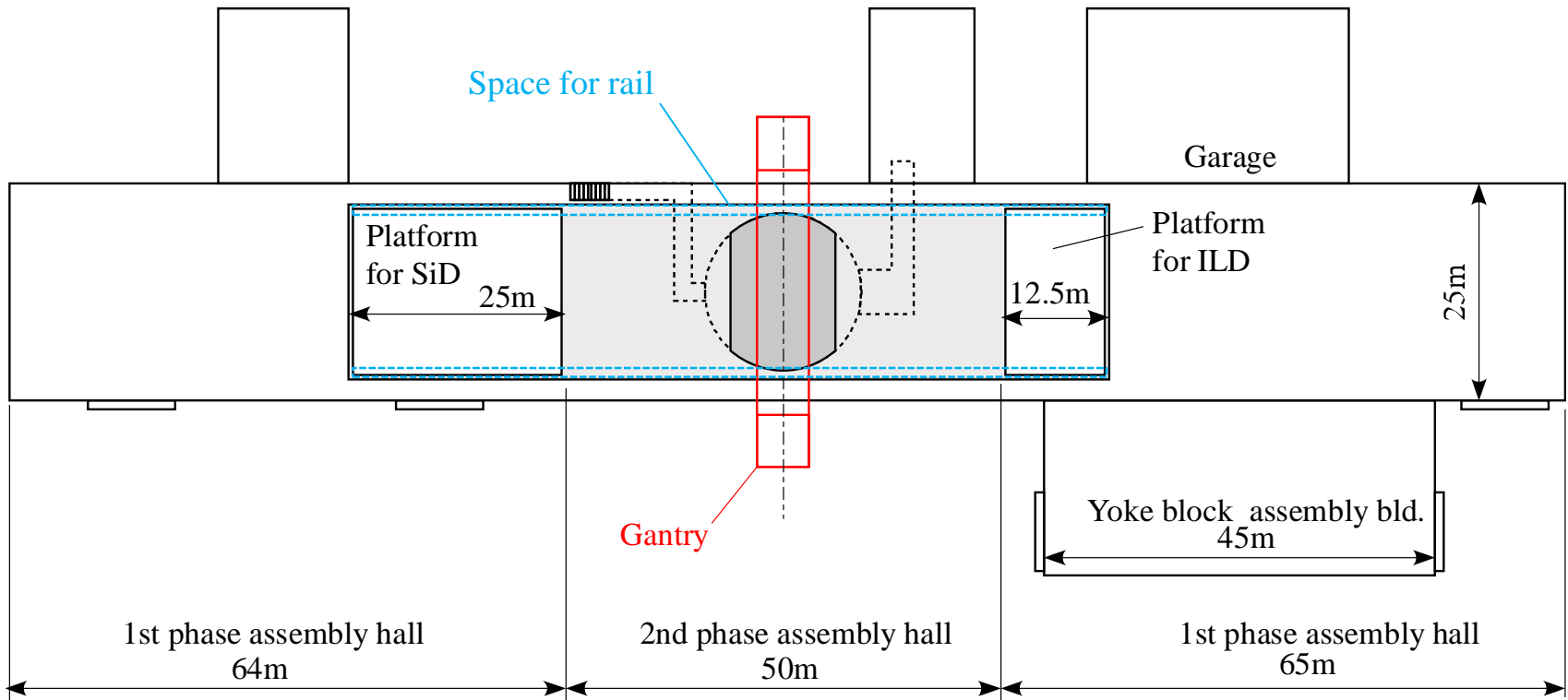


Detector lowering procedure

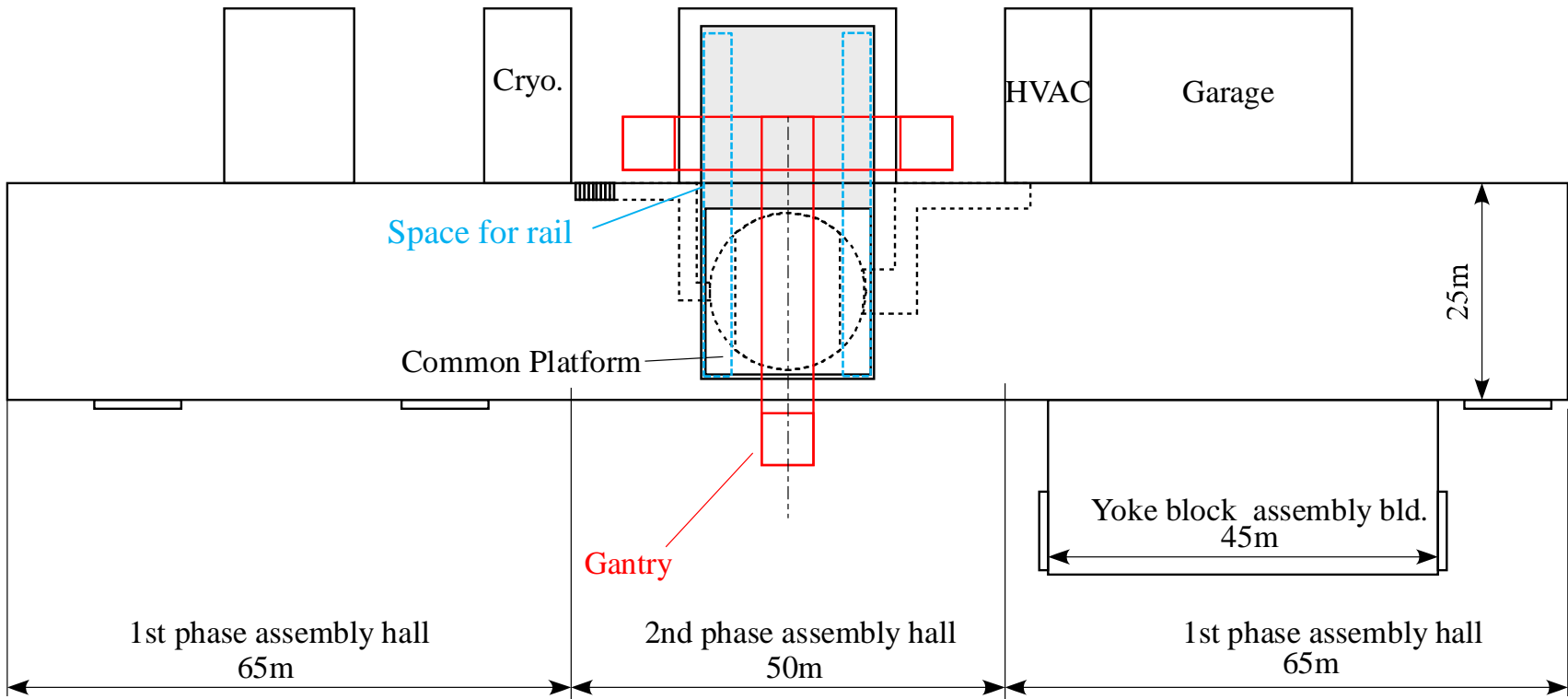
- ILD



Present design



Common Platform design



Pros & Cons of Common Platform

- Merit
 - Load during platform movement is much less (6000t → 2000t including weight of platform)
 - Wider area for rails supporting platform
 - Only one platform is needed → Less cost
 - Boundary between 1st-phase assembly hall and 2nd-phase assembly hall is flat
 - We don't have to construct the platform in the 1st-phase assembly hall → Could be time saving
 - Larger assembly space after completion of the 2nd-phase assembly hall
- Demerit (?)
 - 3 pillars are necessary for Gantry Crane ↔ Stronger against earth quake (?)

ILD UTILITY SURVEY

Previous Survey

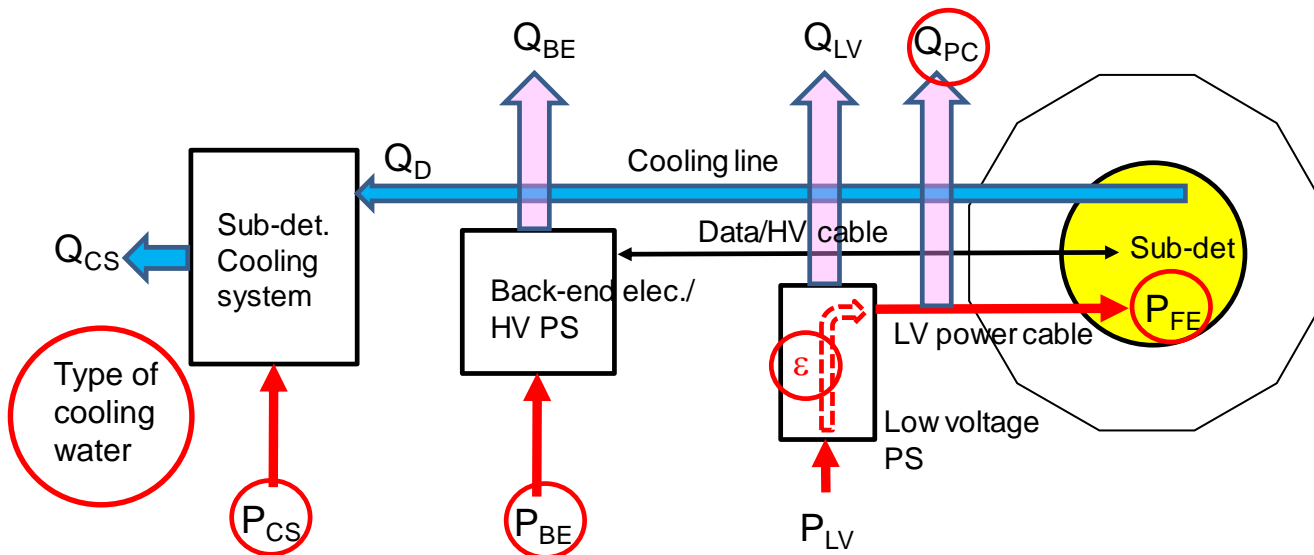
- Requirements for utilities for sub-detectors were surveyed before ALCW2018
 - Electric power
 - Cooling water
 - Space
- The survey items were too much complicated and ambiguous
 - Only half of the sub-detector groups responded
 - There seemed self-inconsistency in their requests
- Therefore we are doing 2nd round of the survey with simpler form

Previous survey

			VTX
Electronics Racks	Platform	Number	
		AC power (kW)	
		Heat loss (kW)	
	Service gallery	Number	
		AC power (kW)	
		Heat loss (kW)	
	U/S cavern	Number	
		AC power (kW)	
		Heat loss (kW)	
	Surface	Number	
		AC power (kW)	
		Heat loss (kW)	
Cables	Detector Hall	Heat loss (kW)	
Sub-detector cooling system	U/S cavern	Floor	
		WxDxH (m ³)	
		AC power (kW)	
	Cooling water	Type	
		Heat load (kW)	
Gas system	Platform	WxD (m ²)	
	Service gallery	WxD (m ²)	
	U/S cavern	WxD (m ²)	
	Surface	WxD (m ²)	
Laser system	Space requirement	Location	
		WxD (m ²)	

2nd round survey (1)

- Only 6 items for electricity/cooling water



- P_{FE} : Power consumption of sub-detector Front-end Electronics
- Q_D : Heat loss in sub-det. (= P_{FE})
- Q_{PC} : Heat loss in power cables
- P_{LV} : AC power input to LV PS
- ϵ : Efficiency of LV PS ($P_{LV} \cdot \epsilon = P_{FE} + Q_{PC}$)
- Q_{LV} : Heat loss in the LV PS ($= (1 - \epsilon) \cdot P_{LV}$)
- P_{BE} : AC power input to back-end elec./HV power supply
- Q_{BE} : Heat loss in the BE/HV PS ($= P_{BE}$)
- P_{CS} : Electric power to drive the cooling system
- Q_{CS} : Heat to be extracted from cooling system ($= Q_D + P_{CS}$)

2nd round survey (1)

Only these 6 items should be given

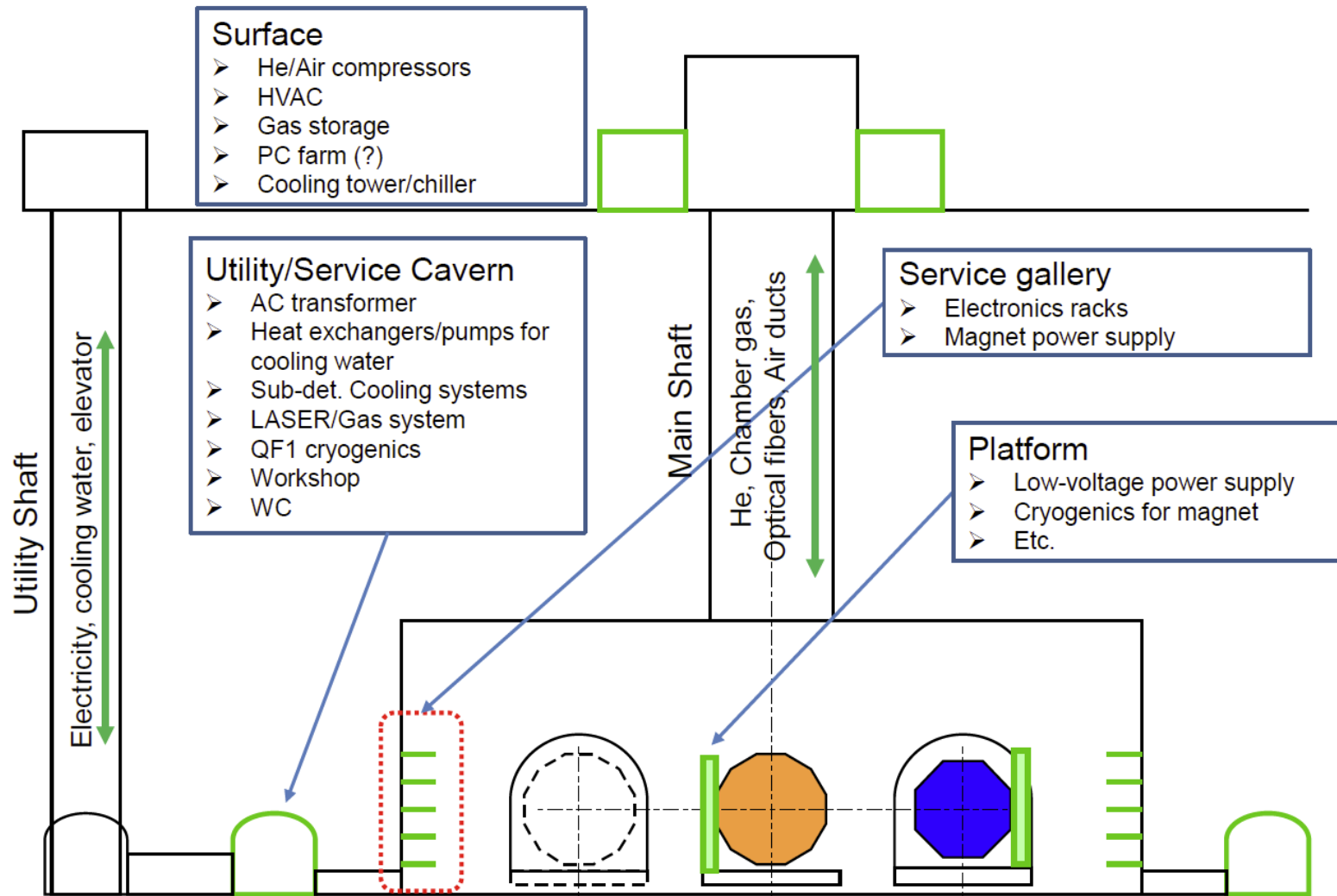
	Sub-detector name	SIT	
P_FE	Power consumption of Front-end Electronics		kW
Q_PC	Heat loss in Power Cables		kW
e	Efficiency of low voltage power supply	80%	
P_BE	AC Power input to Back-end Electronics		kW
P_CS	Electric power to drive Cooling System		kW
	Type of cooling water for cooling system	Chilled water	
P_LV	AC Power input to Low Voltage power supply		0 kW
Q_LV	Heat loss in Low Voltage power supply		0 kW
Q_BE	Heat loss in Back-end Electronics		0 kW
Q_CS	Heat to be extracted from cooling system		0 kW

2nd round survey (2)

- 10/5 items for space requirements

Sub-detector name		SIT	
Number of 19-inch electronics racks	Platform		
	Service gallery		
	Utility/Service Cavern (USC)		
Sub-detector cooling system	Floor in USC	Don't mind	
	WxDxH		m ³
Gas system	Space on surface (WxD)		m ²
	Space in USC (WxD)		m ²
	Space on service gallery (WxD)		m ²
	Space on platform (WxD)		m ²
Laser system	Space in USC (WxD)		m ²
Other requirements			

2nd round survey (2)



SUMMARY AND OUTLOOK

To-do List

- Gantry Crane
 - Discussion on cost sharing
 - Anti-seismic design including its foundation
 - By experts (company)
 - Cost estimate
 - Both for 2000t and 4000t cases
 - Presumably during Preparation Phase
 - Study of detector assembly with 2000t/2500t crane
 - Timeline
 - Size of Assembly Hall/Detector Hall
 - Cost
- Platform in Assembly Hall
 - It has to be clarified whether SiD can move by itself → Probably OK
 - (If no, realistic design of the platform and the rail has to be shown)
- Detector utility survey
 - We would like to get the reply by Mini-Workshop on ILC Infrastructure and CFS for Physics and Detectors on Nov.29th at KEK

(Tasks written in green characters would not be necessary if detector groups share the most of the cost)