# **ILD Installation Timeline** a Reminder

**Karsten Buesser** 

04.04.2023



DESY



### ILC Candidate site in Kitakami, Tohoku



**Ofunato** 大船渡市

Rikuzen-Takata 陸前高田市

遠野市

電石線

IP Campus

気仙沼市 唐梁半島

**Kesen-Numa** 

気仙沼線

## Local Planning: ILC Alignment

#### IP has just been moved north by a few km

• optimisation of surface area arrangements



"Tohoku ILC Civil Engineering Plan"

**DESY.** ILD Installation Timeline I Karsten Buesser, 04.04.2023

#### T. Sanuki, ILCX







### **Push-pull**





### **Magnetic Fields**

#### Magnetic stray fields

- are of concern in an environment shared by two detectors
- "on-beam" detector should be able to operate while maintenance work in "off-beam" detector, 10m away, is required

#### Limits drive thickness of iron yokes

• and this defines the radius of the central access shaft



Vs/m≏2	
4.5 📥	
4.09	
3.68 -	
3.27 -	
2.86 -	
2.45	
2.05	
1.64	
1.23	
0.818	
0.409	
0	

![](_page_5_Picture_11.jpeg)

### **ILD Mechanical Structure**

#### Main structure

- 5 Yoke rings
- central ring carries solenoid and inner detectors
- 2 endcaps with endcap calorimeters

### **Designed for push-pull**

on platform for rapid beam-beam transition

![](_page_6_Picture_8.jpeg)

![](_page_6_Picture_9.jpeg)

![](_page_6_Picture_10.jpeg)

### **IP Campus - Artist's View**

Water chiller & pumps Air intake/exhaust

research building

computing building

©Rey.Hori/KEK

154kV receive 154kV to 66kV Trans 66kV co-generation LNG for co-generation

> He compressor & tanks

IP detector assembly building

ILD&SiD detector preparation building

T. Sanuki, ILCX

![](_page_7_Picture_12.jpeg)

# IP campus In virtual site

#### IP campus ~10ha

![](_page_8_Picture_2.jpeg)

![](_page_8_Figure_3.jpeg)

# IP campus In real site

Space for future 2nd IP campus (Test accelerator ?)

 $\langle \rangle$ 

![](_page_9_Figure_2.jpeg)

## **Surface Assembly - CMS Style**

### Handling

- Gantry crane (temp)
  - 4000t
- 250t cranes in assembly hall
- 40t cranes in underground area
- air pads
- platform system

![](_page_10_Picture_8.jpeg)

![](_page_10_Picture_11.jpeg)

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### **Underground Areas**

![](_page_11_Figure_1.jpeg)

![](_page_11_Picture_3.jpeg)

![](_page_12_Picture_0.jpeg)

![](_page_12_Picture_4.jpeg)

### **Access Shafts**

![](_page_13_Figure_1.jpeg)

![](_page_13_Picture_6.jpeg)

![](_page_14_Picture_0.jpeg)

# Assembly Hall Design

![](_page_14_Figure_2.jpeg)

### **CFS Timeline - ALCW2018**

### CFS timeline on "Pre- and Preparation Phase"

![](_page_15_Figure_2.jpeg)

#### N. Terunuma

![](_page_15_Picture_6.jpeg)

![](_page_15_Picture_7.jpeg)

### IP Campus Development (Draft 03/2016)

#### IP campus schedule(draft)

	P Prepa Ph	Pre aratory lase	Pro	eparat	ory Ph	ase				Con	struc	tion P	hase				
	1	2	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11
Lewel	by	local															
legal	Pre	study								1.115			-				
procedures	Urba	an Plani	ning(de	evelopm	nent pe	ermissi	on), Ag	ricultura	al Land	Act, Fo	orest A	.ct…					
onvironmentel	by l	local		4ye	ars			there	is sol	me po	ssibilit	y to c	ut env	ironm	ental a	ssessi	men
assessment	Pre survey Research & Post-project survey (depends on the development)																
	by	local						1	-		1	1					-
site acquisition arangement	Land	survey	& arra	ngemer	nt												
14 17 17 19 19 19 19 19 19 19 19 19 19 19 19 19	by	local					-										
sito	Pre	study	Basic	& Deta	il desig	in											
development		1	1			1	Devel	opment	(depen	ids on t	the site	the development)					
	Pre	study	<b>♦</b> Basic	design			Detai	design	start	from	the us	able p	lace				
building							Construction										
construction							A.H(23month) + experimental group work will start										
surrounding	Pre	study															
infrastructure			Basi	c & Det	ail des	ian											
(outside of campus) by local			2301			.9.1	Devel	opment	(depen	ds on t	the site	condi	tion)				

\*\* all include the contract procedure \*\* A.H. schedule is from change request NO.ILC-CR-000R

T. Onuki

![](_page_16_Picture_6.jpeg)

### **Technical Detector Construction/Assembly Time Line**

			_		
	Y1	Y2	Y:	3	Y
	Q1 Q2 Q3 Q	4 Q1 Q2 Q3 Q4	Q1 Q2 (	Q3 Q4	Q1 Q2
Land develop.					
AH		Phase-	1		
DH		Civ	/il cor	Istru	uctior
Yoke				Α	ssen
Muon					
Solenoid					As
Endcap HCAL					
Endcap ECAL					
Barrel HCAL					
Barrel ECAL			ΔHr	020	
Tracker				Cac	y
QD0	DH: Dete	ector Hall			
Commissioning	M: Field I	Mapping			
Beam tuning	Ins.: Insta	allation			

![](_page_17_Figure_3.jpeg)

![](_page_17_Picture_4.jpeg)

Commissioning Beam tuning **LC Detector Imeline?** 

	-6	-	5	-4	-3			
Status				Ρ	repa	ar		
Due process				Prop	osal			
Off-site	R&D							
On-site (Surface)								
On-site (Underground)								

**DESY.** ILD Installation Timeline | Karston-Buesser, 04.04.2023 Grant Agreement 645479

![](_page_18_Figure_3.jpeg)

![](_page_18_Figure_4.jpeg)

![](_page_18_Picture_6.jpeg)

![](_page_18_Picture_7.jpeg)

![](_page_18_Picture_8.jpeg)

## **Solenoid Manufacturing**

#### **Solenoid production**

- Assumed module production in industry, assembly on site
- Transportation is an issue
- New idea: wind coil modules on-site also ullet
  - needs to be studied in more details
  - should fit into time lines
  - space in on-site assembly area is required

2020/10/23	-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8			
Organization	IC	T		Pre-Lab.					ILC Lab.								
Status	Pre-pre	paration	ration Preparation Construction/Comm										sioning				
Due process						Det. P	roposa	l <mark>Sub-de</mark>	et. TDR								
On-site (Surface)							Land devel.	Assembly construct	hall ion								
On-site (Underground)							D	etector H	Hall, Ac	cess tur	nnel cor	nstructic	on				
	R&D																
	TDR																
	Bidding												Co	oil Mo			
Solenoid/DID	Assembly	off-site							Prep.	<u>_</u>	M2	M3					
	Assembly	on-site															
	Installation																
	Full currer	nt test				vindin	g in A	m is po:	elaizz								

#### Outline of ILD Coil manufacturing process (1)

![](_page_19_Figure_12.jpeg)

#### Passing Through Tunnels

![](_page_19_Figure_14.jpeg)

![](_page_19_Figure_15.jpeg)

![](_page_19_Picture_16.jpeg)

![](_page_19_Figure_17.jpeg)

![](_page_19_Figure_18.jpeg)

![](_page_19_Figure_19.jpeg)

![](_page_19_Picture_21.jpeg)

![](_page_19_Picture_24.jpeg)

### **Assembly and Transportation**

#### Transportation

- next sea ports are O(30km) away from site
- rural, hilly landscape, winding roads
- max. truck size in Japan: 30t
- heavy-load transports are possible only in very exceptional circumstances
  - requires reinforcements of roads and bridges

### Assembly

- transportation limits require heavy assembly work at or close by the IP site
  - assembly hall at IP campus
  - additional work space in close-by temporary areas

![](_page_20_Figure_12.jpeg)

![](_page_20_Figure_13.jpeg)

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### **IP Campus Access**

![](_page_21_Picture_1.jpeg)

**DESY.** ILD Installation Timeline | Karsten Buesser, 04.04.2023

![](_page_21_Picture_3.jpeg)

## ILC Main Campus Development (Draft 03/2016)

#### ILC main campus-Schedule(Draft)

main critical point is environmental assessment.

	Pre Preparatory Phase		Pre Preparatory Preparatory Phas Phase					Construction Phase										
	1	2	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11	
logal	by I	ocal																
procedures	Pres	study	Consu	Itation	with lo	cal gov	/ernme	nt										
environmental	by I	ocal	5year	s→or	shorte	r?												
assessment	Pres	survey	Resea	arch &	Conse	rvation	Plan	Post-p	project	survey	deper	nds on	the dev	/elopme	ent)			
site acquisition	by I	ocal					-	-			1			-				
arrangement	Land	survey	& arra	ngeme	nt													
site	by loc	al&ILC				4.	Ļ		1									
development	Pres	study	Basic a	& Deta	il desig	in	1	ļ										
(includes infrastructure)	nmental ssment Pre survey Research & Conservation Plan Post-project survey (depends on the development   quisition gement by local Land survey & arrangement Land survey & arrangement Image: start from the usable place staged Construction(depends on si *the first building will be co																	
	Pre	study	Basic	design											1	1		
building construction	by loc	al&ILC						Detail	design	start	t from	the us	able pl	ace				
conoti dotion										stage	ed Cons	structio	on(depe	ends on	site de	evelopn	nent)	
	Dro					1					★the fi	rst bu	ilding v	will be	compl	eted		
surrounding	Pre s					+					(depe	enas o	n the \	oiume	e & Tun	iction)		
infrastructure	by	Cai	Basic a	& Deta	il desig	In			by loo	cal								
(outside of campus)			by loc	al				Develo	opment	(deper	nds on t	he site	condit	tion)				

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![](_page_22_Picture_7.jpeg)

## NEC Facility at Ichinoseki

### **Recently given up facility**

- O(20.000 m2) of floor space
- Used for electronics assembly

#### Directly next to Ichinoseki Shinkansen station

Under discussion (2019) to be made available for preparatory ILC project works

![](_page_23_Picture_6.jpeg)

![](_page_24_Picture_0.jpeg)

## Conclusions

#### Detector Assembly has been studied in quite some detail in the past

- Check E-JADE Deliverable Report #22: <u>https://www.e-jade.eu/publications/deliverable\_reports/</u>
- Technical schedule assumes 9 years of construction, 1 year of commissioning
  - Solenoid construction is on the critical path for the detectors
  - R&D, preparation, and construction in industry requires significant funds very early
  - to some extent already in preparatory phase

#### CFS and site schedules have been estimated by LCC and local experts

- Need a significant "preparatory phase" after green light and before construction start
  - legal procedures, environmental assessment, land acquisition, etc.
  - requires already significant project funding
  - takes 4 (-6) years
- On-site assembly of detector parts can only start after Assembly Hall is ready
  - 3-4 years after construction start, 8-10 years after green light

#### Caveats

- Need to update knowledge about status of local planning
  - Ball has been dropped 2019
- Large uncertainties in all schedules lacksquare

![](_page_25_Picture_23.jpeg)

# Backup

## **Push-pull System**

### **ILC Baseline**

- one interaction region for two detectors
- push-pull system allows for lumi-lumi transition within ulletO(1d)

#### **Constraints**

- Set of rules for the friendly co-existence of two detectors
  - one taking data, one being maintained
- Functional requirements laid down in 2009
  - SLAC-PUB-13657
  - geometric boundary conditions
  - magnetic and radiation environment
  - vacuum
  - alignment and vibration limits
  - etc. ullet

![](_page_27_Picture_16.jpeg)

- Beam height difference between SiD and ILD: 1.6m
- This results in different floor levels in the underground hall

![](_page_27_Picture_19.jpeg)

![](_page_28_Picture_0.jpeg)

LINEAR COLLIDER COLLABORATION

# Trailer access around Assembly hall

ILD End Side Entrance access

![](_page_28_Figure_4.jpeg)

SiD Platform Side Entrance access

![](_page_28_Figure_6.jpeg)

#### ILD Platform Side Entrance access

![](_page_28_Figure_8.jpeg)

SiD End Side Entrance access

![](_page_28_Picture_11.jpeg)

## **ILD Cabling Scheme**

#### **General exits:**

- Barrel detector: gap between barrel yoke rings
- Endcap detector: gap between endcap • and barrel yoke
- FCAL: along QD0

#### The occupation of the available cable paths needs to be reviewed

#### The location and size of the patch panels is critical

![](_page_29_Picture_7.jpeg)

![](_page_29_Figure_9.jpeg)

Detail of the Inner detector region

Fixation of ISS on TPC endplates or inner

VTX fixed on beam

BP hang by small cables.

![](_page_29_Picture_14.jpeg)

![](_page_29_Picture_15.jpeg)

### **VTX Infrastructure**

### **Conceptual design**

CMOS option

![](_page_30_Picture_3.jpeg)

![](_page_30_Figure_4.jpeg)

![](_page_30_Picture_8.jpeg)

![](_page_30_Picture_10.jpeg)

### **TPC Infrastructure**

#### **Special requirements**

- HV, gas system
- requires integration with civil infrastructure • underground and on surface
- conceptual plans exist

Ref.: Interface Ed.: 4 Control Document Rev.: 0 **Template** Date: 2017/11/15

![](_page_31_Figure_6.jpeg)

![](_page_31_Figure_8.jpeg)

![](_page_31_Picture_9.jpeg)

![](_page_31_Picture_10.jpeg)

## **ILD Infrastructure**

### Infrastructure planning

- underground and on surface
- has impact on civil facilities design!
  - cost, timelines
- conceptual studies under way

![](_page_32_Figure_6.jpeg)

#### Power consumption distribution

![](_page_32_Figure_9.jpeg)

# Figure 6.5.