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	

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

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

IP campus In virtual site

IP campus ~10ha

IP campus In real site

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

 $\langle \rangle$

Surface Assembly - CMS Style

Handling

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

11

Underground Areas

Access Shafts

Assembly Hall Design

CFS Timeline - ALCW2018

CFS timeline on "Pre- and Preparation Phase"

N. Terunuma

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	♦ 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

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			

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

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)

Passing Through Tunnels

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

21

IP Campus Access

DESY. ILD Installation Timeline | Karsten Buesser, 04.04.2023

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)				

T. Onuki

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

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

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

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

LINEAR COLLIDER COLLABORATION

Trailer access around Assembly hall

ILD End Side Entrance access

SiD Platform Side Entrance access

ILD Platform Side Entrance access

SiD End Side Entrance access

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

Detail of the Inner detector region

Fixation of ISS on TPC endplates or inner

VTX fixed on beam

BP hang by small cables.

VTX Infrastructure

Conceptual design

CMOS option

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

ILD Infrastructure

Infrastructure planning

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

Power consumption distribution

Figure 6.5.