

Meeting FC du CPPM, 24 Mars 2020
Claude Vallée

DERNIERES NOUVELLES DE L'ILC ET D'ILD

Meeting ICFA du 20 Février 2020

Interim Design Report ILD



ICFA Statement on the ILC Project

February 22, 2020

ICFA was encouraged by the reports from Mr. H. Masuko, Deputy-Director General, MEXT Research Promotion Bureau and Hon. T. Kawamura, Chairperson of the Federation of Diet Members for the ILC, at the ICFA meeting held at the SLAC National Accelerator Laboratory, Stanford, USA, on the 20th February 2020.

Based on these reports:

- ICFA reconfirms the international consensus for a Higgs factory and wishes to see the timely construction of the ILC in Japan.
- ICFA acknowledges and welcomes the inter-governmental discussion between Japan, the United States and European nations, to advance international collaborative activities for the ILC.
- ICFA notes the need for a preparatory phase ahead of the establishment of the ILC laboratory and the construction of the ILC in Japan.

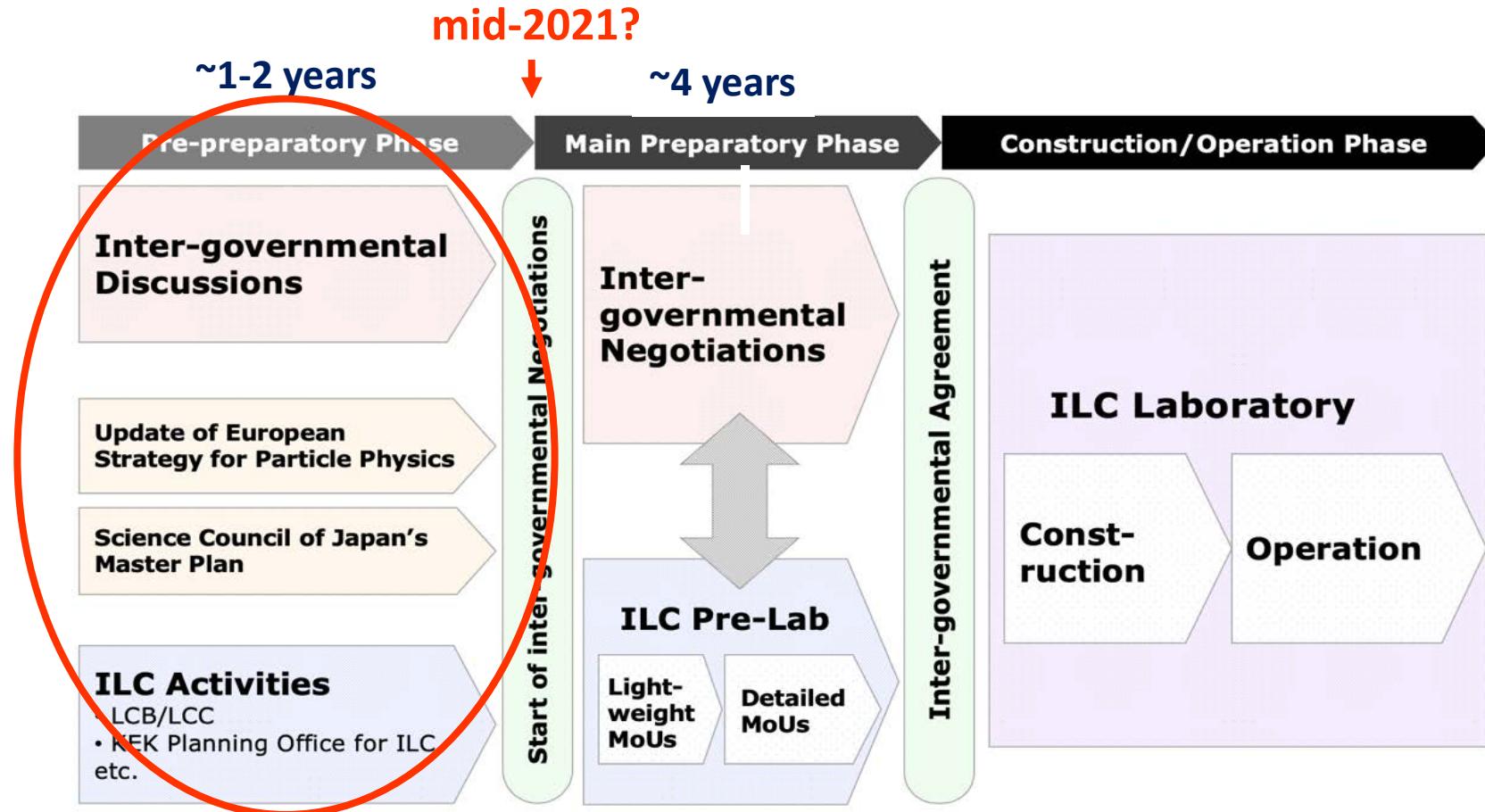
ICFA Statement on the ILC Project

Cont'd

February 22, 2020

- ICFA advocates establishment of an international development team to facilitate transition into the preparatory phase.
 - The development team should be hosted by KEK, with leadership chosen with the help of ICFA.
 - The team would develop a plan for the preparatory phase for the construction of the ILC, including technical, organizational and governance issues. It also would be tasked with understanding the activities and resources required in the preparatory phase. The process of developing the plan should involve the interested laboratories and community.
 - ICFA anticipates that these development activities could be completed in approximately one year, at which point it would be possible to launch the preparatory phase for the ILC, provided Japan expresses intent to do so together with international partners.
- In view of progress towards realisation of the ILC in Japan, ICFA encourages the interested members of the high energy physics community, laboratories, and nations, to support and participate in these preparations aimed at the successful establishment of the ILC.

ICFA Statement is in line with the recommendations of the KEK International Working Group



*Post-LCC structure being set up by ICFA and KEK
to precisely define the future ILC Pre-Lab mandate and organization*

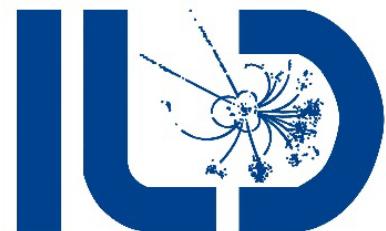
Implications for Detector Collaborations (ILD/SiD/CLICdp) should be clearer around summer

International Large Detector

ILD INTERIM DESIGN REPORT (IDR)

INTERIM DESIGN REPORT

The ILD Concept Group



arXiv:2003.01116v1 [physics.ins-det] 2 Mar 2020

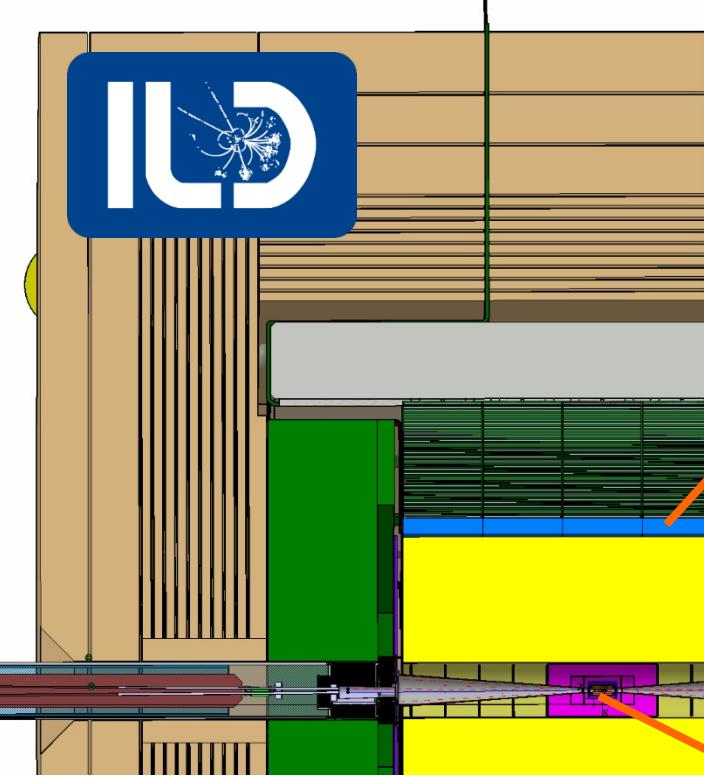
Released as arXiv:2003.01116

Summarizes the progress on
ILD design/technologies/performance/cost
since 2013 (ILC TDR & ILD LOI/DBD)

Contents

	Contents	Contents
Contents	iii	Contents
1 Introduction	1	
2 Science with ILC	3	
2.1 Higgs Physics	4	
2.2 BSM Physics	6	
2.3 Top Quark Physics	7	
2.4 Benchmarking Studies	8	
3 The ILC Environment	11	
3.1 The International Linear Collider Project	11	
3.2 Integration of ILD into the experimental environment	13	
3.3 Experimental Conditions	13	
3.3.1 Beam Conditions	13	
3.3.2 Machine Detector Interface	14	
4 The ILD detector concept	17	
4.1 The overall ILD concept	17	
4.2 Optimizing ILD	18	
5 Detector Layout and Technologies	21	
5.1 Overall Structure of the Detector	21	
5.1.1 Global structure and parameters	21	
5.1.2 Subdetector layouts	21	
5.2 Subdetector Technology Status	32	
5.2.1 Vertex Detector	32	
5.2.2 Silicon Trackers	34	
5.2.3 Time Projection Chamber	37	
5.2.4 Electromagnetic Calorimeter	39	
5.2.5 Hadronic Calorimeter	44	
5.2.6 Very Forward Detectors	48	
5.2.7 Iron Yoke Instrumentation	48	
6 ILD Global Integration	51	
6.1 External ILD integration	51	
6.1.1 Site-related Infrastructure	51	
6.1.2 Detector Utilities and Cavern Ancillary Services	51	
6.1.3 Access and Assembly	57	
6.2 Internal ILD integration	59	
6.2.1 ILD Mechanical Structure	59	
6.2.2 ILD Services and Utilities	59	
6.2.3 Inner Detector Integration	60	
6.2.4 TPC Integration	62	
6.2.5 Electromagnetic Calorimeters Integration	65	
6.2.6 Hadronic Calorimeters Integration	66	
6.2.7 Very Forward System Integration	69	
6.3 Mechanical structure studies	70	
6.4 Coil and yoke studies	72	
6.4.1 Magnet Engineering Studies	72	
6.4.2 Field Optimisation Studies	72	
6.5 Beam background studies	79	
6.5.1 Beamstrahlung	79	
6.5.2 Halo muons	80	
6.5.3 Backscattered neutrons from beam dumps	80	
6.6 Data acquisition	82	
6.6.1 DAQ architecture	82	
6.6.2 DAQ R&D	83	
6.7 Calibration/ Alignment procedures	84	
6.8 Earthquake Safety	85	
6.8.1 Structural Design	85	
6.8.2 Seismic Isolation	87	
6.9 Technical Documentation	88	
6.9.1 Interface Control Documents	88	
7 Physics and Detector Modelling	91	
7.1 Modelling of ILC Conditions and Physics Processes	91	
7.2 Detector Simulation	92	
7.2.1 ILD Simulation Models	92	
7.2.2 Hybrid Simulation	93	
7.3 Event Reconstruction	95	
7.3.1 Digitization	95	
7.3.2 Track reconstruction	96	
7.3.3 Particle Flow	96	
7.3.4 High Level Reconstruction	97	
7.4 Monte Carlo Production on the Grid	97	
8 Detector and Physics Performance	101	
8.1 System performance	101	
8.1.1 Tracking	101	
8.1.2 Particle Flow performance and JER	102	
8.1.3 Vertexing	106	
8.1.4 Charged Particle identification	106	
8.1.5 BeamCal reconstruction	109	
8.2 High-level Reconstruction Performance	110	
8.2.1 Flavour-Tag Performance	110	
8.2.2 Hadronically decaying tau ID	111	
8.2.3 J/Psi reconstruction	111	
8.3 Physics Benchmarks	113	
8.3.1 Luminosity, Energy and Polarisation for the Physics Benchmarks	113	
8.3.2 Hadronic Branching Ratios of the Higgs Boson	113	
8.3.3 Higgs Mass from $ZH \rightarrow ll\bar{b}\bar{b}$	115	
8.3.4 Branching Ratio of $H \rightarrow \mu^+\mu^-$	118	
8.3.5 Sensitivity to $H \rightarrow$ invisible	119	
8.3.6 τ polarisation in $e^+e^- \rightarrow \tau^+\tau^-$	121	
8.3.7 Hadronic WW and ZZ separation in Vector Boson Scattering	122	
8.3.8 Photon Energy Scale Calibration from $e^+e^- \rightarrow \gamma Z \rightarrow \gamma\mu^+\mu^-$	125	
8.3.9 A_{FB} and polarised cross sections from $e^+e^- \rightarrow b\bar{b}$	127	
8.3.10 A_{FB} and polarised cross sections from $t\bar{t} \rightarrow bbqql\nu$	128	
8.3.11 Search for extra Scalars in $e^+e^- \rightarrow ZS^0$	131	
8.3.12 Search for low ΔM Higgsinos	134	
8.3.13 WIMP Search in the Mono-Photon Channel	135	
9 Costing	139	
9.1 The method	139	
9.2 Subdetector costing	140	
9.2.1 VTX	140	
9.2.2 SIT	140	
9.2.3 FTD	141	
9.2.4 Forward Calorimetry (FCAL)	141	
9.2.5 TPC	142	
9.2.6 SET	143	
9.2.7 ECAL	143	
9.2.8 HCAL	144	
9.2.9 Magnet	145	
9.2.10 Iron yoke instrumentation	145	
9.3 Global ILD costing	146	
9.4 Comparison to the DBD cost estimate and discussion	147	
10 Summary and outlook	149	

*~150 pages
comprehensive overview
of interest for any detector
of future Higgs factories*



MAIN ONGOING TASKS AT IN2P3 IN LINE WITH CPPM EXPERTISE

CALORIMETRY:

- 20-layer SiECAL prototype construction and beam test (LLR/LAL)
- Construction of CMS HGCAL
- Development of HCAL large RPC readout planes (IPNL)

More manpower needed for:

- *Improved ASICs for zero-suppression and timing*
- *Cooling and service path integration*
- *Mechanical structure optimisation*

VTX/Si TRACKING:

- Development of PSIRA CMOS chip for ILC (IPHC)
- Construction of CMOS detectors for ALICE and CBM

More manpower needed for:

- *Light weight mechanical structure*
- *Cooling concept*
- *Study of pixel extension to central tracker*

GENERAL:

Weakly covered items:

- *Global engineering*
- *DAQ*