

# Background slides on ILC, CLIC

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# ILC Advisory Panel in MEXT

1<sup>st</sup> survey of technological  
spin-offs and Research trends (FY2014)  
2<sup>nd</sup> survey of technology issues  
(FY2015)

Research contract

MEXT

Under ILC TF headed by  
State Minister of MEXT

ILC Advisory Panel

Established in May 2014

**Particle and Nuclear  
Physics Working Group**

Re-established  
in Jan. 2018

**TDR Validation  
Working Group**

Re-established  
in Jan. 2018

**Human Resources  
Working Group**

Established  
in Nov. 2015

**Organization and  
management Working  
Group**

Established  
in Feb 2017

- Special Committee investigates critical issues required to judge hosting ILC.
- ILC Advisory Panel's Summary (Aug 2015)
- "Report on measures to secure and develop human resources for the ILC" (July 2016)
- A WG to investigate organizational and management issues was recently set up (Feb 2017).
- Particle and Nuclear Physics Working Group and TDR Validation Working group are re-established to evaluate ILC250GeV.
- First working group will be held on middle of January, 2018.

## ICFA STATEMENT ON THE ILC OPERATING AT 250 GEV AS A HIGGS BOSON FACTORY

The discovery of a Higgs boson in 2012 at the Large Hadron Collider (LHC) at CERN is one of the most significant recent breakthroughs in science and marks a major step forward in fundamental physics. **Precision studies of the Higgs boson will further deepen our understanding of the most fundamental laws** of matter and its interactions.

The International Linear Collider (ILC) operating at 250 GeV center-of-mass energy will provide excellent science from precision studies of the Higgs boson. Therefore, **ICFA considers the ILC a key science project complementary to the LHC and its upgrade.**

ICFA welcomes the efforts by the Linear Collider Collaboration on cost reductions for the ILC, which indicate that up to **40% cost reduction** relative to the 2013 Technical Design Report (500 GeV ILC) is possible for a **250 GeV collider.**

ICFA emphasises the **extendibility of the ILC to higher energies** and notes that there is large discovery potential with important additional measurements accessible at energies beyond 250 GeV. ICFA thus supports the conclusions of the Linear Collider Board (LCB) in their report presented at this meeting and **very strongly encourages Japan to realize the ILC in a timely fashion** as a Higgs boson factory with a center-of-mass energy of 250 GeV as an international project<sup>1</sup>, led by Japanese initiative.

<sup>1</sup> In the LCB report the European XFEL and FAIR are mentioned as recent examples for international projects.

Ottawa, November 2017

# KEK-ILC Action Plan

KEK-DG Yamauchi set up a WG to develop a [KEK-ILC action plan](#) in May, 2015.

The KEK-ILC Action Plan was released in January 2016. It contains technical preparation tasks and a human resource development plan for the **pre-preparation phase (current efforts)** and the **main-preparation phase (after “green sign” from MEXT)**. It focuses mainly on a development plan for KEK.

“Producing a **EAP (European Action Plan)** for the ILC in timely manner is very important.”

“After having established a discussion group with DOE, discussions with Europe are likely to become the next important topic for MEXT.”

Extracted from slides of Y.Okada, KEK – EJADE meeting 6.9.16

On the European side it was suggested to use the EJADE H2020 MC project to prepare the EAP – the effort was started October 2016

# E-JADE

Europe-Japan Accelerator Development Exchange Programme

Programme 2015-2018:

- Three main technical WPs
- Supports extended stays of European Researchers in Japan
- Recently adapted to include detector and physics studies for ILC (new partners)

Technical WPs: WP1: LHC with upgrades/FFC/ SuperKEKb, WP2: ATF2, WP3: ILC/CLIC

Partners: CERN (coord), DESY, CEA, CNRS, CSIC, RHUL, OXF with Uni. Tokyo and KEK -> WG for EAP

New partners: VINCA, AGH-Cracow, Tel Aviv University, Liverpool University, Université de Strasbourg, Université Paris-Sud, Tohoku University and Kyushu University.

Authors of EAP:

For EJADE institutes:

CERN: S.Stapnes, CEA: O.Napoli, DESY:

N.Walker/H.Weise/B.List, CNRS: P.Bambade/A.Jeremi, UK: P.Burrows, CSIC: A.Faust-Golfe

EJADE WP3 and centrally: T.Schoerner-Sadenius, M. Stanitzki

TDR: B.Foster

# ILC Project Phases

## 2017–2018: Pre-preparation phase

The on-going activities with relevance to the ILC in Europe are reviewed.

## 2019–2022: Preparation phase

This period needs to be initiated by a positive statement from the Japanese government about hosting the ILC, followed by a European strategy update that ranks European participation in the ILC as a high-priority item. The preparation phase focuses on preparation for construction and agreement on the definition of deliverables and their allocation to regions.

## 2023 and beyond: Construction phase

The construction phase will start after the ILC laboratory has been established and inter-governmental agreements are in place. At the current stage, only the existing capabilities of the European groups relevant for this phase can be described.



# ILC pre-preparation phase in Europe



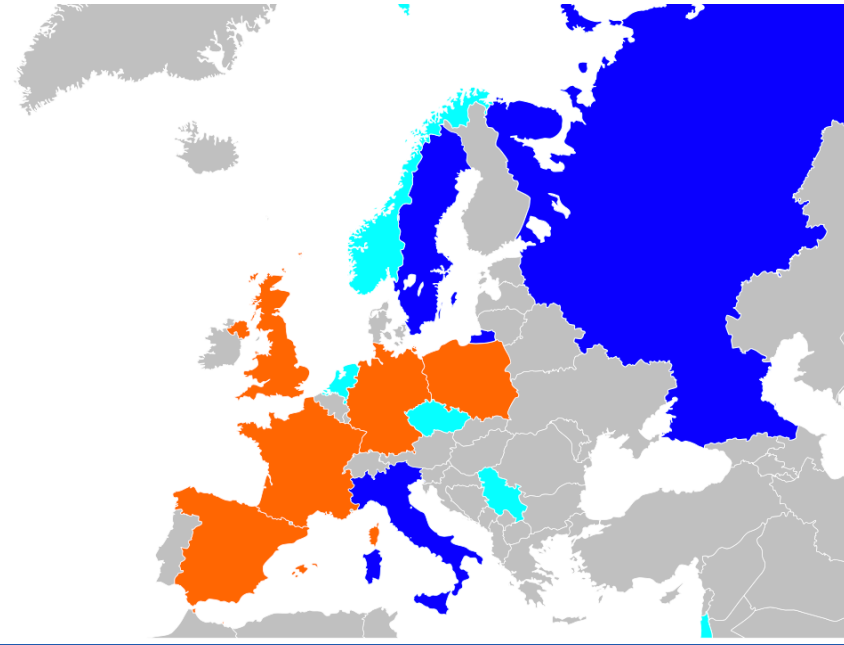
Item/topic	Brief description	CERN	France CEA	Germany DESY	Time line
SCRF	Cavity fabrication including forming and EBW technology,	✓			2017-18
	Cavity surface process: High-Q &—G with N-infusion to be demonstrated with statics, using High-G cavities available (# > 10) and fundamental surface research		✓	✓	2017-18
	Power input-coupler: plug compatible coupler with new ceramic window requiring no-coating	✓			2017-19
	Tuner: Cost-effective tuner w/ lever-arm tuner design	✓	✓		2017-19
	Cavity-string assembly: clean robotic-work for QA/QC.		✓		2017-19
Cryogenics	Design study: optimum layout, emergency/failure mode analysis, He inventory, and cryogenics safety management.	✓			2017-18
HLRF	Klystron: high-efficiency in both RF power and solenoid using HTS	✓			2017- (longer)
CFS	Civil engineering and layout optimization, including Tunnel Optimization Tool (TOT) development, and general safety management.	✓			2017-18
Beam dump	18 MW main beam dump: design study and R&D to seek for an optimum and reliable system including robotic work	✓			2017- (longer)
Positron source	Targetry simulation through undulator driven approach			✓	2017-19
Rad. safety	Radiation safety and control reflected to the tunnel/wall design	✓			2017 – (longer)

## Pre-preparation summary:

Europe has played – and continues to play – a central role in development of the ILC project

Large European projects are being implemented where the ILC/SCRF technology is being put to use and is being validated

European Industry is well prepared to construct parts for ILC



# Preparation Phase 2019-22: Key activities in Europe

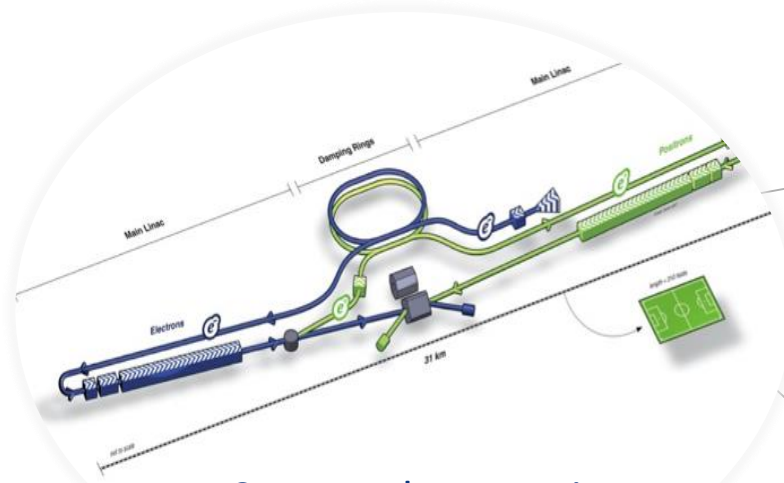
This period needs to be initiated by a positive statement from the Japanese government about hosting the ILC, followed by a European strategy update that ranks European participation in the ILC as a high-priority item. The preparation phase focuses on preparation for construction and agreement on the definition of deliverables and their allocation to regions.

- The European groups will concentrate on preparation for their deliverables, including European industry.
- Europe and European scientists, as part of an international project team, will also participate in the overall finalization of the design, while in parallel contributing to the work of setting up the overall structure and governance of the ILC project and of the associated laboratory.

Key activities in Europe	More details
SCRF activities	
	Cavity fabrication and preparation, Power Couplers, Automation of assembly, E-XFEL > ILC
High efficiency klystron R&D	
Cryogenics system	LHC system similar in size to ILC
Accelerator Domain issues	
	Positron source, Damping Rings, Beam Delivery Systems, Low emittance beam transport, Beam dumps, Positron source
Detector and Physics	
	Design optimization, RMDI, Technical prototypes, TDRs, Physics studies
Documentation system	Experience from E-XFEL
“Regional” Design office	Naturally at CERN, linking to other European National Labs



# Preparation Phase 2019-22: Organization and resources



ILC prep. phase project:  
CERN coordination of  
European effort

R&D  
contracts

MoU annexes or  
similar (with MS  
and NMS  
collaborators)

Techn.  
Transfer  
agreements,  
EU projects.

A European ILC project in the preparation phase 2019-22:

- Resources needed estimated to ~25 MCHF/year (material) and 60 FTE/year (personnel), ramping up from 2019
- Move towards more engineering personnel
- The organisational model above is used for existing studies at CERN, e.g. CLIC/HE-LHC/FCC



# Construction phase 2023 and beyond

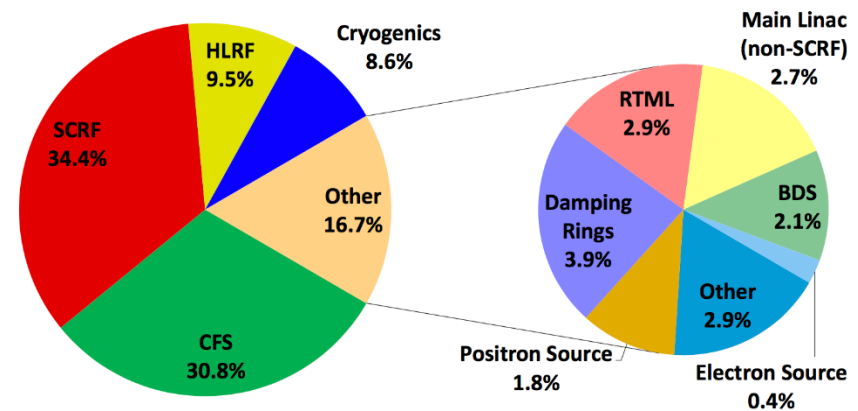
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As mentioned above, the detailed contributions will have to be defined during the preparation phase and formalized by inter-governmental agreements. Some contributions from Europe are imperative for the project - most prominently superconducting RF modules.

So premature to plan in detail, however some comments can be made:

- Focus on technical items for ILC (not CE and infrastructure)
- E-XFEL ~7% of a 250 GeV ILC – and more than 10% of the cryo-modules needed
- Detector construction expected to follow LHC detector model
- Spending significantly above the levels mentioned on previous page only by ~2025-26

Any guidance from Japan on contributions would allow us to make firmer European Planning for this period



# CLIC documents for ESU

## Accelerator documents:

**An accelerator technical description** (around ~150p)

- 380 GeV drive beam, klystron-option, upgrades to 3 TeV and beyond, technical studies, CE and infrastructure, performance studies, cost and power, schedules

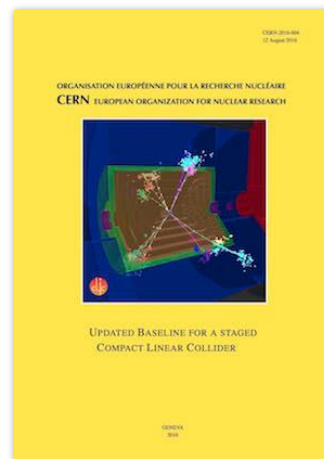
A separate document about the **collaboration's plans for 2020-25** (50p) in the preparation phase including also resource estimates for this period, covering:

- Technical studies and cost/power reduction studies, industrial pre-series where needed
- More detailed site preparation
- Maximising common efforts/collaborative work with outside labs taking Xband in use and other facilities where key components are needed in significant numbers

## Documents for next European Strategy

Ingredients for a CLIC summary report

- ✓ Updated baseline for a staged Compact Linear Collider  
CERN yellow report CERN-2016-004
- ✓ Higgs Physics at the CLIC Electron-Positron Linear Collider  
Eur. Phys. J. C 77, 475 (2017)
- ✓ The New Optimised CLIC detector model CLICdet  
CLICdp-Note-2017-001
- 🕒 Performance of CLICdet Detector Model  
CLICdp-Note early 2018
- 🕒 An overview of CLIC Top Physics  
Complete draft before the end of 2017
- 🕒 Extended BSM studies  
Publication planned 2018
- 🕒 CLIC R&D report (main CLIC technology demonstrators)  
Summary publications 2018
- 🕒 Plan for period 2019-2025 if CLIC supported by next strategy



**A project implementation plan summary for CLIC – acc./detector/physics**  
Similar to CDR volume 3 and the Re-baselining document