

The ILC Project Status & International Development Team



*A Time Projection Chamber
for a Future Linear Collider*

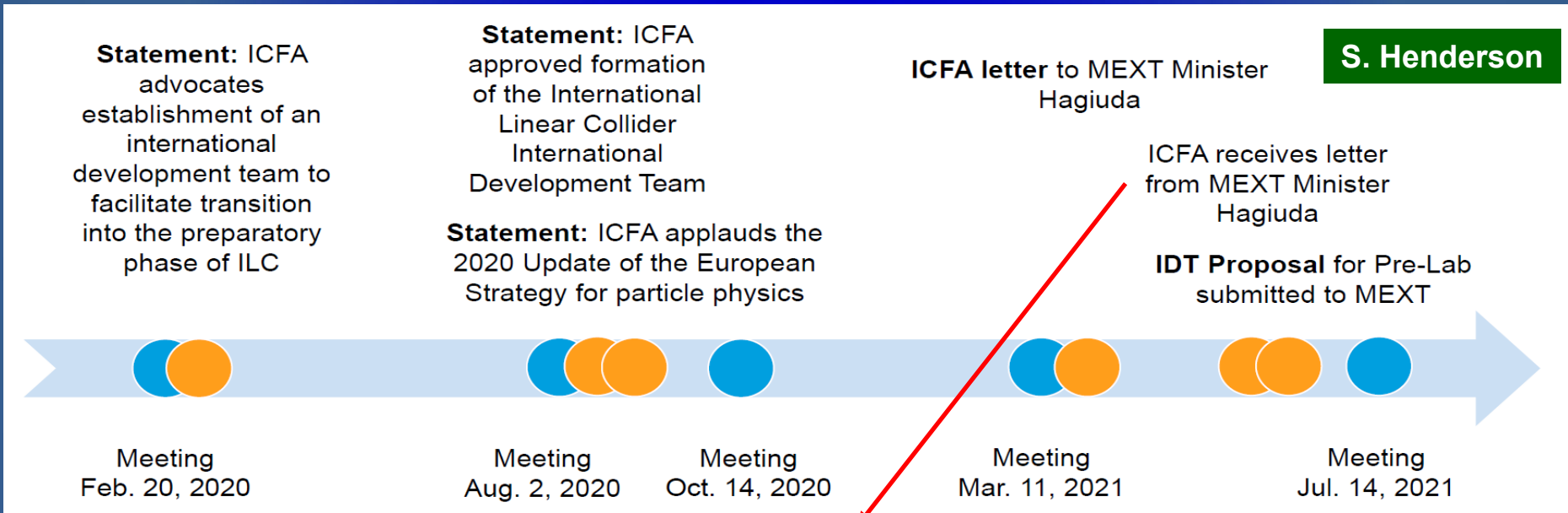
Maxim Titov, CEA Saclay, Irfu, France

Annual LCTPC Collaboration Meeting, January 21 (2022)

Timeline of the Recent ICFA ILC-Related Events (2020-2022)

“ILC as a Global Project”

→ international project, led by Japanese initiative



❖ Letter from MEXT Minister Hagiuda to ICFA Chair (May 31, 2021):

Three keys to move ILC forward:

- Technical feasibility (← Pre-lab funding, but ... in the context of the ILC cost-sharing)
- International cost sharing (ILC ← governments, beyond the IDT framework)
- Broad consensus in Japan (← public, Japanese physics community)

❖ MEXT re-convened the Expert Panel → see Keisuke Fujii talk

Bottom-up approach and Top-down approach in Japan

Purely Academic Projects: institute based → Bottom-up

Scale: ~10-100 M US\$/year

SuperKEKB HL-LHC J-PARC
Subaru Telescope
KAGRA (Gravitational Wave)
Hyper-Kamiokande, etc.

MEXT process

As seen in March 2021:
S. Yamashita @ LCWS2021

- SCJ (Science Council of Japan) Master Plan
- MEXT Roadmap process

Japanese contribution to LHC (~1995) is in between the bottom-up and top-down approaches

Big International Projects: INTER-GOVERNMENT → TOP-DOWN (+ Bottom-up) approaches

Top-level dialogues
& political decision

Scale of Japanese contribution: ~200-1000 M US\$/year

Artemis Program
ITER
ISS (International Space Station)

Prime Minister, Cabinet, Inter-Ministry

Japan has contributed to many projects.
So far, no such projects hosted by Japan.

ILC in Japan

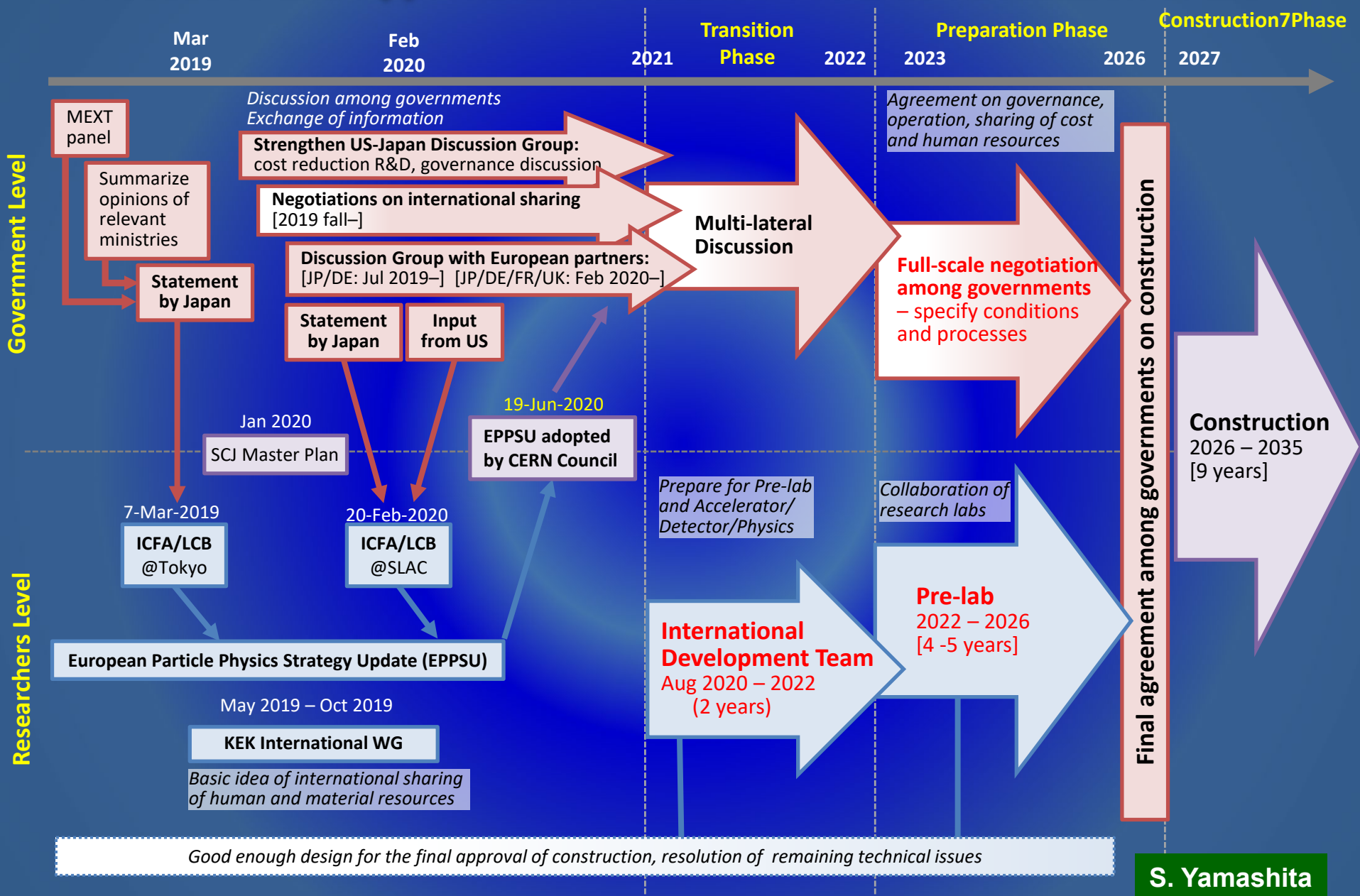
First academic **bottom-up**, then step up to **top-down**

Purpose of the project is purely academic → **MEXT bottom-up approach** ← KEK, community

Big International Projects: INTER-GOVERNMENT → **TOP-DOWN**

Special benefits and roles in hosting the project: INTER-MINISTRY = **TOP-DOWN**

Processes and Approximate Timelines Towards Realization of ILC



S. Yamashita

* ICFA: international organization of researchers consisting of directors of world's major accelerator labs and representatives of researchers
 * ILC pre-lab: International research organization for the preparation of ILC based on agreements among world's major accelerator labs such as KEK, CERN, FNAL, DESY, etc.

International Development Team To Prepare ILC Pre-Lab

- Clarify the **function and organization** of the ILC Pre-lab
- Develop a common understanding for the **condition to start the ILC Pre-Lab**
- Provide an international framework for the **ILC accelerator effort**
- Coordinate further R&D and engineering design work...for a smooth transition to the ILC Pre-lab phase
- Provide an international framework for the **ILC physics and detector** activities
- Coordinate physics and detector R&D effort...for smooth transition to the ILC Pre-lab phase

**Established in
August 2020**

ICFA

<https://linearcollider.org/>

ILC International Development Team

Executive Board

Americas Liaison Andrew Lankford (UC Irvine)
Working Group 2 Chair Shinichiro Michizono (KEK)
Working Group 3 Chair Hitoshi Murayama (UC Berkeley/U. Tokyo)
Executive Board Chair and Working Group 1 Chair Tatsuya Nakada (EPFL)
KEK Liaison Yasuhiro Okada (KEK)
Europe Liaison Steinar Stapnes (CERN)
Asia-Pacific Liaison Geoffrey Taylor (U. Melbourne)

Working Group 1
Pre-Lab Setup

Working Group 2
Accelerator

Working Group 3
Physics & Detectors

- ✓ **Three Working Groups** formed to carry out work of **IDT**:
- ✓ Work with **national authorities** to help in... **establishing** the ILC Pre-lab
- ✓ **Negotiate with international scientific partners...** for **resources needed** for Pre-lab, and ...
- ✓ Pre-lab will **build up confidence** on the project, which is essential for **meaningful governmental decisions**

IDT Activities in 2021

- ✓ Biweekly working group meetings for the accelerator (WG2) and physics and detector (WG3) with many subgroup meetings
- ✓ Weekly Executive Board meetings and occasional WG1 meeting when necessary.
- ✓ Pre-lab proposal completed in June 2021 together with a Technical Preparation document. Proposal describes:
 - Goal (move from technical to engineering description and support intergovernmental discussion);
 - Organisation and start-up (international collaboration of laboratories with small headquarters in Japan for coordination)
 - Work packages for the accelerator and civil construction (in-kind contribution MoU with laboratories)
 - Material budget and required personnel (57.6M ILCU and 364 FTE-yr for the accelerator, civil engineering related work taken by Japan)
 - Time plan (4 years),
 - Timeframe for establishing the physics programme
 - Technical Preparation document gives further technical details on the accelerator work packages
- ✓ Organising a physics workshop to attract more peoples to the ILC, beyond the traditional collider community : ILCX2021 in November 2021, with an industry forum and discussion on the “green” aspects.

ILC Pre-lab Proposal & Technical Preparation Document

Pre-lab proposal developed and submitted to MEXT on Jun. 2, 2021:

Technical Preparation Document:

Proposal for the ILC Preparatory Laboratory (Pre-lab)

International Linear Collider
International Development Team

1 June 2021

arXiv: 2106.00602

Abstract

During the preparatory phase of the International Linear Collider (ILC) project, all technical development and engineering design needed for the start of ILC construction must be completed, in parallel with intergovernmental discussion of governance and sharing of responsibilities and cost. The ILC Preparatory Laboratory (Pre-lab) is conceived to execute the technical and engineering work and to assist the inter-governmental discussion by providing relevant information upon request. It will be based on a worldwide partnership among laboratories with a headquarters hosted in Japan. This proposal, prepared by the ILC International Development Team and endorsed by the International Committee for Future Accelerators, describes an organisational framework and work plan for the Pre-lab. Elaboration, modification and adjustment should be introduced for its implementation, in order to incorporate requirements arising from the physics community, laboratories, and governmental authorities interested in the ILC.

Technical Preparation and Work Packages during ILC Pre-Lab

ILC International Development Team - Working Group 2

The International Linear Collider (ILC) is an electron-positron collider with a total length of approximately 20 km. The International Development Team (IDT) was established by the International Committee for the Future Accelerators in August 2020 to prepare for establishing the ILC Pre-lab as the first step toward the construction of the ILC in Japan. IDT-WG2 is now identifying the accelerator-related activities for the ILC Pre-lab necessary before starting the construction of the ILC. The ILC Pre-lab activities is expected to continue about 4 years and the following accelerator-related activities will be carried out: (1) Technical preparations; (2) Final technical design and documentation; (3) Preparation and planning of deliverables; (4) Civil engineering, local infrastructure, and site.

This document summarizes the "Technical preparations", i.e., accelerator work necessary for producing the final engineering design document. It is anticipated that this document will be a starting point to discuss the international cooperation and technical efforts to be shared as in-kind contribution among the participating laboratories worldwide. It is also expected that the budget requests by the participating laboratories to their funding authorities will be made with reference to this document.

Ver-5: 2021/May/30

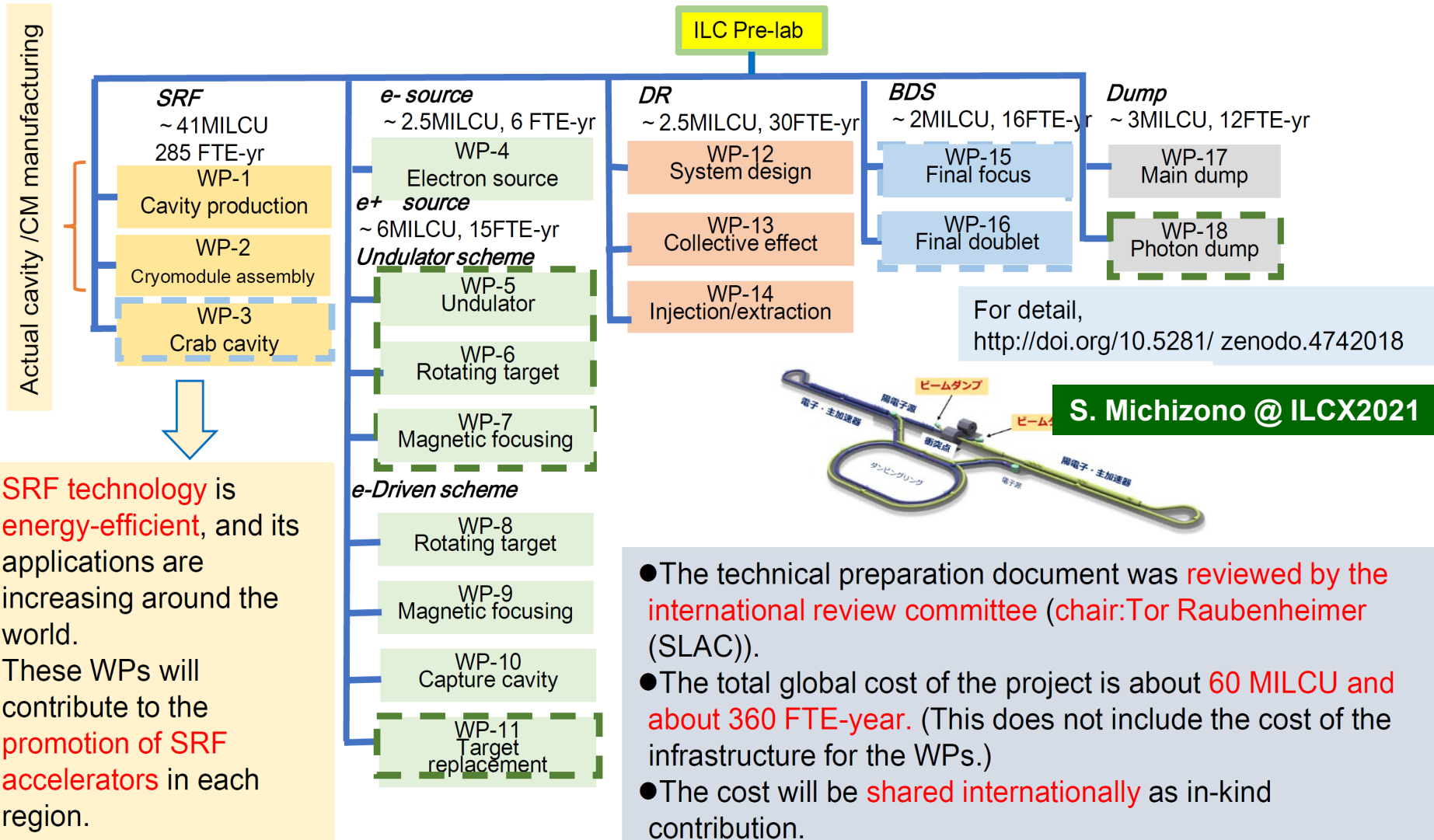
<http://doi.org/10.5281/zenodo.4742018>

Technical Preparation and Work Packages (WPs) during ILC Pre-lab

IDT-WG2

IDT - WG2: Technical Preparation Document

IDT - WG2 summarized the technical preparation as **Work Packages (WPs)** for the Pre-Lab stage in the **Technical preparation Document**



SRF technology is energy-efficient, and its applications are increasing around the world. These WPs will contribute to the promotion of SRF accelerators in each region.

- The technical preparation document was reviewed by the international review committee (chair: Tor Raubenheimer (SLAC)).
- The total global cost of the project is about 60 MILCU and about 360 FTE-year. (This does not include the cost of the infrastructure for the WPs.)
- The cost will be shared internationally as in-kind contribution.

Examples of the ILC-related Worldwide Efforts

	~ 2017	2018~2021
CERN	Cooperation on nano-beam at ATF, study on industrialization of cavity and cryomodule for SRF, cooperation on design of cryogenics, beam dump, and civil engineering	Nanobeam collaboration at ATF, SRF cavity fabrication technology, cryogenics, beam dump and civil design collaboration. Overall coordination of ILC R&D in Europe.
Americas (USA+Canada)	Start of construction of LCLS-II; development of a new SRF cavity treatment method for LCLS-II; development of a crab cavity for HL-LHC.	US-Japan collaboration on SRF cavity performance improvement and cost reduction, assembly and installation of cryomodules for LCLS-II . Production began for in-kind contributions of the RFD crab cavities and cryomodules to the HL-LHC by the US & Canada
France	Experience in assembly of SRF input couplers and cryomodule assembly at XFEL in Europe, cooperation with Nanobeam at ATF	In-kind contributions to the European Neutron Source (ESS), the US PIP-II project, cavity performance improvement at SRF, nanobeam collaboration at ATF.
Germany	TESLA (preliminary stage of ILC) planning study, XFEL construction started in 2007, SRF cost estimate for TDR.	Demonstration of large SRF accelerator with stable operation of XFEL , and improvement of SRF cavity performance
Italy	Contribution to ILC-TDR for cryomodules, cavities and reference Blade tuners, in-kind contribution to half of the cavities and cryomodules at XFEL in Europe.	In-kind contributions to the European Neutron Source (ESS), the US PIP-II project, cavity tuner design at the VSR Upgrade of BESSY storage ring HZB
Spain	Nanobeam collaboration at ATF, in-kind contributions such as superconducting magnets at European XFEL, in-kind contributions to IFMIF in Japan	In-Kind contribution to the European Neutron Source (ESS), CIEMAT was awarded a budget for the R&D of the ILC superconducting magnet.
UK	Nanobeam collaboration at ATF. Contributions to TDR for damping rings, positron sources, beam delivery system, RF sources, and beam dump.	In-kind contributions to the European Neutron Source (ESS) and the US PIP-II projects, design of the LHC crab cavity.

Some other Highlights of the ILCX2021 Workshop

IDT-WG3: Provide an international framework for the ILC physics and detector activities and coordinating efforts in order to sustain the community effort and guarantee a smooth transition to the ILC Pre-Lab phase



- Calorimetry (21 talks) summarised by Taikan Suehara
- Tracking (21 talks) summarised by Yasuo Arai
- Software (13-15 talks) summarised by Thomas Madlener
- Higgs physics (34 talks) summarised by Shinya Kanemura
- BSM physics studies (33 talks) summarised by Shigeki Matsumoto
- Top / Heavy flavor / QCD / EW physics studies summarised by Adrian Irlles and Graham Wilson
- **MDI Activities:** Towards working plan for Pre-lab Intermediate report summarised by R.Pöschl
→ addresses a wide spectrum of expertise/experience & studies also relevant for other e^+e^- collider options

Industry Forum at the ILCX2021: Oct. 26, 2021

17:00-21:00 JST Japan (10:00 – 14:00 CET Europe, 4:00-8:00 EDT US)

Indico link: <https://agenda.linearcollider.org/event/9211/sessions/5325/#20211026>

Zoom: <https://us02web.zoom.us/j/87822164767> (passcode: "ilcx2021")

The goal of the event is to strengthen international cooperation between academia and industrial partners involved in the development of advanced accelerator technologies and instrumentation techniques

17.00-17.10 - Introduction

17.10-17.30 - Overview of the AAA Activities (Tohru Takahashi, Hiroshima University/AAA)

17.30-17.55 - Development of positron source components using HIP technologies through industry-government-academia collaboration (Yutaka Nagasawa, Metal Technology Co. Ltd.)

17.55-18.15 - The possible collaborations on ILC Pre-lab in accelerator technologies from China from Academic and industries (Jie Gao, IHEP, China)

18.15-18.35 - Acceleration technology: A Sustainable Approach to Cleaner Indian Rivers (Raghava Varma, Indian Institute of Technology Bombay)

18.35-18.50 Coffee Break

18.50-19.10 - ILC industry capabilities in Europe, some examples from recent SRF projects (Steinar Stapnes/CERN - Benno List/DESY)

19.10-19.30 - Document on industrial interests on ILC in Spain (Erik Fernández, INEUSTAR)

19.30-20.00 - CERN Industrial Experience (Christina Lara Arnaud, CERN)

20.00-20.30 - Review of Accelerator Technologies in the US (Eric Colby, US DOE-SC-ARDAP)

- Evaluating the relevance of ILC's beam dumps for fixed target experiments;
- « Industry Forum » → create a Basis for International Cooperation in the industrial sector, including green accelerator technologies
- "Green ILC" for the environment (Green ILC WG, AAA) → local Tohoku activities
<https://tipdc.org/assets/uploads/2020/12/guideline03.pdf>(in Japanese)
<https://tipdc.org/assets/uploads/2020/12/guideline04.pdf>(in Japanese)

EJADE II Proposal (under discussion)

Motivation/Scope:

E-JADE II (working title) is a training, education and staff exchange network in the field of accelerator research for high-energy elementary particle physics (HEP). More precisely, it is a "Marie Skłodowska-Curie Action" in the framework of the European "Horizon Europe" programme, focusing on staff exchange (SE) between (and within) Europe and other world regions.

- Providing both specialized and inter-disciplinary training for European researchers at all career levels in state-of-the-art accelerator technologies and science at selected EU and non-EU research organizations,
- Supporting operation and joint R&D at non-EU facilities to enrich and develop the know-how and specialized expertise of European researchers in the field of accelerators
- Intensifying the scientific discussions and exchanges between the foreign experts and Europeans in view of forming a global network of expertise
- Fostering inter-sectoral knowledge exchanges and collaborations between public and private organizations involved in critical technologies for future high-energy electron accelerators

Who: Ph.D. students, Post Doc, Technical staff and Researchers

What:

The funding will cover mainly travel expenses (trip and living expenses)

To be reimbursed we should spend abroad at least 1 month integrated over the 4 years (probably it will be possible to split it in multiple trip, e.g. 2 trips of 2 weeks total)

There will be probably a small amount of money for "consumable or shipping" (about 1k€ per trip)

When: Beginning 2023 -->2026

Where: KEK (Japan), Fermilab, SLAC, JLAB, Cornell (US), Triumf (Canada) and some more

The Next Step and Summary

- ✓ The original timescale to start the ILC Pre-lab was too optimistic
 - there was no progress in the “top-down” governmental approach in 2022
- ✓ ICFA needs to review the situation during the next meeting in March 2022:
 - i.e. the “Full Pre-lab” cannot start with the timescale given by ICFA;
 - Should ICFA continue its support for the ILC constructed in Japan as an international project?
 - If so, under which condition and time scale?
- ✓ IDT is developing ideas needed for the continuation case: e.g.
 - 1) Start, in 2022, some of the crucial accelerator work packages defined in the Pre-lab proposal (a-la “adiabatic start of the Pre-lab”);
 - 2) Start regular working group meetings among suitable level of people from the governmental authorities, possibly assisted by the scientists, to prepare for high level discussion.
- ✓ Many issues to be addressed:
 - For 1) in particular, prospect for the appreciable amount of budget to KEK by MEXT for the accelerator R&D, whose purpose includes the ILC, in 2022 would be necessary;
 - Conclusions of the review by the MEXT Advisory Panel for the ILC progress for the last three years and Prelab proposal is expected by early March. Will they include a supporting statement for 1) to happen?
 - Will the Japanese colleagues persuade MEXT to achieve this?
 - Will the laboratories worldwide go along with this scenario to participate in the WPs?

Final Remarks

- Political process in Japan have been stalled for quite some time
→ is there any **chance to re-start « top-down » political approach** in 2022
- Without **positive signs from Japan** indicating their interest in hosting the ILC, situation in other countries will not change
- **The level of discussion group** meetings between MEXT and foreign counterparts **does not allow** for meaningful multi-lateral discussions on **ILC & cost-sharing**

**IS ANYTHING ELSE STILL POSSIBLE TO UNLOCK
THE ILC SITUATION IN JAPAN ???**