ILC status and planning

Outline

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- Project Timelines and recent news
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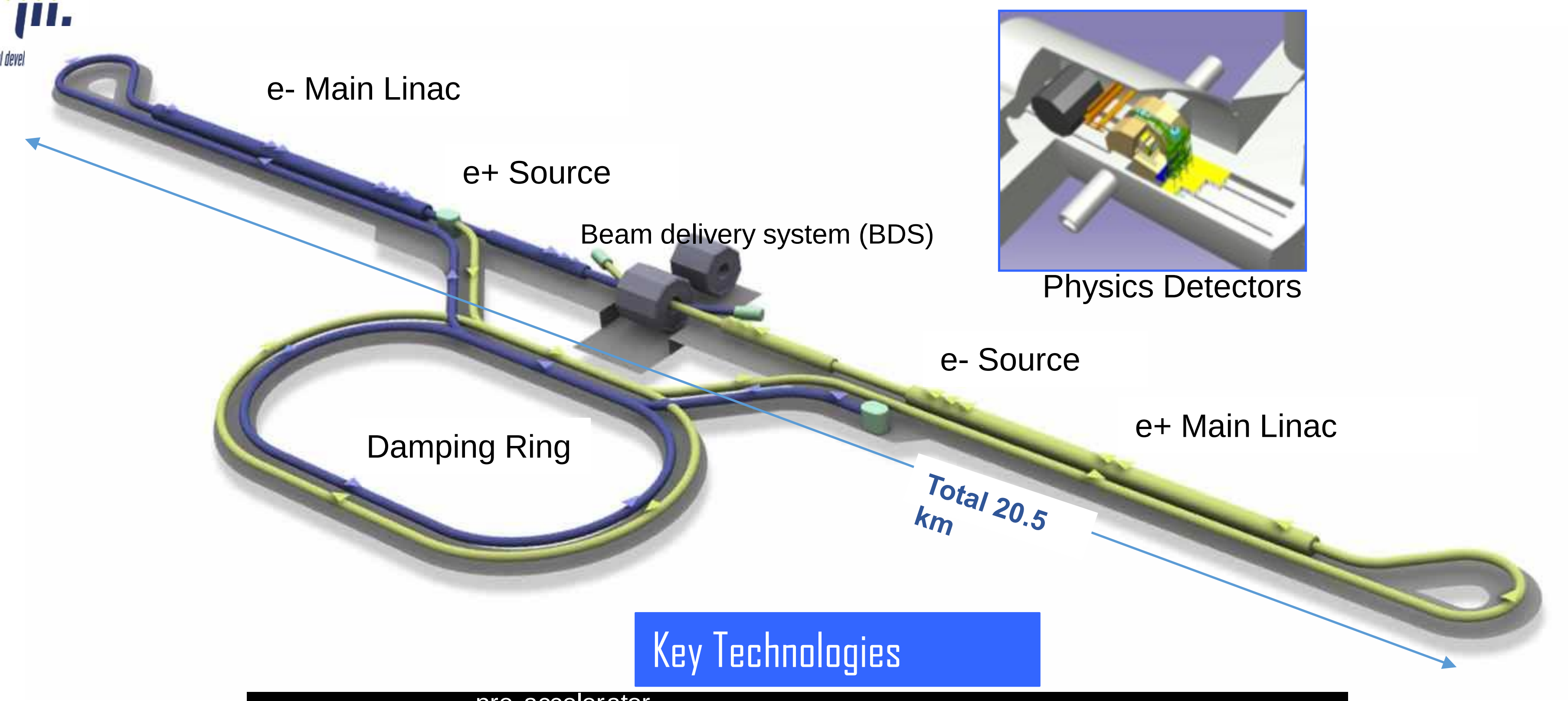
    - Pre-lab phase (4 years) planning
    - Construction (ILC-lab) – not covered today
- Brief updates on:
    - Japan
    - Americas
    - Europe
- Final words

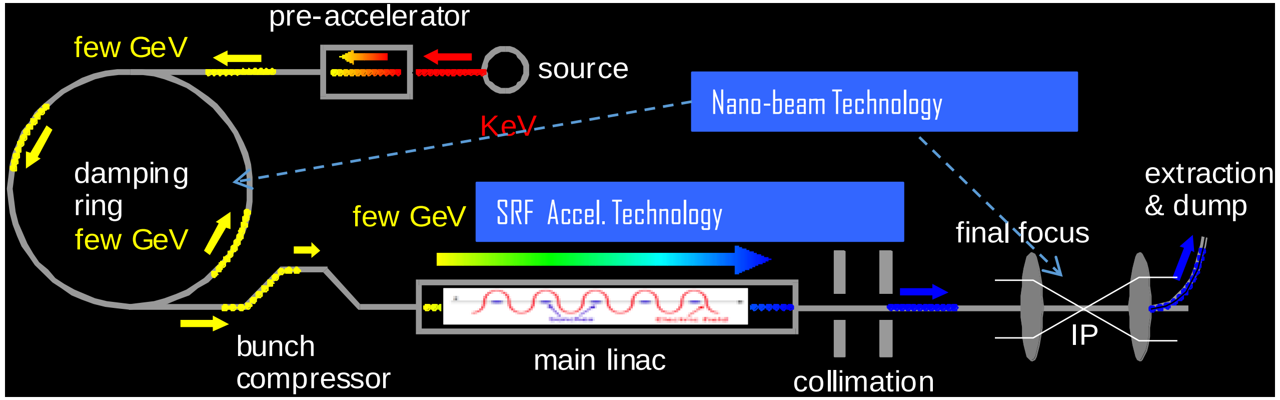
Steinar Stapnes, CERN
(steinar.stapnes@cern.ch)

Design outline: ILC250 accelerator facility



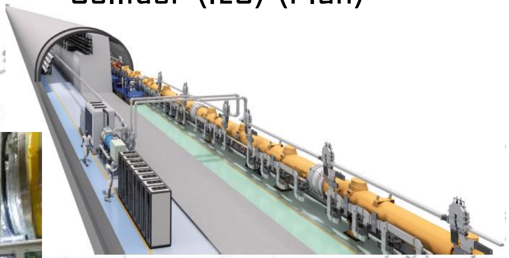
Item	Parameters
C.M. Energy	250 GeV
Length	20km
Luminosity	1.35 x10^{34} $cm^{-2}s^{-1}$
Repetition	5 Hz
Beam Pulse Period	0.73 ms
Beam Current	5.8 mA (in pulse)
Beam size (y) at FF	**7.7** nm@250GeV
SRF Cavity G. Q_0	**31.5** MV/m (**35** MV/m) Q_0 = 1x10^{10}

Key Technologies



Worldwide large scale SRF accelerators

International Linear Collider (ILC) (Plan)



Euro-XFEL
Operation started from 2017
- -100 cryomodules
- -800 cavities
- -17.5 GeV (Pulsed)

LCLS-II + HE (under construction)
- -35 + 20 cryomodules
- -280 + 160 cavities
- - 4 + 4 GeV (CW)

ILC
- -900 cryomodules
- -8,000 cavities
- -250 GeV (Pulsed)

DESY

LAL/Saclay

INFN

Cornell

FNAL

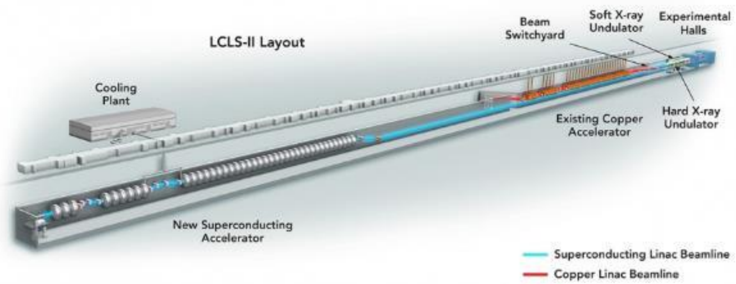
JLab

SLAC

KEK

SINAP

LCLS-II



SHINE (under construction)
- -75 cryomodules
- -~600 cavities
- - 8 GeV (CW)

1.3GHz 9 cell cavity

Potential for upgrades

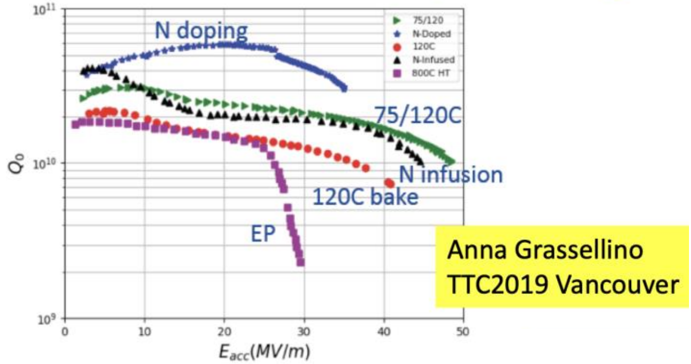
The ILC can be upgraded to higher energy and luminosity.

			Z-Pole [4]		Higgs [2,5]			500GeV [1*]		TeV [1*]
			Baseline	Lum. Up	Baseline	Lum. Up	L Up,10Hz	Baseline	Lum. Up	case B
Center-of-Mass Energy	E_{CM}	GeV	91.2	91.2	250	250	250	500	500	1000
Beam Energy	E_{beam}	GeV	45.6	45.6	125	125	125	250	250	500
Collision rate	f_{col}	Hz	3.7	3.7	5	5	10	5	5	4
Pluse interval in electron main linac		ms	135	135	200	200	100	200	200	200
Number of bunches	n_b		1312	2625	1312	2625	2625	1312	2625	2450
Bunch population	N	10^{10}	2	2	2	2	2	2	2	1.737
Bunch separation	Δt_b	ns	554	554	554	366	366	554	366	366
Beam current		mA	5.79	5.79	5.79	8.75	8.75	5.79	8.75	7.60
Average beam power at IP (2 beams)	P_B	MW	1.42	2.84	5.26	10.5	21.0	10.5	21.0	27.3
RMS bunch length at ML & IP	σ_z	mm	0.41	0.41	0.30	0.30	0.30	0.30	0.30	0.225
Emittance at IP (x)	γe^*_x	µm	6.2	6.2	5.0	5.0	5.0	10.0	10.0	10.0
Emittance at IP (y)	γe^*_y	nm	48.5	48.5	35.0	35.0	35.0	35.0	35.0	30.0
Beam size at IP (x)	σ^*_x	µm	1.118	1.118	0.515	0.515	0.515	0.474	0.474	0.335
Beam size at IP (y)	σ^*_y	nm	14.56	14.56	7.66	7.66	7.66	5.86	5.86	2.66
Luminosity	L	$10^{34}/cm^2/s$	0.205	0.410	1.35	2.70	5.40	1.79	3.60	5.11
Luminosity enhancement factor	H_D		2.16	2.16	2.55	2.55	2.55	2.38	2.39	1.93
Luminosity at top 1%	$L_{0.01}/L$	%	99.0	99.0	74	74	74	58	58	45
Number of beamstrahlung photons	n_g		0.841	0.841	1.91	1.91	1.91	1.82	1.82	2.05
Beamstrahlung energy loss	δ_{BS}	%	0.157	0.157	2.62	2.62	2.62	4.5	4.5	10.5
AC power [6]	Psite	MW			111	138	198	173	215	300
Site length	Lsite	km	20.5	20.5	20.5	20.5	20.5	31	31	40

Increase in energy and luminosity foreseen already at TDR times (see table)

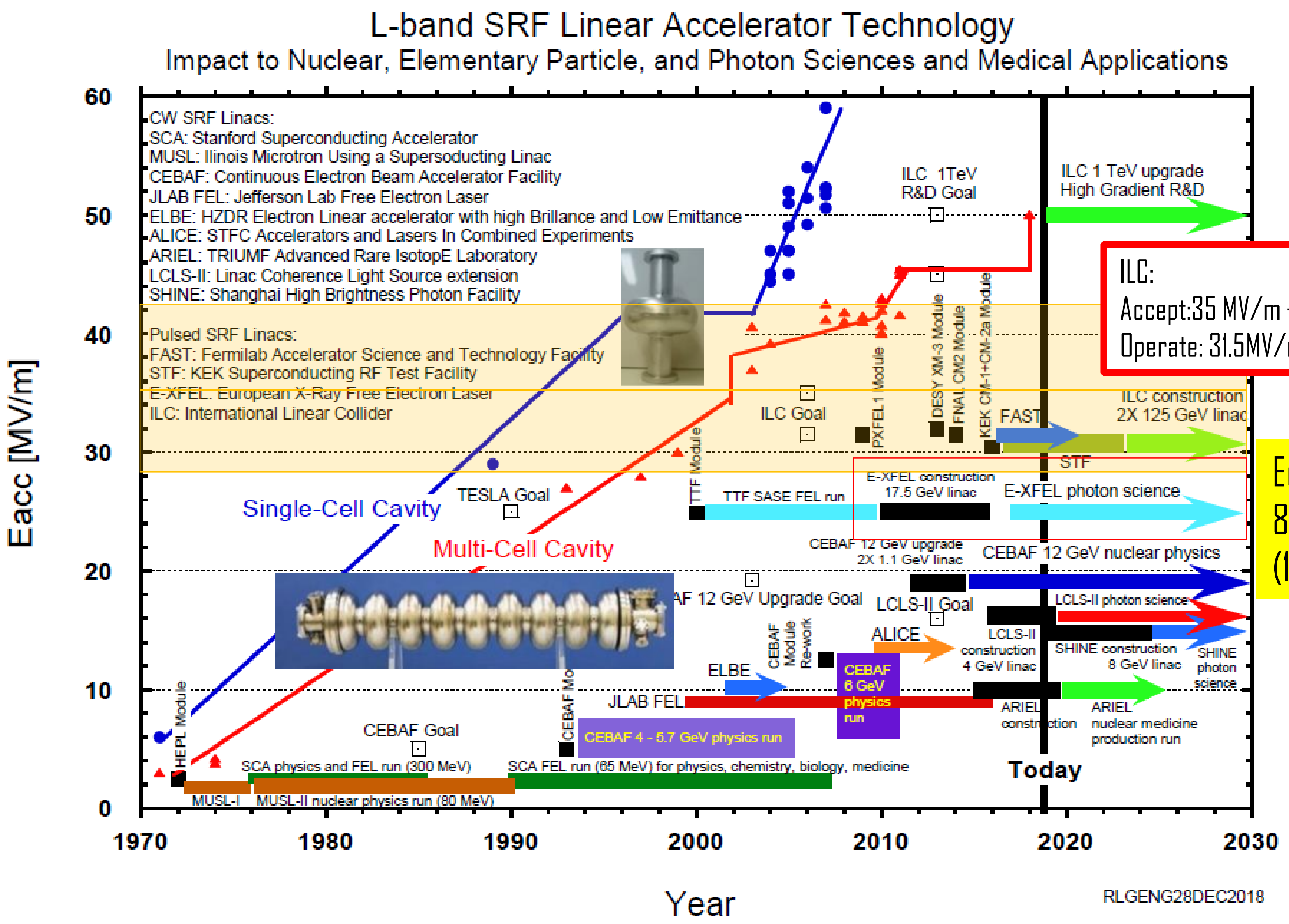
New cavity results open for further optimization (reduce costs, increase energy, increase luminosity …)

- Surface treatments for high-Q and high-G



*There were several typos in the values of the luminosities in the TDR. They have been fixed by CR-0005. https://edmsdirect.desy.de/item/D00000001100895

Technology timeline and prospects for improvements



ILC:
Accept:35 MV/m +/-20%
Operate: 31.5MV/m +/-20%

European XFEL
800 cavities
(10% of ILC ML)

R. Geng (JLAB)

Tohoku ILC Project Development Center

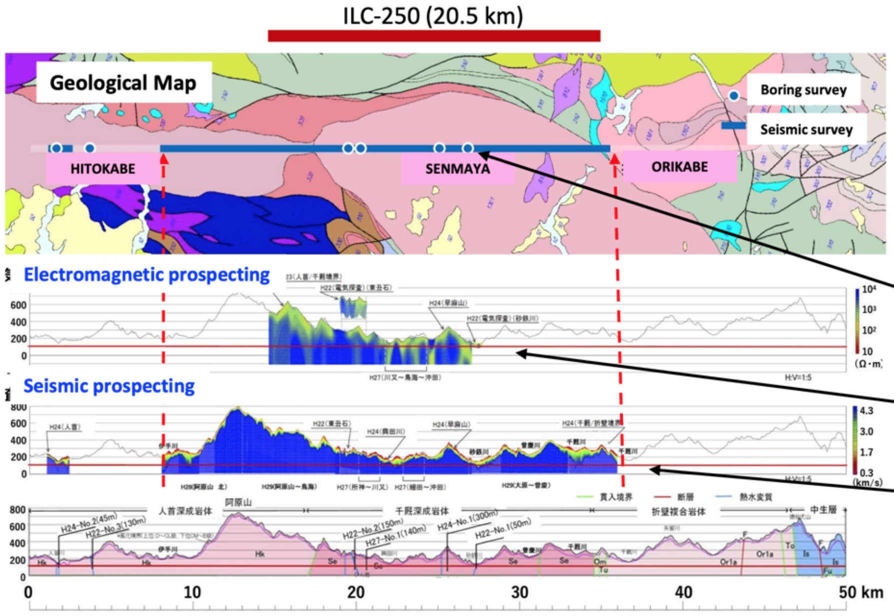
(https://tipdc.org/)

Local governments and universities in Tohoku area established Tohoku ILC Project Development Center this summer to solve issues that should be handled by the region regarding the construction of research facilities and environmental improvement around the ILC candidate site.

Mandate of the center

- Examination of the impact of ILC construction on the natural environment, society, and economy
- Utilization of local resources associated with the location of research facilities and examination for regional promotion
- Examination of system and town development corresponding to acceptance and settlement of researchers and families

Geological survey of the ILC candidate site



- Continuous **granite region**
  HITOKABE, **SENMAYA** and **ORIKABE** bedrock
- **Have capability to extend the ILC up to 50 km in future**
- **Boring geological survey**
  → Direct sampling down to the accelerator depth
- **Electromagnetic prospecting**
  → Cracks in the rock
- **Seismic prospecting**
  → Rock hardness

Diet bills related to recovery efforts

On June 5, 2020, the National Diet (parliament) of Japan passed a series of bills related to the recovery efforts after the Great Eastern Japan Earthquake of 2011, including a 10-year extension of the Reconstruction Agency, which is now set to expire in March 2031. The special annual budget allocated for the recovery efforts will also be sustained.

参議院附帯決議

２６　国際リニアコライダー計画は東北が世界的候補地になっていることから、その推進は福島イノベーション・コースト構想と並んで東北をフィールドとした科学イノベーションの創出による「新しい東北」に資するものであり、国内誘致に向け関係機関と検討を進めること。

Supplementary Resolution #26 by the House of Councillors (unofficial translation)

Since the Tohoku area is the world's candidate site for the International Linear Collider project, its implementation will contribute, alongside the Fukushima Innovation Coast Framework, to the creation of a "New Tohoku" by becoming a breeding ground for scientific innovation; considerations towards hosting in Japan should proceed together with the relevant organizations.

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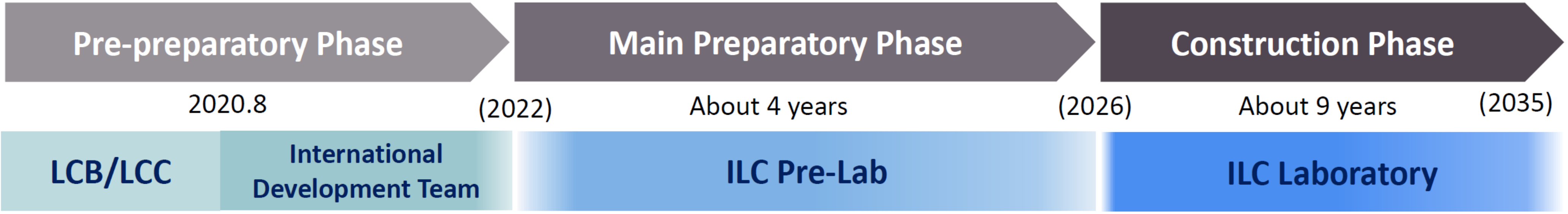
Developments in 2020

- In February ICFA/LCB meeting at SLAC:

  After the presentations by
  - Mr. H. Masuko, Deputy-Director General, MEXT Research Promotion Bureau
  - Hon. T. Kawamura, Chairperson of the Federation of Diet Members for the ILC

  ICFA asked the LCB to propose a way to move to the preparatory phase for the ILC to be constructed in Japan.
- LCB worked out a proposal to setup the International Development Team (IDT), with KEK as the host, to pave a way to establish the ILC Pre-laboratory.
- In June, LCB/LCC ended their terms defined by the ICFA.
- In August ICFA meeting: ICFA setup the ILC IDT and appointed the members of the Executive Board, with an aim to establish the ILC Pre-lab within ~1.5 year.
- Since then, the IDT Executive Board has started working.

Overall timeline



ILC IDT (~1.5 years)

- Prepare the work and deliverables of the ILC Pre-laboratory and work out, with national and regional laboratories, a scenario for their contributions
- Prepare a proposal for the organisation and governance of the ILC Pre-laboratory

ILC Pre-laboratory (~4 years)

- Complete all the technical preparation necessary to start the ILC project (infrastructure, environmental impact and accelerator facility)
- Prepare scenarios for the regional contributions to and organisation for the ILC.

ILC laboratory

- Construction and commissioning of the ILC (~9-10 years)
- Followed by the operation of the ILC
- Managing the scientific programme of the ILC

ICFA

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

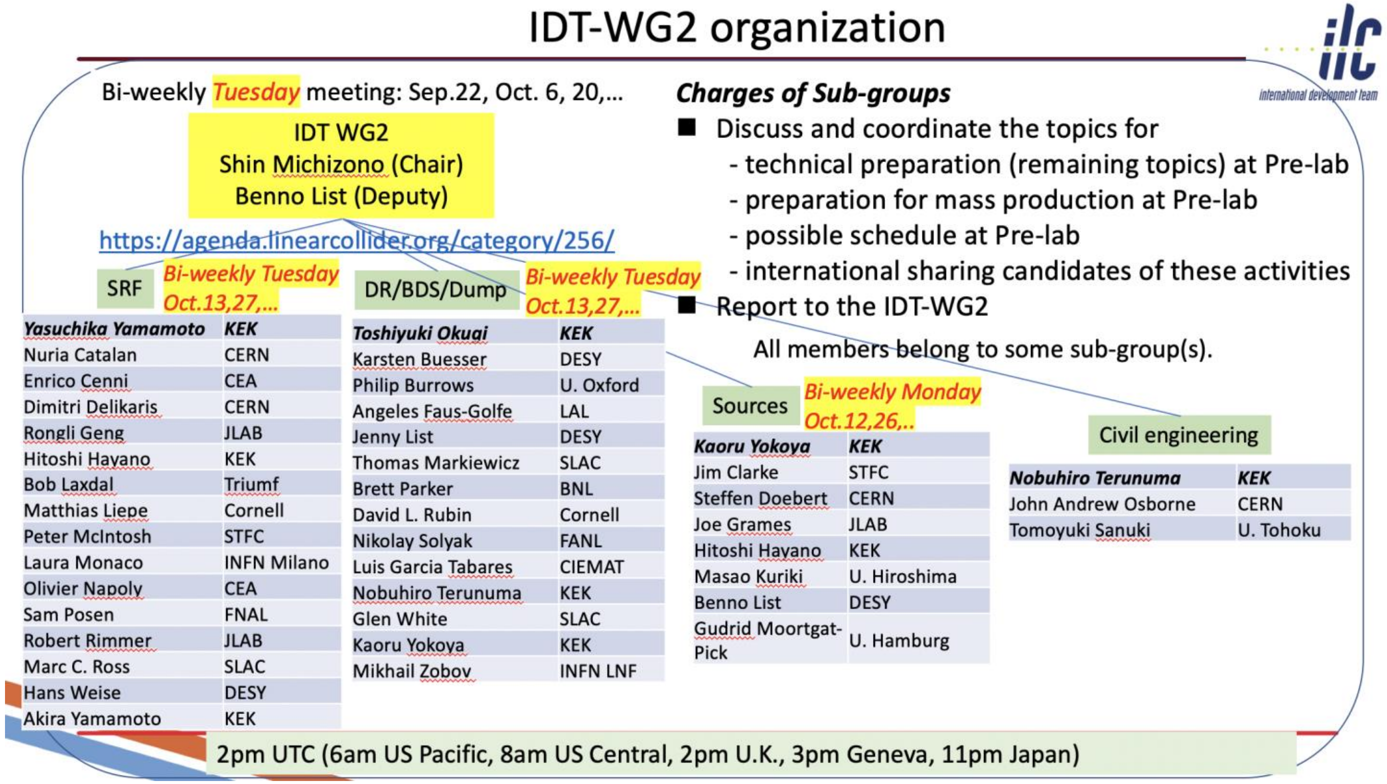
Working Group 3
Physics & Detectors

WGs

WG1 is being set up with representation from/nominated by major labs in some cases in consultation with FAs (around ~5 per region)

In Europe nominations from the Lab Directors Group (LDG)

WG3 (structure and composition evolving):
Hitoshi Yamamoto, Jim Brau, Juan Fuster, Dmitri Denisov, Keisuke Fujii, Frank Simon, Andy White, Aidan Robson, Ties Behnke, Maksym Titov, Christophe Grojean, Michael Peskin, Karsten Buesser, Yuanning Gao, Gerald Eigen, Norman Graf, Frank Gaede, Jenny List, Sakue Yamada



The WGs are still be evolved and the membership expanded/adjusted – in particular WG2 and 3 will remain flexible to involve experts as needed

ICFA mandate for the IDT

- Clarifying the function and organisation of the ILC Pre-Lab based on the KEK International Working Group report (EB and WG1)
- Developing a common understanding for the condition to start the ILC Pre-Lab (EB and WG1)
- Providing an international framework for the ILC accelerator effort and coordinating further R&D and engineering design work for the ILC in order to sustain the community effort and to guarantee a smooth transition to the ILC Pre-Lab phase (WG2)
- Providing an international framework for the ILC physics and detector activities and coordinating physics and detector R&D effort in order to sustain the community effort and guarantee a smooth transition to the ILC Pre-Lab phase (WG3)
- Discussing with international partners (e.g. universities, national and regional laboratories) for resources needed for the ILC Pre-Lab (EB and all WGs)
- Providing necessary information to the national authorities to support their discussion of the establishment of the ILC Pre-Lab (EB and WG1)

All these “activities” are now on-going and followed up in weekly or biweekly meetings of the the IDT-EB, WG2 and WG3 (the two latter also have several subgroups)

Pre-lab accelerator activities

- Technical preparations & SRF R&D for cost reduction [shared across regions]
  - SRF performance R&D
  - Positron source final design and verification
  - Nanobeams (ATF3 and related): Interaction region: beam focus, control and Damping ring: fast kicker, feedback
  - Beam dump: system design, beam window, cooling water circulation
  - Other technical developments considered performance critical
- Final technical design and documentation [central office in Japan with the help of regional offices]
  - Engineering design and documentation, WBS
  - Cost confirmation/estimates, tender and purchase preparation, transport planning, mass-production planning and QA plans, schedule follow up and construction schedule preparation
  - Site planning including environmental studies, civil engineering, safety and infrastructure (see below for details)
  - Review office
  - Resource follow up and planning (including human resources)
- Preparation and planning of deliverables [distributed across regions coordinated by the central office]
  - Prototyping and qualification in local industries and laboratories, from SRF production lines to individual WBS items
  - Local infrastructure development including preparation for the construction phase
  - Financial follow up, planning and strategies for these activities
- Civil engineering, local infrastructure and site [mainly by the Japanese institutions]
  - Engineering design including cost confirmation/estimate
  - Environmental impact assessment and land access
  - Specification update of the underground areas including the experimental hall
  - Specification update for the surface building for technical scientific and administrative needs

Pre-lab physics and detector activities

- Preparing the ILC physics programme by
  - Setting up the ILC Committee (ILCC) as a programme committee for the ILC at the start of the Pre-lab.
  - Call for Expressions of Interest (EoIs) after ~0.5 year for experiments covering a broad physics spectra which can be done at the ILC.
  - Call for Letters of Intent (LoIs) about one year after the EoIs. The ILCC will select a subset of LoIs to proceed for the next step.
  - Call for a Technical Proposal/Technical Design Report shortly before the transition to the ILC Laboratory, where the final approval of the experiments will be made by the ILC Laboratory.
- Approving and monitoring of the progress for the detector R&D programme by the ILCC.
- Organising physics workshops to reflect on the ongoing progress relevant for the ILC physics.

This timeline is the current IDT thoughts and the actual implementation will be led by the Pre-lab directorate

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ILC R&D at KEK

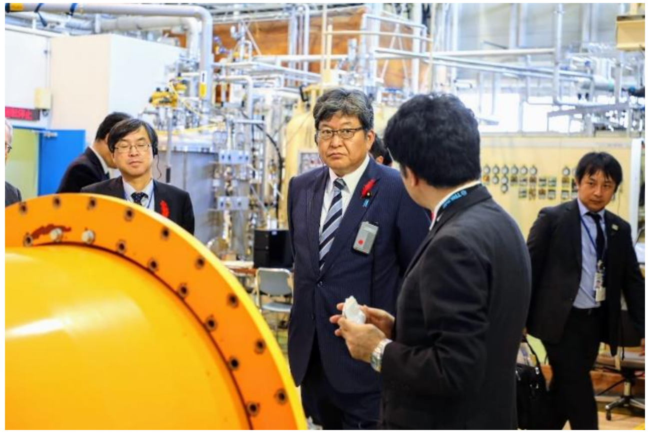
ATF: Technology to handle nano-size beam
STF: Technology to assemble and operate superconducting cavities
CFF: Technology to manufacture superconducting cavities

KEK's role at IDT and beyond

- The next focus will be when ILC Pre-Lab can be started following the IDT.
- The function of the ILC Pre-lab is to do the remaining works in four years.
  - Solve remaining technical issues of the accelerator.
  - Design of the organization and functions of the ILC laboratory
  - Launch the ILC laboratory!
- Since the start of the ILC Laboratory is the official start of the ILC project, it is necessary to reach an international agreement including cost sharing before its start.The ILC Pre-Lab also plays an important role in supporting such international negotiations
- KEK is making every possible effort to start the ILC Pre-Lab soon after the IDT completes its mandate, and to realize the ILC together with the Japanese physics community and supporting groups in the political sector, industrial sector and Tohoku region.

Messages from the Japanese Government

Koichi Hagiuda, Minister of MEXT



- As the Minister of Education, Culture, Sports, Science and Technology, which has jurisdiction over the nation of science and technology, I think it is important for Japan to take an active and bold challenge in this field. (Hagiuda, Feb. 2020)
- It is an international project that requires a huge resource, and we recognize that it is necessary to solve various issues, including technical feasibility and international sharing, and to obtain wide-ranging cooperation both domestically and internationally. (Hagiuda, Feb. 2020)
- The Ministry of Education, Culture, Sports, Science and Technology will keep an eye on discussions by the international research community while exchanging opinions with government authorities in the United States and Europe. (Hagiuda, Sep. 2020)

KEK

Federation of the Diet Members for ILC

- Bipartisan parliamentary league established in 2008 consisting of 150 members from the Japanese National Diet. Chair is Mr. Takeo Kawamura, former MEXT minister.

- It conducts activities in many aspects to promote ILC, including discussions with the U.S. and European Governments. Delegation the Federation have visited U.S. and Europe twice every year before the COVID pandemic.

- It advocates to realize ILC as a national project that crosses ministries.

- “I believe the ILC should be realized through politically-led efforts, cutting across different ministries and agencies. As such, we’re proceeding to realize a budgeting as a national project with a separate budget outside of the regular science and technology budget.” (Statement of the ILC Federation, March 2019)

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Advanced Accelerator Association (AAA)

- An organization of industrial sector to aim to make a leap in science and technology through the development of cutting-edge accelerators jointly by industry and academia.

- 102 companies and 41 universities and research laboratories

- Activities
    - Activate public relations about the ILC by organizing public symposia and awareness event targeting influencers
    - Consider the direction of technological development for the ILC, and make recommendations to related organizations.
    - Create innovative technology to support advanced accelerators.

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JAHEP ILC Steering Panel

- In October 2020, the Japan High Energy Physics Committee (HEPC) that represents the Japanese high energy physics community (Japan Association of High Energy Physics – JAHEP) established the ILC Steering Panel to accelerate community-wide efforts to realize the ILC.
- The ILC Steering Panel, chaired by Satoru Yamashita, is charged to lead the community to advance the ILC project and actively cooperate with other scientific communities, government authorities, legislators, corporate leaders, regional governments, and media, as well as international communities and authorities, toward timely realization of the ILC in Japan.
- The Panel is expected to work closely with the ILC International Development Team and KEK.

ILC Steering Panel Members :

Shoji Asai (University of Tokyo)
Kazunori Hanagaki (KEK)
Toru Iijima (Nagoya University)
Kiyotomo Kawagoe (Kyushu University)
Sachio Komamiya (Waseda University)
Shinichiro Michizono (KEK)
Toshinori Mori (University of Tokyo)
Hitoshi Murayama (UC Berkeley/University of Tokyo)
Yutaka Ushiroda (KEK)
Hitoshi Yamamoto (Tohoku University/IFIC Valencia)
Satoru Yamashita (University of Tokyo) – Chair

Summary of the Japan and KEK slides above

Large activity in at least five directions:

- Work towards Japanese funding of the ILC Pre-lab
- Central role in Pre-lab planning discussions and leadership in many aspects of the technical work followed up in the IDT WGs, and KEK hosts the IDT
- Collaborative projects with many partners across the world and associated agreements
- Activities towards the wider Japanese physics and general community
- Work with Tohoku ILC Project Development Center for site preparation

US – Japan on ILC

U.S. Deputy Secretary of State Stephen Biegun sent a letter to Japan's Foreign Minister Motegi in February 2020.
It is necessary to take decisive action to ensure that Japan and the United States continue to be at the forefront in particle physics, and I strongly support the progress of the International Linear Collider Program. (Article in the Yomiuri newspaper on May 13, 2020, translation by MY)

Workshop pages (link)

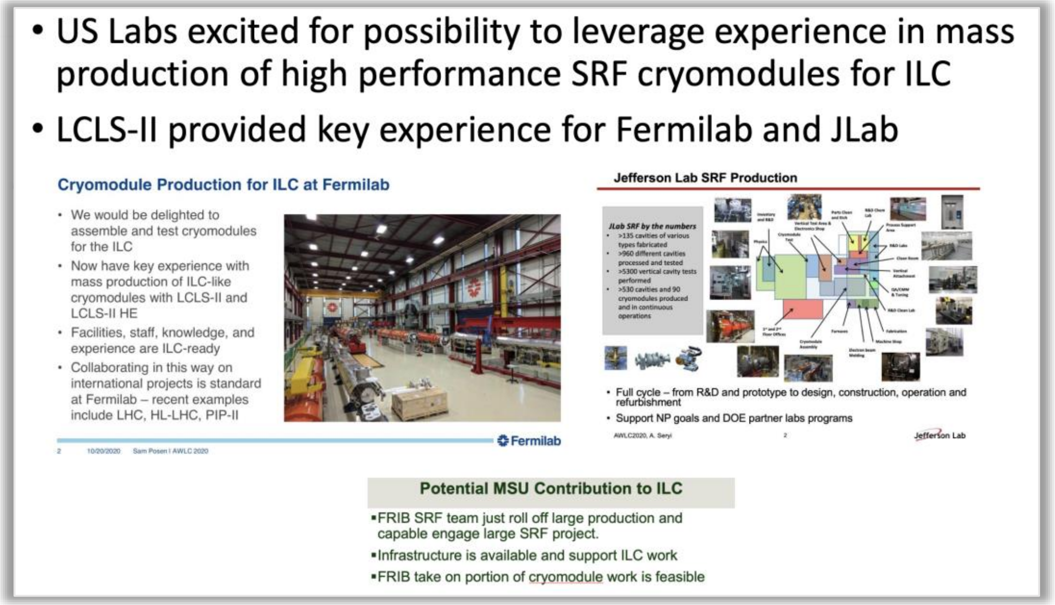
US government views of the ILC - DOE — *Dr Chris Fall*
Zoom — 15:10 - 15:20

US government views of the ILC - NSF — *Dr Saul Gonzalez*
Zoom — 15:20 - 15:30

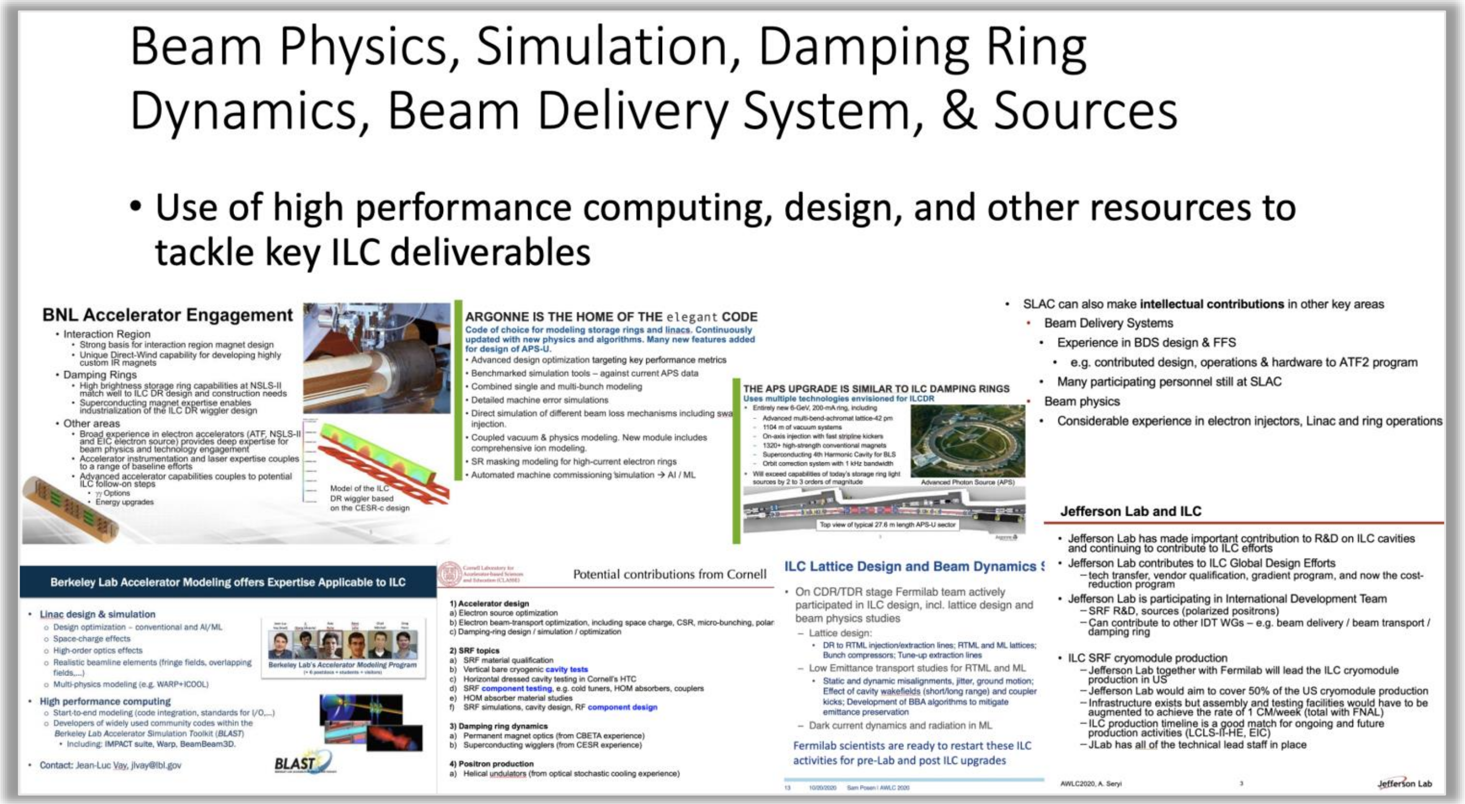
US government views of the ILC - State Department — *L. Reece Smyth*
Zoom — 15:30 - 15:40

- As I have expressed before, there is strong interest in participation by the United States in the ILC program.
- Earlier this year in February, the Secretary of Energy Brouillette also expressed these same thoughts when he wrote to Japan's Cabinet Minister of State for Science and Technology Policy, Mr. Takemoto.
- We plan to continue discussions both bilaterally with MEXT and other officials in the Government of Japan, and multilaterally with the governments of other global regions to not only have a dialogue on the sharing of costs and resources, but also in understanding organizational and governance models for such a largescale research facility as the ILC.

We support the decision to move the ILC efforts forward through the ILC International Development Team, and will continue to work to help educate partner governments about the value of this facility. We also look forward to coordinating with the Government of Japan to advance the facility.



Please see details from parallel session of the Americas Workshop on Linear Colliders (pictures extracted from summary by S.Posen): link



SRF Cryomodule Production for the ILC: FNAL, MSU, J-LAB
SRF Component Treatment, Design, & Test: Cornell, ANL, J-LAB, ORNL, FRIB, FNAL
Beam Physics, Simulation, Damping Ring Dynamics, Beam Delivery System, & Sources: BNL, ANL, LBL, Cornell, SLAC, J-LAB
Magnets –Wigglers, Undulators, Quadrupoles, IR Magnets: FNAL, LBL, FNAL
Key Ancillary Systems: SLAC, LBL, FNAL
Accelerator R&D for Future: FNAL, J-LAB, LBL, ANL

Workshop followed up by KEK/DOE/US labs meeting and WG2 discussions

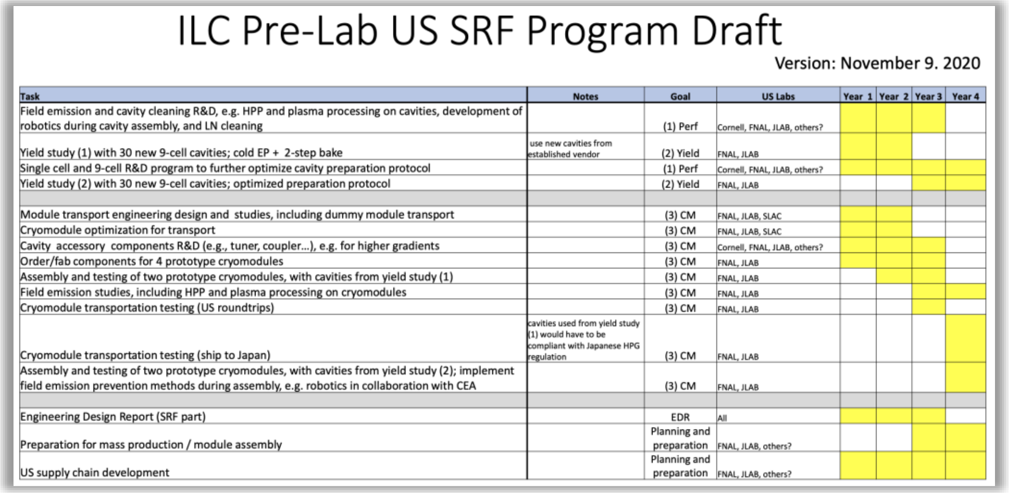
Americas– summary

Strong push in the US (all the examples above) at all levels, many labs interested and well aligned towards ILC, and in many cases using significant resources in developments directly relevant for ILC

Snowmass process important: in addition to collider experiments at ILC also other possibilities, as for example Dark Sector physics at ILC, etc.

Focus on young/next generation in many sessions (Americas workshop on LC and Snowmass)

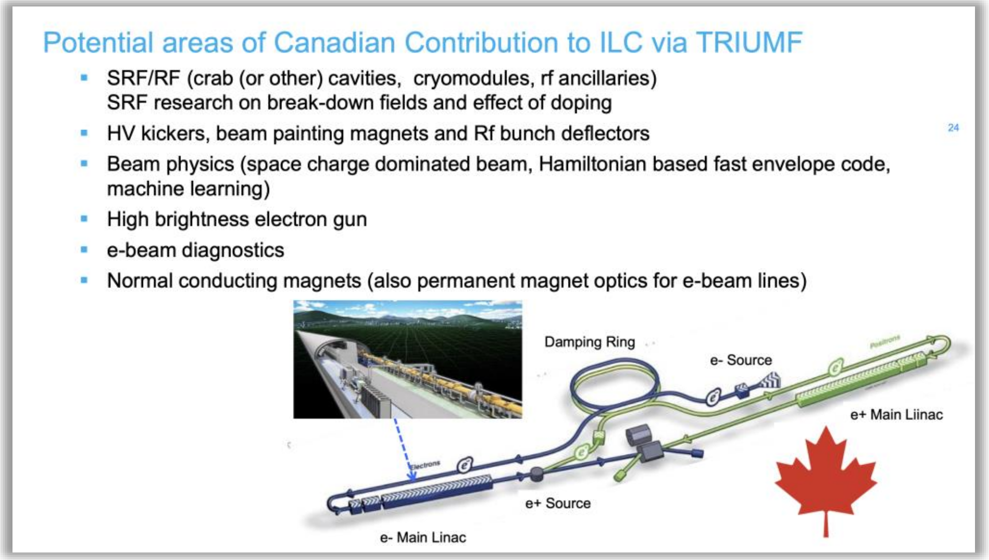
Interests and capabilities in Canada (talks by A.Bellerive and O.Kester) and Latin America (talk by M.Losada)



ILC Pre-Lab US SRF Program Draft

Version: November 9. 2020

Task	Notes	Goal	US Labs	Year 1	Year 2	Year 3	Year 4
Field emission and cavity cleaning R&D, e.g. HPP and plasma processing on cavities, development of robotics during cavity assembly, and LN cleaning		(1) Perf	Cornell, FNAL, JLAB, others?				
Yield study (1) with 30 new 9-cell cavities; cold EP + 2-step bake	use new cavities from established vendor	(2) Yield	FNAL, JLAB				
Single cell and 9-cell R&D program to further optimize cavity preparation protocol		(1) Perf	Cornell, FNAL, JLAB, others?				
Yield study (2) with 30 new 9-cell cavities; optimized preparation protocol		(2) Yield	FNAL, JLAB				
Module transport engineering design and studies, including dummy module transport		(3) CM	FNAL, JLAB, SLAC				
Cryomodule optimization for transport		(3) CM	FNAL, JLAB, SLAC				
Cavity accessory components R&D (e.g., tuner, coupler...), e.g. for higher gradients		(3) CM	Cornell, FNAL, JLAB, others?				
Order/fab components for 4 prototype cryomodules		(3) CM	FNAL, JLAB				
Assembly and testing of two prototype cryomodules, with cavities from yield study (1)		(3) CM	FNAL, JLAB				
Field emission studies, including HPP and plasma processing on cryomodules		(3) CM	FNAL, JLAB				
Cryomodule transportation testing (US roundtrips)		(3) CM	FNAL, JLAB				
Cryomodule transportation testing (ship to Japan)	cavities used from yield study (1) would have to be compliant with Japanese HPG regulation	(3) CM	FNAL, JLAB				
Assembly and testing of two prototype cryomodules, with cavities from yield study (2); implement field emission prevention methods during assembly, e.g. robotics in collaboration with CEA		(3) CM	FNAL, JLAB				
Engineering Design Report (SRF part)		EDR	All				
Preparation for mass production / module assembly		Planning and preparation	FNAL, JLAB, others?				
US supply chain development		Planning and preparation	FNAL, JLAB, others?				



Europe and ILC

Homework done in 2018: European planning document 2018 – presented to CERN Council in June 2018

(slightly more was done than showed in the document concerning in-kind and resource profiles)

Focus on European capabilities for ILC (e.g. SFR on the right)

July 2, 2018

Preparation Plan for European Participation in the International Linear Collider

Towards a European Contribution to the ILC

Authors: Philip Bambade (LAL Orsay)
Philip Burrows (Oxford)
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Andrea Jeremie (LAPP Annecy)
Benno List (DESY)
Olivier Napoly (CEA-Saclay)
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Marcel Stanitzki (DESY)
Steinar Stapnes (CERN)
Nick Walker (DESY)
Hans Weise (DESY)

Content

	Germany DESY	France CEA Saclay	France LAL	Italy INFN Milan	Poland IFJ PAN	Poland WUT	Poland NCBJ	Russia BINP	Spain CIEMAT
Linac									
Cryomodules	✓	✓		✓					
SCRF Cavities	✓			✓					
Power Couplers	✓		✓						
HOM Couplers							✓		
Frequency Tuners	✓								
Cold Vacuum	✓							✓	
Cavity String Assembly	✓	✓							
SC Magnets	✓				✓				✓
Infrastructure									
AMTF	✓				✓	✓		✓	
Cryogenics	✓								
Sites & Buildings									
AMTF hall	✓								

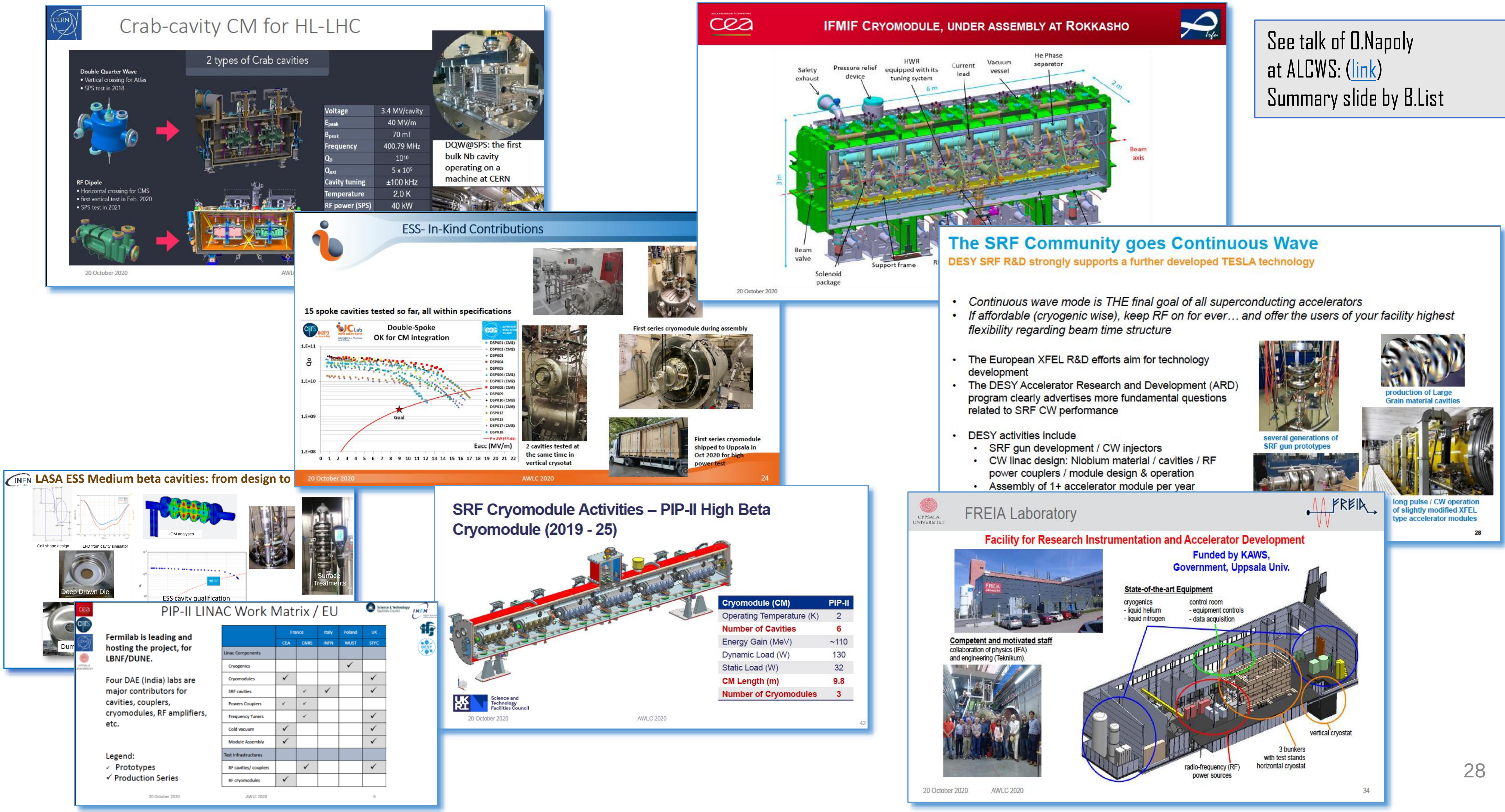
Table 2: Responsibility matrix for cryomodule production and testing for the European XFEL.

	Germany DESY	France CEA	France IPNO	Italy Elettra	Italy INFN-LASA	Poland IFJ-PAN	Spain ESS Bilbao	Sweden ESS	Sweden Uppsala	UK STFC
RF systems				✓			✓	✓		
LLRF									✓	
Cryomodules		✓	✓							
SCRF Cavities		✓	✓		✓					✓
Power Couplers		✓	✓							
HOM couplers										
Frequency Tuners		✓	✓							
Cold Vacuum		✓	✓					✓		
Cavity String Assembly		✓	✓							
RF Tests (Cavites)	✓									✓
RF Tests (Cryomodules)		✓	✓			✓		✓	✓	

Table 3: Responsibility matrix for the cryomodule production and testing for the ESS.

A broad SRF technology base

See talk of O.Napoly
at ALCWS: (link)
Summary slide by B.List



More accelerator possibilities – and detectors

	CERN	France		Germany	Spain	UK	
		LAL	LAPP	DESY	IFIC	Oxford	RHUL
Goal 1							
Very-low β	✓						
Ultra-low β	✓						
Halo control		✓			✓		
Wakefield/Intensity	✓				✓	✓	✓
Instrumentation	✓	✓			✓	✓	✓
Ground motion	✓		✓			✓	
Background				✓			✓
Goal 2							
Stabilisation/Feedback		✓				✓	

Table 4: An overview of present European activities in ATF2.

ATF2, large European participation, including PhD students, and large interest for ATF3

Topic	Details
Beam-dynamics	Overall accelerator design Modeling and simulation tools
Damping rings **RTML** **BDS** **MDI**	Design Optimisation and performance studies
Cost and power	Cost comparison and reviews Power estimates and comparison
Physics and Detector	Physics studies Detector design Software tools

Table 5: An overview of present common activities between ILC and CLIC.

Many common WGs with CLIC – over nearly a decade

Detectors & Physics:
Strong European participation related to ILD, SiD, R&D, physics – BUT many countries not represented. This is problematic when planning for the future. Building up more European membership and participation in IDT WG3 is therefore a priority.

	CERN	DESY	Czech Republic	France	Germany	Italy	Israel	Netherlands	Norway	Poland	Serbia	Spain	UK
Vertexing	✓	✓	✓	✓	✓	✓				✓		✓	✓
Tracking	✓	✓		✓	✓			✓				✓	✓
Calorimetry	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
MDI	✓	✓							✓				✓
System Integration	✓	✓		✓								✓	

Table 6: An overview of present activities in the area of ILC-related detector R&D and integration in Europe.

Obviously, if one includes the capabilities in Europe
built up in LHC, CLIC, R&D projects, etc. one can find world-leading expertise in virtually any technology and detector system

What is needed now ?

Pre-lab planning: two main entry points:

- Pursue R&D interests and capabilities, link to "local" strategic interests [Scientific and Technical Collaboration]
  - For some countries and groups this is the easiest entry point to Pre-lab contributions
- Identification and preparation of ILC deliverables – one main one is a European SFR module line, then other individual WBS items [Qualify to deliver specific parts]
  - SFR module production line requires a multinational approach, other deliverable are a good entry point for countries and groups, linking to capabilities and industry

On-going activities:

- Participation in IDT WG from Europe systematically encouraged (but not complete – see current situation on page 13)
- European monthly information meetings (link)
- SFR capabilities in Europe (labs and industry) to be consolidated into a model for ILC cryomodule production
- "National contacts/communities" actively planning for the next five years (IDT and Pre-lab period) and beyond for ILC - examples from UK, CERN, Spain

In summary, we are working towards a potential contribution list for the Pre-lab:

WB item	R&D interest/skills	Prototypes/Hardware	Local infrastructure	Timeline	Industry	Lab/Group/Country	Resources
…							

UK – renewed engagement in view of Pre-lab planning

Linear Collider UK (LCUK) Collaboration

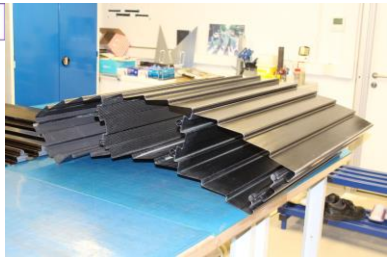
Contacts: Philip Burrows, Aidan Robson

Long standing Consortium of UK particle physics experiment, theory and accelerator groups with interests in a linear collider.

- Previous strong UK research council support for ILC R&D projects, but only very modest support since 2013
- Strong joint CERN/UK CLIC programme 2011-20 ('CLIC-UK')
- Detector R&D largely pursued via CALICE, AIDA2020 … main UK technical interests in silicon vertex/tracking, calorimetry, DAQ/trigger
- Synergies with CLIC, FCCee, CEPC in both detector + accelerator systems remain important

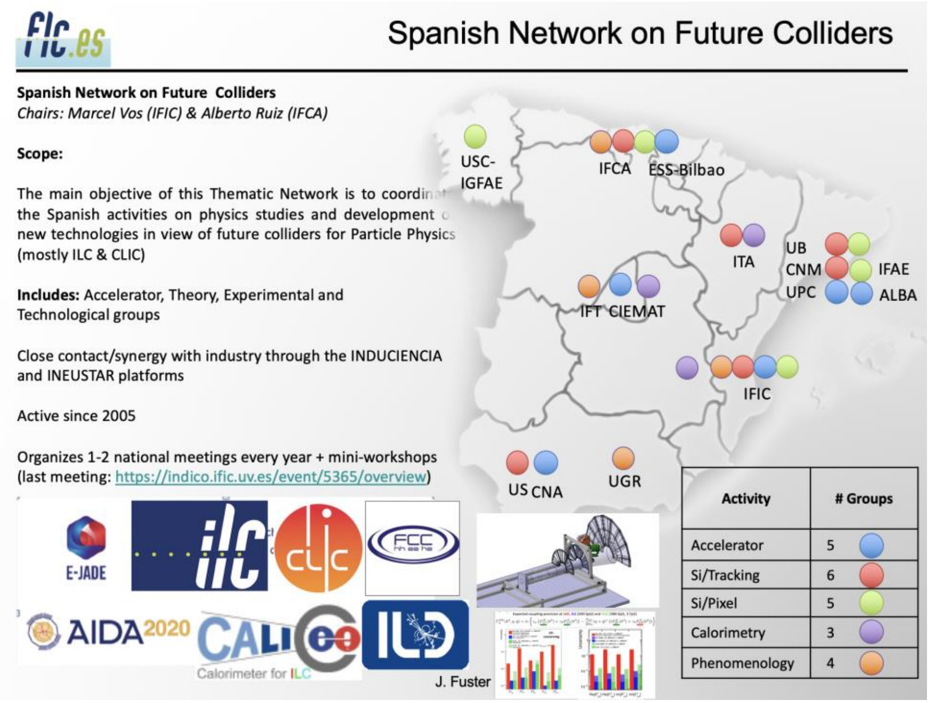
Updates:

- STFC engaged and informed on ILC, UK Tokyo Embassy following ILC developments closely
- LCUK community planning meeting on ILC 18/9/20: https://indico.cern.ch/event/943948/
- UK physicists are engaging with IDT WGs
- UK PP roadmap update (in light of EPPSU) → Spring 2021
    - LCUK input (16/10/20): 'UK participation in the International Linear Collider'
    - Outline case made for UK contributions to Pre-lab + Construction phases (see matrix on the right of key "capabilities")
- Engagement with UK industry ongoing → 'in-kind' contributions essential



Technical system / Institute	Accelerator					Detector			Physics
	BDS/MDI	DR	Beam dumps	e+ source	RF	Si tracker	Calorimetry	DAQ	
Birmingham	X					X	X		X
Bristol						X		X	X
Brunel						X		X	X
Cambridge							X		X
STFC – Daresbury Laboratory	X			X	X				
Durham IPPP									X
Edinburgh						X			X
Glasgow						X			X
Imperial College							X	X	X
Lancaster				X	X	X			X
Liverpool		X				X			X
Manchester	X				X	X			X
Open University						X			
Oxford	X	X			X	X		X	X
QMUL						X			X
STFC – RAL			X			X	X	X	X
RHUL	X							X	X
Sheffield						X			X
Southampton									X
Sussex							X	X	X
UCL	X						X	X	X
Warwick						X			X

Spain – consider deliverables from labs and industry, linking to industrial programmes



Japanese-Spanish regular meetings for ILC planning and possible contributions

- Documentation of Scientific and Technology case of the ILC, as well as Industrial Opportunities
- On-going discussion on possible Spanish technological/industrial interests to the ILC accelerator.

CIEMAT/IFIC: exploring a possible contribution to the splitable, super-conducting magnets of the main LINAC
ALBA-synchrotron: interest in the design of parts of the ILC damping ring,
ESS-Bilbao: interest expressed in the beam dump system of the ILC

INDUCIENCIA/INEUSTAR: identifying companies with interest/capacity to contribute to the construction and matching with scientific and technological interest of the public institutes

Network meetings being followed by: Steinar Stapnes (CERN), Nobuhiro Terunuma (KEK), Akira Yamamoto (CERN/KEK), Hitoshi Yamamoto (Tohoku University /IFIC)

CERN – KEK agreement for the ILC IDT

CERN will facilitate the European participation in the work during the transition to the Pre-Lab Phase; including working groups on Pre-Lab preparation, accelerator and facility, and physics and detectors.

CERN will coordinate the European contributions to the IDT's common fund, as well as the in-kind contributions to the tasks supported by the common fund during the preparation of the Pre-Lab Phase. The CERN office at KEK (set up under Appendix 10) will, as one of its tasks, provide administrative support to the European efforts related to transition to the Pre-Lab Phase.

The Parties will continue, or, as the case may be, undertake, collaborative work in studies related to:

- the accelerator's beam-delivery system and the Accelerator Test Facility 2 (ATF2) (as set out in the 2009 Agreement on Collaborative Work and Appendix 13);
- high gradient acceleration for linear colliders;
- high efficiency klystrons (as set out in Appendix 23);
- detector, physics and software (as set out in Appendix 8);
- cryogenics systems, beam-dumps, superconducting radiofrequency (SC RF) module components and technologies, civil engineering (all areas where CERN has provided technical advice as part of the LCC collaboration); and
- other areas of common interest (e.g.: positron production and beam-dynamics) and/or information exchange related to common challenges (e.g.: costing methodology and power reduction studies).

Any existing collaborative work referred to above will continue to be executed under its relevant Appendix.

APPENDIX 24

to

The Agreement on Collaborative Work (ICA-JP-0103)

between

THE HIGH-ENERGY ACCELERATOR RESEARCH ORGANIZATION (KEK)

and

THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN)

concerning

The work of the ILC International Development Team to facilitate the transition into the "Pre-Lab Phase"

2020

Topic	CLIC – ILC communality	Other	Status wrt ILC and KEK
CE and Cryo	CE common	LHC, all future project	WG2 reps from CERN
ATF2(3), BDS, beamdynamics, instrumentation and related beam-elements	Common	Other nanobeam projects	Participate in ATF3 study – BDS optimization
Positrons	Common for e-driven	All e+e- colliders	WG2 rep. from CERN, target, AMD
Damping Rings	Common	All low emittance rings	Possible effort (performance studies, design and also kicker for CLIC relevant)
Hi-Eff klystron	Common (L-band)	FCC, CEPC etc	Designed (also ongoing SC solenoid work with KEK)
SCRF cavities	For ILC	SCRF generally	Common manufacture studies, e.g. internal EB welding studies/hydro-forming, long term Nb3Sn studies, surface treatment, WG2 rep. from CERN
Couplers	For ILC	SCRF generally	Possible design effort, also common work in the past
Beam dump	Common	(HL)LHC/FCC/muons ..	Advisory and common studies to be considered
Physics and Detectors	Common	Higgs factories	Some common tools, not defined longer term
CERN – KEK office, agreements, WEB pages, LCWS	Partly common	NA	LC project office at CERN working with KEK communication and international office

The ILC-IDT goals this year and next

Establish

- A preliminary list of Pre-lab tasks and deliverables and national/regional laboratories which might be interested in contributing to those
- Pre-lab resource needs for the regional activities and central office (a few % of the ILC cost)
- A preliminary proposal for the Pre-lab organisation and governance by the end of this year.

⟹ Needed for the Pre-lab Japanese funding request preparation by KEK in 2021 to obtain funding in 2022: a similar requirements for the other countries expected.

- Finalise all the inputs needed to set-up the Pre-lab
- Attract more (new) people for the physics and detector activities by
  - During the next Linear Collider workshop (LCWS series, i.e. both CLIC and ILC) in Spring 2021 in Europe (will be remote), include a broad discussion/session on the ILC physics opportunities
  - Organising a dedicated workshop in Autumn 2021 to discuss ideas for experiments at the ILC, at the collision point and beyond covering a broad physics spectra, and associated R&D activities.

Thanks to my IDT colleagues - and their sources - for most of the slides/information

For the Americas slides most of the information is from the Americas Workshop on Linear Colliders

For European slides in particular: O.Napoly, B.List, P.Burrows, J.Fuster – and the European EJADE team

(In most cases I have included links to the more detailed sources in the slides)

Thank you