IDT Update

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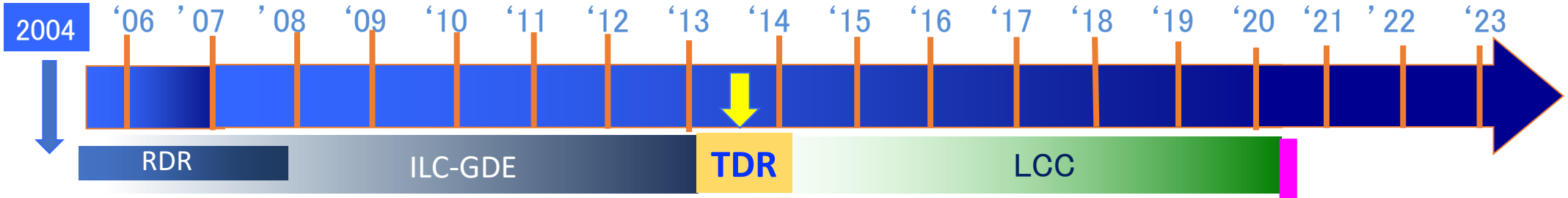
ILC as a global project

- R&D for a future e^+e^- linear collider began in 1980‘s in the three regions.
- By early 2000’s, it became a consensus among the world HEP community that an e^+e^- linear collider with the CM energy of about 500 GeV should be the next collider beyond the LHC.
- ICFA chose the cold technology for LC as a global project and set up a global team (GDE) for design and coordination of R&D for the ILC.
- After eight years of works, the TDR of the ILC was published in June 2013. ICFA set up the Linear Collider Collaboration for the next stage.
- In October 2012, after the discovery of the Higgs boson at LHC, the Japanese HEP community proposed to host the ILC in Japan as a global project. This proposal was welcomed by the HEP communities across the world.

LC technology choice

ILC TDR completion

History of ILC Collaboration



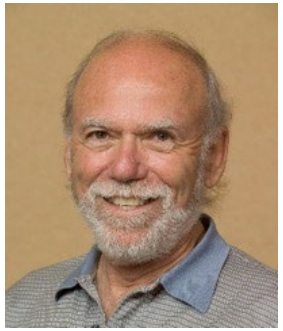
Technology selection

ILC technical design

TDR:
49 countries
392 institutions
>2400 researchers

*I*nternational
*D*evelopment
*T*eam

Tatsuya Nakada (EPFL)
IDT chair



Barry Barish
GDE director
(the Nobel Prize winnerin 2017)

Lyn Evans
LCC director
(former LHC project manager)

LHC

European XFEL

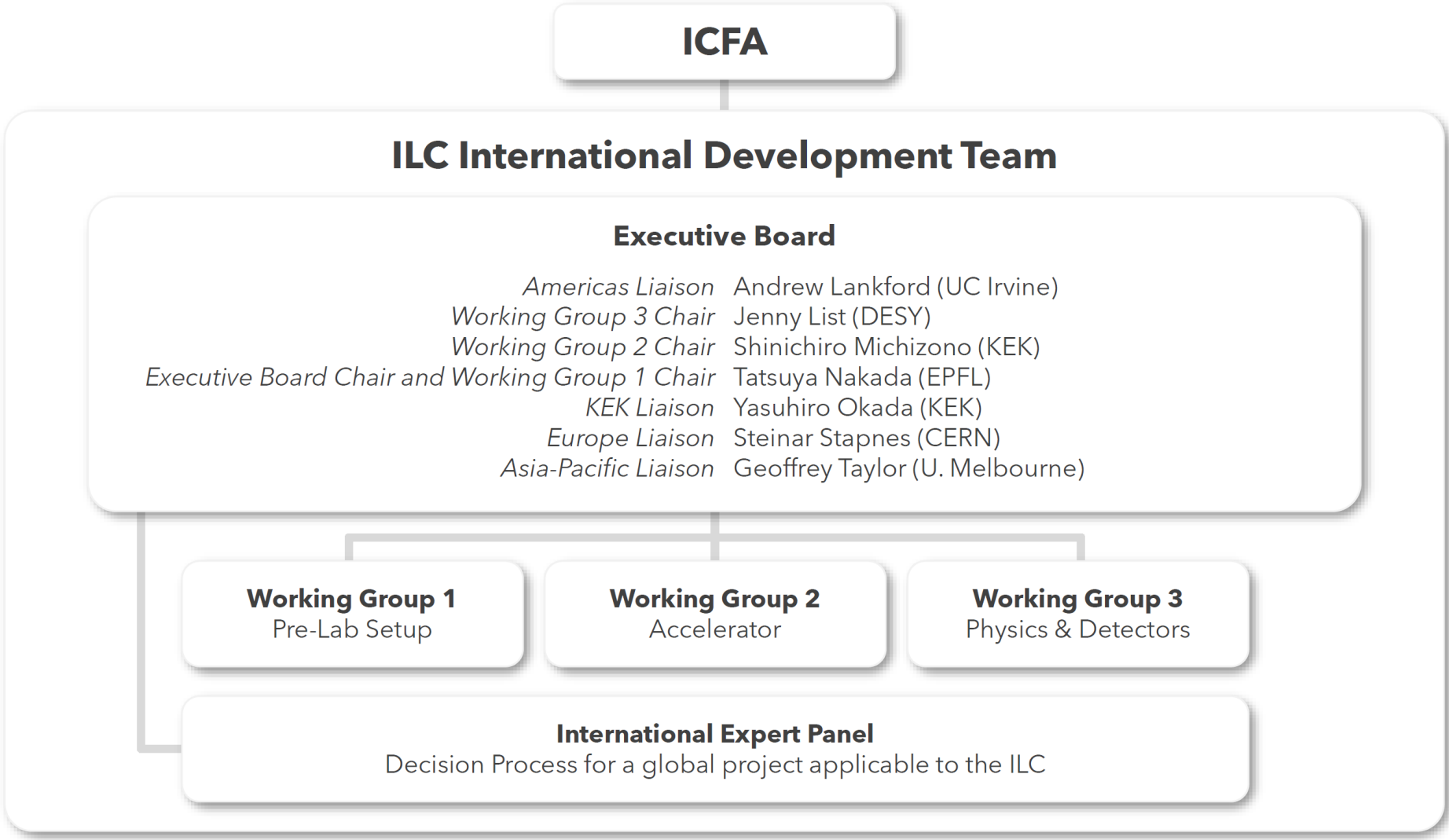
LCLS-II

Establishment of IDT by ICFA

- The ILC International Development Team (IDT) was established by ICFA in August 2020 with a mandate to pave a way for the preparatory phase of the ILC construction.

- During the preparatory phase, technical work resulting in the Engineering Design Report (including civil construction) and intergovernmental negotiation on the sharing of cost and responsibilities for the construction, operation and decommissioning, as well as the organization and governance model for the ILC Laboratory should take place.

Current structure of IDT



IDT-EB meets almost every week remotely since August 2020.

Pre-lab proposal and MEXT Advisory Panel recommendations

- The IDT produced a proposal for the ILC Preparatory Laboratory (Pre-lab) in June 2021. It describes the technical work during the preparatory phase (18 work packages), necessary resources, its organization and processes to reach Pre-lab.

- The ILC Advisory Panel set up by MEXT concluded with recommendations in February 2022. It includes:
  - ✓ it is premature to support a transition to the ILC Pre-lab phase
  - ✓ the research organizations of the countries concerned should work out the technical issues that will be strategically important for development of next-generation accelerators through reinforced collaboration
  - ✓ foster an environment in which the government officials of the countries concerned can discuss while going through the appropriate procedures within each country and sharing their respective circumstances

- IDT, together with KEK and the Japanese HEP community, considered these recommendations and proposed to initiate two activities, ILC Technology Network (ITN) and International Expert Panel (IEP), at the ICFA meeting in March 2022. ICFA supported this proposal.

IDT's view on global projects (I)

Global project: Starts and evolves as a collaborative project of partner countries who make collective decisions on all aspects of the project, such as the scheme for cost and responsibility sharing, project organisation, and host and site location. The ownership is shared among the partners. ITER (an example of top down approach) and SKA (an example of bottom up approach) are examples of large global projects,

International project: Initiated as a project of a laboratory with a limited international participation, a total of $O(10\sim20\%)$ of the accelerator, like HERA (started as a DESY project) and LHC (started as a CERN project). This fraction may become larger but the ultimate ownership remains with the initiator.

Notice that this observation is not meant to indicate that the governance or project structure of ITER or SKA should be used as a paradigm for a future global particle physics project. Governance and project structure need to be judiciously defined by partners on project-by-project basis.

- Nonetheless, ITER and SKA have demonstrated mechanisms for successful creation of global projects.
- A common feature of both is the engagement of government authorities of partner nations in regular discussion from the early days of the development of the project.
- Meanwhile, HEP projects to date have been international projects.

IDT's view on global projects (II)

⇒ Given the required cost and geopolitical and socioeconomical development of the world, future HEP accelerator projects must become global. A Higgs factory could be a good entry point for this new phase!

Technical work of ILC has already advanced to a post-TDR stage by the global effort under the GDE guidance. Meanwhile, government authorities of potential partner nations in the ILC have not regularly met to discuss how to collectively realize the ILC as a global project, apart from exchanging "information" at FALC meetings.

The following key issues must be addressed in order to move forward:

- Resources are needed to move forward with technical work for engineering studies.
- Opportunities are needed to revitalise discussion of government authorities, supported by the community, on how to realize the ILC as a global project.

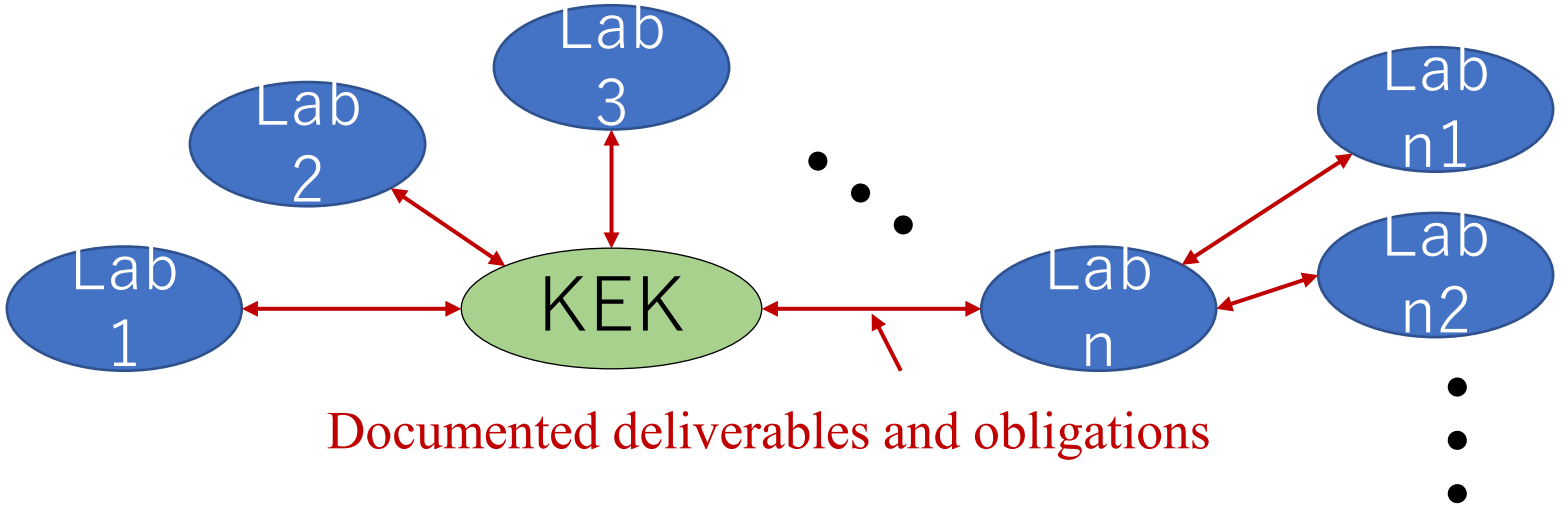
ILC Technology Network (ITN)

IDT and KEK have been preparing to initiate ILC Technology Network (ITN) to execute high priority work packages based on bilateral documents describing deliverables and obligations between KEK and partner laboratories worldwide.

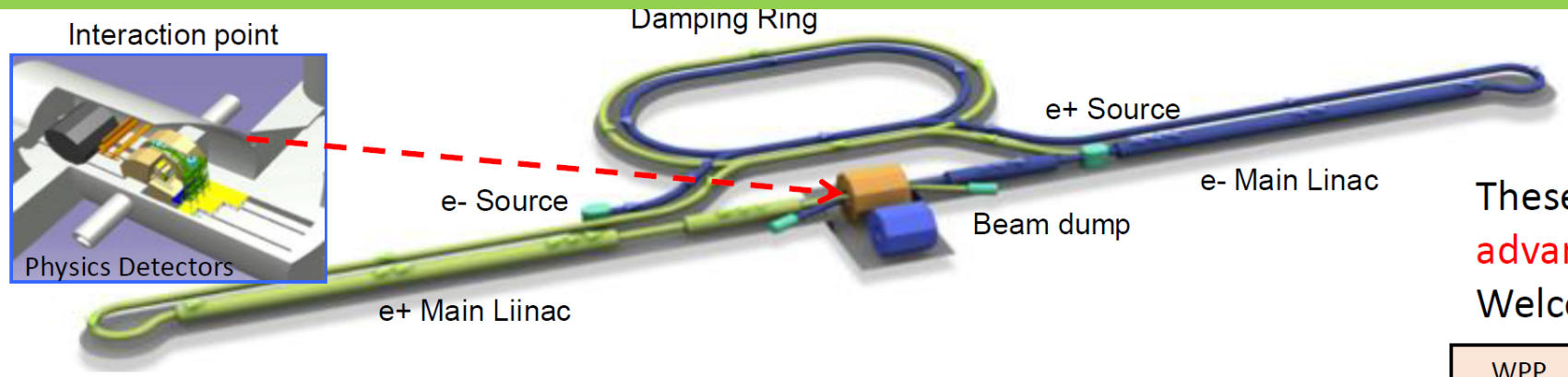
- Pre-lab proposal identified the necessary technical preparations for ILC construction
- Many of the identified topics are in line with broader interests in accelerator R&D
- Increased Japanese budget for accelerator technology R&D provides a seed for required resources.

So far:

- KEK and CERN have agreed that CERN acts as a hub lab for ITN in Europe. Plan to start next month.
- Delegations of IDT and KEK have visited three US labs and discussed possible participation in the ITN.
- Discussions have started with scientists/labs in Asia, for example, in Korea.



WP-Primes at ILC Technology Network



- Creating particles — ***Sources***
  - polarized elections / positrons
- High quality beams — ***Damping ring***
  - Low emittance beams
    - Small beam size (small beam spread)
    - Parallel beam (small momentum spread)
- Acceleration — ***Main linac***
  - superconducting radio frequency (SRF)
- Getting them collided — ***Final focus***
  - nano-meter beams
- Go to ***Beam dumps***

SRF

e-, e+ Sources

Nano-Beam

These WPs can be applied to various advanced accelerators.
Welcome to join!

WPP	1	Cavity production
WPP	2	CM design
WPP	3	Crab cavity
WPP	4	E- source
WPP	6	Undulator target
WPP	7	Undulator focusing
WPP	8	E-driven target
WPP	9	E-driven focusing
WPP	10	E-driven capture
WPP	11	Target replacement
WPP	12	DR System design
WPP	14	DR Injection/extraction
WPP	15	Final focus
WPP	16	Final doublet
WPP	17	Main dump

International Expert Panel (IEP)

IDT set up an International Expert Panel in July 2022 and had regular meeting to discuss a process to implement a global large accelerator project.

Int. Expert Panel members (Chaired by the IDT EB Chair)			
Ursula Bassler	(FR)	Philip Burrows	(GB)
Beate Heinemann	(DE)	Stuart Henderson	(US, ICFA Chair)
Karl Jakobs	(DE, ECFA Chair)	Andrew Lankford	(US, IDT-EB Americas)
Nadia Pastrone	(IT)	Antonio Pich	(ES)
Steinar Stapnes	(CERN, IDT-EB Europe)	Nigel Smith	(CA)
Geoffrey Taylor	(AU, IDT-EB Asia-Pacific)	Katsuo Tokushuku	(JP)

To move forward, the following are necessary:

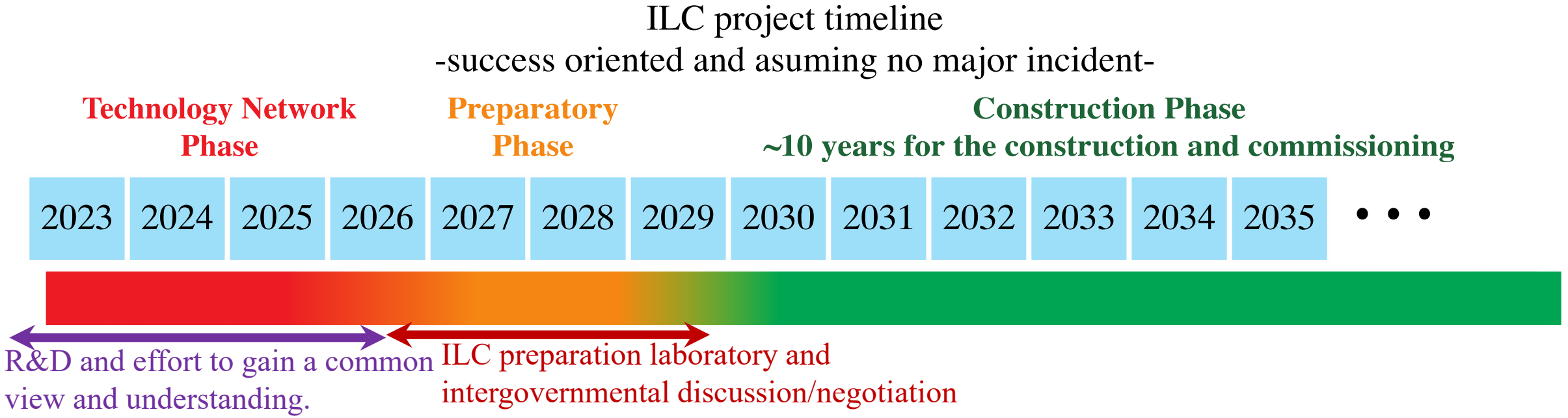
- Establishing regular interactions among partner government authorities
- Developing a common view on how to proceed with a global project, applicable to ILC

A forum of government authorities/agencies of ITN participating laboratories is being established (invitation by KEK), where the forum participants can interact to foster common discussion and understanding on the ILC as a global project among the participants, with facilitation by the IDT International Expert Panel as needed.

Physics and Detector activities

- IDT WG3(Physics and Detectors) involves many HEP community members worldwide.
- Coordinate inputs to the Snowmass process and P5 process as an ILC community.
- Organize ILCX2021 workshop to further develop scientific potentials of the ILC facility.
- Continue to work and contribute to physics and detector studies for Higgs factories.

Timeline



- Technology Network Phase responds to the recommendations by the MEXT Expert Panel.
- ITN work packages are two to four years.
- MEXT funding program for accelerator R&D is planned for five years.
- For entering the Preparatory Phase, interested government authorities, not only Japanese but also European and US, must become ready to discuss ILC specific matters.
- Given ITN, the Preparatory Phase could be less than the four years in the Pre-lab proposal for the accelerator and site-related work.
- P5 discussion in the U.S. and FCC Feasibility Study at CERN will impact the timeline.

Conclusions

- HEP accelerators are reaching a scale required to be global.
- A Higgs factory could be a good entry point to make this transition.
- A linear collider based on SRF acceleration is a Higgs factory that is technically mature and globally affordable with a small environmental impact.
- ILC has been developed as a global project from the conception.
- IDT has put forward a plan to progress in three to four years to start the Preparatory Phase for ILC realization.
- In the meantime, the ILC Technology Network (ITN) ensures that ILC will remain at the technological forefront among Higgs factory candidates.
- ITN is based on bilateral arrangements between KEK and partner laboratories worldwide. US participation is crucial for ITN.