

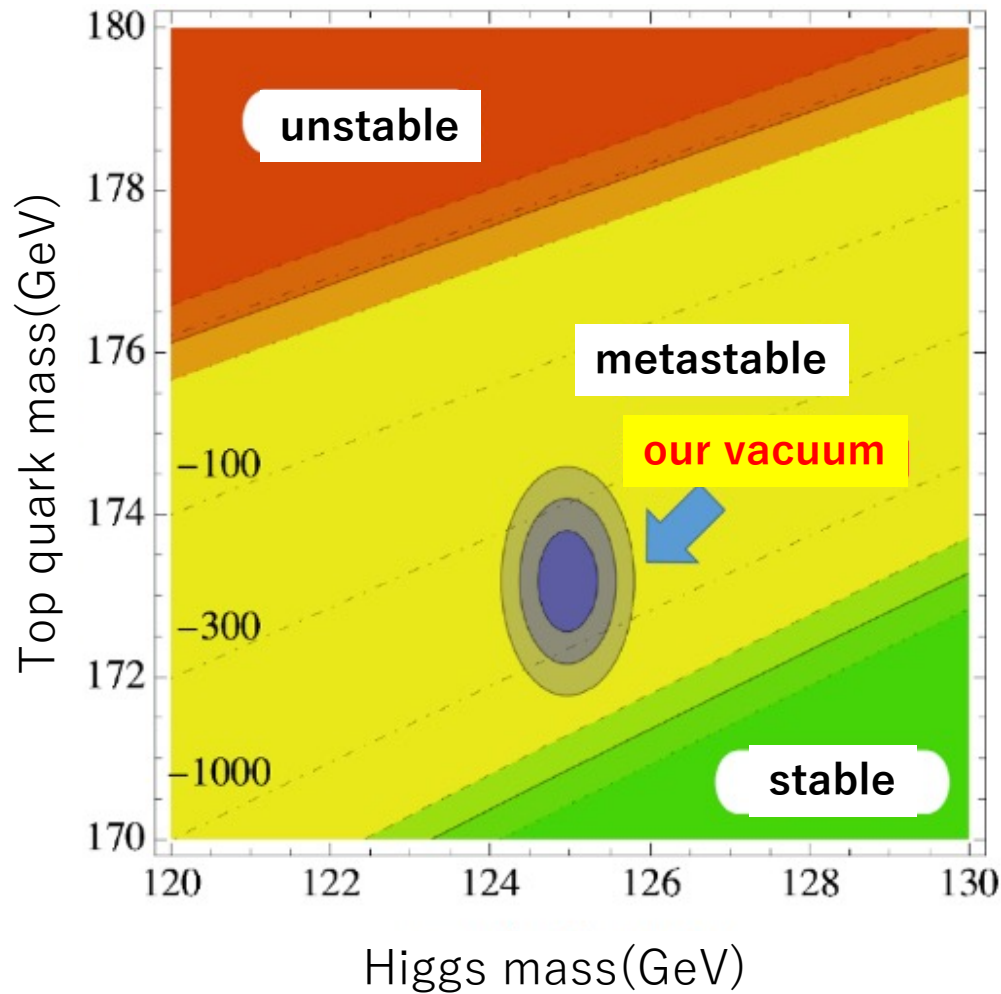


ILC status in Japan

Thank Masa Yamauchi and
Makoto Tomoto for inputs

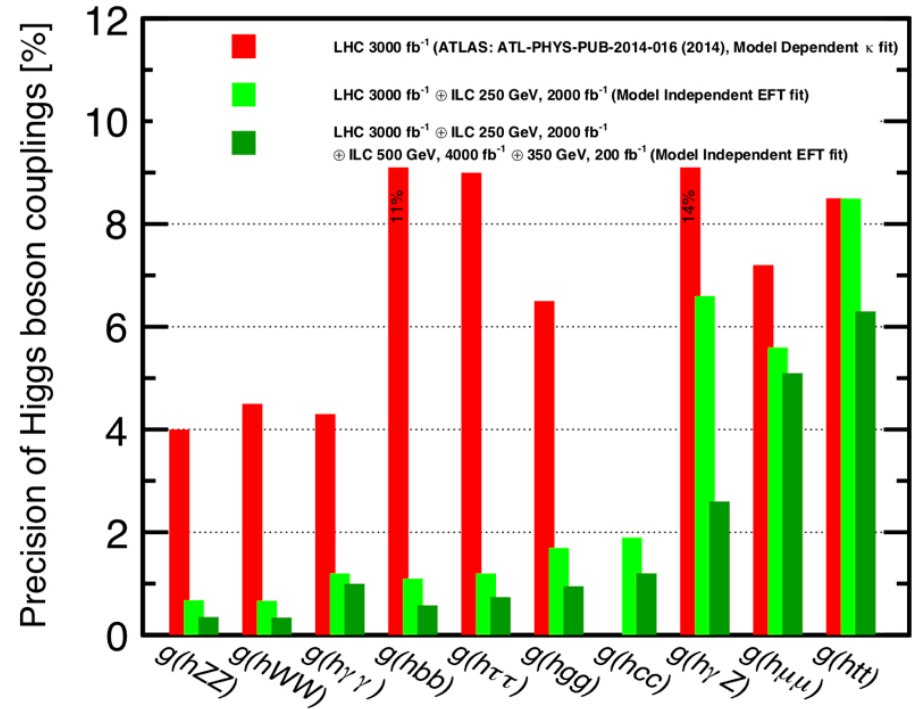
S. Asai
(ILC-Japan,
U-Tokyo)

1 New era of Physics



Tight collaboration with LHC Physicists is important.
 In Japan, we start to Joint Study ILC/LHC/SuperKEKB/theory.

We have obtained the interesting hint from LHC.
 Higgs potential is complicated.
 Higgs is a portal of new physics.



Let's go back
2 years ago

2. Prelab was linked to approval of ILC

Message from MEXT (March 2021)

Message given by the MEXT Minister @ the Diet



- The ILC project needs to resolve its various challenges including its **international cost sharing** and **technical feasibility**, as well as to **obtain broad internal and external cooperation** not for its pre-laboratory but for the ILC project itself.
- Under the current situation that the perspective of broad internal and external cooperation for the ILC project itself as well as its pre-laboratory is not promised, it is difficult to obtain the people's understanding in Japan for investing the pre-laboratory. **It is necessary to obtain the clear perspectives on financial contributions to the ILC project itself from the US and European countries in prior considering the pre-laboratory."**



Three keys to move ILC forward given by MEXT/JG:

1. Technical feasibility
2. International cost sharing
3. Broad consensus

As shown in Tatsuya's talk

We have to overcome the gap between Governments (Global vs International)

3. New scheme for ILC

**May 2021 ILC-Japan was set up by JAHEP
(Japan Association of High Energy Physicists)**

- 1) ILC-Japan represents our community (JAHEP) for ILC Promotion.
- 2) Tight collaboration with KEK and IDT.
- 3) ILC-J has many discussion with Future Project Committee (Younger generation) to recognize ILC value and encourage younger generation to join ILC
- 4) Also encourage our community to contribute ILC
Eagerness of community was limited. (as MEXT said)
- 5) Domestic / International collaboration

ILC-Japan

JAHEP

ICFA

IDT

Future Project Committee

ILC-Japan

Collaboration

KEK

Discussion

Spokesperson

Executive Board

Physics WG

Collaboration TF

Public Relation TF

Internat. negotiation TF

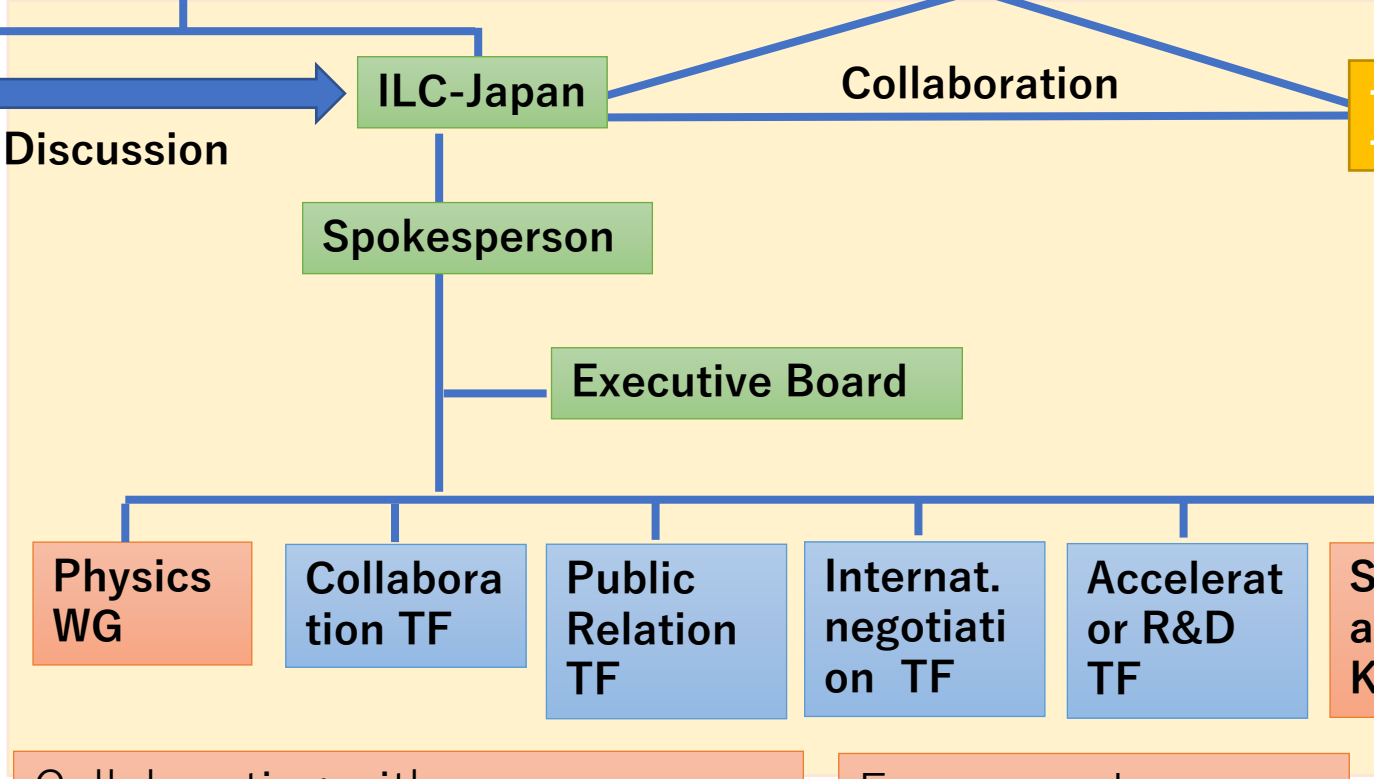
Accelerator R&D TF

Secretariat at KEK

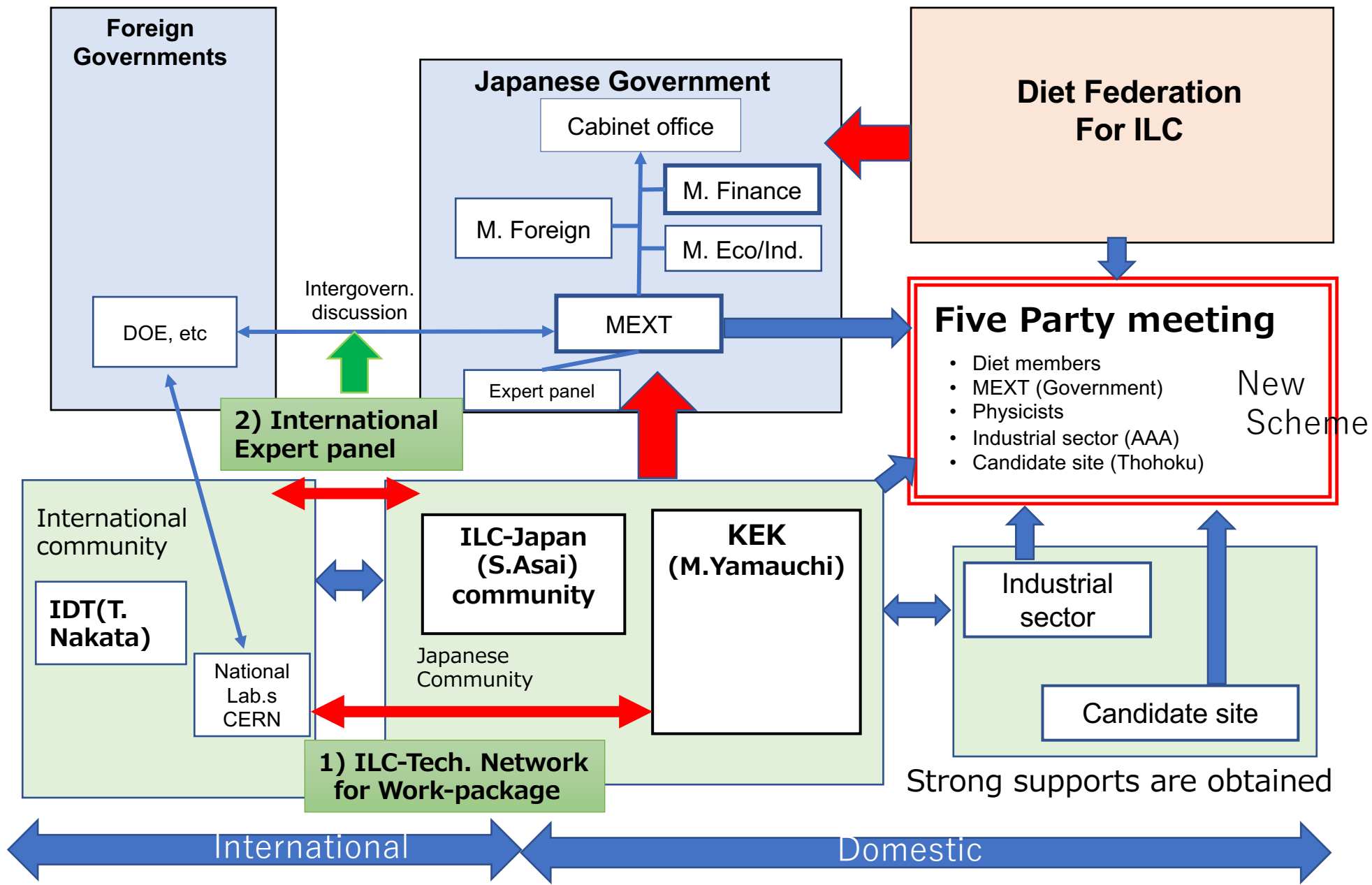
Younger generation are discussing about Physics Potential & Value of ILC
Join of young generation is vital for ILC.

Collaborating with ATLAS/KEKB members (+ Theorist)
Detector R&D -> Collaborating with IDT WG3 + ECFA Roadmap

Encourage Japanese Universities / young students to join ILCTN



Promotion scheme of ILC / relation of Stakeholder



4. ILC Promotions in World-Wide with IDT

ILC-Technology Network to implement the most urgent work-packages in advance.

The budget in Japan in JFY2023 ~ 9.7 hundred Million Yen: Increases by Factor2
Shin Michizono-san has shown the detailed R&D plan in the morning session.

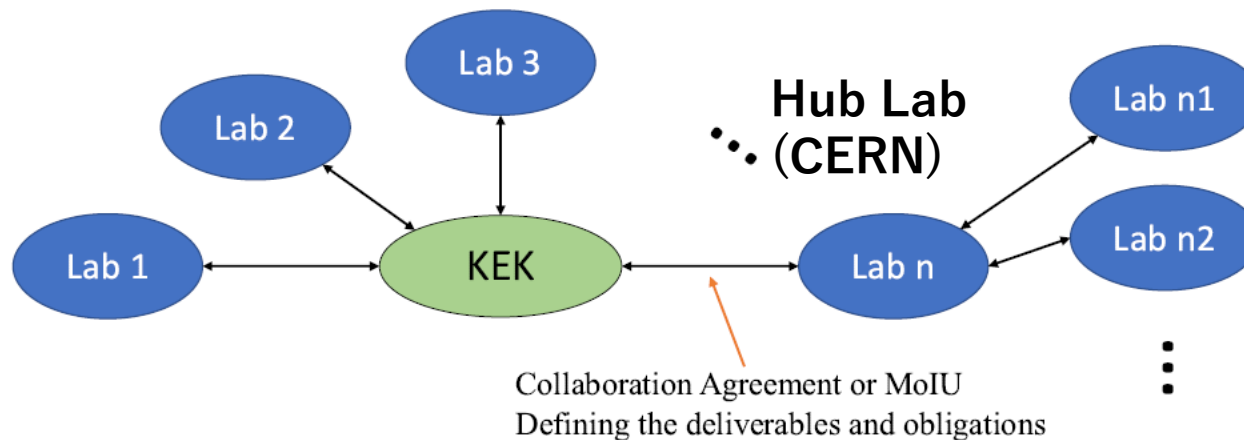
- The ITN is a network of the accelerator laboratories:
KEK, CERN, US National Labs. and Asian Labs...
(It will be launched by agreements between KEK and a partner laboratory
which define the deliverables and obligations)

Purposes

- Make international cooperation tighter / dependable @ Govern. level
(See Tastuya's IDT talk)
- Improve the reliability and completeness of ILC technology
- Potential for application of ILC Technologies

Status

- In Europe, CERN plays a coordinating role(Reported to Council in March).
Main contracts for flow of funds will be made between CERN and KEK, and subsequent contracts between CERN and European labs in the cases where money flow is needed.
In June we starts between KEK and CERN/European National Labs.
- Delegations have so far visited management of the three US laboratories and discussed their possible participation in the ITN. We also subsequently visited the US DOE in January 2023 to make a proposal for the collaboration with the US laboratories by expanding the existing US-Japan Cooperation Program. We are currently awaiting a response from DOE/P5 (**P5 Recommendation for R&D ILCTN is crucial**)
- Asian scientists/Labs will join the ITN.
A group of accelerator scientists in Korea is already exploring the possibility of participation.



ILC Promotions in World-Wide with IDT (2)

To overcome gap between Governments (Global vs International):

Foreign Governments say 「Japan should decide at first」as the usual approach
Japanese Government says 「decide construction world-widely at first」
as Global project.

Chicken and Egg problem for the last ten years.

International Expert Panel

Established by the IDT and
is composed of researchers with extensive experience in international collaborations
and channels of dialogue to national governments.

See Tatsuya's IDT talk

→ These two efforts cultivate **environment for international discussion**

5. Human Resource / Future Plan

arXiv:2203.13979 input for Snowmass

Japan's Strategy for Future Projects in High Energy Physics

Today
↓

X axis is year maybe a few years shifts

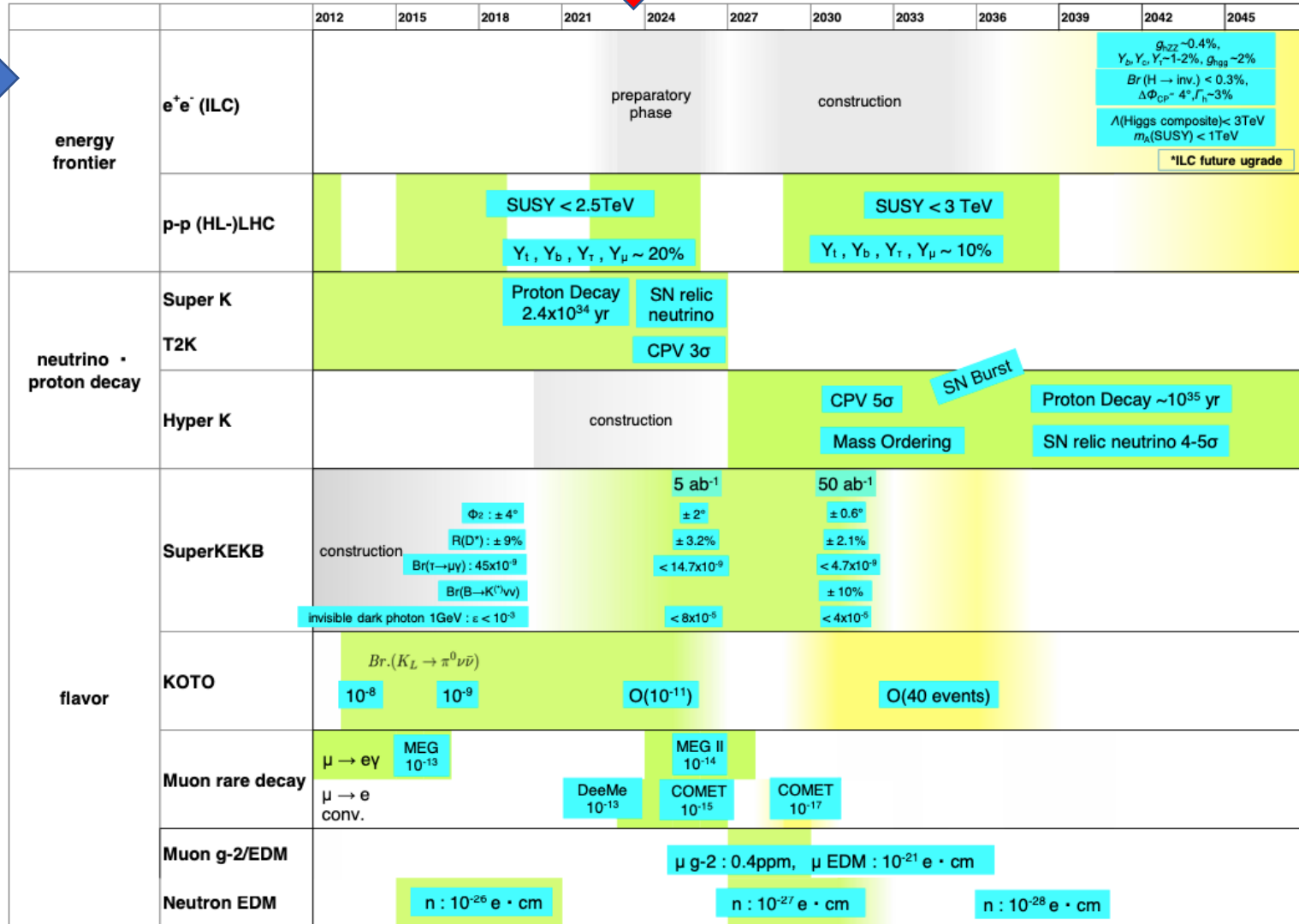
ILC is the future project after SuperKEKB and HK.



Human Resource Flow should be considered.

- LHC/HL-LHC (Detector UG soon)
- SuperKEKB adjusting now
- HyperKamiokande

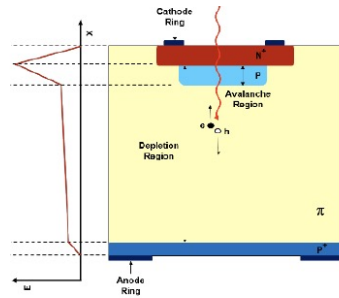
Asking gradually shift



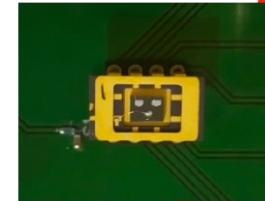
6. Start R&D future Higgs Factory detector

1) KEK Energy Frontier Group (LHC/ATLAS) starts R&D Solid State Detector

2) U-Tokyo ICEPP Group continues to develop calorimeter with high granularity and fine time resolution.



Low Gain Avalanche Diode(LGAD)



New material

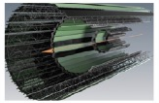
radhard?

Groups involved in MAPS @ Strasbourg



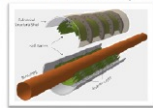
Belle II

- Monitoring of beam BKG
 - MIMOSA-26 (2008)
- Upgrade vertex detector (VTX)
 - CRFLIX sensor (~2024)



ALICE

- Contributed to Inner Tracking System 2 (ITS2)
 - ALPIDE sensor (2017)
- Upgrade with ITS3
 - MOSS stitched sensor (~2025)



Future e+e- collider

- Continuous R&D to match requirements
- Intermediate contribution to CBM
 - MIMOSIS sensor (~2025)

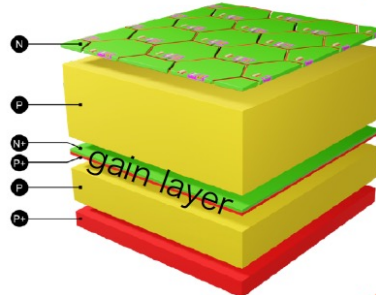


Radiation measurement

- X-ray (<10 keV) spectroscopy & counting
- Ions counting
 - Monolithic-imager sensor
- Ion identification
 - TIIMM sensor



Technical implementation + R&D
by C4Pi = core facility for CMOS pixel sensors



SiGe BiCMOS

Picosecond

~10 ps timing resolution

High Time resolution

Monolithic CMOS

few μm spatial resolution

High Space resolution

Solid state detector :

- Monolithic CMOS sensor with European groups
- Exploiting the properties of SiGe BiCMOS
- Explore LGAD capability
- Radiation hardness of semiconductor detectors
- R&D of the new material sensor

Electronics :

These R&D will/have start

- R&D for ultra high-speed data transfer (optical)
- AI on FPGA

Machine Learning :

- Application of AI/ML to detector operation
- Application of AI/ML to detector production and QC/QA
- Application of AI/ML to Object ID, track/vertex reconstruction

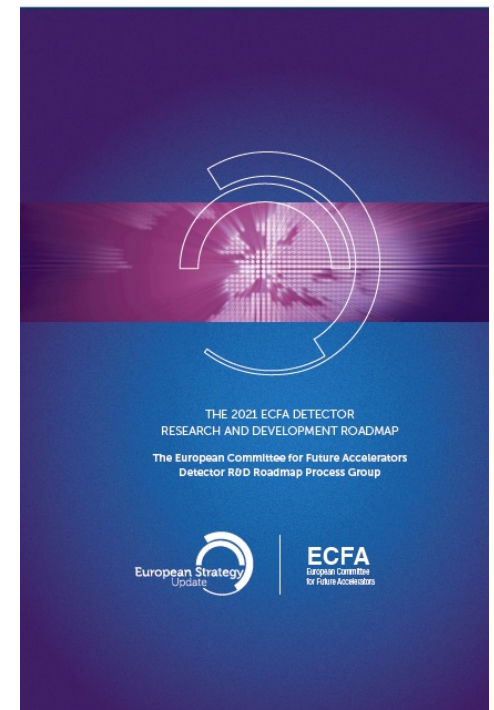
Magnet :

- Feasibility study of the detector magnet
- Possibility of HTS

Calorimeter

Quantum Technology

- ② Boost up
Global discussion



Within the international R&D framework:

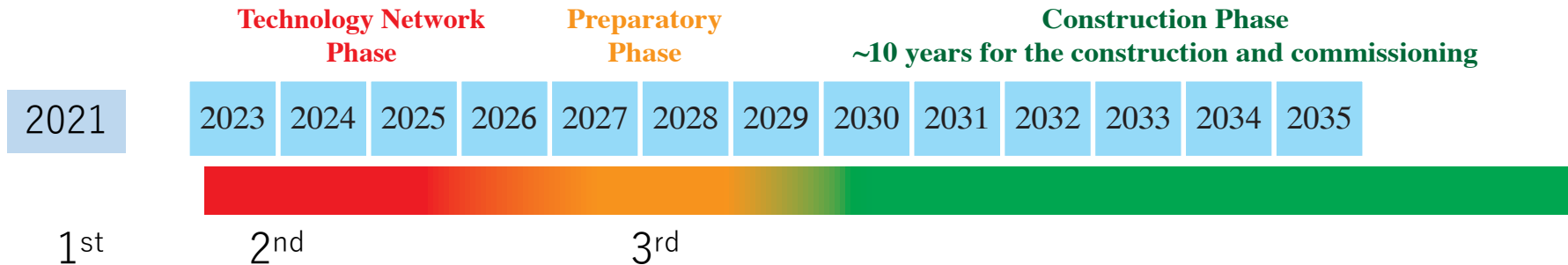
International is crucial for the future detector.

- ① Break through encourage younger generation to join.

7. Timeline / Step-by-Step ILC promotion

This Timeline is considered,
Discussed in IDT/ICFA/Diet Federation.
not Government approved.

IDT view on the ILC project timeline
-success oriented and assuming no major incident-



1st stage Prepare ILCTN
International expert panel makes global script.



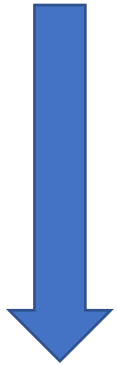
Condition

- Budget is ready
- Various National Labs join ILCTN

2nd Stage ILC TN develops TC-WP

**Community cultivates environment for international discussion
(both @ scientist community and government level)**

Japan takes role / initiative in ILCTN (we are asking to JG)



Condition

- FCC-ee FS final report
- recognize ILC as the most realistic, cost-friendly, carbon-friendly project
- Understand of Governments/Communities ILC is global project
- Better International situation(Pandemic, global economy, tension)

3rd Stage Governments discuss cost sharing/responsibility of ILC
(as Global project)



Condition

- Fix final cost including civil engineering
- Cost sharing / responsibilities are agreed @ Governments

Start construction.

For everybody

2nd Stage ILC TN develops TC-WP

**Community cultivates environment for international discussion
(both @ scientist community and government level)**

Japan takes role / initiative in ILCTN (we are asking to JG)

Now!!

Condition

- FCC-ee FS final report
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Condition

- Fix final cost including civil engineering
- Cost sharing / responsibilities are agreed @ Governments

Start construction.

8. Resolution on the Promotion of ILC Project

Federation of Diet Members had the extended plenary meeting

27th April 2023

- The ILC International Development Team (**IDT**) , in **strong collaboration** with **ILC Japan**, an organization of related researchers in Japan, and the High Energy Accelerator Research Organization (**KEK**), is steadily building the **ILC Technology Network (ITN)**, an organization dedicated to perfecting ILC-related technologies through collaboration among accelerator research institutes around the world.
- The IDT has established an “**International Expert Panel**”, whose progress is well underway, to organize a roadmap for the realization of **a large-scale accelerator as a global project** and the concept of responsibility sharing, and based on these discussions, to provide a forum for explanations and discussions to the governments of individual countries.
- Since the ILC project cannot be realized by one country alone and international cooperation is essential, the Japanese government should work closely with researchers who promote the above activities and exchange views with the governments of the countries concerned.
- Steadily promote the **development of next-generation accelerator technology** that will lead to the promotion of the ILC project under appropriate international cooperation, and **ensure that the necessary budget is secured** for this purpose.

Some parts are picked up. you can find all in appendix.

Extended plenary meeting

(about 150 joined:
close 30 Diet members)

We visited two Ministers
with Diet members
to explain this resolution.



(By Sugawara-san Kesenuma mayor)

Minister of State for Science and Technology Policy



(By Takaichi-san Minister)

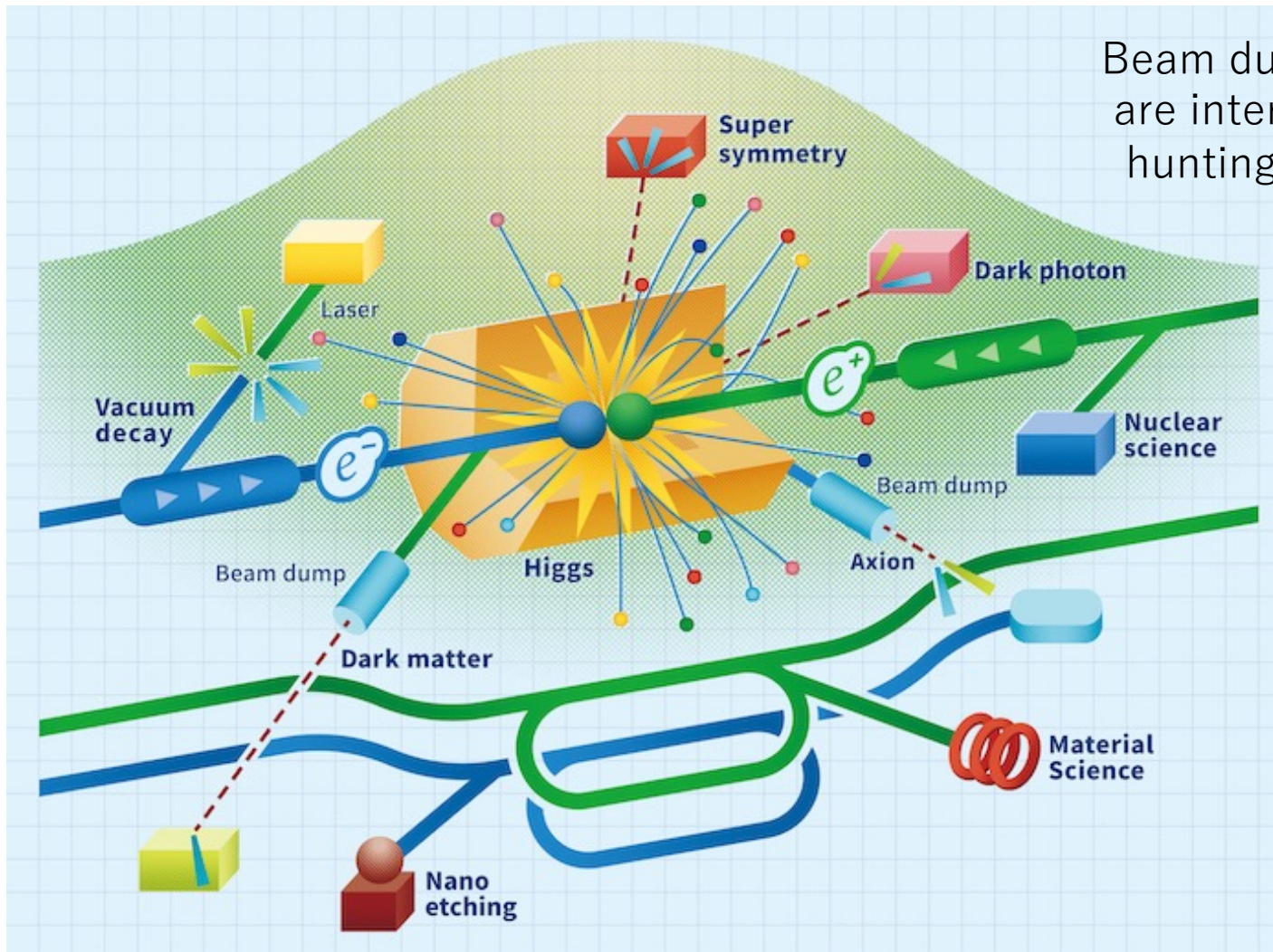
Minister of Education, Culture, Sports, Science and Technology



(By Fujiwara-san
Diet member)

9. Diversities / applications (ILCX2021 online)

Higgs Factory / high energy colliders are very important for us;
But diversities and applications are important for facility



Beam dump experiments
are interesting
hunting for Axion / Paraphoton

Light Source
Laser/XFEL
Nuclear Phys.
Material
Nano beam

Various
proposals
are welcome

Summary

1. ILC is planned as the Global Project:
Global vs International approaches causes
“chicken and egg problem”.
 2. Japanese HEP community makes ILC-Japan in 2021
New promotion scheme in Japan, Five Party meeting
 3. IDT-KEK-ILC-Japan tight collaborations.
 4. ILC technology network will start.
P5 recommendation is crucial for US to join ILCTN
 5. Big pictures of Higgs Physics is necessary.
 6. Detector R&D starts with collaboration of ECFA Roadmap
 7. We determine timeline (Step by Step promotion) with IDT
- Now move forward to 2nd stage (Supported by ICFA/Diet Fed./JAHEP)**

Federation of Diet Members to Promote a Construction of International Laboratory for LC

Particle physics and its underlining accelerator science are an important science and technology, which are disciplines that study the ultimate structure of matter and the fundamental forces of nature, and supports a wide range of R&D from academic research to industrial applications.

In addition, Japan has been a world leader in these fields, having produced many Nobel laureates. While Japan's research capabilities have been declining in recent years, the International Linear Collider (ILC) project in Japan, which will create Asia's first large-scale international science and technology center, has great potential to contribute to the improvement of Japan's research capabilities and growth strategy as a country that advocates science and technology.

Based on this recognition, in October 2022, this Federation of Diet Members resolved to steadily promote the development of next-generation accelerator technology, which will lead to the promotion of the ILC project and to ensure that the JFY2023 budget would be secured for this purpose. Since then, progress has been made as follows:

- In the JFY2023 budget, the budget for the development of advanced accelerator technology was appropriated, far exceeding the previous budget.
- The ILC International Development Team (IDT) , in strong collaboration with ILC Japan, an organization of related researchers in Japan, and the High Energy Accelerator Research Organization (KEK), is steadily building the ILC Technology Network (ITN), an organization dedicated to perfecting ILC-related technologies through collaboration among accelerator research institutes around the world.
- The IDT has established an "International Expert Panel", whose progress is well underway, to organize a roadmap for the realization of a large-scale accelerator as a global project and the concept of responsibility sharing, and based on these discussions, to provide a forum for explanations and discussions to the governments of individual countries.

For Japan, which has made science and technology policy the first pillar of its growth strategy toward the realization of "New Form of Capitalism ," it is extremely important that particle physics research continue to maintain and improve its international competitiveness. In addition, with international affairs such as COVID-19 and the situation in Ukraine having a major impact on international scientific and technological projects, it is recognized that the activities of the international community of researchers mentioned above, which is entering a new phase of realization, will continue to be important.

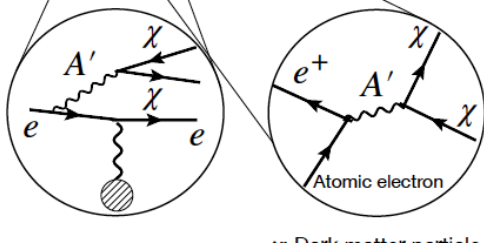
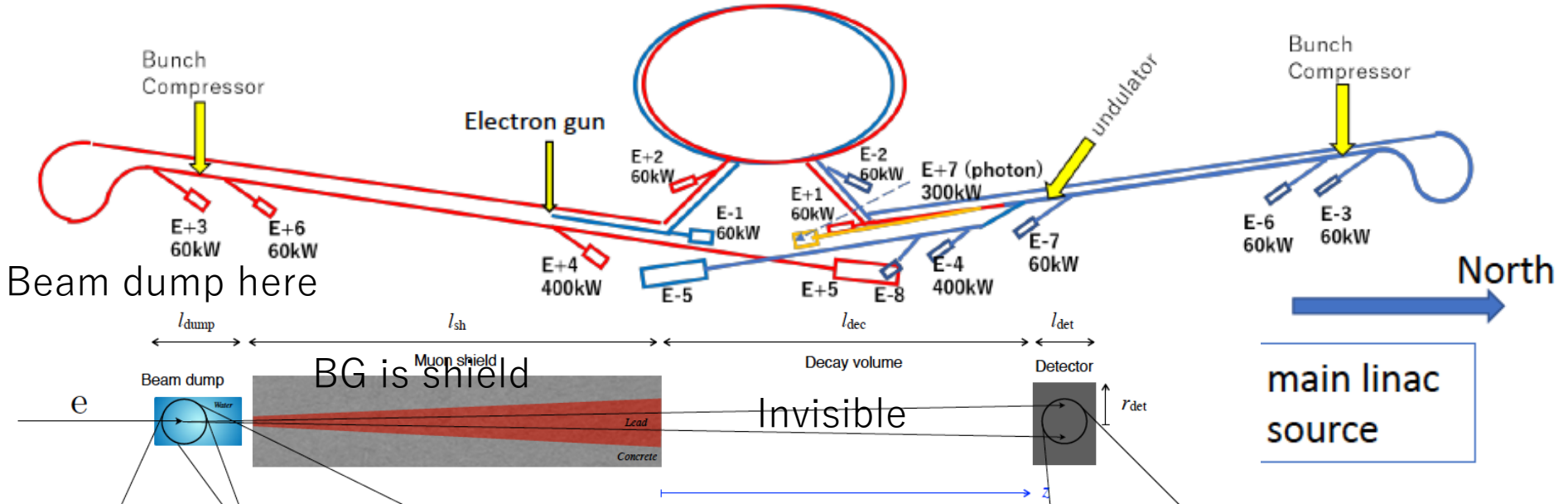
This Federation of Diet Members, will strengthen its structure, and under stronger collaboration between the research community with ILC Japan and KEK, the AAA, the Tohoku ILC Council, the Ministry of Education, Culture, Sports, Science and Technology, and related ministries and agencies, will continue to support the activity policies of the international research community and strive to ensure that these activities will lead to the realization of the ILC project in Japan.

Therefore, this Federation of Diet Members resolved as follows:

1. Promote activities in cooperation with related parties to attract the International Linear Collider (ILC Project) to Japan, which will form Asia's first large-scale international science and technology center.
2. Since the ILC project cannot be realized by one country alone and international cooperation is essential, the Japanese government should work closely with researchers who promote the above activities and exchange views with the governments of the countries concerned.
3. Steadily promote the development of next-generation accelerator technology that will lead to the promotion of the ILC project under appropriate international cooperation, and ensure that the necessary budget is secured for this purpose.

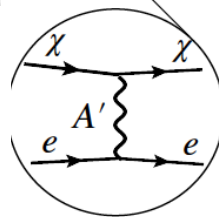
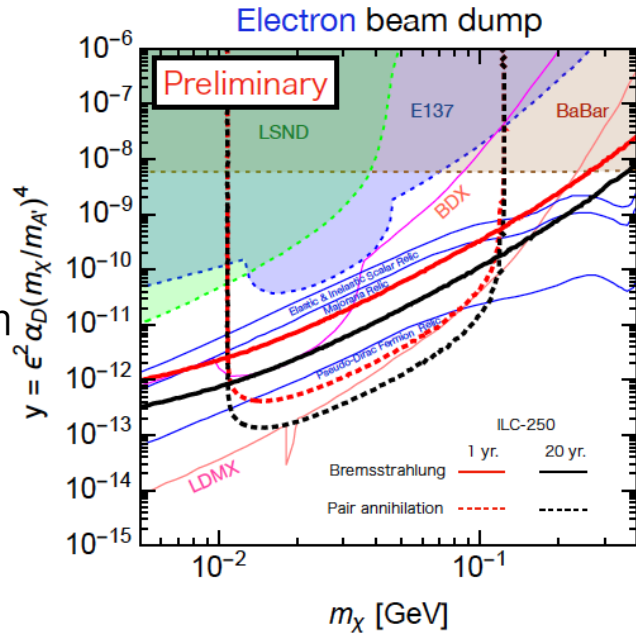
(Tentative Translated by KEK)

Beam dump experiment ALPs



Many electron/positron we can use

$$N_{EOT} = 4 \times 10^{21} / \text{year}$$



Scatter @ detector

Interesting region for DM can be covered.