

# ILC Project (Status and Prospect)

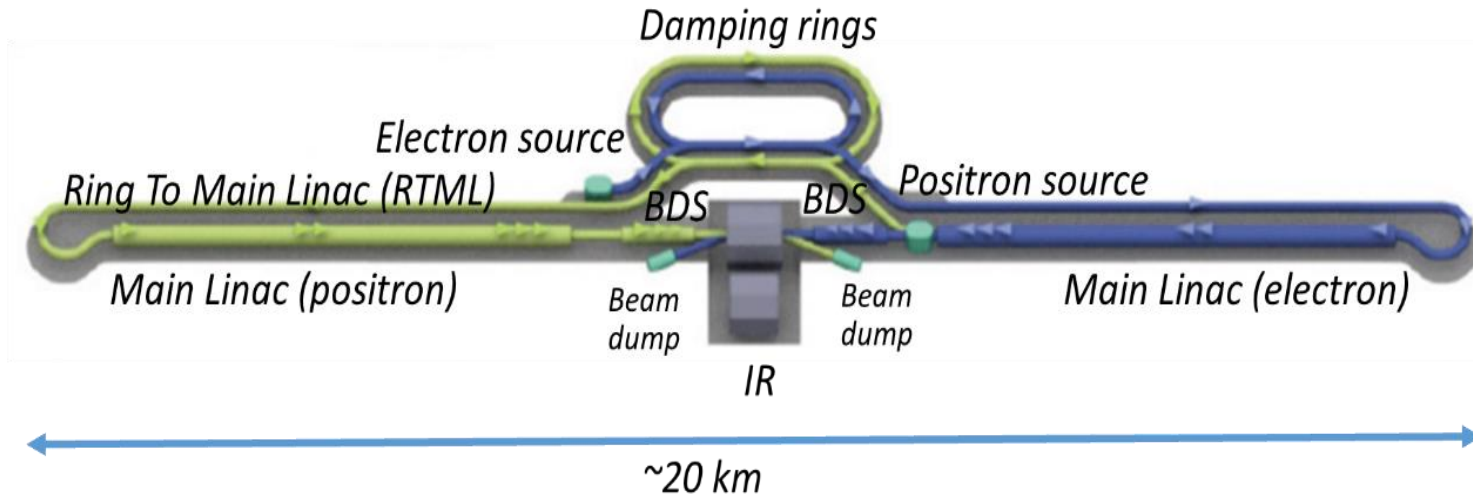
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Executive Director

High Energy Accelerator Research Organization (KEK)

HPNP2019, February 18, 2019, Osaka

The next energy-frontier electron-positron collider to explore physics laws in the early Universe.



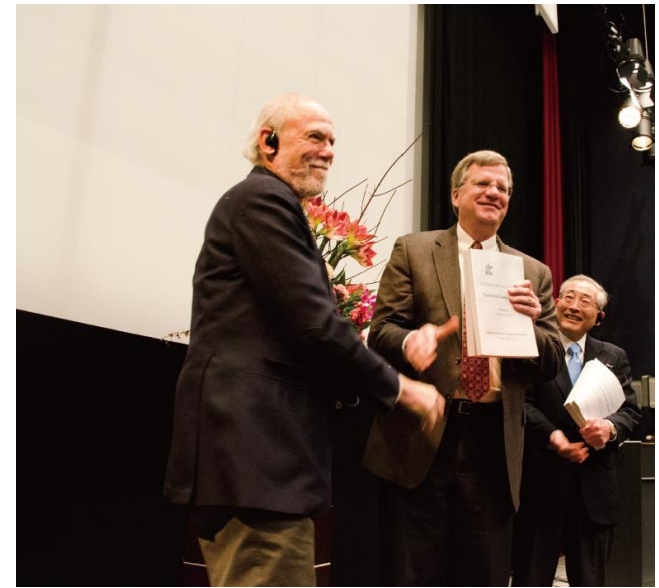
- Collisions of 125 GeV electrons and positrons in a 20 km tunnel. (250 GeV ILC)
- It can produce a large number of the Higgs particles (a Higgs factory).
- It has a good potential to discover new particles/phenomena such as dark matter particles.

- R&D for a  $e^+e^-$  LC started more than 20 years.
- The LC technology choice was made by International Committee for Future Accelerators (ICFA) in 2004 . The GDE, a global team for design and coordination of R&D was established. The GDE was lead by Dr. Barry Barish.
- The Technical Design Report (TDR) of the ILC was published in 2013.
- ICFA set up the Linear Collider Collaboration (LCC) for the engineering design phase.

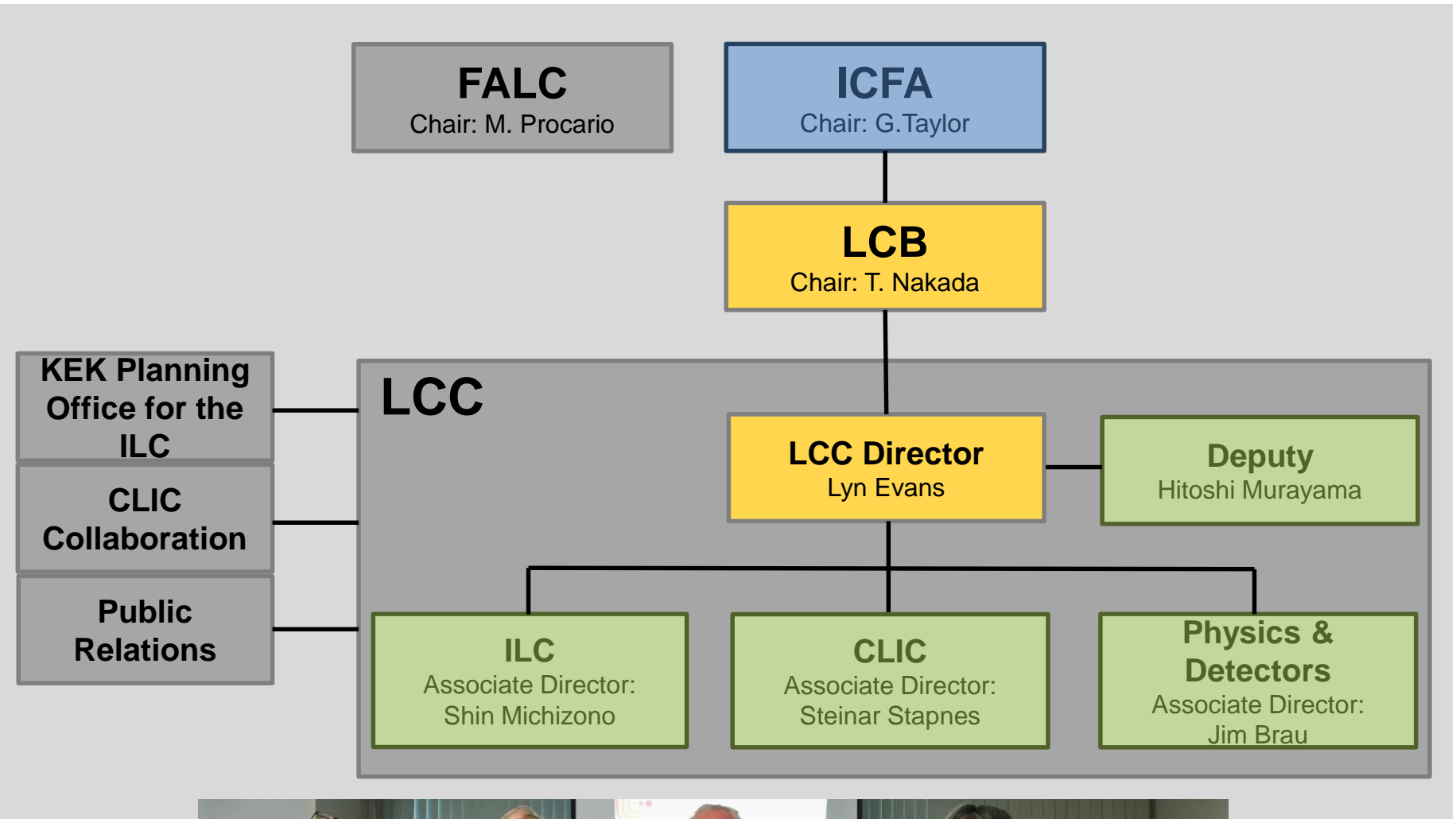
LC technology Choice, Aug. 2004



TDR completion ceremony, Dec. 2012



# LC promotion structure in ICFA



- In October 2012, after the discovery of the Higgs boson at LHC, 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.
- In August 2013, the ILC site evaluation committee by Japanese researchers with technical and socio-environmental experts recommended that *the Kitakami site is evaluated to be the best domestic candidate site for the ILC*. The site was endorsed by LCC.
- MEXT set up the ILC Advisory Panel in May 2014.
- Japanese HEP community proposed to start the ILC as a 250GeV Higgs factory. This proposal was endorsed by LCB/ICFA (November 2017).
- The ILC Advisory Panel released its final report, and subsequently MEXT called for an external evaluation from the SCJ in July 2018. The SCJ report was submitted to the MEXT and published in December 2018.

MEXT= Ministry of Education, Culture, Sports, Science & Technology in Japan  
SCJ=Science Council of Japan

# ILC Site Candidate Location in Japan: Kitakami

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Tunnel is in the hard granite bed rock deep underground  $\Rightarrow$  Earthquake-resistant design



High-way

Oshu

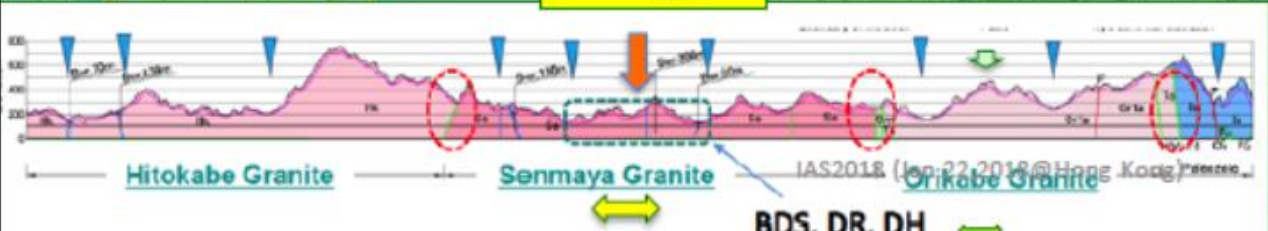
Express-Rail

一関市  
Ichinoseki

Ofunato

Kesen-numa

IP Region



- In LCWS 2016, Morioka, November 2016, the LC community agreed to start considering 250 GeV ILC seriously.
- LCC studied [physics at 250 GeV ILC](#) and [its technical and cost issues](#) and published their reports (available in ArXive).
- In July 2017, the Japanese HEP community (JAHEP) released a statement :[“Scientific Significance of ILC and Proposal of its Early Realization in light of the Outcomes of LHC Run 2 “](#) based on its subcommittee’s report on the scientific significance of the 250GeV ILC .  
<http://www.jahep.org/files/JAHEP-ILCstatement-170816-EN.pdf>
- These reports were informed to LCB. LCB and ICFA released their conclusions and statement supporting 250 GeV ILC.

*“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, led by Japanese initiative.”*

- ✓ Urgency of a Higgs factory
- ✓ Energy extendibility of the ILC

- The ILC advisory panel of MEXT has finished its discussion in July 2018, and released a report “Summary of the ILC Advisory Panel's Discussions to Date after Revision”.  
([http://www.mext.go.jp/component/b\\_menu/shingi/toushin/\\_\\_icsFiles/afielldfile/2018/09/20/1409220\\_2\\_1.pdf](http://www.mext.go.jp/component/b_menu/shingi/toushin/__icsFiles/afielldfile/2018/09/20/1409220_2_1.pdf))
- The report reviews the ILC project in detail.
  - ▶ Scientific potentials
  - ▶ Cost and technical feasibility
  - ▶ Human resources educational program
  - ▶ Organization and management
  - ▶ International cooperation
  - ▶ Discussion of the 250GeV ILC
- All these points are reviewed with positive flavor in the report, but it does NOT give any recommendation.
- It requests the Science Council of Japan to discuss the 250GeV ILC, based on the evaluation given in the panel report.



- Intensive discussions started in the Committee formed in the SCJ in August 2018. 11 meetings were held in August-November. There have been many presentations and many submissions of documents from researchers and various sectors. More than 30 letters from abroad were sent to the Committee.
- The final report was approved at the Executive Board of the SCJ and handed to the MEXT on December 19, 2018.

<http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-24-k273-en.pdf>

- The SCJ recognizes the importance of the Higgs physics “ *It is agreed upon in Japanese high energy physics community that the precision measurement of the Higgs coupling is an important one among those approaches.*”
- “Judging from the plan and preparatory status of the project presented at the moment, the Science Council of Japan does not reach a consensus to support hosting the 250GeV ILC project in Japan.”

Their main concerns are “*Japan’s large share of the overall cost required for the project implementation*”, “*considerable hurdles remain to be cleared* (for technical issues)”, and “*the uncertainty surrounding proper international cost-sharing with respect to the long-term commitment to large budget*”

It should be noted that in the decision-making process by the Japanese government, the SCJ report will be taken into account along with other factors such as merit to the society.

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The SCJ appreciated the scientific significance of the ILC project, the “pursuit of new physics beyond the standard model,” but also pointed out issues concerning the hosting of the ILC project in Japan, in particular the cost-sharing as an international project and the international project organization and management. To address these issues, **we ask the Japanese government to promptly convey a forward-looking position regarding the implementation of international discussions toward the realization of the ILC.**

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The scientific significance of the ILC project is widely accepted, **but the significance and consequences of Japan taking on a major part of the ILC project should be discussed not only from the academic but also societal points of view.** Investigations of the project by researchers have now reached the stage at which further progress requires international discussions by the government. If, in the course of these discussions, it becomes clear that international and domestic conditions are not satisfied, the project will be canceled. We will advance the ILC project, establishing worldwide consensus, including on its budget, while gaining support from both academic circles and society at large.

**As for the identified technical issues,** the global community will cooperate, combining resources to resolve them. Based on our experience and achievements at LHC, KEKB, European XFEL, and other research facilities, we are convinced that we can solve them.

- Non-patrician Federation of Diet members for the ILC was formed in 2008. Advanced Accelerator Association Promoting Science and Technology (AAA) was also established in 2008 as an industry and academia collaboration.
- These organizations have vigorously promoted the ILC project last ten years. Many visits were made to Europe and US.
- The MEXT-DOE discussion group on the ILC was formed in 2016 and decided to start collaboration on ILC cost reduction R&D.
- Diet members together with governmental officials, industrial representatives and researchers visited Europe in January, 2018 and identified counterparts of Japanese representatives in France and Germany at each level.
- Recent visits of the DOE Undersecretary (Dr. Paul Dabbar), a German parliament member (Dr. Stefan Kaufmann) and French National Assembly members to Diet members produced encouraging results.



Dr. P. Dabbar at a Diet member meeting



Dr. S. Kaufmann at KEK-STF

Courtesy  
S. Yamashita

**Unified HQ for  
Implementing  
Regional  
Revitalization**

**Head: Hon. Takeo  
KAWAMURA**

**HQ for Promoting  
National Land  
Resilience**

**Head: Hon.  
Toshihiro NIKAI**

**Research Council  
for Strategy on  
Science, Technology  
and Innovation**

**Chair: Hon.  
Kisaburo TOKAI**

**HQ for Accelerating  
Reconstruction  
from Great East  
Japan Earthquake**

**Head: Hon.  
Fukushiro  
NUKAGA**

**Research Council  
for Strategy on  
Intellectual  
Property**

**Chair: Hon. Akira  
AMARI**

**Liberal Democratic Party  
Coordination Council for Realization of ILC**  
(Representative: Hon. Takeo KAWAMURA)

**(Across-party  
group) Science and  
Technology Group**

**Chair: Hon.  
Hiroyuki HOSODA**

**Advanced  
Accelerator Assoc.  
Promoting Science  
and Technology**

**Chair: Mr. Takashi  
NISHIOKA**

**ILC 100 People  
Committee**

**Knowledgeable  
Advisors**

**Hon. Hiroya  
MASUDA (former  
Minister for Internal  
Affairs)  
Prof. Satoshi FUJII  
(Counselor, Cabinet  
Secretariat)  
Prof. Atsushi  
SUNAMI  
(Vice President,  
GRIPS)**

**Tohoku ILC  
Promotion Council**

**Representative: Mr.  
Hiroaki  
TAKAHASHI,  
Prof. Hideo OHNO**

**ILC Supporters**

**(Across-party  
group)  
Federation of Diet  
Members in  
Support of ILC**

**Chair: Hon. Takeo  
KAWAMURA  
Secretary General:  
Hon. Ryu  
SHIONOYA**

September 18, 2018

- To position ILC as **a cross-policy “national project”**, covering not only science, technology and innovation but also many challenges faced by the national government;
- To secure the financial resources for the realization of ILC (beyond the Olympic Games) **outside the ordinary science and technology**, academic or university budgets; and in addition,
- To make sure that, as for the international agreement of ILC, certain critical decisions, such as the share of oversea investments be roughly half, be satisfied before the international agreement necessary for the start of construction of ILC is reached.

- It is foreseen that the Japanese Government will announce Japan's official position toward ILC at the LCB/ICFA meeting in March in Tokyo.
  
- LCB's three conditions:
  - ▶ Clear expression of interest to host ILC in Japan
  - ▶ Financial support from the host government
  - ▶ Trigger international discussions on cost sharing, organization and others.

ESPP= the European Strategy for Particle Physics

- Discussions on the ILC project at the LCB/ICFA meeting on March 7-8, 2019 in Tokyo
- The update of the European Strategy for Particle Physics (- May 2020)
- International discussions => international negotiations by the government+ Technical preparation phase (~4years)
- ILC Construction (~9years)
- Experiments at the ILC can start early 2030's.



- The ILC proposal has been examined in great detail by the Advisory Panel of MEXT and Science Council of Japan. It is foreseen that the Japanese Government will announce Japan's official position toward ILC at the LCB/ICFA meeting in March in Tokyo. This will be the first important step towards the ILC.
- Many critical decision-making processes are ahead. KEK, together with international research communities, will make all efforts to realize the ILC.