

# **ILC Situation in Japan**

Keisuke Fujii  
February 26, 2019

# ***Brief History of ILC in Japan***

***Oct. 2012***

***JAHEP proposal to host the ILC in Japan***

Following the discovery of the Higgs boson at the LHC, JAHEP proposed to host the ILC in Japan as a global project. The proposal was welcomed by the world HEP community.

***Aug. 2013***

***Site Recommendation by the ILC Site Evaluation Committee***

The ILC Site Evaluation Committee consisting of Japanese researchers and technical and socio-environmental experts recommended Kitakami as the best candidate site in Japan. This recommendation was endorsed by LCC.

***May 2014***

***MEXT ILC Advisory Panel***

MEXT setup the ILC Advisory Panel and started its review of the JAHEP's proposal to host the ILC in Japan.

***July 2017***

***JAHEP proposal to start the ILC as a 250 GeV Higgs Factory***

Based on the LHC Run II results, JAHEP proposed to start the ILC as a 250 GeV Higgs Factory. The proposal was endorsed by LCB/ICFA in November 2017.

***July 2018***

***Final Report from MEXT ILC Advisory Panel***

The MEXT ILC Advisory Panel released its final report, with which MEXT called for an external review by the Science Council of Japan (SCJ).

***Dec. 2018***

***Report from the SCJ committee for ILC***

The ILC Review Committee of the SCJ handed its report to MEXT.

# ***Review by MEXT ILC Advisory Panel***

***The panel finished the review and published its final report in July, 2018. The report is about 140 pages long and in Japanese.***

***The report reviewed***

- scientific significance,***
- technical feasibility and cost,***
- human resources,***
- organization and management,***
- international cooperation, and***
- revision to 250 GeV ILC.***

***The panel was asically positive on all of these points but gave us no clear “Yes”, instead it requested a further discussion by SCJ based on this report.***

[http://www.mext.go.jp/b\\_menu/shingi/chousa/shinkou/038/gaiyou/\\_icsFiles/afieldfile/2018/07/19/1407245\\_1.pdf](http://www.mext.go.jp/b_menu/shingi/chousa/shinkou/038/gaiyou/_icsFiles/afieldfile/2018/07/19/1407245_1.pdf)

- The report has been sent back to the **S**cience **C**ouncil of **J**apan.***
- The report has been translated into English:***

[http://www.mext.go.jp/component/b\\_menu/shingi/toushin/\\_icsFiles/afieldfile/2018/09/20/1409220\\_2\\_1.pdf](http://www.mext.go.jp/component/b_menu/shingi/toushin/_icsFiles/afieldfile/2018/09/20/1409220_2_1.pdf) 3

# SCJ's Report on ILC

**SCJ EB Meeting on Dec. 19 (10:00-12:00)**

- **The SCJ EB endorsed the report from the SCJ's ILC committee. The report was sent back to MEXT immediately after that.**
- **The ILC part of the EB meeting ended in 15 minutes and Mr. Iye commented that the decision belongs to the government. He also confirmed that the scientific significance of the ILC.**



Chairman Iye of the SCJ ILC review committee handing its report to Director Isogai of MEXT Research Bureau.

From an article by K. Nakanishi that appeared in FNN prime

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

# SCJ's Official English Translation of the Executive Summary

**Now available as**

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

***No serious difference from the unofficial  
translation by KEK available from LC Newslines:***

<http://newslines.linearcollider.org/2018/12/21/>



# ***Executive Summary of the Science Council of Japan's Report***

**Emphasis in red by KF**

## **OVERALL ASSESSMENT**

While the 250GeV ILC project requires a long-term commitment to huge budget allocation for its construction and operation, **the expected scientific outcome is that if a certain deviation from the standard model prediction is found upon the precision measurement of Higgs coupling, it may provide a suggestion for the future direction of particle physics.** The Committee and the Subcommittee are not yet convinced that the prospective scientific outcome (possible indication of future direction) is sufficient to justify Japan's large share of the overall cost required for the project implementation. In regard to the technical feasibility of the 250GeV ILC, considerable hurdles remain to be cleared. As such problems are left to be solved in the adequate preparatory period of the project, they constitute matter of concern for the implementation of the project. The uncertainty surrounding proper international cost-sharing with respect to the long-term commitment to large budget allocation is another matter of concern.

**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. **The SCJ considers that government should be cautious regarding a decision to announce its commitment to host the ILC in Japan.**

Particle physics in pursuit of the fundamental structure of natural world has made marvelous developments thanks to the coordinated efforts of theoretical studies and accelerator experiments, and accomplished the monumental establishment of the standard model. The central issue at the moment is the exploration of “physics beyond the standard model.” which is also the target of the ILC project. As the desired way of promoting the accelerator-based high energy physics experiment in the near future, it is envisioned to realize a high-luminosity lepton collider somewhere in the world, which plays a complimentary role to the hadron collider (the Large Hadron Collider and its future upgrade). On the other hand, in view of the finite resources available to humanity, the research style that presupposes and ever-growing scale-up of gigantic experimental facilities would eventually reach the limit of sustainability. The future way of “big science” is a theme to be deliberated by the whole academic community.

### ***KF's assessment of the report***

**Significant improvement from the Nov. 14 draft.**

**Misunderstandings of facts have been corrected.**

**Some good points are also made.**

**The report appreciates the ILC's academic significance.**

**It is not vetoing Eol from the government.**

# ***Clarifications on the report from the Science Council of Japan regarding the ILC***

The purpose of this note is to provide clarifications on the report from the Science Council of Japan (SCJ) regarding the International Linear Collider (ILC), which was released on December 19, 2018.

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) examined the ILC project through the ILC Advisory Panel, and subsequently called for an external evaluation from the SCJ in July 2018. The SCJ is an organization consisting of Japanese scientists, and it conducted a detailed review of the ILC proposal by establishing a special panel. The report was submitted to the MEXT and published after a review in the executive meeting of the SCJ. **While acknowledging the scientific case for the ILC, the panel concluded that it did not support at this time that Japan host the ILC due to issues yet to be resolved. One of the reasons pointed out is that the international negotiation on cost-sharing has not been proven to be successful.**

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. We strongly hope that **an official statement by the Japanese government on its position towards the ILC will be available in a timely manner for full consideration in the European strategy process. KEK, in collaboration with many Japanese and international associates, is working diligently in maintaining the progress and making the ILC a reality in Japan.** Therefore, your continual support is highly appreciated and solicited.

21 December 2018

***Planning Office for the ILC at KEK***

**Emphasis in red by KF**

# ***From KEK: Regarding the “Assessment of the revised International Linear Collider Project”***

We would like to express our gratitude to the review committee of the revised International Linear Collider (ILC) project of the Science Council of Japan (SCJ) for their prompt and detailed evaluation. We here present our opinions in response to **the final report published by the Science Council of Japan.**

**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.**

Humankind has so far revealed the extreme microscopic world by studies using accelerators. However, there remain big questions regarding the natural world that remain unanswered, and it is the greatest challenge of modern physics to elucidate them. There is broad consensus among particle physicists that the Higgs particle holds the key. Precision studies of the Higgs particle have the potential to expand the horizon of humankind’s understanding of nature. The Linear Collider is an important project that can be a major turning point in deciding the “direction of physics” for the next 50 to 100 years.

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.

— *this article has been previously released on the KEK website in Japanese.*

**Emphasis in red by KEK**

# ***Message from politicians in response to Science Council of Japan's final report***

We wish to express our sincere gratitude for the intensive discussions conducted at the Science Council of Japan. It is extremely important that the scientific merits of the ILC and the significance of Japan contributing to international collaborative research have been recognized.

The ILC has a far-reaching impact on a wide range of national policies, such as science and technology innovation, diplomacy and national security, industrial development and growth, and regional revitalization and post-disaster reconstruction. **We believe that it is our political mission to push forward the ILC project as a national priority.**

Japan has been and will remain a science and technology-oriented nation. We will continue to seek public understanding for the ILC project and will work to address the issues raised by the Science Council of Japan.

**The Federation of Diet Members for the ILC and the Liaison Committee for Realizing the ILC will be working at full strength to ensure that the Japanese government reaches a positive decision to realize the ILC project in Japan.**

***Takeo KAWAMURA***

Chairperson, Federation of Diet Members for the ILC

Chairperson, Liaison Committee for Realizing the ILC, Liberal Democratic Party\*

\*In September 2018, the Liberal Democratic Party, created a new organization, called the Liaison Committee for Realizing the ILC. The Liaison Committee brings together various strategic groups involved in making important policies, such as science technology and innovation, regional revitalization, reconstruction from natural disasters, and national resilience.

**Emphasis in red by KF**

# ILC Promotion bodies in Japan

Japan: Parliamentary cabinet system

Government

**National Diet (Parliament)**

Representatives ~480  
Councillors ~240

**Cabinet (Prime Minister's office)**

**Ministries**

**MEXT** (Education, Culture, Sports, S&T)  
**CAO** (Cabinet office) – S&T Council (**CSTI**)  
**MOFA** (Foreign Affairs) -- Embassy  
**MLIT** (Civil, Sightseeing, Transport)  
**METI** (Economy, Trade, Industry)  
+ ...  
**MOF** (Ministry of Finance)

**Political**

**Federation of the Diet Members for ILC (2006, 2008~)**

Founded by LDP in 2006 → Multi-parties in 2008. Now ~150 Members

**Industry & Academia**  
Business sector

**AAA**

**Advanced Accelerator Association (2008~)**  
(2014~ incorporated company)

Industry-Academia cooperation  
Led by Executives of Leading Companies and KEK DG

Central activity in **Researchers**

**KEK**

**ILC Promotion Office**  
(led by KEK DG, 2014~)

Technological leadership for Accelerator  
Cooperation with MEXT

**KEK** JAEA, QST, JAXA, RIKEN,  
**Universities,,**

**SCJ**  
Science Council of Japan

**J-HEP Committee**  
Japan HEP Community

**Local Area**  
Candidate area

**ILC Tohoku Promotion Office**  
(2016, June~)

Led by Local Governments, Business Associations, Univ. Presidents.  
Cooperation of Civil engineering at candidate site area  
Geological surveys, preparation for campus

# Realizing the ILC as National Project with Cross-Cutting Policies

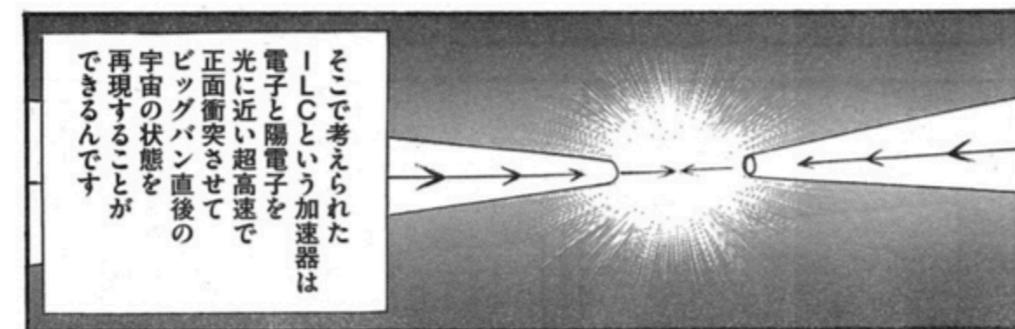
**Established on Sep. 18**



- **MEXT is talking with other ministries.**
- **Ordinary diet session has started**  
→ more activities in the political sector.
- **7 prefectural governors of the Hokkaido and Tohoku area submitted a petition for ILC to chief cabinet secretary Suga.**
- **More media coverage.**
- **A comic series (Chairman Kosaku Shima) featuring ILC started.**
- ...



岩手県議会議員 岩崎友一オフィシャルブログ 〜一直線!! みんなで龍馬...



そこで考えられた ILCという加速器は電子と陽電子を光に近い超高速で正面衝突させてビッグバン直後の宇宙の状態を再現することができます



モーニング8号 (1月24日発売号) より ©弘 兼憲史/講談社

**New**

# **A Joint Statement from the Japanese Major Three Economic Bodies**

Japan Business Federation

<http://www.keidanren.or.jp/policy/2019/015.html>

Japan Chamber of Commerce and Industry

<https://www.jcci.or.jp/cat298/2019/0220140000.html>

Japan Association of Corporate Executives

<https://www.doyukai.or.jp/policyproposals/articles/2018/190220a.html>

# Anticipation for an Eol regarding the ILC in Japan

February 20, 2019

Japan Business Federation  
Japan Chamber of Commerce and Industry  
Japan Association of Corporate Executives

The International Linear Collider (ILC) is an accelerator facility for particle physics experiments to study the origins and mechanisms of the universe, which is being designed and developed by researchers from all around the world.

Given Japan's contribution to the development of elementary particle physics and its advanced technological level, many researchers in other countries expect Japan to lead research in this field as a host country of the ILC. The ILC will be the first large-scale international science and technology base in Asia, and is expected to attract thousands of excellent researchers from abroad, and accumulate state-of-the-art technologies from home and abroad.

We hope the Japanese Government will issue an "Expression of Interest" (Eol) to start international discussions towards hosting the ILC in Japan, and to call on related countries to start international discussions. While advancing towards a final decision, we also request the government to refine the hosting plan, further verify various expected effects, and to foster understanding of stakeholders including those in academia.

**New**

**A Joint Meeting of  
The Federation of Diet Members  
and  
The Liaison Committee for  
Realization of ILC  
on Feb. 21**

[https://www3.nhk.or.jp/news/html/20190221/k10011823061000.html?utm\\_int=nsearch\\_contents\\_search-items\\_001](https://www3.nhk.or.jp/news/html/20190221/k10011823061000.html?utm_int=nsearch_contents_search-items_001)

## Three Points Made in the Resolution: Towards the Realization of the International Linear Collider (ILC)

- We will position the ILC as a new model case beyond the Olympic Games, and a national project that spans across multiple government ministries and agencies and across multiple national policies. As part of our responsibility as politicians and the national legislature, ***we will work at full strength to realize the ILC by securing financial resources from outside the ordinary budgets for science and technology, academic grants or universities.***
- We hope to see ***the acceleration of discussions with governments overseas following an announcement in early March by the Japanese government on its position regarding the ILC project.*** Our Federation and Liaison Committee ***will give our full support in these international discussions at the government level,*** so that an international agreement with appropriate levels of international cost sharing can be reached.
- Since the ILC project requires large expenses from the start of its construction to the completion of the project, we shall assume ***the political accountability to seek public understanding*** regarding the necessity of the research and the path towards its realization.

**Emphasis in red by KF**

**New**

# **MEXT Minister's Press Conference on Feb. 22**

[http://www.mext.go.jp/b\\_menu/daijin/detail/1413820.htm](http://www.mext.go.jp/b_menu/daijin/detail/1413820.htm)

# MEXT Minister's Press Conference, Feb. 22, 2019

## Journalist 1: (2:30~)

I would like to ask about the Linear Collider. Yesterday, MEXT Director of Research Bureau, Mr. Isogai, said that the government's consideration would be explained at the researchers' meeting on March 7. Is the government's stance toward hosting the project going to be clear to some extent at that point?

## Minister:

OK. As a matter of fact, yesterday the Federation of Diet Members for the ILC and the Liaison Committee for Realization of the ILC held a joint meeting. I have heard that various opinions and requests were expressed there about the ILC project and a resolution was passed. As you pointed out, we there showed our plan that **a MEXT officer would attend the March 7th meeting of the Linear Collider Board, known as LCB, and explain the current view of the government regarding the ILC.** As for its contents, we are currently scrutinizing the SCJ report and, as I said before, we are discussing with relevant ministries and agencies. Based on these, MEXT will formulate its view. We have not yet reached the point to talk about its concrete contents.

Emphasis in red by KF

## Journalist 2: (5:10~)

This is about the ILC again. Just recently, the federation of diet members and local councils of the candidate site presented resolutions. Also the three major economic bodies issued a joint statement. There seem to be various such activities on going. Given this situation, could you comment again on the ILC?

## Minister:

OK. As you pointed out, we noticed a message from the three major economic bodies, and also a petition from a group of students. ***We are aware of the strong sentiment toward the ILC. Taking into account these requests, we will continue closely contacting relevant ministries and agencies and collect opinions regarding the ILC project in various sectors of the government.*** We will continue our comprehensive deliberations.

### Journalist 3: (8:43~)

Again going back to the ILC. In the resolution that the federation of diet members published yesterday, it is declared as one of the main points that the budget for the ILC would be from outside the ordinary budget for science and technology, academia, and universities. On the other hand, the director of the research bureau, Mr. Isogai, said that the ILC would be discussed in the Master Plan process, which is, in my understanding, an ordinary MEXT process implying that the project is taken care of by the ordinary budget of MEXT. Isn't the direction the federation of the diet members is pursuing that the budget should come from outside the ordinary academic budget inconsistent with the suggestion by MEXT that the project should be discussed in the Master Plan process?

### Minister:

OK. What the Research Bureau director meant was that ***the Master Plan process would be to get sufficient understanding from scientists from all the other relevant fields, while we would clarify how to position the ILC in our grand national strategy.*** As for the request from the federation of diet members about the budget source, we consider it as ***our responsibility to formulate how to place it in the overall national budget framework, through discussions with relevant ministries and agencies,*** not just with the ministry of finance but more widely with other ministries and agencies.

# Possible Timeline

***March 7-8, 2019  
LCB/ICFA***

The Japanese government explains its position regarding the ILC at the March 7 LCB meeting. LCB/ICFA discuss the ILC project taking the message from the Japanese government into account.

***April 8-9, 2019  
LC Community Meeting in  
Lausanne***

Initiate strategy formulation for linear collider activities and discuss how to present the LC case at the Granada meeting. Address the future ILC organization beyond LCC.

***May 13-16, 2019  
EPPSU Open Symposium  
in Granada***

***Present the ILC case as convincingly as possible to the European HEP community in order to get the ILC placed properly in the 2020 EPPSU.***

***May 2020  
Approval of EPPSU 2020***

***International discussions  
→ International negotiation  
by governments of potential  
partner countries/regions.***

With a basic agreement among partner countries/regions, an ILC pre-Lab will be formed + 4-year preparation phase. Given that the negotiation finished successfully, the ILC Lab will be established.

***9-year ILC construction***

***Early 2030's  
Start of ILC Experiments***

**Now =  
Critical Time for  
the ILC to fly**

# **Linear vs Circular Discussion**

**Political support:** ILC has been considered in depth over a number of years by the government of Japan, which is soon expected to make **an Expression of Interest to host the project.**

Politicians, governments, and funding agencies in Japan have been discussing the ILC with their counterparts in Europe and the US for a number of years, and have been encouraged by these discussions.

**Other large collider projects have not yet reached a similar stage.**

**Technical maturity:**

The RDR (CDR equivalent) for the ILC was published in 2007 and the **TDR in 2013.**

**Circular collider projects have only recently published their CDRs.**

The ILC's quoted performance and costs are deeply understood and thus reliable.

**Timeline:** Given a go-ahead, the ILC will very soon be ready to start construction. First collisions can occur within around 15 years from now.

**According to current run plans, the ILC will complete its 2 ab<sup>-1</sup> 250 GeV run at about the time FCCee begins its ZH run.**

**Physics:** Beam polarization is a powerful tool not available at high energy circular colliders.

When measuring Higgs couplings, **polarization compensates for the lower integrated luminosity at 250 GeV compared to FCCee (2 vs 5 ab<sup>-1</sup>)** not just by the increased rates but also by its power to remove some correlations among different EFT operators.

In the case that ILC observes new phenomena other than in the Higgs couplings, polarization will play an essential role in determining their chiral properties.

Polarization will also allow **systematic uncertainties** on many measurements **to be significantly reduced.**

**Upgradeability:** The ILC's collision energy can be readily upgraded to 500 GeV and above.

**A technical design for a 500 GeV stage exists.**

Likewise, **a technical design exists for upgrading the luminosity:**

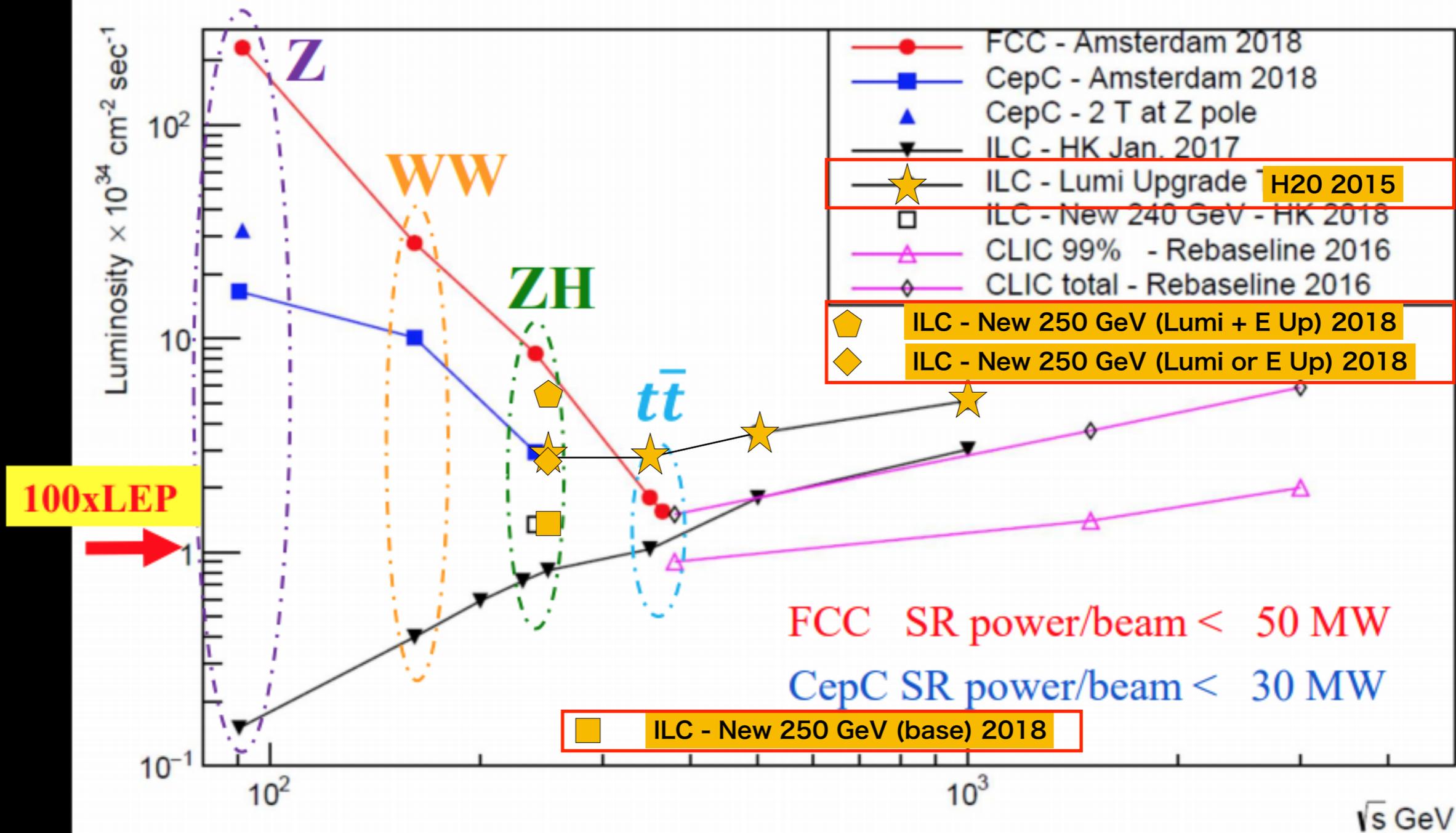
- **by a factor 2 by doubling the number of bunches per pulse,**
- **another factor 2 by doubling the repetition rate.**

The ILC250 infrastructure is reusable. It provides long-term perspectives beyond current technologies (e.g. a plasma-based accelerator).

**Single IP**

## luminosity comparison

$e^+e^-$  Collider Luminosities



# Power of Polarization

coupling	2/ab-250 pol.	+4/ab-500 pol.	5/ab-250 unpol.	+ 1.5/ab-350 unpol
$HZZ$	0.50	0.36	0.64	0.40
$HWW$	0.50	0.36	0.65	0.41
$Hbb$	1.0	0.59	0.87	0.66
$H\tau\tau$	1.1	0.75	0.95	0.75
$Hgg$	1.6	0.96	1.2	0.98
$Hcc$	1.8	1.2	1.4	1.1
$H\gamma\gamma$	1.1	1.0	1.1	1.0
$H\gamma Z$	7.0	3.7	8.3	5.1
$H\mu\mu$	4.0	3.8	3.8	3.7
$Htt$	-	6.3	-	-
$HHH$	-	27	-	-
$\Gamma_{tot}$	2.3	1.6	1.9	1.5
$\Gamma_{inv}$	0.36	0.32	0.34	0.30

***W/o giga-Z but just  
assume x10 better  $A_{LR}$   
as expected from  
improved  $Z\gamma$  analysis***

***W/ tera-Z as assumed  
in FCCee CDR***

***Polarized 2  $ab^{-1}$  is roughly equivalent to unpolarized 5  $ab^{-1}$   
for most couplings, even better for HVV!***

# Beyond 250 GeV

**What we can do for sure at higher energies**

**Precision EW coupling measurement of Top**

**Precision Top mass measurement**

**Direct measurement of Top Yukawa coupling**

**Measurement of 3-point Higgs self-coupling**

**Expansion of search region of new particles**