

ILC Status

Scientific/Technical Progress
at MEXT and SCJ
History since 2013

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2018.9.3 POSIPOL2018, CERN

MEXT and SCJ

- MEXT: Ministry of Education, Culture, Sport, Science, Technology of Japan
A department of Japanese Government
- SCJ: Science Council of Japan
An organization of Academy in Japan, including all fields, natural and social sciences, independent of the government
- After the completion of TDR in 2013, MEXT started to evaluate ILC and first asked the opinion of SCJ

SCJ Report (Sep.2013)

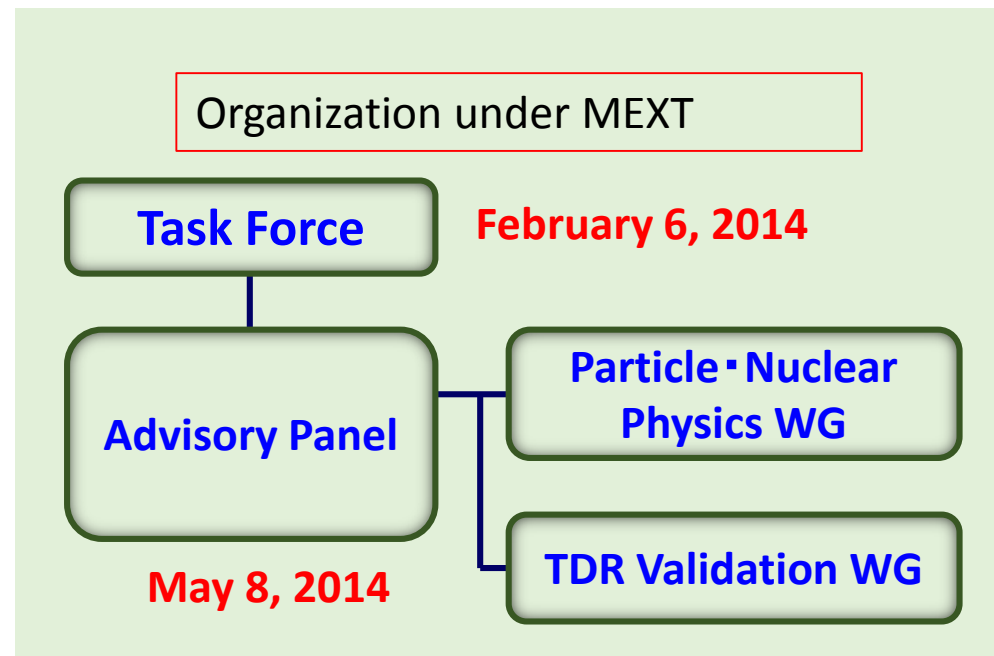
- SCJ (Science Council of Japan) issued “Remarks on the International Linear Collider Project”
http://www.scj.go.jp/ja/info/kohyo/pdf/Report%20on%20ILC_Executive%20Summary.pdf
- We **recognize the scientific merit** of the project in elementary particle physics.
- However,...in light of the huge investment necessary for the project, **a clearer and more convincing explanation for the ILC project, including the relation with the LHC**, is desirable.
- It is too early to approve the project at the present time...We recommend to the government to **approve funding for further necessary investigations to evaluate whether to go ahead with the ILC project** and to **proceed with intensive investigations and discussions for two or three years, including experts in other fields and relevant government agencies**
- It is necessary **to have discussions** with the research institutes and the responsible funding authorities of key countries and regions involved **outside of Japan**, and to obtain clear understanding of the expected **sharing of the financial burden.**

SCJ Report (continued)

- The Committee lists issues to be addressed as follows:
 - A more precise research strategy for the ILC in view of the LHC upgrade path;
 - The funding framework that does not affect the broader field of science or other critical national priorities;
 - Detailed plan of international cost-sharing;
 - A domestic organization to implement the project consisting of the High Energy Accelerator Research Organization (KEK) and universities;
 - Human resources required during construction and operation, in particular, for leadership positions.
- At the end:
Upon completion of the above investigations, SCJ is prepared to contribute to the government's decision by presenting scientific and academic perspectives.

Response of MEXT

- Based on the recommendation of SCJ Sep.2013, MEXT set up an internal (within MEXT) task force in Feb.2014.
- Under the task force, “Advisory Panel”, consisting of science experts, was formed in May 2014.
 - Conclusion by Mar.2016, but might be later
- Advisory Panel set up 2 working groups:
 - ✓ Elementary particle physics and nuclear physics working group (素核物理作業部会)
 - ✓ TDR-validation working group (TDR検証作業部会)



MEXT Commissioned survey (1)

- MEXT also asked a commissioned survey to companies
- In 2014 MEXT commissioned “Survey of spin-off effects of the ILC project from technical and economic aspects and research trends in elementary particle physics and nuclear physics including necessary technologies in the world” (国際リニアコライダー(ILC)計画に関する技術的・経済的波及効果及び世界各国における素粒子・原子核物理学分野における技術面を含む研究動向に関する調査分析)
- Done by NRI (Nomura Research Institute 野村総合研究所)
- Also reported in Apr.2015 meeting of Advisory Panel
- “the ILC project will in the end generate domestic demand worth JPY 2.10 trillion and lead to production worth JPY 4.46 trillion”

Advisory Panel's Summary

- Recommendation 1: The ILC project requires huge investment that is so huge that a single country cannot cover, thus it is indispensable to share the cost internationally. From the viewpoint that the huge investments in new science projects must be weighed based upon the scientific merit of the project, a **clear vision on the discovery potential of new particles as well as that of precision measurements of the Higgs boson and the top quark** has to be shown so as to bring about novel development that goes beyond the Standard Model of the particle physics.
- Recommendation 2: **Since the specifications of the performance and the scientific achievements of the ILC are considered to be designed based on the results of LHC experiments, which are planned to be executed through the end of 2017, it is necessary to closely monitor, analyze and examine the development of LHC experiments.** Furthermore, it is necessary to clarify how to solve technical issues and how to mitigate cost risk associated with the project.
- Recommendation 3: While presenting the total project plan, including not only the plan for the accelerator and related facilities but also the plan for other infrastructure as well as efforts pointed out in Recommendations 1 & 2, **it is important to have general understanding on the project by the public and science communities.**

Advisory Panel's Summary (continued)

- International collaboration
 - The ILC project is an international project requiring enormous investment. It is necessary to conduct the project with **support not only by a single country but also by international collaboration.**
 - The cost should be shared in such kind of international collaboration. It is important to **confirm the willingness of each participating country to cover a reasonable part of the project cost.**
 - The European and American particle physics community expects Japan to proceed with the ILC project in line with their strategies. However, current plans and budget of their countries do not explicitly define the ILC project. **It is necessary to proceed based on worldwide attitudes to the ILC project.**
 - It should be noted that the ILC project will **lose international momentum** if decisions on the ILC project implementation are not made in a **timely manner.**

Advisory Panel's Summary (continued)

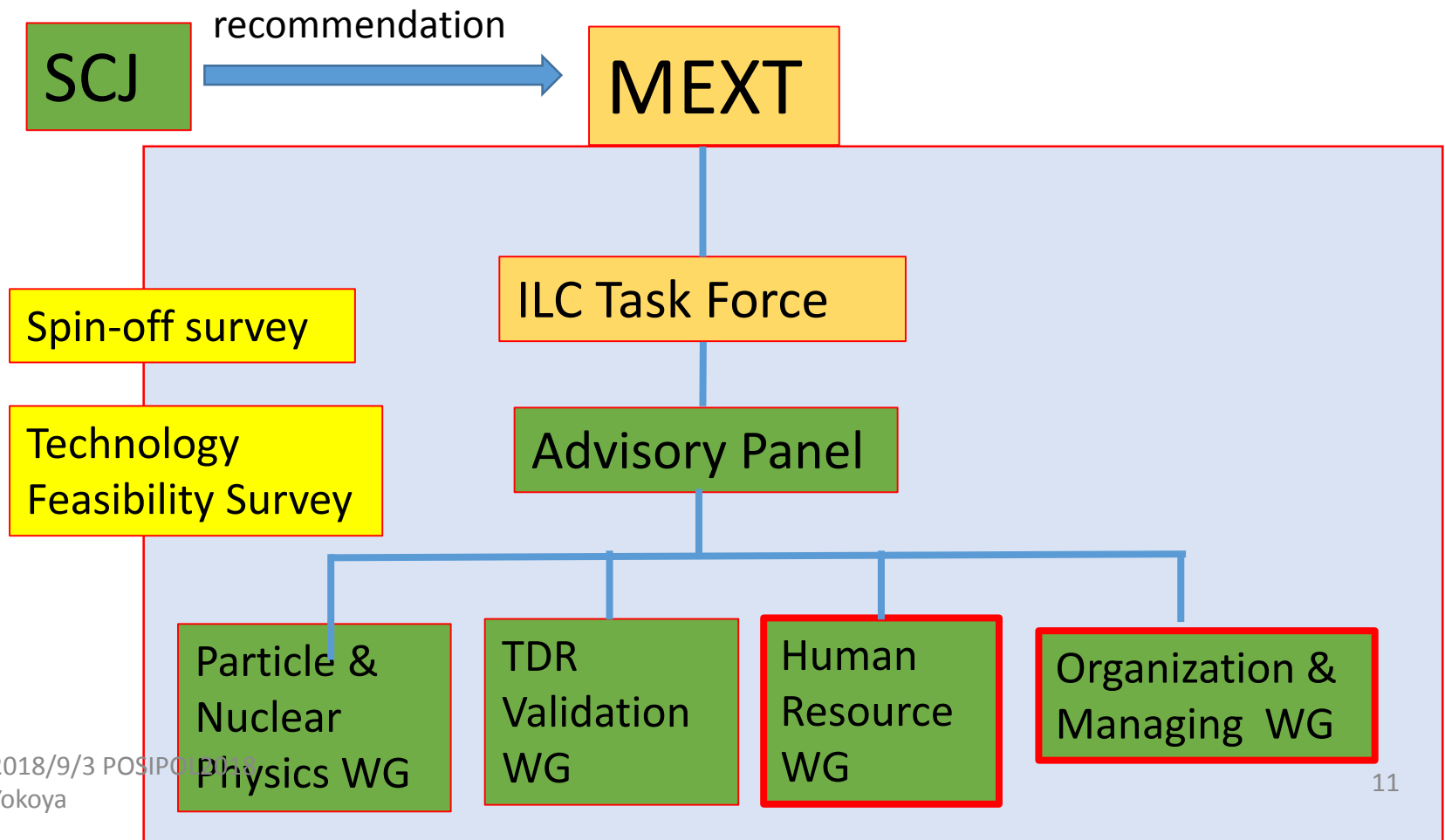
- Future prospects of the investigation
 - We will set up **another working group** to investigate the issue of necessary **human resources and their cultivation**.
 - We will commission **another survey** using an external research agency in order to understand the **world trends in technology issues** related to accelerator construction, and in approaches to **reduce the production cost** of accelerators.
- The opinions in the Advisory Panel Summary are basically identical to those of the SCJ
 - Essential difference is that Advisory Panel is under MEXT
 - Now MEXT started to act according to this report

MEXT Commissioned Survey (2)

- Based on the recommendation of the Advisory Panel, MEXT asked a survey on the technical feasibility and technological issues in accelerator construction (Not an official translation) (国際リニアコライダー (ILC)計画に関する技術的実現可能性及び加速器製作における技術的課題等に関する調査分析)
 - Hearing at domestic/foreign labs and industries
 - Report deadline Feb.1.2016
- Tender of NRI (Nomura Research Institute) was accepted
 - Hearing at KEK: early September 2015
 - Visits to Europe/US institutes and industries in September and November

New Working Group

- Based on the recommendation of the Advisory Panel, new WG's were formed under the Advisory Panel: "Human Resource Working Group" and "Organization & Managing WG"



Human Resource WG (人材の確保・育成方策検証作業部会)

- Based on the recommendation of the Advisory Panel, the third WG was formed under the Advisory Panel: “Human Resource Working Group”
- Mission
 - On the human resources necessary for ILC construction and operation
 - Estimation
 - Recruit, education, in Japan and foreign countries
 - Education of leaders
 - Management staff

NRI Report

- NRI (Nomura Research Institute) Report on ILC Technology
 - Feb. 2016
 - “ILC計画に関する技術的実現可能性等調査分析報告書” (in Japanese only)
 - http://www.mext.go.jp/b_menu/shingi/chousa/shinkou/038/gaiyou/1374357.htm
 - ~240 pages in 3 volumes.
 - The report assigns 4-level ranks for ~30 items of ILC technology
 - ◎ : Double circle: prototype and test done, improvement by small scale R&D
 - ○ : Single circle: prototype and test done, some more R&D needed for mass production
 - △ : Triangle : no prototype, no validation, break through needed
 - × : Cross : basic technology premature

Triangle Items

- There is no “cross” item but there are several “triangles”
- Marx modulator
- **Undulator source**
 - Target (water cooling failed, no prototype for others)
 - Undulator (field accuracy, no beam test)
- **e-Driven source**
 - No target prototype
 - Detailed design of AMD & booster linac
- Feedback system in Damping Ring (high ADC bits)
- Main beam dump (14MW)
 - No prototype
 - Window
 - Safety
 - Possibility of collaboration with CERN being pursued
- Crab cavity
 - No prototype of 9-cell cavity
 - HOM coupler
 - Cryostat design

Staging Report

- The International Linear Collider, Machine Staging Report 2017
 - Oct.2017
 - Addendum to the International Linear Collider Technical Design Report published in 2013
 - KEK 2017-3, DESY 17-180, CERN-ACC-2017-0097
<https://lib-extopc.kek.jp/preprints/PDF/2017/1724/1724003.pdf>
- Physics Case for the 250 GeV Stage of the International Linear Collider
 - Oct. 2017
 - KEK Preprint 2017-31, DESY 17-155, LAL 17-059, SLAC-PUB-17161
<https://lib-extopc.kek.jp/preprints/PDF/2017/1727/1727031.pdf>
- Concentrate on ILC 250GeV
 - Revised cost estimation

Caution: Now the word “Staging” should not be used

Advisory Panel Reactivated

- Following the design change of ILC250, the 2 working groups were re-activated:
 - ✓ Elementary particle physics and nuclear physics working group (素核物理作業部会)
 - ✓ TDR-validation working group (TDR検証作業部会)
- Several Meetings
 - Physics WG: 2018 Jan.18, Feb.5, May.16
 - TDR WG: 2018 Jan.30, Mar.02, Apr.19, May.17
 - And, based on the 2 WGs discussion
Parent panel: 2018 May.31, Jun.19, Jul.04
- Natural questions are
 - Physics merit decreased?
 - Cost reduction reliable?

Second Round at SCJ

- MEXT side committees done
- The ball is now back at SCJ, according to the last line of the first recommendation report
 - What is to be evaluated is ILC@250
- SCJ formed a review committee and its subcommittee
- They are well aware of the time limit coming from the European Strategy
- Meetings
 - Aug.10 main & sub
 - Aug.20 sub
 - Aug.21 main
 - Aug.23 sub
 - Aug.29 main
 - Sep.6 KEK visit by some of the committee members
 - Sep.11 main (closed)
 - **Sep.13 sub**
 - **Sep.18 main**

These 2 meeting might be the last ones?

Main Committee

- Tasks
 - The academic significance of the research in the ILC project, the positioning in the elementary particle physics of the ILC project
 - Positioning in the whole academic research of ILC project
 - Significance of implementing ILC plan in Japan
 - Preparation status for the ILC, budget and human resources necessary for construction and operation
- Members
 - Tadashi KOBAYASHI (Philosophy)
 - Tatsuyoshi SAIJO (Economics, environmental)
 - Takaaki KAJITA (Physics)
 - Hirokazu TAMURA (Physics)
 - Masako YONEDA (Civil Engineering, Vice-chair)
 - Yasuhiro IYE (Physics, Chair)
 - Mitsuru UESAKA (Physics)
 - Naoshi SUGIYAMA (Physics)
 - Tomofumi NAGAE (Physics)
 - Toshio HIRANO (Biology)
 - ✓ Only one member (prof. Iye) from the previous committee

Subcommittee

- Tasks

- Validity of the large facility construction verified from the technical and professional point of view.
 1. Technical feasibility of large facilities
 2. Cost evaluation
 3. Economic ripple effect
 4. Environmental assessment

- Members

- Masashi KAMON (Civil Engineering)
- Tohru NAKASHIZUKA (Biology, environmental)
- Tsuneyoshi MOCHIZUKI (Civil engineering)
- Hitoshi TANAKA (Spring-8)
- Masako YONEDA (Civil Engineering, chair)
- Tatsuyoshi SAIJO (Economics, environmental)
- Yasuhiro IYE (Physics)

Major Issues in SCJ (main and sub)

- Safety is the first issue.
Note: the subcommittee contains only 1 physicist and 1 accelerator experts. Others are civil engineering and environment experts.
- e.g.,
 - Accident on the main dump.
 - Window breaking.
 - Recovery from window failure
 - Tritium.
 - Tunnel repair
 - Loss of power supply (remember Fukushima).
 - Spare power system.
 - Environment assessment. Takes long!
 - Decommissioning
- Other questions
 - Why in Japan?
 - What happens if not be built in Japan?
 - Length of international negotiation
 - Japan lacks strong leaders
 - Understanding by the nation

Siting Issues

- We down-selected the candidate site in 2013, but this is only a judgment by scientists. MEXT is not involved in this decision.
- All the MEXT-related documents have been based on an anonymous site, at least formally.
- There was some misunderstanding among the SCJ committee members in the beginning. They said “Will take >10 years for the studies of site issues!!”
- Now, I think they understand we made already lots of studies about the site.

We are preparing documents for the last meetings!

- List of possible risks
 - including those raised by Nomura report
- Plan for the preparation period (assumed to be 4 years)

Unfortunately, all these are in Japanese

The Final decision to be made by MEXT and Government, not by SCJ.

Only a few more months to approval/disapproval !!