Assessment of the Revised Plan of International Linear Collider Project[1] (Executive Summary)

Science Council of Japan

1 Background of Deliberation

The Revised Plan of the International Linear Collider Project (250GeV ILC) is an international research project in the high energy particle physics area, aiming at detailed investigation of Higgs physics with construction of a linear accelerator for high energy electron-positron collision experiment.

The Director General of the Research Promotion Bureau of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) placed the "Request of Deliberation on the Revised Plan of the International Linear Collider Project" ("Request of Deliberation", hereafter) to the President of the Science Council of Japan (SCJ) on July 20th, 2018. In response to the "Request of Deliberation", the "Deliberation Committee for the Revised Plan of the ILC Project" and the "Subcommittee for Technology Assessment" were established. In view of the huge cost and prolonged construction/operation period of the ILC project, the Committee and the Subcommittee scrutinized the scientific significance, the technical feasibility of the project, the preparatory status of project implementation, including the promotional framework among the relevant research organizations both at home and abroad, and the prospects of securing human resources and international cost-sharing.

2 Assessment

<Scientific significance of the research to be pursued by the 250GeV ILC and the positioning of the 250GeV ILC project in particle physics>[2]

It is widely recognized that pursuit of "physics beyond the standard model" constitutes the most important subject in particle physics today. There are various experimental approaches, both accelerator-based and non-accelerator-based, to the "physics beyond the standard model." 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. The discussion of the future plan, however, has not reached the stage to address such specific issues as allocations of human resources and the

[1] This document is an English translation of the Japanese original for reference purposes.
[2] This and three other items in angle brackets are specific questions given in the "Request of Deliberation".

overall research budget to the different research projects in particle physics.

<Positioning of the 250GeV ILC project in the broader academic research arena>

The 250GeV ILC is a project far larger in scale than various "large research projects" that have been discussed in the formulation of the "Japanese Master Plan of Large Research Projects," in terms of the cost and the project duration. To propose such a research project to the general public (taxpayers), it is crucial to gain the wide support of the academic community at large. The evaluation of the ILC project should be made via further discussions in a broader scope encompassing not only other large projects in particle physics but also those in other research fields.

<Impact of hosting the 250GeV ILC on Japanese public and society>

Like many other purely academic research projects, the ILC project is expected to stimulate intellectual interest of the general public. If the prospective ILC site were to develop as an international center where young researchers are trained and nurtured in an atmosphere of friendly rivalry with world top-class scientists, it would be valuable.

In regard to the technological and economical ripple effects besides the purely academic research outcome, their prospect carries much uncertainty, and the triggering effects are deemed rather limited in extent. The general public and especially the citizens of the prospective construction area of the ILC should be offered more opportunities for comprehensive dialogue with accurate information dissemination by the academic community, on the items advertised in the context of regional development and on the environmental impacts of civil engineering works and radioactive materials generation, as well as expected academic research outcome.

<Status of the preparatory activities toward implementation of the 250GeV ILC project, and conditions such as international cost-sharing and securing human resources for its construction and operation>

In view of the required budget scale and human resources, the 250GeV ILC is obviously a project not executable without unprecedented and steadfast international cooperation. In the present stage, there is no clear prospect for proper international cost-sharing. Nor is the prospect of securing human resources prescribed deemed necessary for the construction of ILC accelerator facility clear. The feasibility of covering the shortage of accelerator-related researchers/engineers in Japan by fresh human resource development and by participation from abroad poses a significant uncertainty factor.

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.

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