

TCMB face-to-face on Oct.26

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LCC-ILC/KEK

- ❑ LCB on August
- ❑ Internal cost review on Sep.26 at KEK
- ❑ Machine Staging Report (for Ottawa IFCA seminar)
- ❑ Recent topics
 - ❑ MEXT survey
 - ❑ KEK's re-estimate for staging 2017 base

Tentative conclusions on the status of the ILC project

from the meeting on 9th August 2017
Linear Collider Board

During the Linear Collider Board (LCB) meeting in Guangzhou on 9 August 2017, the Board reached the following tentative conclusions concerning the ongoing effort to construct the International Linear Collider (ILC).

Status of the new cost reduction effort

The major obstacle for realising the ILC has been its high price tag and various efforts are being made to reduce its cost. Research and development (R&D) efforts on improving the performance of the superconducting cavities seem to indicate that a sizable reduction of the cost, $\sim 10\%$ for a 500 GeV machine, could be achieved. More significant cost reduction can be achieved by reducing the machine energy to 250 GeV. **Together with the gain from the R&D effort, the price tag of a 250 GeV machine could be up to $\sim 40\%$ less than that of a 500 GeV machine** according to the study by the ILC group of the Linear Collider Collaboration (LCC)ⁱ. A recent study by the CLIC groupⁱⁱ indicates that the ILC technology remains the most cost effective way to construct and operate a 250 GeV linear collider for the foreseeable future.

Re-evaluation of the Higgs physics performance at 250 GeV

The Physics and Detector Group of the LCC has re-examined the Higgs physics performance at 250 GeV. Up-to-date studies with new theoretical inputⁱⁱⁱ show that the ILC measurements at 250 GeV with an integrated luminosity of 2 ab^{-1} for the Higgs total width and couplings to bosons and fermions, supplemented by some HL-LHC Higgs results, are sufficient to distinguish between many well-motivated new physics models in regions which cannot be accessed by direct new particle searches at the LHC, even with HL-LHC data.

Japanese effort for the realisation of the ILC at 250 GeV

In October 2012, triggered by the LHC discovery of the Higgs boson at 125 GeV, Japanese Association of High Energy Physicists (JAHEP) released a statement^{iv} on the ILC where they propose to host the ILC in Japan as a global project, starting at 250 GeV then increasing energy progressively to 500 GeV. Recently, the JAHEP has revisited^v their statement after reflecting upon the lack of progress in the project realisation since then and the approval of the LHC high luminosity upgrade project. They made a comprehensive study of physics performance at 250 GeV^{vi} with anticipated additional inputs from experiments at the LHC, SuperKEKB, long baseline neutrino beams and other accelerator facilities as well as astroparticle and astronomy observations. And their final conclusion is the following:

To conclude, in light of the recent outcomes of LHC Run 2, JAHEP proposes to promptly construct ILC as a Higgs factory with the centre-of-mass energy of 250 GeV in Japan.

Tentative conclusions by the LCB

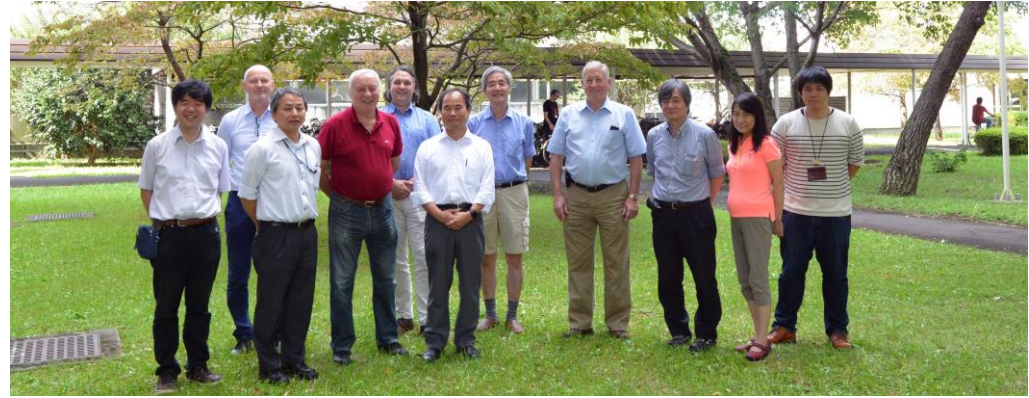
Physics studies by the LCC Physics and Detector Group and the JAHEP make it clear that there is a compelling physics case for the ILC built at 250 GeV. And the cost of such machine is at a level of some of the existing large international scientific facilities. For these reasons, **the LCB strongly supports the JAHEP conclusion to promptly construct the ILC at 250 GeV in Japan and encourages the Japanese government to give their proposal very serious consideration with a favourable conclusion.** Expression of Japanese government's interest to host the machine should enable to start negotiations for realising the project with international participation and pave a way for the interested partners to initiate a meaningful discussion with their own governments for possible contributions.

One of the unique qualities of a linear collider is the capability of increasing its operating energy by improving the acceleration technology and/or extending the tunnel length, with much of the infrastructure such as the electron and positron sources already in place. Therefore, the design and implementation of a 250 GeV machine should not have any constraining elements for such energy upgrade, so that after its successful construction and exploitation, an increase of machine energy could be discussed with well-justified physics goals. Such machine will also serve as an important stepping stone for the future development of this promising technology.

Follow-up

Above conclusions must be finalised by the time of the LCB meeting held in Ottawa on 7 November 2017 during the ICFA Seminar, so that they could be discussed by the

Internal Cost Review with Lyn at KEK



ILC Cost Review
Discussion Minutes

Time: Tuesday, 26 September 2017 from 09:00 to 15:00 (Asia/Tokyo)

Place: KEK, Ni-Go-Kan Bldg

09:00 - 10:30 staging cost review (Nobuhiro TERUNUMA) 1h30'

10:30 - 11:00 human resources, operation cost (Akira YAMAMOTO) 30'

11:00 - 12:00 e-Driven cost review (Kaoru YOKOYA) 1h0'

12:00 - 13:30 Break

13:30 - 15:30 CFS design and cost studies (Hitoshi HAYANO) 2h0'

Reviewers: Lyn Evans (LCC), Tatsuya Nakada (LCB), Shin Michizono (KEK), Steinar Stapnes (CERN), Jim Brau (U. Oregon), Benno List (DESY), Nobuhiro Terunuma (KEK), Toshiyuki Okugi (KEK), Hitoshi Hayano (KEK), Kaoru Yokoya (KEK), Akira Yamamoto (KEK)

Observer: Tsunehiko Omori (KEK), Masao Kuriki (U. Hiroshima), Tomoyuki Sanuki (U. Tohoku), Masakazu Yoshioka (U.Tohoku), Masanobu Miyahara (KEK)

1. staging cost review (Nobuhiro TERUNUMA) 1h30'

Nobuhiro showed various staging costs by scaling from ILC500GeV. These are based on the TDR standard (2012).

Eighty-meter extended undulator is adopted for the positron sources at this estimation.

Option C has the shortest tunnel length (~20 km). Cost reduction effect by SRF cost reduction R&D is ~6%. In case of the success of this SRF cost reduction R&D, ~40% cost reduction is expected.

Option D has full length tunnel for the future ILC 500GeV upgrade and the main linacs are located downstream side of the tunnel (Simple tunnel will be constructed for the upstream side of the tunnel). Around 37.5% cost reduction is expected in this option D.

2. human resources, operation cost (Akira YAMAMOTO) 30'

Akira presented the man-power and operational cost at ILC250GeV scaling from ILC 500GeV.

In comparisons of ILC 250 GeV staging Option C to the TDR baseline 500 GeV, Human Resource may be saved down to ~ 75 % (i.e: reduction of 25 %).

Operational cost may be saved down to ~ 77 %, and it may be further saved down to < 75 %, in case of the SRF cost-reduction R&D successful.

3. e-Driven cost review (Kaoru YOKOYA)

Kaoru explained the e-Driven positron source and its cost. It is found that there is no difference between the costs of the accelerator components for the electron driven and undulator driven positron sources. Some cost reduction (order of 10s of OkuYen) by the e-driven system is expected if the space for timing adjustment is omitted from Option C.

We discussed that do not change the baseline of the positron source (Undulator) so far. However, the electron driven source can be an alternative of undulator because it is safer to achieve the design luminosity at low electron energy (~125GeV).

It is discussed that e-driven positron source can be adopted initially for ILC250 GeV and be replaced by undulator at future upgrade depending on the technical maturity at the ILC construction stage,.

4. CFS design and cost studies (Hitoshi HAYANO) 2h0'

Hitoshi presented the site-specific Tohoku estimate.

When we compare with TDR scheme, this cost study has resulted in 7.8% increase from TDR including an effect of material cost-index increase of ~ 5%. The cost difference between TDR and Tohoku estimate is negligible small when we consider the difference in cost basis (TDR on 2011 and Tohoku on 2014) and cost premium (cost ambiguity) of 30% for CFS described in TDR.

It means that both CFS cost estimates in Tohoku are generally agreed and consistent with the one by LCC/KEK and Tohoku.

This study is finding the way to keep the TDR cost by introducing new solutions proposed.

Further optimization shall be made, reflecting the general material cost status to be possibly, dynamically moved even in coming years.

Machine Staging Report (for Ottawa IFCA seminar)

The International Linear Collider
Machine Staging Report 2017

Linear Collider Collaboration / October, 2017
Editors: Lyn Evans and Shinichiro Michizono

~20 pages report for machine ILC250GeV edited by Lyn and myself.

~40 pages physics report was also prepared by physics group.

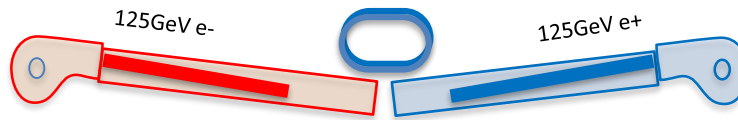
These two documents were submitted to ICFA/LCB.

(Now small revise is ongoing and revised one will be re-submitted in this week.)

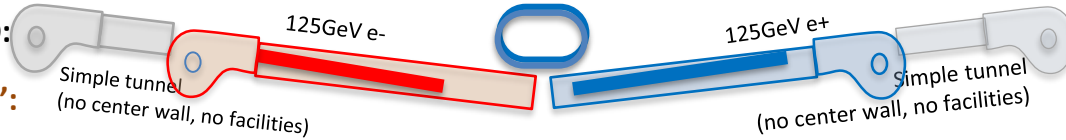
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250 GeV

Option C:



Option D:

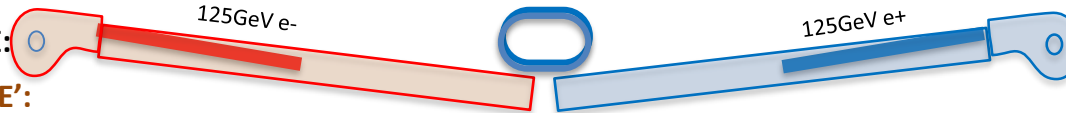


350 GeV Option D':

Simple tunnel
(no center wall, no facilities)

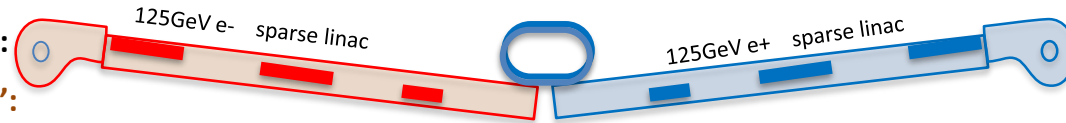
Simple tunnel
(no center wall, no facilities)

Option E:



350 GeV Option E':

Option F:



350 GeV Option F':

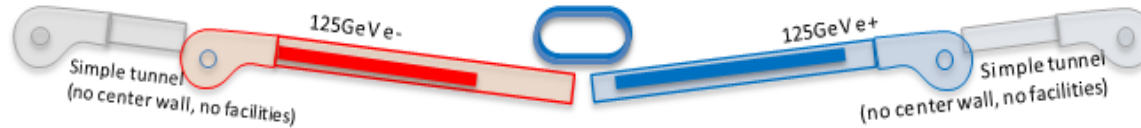
TDR update:



Options A, A': 250 GeV tunnel



Options B, B': 350 GeV tunnel
Options C, C': 500 GeV tunnel



Recent topics

1. MEXT survey of the cost reduction R&D by new technology

In this fiscal year, KEK get a contract about "survey of cost reduction R&D" from MEXT. We will survey and make some study about cost reduction (like N-infusion) by this budget.

The cost reduction session during LCWS2017 will be helpful to this survey.

The external advisory committee will check the survey and next advisory committee will be held on Nov.20. We will report R&Ds of Nb material, N-infusion, input coupler, and normal conducting linear collider (CLIC).

2. KEK's re-estimate of staging cost at 2017 base

After the endorsement of staging at ICFA seminar, we expect that MEXT advisory panel will be held to estimate the staging on the end of January or early February.

Since we will be probably asked the staging cost (when we will build ILC in Japan not 2012 but 2017 base) at the panel, KEK has just started the re-estimate of the staging on 2017 base in two months (before the coming advisory panel).

Of course it is impossible to gather the new cost like GDE era, the accelerator will re-estimate the typical items.

Nb material, Nb cavity, input coupler, klystron In addition, we will check the items not included in TDR.

3. Japanese general election on last Sunday