IDT-WG2 report

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(Dec.15, 2020)

Accelerator activities at ILC Pre-Lab phase

Technical preparations /performance & cost R&D [shared across regions]

- SRF performance R&D, quality testing of a large number of cavities (~100), fabrication and shipping of cryomodules from North America and Europe (for validating shipping)
- Positron source final design and verification
- Nanobeams (ATF3 and related): Interaction region: beam focus, control; and Damping ring: fast kicker, feedback
- Beam dump: system design, beam window, cooling water circulation
- Other technical developments considered performance critical

Technical preparation (WPs)
Essential items before ILC construction
I will submit the proposal be end of Dec.

Final technical design and documentation [central project office in Japan and possibly regional project offices]

- Engineering design and documentation, WBS
- Cost confirmation/estimates, tender and purchase preparation, transport planning, mass-production planning and QA plans, schedule follow up and construction schedule preparation
- Site planning including environmental studies, CE, safety and infrastructure (see below for details)
- Review office
- Resource follow up and planning (including human resources)

Engineering Design Report (EDR)
We will start the discussion about contents of EDR.
I will submit a rough proposal together with proposal of “technical preparation” next week.

Preparation and planning of deliverables [distributed across regions, liaising with the central project office and/or its satellites]

- Prototyping and qualification in local industries and laboratories, from SRF production lines to individual WBS items
- Local infrastructure development including preparation for the construction phase (including Hub.Lab)
- Financial follow up, planning and strategies for these activities

Planning and preparation of Hub lab.

Civil engineering, local infrastructure and site [host country assisted by selected partners]

- Engineering design including cost confirmation/estimate
- Environmental impact assessment and land access
- Specification update of the underground areas including the experimental hall
- Specification update for the surface building for technical scientific and administrative needs

Civil engineering

Meetings for “technical preparation” proposals

https://agenda.linearcollider.org/category/256/

- 6th Positron sub-group meeting was held on Dec.3.
  - US lab preparation was explained.
- 7th Positron sub-group meeting was held on Dec.7.
  - Technical preparations for undulator system were discussed.
- 6th SRF sub-group meeting was held on Dec.8.
  - List of the technical preparations were explained.
- 6th DR/BDS/Dump sub-group meeting was held on Dec.8.
  - List of the technical preparations were explained.
- 3rd Dump sub-group meeting was held on Dec.9.

- Schedule (rather tight schedule to prepare for the technical preparation documentation)
  - Dec.15: 7th IDT-WG2 meeting
  - Dec.17: 7th DR/BDS/Dump sub-group meeting (approval of technical preparation)
  - Dec.21: 8th Sources sub-group meeting (approval of technical preparation)
  - Dec.22: 7th SRF sub-group meeting (approval of technical preparation)

After the approval at each sub-group, I will submit the proposals of technical preparation (by end of Dec.).

The document will be used for the discussion* between IDT and international laboratories (and used as the material for budget request from these laboratories).

*This document is not for the technical selection of the positron scheme (Undulator , e-Driven).

From January, we will move to the discussion about contents of “Engineering Design Report”.

Preparation of proposal

- Each # of Work Package will prepare the proposal. (total 18 proposals)
- Each ~3 pages (under discussion inside each sub-group).

Technical Preparation : SCRF cavity and cryomodule production

Outline : SCJ and MEXTs' ILC Advisory Panel had technical concerns about maintaining cavity quality during mass production and cryomodule assembly. This plan is proposed to demonstrate prototype manufacturing using new cost-effective production methods on the scale of 1% of the full production, corresponding to about 100 cavities in the main preparatory phase. Half of the cavities will be produced in Japan and the other half in other regions/countries. The performance of the cavities will be evaluated to confirm their yields, and plug-compatibility will be checked. Other components, such as couplers and tuners, are also expected to improve (in terms of) their performances; they will also be manufactured, and their yields will be evaluated. Overall testing after assembling these parts into a cryomodule will be the final step of evaluating the performance as an accelerator component. The US and Europe have accumulated significant experiences in cavity production and in formulation of countermeasures against performance degradation after cryomodule assembly. It is anticipated that Germany and the US will work on cost reduction of the cavity fabrication process, and on reproducibility and high yield of cavity performance at the design gradient, while France could play a leading role in automation of cryomodule assembly.

Goals of the technical preparation:

Parameters	Unit	Design
Baseline: Cavity gradient, E, at Q value (Q0)	MV/m	31.5 (±20%) at Q ≥1E10, 35 at Q ≥0.8 E10
Cost-Reduction R&D goal: E and Q		35 at Q ≥2E10, 38.5 at Q ≥ 1.6E10
Cavity production yield	%	90

Items:

- → total ~ 100 nine-cell cavities will be produced with international collaboration.
- → 9-cell Cavity production by cost effective methods
- → RF performance, success yield to be evaluated, under plug-compatible fabrication conditions, with an expected statistics (for example, 20 ~ 30 cavitiy statistics, with fixed fabrication conditions in each region), and enabling to satisfy "high pressure code regulation".
- → Ancillaries production (power coupler, tuner, HOM antenna, etc.)
- → Cryomodule (CM) production (Prototype, Type A, Type B)

Expected cost:

Issue	*Tasks*	*Cost*	*Human Resources (FTE)*
Mass production	*Performance/ mass production technology*	*k$*	

(not including corresponding cost of human resources)

Candidates:

DESY, CEA-Saclay,FNAL、J-LAB ……改ページ……

Appendix

(Current status)

The beam commissioning for the STF-2 accelerator was successfully done in March 2019 at KEK's Superconducting RF Test Facility (STF). The maximum beam energy achieved was 280 MeV, and the average accelerating gradient estimated from the beam energy was 33.1 MV/m, exceeding the ILC specification of 31.5 MV/m. DESY and FNAL have also demonstrated cryomodule operation satisfying the requirements of the ILC.

At KEK's Cavity Fabrication Facility (CFF), single-cell, 3-cell, and 9-cell cavities have been fabricated in collaboration with some local companies since 2012. CFF is equipped with an electron beam welding (EBW) machine, a chemical polishing (CP) system, and a mechanical pressing machine. Cavity fabrication conforming to Japanese high-pressure gas regulations is in progress.

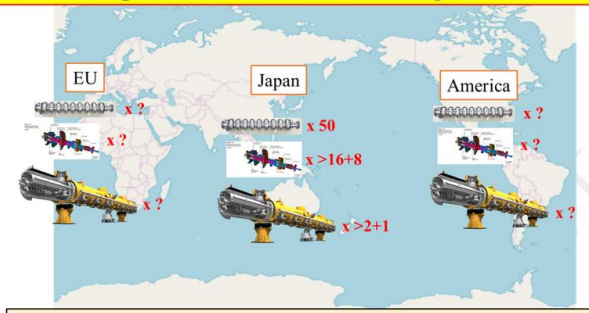
Concerning cryomodules, cavities and other components manufactured in three different regions (Asia, Europe, and Americas) with a common interface design have been brought together and assembled into a cryomodule at the KEK Superconducting Test Facility (STF), and the cryomodule's performance has been tested and successfully demonstrated with the common interface design for the ILC.

Since 2017, the US and Japan have been collaborating on cost reduction. There are two ways to reduce/save the cost of cavities. One is cost reduction of the niobium material. Another is to improve cavity performance, enabling to reduce the required number of cavities. Research on improvement of cavity performance by new surface treatment such as "nitrogen-infusion" is underway worldwide.

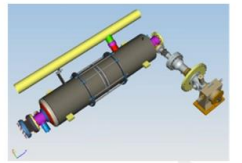
Technology for mass production for the ILC is ready, as demonstrated by successful construction of an accelerator with a few hundred cavities housed in a few tens of cryomodules for the European XFEL and for a similar accelerator currently under construction for LCLS-II in the US. In both cases, after cryomodule assembly, modules were transported on the ground and installed in the tunnel with no major issues caused by the transportation. However, marine/ship transport of cryomodules between two different regions across a sea, and the performance test after transport are yet to be carried out. This will be done as a part of crucial technical preparation in the main preparatory phase.

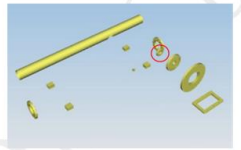
(Add some figures to explain visually)

Before mass production starts, tuner design should be fixed!!



Which lab. is responsible for cavity, power coupler, tuner, CM, etc.?
How many cavities, couplers, CMs are produced?





Item	Variation	TDR Baseline
Cavity shape	TESLA / LL	TESLA
Length		Fixed
Beam pipe flange		Fixed
Suspension pitch		Fixed
Tuner	Blade/ Slide-Jack	Blade
Coupler flange (cold end)	40 or 60	40 mm
Coupler pitch		Fixed
He –in-line joint		Fixed

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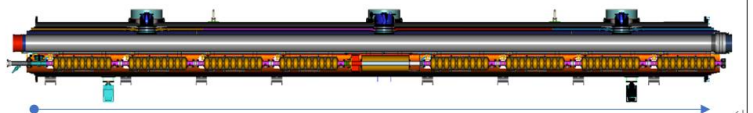

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Snowmass Working Group 03 of the Accelerator Frontier on Higgs Factories

Meeting to discuss and prepare: Report of the Snowmass Working Group 03 of the Accelerator Frontier on Higgs Factories 16 Dec 2020

Teleconference: Wednesday 16 December 2020, 3 hours. 5 AM PST, 8 AM EST, 2PM CET, 10 PM JST, 9PM China.

Zoom connection details to follow.

https://indico.fnal.gov/event/46832/

Meeting to Prepare AF03 Report

Wednesday 16 Dec 2020, 07:00 → 11:00 US/Central

Zoom

Georg Hoffstaetter (Cornell University), Marc Ross (SLAC), Qing Qin (ESRF)

Description We propose to convene a teleconference meeting to prepare for the Snowmass 2021 AF03 Report. The purpose of the meeting is to plan the Report and make writing assignments. The AF03 Report will build on the LOI and should include contributions from each team. The (draft) Report outline will be posted.

Note especially sections 2 and 3, and the (very high-level) executive summary

The meeting agenda will have three parts (1/3:1/3:1/3), roughly corresponding to the 3 Report sections.

1. A presentation on each of the proposed sub-sections (1:10), focused on plans to complete the report (need not be more than a bulleted version of what has already been presented and discussed, LOI, 24 June 2020, and CPM). For each of the sub-sections, it is important for you to submit material a minimum of two weeks ahead of the teleconference to facilitate the development of 'comparative' sections 2 and 3.
2. A structured discussion of plans for section 2. Sergey Belomestnykh will coordinate the discussion of the groups plans to synthesize common technology needs/challenges.
3. Similar for the above, for section 3, Steinar Stapnes, Akira Yamamoto, and Mark Palmer have agreed to coordinate the synthesis of timelines, cost-comparisons, and staging toward the future.

We should plan to re-convene in two months.

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07:00 → 07:20 **Contributions to Implementation Task Force** 20m

Thomas Roser (ITF chair) will introduce 'metrics' and describe how best to contribute to ITF

Speaker: Thomas Roser (BNL)

Pages from 2020_1...

07:20 → 08:20 **Reports from Projects/Concepts** 1h

5 to 10 minutes each: CCC, CEPC, CLIC, ERL-Fcc, FCC-ee, HE-LHC, ILC, LHeC, Muon, FEL g-g

Speakers: Akira Yamamoto (KEK), Benno List (DESY), Daniel Schulte (CERN), Emilio Nanni (SLAC National Accelerator Laboratory), Frank Zimmermann (CERN), Hasan Padamsee (Fermi National Accelerator Lab), Jie Gao (IHEP), Jingyu Tang (Institute of High Energy Physics), Kaoru yokoya (KEK), Katsunobu Oide (KEK), Mark Palmer (Brookhaven National Laboratory), Michael Benedikt (CERN), Nikolay Solyak (FNAL), Oliver Bruning (CERN), Shinichiro MICHIZONO (KEK), Steffen Doebert (CERN), Steinar Stapnes (FNAL), Thomas Roser (BNL), Timothy Barklow (SLAC), Vladimir Litvinenko (Stonybrook University), Walter Wuensch (CERN)

ILC_snowmass2020...

08:20 → 09:20 **Common Technology Needs** 1h

Speaker: Sergey Belomestnykh (FNAL)

ESPP-Symp-2019-a... JointTechnology_15... Technology for Higg...

09:20 → 10:20 **Plans: timeline, cost, upgradeability.** 1h

Use material on hand (LOI, CPM presentations, 24/06-01/07 presentations, +) to cross-cut through Section 3 sub-headings (timeline, cost, upgradeability)

Speakers: Akira Yamamoto (KEK), Mark Palmer (Brookhaven National Laboratory), Steinar Stapnes (FNAL)