IDT-WG2 report

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(July 13, 2021)

- Current status
- Material for ILC advisory panel

Current status/ preparation for ILC advisory panel

- There is no new information at this time.
- The ICFA will be held on the 14th, and Dr. Nakata and the Director of KEK will talk about it.
- The report from IDT-EB chair (Tatsuya Nakada) will mainly focus on the status of the WG activities.

- I assume that the ILC advisory panel will start in August.
- I want to prioritize this response, so it will take some more time to update the WG2 organization.

- In terms of technical preparation, we need to report on our efforts to address the technical issues that were previously pointed out at the ILC advisory panel and the Science Council of Japan. (see next pages)

- I especially want to reflect your activities since 2018 (including studies and simulations).
- We need to create easy-to-understand slides such as graphs and drawings.
- Each group leader will ask you to provide such information.

I would appreciate it if you could provide information to the group leaders and discuss them at the group meeting next week.

Technical Issues pointed out in the report by MEXT's ILC Advisory Panel

Table 4.1: Summary of the ILC Advisory Panel's Discussions to Date after Revision. The quoted page numbers refer to those of the ILC Advisory Panel's report.[21]

Page #	R&D Issues
5, 13, 32	[**Damping Ring**] There still remain issues on several subsystems, such as beam dump, positron source, electron source, beam control, and the injection/extraction of the damping ring.
32	[**Beam Dump**] The whole beam dump system should be developed in the main preparatory phase. The required technologies include durability of the window, where continuous high-power beam pass through, and its maintainability and resistance to earthquakes.
32,33	[**Positron Source**] The helical undulator scheme is adopted as the positron source. It contains some technologies under development such as the cooling of the target irradiated by the gamma rays from the undulator and the replacement method of the activated target.

https://www.mext.go.jp/component/b_menu/shingi/toushin/__icsFiles/afieldfile/2018/09/20/1409220_2_1.pdf

Technical Issues pointed out in the report by SCJ

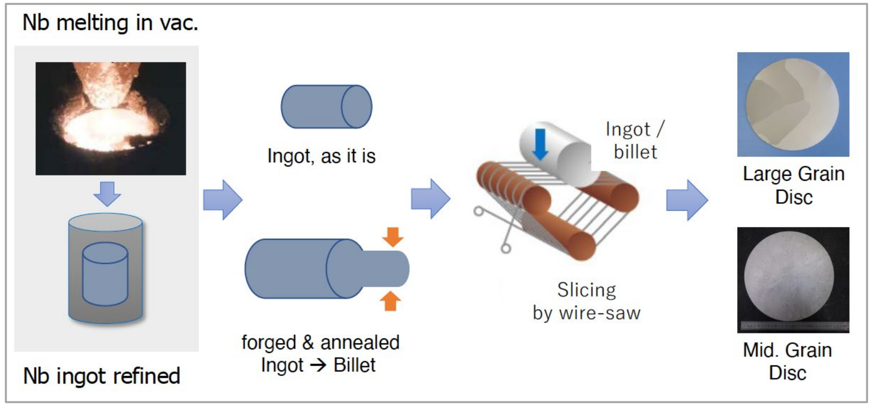
Table 4.2: Technical issues pointed out in the report by the Science Council of Japan.[22]

R&D Issues
[**SCRF**] The design reference value for the SCRF acceleration gradient of 35 MV/m is based on the technical level that is currently achievable. It will be necessary to achieve this reliably and with a good yield including automation techniques; further performance improvement is also desired.
[**SCRF**] It is foreseen that the bulk of the SCRF cavities will be provided through in-kind contribution from the participating countries. An important issue will be the quality assurance that maintains the compatibility among them.
[**Positron Source**] In the main preparatory phase, it is planned that the prototype of the rotating target will be made and the magnetic focusing system immediately after the positron source will be developed. The technology selection is to be made by the second year of the main preparatory phase. The strategy should be clarified, taking into account the R&D cost.
[**Interaction Region**] The technology for the control and feedback system related to the beam focusing and position control needs be established. The acceptable level of microtremor in the interaction region needs to be quantified.
[**Beam Dump**] The soundness monitoring of the window material, the concrete design for a remote-controlled replacement/exchange system, and the detail of the reaction between a high energy beam and water need to be adequately studied during the main preparatory phase.

Original in Japanese: http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-24-k273.pdf

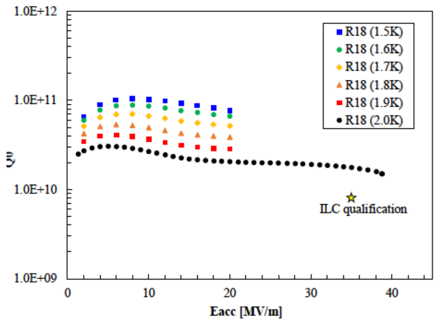
Example of SRF related works from 2018 to now

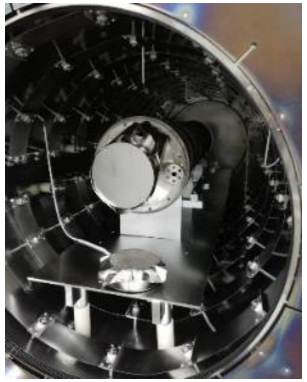
Optimization of the Nb material (process, cost)

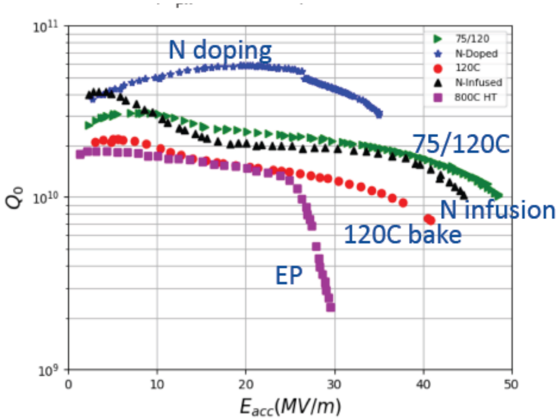


LG: 32/34 MV/m

MGSigle cell performance：
38.8 MV/m (> ILC-spec)

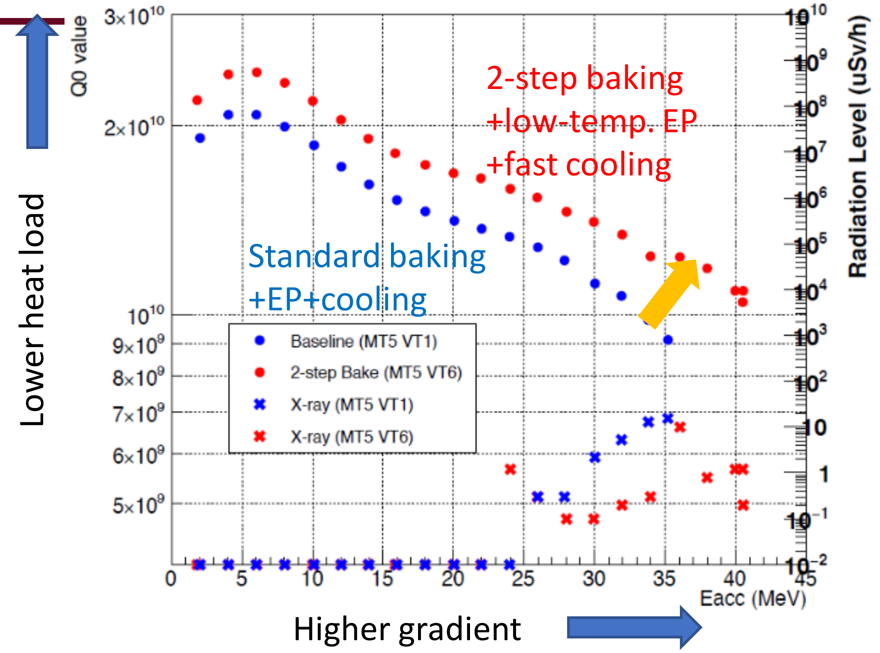






- The cavity that was treated with N-Infusion last year is installed in the STF-2 accelerator.
- From this year, we are also evaluating surface treatment methods such as 75/120C and Ndoping.

Example of SRF related works from 2018 to now



High Gradient Cryomodule (HGC)

- Present **ILC** spec 31.5 MV/m (per TDR)
- Many new advances in SRF technology since ILC TDR. **New treatments** may **enable significant reduction** in ILC cost: flux expulsion, 75/120 two-step bake C, cold EP (processing sequence stays similar)
- Supported by ILC Cost Reduction R&D funds from DOE, Fermilab plans to assemble a cryomodule with cavities with new treatments.
- Goal is to reach higher gradient than has ever been demonstrated in CM test
- Aim will be 38 MV/m average gradient with Q_0 >1.0x10^{10} and a stretch goal of 40 MV/m
- Achieving this would be a key demonstration of the potential for cost reduction for ILC
- Will reuse CM1, the first SRF cryomodule assembled at Fermilab in 2007 – as a part of a collaboration between Fermilab, DESY, and LASA

Fermilab

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High Gradient Cryomodule (HGC)

- Encouraging international participation in HGC. Contributions under discussion:
  - Cavities, cavity performance R&D, advanced cleanroom assembly techniques, magnetic shielding, cryomodule testing, and more
- Labs involved to date:

Fermilab, Jefferson Lab, DESY, cea, Cornell University, KEK-JAPAN, Argonne National Laboratory, TRIUMF

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Technical preparation

Component	Issue	Summary of tasks	Candidates for collaboration
SCRF Cavity	Mass production incl. automation	Performance statistics, mass production technology	France, Germany, US
	Cryomodule transport	Performance assurance after transport	France, Germany, US
Positron Source	Rotating target	Exchanging target, system design	CERN, France, Germany, US + industry-academia efforts
	Magnetic focusing system	System design	France, Germany, Russia, US
	Photon dump[23]	System design	CERN, Germany, US
Damping Ring	Fast kicker	Test of long-term stability, system design	CERN, Italy
	Feedback	Test at SuperKEKB	Italy
Interaction Region	Beam focus/position control	Test of long-term stability	CERN, UK
Beam Dump	Total system	System design	CERN, US
	Beam window, cooling water circulation	Durability, exchangeability, earthquake-resistance	CERN, US + industry-academia efforts

Recommendations on ILC Project Implementation

High Energy Accelerator Research Organization (KEK)

October 1, 2019

These "candidate countries" are preliminary and only for the examples on the "Recommendations on ILC Project Implementation*" (KEK, 2019)
https://www2.kek.jp/ilc/en/docs/Recommendations_on_ILC_Project_Implementation.pdf.
We welcome any partners to join the collaboration.