3rd meeting of SRF subgroup in IDT/WG2

- ✓ New member of SRF subgroup
- ✓ Brief report of KEK-DOE meeting
- ✓ Brief report of SRF session in AWLC2020
- ✓ Discussions on main items in technical preparation period
- ✓ Others (if any)

Attendees: A. Yamamoto, A. Lankford, S. Michizono, H. Hayano, O. Napoly, D. Delikaris, N. C. Lasheras, S. Posen, R. Rimmer, R. Geng, M. Liepe, Kirk, S. Stapnes, P. McIntosh, R. Laxdal, P. Burrows

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

Kirk

IDT-WG2 organization

IDT WG2
Shin Michizono (Chair)
Benno List (Deputy)

Charges of Sub-groups

- Discuss and coordinate the topics for
  - technical preparation (remaining topics) at Pre-lab
  - preparation for mass production at Pre-lab
  - possible schedule at Pre-lab
  - international sharing candidates of these activities
- Report to the IDT-WG2

All members belong to some sub-group(s).

SRF

Yasuchika Yamamoto	***KEK***
Nuria Catalan	CERN
Dimitri Delikaris	CERN
Rongli Geng	JLAB
Hitoshi Hayano	KEK
Bob Laxdal	Triumf
Matthias Liepe	Cornell
Peter McIntosh	STFC
Olivier Napoly	CEA
Sam Posen	FNAL
Robert Rimmer	JLAB
Marc C. Ross	SLAC
Akira Yamamoto	KEK

DR/BDS/Dump

Toshiyuki Okugi	***KEK***
Karsten Buesser	DESY
Philip Burrows	U. Oxford
Angeles Faus-Golfe	LAL
Jenny List	DESY
Thomas Markiewicz	SLAC
Brett Parker	BNL
David L. Rubin	Cornell
Nikolay Solyak	FANL
Luis Garcia Tabares	CIEMAT
Nobuhiro Terunuma	KEK
Glen White	SLAC
Kaoru Yokoya	KEK

Sources

Kaoru Yokoya	***KEK***
Joe Grames	JLAB
Hitoshi Hayano	KEK
Masao Kuriki	U. Hiroshima
Benno List	DESY
Gudrid Moortgat-Pick	U. Hamburg

Civil engineering

Nobuhiro Terunuma	***KEK***
John Andrew Osborne	CERN
Tomoyuki Sanuki	U. Tohoku

Brief report of KEK-DOE meeting

- The meeting done at 7:00~8:22 on 27/Oct (JST)
- Organized by A. Lankford
- 35 people attended
  - Japan: S. Michizono, A. Yamamoto, K. Yokoya, N. Terunuma, Kirk
  - Members of SRF subgroup in Americas: R. Rimmer, M. Liepe, R. Laxdal, R. Geng, S. Posen
- Michizono-san presented ILC overview, IDT, technical preparation, budget request from KEK, Recommendations on ILC Project Implementation, SCRF, positron source, damping ring, final focus system, beam dump, potential US accelerator contribution, and so on.
- A lot of discussions/questions/comments

Schedule of SRF subgroup meeting in IDT/WG2

Meeting #	Date	Contents
1	29/Sep/2020	introduction, member list, schedule/work items in technical preparation, discussions
2	13/Oct/2020	New member, discussions on how many cavities/CMs to be produced, AWLC2020
	19~22/Oct/2020	AWLC2020 on virtual
3	27/Oct/2020	Brief report of KEK-DOE mtg and AWLC, discussions on main items in technical preparation
4	10/Nov/2020	
5	24/Nov/2020	
6	8/Dec/2020	
7	22/Dec/2020	Draft of sharing work items in technical preparation period
?	12/Jan/2021?	
	Feb/2021	First draft of budget request in each region/lab., Submission to WG1/EB
		Preparation for MOU between/among laboratories
	Jun~Jul/2021	Submission of budget request to MEXT, in case of Japan

Main discussion items based on "Recommendations on ILC Project Implementation"

AWLC2020

- Cavity and cryomodule production
  - 100 cavities produced in preparation for mass production
    - ~1% of full production
    - Japan: 50 cavities, other regions/countries: 50 cavities
  - By new cost-effective production method
  - Plug-compatibility re-confirmed/re-established
  - To be checked RF performance/success yield
  - High pressure gas regulation in Japan (cavity/cryomodule production)
  - Coupler/tuner improved/produced/assembled/tested
  - Cryomodule production/test
- Cryomodule transport ("Global Cryomodule transfer")
  - Shipment/transport incl. inspection
  - RF performance rechecked after transport

Pre-Lab schedule (translated into table)

	Technical preparation period (Fiscal year)							
Items	**1**		**2**		**3**		**4**	
Cost down R&D								
Cost estimation based on TDR								
Review				Internal	External			
Engineering design report	Writing					Draft	Publish	
Prototyping of critical items								
Preparation for mass-production technology								

We have to fit the SRF schedule to this overall schedule!

Brief view of cavity production by cost-effective method, and the best recipe

- Step 1 (production)
  - Cavity production by cost-effective method incl. selection of Nb material
  - Reconfirmation of plug-compatibility (only flanges)
  - Not necessary for satisfying high pressure gas regulation of Japan
  - Not necessary for helium tank

Workshop is necessary to discuss those items

- Step 2 (decision of surface/heat treatment methods)
  - Cold temp. EP or standard EP?
  - N-dope, N-inf, Low temp. baking, Mid temp. baking, etc.?

- Step 3 (RF performance check)
  - VT1, but if not successful, VT2 done (after VT3, to be discussed)

- Step 4 (success yield)
  - Estimate success yield for 1st pass and 2nd pass (after 3rd pass, to be discussed)

How many cavities are produced for mass production?

Discussion item

We can refer Volume 3 Part 1 in TDR.

At that time, **16** 9-cell cavities (out of > 50 cavities, **recognized as identical in fabrication and surface process**) were used to evaluate cavity performance.

In the preparation phase, **at least ~ 20 or much more cavities are necessary** to evaluate recent surface treatment method including fabrication method much advanced since TDR.

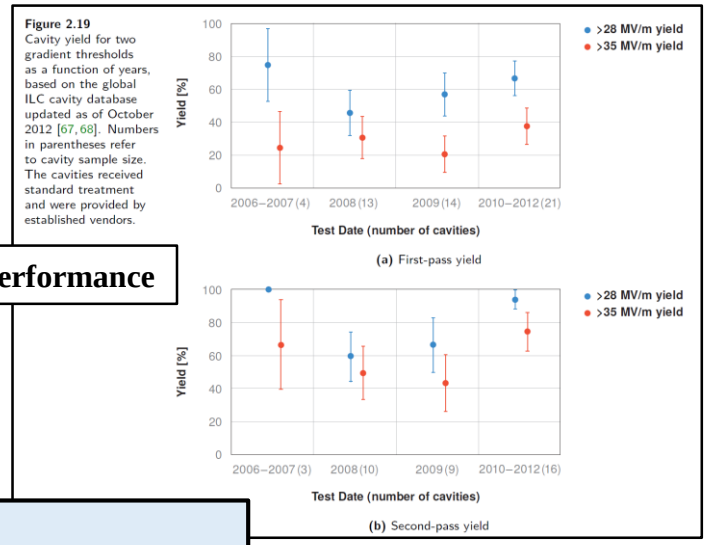
Not only surface treatment method but also what type of Nb material/fabrication method is used has to be discussed.

Table 2.6
Processing and handling of high-purity niobium cavities

Treatment method in TDR

Light BCP etching (10 µm)
Heavy EP (100-120 µm)
Post-heavy-EP cleaning
Vacuum-furnace outgassing (800 °C for 2 h)
RF tuning by no-touch bead-pull
Light EP (25 µm)
Post-light-EP cleaning
First HPR 3 passes (∼ 6 h)
First clean room assembly
Final HPR 3 passes (∼ 6 h)
Final clean-room assembly
Leak checking
In-situ baking at 120 °C for 48 h

History of cavity performance



Helium tank/tuner are not necessary for this evaluation

When we evaluate success yield of cavity performance, each region/lab. has to select one method of fabrication and surface process. But, we don't need world-unified method of fabrication and surface process.

# of cavities	Japan (/Asia)	Americas	Europe
w/o helium tank/tuner	20	20	20
w/ helium tank/tuner			

At least 20 cavities are produced

Questions/Discussions/Comments (memorandum) @3rd meeting

Translation by Kirk

- 50 cavities satisfied with HPG? Or not? Cost should be effectively used. Cavities w/o helium tank is used for only estimation of success yield
  - 10 cavities w/o tank in 1st year, 10 cavities w/ tank satisfying with HPG in 2nd year…
- Necessary for learning impact on high pressure gas regulation of Japan
- How much is one cavity estimated?
- Flexibility in surface treatment is necessary, to be discussed
  - To be decided in technical workshop
- International workshop is necessary to review material/fabrication/surface treatment methods
  - plug-compatibility reconfirmed
  - To be held after TTC meeting 2021 or next LCWS2021?
- New vendors in US
  - Important to find cavity fabrication vendor, in not only US but the other countries
  - To be checked qualification, learning curve expected, capability of large number production, etc.
- In GDE, cost estimation has been done by some vendors, but one vendor was dominant
- Reexamine lesson/learned from what GDE have done
- After E-XFEL construction, cavity fabrication cost is not changed, or a little changed
  - Cost of power coupler increased
- Laboratory-vendor collaboration in cavity fabrication is also necessary
  - KEK has already done
- Year and year plan is necessary in each region for technical preparation period
- Americas laboratory proposals in next meeting
  - Kirk requests responsible persons in each lab.

References

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- ILC Action Plan
  - https://www.kek.jp/ja/newsroom/2016/01/06/1400/
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