

# 32<sup>nd</sup> Meeting of SRF Group in IDT/WG2

- ✓ Preparation for SRF Five-year plan at KEK as Time-critical WPs (Kirk)
- ✓ Others (if any)

Attendees: A. Yamamoto, K. Umemori, H. Hayano, S. Posen, L. Monaco, E. Cenni, R. Geng, R. Ruber, D. Delikaris, P. Burrows, Kirk

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

# Preparation for SRF Five-year plan at KEK

Michizono-san, Akira Yamamoto-san and Kirk have discussed internally the SRF five-year plan at KEK. This plan follows the time-critical WPs discussed with the WG2/SRF group.

In WP-prime 2, we will produce **first** CM for ILC.

Also, we will construct the infrastructure related to helium refrigerator, CM assembly/test area, etc.

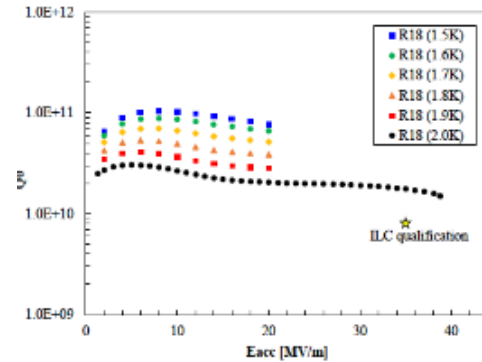
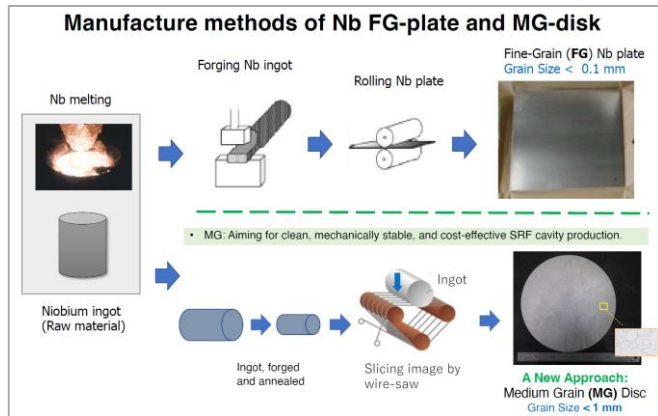
<b>SRF Five-year plan at KEK (currently prospect)</b>					
	F.Y.2023	F.Y.2024	F.Y.2025	F.Y.2026	F.Y.2027
Infrastructure @COI					
Infrastructure @CFF					
Cavity production					
Cavity test	R&D	R&D			
CM production/assembly					
CM test					

# WP-prime 1: SRF Cavity

## (Scoping the Industrial-Production Readiness)

- ◆ Research with single-cell cavities to establish the best production process
  - ◆ Advanced Nb sheet production method
  - ◆ Advanced surface treatment recipe
- ◆ Globally common design compatible with High Pressure Gas Safety (HPGS) regulation
- ◆ 24 nine-cell cavities are to be developed for industrial-production readiness
  - ◆ 8 cavities (4 / batch) in each region
  - ◆ Production process optimized in each region encouraged
- ◆ RF performance/success yield to be examined (at least including 2<sup>nd</sup> pass)
  - ◆ 3<sup>rd</sup> pass to be examined if effective

	# of cavities to be produced		
	Americas	Europe	JP/Asia
single-cell	2	2	2
nine-cell	8	8	8 (+ 12)



Material/Sub-component

QA of Material/Sub-C

Cavity Production

Surface Process

Vertical Test =  
Cavity RF Test

Production process

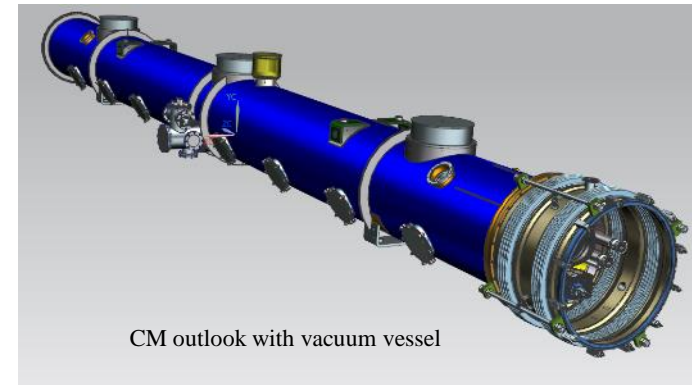
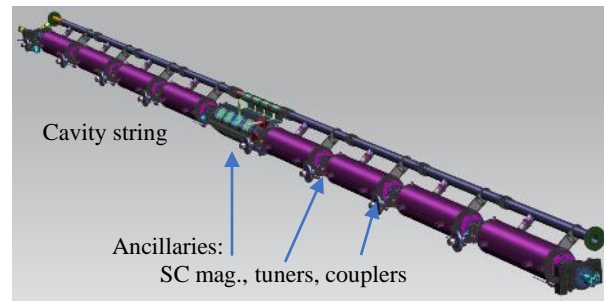
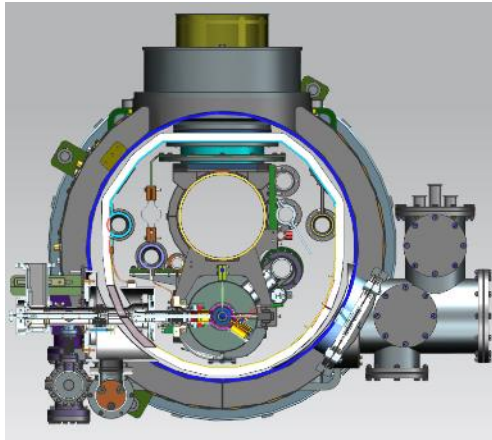


# WP-prime 2: Cryomodule (CM) design

(Scoping the CM Global Transfer and Performance Assurance)

We will produce first CM!

- ◆ Unify cryomodule (CM) design with ancillaries, based on globally common drawings and data-base
- ◆ Establish globally compatible safety design to be approved by HPGS regulations individually authorized in each region.

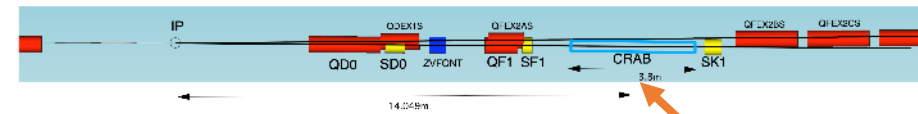


	Americas	Europe	Japan/Asia
CM tech. design base	LELS-II	Euro-XFEL	ILC-TDR
HPGS regulation base	ASME	TÜV and EN	JP-HPGS act
<b>ILC CM design</b>	Common CM design globally adaptable to HPGS regulation in any regions		

# WP-prime 3: Crab Cavity Development with down-selection

- ◆ RF property simulation to optimize cavity design
- ◆ Pre-down-selection to choose two primary candidates
- ◆ Development and evaluation of two prototype cavities
- ◆ Demonstration of synchronized operation with two prototypes
- ◆ Down-selection to choose final cavity design
- ◆ Cryomodule design based on final cavity design

two beamline distance  
 $14.049\text{m} \times 0.014\text{rad} = \mathbf{197\text{mm}}$



Item	Recent specification (after TDR)
Beam energy	125 GeV ( $e^-$ )
<b>Crossing angle</b>	<b>14 mrad</b>
Installation site	14 m from IP
RF repetition rate	5 Hz
Bunch train length	727 $\mu\text{sec}$
Bunch spacing	554 nsec
Operational temperature	2.0 K (?)
Cavity frequency	1.3/3.9 GHz
Total kick voltage	1.845/0.615 MV
Relative RF phase jitter	0.023/0.069 deg rms (49 fs rms)

Elliptical/Racetrack (3.9 GHz)	Lanc. Univ.	
RF Dipole (RFD)	ODU	
Double Quarter Wave (DQW)	CERN	
Wide Open Waveguide (WOW)	BNL	
Quasi-waveguide Multi-cell Resonator (QMIR)	FNAL	

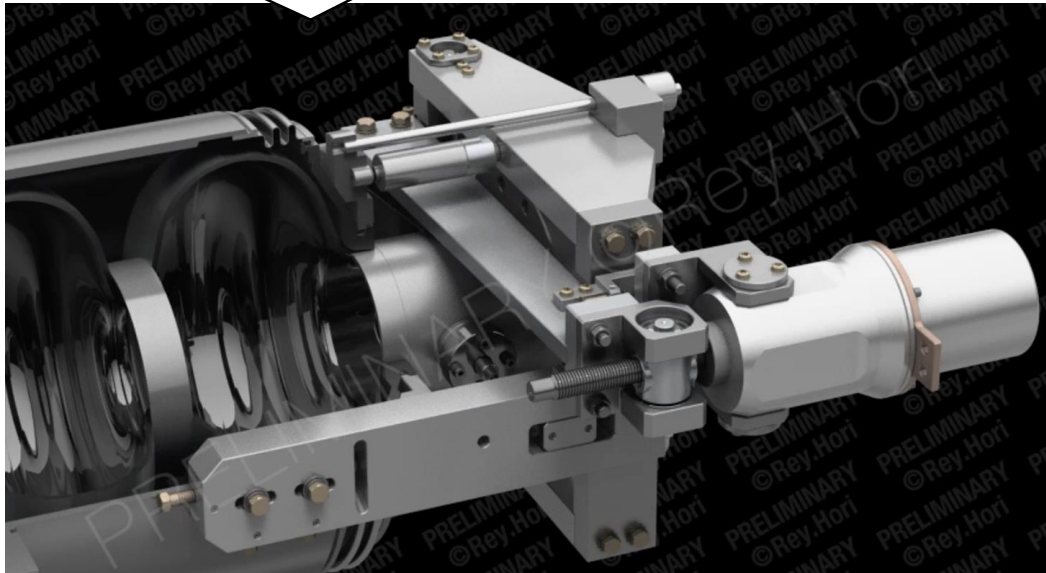
# Change requests related to SRF

If KEK has enough budget from next FY, we'd like to start cavity/CM production as soon as possible.

Then, we have to decide the design of cavity/CM including tuner/coupler/magnet.

Currently, we have two change requests related to tuner/helium tank and position of current lead box for Q-mag.

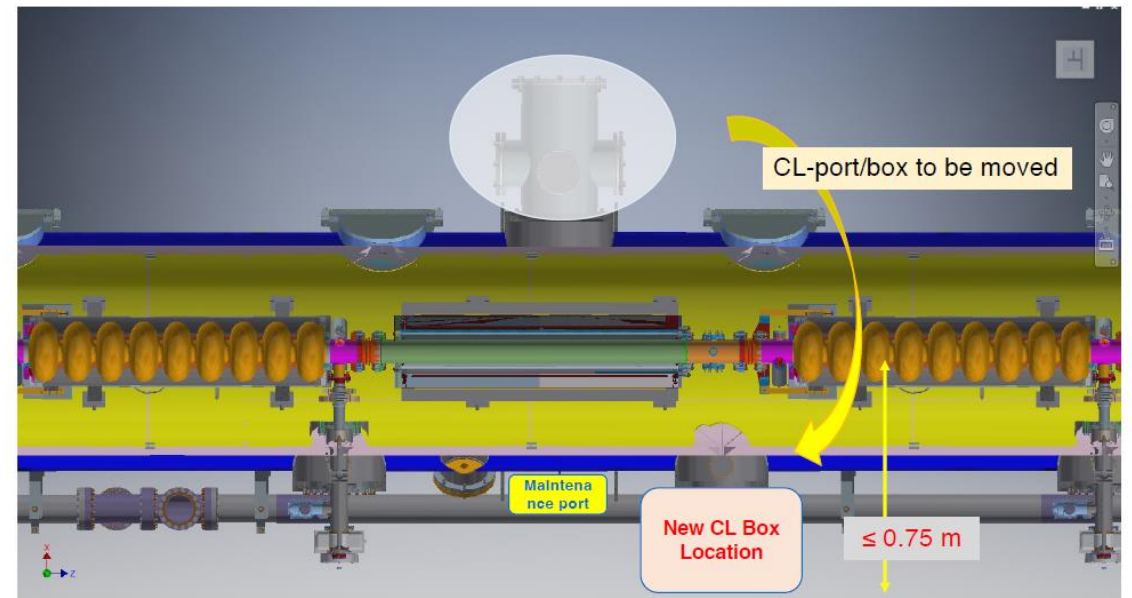
LCLS-II tuner has worked with high reliability, but there is no experience in pulsed mode operation. We need to check this with **first** CM.



**LCLS II (HE)/FNAL's  
N=320 units+ 180units**

CM design is already completed, but we have to design outside components, that is, waveguide system, pumping system for power coupler, current lead box, etc. We need more detailed drawing.

## Proposal for the CL box to be moved to the Coupler Port Side



# Conclusion/Suggestion

Currently, it's difficult to submit these change requests before cavity/CM production.

After CM test and more detailed drawing completed, we will/can submit the change request.

**I'd like to obtain your agreement on this policy including the cavity/CM design within this year.**

If you like to check the 3D model developed by FNAL/KEK, I can provide to the SRF group.

# Meeting schedule and recent progress

<b>Meeting #</b>	<b>Date</b>	<b>Contents</b>
32	08/Nov	Preparation for SRF Five-year plan at KEK as Time-critical WPs
33	22/Nov	
34	06/Dec	
35	20/Dec	
	End of Dec	Budget plan will be fixed
	15~19/May/2023	LCWS2023 @SLAC



# Questions/Suggestions/Comments

The tuner/piezo performance should be checked by pulsed mode operation, but there is no CM test facility to do this.

The design should be unified for first CM.

At least, one cavity from EU and US for each will/can be installed in first CM.

Actually, the SRF five-year plan will proceed through the international technology network.

It will take 1-1.5 years to evaluate the tuner performance in CM test.

After the five-year plan, we think the CM test will continue, and we may find unexpected problem to be solved.

We can put the two goals of cavity performance as the ILC specification (TDR) and as R&D (high-Q/high-G).

Magnetic shield design is different among CEA, DESY, and FNAL.

Kirk can gather some ideas from the SRF experts, then organize the topical meetings to discuss.