35th Meeting of SRF Group in IDT/WG2

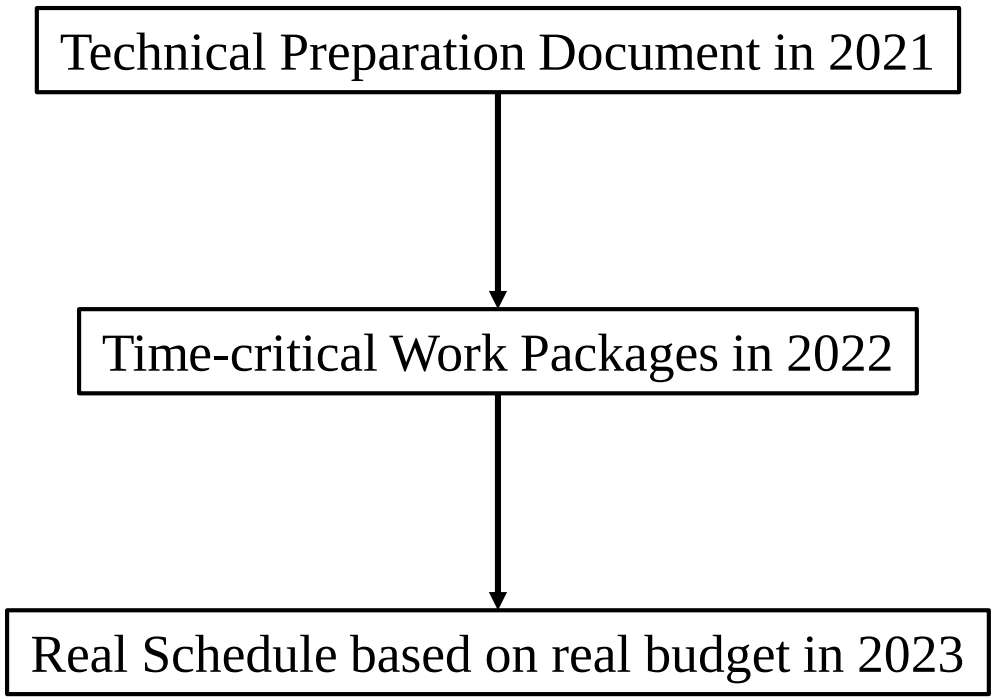
- ✓ SRF 5-year plan in FY2023-2027 at KEK (Kirk)
- ✓ Preparation for the SRF session at LCWS2023 (Sergey/Kirk)
- ✓ Brief report for down-selection review of crab cavity at KEK (Kirk)
- ✓ Others (if any)

Attendees: A. Yamamoto, E. Cenni, S. Belomestnykh, R. Geng, L. Monaco, B. Rimmer, D. Delikaris, N. Solyak, P. McIntosh, Kirk

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

Kirk

Change of plan for ILC



Assumed Pre-Lab for 4-year with enough budget

Proceed with high-prioritized items before Pre-Lab with reduced budget

5-year plan decided after negotiation with MEXT with real budget

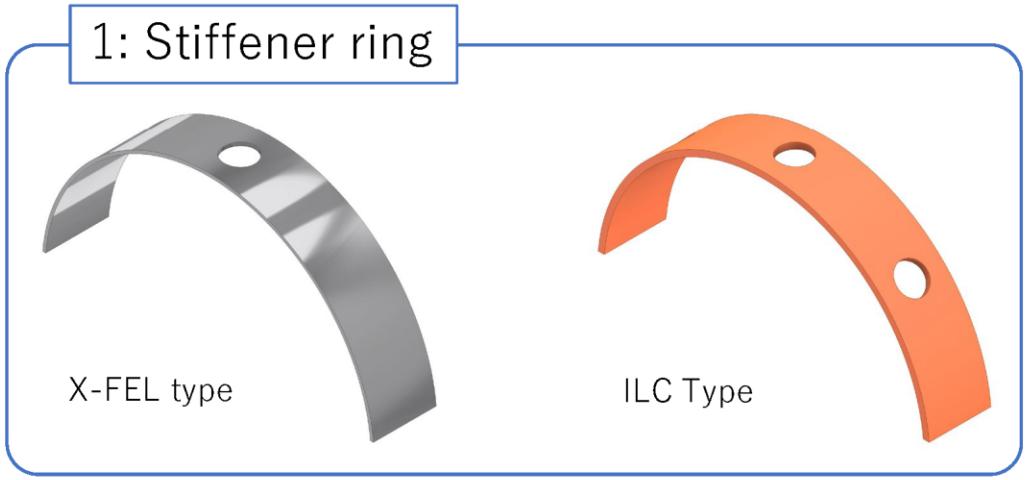
Recent status at KEK

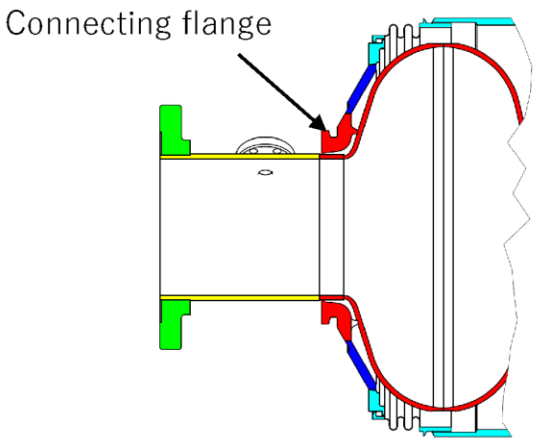
- The budget of FY2023 at KEK was fixed last week
- The detailed schedule is under consideration based on our **“real”** budget
- As for SRF, the main tasks are Nb material procurement, documentation of high-pressure gas safety regulation, cavity production and infrastructure development at COI/CFF
  - Nb material
    - MG Nb material is already being prepared for ordering
    - FG is still under consideration, depending on the number of cavities to be produced
  - HPGS
    - We are just trying to understand the differences among TELSA, LCLS-II, and ILC (see next page)
    - The negotiation with KHK is under progress
  - Cavity production
    - Six single-cell cavities (FG) will be produced for surface treatment study
    - One 9-cell cavity (FG) will be produced to be satisfied with HPGS
    - One 9-cell cavity (MG) will be produced as test production
  - Infrastructure at COI/CFF
    - Cryogenics group is starting to purchase for necessary items
    - EP group is doing the commissioning of vertical EP
    - Cavity group will upgrade the heating furnace, and is doing the commissioning of clean oven
    - CFF group will install a new EBW machine and a cryo-pumping system

ILC cavity design to be discussed

Questions from Umemori-san

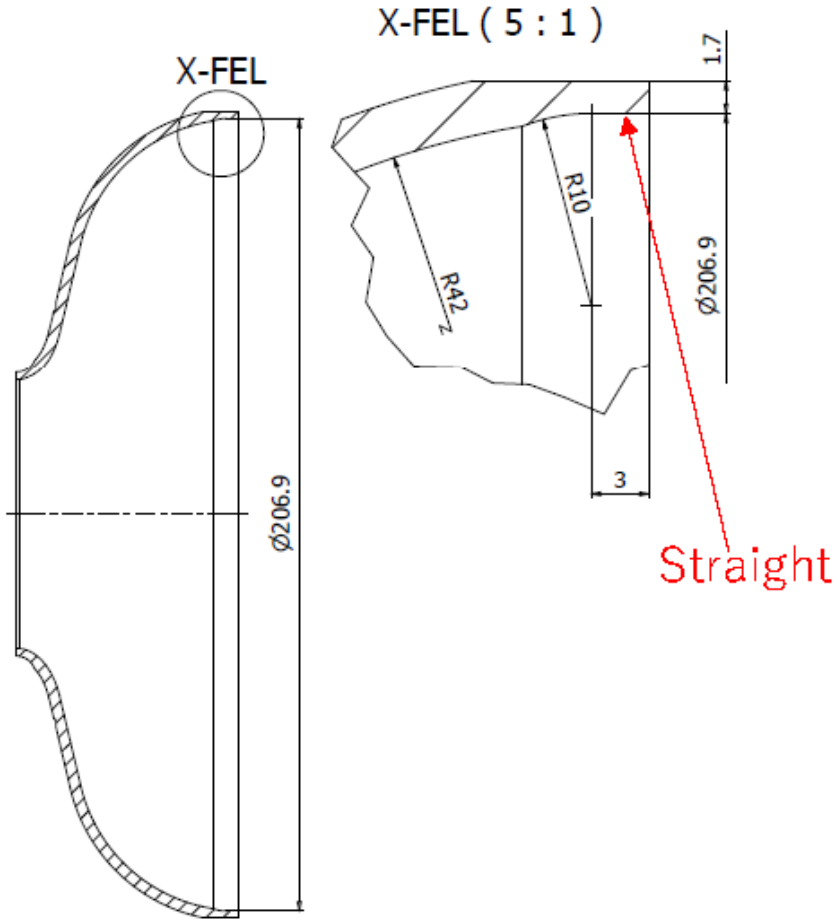
1. Number of holes at stiffener ring
   - X-FEL type: 1 hole
   - ILC type (LCLS-II): 3 hole
   - →Preparing 3 hole type
2. Design of inside shape at equator
   - Described in the following page
3. Thickness of Ti tube for He-tank
   - X-FEL type: 5mm
   - ILC type (LCLS-II): 4mm
   - Need to consider Lorenz Force Detuning
4. Material
   - Low-RRR Nb: Stiffener ring, Connecting flange
   - High-RRR Nb: Others
5. Material specifications
   - Material specifications have to be decided
6. Tuner stopper
   - Necessary for HPGS
   - 0.6mm?
7. How to solve distortion of NbTi conical disc?

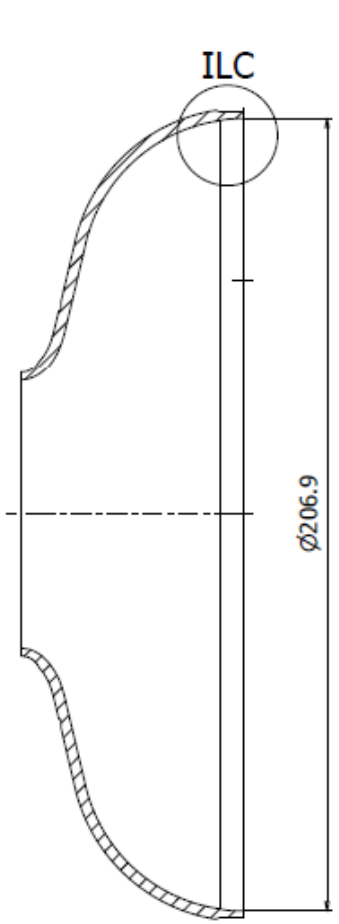


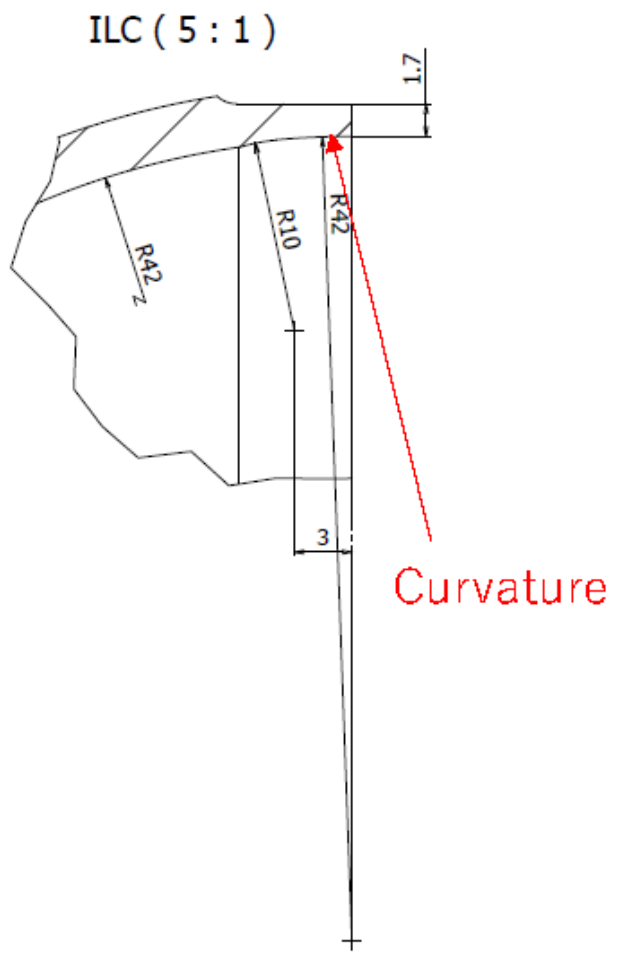


2. Design of inside shape at equator

Questions from Umemori-san

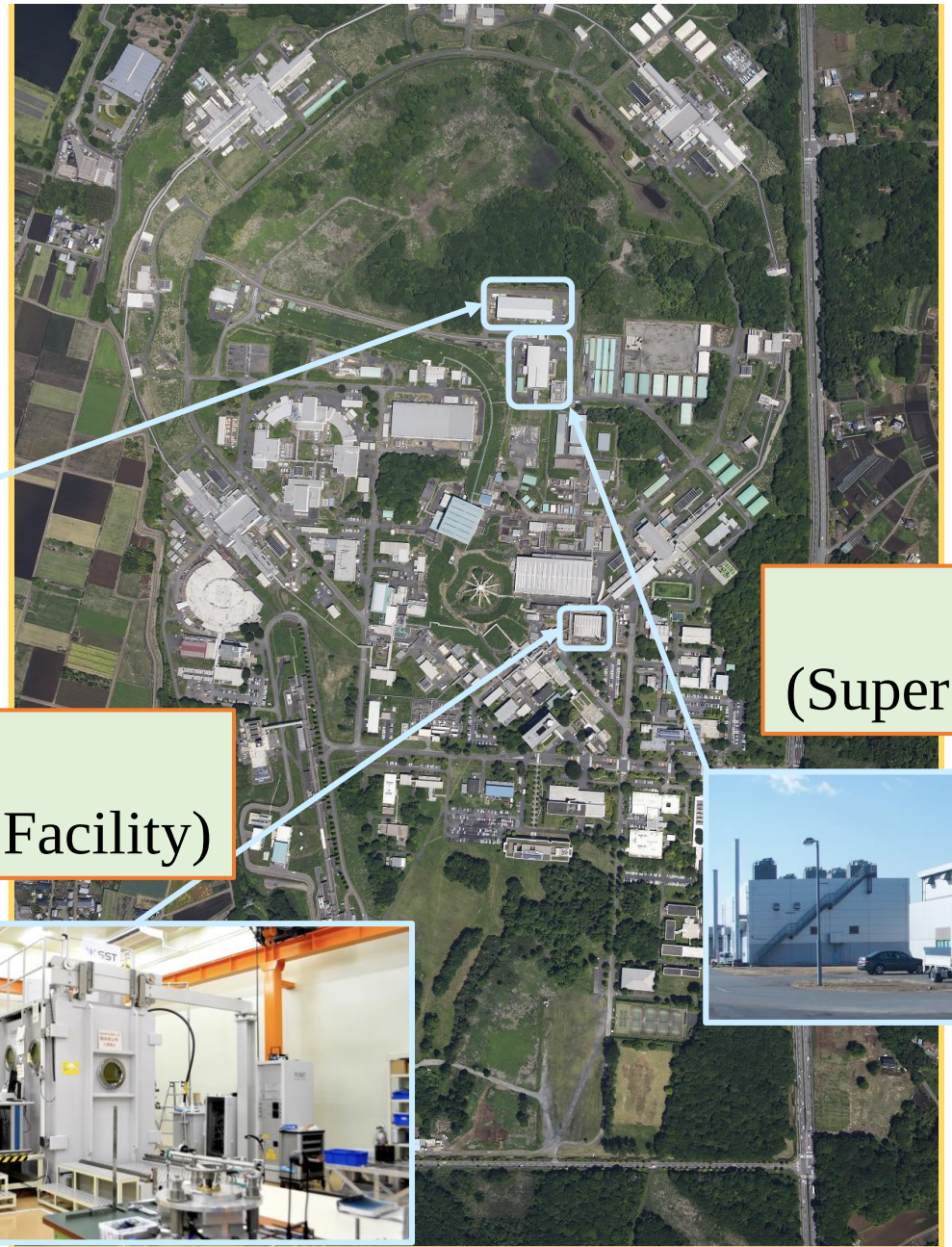






SRF facilities at KEK

COI
(Center of Innovation)



CFF
(Cavity Fabrication Facility)

STF
(Superconducting RF Test Facility)

Work packages related to SRF ①

Work package	Detailed category	Brief description
1.3 GHz Cavity	High pressure gas safety	Documentation, Sample test, Simulation, Negotiation with KHK and local government
	Procurement/Production	Documentation, Negotiation with vendors, Production at CFF
	Quality control/assurance	Nb material evaluation (eddy current scan), RRR measurement, Other material evaluation
	Preparation	Pre-tuning/Field flatness assurance, clean work, inspection, local grinding, pumping/leak check
	Surface treatment	Heating, bulk-EP, light-EP, BCP (outer surface), Rinsing, Drying, Baking
	Vertical test/Yield evaluation	RF measurement, T-/X-ray mapping, 2^{nd} sound, Fluxgate, Demagnetization, Cooling process
	Helium tank welding	TiG welding, Alignment between cavity and tank
	HOM coupler	Tuning HOM couplers
Power coupler	Design	Drawing, Simulation, Sample test
	Procurement/Production	Documentation, Negotiation with vendors
	Preparation/Assembly	Cleaning, Rinsing, Drying, Assembly for high power test, Pumping
	Quality control/assurance	Quality evaluation of ceramics with TiN coating, copper plating, brazing
	High power RF test	RF conditioning with high power, Monitoring temperature/vacuum/electron/arc/luminescence
	Storage	Design of storage jigs (by cavity string assembly)
Frequency tuner incl. piezo	Design	Drawing, Simulation, Sample test
	Procurement/Production	Documentation, Negotiation with vendors
	Preparation/Assembly	Cleaning, Assembly
	Quality control/assurance	Quality evaluation
	Performance test	Performance test at cold temperature

Work packages related to SRF ②

Work package	Detailed category	Brief description
SCQ magnet + cold BPM Systems	Design/Study	Drawing, Simulation, quench protection study
	Procurement/Production	Test coil, Coil/magnet production, Low power test
	Preparation/Assembly	Assembly process, Alignment
	Quality control/assurance	Quality evaluation
	Performance test	Performance test at cold temperature
Magnetic shield	Design/Study	Drawing, Simulation, Study of residual magnetic field inside cryo-vessel, Demagnetization
	Procurement/Production	Test shield production, Production
	Preparation/Assembly	
	Quality control/assurance	Quality evaluation
	Performance test	Performance test using 9-cell cavity at cold temperature
Clean work	Quality control/assurance	Documentation related to work flow in clean room
	Clean items	Ionized gun, Dust monitor, Slow pumping system, Filter, Cart to lift a cavity, Gasket, Bolt/nut,
	Robotics	Study of auto cleaning/assembly
	Preparation	Rinsing cavity outer surface, Drying, Alignment of cavity string
	Assembly for VT	Development of work process with robot
	String assembly	Development of work process with robot
Cryomodule	Design/Study	Drawing, Simulation, HPGS
	Procurement/Production	Documentation, Negotiation with vendor
	Preparation/Assembly	RF cable/feedthrough, Temperature sensor, Fluxgate, Thermal shield, Insulation material, Support post
	Quality control/assurance	Documentation related to work flow in clean room
	Performance test	Cold test at 2K, with low power and high power

Work packages related to SRF ③

Work package	Detailed category	Brief description
Vacuum systems	Pumping system	Beamline, Power coupler, Cryo-vessel, Slow pumping system
	Vacuum gauge	Beamline, Power coupler, Cryo-vessel,
	Gate valve	Development of dust-free GV, Cleaning, Assembly
HOM damper		Not necessary, but under consideration
Alignment		Cavity-to-cavity, Cavity-to-CM
High Level RF System		Klystron, modulator, waveguide, dummy load, variable hybrid, phase shifter, circulator, Magic-T
Low Level RF System		Construction of control systems incl. feed-forward/feed-back (open/closed-loop operation)
Cryogenics	Construction	Upgrade work, Connection of transfer line to CM for cold test
	Pumping system	Pumping system for 2K helium
	Control	Control system
	High pressure gas safety	Negotiation with local government
Installation		CM installed into cave
Machine protection (?)		Performance degradation, dark current, radiation security, possible quench of SCQ-magnet, etc.

Once the MOU is contracted, KEK expects these tasks to be carried out in global collaboration.
It may take several months to half a year before the MOU is contracted.
Note also that KEK must adhere to the schedule related to 5-year plan.

Brief report for down-selection review of crab cavity at KEK

- 4~6/Apr hosted by KEK
- 20 attendee (in-person, partly remote)
- Each group had 1 hour presentation
- Reviewers decided two designs from five proposed designs
- Review chair released final report for this review
- Peter will have the report in the WG2 meeting on 18/Apr
- Who will/can present this topic at LCWS2023?

Meeting/Conference schedule

Meeting #	Date	Contents
35	11/Apr	SRF 5-year plan in FY2023-2027 at KEK, Preparation for LCWS2023
36	25/Apr	
	7~12/May	IPAC2023 @Venice, Italy
	15~19/May	LCWS2023 @SLAC, US
	25~30/Jun	SRF2023 @Grand Rapids, MI, US
	5~8/Dec	TTC Meeting 2023 @FNAL, US

https://indico.slac.stanford.edu/event/7467/overview

https://indico.frib.msu.edu/event/25/