# Introduction and short summary of remote WG high-Q/high-G

A. Miyazaki on behalf of conveners



# Our mission

#### WG-1: Progress on High Q and High Gradient activities

Conveners: Jinfang Chen (SARI), Daniel Bafia (FNAL), Akira Miziyaki (IJCLab)

The scope of this working group is to discuss the most recent results related to pushing niobium towards higher Q and higher gradient. Advances in understanding material evolution under established but also newly developed heat treatments, such as N-doping, N-infusion, Mid-T bake, Two-step Low-T bake with low-temperature EP, and current results on flux-expulsion studies should be discussed. The working group should also focus on operational experiences in existing high-Q/high-G cryomodules. Topics should discuss the activities on large and medium grain niobium materials including results from cavity fabrication, cavity performances and PED requirements. Results from cavity studies with different cavity types and frequencies, which could help to establish a core understanding, should be included.

# We provoke discussions!

## Four sessions

#### Today

#### Tomorrow

Introduction and short summary of remote WG high-Q/hig Akira Miyazaki (CNRS/IN2P3/ 11:00 - 11:15	In-situ baking of SRF cavities Oliver Kugeler (Helmholtz- Zentrum-Berlin)	Recent Beta-NMR Studies at TRIUMF Edward Thoeng (TRIUMF)	Suppression of field emission for the SRF cavities at KEK Tomohiro Yamada (KEK)	
LCLS-II-HE Cavity and CM Results James Maniscalco (SLAC)	<b>Cooldown dependencies of mid-T treated cavity performa</b> <i>Christopher Bate (DESY)</i>	Electromagnetic Response of Disordered Superconductin Mehdi Zarea (Louisiana State	Update on Traveling Wave Cavity Progress at FNAL Fumio Furuta (FNAL)	
11:15 - 11:30	80.5 MHz QWR 4K Q curves with various surface treatments	Anomalous frequency shift within Dynes superconductor	Development and Application of Nb3Sn Thin Film SRF Ca Ziqing Yang (IMP)	
Performance of first mid-T 1.3 GHz cryomodules Jiyuan Zhai (IHEP)	Jacob Brown (MSU)	František Herman (Comenius		
Recent results of SHINE High-Q cavities and cryomodules Jinfang Chen (SARI, CAS)	RF and Material Studies on Interstitial Impurities in Bulk Nb Cavities Hannah Hu (UChicago)	EP parameter investigation for low and high beta 650 MHz niobium cavities Vijay Chouhan (FNAL)	ALD surface engineering for SRF cavities Yasmine Kalboussi (CEA Saclay)	
The first horizontal test results of TESLA-type large grain	14:45 - 15:00	16:45 - 17:00	SRF multi-layer thin film R&D at KEK Ryo Katayama (KEK)	
Tomohiro Yamada (KEK)	Study of interstitial oxygen as a result of various surface t Marc Wenskat (University of	Plasma Electrolytic Polishing Cristian Pira (INFN LNL)	12:00 - 12:15	
Exploring mode mixing in PIP-II LB650 Cavities: Impact of		17:00 - 17:15	Comparison of Nb, Nb3Sn, MgB2, cuprate, and pnictide for future SRF cavities Akira Miyazaki (CNRS/IN2P3 /IJCLb)	
<b>350C furnace baking on reduction post HPR and vertical</b> <b>tests</b> <i>Genfa Wu (FNAL)</i>	Exploring the Effect of Various parameters in the HFQS P Katrina Howard (UChicago)	<b>Topographic Evolution of Heat-Treated Nb Upon Electrop</b> <i>Eric Lechner (JLab)</i>		

# **Enjoy the discussions!**

# Remote WG high-Q/high-G

### 59 members

#### Conveners:

Martina Martinello (martinam@slac.stanford.edu)

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Akira Miyazaki (akira.miyazaki@cern.ch / akira.miyazaki@ijclab.in2p3.fr)



# 2 meetings after the last in-person meeting @六ケ所

### 2022 Dec 14

https://conferenceindico.kek.jp/event/202/timetable/#20221214

Wed 1	4/12					>
		🕂 Imprimer	PDF	Plein écran	Vue détaillée	Filtre
15:00 Introduction					A	kira Miyazaki 0
	Zoom					15:00 - 15:05
	Experiments on f vs T					Daniel Bafia 0
	Zoom					15:05 - 15:25
	Theory on the coherence peak	in f vs T			Frant	išek Herman 0
Zoom						15:25 - 15:45
	Theory on the frequency dip ju	st below Tc				Hikaru Ueki 0
16:00 Zoom						15:45 - 16:05
	Break					
	Zoom					16:05 - 16:10
	f/Q vs T at DESY				Rezv	ran Ghanbari 0
	Zoom					16:10 - 16:30
	f/Q vs T at KEK				Ken	sei Umemori 0
	Zoom					16:30 - 16:50
	Discussion					
	Zoom					16:50 - 17:00

### 2023 Sep 7

#### https://conferenceindico.kek.jp/event/244/timetable/#20230907

<	Thu 07/0	9			>		
		🗏 Imprimer PDF Plein écran	Vue détaillée	Filtre			
	16:00	Impact of Mid-T Heat Treatments on the Sensitivity to Trapped Magnetic Flux	Jonas W	olff (DESY)	Ø		
				16:00 - 16:2	20		
		Influence of High Pressure Rinsing Prior to Mid-T Heat Treatment	Rezvan Ghanbari (DESY)				
				16:20 - 16:4	40		
Ĩ		650 MHz development activities for both science and industrial applications at Fermilab	Kellen McGee	(Fermilab)	Ø		
				16:40 - 17:0	00		
	17:00	Numerical Calculations of Superheating Field in Superconductors with Nanostructured Surfaces W.P.Manula Pathirana (Virginia Military Institute)					
		Mid-T Bakes on Coaxial Multi-mode Cavities	Philipp Kolk	o (TRIUMF)	Ø		
				17:20 - 17:4	40		

Next: 2024 spring?

# Highlights in the meeting on 2022 Dec 14 (1/2)

### Frequency dip ≠ coherence peak

Hikaru Ueki





Inhomogeneous surface disorder



Magnetic vs non-magnetic impurity

# Highlights in the meeting on 2022 Dec 14 (2/2)

#### Results from various labs



- Correlation to high-field Q-slope & anti-Q-slope
- Maybe a quick mean to check performance without going to high field (?)

# Highlights in the meeting on 2023 Sep 7 (1/3)

aft. mid-T

### Various aspects of Mid-T baking

Jonas Wolff (DESY)

#### **Take Home Messages**

#### accurate simulations of ideal Meissner state possible:

- detailed simulation model
- high mesh resolution

#### flux expulsion behavior (for used conditions):

- > no significant impact of cool down velocity
- Iarge impact of spatial temperature gradient

#### mid-T heat treatment:

- no impact of mid-T heat treatment on flux expulsion behavior
- five times larger sensitivity to trapped magnetic flux after mid-T heat treatment

#### Rezvan Ghanbar (DESY)

![](_page_7_Figure_14.jpeg)

# Highlights in the meeting on 2023 Sep 7 (2/3)

### Various aspects of Mid-T baking

![](_page_8_Figure_2.jpeg)

# Highlights in the meeting on 2023 Sep 7 (3/3)

### Superheating field simulation via COMSOL

Manula Pathirana (Virginia Military Institute)

$$\dot{f} - f + f^3 - \nabla^2 f + \frac{\kappa^2}{f^3} \left[ (\partial_x h)^2 + (\partial_y h)^2 \right] = 0,$$
$$\nabla \cdot \left( \frac{\nabla h}{f^2} \right) = \frac{h}{\kappa^2}.$$

![](_page_9_Figure_4.jpeg)

![](_page_10_Picture_0.jpeg)

# Welcome and let's start the session