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# Testing of Advanced RF Structures

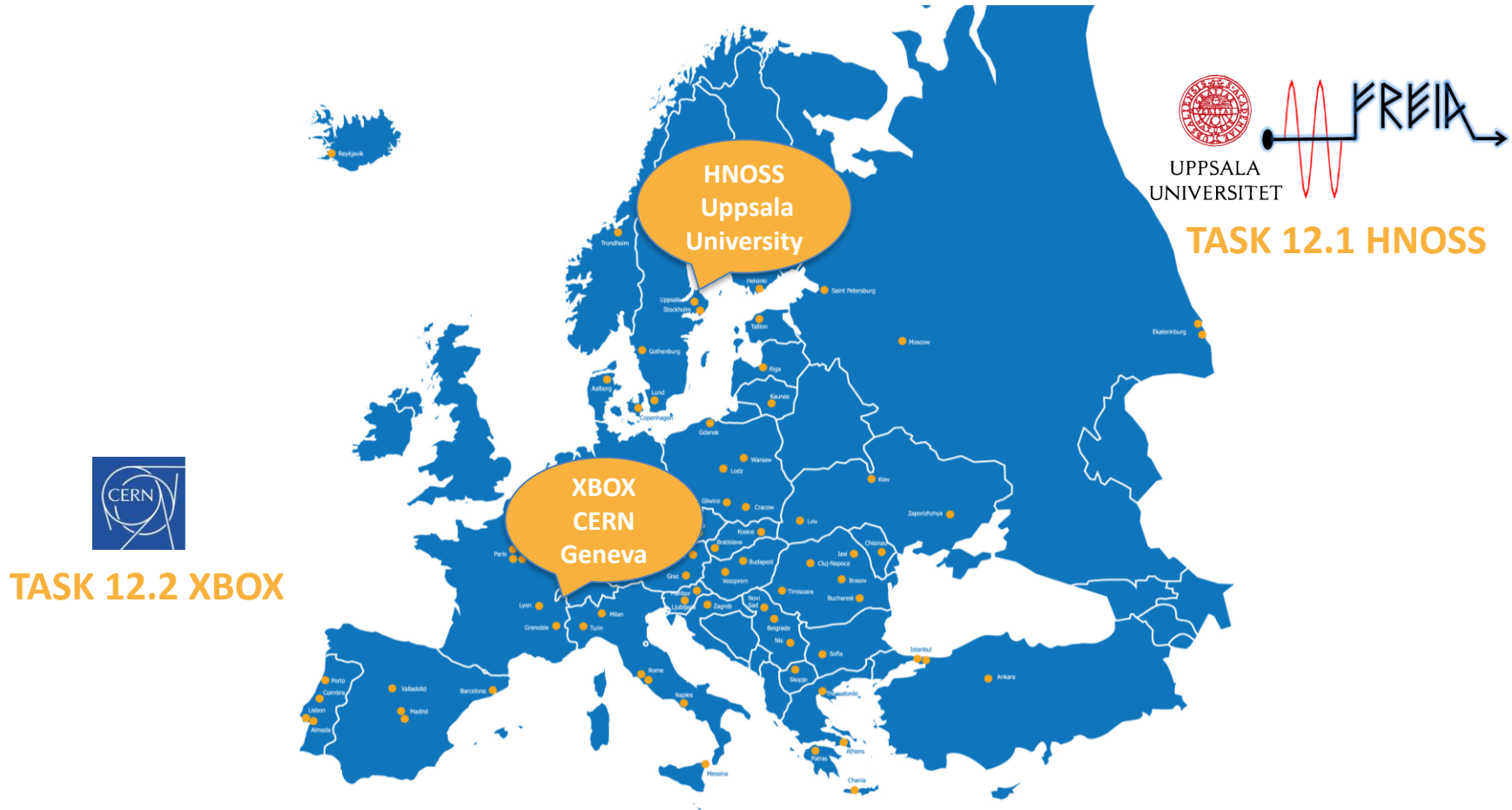
## TNA WP12 RF Test Stands

Final Annual Meeting, 2 May 2022

Roger Ruber (Uppsala University)

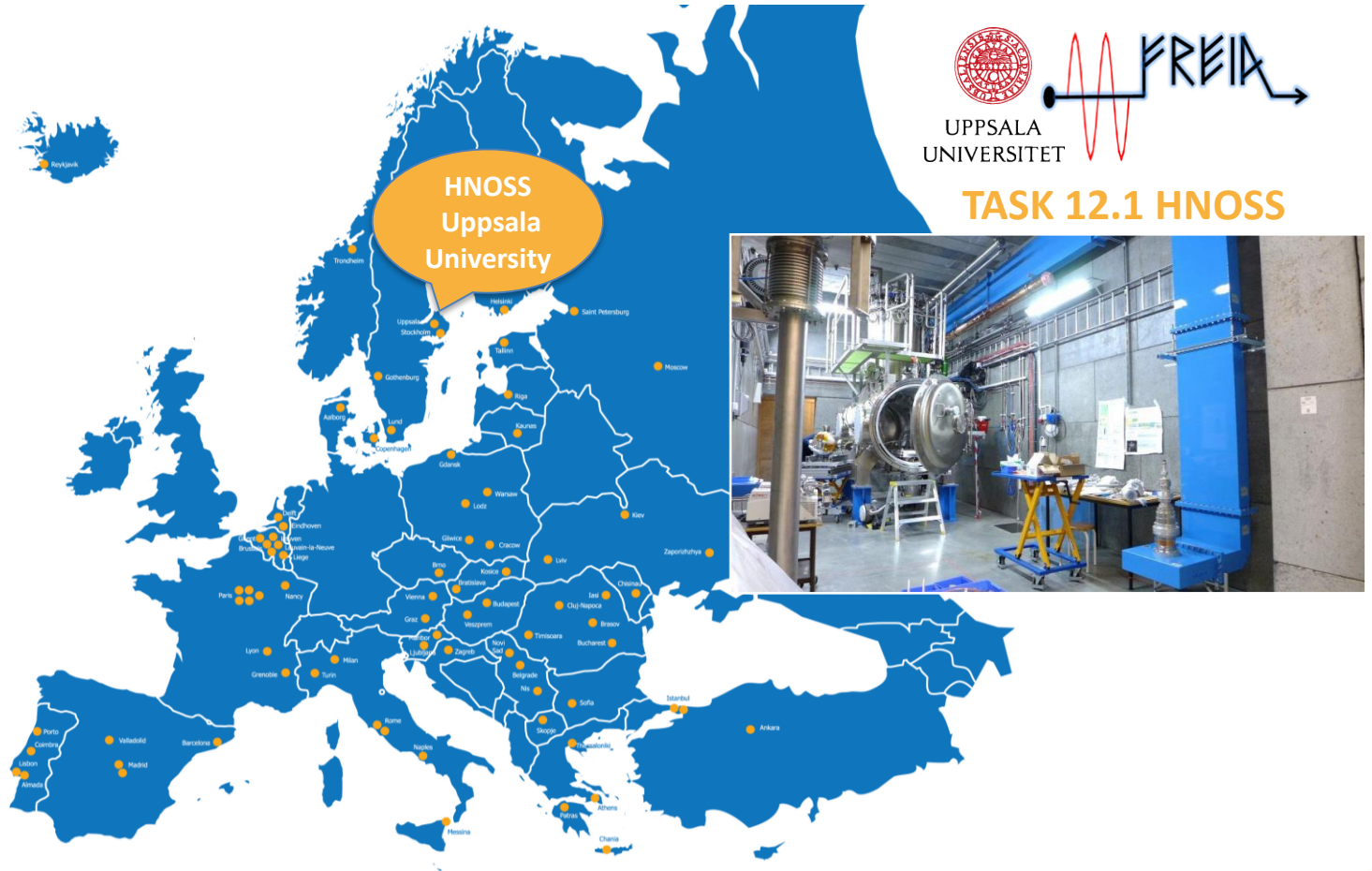
Walter Wuensch (CERN)

# WP12 RF Testing Facilities



The TNA within WP12 groups **TWO** facilities devoted to testing of superconducting RF cavities and normal conducting RF cavities.

# WP12.1 UU/FREIA HNOSS Facility



The **HNOSS** facility at the FREIA Laboratory, Uppsala University, Sweden, is available for testing of superconducting RF cavities with integrated helium tank.

# WP12.1 UU/FREIA HNOSS - Overview

In proposal - 4 projects with a total of ~~2880~~ 3790 access units.

#	Name	Institutes	Status	Access Units	Users
1	ESS High-beta Elliptical Cavity	CEA Saclay	Completed. Reported and published.	1330	18
2	Validation of a prototype double spoke cavity cryomodule	IPN Orsay	Completed. Reported and published.	2048	14
3	RF and piezo actuators study on spoke cavities	Lodz University of Technology	Completed. Reported and published.	36	8
4	HL-LHC crab cavity cold testing	CERN	Completed. Reported and published. Remote participation due to Covid pandemic.	1080	7
<b>TOTAL Achieved</b>				<b>4494 (119%)</b>	<b>47</b>



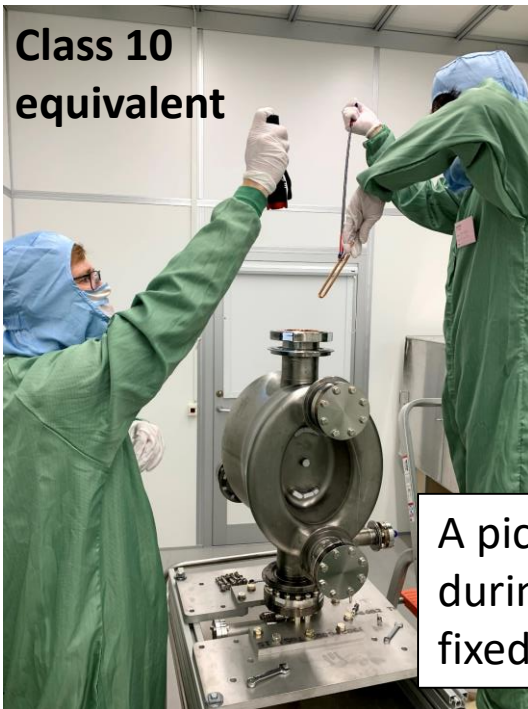
# WP12.1 FREIA-HNOSS-2020-01 (#4)

- Cavity was without helium vessel, so test in helium bath of vertical cryostat GERSEMI (same as for magnets)

Test of SC cavities & magnets (<350kJ)

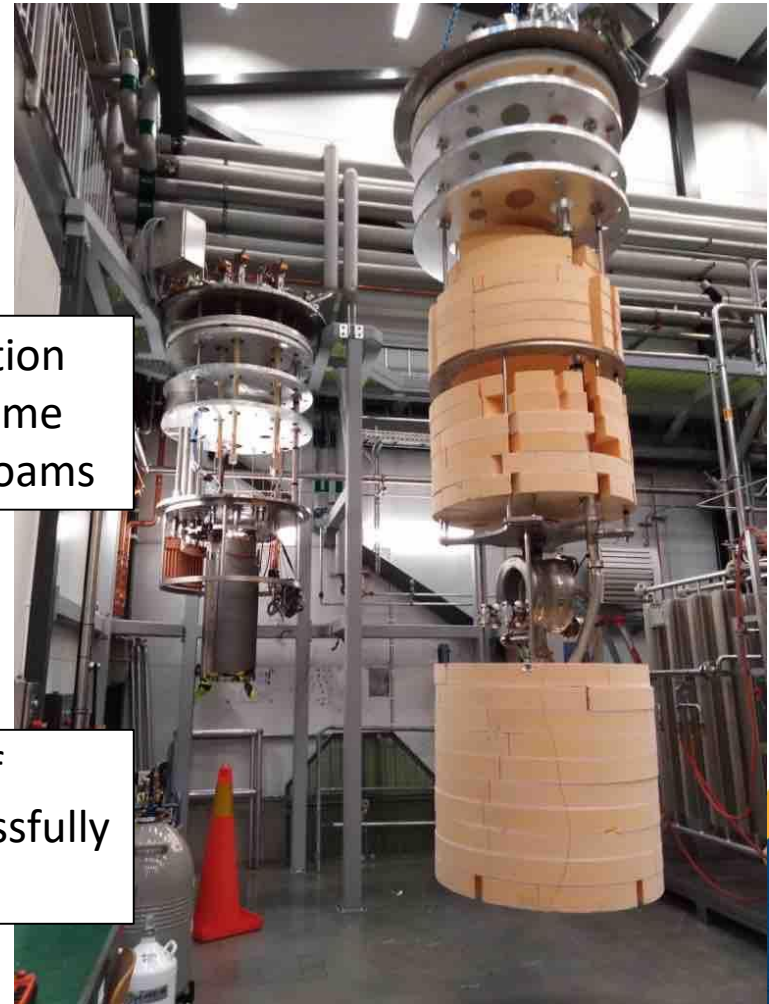
- 3.2m x  $\varnothing$ 1.1m total volume
- 2.65m x  $\varnothing$ 1.1m below lambda plate

Class 10  
equivalent



Flexibly reduction  
of helium volume  
by cryogenic foams

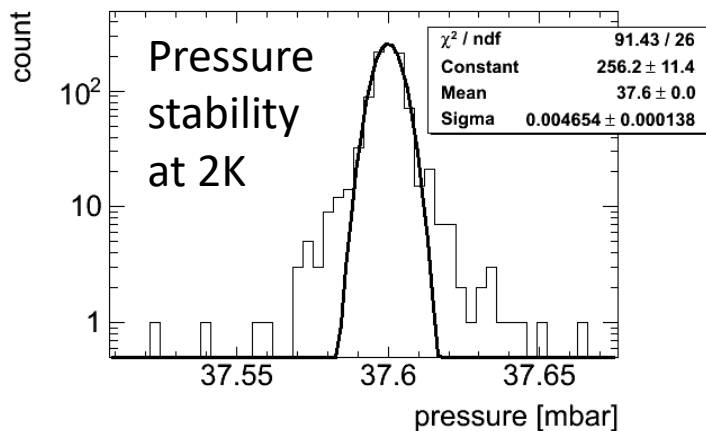
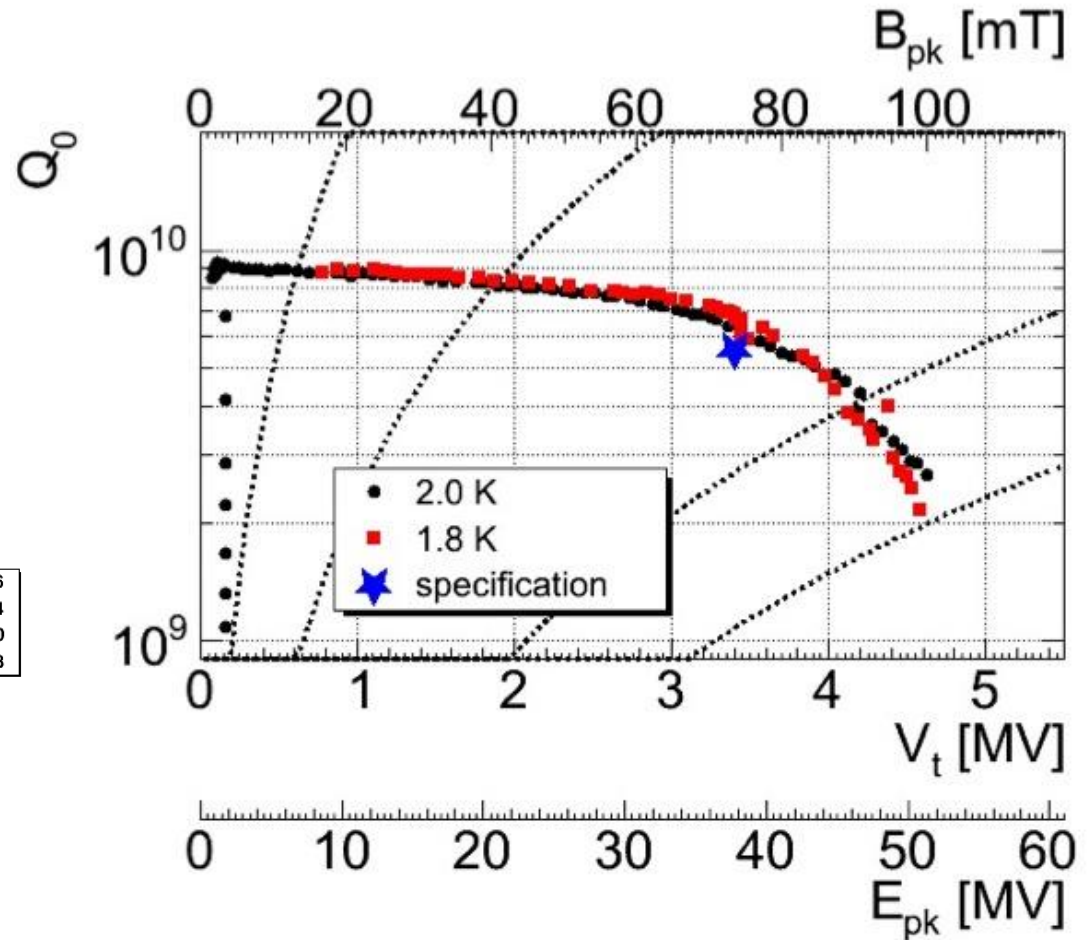
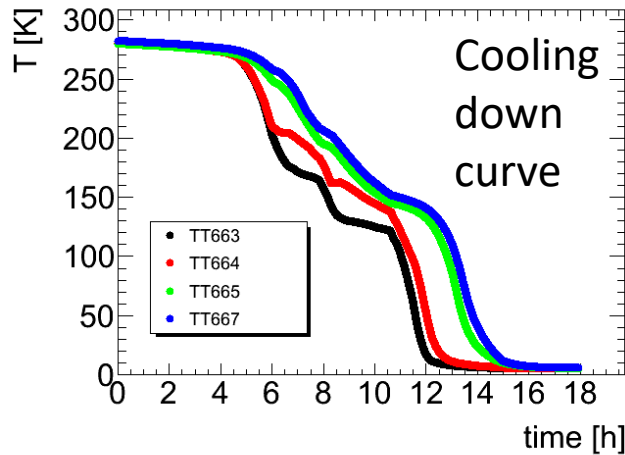
A pick-up antenna fallen off  
during transport was successfully  
fixed in the cleanroom



# WP12.1 FREIA-HNOSS-2020-01 (#4)

arXiv:2011.05210

- Results met project specifications



# WP12.2 CERN XBox Facility



## TASK 12.2 XBOX



The **XBox** facility at CERN, Switzerland, is available for testing of normal conducting RF cavities/structures at X-band frequency.



# WP12.2 CERN XBox - Overview

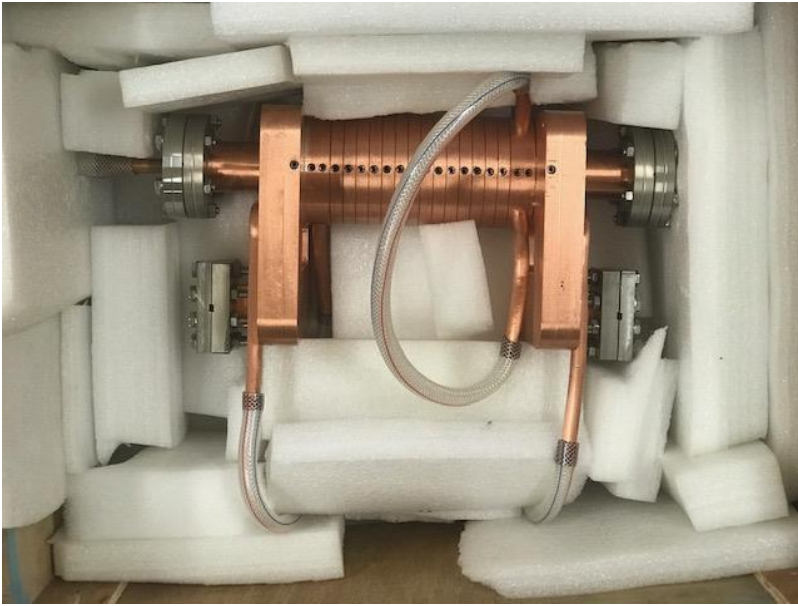
In proposal - 4 projects with a total of ~~6000~~ 7500 access units.

#	Name	Institutes	Status	Access Units	Users
1	Dark current and breakdown Spectrometer	Uppsala University	Completed. Reported and published	1680	6
2	X-band pulse compression chain	PSI and Tsinghua University	Completed. Reported and published, PRAB.	4000	7
3	X-band RF deflecting structure testing	Lancaster University and SARI (Shanghai)	Running. Full remote participation due to Covid pandemic.	(4179)	6
4	Measurement of the Average Power limitation for High Gradient X-band Accelerating Structures for Future Light Sources	Technical University of Eindhoven	Approved. Not carried out due to Covid pandemic.	-	-
<b>TOTAL Achieved Today</b>				<b>9859 (131%)</b>	<b>19</b>





# WP12.2 CERN-XBOX-2019-01 (#3)



SARI (Shanghai) deflector cavity



Lancaster deflector (crab) cavity

## Project 3 X-band RF deflecting structure testing

# WP12.2 CERN-XBOX-2019-01 (#3)

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High-power test of **two** transverse deflecting cavities;

1) so-called crab cavity designed for the CLIC final focus system

- 13 cell structure built by University of Lancaster

2) the deflector for a system to measure longitudinal profiles of very short bunches in XFELs.

- 20 cell structure built by SSRF.

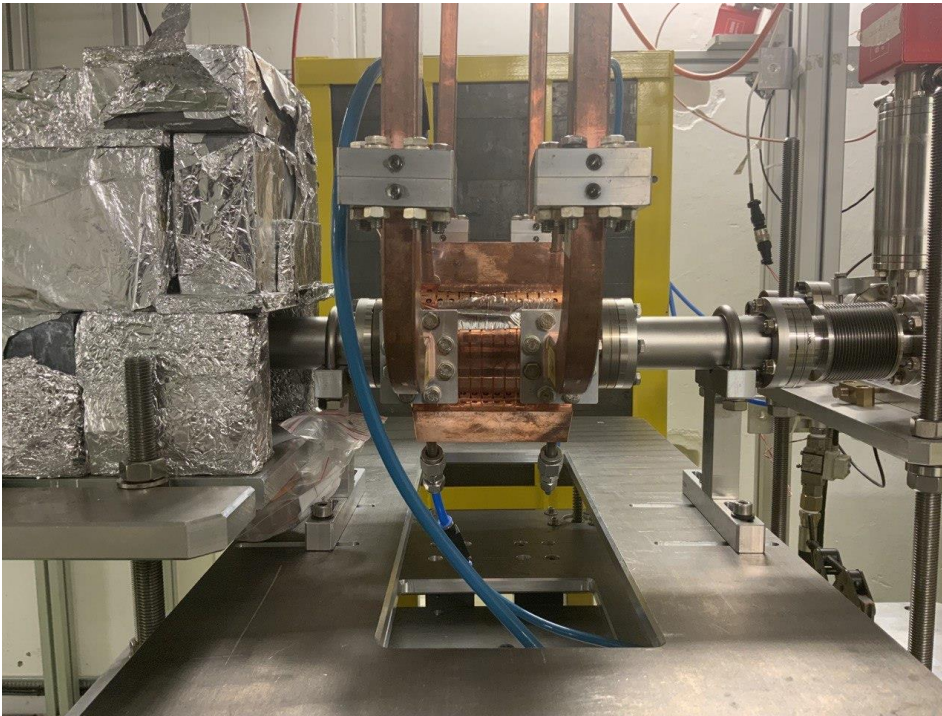
- The two structures were

- high field conditioned and
- now under long-term operation

- in two slots in XBox-3 with input powers up to 40 MW.

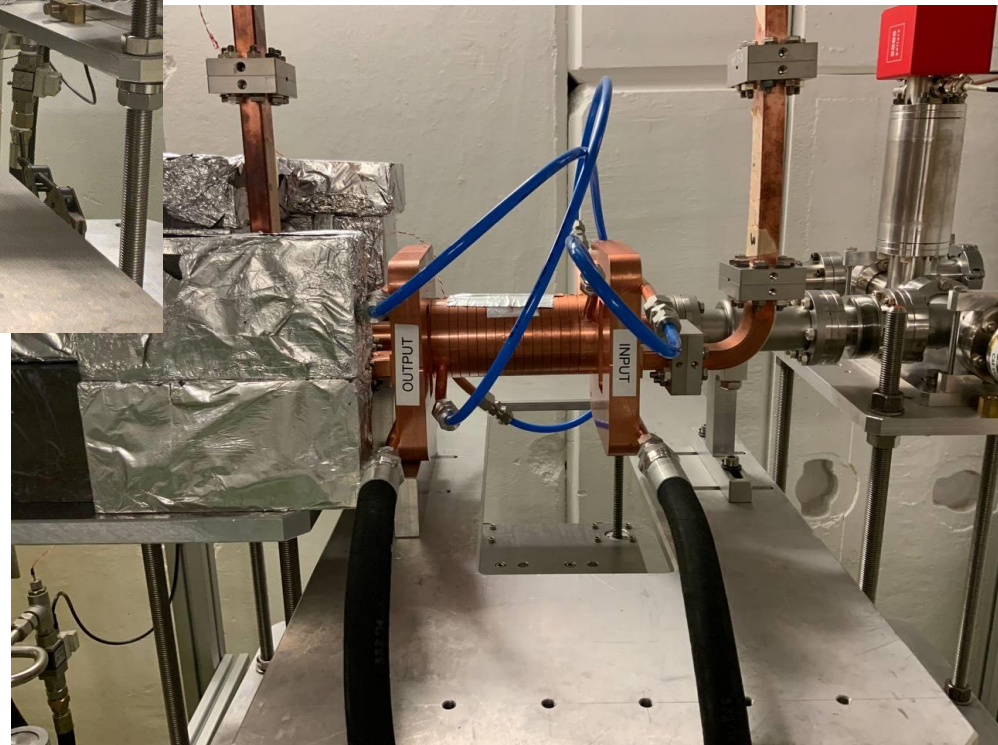
- Publication of results will follow the completion of the run, until the very end of ARIES.

# WP12.2 CERN-XBOX-2019-01 (#3)

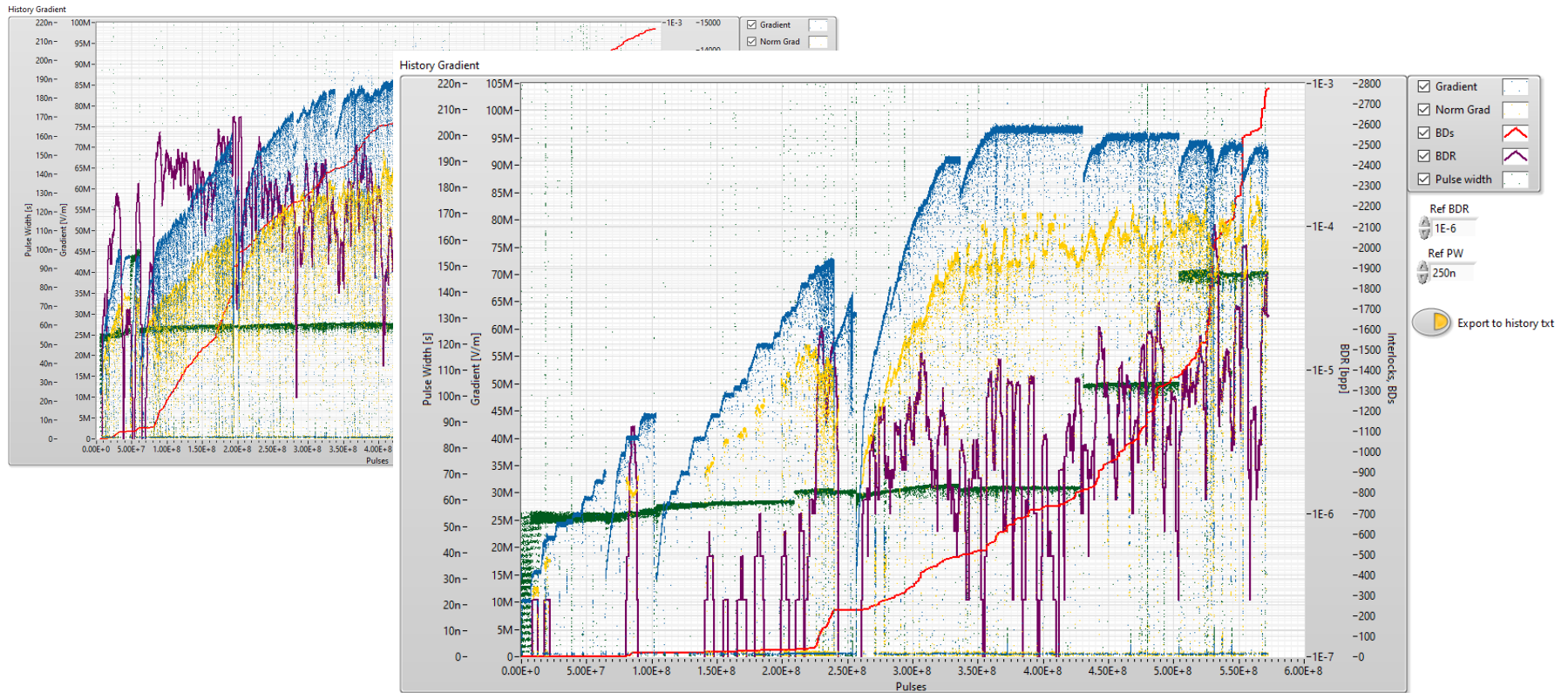


Lancaster crab cavity  
installed in Xbox-3

SSRF deflecting cavity  
installed in Xbox-3



# WP12.2 CERN-XBOX-2019-01 (#3)



## SARI and Lancaster deflecting cavity conditioning histories.

Input power, and corresponding fields, are raised gradually to the operating values, then run at for extended periods at different pulse lengths.

# WP12 TNA - Summary

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- A **typical User Project is quite complex**, often requires some form of approval at the level of the proposing institutes, so lead times are long.
- ARIES TNA has become **very successful** for the facilities and its users!
- We could open to new users with **exciting projects**.
- User **response has been very positive** and overall the users were very pleased to receive these access possibilities.
- It was a **great experience** which we will to **continue** in...

