UPPSALA
UNIVERSITET

ESS weekly meeting (W21)

A. Miyazaki et al.

Done in W21, plan in W22

W21 2021			next CM	CM under test		previous CM
			CM01	**CM03**		**CM05**
THU	20-maj	m	ready for shppping to Uppsala	connect beam vacuum, leak test, pumping		close the box
		a				
FRI	21-maj	m		RF preparation	He leak test	GPS mounted
		a				inside the box
SAT	22-maj			coupler warm conditioning		
SUN	23-maj					
MON	24-maj	m			check safety valve RV90	pick-up at UU
		a				arrive at ESS
TUE	25-maj	m			SV90 fixed	
		a			purging	finalize reports to ESS and Orsay
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		a			N2 shield cooling	
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THU	03-jun	m	**arrive at UU**	Heat load measurements		
		a				
FRI	04-jun	m	thermalization at UU			
		a		warming up		

done

We aim at finishing CM03 test by the end of W22

We expect to receive CM01 in one week time

A. Miyazaki, ESS meeting W20

Done in W21, plan in W22

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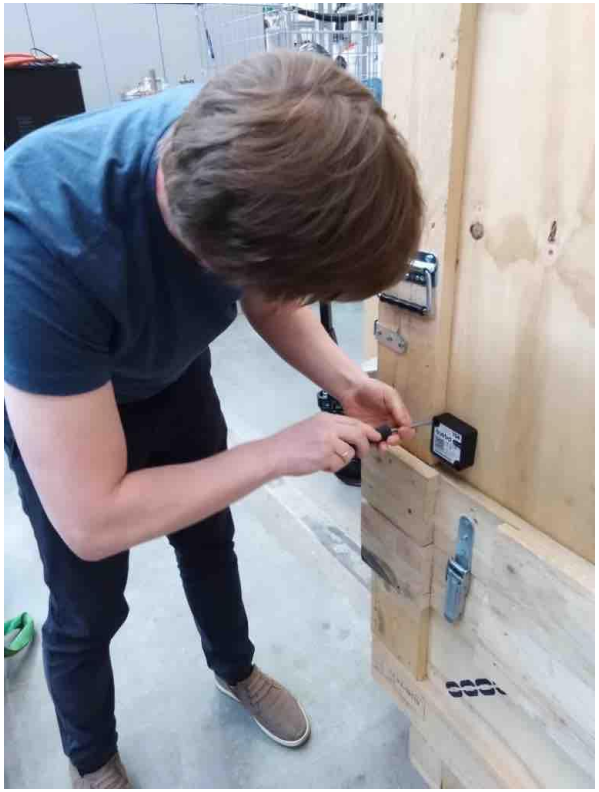
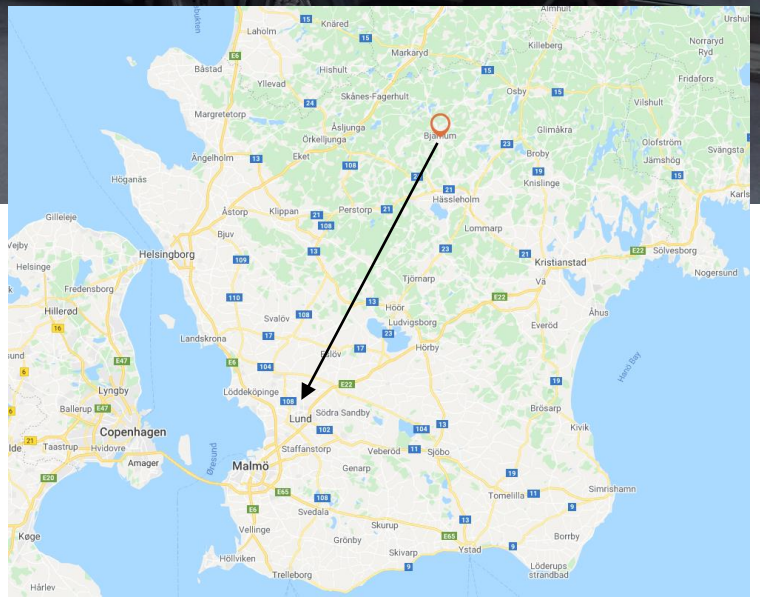
A. Miyazaki, ESS meeting W20

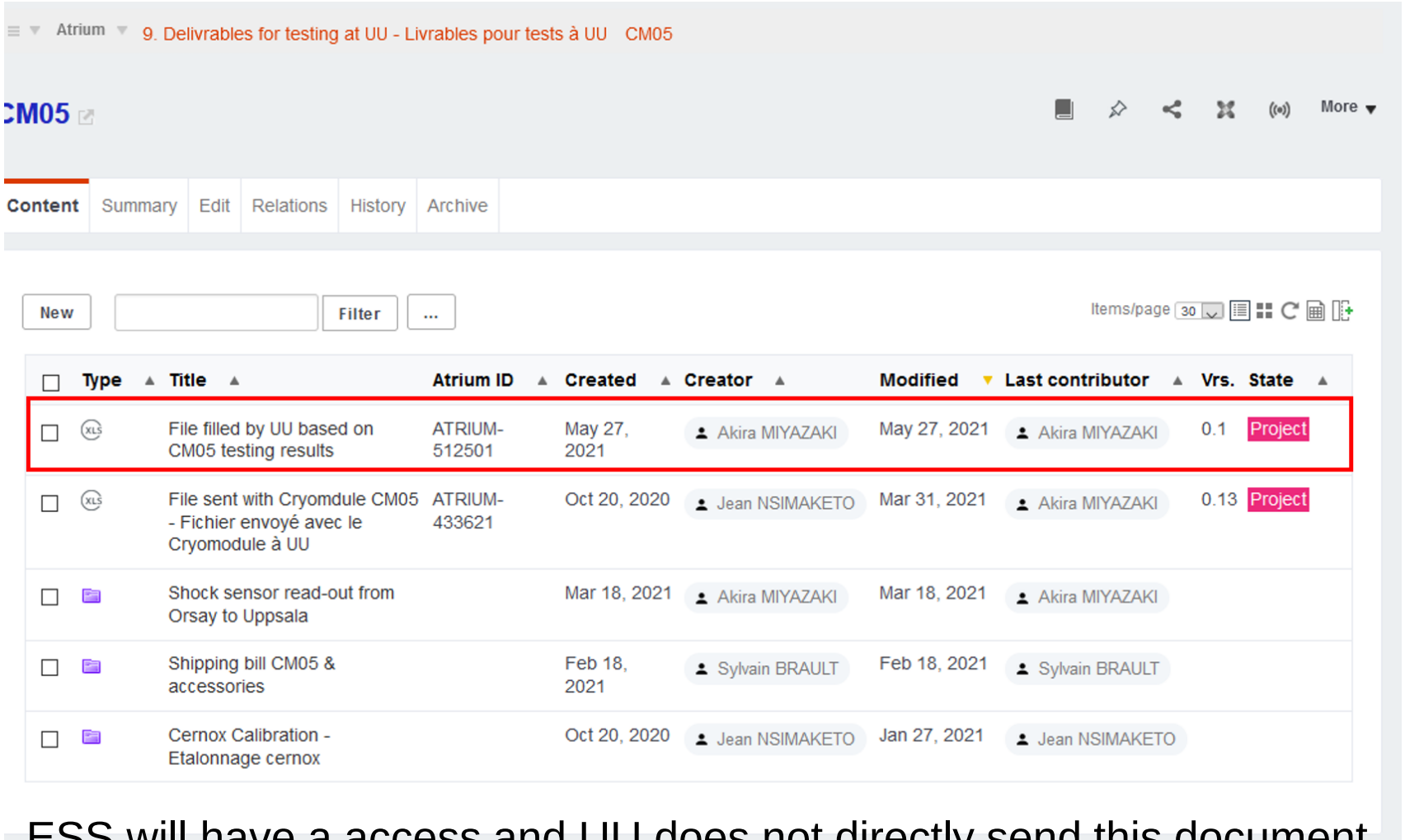
CM05 departure





- GPS tracking worked
- Data sheet uploaded to Atrium
- Report to be circulated

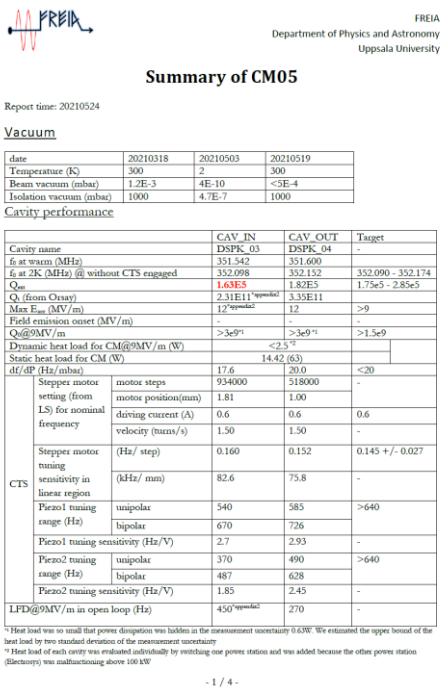
Data sheet (final ver.) uploaded to Atrium



Type	Title	Atrium ID	Created	Creator	Modified	Last contributor	Vrs.	State
XLS	File filled by UU based on CM05 testing results	ATRIUM-512501	May 27, 2021	Akira MIYAZAKI	May 27, 2021	Akira MIYAZAKI	0.1	Project
XLS	File sent with Cryomdule CM05 - Fichier envoyé avec le Cryomodule à UU	ATRIUM-433621	Oct 20, 2020	Jean NSIMAKETO	Mar 31, 2021	Akira MIYAZAKI	0.13	Project
	Shock sensor read-out from Orsay to Uppsala		Mar 18, 2021	Akira MIYAZAKI	Mar 18, 2021	Akira MIYAZAKI		
	Shipping bill CM05 & accessories		Feb 18, 2021	Sylvain BRAULT	Feb 18, 2021	Sylvain BRAULT		
	Cernox Calibration - Etalonnage cernox		Oct 20, 2020	Jean NSIMAKETO	Jan 27, 2021	Jean NSIMAKETO		

ESS will have a access and UU does not directly send this document (but if something very urgent, personally on demand...☺)

Final report of CM05



FREIA
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Uppsala University

Summary of CM05

Report time: 20210524

Vacuum

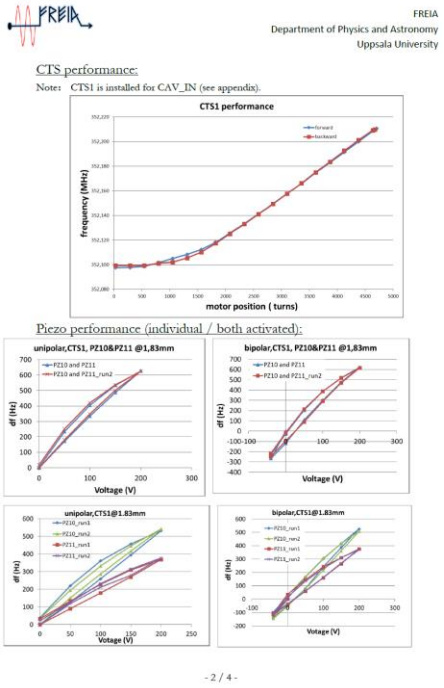
date	20210318	20210503	20210519
Temperature (K)	300	2	300
Beam vacuum (mbar)	1.2E-3	4E-10	<5E-4
Isolation vacuum (mbar)	1000	4.7E-7	1000

Cavity performance

			CAV_IN	CAV_OUT	Target
Cavity name			DSPK_03	DSPK_04	-
f_0 at warm (MHz)			351.542	351.600	
f_0 at 2K (MHz) @ without CTS engaged			352.098	352.152	352.090 - 352.174
Q_{ext}			1.63E5	1.82E5	1.75e5 - 2.85e5
Q_L (from Orsay)			2.31E11 *appendix2	3.35E11	
Max E_{acc} (MV/m)			12 *appendix2	12	>9
Field emission onset (MV/m)			-	-	-
Q_0@9MV/m			>3e9*1	>3e9*1	>1.5e9
Dynamic heat load for CM@9MV/m (W)			<2.5 *2		
Static heat load for CM (W)			14.42 (63)		
df/dP (Hz/mbar)			17.6	20.0	<20
CTS	Stepper motor setting (from LS) for nominal frequency	motor steps	934000	518000	-
		motor position(mm)	1.81	1.00	
		driving current (A)	0.6	0.6	0.6
		velocity (turns/s)	1.50	1.50	-
	Stepper motor tuning sensitivity in linear region	(Hz/ step)	0.160	0.152	0.145 +/- 0.027
		(kHz/ mm)	82.6	75.8	-
	Piezo1 tuning range (Hz)	unipolar	540	585	>640
		bipolar	670	726	
	Piezo1 tuning sensitivity (Hz/V)		2.7	2.93	-
	Piezo2 tuning range (Hz)	unipolar	370	490	>640
		bipolar	487	628	
	Piezo2 tuning sensitivity (Hz/V)		1.85	2.45	-
LFD@9MV/m in open loop (Hz)			450*appendix2	270	-

*1 Heat load was so small that power dissipation was hidden in the measurement uncertainty 0.63W. We estimated the upper bound of the heat load by two standard deviation of the measurement uncertainty
*2 Heat load of each cavity was evaluated individually by switching one power station and was added because the other power station (Electrocorp) was malfunctioning above 100 kW

- 1 / 4 -



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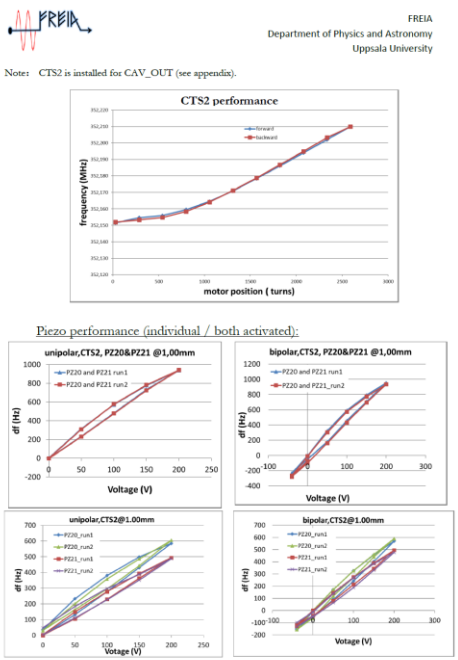
Uppsala University

CTS performance:

Note: CTS1 is installed for CAV_IN (see appendix).

Piezo performance (individual / both activated):

- 2 / 4 -



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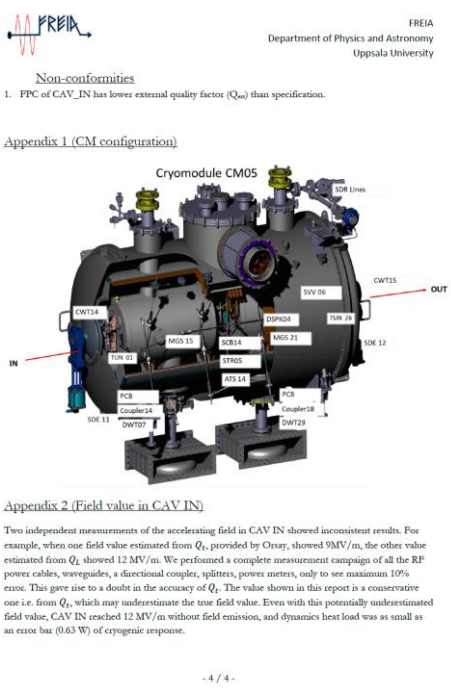
Note: CTS2 is installed for CAV_OUT (see appendix).

Piezo performance (individual / both activated):

- 3 / 4 -



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Non-conformities

1. FPC of CAV_IN has lower external quality factor (Q_{ext}) than specification.

Appendix 1 (CM configuration)

Appendix 2 (Field value in CAV IN)

Two independent measurements of the accelerating field in CAV IN showed inconsistent results. For example, when one field value estimated from Q_L, provided by Orsay, showed 9MV/m, the other value estimated from Q_L showed 12 MV/m. We performed a complete measurement campaign of all the RF power cables, waveguides, a directional coupler, splitters, power meters, only to see maximum 10% error. This gave rise to a doubt in the accuracy of Q_L. The value shown in this report is a conservative one i.e. from Q_L, which may underestimate the true field value. Even with this potentially underestimated field value, CAV IN reached 12 MV/m without field emission, and dynamics heat load was as small as an error bar (0.63 W) of cryogenic response.

- 4 / 4 -

- Concise report in 4 pages to be useful for RF commissioning at ESS
- The pdf version will be circulated after this meeting

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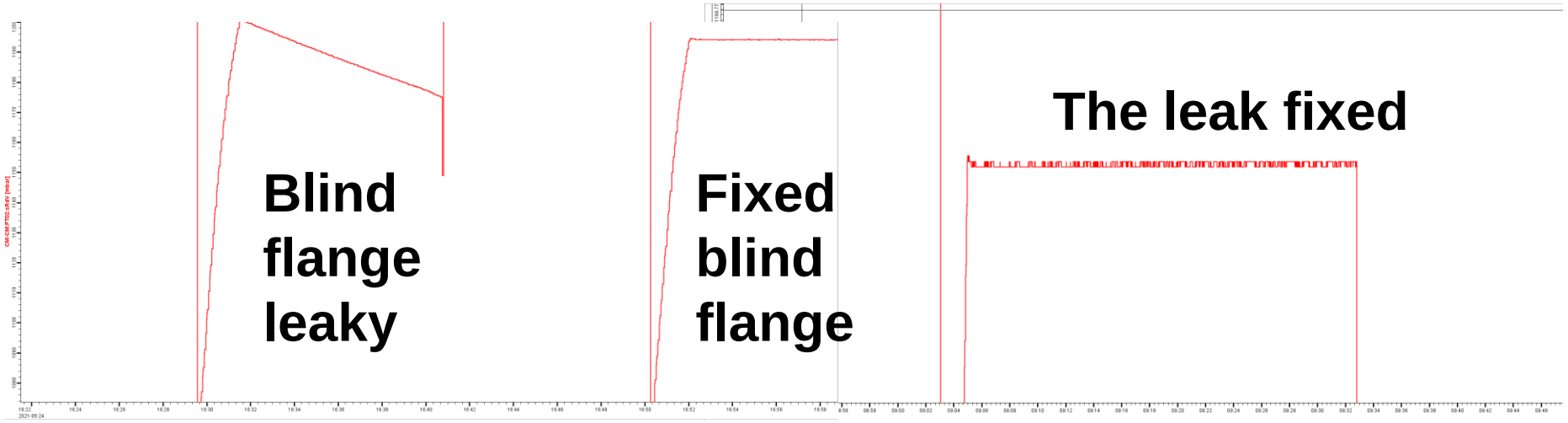
A. Miyazaki, ESS meeting W20

He leak was through the safety valve SV90



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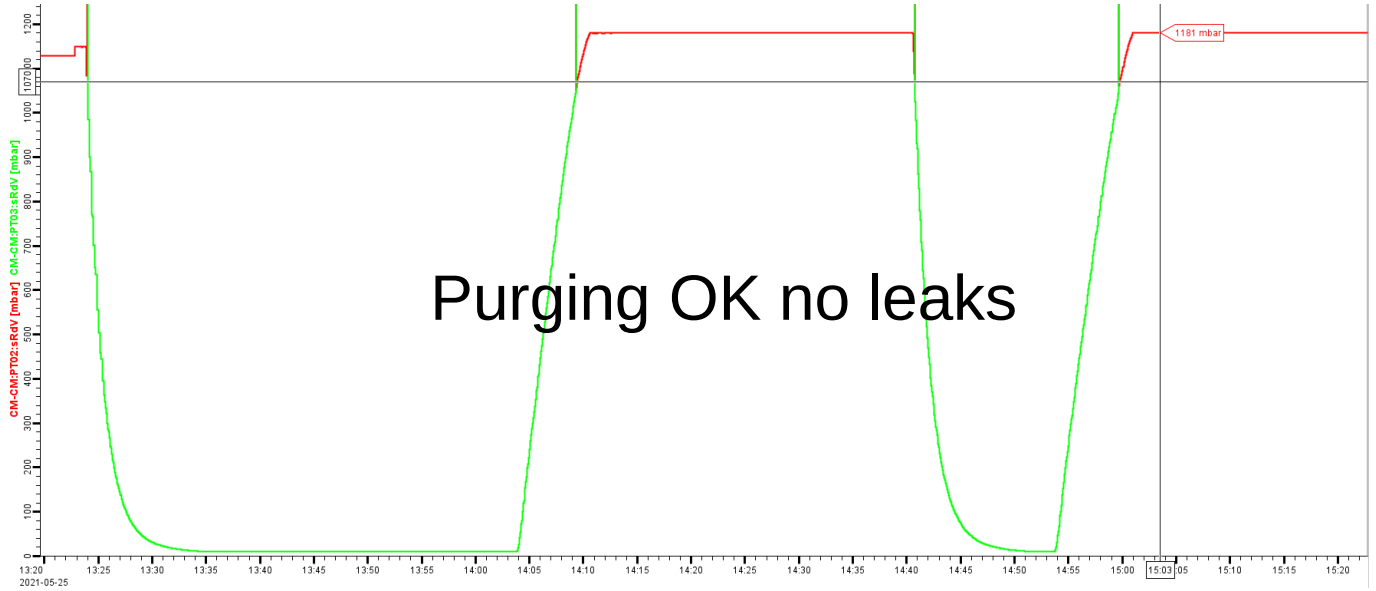
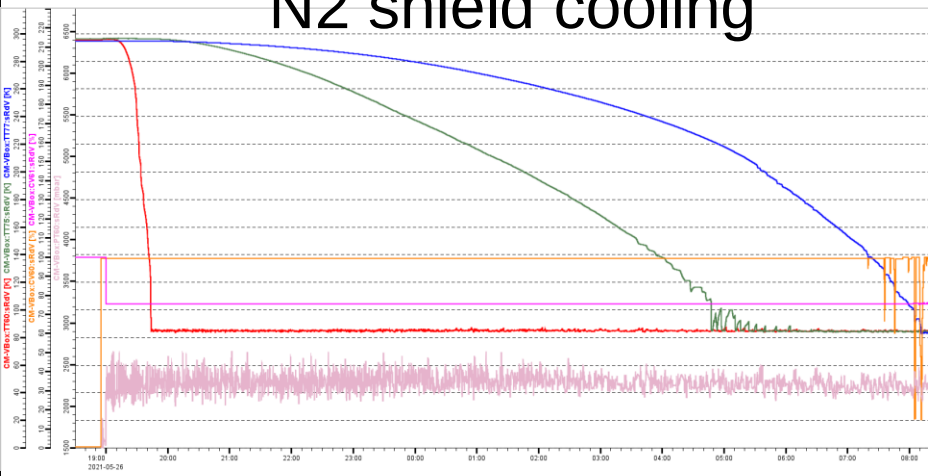
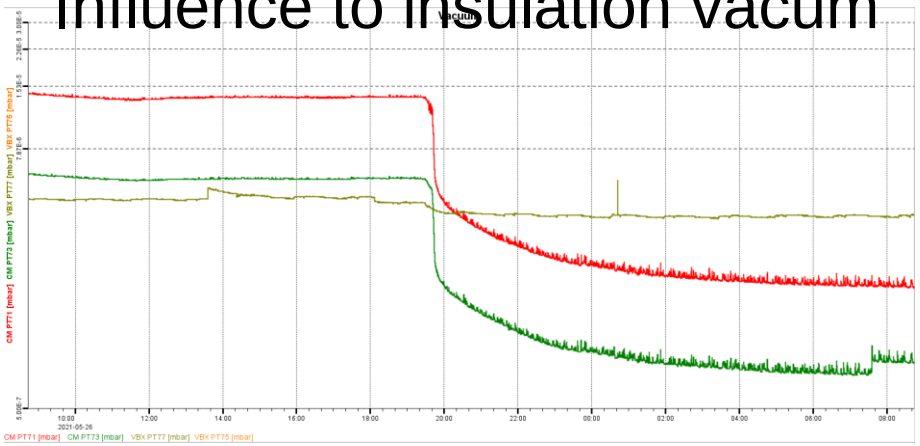
He circuit purging & N2 shield cooling



N2 shield cooling



Influence to insulation vacum



OK

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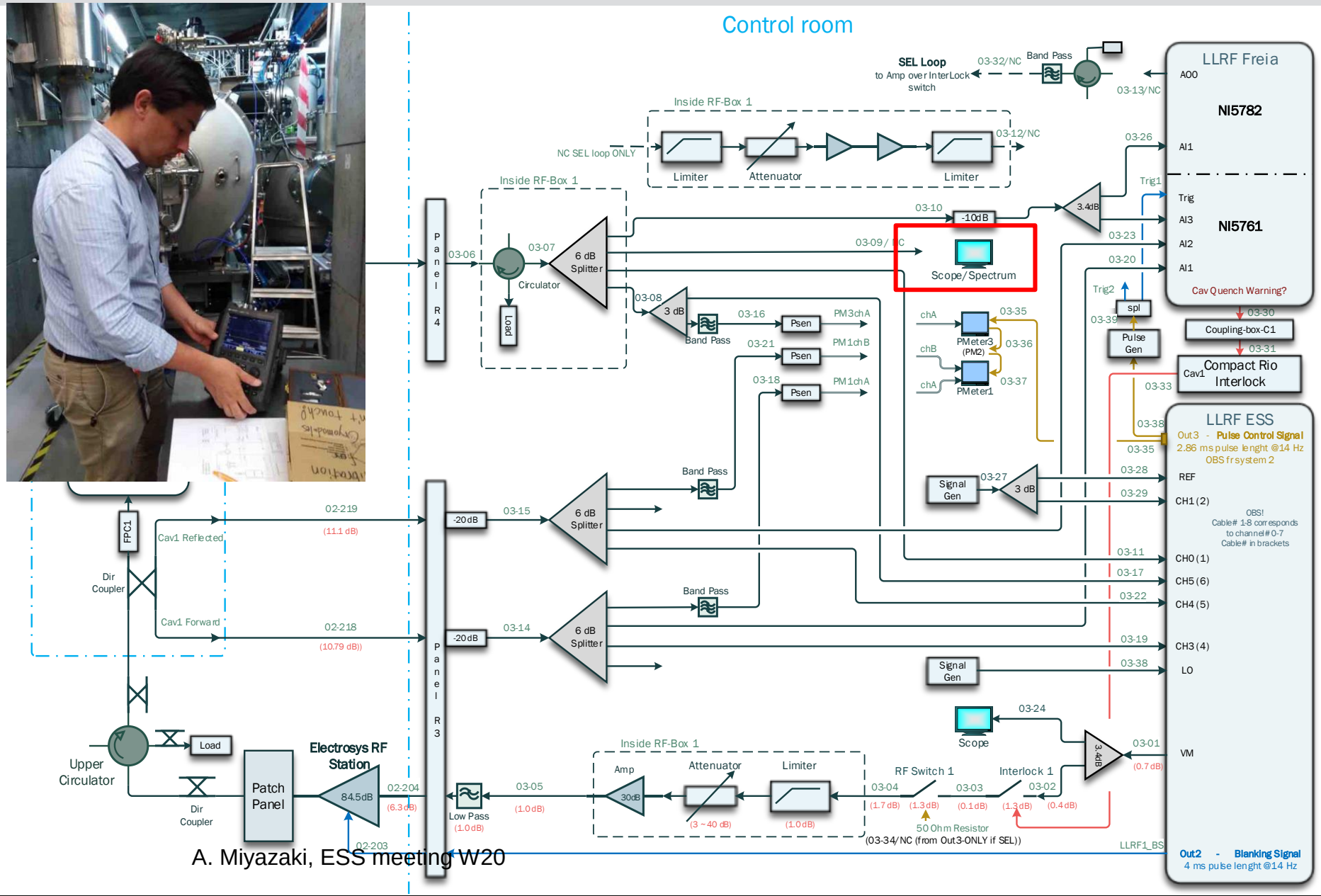
RF calibration → one finding



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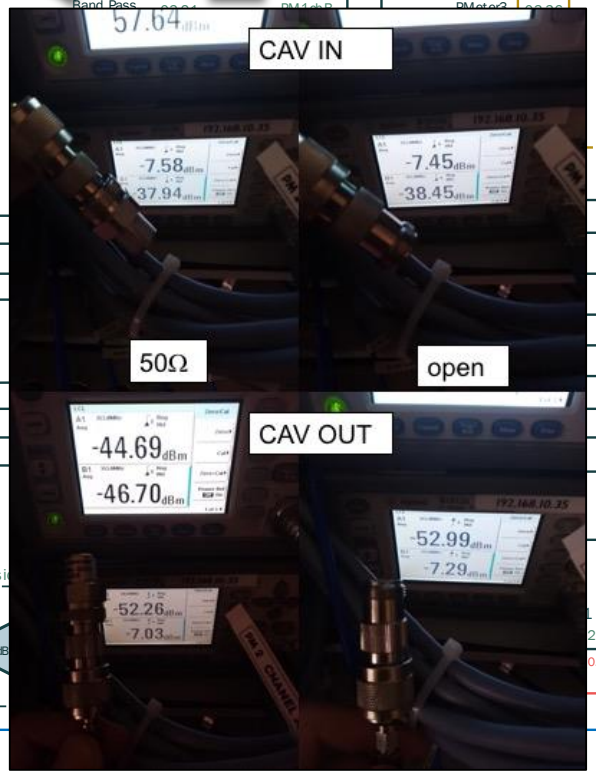
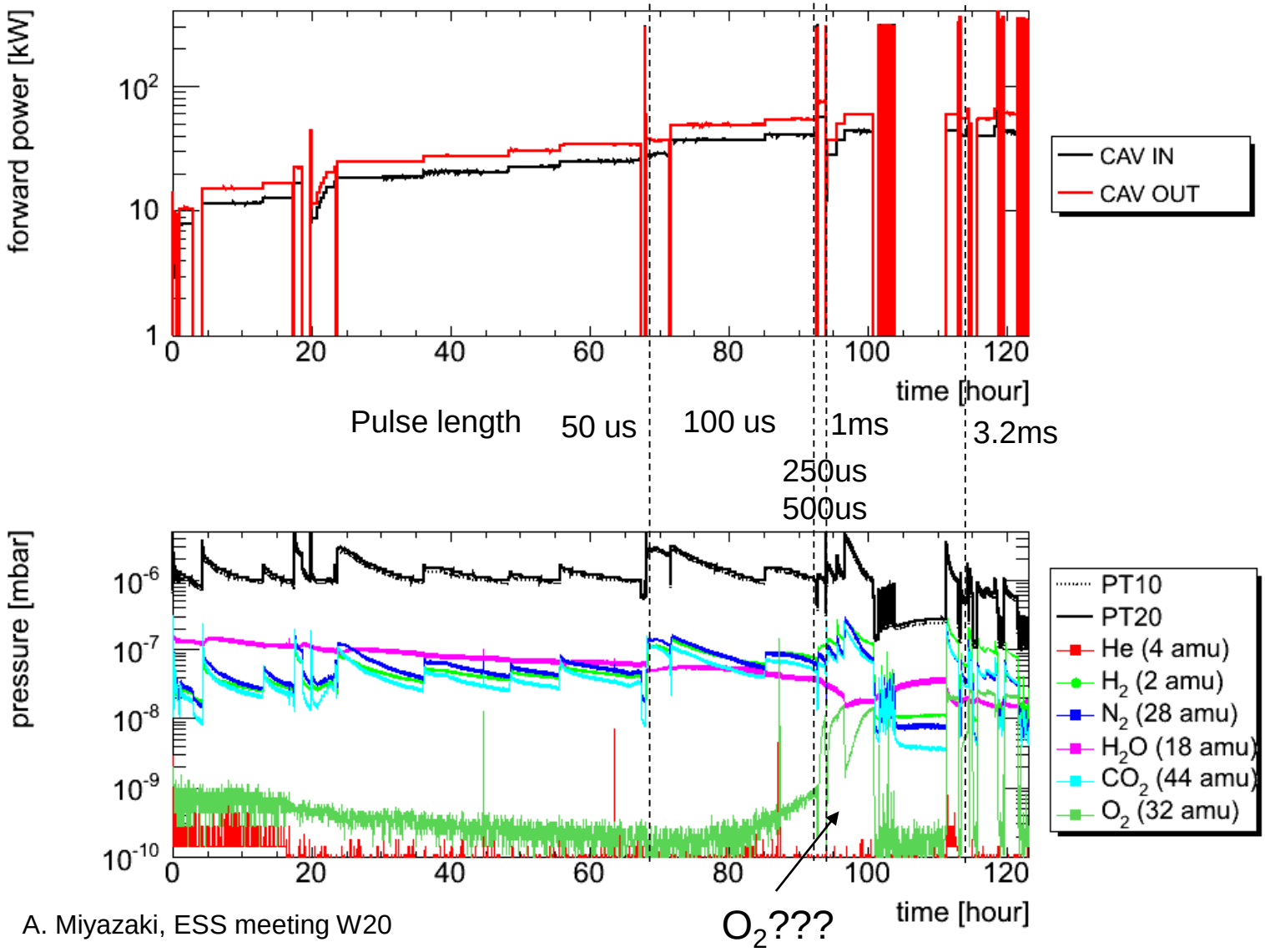


- Cable calibration is consistent with previous measurement
- One port may not be properly terminated during last test with CM05
- Still not enough to explain the power anomaly found in CM05 CAV IN

Coupler warm conditioning

One pump, two stations simultaneously



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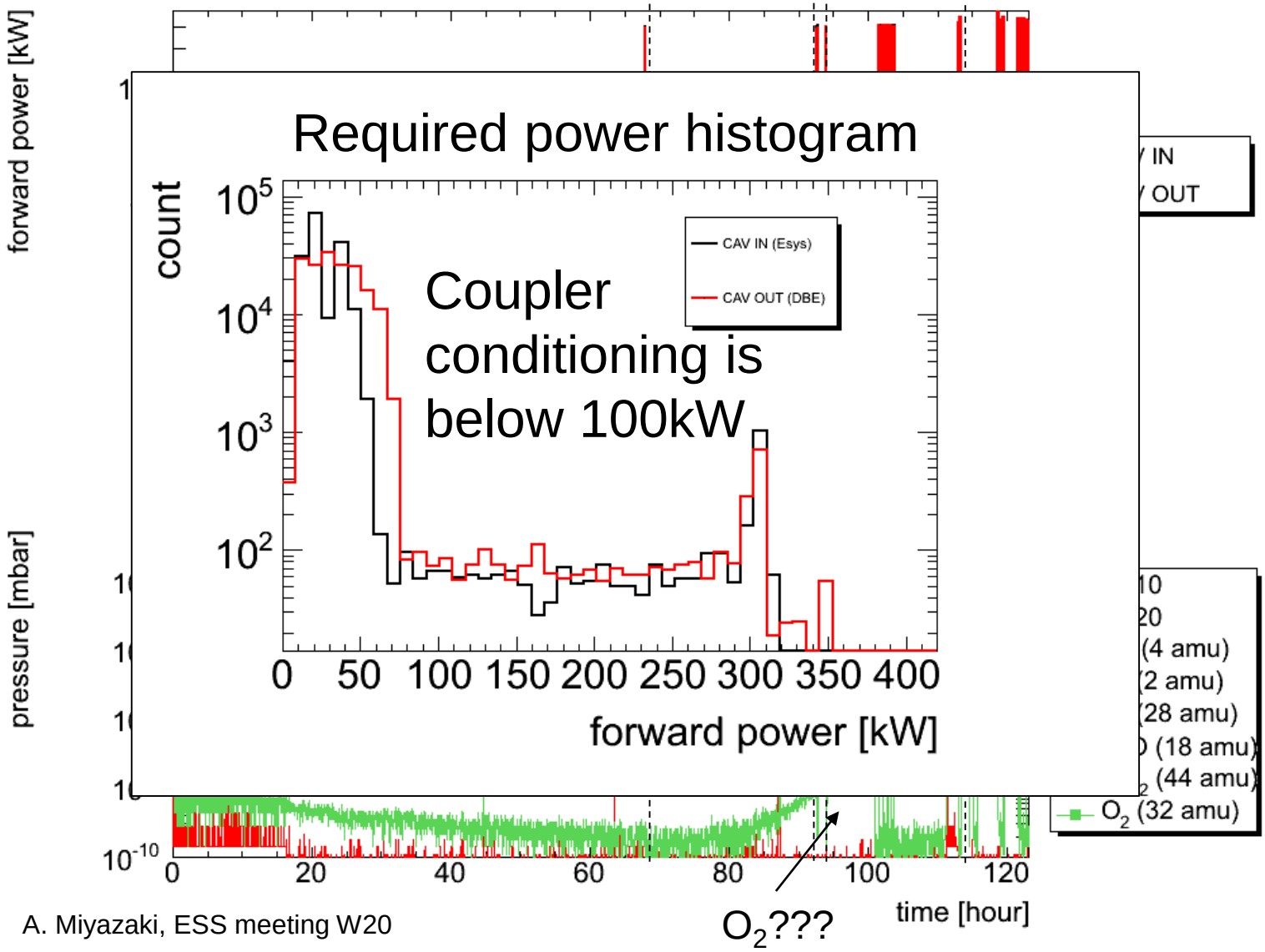

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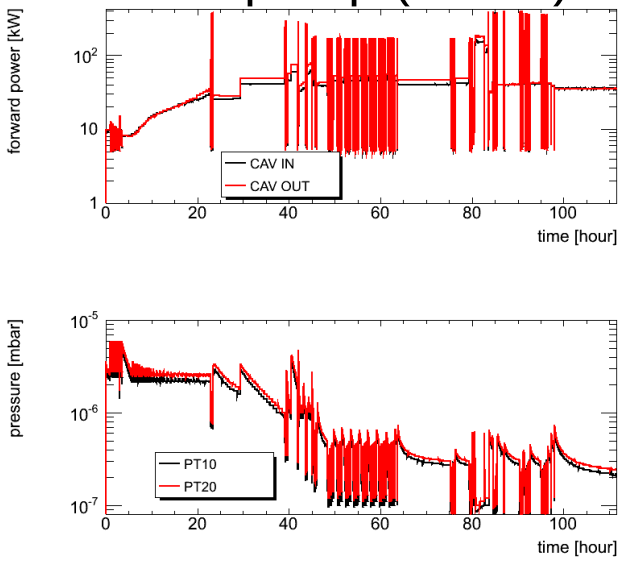
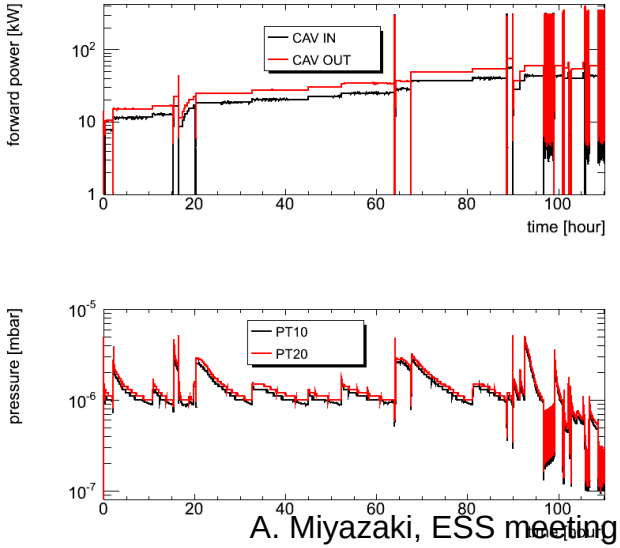
One pump vs two pumps (without down time)

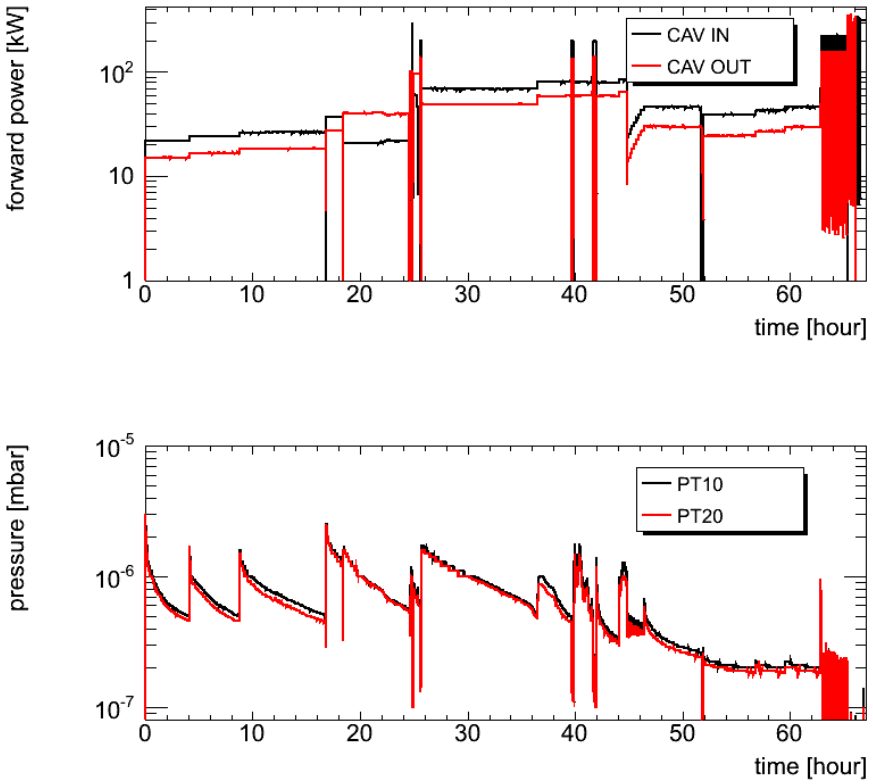
One pump (CM02)



One pump (CM03)

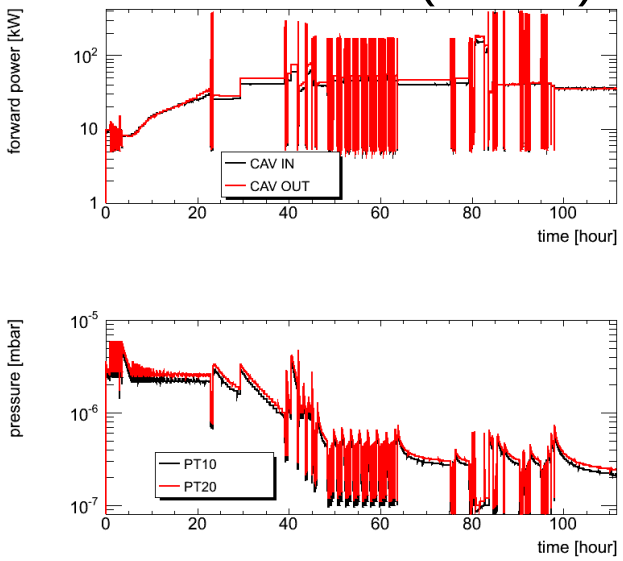


Two pumps (CM05)

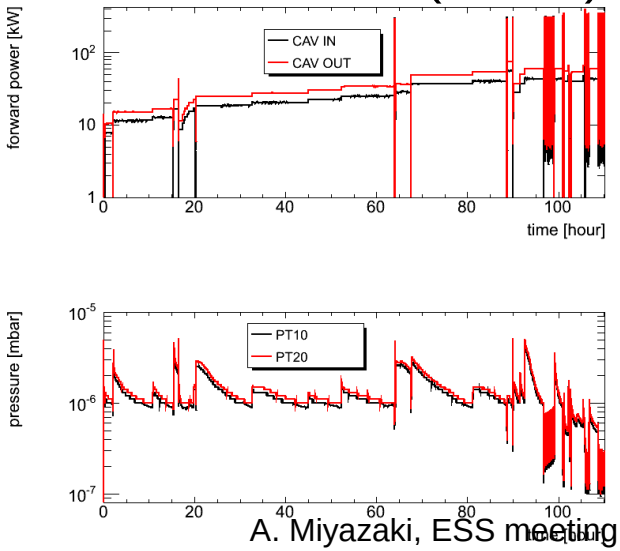


Two stations vs one station(without down time)

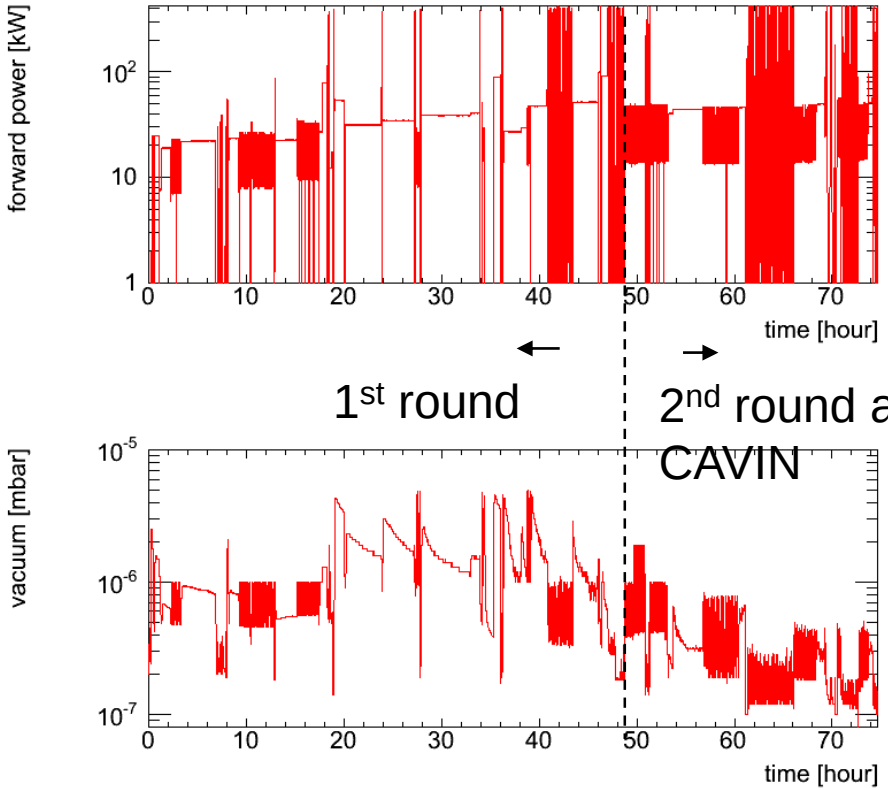
Two stations (CM02)



Two stations (CM03)



One station (prototype)



X 2 (two cavities)

Benefit of **two** stations and **two** pumps

- From one station to two stations
  - From (50+25)x2=150 h to 110 h
  - Gain 40 h
- From one pump to two pumps
  - From 110 h to 70 h
  - Gain other 40 h
- Total gain
  - From 150 h to 70 h (factor **two**)

- With two stations and two pumps, coupler warm conditioning would take 70 hours = **3 days (for example Friday, Saturday, Sunday)**
- The second pumping station seems like a big benefit for us to fit the planning into one week (if stations do not die...)

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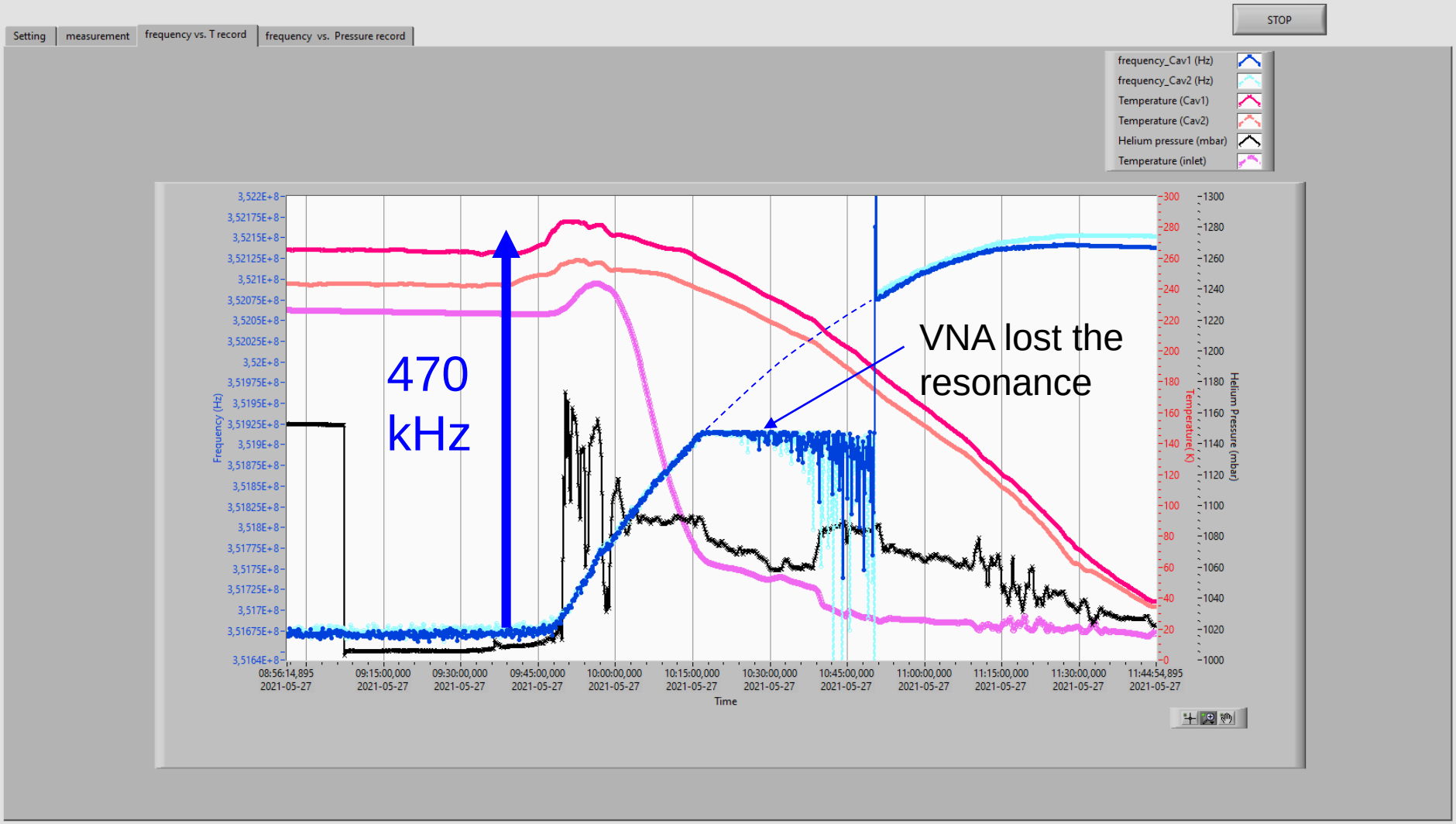
A. Miyazaki, ESS meeting W20

4K cooling progress



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Busy week but feasible ☺

A. Miyazaki, ESS meeting W20