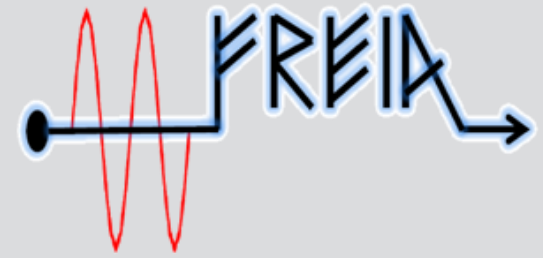




UPPSALA
UNIVERSITET



ESS weekly meeting (2022 W03)

A. Miyazaki et al.

FREIA Planning		2022-01-19		2022														
		January					February					March				Apr		
Equipment	Responsible	3	10	17	24	31	7	14	21	28	7	14	21	28	4	11		
		week #																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Liquefier & 2K pumps	Esat		█	█	█			█	█			█	█					
RF power stations	Mykhailo		█		█		█		█		█		█		█			
Cryomodule test stan	Akira		█	CM07	█		█	CM08	█		█	CM09	█		█			

We are here

CM07 to ESS
CM09 from Orsay

CM08 to ESS
CM10 from Orsay

- Optimistic planning without any contingency
- We aim at testing three modules before the Easter holidays



W02 & W03 progress & W04 plan



week		W02											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		10-jan		11-jan		12-jan		13-jan		14-jan		15-jan	16-jan
		m	a	m	a	m	a	m	a	m	a		
present CM	CM07	restart power station, water cooling		coupler warm conditioning				purging		N2 cooling			
next CM	CM08	New Beckhoff PLC test											

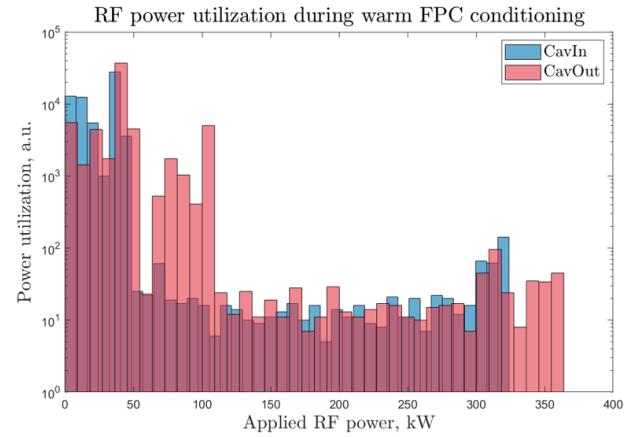
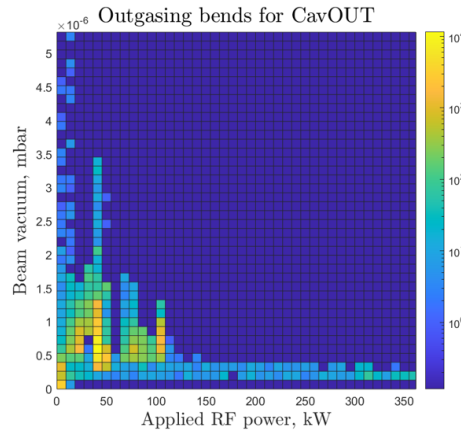
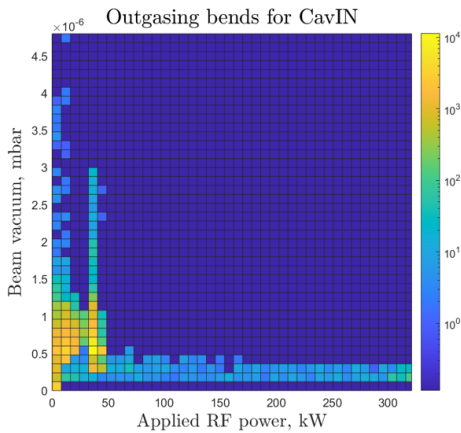
week		W03											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		17-jan		18-jan		19-jan		20-jan		21-jan		22-jan	23-jan
		m	a	m	a	m	a	m	a	m	a		
present CM	CM07	Filling Dewar	LHe cooling	4K filling		2K pumping	RF calibration interlock setup	MP conditioning		CTS test (Phytron?)			
next CM	CM08	Beckhoff PLC preparation		coupler cold conditioning	Beckhoff PLC test through the long cable to the bunker								

We are here

week		W04											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		24-jan		25-jan		26-jan		27-jan		28-jan		29-jan	30-jan
		m	a	m	a	m	a	m	a	m	a		
present CM	CM07	CTS test with Beckhoff		heat load measurement		start warming up	warming up		vent insulation vacuum	warming up completed	disconnect pumps		
next CM	CM08	doorknob mounting											
next next CM	CM09	preparation at Orsay											

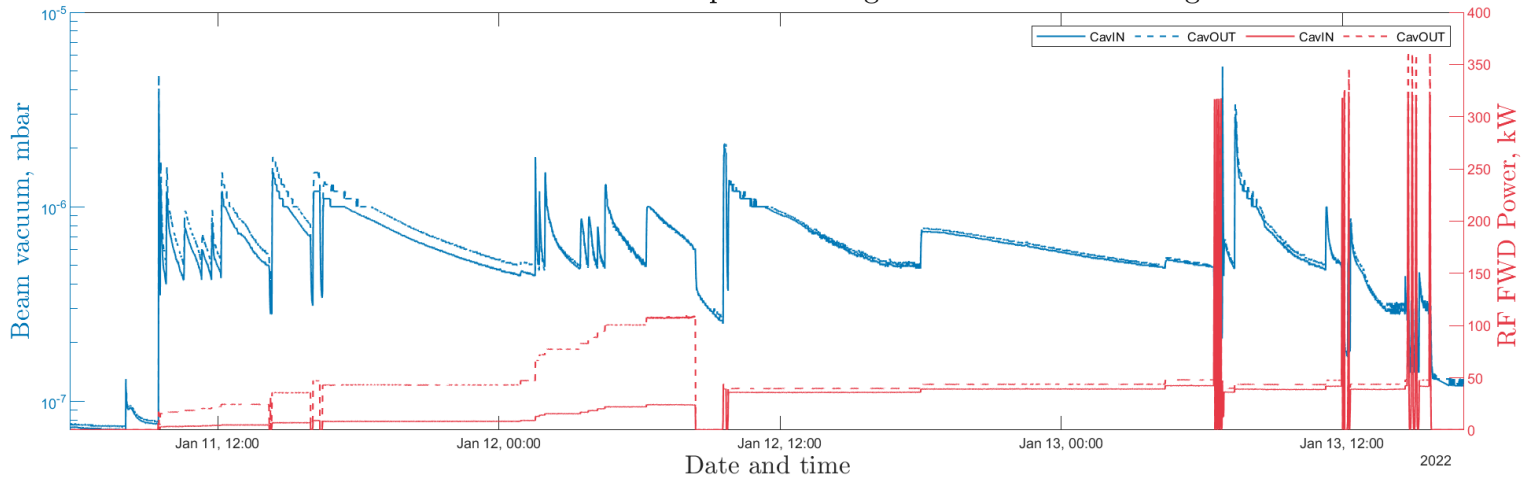
Test CTS with Phytron first and then test Beckhoff with the verified CTS

CM07: coupler warm conditioning



Total time: 54h 20m / Down time: 1h 25m (technical intervention only)

Beam vacuum and RF FWD power during warm FPC conditioning

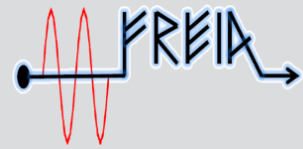


Courtesy Mysha

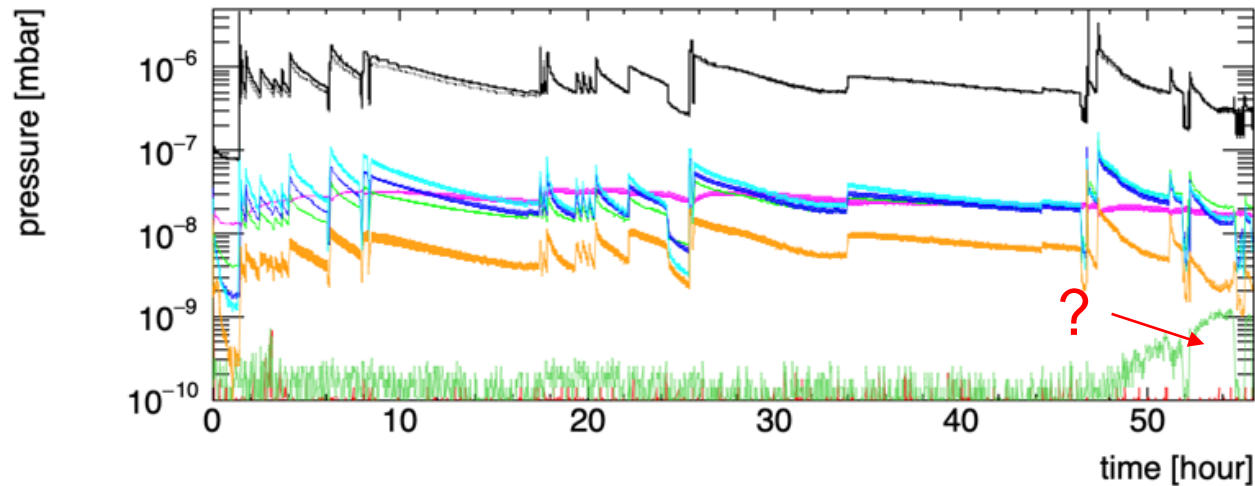
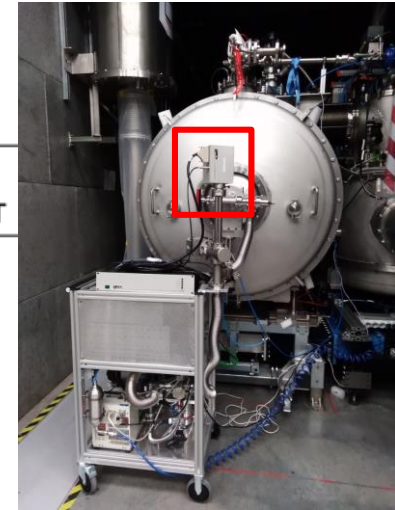
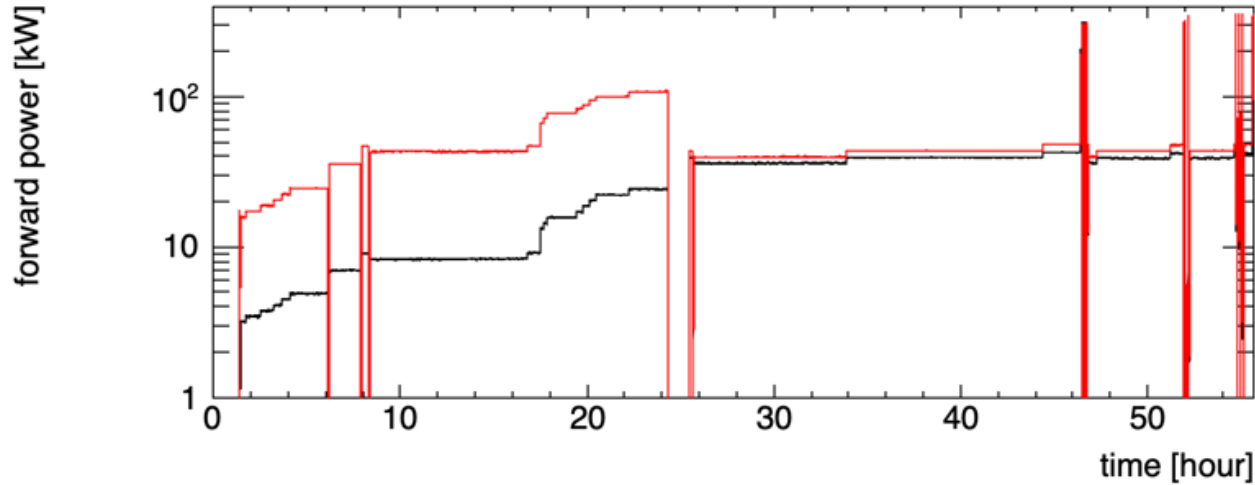
LLRF pulse width [us]



Out gassing during coupler conditioning

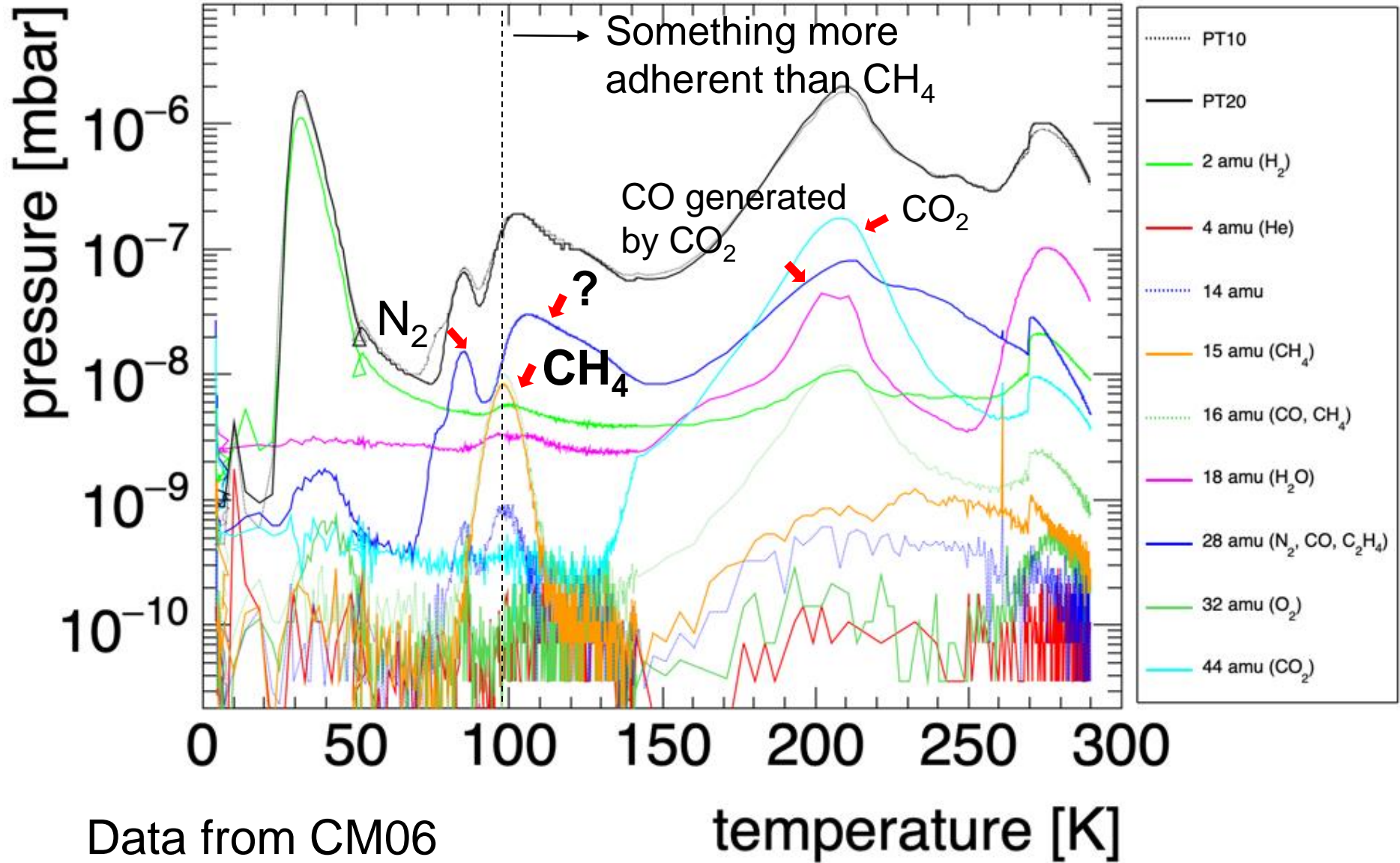


RGA



CO, C₂H₄, etc

Cf. Outgassing from cavities during warming up



Tunneling current

$$J \propto \exp\left(-6.53 \times 10^6 \frac{\phi^{3/2}}{\beta E}\right)$$

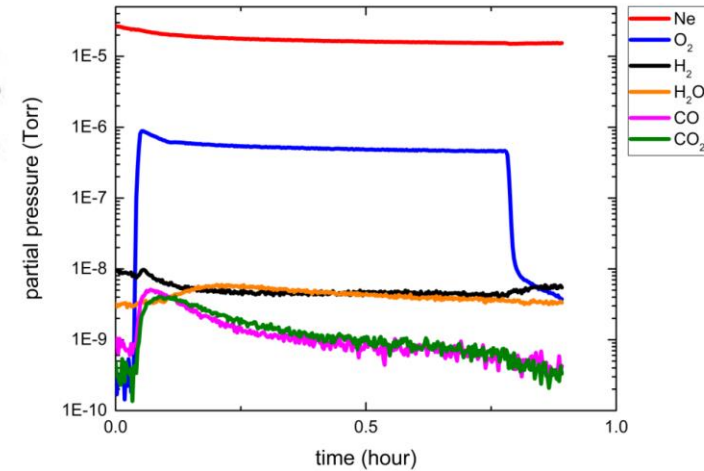
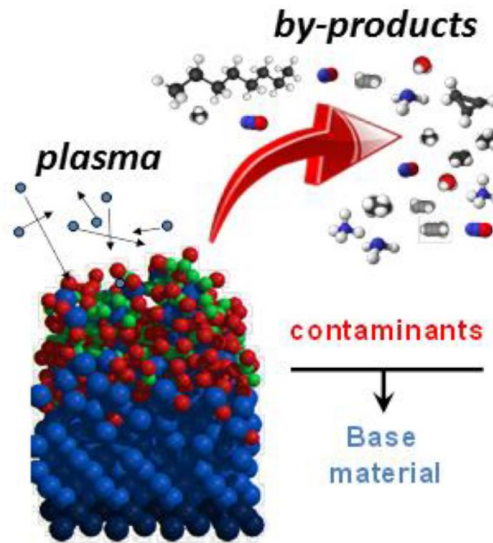
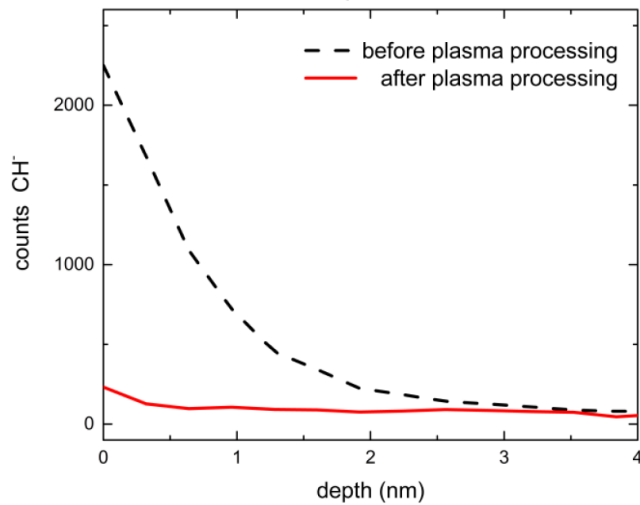
- Polycrystalline niobium's surface work function $\phi \sim 4.3$ eV
- Surface pentoxide (Nb_2O_5) $\phi \sim 5.2 - 5.3$ eV
- Surface monoxide (NbO) $\phi \sim 4.2$ eV
- **Carbonaceous layer $\phi \sim 3.6$ eV**

<https://www.osti.gov/servlets/purl/1234337>

Plasma processing to get rid of CH from the surface

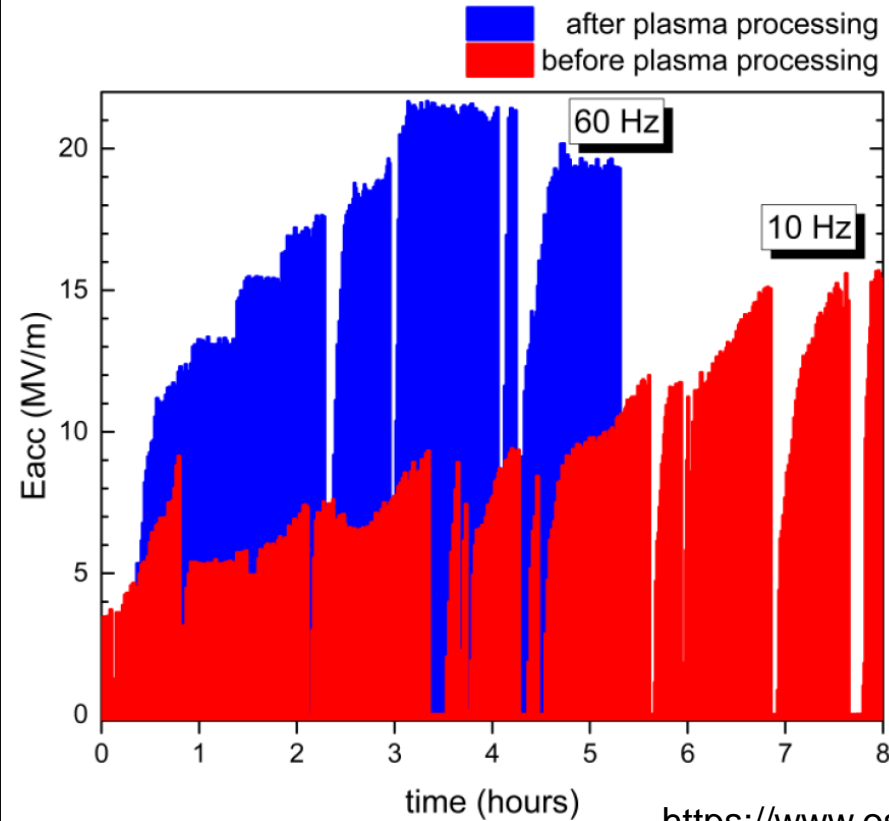
Study at SNS

15 min of active plasma over 3 hours

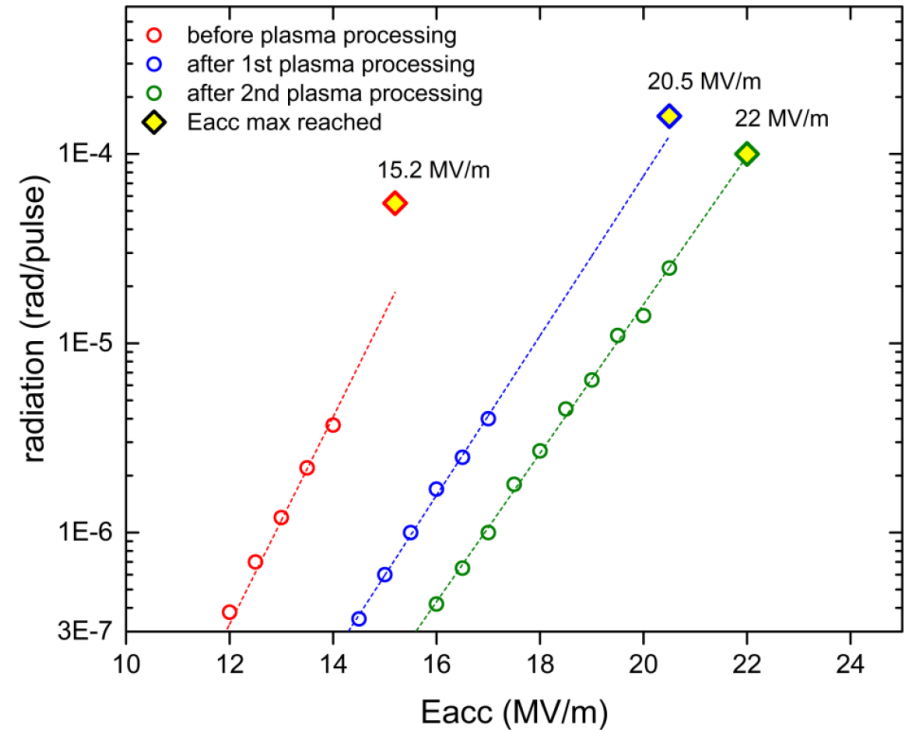


E_{acc} reach was increased

Radiation dose decreased

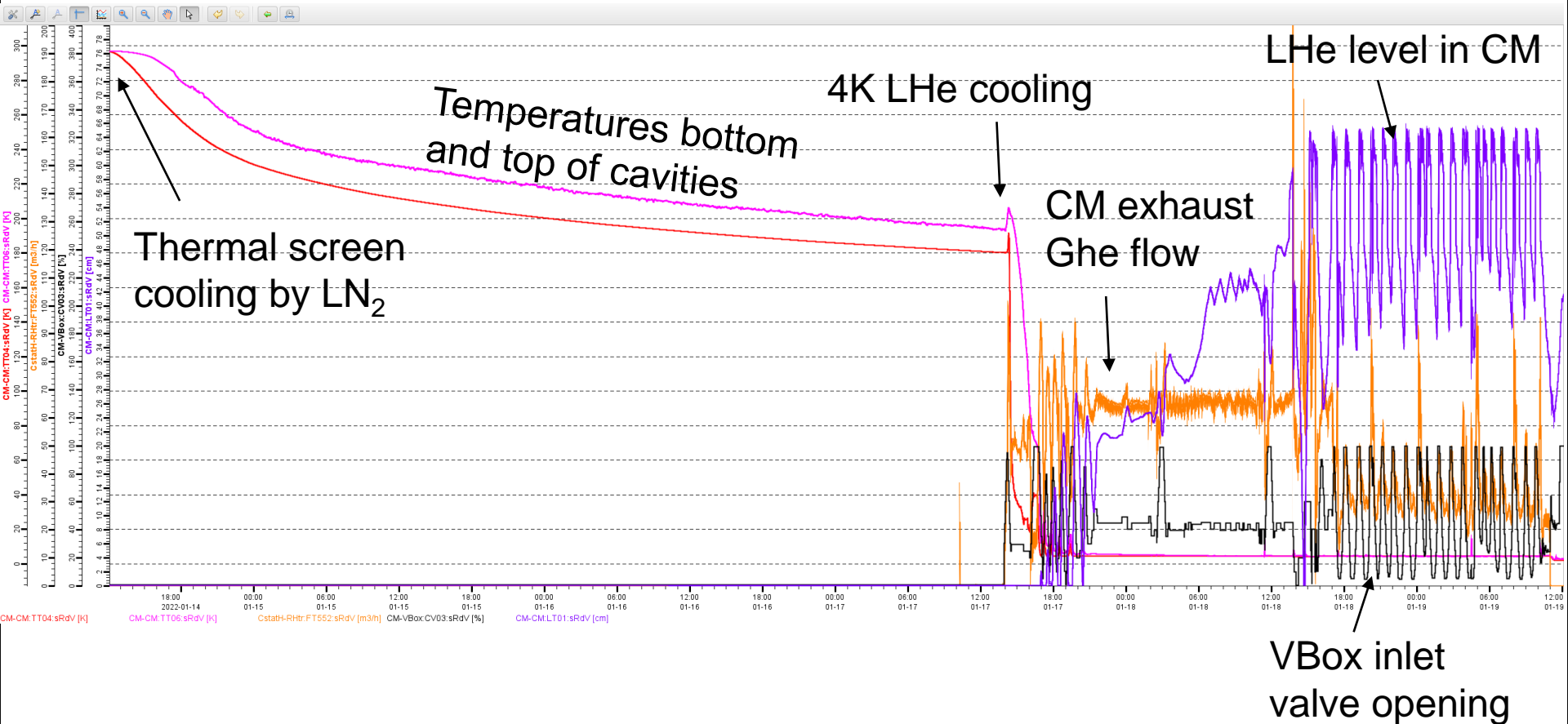


<https://www.osti.gov/servlets/purl/1234337>



Field emission has not been a limiting factor of spoke modules so far but we need to be careful in the future due to CH content

CM07: cooling down



- Precooling by the LN shield over one weekend
- LHe cooling was quick (6 hours) to reach 4K
- “Stable” operation with 4K LHe took about one day

CM07: coupler conditioning at cold



FREIA RF Conditioning System

time: 01-18-12:02:33

QUIT

HELP



Calibration

Calibration On

Auto Process

Auto Process Start

Auto Cycle

Auto Cycle On

Instrument state

Cold Cathod Gauges

Power Meter

DB RF Station

Electrosys Station

Signal Generator

Interlock system

Procedure state

Initialize state

End state

Increase state

Hold state

Decrease state

Vacuum Upper Limit state

Fault Detection state

Ramp After Fault Detection

Operator panel | Instrument State | Power source configuration | Initial State | Power State | Checking state | Watchdog setting

Current parameters

Vacuum Upper Limit (mbar)
5E-6

RF Upper Limit (dBm)
84

Vacuum Lower Limit (mbar)
5E-7

RF Lower Limit (dBm)
60

RF Increment (dB)
0,2

Soak Time (Sec)
60

Pulse Width (us)
3500

RF TB Increment (dB)
3

Step interval (Sec)
2

Pulse Delay (us)
400

Coupler under conditioning
Coupler 1 & 2

Parameter setting mode
Manually

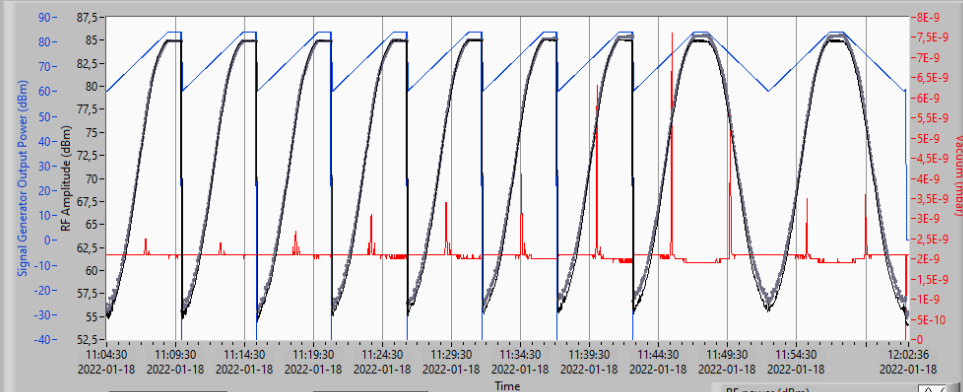
Reset current power level?

RF Pulse Width List: 50 50 100 250 500 1000 2000 3500 0 0 0 0 0 0 us

RF Pulse Delay List: 1975 1975 1950 1875 1750 1500 1000 400 0 0 0 0 0 0 us

Conditioning chart

Multiplexing monitor



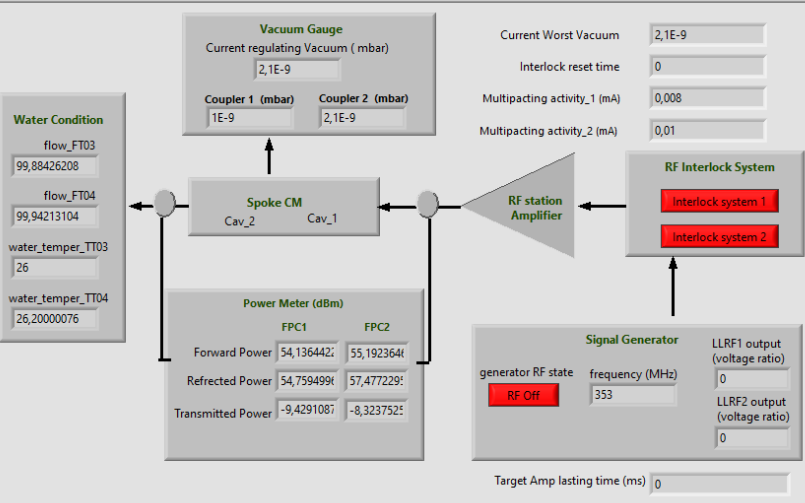
Waveform Pause

Save Plot

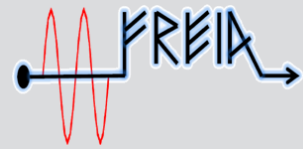
RF power (dBm)

RF power 2 (dBm)

Vacuum (mbar)



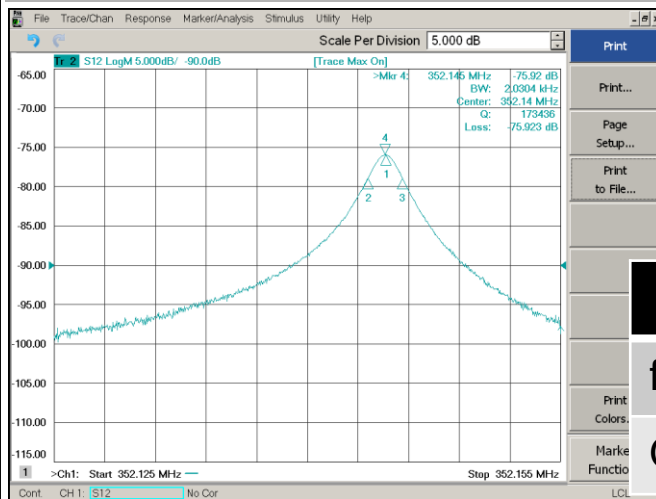
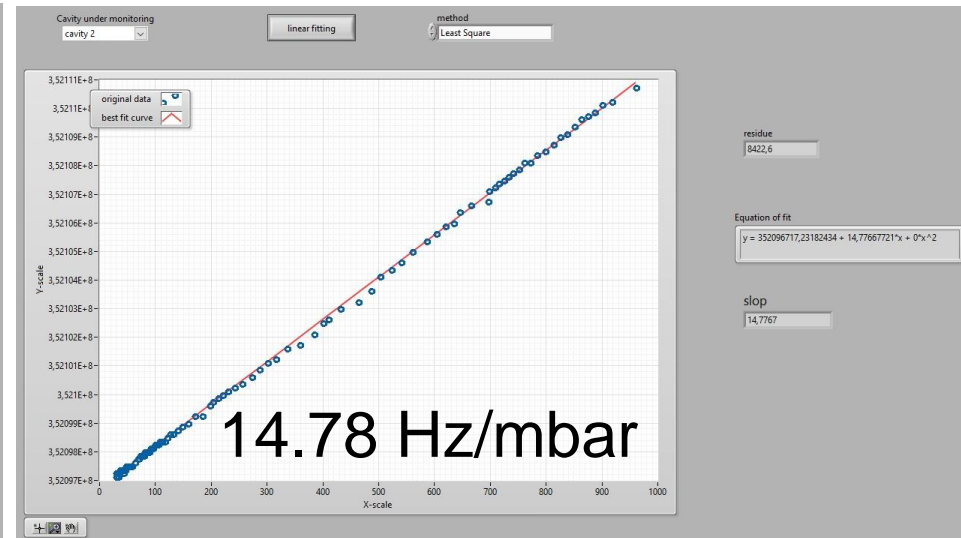
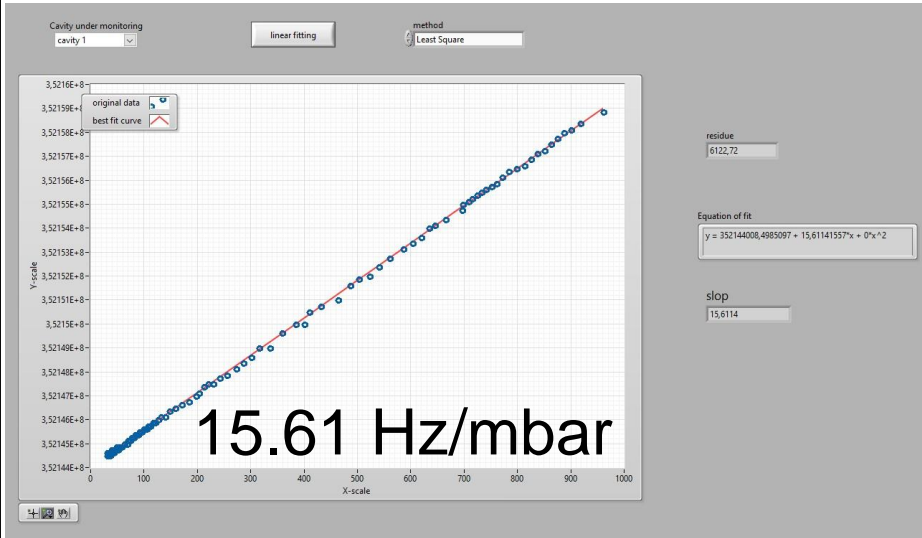
CM07: LT02 malfunctioning (?)



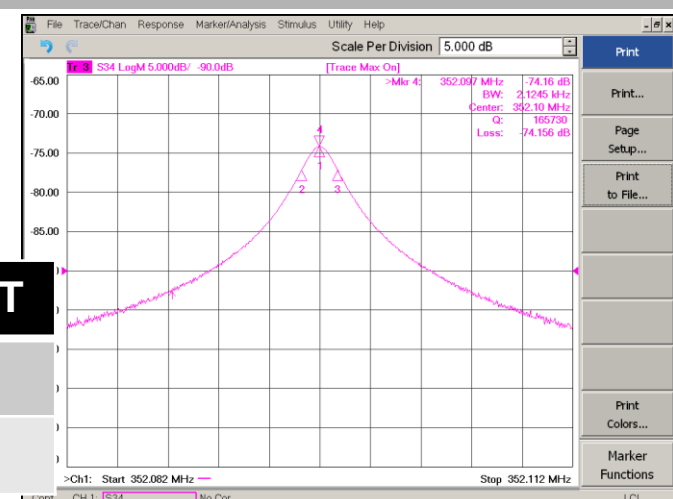
- Some warning messages when 4K LHe was firstly there (burn out protection even with LHe, open sensor)
- Unable to check electric connection because LT01 is used as a regulation target and they share the same cable
- We will check this after the test

CAV IN

CAV OUT



	CAV IN	CAV OUT
f_0 [MHz]	352.145	352.097
Q_L	1.73e5	1.66e5

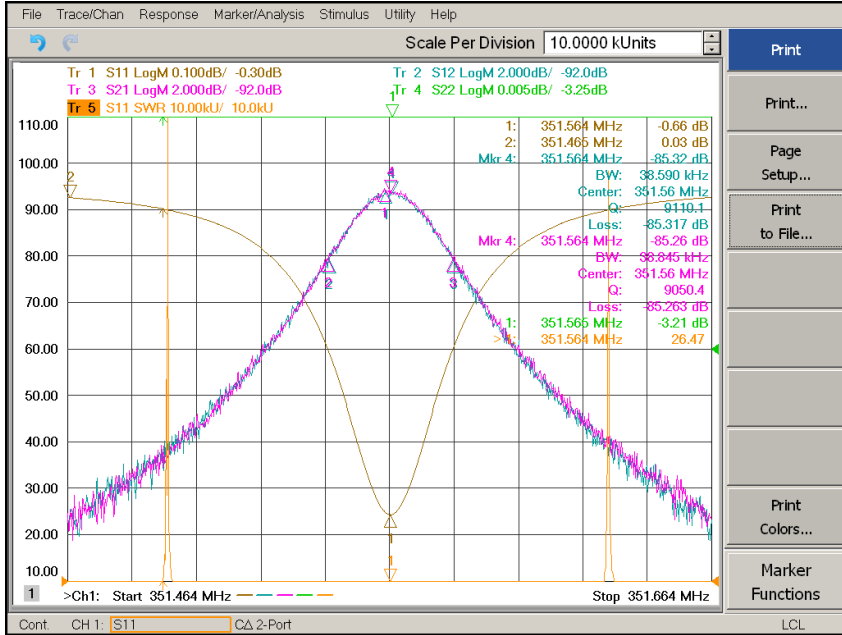


Q_L from VNA is low but please wait for τ in field decay

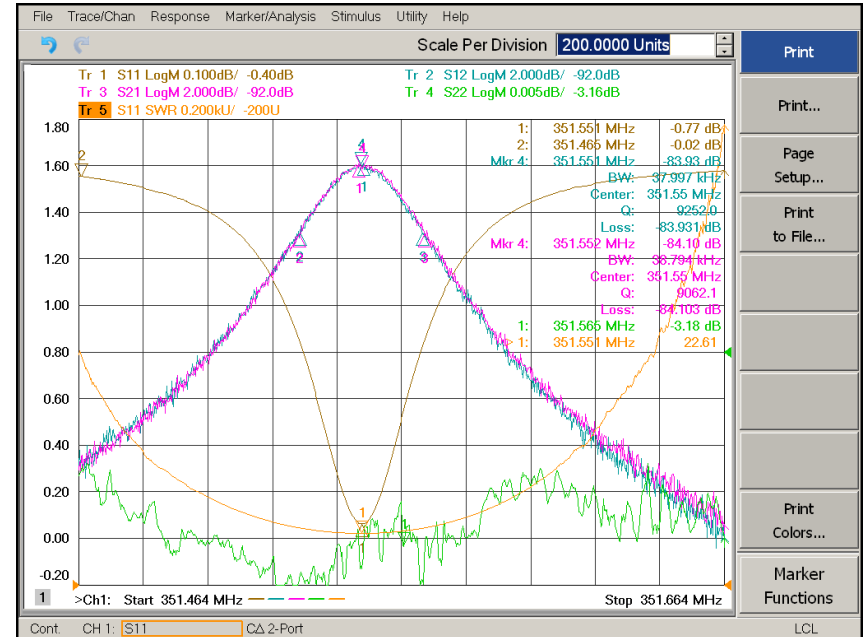
CM08: reception test (Dec 2021)



CAV IN



CAV OUT



	CAV IN	CAV OUT
f_0 [MHz]	352.564	352.552

Cavity, sensors, vacuum all OK

Socket assembly						Verified by:
Socket name	Sensor/ Actuator type	PID name	Serial number	Electrical value (Ω) (before shipping)	C / NC	
LC01	Cemox	TT04	X133097	56.5	C	
	Cemox	TT05	X132704	93.7	C	
	Cemox	TT06	X133196	55.85	C	
	Cemox	TT07	X133155	52.25	C	
	Cemox	TT08	X133087	53.1	C	
	Cemox	TT09	X132648	59.2	C	
	PT 100	TT10	PT65	106.3	C	
	PT 100	TT11	PT61	105.7	C	
	Cemox	TT12	X133185	55.85	C	
	PT 100	TT20	PT69	106.15	C	
	PT 100	TT21	PT67	105.7	C	
	Cemox	TT22	X132659	59.15	C	
PT Coupler	PT 100	TT20	PTC34	107	C	
		TT20	PTC11	107.1	C	
LC02	Heaters	EH01	EH03	84.3	C	
		EH02	EH05	84.1	C	
		EH10	EH10	83	C	
		EH20		83.2	C	
LC03	Motor sensor	SM10		247/24	C	
	a limit sensor	LS10		2	C	
	Motor sensor	SM20		247/24	C	
		LS20		1.9	C	
LC07	Liquid Helium Level Sensor	L101	1309	365.3	C	
		L102	1311	368.55	C	
Socket name	Sensor/ Actuator type	PID name	Serial number	Electrical value (μF) (before shipment)	C / NC	
LC04	Actuators	P210		1424	C	
		P211		1416	C	
		P220		1417	C	
		P221		1422	C	
		P222		1422	C	

VACUUM GAUGE OF CAVITY STRING AT UU					
Date	Time	Pfeiffer TPG2020 (mbar)	Limit	Name of controller	
2021-12-17	14:00	4.10E-04	1.00E-01	A Miyazaki	
2021-12-20	09:00	4.40E-04	1.00E-01	C. Svanberg	
2021-12-21	10:30	4.40E-04	1.00E-01	C. Svanberg	
2021-12-22	15:00	4.40E-04	1.00E-01	C. Svanberg	
2021-12-23	11:00	4.40E-04	1.00E-01	A Miyazaki	
2021-12-24	09:00	4.50E-04	1.00E-01	A Miyazaki	
2021-12-27	10:30	4.60E-04	1.00E-01	C. Svanberg	
2021-12-28	09:15	4.60E-04	1.00E-01	C. Svanberg	
2021-12-29	10:30	4.60E-04	1.00E-01	C. Svanberg	
2021-12-30	09:00	4.60E-04	1.00E-01	C. Svanberg	
2022-01-03	08:30	4.80E-04	1.00E-01	C. Svanberg	
2022-01-04	13:00	4.80E-04	1.00E-01	C. Svanberg	
2022-01-05	09:20	4.80E-04	1.00E-01	C. Svanberg	
2022-01-10	10:00	5.00E-04	1.00E-01	C. Svanberg	
2022-01-11	12:00	5.00E-04	1.00E-01	C. Svanberg	
2022-01-12	08:50	5.00E-04	1.00E-01	C. Svanberg	
2022-01-13	08:50	5.10E-04	1.00E-01	C. Svanberg	
2022-01-14	08:45	5.10E-04	1.00E-01	C. Svanberg	
2022-01-17	08:40	5.20E-04	1.00E-01	C. Svanberg	
2022-01-18	09:00	5.20E-04	1.00E-01	C. Svanberg	
2022-01-19	09:30	5.20E-04	1.00E-01	C. Svanberg	

600 mA in config → 0.43A measured

Fwd	Back
4.6	4.06
4.5	4.4
4.6	4.3

4.57	4.25	Average
4.41		Mean

Digital torque
(driver CTS1)

Remember before the 77K test, I put 900 mA in order to get 0.6 A measured and 4 to 5 N.m output torque.

But now when I measure torque it exceed 6 N.m ...

So I put back 600 mA, and here are the values obtained lastly :

- **Current : 0.38 A**
- **Torque : 4.3 N.m**

From Nicolas

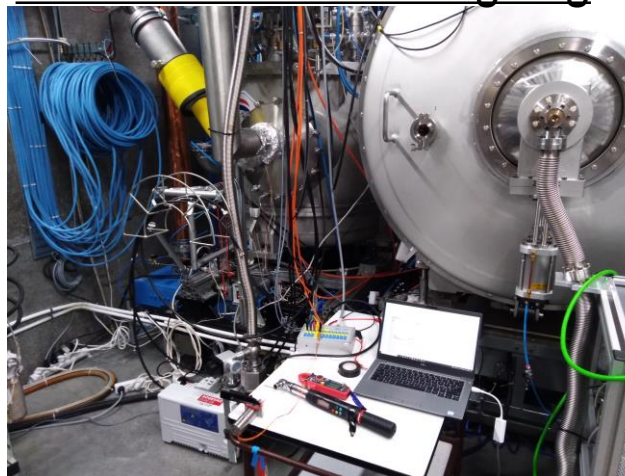
So current measurement is a bit low, but torque is satisfying and vibration are OK as well.

I would recommend to stay on these value for the cryomodule test and not be overconfident on the current measurement.

Installed in the rack



Test in the bunker on going



- Nicola's results were reproduced in the control room and in the bunker → our cabling is OK
- Working on the limit switch