UPPSALA UNIVERSITET

ESS spoke CM04/CM02 (2nd run) weekly meeting 20210225

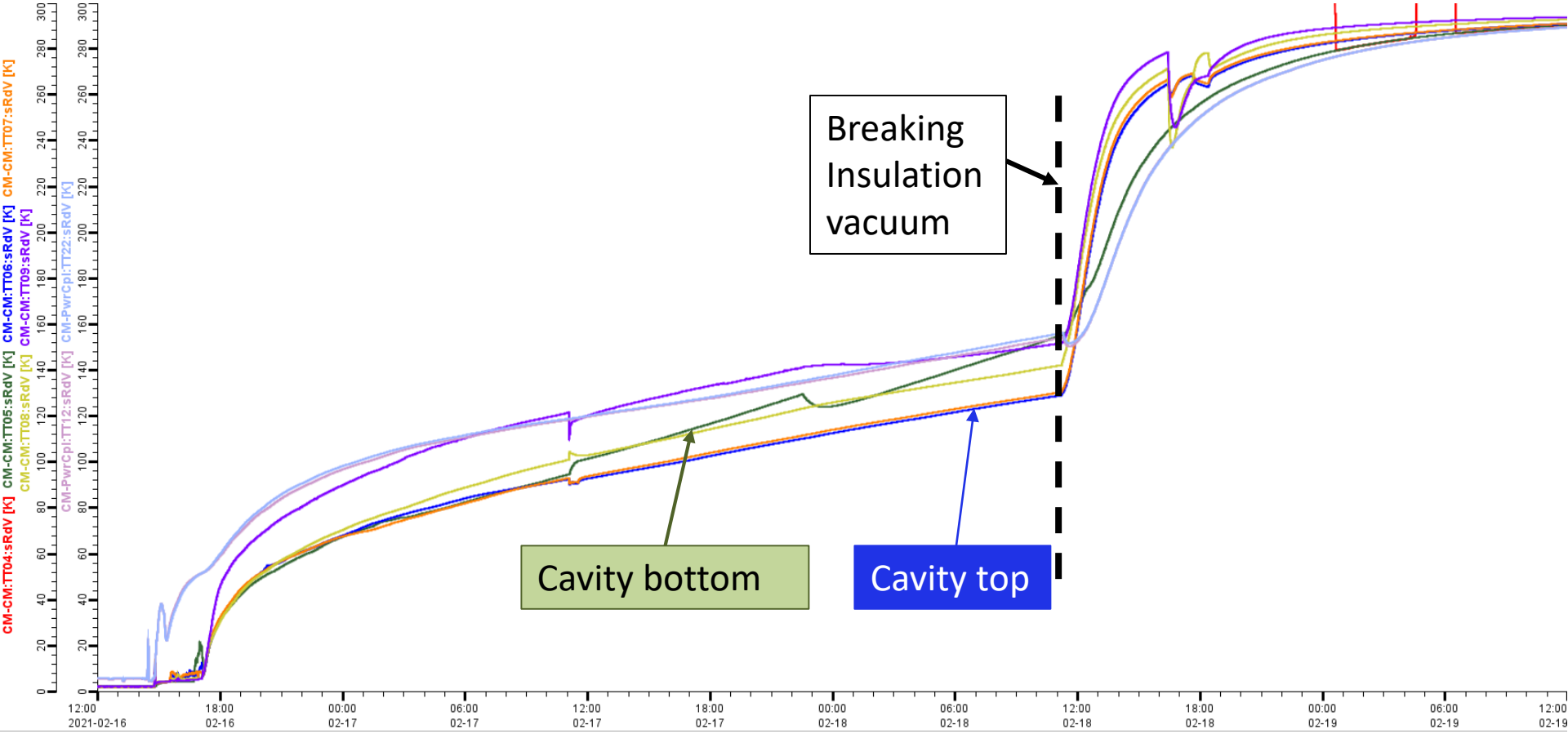
Han Li

CM status

- CM04 warm up
- CM04 leak test
- CM04 alignment test
- CM02 arrival
- Test plan

CM04 warm up

- CM04's warm-up took around 3 days
- Breaking insulation vacuum (by injecting N_2 gas) is effective to shorten the warming procedure



Leak test

➢1st run:

✓With RGA connected, 1 hour RGA running for measurement stabilization, then angle-valve on (all pipes and accessory have been leak test when installed)

✓Pump down the helium circuit (< 10 mbar) @ around 220 K of the cavities

✓Refill the helium circuit with helium gas to 1 atm

Purpose : to check if the helium leak appears at warm
Observation:

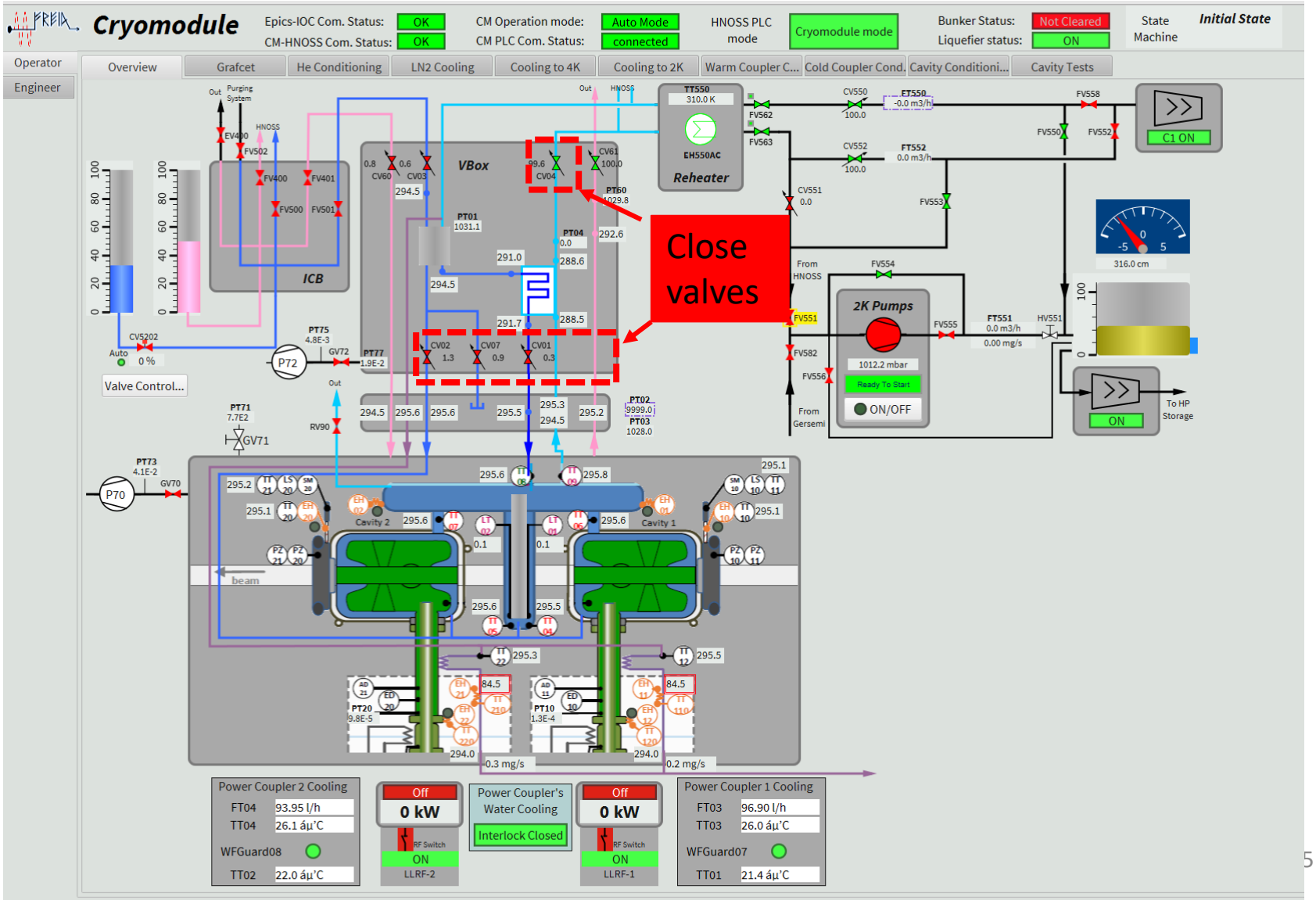
Helium circuit pressure ⬇ Helium peak ⬇

Helium circuit pressure ⬆ Helium peak ⬆

Conclusion: It is a leak at warm !

Cryo-line configuration for 2nd leak test

- Separate cavity helium vessel and FPC supercritical helium gas line



Leak test

- 2nd run:

✓ Isolate the 4 K tank and the 2 K tank by closing relate valves (CV01, CV02, CV07, CV04 for the cryomodule)

✓ With RGA connected and angle-valve on

✓ Start purging procedure , pump down the 4 K tank(< 10 mbar) @ RT

✓ Monitor pressure in interested region:
Cavity helium vessel pressure (2 K tank , PT03)
FPC supercritical helium line pressure (4 K tank , PT01)

✓Refill the helium circuit with helium gas to 1 atm

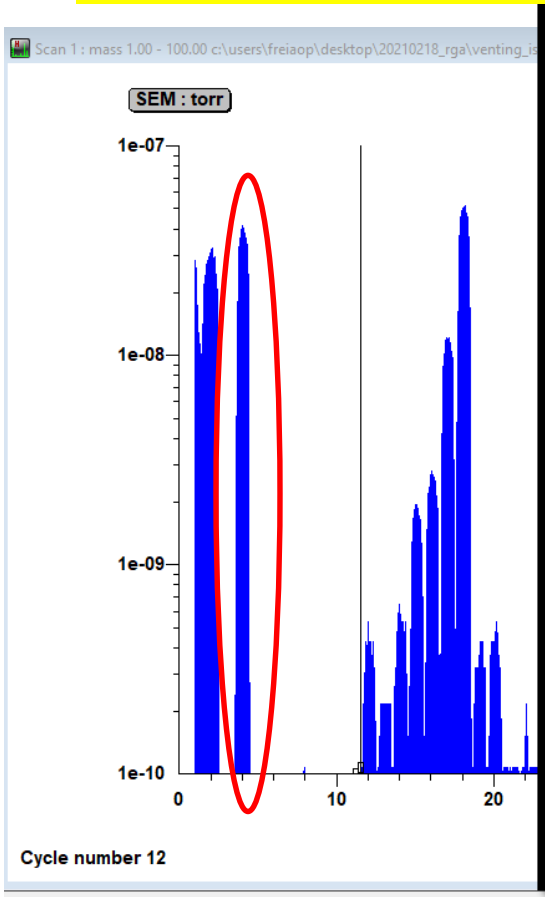
Purpose: localize the leaking position
Observation:
the pressure is only pumping down in the 4 K tank (including the supercritical helium line)
the 2 K tank pressure(including cavity vessels) are constant (PT03 around 1025 mbar)

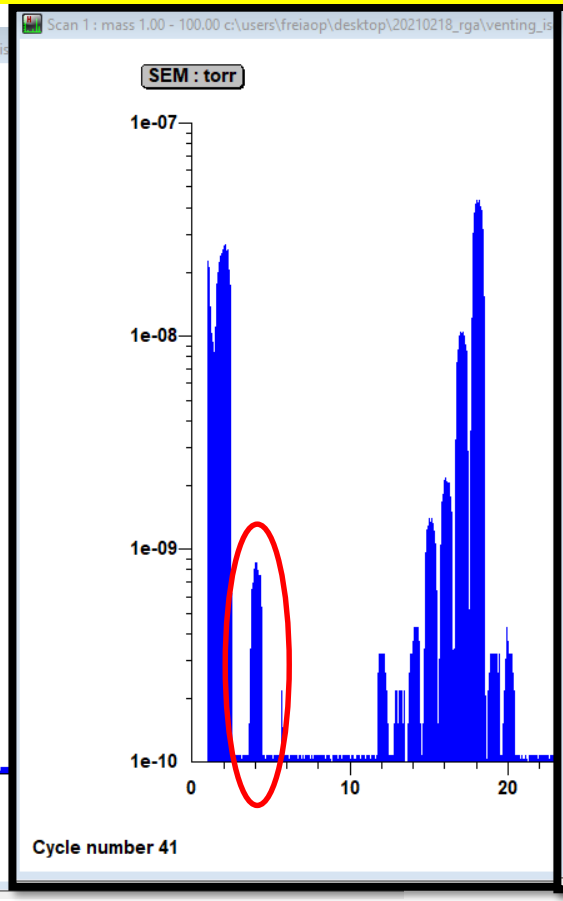
supercritical helium line pressure ⬇ Helium peak ⬇

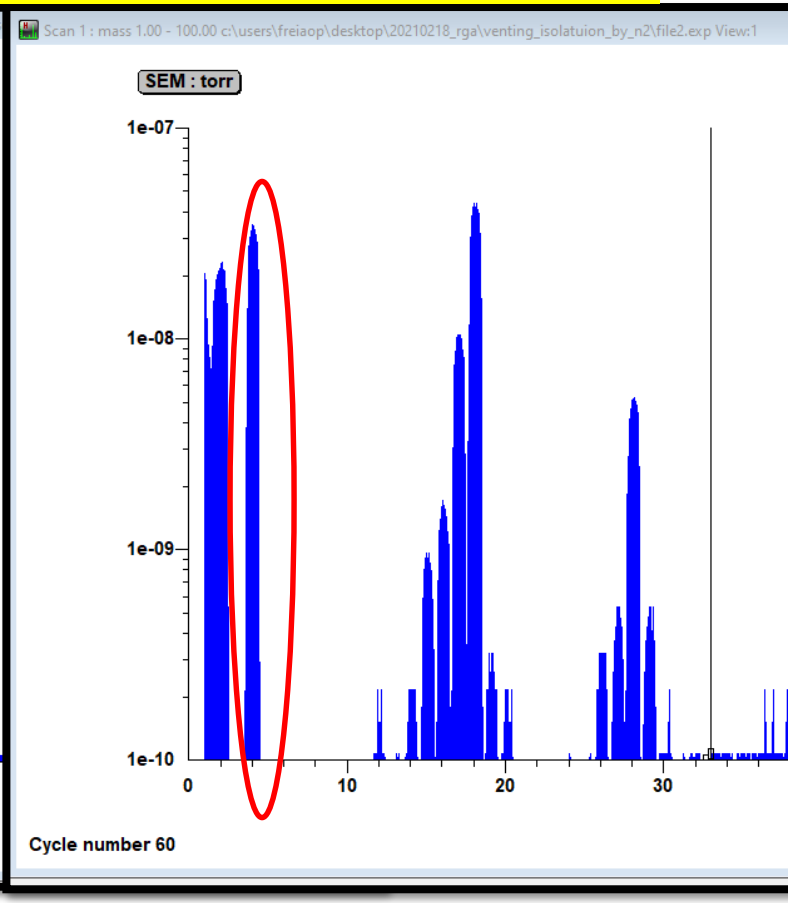
supercritical helium line pressure ⬆ Helium peak ⬆

Leak position

- Leak test with purging system at warm
- conclusion: the leak is in FPC line (the double wall tube of Cav_OUT?)





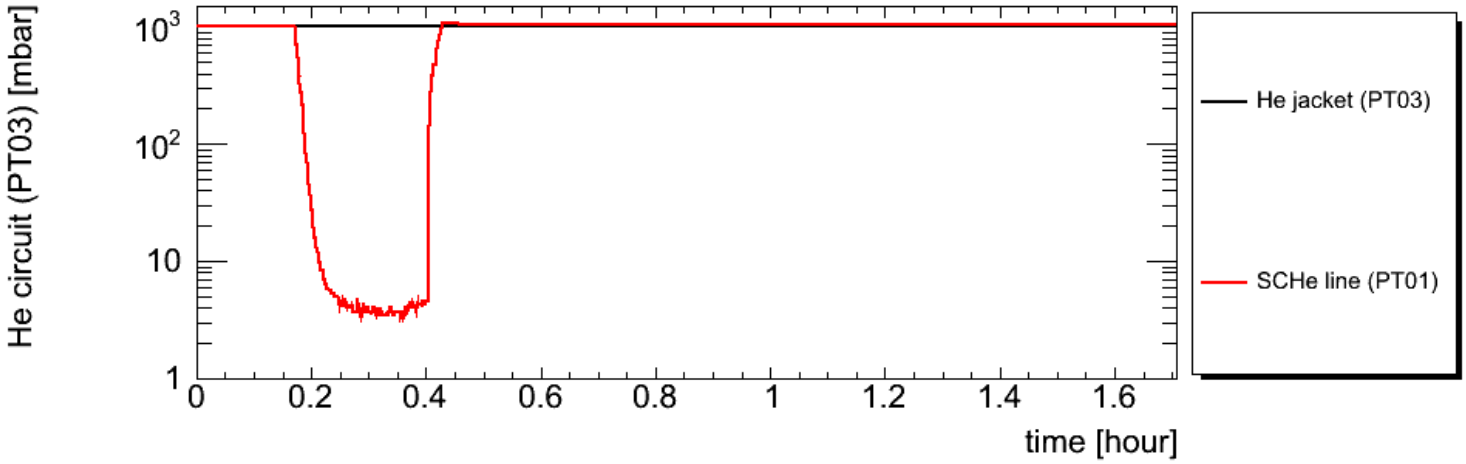


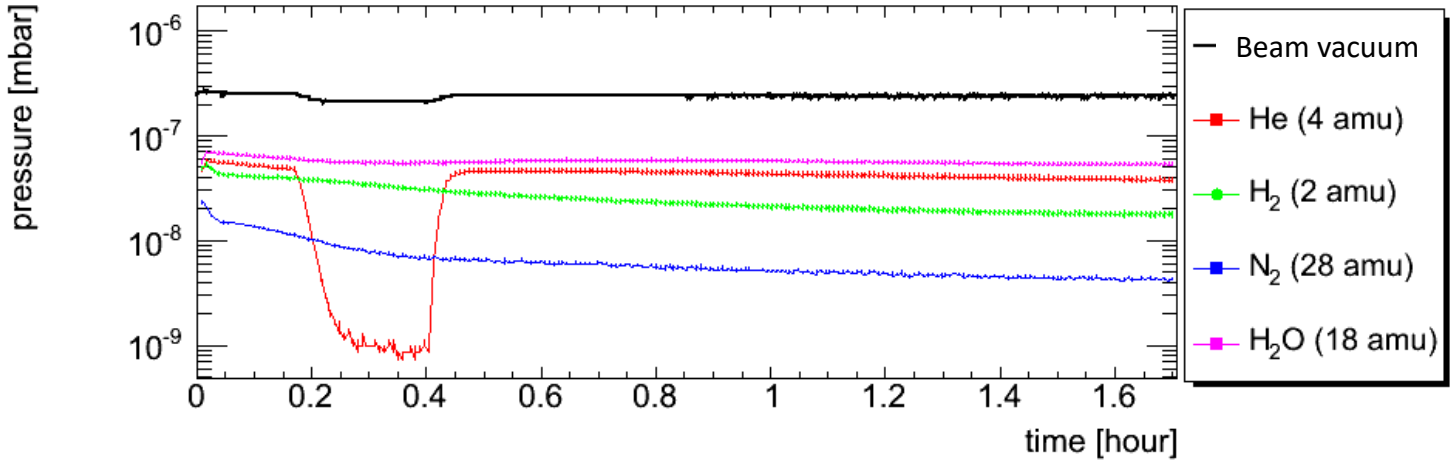
Baseline
1 atm

Purging
< 10 mbar

Venting with helium gas
1 atm

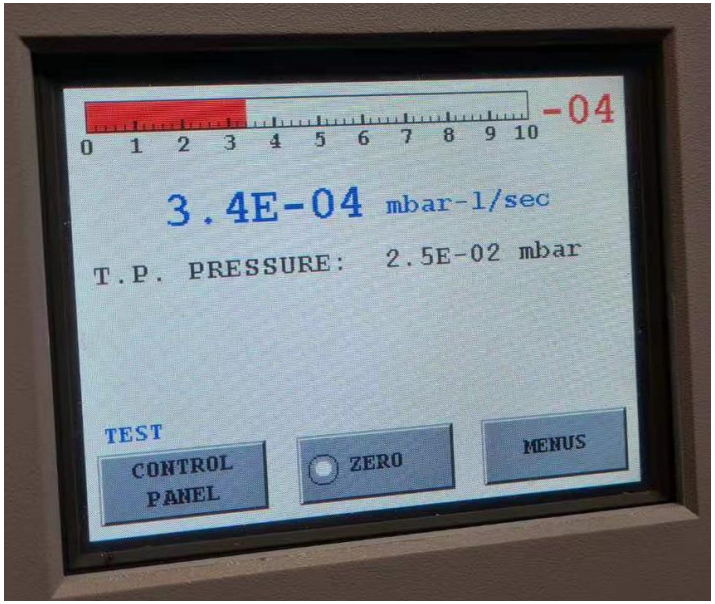
RGA analysis



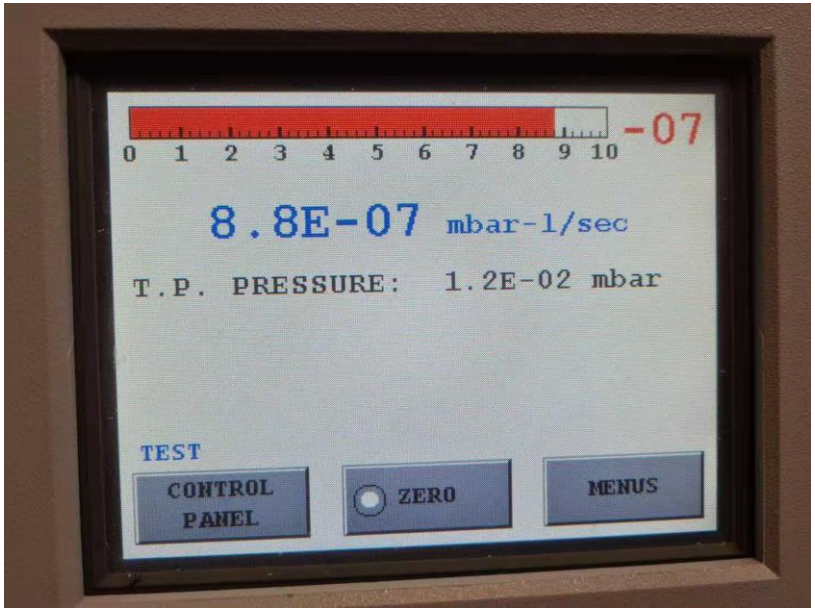


Leak detector

- Leak rate at warm 8.8 E-7 mbar.l/s



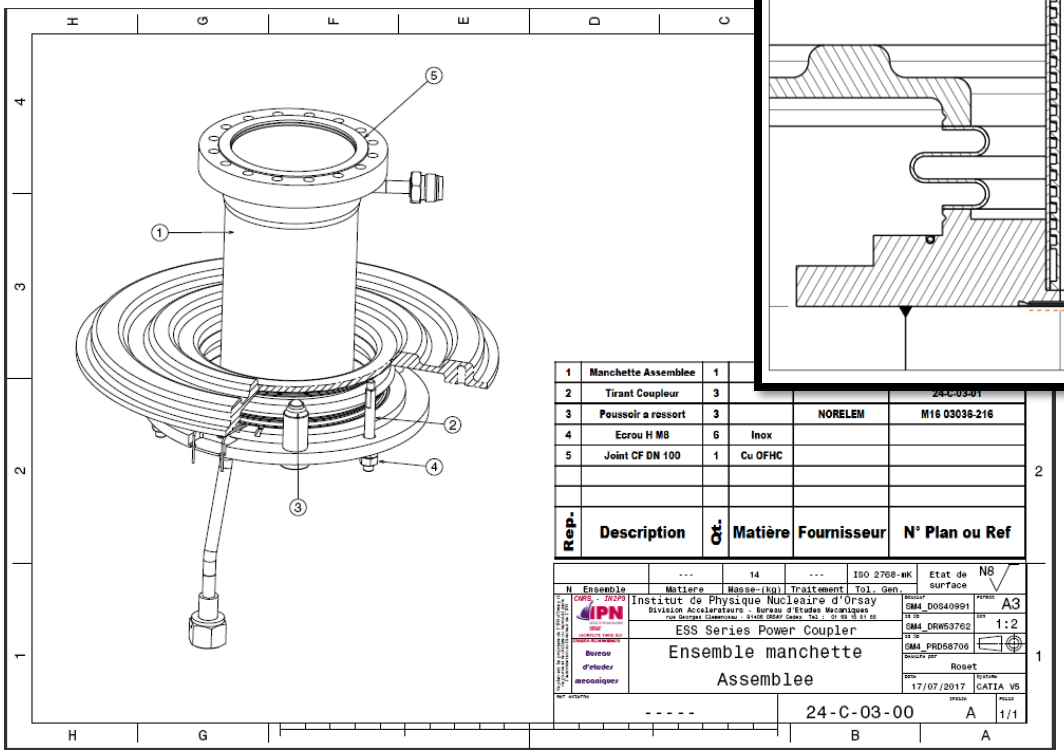
after angle-valve open

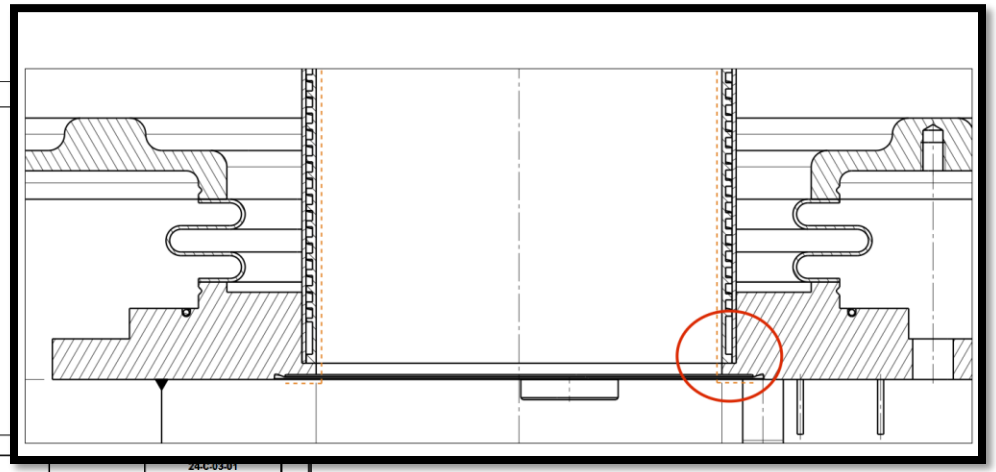


Helium pressure from 31mabr to 1bar

Discussion

- ➢ What cause the leak?
- ✓ Welding procedure?
- ✓ CM assembly (FPC, doorknob)?
- ✓ Transportation? ⟹ No shock has been logged during the shipment
- ✓ Cooldown procedure at FREIA?





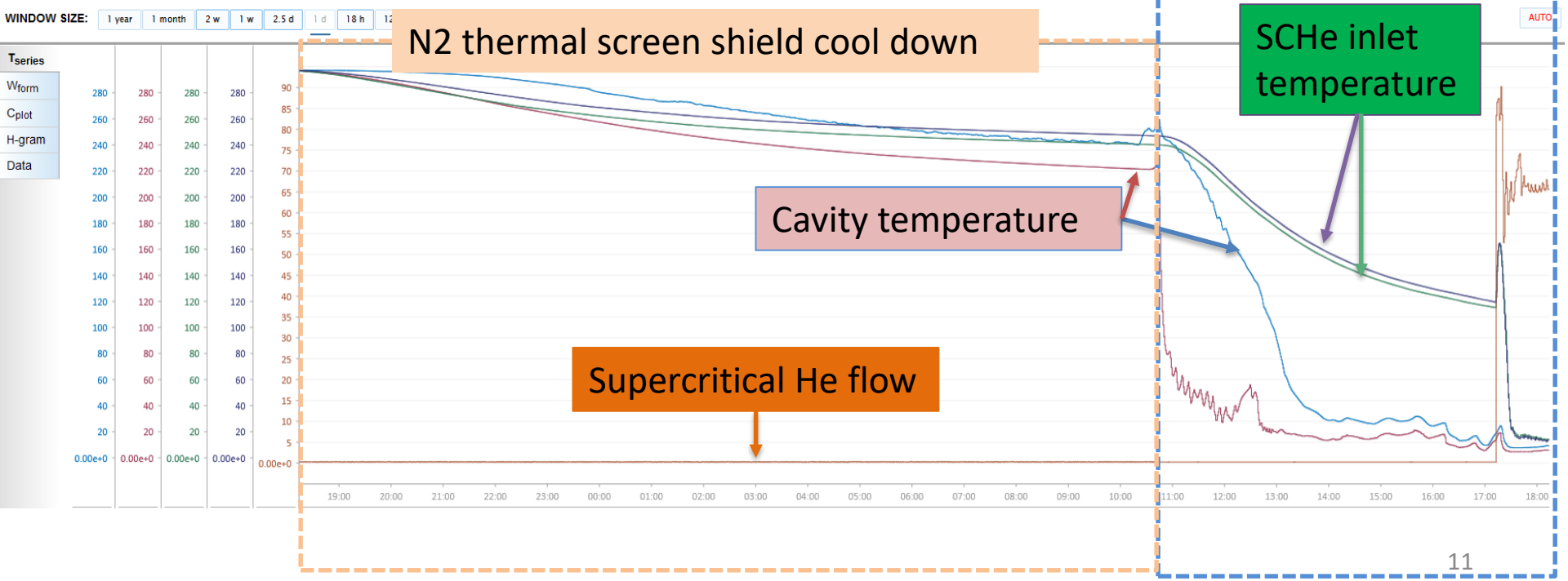
Cross-section of double-wall tube

FPC cooldown

FPC cooldown: from 240 K -> 120 K within 6 hours **0.33K/min**
from 120 K -> 15 K within 0.5 hours **3.5K/min**
a temperature peak due to warm He gas from 120 -> 160 K
from 160 K -> 15 K within 15 min **9.6K/min**

What is the standard FPC cooldown procedure?
Which one has the priority (inlet temperature or flow)?

Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
x	☑	CM-CM:TT06:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-01-27 **06:40:04**	249.16040675324675	
x	☑	CM-CM:TT05:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-01-27 **06:40:04**	229.0303490294599	
x	☑	CM-PwrCpl:TT22:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-01-27 **06:40:04**	244.9869747204752	
x	☑	CM-PwrCpl:TT12:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-01-27 **06:40:04**	252.0028957793765	
x	☑	CM-PwrCpl:FT21:sRdV	DBR_SCALAR_DOUBLE	mg/s		linear	2021-01-27 **06:40:04**	0.3110540012518565	

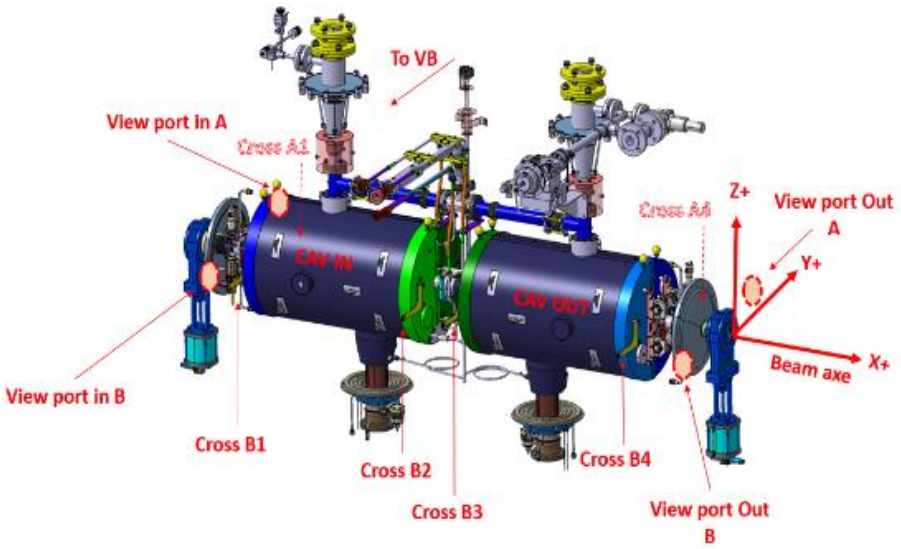


CM alignment checking

date		20210126	
Measurement at room temperature	**Side B**	**Y (mm)**	**Z (mm)**
	View port in B	/	/
	Cross B1	0.29 (red)	0.04 (black)
	Cross B2	0.61 (red)	> -1.2 (black) (-1.35?)
	Cross B3	0.89 (red)	1.05 (red)
	Cross B4	0.74(red)	0.1(red)
	View port out B	/	/

date		20210128	
Measurement at cold	**Side B**	**Y (mm)**	**Z (mm)**
	View port in B	/	/
	Cross B1	0.6 (black)	0 (without offset)
	Cross B2	0.32 (black)	> -1.2 (black) (-1.35?)
	Cross B3	0.14 (black)	1.15 (red)
	Cross B4	0.4 (black)	0.39 (red)
	View port out B	/	/

date		20210222	
Measurement at room temperature after cold	**Side B**	**Y (mm)**	**Z (mm)**
	View port in B	/	/
	Cross B1	0.1 (red)	0.04 (red)
	Cross B2	0.43 (red)	> -1.2 (black) (-1.35?)
	Cross B3	0.74 (red)	0.98 (red)
	Cross B4	0.6 (red)	0.14 (red)
	View port out B	/	/



Conclusion:

- Mainly displacement at Y axis
- ~ 1 mm from 300K to 2 K
- ~ 0.15 mm before and after cooldown

what is the acceptance criteria?

CM02 arrival

- CM02 arrival on 19th Feb.
- No big vibration has been logged during transportation
- Incoming test:
  - Electrical continuity check √
  - Cavity parameter check √

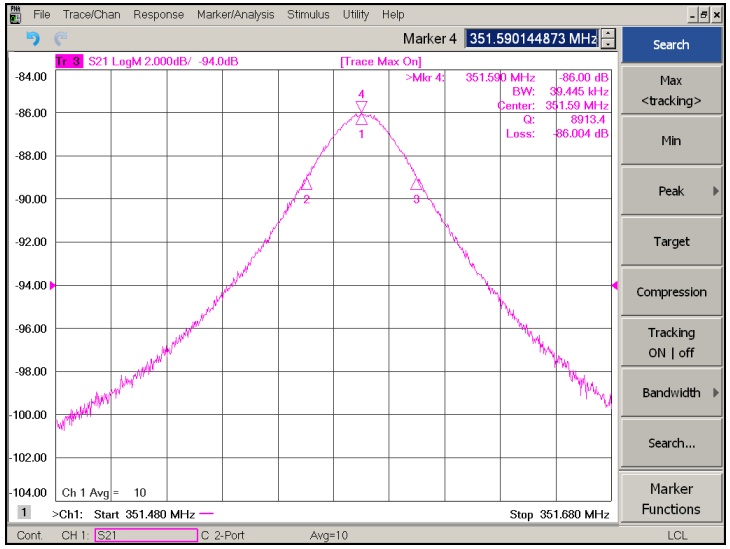
Electrical continuity check

- Instrumentation cabling has been modified
- Similar result as previous test -> TT12 is malfunctional

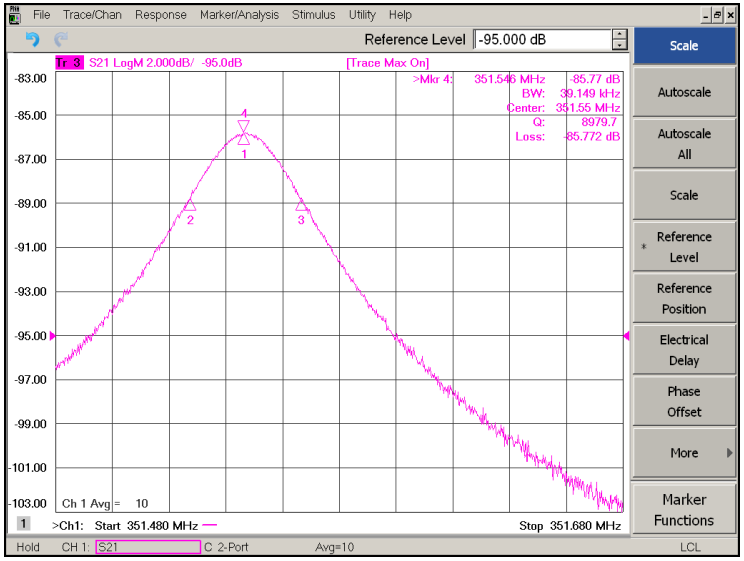
Cables verification CM02 at IJCLab			v2
Socket assembly		Verified by : T. Gerardin / J.-C. Roux	
Socket name	*PID name*	*Electrical value (Ω) (before shipment)*	*C / NC*
LC01	TT04	60,51	C
	TT05	60,51	C
	TT06	60,77	C
	TT07	61,25	C
	TT08	91,99	C
	TT09	93,87	C
	TT10	106,5	C
	TT11	106,52	C
	TT12	1,93	NC
	TT20	106,48	C
	TT21	106,56	C
	TT22	88,71	C
PT Coupler	TT120	107,54	C
	TT220	107,55	C
LC02	EH01	84,24	C
	EH02	85,44	C
	EH10	82,32	C
	EH20	82,33	C
LC03	SM10	2,38 / 2,41	C
	LS10	2,07	C
	SM20	2,45 / 2,55	C
	LS20	2,21	C
LC07	LT01	369,1	C
	LT02	368,91	C
Socket name	*PID name*	*Electrical value (µF)*	*C / NC*
LC04	PZ10	12,72	C
	PZ11	12,96	C
	PZ20	12,63	C
	PZ21	11,88	C

Cables verification CM02 at UU			v2
Socket assembly		Verified by : A. Miyazaki	
Socket name	*PID name*	*Electrical value (Ω) (after transport)*	*C / NC*
LC01	TT04	59,8	C
	TT05	59,95	C
	TT06	60,4	C
	TT07	61,9	C
	TT08	91,25	C
	TT09	93,5	C
	TT10	105,5	C
	TT11	105,75	C
	TT12	2,95	NC
	TT20	105,55	C
	TT21	107,7	C
	TT22	87,8	C
PT Coupler	TT120	107	C
	TT220	107	C
LC02	EH01	84,1	C
	EH02	85.2	C
	EH10	82,3	C
	EH20	82	C
LC03	SM10	2,2 / 2,3	C
	LS10	1,9	C
	SM20	2,2 / 2,3	C
	LS20	1,9	C
LC07	LT01	367,6	C
	LT02	368,1	C
Socket name	*PID name*	*Electrical value (µF)*	*C / NC*
LC04	PZ10	14,2	C
	PZ11	14,21	C
	PZ20	14,13	C
	PZ21	14,36	C

CM02 Cavity parameters @ RT



Cav_IN



Cav_OUT

Item/Cavity location	Cavity IN	Cavity OUT
Cavity	DSPK2	DSPK7
Frequency (MHz) Osary	351.588	351.546
Frequency (MHz) UU	351.590	351.547
Qext Orsay	1.9E5	2.4E5
Qext UU	2E5	2.5E5

Preliminary time plan

Test item	time	comment
CM04 Warm up (RGA connect) CM02 arrival	15th -21th Feb.	
CM04 Leak test /alignment at warm CM02 unpack, incoming test	22th Feb.	
CM04 Disconnect, packing	23th -26th Feb.	
CM02 installation CM04 shipment	1st- 12th Mar.	
CM02 FPC warm conditioning	15th -17th Mar.	CM02
CM alignment measurement	18th Mar.	CM02
CM cooldown to 4 K	19th Mar.	CM02
CM cooldown to 2 K	22th Mar.	CM02
FPC cold conditioning	23rd Mar.	Simultaneously
CTS test	24th -25th Mar.	CTS measurement
Cavity conditioning (on resonance) Heat load/Q measurement	29th -30th Mar.	Open loop

Note: Plan might be adjusted depend on FREIA's situation