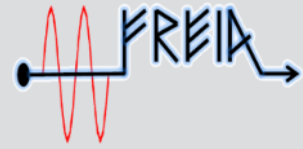




ESS spoke CM04
weekly meeting
20210128
Han Li



- CM installation
- FPC conditioning
- CM insulation vacuum
- CM alignment measurement
- CM cooldown
- Beam vacuum
- Test plan

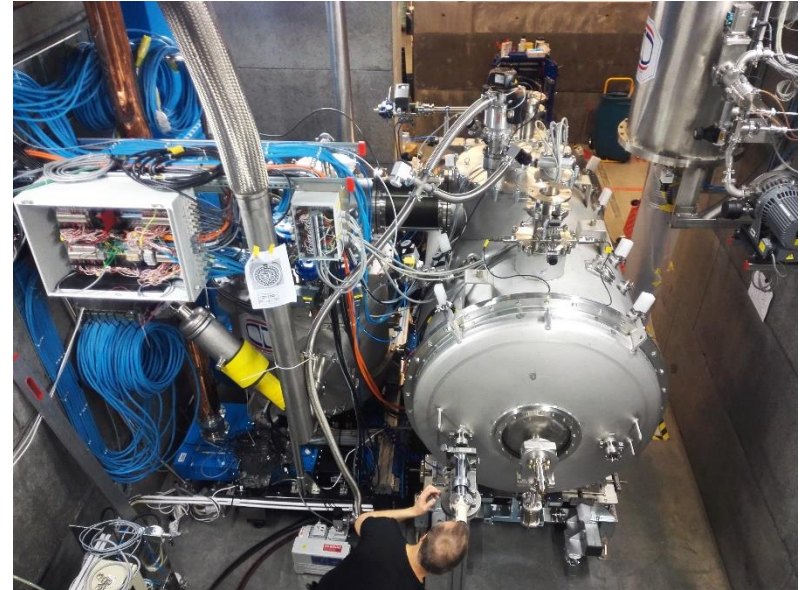


CM04 installation



Hardware:

- Doorknob ✓
- Sensors and gauges: arc detector, electron pickup ✓
- Safety valve mounting ✓
- Pressure gauge mounting ✓
- Turbo-pump mounting for insulation vacuum ✓
- Waveguide bellows mounting ✓
- Cryogenic jumper ✓
- CM alignment checking without insulation vacuum ✓
- Beam vacuum pumping cart connection ✓
- CM alignment checking with insulation vacuum ✓
- FPC water cooling pipe connection ✓
- Cabling: arc, e-pickup, lemo connector... ✓
- Close bunker ✓





FPC warm conditioning



- FPCs' conditioning are done by FREIA auto conditioning program
- Test with RF station and coupler (off resonance) up to around 350kW @ 3.2ms
- Using e- pickup and arc interlock for FPC
- Frequency for off resonance conditioning : 353 MHz
- Only one pumping cart connected the CM:
 - ✓ To check if it is necessary to have two pumping
 - ✓ Try to avoid risk of contamination

Parameter	value
Loop control time (s)	1
Pulse repeat rate (Hz)	14
Vacuum upper limit (mbar)	5e-6
Vacuum lower limit (mbar)	2e-6
Initial pulse length (μs)	50
pulse length step	50μs, 100μs, 250μs,500 μs, 1ms, 2 ms,3.2ms
Vacuum hardware interlock (mbar)	1e-5
e- pickup interlock (mA)	2

the vacuum baseline is around 1.2E-6 mbar (without RF)

FPC warm conditioning

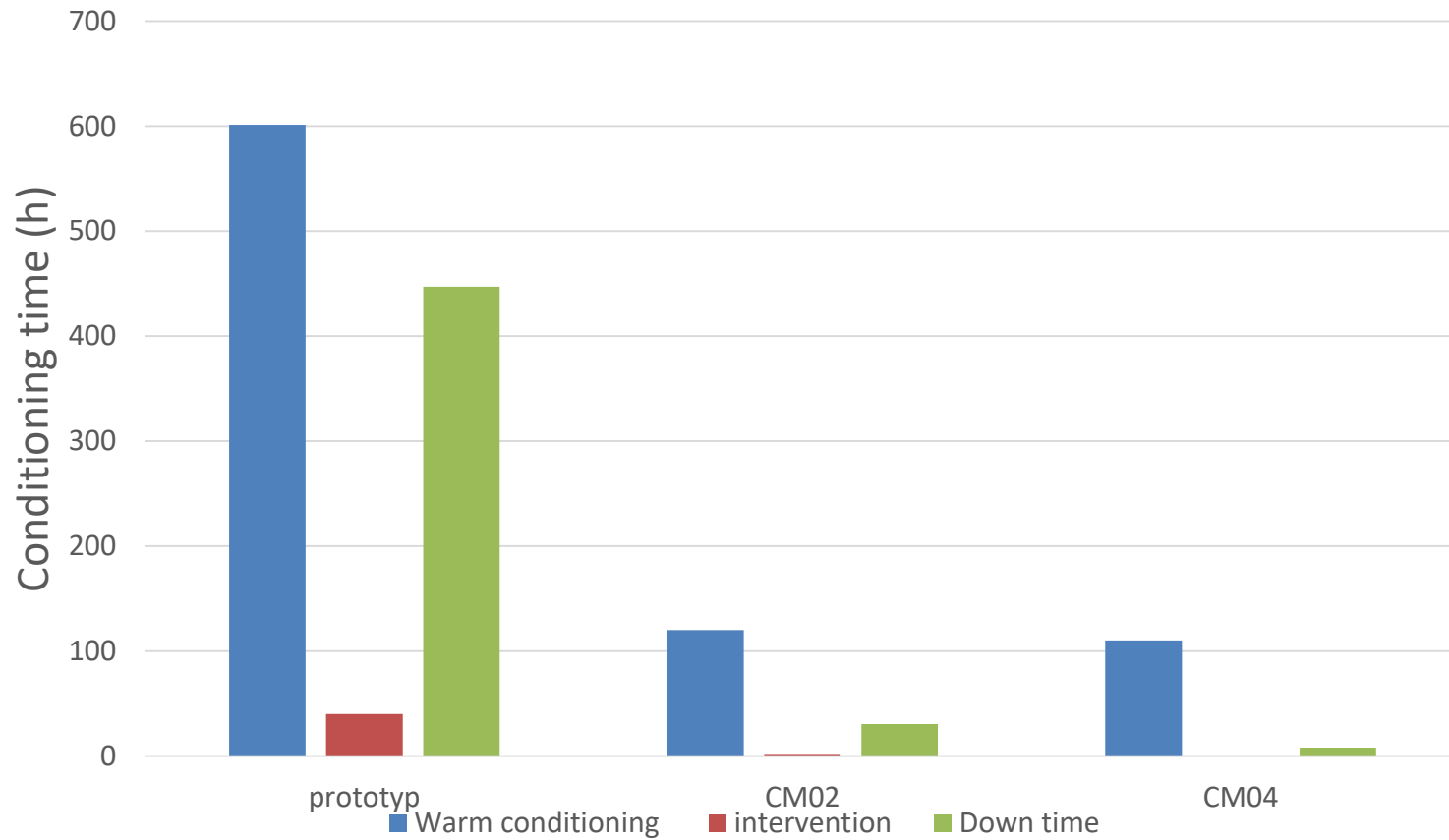


- Before FPC warm conditioning
 - ✓ the vacuum baseline is around $1.2\text{E-}6$ mbar (without RF)
 - ✓ $7\text{E-}6$ mbar with RF
- After FPC warm conditioning,
 - ✓ the vacuum baseline is around $4.5\text{E-}7$ mbar
 - ✓ $7\text{E-}7$ mbar with RF

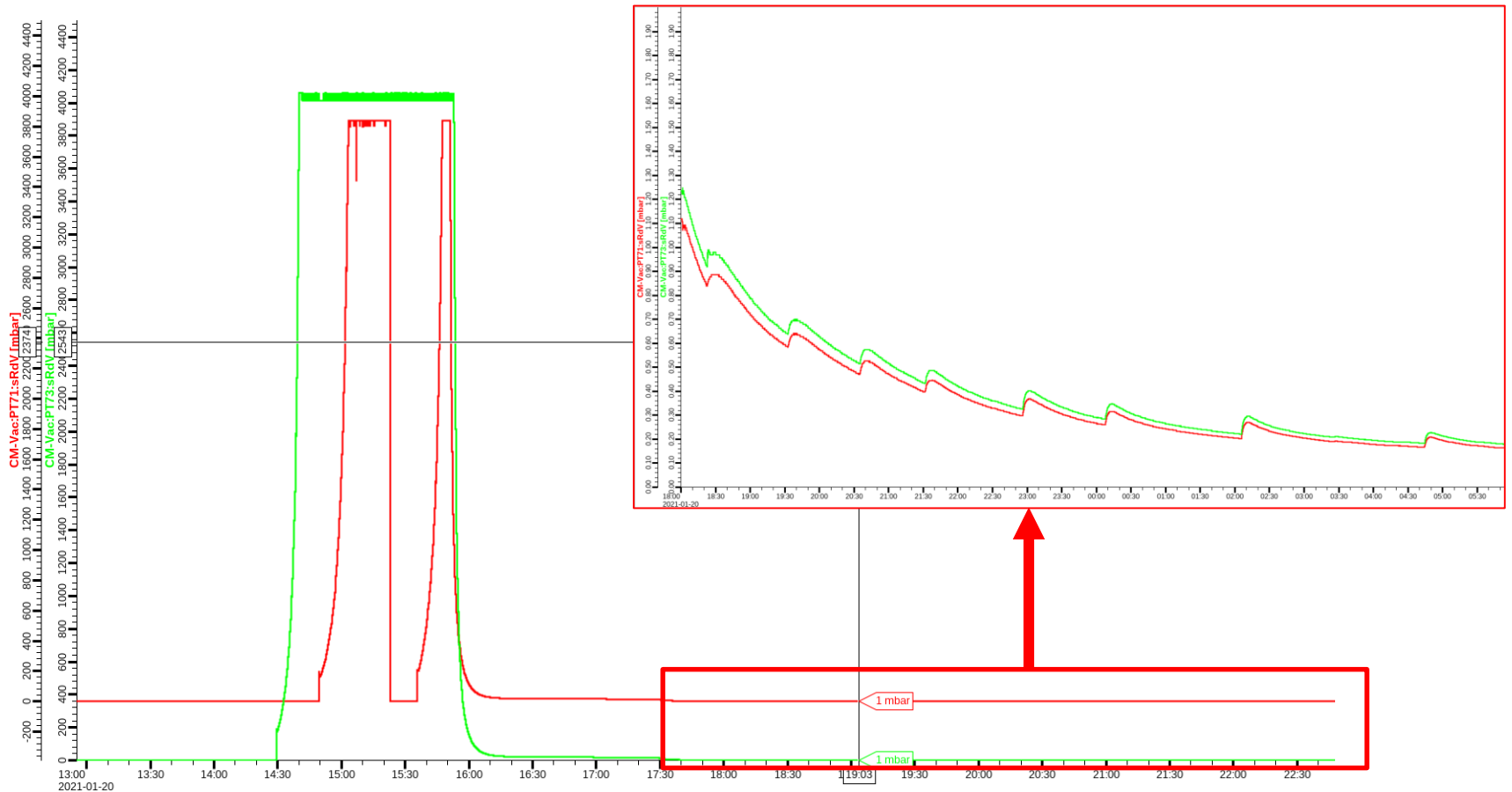
- Comparison with CM02
 - ✓ the vacuum baseline is around $1.5\text{E-}7$ mbar
 - ✓ $2.5\text{E-}7$ mbar with RF



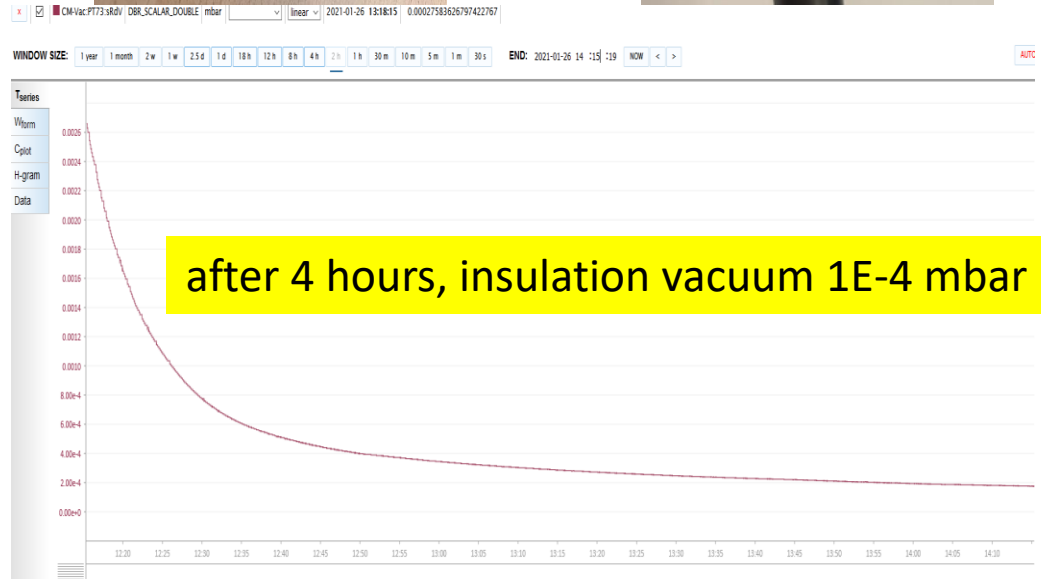
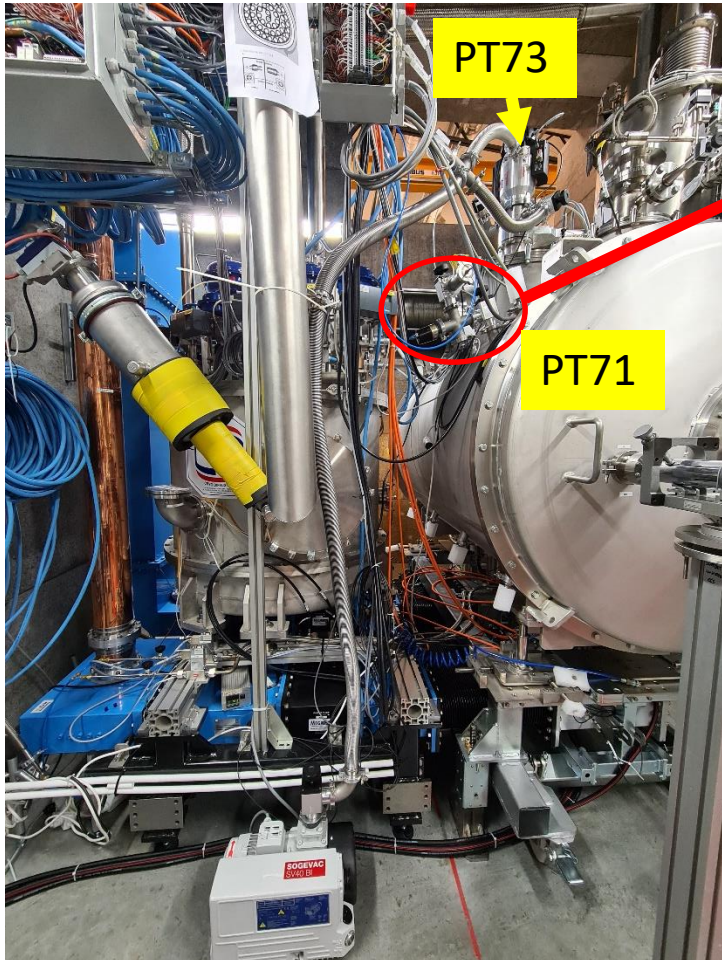
➤ Around 4 days for FPC warm conditioning



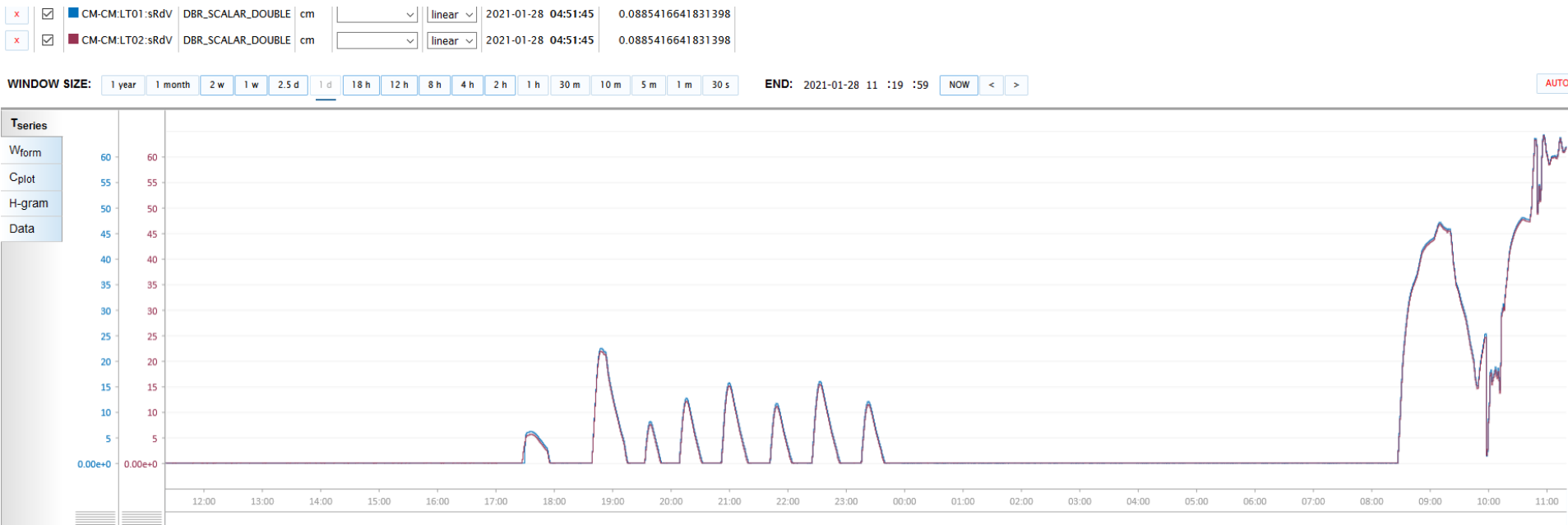
- After 5 hours, insulation vacuum was still around 1 mbar (20210120)
- Strange curve of insulation vacuum during overnight pumping
- Suspect a leak for the insulation vacuum



- Cracked rubber gasket are the cause of leakage of insulation vacuum (20210126)
- Replace the new ones

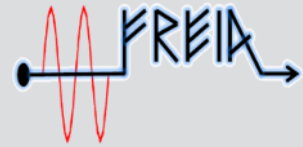


- 4K LHe in CM04 recovers and disappears periodically
- 4K stabilization after 25 hours
- Comparison for CM02 :around 9 hours for the stabilization of 4 K and reach 62cm of LHe





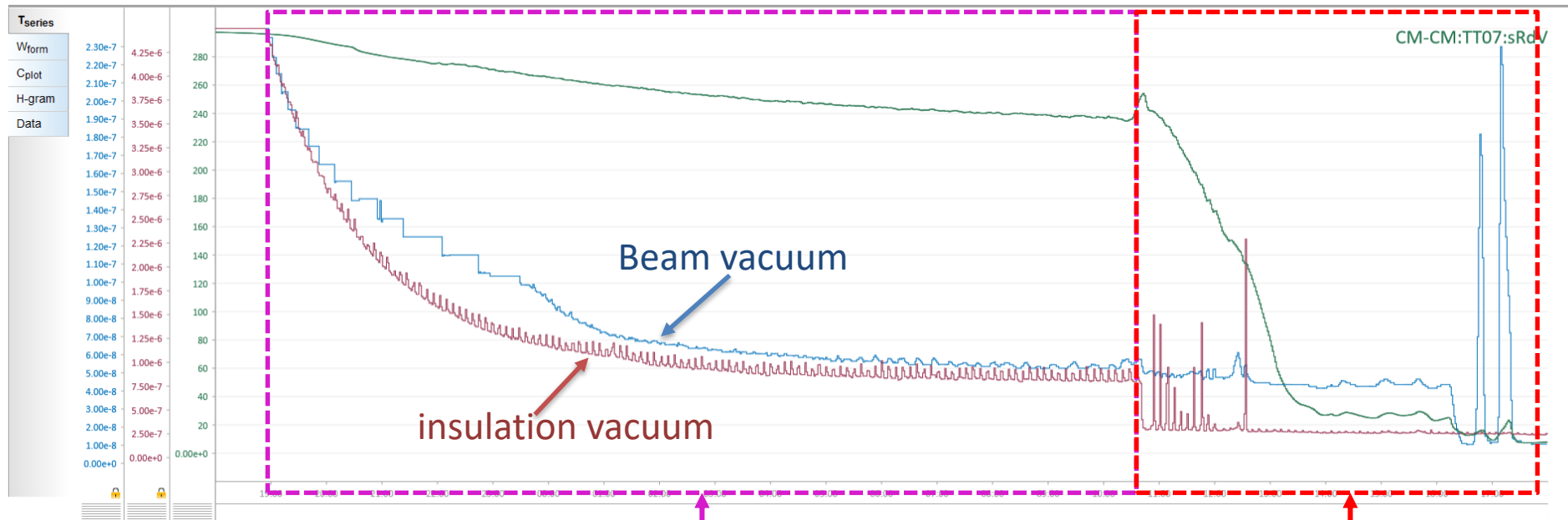
vacuum



- Periodical spike in the insulation vacuum after LN2 cooldown
- Beam vacuum spike during 4K cooldown

Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT10:sRdV	DBR_SCALAR_DOUBLE			linear	2021-01-26 19:53:30	1.65e-7	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT73:sRdV	DBR_SCALAR_DOUBLE	mbar		linear	2021-01-26 19:53:30	0.0000029584457479359116	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-CM:TT07:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-01-26 19:53:30	290.7217820009445	

WINDOW SIZE: 1 year 1 month 2 w 1 w 2.5 d 1 d 18 h 12 h 8 h 4 h 2 h 1 h 30 m 10 m 5 m 1 m 30 s END: 2021-01-27 18 :00 :00 NOW < > AUTO



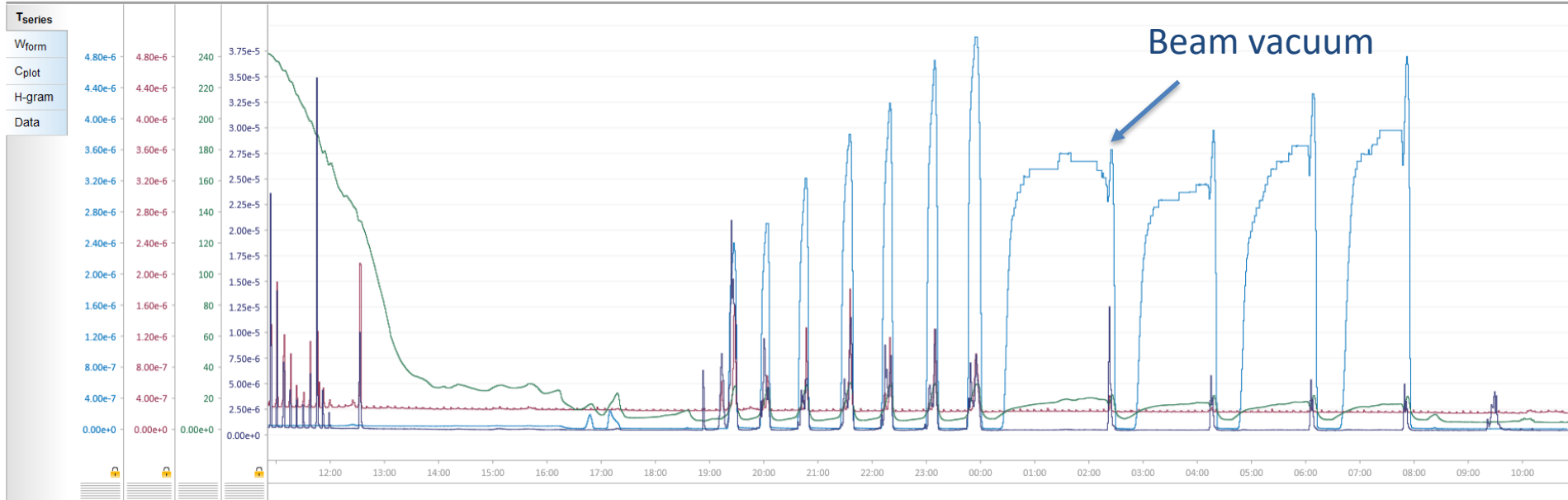
LN2 thermal screen shield cooldown

4K cooldown

- Beam vacuum spike during 4K up to $5E-6$ mbar
- Higer than insulation vacuum
- Connect RGA? 2 K pumping?

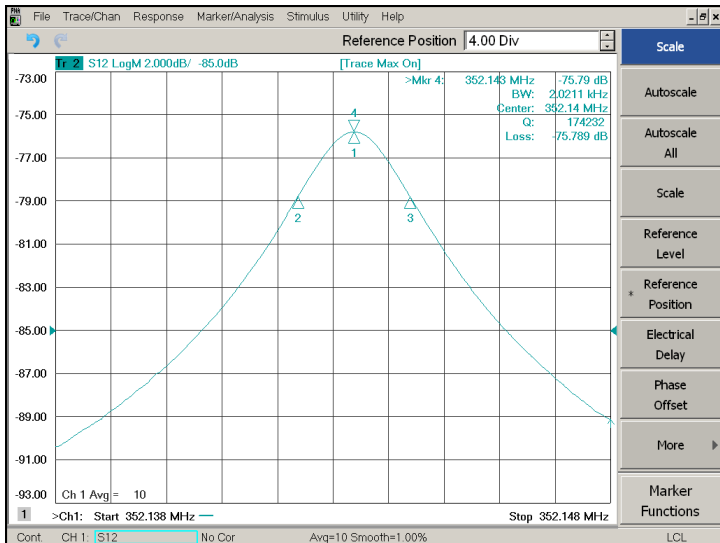
Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT10:sRdV	DBR_SCALAR_DOUBLE			linear	2021-01-28 02:52:57	3.3499999999999997e-7	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT73:sRdV	DBR_SCALAR_DOUBLE	mbar		linear	2021-01-28 02:52:57	2.2700363189187556e-7	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-CM:TT07:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-01-28 02:52:57	10.766831134438744	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT77:sRdV	DBR_SCALAR_DOUBLE	mbar		linear	2021-01-28 02:52:57	4.67261031644739e-7	

WINDOW SIZE: END: 2021-01-28 10 :50 :40

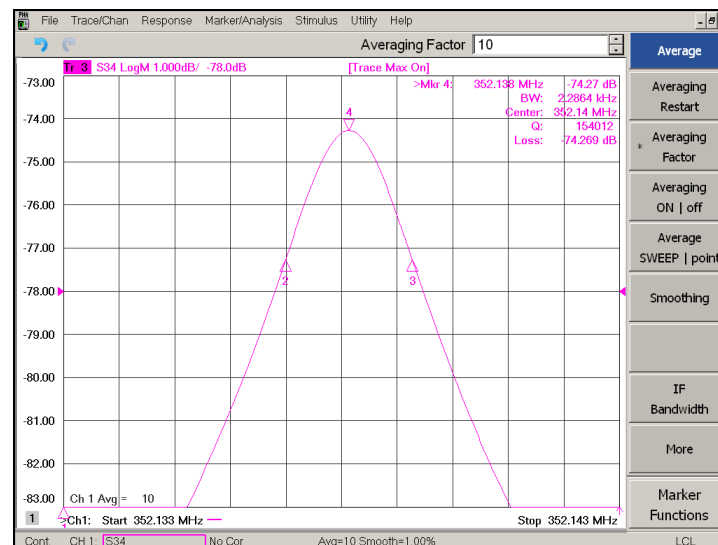




Cavity parameters at 4K



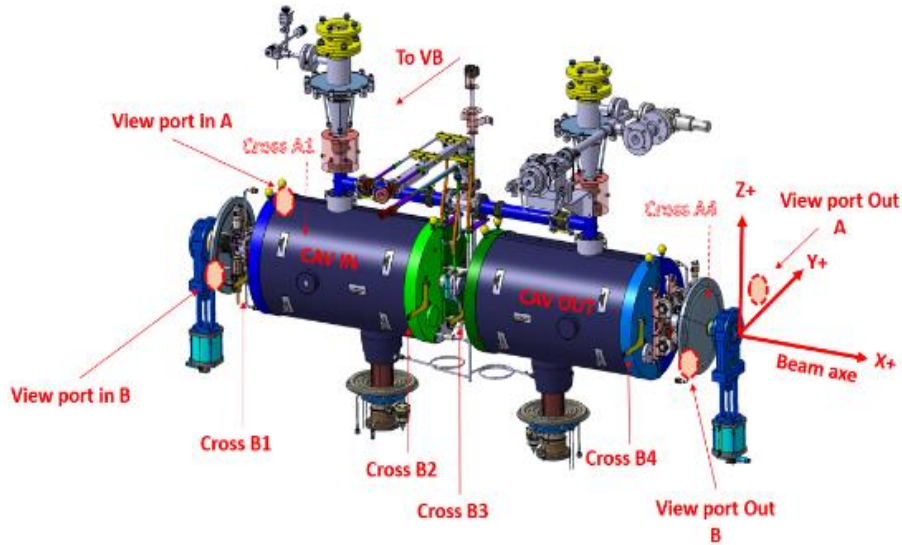
Cav_IN



Cav_OUT

	UU test	
Cavity location	Cavity IN	Cavity OUT
Cavity	DSPK10	DSPK17
Frequency (MHz)	351.143	352.138
Qloaded	1.74E6	1.54E5

CM alignment checking

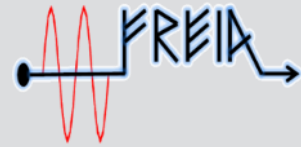


date 20210126			
Measurement at room temperature	Side B	Y (mm)	Z (mm)
	View port in B	/	/
	Cross B1	0.29 (red)	0.04 (black)
	Cross B2	0.61 (red)	> -1.2 (black) (-1.35?)
	Cross B3	0.89 (red)	1.05 (red)
	Cross B4	0.74 (red)	0.1 (red)
	View port out B	/	/

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	/	/



Preliminary time plan



Test item	time	comment
Arrival, unpacking, initial inspection	11 th -12 th Jan.	
CM installation	13 th -15 th Jan.	
CM alignment measurement	18 th -21 th Jan.	
FPC warm conditioning	22 th -25 th Jan.	1) Simultaneously 2) Could be prolonged depended on the progressing
Insulation vacuum		CM alignment measurement
CM cooldown to 4 K	27 th Jan.	
CM cooldown to 2 K	28 th Jan.	
FPC cold conditioning	29 th Jan.	Simultaneously
CTS test	1 st -2 nd Feb.	CTS measurement
Cavity conditioning (on resonance)	3 rd Feb.	Open loop
Heat load/Q measurement	4 th Feb.	1)Each cavity 2) PID
CM alignment measurement	5 th Jan.	
Warm up	6 th -9 th Feb.	
Disconnect, packing, shipment	10 th -15 th Feb.	