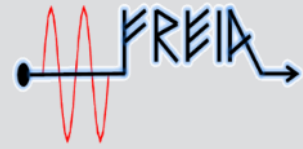
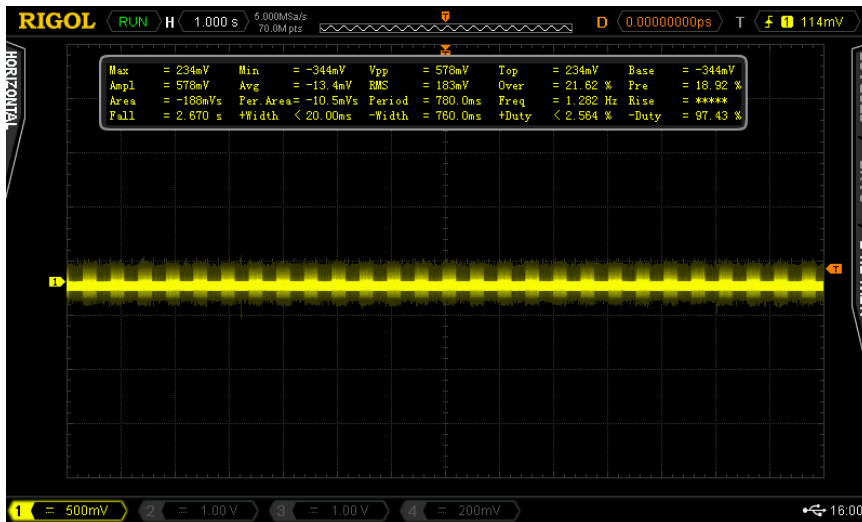


ESS spoke CM04  
weekly meeting  
20210218  
Han Li

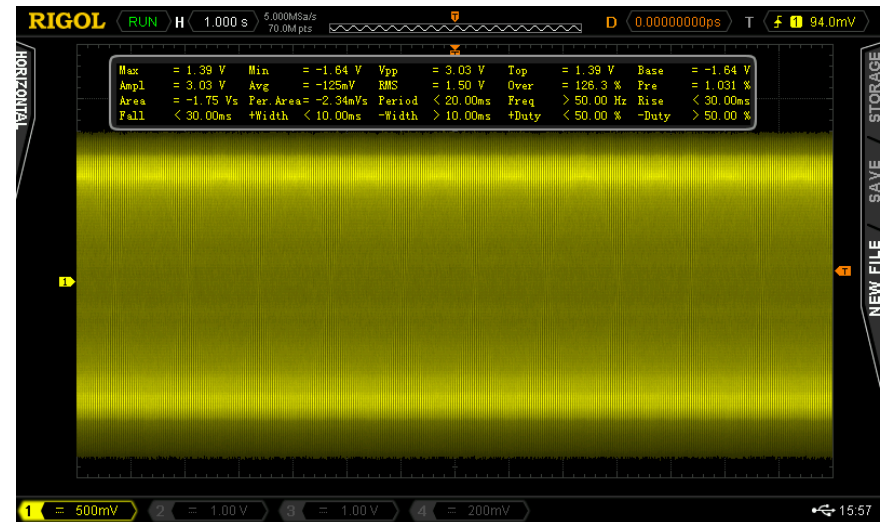


- CM RF test
- CM vacuum test
- CTS driver test
- Test plan

- Put 1 ohm resistance in series in the loop, while monitoring it's voltage
  - CTS driver1 delivers slightly lower current than set-point
  - CTS driver2 delivers current according to the set-point



Noise background

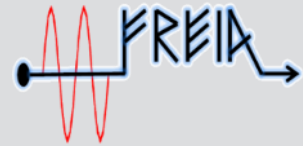


CTS moving

	setting	Tint	Vrms, V	Vnrms, V	$I=V_{rms}/R$	$I=(V_{rms}-V_{nrms})/R$
Driver1	0.6 A	14 s	0,919	0,343	0,84	0,51
	1.2 A	14 s	1,52	0,356	1,38	1,07
Driver2	0.6 A	14 s	0,892	0,184	0,81	0,64
	1.2A	14 s	1,5	0,183	1,36	1,20



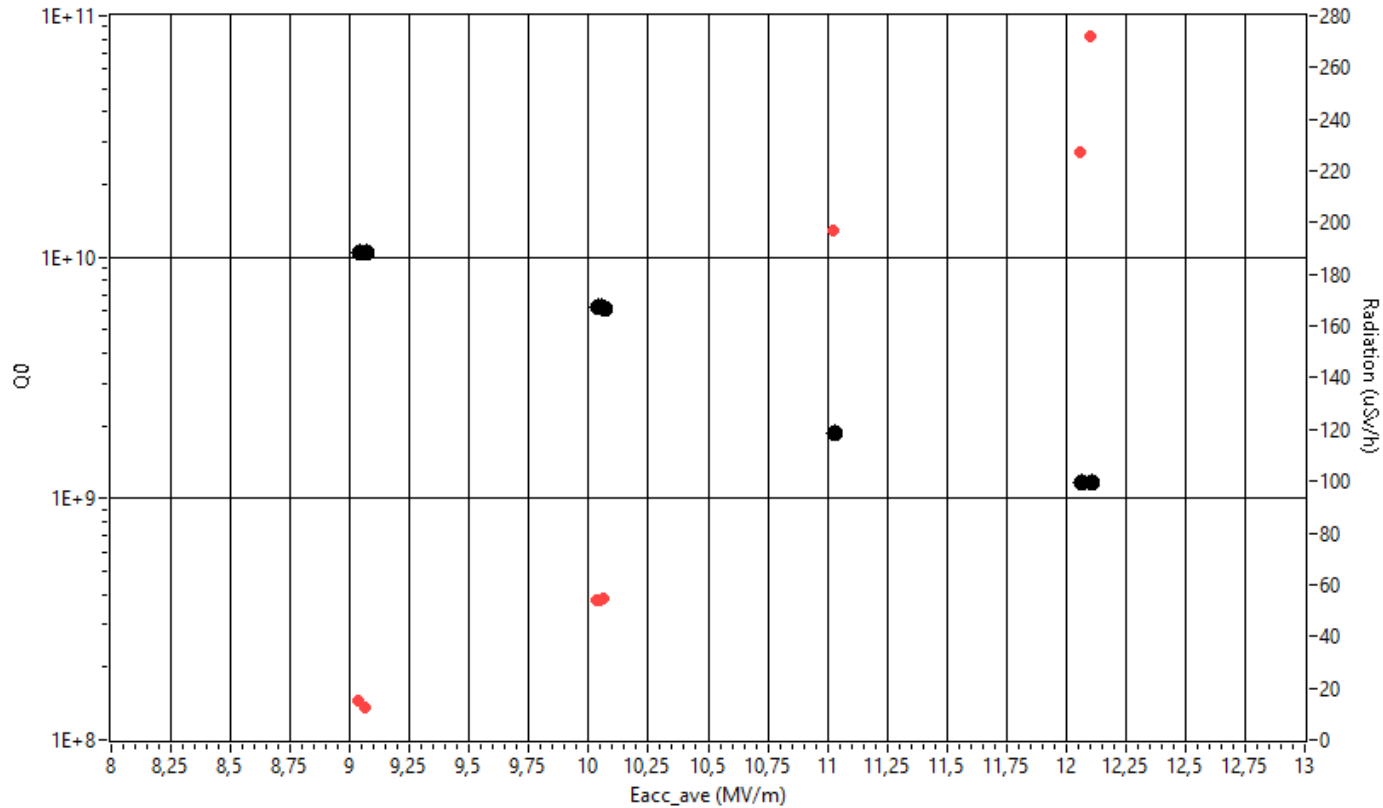
# RF measurement summary

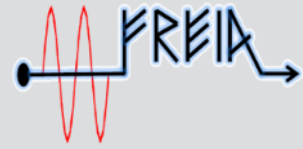


Test	Item	Unit	Acceptant criteria	Measured value
External Q	Cavity "IN"		$1.75E+05 < QL < 2.85E+05$	$1.77E+05$
	Cavity "OUT"		$1.75E+05 < QL < 2.85E+05$	<b><math>1.54E+05</math></b>
Frequency @ 2K (CTS OFF)	Cavity "IN"	MHz	$>352.089$ $<352.175$	352.128
	Cavity "OUT"	MHz	$>352.089$ $<352.175$	352.125
Eacc max	Cavity "IN"	MV/m	$\leq 12$	12
	Cavity "OUT"	MV/m	$\leq 12$	12
Heat losses	Static losses (RF OFF)	W	<b><math>&lt; 8 (?)</math></b>	12.3
	Dynamic losses (Eacc=9MV/m)	W	$< 5$	4.5

CAV\_IN:

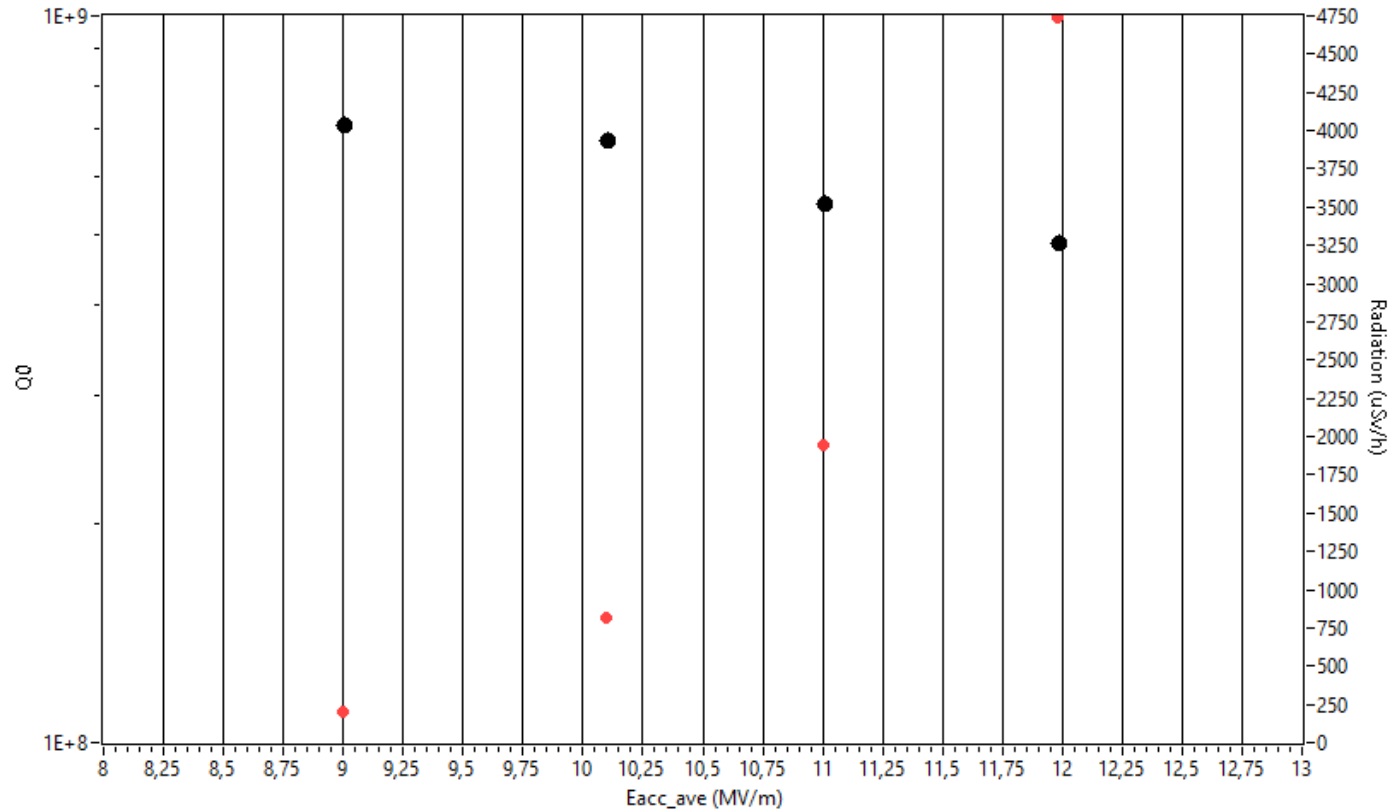
- Max Eacc 12 MV/m (limit by measurement)
- Field emission onset 11 MV/m
- Q0 at 9 MV/m  $1.05 \times 10^{10}$



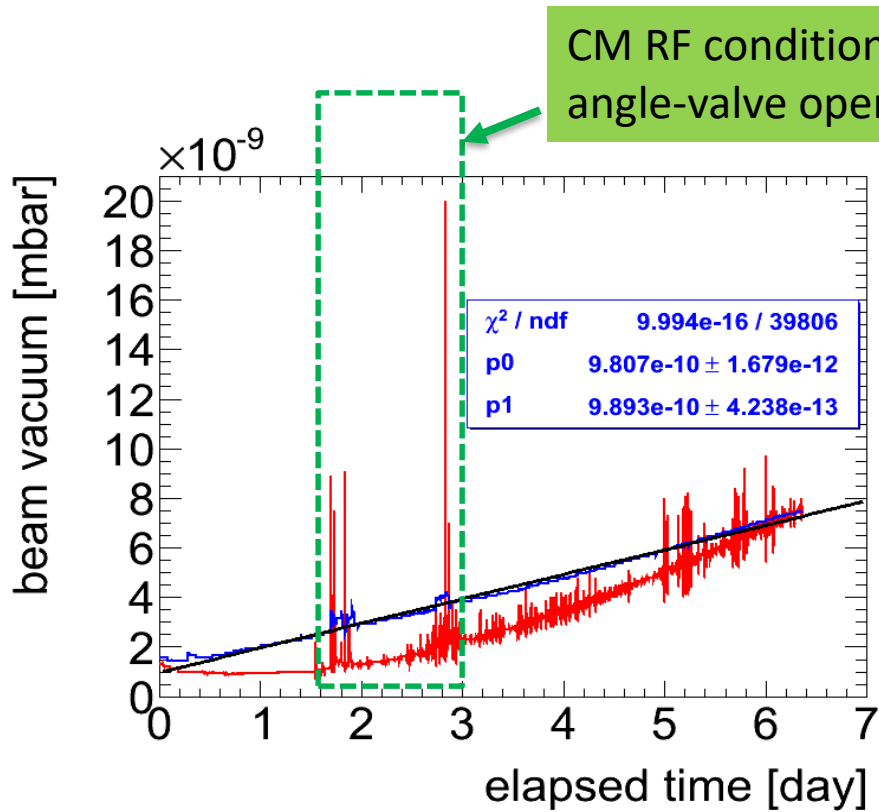


## CAV\_OUT:

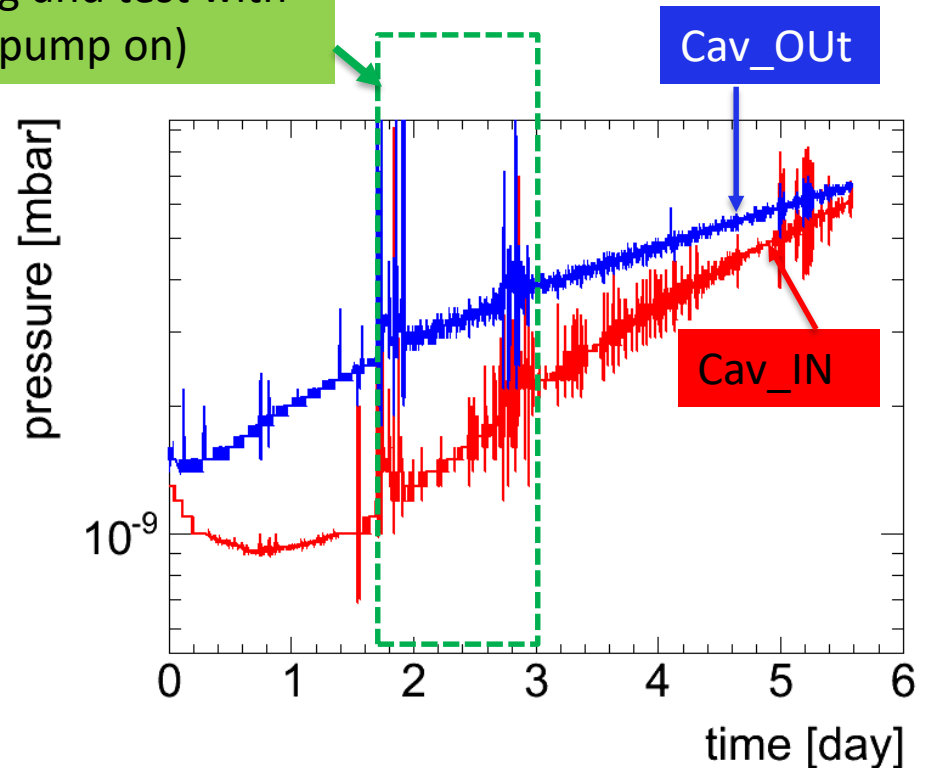
- Max Eacc 12 MV/m (limit by measurement)
- Field emission onset 8.5MV/m
- Q0 at 9 MV/m  $7.1 \times 10^8$



- Beam vacuum increase linearly within past 6 days after cooldown (all at 2 K)
- Angle-valve kept close except RF conditioning and test



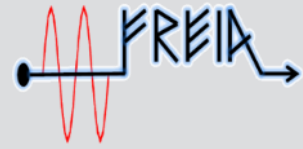
Linear scale



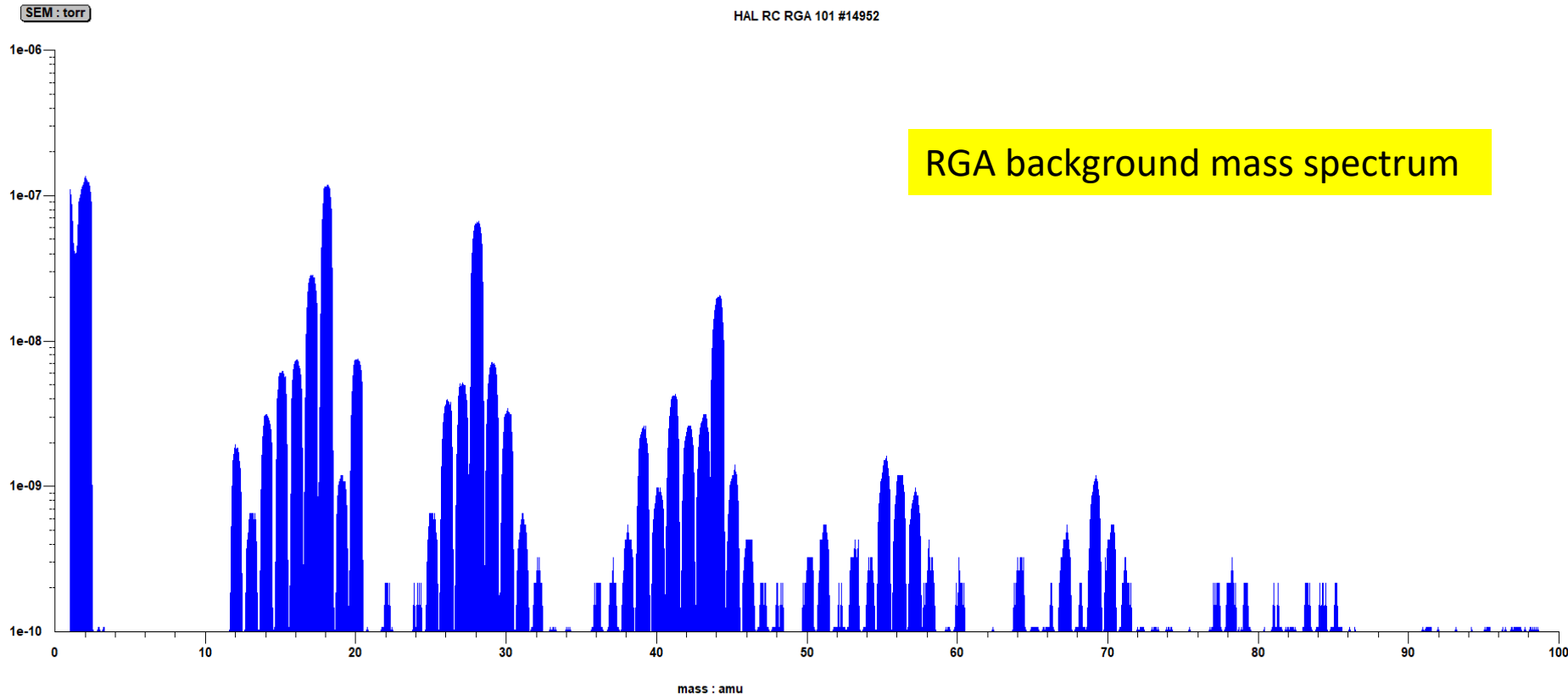
Logarithm scale



# RGA connection

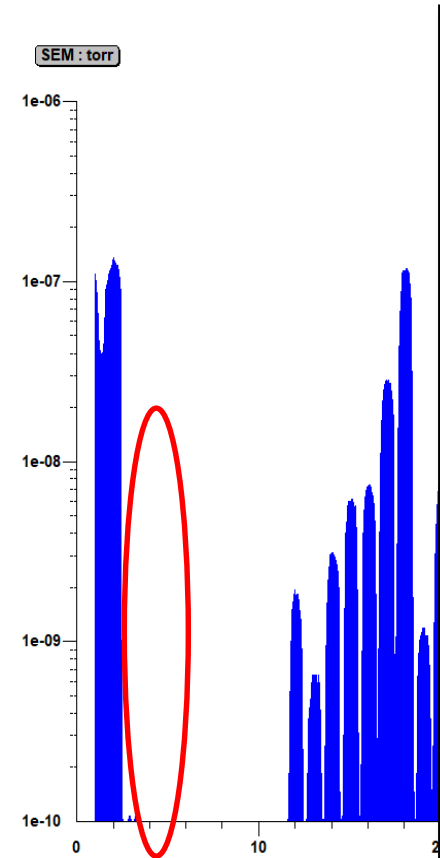


- Close the angle valve
- Connect a RGA between TP and Leak detector
- Leak test for the piping
- Prepare data acquisition of the RGA through the control system

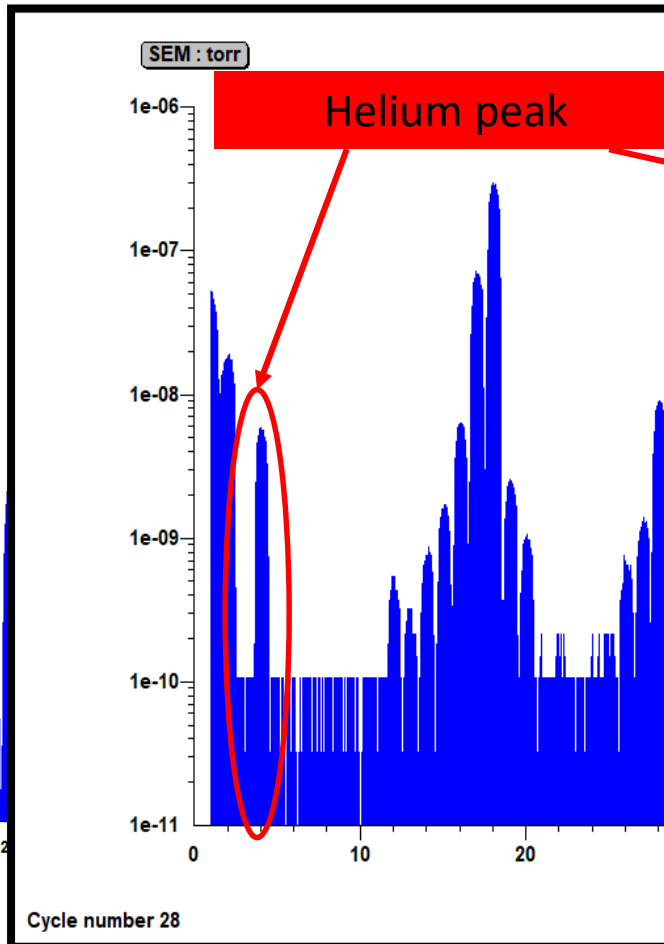




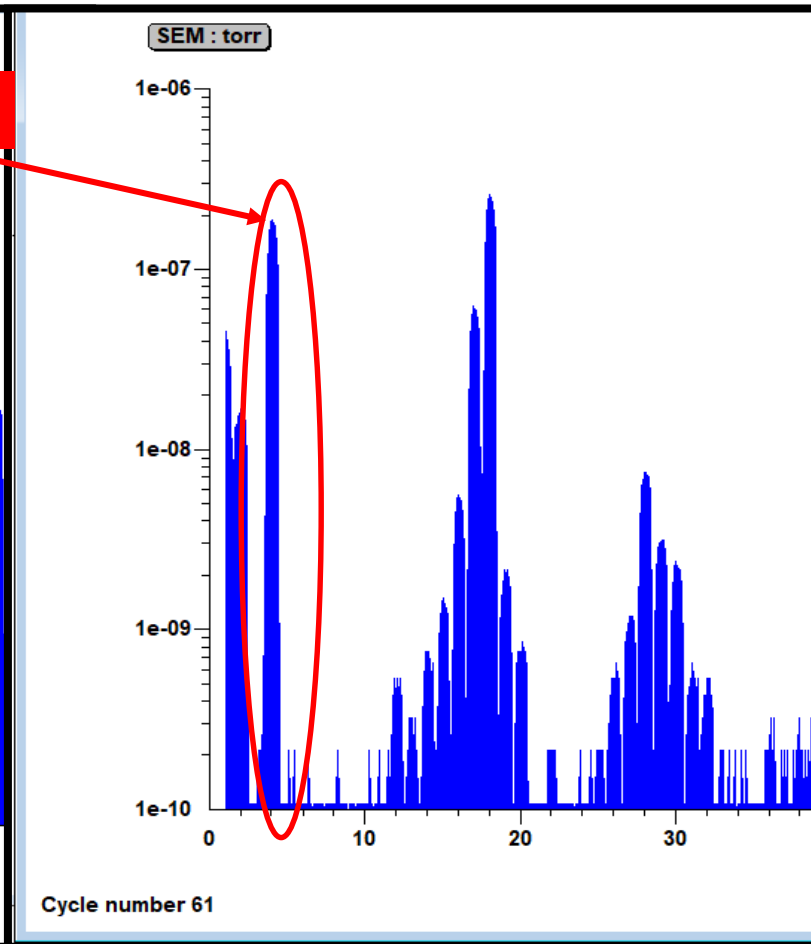
# Clear Helium signal (RGA)



Before angle-valve  
open

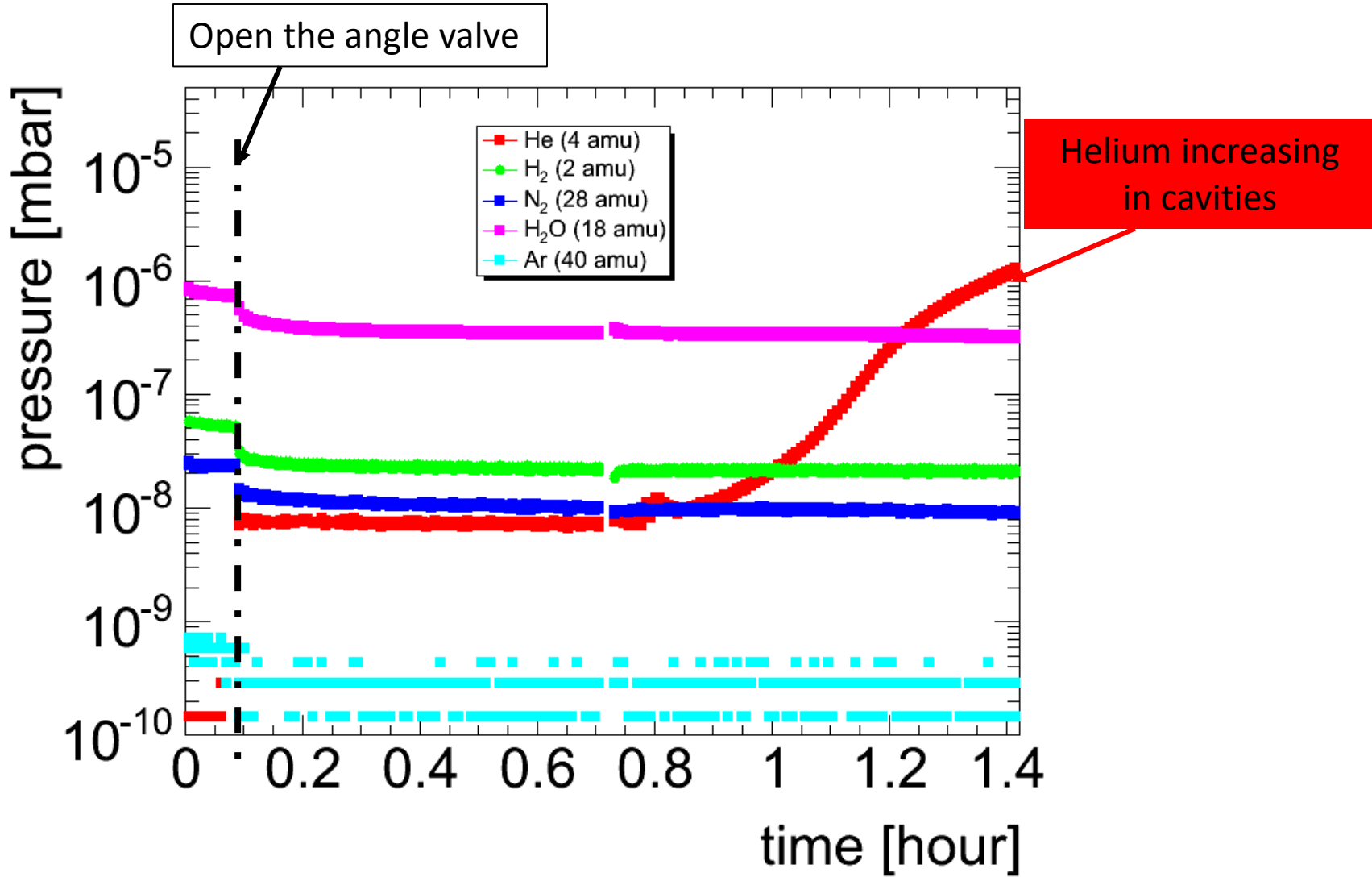


after angle-valve  
open



Helium pressure from  
31mabr to 1bar

# Clear Helium signal (RGA)



## ➤ Suspected correlation between beam vacuum and Helium tank pressure

Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CM-Vac:PT20:sRdV	DBR_SCALAR_DOUBLE			linear	2021-02-16 13:48:03	7.7e-9	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT10:sRdV	DBR_SCALAR_DOUBLE			linear	2021-02-16 15:22:39	0.000001	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CM-CM:TT06:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-02-16 13:47:55	2.0853444811311954	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-PwrCpl:FT21:sRdV	DBR_SCALAR_DOUBLE	mg/s		linear	2021-02-16 15:22:55	40.66840362548828	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-CM:PT03:sRdV	DBR_SCALAR_DOUBLE	mbar		linear	2021-02-16 14:43:23	19.600000381469727	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	CM-CM:PT02:sRdV	DBR_SCALAR_DOUBLE	mbar		linear	2021-02-16 15:23:03	1098.5999755859375	

WINDOW SIZE: 1 year 1 month 2w 1w 2.5d 1d 18h 12h 8h 4h 2h 1h 30m 10m 5m 1m 30s END: 2021-02-16 15 :12 :12 NOW < >

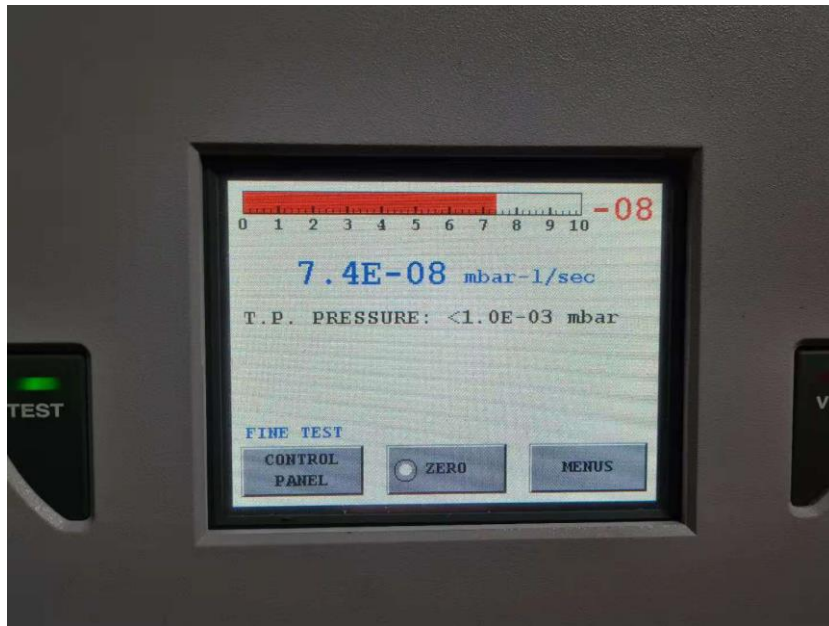


Helium circuit/vessel pressure

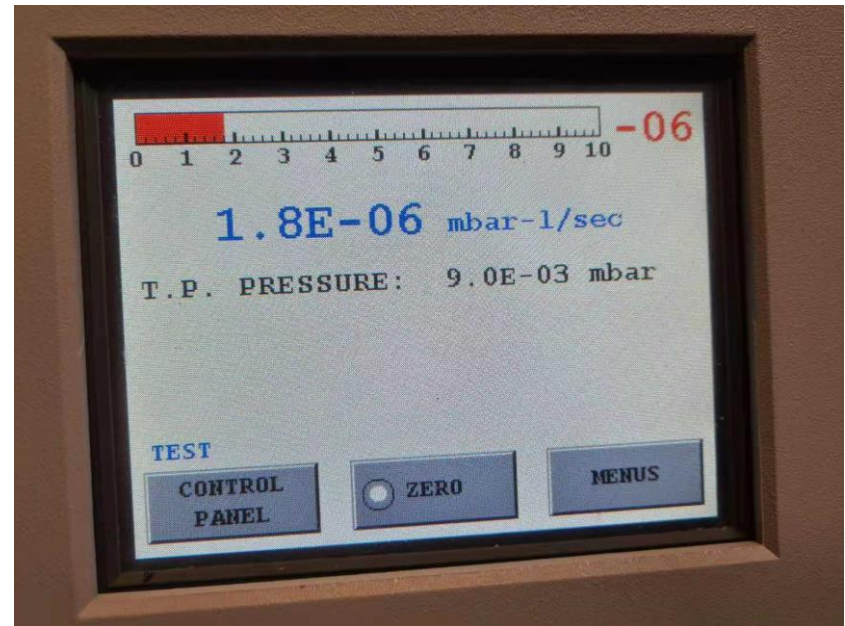
supercritical Helium gas

Close supercritical Helium gas flow, but still same pressure in the pipe(same as the 4 k tank)

- Background baseline:  $1.2 \text{ E-9 mbar}\cdot\text{l /s}$
- Cross-check with the RGA



after angle-valve open

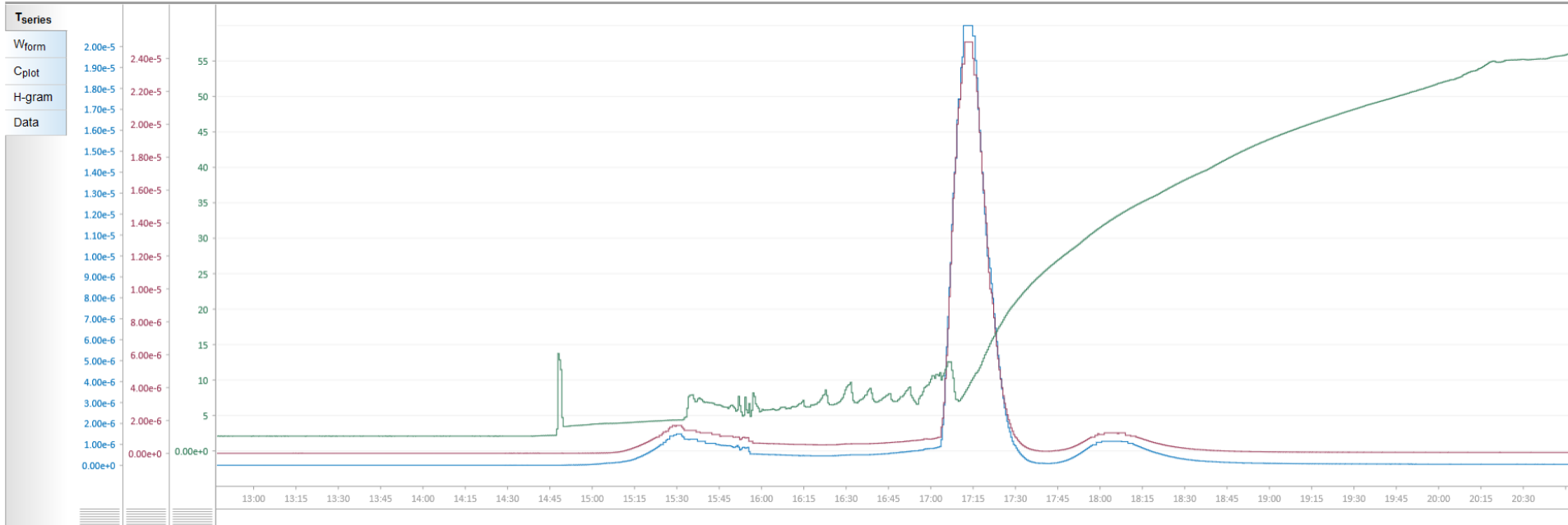


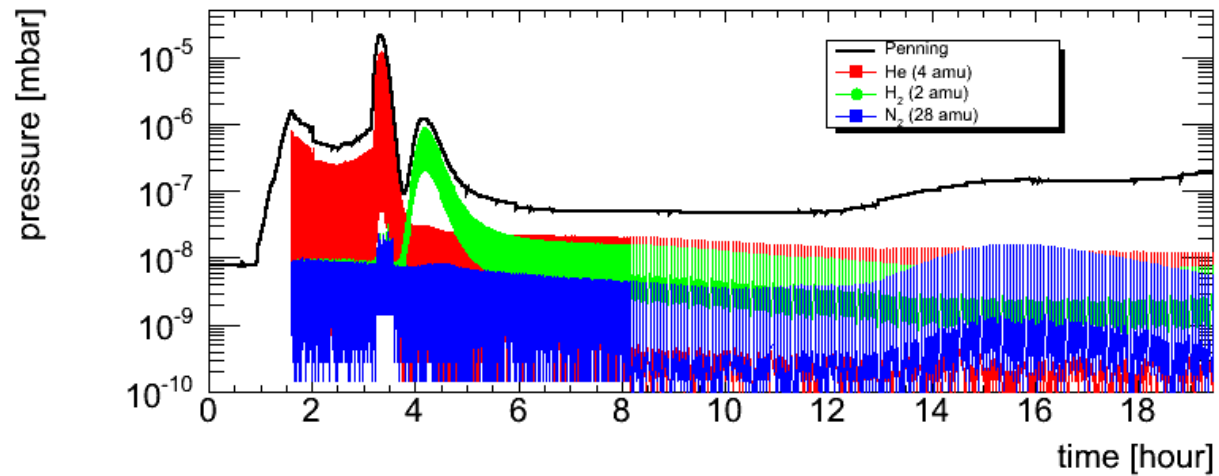
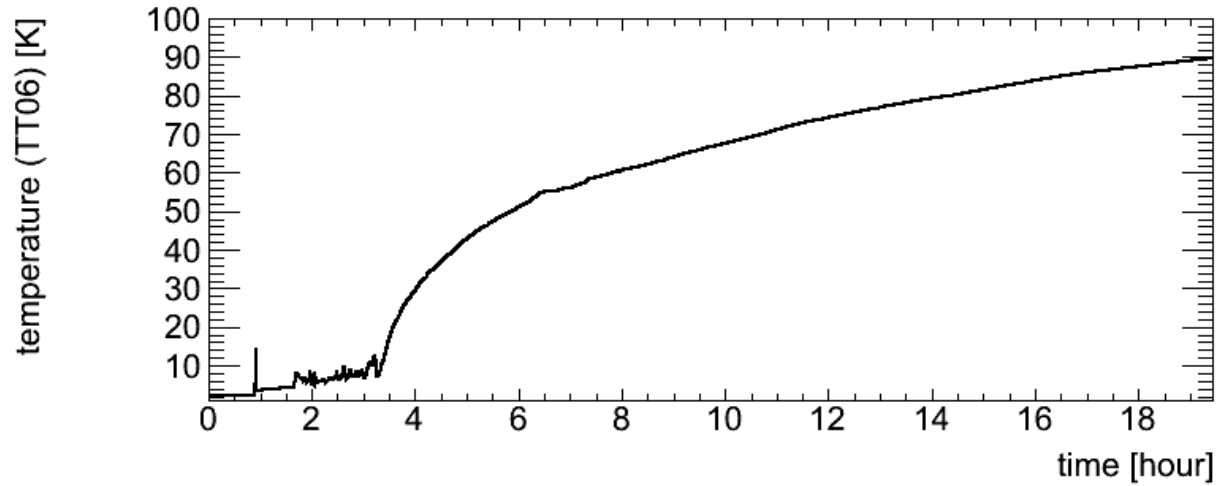
Helium pressure from 31mabr to 1bar

- Similar outgassing as those in last thermal cycle has been observed
- Always with pump on

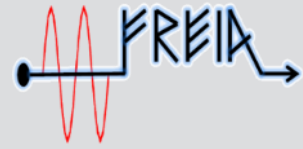
Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT20:sRdV	DBR_SCALAR_DOUBLE			linear	2021-02-16 13:48:06	7.74e-9	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-Vac:PT10:sRdV	DBR_SCALAR_DOUBLE			linear	2021-02-16 13:48:06	8.2e-9	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	CM-CM:TT06:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-02-16 13:48:06	2.084993418977207	

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: 2021-02-16 20:46:33 NOW < >

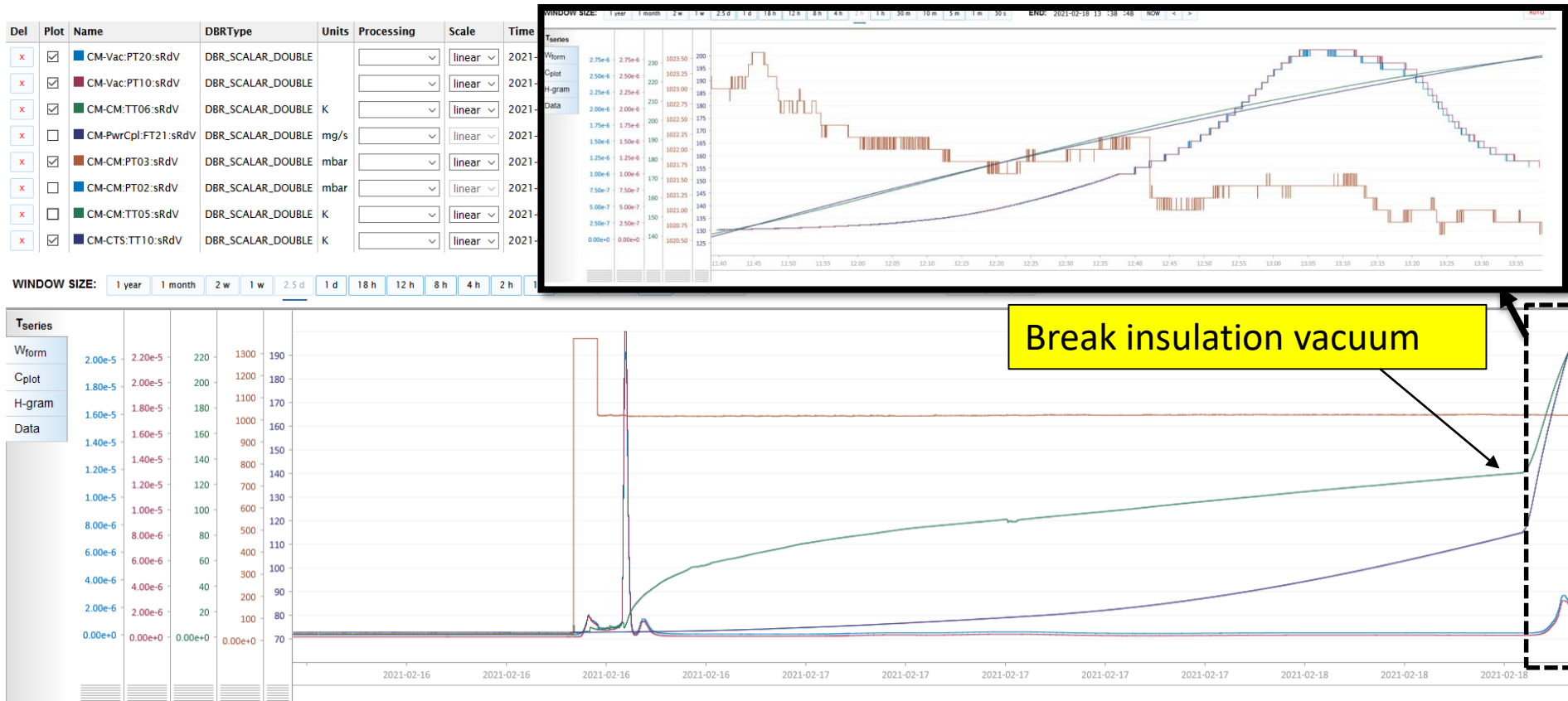




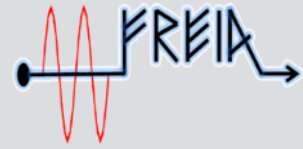
# Warm up (break insulation vacuum)



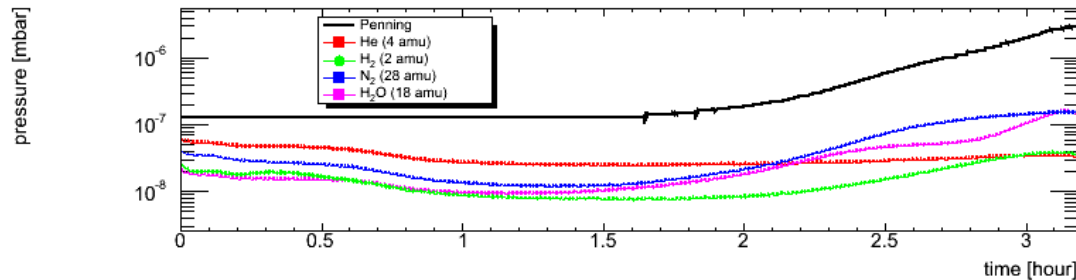
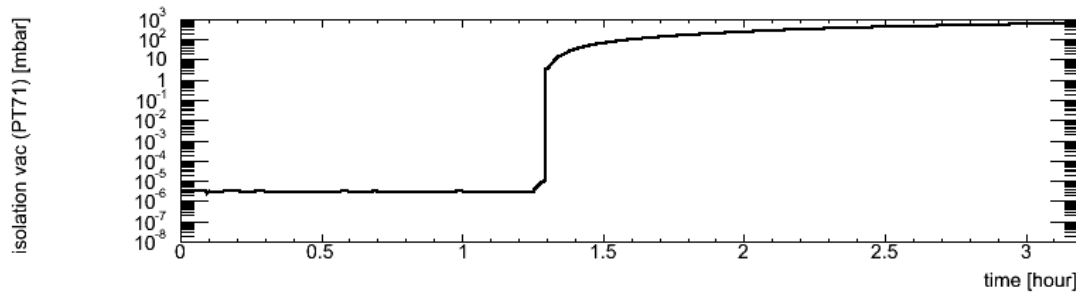
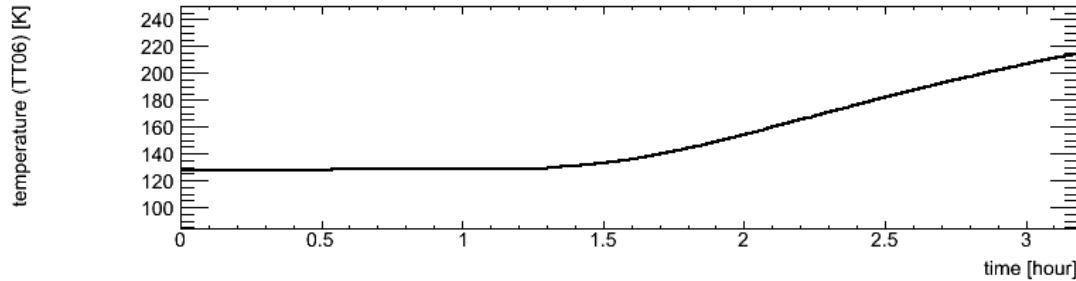
- Inject N2 gas to break insulation vacuum to accelerate the warm up procedure
- Cavity temperature around 180 K
- An surprise outgassing appear (RGA analysis is ongoing)



# Warm up (break insulation vacuum)



- No N<sub>2</sub> peak has been found in RGA analysis while breaking the insulation vacuum



Only small increasing of water and N<sub>2</sub> after 1 hour of N<sub>2</sub> venting

Outgassing during to temperature?





# Preliminary time plan



Test item	time	comment
Arrival, unpacking, initial inspection	11 <sup>th</sup> -12 <sup>th</sup> Jan.	
CM installation	13 <sup>th</sup> -15 <sup>th</sup> Jan.	
CM alignment measurement	18 <sup>th</sup> -21 <sup>th</sup> Jan.	
FPC warm conditioning	22 <sup>th</sup> -25 <sup>th</sup> Jan.	
Insulation vacuum		CM alignment measurement
CM cooldown to 4 K	27 <sup>th</sup> Jan.	
CM cooldown to 2 K	28 <sup>th</sup> Jan.	
FPC cold conditioning	29 <sup>th</sup> Jan.	Simultaneously
CTS test	1 <sup>st</sup> -2 <sup>nd</sup> Feb.	CTS measurement
Cavity conditioning (on resonance) Heat load/Q measurement	3 <sup>rd</sup> -4 <sup>th</sup> Feb.	Open loop
CTS test (2 <sup>nd</sup> run)	5 <sup>th</sup> Feb..	
Thermal cycle	8 <sup>th</sup> Feb.	
CM cooldown to 4 K	9 <sup>th</sup> Feb.	
CM cooldown to 2 K	10 <sup>th</sup> Feb.	
Cavity conditioning Heat load/Q measurement	11 <sup>th</sup> -12 <sup>th</sup> Feb.	
Warm up (RGA connect)	15 <sup>th</sup> -21 <sup>th</sup> Feb.	
Leak test /alignment at warm	22 <sup>th</sup> Feb.	
Disconnect, packing, shipment	23 <sup>th</sup> -26 <sup>th</sup> Feb.	