UPPSALA UNIVERSITET

ESS spoke CM02 (2nd run) /CM05 weekly meeting 20210401

Han Li

CM status

- CM05 incoming test
- CM02 RF performance
- CM02 warm up
- Test plan

CM05 incoming test

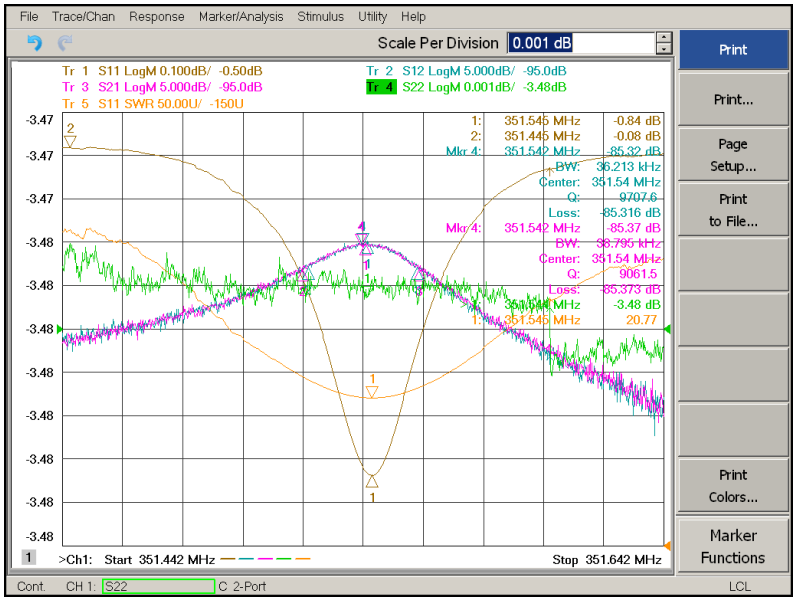
- All sensors and electrical continuity are OK

Cables verification CM05 at IJCLab			v1
Socket assembly		Verified by : G.Theron	
Socket name	*PID name*	*Electrical value (Ω) (before shipping)*	*C / NC*
LC01	TT04	68.31	C
	TT05	68,74	C
	TT06	74,3	C
	TT07	62.22	C
	TT08	67.25	C
	TT09	69.53	C
	TT10	108.08	C
	TT11	108.14	C
	TT12	67.12	C
	TT20	108.18	C
	TT21	108.24	C
	TT22	69.24	C
PT Coupler	TT120	107,64	C
	TT220	107,61	C
LC02	EH01	84.47	C
	EH02	84.56	C
	EH10	83.06	C
	EH20	82.28	C
LC03	SM10	2.43 / 2.46	C
	LS10	2.11	C
	SM20	2.50 / 2.49	C
	LS20	2.02	C
LC07	LT01	369.11	C
	LT02	369.86	C
Socket name	*PID name*	*Electrical value (µF) (before shipment)*	*C / NC*
LC04	PZ10	12.86	C
	PZ11	12.84	C
	PZ20	12.71	C
	PZ21	12.70	C

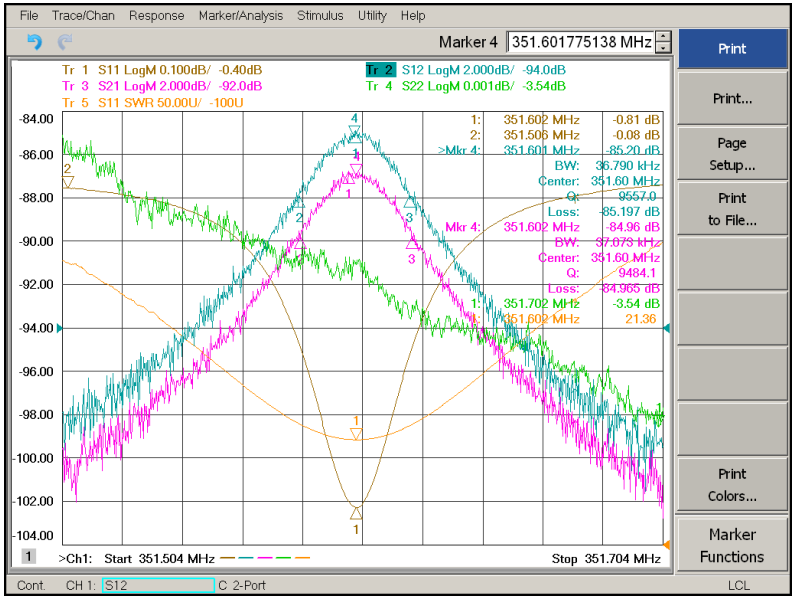
Cables verification CM05 at UU			v1
Socket assembly		Verified by :	
Socket name	*PID name*	*Electrical value (Ω) (before shipping)*	*C / NC*
LC01	TT04	69,15	C
	TT05	69,45	C
	TT06	75,05	C
	TT07	62,8	C
	TT08	67,65	C
	TT09	69,8	C
	TT10	104,75	C
	TT11	106,45	C
	TT12	67,8	C
	TT20	104,25	C
	TT21	114,3	C
	TT22	69,9	C
PT Coupler	TT120	106,6	C
	TT220	106,4	C
LC02	EH01	83,4	C
	EH02	84,4	C
	EH10	82,9	C
	EH20	82	C
LC03	SM10	2,3 / 2,4	C
	LS10	1,9	C
	SM20	2,4 / 2,3	C
	LS20	1,9	C
LC07	LT01	366,6	C
	LT02	367,55	C
Socket name	*PID name*	*Electrical value (µF) (before shipment)*	*C / NC*
LC04	PZ10	14	C
	PZ11	13,91	C
	PZ20	13,86	C
	PZ21	14,21	C

CM05 incoming test

- Similar as Orsay's outgoing result.



CAV_IN



CAV_OUT

		frequency @RT	QL
Cav_in	UU	351.542	9061
	Orsay	351.546	8822
Cav_out	UU	351.602	9484
	Orsay	351.601	8910

CM05 installation

Hardware:

- Doorknob √
- Sensors and gauges: arc detector, electron pickup √
- Waveguide bellows mounting √
- Safety valve mounting
- Pressure gauge mounting
- Turbo-pump mounting for insulation vacuum
- Cryogenic jumper
- View ports for alignment
- Beam vacuum pumping cart connection
- FPC water cooling pipe connection
- Cabling: arc, e-pickup, lemo connector…
- CM alignment checking with insulation vacuum
- Close buncker

CM02 RF performance

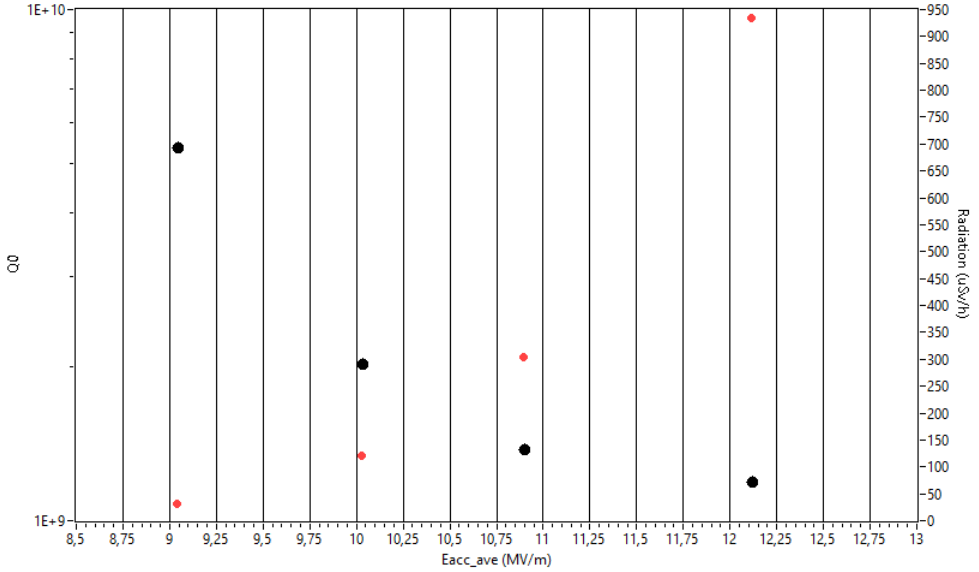
Will be the first CM ship to ESS!!

Test	Item	Unit	Acceptant criteria	Measured value
External Q	Cavity "IN"		1.75E+05< QL<2.85E+05	1.54E+05
	Cavity "OUT"		1.75E+05< QL<2.85E+05	2.2E+05
Frequency @ 2K (CTS OFF)	Cavity "IN"	MHz	>352.089 <352.175	352.134
	Cavity "OUT"	MHz	>352.089 <352.175	352.098
Eacc max	Cavity "IN"	MV/m	≤12	12
	Cavity "OUT"	MV/m	≤12	12
Heat losses	Static losses (RF OFF)	W	<10.7 (?)	14.3
	Dynamic losses (Eacc=9MV/m)	W	<5	1.3

RF performance

CAV_IN:

- Max Eacc 12 MV/m (limit by measurement)
- Field emission onset 9 MV/m
- MP region 4-5 MV/m, 6-7 MV/m
- Q0 at 9 MV/m 5.34 $\times 10^9$



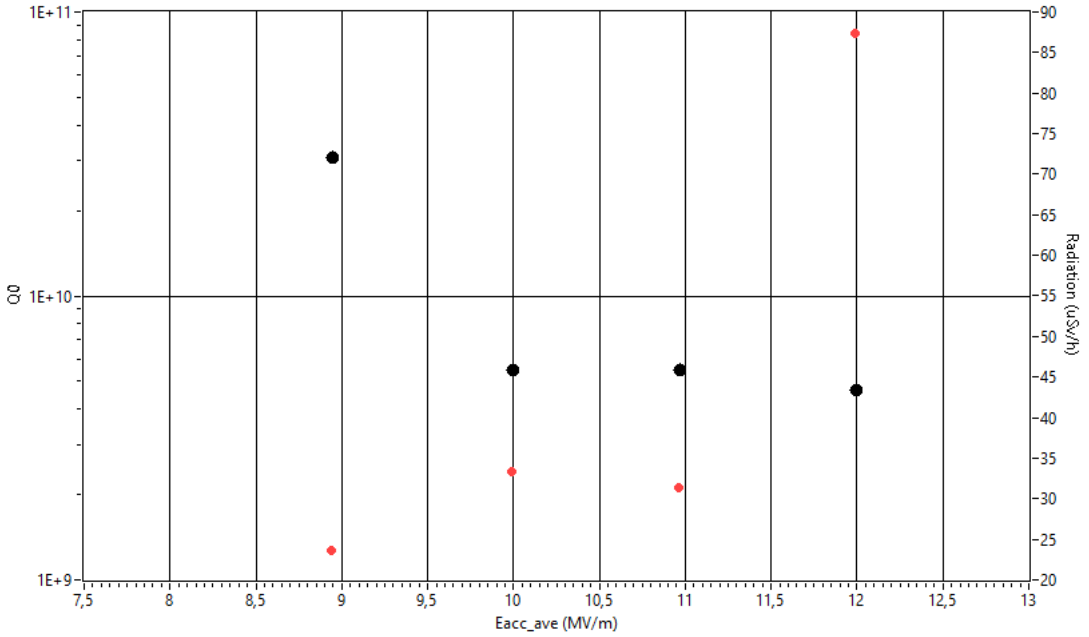
	FE onset	Arcing at doorknob	Quench point
1st test (last December)	9 MV/m	11 MV/m	11.4
2nd test	9 MV/m	11 MV/m	>12

Manage to process the arcing in the 2nd run

RF performance

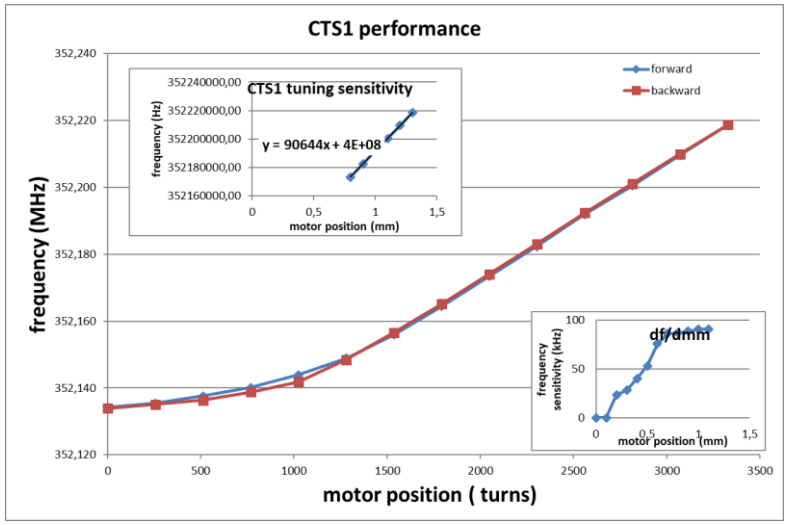
CAV_OUT:

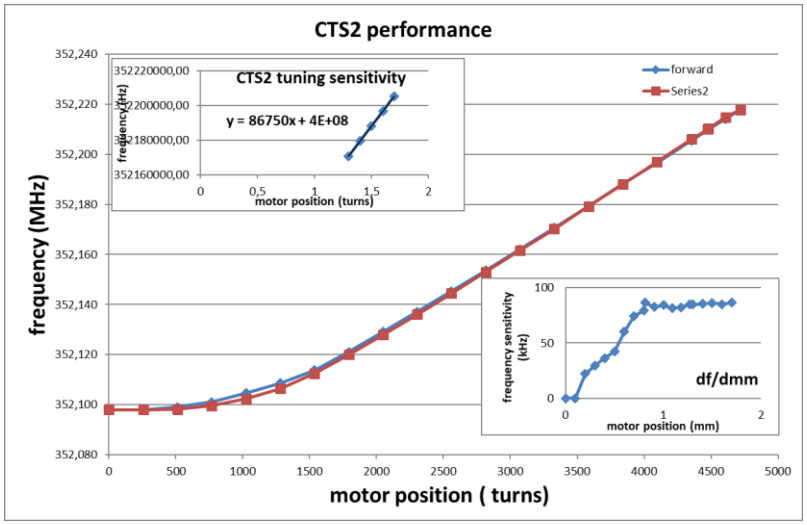
- Max Eacc 12 MV/m (limit by measurement)
- Field emission onset 12 MV/m
- MP region 4-5 MV/m, 6-8 MV/m
- Q0 at 9 MV/m 3 $\times 10^{10}$ (with measurement uncertainty 0.5 W)



CTS test

- Both CTSs work well with 0.6 A driving current.
- No missing step has been observed.
- Both CTSs meet the target frequency (CTS1 1.2 mm & CTS2 1.75 mm)



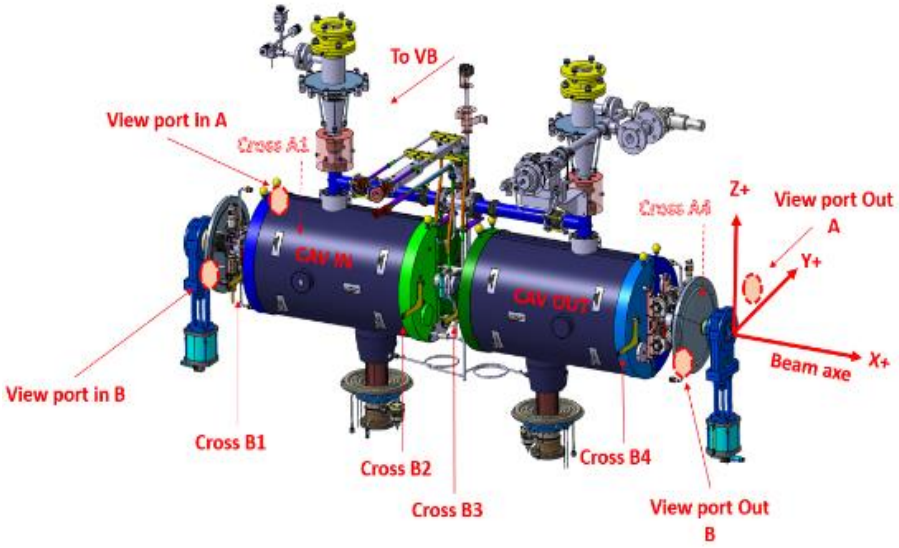


Tuning sensitivity			Position for target frequency
First run	Cav_in	--	--
Second run		90.6 KHz/mm	1.2 mm
First run	Cav_out	85 KHz/mm	1.74 mm
Second run		86.7 KHz /mm	1.74 mm

CM alignment checking

date		20210315	
Measurement at room temperature	**Side B**	**Y (mm)**	**Z (mm)**
	View port in B	/	/
	Cross B1	0.87 (red)	0.41 (red)
	Cross B2	0.53 (red)	0.25 (red)
	Cross B3	0.50 (red)	0.81 (black)
	Cross B4	0.84(red)	0.06 (red)
	View port out B	/	/

date		20210325	
Measurement at cold	**Side B**	**Y (mm)**	**Z (mm)**
	View port in B	/	/
	Cross B1	0.05(black)	0.52 (red)
	Cross B2	0.59 (black)	0.34 (red)
	Cross B3	0.77 (black)	0.66 (black)
	Cross B4	0.1 (black)	0.30 (red)
	View port out B	/	/



Conclusion:

- Mainly displacement at Y axis
- ~ 1 mm from 300K to 2 K
- Alignment instrument was moved mistakenly by people so we loose the reference at warm.

CM02 warm up

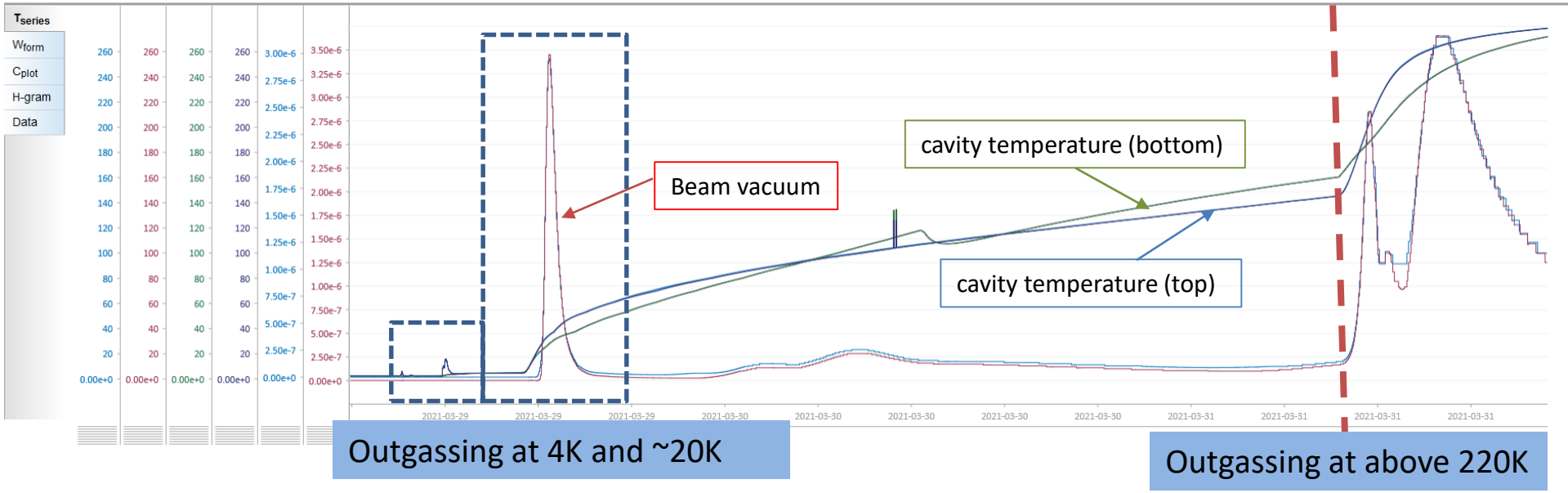
- It took 4 days for warming up to RT
- Break insulation vacuum with N2

Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
x	☑	CM-CM:TT06:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-03-29 **09:03:45**	2.266232991262593	
x	☑	CM-CM:TT04:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-03-29 **09:03:45**	2.182886968974246	
x	☑	CM-CM:TT05:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-03-29 **09:03:45**	2.6095725097572213	
x	☑	CM-CM:TT07:sRdV	DBR_SCALAR_DOUBLE	K		linear	2021-03-29 **09:03:45**	2.283904383133397	
x	☑	CM-Vac:PT10:sRdV	DBR_SCALAR_DOUBLE			linear	2021-03-29 **09:03:45**	2.2526315789473685e-10	
x	☑	CM-Vac:PT20:sRdV	DBR_SCALAR_DOUBLE			linear	2021-03-29 **09:03:45**	2.5450000000000005e-10	

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: 2021-03-31 20 :56 :23 NOW < > AUTO

Break insulation vacuum

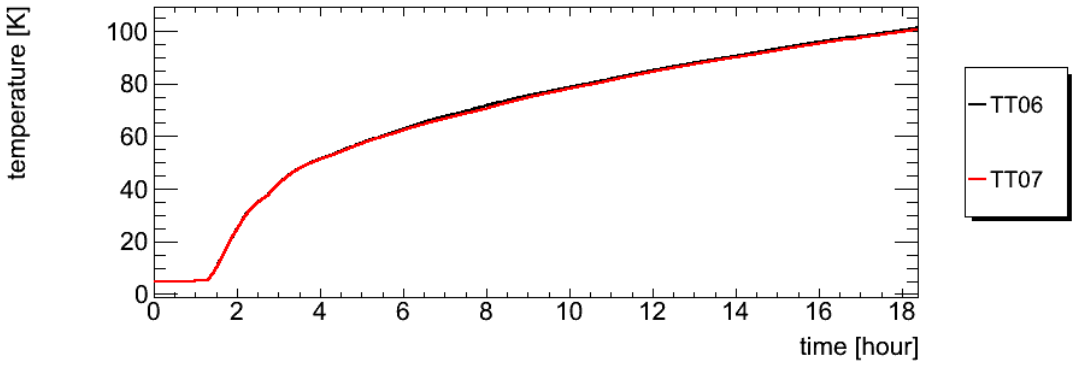


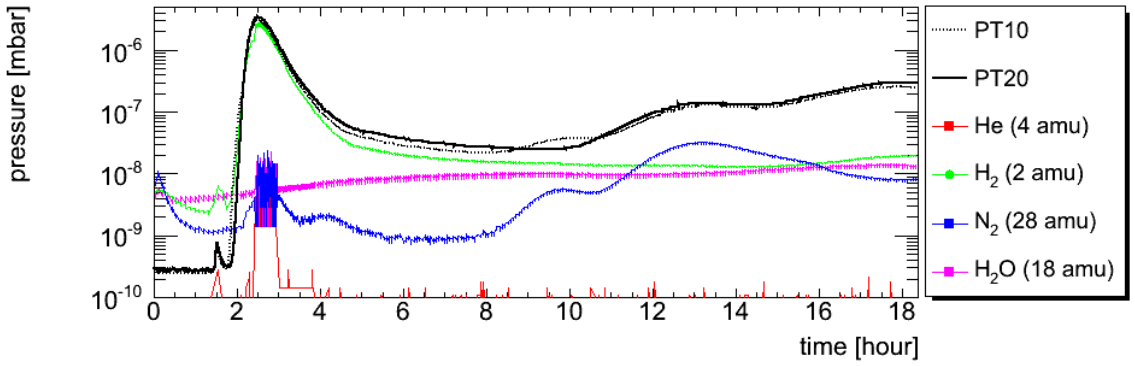
Outgassing at 4K and ~20K

Outgassing at above 220K

CM02 warm up

- Outgassing of H2 and N2 have been observed by RGA





Preliminary time plan

Test item	time	comment
CM04 Warm up (RGA connect) CM02 arrival	15th -21th Feb.	
CM02 installation CM04 Disconnect, packing, shipment	1st- 12th Mar.	
CM02 FPC warm conditioning	15th -17th Mar.	CM02
CM alignment measurement	16th Mar.	CM02
Heater repair	18th	
CM cooldown to 4 K	19th Mar.	
FPC cold conditioning	22th Mar.	Simultaneously
CM cooldown to 2 K	24rd Mar.	
CTS test	24th Mar.	CTS measurement
alignment at cold	25th Mar.	
Cavity conditioning (on resonance) Heat load/Q measurement	25th -26th Mar.	Open loop
Warm up	27th -31st Mar	
alignment at warm	1st Apr.	
Disconnect, packing, shipment	2nd -9th Apr.	