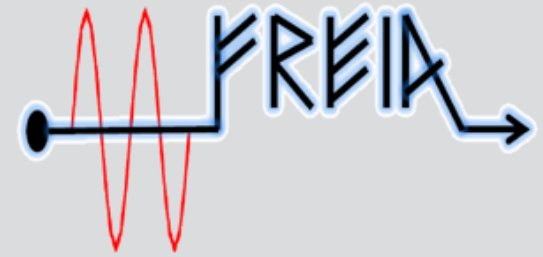




UPPSALA
UNIVERSITET



ESS weekly meeting (2022 W04)

A. Miyazaki, M. Zhovner et al.

General planning: no major change



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



W03 & W04 progress



week		W03											
date		MON 17-jan		TUE 18-jan		WED 19-jan		THU 20-jan		FRI 21-jan		SAT 22-jan	SUN 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		standby to fill up Dewar	standby	4K operation	stand by
		Beckhoff PLC preparation		coupler cold conditioning	Beckhoff PLC test through the long cable to the bunker								
next CM	CM08												

week		W04											
date		MON 24-jan		TUE 25-jan		WED 26-jan		THU 27-jan		FRI 28-jan		SAT 29-jan	SUN 30-jan
		m	a	m	a	m	a	m	a	m	a		
present CM	CM07	4K filling; 2K pumping	CTS test	piezo and heat load		CTS test with Beckhoff PLC; heat load		heat load		start warming up		vent insulatyion vacuum	warming up
next CM	CM08	doorknob mounting											
next next CM	CM09	preparation at Orsay											

We are here



W05 & W06 & CM07 plan



week		W05											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		31-jan		01-feb		02-feb		03-feb		04-feb		05-feb	06-feb
		m	a	m	a	m	a	m	a	m	a		
previous CM	CM07	warming up completed	disconnect vac pumps	disconnect cryogenics	swap modules	N2 filling		out going test		waiting in the box			
present CM	CM08					connect cryogenics		connect vacuum pumps		pumping vacuum			
next CM	CM09	preparation at Orsay							departure from Orsay		transport		

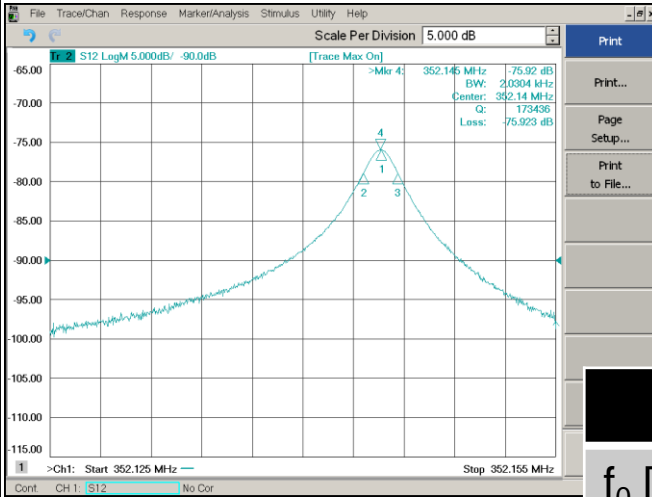
week		W06											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		07-feb		08-feb		09-feb		10-feb		11-feb		12-feb	13-feb
		m	a	m	a	m	a	m	a	m	a		
previous CM	CM07	departure to ESS		preparing report				publish report					
present CM	CM08	coupler warm conditioning							purging		N2 cooling		
next CM	CM09	transport from Orsay					arrival at UU		reception test				

Can be flexible

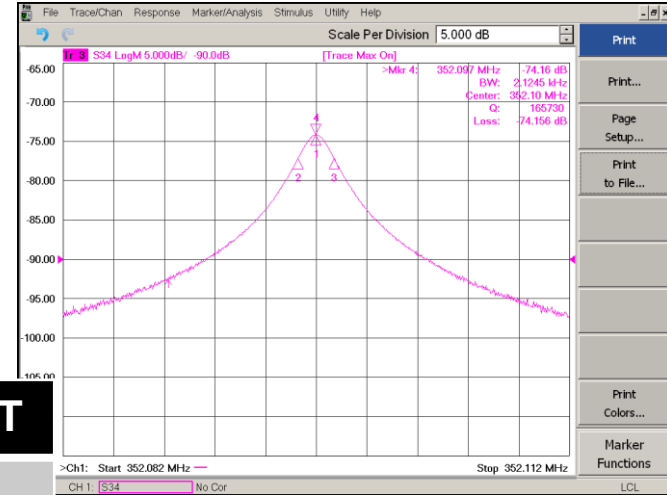
week		W07											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		14-feb		15-feb		16-feb		17-feb		18-feb		19-feb	20-feb
		m	a	m	a	m	a	m	a	m	a		
present CM	CM08	LHe cooling	4K filling		coupler cold conditioning	2K pumping	RF calibration interlock setup	MP conditioning		CTS test			
next CM	CM09												

(One concern: Covid cases are reported in the lab)

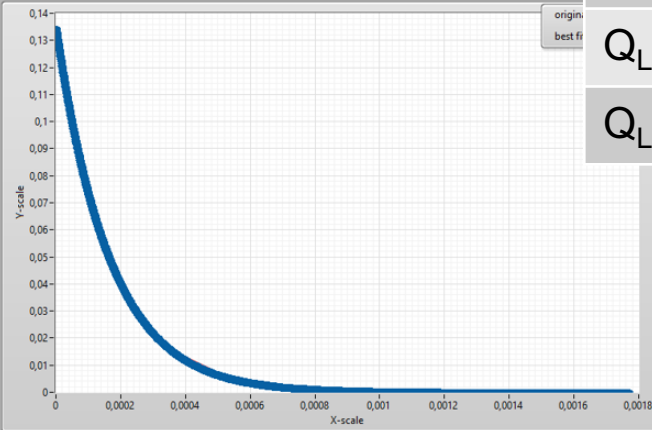
CAV IN



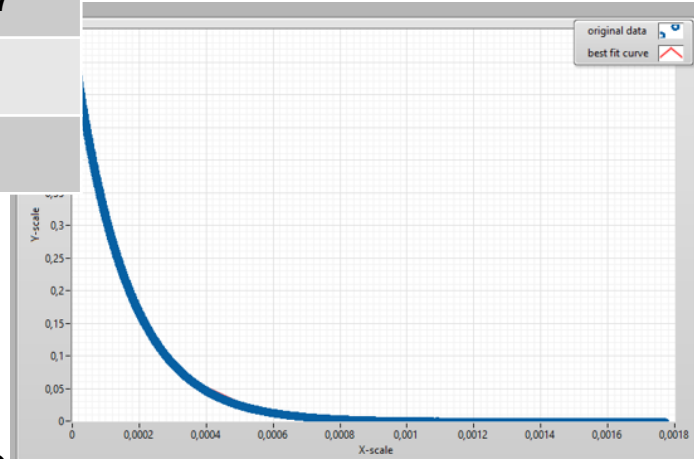
CAV OUT



	CAV IN	CAV OUT
f_0 [MHz]	352.145	352.097
Q_L (VNA)	1.73e5	1.66e5
Q_L (decay)	1.83e5	1.76e5



Tom Powers@TTC2022
 “We have 30% error in
 Jlab due to reflection
 from a circulator...we
 need beam loading to be
 sure”

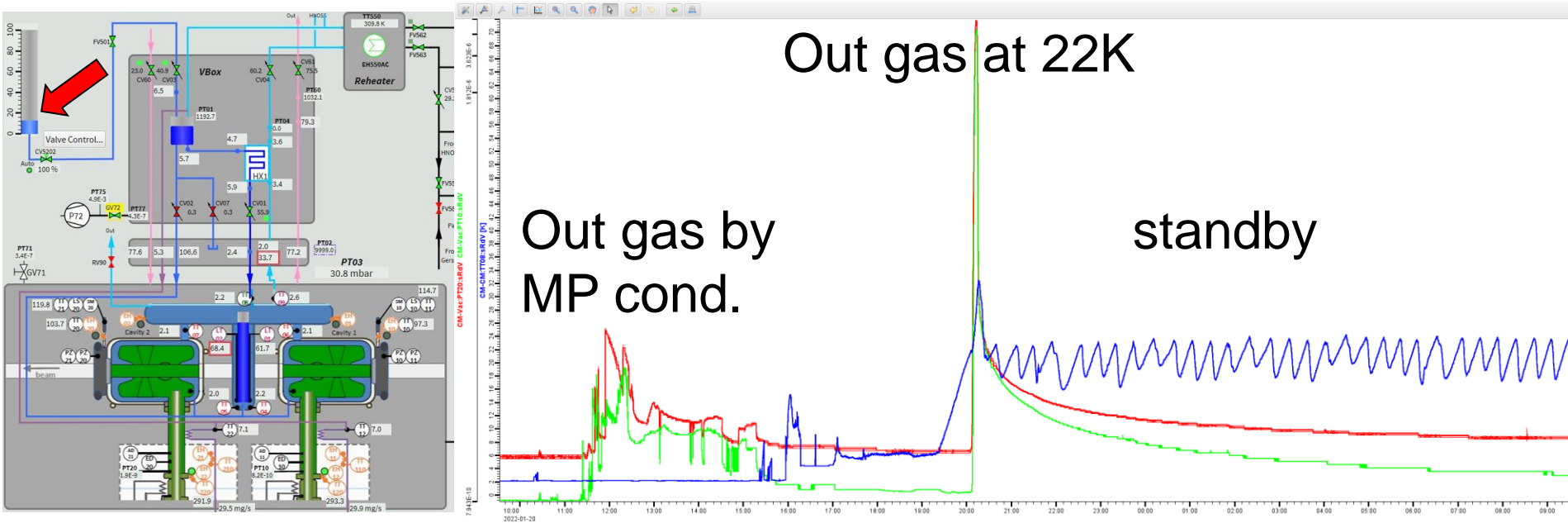


decay time 0,000165633 s QL from decay time 183273

decay time 0,000159412 s QL from decay time 176389

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

Intervention due to low LHe level in Dewar

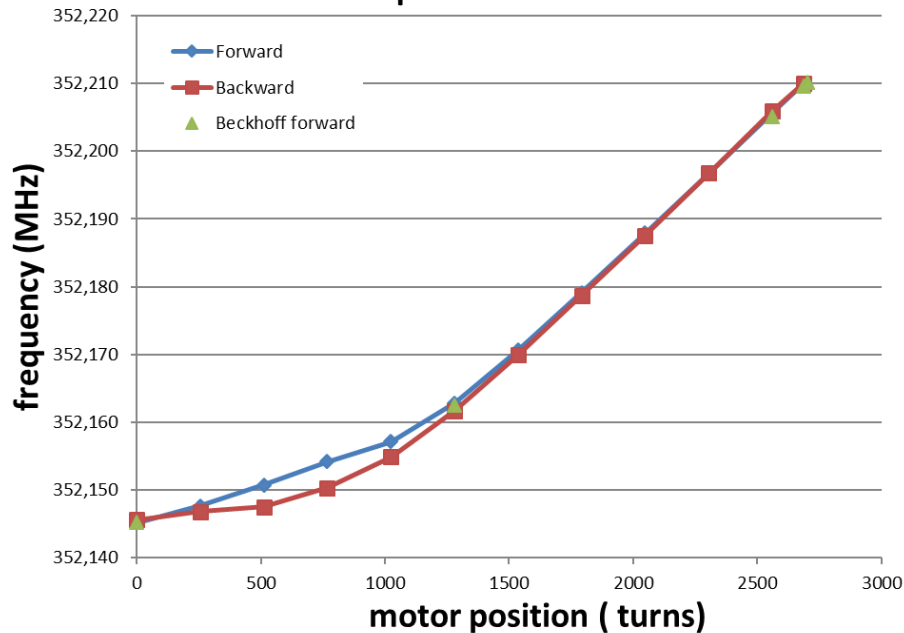


- We cannot maintain the LHe level in the Dewar for unknown reason
- We went to standby operation over the weekend to fill up the Dewar
- Re-cooling down and re-filling was successful and we found an optimum pressure to maintain the LHe.

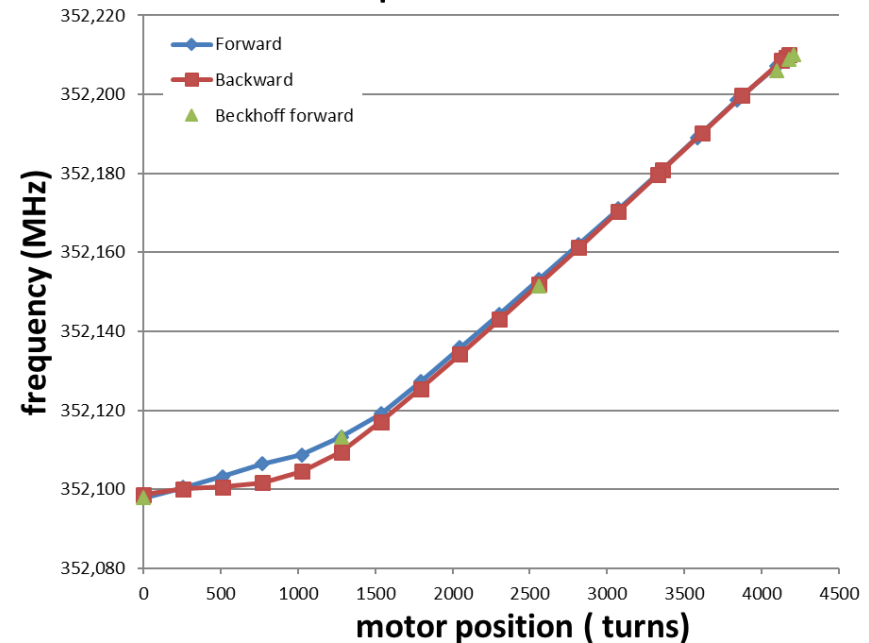
CM07: CTS test (stepper motors)



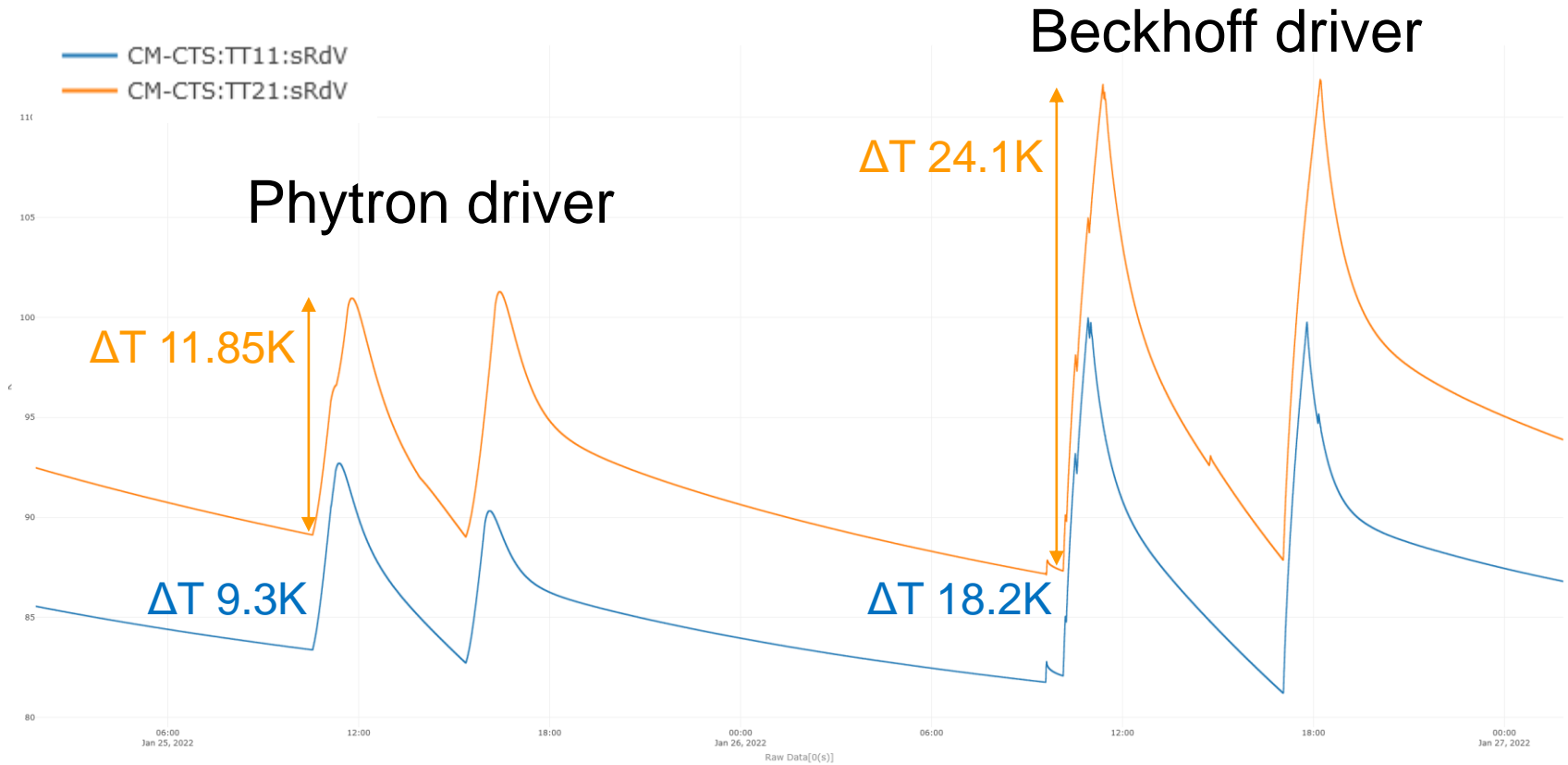
CTS1 performance



CTS2 performance

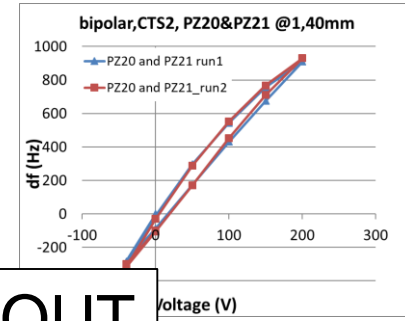
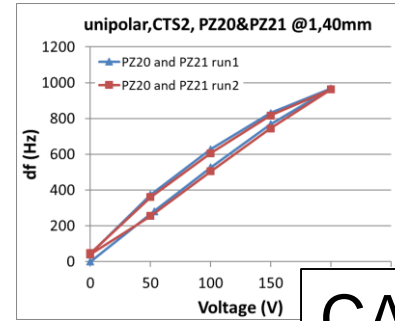
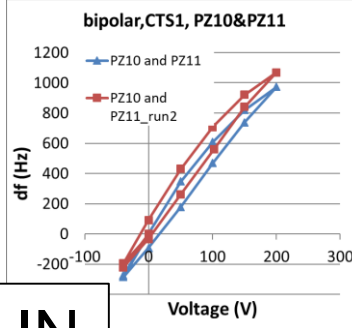
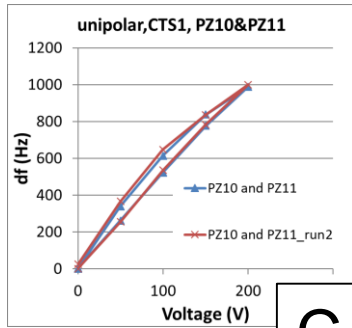


- First test with Phytron driver
 - both CTSs reached the target and properly moved back
- Second test with Beckhoff driver reproduced the results
- Note: the old Beckhoff was OK for the prototype two motors so we need to gain more statistics



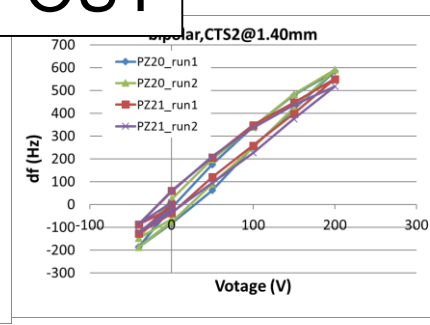
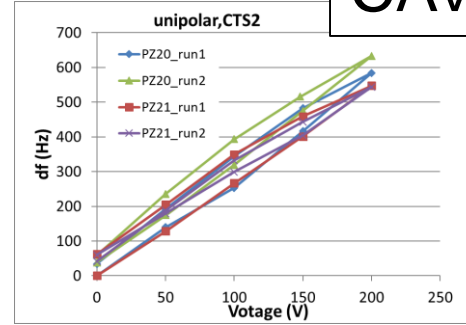
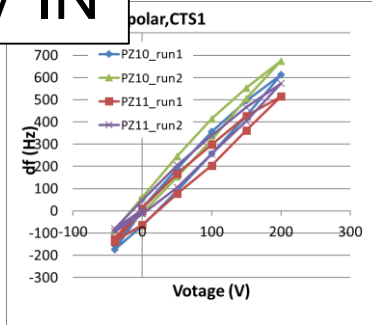
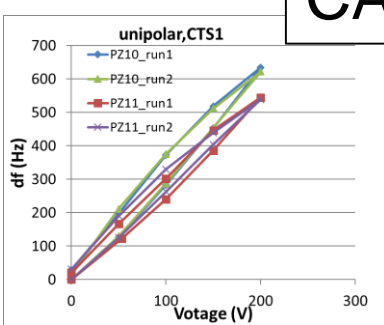
- TT11 and TT21 show ~2X higher heating when we use the Beckhoff driver.

CM07: CST test (piezo summary)



CAV IN

CAV OUT



		Δf [Hz]
PZ10	unipolar	622
	bipolar	797
PZ11	unipolar	539
	bipolar	667
PZ10&PZ11	unipolar	999
	bipolar	1291

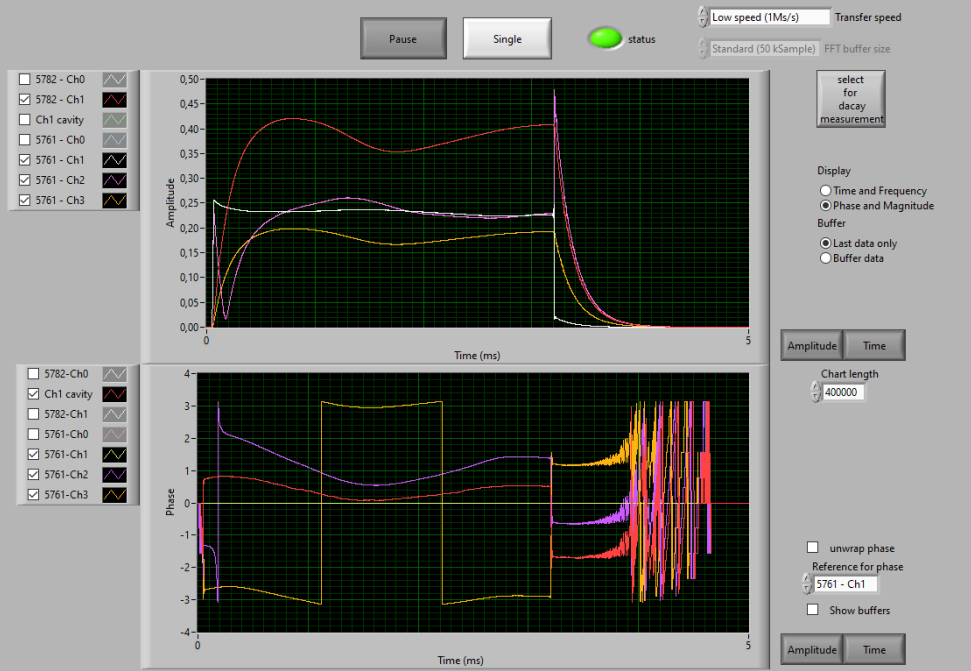
		Δf [Hz]
PZ20	unipolar	573
	bipolar	771
PZ21	unipolar	502
	bipolar	669
PZ20&PZ21	unipolar	923
	bipolar	1249

CM07: CAV IN reached >10 MV/m

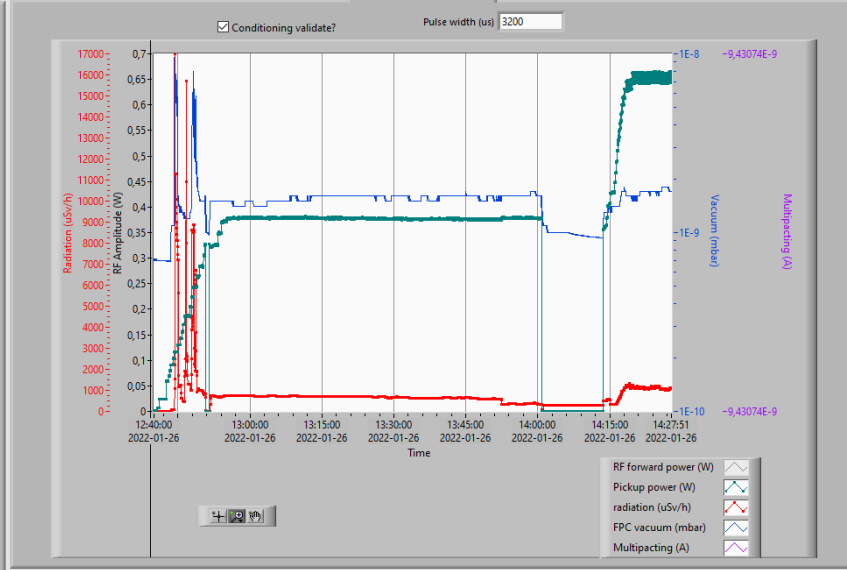



FREIA SPOKE HIGH POWER TEST_Cav 1
time: 14:36:34

Configuration Calibration and pulse parameter setting Phase shifter and Gain controller PNA Scope decay measurement heat load measurement LFD measurement



Q Measurement results display Other Measurement results display Conditioning results display



FPGA setup

Mode: Real IO Mixer freq [MHz]: 352.2 Trigger: Trigger input
 Output mixer frequency [MHz]: 352.2 Period: 0
 Output enabled:
 Output delay: 0 ns
 Output delay delta: 0 ps

PID control Adaptive FF Offsets Feed forward Cavity model FFT Delay
 Quench detection Scale

Measure Tau at Time: 32200 Tau set: 120 Enable: Reset Quench Warning:
 Tau [us]: 165.12 Quench_Warning:

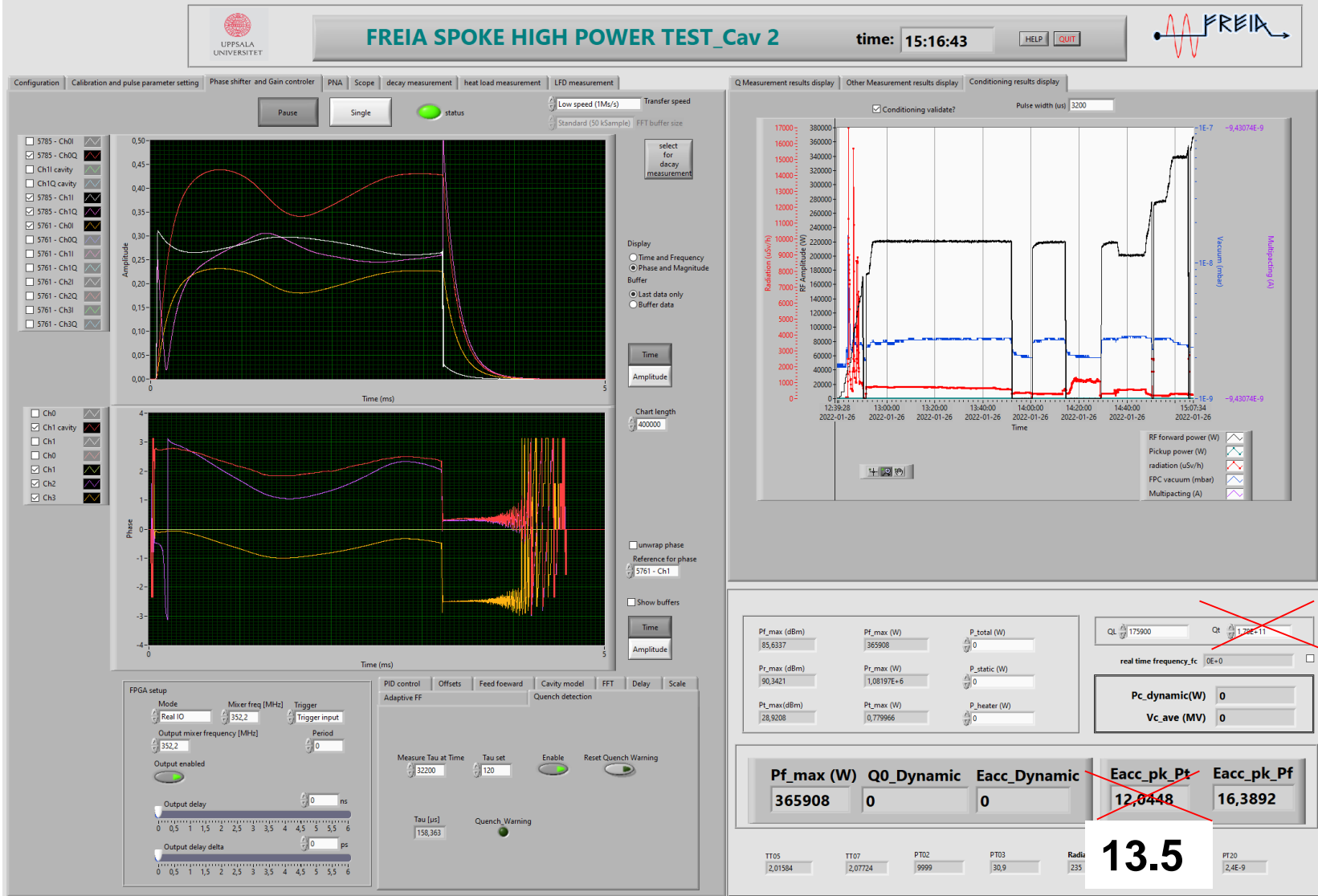
Pf_max (dBm): 84,1397	Pf_max (W): 259400	P_total (W): 0	Qt: 183300	Qt: 2.1E-9
Pr_max (dBm): 89,6908	Pr_max (W): 931289	P_static (W): 0	real time frequency_fc: 0E+0	
Pt_max (dBm): 28,2289	Pt_max (W): 0,665102	P_heater (W): 0	Pc_dynamic(W): 0	
			Vc_ave (MV): 0	

Pf_max (W)	Q0_Dynamic	Eacc_Dynamic	Eacc_pk_Pt	Eacc_pk_Pf
259400	0	0	12,0714	14,0866

TT04: 2,1807	TT06: 5,05496	PT02: 9999	PT03: 33,5	Rad: 11:	10.94	PT20: 2E-9
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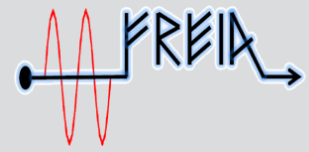
- We found that we swapped Qt values in CAV IN and CAV OUT so we redo the measurement later today

CM07: CAV OUT reached over 12 MV/m

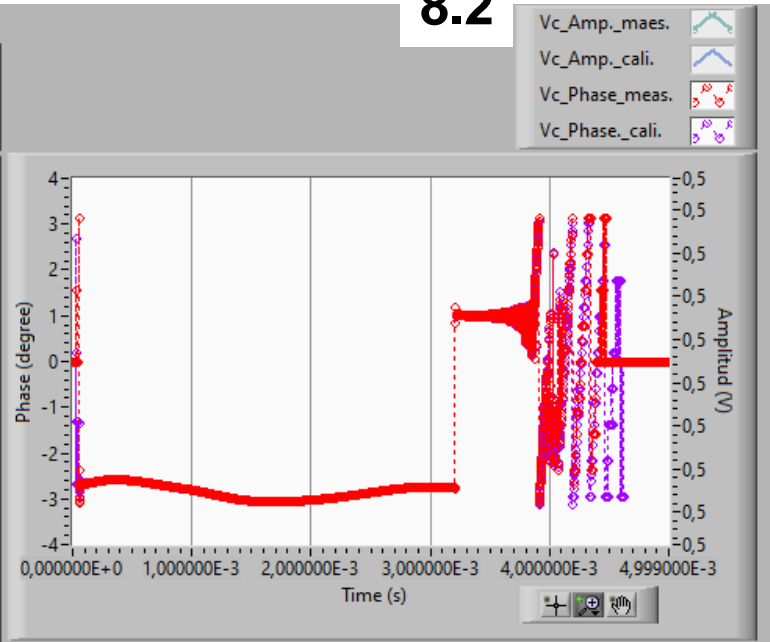
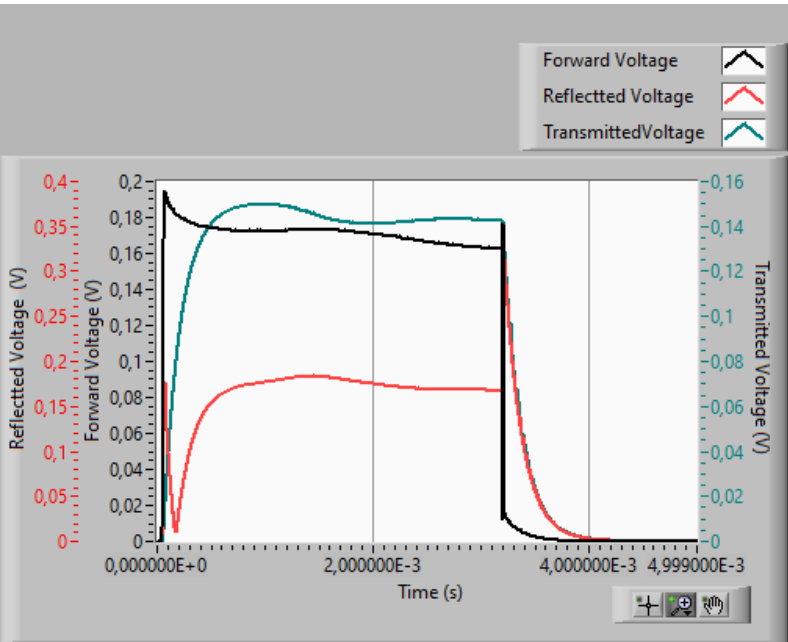


- MP was conditioned in the 1st run before the standby operation
- No FE

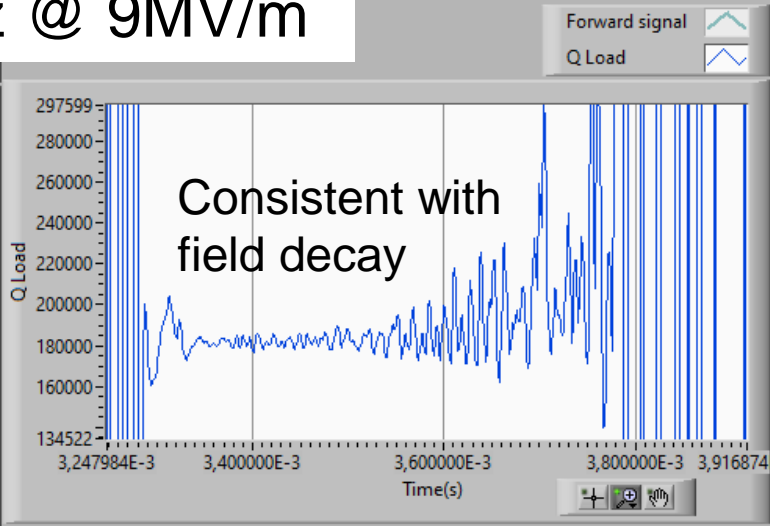
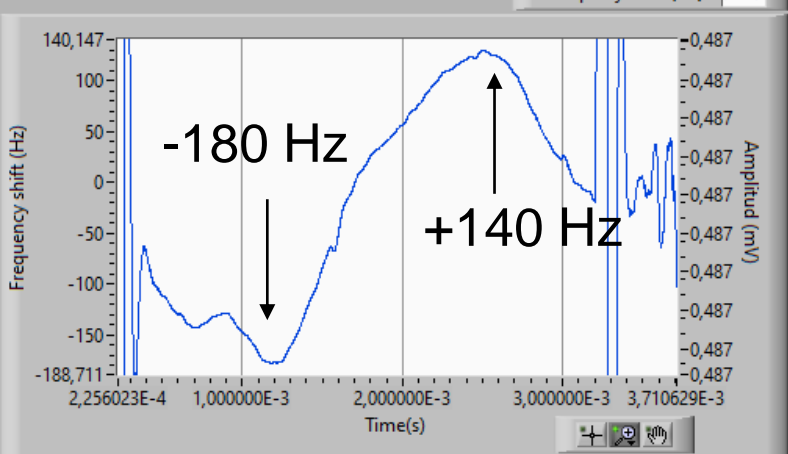
CM07: CAV IN dynamics LFD @ ~~9MV/m~~



8.2

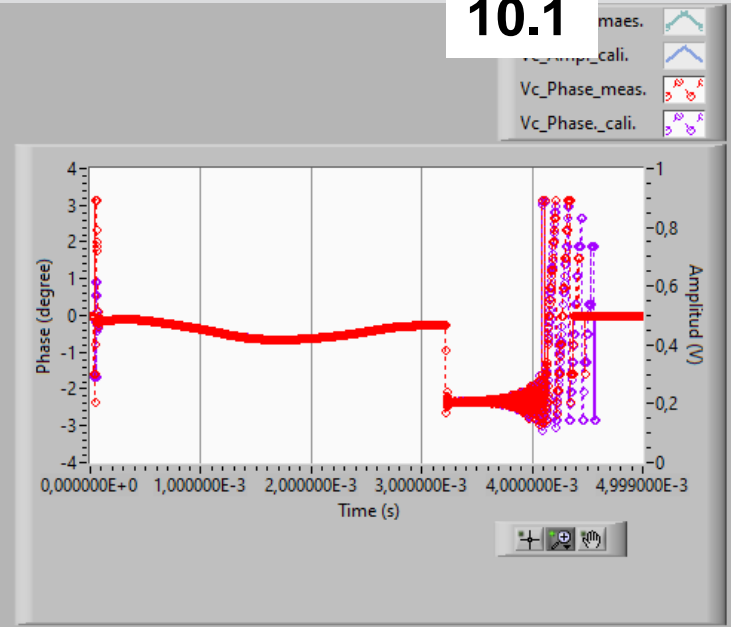
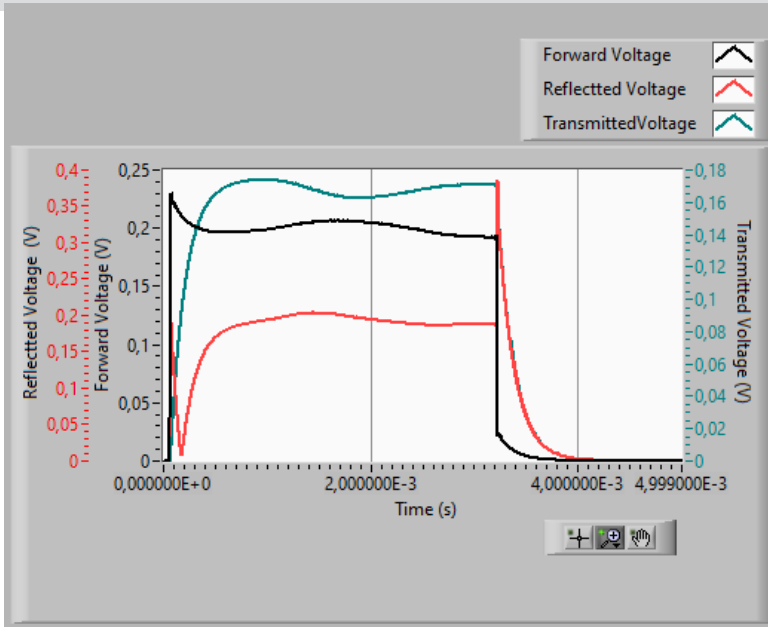


$\Delta f = 320 \text{ Hz} \rightarrow 405 \text{ Hz} @ 9 \text{ MV/m}$

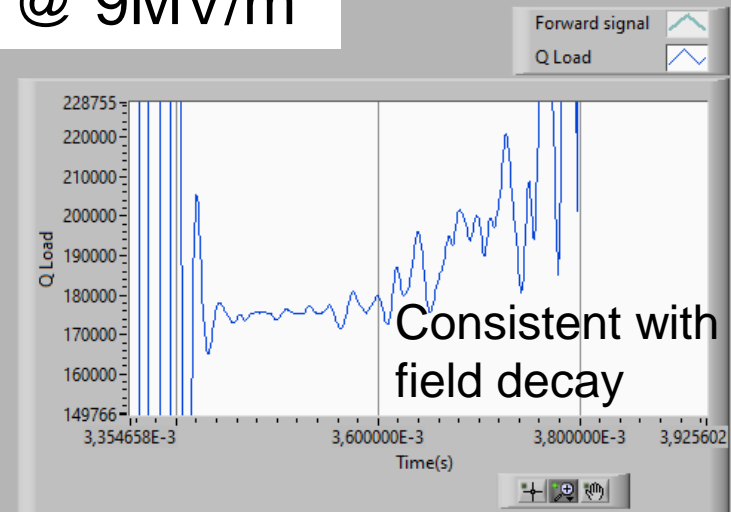
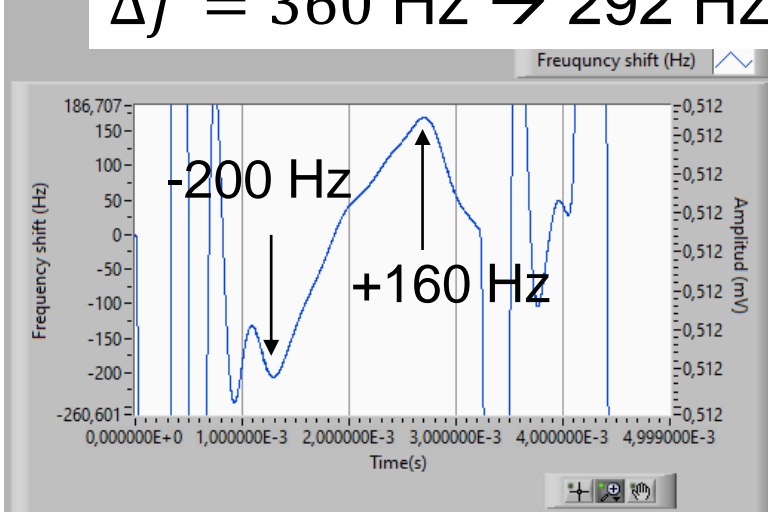


CM07: CAV OUT dynamics LFD @ ~~9MV/m~~ FREIA

10.1



$\Delta f = 360 \text{ Hz} \rightarrow 292 \text{ Hz @ } 9 \text{ MV/m}$

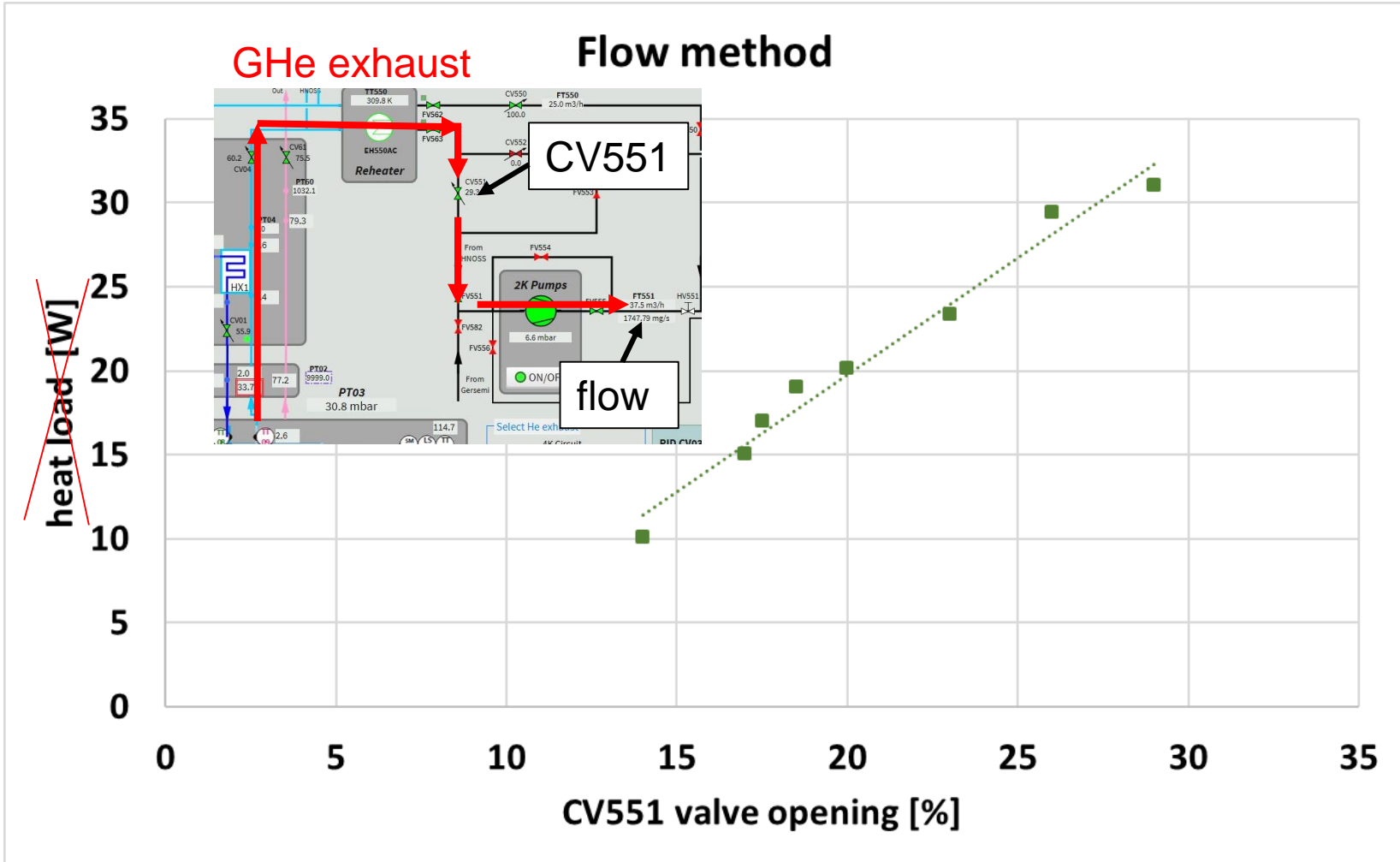


CM07: heat load from GHe flow



Date	2022-01-26					
Value name	Static	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
Cavity 1 MV/m	0	8.2 9	8.2 9	0	10.9 12	0
Cavity 2 MV/m	0	10.1 9	0	10.1 9	0	13.5 12
FT551 [m3/h]	21,98	22,37	23,34	24,28	23,86	21,26
Heat load [W]	23,52	23,94	24,97	25,98	25,53	22,75
σ [W]	0,35	0,43	0,5	0,54	0,46	0,43
RF ON – RF OFF is small or 0 consistent						
CV01	0%					
CV03	30%					
CV04	43%					
CV551	25%					

- Dynamics heat load from the cavities are invisibly small as usual
- The absolute value of the static heat load is higher than usual
- There seems strong operator dependence due to their individual tolerance for pressure stability and valve opening to control it



- Clearly, we are not measuring true heat load
- Relative information would still be valid if the valve opening is the same
 - The small dynamic heat load by RF is relative