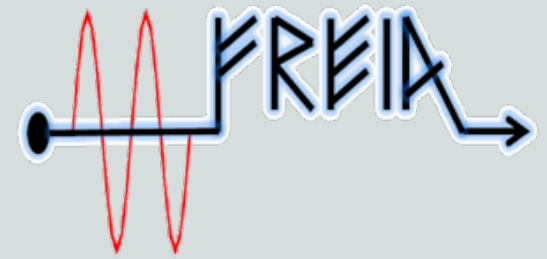




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ESS weekly meeting (2021 W40)

A. Miyazaki et al.

General planning updated



Michal Sienkiewicz and Marcin Wartak from IFJ PAN would like to visit us from Oct 20th to 22nd

Cedric from Orsay may join us in W43-W44-W45



FREIA Planning		2021-10-06															
		September				October				November				December			
Equipment	Responsible	6	13	20	27	4	11	18	25	1	8	15	22	6	13	20	27
		week # 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51															
Liquefier & 2K pumps	Esat	Yellow	Yellow	Yellow	Blue	Yellow	Yellow	Yellow	Blue	Blue	Yellow	Yellow	Blue	Yellow	Blue	Yellow	Yellow
RF power stations	Mykhailo			Green	Green			Green	Green	Green			Green	Green	Green		
Cryomodule test stand	Akira	Yellow	Yellow	Green	CM04	Yellow	Green	CM03	Yellow	Yellow	Green	CM06	Yellow	Yellow	Yellow	Yellow	Yellow

We are here



In Oct and Nov, Akira will be physically away from Sweden but remotely lead the project from Germany

**Big question mark:
Compressor repairing before W43?**



Original plan

week		W39											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		27-sep		28-sep		29-sep		30-sep		01-okt		02-okt	03-okt
		m	a	m	a	m	a	m	a	m	a		
present CM	CM04	Purging	N2 cooling	cooling down		4K filling	coupler cold conditioning	2K pumping	RF calibration at cold	MP conditioning		CTS thermalization	
next CM	CM03	reception tests											
next next CM	CM06	preparation at Orsay											

The circulation compressor Kaeser tripped → **emergency mode**

week		W39											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		27-Sep		28-Sep		29-Sep		30-Sep		1-Oct		2-Oct	3-Oct
		m	a	m	a	m	a	m	a	m	a		
present CM	CM04	Purging	N2 cooling	cooling down		4K filling	coupler cold conditioning	2K pumping	RF calibration at cold	CTS test at 2K		MP conditioning, heat load, LFD, field decay	kept at 2K
next CM	CM03	reception tests											
next next CM	CM06	preparation at Orsay											

Thanks everybody for the hard work!



W40 progress, W41 & W42 planning



week		W40											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		4-Oct		5-Oct		6-Oct		7-Oct		8-Oct		9-Oct	10-Oct
		m	a	m	a	m	a	m	a	m	a		
present CM	CM04	start warming up	disconnect things except for cryogenic lines				warming up completed		disconnect cryogenic lines				
next CM	CM03	doorknob mounting & water leak check						waiting in the docking area					
next next CM	CM06	preparation at Orsay											

week		W41											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		11-Oct		12-Oct		13-Oct		14-Oct		15-Oct		16-Oct	17-Oct
		m	a	m	a	m	a	m	a	m	a		
previous CM	CM04	swap modules. Connect waveguide		filling dry N2		doorknob dismounting	outgoing test (LEMO, VNA) shock sensors	activate shock sensors, close the box		waiting in the box			
present CM	CM03			connect cryogenic lines		connect pumping stations		leak tests and He purging		beam vacuum pumping			
next CM	CM06	preparation at Orsay											

week		W42											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		18-Oct		19-Oct		20-Oct		21-Oct		22-Oct		23-Oct	24-Oct
		m	a	m	a	m	a	m	a	m	a		
previous CM	CM04	departure to ESS		preparation of documents				publish test report					
present CM	CM03	coupler warm conditioning						Nitrogen cooling					
next CM	CM06	departure from Orsay		transport over the sea				reception at UU		thermalization at UU		4	



W40 progress, W41 & W42 planning



week		W40											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		4-Oct		5-Oct		6-Oct		7-Oct		8-Oct		9-Oct	10-Oct
		m	a	m	a	m	a	m	a	m	a		
present CM	CM04	start warming up	disconnect things except for cryogenic lines				warming up completed		disconnect cryogenic lines				
next CM	CM03	doorknob mounting & water leak check						waiting in the docking area					
next next CM	CM06	preparation at Orsay											

week		W41											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		11-Oct		12-Oct		13-Oct		14-Oct		15-Oct		16-Oct	17-Oct
		m	a	m	a	m	a	m	a	m	a		
previous CM	CM04	swap modules. Connect waveguide		filling dry N2		doorknob dismantling	outgoing test (LEMO, VNA) shock sensors		close the box		waiting in the box		
present CM	CM03			connect cryogenic lines		connect pumping stations		leak tests and He purging		beam vacuum pumping			
next CM	CM06	preparation at Orsay											

**Shock sensors:
Felix → Mykhailo**

outgoing test (LEMO, VNA) shock sensors

week		W42												
date		MON		TUE		WED		THU		FRI		SAT	SUN	
		18-Oct		19-Oct		20-Oct		21-Oct		22-Oct		23-Oct	24-Oct	
		m	a	m	a	m	a	m	a	m	a			
previous CM	CM04	departure to ESS		Felix				preparation of documents		publish test report				
present CM	CM03	coupler warm conditioning												
next CM	CM06	departure from Orsay		transport over the sea				reception at UU		thermalization at UU		5		

Guillaume, Vincent

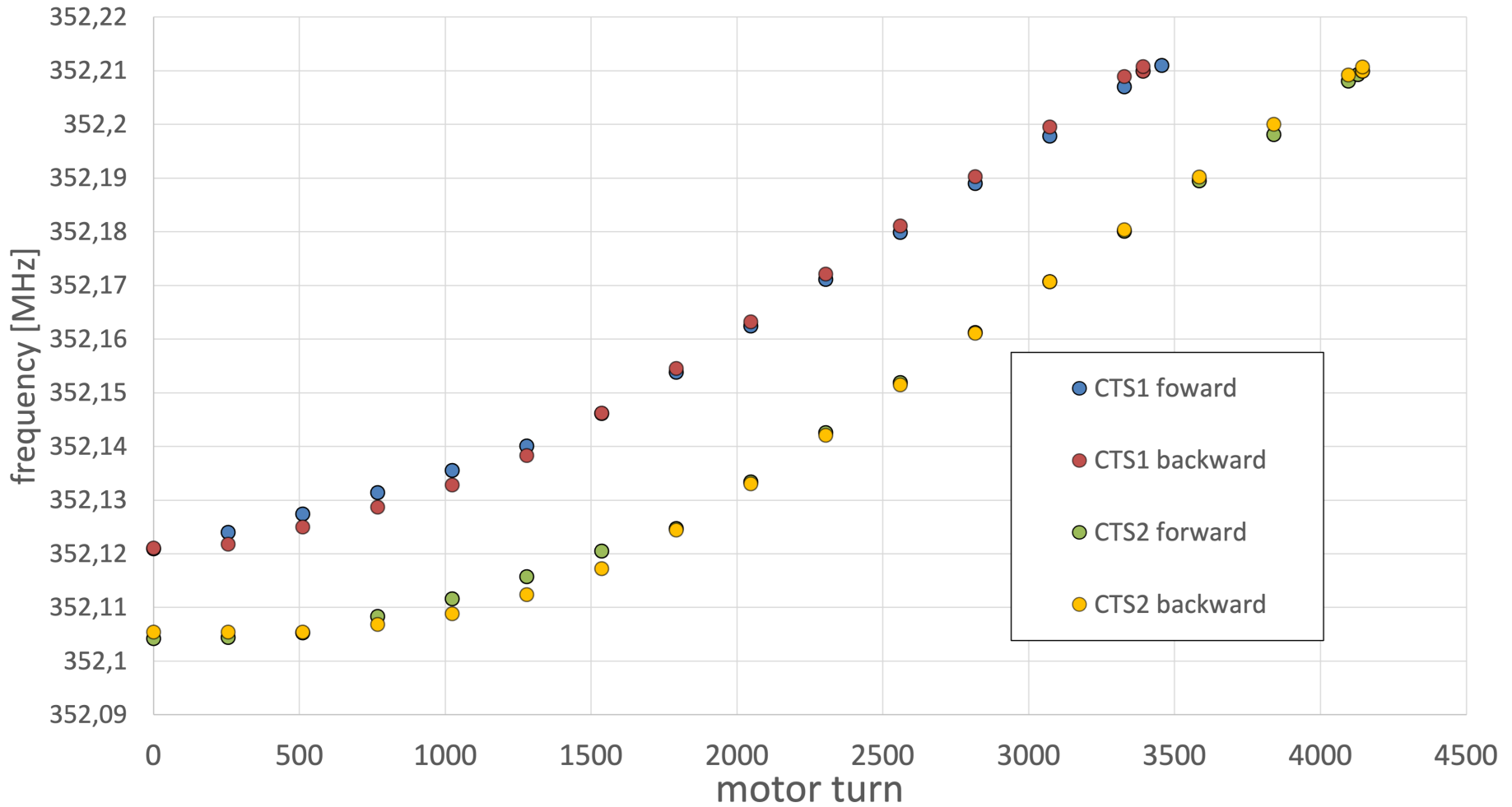


We are keeping an extra pallet of CM04

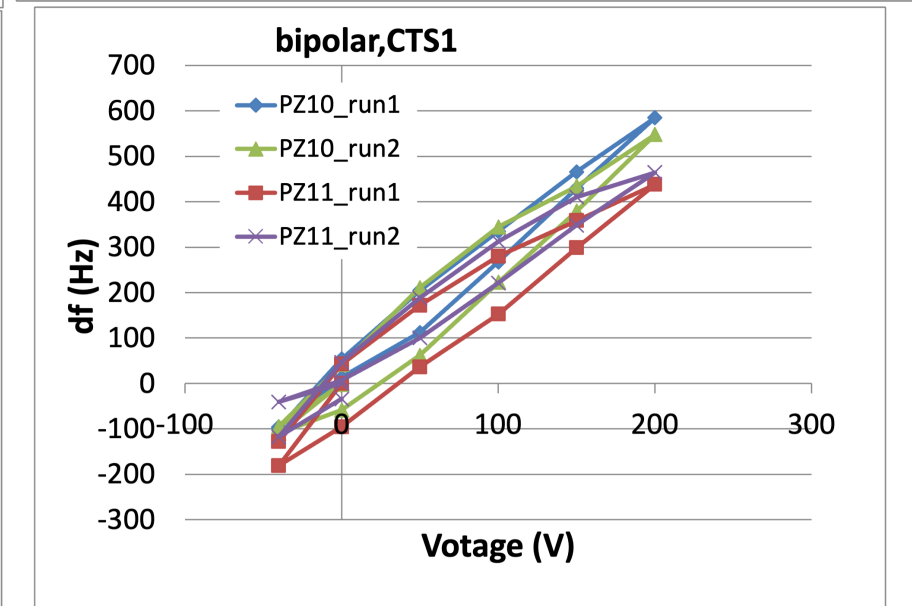
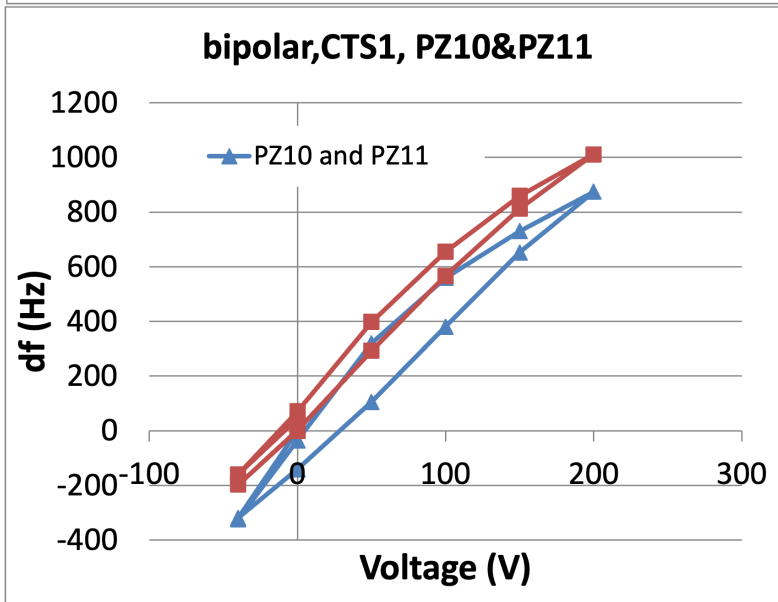
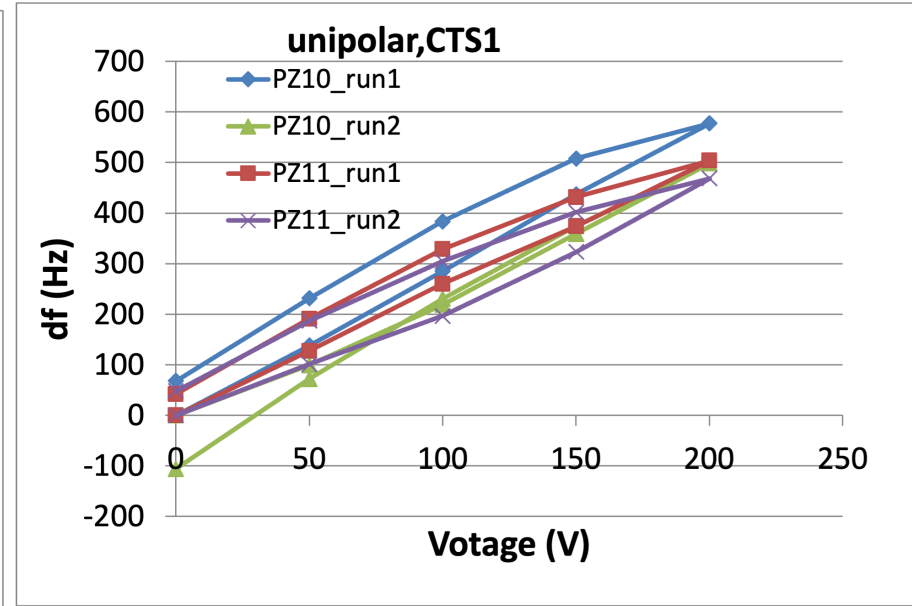
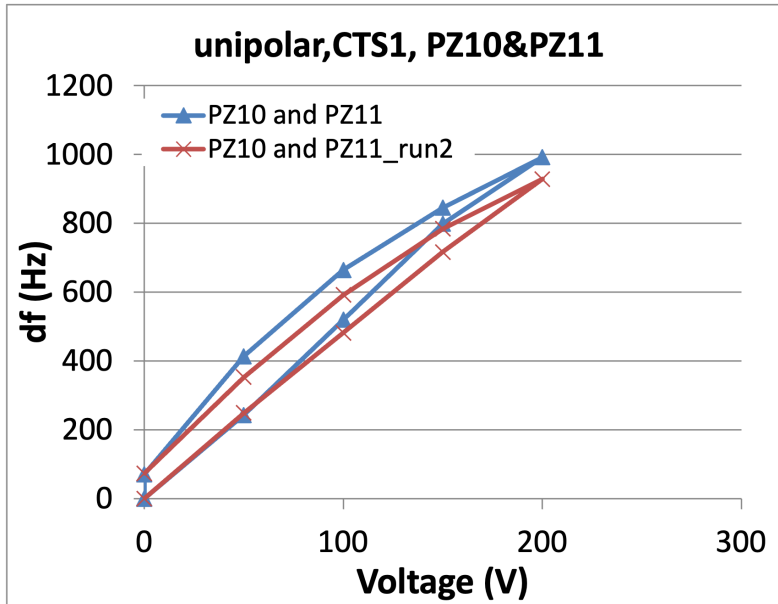


- The extra pallet contains bellows kept as a spare
 - Also, four adjustable feet to place CM04 on a frame at ESS
 - If I 'm not mistaken, we are using these feet (we have two frames and CM02, CM04's feet may be in use)
 - Question: does ESS have feet?
- Yes, Guillaume sent 32 feet!

With Phytron driver



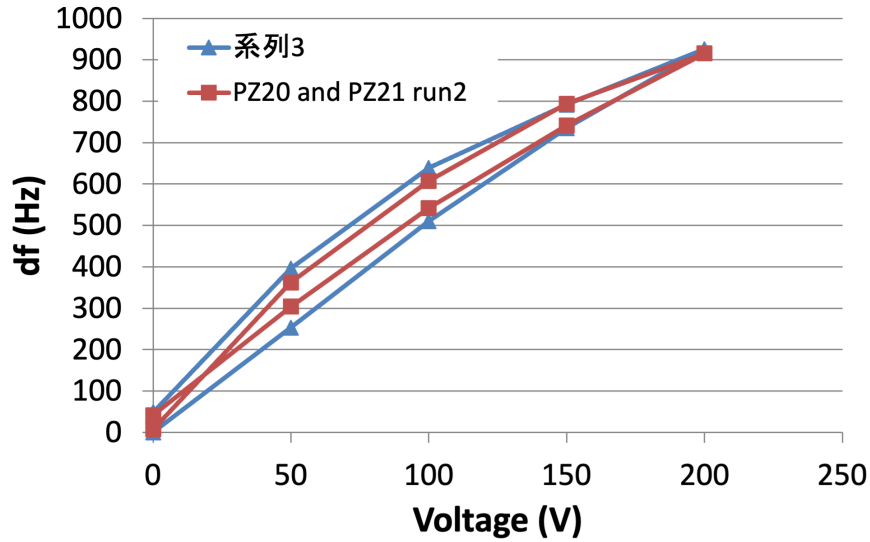
→ OK 😊



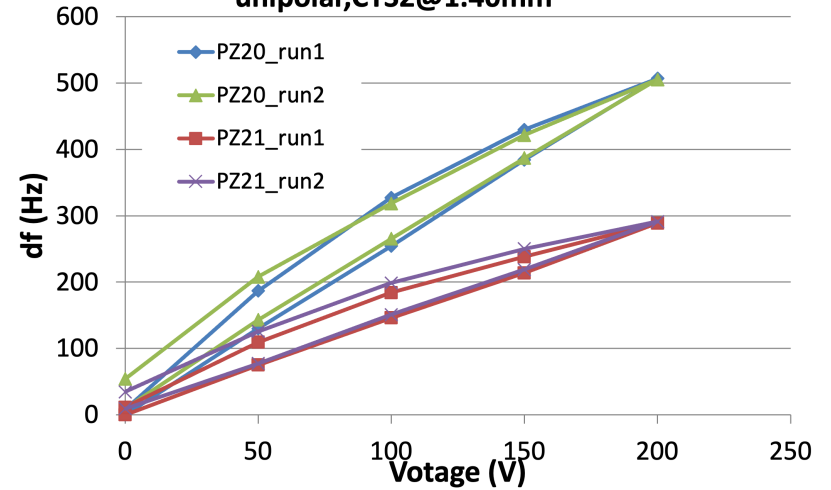
CM04: Piezos on CAV OUT



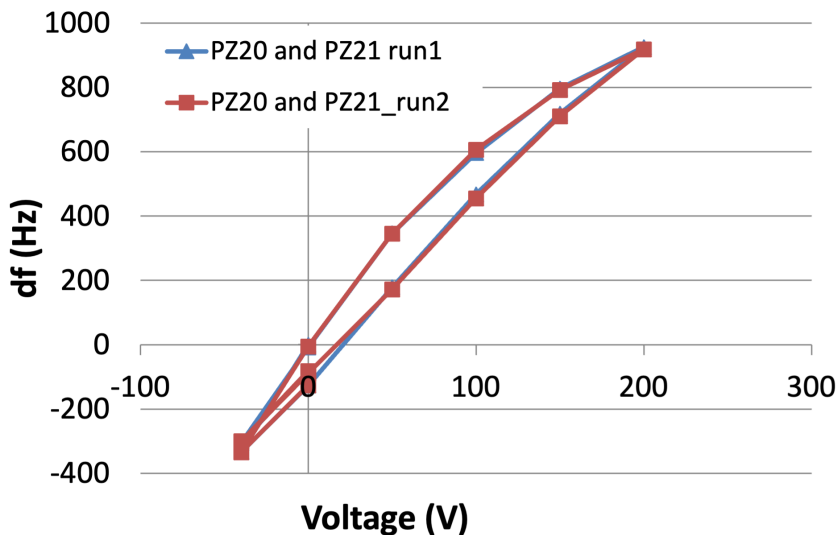
unipolar,CTS2, PZ20&PZ21 @1,40mm



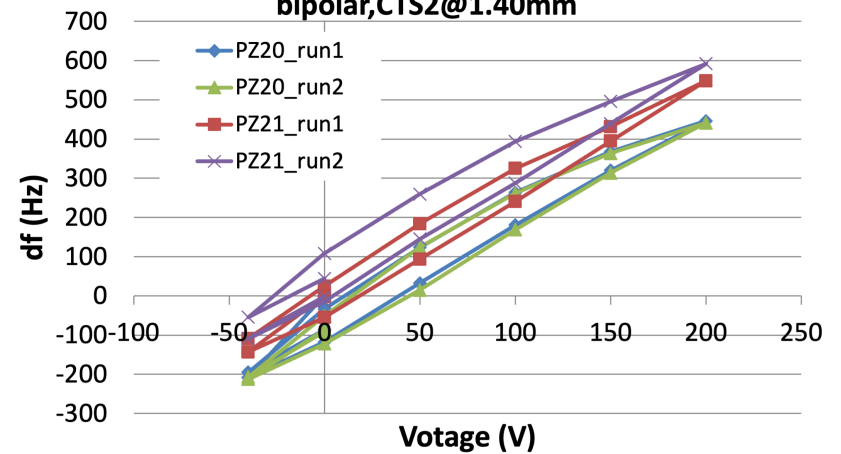
unipolar,CTS2@1.40mm



bipolar,CTS2, PZ20&PZ21 @1,40mm



bipolar,CTS2@1.40mm

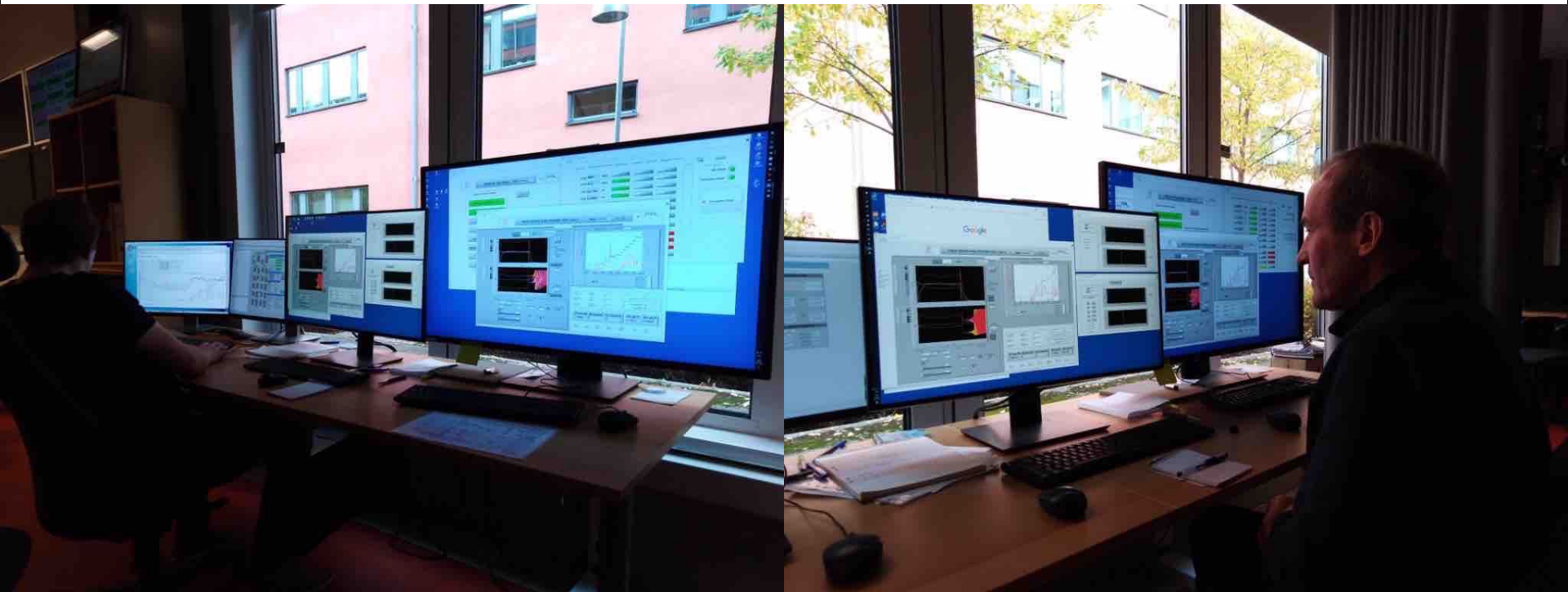


		Δf [Hz]
PZ10	unipolar	604
	bipolar	695
PZ11	unipolar	478
	bipolar	421
PZ10&PZ11	unipolar	856
	bipolar	1072

		Δf [Hz]
PZ20	unipolar	451
	bipolar	658
PZ21	unipolar	566
	bipolar	658
PZ20&PZ21	unipolar	908
	bipolar	1226

Remark:

- Resonant frequency was shifted by a few hundred hertz during the 1st measurement of PZ20 and PZ21
- We recognized this issue and performed 2nd measurement
- The pressure was very stable, so we do not have any reason why the frequency was shifted
- We use phase $\sim \text{Arctan}(f-f_0)$ to measure small change in frequency but instead ignorant of dramatic change



- Software issues were all understood
- Procedure for Interlock setup was established
- In case of emergency, Akira can connect these computers via VPN (Tor, please tell me their IP address 😊 → done)

CM04: CAV IN RF MP conditioning



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FREIA SPOKE HIGH POWER TEST_Cav 1

time: 14:31:16 HELP QUIT



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

 ● status

High speed (10Ms/s) Transfer speed
 Standard (50 kSample) FFT buffer size

Display
 Time and Frequency
 Phase and Magnitude
 Buffer
 Last data only
 Buffer data

 Chart length

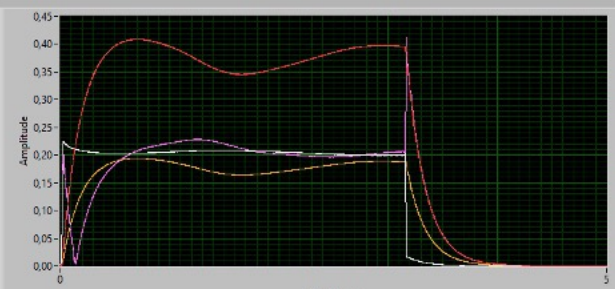
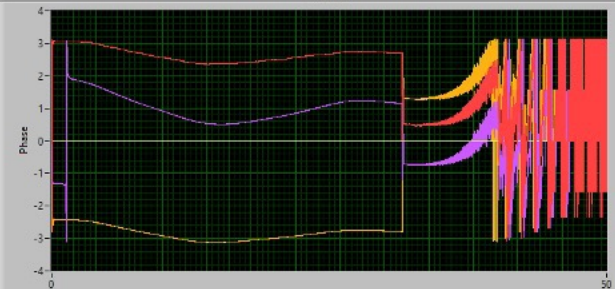
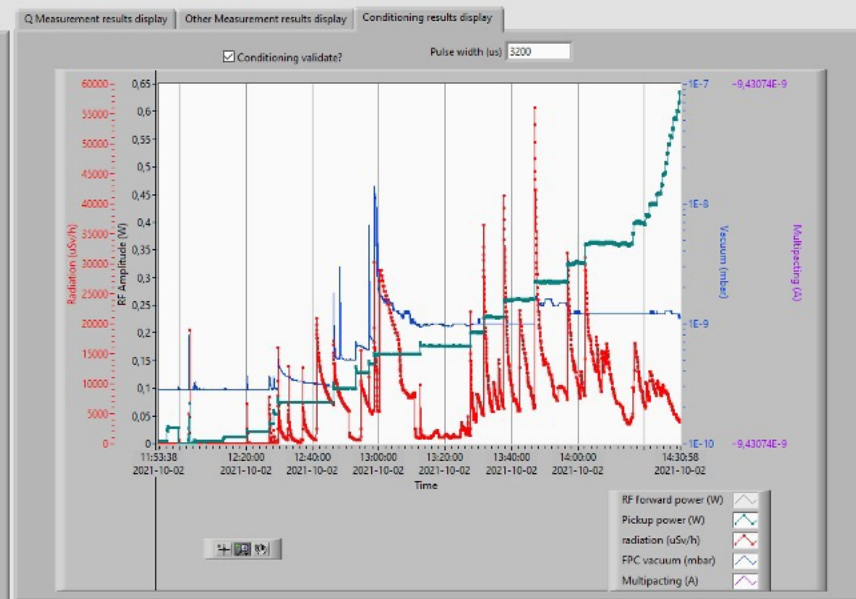
unwrap phase
 Reference for phase
 5761 - Ch1
 Show buffers

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
 Measure Tau at Time: 32200 Tau set: 130 Enable: Reset Quench Warning:
 Tau [µs]: 170,727 Quench Warning:

5782 - Ch0
 5782 - Ch1
 Ch1 cavity
 5761 - Ch0
 5761 - Ch1
 5761 - Ch2
 5761 - Ch3

Pf_max (dBm) 82,9922	Pf_max (W) 199170	P_total (W) 0	QL 178531	Qt 2,31E+11
Pr_max (dBm) 80,3445	Pr_max (W) 683050	P_static (W) 0	real time frequency_fc 0E+0	
PL_max(dBm) 28,0135	PL_max (W) 0,652928	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
199170	0	0	12,3505	12,1817

TT04	TT06	PT02	PT03	Radiation	PT10	PT20
2,07252	2,10036	9999	30,8	3500	1,1E-9	3E-9

12MV/m without field emission 😊

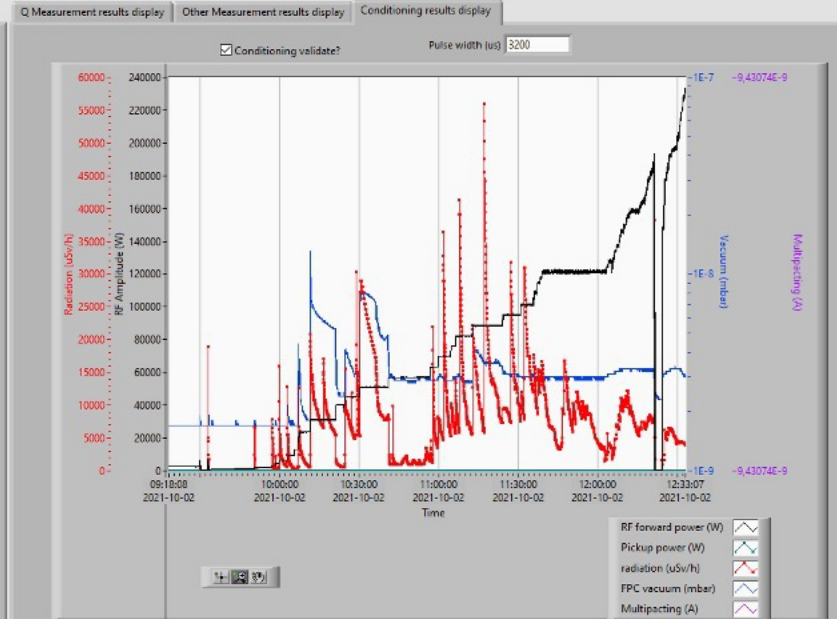
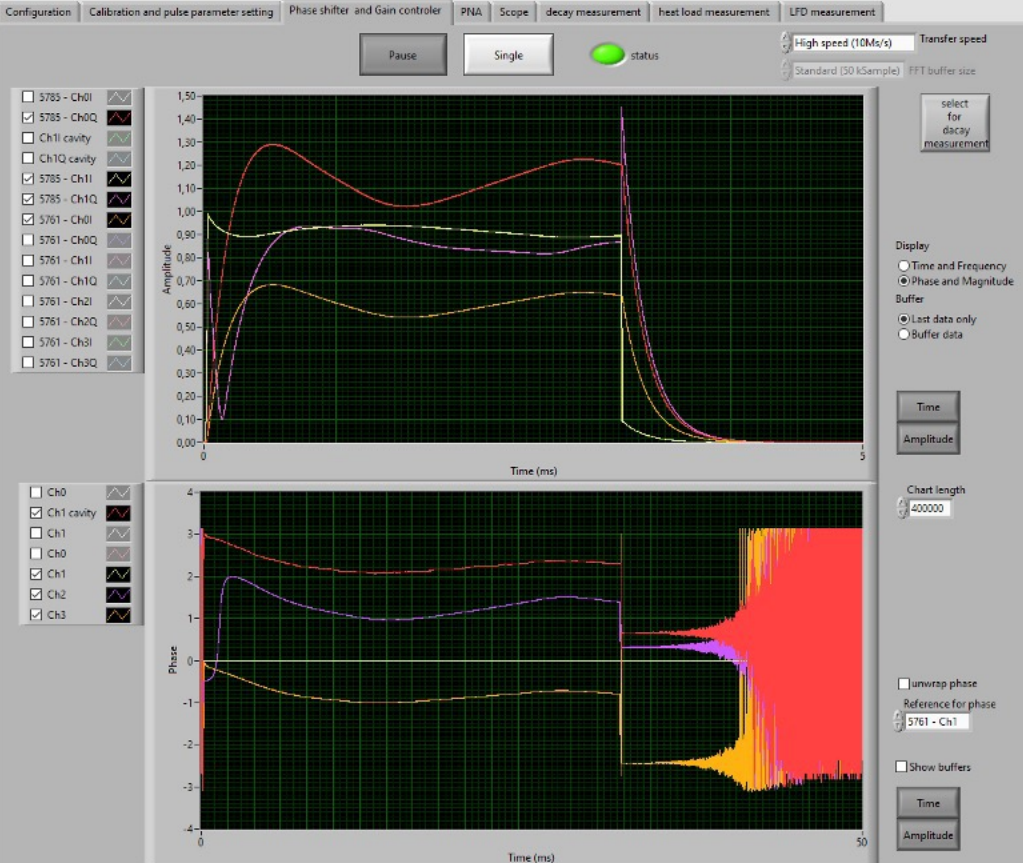
CM04: CAV IN RF MP conditioning



FREIA SPOKE HIGH POWER TEST_Cav 2

time: 15:03:17

HELP QUIT



FPGA setup

Mode: Real IO Mixer freq [MHz]: 352.2 Trigger: Trigger input

Output mixer frequency [MHz]: 352 Period: 0

Output enabled

Output delay: 0 0.5 1 1.5 2 2.5 3 3.5 4

Output delay delta: 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6

PID control Offsets Feed forward Cavity model FFT Delay Scale

Adaptive FF Quench detection

Measure Tau at Time: 32000 Tau set: 130 Enable Reset Quench Warning

Pf_max [dBm] 83,6735	Pf_max (W) 232997	P_total (W) 0	Qf 187020	Qf 3,35E-11	
Pf_max (dBm) 87,2465	Pf_max (W) 530453	P_static (W) 0	real time frequency, f0 0E+0		
Pf_max (dBm) 26,228	Pf_max (W) 0,419566	P_heater (W) 0	Pc_dynamic(W) 0		
			Vc_ave (MV) 0		
Pf_max (W) 232997		Q0_Dynamic	Eacc_Dynamic	Eacc_pk_Pt 12,1095	Eacc_pk_Pf 13,4538
Radiation 3830	PT10 1,3E-9	PT20 3E-9	13		

12MV/m without field emission 😊



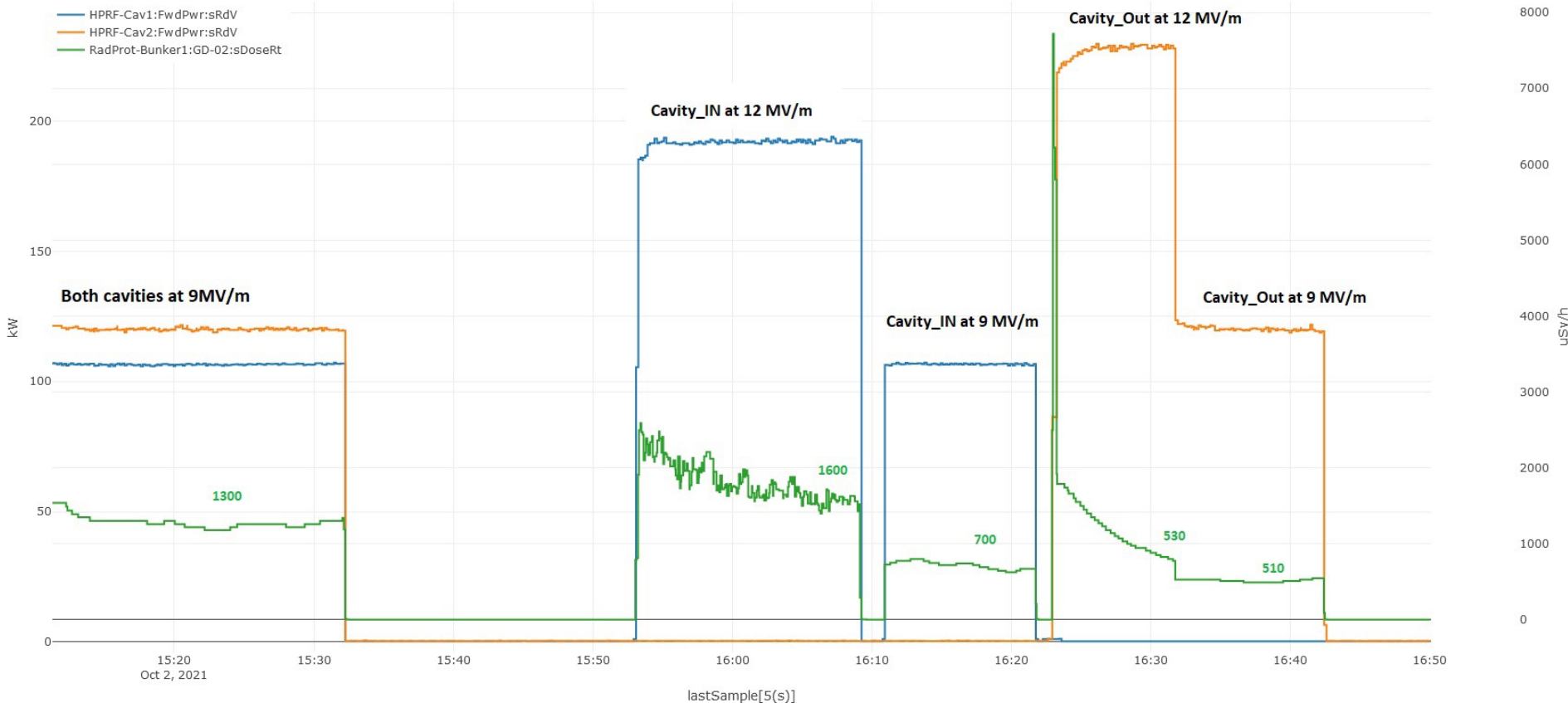
CM04: X-ray dose



EPICS Archiver Appliance Viewer

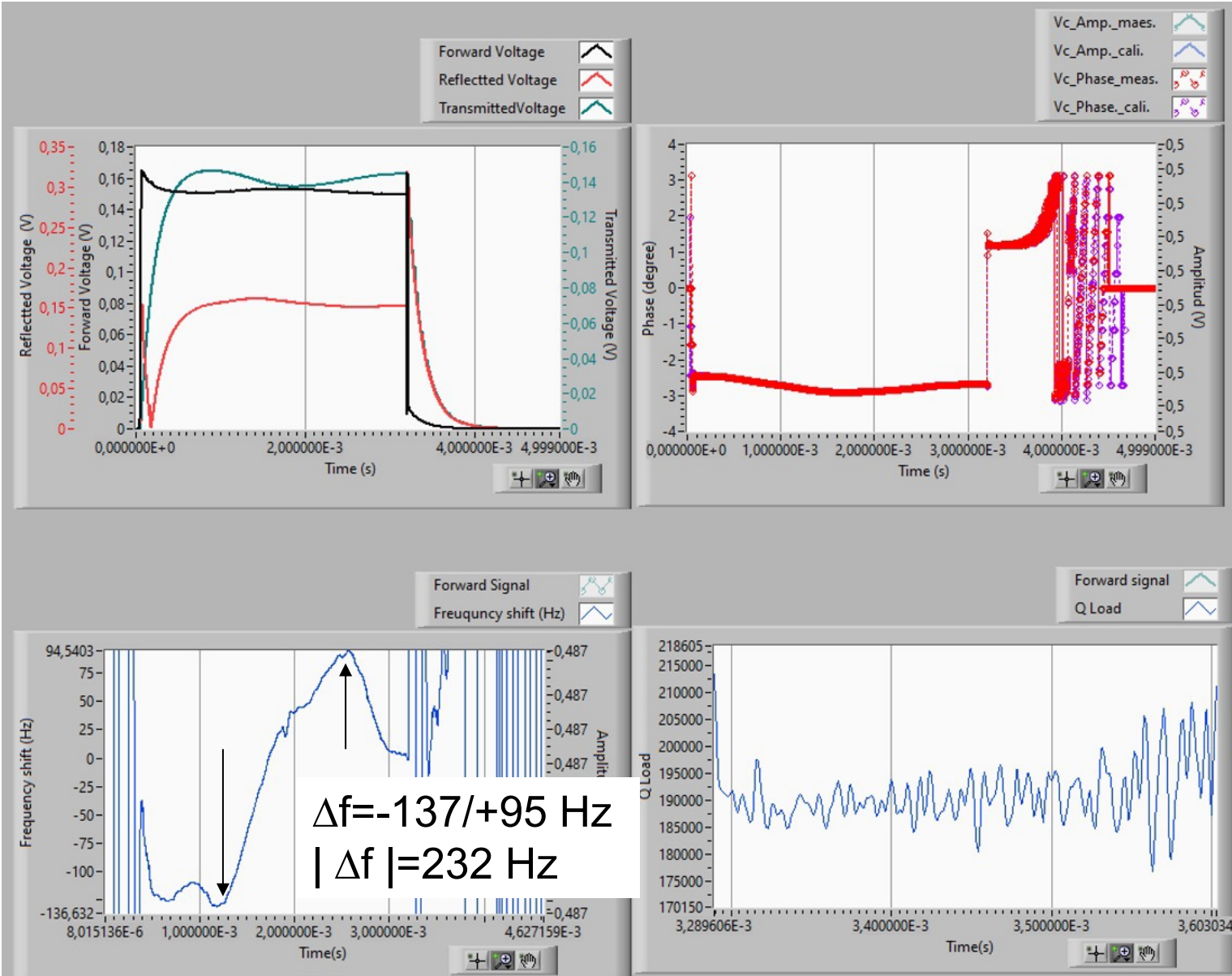
30s 1m 5m 15m 30m 1h 4h 8h 1d 2d 1w 2w 1M 6M YTD 1Y Live

— HPRF-Cav1:FwdPwr:sRdV
— HPRF-Cav2:FwdPwr:sRdV
— RadProt-Bunker1:GD-02:sDoseRt

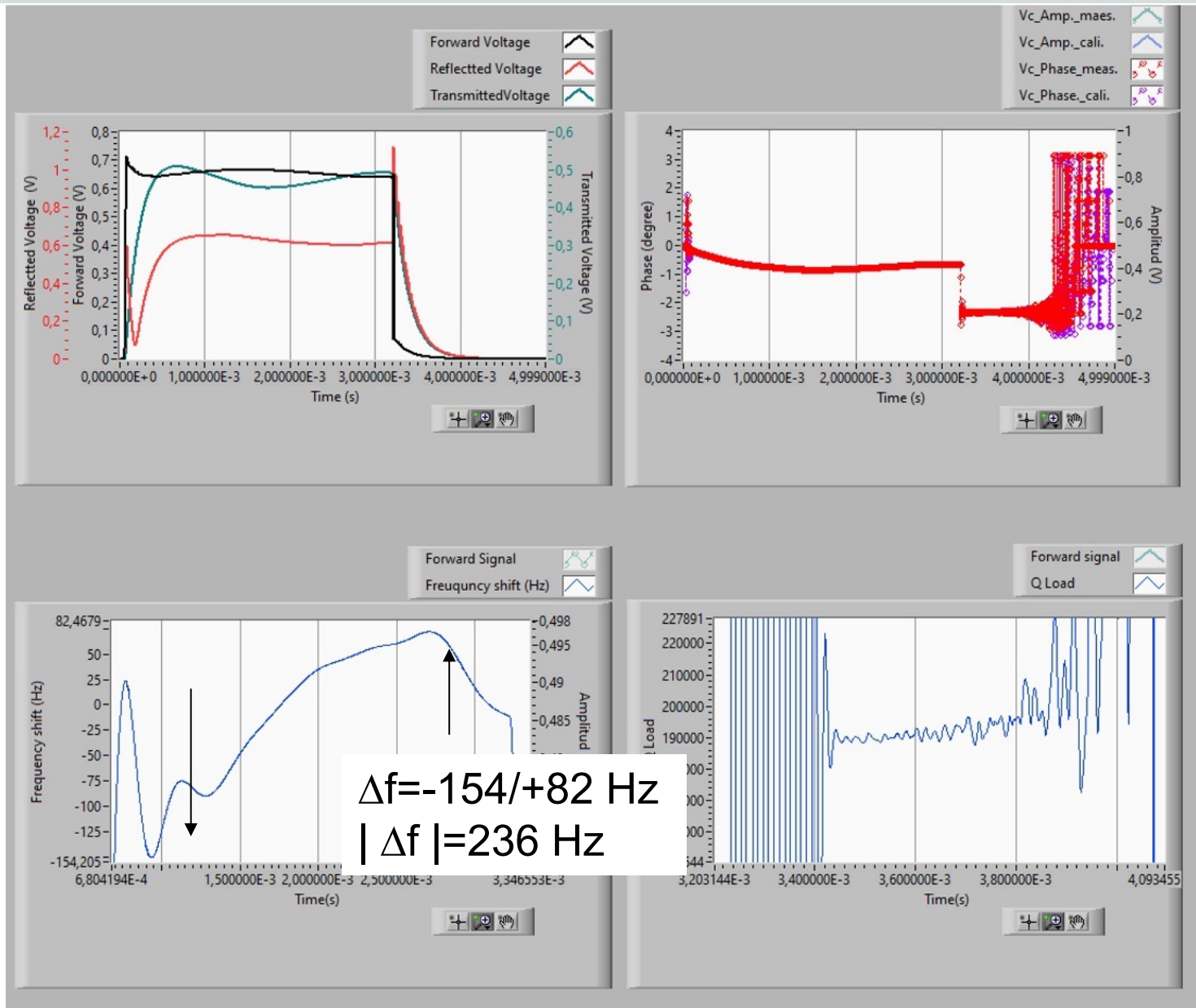


- We replaced the detector in a position with equal distance from both cavities
- Similar X-ray dose indicates similar level of cleanness

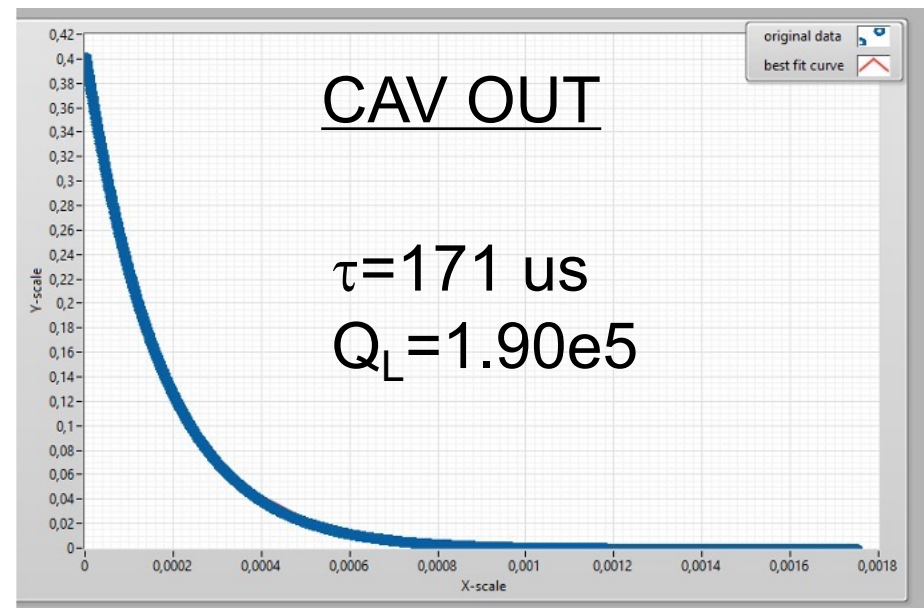
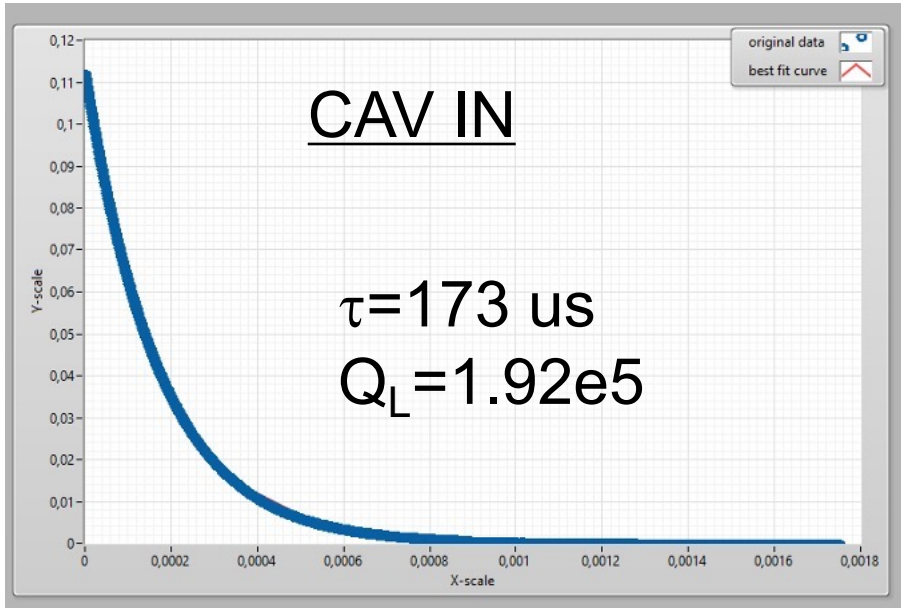
CM04: CAV IN: Dynamic LFD@9MV/m



CM04: CAV OUT: Dynamic LFD@9MV/m



$\Delta f = -154 / +82 \text{ Hz}$
 $|\Delta f| = 236 \text{ Hz}$



	CAV IN	CAV OUT
From VNA	1.81e5	1.82e5
From exp fit	1.92e5	1.90e5
By-pro of LFD	1.9e5	1.9e5

Ok, but again frequency domain measurement with VNA seems underestimate the Q_L

Value name	Static	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Static
Cav 1	0 MV/m	9 MV/m	12 MV/m	9 MV/m	0 MV/m	0 MV/m	0 MV/m
Cav 2	0 MV/m	9 MV/m	0 MV/m	0 MV/m	12 MV/m	9 MV/m	0 MV/m
FT551 [m ³ /h]	14.3	13.38	14.13	13.07	13.86	13.28	13.59
Heat Load [W]	15.34	14.96	15.12	13.98	14.83	14.21	14.54

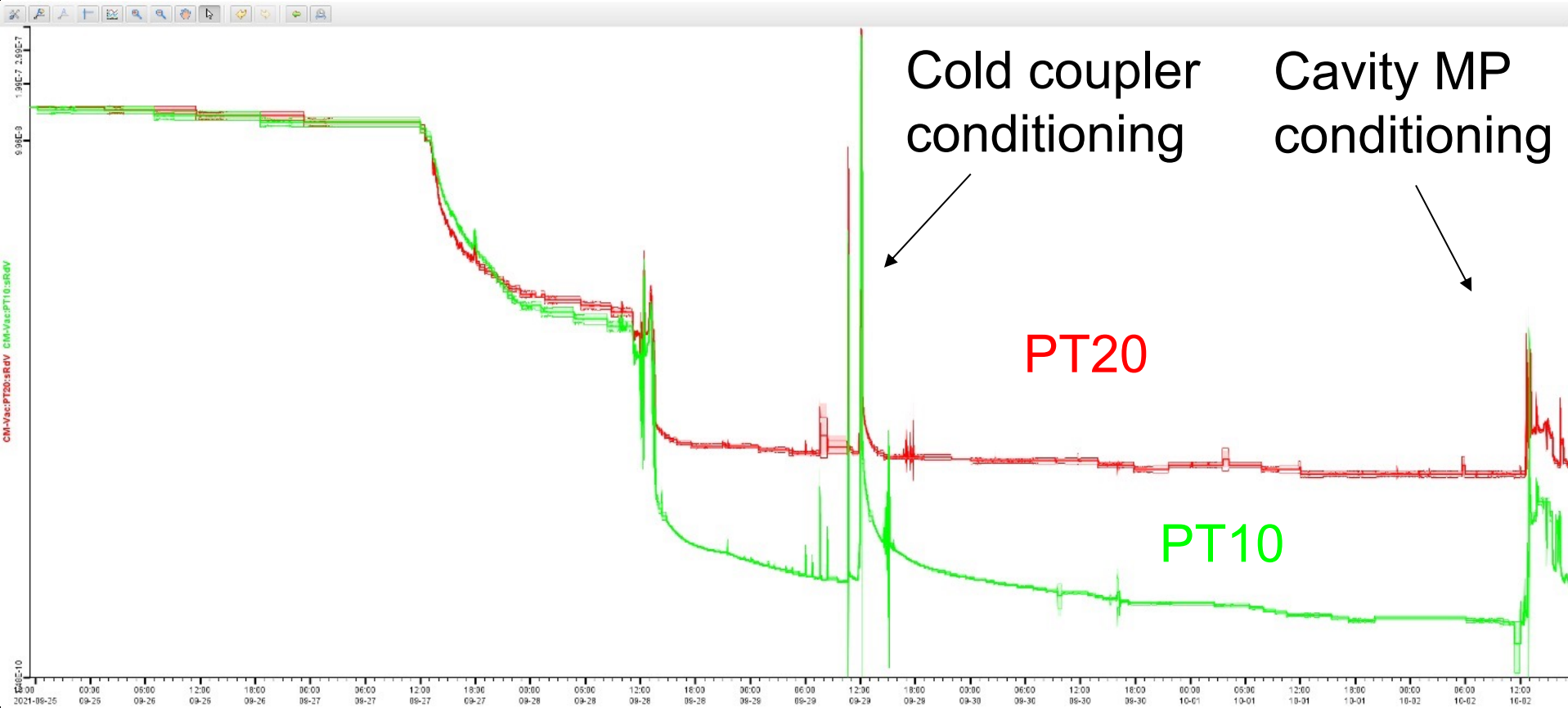


$$\Delta P < 0$$

Power dissipation by RF
< measurement error (~1W)

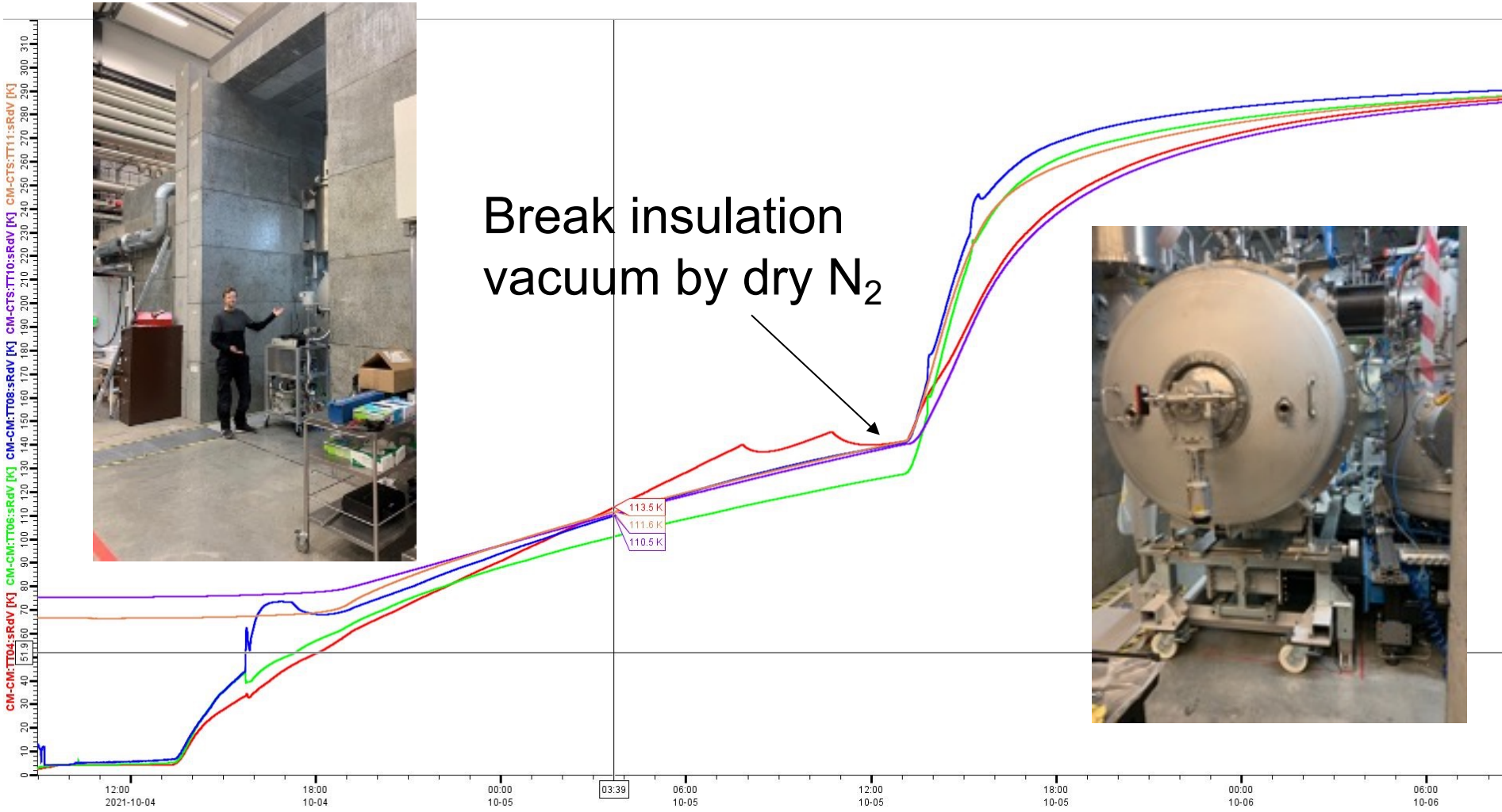


CM04: beam vacuum was leak tight

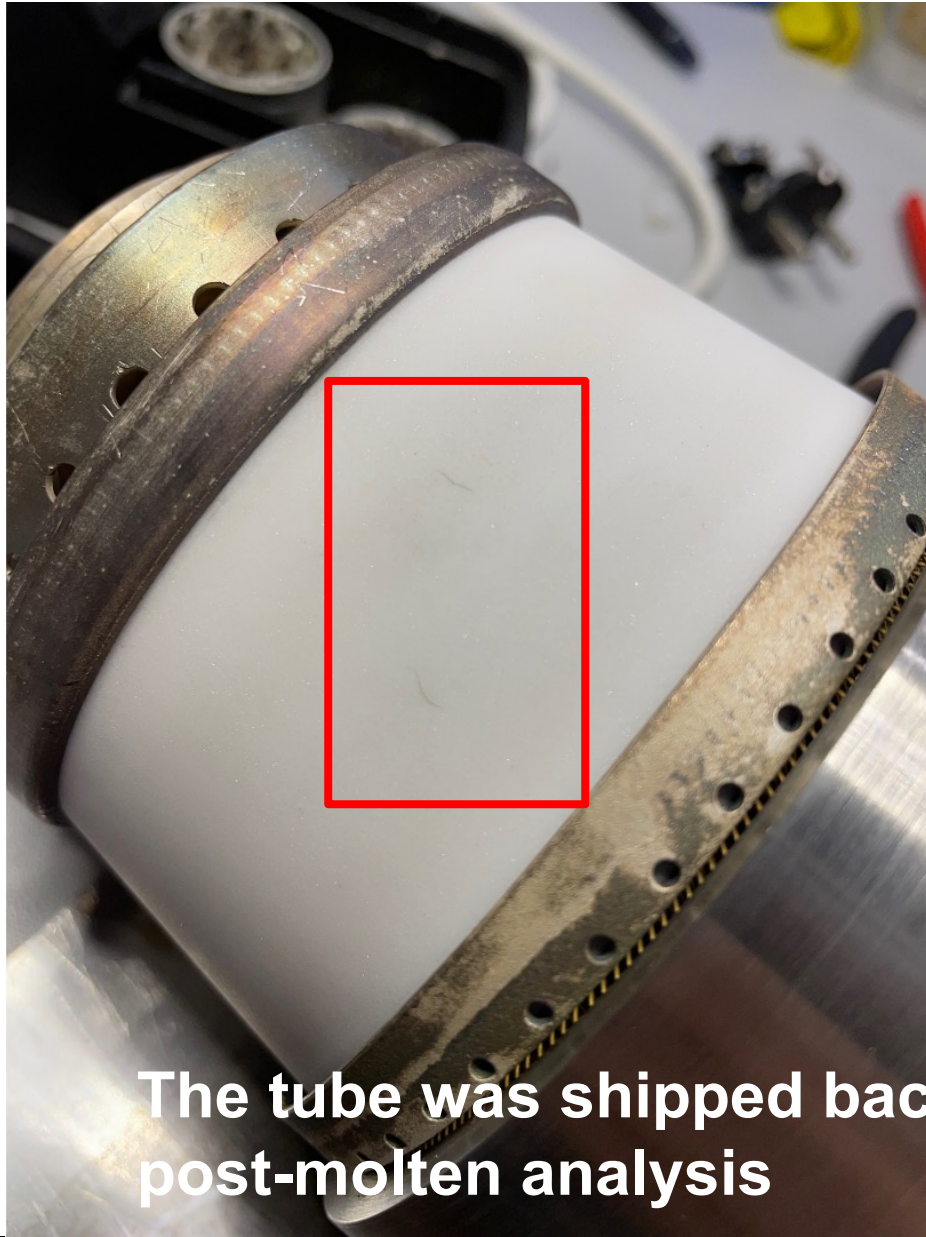


OK but again PT20 (CAV OUT; FPC2)
showed systematically higher value at cold

CM04: Warming up & preparation for shipping



Ready in the transport box middle of next week



The tube was shipped back to THALES at Thonon for post-molten analysis