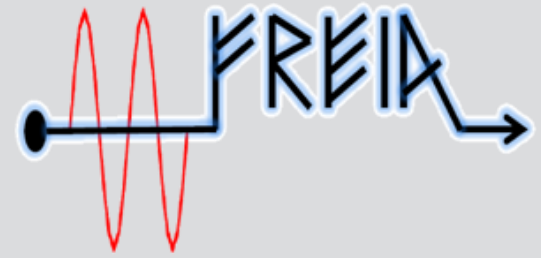




UPPSALA  
UNIVERSITET



# ESS weekly meeting (2021 W39)

A. Miyazaki et al.

# General planning no major update



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

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



FREIA Planning	2021-08-25																												2022			
			August					September					October					November					December					January				
Equipment	Responsible		2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	6	13	20	27	1	8	15	22	29				
		week #	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	1	2	3	4	5				
Liquefier & 2K pumps	Esat																															
RF power stations	Mykhailo																															
Cryomodule test stand	Akira																															

We are here

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



# W38&W39 progress



week		W38												
date		MON		TUE		WED		THU		FRI		SAT	SUN	
		20-sep		21-sep		22-sep		23-sep		24-sep		25-sep	26-sep	
		m	a	m	a	m	a	m	a	m	a			
previous CM	CM01	shock sensor ON departure to ESS		preparation of documents				publish test report						
present CM	CM04	Electrosys for FPC1 conditioning			Electrosys fixed	Electrosys for FPC1	Electrosys for FPC2 conditioning			FPC1 2nd round		FPC2 2nd round	FPC1 3rd round	
		DB station to repair --> Crowbar & fuse may be due to a short circuit in either tube or cavity of tetrode						Test DB station with a new tube		Condition the tubes				
next CM	CM03	transport via Lund						reception at UU		thermalization at UU				

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											

We are here



# W40, 41 Planning



## Tentative goal of CM04

week		W40											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		04-okt		05-okt		06-okt		07-okt		08-okt		09-okt	10-okt
		m	a	m	a	m	a	m	a	m	a		
present CM	CM04	CTS test at 2K		heat load measurements				start warming up		vent insulation vacuum		warming up	
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-okt		12-okt		13-okt		14-okt		15-okt		16-okt	17-okt
		m	a	m	a	m	a	m	a	m	a		
present CM	CM04	remove concrete blocks	disc. Pumping stations & cables	disc. Water pipes, insulation bellows	disc. waveguide	disc. cryogenic lines	swap modules. Connect waveguide	filling dry N2		outgoing test (LEMO)			
next CM	CM03							warm test of the stepper motors					
next next CM	CM06	preparation at Orsay											

# W42 & 43 planning: transport week



## Plan B

week		W42											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		18-okt		19-okt		20-okt		21-okt		22-okt		23-okt	24-okt
		m	a	m	a	m	a	m	a	m	a		
previous CM	CM04			doorknob dismounting	outgoing test (VNA), shock sens.					activate shock sensors, close the box	waiting in the box		
present CM	CM03	connect cryogenic lines		connect pumping stations		leak test of beam vacuum pumps, pump from one side, TPG300 starts		leak test & purging of He circuit, RF calibration, stations		vacuum pumping			
next CM	CM06	preparation at Orsay											

week		W43											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		25-okt		26-okt		27-okt		28-okt		29-okt		30-okt	31-okt
		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	Plan A coupler warm conditioning											
next next CM	CM06	departure from Orsay		transport over the sea				reception at UU		thermalization at UU			

- **Plan A: W43** is just one example and we can be flexible
- For example, **Plan B W42**: CM04 departure on Oct 19-20<sup>th</sup> and CM06 reception on Oct 21<sup>st</sup> would also be feasible
  - We need to change priorities in mechanical work of CM03

week		W42											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		18-okt		19-okt		20-okt		21-okt		22-okt		23-okt	24-okt
		m	a	m	a	m	a	m	a	m	a		
previous CM	<b>CM04</b>			doorknob dismounting	outgoing test (VNA), shock sens.					activate shock sensors, close the box	waiting in the box		
present CM	<b>CM03</b>	connect cryogenic lines		connect pumping stations		leak test of beam vacuum pumps, pump from one side, TPG300 starts		leak test & purging of He circuit, RF calibration, stations		vacuum pumping			
next CM	<b>CM06</b>	preparation at Orsay											

week		W43											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		25-okt		26-okt		27-okt		28-okt		29-okt		30-okt	31-okt
		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											
next next CM	CM06	departure from Orsay		transport over the sea				reception at UU		thermalization at UU			

- CM03's cavity strings were already condition in May-June
- We probably do not need 1 week for this time → 1-2 days?
- Not easy to anticipate but start cooling down from Oct 28<sup>th</sup> might also be an option (→ Operator from ESS?)

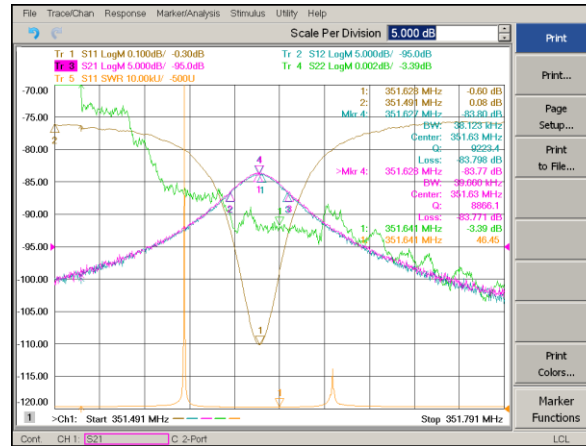
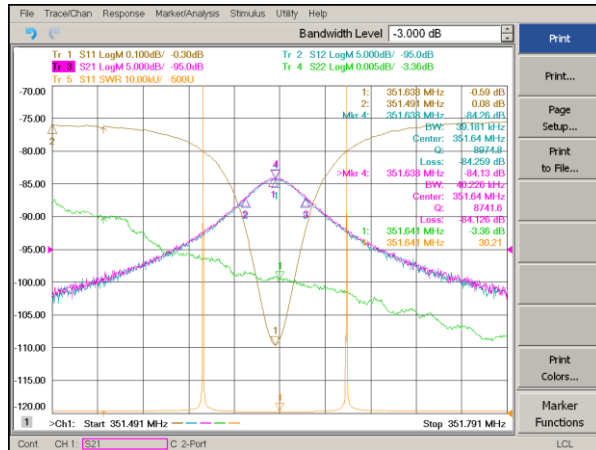
# Reception test of CM03



CAV IN

CAV OUT

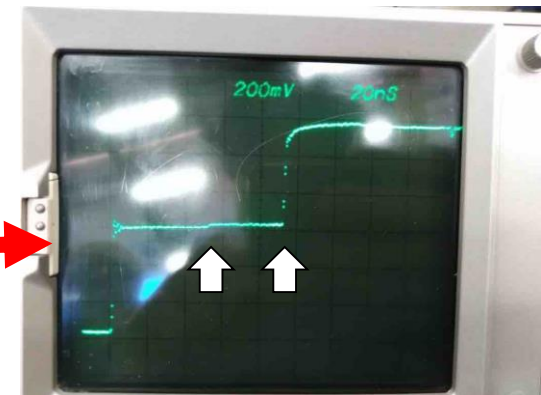
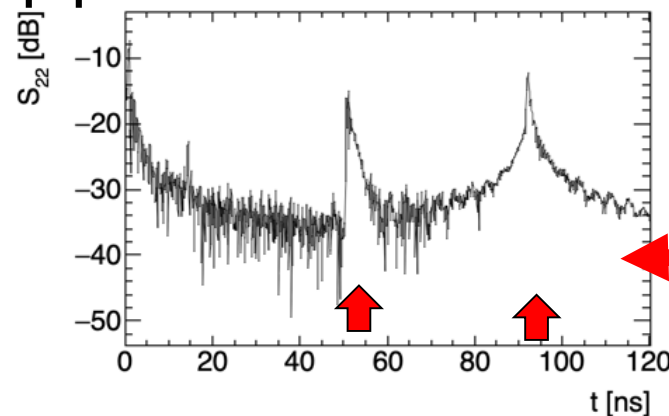
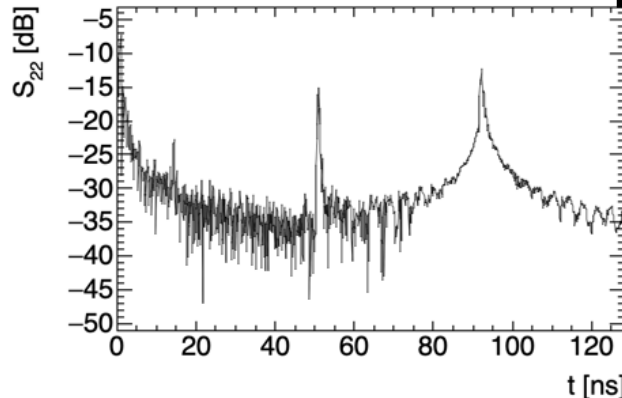
New (old) toy  
Direct TDR



CAV IN

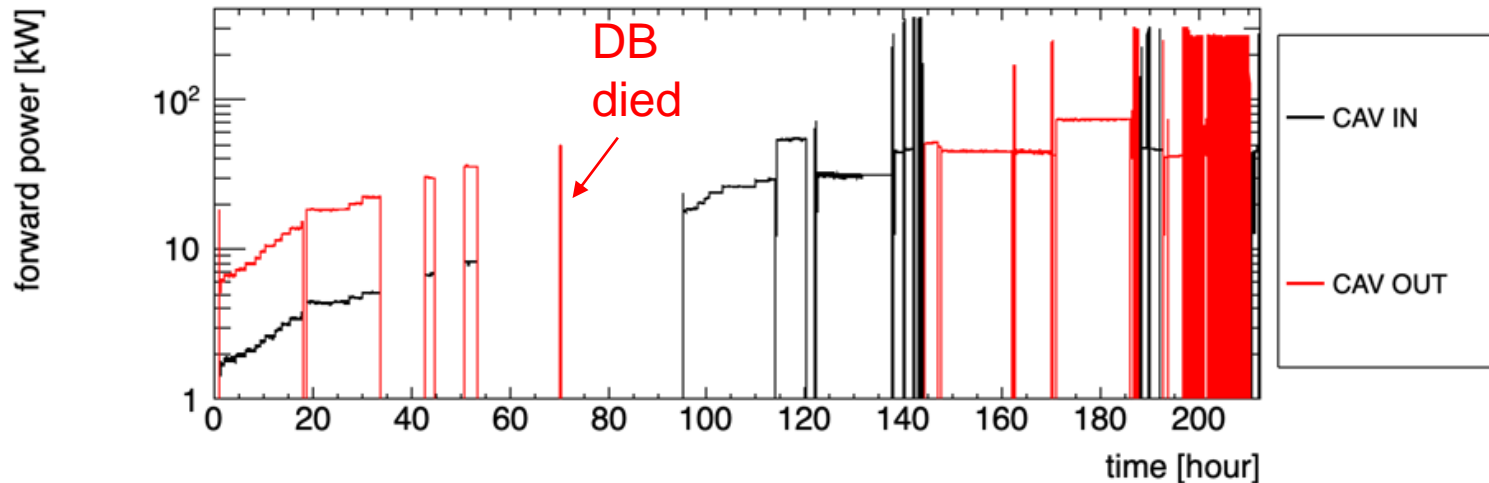
TDR by  
FFT

CAV OUT

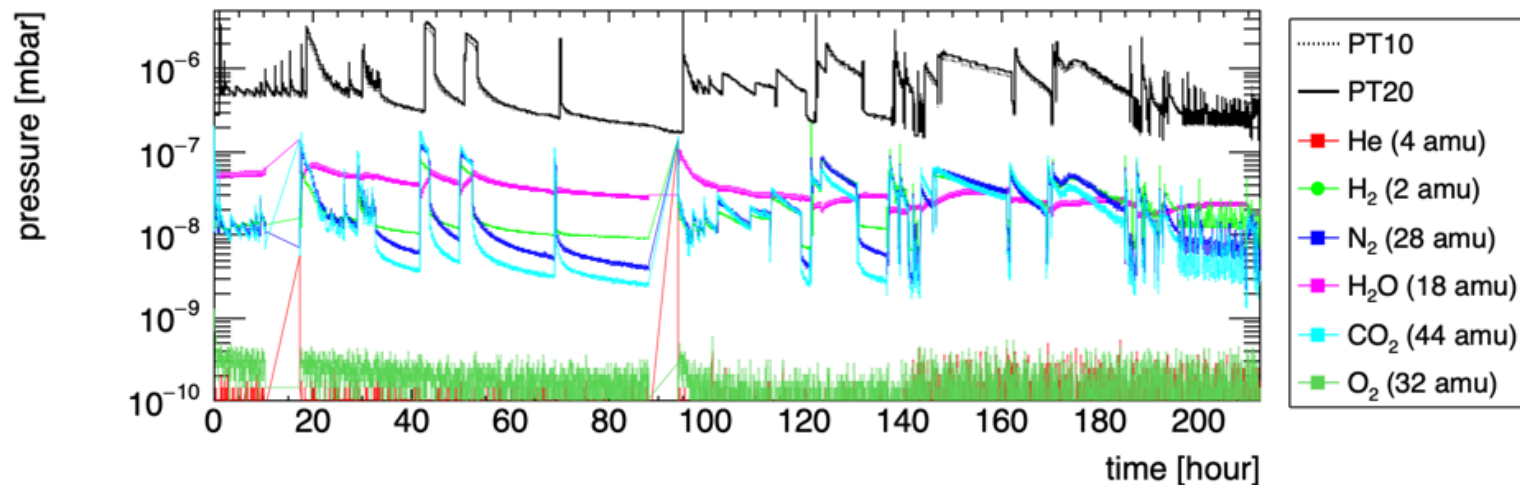


LEMO connectors are also OK

## Real time including down time & investigation: 9 days

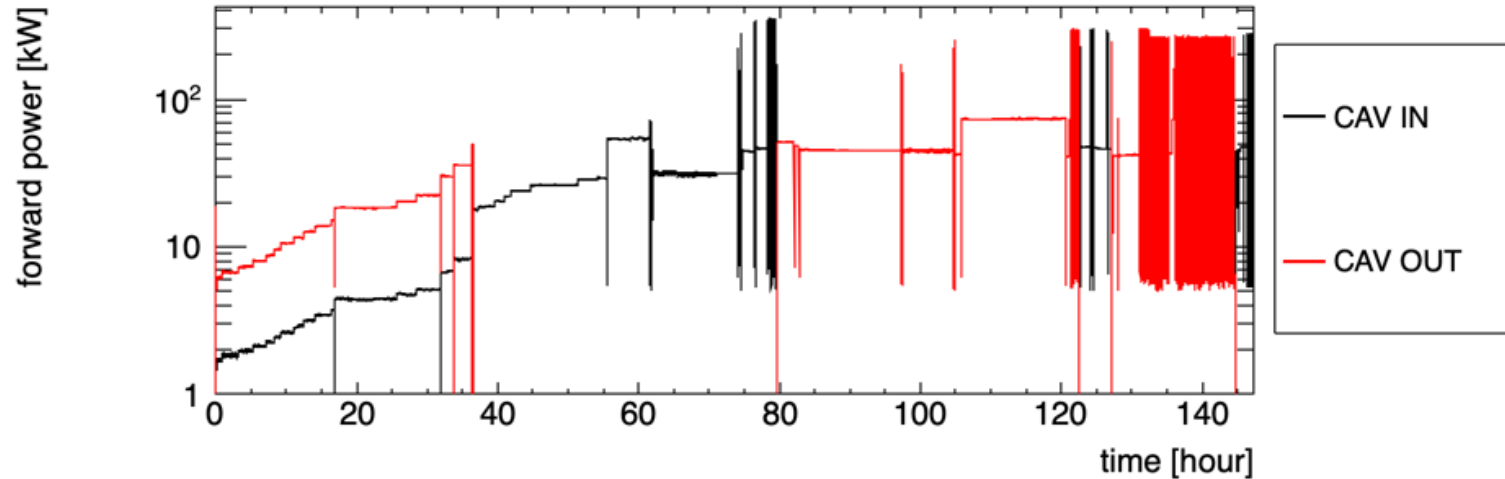


## RGA analysis

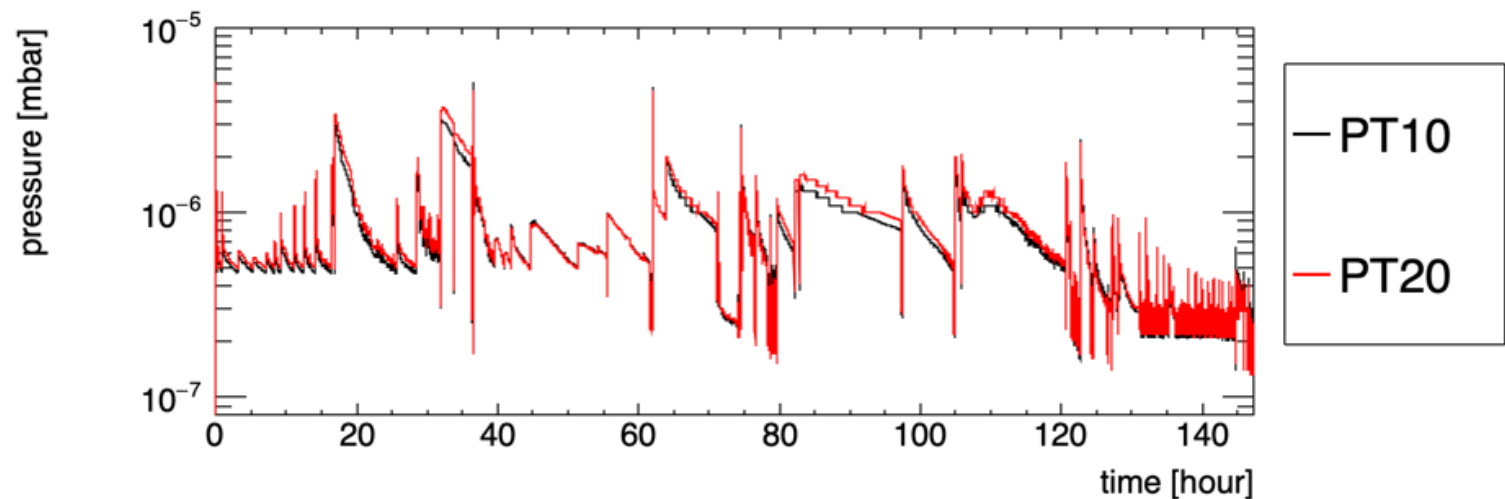




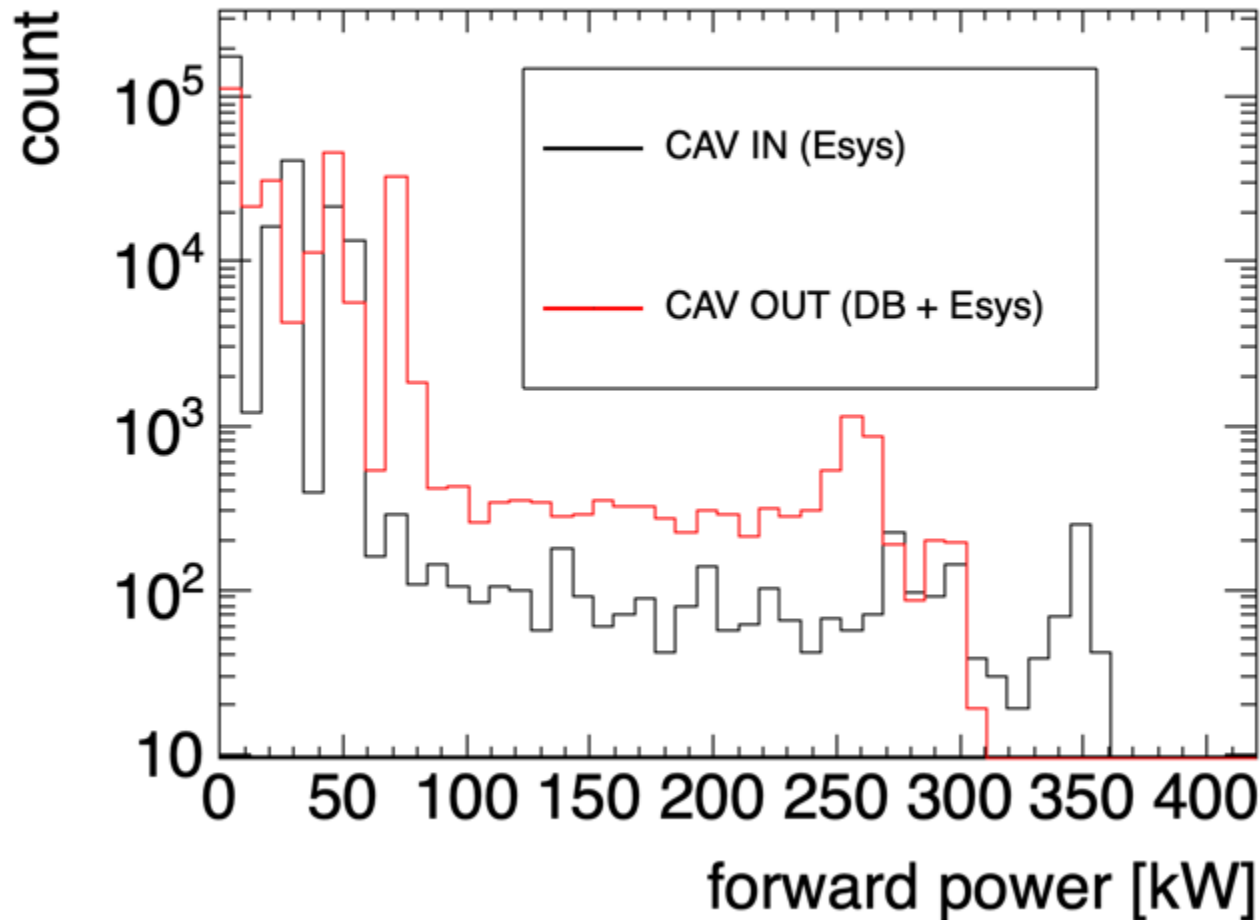
Only up-time: 6.3 days (comparable to prototype)



Down-time was only 3 days → thanks to Mysha's team

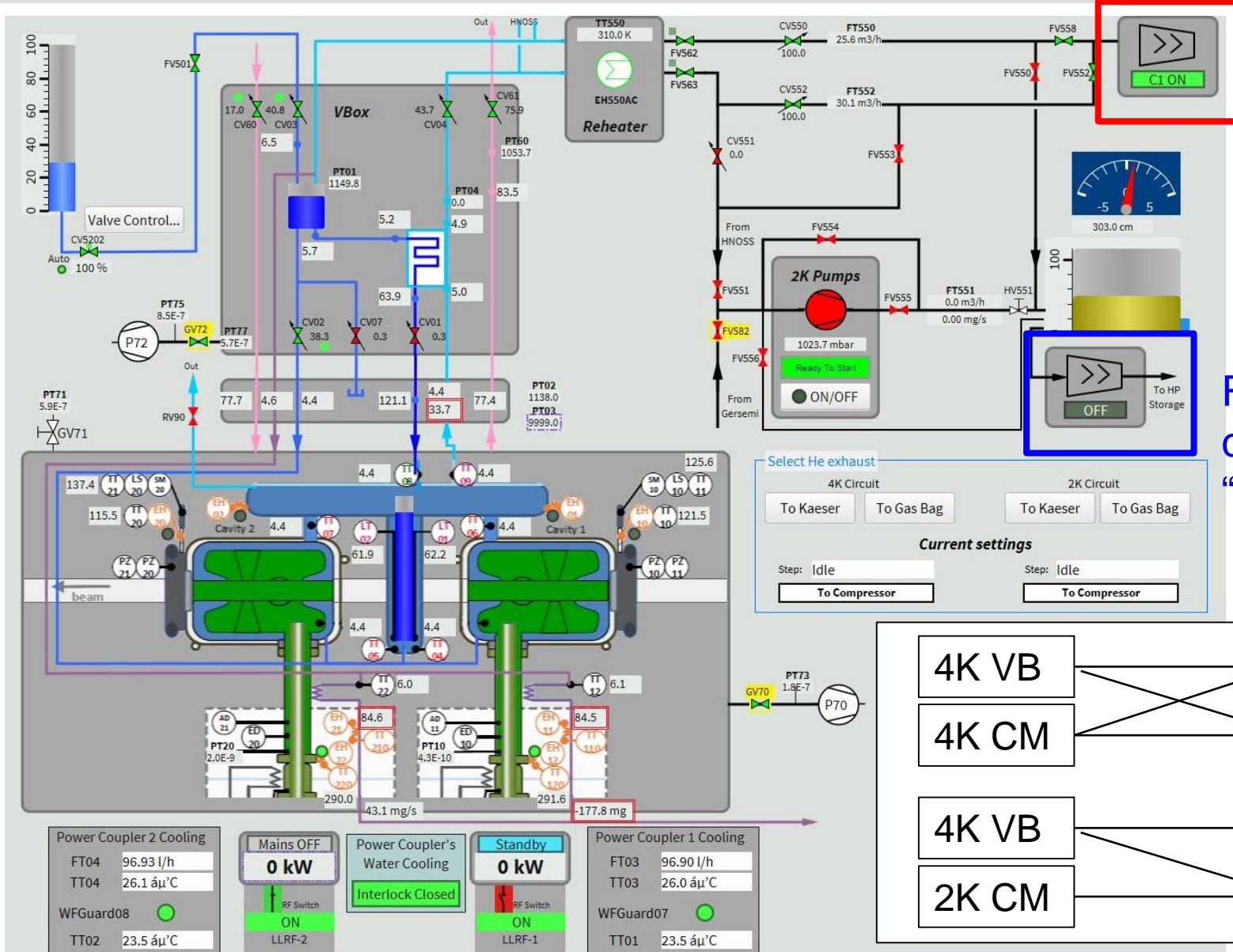


# CM04: Statistics of power demand



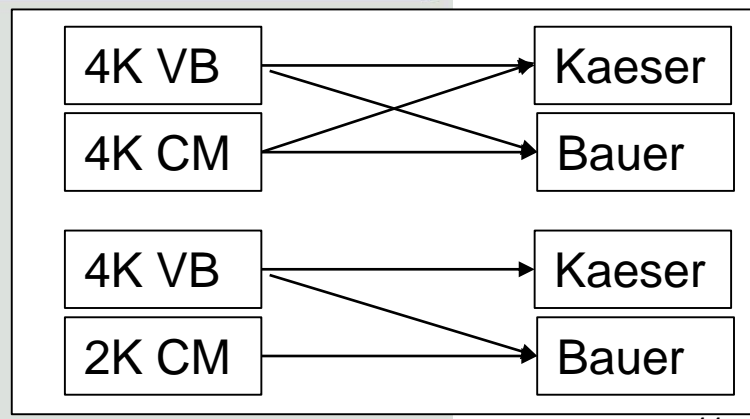
<100kW most of the time → but power stations die ☹  
Feedback to THALES with surprise

# Cf. Our cryogenic architecture



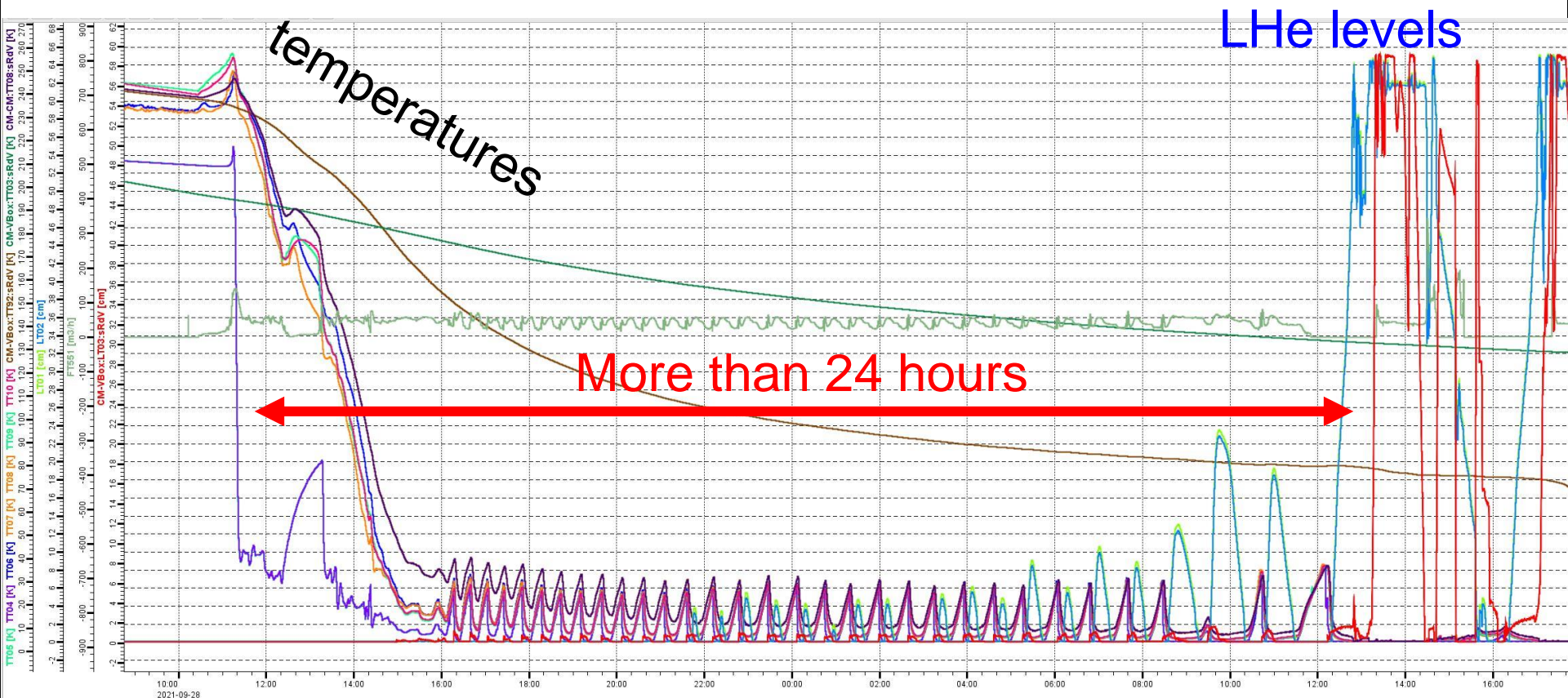
Circulation  
compressor  
"Kaeser"

Recovery  
compressor  
"Bauer"





# CM04: Cooling down & 4K filling



LHe levels

temperatures

More than 24 hours

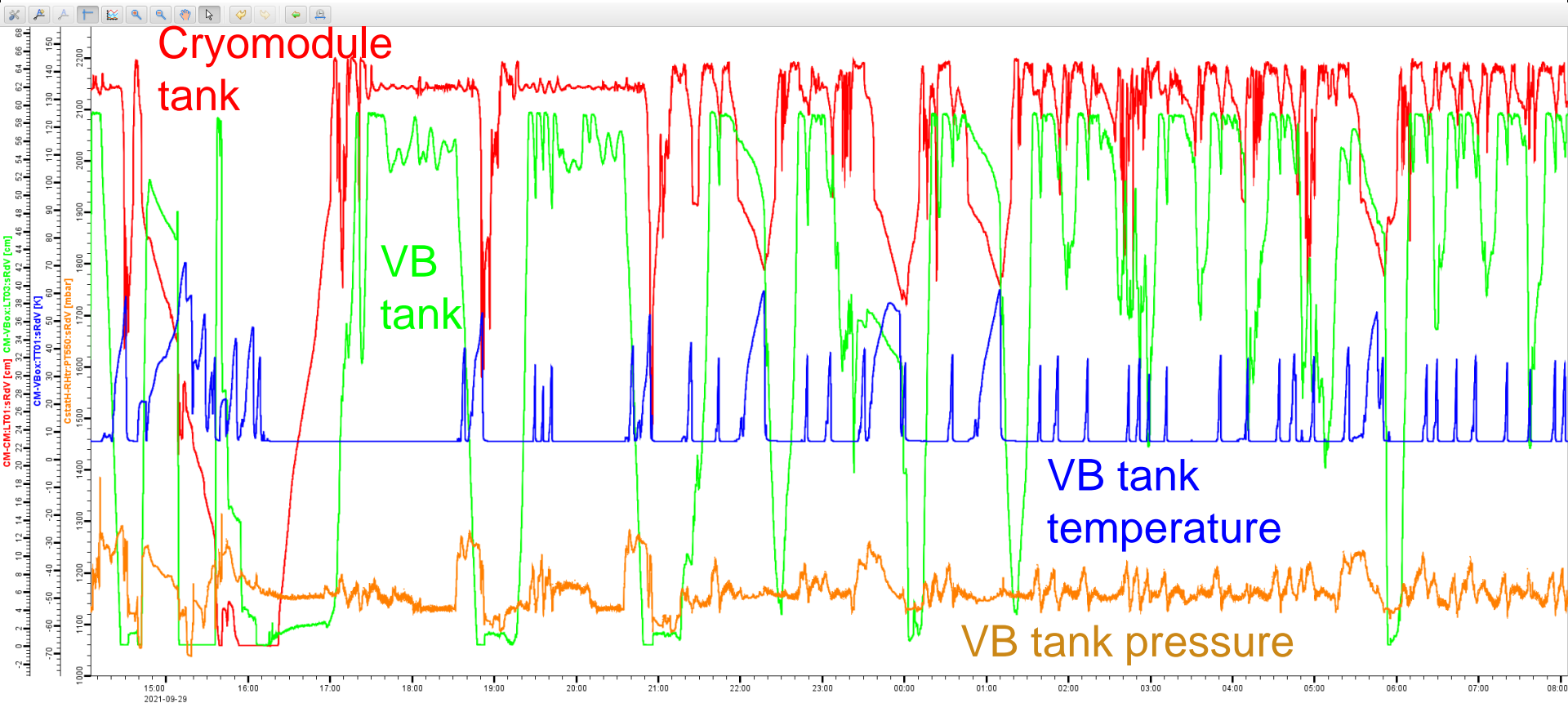
- The present recovery compressor “Bauer” cannot handle all the GHe flow especially when a Dewar is filled
  - Use the circulation compressor in parallel or alone (update document?)
- The circulation compressor “Kaeser” tripped once
  - Maintenance? → possible between CM04 and CM03 (W41, 42, 43)?



# Instability over night with 4K operation



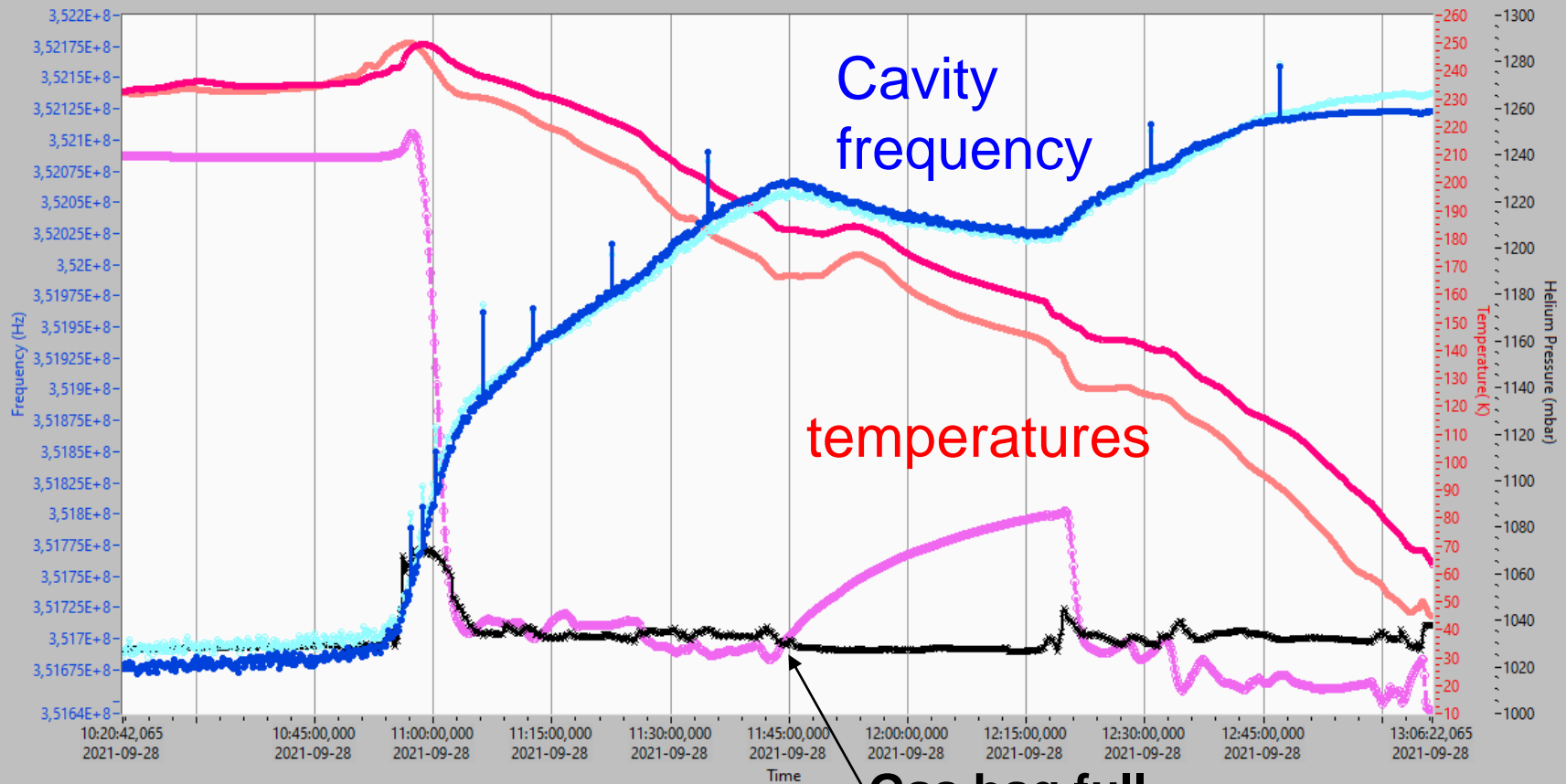
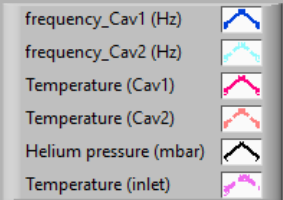
Cryogenic system especially VB (4K system) has recently been more unstable than before, since after summer → cause instability in cryomodule



- Cause & effect is unknown
- More issues in Valve Box → usually connected to circulation compressor
- Speculation: something related to Kaeser? Can service help this issue? <sup>13</sup>



# CM04: frequency during cooling down

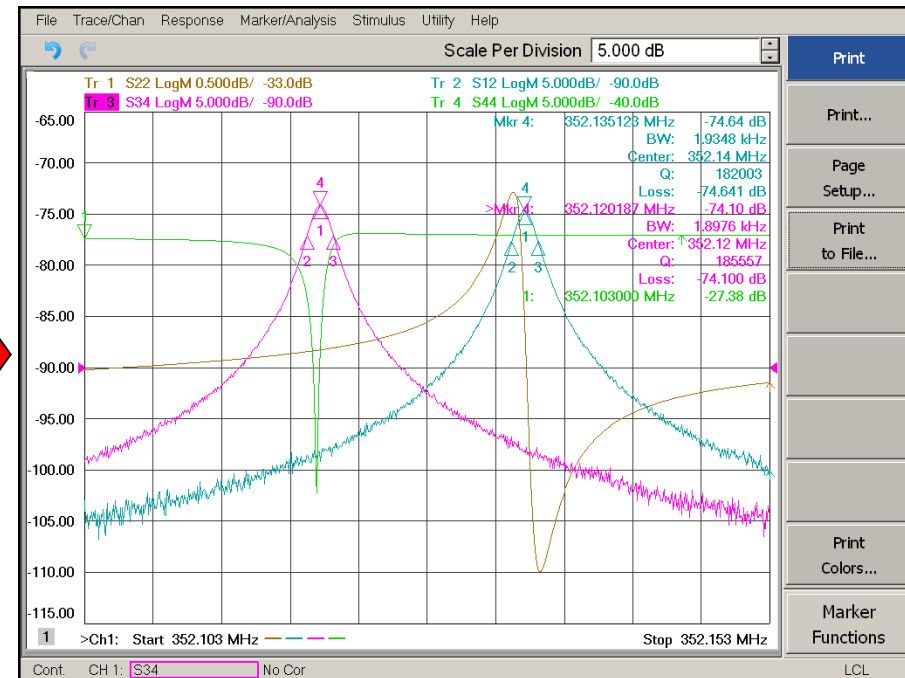
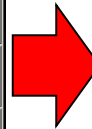
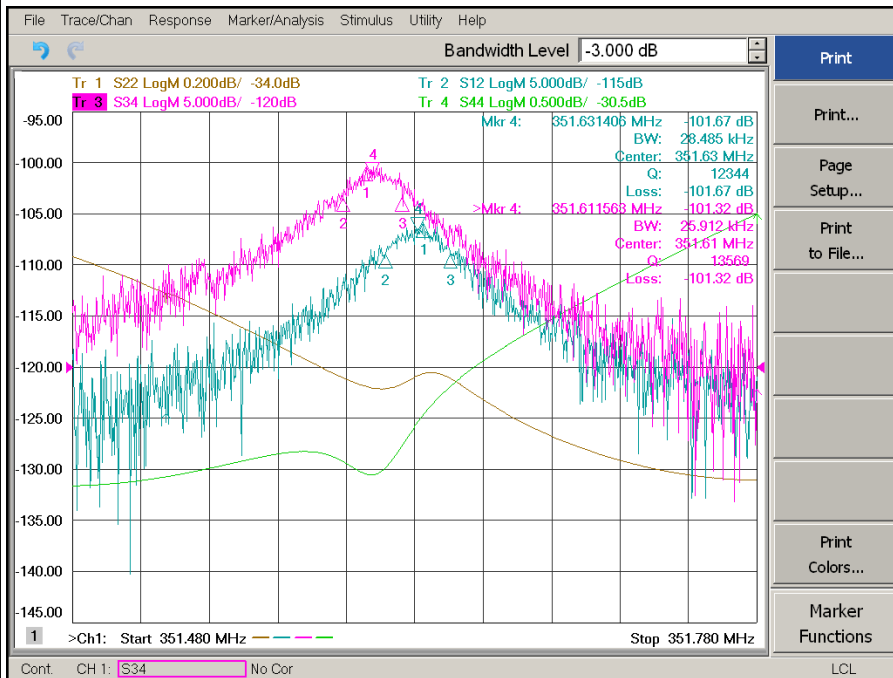


# CM04: S-parameters change by cooling

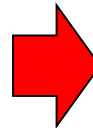


300K, insulation vacuum 1e-5 mbar

4K, insulation vacuum 1e-5 mbar



	CAV IN	CAV OUT
f0 MHz	351.631	351.611
QL	1.23e4	1.36e4



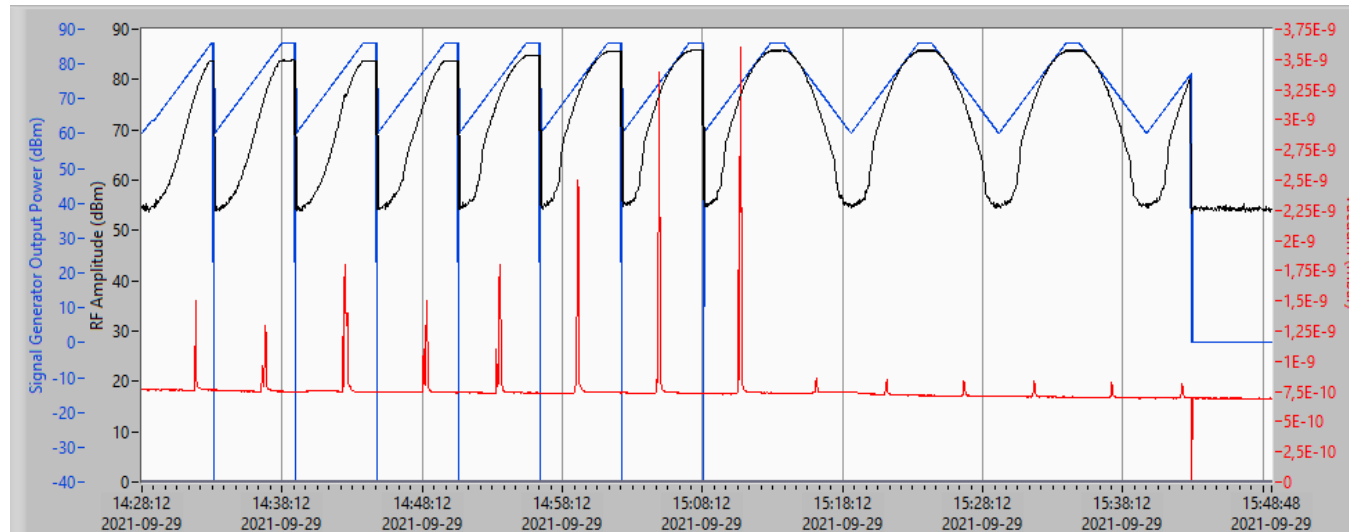
	CAV IN	CAV OUT
f0 MHz	352.135	352.120
QL	1.82e5	1.86e5

	CAV IN	CAV OUT
$\Delta f$ kHz	+504	+509

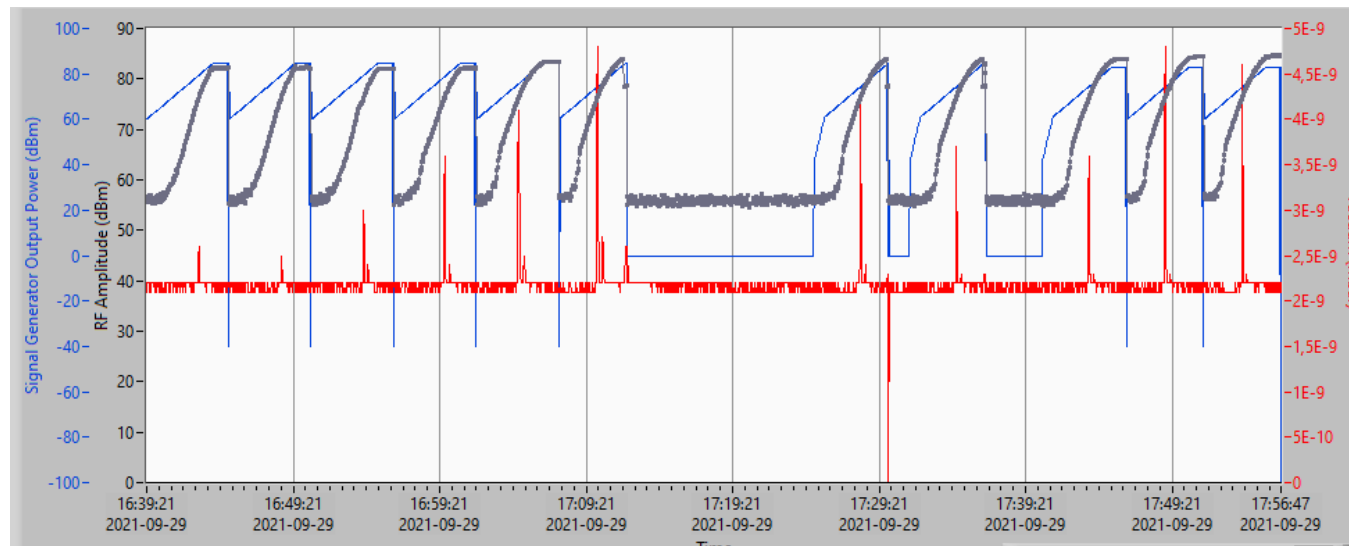
# CM04: Coupler cold conditioning



FPC1 conditioning with Electrosys → OK

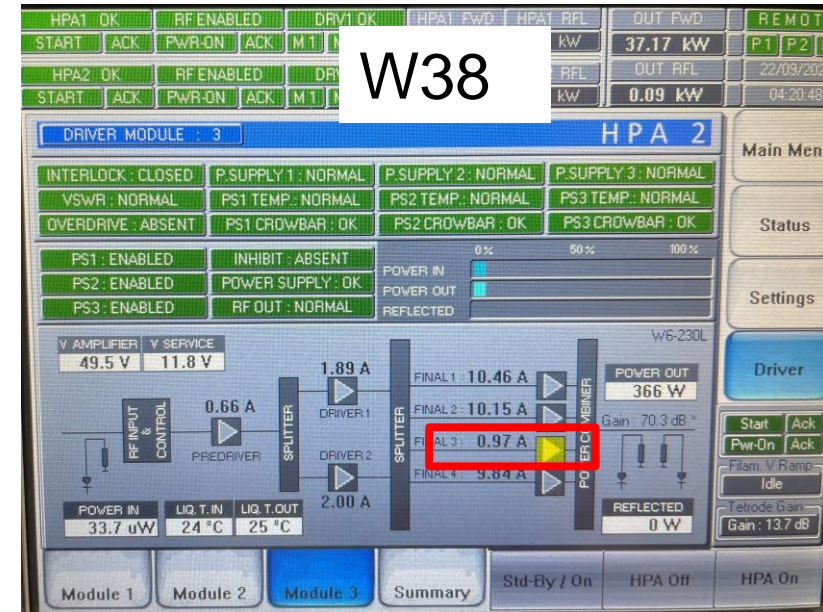
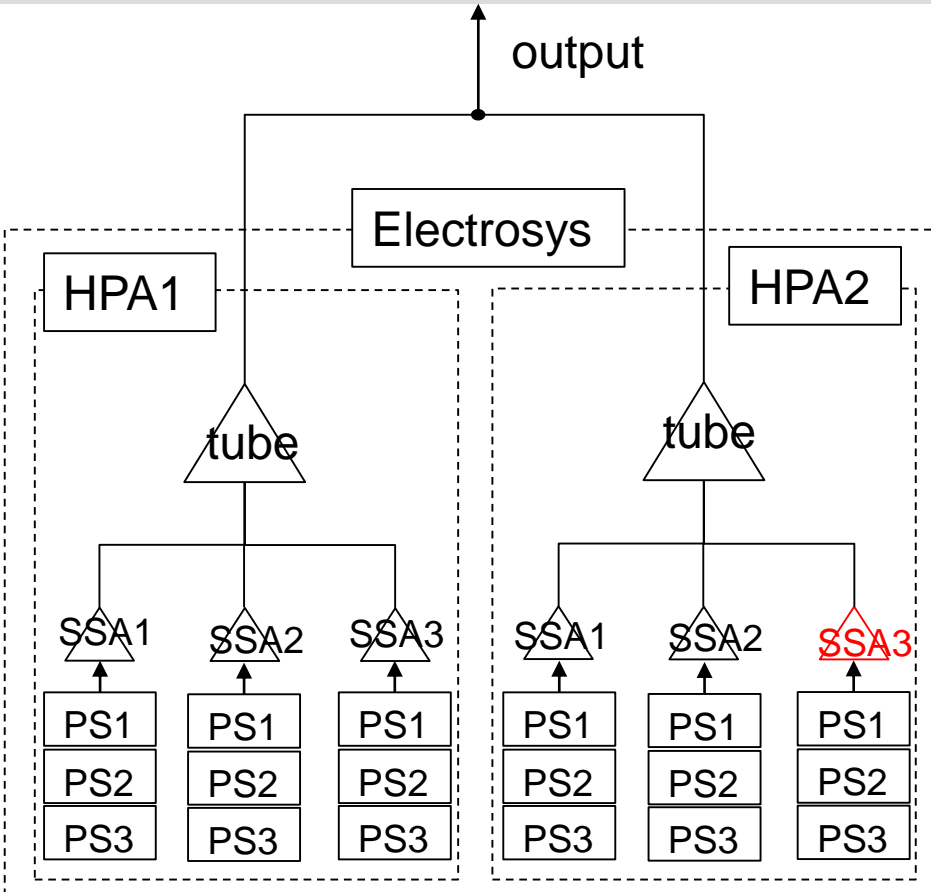


FPC2 conditioning with Electrosys → OK but Electrosys showed issues





# Electrosys issues update (HPA2-SSA3)

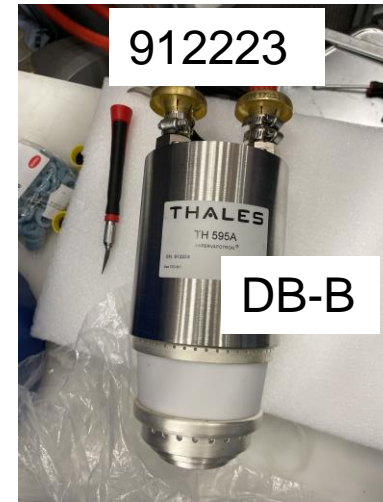


- The transistors are getting broken
- A spare SSA was ordered but was not manufactured yet due to lack of raw materials
- Electrosys promised to ship it by the **last week of October**

# Issues in DB: updated



- The tube 595A 901204 (**4800 hours**) was replaced to a virgin new spare 912223 in **DB-B**
- Too high dark current between G1 and G2 in 901204 at room temperature but with normal capacitance
  - THALES wants us to send 901204 back
  - Under discussion @ ESS (INFN in between)
- Even after installing 912223 in DB-B, **Crowbar-In tripped** with RF power of only above 240 kW
- A dedicated test with thin wires showed Crowbar circuit is fast enough to protect the tubes
- **We cannot identify which section is the cause** of Crowbar
- The tube in **DB-A** is TH595A 907196 (**4800 hours**)
  - The same issue might happen also in this tube



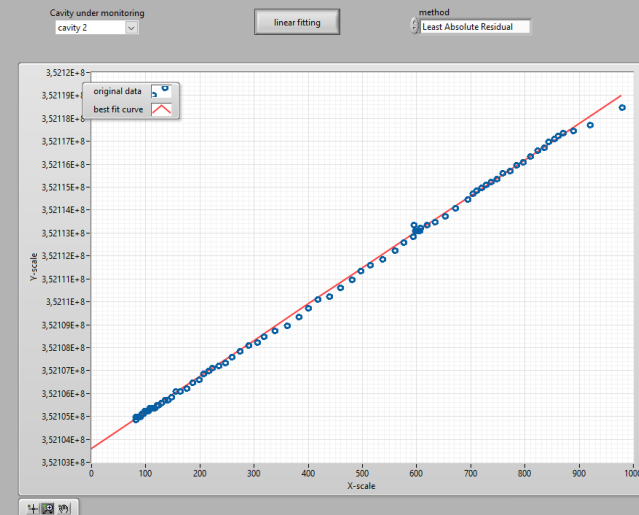
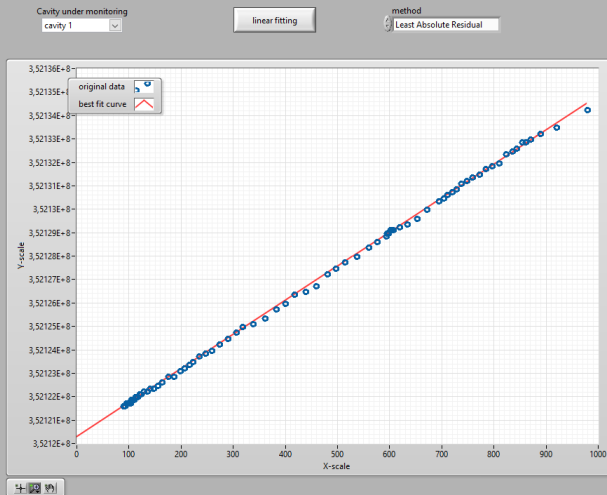
→ We decided to replace the tube in **DB-A** to another virgin new spare **916278** because the issue in Electrosys is growing

**In parallel, Taskforce work is proposed by THALES for tube issues in general**

(priority? Testing CMs and tubes at the same time?)

## CAV IN

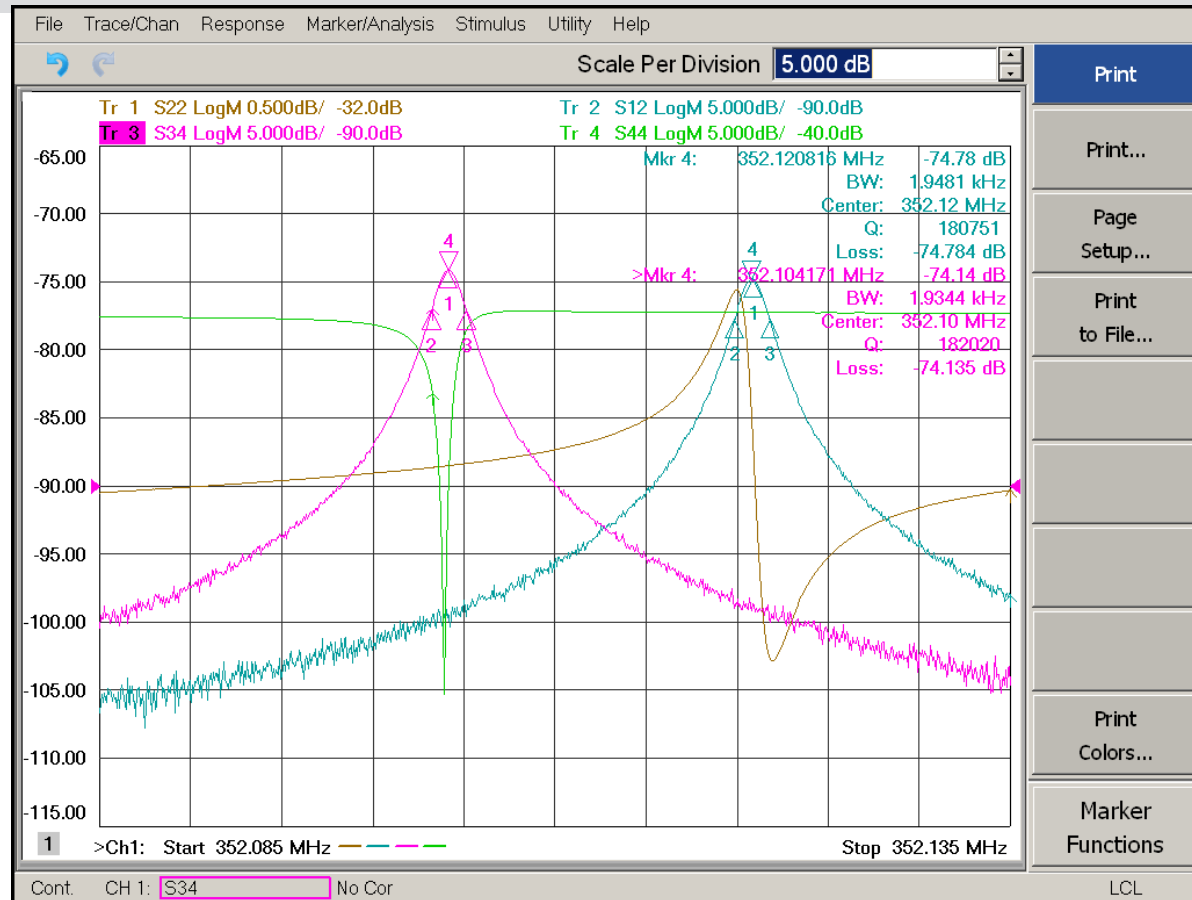
## CAV OUT



	CAV IN	CAV OUT
df/dp Hz/mbar	-14.5	-15.7

Both are <20 Hz/mbar OK 😊

# CM04: cavities at 2K, no CTS engaged



	CAV IN	CAV OUT
f0 MHz	352.121	352.104
to 352.210 MHz	+89 kHz	+104 kHz
QL	1.81e5	1.82e5