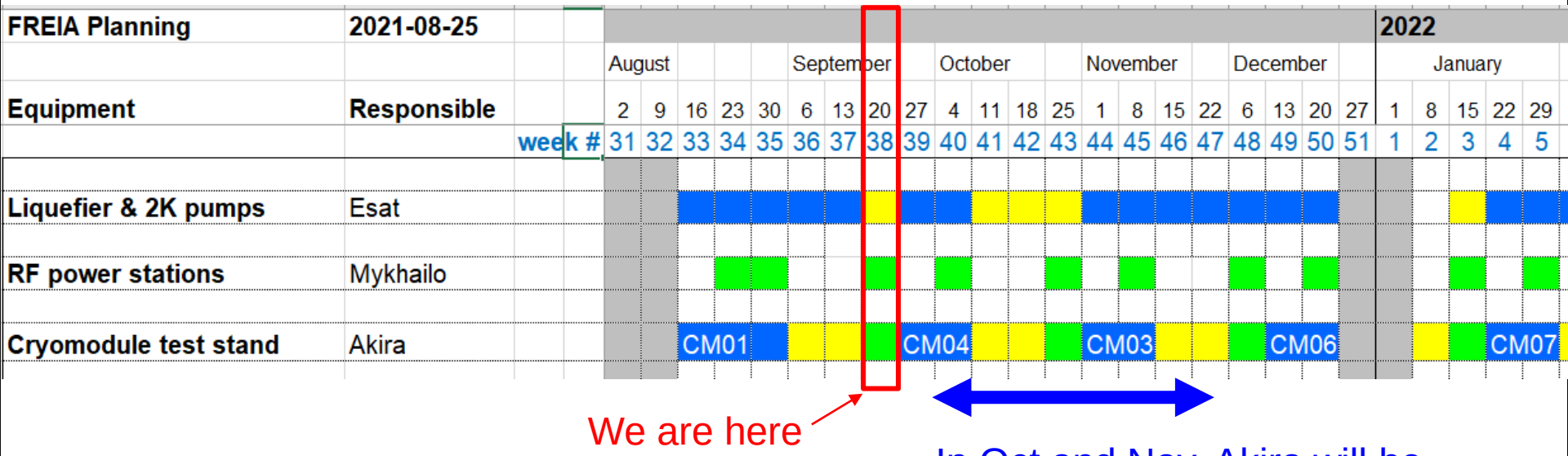
UPPSALA
UNIVERSITET

ESS weekly meeting (2021 W38)

A. Miyazaki et al.

General planning no major update (?)

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



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

W37&W38 progress

week		W37											
date		MON		TUE		WED		THU		FRI		SAT	SUN
		13-sep		14-sep		15-sep		16-sep		17-sep		18-sep	19-sep
		m	a	m	a	m	a	m	a	m	a		
previous CM	**CM01**			doorknob dismounting	outgoing test (VNA), shock sens.	waiting in the box							
present CM	**CM04**	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 ON		coupler warm conditioning				issue in DB station	
next CM	**CM03**	prepared at Orsay								departure at Orsay			

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			Chance to continue simultaneous conditioning?		Condition cross-contamination	
		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					
next CM	**CM03**	transport via Lund						**reception at UU**		thermalization at UU			

We are here

Progress of coupler warm conditioning

Del	Plot	Name	DBRType	Units	Processing	Scale	Time (local)	Value	Notes
x	☑	CM-Vac:PT10:sRdV	DBR_SCALAR_DOUBLE			log10	2021-09-16 16:22:01	8.276271186440678e-7	
x	☑	CM-Vac:PT20:sRdV	DBR_SCALAR_DOUBLE			log10	2021-09-16 16:22:01	8.525000000000001e-7	
x	☑	HPRF-Cav1:FwdPwr:sRdV	DBR_SCALAR_DOUBLE	kW	raw	linear	2021-09-16 16:27:55	1.8496522282600385	
x	☑	HPRF-Cav2:FwdPwr:sRdV	DBR_SCALAR_DOUBLE	kW	raw	linear	2021-09-16 16:27:55	6.678082500638768	
x	☑	LLRF:SigGen:PlsWdth	DBR_SCALAR_DOUBLE	µs	raw	linear	2021-09-16 15:23:56	50	

FPC2 conditioning by Electrosys

Mainly FPC2 conditioning by DB (gain of DB is higher at low power)

FPC1 conditioning by Electrosys → done

- FPC2 is under conditioning by Eletrosys
- Cross-contamination must be cleaned over the weekend: "2nd round"

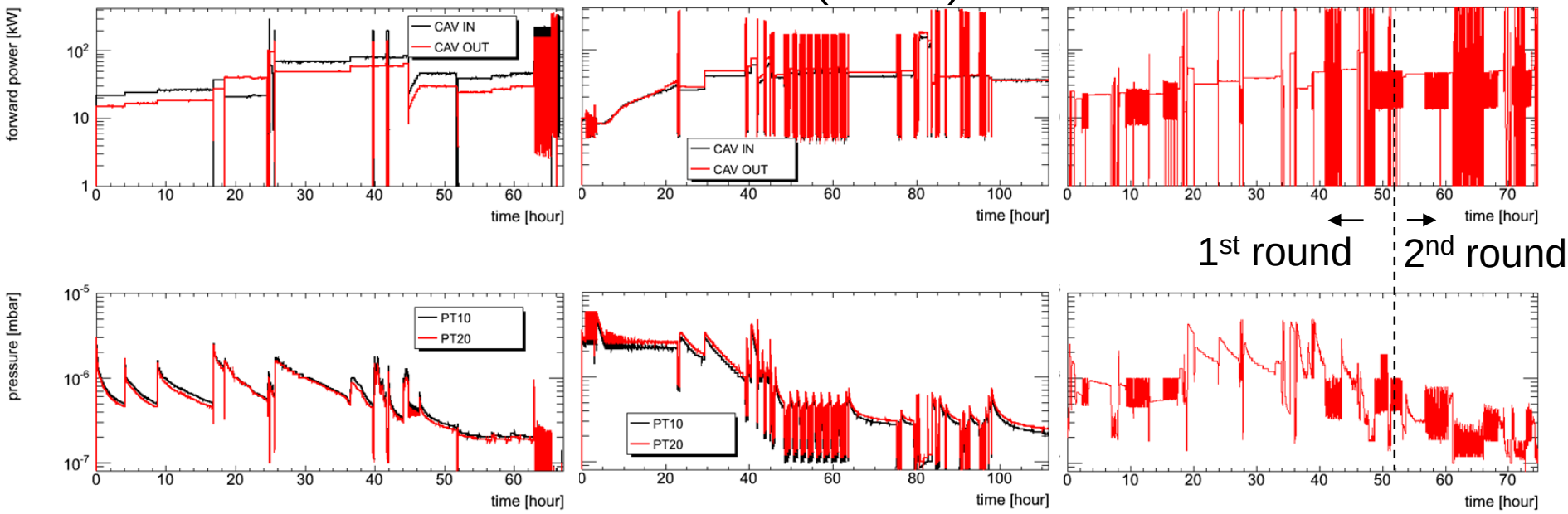
Cf. Impact of lack of pumps & stations

Slide from 2021 W21

Two pumps & two stations (CM05)

One Pump & two stations (CM02)

One Pump & one station (prototype)



1st round

2nd round

70 hours (3 days)

110 hours (4.5 days)

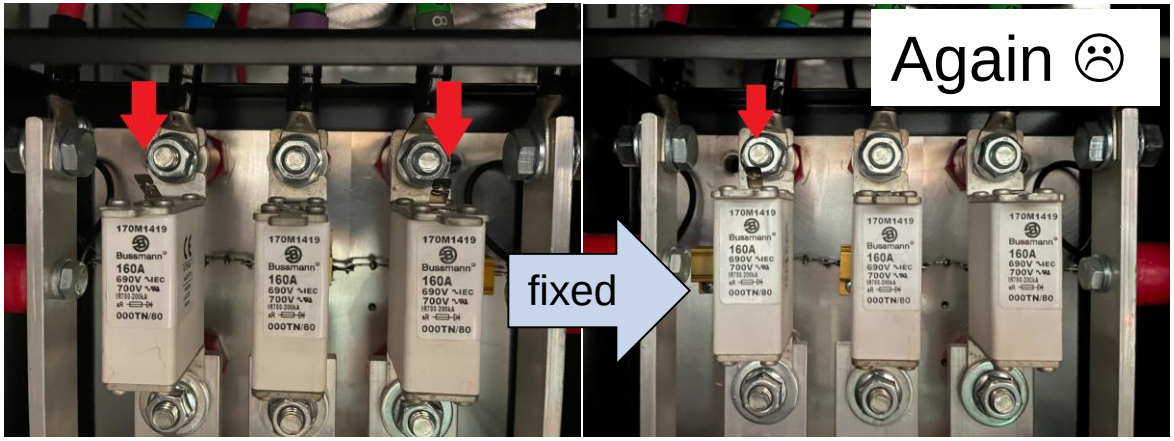
(50+25)x2
=150 hours (6 days)

- We decided to take a risk and use the second pumping station in which I suspect a leak in its internal gate-valve (see slides W37)
- Unfortunately, we probably need to sacrifice weekends to make it on time

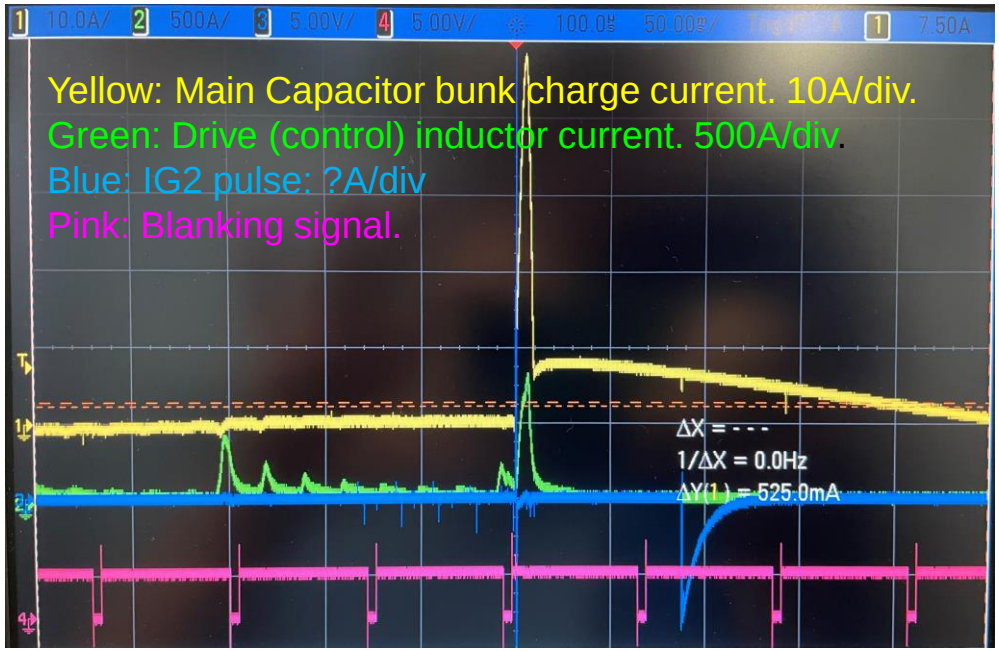
Issues in DB station (Mysha sacrificed WEs)

Story

- Annoyed by “Crowbar IN” of DB-B in past months
- This time, fuses were damaged and happen again and again even if it is fixed
- Disconnect the HV line from the tube → no problem

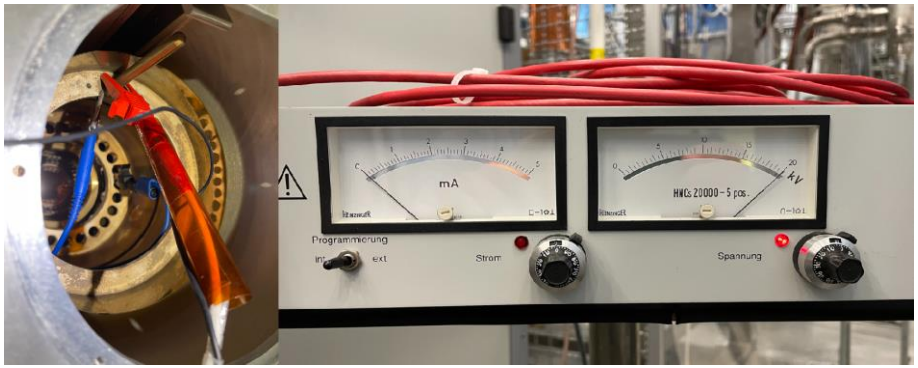


→ tube or cavity of tetrode was doubted



DB-B: either cavity or tube

Cavity passed the HV test



Tube did NOT

The tube under debate: 595A 901204

- Start operation on September 2019
- The first 595A type tube
- Total service (filament ON) time: 4800 hours (0.5 years)
- ESS project requirements :> 20,000 hours (2 years)
- No short-circuit or low capacitance at room temperature between any grids and/or cathode

HV test at room temperature (*preliminary*)

→ Cathode-G1:2kV OK, Anode-G2:20kV OK,

→ **G1-G2**: 750-1000V discharge << 1500V with 6uA (spec.)

Cf. TH595 761496 was broken in DB-B in 2019

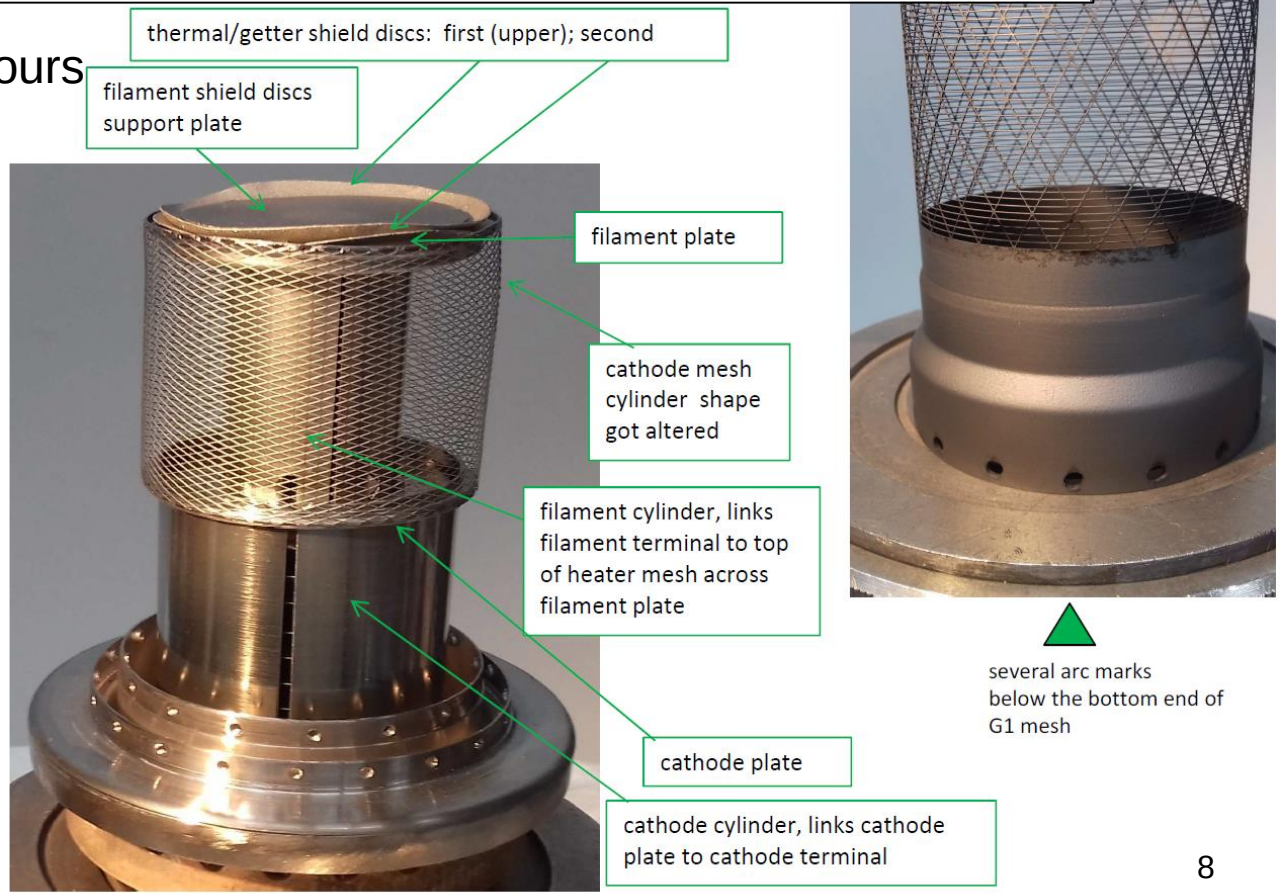
THALES Customer Technical support RFMS0T 60088363 13 Sep 2019

Tetrode insulation in cold condition is OK.
Short-circuit, K to G1, as soon as filament voltage is exceeding 2 V.

Not repairable / Non réparable

The upper (first) thermal/getter shield got deformed. The second one got partially stuck with filament plate.
Filament plate deformed, resulting in cathode deformed, and cathode eventually in touch to G1 mesh.
Marks of severe arcs, G1 to G2, at the bottom of grid mesh. (see picture of G1)

Filament service time 3000 hours



R. Ruber et al., FREIA report 2019/6

“G1 voltage went down to 5V with warm filament and when the filament cold off the voltage reached normal -300 to -200 V”

Cf. TH595 755305 was broken in Electrpsys in 2019

THALES Customer Technical support RFMS0T 60086796 22 Jul 2019

Filament service time 573 hours

-Anode inner surface got blackened. Main insulator got darkened (see picture)

-Marks of severe arcs, G1 to G2, at the bottom of grid mesh. (see picture of G1)

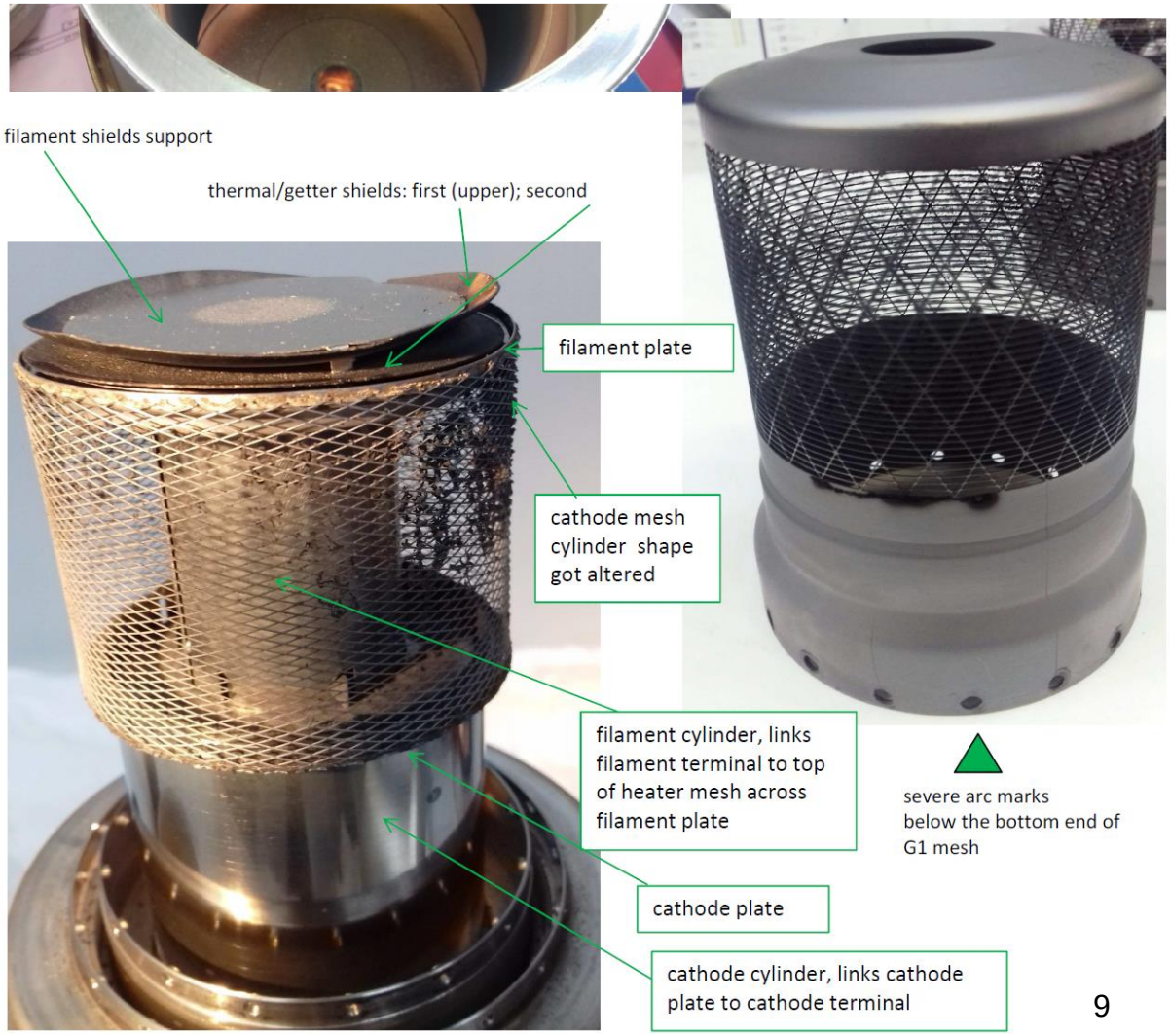
-The upper (first) thermal/getter shield got deformed, which fostered electrical arc with G1 top inner surface

-The second thermal/getter shield got stuck with filament plate.

-Inside the heater cylindrical inner structure, the uppest thermal shield got rolled in shape, and brittle.

-Cathode got deformed. Also, the tantalum belts, onto which cathode mesh ends are welded, got partly crushed into powder, resulting in snow crystal-shaped particles in-between cathode-to-G1 gap.

Not repairable / Non réparable



Actions for cryomodule testing

- The tube 595A 901204 was replaced to a new spare 912223
- The new filament was flushed over night
- OK with HV test without RF
- RF test with a dummy load is planned before connecting it to the module
  - Cavity may need to be tuned
- Hopefully simultaneous conditioning again from Friday tomorrow
  - Otherwise, re-conditioning of FPC1&2 needs some iterations over WE

week		W38															
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		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									
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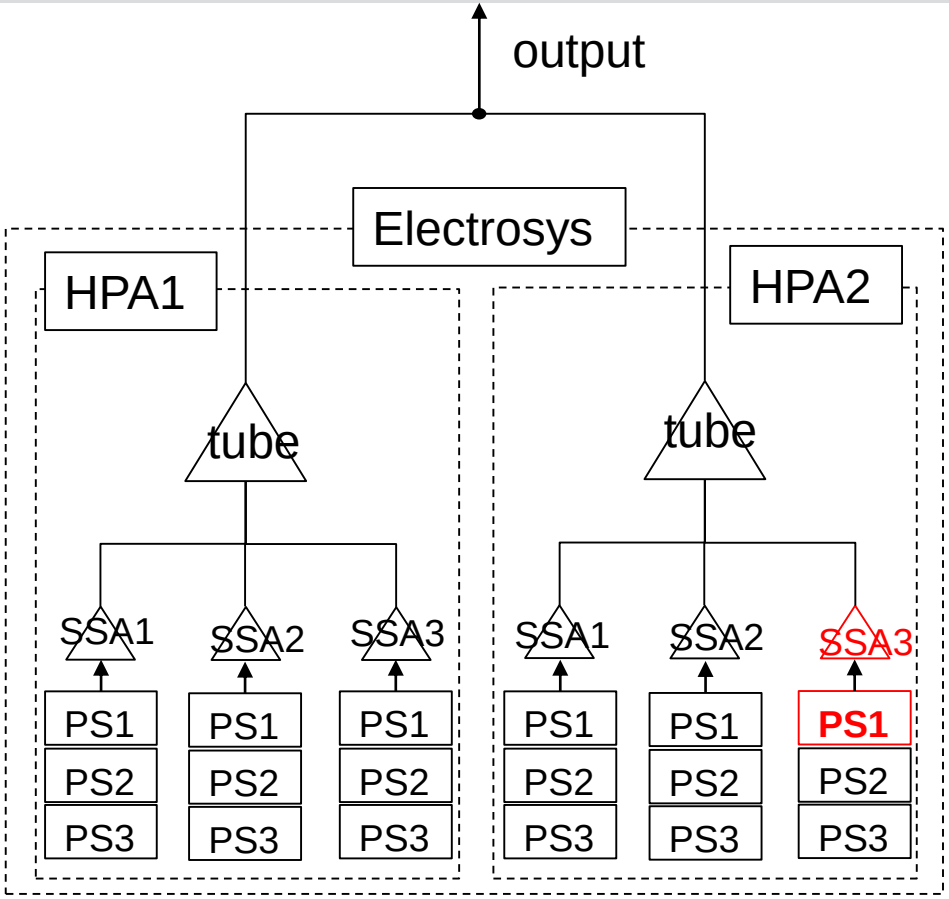
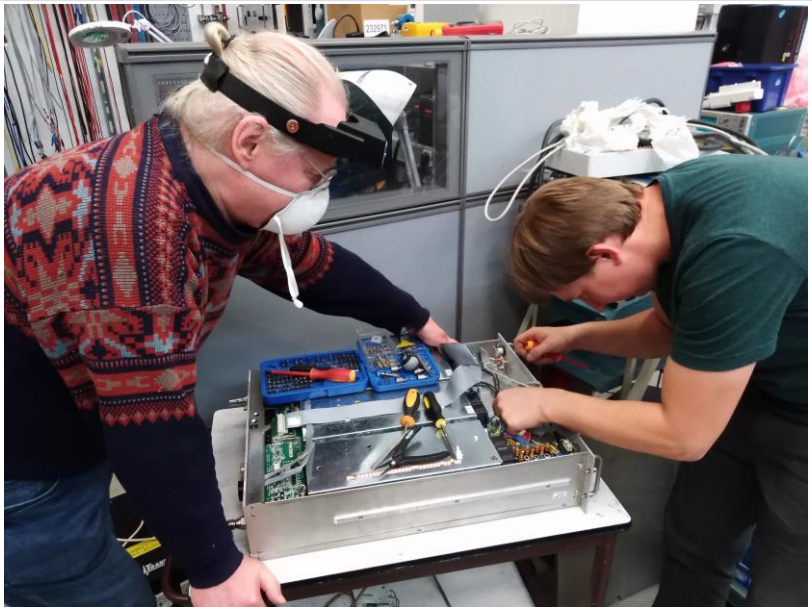
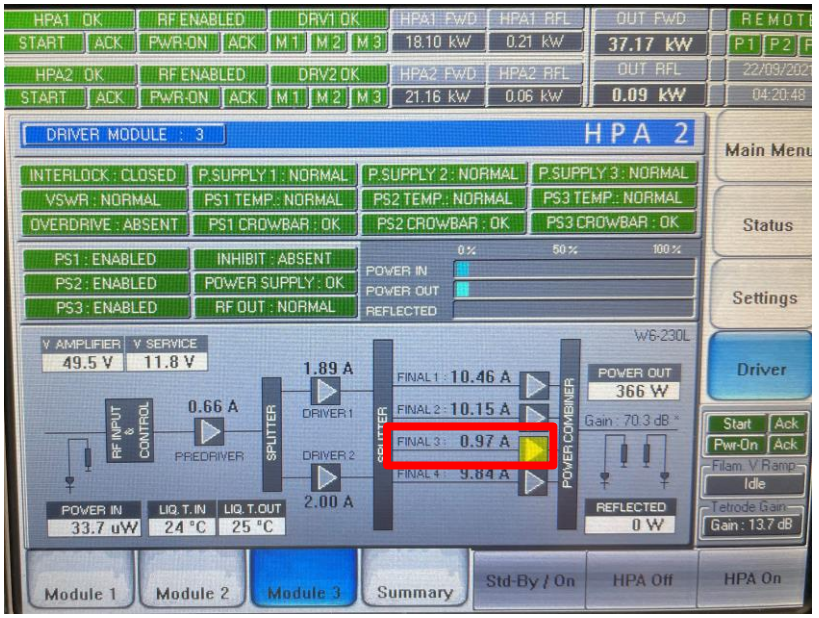
Electrosys issues (HPA2-SSA3)

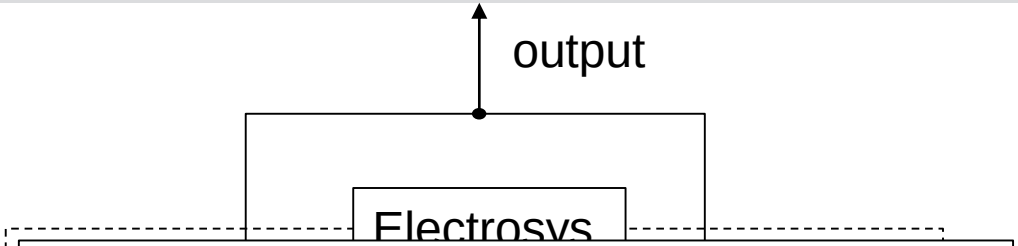






- We have three spare PSs replaced HPA2-SSA3-PS1 to a spare module S1
- One transistor is still malfunctioning but without any issues in the PSs (not critical)
- Asking Electrosys about spare SSA (we ordered before but they did not answer)

Electrosys issues (HPA2-SSA3)



Cf. R. Ruber et al., FREIA report 2019/6

3.2. Pre-amplifier for HPA2

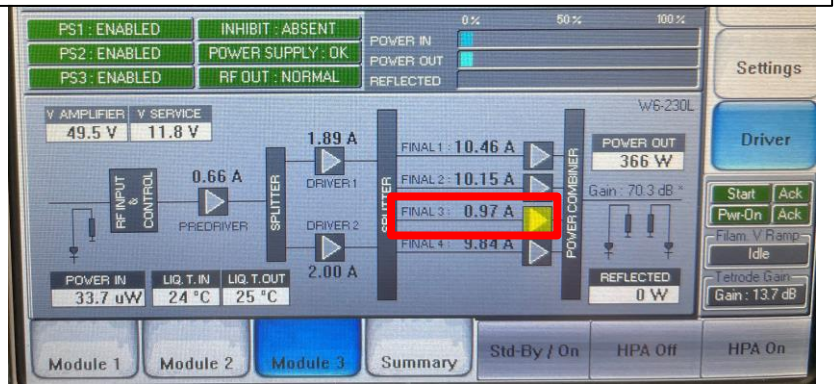
The pre-amplifier module 3 for HPA2 gives low output RF power. An extensive investigation shows that the "driver" and "final" amplifier modules are working correctly and therefore the problems must be located in the RF input control. The PA (AH101 transistor), right before the input to the pre-driver stage, was broken.

Itelco-Electrosys ships (for free) a new part: AH101 RF-amplifier.

Next another part in the RF control is malfunctioned: analogue switch ADG901BRM.

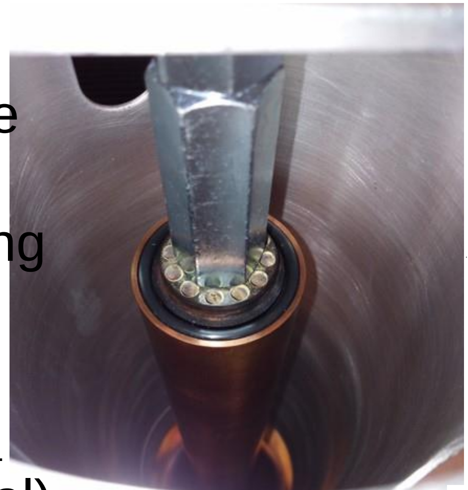
Itelco-Electrosys ships a new part. Since then the pre-amplifier works correctly.

- We have three spare PSs replaced HPA2-SSA3-PS1 to a spare module S1
- One transistor is still malfunctioning but without any issues in the PSs (not critical)
- Asking Electrosys about spare SSA (we ordered before but they did not answer)



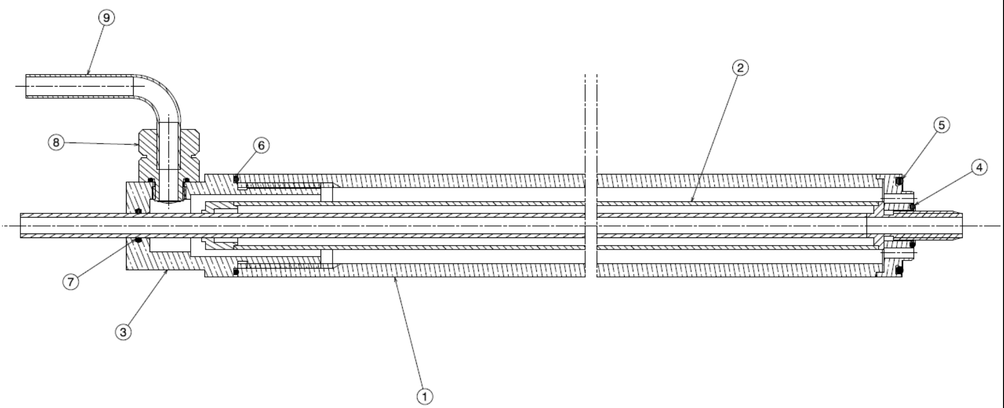
One minor point: small leak in water cooling

Small leak at the coupler cooling line was fixed by tightening but O-ring may be old



<u>Water parameters:</u>

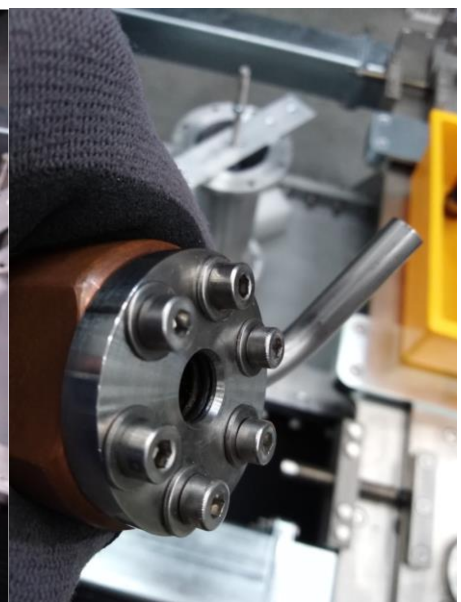
- 3 bar (differential)
- 100L/h



9	Tuyau Alim eau Ø10 ep1	1		24-A-05-24	
8	Raccord Vebeo 10	1		SNFBO	0213-120-1072
7	Joint Dia10 T2	1	Viton		
6	Joint Dia37 T2	1	Viton		
5	Joint Dia34,5 T3	1	Viton		
4	Joint Dia14 T2	1	Viton		
3	Fermeture Inf	1		24-A-05-23	
2	Circuit Interne	1		24-A-05-22	
1	Corps Antenne	1		24-A-05-21	
Rep.	Description	Qt.	Matière	N° Plan/Ref	Observation

24-A-05-00
N Ensemble
Matière
CNRS - IN2P3
IPN ORSAY
Institut
Division
Division Accélérateurs
Bureau d'etudes mecaniques
Ref externe
- - - - -
24-A-05-20
A
N8
Format A2
Ech 1:1
Système CATIA V5
Folio 1/1

"Joint diamètre", est-ce que c'est intérieur, extérieur ou l'autre?
→ ***Inner diameter!***



Departure of CM01

Reports on CM01 finalized

FREIA

Department of Physics and Astronomy

Uppsala University

Summary of CM01

Report time: 20210923

VACUUM GAUGE OF CAVITY STRING AT UU

Date	Time	Pfeiffer TPG2020 (mbar)	Limit	Name of controller
2021-06-07	13:48	2,80E-03	1,00E-01	C. Svanberg
2021-06-08	09:50	2,80E-03	1,00E-01	C. Svanberg
2021-06-09	10:45	2,90E-03	1,00E-01	C. Svanberg
2021-06-10	10:30	3,00E-03	1,00E-01	C. Svanberg
2021-06-11	10:30	3,00E-03	1,00E-01	C. Svanberg
2021-06-14	10:00	3,20E-03	1,00E-01	C. Svanberg
2021-06-15	09:30	3,20E-03	1,00E-01	C. Svanberg
2021-06-16	09:20	3,20E-03	1,00E-01	C. Svanberg
2021-06-17	10:30	3,30E-03	1,00E-01	C. Svanberg
2021-06-18	10:00	3,30E-03	1,00E-01	C. Svanberg
2021-06-21	11:45	3,50E-03	1,00E-01	C. Svanberg
2021-06-22	09:30	3,60E-03	1,00E-01	C. Svanberg
2021-06-23	13:30	3,60E-03	1,00E-01	C. Svanberg
2021-09-09	10:40	UR	1,00E-01	C. Svanberg
2021-09-10	09:15	UR	1,00E-01	C. Svanberg
2021-09-13	09:20	UR	1,00E-01	C. Svanberg
2021-09-14	09:15	UR	1,00E-01	C. Svanberg
2021-09-15	13:00	UR	1,00E-01	C. Svanberg
2021-09-16	09:30	UR	1,00E-01	C. Svanberg
2021-09-17	10:00	UR	1,00E-01	C. Svanberg

Cables verification CM01 at UU — v1

Socket assembly — Verified by :

Socket name	PID name	Serial number	Electrical value (Ω) (before shipping)	C / NC
LC01	TT04	X132594	67,75	C
	TT05	X132597	91,85	C
	TT06	X133036	58	C
	TT07	X133037	52,45	C
	TT08	X133045	53,45	C
	TT09	X133075	52,5	C
	TT10	PT01	107	C
	TT11	PT02	107,35	C
	TT12	X133076	57,6	C
	TT20	PT03	107,3	C
	TT21	PT04	106,85	C
	TT22	X133077	51,95	C
PT Coupler	TT120	PTC05	108,3	C
	TT220	PTC16	108,3	C
LC02	EH01	EH01	84,1	C
	EH02	EH02	84,5	C
	EH10	EH03	83	C
	EH20	EH04	82,7	C
LC03	SM10		2.4 / 2.3	C
	LS10		1,9	C
	SM20		2.3 / 2.4	C
	LS20		1,9	C
LC07	LT01	7319	365,75	C
	LT02	7320	366,75	C

Socket name	PID name	Serial number	Electrical value (µF) (before shipment)	C / NC
LC04	PZ10		13,81	C
	PZ11		13,98	C
	PZ20		13,94	C
	PZ21		14,07	C

CM01

UU					
2021-06-08		2021-08-19		2021-09-14	
PNA N5221A		PNA N5221A		PNA N5221A	
21		2K		not measured	
2,80E-03		7,00E-10		UR	
PA		5,00E-07		PA	
PA		31		PA	
RF measurements @ T=300K after delivery		**RF measurements @ T=2K during the test**		**RF measurements @ T=300K after testing**	
Cavity IN	Cavity OUT	Cavity IN	Cavity OUT	Cavity IN	Cavity OUT
DSPK13	DSPK14	DSPK13	DSPK14	DSPK13	DSPK14
CPL10	CPL12	CPL10	CPL12	CPL10	CPL12
DWT12	DWT14	DWT12	DWT14	DWT12	DWT14
-0,02	-0,01			-0,03	-0,01
-0,69	-0,7			-0,7	-0,69
-83,9	-84,1	-75,08	-73,34	-83,94	-84,07
351,558	351,568			351,567	351,576
		352,112	352,128		
		-0,554	-0,560		
40,1	39,3	1,91	1,83	39,4	39,15
8750	8940	184025	192899	8924	8981
13824-010-01	13824-010-02	13824-010-01	13824-010-02	13824-010-01	13824-010-02
-3,58E+00	-3,76E+00	-1,93	-1,86		
Results (under coupled)		**Results (over coupled)**		**Results (under coupled)**	
		0,0	0,0		
-0,67	-0,69	-74,1	-72,4	-0,67	-0,68
-82,1	-82,2			-83,9	-84,1
2,36E+05	2,34E+05			2,40E+05	2,39E+05
		184025	192899		
2,07E+05	2,07E+05			2,07E+05	2,07E+05
2,11E+11	2,27E+11	1,90E+13	1,34E+13	3,27E+11	3,45E+11
9087	9295			9268	9332

Performances — ATRIUM-433624 — Date : 31/05/2021

CM01 Configuration

IN		OUT	
In cavity	SPK-DSPK-13	Out cavity :	SPK-DSPK-14
Coupler	SPK-CPL-10	Coupler	SPK-CPL-12
Double wall tube	SPK-DWT-12	Double wall tube	SPK-DWT-14
Tuning System	SPK-TUN-02	Tuning System	SPK-TUN-03

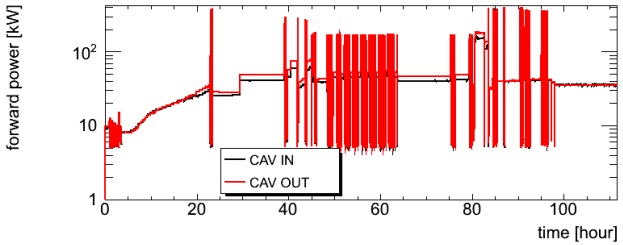
		Specification or measured value @ Orsay (before shipping)	Measured values @ UU	C / NC	Measured values @ Lund	C / NC
External Q						
Cavity "IN"		1.75E+05< QL<2.85E+05	1,94E+05	C		To be completed
Cavity "OUT"		1.75E+05< QL<2.85E+05	2,29E+05	C		To be completed
Frequency min @ 2K (tuning system OFF)						
Cavity "IN"	MHz	>352,089 <352,175	352,112	C		To be completed
Cavity "OUT"	MHz	>352,089 <352,175	352,128	C		To be completed
Eacc max						
Cavity "IN"	MV/m	≤12	12	C		To be completed
Cavity "OUT"	MV/m	≤12	12	C		To be completed
Heat losses						
Static losses (RF OFF)	W	<8	16,45	NC		To be completed
Dynamic losses (RF ON, Eacc=9MV/m	W	<13	17,48	NC		To be completed
Pressure sensitivity						
Cavity "IN"	Hz/mbar	<20	17	C		To be completed
Cavity "OUT"	Hz/mbar	<20	14	C		To be completed
Lorenz forces detuning factor						
Cavity "IN"	Hz/(MV/m)²	>-8	-4,074074074	C		To be completed
Cavity "OUT"	Hz/(MV/m)²	>-8	-3,209876543	C		To be completed
Tuning sensitivity						
Cavity "IN"	Hz/step	0.145 +/- 0.027	0,176	NC		To be completed
Cavity "OUT"	Hz/step	0.145 +/- 0.027	0,169	C		To be completed
Piezo detuning for KL=-8 Hz/(MV/m)²						
Cavity "IN"	Hz	>640	942	C		To be completed
Cavity "OUT"	Hz	>640	701	C		To be completed
Vacuum						
Insulation vacuum	mbar		4,50E-07	C		To be completed
Beam vacuum (coupler gauge of Cavity "IN")	mbar	<10^{-8}	6,10E-10	C		To be completed
Beam vacuum (coupler gauge of Cavity "OUT")	mbar	<10^{-8}	1,20E-09	C		To be completed

Reception of CM03

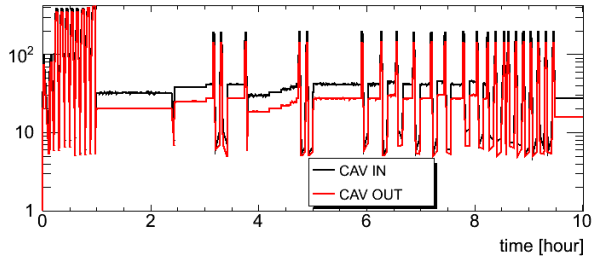
- Only stepper motor was fixed
- The cavity string STR04 was never exposed to air

→ coupler conditioning may be as quick as CM02's 2nd test

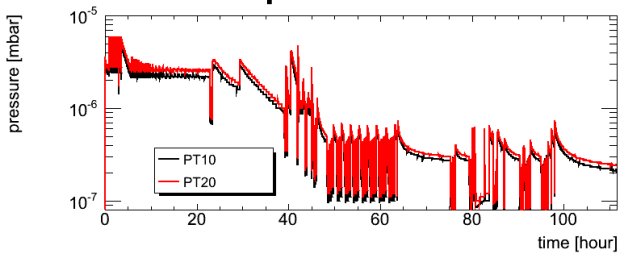
→ Within one day (?)

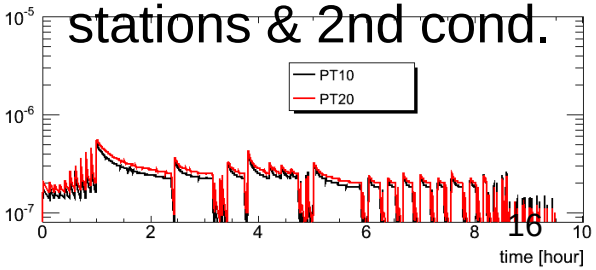


One Pump & two stations



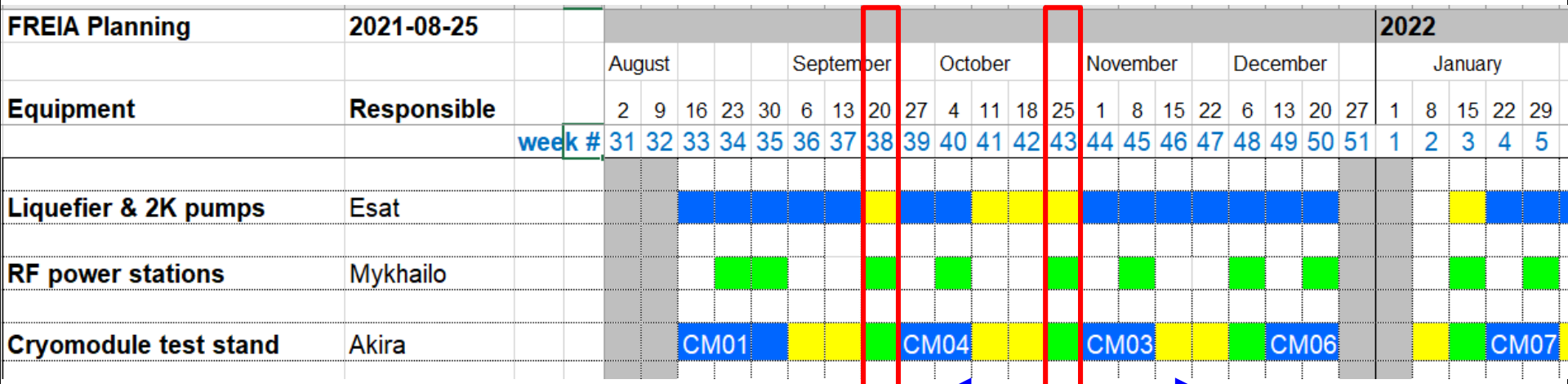
Two Pumps & two stations & 2nd cond.





General planning no major update (?)

This week may not be necessary!



We are here

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

W39, 40 41 planning

Theo will come to help us

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 test LEMO		reception test VNA									
next next CM	**CM06**	preparation at Orsay											

Tentative goal

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											

Avoid weekend

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											