Motor intervention at ESS

4th and 5th July

Timeline summary

- Monday morning : Open the cryomodule
  - Opening cryomodule (only the Cavity Out side), visual inspection, replacement of the motor (CTS2) **Crane needed**

- Monday afternoon : Motor and Gages activities
  - Cabling and setting up the hardware and software, blocking disengage system, then try a frequency sensitivity measurement (max detuning allowed is 13 kHz to remain below 40 MPa on mechanical stress of the cavity) **VNA and Coupleur RF connection needed here**

- Tuesday morning : Close the cryomodule
  - Final inspection, double check the disengage system is free (blocker should have been removed), proceed to alignment and close the cryomodule **Crane + Laser Tracker needed**

- Tuesday afternoon :
  - Extra time / Departure

Electrical connection

(m)	Cable reference, gauge and material	N° Pin	Signal	Socket type	Name
	Habia B 2213 T 2 I20: AWG22, tin plate copper	8	V−		

SOCKET EQUIPED WITH A CABLES AND A PLUGS

(m)	Cable reference, gauge and material	N° Pin	Signal	Socket type	Name
	Habia B 2619 T 2x2 I09-89: AWG26, tin plated copper	1	D		
		2	C		
		3	B		
		4	A		
	Habia B 2807 T 2 I90: AWG28, tin plated copper	5	Dry (N.C.)	LEMO-HGC.3B.312.C.L.L.PV.E	CMXX-LC03
		6	Dry (N.C.)		Feedthrough connector on Cryomodule
	Habia B 2619 T 2x2 I09-89: AWG26, tin plated copper	7	D		
		8	C	CTS2	
		9	B		
		10	A		
	Habia B 2807 T 2 I90: AWG28, tin plated copper	11	Dry (N.C.)		
		12	Dry (N.C.)		

SOCKET EQUIPED WITH A CABLES AND A PLUGS

(m)	Cable reference, gauge and material	N° Pin	Signal	Socket type	Name
	Habia B 2807 T 2 I90: AWG28, tin plated copper	1	V−		

Resistance measurement :
- Beetween phase A and B : 2.7 ohm ➔ **OK**
- Beetween phase C and D : 2.7 ohm ➔ **OK**
- Beetween limit switch signals : 2.3 ohm ➔ **OK (normally closed)**

Motor intervention

- Visual inspection
  - Take pictures, measure the distance/position of the actuator

- Connecting to motor
  - Use dummy motor for software/hardware check up, very usefull
    - Double check parameters, speed, etc.

- Try some runs with the suspicious motor
  - Backwards 10 turns, 2 turns at the time ➔ **OK**
  - Forward 10 turns, 2 turns at the time ➔ **OK**
  - Homing procedure ➔ **OK**

Memo :

1 motor turn is equivalent to :
- 200 motor steps (full step)
- 1600 motor steps (1/8 steps)
- 12800 motor steps (1/64 steps)

1 screw turn is equivalent to :
- 51200 motor steps (full step)
- 409600 motor steps (1/8 steps)
- 3276800 motor steps (1/64 steps)
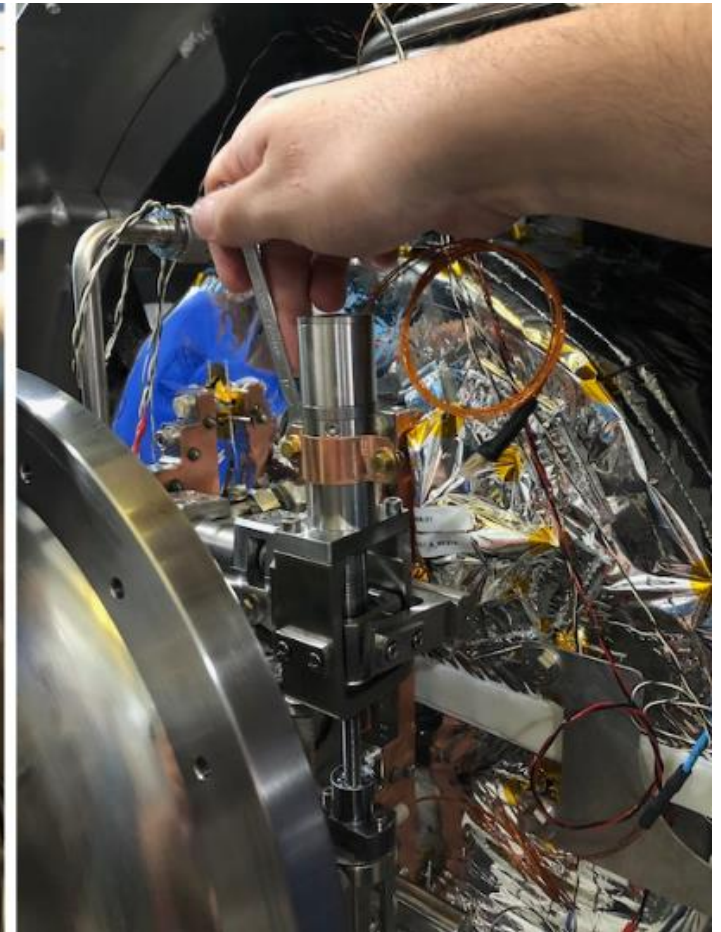
Everything is fine ! 🙃

Thanks everyone….

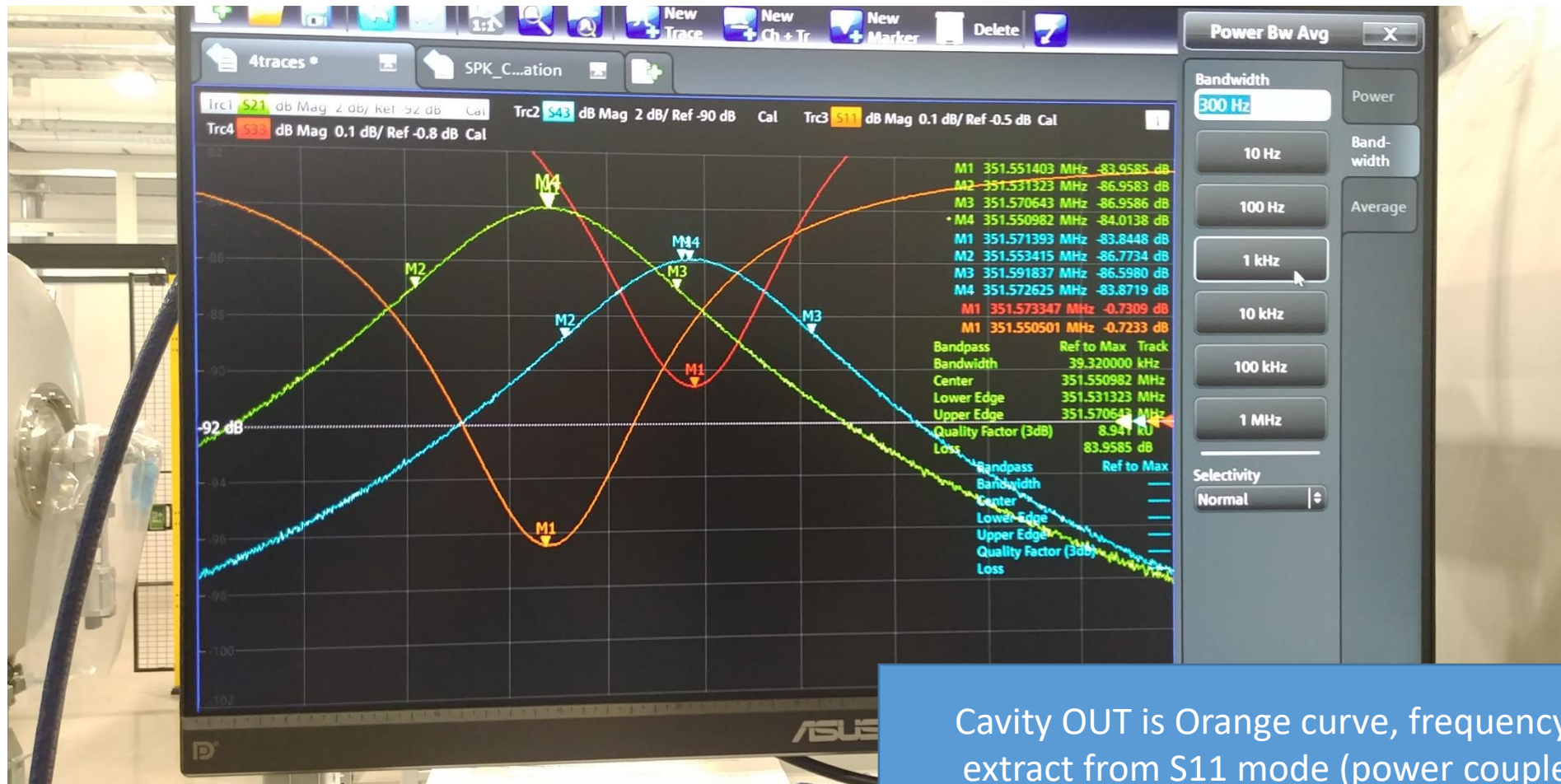…the adventure seems not finished!

Motor replacement

➜ **OK**

Note that we now put the copper collar of the PT100 sensor on the gearhead body, just by precaution.

➜ Will have slight incidence on temperature response

➜ True on CM12, and CM10 CTS2 then.

VNA Measurement

Cavity OUT is Orange curve, frequency is extract from S11 mode (power coupler)
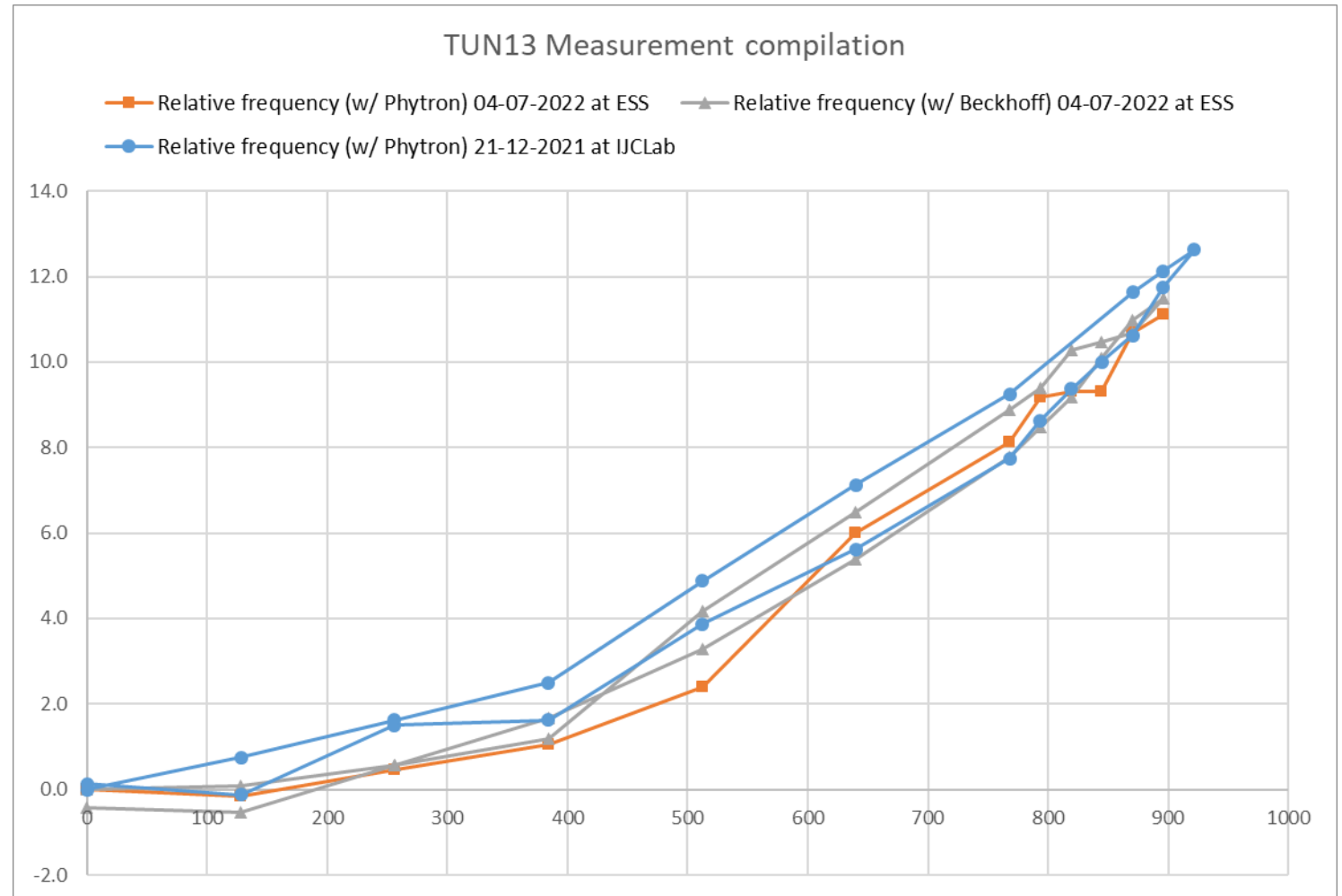
Frequency measurement at warm

Those measurement can be done thx a blocker part on the disengage system, and we must not exceed 13 kHz relative frequency to stay in elastic limit of Niobium (40 MPa)

1/ Frequency measurement with **Phytron MCC2 ➜ OK**

2/ Frequency measurement with **Beckhoff EL7041 ➜ OK**

Nice reproducibility from measurement made **at IJCLab before sending de cryomodule.**

TUN13 Measurement compilation

- Relative frequency (w/ Phytron) 04-07-2022 at ESS
- Relative frequency (w/ Beckhoff) 04-07-2022 at ESS
- Relative frequency (w/ Phytron) 21-12-2021 at IJCLab

Conclusion

- Initial Motor #170944229 of CTS2 from CM10 didn't show any sign of failure.

- This motor will be send back at IJCLab and tested again in LN2 cryostat. Probably on September/October.

- Phytron meeting is foreseen for August/September in order to report them this strange failure and discuss about risk and consequences for the rest of the motors qualified.

- This motor have been replaced by #170944234 motor.

- Warm temperature test with this motor driven successively by Phytron and Beckhoff motor driver gave satisfying results : no vibration, no loss of steps.

Thanks for many help from everyone on site.