Improvement in cold mass assembly

H. Prin

Report on Ongoing Actions for MQXFB

14/12/2022

https://indico.cern.ch/event/1217344/

Prenious session https://indico.cern.ch/event/1177429/

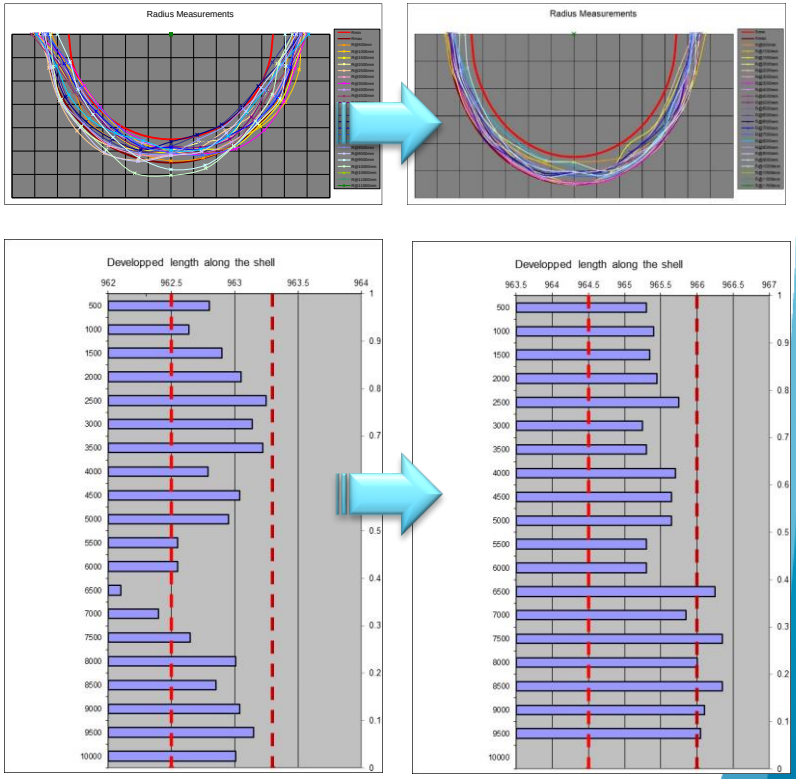
Outline

- Shell production in AP-Tela
- Observations during LMQXFBT4 disassembly
  - Stainless steel shell
  - V-Taps NC and CBT removal
  - MQXFBP3 coils inspection
  - Aluminium cylinders and coil pack
  - Aluminium cylinders and yoke

Shell production in AP-Tela

Following our visit in May and thanks to weekly meetings, very encouraging results were obtained:

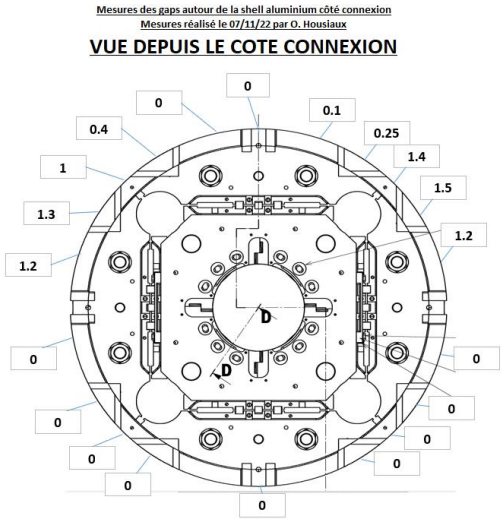
- *in terms of shell production rate, the company demonstrated its ability to produce at least one shell per week,*
- *shaping accuracy was significantly increased thanks to a new technician hiring to calibrate the profile machining,*
- *developed length with lower variations and with the minimum guaranteed,*
- *14x 10m shells are available at CERN for the next cold masses, pairing simulations were computed to reach a minimum developed length value above 1929mm for MQXFB cold masses and minimise deviations,*
- *Common developed length measurement tooling has been developed and is being prepared*

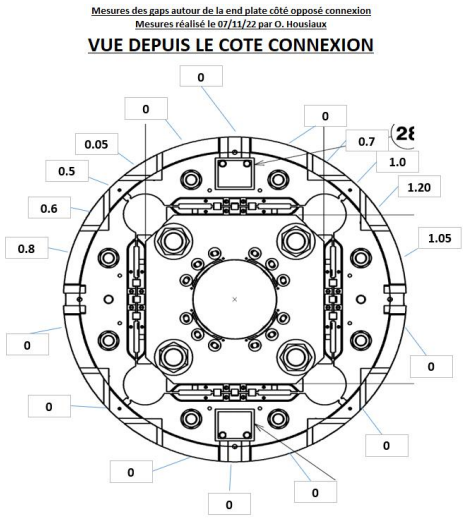


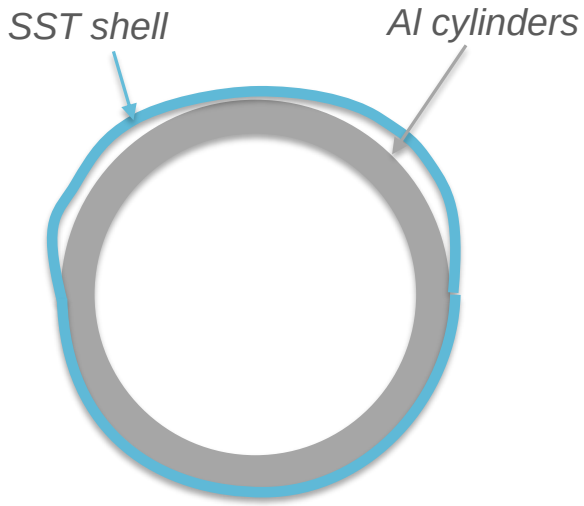
Observations during LMQXFBT4 disassembly
Stainless steel shell

Dismantling report LHC-LMQXFBT-RPT-0002 EDMS 2790502

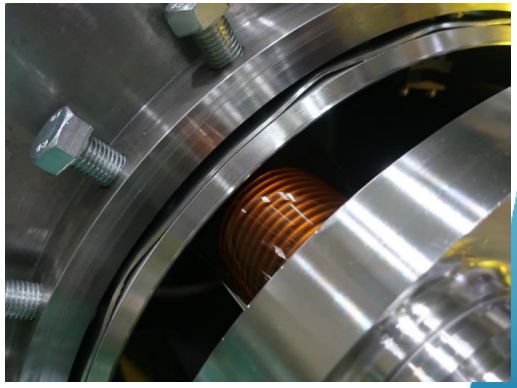
- "Mickey's ears" on the upper shell







New tooling being designed inspired from the one used in KEK to round the shells in the extremities

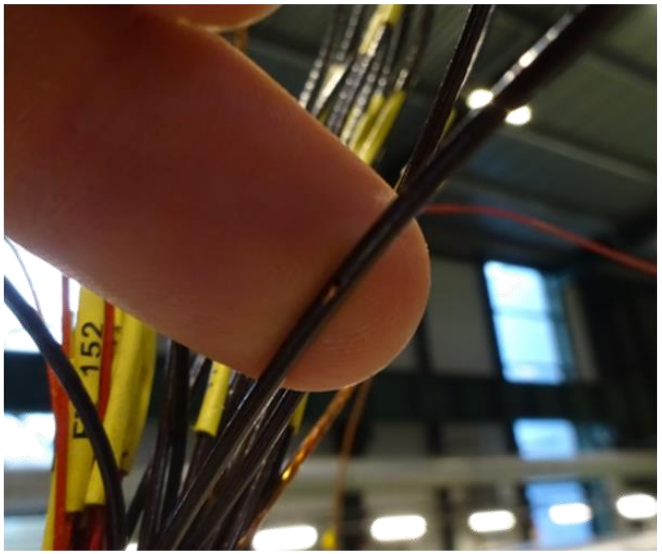


Observations during LMQXFBT4 disassembly
V-Taps NC and CBT removal

1 INSPECTION OF THE WIRES YT123 AND YT124, NCR 2773498

The pictures taken during these inspections are archived in DFS and in EDMS.

The inspection after the decryostating showed few scratches but no clue of missing insulation.

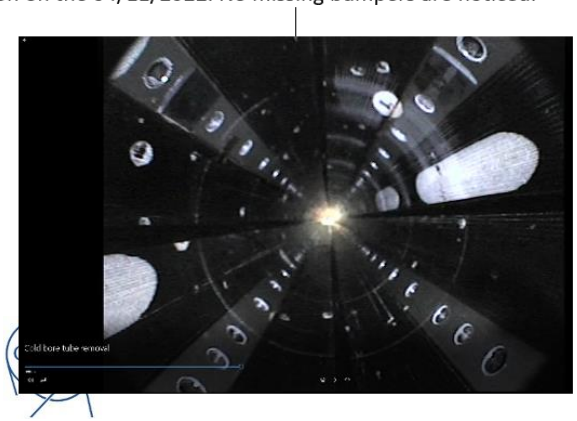


New electrical test protocol before inserting the instrumentation wires indie the IFS capillary under development:

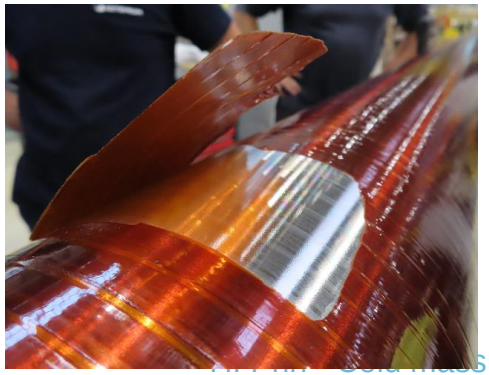
- *aluminium sheets*
- *thin wires comb*
- *Water immersion*

2.2 Inspection during cold bore removal

During the cold bore dismantling, an endoscopy was performed to check no bumpers are lost. R. Berthet performed this operation on the 04/11/2022. No missing bumpers are noticed.



Cold bore tube insulation damages



Insulation scheme similar to the one used for the CP and D1 is being envisaged (LHC-LMQXF_S-DF-0007 EDMS 2805343)

- *Pions thickness to be reviewed in MQXFB*
- *Compatibility with MCBXFB centering pieces to be checked*

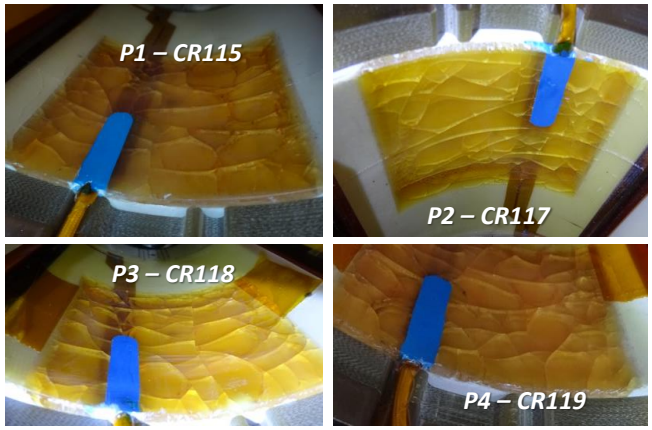
Observations during LMQXFBT4 disassembly MQXFBP3 coils inspection

2.3 Coils inspections after Cold bore removal

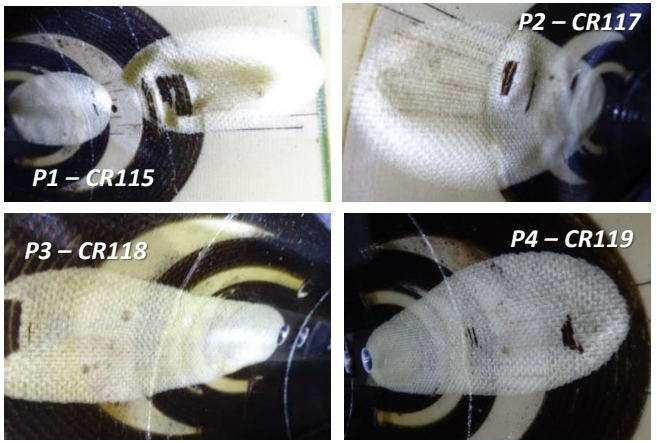
On the 07/11/2022, O. Housiaux performed the inspection of the coils extremities. The pictures are available in DFS and in EDMS.

On both sides, all the bullets are in contact with the pushers:

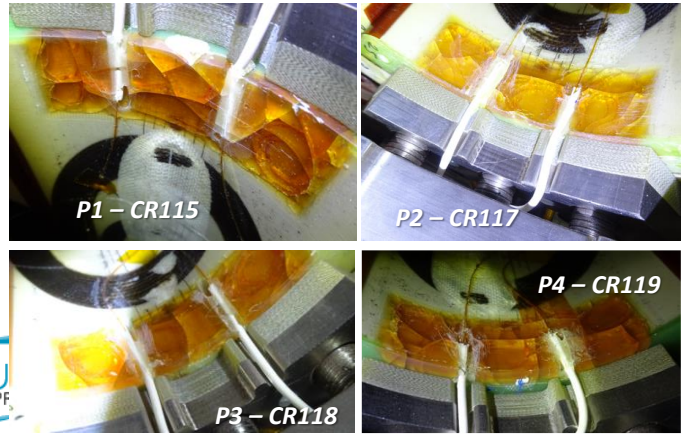
Cracked resin
on the connection side



Bubbles
on the connection side



on the non connection side

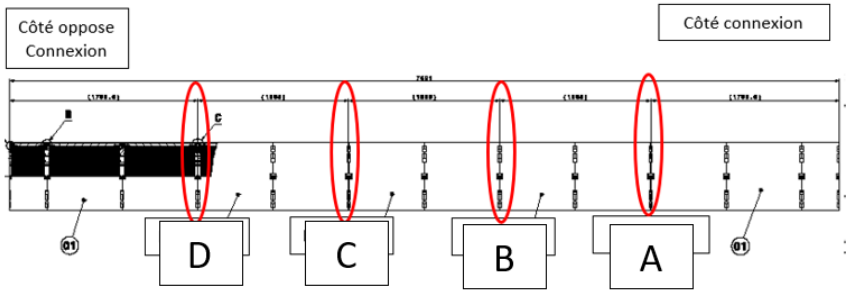


on the non connection side

Observations during LMQXFBT4 disassembly
Aluminium cylinders and coil pack

6.1 Measurement of the gaps between the aluminium shells

The gaps between the aluminium shells were measured on positions 1, 2 and 3 for each top pole (see 5.1).



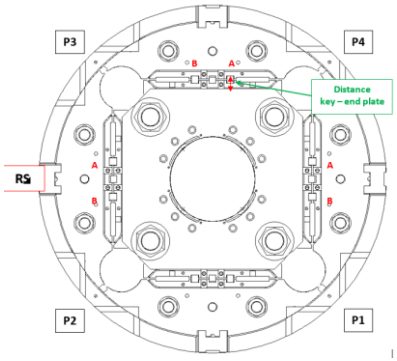
	Gap between aluminium shells, mm							
	Position A		Position B		Position C		Position D	
Step	P3	P4	P3	P4	P3	P4	P3	P4
After loading	0.65	1.20	1.45	1.70	1.10	1.25	1.95	1.80
After dismantling of LMQXFBT03	0.54	1.02	1.58	1.38	1.19	1.03	1.65	1.75
After upper shell removal (P1/P2)	0.65 (P2)	1.25 (P1)	1.55 (P2)	1.50 (P1)	1.15 (P2)	1.20 (P1)	1.80 (P2)	1.80 (P1)
After lower shell on the ass. bench *	0.70	1.10	1.63	1.50	1.25	1.15	1.75	1.80

Max 0.2mm

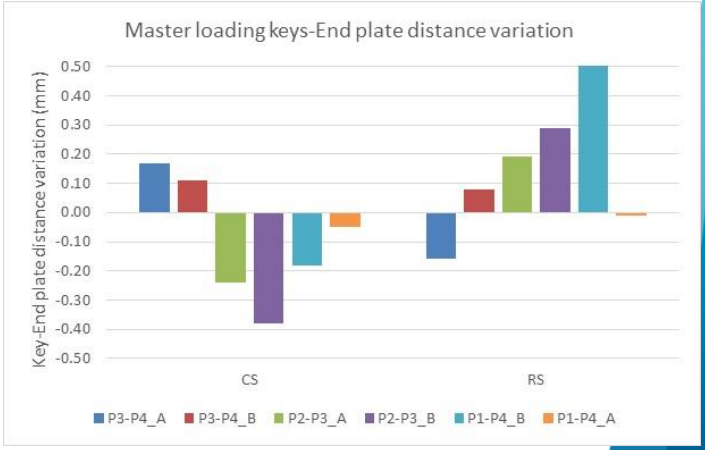
6.2 Measurement of the end plate – master loading keys distances

The distance between the master loading keys and the end plate was measured for 6 master loading keys (the values for the lower keys are never measured due to lack of access).

The measured values are presented on the chart hereunder and compared to the ones measured after the removal of the half shells from HCLMQXFBT01-CR000003 for their replacement.



	Distance Master loading key – End plate, mm			
	CS		RS	
Position	After half shells removal	After cold tests	After half shells removal	After cold tests
P2-P3_A	23.12	23.29	23.36	23.20
P2-P3_B	23.03	23.14	22.77	22.85
P3-P4_A	23.02	22.78	23.50	23.69
P3-P4_B	23.07	22.69	22.97	23.26
P1-P4_B	23.30	23.12	22.97	23.58
P1-P4_A	23.30	23.25	22.66	22.65



Observations during LMQXFBT4 disassembly
Aluminium cylinders and yoke

6.3 Measurement of position of the aluminium shell with respect to the yokes at the extremities

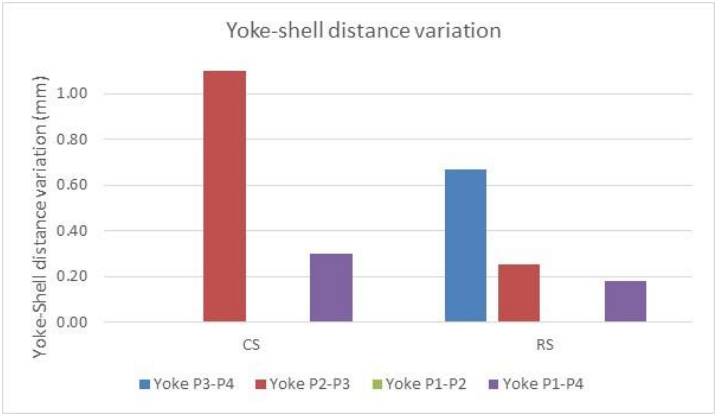
The position of the aluminium shells with respect to the yokes was also measured after cold tests.

The comparison of the values is presented on the chart below. Positive values imply that the yoke does not exceed from the shell.

	Distance Yoke - Shell, mm			
	CS		RS	
Position	After half shells removal	After cold tests	After half shells removal	After cold tests
Yoke P3-P4	1.16	1.15	0.75	1.42
Yoke P2-P3	-0.55	0.55	-0.30	-0.05
Yoke P1-P2	0.62	-	0.91	-
Yoke P1-P4	-0.10	0.20	1.32	1.50

Max 1.1mm

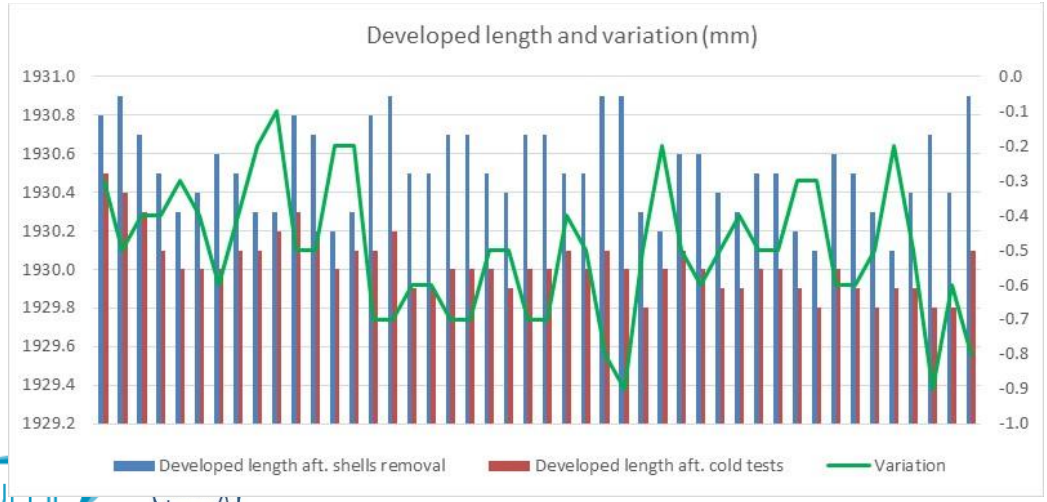
Max 0.7mm



6.4 Measurement of the aluminium shells developed length

The developed length of the aluminium shells was measured with a pi-tape.

In the chart below, the values are presented, as well as the average. A column with the average values after the removal of the half shells for their replacement is also included to show any changes.



Max 0.9mm circumferential
↳ 0.13mm radially

LMQXFB02 (MQXFBP3+MCBXFBP2)
LMQXFBT06 (MQXFBMT04)

Longitudinal welding planed mid and end of January 2023