



Field quality of HCQQXF_SB014-CR000001 (LMQXFB01 type Q2b, with MQXFBP2 and MCBXFBP1e)

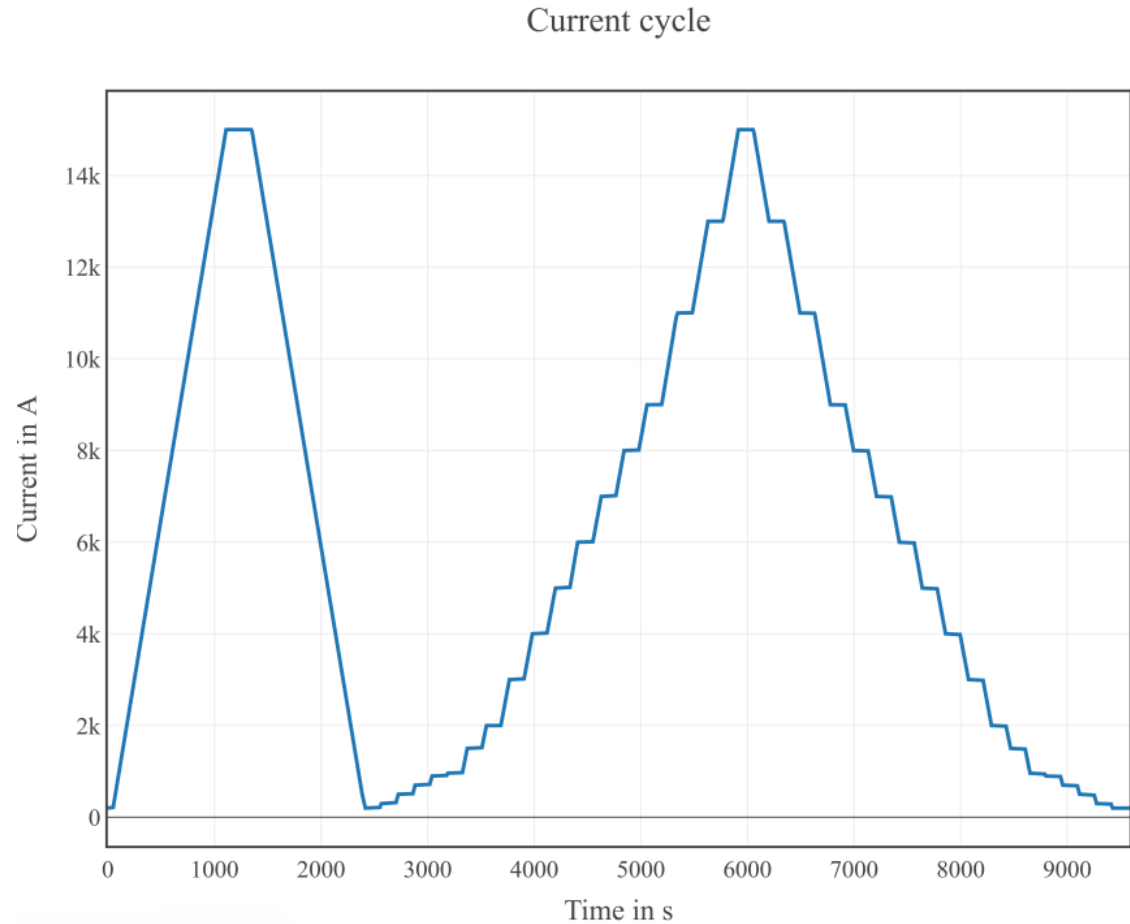
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MAB meeting 09/12/2024

MM cycle for MQXFBP2

- Magnetic measurements with rotating coil were not performed on the final assembly.
- Stair-step cycle was performed on the temporary cold mass.
- Field quality is evaluated from stair-step cycle.



MQXFBP2 – Field quality

	MQXFB04		Unit
	At I_{inj}	At I_{nom}	
I	960	15800	A
Main Field	61.790	929.55	T
ML	7.157	7.175	m
FD		0.438	mrاد
b₃	12.46	1.11	Units at 50 mm
b₄	0.83	0.93	
b₅	-0.12	-0.19	
b₆	-1.69	0.32	
b₇	0.62	0.26	
b₈	-0.09	0.02	
b₉	0.11	0.23	
b₁₀	1.93	-0.34	
a₃	4.74	1.71	
a₄	-2.31	-1.25	
a₅	-0.88	-1.43	
a₆	0.11	0.04	
a₇	0.25	0.26	
a₈	0.14	-0.06	
a₉	0.4	0.11	
a₁₀	-0.01	-0.03	

* Machine cycle was not performed. Field quality is evaluated form stair-step cycle.

MQXFBP2 - Transfer function

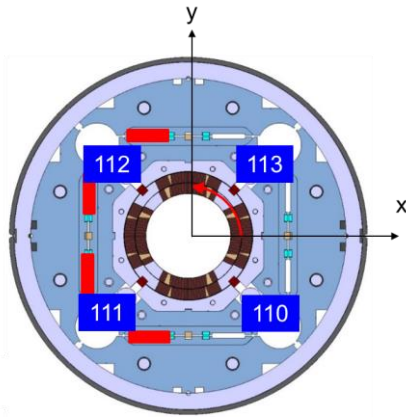
Transfer function (T kA ⁻¹)		
	Room Temperature	1.9 K at nominal
MQXFBP1	63.394	*58.562
MQXFBP2	63.359	*58.708
MQXFBP3	63.328	58.616
MQXFB02	63.407	58.649
MQXFB03	63.458	58.571
MQXFB04	63.426	58.654
MQXFB05	63.434	58.700
MQXFB06	63.396	–
MQXFB07	63.444	–
Average	63.401	58.637
Range (units)	21	25

The integral field of all magnets, measured so far, is within 25 units (max-min).

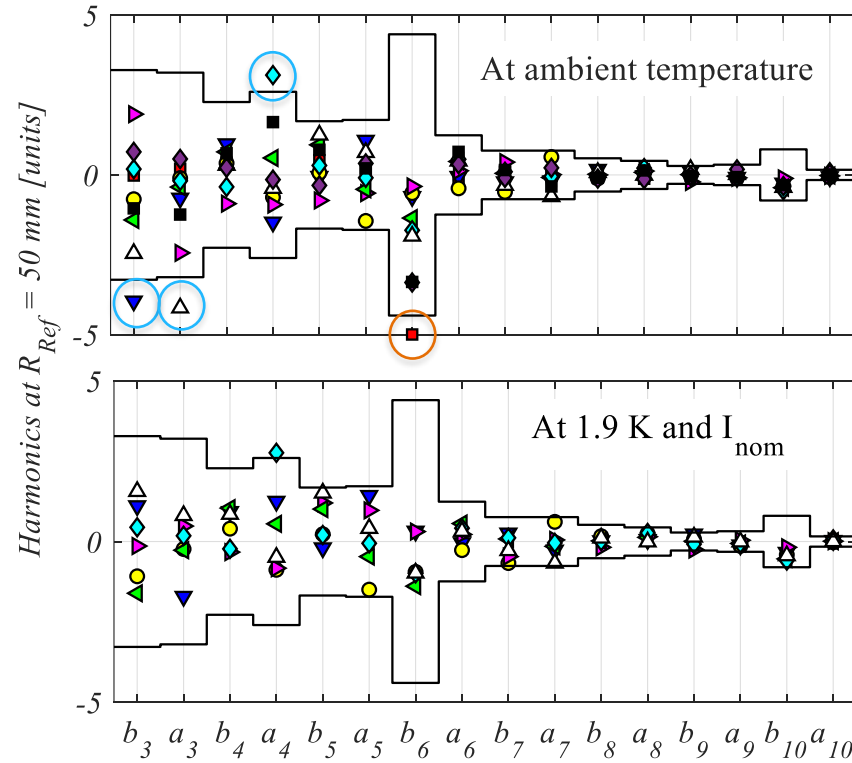
* Measured at a current lower than nominal and then extrapolated to nominal

MQXFBP2 - Field quality

- The MQXFBP2 is shimmed to correct the b_3 (expected correction +3.4 units)



- Multipoles corrected by applying magnetic shimming
- Systematic b_6 corrected by modifying the coil cross-section



■ MQXFBP1	▼ MQXFBP2	● MQXFBP3	► MQXFB02
▲ MQXFB03	◆ MQXFB04	△ MQXFB05	◆ MQXFB06
■ MQXFB07	— $3\sigma + \sigma$ (uncert.)		

MQXFBP2 – Magnetic axis horizontal

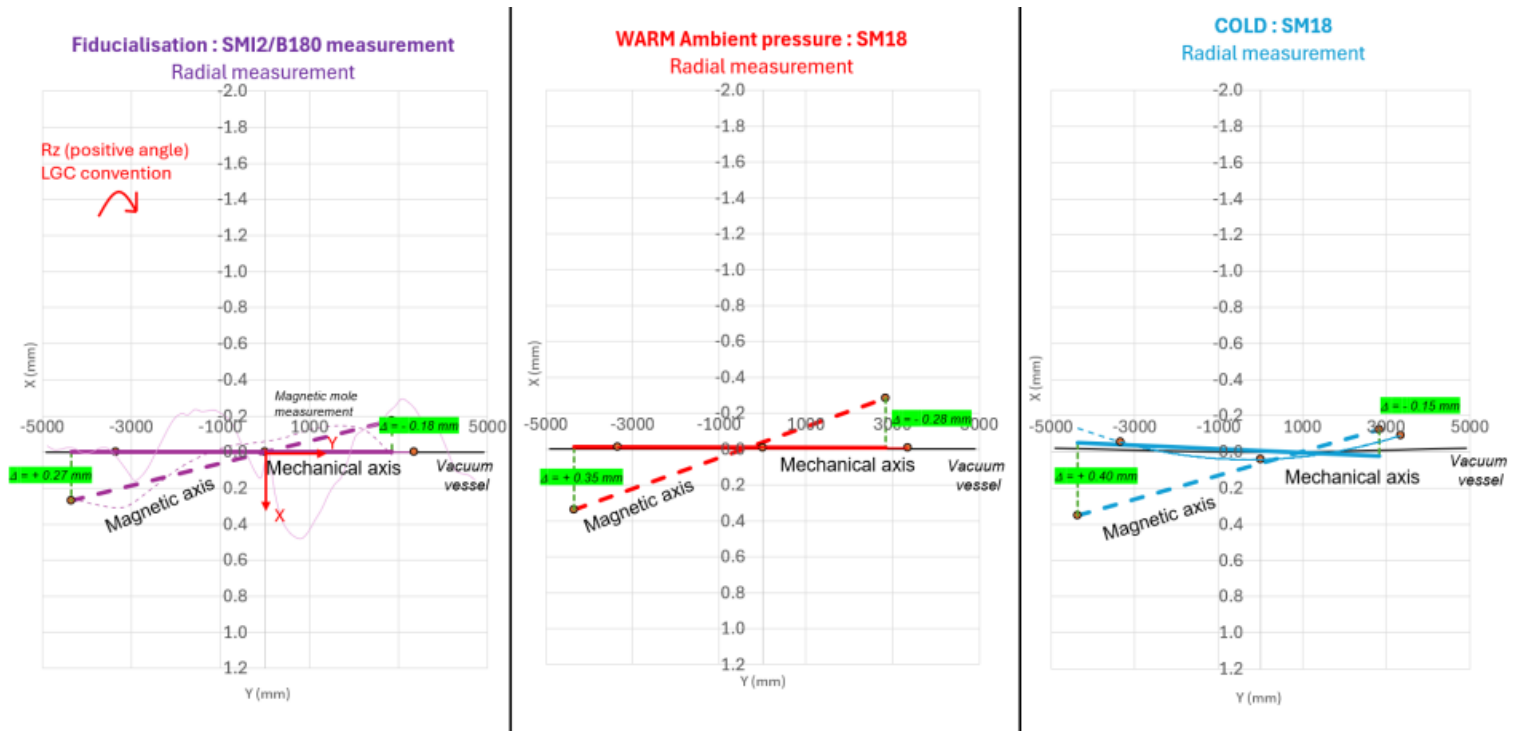


Figure 20: Radial movement between the 3 steps of measurements.

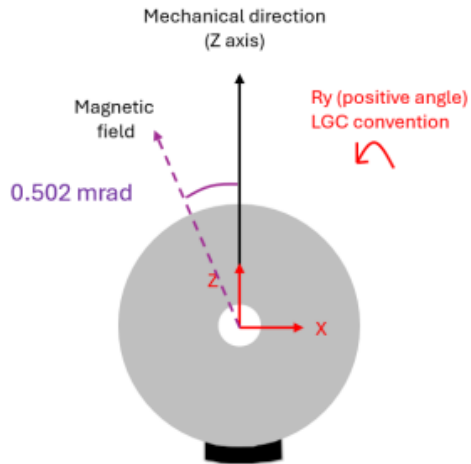
MQXFBP2 – Magnetic axis vertical



Figure 21: Vertical movement between the 3 steps of measurements.

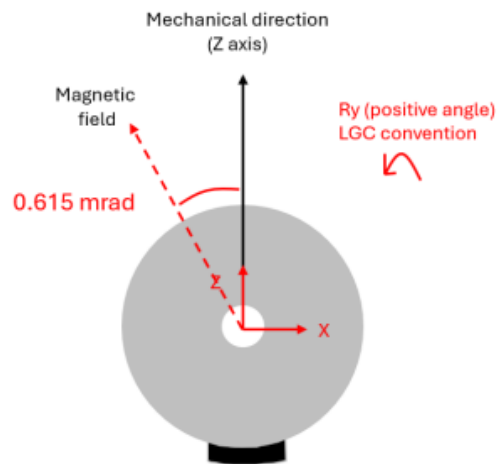
MQXFBP2 – Field direction

Fiducialisation : SMI2 measurement
Magnetic field



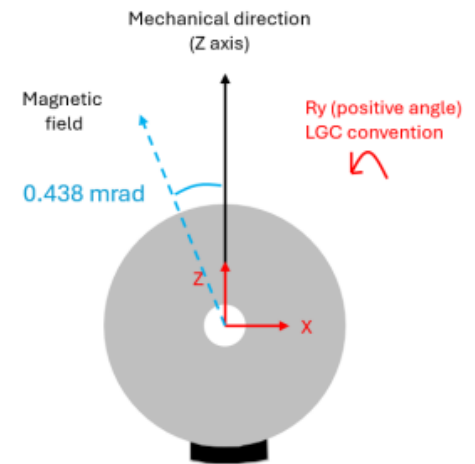
	LGC conv.
Delta Roll. (mrad) meca → magn	+ 0.502

WARM Ambient pressure : SM18
Magnetic field



	LGC conv.
Delta Roll. (mrad) meca → magn	+ 0.615

COLD : SM18
Magnetic field



	LGC conv.
Delta Roll. (mrad) meca → magn	+ 0.438

Figure 22: Direction of magnetic field between the 3 steps of measurements.

MCBXF02e – Field quality

- Magnetic measurements at cold and nominal current were performed on the MCBXFBP1d version
 - b5 is at -9.96 units which exceeds the specification of ± 7 units
 - b7 is at -5.20 units which exceed the specification of ± 5 units.
 - NCR [EDMS 3195926](#)
- In MCBXFBP1e, the yoke laminations and magnet endplates were changed to make it compatible with the cold mass.
- The magnet was not tested at cold in the vertical cryostat after this modification.
- The expected impact on field quality of the changes in the iron yoke, based on ROXIE, is less than 1 unit

MCBXFB02e – Field quality

	MCBXFB		Unit
	H at I_{nom} V at 0	H at 0 V at I_{nom}	
I	1740	1430	A
Main Field	2.8283	2.5539	Tm
ML	1.067	1.121	m
FD	0.233	2.377	mrad
b₂	1.37	-0.75	Units at 50 mm
b₃	-8.80	-0.30	
b₄	-0.35	0.03	
b₅	-9.96	0.05	
b₆	-0.22	-0.08	
b₇	-5.20	-0.28	
b₈	-0.02	0.03	
b₉	-0.40	0.07	
b₁₀	0.24	0.01	
b₁₁	2.14	0.03	
a₂	0.19	1.56	
a₃	1.01	7.57	
a₄	1.22	0.18	
a₅	1.34	-1.23	
a₆	0.43	-0.28	
a₇	0.68	2.76	
a₈	0.19	0.06	
a₉	0.01	-0.55	
a₁₀	-0.04	0.01	
a₁₁	-0.22	-0.04	