



Status of field quality in WP3 magnets

E. Todesco, S. Izquierdo Bermudez, L. Fiscarelli

Please do not use these measurements for simulations!



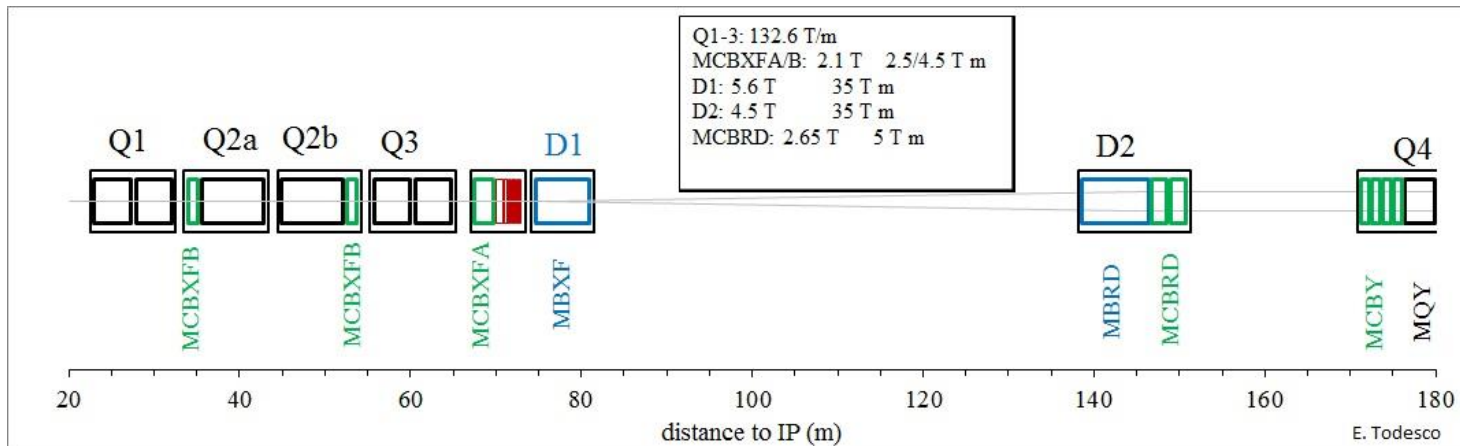
4 December 2018 – CERN, WP2 meeting

SUMMARY

- Main magnets
 - MQXFA
 - D1
 - D2
- Correctors
 - MCBXF
 - HO correctors
 - D2 corrector

MQXF

- Measurements of
 - 5 short model
 - 1 prototype
- Main worry: non allowed multipoles
 - Increase of corrector strength
- One corrective action ongoing
 - Increase b_6 by 4 units



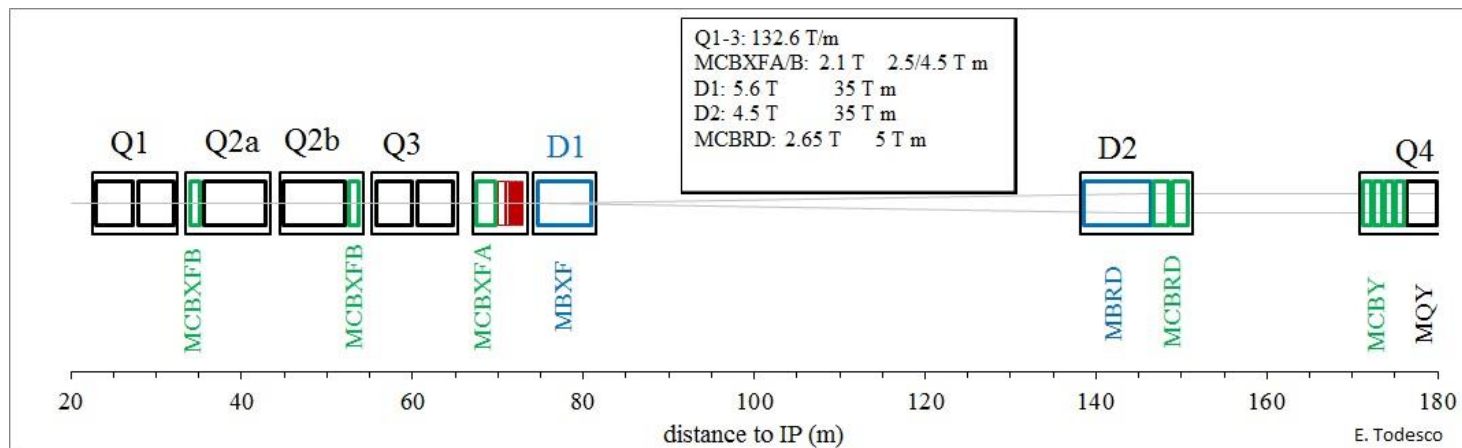
MQXF

- Recent data of MQXFS6 confirm the low b_6 and very good order 4 and 5
 - All data straight part at nominal except MQXFS6 (room temperature, after loading)
 - In MQXFS6 a_3, b_3 shall be corrected with magnetic shimming

	b_3	a_3	b_4	a_4	b_5	a_5	b_6	a_6	b_7	a_7	b_8	a_8
MQXFS1	-4.39	3.13	0.14	-6.90	2.75	-0.97	0.68	0.44	0.19	0.26	0.24	-0.67
MQXFS3	-1.02	-1.31	-0.86	3.72	-3.23	-1.70	-1.83	0.87	0.35	-0.27	-0.16	0.33
MQXFS5	-1.54	-0.72	0.38	-1.76	0.22	-0.76	-4.26	-0.12	-0.75	-0.35	0.03	-0.03
MQXFS4	-2.62	-1.16	0.54	4.74	3.15	-0.21	-3.79	0.36	-0.32	-0.19	0.00	0.77
MQXFAP 2	-0.87	3.17	-1.25	2.54	-0.99	1.48	-4.18	0.4				
MQXFS6*	4.65	4.90	0.15	1.17	0.54	-1.24	-4.87	-0.73	0.85	1.63	-0.05	0.45
4 sigma	3.28	2.60	2.28	2.60	1.68	1.71	4.4	1.24	0.76	0.76	0.52	0.44

MBXF (D1)

- Measurements of 2 short models
- Main worry: b_3
 - One change of cross section from MBXFS1 to MBXFS2



MBXF

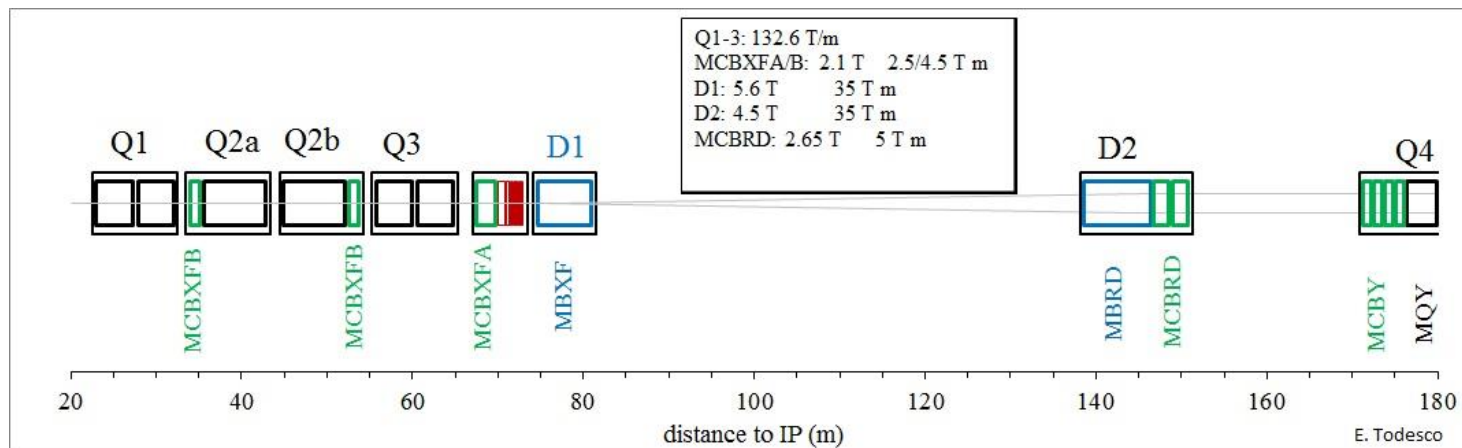
- Recent data of MBXFS2 show that we are still out of b_3
 - From MBXFS1 to MBXFS2 there was a correction of 10 units, not observed
 - So, 10 units to be corrected – to be possibly done through iron shaping ?
 - All other multipoles look very good

	b_2	a_2	b_3	a_3	b_4	a_4	b_5	a_5	b_6	a_6	b_7	a_7
MBXFS1	-0.36	-0.23	18.76	0.29	0.00	0.19	-1.14	0.05	-0.04	0.03	0.18	0.08
MBXFS2	-2.52	0.16	24.81	0.15	-0.40	0.16	1.09	-0.14	0.13	0.09	-0.50	0.02
4 sigma	0.80	2.72	2.91	1.13	0.51	1.78	1.46	0.61	0.24	0.70	0.66	0.23

Data of the straight part at 12 kA, measured at KEK (K. Suzuki, et al)

MBRD (D2)

- Room temperature measurement of 1 short model
- Main worry: compensation of the two apertures
 - A measure is available of the collared col (no iron)



MBRDS1

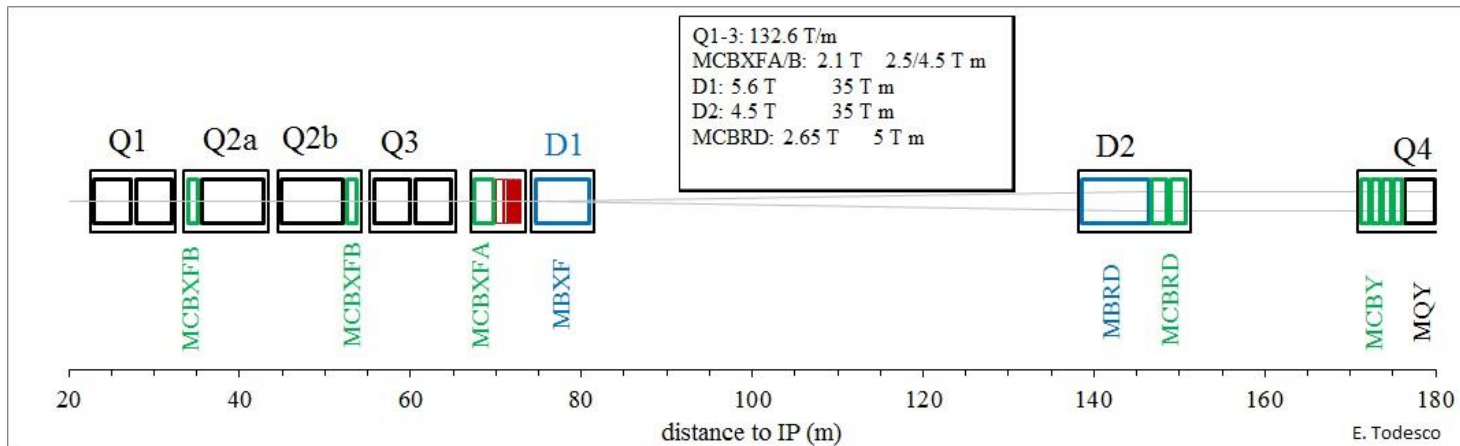
- Measurements of collared coil (one by one)
 - Lot of perturbations, but put in evidence a short
 - Short repaired
- Measurements of collared coil together
 - Still some external perturbations on skew (no iron to shield)
 - Good reproducibility of the two apertures in b_2, b_3, b_4, b_6
 - The real check will be with the magnet assembled in the iron yoke

	b_2	a_2	b_3	a_3	b_4	a_4	b_5	a_5	b_6	a_6	b_7	a_7
Aper. 1	209	1.0	81.0	-2.8	-9.0	1.1	-0.0	2.4	-3.0	0.57	-0.34	1.7
Aper. 2	-204	1.6	81.5	-3.7	10.3	-0.3	3.2	1.4	3.1	1.9	0.39	1.7
4 sigma	0.80	2.72	2.91	1.13	0.51	1.78	1.46	0.61	0.24	0.70	0.66	0.23

Data of the straight part, room temperature measured at ASG (A. Barutti, et al)

MCBXF (NESTED CORECTORS)

- Inner dipole aperture has been completed
 - Magnetic measurements at room temperature are available



MCBXF (NESTED CORECTORS)

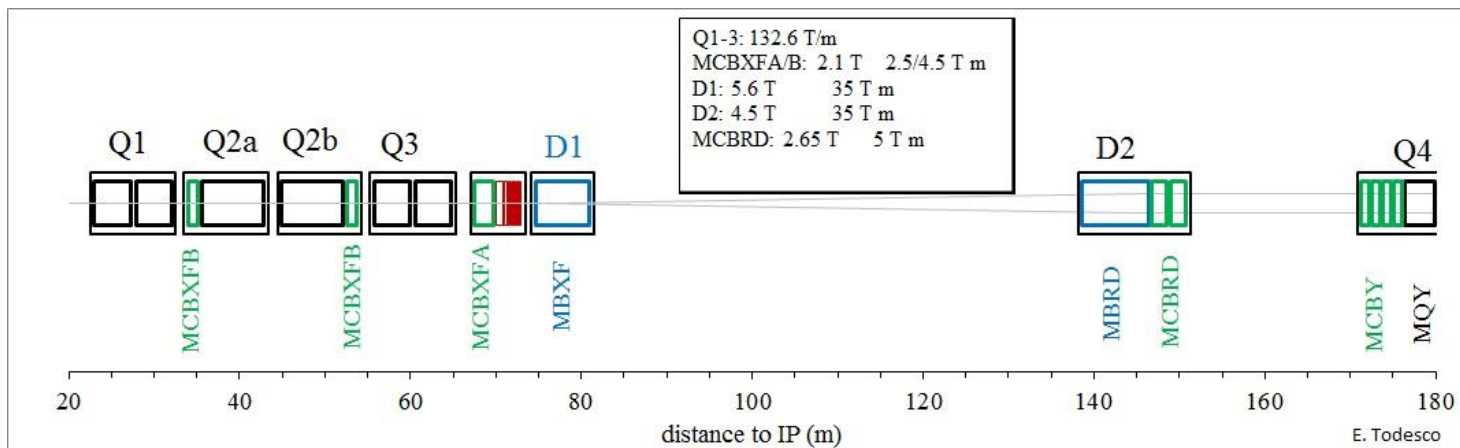
- Tolerance of 10 units
- b_3 value to be checked
 - We expect -20 units, we measure 20 units
 - Saturation should increase
- Very good high orders

	b_2	a_2	b_3	a_3	b_4	a_4	b_5	a_5	b_6	a_6	b_7	a_7
MCBXF BP1	-1.59	-0.95	21.7	0.15	-0.55	0.29	-3.17	0.02	-0.21	0.07	1.68	0.00

Data of the straight part, room temperature measured at CERN (L. Fiscarelli, et al)

HO CORRECTORS

- Sextupole, octupole, decapole, dodecapole, built and tested
 - Magnetic measurements on sextupole octupole and decapole
 - Dodecapole tested, measurements coming in 2019



HO CORRECTORS

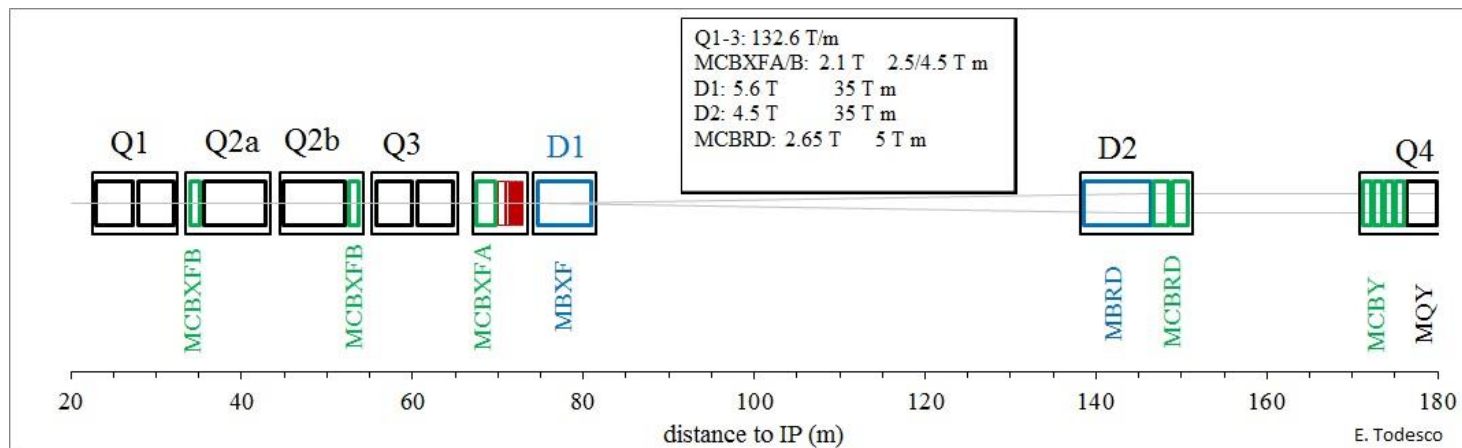
- Tolerance of 100 units
- No issue, very good FQ

	b_2	a_2	b_3	a_3	b_4	a_4	b_5	a_5	b_6	a_6	b_7	a_7
MCSXFP1					-4	-1	-0	-1	0	-1	0	-0
MCOXFP1							3	-10	-2	2	1	-1
MCDXFP1									6	-2	-6	3

Integrals at nominal current, measured at CERN (L. Fiscarelli, et al)

MCBRD (CCT CORECTORS)

- Two aperture short model built, tested and measured
- Two aperture prototype built, tested and measured



MCBRD (CCT CORECTORS)

- Tolerance of 10 units
 - Short model has -5 units of systematic b_3
 - Prototype has -10 units of systematic b_3
 - It becomes -15 in the less favourable configuration (H and V powered)
 - The other multipoles are OK
- Feedback on former shape foreseen on a third aperture

CONCLUSION

- MQXF
 - b_6 correction need is confirmed: we are about at -4 units
 - Not allowed are improving
- D1
 - The b_3 correction was not effective, to be understood – we possibly need to reduce b_3 by 10 units
 - Third model shall have the same cross-section to check reproducibility
- MCBXF
 - Room temperature measurements show a too large b_3 (20 units) to be confirmed by powering test

CONCLUSION

- D2
 - Good outlook from magnetic measurements at room temperature of collared coil
 - Measurement with yoke will tell more about the cross-talk
- HO correctors
 - Everything looks ok
- D2 correctors
 - There are about 10-15 units (negative) of b_3 in the prototype, to be understood and corrected