Corrections to "The LHC Main Dipoles and Quadrupoles Toward Series Production"

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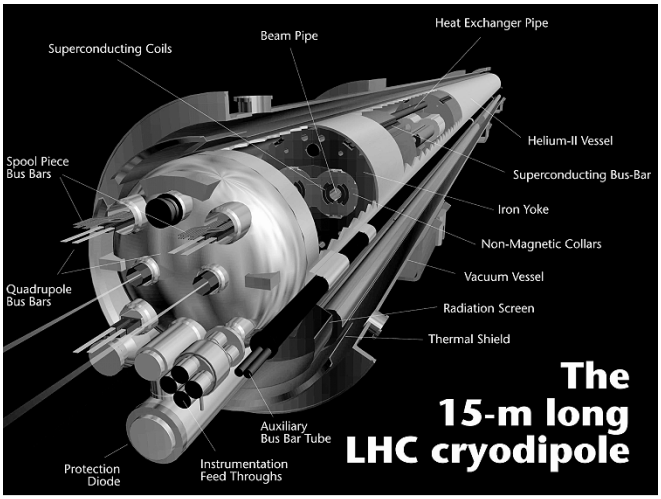

Fig. 1. An artistic view of the LHC dipole in its cryostat.

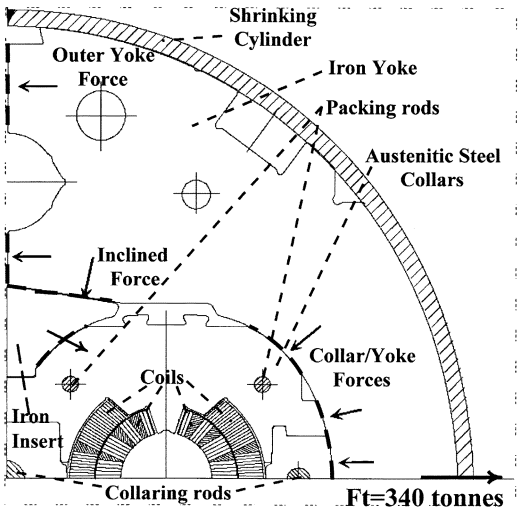

Fig. 2. Cross section of the dipole (only one quadrant) showing the position of interferences between yoke, pushed by shrinking cylinder, and collars. 340 tonnes is the total radial force (including the lower quadrant).

In the above paper [1], the figures were named incorrectly. The correctly named figures follow.

Manuscript received August 5, 2002.

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Digital Object Identifier 10.1109/TASC.2003.821639

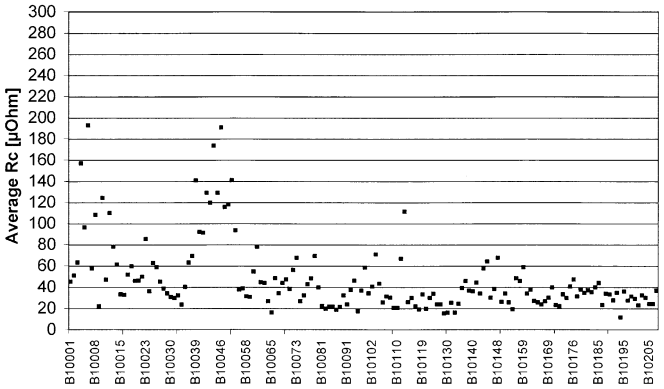

Fig. 3. Interstrand resistance, R_c, for an inner cable of one contract (last 18 months production). The 20–40 $\mu\Omega$ is really at hand (acceptable 15–150).

TABLE I
CABLES CHARACTERISTICS

STRAND	**Type 01**	**Type 02**
Diameter (mm)	1.065	0.825
Cu/NbTi ratio	1.6-1.7 ± 0.03	1.9-2.0 ± 0.03
Filament diameter (μm)	7	6
Number of filaments	8800	6425
Ic (A) @1.9 K	515 (±4 %) @ 10 T	380 (±4 %) @ 7 T
Jc (A/mm^2) @1.9 K	1530 @ 10 T	2100 @ 7 T
μ_0M (mT) @1.9 K, 0.5 T	30 ±4.5	23 ±4.5
CABLE	**Type 01**	**Type 02**
Number of strands	28	36
Width (mm)	15.1	15.1
Mid-thickness (mm) @ MPa	1.900 ±0.006	1.480 ±0.006
Keystone angle (degrees)	1.25 ±0.05	0.90 ±0.05
Cable Ic (A) @ 1.9 K	13750 @ 10T	12960 @ 7T
Maximum Ic cabling degradation	5 %	5%
Interstrand resistance (μΩ)	10-50	20-80

TABLE II
MAIN DIPOLES CHARACTERISTICS

Nominal operating field	T	8.33
Ultimate operating field	T	9
Quench field from short sample	T	9.65
Coil aperture	mm	56
Coil thickness (two layers)	mm	30.5
Magnetic Length @1.9 K	m	14.3
Nominal operating current	A	11850
Operating temperature	K	1.9
Distance between aperture axes @1.9 K	mm	194
Cold Mass Outer diameter	mm	570
Overall length of cold mass	m	15.18
Mass of the magnet cold mass	t	27.5
Stored energy @ 8.3 T, both channels	MJ	7.1
Self Inductance (7.6 mH/meter)	mH	100
ΣF_x per unit length per quadrant	MN/m	1.7
Axial e.m. force	MN	0.37

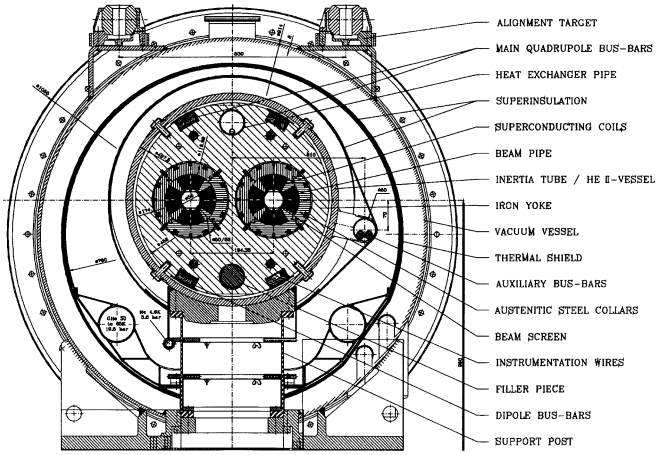

Fig. 4. Cross section of a LHC Main Quadrupole in its cryostat.

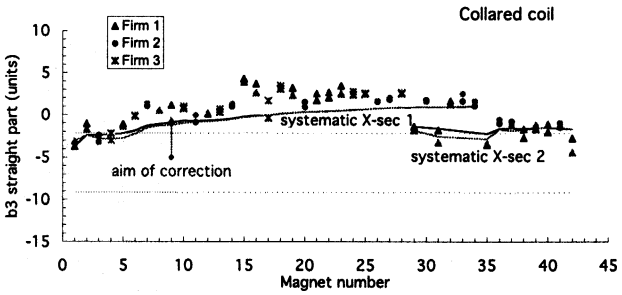

Fig. 5. Sextupole (main harmonic) of collared coils for the pre-series production. Note the effect of cross-section change and its delayed effect. Limits between -2 and -9 units (1 unit: $= 10^{-4}$ of the main field).

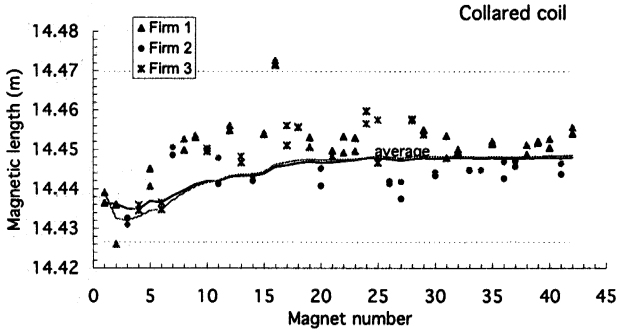

Fig. 6. Magnetic length of collared coils, showing no systematic effect. Limits are 14.425 and 14.47 m.

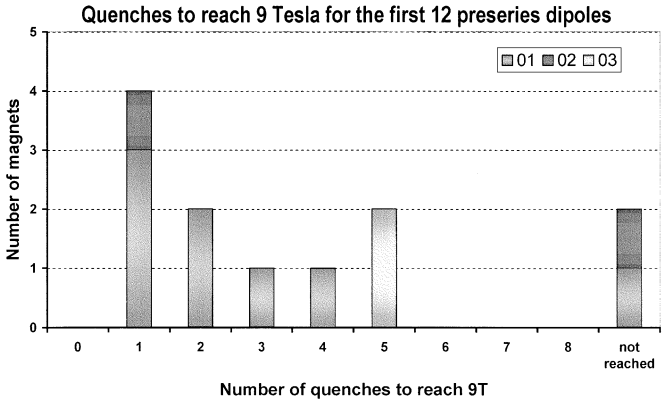

Fig. 7. Results obtained in the first training cycle (at 1.9 K) for the pre-series dipole tested so far.

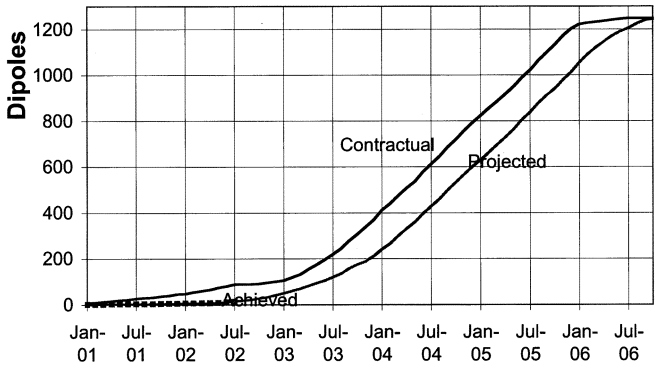

Fig. 8. Delivery of Main Dipoles. Today 13 magnets have been delivered.

REFERENCES

[1] L. Rossi, "The LHC Main Dipoles and Quadrupoles Toward Series Production," *IEEE Trans. Appl. Superconduct.*, vol. 13, no. 2, pp. 1221–1228, June 2003.