LQXA01 Test Report

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Quench Training

LQXA01 was tested in a single test cycle. It was ramped to 7228 A (~223 T/m[1]) after one trip on SC leads at 6299 A. A manual trip was done without energy extraction at 7228 A. The magnet was then again ramped to 7228 A.

Table 1 is a list of quenches executed as part of quench current studies. Note that a high current trip on the leads is included as the magnet was quenched at high current when the heaters fired.

Summary: The magnet reached full field without a spontaneous quench before and after a full energy dump into the magnet.

Table 1: List of quenches

date	time	test cycle	current (A)	ramp rate (A/s)	location	gradient (T/m)
LQXA01						
4/28/04	2145	1	6299	10	sc leads trip	196
4/29/04	1357	1	7228	10	no quench	223
4/29/04	1840	1	7228	-	tripped, dump delayed 1 s	223
4/30/04	1740	1	7228	10	no quench	223

Magnetic Field Quality Measurements

No field quality measurements were made.

Magnetic Field Strength Measurement

Integral strength measurements were performed at 1.9K during the first TC with SSW at 392, 2011, 6134 and 7228 A on the up ramp and 392 A on the down ramp. These were about 30 units high compared to field strength measurements at KEK for all currents measured. SSW measured integral field strength is given in Table 2.

Table 2: Field strength vs. current.

Current (A)	integral gradient transfer function (T/kA)	integral field strength(T)
392	201.77	79.1
2011	200.69	403.6
6134	193.37	1186.1
7228	191.16	1381.7
392	201.10	78.8
up ramp except for the last row		

[1]Gradiant quoted is only approximate. I eyeballed the TF measurements off a slide from Norihito shown at the FNAL/KEK video meeting on 6/10/04 with an L_{mag} of 6.2 m. I used SSW measurements.

Summary: SSW measurements of the TF at 392 A (2011, 6134, 7228) are 0.6% (0.3%) higher than measurements made using a rotating coil at KEK[2]

Alignment

LQXA01 had alignment measurements at each stage of testing at MTF.

Table 6: Major alignment data sets

Warm before TC1	4/19/04
Cold TC1	4/27/04
Warm after TC1	5/18/04

The magnet position changed significantly during first cooldown vertically by about 0.5mm. There was a smaller change horizontally, of about 0.1mm. Both vertical and horizontal changes were the same at the two posts: yaw and pitch did not change. The cold mass position did not return to its initial position upon warm-up after TC1, but rather stayed close to its cold value (within about (0.1mm).

Data are posted at the following URL.

http://wwwtsmtf.fnal.gov/~dimarco/usrAnalysisLQX/LQXA01/SSW/LQXA01_align.html

A summary plot showing the changes in cold mass position at various points in the TC is shown in Fig. 1. The positions are given relative to the Cold TC1 measurements being on the magnet true axis.

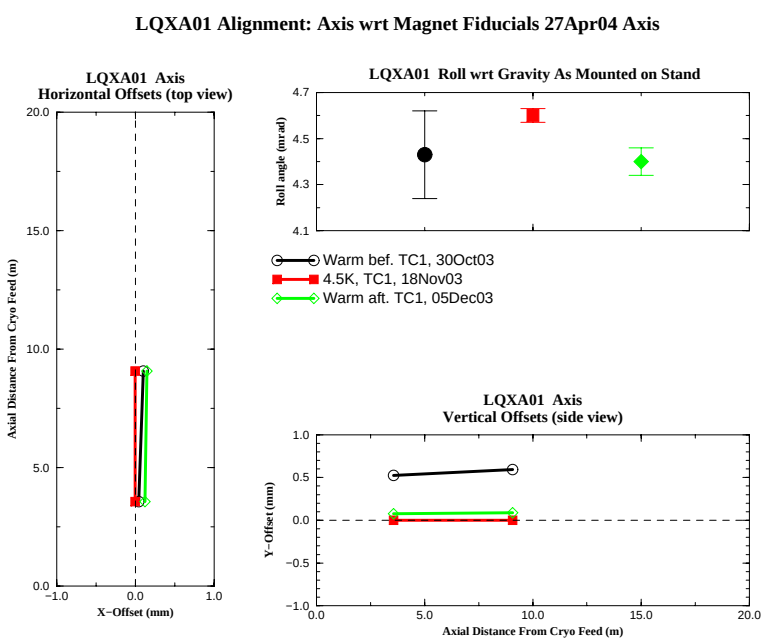

Figure 2: Alignment summary plot. The dates are wrong in the label.

[2] From the same slide of Norihito's…

Summary: Some change in cold mass position was observed during cooldown and the cold mass did not return to its initial position. The warm after TC1 and cold measurements are fairly close, having changed only 0.13mm horizontally and 0.08mm vertically. Yaw and pitch did not change over thermal cycle.

Other tests performed

The corrector was powered for testing.

Other items of interest

A discussion of the KEK-FNAL strength difference can be found at this URL:

http://tdserver1.fnal.gov/schlabach/My%20Work/hgq/acceptance/LQXA01/tf_questions/tf_questions.html

Appendix A: List of alignment measurements

LQXA01 SSW Measurements Log

(Column 1 is status: R indicates used directly for results; “a” indicates ancillary)

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Production measurements

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/usr/analysis/LQX/LQXA01/SSW/

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a 031015_14:00 rollCheck_15Oct03/031015_14:00.checkX_DC
a 031015_14:07 rollCheck_15Oct03/031015_14:07.checkX_DC
a 031015_14:17 rollCheck_15Oct03/031015_14:17.checkX_DC
a 031015_14:26 rollCheck_15Oct03/031015_14:26.checkX_DC
a 031015_14:53 rollCheck_15Oct03/031015_14:53.roll
a 031015_15:39 rollCheck_15Oct03/031015_15:39.roll
R 031015_16:22 rollCheck_15Oct03/031015_16:22.roll
R 031016_09:39 rollCheck_15Oct03/031016_09:39.roll_aftAdj1
R 031016_10:17 rollCheck_15Oct03/031016_10:17.roll_aftAdj1
R 031016_11:39 rollCheck_15Oct03/031016_11:39.roll_aftAdj2
R 031016_12:34 rollCheck_15Oct03/031016_12:34.roll_aftAdj2
a 040330_11:24 MTF/mounting_30Mar04/QA/040330_11:24.testX
R 040330_11:31 MTF/mounting_30Mar04/QA/040330_11:31.checkXY
R 040330_12:15 MTF/mounting_30Mar04/QA/040330_12:15.checkY_aftAdj
a 040330_12:26 MTF/mounting_30Mar04/QA/040330_12:26.checkY_aftAdj_repeat/040330_12:26.checkY_aftAdj
a 040330_12:26 MTF/mounting_30Mar04/QA/040330_12:26.checkY_aftAdj_repeat/040330_12:33.checkY_aftAdj
a 040330_12:26 MTF/mounting_30Mar04/QA/040330_12:26.checkY_aftAdj_repeat/040330_12:40.checkY_aftAdj
a 040330_12:26 MTF/mounting_30Mar04/QA/040330_12:26.checkY_aftAdj_repeat
a 040406_16:14 MTF/mounting_30Mar04/QA/040406_16:14.sag
R 040406_17:30 MTF/mounting_30Mar04/QA/040406_17:30.centerXY
R 040407_07:17 MTF/mounting_30Mar04/QA/040407_07:17.centerY
R 040407_17:07 MTF/mounting_30Mar04/QA/040407_17:07.CheckXY
R 040407_17:43 MTF/mounting_30Mar04/QA/040407_17:43.CheckXY
R 040408_10:26 MTF/mounting_30Mar04/QA/040408_10:26.CenterXY
a 040416_15:09 MTF/warm_befTC1_16Apr04/QA/040416_15:09.CenterXY
a 040419_09:06 MTF/warm_befTC1_16Apr04/QA/040419_09:06.checkY
R 040419_08:11 MTF/warm_befTC1_16Apr04/QA/040419_08:11.CenterXY
R 040419_14:13 MTF/warm_befTC1_16Apr04/QA/040419_14:13.checkXY_aftSurvey
R 040419_14:38 MTF/warm_befTC1_16Apr04/QA/040419_14:38.roll
a 040427_16:18 MTF/cold_TC1_1.9K_27Apr04/QA/040427_16:18.checkX/040427_16:39.checkX
a 040427_16:18 MTF/cold_TC1_1.9K_27Apr04/QA/040427_16:18.checkX/040427_16:42.checkX
a 040427_16:18 MTF/cold_TC1_1.9K_27Apr04/QA/040427_16:18.checkX/040427_16:44.checkX
a 040427_16:18 MTF/cold_TC1_1.9K_27Apr04/QA/040427_16:18.checkX/040427_16:56.checkX
a 040427_16:18 MTF/cold_TC1_1.9K_27Apr04/QA/040427_16:18.checkX/040427_17:10.testX_392A
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a 040428_17:41 MTF/cold_TC1_1.9K_27Apr04/QA/040428_17:41.testX_392A
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R 040429_16:54 MTF/cold_TC1_1.9K_27Apr04/QA/040429_16:54.strX_7228A
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a  040430_09:32 MTF/cold_TC1_1.9K_27Apr04/QA/040430_09:32.checkY
R  040430_09:48 MTF/cold_TC1_1.9K_27Apr04/QA/040430_09:48.checkXY_aftSurvey
a  040430_10:02 MTF/cold_TC1_1.9K_27Apr04/QA/040430_10:02.roll
a  040430_15:49 MTF/cold_TC1_1.9K_27Apr04/QA/040430_15:49.vertFieldCor_298A
a  040430_15:53 MTF/cold_TC1_1.9K_27Apr04/QA/040430_15:53.vertFieldCor_298A
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a  040429_18:11 MTF/cold_TC1_1.9K_27Apr04/QA/040429_18:11.strX_392A_dnramp
a  040430_16:14 MTF/cold_TC1_1.9K_27Apr04/QA/040430_16:14.vertFieldCor_100A
a  040511_15:16 MTF/warm_aftTC1_11May04/QA/040511_15:16.test
a  040511_15:21 MTF/warm_aftTC1_11May04/QA/040511_15:21.centerXY
a  040511_16:18 MTF/warm_aftTC1_11May04/QA/040511_16:18.checkXY
a  040511_16:37 MTF/warm_aftTC1_11May04/QA/040511_16:37.roll
a  040512_15:16 MTF/warm_aftTC1_11May04/QA/040512_15:16.checkXY_aftSurvey
a  040511_16:59 MTF/warm_aftTC1_11May04/QA/040511_16:59.roll_repeat/040511_16:59.roll
a  040511_16:59 MTF/warm_aftTC1_11May04/QA/040511_16:59.roll_repeat/040511_17:31.roll
R  040511_16:59 MTF/warm_aftTC1_11May04/QA/040511_16:59.roll_repeat
a  040513_07:45 MTF/warm_aftTC1_11May04/QA/040513_07:45.checkY_backToAftSurvOrig
a  040512_16:09 MTF/warm_aftTC1_11May04/QA/040512_16:09.checkY_aftSurv_aftAdj
a  040512_15:37 MTF/warm_aftTC1_11May04/QA/040512_15:37.checkY_aftSurv_repeat/040512_15:37.checkY_aftSurv
a  040512_15:37 MTF/warm_aftTC1_11May04/QA/040512_15:37.checkY_aftSurv_repeat/040512_15:46.checkY_aftSurv
a  040512_15:37 MTF/warm_aftTC1_11May04/QA/040512_15:37.checkY_aftSurv_repeat
a  040518_13:12 MTF/warm_aftTC1_11May04/QA/040518_13:12.checkY
a  040512_16:39 MTF/warm_aftTC1_11May04/QA/040512_16:39.checkY_aftSurv_aftAdj2
a  040512_16:52 MTF/warm_aftTC1_11May04/QA/040512_16:52.checkY_aftSurv_aftAdj3
a  040513_08:02 MTF/warm_aftTC1_11May04/QA/040513_08:02.checkY_2AdjSteps
a  040513_08:13 MTF/warm_aftTC1_11May04/QA/040513_08:13.checkY_2AdjSteps_plusAdj
a  040513_08:31 MTF/warm_aftTC1_11May04/QA/040513_08:31.checkY_2AdjSteps_plusAdj2
a  040513_08:45 MTF/warm_aftTC1_11May04/QA/040513_08:45.checkY_4mmStep
a  040513_09:02 MTF/warm_aftTC1_11May04/QA/040513_09:02.checkY_4mmStep_adj
a  040513_09:19 MTF/warm_aftTC1_11May04/QA/040513_09:19.checkY_4mmStep_adj2
a  040513_09:30 MTF/warm_aftTC1_11May04/QA/040513_09:30.checkY_4mmStep_adj3
a  040513_09:57 MTF/warm_aftTC1_11May04/QA/040513_09:57.checkY_3mmStep
a  040513_09:43 MTF/warm_aftTC1_11May04/QA/040513_09:43.checkY_4mmStep_adj4
a  040518_13:26 MTF/warm_aftTC1_11May04/QA/040518_13:26.checkY
a  040513_10:11 MTF/warm_aftTC1_11May04/QA/040513_10:11.checkY_3mmStep_10mmVibStep
a  040513_10:35 MTF/warm_aftTC1_11May04/QA/040513_10:35.checkY_4mmStep
a  040513_10:23 MTF/warm_aftTC1_11May04/QA/040513_10:23.checkY_3mmStep_10mmVibStep_adj1
a  040513_11:03 MTF/warm_aftTC1_11May04/QA/040513_11:03.checkY_4mmStep_adj1
a  040513_11:13 MTF/warm_aftTC1_11May04/QA/040513_11:13.checkY_4mmStep_adj1
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a 040513_11:33 MTF/warm_aftTC1_11May04/QA/040513_11:33.checkY_backToAftSurvOrig
R 040513_11:50 MTF/warm_aftTC1_11May04/QA/040513_11:50.dipRotWire_cor1
R 040513_13:45 MTF/warm_aftTC1_11May04/QA/040513_13:45.dipRotWire_cor2
R 040513_14:37 MTF/warm_aftTC1_11May04/QA/040513_14:37.dipRotWire_cor2_Y
R 040513_14:45 MTF/warm_aftTC1_11May04/QA/040513_14:45.dipRotWire_cor2_X
R 040513_14:53 MTF/warm_aftTC1_11May04/QA/040513_14:53.dipRotWire_cor2_X
R 040513_15:05 MTF/warm_aftTC1_11May04/QA/040513_15:05.dipRotWire_cor2_X
R 040513_15:12 MTF/warm_aftTC1_11May04/QA/040513_15:12.dipRotWire_cor2_X
R 040513_15:15 MTF/warm_aftTC1_11May04/QA/040513_15:15.dipRotWire_cor2_X
R 040513_15:21 MTF/warm_aftTC1_11May04/QA/040513_15:21.dipRotWire_cor2_Y
R 040513_15:25 MTF/warm_aftTC1_11May04/QA/040513_15:25.dipRotWire_cor2
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:01.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:05.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:09.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:12.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:16.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:19.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:23.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:26.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:30.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat/040513_16:34.dip_cor2_X
R 040513_16:01 MTF/warm_aftTC1_11May04/QA/040513_16:01.dip_cor2_X_repeat
R 040514_06:40 MTF/warm_aftTC1_11May04/QA/040514_06:40.dip_cor1_X_repeat/040514_06:40.dip_cor1_X
R 040514_06:40 MTF/warm_aftTC1_11May04/QA/040514_06:40.dip_cor1_X_repeat/040514_06:44.dip_cor1_X
R 040514_06:40 MTF/warm_aftTC1_11May04/QA/040514_06:40.dip_cor1_X_repeat
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_06:52.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_06:56.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:33.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:00.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:05.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:08.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:12.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:15.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:19.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:22.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:26.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:29.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:36.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:40.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat/040514_07:43.dip_cor1_Y
R 040514_06:52 MTF/warm_aftTC1_11May04/QA/040514_06:52.dip_cor1_Y_repeat
R 040518_10:29 MTF/warm_aftTC1_11May04/QA/040518_10:29.checkXY_befSurv2
a 040518_11:05 MTF/warm_aftTC1_11May04/QA/040518_11:05.checkSag
R 040519_08:07 MTF/warm_aftTC1_11May04/QA/040519_08:07.checkXY_aftSurv2
R 040209_14:53 flangeAlign_09Feb04/040209_14:53.sag
R 040209_16:48 flangeAlign_09Feb04/040209_16:48.centerXY
a 040210_07:16 flangeAlign_09Feb04/040210_07:16.checkY
a 040210_07:42 flangeAlign_09Feb04/040210_07:42.checkY
a 040210_08:03 flangeAlign_09Feb04/040210_08:03.checkX
R 040210_08:36 flangeAlign_09Feb04/040210_08:36.checkX
R 040210_09:19 flangeAlign_09Feb04/040210_09:19.checky
R 040210_10:33 flangeAlign_09Feb04/040210_10:33.checkXY