SLAC Magnetic Measurement Plan and Traveler for LCLS-II Unipolar LTUS Quadrupoles of Type 1.26Q3.5

Revision 0, Initial Release Dec. 9, 2016 (approved: P. Emma, Dec. 9, 2016)

This traveler is intended to cover mechanical fiducialization and magnetic measurements of the LTU quadrupole magnets needed for LCLS-II. There are 6 of these magnets addressed in this traveler and needed for installation in the LCLS-II LTUS beamline, each of which is about 10-cm long. After installation these 6 will be powered in series with a unipolar supply and the individual magnet polarities determined by local wiring. The MAD names are QE31B, QE33B, QE35B ("P" polarity), and QE32B, QE34B, QE36B ("N" polarity).

Receiving:

The following information is to be noted upon receipt of the magnets by the SLAC MFD group:

Received by (MMG initials):	SDA
Date received (dd-mmm-yyyy):	12/19/2016
SLAC barcode number:	4031
Vendor serial number on the magnet:	33

Place a barcode sticker on the magnet and also duplicate the barcode sticker here →	

Preparation:

A beam direction arrow, with text "beam direction", is to be applied to the top and/or connector side of the magnet with a sticker supplied by LCLS (J. Amann will determine the direction).

Beam-direction arrow in place (initials):	SDA

Fiducialization:

Fiducialization may be done before or after magnetic measurements. The magnet is to be fiducialized by the CMM group. This will require the installation of removable tooling balls, location of the geometric axis of the poles of the magnet, and location of tooling balls with respect to the center of this geometric axis when the poles are aligned precisely horizontal.

CMM technician (initials):	KC

URL of on-line CMM fiducialization data (please modify or correct if necessary):

http://www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS-II/quad/4031/4031_Fiducial_Report.pdf

Magnetic Measurements:

Enter URL of on-line magnetic measurements data (please modify or correct if necessary):

http://www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS-II/quad/4031/

1) Mark 3 of these magnets as a "QF" (positive polarity) and 3 of them as a "QD" (negative polarity). These marks will be replaced with MAD magnet name assignments after all 6 magnets are measured.

Magnet marked as (please enter "QF" or "QD"):	QD

2) Determine the connection polarity (with supply outputting positive current) which produces the correct field polarity for the "QF" or "QD" magnet as shown below (depending on its QF or QD assignment):

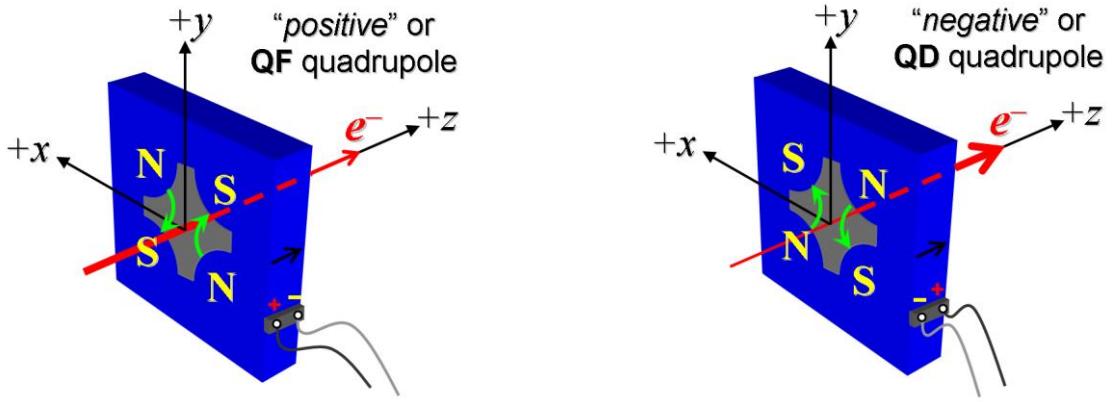

Figure 1. The quadrupoles: QE31B, QE33B, QE35B have "positive" polarity (left), while the quadrupoles: QE32B, QE34B, QE36B have "negative" polarity (right).

3) Mark the polarity near the magnet leads with clear "+" and "–" labels as shown above.

Polarity has been labeled (initials):	SDA
Magnet polarity chosen from Fig. 1 is (P or N):	N

4) Connect the magnet terminals in the correct polarity as established above, to a power supply with maximum current $I \geq 12$ A (*e.g.*, MCOR12). Use "3-Linear Ramping Trim" control.

5) **For one of these 6 magnets**, run the magnet up to 12 A for ~1 hr (or as needed) for a thermal test (record maximum temperature).

Ambient temperature (°C):	Measured on 4029
Final magnet temperature at 12 A maximum (°C):	Measured on 4029

6) Standardize the magnet, starting from zero to 12 A and back to zero, through three full cycles, finally ending at zero, with a flat-top pause time (at both 0 and 12 A) of 5 seconds. Use a ramp rate of 1 A/sec, if possible, and record the ramp rate used.

Standardization complete (initials):	SDA
Ramp rate used (A/sec):	1 A/sec

7) Measure the length-integrated field gradient, $\int Gdl$, from 0 to 12 A in 1-A steps (13 'up' measurements), and then back down from 12 A to 0 in 1-A steps (13 'down' measurements).

Filename & run number of $\int Gdl$ up & down data:	Strdat.ru1

8) With rotating coil, measure the magnet harmonics at 12 A current setting. Multipole values should be given as a percentage of the quadrupole moment evaluated at the probe radius.

Filename & run number of harmonic data:	Hardat.ru1
Probe radius used for harmonics (cm):	1.40208 cm
Rotating Coil Designation (Name)	1_124DQB22_4_Layer

9) Confirm the pole-tip field using a Hall probe at an excitation current of 12 A.

Hall probe pole-tip field at 12 A (mean of 4 poles):	0.293 +/- 0.005 T

10) Measure the inductance and resistance of the magnet:

Inductance of coil (mH):	9.66 mH
Resistance of coil (Ohms):	0.3714 Ohm
Ambient temperature in degrees C	14.9 C

11) Upon completion of tests, send traveler to Mark Woodley for acceptance at mailstop 54.

Magnet accepted (signed):	MDW via email
Assigned beamline location (MAD-deck name):	**QE32B**


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LCLS-II