



LCLS Engineering Specification Document #	1.3-102	Linac	Revision 0
LCLS Quadrupole Magnet Specification			
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Brief Summary: This specification summarizes the engineering requirements for each LCLS Quadrupole magnet type.

Keywords: Quadrupole Magnet

Key WBS#'s: 1.3.3.5; 1.3.3.7; 1.3.3.10



This document contains specification sheets that represent the engineering requirements for the different design models of LCLS Linac quadrupole magnets. Each sheet is a superset of requirements that will define the performance of identical magnets within a design model type. A unique WBS designation, identifying the model type, has been added to the individual specification chosen to represent the model type.

All LCLS magnets will be consistent with the latest version of the Electrical Safety Guidelines in the SLAC ES&H Manual. Particular attention must be paid to the section concerning Magnet Terminal Covers.

All LCLS magnets will conform to the LCLS Paint and Color Scheme.

All LCLS magnets will attempt to conform with, and will be reviewed against, the latest SLAC designs relating to improved magnet reliability.

All LCLS magnet design must file a SLAC DL design document in the Spires system. All new LCLS magnet designs will have individual Magnetic Measurement Procedures that must be approved by the System Physicist.

LCLS MAGNET

11-Mar-2004

MAD Deck: LCLS08MAR04

Description:

WBS 1.3.3.5 Quadrupole Magnet (Quad_LTU)

Magnet common name (MAD deck):	QT12	Operating point	
Magnetic type (dipole/quad):	quadrupole	nominal MAD k (m ⁻²):	0.84020
Magnet focuses in X or Y:	X	upper-limit MAD k (m ⁻²):	0.0
Used as corrector magnet (yes/no):	no	lower-limit MAD k (m ⁻²):	-0.6
LCLS accelerator area:	DL2	nominal excitation current (A):	107.099
Z-location of cntr. w.r.t. cathode (m):	1275.000	upper-limit excitation current (A):	0.00
Nominal beam energy (GeV):	14.100	lower-limit excitation current (A):	-92.21
Upper-limit beam energy (GeV):	17.000	nominal integrated gradient (kG):	182.14055
Lower-limit beam energy (GeV):	3.000	upper-limit integrated gradient (kG):	0.000
Magnet used for LCLS only (yes/no):	yes	lower-limit integrated gradient (kG):	-156.821
New, Relocated, or Existing magnet:	Existing	nominal pole-tip field (kG):	4.544
Magnet		nominal focal length (m):	-2.582
design designation type:	0.91Q17.72	nominal main coil voltage drop (V):	?
magnet serial number:	?	NA	?
magnet "primary,micro,unit":	QUAD,?	Installation	
effective magnetic length (m):	0.4609	horiz. half-width stay-clear (mm):	8
pole-tip radius (mm):	11.500	vert. half-height stay-clear (mm):	8
main coil resistance (ohms):	0	field accuracy w.r.t. string (%):	0.30
magnet is water-cooled (yes/no):	yes	x alignment tol. (mm):	0.23
includes trim-coil (yes/no):	no	y alignment tol. (mm):	0.29
NA	NA	z alignment tol. (mm):	2.00
Power-supply		azimuthal roll tol. (mrad):	3.00
power-supply name or type:	?	sext field tol. (% @ r=20 mm):	20
main supply "primary,micro,unit":	QUAD,?	12-pole field tol. (% @ r=20 mm):	100
Bipolar or Unipolar main supply:	Unipolar	N TC's or klixons on magnet:	?
rms regulation tol. of main (%):	0.40	water flow required (gal/s):	?
approx. max. required current (A):	101.4	I vs B coeff's (below) Final or	
approx. max. voltage of main (V):	?	Temp:	Temporary
total N magnets on main string (>0):	4	p_0 (A):	0.000
names of other magnets on main:	QT12, QT22, QT32, QT42	p_1 (A/kG):	0.588
		p_2 (A/kG ²):	0.000
		p_3 (A/kG ³):	0.000
		p_4 (A/kG ⁴):	0.000
controller type:	?	p_5 (A/kG ⁵):	0.000
needs Shunt, Boost, or Trim supply:	none	p_6 (A/kG ⁶):	0.000
NA	NA	p_7 (A/kG ⁷):	0.000
NA		p_8 (A/kG ⁸):	0.000
NA		p_9 (A/kG ⁹):	0.000

LCLS MAGNET

11-Mar-2004 MAD Deck: LCLS08MAR04

Description:		WBS 1.3.3.10 Quad Magnet (QA)	
Magnet common name (MAD deck):	QA11	Operating point	
Magnetic type (dipole/quad):	quadrupole	nominal MAD k (m ⁻²):	-3.97171
Magnet focuses in X or Y:	Y	upper-limit MAD k (m ⁻²):	0.0
Used as corrector magnet (yes/no):	no	lower-limit MAD k (m ⁻²):	-5.0
LCLS accelerator area:	L1	nominal excitation current (A):	-25.540
Z-location of cntr. w.r.t. cathode (m):	23.337	upper-limit excitation current (A):	0.00
Nominal beam energy (GeV):	0.189	lower-limit excitation current (A):	-42.53
Upper-limit beam energy (GeV):	0.250	nominal integrated gradient (kG):	-2.55399
Lower-limit beam energy (GeV):	0.130	upper-limit integrated gradient (kG):	0.000
Magnet used for LCLS only (yes/no):	yes	lower-limit integrated gradient (kG):	-4.253
New, Relocated, or Existing magnet:	Existing	nominal pole-tip field (kG):	-0.382
Magnet		nominal focal length (m):	2.468
design designation type:	QA	nominal main coil voltage drop (V):	?
magnet serial number:	?	NA	?
magnet "primary,micro,unit":	QUAD,LI??,?	Installation	
effective magnetic length (m):	0.1020	horiz. half-width stay-clear (mm):	12
pole-tip radius (mm):	15.240	vert. half-height stay-clear (mm):	12
main coil resistance (ohms):	0	field accuracy w.r.t. nom. (%):	2.00
magnet is water-cooled (yes/no):	(unsure)	x alignment tol. (mm):	2.00
includes trim-coil (yes/no):	no	y alignment tol. (mm):	1.00
NA	NA	z alignment tol. (mm):	4.00
Power-supply		azimuthal roll tol. (mrad):	20.00
power-supply name or type:	?	sext field tol. (% @ r=20 mm):	100
main supply "primary,micro,unit":	QUAD,LI??,?	12-pole field tol. (% @ r=20 mm):	100
Bipolar or Unipolar main supply:	Unipolar	N TC's or klixons on magnet:	?
rms regulation tol. of main (%):	2.00	NA	?
approx. max. required current (A):	46.8	I vs B coeff's (below) Final or Temp:	Temporary
approx. max. voltage of main (V):	?	p_0 (A):	0.000
total N magnets on main string (>0):	1	p_1 (A/kG):	10.000
NA		p_2 (A/kG ²):	0.000
		p_3 (A/kG ³):	0.000
controller type:	?	p_4 (A/kG ⁴):	0.000
needs Shunt, Boost, or Trim supply:	none	p_5 (A/kG ⁵):	0.000
NA	NA	p_6 (A/kG ⁶):	0.000
NA		p_7 (A/kG ⁷):	0.000
NA		p_8 (A/kG ⁸):	0.000
NA		p_9 (A/kG ⁹):	0.000
Comments:			

LCLS MAGNET

27-Apr-2004 MAD Deck: LCLS19APR04

Description:		WBS 1.3.3.7 Quad Magnet (QE)	
Magnet common name (MAD deck):	QM22	Operating point	
Magnetic type (dipole/quad):	quadrupole	nominal MAD k (m ⁻²):	-3.33787
Magnet focuses in X or Y:	Y	upper-limit MAD k (m ⁻²):	0.0
Used as corrector magnet (yes/no):	no	lower-limit MAD k (m ⁻²):	-5.0
LCLS accelerator area:	BC2	nominal excitation current (A):	-107.971
Z-location of cntr. w.r.t. cathode (m):	422.730	upper-limit excitation current (A):	0.00
Nominal beam energy (GeV):	4.540	lower-limit excitation current (A):	-210.19
Upper-limit beam energy (GeV):	5.900	nominal integrated gradient (kG):	-53.98539
Lower-limit beam energy (GeV):	3.200	upper-limit integrated gradient (kG):	0.000
Magnet used for LCLS only (yes/no):	yes	lower-limit integrated gradient (kG):	-105.093
New, Relocated, or Existing magnet:	Existing	nominal pole-tip field (kG):	-6.965
Magnet		nominal focal length (m):	2.805
design designation type:	QE	nominal main coil voltage drop (V):	?
magnet serial number:	?	NA	?
magnet "primary,micro,unit":	QUAD,LI??,?	Installation	
effective magnetic length (m):	0.1068	horiz. half-width stay-clear (mm):	12
pole-tip radius (mm):	13.780	vert. half-height stay-clear (mm):	12
main coil resistance (ohms):	0	field accuracy w.r.t. nom. (%):	1.00
magnet is water-cooled (yes/no):	(unsure)	x alignment tol. (mm):	0.30
includes trim-coil (yes/no):	no	y alignment tol. (mm):	0.08
NA	NA	z alignment tol. (mm):	2.00
Power-supply		azimuthal roll tol. (mrad):	8.00
power-supply name or type:	?	sext field tol. (% @ r=20 mm):	100
main supply "primary,micro,unit":	QUAD,LI??,?	12-pole field tol. (% @ r=20 mm):	100
Bipolar or Unipolar main supply:	Unipolar	N TC's or klixons on magnet:	?
rms regulation tol. of main (%):	0.40	NA	?
approx. max. required current (A):	231.2	I vs B coeff's (below) Final or Temp:	Temporary
approx. max. voltage of main (V):	?	p_0 (A):	0.000
total N magnets on main string (>0):	1	p_1 (A/kG):	2.000
NA		p_2 (A/kG ²):	0.000
		p_3 (A/kG ³):	0.000
controller type:	?	p_4 (A/kG ⁴):	0.000
needs Shunt, Boost, or Trim supply:	none	p_5 (A/kG ⁵):	0.000
NA	NA	p_6 (A/kG ⁶):	0.000
NA		p_7 (A/kG ⁷):	0.000
NA		p_8 (A/kG ⁸):	0.000
NA		p_9 (A/kG ⁹):	0.000
Comments:			