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Magnet Field Check Safety Dump BX3 BYDs

James Turner Author	James Turner Signature	3/16/09 Date
Paul Emma Manager, LCLS Physics	Paul E Signature	3/12/09 Date
Darren Marsh Quality Assurance Manager	Darren Marsh Signature	3/16/09 Date

Change History Log

Rev Number	Revision Date	Sections Affected	Description of Change
000	Oct 20, 2008	All	Initial Version
001	Dec 09, 2008	Safety Dump	Add acceptable measurement range
002	Mar 11, 2009	Safety Dump	Change tolerance on acceptable field

Magnet Field Check Procedure for Safety Dump, BX3 and BYD Magnets

J. Turner, 20 October, 2008

Stanford Linear Accelerator Center, 2575 Sand Hill Rd., Menlo Park, CA 94025, USA

Safety Dump Permanent Magnet Field Check Procedure

Introduction

PRD 1.1-006 "Requirements for LCLS Magnets" contains the polarity and field required for the permanent magnets BXPM1, BXPM2, and BXPM3. "N" field polarity in this PRD references PRD 1.1-010-r1 "Magnet Polarity Convention". These indicate the magnets should be "North on top". At 0.94 m effective length with a required field of 3 kG-m, the central field measured by a hand held Hall probe should be 3.2 ± 0.2 kG.

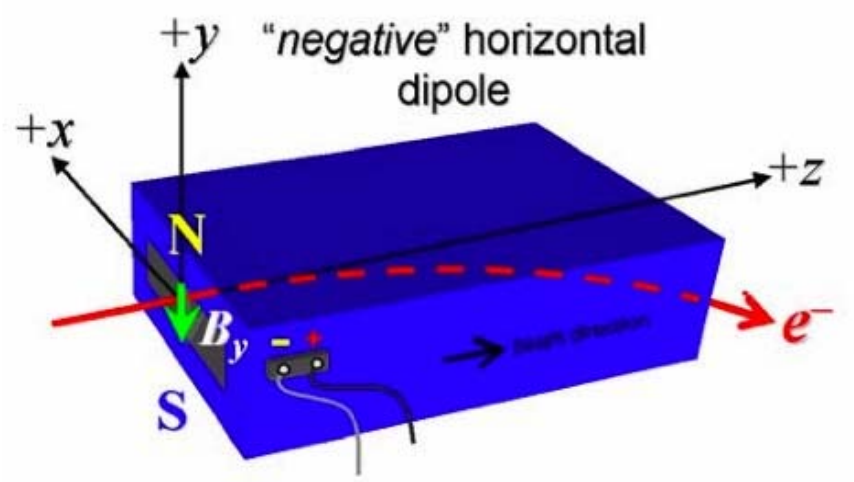

Figure 1 From PRD 1.1-010-r1 "Magnet Polarity Convention" This is for all BXPMs (and BX31 and BX32).

Safety Note

This activity requires Work Authorization form to be completed. Be sure to remove loose magnetic material from your person before getting close to these magnets. A dangling badge or flashlight will move rapidly in a 3 kG field.

Measurement

This procedure assumes a Bell model 4048 Gauss meter is used. Taking the accuracy of this hand held meter to be ±2% for dc fields (from the Bell model 4048 specification sheet), this gives a measurable acceptance range of 3.1 kG to 3.3 kG. To achieve this range in the center field, the measurements close to the aisle side of the vacuum pipe have an acceptance range of 2.9 kG to 3.4 kG. For this and most other hand held Gauss meters, orienting the probe release button or "bump" on the probe perpendicular to the flux gives the maximum value and a positive readback indicates flux direction going into the "bump". This is consistent with the bump pointing at a North Pole.

Orient the Gauss meter probe in order to read a positive number when pointing at the top permanent magnet assuming it is a "North" pole. Verify that reversing the probe reverses the observed sign, re-orient the probe for maximum readout (in the positive readout direction) and verify that visually this appears perpendicular to the expected flux lines. Record the maximum consistently obtained value.

Perform this measurement on each permanent magnet near each end, near the center, and near each quarter point (5 locations per magnet). Record results in kilogauss. Report results to the LCLS Radiation Physicist as well as the LCLS Lead Commissioning Physicist.

	UPBEAM END [KG]	UPBEAM 1/4 POINT [KG]	CENTER [KG]	DOWNBEAM 1/4 POINT [KG]	DOWNBEAM END [KG]	INITIALS	DATE
BXPM1							
BXPM2							
BXPM3							

Based on tracking, the lower limit tolerance for the average field should be 3.0 kG (95% of 3.2 kG). The upper limit should be 3.4 kG (105% of 3.2 kG). Individual magnets can vary by up to 10% (0.3 kG) from the nominal 3.2-kG level.

Compute the average field in each magnet and the average for the sum.

	BXPM1 AVG [KG] (TOL=2.9-3.5)	BXPM2 AVG [KG (TOL=2.9-3.5)]	BXPM3 AVG [KG] (TOL=2.9-3.5)	SUM AVG [KG] (TOL=3.0-3.4)	IN TOLERANCE (Y/N)?	INITIALS	DATE
BXPM1-3							

BYD and BX3 Magnet Field Polarity and Connectivity Check Procedure

Introduction

PRD 1.1-006 "Requirements for LCLS Magnets" Table 2 contains the polarity and field required for the BYD and BX3 magnets.

BX31	LTU	*4D102.36T*	2.62	-1.1	-4.0	-5.2	0.003	9	N
BX32	LTU	*4D102.36T*	2.62	-1.1	-4.0	-5.2	"	9	N
BX35	LTU	*4D102.36T*	2.62	+1.1	+4.0	+5.2	"	9	P
BX36	LTU	*4D102.36T*	2.62	+1.1	+4.0	+5.2	"	9	P
BYD1	DUMP	1.69VD55.1	1.40	-3.5	-13	-17.1	0.005	9	N
BYD2	DUMP	1.69VD55.1	1.40	-3.5	-13	-17.1	"	9	N
BYD3	DUMP	1.69VD55.1	1.40	-3.5	-13	-17.1	"	9	N

Figure 2 Excerpt from PRD 1.1-006 Table 2. The right most column is for polarity.

"N" and "P" field polarities in this PRD reference PRD 1.1-010-r1 "Magnet Polarity Convention". For the BYDs (BYD1, BYD2, BYD3) all bending down this makes a "North" magnetic polarity in the south side of the tunnel, or right side as the beam would see it.

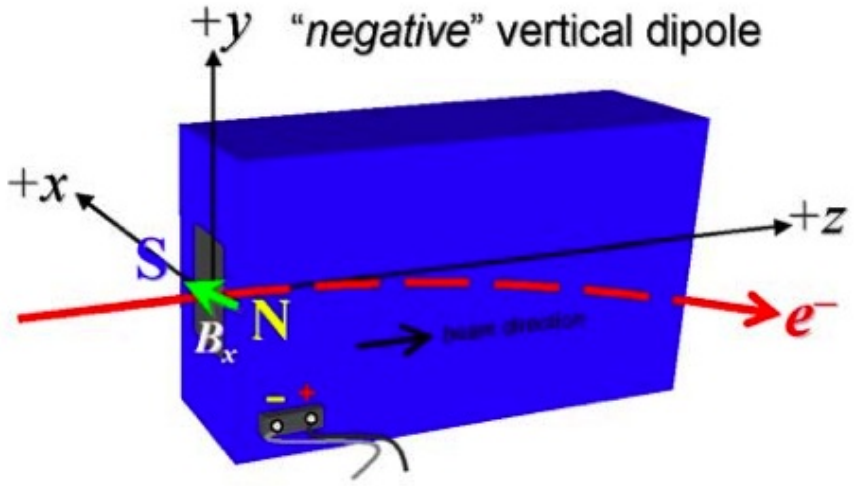

Figure 3 From PRD 1.1-010-r1 "Magnet Polarity Convention". This is right for BYD1, BYD2, and BYD3.

For BX31 and BX32, "North" magnetic polarity should be on top to bend electrons to their right or south in the tunnel as shown in **Figure 1**. BX35 and BX36 have "South" on top to bend the beam back to the left or north in the tunnel see **Figure 4**.

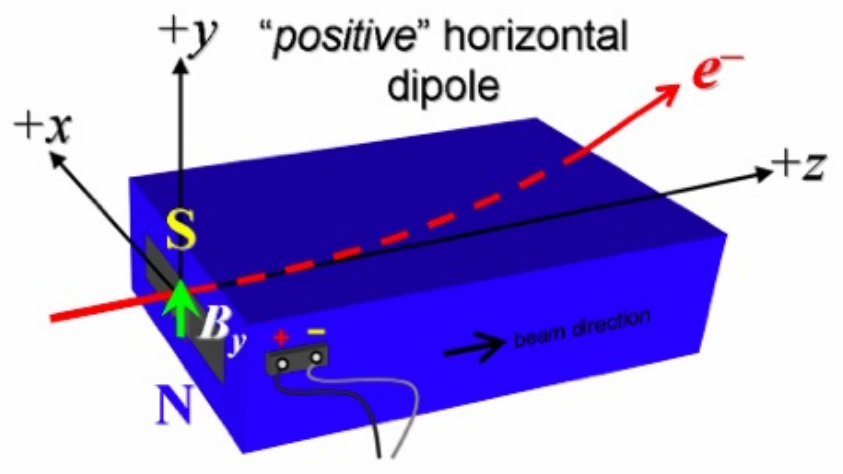

Figure 4 From PRD 1.1-010-r1 "Magnet Polarity Convention". This is the convention for BX35 and BX36.

Measurements

Turn the BX3-BYD power supply on and insure the BX3 trim supplies are off.

Field measurement of main supply

The measurement portion of this procedure is essentially the same as the measurement method for the permanent magnets, and in each case the required polarity needs to come from Table 2 in PRD 1.1-006. Note field polarities on each magnet due to the main supply.

Connectivity of main supply

While measuring BYD1, have the field set to zero and observe the Gauss meter change is concurrent with the power supply being lowered.
Raise the power supply back up and do the same on BYD2.
Raise the power supply and do the same on BYD3.
Raise the power supply and do the same on BX31.
Raise the power supply and do the same on BX32.
Raise the power supply and do the same on BX35.
Raise the power supply and do the same on BX36.

Turn the main power supply off.

Turn on to positive current the trim for BX31

Field measurement of the trims

The measurement portion of this procedure is essentially the same as the measurement method for the main supply on the BX3s, and in each case the required polarity needs to come from Table 3 in PRD 1.1-006. When given positive current, each trim should add to the field from the main supply. Note field polarities on each magnet due to its trim supply.

Connectivity of trim supplies

Turn the main supply off, turn BX31 trim on to positive current. Measure BX31 field, have the trim supply set to zero and observe the Gauss meter change is concurrent with the power supply being lowered.

Turn off the trim for BX31, turn on the trim to BX32 to positive current. Repeat "Field measurement of the trims" and "Connectivity of trim supply" above.

Turn off the trim to BX32, turn on the trim to BX35 to positive current. Repeat "Field measurement of the trims" and "Connectivity of trim supply" above.

Turn off the trim to BX35, turn on the trim to BX36 to positive current. Repeat "Field measurement of the trims" and "Connectivity of trim supply" above.

The BYD dipoles do not have trim coils.

Record all results. Compare the field polarity measured with those listed in PRD 1.1-006, and if they match enter "ok" in the table, else enter "error". When connectivity is established also enter "ok" or "error". Report results to the LCLS Radiation Physicist as well as the LCLS Lead Commissioning Physicist. Correct any errors. Remeasure. Re-report.

	POLARITY (OK/ERROR)	**CONNECTIVITY (OK/ERROR)**	**INITIALS**	**DATE**
BYD1				
BYD2				
BYD3				
BX31 (Main)				
BX32 (Main)				
BX35 (Main)				
BX36 (Main)				
BX31 TRIM				
BX32 TRIM				
BX35 TRIM				
BX36 TRIM				