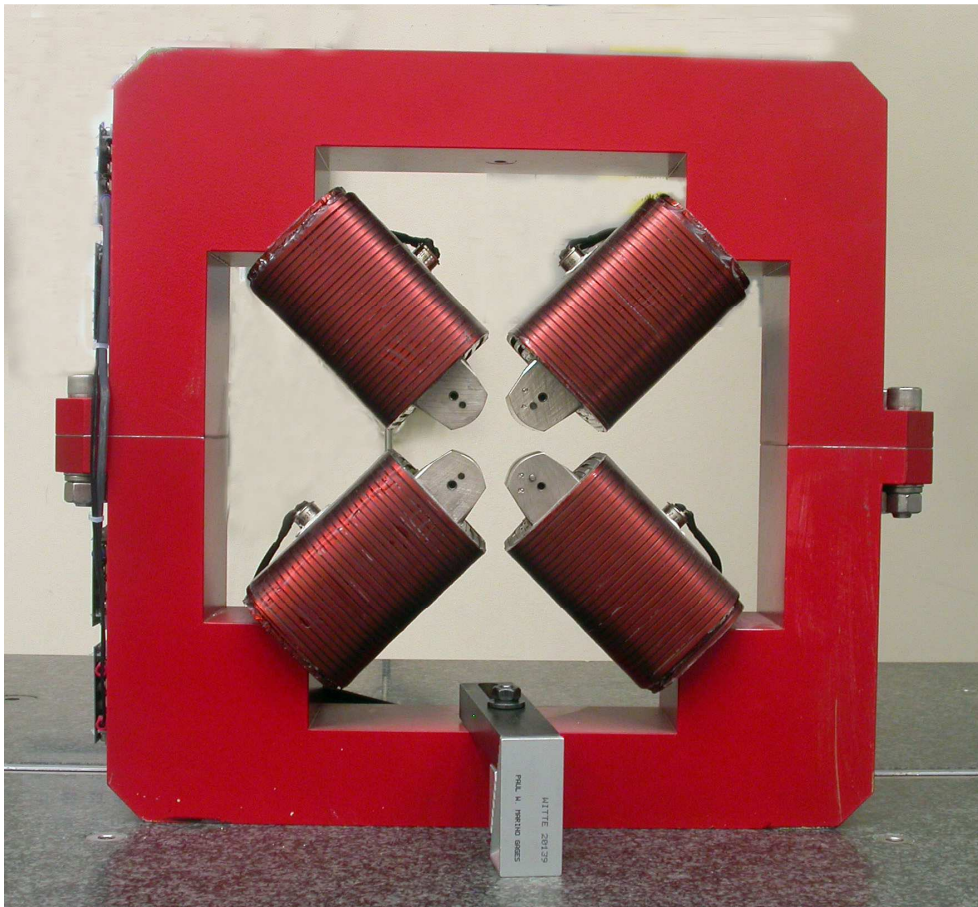# LCLS II Magnet Fiducialization Report
Injector Quadrupole 1.26Q3.5

Inspector : K. Caban

Engineer : J. Amann

Drawing No. : SA-380-309-12 R1

Barcode No.: 4025

Mfg. S/N : 030

Coordinate System Setup

Spatial Alignment

The Spatial Alignment of the magnet is created through a composite best-fit of the pole tips. Each pole tip scanned .150 inch inboard from the upstream magnet face and the downstream magnet face. A composite best-fit of the upstream poles and the downstream poles is made with the nominal pole tip shape and location. An axis is created through the two best-fit centerpoints. This axis is the spatial alignment of the magnet and defines the Z axis.

Planar Alignment

The Planar Alignment of the magnet is the created by averaging the rotations of the composite best-fits of the upstream pole tips and downstream pole tips. This direction defines the Y and X directions of the magnet.

Coordinate Origins

The origins of the magnet coordinate system are as follows. The XY origin lies on the axis of spatial alignment. The Z origin is the intersection of the mid-plane between the upstream and downstream magnet faces and the Z axis.

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Tooling Ball Locations

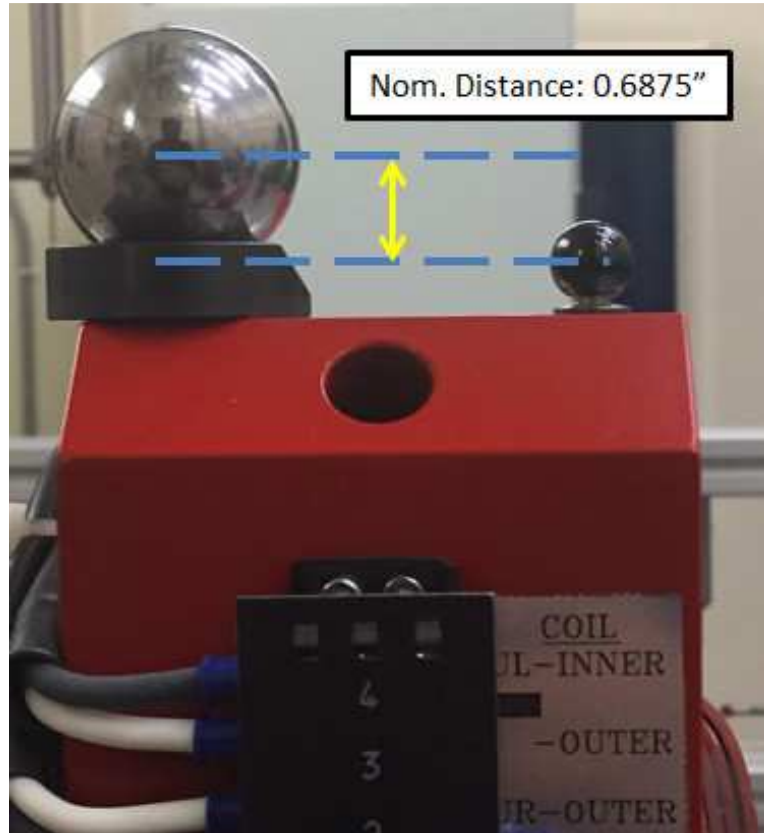| Tooling Ball	X Coord.	Y Coord.	Z Coord.
TB 1	6.4980	8.8755	-1.2456
TB 2	6.4979	8.8755	1.2565
TB 3	-6.5017	8.8760	1.2525
TB 4	-6.5006	8.8769	-1.2476
TB A	6.4987	8.1887	-1.2456
TB B	6.4980	8.1876	1.2537
TB C	-6.5011	8.1885	1.2525
TB D	-6.5005	8.1899	-1.2476

Tooling Ball Locations (1-4) are 1 inch above unpainted surface pads
Tooling Ball Locations (A-D) are 5/16 inch above unpainted surface pads

Dimensions in Inch

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1" Tooling Ball to 5/16" Tooling Ball Difference

Tooling Ball	Nom Dist.	Actual Dist.
TB 1	0.6875 ± 0.001	0.68679
TB 2	0.6875 ± 0.001	0.6879
TB 3	0.6875 ± 0.001	0.68755
TB 4	0.6875 ± 0.001	0.68701

Dimensions in Inch

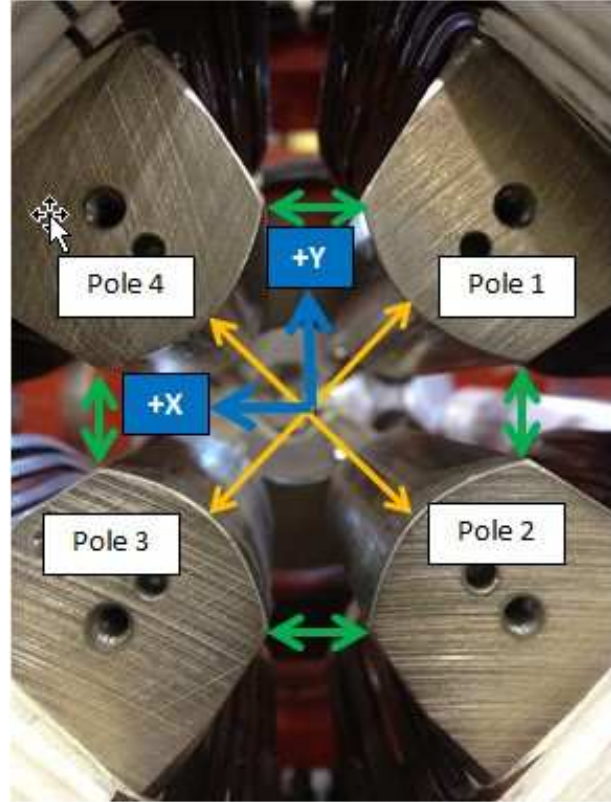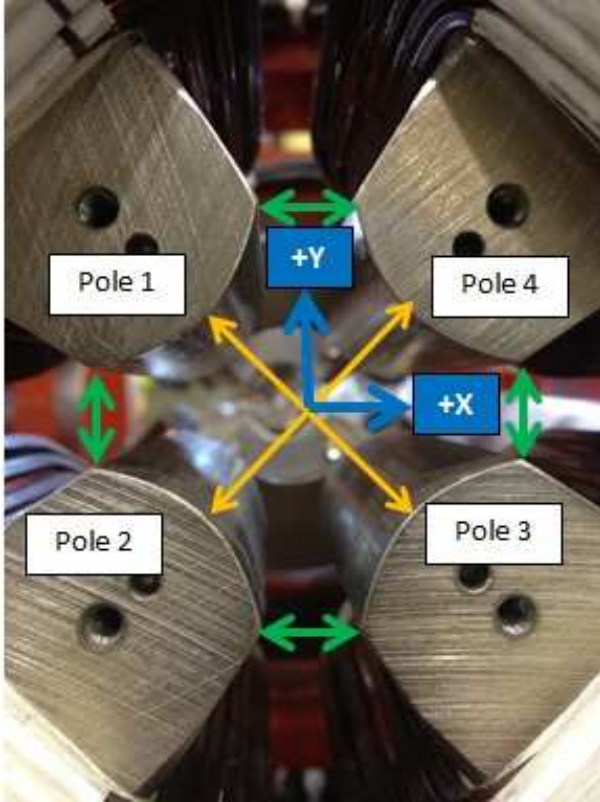**Barcode # : 4025**

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Pole Tip Gap Measurements

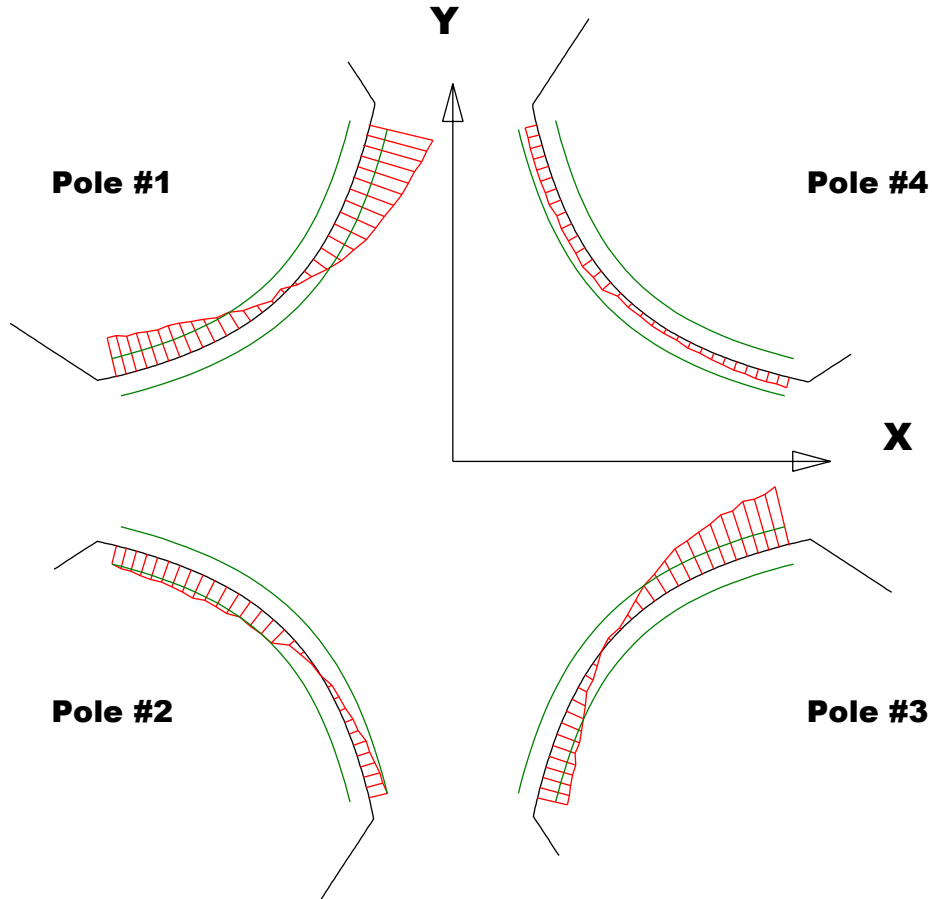**Pole Tips View from Downstream**   **Pole Tips View from Upstream**

	Nominal Distance	Downstream Pole Ends	Upstream Pole Ends
Pole Tip Distance 1-3	1.260	1.26012	1.26042
Pole Tip Distance 2-4	1.260	1.26071	1.26084
Gap 1-2	.422	0.42664	0.42351
Gap 2-3	.422	0.42315	0.42342
Gap 3-4	.422	0.4171	0.41821
Gap 4-1	.422	0.4179	0.41904

Dimensions in Inch

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Composite Best-fit of Pole Tips, Downstream

Black = Nominal Pole Tip

Red = Pole Tip Deviations

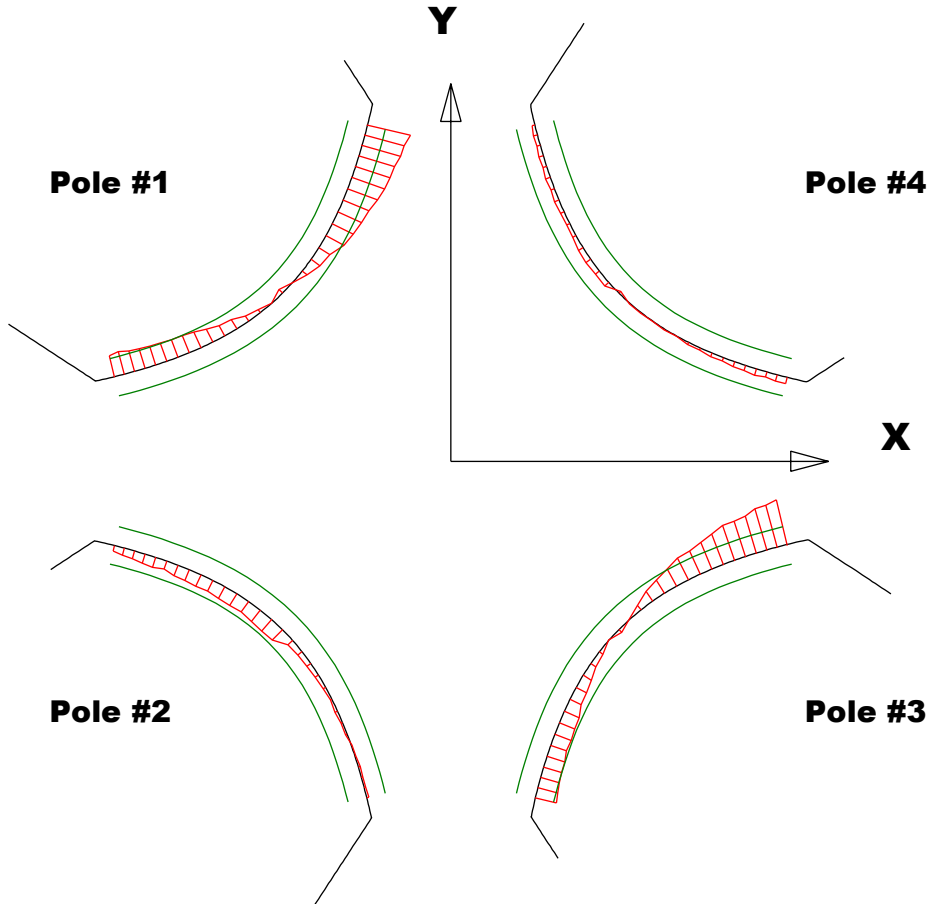Green = +/- .001 Tolerance

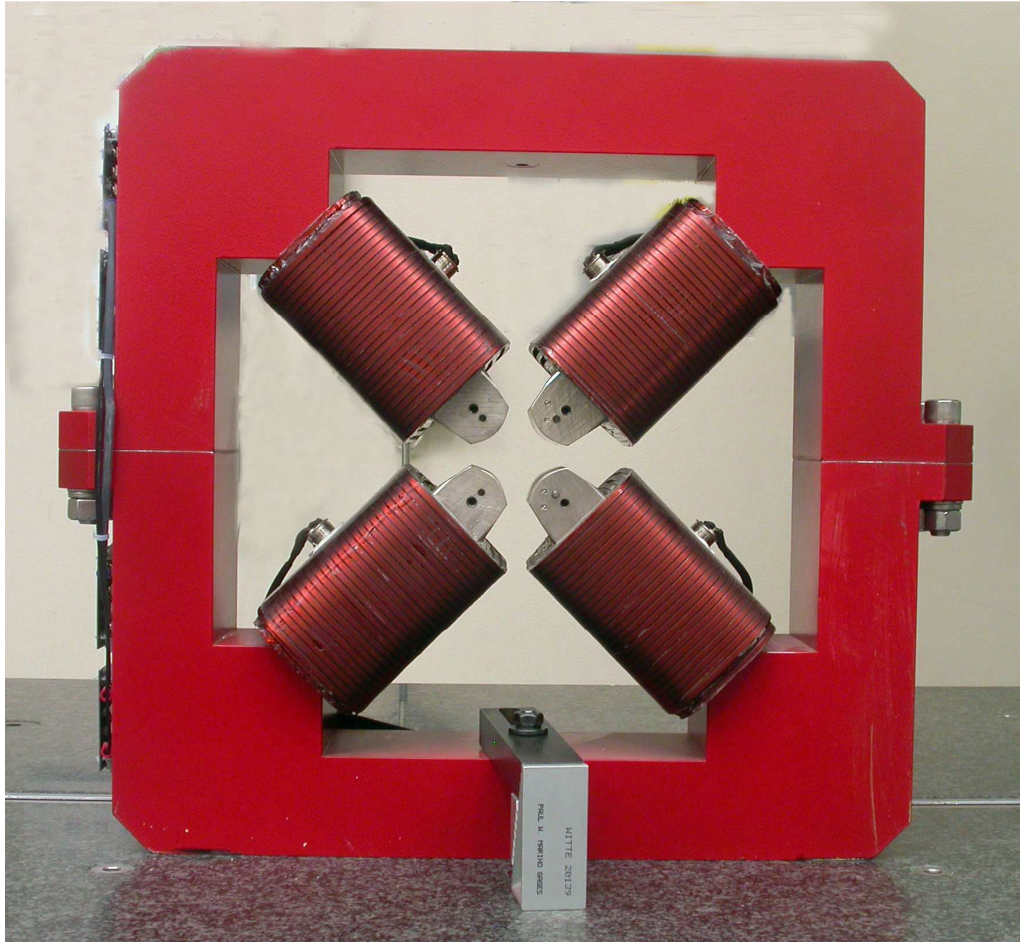Dimensions in Inch

Pole Tip Deviations

Pole Tip	#1	#2	#3	#4
Min. Dev.	-0.00211	-0.00134	-0.00164	0.00023
Max. Dev.	0.00344	0.00101	0.00314	0.00066

Barcode # : 4025
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Composite Best-fit of Pole Tips, Upstream

Pole #1

Pole #4

Pole #2

Pole #3

Black = Nominal Pole Tip

Red = Pole Tip Deviations

Green = +/- .001 Tolerance

Dimensions in Inch

Pole Tip Deviations

Pole Tip	#1	#2	#3	#4
Min. Dev.	-0.00124	-0.00081	-0.00116	-0.00012
Max. Dev.	0.00234	0.00012	0.00245	0.00035

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Angle of the Composite Pole Tip Best-Fit In Relation to Tooling Ball Plane

Angle in Decimal Degrees ° = 0.00444

Angle in Milliradians =   0.07755

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