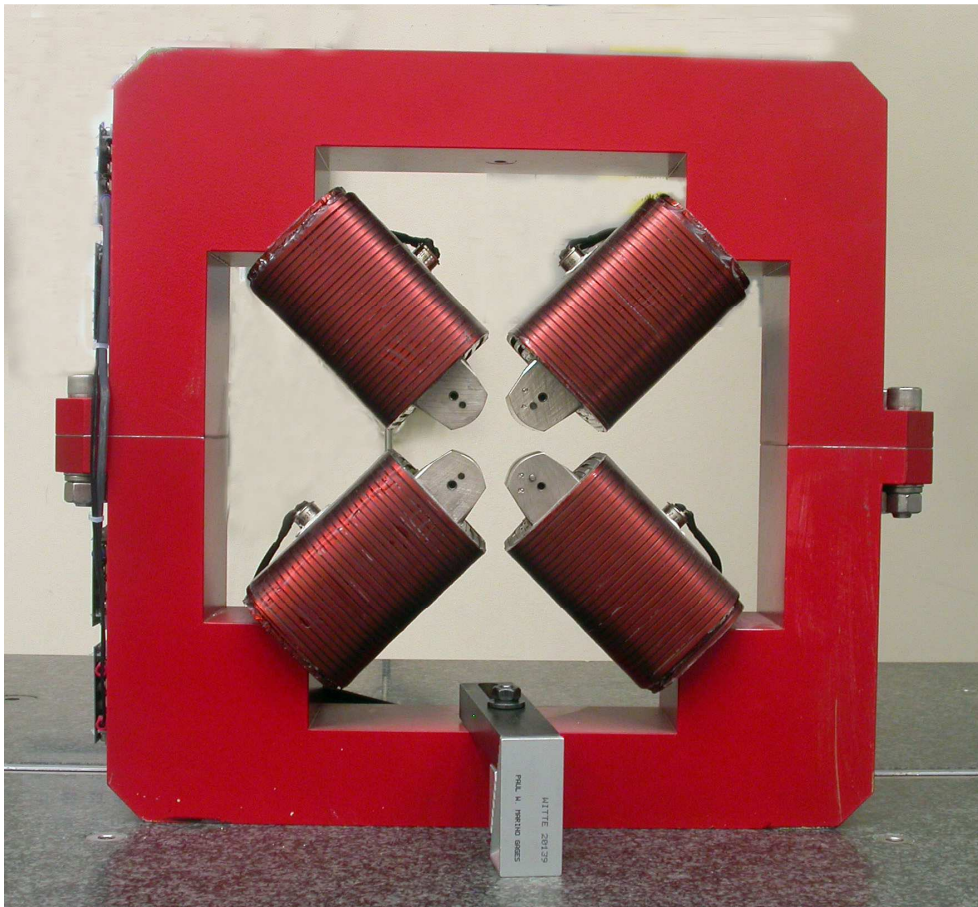


# LCLS II Magnet Fiducialization Report

## Injector Quadrupole 1.26Q3.5



Inspector : K. Caban

Engineer : J. Amann

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

Barcode No.: 4029

Mfg. S/N : 028

## 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 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	6.5144	8.8609	-1.2490
TB 2	6.5159	8.8599	1.2508
TB 3	-6.4833	8.8843	1.2537
TB 4	-6.4843	8.8850	-1.2466
TB A	6.5133	8.1736	-1.2501
TB B	6.5141	8.1729	1.2496
TB C	-6.4842	8.1971	1.2527
TB D	-6.4850	8.1977	-1.2467

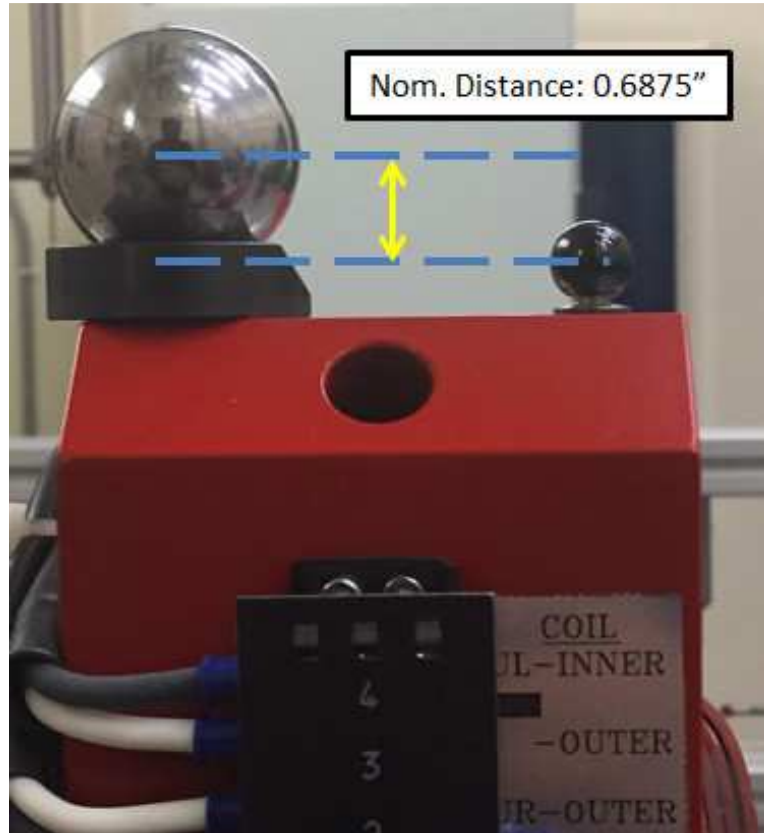
Tooling Ball Locations (1-4) are 1 inch above unpainted surface pads  
 Tooling Ball Locations (A-D) are 5/16 inch above unpainted surface pads

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	0.68723
TB 2	0.6875 ± 0.001	0.68699
TB 3	0.6875 ± 0.001	0.68716
TB 4	0.6875 ± 0.001	0.68726

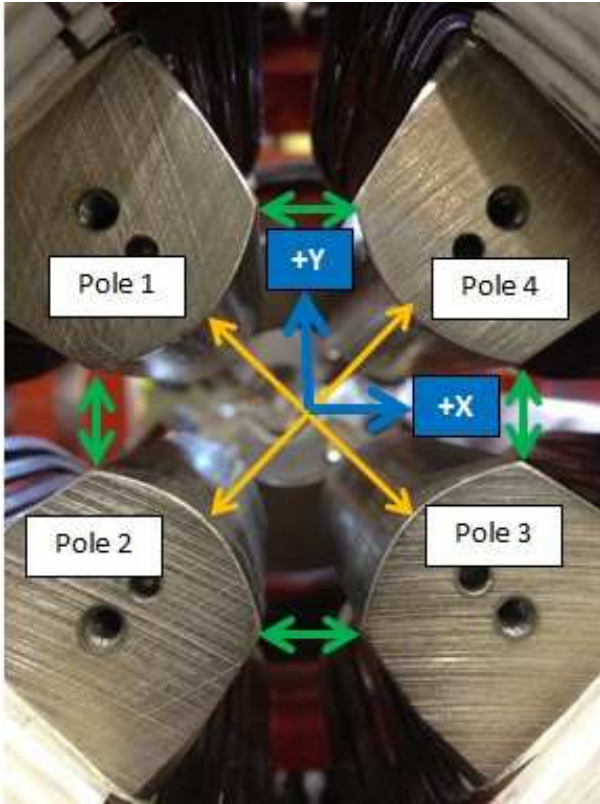
Dimensions in Inch

**Barcode # : 4029**

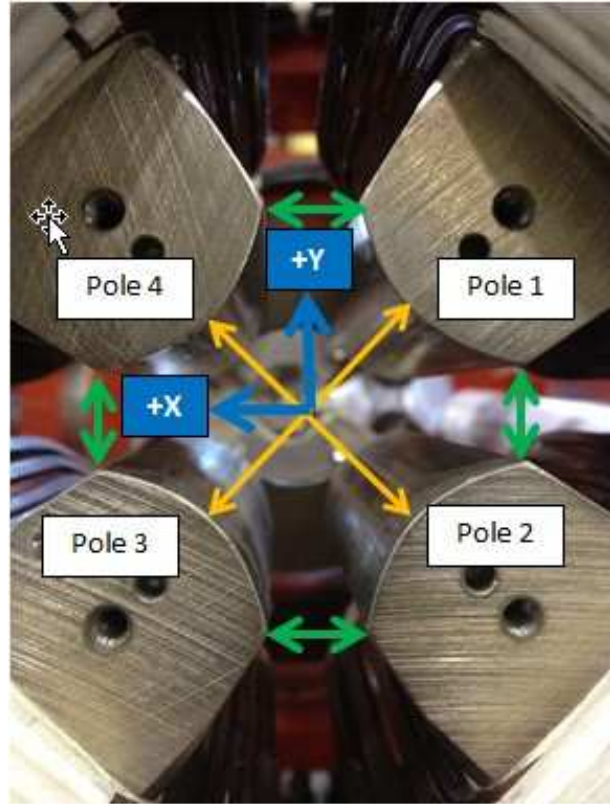
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## Pole Tip Gap Measurements

**Pole Tips View from Downstream**



**Pole Tips View from Upstream**



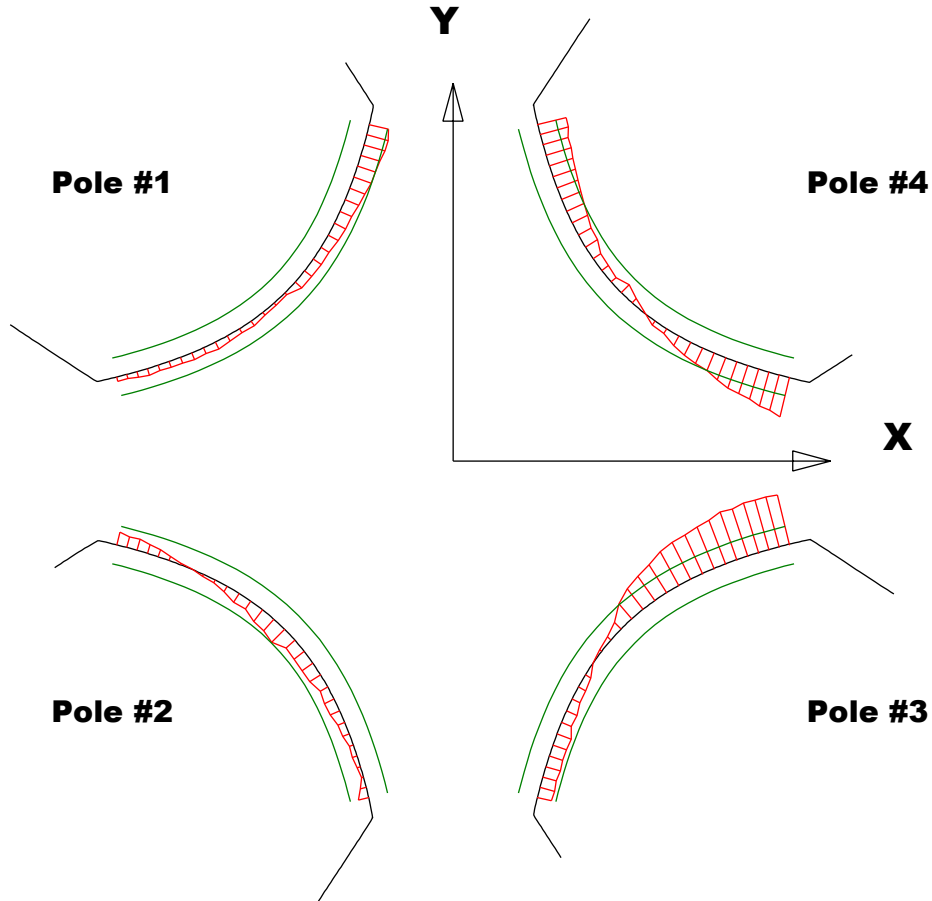
	Nominal Distance	Downstream Pole Ends	Upstream Pole Ends
Pole Tip Distance 1-3	1.260	1.25922	1.26188
Pole Tip Distance 2-4	1.260	1.26152	1.26042
Gap 1-2	.422	0.42175	0.42048
Gap 2-3	.422	0.42669	0.42731
Gap 3-4	.422	0.41636	0.41679
Gap 4-1	.422	0.42452	0.42558

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

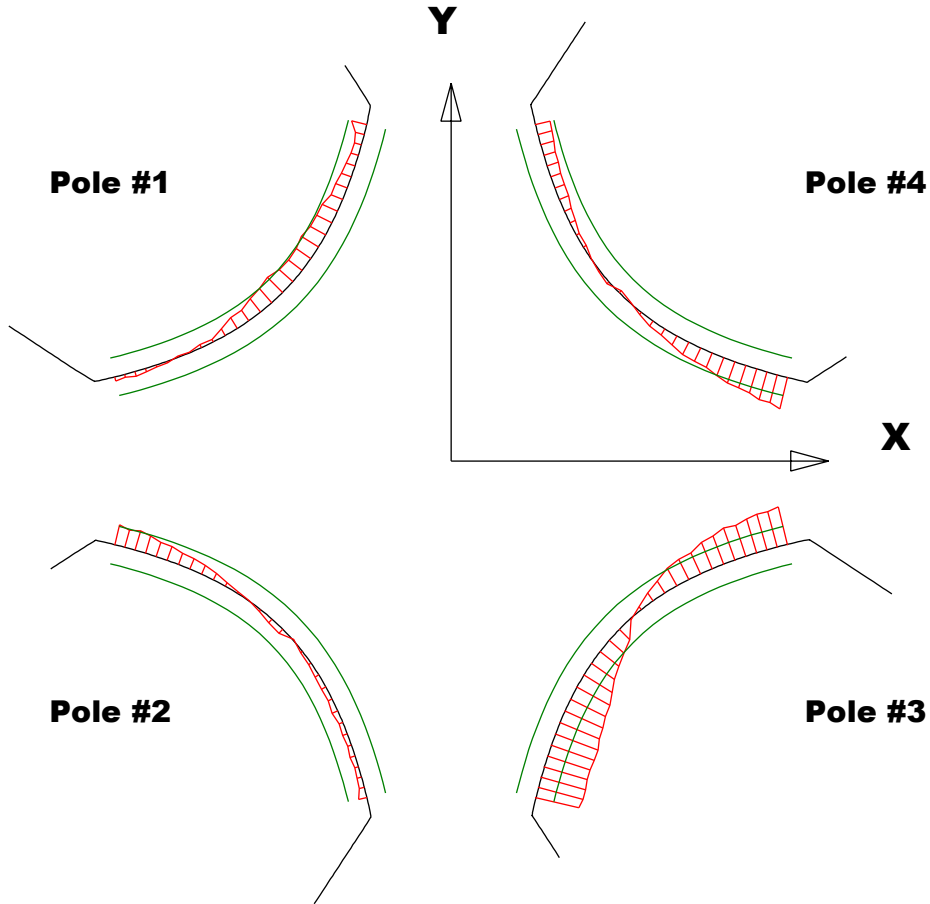
### Pole Tip Deviations

Pole Tip	#1	#2	#3	#4
Min. Dev.	0.00015	-0.00096	-0.00081	-0.00155
Max. Dev.	0.00119	0.0007	0.00275	0.00215

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## Composite Best-fit of Pole Tips, Upstream



Black = Nominal Pole Tip  
 Red = Pole Tip Deviations  
 Green = +/- .001 Tolerance

Dimensions in Inch

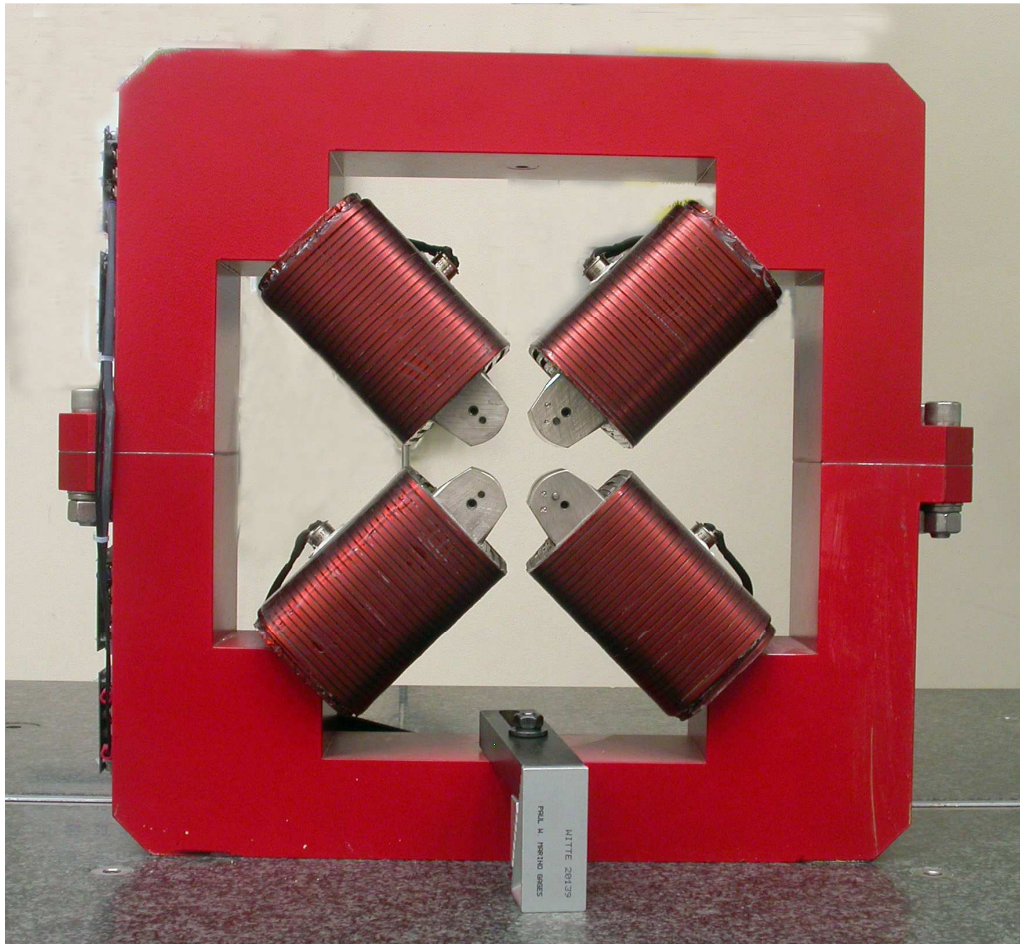
### Pole Tip Deviations

Pole Tip	#1	#2	#3	#4
Min. Dev.	-0.00115	-0.00045	-0.00244	-0.0008
Max. Dev.	0.00026	0.00108	0.00204	0.00172

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



Angle in Decimal Degrees  $^{\circ}$  = 0.10787

Angle in Milliradians = 1.88275

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