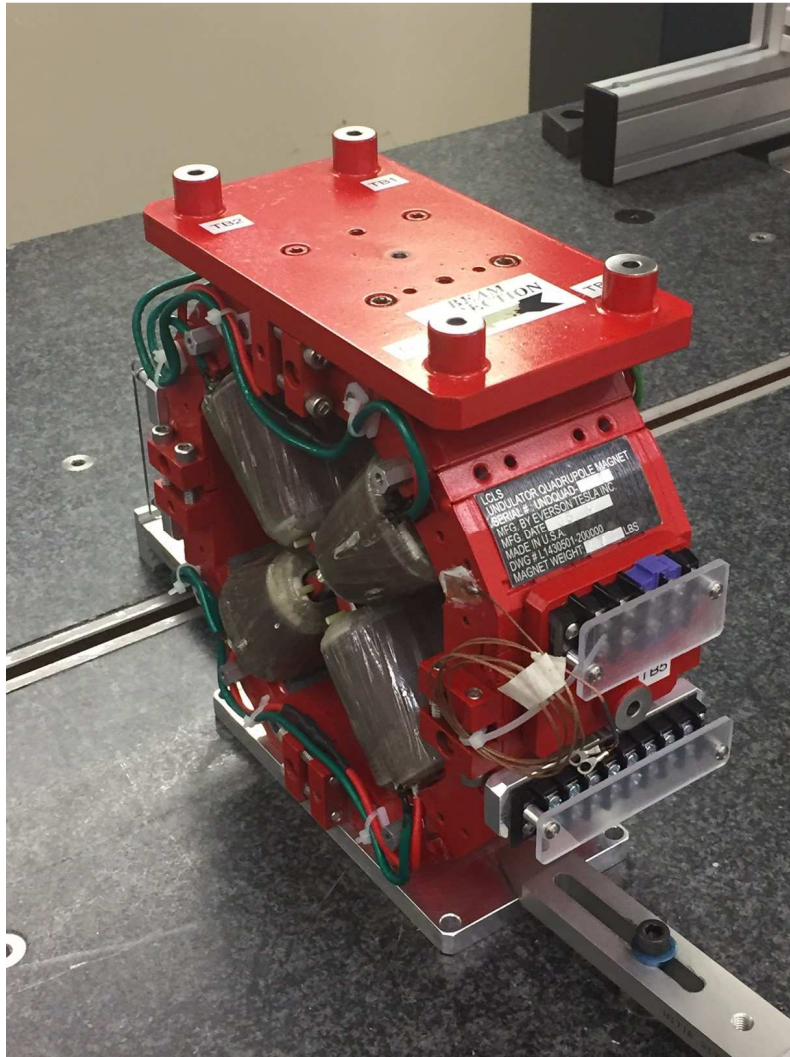


# LCLS II Undulator Quadrupole Fiducialization Report



Inspector : K. Caban  
Engineer : J. Amann  
Drawing No. : SA-381-012-22  
Barcode # : 4094  
Mfg. S/N : 025

## **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.

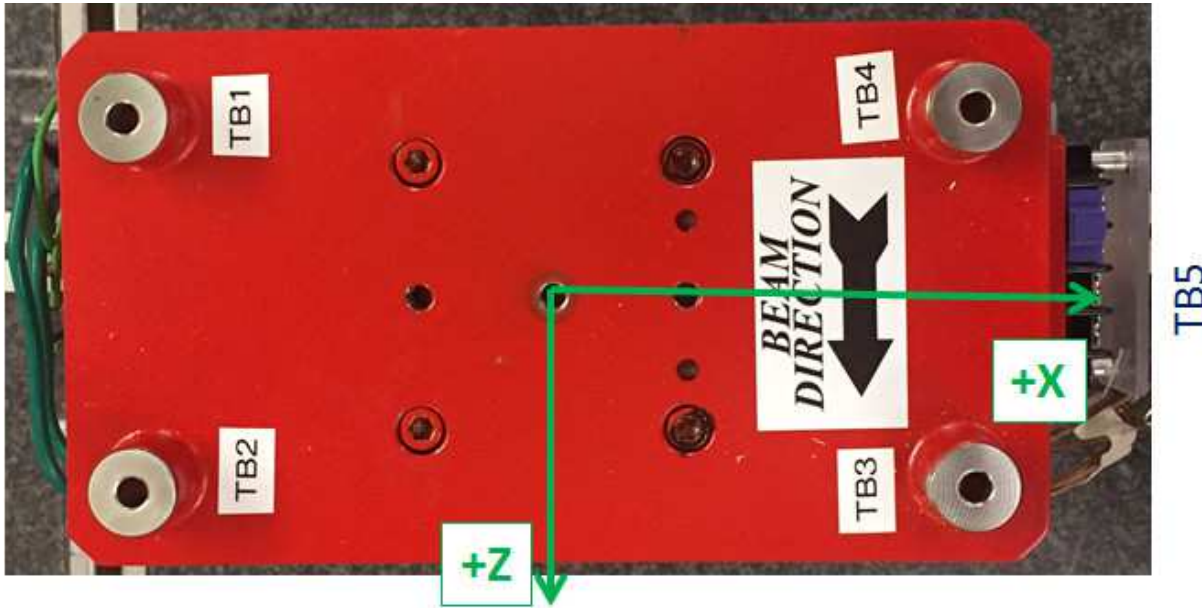
### **Coordinate Origins**

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.

**Barcode # : 4094**

**Mfg. S/N : 025**

## Tooling Ball Locations



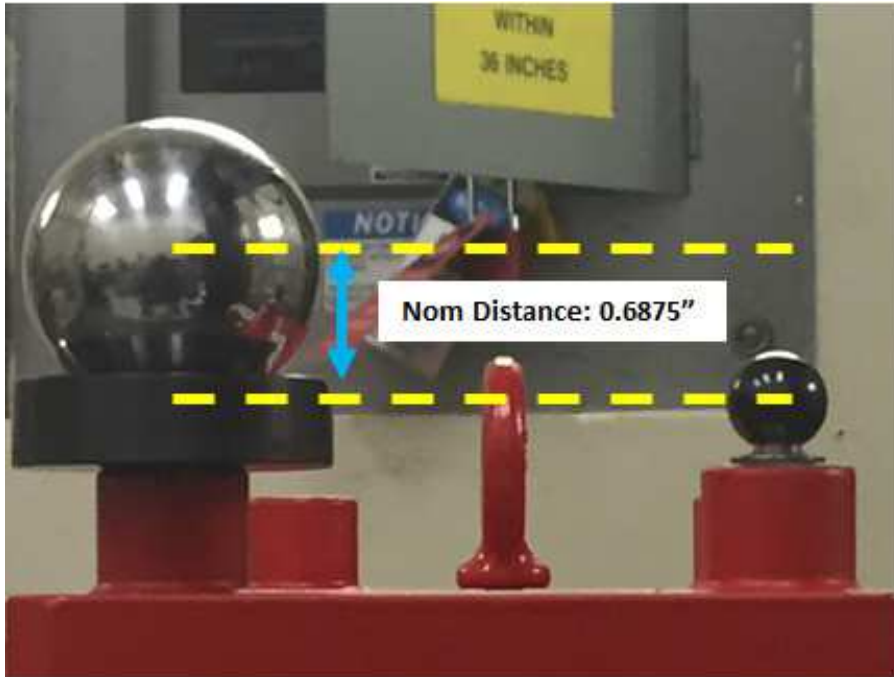
Tooling Ball	X Coord.	Y Coord.	Z Coord.
TB 1	-3.37030	6.81655	-1.50858
TB 2	-3.36582	6.81936	1.49454
TB 3	3.38155	6.81355	1.47936
TB 4	3.37959	6.81445	-1.52060
TB 5	6.58784	0.11763	-0.02707
TB A	-3.37078	6.13022	-1.50760
TB B	-3.36663	6.13258	1.49283
TB C	3.38325	6.12603	1.47966
TB D	3.37703	6.12713	-1.52022
TB E	5.89981	0.12154	-0.02655

Tooling Ball Locations (1-5) are 1 inch above Tooling Ball Adapter Plane  
 Tooling Ball Locations (A-E) are 5/16 inch above Tooling Ball Adapter Plane  
 Dimensions in Inch

**Barcode # : 4094**

**Mfg. S/N : 025**

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



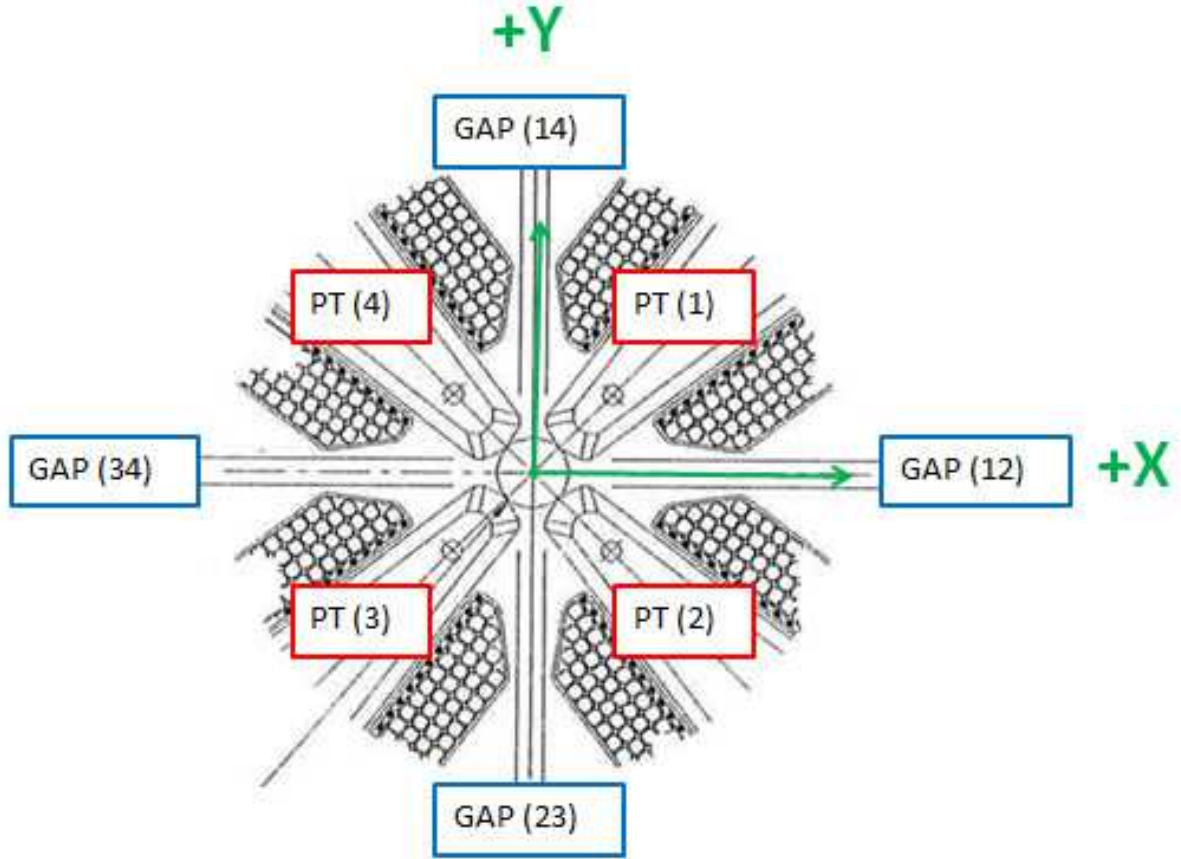
Tooling Ball	Nom Dist.	Actual Dist.
TB 1	0.6875 ± 0.001	0.68633
TB 2	0.6875 ± 0.001	0.68678
TB 3	0.6875 ± 0.001	0.68751
TB 4	0.6875 ± 0.001	0.68733
TB 5	0.6875 ± 0.001	0.68804

Dimensions in Inch

**Barcode # : 4094**

**Mfg. S/N : 025**

## Pole Tip Gap Measurements



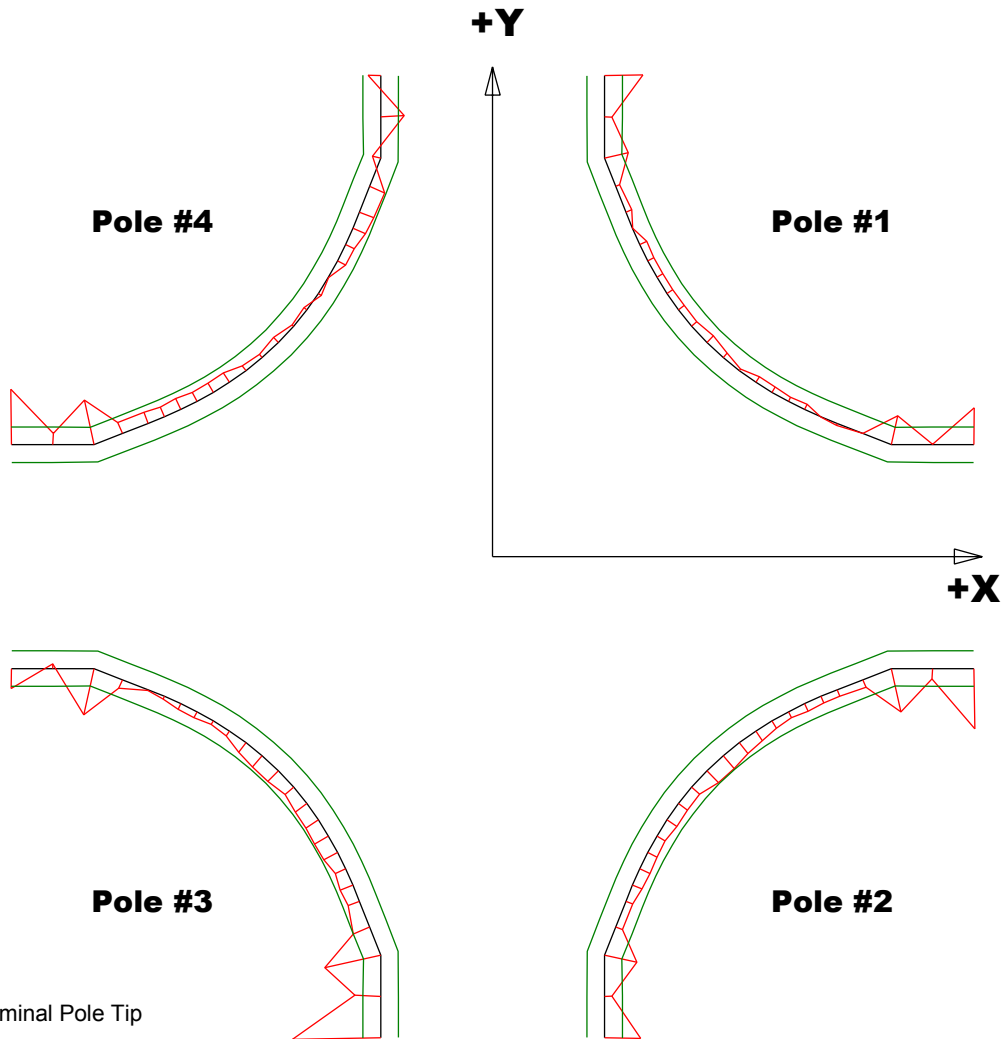
	Nominal Distance	Downstream Pole End	Upstream Pole End
Pole Tip Distance 1-3	0.433 ± .002	0.43425	0.43544
Pole Tip Distance 2-4	0.433 ± .002	0.43422	0.43319
Gap 1-2	0.159 ± .002	0.1606	0.15958
Gap 2-3	0.159 ± .002	0.16182	0.16039
Gap 3-4	0.159 ± .002	0.16023	0.16085
Gap 4-1	0.159 ± .002	0.15905	0.16076

Dimensions in Inch

**Barcode # : 4094**

**Mfg. S/N : 025**

## Composite Best-fit of Pole Tips, Downstream



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

Dimensions in Inch

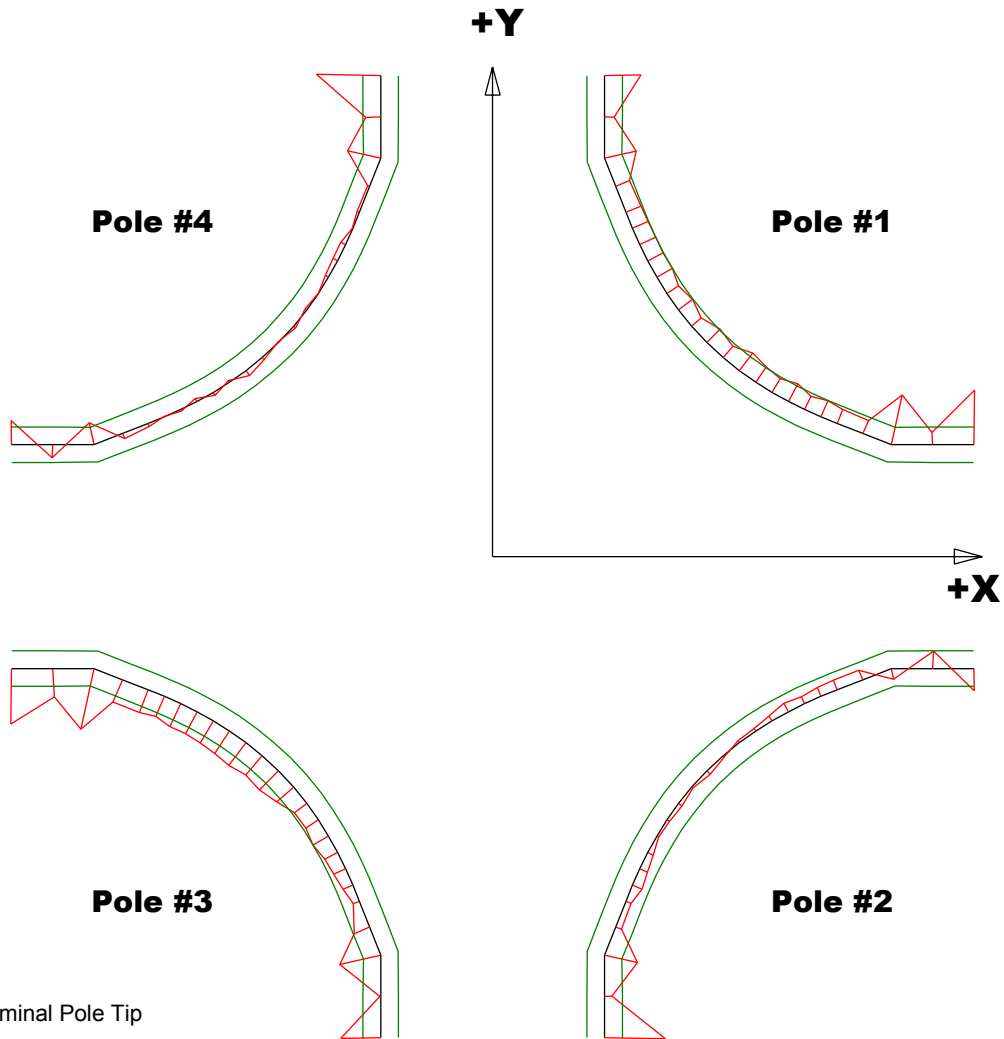
### Pole Tip Deviations

Pole Tip	#1	#2	#3	#4
Min. Dev.	-0.00217	-0.0034	-0.00498	-0.00312
Max. Dev.	0.00012	-0.00037	0.00026	0.00132

**Barcode # : 4094**

**Mfg. S/N : 025**

## Composite Best-fit of Pole Tips, Upstream



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

Dimensions in Inch

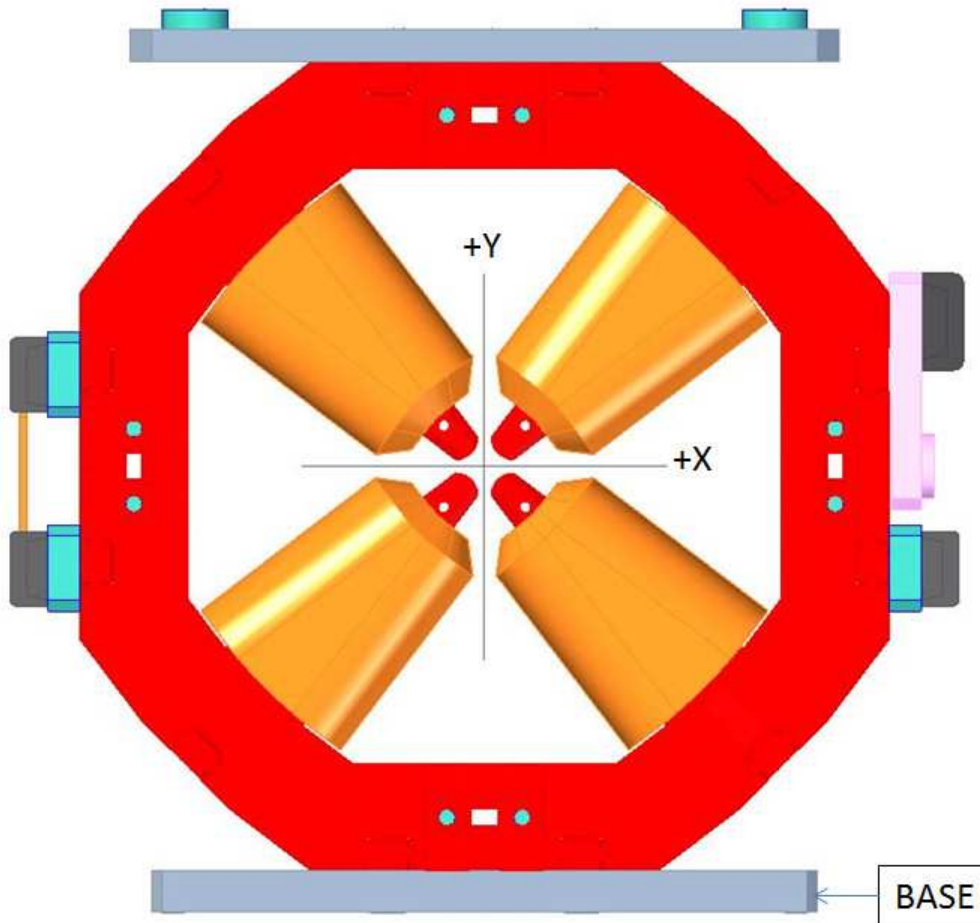
### Pole Tip Deviations

Pole Tip	#1	#2	#3	#4
Min. Dev.	-0.00306	-0.00341	-0.00349	-0.00362
Max. Dev.	-0.00054	0.00098	-0.00005	0.00074

**Barcode # : 4094**

**Mfg. S/N : 025**

## Angle of the Composite Pole Tip Best-Fit In Relation to Base



Angle in Decimal Degrees ° :0.05202

Angle in Milliradians :0.90793

**Barcode # : 4094**

**Mfg. S/N : 025**