

## SLAC Traveler for LCLS undulator re-tuning. Undulator S/N # 29      Dataset0002

This traveler is intended to cover magnetic measurements and mechanical fiducialization of the undulator segments at MMF.

### Preparation:

Move the undulator inside the temperature controlled room and keep it in the crate for 7 days to get the room temperature.

### Placing undulator on the measurement bench:

Earthquake T-bolts attached		✓
Thermistor blocks attached		✓
X-trajectory shims modified		✓
Y-trajectory shims replaced		✓
Check interference with probes		✓
Check end plates		✓
Technician (initials):		RC
Date (mm-dd-yyyy):		6/11 08

### Tuning.

Follow the fine tuning test plan to align the undulator to the bench, measure x , y field and calculate the trajectories, phases and field integrals, and fiducialize the undulator (LCLS-TN-06-17, LCLS-TN-07-2). X and Y to be set to 10 $\mu$ m; roll to 0.1mrad; pitch to 0.005mrad, and yaw to 0.010mrad.

Mechanical alignment done		✓
Magnetic alignment done		
Probe roll angle checked		

The following information is to be noted by an engineer upon finishing alignment to the granite:

Engineer (initials):	YL
Date (mm-dd-yyyy):	06/11/08
Average X (m):	0.028963
Average Y (m):	0.000359
Final Roll (rad):	+9.6 · 10 <sup>-6</sup>
Final Pitch (rad):	-1.9 · 10 <sup>-6</sup>
Final Yaw (rad):	+1.9 · 10 <sup>-6</sup>

The following information is to be noted by an engineer upon final tuning:

Engineer (Initials):	YL
Date (mm/dd/yyyy)	06/16/08
Reference magnet measurement (T):	<del>+10.10<sup>-6</sup></del> 0.369122
First integral Y at center (Tm):	-18.10 <sup>-6</sup>
Second integral Y at center (Tm <sup>2</sup> ):	+10.10 <sup>-6</sup>
First integral X at center (Tm):	+19.10 <sup>-6</sup>
Second integral X at center (Tm <sup>2</sup> ):	-10.10 <sup>-6</sup>
Magnetic axis position X (m):	0.028965
Magnetic axis position Y (m):	0.000368
Final Phase error rms (°):	4.2
Final max X trajectory error (μm):	-0.7
Final max Y trajectory error (μm):	±0.2
Measured K-value:	3.488077
X-field correction (T):	-9.10 <sup>-6</sup>
Y-field correction (T):	-5.10 <sup>-6</sup>
Final Phase error entrance (°):	-0.4
Final Phase error cell (°):	+1.0
Final Phase error exit (°):	+2.6
Slot number	27

URL of on-line Final tuning data:

[www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator/L143-112000-29/DATASET002/Fine%20Tuning/](http://www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator/L143-112000-29/DATASET002/Fine%20Tuning/)

**Fiducialization on Kugler bench:**

Upon completion of the tuning the undulator should be fiducialized; optical measurements to be done the same day as magnetic measurements.

Attach pointed magnets to the both ends of the undulator. Measure position of the PM centers w.r.t. the undulator center line.

The following information is to be noted by an engineer:

Engineer (Initials):	YL
Upstream PM X offset (m):	0.029384
Upstream PM Y offset (m):	0.000261
Downstream PM X offset (m):	0.029344
Downstream PM Y offset (m):	0.000252
Reference upstream PM X offset (m):	0.076974
Reference upstream PM Y offset (m):	0.000261
Reference downstream PM X offset (m):	0.077121
Reference downstream PM Y offset (m):	0.000568
Keyence probe (m):	+0.011068
Keyence block (m):	-0.011408

Have an alignment crew to measure offsets between PM tooling balls, the undulator tooling balls, reference PM tooling balls to an alignment reference line, Hall probe in X and gage block in Y. Attach alignment data sheet to the traveler.

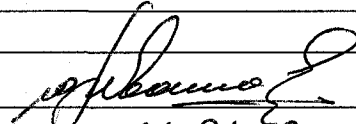
Surveyor (initials):	LG
Date (mm/dd/yyyy):	06/17/08

Move the undulator to CMM to finalize the fiducialization.

Attach CMM data sheet to the traveler.

URL of on-line fiducialization data:

[www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator/L143-112000-29/DATASET002/](http://www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator/L143-112000-29/DATASET002/)

Undulator tuning completed (signed):	
Date (mm/dd/yy)	06/18/08