

SLAC Traveler for LCLS undulator re-tuning.

Undulator S/N # 03 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):		SJ
Date (mm-dd-yyyy):		10/06/08

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 μ 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):	10/08/08
Average X (m):	0.028182
Average Y (m):	0.000283
Final Roll (rad):	-11.10 ⁻⁶
Final Pitch (rad):	+0.5.10 ⁻⁶
Final Yaw (rad):	+1.5.10 ⁻⁶

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Tuning process checklist:

X_0, Y_0 at nominal K found and recorded	✓
Trajectories straightened to $\pm 1\mu\text{m}$	✓
Phases set to $\pm 10^\circ$	✓
Upstream PM measured	✓
Long coil set	✓
Optical measurement of coil position done	✓
Kugler bench is OFF	✓
Field integrals tuned $\pm 6\text{ mm}$	✓
Coil and stages set in park position	✓
Kugler bench ON and re-initialized	✓
Trajectories, phases, and K checked	✓
Shims glued (if necessary)	✓
Shim table updated	✓
Gap clearance checked	✓
Trajectories, phases, and K checked	✓
Upstream PM measured	✓
Kugler bench OFF	✓
Long coil set for final measurements	✓
Optical measurement of coil position done	✓
Field integrals checked	✓
Final long coil dataset taken	✓
Coil and stages in park position	✓
Kugler bench ON and re-initialized	✓
Reference magnet measured	✓
Y_0 at min K checked	✓
Final Hall probe dataset taken	✓
Final dataset in retracted position taken	✓

$t = 19.91 \text{ }^\circ$

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

Engineer (Initials):	YL
Date (mm/dd/yyyy)	10/15/08
Reference magnet measurement (T):	-0.369125
First integral Y at center (Tm):	$-7 \cdot 10^{-6}$
Second integral Y at center (Tm ²):	$+10 \cdot 10^{-6}$
First integral X at center (Tm):	$+5 \cdot 10^{-6}$
Second integral X at center (Tm ²):	$+13 \cdot 10^{-6}$
Magnetic axis position X (m):	0.027715
Magnetic axis position Y (m):	0.000305
Final Phase error rms (°):	3.1
Final max X trajectory error (μm):	+0.5
Final max Y trajectory error (μm):	-0.5
Measured K-value:	3.488982
X-field correction (T):	$-10 \cdot 10^{-6}$
Y-field correction (T):	$-6 \cdot 10^{-6}$
Final Phase error entrance (°):	-1.4
Final Phase error cell (°):	-1.0
Final Phase error exit (°):	-0.1
Slot number	25

URL of on-line Final tuning data:

www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator/L143-112000-03/DATASET0002Fine%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):	0.028302
Upstream PM Y offset (m):	0.000210
Downstream PM X offset (m):	0.028337
Downstream PM Y offset (m):	0.000165
Reference upstream PM X offset (m):	0.075898
Reference upstream PM Y offset (m):	0.000235
Reference downstream PM X offset (m):	0.075937
Reference downstream PM Y offset (m):	0.000335
Keyence probe (m):	+0.011040
Keyence block (m):	-0.011426

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.

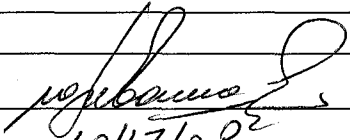
Surveyor (initials):	LG
Date (mm/dd/yyyy):	10/15/08

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/L143-112000-03/DATASET0002

Undulator tuning completed (signed):	
Date (mm/dd/yy)	10/17/08