SLAC Traveler for LCLS undulator re-tuning.
Undulator S/N # 22   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 checked	*SRL*	✓
Thermistor blocks attached	*SRL*	✓
X-trajectory shims modified	*SRL*	✓
Y-trajectory shims replaced		✓
Check interference with probes		✓
Check end plates	*SRL*	✓
Technician (initials):	*SRL*	
Date (mm-dd-yyyy):	03/12/2009	

} X

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 10µm; 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):	X	
Date (mm-dd-yyyy):	03/12/09	
Average X (m):	0.028785	0.028808
Average Y (m):	0.000357	0.000404
Final Roll (rad):	$-3 \cdot 10^{-6}$	$+4 \cdot 10^{-6}$ ✓✓
Final Pitch (rad):	$+1.7 \cdot 10^{-6}$	$+0.2$
Final Yaw (rad):	$+1.8 \cdot 10^{-6}$	$+3.4$

✓✓ *After Granite re-alignment*

$t = 19.97\,°C \qquad t = 19.93\,°C$

03/23/09
Fiducializati
Check

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

Engineer (Initials):	$\mathcal{X}$	
Date (mm/dd/yyyy)	03/18/09	
Reference magnet measurement (T):	-0.369153	
First integral Y at center (Tm):	$-2 \cdot 10^{-6}$	
Second integral Y at center (Tm^2):	0.0	
First integral X at center (Tm):	$+1 \cdot 10^{-6}$	
Second integral X at center (Tm^2):	$-2 \cdot 10^{-6}$	
Magnetic axis position X (m):	0.028808	0.028800
Magnetic axis position Y (m):	0.000424	0.000395
Final Phase error rms (°):	3.2	3.2
Final max X trajectory error (μm):	$+0.7$	-0.04 $+0.$
Final max Y trajectory error (μm):	-0.8	-0.04 $-0.$
Measured K-value:	3.495006	3.495004
X-field correction (T):	$+0.02 \cdot 10^{-6}$	-0.04
Y-field correction (T):	$-0.06 \cdot 10^{-6}$	-0.04
Final Phase error entrance (°):	-1.0	-1.0
Final Phase error cell (°):	$+0.6$	$+0.2$
Final Phase error exit (°):	$+0.9$	$+0.7$
Slot number	12	

URL of on-line Final tuning data:

www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator
/L143-112000-22/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:

03/23/09

Engineer (Initials):	X	X
Upstream PM X offset (m):	0.029231	0.029224
Upstream PM Y offset (m):	0.000356	0.000333
Downstream PM X offset (m):	0.029163	0.029167
Downstream PM Y offset (m):	0.000220	0.000230
Reference upstream PM X offset (m):	0.076860	0.076853
Reference upstream PM Y offset (m):	0.000296	0.000286
Reference downstream PM X offset (m):	0.076829	0.076818
Reference downstream PM Y offset (m):	0.000291	0.000283
Keyence probe (m):	+0.011154	+0.011136
Keyence block (m):	−0.011368	−0.011366

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.
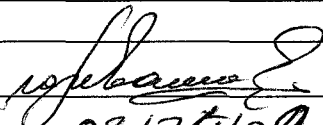
Surveyor (initials):	L G
Date (mm/dd/yyyy):	03/18/09

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
/L143-112000-22/DATASET002

Undulator tuning completed (signed):	
Date (mm/dd/yy)	03/26/09