SLAC Traveler for LCLS undulator re-tuning.
Undulator S/N # 19 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		✓	EC
Thermistor blocks attached		✓	
X-trajectory shims modified		✓	
Y-trajectory shims replaced		✓	YL
Check interference with probes		✓	
Check end plates		✓	EC
Technician (initials):		✓	
Date (mm-dd-yyyy):		✓	5/7/09

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):	YL
Date (mm-dd-yyyy):	05/07/09
Average X (m):	0.029126
Average Y (m):	0.000430
Final Roll (rad):	$-3 \cdot 10^{-6}$
Final Pitch (rad):	$-0.2 \cdot 10^{-6}$
Final Yaw (rad):	$+1.2 \cdot 10^{-6}$

$t = 19.96\ ^{\circ}C$

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

Engineer (Initials):	X
Date (mm/dd/yyyy)	05/12/09
Reference magnet measurement (T):	−0.369157
First integral Y at center (Tm):	$+3 \cdot 10^{-6}$
Second integral Y at center (Tm^2):	$-3 \cdot 10^{-6}$
First integral X at center (Tm):	$+10 \cdot 10^{-6}$
Second integral X at center (Tm^2):	$+16 \cdot 10^{-6}$
Magnetic axis position X (m):	0.029166
Magnetic axis position Y (m):	0.000424
Final Phase error rms (°):	3.3
Final max X trajectory error (μm):	−0.7
Final max Y trajectory error (μm):	−0.6
Measured K-value:	3.498171
X-field correction (T):	$-0.10 \cdot 10^{-6}$
Y-field correction (T):	$+0.02 \cdot 10^{-6}$
Final Phase error entrance (°):	−1.5
Final Phase error cell (°):	+1.4
Final Phase error exit (°):	+0.8
Slot number	5

URL of on-line Final tuning data:

www-group.slac.stanford.edu/met/MagMeas/MAGDATA/LCLS/Undulator/L143-112000-19/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):	YW
Upstream PM X offset (m):	0.029357
Upstream PM Y offset (m):	0.000354
Downstream PM X offset (m):	0.029387
Downstream PM Y offset (m):	0.000308
Reference upstream PM X offset (m):	0.076842
Reference upstream PM Y offset (m):	0.000330
Reference downstream PM X offset (m):	0.076803
Reference downstream PM Y offset (m):	0.000320
Keyence probe (m):	+0.011116
Keyence block (m):	−0.011364

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):	05/12/09

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/L143-112000-19/DATASET002

Undulator tuning completed (signed):	
Date (mm/dd/yy)	05/18/09