**ECKO-7-33 magnetic measurements results**

1. The mechanical measurement of the magnet's centers relative to the tooling balls on the CCM, so we can align it.

So I would think one measures at z=0 and z=33/55cm the lower and upper pole tip relative to the tooling balls for y and a reasonable location either on the pole tips or the support frame for x.

Maybe one measures in addition whether the surfaces are parallel at least at the ends.

An alignment crew has measured positions of the undulator tooling balls w.r.t. the magnetic axis defined by Hall probe measurements. In the bench coordinate system the magnetic axis is found by the following procedure:

For x position; scan By vs. x at every pole, find a pole center in x, and fit a line through the all pole centers.

For y position; scan By vs. y at every pole, fit a curve, find a pole center at minimum, and fit a line through the all pole centers.

The magnetic axis position is:

X0 = 0.030600m

Y0 = 0.000216m

The fiducialization data could be found at:

V:\MET\MagServe\MagData\LCLS\Undulator\ECKO7-55\DATASET0001\Fine Tuning\ fiducialization\_data

2. First field integral in the range from x=-2.5 mm to x=2.5 mm at y =0 with a step length of 0.5 mm. The uncertainty should be around 10 Gcm.(in order to get the integral value, you need to measure the By field from z =0 to z =33)

2.1 Second field integral for the same range and step size. Tolerance should be 1000 Gcm^2, as per Dao.

The first and second field integrals at x=0, y=0 are calculated from the Hall probe measurements. The probe measurements are corrected for the probe zero drift and offset but not for the earth fields.

First By = -48 G⋅cm

Second By = -29 G⋅cm 2

First Bx = +16 G⋅cm

Second Bx = +9 G⋅cm 2

In the tunnel the Earth field estimate is:

Bx\*L = 2x10-5 T \* .7 m = 1.4x10-5 Tm = +24 G⋅cm;

By\*L = -4x10-5 T \* .7 m = -2.8x10-5 Tm. = -48 G⋅cm.

The first and second field integrals vs. X are measured by the 3.6m long coil. The measurements are then re-calculated for 1.2m measurement range.

Results of the coil measurements are summarized in:

V:\MET\MagServe\MagData\LCLS\Undulator\ECKO7-55\DATASET0001\Fine Tuning\Long Coil Scans\field integrals.xlsx

3. By vs x at y=0 at some longitudinal position. at 2 or 3 field maxima (or maybe all 10 maxima)?

We have measured By vs X at all poles. Results are in:

V:\MagData\LCLS\Undulator\ECKO7-55\DATASET0001\Fine Tuning\Align X Scan\Run 006\ bscanx\_dat.\*\*\*

By field values are in column #4 (T); \*\*\* means the pole number.

4. By vs z at x=0 and y=0.

Results are in:

V:\MET\MagServe\MagData\LCLS\Undulator\ECKO7-55\DATASET0001\Fine Tuning\Z Scans\Run 015\ x+00000\_y+000\_bscanz.dat

Trajectories and phase errors are in:

V:\MET\MagServe\MagData\LCLS\Undulator\ECKO7-55\DATASET0001\Fine Tuning\ trajectories and phases.docx

Constants are added to the measured fields to compensate for the probe zero drift:

CORR\_BX\_ADD = -0.000005 T

CORR\_BY\_ADD = -0.000006 T

Earth fields are subtracted to compare with the LTI measurements. The earth fields measured in MMF are in:

V:\MET\MagServe\MagData\LCLS\Background\_fields\Kugler\_probe\ earth\_fields\_bscanz.dat

The real trajectories (without earth field corrections) are in:

V:\MET\MagServe\MagData\LCLS\Undulator\ECKO7-55\DATASET0001\Fine Tuning\Z Scans\Run 015\ id\_anal.ps

5. Undulator parameter K with an accuracy of 1.0%.

The measured K is 2.0863 at 20.04°C; ΔK/K = 0. 7%.