Fermilab

6/20/91
TS-SSC 91-127

To: Wally Zimmerman

From: Jim Strait

Subject: Change in shim for long 50 mm outer coil mold

The shim under the stop bar on the long 50 mm magnet outer mold should be increased from 7 mils to 10 mils starting with the next coil (15M-50-2008 for DCA313). This will give a total thickness of the stop bar plus shim of 0.250 inch.

Over the course of long coil production, the average size of both the inner and the outer coils has become progressively smaller. Fig. 1 and Table I shows the average coil size versus coil number and indicates which coils belong to which magnet. Between inner coils 1 and 2 (15M-50-1001 and -1002) the mold shim was increased by 5 mils and between outer coils 1 and 2 the outer mold shim was decreased 3 mils. Since then the mold conditions have remained nominally constant, but the inner coil size has decreased about 2.5 mils and the outer coil size has decreased almost 5 mils. The cause of this decrease is not known.

Based on experience with the short 50 mm magnets and the first two long 50 mm magnets, the target size range for inner coils is approximately +7 to +11 mils relative to the master and for outer coils is approximately -4 to 0 mils relative to the master. Fig. 2 ("Wake plot[1]") summarizes the size and preload data for all 50 mm magnets made so far. The position of the square for each magnet gives the size relative to the master of the inner and outer coils at the strain gauge pack. The length of the arrow in each direction gives the difference between the measured coil prestress and the center of the target band: 10 kpsi in the inner coil and 8 kpsi in the outer coil. If the arrow points to the right or up, then the outer or inner prestress is above the center of the target band and therefore the outer or inner coil is must be larger than the center of the target coil size band. In the absence of measurement errors, the arrows should all point away from a common point which corresponds to "perfect" inner and outer coil sizes. From this plot it seems that the target inner coil size is about +9 mils and the target outer coil size is about -2 mils. A band of ±2 mils about these gives the target ranges quoted above.

The most recent inner coils still lie within the target range, so no inner mold shim change is needed at this time. However, if the trend towards smaller coil sizes continues, the mold cavity may have to be increased later. The most recent outer coil (15M-50-2007) is 1 mil smaller than the lower bound and the two previous coils (2005 and 2006) are near the bottom of the target range. The 3 mil increase in mold cavity should put the next outer coil at or a little above the center of the target range.

Reference

[1] M. Wake, Relationship between coil-size and preloading in 50 mm magnets, TS-SSC 91-070, 4/15/91.

cc: R.Bossert, J.Carson, S.Delchamps, S.Gourlay, W.Koska, E.G.Pewitt, R.Rihel, P.Sanger, R.Sims, M.Wake, D.Smith, M.Wake, Magnet Control Board members not listed above.

Table I

Summary of Long Coil Average Sizes

Inner	Inner	Outer	Outer
1	0.0105 (with 5 mil shim)	1	0.0025 DCA310
1	0.0055 DCA310	2	-0.0004
2	0.0107	3	-0.0018
3	0.0104 DCA311	4	-0.0023 DCA311
4	0.0094	5	-0.0037
5	0.0085 DCA312	6	-0.0032 DCA312
6	0.0082	7	-0.0050

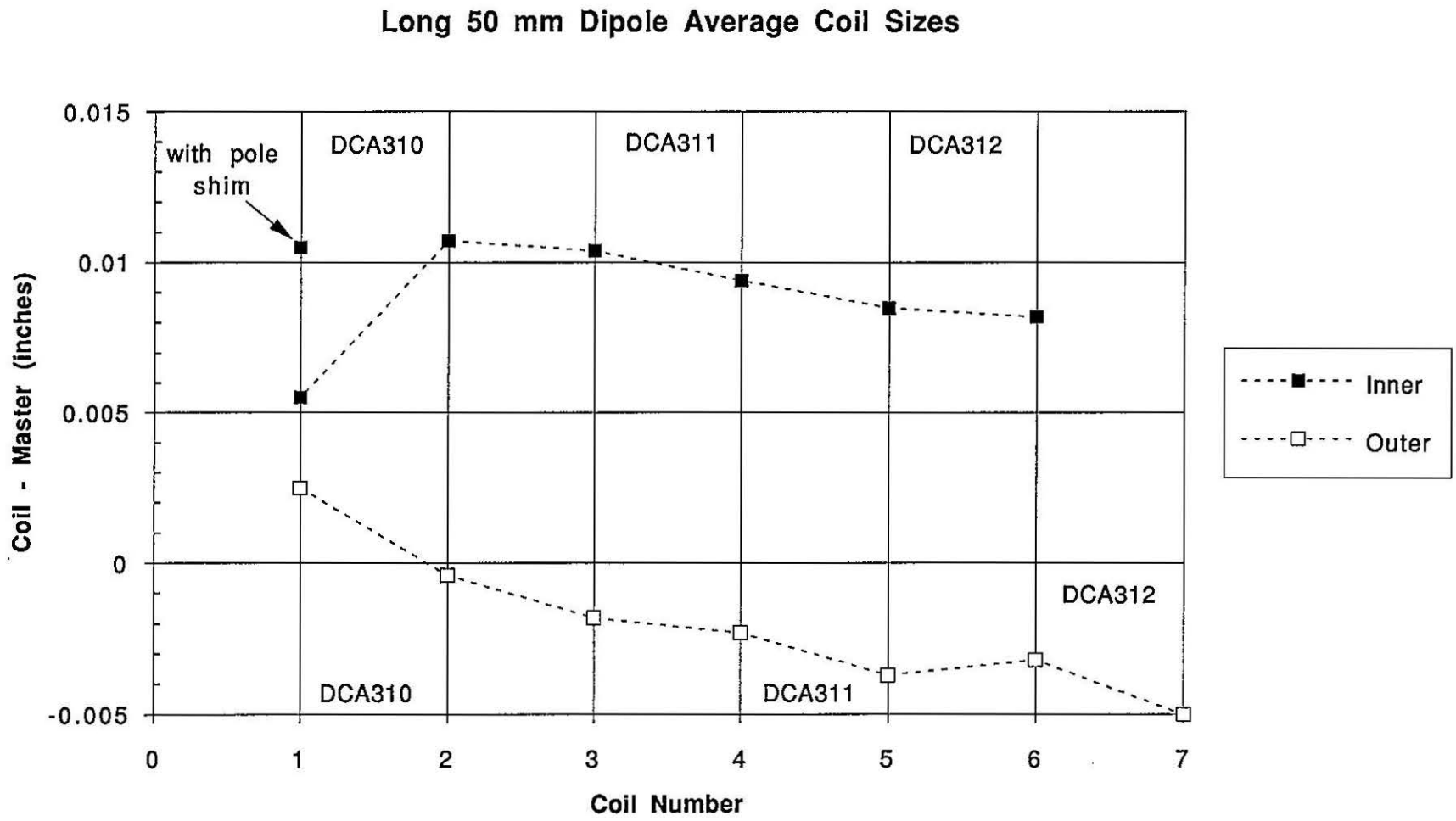
Long 50 mm Dipole Average Coil Sizes
0.015
0.01
0.005
0
-0.005
Coil - Master (inches)
with pole shim
DCA310
DCA311
DCA312
DCA312
DCA310
DCA311
0
1
2
3
4
5
6
7
Coil Number
Inner
Outer

Figure 1

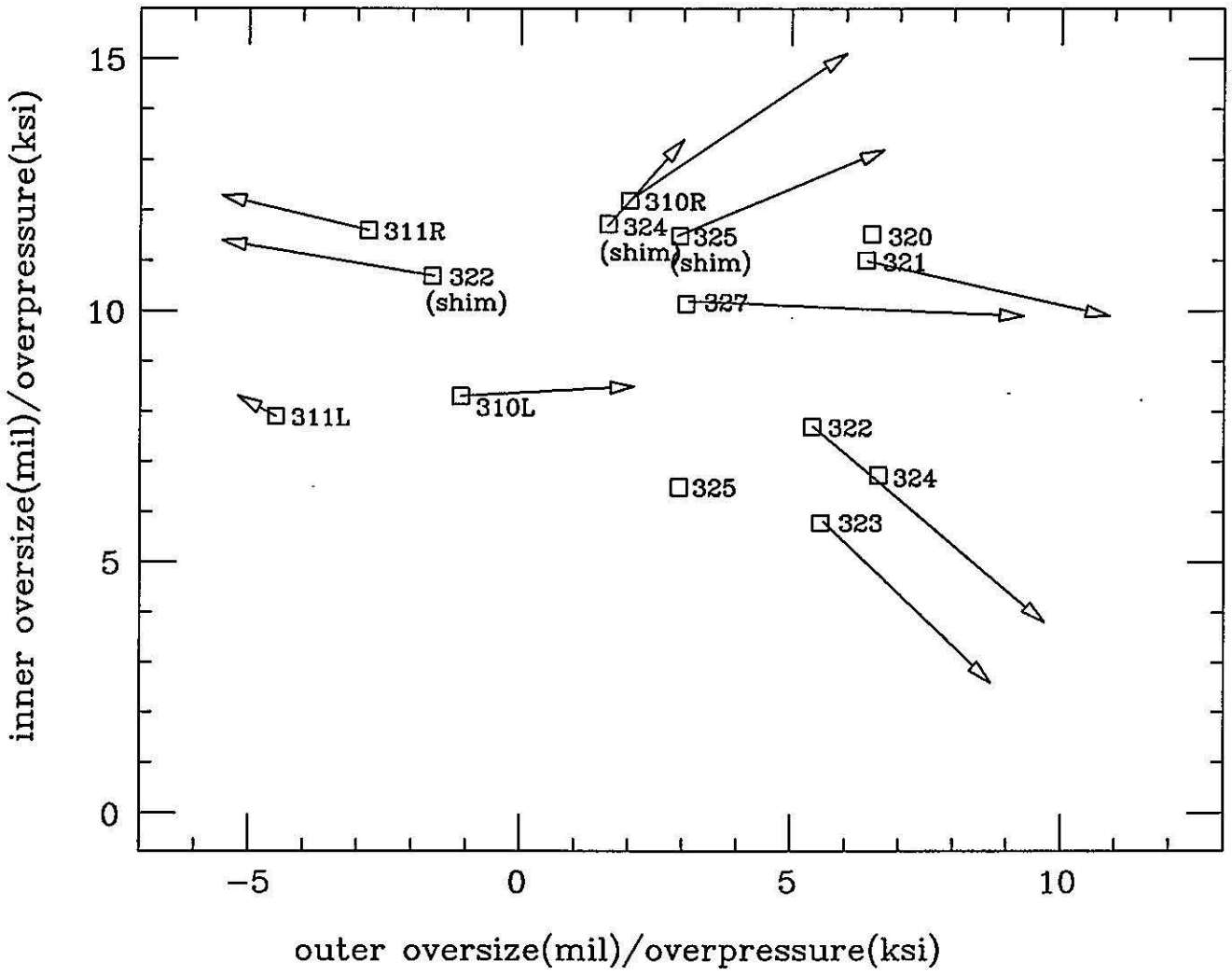
15
10
5
0
−5
0
5
10
inner oversize(mil)/overpressure(ksi)
outer oversize(mil)/overpressure(ksi)
311R
322
(shim)
310R
324
(shim)
325
(shim)
320
321
327
311L
310L
322
324
325
323

Figure 2