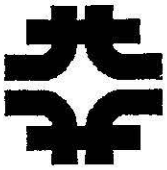

TS-SSC-92-003 *
January 6, 1992
Masayoshi Wake

Estimation From Ten Stack Measurement Results(II)

Previous note TS-SSC-91-242 described interpretation of ten stack results using preliminary results. More data were accumulated since then and some of the data used in that analysis was found wrong. Sample H1 and H2 in early data were actually mislabeled. Mystery in the difference between ten stack and coil was caused by this. This note is to make correction on the previous note and to draw a necessary thickness value for the magnet design. The results are much more consistent with magnet data. The data used in this note are summarized in Table1.

The same method as the previous note was used to find the dependence to the curing pressure. By the try and error iteration following curing pressure dependence was found for each material.

Pressure Dependence	Kapton-H	Kapton-HA	Kapton-LT	Glass Tape
mil/10stack/ksi	0.16	0.18	0.20	1.43

There is not much differences among different kind of Kaptons but glass tape apparently has large dependence on the curing pressure. This means a large dynamic range to adjust the size of the cured coil.

Using above coefficient as the correction factor, 10 ksi data can be converted to 6 ksi. Fig 1 is the plot of ten stack sizes as a function of insulation layer number. 10 ksi data and 6 ksi data are shown consistently on the same linear line regardless the kind of Kapton, Kaptons are found to be 1.2 mil/layer for the 6 ksi curing which may be close to the averaged pressure in the curing process. One layer means one wrap and has one sheet of Kapton in both faces. The thickness of glass tape is 3.5 mil/layer which correspond to 2.6 times of Kapton's.

If 10 stack data are scaled to the coil data adjusting the sample with glass tape as the reference, the comparison is given in Fig2 and Fig3. The agreement between coil data and ten stack data is not bad. For the inner coil, some coils seem to be deviated more than other data. This may be because these coils were cured with large change of curing shims.

These values are consistent with the experience of the change in wedge insulation. We replaced 3 wrap layers of glass tape to 6 layers of Kapton and had

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reduction of about 3 mil. The calculated value from above interpretation gives (3.5-1.2x2)x3=3.3 mil.

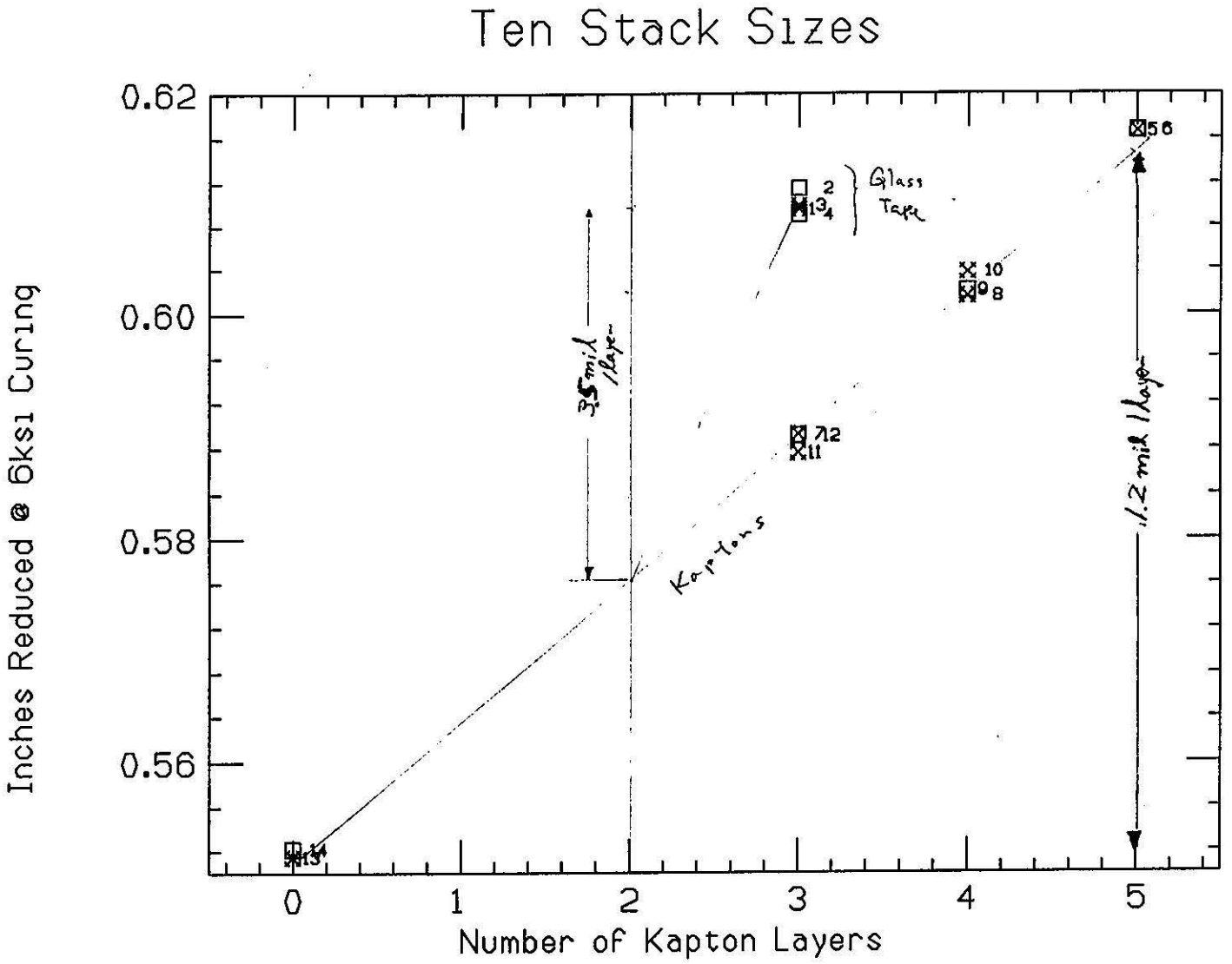
Therefore the numbers for the design of the coils would be :

material	single sheet thickness
Kapton-H/HA/LT	0.60 mil
Glass Tape	1.75 mil

For the minimum insulation coil, these numbers give 50 mil as the total shimming of wedges. Although, if we directly use the coil data without taking the difference of shimming into account, the total shimming of wedges is 60 mil.

Table1.

Sample Number		Stack	pressure *ksi*	H layer	HA layer	LT layer	GT layer	$D_{initial}$ (in)	D_{final} (in)
gt8	01	10	10	2	0	0	1	0.6250	0.60258
gt9	02	10	6	2	0	0	1	0.6270	0.61152
gt10	03	10	10	2	0	0	1		0.60294
gt11	04	10	6	2	0	0	1		0.60908
h1	05	10	10	5	0	0	0	0.6345	0.61342
h2	06	10	6	5	0	0	0	0.6345	0.61668
h3	07	10	10	3	0	0	0		0.58730
ha2	08	10	10	0	3	1	0	0.6215	0.59860
ha3	09	10	6	0	3	1	0	0.6220	0.60206
hl50-1	10	10	10	0	2	2	0		0.60072
ha50-2	11	10	10	0	2	1	0		0.58538
ha50-3	12	10	6	0	2	1	0	0.6075	0.58910
bare2	13	10	10	0	0	0	0		0.55150
bare3	14	10	6	0	0	0	0		0.55220
COIL128	15	22	6	2	0	0	1		1.0130
COIL129	16	22	6	4	0	0	0		0.9982
COIL130	17	22	6	5	0	0	0		1.0206
COIL131	18	22	6	5	0	0	0		1.0150
COIL132	19	22	6	3	0	0	0		0.9547
COIL133	20	22	6	0	2	1	0		0.9490
COIL230	21	27	6	4	0	0	0		0.9900
COIL231	22	27	6	5	0	0	0		1.0162
COIL232	23	27	6	3	0	0	0		0.9460
COIL233	24	27	6	0	2	1	0		0.9440
COIL229	25	27	6	2	0	0	1		0.9966


Ten Stack Sizes
Inches Reduced @ 6ksi Curing
0.62
0.60
0.58
0.56
0
1
2
3
4
5
Number of Kapton Layers
Glass Tape
3.5 mil / layer
Kaptons
1.2 mil / layer

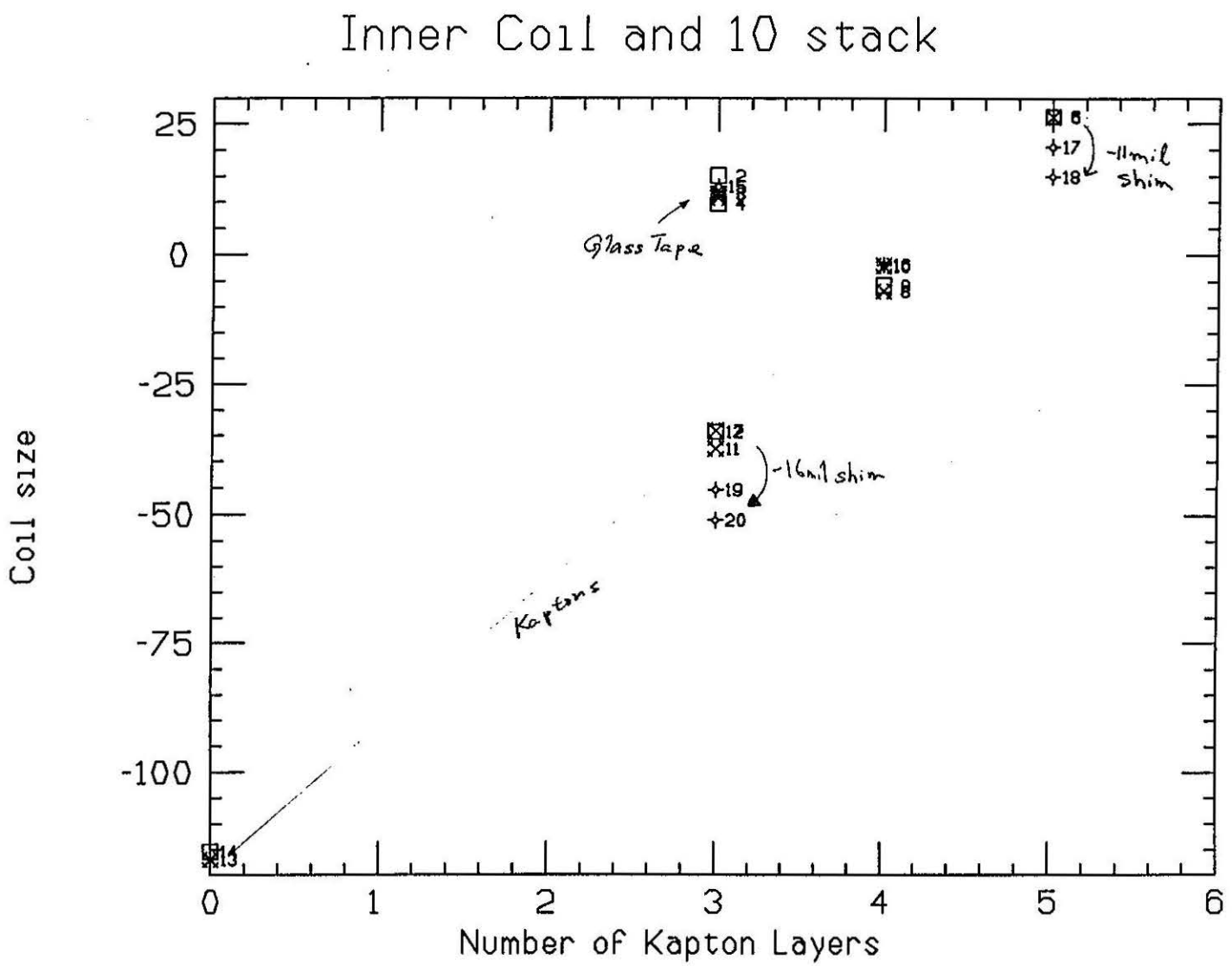

Inner Coil and 10 stack
Coil size
Number of Kapton Layers
25
0
-25
-50
-75
-100
0
1
2
3
4
5
6
Glass Tape
Kaptons
-11mil shim
-16mil shim

Fig. 2

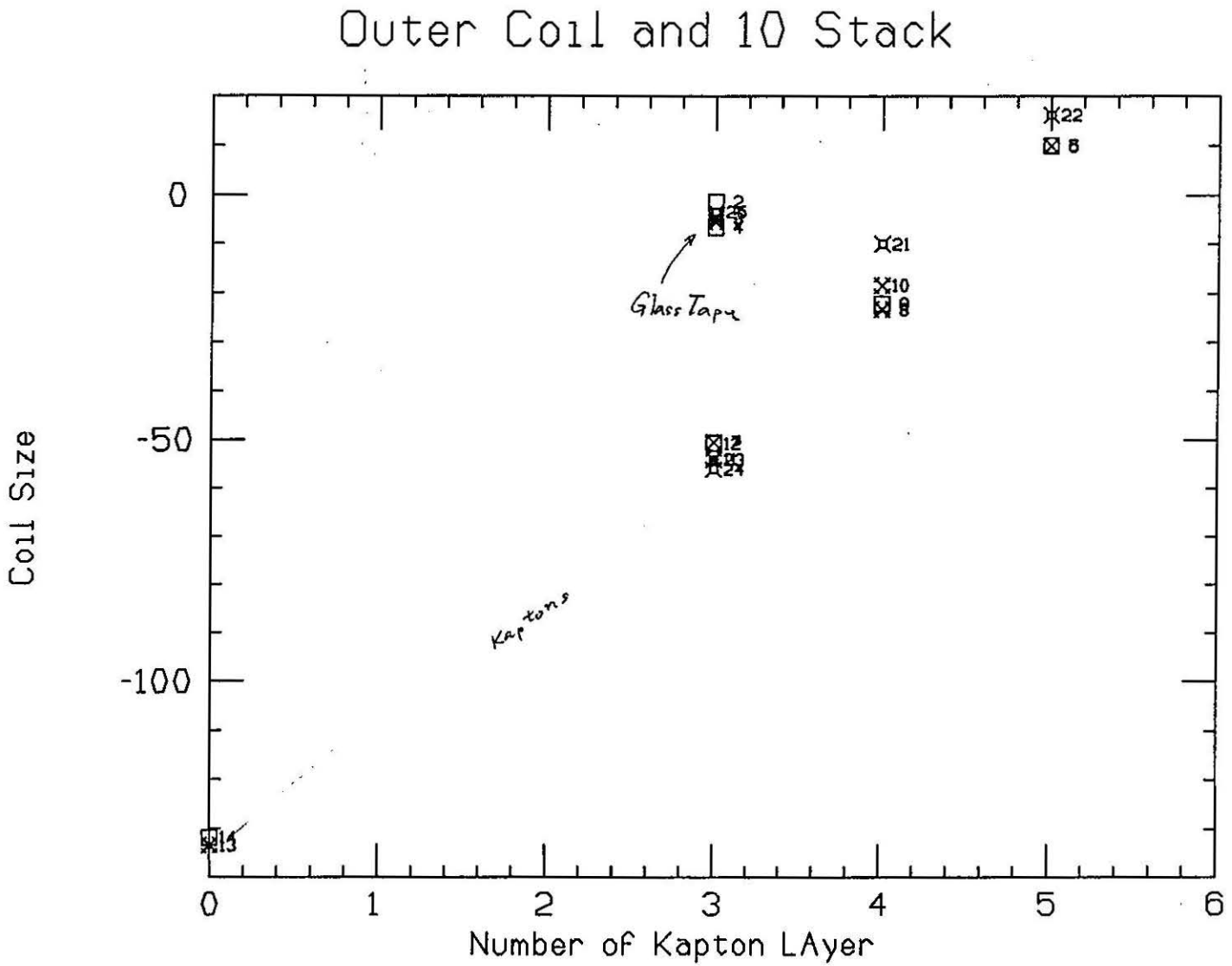

Outer Coil and 10 Stack
Coil Size
0
-50
-100
0
1
2
3
4
5
6
Number of Kapton LAyer
Glass Tape
Kaptons
22
6
21
10
8
12
20
24
13

Fig. 3