Fermilab

TS-SSC 91-211
11/1/91
R.E. Sims*

Sizes and Moduli of First all-Kapton Coils

Attached are summaries of the coil sizes and moduli of the first short coils molded at Fermilab with the glass tape replaced by Kapton coated with 3M 2290 B-stage epoxy. All coils were cured with the standard curing cycle[1] and the standard curing mold shims[2]. The specific characteristics of each coil are noted on the tables and graphs. Creep measurements were made on the coils at one measurement position using the sizing gauge.

[1] M. Wake and R.E. Sims, Molding procedure of 1.5 m dipole, TS-SSC 91-072, 4/24/91.

[2] R. Bossert, Curing mold shims on practice coils 126 and 127, TS-SSC 91-166, 8/20/91; M. Wake, Coil size and shimming of DSA series outer coil (II), TS-SSC 91-102, 5/31/91.

*Cover page "ghost written" by Jim Strait.

Chart Version # 1.0
SHORT 50MM Inner Coil # 1M-50-128 Experimental Coil

Master Used - Inner Master #1
Press Fixture Serial Number Used -
Machine Serial Number Used - Not Available

Shim Size Used - No Shim Used

Mean Arc of Master - 1.5946"

	QUADRANT I/III POSITION 1-14				QUADRANT II/IV POSITION 1-14				WHOLE COIL		
	8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE
AVERAGE	0.0180	0.0148	2.03E+06	AVERAGE	0.0164	0.0131	2.13E+06	AVERAGE	0.0172	0.0139	2.08E+06
STD DEV	0.0010	0.0007	2.29E+05	STD DEV	0.0012	0.0009	1.04E+05	STD DEV	0.0014	0.0012	1.73E+05
RANGE	0.0023	0.0023	5.54E+05	RANGE	0.0026	0.0025	2.20E+05	RANGE	0.0048	0.0042	5.54E+05
MAX	0.0194	0.0160	2.28E+06	MAX	0.0172	0.0143	2.28E+06	MAX	0.0194	0.0160	2.28E+06
MIN	0.0171	0.0137	1.73E+06	MIN	0.0146	0.0118	2.06E+06	MIN	0.0146	0.0118	1.73E+06

GLASS EPOXY TAPE ON CABLE & ALL KAPTON ON WEDGES

Chart Version # 1.0
SHORT 50MM Inner Coil # 1M-50-129 Experimental Coil

Master Used - Inner Master #1
Press Fixture Serial Number Used -
Machine Serial Number Used - Not Available

Shim Size Used - No Shim Used

Mean Arc of Master - 1.5946"

	QUADRANT I/III POSITION 1-14				QUADRANT II/IV POSITION 1-14				WHOLE COIL		
	8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE
AVERAGE	0.0058	-0.0015	8.86E+05	AVERAGE	0.0071	-0.0006	9.16E+05	AVERAGE	0.0064	-0.0011	9.01E+05
STD DEV	0.0010	0.0006	5.08E+04	STD DEV	0.0006	0.0012	3.20E+04	STD DEV	0.0010	0.0010	4.25E+04
RANGE	0.0021	0.0019	1.13E+05	RANGE	0.0014	0.0041	7.82E+04	RANGE	0.0030	0.0041	1.13E+05
MAX	0.0068	-0.0007	9.56E+05	MAX	0.0077	0.0014	9.56E+05	MAX	0.0077	0.0014	9.56E+05
MIN	0.0047	-0.0026	8.43E+05	MIN	0.0063	-0.0027	8.78E+05	MIN	0.0047	-0.0027	8.43E+05

(AVERAGES, STD DEV, RANGE, MIN, MAX, FOR CALCULATIONS ABOVE ARE FROM THE COIL WITH RESPECT TO THE MASTER)

ALL KAPTON (H) ON CABLE & WEDGES 50% WRAP OVER 50% WRAP

Chart Version # 1.0
SHORT 50MM Inner Coil # 1M-50-130 Experimental

Master Used - Inner Master #1
Press Fixture Serial Number Used -
Machine Serial Number Used - Not Available

Shim Size Used - No Shim Used

Mean Arc of Master - 1.5946"

	QUADRANT I/III POSITION 1-14				QUADRANT II/IV POSITION 1-14				WHOLE COIL		
	8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE
AVERAGE	0.0265	0.0209	1.21E+06	AVERAGE	0.0262	0.0203	1.17E+06	AVERAGE	0.0263	0.0206	1.19E+06
STD DEV	0.0003	0.0006	3.28E+04	STD DEV	0.0012	0.0010	7.56E+04	STD DEV	0.0008	0.0009	5.72E+04
RANGE	0.0006	0.0021	6.95E+04	RANGE	0.0025	0.0037	1.76E+05	RANGE	0.0025	0.0037	1.76E+05
MAX	0.0266	0.0219	1.25E+06	MAX	0.0276	0.0219	1.28E+06	MAX	0.0276	0.0219	1.28E+06
MIN	0.0260	0.0198	1.19E+06	MIN	0.0251	0.0182	1.10E+06	MIN	0.0251	0.0182	1.10E+06

(AVERAGES, STD DEV, RANGE, MIN, MAX, FOR CALCULATIONS ABOVE ARE FROM THE COIL WITH RESPECT TO THE MASTER)

ALL KAPTON (H) ON CABLE AND WEDGES 50% WRAP OVER 66% WRAP

Chart Version # 1.0
SHORT 50MM Outer Coil # 1M-50-227

Master Used - Outer Master #1
Press Fixture Serial Number - 72195
Machine Serial Number Used - SEMI-02

Shim Size Used - No Shim Used

Mean Arc of Master - 1.4513"

	QUADRANT I/II POSITION 1-14				QUADRANT III/IV POSITION 1-14				WHOLE COIL		
	8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE
AVERAGE	-0.0002	-0.0024	2.57E+06	AVERAGE	-0.0009	-0.0034	2.33E+06	AVERAGE	-0.0005	-0.0029	2.45E+06
STD DEV	0.0008	0.0009	1.88E+05	STD DEV	0.0006	0.0010	2.94E+05	STD DEV	0.0007	0.0010	2.60E+05
RANGE	0.0017	0.0032	4.42E+05	RANGE	0.0013	0.0030	7.04E+05	RANGE	0.0019	0.0038	8.29E+05
MAX	0.0004	-0.0013	2.77E+06	MAX	-0.0002	-0.0021	2.64E+06	MAX	0.0004	-0.0013	2.77E+06
MIN	-0.0013	-0.0045	2.33E+06	MIN	-0.0015	-0.0051	1.94E+06	MIN	-0.0015	-0.0051	1.94E+06

(AVERAGES, STD DEV, RANGE, MIN, MAX, FOR CALCULATIONS ABOVE ARE FROM THE COIL WITH RESPECT TO THE MASTER)

GLASS-EPOXY TAPE ON CABLE + KAPTON WEDGES

Chart Version # 1.0
SHORT 50MM Outer Coil # 1M-50-230 EXPERIMENTAL

Master Used - Outer Master #1
Press Fixture Serial Number Used -
Machine Serial Number Used - Not Available

Shim Size Used - No Shim Used

Mean Arc of Master - 1.4513"

	QUADRANT I/II POSITION 1-14				QUADRANT III/IV POSITION 1-14				WHOLE COIL		
	8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE
AVERAGE	-0.0043	-0.0095	1.12E+06	AVERAGE	-0.0043	-0.0101	1.05E+06	AVERAGE	-0.0043	-0.0098	1.09E+06
STD DEV	0.0005	0.0004	6.19E+04	STD DEV	0.0004	0.0004	6.39E+04	STD DEV	0.0004	0.0005	7.06E+04
RANGE	0.0010	0.0014	1.48E+05	RANGE	0.0008	0.0014	1.44E+05	RANGE	0.0012	0.0019	2.33E+05
MAX	-0.0040	-0.0088	1.19E+06	MAX	-0.0038	-0.0093	1.10E+06	MAX	-0.0038	-0.0088	1.19E+06
MIN	-0.0050	-0.0102	1.04E+06	MIN	-0.0046	-0.0107	9.56E+05	MIN	-0.0050	-0.0107	9.56E+05

(AVERAGES, STD DEV, RANGE, MIN, MAX, FOR CALCULATIONS ABOVE ARE FROM THE COIL WITH RESPECT TO THE MASTER)

ALL KAPTON 50% WRAP OVER 50% WRAP

Chart Version # 2.0 10/19/91
SHORT 50MM Outer Coil # 1M-50-231 EXPERIMENTAL

Master Used - Outer Master #1
Press Fixture Serial Number Used -
Machine Serial Number Used - Not Available

Shim Size Used - No Shim Used

Mean Arc of Master - 1.4513"

	QUADRANT I/II POSITION 1-14				QUADRANT III/IV POSITION 1-14				WHOLE COIL		
	8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE		8 kpsi	12 kpsi	MOE
AVERAGE	0.0225	0.0168	1.13E+06	AVERAGE	0.0212	0.0156	1.16E+06	AVERAGE	0.0218	0.0162	1.15E+06
STD DEV	0.0003	0.0009	1.07E+04	STD DEV	0.0016	0.0015	4.86E+04	STD DEV	0.0013	0.0014	3.73E+04
RANGE	0.0008	0.0033	2.16E+04	RANGE	0.0037	0.0045	1.10E+05	RANGE	0.0037	0.0045	1.10E+05
MAX	0.0228	0.0179	1.13E+06	MAX	0.0233	0.0183	1.20E+06	MAX	0.0233	0.0183	1.20E+06
MIN	0.0220	0.0146	1.11E+06	MIN	0.0196	0.0138	1.09E+06	MIN	0.0196	0.0138	1.09E+06

(AVERAGES, STD DEV, RANGE, MIN, MAX, FOR CALCULATIONS ABOVE ARE FROM THE COIL WITH RESPECT TO THE MASTER)

ALL KAPTON 50% WRAP OVER 66% WRAP

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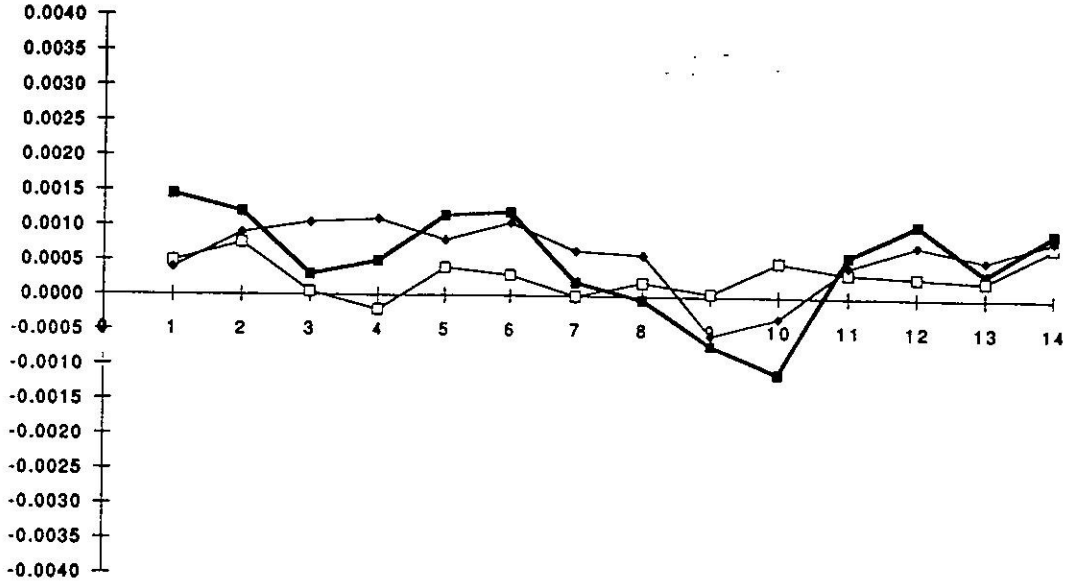
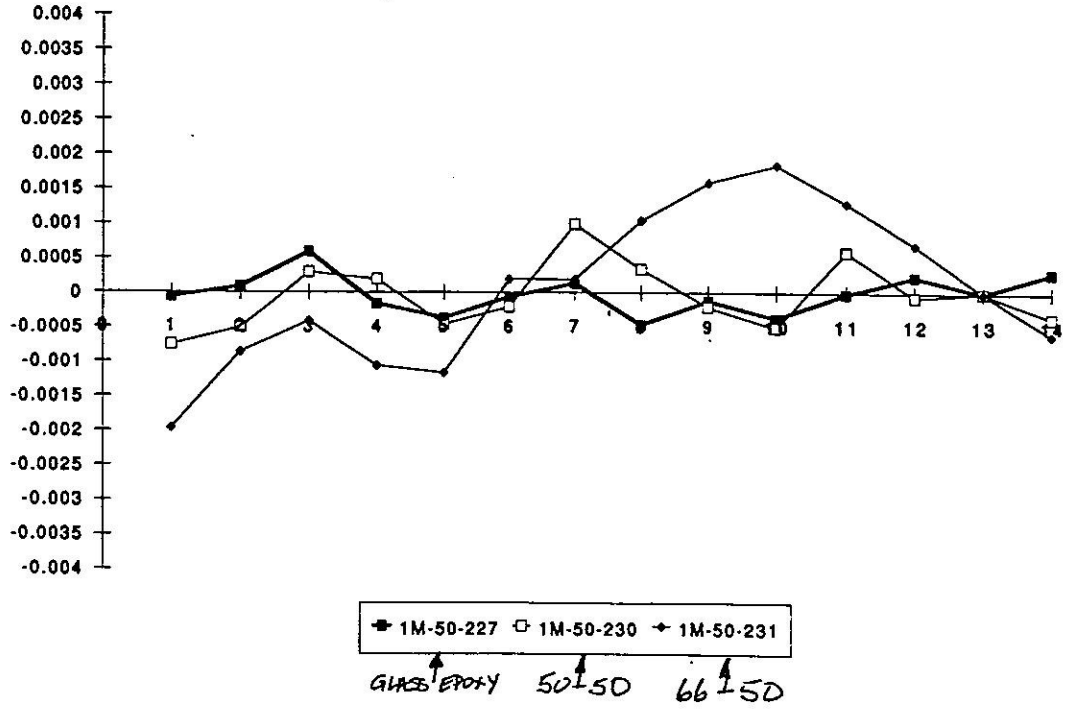
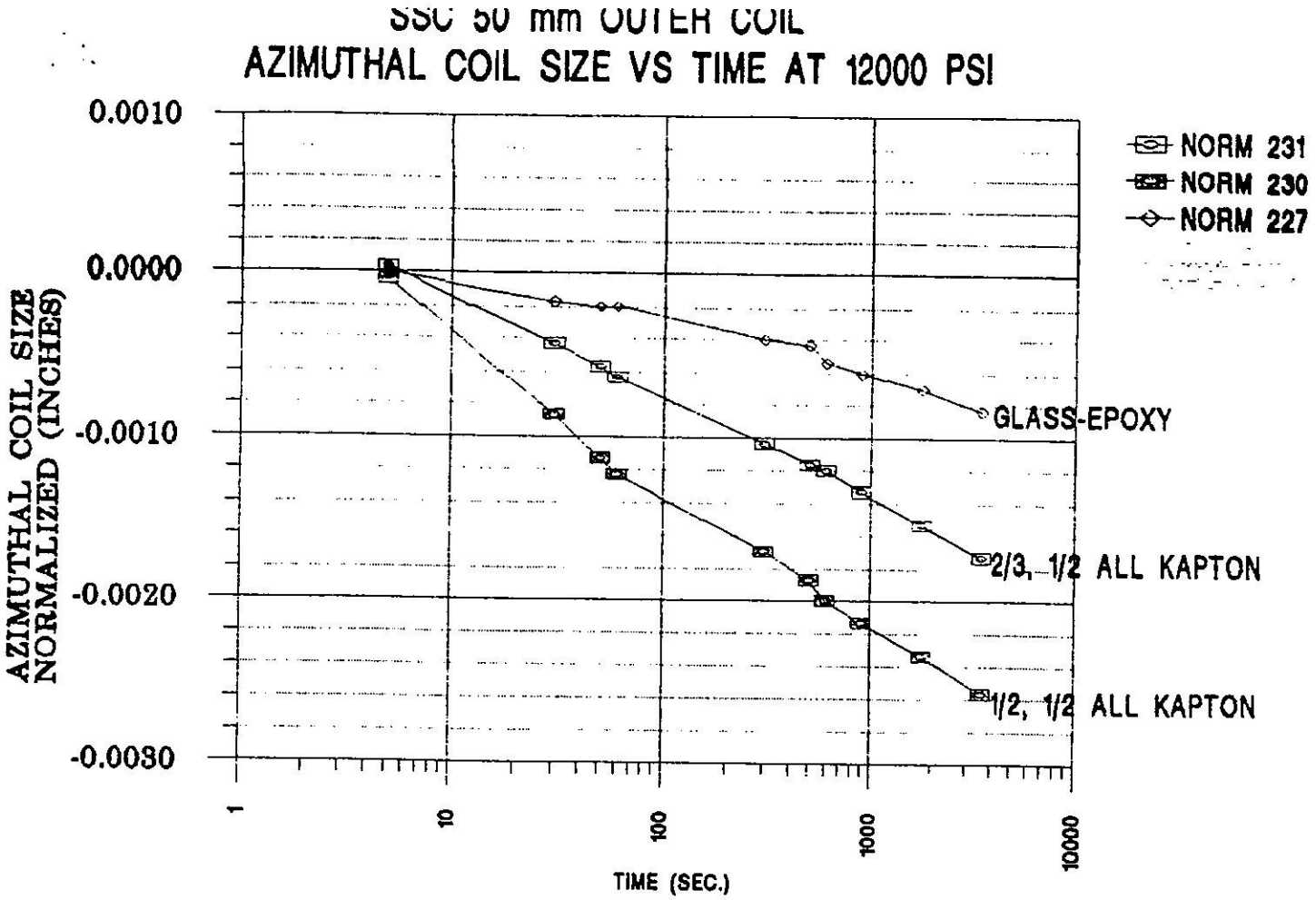
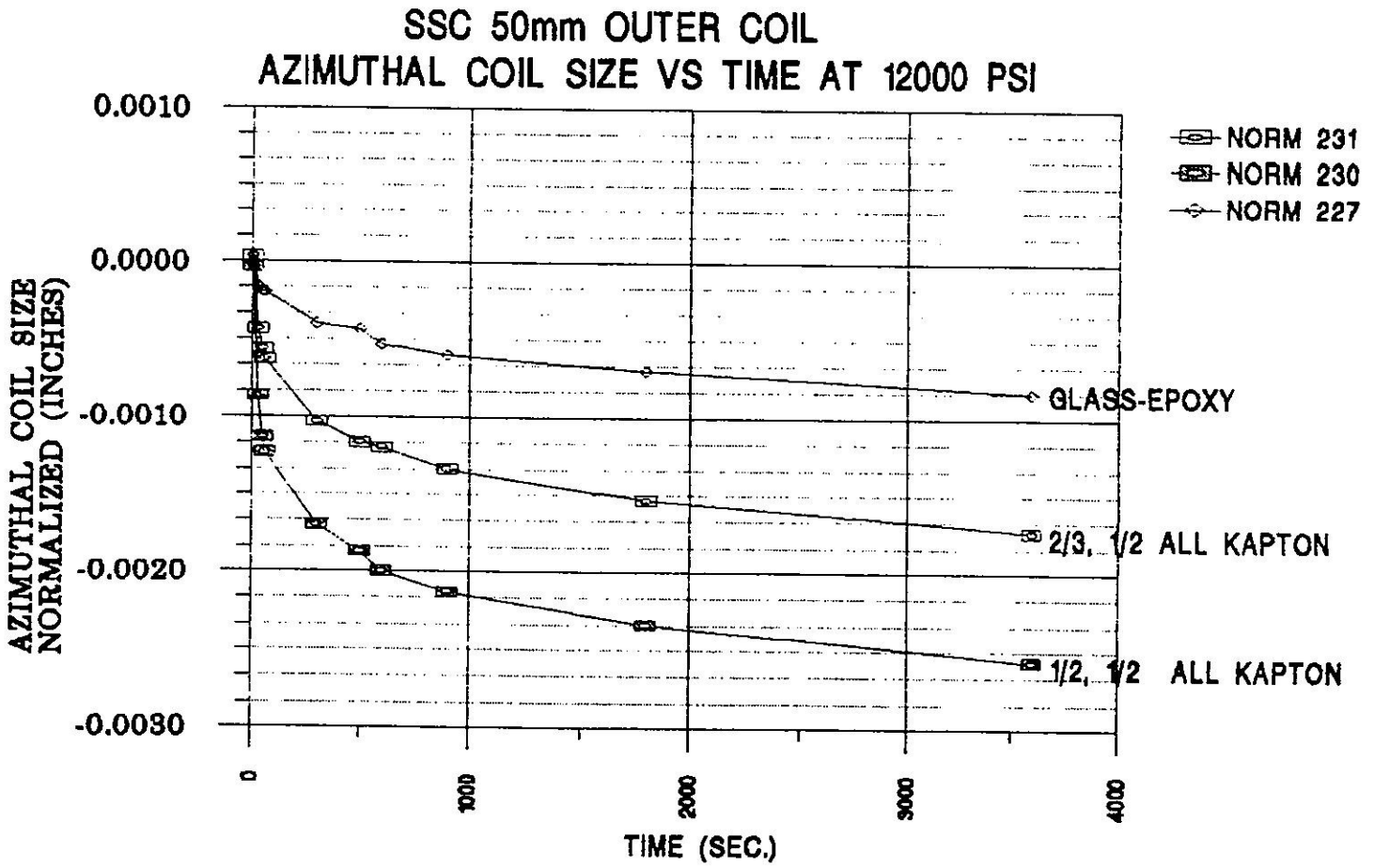
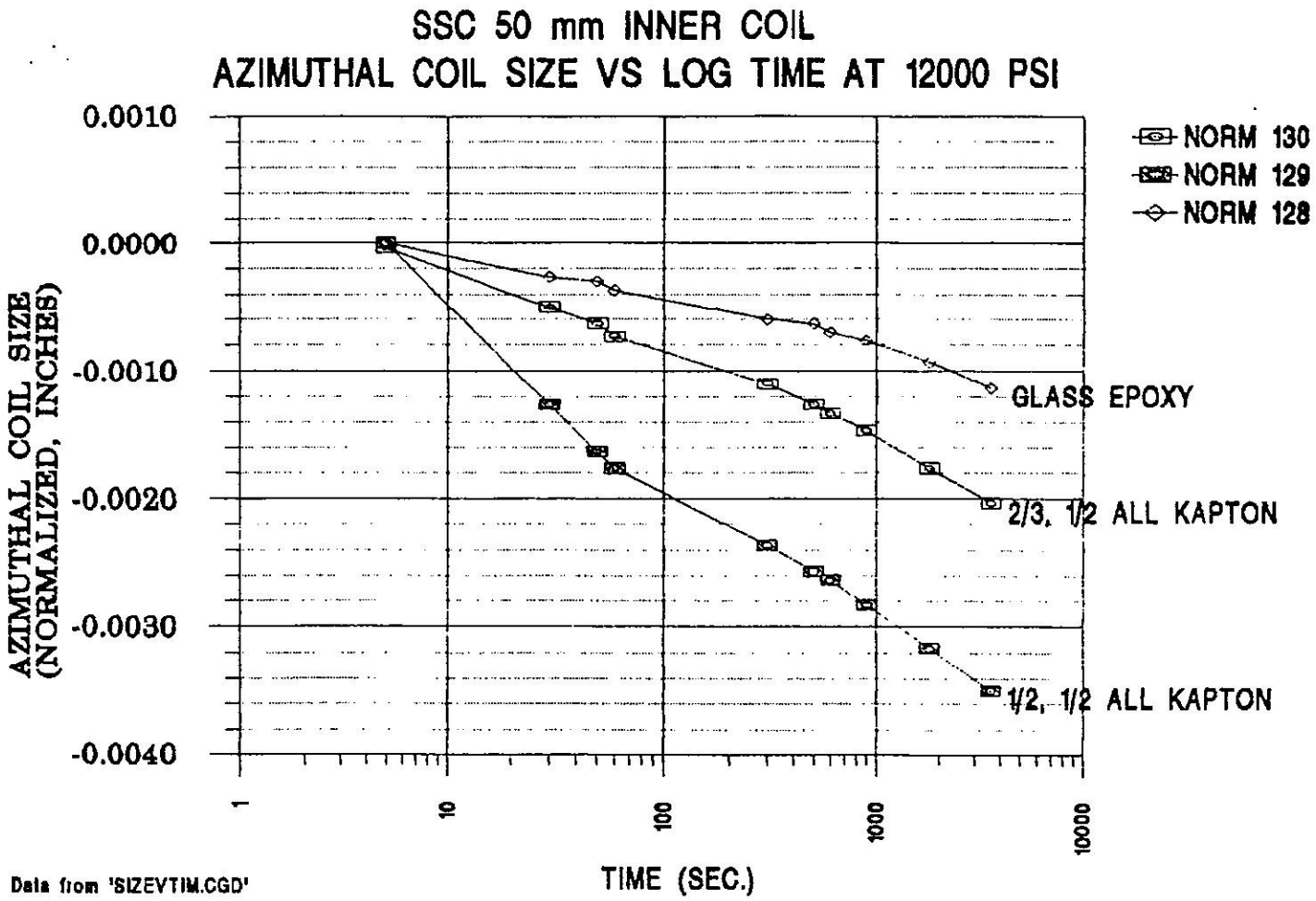


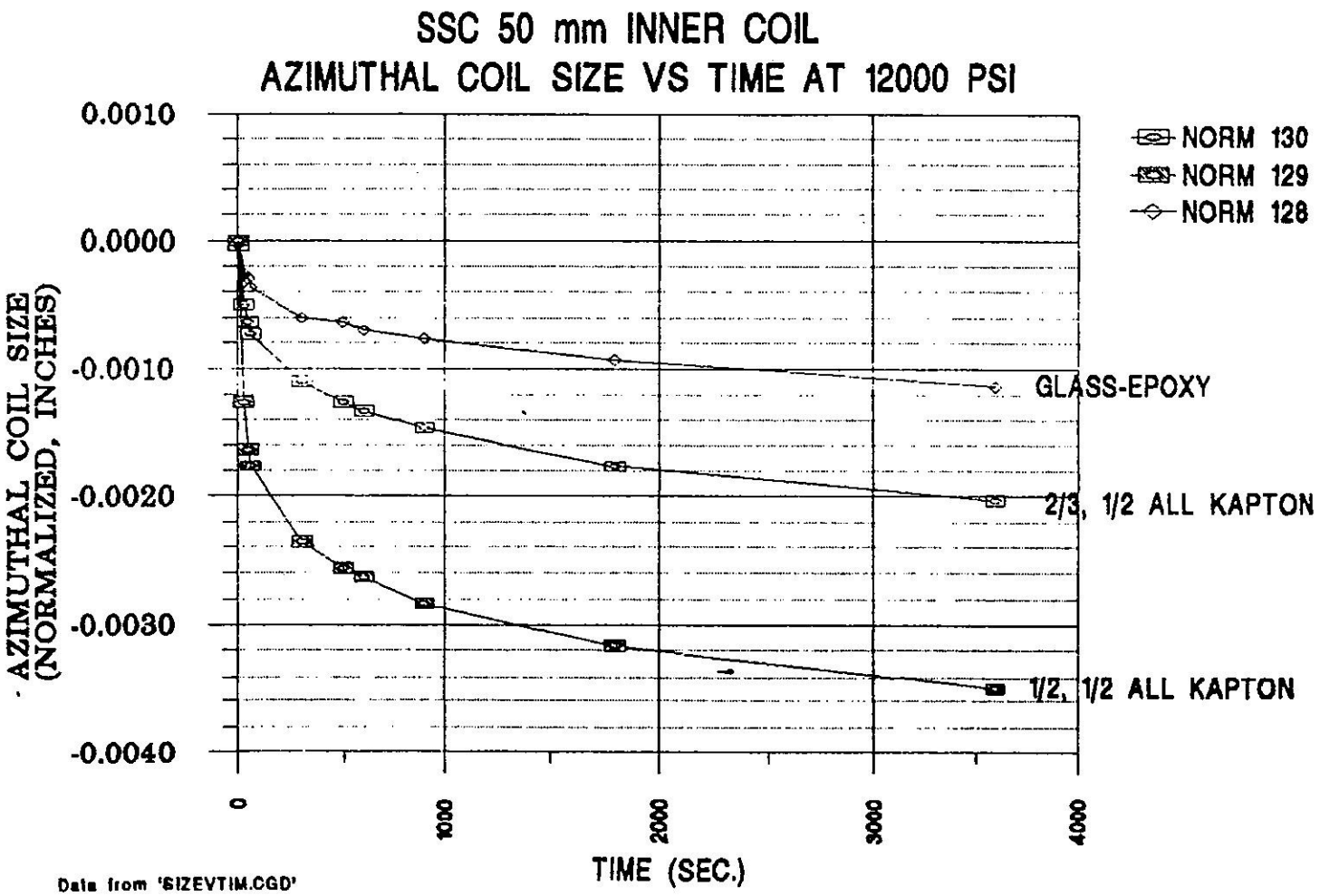
VERTICAL ERROR (QUAD. VIII + IIIV / 2)



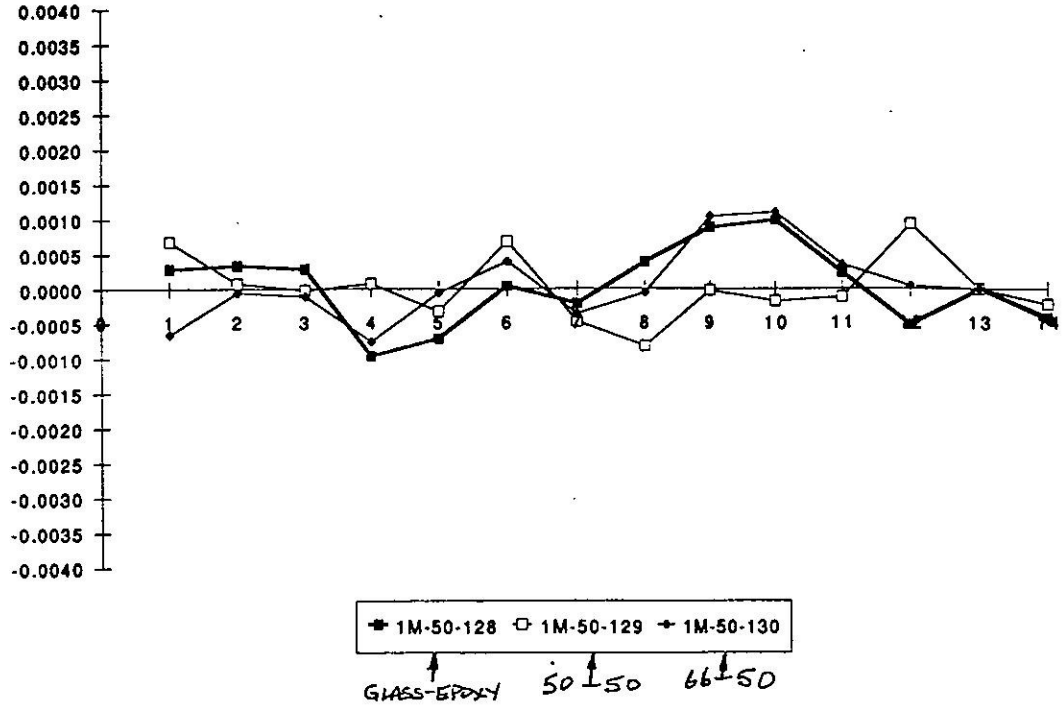
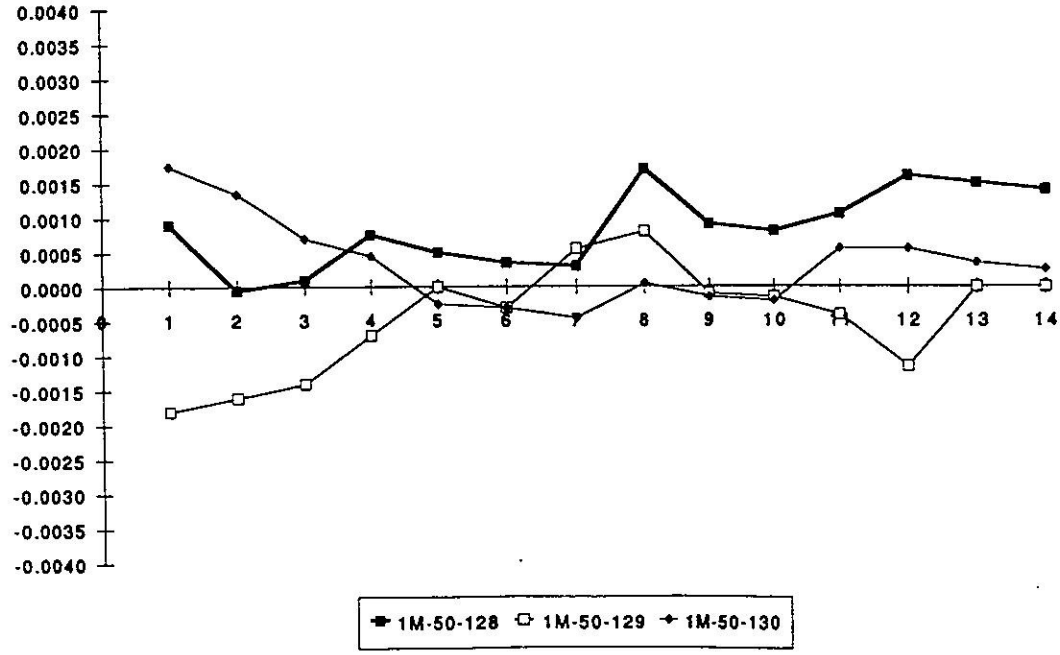

SSC 50 mm OUTER COIL
AZIMUTHAL COIL SIZE VS TIME AT 12000 PSI
0.0010
0.0000
-0.0010
-0.0020
-0.0030
AZIMUTHAL COIL SIZE
NORMALIZED (INCHES)
1
10
100
1000
10000
TIME (SEC.)
NORM 231
NORM 230
NORM 227
GLASS-EPOXY
2/3, 1/2 ALL KAPTON
1/2, 1/2 ALL KAPTON


SSC 50mm OUTER COIL
AZIMUTHAL COIL SIZE VS TIME AT 12000 PSI
0.0010
0.0000
-0.0010
-0.0020
-0.0030
AZIMUTHAL COIL SIZE
NORMALIZED (INCHES)
0
1000
2000
3000
4000
TIME (SEC.)
NORM 231
NORM 230
NORM 227
GLASS-EPOXY
2/3, 1/2 ALL KAPTON
1/2, 1/2 ALL KAPTON


SSC 50 mm INNER COIL
AZIMUTHAL COIL SIZE VS LOG TIME AT 12000 PSI
0.0010
0.0000
-0.0010
-0.0020
-0.0030
-0.0040
AZIMUTHAL COIL SIZE (NORMALIZED, INCHES)
1
10
100
1000
10000
TIME (SEC.)
NORM 130
NORM 129
NORM 128
GLASS EPOXY
2/3, 1/2 ALL KAPTON
1/2, 1/2 ALL KAPTON
Data from 'SIZEVTIM.CGD'


SSC 50 mm INNER COIL
AZIMUTHAL COIL SIZE VS TIME AT 12000 PSI
0.0010
0.0000
-0.0010
-0.0020
-0.0030
-0.0040
AZIMUTHAL COIL SIZE (NORMALIZED, INCHES)
0
1000
2000
3000
4000
TIME (SEC.)
NORM 130
NORM 129
NORM 128
GLASS-EPOXY
2/3, 1/2 ALL KAPTON
1/2, 1/2 ALL KAPTON
Data from 'SIZEVTIM.CGD'

VERTICAL ERROR (QUAD. I/III + II/IV / 2)



HORIZONTAL ERROR (QUAD. I/III - II/IV / 2)