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B5 tunes for experiment 766

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June 1985

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

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No. 112

B5 Tunes for Experiment 766

Gerry M. Bunce

June 3, 1985

The following plots were made for a beam at the B-target which is (1.4 mm x 1 mrad)_x . (1.3 mm x 2 mrad)_y. These are half sizes, taken from calculations for the switchyard; however, they appear to be consistent with the observed spot size on B. After the beam traverses the target, the multiple-scattering blow-up should be ± 2 mrad. The plots do not have this additional spread folded in. A $\Delta p/p$ of $\pm .3\%$ was used and it is assumed the servo system holds the beam steady at B. These sizes are Transport half sizes, which nominally contain 90% of the beam.

Tune A This is the "standard" tune where the upstream quads are set for B1 at 10 GeV/c. The "wavy hole" aperture (vertical) is shown as $\pm 1/2$ ". This tune appears to give poor transmission, as is observed. Q6/7, however, are at opposite polarity from what is now used!

Tune B The polarities of the upstream quads remain the same and the beam is squeezed through the apertures.

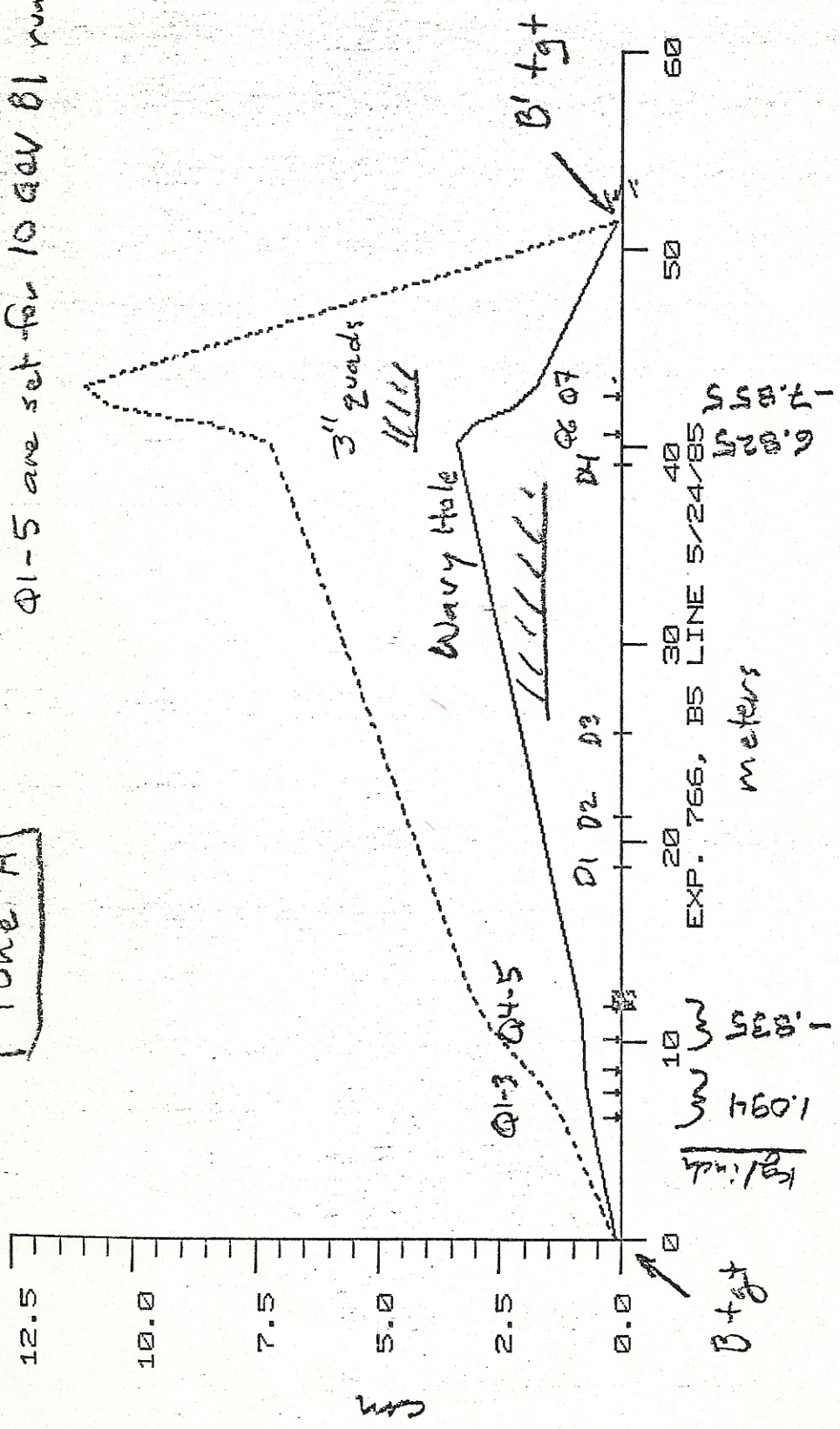
Tune C The upstream quad polarities are interchanged. The transmission should be quite high.

Tune D Again, the upstream quad polarities have been inverted, but with their settings chosen to get optimum (but poor compared with Tune A) momentum selection and transmission for B1. This solution would seem to have no better transmission for B5 than Tune A, so it has little going for it.

Note: B and C are not ideal for the B1 line! Tune A has been found to give more transmission (x1.5 to 2) and a smaller spot at B' than the previous E766 tune.

Tune A

June 5, 1985
 Q1-5 are set for 10 dBV B1 running.

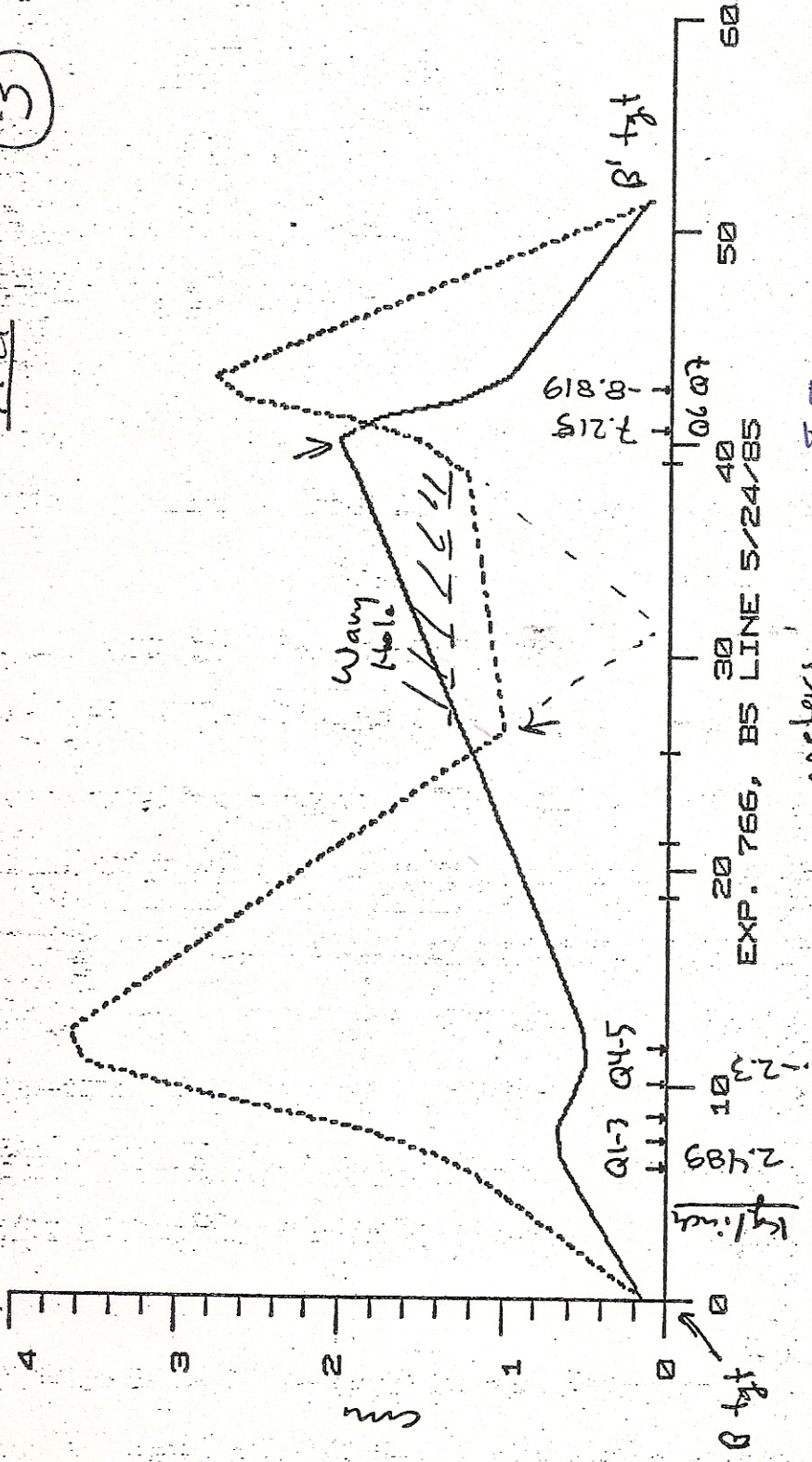


Distance (m)	Current (kA)	POL.	D:bulk
10	1.094	A	950
10	.652	B	1043
40	6.025	A	2560
40	7.555	B	2976
60	1.60kA	A	2560
60	-1.86	B	2976

Tune B

3rd 2 wads
1/1cc

3



∴ 625 to get
d. bubble ch.

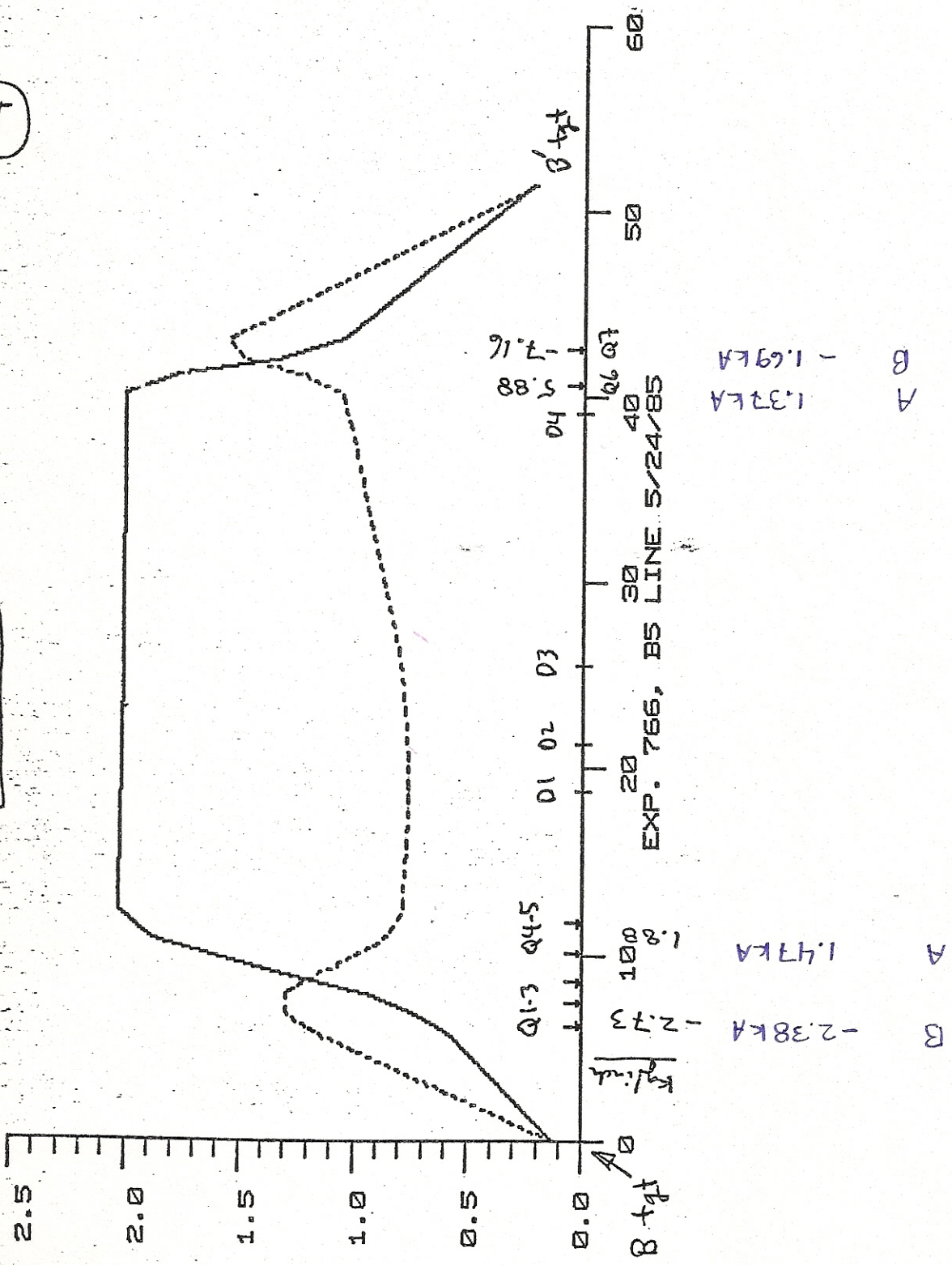
A 2.17KA
B -1.80KA

→

A 1.70KA
B -2.45KA

4

Tune C



A

B

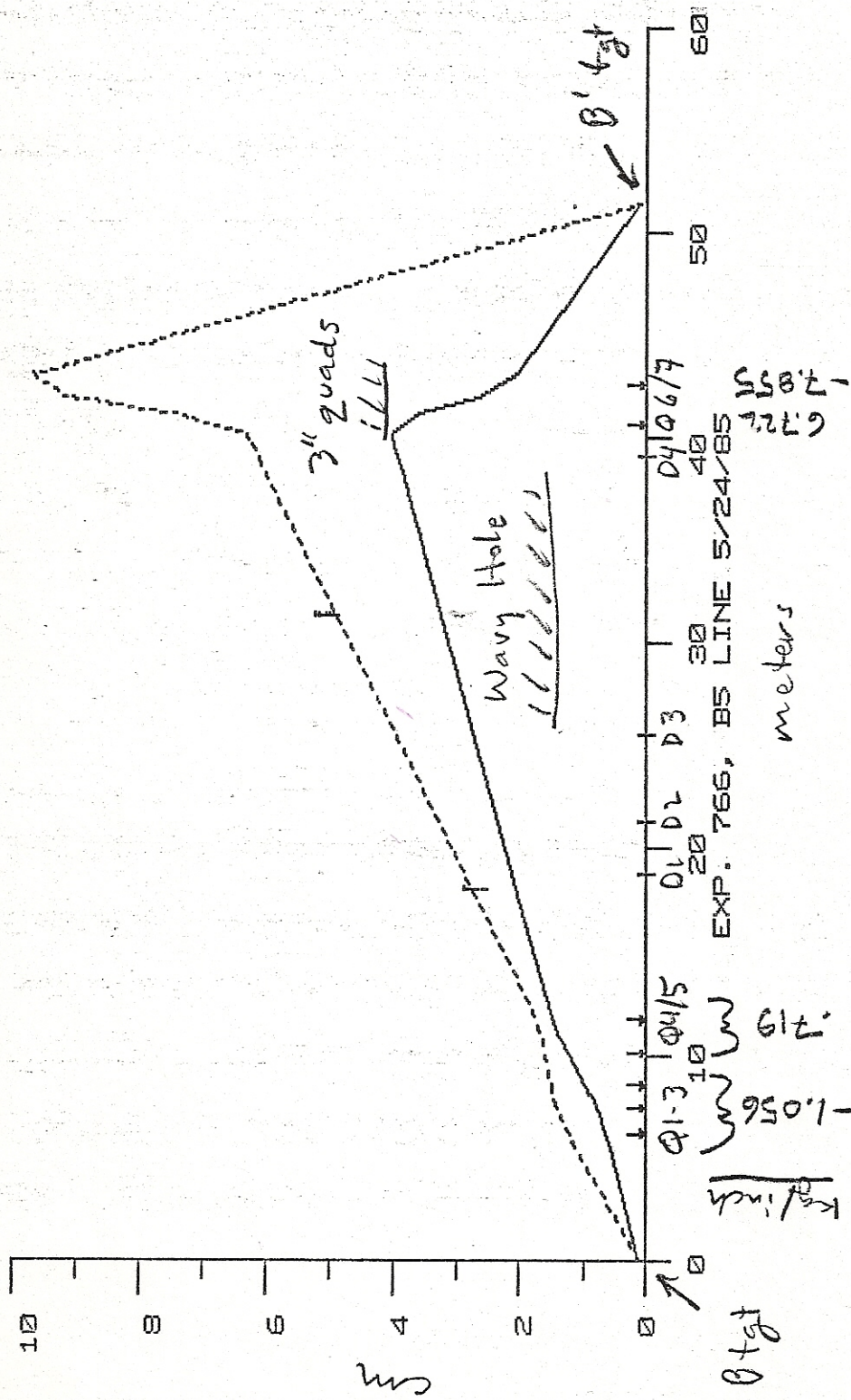
A

B

REVERSED Q1-5, 10.69 GEV TUNE FOR B1

Tune D

11-Jun-85 09:28



D.66uk
 pd. 920
 current 920amps
 K/inch 1.056
 7.19
 562
 A 920
 B 562

6.72%
 7.855
 D4 106/7
 40
 30
 20
 10
 EXP. 766, B5 LINE 5/24/85
 meters
 A 1540
 B 1887
 2464
 3019

Tune C

"EXP: 766, B5 LINE 5/24/85

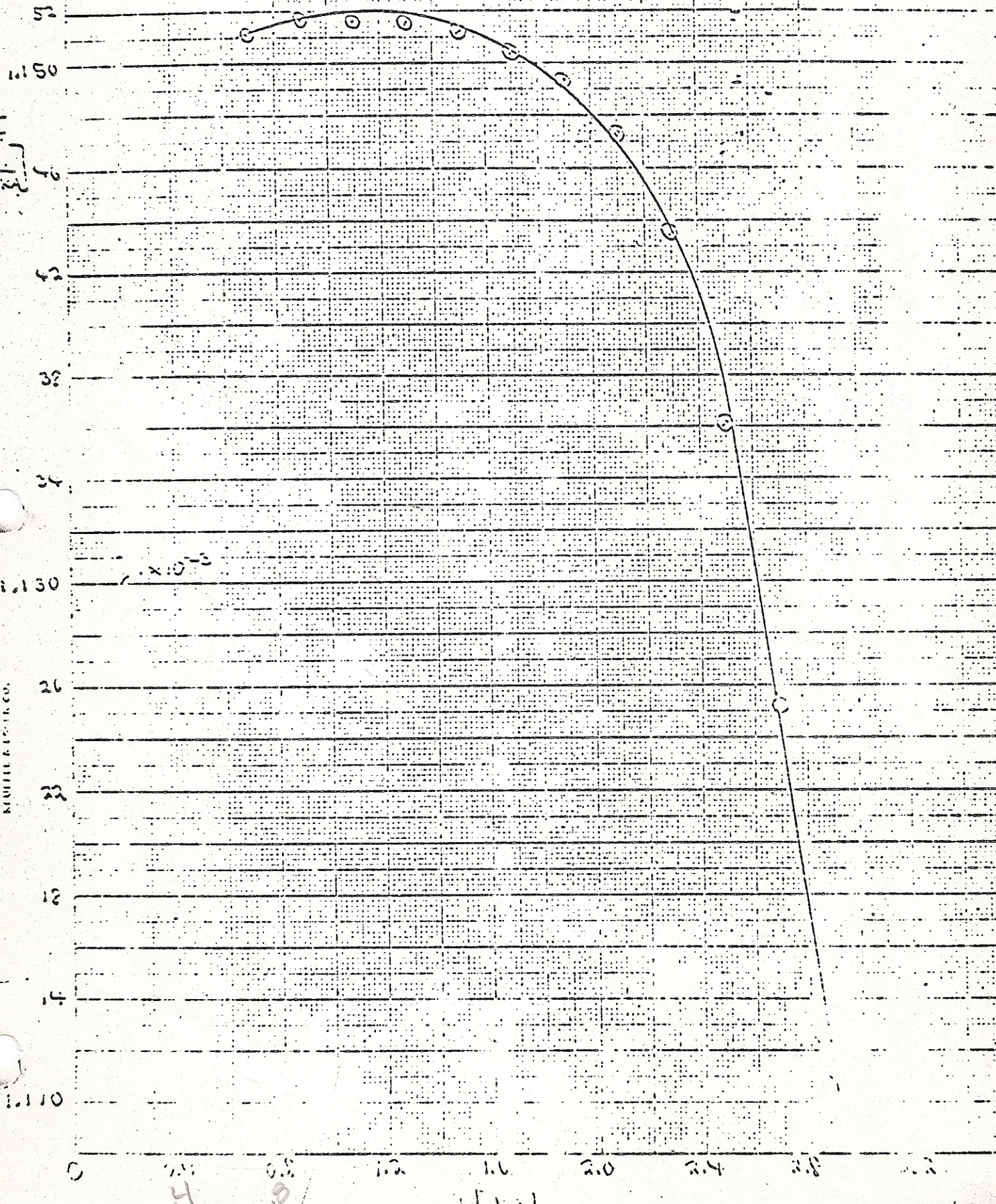
DRIFFT	3:	"D1	5.690000	0.000000	0.000000	0.000000
QUAD*	5:	"Q1	0.932000	-2.733000	2.540000	0.000000
DRIFFT	3:	"D2	0.249000	0.000000	0.000000	-9.326000
QUAD*	5:	"Q2	0.932000	-2.733000	2.540000	0.000000
DRIFFT	3:	"L2	0.249000	0.000000	0.000000	-9.326000
QUAD*	5:	"Q3	0.932000	-2.733000	2.540000	0.000000
DRIFFT	3:	"L3	0.435000	0.000000	0.000000	-9.326000
QUAD*	5:	"Q4	1.321000	1.884000	2.540000	0.000000
DRIFFT	3:	"L4	0.253000	0.000000	0.000000	9.925000
QUAD*	5:	"Q5	1.321000	1.884000	2.540000	0.000000
DRIFFT	3:	"L5	5.480000	0.000000	0.000000	9.925000
ROTAT	2:	"D1	0.600000	0.000000	0.000000	0.000000
BEND*	4:	"D1	1.981000	9.883000	0.000000	1.179000
ROTAT	2:	"D2	0.508000	0.000000	0.000000	0.000000
DRIFFT	3:	"D2	0.600000	0.000000	0.000000	0.000000
ROTAT	2:	"D2	0.600000	9.883000	0.000000	1.179000
BEND*	4:	"D2	1.981000	9.883000	0.000000	1.179000
ROTAT	2:	"D3	0.600000	0.000000	0.000000	0.000000
DRIFFT	3:	"D3	2.350000	0.000000	0.000000	0.000000
BEND*	4:	"D3	1.981000	0.000000	0.000000	0.000000
DRIFFT	3:	"D4	1.960000	0.000000	0.000000	0.000000
BEND*	4:	"D4	1.070000	0.000000	0.000000	0.000000
DRIFFT	3:	"Q6	0.500000	0.000000	0.000000	0.000000
QUAD*	5: 0 1	"Q6	1.000000	5.883000	2.540000	4.275000
DRIFFT	3:	"Q7	0.910000	0.000000	0.000000	0.000000
QUAD*	5: 0 1	"Q7	1.000000	-7.163000	2.540000	-3.209000
DRIFFT	3:		8.430000	0.000000	0.000000	0.000000
FIT	10:		1.000010	0.100000	0.010000	0.000000
FIT	10:		3.000030	0.100000	0.010000	0.227000

TUNE D

"EXPL	PLS	BS	LINE	5/24/85	"D1	5.690000	0.000000	0.000000	0.000000
DRIFT	3:		"D1		"D1	5.690000	0.000000 <td>0.000000</td> <td>0.000000</td>	0.000000	0.000000
QUAD*	5:		"Q1		"Q1	0.932000	-1.055600	2.540000	-24.379000
DRIFT	3:		"D2		"D2	0.249000	0.000000	0.000000	0.000000
QUAD*	5:		"Q2		"Q2	0.932000	-1.055600	2.540000	-24.379000
DRIFT	3:		"L2		"L2	0.249000	0.000000	0.000000	0.000000
QUAD*	5:		"Q3		"Q3	0.932000	-1.055600	2.540000	-24.379000
DRIFT	3:		"L3		"L3	0.435000	0.000000	0.000000	0.000000
QUAD*	5:		"Q4		"Q4	1.321000	0.719000	2.540000	25.644000
DRIFT	3:		"L4		"L4	0.253000	0.000000	0.000000	0.000000
QUAD*	5:		"Q5		"Q5	1.321000	0.719000	2.540000	25.644000
DRIFT	3:		"L5		"L5	5.480000	0.000000	0.000000	0.000000
ROTAT	2:		"D1		"D1	1.981000	9.883000	0.000000	1.179000
BEND*	4:		"D2		"D2	0.600000	0.000000	0.000000	0.000000
ROTAT	2:		"D3		"D3	0.600000	0.000000	0.000000	0.000000
BEND*	4:		"D4		"D4	0.508000	0.000000	0.000000	0.000000
ROTAT	2:		"Q6		"Q6	0.600000	0.000000	0.000000	0.000000
BEND*	4:		"Q7		"Q7	1.981000	9.883000	0.000000	1.179000
ROTAT	2:					2.350000	0.000000	0.000000	0.000000
BEND*	4:					1.981000	0.000000	0.000000	0.000000
DRIFT	3:					11.960000	0.000000	0.000000	0.000000
BEND*	4:					1.070000	0.000000	0.000000	0.000000
DRIFT	3:					0.500000	0.000000	0.000000	0.000000
QUAD*	5:	0 1				0.910000	6.722000	2.540000	3.764000
QUAD*	5:	0 1				1.000000	-7.855000	2.540000	-2.913000
DRIFT	3:					8.430000	0.000000	0.000000	0.000000
FIT	10:					1.000010	0.100000	0.010000	0.125300
FIT	10:					3.000030	0.100000	0.010000	0.100300
	0:					0.000000	0.000000	0.000000	0.000000

$\frac{G}{H}$
 $\frac{K \cdot G}{H}$

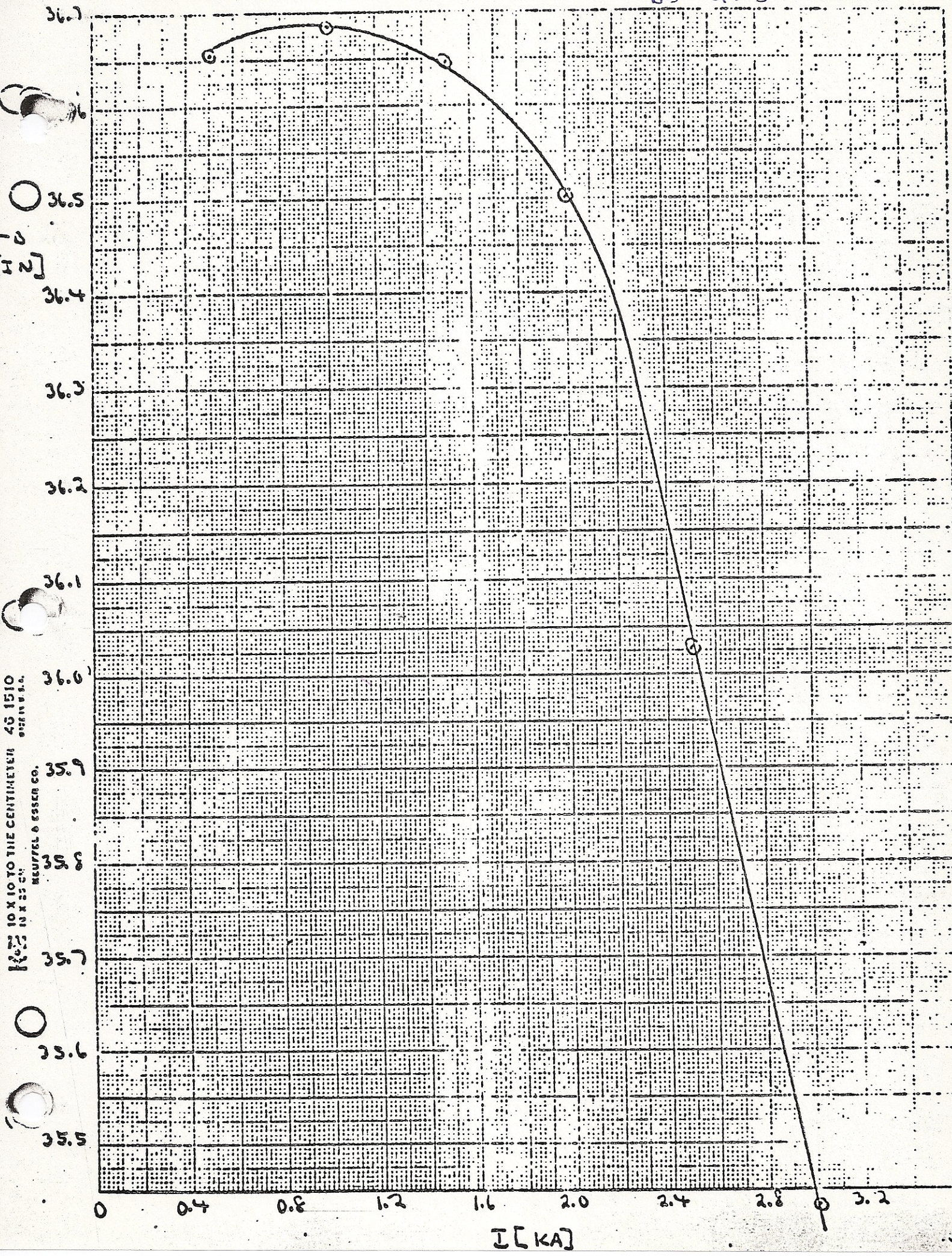
16 X 10 TO THE CENTER 40 1510
 10 X 25 00
 MILLER & CO. CO.



$\times 10^{-3}$

H 9/ 11/11

B5 Q1-3 N8Q52



10 X 10 TO THE CENTIMETER 45 1510
HEUFFEL & ESSER CO.

Parby

B5 Q4-5

Multiply by kamps to get gradient

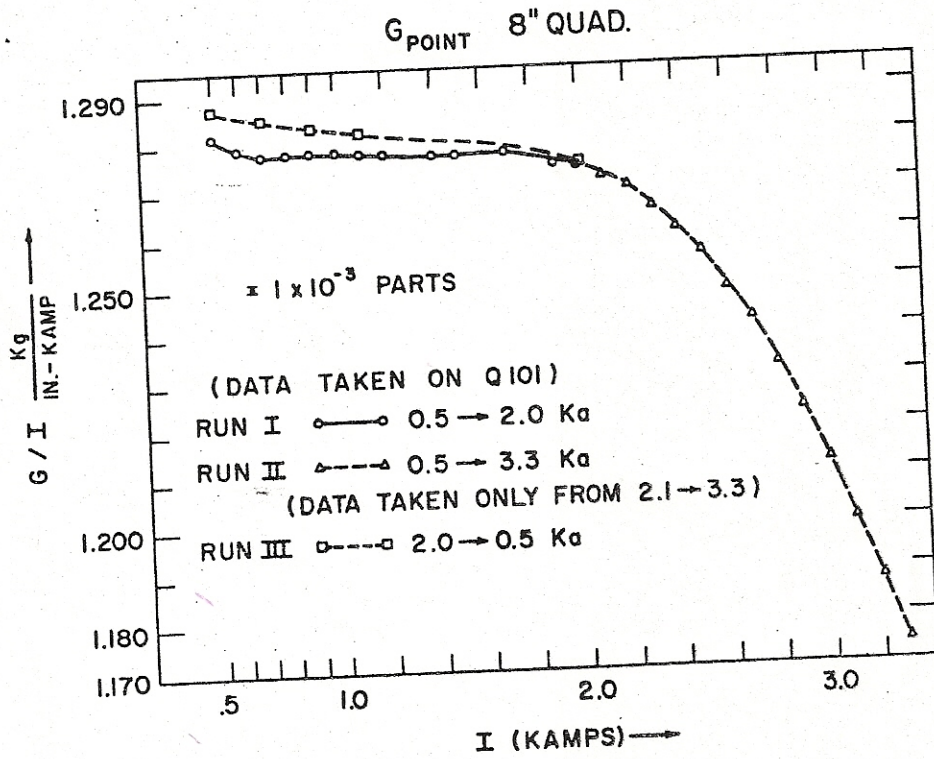


Fig. 6. Gradient, G point, vs I for 8 inch quadrupoles.

Dawby

B5 Q4-5

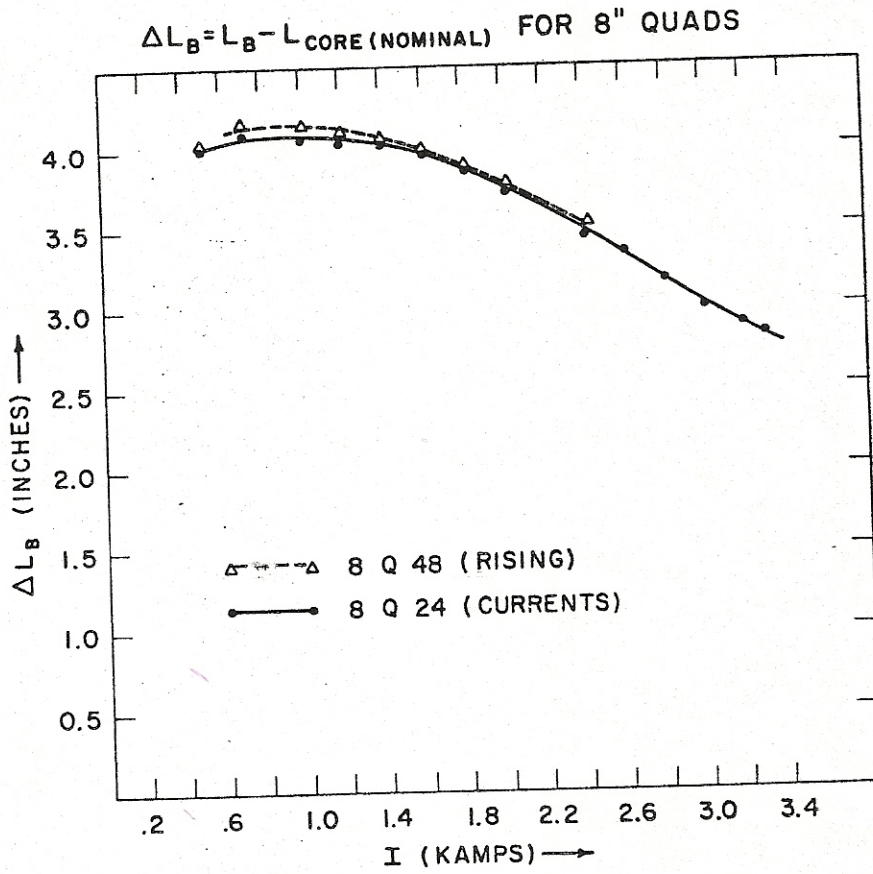


Fig. 7. Magnet length, L_B , vs I for 8 inch quadrupoles. ($L_B = \Delta L_B + L_{core}$).

B5Q6/7

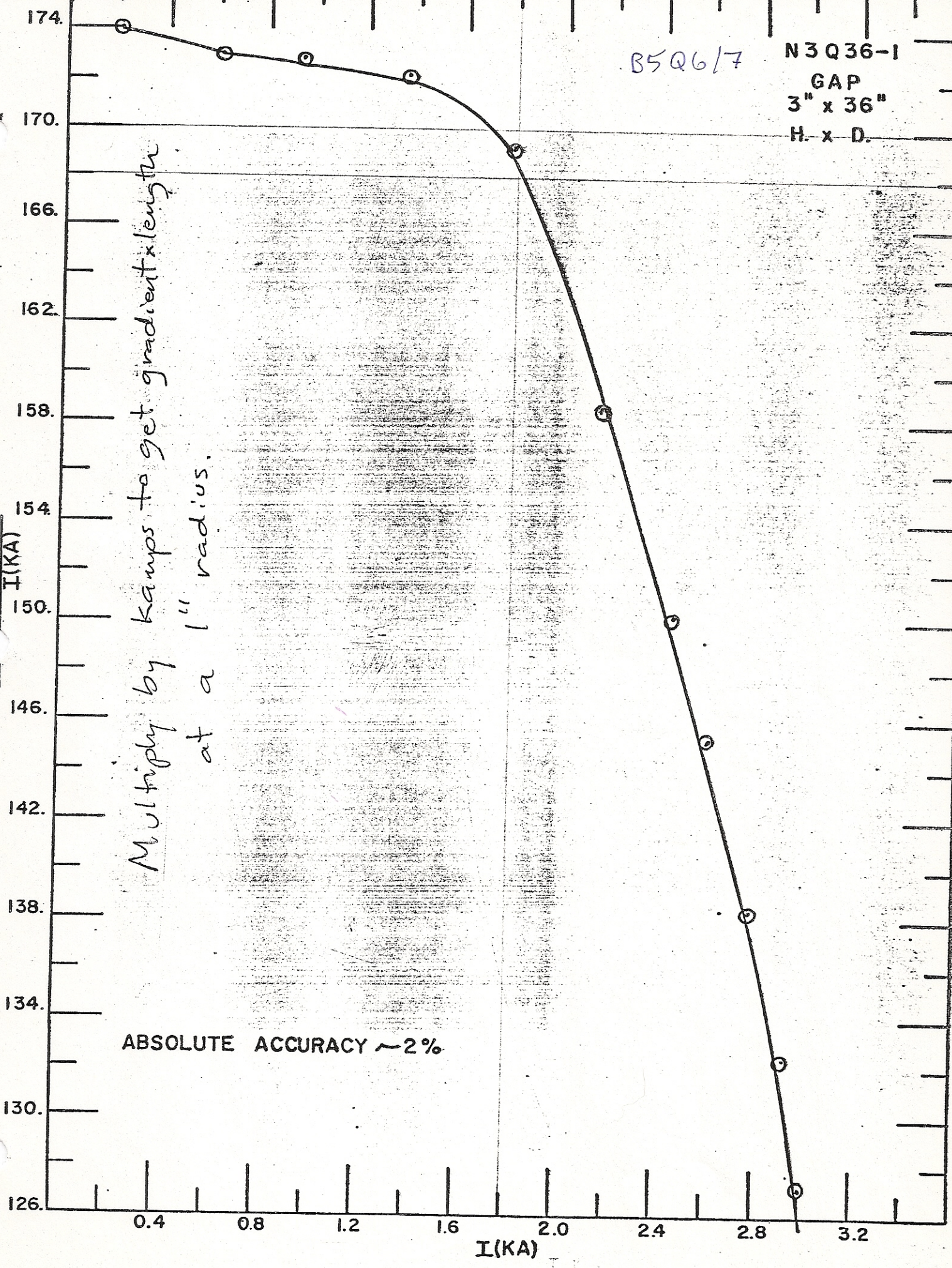
N3Q36-1

GAP
3" x 36"
H. x D.

$G \left(\frac{KG}{IN} \right) \times Lb (IN)$
 $I (KA)$

Multiply by kamps to get gradient x length
at a 1" radius.

ABSOLUTE ACCURACY ~ 2%



Danby

Multiply by kamps to get $\int B ds$ in kgauss-inches

18D72 (6" gap)

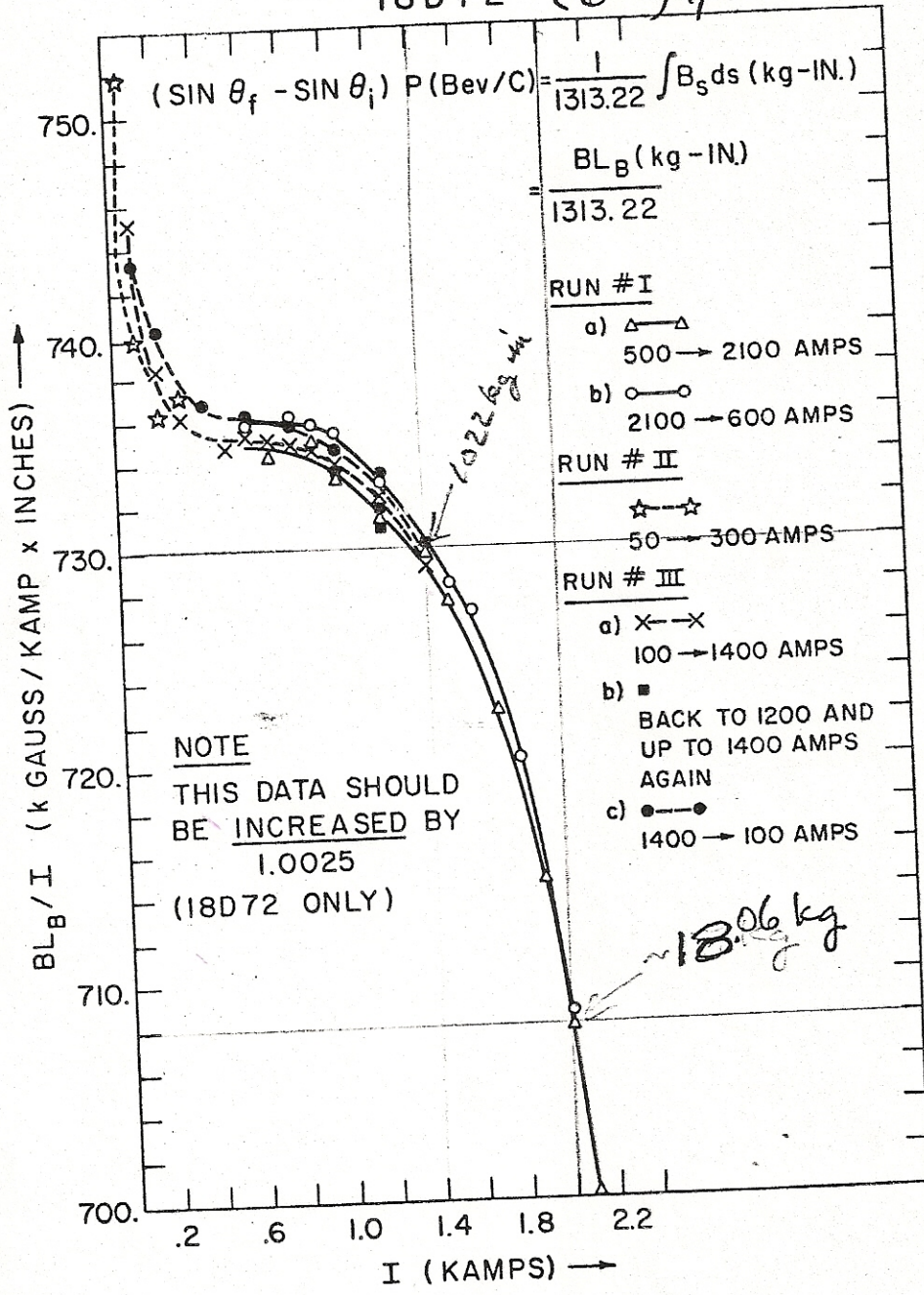


Fig. 2. $\int B_s ds$ vs I for 18D72 magnets.

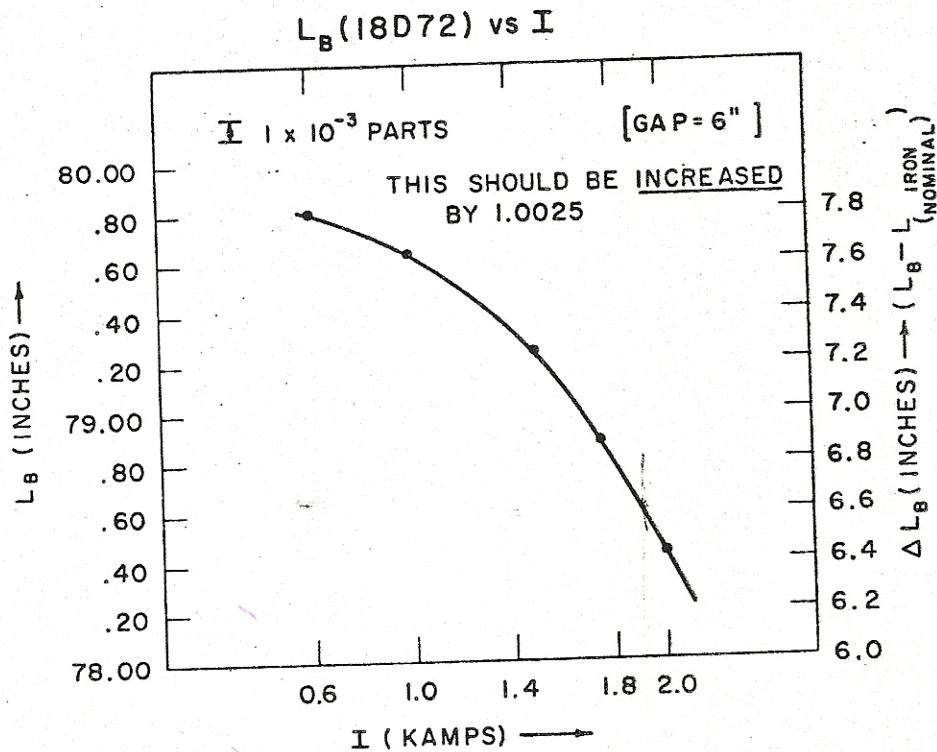


Fig. 3. Magnet length, L_B , vs I for 18D72 magnets.

300 1/2

$$\begin{aligned}
 (\sin \theta_1 - \sin \theta_2) \lambda &= \left[\frac{B_{11} \sin \theta_1}{B_{12} \sin \theta_2} \right] \lambda \quad [B_{11} \sin \theta_1] [KS - IN] \\
 &= \left[\frac{B_{11}}{B_{12}} \right] \lambda \quad [KS - IN] \\
 &= \left[\frac{B_{11}}{B_{12}} \right] \lambda \quad [KS - IN]
 \end{aligned}$$

746.0

742.0

738.0

734.0

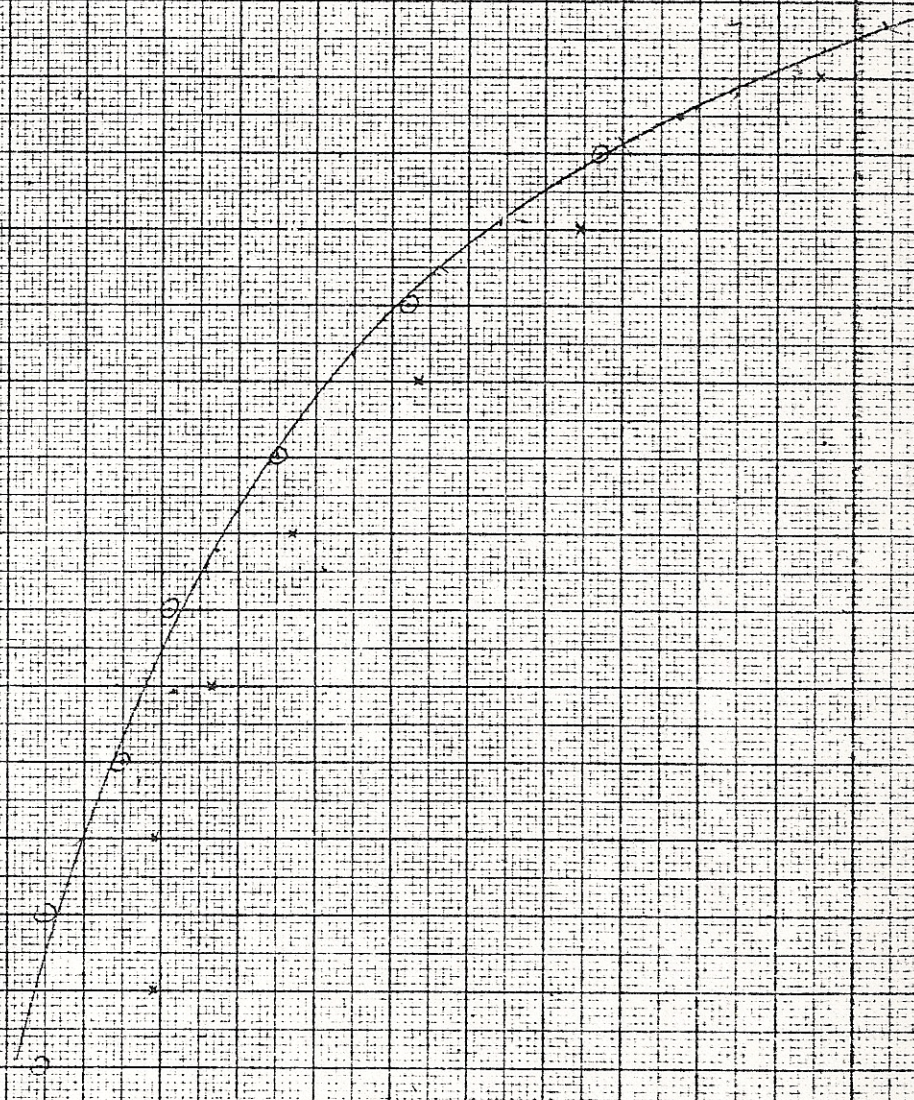
730.0

$\frac{B_{11}}{B_{12}} \left[\frac{KS - IN}{L \cdot KA} \right]$

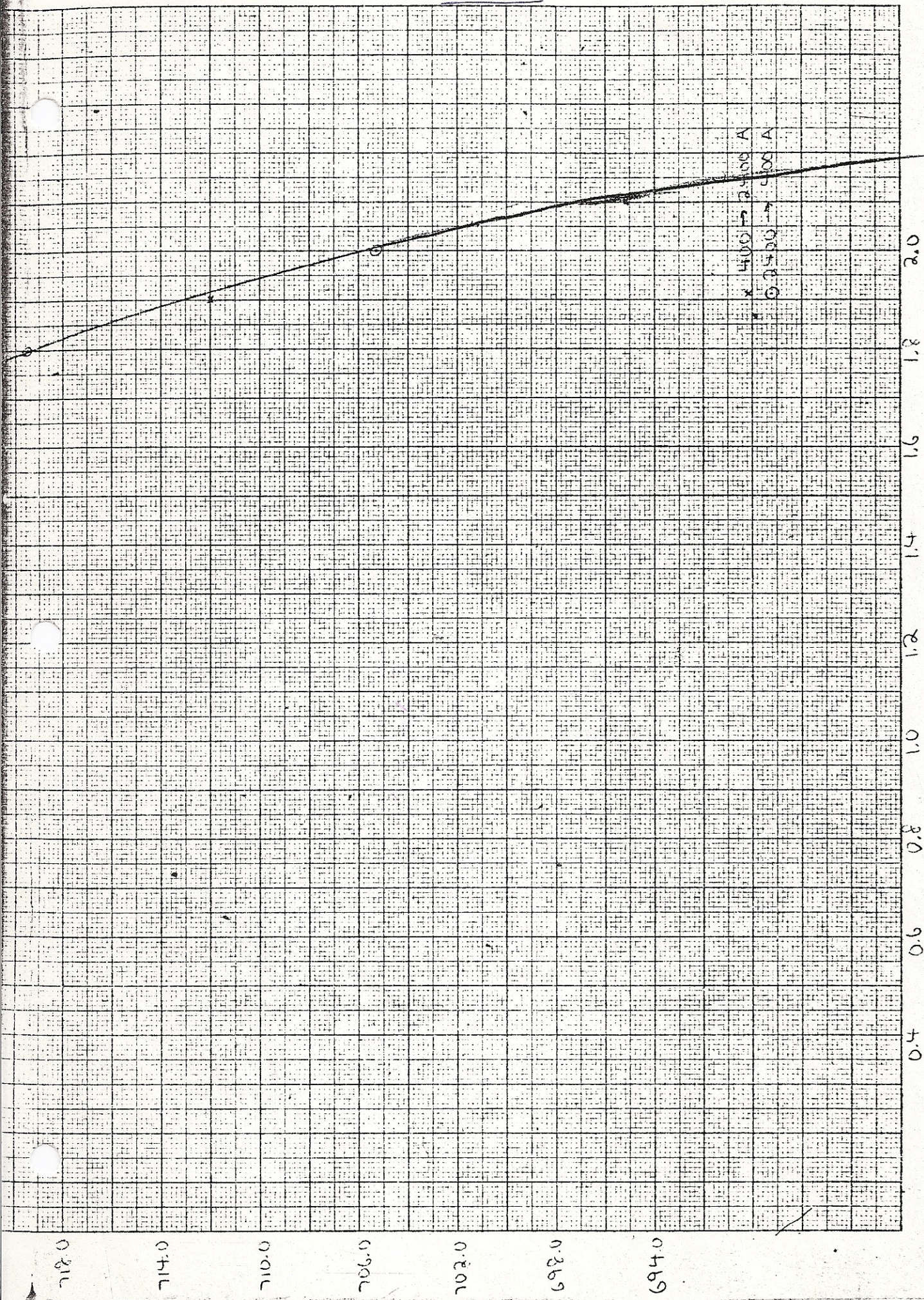
726.0

722.0

$\downarrow \times 10^3$



B502

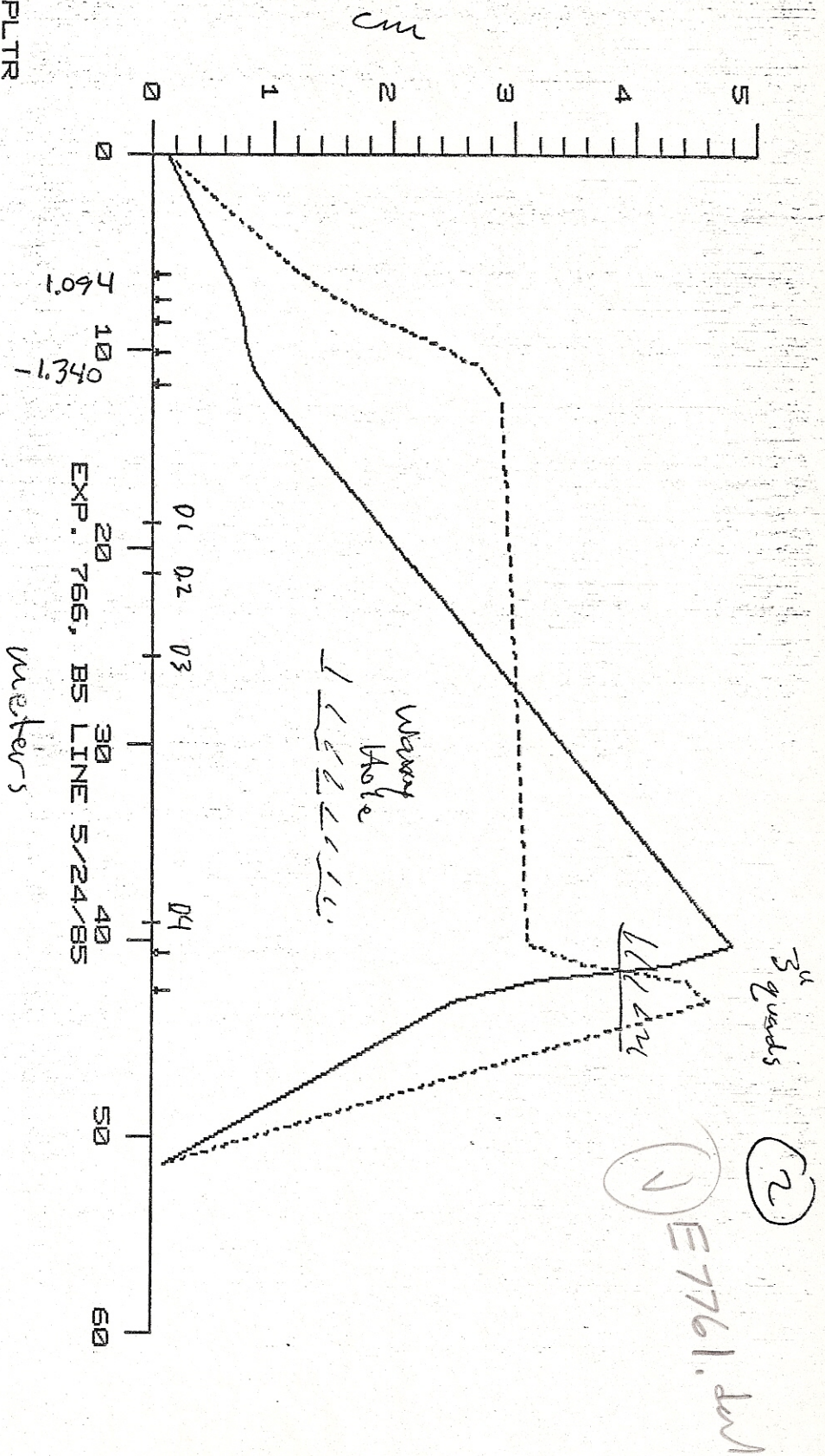


4000 → 2500 A
0.2500 → 0.5000 A

30D7Z

ENTER UP TO 55 CHARACTERS OF DESCRIPTION:

RUN PLTR



(2)

DRIFT	3.	"D1	5.690000	0.000000	0.000000	0.000000	0.000000
QUAD*	3.	"Q1	0.932000	1.094000	2.540000	23.838000	
DRIFT	3.	"D2	0.249000	0.000000	0.000000	0.000000	
QUAD*	3.	"Q2	0.932000	1.094000	2.540000	23.838000	
DRIFT	3.	"L2	0.249000	0.000000	0.000000	0.000000	
QUAD*	3.	"Q3	0.932000	1.094000	2.540000	23.838000	
DRIFT	3.	"L3	0.435000	0.000000	0.000000	0.000000	
QUAD*	3.	"Q4	1.321000	-1.340000	2.540000	-13.423000	
DRIFT	3.	"L4	0.253000	0.000000	0.000000	0.000000	
QUAD*	3.	"Q5	1.321000	-1.340000	2.540000	-13.423000	
DRIFT	3.	"L5	5.480000	0.000000	0.000000	0.000000	
ROTAT	3.	"D1	0.600000	0.000000	0.000000	0.000000	
BEND*	2.		1.981000	9.883000	0.000000	1.179000	
ROTAT	2.		0.600000	0.000000	0.000000	0.000000	
DRIFT	2.		0.508000	0.000000	0.000000	0.000000	
ROTAT	2.		0.600000	0.000000	0.000000	0.000000	
BEND*	2.	"D2	1.981000	9.883000	0.000000	1.179000	
ROTAT	2.		0.600000	0.000000	0.000000	0.000000	
DRIFT	2.	"D3	2.350000	0.000000	0.000000	0.000000	
BEND*	3.		1.981000	0.000000	0.000000	0.000000	
DRIFT	3.	"D4	1.966000	0.000000	0.000000	0.000000	
BEND*	4.		1.070000	0.000000	0.000000	0.000000	
DRIFT	3.		0.500000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q6	1.000000	6.817000	2.540000	3.714000	
DRIFT	3.		0.910000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q7	1.000000	-7.630000	2.540000	-3.003000	
DRIFT	3.		8.430000	0.000000	0.000000	0.000000	
FIT	10.		1.000010	0.100000	0.010000	0.100000	
FIT	10.		3.000030	0.100000	0.010000	0.100000	

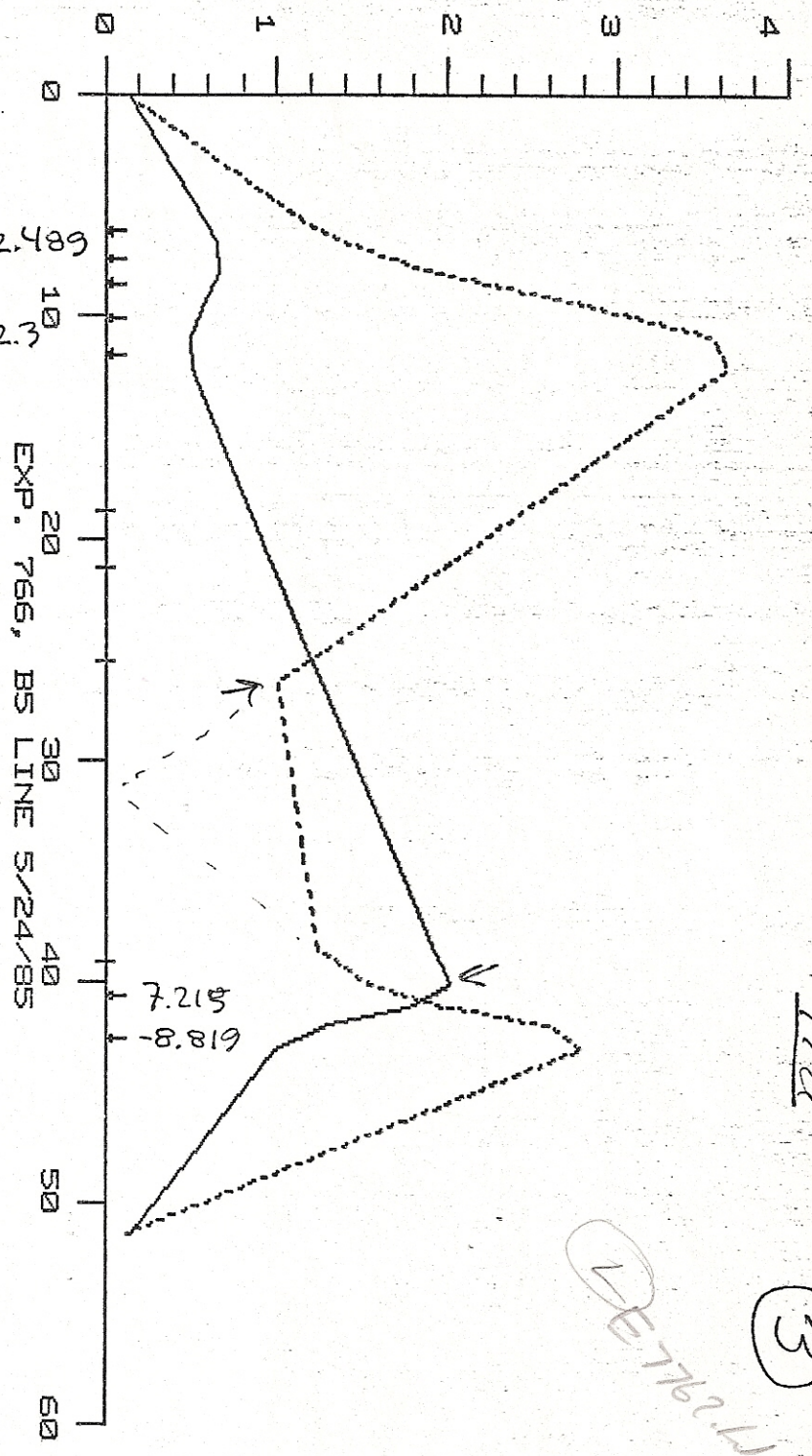
RUN PLTR

ENTER UP TO 55 CHARACTERS OF DESCRIPTION:

3" Quads
L1C

(3)

DE 766



→ : requested sizes

.TECO FORØS.DAT4HARACTERS OF DESCRIPTION:

L2K Core1
 *S04#0LT#
 S.Ø 1.321 -1.395 2.54 'Q4' ;
 *FS1.395#2.1Ø1#EX#
 CPU TIME: 4.36 ELAPSED TIME: 6.63
 .TY FORØS.DAT
 .EXP. 766, BS LINE 5/24/85'
 ØRUN PLTR
 1. .13 1. .13 2. .Ø. .3 28.5 ;
 16. .3. 1836.15 ;
 3.Ø .5.69 'D1' *CTERS OF DESCRIPTION:
 5.Ø .932 2.489 2.54 'Q1' ;
 3.Ø .249 'D2' *
 5.Ø .932 2.489 2.54 'Q2' ;
 3.Ø .249 'L2' *

DRIFFT	3.	"D1	5.690000	0.000000	0.000000	0.000000	0.000000
QUAD*	5.	"Q1	0.932200	2.489000	2.540000	10.566000	
DRIFFT	3.	"D2	0.249000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q2	0.932200	2.489000	2.540000	10.566000	
DRIFFT	3.	"L2	0.249000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q3	0.932200	2.489000	2.540000	10.566000	
DRIFFT	3.	"L3	0.435000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q4	1.321000	-2.101000	2.540000	-9.483000	
DRIFFT	3.	"L4	0.253000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q5	1.321000	-2.549000	2.540000	-6.955000	
DRIFFT	3.	"L5	5.480000	0.000000	0.000000	0.000000	
ROTAT	2.	"D1	0.600000	0.000000	0.000000	0.000000	
ROTAT	4.	"D1	1.981000	9.883000	0.000000	1.179000	
BEND*	2.	"D2	0.600000	0.000000	0.000000	0.000000	
ROTAT	2.	"D2	0.600000	0.000000	0.000000	0.000000	
DRIFFT	3.	"D3	2.350000	0.000000	0.000000	0.000000	
BEND*	4.	"D3	1.981000	0.000000	0.000000	0.000000	
DRIFFT	3.	"D4	11.960000	0.000000	0.000000	0.000000	
BEND*	4.	"D4	1.070000	0.000000	0.000000	0.000000	
DRIFFT	3.	"D6	0.500000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q6	1.000000	7.215000	2.540000	3.519000	
DRIFFT	3.	"Q7	0.910000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q7	1.000000	-8.819000	2.540000	-2.578000	
DRIFFT	3.	"Q8	8.430000	0.000000	0.000000	0.000000	
FIT	10.	"Q8	1.000000	0.000000	0.000000	0.000000	
FIT	10.	"Q9	3.000000	0.000000	0.000000	0.000000	
FIT	10.	"Q9	0.000000	0.000000	0.000000	0.000000	

5.01 1.0 6. 2.54 'Q6' ;
 ^C##

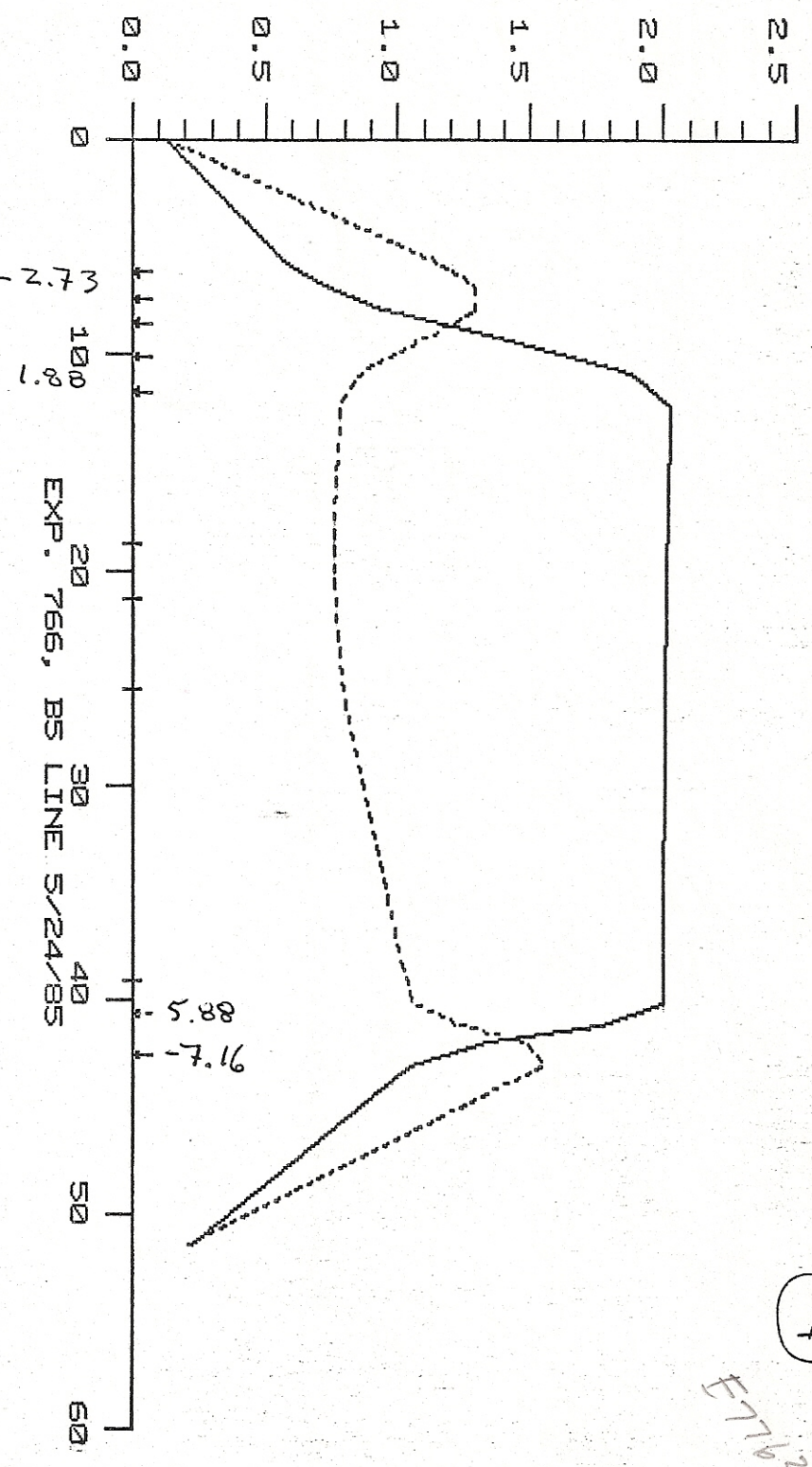
.TECO FOR05.DAT4HARACTERS OF DESCRIPTION:

```

L2K Core1
*SQ4$QLT##
5.0 1.321 -1.395 2.54 'Q4' ;
*FS1.395$2.101$EX##
CPU TIME: 4.36 ELAPSED TIME: 6.63
TY FOR05.DAT
'EXP. 766, BS LINE 5/24/85'
ORUN PLTR
1. .13 1. .13 2. 0. .3 28.5 ;
16. 3. 1836.15 ;
3.0 5.69 'D1' *CTERS OF DESCRIPTION:
5.0 .932 2.489 2.54 'Q1' ;
3.0 .249 'D2' *
5.0 .932 2.489 2.54 'Q2' ;
3.0 .249 'L2' *
5.0 .932 2.489 2.54 'Q3' ;

```


(4)
E7763.205



*S884\$I \$0TT\$\$
5.0 1.321 1.884 2.54 'Q4' ;
*S10. \$0LT\$\$
10. 1. 1. 2. .1 ;ARACTERS OF DESCRIPTION:
*4K\$EX\$\$

Q1-3 } reversed polarity
Q4.5 }

.RUN TT\TRANSIZ5,64

STOP

END OF EXECUTION
CPU TIME: 3.98 ELAPSED TIME: 12.13
EXIT

.RUN PLTR

ENTER UP TO 55 CHARACTERS OF DESCRIPTION:

(4)

DRIFT	3.	"D1	5.690000	0.000000	0.000000	0.000000	0.000000
QUAD*	5.	"Q1	0.932000	-2.733000	2.540000	-9.326000	
DRIFT	3.	"D2	0.249000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q2	0.932000	-2.733000	2.540000	-9.326000	
DRIFT	3.	"L2	0.249000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q3	0.932000	-2.733000	2.540000	-9.326000	
DRIFT	3.	"L3	0.495000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q4	1.321000	1.884000	2.540000	9.925000	
DRIFT	3.	"L4	0.253000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q5	1.321000	1.884000	2.540000	9.925000	
DRIFT	3.	"L5	5.480000	0.000000	0.000000	0.000000	
ROTAT	2.	"D1	0.600000	0.000000	0.000000	0.000000	
BEND*	4.		1.981000	9.883000	0.000000	1.179000	
ROTAT	2.		0.600000	0.000000	0.000000	0.000000	
DRIFT	3.		0.508000	0.000000	0.000000	0.000000	
ROTAT	2.	"D2	0.600000	9.883000	0.000000	1.179000	
BEND*	4.		1.981000	0.000000	0.000000	0.000000	
ROTAT	2.		0.600000	0.000000	0.000000	0.000000	
DRIFT	3.	"D3	2.350000	0.000000	0.000000	0.000000	
BEND*	4.		1.981000	0.000000	0.000000	0.000000	
DRIFT	3.	"D4	11.960000	0.000000	0.000000	0.000000	
BEND*	4.		1.070000	0.000000	0.000000	0.000000	
DRIFT	3.	"Q5	0.500000	0.000000	0.000000	0.000000	
QUAD*	5.	"Q6	1.000000	5.883000	2.540000	4.275000	
DRIFT	3.	"Q7	0.910000	0.000000	0.000000	0.000000	
QUAD*	5.		1.000000	-7.163000	2.540000	-3.209000	
DRIFT	3.		8.490000	0.000000	0.000000	0.000000	
FIT	10.		1.000100	0.100000	0.010000	0.000000	
FIT	10.		3.000030	0.100000	0.010000	0.227000	

*S884\$I \$0TT\$\$
 5.0 1.321 1.884 2.54 'Q4' ;
 *S10. \$0LT\$\$
 10. 1. 1. 2. .1 ;RRACTERS OF DESCRIPTION:
 **4K\$EX\$\$

.RUN TT\T\TRANSI25,64

STOP

END OF EXECUTION
 CPU TIME: 3.98 ELAPSED TIME: 12.13
 EXIT

.RUN PLTR

ENTER UP TO 55 CHARACTERS OF DESCRIPTION: