COMPUTATION NOTE BOOK

NATIONAL | 43-648
Made in U. S. A.

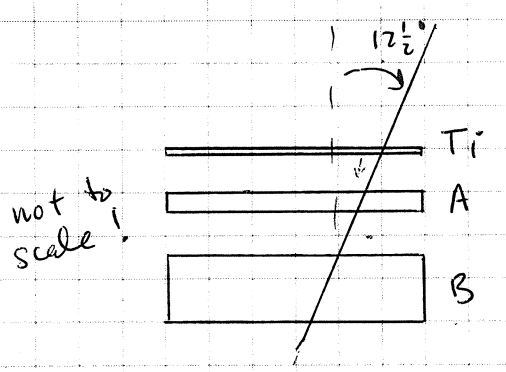
Course IMP ANALYSIS

Name J. CHILDS

Isotope Analysis Program : (ISOTIMP)

Converting RNGENG to generate mass curves in data statement form to be incorporated into 'ISOTIMP'.

IMP-6 Data — LED detector
(from a RNGENG run)



	Zone	Material	Z	A	A/Z	t (cm)	g/cm²	ρ g/cc	Ion POT'L
	1	Ti	22	(47.901)	2.1773	.0002	.0010	4.54	247.4
A	2	Si	14.	27.744	1.9817	.0146	.0340	2.33	172.3
B	3	Si	14	27.744	1.9817	.3000	.6990	2.33	172.3

but assume 12½° incidence

Given an absorber of thickness ΔX and an incident particle of energy E, can determine the outgoing energy E' as follows:

$$\xrightarrow{E} \boxed{\Delta X} \longrightarrow E'$$

$$R(E) = \Delta X + R(E')$$

$$E' = R^{-1}(R(E) - \Delta X)$$

If given E' (i.e., the B detector energy), can calculate the energy in A detector as follows:

$$\xrightarrow{E_I} \boxed{\Delta X_A} \longrightarrow E_B \qquad E_A = E_I - E_B$$

$$R(E_I) = \Delta X_A + R(E_B)$$

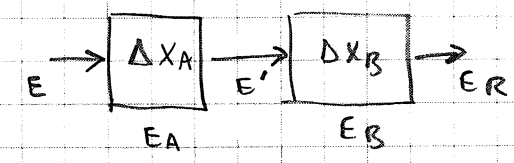
$$E_I = R^{-1}(R(E_B) + \Delta X_A)$$

$$\boxed{E_A = E_I - E_B = R^{-1}(R(E_B) + \Delta X_A) - E_B}$$

program:

```
DO α B channel = 1, max
    calculate E_B (B channel)
    calculate R(E_B)
    calculate E_A = R^-1(R(E_B)+ΔX_A) - E_B
    calculate A channel (E_A)
```

For <u>penetrating</u> particles, (i.e. $E_R > 0$ below) we are given ΔX_A, ΔX_B, E_B, & need E_A.



$$R(E') = \Delta X_B + R(E_R) \quad , \quad E' = E_B + E_R$$

$$R(E') = \Delta X_B + R(E' - E_B)$$

$$R(E) = \Delta X_A + R(E') \quad , \quad E = E_A + E'$$

$$R(E_A + E') = \Delta X_A + R(E')$$

→ So, need to solve $R(E') = \Delta X_B + R(E' - E_B)$ for E', and then plug into

$$E_A = R^{-1}\left(R(E') + \Delta X_A\right) - E'$$

Program:

First, set up E' table based on E_B

$$E_B = E' - R^{-1}\left(R(E') - \Delta X_B\right)$$

Do ∝ B channel = max, min
calculate E_B (B channel)
Determine E' by reiteration
use table for initial limits
interpolate
Calculate $E_A = E_A(E', \Delta X_A)$
calculate A channel (E_A)

Rough calibration of IMP-6, 7 LED detectors.

IMP-6: min A channel ~ 20
min A " halfwidth ~ 24

(using V.K.B.'s calibration)

max B channel ~164
max B " halfwidth ~ 162

IMP-7: min A channel ~ 20
min A " halfwidth ~28

max B channel ~160
max B halfwidth ~158

Thickness of B detector = .300 cm × $\frac{1}{\cos(12\frac{1}{2}°)}$ = .3073

~~Now, A detector = .0146 × $\frac{1}{\cos(\ )}$ = .01492~~

RNGENG says that 92.7 Mev α's will just stop in .3072 cm. of Si.

Thickness of A detector = .0146 × $\frac{1}{\cos(-)}$ = .01495

RNGENG says that the corresponding A energy is 2.516 Mev. (ie, min A energy in coincidence)

Assume offsets ~ 2 channels each

$$B_{ch} = B_s \cdot E_B + B_{off}$$

$$B_s = \frac{B_{ch} - B_{off}}{E_B} = \frac{162 - 2}{92.7} = 1.726 \text{ ch/Mev}$$

(or .579 Mev/ch.)

$$A_{ch} = A_s \cdot E_A + A_{off}$$

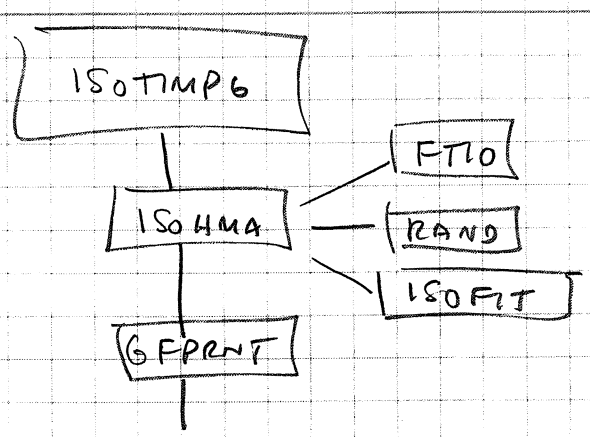
$$A_s = \frac{A_{ch} - A_{off}}{E_A} = \frac{24 - 2}{2.516} = 8.74 \text{ ch/Mev}$$

(or .1144 Mev/ch)

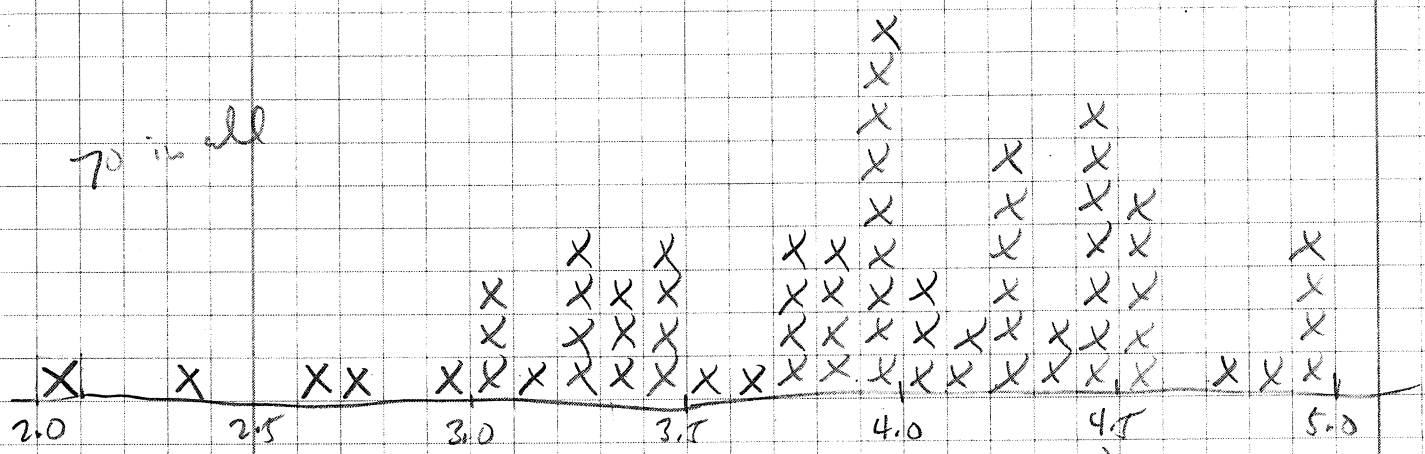
So use

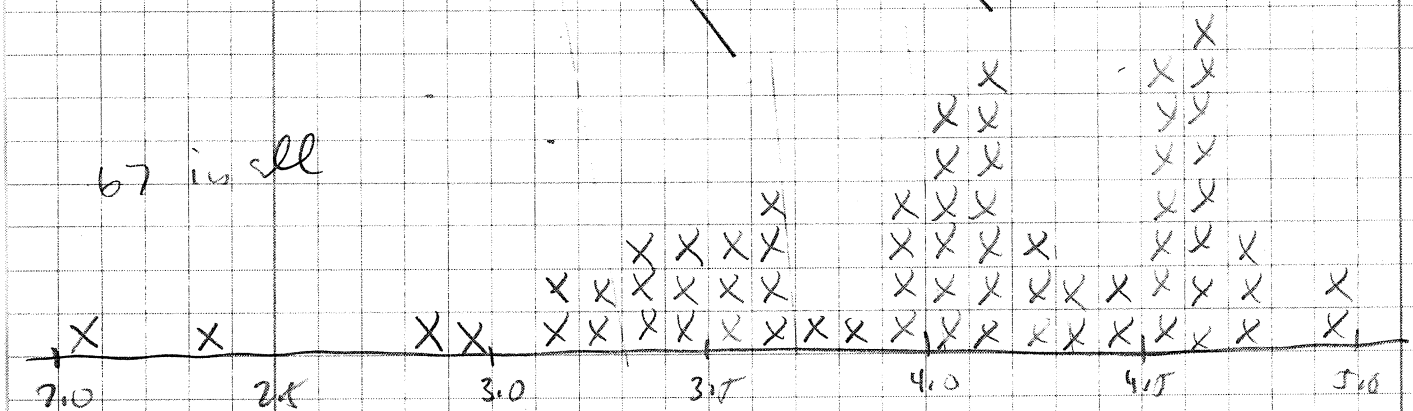
$$A(\text{ch.}) = 8.74 \times E_A + 2$$

$$B(\text{ch.}) = 1.726 \times E_B + 2$$

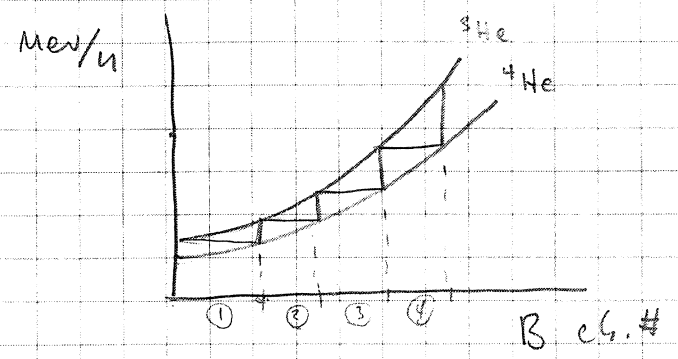

ISOTIMP6
ISOHMA
FTIO
RAND
ISOFIT
GFPRNT

Hand analysis





1) Plot ^3He & ^4He response curves (E/nucleon vs. B channel) to get B channel boxes



Boxes chosen so that ^3He energy range of first box is same as ^4He " " of 2nd box, etc.

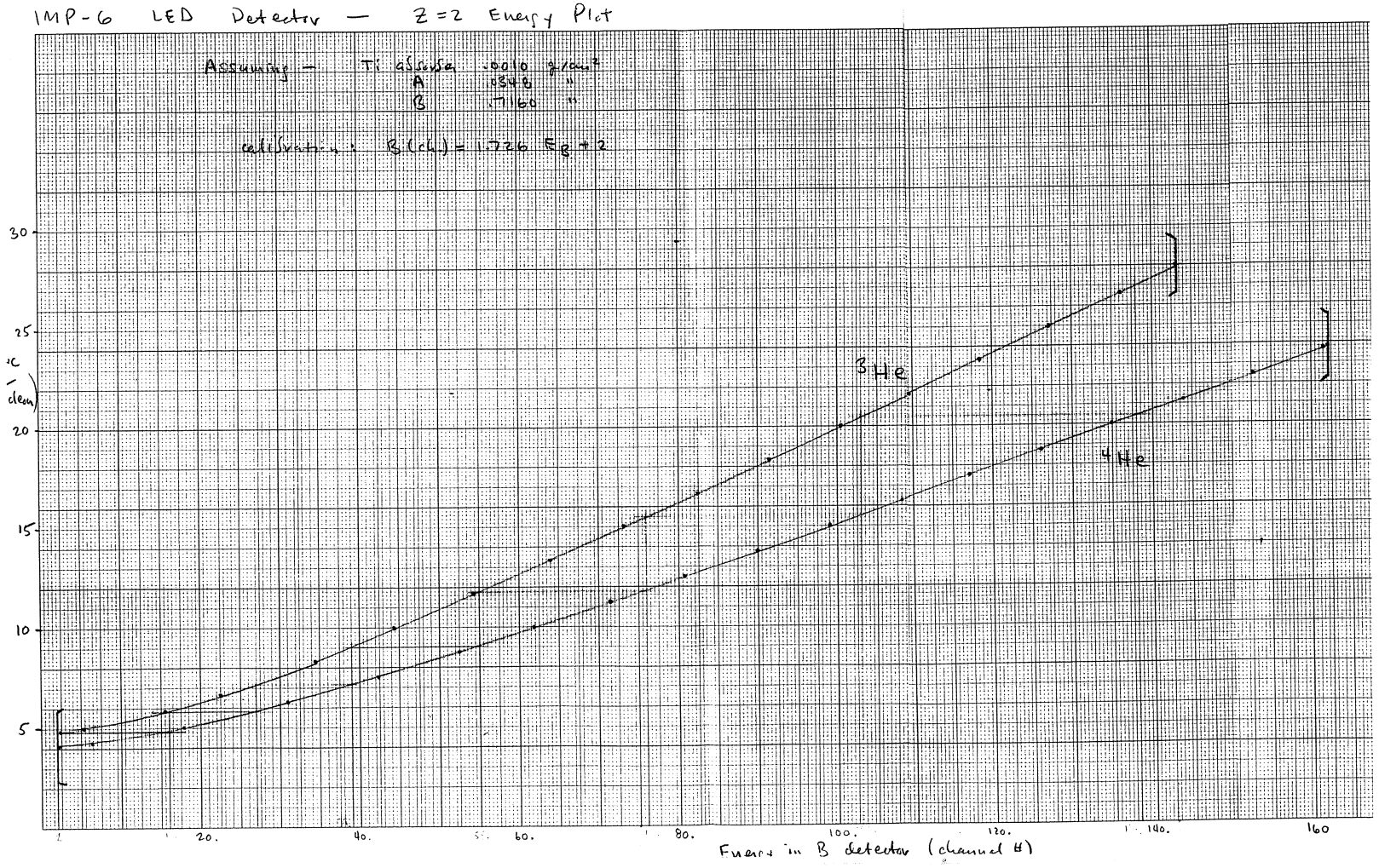
2) Pick strong ^4He event for calibration

Try: 16-19 MAY 71 — Interval #16
20-23 APR 71 (20th) — ~~Interval #10~~ ~~#7~~ #42

Calculation of E_{inc} vs. B channel curves — (IMP-6 LED)
Source: RNGFNG calculation for ^3He & ^4He
using Ti absorber .0010 g/cm²
A .0348 "
B .7160 "
and assuming $B(ch.) = 1.726 \times E_B + 2$

E_{inc} (^3He)	Mev/nucleon	E_B	B ch.
14.6	4.87	.073	2.3
15	5.00	1.89	5.3
17.5	5.83	7.83	15.5
20	6.67	11.95	22.6
25	8.33	18.78	34.4
30	10.00	24.54	44.35
35	11.67	30.26	54.2
40	13.33	35.78	63.8
45	15.00	41.19	73.1
50	16.67	46.51	82.3
55	18.33	51.78	91.4
60	20.00	57.01	100.4
65	21.67	62.20	109.4
70	23.33	67.37	118.3
75	25.00	72.51	127.2
80	26.67	77.64	136.0
84.0	28.00	81.73	143.1

IMP-6 LED Detector — Z = 2 Energy Plot



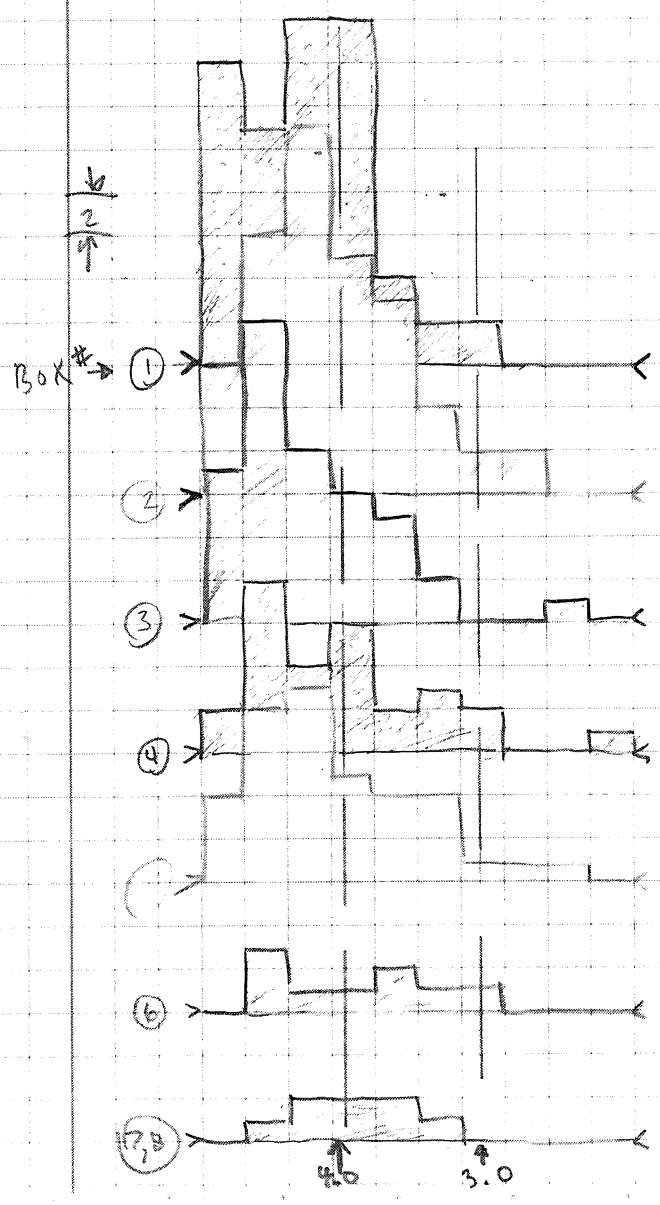
E_{inc} (^4He)	Mev/nucleon	E_B	B ch.
16.4	4.10	.14	2.2
17	4.25	2.53	6.4
20	5.00	9.20	17.9
25	6.25	16.83	31.0
30	7.50	23.35	42.3
35	8.75	29.14	52.3
40	10.00	34.64	61.8
45	11.25	40.18	71.4
50	12.50	45.59	80.7
55	13.75	50.93	89.9
60	15.00	56.22	99.0
65	16.25	61.46	108.1
70	17.50	66.68	117.1
75	18.75	71.86	126.0
80	20.00	77.02	134.9
85	21.25	82.17	143.8
90	22.50	87.30	152.7
95	23.75	92.42	161.5
(95.3	23.83	92.72	162.0

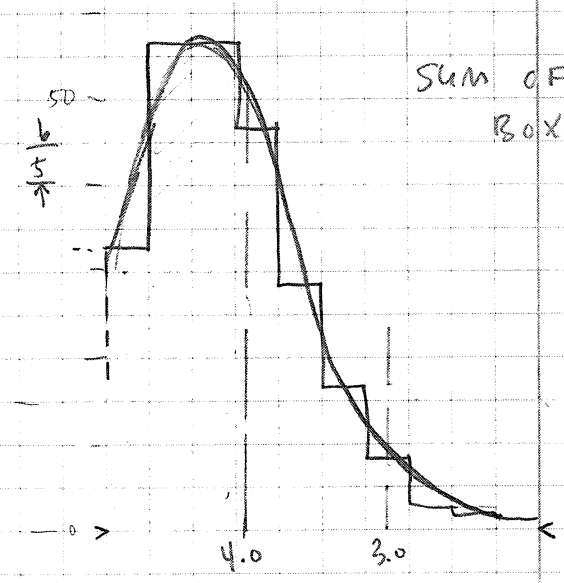
B channels from energy plots: 2, 16, 27, 39, 55, 76, 103,

Box	^{3}He energy Mev/u	^{3}He energy total	^{4}He energy Mev/u	^{4}He energy total
2-16	4.8-5.8	14.4-17.4	0-4.8	0-14.4
16-27	5.8-7.2	17.4-21.6	4.8-5.8	14.4-17.4
27-39	7.2-9.0	21.6-27.0	5.8-7.2	17.4-21.6
39-55	9.0-11.8	27.0-35.4	7.2-9.0	21.6-27.0
55-76	11.8-15.5	35.4-46.5	9.0-11.8	27.0-35.4
76-103	15.5-20.5	46.5-61.5	11.8-15.5	35.4-46.5
103-138	20.5-27.0	61.5-81.0	15.5-20.5	46.5-61.5
138-162	27.0-28.0	81.0-84.0	20.5-23.8	61.5-71.4

Plotting away 3/10's of an AMU.

	Box 1	2	3	4	5	6	7	8	SUM
4.7-4.9	14	6	7	2	4	0	0	0	33
4.4-4.6	11	12	14	8	8	3	0	1	57
4.1-4.3	16	17	8	4	9	1	1	1	57
3.8-4.0	16	11	6	6	5	1	0	2	47
3.5-3.7	4	9	5	2	4	2	2	0	28
3.2-3.4	2	4	2	3	4	1	1	0	17
2.9-3.1	2	2	0	2	1	1	0	0	8
2.6-2.8	0	2	0	0	1	0	0	0	3
2.3-2.5	0	0	1	0	1	0	0	0	2
2.0-2.2	0	0	0	1	0	0	0	0	1



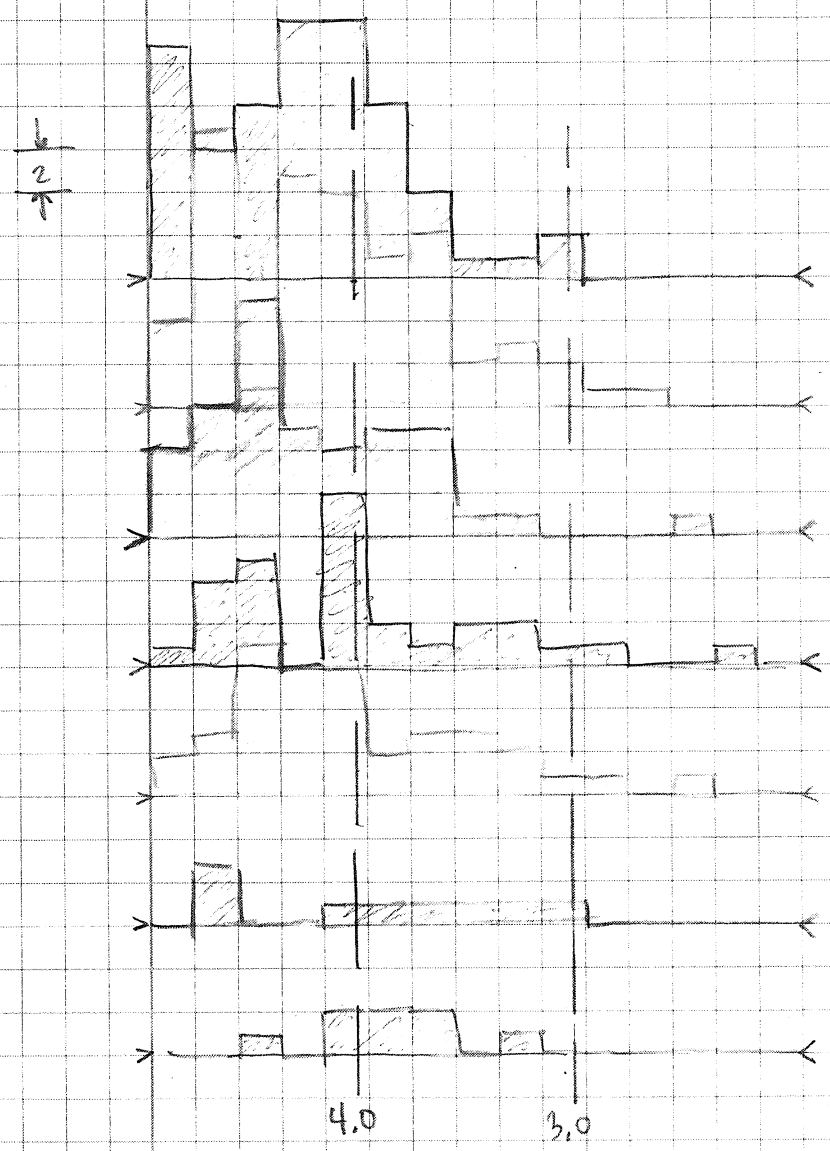


SUM OF ALL BOXES

obviously, we're chopping useful data off, particularly with low boxes.

Plotting every 2/10's of an Arch

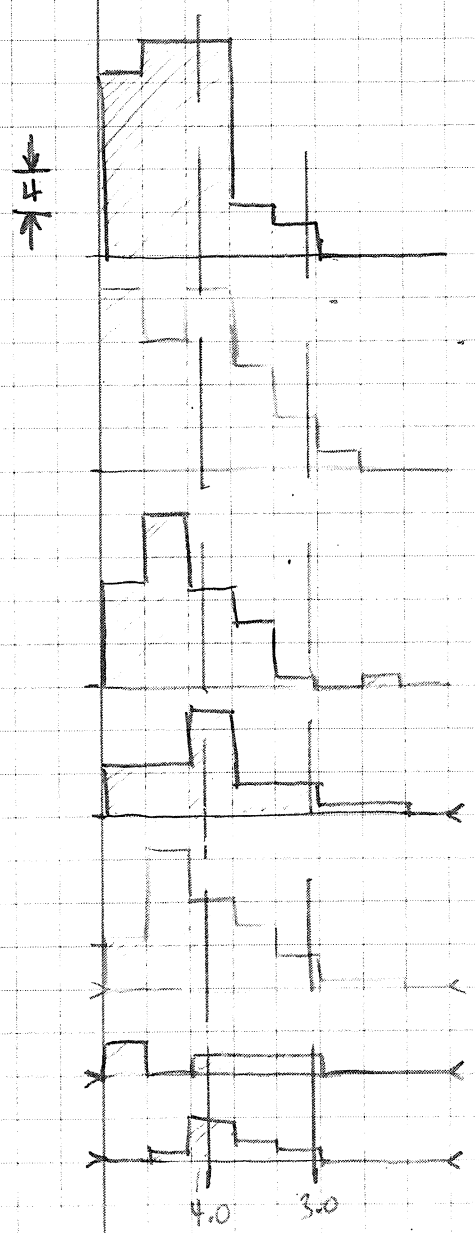
Box	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	11	6	8	12	12	8	4	1	1	2	0	0	0	0	0
2	4	13	1	11	10	7	8	2	3	2	1	1	0	0	0
3	4	6	11	5	4	5	5	1	1	0	0	0	1	0	0
4	1	4	5	0	8	2	1	2	2	1	1	0	0	1	0
5	2	3	7	6	6	2	3	3	2	1	1	0	1	0	0
6	0	3	0	0	1	1	1	1	1	1	0	0	0	0	0
7	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0
8	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0



This looks like a good number of channels in mass axis.

Plotting every 4/10's of an AMU

Box	1	2	3	4	5	6	7	8
1	17	20	20	5	3	0	0	0
2	17	12	17	10	5	2	0	0
3	10	16	9	6	1	0	1	0
4	5	5	10	3	3	1	1	0
5	5	13	8	6	3	1	1	0
6	3	0	2	2	2	0	0	0
7	0	0	1	2	1	0	0	0
8	0	1	3	0	0	0	0	0



Strong ^4He event 31 AUG '71 (orbit #42)

Plot 2/10's of AMU

Box															
1	92	83	128	125	97	69	43	17	5	5	0	1	0	4	2
2	92	107	141	135	116	101	45	30	16	2	3	3	2	2	2
3	116	95	139	108	97	90	43	33	5	2	2	2	0	3	1
4	88	116	98	130	96	52	30	28	12	4	2	3	2	2	0
5	67	72	88	80	67	69	61	37	17	7	3	0	1	0	1
6	46	77	84	86	85	72	34	27	9	5	1	0	3	0	1
7	27	47	46	59	61	55	20	16	8	2	3	0	0	0	0
8	10	22	30	15	23	17	15	7	7	2	0	0	0	0	0

245
run 2 SEP 71 for 24 hours

~~Picking~~
Observe that ΔY offset looks like 4, not 2 as was guessed for the calibration curves.

Picking equidistant points along X-axis:

$Y =$	120	77	60	48	40	32	94
$\Delta Y =$	5	4.5	3.3	3.0	2.8	2.5	5
$\Delta Y / Y =$	.04	.06	.055	.06	.07	.078	.053
$(\Delta Y - 1)/Y =$	.033	.045	.042	.042	.045	.047	.042
$(\Delta Y - 2)/Y =$	.025	.032	.022	.021	.020	.016	.032

.044

So, set $\Delta Y = -1$ and coef of $Y = \underline{.956}$

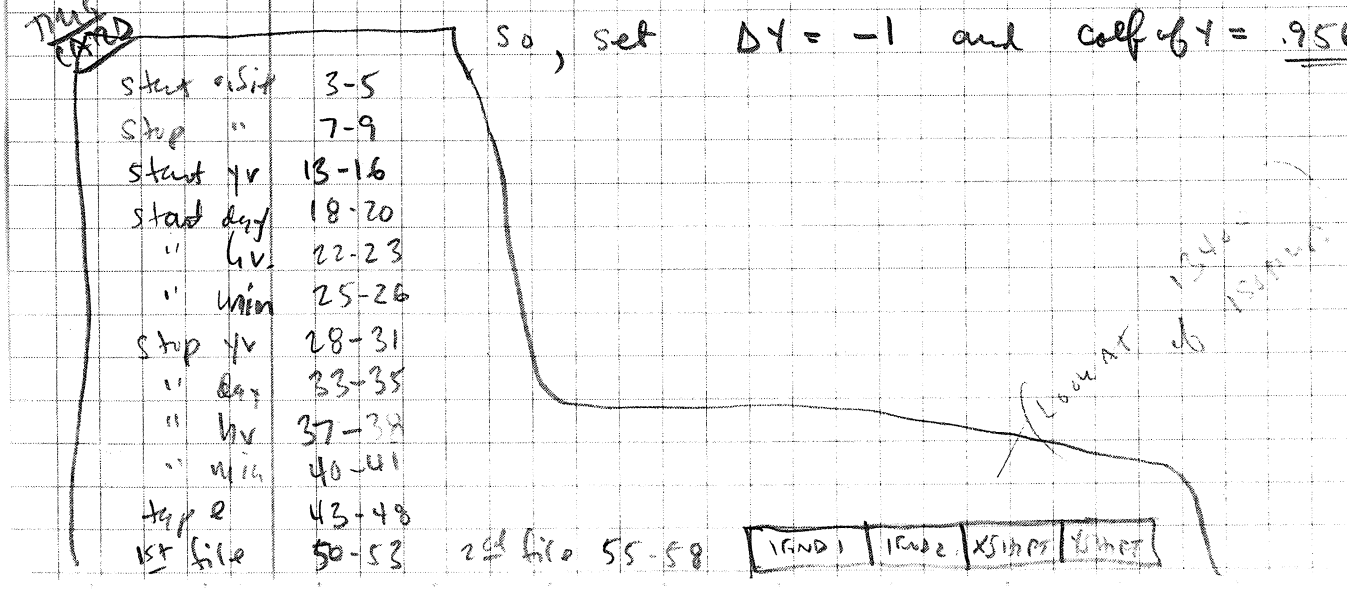
TMS CARD

start orbit	3-5
stop "	7-9
start yr	13-16
start day	18-20
" hr	22-23
" min	25-26
stop yr	28-31
" day	33-35
" hr	37-38
" min	40-41
tape	43-48
1st file	50-53

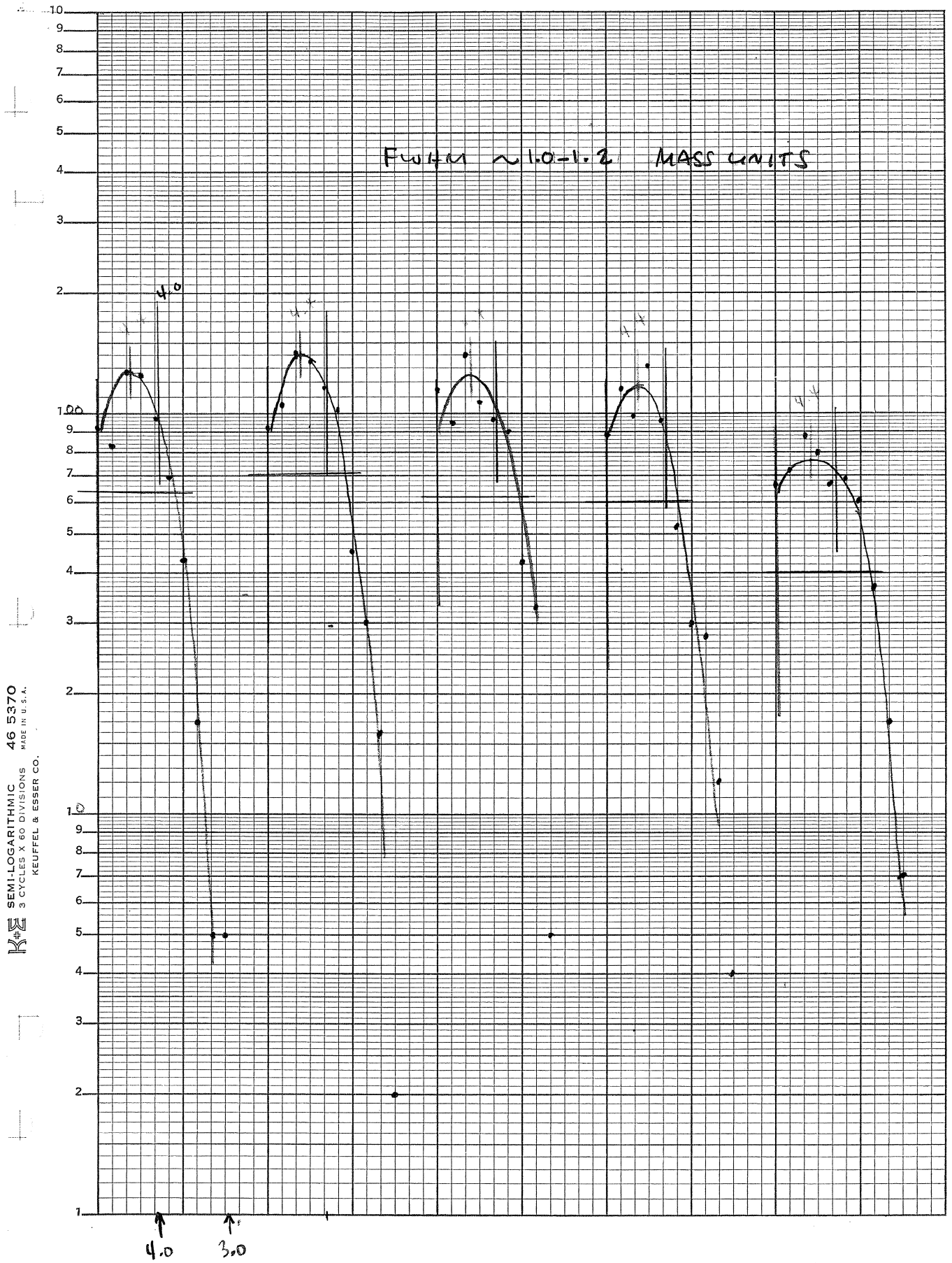
2nd file 55-58

IFND1	IFND2	XSHIFT	YSHIFT

Look at 1340 ISOTOPE



PS. 18 -1


FWHM ~1.0-1.2 MASS UNITS
4.0
4.0
3.0
SEMI-LOGARITHMIC
3 CYCLES X 60 DIVISIONS
KEUFFEL & ESSER CO.
46 5370
MADE IN U.S.A.

Consider for program

→ selective gain shifting

Overlap IMP-6 ^3He-rich events:

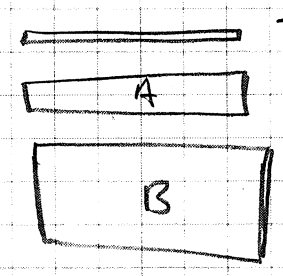
1) 30 JUN 0300 — 1 JUL 1200 1971

2) 12 MAY 1500 — 13 MAY 2115 1971

IMP-7 Calibration analysis

interval	140	142	144	146	148	150	152	154	156	158 (B)	160	162	164	166	168	170	14	16	18	20	22	24 (A)	26	28	30	32	Offset B	Offset A
181	1	2	2	3	1	1	2	1	0	1	0	1	0	0	0	1	0	0	0	1	2	6	11	21	28	47	30	1	4
182	0	1	2	2	3	0	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	8	10	8	11	11	13	1	4
183	9	4	9	11	11	13	9	7	10	5	0	0	0	0	0	0	0	0	0	2	7	38	53	63	62	64		1	4
184	20	32	16	34	28	21	30	25	24	14	4	3	1	0	0	0	0	0	0	6	36	88	160	192				3/4	3
185	1	1	3	9	7	8	3	3	5	1	0	0	0	0	0	0	0	0	0	2	2	21	38	39				1	3½
186	3	0	3	6	2	4	5	6	5	1	1	0	0	0	0	0	0	1	1	1	3	12	18	9				1	4
187	0	0	2	1	0	1	0	1	0	0	2	0	0	0	0	0	0	1	1	0	1	3	3	7				2	4
188	1	0	0	2	1	2	0	1	0	0	0	1	0	0	0	0	1	0	0	0	3	3	0	7				1	4
189	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	2	1	3	0				2	4½
190	2	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	6	1	7	4				1	3
191	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	4	2				2	3
192	0	0	1	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	4	2				2	3
193	0	0	0	0	3	2	0	2	0	1	0	0	0	0	0	0	0	0	0	1	2	2	4	1				2	3
194	3	2	5	2	5	2	4	5	3	2	0	0	0	0	0	0	0	0	0	3	4	11	23	23				½	3
195	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2				1	3
196	0	1	1	2	2	2	2	1	0	1	0	0	0	0	0	0	0	0	0	1	2	4	4	4				2	4
197	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	3	6				2	3
198	1	0	2	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	1	2	3	4				2	3
199	1	1	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	8	2				2	3
200	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	5	3				2	3
201	0	0	2	0	1	0	3	0	1	0	0	0	0	1	0	0	1	0	0	0	0	3	5	3				2	3
202	1	0	0	1	1	0	0	1	2	0	1	0	0	0	0	0	0	0	0	0	1	1	6	3				2	3
203	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	7				2	3
204	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	2	5	3				1½	3
205	2	4	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	4	4	6				2	3
206	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	2	4	3				2	3
207	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	3	2	3				2	3
208	1	0	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	8	7				2	3
209	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	2	4	2				2	3
	49	53	51	78	76	60	65	59	62	36	9	6	1	1	0	1	2	3	3	22	73	232	401	436				1.6	3.31

MP-6 LED
(from RNGENG run)



Ti .001 gm/cm²
Si .0370 g/cm²
Si .6980 g/cm²

If assume $12\frac{1}{2}°$ incidence,

Ti	.0010	g/cm²
A	.0379	"
B	.7160	"

A channel : offset = 3.3 ch. min ch. = 24.0
B channel : offset = 1.6 ch. max ch. = 158.5

Thickness of B detector = .3073 cm., which will just stop 92.7 MeV α's
Thickness of A detector is .0163 cm., corresponding to energy of 2.736. (i.e. max A energy is 2.736 MeV)

$$B_{ch} = \beta \cdot E_B + B_{off}$$

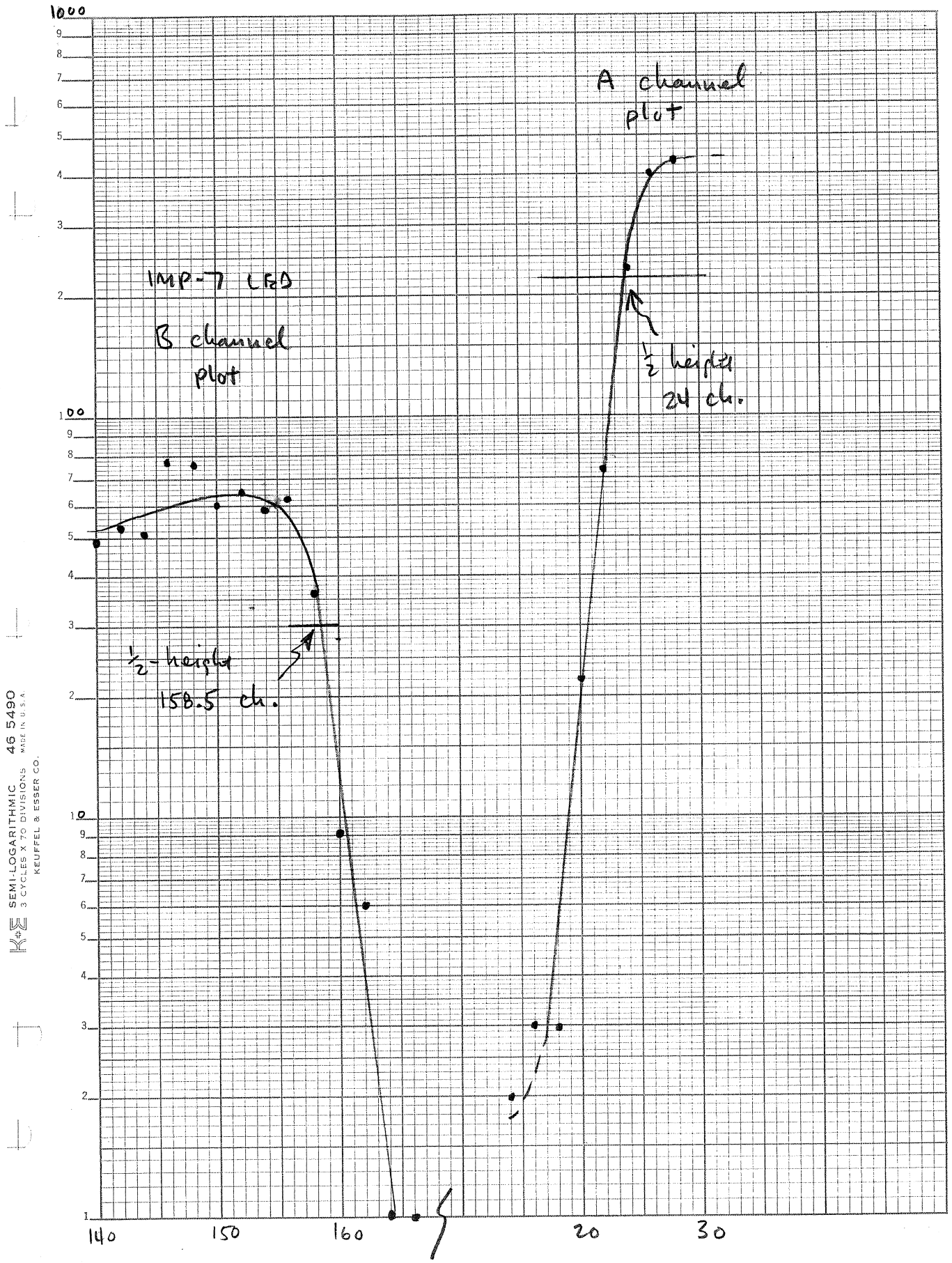
$$\beta = \frac{B_{ch} - B_{off}}{E_B} = \frac{158.5 - 1.6}{92.7} = 1.6925 \text{ ch/MeV}$$

(or .5908 MeV/ch.)

$$A_{ch} = \alpha \cdot E_A + A_{off}$$

$$\alpha = \frac{A_{ch} - A_{off}}{E_A} = \frac{24.0 - 3.3}{2.736} = 7.5658 \text{ ch/MeV}$$

(or .1322 MeV/ch.)


A channel plot
IMP-7 LED
B channel plot
½ height 24 ch.
½-height 158.5 ch.
1000
100
10
1
140
150
160
20
30
SEMI-LOGARITHMIC 46 5490
3 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

Tabulation of E_{inc} vs. B channel for IMP-7 LED.

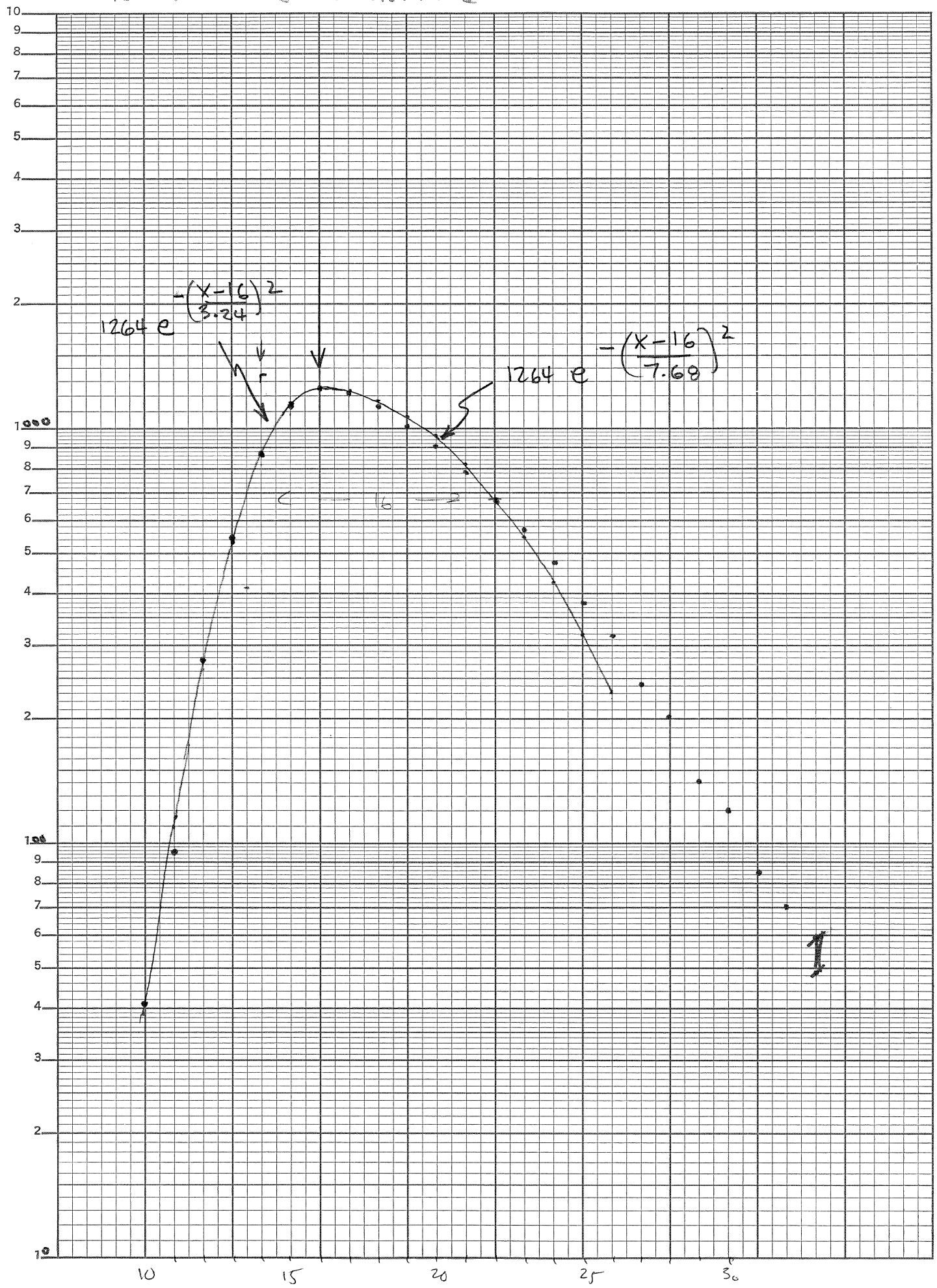
Source: RNGBNG calculation for ^3He and ^4He
using T: absorber .001 g/cm²
A .0379 "
B .7160 "

and assuming $B(ch.) = 1.6925 \times E_B + 1.6$

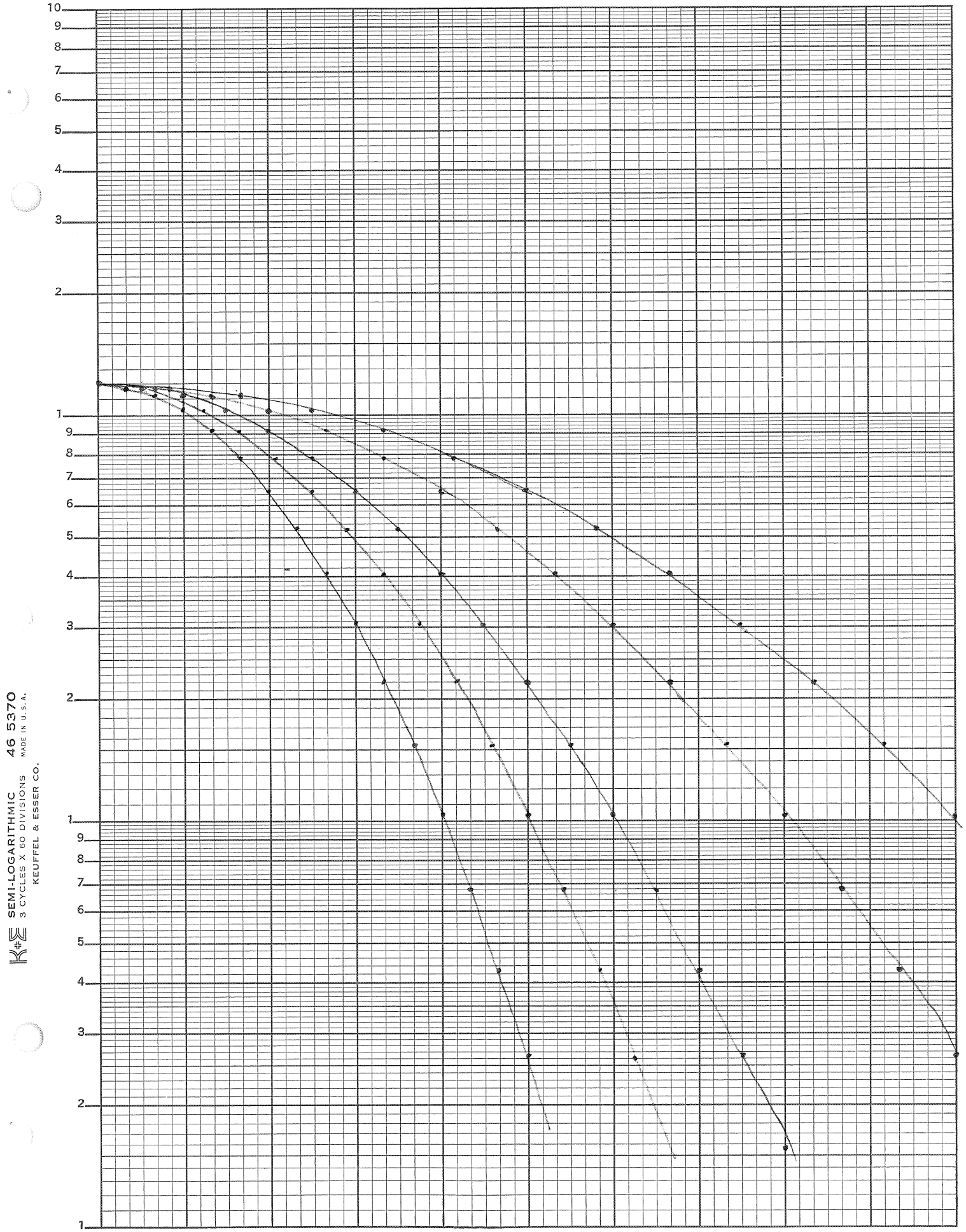
	E_{inc}	MeV/u	E_B	B ch.
^3He	15.4	5.13	.47	2.4
	17.5	5.8	6.6	12.8
	20	6.67	11.1	20.4
	25	8.33	18.2	32.4
	30	10.0	24.0	42.2
	35	11.67	29.8	52.0
	40	13.33	35.4	61.5
	45	15.	40.85	70.7
	50	16.67	46.2	79.8
	55	18.33	51.5	88.8
	60	20.	56.75	97.6
	65	21.67	62.0	106.5
	70	23.33	67.1	115.2
	75	25.	72.3	124.0
	80	26.67	77.4	132.6
	84.2	28.07	81.7	140.0

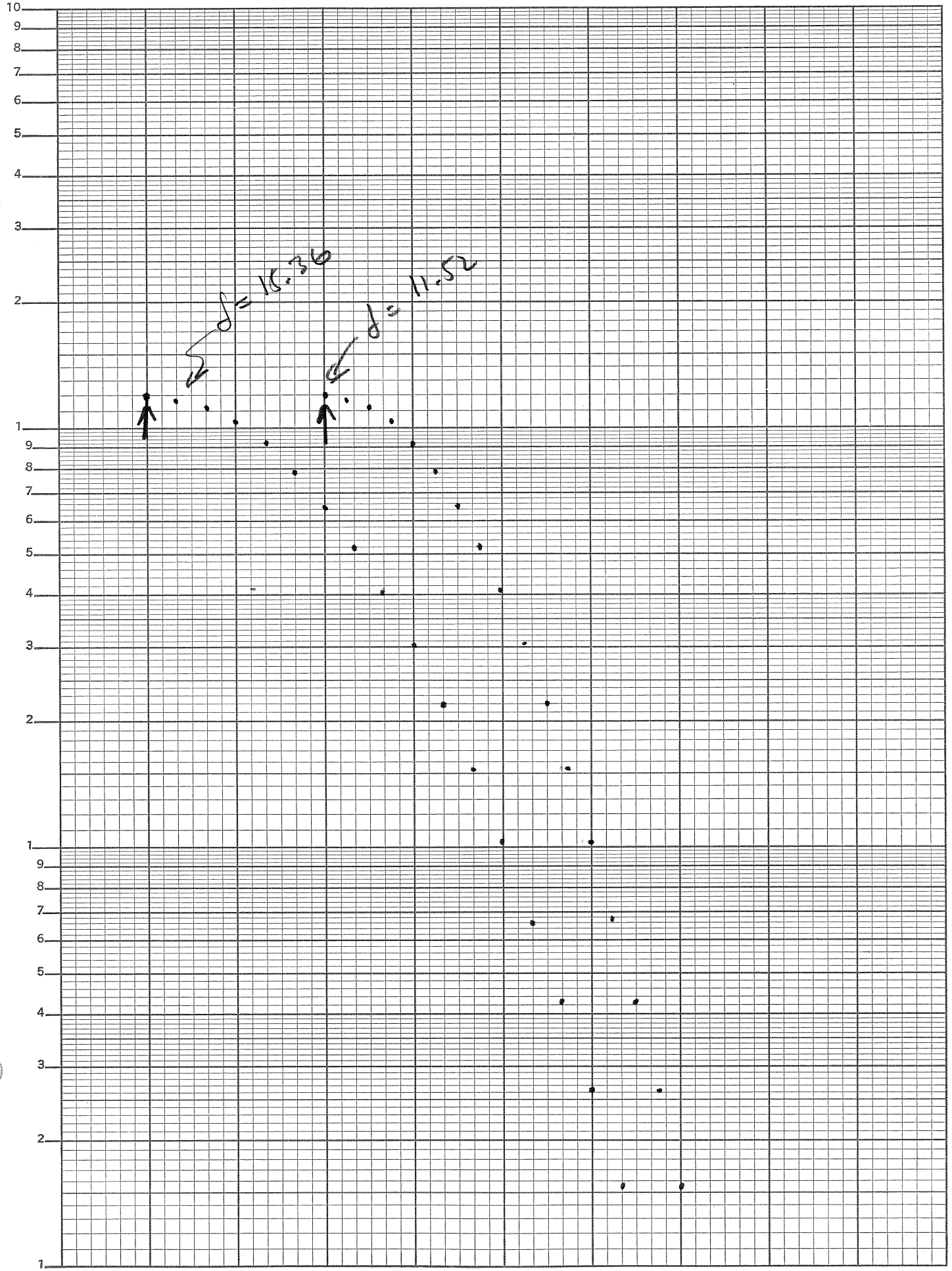
IME-6

Discontinuous Gaussians



SEMI-LOGARITHMIC 46 5370
3 CYCLES X 60 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

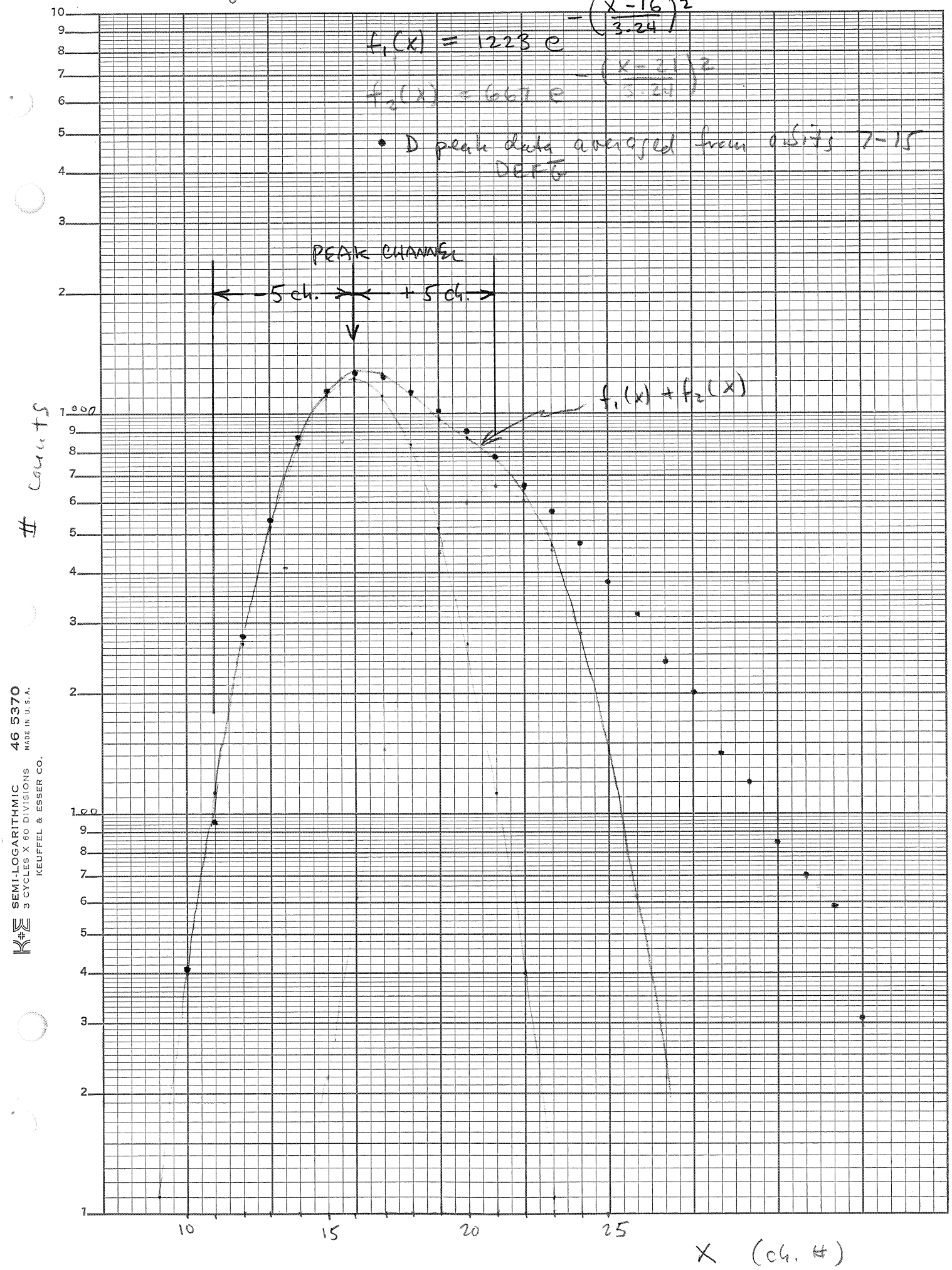

10
9
8
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
SEMI-LOGARITHMIC
3 CYCLES X 60 DIVISIONS
KEUFFEL & ESSER CO.
46 5370
MADE IN U.S.A.

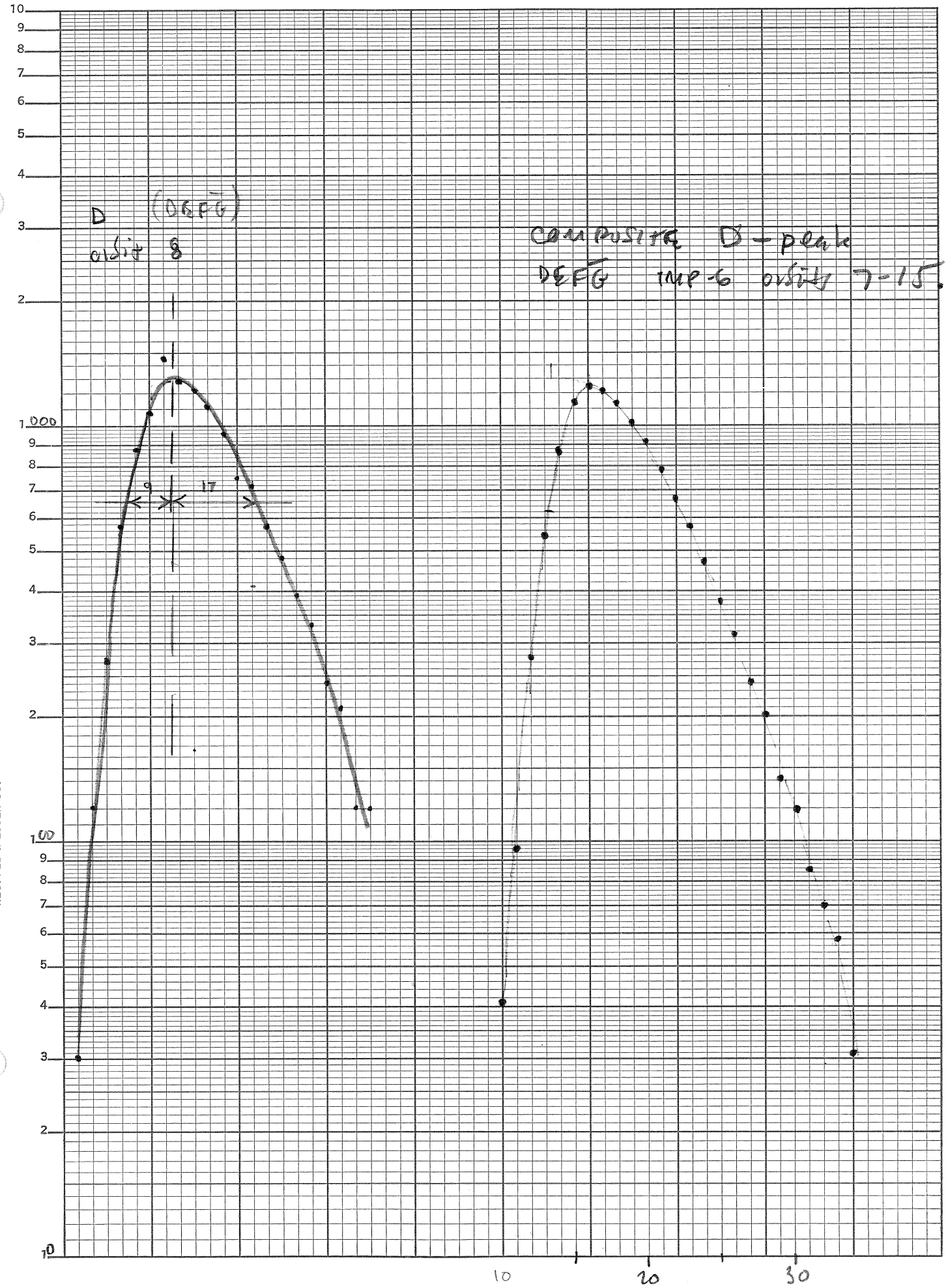


SEMI-LOGARITHMIC 46 5370
3 CYCLES X 60 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

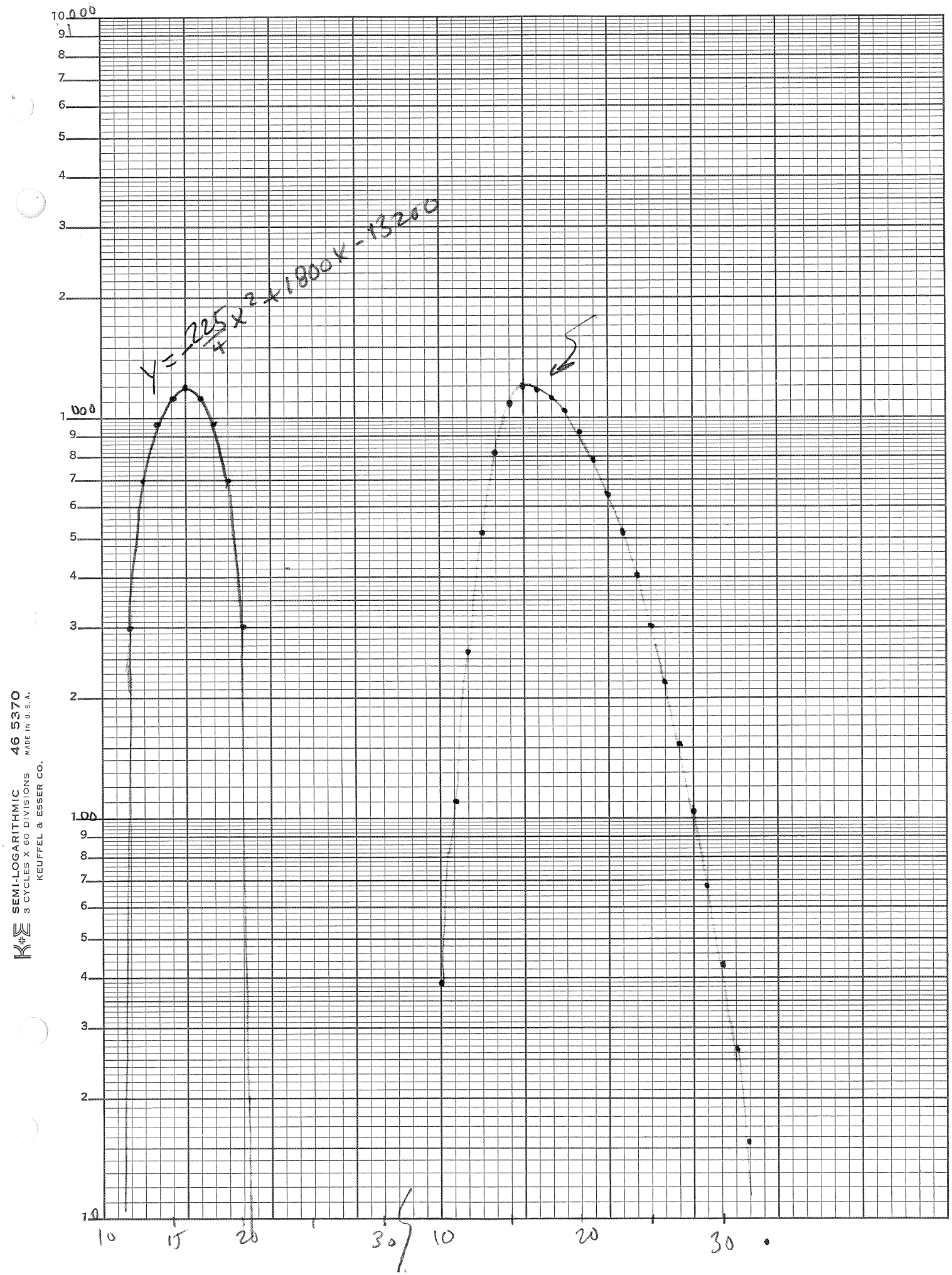
IMP-6

Sum of Gaussians





SEMI-LOGARITHMIC 46 5370
3 CYCLES X 60 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.



10,000
1,000
100
10
$y = -\frac{225}{4}x^2 + 1800x - 13200$
10
15
20
30
10
20
30
SEMI-LOGARITHMIC 46 5370
3 CYCLES X 60 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

Table 14-2c. IMP-8 Rate Identification Table

ID	Geometry Factor	Live Time	RATE
1	2.810	10.24	DI.E.-F.-G
2	2.540	10.24	DI.E.F.-G
3	2.810	10.24	DI.-D2.E.-F.-G
4	2.810	10.24	DI.-(DI&EI)1.E.-F.-G
5	0.0	10.24	ID1
6	0.0	10.24	ID2
7	2.810	10.24	DI.(DII&EII)R.E.-F.-G
8	2.540	10.24	DI.E.F
9	2.540	10.24	DI.(DI&EI)2.-(DII&EII)R.E.F.-G
10	2.540	10.24	DI.(DII&EII)R.E.F.-G
11	0.0	10.24	DI
12	0.0	10.24	E
13	0.0	10.24	F
14	0.0	10.24	G
15	2.810	10.24	DI.(DI&EI)1.E.-F.-G
16	2.810	10.24	(DI&EI)2.E.-F.-G
17	0.390	10.24	(A&B)1.B.-C
18	0.390	10.24	A.B.-C
19	0.0	10.24	A1
20	0.390	10.24	(A&B)1.-B.-C
21	0.0	10.24	B
22	0.390	9.20	(A&B)2.A.B.-C
23	0.390	9.20	(A&B)2.A.-B.-C
24	0.0	10.24	A1.B
25	0.390	10.24	A1.-B.-C
26	0.0	10.24	C
27	4.830	5.12	DI4
28	4.830	5.12	DI3
29	4.830	5.12	DI2
30	4.830	5.12	DI1
31	0.0	5.12	F
32	0.0	5.12	E
33	0.0	5.12	DII
34	4.830	5.12	DI
35	0.165	5.12	DI.DII.S1D.-F
36	0.165	5.12	DI.DII.S2D.-F
37	2.540	SECTORED:	DI.E.F.-G
38	2.900	SECTORED:	DI.-D2.E.-F.-G
39	2.900	SECTORED:	(DI&EI)1.E.-F.-G
40	2.900	SECTORED:	DI.-(DI&EI)1.E.-F.-G
41	0.390	SECTORED:	A1.-B.-C
42	0.390	SECTORED:	A1.B.-C
43	0.165	SECTORED:	DI.DII.-F
44	0.165	SECTORED:	DI.DII.S1D.-F

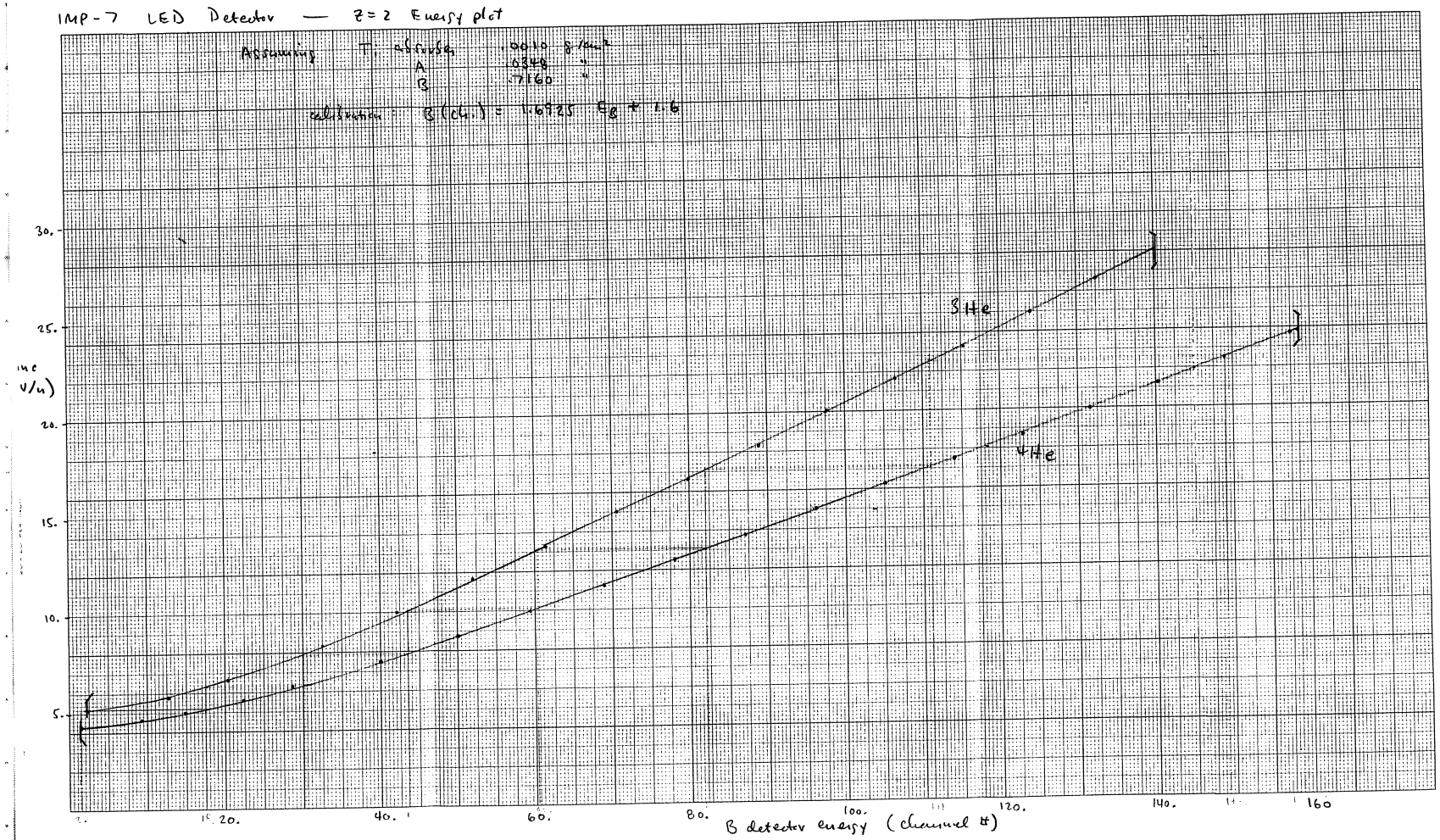
Table 14-2b. IMP-7 Rate Identification Table

ID	Geometry Factor	Live Time	RATE
1	2.940	10.24	DI.E.-F.-G
2	2.550	10.24	DI.E.F.-G
3	2.940	10.24	DI.-D2.E.-F.-G
4	2.940	10.24	DI.-(DI&EI)1.E.-F.-G
5	61.900	10.24	ID1
6	61.900	10.24	ID2
7	2.940	10.24	DI.(DII&EII)R.E.-F.-G
8	2.550	10.24	DI.E.F
9	2.550	10.24	DI.(DI&EI)2.-(DII&EII)R.E.F.-G
10	2.550	10.24	DI.(DII&EII)R.E.F.-G
11	61.900	10.24	DI
12	0.0	10.24	E
13	0.0	10.24	F
14	0.0	10.24	G
15	2.940	10.24	DI.(DI&EI)1.E.-F.-G
16	2.940	10.24	(DI&EI)2.E.-F.-G
17	0.390	10.24	(A&B)1.B.-C
18	0.390	10.24	A.B.-C
19	0.0	10.24	A1
20	0.390	10.24	(A&B)1.-B.-C
21	0.0	10.24	B
22	0.0	10.24	IA2
23	0.0	10.24	IA1
24	0.0	10.24	A1.B
25	0.390	10.24	A1.-B.-C
26	0.0	10.24	C
27	0.014	5.12	SI1.-SII.-SIIA.-SIII
28	0.014	5.12	SI2.-SII.-SIIA.-SIII
29	0.014	5.12	SI3.-SII.-SIIA.-SIII
30	0.014	5.12	SI4.-SII.-SIIA.-SIII
31	0.014	5.12	SI1.-SII.-SIIA.-SIIIF
32	0.014	5.12	SI2.-SII.-SIIA.-SIIIF
33	0.014	5.12	SI3.-SII.-SIIA.-SIIIF
34	0.014	5.12	SI4.-SII.-SIIA.-SIIIF
35	0.014	5.12	SI.SII1.-SIIA.-SIII
36	0.014	5.12	SI.SII2.-SIIA.-SIII
37	0.014	5.12	SI.SII3.-SIIA.-SIII
38	0.014	5.12	SI.SII4.-SIIA.-SIII
39	0.014	5.12	SI.SII1.-SIIA.-SIIIF
40	0.014	5.12	SI.SII2.-SIIA.-SIIIF
41	0.014	5.12	SI.SII3.-SIIA.-SIIIF
42	0.014	5.12	SI.SII4.-SIIA.-SIIIF
43	0.014	5.12	SI
44	0.014	5.12	SIF
45	0.0	5.12	SII
46	0.0	5.12	SIIF
47	0.0	5.12	SIIA
48	0.0	5.12	SIIAF
49	0.0	5.12	SIII
50	0.0	5.12	SIIIF
51	2.550	SECTORED:	DI.E.F.-G
52	2.940	SECTORED:	DI.-D2.E.-F.-G
53	2.940	SECTORED:	(DI&EI)1.E.-F.-G
54	2.940	SECTORED:	DI.-(DI&EI)1.E.-F.-G
55	0.390	SECTORED:	A1.-B.-C
56	0.390	SECTORED:	A1.B.-C
57	0.014	SECTORED:	SI5.-SII.-SIIA.-SIII
58	0.014	SECTORED:	SI6.-SII.-SIIA.-SIII
59	0.014	SECTORED:	SI7.-SII.-SIIA.-SIII
60	0.014	SECTORED:	SI5.-SII.-SIIA.-SIIIF
61	0.014	SECTORED:	SI6.-SII.-SIIA.-SIIIF
62	0.014	SECTORED:	SI7.-SII.-SIIA.-SIIIF
63	0.014	SECTORED:	-SI.SII5.-SIIA.-SIII
64	0.014	SECTORED:	-SI.SII6.-SIIA.-SIII
65	0.014	SECTORED:	-SI.SII7.-SIIA.-SIII
66	0.014	SECTORED:	-SI.SII5.-SIIA.-SIIIF
67	0.014	SECTORED:	-SI.SII6.-SIIA.-SIIIF
68	0.014	SECTORED:	-SI.SII7.-SIIA.-SIIIF

Table 14-2a. IMP-6 Rate Identification Table

ID	Geometry Factor	Live Time	RATE
1	2.800	4.76	DI.E.-F.-G
2	2.330	4.76	DI.E.F.-G
3	2.800	4.76	DI.-D2.E.-F.-G
4	2.800	4.76	DI.-(DI&EI)1.E.-F.-G
5	0.0	5.12	ID1
6	0.0	5.12	ID2
7	2.800	4.76	(DII&EII)R.E.-F.-G
8	2.330	5.12	DI.E.F
9	2.330	4.76	(DI&EI)2.-(DII&EII)R.E.F.-G
10	2.330	4.76	(DII&EII)R.E.F.-G
11	0.0	5.12	DI
12	0.0	5.12	E
13	0.0	5.12	F
14	0.0	5.12	G
15	2.800	4.76	(DI&EI)1.E.-F.-G
16	2.800	4.76	(DI&EI)2.E.-F.-G
17	0.390	5.12	A.(A&B)1.B.-C
18	0.390	4.76	AI.B.-C
19	0.390	5.12	AI
20	0.390	4.76	(A&B)1.-B.-C
21	0.390	5.12	AI.B
22	0.390	5.12	B
23	0.390	4.76	AI.-B.-C
24	0.390	5.12	IA2
25	0.0	5.12	C
26	0.390	5.12	IA1
27	0.0	5.12	AS1
28	0.150	6.12	(S1)7.-AS1
29	0.150	5.12	(S1)6.-AS1
30	0.150	5.12	(S1)4.-AS1
31	0.150	5.12	(S1)2.-AS1
32	0.150	5.12	(S1)5.-AS1
33	0.150	5.12	(S1)3.-AS1
34	0.150	5.12	(S1)1.-AS1
35	0.0	5.12	AS2
36	0.150	5.12	(S2)7.-AS2
37	0.150	5.12	(S2)6.-AS2
38	0.150	5.12	(S2)4.-AS2
39	0.150	5.12	(S2)2.-AS2
40	0.150	5.12	(S2)5.-AS2
41	0.150	5.12	(S2)3.-AS2
42	0.150	5.12	(S2)1.-AS2
43	0.150	5.12	(T1)1.-AT1
44	0.0	5.12	AT1
45	0.150	5.12	(T1)7.-AT1
46	0.150	5.12	(T1)6.-AT1
47	0.150	5.12	(T1)5.-AT1
48	0.150	5.12	(T1)4.-AT1
49	0.150	5.12	(T1)3.-AT1
50	0.150	5.12	(T1)2.-AT1
51	0.150	5.12	(T2)1.-AT2
52	0.0	5.12	AT2
53	0.150	5.12	(T2)7.-AT2
54	0.150	5.12	(T2)6.-AT2
55	0.150	5.12	(T2)5.-AT2
56	0.150	5.12	(T2)4.-AT2
57	0.150	5.12	(T2)3.-AT2
58	0.150	5.12	(T2)2.-AT2
59	2.330	SECTORED:	DI.E.F.-G
60	2.800	SECTORED:	DI.-D2.E.-F.-G
61	2.800	SECTORED:	(DI&EI)1.E.-F.-G
62	2.800	SECTORED:	DI.-(DI&EI)1.E.-F.-G
63	0.150	SECTORED:	(S1)1.-AS1
64	0.390	SECTORED:	A1.B.-C
65	0.150	SECTORED:	(S2)5.-AS2
66	0.150	SECTORED:	(S2)3.-AS2
67	0.150	SECTORED:	(S2)1.-AS2
68	0.390	SECTORED:	A.(A&B)1.B.-C
69	0.150	SECTORED:	(S1)5.-AS1
70	0.150	SECTORED:	(S1)3.-AS1

IMP-7 LED Detector — Z = 2 Energy plot



	Einc	Mev/n	E_B	B ch.
^4He	17.2	4.30	.012	1.6
	18.5	4.63	4.5	9.25
	20	5.0	7.8	14.8
	22.5	5.63	12.2	22.3
	25	6.25	16.0	28.7
	30	7.5	22.7	40.0
	35	8.75	28.6	50.0
	40	10.0	34.15	59.4
	45	11.25	39.7	68.8
	50	12.5	45.2	78.1
	55	13.75	50.6	87.2
	60	15.0	55.9	96.2
	65	16.25	61.15	105.1
	70	17.5	66.4	114.0
	75	18.75	71.6	122.8
	80	20.0	76.8	131.6
	85	21.25	81.9	140.2
	90	22.5	87.1	149.0
	95	23.75	92.2	157.6
	95.5	23.87	92.7	158.5

IMP-7

B channels from energy plots

	^{3}He energy		^{4}He energy	
Box	Mev/u	total	Mev/u	total
2-18	5.2-6.4	15.6-19.2	4.3-5.2	17.2-20.8
18-30	6.4-7.8	19.2-23.4	5.2-6.4	20.8-25.6
30-43	7.8-10.0	23.4-30.0	6.4-7.8	25.6-31.2
43-60	10.0-12.5	30.0-37.5	7.8-10.0	31.2-40.0
60-82	12.5-17.0	37.5-51.0	10.0-12.5	40.0-50.0
82-111	17.0-22.5	51.0-67.5	12.5-17.0	50.0-68.0
111-149	22.5-28.0	67.5-84.0	17.0-22.5	68.0-90.0
149-158	—		22.5-23.8	90.0-95.2

6-18

From inspection, change calibration to

$$A_{ch} = 7.566\ E_A + 6.3$$
$$B_{ch} = 1.635\ E_B + 5.0$$

From ATS, offsets $\Delta B = 3.0$, $\Delta A = 4.0$

$B_{max} = 15\%$, $A_{min} = 27$

$$\beta = \frac{B_{ch} - B_{off}}{E_B} = \frac{158 - 3.0}{92.7} = 1.672 \text{ ch/MeV}$$
(= .600 MeV/ch.)

$$\alpha = \frac{A_{ch} - A_{off}}{E_A} = \frac{27 - 4.0}{2.736} = 8.406 \text{ ch/MeV}$$
(= .119 MeV/ch.)

$$\therefore \boxed{\begin{aligned} A_{ch} &= 8.406\ E_A + 4.0 \\ B_{ch} &= 1.672\ E_B + 3.0 \end{aligned}}$$

– to fine tune the fitting, adjust the gains.

E_A	E_B	A_{ch}	B_{ch}
2.73	91.8	27	156.5
3.16	76.8	30.5	131.4
3.76	61.2	35.6	105.3
4.70	45.2	43.5	78.6
6.26	28.6	56.6	50.8
8.85	16.0	78.4	29.7
12.00	7.84	104.9	16.1
15.1	2.49	130.9	7.2

IMP-6 GAIN SHIFTS —

running HIGH GAIN PLOT Program with histogram limits

D 10-34
E 36-60
F 10-40

gave identical values to D vs E ~~for~~ as previous run, different values for D vs F

On the 91, 5½ ovsitv tole (1.0, 1.1)

so 9 will take ~ (1.6, 1.8)

3×9 will take ~ (4.9, 5.4)

.9, 1.0, 1.1 with (006406)

5 5½
006 406

IMP-6 ORBITS 7-15

D vs E DEFG x1

D:

orbit	7	8	9	10	11	12	13	14	15	Σ(7-15)	Σ(7-15)/9
10	30	30	30	60	30	60	60	40	30	370	41
11	90	120	60	90	90	120	120	80	90	860	96
12	240	270	210	330	300	270	270	280	330	2500	278
13	480	570	540	540	600	540	630	520	480	4900	544
14	750	870	810	1080	750	990	870	880	870	7870	874
15	1140	1080	1020	1260	1287	1200	1110	1080	1110	10287	1143
16	1140	1478	1110	1170	1170	1200	1290	1520	1310	11390	1265
17	1216	1290	1050	1290	1170	1270	1370	1200	1280	11150	1238
18	1110	1230	1080	1140	1050	1110	1140	1200	1140	10200	1133
19	960	1110	930	930	990	1050	1140	960	990	9060	1007
20	870	960	780	930	840	930	870	920	960	8120	902
21	750	750	780	750	720	780	840	880	810	7060	784
22	630	720	570	690	660	720	660	680	690	5580	665
23	570	570	480	630	540	510	600	640	600	5140	571
24	450	480	390	450	480	510	510	480	510	4260	473
25	390	390	330	360	330	390	420	400	390	3400	378
26	300	330	270	300	300	330	330	360	330	2850	317
27	240	240	210	210	240	270	240	240	270	2160	240
28	240	210	180	210	180	180	210	200	210	1820	202
29	150	120	120	120	150	150	150	160	150	1270	141
30	120	120	90	120	120	120	150	120	120	1080	120
31	90	60	60	90	90	90	90	80	120	770	85
32	60	60	30	60	60	80	90	80	90	630	70
33	60	60	60	60	30	60	60	80	60	530	59
34	30	30	30	30	30	30	30	40	30	280	31

$$Y = A e^{-\left(\frac{x-\bar{x}}{\delta}\right)^2}$$

at $\frac{1}{2}$-height, $\frac{1}{2}A = A e^{-\left(\frac{x-\bar{x}}{\delta}\right)^2}$

$$\ln(.5) = -\left(\frac{x-\bar{x}}{\delta}\right)^2$$

$$\sqrt{.693}\,\delta = x - \bar{x}$$

$$\delta = \frac{x-\bar{x}}{.833}$$

$\bar{x} = 16$

$A = 1200$

left-hand side $x - \bar{x} = 2.7$

$\delta_1 = 3.24$

right-hand side $x - \bar{x} = 6.4$

$\delta_2 = 7.68$

$$F_1 = \begin{cases} 1200\, e^{-\left(\frac{x-16}{3.24}\right)^2} & \text{for } x \le 16 \\ 1200\, e^{-\left(\frac{x-16}{7.68}\right)^2} & \text{for } x > 16 \end{cases}$$

$$\chi_i^2 = \left(\frac{Y_i - f(x_i)}{\Delta Y_i}\right)^2 = \frac{(Y_i - f(x_i))^2}{Y_i}$$

$$\Delta Y_i = \sqrt{Y_i}$$

CH #	$\bar{D}$	F_1	$\bar{D}/F_1$	$F_1 \times 1.054$	χ^2	$\bar{D} - F_1(1.55)$
10	41	39	1.051	41.	.00	
	96	110	.872	116.	4.17	-14
	278	261	1.065	275	.03	17
	544	509	1.069	536	.12	35
	874	820	1.066	864	.11	54
15	1143	1091	1.048	1150	.04	52
	1265	1200	1.054	1264	.00	65
	1238	1180	1.049	1243	.02	147
	1133	1121	1.011	1181	2.03	313
	1007	1030	.978	1085	6.04	498
20	902	914	.987	963	4.12	641
	784	785	1.00	827	2.36	674
	665	651	1.022	686	.66	626
	571	523	1.09	551	.70	560
	473	405	1.17	427	4.47	470
25	378	304	1.24	320	8.90	378
	317	220	1.441	232	22.8	317
	240	154	⋮			240
	202	104	⋮			202
	141	68	⋮			141
30	120	43				120
	85	26.5				85
	70	15.6				70
	55	8.84				55
	31	4.94				31
35						

Ch #	$\bar{D}$	f_1	$\bar{D}-f_1$	f_2	$\bar{D}-f_1-f_2$	$\bar{D}-f_1-f_2+f_3$	f_3'	$\bar{D}-f_1-f_2+f_3'$
10	41	41	0		0	2	1	1
	96	117	-21		-21	-15	4	-17
	278	275	3		3	16	9	12
	544	537	7	1	6	32	17	23
	874	864	10	6	4	46	27	31
15	1143	1150	-7	22	-29	27	36	7
	1265 ⟷	1265	0	62	-62 (BAD)	0	40	-22
	1238	1150	88	145	-57	-1	36	-21
	1133	864	269	283	-14	41	27	13
	1007	537	470	455	15	41	17	32
20	902	275	627	606	21	34	9	30
	784	117	667 ⟷	667	0	6	4	4
	665	41	624	606	18	20	1	19
	571	12	559	455	104	104		104
	473	3	470	283	187	187		187
25	378	⋮	378	145	233	233		233
	317		317	62	255	255		255
	240		240	22	218	218		218
	202		202	6	196	196		196
	141		141	1	140	140		140
30	120		120		120	120		120
	85		85		85	85		85
	70		70		70	70		70
	55		55		55	55		55
	31		31		31	31		31
35								

$$f_1 = 1265\, e^{-\left(\frac{x-16}{3.24}\right)^2}$$

$$f_2 = 667\, e^{-\left(\frac{x-21}{3.24}\right)^2}$$

$$f_3 = .049\, f_1 \quad , \quad f_3' = \frac{40}{1265} f_1$$

Ch #	$\bar{D}$	F_{4A}	F_{4B}	$D - F_4$	F_{4A}'	$F_4^* = F_{4A}' + F_{4B}$	$\bar{D} - F_4^*$	χ^2
10	41	39	-	2	40	40	1	.02
11	76	111	-	-15	113	113	-17	3.01
12	278	262	-	16	266	266	12	.52
13	544	510	2	32	518	520	24	1.06
14	874	822	6	46	836	842	32	1.17
15	1143	1094	22	27	1112	1134	9	.09
16	1265	1203	62	0	1223	1285	-20	.32
17	1238	1094	145	-1	1112	1257	-19	.29
18	1133	822	283	28	836	1119	14	.17
19	1007	510	455	42	518	973	34	1.15
20	902	262	606	34	266	872	30	1.00
21	784	111	667	6	113	780	4	.02
22	665	39	606	20	40	646	19	.54
23	571	11	455	105	11	466	105	19.3
		3						

$$F_{4A}' = \frac{1233}{1203} F_{4A}$$

$$F_4(x) = \overset{F_{4A}}{1203\, e^{-\left(\frac{x-16}{3.24}\right)^2}} + \overset{F_{4B}}{667\, e^{-\left(\frac{x-21}{3.24}\right)^2}}$$

18 821 283

1104

Split Gaussians

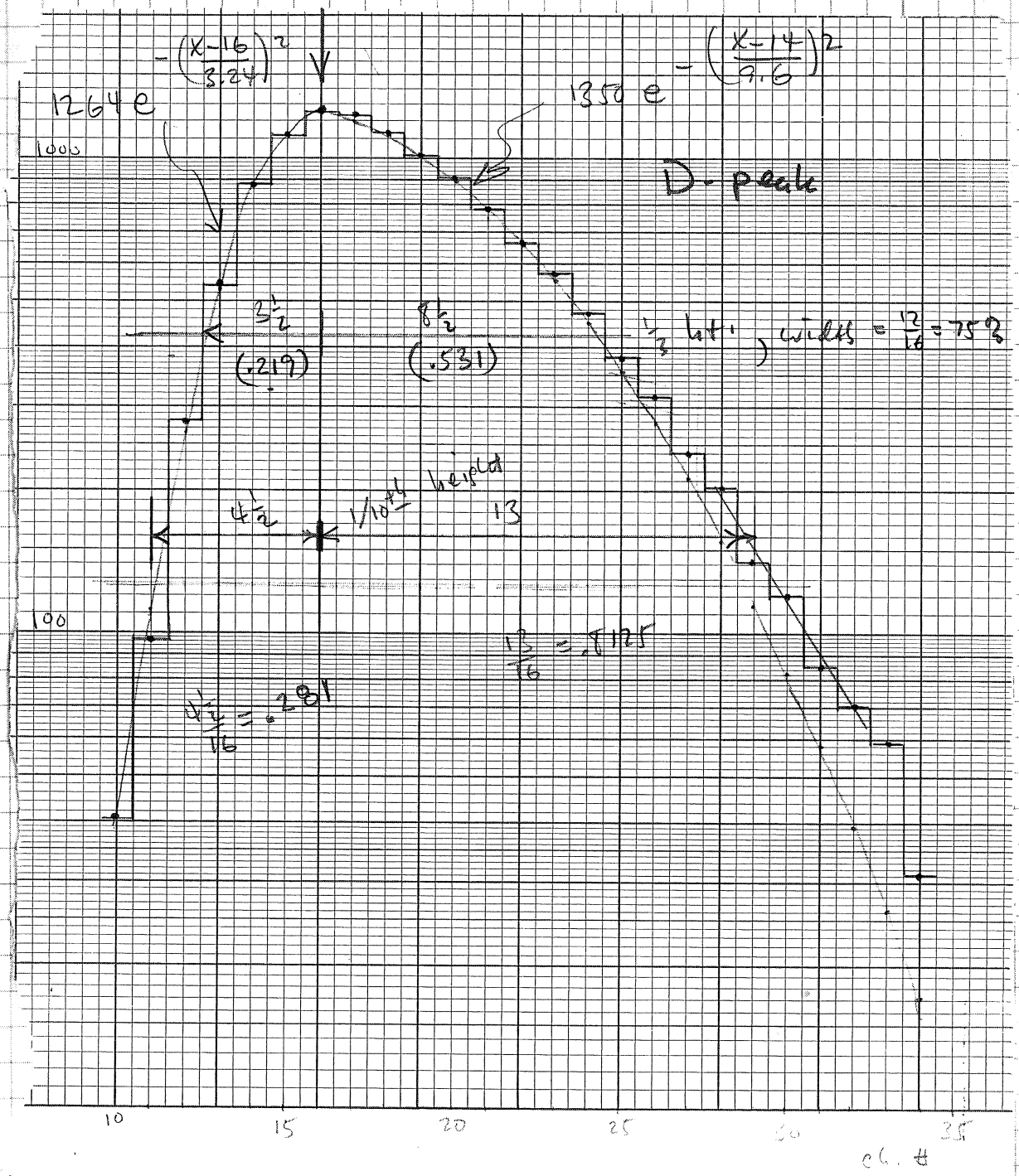
right hand side $f_1 = 1350\, e^{-\left(\frac{x-14}{9.6}\right)^2}$

x		f_1	$f_1 \times \frac{1265}{1293}$	χ^2
16		1293	1265	.00
17		1224	1197	1.36
18		1135	1110	.47
19		1029	1007	.00
20		913	893	.09
21		793	776	.08
22		674	659	.05
23		560	548	.93
24	10	456	446	1.54
25		363	355	1.40
26	12	283	277	5.05
27		216	211	3.50
28		161	157	
29	15	117	114	
30		84	82	
31		59	58	
32		40	39	
33		27	26	
34	20	17.6	17	

7-23

New approach:

Locate peak channel, scan certain percent on each side of peak and calculate mean from that.

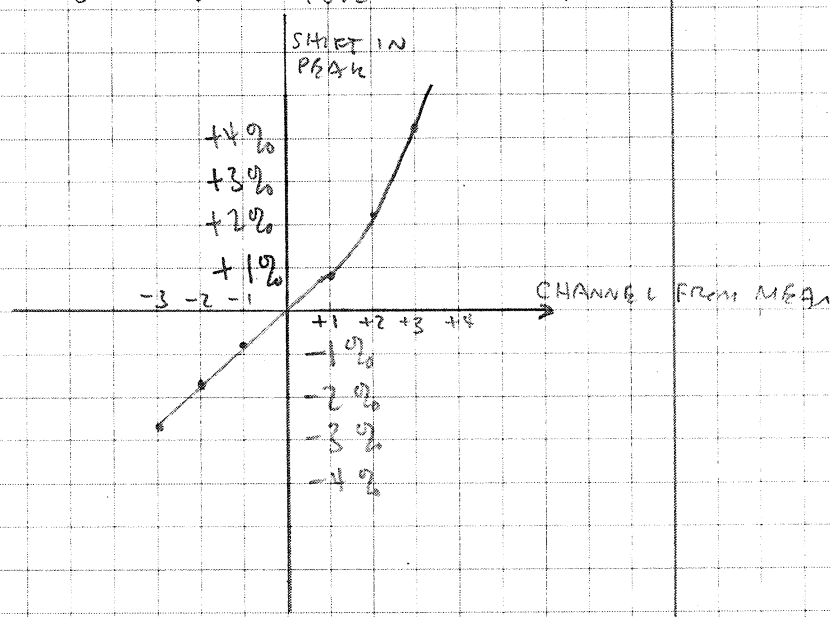


Test for max channel approach:

ch#	$\bar{D}$	$\bar{D} \times$ ch#
	15	120
10	41	410
	96	1056
	278	3336
	544	7072
	874	12236
15	1143	17145
	1265	20240
	1238	21046
	1133	20394
	1007	19133
20	902	18040
	784	16464
	665	14630
	571	13133
	473	11352
25	378	9450
	317	8242
	240	6480
	202	5656
	141	4089
30	120	3600
	85	2635
	70	2240
	59	1947
	31	1054
35		

$\bar{D} = 12412$ $\quad \bar{D} \times$ ch# $= 233204$

MIN	MAX	$\overline{CH}$	Compared to 18.71
-2	+16	19.49	+ 4.2 %
-3	+15	19.12	+ 2.2 %
-4	+14	18.88	+ .9 %
-5	+13	18.71	0.0 %
-6	+12	18.56	- .8 %
-7	+11	18.39	-1.7 %
-8	+10	18.20	-2.7 %



$$\bar{X} = \frac{\Sigma Y(x) \cdot X}{\Sigma Y(x)}$$

-8 to +10 $\overline{CH} = \frac{213634}{11739} = 18.20$

-2 to +16 $\overline{CH} = \frac{226205}{11608} = 19.49$

-5 to +13 $\overline{CH} = \frac{229194}{12251} = 18.71$

-6 to +12 $\overline{CH} = \frac{225515}{12151} = 18.56$

-4 to +14 $\overline{CH} = \frac{231738}{12275} = 18.88$

-7 to +11 $\overline{CH} = \frac{219994}{11964} = 18.39$

-3 to +15 $\overline{CH} = \frac{231037}{12082} = 19.12$

If max channel is X_{max}, then lowest complete channel will be ~~INT (.3125 X_{max} -.5)~~

$$X_1 = X_{max} - INT(.3125\, X_{max} - .5)$$

The highest complete channel will be

$$X_2 = X_{max} + INT(.8125\, X_{max} - .5)$$

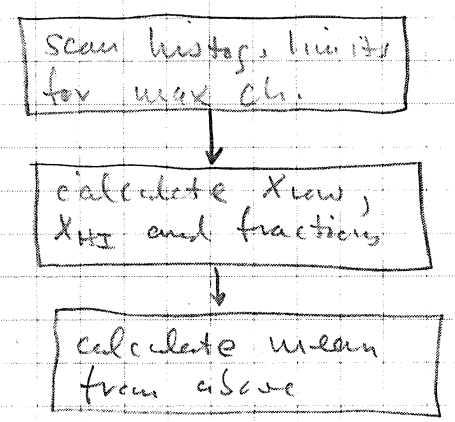
Set $X_{LOW} = .3125\, X_{max} - .5$
$X_{HI} = .8125\, X_{max} - .5$

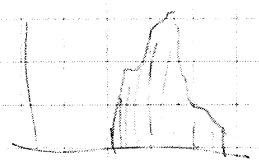
If $X_{LOW} = INT(X_{LOW})$ no lower fraction

otherwise, $X_{LOW} - INT(X_{LOW})$ is the fraction of channel $X_1 - 1$ to be included.

If $X_{HI} = INT(X_{HI})$ no upper fraction

otherwise, $X_{HI} - INT(X_{HI})$ is the fraction of channel $X_2 + 1$ to be included.



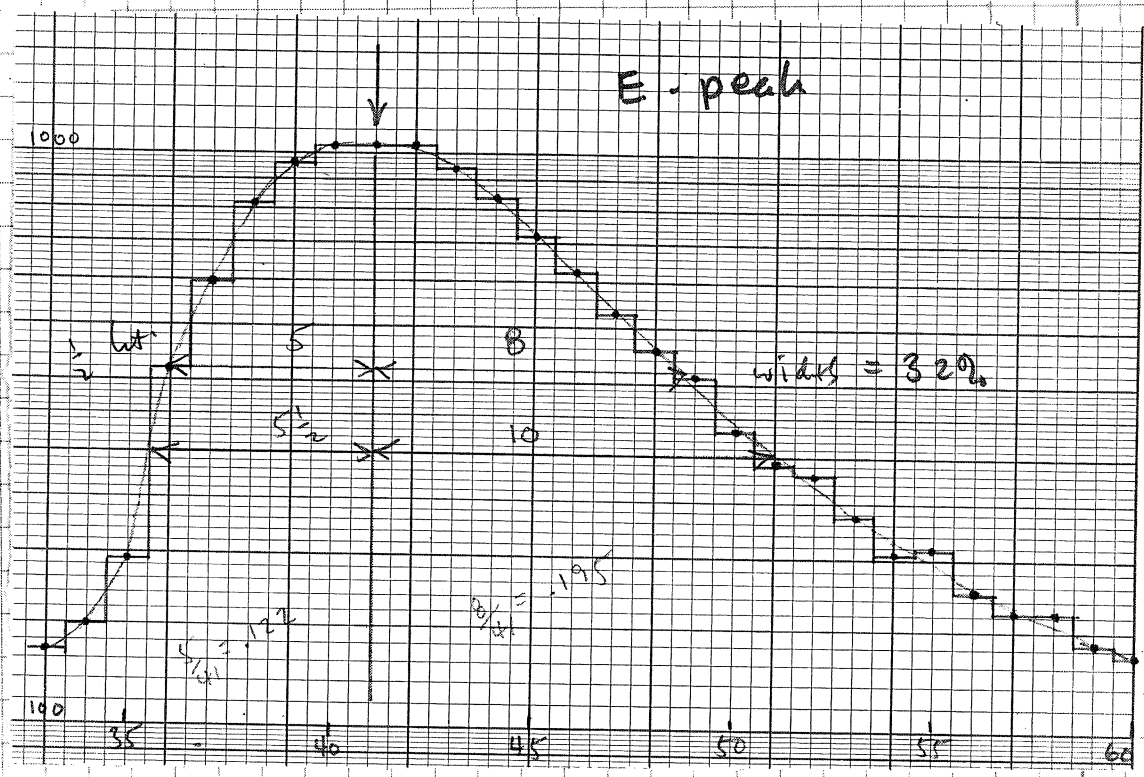


HISTO LIMITS
XMIN, XMAX, XBAR
INTEGRATED COUNTS AT 10% PEAK HT.

IMP-6 ORBITS 7-15

D VS E DRFG x1

E:	7	8	9	10	11	12	13	14	15	Σ(7-15)	Σ(7-15)/9
~~36~~ 33	120	120	160	150							137
~~37~~ 34	150	150	120	180							150
35	150	180	160	300							197
36	270	300	320	450	460	480	420	510	570	3770	419
37	510	420	406	690	660	600	660	750	690	5380	598
38	630	630	640	870	810	930	930	900	990	7330	814
39	780	930	760	1050	1070	990	870	1135	1100	8685	965
40	1020	870	995	1100	990	1050	1130	1020	1020	9195	1022
41	930	1200	840	1020	1020	1080	990	1110	990	9180	1020
42	1115	1110	820	870	990	1125	1080	1080	1020	9210	1023
43	870	1020	940	990	930	1020	930	900	870	8470	941
44	810	930	800	840	780	840	960	780	810	7550	839
45	690	810	720	720	630	720	780	720	660	6450	717
46	680	720	600	630	570	570	630	600	630	5640	627
47	510	630	520	540	450	570	540	570	450	4780	531
48	480	480	460	480	450	420	450	450	450	4120	458
49	450	510	380	390	360	420	450	360	390	3710	412
50	360	360	320	300	330	300	330	360	330	2990	332
51	270	330	260	300	270	300	330	270	330	2660	295
52	300	300	280	270	240	240	330	270	270	2500	278
53	210	270	200	240	210	270	240	240	240	2120	236
54	210	240	220	210	180	180	180	210	210	1840	204
55	210	210	200	210	180	210	240	210	210	1880	209
56	180	180	180	180	150	180	180	180	180	1590	177
57	150	180	140	150	150	180	150	180	180	1460	162
58	150	180	160	180	150	180	150	150	150	1450	161
59	150	180	120	150	120	120	180	150	120	1290	143
60	150	120	140	120	150	150	120	120	150	~~1360~~ 1220	136


E - peak
1000
100
½ ht
5
8
5½
10
width = 32%
5/41 = .122
8/41 = .195
35
40
45
50
55
60

IMP-6 ORBIT 7-15
D vs. F DEFG #1

F	7	8	9	10	11	12	13	14	15	ΣN	ΣN/9
10	40	0	40	0	0	50	0	50	0	180	20
12	40	50	80	100	50	50	100	50	50	570	63
14	240	250	240	300	250	250	300	300	300	2430	270
16	760	850	760	1000	900	950	1000	950	950	8120	902
18	1480	1750	1480	1900	1650	1850	1900	1900	1850	15,760	1751
20	1970	2110	1950	2140	2050	2150	2220	2240	2180	19,050	2117
22	1840	1950	1680	1900	1850	1900	1900	1900	1950	16,870	1874
24	1400	1500	1360	1550	1450	1600	1550	1600	1500	13,510	1501
26	1120	1200	960	1150	1100	1100	1100	1150	1100	9980	1109
28	800	850	680	750	700	800	850	850	800	7080	787
30	560	550	480	450	550	500	550	550	500	4650	521
32	360	350	320	350	350	350	350	350	350	3130	348
34	240	250	200	250	200	250	250	200	250	2050	232
36	120	150	160	150	150	150	150	200	150	1380	153
38	120	100	80	100	100	100	100	100	100	900	100
40	80	50	40	50	50	50	50	50	50	470	52

test for I ch. #

ch	F̄	F̄ × ch. #	Σ ch.	
10	20	200	200	20
12	63	756	956	83
14	270	3780	4736	353
16	902	14432	19168	1255
18	1751	31518	50686	
20	2117	42340	93026	
22	1874	41228	134254	
24	1501	36024	170278	8493
26	1109	28834	199112	9607
28	787	22036	221148	10394
30	521	15630	236778	10915
32	348	11136	247914	11263
34	232	7888	255802	[illegible]
36	153	5508	261310	[illegible]
38	100	3800	265110	11745
40	52	2080	267190	[illegible]

$D_{L0} = .2$

$D_{ep} = .4$

① peak = ch. 20 (4.0, 8.0) → (16.0, 28.0)

$\frac{199112 - 4736}{9254} = 21.0$

ch. 10 — (2, 4) → (8.0, 14.0)

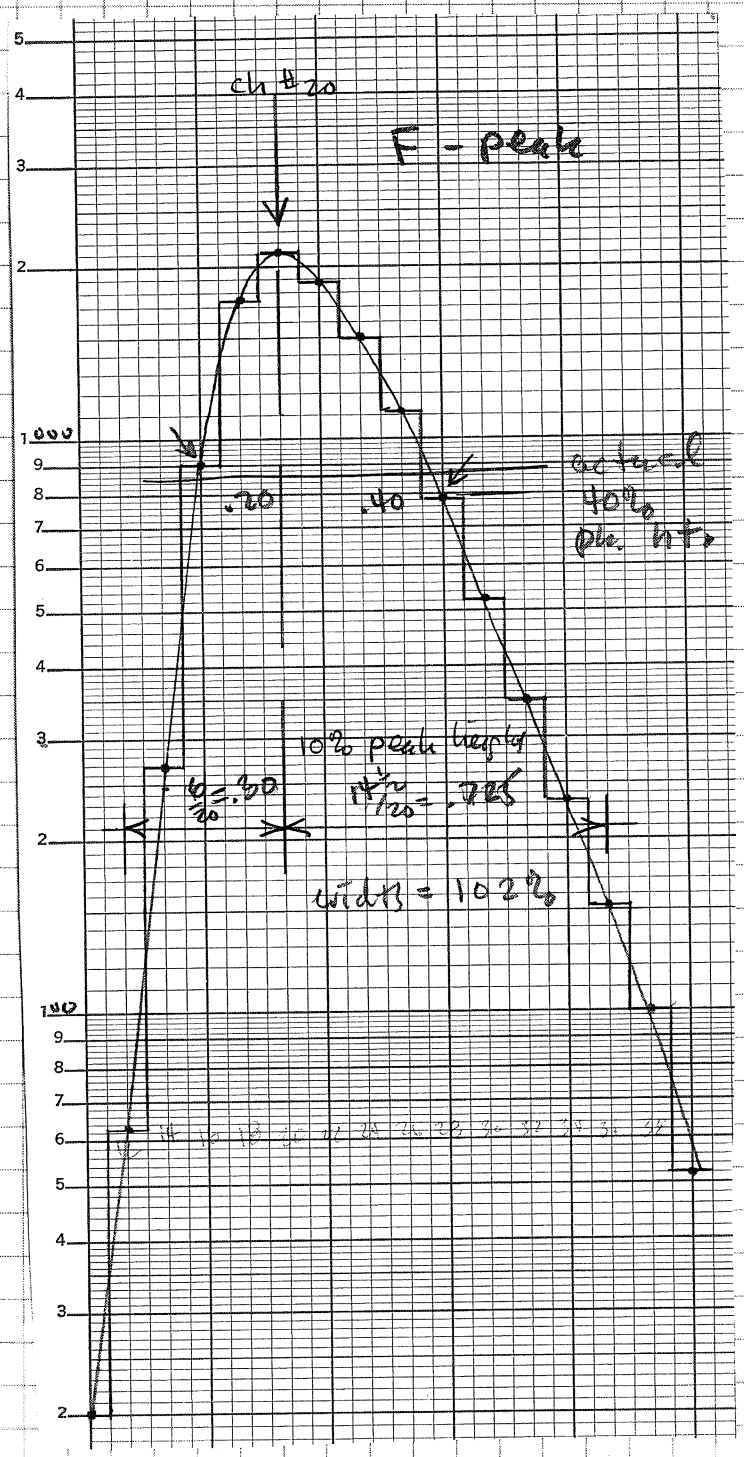
$\frac{97168}{9254} = 10.5$

② peak = ch. 22 (4.4, 7.4) → (17.6, 30.8)

ch. 11 (2.2, 4.4) → (8.8, 15.4)

$\frac{221148 - 8493 + 1255 + 3126}{10 - 1255 + 139 + 208} = \frac{10455.9}{7.4} = 11.08$

$\frac{1.27}{1.18} = 1.071$ $\frac{11.08}{10.5} = 1.055$


ch #20
F - peak
.20
.40
actual
40%
pk. ht.
10% peak height
6/20 = .30
14½/20 = .725
width = 102%

Test results of max channel peak finder

orbit	GF	$\bar{D}$ (D vs B)	$\bar{D}$ (D vs F)			
7	.9	19.7	19.7	.925	.921	.924
8		19.3	19.3	.919	.919	
9		19.3	19.3	.923	.923	
10		19.4	19.2	.942	.923	
7	1.0	21.3	21.4	1.0	1.0	
8		21.0	21.0	1.0	1.0	
9		20.9	20.9	1.0	1.0	
10		20.6	20.8	1.0	1.0	
7	1.1	22.7	23.0	1.066	1.075	1.070
8		22.5	22.3	1.071	1.062	
9		22.4	22.4	1.072	1.072	
10		22.3	22.1	1.082	1.062	

19.3	.919	18.3	.915	15.3	.900	12.3	.878
21.0	1.00	20.0	1.00	17.0	1.0	14.0	1.0
22.4	1.067	21.4	1.070	18.4	1.082	15.4	1.1

0 – 1.0

HD = (HD + RAND) * GFACT

if HD = 1, G.F. = 1.1, HD = (1 – 2) * 1.1 = 1.2 (1.65)

~~HD~~

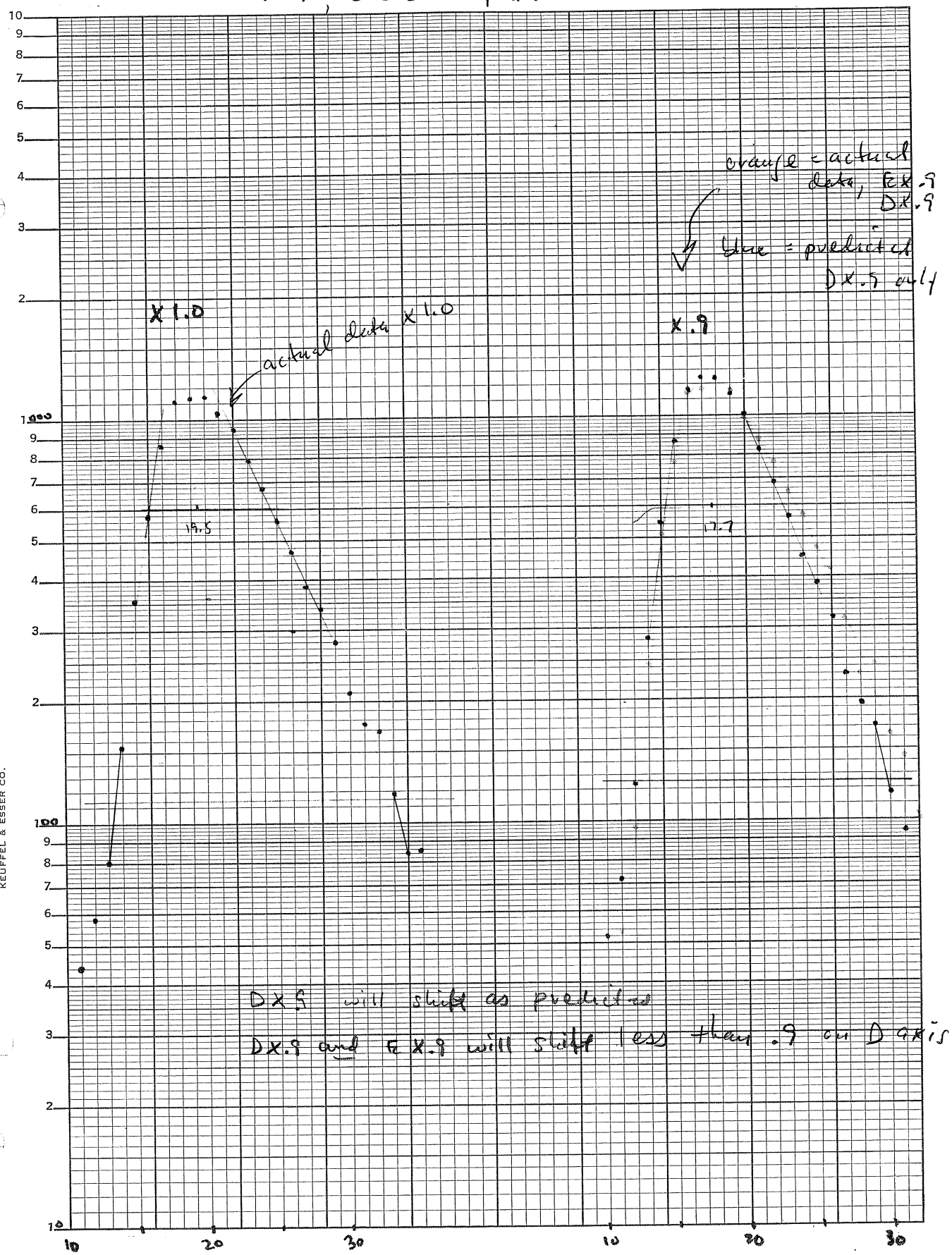
if HD = 20, G.F. = .9, HD = (20 – 21) * .9 = 18 – 18.9 (18.45)

G.F. = 1.1, HD = (20 – 21) * 1.1 = 22 – 23.1 (22.55)

			.9				norm
						11	
						12	388
280	13	244	11.7 – 12.6	.33 in 11,	.67 in 12	13	712
534	14	508	12.6 – 13.5	.44 in 12,	.56 in 13	14	1111
652	15	773	13.5 – 14.4	.56 in 13,	.44 in 14	15	1286
761	16	1151	14.4 – 15.3	.67 in 14,	.33 in 15	16	1339
1079	17	1160	15.3 – 16.2	.78 in 15,	.22 in 16	17	1268
853	18	1216	16.2 – 17.1	.88 in 16,	.11 in 17	18	1080
1115	19	1133	17.1 – 18.0	100 in 17			
890	20	982	18.0 – 18.9	1.00 in 18			
835	21	878	18.9 – 19.8	.11 in 18,	.89 in 19		
716	22	771	19.8 – 20.7	.22 in 19,	.77 in		
691	23	643	20.7 – 21.6	.33 in 20			
521	24	574	21.6 – 22.5	.44 in 21			
505		470		.55 in 22			
467		416		.66 in 23			
379		313		.77 in 24			
297		250		.88 in 24			
		243					
		163					
		144					
		100					

	x1.0		.9		x.9	act
10			.88 of 11	.22 of 12	52.	
11	44		.77 of 12	.33 of 13	72.	53
12	58		.66 of 13	.44 of 14	122	96
13	80		.55 of 14	.55 of 15	283	244
14	155		.44 of 15	.66 of 16	544	508
15	355		.33 of 16	.77 of 17	866	773
16	579		.22 of 17	.88 of 18	1172	1151
17	865		.11 of 18	1.00 of 19	1248 ~~225~~	1160
18	1102		.11 of 21	1.00 of 20	1250.5	1216
19	1126		.22 of 22	.88 of 21	1128	1133
20	1136		.33 of 23	.77 of 22	1003	982
21	1032		.44 of 24	.66 of 23	827	878
22	950		.55 of 25	.55 of 24	686	771
23	793		.66 of 26	.44 of 25	561	643
24	672		.77 of 27	.33 of 26	452	574
25	563		.88 of 28	.22 of 27	385	470
26	466	23.4 24.3	1.00 of 29	.11 of 28	317.5	416
27	381	24.3 25.2	1.00 of 30	.11 of 31	230	313
28	338	25.2 26.1	.88 of 31	.22 of 32	195	250
29	280	26.1 27.0	.77 of 32	.33 33	171	243
30	210	27.0 27.9	.66 of 33	.44 34	117	163
31	177	27.9 28.8	.55 of 34	.55 35	94	144
32	169		.44 of 35	.66 36		100
33	119		.33 of 36	.77 37		81
34	84		.22 of 37	.88 38		
35	85					

ORBIT 7, DVSR D peak



HGAIN PLOT TEST

orbit	GF	$\bar{D}$	$\bar{E}$	$\bar{D}$	$\bar{F}$
7	D = .9 E = 1.0 F = 1.0	19.2	48.4	19.2	22.2
8	D = .9 E = 1.0 F = 1.0	18.9	48.5	18.9	22.1
	RATIOS:	.901 .900		.897 .900	

8-4-75 Now, change order of calculation:

1) set X_{max}, Y_{max}

2) set X_L, X_H, Y_L, Y_H, fractional & floor-ceiling

calculate new means $\bar{x}$ $\bar{y}$ using floor-ceiling on off axis.

8-5) With new limit modifications, results:

orbit	GF D	GF E	GF F	$\bar{D}$	$\bar{E}$	$\bar{D}$	$\bar{F}$	RATIOS			
7	.9	1.0	1.0	19.1	48.3	19.2	22.3	.897	1.0	.901	1.0
8		"		18.8	48.5	18.8	22.2	.904	1.004	.900	1.0
9		"		18.5	47.4	18.7	22.1	.898	1.0	.895	1.0
10		"		18.1	46.4	18.7	22.0	.896	1.0	.899	1.0
7	1.0	1.0	1.0	21.3	48.3	21.3	22.3				
7	.9	.9	.9	19.1	43.4	19.4	20.3	.897	.899	.911	.910
8		"		18.7	43.0	19.1	20.2	.899	.896	.914	.910
9		"		18.4	42.4	19.0	20.2	.893	.895	.909	.914
10		"		18.5	42.0	19.0	20.0	.916	.905	.913	.909
7	1.0	1.0	1.0	21.3	48.3	21.3	22.3				
8		"		20.8	48.0	20.9	22.2				
9		"		20.6	47.4	20.9	22.1				
10		"		20.2	46.4	20.8	22.0				

D 13, 8, 6, 2, 13, 9, 9, 8 → 8 | 68 → 8

83, 80, 74, 64 → 4 | 351 → 75

Looks good! Error is ≤ 1%. So, run whole series of orbits for GFs = ~~.8~~ (have), 1.0, 1.1

Program needs

source	.20	.08
link	.03	.31
	.23	.39

3.00 1.23
.23 .39
2.77 .84
(.462, .140)
6 orbits
2 cases ea.

FORT + LINK (.23, .39)
EACH ORBIT (.46, .14) 6 | 2.65 .82 → .44 .14

2.50 1.09
.23 .39
2.27 .70
(.454, .140)
5 orbits
2 cases ea.

1 mount

7-10 thrice = 12 × (.46, .14) = (5.52, 1.68)
.23 .39
(5.75, 2.07)

But need

7-10 1.1 1.1 1.1
9, 10 1.0 1.0 1.0

.23, .39
2.76, .84
2.99 1.23

(003, H01)

7.5 2.2

H07 H02

1-20

1-30: 50 × (.46, .14) 20 × (.46, .14)

Tonite — submit ISOTIMP 7 (150) HCP
submit HGAINGT for orbits 1 - 20 ~~15~~
— OR — submit CREBRARD job

Results of 1.1, 1.0 runs

orbit	GF D	GF E	GF F	$\bar{D}$	$\bar{E}$	$\bar{D}$	$\bar{F}$	RATIOS			
7	1.1	1.1	1.1	22.7	51.8	23.0	24.2	1.066	1.072	1.080	1.085
8	"	"	"	22.8	52.5	22.5 ~~24.0~~	24.0	1.096	1.094	1.077	1.081
9	"	"	"	22.4	51.9	22.3	24.0	1.087	1.095	1.067	1.086
10	"	"	"	22.2	50.8	22.2	23.9	1.099	1.095	1.067	1.086
9	1.0	1.0	1.0	20.6	47.4	20.9	22.1				
10	1.0	1.0	1.0	20.2	46.4	20.8	22.0				

STANDARDS : $\bar{D}$ 20.8 $\bar{E}$ 47.5 $\bar{F}$ 22.1

SUBMIT ISOTYPCL + IHR3DATO WITH ONLY 2nd 1ms of TIME DATA, (002H01)

HGAINGTA WITH 1 - 15, OUT=1, (H07H02)
" B 31 - 50, " , (010H03)

8-6 IMP-6 gain shifts (using HGPLOT).

standards: D = 20.8, E = 47.5, F = 22.1

orbit	D	E	D	F
1	1.119	.980	1.142	1.095
2	1.042	1.010	1.052	1.071
3	1.058	1.017	1.060	1.075
4	.977	.998	.989	.997
5	.989	1.012	.995	1.005
6	.985	1.006	.995	1.004
7	1.023	1.018	1.025	1.007
8	1.000	1.010	1.006	1.003
9	.988	.998	1.003	.999
10	.972	.977	.999	.994
11	.990	.986	1.001	.998
12	1.001	.997	1.007	.998
13	.993	.990	1.015	.995
14	.990	.975	1.008	.997
15	.990	.972	1.008	.994
16	.978	.975	.992	.993
17	.983	.976		.995
18				
19				
20				
21	~~.970~~	~~.942~~	~~.993~~	~~.993~~
22				
23				
24				
25				
26				
27				
28				
29				
30				
31	.970	.942	.993	.993
32	.974	.959	.952	.990
33	.968	.955	.985	.991
34	.956	.960	.971	.989
35	.970	.956	.990	.989
36	.957	.949	.981	.990
37	.957	.938	.984	.988
38	.967	.958	.984	.987

ovsit	D	E	D	F
39	.956	.960	.973	.985
40	.955	.961	.987	.978
41	.971	.957	.991	.985
42				
43				
44				
45				
46				
47				
48				
49				
50				

Need ovsit 17 $\bar{D}$ (D vs F)
ovsit ~~18~~ 30 all } → (6.3, 2.1)
007003

1-17 took (7.0, 2.5) (.41, .15)
31-50 took (8.4, 2.8) (.42, .14)

17-23
~~24~~-30

IMP-6 GAIN SHIFT

Test for ±20% gain shifts, orbits 7-10
- old E limits were 36-60
- changed to 30-65

D: 10-34 −35% / +80%
E: 36-60 −17% / +25%
F: 10-40 −30% / +90%

E: 30-65 −30% / +40%

orbit	G.F.	D	E	D	F	D	E	D	F
						ratios (E: 30-65 - this) / (E 36-60)			
7	1.0	21.1	48.3	20.8	22.2	.99	1.00	.98	1.00
8	"	20.8	48.0	20.9	22.1	1.00	1.00	1.00	1.00
9	"	20.6	47.4	20.8	22.1	1.00	1.00	1.00	1.00
10	"	20.2	46.4	20.5	21.9	1.00	1.00	.99	1.00
7	0.8	17.0	38.4	17.3	18.0	.806	.795	.832	.811
8	"	16.7	38.1	17.0	18.0	.803	.794	.813	.814
9	"	16.5	38.0	16.9	17.9	.801	.792	.813	.810
10	"	16.2	37.5	16.8	17.8	.802	.808	.820	.813
7	1.2	25.1	57.7	24.6	26.0	1.190	1.195	1.183	1.171
8	"	25.0	58.4	24.3	25.9	1.202	1.217	1.163	1.172
9	"	25.0	57.8			1.214	1.219		
9	"	24.5	56.8	24.1	25.8	1.189	1.198	1.159	1.167
10		24.3	55.7	23.7	25.7	1.203	1.200	1.156	1.174

±1%

$.8 * \bar{D} = .80 * \bar{D}$ (D vs E) ±<1%
$.8 * \bar{E} = .80 * \bar{E}$ (D vs E) ±<1%

$1.2 * \bar{D} = 1.20 * \bar{D}$ (D vs E) ±1%
$1.2 * \bar{E} = 1.20 * \bar{E}$ (D vs E) ±<1%

$.8 * \bar{D} = .82\,\bar{D}$ ±1% (D vs F)
$.8 * \bar{F} = .81\,\bar{F}$ ±<1% "

$1.2 * \bar{D} = 1.165\,\bar{D}$ ±<1% (D vs F)
$1.2 * \bar{F} = 1.17\,\bar{F}$ ±<1% (")

8-11

Looks ok.
Shift standard ~~est~~ histograms down 10% to conform with observed shift & redo ~~to~~ 41 – 46.
If ok, then start production.
Gain shift will be a smooth curve thru data points. Table will be table of curve values.

Present values:		Shift to:
D:	10 – 34	9 – 31
E:	30 – 65	27 – 59
F:	10 – 40	9 – 36

(H03, H01)

Time for production runs:

orbits	time	comments	time/orbit
17-30	(6.0, 2.2)		(.43, .16)
1-16	(7.1, 2.5)	beginning of tape	(.44, .16)
31-50	(8.4, 2.9)	" " "	(.42, .15)

OUT = 1

(.45, .16)

E (D vs F) = 35 - 60

Do:	51-60	(4.5, 2.0)	$6\frac{1}{2}$	(2)
	~~61-90~~	~~(13.5, 5.0)~~		
→	61-75	(7.0, 3.0)		(3)
	91-105	(" ")		(4)
	121-135			
	76-90			
	106-120			
	136-150			

Test run on visit 41-46 shows compatibility with previous D vs E to 1%
but D vs F D is off by 2-3%
F " " " 2-3%

so rerun #10-20 and #47-50

Discrepancy with test runs due presumably to E limits changed from 36-60 to 27-59
Should have $E_{low} = 35$ since $27 \le E \le 34$ is upper tail of proton peak.

retest 45-55

D vs E is ok, but D vs F needs monitoring — need to set E limits as much on He as possible.

8-12) set E (D vs E) to 35-60, OUT = 1

ZBSOCHG1	51-60
ZBKMWHO2	61-75
ZBRPDHO3	91-105
ZBHOAHG4	121-135

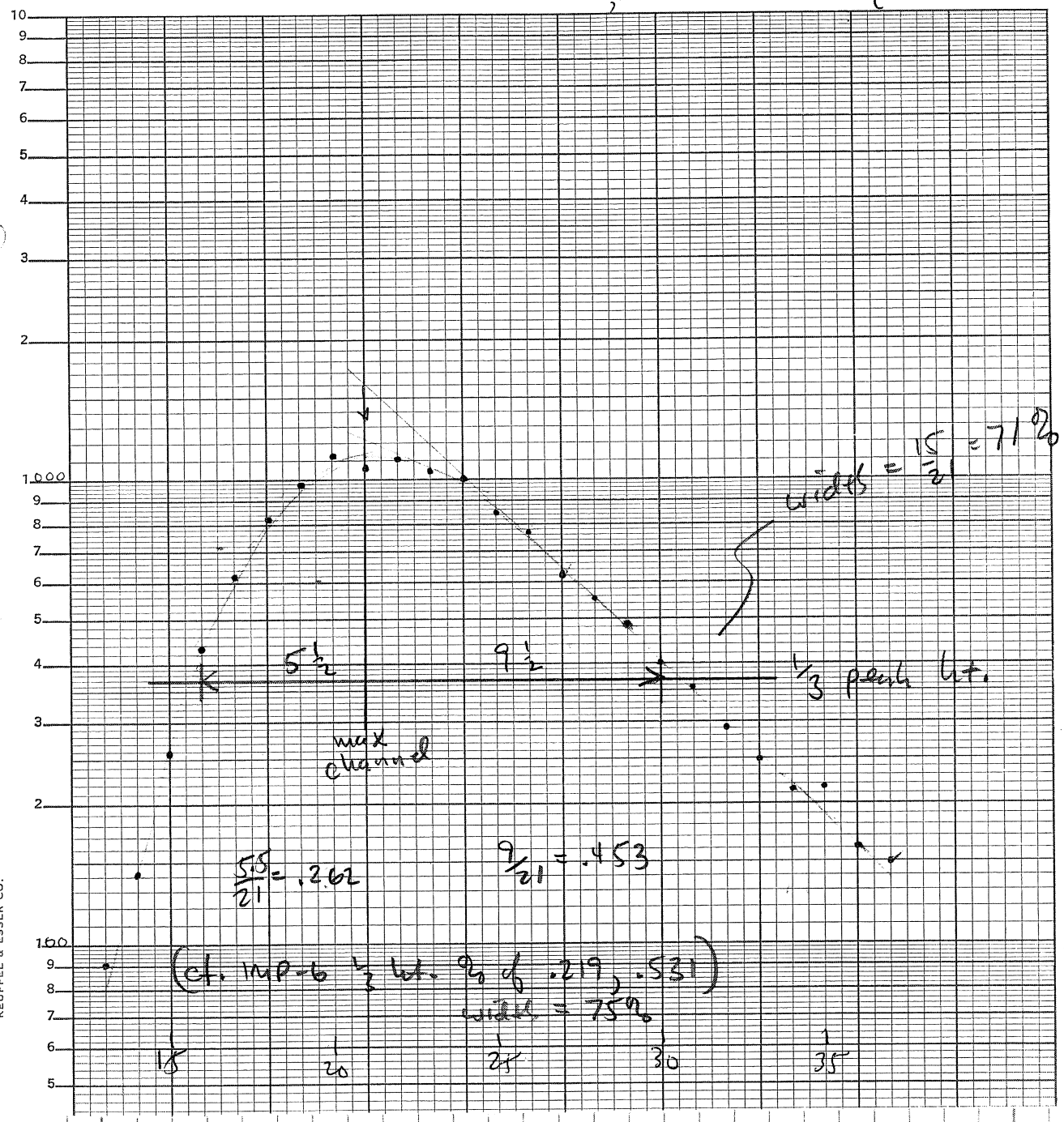
8-26) Now have 1-150

need ~~151-165~~ ZBJDCHG1 166-180
~~181-195~~ ZBKMWHO2 196-210
211-225 ZBHOAHG3 226-240
241-255 ZBRPDHG4 256-270
271-285 286-300
301-313

IMP-7 D-peak from D vs E interval

Protons

IMP-8 D-peak from D vs E, interval 121 $\left\{ \begin{array}{l} D = 13-37 \\ E = 40-59 \end{array} \right.$



K+E SEMI-LOGARITHMIC 46 5370
3 CYCLES X 60 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

Interval 121: DEFG E

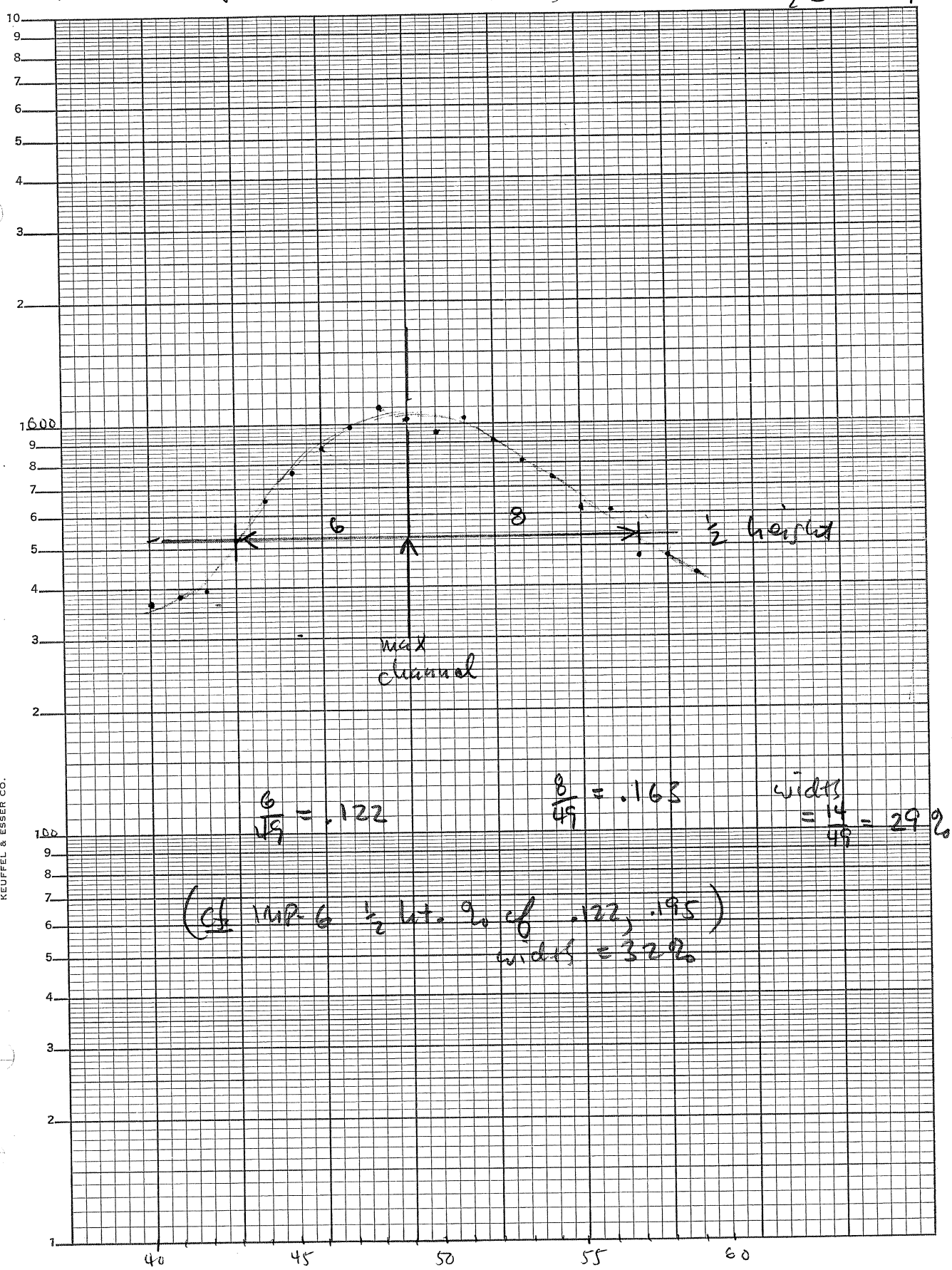
		40				45				50				55							ΣE
	30	4	6	5	13	20	19	25	24	21	32	29	25	17	20	18	20	32	24	26	21	401
		8	7	9	19	19	21	30	28	33	30	34	27	24	24	25	29	31	32	24	35	489
		6	15	22	18	17	27	30	33	30	38	34	31	37	32	41	35	27	29	42	31	557
		9	20	10	21	25	24	38	41	44	39	38	41	41	36	34	29	36	25	38	38	627
		14	26	21	31	30	33	36	38	51	51	43	45	48	57	44	54	52	34	35	31	774
D	25	19	32	29	25	43	38	48	46	62	48	46	58	53	55	50	48	46	45	29	30	850
		24	26	36	34	34	59	51	62	70	72	66	73	75	68	62	50	46	30	39	32	1009
		28	38	31	38	45	53	74	77	76	62	64	90	60	58	67	44	35	41	33	27	1041
		32	30	25	29	58	59	53	73	90	94	98	77	79	63	54	48	53	35	26	29	1105
		33	26	36	30	41	63	72	95	90	85	84	85	79	55	46	45	45	30	22	12	1074
	20	44	35	23	44	52	58	79	102	104	95	82	84	78	59	46	33	42	23	20	20	1123 ←
		30	22	31	46	63	65	75	78	104	73	64	59	61	50	42	34	33	14	21	12	977
		23	27	23	42	47	59	62	77	78	72	48	42	55	50	36	29	22	16	8	8	824
		28	21	23	44	47	44	44	46	39	42	48	40	32	29	27	12	18	10	11	6	611
		14	13	18	22	31	34	35	32	46	33	32	37	16	24	20	10	2	5	5	5	434
	15	13	7	12	13	[illegible]	14	[illegible]	21	25	18	22	20	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	259
		13	10	10	6	4	13	3	9	17	8	8	1	10	8	3	3	2	2	2	2	142
		16	4	[illegible]	7	6	[illegible]	4	[illegible]	9	7	4	4	7	[illegible]	[illegible]	2	1	0	2	1	91
	ΣD	316	344	342	456	572	656	752	852	938	866	810	873	755	680	612	520	520	393	379	337	
		[illegible]	[illegible]	2	2	[illegible]	1	2	8	13	10	9	14	[illegible]	9	12	[illegible]	[illegible]	10	12	6	150
		[illegible]	3	4	2	6	6	7	10	9	20	[illegible]	[illegible]	[illegible]	9	12	8	7	5	7	7	161
	35	[illegible]	1	3	2	1	11	12	12	15	12	[illegible]	1	15	11	27	9	9	12	10	11	217
		2	1	1	1	6	10	11	10	15	17	17	20	18	16	16	9	10	10	9	15	214
		5	2	9	9	6	15	16	15	17	17	10	14	19	19	14	12	15	10	14	11	249
		2	6	6	6	15	13	14	18	17	21	16	18	[illegible]	[illegible]	14	16	[illegible]	10	18	15	291
		[illegible]	[illegible]	2	14	10	18	[illegible]	[illegible]	[illegible]	22	21	23	17	19	[illegible]	16	24	[illegible]	[illegible]	15	356
	50																					
		369	312	394	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

60

IMP-7 E-peak from D vs E

	interval 121	122	123	SN	SN/3
35	340	420	360		373
36	320	400	370		370
37	280	360	330		323
38	280	320	330		310
39	280	340	330		317
40	360	400	390		383
41	420	520	480		473
42	580	660	630		623
43	680	780	780		747
44	800	920	870		863
45	840	960	960		920
46	880	960	1013		951
47	820	980	960		920
48	780	920	900		867
49	800	920	840		853
50	680	720	780		727
51	620	740	630		663
52	580	600	600		593
53	480	560	570		537
54	420	540	480		480
55	360	440	420		407
56	340	360	390		363
57	340	360	390		363
58	300	340	330		323
59	280	320	220		290

IMP-8 E-peak from D vs. E, interval 121 { D = 13-37, E = 40-59



$\frac{6}{49} = .122$

$\frac{8}{49} = .163$

width $= \frac{14}{49} = 29\%$

(cf. IMP-6 ½ ht. % of .122, .195)
width = 32%

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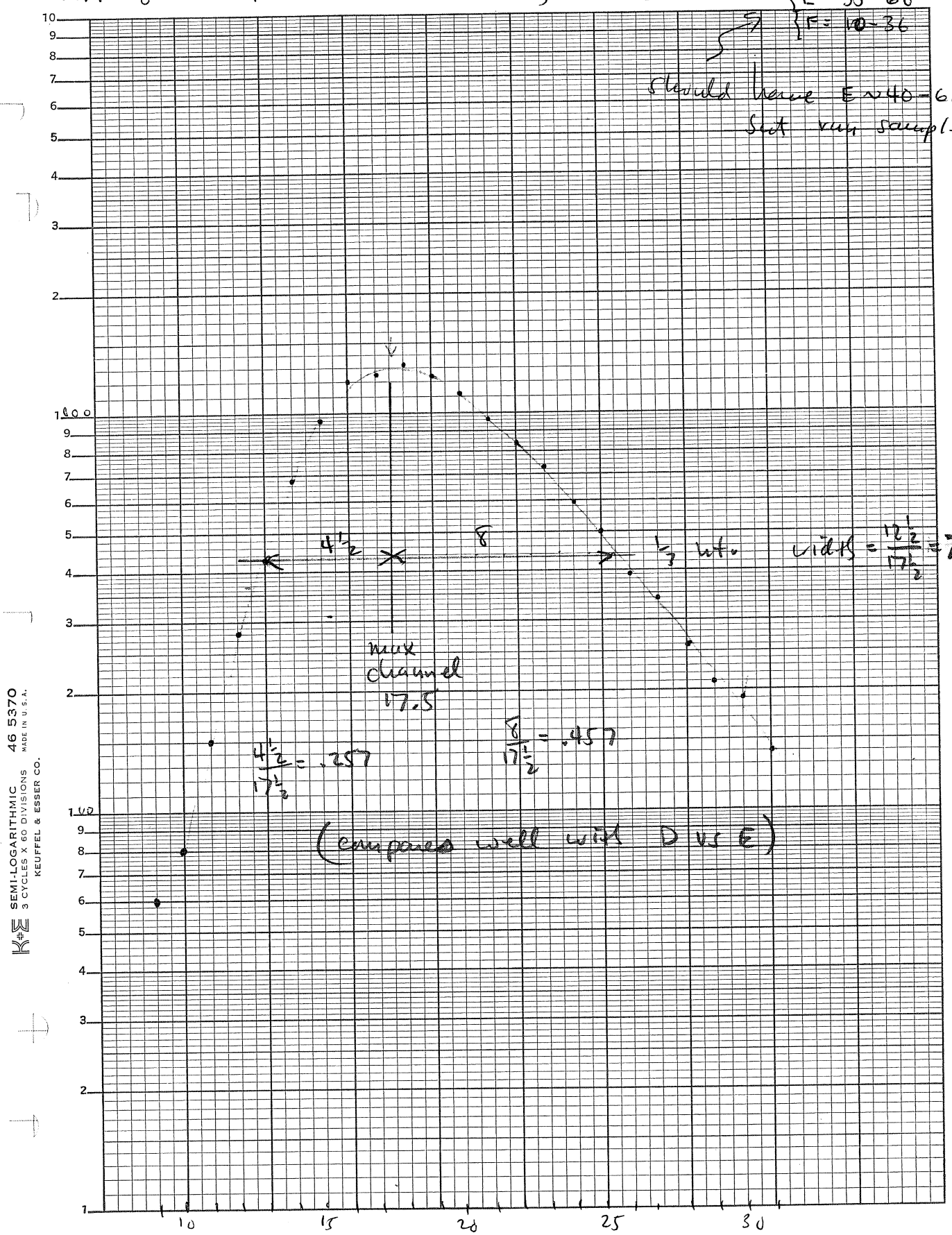
KEUFFEL & ESSER CO.

IMP-7 D-peak from D vs F

	interval 121	122	123	SN/3
9	60	60	60	60
10	60	90	90	80
11	150	150	150	150
12	240	300	300	280
13	360	480	450	430
14	600	720	720	680
15	870	1020	990	960
16	1080	1290	1230	1200
17	1170	1320	1260	1250
18	1250	1350	1350	1317
19	1140	1290	1290	1240
20	1020	1170	1140	1110
21	870	1020	990	960
22	780	870	870	840
23	660	750	780	730
24	540	630	600	570
25	450	540	510	500
26	360	420	390	390
27	330	330	360	340
28	240	270	270	260
29	180	210	240	210
30	180	180	210	190
31	120	150	150	140

MP-8 D-peak from D vs F, intervals 121-123 {D = 9-31, E = 35-60, F = 10-36}

Should have E ≈ 40-60
Set run samples.

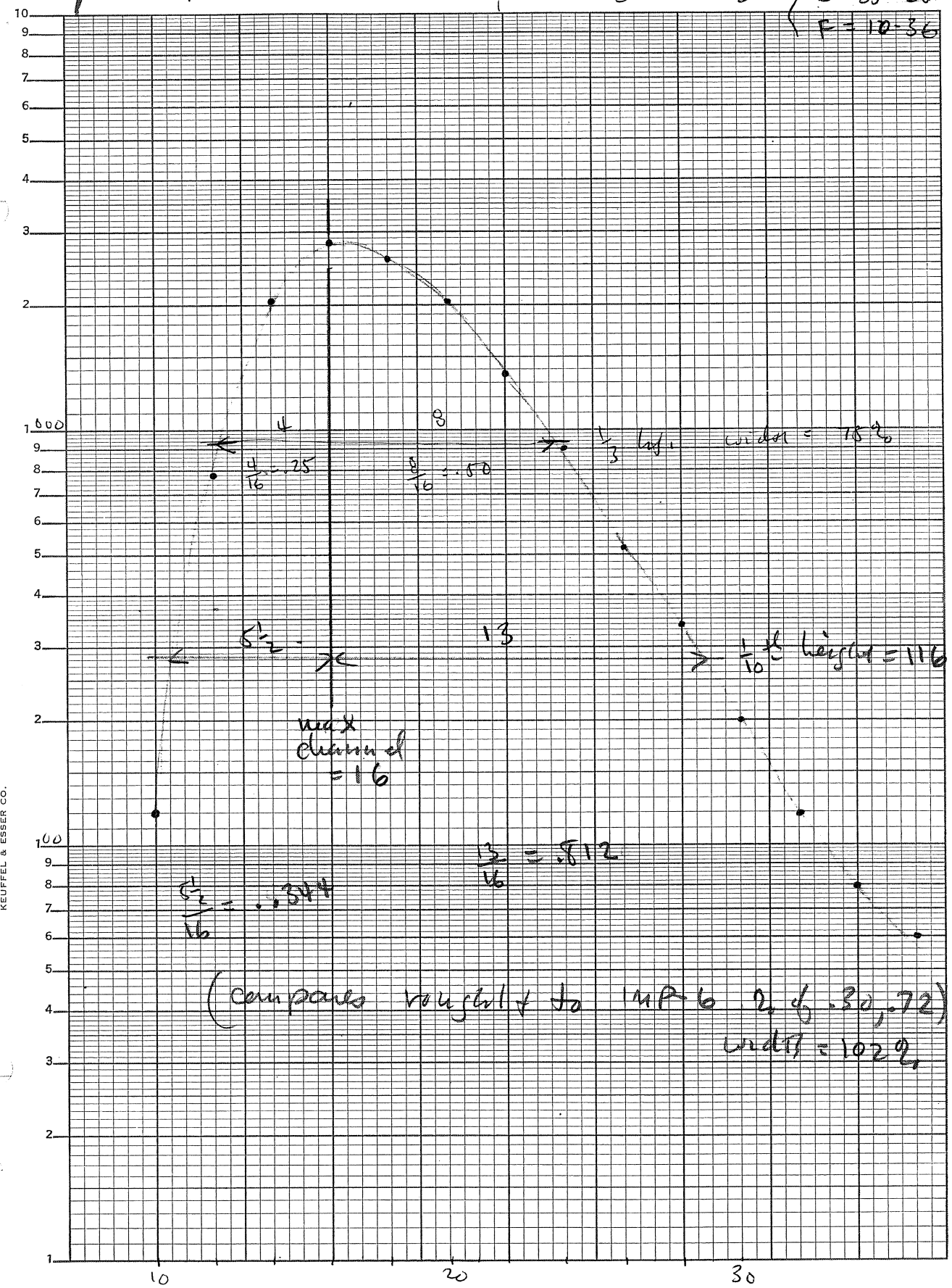


IMP-7 F-peaks from D vs. F

	interval 121	122	123	ΣN/3
10	120	120	120	120
12	720	840	780	780
14	1860	2160	2100	2040
16	2555	2900	2950	2802
18	2340	2700	2700	2580
20	1920	2100	2100	2040
22	1260	1500	1380	1380
24	900	900	900	900
26	420	600	540	520
28	300	360	360	340
30	180	180	240	200
32	120	120	120	120
34	60	120	60	80
36	60	60	60	60

IMP-8 F-peak from D vs F, intervals 121-123

D = 8-31
E = 35-60
F = 10-36



orbits 121 - 130 took 1 tape, 300k (007001)

9-10-75)

So, pick for peak shapes (IMP-8)

DLOW = .26 DHI = .45 1/3 ht.

ELOW = .12 EHI = .16 1/2 ht.

FLOW = ~~.34~~ .25 FHI = ~~.81~~ .50 1/3 ht.

~~E limits~~

D vs E : D : 10 - 35
E : 40 - 60

D vs F : D : 10 - 35
E : 40 - 60 ← should be monitored
F : 10 - 40

30/tape Do orbits 105 - 120 (H11002) ZBYDCHGP
121 - 140 (H11002) ZBHDATHGP

IMP-8 D-peak from D vs E

interval	121	122	123	124	ΣN/4
9	200	200	200	240	210
10	320	400	360	320	350
11	520	560	520	520	530
12	680	720	760	760	730
13	880	880	840	880	870
14	1000	1000	1000	1000	1000
15	1040	1120	1080	1040	1070
16	1200	1240	1200	1120	1190
17	1240	1360	1320	1280	1300
18	1400	1440	1440	1320	1400
19	1440	1480	1480	1440	1460
20	1500	1555	1510	1525	1520
21	1400	1520	1320	1440	1420
22	1320	1400	1320	1320	1340
23	1200	1240	1200	1280	1230
24	1120	1080	1040	1040	1070
25	960	960	880	960	940
26	840	840	800	800	820
27	680	720	680	680	690
28	600	640	560	600	600
29	480	480	480	480	480
30	400	440	400	400	410
31	360	320	320	360	340

Is D peak broadened due to bad E acceptance limits?

IMP-8 E-peak from D vs E

interval	121	122	123	124	~~ΣN~~ ΣN/4
35	450	450	480	510	472
36	390	420	480	480	442
37	420	450	450	420	435
38	360	420	360	360	375
39	360	330	360	330	353
40	360	390	330	360	368
41	360	360	330	360	353
42	360	420	390	360	383
43	510	510	450	510	495
44	600	630	600	540	593
45	690	810	720	720	735
46	810	900	810	810	833
47	900	930	900	900	908
48	1020	1020	930	960	983
49	930	960	990	960	960
50	870	930	870	930	900
51	870	900	870	840	870
52	810	780	750	780	780
53	720	690	690	750	713
54	630	750	660	600	660
55	540	570	570	540	555
56	540	510	540	540	532
57	420	450	420	480	442
58	390	420	360	360	382
59	360	360	390	360	368

IMP-8 D-peak from D vs. F

interval	121	122	123	~~124~~	$\Sigma N/3$
9	60	60	30		50
10	30	30	60		40
11	60	60	60		60
12	90	90	90		90
13	150	150	150		150
14	210	240	270		240
15	360	360	390		370
16	540	540	570		550
17	720	780	750		750
18	900	930	960		930
19	1080	1080	1110		1090
20	1170	1230	1183		1200
21	1110	1280	1110		1167
22	1170	1230	1140		1180
23	1080	1110	1050		1080
24	1020	990	960		990
25	870	900	840		870
26	780	780	750		770
27	630	690	630		640
28	570	600	540		570
29	480	480	480		480
30	360	420	390		390
31	360	330	330		340

IMP-8 F peak from D vs F

Interval		121	122	123	124	125	S N/5
12	16	50	50	50	[illegible]	50	40
14	18	200	200	250	250	200	220
16	20	550	650	600	650	600	610
18	22	1200	1300	1250	1250	1350	1270
20	24	2000	2050	1900	2000	1950	1980
22	26	2310	2350	2343	2360	2245	2320
24	28	2150	2250	2100	2050	2050	2120
26	30	1750	1800	1700	1700	1700	1730
28	32	1250	1350	1300	1350	1300	1310
30	34	900	950	950	900	1000	940
32	36	650	650	600	650	700	650
34	38	450	500	450	500	450	470
36	40	350	350	350	300	350	340

for IMP-6, need 166 – 180
196 – 270
301 –

one matrix tape = 30 orbits, ≤420 frames

271 – 300 took 166k, (10.7, 3.7), 2 mounts.

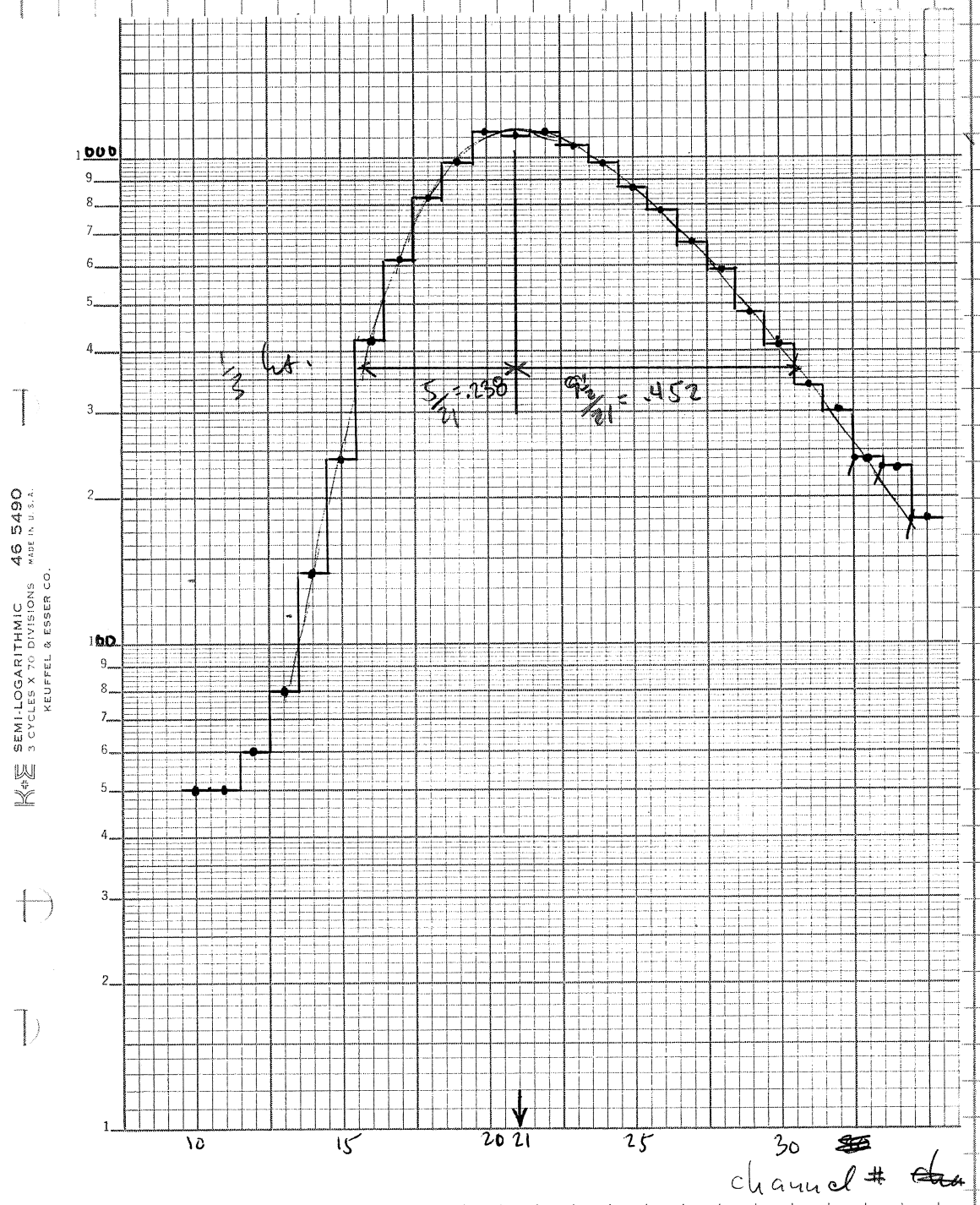
G61	166 – 180	(010004)
G62	196 – 210	(010004)
G63	211 – 240	(012005)
G64	241 – 270	(012005)
G65	301 – 315	(010004)

9/18) The F calculation is wrong —
i.e. taking a fraction of a zero value channel.
Need to convert F channel values to ½ their value.

REDO of IMP-8 peak shape analysis — with narrower limits

D from D vs. E

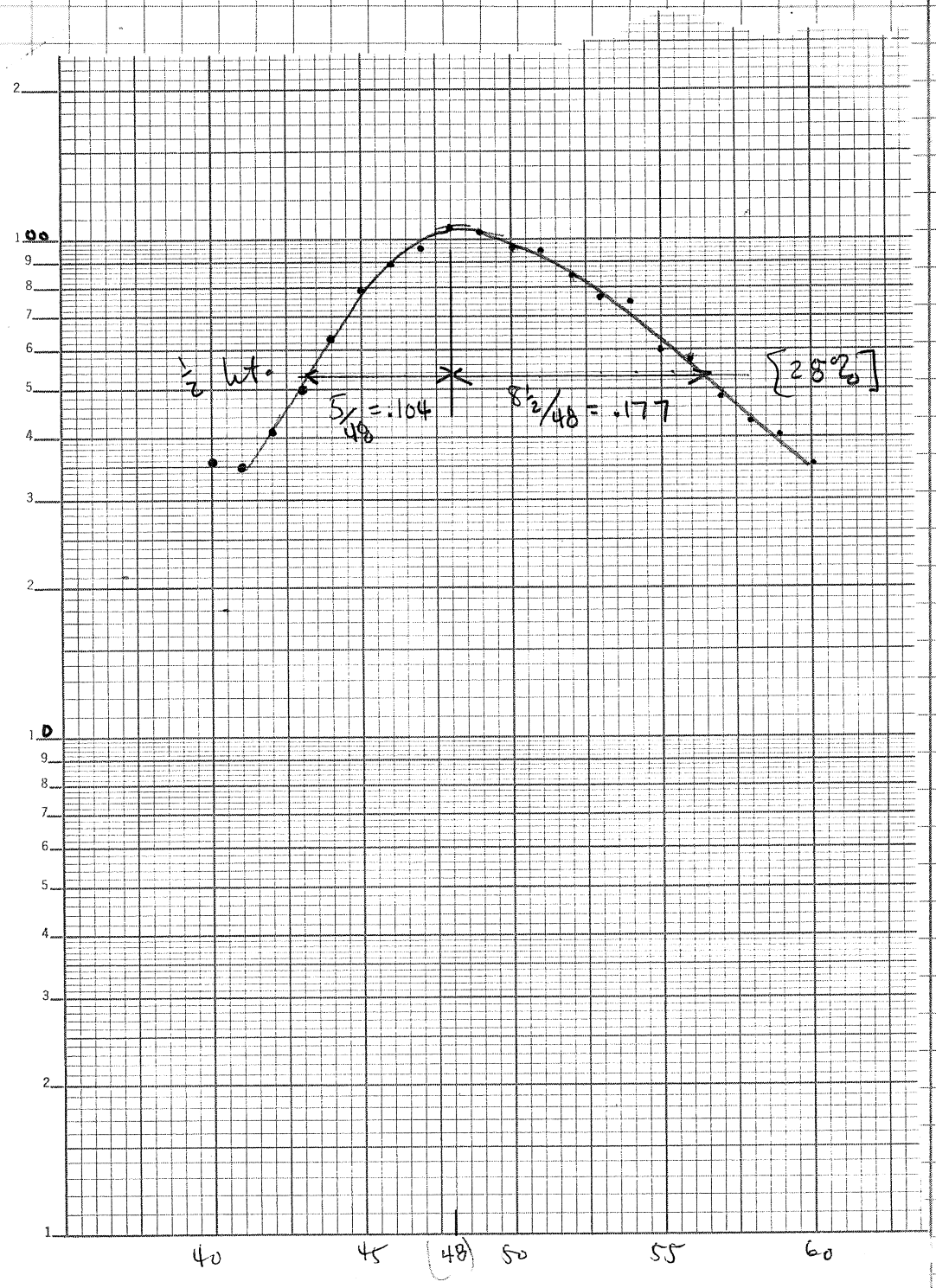
orbit	121	122	123	$\Sigma N/3$
10	30	60	60	50
11	60	60	30	50
12	60	60	60	60
13	90	90	60	80
14	120	150	150	140
15	240	240	240	240
16	420	420	420	420
17	600	630	630	620
18	810	840	840	830
19	960	1020	990	990
20	1140	1170	1110	1140
21	1080	1205	1050	1112 ←
22	1110	1170	1125	1135
23	1050	1080	1050	1060
24	1020	960	930	970
25	870	900	840	870
26	780	810	750	780
27	630	720	660	670
28	600	600	570	590
29	480	480	450	480
30	390	420	420	410
31	360	330	330	340
32	300	300	300	300
33	240	210	270	240
34	210	240	210	230
35	210	150	180	180


1000
9
8
7
6
5
4
3
2
100
9
8
7
6
5
4
3
2
1
10
15
20 21
25
30
channel #
1/3 ht.
5/21 = .238
9 1/2/21 = .452
SEMI-LOGARITHMIC 46 5490
3 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

REDO of IMP-8 peaks—

E from D vs E

orbit	121	122	123	EN/3
40	360	390	330	360
41	360	360	330	350
42	390	420	420	410
43	510	510	480	500
44	630	630	630	630
45	750	870	750	790
46	870	930	870	890
47	960	960	960	960
48	1090	1100	990	1060
49	990	1020	1060	1023
50	930	990	960	960
51	930	960	930	950
52	870	840	810	840
53	780	750	750	760
54	720	810	720	750
55	600	600	600	600
56	600	540	570	570
57	450	510	480	480
58	450	450	390	430
59	390	390	420	400
60	330	360	360	350



K&E SEMI-LOGARITHMIC 46 5490
3 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

Redo of 14P-9

F from D vs F

o.sit	121	122	123	$\Sigma N/3$
10	34			
12	27			
14	31 ~~50~~	50	50	50
16	250	300	250	267
18	950	950	950	950
20	1850	1900	1800	1850
22	2280	2350	2280	2270
24	2200	2290	2100	2197
26	1800	1850	1750	1800
28	1350	1450	1450	1417
30	1000	1050	1050	1033
32	700	700	650	683
34	500	550	500	533
36	377			
38	~~340~~ 290			
40	~~312~~ 206			
42	~~158~~ 175			
		122		
		97		
		65		
		48		

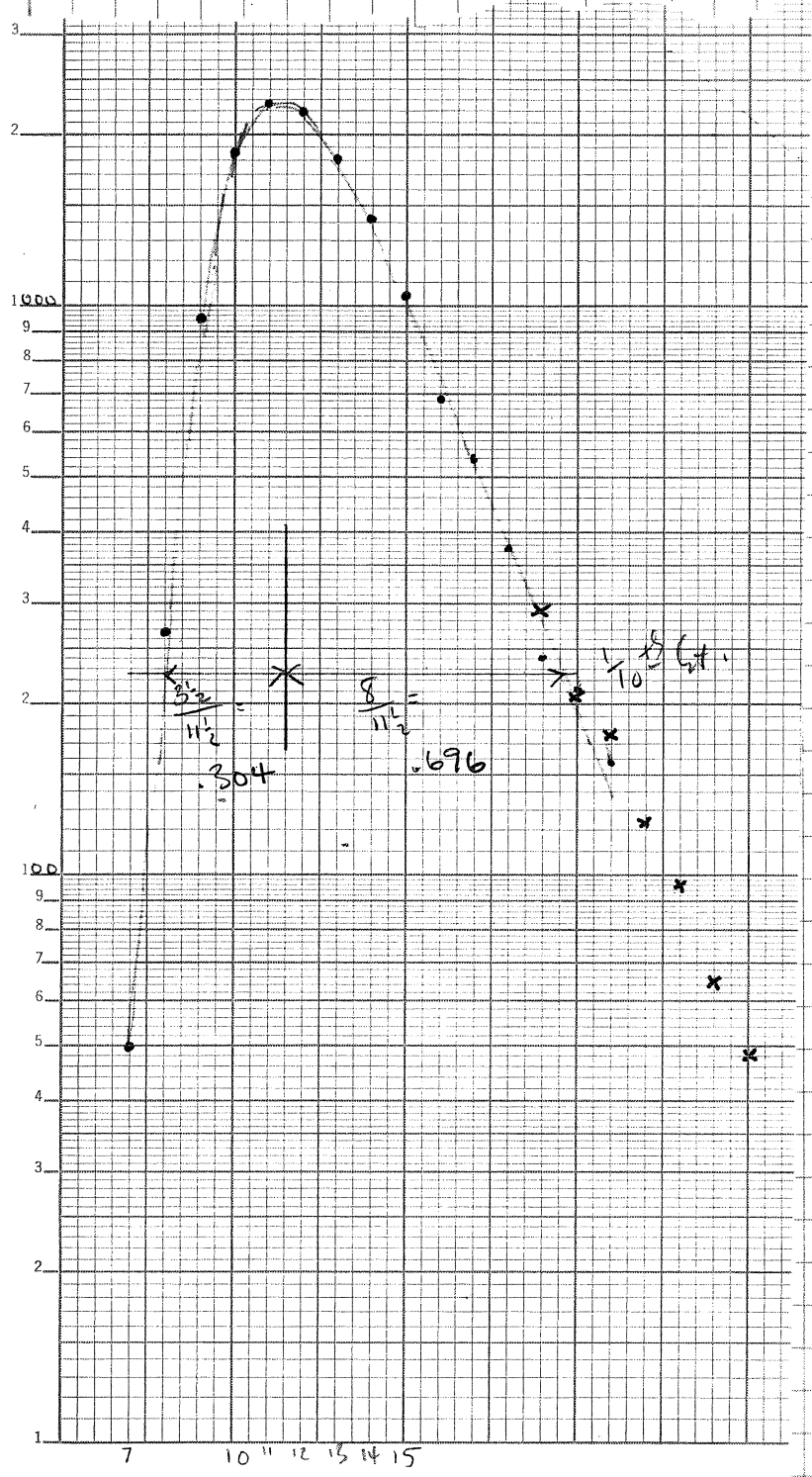
ch. #	ch. #(ch)	st.	st(ch)
5	170	170	34
6	162	332	61
7	350	682	111
8	2136	2818	378
9	8550	11368	1328
10	18500	29868	3178
11	24970	54838	5448
12	26364	81202	7645
13	25400	106602	9445
14	19838	126440	10862
15	15495	139935	11885
16	10928	150863	12578
17	9061	159924	13111
18	6786	166710	13488
19	5510	172220	13778
20	4120	176340	13984
21	3675	180015	14159
22	2684	182699	14281
23	2231	184930	14378
24	1560	186490	14443
25	1200	187690	14491

.304, .696

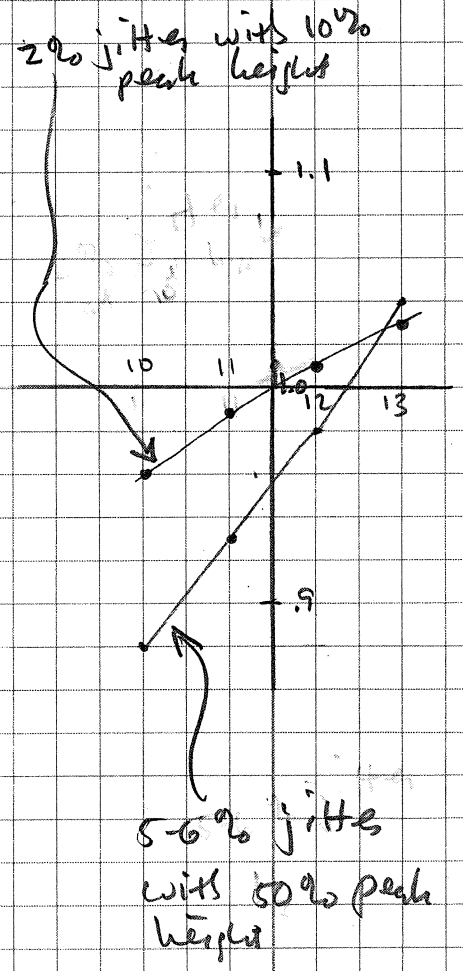
MAX CH.	(x, y)	Σ ch x(ch)	Σ(ch)			
10	(6.96, 16.96)	139603 + 6 + 10491	11834 + 2 + 655	12.02		.96
11	(7.66, 18.66)	159242 + 119 + 4479	13000 + 17 + 249	12.35	12.5	.99
12	(8.35, 20.35)	169462 + 1388 + 1442	13400 + 173 + 72	12.62		1.01
13	(9.05, 22.05)	168647 + 8122 + 134	12831 + 902 + 6	12.88		1.03

.15, .35

MAX CH.	(x, y)	Σ ch. x(ch)			
10	(8.5, 13.5)	78384 + 1068 + 1700	7267 + 133 + 900	10.98	.88
11	(9.35, 14.85)	93234 + 5557 + 16962	8117 + 617 + 1204	11.64	.93
12	(10.2, 16.2)	110067 + 14800 + 2186	8717 + 1480 + 136	12.30	.58
13	(11.05, 17.55)	96025 + 23721 + 4983	7130 + 2156 + 293	13.02	1.04



3
2
1000
9
8
7
6
5
4
3
2
100
9
8
7
6
5
4
3
2
1
7
10
11
12
13
14
15
$\frac{3\frac{1}{2}}{11\frac{1}{2}}$ =
.304
$\frac{8}{11\frac{1}{2}}$ =
.696
$\frac{1}{10}$ ± Cut.
SEMI-LOGARITHMIC 46 5490
3 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.



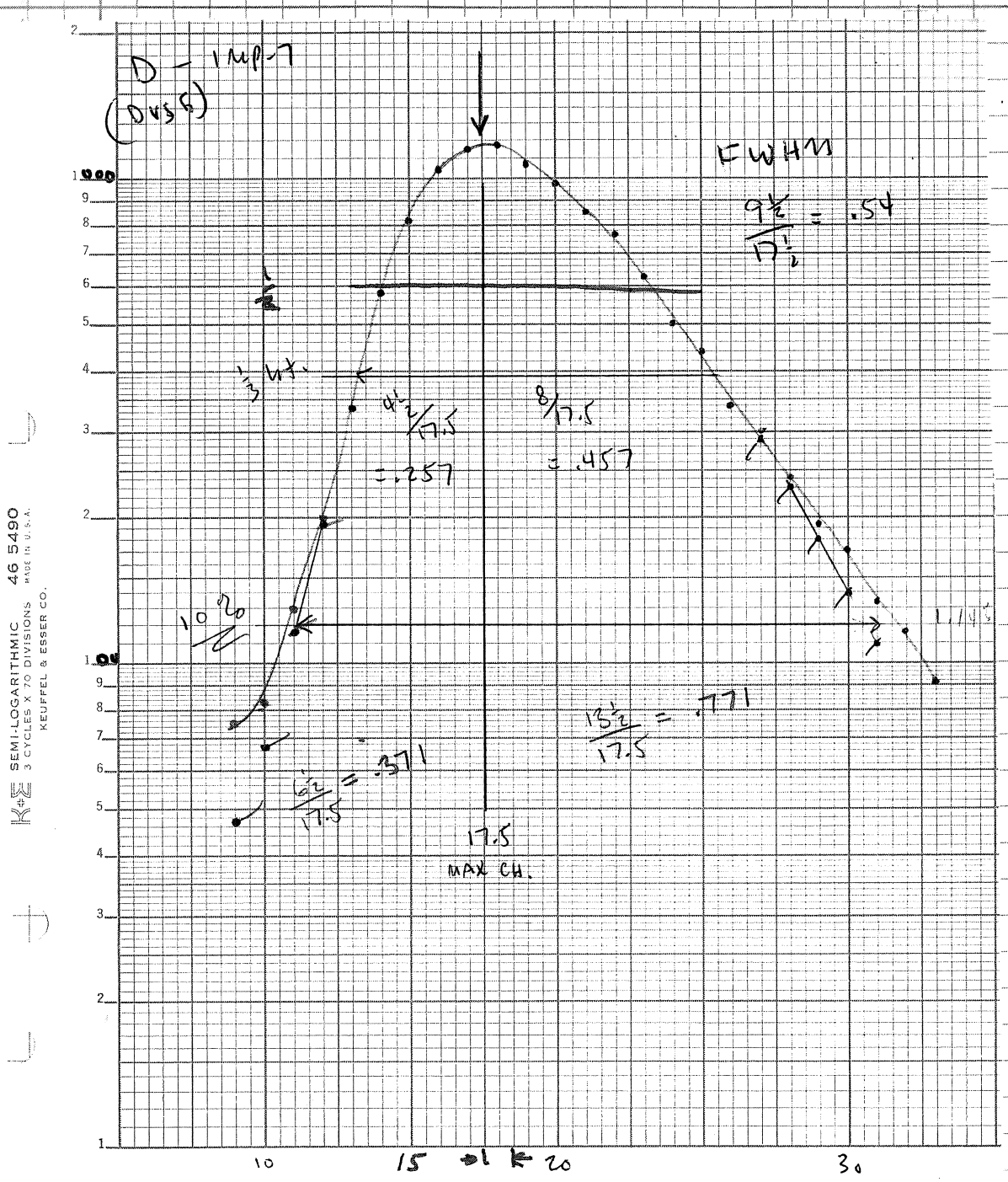
2% jitter with 10% peak height
1.1
10
11
1.0
12
13
.9
5-6% jitter with 50% peak height

IMP-7 ANALYSIS —

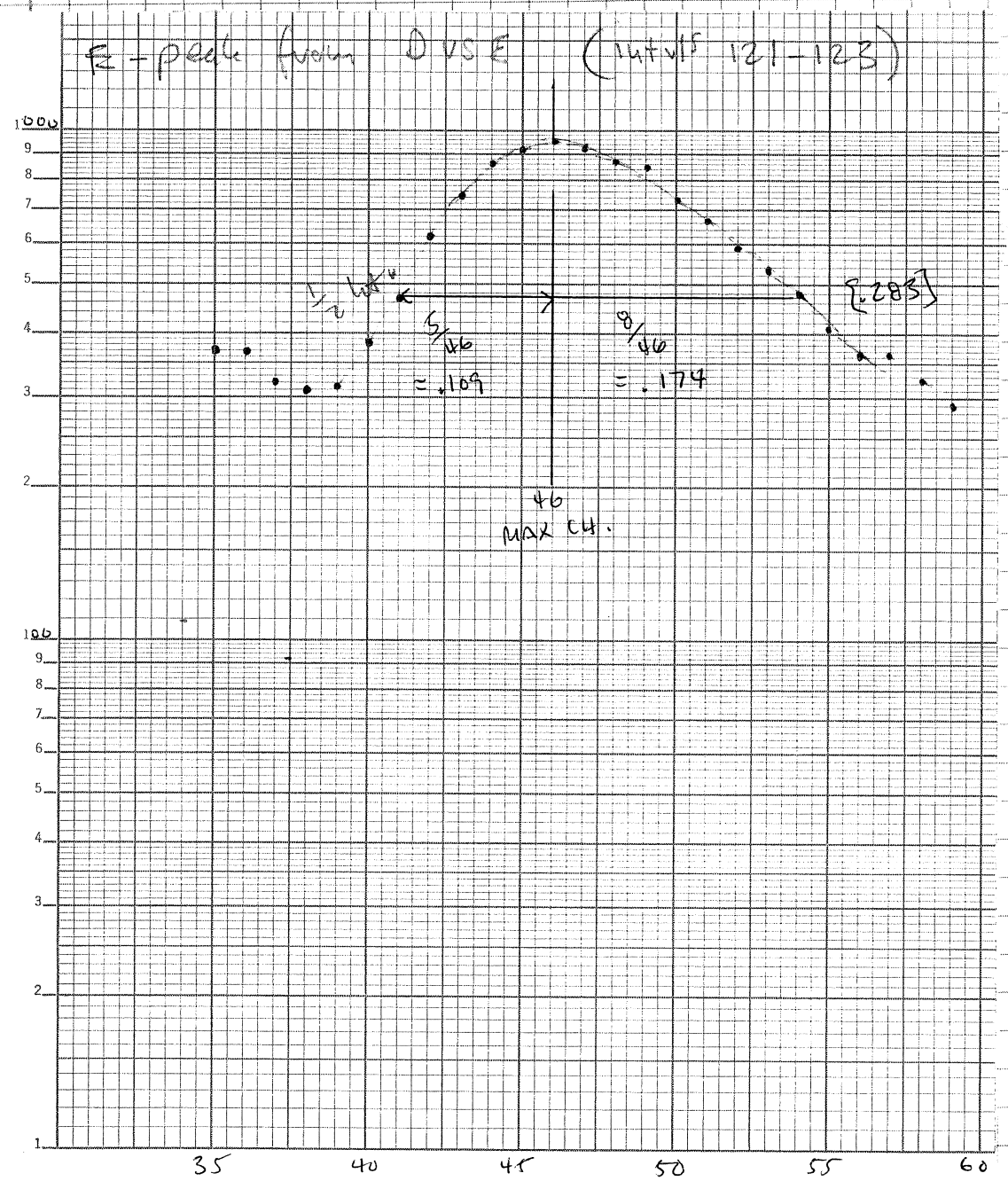
~~see data from pg. 58~~

INTERVAL 121 — need do this for D only

	25	27		30					35	36	EX	D_{raw}	D_{corr} = D_{raw} − EX
31			1	1				1	1	1	1	6	120	110
30			1	2		2		1		2		8	150	140
								1				1	180	180
		1	1	1			2			2		7	240	230
			2	1	2				1	1	1	8	300	290
		1		1	1	4	2	3	3	2		17	360	340
25		1		3			1	1	1	1	4	12	450	440
		1			2		2		1	1	1	8	510	500
		2	2	3	1	3	2	1	1	3	9	27	660	630
		1	3	2	1	1	3	6	6	11	9	41	810	770
		2	3	1	5	4	8	7	6	8	9	53	900	850
20		3	6	2	7	4	5	17	19	21	26	110	1080	970
		5	8	4	8	8	12	18	30	25	32	150	1230	1080
		7	10	12	15	19	17	27	24	33	34	198	1380	1182
		10	25	21	21	27	37	42	42	41	27	293	1443	1150
		18	30	35	33	50	54	52	36	33	23	364	1410	1050
15		45	40	53	71	56	62	49	52	43	32	503	1320	820
		51	76	62	66	67	68	53	34	29	25	531	1110	580
		88	103	91	87	74	63	43	42	30	34	655	990	335
		118	128	105	97	59	62	44	28	33	31	705	900	195
		150	101	101	66	47	42	29	29	20	18	603	720	117
10		112	94	63	51	30	25	28	19	11	10	443	510	67
9		80	57	26	33	14	14	13	7	8	1	253	300	47


D - IMP-7
(DVS8)
FWHM
9½/17½ = .54
1/3 ht.
4½/17.5
= .257
8/17.5
= .457
10/20
13½/17.5 = .771
6½/17.5 = .371
17.5
MAX CH.
10
15
20
30
SEMI-LOGARITHMIC
3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.
46 5490
MADE IN U.S.A.

IMP.7 ANALYSIS — data from pg. 60



K+E SEMI-LOGARITHMIC 46 5490
3 CYCLES X 70 DIVISIONS MADE IN U.S.A.
KEUFFEL & ESSER CO.

IMP-7 — D from D vs F see pg. 63
(.257, .457) at $\frac{1}{3}$ ht.

F — pg. 64-5

Thus, table of peak shape

Summary of peak shape info.

			(below, above)	
IMP-6	D (D vs E)	at $\frac{1}{3}$ ht.,	(.219, .531)	~~widths~~ widths = .7
	E (D vs E)	at $\frac{1}{2}$ ht.	(.122, .195)	widths = .3
	F (D vs F)	at $\frac{1}{10}$th ht.	(.300, .725)	widths = 1.
IMP-7	D (D vs E)	at $\frac{1}{3}$ ht.	(.257, .457)	widths = .71
	E	at $\frac{1}{2}$ ht.	(.109, .174)	widths = .28
	F	at $\frac{1}{10}$th ht.	(.344, .812)	widths = 1.16
	(D (D vs F)	at $\frac{1}{3}$ ht.	(.257, .457)	widths = .71
IMP-8	D (D vs E)	at $\frac{1}{3}$ ht.	(.238, .452)	widths = .69
	E	at $\frac{1}{2}$ ht.	(.104, .177)	widths = .28
	F	at $\frac{1}{10}$ ht.	(.304, .696)	widths = 1.

Convert D to $\frac{1}{10}$th heights:

IMP-6	at $\frac{1}{10}$th ht.		(.28, .81)
IMP-7	"	"	(.37, .77)
IMP-8	"	"	(.34, .77)

Testing of IMPEAK —

data ((IPLOT(I, J); I = 1, 16), J = 1, 16)

0	0	1	0	5	0	1	0	5	0	18	0	76	0	198	0	
0	0	0	0	6	0	13	0	8	0	16	0	54	0	192	0	
0	0	1	0	5	0	11	0	6	0	11	0	72	0	197	0	
0	0	1	0	2	0	7	0	14	0	7	0	39	0	199	0	
0	0	0	0	8	0	2	0	3	0	7	0	32	0	128	0	
0	0	0	0	1	0	3	0	2	0	3	0	16	0	50	0	. . . .
0	0	0	0	4	0	4	0	4	0	6	0	5	0	15	0	
0	0	1	0	4	0	2	0	4	0	1	0	2	0	5	0	
0	0	0	0	1	0	5	0	4	0	1	0	2	0	5	0	
0	0	0	0	7	0	4	0	3	0	10	0	3	0	8	0	
0	0	0	0	10	0	10	0	10	0	6	0	7	0	13	0	
0	0	0	0	23	0	21	0	9	0	8	0	15	0	21	0	
0	0	0	0	16	0	26	0	14	0	12	0	7	0	44	0	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	. . . .

J ↑

I →

So, F data in odd channels 1, 3, 5, 7, 9, 11, ...

real space 1, 3, 5, 7, 9, 11, 23 ...

comp. space 1, 2, 3, 4, 5, 6, 7, ...

$$R = 2 * C - 1$$

$$C = \frac{R+1}{2}$$

RADO IMP-6 D-peaks from D vs. F

orbit	181	182	183
9	120	120	120
10	400	270	270
11	840	660	600
12	1360	1020	1080
13	1520	1350	1260
14	1560	1230	1350
15	1440	1110	1230
16	1480	1050	1020
17	1120	900	870
18	1000	750	780
19	800	630	660
20	600	480	480
21	520	360	360
22	360	330	330
23	280	180	210
24	200	150	180
25	160	120	150
26	120	90	90
27	80	60	60
28	40	30	60
29	40	30	30
30	40	30	30
31	40	30	30

.219 → .781
.531 → 1.531

.781 × 14 = 10.93
1.531 × 14 = 21.43
11 — 21
[10] [22]

COMPARING $\frac{1}{10}$th vs. $\frac{1}{3}$rd peak ht., $\overline{D}$.

	#	Σ#	ch×#	Σch#
9	120	120	1080	1080
10	400	520	4000	5080
11	840	1360	9240	14320
12	1360	2720	16320	30640
13	1520	4240	19760	50400
14	1560	5800	21840	72240
15	1440	7240	21600	93840
16	1480	8720	23680	117520
17	1120	9840	19040	136560
18	1000	10840	18000	154560
19	800	11640	15200	169760
20	600	12240	12000	181760
21	520	12760	10920	192680
22	360	13120	7920	200600
23	280	13400	6440	207040
24	200	13600	4800	211840
25	160	13760 ←	4000	215840
26	120	13880	3120	218960
27	80	13960	2160	221120
28	40	14000	1120	
29	40			
30	40			
31	40			

.07

.43

$\frac{1}{3}$rd

$\overline{14}$

11 — 21
[10] [22]

$$15.40 = \frac{187600 + 355 + 3405}{12240 + 28 + 155}$$

$\overline{15}$

11.715 — 22.965
12 — 22
[11] [23]

$$15.90 = \frac{186280 + 2633 + 6214}{11760 + 239 + 270}$$

$\gtrsim 3\%$ change in gain shift for ± 1 channel

But, instead of $\frac{1}{3}$ height, go to $\frac{1}{10}$th height: (.281, .8125) → (.719, 1.8125)

$\overline{14}$

10.066 — 25.375
11 — 25
[10] [26]

$\frac{1}{10}$th

$$\frac{210760 + 3736 + 1170}{13240 + 374 + 45} = 15.79$$

$\overline{15}$

10.785 — 27.188
11 — 27
[10] [28]

$$\frac{216040 + 860 + 210}{13440 + 86 + 7} = 16.04$$

So, so with 10% D peak heights:

with imp-6, — (.281, .8125) .993

imp-7: (.371, .771) 1.14

imp-8: (.341, .773)

GAIN SHIFT COVERAGE

IMP-6

D vs E 1 — 313

D vs F 31 — ~~[illegible]~~ - 296

IMP-8 101 — 175

10-28-75 — need to do 1-30, ~~[illegible]~~ LPT. 297-313 IMP-6
176-220 IMP-8

IMP-8 catalog: have MATR 7, 8, 10, 6, 11, 9
6 starts 10/30/73
11 ends 2/11/75 (not full)

		YS.#
~~1-40~~	1-20	1
~~41-80~~	21-40	2
~~81-120~~	41-60	3
~~121-160~~	61-80	4
~~161-200~~	81-100	5
~~201-240~~	101-120	6
~~241-280~~	121-140	7
~~281-320~~	141-160	8
	161-180	9
	181-200	10
	201-220	11
	221-240	12

(IMP-8 176-180 missing)

Sub	SUBMIT:	orbit		frames	
~~6 [illegible]~~	~~IMP-6:~~	~~1-30~~	~~(10,3)~~	~~250~~	
6 61		297-313	(5,3)	200	✓
6 81	IMP-8:	181-200	(15,3)	300	no
6 82		201-220	(15,3)	300	✓

IMP-8
P = # pp/orbit
T = (.6, .08)/orbit

IMP - 8 GAIN SHIFTS

STANDARD — ~~ex~~ intervals 110 - 120

PFLUX: 12/3/75

2 Boxes for IMP-8 proton flux (for NOAA Bulletin)
DEFG

E ch #	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Box 1 up	141	141	141	141	141	137	132	128	123	119	115	111	108	104	100	97	94	91	89	86
" " low	0	108	104	100	96	92	89	86	83	80	77	74	71	68	65	63	61	59	57	56	54

E ch.	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	-	-
Box 1 up	83	81	79	77	75	72	70	68	66	65	64	63	62	61	60	59	0	- - - -	
Box 1 dn	53	51	50	48	46	45	44	43	42	41	40	39	38	37	36	35	0	- - -	

E ch. #	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
Box 2 up	0	0	58	57	56	56	55	54	53	53	52	51	50	49	49	48	47	47	46	46	45	45	44	44	43	43
Box 2 dn	0	0	34	34	33	32	32	31	30	29	28	28	27	27	26	26	25	25	24	24	23	23	22	22	21	21

E ch #	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Box 2 up	42	42	41	41	41	40	40	39	39	39	38	38	38	37	37	37	37	36	36	36	35	35	34	34	34
Box 2 dn	20	20	20	19	19	19	19	18	18	18	18	18	18	17	17	17	17	17	17	17	17	17	17	17	17

E ch #	91	92	93	94	95	96	97	98	99	100
Box 2 up	33	33	32	32	31	30	29	27	0	0
Box 2 dn	18	18	18	19	19	20	21	22	0	0

Box 1 is nominally 20-40 Mev protons.
Box 2 " " 40-80 " "

IMP-7 GAIN SHIFTS :

~~[illegible]~~ intervals 1-190 are on LPT
- but should do all on LPT
Stscnt = 1!

in testing, did

121-123 in (1.75, .52) w. 180k

121-130 in (4.06, 1.32) w. 182k

so (.41, .13) / ~~[illegible]~~ interval

Do 1-30 (12.3, 3.9) → (15, 5) 200k
31-60
61-90
91-120

3/3/77

CONVERSION NORMALIZATION BETWEEN IMP-7 STANDARD ORBITS (INTERVALS 110-125) AND IMP-6 STANDARD ORBITS (7-15).

	IMP-6/IMP-7
D	1.04
E	1.02
F	1.20

So that if you want the equivalent IMP-6 D, value, use 1.04 * (IMP-7 D) etc.

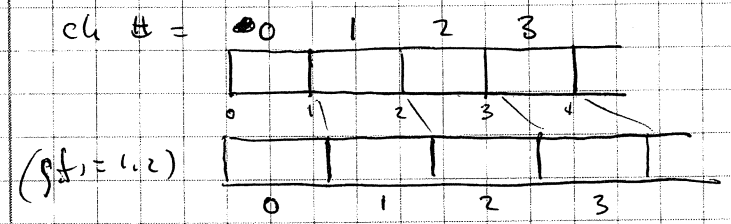
Flux programs:

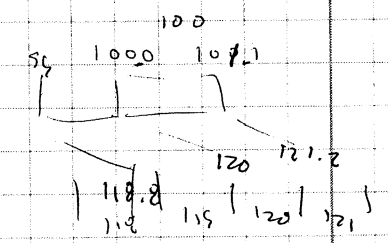
we need a similar set of values for IMP-8 to IMP-6

IMP-6 tape bad
IMP-7 both α & p
IMP-8 attempting, but need norm.

2/3/77

Digression on gain shifts:





If old has 1000 counts,
new 0 will have $5/6 \times 1000 = 833$
new 1 will have 167

	Old PHA pt. (index)	(New PHA pt)	New index	
	1000 cts in 0 (1)	833 cts in (0)	1	
		167 cts in (1)	2	
G.F. = 1.2	1000 cts in 1 (2)	667 cts in (1)	2	
		333 cts in (2)	3	
	1000 cts in 2 (3)	500 cts in (2)	3	
		500 cts in (3)	4	
	⋮	⋮		
	1000 cts in 100 (101)	833 cts in (120)	121	
		167 cts in (121)	122	28
	1000 cts in 99 (100)	167 cts in (118)	119	139, 13
		833 cts in (119)	120	694

Currently, the random number generator act ~~[illegible]~~ like 100 is the approp. input, the disp method ~~[illegible]~~ sees 100 and treats it like 99. So add 1 to IX, IY for disp. (as in ANALIMP, etc.)