BOOK 125R (Book is 308 pages and 10"x12")

Notes:
spine "CEF 2"

lots of red pencil throughout book

Blank pages: page opposite 1, 4, 6, 14, 32, 34-40, 58, 62, 68, 82, 84, 96, 110, 118, 120, 130, 142, 152, 162, 166, 168, 173, 174, 176, 178, 180, 184, 186, 188, 194-196, 200, 216, 232, 238, 250, 251, 254, 260, 272-274, 282, 290, 296, 306-308, page opposite 308, inside back cover.

1 graph on each of the listed pages:
12, 16, 20, 26, 50, 52, 54, 56, 64, 78, 80, 86, 100, 106, 126, 136, 137, 141, 153, 154, 156, 160, 164, 170, 172, 202, 206, 207, 212, 218, 224, 240, 264, 266, 294, 300, 304

2 graphs on each of the listed pages:
2, 10, 18, 22, 24, 28, 30, 42, 48, 72, 76, 88, 90, 92, 94, 102, 112, 114, 134, 198, 220, 228, 230, 242, 244, 258, 262, 276, 280, 292

3 graphs on each of the listed pages:
8, 46, 66, 70, 74, 104, 140, 146, 158, 208, 226, 234, 236, 246, 248, 268, 284, 286, 302

4 graphs on each of the listed pages:
116, 132, 138, 144, 204, 222, 270, 278, 288

page 44 has 5 graphs
pages 108, 128, & 148 (large) each have 1 graph and 1 photo
one loose sheet between pages 78 & 79
page 122 has 1 sheet, 1 graph, & 2 photo attached
page 124 has 1 photo & 2 graphs
page 150 has 1 large graph
page 252 has sheet glued down
page 303 1 graph & 1 sheet of paper

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
June 1, 2001

This logbook was by far one of the hardest to get a good copy for scanning. It had lots of red pencil markings which is very hard to pick up with the copier and the scanner. I'm sorry for the quality not being the best on this one.
Sheila Finch/RSICC
6/1/01

[redacted]

Classification of this work remains unchanged per conversation with L. R. Phillips, Y-12 Classification on 10-25-72.

Dee Magnuson
CRD

This notebook was apparently classified by a Y-12 Classification Officer. We assume the ORNL Classification Officer was not available at the time classification was needed.

RESTRICTED DATA
This document contains Restricted Data as defined in the Atomic Energy Act of 1954. Unauthorized disclosure subject to Administrative and Criminal Sanctions.

Classification changed to: remains [redacted]
(level and category)
By authority of: CG-TW-5
(classification guide)
E. Harrington 6/4/94
ADC or ADD signature (reviewer) Date
ADD signature (final reviewer) Date

This is one of the 15 Log Books mentioned below.

DIVISION	DEPARTMENT	SECTION	BLDG.-ROOM
Technical	J. D. McLendon 3-5819		

DESCRIPTION OF RECORDS	DATES FROM	DATES THROUGH	CODE NO.	RETENTION PERIOD
15 Log Books containing record of experiments performed at Bldg. 9213, Oak Ridge Critical Experiments Facility	1950	1974	2351-CS-5	INDEFINITE

~~SECRET~~

BOX NO. 1 OF 5 TYPE MATERIAL: [X] RECORD [ ] NON-RECORD [X] CLASSIFIED [ ] UNCLASS.

TO BE COMPLETED BY PLANT RECORDS DEPARTMENT

LOCATION BLDG.	ROOM	ROW OR SECTION	TIER	SHELF OR DRAWER	BOX	RECORDS VERIFIED BY
		10	9		20	K B McNeill
						DATE 2-27-75

UCN-578 (12 5-69)

RETIRED RECORDS CONTROL

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Transfer to 1-7-83

Confidential
ORNL Technical Notebook No. 6178

Assigned to: A. D. Callihan (J. T. Thomas) Date: 1-6-83

Division:

Dept./Section:

Program/Project: Oak Ridge Critical Experiments Facility

Bldg 9213

Content

Research/Technical Description(s)/ Other Type Data	Inclusive Dates	Pages

Classification changed to: U
(level and category)
By authority of: CG-W-5 Topic 931.2
(classification guide)
[signature] 3/31/00
ADC or ADD signature (first reviewer) Date
David E Hamm 3/16/00

October 7, 1971 Critical Experiments with U-Metal at Intermediate Enrichment

Metal Pieces Available with 3.25 x 3.25 in base

No.	wt 18 ea 3.25 in. high			9 ea 2.0 in		9 ea 1.0 in		9 ea 0.75 in		9 ea 0.50 in	
112	10659	121	10632	91	6541	15	3268	24	2446	33	1635
113	10607	122	10618	92	6540	16	3272	25	2459	34	1641
114	10647	123	10612	93	6553	17	3277	26	2450	35	1642
115	10634	124	10631	94	6550	18	3273	27	2459	36	1639
116	10607	125	10652	95	6549	19	3265	28	2445	37	1636
117	10617	126	10622	96	6542	20	3276	29	2449	38	1654
118	10594	127	10633	97	6544	21	3284	30	2451	39	1641
119	10622	128	10636	98	6538	22	3265	31	2451	40	1636
120	10608	129	10608	99	6529	23	3274	32	2461	41	1629
	95595		95644		58886		29454		22071		14753

9 ea 0.25 in		18 ea @ 0.125			
42	790	51	415	60	417.5
43	793	52	418	61	"
44	798	53	417.5	62	"
45	796	54	"	63	"
46	793	55	"	64	"
47	789	56	"	65	"
48	789	57	"	66	"
49	791	58	"	67	"
50	790	59	"	68	"
	7129		7513		

53-68 are unnumbered

Total 331045 g

wt'd aver g U/g = .99904
Isotopic .37541

For Polyethylene Reflected Assemblies

4 ea 3.25 x 3.25 x 6.50 in (CH_2)n Blocks 8 ea 3.25 x 3.25 x 3.25

4 ea 3.25 x 6.50 x 6.50 in

4 ea 6.50 x 6.50 x 6.50 in For Top and bottom

also

20 ea 5.75 x 5.75 x 15.75 in, for Base and Sides

4 ea 7.5 x 7.5 x 7.5 in.

4 ea 3.75 x 7.5 x 7.5 in.

8 ea 3.75 x 3.75 x 3.75 in.

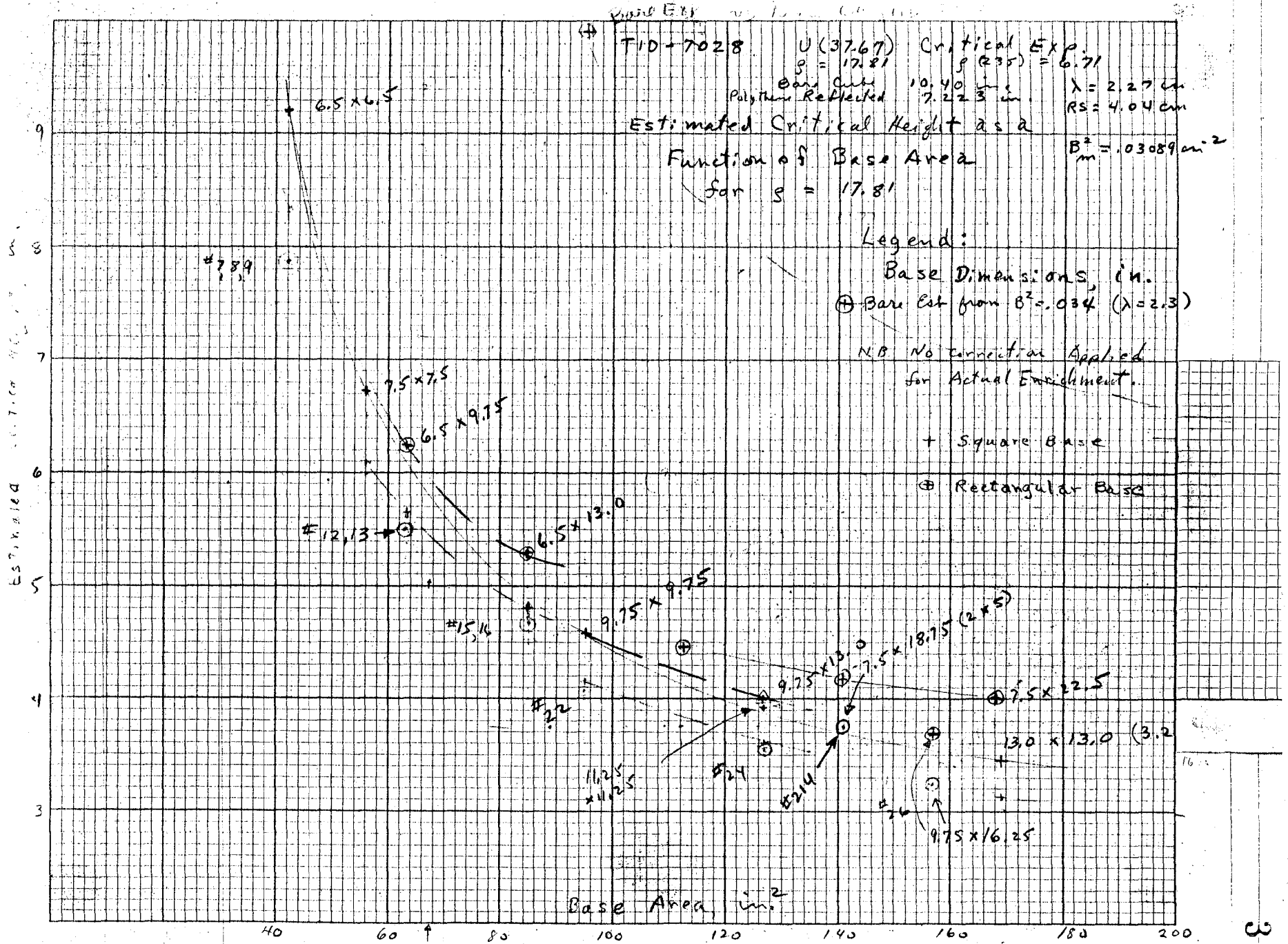
18.80 x .99904 = 18.78195
x .37541

5	7.050 93	.0180727
8	11.731 02	.0296887

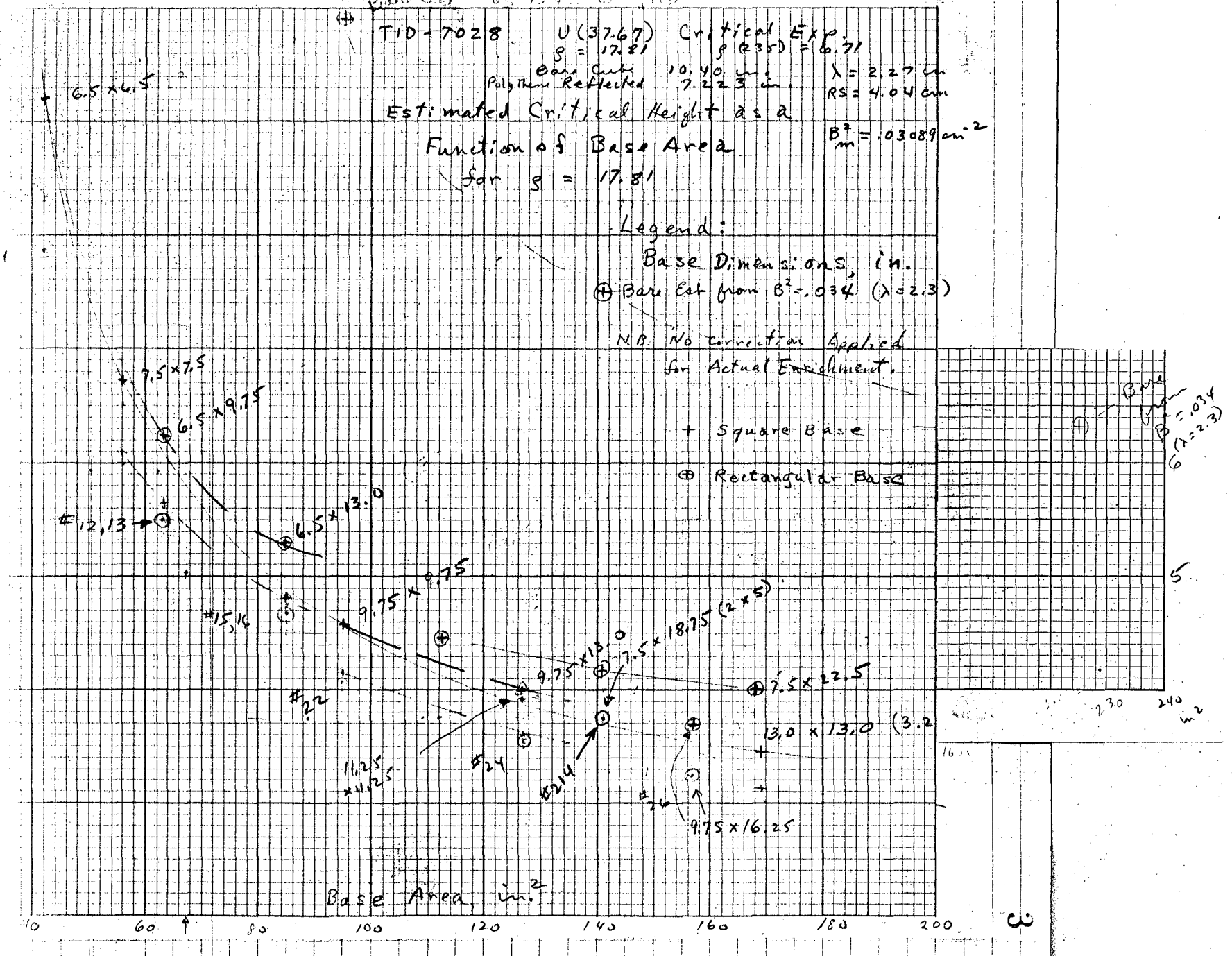
.025 .68

413

Critical heights for U(37.67) metal of TID-7028 extrapolated for other parallelopiped assemblies were calculated and a density correction applied. See p 3 for calculated curves


TID-7028
U (37.67) Critical Exp.
ρ = 17.81
ρ (235) = 6.71
Bare Cube 10.40 in.
Polythene Reflected 7.223 in.
λ = 2.27 cm
RS = 4.04 cm
Estimated Critical Height as a Function of Base Area for ρ = 17.81
B²m = .03089 cm⁻²
Legend:
Base Dimensions, in.
⊕ Bare Est from B² = .034 (λ = 2.3)
N.B. No correction Applied for Actual Enrichment.
+ Square Base
⊕ Rectangular Base
6.5 x 6.5
#7,8,9
7.5 x 7.5
6.5 x 9.75
#12,13
6.5 x 13.0
#15,16
9.75 x 9.75
9.75 x 13.0
7.5 x 18.75 (2 x 5)
7.5 x 22.5
#22
11.25 x 11.25
#24
#21
13.0 x 13.0 (3.2
#26
9.75 x 16.25
Base Area, in.²
Estimated
40
60
80
100
120
140
160
180
200
9
8
7
6
5
4
3

[redacted]


TID-7028 U(37.67) Critical Exp.
ρ = 17.81 ρ(235) = 6.71
Bare Sphere 10.40 in.
Polythene Reflected 7.223 in.
λ = 2.27 cm
RS = 4.04 cm
Estimated Critical Height as a Function of Base Area for ρ = 17.81
B^2_m = .03089 cm^{-2}
Legend:
Base Dimensions, in.
Bare Est from B^2 = .034 (λ = 2.3)
N.B. No correction Applied for Actual Enrichment.
+ Square Base
Rectangular Base
6.5 x 6.5
9.5 x 7.5
6.5 x 9.75
#12,13
6.5 x 13.0
#15,16
9.75 x 9.75
9.75 x 13.0
7.5 x 18.75 (2 x 5)
7.5 x 22.5
#22
13.0 x 13.0 (3.2
11.25 x 11.25
#24
#214
#26
9.75 x 16.25
Bare from B^2 = .034 (λ = 2.3)
Base Area, in.^{2}
60
80
100
120
140
160
180
200
230
240
in.^{2}
5
6

3

3.75 x 3.75 x 3.75 in. Blocks with 2 holes for Tinkertoy Assemblies

Part No	Weight	Part No	Weight	Part No.	Weight
0071	16291	0131	16205	0166	16256
2	279			7	229
		3	236		
		4	217	9	207
5	276	5	196	70	244
6	188	6	251	1	174
7	268	7	242	2	195
8	192			3	264
9	265	9	242		
0080	271	0140	207		
				Total	1039213.
1	275	1	216		
2	230	2	214		331045.
3	289	3	243		
4	283				1370258.
5	240	5	286	A	3568
				B	5087
6	270	6	240	Total	1378913
7	215	7	256		
8	246	8	206		
9	199	9	253		
0090	230	0150	254		
0100	233				
1	242	2	238		
2	270	3	260		
3	251	4	280		
4	190	5	229		
		6	243		
6	217	7	239		
7	212	8	228		
		9	238		
9	253	60	236		
0110	225				
		2	232		
		3	264		

Polyethylene Reflected Solid Assembly, Base 6.5x6.5
Operating Clode
4772

November 5, 1971

Approval of S-9 - by telephone GAS. @ 8⁴⁰AM 11-5-71

Decision by L. Phillips that Critical Experiment Data is Confidential but Experiment Plan that Mr Burkhart showed him was not classified! Both Vanstrum and he agreed that the Critical Experiment Data should not necessarily be classified and they thought they should get a special ruling from Washington on this matter. DW Magnuson

Instrument Check on 11-5-71 **Source** 10 mc ^{60}Co

						Location
X2.5	PM-1 950 V Bal 4.80	Low Trip OK	Scram	Alarm Trip OK		Beneath Table
	PM-2			Alarm Trip		
	IC-1 1.8×10^{-10}	Meter Trip OK		Fast Trip OK		Beneath Table
	IC-2 3×10^{-13}	Meter Trip OK				- On Table
	IC-3 2×10^{-9}	Calibration OK		A OK		" "
	IC-4 1×10^{-10}	Calibration OK Unstable		B OK		On Platform
	CRM	Meter Trip		C OK		

EXP #1

Placed 0112 on N table & 0113 on S table $\boxed{21266.9}$ — Δρ OK

Source Inserted, Response noted on IC-2 & IC-3, — Peroxide OK

1³⁰PM Start assembly — with 2 ea 3.25 x 3.25 x 3.25 — Plates OK

making 3.25 x 6.50 x 3.25 which is entirely

1⁴⁰PM IC-1 Bkg .01 x 10 x 10^{-11}

IC-2 0.12 x 3 x 10^{-11}

IC-3 6.7 x 10^{-12}

IC-4 1 x 10^{-12} Bkg

1⁴⁰PM Table Closed = 0.010

New Table	Position	Indicator
Dig. VM	.045	1.971
Bijou	.038	1.967
Contact	.033	
22 Rev	1.953	1.945
20	1.695	
18	1.454	
16	1.230	1.229
14	1.025	
12	.832	
10	.655	0.656
8	.495	
6	.349	
4	.216	
2	.096	
0	.010	
0.3	.011	
	Starts to move	

Exp #2

Placed 0112 + 0114 on N Table
0113 + 0115 on S Table } 42547.9

1⁵¹PM Start Assembly Source Inserted, Response OK

2⁰¹PM making 3.25 x 6.5 x 6.5

IC-1 1

2 0.155 x 3 x 10^{-11}

3 3.6 x 10^{-12}

4 1.2 x 10^{-12}

Table Closed = 0.010

Exp #3

Placed 0112 + 0114 + 0116 + 0116 on N
0113 0115 0117 0118 on S } 84999.

2¹¹PM Start Assembly Source Inserted Resp OK making a 6.5 in cube.

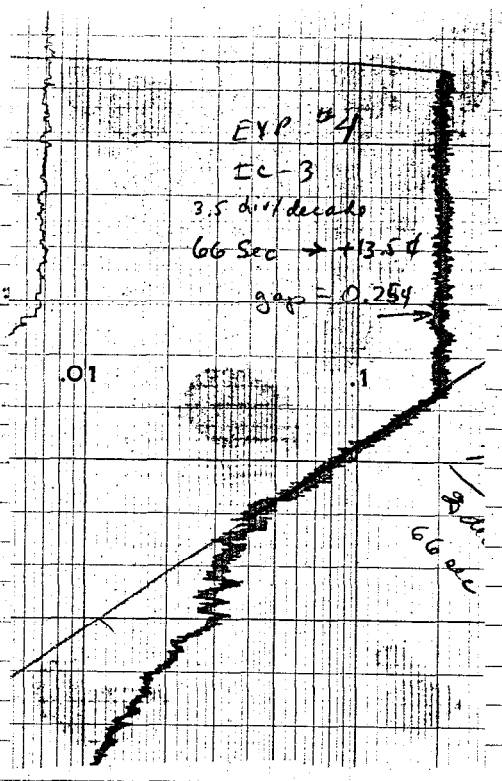
Table Closed = 0.010

IC-1 Bkg .01 x 10 x 10^{-11}

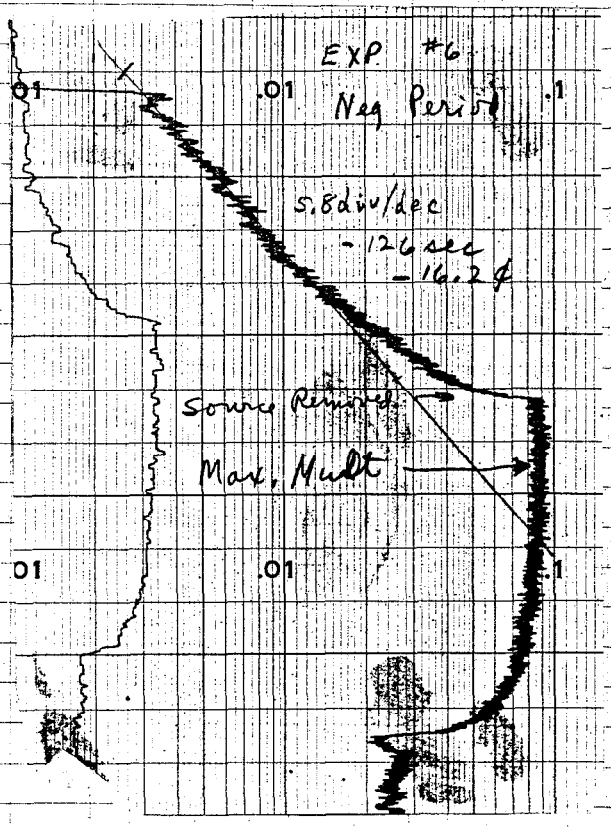
2 .27 x 3 x 10^{-11}

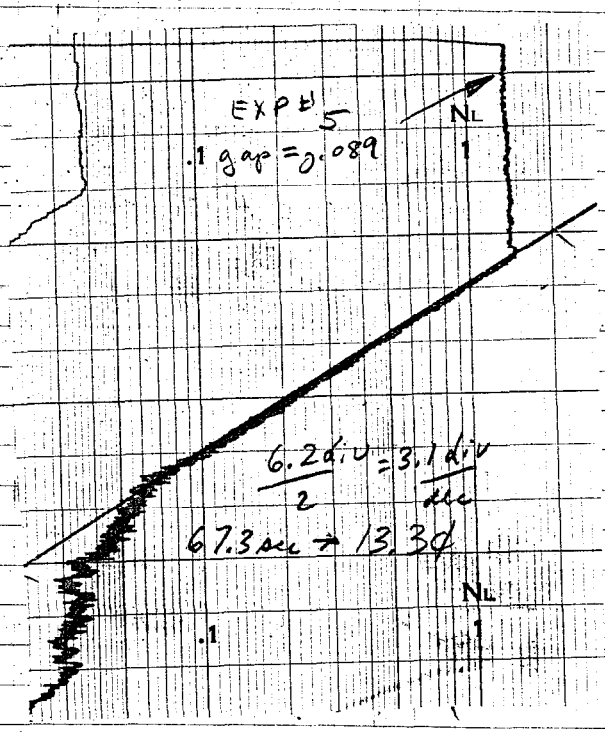
3 9.0 x 10^{-12}

EXP 1 EXP 2



first fire 13.2 ϕ





EXP #4

North	South	
0112	0113	Cuboid of 6.5 x 6.5 x 8.5 when assembled
114	115	
116	117	
118	119	
92	91	
94	92	

111 183 g.

2^{45} PM Start Assembly, Source Inserted Resp OK,

2^{53} On Pos Period @ 251 − .01 = .241 in sepn 66 sec → 13.5¢

Source Removed

Approx Level @ .264 − .01 .254 in. sepn

IC-3 2×10^{-10}

Cuboid 6.5 x 6.5 x 8.5 is supercritical $\frac{13.5¢}{.013 \text{ in}} = \$10/\text{in.}$

EXP #5

Cuboid of 6.5 x 6.5 x 8.0

N	S	
0112	0113	3 1/4
0114	5	
0116	7	3 1/4
0118	9	
20	21	1
22	19	
34	33	1/2
36	35	

102 646.g

Note: 0015, 16, 17, 18 } BASES ARE RHOMBIC & NOT SQUARE

3^{22} PM Start Assembly Source Inserted Inst Resp. OK

3^{34} PM On Pos Period Source Out Table = 0.082 − .01 = .072 in.

40 PM Level 0.099 − .01 .089 in,

6.5 x 6.5 x 8.0 Cuboid is supercritical 13.3¢/ 0.017 in = $8/in

EXP #6

Cuboid of 6.5 x 6.5 x 7.75

N	S		
0112	0113	3 1/4	
4	5		
6	7	3 1/4	84 997
8	9		
20	19	1	13 090
22	21		
42	43	1/4	3 177
44	45		

101 264

3^{47} PM Start assembly Source Inserted Inst Resp. OK,

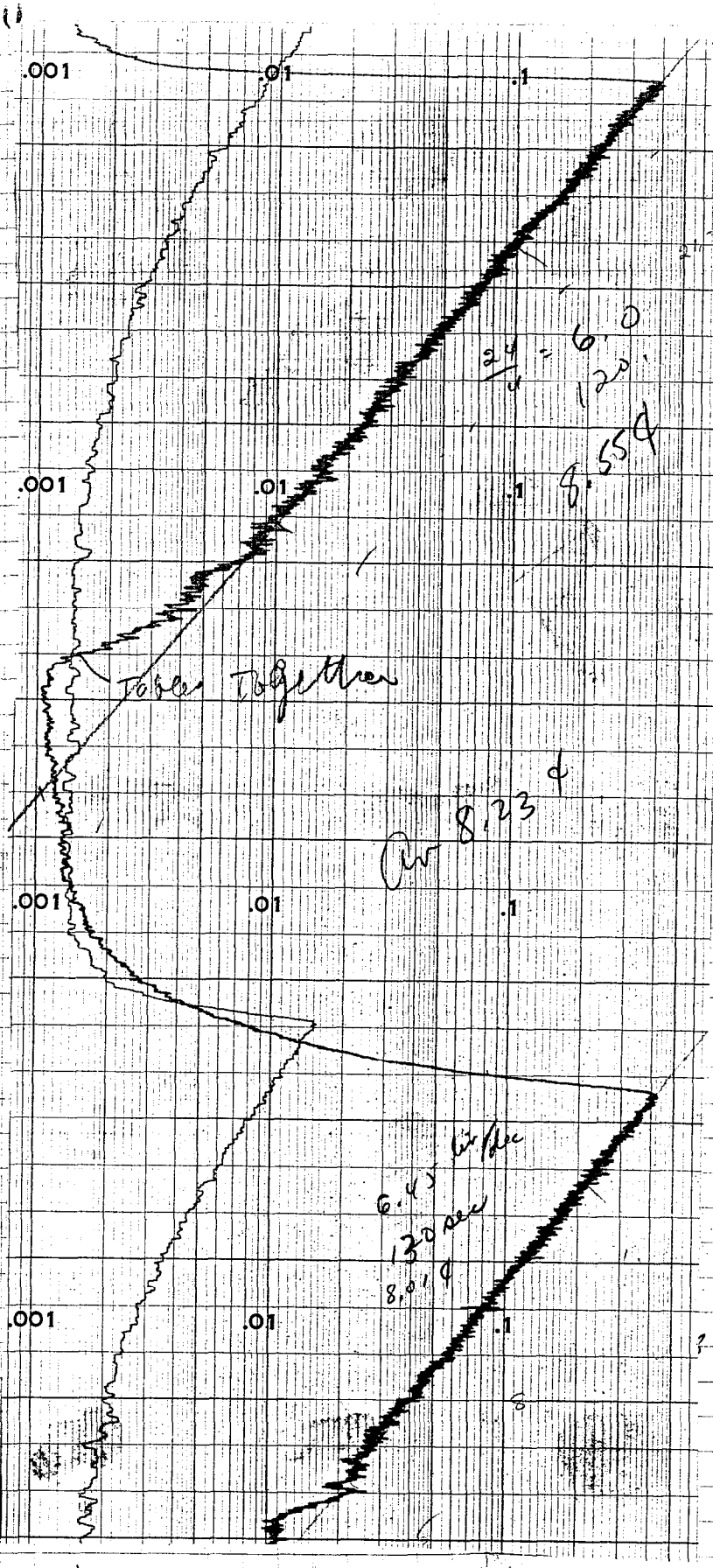
4^{04} PM Sub Critical, Source Multiplication Levels.

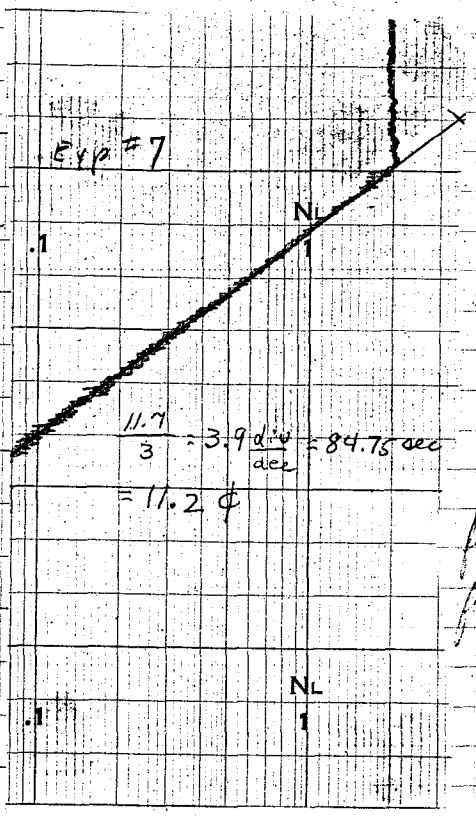
IC-2 $0.32 \times 3 \times 10^{-10}$

IC-3 $9. \times 10^{-11}$

IC-4 3.4×10^{-12}

Leo Magnuson





fast
fris
11.0¢

av 8.05¢

? ¢

Instrument Check on Nov 8, 71 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Alarm Trip	Scram Tables
PM-2				Alarm Trip	
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	OK	Red Mon.	
IC-3	2×10^{-9}	Calibration	OK	A	OK
IC-4	2×10^{-9}	Calibration	OK Unstable	B	OK
CRM		Meter Trip		C	OK

Reading Operating Clock 4775 hrs

EXP #7

Cuboid of 6.5 x 6.5 x 7.875 added 1668 g to Exp #6 = 102,932 g.

N	S	
51-52	(53-54)	Red Lite ✓
833	835	Personnel Ck ✓

8 38 AM Start Assembly Source Inserted, Inst Resp OK — Air Press Ap ✓

8 48 On pos. period – Source Removed. Table = 0.010 – .010 = 0.0 — Bypass Panel ✓

8 53 Start to Level

Note: When leveling, changes in table position of less than 0.001 can be seen on the change in neutron level.

9 02 Level Table Pos. .035 – .010 = .025 $\frac{11.2}{.025} = \frac{\$4.48}{in}$

EXP #8

Repeat #7 added 3¼ x ¾ x 6.5 $(CH_2)_n$ block under source region so that source neutrons must penetrate 6.5 in of reflector to get to assembly!

N.B. 5¾ $(CH_2)_n$ reflector on bottom and sides (E & W)

6½ in " on top and ends (N & S)

9 23 Start Assembly, Source Inserted, Resp. OK

9 34 On pos. period, " Removed Period is longer than #7 Table = .011

9 41 Start tables apart for neutrons to decay and reassembly without source. There may be adequate spontaneous fission neutrons in the ^{238}U in the assembly.

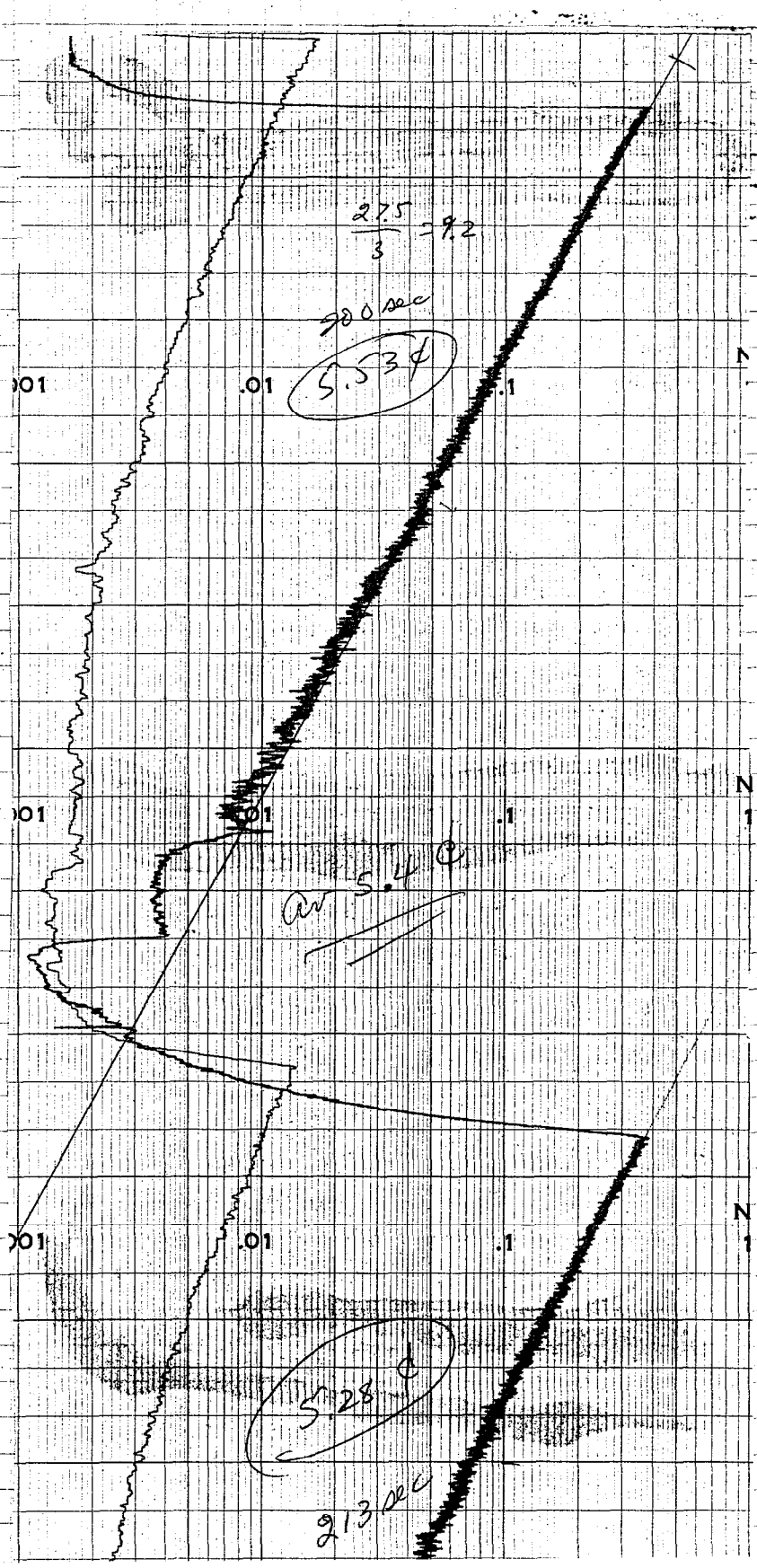
9 45½ Start reassembly ~ 9 48 Tables together, only slight increase on IC-3 even smaller indication on IC-2 Table = .011

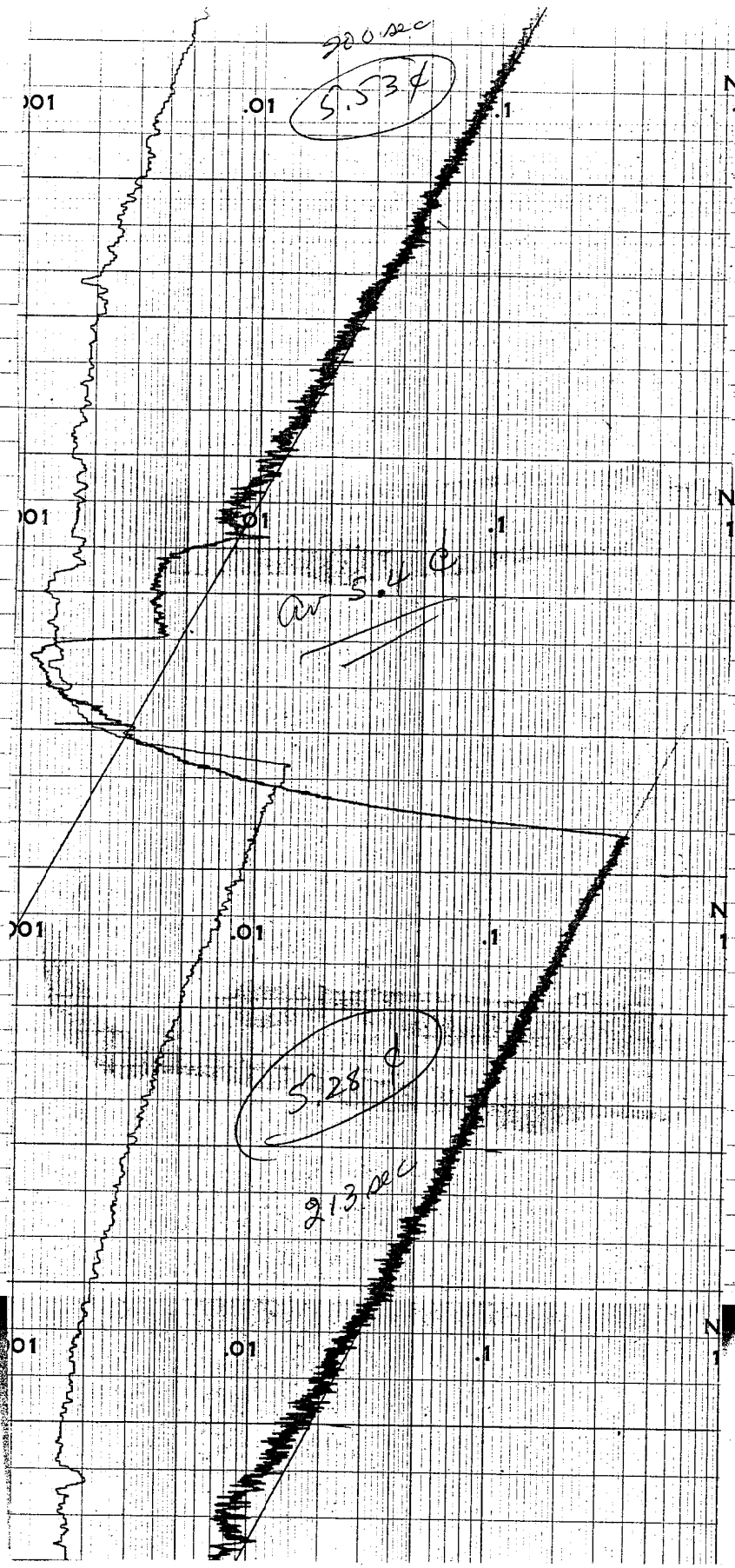
Separate tables – Remove top and East Reflector for alignment check

" Sides also

EW on N Table	6.515	3 elevations	SW Ht	7.881
EW on S Table	6.512	3 elevations	SE Ht	7.878
NS on W side	6.512	3 "	NE Ht	7.876
NS on E side	6.512	3 "	NW Ht	7.878
	6.513 x 6.513 x 7.878			7.878

Added Reflector S & N and East, separate tables to ADD


27.5/3 = 9.2
200 sec
5.53¢
.01
.1
fast fiss
5.4¢
av 5.4¢
fast fiss
5.2¢
5.28¢
913 sec



fast fiss
5.4¢

fast fiss
5.2¢

EXP # 9

Repeat of #7 with best alignment possible.

Reflected Cuboid 6.513 x 6.513 x 7.878.

11 05 Start Assembly, Source Inserted Inst Response OK

11 14 On Pos Period A " Removed Table @ .011 Rev = 0.0.

11 27 Separate tables to 1.125 indicator sepn = 1.114 in.

Add 1" Plexiglas to E & West sides of Ass.

11 30 Start Reass, Ins. Source Inst Resp OK

11 33 On Pos Period B Source Removed Table @ .011 $\Delta\rho = 0.25¢$

11 45 Shutdown by Pushing Manual Scram Button. Not significant

IC-3 @ 3. $\times 10^{-10}$

Temp = 21.5 °C

B = 200 sec 5.53
A = 213 sec 5.28 } 5.4¢

1.046 x 5.32 x .00011 x 1/100

$\Delta\rho$ = .00.0357

6.5 x 9.75 Base Area Critical EXPERIMENT

EXP #10

Placed Cuboid of 6.5 x 9.75 x 5.25 in on tables when Assembled without Top Reflector and Part of E. side Reflector Should be sub critical for Alignment check of N & S Tables.

N	S	
112	113	63771
114	115	
116	117	
92	91	39275
94	93	
96	95	

103046 g Total

Inst reset ✓
Δp ✓
Red Lite ✓
Person ✓
Bypass ✓

1^{15} Start Assembly, Source Inserted Inst Resp.
1^{25} Table = 0.011 Rev 0.0 — Sub crit.
Remove Source to check Align Ment

EXP #11

Fully Reflected 6.5 x 9.75 x 5.25 cuboid, same as #10

1^{30} Start Assembly Source Inserted Resp OK
1^{47} Table Closed — Sub critical Pos ind 1.950 47 → 0.011
IC-2 = .12 x 3 x 10^{-12} IC-3 = 5 x 10^{-12}

EXP #12

Fully Reflected 6.5 x 9.75 x 5.50 Cuboid added

N	S	
42	43	4759
44	45	
46	47	

103046
107805 g Total

1^{58} Start Assembly, Source Inserted Response OK Δp OK
2^{10} Tables closed 0.011, Source out 1.958
Slightly sub critical
2^{11} Insert source to raise power
2^{22} Source out Neg period A 37.6 div/dec
2^{35} Source In to Raise Power Start source out 2^{42} hold power const
2^{54} Source out Neg period B 31.4 div/dec
Av 34.5 div/dec = −750 sec
= −1.83 ¢

3^{07} Separate Tables 1.

	N–S		EW		HT		
Measurements	E	6.511	N	9.778	S E	5.500	
		6.512		9.760	Cnt	5.500	
	W	6.503	S	9.772	W	5.504	
		6.507		9.762	N W	5.501	5.500
		6.508		9.768	Cnt	5.500	

68
31
12

N	S	
112	113	
114	115	63.771
116	117	
92	91	
94	93	39.275
96	95	

103.046 g Total

without top reflector and [illegible]
Should be sub critical for Alignment
check of N & S Tables.

Inst reset ✓
Δp ✓
Red Lite ✓
Person ✓
Bypass ✓

1^{15} Start Assembly, Source Inserted Inst Resp.
1^{25} Table = 0.011 Rev 0.0 — Sub crit.
Remove Source to check Align Ment

EXP #11

Fully Reflected 6.5 × 9.75 × 5.25 cuboid, same as #10

1^{30} Start Assembly Source Inserted Resp OK
1^{47} Table Closed — Sub critical Pos ind 1.950 47 → 0.011
IC-2 = .12 × 3 × 10^{-12} IC-3 = 5 × 10^{-12}

EXP #12

Fully Reflected 6.5 × 9.75 × 5.50 Cuboid
added

N	S	
42	43	
44	45	4.759
46	47	

103.046
107.805 g Total

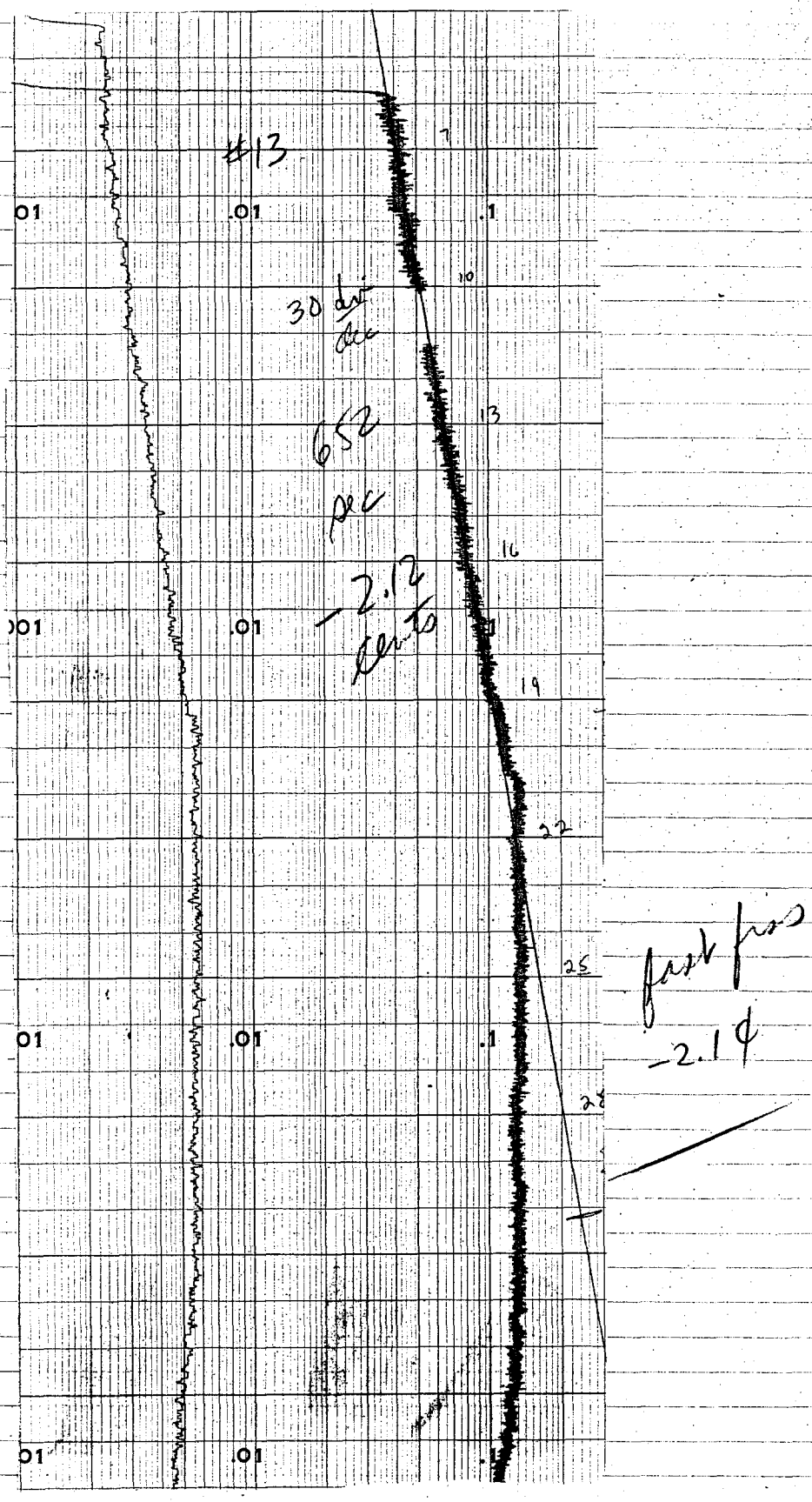
1^{58} Start Assembly, Source Inserted Response OK Δp OK
2^{10} Tables closed 0.011, Source out 1.958
Slightly sub critical
2^{11} Insert source to raise power
$N2^{22}$ Source out Neg period A 37.6 div/dec
2^{35} Source In to Raise Power Start source out 2^{42} hold power const
2^{54} Source out Neg period B 31.4 div/dec
Av 34.5 div/dec = −750 sec
= −1.83¢

3^{07} Separate Tables 1.

	N–S		EW		HT	
Measurements	E	6.511	N	9.778	S-E	5.500
		6.512		9.760	Cnt	5.500
	W	6.503	S	9.772	W	5.504
		6.507		9.762	N W	5.501 5.500
		6.508		9.768	Cnt	5.500
					E	5.497

68
31
12

Bottom of page 15


#13
.01
.01
.1
7
10
30 dv/dec
13
652 sec
16
-2.12 cents
19
22
25
28
fast fiss
-2.1¢

Selected Heaviest pieces available

S		N		EW	N-S	Int
112, 115, 128	31929	114, 125, 127	31932	N 9.758	E 6.503	NE 5.510
				63	6.509	NCent 05
94, 96, 97	19636	93, 95, 98	19636	67	W 6.505	NW 05
				S 08	6.505	SW 05
				9.764	× 6.505	Cent 04
						E 00
						× 5.505
43, 45, 49	2380	42, 44, 46	2381			
	53945		53943			

107.888 kg, an increase of 83 g over EXP#12

Placed 1/4" Plexiglass on top of 5 3/4 in reflector block to make a perfect flat surface for stacking metal pieces.

Instrument Check on Nov 9 **Source** 10mc ^{60}Co

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	10×10^{-11}	Meter Trip	OK	Fast Trip	Screwed Tube
IC-2	3×10^{-11}	Meter Trip	OK		Red Mon
IC-3	2×10^{-9}	Calibration	Dwm		A OK
IC-4	2×10^{-9}	Calibration	Unstable on 10^{-8}		B OK
CRM		Meter Trip			C

Red Lite & Pers Ck OK
Cell Dp OK

EXP #13

9:50 Source Inserted, Sub Response OK — 1.944 −.011
Start assembly

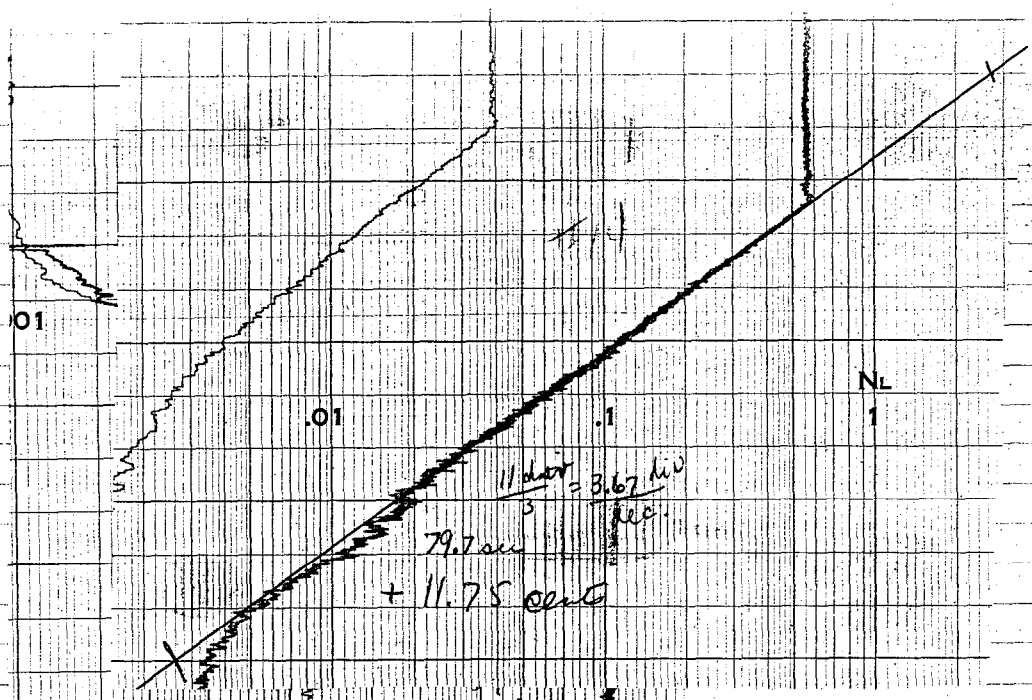
9:00 Near critical Tables closed, Source removed partially power @ 3×10^{-11}
Insert source to increase power

9:10 Power at .44 × 3×10^{-10} IC 2 } Hold constant for ~10' by slowly removing Source
1.3 × 10^{-10} IC 3 }

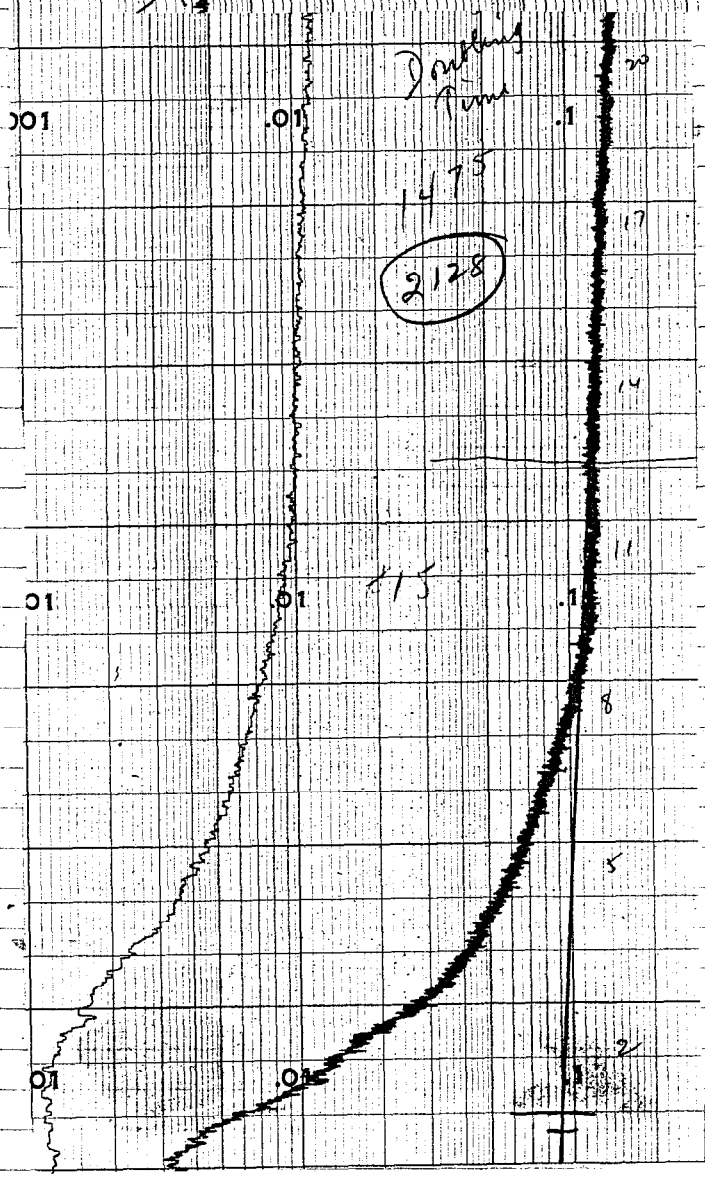
9:20 Remove source Completely
Negative Period 30 div/decade = −652 sec → −2.12 ¢

9:32 Shut down —

1.041 × .0212 × .00641 = .00014



fast fiss
11.5 ¢



fast fiss.
0.6 ¢

Reflected 6.5 x 13.0 x 4.75 Cuboid

S	N	
112	114	
115	125	85 075
128	127	
116	113	
18	15	
20	17	26 182
22	19	
23	21	
34	33	
36	35	12 724
38	37	
40	39	
		123981 g

Unreflected assembly checked for alignment, Tables closed 0.011

Tables separated and halves reflected.

Note: 15, 17, 18 are rhomboids

EXP #14

10^{30} AM Start Assembly, Source Inserted Inst Resp. OK Δp OK

45 Source Out, on + Period 0.0595 +11.75 ¢

49 Start to Level

55 Slightly Pos 0.075

57 Level 0.076 .0165 = $7.02/in.

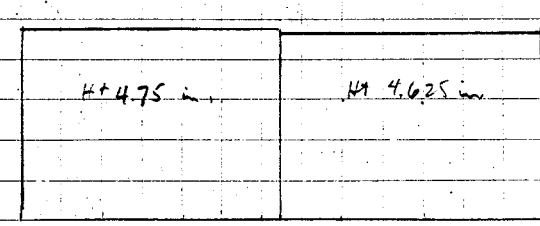
Shut down

EXP #15

6.5 x 6.5 x 4.75 + 6.5 x 6.5 x 4.625

6.5 x 13.0 x 4.6875 ave ht,

S	N	
112	114	
125	125	
128	127	2 2 3
116	113	85 075
20	19	
22	21	13 099
24	25	9 714
26	27	
34	33	
36	35	
38	37	
40	39	12 724
51	x	
52	x	1668
		122280 g



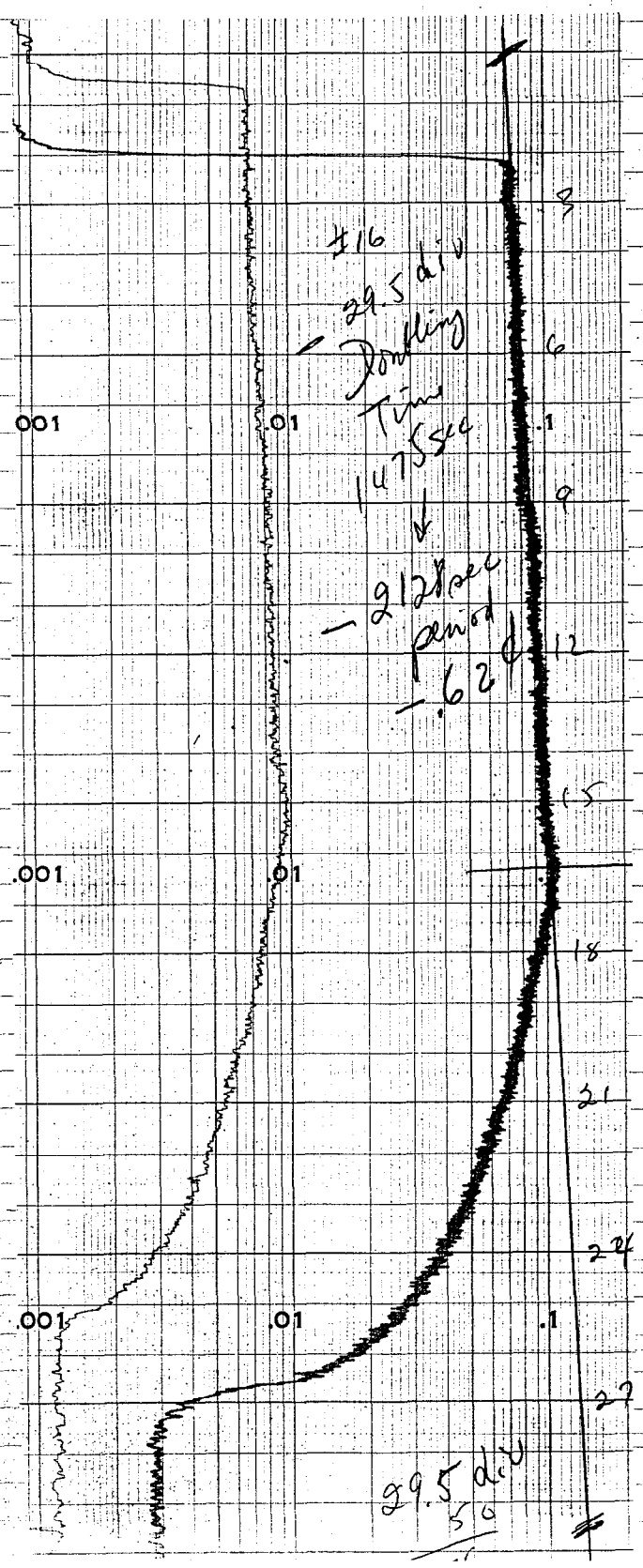
11^{11} Start Assembly, Source Inserted Inst Resp. OK Δp OK

11^{20} ~~Subcritical~~ — Insert Source to Raise Power Table Closed = .011

11^{25} IC-3 = 1.0×10^{-10} Start holding power constant

11^{28} Source Out Power ~ constant, very near critical!

+ Period 2128. secs → + 0.6 ¢



#16
29.5 div
Doubling Time
1475 sec
2128 sec period
.62 ¢
.001
.01
.1
3
6
9
12
15
18
21
24
27
29.5 div
50

fast fiss
0.6 ¢

EXP #16 (Repeat of #15) 122.280 kg

Removed Reflector for Measurements -

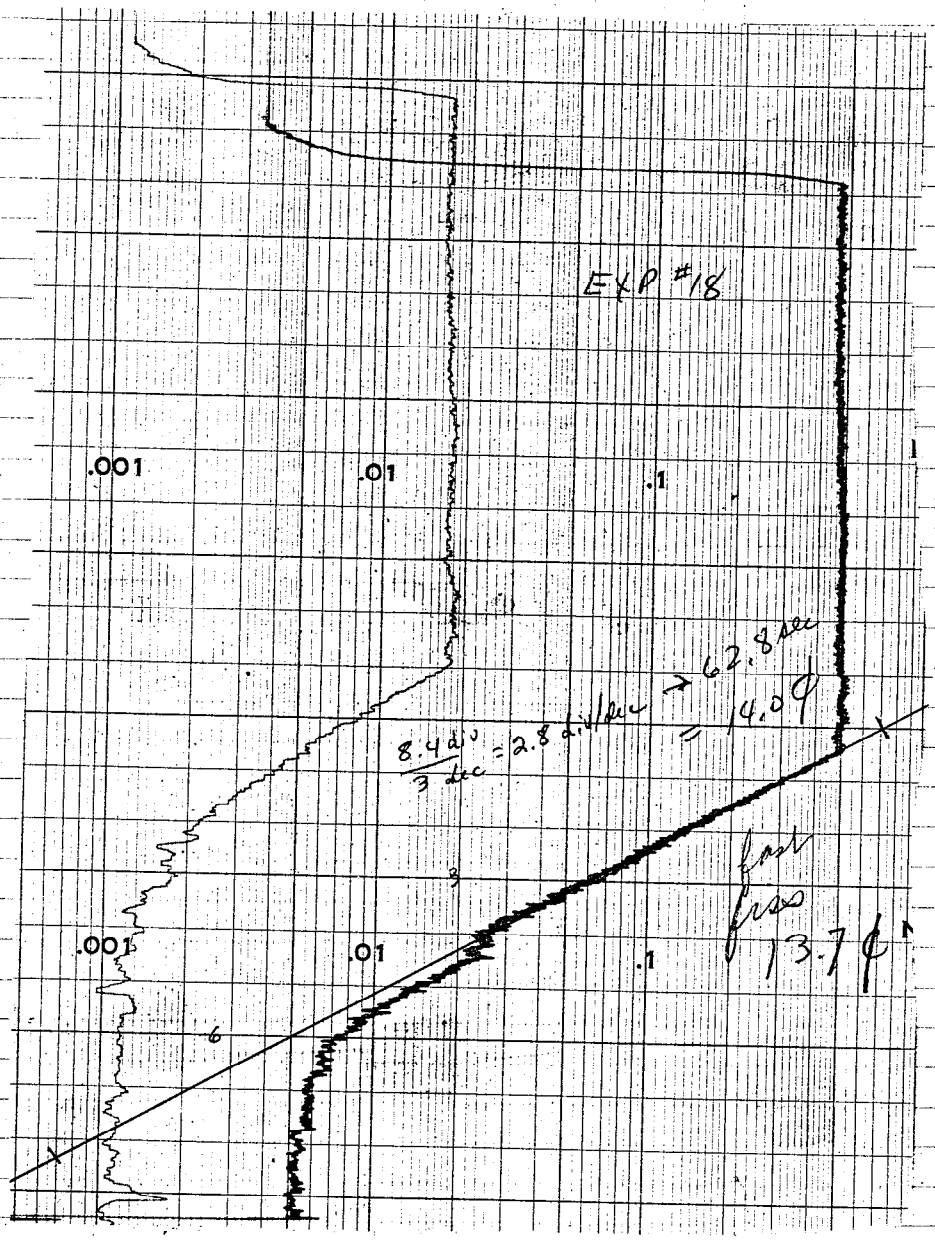
E W		N S		Height	N	S	
N bott	13.028	W side bott	6.503				
N Top	31	E side bott	6.509	E 1	4.640	4.630	> 4.637
S Top	20	W 1 Top	6.506	To 2	4.640	4.638	
S bott	22	T 2 "	6.510	W 3	4.759	4.762	> 4.761
		O 3 "	6.508	4	4.757	4.765	
		E 4 "	6.511				4.699
	13,025		6.508	Av	4.699	4.699	
					4.699		

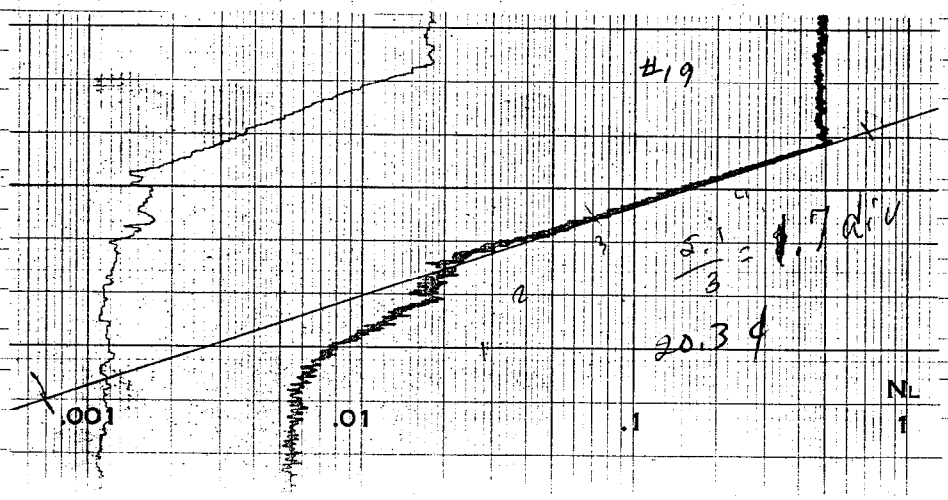
Rotated by 90 one 4.625 stack to get better fit.
Tapped with hammer to close all gaps possible.

1 23 Start Assembly, Source Inserted Resp OK — Red Lite Pers Ck ✓
1 31 Tables assembled — Source Into raise to power — Bypass Ck ✓
(no apparent change in react.) 1.950 → .011 — Sp OK ✓
1 40 Remove Source for Period Meas.

Negative Period 29.5 div. doubling time
1/.693 × 1475 → .2128 sec → -0.6 ¢

Reactivity change — 1.2 ¢





36.94 sec
fast fiss
19.5 ¢

EXP #17

Reflected 9.75 x 9.75 Base Area Est Ht = 4.0 in.

	N	S	
		5	
		113	
	125	114	
3.25	127	115	
	113	116	
		117	
		112	95692
	25	24	
	27	26	
.75		28	
	31	29	22071
		30	
Nom 4.00 in.		32	117763

2^{12} Start assembly, Source Inserted, Inst Resp OK Inst Bypass OK Δρ OK
Subcritical IC - 2 $.44 \times 3 \times 10^{-11}$ Table to 0.011
3 1.4×10^{-11}

EXP #18

9.75 x 9.75 Base Area Nom Ht = 4.125 (added 1/8" to EXP #17)

2^{36} Start Assembly Source Inserted Inst Resp OK. 117763
2^{47} On Positive Period Source Out 0.104 (1.953 — .) 3755
49 Start to Level 121518 g
58 Shut Down level @ 0.130 - 0.011 = 0.119 inch gap
2.8 div/sec = +62.8 sec → 14.0 ¢

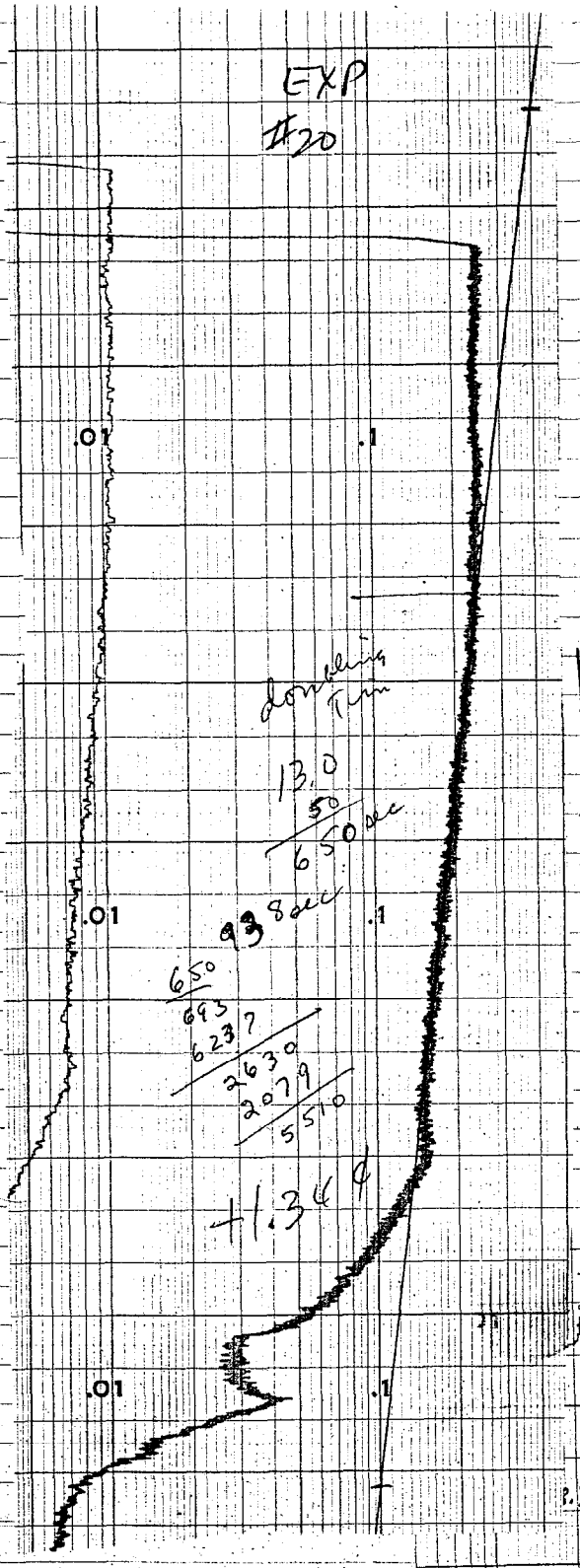
$\frac{14.0}{.026}$ = \$5.4 /inch

EXP #19

3.25 x 9.75 N table 4.0 in high } (Removed 1/8 from N from #EXP 18)
6.5 x 9.75 S table 4.125 in. high }

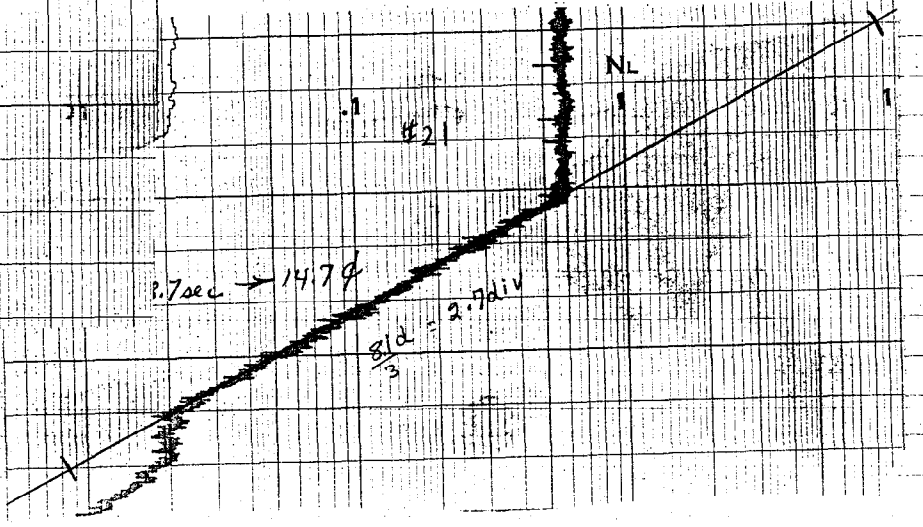
3^{08} Start assembly, Insert Source, Inst Resp OK Δρ OK,
3^{16} Source Out On + period Table .040 → 36.94 sec per → 20.3 ¢
3^{25} level 0.077 - .011 = .066
Δρ = .130 - .077 = 0.053

$\frac{20.3\ ¢}{.037}$ = \$5.5 /inch.



fast fiss (938)
1.3¢

fast fiss 14.3 ¢



EXP #20 120 268

Removed 3 ea 1/8 x 3 1/4 x 3 1/4 on 1253 g Now 3 pc 1/8 x 3 1/4 x 3 1/4 forming a middle row on top.

119,015 g

N	A	A	A	4 in high
S	B	B	B	← 4 1/8
	A	A	A	← 4.0 high

3 34 Start Assembly Source Disarted, Inst Resp OK Δρ OK
3 43 Table Closed Source In, Raise to power - very near critical
3 47 Remove Source Table pos = 0.011
Doubling T = 650 sec +1.34 ¢
3 55 Start to Level per = 938 sec 1.340 / .009 = # 1.50 / inch
4 00 Level @ 0.020 - 0.011 = .009
Shut down. T = 21.0 °C
Lights left on in 113 overnight

Instrument Check on 11-10-71 Source 10 mc ^{60}Co

950 V	PM-1 Bal 5.00	Low Trip OK		Alarm Trip OK	
	~~PM-2~~			~~Alarm Trip~~	
	IC-1 10×10^{-10}	Meter Trip Scram Table		Fast Trip OK	
	IC-2 3×10^{-10}	Meter Out OK		Red. Mon.	
	IC-3 1×10^{-9}	Calibrate Down		A	OK
Unstable on Calibrate →	IC-4 1.5×10^{-9}	Calibrate Down		B	OK
	~~CPM~~	~~Meter Trip~~		C	OK

EXP #21

Add 3 ea 1/8 x 3 1/4 x 3 1/4 on 1253 g to EXP #20

Mass now 120 268 same as #19 but arranged diff.

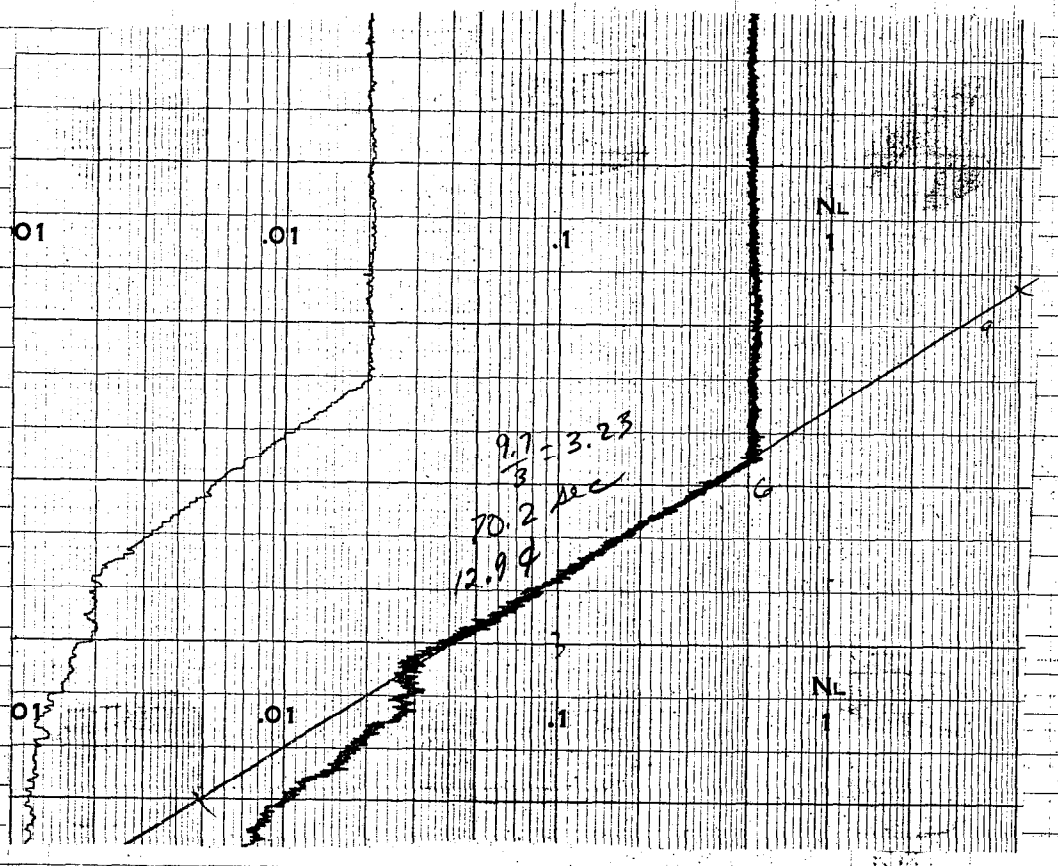
N				← 4 1/8 high
S				4 "
				4 1/8 "

By pass Panel OK

8 32 Start Assembly Source In Inst Resp OK Δρ OK Red Lite Pers. Ch OK
8 43 Source Out On Positive Period 0.032 - .011 = .021
8 45 Start to level
8 5 Level 0.056 - .011 = .045

$\frac{14.7}{.024}$ = #6.1 / inch

1253
3759



12.6 ¢
fast fission

EXP #22 Repeat #18

4 1/8 x 9.75 x 9.75 Cuboid 171518 g 8^45

9^01 Start Assembly, Source Ins. Inst Resp OK Δp OK

15 On Positive period, Source out, Table 0.115 - 011 = 0.104

18 Start to Level

28 Level Table 0.138 - 011 = 0.127

EW				
9.762	4.138	4.141	4.137	
9.768	4.139		4.130	
9.768	4.134	4.132	4.133	x 4.136
9.766				
NS	9.758	9.768	9.763	
		9.763		

Pos Period 70.2 sec → 12.9 ¢

1.0525 x .126 x .00641 = .00085

$\frac{12.9}{.023}$ = $5.6 / inch

# 18	.119		
# 19	.066	> .057 .059	1/8" 3 removed edge row
# 20	.009	> .067	1/8" 6 removed edge row
.123			
# 21	.045	> .078	3 removed center
# 22	.127		

$.123 = x \times (.118 + .078) = .196x$

$x = \frac{.123}{.196} = .62755 \times .125 = .078$

$.37245 \times 3755 = 1398.5$

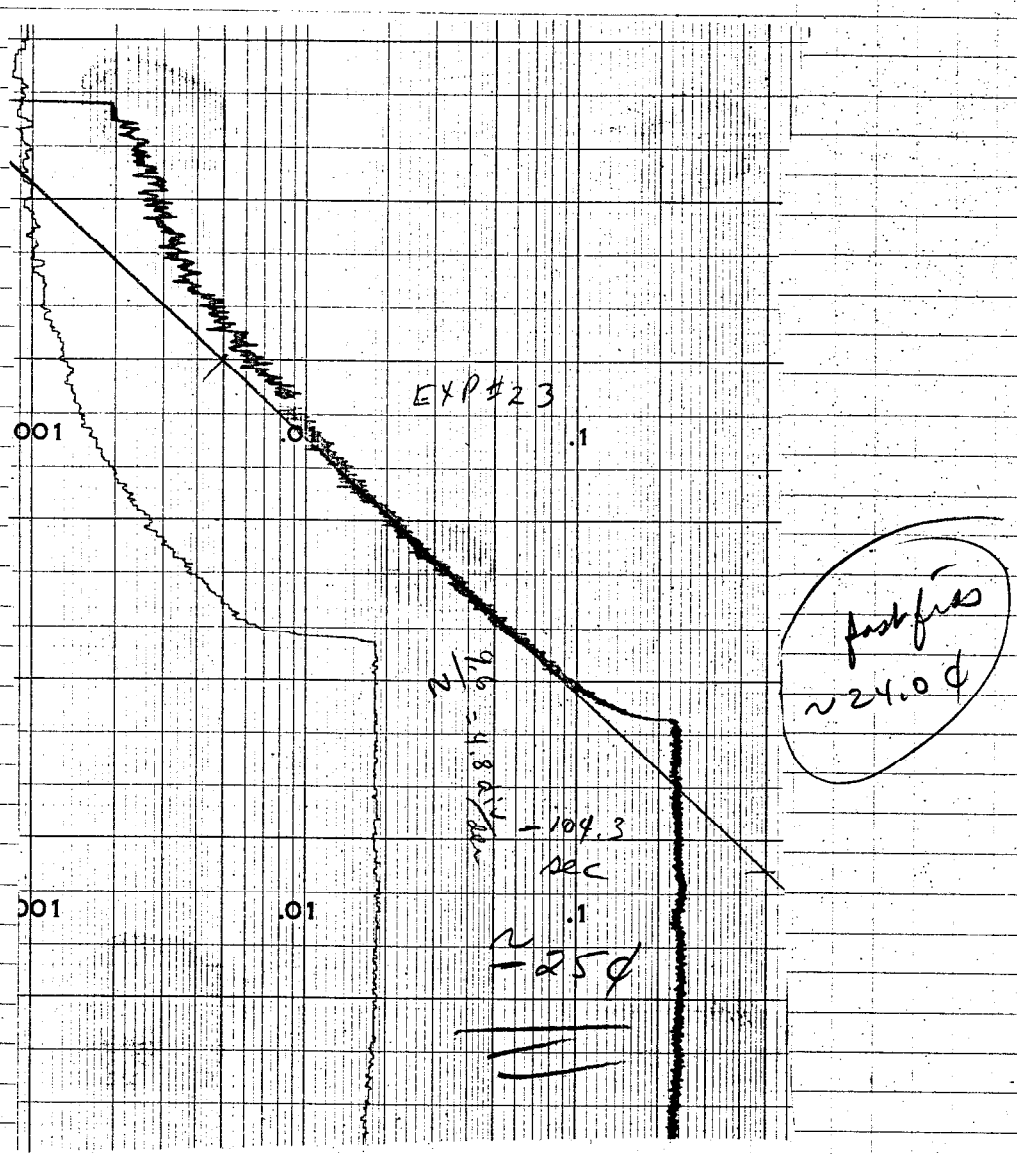
117763

119162

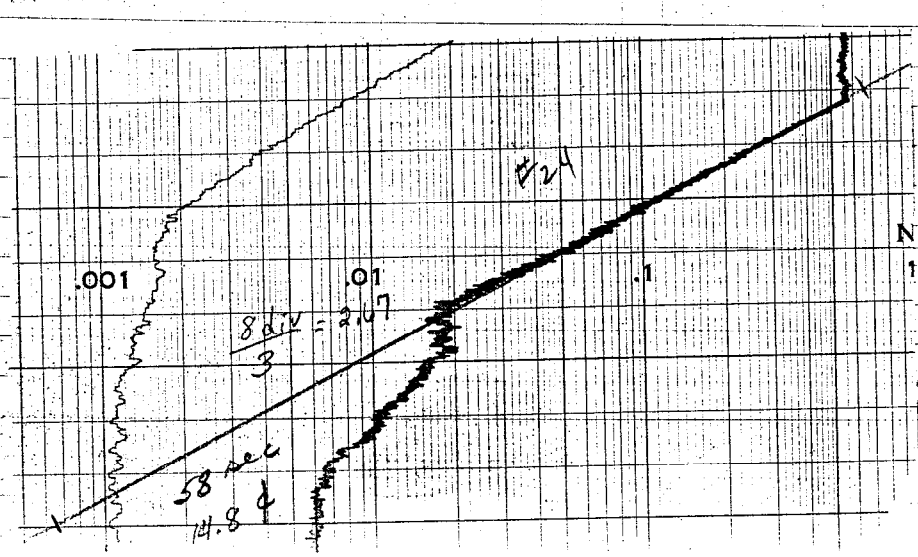
Measured height = 4.136

.078

4.058



fast fiss
~24.0 ¢



fast fission
14.45 ¢

9.75 x 13.0 Base Area
x 3.5 height 6.5x9.75 on N
6.5x9.75 on S

112 – 120	95595
125, 127, 128	31921
42 – 50	71.29
51 – 52 (53 – 54 55 56)	833
	1670
	137148

EXP #23

10:22 Start Assembly Source Inserted, Inst Reg OK, ΔP OK, Bypass Pump OK
10:33 Tables Closed — 0.011 - 011 = 0.0
10:36 Remove Source for Neg Period — Power really not high enough Subcritical
10:40 Insert source and add 2nd source to assembly to Raise power.
52 Remove Sources for Period Meas.
~ -104 sec ≈ -25¢
11:05 Shut down.

EXP #24

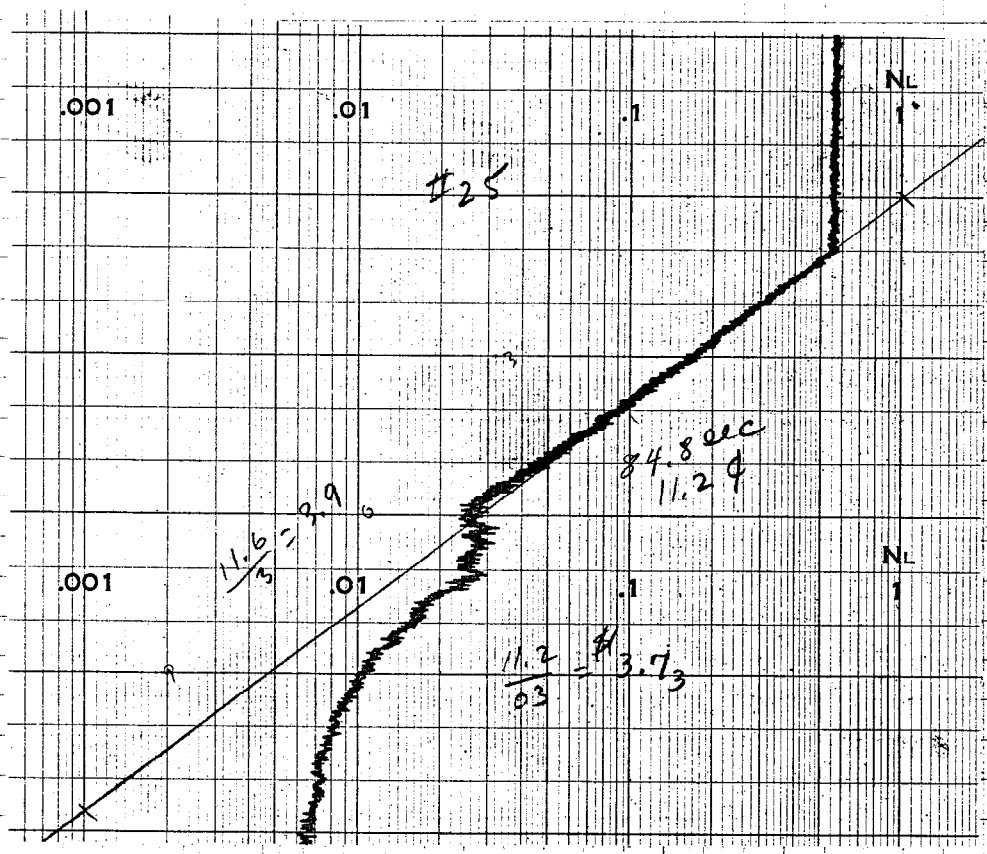
Add 6ea 1/8 x 3 1/4 x 3 1/4 to North Half height = 3 5/8
+2503 + 137148 = 139,651

11:10 Start Assembly Source Inserted Regime OK ΔP OK
11:24 Source Out on Positive Period .090 – .011 = .079 inches
27 Start to Level
34 Level .123 – .011 = .112 inches
" Shut down.

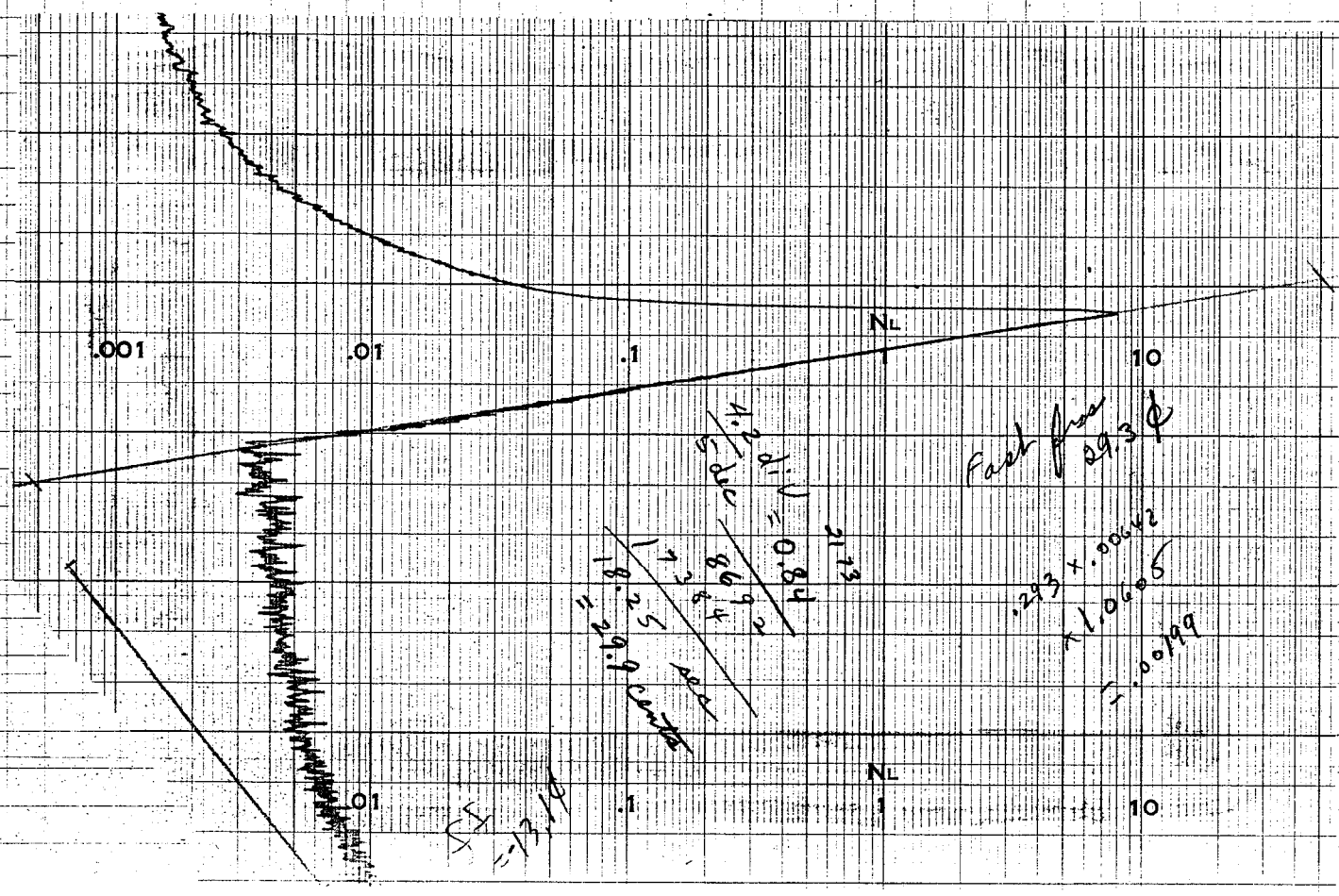
$\frac{2.67 \text{ div}}{\text{dec}} \rightarrow 58.0 \text{ sec} \rightarrow \frac{14.8¢}{.033} = \frac{\$4.5}{\text{inch}}$

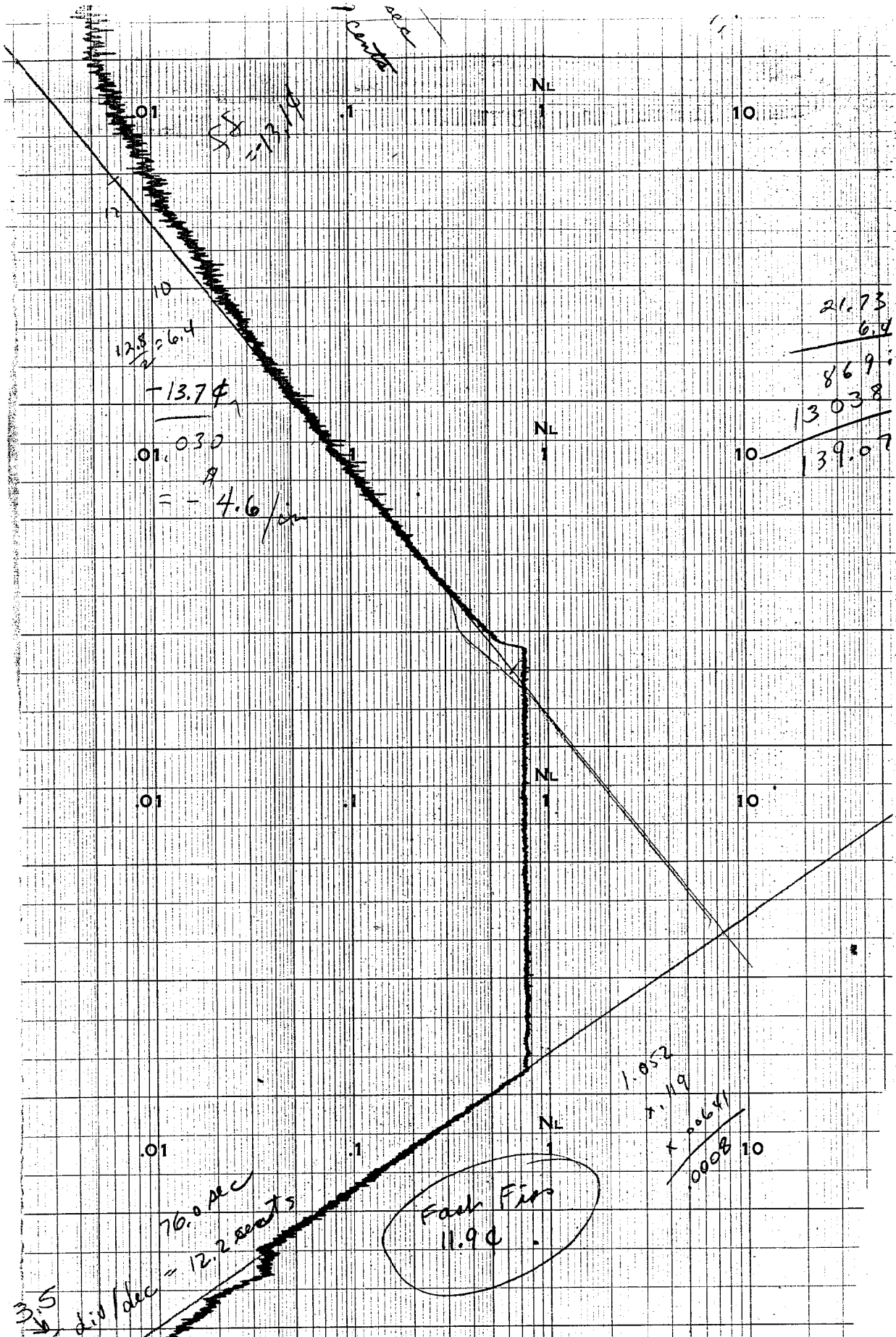
N

	3.6	33	33	33	9.766
		39		26	9.761
13,022					
13.022	3.4	94		08	9.761
13.010	3.5	10	15	12	9.765
13,018		3.633			9.763
		3.510			
		2.572			



fast free
11.0¢




NL
.01
.1
1
10
12
10
12.8/2 = 6.4
-13.7¢
.030
= -4.6/in
21.73
6.4
869
13038
139.07
1.852
+.119
+.0641
.0008
76.0 sec
= 12.2 seconds
Each Fire
11.9¢
3.5 div/sec

Instrument Check on Nov. 11, 71 Source 10 mc ^{60}Co

9 50 V

PM-1	Bal 5.00	Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	10×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip	Scram Table	RAD MON	
IC-3	2×10^{-9}	[illegible]	DWM	A OK	Changed Set Pt to 30 R
IC-4	Out for Repair	[illegible]	~~Dw~~	B OK	
CRM		Meter Trip		C OK	

Recorder → required 300 sec to travel upscale with input open.

EXP #25

9.75 x 19.50 x 3.25 — 9.75 x 9.75 x 3.25 on each Table

18 ea 3¼ in cubes

9 24 Start Assembly, Source Inserted, Inst Resp. OK, Δp OK, Red Lite & Pers Ck OK

Bypass Panel, Inst Scales

9 36 Source Dwgn Pos Period — Table Ind. 1.940 / 1.935

Table Ind 0.560 — 84.8 sec 11.24

95595
95644
181239

9 40 / 46 Start to Level

Level at Ind. 0.590 − .011 = 0.579

Supercritical

$\frac{\Delta \rho}{\Delta l} = \frac{\$0.112}{0.030} = \$3.73/\text{inch}$

see #26

assume → 16.265 / 3.255 / 19.520 × 9.764 × 3.254

EXP #26 (all 3¼ cubes but 119, 122, 129)

9.75 x 16.25 x 3.25 — 9.75 x 9.75 x 3.25 South

9.75 x 6.50 x 3.25 North

9 55 Start Assembly, Source Inserted, Resp. OK, Δp OK. Table Ind 1.943 / 40

10 05 On Pos Period — Ind. .062 − .011 = .051

09 Start to Level — 76 sec → 11.9¢ / .029 = 410¢/in — mass = 159,391.

18 Level — Ind .091 − .011 = .080

18½ On Neg Period — Ind .121 − .011 = .110 — 139 sec → 13.1¢/.03 = 437¢/in

Estimated excess react to be only ~32¢ — T = 21.7 °C

.081 x 400 = 32

IC-1 to 10×10^{-10} Scale

IC-2 to 10×10^{-9} Scale

Closed table for approx 17 sec period, (~30 ¢ excess.) — ff = 30.1¢ excess

36 Tables Closed — 011 − 012 — .0115 — 17.25 sec — $\frac{29.9¢}{.080} = \$3.7/\text{inch}$

38 Shut down

3.2	55	52	52	9.758
	58		52	9.762
	57		51	9.764
	54		50	9.765
	57	60	55	9.770

16.257 / .268 / .72 — 9.764 × 3.254

Recorder → IC-4 Out for Repair ~~Ans~~ B OK
required CRM _____ Motor Trip _____ C OK
300 sec to travel rescale with input open.

EXP #25

9.75 × 19.50 × 3.25 9.75×9.75 ×3.25 on each Table,

18 ea 3¼ in cubes

9 24 Start Assembly, Source Inserted, Inst Resp. OK, Δp OK, Red Lite & Pers Ck OK
Bypass Panel, Inst Scales

9 36 Source Outgoing Pos Period Table Ind. 1.940 / 1.935
Table Ind 0.560 84.8 sec 11.2¢

95595
95644
181 239

9 40 Start to Level
46 Level at Ind. 0.590 − .011 = 0.579
Supercritical

$\frac{\Delta \rho}{\Delta l} = \frac{\$0.112}{0.030} = \$3.73/\text{inch}$

see #26
16.265
3.255
assume → 19.520 × 9.764
× 3.254

EXP #26 (all 3¼ cubes but 119, 122, 129)

9.75 × 16.25 × 3.25 9.75 × 9.75 × 3.25 South
9.75 × 6.50 × 3.25 North

9 55 Start Assembly, Source Inserted, Resp. OK, Δp OK. Table Ind 1.943 / 40
10 05 On Pos Period Ind. .062 − .011 = .051
09 Start to Level 76 sec → 11.9¢/.029 = 410¢/in mass = 159,391.
18 Level Ind .091 − .011 = .080
18½ On Neg Period Ind .121 − .011 = .110 −139 sec → 13.1¢/.03 = 437¢/in
Estimated excess react to be only ~32¢
.081 × 400 = 32

T = 21.7 °C

IC-1 to 10×10⁻¹⁰ Scale
IC-2 to 10×10⁻⁹ Scale
Closed table for approx 17 sec period, (~30 ¢ excess)

ff = 30.1¢ excess

36 Tables Closed 011 − 012 .0115 17.25 sec $\frac{29.9¢}{.080} = \$3.7/\text{inch}$

38 Shut down

3.2	55	52	52	9.758
	58		52	9.762
	57		51	9.764
	54		50	9.765
	57	60	55	9.770
	16.257			9.764
	.268			
	.272			
	16.265			

× 3.254

[redacted]

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Summary

E&P No.	SIZE	Mass	ρ Cents	Gap		
7-8-9	6.513 × 6.513 × 7.878 ρ = 18.80	102932	11.2, 8.2, 5.4			(1)
12	6.508 × 9.768 × 5.500 ρ = 18.82	107 805	-1.8			(2)
13	6.505 × 9.764 × 5.505 ρ = 18.83	107 888	-2.1			(3)
15,16	6.508 × 13.025 × 4.699 ρ = 18.73	122 280	0.6, -0.6			(4)
18,	9.763 × 9.766 × 4.136	121518	0	.119	5.4	
	Removed 3ea 1/8 edge	120 268	0	.066	5.5	
	6ea 1/8 edge	119 015	0	.009	1.5	(6)
	Removed 3ea 1/8 Mid Row	120 268	0	.045	6.1	
	-	121 518	0	.127	5.6	
					$5.65	

Total worth of top = .119 − .009 = .110
.127 − .045 = .082
.192

average gap $\frac{119 + 127}{2}$ = .123

$\frac{.123}{.192} \times .125 = .080$ (= .6406₂₅) ∴ HT at Critical = 4.056

.64 × 3755 = 2406 g
121518 = 2406 = 119,112 g — 0 — 0 — (5)

9.763 × 9.766 × 4.056
3 × 3 — 18.80
3 × 4 — 0 — .112

24 — 9.763 × 13.018 × 3.572 = 139,651 — 50¢ — 0 — (7)
ρ = 18.77
3 × 5 — 29.9¢ — 0 — (8)

26 — 9.764 × 16.265 × 3.254 = 159,391
ρ = 18.82

Summary

ELP. NO.	SIZE	Mass	ρ (cents)	Gap		
7-8-9	6.513 × 6.513 × 7.878 ρ = 18.80	102 932	11.2, 8.2, 5.4			
12	6.508 × 9.768 × 5.500 ρ = 18.82	107 805	-1.8			
13	6.505 × 9.764 × 5.505 ρ = 18.83	107 888	-2.1			
15, 16	6.508 × 13.025 × 4.699 ρ = 18.73	122 280	0.6, -0.6			(4)
18,	9.763 × 9.766 × 4.136	121 518	0	.119	5.4	
	Removed 3ea 1/8 edge	120 268	0	.066	5.5	
	6ea 1/8 edge	119 015	0	.009	1.5	(6)
	Removed 3ea 1/8 Mid Row	120 268	0	.045	6.1	
		121 518	0	.127	5.6	
					$5.65	

Total worth of top = .119 − .009 = .110
.127 − .045 = .082

average gap $\frac{119 + 127}{2}$ = .123 .192

$\frac{.123}{.192} \times .125 = .080$ (= .6406 25) ∴ HTab Critical = 4.056

.64 × 3755 = 2406 g
121 518 − 2406 = 119,112 g 0 0 (5)

9.763 × 9.766 × 4.056
3 × 3 18.80

3 × 5 0 .112

24 9.763 × 13.018 × 3.572 = 139,651 50¢ 0 (7)
ρ = 18.77

3 × 5 29.9¢ 0 (8)

26 9.764 × 16.265 × 3.254 = 159,391
ρ = 18.82

Bare Assembly of Metal Cubes

Base Area 9 3/4 x 9 3/4 ; Measure Multiplication as a function of height of assembly with IC-1, 2, 3. (4 out for repair)

Instrument Check on 11-15-71 Source 10 mc ^{60}Co

PM-1		Low Trip	Scram Table	Alarm Trip	OK
~~PM-2~~				~~Alarm Trip~~	
Noisy → IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
Noisy → IC-2	3×10^{-10}	Meter Trip	OK		Rad Mon
Spikes IC-3	3×10^{-10}	Calibration	Dwh	A	OK
IC-4	Out for Repair	Calibration		B	OK
CRM		Meter Trip		C	OK

Full sepn. Table Ind 1.981 - 1.956 drift in ~10-15 Min

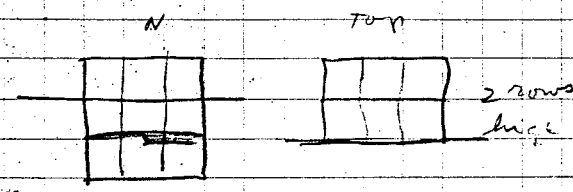
IC-1, 2 & 3 now in Paraffin "howitzers"

Source Inserted Response OK, Red Lite, Pers Ck, Bypass OK

IC-2 IC-3 EXP # 27

18 ea 3 1/4 cubes 191 239 g

9.75 x 9.75 X 6.5 inches



9.09 Start Assembly, Source in contact with paper on top of assembly - Subcritical @ 9 16

Table Ind 0.011

			S		M
IC-1	.11 x 3×10^{-11}	Bkg	.05 x 3×10^{-11}	~ 2
2	.22 x 3×10^{-11}	Bkg	.15 x 3×10^{-11}	~ 1.5
3	8.5 x 10^{-12}	Bkg	.6 x 10^{-12}	~ 1.5

EXP # 28

Add 2 x 3 1/4 x 3 1/4 - 9 ea 58 886 Insert Source to top of assembly

3 1/4 cubes 18 ea 191 239 Inst Resp OK Δp OK

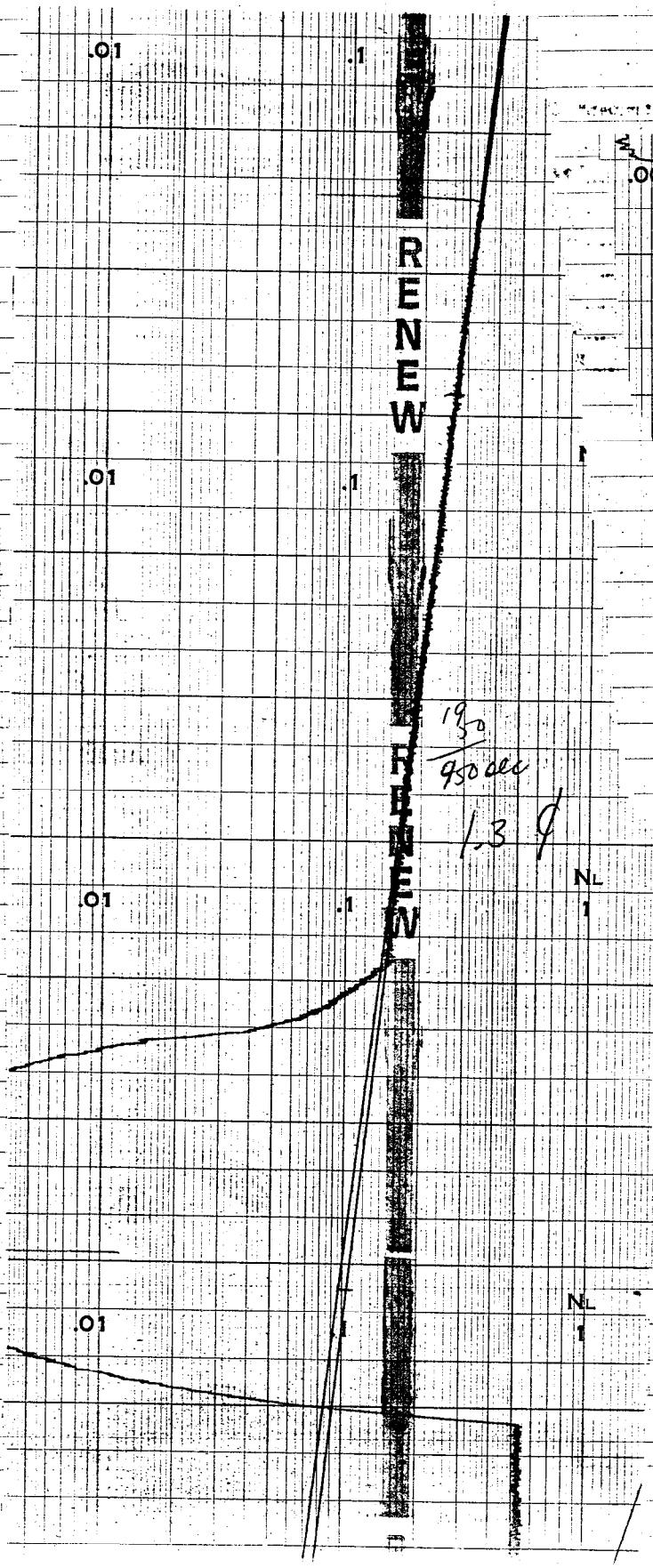
250 125 g

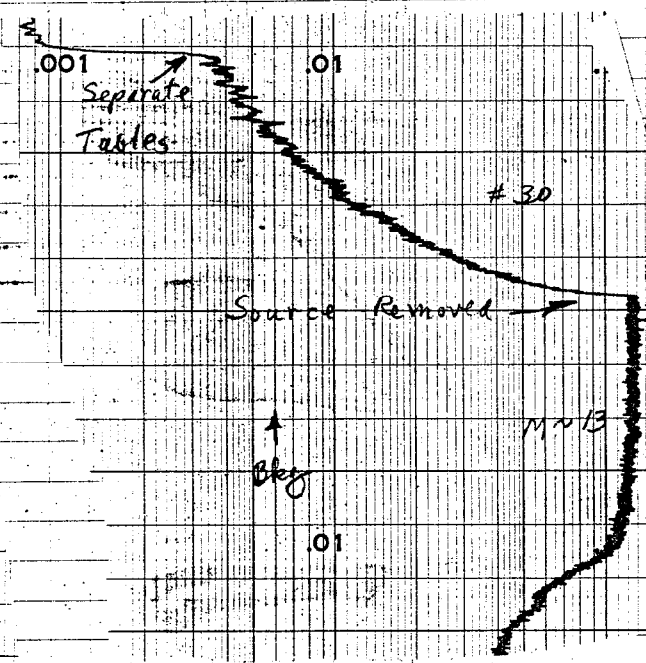
9 29 Start Assembly, 1.952 9 39 Table Ind = 0.011 Subcritical

				R
IC-1	.25 x 3×10^{-11}	Bkg	.05 x 3×10^{-11}	.11/.25 = .44
2	.42 x 3×10^{-11}	Bkg	.175 x 3×10^{-11}	.22/.42 = .54
3	1.45 x 10^{-11}	Bkg	6 x 10^{-12}	8.5/14.5 = .60

No crack visible between Tables! — Good Stack.

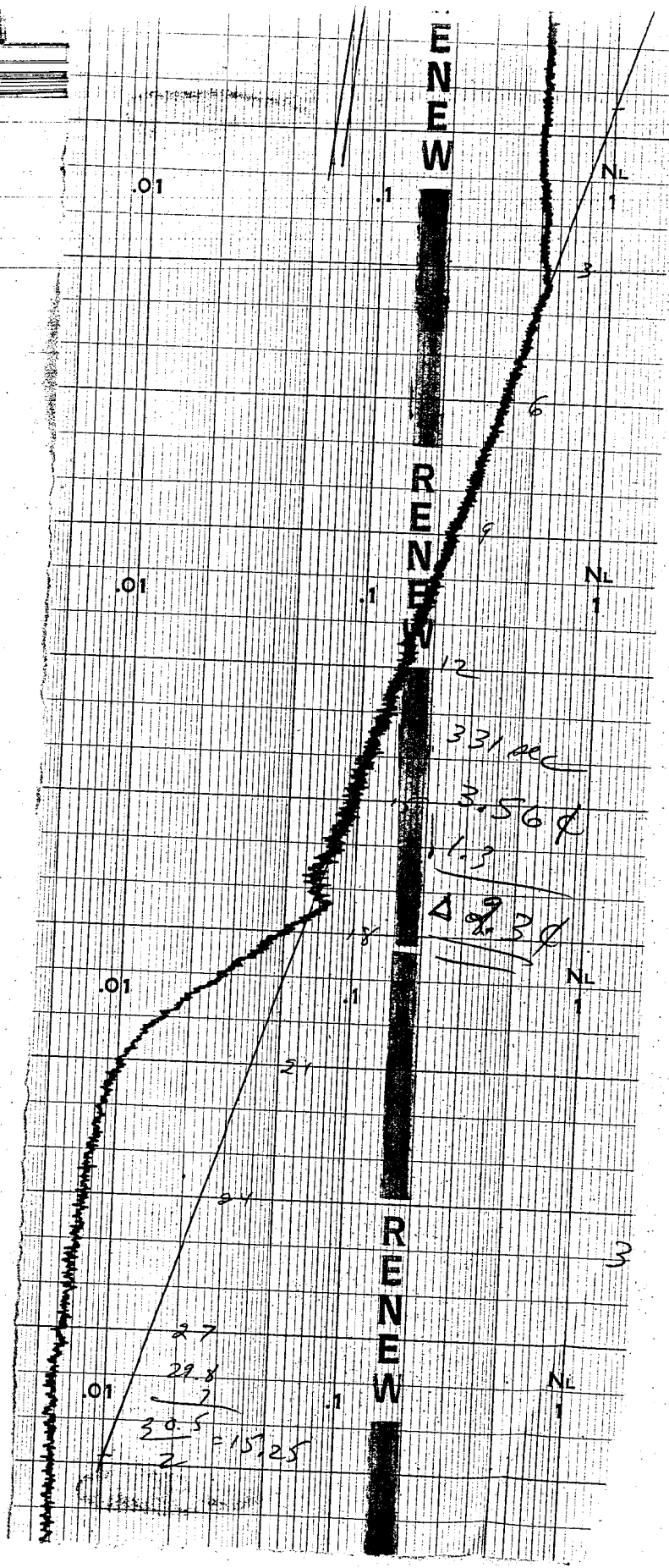
Plot of Reciprocal Multiplication indicates criticality between 10 and 11.5 in. (only 2 pts.)





950 sec
fast fiss = 1.3 ¢

331 sec
fast fiss = 3.5 ¢



RENEW
.01
.1
NL
1
3
6
9
12
331 sec
3.56¢
1.3
Δ 2.3¢
18
21
24
27
29.8
30.5
2
= 15.25

EXP #29

add 9 ea 0.25 in Thick CuBOIDS 7129
0.50 in " 14753
250125

Assembly 9.75 x 9.75 x 9.25 in. 272008 g

9:55 Start Assembly Source Inserted Response OK ΔP OK
10 08 Subcritical Table Ind = 0.011. R.

IC-1	$.52 \times 3 \times 10^{-11}$	.11/.52	=	.21
2	$.77 \times 3 \times 10^{-11}$	.22/.77	=	.29
3	2.7×10^{-11}	8.5/27	=	.31

Est of Crit Ht 9.9, 11.25, 10.75 in.

EXP #30

Remove 0.25 in.
add 0.75 in. 22071
to 0.5 14753
and 2.0 } 250125
6.5

height = 9.75 in Cube
x 9.75
x 9.75

286949

Source Inserted Resp. OK Δp OK

10:23 Start Assembly
10:35 Subcritical, Table 0.011 – 0.012. R

Power Drifted for	IC-1	$.27 \times 3 \times 10^{-10}$	.11/2.7	=	.041
Several Minutes after Ass.	2	$.4 \times 3 \times 10^{-10}$	.22/4.	=	.055
Very Close	3	1.25×10^{-10}	8.5/125.	=	.07

Remove Source Neg Period Too steep to measure react. for meaning.
EST of Crit Ht ~ 9.875.

EXP # 31

add 9 ea 1/8 in. x 3 1/4 x 3/4 Nom ht = 9.875 3757
286946
Base 9.75 x 9.75 $\boxed{290703}$ g

Source Inserted Resp OK ΔP OK

10:49 Start Assembly
10:01 On positive Period Source Out Table Ind = .012
+3.6 ¢

10:10 Start to level. Note: First increments of table sepn. do not change reactivity! T = 21.9 °C

Level 0.024 Ind – .012 = .012 gap.

Separate tables to 1" Bypass IC-2, Move IC-2 & 3 so that paraffin howitzers are perhaps 6-7 ft away
Close tables to measure positive period B. Table Ind .011 +
+1.3¢
Δp = 2.3 ¢ /or Paraffin howitzers ??

9:55 Start assembly Source Inserted Resp. [illegible]

10:08 Subcritical Table Ind = 0.011. R.

IC-1 $.52 \times 3 \times 10^{-11}$ .11/.52 = .21

2 $.77 \times 3 \times 10^{-11}$ .22/.77 = .29

3 2.7×10^{-11} 8.5/27 = .31

Est of Crit Ht 9.9, 11.25, 10.75 in.

EXP #30

Remove 0.25 in.

add 0.75 in. 22071

to 0.5 14753

and 2.0 } 250125

6.5

height = 9.75 in Cube

×9.75

286949 ×9.75

Source Inserted Resp. OC Δρ OC

10:23 Start assembly

10:35 Subcritical, table 0.011 – 0.012. R

Power Drifted for IC-1 $.27 \times 3 \times 10^{-10}$ .11/2.7 = .041

Several Minutes after Ass. 2 $.4 \times 3 \times 10^{-10}$ .22/4. = .055

Very Close 3 1.25×10^{-10} 8.5/125. = .07

Remove Source Neg Period Too steep to measure react. for meaning.

EST of crit Ht ~ 9.875.

EXP # 31

Add 9 ea 1/8 in. × 3 1/4 × 3/4 Nom ht = 9.875 3757

286946

Base 9.75 × 9.75 $\boxed{290703}$ g

Source Inserted Resp OC Δρ OC

10:49 Start assembly

10:01 On positive Period Source Out Table Ind = .012

+3.6 ¢

10:10 Start to level. Note: First increments of table sepn. do not change reactivity! T = 21.9 °C

Level 0.024 Ind – .012 = .012 gap.

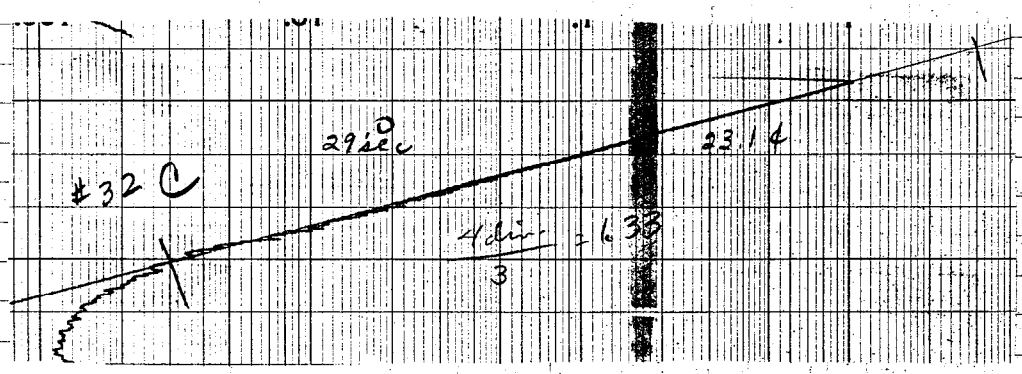
Separate tables to 1" Bypass IC-2, Move IC-2 & 3 so that paraffin howitzers are perhaps 6-7 ft away

Close tables to measure positive period B. Table Ind .011 +

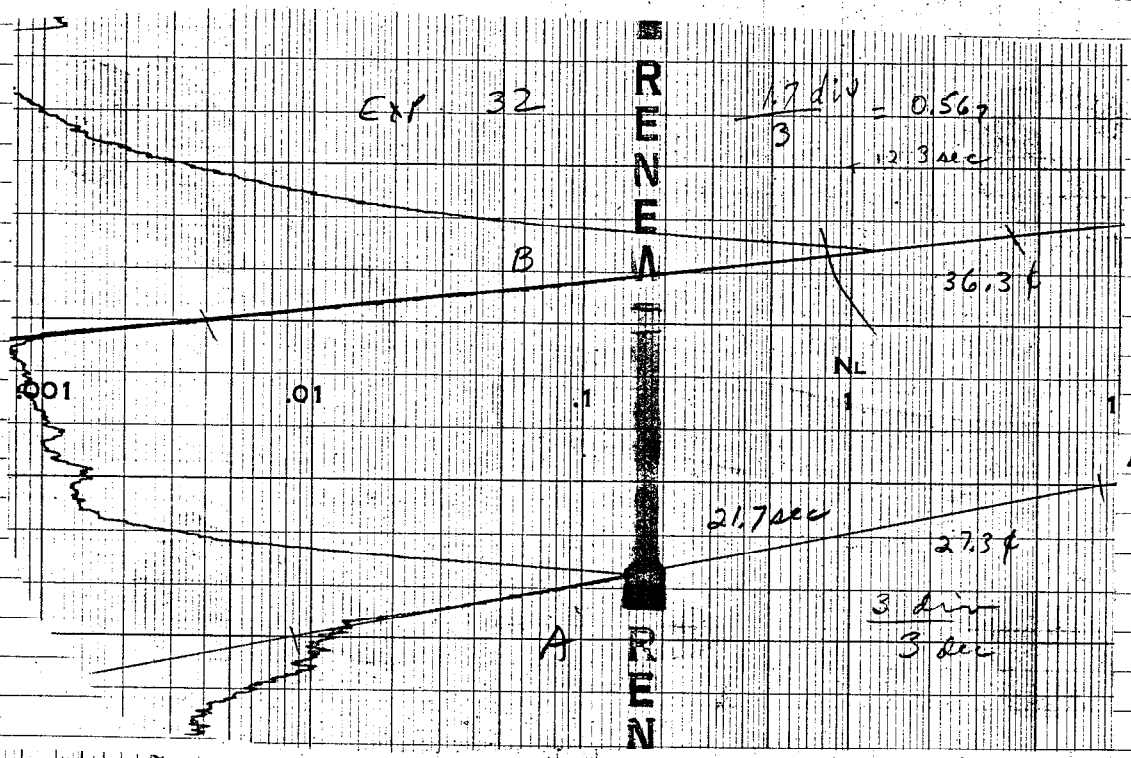
+1.3¢

Δρ = 2.3 ¢ for Paraffin Howitzers ??

Bottom of 43

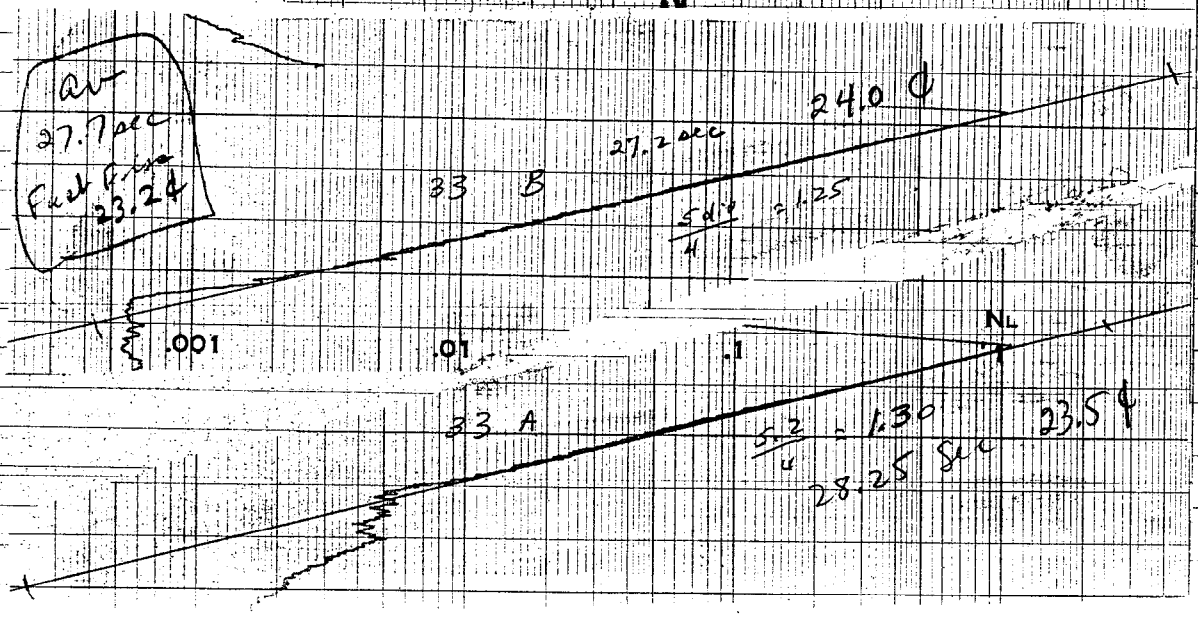


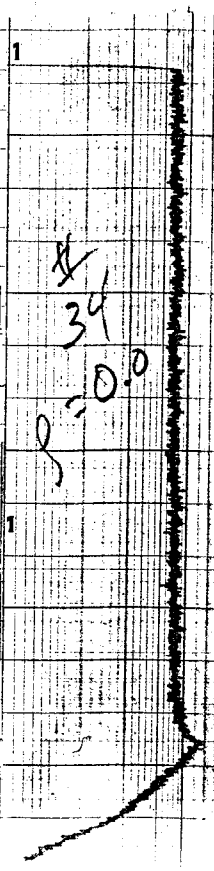
Fast Fiss
29.0 sec
22.6 ¢



Fast Fiss.
35.6 ¢

26.7 ¢





EXP #32

Added 1/8 x 3 ft x 3 ft alum plate
+ 5 rows of 3" x 3" boxes 3 ft long
Simulating structure over half of the top of the assembly
Insert Source OPOC

1 30 Start assembly
1 40 On Positive Period (A) ~.032 + period Δρ = 27.3 ¢ 26.65
Decrease power for better period
1 45 Tables fully closed .011. + Period Δρ = 36.3 ¢ 35.6
(B) separate to 1 inch remove x1.095
3 ea 1/8 U plates from movable table .00250

1 50 Start assembly from 1.2 in gap. 1.085 → .00160
1 55 On Pos Period (C) 29 sec → 23.1 ¢ 22.6
∴ 3 ea 1/8 x 3 1/4 x 3 1/4 with 13.2 ¢ 13.0

EXP #33

Added 4 ea 1/4 in. x 3' x 3' iron plates Hot Rolled Steel

2 08 Start Assembly Tab
2 16 Tables closed on pos Period (A) 22.9
Δρ = 23.3
Separate tables to ~1 inch
2 27 Repeat Period Meas. (B) 23.5 27 ¢
Av 23.2 23.2
22.6
0.6 ¢

EXP #34

Remove Top Half Reflector
and 3 ea 1/8 x 3 1/4 x 3 1/4
(Repeat of EXP # 31 B)
Insert Source.

2 36 Start Assembly
2 48 On Pos. Period with Source & Tabs @ .012
2 50 Source Removed for Period Meas.
Infinite Period React = 0.00

ρ (EXP #34) − ρ (EXP 31 B) = 1.3 ¢ Av 0.7

Summary with Half Top Reflector 35.6
0.6
36.2

Insert Source Δρ ok

1.30 Start assembly

1.40 On Positive Period (A) ~.032 + period Δρ = 27.3 ¢ 26.65

Decrease power for better period

1.45 Tables fully closed .011. + Period Δρ = 36.3 ¢ 35.6

(B) Separate to 1 inch remove x1.095

3 ea 1/8 U plates from movable Table .00250

1.50 Start assembly from 1.2 in gap. 1.085 → .00160

1.55 On Pos Period (C) 29 sec → 23.1 ¢ 22.6

∴ 3 ea 1/8 x 3 1/4 x 3 1/4 worth 13.2 ¢

13.0

EXP #33

Added 4 ea 1/4 in. x 3' x 3' iron plates Hot Rolled Steel

2.08 Start Assembly Tab

2.16 Tables closed on pos Period (A) 22.9

Δρ = 23.3

Separate tables to ~1 inch

2.27 Repeat Period Meas. (B) 23.5 0.7 ¢

Av 23.2 23.2

22.6

0.6 ¢

EXP #34

Remove Top Half Reflector

add 3 ea 1/8 x 3 1/4 x 3 1/4

(Repeat of Exp # 31 B)

Insert Source.

2.36 Start Assembly

2.48 On Pos. Period with Source, Table @ .012

2.50 Source Removed for Period Meas.

Infinite Period React = 0.00

ρ (EXP #34) − ρ (EXP 31 B) = 1.3 ¢ Av 0.7

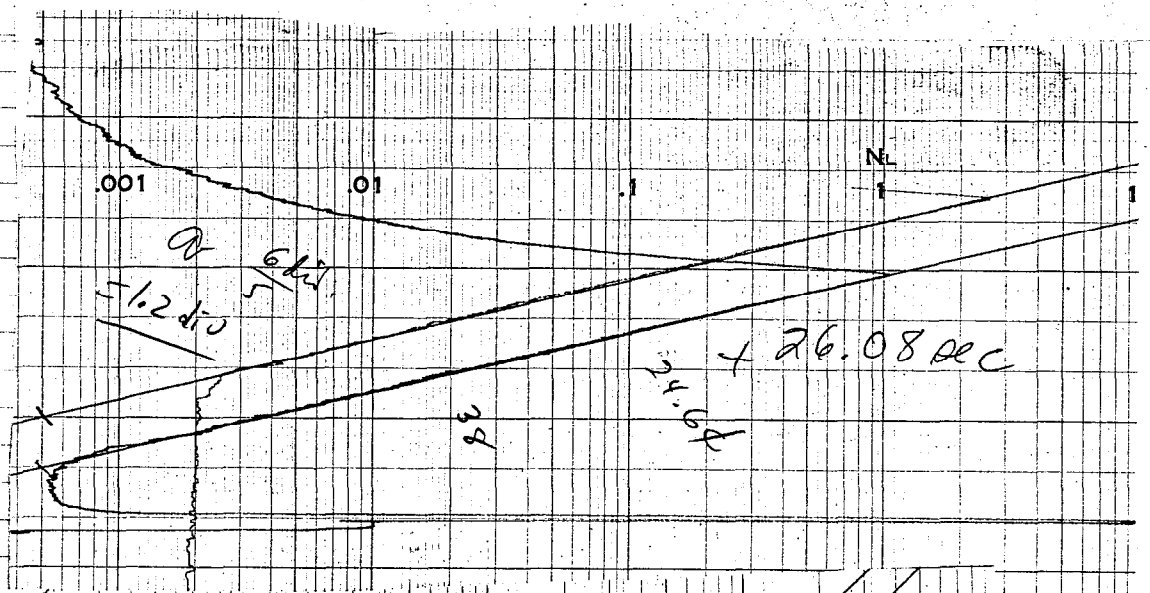
Summary Worth Half, The Top Reflector 35.6

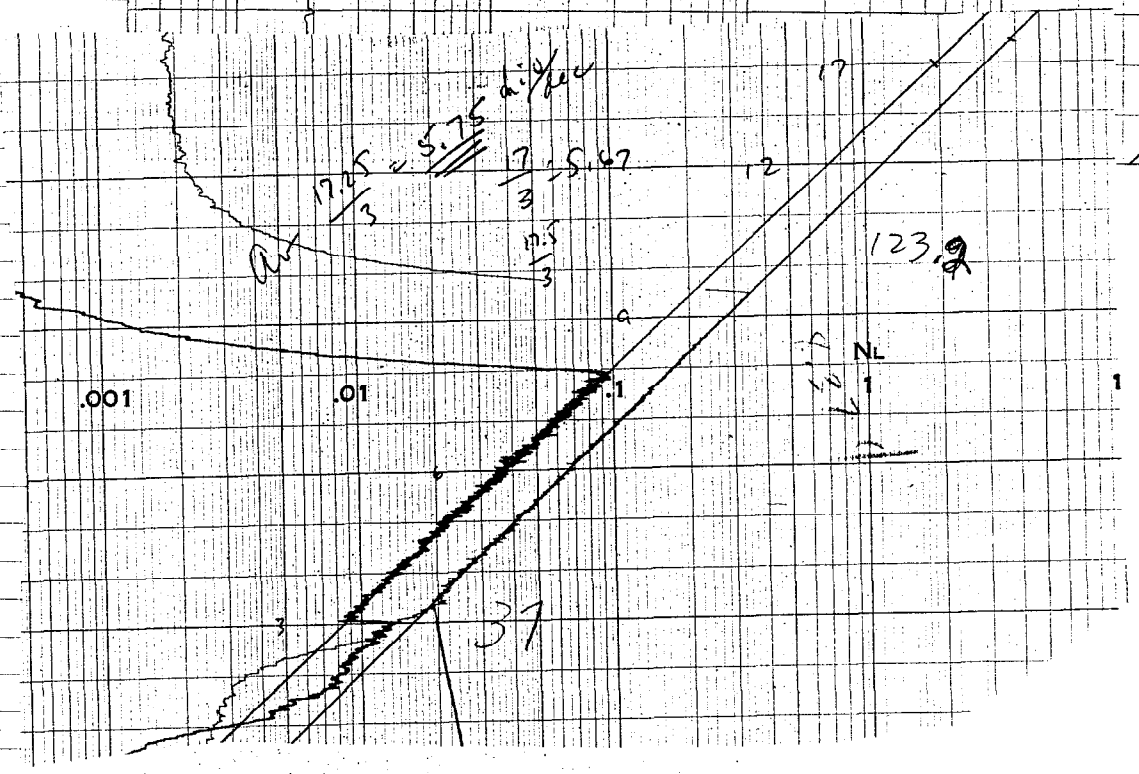
+ 0.6

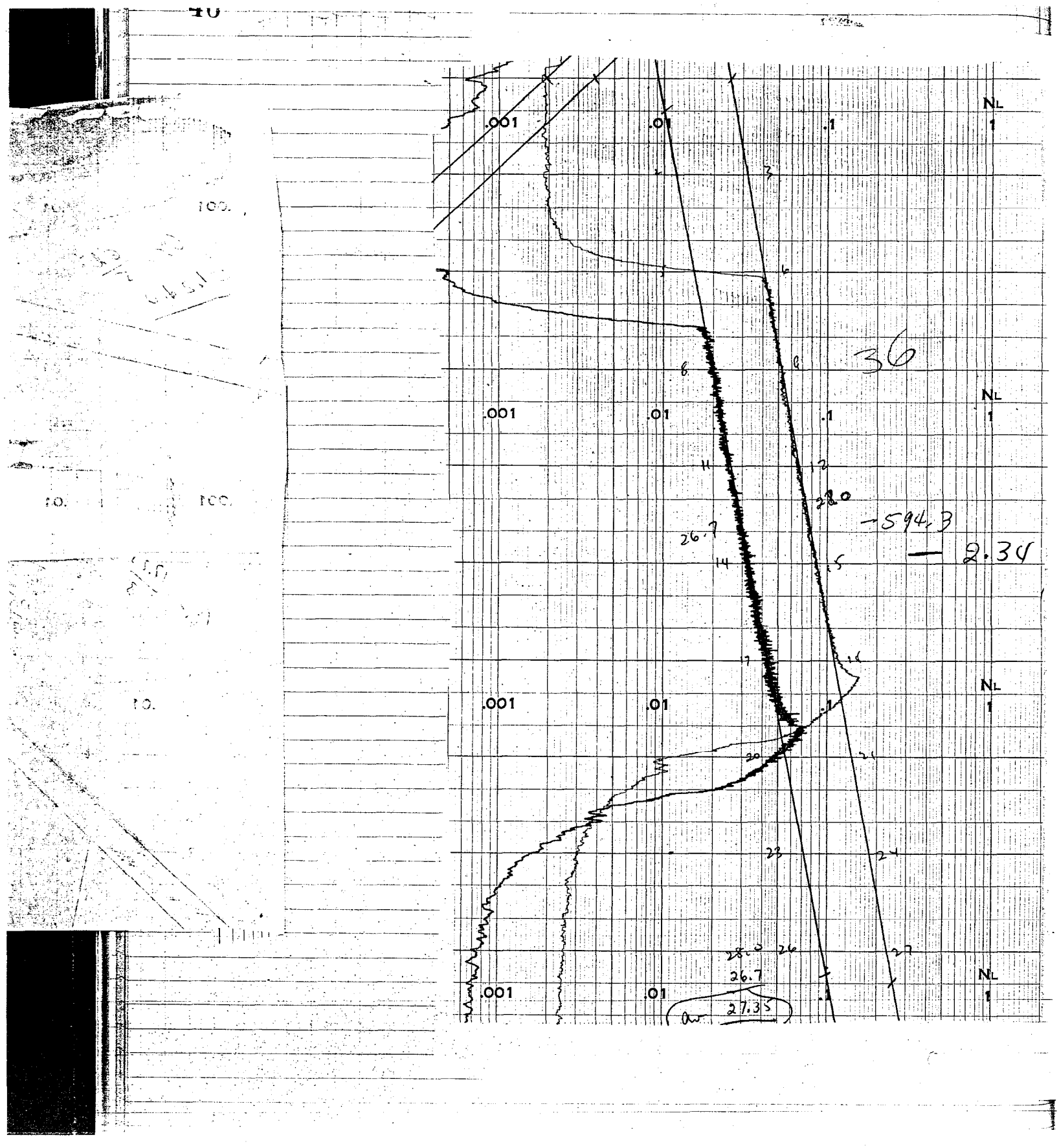
36.2

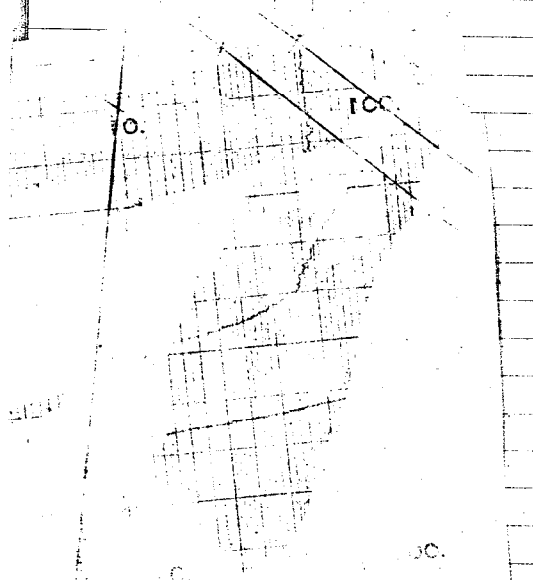
37.[illegible] with [illegible] Top Refl

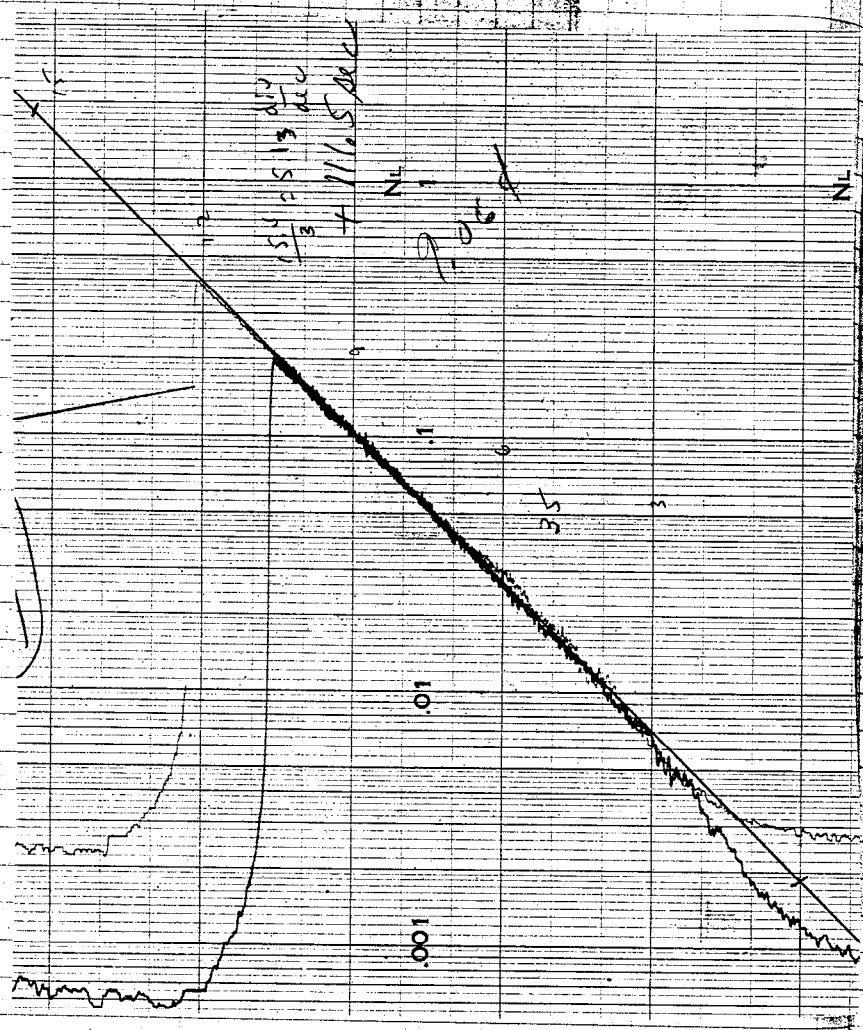
Bottom of page 45 [illegible]


.001
.01
.1
NL
1
1
6 div
5
= 1.2 div
+ 26.08 sec
24.64
38


17.25/3 = 5.75 div/sec
17/3 = 5.67
17.5/3
17
12
123.2
NL
.001
.01
.1
1
1
37


.001
.01
.1
NL
1
36
-594.3
2.34
26.7
28.0
27.35





9⁰⁹
9¹⁴
9²⁵
9³⁵
9⁴⁵
9⁴⁷
10⁰⁰
10⁰⁵
10¹⁷
20+

EXP # 35

Repeat Measurements on Worth of ½ Top Reflector (# 31-34)

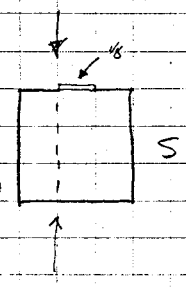
Remove 6 ea 1/8 x 3 1/4 x 3 1/4 U Metal from top, 3 ea remain on middle row
Add 1/8 Al + Al Boxes + 1 in of Iron Top Reflector
Excess react estimated to be ~ 10 ¢

Mass = 290.703
− 2505
288 1989

Instrument Check on 11-16-71 Source 10 mc ^{60}Co

950 V	PM-1	Bal 5.00	Low Trip	OK	Alarm Trip Scan Table
	PM-2				Alarm Trip
Replaced Batteries on Ion Chambers	IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip OK
	IC-2	3×10^{-10}	Meter Trip	OK	Red Mon
	IC-3	4×10^{-10}	Calibration	DWM	A OK
11-15-71 4 PM Returned to Service	IC-4	1.5×10^{-9}	Calibration	DWM	B OK
	CRM		Meter Trip		C OK

9^09 Start Assembly
9^19 In Pos Period Table Closed Ind = 0.012 T = 21.7 °C
9^25 Shut down
+ 11.[illegible]
− 9.1 ¢ f.f. 8.94
1.0665 (→ .00061)
(Remove Top Refl add 6 ea 1/8 x 3 1/4 x 3 1/4)



EXP # 36 (Same as # 34, 31B)
9.75 x 9.75 x 9.875 Cubid 290,703 g

9^35 Start Assembly
9^45 Tables Closed Ind = 0.012 Source used to increase power to ~10^{-10} on IC-3 -4
9^47 Removed Source Slight negative period −57.2 sec
Separate Tables 1"
− 2.3 ¢ f.f. −2.3 ¢
1.0054 → .00016

EXP # 37

Add 3 ea to North table
(+2C+B)

C	B	C
B	A	B
C	B	C

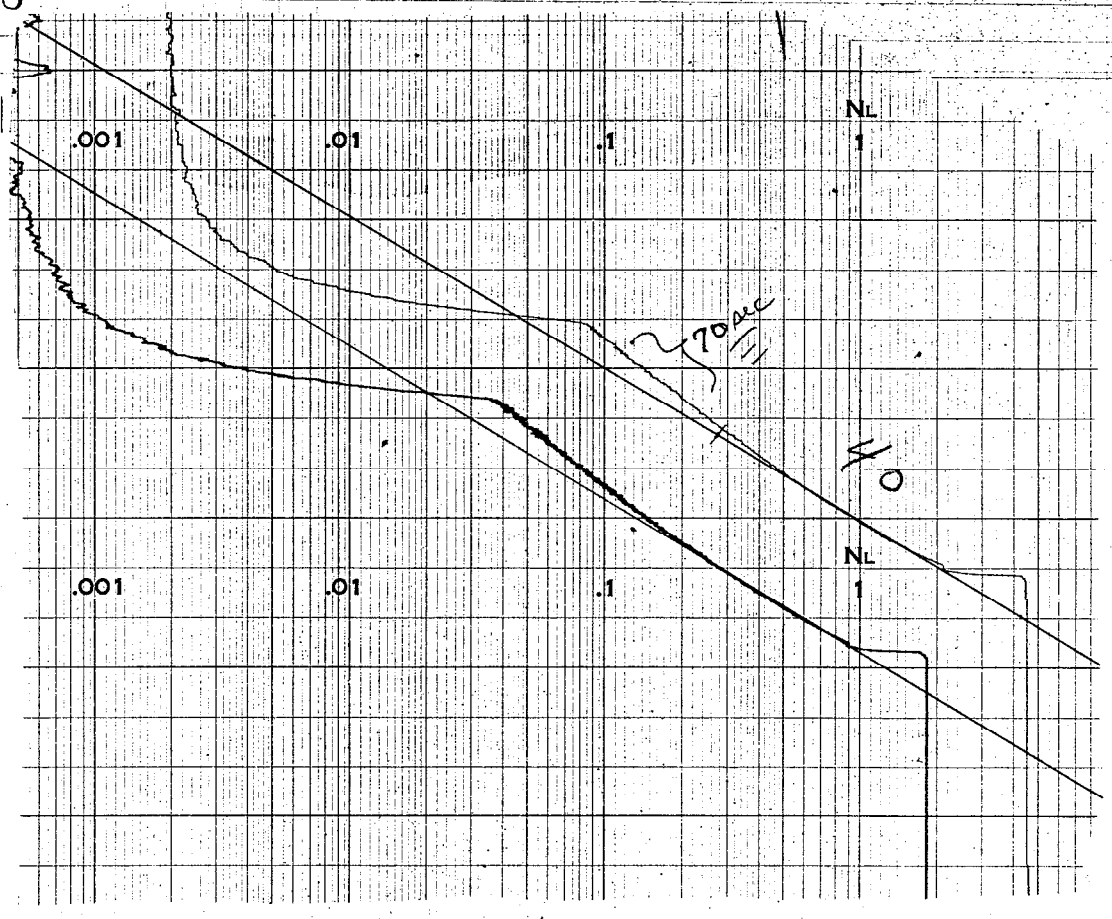
10^03 Insert Source Start Assembly
10^05 Tables Closed Ind −0.011 Source Out + Period
+ 1[illegible]
+ 5.4 ¢ f.f. 8.2 ¢
1.0660 → .00056

417
9
3753
2
1877
3753
5630
290703

EXP # 38

Remove (2C+B) add to Center Row A+2B

0^17 Insert Source Start Assembly
0^20 Tables Closed Ind 0.0 Source Out + Period
+ 6.1 sec
+ 1.6 ¢ f.f. 24.0 ¢
1.0822 (→ .00166)



10 29

10 15

10 58

11 09

11 19

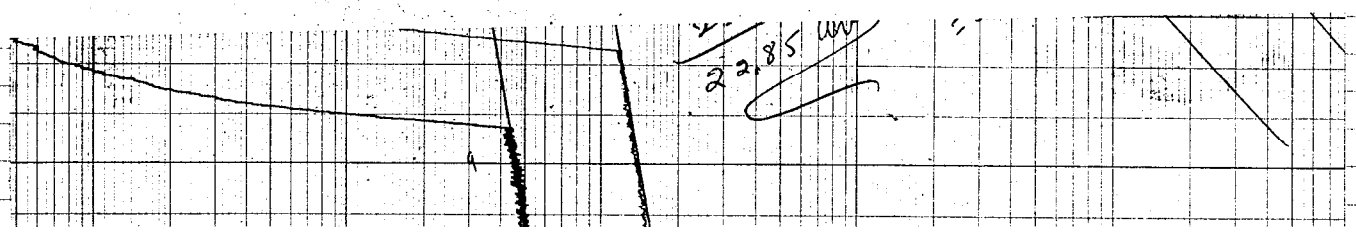
11 24

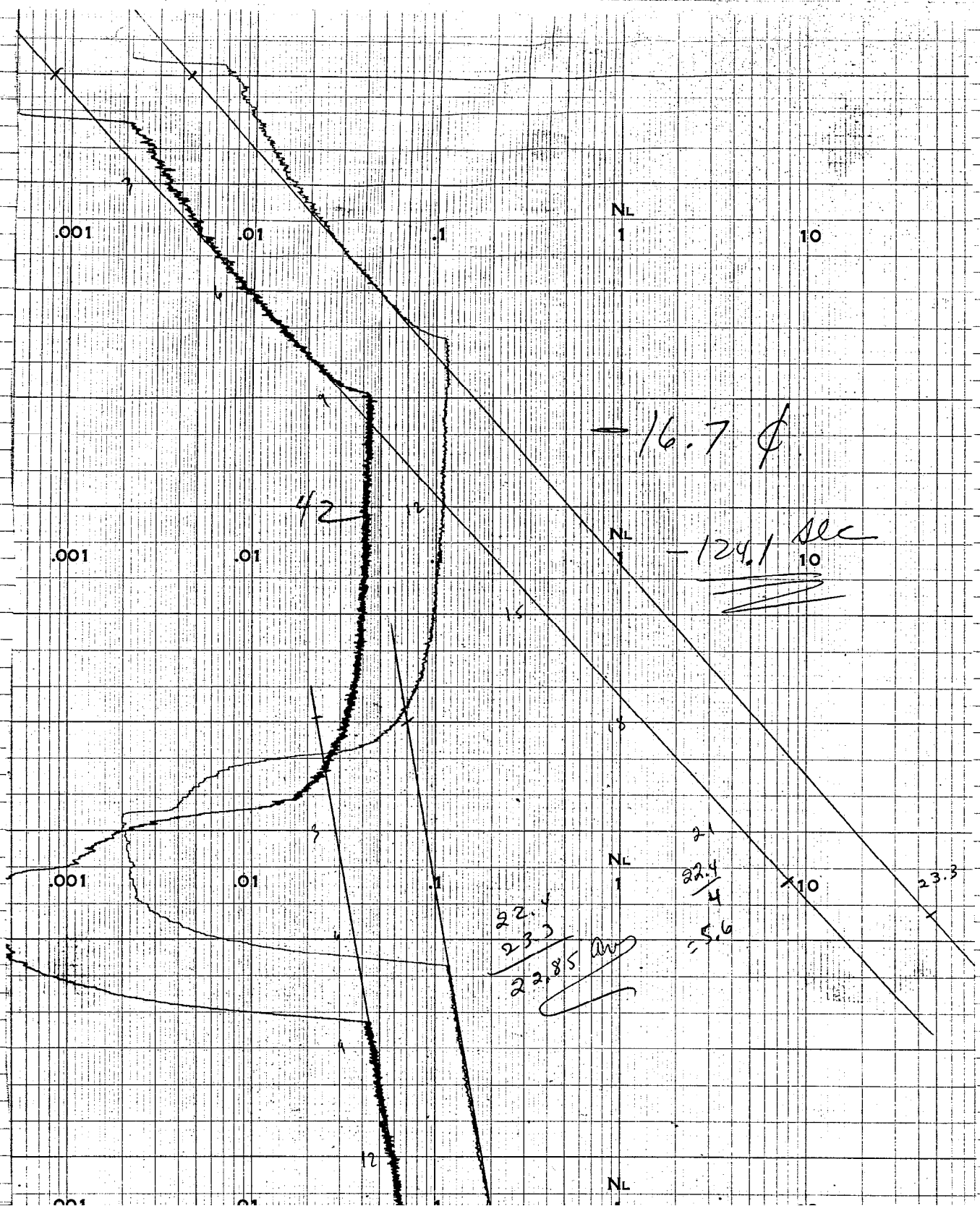
11 26

11 27

11 37

11 45



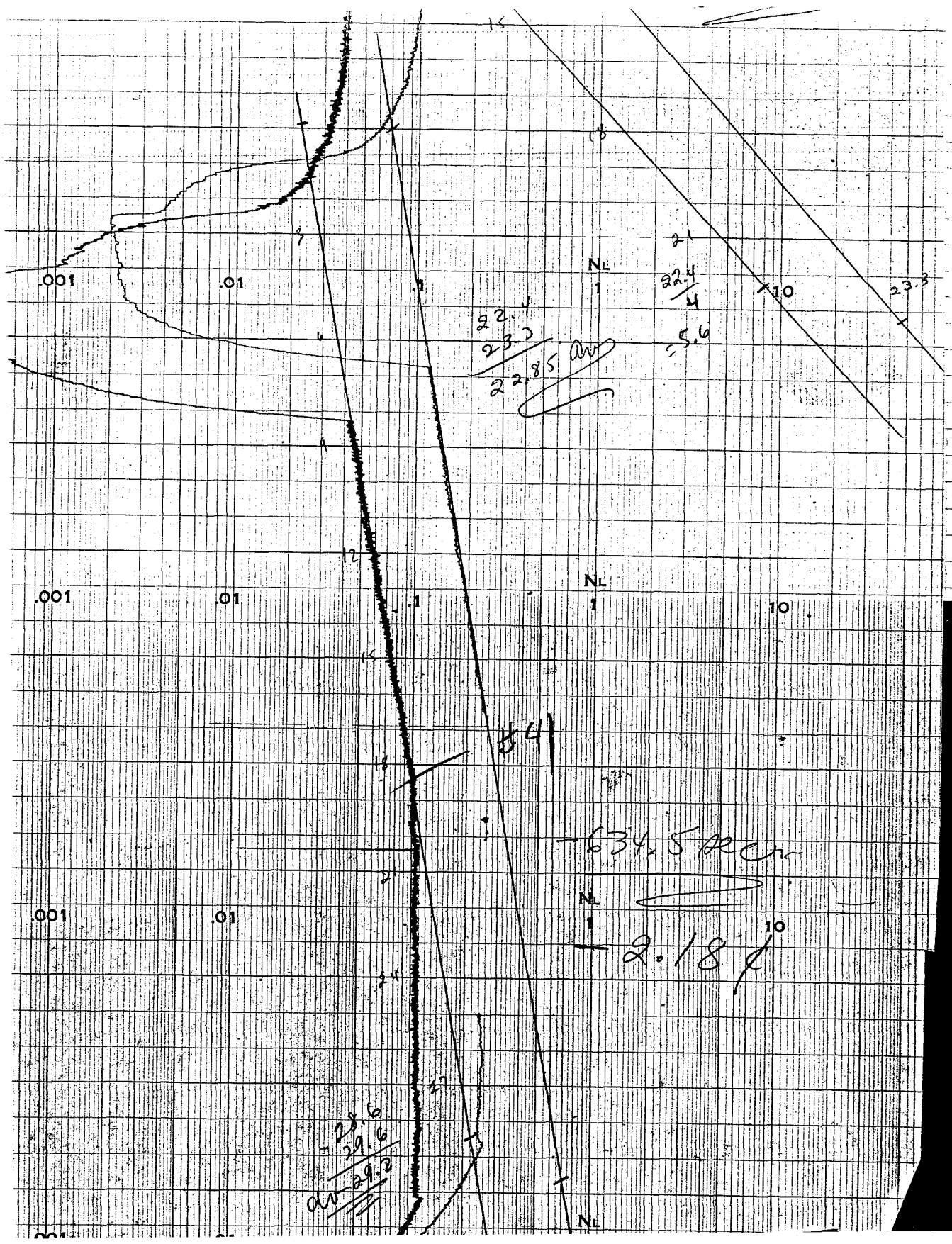


10 29

10 15

10 58
11 00
11 19
11 24

11 26
11 27
11 37
11 45



1126
1127
1137
1145

EXP #39

Remove (2A + 4B) Middle Row now only 9.75 high

10^{29} Insert Source, Start Assembly –

Power level too low for Neg Period

Separate Table to 0.86 in.

EXP #40

Add 2 ea large sources manually

Tables to 0.038 Raise Power IC-3 1.9×10^{-9}

10^{15} -4 4.6×10^{-9}

A 90 mr

B 325 mr

C 275 mr

Remove sources manually

Close Tables for Neg Period. ~80 sec

Too Steep for accurate Meas.

EXP #41 (Repeat of #36) 9.875 in high)

Add 3 plates 1/8 to middle Row, Insert source.

10^{58} Start Assembly

11^{00} Tables Closed Incl = 0.012 Source In to Raise Power Level

11^{19} Start Neg Period – 634.5 –

– 2.2 ¢ f.f. -2.1 ¢

11^{24} Separate Tables 1 in. 1.041 – .00014

EXP #42

Remove 3 ea plates 1/8 in from Movable Table 9.75 high

11^{26} Fixed Table 9.875

11^{27} tables Closed 012 Source In To Raise Power.

11^{37} Remove Source for neg period

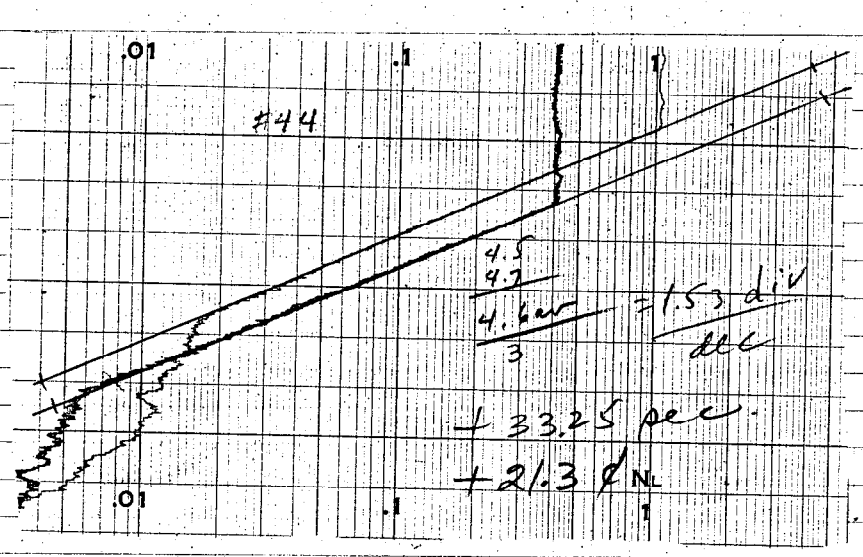
11^{45} Shut down – – 121.1 –

– 16.7 ¢ f.f. -16.4 ¢

1.023 → .00108

Measurements of #41 230 kg

	Height		E-W		N-S	
South	9.894		9.774		6.509	
	92		73		6.512	
	98		65		04	6.510
	98	9.896	71		21	
	94		67	9.771	05	
			72		04	gap .002
NORTH	9.898		9.780		3.250	
	9.905		65		50	
	9.888		70		50	3.251
					52	
					[illegible]	



235 Fast Fission + 20.8 ¢ CF

1.059 → .0014

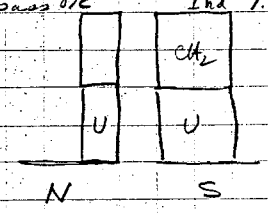
Measure Reflector Savings for Single Top Reflector Surface for 9.75 × 9.75 base.

EXP #43 (Same as EXP #27 + Top CH_2 Reflector)

6.5 in high with 6.5 in $(CH_2)_n$ Top Reflector

191 239 g

Insert Source Red Rite OK Op OK Bypass OK Ind 1.945



1^{54} Start Assembly

2^{04} Tables Closed, no multiplication observed

EXP #44

Added 9ea 0.75 }
9ea 0.50 } New Ht = 7.75 with Top Reflector of CH_2

2^{14} Insert Source Start Assembly 22071

14753

2^{23} Table Closed Ind = .011 191 239

Only Slight Increase in Mult 228063 g

EXP #44

Remove 9ea 0.75 9ea 0.50

Add 9ea 2.0 New Ht 8.5 in.

2^{32} Start Assembly Source Inserted

2^{44} Source Out On pos Period Ind = 0.053 > $\frac{21.3¢}{.017 \text{ in.}}$ = $12.5

2^{47} Start to Level ~ 0.070

2^{52} Level & Shut down 0.070

Super Critical ff = 20.8¢

EXP #45

Height 8.375	2ea	3.25	6.5		191 239
	1ea	1.0	1.0	7.5	29 454
		0.75	0.75	8.25	22 075
			.125	8.375	3 758
					246526 g

3^{05} Start Assembly

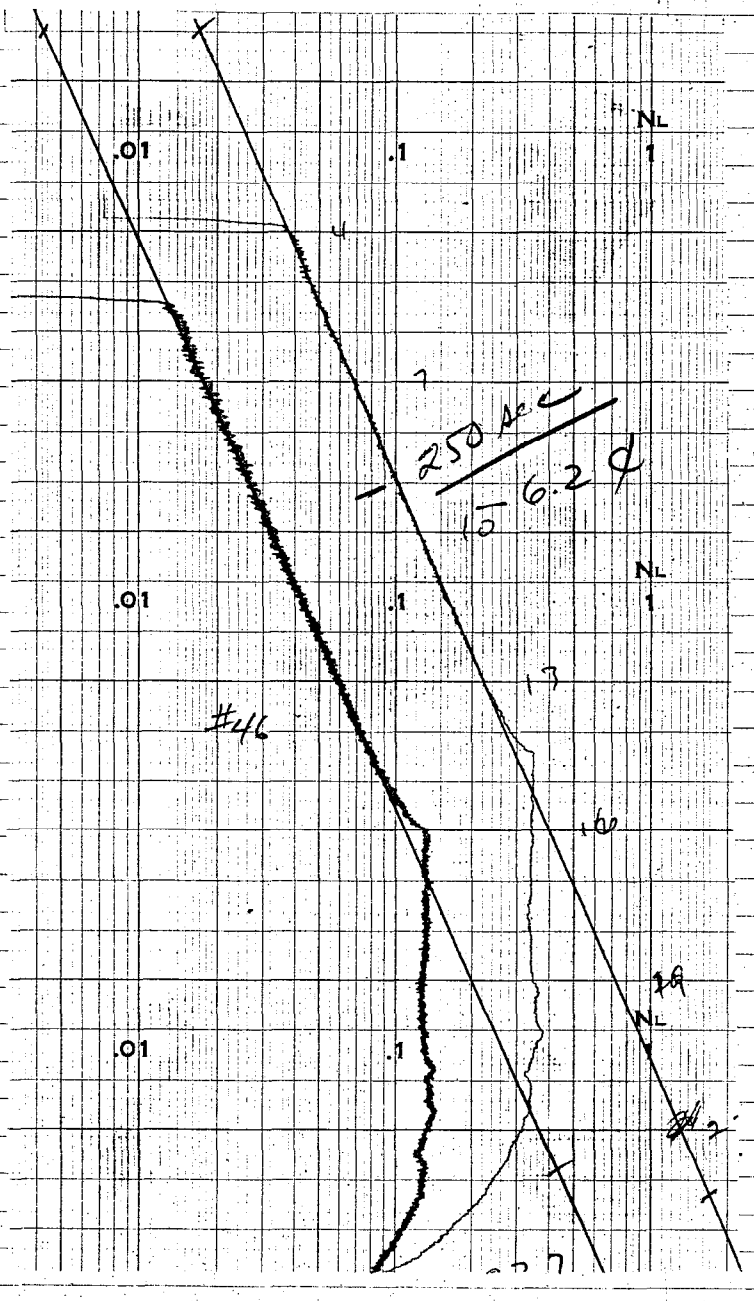
3^{16} Tables Closed Source In, Power Rising.

0.011

Sub critical — poor period meas. 9.875

Gap in plastic visible 8.375

1.500 Real Sav



Fast Fission - 6.07 ¢

EXP #46

Realigned assembly, put 1" pieces on top.
Moved source drive so that source can be position on side of metal. 246.526 g

338 Start Assembly, Source Inserted.
358 Remove source meas. neg period. -250 sec
-6.2 ¢ 11, 6.1¢

NOTE
ALL PERIODS AND REACTIVITIES ARE BASED ON ^{235}U THERMAL FISSION DELAYED NEUTRON YIELDS. or ^{235}U Fast Fission Yields. THESE MUST BE CORRECTED BY USING YIELDS FOR THIS METAL ENRICHMENT AND WILL BE DIFFERENT FOR EACH REFLECTED SYSTEM.

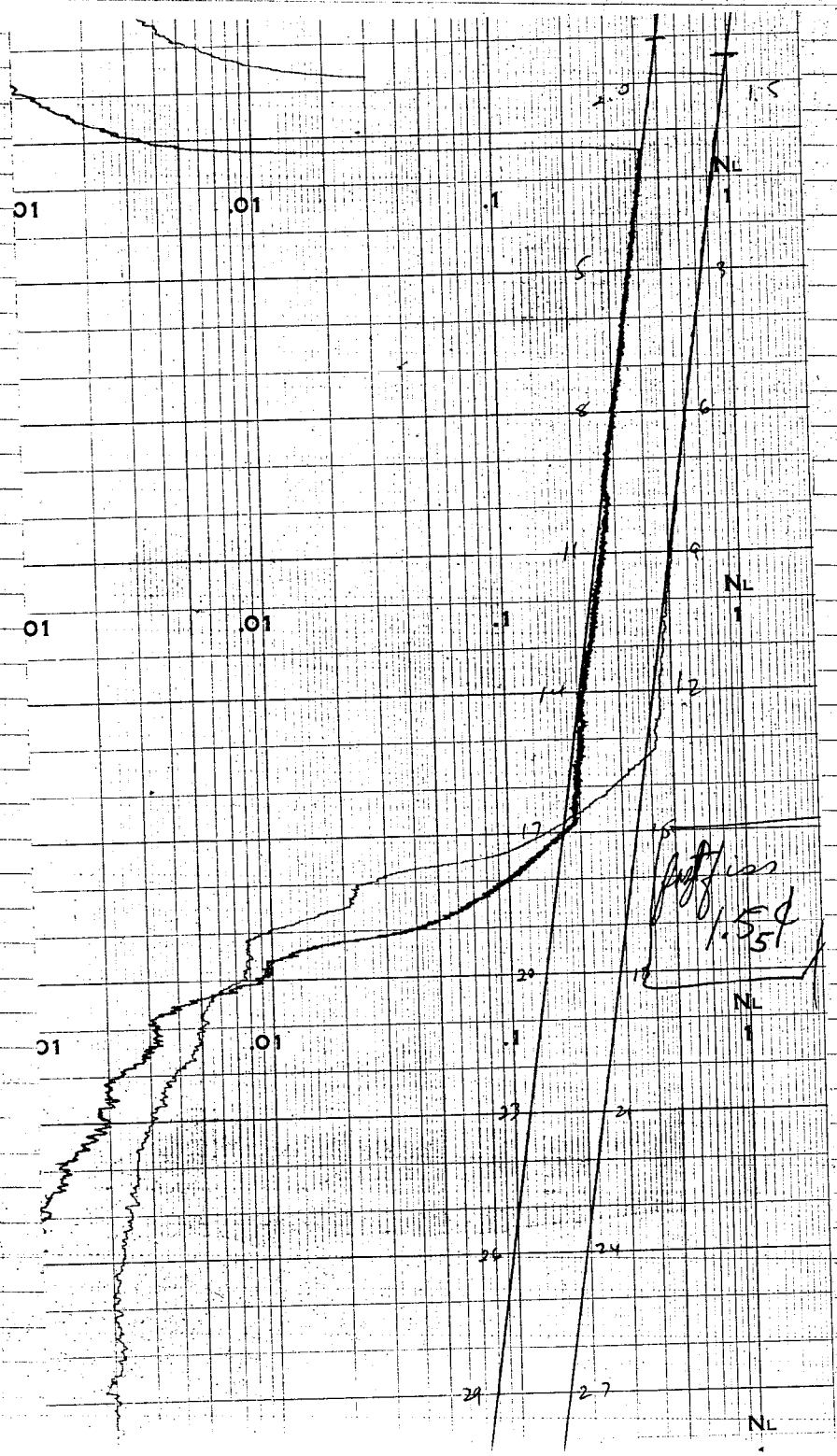
Measurements on Exp #46

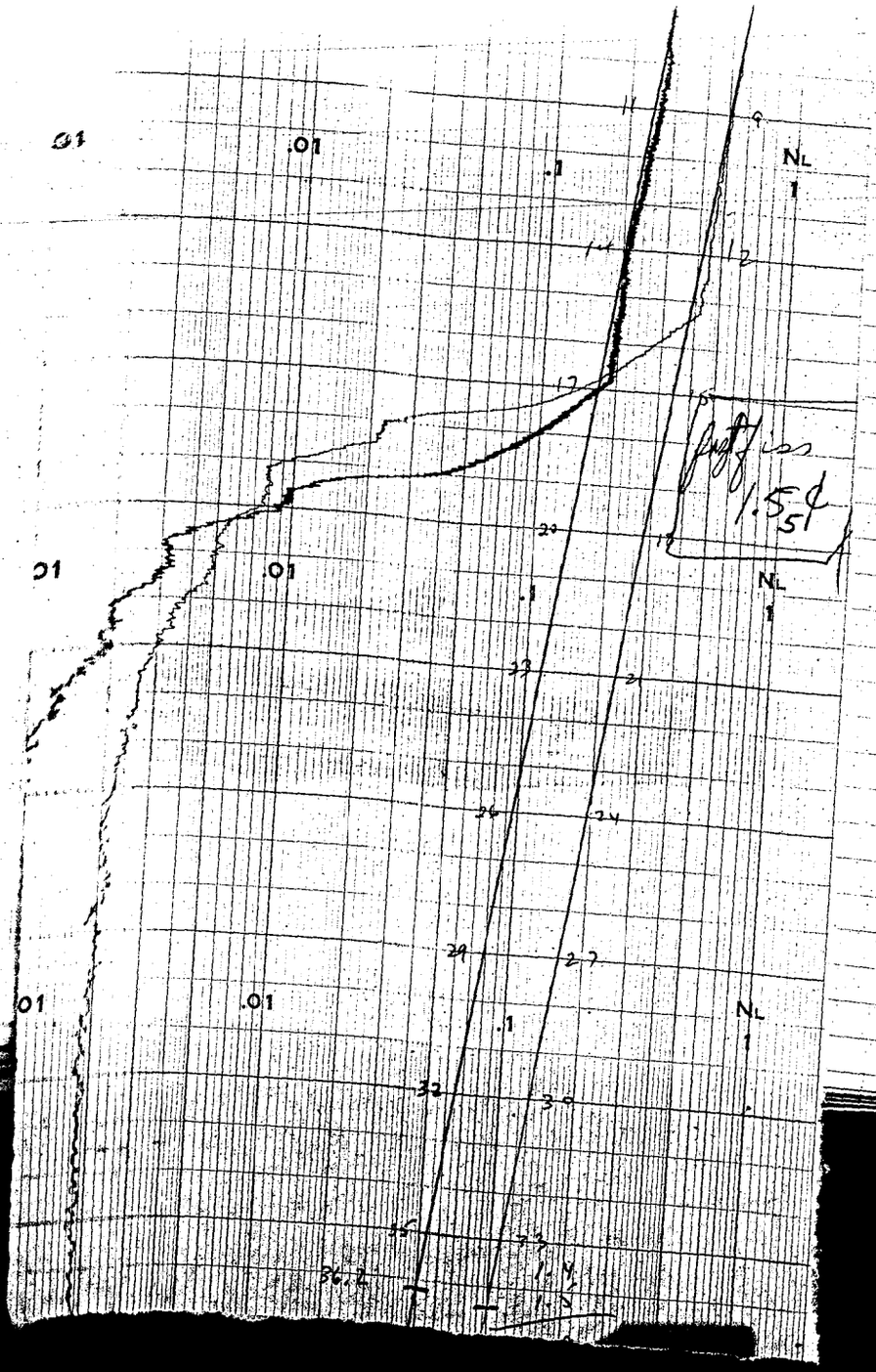
North Table

N S	E W	Height
3.250	9.770	8.393
50	9.756	95
47	9.766	79
50		95
51		
52		
52		
3.250		

South Table

6.505		9.772	8.392
14		69	95
00	9.00?	56	
11		65	94
04	002	62	
15		64	85


.01
.01
.1
1
NL
2.0
1.5
5
3
8
6
11
9
14
12
17
15
20
18
23
21
26
24
29
27
Suffiss
1.5¢



N 3
6.507
12
10
06
499
505
23
6.509

3.255
47
51
48
47
47
50
3.249
gap? .082
9.760

Instrument Check on 11-17-71 **Source** 10 mc ^{60}Co

950 ✓ PM-1 Bal 5.00 **Low Trip** OK **Alarm Trip** OK
PM-2 _____ _____ **Alarm Trip** _____
IC-1 _____ **Meter Trip** Scram Tables **Fast Trip** OK
IC-2 _____ **Meter Trip** OK Rad Mon
IC-3 3.6×10^{-10} **Calibration** OK Down A OK
IC-4 1.7×10^{-9} **Calibration** OK Down B OK
CRM _____ **Meter Trip** _____ C OK

Inspection of Stack in EXP #46 revealed some cracks and gaps; Thus it was decided unstack and rebuild and repeat #46. (18 ea cubes stacked with tables together)

EXP #47 (Repeat of #46 after rebuilding)

Insert Source, Reg OK, Δp OK, Red Lite Personnel Ck OK, Bypass, Rest OK

Start Assembly Source In to Raise Power

953 Remove Source on Pos. Period +785.5 sec +1.5$_5$ ¢ f.f.

954 Start Pos. Period

1005 Shut Down

$\Delta\rho = -(-6.07)$
$+1.55$
$= 7.6_2$ ¢

South Table

NS	EW	HT
6.507	9.772	8.396
12	64	92
10	70	87
06	73	91
499	64	90
505	79	
23		
6.509		

∴ Reflector Savings for $(CH_2)_n$ on top = 1.50 inches

9.896
8.392
1.504 in.

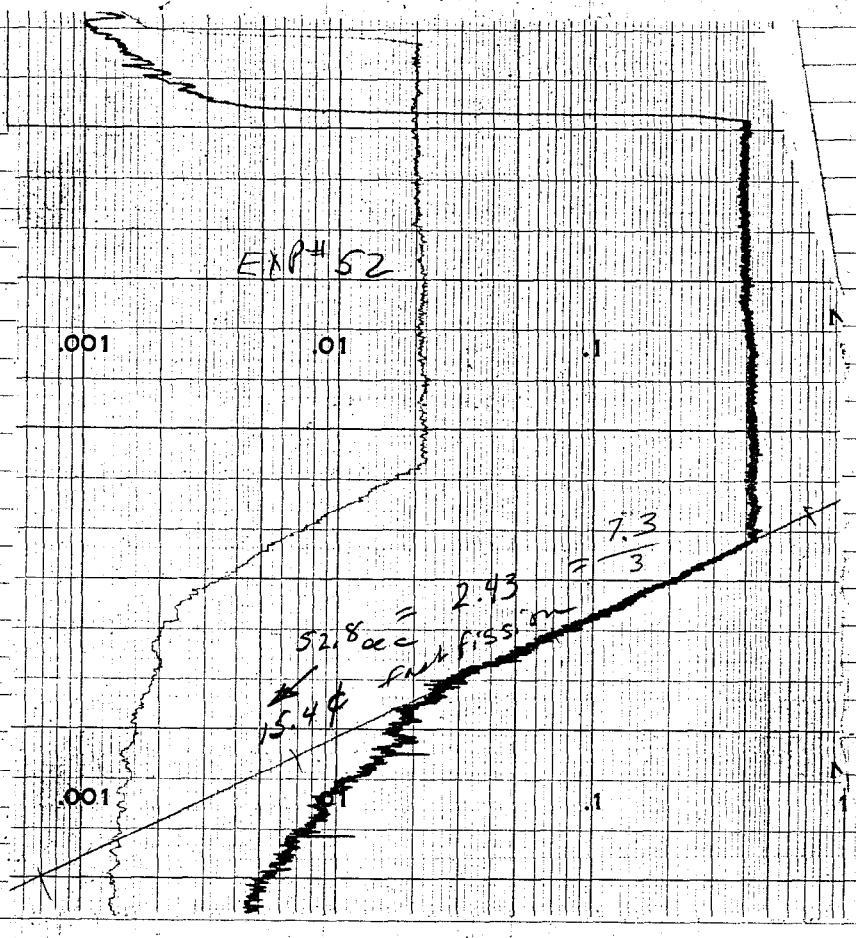
Must conclude that Exp #46 had a gap at plane of separation

North

3.255	9.769	8.399
47	79	.400
51	70	.381
48	9.771	8.392 av
47		
47		
50		
3.249		
.082		
9.760	× 9.771 × 8.392	

246 526 g

g = 18.798


EXP# 52
.001
.01
.1
.001
.01
.1
1
52.8 sec = 2.43 = 7.3/3
fast fission
15.4¢

this exp follows p 65

Instrument Check on 12-6-71 Source ^{60}Co 10 mc

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	Scram Tables
IC-2	3×10^{-10}	Meter Trip	OK		MONITRON
IC-3	Meter - OK 2×10^{-10}	Calibration		A	OK
IC-4	2×10^{-10}	Calibration	SWM	B	OK
CRM		Meter Trip		C	OK

Batteries Replaced in Recorder for IC-3-4.

Red Lite OK
Pers. OK
Δp OK
Bypass OK
Reset OK
Source Resp OK

EXP # 52

2 x 2 x 2 CH_2 - Refl. Array of 3.75 in Cubes

.240 SWM

Cell Spacer = 0.250 inch

Turned on
Table Ind (2) .030
Dr. Stud .
to .010

1^{00} Start Assembly
1^{14} Source Out on Positive Period +15.4 ¢
Table Ind 0.208
1^{17} Start to level
24 Level Ind 0.246 - .101 = .145

038

Comparison of Screw & Indicator Ind.

Rev	
20.0	1.777
18.0	1.540
16.0	1.318
14.0	1.114
12.0	0.924
10.0	0.748
8.0	0.587
6.0	0.442
4.0	0.310
2.0	0.
0.0	0.

between units on bottom

Add ~~1/16~~ and ~~1/32~~ in 3 Directions.
.050 .025

go to p 65

.145 × $4 = $0.6
.145 × 7.5 = $1.1

$\frac{15.4\ ¢}{.038}$ = $4.05 possibly

a crooked stack or in contact and leaning.
since previous $\frac{\Delta\rho}{\Delta l}$ = $7./in

Next EXP on p 65

Note if table separation is $7.5/in
Unit separation reactivity would be > $22.5/in. perhaps $3 to $4/0.10
or $0.3 to 0.4/10 mils

Since .050 in. increase resulted in subcriticality.
The tableworths and displacements vs react. are not self-consistent

4x4 array Calc.

Unit	Cell Dim		
±4.76	± 5.87	Bare	0.989 ± 0.0022
	"	2 column Digitized	1.0030 ± 0.0022
	"	w. 0.12cm Al ±4.88	1.009 ± 0.003
	"	w. 0.24cm Al ±5.00	1.015 ± 0.003
±4.76	±8.47	Reflected	1.0222 ± 0.0027
		2 column Dig.	1.0292 ± 0.0027
		w. 0.12cm Al	1.025 ± 0.003
		w. 0.24cm Al	1.037 ± 0.003

10 fission/sec kg 238 ~ 20 n/sec/kg

$10 \times 400 \times 2 = 8 \times 10^3$ n/sec

3¼ modules
331 kg
$\times .375 = 125$ kg ^{238}U
$\times 20$
$\sim 2.5 \times 10^3$ n/sec

for ~~[illegible] kg~~ 640 kg
$\times 20 = 1.28 \times 10^4$ n/sec estimated source strength

for 64 unit array

3.75 in. Cubes for Array Experiments

		100	16 233				
71	16 291	101	242	131	16 205		
72	16 279	102	270			152	16 238
		103	251	133	236	153	260
		104	190	134	217	154	280
75	16 276			135	196	155	229
76	16 188	106	16 217	136	16 251	156	16 243
77	268	107	212	137	242	157	239
78	192					158	228
79	265	109	253	139	242	159	238
80	271	110	225	140	207	160	236
81	16 275		6600	141	16 216		
82	230			142	214	162	232
83	289			143	243	163	264
84	283					164	166
85	240			145	286	165	227
						166	256
86	16 270			146	16 240	167	229
87	215			147	256		
88	246			148	206	169	207
89	199			149	253	170	244
90	230			150	254	171	174
	4507				10564	172	195
						173	264
							15213

47 units Total Weight 763 433.

Av. Weight 16 243.468 U → 16 225.3 for a = 3.75 in. ρ = 18.7968

Av. Isotopic = .37486 235 → 6082.2 = 9.525 cm

Av. g U/g = .99888 238 → 10 143.1 a/2 = 4.7625 cm

235 7.03827 g/cm³ 235 → 1.8040 E-2

238 11.7375 238 → 2.9705 E-2

64 units

Total Weight 1039 213.

16 237.703 U = 16 219.52 ρ = 18.7692

.37486 ^{235}U = 6080.05 7.0358 1.8034 E-2

.99888 ^{238}U = 10139.47 11.7334 2.9695 E-2

Instrument Check on 12-2-71 Source 10 mc ^{60}Co

PM-1 950V Bal 5.00 Low Trip OK Alarm Trip OK
~~PM-2~~ Alarm Trip
IC-1 3×10^{-10} Meter Trip OK Fast Trip Scram Table
IC-2 3×10^{-10} Meter Trip OK Monitor
IC-3 $\sim 2 \times 10^{-9}$ Calibration Auth A OK
IC-4 1.5×10^{-9} Calibration Auth B OK
CRM Meter Trip C OK

Source Rep ✓
Red Pkt ✓
Personnel ✓
ΔP ✓
Bypass ✓
Inst Sc. ✓

Table position has new zero

EXP # 48

Start Assembly Array II w. 3.75 in. 0.625 spacing

2 x 2 x 2 Array, Reflected (CH_2) w. small amount of Plexiglas.
Spacing between units vertically maintained by
4 ea 5/8 x 5/8 x 8.75 in Alum. Bars
Spacing beneath maintained by
4 ea 5/8 x 5/8 x 8.75 in. Alum Bars.
Other spacings set similarly with tables closed, without 3 side or top reflectors. (Bottom & part of 1 side of reflector present for alignment purposes.

9^{10} Tables Assembled — essentially no multiplication.
IC-3 2.0×10^{-12} Tables Closed 0.101

EXP. # 49

Moved 4 units on fixed table 5/8" so that when Tables are closed, units will be in contact with those 4 on the movable table.

9^{30} Start Assembly, Source Rep OK.

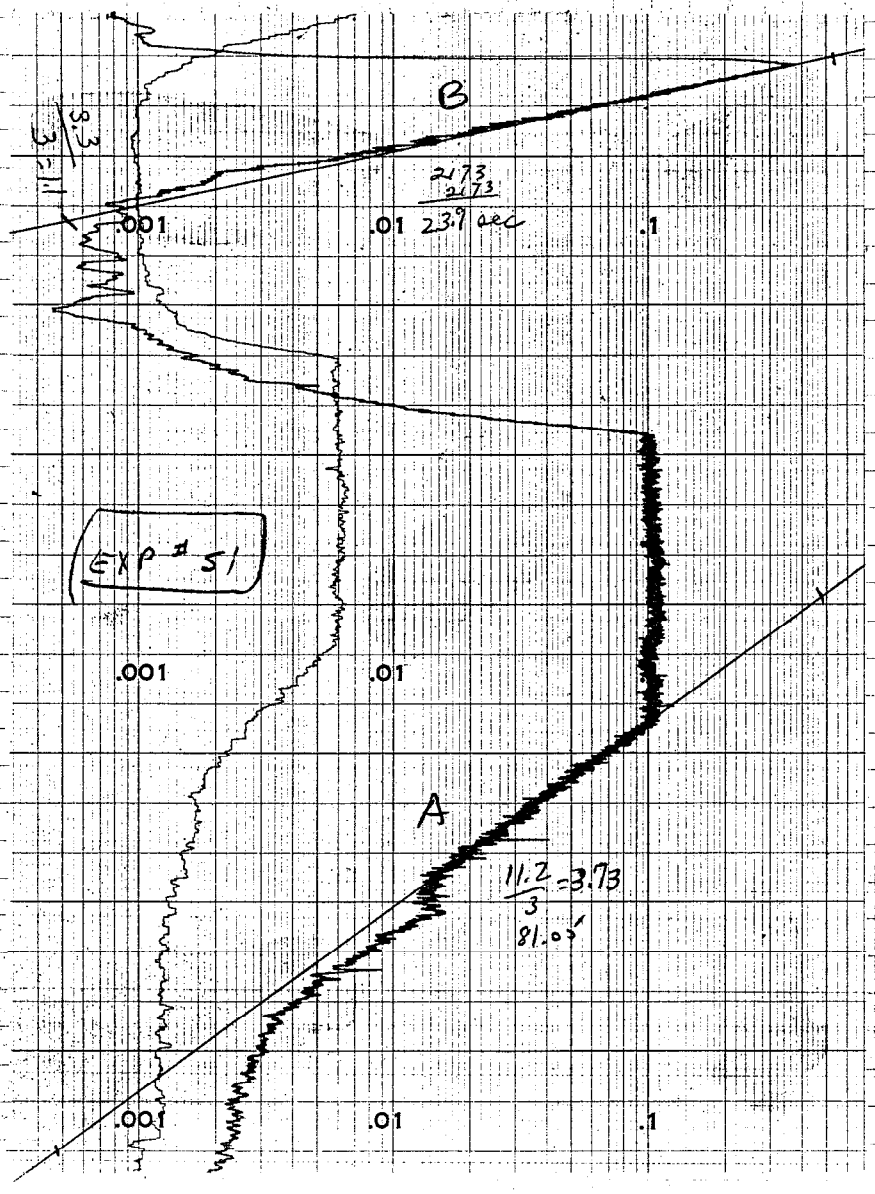
1.948 Contact

9^{50} Assembled Table -.101 Subcrit

Some Mult IC-3 2.4×10^{-12}

Rezero Indicator
Dec 13, 71 0.742
0.099

Table	Indicator	
21.5	1.941	
20.0	1.761	=1.66
18.0	1.523	=1.422
16.0	1.308	1.207
14.0	1.105	1.004
12.0	0.917	0.816
10.0	0.742	0.641
8.0	0.583	0.482
6	0.439	0.338
4	0.308	0.207
2	0.191	0.090
0	0.101	0.000


B
3.3
3 = 1.1
2173
2173
23.9 sec
.001
.01
.1
EXP # 51
.001
.01
A
11.2
3
= 3.73
81.05'
.001
.01
.1

EXP #50

Reduce Vert gap to 0 (units in contact) between units on fixed and movable Tables; gap between reflector and units maintained at 5/16" between units & Reflector
Top reflector gap now should be ~ 5/16" + 1/8" = 7/16"

10^{20} Source Resp OK Start Assembly
10^{35} Sub Critical Son Mult 8×10^{-12}.
Separate Tables > 2 inches

EXP #51

Moved N & S side reflectors on Tables to close gap between units and reflector.

10^{47} Start Assembly Source Resp OK
53 On Pos Period 0.201 − .101 in = 0.100 Period A (Reflector in contact at top.
55 Start To Level 81.05 sec → 11.33 ¢
1100 Level 0.216 − .101 = 0.115 $\frac{11.33}{.015}$ = $7.55/inch

Reduce Power

Pos Period 0.182 − .101 = 0.081 Period B
23.9 sec → 25.25 ¢ / .034 = $7.43/inch
System
5/8" gap E-W 0 gap Vertically and 0.115 gap N-S table sepn
.625 + .115 = .74

Use 0.25 gap for stacking new array.

See Page 57 12-6-71 data (put on wrong page)

12-6-71 Increase spacing to 0.300 between Units
Bottom spacing 0.125 + .025 = .150 Cell size 3.75 + .30 = 4.050 in.

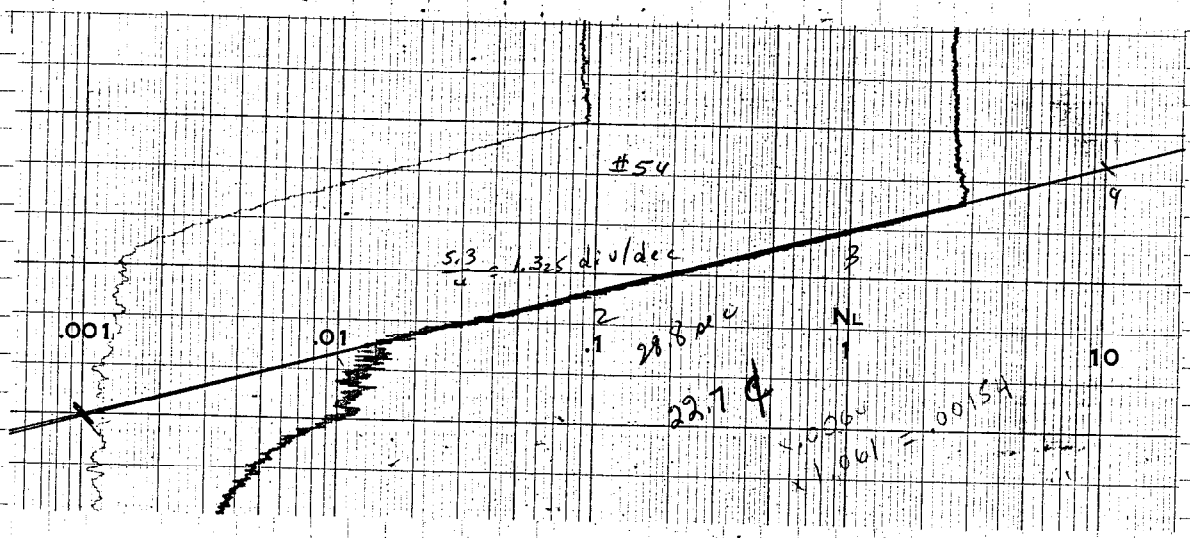
EXP #53

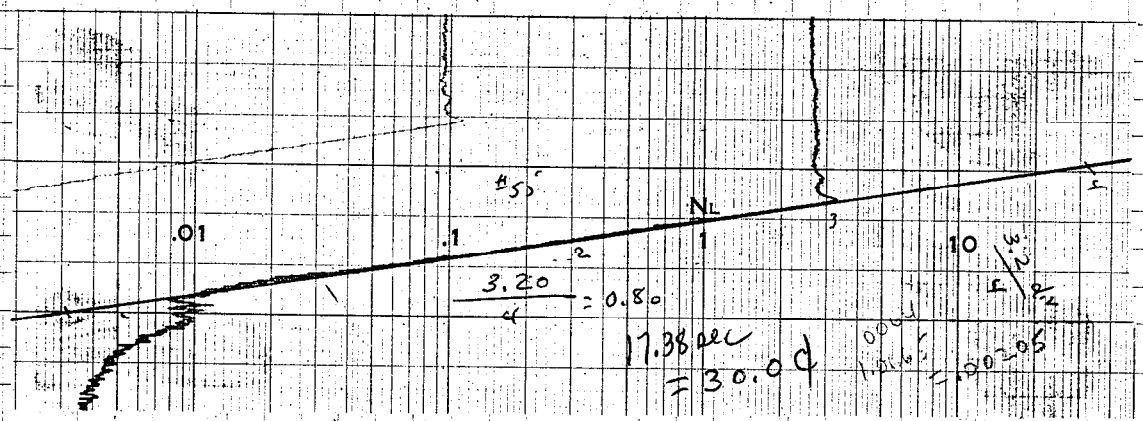
3^{20} Start assembly Red Lite On — Source Resp OK Core Size 8.1 × 8.1 × 8.1
Tables > 2.0 in. Note Table Indicator 1.939
2.030 1.939 = 0.091 in. & change 0.0

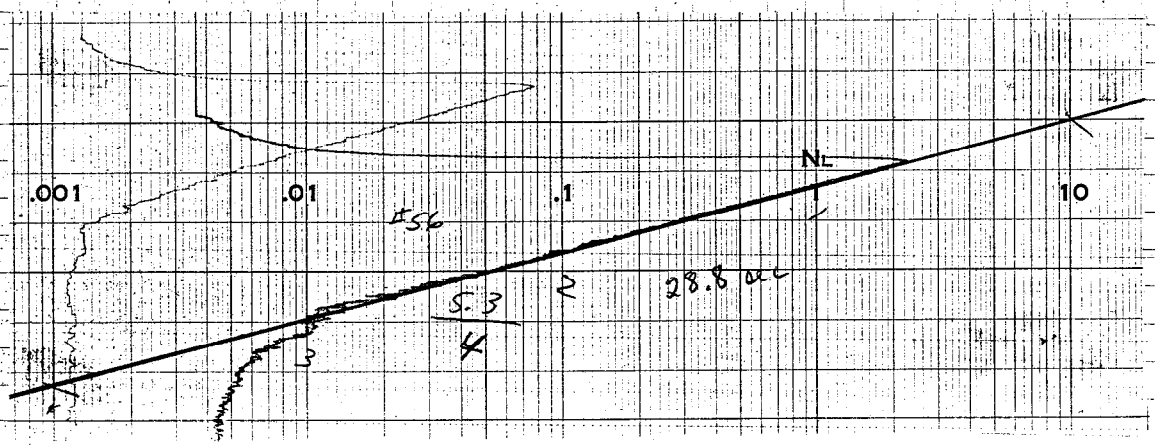
3^{30} Subcritical
Source Removed

Change spacing to (0.240) + .016 = (0.256) + 3.75 = 4.006
0.125 + .008 = 0.133
Core size 8.022 × 8.022 × 8.022

N.B. Spacer used to set gap between units was 0.010 under size, gaps 0.256
Reflector gaps set at 0.133


#54
5.3/4 = 1.325 div/dec
.001
.01
.1
1
10
NL
28.8 sec
22.1 ¢


#55
.01
.1
1
10
NL
3.20/4 = 0.80
17.38 sec
= 30.0 ¢


.001
.01
.1
1
10
NL
#56
5.3/4
28.8 sec

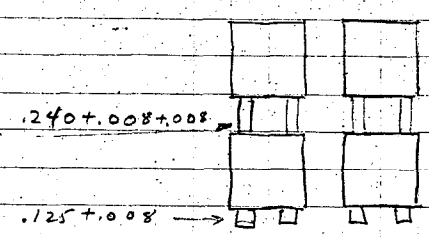
Instrument Check on 12-7-71 Source 10 mc ^{60}Co

PM-1 9.50 V Bal 4.80 Low Trip OK Alarm Trip OK
PM-2 Alarm Trip
IC-1 Meter Trip OK Fast Trip OK
Put Chamber Under Assembly ← IC-2 Meter Trip Scram Temp = 21°C
IC-3 1.2×10^{-10} Calibration DWM A OK
IC-4 1.8×10^{-10} Calibration DWM B OK
CRM Meter Trip C OK

EXP # 54

With spacers set gaps at reflector @ .125 + .008 = .133
between units @ .240 + .016 = .256 DWM Dec 9

Cell unit size 3.75 + .266 = 4.016 ± .010 or less.
Spacers are accurate to perhaps 5 mils



9 42 AM Start Assembly Source Resp OK Red Light & Pers OK Bypass OK ΔP OK
53 AM On Pos Period Source Out, Table Ind .102 zero.

Last Rev of Closure affects reactivity, very little
10 02 Level Table Ind @ 0.181 ρ_{exc} = 22.7 ¢

EXP # 55

Add 2 ea 5/8 × 1/4 × 8 in Al Spacers between halves of Assembly

Add 2 ea 5/8 × 1/8 × 8 in Al Spacers 1 on top of N half
10 42 Start Assembly Source Resp OK Red Light OK 1 on " " S half
10 50 Tables Assembled ΔP OK
POS Period Ind zero 0.102 Bypass OK
10 59 Level 0.193

ρ_{exc} = 30.0 Δρ = 7.3 ¢

Remove Al spacers repeat 54.

EXP # 56

11 18 Start Assembly Source Resp OK ΔP OK Table Ind Max 1.93 ? Drift ?
11 26 On Pos Period Ind zero = 0.102 Rev 20.0 1.774 -.102
18.0 1.540 -.102
16.0 1.319 -.102
10.0 0.746

ρ_{ex} = 22.7 ¢

2 X 2 x 2 Array less react. of alum spacers

7.3 X 2 = 14.6 22.7

$\times \frac{.266}{.25} = 15.5$ ¢ —

7.2 ¢ excess reactivity of 2 x 2 x 2 with .266 spacer

.00051 x 2 x $\frac{.266}{.25}$ = .00109

.00[illegible] − .00[illegible] = .00045

Units used in Assembly

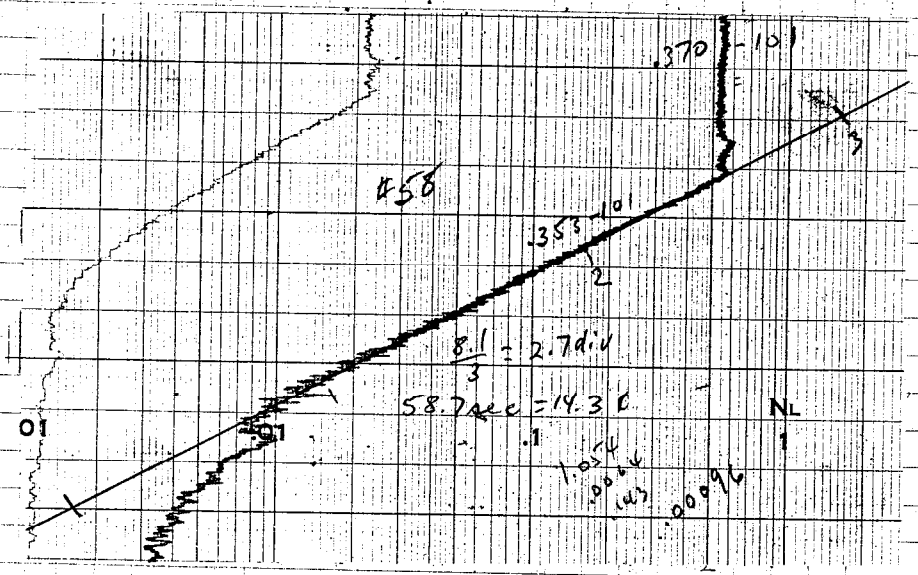
No.	wt
0080	16 271
0100	16 233
0110	16 225
0141	16 216
0147	16 256
0149	16 253
0156	16 243
0157	16 239

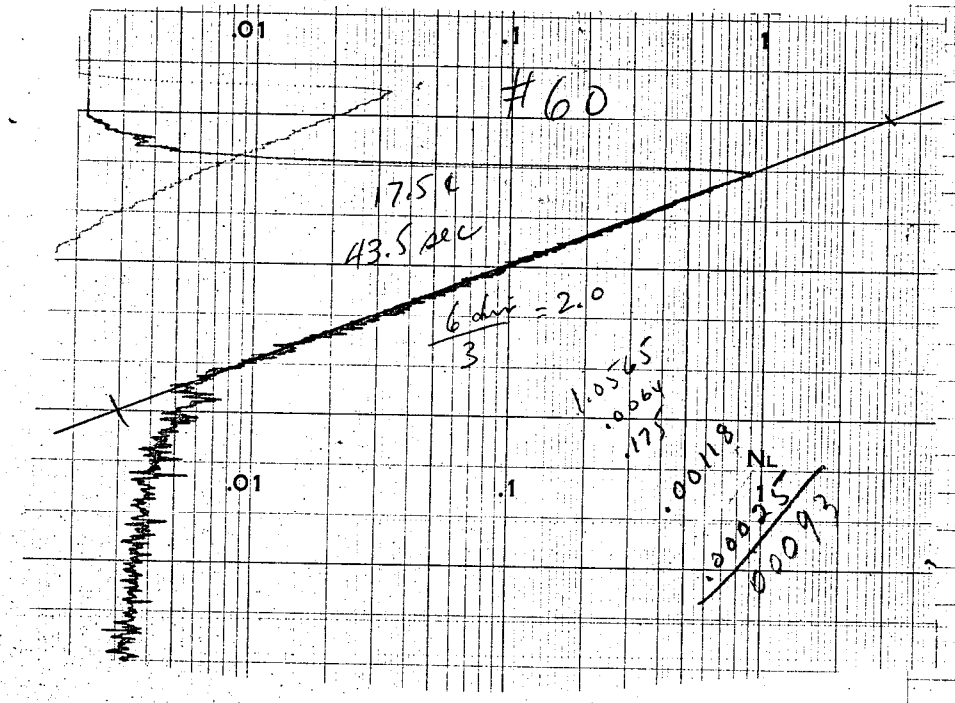
$av = \frac{129\,936}{8}$ g = 16242. (Not significantly different from av of 47 (16243.47)

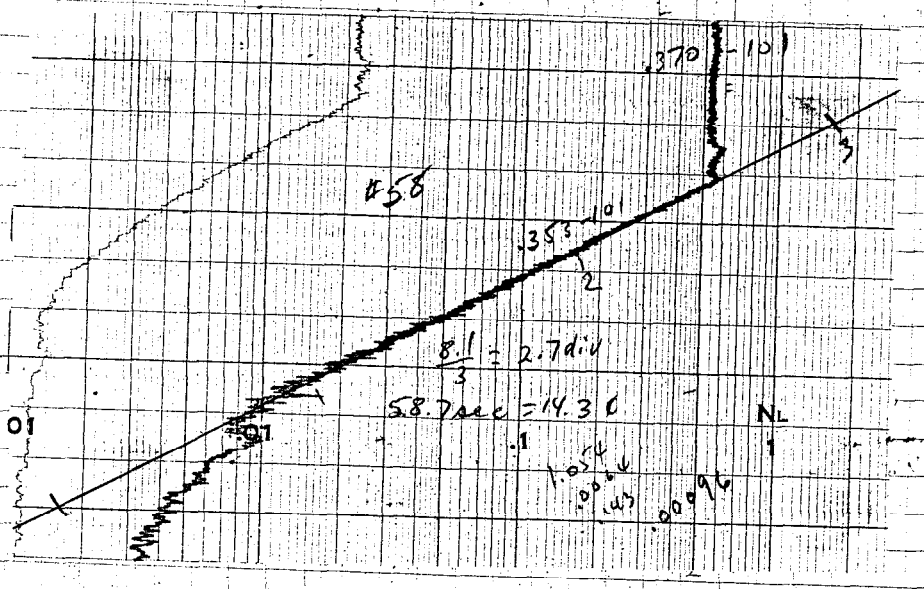
$\bar{\rho} = \left(\frac{3.75}{3.75 + .271}\right)^3 \times 18.77 = 15.225$ g/cm

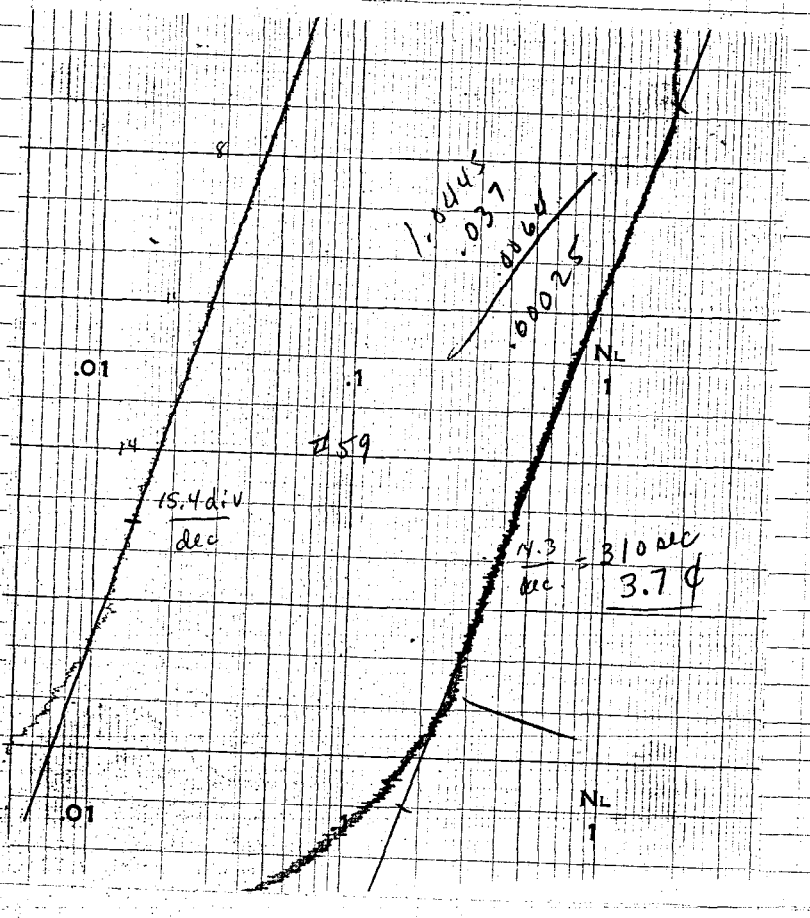
.814165

.811132


.370 -101
3
#58
.353 -101
2
8.1/3 = 2.7 div
58.7 sec = 14.3 ¢
NL
.01
.01
.1
1
1.054
.0064
.143
.00096


.01
.1
1
#60
17.5 ¢
43.5 sec
6 div/3 = 2.0
1.0565
.0064
.175
.00118
NL
.01
.1
1
.00025
.00093


.370 -101
3
#58
.353 -101
2
8.1/3 = 2.7 div
58.7 sec = 14.3 ¢
01
.01
.1
NL
1
1.054
.0064
.43
.00096


8
1.0445
.037
.0064
.00025
.01
.1
NL
1
14
#59
15.4 div/dec
14.3/dec = 310 sec
3.7 ¢
.01
NL
1

8 cubes as 1 Unit

Single Unit with Reflector Gap at 0.500 inches.
Assembly without top reflector for check on reactivity gain of combining 8 units into a single unit.

Single cell size 8.5 in Cube
Critical core size 2x2x2 was 8.032 cube

EXP #57

137 PM Start Assembly Red Pite Pers OK Source Resp OK, Bypass OK
145 Subcritical some multiplication

Removed side reflectors and aligned cubes in single unit - raised north table ~ 5-10 mils. Because of imperfect machining & handling - when units are in contact some light transmission by the crack is observed.

EXP #58

2 05 Start Assembly Source Resp OK Bypass OK Δp OK
2 16 On Pos Period Table Ind = 0.353 - .101 = .252
2 20 Start to level 0.370 - .101 = .269 in. gap
2 26 Level

+14.3 ¢ / .017 = $8.4 inch

EXP #59 Core size = #57

4 cubes as a Unit Cell size = 4.25 x 8.50 x 8.50
Tables Closed 4 cube unit oriented N-S and Vert.
And 4 unit aligned without top and N-S Side reflectors
3 12 Start Assembly Separated and replaced reflector
3 28 Tables Closed Source Out near critical Ind = 0.102 zero.
Insert source to raise power
3 32 Remove Source for Pos Period → 3.7 ¢
3 42 Start to Level
3 49 Level 0.142 - 102 = 0.040
Observed Top reflector gap to be greater than 0.500 in ~ 0.55 in and assembly must be checked!

EXP #60

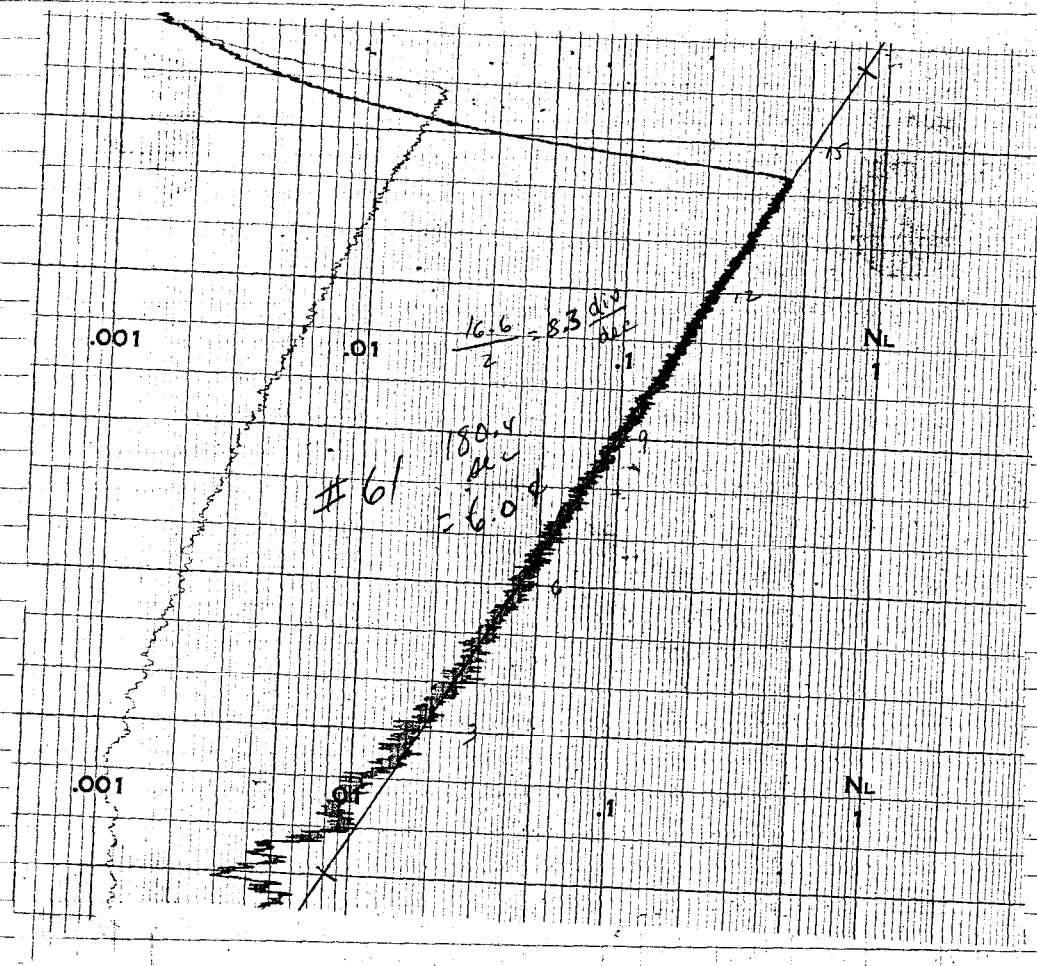
Added 0.506 x 1.0 x 8.0 Alum Bar on Top of N. Half.
Start Assembly, Source
4 12 On Pos. Period Source Out +17.5 ¢
Shut Down

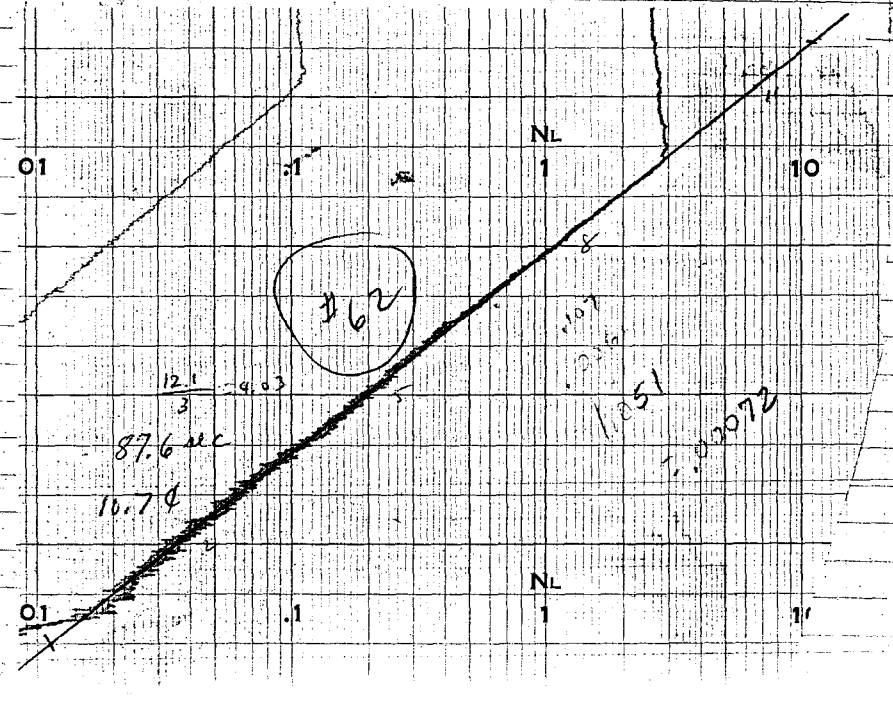
13.8 ¢ Due to Al

$\frac{20}{8} = 2\frac{1}{2}$

$\frac{5}{8} + \frac{5}{8} + \frac{5}{8} + \frac{5}{8} \times 13.8 = 34.5$ ¢

$\frac{2.5}{} \times .00093 = .00233$


.001
.01
.1
1
NL
16.6/2 = 8.3 deg/sec
#61
180.4 sec
= 6.0 ¢


.01
.1
1
10
NL
#62
12.1/3 = 4.03
87.6 sec
10.7 ¢
1.851
1.02072

Instrument Check on 12-8-71 **Source** 10 mc ^{60}Co

PM-1	950V Bal 4.80	Low Trip	Seram Table	~~Alarm~~ Hi Trip	OK
PM-2				Alarm Trip	
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	OK		
IC-3	1.8×10^{-10}	Calibration	DWM	A	OK
IC-4	1.5×10^{-10}	Calibration	DWM	B	OK
CRM		Meter Trip		C	OK

EXP #61

Recheck of Period for #59 with Top Reflector gap corrected to 0.50 in.

900 AM Source Resp. OK Start assembly — Δρ OK

910 Source Out on Pos Period Table Ind Zero = 0.101. → 6.0¢ — Red Lite OK

917 Separate Tables = 0.102 — Bypass OK

Remove Reflector — Source Resp OK

Check alignment with Tables closed

Separate Tables

Replace Refl.

EXP #62 — Repeat of #61

945 Start Assembly Source Resp OK

~~1000~~ 955 On Pos Period 0.102 → 10.7¢

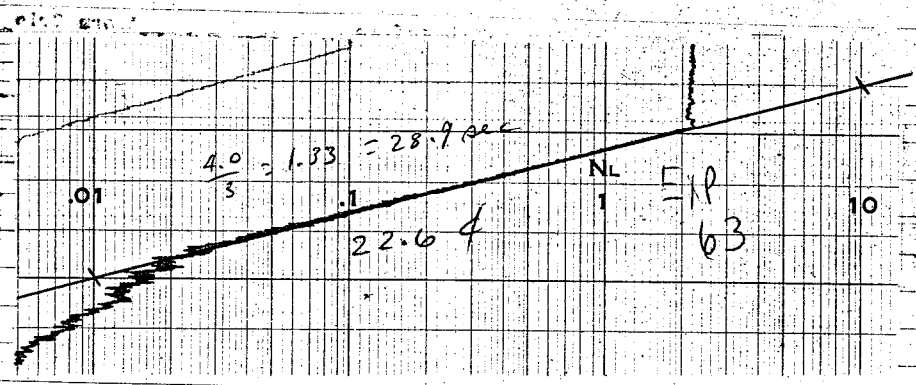
1000 Start to Level

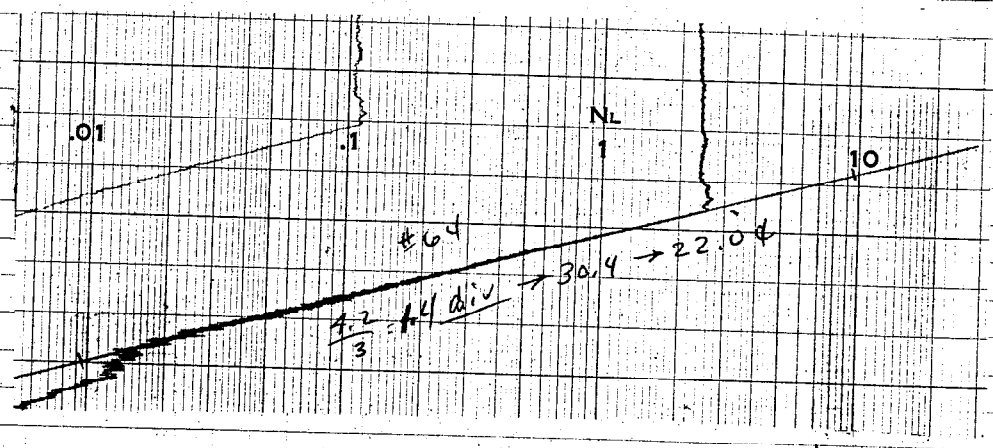
1006 Level 0.154

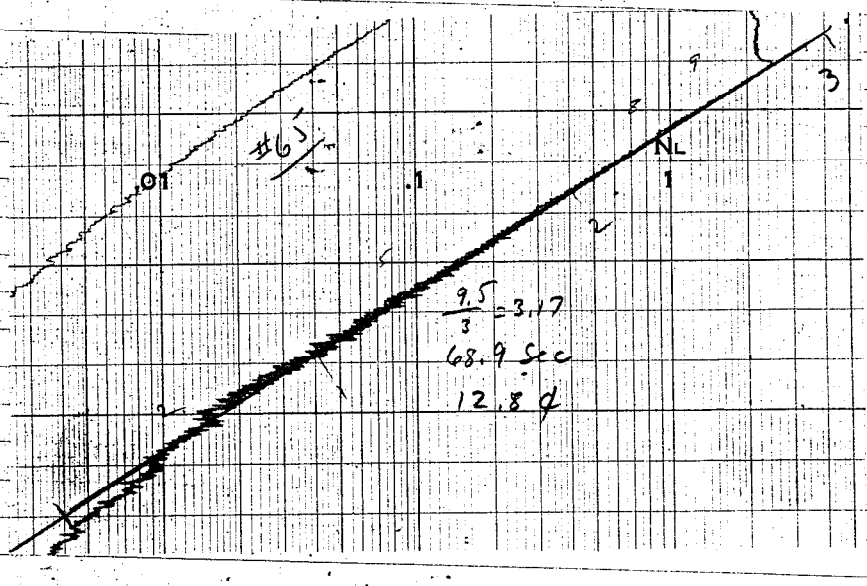
4 cubes per unit 2 N-S
1 E-W
2 Vert

2 units in E-W.

$$\bar{\rho} = \left(\frac{3.75}{4.25}\right)^3 18.77 = 12.894$$


.01
.1
NL
1
10
4.0/3 = 1.33 = 28.7 sec
22.6 d
Exp
63


.01
.1
NL
1
10
#64
4.2/3 = 1.4 div → 30.4 → 22.0 d


.01
.1
NL
1
2
3
#65
9.5/3 = 3.17
68.9 sec
12.8 d

Estimate 5/8" spacing around 2 x 2 x 2 unit will be near crit
Place units on 5/8" Al bars. 8 3/4" long
Assemble without some side refl and top refl
Align 2 x 2 x 2 unit
Separate tables
Assemble Reflector w. 5/8" gap

EXP #63

12^{41}	Start Assembly	Source Resp OK	Red Lite OK	Bypass OK	Op OK
50	On Pos Period		0.236		
52	Start to Level		0.276	−.102 = .174	+ 22.6 ¢ / .040 = $5.65 / in

Super critical with 0.174 in gap

Moved N-S end reflectors back 0.150 in.

EXP #64

1^{11}	Source Resp. OK	Start Assembly	Op OK	
1^{20}	On Pos Period source out	0.187	> 0.039	+ 22.0 / .039 = $5.64 / in
1^{23}	Start Level	0.226		

Δ = .276
226
.050

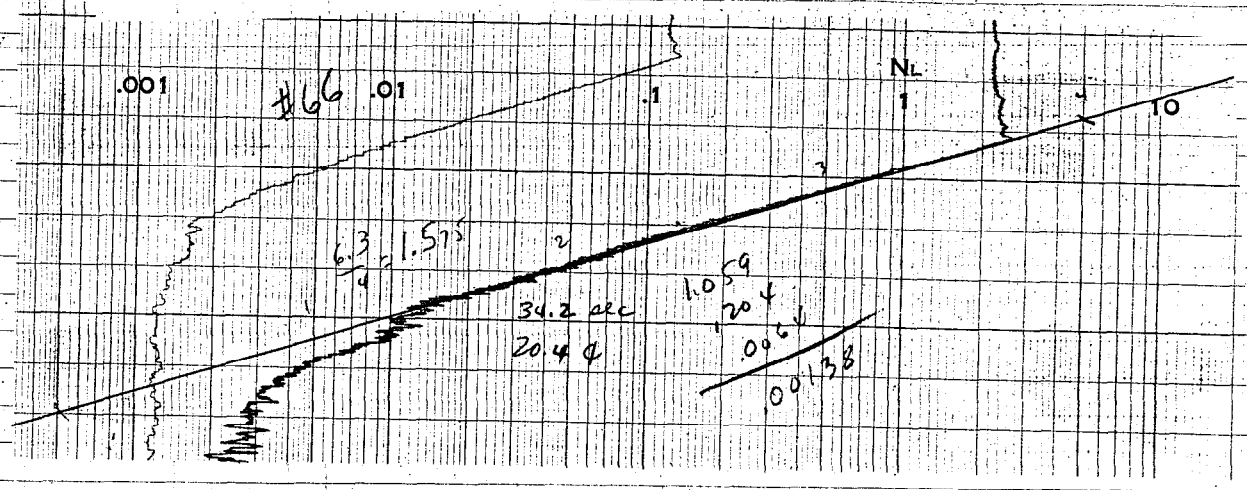
Moved N-S end reflectors to (5/8) + 1/8
Moved Top Reflector up to (5/8) + 1/4
Moved W side Reflector (west) to (5/8) + 1/4

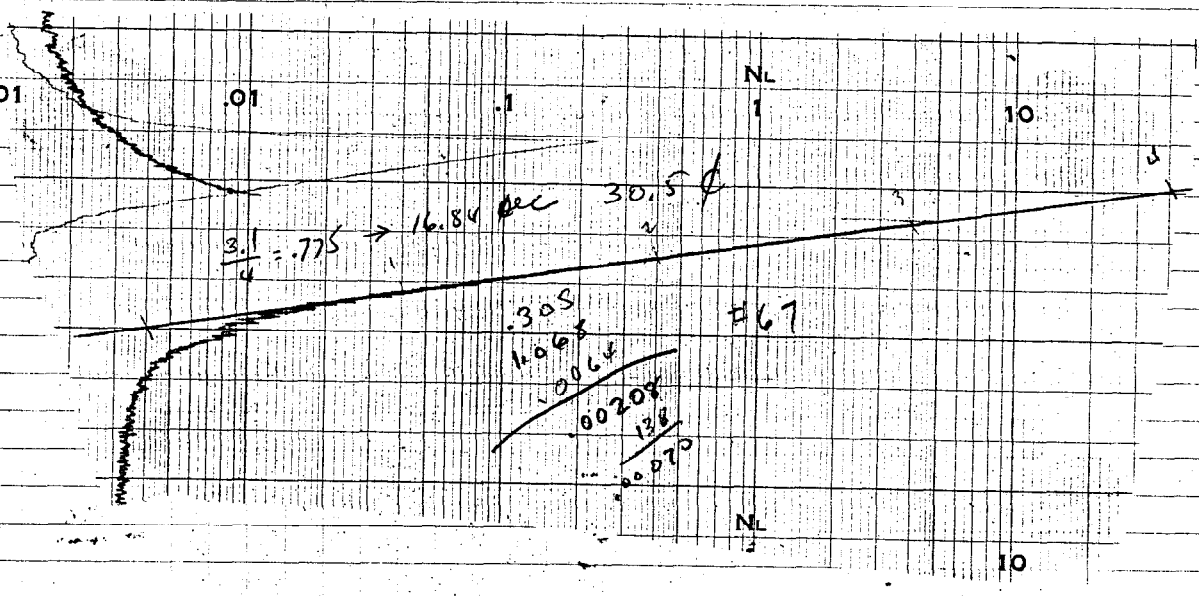
Reflector cavity now 9.0 x 9.0 x 9.0 with 2x2x2 off center by 1/8 east 1/8 down.

EXP #65

1^{50}	Start Assembly	Source Resp OK		
2^{01}	On Pos Period	Tables Closed	0.102	Source Out 12.8 ¢
2^{07}	Start To Level		~~0.1~~	
2^{1}			0.159	> 0.057 = $2.25/in

~~4 x .750 / .625 = 48 x ¢ =~~





2^{59}

2^{09}

2^{12}

2^{20}

2^{30} p

239

EXP # 66

Centered 2 x 2 x 2 CUBE UNIT in Reflector Box – GAP = 0.750 on 6 sides

2^{59} Start Assembly Source Resp. OK ΔP OK

On Pos Period

2^{04} Table Closed Source Out zero .103

2^{12} Start to level .171

2^{20} Level .068

$\frac{20.4\ ¢}{.068} = \$3.00/\text{inch}$

Add 1 ea 5/8 x 5/8 x 8 3/4 in.

EXP # 67

2^{30} PM Source Resp OK, ΔP OK Start Assembly

239 On pos. Period 0.103

IC-2 scale not changed 30.5 ¢

Inst trip for shut down

1 ea 5/8 x 5/8 Al = 10.1 ¢

$4 \times \frac{.75}{.625} \times 10.5 = 50.4\ ¢$ $4 \times \frac{75}{625} \times .00070 = .00336$

Unperturbed system = +20.4 ¢

Al correction −50.4 ¢

−30.0 ¢

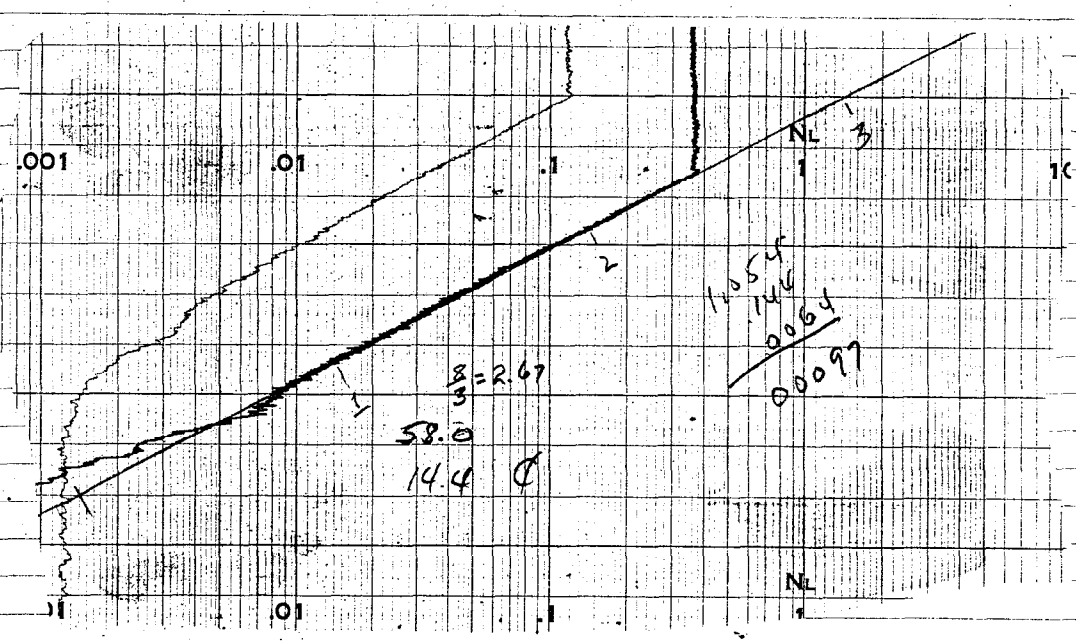
$\rho = \left(\frac{3.75}{4.5}\right)^3 18.77$

$.54696_{47} = 10.862$

20.4

12.8

5.6



943

1255

105

109

114

238	53	-5	-33	0	
	41	4	-3	22	
	38	32	-21	42	12
	-50	13	-42	-9	
	30	-48	13	5	
	-46	-21	4	1	24
	27	-26	4	-10	
	33	15	-31	0	
	37	-13	-23	-2	36
	-8		-24	-6	
	51		5	26	
	45		48	-72	45
	2		2	-11	
	32		18	18	
	-23		-32	-9	54
	8		15	-31	
	-39		16	6	
	-8			-64	62
				-43	
				26	64

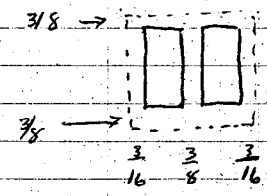
$$\sum \sigma^2 = 53763$$

$$\left(\frac{\sum \sigma^2}{n}\right)^{1/2} = 29$$

2 cube Units (1 x 1 x 2)

4 Unit Array. Estimated spacing 3/8 in.

Place 4 cubes in approx. alignment, no refl.
Close Tables
Align 4 units
Add 4 units on top
Check Alignment
Separate Tables
Add Reflector.



Reflector cavity
3.75
3.75
.375
.375
8.250 in cube

EXP # 68

Instrument Check on 12-9-71 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Alarm Trip	~~Scram~~ OK. Table
PM-2				Alarm Trip	
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	OK		
IC-3	2×10^{-10}	Calibration			A OK
IC-4	1.8×10^{-10}	Calibration			B OK
CRM		Meter Trip			C OK

Scram Tables on loss of Hi Press

943 Start Assembly Source Resp OK Δp OK Red Lite OK Bypass OK

Subcritical Very little Multiplication

Change gap to 0.322 between units and top & bottom
0.161 between side reflectors.

EXP # 69

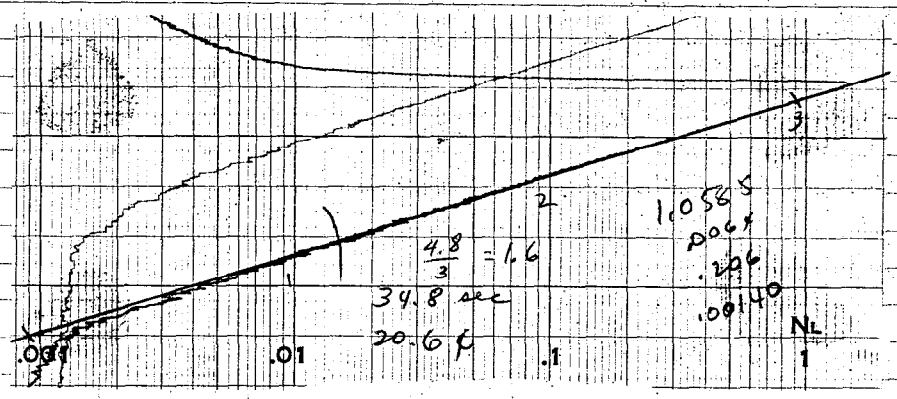
1255 Start Assembly — Source Resp OK Red Lite OK Δp OK
(Placed IC-3 under Assembly)
105 Tables Closed Source Out Table Ind. zero 0.103
On Pos Period
109 Start to Level
114 Level

3.75
.322
4.072
4.072
+14.4 ¢ 8.144 Refl. Cavity

0.190
14.4 / .087 = $1.65 / inch

1 ea x 5/8" x 8" Add 0.24 + .025 + .025 = 0.290 in on North Half

Wall: Al in #69 = 4 x .322/2.9 x 6.2 = 27.5



$$\frac{.00140}{.00043} \times 4 \times \frac{.322}{.29} = .00191$$

EXP #70 (EXP #69 + alum)

Check Reactivity with added 0.29 x ½ x 8 in alum

1^{24} Start Assembly Source Resp OK Op OK

1^{32} On Positive Period Table zero 0.103

1^{35} Shut down without leveling

$\rho = 20.6$ ¢

14.4

6.2 ¢ worth of Al

+14.4

− 27.5

− 13.1 ¢

$6.2 \times \frac{.322}{.29} \times 4 = 27.5$

$\bar{\rho} = \left(\frac{3.75}{4.072}\right)^3 \times 18.77 = 14.660\ g/cm^3$

.781035

December 9-10, 13 & 14, 1971

attempts to align 3x3x3 (27 unit) system on "TINKERTOY" RODS were futile - Spacer system didn't work either.

J.T.T. also tried and remarked "this is impossible.

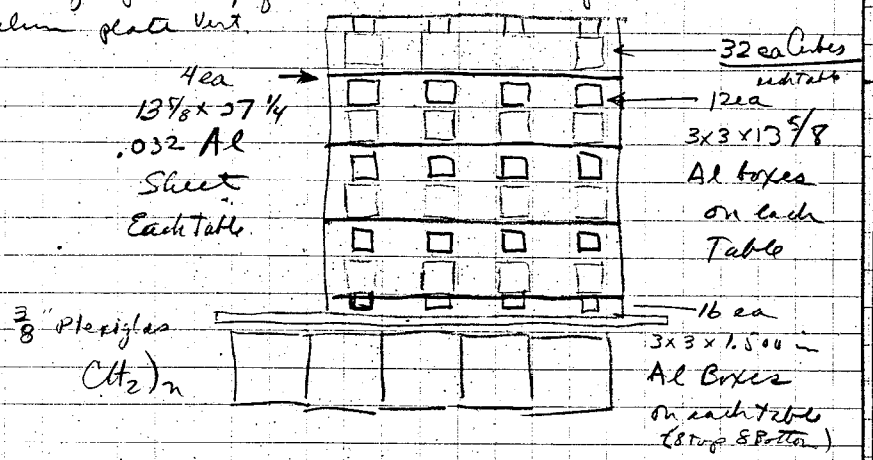
DWM

Calculate gap for 4x4 array is ~ 3.00 inches

Using 3x3 in Alum Boxes for spacers, first stack will be spaced 3 in + .032 in thick Alum plate Vert.

3 in. Box E W and N-S-

Spacing will be 3.032 in.



Tested one 3x3 x 13 5/8 box with 400 lbs ok

Expected total weight = 2x3 = 6 units x16.2 kg x 2.2 = 214 lbs.

DWM

12-17-71

[illegible]	0	0.100	0	0.099	0.000
[illegible]	2			0.125	0.025
[illegible]	4			[illegible]	0.207
0.0 Rev.	[illegible]			[illegible]	0.341
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	10			[illegible]	0.650
	12	0.924	.524	[illegible]	[illegible]
	14	1.117	1.017	[illegible]	1.118
	16	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	1.444	[illegible]	1.447
	20	[illegible]	[illegible]	[illegible]	[illegible]

ERR recalibrated Table Pos Ind ~ Dec 15, 1971.

ERR measured scram time on Dec 16, 1971.

Jan 4, 1972

The new method of spacing units was discussed with WCT & JTT and the Burhardt & Buxton committees were also informed.

Instrument Check on Jan 5, 72 Source 10 mc ^{60}Co from 19 in.

PM-1		Low Trip	Scram Table	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip	OK	Rad Monitor	
IC-3	5×10^{-10}	Calibration		A	OK
IC-4	3×10^{-11}	Calibration		B	OK
CRM		Meter Trip		C	OK

EXP # 71

Assembled Tables with 16 ea 16.2 kg units on each table
spaced 3 in x and y
" 3.032 in z direction — 4x4x2 array
half of the 4 x 4 x 4 array no top reflector

Very little Multiplication
IC-2 = $0.14 \times 3 \times 10^{-11}$ DWM CC

EXP # 72

Assembled Tables with 24 ea 16.2 kg Units on each Table
making a 4x4 x 3 array with out top reflector
IC-3 = 2.4×10^{-12}
Very little Multiplication IC-2 = $0.10 \times 3 \times 10^{-11}$
Check table Alignment OK

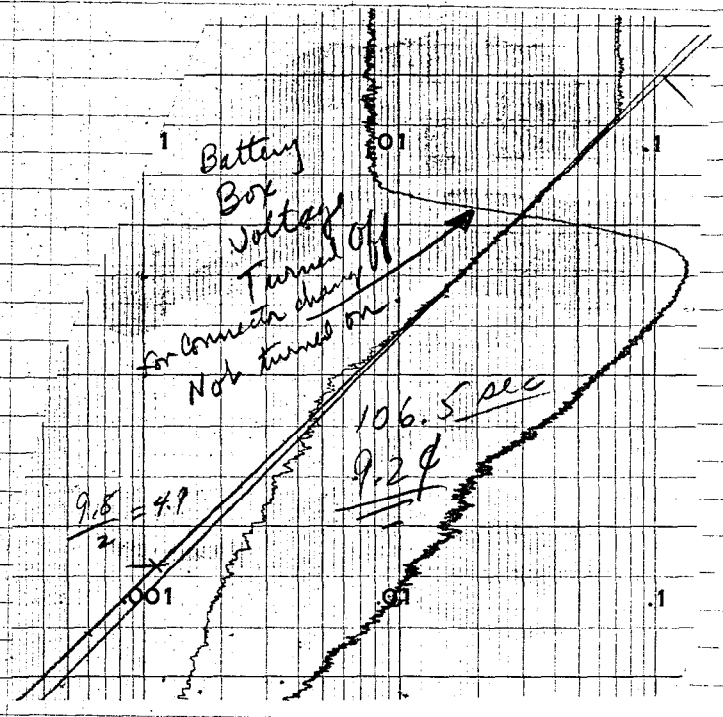
EXP # 73

4 x 4 x 4 Array of 16.2 kg units

spacing W to E 1.5, 3.0, 3.0, 3.0, 1.5+
" N to S 1.5+, 3.0, 3.0, 3.0, 1.5+
" Vert 1.532, 3.032, 3.032, 3.032, 1.532

3:20 PM Start Assembly Source Response on Table Assembly to 16.0 in.
ΔP OK, Pers Ch. OK, Rad Lit On, Bypass OK

3:08 PM Tables in contact 0.103
IC-1 $.03 \times 3 \times 10^{-11}$
2 $.28 \times 3 \times 10^{-11}$
3 7×10^{-12}
4 2.2×10^{-12} Some Multiplication but sub critical


1
.01
.1
Battery
Box
Voltage
Turned Off
for Connector change
Not turned on
106.5 sec
9.2¢
9.8/2 = 4.9
.001
.01
.1

Instrument Check on Jan 6 72 Source 10 mc ^{60}Co

Bal 4.60

PM-1	950V	Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1		Meter Trip	Scram Table	Fast Trip	OK
IC-2		Meter Trip	OK		Monitron
IC-3	1×10^{-9}	Calibration	Dwn		A OK
IC-4	1.5×10^{-9}	Calibration	Dwn		B OK
CRM		Meter Trip			C OK

EXP # 74

4 x 4 x 2 Double Unit assembly, Each unit 2 cubes in z direction
Reflected

N-S spacing 1.625, 3.0, 3.0, 3.0, 1.625

E-W Spacing 1.500, 3.0, 3.0, 3.0, 1.50

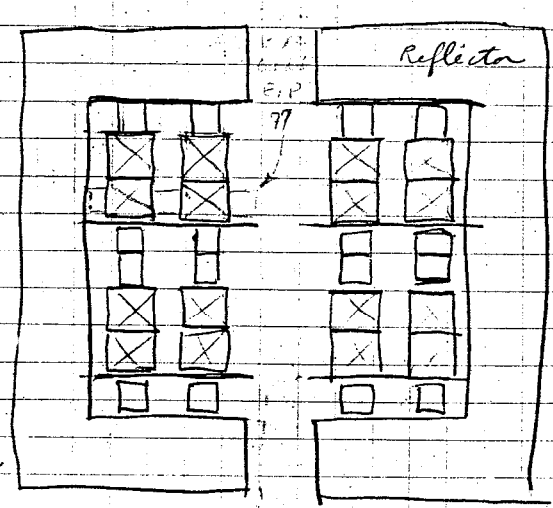
Final Z spacing 3.032, 6.032, 3.032

32 units in a 4 x 4 x 1 array (half assembly)

Assemble tables No multiplication IC-2 = .15 — 3×10^{-11}
Checked Spacing between units between halves. 3.00 OK
Exp #75 IC-3 = 3×10^{-12}

Double Unit Assembly 64 units, see above for dimensions

Core Dimensions (Inside Refl.)
N-S = 27.25
E-W = 27.00
Vert = 27.10



Red Lite, OK, Δp OK, Bypass OK, Source

1^{18} Start Assembly
1^{31} Source Out on Positive Period
Table Ind = 1.438 - .10
= 1.338

1^{40} Level Ind = 1.478 - .10
= 1.378

9.2/0.040 in

= 2.3 $/in x 1.378 ~ $4.4 super crit

Instrument Check on [illegible] 72 Source [illegible]

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1		Meter Trip		Fast Trip	
IC-2		Meter Trip			
IC-3		Calibration			
IC-4		Calibration			
ERM		Meter Trip			

EXP #76

N-S Spacing 1.563, 3.126, 3.126, 3.126, 1.563 27½
E-W Spacing " " " " " 27½
Vert " 3.032, 6.032, 3.032 with 3ea Alum Sheet 27" × 27" × 0.032" 28.096

Double Unit 4 × 4 × 2 Array Reflected

9 12 Source Response OK, Pers Ck, Δp OK, Bypass off Start assembly
9 24 On pos period Table Ind 1.124 − .1 = 1.024
26 Start to level at IC-3 = ~5 × 10⁻¹⁰
33 Table Ind 1.170 − .1 10.7¢

Δ = 0.046 → 10.7/.046 = 2.33 $/in.

Δx = 0.5 in
+ Δy = 0.5 in
=
ΔTable = 1.378 − 1.070 = 0.308

est. ρexc = 1.07 × 2.33 = $2.49

2-2-72 ρex = .07 × 212 = 15
.5 × 195 = 97.5
.5 × 115 = 57.5
170

EXP #77

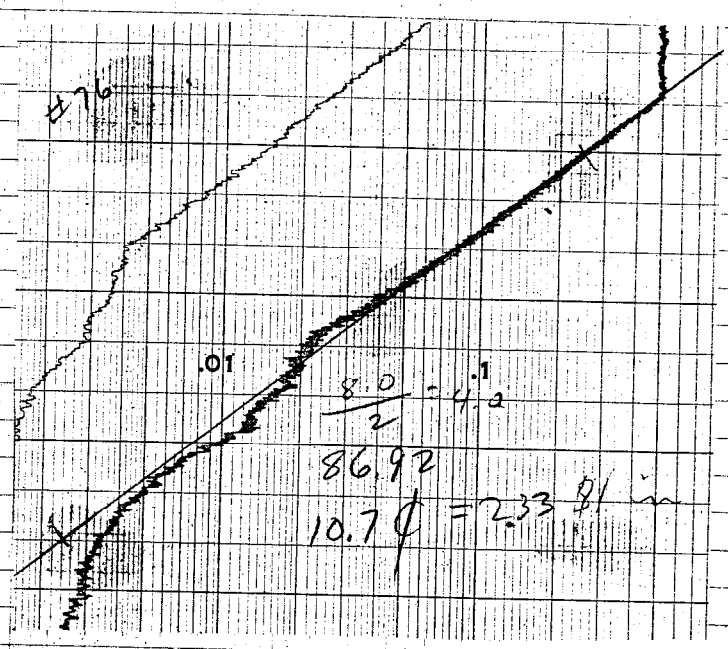
Add 3 boxes on Alum shelf supporting Top Units on North half Total length 37¼ in.

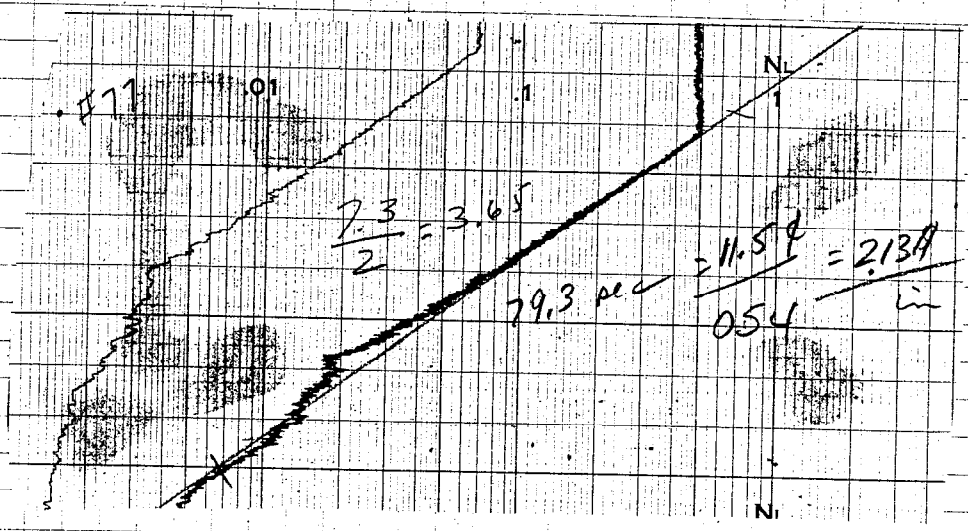
9 40 Start Assembly
48 On pos period 1.129 − .1 = 1.029 → 79.3 sec → 11.5¢
58 ~level 1.183
10 00 Level 1.183 − .1 = 1.083

11.5 / .054 = 2.13 $/in

Δρ = .013 × 2.23 $ = 2.9¢ ΔTable = 1.083 − 1.070 = .013
3 Boxes 3 boxes

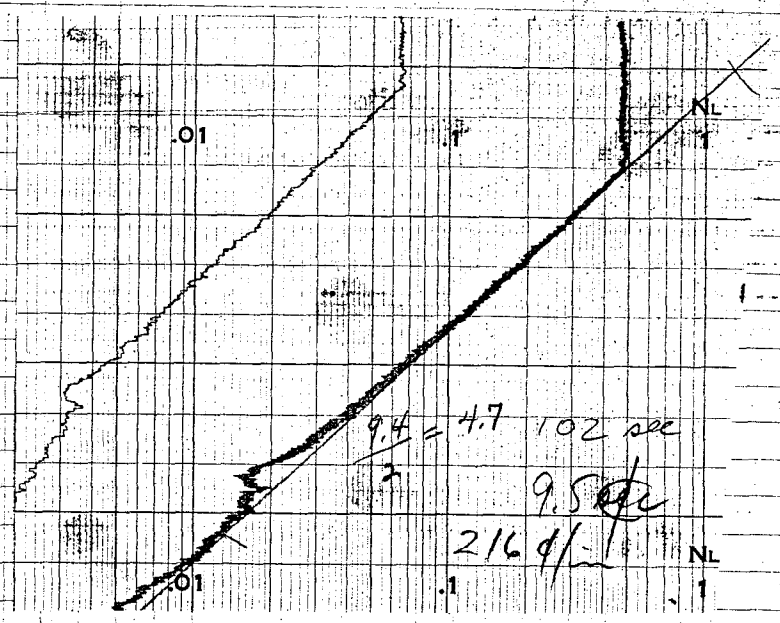
~1.0¢/box × 24 = $0.24
~3 layers Alum ?

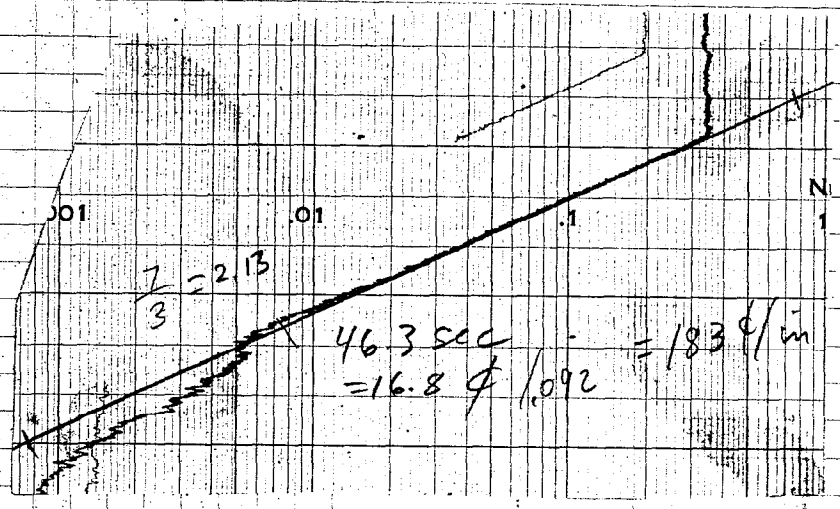




9 1
9 2
2
3

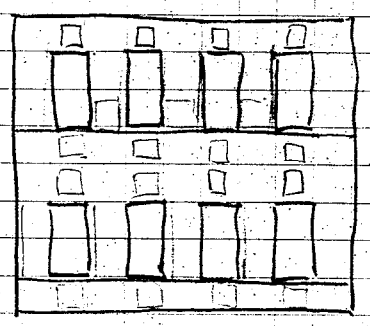
9 40
48
58
10 00


.01
.1
NL
1
9.4/2 = 4.7
102 sec
9.5 sec
216 ¢/in
.01
.1
NL
1


.001
.01
.1
NL
1
7/3 = 2.13
46.3 sec
= 16.8 ¢ /.092
= 183 ¢/in

EXP # 78 0.032 in

Add 8 pcs of alum ~ 6¾ x 13½ on North half



Source Resp OK Rec Lite Bypass

10^20 Start Assembly

10^27 On pos per 1.162 − .1 = 1.062

10^42 Level 1.206 − .1 = 1.106

1.106
1.083
.023 × 216 = 5.0¢

9.5 / .044 = 216 ¢/in

~2.5¢/per 13.5 × 27.0 in pc. × 6 = 15¢ exc

1.0 ... 1.4

1.2 ... 2.5

.075	.075	16
.20	.20	.172

.02 × 2.2 = ... in

3.20	6.4
.032	.032
3.168	6.368

If ... 3.25 ... x ... then vert 3.092 should be crit.

EXP # 79 Core

E-W Spacing 1.625, 3.25, 3.25, 3.25, 1.625 28 in. ~~mon~~

N-S Spacing " " " " " 28 in. ~~mon~~

Vertical " 3.032, 6.064, 3.032

12.096 = 27.1
15
27.096 measurement

	N	S
E-W	71.2 cm	71.2
	71.4	71.2
Vert	68.9	68.9
	68.9	68.9

3^00 Source Resp OK, Bypasses OK, Ap OK, Pers & Rec Lite OK, Start assembly

3^08 On Pos Period 0.621 − .1 = 0.521

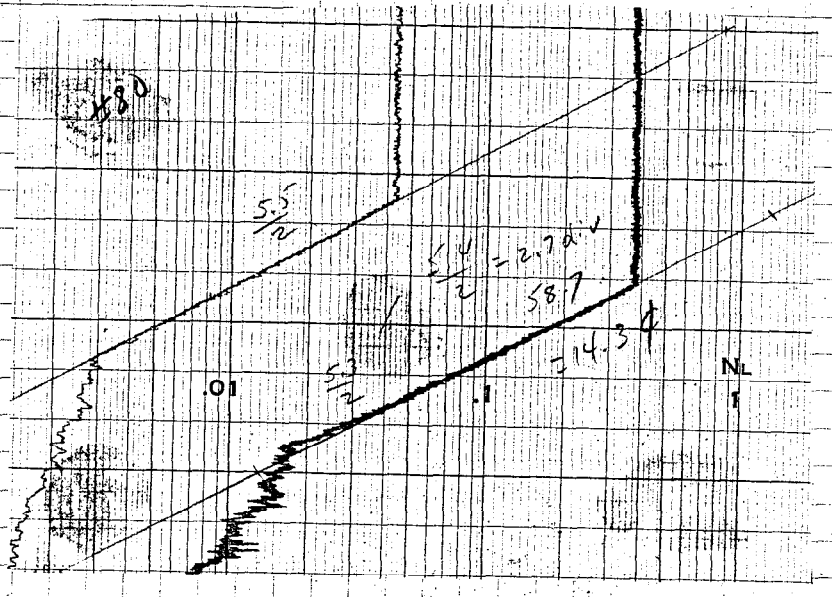
3^10 Start to level @ IC-3 = 3.5 × 10^-10

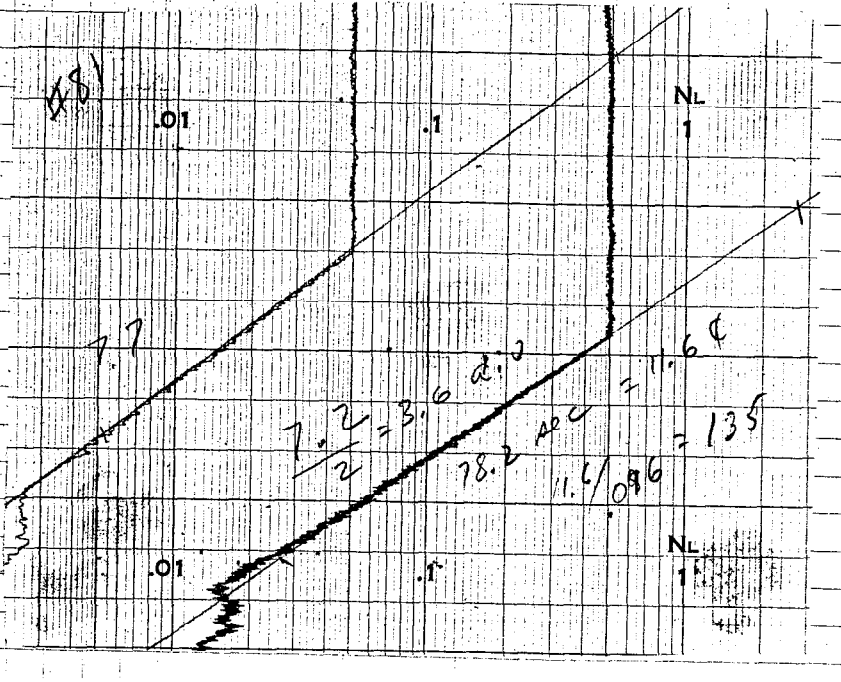
3^17 Level 0.713 − .1 = 0.613

16.8¢ / .092 in → 183¢ in

2-2-72 .113 × 183 20.7
.15 × 1.5 57.5
78.2¢

... = 183 × .613 = 111¢


#80
5.5/2
5.4/2 = 2.7 div
58.7
= 14.3 ¢
5.3/2
.01
.1
NL
1


#81
.01
.1
NL
1
7.7
7.2/2 = 3.6 div
78.2 sec = 11.6 ¢
11.6/.096 = 135
.01
.1
NL
1

3.00 ρ_{exc} = (2.3 + 1.3)/2 × 1.378 = 2.6 $ > .9
3.125 = (2.16 + 1.0)/2 × 1.070 = 1.7 $ > .9
3.25 = 1.83 + 0.8)/2 × .613 = 0.8 $

Estimate 3.25 − 3.032 = 0.218 change in vert dir
will be supercritical $\frac{109}{125}$ × 0.96 = .848

~~Jan 10, 1972 — M. Garrison to make 16ea 6.468~~
~~32ea 3.218~~

3.25
3.25
3.03
9.53 / 3 = 3.18

Instrument Check on _____ **Source** _____

950 Volt

PM-1	Bal 4.60	Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip	Scram Tables		Monitor
IC-3	1.5×10^{-9}	Calibration	Down		A OK
IC-4	1.5×10^{-9}	Calibration	Down		B OK
CRM		Meter Trip			C OK

Exp # 80

4 × 4 × 4 Array with E−W 1.375, 2.75, 2.75, 2.75, 1.375
N−S 1.875, 2.75, 2.75, 2.75, 1.875
Vert 1.532, 3.032, 3.032, 3.032, 1.532

1.375 in gap on E wall of reflector cavity was 2.375 until pieces of plexiglas 6ea 1 × 12 × 6 were inserted, should have been 1 × 13.5 × 6.75 to fill the gap completely
1ea 1 × 12 × 5, 1ea 1 × 12 × 5¼

Source response OK, Red Lite & Pers. Ch OK, Bypass OK
Δp OK

1 10 Start Assembly
1 18 On positive Period 0.876 − .1 = .776
1 21 Start to Level @ TC-2 = .6 × 10 × 10^{-10}
1 28½ Level 0.944 − .1 = .844
Shut down

14.3 ¢ / 0.068 = 210 ¢ / in

.844 × 150 = 126 ¢
42

EXP # 81

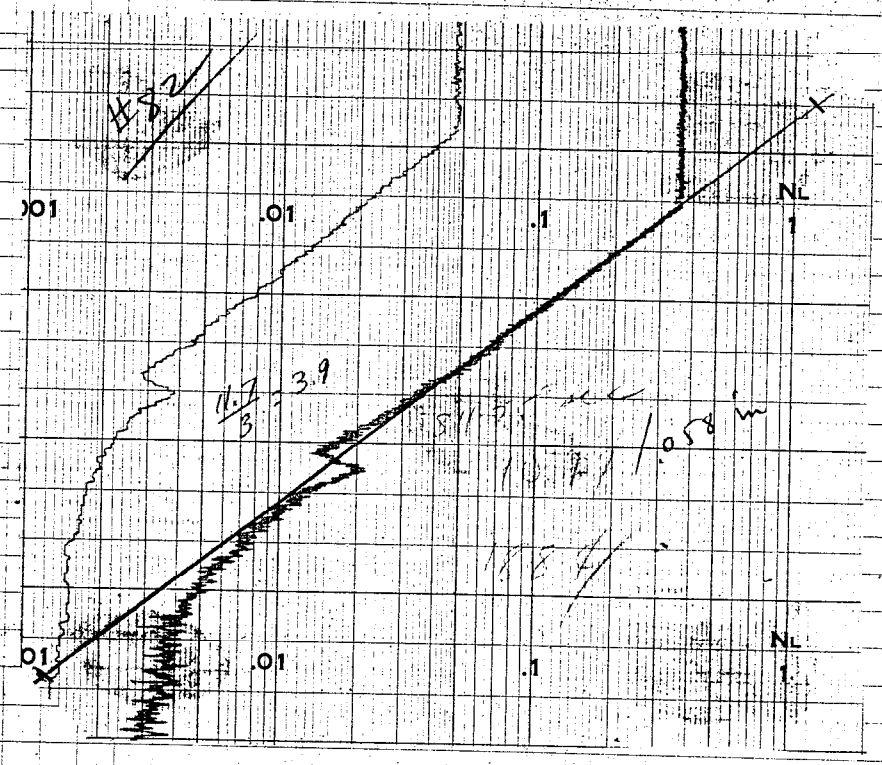
Remove 1" plastic from E face of reflector cavity

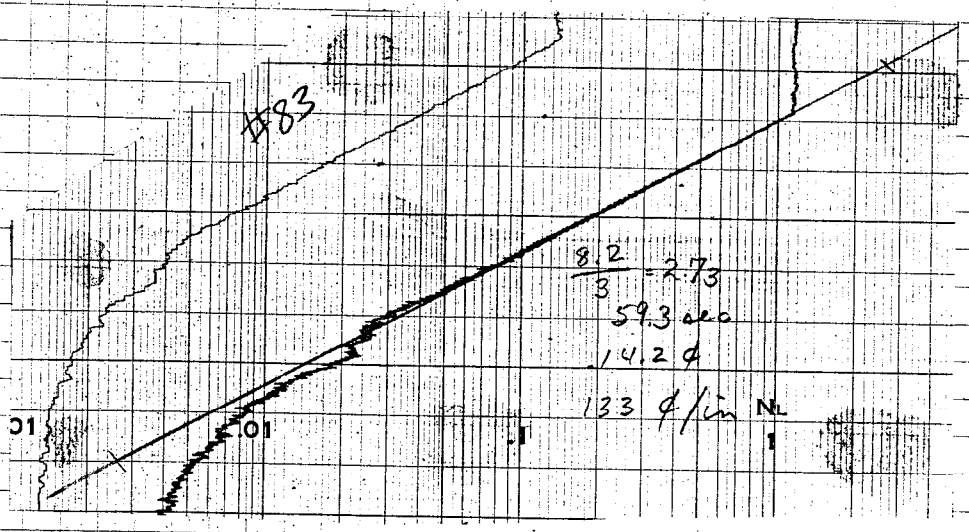
4 × 4 × 4 Array with E−W 2.375, 2.75, 2.75, 2.75, 1.375
N−S 1.875, 2.75, 2.75, 2.75, 1.875
Vert 1.532, 3.032, 3.032, 3.032, 1.532

1.35 Start Ass.
1 43 On pos Period 0.364
1 45½ Start to Level @ .6 × 10 × 10^{-10}
1 54 Level 0.450 / .086 = 11.6 ¢ / .1 = .35 = 135 ¢ / in ch

.35 × 110 = 38.50 ¢

ρ(1" Ear) = 88 ¢


#82
.01
.01
.1
NL
1
11.7/3 = 3.9
.058 in
.01
.01
.1
NL
1


#83
8.2/3 = 2.73
59.3 deg
14.2 ¢
133 ¢/in
.01
.01
.1
NL
1

Exp #82

4 x 4 x 4 Array E-W 1.375, 2.75, 2.75, 2.75, 1.375
N-S 1.500, 3.00, 3.00, 3.00, 1.50
Vert 1.532, 3.032, 3.032, 3.032, 1.532

26.0 x 27.0 x 27.160
or 26.720

Instrument Check on Jun 11 72 Source 10mc ^{60}Co

950V PM-1 Bal 4.50 Low Trip Scram Table Alarm Trip OK
PM-2 Alarm Trip
IC-1 3×10^{-10} Meter Trip OK Fast Trip OK
IC-2 3×10^{-10} Meter Trip Monitor
IC-3 1.8×10^{-10} Calibration A OK
IC-4 2.0×10^{-10} Calibration B OK
CRM Meter Trip C OK

Source Inserted, Δρ OK Rod X-y, ρ Res. Ch OK, Bypass Panel Sch

9:19 AM Start Assembly
29 On Positive Period Table Rod = 0.711 − .1 = .612 } 10.9¢
31½ Start to level
.2 Level = 0.769 − .1 = .669

10.9 / .058 = 188¢/in

Total ρ = .67 x 135 = 90¢
115/3 = 57.5
135 x .17 31.5 89¢

Exp #83

4 x 4 x 4 Array E-W 1.438, 2.[illegible], [illegible], [illegible], 1.438
N-S 1.5, 3.0, [illegible], [illegible], 1.5
Vert 1.532, 3.0[illegible], [illegible], [illegible], 1.532

1:15 Start Assembly
1:24 On Pos Period 0.349 − .1 = .249 → 59.3 sec → 14.2¢ 26.5 x 27 x 27.160
1:26 Start to Level 8.907/3 = 2.970 or 26.887
31 Level @ 0.615 x 3 x 10⁻⁹ on IC-2
0.456 − .1 = .356 average
.356 x 110¢/in
= 39¢ excess
51¢/.125 = .4¢/MIL or 400¢/in
126¢/in 3 dir

14.2¢/.107 = 133¢

Machine
32 ea 2.936
16 ea 2.968 2-3-72
16 ea 1.484
Make core 2.968
3.75
6.718 x 4 = 26.872

This core has only 2 shelves of 032 Alum

2.96875 / 32 = 2.937
1.4844 / 32 = 1.452
2.907 / 49 = 2.956 / 32 = 2.924
1.478 / 32 = 1.446

204/.4 = 50 mil

26.0 x 27.0 x 27.160
av 26.720

Instrument Check on Jan 11 72 Source 10mc ^{60}Co

950V

PM-1	Bat 4.50	Low Trip	Scram Tables	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip			Moulton
IC-3	1.8×10^{-10}	Calibration			A OK
IC-4	2.0×10^{-10}	Calibration			B OK
CRM		Meter Trip			C OK

Source Inserted, Δp OK Rec Ch. & Pers. Ch OK, Bypass Panel Set

9 19 AM Start Assembly
29 On Positive Period Table Ind = 0.711 − .1 = .612
31½ Start to level
.2 Level = 0.769 − .1 = .669 } 10.9¢

10.9 / .058 = 188¢/in

Total ρ = .67 x 135 = 90¢
115/2 = 57.5
185 x .17 31.5 89¢

Exp# 83

4 x 4 x 4 Array E-W 1.438 1.438
N-S 1.5 3.0 1.5
Vert 1.532 3.0 1.532

1 15 Start Assembly
1 24 On Pos Period 0.349 − .1 = .249 → 59.3 sec → 14.2¢ 26.5 x 27 x 27.160
1 26 Start to Level
31 Level @ 0.615 x 3 x 10⁻⁹ on IC-2
0.456 − .1 = .356
14.2¢/.107 = 133¢

8.907/3 = 2.970 av 26.887

.356 x 110¢/in average
= 39¢ excess
51¢/.125 = .4¢/MIL or 400¢/in
12¢/in 3 dir

Machine
32 ea 2.936
16 ea 2.968
16 ea 1.484
Makes core 2.968
3.75
6.718 x 4 = 26.872

2-3-72

This core has only 2 shelves of 032 Alum

2.96875 / 32 = 2.937
1.4844 / 32 = 1.452
2.907 / 49 = 2.956 / 32 = 2.924
1.478 / 32 = 1.446

20¢/.4/mil = 50 mil

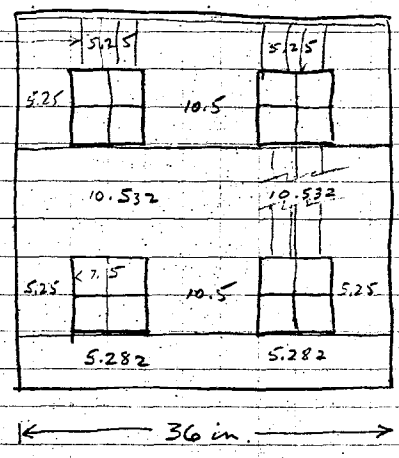
Bottom of page 95
SJ

64 units 2 x 2 x 2 Array of Units which are (2x2x2) = 8 cubes each

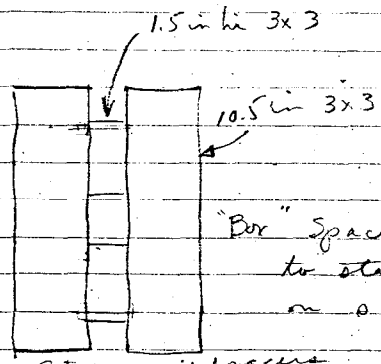
Spacers on top not used

Top Reflector Slabs of Polyethylene ~6" x 27½ x 68" Vert 36.096

Mounted Source Drive on Top Reflector Slab

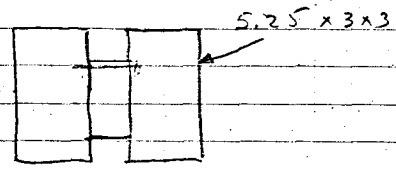


5.25
5.25
3.75
3.75
18.00
2
36.00



Between unit spacers

"Box" Spacers were bolted together in the N-S direction to stabilize the stack and prevent disruption on scram. Discussed with WCT. —



Bottom spacer.

Aligned Reflector edges before stacking 2 units of 8 cubes each on Fix. Table

3:10 PM Jan

With 2 units on North

2 units on South Check Multiplication when Assembled

M-230 source between units on South Table.

Essentially no multiplication when assembled.

Instrument Check on Jan 13 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	[illegible]	OK		Monitor
IC-3	1.8×10	[illegible]	DWM		A OK
IC-4	1.8	[illegible]	DWM		B OK
CRM		Meter Trip			C OK

M-230 PuBe Source Inserted between upper units on STable

EXP #84

2×2×2 Array of (2×2×2) cube Units
Source Inserted
Red Lite Pers Ch
Bypass Panel Set
Up OK

Spacings
EW 5.25, 10.50, 5.25
NS 5.25, 10.50, 5.25
Vert 5.282, 10.532, (5.186)
Core 36.00 × 36.0 × 36.0

DWM CC ADC

8 30 Start Assembly
8 00 Subcritical
Separate Tables

IC-2 → $.47 \times 3 \times 10^{-11}$
-3 → 6.0×10^{-12}

EXP #85 2×2×2 of 2×2×2 units

Added 5 ea 1 × 2 7/8 × 18 Plexiglass to Bottom of North
5 ea 1 × 2 7/8 × 18 " " " " South
2 ea 1 × 13 × 15 " to Sides of South Half

8 51 Start Assembly
9 05 Subcritical
Source Inserted To Alum Shelf (Same position as #84)

IC-2 → $0.50 \times 3 \times 10^{-11}$
-3 7.0×10^{-12}

EXP #86 2×2×2 array of 2×2×2 units

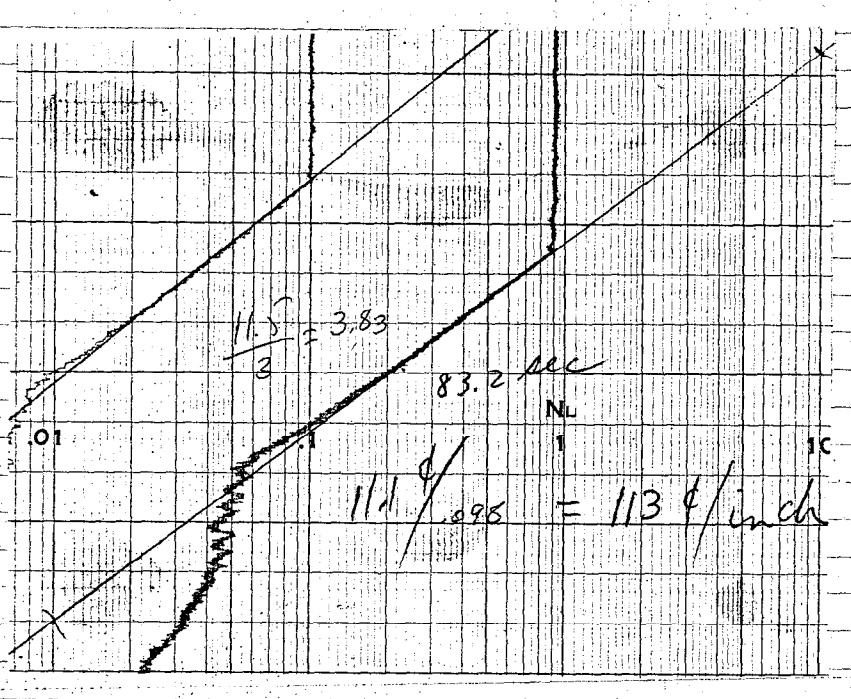
Added 2 ea - 1 × 13 × 15 between units (Vertically in N-S dir on South Table

9 20 Start Assembly
9 33 Subcritical but with appreciable Multiplication

IC-2 → $0.32 \times 10 \times 10^{-11}$
-3 1.3×10^{-11}

IC-3 $M = \frac{.013}{.001} = 13$

Recalculated Spacing, should have been 4.25, 8.50


11.5/3 = 3.83
83.2 sec
Nu
.01
.1
1
10
11d ¢/.095 = 113 ¢/inch

EIP # 87

2 x 2 x 2 — Vert Spacing 4.718 +.032, 9.468 +.032, 4.75
64 units — NS " 4.25, 8.50, 4.25
8 cube unit — EW " 4.25, 8.50, 4.25
Core 32 x 32 x 34

Instrument Check on Jan 18, 72 Source 10 mc ^{60}Co

PM-1 _____ Low Trip OK Alarm Trip Scram Table
PM-2 _____ Alarm Trip _____
IC-1 3×10^{-10} Motor Trip OK Fast Trip OK
IC-2 3×10^{-10} OK
IC-3 $>1 \times 10^{-9}$ Sw In
IC-4 $>1 \times 10^{-9}$
CRM _____ Motor Trip _____

A OK Set Point @ 30 R
B OK @ 40 R
C OK @ 40 R

Insert source between upper 2 units on South Table — Red Lite & Pers ck OK
Bypass Panel set OK
$\Delta p = 1.5$ in H_2O OK

10^{40} Start Assembly
10^{10} On Pos Period Rev 23.15 → 2.12 in sepn.
~ Level 23.48 → 2.17 in sepn

Critical with ~2.17 in Table separation

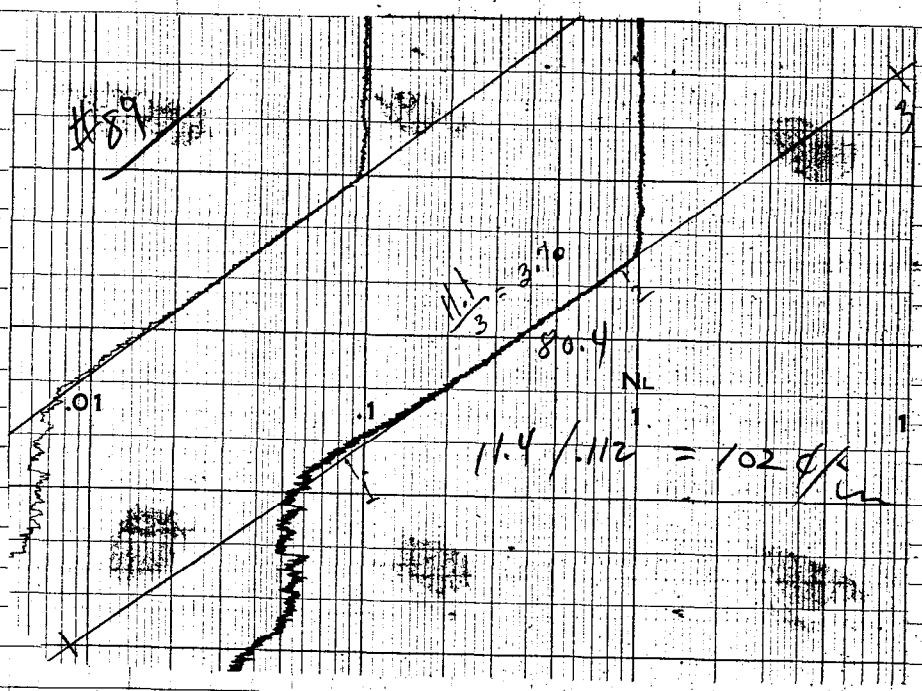
Exp # 88

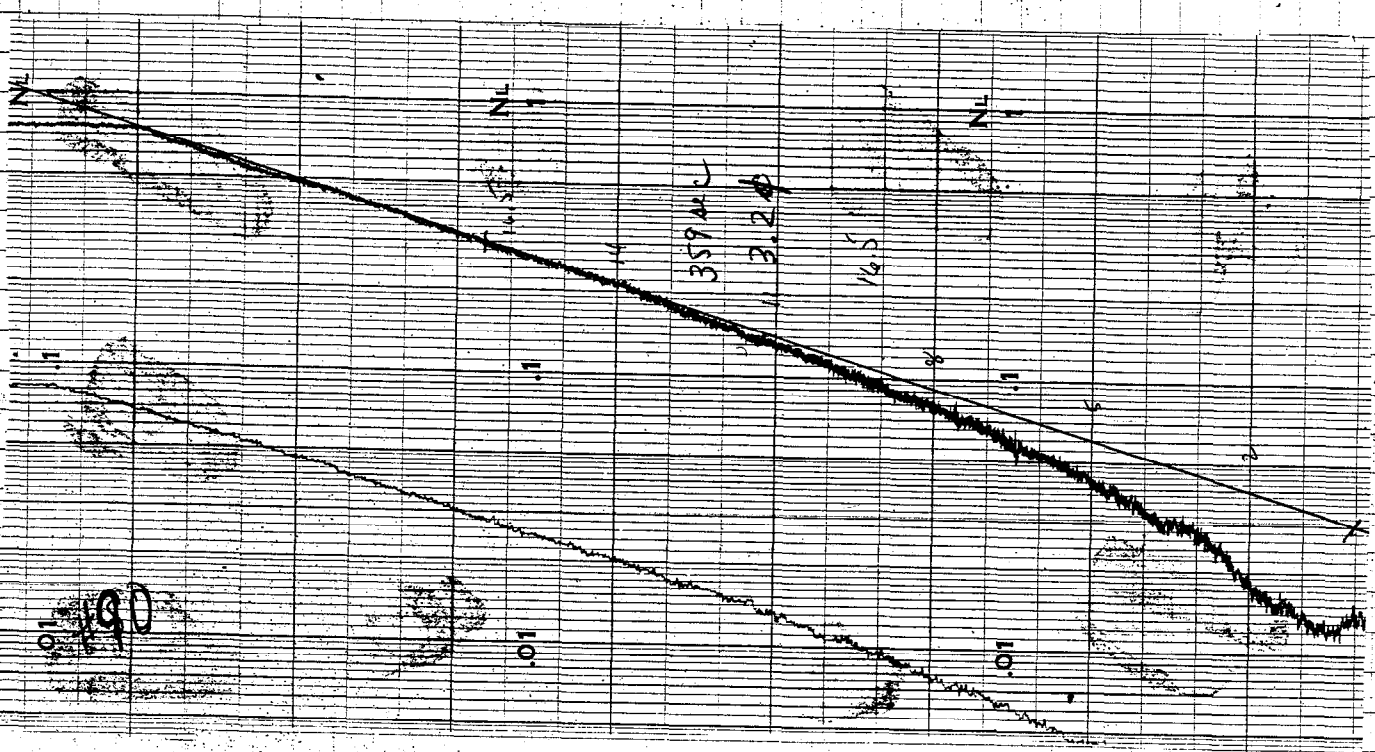
Vert. Spacing 4.718 +.032, 9.468 +.032, 4.75
E-W 4.75, 9.50, 4.75
N-S 4.75, 9.50, 4.75
Core 34.0 x 34.0 x 34.0

Source inserted between Top pair of units, South half.

2^{10} Start Assembly — Red Lite & Pers ck OK
2^{18} Source Removed Rev = 10.4 Ind 0.782 - .1 = .682 Bypass Panel OK
2^{21} Start to level — $\Delta p = 1.5$ in H_2O
2^{29} Level 0.880 - .1 = .780

11.1 ¢ / .098 = 113 ¢/in


#89
11.1/3 = 3.70
80.4
NL
.01
.1
1
11.4 / .112 = 102 ¢/cm


NL
.1
.01
359 sec
3.2 ¢
#90

EXP #89

2 x 2 x 2 Assembly — Vert 4.75 x 9.50, 4.75

North Table — E-W 4.875, 9.75, 4.875 } 34.5 x 17 1/4

N-S 4.875, 4.875

South Table Unchanged } 34 x 17

Instrument Check on Jan 19, 72 **Source** 10 mc ^{60}Co

PM-1		Low Trip	✓	Alarm Trip	✓
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	✓	Fast Trip	✓
IC-2	3×10^{-10}	[illegible]	✓	Monitron	
IC-3	$\sim 1.5 \times 10^{-9}$	[illegible]	DWM	A	✓
IC-4	$\sim 1.5 \times 10^{-9}$	[illegible]	DWM	B	✓
CRM		Meter Trip		C	✓

9 25 Start Assembly — Source Inserted ✓

9 33 On positive Period — Ind = 0.597 = 0.497 — Red Lite & Pers. Ck ✓

9 00 Start to Level — Bypass Panel ✓

9 28 — 0.709 − .1 = 0.609 — Δp = 1.5 in H_2O ✓

Inst. Reset ✓

Separate Tables — 0.112 = 1.0211 — 9 28 Table Indicator on start reads .031 → 2.031 v

9 31 .021

32 .020

33 .018

Δl = 0.780

0.609

0.171 x2 = .34 for 0.5 in change in inside box.

EXP #90

11 05 Start Assembly — North Table Unchanged

11 18 On pos period, Tables closed — Ind = 0.106 − .1 → .006 — EW 34.5 x 17 1/4 x 34 hi

11 34 Start to Level — South Table

41 Level — Ind = 0.191 − .1 → .091 — EW 35 x 17 1/2 x 34 hi

3.2¢ / .085 — EW 5.00, 10.0, 5.0

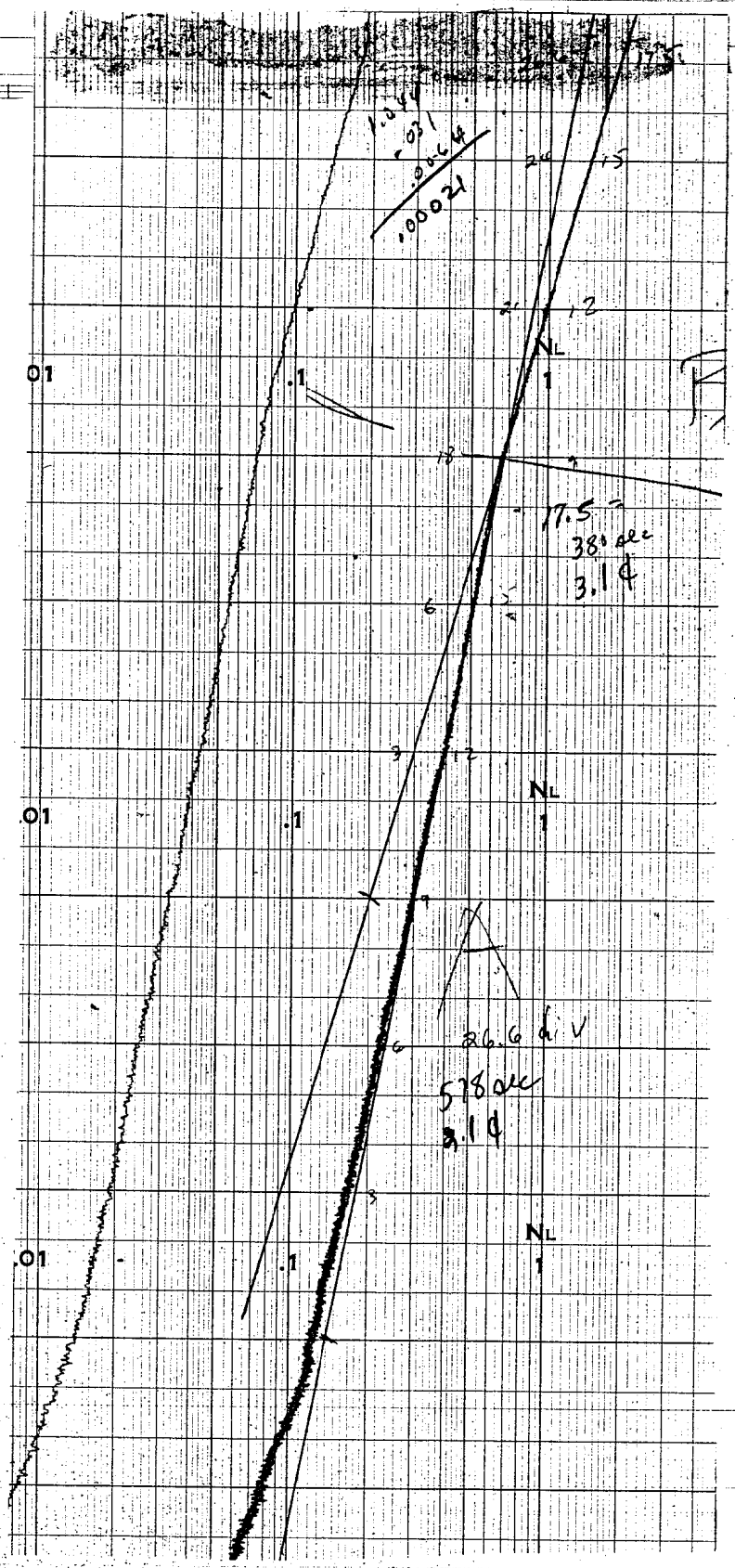
= 37.6 ¢/in

Source Inserted ✓

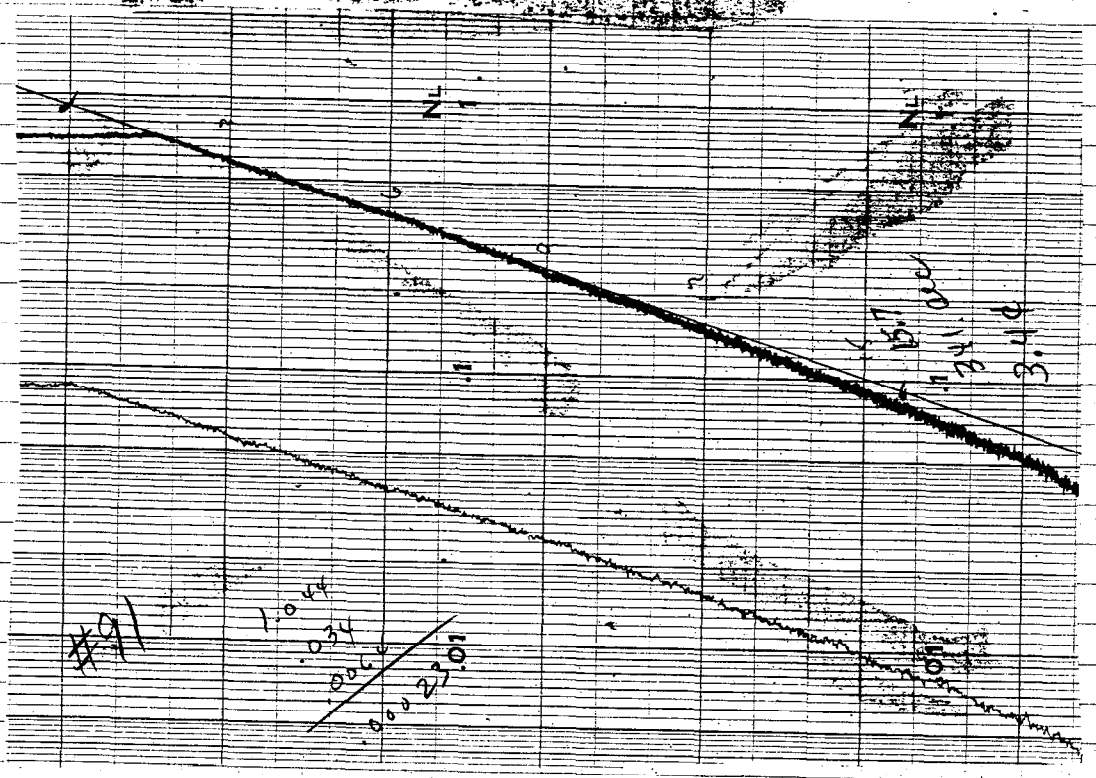
Red Lite Pers Ck ✓

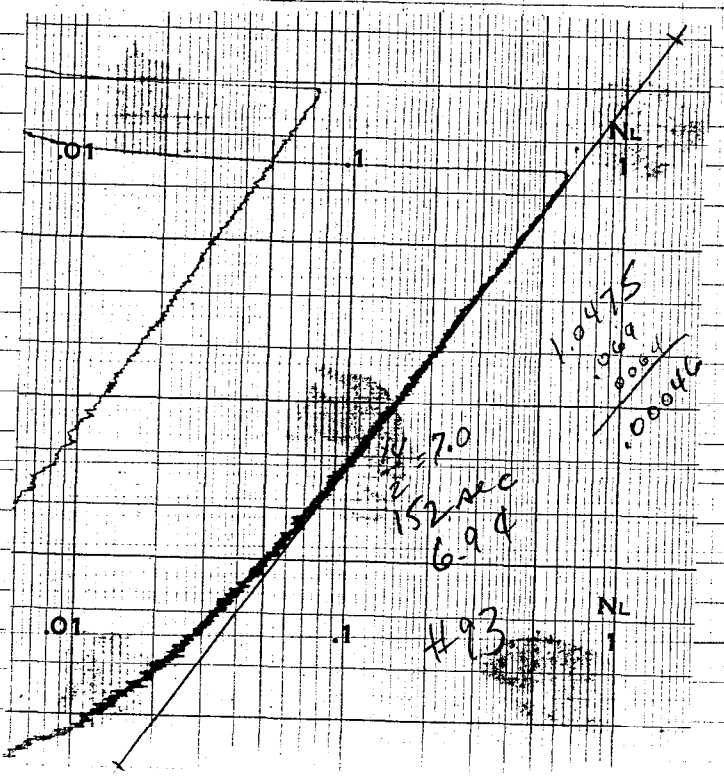
Bypass & Inst Reset ✓

Δp = 1.5 in. ✓



1.044
.031
.0064
.00021
24
15
21
12
NL
.01
.1
1
18
17.5 =
380 sec
3.1 ¢
6
3
12
NL
.01
.1
1
7
26.6 div
6
578 sec
3.1 ¢
3
NL
.01
.1
1


NL
1
.1
.01
#91
1.044
.034
.0064
.00023
15.7
341 sec
3.4 d


.01
.1
NL
1
1.0475
.069
.0064
.00046
7.0
152 sec
6.9 d
#93

EXP # 91

Repeat #90 without Source using only ^{238}U spont fission source estimated to be 1039 x .625 x 10 x 2 ~13000 n/sec

1^{10} Start Assembly
Definite Multiplication shown on IC-2 & 3 when Tables at 2.0 in.

$\Delta p = 1.5$ in H_2O ✓
Bypass Inst ✓
Red Lite & Pers ✓

1^{17} Tables Closed Power Rising Table Ind 0.105 − .1 = .005
1^{35} Start to Level
1^{42} Level

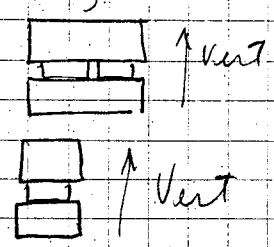
0.189

Shutdown 3.4¢ / .084 = 40.4 ¢/in.

QED, NO EXTRANEOUS SOURCE NEEDED.

EXP # 92

On North Table:
Add 2ea 3x3 x 8.5 in boxes } between units
2ea 3x3 x 1.5
Add 2ea 3x3 x 4.25 boxes
1ea 3x3 x 1.5



1^{49} Start Assembly
1^{58} Tables Closed for Power Rise.
IC-3 = 0.1 (or 1×10^{-10})
Set Indicator .141 − .1 = .041 2.1¢/.046 = 45.7
Power to ~ 7×10^{-10} Period A
$2^{20\frac{1}{2}}$ Set Indicator to .105$_5$ − .1 = .005$_5$
Period B 3.1¢/.087 = 35.6
2^{27} Start to Level .187 − .1 = .087 1.0¢/.035$_5$ = 28.2
2^{35} Shut down

$\Delta\rho$ (92 − 91) = −0.3 ¢

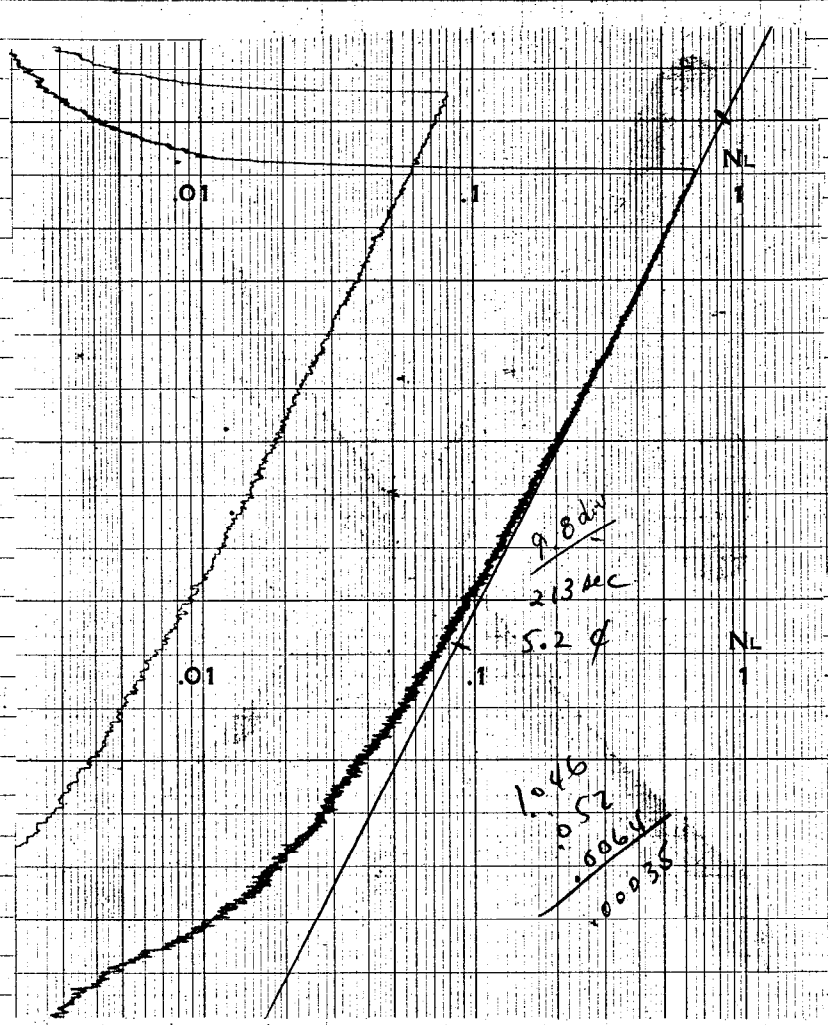
EXP # 93

Added .032 alum equiv of Bottom Shelf.

2^{48} Start Assembly
2^{56} On Pos Period 0.105$^+$ − .1 ρ = +6.9 ¢
$3^{04\frac{1}{2}}$ Shut down

gain of 3.8 ¢ for 1 bottom shelf.

.00046
.00021
25 x 2 = .00050 Bottom Shelf Corr



00035
00021
00014 x 2 = .0028 Top Shelf
Cor

EXP #94
Moved alum Shelf to simulate top shelf.
(Compare to #92.)

3^{12} Start Assembly
3^{21} Tables Closed Pri Pos Period.

ρ (94-92) = 5.2 − 3.1¢ = 2.1¢

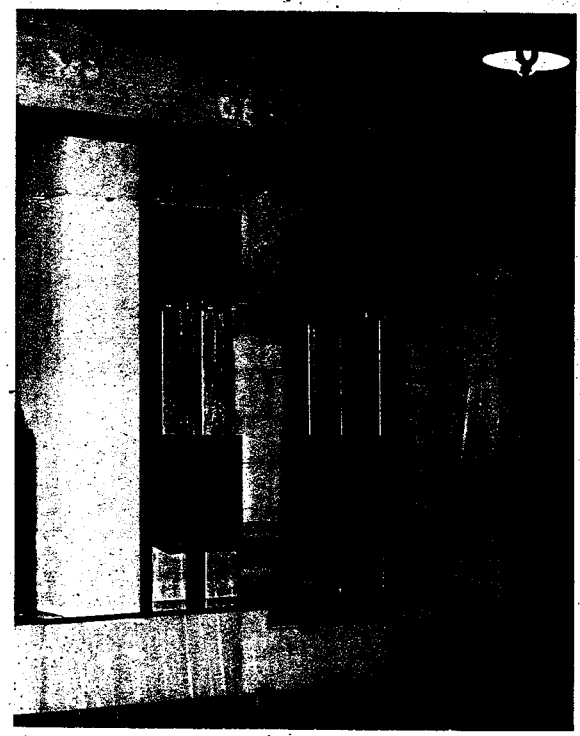
ρ

∴ Therefore EXP #90 corrected for Aluminum

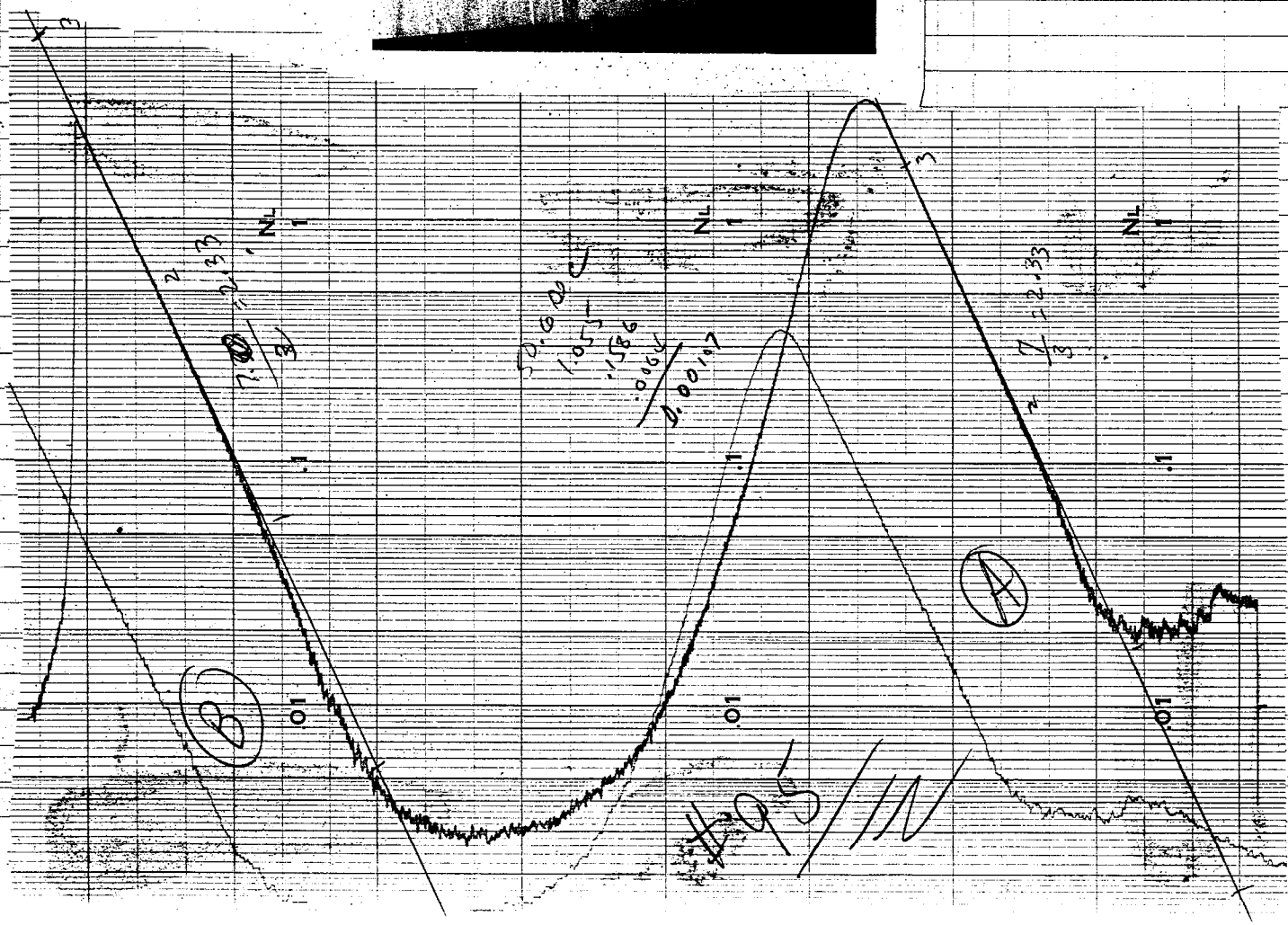
	+ 3.2 ¢	
2 ea lower	− 7.6	.00050
2 ea upper	− 4.2 / 11.8	.00028
Support boxes	2.4 / 9.4	
top and Middle (8 x −.3) = +2.4		− .00078
		+ .00016
	5.6 − 11.8 = − 6.2 ¢	− .00062

One must conclude that the worth of the Aluminum support structure is less important than the ability to position elements precisely, probably

CONFIDENTIAL



EXP # 95



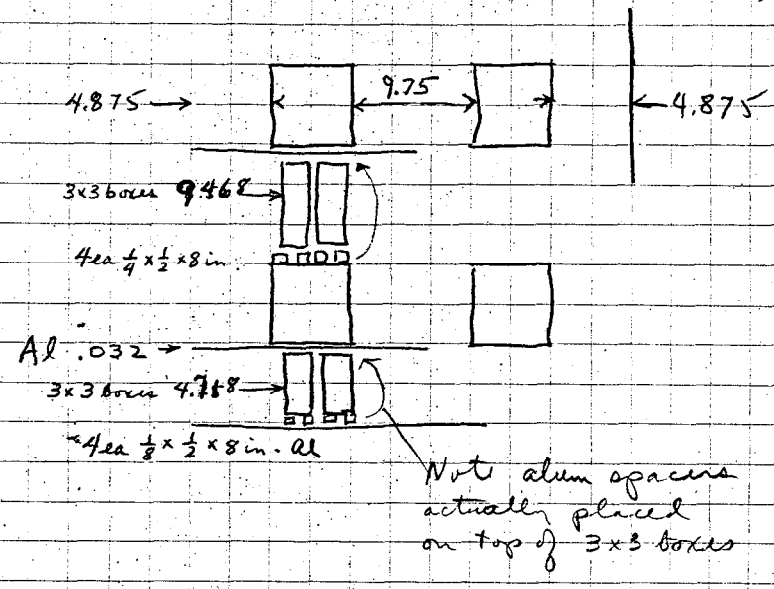
EXP #95

"Final" Assembly, Symmetrical

2 × 2 × 2 array of units 2×2×2 cubes.

Core size to be 34.5 × 34.5 × 34.5 (Measured)

$\bar{\rho} = \left(\frac{15.0}{34.5}\right)^3 \times 18.77 = 1.5427$



Instrument Check on _____ Source _____

[redacted] Low Trip _____ Alarm Trip _____

Alarm Trip _____

Meter Trip _____ Fast Trip _____

IC-[redacted]

CRB _____

Instrument Check on Jan 20, 72 Source 10 mc ^{60}Co

1:35 Start Assembly 950V

1:46 On Pos. Period

Tables Closed. Ind = ~~.107~~ 0.106

Pos Period A = 15.9¢

Decay Power to < 10^{-11} on IC-3

Ind to > 2.00

2:00 On Pos Period B Tables Closed Ind = 0.107

= 15.9¢

−9.4

$\Delta\rho$ = 6.5¢

PM-1	Bal 4.50	Low Trip	✓	Alarm Trip	✓
PM-[redacted]				Alarm Trip	[redacted]
IC-1	3×10^{-10}	Meter Trip	✓	Fast Trip	✓
IC-2	3×10^{-10}	Meter Trip	✓		Monitor
IC-3	1.8×10^{-9}	Calibration	Dwn		A ok
IC-4	1.8×10^{-9}	Calibration	Dwn		B ok
CRB					C ok

Insert Source ✓

Inst — Bypass Panel ✓

Red Lite Pres. Ck ✓

Δp = 1.5 in. H_2O ✓

K ≅ 1.000 corrected for Alum support.

Instrument Check on Jan 21, 72 [redacted] 10 mc ^{60}Co

[redacted]		Low Trip	OK	Alarm Trip	OK
[redacted]				Alarm Trip	
IC-1	3×10^{-10}		Scram Table	Fast Trip	OK
IC-2	3×10^{-10}		OK		
IC-3	1.8×10^{-9}	Calibrate	Dwn	A	OK
IC-4	1.5×10^{-9}	Calibrate	Dwn	B	OK
CRM		Meas.		C	OK

EXP # 96

4 x 2 x 2 Array of (1 x 2 x 2 units of Cubes)

Spacing E W = 1.875, (3.75), 3.75, (3.75), 3.75, (3.75) 3.75 (3.75) 1.875

Spacing N-S = 3.75, (7.50), 7.50, (7.50), 3.75

" Vert = 4.532, (7.50), 9.032, (7.50), 4.5

Core Size = 30.0 x 30.0 x 33 1/16 (Measured)

9 48 Start Assembly
10 00 Subcritical Ind 0.109

Source Inserted OK
Inst Set OK
Bypass Panel OK
Δp = 1.5 in OK
Red Lite & Pers. Ck OK

Source in contact Alum Shelf.
IC-2 $.24 \times 10 \times 10^{-11}$
-3 3.4×10^{-11}

Withdraw Source — #6 subcritical.

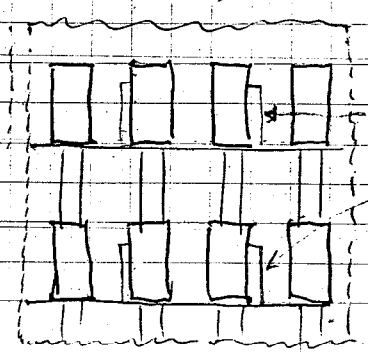
EXP # 97

Changed Vertical spacing only 3.686 norm
3.782 (7.50) 7.532 (7.50), ~~3.782~~

Core Measures 30.0 x 30.0 x 30 1/32.

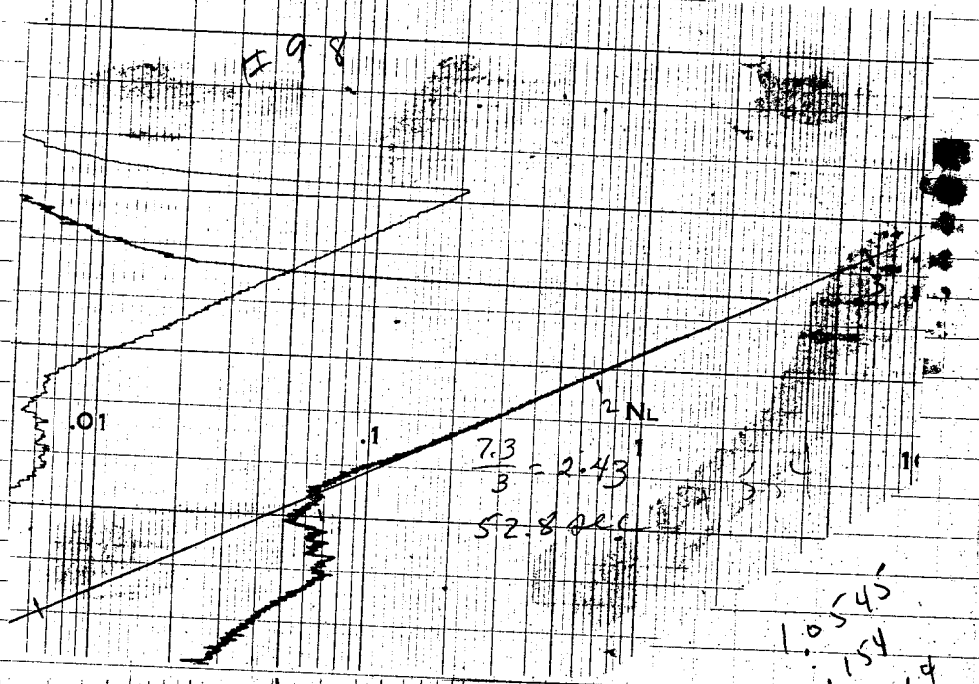
1 35 Start Assembly
1 45 Tables Closed Subcritical but source partly wdrn
Insert source Ind = 0.109
Power Rise to 1.5×10^{-10}
1 49 Remove Source
Negative period indicates several # subcritical

Red Lite & Pers. Ck OK
Bypass OK
Inst OK
Source OK
Δp = 1.5 in. OK

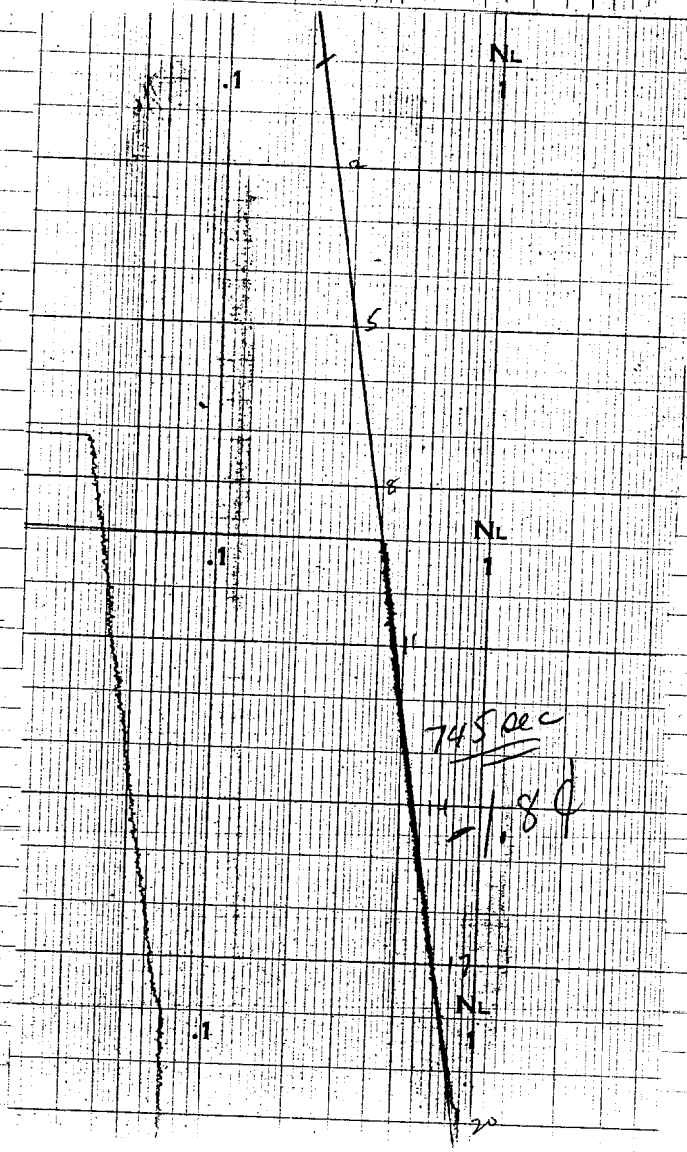


4 ea 1 x 2 1/8 x 6 Plexiglas added to North for #98

#98

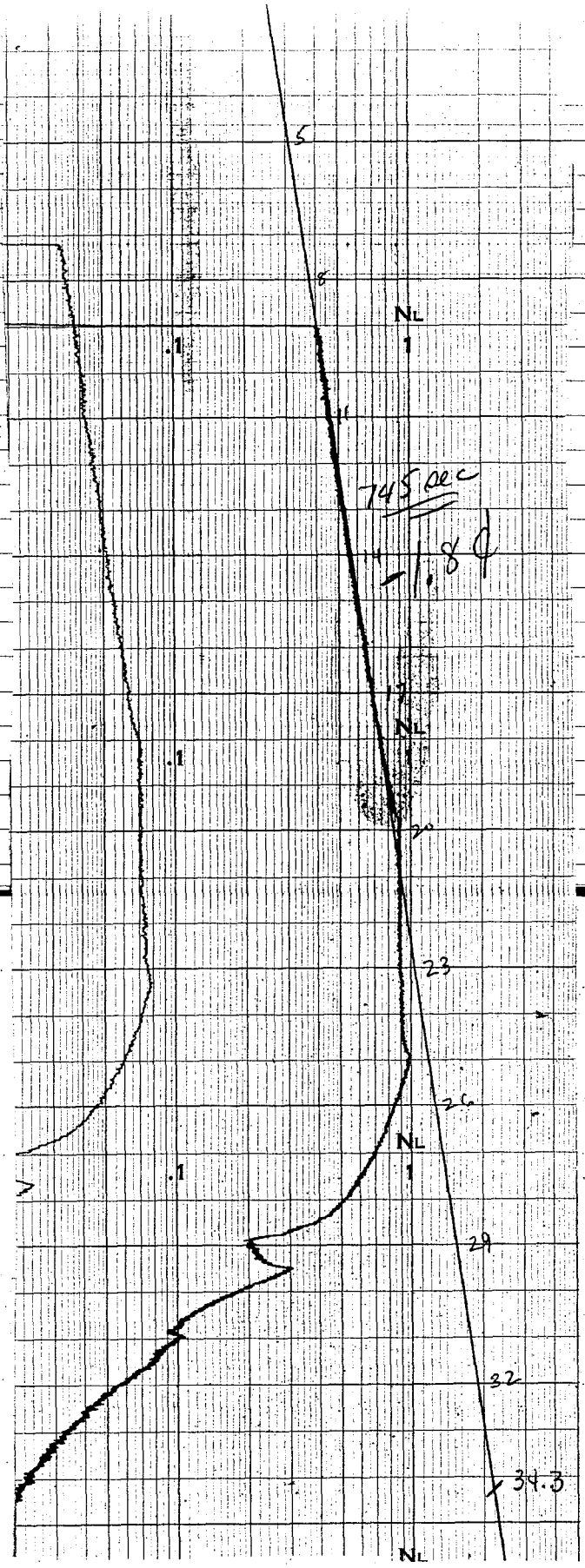


1.0545
.154
.0064
.00104
.00012
.00076
4
.00464



1.00104
.00464
.99640

1.041
.0064
.018
.00012



.00464

1.00104
.00464
.99640

1.041
.0064
.018
-.00012

EXP #98

Added 4ea 1 x 3 x 6 pc of Plexiglass

see sketch #97

2^{02} PM Start Assembly

2^{11} Tables Closed 0.110 $\rho = +15.4¢$

On Pos Period

2^{14} Shut Down at IC-2 .65 x 3 x 10^{-9}

EXP #99

Removed 1pc - 3ea 1x3x6 Plexiglass remain

2^{22} Start Assembly

2^{34} Subcritical - Source Inserted to Raise Power, Appears to be supercrit

Power @ IC-3 = 10^{-9} 2^{37} Start jogging source out

Table Ind = 0.109+

2^{40} Withdraw Source for neg period

2^{48} End - Shutdown

-745 sec → -1.8¢

∴ 1pc 1x3x6 plexiglass = 17.2¢

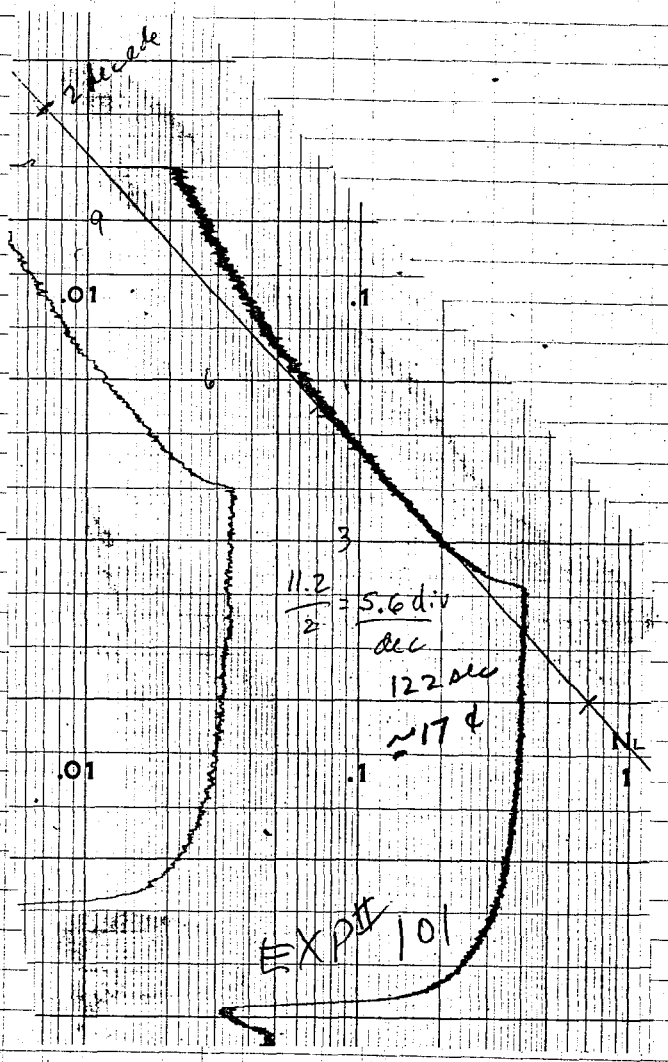
3pc 51.6¢

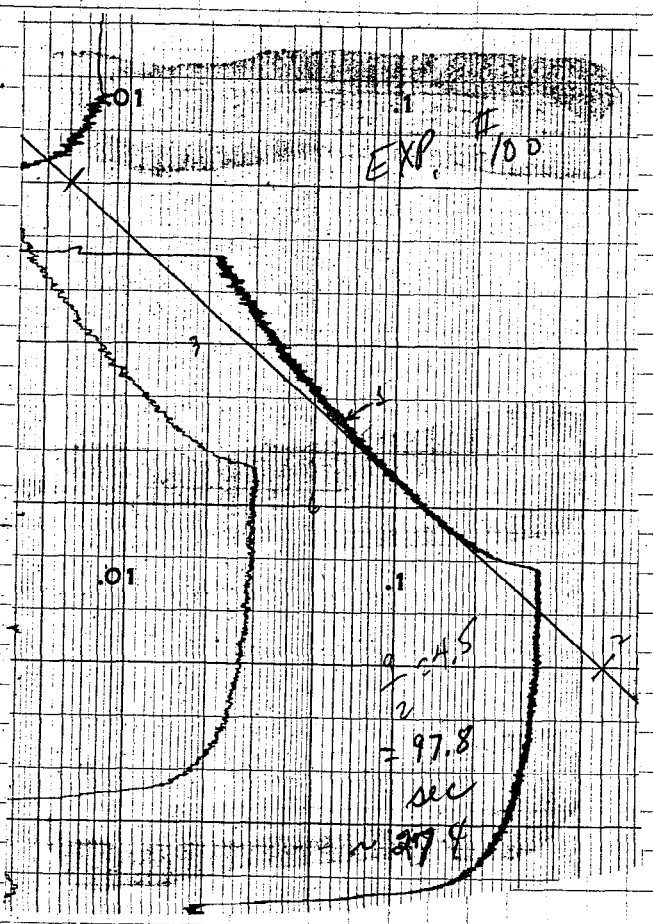
1.8

∴ EXP #97 = - 53.4¢

~~EXP #100~~

~~Machine Boxes to 1ea~~


2 decade
.01
.1
1
N_L
$\frac{11.2}{2} = \frac{5.6 \text{ div}}{\text{dec}}$
122 sec
≈17 ¢
EXP# 101


.01
.1
EXP. # 100
$\frac{9}{2} = 4.5$
= 97.8 sec
≈ 29 ¢

Instrument Check on Jan 25, 72 Source 10 mc ^{60}Co

PM-1			OK		OK
PM-2					
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK Scram Table
IC-2	7×10^{-10}	Meter Trip			Monitor
IC-3	1.8×10^{-9}	Calibration			A OK
IC-4	1.8×10^{-9}	Calibration			B OK
CRM		Meter Trip			C OK

Exp #100 (Vertical spacing reduced)

4 × 2 × 2 Array — 1 × 2 × 2 (= 4) cubes per unit

30 × 30 × 29.5 design size — unit + air = = 7 1/2 E-W Horiz & N-S

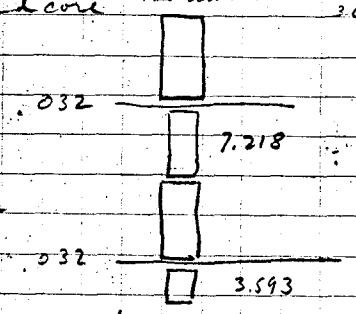
30 × 30 × 29 9/16 measured core — Unit + air = 3.75 + 3.625 = 7 3/8 Vert

8 23 Source Inserted, Resp OK — Red Pit & Pers Ch OK

$\Delta p = 1.5$ in H_2O OK

8 29 Start Assembly — Bypass Set OK

8 40 Subcritical, Source Inserted to Raise Power level — Table Ind 0.109. IC-3 = 3.4×10^{-10}



Approx. Negative Period — ~ 98 sec (Power level not high enough)

Inspected Reflector on far side, no gaps!

EXP # 101

Lowered Top Reflector 1/16" on Both halves,

Core Now Measures 29 1/2 in high

× 30.0 × 30.0.

9 15 Start Assembly.

9 25 Tables Closed Ind = 0.111 Source fully Inserted to Raise Power (Subcritical)

9 30 Source Removed for neg period IC-3 = 4.1 $\times10^{-10}$ (Not high enough)

9 37 Shut down ~122 sec ~ −17 ¢ subcritical

EXP #102

Add Zea 1 × 2 7/8 × 6 in Plexiglas to Exp # 101 (see p 111)

9 45 Start assembly

9 50 Scrammed — no indication of power failure or trip by instruments

Screw reversed.

Possible cause — drop in air pressure triggers [illegible] ERR

Bottom of pg. 115 ~~88~~

Instrument Check on Jan 25, 72 Source 10 mc ^{60}Co

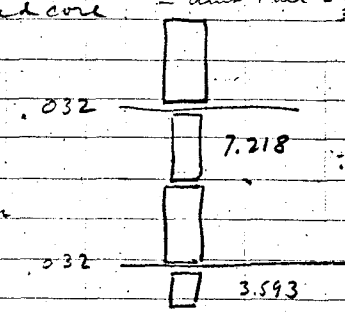
PM-1		Meter Trip	OK	Fast Trip	OK
PM-2				Meter Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK Scram Table
IC-2	7×10^{-10}	Meter Trip			Monitor
IC-3	1.8×10^{-9}	Calibration			A OK
IC-4	1.8×10^{-9}	Calibration			B OK
CRM		Meter Trip			C OK

Exp #100 (Vertical spacing reduced)

4 × 2 × 2 Array 1 × 2 × 2 = 4 cubes per unit

30 × 30 × 29.5 design size unit + air = = 7 1/2 E-W Irrig & N-S

30 × 30 × 29 9/16 measured core — Unit + air = 3.75 + 3.625 = 7 3/8 Vert



8^{23} Source Inserted, Resp OK Red Lit & Pers Ch OK

Δp = 1.5 in H_2O OK

8^{29} Start Assembly Bypass Sel OK

8^{40} Subcritical, Source Inserted to Raise Power level Table Ind 0.109. IC-3 = 3.4×10^{-10}

Approx. Negative Period — ~ 98 sec (Power level not high enough.)

Inspected Reflector on far side, no gaps!

EXP # 101

Lowered Top Reflector 1/16" on Both halves,

Core Now Measures 29 1/2 in high

× 30.0 × 30.0.

9^{15} Start Assembly.

9^{25} Tables Closed Ind = 0.111 Source fully Inserted to Raise Power (Subcritical)

9^{30} Source Removed for neg period IC-3 = 4.1 $\times 10^{-10}$ (Not high enough.)

9^{37} Shut down ~122 sec ~ = 17 ¢ subcritical.

EXP #102

Add Zea 1 × 2 7/8 × 6 in Plexiglas to Exp # 101 (see p 111)

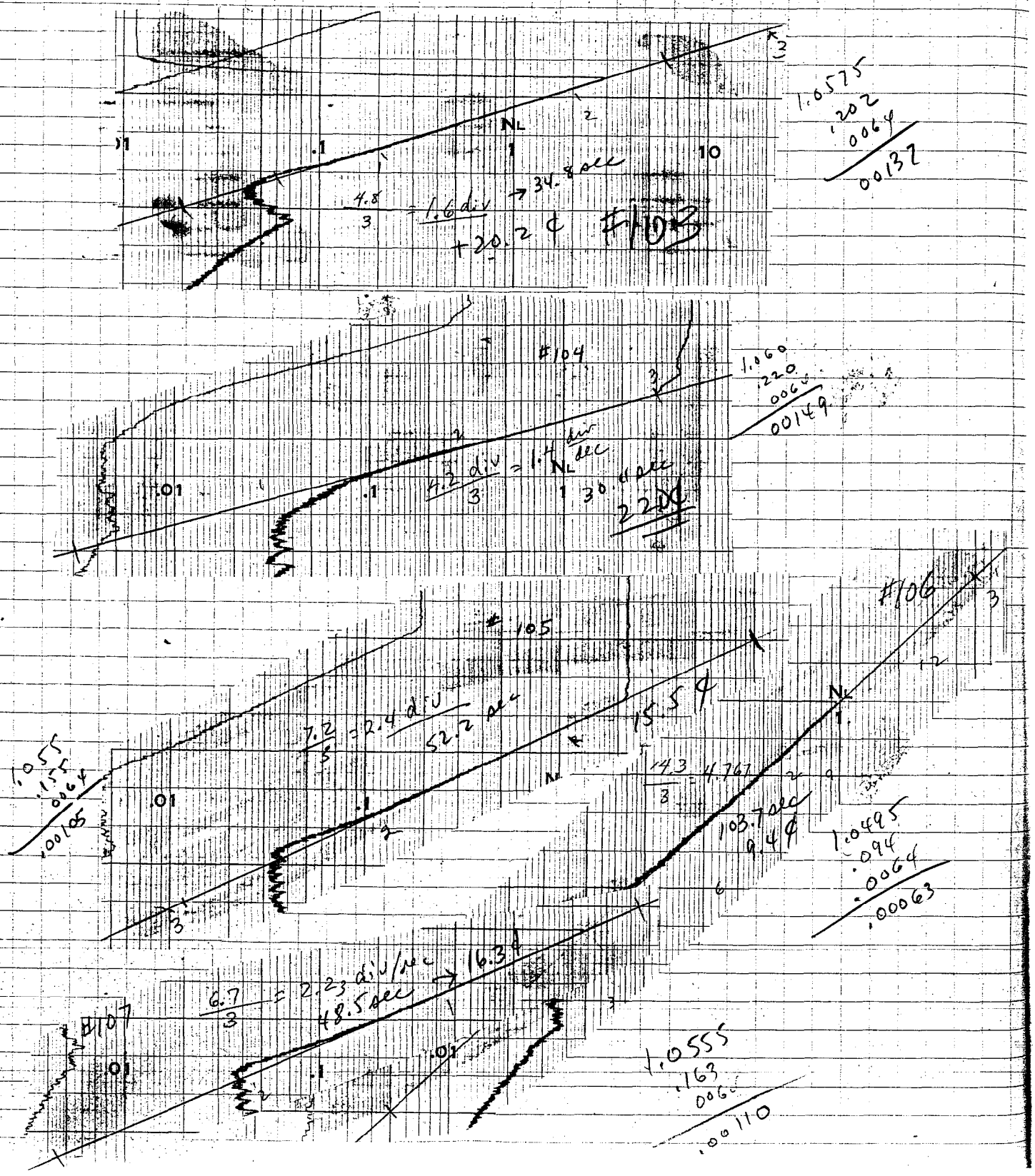
9^{45} Start assembly

10^{50} Scrammed — no indication of power failure or trips by instruments

Screw reversed.

10^{03} Possible cause — drop in air pressure triggers scram ERR

Checked with M. Garrison in Stop and they had blown down the Air Tank!


#103
1.0575
.202
.0064
.00132
4.8/3 = 1.6 div → 34.8 sec
+20.2 ¢
#104
1.060
.220
.0064
.00149
4.2 div/3 = 1.4 div/sec
30.0 sec
22¢
#105
1.055
.155
.0064
.00105
7.2/5 = 2.4 div
52.2 sec
15.5 ¢
#106
1.0495
.094
.0064
.00063
14.3/3 = 4.767
103.7 sec
9.4¢
#107
6.7/3 = 2.23 div/sec
48.5 sec → 16.3¢
1.0555
.163
.0064
.00110

EXP # 103 (with 2 ea 1 x 2 7/8 x 6 plex.

10^{04} Start Assembly
10^{12} Tables Closed — On positive period (Source Out)
Ind = 0.111
10^{13} 1/2 Shut Down + 34.8 sec
To restack ρ_{excess} = + 20.2 ¢

ρ_{excess} of Assembly #101 w.o. plex = +20.2 − 34.4 = −14.2 ¢
(vs −17 ¢ meas)

EXP # 104

4 x 2 x 2 Array of 1 x 2 x 2 Units Change Spacing in

		Measured Core
N − S	3.625	29.5
E − W	3.75	30.0
Vert	3.625	29.5

$\frac{11.00}{3}$ = 3.667

Source Inserted, Resp OK
Red Lite & Pus. Ch OK
Bypass Panel OK
Δp = 1.5 in H_2O OK

1^{44} Start Assembly
1^{53} 1/2 Tables Closed On Pos Period Table Ind 0.111.
1^{55} Start to Level
2^{02} Level Table Ind 0.388 − = .277
Separate ρ_{ex} = 22.0 $\frac{22.0}{.277}$ = 79.4 ¢/inch

EXP # 105

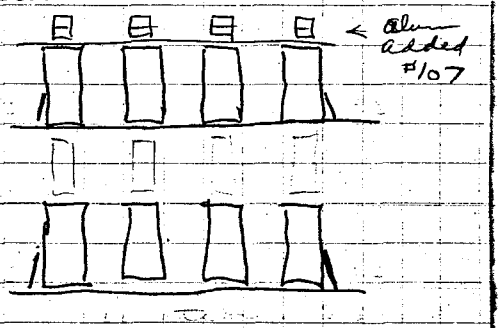
Add 4 ea .073 x 2 7/8 x 9 in. S.S. Top Shelf North & South Tables
(to decrease reactivity)

Note:
E − W ≡ X
N − S ≡ Y
Vert = Z
Cell-Units are 1 x 2 x 2 = 4 cubes
Array has 4 x 2 x 2 = 16 cells

2^{07} Start Assembly
2^{16} Table Closed Ind = 0.111 Source Removal
On Pos. Period
2^{18} 1/2 Start to level
25 Level = 0.319 − .111 = 0.208
ρ_{ex} = 15.5 $\frac{15.5}{.208}$ = 74.5 ¢/inch

EXP # 106

Add 4 ea .073 x 2 7/8 x 9 in. SS total 8 ea



2^{33} 1/2 Start Assembly
4^{11} 1/2 On Pos Period Ind = 0.110
4^{6} 1/2 Shutdown ρ_{ex} = 9.4 ¢

EXP # 107

Add 1 ea .032 x 13.5 x 27 al shelf } On top of assembly
+16 ea 1.50 Al Boxes 3X3

2^{54} Start Assembly
3^{02} On pos period Ind = 0.112
3^{06} Shutdown ρ_{ex} = 16.3 ¢

Summary for: 4x2x2 array of 1x2x2 units

Core Size

30.0x29.5 x 29.5

$\frac{29.5^3}{4} = 7.375$

	EW	NS	Vert
Spaces	3.75	3.625	3.625

ρ_{ex} = 22.0¢

13.8¢ 2(Bottom shelf worth + spacers 3")

~~15.1~~ ¢

8.2

~~[illegible]~~7.6 Middle Shelf worth estimated at $\frac{21}{3.8} \times 6.9 \times 2 = 7.6$

ρ_{ex} → ~~[illegible]~~ ¢

0.6¢

104	1.00149	> -44 = 4 SS
105	105	> -42 = 4 SS
106	63	> +47 = Al
107	110	

Al worth 2x47 = 94

ρ_{ex} = 1.00149

− .00097

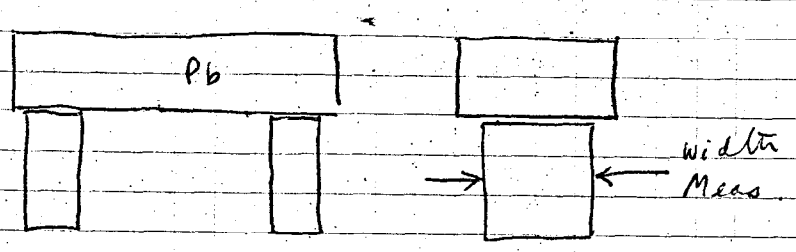
1.00052

Jan 24, 1972

Additional Testing of strength of 3x3 al boxes.

Two each 1½ long were used to support up to 12 lead bricks 25 lb ea

No of Brick	wt	width measurement
8	200	3.108
9	225	3.115
10	250	3.121
11	275	3.128
12	300	3.134
8	200	3.120
3	75	3.096
0	0	3.060



N.B. Initial width measurement of these 1½ long machined box sections have shown them all to be deformed slightly due to or because of the clamping arrangement used in the milling operation

Nevertheless, the Al. boxes will support ~ 100# per inch.

Also, using some bars oriented at right angles prevents vibration or horizontal oscillations.

DWM. WCT. CC.

$3.75^3 = 52.734375$

$4.25^3 = 76.765625$

$\times 1.18 \times 16.387 = 465$ g Plex per unit

19.76 ¢/box

$\times 64$

\$ 12.65 for $\frac{1}{4}$ in Plexiglas

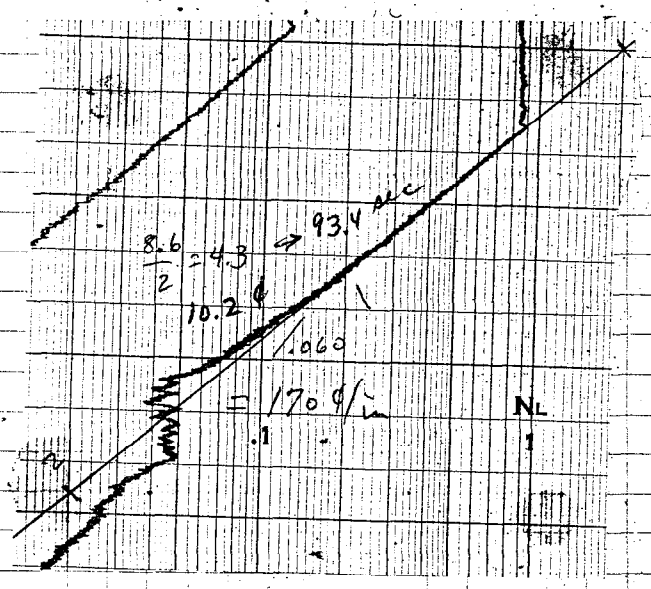
for 1 in Plex

2 to 3 times as much reactivity!

$\sim$ \$25. or $\Delta k \approx 0.175$

.007

.175 for optim moderation



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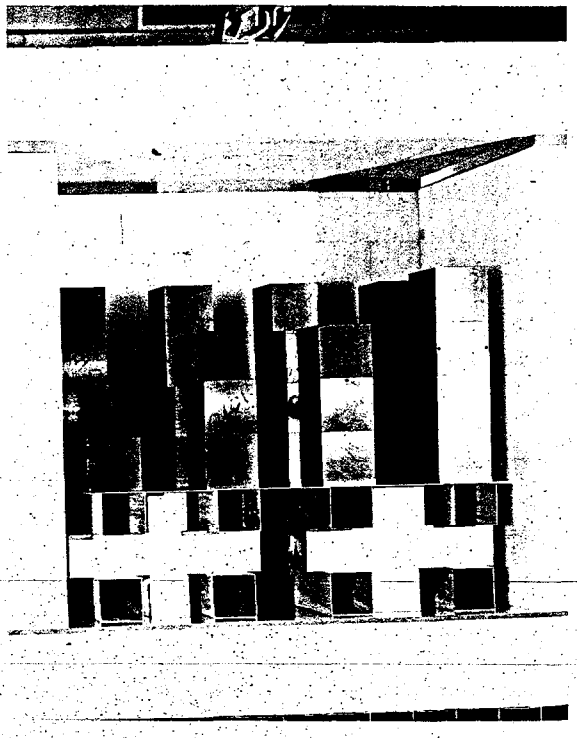

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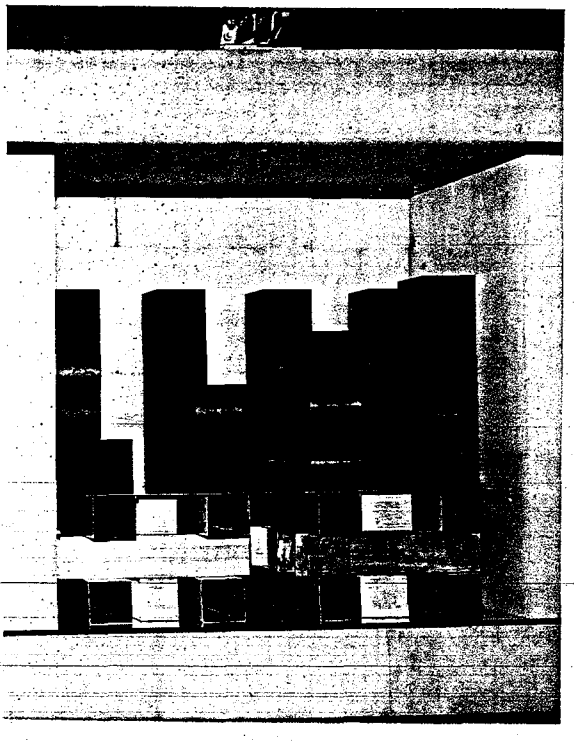


Instrument Check on Jan 26, 72 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Motor Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Motor Trip	Scramm Tables		
IC-3	1.6×10^{-9}	[illegible]	DWN	A	OK
IC-4	1.7×10^{-9}	[illegible]	DWN	B	OK
CRM		Motor Trip		C	OK

Source inserted to Midplane, Response OK

Red lite & Pers Ck OK
$\Delta p = 1.5$ in OK
Bypass OK

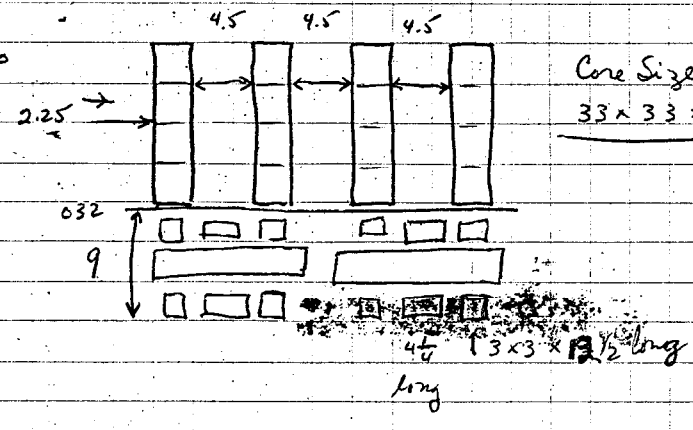
EXP # 108

Units $1\times2\times4 = 8$ cubes $4\times2\times1$ Array

1^{01} PM Start Assembly
1^{10} PM On Pos Period Source Out

level @ IC-3 = 8.5×10^{-10}

	On Pos Period	~~1.560~~	> 59
$1^{12\frac{1}{2}}$	Start to level	1.558	> .060 in
$1^{17\frac{1}{2}}$	Level	1.619	
	Shut Down		



Core Size
$33\times33\times33$

Estimated ρ_{ex} = [illegible]

Estimated core size for [illegible] = $34\times34\times34$

EXP # 109

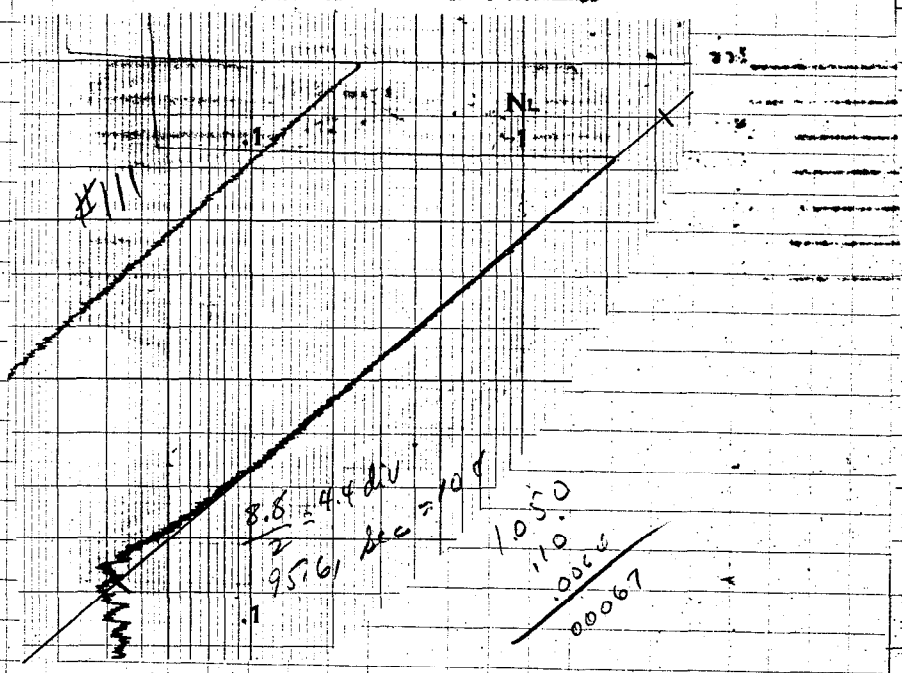
Units $1\times1\times4 = 4$ cubes $4\times4\times1$ Array Core Size $33\times33\times33$

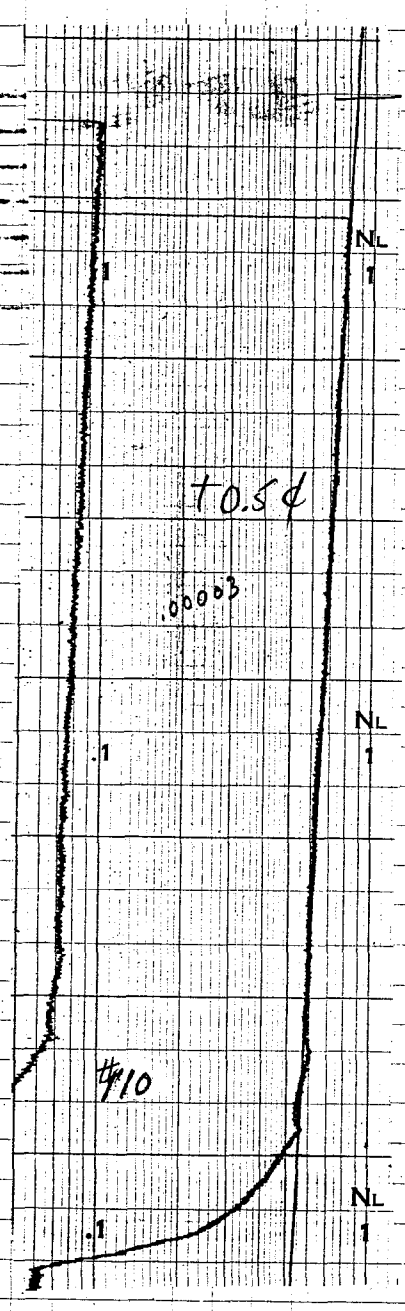
Source Inserted to Midplane, manually.
$\Delta p = 1.5$ in OK
Bypass Panel OK
Red Lite & Pers Ck OK

3^{10} Start Ass
3^{18} Table Closed 1.6×10^{-11} on IC-3 very little Mult.
Ind = 0.115
Re zeroed table indicator to 0.100
Alum on table top showed tables to be closed.

Subcritical

Unloaded North Table
Closed Tables Ind = 0.098
Repeat last 0.1 in → 0.097





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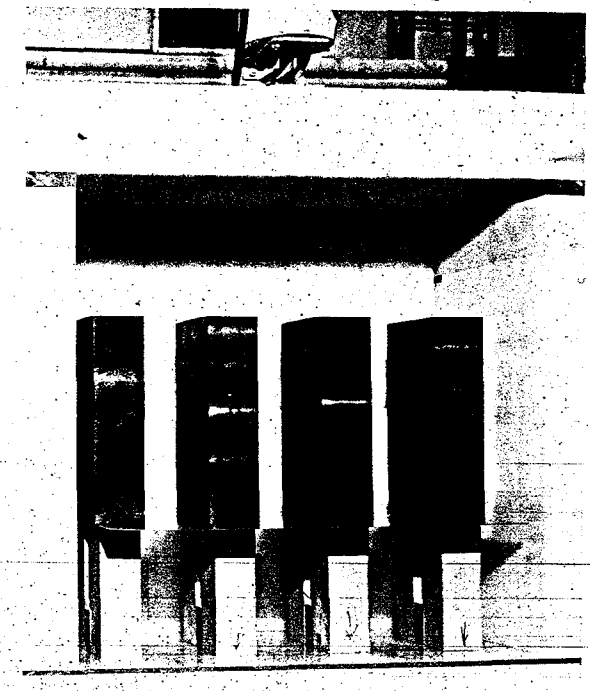


EXP #110 and #111 } South half

Instrument Check on Jan Source 10 mc ^{60}Co

PM-1		Low Trip	Scram Table	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	OK		Monitron
IC-3	1.6×10^{-9}	Calibration	Calibrate AWM		A OK
IC-4	1.8×10^{-9}	Calibration	AWM		B OK
CRM		Meter Trip			C OK

EXP #110

1x2x4 = 8 cubes/unit 4 x 2 x 1 Array 2.375

E-W 2.375 (3.75) 4.75 (3.75) 4.75 (3.75) 4.75 (3.75)

N-S 4.75 (7.50) 4.75 + 4.75 (7.50) 4.75

Vert 9.50 (15.0) 9.50

Core 34.0 x 34.0 x 34.0 (Measured)

12 49 Start Assembly

Insert Source bottom at HMP, Resp Pk

50 Very Close to Critical at Low Power

Insert source to raise Power.

1 02 Level at 5×10^{-10} on IC-3 by slowly withdrawing Source

1 03 1/2 Source Out, On Pos Period +0.5¢ table Ind 0.10

Red Lite & Pers Ck OK

Bypass Panel OK

$\Delta\rho$ = 1.5 in Hw OK

EXP #111

Add 032 x 14 3/4 x 30 al sheet to North half } Mock up of support for one Table.

add 8 ea 7.218 x 3 x 3

8 ea 1.5 x 3 x 3

8.7 18 instead of 9.468

1 22 Start Assembly

1 30 On Pos Period Table Ind 0.103

1 37 Shut down

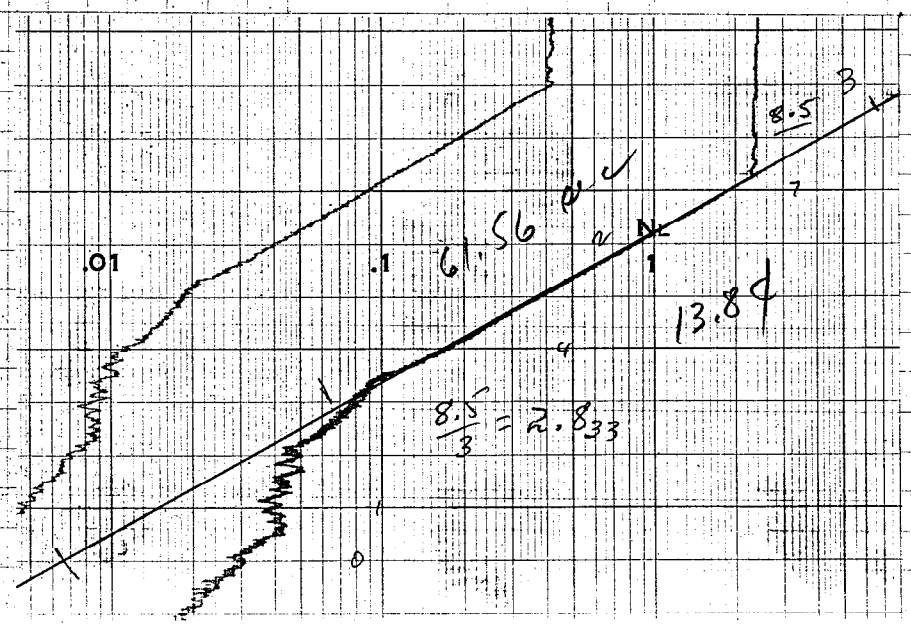
95.6 sec → +10.0 ¢ → .00067
.00003

.00064
−.00128
1.00003
.99875

$\Delta\rho$ = 9.5¢ per support
x 2
19¢

For #110 ρ_{excess} = −18.5 corrected for Al Support

.00067
3
64
x 2 = 1.00003
.00128

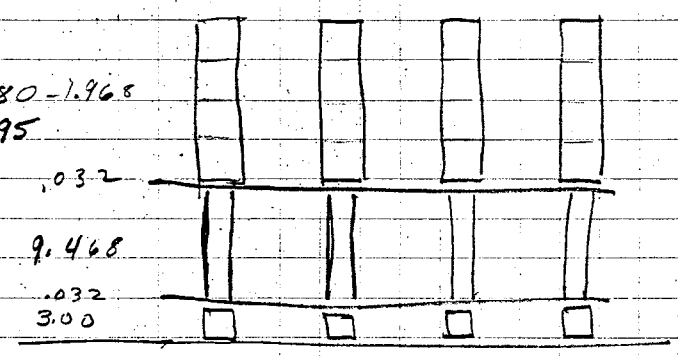

.01
.1
1
8.5
3
61.56
13.8
8.5/3 = 2.833

Assembly of 1 × 4 × 4 = 16 cubes per unit cell into an Array 4 × 1 × 1 of Cells

Placed 16 ea cubes on North Table
and 8 ea " " South Table
Assemble Tables to align South To North cubes making the 1 × 4 × 4 cell when fully loaded and assembled. Aligned OK.

Indicator 2.050 to .100 → 0.090 (drifted)

Plan View



Total of 24 ea cubes on North Table 1.980 - 1.968
12 ea " " South Table .095
close Tables for alignment,

Total of 32 ea on South & North
Reflector Cavity
40.0 } South 40 1/16
40 1/16 } 40
40.0 } North 40 1/16
40 1/16 }
~40 1/16 × 40 1/16 × 40 1/16 Cube

Elevation

Instrument Check on Jan 28, 72 Source 10 mm ^{60}Co.

PM-1 _____ Low Trip OK Hi Trip OK
PM-2 _____
IC-1 3×10^{-10} MTA Trip OK fast Trip OK
IC-2 3×10^{-10} MTA Trip OK
IC-3 1.8×10^{-9} A OK
IC-4 1.8×10^{-9} B OK
[illegible] _____ Meter Trip _____ C OK

Rad Lnt Pers Ck OK
Source Inserted OK
Resp OK
Bypass Panel OK
$\Delta p = 1.5$ in H_2O OK

EXP #112

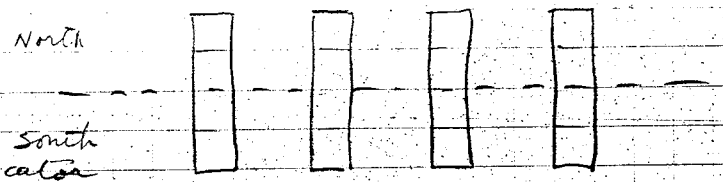
10^{50} Start Assembly of 1 × 4 × 4 = 16 cubes per unit
4 × 1 × 1 array

11^{05} On positive Period 0.792 Table Ind
OR Start To Level
13 Level 0.824

13.8 / .032 = 431. ¢/in.

Estimated ρ_{ex} = 410 × .2 · 0.82
+ [illegible] = 1.5

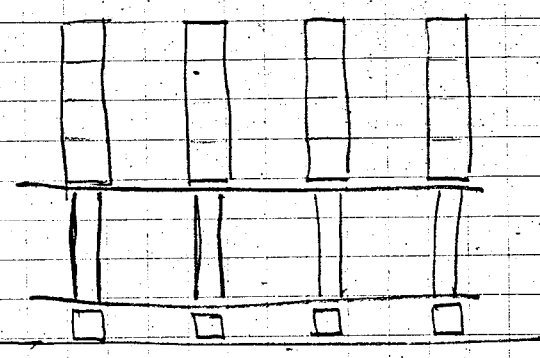
Bottom of pg 127 ~~88~~



Placed 16 ea cubes on North Table
and 8 ea " " South Table
Assemble Tables to align
South To North cubes making
the 1x4x4 cell when fully
loaded and assembled. aligned OK

Indicator
2.050
to .100 → drifted 0.090

Plan View



Total of 24 ea cubes on North Table 1.980 - 1.968
12 ea " " South Table .095
close Tables for alignment, .032

Total of 32 ea on South & North 9.468
Reflector Cavity .032
3.00

40.0 } South 40 1/16
40 1/16 } 40
40.0 } North 40 1/16
40 1/16

Elevation

~40 1/16 x 40 1/16 x 40 1/16 Cube

Instrument Check on Jan 28, 72 Source 10 mm ^{60}Co.

PM-1 _____ Low Trip OK Hi Trip OK
PM-2 _____
IC-1 3×10^{-10} MTR Trip OK fast Trip OK
IC-2 3×10^{-10} MTR Trip OK
IC-3 1.8×10^{-9}
IC-4 1.8×10^{-9}
[illegible] _____ Meter Trip _____

A OK
B OK
C OK
Rel Lnts Pers Ck OK
Source Inserted OK
Resp OK
Bypass Panel OK
$\Delta p = 1.5$ in H_2O OK

EXP #112

^{50} Start Assembly of 1x4x4 = 16 cubes per unit
4x1x1 array

11^{05} On positive Period 0.792 Table Ind
08 Start to Level
13 Level 0.824

13.8 / .032 = 431. ¢/in.

Estimated ρ_{ex} = 410 x .2 = 0.82
+ 305 x .5 = 1.5
$ 2.32

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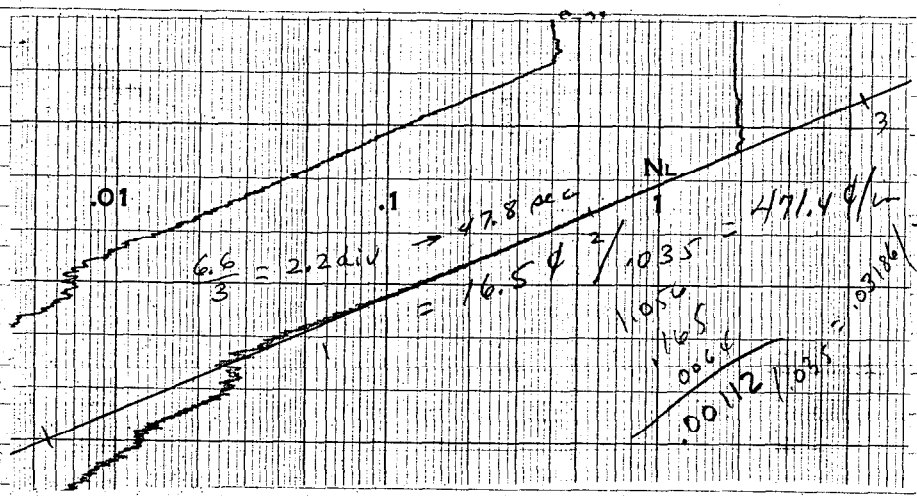
EXP # 113 [illegible] Top Reflector [illegible] fully assembled [illegible] photograph



assembled 41 in x 41 in x 41 in Reflector Box without Top Reflector and half South face
Placed units 2 layers on North table
and 1½ on on South
Assembled tables for alignment of 2 layers at plane of separation
Placed 4 units on South table to complete 2 layers
Placed 2 layers on North
2 layers on South
Assembled tables for alignment of completed stack 0.099
Separate Tables
~12:30 Re assemble unreflected (Top and ½ South face) for picture
Separate and complete reflector.

Instrument Check on Jan 31, 72 Source 10 mc ^{60}Co

950 V.	PM-1 Bal 4.4	Meter Trip	OK	Alarm Trip	
	PM-2			Alarm Trip	
	IC-1 3×10^{-10}	Meter Trip		Fast Trip	
	IC-2 3×10^{-10}	Meter Trip		MONITRON	
	IC-3 $\times 10^{-9}$	Calibration	Dwm	A	
	IC-4 $\times 10^{-9}$	Calibration	Dwm	B	
	CRM	Meter Trip		C	

EXP #113

2:12 pm Start Assembly
2:22 On Position Period
TTB Ind = 0.505
2:25 Start To Level
2:31 Level = 0.540 − .1 = .44

41 x 41.0 x 41 Core Size

Nominal Cell size 10¼ x 41 x 41
6½
3¼

EW Spacing 3¼, 6½, 6½, 6½, 3¼
NS Spacing 13, (15.0), 13
Vert Spacing 13, (15.0), 13

16.5 / .035 = 471.4 ¢/in.

470 x .44 = 2.07

2.07 + 450 x .28
1.26 = 3.33

Δ 1.26

1.26
1.5

2.07 − 1.89 = 18¢

2.20 − 1.89 = 31¢
2.07 − 1.89 = 18¢

Instrument Check on 2 Feb 72 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	[illegible]	Meter Trip	[illegible]	Fast Trip	OK
IC-2	[illegible]	Meter Trip	OK		
IC-3	[illegible]	[illegible]	[illegible]	A	OK
IC-4	[illegible]	[illegible]	[illegible]	B	OK
CRM		Meter Trip		C	OK

EXP # 114

Core Size 42.5 x 42.5 x 42.5 (Measurement OK)

E.W. Spacing 3.438, (3.75) 6.875 (3.75) 6.875 (3.75) 6.875 (3.75) 3.438

N.S. 13.75 (15.0) ~~27.5~~ 13.75

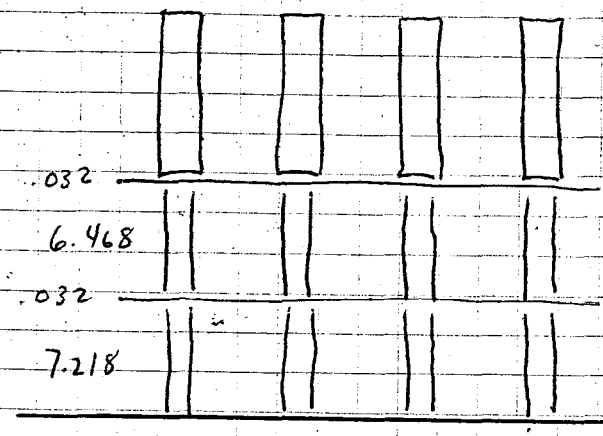
Vert. 7.218, .032, 6.468, .032, (15.0) 13.75

Assembled Tables for alignment with 2 layers } without Top reflector & part of South face.
" " " " " 4 layers }

Table Ind Zero = 0.096

$10^{23}\frac{1}{2}$ Start Assembly

10^{32} Tables Closed
Subcritical

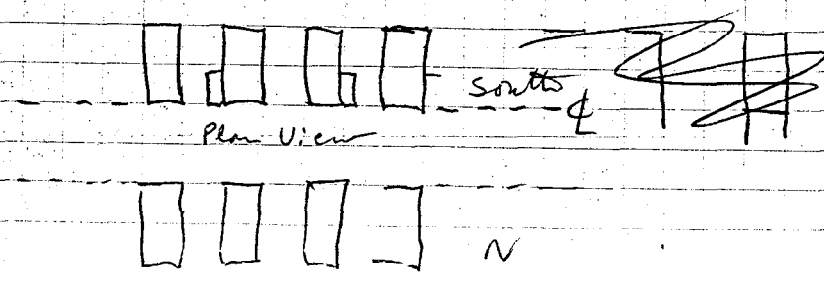


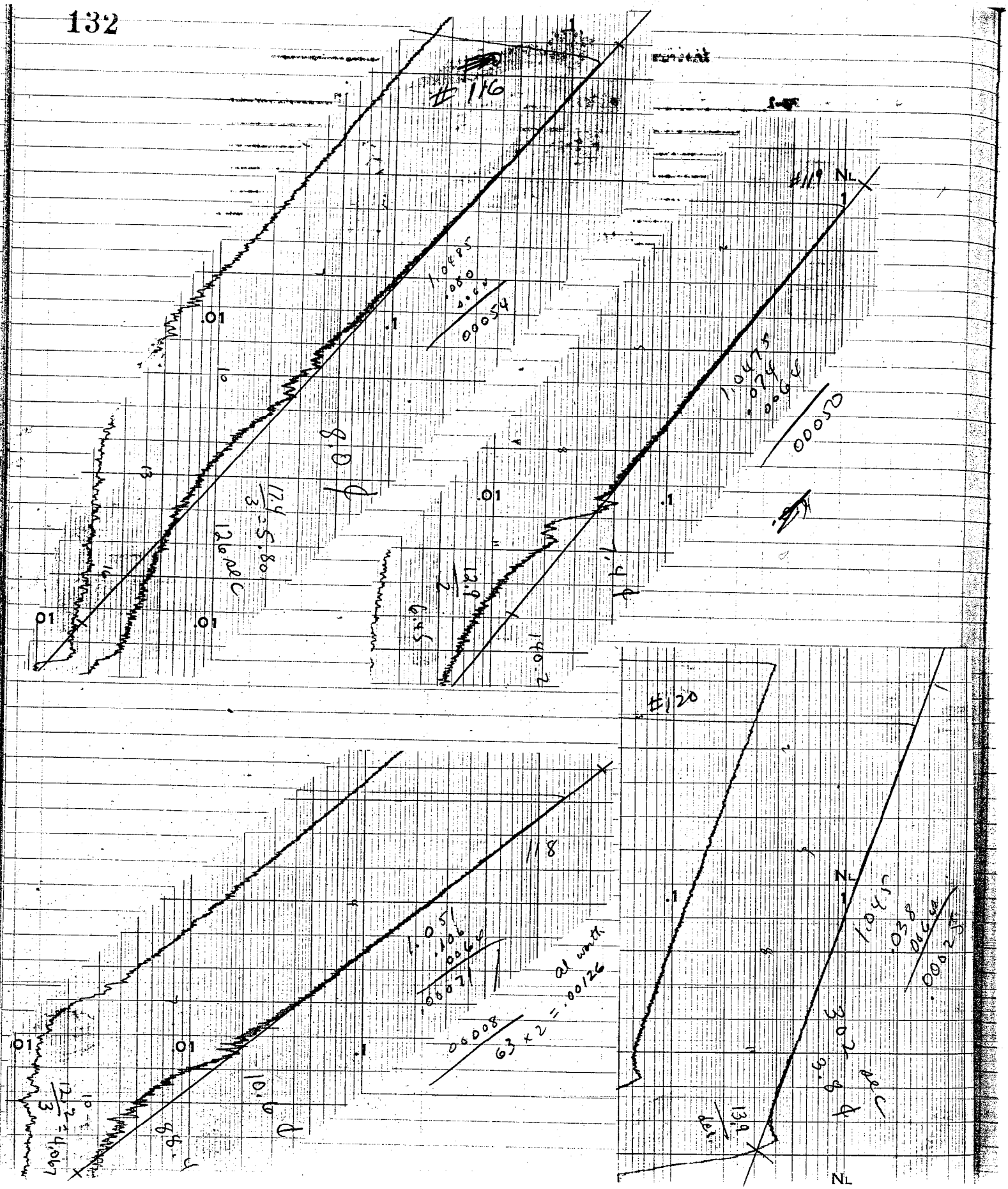
Red Lite & Pers Ck OK
Source Resp + OK
Inst Scales
Bypass Panel OK
$\Delta p = 1.5$ in H_2O OK

EXP # 115 Add 2 ea 1 x 2 7/8 x 6 in Plexiglas on South ~~North~~ Table
Source Inserted, Resp OK,

10^{45} Start Assembly

10^{55} On pos period
Tables @ 0.134
Period too fast to measure reactivity if fully closed




#116
#119
NL
1
.01
.1
1.0485
.080
.0064
00054
1.0475
.074
.0064
00050
8.0 ¢
17.4/3 = 5.80
126 sec
12.9/2
6.45
7.4 ¢
140.2
#120
118
1.051
.106
.0064
.00071
00008
63 x 2 = .00126
al worth
10.6 ¢
88.4
12.2/3 = 4.067
1.045
.038
.0064
.00025
302 sec
3.8 ¢
13.9 det.

EXP #116

Replace 1" pieces with 4ea 1/4 x 3 x 6

Source Inserted, Resp. OK. 2ea on North 2ea on South

11[01] Start Assembly

11[10] On Position Period Ind = ~~0.098~~ 0.097 8.0 ¢

Separate Table to ~6" remove 1 pc 1/4 x 3 x 6

Source Inserted 3 pc 1/4 x 3 x 6 remain

EXP #117

11[22] Start Reassembly from ~6"

11[31] Tables Closed Source Out, Ind = 0.096

On slight Pos. Period 1.2 ¢

11[39] Shut Down

00054
8
00046
3
000138

1.00008
138
.99870

1 pc ≡ 6.8 ¢

3 pc 20.6

EXP #118 Added Mockup of bottom support to North Table Top.

12[47] Start Assembly Red Lite On Pos. OK. Source Resp OK

56 Tables Closed, Source Out Ind = 0.097

Shut down IC-3 = 1.3 x 10^-9 10.6 ¢

and Support worth 9.4 ¢ x 2 = 18.8 ¢

EXP #119 Same as #116 4ea 1/4 x 3 x 6 Plexiglass

2[08] Start Assembly Source Resp OK

2[16] On Pos Period Tables Closed Ind 0.097

Shut Down IC-3 = 1 x 10^-9

7.4 ¢ and 7.7 ¢

EXP #120 w. 4ea 1/4" 3 x 6

Moved one of the top blocks central row on south

1[32] Start Assembly Source Resp OK toward center 1/2" (use 1/2 plexiglas spacer to set block position)

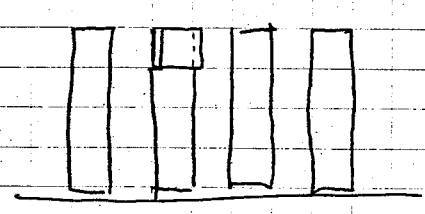
1[40] On Pos Period Source Out slightly Pos south Face

141 Insert Source to Raise Power

142 Source out IC-3 = 4 x 10^-10

On Pos Period Ind = 0.096

Shut down IC-3 ~ 2.5 x 10^-9

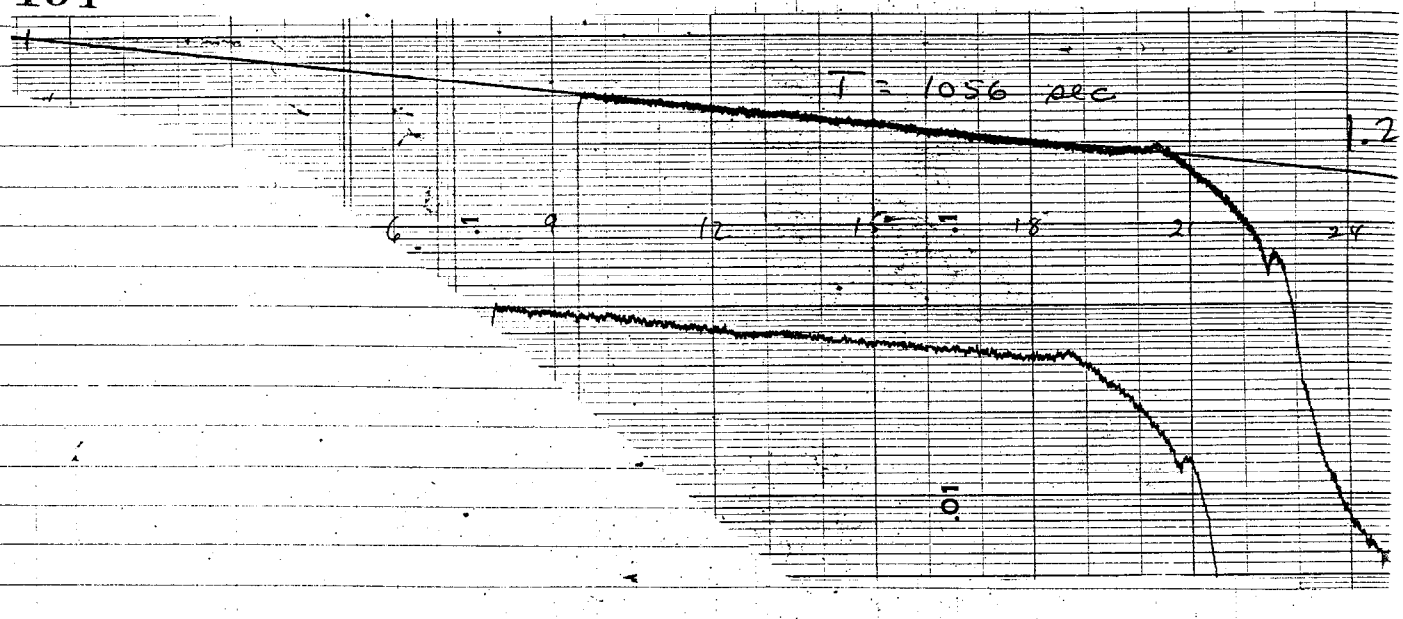


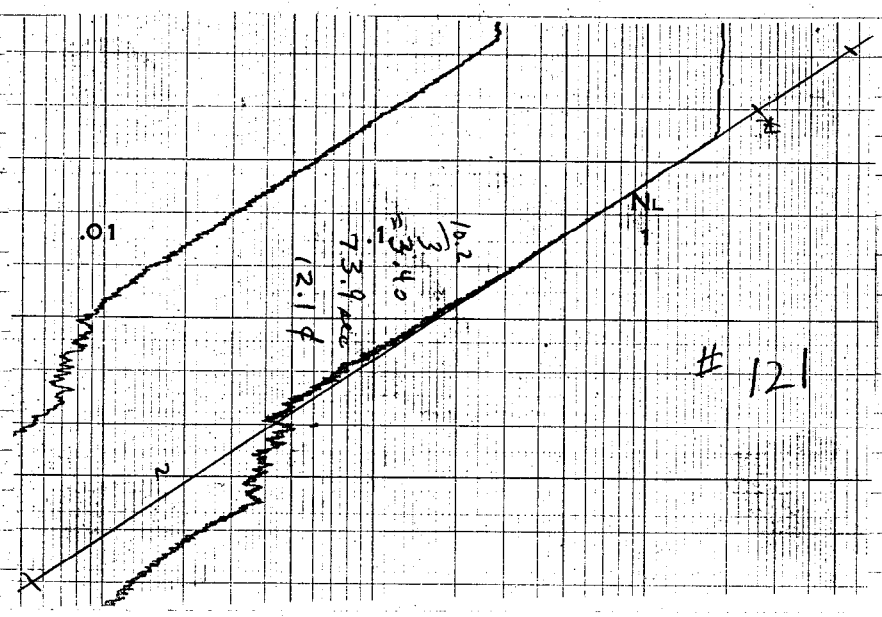
3.8 ¢

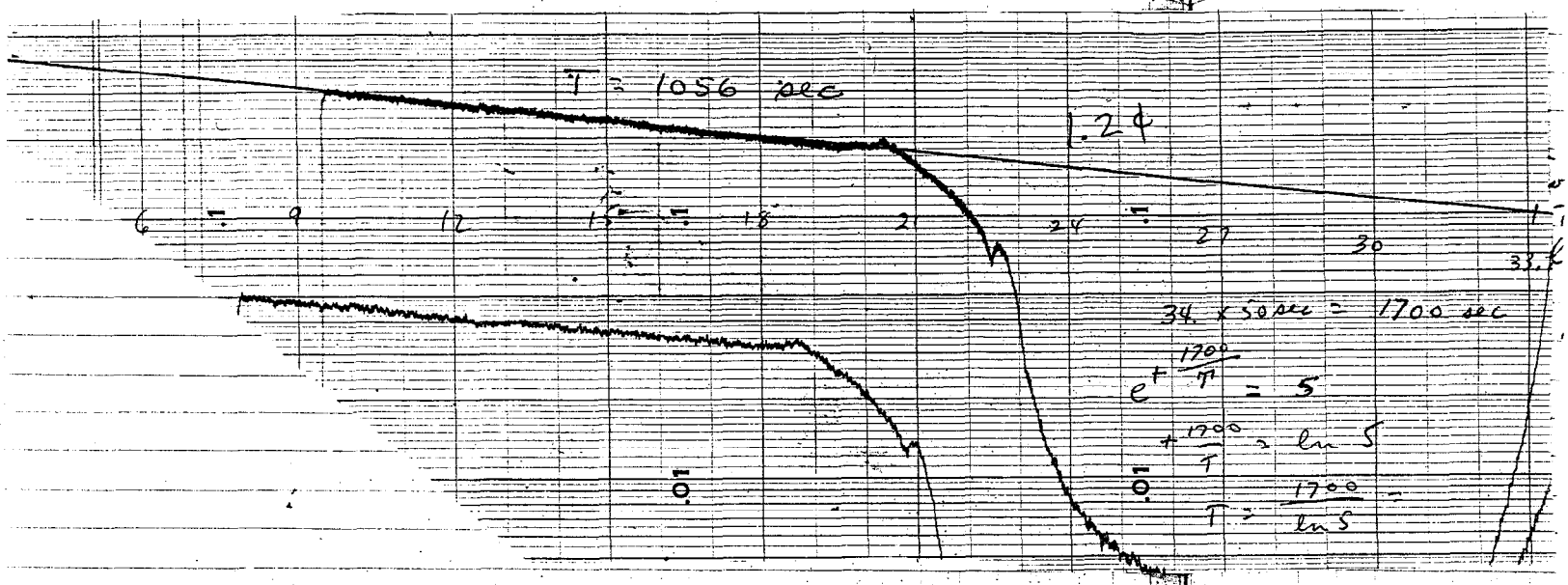
Assembly Corrected for Plastic and Alum Support

Move Block 1/2" Δρ = 3.6 ¢

ρ_{ex} = 1.2 ¢ − 20.6 − 18.8 ¢ = −38.2 ¢


T = 1056 sec
1.2
6
9
12
15
18
21
24
.01


.01
.1
1
10.2
3
3.40
73.9 sec
12.1 ¢
NL
#121



$34 \times 50\,sec = 1700\,sec$

$e^{+\frac{1700}{T}} = 5$

$+\frac{1700}{T} = \ln 5$

$T = \frac{1700}{\ln 5} =$

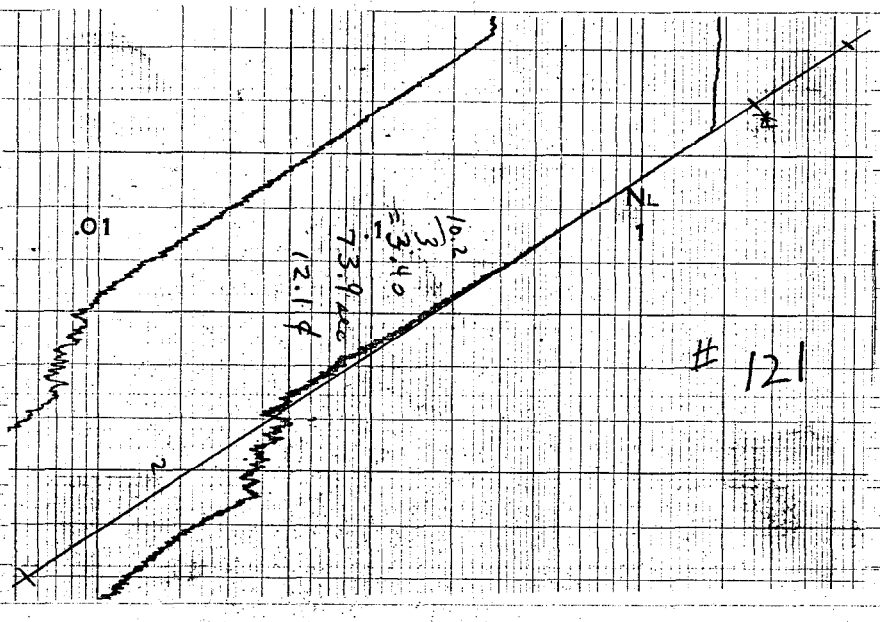
42.5 i

41.0 i

40.0 i

See P,1

Del



121

EXP # 121.
Same as #115
Source Reg OK

2^{55} On Pos Period - Source Removed
Table Ind = 0.170
2^{58} Start To level ~1.9×10^{-9} on IC-3

3^{10} Level Ind = 0.217

12.1 / .047 = 257 ¢/in

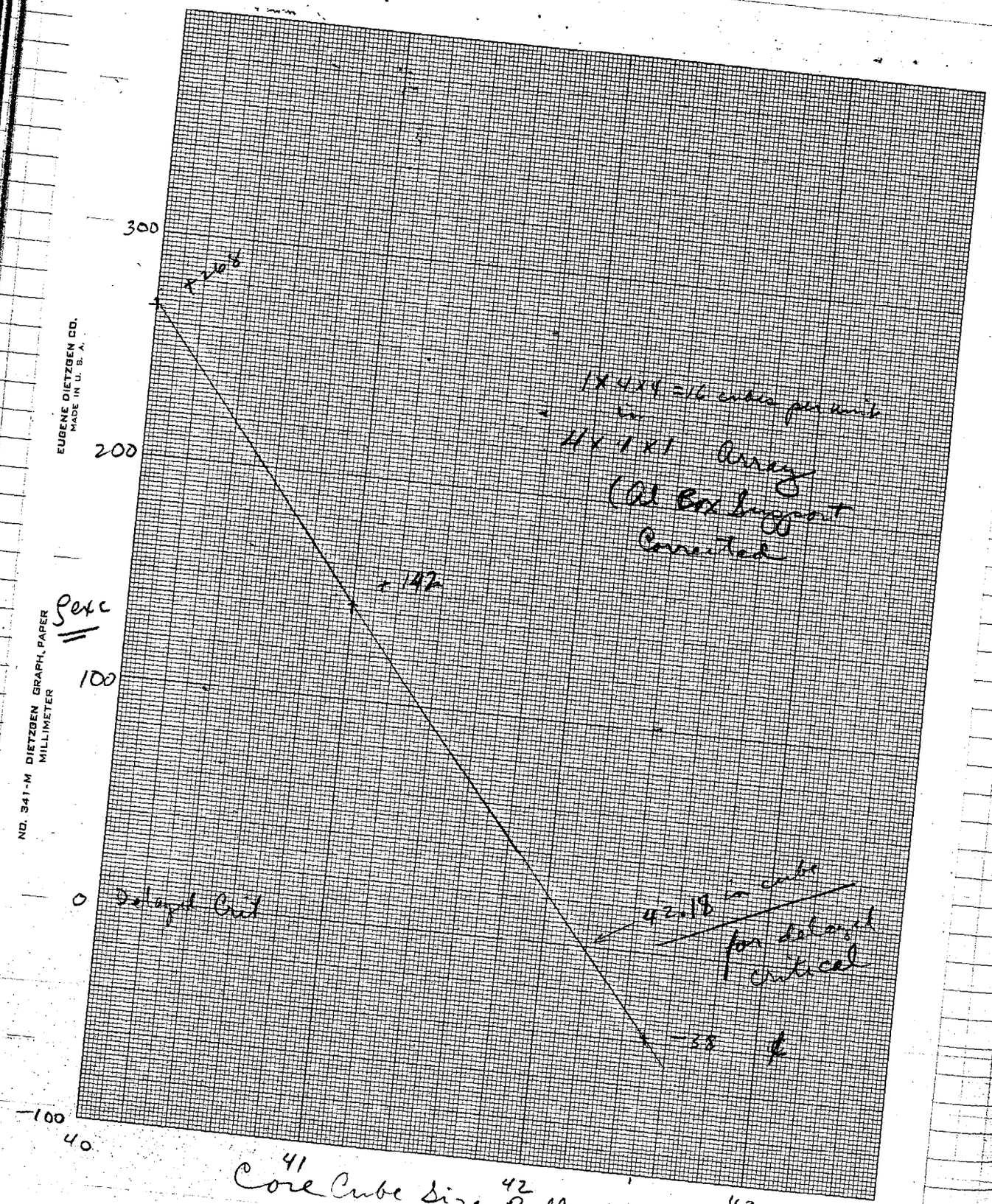
42.5 in. assembly − 38.2 ¢

41.0 in. assembly ρ = 161 ¢ − 18.8 (al cor)
= 142 ¢

0 - .2	@ 250	50
.2 - .25	@ 440	22
.25 - .44	@ 470	89
		161

40.0 in. assembly ρ = 161 ¢ + 126 = 287
19 al
268

See P. 136 for figure
Delayed Crit Size 42.16
Cell size 10.54 × 42.16 × 42.16 in

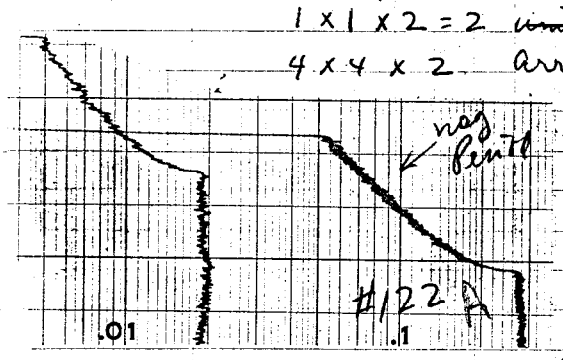

300
200
100
0
-100
40
41
42
43
+268
+142
-38
ρexc
Delayed Crit
1x4x4 = 16 cubes per unit
in
4x4x1 Array
(Al Box Support
Corrected
42.18 in cube
for delayed
critical
Core Cube Size, Reflector Cavity
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 341-M DIETZGEN GRAPH PAPER
MILLIMETER

Instrument Check on Feb 4 72 Source 10 mc ^{60}Co 8:30 AM

PR-1		Low Trip	OK	Hi Alarm Trip	OK
PR-2				Alarm Trip	
IC-1	[illegible]	Meter Trip	OK	Fast Trip	Scram Tables
IC-2	[illegible]	Meter Trip	OK		
IC-3	1.5×10^{-9}	Calibration	DWM	A	OK
IC-4	1.5×10^{-9}	Calibration	DWM	B	OK
TRM		Meter Trip		C	OK

1 x 1 x 2 = 2 ~~units~~ cubes per cell or unit

4 x 4 x 2 array (See pages 87-91 for preliminary exp) #74-79



E-W 1.625 (3.75) 3.25 (3.75) 3.25 (3.75) 3.25 (3.75) 1.625

N-S 1.625 (3.75) 3.25 (3.75) 1.625 — 1.625 (3.75) 3.25 (3.75) 1.625

Vert 3.218 + .032, (7.5) 6.468 + .032, (7.5) 3.25

Core 28.0 x 28.0 x 28.0 (Measured)

EXP #122 A

9:46 Start Assembly.

9:55½ Tables Closed 0.96

Subcritical

Insert Source IC-3 → 3×10^{-10}

10:01 Remove Source Neg Period of ~.100 sec

To steep and to low power for neg period measurement

Red Kit and Pers Check CC

Source Inserted CC DWM

Bypass CC

Dp = 1.5 in DWM

EXP #122 B

Add 4 ea 1/4 X 3 x 6 Plexiglas on South Half at Mid Plane Row of Blocks

10:10 Start Assembly, Source Inserted DWM

10:19 Tables closed — Source Out Ind = 0.093

Slightly Neg. Period

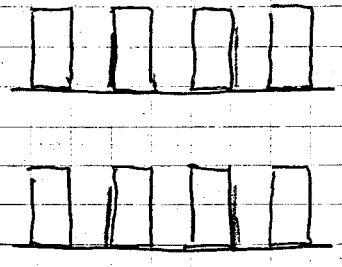
Source Inserted, to Point Power

10 22½ Start to level — withdraw source slowly

IC-3 @ 7×10^{-10}

10 30 Withdraw Source for Neg Period -4.64

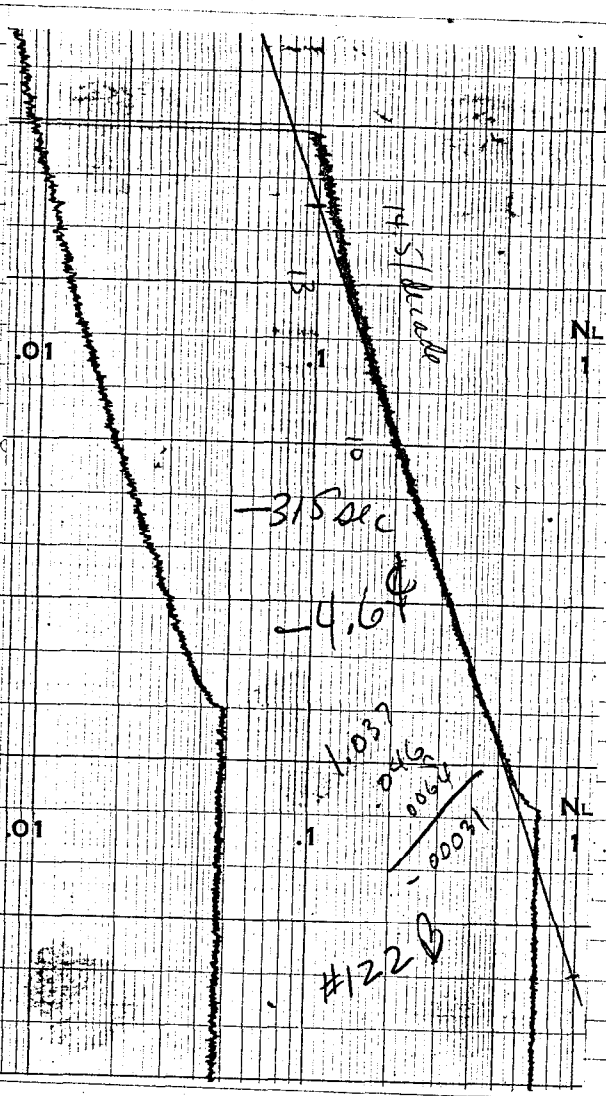
10 40 Shut Down

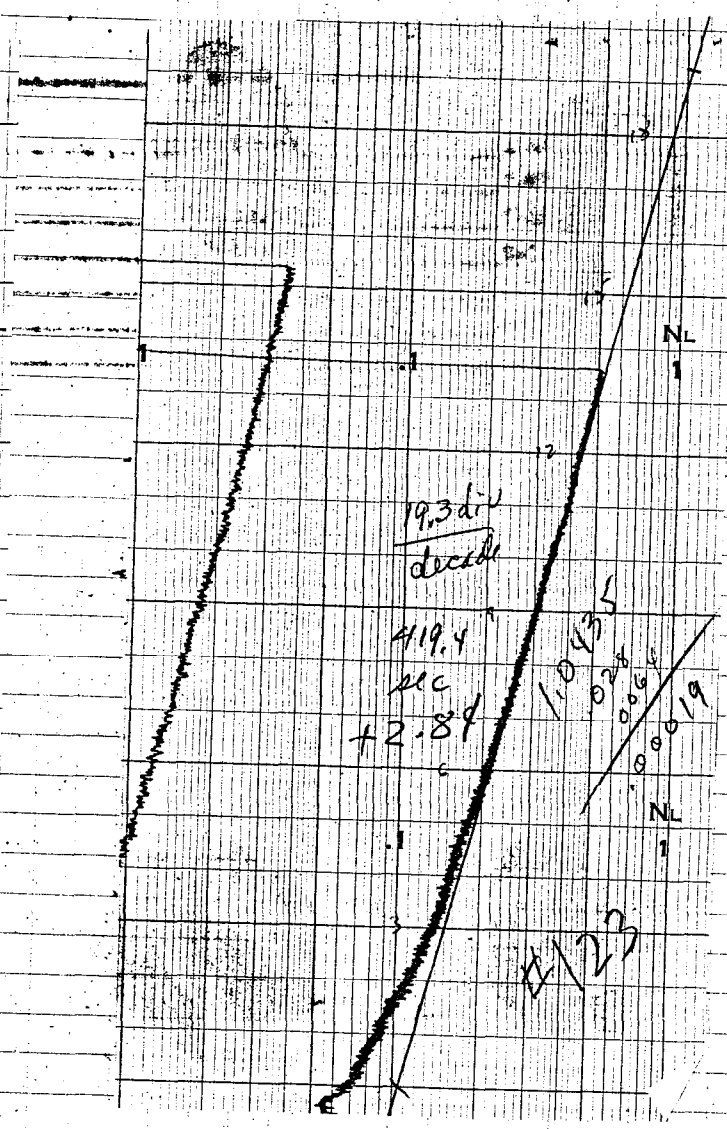


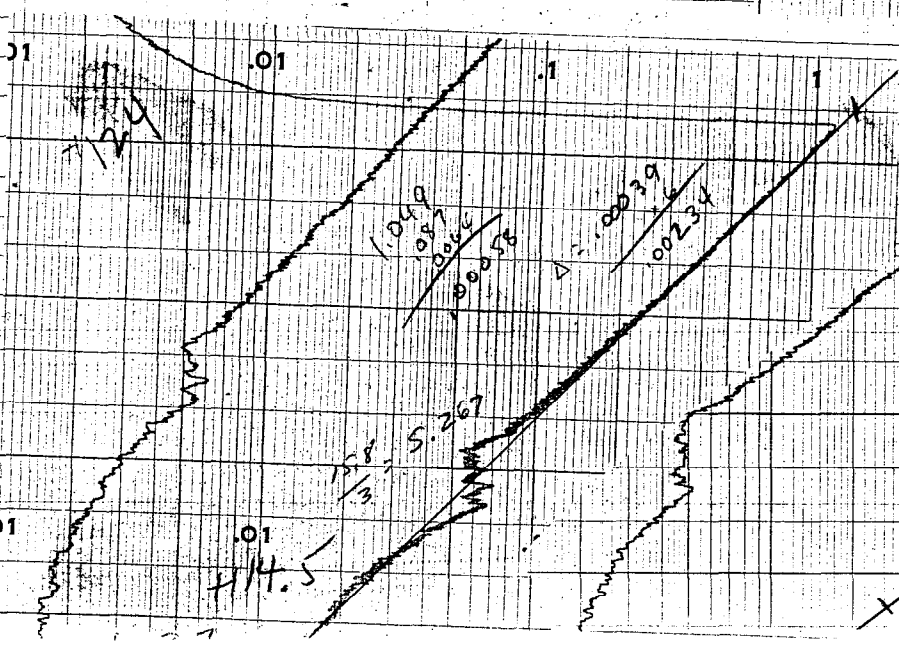
ρ_{ex} = 8.7 - 35.9 = - 27.2 ¢

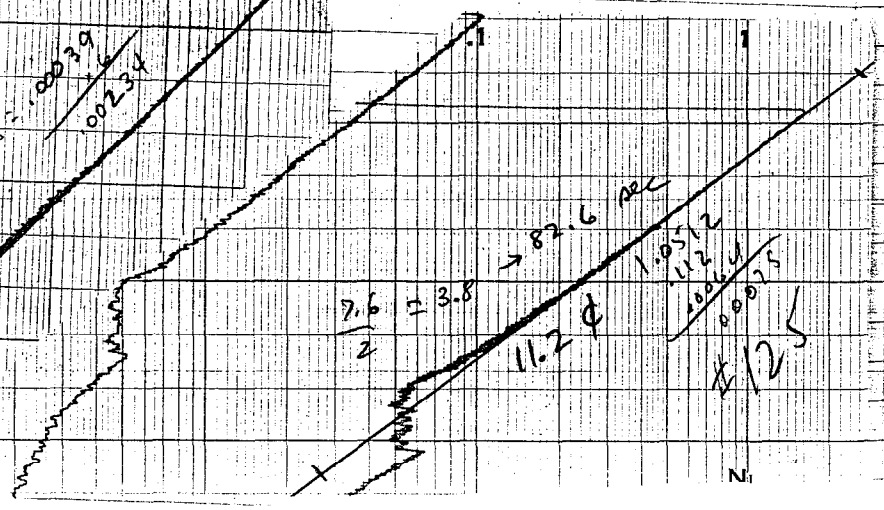
- 26.6

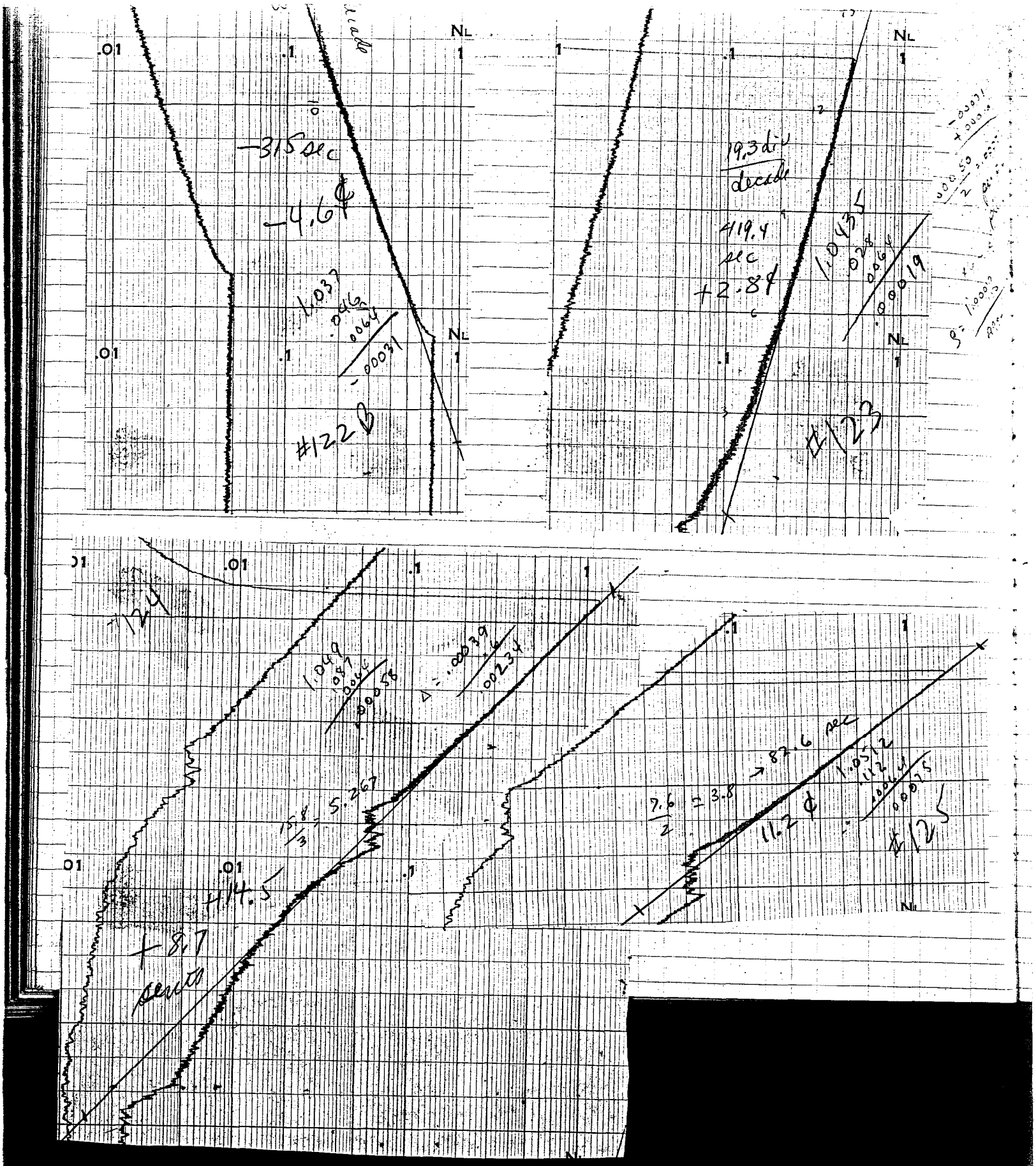
- 53.8 ¢


.01
.1
1
NL
-315 sec
-4.6¢
1.037
.046
.0064
-.00031
#122


.1
1
NL
19.3 div
decade
419.4
sec
+2.8¢
1.0435
.028
.0064
.00019
#123


.01
.1
1
#124
1.049
.087
.0064
.00058
Δ = .00039
.00234
15.8/3 = 5.267
+14.5


.1
1
82.6 sec
7.6/2 = 3.8
11.2¢
1.0512
.112
.0064
.00075
#125
NL



NL
.01
.1
1
-315 sec
-4.6¢
1.037
.046
.0064
-.00031
#122
19.3 div
decade
419.4
sec
+2.8¢
1.0435
.028
.0064
.00019
#123
.01
.1
1
.1
1
.01
.01
.1
1
.01
.01
.1
1
#124
1.049
.087
.0064
.00058
Δ = .00039
.6
.00234
15.8/3 = 5.267
+14.5
+8.7
sents
7.6/2 = 3.8
→ 82.6 sec
11.2¢
1.0512
.112
.0064
.00075
#125

EXP #123

Add 2ea ¼×3×6 Plexiglas to North
Total 6 ea plexiglas 87 gr/piece

10^{45} Start Assembly Source Inserted
10^{56} Table Closed Source Out, Pos. Period 0.093 + 2.8
Shut Down IC-3 @ 5×10^{-10}

Δg (123-121 = 2.8 − (−4.6) = 7.4 ¢

$\frac{7.4}{2}$ = 3.7 ¢/per piece of Plexiglas on 42.5 ¢ kg

−3.7
6
−22.2
+2.8
−19.4

EXP #124

Add 1 ea 13.5 × 27 in × 032 Al Sheet on top of South Half

11^{12} Start Assembly Insert Source
11^{22} On Pos Period Ind = 0.093 +8.7
Shut Down IC 3 = 1×10^{-9}

Δg (#124−123) = 5.9 ¢ → 00039
2× = .00078

EXP #125

add 8 ea 3×3×~3 in
Al Boxes on Top of Al Sheet on Top of South Half.

11^{36} Start Assembly Insert Source
11^{44} On Pos Period Ind = .093 → + 11.2 ¢ → .00075
11^{48} Shut Down IC 3 = 1.5×10^{-9}

Δg (125−123) = 8.4 ¢ Bottom Shelf + spacer
Δg (125−124) = 2.5 ¢ Spacers only

EXP #126

Remove Alum Shelf + 8 ea 3×3×3 boxes
Add 3 ea 3¾ × 13½ × .032 alum } on top off bottom tiers of fuel both tables
3 ea 3½ × 13½ × .032 "

1^{48} Start Assembly Insert Source 11¼
Red Lt. On & Ck. (East on) 10½
1^{56} On Pos Period Ind = 0.093 20.75 of a shelf.
2^{06} IC-3 = 1×10^{-9} ↘ 5.2 ¢ 27.0
Shut Down

EXP #127

Add 12 ea 3.618 × 3×3 boxes on North & South on top of above shelves in #126

2:14 Start Assembly, Insert Source
2:22 On Pos Period Ind = 0.093
2:31 Start to Level
2:51

> 6.0 ¢/.076

Bottom of pg 139 ~~88~~

Shut down IC-3 @ 5×10^{-10}

Δg (123-121 = 2.8 − (−4.6) = 7.4 ¢

$\frac{7.4}{2}$ = 3.7 ¢/per piece of PCV or 42.5 ¢ kg

−3.7
−22.2
+2.8
−19.4

EXP #124

Add 1 ea 13.5 x 27 in x 032 Al Sheet on top of South Half

11 12 Start assembly Insert source

11 22 On Pos Period Ind = 0.093 +8.7

Shut Down IC 3 = 1×10^{-9}

Δg (#124−123) = 5.9 ¢ → 00039

2x = .00078

EXP #125

add 8 ea 3x3 x ~3 in Al Boxes on Top of Al Sheet on Top of South Half.

11 36 Start assembly Insert Source

11 44 On Pos Period Ind = .093 → + 11.2 ¢ → .00075

11 48 Shut Down IC 3 = 1.5×10^{-9}

Δg (125−123) = 8.4 ¢ Bottom shelf + spacer

Δg (125−124) = 2.5 ¢ Spacers only

EXP #126

Remove Alum Shelf + 8 ea 3x3x3 boxes

Add 3 ea 3 3/4 x 13 1/2 x .032 alum } on top off bottom tiers of fuel both tables

3 ea 3 1/2 x 13 1/2 x .032 "

1 48 Start Assembly Insert Source 11 1/4

Red Lite On & Ck. (East on) 10 1/2

1 56 On Pos Period Ind = 0.093 20.75 of a shelf.

2 06 IC-3 = 1×10^{-9} ↘ 5.2 ¢ 27.0

Shut Down

EXP #127

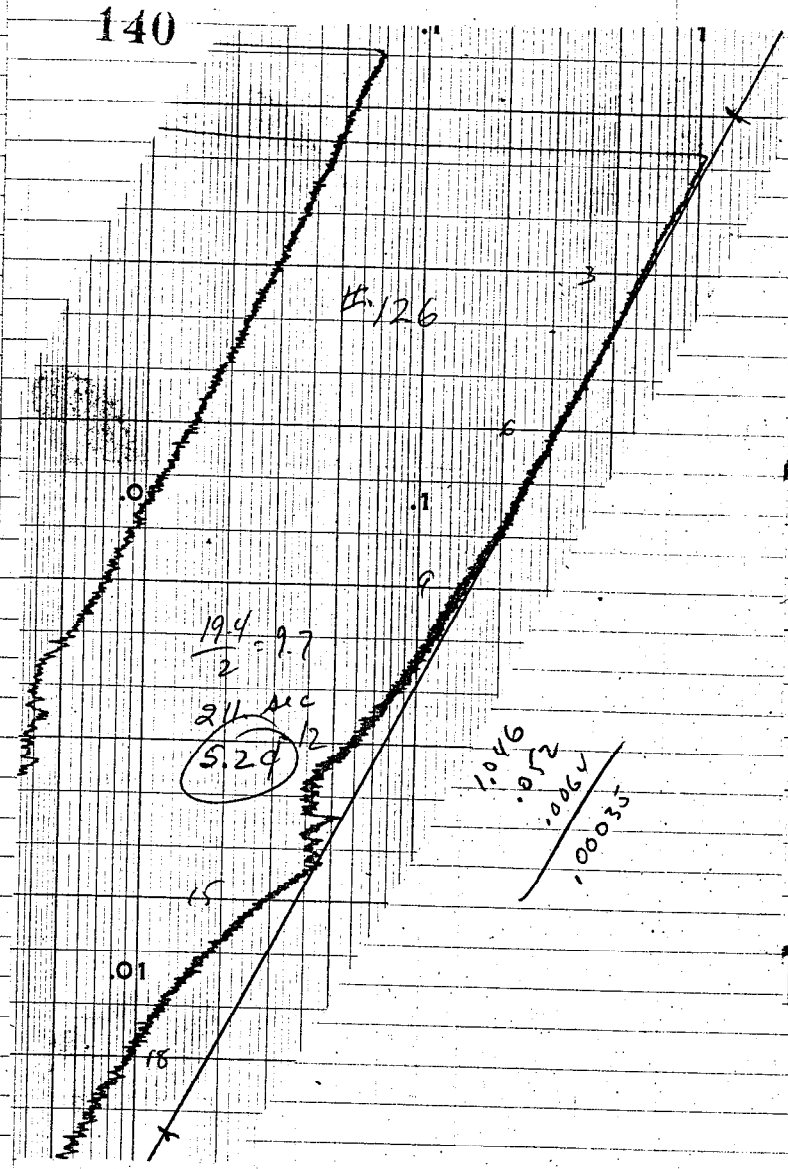
Add 12 ea 3.618 x 3x3 boxes on North & South on top of above shelves in #126

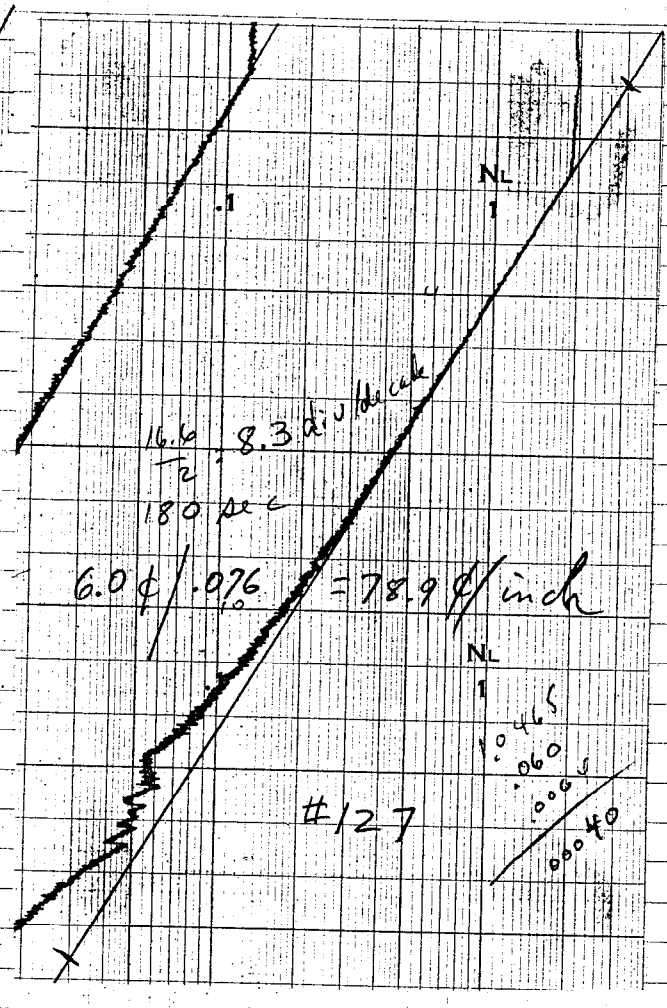
2:14 Start Assembly, Insert Source

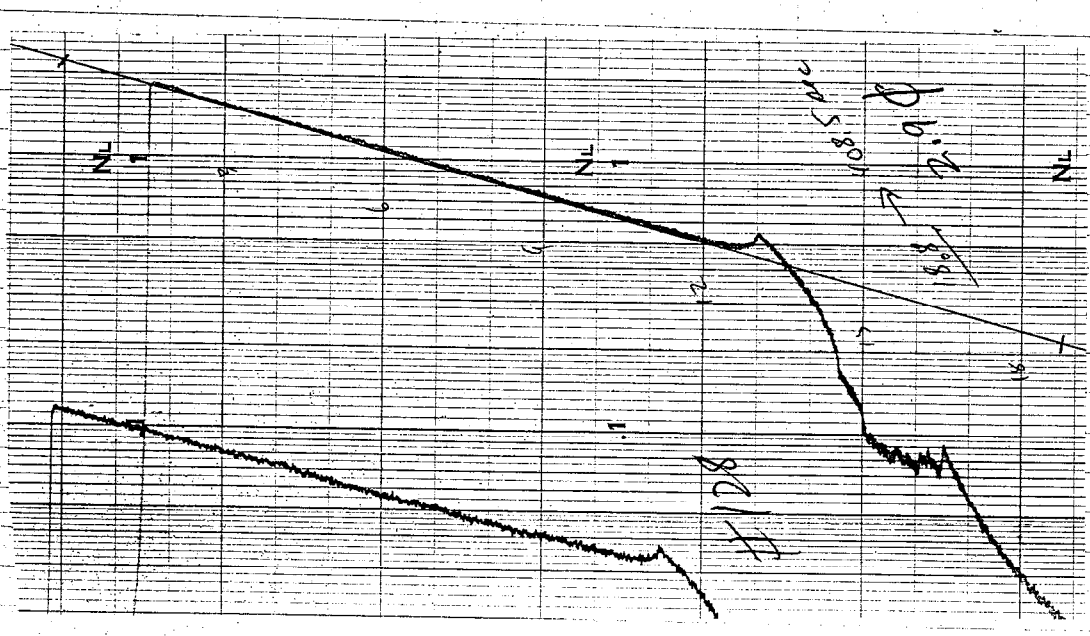
2:22 On Pos Period Ind = 0.093

2 31 Start to Level

39 Level Ind = 0.169 > 6.0¢/.076


#126
19.4/2 = 9.7
211 sec
5.29
1.046
.052
.0064
.00035


16.6/2 = 8.3 div/decade
180 sec
6.0 ¢/.076 = 78.9 ¢/inch
#127
1.0465
.060
.0065
.00040


#128
1.0435
.029
.0064
.00019

EXP #128

Repeat of #123 (w. 6ea 1¼ x 3 x 6 plexiglas)

Plexiglas on for exp 123–128

2 48 Start Assembly Source Inserted

2 57 Tables Closed

Re insert source to Raise Power to ~ 5×10^{-10} IC-3

Withdraw Source

3 08 IC-3 to 2×10^{-9} Shut Down

+Per → 408.5 sec → 2.9 ¢

12 boxes $\Delta\rho$ = 127-126 = 0.8 ¢

Partial midshelf $\Delta\rho$ = 126-125 = 2.3 ¢

00035 - 0.0019

16

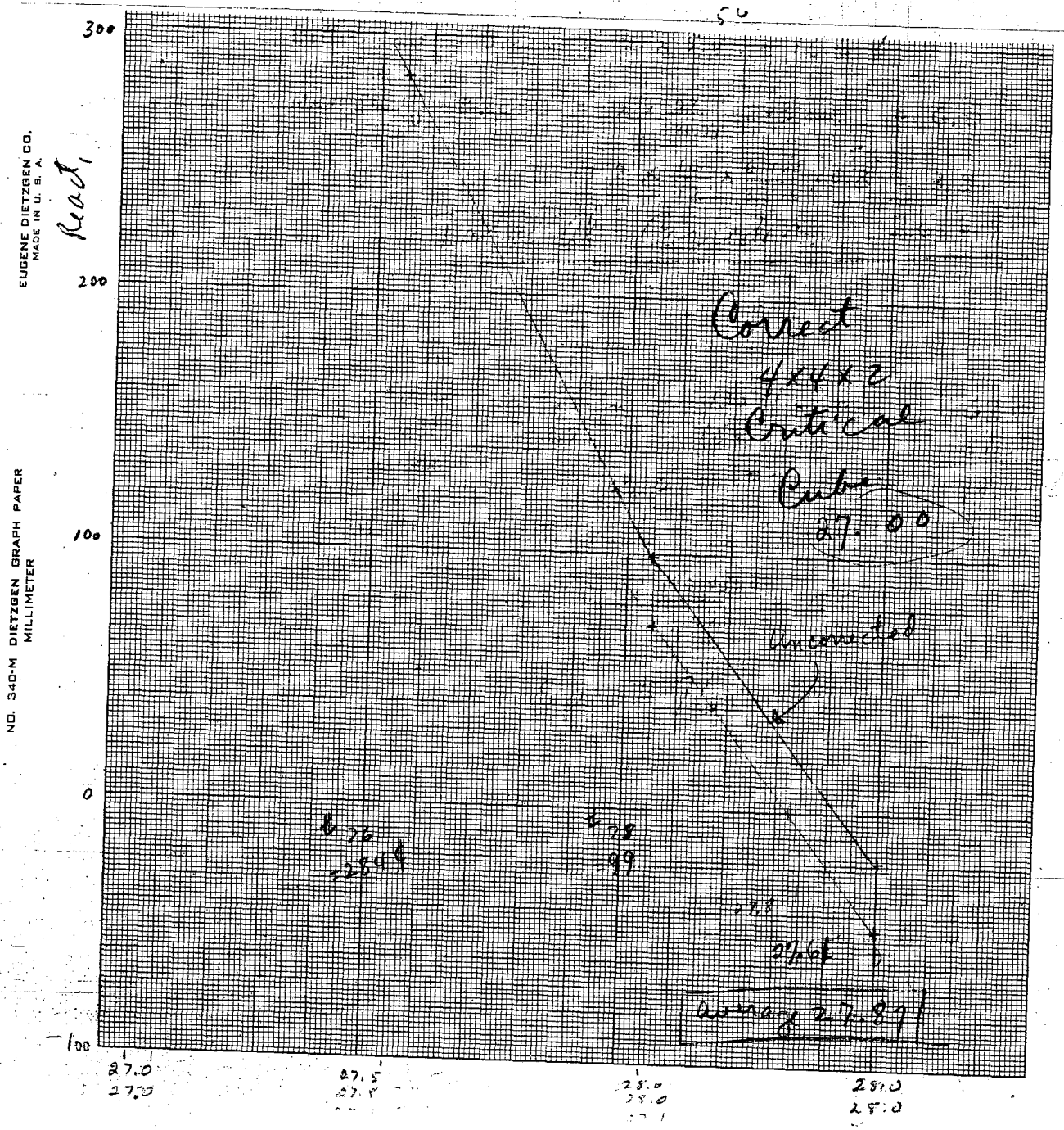
56

12

42

24

00178



EXP #128

Repeat of #123 (w. 6ea 1/4 x 3 x 6 plexiglas)

Plexiglas on for exp 123–128

2 48 Start Assembly Source Inserted

2 57 Tables Closed

Re insert source & Raise Power to ~ 5×10^{-10} IC-3

Withdraw Source

3 08 IC-3 to 2×10^{-9} Shut Down

+Per → 408.5 sec → 2.9 ¢

12 boxes $\Delta\rho = 127 - 126 = 0.8$ ¢

Partial mid shelf $\Delta\rho = 126 - 125 = 2.3$ ¢

00035 − 00019 16

Bottom Shelf + Boxes $= 2 \times 8.4 = 16.8$ ¢ (56) .00412

Mid Shelf + Boxes $= 2 \times \frac{27}{20.75} \times 2.3 = 6.0$ (16) 42

$+ 2 \times \frac{16}{12} \times \frac{6.468}{3.618} \times 0.8 = 3.8$ (5) 24

Total Al Correction 26.6 ¢ .00178

From Table	0 – .5 in	135 ¢/in av	67.5
React Curve for	.5 – .67	185	31.5
		Exp #78	99. ¢

Various Assemblies 1.38
.67
.71 in $\times \frac{190 + 332}{2} = 185$
99
284 ¢

Exp #76

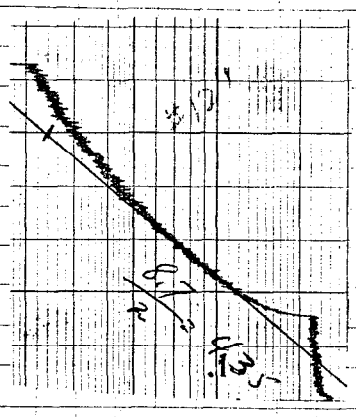
00075
19

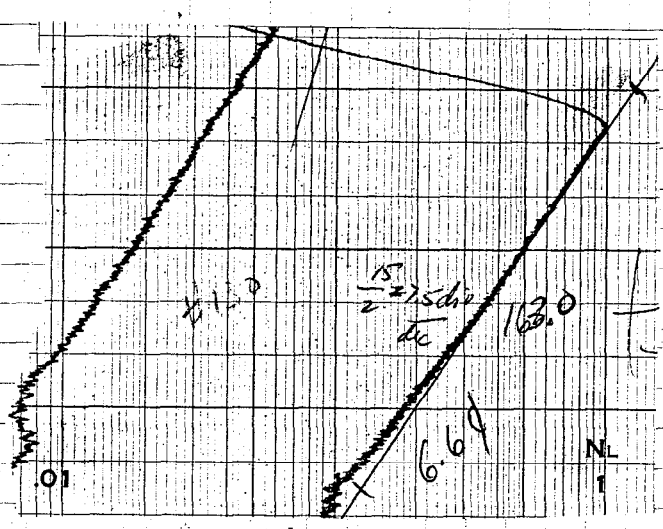
.00056 8 ea 3x3 x3 + Sheet
2

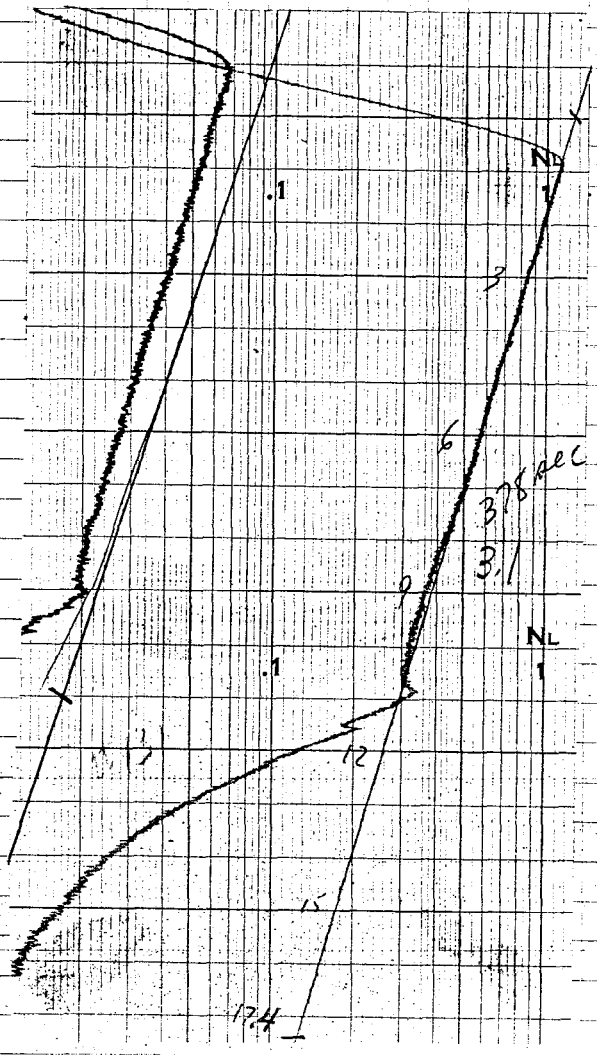
.00112
42

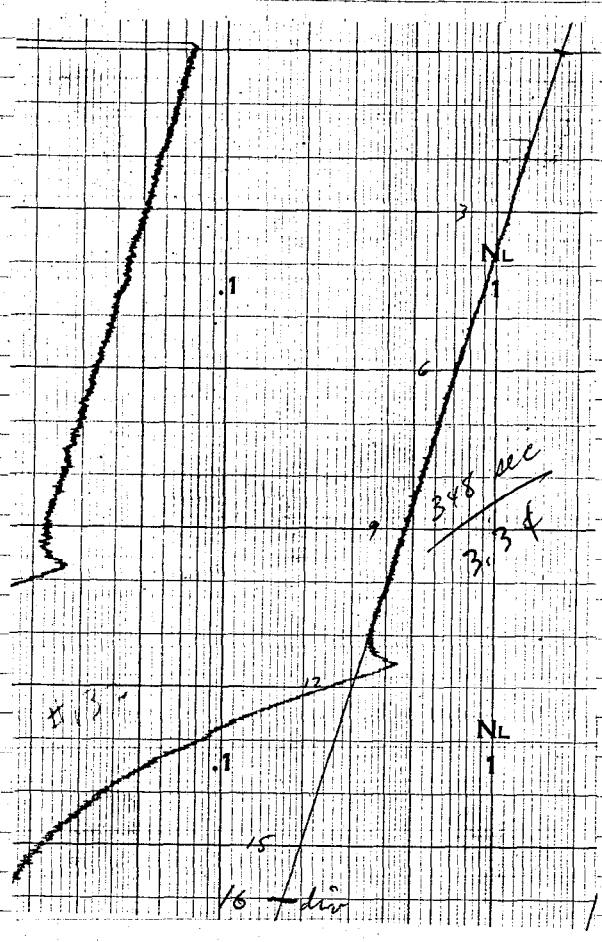
.00154 al con

127 .00040
123 19
21
2
42 x 27/20.2




.01
NL
1
163.0
6.6¢


.1
NL
1
3
6
378 sec
3.1
9
.1
NL
1
12
15
17.4


.1
NL
1
3
6
348 sec
3.3¢
9
12
.1
NL
1
15
16 div

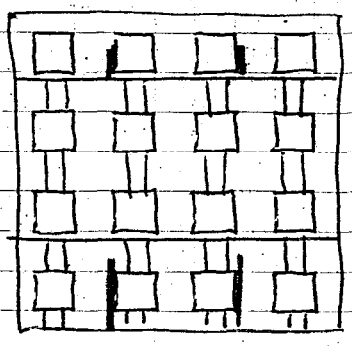
Instrument Check on Feb 8, 72 Source 10 mc ^{60}Co

950 ✓ PM-1 Bal 4.50 Low Trip OK Trip OK
PM-2
IC-1 2 x 10^-10 Meter Trip OK OK
IC-2 2 x 10^-10 Meter Trip Screw Table
IC-3 1.7 x 10^-1 Calibration Dwtn A. OK
IC-4 1.6 x 10^-1 Calibration Dwtn B. OK
CPM Meter Trip C. OK

4 x 4 x 4 Array of
1 x 1 x 1 Cubes as a unit.

E-W 1.484 (3.75) 2.968 (3.75) 2.968 (3.75) 2.968 (3.75) 1.484
N-S 1.484 (3.75) 2.968 (3.75) 1.484 - 1.484 (3.75) 2.968 (3.75) 1.484
Vert 1.484 (3.75) 2.968 (3.75) 2.968 (3.75) 2.968 (3.75) 1.484
2.936 + .032 2.936 + .032

Red Lit + Pers. Ck OK Indicator
Δp = 1.5 in. OK 2.026
Bypass OK 0.002
Source Inserted
Manually Dwtn OK



CORE = 26.875^3
(Measured)

Note - Only 2 alum shelves

EXP # 129

2^{33} Start Assembly
43 tables Closed Source Removed On Neg Period
Insert Source to Raise Power Ind .098 $\rho = 6.6 - 8\sqrt{\frac{2.5+3.3}{2}} = 20.6$ (27.2)
47½ Remove Source Neg Period
Power on IC-3 → 2.5 x 10^-10 not high enough for accurate neg period.

Table Halves are misaligned ~ 1/16 in.

C.C. Source Inserted Manually EXP # 130
2^{59} Start Assembly 1.995 Add 8 ea 3 x 6 x 1/4 Plexiglass 4 on each Table
1.988 As shown on sketch above in red.
3 07½ On Pos Period Source Removed Ind = .098
Shut Down Screw to 32 Rev.

EXP # 131 Remove 1 pc Plexiglas bottom South Table
3^{17} Start Re assembly 2.035 7 pc Remain.
21½ On Pos Period Source Out Ind = .098+
Screw to 32 Rev

EXP # 132 Move 1 pc Plexiglas from Upper to Bottom South Table
3^{37} Start Re Assembly 2.043
3^{41} " " "

IC-3 1.7 X 1.5-1 Calibration Dwtn
IC-4 1.6 X 1.5-1 Calibration Dwtn
Meter Trip

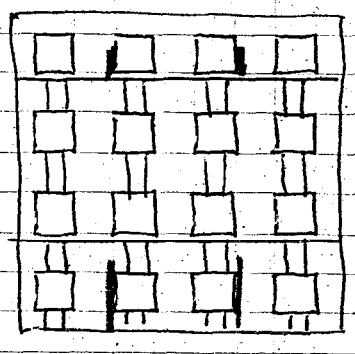
A OK
B OK
C OK

4 X 4 X 4 Array of
1 X 1 X 1 Cubes as a unit.

E-W 1.484 (3.75) 2.968 (3.75) 2.968 (3.75) 2.968 (3.75) 1.484
N-S 1.484 (3.75) 2.968 (3.75) 1.484 - 1.484 (3.75) 2.968 (3.75) 1.484
Vert 1.484 (3.75) 2.968 (3.75) 2.968 (3.75) 2.968 (3.75) 1.484
2.936 + .032 2.936 + .032

Red Lit + Pers. Ck OK
$\Delta p = 1.5$ in. OK
Bypass OK
Source Inserted Manually Dwtn OK

Indicator
2.026
0.002



CORE = 26.875^3 (Measured)

Note - Only 2 alum shelves

EXP # 129

2^{33} Start Assembly
43 tables Closed Source Removed On Neg Period
Insert Source to Raise Power Ind .098 $\rho = 6.6 - 8\sqrt{\frac{2.5+3.3}{2}} = 20.6$ (27.2)
$4^{7\frac{1}{2}}$ Remove Source Neg Period
Power on IC-3 → 2.5×10^{-10} not high enough for accurate neg period.

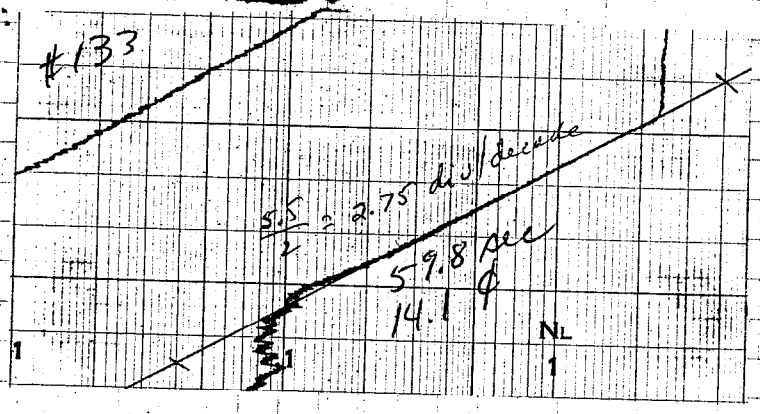
Table Halves are misaligned ~ 1/16 in.

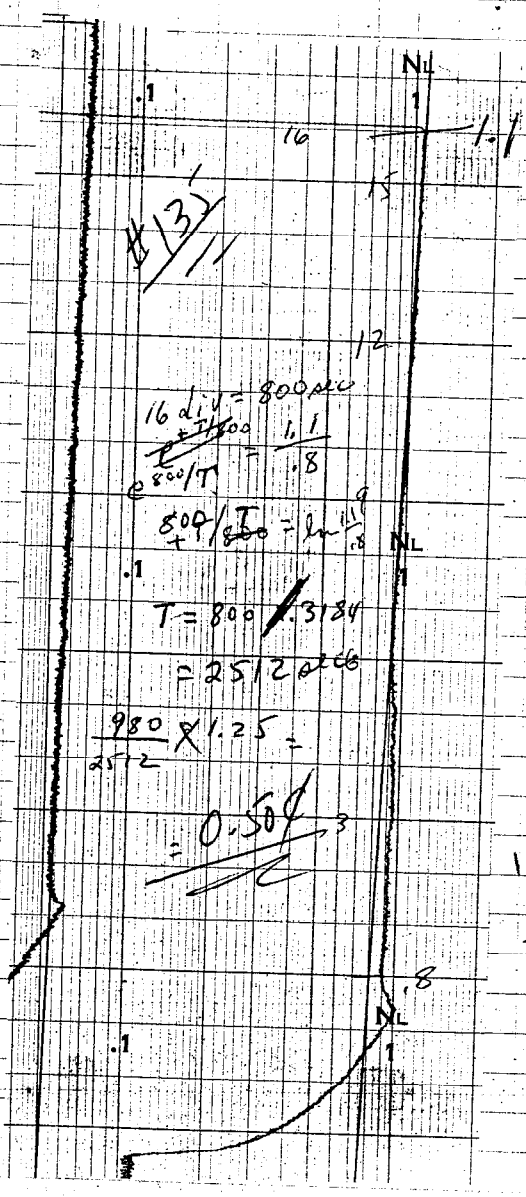
C.C. Source Inserted Manually EXP # 130
2^{59} Start Assembly 1.995 1.988
Add 8 ea 3 X 6 X 1/4 Plexiglass 4 on each Table As shown on sketch above in red.
$3^{07\frac{1}{2}}$ On Pos Period Source Removed Ind = .098
Shut Down Screw to 32 Rev.

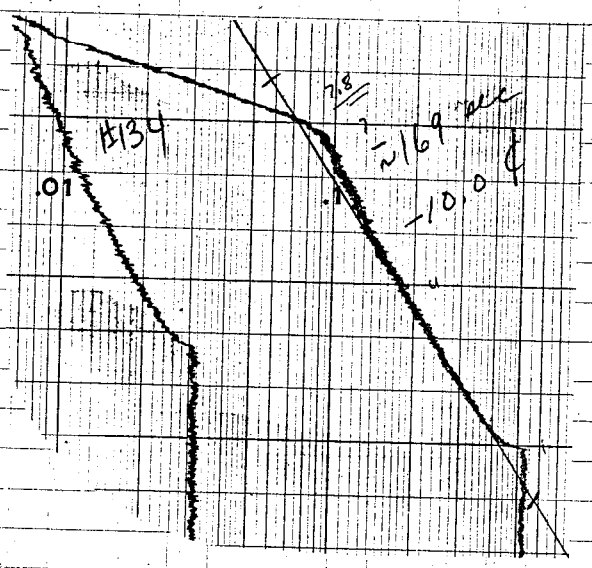
EXP # 131 Remove 1 pc Plexiglas bottom South Table 7 pc Remain.
3^{17} Start Re assembly 2.035
$21\frac{1}{2}$ On Pos Period Source Out Ind = .098+
Screw to 32 Rev

EXP # 132 Move 1 pc Plexiglas from Upper to Bottom South Table
3^{37} Start Re Assembly 2.043
3^{41} On Pos Period

Bottom of pg 145







1.041
.005
.00641
1.00003
5.5

1.031
.10
.0064
-.00066
.00003
.00069
.00207
.00003
.00210

EXP # 129 [illegible] 2 alum shelves
EXP # [illegible] 5 alum shelves + Spacers on top.

$\Delta\rho \approx 60$ ¢
Reflector aligned before array was stacked.

Instrument Check on Feb. 10, 72 **Source** 10mc ^{60}Co

950 V

PM-1	Bal 4.50	Low Trip	SCRAM	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip	OK		MONITRON
IC-3	[illegible]	Calibration	DWM	A	OK
IC-4	1.8×10^{-1}	Calibration	DWM	B	OK
Table Ind CRM	1.959	Meter Trip		C	OK

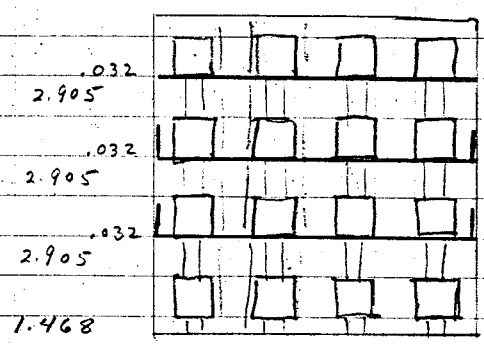
Table position Indicator repaired! Tables closed
Ind = 0.098

Source Inserted Resp OK
Red lite & Pers. Check OK
$\Delta\rho$ = 1.5 in. H_2O

Monitron A set to 20 R — may trip more positively.

EXP # 133 Assembly size reduced
26 3/4 x 26 3/4 x 26 3/4 (measured)

1:39 Start Assembly
1:48 Tables Closed & Source Out
On Positive Period — Ind = .281
14.1 ¢ Screw Resp 3.6
53 Start to Level Ind = .391
Screw Rev. 5.4
59 Shut down



Note: Now there are 3 alum shelves!

2 ea pc 2 7/8 x 9 in
S.S. exp 134
.073 on North
.060 on South

Table Ind → 2.057+ ? 14.1/.11 = 128 [illegible]
128 x .284 = 36 ¢

Add 8 ea .060 x 2 7/8 x 9 on South half
Add 8 ea .073 x 2 7/8 x 9 on North half

EXP # 134

2:32 Start Assembly Source Resp OK Ind = 2.060 Screw 64.0
2.058
40 tables Closed Source Out Neg Period .107 Scre 0.0
41 Insert Source to Raise Power
Level at 0.5×10^{-9} on IC-3
51 Remove Source Neg Period ~ -169 sec ~ -10.0 ¢

EXP # 135 Remove 2 ea .073 North 6 ea remain
noted friction [illegible] spring return of Ind → 1.801 2 ea .060 South 6 ea remain
3:01 Insert Source Resp OK Manually to — 2.060
Start Assembly
[illegible] Tables Closed Source Out ~ Delayed [illegible] Table Ind = 0.108 at Closure

950 V

PM-1	Bal 4.50	Low Trip	SCRAM	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip	OK		MONITRON
IC-3	1.5×10^{-9}	Calibration	DWM	A	OK
IC-4	1.8×10^{-1}	Calibration	DWM	B	OK
Table Ind CRM	1.959	Meter Trip		C	OK

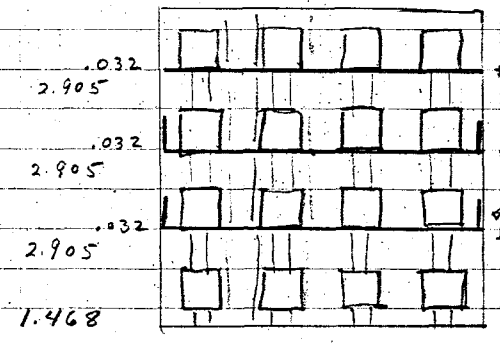
Table position Indicator repaired! Tables closed
Ind = 0.098

Source Inserted Resp OK
Red lite & Pers. Check OK
Δp = 1.5 in. H_2O

Monitron A set to 20 R — may trip more positively.

EXP # 133 Assembly size reduced
26 3/4 x 26 3/4 x 26 3/4 (measured)

1:39 Start Assembly
1:48 Tables Closed & Source Out
On Positive Period — Ind = .281
14.1 ¢ Screw Resp 3.6
53 Start to Level Ind = .391
Screw Rev. 5.4
59 Shut down



Note: Now there are 3 alum shelves!

2 ea pc 2 7/8 x 9 in
S.S. Exp 134
.073 on North
.060 on South

Table Ind → 2.057+ ? 14.1/.11 = 128 ¢/in
128 x .284 = 36 ¢

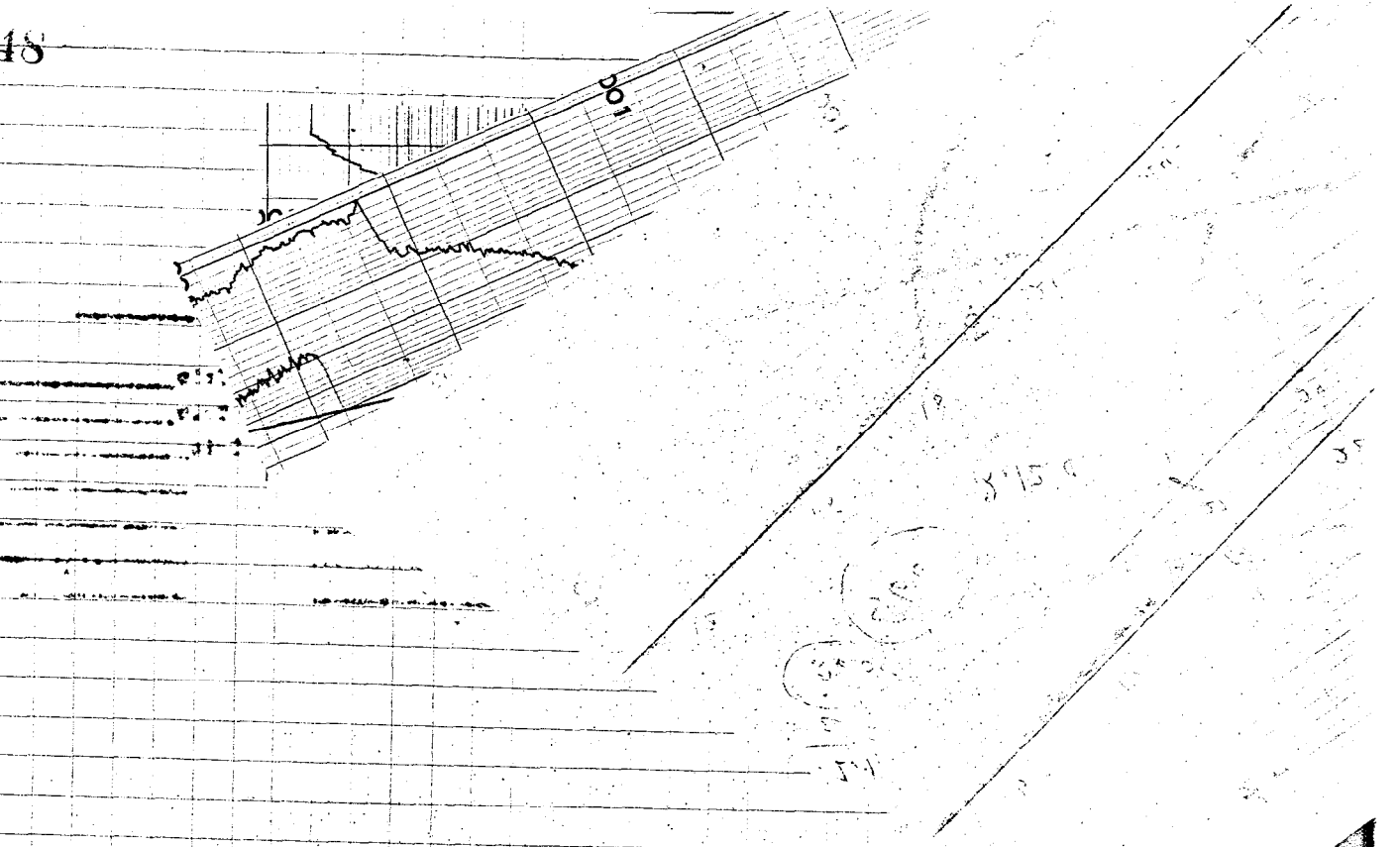
Add 8 ea .060 x 2 7/8 x 9 on South half
Add 8 ea .073 x 2 7/8 x 9 on North half.

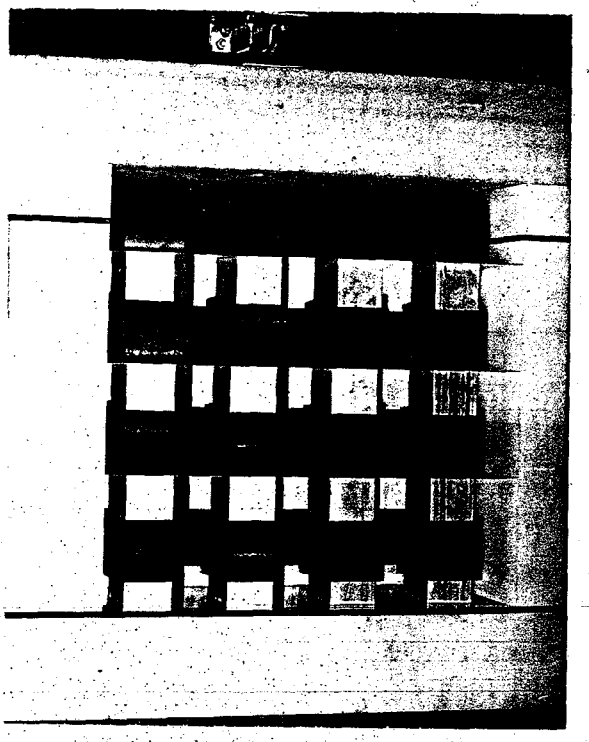
EXP # 134

2 3.2 Start Assembly Source Resp OK Ind = 2.060 Screw 64.0
2.058
40 tables Closed Source Out Neg Period .107 Scre 0.0
41 Insert Source to Raise Power
Level at 0.5×10^{-9} on IC-3
51 Remove Source Neg Period ~ -169 sec ~ -10.0 ¢

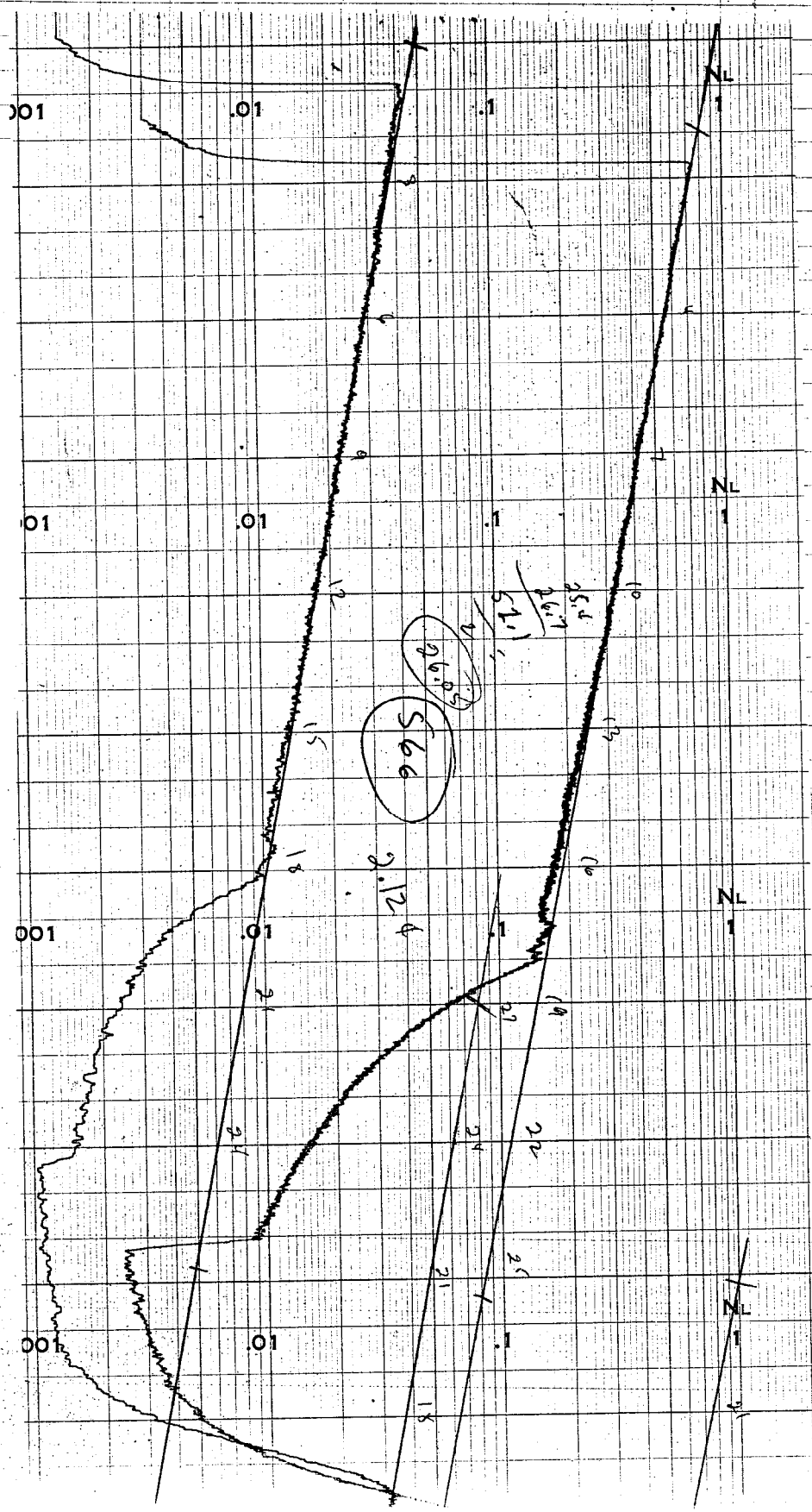
EXP # 135 Remove 2 ea .073 North 6 ea remain
noted friction in spring return of Ind → 1.801 2 ea .060 South 6 ea remain
3:01 Insert Source Resp OK Manually to — 2.060
Start Assembly
310 Tables Closed Source Out ~ Delayed Crit Tables Ind = 0.108 at Closure
Insert Source Raise Power — Remove source Post Period = 0.50¢

Bottom of pg 147 ~~88~~



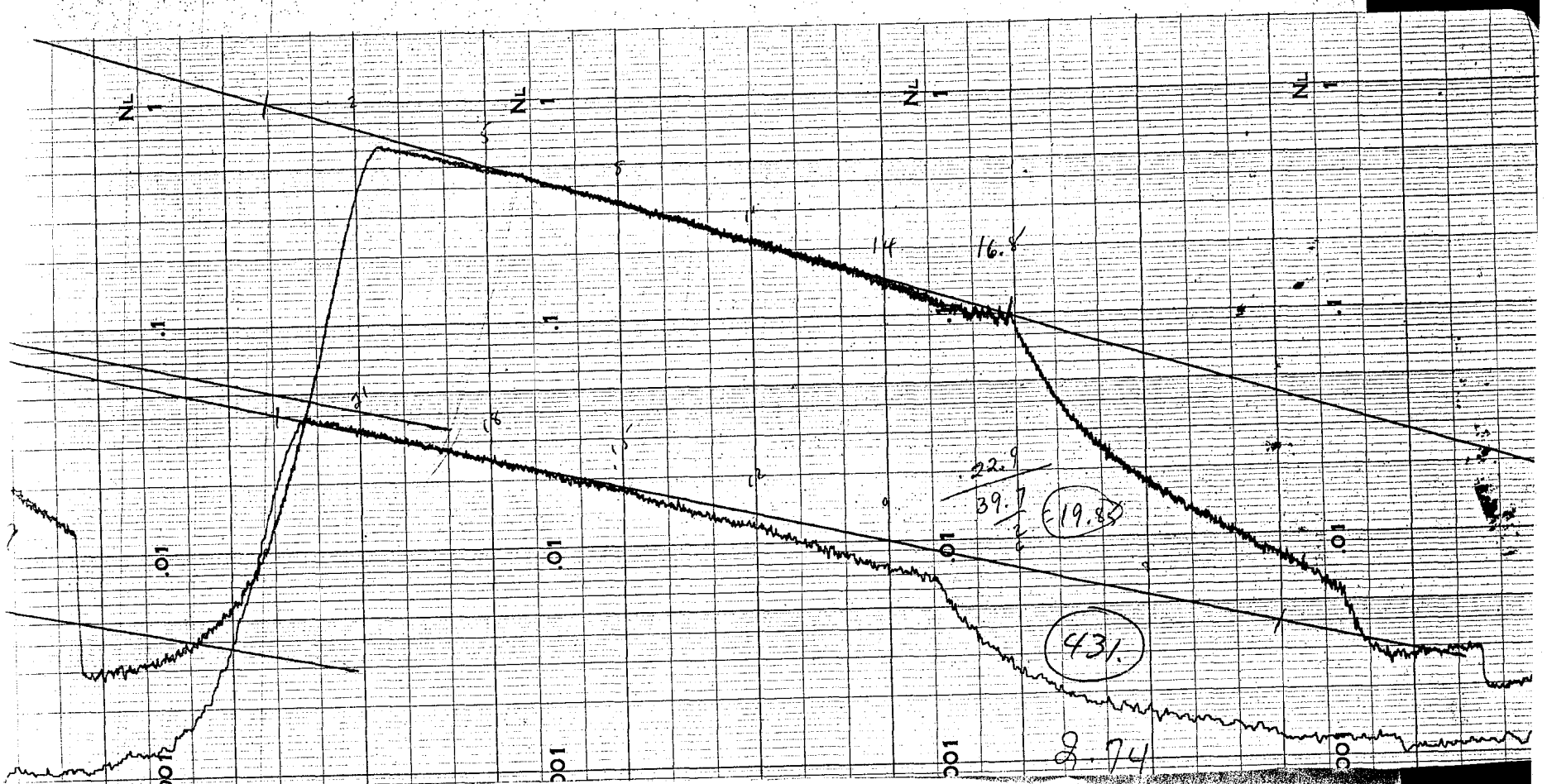


CONFIDENTIAL

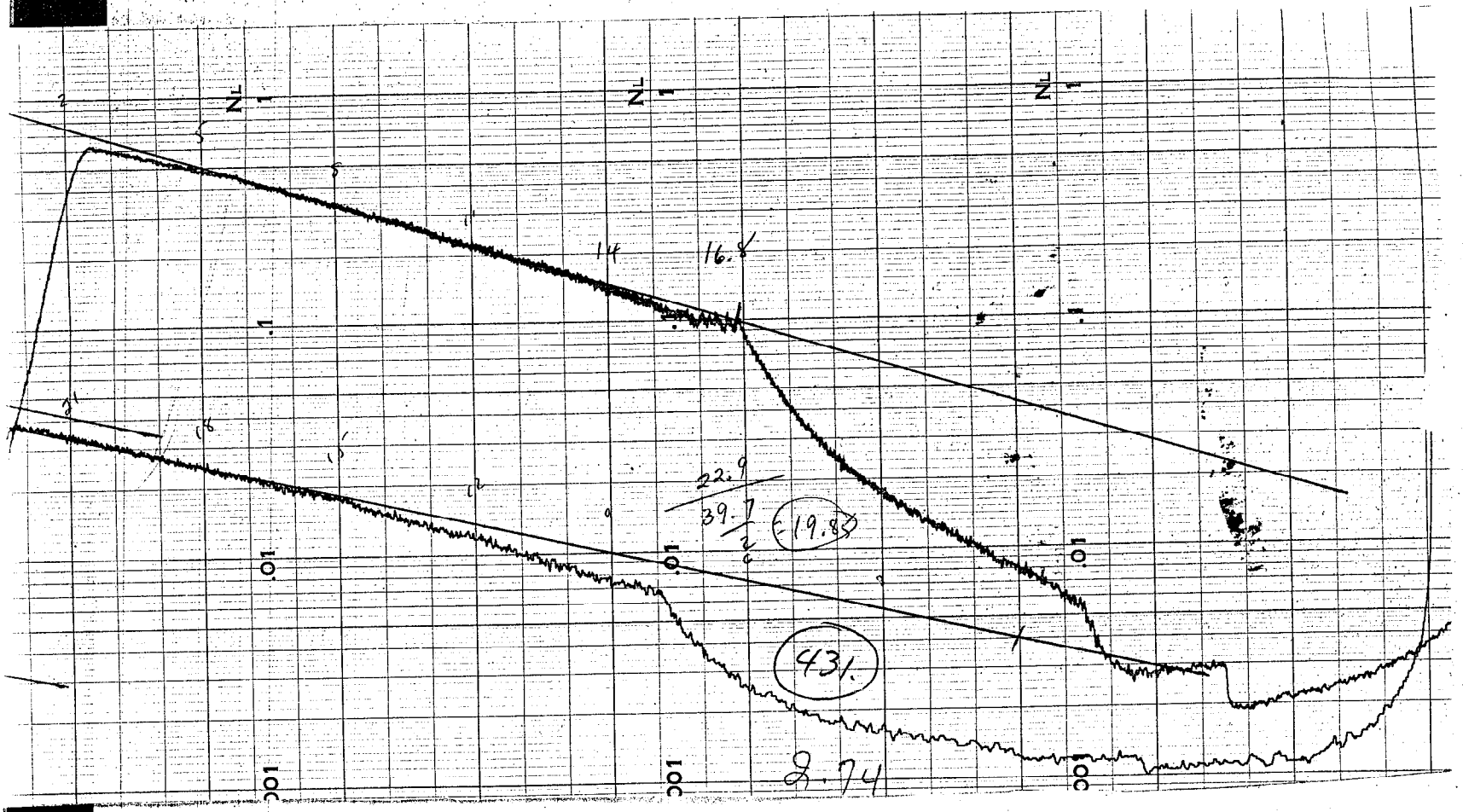


001
.01
.1
1
NL
566
2.124

CONFID



NL
1
.1
.01
.001
14
16.8
22.9
39.7
19.85
431.
2.74



14
16.8
22.9
39.7
19.85
431.
2.74

#136

In North Add Mockup of Half of Shelf #1 $8\frac{1}{8} \times 13\frac{1}{4} \times .032$

Source Inserted Pins Ok $6\frac{1}{8}$ " "

3:32 Start Assembly $6\frac{1}{8}$ " "

3:40 Table Closed On Pos Period Ind = .107 $26\frac{3}{4}$ vs $5\frac{5}{8}$ Ratio = 1.044

3:50 Separate table — Screw Only $5\frac{1}{4}$ " "

Δg (136 − 135) = 2.74 − .50 = 2.24

#137

Moved Alum to mockup Half of Shelf #3

3:56 Start Re assembly — Source Inserted

4:05 On Pos Period Ind = .107

4:12 Separate Tables — Screw Only

Δg (137 − 135) = 2.19 − .5 = 1.69

#138

Moved Alum to Mock up Half of Shelf #2

4:18 Start Re assembly Source Inserted Pins Ok

4:25 On Pos Period Ind = 0.107

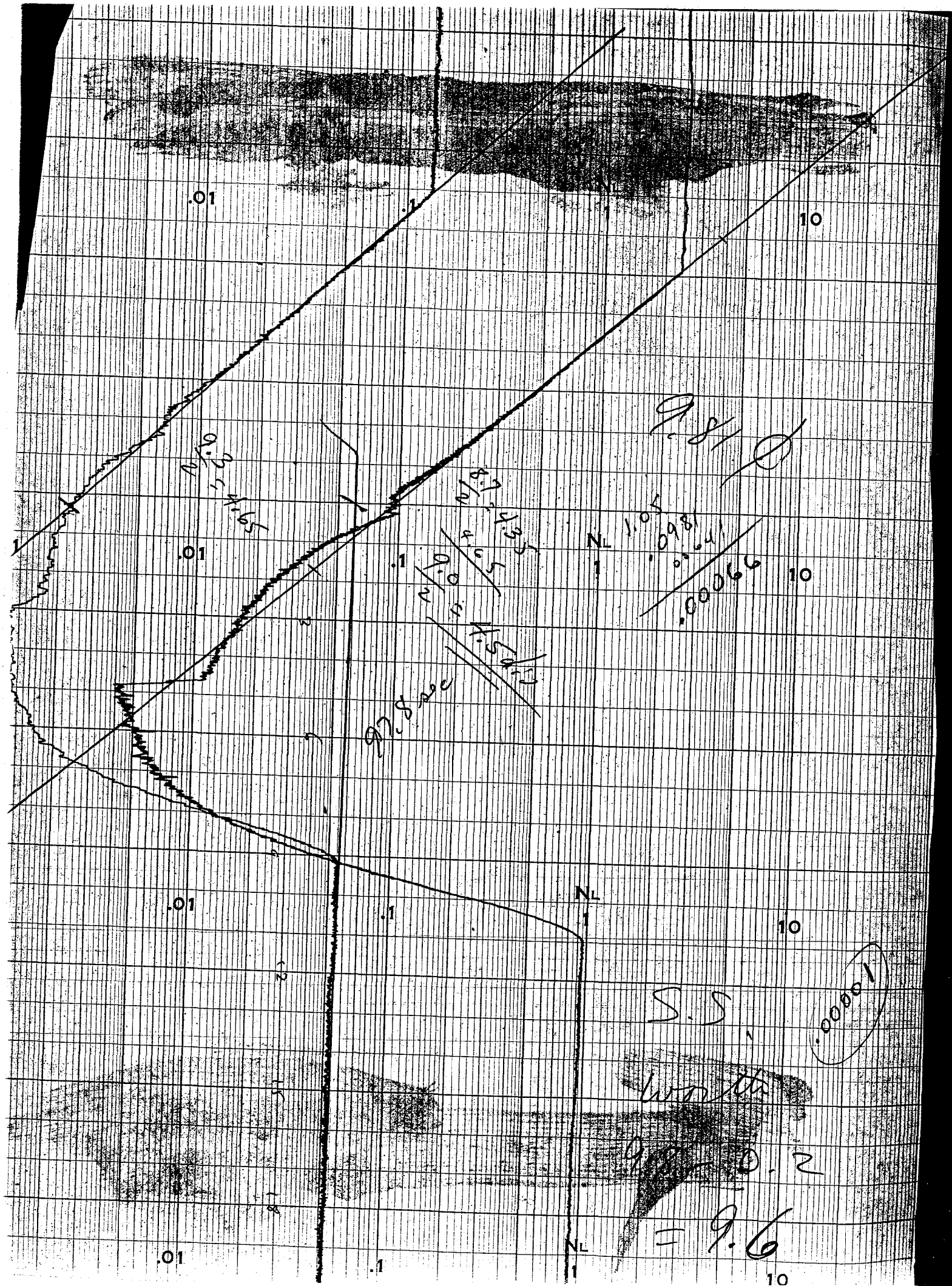
4:38 Shut Down

Δg (138 − 135) = 2.12 − .50 = 1.62

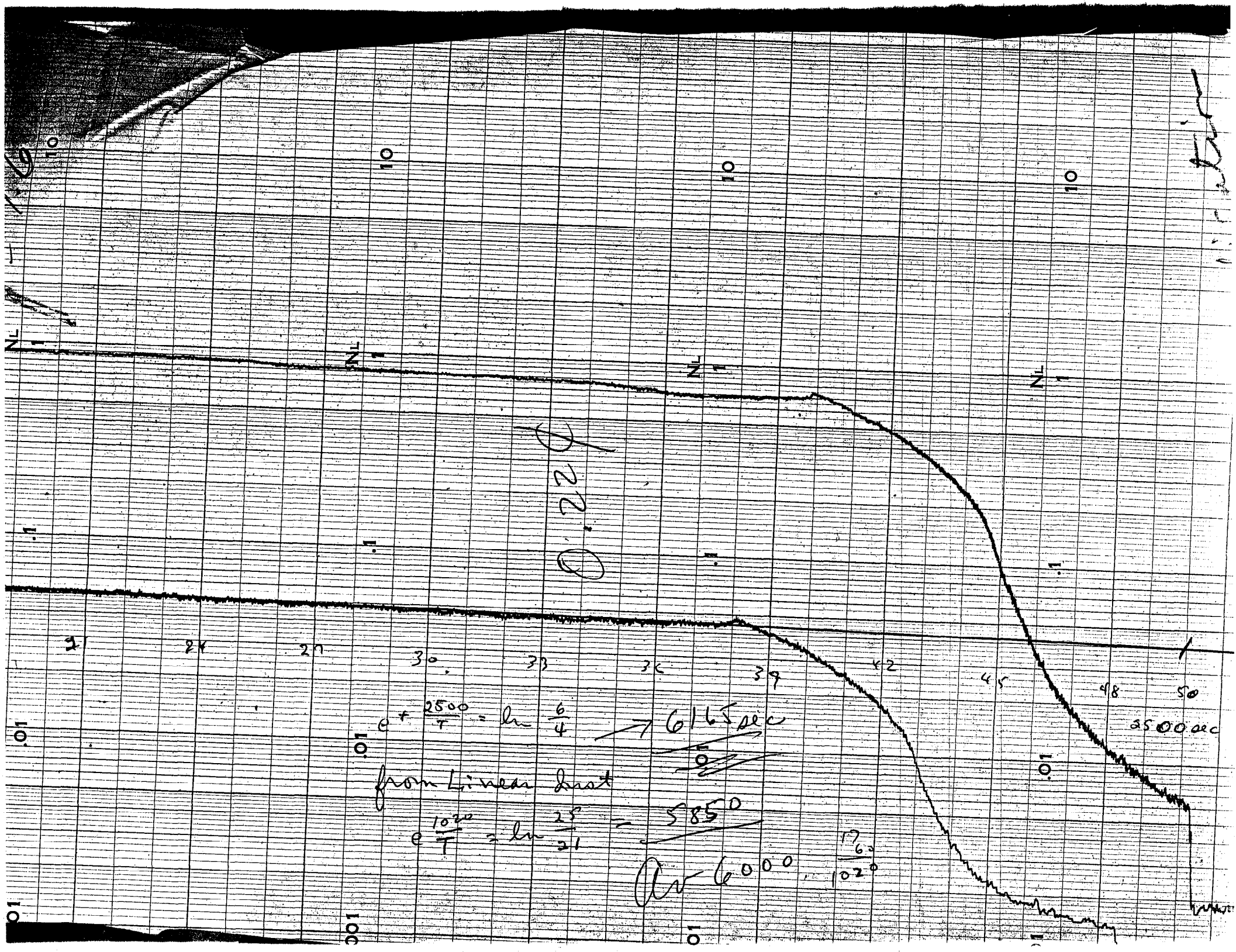
Total Correction for 3 Shelves = 2 × 5.55 = 11.1 ¢
on North & South.

Steel worth ~ 3 × 10.5 = 30.5

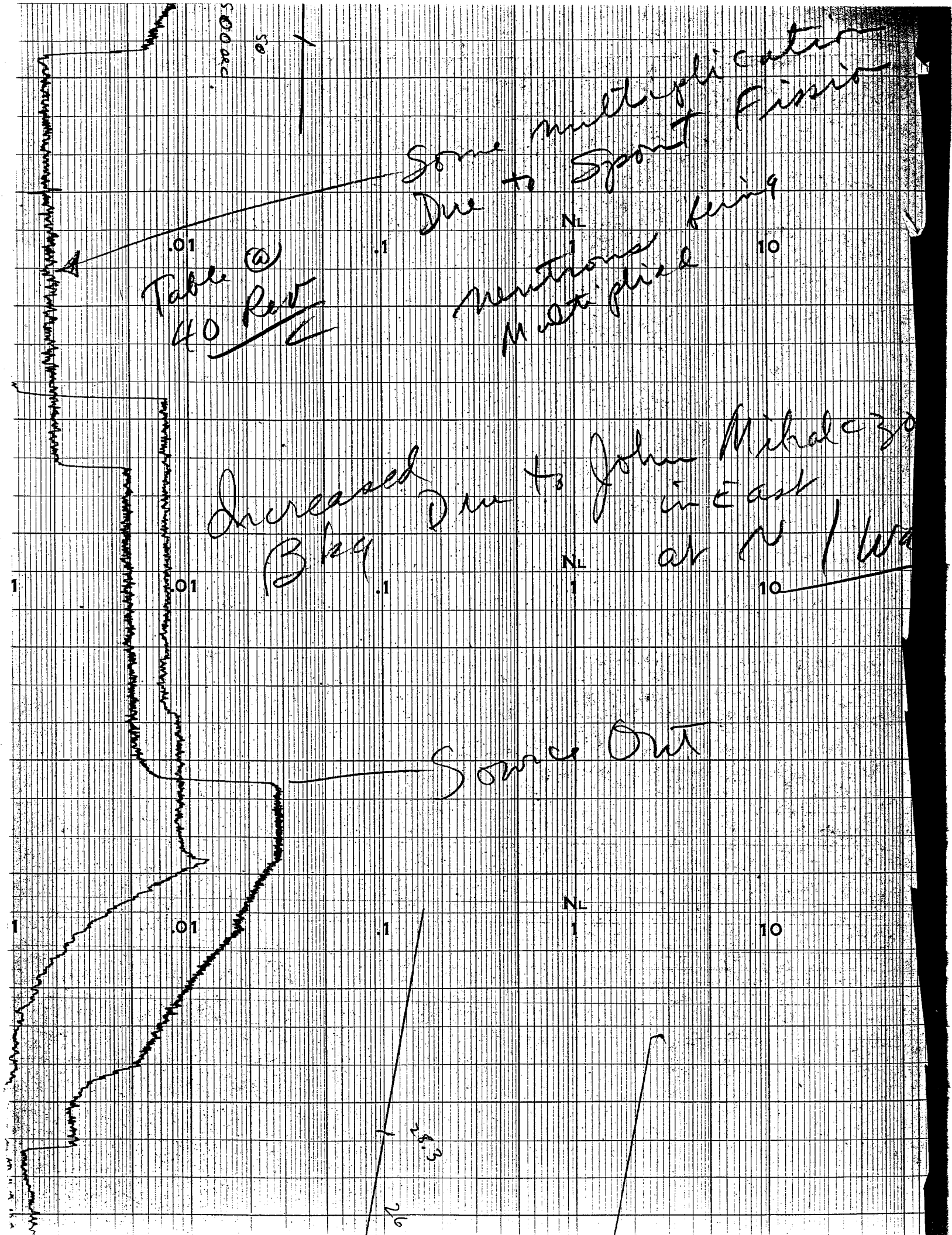
Sex for #133 = 0.5 + 30.5 = 31 ¢.



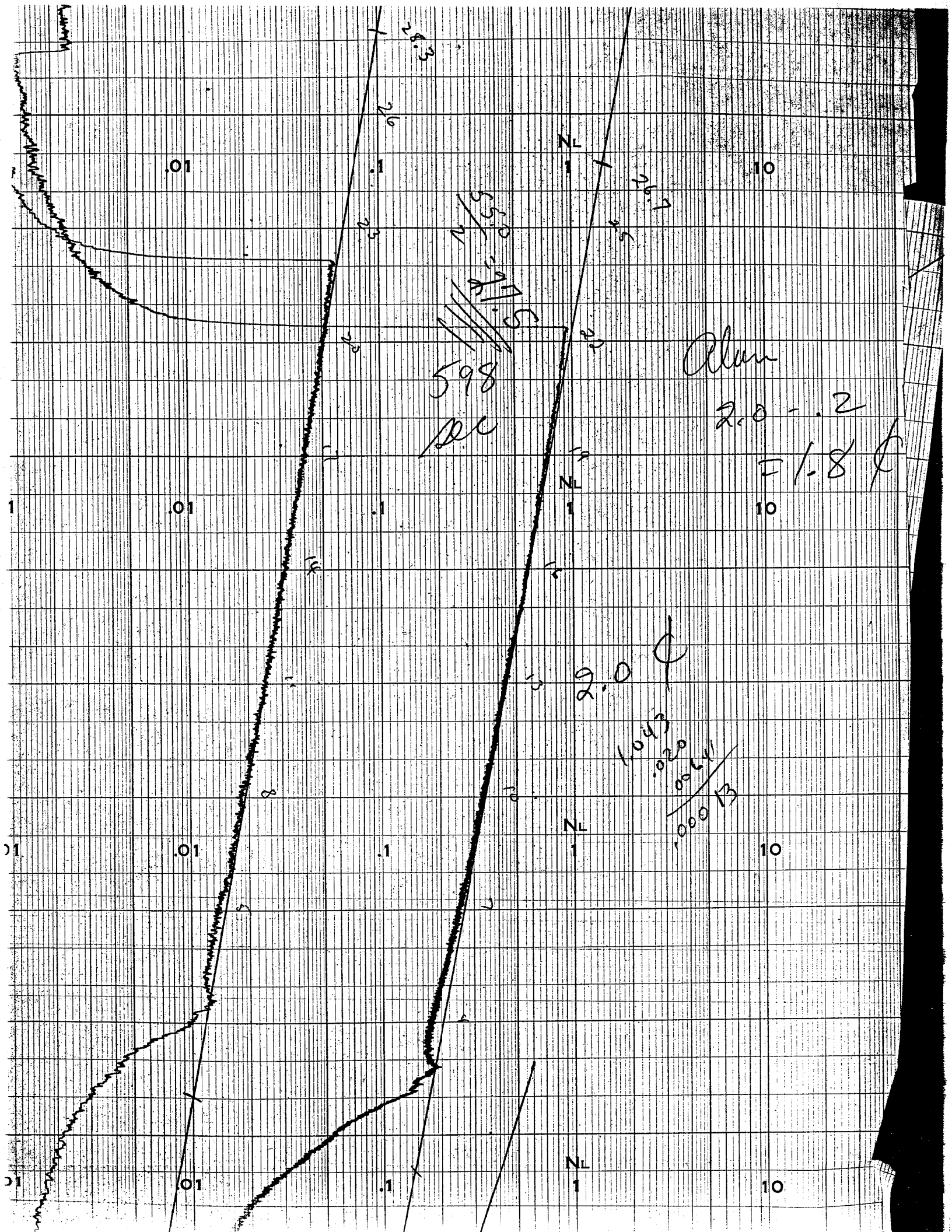
.01
.1
1
10
NL
9.81 Ø
1.05
.0981
.00066
97.8 sec
S.S.
.00001
worth
9.8 - 0.2
= 9.6



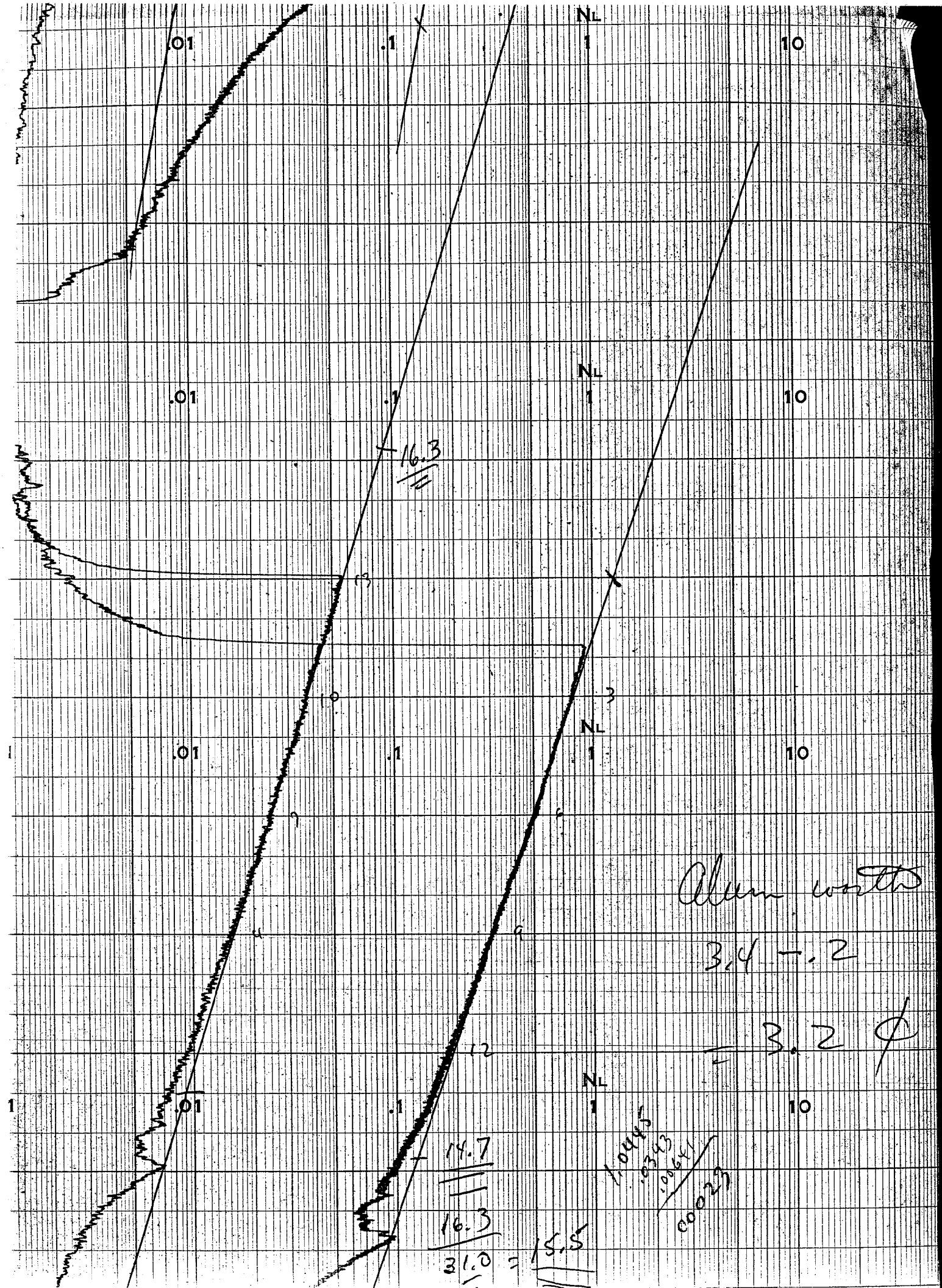
21
24
27
30
33
36
39
42
45
48
50
2500 sec
$e^{+\frac{2500}{T}} = \ln \frac{6}{4}$ → 6165 sec
from Linear Inst
$e^{\frac{1020}{T}} = \ln \frac{25}{21}$ = 5850
Av 6000
17
60
1020



Some multiplication
Due to Spont Fission
Table @
40 Rev
neutrons being
Multiplied
Increased
Bkg
Due to John Mihalczo
in East
at N 1 Wa
Source Out
NL
.01
.1
1
10
28.3
26



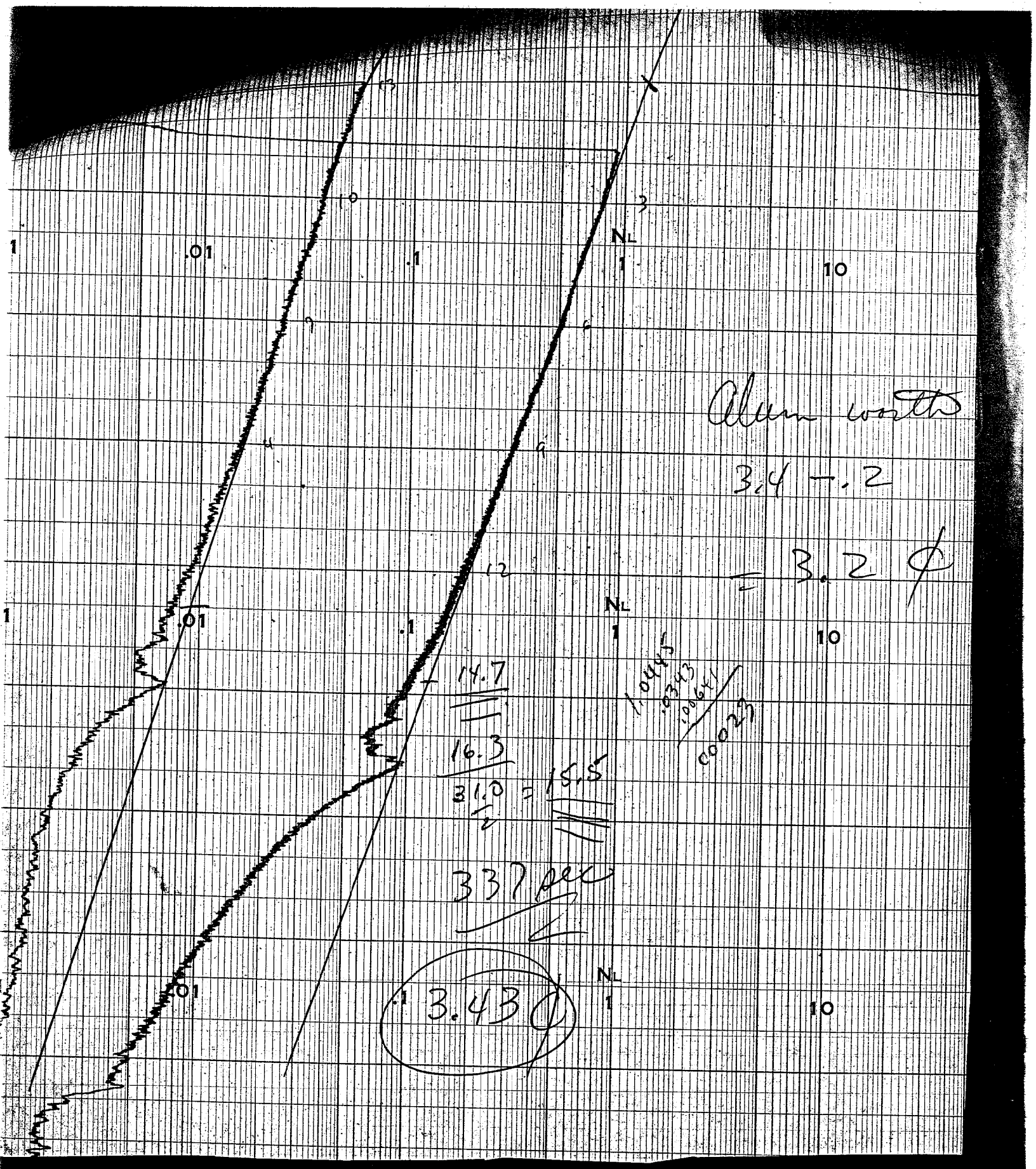
NL
.01
.1
1
10
28.3
26
26.7
598
sec
Alum
2.0 - .2
= 1.8 ¢
2.0 ¢
1.043
.020
.0041
.0013



Alum worth

3.4 − .2

= 3.2 ¢



Alum worth

3.4 − .2

= 3.2 ¢

14.7

16.3

31.0 = 15.5

$\frac{31.0}{2}$

1.0445
.0343
.00641
.00023

337 sec

3.43 ¢

Instrument Check on Feb 11, 72 Source 10 mc ^{60}Co

PM-1 Bal 4.50 Low Trip OK Trip Scram Table

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK

IC-3 1.7×10^{-9} [illegible] DWM A OK

IC-4 1.9×10^{-9} [illegible] DWM B OK

C OK

EXP # 139 (#135 + 8ea 1.468 + 8 ea 2.905 Al Boxes)

Add Mockup of 1.468 boxes 8ea placed on top of North half

Add Mockup of Middle row of 2.905 boxes 6ea on North, 2ea on South half

(Removed shelf mockup) 6ea 073 & 6ea 060 SS remain

9 20 Start Assembly Source Inserted Resp. OK

9 29 On Positive Period Ind = 0.106 Δp = 1.5 in. H2O OK

9 42 Shut Down Bypass Panel OK

Red Lite & Pers Ck OK

EXP # 140 (#135 + 8ea 2.905 Al Boxes)

Add Mock up of 1st or 3rd row of 2.905 boxes

8ea added to South Half 4ea top shelf

2ea 1st shelf

2ea 2nd shelf

9 49 Start Assembly Source Resp OK

9 57 On Positive Period Ind = 0.105

~10 10 Shut Down

EXP #141 (Repeat of #135) 6ea SS 6ea SS

10 20 Start Assembly Source Resp OK

Stop because East at high power Background increase

10 43½ Resume assembly Ind to 0.107 from 1×10^{-11} to 7.5×10^{-11} on IC-4

10 52 Withdraw source after IC-3 → 7×10^{-10}

11 16 Shut Down – Screw only $\left(\frac{IC-2}{T}\right)e^{+\frac{17\times60}{T}} = \frac{2.5}{2.1}$ T = 5850 sec.

$T = \frac{1020}{\ln 2.5/2.1}$ T = 6165 (ln IC-4

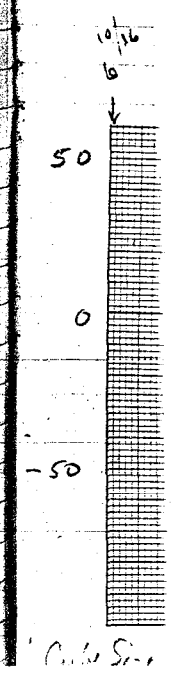
EXP #142 (#141 less 4ea SS 2ea 073 2ea 060)

11 21 Start Reassembly Source Resp OK

11 26 On Positive Period Ind = 0.107

11 31 Start to level

11 38 Shut Down Ind. = 0.219 > 0.112



5
3
90
180

Summary

$\rho(135) = 0.5$ } average 0.35 ¢ with 6 ea .073 SS
$\rho(141) = 0.2$ 6 ea .060 SS

$\Delta\rho(142) - (141) = 9.8 - 0.2 = 9.6$ ¢ 00066 − 00001 = .00065
3
28.8 .00195
.00001

$\therefore \rho(133) = 28.8 + 0.35 = 29.2$ ¢ vs 36¢ from $\frac{\Delta\rho}{\Delta l}$ meas

$\rho_{ex} = .00196$

Aluminum corrections

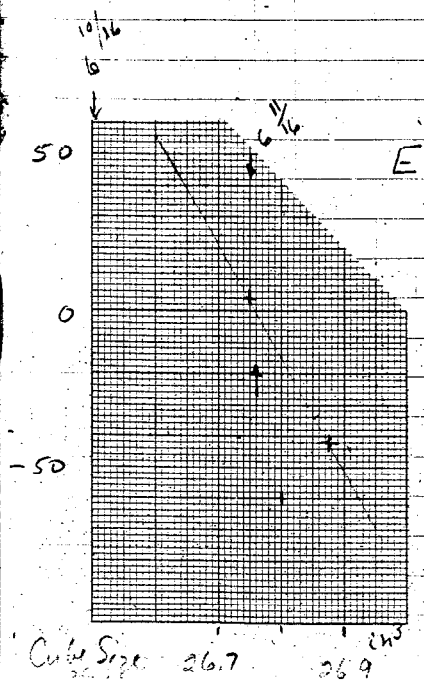
Bottom shelf #1 = 2 × 2.24 = 4.5
#2 2 × 1.62 = 3.2
#3 2 × 1.69 = 3.4
Box Supports 11.1 × 1.044 = 11.5 ¢

1.468 + 1 row 2.905
~~Δρ excess for~~ 2 × 3.2 = 6.4
2 rows of 2.905
4 × 1.8 = 7.2
13.6 13.6
25.1

Corrected reactivity = 29.2 − 25.1 = 4.1 ¢
26¾ × 26¾ × 26¾ box or core

Corrected reactivity for EXP #129
1 shelf not used worth 3.6 ¢
25.1
3.6
21.5 ¢

$\rho(129) - 21.5 = -20.6 - 21.5 = -42.1$

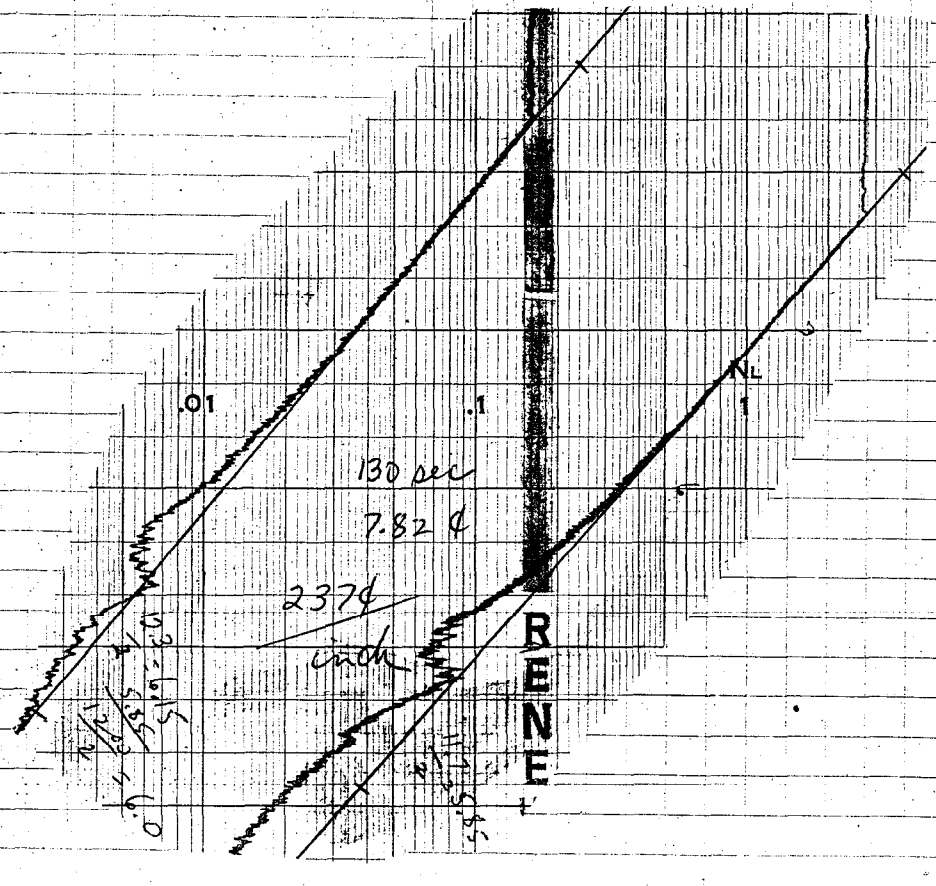


Extrapolated corrected critical cube size
= 26.76 in.

67.94 a_n = 8496

1.05
00.251
.00641
.00169 Support
Correct

000196
210
406/2 = .00203


.01
.1
1
N_L
130 sec
7.82 ¢
2374
inch
RENE

5 X 4 X 3 Assembly 60 units

If size of cell is identical 33.4375 x 26.75 X 20.0625

Assume Change in Number $\Delta k/k / \Delta m/m \sim 1/4$ $\Delta k = 1/64 = 1.5\%$

$\Delta \rho / \Delta \ell = 1.00/.33$. For 4x4x4 cube or .08 per unit

a $2.5 change corresponds to cell length change of .20 in.

Use 1.468 and 2.905 in. vertically

Use 1.25 and 2.5 in horizontally

$\frac{26\frac{3}{4}}{4} = 6\frac{11}{16}$

2.50
3.75
6.25 x 5 = 31.25 in } Shelf Area
6.25 x 2 = 12.50 in }

31.25
26.75
4.5 in.

3/4 x 26.75 = 20.0625

Use 18.75 x 31.25 x 20.0 in Box

Instrument Check on 14 Febr 72 **Source** 10 mc ^{60}Co

PM-1	Bal 4.50	Low Trip	OK	Hi Trip	OK
IC-1	3×10^{-10}	Meter Trip	Scram Tables	Fast Trip	OK
IC-2	3×10^{-10}	Meter Trip	OK		
IC-3	2.4×10^{-9}	Calibration	DWTN	A	OK
IC-4	2.0×10^{-9}	Calibration	DWTN	B	OK
Source	Inserted Resp OK			C	OK

EXP # 143

Single Cube Units 5X4X3 Array

Red Lite & Pers Ck OK
$\Delta p = 1.5$ in H_2O OK
Bypass Pane OK

Use spacers from #142 Vertical Core height = 20.0625
use 1 1/4 spacers & 2 1/2 spa. EW Core 31.25 20 1/16 (measured average
N core 12.5
S core 12.50

Cell size = 6 1/4 x 6 1/4 x 6 11/16

128 Start Assembly
136 On Pos Period Ind = 1.239 Source Out.
42 Start to Level 1.131
52 " 1.272
Shut Down 108
1.164

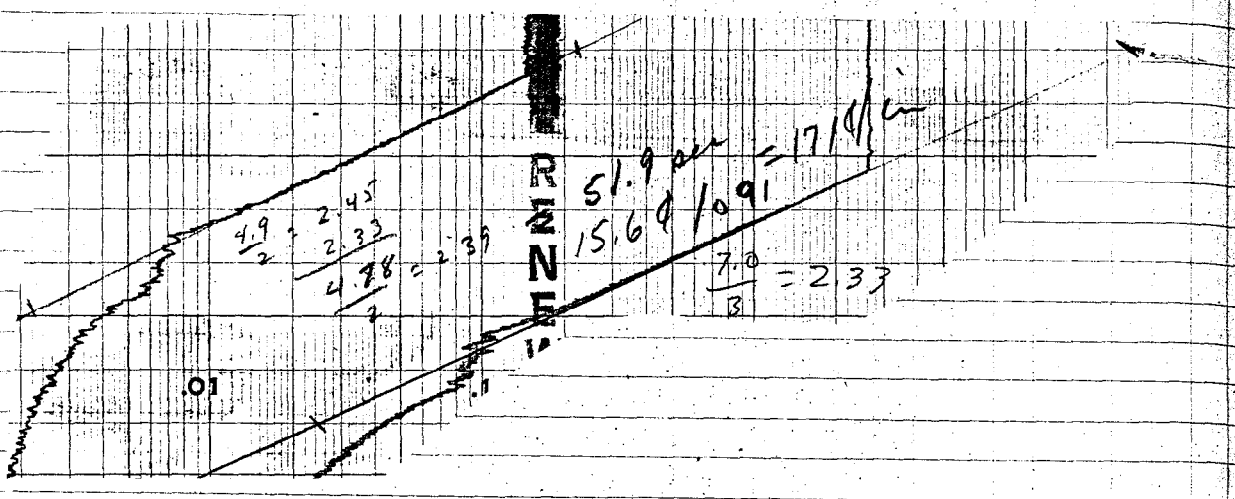
7.82¢/.033 = 237 ¢/in

Est $\rho_{ex} = \frac{125}{2} + \frac{215}{2} + 235 \times .16$

37.6
107.5
62.5
ρ_{ex} = 207.6

Note Increase cell size from 6 1/4 to 6 3/8

12.75 x 31 7/8



8

Instrument Check on 15 Feb 72 **Source** 10 mc ^{60}Co

PS-1	Bal 4.50	Low Trip	OK	Trip	OK
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	Screwed Table
IC-2	3×10^{-10}	Meter Trip	OK		
IC-3	2.2×10^{-9}	Calibration	DWM		OK
IC-4	1.8×10^{-9}	Calibration	DWM		OK
	Source Inserted	Resp OK			OK

EXP #144

Nom Cell size $6\frac{3}{8} \times 6\frac{3}{8} \times 6\frac{11}{16}$

Nom Core Size $31\frac{7}{8} \times 25\frac{1}{2} \times 20\frac{1}{16}$ (Measured)

Array $(5 \times 4 \times 3)$

8^{43} Start Assembly

^{52} On POS Period

$53\frac{1}{2}$ Start to Level

Ind = 2.022 (2.042)

Ind = 0.726 − (.108) = .618

817 > 171 ¢/in

~~816~~ ~~186~~ ¢/in

15.9 / .09¢ −.108 = 709

Red Lit & Pers. Ck OK

$\Delta p = 1.5$ in. H_2O OK

Bypass Pad OK

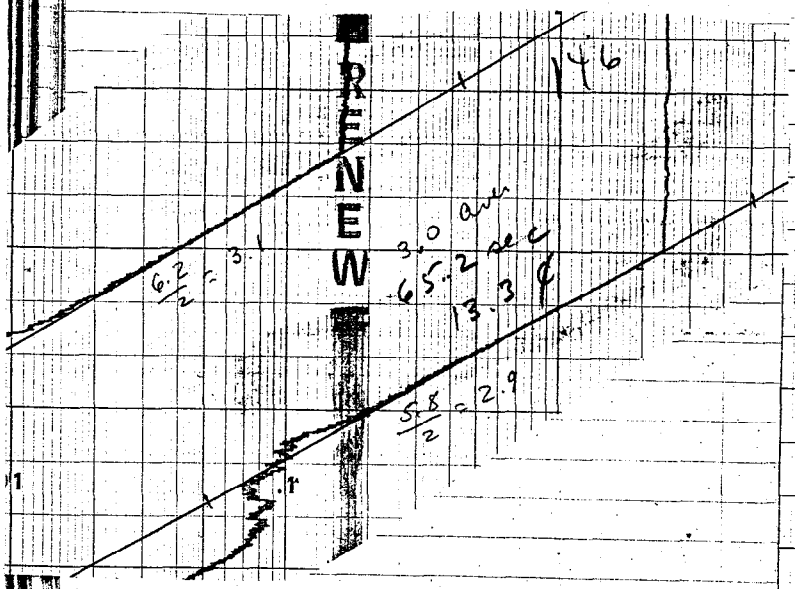
Change in Table gap 1.131 − 0.709 = 0.435

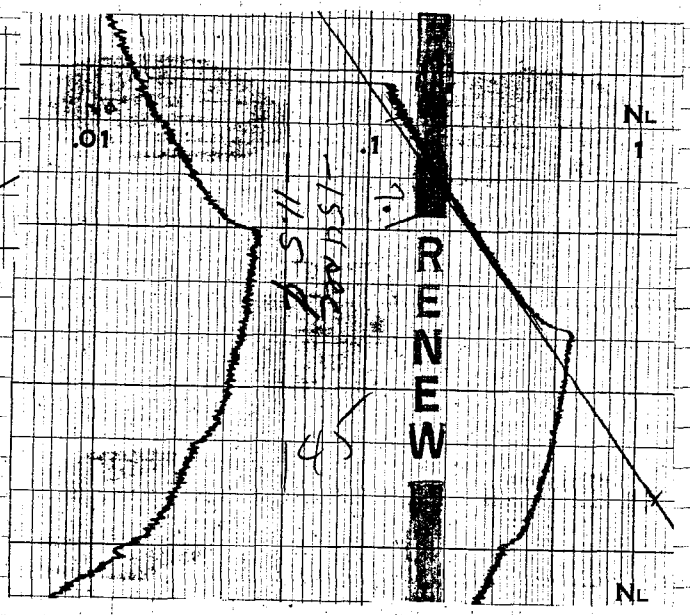
Change in cell size −2 dim = 0.125

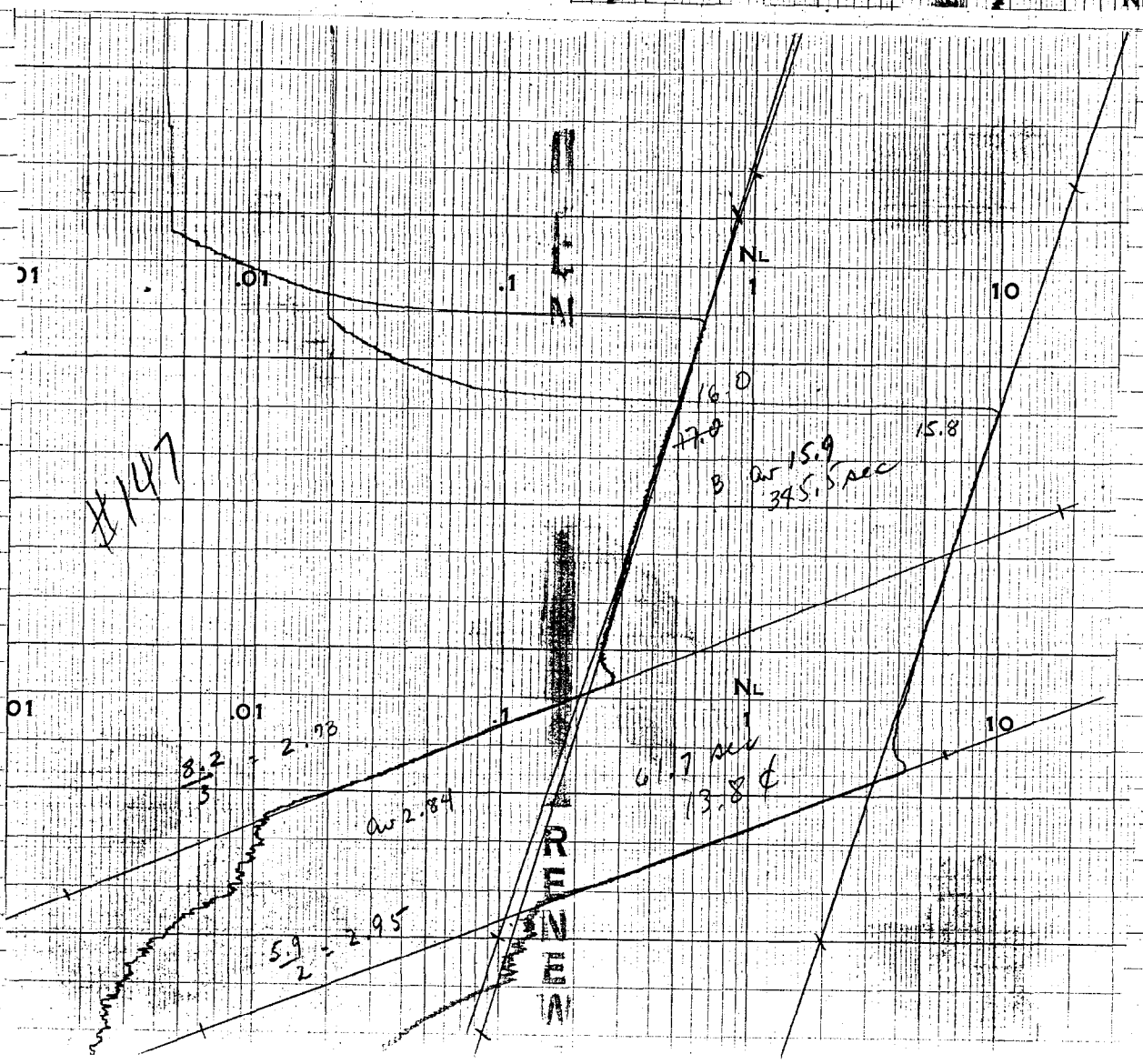
$\rho\,(1.164 - .709) = .455 \times \left(\frac{237 + 171}{2}\right) = 92.8¢$

ρ_{est} .709 − 0 = .709 × 115 av = 81.7

174.5¢


RENEW
146
3.0 av
65.2 sec
13.3 ¢
6.2/2 = 3.1
5.8/2 = 2.9
.01
.1


RENEW
.01
.1
NL
1


RENEW
.01
.1
NL
1
10
16.0
17.8
15.8
B av 15.9
345.5 sec
#147
8.2/3 = 2.73
av 2.84
5.9/2 = 2.95
61.7 sec
13.8 ¢

Instrument Check on Febr 16, 72 **Source** 10 mc ^{60}Co

950 V. [redacted] Bal 4.50 **Low Trip** OK **Hi Trip** OK

IC-1	3×10^{-10}	Meter Trip	OK	[illegible]	OK
IC-2	3×10^{-10}	Meter Trip	Scrammed Tables		Monitron
IC-3	1.1×10^{-9}	Calibration	DWM		A OK
[redacted]	1.8	Calibration	DWM		B OK
					C OK

Source Inserted Manually, CC — EXP #145

Red Lite & Pers Ck OK — 5 x 4 x 3 Array (Single Units)

Bypass OK — Nom. Cell size 6½ x 6½ x 6 11/16

Δp = 1.5 in H_2O OK — " Array size 32½ x 26 x 20 1/16 Measured OK,

9 06 Start Assembly

9 14 Tables Closed Source partially withdrawn, insert source to raise Power IC-3 = 4.8×10^{-10}

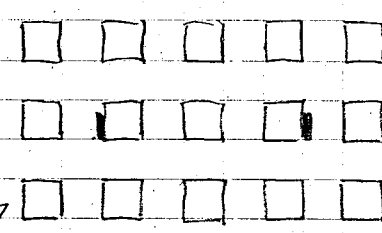
Ind 0.105 - .112 (Erratic)

9 20 Withdraw Source Neg Period — 154 sec → − 11.5 ¢

9 24 Shut Down Ind 0.108

EXP #146

Add 4 ea ½ x 2⅞ x 6 Plexiglas



Plexiglas Add 2 ea ½ x 2⅞ x 6 to each Table

9 30+ Start Assembly

9 39 On Pos Period Ind = 0.265 − .108 = .157

9 42 Start to Level +65.25 → 13.3 ¢

9 48 Level 0.372 = .264

" Shut Down, Screw Only, to 36. 13.3 / .107 = 124 ¢/in

EXP #147

Remove 1 ea ½ x 2⅞ x 6 Plexiglas

3 ea Remain

9 52 Start Reassembly Insert source

10 58 On Pos Period Table Ind = 0.108 + 61.7 sec → 13.8 ¢

Set Table at Ind = 0.265 On Pos Period 345.5 → 3.3 ¢

10 06 Shut Down 10.5 / .157 = 66.9

ρ (1 pc plexiglass = 13.3 − 3.3 = 10.0 ¢

ρ (145) = ρ #147 — 30.0 ¢ = 13.8 − 30

= − 16.2 ¢

IC-2	3×10^{-10}	Scrammed Tables		Monitor
IC-3	1.1×10^{-9}	Calibration	DWM	A OK
[illegible]	1.8	Calibration	DWM	B OK
				C OK

Source Inserted Manually CC

EXP #145

Red Lite & Pers Ck OK 5 x 4 x 3 Array (Single Units)

Bypass OK Nom. Cell size 6½ x 6½ x 6 11/16

Δp = 1.5 in H_2O OK " Array size 32½ x 26 x 20 11/16 Measured OK,

9 06 Start Assembly

9 14 Tables Closed Source partially withdrawn, insert source to raise Power IC-3 = 4.8×10^{-10}

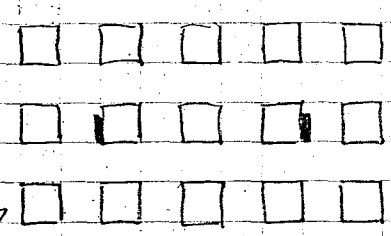
Ind 0.105 - .112 (Erratic)

9 20 Withdraw Source Neg Period - 154 sec → - 11.5 ¢

9 24 Shut Down Ind 0.108

EXP #146

Add 4ea ½ x 2⅞ x 6 Plexiglas



Plexiglas Add 2ea ½ x 2⅞ x 6 to each Table

9 30+ Start Assembly

9 39 On Pos Period Ind = 0.265 - .108 = .157

9 42 Start to Level +65.25 → 13.3 ¢

9 48 Level 0.372 = .264

" Shut Down, Screw Only, TO 36. 13.3 / .107 = 124 ¢/in

EXP #147

Remove 1ea ½ x 2⅞ x 6 Plexiglas

3ea Remain

9 52 Start Reassembly Insert source

10 58- On Pos Period Table Ind = 0.108 + 61.7 sec → 13.8 ¢

Set Table at Ind = 0.265 On Pos Period 345.5 → 3.3 ¢

10 06 Shut Down 10.5 / .157 = 66.9

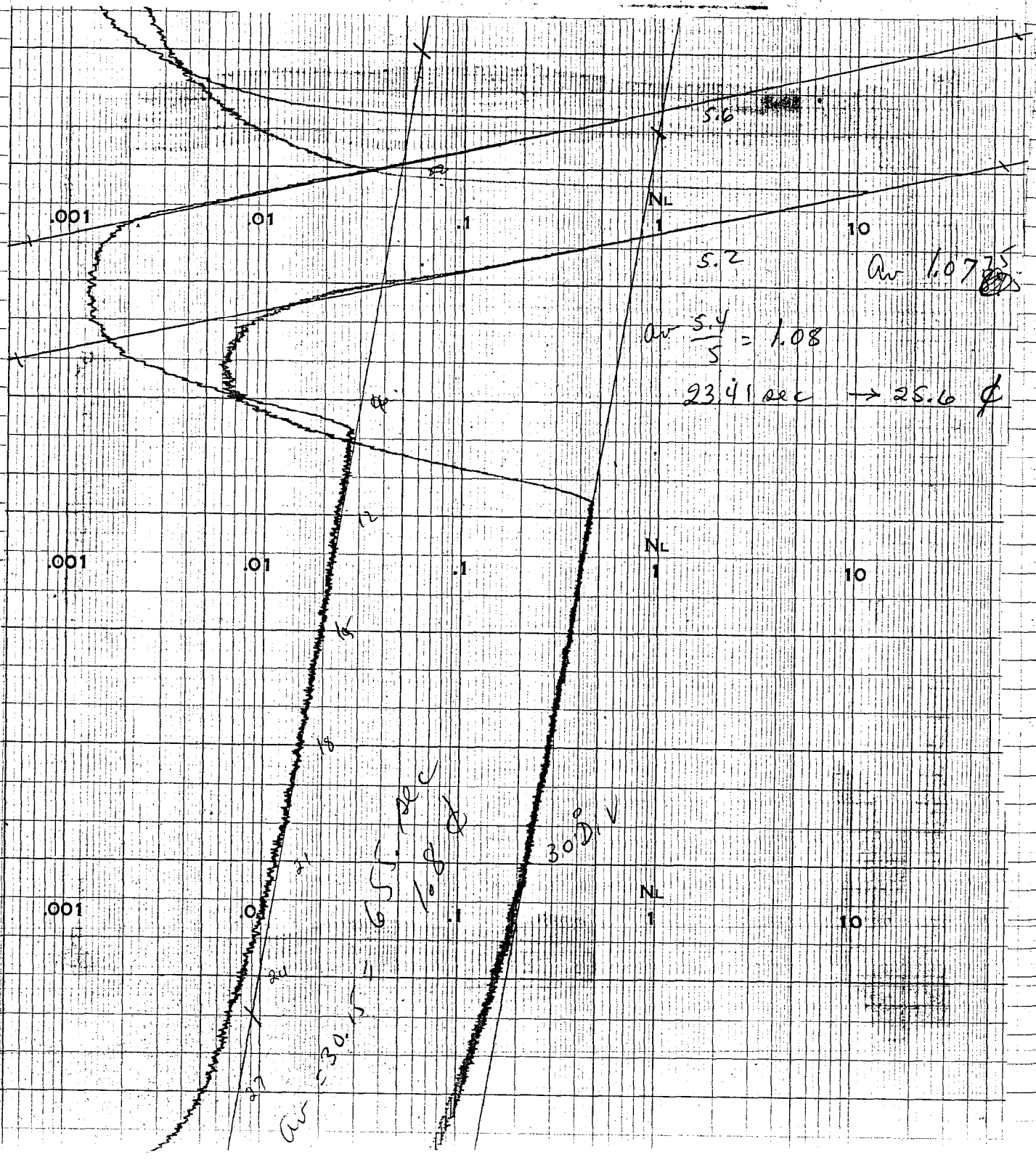
ρ (1pc plexiglass = 13.3 - 3.3 = 10.0 ¢

ρ (145) = ρ #147 — 30.0 ¢ = 13.8 - 30

= - 16.2 ¢

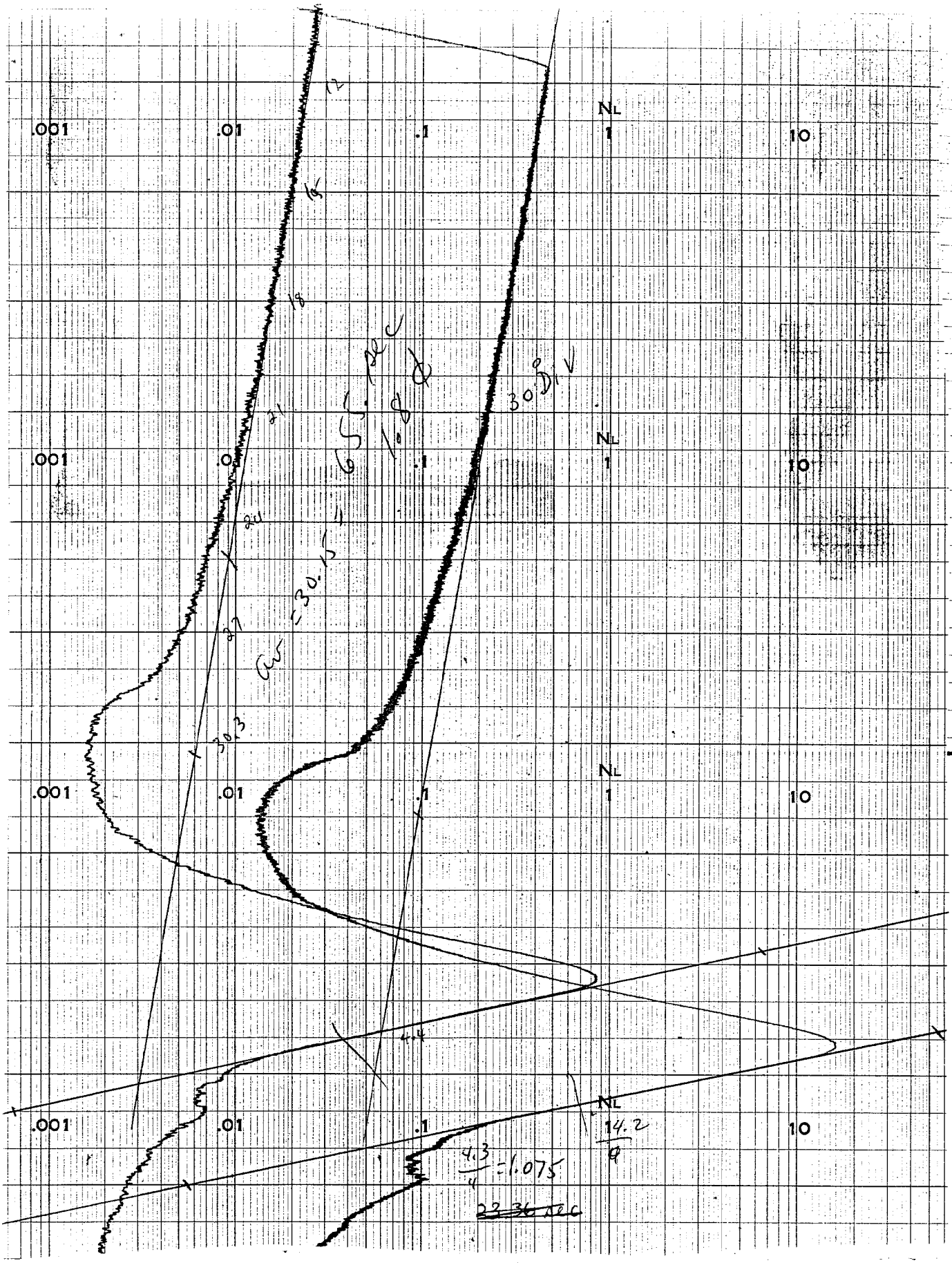
Bottom of Pg 159

58



.001
.01
.1
1
10
NL
5.6
5.2
Av 1.0775
Av 5.4/5 = 1.08
23.41 sec → 25.6 ¢
12
15
18
21
24
27
30° Div
Av = 30.15 = 655 sec
1.8 ¢

Bottom
Of pg 160 sft



1 Sta
1 11 Table
1 17 Sy Start
1 35 Sep
1 38 Re
1 43

Note: From the erratic behavior of the Table Position Indicator the $\Delta g / \Delta l$ from that last series are erratic.

Instrument Check on 18-Feb-72 **Source** 10 mc ^{60}Co

PM-1		Low Trip	Scrammed Table	Hi Trip	OK
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	10×10^{-10}	Meter Trip	OK		
IC-3	2×10^{-9}	Calibration	DWM	A	OK
IC-4	2×10^{-9}	Calibration	DWM	B	OK
				C	OK

Source Inserted OK
Bypass OK
Red Lite OK
$\Delta p = 1.5$ in H_2O OK

EXP # 148
Nom Cell size $6\,^{17}/_{32} \times 6\,^{17}/_{32} \times 6\,^{17}/_{32}$
Nom. Array size $32\,^{21}/_{32} \times 26\,^{1}/_{8} \times 19\,^{19}/_{32}$ (Measured)
for 5 x 4 x 3 Array

1.063
.256
.0064
.00 .74

1.02 Start Assembly
1.11 Tables Closed On Positive Period A 0.114 25.6 ¢

Separate, screw only to ~30 Rev. In = 1.977
1.17 Start Assembly On Positive Period B 0.372 1.8 ¢
1.35 Separate, screw only
1.38 Reassemble
on Positive Period C, Tables closed 0.114 25.6 ¢
1.43 Shut down

A - B = 23.8 ¢

EXP # 146 .265 - .372 = 13.3

147 .108 - .265 = 13.8 - 3.3 = 10.5

23.8 ¢

Fantastic Agreement!

To the precision of calculations we can probably assume that the alum is worth ~24¢

∴ k = 1.000

SXU X

[redacted] 22 Feb 72 [redacted] 10 mc ^{60}Co

950V [redacted] Bal 4:50 [redacted] [redacted] Scram

Note
IC-2 & IC-3 moved
to South Reflector Face

[redacted]	3×10^{-10}	[redacted] OK	[redacted] OK
[redacted]	3×10^{-10}	[redacted] OK	
[redacted]	1.7×10^{-9}	[redacted]	A OK
[redacted]	1.7×10^{-9}	[redacted]	B OK
[redacted]			C OK

Red Lite On & OK
Pers Ch.

EXP # 149

8 x 4 x 2 Array Unit Cell = 6 3/8 x 6 3/8 x 6 17/32 Source Inserted
Core = 51 x 25 1/2 x 13 11/16 Manually OK
average measurement Bypass Panel OK
of height 13 11/16" Op = 1.5 in H_2O OK

3 50 Start Assembly
4 00 Subcritical Tables Closed
0.28 x 10 x 10^{-11} IC-2
2.7×10^{-11} IC-3 M ~ 10

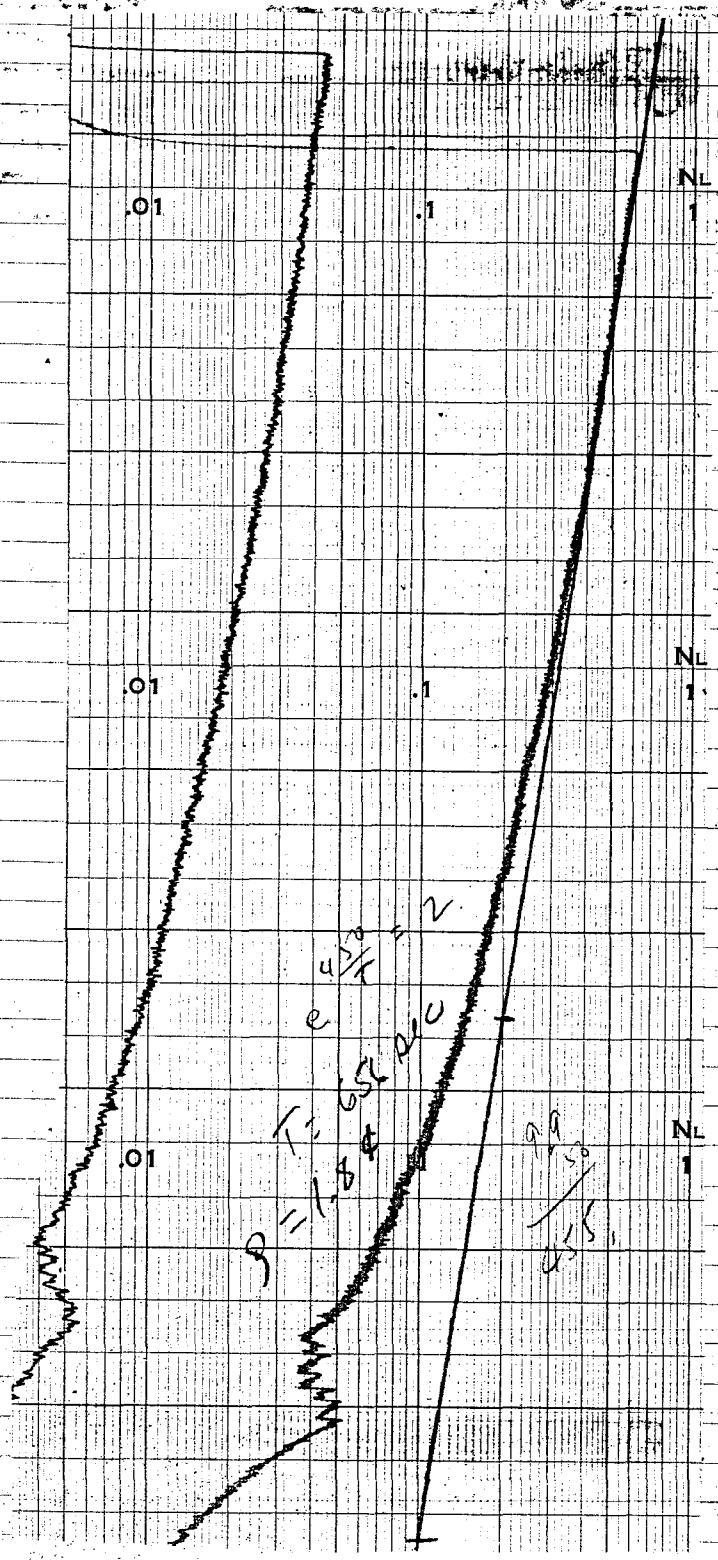
Add 4 ea 1 x 2 7/8 x 6 Plexiglass 2 ea on each table at interface

EXP #150

4 10 Start Assembly
4 18 Subcritical
IC-3 = 3.44×10^{-11}
2 = $.34 \times 10 \times 10^{-11}$ Withdraw Source — highly Subcrit.

Change Cell size to 6 7/8 x 6 7/8 x 6 17/32
With one larger on North & 2 layers on South (48 units)

23 Feb 72 Checked Spacing with tables Closed Ind = 0.103
with calipers — distance between units
at split table is equal to the spacings elsewhere


.01
.1
NL
1
.01
.1
NL
1
.01
NL
1

Instrument Check on 23 Feb 72 Source 10 mc ^{60}Co

950 V PM-1 Bal 4.50 Low Trip OK Hi Trip OK

IC-1 3×10^{-10} Meter Trip Screen and Table Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK MONITRON

IC-3 1.9 Calibration Dw In A OK

IC-4 1.7×10^{-9} Calibration Dw In B OK

C OK

Source Inserted Manually Resp OK

EXP #156 Personnel Red Lite OK

8 x 4 x 2 Array Array Size $49 \times 24\frac{1}{2} \times 13\frac{1}{16}$ $\Delta p = 1.5$ in H_2O OK

Non-uniform cell size $6\frac{1}{8} \times 6\frac{1}{8} \times 6\frac{17}{32}$ Bypass Panel OK

Measured gap at end was some undersize — use under size spacer by a few mils for future assemblies.

1^{59} Start Assembly

2^{09} Subcritical reinsert source to raise power Ind = 0.104

2^{11} Hold power = constant for ~3'. withdraw source

IC-3 ~ 3.8×10^{-10}

-2 ~ $.16 \times 3 \times 10^{-9}$

2^{14} Withdraw Source for neg period. ~ -94.5 sec ~ 30¢

Shut down, Screen Only to 40.0 Rev

Add 4 ea $\frac{1}{2} \times 2\frac{7}{8} \times 6$ ea Plexiglass

EXP #152

2^{24} Start Re Assembly

2^{29} Tables Closed In Pos Period Ind = 0.104

T = +656 Sec → +1.8¢

Change size to $6\frac{1}{4} \times 6\frac{1}{4} \times 6\frac{1}{4}$

Use spacer of 2.495 and 1.245, 5 mil undersize

In the 8 unit row, the length checked well

Assemble tables with 32 bottom units on both Tables

Table gap OK between units table Ind = 0.101.

Instrument Check on 28 Feb 72 **Source** 10 mc ^{60}Co

[illegible]-1	Bal 4.35	Low Trip	OK	Trip	OK
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	[illegible]
IC-2	3×10^{-10}	Meter Trip	OK		
IC-3	1.5×10^{-9}	Calibration	DWM	A	OK
IC-4	1.7×10^{-9}	Calibration	DWM	B	OK
				C	OK

8 X 4 X 2 Array

Source Inserted OK

Bypass Panel OK

Red Lite OK

$\Delta p = 1.5$ in H_2O OK

Cell size 6.25 x 6.25 x 6.25

Measured array 50 X 25 x 12½

EXP #153

104 Start Assembly

108 Stop Assembly (Run 108 at high Power)

120 Continue Assembly

123 Subcritical — Table 2 0.103 Source Insert to raise power → 2.5×10^{-10}

128 Subcritical Remove Source Probably more than -$/.

EXP #154

Changed cell size in E-W Dir from 6¼ to 6⅛ on Movable Table Only Added ½ x 12 x 12 plexiglass on end (East)

156 Start Assembly

206 Subcritical IC-3 → 3.0×10^{-10}

Table 2 d = .103

EXP #155

Changed Cell size on Fixed Table — North Table

EW	6⅛	49	50 6¼ x 6¼ x 6¼
NS	6¼	12½	12½
Vert	6¼	12½	12½

252 Start Assembly

302 Subcritical — Power to IC-3 = 4.3×10^{-10}

Table 2 d 0.103+

		EXP #156 · unit	Array
3^{50}	Start Assembly	E-W size $6\frac{1}{8}$	49
3^{58}	Very close to critical	N-S " $6\frac{1}{4}$	$12\frac{1}{2}$ each Table
	source out	Vert " $6\frac{1}{4}$	$12\frac{1}{2}$
	Insert source		

to Raise Power to IC-3 = 1.0×10^{-9} Table Ind 0.103

11^{54} Withdraw source completely for negative period

4^{19} Shut Down

IC-2 $e^{-\frac{12 \times 60}{T}} = \frac{47.5}{82.0}$

EW NS VERT

$6\frac{1}{8}$ $6\frac{1}{8}$ × $6\frac{1}{4}$ near crit - ¢

T = 1319 sec

$6\frac{1}{8}$ × $6\frac{1}{8}$ × $6\frac{17}{32}$ near crit - 27 ¢

IC-3 $e^{-\frac{1925}{T}} = \frac{.2}{1.0}$

$6\frac{3}{16}$ × $6\frac{3}{16}$ × $6\frac{3}{16}$

× 8 × 4

T = 1196

48 × × $6\frac{1}{4}$

$1\frac{1}{2}$

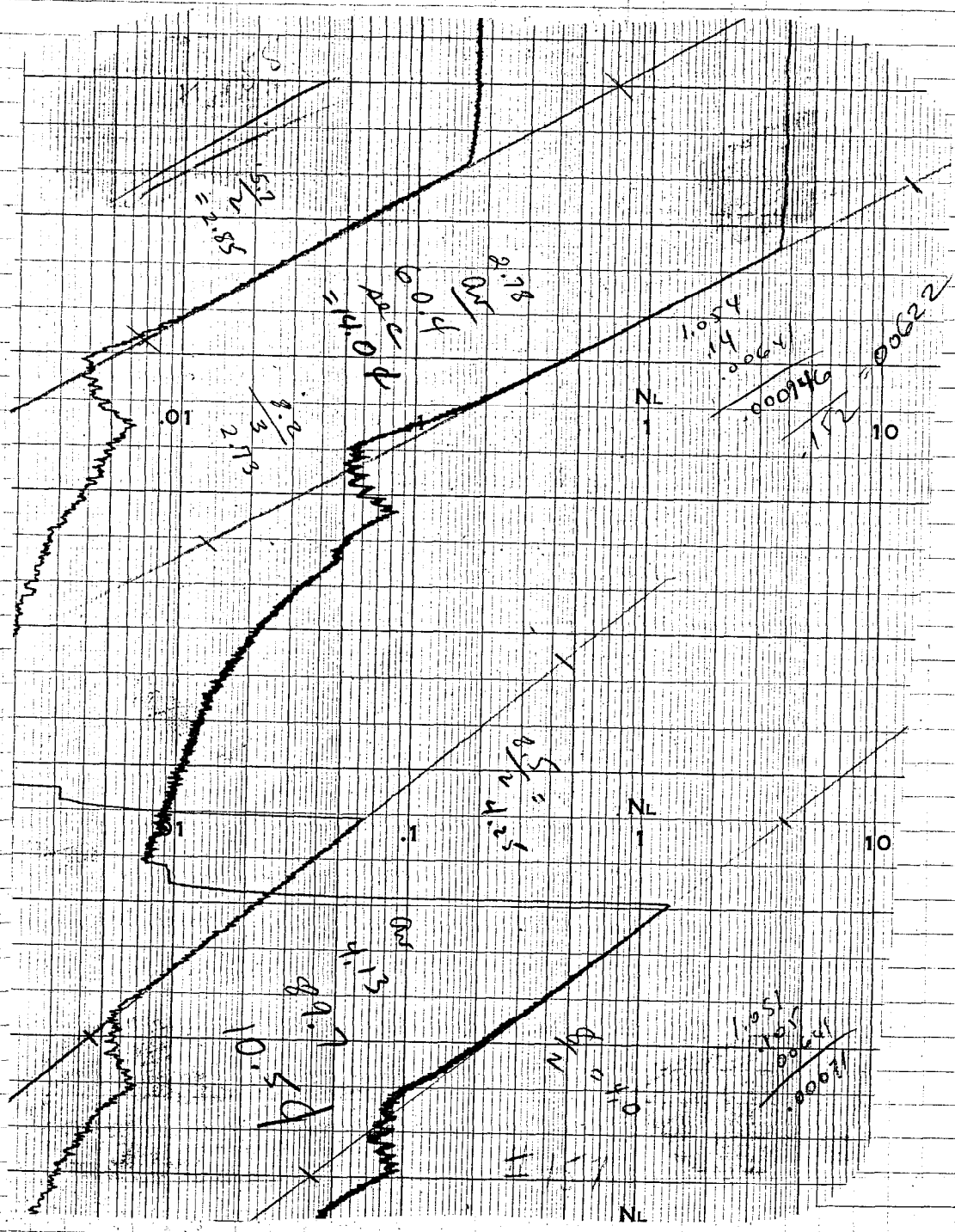
$49\frac{1}{2}$ × $24\frac{3}{4}$ ×

IC-4 $e^{-\frac{1700}{T}} = \frac{3.7}{15.0}$

T = 1214

Average Period = -1243 sec

-1.1 ¢


.01
.1
1
10
NL
NL
NL
.1
1
10
.01
.1
1
10

Instrument Check on Mar 1 72 Sa. 10 mc ^{60}Co

950 V PM-1 Bal 4.40 Low Trip OK OK

IC-1 Meter Trip OK Fast Trip OK

IC-2 Meter Trip Scrammed Table Monitor

IC-3 1.5 x 10^-9 Calibration A OK

IC-4 1.8 x 10^-9 Calibration B OK

C OK

Source Resp OK Bypass OK

8 x 4 x 2 Array Δp 1.5 in H2O Rectite On

(49 1/2 x 24 3/4 x 12 3/8) Nom (Measured OK) Pres OK

6 3/16 x 6 3/16 x 6 3/16 Unit size

EXP # 157

1 27 pm Start Assembly

135 On Pos Period Table @ 0.129 Reflector probably holding

Tables not closed. tables apart.

139 Shut down

Realigned Top Reflectors and Side Reflectors

EXP # 158

1 52 Start Assembly

2 01 On Pos. Period Table Ind 0.109

2 03 Start to level

Level 0.261 > .152 14.0 ¢ → .000946 / .152 = .00622 in

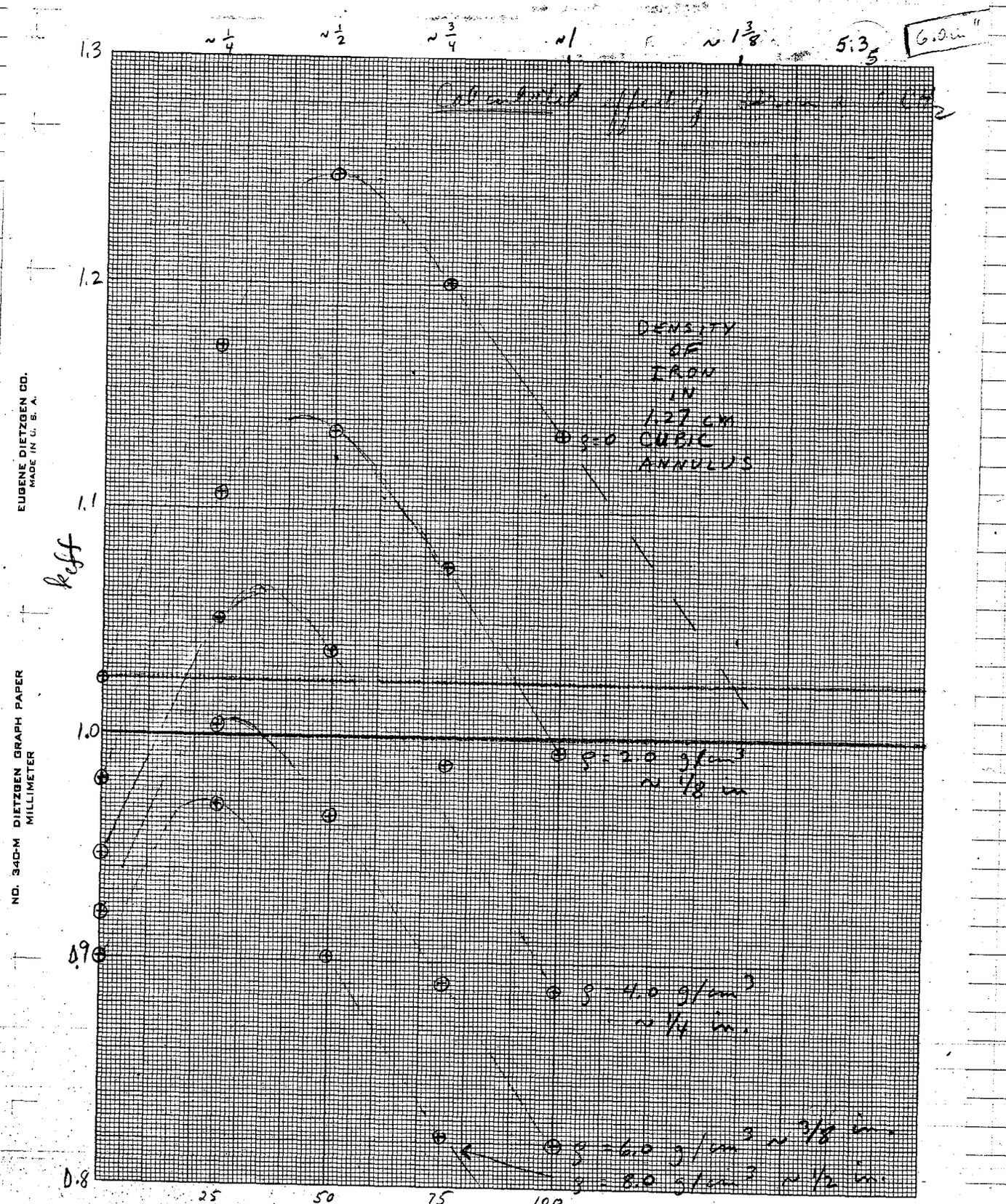
2 12 Shut Down

Aligned Reflector Again

6 3/16 6.188

3.75

2) 2.438 = 1.219


~1/4
~1/2
~3/4
~1
~1 3/8
5:3
6.0 in
1.3
1.2
1.1
1.0
0.9
0.8
keff
DENSITY OF IRON IN 1.27 cm CUBIC ANNULUS
ρ=0
ρ=2.0 g/cm³ ~1/8 in
ρ=4.0 g/cm³ ~1/4 in.
ρ=6.0 g/cm³ ~3/8 in.
ρ=8.0 g/cm³ ~1/2 in.
25
50
75
100
PERCENT OF THEORETICAL DENSITY IN 2.46 cm THICK CUBIC ANNULUS OF CH2
EUGENE DIETZGEN CO. MADE IN U. S. A.
NO. 340-M DIETZGEN GRAPH PAPER MILLIMETER

Instrument Check on Mar 2, 72 Source 10 mc ^{60}Co

950V PM-1 Bal 4.35 Low Trip OK Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK A OK

IC-3 1.8×10^{-9} Calibration Dw On B OK

IC-4 1.8×10^{-9} Calibration Dw On C OK

Source Resp OK

Level at IC-3 @ 2.4×10^{-9}

Red Lite OK OK

$\Delta\rho = 1.5$ OK

Bypass Panel OK

EXP #159

Purpose: Measure excess Reactivity of unperturbed system similar to 157 & 158

8 x 4 x 2 array of 6 3/16 x 6 3/16 x 6 3/16 unit cell sizes.

9 02 Start Assembly — delay criticality because East Cell at power

9 18 On Positive Period Ind = 0.109

9 20 Start to Level

9 28 Level Ind = 0.269 $\frac{15.75¢}{0.160} = 98.4$ ¢/in

" Shut Down, Screw Only — Separate completely

1.0595
.1575
.00661
.00107
.00669

#160

Purpose: Measure $\Delta\rho$ for 1 pc 0.476 x 4 x 11 7/8 Plexiglass

9 38 Start Assembly Source Resp OK

9 47 On Pos Period Ind = 0.364 − .109 = .255

50 Start to Level

10 00 Level 0.430 $\frac{9.75¢}{.066} = 147.7$ ¢/in

Separate ~39.5 sec

1.0575
0975
00641
000661 / .066 = .010/in

Average of six meas each

0.476	#1
0.485	#2
0.483	#3
0.480	#4
0.481	Average

Plexiglass

Top Row

middle of assembly on North Table

#161

Purpose: Measure $\Delta\rho$ for 2 pc {0.476 x 4 x 11 7/8, 0.485 x 4 x 11 7/8}

10 16 Start Assembly Source Resp OK

25 On Positive Period Ind = 0.543 − .109 = .434

31 Start to level

40 Level 0.553 $\frac{7.8}{.040} = 195.$ ¢/in

Shut Down

1.048
.078
00641
.000524
040
= .0131

#162

Purpose: Measure $\Delta\rho$ for 3 pc {0.476, 0.485, 0.483} 4 x 11 7/8

10 46 Start Assembly Source Resp OK

55− On Pos Period 0.640− − .109 = .501−

57+ Start to Level

11 06 1/2 Level 0.705 $\frac{12.3}{065} = 189$ ¢/in

Shut Down

1.052
.123
00641
000829
065
= 01276

Source Resp OK

Red Lite OK OK
$\Delta\rho = 1.5$ OK
Bypass Panel OK

EXP #159

Purpose: Measure excess Reactivity of unperturbed system similar to 157 & 158
8 x 4 x 2 array of 6 3/16 x 6 3/16 x 6 3/16 unit cell sizes.

9 02 Start Assembly — delay criticality because East Cell at power
9 18 On Positive Period Ind = 0.109
9 20 Start to Level
9 28 Level Ind = 0.269 $\frac{15.75¢}{0.160}$ = 98.4 ¢/in
Shut Down, Screw Only — Separate completely

1.0595
.1575
.0005
.00107
.00669

#160

Purpose: Measure $\Delta\rho$ for 1 pc 0.476 x 4 x 11 7/8 Plexiglass

9 35 Start Assembly Source Resp. OK
9 47 On Pos Period Ind = 0.364 − .109 = .255
50 Start to Level
10 00 Level 0.430 $\frac{9.75¢}{.066}$ = 147.7 ¢/in
Separate

~39.5 sec

1.0575
0975
00641
000661 / .066 = .010/in

Average of six meas each

0.476	#1
0.485	#2
0.483	#3
0.480	#4
0.481	Average

Plexiglass

Top Row

middle of assembly on North Table

#161

Purpose: Measure $\Delta\rho$ for 2 pc {0.476 x 4 x 11 7/8, 0.485 x 4 x 11 7/8}

10 16 Start Assembly Source Resp OK
25 On Positive Period Ind = 0.543 − .109 = .434
31 Start to level
40 Level 0.553 $\frac{7.8}{.040}$ = 195. ¢/in
Shut Down

1.048
.078
00641
.000524
040
= .0131

#162

Purpose: Measure $\Delta\rho$ for 3 pc {0.476, 0.485, 0.483} 4 x 11 7/8

10 46 Start Assembly Source Resp OK
55− On Pos Period 0.640− − .109 = .501−
57+ Start to Level
11 06 1/2 Level 0.705 $\frac{12.3}{065}$ = 189 ¢/in
Shut Down

1.052
.123
00641
000829
065
= 01276

Bottom of PS173 88

Instrument Check on Mar 2, 72 Source 10 mc ^{60}Co

950V PM-1 Bal 4.35 Low Trip OK Screwed Table Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK A OK

IC-3 1.8×10^{-9} Calibration Dw On B OK

IC-4 1.8×10^{-9} Calibration Dw On C OK

Source Resp OK

Level at IC-3 @ 2.4×10^{-9}

Red Lite OK OK

$\Delta p = 1.5$ OK

Bypass Panel OK

EXP #159

Purpose: Measure excess Reactivity of unperturbed system similar to 157 & 158

8 × 4 × 2 array of 6 3/16 × 6 3/16 × 6 3/16 unit cell sizes.

9 02 Start Assembly – delay criticality because East Cell at power

9 18 On Positive Period Ind = 0.109

9 20 Start to Level

9 28 Level Ind = 0.269 $\frac{15.75¢}{0.160} = 98.4$ ¢/in

" Shut Down, Screw Only – Separate completely

1.0595
.1575
.00107
.00669

#160

Purpose: Measure $\Delta\rho$ for 1 pc 0.476 × 4 × 11 7/8 Plexiglass

9 38 Start Assembly Source Resp OK

9 47 On Pos Period Ind = 0.364 − .109 = .255

50 Start to Level

10 00 Level 0.430 $\frac{9.75¢}{.066} = 147.7$ ¢/in

Separate ~39.5 sec

1.0575
.0975
.00641
.000661 / .066 = .010/in

Average of six meas each

0.476	#1
0.485	#2
0.483	#3
0.480	#4
0.481	Average

Plexiglass

Top Row

middle of assembly on North Table

#161

Purpose: Measure $\Delta\rho$ for 2 pc {0.476 × 4 × 11 7/8, 0.485 × 4 × 11 7/8}

10 16 Start Assembly Source Resp OK

25 On Positive Period Ind = 0.543 − .109 = .434

31 Start to level

40 Level 0.553 $\frac{7.8}{.040} = 195.$ ¢/in

Shut Down

1.048
.078
.00641
.000524
.040
= .0131

#162

Purpose: Measure $\Delta\rho$ for 3 pc {0.476, 0.485, 0.483} 4 × 11 7/8

10 46 Start Assembly Source Resp OK

55− On Pos Period 0.640− − .109 = .501−

57+ Start to Level

11 06 1/2 Level 0.705 $\frac{12.3}{065} = 189$ ¢/in

Shut Down

1.052
.123
.00641
.000829
.065
= .01276

IC-4 1.8 x 10^-9 Calibration Dev On — C OK — IC-3 @ 2.4x10^-

Source Resp OK

Red Lite OK OK
Δρ = 1.5 OK
Bypass Band OK

EXP #159

Purpose: Measure excess Reactivity of unperturbed system similar to 157 & 158
8 x 4 x 2 array of 6 3/16 x 6 3/16 x 6 3/16 unit cell sizes.

9 02 Start Assembly — delay criticality because East Cell at power
9 18 On Positive Period Ind = 0.109
9 20 Start to Level
9 28 Level Ind = 0.269 > 15.75¢ / 0.160 = 98.4 ¢/in
" Shut Down, Screw Only — Separate completely

1.0595
.1575
.00107
.00669

#160

Purpose: Measure Δρ for 1 pc 0.476 x 4 x 11 7/8 Plexiglass

Average of six meas each	
0.476	#1
0.485	#2
0.483	#3
0.480	#4
0.481	Average

9 35 Start Assembly Source Resp OK
9 47 On Pos Period Ind = 0.364 − .109 = .255
50 Start to Level
10 50 Level 0.430 > 9.75¢ / .066 = 147.7 ¢/in
Separate ~39.5 sec

Plexiglass

1.0575
.0975
.00641
.000661 / .066 = .010/in

Top Row
middle of assembly on North Table

#161

Purpose: Measure Δρ for 2 pc {0.476 x 4 x 11 7/8, 0.485 x 4 x 11 7/8}
10 16 Start Assembly Source Resp OK
25 On Positive Period Ind = 0.543 − .109 = .434
31 Start to level
40 Level 0.553 > 7.8 / .040 = 195. ¢/in
Shut Down

1.048
.078
.00641
.000524
.040
= .0131

#162

Purpose: Measure Δρ for 3 pc {0.476, 0.485, 0.483} 4 x 11 7/8
10 46 Start Assembly Source Resp OK
55− On Pos Period 0.640− − .109 = .501−
57+ Start to Level
11 06 1/2 Level 0.705 > 12.3 / 065 = 189 ¢/in
Shut Down

1.052
.123
.00641
.000829
.065
= 01276

Bottom of Pg 175

#163

Purpose: Measure $\Delta\rho$ for 4 pc .476 .485 .483 .480 } 4 x 11 7/8 Plexiglass

1 3 Start Assembly Source Resp OK
11 20½ On Pos Period 0.727
24 Start to Level
31 Level 0.789 > $\frac{10.4}{.062}$ = 167.7 ¢/in
Shut Down

1.051 .484 .00641 .00070 .062 = .0113

ρ = 104 - 16 = 88

#164 5 pc .476 .485 .483 .480 .437 } 4 x 11 7/8

Purpose: Measure $\Delta\rho$ for 5 pc

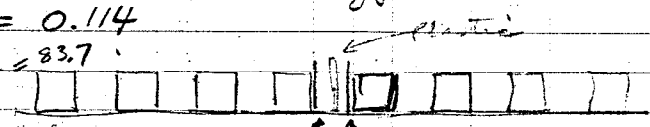
11 37 Start Assembly Source Resp OK
45 On Pos Period Ind = 0.789
48 Start to Level → level 0.846 $\frac{11.6}{.057}$ = 203.5
Level ~~Table Ind = 0.84~~
Shut Down

1.052 .116 .00641 .00078 .057 = .0137

#165

Purpose: To Measure $\Delta\rho$ for 2 pc 1/8" x 4 x 12" Steel Plate

1 12 PM Start Assembly Source Resp OK $\Delta\rho$ OK Bypass OK Red Pt OK
1 20½ On Pos Period Table Ind = 0.114
126 Start to Level
132 Level @ 0.206 > $\frac{7.7¢}{.092}$ = 83.7



1.048 .077 .00641 .000517 .0056/in

#166

Purpose To Measure $\Delta\rho$ for { 2 pc 1/8 x 4 x 12 Steel
1 pc 0.476 x 4 x 11 7/8 Plexi

1 40 Start Assembly, Source Resp OK
48 On Pos Period Table Ind = 0.300
Start to Level
2 02 Level Ind = 0.372 > $\frac{9.6}{.072}$ = 133.3 ¢/in
shut down

IC-3 = 8 x 10^-9

1.050 .096 .00641 .000646 .072 = .00897/in

#167

Purpose: To Measure $\Delta\rho$ for 2 pc 1/8 x 4 x 12
2 12 Start Assembly Source Resp OK 2 pc 0.476 0.480 x 4 x 11 7/8
2 20 On Pos Period Table Ind = 0.459
2 25 Start to level
2 31 Level 0.520 > $\frac{9.7}{.061}$ = 159 ¢/in

1.05 .097 .00641 .000653 .061 = .0107

IC-2

$e^{\frac{120}{T}} = \frac{47.5}{14.5} = 3.276$ T = 101.14 sec

Average IC-3 4 > 101.0 sec

#168

Purpose: To measure $\Delta\rho$ for 2 pc 1/8 × 4 × 12 Steel
3 pc (0.476 .480 .485 4 × 11 7/8 Plex

2 38 Start assembly Source Resp OK
2 46 On Pos Period Table Ind = 0.575
2 53 Start to Level
2 59 Level Ind = 0.627 $\frac{9.5}{.052}$ = 183 ¢/in
Shut down

1.05
.095
.00641
.000639 / .052 = .0123

#169

Purpose: To measure $\Delta\rho$ for 2 pc 1/8 × 4 × 12 Steel
+ 4 pc 0.476 0.480 0.485 0.483 } 4 × 11 7/8 Plexiglas

3 07 Start assembly Source Resp OK
3 19 On Pos Period Ind = 0.658
3 24 Start to Level
3 32 Level 0.702 $\frac{8.7}{.044}$ = 198 ¢/in
IC-3 = 2.4 × 10⁻⁹

1.049
.087
.00641
.000585 / .044 = .0133

#170 (Same as #159)

Purpose: To Measure $\Delta\rho$ for Unperturbed system
no steel no plastic

2 39 Start assembly Source Resp OK
3 47 On Pos Period Ind = 0.109 — .114
Start to Level
4 04 Level Ind = 0.281 $\frac{16.6}{.172}$ = 96.5 ¢/in
Shut Down

Instrument Check

PM-1 Low Tr...

IC-1

IC-2

IC-3

IC-4

Instrument Check on Mar 3, 72 Source 10mc ^{60}Co

950 V PM-1 Bal 4.35 Low Trip OK Hi Trip Scram Tables

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK

IC-3 1.7×10^{-9} Calibration DWM

IC-4 1.7×10^{-9} Calibration DWM

Source Inserted CC

MONITRON

A OK

B OK

C OK

$\Delta p = 1.5$ in H_2O OK

Red Lite Pers Ch OK Bypass OK

EXP # 171

Purpose: To Measure $\Delta\rho$ for 2ea 1/8 4 x 12

2ea 1/4 4 x 12

3ea 0.476, 0.485, 0.483 } 4 x 11 7/8

8:41 Start Assembly

8:52 On Positive Period Table Ind = 0.359

55 1/2 Start to Level

9:03+ Level 0.431

Shut Down

$\frac{10.85}{.072} = 151$ ¢/in

1.051
0.1085
.00641
000731
.072
= .01015

EXP # 172

Purpose: To Measure $\Delta\rho$ for 2ea 1/8 x 4 x 12 } Steel

2ea 1/4 x 4 x 12

2ea 0.476, 0.485 } 4 x 11 7/8 Plex.

9:10 Start Assembly, Source Resp OK

9:18 1/2 On Positive Period 0.275

22 1/2 Start to Level

9:30 Level 0.361

$\frac{11.3}{.086} = 131$ ¢/in

1.051
.113
.00641
000761
.86
= .00885/in

EXP # 173

Purpose: To Measure $\Delta\rho$ for 2ea 1/8 x 4 x 12 } Steel

2ea 1/4 x 4 x 12

1ea 0.476 x 4 x 11 7/8 Plex

9:38 Start Assembly, Source Resp OK

9:49 On Pos. Period

Tables Closed Ind = 0.114

9:54 Start to Level

10:01 1/2 Level Ind = 0.237

Shut Down

$\frac{11.3}{.123} = 91.9$ ¢/in

000761
.123
= .00619

Note
Moved
EC-4
Chamber
to
West Side
of
Assembly

EXP # 174

Purpose: To measure Δρ for 2ea 1/8, 2ea 1/16 } 4 x 12 Steel (No Plexiglas)

1025 Start Assembly Source Inserted
1035 Table Closed
Critical Power Rise to 1.7 x10⁻⁹ on IC-3
Subcritical
042 Start Neg Period −7.0¢

1.0475
.07
.00641
.00047

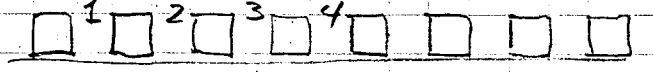
EXP # 175

Purpose: To measure unperturbed System Δρ.
(No Steel No Plexiglas)

105 Start Assembly, Source Resp OK
114 On Positive Period Δrd = 0.114 ⟶ 16.4 ¢
Shut Down at IC-3 → 3.8x10⁻⁹
IC-2 off scale shut down Assembly.
Offscale on (3x10⁻⁹)

EXP #176

Purpose: To Measure Δρ for 4pc Plexiglas in Slot 1
(Slot 4 measured #169)



150 Start Assembly Source Resp OK
Red Lite OK
201 On Positive Period Δρ = 1.5 in OK
Δrd = 0.575 Bypass OK
Start to level
Level at Δrd = 0.632 ⟶ 10.9 / .057 = 191 ¢/in

1.051
.109
.00641
.000734
.057 = .0129

Δρ (4ea slot 1)
75−16 = 59 ¢

EXP #176

Purpose: To measure Δρ for 4pc Plexiglas Slot 2

212 Start Assembly Source Resp OK
220 On Pos Period Δrd @ = 0.661
224 Start to Level
230 Level Δrd = 0.723 ⟶ 12.6 / .062 = 203 ¢/in
115 " 91−16 = 75

1.0525
.126
.00641
.000850
.062
= .0137 / in

EXP #177

Purpose To measure Δρ for 4pc Plexiglas Slot 3
Start Assembly Source Resp OK

244 Start Assembly

251 On Pos Period 0.719
255 Start to level
305 Level 0.772 ⟶ 11.1 / .053 = 209 ¢/in

1.051
.111
.00641
.000748
.053
.0141

Subcritical

42 Start Neg Period −7.0¢

1.0475
.07
.00641
.00047

EXP #175

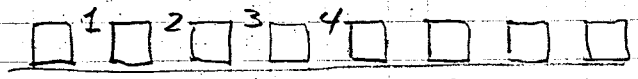
Purpose: To measure unperturbed System Δρ.
(No Steel No Plexiglass)

05 Start Assembly, Source Resp. OK
14 On Positive Period Ind = 0.114 → 16.4¢
Shut Down at IC-3 → 3.8×10^{-9}
IC-2 scram shut down Assembly.
Off scale on (3×10^{-9})

EXP #176

Purpose: To Measure Δρ for 4 pc Plexiglas in Slot 1
(Slot 4 measured. #169)

1 2 3 4



50 Start Assembly Source Resp OK
Red Lite OK
01 On Positive Period Δρ = 1.5 in. OK
Ind = 0.575 Bypass OK
05 Start to level
Level at Ind = 0.632 > $\frac{10.9}{.057}$ = 191 ¢/in

1.051
.109
.00641
.000734
.057 = .0129

Δρ (4 ea Slot 1)
75 − 16 = 59¢

EXP #176

Purpose: To measure Δρ for 4 pc Plexiglas Slot 2

12 Start Assembly Source Resp OK
20 On Pos Period Ind @ = 0.661
24 Start to Level
30 Level Ind = 0.723 > $\frac{12.6}{.062}$ = 203 ¢/in
.115
91 − 16 = 75

1.0525
.126
.00641
.000850
.062
= .0137 / in

EXP #177

Purpose To measure Δρ for 4 pc Plexiglas Slot 3
Start Assembly Source Resp OK

44 Start Assembly

51 On Pos Period 0.719
55 Start to level
05 Level 0.772 > $\frac{11.1}{.053}$ = 209 ¢/in
Shut down
101 − 16 = 85

1.051
.111
.00641
.000748
.053
= .0141

Bottom of
PS 183

Instrument Check on 8 Mar 72 Source 10 mc ^{60}Co

950V PM-1 4.35 Low Trip OK Hi Trip OK

IC-1 3×10^{-10} Meter Trip Scram Tables Fast Trip OK
IC-2 3×10^{-10} Meter Trip OK
IC-3 1.7×10^{-9} Calibration
IC-4 1.8×10^{-9} Calibration
I

A OK
B OK
C OK

EXP #178

Purpose: Repeat Δρ of 8x4x2 array

Source Resp OK
Red Lite OK
Δρ = 1.5 OK
Bypass OK

~2^45 Start Assembly
:53 On Pos Period 0.114
Start To Level ~ 0.279 > Δρ = 16.6 ¢
On Level ~ 0.279
Shut Down

(Demonstration Run for C.E Newton et al)

Instrument Check on 9 Mar 72 Source 10 mc ^{60}Co

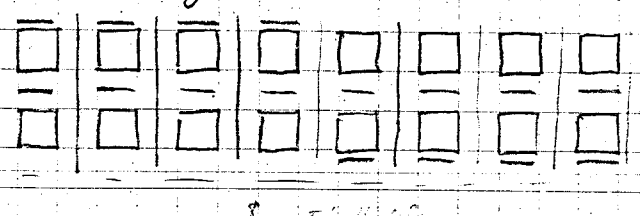
PM-1 Low Trip OK Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip Scram Tables
IC-2 3×10^{-10} Meter Trip OK
IC-3 1.7×10^{-9} Calibration Auto
IC-4 1.7×10^{-9} Calibration Auto
I

EXP #179

Purpose: To Measure Δρ for 64 ea 1/8x2x2 Angle 4 ea around each unit
+ 16 ea 1/2x4x4 Plexiglas, see rel marks on sketch

AM Source Resp OK
Red Lite OK
Δρ = 1.5 in 1/20
Bypass OK



Start Assembly
9:24 Tables Closed On Pos Period
Separate to reduce power
and repeat period over lower power range.
9:33 On Pos Period 0.114
9:34 Shut Down

EXP #180

Purpose: To Measure Δp for 64 ea 1/8 x 2 x 2 Angle
16 ea 1/2 x 4 x 4 Plex
4 ea 1/2 x 4 x 12 Plex
(See Blue on Sketch p 185)

9 49 Start Assembly Source Reg OK

9 57 1/2 On Pos Period Ind = 0.678
10 02 Start to Level
08 Level = 0.726 — .048
Shut Down
1.0059

$\Delta\rho \sim 91¢$

EXP #181

To Measure $\Delta\rho$ for 64 ea 1/8 x 2 x 2 Angle Iron
16 ea 1/2 x 4 x 4 Plex
8 ea 1/2 x 4 x 12 Plex
(4 ea added in Red on Sketch)

16
24
40

10 18 Start Assembly, Source Inserted Manually.
24 On Pos Period Ind = 0.924⁻
.923⁺
29⁺ Start to Level
37 Level 0.965 > $\frac{10.57}{.060_5}$ = 220 ¢/in
Shut Down

$\Delta\rho \sim 141$

EXP #182

Purpose to Measure $\Delta\rho$ for 64 ea 1/8 x 2 x 2 } Angle Iron
64 ea 1/4 x 2 x 2 1/2 }
(or $\Delta\rho$ for 64 ea 1/4 x 2 x 2 1/2 16 ea 1/2 x 4 x 4
8 ea 1/2 x 4 x 12

16
24
40

10 49 Start Assembly Source Inserted Manually
57 Subcritical Ind = 0.115 Source in to Raise Power
11 02 1/2 Remove Source Neg Period −116.25 sec to IC-3 = 4×10^{-10}
~ −18.8 ¢

1.018
−.188
−.00641
−.00123
.9988

EXP #183

Purpose To Measure Δp for 64 ea 1/8 x 2 x 2 } Iron
64 ea 1/4 x 2 x 2 1/2 }
Source Inserted Manually 16 ea 1/2 x 4 x 4 }
11 14 Start Assembly 8 ea 1/2 x 4 x 12 }
22⁺ On Pos Period 0.587 + 7 ea 1/2 x 4 x 12 } Plex Between units only
24⁺ Start to Level + 4 ea 1/2 x 4 x 4 } at Midplane
33 1/2 Level 0.658 > $\frac{15.1}{0.071}$ = 213 ¢/in
+78¢

16
24
21
4
65

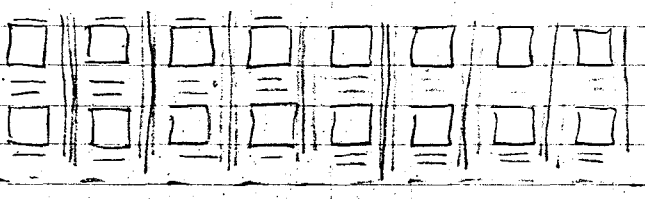
0051

TOP ROW only

189

EXP #184 SOUTH TABLE

Purpose to Measure $\Delta\rho$ for Steel and Plexiglass



Start Ass. Source Inserted Manually

On Pos Period Ind = 0.833

Start to level

Level Ind = 0.889 $\Big\rangle \frac{13.5}{.056}$

Shutdown

$\Delta\rho = 125¢$

$= 241 \frac{¢}{in}$

64 ea 1/8 x 2 x 2 } Angle Iron
64 ea 1/8 x 2 x 2 1/2 }
15 ea 1/2 x 4 x 12
32 ea 1/2 x 4 x 4

45
32
27

1.0080

EXP #185

Purpose: To Measure $\Delta\rho$ for 7 more (1/2") x 4 x 12 Plexiglas (see Blue on above sketch)

Start Assembly Source Resp OK

On Pos Period Ind = 0.999$_5$

Start to level

Level Ind = 1.047$_5$ $\Big\rangle \frac{12.9¢}{.048} = 269¢$

$\Delta\rho \sim 165¢$

1.0525
.129
.00641
.000570
$\approx .01813$/in.

ρ = 1.0104

27
31
98

Assume 1. 3 Dimensional effect = 3/2 X 2 DIMENS
2. All of reactor = 4 x effect on 16 blocks
3. Reactor effect 6 x larger than measured

#181 $\therefore$ $\Delta\rho = 141 \times 6 = 846¢$ for 1/8 Steel + 1/2 Plex
$= 0.059_{22}$ if $\beta = .007$

#184 $\Delta\rho = 125 \times 6 = 750¢$ for 3/8 Steel + 1 Plex
$= 0.0525$

$\Delta\rho = -19 \times 6 = 114¢$ for 3/8 Steel + 1/2 Plex
$= .0079_8$

Assume $\Delta\rho$ for increasing Plex 1/2 in one dimen = the other dim
add 7 plex = 40¢

$\Delta\rho = 80¢ \times 6 = 480 + 750 = \$12.30$
.007
.08610 for 1 1/2 Plex or 3/4 per cell

190

8
8

9
9

9

9
10

kaff
av .9880
for 3/8" Steel
no Plexiglas

1.050
.099
.00641
.00067

7 36
1 36
4 54
-126
+ 7
-119

vs 121
-.0120 av

Instrument Check

PM-1 _____

IC-1 _____

IC-2 _____

IC-3 _____

IC-4 _____

Instrument Check on 10 Mar 72 **Source** 10 mc ^{60}Co

950V PM-1 Bal 4.45 Low Trip OK Hi Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip Scanned Tables

IC-3 1.7×10^{-9} Calibration [illegible] A OK

IC-4 1.7×10^{-9} Calibration [illegible] B OK

C OK

EXP # 186

Purpose to evaluate $\Delta\rho$ for {64 ea 1/8 x 2 x 2 / 64 ea 1/4 x 2 x 2 1/2} Angle Iron

8 41 Start Assembly, Source Reg OK

8 50 Red Lite OK 4 ea 1/2 x 4 x 12 in Slot 4 #163 88¢ .0054

Subcritical Bypass OK 4 ea 1/2 x 4 x 12 in Slot 1 176 59¢ .0036

IC-3 = 3×10^{-10} $\Delta\rho$ OK 147¢ 90

Ind = 0.110 16

163

EXP # 187

9 01 Start Assembly 4 ea Plex Slot 1 59 36

9 10 Subcritical Slot 7 59 36

Insert source to Raise power Slot 2 75 46

9 14 On Neg Period Ind = 0.110 193¢ 118

9 23 Separate Tables −4.2 ¢ 16

209

1.041
.042
.00641
.00028

EXP # 188

Repeat with Plastic in Slot 1, 4 & 7

9 30 Start Assembly 59

39 On Pos Period Closed Ind = 0.111 88

43 Start to Level 59

Level Ind = 0.206 > $\frac{9.9}{.095}$ = 104¢/in 206 16 222

$\Delta\rho$ = −4.2 − (9.9) = 14.1¢

Shut Down ρ ($\frac{3}{8}$ sall) = 9.9 − 206 = −198

EXP # 189

Purpose: To measure $\Delta\rho$ for 64 ea 1/8 Steel Angle 4 ea Plex Slot 1 59¢

9 59 Start Assembly, Source Reg OK

10 07 Near Critical Ind = 0.110 Power to IC-3 ~ 1.5×10^{-9} 36

10 On Neg Period 2

19 −2.5¢ 35

Instrument Check on 10 Mar 72 Source 10 mc ^{60}Co

950V PM-1 Bal 4.45 Low Trip OK Hi Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip Scrammed Tables

IC-3 1.7×10^{-9} Calibration [illegible] A OK

IC-4 1.7×10^{-9} Calibration [illegible] B OK

C OK

EXP # 186

Purpose to evaluate $\Delta\rho$ for {64 ea 1/8 x 2 x 2 / 64 ea 1/4 x 2 x 2 1/2} Angle Iron

8 41 Start Assembly, Source Reg OK

8 50 Red Lite OK 4 ea 1/2 x 4 x 12 in Slot 4 #163 88¢ .0054

Subcritical Bypass OK 4 ea 1/2 x 4 x 12 in Slot 1 176 59¢ .0036

IC-3 = 3×10^{-10} $\Delta\rho$ OK 147¢ 90

Ind = 0.110 16

163

EXP # 187

9 01 Start Assembly 4 ea Plex Slot 1 59 36

9 10 Subcritical Slot 7 59 36

Insert source to Raise power Slot 2 75 46

9 14 On Neg Period Ind = 0.110 193¢ 118

9 23 Separate Tables −4.2¢ 16

1.041 .042 .00641 .00028 209

4

213

EXP # 188

Repeat with Plastic in Slot 1, 4 & 7

9 30 Start Assembly 59

39 On Pos Period Closed Ind = 0.111 88

43 Start to Level 59

Level Ind = 0.206 > $\frac{9.9}{.095}$ = 104¢/in 206 16 222

$\Delta\rho$ = −4.2 − (9.9) = 14.1¢

Shut Down ρ ($\frac{3}{8}$ still) = 9.9 − 206 = −198

EXP # 189

Purpose: To measure $\Delta\rho$ for 64 ea 1/8 Steel Angle 4 ea Plex Slot 1 59¢

9 59 Start Assembly, Source Reg OK

10 07 Near Critical Ind = 0.110 Power to IC-3 ~ 1.5×10^{-9} 36

10 On Neg Period 2

18 Shut Down −3.5¢ −59 − 3.5 ≈ 62.5 38

9962

Bottom of page 191

88

1.067
.308
.00641
.00211

54
21
.0033

9967
9962
9962
11/3 = 4

Av
.9964

for 1/8" Steel

EXP #190

4 ea Plex to Slot 4 → 88¢

64 ea 1/8 × 2 × 2 Steel Angle

10^25 Start Assembly Source Rep OK

1034 Separate Table to lower power to start Pos Period at Lower Power

39 Tables Close On Pos Period 16.5 sec 30.8¢

41^n Shut down 0.110

88 − 31 = 57

Slot 1 → Slot 4 = 30.8 + 3.5 = 34¢

88 − 59 = 29

EXP #191

10^51 Start Assembly Source Rep OK 4 ea Plex to Slot 2 → 75¢

11^00 On Pos Period 0.109 +15.1¢ 64 ea 1/8 × 2 × 2 Steel Angle 75 − 15 = 60

Shut Down IC-3 = 2.3 × 10^-9

Δρ (190 − 191) is not consistent with Δρ (Slot 4 − 2) or Δρ (Slot 4 − 1)

EXP #192 (Repeat #189)

11^15 Start Assembly Source Rep OK 4 ea Plex Slot 1 → 67¢ ?

23 Subcritical Power to IC-3 ~ 2.0 × 10^-9 64 ea 1/8 × 2 × 2 Angle Iron

27 1/2 On Neg Period Δρ = 0.109

− 3.4¢

36 Shut Down

Δρ = 15.1 − (−3.4)

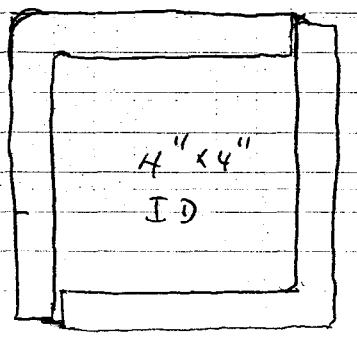
Slot 1 to Slot 2 = 18.5¢

Slot 1 to Slot 2 = 75 − 59 = 16

OK

March 13, 1971

Ordered from WCT 64 ea 1/4" thick Cubic Boxes



4 1/2 × 4 1/2 OD

End plates 128 ea 1/4 × 4 1/2 × 4 1/2 Steel

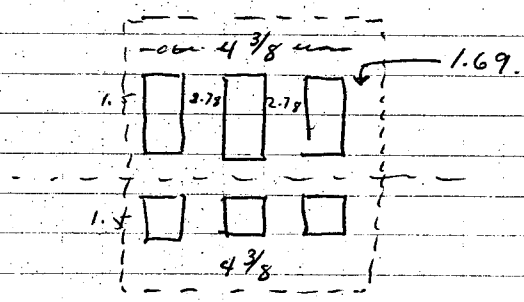
March 13, 1972

Start assembly of 27 unit array
as 3 ea of 1x3x3 Cells.

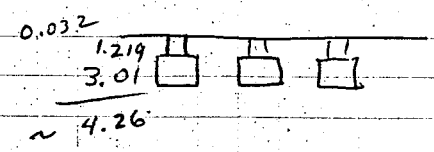
In a 20 x 20 x 20 core

20
11.25
8.75 / 2 = 4.3/8

8.75
1.50
7.25
5.56
1.69



Align Tables after 1st layer
on North & South.
Ind = 0.105



Instrument Check on _____ Source _____

PM-1		Low Trip		Hi Trip	
		Table operation checked previously on subcrit system			
IC-1	3×10^{-10}	Meter Trip	✓	Fast Trip	✓
IC-2	3×10^{-10}	Meter Trip	✓		MONITRON
IC-3	1.8×10^{-9}	Calibration	DWM	A	OK
IC-4	1.8×10^{-9}	Calibration	DWM	B	OK
				C	OK

$\Delta p > 1.5$ OK
Bypass OK
Person OK
Source OK

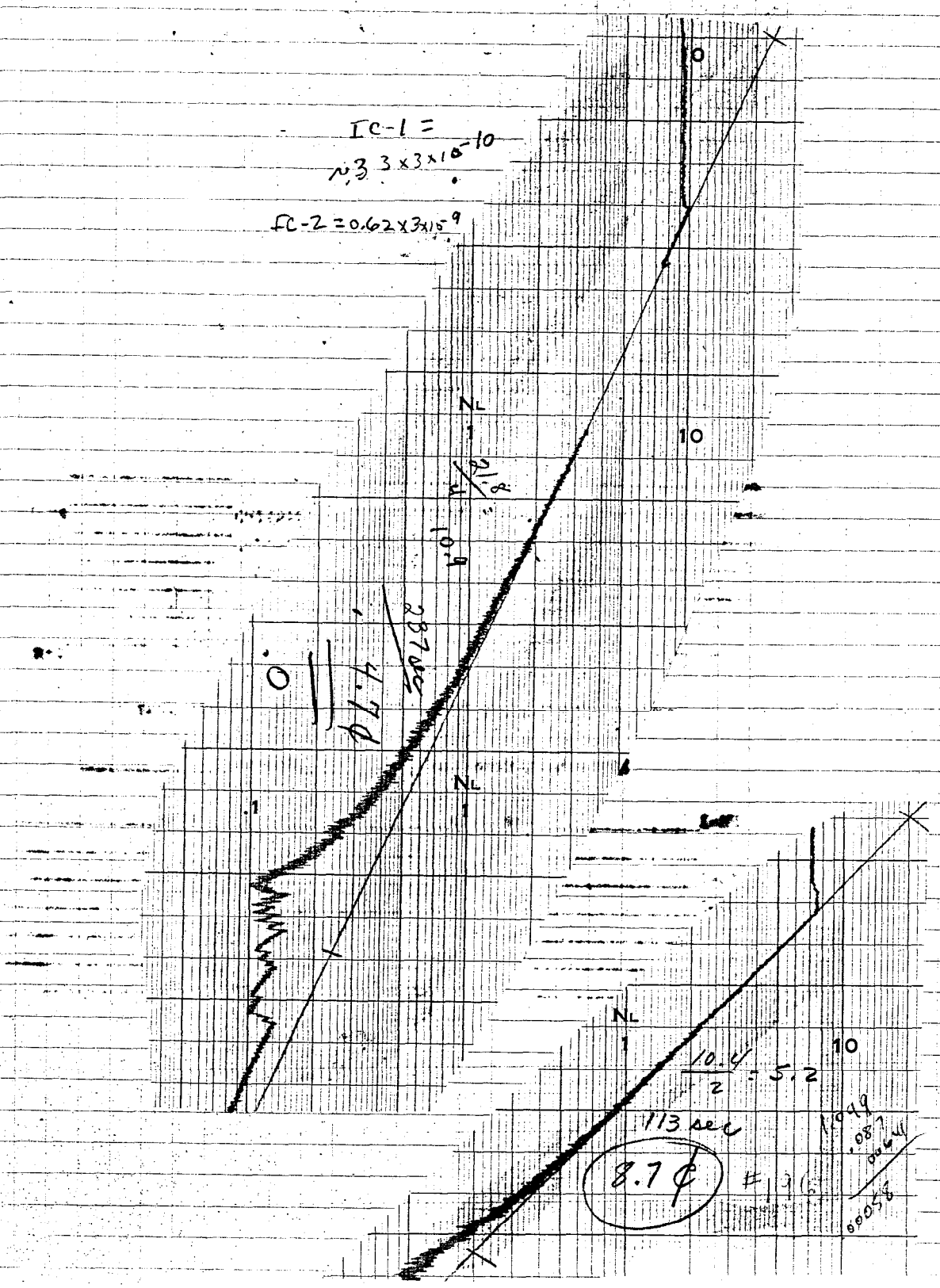
EXP #193

Preliminary Search for Crit cality for 9 unit 3 ea 27 Total
in 20 x 20 x 20 in Core

Spacing 2.78 between EW 1.5 - 2.78 - 2.78 - 1.69
NS 1.375 - 11.25 - 1.375
Vert 1.26 - 11.25 - 1.49

157 Start Assembly
206 On Pos Period
~ 210 Start to Level
216 Level
Start Down

Ind 1.4795 88.0 sec
Ind 1.5035 = 10.64 / .024 = 443 ¢/in


IC-1 =
~3 3×3×10^-10
IC-2 = 0.62×3×10^-9
NL
1
10
10
NL
1
.1
NL
1
10
10.4/2 = 5.2
113 sec
8.7¢
#196
1.099
.087
.0064
.00058

EXP # 194

27 Unit Array 3 ea 1×3×3 Units – aligned 1st row before final assembly

Core Size 20.25 × 20.25 × 20.25

Unit Cell: 6.75 in^3 Spaces EW 1.5 – 3.0 – 3.0 – 1.5

NS 4.5 (11.25) 4.5

Vert 4.532 (11.25) 4.468

Note: Polyethylene placed around chambers to increase sensitivity

Insert Source Manually

3^{35} Start Assembly

3^{44} On Pos Period Ind 1.224 77.7 sec

3^{47} Start to Level

3^{5} Level 1.262 > 11.7¢ / 0.038 = 308 ¢/in

Instrument Check on Mar 14, 72 Source 10 mc ^{60}Co

950 V PM-1 Bad 4.10 Low Trip [illegible] Hi Trip OK

IC-1 [illegible] Meter Trip OK Fast Trip OK

IC-2 [illegible] Meter Trip OK Monitor

IC-3 25×10^{-9} [illegible] A OK

IC-4 Out for Sl Calibration B [illegible]

C [illegible]

Note: CH$_2$ [illegible] 2 – 3 – 4 Chamb. To [illegible] [illegible] 3 [illegible] 3 [illegible] 4.

EXP #195 Source Reg OK

Multiplication noted with table @ 16 in.

9^{40} Start Assembly

9^{48} On Pos Period 237 sec 27 Unit Array 3 ea 1×3×3 Units

Ind = 0.815 ↓ 21 × 21 × 21.0 Meas.

10^{01} Start to Level 4.7¢ EW 1 5/8 – 3 1/4 – 3 1/4 – 1 5/8

10^{0} Level Ind = 0.826 NS 4 7/8 – (11.25) 4 7/8

.011 4.7 Vert (4 7/8 + .032)(11.25)(4 7/8 – .032)

.011

= 427 ¢/in

Restack in Core 22 1/8 × 22 1/8 × 22 1/8

EXP # 196 EW = 1 13/16 – 3 5/8 – 3 5/8 – 1 13/16

3^{10} Start Assembly, Source inserted Manually NS = 5 7/16 – (11.25) – 5 7/16

20 On Pos Period Closed @ 0.107 Vert = .032 Al Shelf

25 1/2 Start to Level 4.718 Box

.625 Alum Bar

Level 0.161 .0625 – SS Shim

8.7¢ / .054 5.4375 = 5 7/16

= 161¢ / inch

1st layer align Ind = 0.108

Instrument Check on Mar 15, 72 Source [illegible] 201

950 V FM-1 Bal 4.40 Low Trip OK Hi Trip Scram Tables

IC-1 3×10^{-10} [illegible] Trip OK Past Trip OK

IC-2 3×10^{-10} [illegible] OK

IC-3 2.5×10^{-9} Calibrated [illegible] A OK

IC-4 Not in Service [illegible] B OK

C OK

Note IC-4 Beck. back in ~~service~~ in rack
Still Drifting Wildly
Calibration found to be N.G.
Do Not use for Periods.

27 unit Array
3 ea of 9 unit Cells.

EXP #197

Mock up of support on North 2/3 placed on top.

Bypass OK — 032 Alum Shelf
Red Lit. OK — Boxes
$\Delta p = 1.5''$ OK — 5/8 Bars
Source Inserted Manually. — SS strips for Shims.

8 50 Start assembly
9 05 On Positive Period — — Table motion seems a bit jerky for small changes in motor drive.
Ind = 0.160
Period A + 94.2 sec → +10.1¢

9 07 ~~Separate~~ Start to Level
Level Ind = 0.184 — 10.1/.024 = 421 ¢/in
Separate Screw Only to lower Power
Measure $\Delta\rho$ with Tables Closed. ~107 − 108

9 23 On Positive Period +B + 41.8 sec → + 18.0 ¢ — 18.0/.076 = 237

1.057
.18
.00644
.00122

9 26 1/2 Manual Scram To Shut Down

Worth of 2/3 Supp = 10.1 ¢

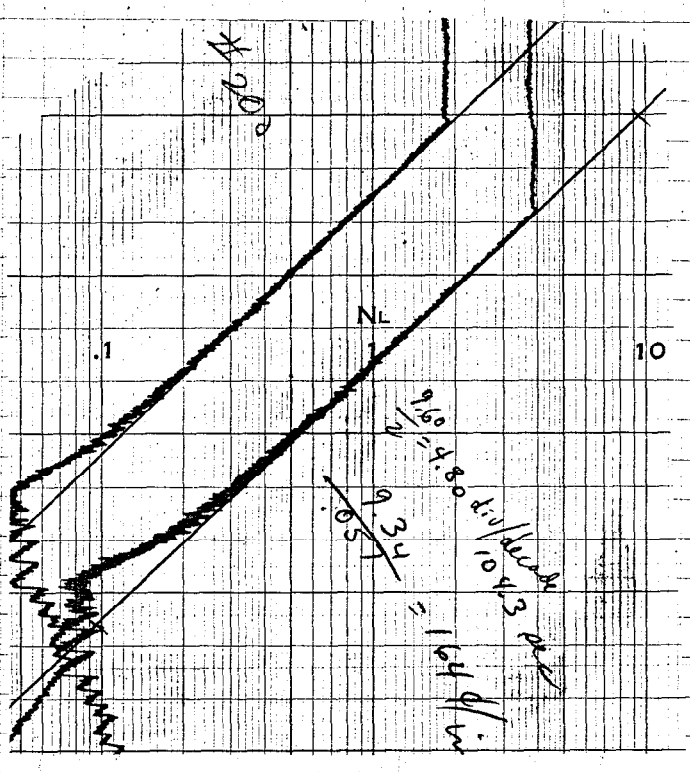
Worth of all of suppor = 15 ¢

Corrected Reactivity of #196 = 8.7 − 15 = −6 ¢

$(22\,1/8)^3$
7 3/8 " Cell

122
1.00058
.00064 = 2/3
32
.00096 Alum Cover

202



27 unit Array 3×3×1 Array
3 cubes per cell 1×1×3 Cell

Cell size 6.0^3
Array 18.0^3

EXP #198

By Pass OK
Red light OK
$\Delta p = 1.5$ in H_2O
Source inserted Manually

1.0495
.0844
.00641
.00057

1^{53} Start Assembly
2^{06} On Pos Period Ind = 0.487 → 107.1 sec → 8.4_4 ¢
2^{10} Start to Level
Level 0.530

$\frac{8.44}{.043} = 196$ ¢/in

.013204/in
×.42
Δg_{ex} = .00555

IC-3 = 4×10^{-9}

$\Delta g = (.53 - .11) \times 170$ ¢/in = 71¢

Instrument Check on Mar 16, 72 Source _____

950 V	FM-1 Bal = 4.40	Low Trip	OK	Hi Trip	OK
	IC-1 3×10^{-10}	Meter Trip	Scram Tables	Fast Trip	OK
	IC-2 3×10^{-10}	Meter T	OK		
Source on top of chamber →	IC-3 4×10^{-10}	Calibration	DWM		
	IC-4 2×10^{-9}	Calibration	DWM		

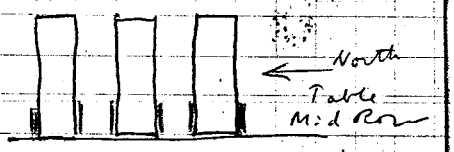
EXP #199

27 Unit Array 3×3×1 Array
3 cubes per cell 1×1×3 Cell
Bottom spacer 3.530
Shelf .032
3.562 = 3 9/16
Array Core 18 3/8 × 18 3/8 × 18 3/8 (Meas.)

$\Delta p = 0.14$ " H_2O OK
all previous entries in error ×10
Bypass OK
Source

11^{09} AM Start Assembly
^{19} Subcritical Insert Source to Increase Power IC-3 to 1.0×10^{-9}
Ind = 0.109
^{22} Remove Source Neg Period → 2-50 sec Very Subcrit > $1

EXP #200 Add 4 ea ½ × 2 7/8 × 6 Plexiglas



6 4 ea ½ × 2 7/8 × 6 Plexiglas
(12) (34) (5)

12^{46} PM Start Assembly Source Resp OK
$12^{54\frac{1}{2}}$ On Pos Period Δp OK
Ind (Closed) = 0.116 Bypass OK
Red Lite OK
12^{58} Start to Level 0.168

9.3_4 ¢ / .057 = 164 ¢/in

1.0495
.0934

Source inserted Manually

.0014
.00641
.00057

1^{53} Start Assembly
2^{06} On Pos Period Ind = 0.487 → 107.1 sec → 8.4_4 ¢
2^{10} Start to Level
Level 0.530

$\frac{8.44}{.043} = 196$ ¢/in

IC-3 = 4×10^{-9}

.013204/in
x.42
$\Delta\rho_{ex}$ = .00555

$\Delta\rho = (.53 - .11) \times 170$ ¢/in = 71¢

Instrument Check on Mar 16, 72 Source _____

950 V FM-1 Bal = 4.40 Low Trip OK Hi Trip OK

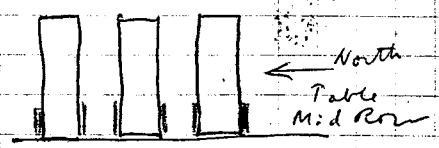
IC-1 3×10^{-10} Meter Trip Scram Tables Fast Trip OK
IC-2 3×10^{-10} Meter T... OK
Source on top of chamber → IC-3 4×10^{-10} Calibration DWM
IC-4 2×10^{-9} Calibration DWM

EXP # 199
27 Unit Array 3 x 3 x 1 Array
3 cubes per cell 1 x 1 x 3 Cell
Bottom spacer 3.530
Shelf .032
3.562 = 3 9/16
Array Core 18 3/8 x 18 3/8 x 18 3/8 (Meas.)

$\Delta p = 0.14$ " H_2O OK
all previous entries in error x10
Bypass OK
Source

11^{09} AM Start Assembly
^{19} Subcritical Insert Source to Increase Power IC-3 to 1.0×10^{-9}
Ind = 0.109
^{22} Remove Source Neg Period → 2-50 sec Very Sub crit > $1

EXP # 200 Add 4 ea ½ x 2 7/8 x 6 Plexiglas



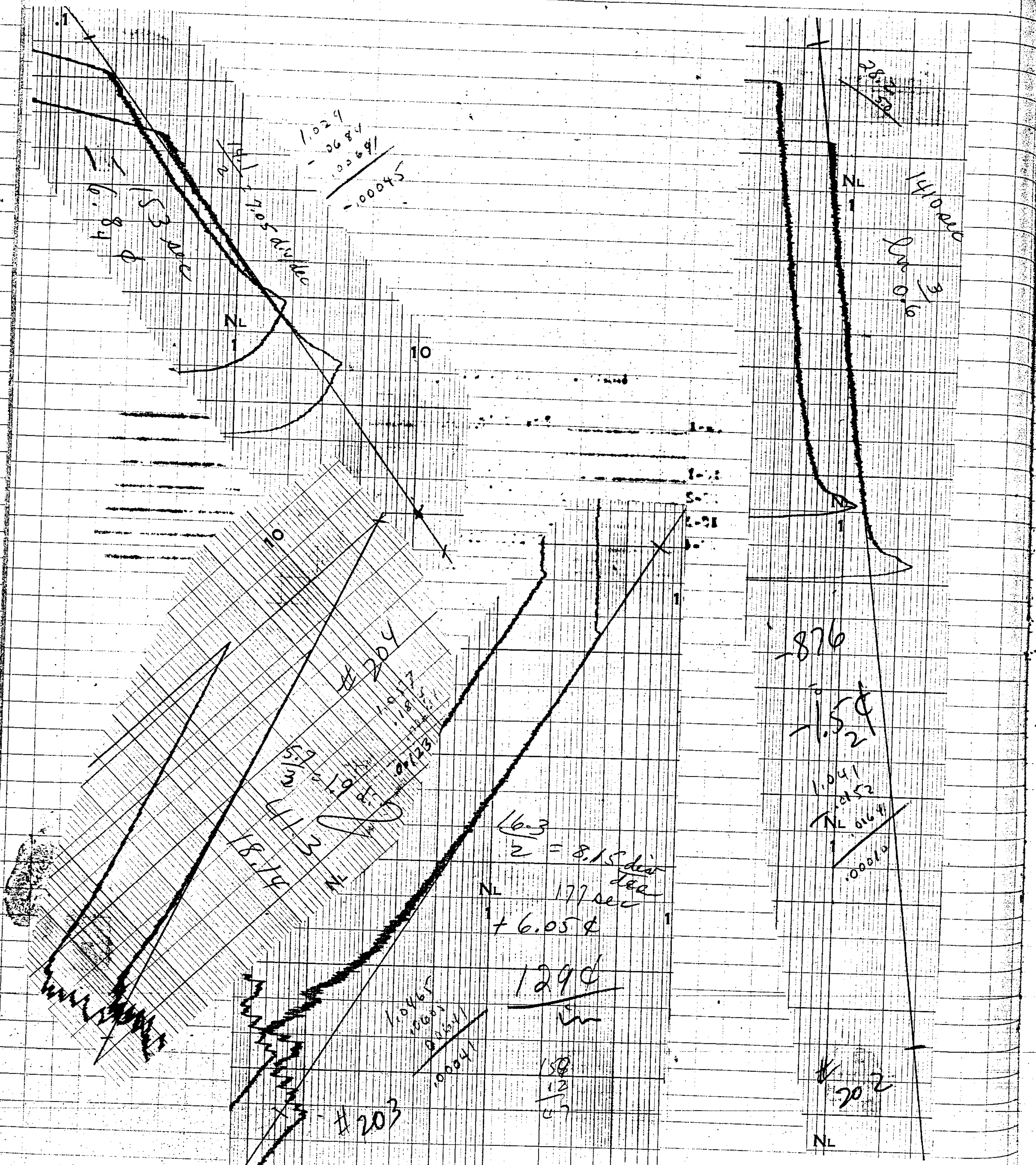
6 4 ea ½ x 2 7/8 x 6 Plexiglas
1 2 3 4 5

12^{46} PM Start Assembly Source Resp OK
$12^{54\frac{1}{2}}$ On Pos Period Δp OK
Ind (Closed) = 0.116 Bypass OK
Red Lite OK
12^{58} Start to Level 0.168

9.3_4 ¢ / .057 = 164 ¢/in

1.0495
.0934
.00641
.000628 / .057 = .0110

Bottom of
pg 203



NL
1
10
1.1
153 sec
7.05 div/sec
1.029
-.00045
#204
18.14
#203
16.3/2 = 8.15 div/sec
177 sec
+6.05 ¢
1.29 ¢
140 sec
28.8
-.876
1.041
.00016
#202

EXP #201

Measure Δρ for 1pc of 1/2 x 2 7/8 x 6 Plex Outside pc #4. See sketch

1 17 Start Assembly Source Resp OK

1 25 Tables Closed Bypass OK 3pc @ ①②③

Reinsert Source Δρ OK

To Raise Power Red line OK

Ind = 0.112

Neg Period 4x10^-9 to 4x10^-10 on IC-3 -153 sec

Shut Down Screw only -6.8₄ ¢

EXP #202

1 40 Start Assembly 4 pc 1/2 x 2 7/8 x 6 Slots ①②③ ⑤

1 48 Near Critical Ind = 0.112

1 49 Insert Source to Raise Power

1 50 Remove Source Neg Period -876 sec → -1.5₂ ¢

1 59 Shut Down

EXP 203

Add 1pc Total 5pc in Slots 6, 1, 2, 4, 5

Move 1pc

2 08 Start Assembly Source Resp OK

2 16 On pos period Ind = 0.112

2 23½ Start to Level

Level 0.159

6.05¢/.047 = 129¢/in

EXP #204

Purpose To Measure Δρ for Mocking of Support Struct - Shelf + Boxes.

2 51 Start Assembly Source Resp, OK

3 00 On Pos. Period Ind = 0.112 → 18.14 ¢

Shut Down by Power Rise to Scram Level on IC-2 (3x10^-9) x 120%

IC-3 to 5.5x10^-9

① Slot 5 = -6.84

or 6 -1.52

5.3₂ ¢

+.00063 1+2+3+4 = 9.34

① .00108 -.00045 1+2+3 = -6.84 4 = 16.18

② Slot 4 = +9.34 - (6.84)

or 1 = 16.18 ¢

② .00035 -.00010 1+2+3 +5 = -1.52 5 = 5.32

③ .00092 +.00041 6+1+2+ 4+5 = 6.05 3 =

③ Slot 3 = -6.05

or 2

6+1+2+3 +5 = 2.81

3-4 = 3.14

3 = 19.32

1+2+3+4 = 71¢

16.18
19.32
35.50

Shelf worth
18.14
6.05

To Raise Power Red line OK
Ind = 0.112
Neg Period 4×10^{-9} to 4×10^{-10} on IC-3 −153 sec
Shut Down Screw only -6.8_4 ¢

EXP #202

1 40 Start Assembly 4 pc ½ × 2⅞ × 6 Slots (1)(2)(3)(5)
1 48 Near Critical Ind = 0.112
1 49 Insert Source to Raise Power
1 50 Remove Source Neg Period −876 sec → -1.5_2 ¢
1 59 Shut Down

EXP 203

Add 1 pc Total 5 pc in Slots 6, 1, 2, 4, 5
Move 1 pc
2 08 Start Assembly Source Resp OK
2 16 On pos. period Ind = 0.112
2 23½ Start to Level
Level 0.159
6.05¢/.047 = 129¢/in

EXP # 204

Purpose To Measure Δρ for Mocking of Support Struct − Shelf + Boxes.
2 51 Start Assembly Source Resp. OK
3 00 On Pos. Period Ind = 0.112 → 18.14 ¢
Shut Down by Power Rise to Scram Level on IC-2 $(3 \times 10^{-9}) \times 120\%$
IC-3 to 5.5×10^{-9}

① Slot 5 = −6.84
or 6 −1.52
5.3_2 ¢

+.00063 1 + 2 + 3 + 4 = 9.34

(4) .00108 −.00045 1 + 2 + 3 = −6.84 4 = 16.18

② Slot 4 = +9.34 − (6.84)
or 1 = 16.18 ¢

(2) .00035 −.00010 1 + 2 + 3 + 5 = −1.52 5 = 5.32

(3) .00092 +.00041 6 + 1 + 2 + 4 + 5 = 6.05 3 =

③ Slot 3 = −6.05
or 2

6 + 1 + 2 + 3 + 5 = 2.81

3 − 4 = 3.14
3 = 19.32
1 + 2 + 3 + 4 = 71 ¢

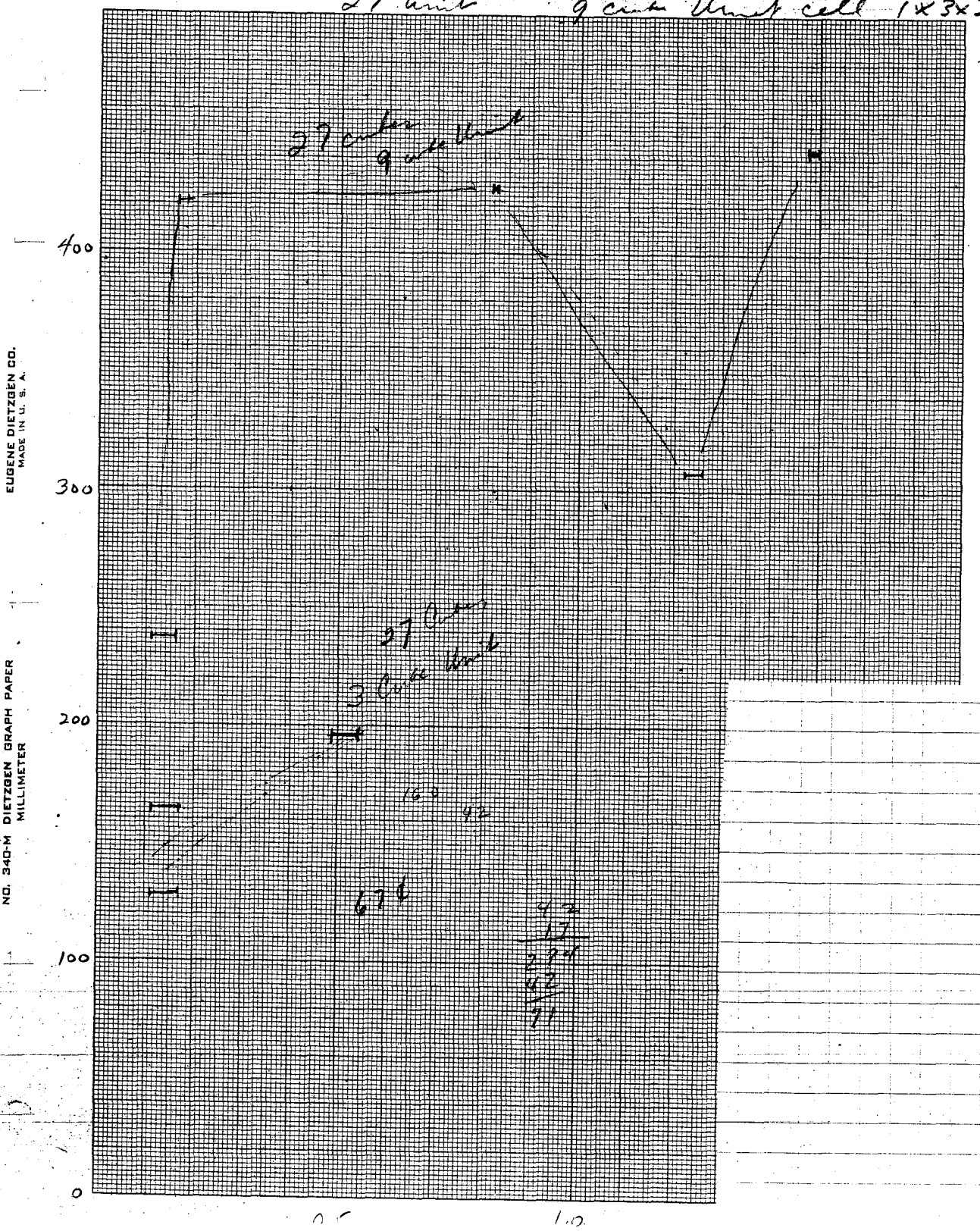
16.18
19.32
35.50

Shelf worth
18.14
6.05
12.09

Δρ (est.) EXP #199 = −71 + 9.3 = −61.7 ¢

Bottom of
pg 205
SJB

27 unit 9 cubic Unit cell 1x3x3



EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340-M DIETZGEN GRAPH PAPER
MILLIMETER

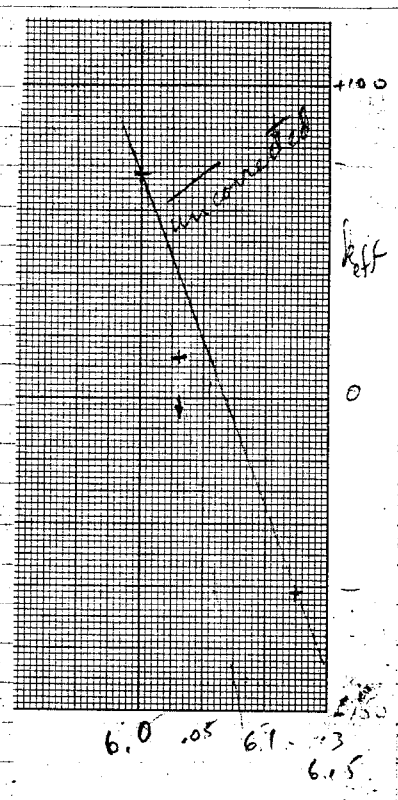
Uncorrected

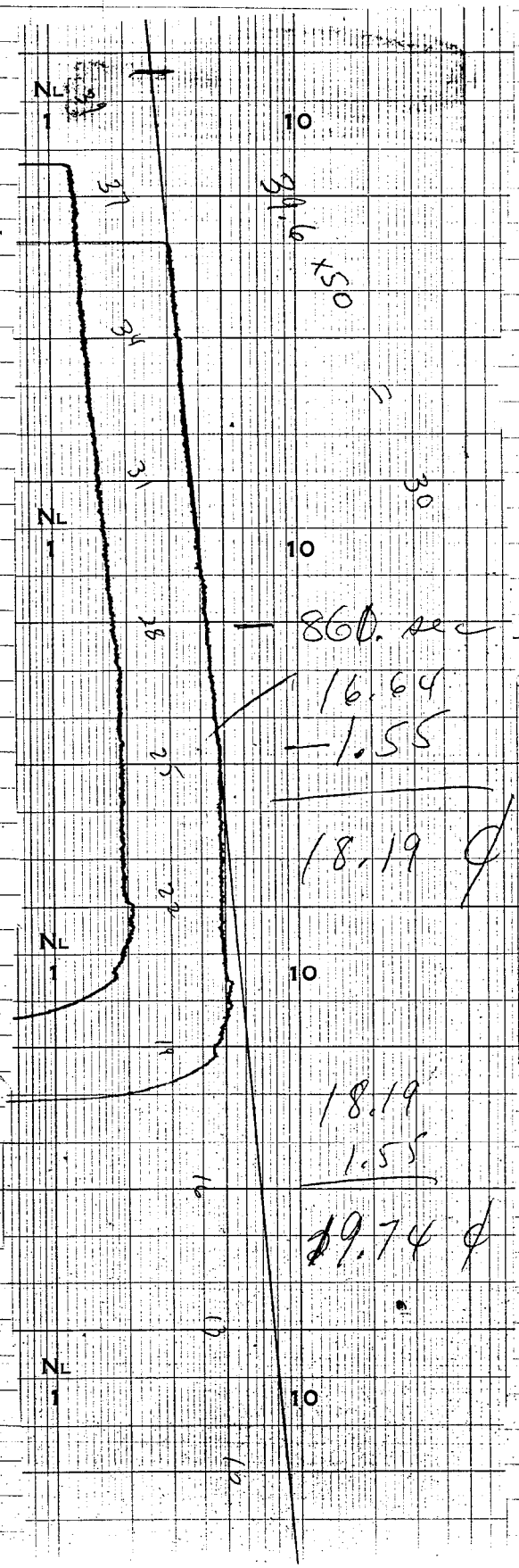
6 in cell $\Delta\rho = 71\ ¢$

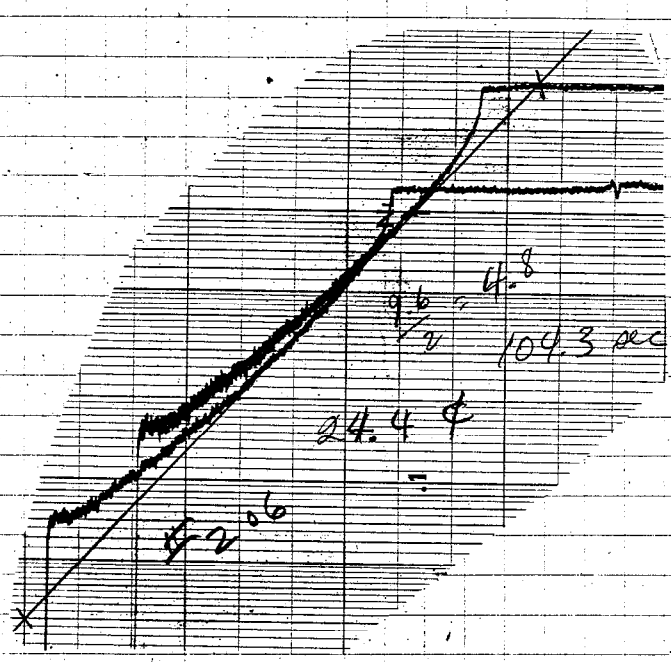
6 1/8 in cell $\Delta\rho = -62\ ¢$ Shelf worth 12.1 ¢

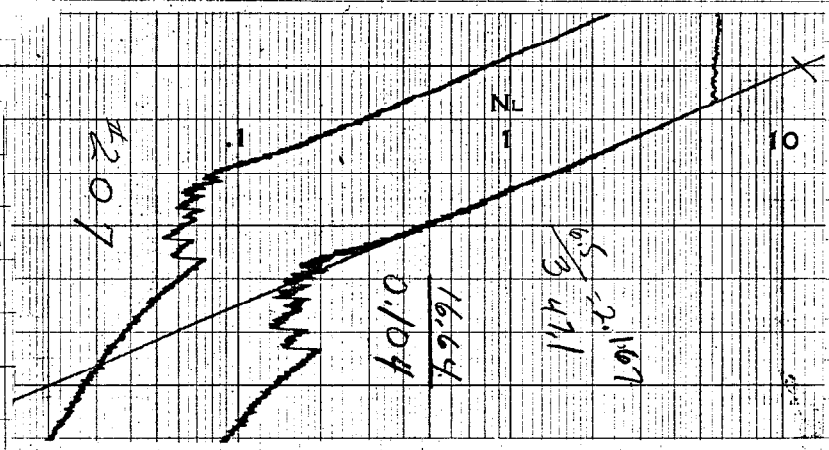
6.06 in Cell $\Delta\rho = 12\ ¢$ Assume Shelf Correct = 12 ¢

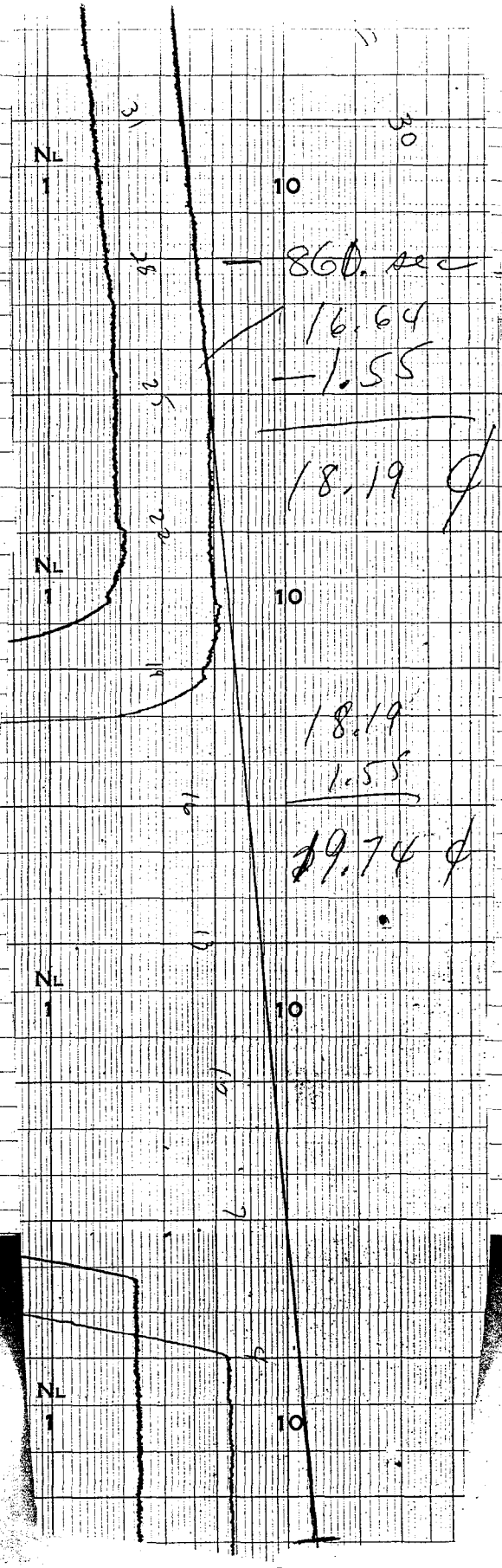
therefore Cell size = 6.06 in.



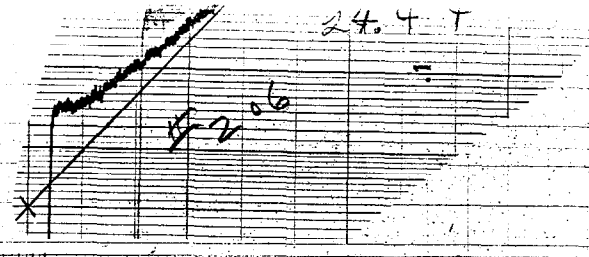

NL
1
10
39.6 x50
860. sec
16.64
-1.55
18.19 ¢
18.19
1.55
19.74 ¢


9.6/2 = 4.8
104.3 sec
24.4 ¢
2.06

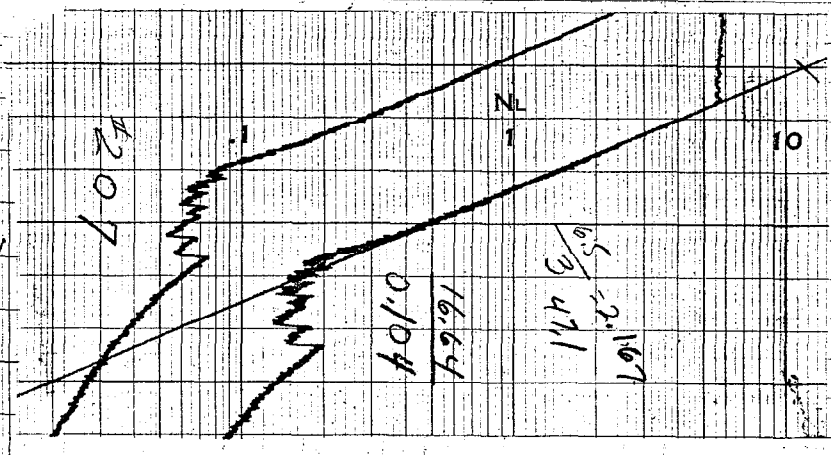

NL
1
10
207
16.64
0.104
6.5/3 = 2.167
47.1



NL
1
10
— 860. sec
16.64
−1.55
18.19 ¢
18.19
1.55
19.74 ¢



24.4 T



NL
.1
1
10

27 Unit Array 3x3x3 — 16 7/8" Cube Cell 5 5/8

Instrument Check on 17 Mar 72 Source 10 mc ^{60}Co

PM-1 _____ Trip OK Trip OK

IC-1 _____ Trip OK Trip Scram Table

IC-2 _____ OK MONITRON

IC-3 3.4×10^{-10} Calib Arch A OK

IC-4 1.6×10^{-9} " Arch B OK

Source Inserted Manually C OK

EXP# 205

Red Lt

10 56 Start Assembly

$\Delta\rho = 0.14$

11 04 Sub crit Inv d = 0.112 - 0.111

Bypass

Insert Source to Raise Power IC-3 — 4.7×10^{-10}

Remove Source 4 — 2.3×10^{-10}

Highly Sub Critical

EXP# 206

27 Unit Array 3 X 3 x 3 — $16\frac{1}{2} \times 16\frac{1}{2} \times 16\frac{7}{8}$

Cell Unit $5\frac{1}{2} \times 5\frac{1}{2} \times 5\frac{5}{8}$

1 39 Start Assembly Source Ins. Manually

1 48 Subcritical Inv d = 0.111 $\Delta\rho = 0.14$ OK

Insert Source to Raise Power Bypass Panel OK

IC-3 = 3×10^{-9} Red Lite OK

4 = 1.3×10^{-9}

$\Delta\rho$ (Est.) = -17.74 ¢

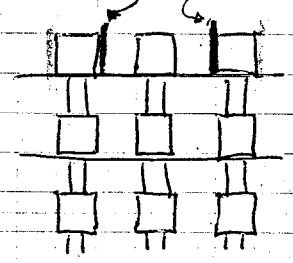
1 50 Hold level by withdrawing source

1 55 Remove Source for Neg Period

EXP# 207

27 Unit Array + 2 pc $\frac{1}{2} \times 4 \times 4$ Plexiglas on South 1/3

Insert Source



2 09 Start Assembly

2 17 On Positive Period 0.112

2 19+ Start to Level

2 27 Level 0.216

$\frac{16.64}{0.104} = 160\,¢/in$

Start Down, Screw Only

Remove 1 pc Plexiglas

EXP# 208

27 Unit Array + 1 pc $\frac{1}{2} \times 4 \times 4$ Plexiglas

2 30 Start Assembly

2 [illegible] Near Crit 0.113

[illegible] Insert Source [illegible] Level @ IC-3 = 4.3×10^{-9}

IC-4 1.6 x 10^-9 " " AVN B OK
Source Inserted Manually C OK

EXP# 205

Red Lite
Δp = 0.14
Bypass

10^56 Start Assembly
11^04 Sub crit Ind = 0.112 - 0.111
Insert Source to Raise Power IC-3 — 4.7 x 10^-10
Remove Source 4 — 2.3 x 10^-10
Highly Sub Critical

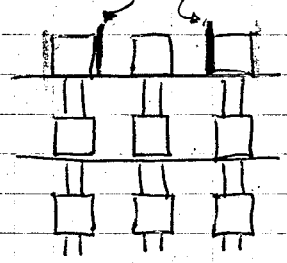
EXP# 206

27 Unit Array 3 X 3 x 3 — 16½ x 16½ x 16 7/8
Cell Unit 5½ x 5½ x 5 5/8

1^39 Start Assembly Source Ins. Manually
1^48 Subcritical Ind = 0.111 Δp = 0.14 OK
Insert Source to Raise Power Bypass Panel OK
IC-3 = 3 x 10^-9 Red Lite OK
4 = 1.3 x 10^-9
Δρ (Est) = -17.74¢
1^50 Hold level by withdrawing source
1^55 Remove Source for Neg Period

EXP# 207

27 Unit Array + 2 pc ½ x 4 x 4 Plexiglas on South 1/3
Insert Source



2^39 Start Assembly
2^17 On Positive Period 0.112
2^19+ Start to Level
2^27 Level 0.216

$\frac{16.64}{0.104} = 160¢$ in

Start Down, Screw Only
Remove 1 pc Plexiglas

EXP# 208

27 Unit Array + 1 pc ½ x 4 x 4 Plexiglas

2^30 Start Assembly
2^30 Near Crit 0.113
2^39 Insert Source Raise Power Level @ IC-3 = 4.8 x 10^-9
2^45 Remove Source — Neg Period — 860 sec → -1.55¢

Bottom of
PG 209 [illegible]

EXP # 209 $\Delta g = 31.2$ ¢ Corrected $+20.2$ ¢

Worth of Steel

31.2	.00213
22.7	.00155
8.5 ¢	.00058

Worth of Steel

22.7	.00155	
15.4	.00105	Total Steel 15.8
7.3	.00050	.00108

Worth of Alum

−15.4	−.00105	
+4.9	.00033	
−18.5	.00072	.00108
+15.8	.108	.00072
~~27.3~~	.00036	36
	.00018	

2/3 of Alum 7.3 ¢

1/3 3.7 .00054

11.0 ¢

#206	16.64
207	−1.55
	18.19
	x2 = 36.36 ¢
	−16.64
	19.72

∴ #205 = −20 ¢

∴ $\frac{1}{8}$" in 1 dim = 51 ¢

$\frac{1}{8}$" in 3 dim = 153 ¢

$\frac{20}{153} \times .125 = .016$ in correction

EXP # 209 $\Delta g = 31.2$ ¢ Corrected +20.2 ¢

Worth of Steel 31.2 .00213
22.7 .00155
8.5 ¢ .00058

Worth of Steel 22.7 .00155
15.4 .00105 Total Steel 15.8
7.3 .00050 .00108

Worth of Alum −15.4 −.00105
+4.9 −.00033
−18.5 −.00072 .00108
+15.8 108 .00072
~~24.3~~ .00036 .36
.00018

2/3 of Alum 7.3 ¢
1/3 3.7 .00054
11.0 ¢

#206 16.64
207 −1.55
18.19
x2 = 36.36 ¢
−16.64
19.72

∴ #205 = −20 ¢

∴ $\frac{1}{8}$" in 1 dim = 51 ¢
$\frac{1}{8}$" in 3 dim = 153 ¢

$\frac{20}{153} \times .125 = .016$ in correction for #209

Bottom of page 210
SJA

Inst Check ... 20 MAR, 72 Source 10 mc ^{60}Co

PM-1	Lo Trip OK	Hi Trip OK		
IC-1	Meter Trip OK	Fast Trip OK		
IC-2	Meter Trip Scram Table	MONITRON		
IC-3 2.2×10^{-10}	Calibrated Dwn	A OK		
IC-4 1.7×10^{-9}	" Dwn	B OK		
		C OK		

550
3.75
1.750
32
1.718
0.875

EXP #209

27 Unit Array 3 x 3 x 3 16½ x 16½ x 16½ Measured

Source Inserted Manually OK Unit Cell 5½ x 5½ x 5½

Red Lite Check OK EW 0.875 — 1.75 — 1.75 — 0.875

Bypass OK NS 0.875 — 1.75 — (split) 1.75 — 0.875

$\Delta p = 0.14$ OK Vert 0.875 — 1.718 + .032 — 1.718 + .032 — 0.875

2^{28} PM Start Assembly

2^{43} On Positive Period Source Out

@ IC-3 — 5×10^{-9} Shut Down Screw Only

Repeat Positive Period 31.2 ¢ (21.6 sec)

Ind @ 0.108 / 0.178

~2^{53} Start To level

3^{00} Level 0.286 IC-3 = 1.5×10^{-8}

Shut Down

1.064
.312
.0064
.00213

EXP #210

3^{14} Start Assembly 3 x 3 x 3 + 2 pc St St. on left side Mid Shelf North Half

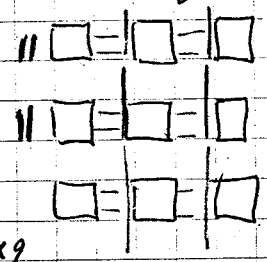
Source Ins - Resp OK .066 x 2½ x 9

3^{22} On Positive Period 0.108

Shut Down IC-3 = 1.0×10^{-8} 22.7 ¢

Screw Only

26.0
1.062
.227
.00641
.00155



EXP #211

Add 2 pc St St (062+062) x 2¾ x 9

now 4 ea

3^{30} Start Assembly Source Resp OK 31.9 sec

3^{34} On Pos Period 0.108_5 / 15.4 ¢ / .095 = 162 ¢/in.

Start to level

Level 0.203_5

1.0595
.154
0.00641
.00105

EXP #212

3^{55} Start Assembly, Source Resp OK | Add 4 ea STS 2 ea 066 x 2½ x 9

2 ea 062 x 2¾ x 9

4^{15} On Pos Period 0.109 | Add 10 ea 1.50 Boxes 2 ea 1⅝ } See Blue on Sketch above

Start to level | Add 2 shelves of Al .032

Level 0.148

4.9¢/.032 = 132 ¢/in

225 1.0455
.049
.000325

1.1 x 10⁻⁷ " Swan B OK
C OK

EXP #209

27 Unit Array 3 x 3 x 3 16½ x 16½ x 16½ Measured
Source Inserted Manually OK Unit Cell 5½ x 5½ x 5½
Red Lite Check OK EW 0.875 — 1.75 — 1.75 — 0.875
Bypass OK NS 0.875 — 1.75 — (split) 1.75 — 0.875
Δp = 0.14 OK Vert 0.875 — 1.718 + .032 — 1.718 + .032 — 0.875

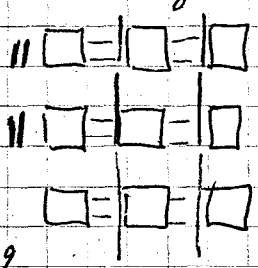
2²⁸ pm Start Assembly
2⁴³ On Positive Period Source Out
@ IC-3 - 5x10⁻⁹ Shut Down Screw Only
Repeat Positive Period 31.2 ¢ (21.6 sec)
Ind @ 0.108 0.178
~2⁵³ Start To level
3⁰⁰ Level 0.286 IC-3 = 1.5x10⁻⁸
Shut Down

1.064
.312
.0064
.00213

EXP #210

3¹⁴ Start Assembly 3x3x3 + 2 pc St St on left side Mid Shelf North Half
Source Ins - Resp OK .066 x 2½ x 9
3²² On Positive Period 0.108
Shut Down IC-3 = 1.0 x 10⁻⁸ 22.7 ¢
Screw Only

26.0
1.062
.227
.00641
.00155



EXP #211

Add 2 pc St St (062+062) x 2¾ x 9
now 4 ea

3³⁰ Start Assembly Source Resp OK 31.9 sec
3³⁴ On Pos Period 0.108₅ 15.4¢ = 162 ¢/in
Start to level
Level 0.203₅ .095

1.0595
.154
0.0064
.00105

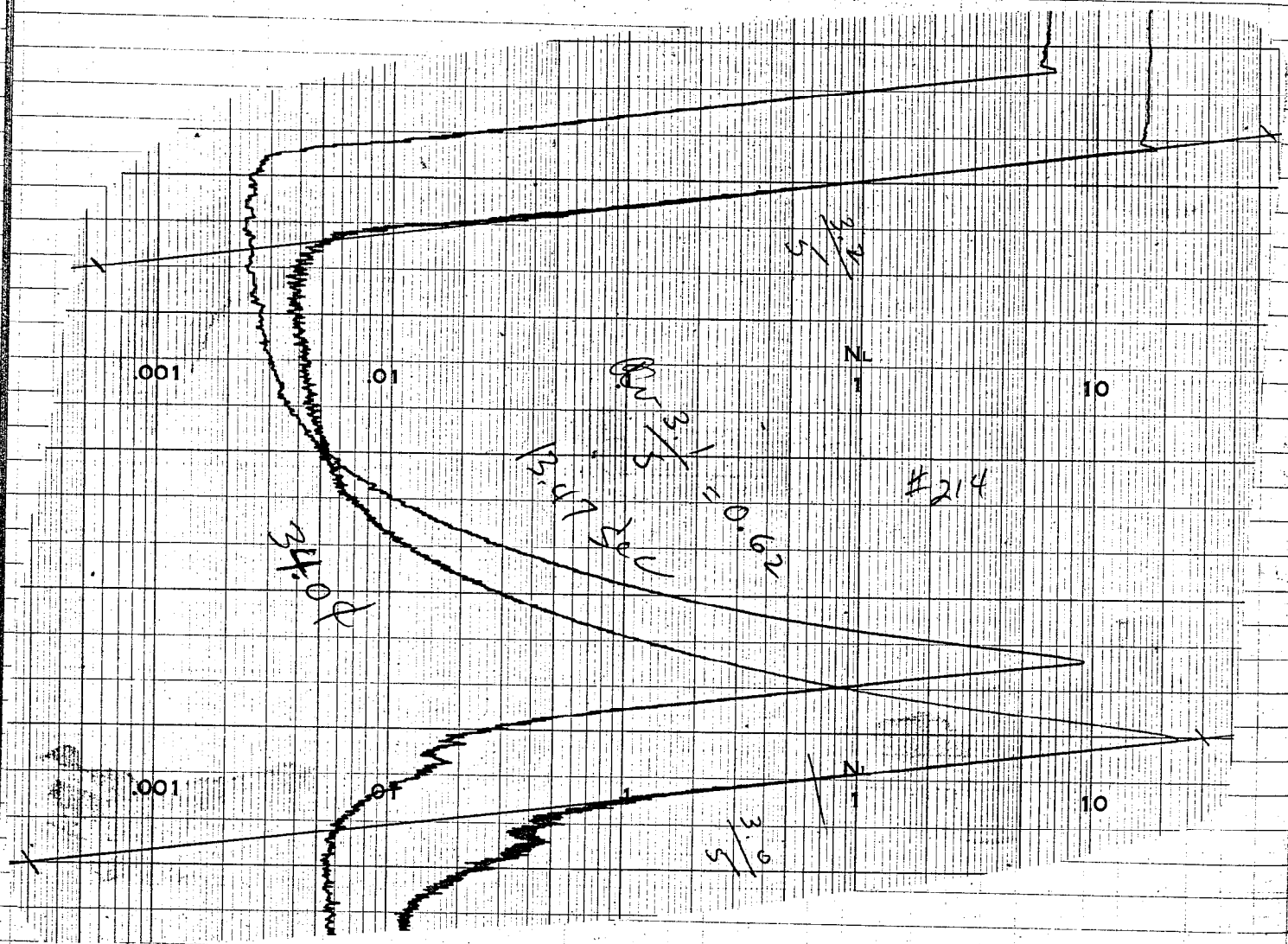
EXP #212

3⁵⁵ Start Assembly, Source Resp OK | Add 4 ea STS 2 ea 066 x 2½ x 9
2 ea 062 x 2¾ x 9
On Pos Period 0.109 | Add 10 ea 1.50 Boxes 2 ea 1⅝ } See Blue on Sketch above
4¹⁵ Start to level | Add 2 shelves of Al .032
Level 0.148

4.9¢/.037 = 132 ¢/in

.225 1.0455
.049
.000328 0.00641

Bottom of pg
211



1.070
.34
.00611

.00233

Instrument Check on 21 Mar 72 Source 10 mc ^{60}Co

PM-1	Bal	Low Trip	Scram Tables OK	Trip	OK
IC-1	[illegible]	Meter Trip	OK	Fast Trip	OK
IC-2	[illegible]	Meter Trip	OK		
IC-3	1.6×10^{-9}	Calibration	[illegible]	A	OK
IC-4	2.0×10^{-9}	Calibration	[illegible]	B	OK
		Source Inserted Manually		C	OK

Reflected

Resp. OK

EXP #213

Purpose To Assemble 3.75 in hi critical single unit
7.56 in wide
Variable length estimated to be 18.75 in or greater.
4 cubes on North + 4 cubes on South, aligned cubes on Tables @ 0.108.
15.0 in long Subcritical Assembly

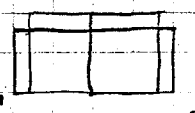
10^{45} Start Assembly — Red Lite On OK
10^{55+} Tables Closed Ind = 0.108 — Δp = 0.14 in H_2O OK
Sub critical — IC-3 = 1.1×10^{-11} — Bypass Panel OK
Shutt Down — IC-4 = 5×10^{-12}

EXP #214 — Add 2 cubes on North Half.
Purpose — Measure Criticality for 10 cubes 2×5×1

11^{03} Start Assembly
$11^{11\frac{1}{2}}$ On Positive Period Ind = 0.110
11^{13} Separate Screw Only
Repeat Period
$11^{22\frac{1}{2}}$ On Pos Period Ind = 0.110
24 Start to Level
35 Level 0.193 > $\frac{34.0¢}{.083}$ = 410 ¢/inch

EXP #215
Remove 2 cubes on North
Add 2 cubes 3¼ × 3¼ × 3¼
Add 4 ea ½ × 3¼ × 3¼

End View Looking South



Close reflected

	North	South
N-S	3.25 + 3.75 + 3.75	3.75 + 3.75
E-W	3.75 + 3.75	3.75 + 3.75
Vert	3.75	3.75

2 ea ½ × ½ × 3¼ corners missing

1^{10} Start Assembly, Source Resp OK
1^{19} Near Crit Insert Source to Raise Power
1^{22} Remove Source on Positive Period Ind 0.109
1^{33} Start to Level 326 sec + 3.52 ¢
1^{43} Approx Level 0.112
Table seems to be moving erratically for small changes

Reflec

Calibration

Source Inserted Manually

Resp. OK

C OK

EXP #213

Purpose To Assemble 3.75 in hi critical single unit
7.50 in wide
Variable length estimated to be 18.75 in or greater.
4 cubes on North + 4 cubes on South, aligned cubes on Tables @ 0.108.
15.0 in long Subcritical Assembly

10^{45} Start Assembly — Red Lite OK
10^{55+} Tables Closed Ind = 0.108 — $\Delta\rho$ = 0.14 in Hrd OK
Sub critical — IC-3 = $1.1 \cdot 10^{-11}$ — Bypass Panel OK
Shut Down — IC-4 = 5×10^{-12}

EXP #214 — Add 2 cubes on North Half.

Purpose — Measure Criticality for 10 cubes 2×5×1

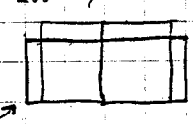
11^{03} Start Assembly
$11^{11\frac{1}{2}}$ On Positive Period Ind = 0.110
11^{13} Separate Screw Only
Repeat Period
$11^{22\frac{1}{2}}$ On Pos Period Ind = 0.110
24 Start to Level
35 Level 0.193

$\frac{34.0¢}{.083}$ = 410¢/inch

EXP #215

Remove 2 cubes on North
Add 2 cubes 3¼ × 3¼ × 3¼
Add 4 ea ½ × 3¼ × 3¼

End View
Looking South



Close reflected

		North	South
	N-S	3.25 + 3.75 + 3.75	3.75 + 3.75
2 ea ½ × ½ × 3¼ corners missing	E-W	3.75 + 3.75	3.75 + 3.75
	Vert	3.75	3.75

1^{10} Start Assembly, Source Resp OK
1^{19} Near Crit Insert Source to Raise Power
1^{22} Remove Source on Positive Period Ind 0.109
1^{33} Start to Level 326 sec + 3.52¢
1^{43} Approx Level 0.112
Table seems to be moving erratically for small changes

Bottom of
PB 213

Start Planar Arrays
Units sitting on
Bottom Reflector

EXP # 216

3 x 3 x 1 — no spacing (Should be supercrit.)

2^{07} Start Assembly Source Resp OK 35.3 sec Red Lite OK

2^{16} On Positive Period Ind = 0.618 20.04 ¢ Bypass OK

17+ Start to head Ind = 0.657 - 0.108 .039 = 514 ¢/in Δp = 0.14 "H2O OK

Level ↗ gap = 0.549 inches

Shut Down

EXP # 217

Cell size 4" x 4" x 4"

Array 3 x 3 x 1, units not centered in cell but

North 3 x 1 x 1 sitting on Plexiglas bottom Reflector

South 3 x 2 x 1

EW NS Vert

3^{57} Start assembly

3^{17} Ind = 0.110 Subcritical IC-2 = .09 x 3 x 10^{-10}

Very little multiplication IC-3 = 3.8 x 10^{-11} All on top of reflector

Shut Down IC-4 = 4.8 x 10^{-11}

EXP # 218 Cell size 3 7/8 x 3 7/8 x 4

Array 3 x 3 x 1

3^{43} Start assembly Source Response OK IC-3 = 6.5 x 10^{-11}

3^{51} Tables @ 0.110 Sub critical 4 = 1.2 x 10^{-10}

Shut Down

Change to Cell size 3 7/8 x 3 7/8 x 3 7/8

Instrument Check on 22 Mar 72 Source 10 mc ^{60}Co

950V PM-1 Bal 4.40 Low Trip OK Trip Scrammed Table

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK Monitor

IC-3 6×10^{-10} Calibration DWM A OK

IC-4 1.6×10^{-9} Calibration DWM B OK

C OK

EXP #219

Purpose: check criticality of $3\frac{7}{8}'' \times 3\frac{7}{8} \times 3\frac{7}{8}$ Cell size

8^{55} Start Assembly Source Resp. OK $3 \times 3 \times 1$ Array.

$\Delta p = 0.14'' H_2O$ OK

9^{10} Subcritical Bypass Panel OK IC-3 - 6.5×10^{-11}

Ind = 0.110 Red Lite OK -4 = 2.0×10^{-10}

EXP #220 Change to $3\frac{13}{16} \times 3\frac{13}{16} \times 3\frac{13}{16}$ Cell size

10^{06} Start Assembly Source OK $11\frac{7}{16} \times 11\frac{7}{16} \times 3\frac{13}{16}$ Array prob closer to $3\frac{7}{8}''$

$10^{14\frac{1}{2}}$ On Positive Period Δp OK (Not a precision alignment because of the many plastic pieces)

Ind = 0.190 Bypass OK

Start % level Red Lite OK

10^{25} Level 0.250

21.2 sec 27.0¢/.060 = 450 ¢/in

1.064
.212
.0041
.001446
.560

.250

.0241/in. x .140

ρ = .00337

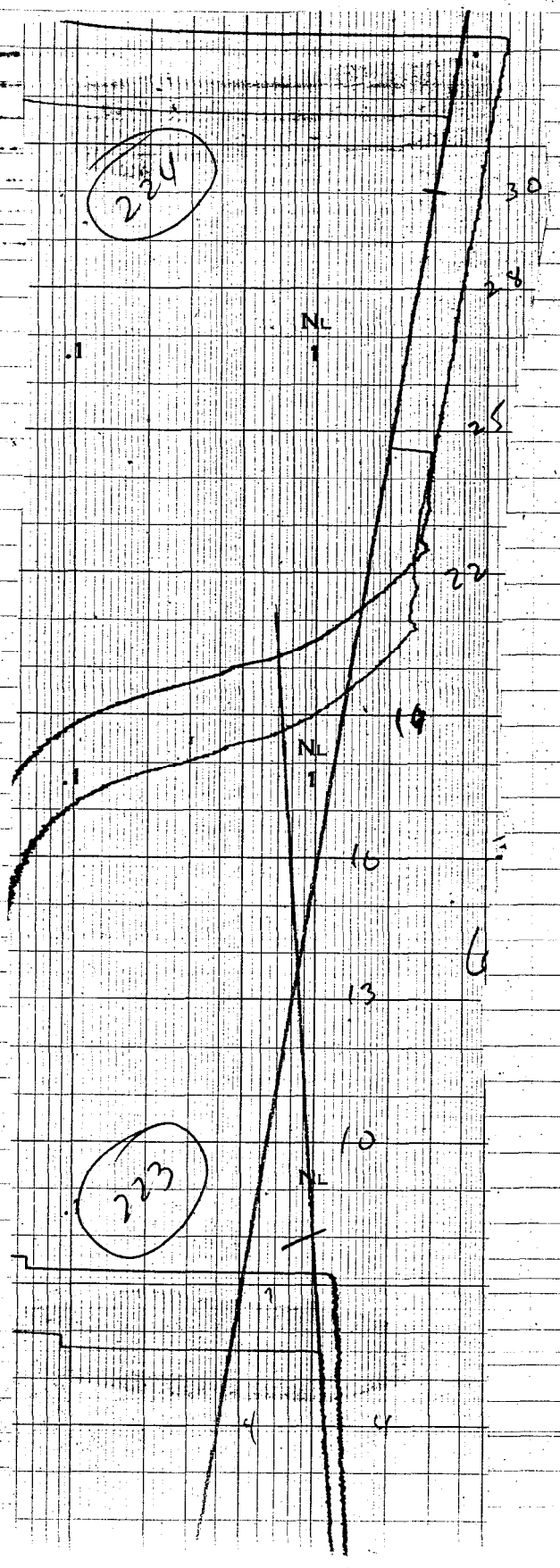
Critical size between $3\frac{13}{16}$ and $3\frac{7}{8}$

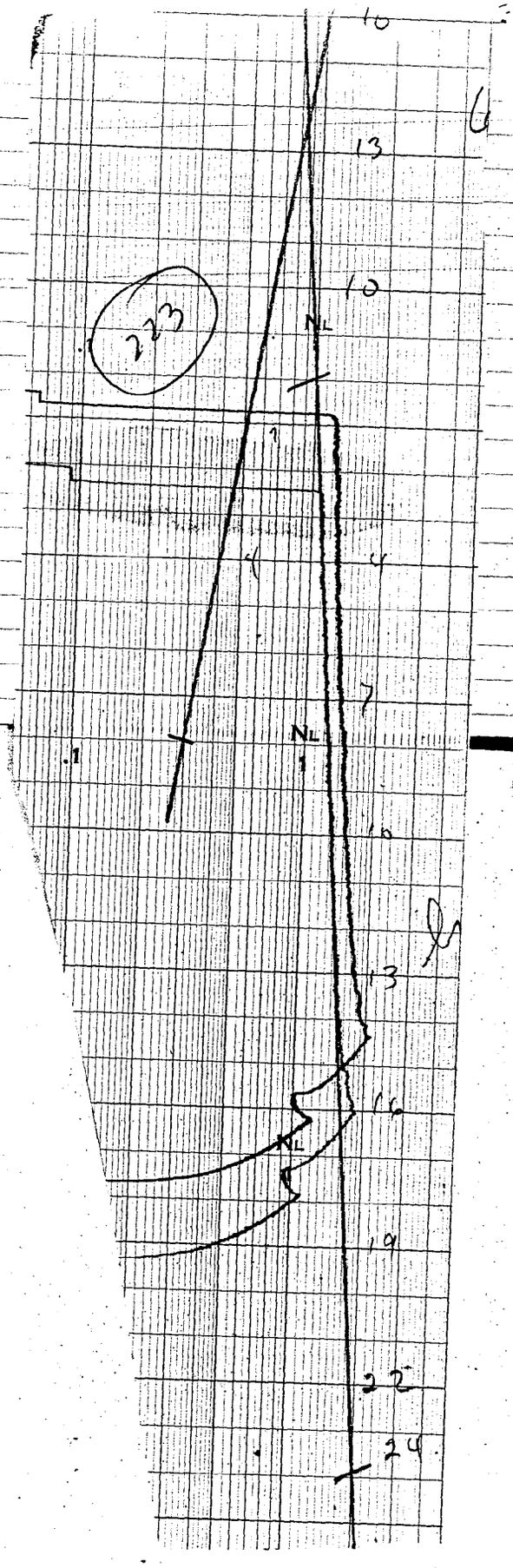
3.8125 = 4.8419 cm
4.7625
.0794
4.8419
.49213

$3\frac{27}{32}$ 3.84375 $\bar{\rho}$ = 17.43

$3\frac{24}{32}$

3


224
30
28
NL
.1
1
25
22
19
NL
.1
1
16
6
13
10
223
NL
1
4
4



Start
IC
L

3^{20} Start
3^{30+} On Pos
Near (
Rais P
I
3^{35} Remo
Ne
Sl

3^{52} Start Ass
4^{01} Tables (
40^{3+} Rem

4 x 4 x 1 Planar Array
Units on Bottom Reflector
Nominal size 4 1/4 x 4 1/4 x 4 1/4
Use 1/8 and 1/4 plastic spacers 17 x 17 x 4 1/4
17 1/16 x 17 1/16 x 4 1/4 + Meas

EXP # 221

1 19 Start Assembly — Red Lite OK
28 On Positive Period 0.404 — Source OK
Start to Level — IC-3 = 4 x 10^-9 — Bypass OK
37+ Level 0.468 — IC 4 = 7 x 10^-9 — Δp = .14 "H2O OK
Shut Down
36.4 sec → 19.66 ¢ /.064 — Table Sep ~ 468
110
= 307 ¢/in — 6) 358 ≈ .060

EXP # 222
4 x 4 x 1 Planar Array
Nominal size = 4 3/16 x 4 3/16 x 4 3/16
(Will be more supercritical)
16 12/16 x 16 12/16 x 4 3/16

2 31 Start Assembly — Source Resp OK
38 1/2 On Pos Period — Bypass "
Ind = 0.7745 — Red Lite "
Start to Level — Δp = 0.14 "H2O "
IC-3 = 5 x 10^-9 — 25.0 sec
4 = 7 x 10^-9 — 24.62 ¢
Level Ind = 0.8405 — .066 = 373 ¢/in

EXP # 223 — 4 x 4 x 1
3 20 Start Assembly — Source Resp OK — 4 5/16" Unit Cell
3 30+ On Pos Period ? or Neg. — Red Lite " — Meas 17 1/4 x 17 1/4 x 4 5/16
Near Crit — Δp = 0.14 " — ρ = 12.342
Raise Power with Source — Bypass " — −1730 sec
Ind = 0.115 — −0.77 ¢
3 35 Remove Source — IC-3 = 1.8 x 10^-9 — 4.3125
Neg Period — 4 = 2.0 x 10^-9
Inspect Plan of sepn.
Shut Down
Inspect gap — Repeat assembly — Top Reflectors probably interfering
Moved West of North ~ 1/16

EXP # 224
3 52 Start Assembly — Source Resp OK
4 01 Tables Closed — Power Rising to ~2.6 x 10^-9 IC-3 — Ind = 0.112
40 3+ Remove Source — On Pos Period 652 sec.
1.043
.0185
.0041
1 85 ¢

Start to Level

37+ Level 0.468 {IC-3 = 4×10^{-9} / EC 4 = 7×10^{-9} Bypass OK $\Delta p = .14$ "H_2O OK

Shut Down

36.4 sec → 19.66 ¢ /.064 Table Sep ~ 468

110

= 307 ¢/in 6) 358 ≈ .060

EXP # 222

4 x 4 x 1 Planar Array

Nominal size = 4 3/16 x 4 3/16 x 4 3/16

(Will be more supercritical)

16 12/16 x 16 12/16 x 4 3/16

2^{31} Start Assembly Source Resp. OK

$38^{1/2}$ On Pos Period Bypass "

Ind = 0.7745 Red Pile "

Start to Level $\Delta p = 0.14$ "H_2O "

IC-3 = 5×10^{-9} 25.0 sec

4 = 7×10^{-9} 24.62 ¢

Level Ind = 0.8405 .066 = 373 ¢/in

EXP # 223 4x4x1

3^{20} Start Assembly Source Resp OK 4 5/16" Unit Cell

3^{30+} On Pos Period ? or Neg. Red Pile " Meas 17 1/4 x 17 1/4 x 4 5/16

Near Crit $\Delta p = 0.14$ " $\bar{\rho} = 12.347$

Raise Power with Source Bypass " −1730 sec

Ind = 0.115 −0.77 ¢

3^{35} Remove Source IC-3 = 1.8×10^{-9} 4.3125

Neg Period 4 = 2.0×10^{-9}

Inspect Plan of sepn.

Shut Down

Inspect gap — Repeat assembly Top Reflectors probably interfering

Moved West of North ~ 1/16

EXP # 224

3^{52} Start Assembly Source Resp OK

4^{01} Tables Closed Power Rising to ~2.6×10^{-9} IC-3 Ind = 0.112

40^{3+} Remove Source On Pos Period 652 sec

1.85 ¢

1.043
.0185
.00641
.00012

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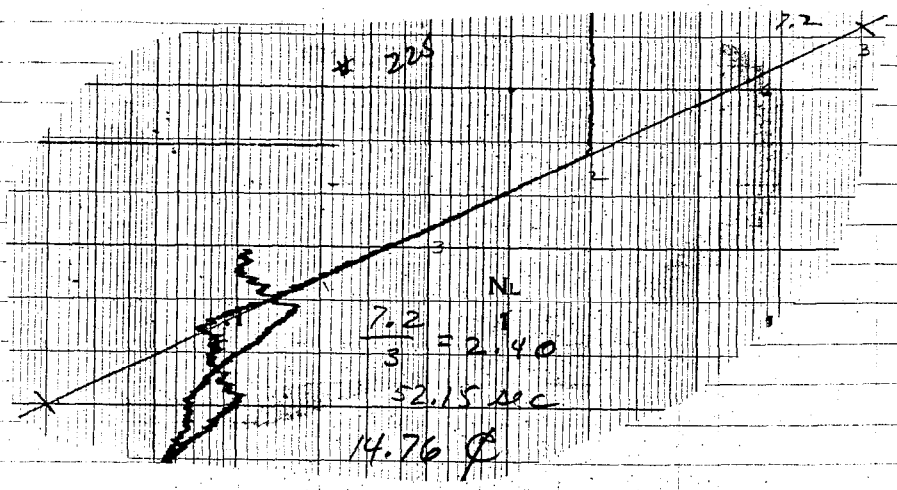
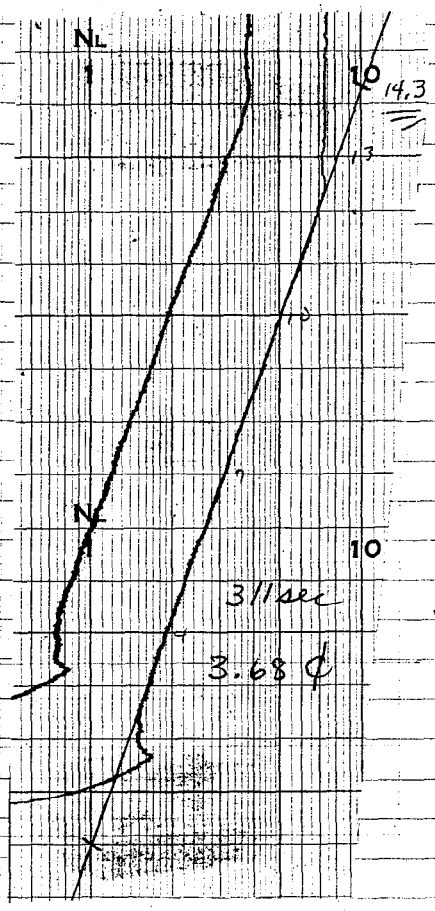




1.0445
-.0368
.00641
.00025

EXP # 225

5x5x1 Planar Array 3x5 South Table

Spacing 7/8" 2x5 North Table.

Unit size = 4 5/8

Instrument Check on Mar 27 72 Source 10 mc ^{60}Co

950 ✓ PM-2 Bal 4.40 Low Trip OK Trip OK

IC-1 3×10^{-10} Water Trip Scrammed Table Fast Trip OK

IC-2 3×10^{-10} OK Monitor

IC-3 6.5×10^{-10} Calibration A OK

IC-4 1.9 B OK

C OK

Source Inserted Manually Red Lite OK, Bypass $\Delta p = 0.14"$

933 Start Assembly

942 On Pos Period 0.256

944+ Start to Level 52.15 sec

952 Level 0.345 > 14.76 ¢

111 / .235 .089 = 166 ¢/inch

5x5x1 Increase size 1/16 on Fixed or South Table

Planar Array Spacing = 15/16 between units 15/32 on side

Units on Reflector

EXP # 226

938 Start Assembly Source Inserted Manually — Bypass Red Lite Δp OK

1047½ Subcritical Ind = 0.111

5x5x1 Spacing 7/8 + 2ea .015

Planar Array 4 11/32 Units Nom 29/32

Edge 7/16 + .05

EXP # 225 + 2ea 0.015

EXP # 227

1 14 Start Assembly Red Light

1 22 Subcritical 0.112 Source Inserted Manually

Insert Source Resp OK

Neg Period = ~ −109¢ Bypass OK

IC-3 not high ~ −22 ¢ $\Delta p = 0.14$

4 enough above source to measure good period

North

5x5x1 EXP # 228

Planar Array Spacing 7/8 + 1ea 0.015 = 57/64

Nom Size 4 41/64 → 4.640625

South

221 Start Assembly Source

31 Near Critical 0.112 Red Lite

Insert Source to Raise Power Bypass OK

32 On Pos Period IC-3 → 1.6×10^{-9} Δp

~40 Start to Level 4 8.3×10^{-10} > 3.68¢ / .015 = .0245 ¢/in → $\bar{\rho}$ = 9.9044

46 " " 0.127 Indicator sticking!

1 2 3 4

1 2 3 4

IC-1 3×10^{-10} Water Trip Scrammed Table Fast Trip OK
IC-2 3×10^{-10} OK Monitor
IC-3 6.5×10^{-10} Calibration A OK
IC-4 1.9 B OK
C OK

Source Inserted Manually Red Lite OK, Bypass $\Delta p = 0.14''$.

933 Start Assembly
942 On Pos. Period 0.256
944+ Start to Level 52.15 sec
952 Level 0.345 > 14.76 ¢
111
.235 .089 = 1.66 ¢/inch

5X5X1 Increase size 1/16 on Fixed or South Table
Planar Array Spacing = 15/16 between units 15/32 on side
Units on Reflector

EXP # 226

936 Start Assembly Source Inserted Manually — Bypass Red Lite Δp OK
1047½ Subcritical Ind = 0.111

5X5X1 Spacing 7/8 + 2ea .015
Planar Array 4 11/32 Units Nom 29/32
Edge 3/16 + .05
EXP # 225 + 2ea 0.015

EXP # 227

114 Start Assembly Red Light
122 Subcritical 0.112 Source Inserted Manually
Insert Source Resp OK
Neg Period = ~ −109¢ Bypass OK
IC-3 not high ~ −22 ¢ $\Delta p = 0.14$
4 enough above source to measure good period

North
South

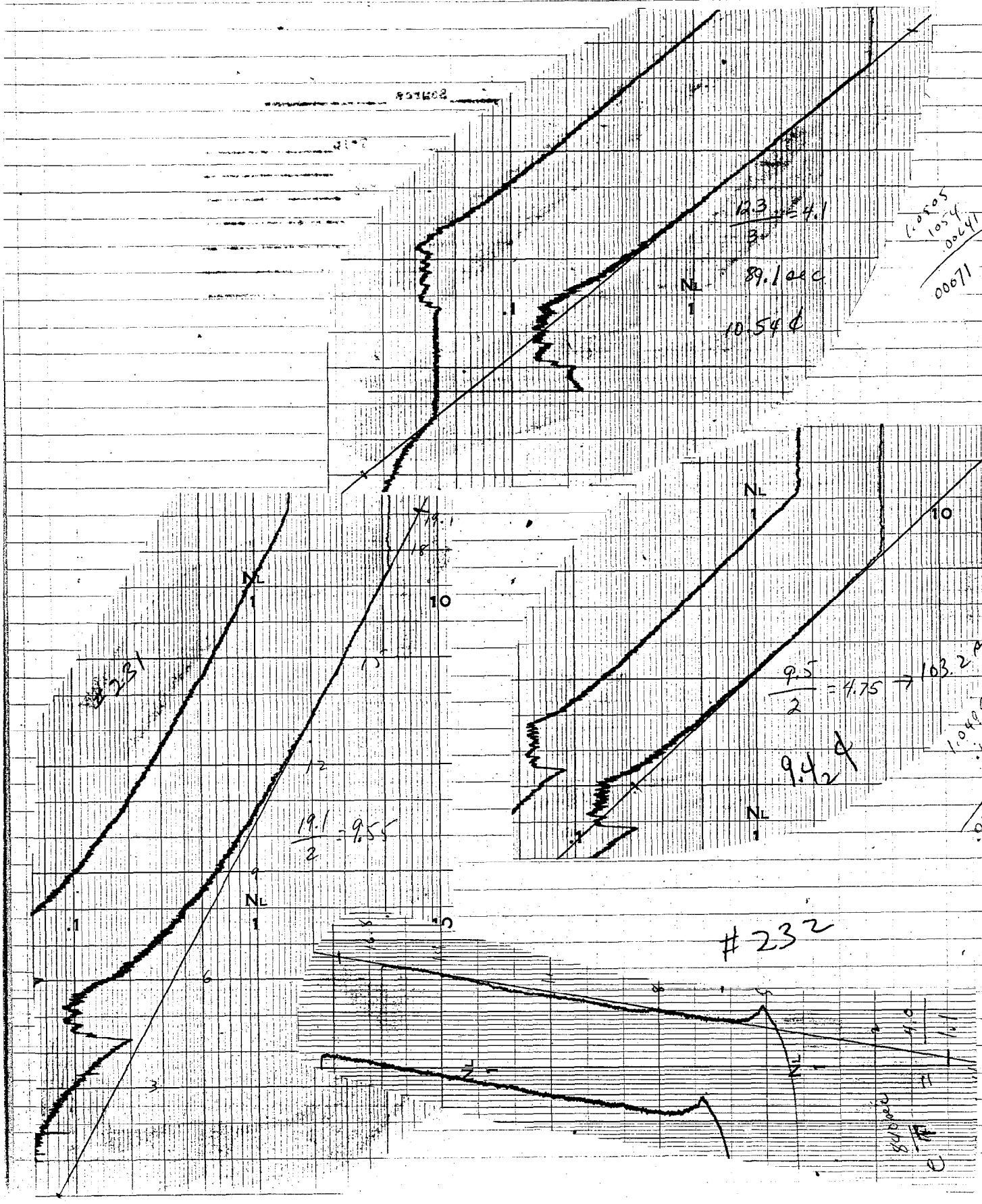
5X5X1 EXP # 228
Planar Array Spacing 7/8 + 1ea 0.015 = 57/64
Nom Size 4 41/64 → 4.640625

221 Start Assembly Source
31 Near Critical 0.112 Red Lite
Insert Source to Raise Power Bypass
32 On Pos Period IC-3 → 1.6×10^{-9} Δp
~40 Start to Level 4 8.3×10^{-10}
46 Level 0.127 > 3.68¢ / .015 = .0245 ¢/in Indicator sticking!

OK

$\bar{\rho} = 9.9044$

Bottom of pg 221
SJP



12.3/3 = 4.1
89.1 sec
10.54 ¢
1.0505
.1054
.00641
.00071
NL
1
.1
10
19.1/2 = 9.55
9.5/2 = 4.75 → 103.2 sec
9.42 ¢
1.0495
.0942
.00641
.00063
#232

EXP #229

6X6x1 Planar Array Spacing 1 1/8"
Units on Reflector
Unit Cell = 4 7/8" Cube

3 54+ Start Assembly
4 05 On Positive Period 0.114
4 10 Start to Level
4 20 Level 0.194
Shut Down

10.54 ¢ / .080 = 132 ¢/in

Red Lite
Δρ
Source
Bypass
OK

ρ = 8.543

EXP #230

Instrument Check on 28 Mar 72 **Source** 10 mc ^{60}Co

PM-1 Bal 4.40 Low Trip OK Trip OK

IC-1 3×10^{-10} Meter Trip OK Fault Trip Scrammed Tables
IC-2 3×10^{-10} Meter Trip OK MONITRON
IC-3 1.6×10^{-9} Calibration Dwn A OK
IC-4 1.8×10^{-9} Calibration Dwn B OK
C OK

7X7x1 Array
1 1/4" Spacing
Overall Meas
35 1/8" wide
South Trp
Reflector 4 15/16" instead of 5"

Source Inserted Manually ✓ Red Lite ✓ Bypass ✓ Δρ = 0.14

10 22 Start Assembly
10 30 On Pos Period Δρ = 0.746
Start to level
Level Δρ = 0.8015

7 X 7 X 1 Planar Array
with South Trp Reflect @ 5 1/16"

(Raise Reflector on South 1/8" with Plex. Spacers.

EXP #231

10 50 Start Assembly
10 58 On Pos Period Δρ = 0.6745
~11 07 Start to Level
Level Δρ = 0.7005

.026

Source OK
Bypass OK
Δρ OK
Red Lite OK

0.099/per 1/8"

7x7x1 Planar Array
5 1/16" nom size E-W Measures 35 11/16" or 8 spaces
5.080357

EXP #232

3 58 Start Assembly
4 06 Near Critical Δρ = 0.116
Insert source to Raise Power.
1 08 Remove Source On Pos Period
4 16 Shut Down

1.0435
.0150

651 sec
1.86 ¢

Source OK
Red Lite Thrs. Ck OK
Bypass OK
Δρ = 0.14 OK

ρ̄ = 7.510

4" Level 0.194 .080 Bypass
Shut Down = 132 ¢/in $\bar{\rho} = 8.543$

EXP # 230

Instrument Check on 28 Mar 72 **Source** 10 mc ^{60}Co

PM-1	Bal 4.40	Low Trip	OK	Trip	OK
IC-1	3×10^{-10}	Meter Trip	OK	Past Trip	Scrammed Tables
IC-2	3×10^{-10}	Meter Trip	OK		MONITRON
IC-3	1.6×10^{-9}	Calibration	DWM		A OK
IC-4	1.8×10^{-9}	Calibration	DWM		B OK
					C OK

7X7X1 Array
1 1/4" Spacing
Overall Meas
35 1/8" wide
South top
Reflector 4 15/16" instead of 5"

Source Inserted Manually ✓ Red Lite ✓ Bypass ✓ $\Delta p = 0.14$

10^{22} Start Assembly
10^{30} On Pos Period Ind = 0.746
Start to level
Level Ind = 0.8015

7X7X1 Planar Array
with South top Reflector @ 5 1/16"

(Raise Reflector on South 1/8" with Plex. Spacers.

EXP # 231

10^{50} Start Assembly
10^{58} On Pos Period Ind = 0.6745
~11^{07} Start to Level
Level Ind = 0.7005
.026

Source OK
Bypass OK
Δp OK
Red Lite OK

0.099/ per 1/8"

7X7X1 Planar Array
5 1/16" nom size E-W Measures 35 11/16" or 1/8 oversize
5.080357

EXP # 232

3^{58} Start Assembly
4^{06} Near Critical Ind = 0.116
Insert source to Raise Power.
4^{08} Remove Source On Pos Period
4^{16} Shut Down.

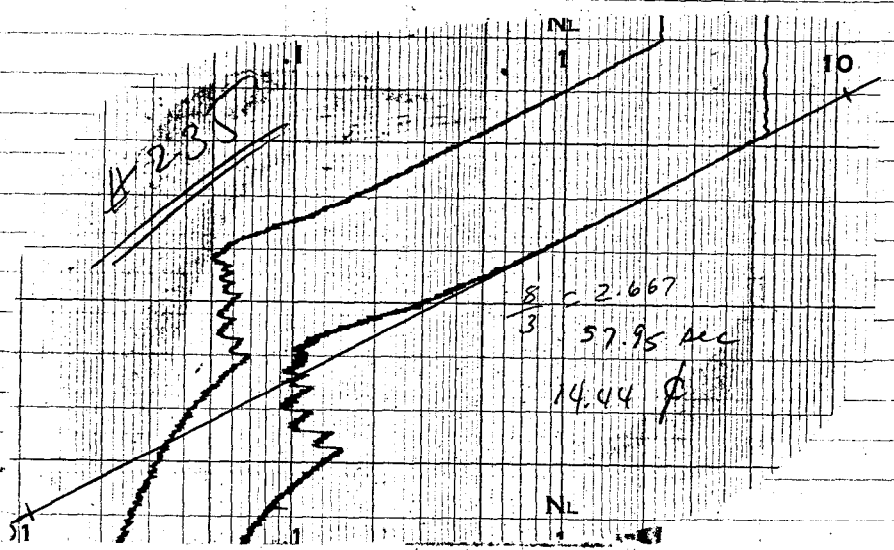
1.0435
.0186
.00641
.00012

651 sec
1.86¢

Source OK
Red Lite + Pers. Ck OK
Bypass OK
$\Delta p = 0.14$ OK

$\bar{\rho} = 7.548_8$ for 5.080

Bottom of 223 gp



1150
1157
1101
1107

Instrument Check on Mar 29, 72 Source 10 mc ^{60}Co

PM-1 _____ Low Trip OK Trip OK

IC-1 _____ Meter Trip OK Fast Trip OK

IC-2 _____ Meter Trip [illegible]

IC-3 2×10^{-9} Calibration [illegible]

IC-4 1.1×10^{-9} Calibration [illegible]

8 x 8 x 1 Planar Array with Top Reflector at 8.0 inches
1 5/16 inch spacing — same as 7x7x1 array

EXP #233

9 20	Start Assembly		Source Resp	OK
			Red Lite	OK
9 30	Tables Closed Ind 0.112		Bypass	OK
	Sub Critical	IC-2 $0.14 \times 3 \times 10^{-10}$	$\Delta\rho = 0.14$	OK
		3 1.2×10^{-10}	→ On Side of Assembly.	
		4 5×10^{-11}		

EXP # 234

8 x 8 x 1 Planar Array
1 5/16 inch spacing EW & NS
Top Reflector at ~ 6 29/32 inches

9 58	Start Assembly		Source Resp	OK
10 08	Subcritical Source Inserted	0.112	Bypass	OK
	IC-2	$0.35 \times 3 \times 10^{-10}$	Red Lite	OK
	-3	3.6×10^{-10}	$\Delta\rho = 0.14''$.	OK
	-4	1.3×10^{-10}		

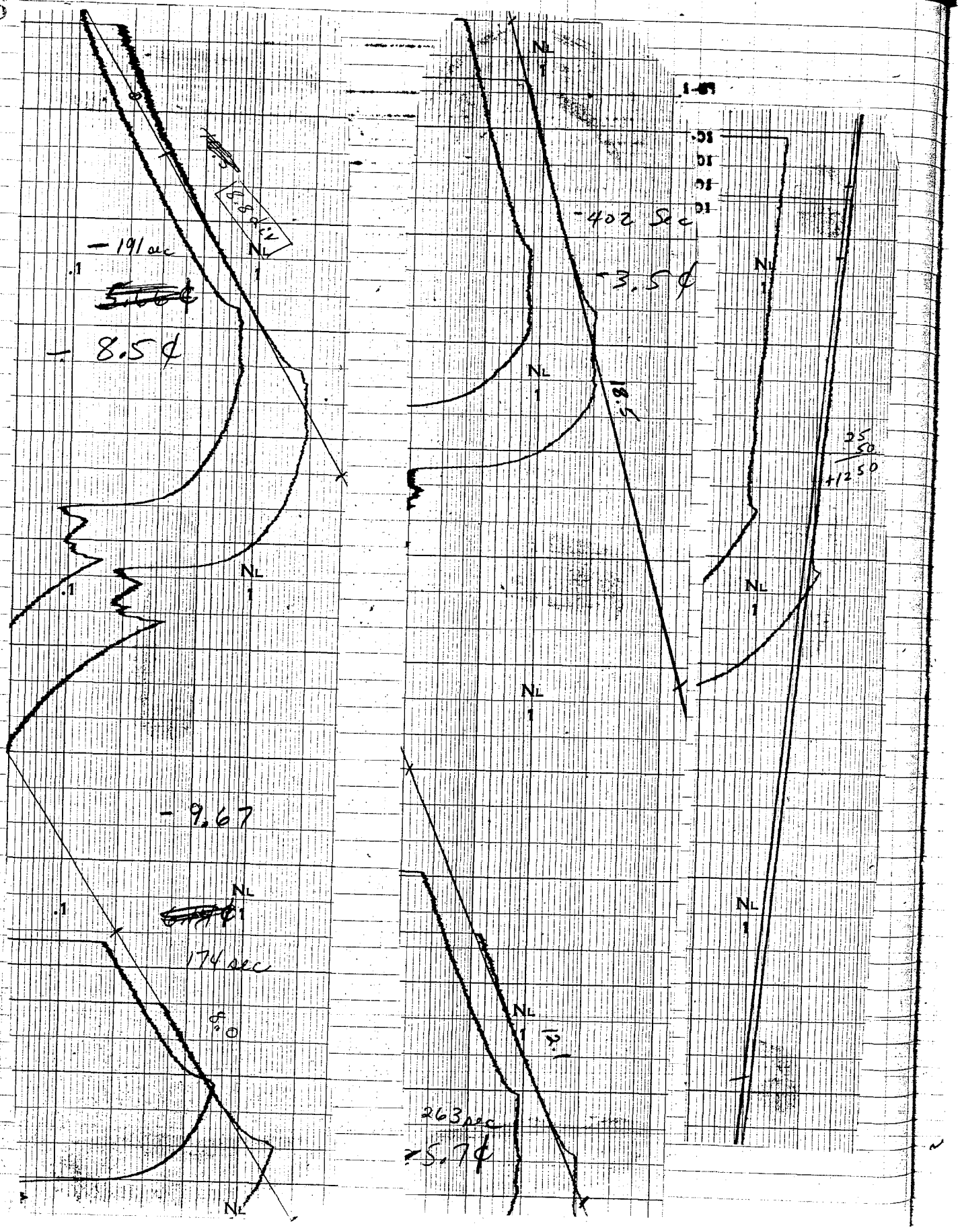
Remove Source — Prompt Jump Ratio ~ 3
Highly Sub Critical

EXP #235

8 x 8 x 1 Planar Array 1 5/16" spacing + 3.75 = 5.06 (5.08)
Top Reflector at 5 15/16 inch

11 50	Start Assembly		Source	OK
11 57	On Pos Period	0.410	Bypass	
11 01	Start To Level		Red Lite	
11 07	Level	0.528	$\Delta\rho$	
	Shut Down			

$\frac{14.44}{0.118} = \frac{122\,¢}{\text{Inch}}$



-191 sec
-8.5¢
8.8 div
NL
1
.1
-9.67
174 sec
8.0
-402 Sec
-3.5¢
18.5
12.1
263 sec
-5.7¢
25
50
+1250

EXP #236

Set Top Reflectors at ~~6 3/16~~" 6 1/4" width measured 40 5/8

12 57 Start Assembly 0.115 Unit size Red Lite OK

1 06 Near Critical Ind = ~~0.116~~ 5.08 x 5.08 x 6 1/4" Bypass OK

Insert Source to Inc. Power ΔP OK

1 08+ Subcritical Source Withdrawn −174 sec Source OK

Neg Period − −9.7 ¢

Found measured height to be greater than 6 1/4" on one half of the North Half.

Placed Lead Bricks strategically to ~~get~~ make the average height 6.25 inches on both halves

EXP #237 Source Inserted Manually

1 19 Start Assembly Bypass

1 27+ Near Crit Ind = 0.116 Red Lite } OK

Insert Source Raise Power IC-3 − 2 x 10^-9 ΔP = 0.14

1 32 Remove Source On Neg Period −191 sec −8.5 ¢

EXP #238 Moved Lead Bricks to depress center ~ 1/16"

1 50 Start Assembly

1 50 Near Crit 0.115 −263 sec

Remove Source Negative Period −5.7 ¢

EXP #239

Changed Top Reflector North half − Measure 6 3/16

2 24 Start Assembly South half = 6 1/4

2 32 Near Crit Ind = 0.115

Power Rise to 2 x 10^-9 Average 6 7/32 = 6.21875

Remove Source −402 sec Source

Neg Period −3.5 ¢ Red Lite } OK

Bypass

ΔP

−8.5 − (−3.5) = 5 ¢ per 1/16 in on ½.

Changed Top Reflector North half − Measures 6 1/8 } Vert

South " " 6 1/4

EXP #240

2 48 Start Assembly Source

57 Near Crit Ind = 0.115 Red Lite } OK

59 Remove Source Bypass

Pos Period ΔP

~3 07 Shut Down +1250 sec Period

.0098 ¢

1.042 Horiz. Cell size same as 7 x 7

.0098

5.0804

Found measured height to be greater than 6 1/4" on one half of the North Half

Placed lead Bricks strategically to make the average height 6.25 inches on both halves

EXP # 237 Source Inserted Manually

1 19 Start Assembly

1 27+ Near Crit Ind = 0.116 Bypass Red Lite } OK

Insert Source Raise Power IC-3 – 2×10^{-9} $\Delta\rho = 0.14$

1 32 Remove Source On Neg Period -141 sec -8.5 ¢

EXP # 238 Moved Lead Bricks to Approx center ~ 1/16"

Start Assembly

Near Crit 0.115 -263 sec

Remove Source Negative Period -5.7 ¢

EXP # 239

Changed Tap Reflector North half - Measure 6 3/16

2 24 Start assembly South half = 6 1/4

2 32 Near Crit Ind = 0.115 Average 6 7/32 = 6.21875

Power Rise to 2×10^{-9}

Remove Source -402 sec Source Red Lite Bypass $\Delta\rho$ } OK

Neg Period -3.5 ¢

-8.5 - (-3.5) = 5 ¢ per 1/16 inch ±

Changed Tap Reflector North half - Measure 6 1/8 } Vert
South " " 6 1/4

EXP # 240

2 48 Start Assembly

57 Near Crit Ind = 0.115 Source Red Lite Bypass $\Delta\rho$ } OK

59 Remove Source

Pos Period

~ 3 07 Short Down +1250 sec Period

00.98 ¢

1.042
.0098
.00041
.00007

Horiz. Cell size same as 7x7

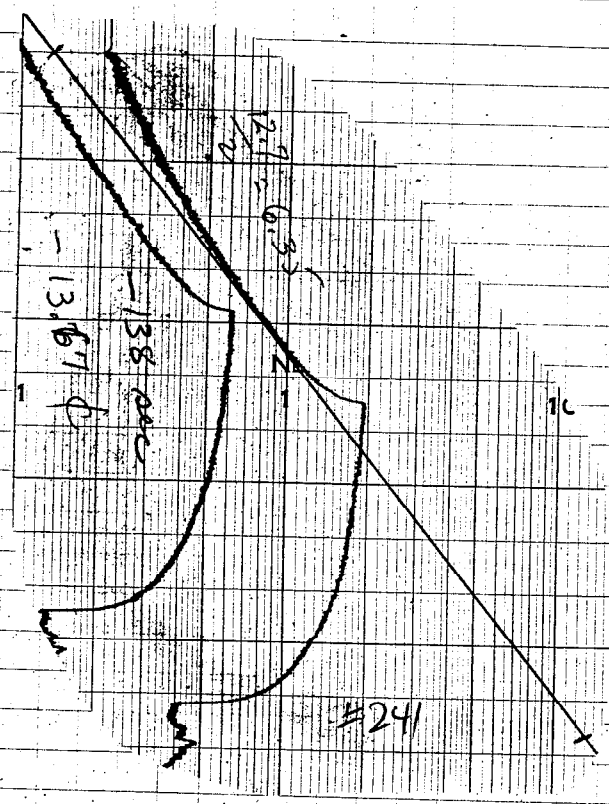
5.0804

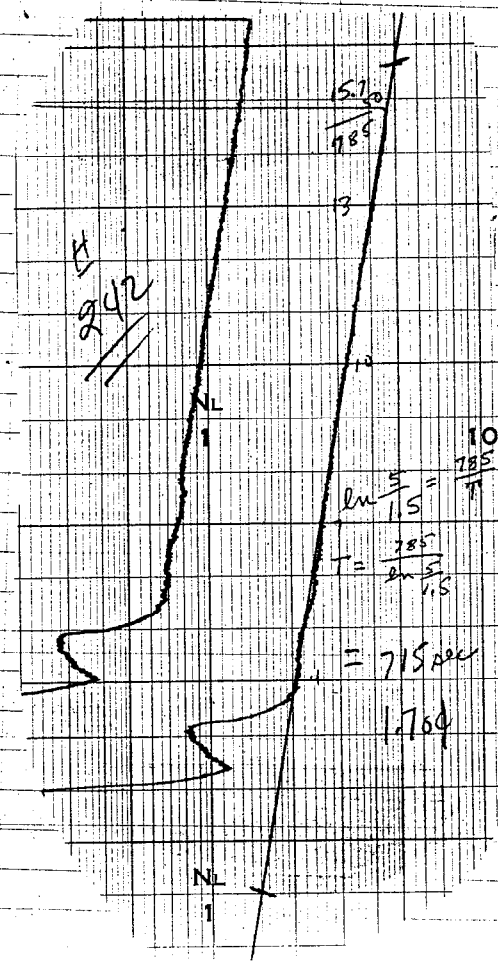
Bottom of PS 227

5.25
32

5 3/16 4 19/16
3.75 3/4 12/16
1 7/16 1.4375

0.5 + 7/32 0.71875





EXP #240

8×8×1 Planar Array Uniform spacing Vert & Horiz

$1\frac{1}{2}$" nom. gap $+3\frac{3}{4}$ = $5\frac{1}{4}$ in. cell

E-W Meas = $.42\frac{5}{32}$ in. | 42.15625" | 5.26953"

$\bar{\rho}$ = 6.7646

Instrument Check on 29 Mar 72 Source 10 mc ^{60}Co

750V PM-1 Bal 4.40 Low Trip Scramme Tables Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 3×10^{-10} Meter Trip OK MONITRON

IC-3 1.5×10^{-10} Calibration DWM A OK

IC-4 1.7×10^{-10} Calibration DWM B OK

Source Inserted Manually C OK

8^{35} Start Assembly Red Light + Pers OK

8^{46} Sub Critical Ind = 0.108 Bypass "

IC-2 = $.42\times3\times10^{-10}$ Δp=0.14 "

3 = 3.4×10^{-10}

4 = 1.5×10^{-10}

Remove Source. Bromp Jun 3.4/1.7 ≈ 2

EXP #241

8×8×1 Planar Non Uniform Spacing Vert Cell = 5.00 av.

Horizon 5.269_{53}"

9^{41} Start Assembly Source Resp. OK, Bypass OK, Δp=0.14, Red Lite on OK

9^{50} Subcritical Ind = ~~0.110~~ 0.113

Source Inserted fully to Raise Power IC-2 = $.16\times3\times10^{-9}$

9^{55} Start Neg Period −138 sec 3 = 2. $\times10^{-9}$ Still Rising

−13.7 ¢ 4 = 6. $\times10^{-10}$

EXP #242

Vert Cell size → 4.875 inches | Average Meas

10^{26} Start Assembly E-W − Same ($42\frac{5}{32}$)

10^{34} On Pos Period 0.115 5.269

44 Start to Level IC-3 = 6.5×10^{-9}

Level 0.187 4 = 2.2×10^{-9} +160 sec → 6.6¢

/.072

EXP #243

Vert Cell North $4\frac{15}{16}$ average

South $4\frac{7}{8}$ $4\frac{29}{32}$ 4.90625

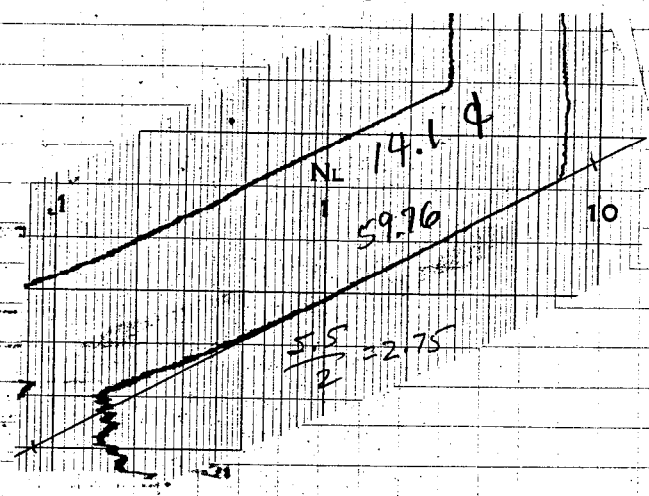
10^{59} Start Assembly

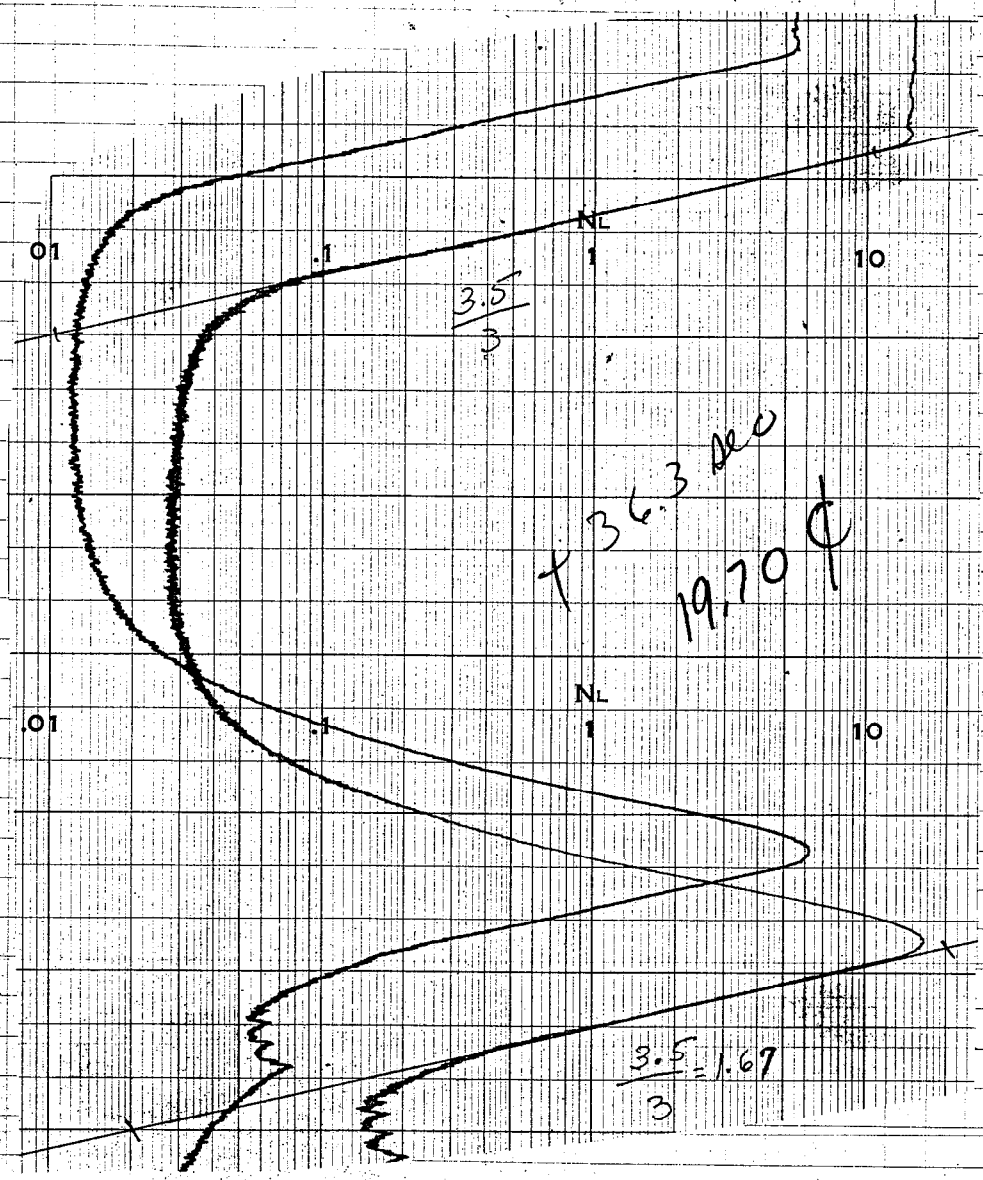
11^{08} Near Crit. 0.116

11^{13} Source Out on Slow Pos. Period IC-3 ~ 2.6×10^{-9}

11^{21} Shut Down

$\Delta\rho_{ex}$ 1.70¢


.1
NL
1
10
14.1 ¢
59.76
5.5/2 = 2.75


01
.1
NL
1
10
3.5/3
36.3 Deo
19.70 ¢
.01
.1
NL
1
10
3.5/3 = 1.67

EXP # 244

8 x 8 x 1 Planar Array Equilateral

Reflector Separation Average 5 3/16" Nom

E-W Meas 41 19/32 x8

40 24/16 = 41 1/2

Average 5.200 in

5 3/16 + 1/8 x 3/32

3/16 + 3/256 = 51/256

2^30 Start Assembly

40 On Pos Period 0.358

Start to Level

Level 0.477 > 14.1/0.119 = 118¢ inch

zero 0.11

gap = Δl = 0.367

Red Lite & Pers. Ck OK
Bypass OK
Δp = 0.14 OK
Source Resp OK

EXP # 245

Check Separation Dividers. N-S Dimension under size increased to 5 3/16" Nom. Same as E-W.

Check Criticality.

3 40 Start Assembly

3 46 On Pos Period A 0.116

Repeat Period

~ 50 Start Screw Back and forth 0.116

4 00 On Pos. Period B

~ 4 03 Start to Level

4 09 Level 0.362

19.70¢ / .246 = 80.1 ¢ inch

1.0585
.197
.00641
.00134

---

15 mils in one direction

Changed React ~ 14 ¢

then to Change React 19.7 ¢

10 mil in 2 direction would be required

Critical Dimensions 5.210^3

$\bar{\rho}$ = 6.999

Instrument Check on April 3 Source 10 mc ^{60}Co

750V PM-1 Bal. 4.40 Low Trip OK Trip Scrammed Tables

IC-1 3×10^{-10} Meter Trip OK Past Trip OK

IC-2 Out for Repair Meter Trip X

IC-3 ~ 2×10^{-9} Calibration Down

IC-4 ~ 2×10^{-9} Calibration Down

IC-1 output on Wheelco Recorder (Temp)

MONITRON
A OK
B OK
C OK

EXP #246

8×8×1 Planar - Units on Bottom Refl.
1⅛" Spacing, Reflector Span = 9.75 in.

Source Inserted Man
Red Lit ✓
Δρ = 0.14 ✓
Bypass ✓

9.58 Start Assembly
10.06 Subcritical IC-3 = 1.4×10^{-10}
Ind 0.107 -4 = 6.5×10^{-11}
Remove Source Prompt Jump Ratio ≈ 1.4/.45 ~ 3
Shut Down

New Battery - Wheelco

EXP #247

8×8×1 Planar 1⅛" Spacing
Top Reflector lowered to 9.0 inches

10.38 Start Ass.
10.48 Subcritical Ind 0.115

Source Ins. ✓
Red Lit ✓
Bypass ✓
Δρ = 0.14 ✓

IC-3 = 2.4×10^{-10}
4 = 1.2×10^{-10}
1 = $0.11\times10\times10^{-11}$

Remove Source Prompt Jump Ratio 2.4/0.8 ~ 3
~10.50+ Separate Tables

EXP #248

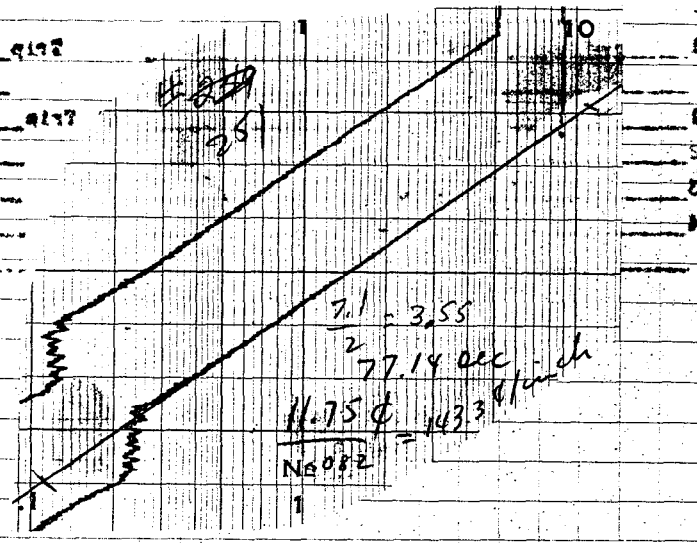
8×8×1 Planar 1⅛ Spacing
North Refl. - 9 in.
South Refl. - 8 in.

10.58 Start Assembly
11.08 Subcritical
10½ Remove Source Prompt Jump Ratio 5.2/3 = ~~1.4~~ 1.7
Shut Down

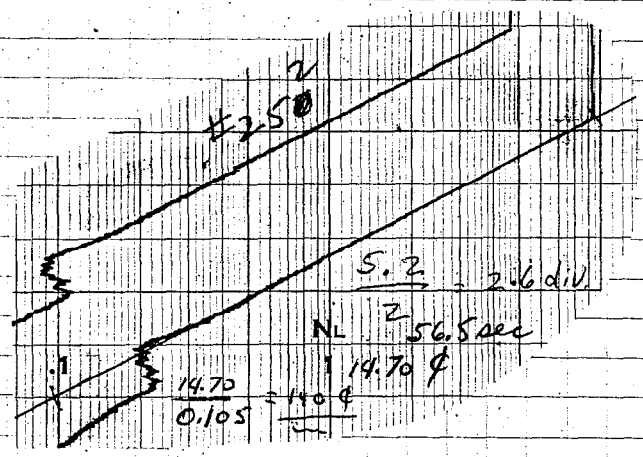
EXP #249

8×8×1 Planar 1⅛" Spacing
3 Dimension 8¼ inch

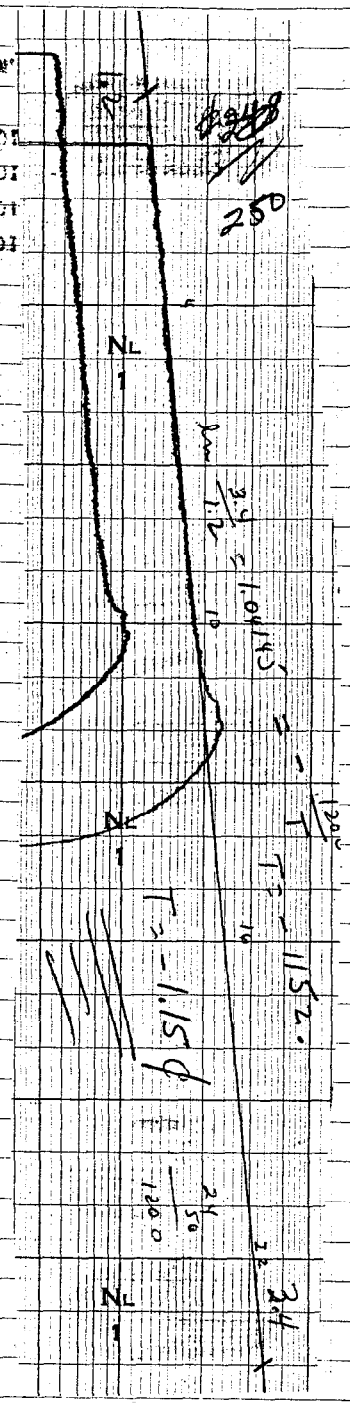
42 Sub Critical IC-3 = 8×10^{-10}
1.44 Remove Source 4 = 4.6×10^{-10} } Ind = 0.115
Prompt Jump ~8/5 = ~1.6



#251
7.1/2 = 3.55
77.14 sec
11.75 ¢ / N=0.82 = 143.3 ¢/inch



#252
5.2/2 = 2.6 div.
56.5 sec
14.70 ¢
14.70/0.105 = 140 ¢



250
NL
1
T = -1.15 ¢

EXP # ~~248~~ 250

8x8x1 Planar Array 1 1/8 in Spacing — average (4.887)

Measured east-west $\boxed{39\ 3/32}$

8 in z dimension

Red Lite ✓
Source Ins. ✓
$\Delta p = 0.14$ ✓
Bypass ✓

1 54 Start assembly
2 04 Near Critical
Insert Source to Raise Power to 2×10^{-9}
2 05 Start Neg. Period — 1152 sec
2 13 Start Down = −1.15 ¢

1.04
.0165
.0064
00008

EXP # ~~249~~ 251

8x8x1 Planar Array 0.75 in Spacing

z dimension = Reflectors 13 in apart

Source ✓
Bypass ✓
Red Lite ✓
$\Delta p = 0.14$ ✓

3 32 Start Assembly
3 40 On Positive Period 0.908
43 Start to level
51 Level 0.990

$\frac{11.75¢}{.082} = 143.3¢$ inch

.110

0.880 inche separation

EXP # ~~250~~ 252

8x8x1 Planar Array 0.75 in Spacing

4.5 in cell
8
36.0 in

z dim = 14 in. Measured 36 3/32

Red Lite ✓
Bypass ✓
Source ✓
$\Delta p = 0.14$ ✓

4 05 Start Assembly
4 12 On Pos Period Ind = 0.540
15 1/2 Start to Level ~~06~~
Level 0.645

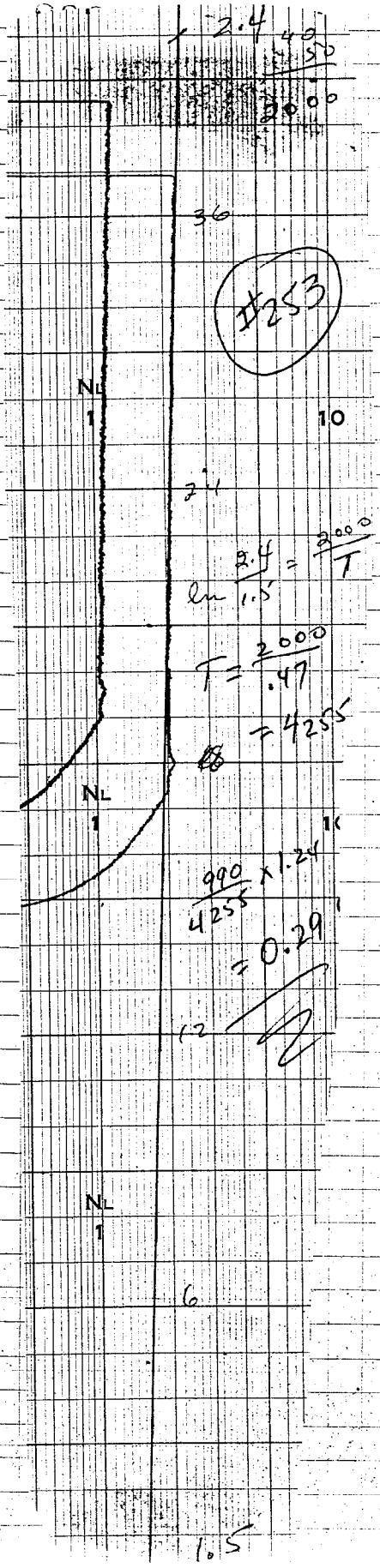
$\frac{14.70}{0.105} = 140$ ¢/in.

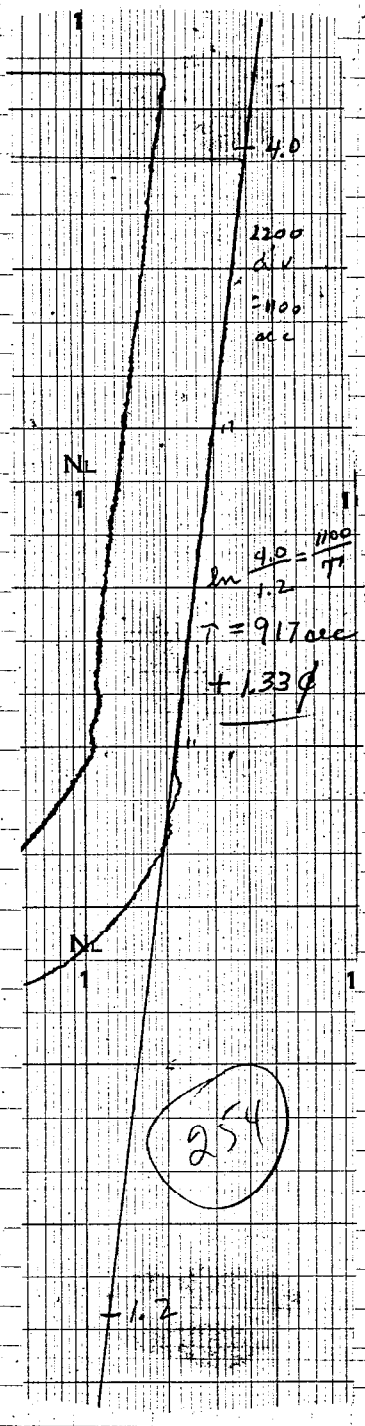
4 21

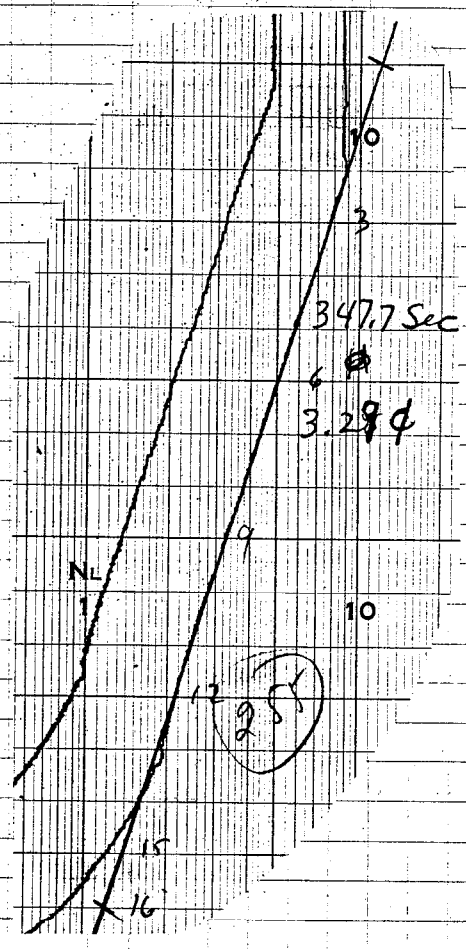
990
645

.345 x 140 ¢/in = 48.3 ¢ per in of z dim Reflector change.

Δg = .545 x 140 ¢/in = 76.3 ¢


2.4
40
50
2000
36
#253
NL
1
10
24
$\ln \frac{2.4}{1.5} = \frac{2000}{T}$
$T = \frac{2000}{.47}$
$= 4255$
NL
1
10
$\frac{990}{4255} \times 1.24$
$= 0.29$
12
NL
1
6
1.5


1
4.0
2200
div
=1100
sec
NL
1
1
$\ln \frac{4.0}{1.2} = \frac{1100}{T}$
$T = 917$ sec
$+1.33\phi$
NL
1
1
254
1.2


10
3
347.7 Sec
6
3.28ϕ
NL
1
10
9
12
255
15
16

EXP # 253

Instrument Check on 4 Apr 72 Source 10 mc ^{60}Co

8X8X1
Planar Array
Spacing 3/4"
Measured 36 3/32
~ l = 4.512

FM-1		Low Trip	OK	Trip	OK
IC-1		Motor Trip	Screwed Tables	Fast Trip	OK
IC-2	Out for Repair	Motor Trip	OK		MONITRON
IC-3	2×10^{-9}	Calibration	SWM		A OK
IC-4	2×10^{-9}	Calibration	SWM		B OK
					C OK

7 56 Start assembly — z DIM = 15 inches — Source Inserted Manually OK
10 06 Subcritical — 0.109 – 0.110 — Red Lite & Pers. Ck OK
Near Critical — Δp = 0.14 OK
10 11 Remove Source — Bypass OK
Pos Period T = +4255 sec → 0.29 ¢
Shut Down.

EXP # 254

8X8X1 Planar Array Spacing 5/8"
z Dimension 19 3/4"

2 45 Start Assembly — Source ✓
Near Critical — Ind = 0.121 – .116 — Bypass ✓
Insert Source to Raise Power — Red Lite ✓
2 59 On Pos. Period 917 sec +1.33 ¢ — Δp = 0.14 ✓

Shut down to Inspect Plane of Separation – Bumped some blocks.

EXP # 255 (Repeat 254)

3 15 Start assembly (Assemble without external source!)
3 19 Closed! Needs an assist of source to raise power.
Ind = 0.115 –
3 28 Source Removed for Positive Period +348 sec
37 Start to level 3.29 ¢
44 Level Ind = 0.130

1.044
0329
00641

1.00022
09
30/2 = 00015

Start EXPERIMENTS WITH ONLY BOTTOM Reflector

Note Slabs on each half of table are super-critical if top reflected accidentally !!

Using Bucklings theory, estimate of critical thickness bottom reflected only, is 8.9 cm vs 9.252 for 8x8x1.

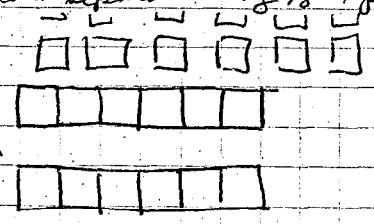
∴ 8x8x1 is super critical

6x6x1 is estimated to have a crit ht of 9.496 cm

(3.75 = 9.525 cm)

Therefore remove 64-36 = 28 Blocks from Table
Completed Apr 5-71

Align 6 blocks on each table — assemble for final alignment
Separate tables, other 12 blocks on each table separated by 7/8" spacing
Ind = 0.111



Instrument Check on Apr 5, 71 Source 10 mc ^{60}Co

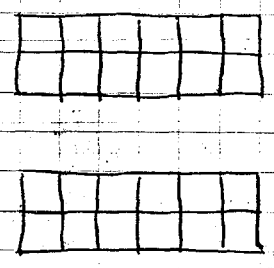
FM-1		Low Trip	OK	Hi Trip	OK
IC-1		Motor Trip	OK	Fast Trip	Scram Tables
IC-2	Out for Repair	Motor Trip	—		MONITRON
IC-3	~2 x10^{-9}	Calibration	Dwn		A OK
IC-4	~2 x10^{-9}	Calibration	Dwn		B OK
					C OK

EXP#256 — Red Lit & Pers. Ck OK, Exp = 0.14 OK, Bypass OK.

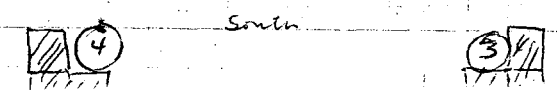
9 16
9 24½ Start to Assemble without external Source { 2x6x1 North / 2x6x1 South } No Top Reflector

No multiplication indicated

North



South



∴ 8x8x1 is super critical

6x6x1 is estimated to have a crit ht of 9.496 cm

(3.75 = 9.525 cm)

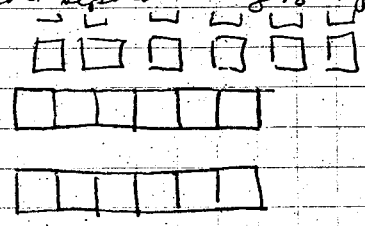
Therefore remove 64-36 = 28 Blocks from Table.

Completed Apr 5-71

Align 8 blocks on each Table — assemble for final alignment

Separate Tables, other 12 blocks on each table separated by 7/8" spacing

Ind = 0.111



Instrument Check on Apr 5, 71 Source 10 mc ^{60}Co

FM-1		Low Trip	OK	Hi Trip	OK
IC-1		Meter Trip	OK	Fast Trip	Scram Tables
IC-2	Out for Repair	Meter Trip	—		MONITRON
IC-3	~2 x10^{-9}	Calibration	Dwm		A OK
IC-4	~2 x10^{-9}	Calibration	Dwm		B OK
					C OK

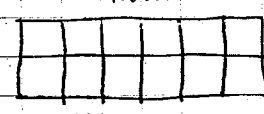
EXP #256 — Red Lit & Pers. Ck OK, Δp = 0.14 OK, Bypass OK.

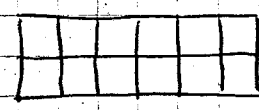
9 16 Start to Assemble without external Source { 2x6x1 North / 2x6x1 South } No Top Reflector

9 24½

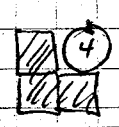
No multiplication indicated

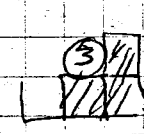
North





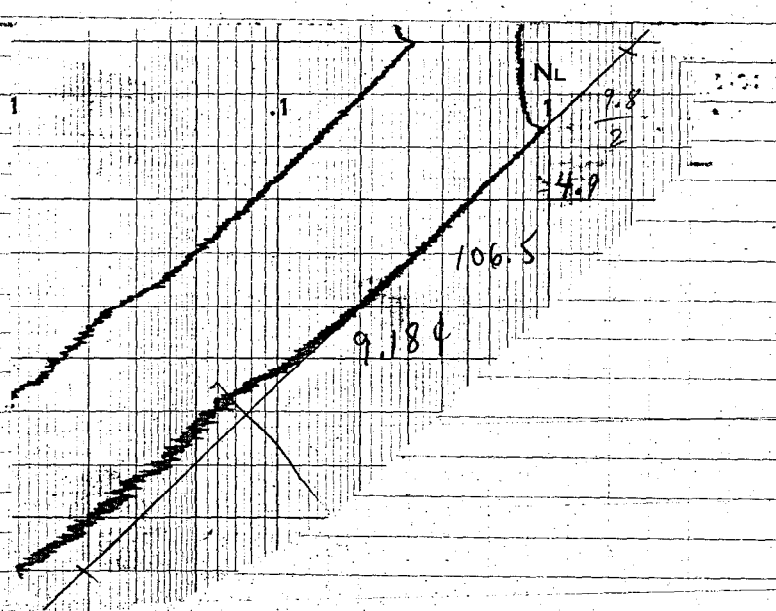
South





Bottom of pg 239

SYS

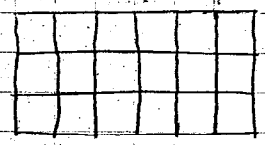

1
.1
NL
1
7.8
2
4.9
106.5
9.184

EXP #257

9^{37} Start Assembly - 6x6x1 No Top Reflector
$9^{46\frac{1}{2}}$ Added 5.3×10^{6} Pu Be Source below Assembly Pu Be 6

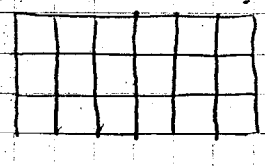
Subcritical — Ind = 0.113

1 = .025/.02 $\times 3\times10^{-11}$
IC-3 = 2.6/1.3 $\times10^{-11}$
4 = 2.4/1.2 $\times10^{-11}$



Red Lit
Bypass
Up

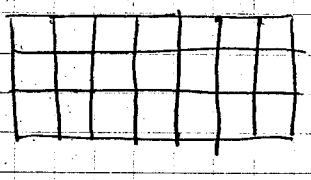
$9^{48\frac{1}{2}}$ Start Down
Mult N. 2



Add 6 blocks to make 6x7

EXP #258

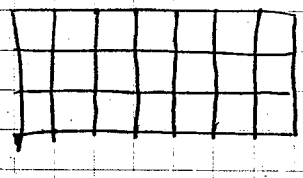
7 x 6 x 1 Slab No Top Reflector



Red Lit
Bypass
Up
OK

10^{01} Start Assembly
$10^{10\frac{1}{2}}$ Subcritical Ind = 0.114

1 .035/.02 $\times 3\times10^{-11}$
3 5.5/1.2 $\times10^{-11}$ M = $4\frac{1}{2}$
4 4.2/1.2 $\times10^{-11}$ M = $3\frac{1}{2}$



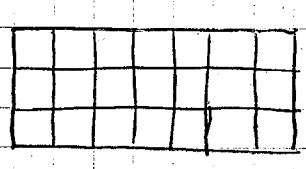
Remove Source Manually.

Separate Tables
3 → 1.8×10^{-11}
4 → 1.5×10^{-11}

3 0.85×10^{-11}
4 0.75×10^{-11}

added 7 ea Cubes to Make 7x7x1

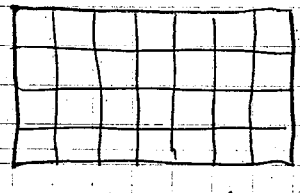
$10^{21\frac{1}{2}}$ Start Assembly EXP #259
Source Pu Be 6 Placed Manually Under South Half
10^{34} Super Critical 7x7x1 Slab
No Top Reflector



Red Lit
Bypass
Up

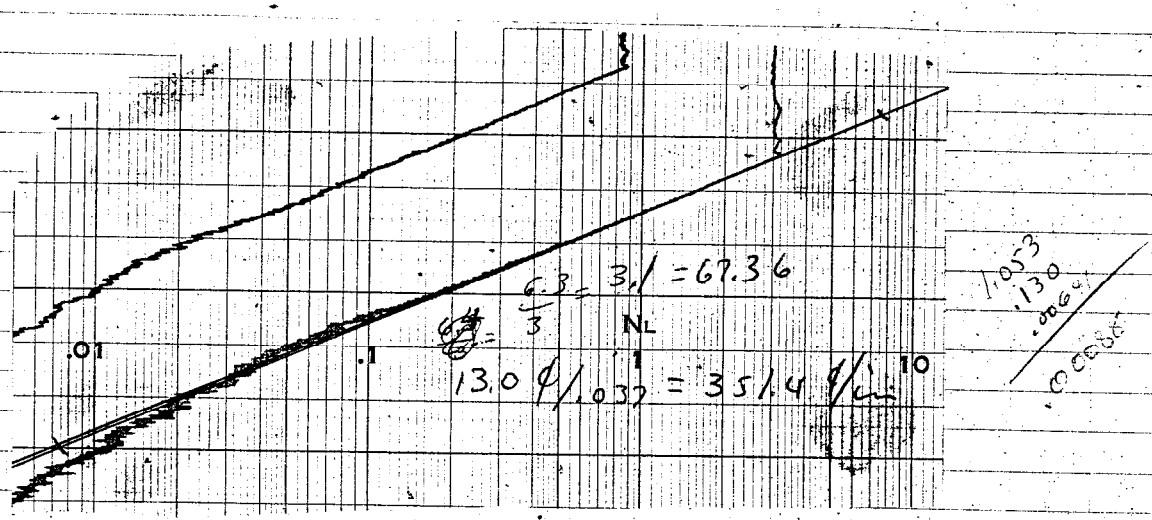
On Pos Period
@ 0.246

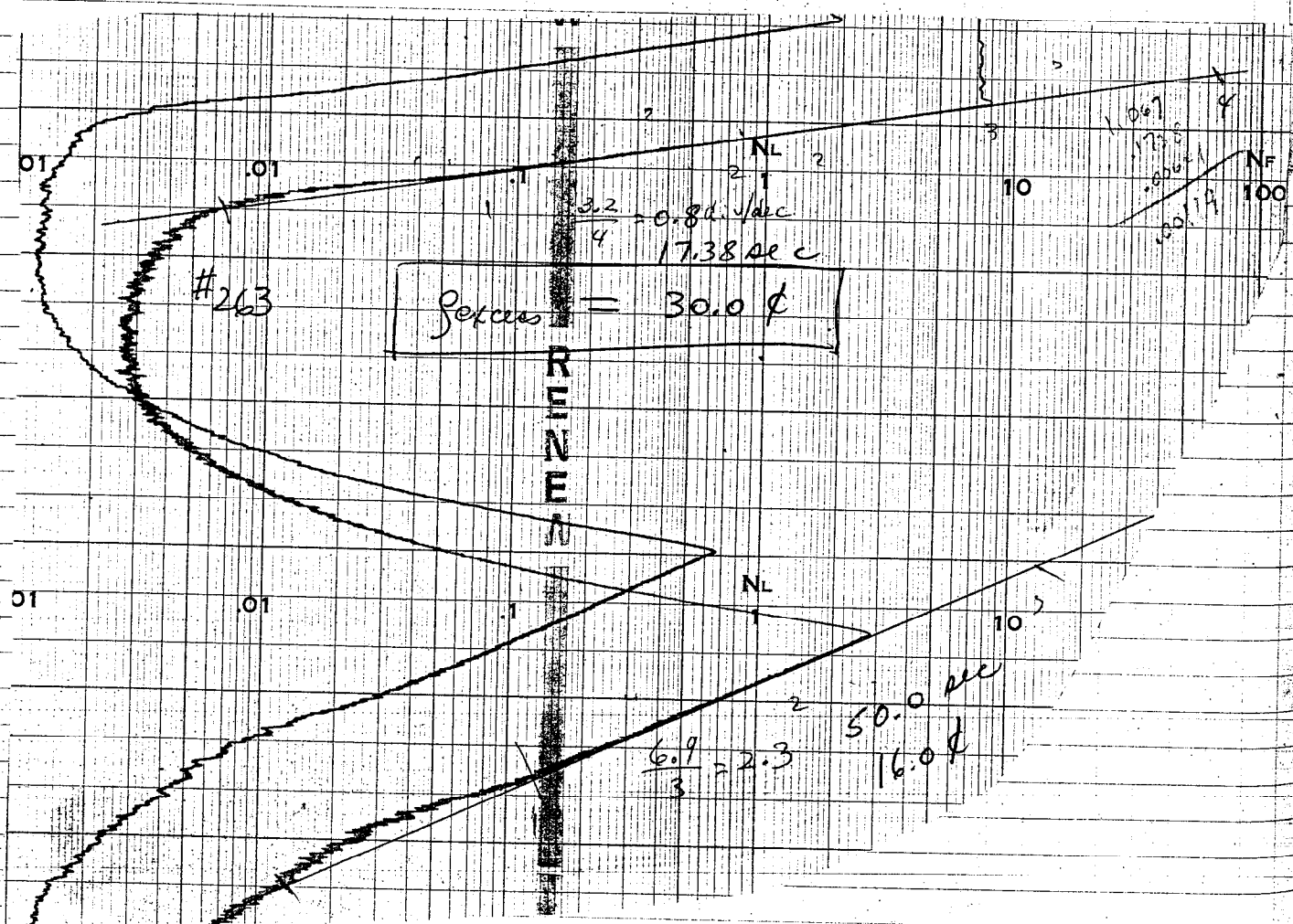
106.5 sec
$\frac{9.18\,¢}{.023} = 399\,¢/in$



10^{38} Start To Level
42 Level 0.269 − 0.114 = 0.155 inch gap

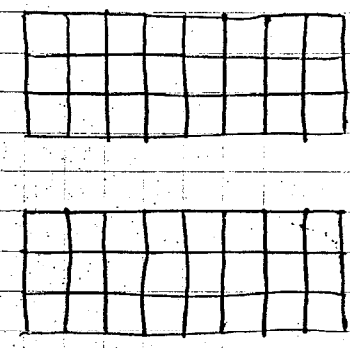
399 X .155 = Max of 62¢ excess react.


.01
.1
1
10
NL
6.3/3 = 3.1 = 67.36
13.0 ¢/.037 = 351.4 ¢/in
1.053
.130
.00641
.00086


.01
.01
.1
1
10
100
NL
NF
3.2/4 = 0.8 div/dec
17.38 sec
#263
ρexcess = 30.0 ¢
RENEN
.01
.01
.1
1
10
NL
6.9/3 = 2.3
50.0 sec
16.0 ¢

EXP # 260 No Side Reflector

10^{48} Start assembly 8x6x1 Slab No Top Reflector
Pu Be-6 Source Placed Manually.
10^{59} Tables Closed On Pos Period Ind = 0.115
Start To Level IC3 = 3×10^{-9}
11^{07} Level 0.152



Red Lite
Bypass
Δp

48 cubes

$\rho_{exc} = 13.0¢/.037 = 351.4$ ¢/in

Return to 8x8x1 Planar Array Only Bottom Reflector.

EXP # 261

8 x 8 x 1 Planar Array No Top Reflector
$\frac{1}{4}$" Spacing (Estimated to be subcritical
Pu-Be 6 Source Placed Manually under Top Reflector at 60 in.)
South Half.
1^{22} Start Assembly
1^{32} Subcritical IC = 3 → 1.8/1.4 $\times 10^{-12}$

Red Lite
Bypass
Δp
OK

EXP # 262

Previously 15 mils in one direction → 14¢
Changed 1/8" in 2 directions maybe ~ $3 increase.
8X8X1 Planar Array No Top Reflector No Side Reflectors
$\frac{1}{8}$" Spacing Pu-Be 6 inserted Manually below
2^{01} Start Assembly
$2^{08\frac{1}{2}}$ Sub critical 0.116 Separate
IC-3 → 3.2/1.4 $\times 10^{-12}$
-4 → 1.4/0.8 $\times 10^{-12}$

Red Lite OK
Bypass OK
Δp = 0.14 OK

EXP # 263

8X8X1 Planar Array No Top Refl. No Side Ref
Bottom Reflected
Spacing 1/16 inch Pu Be 6 Source inserted Manually
2^{45} Start Assembly
2^{56} On Pos Period A 0.156 IC-3 = 2.8×10^{-9}
Separate Screen Only Repeat Period with Tables Closed
Pos Period B 0.116
3^{05} Start To Level 0.198
2^{17}

Red Lite
Bypass
Δp 20.14
OK

Measures 30 ½ inches
therefore spacing is $\frac{8}{16} \times \frac{1}{7} = .071_4$"

48 cubes

Return to 8x8x1 Planar Array Only Bottom Reflector.

EXP #261

8 x 8 x 1 Planar Array No Top Reflector
1/4" Spacing (Estimated to be subcritical
Pu-Be 6 Source Placed Manually under Top Reflector at 60 in.)
South Half.

1 22 Start Assembly
1 32 Subcritical IC = 3 → 1.8/1.4 x10^-12

Red Lite
Bypass } OK
Δp

EXP #262

Previously 15 mils in one direction → 14¢
Changed 1/8" in 2 directions maybe ~ $3 increase.
8X8X1 Planar Array No Top Reflector No Side Reflectors
1/8" Spacing Pu-Be 6 inserted Manually below

2 01 Start Assembly
2 08½ Subcritical 0.116 Separate
IC-3 → 3.2 / 1.4 x10^-12
-4 → 1.4 / 0.8 x10^-12

Red Lite OK
Bypass OK
Δp = 0.14 OK

EXP #263

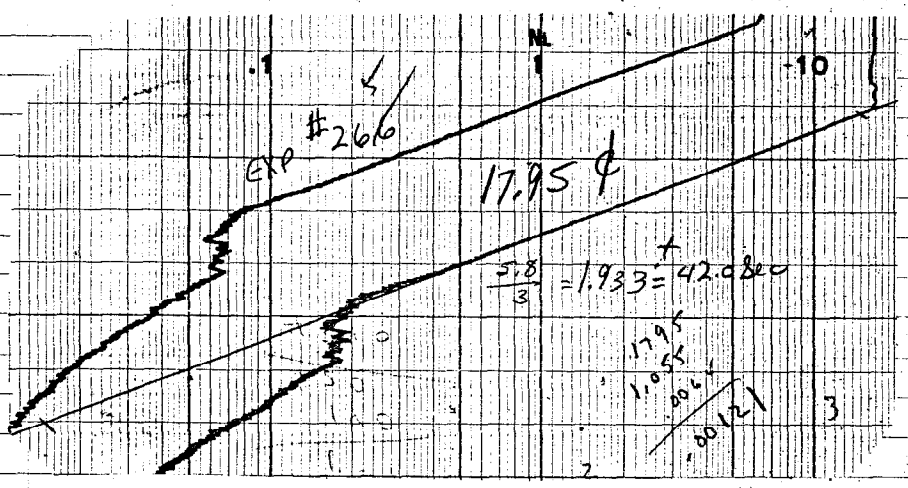
8X8X1 Planar Array No Top Refl. No Side Ref
Bottom Reflected
Spacing 1/16 inch Pu Be 6 Source inserted Manually

2 46 Start Assembly
2 56 On Pos Period A 0.156 IC-3 = 2.8x10^-9
Separate Screen Only Repeat Period with Tables Closed
Pos Period B 0.116
3 08 Start To Level 0.198
3 17 Level

Red Lite
Bypass } OK
Δp 20.14

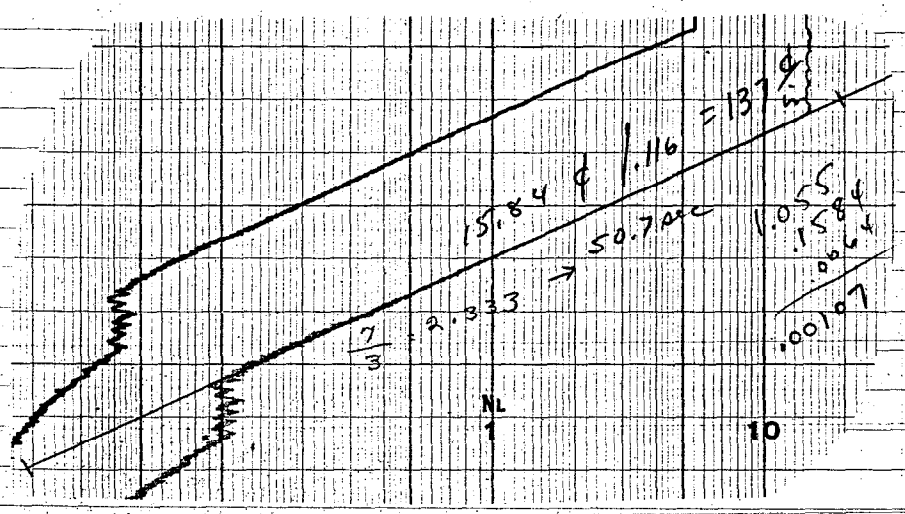
Measures 30 ½ inches
Therefore spacing is 8/16 x 1/7 = .071 4"
4.8532 cm 3.75 / 3.821 4

Bottom of
PS 243 sht



.00121
1.07

266



Instrument Check on 11 Apr 72 Source 10 mc 60 Cy

PM-1 _____ Low Trip Scrammed Tables Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 Out for Repair Meter Trip _____ MONITRON

IC-3 1.6×10^{-9} Calibration DWM A

IC-4 1.7×10^{-9} Calibration DWM B

Insert Source Resp OK C

EXP # 264

Units 1 x 1 x 4 cubes Nominal Array Size 30x30x30

Reflected Array 4 x 4 x 1

Red Lite & Pers Ck OK

Bypass OK

$\Delta p = 0.14$ OK

8^{51} Start Assembly

9^{00} On Positive Period .0.945 − .111 = 0.845

Change scales on IC-1 − Scrammed system on release of bypass switch

---

Note − tables were re aligned prior to stacking EXP # 264

Table zero = 0.111

EXP # 265

Units 1x1x4 Array Reflected 4x4x1 Core = 30½ x 30½ x 30½

Note: Assembly of units is positioned 1/16" east of center

12^{51} Start Assembly Source Resp OK Bypass OK 1/16 South of Center

Red Lite OK Δp OK 1/32 Above Center

12^{59} Tables @ 0.293 On Pos Period

Start to level IC-3 = 1.7×10^{-8}

4 6.5×10^{-9} > $\frac{17.95¢}{.128}$ = 140 ¢/inch $\frac{30\frac{1}{2}}{4} = 7\frac{5}{8}$

12^{09} Level 0.421

Shut Down −111 = .31 x 140 = 43.4 ¢ or less!

EXP # 266

Added 4 pc .075 x 2⅞ x 9 Stainless Steel (See sketch 269)

Purpose − Measure reactivity change due to St.St.

1^{15} Start Assembly Red Lite OK Source Resp OK

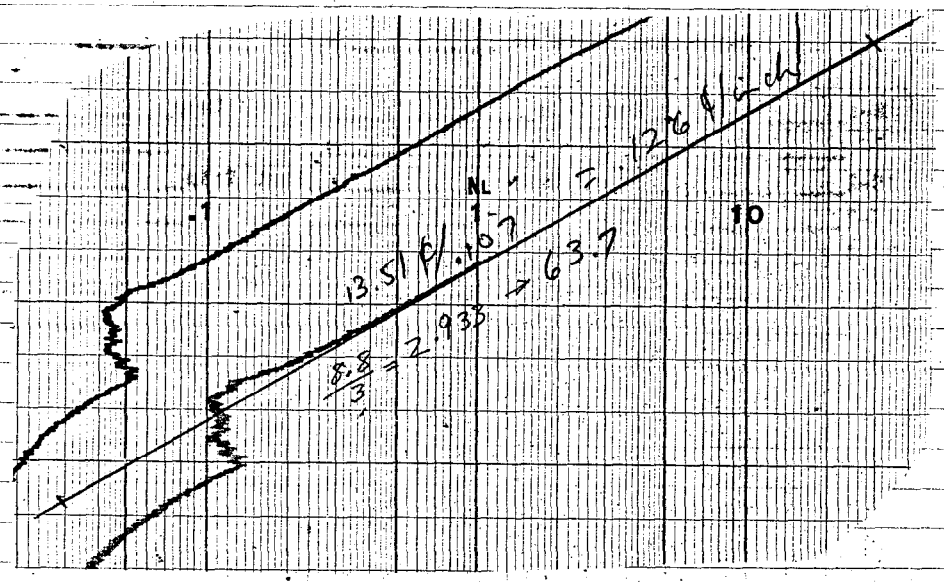
Δp OK Bypass OK

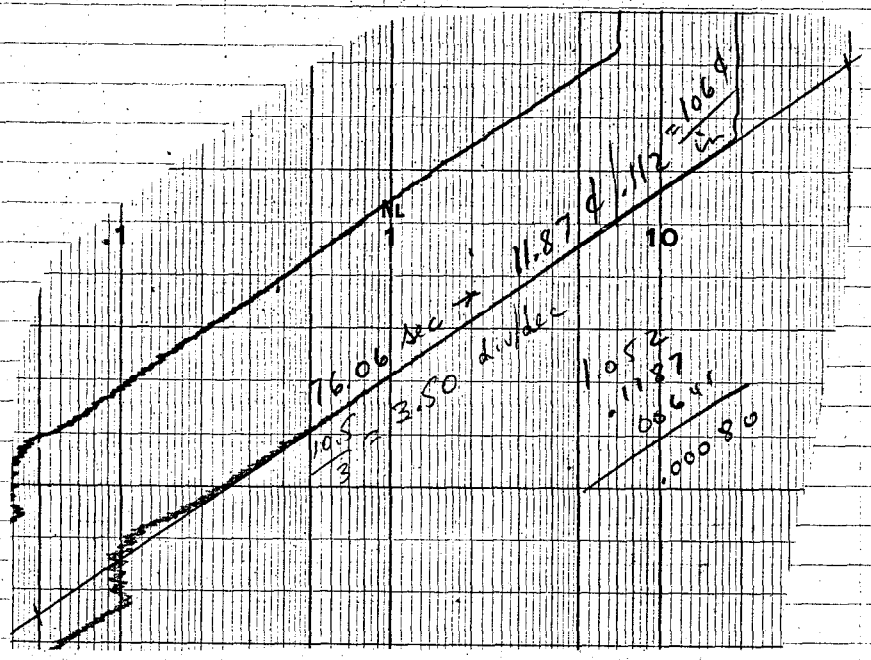
On Pos Period 0.258

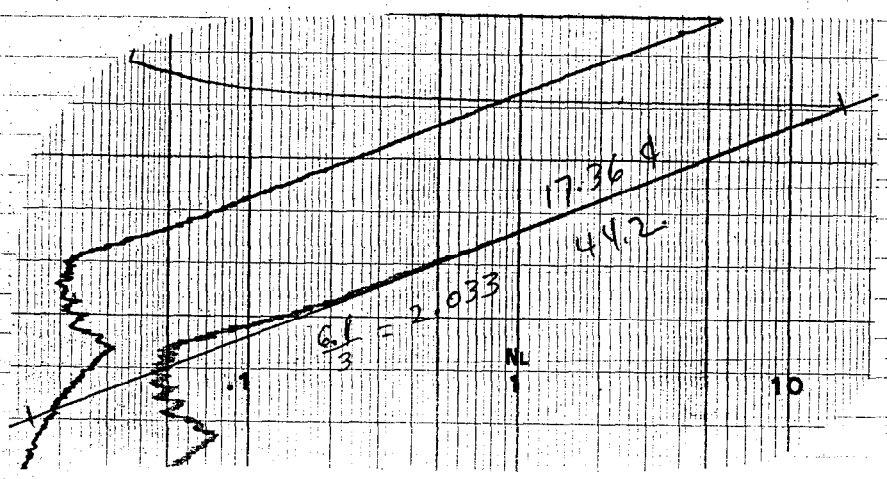
$28\frac{1}{2}$ Start to Level IC-3 = 1.5×10^{-8} > $\frac{15.84¢}{0.116}$ = 137 ¢/in

1^{38} Level 0.374

Shut Down







1.056
.1736
.00641
.00118
80
.00038
.4
.00152

EXP #267

Added 4pc .066 x 2½ x 9 St. St.

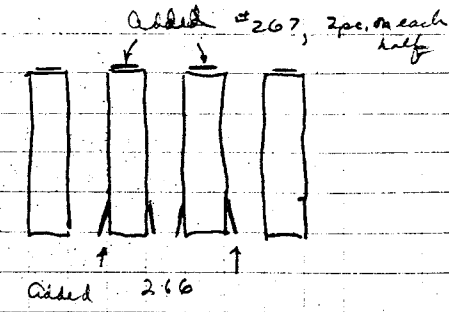
1^45 Start Assembly — Bypass, Δp, Source, Red Lite OK

On Positive Period 0.229

Start to Level

20^3½ Level .336 — 13.51 ¢ / .107 = 126 ¢/in.

Shut Down .107



421 .336 = .085 x 140 =

EXP #268

Added 8pc SS

4 ea 062 x 2⅞ x 9 } See blue on sketch

4 ea 072 x 2⅞ x 9

2^11 Start Assembly — Red Lite Source Bypass Δp = 0.14 OK

2^19½ On Pos Period Closed @ 0.112

0.111

2^25½ Start to Level

2^31 Level 0.223

11.87 / 0.112 = 106 ¢/in

EXP #269

Remove 4ea pc SS 1ea of each type

2^39 Start Assembly

2^47½ On Pos Period 0.111

Shut Down @ IC-3 = 1.5 x 10^-8

ρ_{ex} = 17.36

Red Lite, Source, Bypass, Δp } OK

Worth of SS, 4pc 17.36 ¢

11.87 ¢

5.49 ¢ 4 e

Total worth x 4

21.96 ¢

Exp. #265 Total ρ_{ex} + 11.87

33.83 ¢

av. in Table

125 ¢ x .31

39 ¢ excess

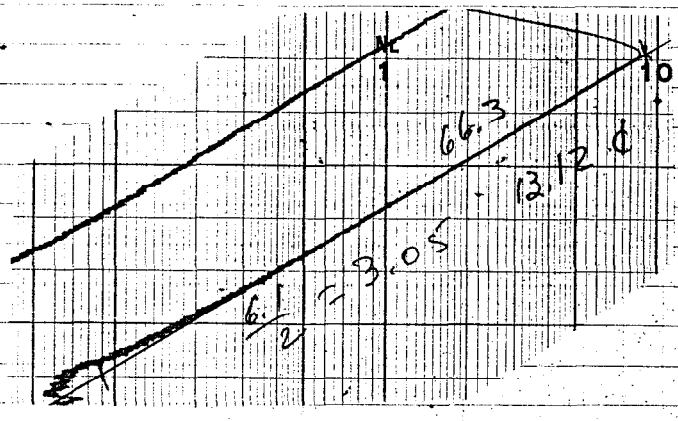
vs 34 ¢

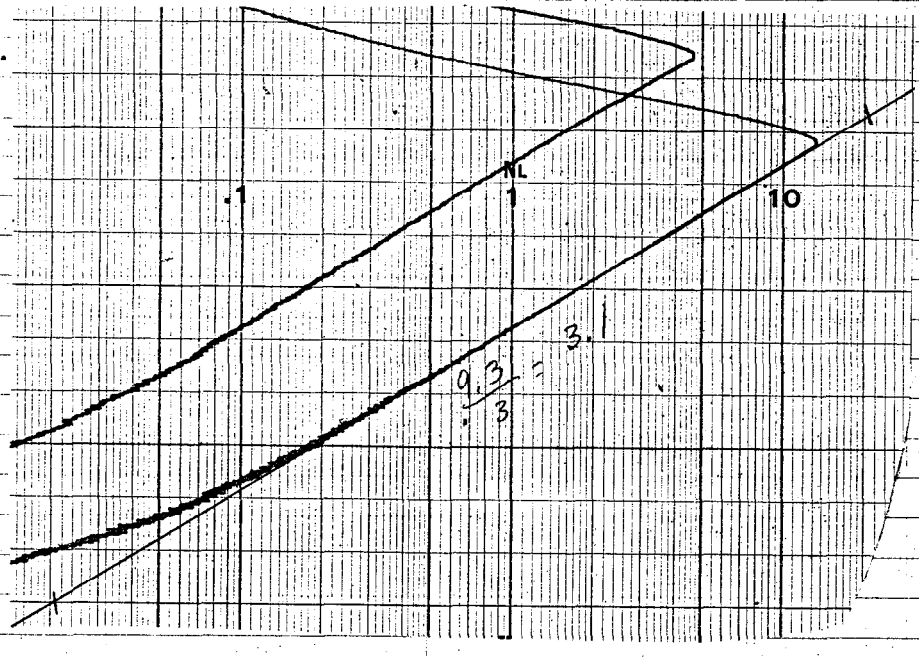
#268

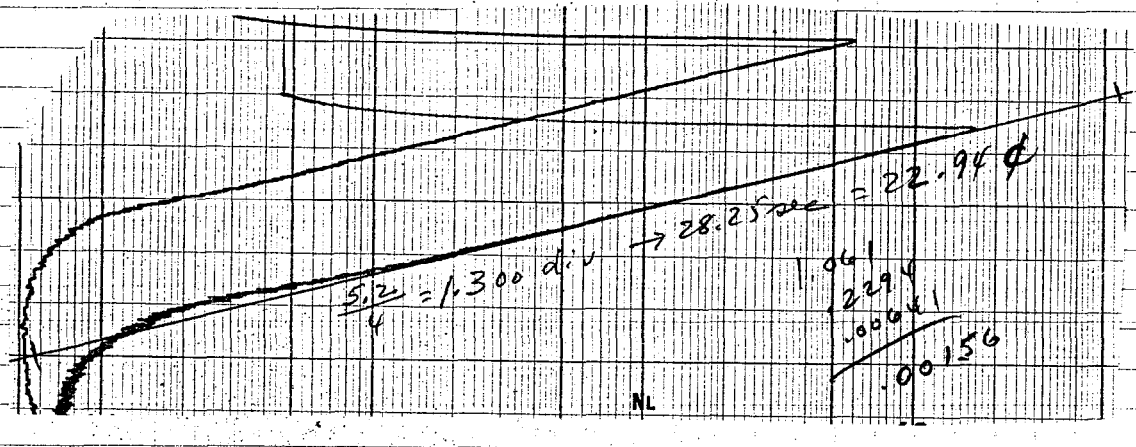
Steel 0.00152

ρ_{ex} 0.00080

Red #265 .00232


NL
1
10
66.3
13.12 ¢
6.1/2 = 3.05


.1
NL
1
10
3.1
9.3/3 =


22.94 ¢
28.25 sec
5.2/4 = 1.300 div
NL

EXP # 270

Purpose. Measure React of Support Structure — Replaced 4pc Steel, added Mockup of Bottom Support on North Tube
(# 268 + ½ of Support Structure)

3°2 Start Assembly
3'' On Positive Period
Ind. @ 0.223
66.3 sec → 13.12 ¢
0.223 = 11.87 ¢
Total 24.99 ¢

Source Rup
Bypass
Δp
Red Lit
} OK

½ Support Structure = 13.12 ¢

EXP # 271

Repeat Period for 270. Approach 0.223 only from Closure

On Pos Period @ 0.223 67.4 → 12.97
11.87
24.84

EXP # 272

Repeat 270 - 271 with Tables Closed.
3'' On Pos Period 0.111. power to 1.7×10^{-8} on IC-3
Shut Down

ρ_{ex} = 22.94

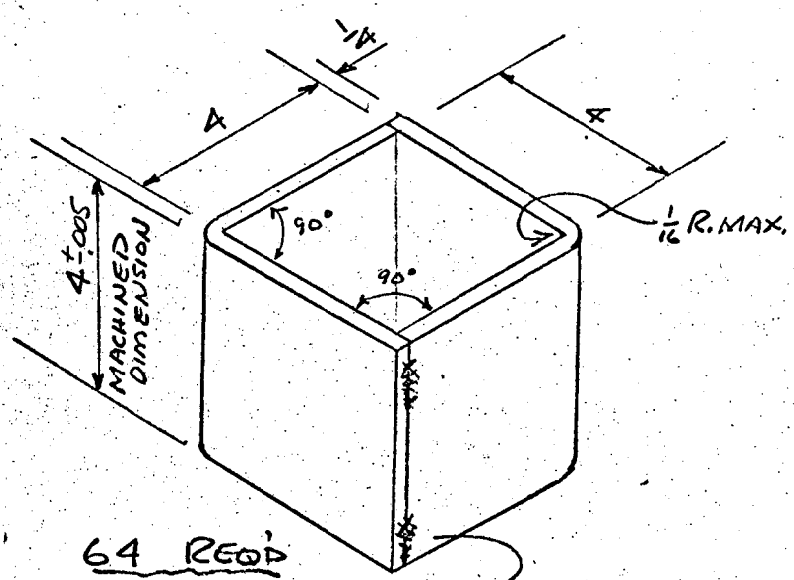
Summary for 1×1×4 unit
4×4×1 Array

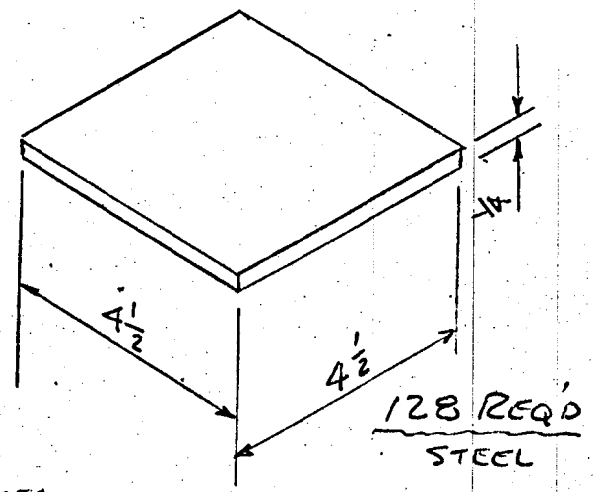
13.12
12.97
$\frac{26.09}{2}$ = 13.05
×2

265 ρ_{ex} = 33.8
Total width of Support 26.1
Corrected ρ_{ex} = 7.7 ¢

½ al = .00156
.00080
.00076
2
Total .00152

265 corrected 1.00232
.00152
1.00080





NOTES:

1- USE FLAT NON-RUSTY HOT ROLLED STEEL PLATE

2- SHEARED EDGES ACCEPTABLE

3- ALL SURFACES MUST BE SQUARE AND PARALLEL SO THAT INSIDE IS A CUBE

4- MACHINE TOP AND BOTTOM TO FINISHED DIMEN. AND SQUARE WITH SIDES.

9213
SPECIAL ARRAY BOXES

Check! W.O. S-545

Tunnell 3-5237 3/15/72

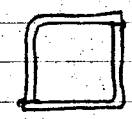
Repeat: Are there other restrictions or conditions?

April 12, 1972

Modeling Experiments for Shipping Containers
~1/4" Steel Boxes + 1" Plexiglass dividers.

Scrap Plexiglas cut are follows:

48 pc $5\frac{5}{8} \times 5\frac{5}{8} = 1518.75\ in^2$
$9798.3675\ cm^2$



Steel Box 4" high
4" I D square
~ 1/4" Thick Steel Plate

Total weight = 27.65 kg
$\rho = 1.18 \rightarrow Vol = 23432\ cm^3$
Average Thickness = 2.391_{44} cm

24 pc 12 ea $5\frac{5}{8} \times 12\frac{3}{8}$
12 ea $5\frac{5}{8} \times 13\frac{3}{8}$ $= 1738.125\ in^2$
$= 11213.687\ cm^2$

1.195

Total weight = 32.650
$Vol = 27669.49\ cm^3$
Average thickness = 2.467_{47} cm

.6875

12 pc 6 ea $12\frac{11}{16} \times 12\frac{3}{8}$
6 ea $12\frac{11}{16} \times 13\frac{3}{8}$ $\Big\} = 1960.21875\ in^2$
$= 12646.547\ cm^2$

$24\frac{32}{16}$
$25\frac{3}{8} \times 25\frac{3}{4}$

Total weight = 36800
Vol = 31186.44

Average thickness = 2.46600 cm

total Volume = 82287.93
Total weight = 97100
total Area = 33658.61
Average thickness = 2.444_{78} = 2.445 cm

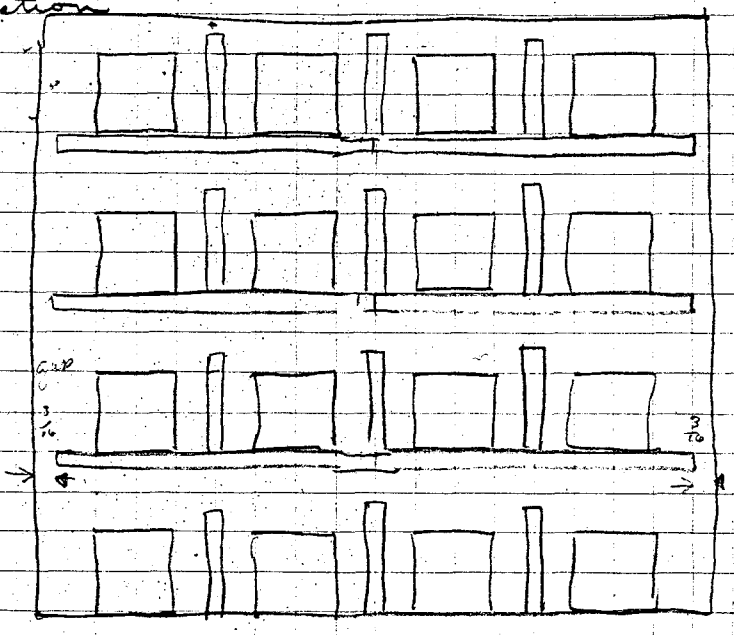
Steel Boxes 62 weigh 127.27 kg → 280 lbs Area 2052.74 g
ASTM A575 $\rho = 7.84$ Vol = 261.829
Steel Vol = $[(10.16 + t)^2 - 10.16^2] \times 10.16$
$t^2 + 20.32t - 25.771 = 0$ $t = \frac{-20.32 + \sqrt{412.902 + 103.084}}{2}$ 22.7153
$\frac{t}{2} = 0.599$ cm. → 0.60 $= 2.3953/2 = 1.19765$

End Plates 128 ea weigh 80.05 kg = 625.391 g each
ASTM A575 $4\frac{1}{2} \times 4\frac{1}{2}$ $\rho = 7.84$ vol = $79.769\ cm^3$
Area = $130.64_{49}\ cm^2$ Thickness = 0.6106 cm

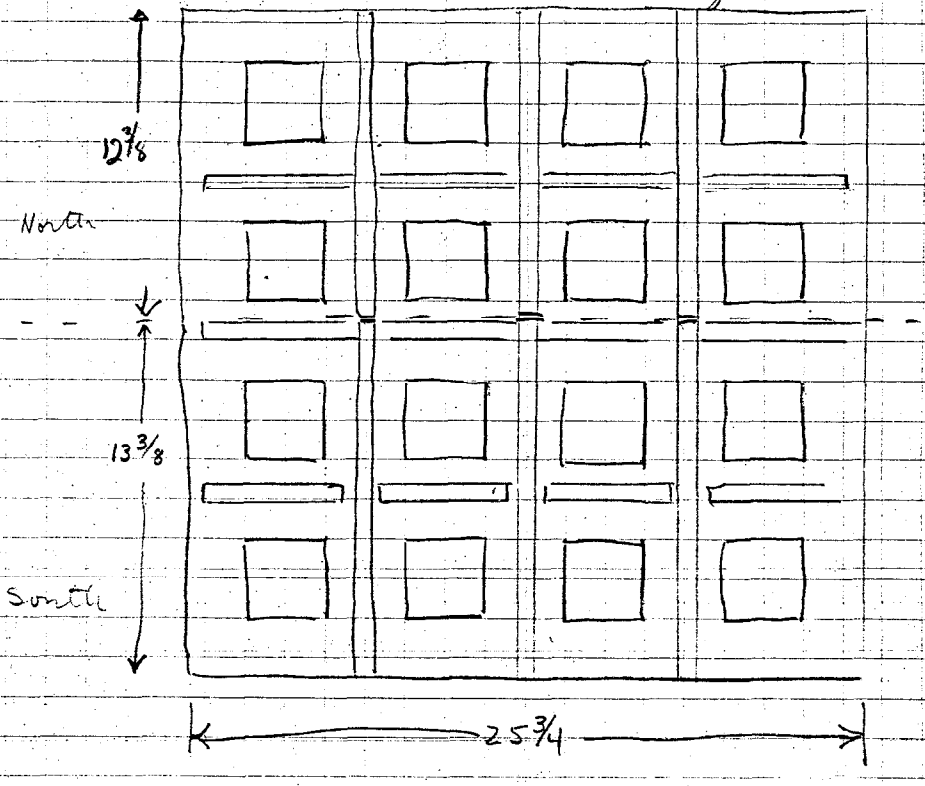
thickness 0.61 cm.

EXP # 273

Purpose: to verify that 1/4" Steel containers compensates for more than optimum moderation



Core size 25 3/4 instead of 26 3/4
(4 x 4 x 4 array size)
because 1/2 in of plexiglas on sides and top & bottom included in reflector



Apr 25

		Meas	Sepn
Rev Dia	49.35 Rev. =	7 11/16	in.
Ford Dia	49.35 Rev. =	7 45/64	in.

7.655
.733 > 7.696 19.546

Void Box = ±9.774 ± 9.774

1.031
− .11
.0000
− .000727
.9993

Instrument Check on 13 Apr 72 Source 10 mc ^{60}Co

950V IM-1 Bal 4.65 Low Trip OK Hi Trip Scram Tables

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK

IC-2 Out for Repair Meter Trip MONITRON

IC-3 2×10^{-9} Calibration Down A OK

IC-4 2×10^{-9} Calibration Down B OK

C OK

EXP # 273 (cont)

12 52 Start Assembly

Mult of IC-3 $\frac{3.6 \times 10^{-11}}{0.75 \times 10^{-12}} = 4.8$ when North half moved to 16 in.

Likely to be critical with large gap

Source Resp OK
Δp ≈ 0.14 OK
Bypass OK

104 IC-3 = 1.4×10^{-9}
4 = 4.6×10^{-10} } with source inserted

104+ Remove source on negative Period ~159 sec = ~11¢
within ~10-15¢ of delayed critical
Ind — Rev 49.35 → 7.85 inches
Rough Pos Ind 8.0 in separation
Very Super Critical

548
774

EXP # 274

Add 2pc 0.036 × 12 × 18 in cadmium Sheet on top of North and South halves.

1 27 Start assembly

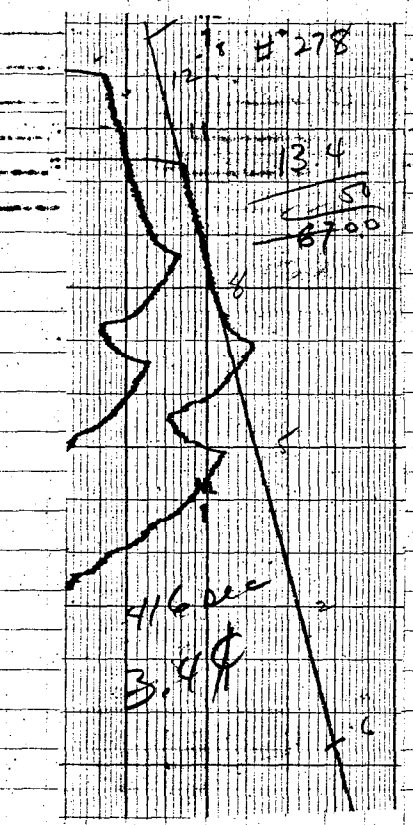
at high Multiplication Rev = 45.35 → 6.6 inches
Power Rising slowly — remove Source.
Slightly super critical

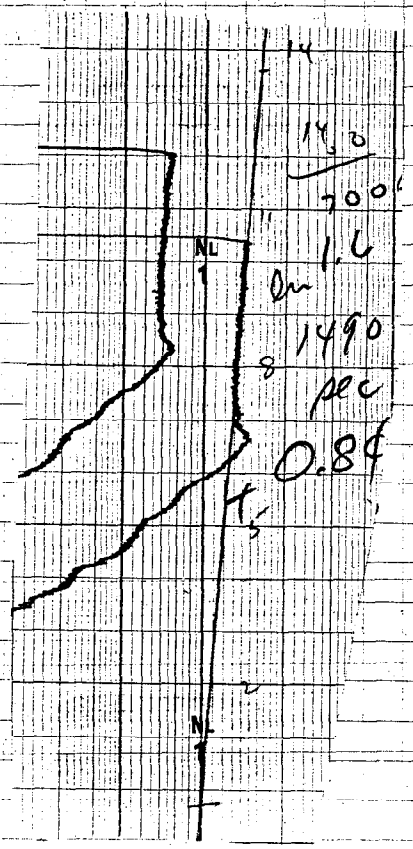
1 37 Separate Tables a jog only.
Near Crit @ = 45.50 → 6.65
Very Super critical

Add 2pc 0.036 × 12 × 18 in Cad
Total 4pc on Top and E Sides of Both halves
Remove 16 ea 1" × 5 5/8 × 5 5/8 at Plane of Sepn

EXP # 275

1 54 Start Assembly
2 31 Power Rising slowly — Remove Source Slightly Super Critical
Rev = 37.3 → 4.55 inches
Shut Down
Very Super Critical


#278
13.4
8700
416 sec
3.4¢


14.0
700
1.6
1490
sec
0.8¢

Remove "Egg Crate" Plastic from Top Layers
North and South Tables

2 7 Start Assembly — Remove 3 ea 1" x 5 5/8 x 12 3/8
2 24 Power Rising ~ — 3 ea . x 13 3/8
25 Remove Source — 8 ea 1" x 5 5/8 x 5 5/8
Slightly Pos Period
Ind Rev = 32.0 → 3.5 in
Rough Pos. Ind ~ 3 1/2 in.
Shut Down

Very Super Critical

EXP # 277
North Table now has 24 "units" - (Removed Top Row)
Removed all cadmium.
South Table Missing 4 ea 5 5/8 x 5 5/8 in Top Row
" 16 ea " x " at Mid Plane.

2 46 Start Assembly — 56 Unit Array
2 56 Remove Source — Slightly Sub Critical
at 34.8 Rev = 4.0 in Sepn.

Very Super Critical

EXP # 278
Remove 8 units South Table

48 unit Array - 4 x 4 x 3.
Replaced Plastic at Midplane

3 19 Start Assembly
3 28 Power Rising — Remove Source
Rev 30.2 → 2.9 in separation gap
Slightly subcritical ~ -3.4 ¢ - 416 sec
gap 2.9 in Super Critical

EXP # 279
Add 2 pc Cadmium 036 x 12 x 18 on East reflector-core
interface ~~both~~ South & North Tables.

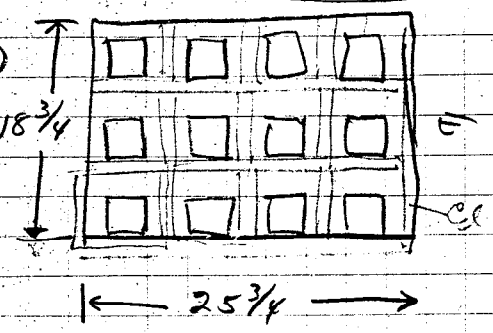
3 38 Start Assembly
3 45 Remove Source - near Critical Pos Period
Rev = 25.8 → 2.5 inch separation

0.8 ¢

EXP #280

Remove 12ea pc 1 x 5 5/8 x 5 5/8 Plexiglas at mid plane – 2pc Cd 036x12x18 Remain on east Faces

3 59 Start Assembly
4 07 1/2 Source Out
Near Crit-level @ 22.2 Rev
$\rho_{ex} \approx 0$ = 2.0 in. Sepn



Super Critical

6.6875
8.493

Instrument Check on 14 Apr 72 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Hi Trip	OK
IC-1		Meter Trip	Scram Table	Fast Trip	OK
IC-2	Out for Repair				Monitron
IC-3	1.5×10^{-9}	Calibration		A	OK
IC-4	1.7×10^{-9}	Calibration		B	OK
			Source Resp OK	C	OK

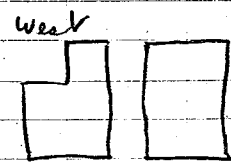
EXP #281

		E-W	N-S	Vert
44 Unit Array	20 on North	4	2	2
	24 on South	4	2	3

Cadmium Removed
Plastic at Interface Replaced.

X section from West

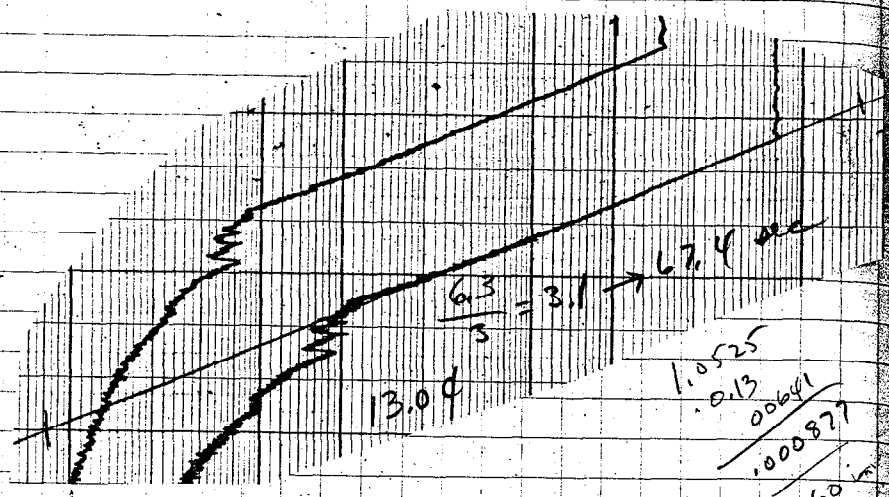
Top layer 3x4
Mid layer 4x4
Bot layer 4x4



8 50 Start Assembly
9 10 On Positive Period Source Out Rev = 24.25 Red Lite & Pers Ck OK
9 13 1/2 Start to Level ~~24~~ Bypass OK
Level Rev 24.7 $\Delta p = 0.14$ OK

Shut Down ~ 2.35 in sepn

meas 2.284



1.0525
.013
.00641
.000827
860
= .01462
x .81
= .0119

n = neutrons per cm^3

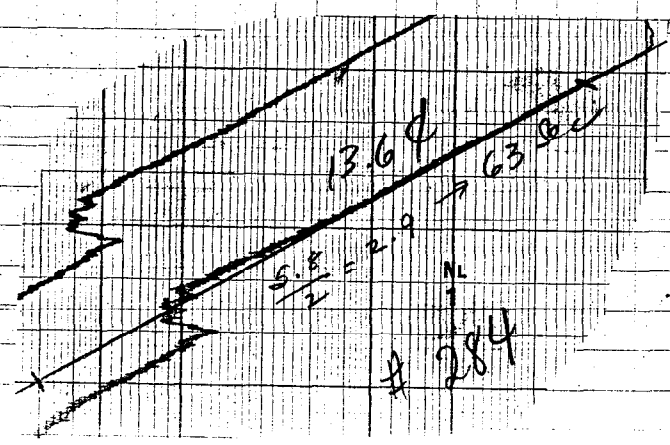
c = precursor density per cm^3

λc = delayed neutron per sec per cm^3

$n \times \nu \times \sigma_f$ = fission rate

$l_d \lambda c$ = delayed neutron density

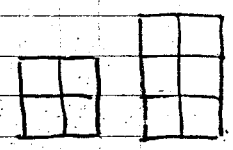
$l_d \lambda c \times \nu_d \times \sigma_{fd}$ = fission rate



EXP # 282

928 Start Assembly of 40 unit Array
36 On Pos Period Incl = 0.860
67.4 → 13.0 ¢ Rev = 11.1 ~ 0.8 in
Calib − 0.73
48 Level 0.920

x section from west



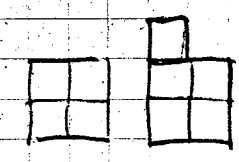
0.80

13.0/.060 = 217¢/in 4×2×2 4×2×3

36 unit Array EXP # 283

1120 Start Assembly
1132 Tables Closed 0.121

Red Lite
Source
Bypass
Δp
OK



Subcritical

4×2×2 4×2×2 + 4×1×1

IC-3 = 9×10^-11
IC-4 = 3.3×10^-11

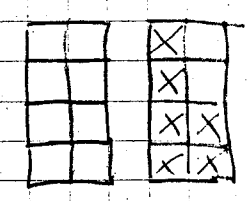
EXP # 284

1257 Start assembly of 38 Unit Array

Top View of

Pos Period 0.295
Start To Level
116 Level 0.360

Red Lite
Δp = 0.14
Bypass
Source



3rd layer has 6 units

1.053
.136
00641
000918
.065 = .0141/in + .25

13.6¢ / .066 = 206.

4×4×2 + 6 units on 3rd layer on South Table

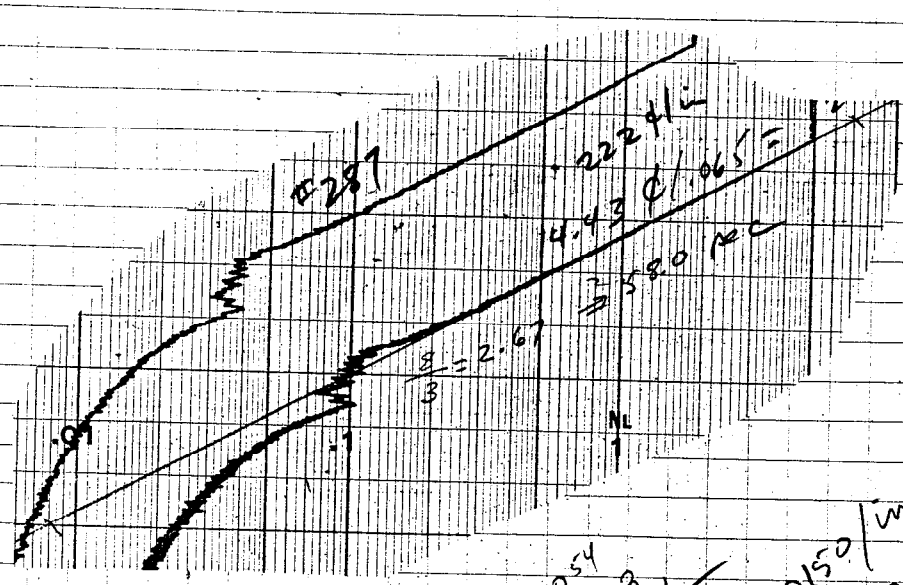
.36 − .11 = .25

Estimate of excess Reactivity

k_{eff} = 1.0035

is .25 in × 200¢/in = 50¢ 38 unit Array

64 units 8 inches × 200 = $16
× .007 = 0.10
∴ $k_{eff} \approx 1.10$



1.054
.1443
.0641
000975
.065 = .0150/in.
x 2.29 in
.034

218
.015
1090
218
.0327

64 unit Array in 1/4 Steel Boxes with 1" Plexiglass divides

Core reflector box size includes 1/2" of Plastic of Cells
25 3/4 x 25 3/4 x 33 1/8" (1/8" oversize

EXP # 285

3" spacers on top of Steel Boxes - Same plastic used as in previous series

4 1/2 + 3 = 7 1/2" x4 = 34 in -1 = 33 in.

+ 1" Plastic = 8 1/2" nominal height of Cell!

Note: Omitted 3" spacer on top of 3rd layer South Table

Instrument Check on 17 apr 72 Source 10 mc ^{60}Co

950 V PM-1 Bal 465 Low Trip OK Trip OK

IC-1 3×10^{-10} Meter Trip Scram Tables Fast Trip OK

IC-2 Out for Repair Meter Trip

IC-3 2×10^{-9} Calibration DWM

IC-4 2×10^{-9} Calibration DWM

Source Resp OK

$\Delta p = 0.14$ OK

Bypass OK

Red Lite & Pers Ck OK

10 15 Start Assembly

10 23 On Pos Period Rev = 27.3 → 2.75 in.

26 Start to Level

Rev = 27.8 → 2.80

Note: Omitted 3" spacers on top of 3rd layer south Table.

EXP # 286

Restack 4th layer South Table

Core 26 3/4 x 26 3/4 x 33 1/8 -"

Cell 6 11/16 x 6 11/16 x 8 1/2 +

11 04 Start Assembly

14 On Positive Period Rev = 24.3 2.14 5

Start to Level ~ 24.7

Level 24.70 + → 2.18 in separation

apr 25
Meas Separ for 24.7
2 19/64 forw
2 9/32 rev dir.
av 2.289 in.

Rev [illegible] N-S 1" X 5 5/8 x 12 1/8 [illegible] divides 5.81 in

EXP # 287

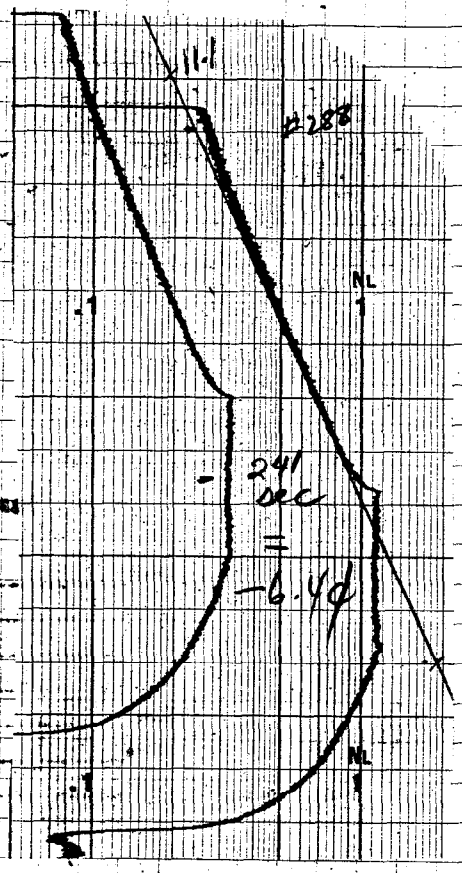
11 28

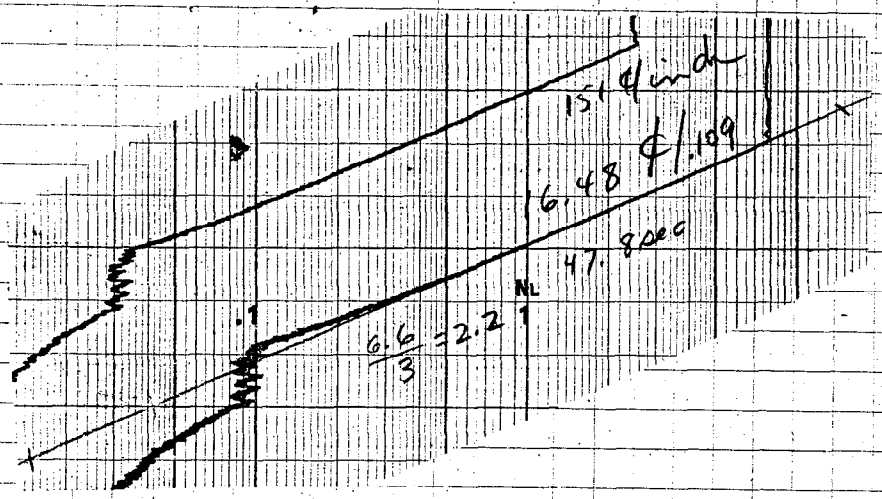
11 37 On Pos Period 0.861 Indicator -.11 = .75

40 Start to level

level 0.926

14.43 / .065 = 222 ¢/in ch


11.1
#288
NL
1
.1
241 sec
=
-6.4¢
NL
1
.1


151 ¢/inch
16.48 ¢/.109
47.8 sec
NL
1
.1
6.6/3 = 2.2

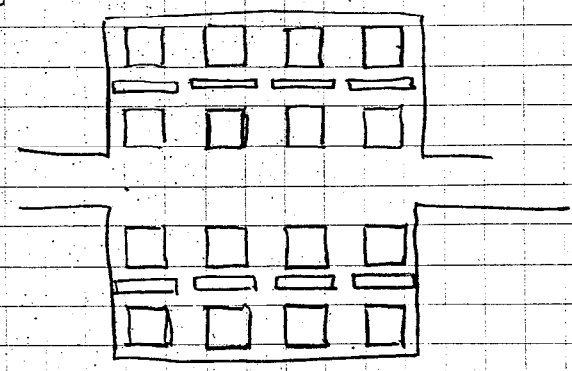
EXP #288

Removed Plastic at Plane of separation. 16 ea 5 5/8 x 5 5/8 only 32 ea 5 5/8 x 5 5/8 remain

2 22 Start Assembly
Tables Closed — near Crit
2 30 Source Inserted to Raise Power $\Delta\rho = 0.14$ } OK
+ Indicator = 0.111 Bypass

2 33 Start to remove source
2 35 Remove Source for Neg Period

2 41 Shut Down

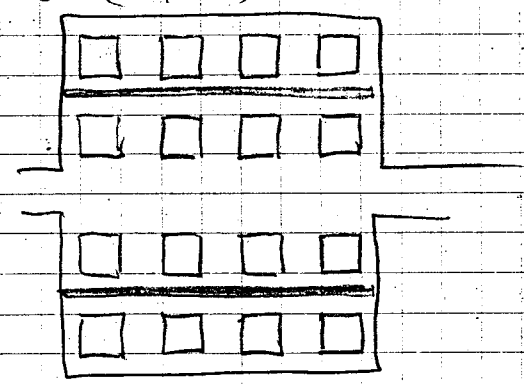


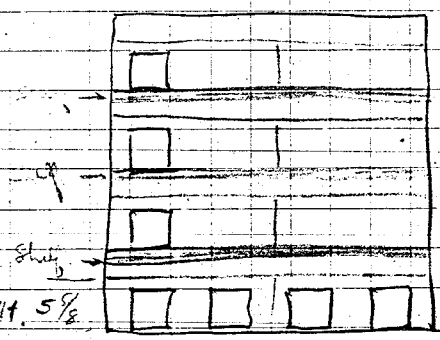
EXP #289

Replace 32 ea 5 5/8 x 5 5/8 by
8 ea 5 5/8 x 12 3/8 } so that plastic is
8 ea 5 5/8 x 13 3/8 } continuous across the array.

Equivalent of adding 1" x 1" x 5 5/8" (24 ea)

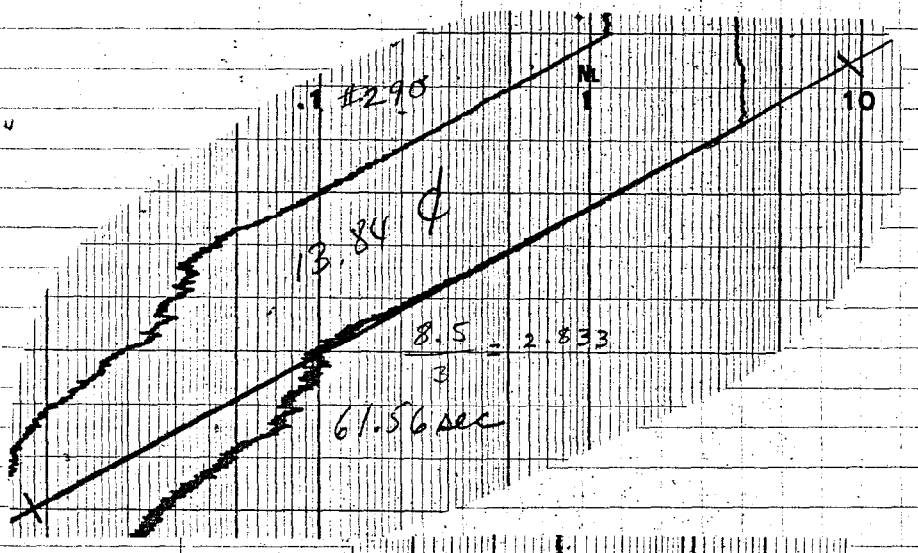
2 04 Start Assembly
2 12 On POS Period Ind = 0.110
Start To Level
2 21 Level 0.219
Shut Down 0.109

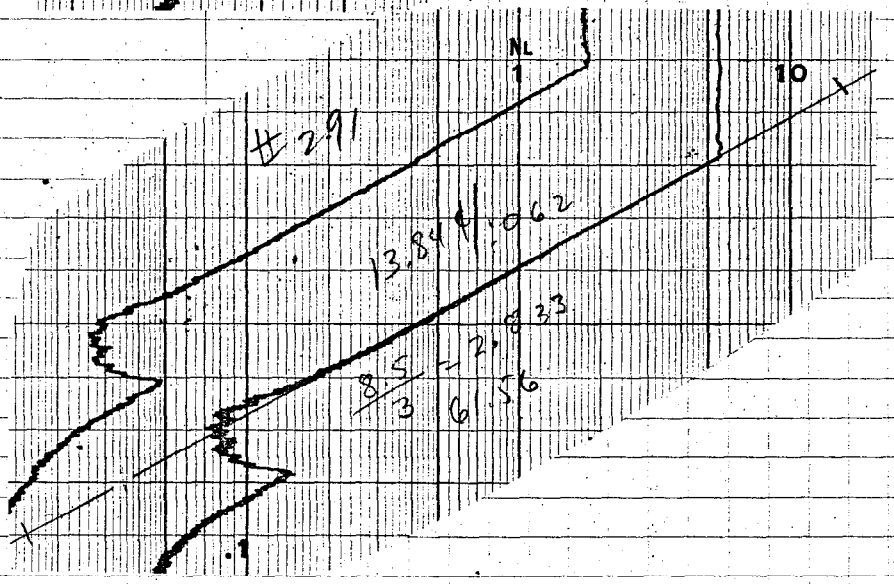


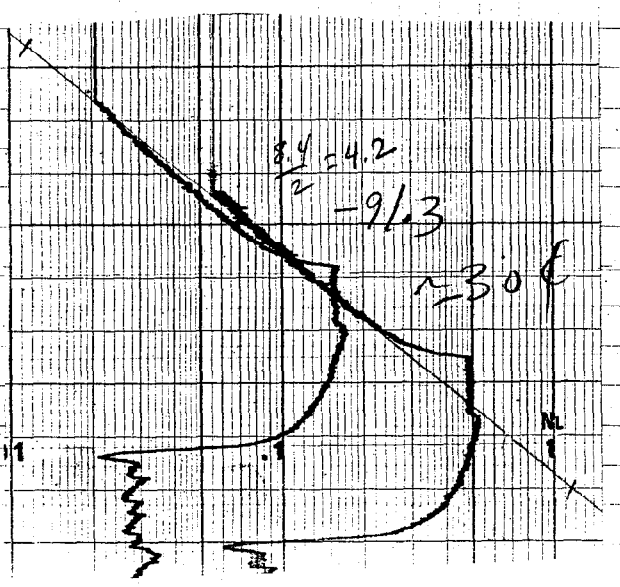


Plastic Ht. 5 5/8

Cell size nominally 6 11/16 x 6 11/16 x 8 1/2 +
Core 25 3/4 x 25 3/4 x


.1
#290
NL
1
10
13.84 ¢
8.5/3 = 2.833
61.56 sec


NL
1
10
#291
13.84 ¢ 1.062
8.5/3 = 2.833
61.56
.1


8.4/2 = 4.2
-9.3
~30 ¢
1
.1
NL
1

19 Apr 72 . 10 mc 60 CO

PM-1 Baldwin 4.65 Low Trip OK Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip Sam... Table

IC-2 Meter Trip Out for Repair MONITRON

IC-3 42×10^{-9} Calibration Dwtn A OK

IC-4 2×10^{-9} Calibration Dwtn B OK

Source Resp. OK C OK

Red Lit OK

Bypass OK

Δp - 2/4 OK

EXP # 290

4x4x4 Array with Steel Boxes + 1" Plastic 5 5/8 in high 2DIM

1" " Shelf

Core 26 3/4 x 26 3/4 x 37 1/8

(Poly Box Cavity 25 3/4 x 25 3/4 x 36 1/8 Measured)

Core includes ½" Plastic on Cavity walls!

Nominal Cell size =

6 11/16 x 6 11/16 x 9 1/4

37 in

8 36 Start Assembly

8 44 On Pos Period Ind 1.189

Start to Level

9 05 Level 1.242 - .11 = 1.132 in gap

Shut Down 13.84 / .053 = 261 ¢/inch

3% error 1.10 in → 2.8 cm or ± 1.4 cm Void Box

Remove 12 ea 1" x 5 5/8 x 13 3/8 on South Table

EXP # 291

9 20 Start Assembly

9 28 On Pos Period Ind = 0.454

31 1/2 Start to Level

Level Ind = 0.516 13.84 ¢ / .062 = 223 ¢/in

0.11

.406 in gap

Remove 6 ea 1" x 5 5/8 x 12 3/8 on North Table

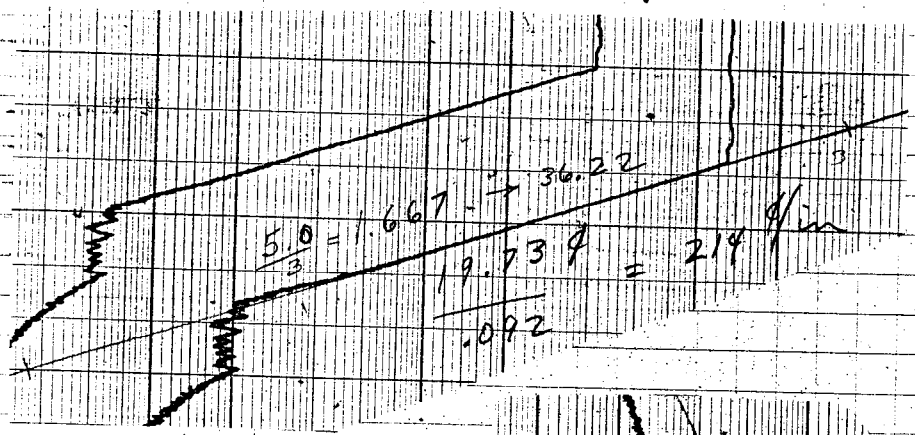
EXP # 292 on layers 4 & 3.

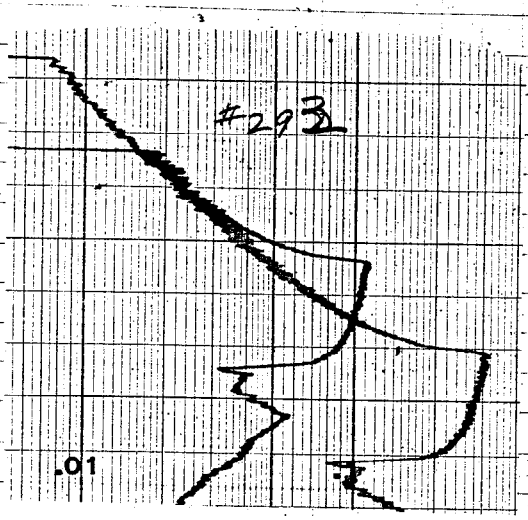
9 56 Start Assembly

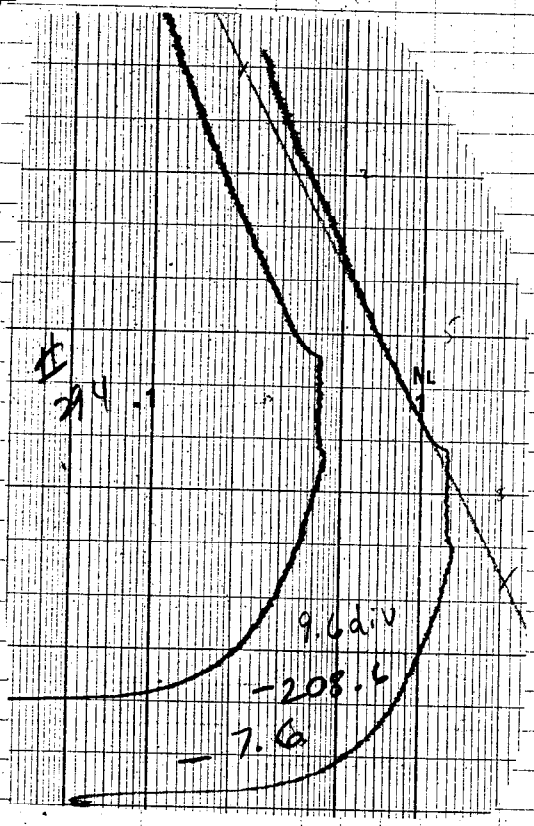
10 04 Subcritical Source Inserted to Raise Power 0.109 = Ind Zero

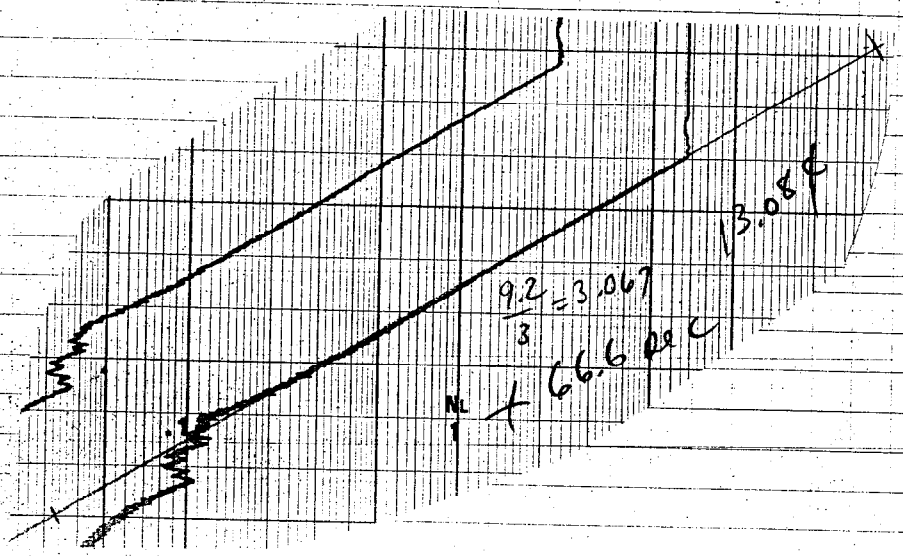
10 06 Start to Remove Source slowly

07 On Neg Period.


5.0/3 = 1.667
36.22
19.73 g
.092
= 214 g/in


#293
.01


#294
.1
NL
9.6 div
-208.6
-7.6


13.08
9.2/3 = 3.067
66.6 sec
NL

Add 3 ea to 3rd layer North Table
now 9 ea 1" x 5 5/8 x 12 3/8 remain
EXP # 292

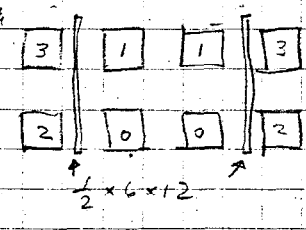
.25 Start Assembly
.33 1/2 Pos. Period 0.217
10:35 1/2 Start to Level
4 Level 0.309 > 19.73 ¢/.092 = 214 ¢/in

EXP # 293
1.56 Start Assembly 1 & 2nd layers Plastic 2 Dim
1.04 1/2 Sub critical Insert Source 3rd layer " 2 Dim
Power to 3x10^-9 w. source only on South
.06 Neg Period 4 ea 1/2 4x6 instead of 1" x 5 5/8 x 5 5/8
Ind = 0.11 at Plane of Sym
4 th layer no plastic
~ 0.625 of The Plastic

Add [2 ea 1/2 x 6 x 12 Plexiglas] on 2nd shelf side cells
EXP # 294

.20 Start Assembly
Near Critical Ind = 0.111
Insert Source to Pause
Remove Source Neg Period

Cells layer 1 1/2 Plastic 4 sides
layers 2 " "
layer 3 South " "
layer 3 North

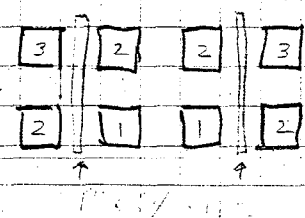


Cells layer 4 1/2 Plastic on outside edge only

Changed 3rd Layer North Table
EXP # 295

1.00 Start Assembly
On Pos Period Ind = 0.111
1.14 Start to Level
Level 0.206

Source
Red
Op:
Bypass
OK



13.08 / .095 = 138 ¢ Note numbers in boxes

10:35½ Start to Level
4 Level 0.309 > 19.73¢/.092 = 214 ¢/in

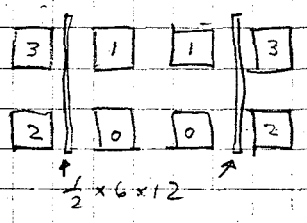
EXP # 293

1056 Start Assembly — 1 & 2nd layers Plastic 2 Dim
1104½ Sub Critical Insert Source — 3rd layer " 2 Dim
Power to 3×10^{-9} w. source — only on South
06 Neg Period — 4 ea ½ 4×6 instead of 1" × 5⅝ × 5⅝
Ind = 0.11 — at Plane of Sepn
4 th layer no plastic
~ 0.625 of The Plastic

Add [2 ea ½ × 6 × 12 Plexiglas] on 2nd shelf side cells
Exp #294

1120 Start Assembly
Near Critical Ind = 0.111
Insert Source [illegible]
[illegible] Source Neg Period

Cells layer 1 ½ Plastic 4 sides
layer 2 " "
layer 3 South " "
layer 3 North

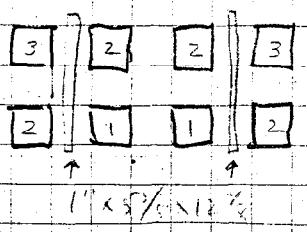


Cells layer 4 ½ Plastic on outside edge only

Changed 3rd Layer North Table
EXP # 295

100 Start Assembly
On Pos Period Ind = 0.111
114 Start to Level
Level 0.206

Source
Red
Op:
Bypass
OK



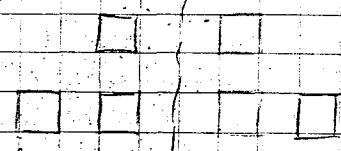
13.08 / .095 = 138 ¢/inch

Note numbers in boxes indicate plastic on x sides of cell.

Bottom of
PG 271 88.

Bare Arrays

4 x 4 x 4 Array Spacing, cell 0.875 in



April 20 1972
Stacked + 4 ea units [illegible] table & aligned gap
Stacked 12 ea units [illegible] table & checked alignment

No external Source!

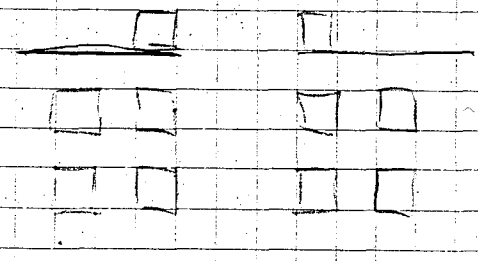
		Multiplication		
	IC-1	2	3	4
12 ea (1 Table)	$.02 \times 3 \times 10^{-11}$	x	1.8×10^{-12}	9.5×10^{-13}
Int. 0.108 24 ea (2 Tables)	$.02 \times 3 \times 10^{-11}$		2.0×10^{-12}	1.2×10^{-12}

Above readings include Bk. from EAST Cell

24 ea (2 Tables Closed)	$.01 \times 3 \times 10^{-11}$	6.0×10^{-13}	4.6×10^{-13}
12 ea (1 table)	.01	6.0	4.6

No Change on Separation

[illegible] Table



Alum shelf used to give Stability

875
32
0.907 gap at midplane

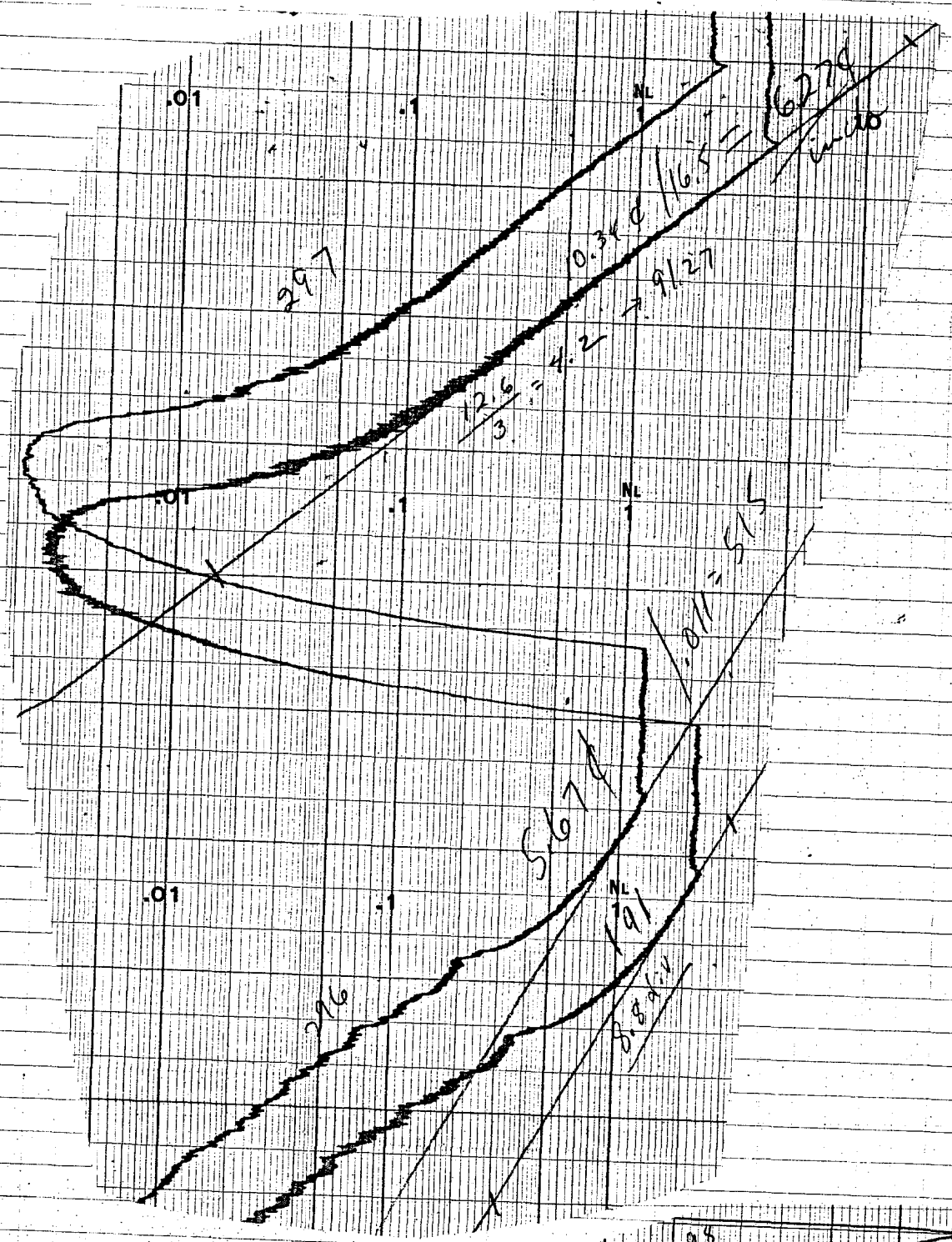
April 21, 1972
Assemble 40 ea units
No Mult without Source
Add Pu Be 6

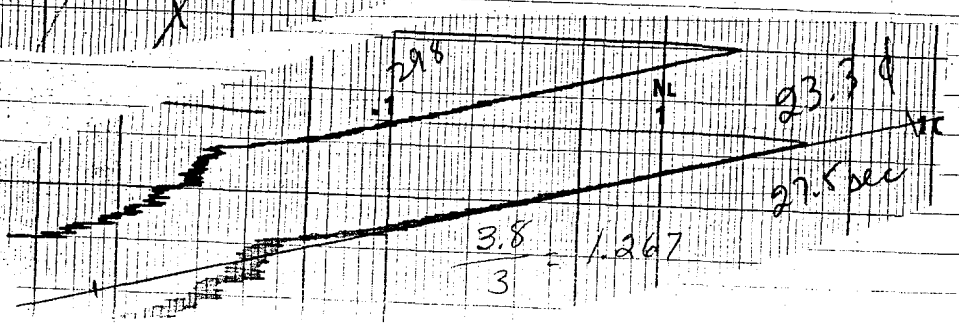
	1	3	4
40	$.045 \times 3 \times 10^{-11}$	7.5×10^{-12}	3.8×10^{-12}

Separate Tables

.025	3.0	1.6×10^{-12}

Indicating a Multiplication of 2.5
Table Closed = 0.111


.01
.1
NL
1
297
10.34 ¢ / 16.5 = 6.27 ¢ / inch
12.6 / 3 = 4.2 → 9.27
.011 = 5.15
5.67 ¢
191
8.8 div
296


298
.1
NL
1
23.3 ¢
27.5 sec
3.8 / 3 = 1.267

Instrument Check on Apr 21, 72 Source 10 mc Co

PM-1 _____ Low Trip Scr[illegible] Trip OK

IC-1 [illegible] Meter Trip OK Fast Trip OK

IC-2 [illegible] Meter Trip [illegible]

IC-3 _____ Calibration [illegible] A OK

IC-4 _____ Calibration [illegible] B OK

C OK Set to 30 R

[illegible] Source Placed Manually below 4x4x4 array on 1/8" Al Plate

[illegible]

Δp 0.14 AC

Red Lite OK

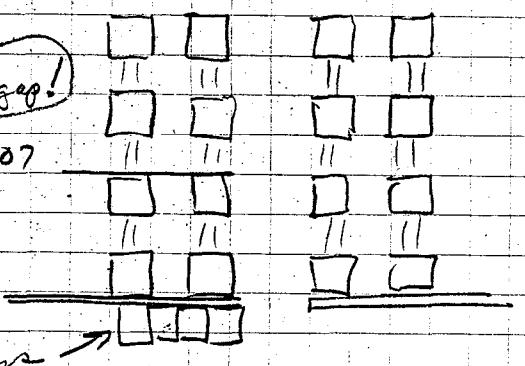
EXP # 296

4 x 4 x 4 Bare Array

32 units on each half

0.875 spacer

Note: No gap at Midplane ∴ Table sepn = gap!



1 49 Start Assembly

2 00 On + Period 1.384 0.907

− .111

1.273 in gap

Very Poor Period Table Sepn. 5.67¢ / .011 1/8" Al

2 03 Start to level

IC-3 = 2.2 x 10^-9

IC-4 = 1.4 x 10^-9 = 515

Level 1.395

5 Rows

Al Boxes on Tables

Screw Only to Shut Down Remove Source

EXP # 297 Repeat with only Internal source.

2 11 On Pos Period Id = 1.374

2 16 1/2 Start to level. > 10.34 ¢

Level 1.390 5 − .1 = 1.28

.57

.40

10.34 / .0165 = 627¢ inch

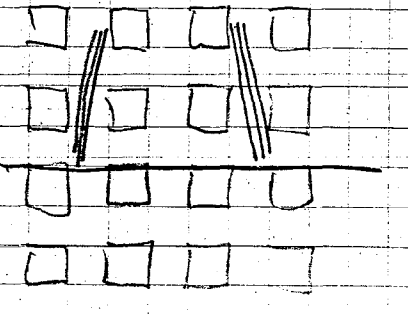
254 ¢ excess

EXP # 298

Added 12 pc Stainless

at 4 equal 1 pc .066 x 2 1/2 x 9

locations 2 pc .074 x 2 7/8 x 9

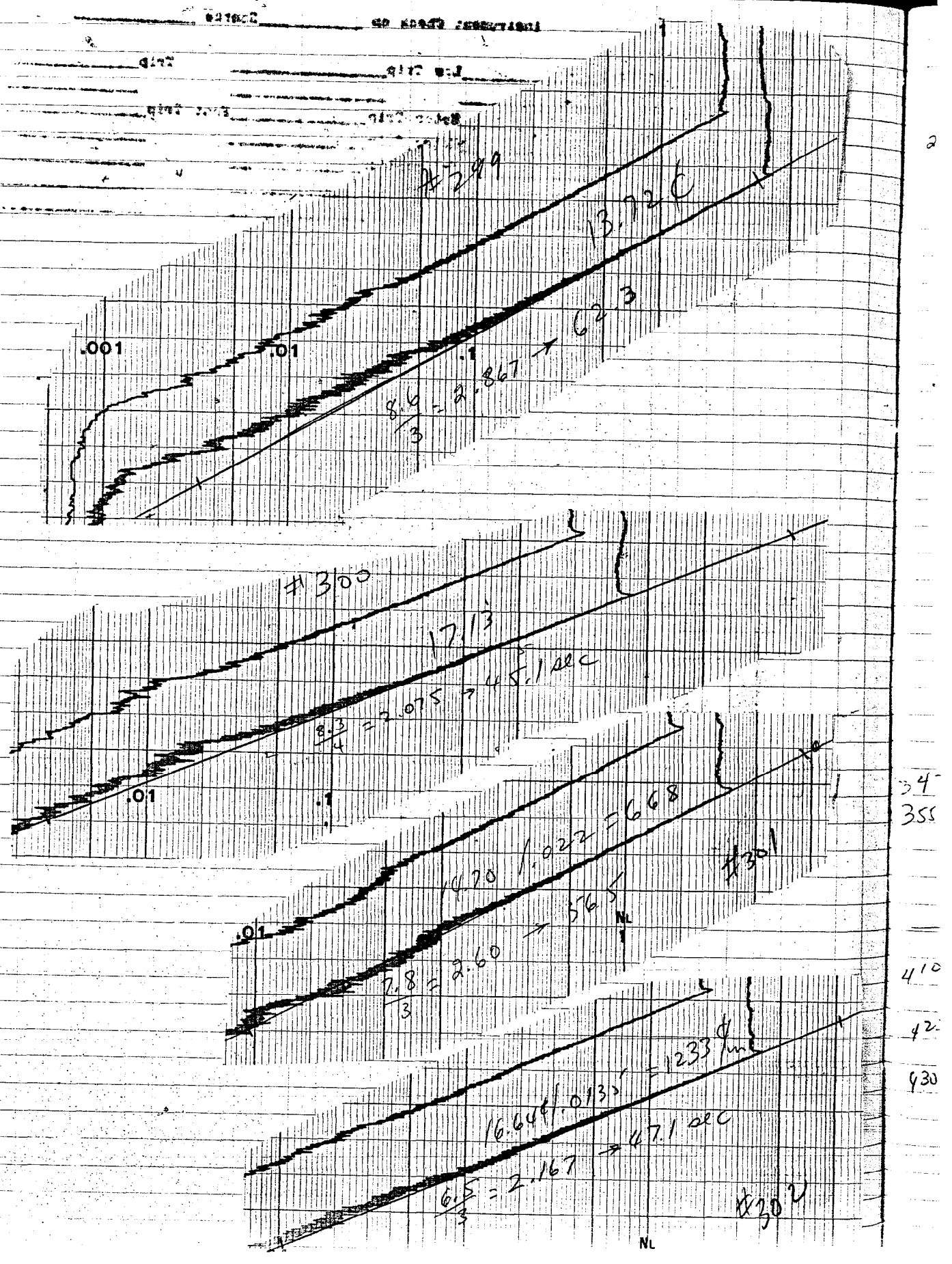


2 28 Start Assembly

2 36 On Pos Period 1.378 → 23.3 ¢

2 38 Shut Down

Steel Added reactivity!


#299
13.72 ¢
.001
.01
.1
8.6/3 = 2.867 → 62.3
#300
17.13
8.3/4 = 2.075 → 45.1 sec
.01
.1
14.70 / .022 = 668
#301
.01
NL
7.8/3 = 2.60 → 56.5
16.64¢ / .0135 = 1233 ¢/m
6.5/3 = 2.167 → 47.1 sec
#302
NL
2
34
355
410
42
430

#299

Remove 2 corner Blocks Top Row North Table

62 unit Array

(64 − 2) Array

2 46 Start Assembly

2 On Pos Period Ind 1.245

2 59 Start to level

Level 1.2635

$\frac{13.72}{.0185} = 742¢/in$

Top View

Top Layer

North Table

#300

Remove 4 blocks Top Row South Table

58 Unit Array

3 16 PM Start Assembly

On pos Period 0.880

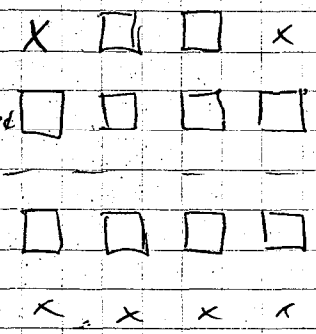
Start to level

0.902

.111

.791

$\frac{17.13}{.022} = 778¢/in$



#301

60 Unit Array 4 removed from South Table

28 remain

32 unit on North Table

3 47 Start Assembly

3 55½ On Pos Period ~~1.010~~ − 1.009

Start to level

Level 1.031

.111

$\frac{14.7}{.022} = 668¢/inch$

2¢ ~ 3 Mils

0.920 in sep at Midplane

$\frac{825}{.045 \times 668} = 30¢$

#302

4 10 Start Assembly add 1/8 Al + 4 Row of Boxes on North Half

On Pos Period 1.0545 60 Unit Array

4 23½ Start to level

level 1.068

4 30 Shutdown

.111

.157 in sep

$\frac{16.64¢}{.0135} = 1233¢/in$

Δ = .037

× 2 = .074

.111 #301 = 0.846

.111 #302 = 1.206

+ Per #301 1.009

+ Per #302 1.0545

.0455

.003

.0485

worth of Refl

North Table

300

Remove 4 blocks Top Row South Table

58 Unit Array

3[16] PM Start Assembly

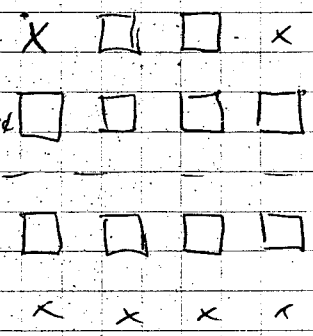
On pos Period 0.880

Start to level

0.902 > $\frac{17.13}{.022}$ = 778¢/in

.111

0.791



301

60 Unit Array 4 removed from South Table

28 remain

32 unit on North Table

47 Start Assembly

355½ On Pos Period ~~1.010~~ 1.009

Start to level

Level 1.031 > $\frac{14.7}{.022}$ = 668¢/inch 2¢ ~ 3 Mils

.111

0.920 in sep. at Midplane

875

.045 x 668 = 30¢

302

4[10] Start Assembly add 1/8 Al + 4 Row of Boxes on North Half

On Pos Period 1.0545 60 Unit Array

423½ Start to level

level 1.068 > $\frac{16.64¢}{.0135}$ = 1233¢/in

430 Shutdown

.111

.957 in sep.

Δ = .037

x 2 = .074

Corrected #301 = 0.846

Corrected #297 = 1.206

+ Per #301 1.009

+ Per #302 1.0545

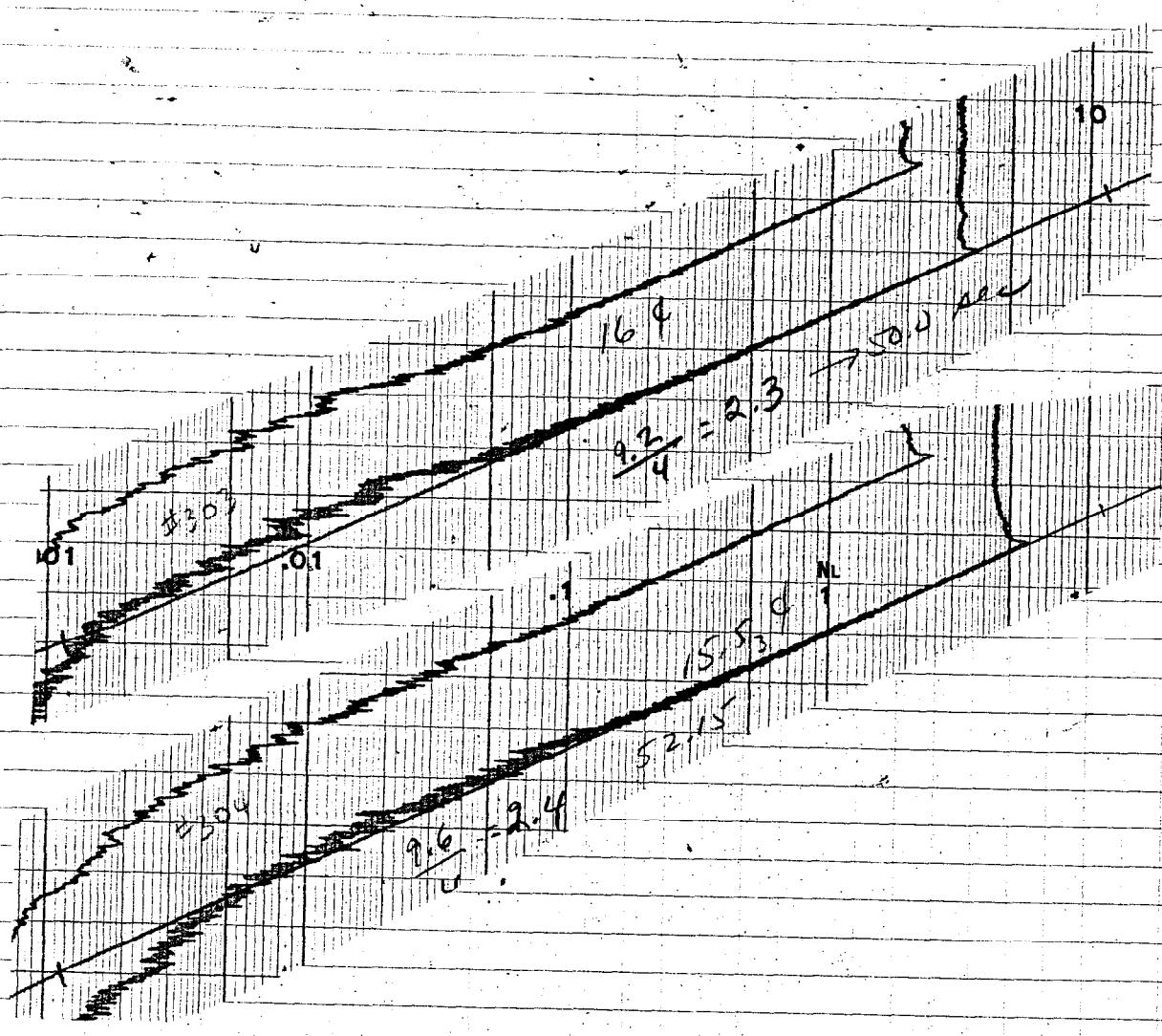
.0455

.003

.0485

worth of Refl

Bottom of PS279 SJ


10
16 ¢
9.2/4 = 2.3
50.0 sec
#303
.01
.01
.1
NL
1
15.5 ¢
52.15
#304
9.6/4 = 2.4

Instrument Check on 24 Apr 72 Source 10 mc ^{60}Co

950 V PM-1 Bal 4.75 Low Trip OK Trip Seran Tables

IC-1 Meter Trip OK Fast Trip OK

IC-2 Out for Rep Meter Trip

IC-3 4x10-10 Calibration Dwon A OK

IC-4 3x10-10 Calibration Dwon B OK

C OK

EXP #303

4x4x4 Bare Array

EW Spacing (.875 + .0625)

No ext. Source! NS " (" ")

Bypass OK Vert Spacing .875, .875 + .032, .875

Δp 0.14 OK

Red Lite OK Unit stacked with out gaps at midplane

Separation of Tables indicate separation of Mid Plane gap between units

11^16 Start Assembly

11^27 On Pos. Period Ind = 1.162

30 Start to Level

Level 1.178 > 16.0¢ / .016 = $10

.111

Gap 1.067 inches

.938

0.129

Table Reflection .074

0.055 x ~$10/in = 0.55¢ excess

EXP #304 Add Mockup of Reflector on North Table.

12^54½ Start assembly — No Ext Source. Red lite OK Δp OK Bypass OK

12^07 On Pos Period Ind = 1.226

Start to level

Level 1.261 > 15.53 / .035 = $4.44

Start Down 1.178 Reflector width .083 in x2 = .166

Check on table motion!

For + period #303 1.162

+ " #304 1.226

Δ = 0.064

ERR CC / Cmm

Table [illegible] needed to [illegible] Table [illegible] Indicator was [illegible] properly or [illegible] Table was [illegible] [illegible]. See Table files for details.

1. [illegible] direction of screw, table position does not [illegible] immediately, [illegible] is ~ 12 mils in calibration curve.

2. Found calibration off ~ 3%.

3. Reset [illegible] 0.100

4. Reset calibration at 1" with dial indicators on East [illegible] [illegible]
+/.002 +/.0025 Reads 1.100

5. Separate tables
[illegible] reads 2.016 in fully extended.

There is an apparent error in the reactivity/inch or sensitivity in EXP # 303 and the difference in Table pos for the worth of the reflector mockup ρ(304) − ρ(303) does not agree with the previous measurements, ρ(302) − ρ(301)

Note

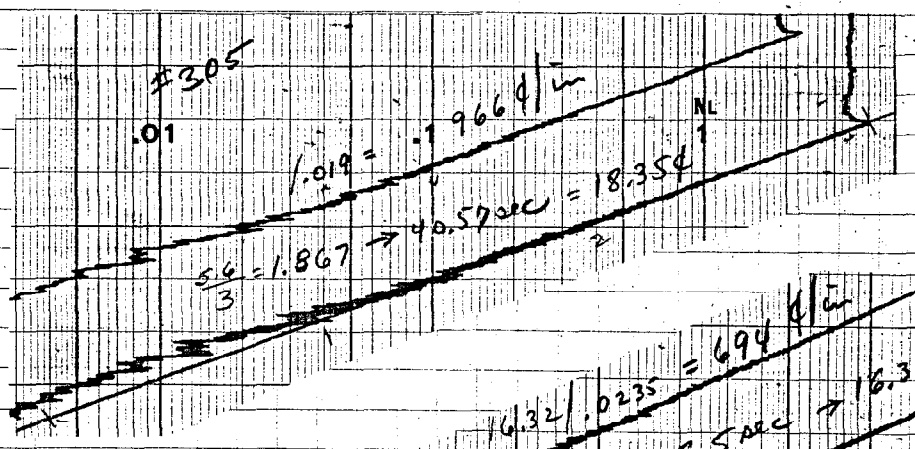
Discovered average meas of spacer was ~.850 !
some dim as small as .840

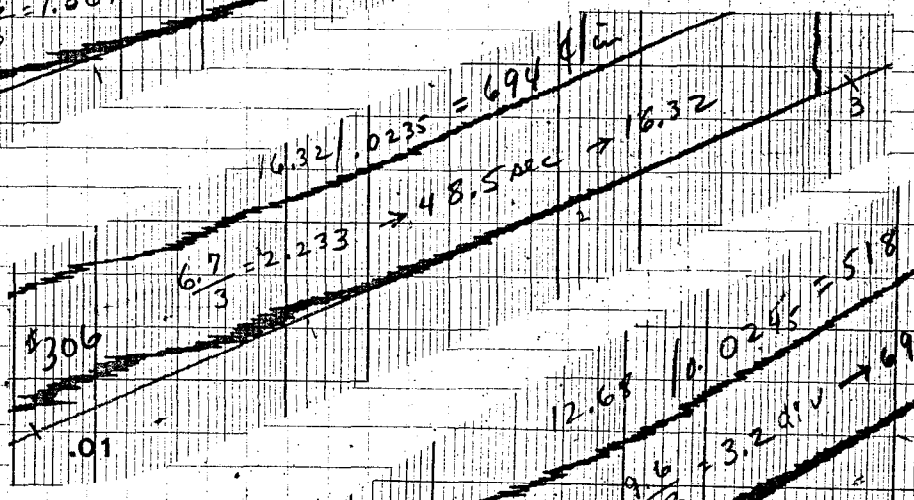
Re aligned units on movable table (North) set spaces between units at 0.890 which is very closed to what was found on tables.

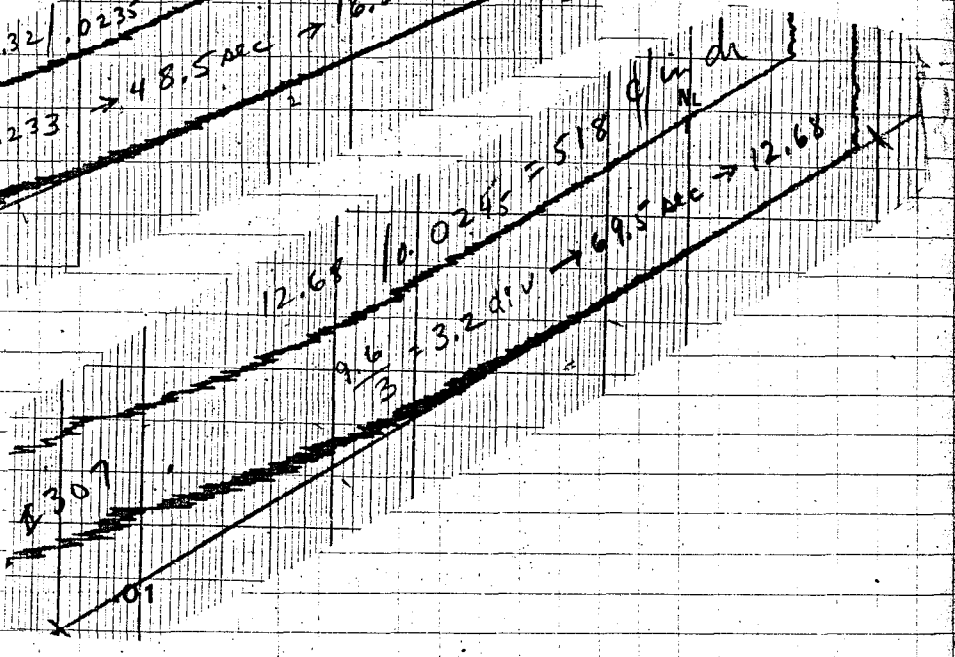
Vertical space will be set with 850 + 032 = .882

Instrument Check on 25 Apr 72 Source 10 mc ^{60}Co

PM-1		Low Trip	OK	Trip	OK Scram
IC-1	3×10^{-10}	Meter Trip	OK	Fast Trip	OK
IC-2	Out for Rep	Meter Trip			
IC-3	3×10^{-10}	Calibration	Down	A	OK
IC-4	3×10^{-10}	Calibration	Down	B	OK
				C	OK


#305
.01
NL
1
1.019 = .1966 d/in
5.6/3 = 1.867 → 40.5 sec = 18.354
2


16.32 / .0235 = 694 d/in
6.7/3 = 2.233 → 48.5 sec → 16.32
3
#306
.01


12.68 / .0245 = 518 d/in
NL
9.6/3 = 3.2 div → 69.5 sec → 12.68
#307
.01

EXP # 305

4 x 4 x 4 Bare Array

4 x 4 x 1 aligned, Table gap = 0° zero = 0.100
4 x 4 x 2 " " " " = 0.106
4 x 4 x 3 " " " " = 0.110

EW Spacer .890, 890, 890
NS Spacer .890 on each Table
Vert Spacer .850 + .032 = .882
.850 + .032 = .882
.850 + .032 = .882

146 Start Assembly No EXT Source!
156 On Pos Period Ind = 1.132⁻ 18.35¢ Bypass OK
555 Start to level 40.57 Red Lite OK
Level 1.151⁻ Δp = 0.14 OK

18.35 / 0.019 = 966 ¢/in gap = 1.04 inches

890
882
882
.885
3.75
4.635
11.773
5.887

EXP # 306

4x4x4 Bare Array with Mock up of Reflector — 1/8 Alum + 4 Rows Boxes only on North half.

113 Start assembly
223⁺ On Pos Period Ind = 1.1835
226 Start to level
Level 1.2070 − 1.151 = .056 worth of ½ Reflector

16.32 / 0.0235 = 694 ¢/in. .112

∴ 1.04 − .11 = 0.93 inches on gap

Add Shelf equiv in Vert plane on South, Remove Top Reflector Mockup

EXP # 307

250 Start Assembly
301 On Pos Period @ 1.150⁺ Note — this period is the worth of the Alum Shelf on South.
Start to level
320 Level 1.175
Shut Down 12.7 / 24.5 = 518 12.7 ¢

x2 = 25.4 ¢ / 507 ¢/in = .050

1.15 − .11 − .11 − .04 = .89 (zero, Ref)
Within the precision of Meas.
the array gap = EW, NS spacing

25.4 ¢ / 966 = .026

N S Spacer .890 on each Table
Vert Spacer .850 + .032 = .882
.850 + .032 = .882
.850 + .032 = .882

1 46 Start Assembly No Ext. Source!
1 56 On Pos Period Ind = 1.132⁻ 18.35¢ Bypass OK
5 55 Start to level 40.570 Red Lite OK
Level 1.151⁻ Δp = 0.14 OK

890
882
882
.885
3.75
4.635
11.773
5.887

18.35 / 0.019 = 966 ¢/in gap = 1.04 inches

EXP # 306

4 x 4 x 4 Bare Array with Mockup of Reflector — 1/8 Alum + 4 Rows Boxes only on North half.

1 13 Start assembly
2 23⁺ On Pos Period Ind = 1.1835
2 26 Start to level
Level 1.2070 − 1.151 = .056 worth of ½ Reflector

16.32 / 0.0235 = 694 ¢/in. 2/.112

∴ 1.04 − .11 = 0.93 inches on gap

Add Shelf equiv in Vert plane on South, Remove Top Reflector Mockup

EXP # 307

2 50 Start Assembly
3 01 On Pos Period @ 1.150⁺ Note — this period is the worth of the Alum Shelf on South.
start to level
3 20 Level 1.175
Shut Down 12.7 ¢

12.7 / 24.5 = 518

x2 = 25.4 ¢ / 507 ¢/in = .050

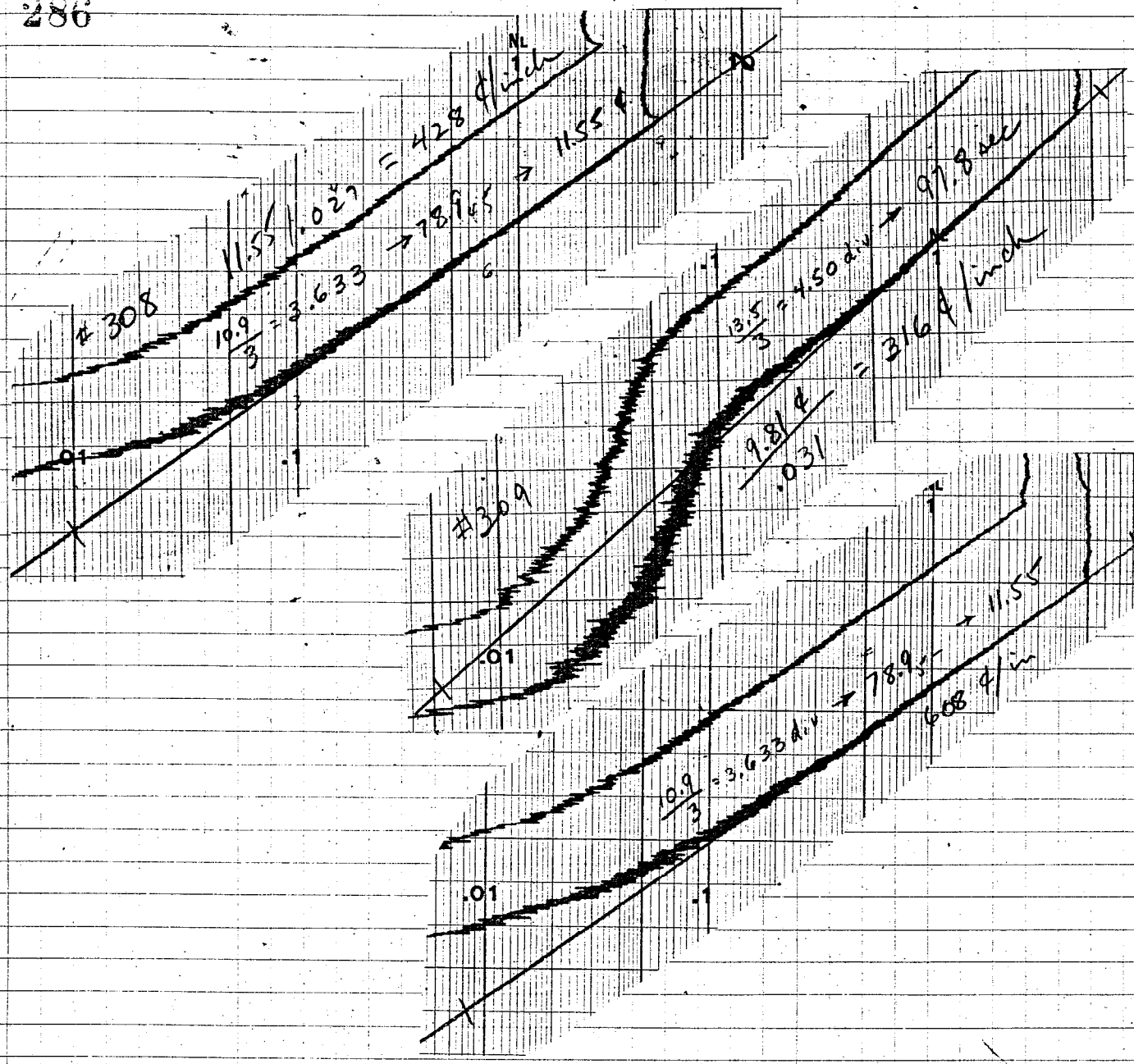
1.15 − .11 − .11 − .04 = .89 (3 00 Ref)
Within the precision of Meas.
the array gap = EW, NS spacing
at delayed crit, corrected for Refl & al.

25.4 ¢ / 966 = .026

Av = .038 in.

[redacted]

Bottom of pg 285
58



NL
1
10
#308
11.55 / .027 = 428 ¢/inch
10.9/3 = 3.633 → 78.945 → 11.55 ¢
.01
.1
#309
13.5/3 = 4.50 div → 97.8 sec
9.81 ¢/.031 = 316 ¢/inch
.01
.1
1
10
10.9/3 = 3.633 div → 78.95 → 11.55
608 ¢/in
.01
.1

EXP # 308

Repeat 307 for reproducibility check

3 50 Start Assembly

On Pos Period @ 1.150+ 11.55¢

Start - Level

418+ Level 1.177+ > .027 = .428 ¢/inch

Shut Down

Instrument Check on 26 Apr 72 Source 10 mc Co

Purpose Repeat of 307 and 308 after Table Check Out

950V FM-1 Bal 4.75 Low Trip OK Trip OK

IC-1 3x10⁻¹⁰ Meter Trip Scram Fast Trip OK

IC-2 Out for Repair Trip

IC-3 4x10⁻¹⁰ Calibration Down

IC-4 3x10⁻¹⁰ Calibration Down

MONITRON
A OK
B OK
C OK

309

No Source! Red lite — Δp — Bypass OK

905 Start Assembly

927 On Pos Period @ 1.150+ only slightly supercritical

933 On Pos Period @ 1.140+

Start To Level

945 Level 1.171 > 9.81¢/.031 = 316¢/in

EXP # 310

Repeat of # 306 with Mockup of Reflector on North

Remove Mockup of alum shelf on South

958 Start Assembly

1007 On Pos Period 1.184

1011 Start To Level

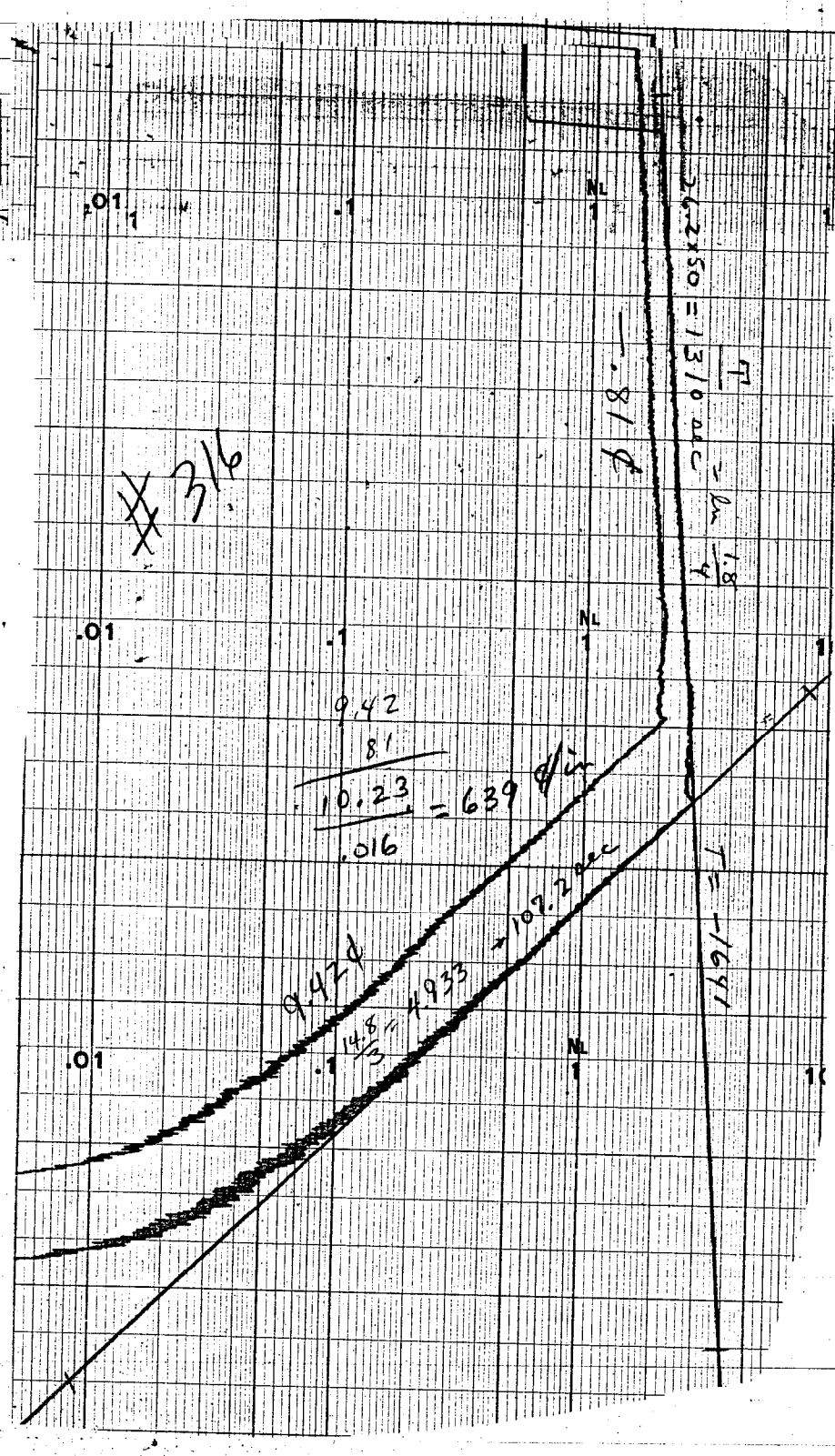
Level 1.203 > 11.55¢/.019 = 608¢/in

Note: Found Nut loose — Fastens Table To Gearbox.

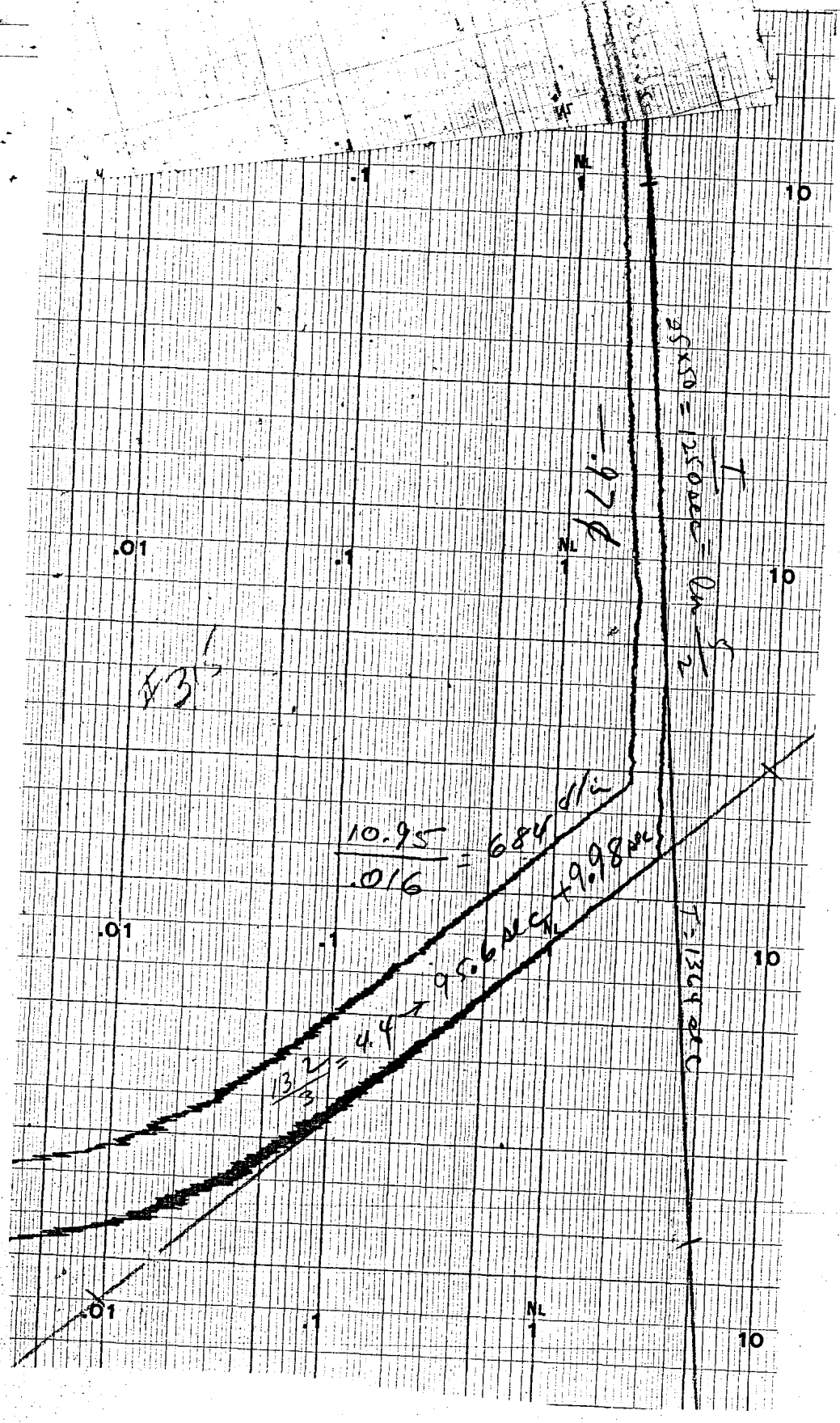
Tightened Nut!

CCDW

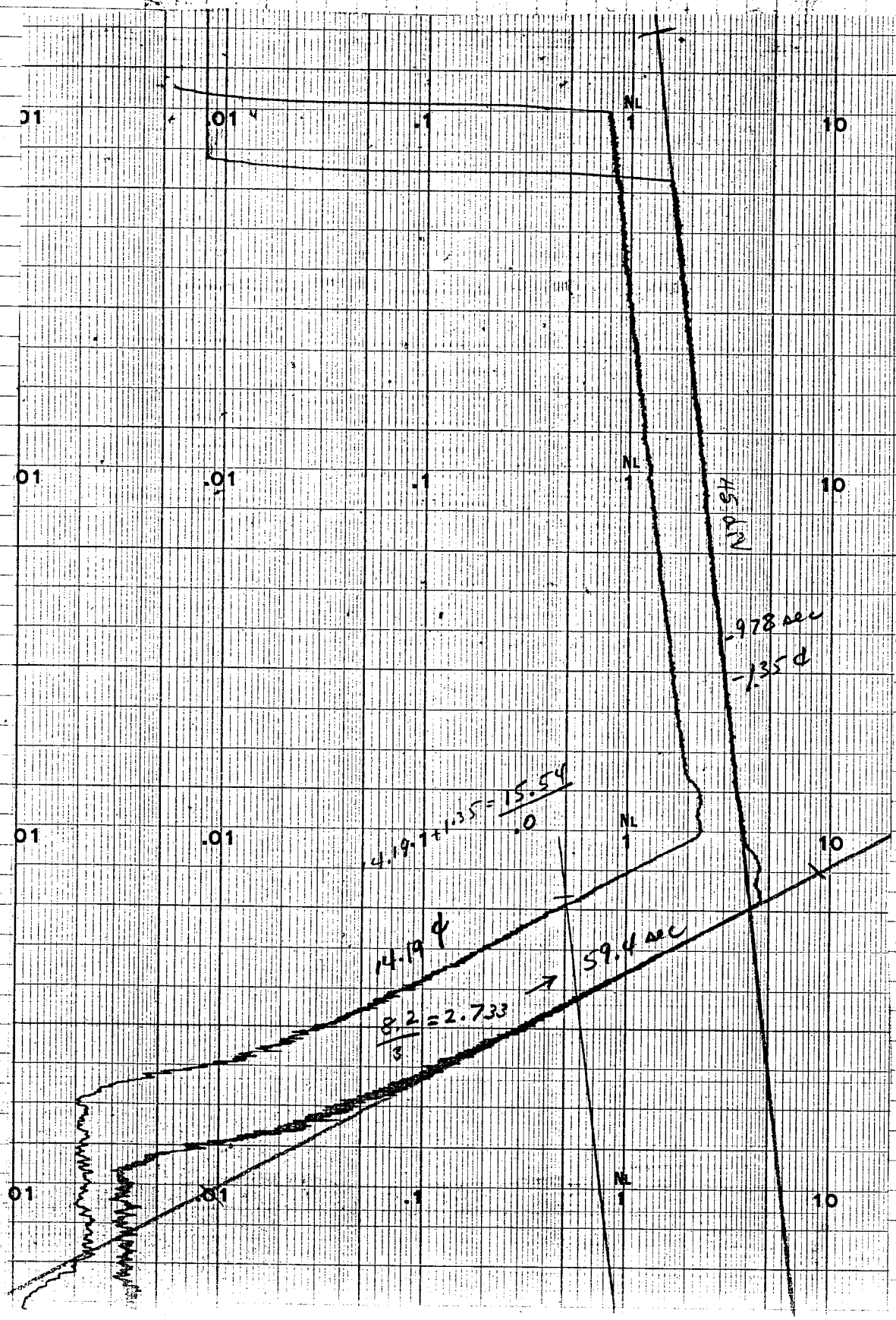
Checked Oil in Logan Regulator, operated table as low as 12 PSIG without stopping. At 10 PSIG, Table would not move in Reverse.

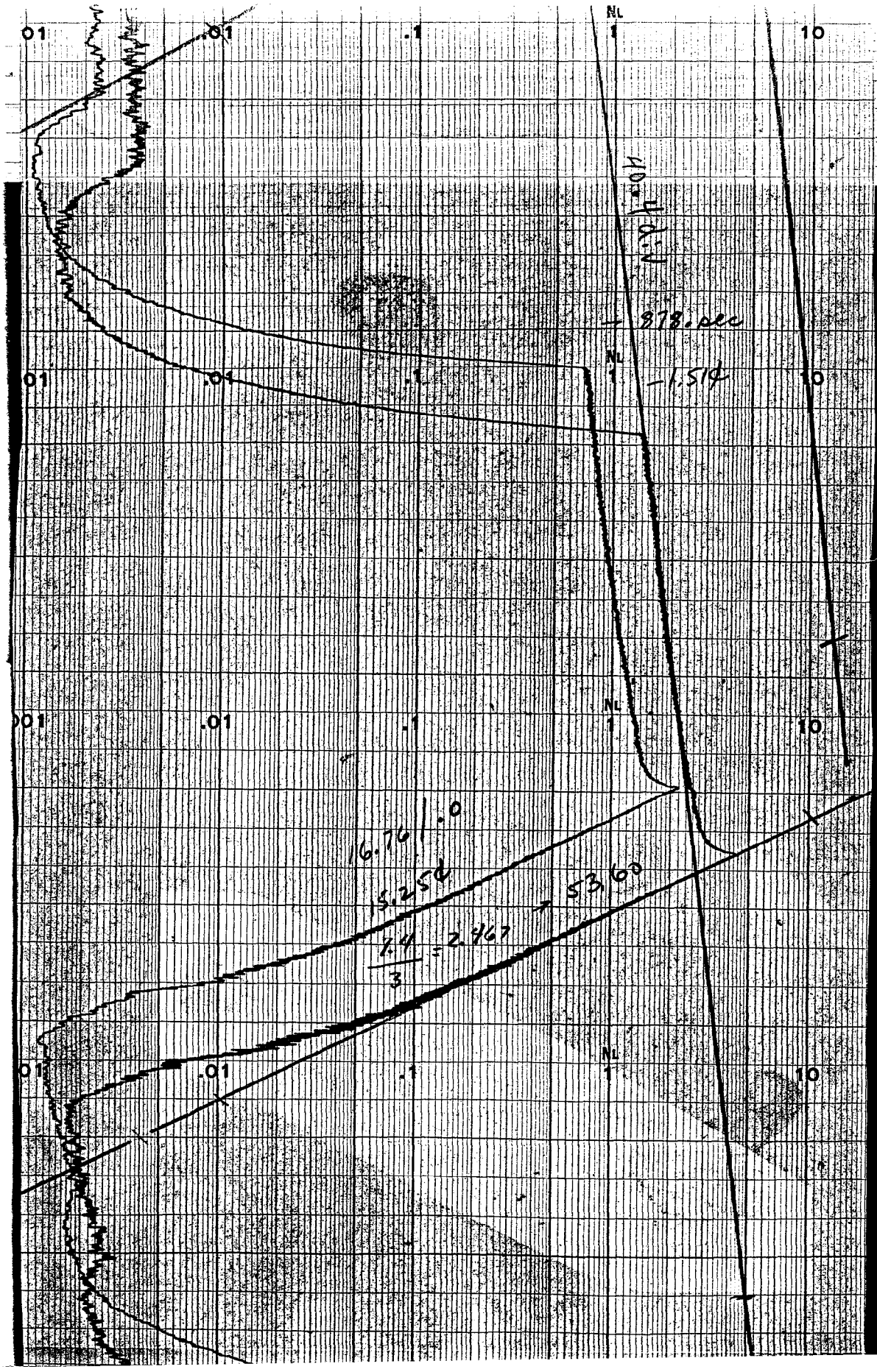


.01
.1
NL
1
26.2x50 = 1310 sec
T
= ln 1.8/4
-.81 ¢
#316
9.42
81
10.23
.016
= 639 ¢/in
9.42¢
14.8/3 = 4.933
107.2 sec
T = -1641

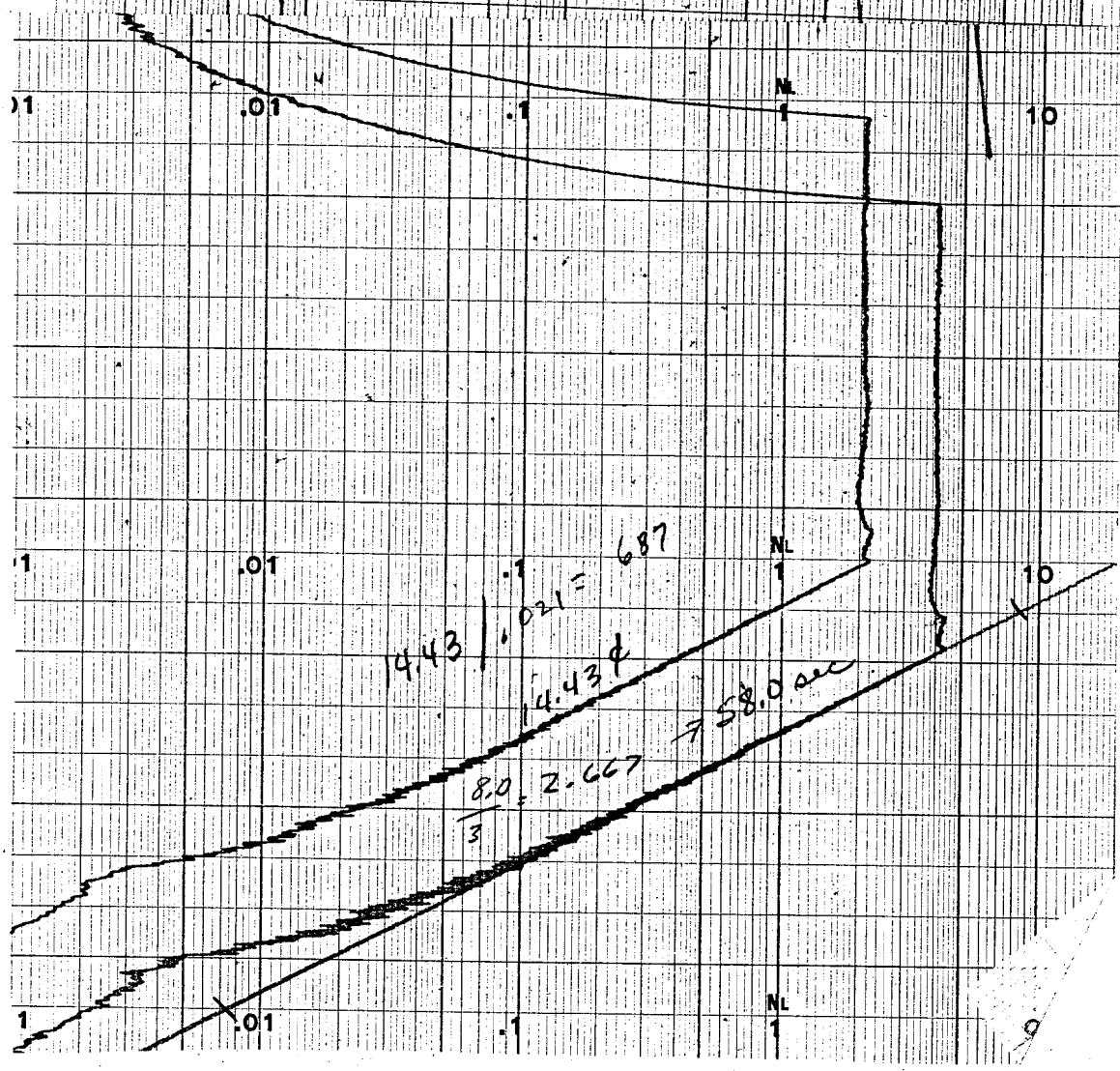


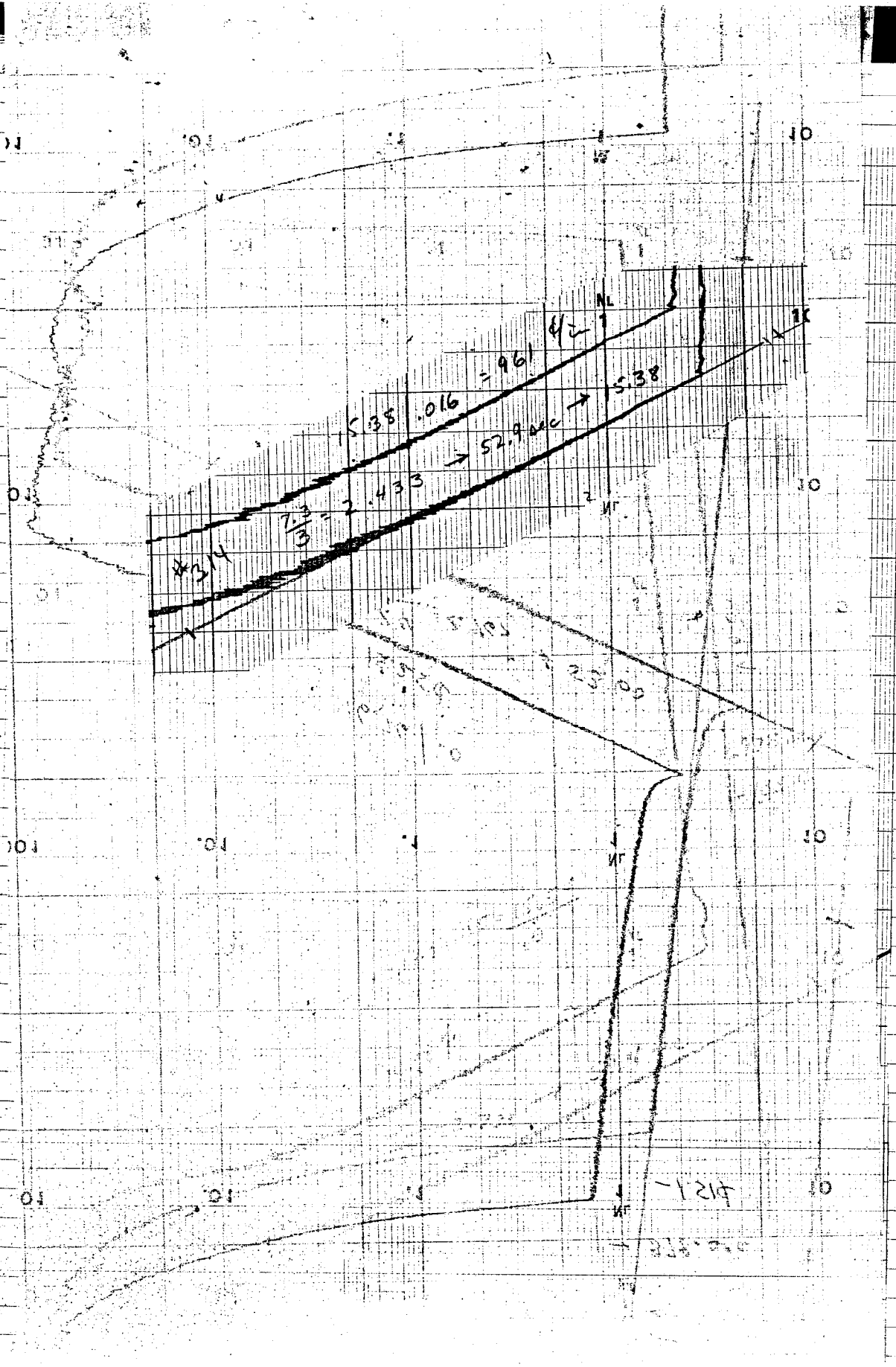
.01
.1
1
10
NL
.97¢
25x50 = 1250 sec = ln 5/2
T
T = 1364 sec
10.95 / .016 = 684 d/in
13.2/3 = 4.4 → 95.6 sec + 9.98 sec


.01
.01
.1
NL
1
10
.978 sec
1.35 ¢
4.19·1+1.35 = 15.54 / .0
14.19 ¢
59.4 sec
8.2 / 3 = 2.733



2 38


.01
.1
1
10
NL
14.43 | .021 = 687
14.43 ¢
8.0/3 = 2.667
→ 58.0 sec



15.38 .016 = 961 ¢/in
15.38
52.9 sec
7.3/3 = 2.433
#314

EXP # 311

10^{48} Start Assembly
10^{56} On Pos Period Ind 1.184 Rev. 15.03
10^{59} Start to Level > 14.43 / .021 = 687 ¢/inch
11^{06} Level 1.205 Rev 15.29
Separate with Screw

EXP # 312

11^{16} On Pos Period Ind 1.183+ Rev. 15.03
Start to level - neg Period > 16.76 ¢ / .025 = 670 ¢/inch
Set at Ind 1.208 Rev 15.32
for neg Period -1.5 ¢
Shut Down with screw

Reassemble for EXP #313
11^{40} On Pos Period Ind = 1.184 Rev 15.04
Set Ind = 1.207 for neg Period > $\frac{15.54}{.023}$ = 676 ¢/inch
11^{55} Shut Down -1.35

EXP # 314

Recheck Critical Conditions for #305
1^{12} Start Assembly
$1^{20\frac{1}{2}}$ Set to Ind = 1.132 On Pos Period
1^{24} Start to level 52.9 sec - 15.35 > $\frac{15.3}{.016}$ = 961 ¢/in
Level = 1.148-
Separate screw and repeat

note $\frac{15.35}{680}$ = .0226
perhaps ~ 5 mil error!

EXP # 315

On Pos Period @ 1.133+ 95.6 sec 9.98
Start To level
2^{02} Set to (~1.148) 1.149+ for neg Period > $\frac{10.95}{.016}$ = 684 ¢/Inch
-1364 -.97
10.95

EXP # 316

Repeat #307, 308, 309. w. Mockup of Alum Shelf on South Table.
2^{20} Start Assembly
2^{28} On Pos Period 1.150+ +107.2 sec → 9.42 ¢
2^{36} Start To Level > $\frac{10.23}{.016}$ = 639 ¢/in
2^{38} On Neg Period 1.166+
-1641 sec, -.81 ¢

$\frac{.81 ¢}{671 ¢/in}$ = 1 mil
1.165

Start To level - neg Period > 16.76 ¢ / .025 = 670 ¢/min
Set at Ind 1.208 Rev 15.32
for neg Period -1.51¢
Shut Down with screw

Reassemble for EXP #313.

11 40 On Pos Period Ind = 1.184 Rev 15.04 > 15.54 / .023 = 676 ¢/min
Set Ind = 1.207 for neg Period
11 55 Shut Down -1.35

EXP #314

Recheck Critical Condition for #305

1 12 Start Assembly
1 20½ Set to Ind = 1.132 On Pos Period
1 24 Start to level 52.9 sec → 15.35 > 15.3 / .016 = 61 ¢/in
Level = 1.148⁻
Separate screw and repeat

15.35 / 680 = .0226 note
Perhaps ~5 mil error!

EXP #315

On Pos Period @ 1.133⁺ 95.6 sec 9.98
Start To level > 10.95 / .016 = 684 ¢/Ind
2 02 Set to (w/ 1.148) 1.149⁺ for neg Period
-1364 -.97
10.95

EXP #316

Repeat #307, 308, 309. w. Mocking of Alum Shelf on South Table

2 20 Start Assembly
2 28 On Pos Period 1.150⁺ +107.2 sec → 9.42¢
2 36 Start To Level > 10.23 / .016 = 639 ¢/in
2 38 On Neg Period 1.166⁺
-1641 sec, -.81¢

.81¢ / 671 ¢/in = 1 mil
crit = 1.165

Bottom of pg 289

Summary

Average Table worth 311 687
312 670
313 676
314 ~~961~~ Discard
315 684
316 639

$\frac{3356}{5}$ = 671 ¢/inch

311 Critical 1.205 w. Refl.
31 " " 1.148
+ " " 1.165 w. Al Shelf

Δ .057x2 = .114
.017x2 = .034
.148

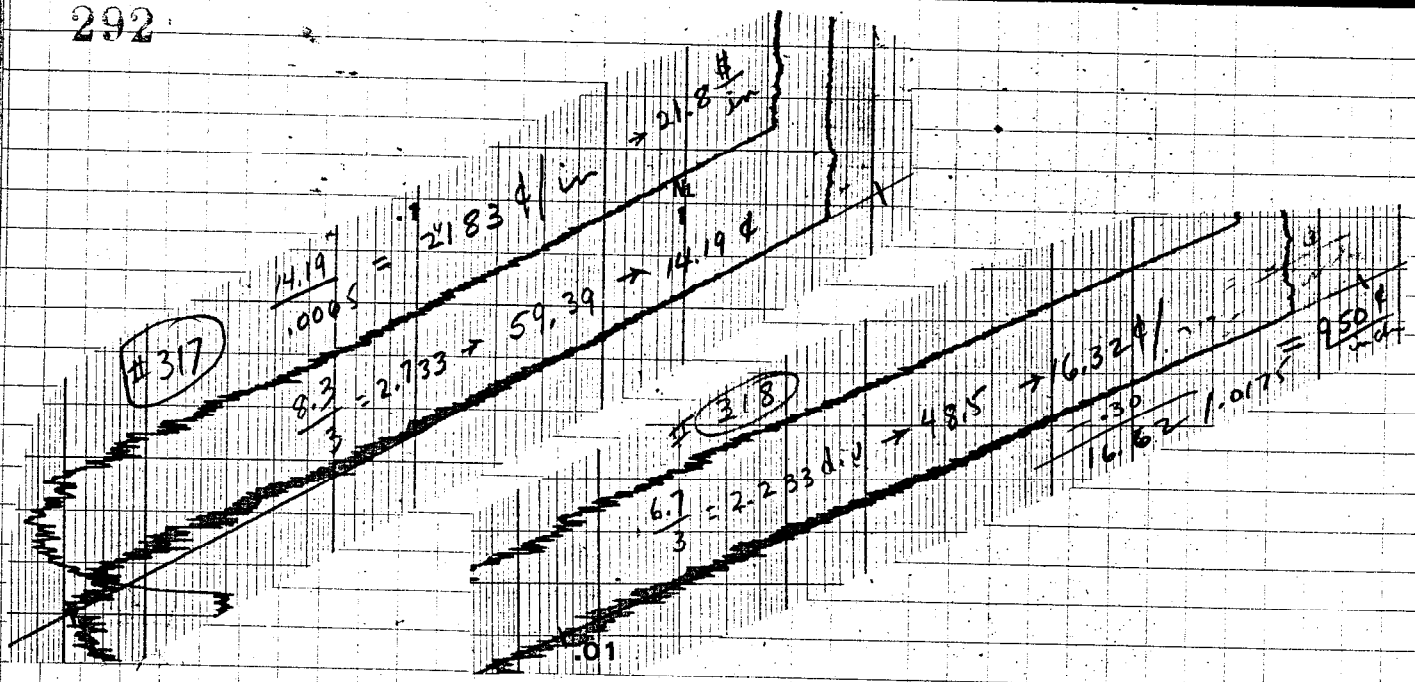
1.148 − 0.100 = 1.048
.148
0.900 gap

Vert Spacing = .882
Horiz = .890

Estimate Corrected Spacing

= .890 inches → 2.26 cm

Va. Box 4.7625
Void 5.8925


#317
14.19 / .0065 = 2183 ¢/in → 21.8 $/in
8.3 / 3 = 2.733 → 59.39 → 14.19 ¢
#318
6.7 / 3 = 2.233 div → 48.5 → 16.32 ¢/
.30 / 16.62 / .0175 = 950 ¢/in
.01

Instrument Check on 27 Apr 72 Source Unc ^{60}Co

PM-1 _____ Low Trip OK Trip OK

IC-1 3×10^{-10} Meter Trip OK Fast Trip ~~Screwed~~ Tables

IC-2 Out for Repair Meter Trip _____ Monitor

IC-3 3×10^{-10} Calibration Dwn A OK

IC-4 3×10^{-10} Calibration Dwn B OK

C OK

EXP #317 Placed Pu-Be Source on Tables after 18 unit alignment check. Indicator zero = 0.092

9 45 AM Start Assembly Red Lite ✓

9 56 0.60 Near Crit – Reduce sep ~ to 0.57 remove Source. Bypass ✓

10 01 On pos Period Ind = 0.514 sec $\Delta\rho$ = 0.14 ✓

04½ Start to Level

Near Level 0.517 ± 14.19 Vertical Spacers 0.240

Slight Negative Period .0065 Horizontal Spacers 0.253

but level at end = 2183¢ except at Plane of separation

Indicator change to 0.5175 in 18 on North 9 on South

Add Mock up of Reflector to North 2/3 of assembly

EXP #318 – No Source External only Int. Source

10 50 Start Assembly

11 01 On Pos. Period Ind = 0.562 → 48.5 sec → 16.32 ¢

Start to level

On Neg Period Ind 0.579 + → −.30¢

$\frac{720}{\pi \text{ sec}} = \ln\frac{42.5}{50.} = 4430$

16.62/.0175 = 950¢/inch

~0.30¢

5795
5175
$\frac{3}{2}\times.062 = .091$

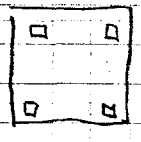
5175
092
.4255
091
0.3345 inches at gap.

Vert .240
.240
EW .253
.335
NS .253
.253
1.574/6 = 0.263 average gap

EXP #319

Assemble 27 Unit Bare with small spacers ½×½ cut from 0.240 and .025 in al. Form each per block and stack on top of 4.718 in long boxes to reduce reflector effect of support.

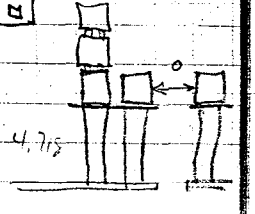
Aligned 2 layer with 9 units.

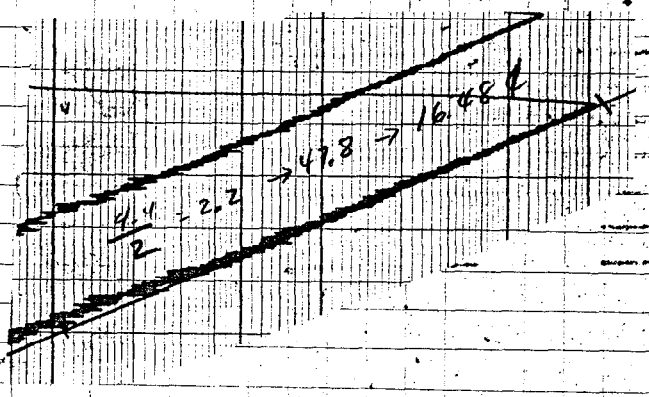


Found zero for Ind @ 0.082

Max on Ind @ 1.980 !

Physical Shim needed to be the Real Crit! Rezeroed and calibrated at 1 inch with Dial Indicator.




4.4/2 = 2.2 → 47.8 → 16.48 ¢

EXP #319 (Cont)

with 18 units on tables — Aligned units Ind = 0.102

295

4^{05} Start Assembly No Source! Bypass Red Lite

Average Spacing 240 + 25 = .265

On Pos Period

Ind = 0.3775 − .102 = .275, gap

Δp =

average sepn = .265, .265, .265, .265, .265, .275 = .267

Note when stacked as above columns are not as stable as columns which have Al shelves!

Restack with .032 Al shelf + 0.240 buttons for spacer vertically!

Instrument Check on 28 Apr 72 Source 10 mc ^{60}Co

Note: Shift — zero

PM-1 Bal = 6.45 Low Trip Scr ammed Table Trip OK

IC-1 3×10^{-14} Meter Trip OK Fast Trip OK

IC-2 Out For Repair MONITRON

IC-3 3×10^{-10} Calibration Dwon A OK

IC-4 Calibration Dwon B OK

C OK

Recalibrated Linear Pot

Table zero	0.100	Dial Ind	0.000
Moved table	1.100		1.010
zero	.100		.000
	1.102		1.010
Adjusted Pot ↓			
	1.110		1.010

Aligned 1st and second layers with Table closed and

1st layer 4.718 + .032 from 1/8 Al & 5 layers of boxes — (Table)

2nd layer 0.240 + .032 from 1st layer

3rd layer 0.240 + .032 from 2nd layer

Front faces at plane of sepn aligned with other units with tables separated

North South

Table zero, units in contact

EXP #320 (see p 296 for description)

10^{00} Start assembly
10^{13} On Pos Period – ~ .381
Separate to get Binoculars to read dial indicator
10^{25} Start reassembly from 1.142.

		Dial Ind	Ind
30	On Pos Period		
32½	Start to level	.279	.387 – .1 = .287
36	On Neg Period	.2955	.404 – .1 = .304 > .017
37	near Critical		
40	Critical level	.2955	.404 – .1 = .304

EXP #321 with Refl Mocking + Al Shelf on North

		Ind	Dial
11^{05}	Start assem	1.121	1.000
		917	.795
		714	.600
		.514	.400
1120	On Pos Period	.425 – .1 = .325	.314
1122	Start to level		
	Near Level –		.331
1130	Level	.442 – .1 = .342	.3305

304

$\frac{3}{2} \times .0265 = .039_{75} \rightarrow .040$

Corrected #320 = 304 – .040
= .265

Average gap = .272 vert
.272
.265
.265 } Horiz
.265
.265

Av = 0.268 vs 0.267 prev exp.

3.75
268
4.018 → 10.206
5.103

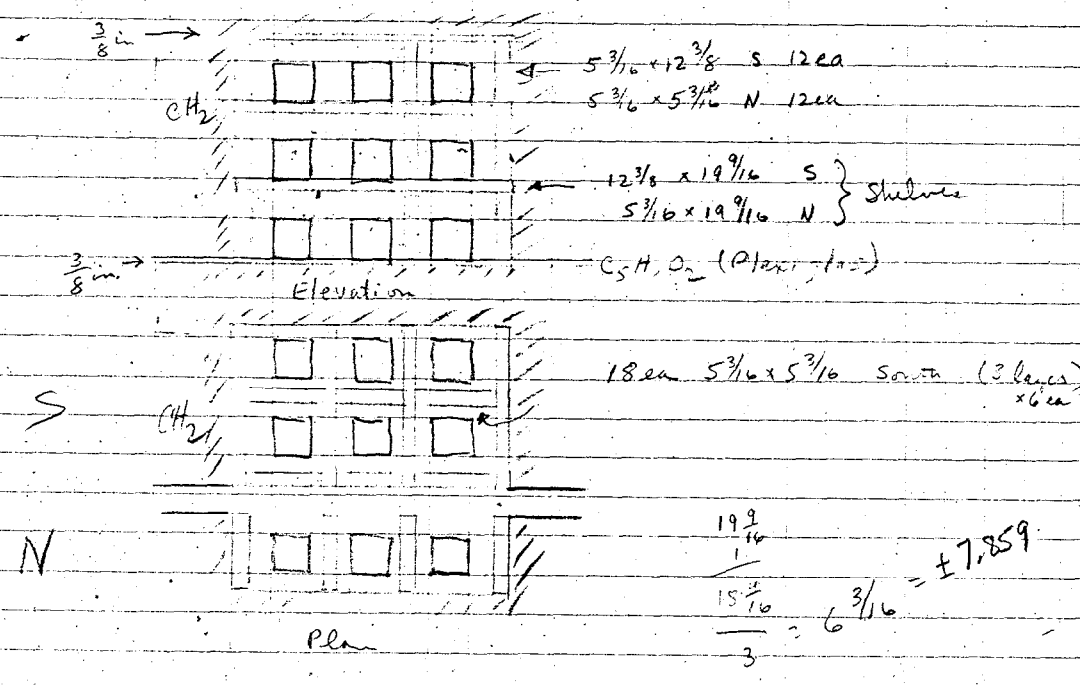
Plexiglas cut to

2 ea 1 × 12 3/8 × 19 9/16
2 ea 1 × 5 3/16 × 19 9/16
12 ea 1 × 5 3/16 × 12 3/8
30 ea 1 × 5 3/16 × 12 3/8

Area
2265.03 in^3
14613.07 cm^2

total weight = 41.80 kg
d/ρ = 1.18 volume = 35423.73 cm^3

Average thickness = 2.424 cm



$$\frac{19\frac{9}{16}}{\frac{15\frac{11}{16}}{3}} = 6\frac{3}{16} = \pm 7.859$$

3 x 3 x 3 Array with Iron Boxes
and 1" Plexiglass dividers
ITT estimated cell size @ 6 3/16 inches

May 2, 1972
Replaced (CH2)n bottom reflector on tables with 3/8 in Plexiglass for flat surface
Closed tables to align side reflector (scribe marks on plastic also aligned
Placed 12 units on fixed South Table (w. iron & 1" plex divider
Placed 6 units on movable North Table
Reflected critical assembly, source in Top Refl Hole Page 6
Assembled to check alignment and multiplication

Tables

Separated	IC-1	3	4	Table	Dial
52 in	$.01 \times 3 \times 10^{-10}$	1.8×10^{-12}	7.7×10^{-13}		
16 in	$.01 \times 3 \times 10^{-10}$	2.7×10^{-12}	1.1×10^{-12}		
0 in	$.01 \times 3 \times 10^{-10}$	5.0×10^{-12}	2.0×10^{-12}	.108 - .1 = .008	.0045

Load remaining units for 3 x 3 x 3 Array.

Instrument Check on May 3, 72 Source ≈10 mc ^{60}Co

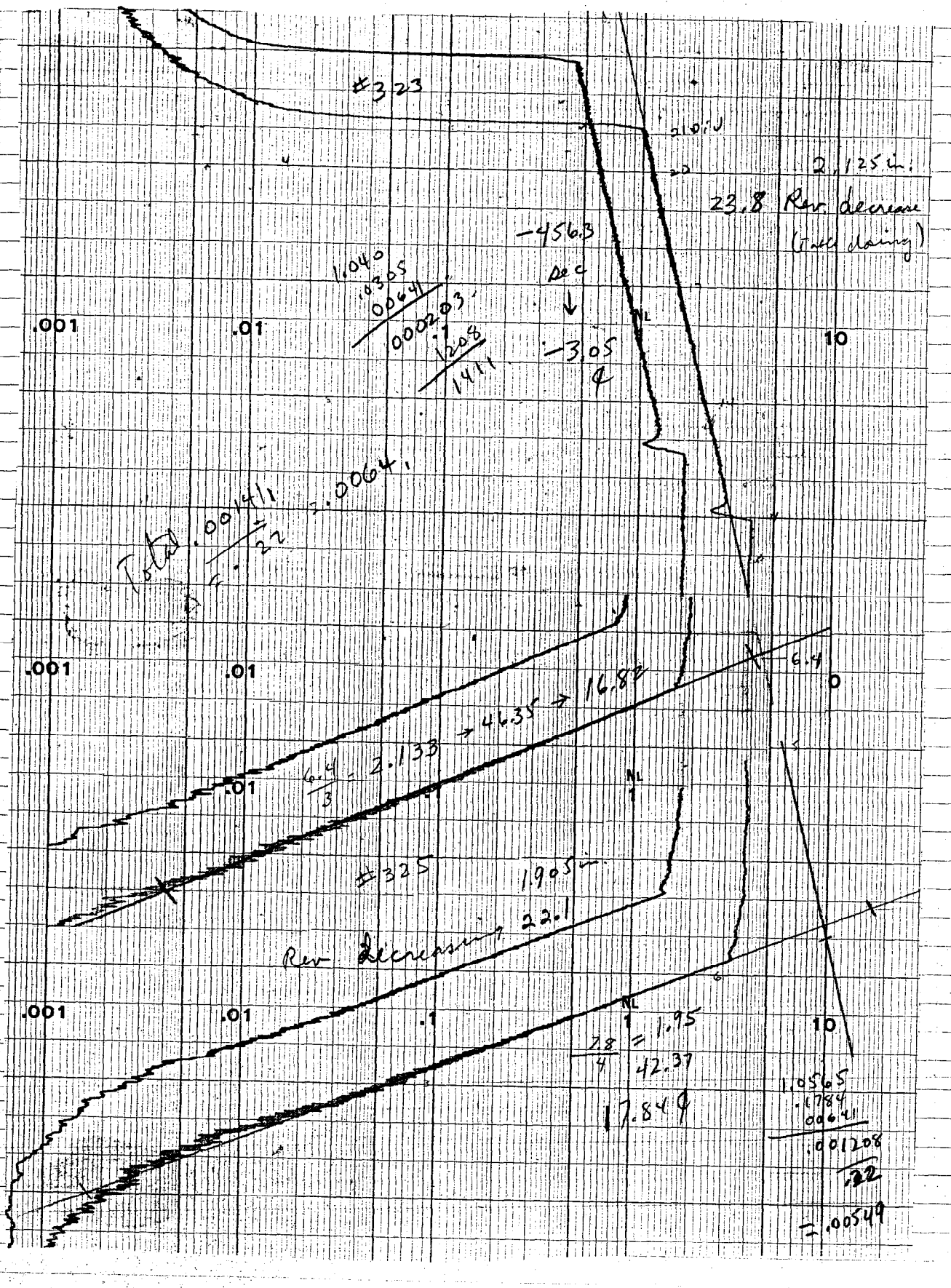
950 V PM-1 Bal 7.15 Low Trip OK Trip Scram Tables

IC-1 3×10^{-10} Meter Trip OK Fast Trip OK
IC-2 Meter Trip Monitor
IC-3 3×10^{-9} Calibration Down A
IC-4 1.8×10^{-9} Calibration Down B
Source placed manually C

EXP # 322
Reflected 3 x 3 x 3 Array with IRON BOXES
with 1" Plexiglass shelves & Dividers
Cell size 6 3/16 in.

.55 Start Assembly
Critical Multiplication @ 22.4 Rev
Power Rising IC-3 $\geq 10^{-9}$, 4 $> 5 \times 10^{-10}$ } on approx period
Check of Red Lite OK
Bypass OK
$\Delta\rho = 0.14$ OK
Source still in place
9.04 Shut Down -- Source Only to ~53 Rev Rem - Source

EXP # 323 No external source
9.25 Start Assembly from 53 Rev
31½ On positive Period Rev = 22.1 decreasing → 17.84 $\frac{20.89}{.22} = 95¢$
34 Start to level
41 Level Rev = 22.75 Decreasing
Rev to 23.5
Neg Period 23.8 — 3.059


#323
2.125 in.
23.8 Rev. decrease
(Table closing)
-456.3
sec
-3.05
¢
1.040
.0305
.0064
.000203
.1208
.1411
.001
.01
.1
10
NL
Total .00141 / .22 = .0064
6.4
6.4/3 = 2.133 → 46.35 → 16.82
#325
1.905 in.
Rev Decreasing 22.1
7.8/4 = 1.95
42.37
17.84 ¢
1.0565
.1784
.00641
.001208
.22
= .00549

EXP # 324

Remove 3 ea from North Table
Reflected 24 units (3x3, 3x3 and 3x2)

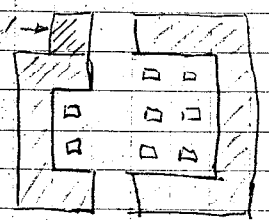
1[12] Start Assembly — no ext. source
Separated to add
More Reflector on North
Red Lite OK
Bypass OK
Δp = 0.1K OK

Bal on PM = 7.40

EXP # 325

1[27] Start Assembly
1[35] On pos period
Dial .834 .948 − .108 = .840
Rev 12.4

Reflector added → across Top



North South

1[39] Start to level
Level
.908 1.023 − .108 = .915
Shut down of running screw to 24.5
Δ = .074

16.82 / .075 = 224

1.056
.1682
.0061
001139
075
= .0152

Set screw at 23.8 Rev
Set screw at 22.1 Rev

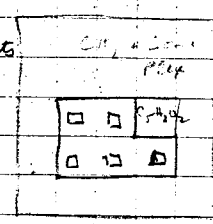
Meas. sep = 2,125 av.
1.905
.22 in

Dial Indicator Mount & Bumped! Can't use [illegible]

EXP # 326

Removed 1 unit, North now has 5 units

2[19] Start Table Ind Rev
On Pos Per .313 4.1
South 18
Total 23



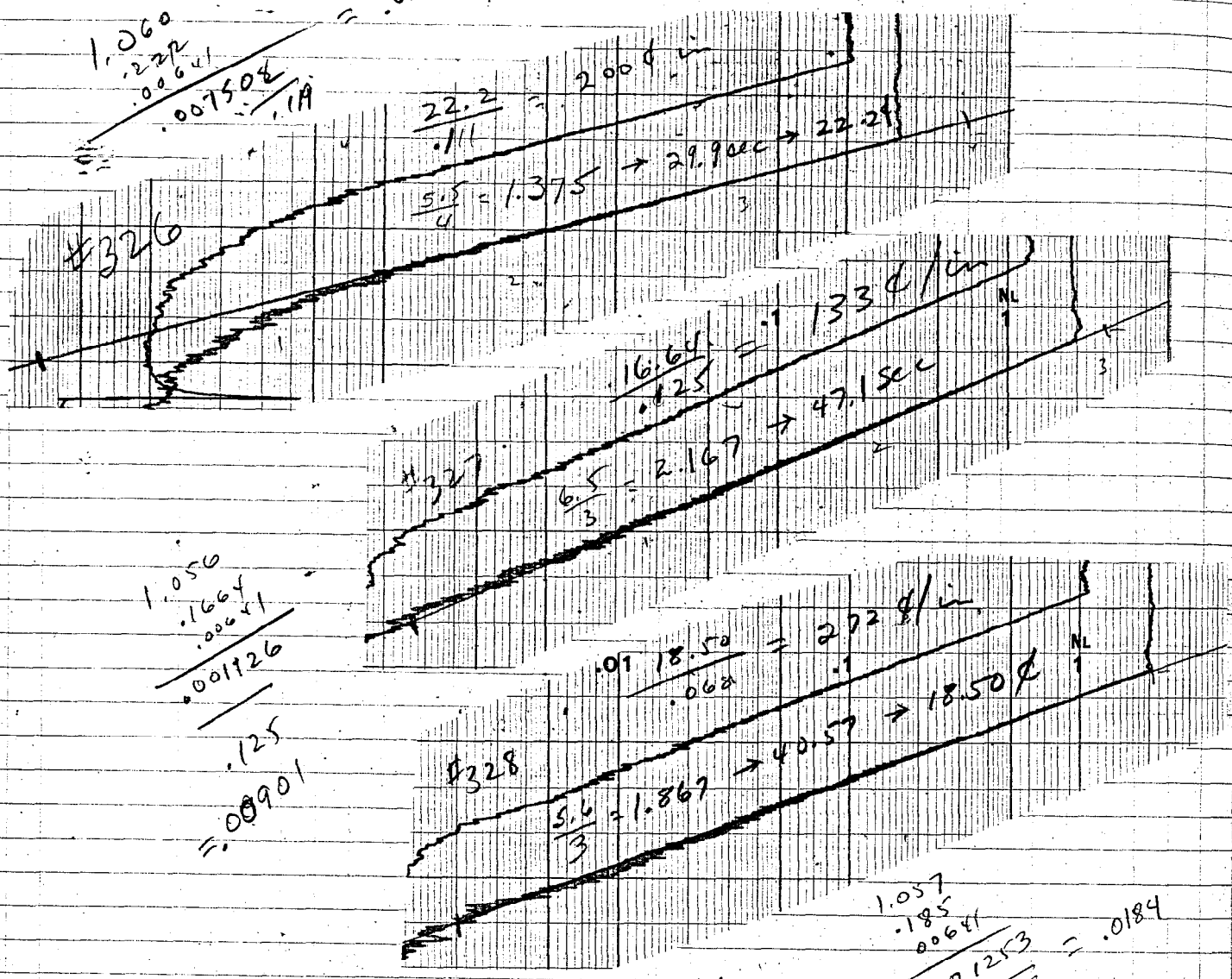
2[32] Start to level
Level .432
.108
0.324

22.2¢ / .119 = 200 ¢/in

EXP # 327

Add 5 pc ¼ x 2½ x 4½ Steel, lea to top of each cell on North table

2[50] Start Assembly
On pos Period Tables Closed Ind = 0.111 — zero
Start to level
Level 0.236
Shut Down .125



1.060
.222
.00641
.007508
.119
= .01267/in
22.2
.111
= 200¢ in
5.5
4
= 1.375 → 29.9 sec → 22.2¢
#326
16.64
.125
= .1 133¢/in
NL
1
#327
6.5
3
= 2.167 → 47.1 sec
1.056
.1664
.00641
.001126
.125
= .00901
.01
18.50
.068
= 272¢/in
.1
NL
1
#328
5.6
3
= 1.867 → 40.57 → 18.50¢
1.057
.185
.00641
.001253
.068
= .0184

EXP # 328

3^{58} Start Assembly 3 x 3 x 3 Array with 3 ea $\frac{1}{4} \times 4\frac{1}{2} \times 4\frac{1}{2}$ Steel on top of boxes

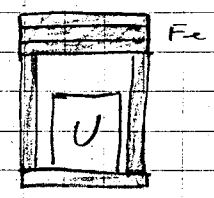
4^{08} On Pos. Period Ind = 0.480

11 Start to level = 0.548

" Level

4^{17} Start Down .111

.437 in separation

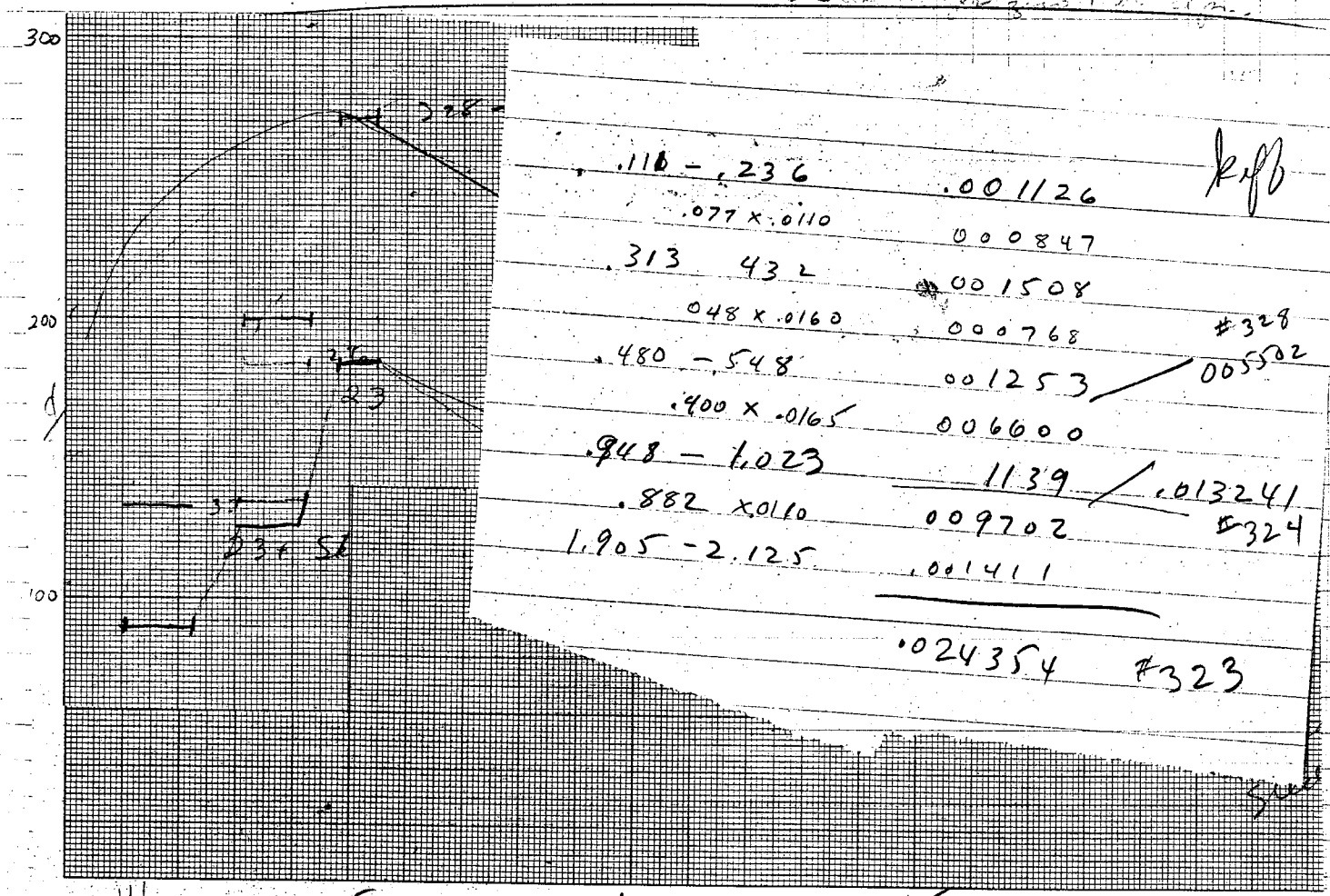


For 27 unit array 54 pieces of steel changed gap .437 (2.125)

$\frac{1.688}{54} = .031$ in / pc

18 ea x .031 = .558

add more steel to get zero [illegible]



.110 – .236	.001126	
.077 x .0110	000847	
.313 432	001508	
048 x .0160	000768	#328
.480 – .548	001253	005502
.400 x .0165	006600	
.948 – 1.023	1139	.013241
.882 x .0110	009702	#324
1.905 – 2.125	.001411	
	.024354	#323

Keff

EXP # 328

3 58 Start Assem. Ck.

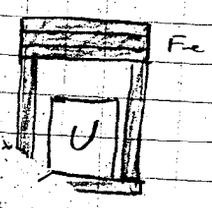
4 08/11 On Pos. Period. Ind = 0.480

Start to level = 0.548

Level

4 17 Start Down

3 x 3 x 3 Array with 3 ea 1/4 x 4 1/2 x 4 1/2 Steel on top of boxes

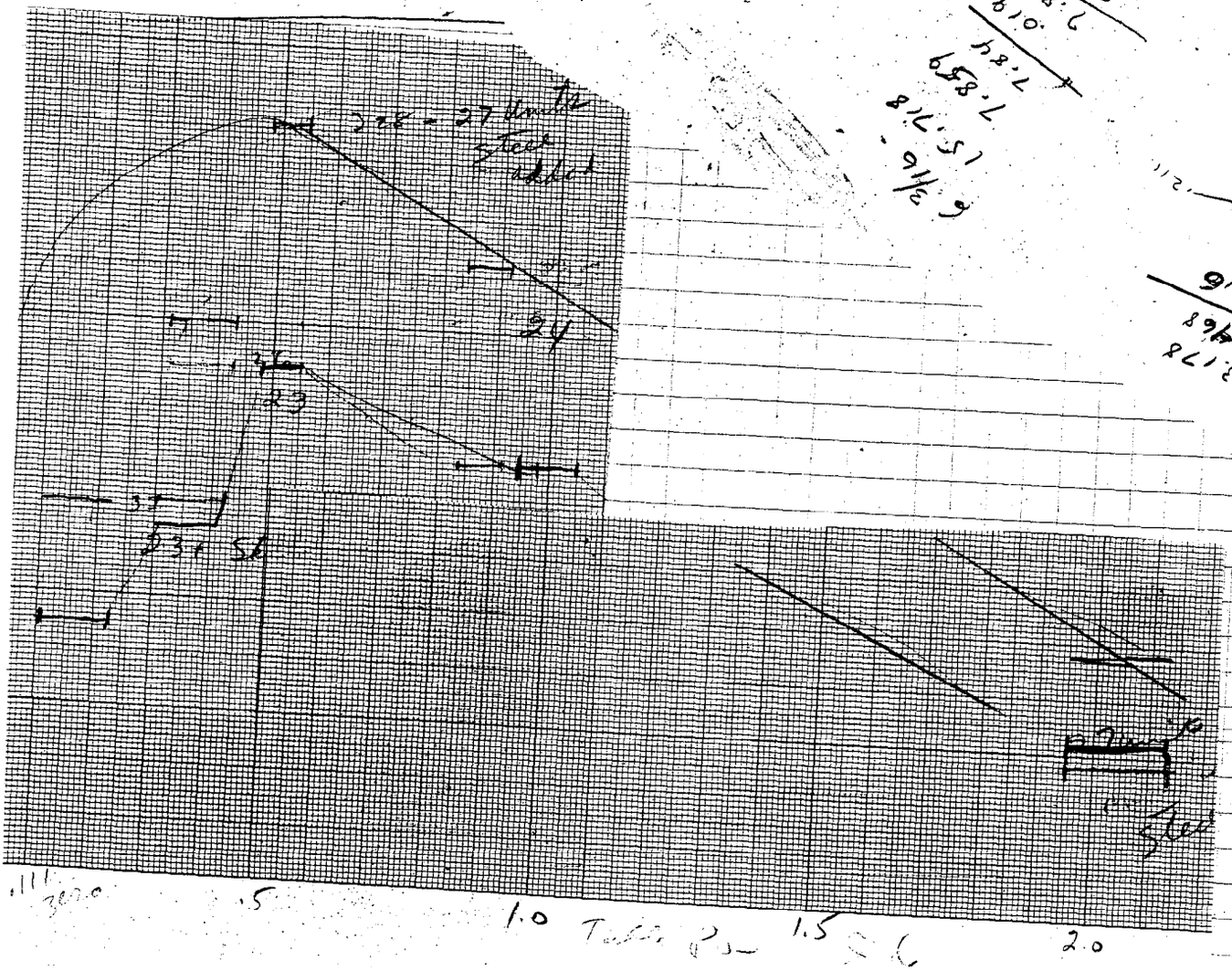


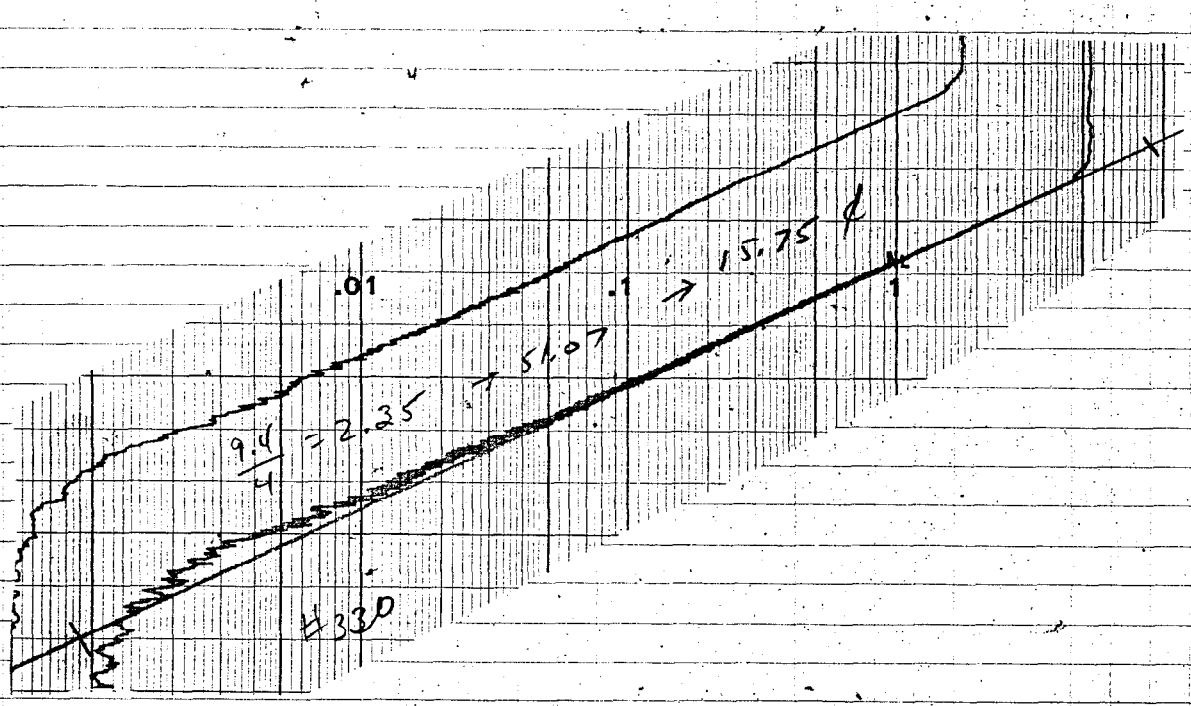
.111

.437 in pk

For 27 unit array 54 pieces

18 ea x 6




.01
.1
1
15.75
51.07
9.4/4 = 2.35
#330

Instrument Check on [illegible] Source 10 mc ^{60}Co

PM-1	[illegible]	Low Trip	OK	Trip	OK
IC-1	[illegible]	Power Trip	[illegible]	Fast Trip	OK
IC-2	[illegible]	Motor Trip			MONITRON
IC-3	1.5×10^{-9}	Calibration	[illegible]	A	OK
IC-4	1.5×10^{-9}	Calibration	[illegible]	B	OK
				C	OK

EXP # 329

[illegible] 18 ea Steel Plates [illegible] To the [illegible] side of units on North Table

9^{40} AM Start assembly
4^{51} tables Closed Ind = 0.110
Sub Critical

Red Lit Pers. Check OK
Bypass OK
$\Delta p = 0.14$ OK
No Ext. Source Start up!

IC-3 $1 \rightarrow$ ~~2.5~~ 3.0 $\times 10^{-12}$
IC-4 $5 \times 10^{1} \times 10^{-13}$

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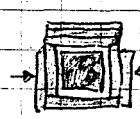
from Bottom layer Remove 6 ea pc Steel from sides → 6 ea units have 2 ea on E-W sides
EXP # 330

10^{00} start Assembly
10^{10} On Pos Period Ind = 0.111. tables Closed
$15^{1}/_{2}$ Start to level
Level ~~0.2165~~ 0.217



← Extra piece on 6 units (2nd and 3rd layer North Table)

10^{29} AM Shut Down

Operating Time 4958
4772
186 hours
for 330 EXP.