BOOK 115R

Notes:
"FBR #1 61" on spine
"-FBR- Crit.t 1st Burst 61" on front
"FBR #1" on front
"FB" on front

Blank pages: inside cover, page opposite page 1, 1, 2, 4, 12, 13, 71, 72, 122, 129, inside back cover

1 (8.5") loose sheet between pages 66 & 67
pages 102, 103, and 112 have half sheet taped
page 131 has graph stapled
page 133 has big sheet clipped
page 134 has 5 graphs stapled
page 146 has 2 big graphs stapled
page 149 has 1 graph stapled
page 152 has 3 graphs stapled
4 (different sizes) loose sheets between page 152 and inside back cover sheet

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
March 29, 2001

Fast Burst Reactor Critical Expts

E-4

Test to check the performance of the Vertical Assembly machine

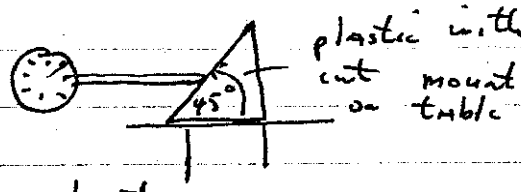
1) Position Reproducibility

100 psi scram

~ 60 psi Air

position indicated by gauges readind to 1 mil

One gauge measuring vertical motion and one measuring lateral motion.



No top hold deviation about zero

0	0
0	0
-1	-1
0	0
-3	-3
-3	-3
-2.5	-2.5
+1	+1
+1.5	+1.5
-4	-.25
	-.5
	-4
	-2.5

Vertical Displacement

6.5 mils

Fast speed closure

Another run with top hold fast speed closure

	Vertical	Lateral	
	-7	-.5	
Vertical	-5	-.5	
6 mil	-5.5	-11	5 mil Lateral
	-1	-6	
	-2.5	-2	
	-4	-2.5	
	-3.5	-1.5	
	-5.5	-1.5	
	-6	0	

Slow speed closure.

Vertical		Lateral	
4	0	89	0
61	0	89	0
61	0	89	0
61	0	89	0
61	0	89	0
Table oscillation			
61	0	89	0

Scram

52.5	11
5,6.5	11
52.5	11

1 m

11

2/23/01 slow speed closure

Vertical	Lateral	
56	14.5	
Combined scram		
55	15	
Combined scram		
55	15	
Combined scram + oscillation		
53.5	22	
Combined scram + oscillation		
54	16	
54	14	same procedure
54	12	
54	15	
54.5	13	
Foam rubber taken out		
58	97	
58	98.5	1 mil
59	99	
59	95.5	
Foam rubber back in hydraulic scram only		
59	92	rubber injured
56.5	32	
56	31.5	1 mil
57	32.5	
57	32.5	
56.5	32	

Variation with Load.

58.25	22	no top hold.	
58.75	22	top hold.	no load
58.75	22		
58	21		50 lbs
58	21		
57.8	21		100 lbs
57.5	20.8		
52.5	19		200 lbs

Table creep-

200 lb load.

Time	dial reading	
8.57	0.200	
9.30	0.200	No creep.
10 3.	0.200	
11.50	0.200	

Selsyn behavior to motion of table

33.628 up
33.628 up
52.999 down
33.626 up
52.998 down

33.624 up — no better than 30 mils
52,976 down — After scram.
~~Scram~~ 33,122 up
33.' scram
52,963 down

Summary

1.) Selsyn no better than 30 mils After scram
2) very little creep
3) 2.25 mil deviation in vertical position with 200 lb load.
4) Position problem may exist After A scram.
5.) Between scrams Less than 1 mil variation of vertical position with hydraulic motion.

Table position vs time after scram.

220 psi scram

Position inches	L=75 I=90 (3/16 +1/8 inlay) time	2 parts + 3/16 on top	1 part on top 1 part in middle 3/16 on top	
6	2.5 x80 msec	2.4	2.55	2
6 3/4	2.65	2.55	2.6	2
6 2/4	2.75	2.6	2.7	2
7 1/4	2.9	2.75	2.85	2
8	3	2.9	3.0	3
8 3/4	3.15	3.0	3.1	3
9.5	3.35	3.15	3.3	3
10.1/4	4.8	3.35	3.45	3
11	5.2	3.5	3.65	3
11 3/4	5.5	3.8	3.9	3
12 1/2	5.85	4.2	4.35	3
13 1/4	6.25	4.85	4.85	
14	6.85	5.45	5.5	
14 3/4	7.35	6.1	6.1	
15 1/2	8.2	7.4	7.4	
17	10.3	10.1	10.1	
20	13.15	13.0	13.0	

240 lbs	260 lbs	180 lbs	120 lbs	120 lbs 2 parts + 3/16 on tip	am.
2.55	2.6	2.8	2.8	3.15	.252
2.6	2.7	2.9	2.85	3.25	.26
2.7	2.85	3.0	3.0	3.4	.272
2.85	2.95	3.15	3.1	3.5	.28
3.0	3.1	3.25	3.2	3.65	.292
3.1	3.2	3.35	3.35	3.8	.304
3.2		3.5	3.55	3.95	.316
3.4	3.35	3.7	3.8	4.2	.336
3.6	3.5	3.9	4.2	4.45	.356
3.8	3.7	4.15	4.95	5.35	428
3.95	3.85	4.65	5.7	~~6.95~~ 6.1	488
4.35	4.15	5.25	6.55	6.95	556
4.9	4.6	5.9	7.4	7.75	62
5.4	5.25	6.6	8.2	8.6	688
6.5	6.95	7.95	9.95	10.35	828
8.85	9.4	10.8	13.5	13.7	1096
11.35	11.95	13.8	17.3	17.65	1412

Counters #3 East side of Reactor support at Reactor level

	Fine Gain	Coarse Gain	Rise time	Dose
#1	1	8	0.2 μs	19
#2	1	8	0.2 μs	26
#3	1	4	0.2 μs	21

Counter #2 Against South wall (Rm #108) at Reactor level.

Counter #1 Against North wall (Rm #108) 2 ft above Reactor level

9-6-61

INSTRUMENT CHECK

PM1 M-226 & 8

Wednesday

	F	A	B	C	D	E
	OK	10/1600	opr	10^{-12}	10/1000	1050V.
		6"	0	20"	2"	
F.S. Trip		100	0%	100	80	100+

C.A. FBR Expr. FBR 1A Run 1

Shee Date 9-6-61 Time 2:30 P.

Purpo multiplication for initial loading

Loading – 2½" Fuel Thickness ; Bolts in ; Rods out
Safety in ; Plexiglas up
Source PuBe #467 in fuel

5 min.	Counters	#1 BF_3	#2 BF_3	#3 BF_3	#4 Fission
	Scale 64	13^{+60}	32^{+17}	138^{+8}	8817
		14^{+18}	32^{+20}	140^{+46}	1768
		13^{+7}	30^{57}	139^{+43}	999

Same Fuel Conditions except ~~with~~ Rods in; Plexiglas out

5 min
Scale 64

#1	#2	#3	#4
14 +33	31 +34	138 +27	773
12 +59	32 +2	138 +48	857
13 +52	31 +0	137 +52	817

Same Fuel Conditions; Safety out; Mass Rods out; Reg. rod out; Burst Rod in; Plexiglas up.; Paraffin up (on Movable Table).

5 min
scale 64

#1	#2	#3	#4
11 +28	30 +17	135 +48	10,076
10 +39	30 +44	136 +11	4,250
10 +6	31 +6	136 +12	3,347

.4489

INSTRUMENT CHECK

Time 8:30 Source Pu Be

Sys – OK

Ch	A	B	C	D	E
F					
OK	1%/min	apr	10^{-12}	1%/1000	1053
Source Dist.	6"	✕	36"	2"	
% F.S. Trip	80		120	60	120

1B 1st Loading of FBR. ~~2 1/4~~ 2 3/8" measured

	Rods in	Safety out	Rctl in	
5 min	#1	#2	#3	
Scale 64	$11^{+47} = 751$	$18^{+19} = 1171$	$82^{+29} = 5277$	
	$10^{+50} = 690$	$19^{+4} = 1220$	$83^{+33} = 5345$	
	$11^{+44} = 748$	$18^{+22} = 1174$	$84^{+32} = 5376$	#1
	$11^{+19} = 704$	$17^{49} = 1137$	$82^{36} = 5284$	
T	2912	3614	21,314	E
CPM	145.6	180.7	1,065	1391.3
1/CPM	6868	5534	9389	7187

Reflector 12"x18"x Paraffin in. away to simulate a man. 1" thick plexiglas against core to simulate hands on core

Ru

1st loading (cont.)

	Rods	Safety	Rf	Safety blade insert reading: Red / Black
	in	in	out	0 / 0
5 min scale 64	#1	#2	#3	
	14 +41	19 +36	106 +44	
	15 58	21 +43	110 49	
	13 33	20 63	108 6	
	13 +33	19 +59	108 28	E
T	3,685	5,257	27,775	1835
CPM	184	263	1,389	7220
$\frac{T}{CPM}$	543	3802	7204	
	out	out	out	
5 min, scale 64	#1	#2	#3	
	13 10	19 41	92 57	
	13 23	19 43	95 42	
	13 4	19 12	94 61	
	12 40	—	96 31	
T	3141	3744	24,319	E
CPM	167	187	1,621	1975
$\frac{T}{CPM}$	5988	5347	6169	5063
5 min	out	out	in	
scale 64	#1	#2	#3	
	11 48	18 5	79 5	
	10 24	18	79 42	
T	1716	2310	10,179	E
CPM	141.6	231	1,018	1390.6
$\frac{T}{CPM}$	7062	4329	9823	7191

Run 2 7/8 Alcd

2nd Loading – 3 5/16" 3 5/16" measured

	Rods in #1	Safety out #2	Ret in #3	
	12 43	20 38	95 31	
5 MIN	13 12	20 2	94 12	#1
	13 6	19 37	92 25	–
Total	2,497	3,853	18,056	E
CPM	166	257	1,204	1627
1/CPM	6024	3891	8305	6146

	Rods in #1	Safety in #2 scale 16	Rod out #3	
	18 +63	93 +11	135 +1	
	17 +~~25~~	92 +6	135 +47	#2
	18 +26	95 +10	138 +48	E
T	3481	~~17,947~~ 4807	26,208	
CPM	232	~~1196~~ 300	1,747	2279
1/CPM	4310	3333	572	4387

	Rods out	Safety out scale 16	Refl. out	
	15 +37	79 +14	108 +11	
	15 +27	81 +8	108 +46	
	16 +5	82 +13	111 +51	#3
	3,031	3907	21,036	E
	202	260	1402	1864
	4950	3846	7132	5364

	Rods out	Safety out	Refl. in	
		scale 16		
5 min	12 +17	77	91 +23	
	11 +26	77 +8	95 +44	
	11 +47	73 +10	91 +57	
T	2266	3650	17,852	
CPM	151	243	1190	1503
$\frac{+}{CPM}$	6622	4115	8403	6653

9-8-61

INSTRUMENT CHECK

Time 8:40 AM

Source M-230 γ

	Channel A	B	C	D	E
F	10/100	opc	1"	10/100	150
	7"	o/c	15"	1/2	8"
	90		100	80	100

Run 3

3rd Loading - ~~4"~~ 4 1/4" measured 7/8 Added

	Rods in ctr #1	Safety out ctr #2 scale 16	Reflector in ctr #3	
@ 4 min	11 +25	69 +1	90 +18	
	11 +14	65 +1	88 +48	#1
	11 +6	66 +0	88 +42	E
T	2157	3202	17,132	
CPM	143.8	213.4	1,142	1499
1/CPM	6954	4686	8756	6671

	Rods in	Safety in	Reflector out	
	19 +54	23 +12	137 +28	
	18 +53	23 +0	140 +30	#2
	19 +60	22 +51	135 +2	E
T	3687	4415	26,428	
CPM	307	368	2,202	2877
1/CPM	3257	2717	4541	3475

Run 4

	Rods out	Safety out	Refl. out	
				#2
4 min	14^{+0}	17^{+34}	100^{+27}	
	14^{+37}	18^{+28}	98^{+49}	
T	1829	2322	12,748	
CPM	228.6	290	1,594	2113
$\frac{1}{CPM}$	4374	3448	6274	4732

	Rods out	Safety out	Refl. in	
4 min	10^{63}	14^{14}	85^{24}	
	10^{+47}	16^{+52}	82^{+54}	
T	1390	2114	10,766	
CPM	173.7	264	1,345	1783
$\frac{1}{CPM}$	5757	3787	7435	5608

4 min Counts

C

$\frac{1}{C}$

4 min

C

$\frac{1}{C}$

3 min Count

C

$\frac{1}{C}$

3 min

Run 4

7/8 Added

4th Loading – 5 7/32" measured *

* In this loading main adjustment rod is withdrawn 1 1/4 inches

4 min Counts	Rods in	Safety out	Reflector in	
	12^{+15}	14^{+18}	97^{+51}	
	12^{+36}	18^{+7}	100^{+1}	
T	1587	2393	12,660	E
CPM	198.3	299	1,583	2080
$\frac{1}{CPM}$	5042	3344	6317	4807

4 min	Rods in	Safety in	Refl. out	
	26^{+21}	28^{0}	183^{+48}	#2
	26^{12}	28^{+36}	180^{+52}	
T	3361	3620	23,332	E
CPM	420	453	2,917	3,790
$\frac{1}{CPM}$	2380	2207	3428	2638

3 min Counts	Rods out	Safety out	Refl out	
	12^{+2}	13^{+50}	84^{+45}	#3
	11^{+51}	13^{+57}	86^{+46}	
T	1525	1771	10,971	E
CPM	254	295	1,618	2167
$\frac{1}{CPM}$	3937	3389	6180	4614

3 min.	Rods out	Safety out	Refl in	
	8^{+59}	12^{+43}	69^{+52}	
	9^{+31}	13^{+53}	71^{+5}	
	1178	1698	9017 / ~~5 37~~ / 1502 / ~~756~~	
	196.3	283	6657 ~~322~~	1981
	5094	3533		5047

24 Runs

7/8

5th Loading : 6 6/32" 7/8 Add-a

	Rods in	Safety out	Reflector in	
3 min				
Scale 64	10^{52}	15^{37}	88^{16}	#1
	11^{19}	15^{5}	88^{13}	
T	1415	1962	11,293	E
CPM	235.8	327	1,882	2,445
1/CPM	4240	3058	5313	4089

	Rods in	Safety in	Reflector out	
	28^{9}	27^{xx}	192^{59}	#2
	27^{37}	27^{41}	192^{32}	
T	3,566	3,522	24,667	E
CPM	594	587	4,111	5292
1/CPM	1683	1703	2432	1889

	Rods Out	Safety out	Reflector out	
	13^{0}	16^{+36}	95^{+11}	#3
	13^{3}	15^{24}	92^{+42}	
T	1667	2044	12,021	E
CPM	278	341	2004	2623
1/CPM	3597	2932	4990	3812

	Rods out	Safety out	Refl. in	
	10^{0}	13^{+40}	80^{+36}	#4
	9^{56}	14^{0}	79^{+12}	
T	1272	1768	10,224	
	212	295	1704	2211
	471	3389	5868	4522

Run 6

6 th Loading - 1/2" Add-d 6 17/32"

6 3/16 of core (lower portion) has a hole large enough for the safety block. The 1/2" Plate added in this loading does not. The safety block can not be inserted all the way into the core 5/16" of it will protrude from the bottom of the assembly

100 fine divisions on the synchro segment 1"

as 5/16" ~ 31.25 ~~division~~ reading

1 count limit light will come on at 2 division past 12 o'clock 31.25 5 mils per division

2.00

33.25

Inserting block till synchro reads 35 means that the block is

Safety block protrudes 5/16" Below bottom of core

	Rods in	Safety out	Refl in	
3 min	13 7	17 19	104 13	
Scale 64	12 8	16 46	102 59	
T	1615	2177	13,256	Σ
CPM	269	363	2,209	2841
1/CPM	3717	2757	4526	3519

	Rods in	Safety in	Refl. out	
3 min	37^{+41}	33^{+7}	253^{+8}	
	39^{+24}	33^{+61}	253^{+46}	
T	4929	4292	32,438	E
CPM	822	715	5,406	6943
$\overline{CPM}$	1216	1398	1850	1440

	Rods out	Safety out	Refl out	
	14^{+41} ~~$+0^{+2}$~~	16^{+43} ~~$+6^{+9}$~~	103^{+49} ~~-90^{+49}~~	
T	937	1067	6641	
CPM	312.3	356	2214	2882
$\overline{CPM}$	3202	2808	4516	3469

	Rods out	Safety out	Refl. in	
				#4
	10^{+22}	16^{+9}	90^{+49}	
	11^{+48}	15^{+52}	91^{+34}	
T	1414	2042	11,667	
CPM	236	341	1,944	2521
$\overline{CPM}$	4237	2932	5144	3966

Run 7A Safety Block Protrudes below bottom of core

7th Loading - added ½" - 7 1/16" measured

3 min	Rods in	Safety in	Reflector Out	
Scale 64	52^{+17}	45^{+29}	346^{+22}	#2
	55^{+3}	44	343^{+20}	
T	6868	5725	44,138	
CPM	1145	954	7,356	9,455
$\frac{1}{CPM}$	8733	1048	1359	1057

	Rods in	Safety Out	Reflector in		
					#1
3 min	17^{+16}	18^{+22}	115^{+57}	moved at Table	
	16^{+43}	18^{+21}	116	took 4"	
	14^{+21}	17^{+58}	116^{+57}		
T	917	1146	7481		3181
CPM	~~152.8~~ 306	~~191~~ 382	~~1246~~ 2493		~~1590~~
$\frac{1}{CPM}$	~~654~~ 3267	~~5235~~ 2617	~~8025~~ 4011		3143 ~~6182~~

	Rods out	Safety Out	Refl. in	
				#4
	12^{50}	18^{30}	102^{46}	
T	818	1182	6574	2858
CPM	273	394	2191	
$\frac{1}{CPM}$	3663	2538	4564	3498

	Rods out	Safety out	Refl. out	
	16^{+21}	17^{+20}	114^{+19}	#3
	16^{+24}	18^{+31}	111^{+9}	
T	2093	2291	14,428	
CPM	348.8	382	2,405	3136
$\frac{1}{CPM}$	2866	2617	4158	3188

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9-11-61

INSTRUMENT CHECK

Time 8:10 AM Source M-230

	Channel A	B	C	D	E
Source	OK	10/300 cps	10^{-10}	10/1000	1050 V.
Source Dist.	2"	OK	18"	½"	
% F.S. Trip	90		100	80	100

C.A. _____ Expr. FBR Run 7B

Sheet _____ Date 9-11-1961 Time AM

Purpose Loading of FBR

Repeat of 7th Loading

Run 7B

7th Loading - Repeat of #2

	Rods in ctr #1	Safety in #2	Reflector out #3	
3 minutes	48 +57	42 +52	330 +25	
Scale 64	48 +31	43 +31	336 +47	
	46 +54	43 +0	335 +62	
T	9230	8278	64,198	
CPM	1026	897	7,133	9056
$\frac{1}{CPM}$	9746	1114	1402	1104

Run 8 8th Loading - 7¾" High (Measured)

Safety Block @

					1/Reg.
1 min cts	3" -	8^{+42}	8^{+8}	62^{+38}	128
	2" -	11^{+0}	9^{+53}	74^{+16}	118
	1" -	12^{+11}	12^{+14}	89^{+58}	877
	Safety in Rods out	14^{+20}	12^{+7}	101^{+3}	784

	Rods in	Safety in	Refl. out	
2 min cts	39^{+42} $^{+11}$ 41	37^{+52} $^{+37}$ 34	273^{+16} $^{+18}$ 270	#2
T	5173	4394	34,784	
CPM	1293	1098	8,696	11,087
1/CPM	7734	9107	1150	9019

	Rods in	Safety out	Refl. in	
2 min ct	9^{+52} $^{+45}$ 9	12^{+52} $^{+27}$ 13	83^{+16} $^{+28}$ 84	#1
T	1249	1679	10,732	
CPM	312	420	2,683	3,415
1/CPM	3205	2381	3727	2928

	Rods out	Safety out	Refl in.		#4
2 min	7^{+40}	12^{+16}	74^{35}		
	488 4098	784 2551	4791 4173		3032
	244	392	2396		3298

	Rods out	Safety out	Refl. out	
	10^{+35}	11^{+62}	81^{+42}	#3
	675	766	5226	
	338	383	2613	3334
	2958	2611	3827	2999

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Run 9

gas ~~loading~~ - 7 in High (Measured)

	Safety Block			1/CPM
1/min	3" -	8^{+9}	8^{+52}	63^{+37} 1953
	2" -	10^{+25}	9^{+50}	77^{+56} 1610
	1" -	14^{+24}	12^{+23}	98^{+60} 125
	3/4" -	15^{+16}	13^{+49}	102^{+58} 1193
	1/2" -	15^{+50}	13^{+14}	110^{+42} 1149
	0.35" -	16^{+15}	14^{+24}	107^{+17} 1132

	Rods in	Safety in	Ref out	
1/min count	23^{3}	19^{3}	155'	
	22^{62}	18^{15}	153 45'	
	22^{4}	19^{33}	155' 23	#2
T	4357	3635	29700	
CPM	~~4357~~ 1452	1212	9900	1256
1/CPM	6887	825	101	796

	Rods in	Safety out	Ret in	
1/min Count	4^{52}	6^{55}	42^{54}	#1
	4^{36}	6^{16}	43^{21}	
T	600	839	5515	
CPM	300	420	2758	3478
1/CPM	333	238	~~362~~ 362	288

	Rods out	Safety out	Red in	
1 min counts	4^{21}	5^{63}	36^{12}	#4
	4^{7}	5^{41}	37^{50}	
T	~~3478~~ 540	744	4734	
cpm	270	372	~~2367~~ 2367	
1/cpm	370	269	422	

	Rods out	Safety out	Ref out	
				#3
1 min counts	5^{28}	5^{12}	40^{39}	
	5^{34}	5^{54}	40^{53}	
T	702	706	5212	
cpm	351	353	2606	
1/cpm	284	283	384	

Run 10 — 10 [illegible] Loading — $7\frac{23}{32}$" (measured)

Safety Block

3"	9^{1}	9^{11}	67^{26}	1718
2"	11^{3}	10^{14}	81^{34}	1512
1.	16^{23}	13^{39}	106^{52}	114
.35"	18^{3}	16^{34}	126^{40}	103

	Rods in	Safety in	Red out	
1 min counts	28^{53}	24^{36}	200^{14}	#2
	28^{46}	24^{47}	199^{34}	
T	3683	3155	~~25536~~ 25584	
cpm	1842	1578	12792	16,212
1/cpm	5428	634	7818	6168

	Rods in	Safety out	Ref in	
				#1
1 min	5^{29}	7^{43}	46^{35}	
Scale 64	5^{20}	6^{47}	46^{33}	
T	689	922	5966	
CPM	345	461	2978	3784
$\frac{1}{CPM}$	2898	2169	3359	2642

	Rods out	Safety out	Refl. in	#4
	4^{+12}	6^{+43}	39^{+0}	E
1 Min	268	427	2496	3191
	373	2341	4006	3133

	Rods out	Safety out	Refl out	#3
	5^{+63}	6^{+1}	42^{+32}	
	383	385	2720	3488
	261	260	3676	2867

Run 11

11th LOADING - $7\frac{31}{32}$" Measured

	Rods in	Safety in	Refl out	#2
1 min	10^{+27}	8^{+51}	68^{+146}	
Scale 256	10^{+23}	8^{+43}	67^{+247}	
T	5170	4190	34,953	
CPM	2585	2095	17,477	22,157
$\frac{1}{CPM}$	3868	4773	5721	4513

	Rods in	Safety out	Refl. in	#1
	1 +100	1 +222	12 +50	E
CPM	356	478	3122	3956
1/CPM	2809	2092	3203	2528

	Rods out	Safety out	Refl. in	#4
	1 +60	1 +163	10 +30	E
CPM	326	419	2590	3335
1/CPM	3067	2386	3861	2998

	Rods out	Safety out	Refl. out	
	1 +87	1 +156	10 +112	II 3
CPM	343	412	2672	3427
	2915	2427	3742	2918

34 98.572-4

9-12-61

M-226

INSTRUMENT CHECK

Source Ra Be X

8:10

	Channel A	B	C	D	E
F	1/1000	opc	10^{-12}	1/1000	150
O/C	7"	O/C	2'	2"	10"
	90		10?	70	100

Sc. F.S.

Run 12

Sheet ____ Date 9-12-1961 Time ____ AM

Purpose Initial Assembly of FBR
7½" H Source external
Glory hole plug in

	Rods in	Safety in	Reflector Out	
2 min Scale 256	10^{+83} 10^{+184} 10^{+84} 10	7^{+246} 7^{+230} 7^{+163} 7	62^{+127} 62^{+92} 62^{+24} 62	
T	8031	6015	47,889	
CPM	1338	1002	7,976	10,316
1/CPM	7473	9980	1253	9693

Glory Plug in

Run 13

Height = $7\frac{15}{16}$" Measured - External Source

	Rods in	Safety in	Reflector out	
2 min	17^{+135}	12^{+163}	106^{+244}	
Scale 256	17^{+170}	12^{+241}	107^{+65}	
	17^{+45}	12^{+61}	107^{+29}	
T	13,426	9681	82,258	E
CPM	2,237	1,615	13,709	17,561
$\frac{1}{CPM}$	4470	619	7294	5694

Run 14 Height = $8\frac{3}{16}$" Measured - External source

Glory hole plug in

2 min	Rods in	Safety in	Reflector out	
Scale 256				
	26^{+123}	19^{+242}	167^{+186}	
	26^{+184}	19^{+158}	166^{+160}	
T	13,619	10,128	85,594	
CPM	3,404	2,532	21,398	27,334
$\frac{1}{CPM}$	2937	3949	4673	3658

36

Run 15' HEIGHT = $8\frac{13}{32}$" - External Source - Glory Plug in. 9/13

2 min	42 +18	31 +79	264 +70	
Scale 256	42 +42	30 +240	266 +225	
	42 +115	31 +105	267 +27	
T	32,431	23,976	205,634	
CPM	5,408	3,996	34,272	43673
$\overline{CPM}$	1850	2502	2918	2289

2 min
Scale

9/13/61

INSTRUMENT CHECK P. Bc

Time 8:25 AM PM Source γ

		Channel A	B	C	D	E
FBR OK	F	10/1000	opr	-12	10/1000	1050
Range	OK	6"		30"	1"	1"
Source Dist.						
% F.S. Trip		100		100	80	100

73
89

C.A. ____ Expr. FBR Run 15'

Sheet ____ Date ____ 19 ____ Time ____ AM PM

Purpose FBR - Assembly 8 19/32"

	Rods in	Safety in	Refl. out	
2 min cts				
Scale 64	91 +75	66 +131	588 +76	
	91 +12	65 +246	584 +50	
T	46,674	33,913	299,646	E
CPM	11,670	8,478	74,911	95,059
~~CPR~~	8569	11180	1335	1052

Inserted Reflector to obtain Critical System

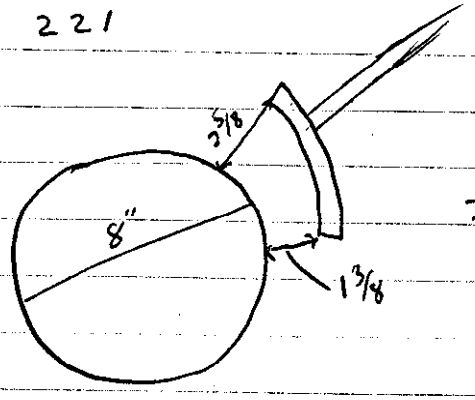
Refl. Setsyn = 34.29 level = 34.03

Pos Period = 130 sec Burst Rod Stroke @ 7.875"

8.0 ¢ ρ 1.10 ± 0.10

Safety in, Mass adj. in, Reg. Rod in, Burst Rod out

2 min scale 25k CPM	35^{+87}	26^{+2}	225^{+165}	Σ
	4524	3329	28,883	36,736
	221	3003	3462	2722



34.03 reading of Selsyn for plastic corresponds to this position of the plastic reflector

Extrapolated Critical height - 8 3/4 in with the burst rod in

C.A. _____ Expr. FBR Run 16

Sheet _____ Date _____ 19 ___ Time _____ A.M. P.M.

Purpose Evaluation of fuel equivalent to the burst rod.

Critical point with burst rod out 8 19/32 in High Plastic position

Plastic position reading at init. = 35.84

Shutdown with Safety blade water ~ 19.8 ± 0.2

C.A. _____ Expr. FBR Run 17

Sheet _____ Date _____ Time _____ AM PM

Purpose Evaluation of rate equation to the burst rod (cont'd)

Critical point with 1/8" piece removed and with burst rod in.

Height = 8 15/32

period = 35.37

Plastic position reading at crit = 35.13

Burst Rod with more than 1/8" Fuel on top

C.A. _____ Expr. FBR Run 18

Sheet _____ Date _____ 19 Time _____ AM PM

Purpose Multiplication with Burst rod out H = 8 15/32

2 min	25 +54	18 +97	154 +228	
Scaler 256	24 +133	18 +0	156 +165	
T	12,733	9313	~~77,753~~ 79,753	25,449
CPM	3,183	2328	~~+3,788~~ 19,938	~~+4,099~~
÷ cpm	3141	4295	~~7250~~ 5015	~~5181~~ 3929

INSTRUMENT CHECK

Expr. FBR Run 19

Sheet ____ Date ____ AM PM

Purpose Critical with Burst rod in

H = 9 13/32"

Plastic — 35.42

F.S. Trip

Expr. ____ Run 20

Sheet ____ Date 9-13-1961 Time ____ AM PM

Purpose Multiplication.

H = 8 13/32"

Burst Rod out

2 min	22 96	C	152 +1	
Scale 256	23 +180	16 226	150 +216	
	11,786	4322	77,016	
	2949	2161	19,254	24,364
	3391	4627	5193	4104

9-14-61

INSTRUMENT CHECK

Time AM Source Pu Be

F	Channel A	B	C	D	E
	10 / 100	opr	10	10 / 100	1050
Source Dist.	8"	OK	13"	4"	8"
	100		100	80	100

CA ____ Expr. FBR Run 21

Sheer ____ Date 9-14 19 61 Time ____ AM PM

Purpose 8 23/32 High Burst no. 10

	ctr #1	ctr #2
2 Min.	272 + 49	196 + 67
	~~69,681~~	50,243
CPM	34841	25,122
1/CPM	2870	3980

4 Critical with Plastic Refl. @ 21.56

\+ Removed Refl. Neg. Period ~ 23 ¢

C.A. _____ Expr. _____ Run 22

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose H = 8 31/32"

Burst Rod out

3 Bolt Insert plugs removed

Reg Rod stuck - not critical

C.A. _____ Expr. _____ Run 23

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose H = 8 31/32 Burst rod out

Bolt inserts all in U-M.

4 8 x 18 x 12" ref completely removed from its former position which was 67" from edge of core

Plastic reflector position = 32.82

Reactivity upon removal of plastic = - 46¢

INSTRUMENT CHECK

C.A. _____ Expr. _____ Run _____

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose _____

Range _____

Source Dist. _____

% F.S. Trip _____

Core ____ Expt. FBR Run 24

Sheet ____ Job ____ ID ____ Time ____ AM PM

Description H = 9 1/32 Burst rod out
longitudinal chamber mm onto the
floor

Regulating rod ~ 1/16" from being all the
WAY in or less

Plastic position = 30.94 at critical

neg. reactivity ≈ 19 ¢

9-15-61

Run 26

INSTRUMENT CHECK

Time 8:40 AM

S. Pu Be

	A	B	C	D
Range	$\frac{10}{100}$ opr	10^{-12}	$\frac{40}{1000}$	105
Source Dist.	8" oc	36"	2"	8"
% F.S. Trip	90	100	70	100

C.A. _____ Expr. FBR Run 25

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Run 2

Purpose Inserts in all 9 bolts were in serted as far as they would go — additional ½" The 6 non-supporting bolts were screwed down till heads were against core and tightened some what. Two ½" u-mo plugs (.29" dia) were in serted in glory hole to complete filling it. Burst rod shaft is in insented position (but burst rod is removed)

9 AM 10 Ma. Rod position; pos. period Red = 21.5" Black 8.7-8.8

Positive Period +183.5 sec 6.0 ¢

Pette readings — ave = 6.1 ¢

System scramed during pos. period due to voltage on Σ bus, cause unknown

Run 26 Repeat of last exp.

pos. period with reg rod = 7.55" (~1/16" up)

Ma rod = red = 21.5" ; black 8.7 - 8.8

Period	Petter reading
+181.9	~~6.05 ¢~~
+6.03 ¢	+6.02 ¢

Note: System scrammed again at ~ same power level (Log n ~ .2) ~~Period~~ Period Safety slow scram (~~fast~~) suspect.

Period safety slow scram has been by-passed

Run 27 Repeat again of above experiment

pos. period with reg rod = 7.55"

Ma rod = red = 21.5" black 8.7 - 8.8

Positive Period	Petter
166	
6.5	6.5 ¢

Ma rod reading at exit = red 14.5
black = 7.5"

Burst rod ~~st~~ steel shaft was removed and was worth ~ 3/4 ¢ (0.75 ¢)

M.A. rod reading after leveling (after removing burst rod shaft above) red 2.8
black .05"

Safety block scrammed: worth by Petter = 19.12 ¢

C.A. _____ Expr. FBR Run 28

Sheet _____ 9-15-61 Time _____ ~~AM~~ PM

Purpose To Evaluate Reflection From floor & Table

Raised Reactor and B[redacted] Reactor A Frame 50 7/8" up from original position by setting the A Frame on Steel Frames.

Reactor scramed with Log N = .0002 after all rod movements had stopped. apparent cause was high magnet current

Run 29 Repeat of the above Run

Measured Positive Period -

period = 923 sec

P = 1.35 ¢

INSTRUMENT CHECK

Time 8:10 AM PM Source Pu Be

Channel	A	B	C	D	E
F	10/1000	opr	10 1/2	10/100	1050
O/C	12"	ok		4"	8"
Source out					
Sc. Sub. Trip	100		100	85	100

C.A. _____ Expr. _____ Run 30

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose Critical Height with Burst rod

1N. - Bolts not screwed in

3 Bolt inserts out - Subcritical

C.A. _____ Expr. _____ Run 31

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose 3 Bolt inserts Added

$8\frac{27}{32}'' = +1$

To measure worth of Reg rod over increment

{ Reg rod reading = 1.7 (starting zero at 8 or 1/2 noon)

corresponding period : 62.2 Sec.

Reg rod reading = 2.82 at level

~~corresponding level~~ ✓

48 Measurement of MA rod worth over increment

	blade (~~left~~)	Rod (~~right~~)
at Insert limit MA rod reading =	~~8.78~~ −0.78	21.5

measurement of reg rod worth

just crit { Reg rod = 1.7
MA rod = 0.66 (blade) ; 14.1 (rod)

measurement of MA rod worth over insert

MA rod has been moved 1.425"

Burst rod removed 7 7/8" : worth − Potte = 1.088

Summary:

Burst rod worth ~~$ 1.088 - 7\frac{7}{8}$~~ stroke
Reg rod = 1.12 in = 14.1 ¢
~~Burst rod~~
Mass Adjustment rod (Lower) − 1.425" = 14.1 ¢

C.A. _____ Expr. FBR Run 32
Sheet _____ Date _____ by _____ Time _____ AM PM
Purpose 1 Bolt insert ~~put in~~ taken out
8 27/32

Reg Rod position = −0.49 at insert limit
MA rod " = −.78 blade 22.5 rod (at insert limit)
corresponding period = 12.05 ¢ = +77 sec

measurement of reg rod worth

Reg rod position = ~~1.7~~ 1.65

MA rod .786 ; 22.5 rod insert limit

corresponding period — level (∞)

measure worth of one insert

Reg rod position = 1.7

MA rod = .786 ; 22.5 rod INSERT Limit

corresponding period = ~~1.5~~ ¢

" Petts = ~~0.0145~~ ¢

~~Remove burst Rod~~

~~Reg. rod~~ 1.64

Safety block run down ten tenths of inch then back in when level — reproduced level

Remove Burst Rod

Reg rod = ~~1.64~~ 1.62 } level

MA rod = in

corresponding Petts = ¢ 1.0815

SUMMARY

Burst rod ¢ 1.0815 — 7 7/8" stroke

* Bolt insert — 15.6 ¢

Reg Rod — in to 1.7 — Lower 2.19 in = 12.05 ¢

~~Mass Adjustment~~ —

C.A. _____ Expr. FBR Run 33

Sheet _____ Date _____ AM PM

Purpose Two Bolt inserts removed
Bolts screwed down
H = 8 27/32 Burst Rod not in
Sub critical

Expr. FBR Run 34

19 Time AM PM

Same As Above But with
Burst Rod in

Mg rod in -.786; 22.3 rod
Reg rod = 1.62
two inserts removed; 6 bolts are
tightened down
corresponding period = 6.0¢ 183 sec

leveled with reg rod = 2.06

Reg rod ran out to ~~2.4~~ 2.6 for neg
period and walks of rod from
2.06" to 2.60"
Reactivity = ~~6.8~~ ¢ T = -247.5 6.25 ¢

SUMMARY Reg Rod 1.62 to 2.06 = 6.0 ¢
2.06 to 2.6 = 6.25 ¢

C.A. _____ Expr. FBR Run 35

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose H = 8 25/32 All bott / insets in

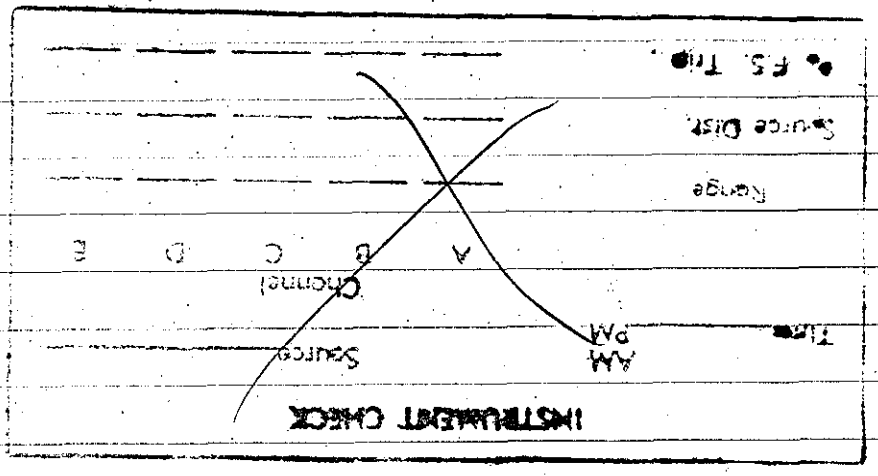
Reg Rod pos = 1.7

MA Rod = -.78 b, 21.3 rod

pos period = 115 sec 8.85 ¢

Reg Rod pos at crit = 2.45

Burst Rod Worth = $1.0865



9-19-61

INSTRUMENT CHECK

Po, Be ✓

Time 9:00 AM

	A	B	C	D
Range	F	10^{-12}		
Source Dist.	O.K.	7"	8"	2" 8"
% F.S. Trip		100 80	100	80 100

Oper. _____ Expr. FBR Run 36

Sheet _____ Date _____ 9 Time _____ AM PM

Purpose Evaluation of Glory hole plug
8 25/32 in One Belt insert removed

MA rod position = -7.86 ; 21.0 red
Reg rod " = -.50
corresponding period = +133.2 sec — 8.0¢ } either 7.86¢

MA rod position after leveling = 0.20 ; 17.5 red

Check of Range of Operation of Fission Chamber

Chamber Position	Counts (1 min)
Insert limit	92600
Withdraw limit	5835

Burst Rod Removed (7 7/8") by
air pressure
Pelle = #1.0802

C.A. _____ Expr. FBR Run 37
Sheet _____ Date _____ 19 ___ Time _____ AM PM
Purpose Bolt insert put back + Glory
hole plug removed

MA rod position = -0.78 ; 22.2 rod
Reg rod " = -0.51
corresponding period = +321 ms = 3.66 ¢

MA rod position after leveling = -0.256 ; 25.9 rod

Summary.
1. Glory hole plug — 19.94 ¢
2. Burst Rod — $1.0802 7 7/8" stroke
3. Mass Adj rod calibration

C.A. _____ Expr. FBR Run 3.8
Sheet _____ Date _____ Time _____ AM PM
Purpose Glory hole plug put back in for purpose of getting period so Δρ/ρk can be measured

MA rod position = -.786 ; 22.0 rod
Reg rod = -.51
Safety blade position = .7 blade ; 20.6
corresponding period = + 28.2 sec ; ρ = 23.4
" Petts = + 23.04 cents

Leveled with safety blade; position = 32.2 rod

C.A. _____ Expr. FBR 39
Sheet _____ Date _____ Time _____ AM PM
Purpose 1/16" of fuel removed from assembly above to get Δρ/ρk
8 23/32" - critical ρ = 0

A small plastic reflector has been attached to side of reactor in order to get power level. String attached so it can be pulled off
Plastic dimensions:
1" x 2" x 3.5"
Location: Bottom edge of plastic even with bottom edge of core; 3.5" dimension is vertical

Period with all rods in =
Petts " " " " = 22.76 cents

Then plastic was removed:
(no other changes made)
Petts = 0.0 cents

Summary
1.) 1/16" Fuel on top worth 23.4 ¢
2) Safety block worth ~ 0.23 ¢ per mil at insert limit
3) Critical heigh $8\frac{23}{32}$ Burst rod in

C.A. _____ Expr. FBR Run 40
Sheet _____ Date _____ 19 __ Time _____ AM PM
Purpose Evaluate the reactivity worth of heater + bottom insulation (but not top Insulation)

Loading same as last exp.
MA rod = -0.78 block; 21.1 red ("in")
Reg rod = -0.51 ("in")
corresponding period = 70.1 sec; ρ = 12.9 ¢
Petts = 12 cents

Leveled with MA rod = 0.54 block; 0.15" red

Burst rod removed by air pressure:
Pottle = # 1.0739

Summary:
The Wooth of Heater = 12.5 ϕ
Remove Burst Rod = # 1.0739 ϕ

9-21-61

INSTRUMENT CHECK

Time 10:15 AM PM Source Pu Be γ

	Channel F	A	B	C	D	E
Range		$\frac{1}{1000}$	opr	1^{-12}	$\frac{1}{1000}$	1050
Source Dist.	OIC	N.G	OIC	27	1½"	7"
% F.S. Trip		out of trip circuit		100	80	100

C.A. _____ Expr. _____ Run 41

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose Critical Run BEFORE TEMP COEFF. MEASUREMENT. FURNACE IN PLACE - FURNACE OPERATION OK BEFORE SET UP AROUND REACTOR

Rod Calibration

Rod Position

	Reg Rod	MA Rod	Period	ρ	pette
A 1)	Limit Limit −0.51	1.33 > 1.30 (30)	104.4 ~~313.3~~	9.55¢ 10-100 + 9.84 ¢ 100-1K 9.9¢ ¢	
B	−0.51	1.73 > 1.69 (69)	∞		0
C	+0.50	1.73 > 1.69 (.19)	−329.0	−4.48¢	−4.33 ¢
D	1.5	1.73 > 1.69 (.19)	−144.8	12.8¢	13.34 ¢

	Rg Rd	MA Rd	T	ρ	ρ cttle	S
E	1.25	$+1.33_{33} > 1.3$"	∞			
F	1.25	$1.02_{0} > 1.0$	+164.4	6.58 ¢	6.31 ¢	
G	1.91	$1.02_{0} > 1.0$	∞			
H	+1.91	$1.51_{0} > 1.5$	-148.3	-12.34 ¢	-11.93	
I	1.91	$1.02_{-} > +1.0$	∞			
J	1.91	$.53_{0} > +0.50$"	+108.6	+9.2 ¢	+9.003 ~~+5.03~~	A1
K	2.65	$.53_{0} > 0.50$	∞			B2
L	2.65	$1.27_{25} > 1.25$	-126.0	-16.17 ¢	-15.03	
M	2.65	$.53_{0} > 0.50$	∞		±0	
N	2.65	$.0_{0} > 0.0$	+160.0	+6.72 ¢	6.56 ¢	
O	3.17	$.0_{0} > 0.0$	∞			
P	3.17	$.75_{25} > 0.75$	-149.8	-12.11 ¢	11.36 ¢	
Q	3.18	$.0_{0} > 0$	∞			
R	3.18	$-.75_{78}$ ~~-.805~~ -.781	+216.5	+5.2 ¢	4.90 ¢	

S RR + 3.54 MA - -0.78" ∞ Period

C.A. _____ Expr. FBR Run 42
Sheet _____ Date _____ 19 Time _____ AM PM
Purpose Temp Coeff Measurement.

A 1 Reg Rod limit -0.51 MA Rod. limit 1.40 / 40 > +1.4" Period ∞ Petite +7.57 ¢

B 2 T -0.51 1.7 / 18.6 > 1,686 in ∞ critical point

HEAT ADDED Power Level Decreased.

MA Rod Moved in to raise power level

HIGH MAGNET CURRENT SCRAMMED THE SYSTEM. Source inserted & safety block reinserted.

System crit at 21.911 22°C
with MA rod = 1.486 i.e. 1.7 blocks 18.6 rod
and Reg. Rod "in"

Thermocouple Readings – 4:20 PM – #7 - 0°C as Ref. pt.

#3 - 47 °C	#6 - 45° C	#8 - 44
#14 - ~~47~~ 47°	#1 - 45°	#11 - 44
45.03°C #6 - 45°	#16 - 45°	#12 - 44
#13 - 48.5°	#10 - 45°	#4 - 44.5°
#2 - 45°	#9 - 45°	#5 - 44.5°

Power level raised to ~ .1 on Log N 70.4
and then leveled by moving MA rod
to 1.421

Then

21.91 / 45.03 MA rod moved to 1.686 and neg. period obtained (corresponding to change in reactivity due to heating from 22°C)

T = -229.6 sec P = -6.82 ρ_{Pette} = -6.65 ¢

ρ_{MA} = 6.59 ~.30 ¢/°C

Thermocouple Readings: 96.6

#1	71.2	6	71.5	11	71
2	70.7	7	0	12	71.3
70.79°C 3	70	8	72.3	13	71.5
4	70.5	9	71.5	14	67.8
5	70.5	10	71.5	15	71
				16	71

7:00 PM MA rod = ~~1.057~~ 1.07 at critical Log N = .1

Next:

MA rod withdrawn to 1.421 for period

T = -201.9 sec P = 8.02 ρ_{Pette} = 7.76 ¢

ρ_{MA} = 8.2 ~.34 ¢/°C

MH Rd Calibration 0.155 in to 1.07 in = 15.42¢

Second reading of thermocouples (for coeff. measurement from 22 to 71)

	1 - 71	6 - 71	11 - 71	16 - 70.8
	2 - 70	7 - 0	12 - 71.5	
70.42 °C	3 - ~~74~~ 69	~~8 - 73.8~~	13 - 71.2	
	4 - 70	9 - 71.3	14 - 67	
	5 - 70	10 - 71.3	15 - 70.8	

MA rod = 1.685

T = 120.6 ? P = 16.09 ? Petto = 14.7

C_{MA} = 14.7

Thermocouple Readings

	1 96.7	6 - 97	11 - 97	16 - 96
	2 - 96.2	7 - 0	12 - 96.2	
96.34 °C	3 - 96.2	8 - 94	13 - 97.5	
	4 - 96	9 - 96.5	14 - 94.2	
	5 - 96	10 96.8	15 - 94.5	

Leveled with MA rod = ~~5.205~~ 0.705

MA rod moved to 1.07 for neg period

T = 200.8 P = 8.1¢ Petto = 7.801

P = 7.0¢

Power level raised and MA rod then moved to 1.42 for neg period ~~ff for coeff from 45° to 80°C~~

T — P 3 Petto = 15.42¢

C_{MA} = 15¢

Thermo Couple locations

#

1. — at inside edge of upper core Thermocouple position (inside)
2 - under bolt head next to reg. rod (east side of bolt; bolt is west of reg rod)
3 2in hole in stainless rod (hole is ~ 4" up from bottom)
4 2in bolt hole of washer that holds guide tube for reg. rod (TC held in place by washer)
5 At midplane vertically between guide tube and reactor on MA tube. (couple on surface nearest center of reactor
6. ~ 1/2" in glory hole up from bottom
7. — 0 (reference)
8. — 2in air ~ half core height
9. 1/8" in from outside edge of upper thermocouple hole
10 lower thermo position (in hole)
11 30/16" up from bottom on center side of bolt hole, between bolt and wall.
12 ~1/8 inside lower thermo hole
13 in safety guard bolt support hole on north side
14 2in safety block ~~staiglass bolt support hole on north side~~ block pushed up to top of slot.

15 - 1" down from top in glass bolt plug

16. at mid plane vertically in bolt hole (with bolt insert in but not screwed down)

Thermocouple Readings at Room Temp. before first temp. run (see p. 59)

# 1	21.9 °C	# 9.	21.8
2	21.9	10.	22.
3	21.9	11.	22
4	22	12.	22
5	22	13.	21.8
6	22	14.	21.8
7	0	15.	22
8	21.5	16.	22.1

INSTRUMENT CHECK

Time 8:00 AM — By B.

8/22/61

Chan. A B C D E

Range F — Oper 10⁻⁴ 10⁻³ 10⁻² 1.5V

Source Disc. OK — OK 30" 2" 7"

% F.S. TMB — 100 70 100

FBR 43

Thermo couple Readings

	1 - 22	6 - 22.2	11 - 22.3	16 - 22.2
22.21°C	2 - 22	7 - .5 (reference)	12 - 22.4	
	3 - 22.4	8 - 22	13 - 22.2	
	4 - 22.2	9 - 22.2	14 - 22	
	5 - 22.4	10 - 22.3	15 - 22.4	

I MA rod at critical = 1.709

Reg Rod "in"

8:40 AM Heat Turned on (60% of full scale on Power Stat)

10:35 AM Thermo Readings:

	1 - 44	6 - 43.5	11 - 44.1	16 - 43.5
	2 - 43.8	7 0	12 - 43	
43.84°C	3 - 45	8 - 40	13 - 44	
	4 - 43.5	9 - 43.2	14 - 45.1	
	5 - 43.5	10 - 43.5	15 - 44	

at 66°C
MA rod reading at critical = 1.456

MA rod reading for period = ~~1.65~~ 1.709
T = ρ = Petto = -6.56 ¢
ρ_{MA} = 6.4 ¢

10:55 AM Heat Turned on

Temp Readings:

	1 - 66.2	6 - 67	11 - 66	16 - 66
66.19°C	2 - 65.2	7 - 0	12 - 66.5	
	3 - 66.8	8 - 65.5	13 - 67	
	4 - 65.2	9 - 66.1	14 - 66.2	
.2	5 - 65.4	10 - 67	15 - 66	

1:15 PM MA rod reading = 1.154 at crit

43.84 MA rod moved to 1.456 for neg period
66.19 T = -221.5 ρ = -7.18 Petto = -7.56 ¢
ρ_{MA} = 7.0 ¢

Power level raised again and MA
) 3221 rod then placed at 1.709 for neg. period
66.19 T = -143.3 ρ = -13.48 Petto = -13.67 ¢
ρ_{MA} = -13.5 ¢

3.5 1:40 PM Heat Turned on

Thermo Couple Readings:

	1- 107.1	6- 107	11- 107.2	16- 106.8
	2- 107.3	7- 0	12- 107	
107.08°C	3- 107.3	8- 107.6	13- 107.2	
	4- 107.3	9- ~~107.2~~	14- 106.5	
	5- 107.4	10-	15- 106.8	

MA rod at crit at 0.479

MA moved to 1.154 for neg. period
T = P = Pette = -12.414

Thermocouple Reading

	1. 106.5	6. 106.5	11 106	16 106
	2. 105.5	7.	12 105	
105.7	3. 105	8.	13 106.6	
	4. 105	9. 107	14 103	
	5. 105.2	10 106.5	15 106	

MA rod reading at crit = 0.515
MA rod = 1.454 for neg. period
T = P = Pette = -19.824

MA rod moved to 1.709 (after raising power)
Pette = -26.3 ¢

4 GS Heat Sheet

CRITICAL FACILITY
LOG-N

.11

FAST BURST
SCALAR

μμ AMMETER

9.8
10^{-9} RANGE

46226/60

44522/60

FAST BURST
LOG-N

.018

FAST BURST
CRM

560 RECORDER

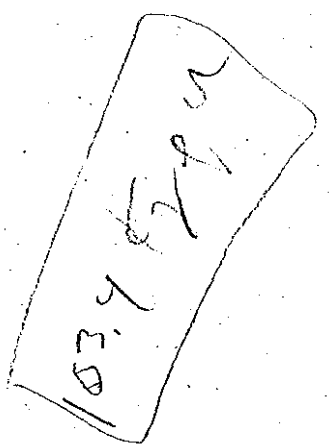
950 METER

NO NOISE WITH FISSION CHAMBER SWITCH

NOTE:

FISSION CHAMBER WAS FULLY WITHDRAWN FOR THESE TESTS

θ	x		t
	cm		
.695 = 0			
.748 = 12.95		.053	.137
.785 = 18.25		.090	.12,29
.825 = 27.31		.130	.33
.883 = 37.35		.188	.478
.981 = 52.23		.256	.650
1.046 = 72.85		.351	.891
1.220 = 1.064		.525	.1339
1.330 = 1.3		.635	1.613
1.490 = 1.7		.895	2.27
1.695 = 2.0		1.010	2.54



9-25-61

INSTRUMENT CHECK

Time 8:20 AM Source Pu Be + γ

	Channel A	B	C	D	E
F	$\frac{10}{1000}$	off	10^{-2}	$\frac{10}{10^1}$	1050 V.
Source Dist.	0"		30"	2"	3"
% F.S. Trip	OK		100	85	

C.A. _____ Expr. FBK Run 44

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose Thermocouples taken from under bolt heads out of bolt holes out of glory hole, and balls (6) tightened down — Temp. Coeff

9:15 AM Thermocouple Readings (°C)

	1. - 20.5	6 20.5	11 - 20.5	16 - 20.5
20.48	2. - 20.5	7 —	12 - 20.5	
	3. - 20.2	8 - 20.5	13 - 20.5	
	4. - 20.5	9 - 20.5	14 - 20.5	
	5. - 20.5	10 - 20.5	15 - 20.5	

Crit with:

Reg rod = -.51

MA rod = 1.997

(source was "in")

Measurement of worth of Safety Block:

Safety block removed to reading of 0.946 for neg. period (Safety block in at ~ 0.70)

Note: sources were "in"

Petts = 44.1 ¢

Repeat with source out

Reg rod = -0.51

MA rod = 1.990

Safety = -0.69 at contact

Safety block removed to reading of =

11:35

1:35

ΔT 84.8

11:25 Thermocouple Readings:

ΔT 50.5

✓ 1 - 55.1	~~6 - 55.1~~	~~4 - 56~~	~~16 - 47~~
54.78 ~~2 - 54.9~~	~~7 - 0~~	12 - 54.5	
✓ 3 - 54	~~8 - 54.9~~	13 - 54	
✓ 4 - 55.7	✓ 9 - 55.4	✓ 14 - 54.2	
✓ 5 - 55.6	✓ 10 - 54.5	~~15 - 55~~	

MA rod reading = 1.648 at crit

Moved to 1.990 for neg period ✓

T = -177 P = 9.46 Petts = -9.67 ¢

P(MA rod curve) = .27

ΔT 54.3

0.282

11:35 AM Heat Turned On

1:35 Thermocouple Readings:

1 - 106.1	~~6 - 106~~	~~11 - 109~~	~~16 - 74~~
~~2 - 105.9~~	~~7 - 0~~	12 - 105.9	
3 - 104	~~8 - 106.7~~	13 - 105.5	
4 - 106	9 - 106.2	14 - 103.3	
5 - 105	10 - 106	~~15 - 104.5~~	105.33°C

MA rod at Crit = +.966

ΔT 84.84 MA rod moved to 1.990 for neg. period

T ——— P Pettp = -25.68 ¢
0.303 ¢/°C

ΔT 50.55°C MA rod = 1.648 for neg period
Pettp = -15.88 ¢ 0.314 ¢/c

Thermocouple Readings:

1. - 134.9	9 - 134.2	14 - 131
3. - 132.9	10 - 136	
4. - 133	12 - 136.2	
5. - 132	13 - 135	Avg - 133.9

MA rod at Crit = +0.418

MA rod moved to 1.990 for neg period
ΔT=113.42 → Pelto = -35.62 ¢ 0.314 ¢/°C

Obtained critical again, Then
ΔT=79.12 MA rod moved to 1.648 for neg period
Pelt = -25.8 ¢ 0.326 ¢/°C

Power level raised again, Then
MA rod moved to +0.966 for neg period

Temp.

1 - 133	9 - 132	14 - 124	
3 129.5	10 - 134		
4 130.5	12 - 133	Avg = 131.22° C	
5 130	13 - 133		

Obtained crit again - MA = 0.450 at Crit
25.89 ΔT → MA rod moved to 0.966 for neg period
Pelt = -9.5 ¢ T = ρ =
367 ¢/°C

Thermocouple Reading

1	134.5	9	135.5	14	127.5
3	131.5	10	138		
4	134	12	136		
5	132.5	13	136		

MA rod at crit = 0.509
Burto Rat Removed
Pelto = $107.08

9-26-61

INSTRUMENT CHECK

Time ____ AM PM Source Ra Be + Y

	Channel A	B	C	D	E
F					
Reading	✓	opr	10^{-12}	$\frac{1}{1000}$	1050
Source Dist.	OK	OK	28"	2"	8"
% F.S. Trip			100	70	100

C.A. F. B. R Expr. ____ Run 45

Sheet ____ Date 9-26 19 61 Time ____ AM PM

Purpose Rod Calibration

Odd 1/32" fuel height in stacking

Height = 9 5/32", Burst Rod in.

Run A	Reg R.d	MA R.d.	T	ρ	ρ ette
	−0.51 in	3.875	+124.9	8.27	8.13 ¢
45 B	1.25	3.875	∞		
C	1.25	4.00	−329.1	−4.48	4.12 ¢
D	1.25	~~4.00~~ 3.875	∞		
E	1.25	3.675	+165.1	+6.55	6.56 ¢
F	1.90	3.675	∞		
G	2.30	3.675	314.9	−4.71	4.35 ¢
H	2.30	~~3.675~~ 3.55	∞		

	Reg R.2	MA R.2	T		Pette
I	2.30	3.30 in	+121.6	8.45	8.19
Scram					
J	~~2.30~~	3.30 in	∞		
K	3.6	3.3	−177.5	9.53	8.94
Scram					
L	3.6	3.026	∞		
M	3.6	2.75	+100.6	+9.87	9.69
N	4.36	2.75	∞		
O	4.9	2.75	−201.3	−8.06	8.12
P	4.9	2.51	∞		
Q	4.9	2.25	+133.1	+7.82	7.68 ‡
R	5.6	2.25	∞		
S	6.3	2.25	−220.9	7.19	6.71 ‡
T	6.3	2.035	∞		
U	6.3	~~2.035~~ 1.65	+95.57	10.2	10.18 &
V	7.92	1.65	∞		
W	8.09	1.65	—		

0.5 ‡ ~~0.058~~

0.47 "C" 2.67

X	8.09	1.635	∞		
Y	8.09	1.25	+101.4	9.8¢	8.64 ¢
Z	8.09	0.9	+45.61	17.1¢	17.83 ¢
Z_2 out	8.09	0.80	+26.06	20.4¢	24.62 ¢
Z_3 in	+0.76	4.00	∞		
Z_4	+0.76	4.30	−165.1	10.5¢	9.89 ¢
Z_5	+0.76	4.5	−	6.7	− 16.59
Z_6	0.76	4.7		6.51	− 23.10
Z_7	0.76	4.9		5.88	−28.98
Z_8	0.76	5.1		6.5	35.48
Z_9	0.76	5.3		6.14	41.62 ¢
~~Z_{10}~~	~~0.76~~	~~5.~~			

9-27-61

Z_{10}	7.92	1.644	∞	
Z_{11}	8.45 (out)	1.644	−	1.42 ¢

C.A. _____ Expr. _____ Run 46

Sheet _____ Date 9-26-1961 Time _____ AM PM

Purpose Safety Block Evaluation

46 A1 RR MA

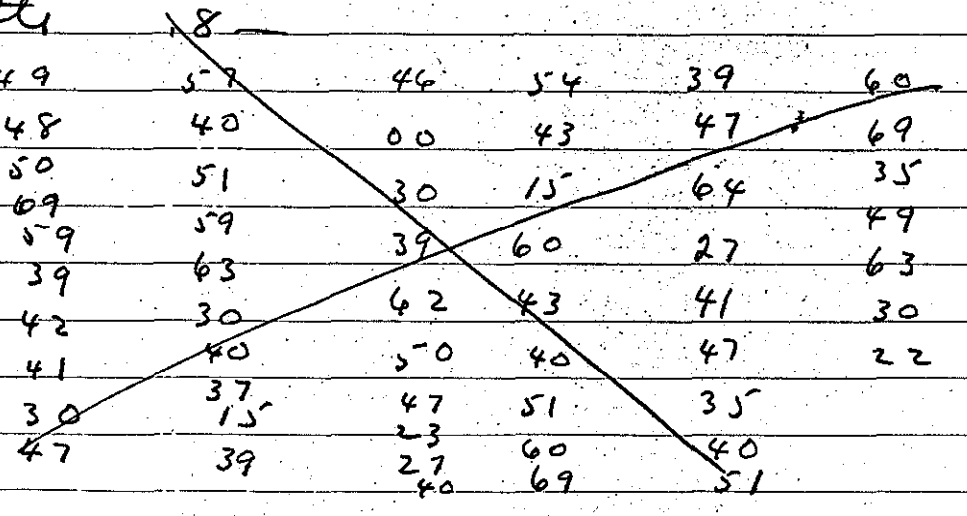
-0.51 4.132 ∞

Position where Safety Block makes Contact with physical stop.

.695	.695	.71
.695	.700	
.690	.695	
.696	.695	

			Period	Petit
40 A_2	Safety Block @	0.748	-	- 12.95
A_3	"	0.788	-	18.25
A_4	"	0.825		27.31
A_5	"	0.883		37.35
A_6	"	0.951		52.23
A_7	"	1.046		72.95 ¢
A_8	"	1.22		1.064

Pett



49	57	46	54	39	60
48	40	00	43	47	69
50	51	30	15	64	35
69	59	39	60	27	49
59	63	62	43	41	63
39	30	50	40	47	30
42	40	47	51	35	22
41	37	23	60	40	
30	15	27	69	51	
47	39	40			

INSTRUMENT CHECK

Time 9:00 AM / PM Source Pu Be γ

	Channel A	B	C	D	E
Range	F	10	10^{-12} opr	10 / 1000	1050
Source Dist.	OK		OK	2"	6"
% F.S. Trip			100	75	100

C.A. _____ Expr. FBR Run 47 AM / PM

Sheet _____ Date _____ 19 __ Time _____

Purpose Rod Calibration Reg. Rod
Safety Block calibration

	Reg Rod.	MA Rx	T	e	ρ eff
47A	7.92	1.644	∞		
47B	8.45 out	1.644	–		1.429
~~47C~~	~~Safety Block Evaluation~~				
47C	7.92	1.653	∞		
47D	8.45	1.653	–		
47E	8.45	1.6	∞		
	Safety Block Evaluation				
47D	133 in				1.3
47E	1.492				1.7
47F	1.695				2

Repeat of MA R.d Calibration

(~~That is 2, through 2, on p 25~~)

	Reg Rod	MA Rod		Pellet
47 G	0.76	4.0		cliff
47 H	0.76	4.7	5.82	22.8 ¢
I	0.76	4.9		28.62 ¢
J	0.76	4.5	6.47	16.13 ¢
K	0.76	4.3	6.13	~~41.00~~ 10 ¢
L	0.76	5.1	5.93	~~45.57~~ 34.55
M	0.76	5.3	5.52	~~45.58 ¢~~ ~~TC~~ 45.07
N	0.76	5.5	5.51	45.58
O	0.76	5.7	5.17	~~55.08~~ 50.75
P	0.76	5.9	4.53	~~55.53~~ 55.28
Q	0.76	6.1	4.62	~~59.99 ¢~~ 59.9 ¢
R	0.76	6.4025	5.97	65.87
S	0.76	6.8	7.0	72.87
T	0.76	7.2	4.37	77.24 ✓
U	-0.51	4.143	∞	0 CRITICAL
V	-0.51	7.6		76.48
W	-0.51	out 8.025		78.28

CA _____ Expr. _____ Run 48

Sheet _____ Date _____ 19 ___ Time 1 ~~AM~~ PM

Purpose Burst Rod Evaluation

Reg Rod - -0.51 in

MA Rod - +4.1375

Burst Rod summed 109.4 ¢

EA. _____ Expr. FBR Run 48

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose MA Rod Calibration
2-U-Mo Bolt inserts removed
Burst Rod Calibration 7 7/8" Stroke

	Reg Rod	MA Rod	T	ρ	Rate
48 A	8.45 in	− 0.768			4.214
48 B	8.45 in	− 0.042	∞	0	0
48 C	8.45	+ 0.50	−		−6.427
48 D	8.45	− 0.042	Burst Rod Removed		
	7 7/8" Stroke		1,072 #		

MASS ADJUSTMENT ROD
INSERT LIMIT LIGHT = 0.768 ~~corrected~~ To
At THIS SYNCRO READING ROD BOTTOM
is 0.028 inches up from bottom

9/28/61

INSTRUMENT CHECK

Time 9:00 AM ~~PM~~ Source Pu Be γ

	F	A	B	D	E
Range	c/s	opr	10^{12}	$\frac{10}{100}$	105
Source Dist.					
% F.S. Trip		100	80	105	

C.A. Expr. FBR Run 49

Sheet Date 9/28 19 61 Time 9 AM ~~PM~~

Purpose Calibration of Total Rod worths

H = 9 1/32" 9x9x1" Thick

plexiglas mounted on Air cylinder

on other half of split tables

All Bolt Inserts in U-Mo

Total Value of Regulating Rod. petts

A. Critical with Regulating Rod in

RR	MA Rod	Burst Rod.
-0.51	+ 4.099	in 9x9x1" Plex 67" Away

B RR - -0.51 MA + 4.099 BR in Plexiglas — 17.13

T petts = 11.0 ±

.1—

13	09	07	10	15'	04
03	18	20	07	09	12
04	13	11	05'	05'	09
06	02	03	12	15'	14
05'	11	09	06	13	10
12	17	08	99	05'	05'
14	09	07	05'	08	09
00		06	07	12	14

08 10 07 08 04
07 06 14 10 05'
09 07 04 08 08

ave Petts =

C
MA = 4.099
Reg Rod = 3
Plexiglas = 14.06
} crit

D
MA rod = 4.099
Reg Rod = 5.0"
Plexiglas = 12.41
} crit

* Plexiglas & Not Vertical

E
MA rod = 4.099
Reg rod = 7.0
Plexiglas = 11.76"
} crit

F
MA rod = 4.099
Reg rod = 8.45' (out)
Plexiglas = 11.60
} crit

Petts = - .8678

A
B

Hen plastic fired out and tables would back also - table was moving during following

Path readings

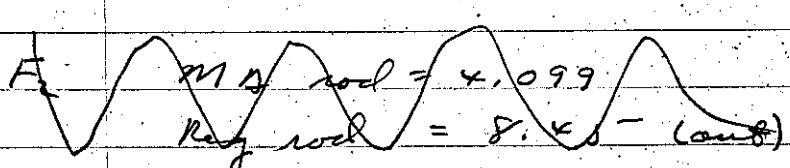
.8

45	63	64	60	71	76	80	83	74
47	60	62	76	70	63	61	90	57
50	57	58	80	52	75	47	59	74
72	58	66	62	60	77	79	80	49
57	95	60	67	92	81	62	67	99
62	60	51	51	63	55	80	99	81
39								
53								

ave → 666

95	47	95	99	59	20	86	99	91	62
51	58	59	35	21	79	76	50	80	90
87	62	41							
50	82								
		90							

ave → 678



C.A. _____ Expr. FBR Run 50

Sheet _____ Date _____ Time _____ AM PM

Purpose Critical Position determined with Plastic Fired H-tables At 11.60 in

	RR	MA Rd	BR in.	
A	−0.51	+4.125		CRITICAL
B	H table moved back to 57 in			

T

$\frac{77}{70}$ in 100 sec

ρ

pette A

84 Value of 9x9x1 Plex - Field - Tables at 11.6 → 57. in pette readings 49 B.

1.7	1.0	0.9	1.5	0.9	1.3	0.7	1.1	1.0
1.4	1.0	1.5	0.9	1.3	0.8	1.4	1.3	1.2
1.2	0.6	0.7	0.5	0.3	1.5	1.3	1.2	0.6
0.7	0.9	1.6	0.9	1.0	0.8	1.1	1.0	1.2
1.0	0.8	0.9	1.2	1.8	1.2	0.5	0.8	0.5
1.0	1.0	1.7	1.3	1.1	0.9	0.4	1.2	0.8
0.9	0.4	1.8	0.9	0.9	0.9	1.2	1.5	0.4

ave = 1.0894

C. Plastic Cocked + RR out MA 4.125 BR in H Tables brought to 11.57 system critical

Plastic Field RR Value

Pette ~~.8848~~ .8438

49	51	30	33	15	64
48	59	39	41	60	27
50	63	62	40	43	41
69	30	50	37	40	47
59	40	47	40	51	35
39	34	39	23	51	40
42	15	50	27	60	63
41	39	63	40	69	30
30	46	40	54	39	22
57	00		43	41	35
40					49

ave = 4378

D Plastic Cocked RR out MA 4.125 BR in H Tables 11.62

Plastic Field

Petty Readings (D) .8 ±63

43	27	30	70
45	56	19	50
46			
44	35	40	47
41	49	47	
50	40	49	
29		39	
45	37		
ave: 46 40	27	50	
51	59	42	
44	49	70	
59	58	59	
50	41	58	
49	39	30	
50	46	59	
44	35	30	
49		70	
50	46	63	

Run D1: Reflector calibration

Positive period with tables, ∴ plastic moved in closer to core (from crit position)

Table position = 10.18

MA rod = withdrawn

Reg rod = withdrawn

Petty = +0.298

ave = .298

07

13

05

12

13

09

.1

Run

24	24	29
19	24	24
23	21	28
24	24	21
30	22	22
25	00	28
25	20	29
		19

Run E (Repeat)

Reg rod = 8.45
MA rod = 4.125
Plastic cookoff
Table = 11.575
} crit

Table readout for Petts reading

Petts = .8584

43	48	35	43	69	82
50	57	40	55	43	99
45	58	60	60	61	75
63	59	49	50	31	59
43	55	55	49	40	65
45	44	59	55	84	80
47	69	41	74	62	74
50	49	74	59	59	69
43		60	59	84	5.84
			51	81	3330
				70	
				59	

A

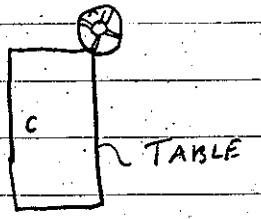
B

Run F Table = 11.565" Plastic Cooked
MA = 9.123" Reg. Rod 8.45" (Out)
Plastic Fired for Petti readings: .8601

.850	46	54	78	35	61	64	59
60	43	59	59	66	60	59	55
64	60	44	39	62	64	60	83
74	55	30	72	76	61	73	39
62	40	51	74	74	75	80	65

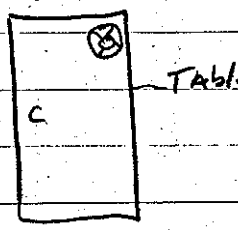
C.A. _____ Expr. FBR Run 51
Sheet _____ Date _____ 19 ___ Time _____ AM PM
Purpose BF3 Ion Chamber on petti changed to BNL Type. Plastic on Air Cyl straightened.

A Chamber pig placed on ~~jack on corner~~ of table



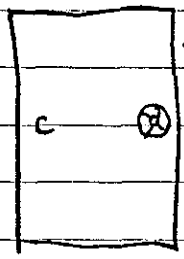
CRITICAL RR = −0.51
MA = +4.106
BR in
Plastic ~~Fired~~ - Tables back

B Chamber pig moved close to center



RR = −0.51
MA = +
BR in
Plastic Fired - Tables back

C. BNL Ion Chamber moved



RR in MA 4.087 BA in
Plastic fixed Tables out – critical

D RR out - determine critical with plastic cocked
MA rod = 4.087
Table = 11.475

E Plastic fixed
Table = 11.475
MA = ~~4.087~~ 4.117
RR ~~out~~ in
} crit

F Table = ~~11.475~~ 11.46 BR in
MA = 4.117
RR = +.145
Pertp = 0.8399

46	28	47
38	30	45
43	35	40
36	34	37
44	40	42
31	39	47
	42	55

G Table = 10.05" Plastic cocked
MA = out
RR = out
for pas. period
Putts 07 ~~07~~ 07 01 04 02 02 06 04
=+0.2036 06 99 00 05" 01 01 99 04 05"
= 20.36 ✝ 04 07 08 04 05"

H RR rod out
MA rod = 4.117
Table = 11.474
Plastic - cocked
} crit

Plastic Fired:
Putts = 83.65" ✝

31	37	42	40
37	29	30	41
33	34	40	29
34	30	35"	
40	43	48	
42	40	42	
39	40	34	
36	35"	37	
42	36	34	

H✝ RR out
MA = 4.117
~~Plastic~~ Table = 11.475"
} crit COCKED

moved plastic to 11.10 for Putts = 17.14 ✝

I RR out
MA rod = 4.117
table = 11.47
Plastic Cocked
Plastic fired

32	38	33	37	30	40	46
42	44	29	37	40	35	42
47	42			31	30	35
27	30	49	37	36	42	49
			40		21	37

Pette ave = 83.72 #

ORNL Ion chamber runs from 1K down
BNL Ion Chamber runs from 2K down

Plastic 2 in From core when selsyn reads 11.50
Stroke of cyl 23.3/8 in

C.A. _____ Expr. _____ Run 52
Sheet _____ Date _____ 19 ___ Time _____ AM PM
Purpose Measure value of burnt rod for 7 7/8" stroke (9 1/32" ht)

Reg. Rod – insert
MA rod – 4.105
BR – in
} Crit

BR fired out: 142-33 # on Pette

09	24	30	39	29
40	37	29	24	35
05	30	03	27	43
25	25	23	27	05
02	31	30		30

Summary 3 Bolts HAND TIGHT ONLY

I Regulating Rod evaluation

Pette calibration of total worth $-9\frac{3}{32}$ in. stroke from bottom to "out"

ORNL Ion Ch (1K ↓)	BNL Ion Ch (2K ↓)
84.38 ¢	83.99
84.63 ¢	83.65
85.84 ¢	83.72
86.01 ¢	

II Burst rod evaluation

value for $8\frac{7}{8}$" stroke = 112.33 ¢

with BNL Ion Ch (2K ↓)

III PLEXIGLAS EVALUATION – 9x9x1" PIECE

92

9/29/61

INSTRUMENT CHECK

Time AM Source Pu Be

	F	A	D	E
Range	O/C	Opn	1/3	10/1000	100
Source Dist.		O/C	30"	2"	
% F.S. Trip			100	90	100

C.A. _____ Expr. FBR Run 53

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose Burst Rod Calibration

MASS ADJUSTMENT ROD RE ZEROED

INSERT LIMIT -0.795 PHYSICAL MOTION

WITHDRAL LIMIT +8.025 8 27/32

A

Reg Rod MA BR

-.59 4.345 in

Plastic fired – tank broke

Critical

A_1 Burst Rod fired out 7 7/8" stroke

Δ = 113.1 F BNL Ion Chamber (900 V)

B Burst Rod removed (laid on table) — shaft up
MA = 4.345 ; RR = -.51
Plastic cocked
Plastic Evaluation
Table position = 10.84 bar level
Table position = 10.61 bar gas period
these are readings from relays
Value of plastic 10.61 - 10.84" = 17.75 ℄

~~B1~~

C Burst rod shaft down (or "in") — BR still out
MA = 4.345 RR = -.51
Plastic cocked
Table position 10.91 crit

D Burst Rod in.
RR - -0.51
Plastic - final table 10.91
MA Rod - 4.3625

E ~~Burst Rod out~~ - RR - -0.51

MA rod = 4.3625 crit
Table = 10.91 ; Plastic fired
Burst rod fired out 7/8"
Pods = #1,1332

17	26	40	48
28	39	38	
14	~~30~~	43	
24	29	38	
42	39	40	
34			

5769

E Burst Rod out Shaft down
RR – −0.51
MA Rod – 4.3625
Plastic Cocked. Tables 10.875
} CRITICAL

Plastic Fired Burst Rod worth 122.37
pellet readings # 1, 2 237

20	34	35	34	04	30	05	03
14	34	41	30	27	05	30	27
15	30	30	40	15	26		
25	27	32	30	22	05	03	27
03	30	20	07	39	35	34	
22	40	03	20	25	30	26	
25	26	27	05	23	23	34	
23	05	45	31	34	10	24	
		26	25	34			

F Evaluation of plastic against core:
table position = 9.50 ; Burst Rod out – Shaft down
Plastic cocked
RR rod = out
MA rod = 6.465 – Critical –

Plastic Calibration

Moved plastic back (from 9.50 above)
Table = 10.49 for neg period
Pellet 1.1

G.

79	79	79
64	90	89
71	84	81
80	87	75
70	70	82
84	75	
75	90	
81	86	

8014
21 1683

~~Plastic Calibration (cont.)~~

H RR = in Burst rod out - shaft down
MA = 4.362⁻
Plastic cocked
Table position = 10.874 Critical
Petts reading 1.2237

15	25	31	25	18	19
16	23	40	29	20	10
18	30	29	30	23	
24	13		22	26	10
20	40	35	34	20	
20	29	31	30	09	
29	30	16	03	07	
26	26	05		35	

Plastic Evaluation

RR = 4.0 Burst rod out
MA = 4.362
Plastic cocked
Table = ~~10.2~~ 10.15 top pos. period

I Petts =

170	165	62	73	71	69	67
70	65	66	70	70	70	72
67	64	69	70	69	69	
73	70	74	71		74	74
69	72	73	68	70	69	72
67	68	70	72	71	72	
71	69	72	70	76	70	60
70	69	59	69	70	70	
		69	67	65	71	
				68	69	

6932
59) 4090

J Burst rod eval

RR = in
MA = 4.362
Table = 10.88
Table cracked

} BR out - shaft down crit

Plastic Fired - Pitts Readings

Pattn 1.2 224

		13	30	27	20	05	21
		34	19	20	13	30	27
15	30	30	25	20	15	25	40
26	20	27	03	34	27	27	30
24	03	15	29	25	24	34	20
	09	13	25	15	20	30	03
	21	25	22	30	22	09	25

* ORNL Chamber on pattn. (1K+)

K_1 ?Plastic Evaluation

BR - out
RR - 4.0
MA Rnd - out 8.025
Plastic cracked Tables 9.769 ✓

} CRITICAL

K_2

RR - 9.0
Tables - 9.96
MA - out

} CRITICAL

K_3

RR - -0.51
Table - 10.098
MA - out

} CRITICAL

K_4 MA Rod – 6.75
RR in
Tables 10,204 } CRITICAL

K_5 MA Rod 6.0
RR in
Tables 10.335 } CRITICAL

K_6 MA Rod 5.0
RR in
Tables 10,62 } CRIT

L_6 RR in
MA Rod 4.362
BR out shut down
Plastic Cocktail Tables 10.885 } CRIT

Plastic Fuels pellet # 1.219

1.2	19	12	35	21 → 1.217		→ 1.221
	20	30	26	22	29	30
	10	13	05	19	30	35
	32	24	20	12	15	22
	24	25	21	13	30	05
	1.170	40	27	32	20	1.199
	34	21	199	24	20	1.199

M. Plastic Evaluation

RR - 5.00 CRITICAL

MA - 4.3625

BR out.

Plastic cocked - Tables 10.18

N Burst Rod Evaluation

RR - -0.51 CRITICAL

MA - 4.3625

BR - out shaft down

Plastic cocked Tables 10.18

Plastic Find. Pattern (ave) = 1.2202

1.216	25	22	11	1.211	07	22	11
23	42	30	15	12	21	03	15
19	20	03	25	05	25	40	
17	07	32	05	17	04	30	
15	30	20		20	49	19	
35	27	03		35	30	31	

Patt = 1.2199 Patt = 1.2205

O Plastic Evaluation

MA = 4.362

ER = 6

Table = 10.07

Cut

BR out (on table) Shaft in Plastic cocked } Cut

P

MA = 4.362
TAble = 10.88
RR = in
Plastic cooled
plaster fried
Pellet (one) = ~~1.71~~ 1.2171

Crit

03,8 VAR.

15	35	30	05	10	02	07
20	30	12	25	13	18	04
30		22		22	05	20
20	20	22	01	19	20	01
11	17	04	20			20
13	14	07	40	12	30	02
21	22	10		15	19	40
22	20		15	27	20	04
19	22	09	30	08	22	
19	225	134	.194	.158	170	122

29 – DSCRODE
55

SUMMARY

.017

I Burst Rod Total worth.
Rod in – to. Rod removed with shaft down
pellet. ORNL BNL

~~5~~	1.2171	1.2237
~~5~~	1.2202	1.2237
~~5~~	1.219	1.2224
Av	1.219	1.223

Average – 122.1 ¢

out

100 Summary of Plastic Evaluation

Run		P (cents)
~~F+G~~ B	~~10.61 → 10.86~~ ~~9.50 → 10.49~~	17.75
F+G	9.50 → 10.49	-118.0
H	10.874 → 0	-122.37
I	10.874 → 10.15	-16.93
J	10.88 → 0	-122.24

K_1 R.R. = 4.0 (= 41.4¢) 9.769
K_2 RR = 2.0 (= 15.8¢) 9.960
K_3 RR = in (= 80¢) 10.098
K_4 MA 4.36 (= 124.0) 6.75 (= 184.5) 10.204
K_5 MA 6.00 (= 171.00) 10.330
K_6 MA 5.00 (= 144.00) 10.62

25.6¢

L BR out; RR in; MA = 4.362 (= 124.0¢); Plastic 10.885 → 123.33 + 20 - .33

F
51 H ~~11.46~~ → 0 84.0 83.65
I 83.72
51 H→I 11.475 → 11.10 17.14¢

Further Summary:

P (dollars)	dist from Reactor (in	P (dollars)	dist from Reactor
2.4809	0.0	1.4333	1.120
2.3633	0.269	1.233	1.380
1.9448	0.598	0.6795	1.60
1.4039	0.650	0.8509	1.96
1.8338	0.704	0.0109	32.875
1.7033	0.830		
1.300	0.990		

In all previous measurements
* Burst Rod in position 0.085 in up from bottom of core

C.A. _____ Expr. FBR Run 54
Sheet _____ Date _____ 19 ___ Time _____ AM PM
Purpose Burst Rod Evaluation
Bottom of Burst rod is at bottom of core when in.

RR in BR in MA Rod 4.357
BR withdrawn

A
Source in — pette = 1.0873 — ORNL

1.057	1.091	1.090	1.087
1.071	1.089	1.083	1.012
1.096	1.096	1.103	1.095
1.068	1.087	1.089	1.104
1.085	1.090	1.099	
1.093	1.095	1.094	
1.088	1.093	1.107	
1.079		1.090	

B. MA 4.345 Crit. ORNL
BR Withdrawn pette 1.091

1.072	79	1.101	1.089	1.074
78	96	1.100	1.105	1.084
83	99	1.087	1.085	1.095
95	1.110	1.079	1.090	1.100
98	1.108	1.099	1.079	
81	1.087	1.100	1.075	
78	1.105			

108.72
31 | 33702

102

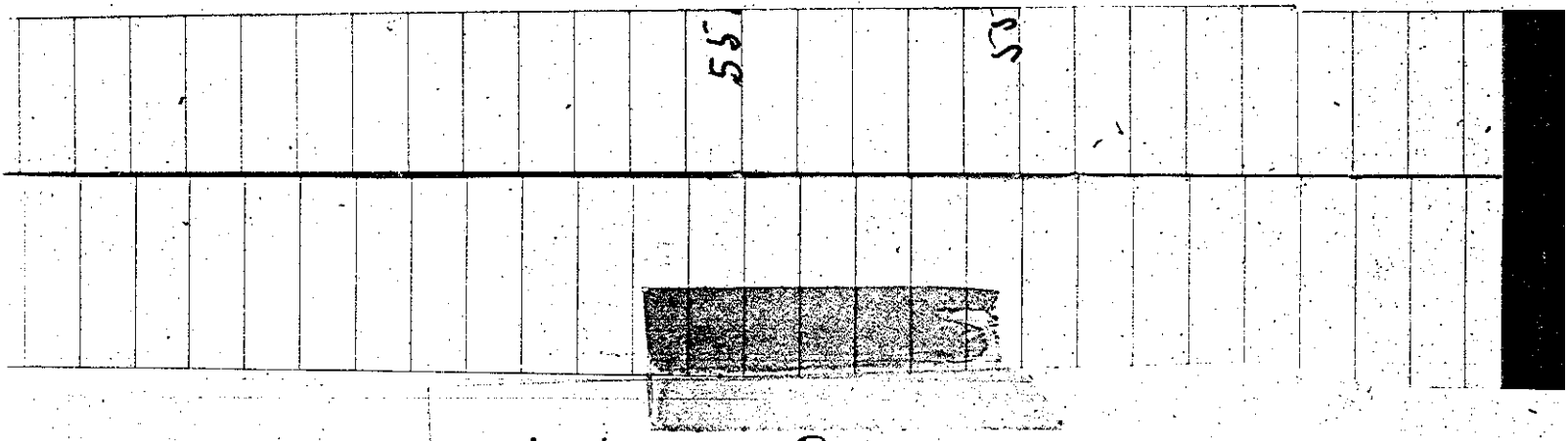
C BNL MA Rod 4355

pellet reading Average 1.129

20	29	37
26	27	27
20	30	21
21	21	
26	43	29
30	20	34
39	21	30
34	30	
30		

29 31
22) 645 0

Core Height 9.02 in
9.04
9.029
9.040



Loading – Run 54

	Gr U
7 pcs ~ 1" –	55, 810
4 pcs ~ ½" –	17, 398
2 pcs ~ ¼" –	4, 132
1 pc ~ ⅛" –	1, 247
1 pc ~ 1/16" –	626
9 bolts –	9, 223
9 bolt inserts –	1, 079
Glow Plug –	113
Safety –	10, 109
M.A. Rod –	1, 746
Burst Rod –	965
Reg. Rod –	658
Total	103, 106 gms U

10-3-61

Loading Run 55 — Landing 10-3-61

	Gr U
7 pcs ~ 1"	55,810 — 55435
7 pc ~ ½"	4,247 — 4379 — 4395 — 4280
1 pc ~ 1½"	13,212 — 13212
2 pc ~ ¼"	4,132
1 pc ~ ⅛"	1,247 — 1243
1 pc ~ 1/16"	626 — 625
9 bolts	9,223 — 9232
9 bolt inserts	1,079
1 Glow Plug	113
Safety Block	10,109 — 19,074
M.A. Rod	1,746 — 1735
Burst Rod	965 — 958
Reg. Rod	658 — 653

Total 103,167 gms U

Bottom piece	8125
center	7939
without TC	7991
" TC	7836
" "	8005
with TC	7807
" "	7976

10-3-61

INSTRUMENT CHECK

Time 11:35 AM — Source Pu Be + F

	A	B	C	D	E
F.					
OK	Sq	apt	10^{-2}	10/100	1030V.
		0°	26"	3"	5"
		OK	100	80	100+

C.A. F.B.R. Expr. _____ Run 55

Sheet _____ Date 10-3-1961 Time _____ AM ~~PM~~

Purpose To Check Critical Positions after substituting 1 piece 2 fuel ~~$\frac{5}{16}$~~ in. for 3 pcs - ~~$\frac{3}{16}$~~ Thick.

55A See 53A p. 92

Reg. Rod M. A. B. R. } Critical

-0.51 ~~4.60~~ 4.60 in

55B Pulsing equipment in place

-0,51 5,68 in ~ ∞

7/4/64

INSTRUMENT CHECK P. B.

Time 8:15 AM PM Source δ

	Channel A	B	C	D	E
Range	F	1 per	1	1/100	105
Source Dist.	OK	at	26"	2.5'	4"
% F.S. Trip			100	70 in meter	100

C.A. _____ Expr. _____ Run 56

Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose Critical Run For Pulse neutron expts

56 A Crit Conditions

RR = in

MA = 5.795 TF 3-4

BR = in

Review

MA = 5.705 TF 5

56 B Detector moved against cam at bottom

RR in BR in MA = 5.436 TF-6

F/S/G

INSTRUMENT CHECK

Time 8:15 AM PM Source Pu Be

	F	A	B	D	E
Range	O/C		2pr 15"	1"/00	105°
Source Dist.			OK 29"	2"	6"
% E.S. Trip			100	80	100

C.A. _____ Expr. _____ Run 57

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose Critical Run F- PN expts

57A FR in RR in MA - 5.826 CRITICAL

C.A. F B R Expr. _____ Run 58 A
Sheet _____ Date 10-5-1961 Time _____ AM PM
Purpose Crit Run for PM Exp's.

58 A Core has been rotated 120°
so that BR is on MA rod drive,
M.A. rod is on RR drive and
R.R is on BR shaft

R.R.	M.A.	B.R.	
in	2.96	out	} Critical Log N = .00026

~ 4:00 PM Ctr Rate = 55 on 10,000
"C" = 50 on 10^{-12}

58B R.R. M.A. B.R. } Critical
in 1.99 out Log N = .0008
"C" = 84 on 5×10^{-12}
At End of run was slightly super — $T = +\frac{1660}{\log 1.5} =$

C.A. _____ Expr. _____ Run 58 C
Sheet _____ Date 10-5-61 Time 9:30 AM PM
Purpose Fired Reg. Rod (out 77⅛") from bottom
ORNL
Value = 77.68 #

12/6/61

INSTRUMENT CHECK P.D.

Time 8:30 AM PM Source X

	F	A	B	C	D	E
				Channel		
Range	OK	—	OK	0 -12	4/100	1.50
Source Dist.		—	OK	✓	✓	35"
% F.S. Trip		—	—	100	80	100

C.A. ____ Expr. FBR Run 59 A

Sheet ____ 9 Time ____ AM PM

Purpose CRitical Run For PN syst

MA-2.21 RR in BR out

Critical check after TF 9 -

82
85 in 5 min

C.A. ____ Expr. ____ Run 59 B

Sheet ____ Date ____ 19 ____ Time ____ AM PM

Purpose 2 NC 404 Horyank detectors placed adjacent to syster BR out

RR in MA R - +3.01

Rossi a 3

10-

CRITICAL POSITIONS

C.A. FBR Expr. _____ Run 59 B

Mode Pos. _____ L _____ T _____ R _____

Control Rod _____ Channel _____

R.R. in A Out

M.A. @ 3.00 .00014

B.R. out C 70 10^{-12}

D 40 $\frac{10}{25}$

E 0 700 V.

Ct. Rate 60 @ 30,000

Tim Crit. _____ AM PM Duration 50 min.

CRITICAL POSITIONS

C.A. FBR Expr. _____ Run 59C

Mode Pos. _____ L _____ T _____ R _____

Control Rod _____ Channel _____

R.R in A out

MA @ 3.00 B 0.00021 → .00017

BR - out C 30 2×10^{-12}

D 20 $\frac{10}{50}$

E 0 930

CR - 20 @ 100,000

Tim Crit. _____ AM PM Duration 30 min.

negative Period - "C" from 40 → 30 in 18 min

10-7-61

INSTRUMENT CHECK Pu Be

Time 9:00 AM ~~PM~~ Source

	Channel A	B	C	D	E
	F OK	cpr	1	12 1000	1050
Source Dist.		OK		4"	
% F.S. Trip			100	90	100

C.A. _____ Expr. _____ Run 60

Sheet _____ Date _____ 19 _____ Time _____ AM PM

Purpose Crit for Pulse Neutron Expt.

RR = out

MA = 2,40 } crit.

almost out → BR = ~~0~~ 2.00

TF-10 neutron period after

$\rho = +$

CR $\frac{80}{75}$ in 250 sec

Period for same conditions as above

Dog 70-80 in 200 sec

CRM 70-80 in 250 sec

C.A. ~~Crit for Rossi 2~~ Expr. _____ Run 61

Sheet _____ Date _____ 19 __ Time _____ AM PM

Purpose Crit for Rossi 2

MA = 2.60
RR = inf
BR = 0.00
} crit.

C.A. FBR Expr. _____ Run 62

Sheet _____ Date 10-7 1961 Time 3:30 AM PM

Purpose Burst Rod Calibration with Pitte

Burst Rod on M.A. drive

M.A. Rod on R.R. drive

R.Rod on Burst Rod drive

62	Burst Rod	Mass Adj. Rod	Reg. Rod	Period	Pitte ¢
A	-0.694 (in.)	0.0	4.3 in	+	17.78
B	0.0	.694	4.3 in	+	15.20
C	+0.70	1.394	4.3 in	+	9.63
D	1.20	1.894	4.3 in	+	3.78
E	1.454	2.148	4.3 in	∞	—
F	2.00	2.694	4.3 in	—	8.16
G	2.00	2.694	3.78 in	+	8.67
H	2.503	3.197	3.78 in	∞	—
I	3.00	3.694	3.78 in	—	9.70
J	3.00	3.694	3.15 in	+	9.66
K	3.497	4.191	3.15 in	∞	—

112

	Burst Rod	M.A. Rod	Reg. Rod	Period	Pcp ¢
L	4.00 4.694	3.15	in	−	10.05
M	4.00 4.694	2.53	in	+	10.4
N	4532 5.226	2.53	in	∞	—
O	5.00 5.694	2.53	in	−	8.3
P	5.00 5.694	1.87	in	+	11.37
Q	5.692 6.386	1.87	in	∞	-
R	6.20 6.894	1.87	in	−	6.66
S	6.20 6.894	1.32	in	+	6.17
T	6.775 7.469	1.32	in	∞	—
U	7.176 7.870	1.32	in	−	3.28
V	7.176 7.870	0.89	in	+	5.23
W	8.045 (out) 8.739	0.89	in	+	0.68

+.35

10-7-61 4:10 PM Safety Block Evaluation - > #20

Worth of last of BR from 8.377 to 8.045: Pcp = 1.2 ¢

BR Motion from zero (inches)	P cents
0.0	0.0
.694	2.58
1.394	8.15
1.894	14.00
2.148	17.78
2.694	25.94
3.197	34.61
3.694	44.31
4.191	53.97
4.694	64.02
5.226	74.42
5.694	82.78
6.386	94.15
6.894	100.81
7.469	106.98
7.870	110.26
8.739	114.81
9.071	116.01

INSTRUMENT CHECK

Time AM PM Source

Chan. #

	A	B	C	D	E
Range		opr	10^{-12}	10^{-3}	1.5
Source Dist.		0	3"		8"
% F.S. Trip			100	80	100

103,167
- 4132 - 2 - ¼" pcs
99,035
4,395 - 1 - ½" pc.
103,630 gm

10/19/61

INSTRUMENT CHECK

Time ____ AM / PM Source ____

	Channel A	B	C	D	E
Range					
Source Distr.	See Page 154				
% F.S. Trip	U-Metal Slab Bolt				

C.A. ____ Expr. ____ Run 63

Sheet ____ Date ____ 19 ____ Time ____ AM / PM

Purpose RA in BR - 6.74
MA - +1.33

Run 2
MA rod = -0.51
Reg. Rod = in (on burst shaft)
Burst R = 6.705
System not crit, as "should" be from obs'd run — shut down to see why

Explanation of above difficulty — no air pressure

Run 3 Repeat run

MA = 1.42 (on Neg. rod drive)

Burst = withdraw

Neg. Rod = in (on Burst shaft)

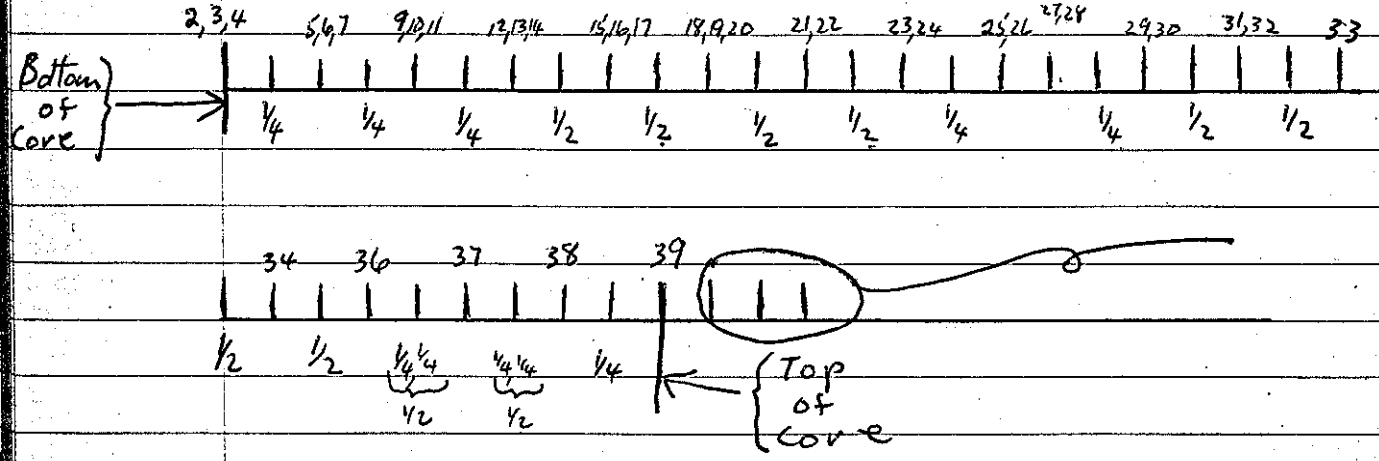
10-23-61

INSTRUMENT CHECK

Time 9:25 ~~PM~~ AM Source Pu Be + K

	Channel A	B	C	D	E
Range		~~Pu~~	10	12 / 15	1050
Source Dist.		8"	30"	12"	6"
% F.S. Trip		BK	100	98	100+

Vertical Foil Traverse.



Notes: The vertical lines correspond to relative foil or spacer positions, beginning from bottom of 9 1/16" high core. Upper numbers are foil numbers. Lower numbers give length of spacers (inches)

Foil Calibrations: U-Mo Foils; 0.295" dia, 1/16" thick

#1	1.0000	29	1.00625
2	1.00720	30	1.00690
3	1.00058	31	1.00766
4	0.98670	32	1.00003
5	0.99445	33	1.00236
6	0.99216	34	1.00797
7	1.00249	36	1.01014
9	1.00101	37	0.99900
10	0.99201	38	0.99607
11	1.01802	39	1.00300
12	1.00049	40	0.99938
13	1.00129	41	1.00421
14	0.99092	42	1.01859
15	1.00755	43	1.00548
16	1.00018	44	1.00349
17	0.99350	45	0.99844
18	0.99827	46	1.00689
19	0.99866	47	0.99686
20	0.99056	48	0.99687
21	0.99865	49	0.99917
22	0.98542	50	1.00878
23	1.00423		
24	0.99884		
25	1.00426		
26	0.99202		
27	0.99832		
28	0.99780		

(9.28)

CRITICAL POSITIONS

C.N. _____ Expr. _____ Run _____

Ie Pos. _____ L _____ T _____

Channel _____ Channel _____

BR = "In" _____ A _____

MA = 6.05 _____ B log N = .11 _____

RR = IN _____ C 7.8 5×10^{-10}

1 _____ D 67.5 $\frac{1000}{200}$

E 2.0 @900 V

Tim Crit. _____ AM / PM Duration _____ min.

Foils exposed for 500 sec. at log N of 0.11

Inst.

FBR Consol Instrument Readings

Log Count Rate = 5 5 0

Log N = 0.018

Neutron = 10 %

outsi... of block

10-24-61

INSTRUMENT CHECK

Time 9:50 AM ~~PM~~ Source Pu Be + γ

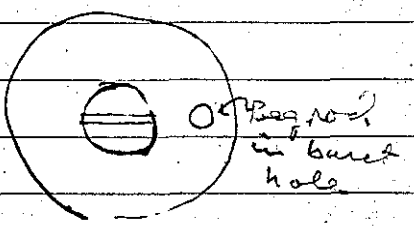
	A	B	C	
Range	F 9	10	10/100	1050 V.
Source Dist.	4 0"	30	1"	8"
% F.S. Trip	OK	100	8	100 T

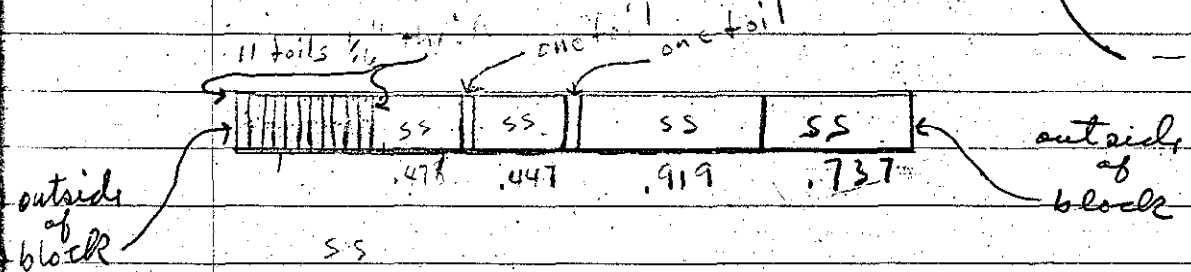
C. FBR Expr. _____ Run 64

Shee _____ Date _____ 19 __ Time _____ AM PM

Purpo _____

Traverse in Safety Block





Foil #s, in the order as shown in above diagram
-106, 105, 104, 103, 102, 101, 100, 99, 98, 97, 96, 95, 94

(SS designates stainless spacer, no. beneath given length of spacer)

CRITICAL POSITIONS

FBR Expr. Run 64

Table Pos. L T R

Control Rod	Channel
	A Dust
	B .1
	C 5.5' 5"/19 - 10
	D 48 1000/200
	E 1.0 @ 900 V

Crit. AM PM Duration 20 min

C.A. FBR Exp. Run 6S

Sheet 10-24-61 Time 2:20 ~~AM~~ PM

Purpose: Evaluation of Curved Plastic

Insert Limit on Safety 1.357

RR = out

	Safety	MA	30¢ B.R.	Plastic Tables	Price
2:50 PM	in	2.55 3.01	in (-0.105)	57.56	∞ 48.28
	in	3.42 3.93	in	13.58	∞ 4.30
	in	4.30 4.81	in	11.97	∞ 2.69
	in	5.50 6.01	in	11.04	∞ 1.76
	in	7.10 7.58	in	10.54	∞ 1.26
	in	~~out~~ (8.13) 8.13	in	10.38	∞ 1.10
	in	8.64	1.5 2.30	10.25	∞ 0.935
	in	—	3.0	10.01	∞ 0.73
	in	—	4.52 5.32	9.82	∞ 0.54
	in	—	6.00	9.68	∞ 0.40
	in	— (out)	8.377	9.58	∞ 0.31
	1.465	out	8.377	9.495	∞ 0.215
	1.636	out	8.377	9.35	∞ 0.07
3:40 PM	1.70	out	8.377	9.28	∞ 0.0

Fixed Plastic - Petty = $3.488

Dropped Safety out: Petty > $20

Fission chamber count rate vs dist from Insert position

Phs		30 in	
50	312,646	30 in	30 0
50	310,698	"	0
50	250,925	"	1"
"	250,252	"	1"
"	183,563	"	2"
"	181,496	"	2"
"	117,702	"	3"
"	117,886	"	"
"	68,264	"	4
"	68,432	"	"
"	34,911	"	5"
"	34,994	"	"
"	18,758	"	6
"	18,931	"	6
"	11,629	"	7"
"	11,712	"	"

INSTRUMENT CHECK

Time ____ PM

Source Pu Be + γ

Channel	C	D	E
Source	1.5×10^{-10}		
Source Dist.	24 hours		
% F.S. Trip	0 Tripped		

C.A. ____ Expr. ____ Run 66

Sheet ____ Date ____ 19 ____ Time ____ AM PM

Purpose ____

BR = "in"

Reg Rod = "in"

MA Rod ~ 5,804

Safety in at ~ 12:30

CRITICAL POSITIONS

C.A. ____ Expr. ____ Run ____

Start Pos. ____ T ____ R ____

Control Rod	Channel
P BR	
portally withdrawn → Log Comp R 3500	A 76 3×10^{-9}
Log N .015	B
μA 10%	C 3.8×10^{-9}
	D 61.5 1000/200
Log W = .08	E 10% 1.0 870 volts
withdraw limit } LCR = 1800	F 8%

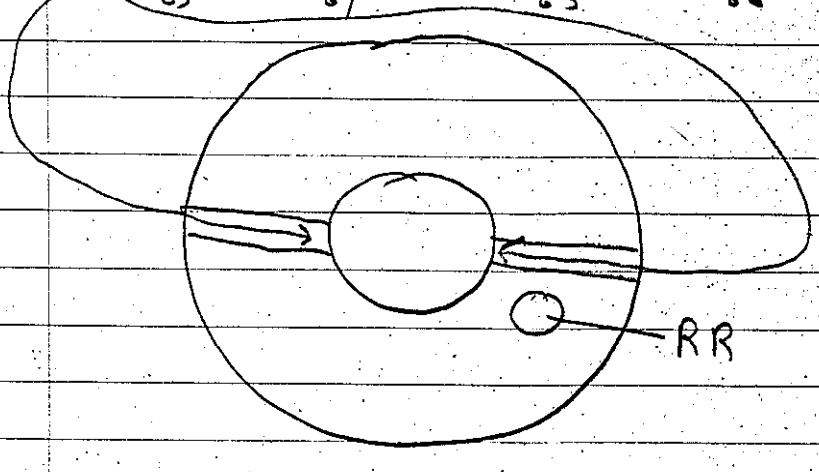
AM PM Duration ____ min.

Foil Loading -

RADIAL -

F F F F 1/4 F F 1/4 F 1/2 F 1/2 F F F F
51 52 53 54 55 56 57 58 59 60 61 62

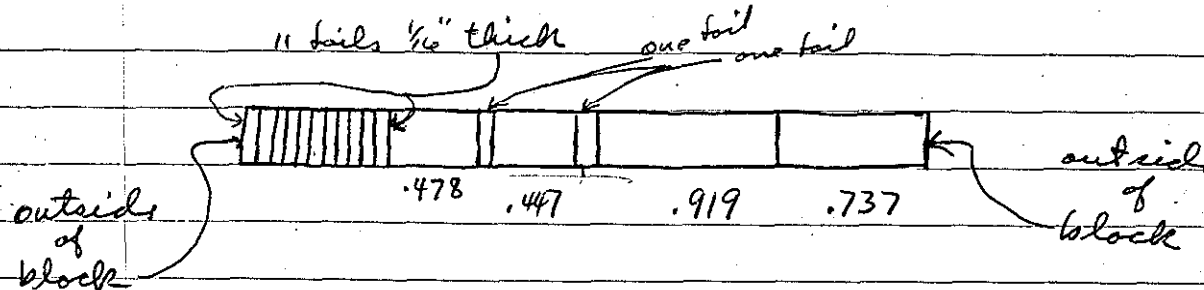
F 1/2 F 1/2 F 1/2 F 1/2
63 64 65 66



RADIAL IN SAFETY BLOCK

11/7/61 Fission traverse through Safety Block and Vertically
(traverse run ~ 4:00 PM

I. Foil positions in Safety Block

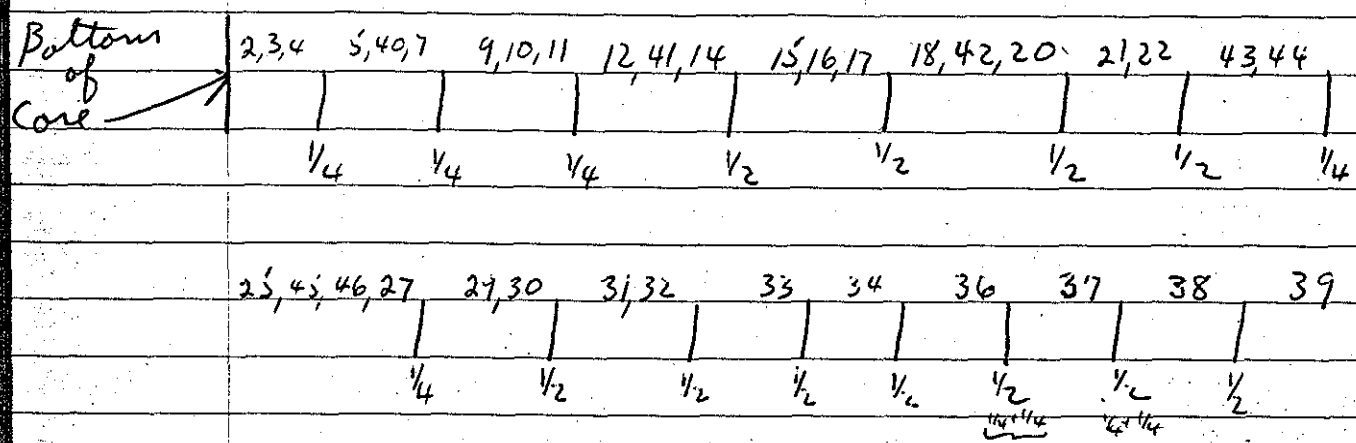


Foil #'s in order shown in diagram

102, 101, 110, 100, 99, 109, 108, 98, 107, 97, 96, 95, 94

foils 107, 108, 109 and 110 had not been used before

II Foil positions in glory hole ~~plus~~



Beginning at the bottom of the core, the upper

numbers represent coil # and relative positions.
The lower # represent a 4-mo 'spacer' at
that position having the given lengths (1/4" or 1/2").

INSTRUMENT CHECK — Burst Rod Calibration

Time 9:55 AM ~~PM~~ Source Pu-Be + γ

		Channel A	B	C	D	E
Range	F	___	open	10^{-12}	10/1000	10.0
Source Dist.	OK	___	0	28 in.	3"	7"
% F.S. Trip		___	OK	100	95	100+

(9213) μμA .5 on 3×10^{-10}

11/15/61

INSTRUMENT CHECK Pu Be

Time AM PM Source ✗

	Channel				
	F	A	B	C	D	E
Range	OK	$\frac{1}{1000}$	opr	10^{-12}	$\frac{1}{1000}$	1050V OK
Source Dist.		OK				
% E.S. Trip						

C.A. _____ Expr. _____ Run 68

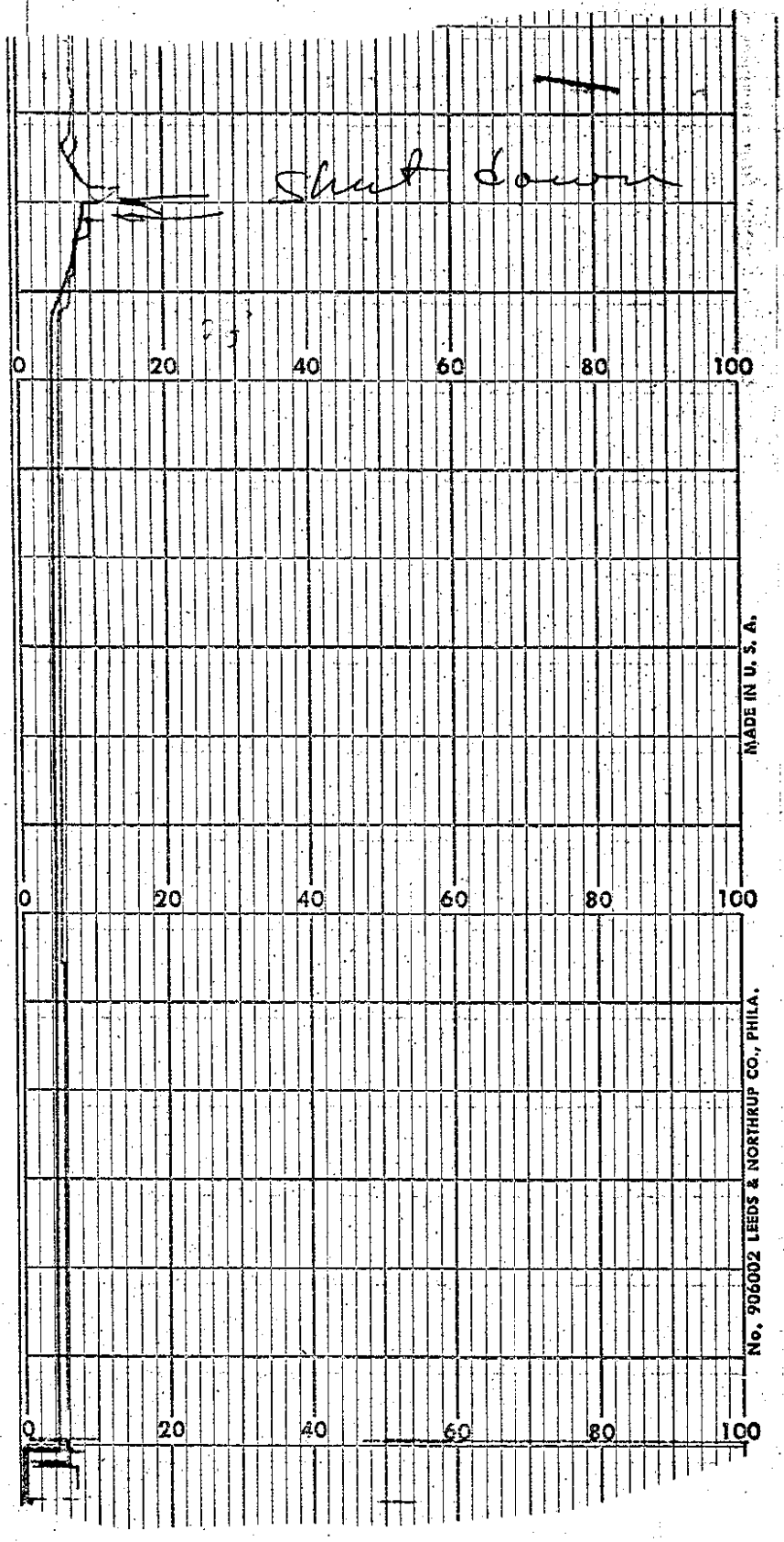
Sheet _____ Date _____ 19 ___ Time _____ AM PM

Purpose Power run on FBR.

E trips with source at 1050 volts & screens FBR responds on -60 volts.
Detector is in the same position but shielded with about 12" Lead on front

D in room unshielded will be removed from trip circuit if level gate too high

A in 107 next to instrument rack → o—A


Shut down
0
20
40
60
80
100
MADE IN U. S. A.
No. 906002 LEEDS & NORTHRUP CO., PHILA.

F in 107 behind instrument rack ⟹
Will be light in scram circuit

All these instruments are tied to the FBR through the scram system in 107.

Fission required in sample 10^{12} fissions
glory hole plug has 0.001 of mass in reactor

Fissions in reactor in run $10^{12} \times 10^{3} = 10^{15}$

10^{15} fissions $= 3.1 \times 10^{10} \frac{\text{f}}{\text{w sec}}$ 100 w $\times$ seconds

$$\times = \frac{10^{15}}{3.1 \times 10^{10} \; 100} \qquad 330 \times 10^{3} \text{ sec} \sim 5 \text{ min}$$

BR

POWER	°F
1 KW	580°F
½ KW	400 °F
250 w	300 °F
125	200 °F

All rods have been "eroded"
(except BR which is 0.035" when in)

Critical Conditions: Note: safety alarm beam + rod correctly.

Burst Rod - in
Reg. Rod - in at zero
M A Rod - 7.00

Log CR ("in") = 1000
Log N off scale
Log CR ("out") = 50

Purpose:
To introduce 20¢ reactivity to get up to power (20¢ is obtained by moving MA from 7.00" to 6.20")
20¢ added as explained above
Period from LCR period 30-50

FBR Log CR = 2000 when
Log N .0001 9213 Log N = 0.1

Log N Period 25-30 sec

Returned to Crit. at ~ 4.947
(for ~ 8 min)

8 OC PIN Raised power level again

8 OS Leveled again - MA = 6.88
Log N = 0.11

Events in 107 DURING
SEMi STEADY STATE Run

	A'	D	B,	~~725~~ E	~~750~~ F		20 mr Survey
	1000/200	1010/1000 tripped	~~##~~	675V	750V		
3	48	meter out	40	50%	7%		7mr@ window. 4mr
			set.	f.s -			15 mr @ window - control
	1000/1000	—	50		610V		12 mr @ desk 107
			45		7%		
	44 (factor-5)						13mr
	46 (40 mr)				8%		~23 mr @ window -
my							30 mr @ mid window
	43						20 North
	drop						12 mr @ control desk
12	40				7%		11 mr @ desk
	34.5				7%		10 mr @ desk
	1000/1000						
	34				7%		10 mr -
	Scram -						18 mr @ centr

(1-48) Y-12 DATA SHEET

(C - reverse polarized (no chamber))

1mr at desk — (112 Beckman tripped)

VIC alarm tripped in 108

27

25 r at tunnel door -

225 mr at 107 end of tunnel

(112 Keithly also tripped)

~~44 mr~~

temperature effect -

desk -

entire region 1 15 r at door to 108

1.5 r/h door 107-108

300 mr "

275

700

(DSE in room again)

correcting for Temp effects -
moved MA to — 6.80

8 28 PM Level drifting down - inserted MA more to 6.703 to compensate

8 31 Log N = 0.10
Log CR = 1800 ~~2 MC~~ PA = 50.5
Thermocouple ≅ 80°F
Temp rise = 50°F

A	F	
3K 1000/1000	9% 610 Volts	10 mv/hr at console 107 18 mv/hr at Center window (107) 15 mv/hr Door to cell

8 39 Shut down

Glory hole plug used in this experiment is 883-50 -1597- 145 gms of alloy.
Sent to Wyatt 11/16/61 - ~12 AM.
3.1 X 10^13 f in angle

Stroke of burst rod fixed as follows:

7.491" from bottom of core when up

0.040 - from " " " " down

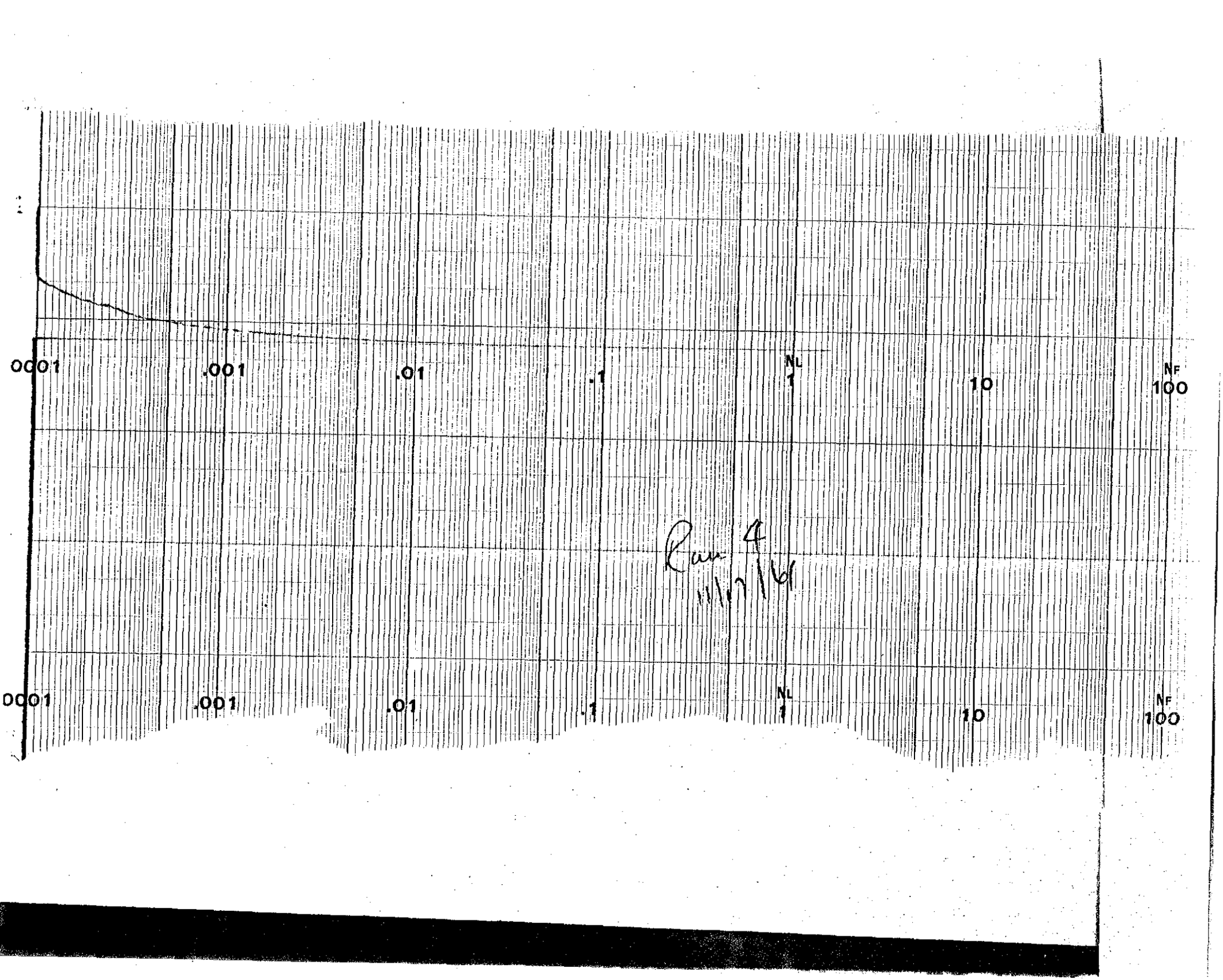
∴ 7.451" stroke

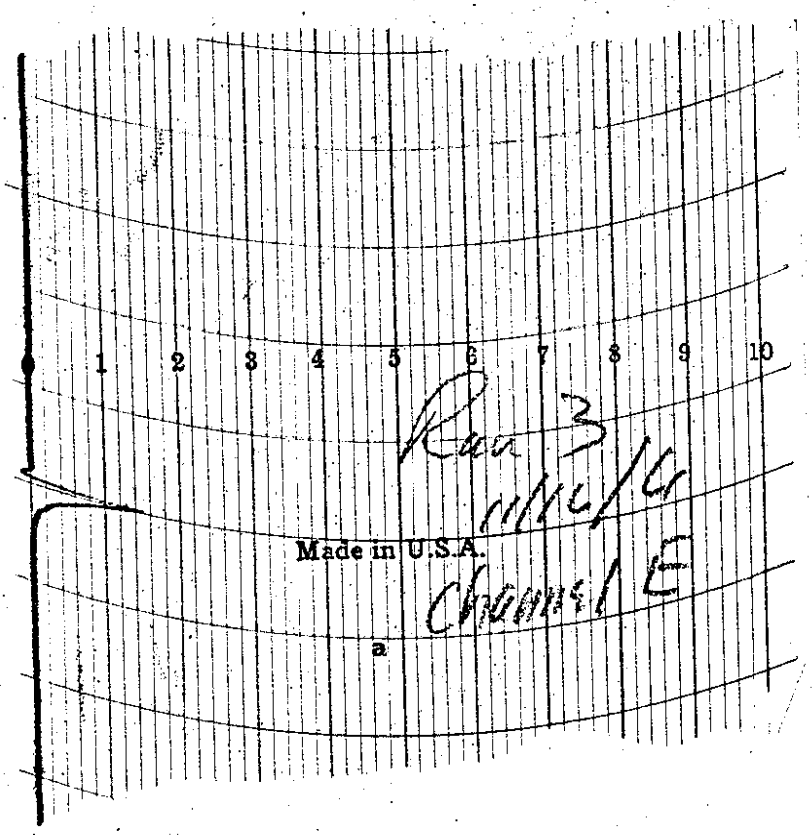
$P_{7.451}$ = 104.5 ℔ on Red* curve

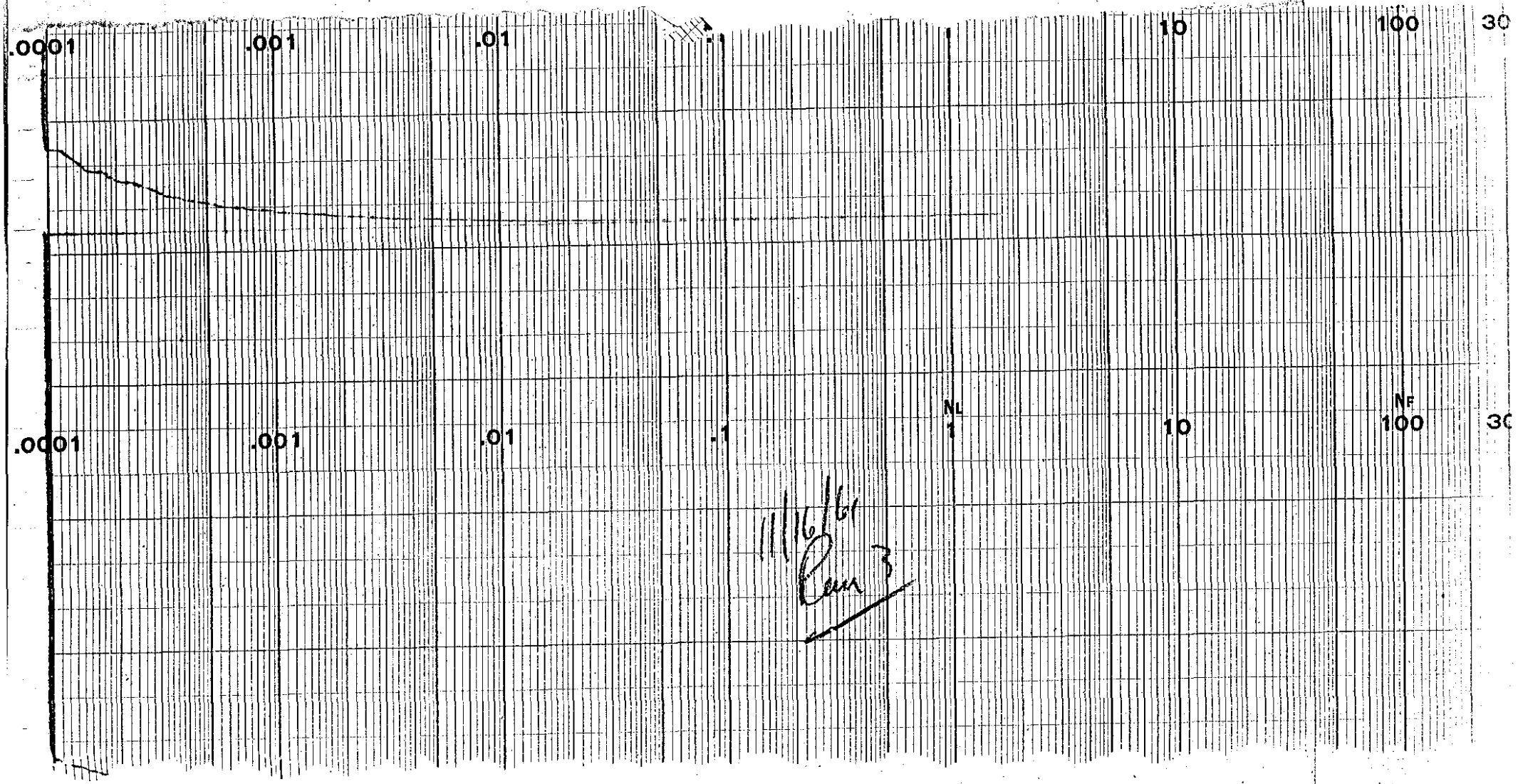
$P_{7.451}$ = 107.0 ℔ on Block* curve

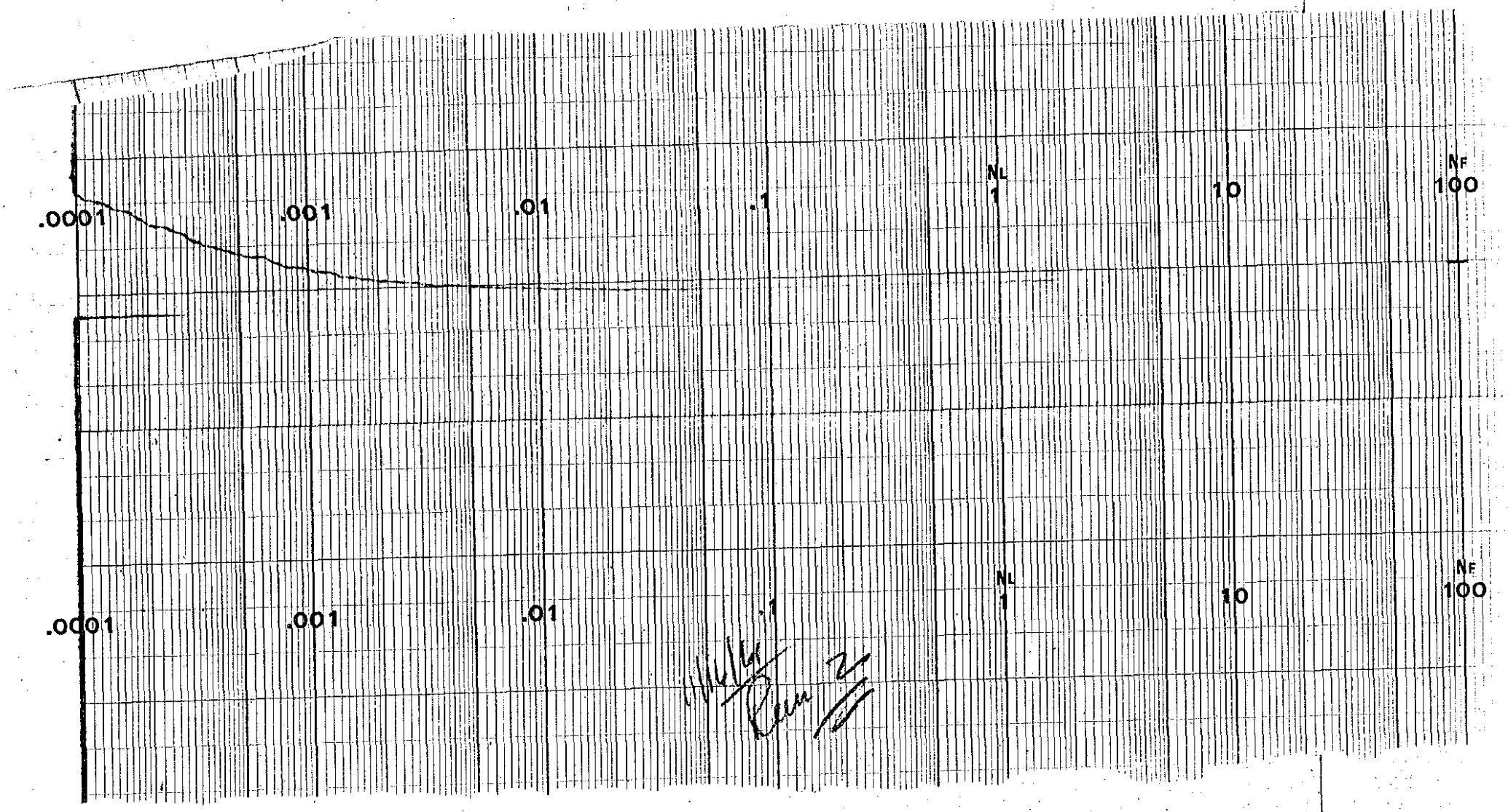
*There are two different burst rod calibration curves

11/17/ cc
Run 2
1 division = 5 sec


.0001
.001
.01
.1
NL
1
10
NF
100
Run 4
11/17/14
.0001
.001
.01
.1
NL
1
10
NF
100


1
2
3
4
5
6
7
8
9
10
Run 3
mc/c
Channel E
Made in U.S.A.


.0001
.001
.01
.1
1
10
100
30
NL
NF


.0001
.001
.01
.1
NL
1
10
NF
100
.0001
.001
.01
.1
NL
1
10
NF
100

7:00 PM coming up on period for low level delayed crit

Counts from CR Channel for DC

	173143	~~175651~~	178968
MA rod change →	175651	176,689	179661
		180323	179184
7:18 PM	177770	180946	181049

LCR = 2800

Critical MA = 3.468

Reg Rod = in (zero)

MA Rod withdrawn to 5.10 for a decrease of reactivity of ~ 55 ¢

7:40 PM Safety block driven out

Safety put back in
Burst rod inserted ~ 8:08 PM
Scrammed 8:10 by "D" –

Period measured 5.78 sec on LV in 107
Reactivity ~ +49 ¢ Expt Aimed for 50 ¢. This verifies rod calibrations Burst Rod = ~ 105 ¢

3 Thermocouples put in core 1) under Bolt washer
2 others in holes for normal thermocouples
1 in AIR Readout on A 0–200 °C Brown recorder in 107

9:30 Run 2

9:47 Temp

# 2	22°
# 4	22
# 5	21.5
# 9	21.5

Critical:

MA = 3.49
RR = in
BR = up (as shown on page 134)

10:06 MA rod moved from 3.49 to 4.49 to give 70% when burst rod is inserted
Safety block withdrawn

10:12 Safety block put back in
Burst rod inserted ⟵ 1
Period from LCR = ———
" BF_3 " (count rate Channel) = 2.03 sec
Period from Log N (9213) = 1.8 sec

10:36 PM Thermocouples:

# 2 -	~21.5	# 5 -	~21.5
# 4 -		# 9 -	

11:10 PM Run 3 Thermocouples

#2	21.8	5	21.5
#4	21.0	9	21.5

BR out RR in MA Rod

Critical:
MA rod = 3,45
RR = in
BR out

11:22 PM MA rod withdrawn to 4.05
Safety block withdrawn
Withdrawing MA from 3:45 to 4.05 removes 20¢ ;:

11:32 PM Burst rod inserted — 2

Log W period (9213) =

Thermocouples

#2	21.8	#5	21.5
#4	21.0	#9	21.5

Run 4

Crit

MA = 3.453 ; BR - out
RR = in

MA rod moved to 3.82 to remove 13 ¢ to give 92 ¢ excess when burst rod is inserted

12 34 AM Burst rod inserted ← 3

Thermocouples — no change

Run 5

Critical

MA rod = 3,453

RR " in

BR out

1:12 AM MA rod moved to 3.72 ~~for neg neg~~ to remove ~8¢ so introduction of burst rod will give ~97¢. Neg period to be measured from log chart log N T = 178 sec ; P = 9.5 cents Neg period not correct - go back up in power

1:34 MA rod set on 3.65 to remove reactivity - to be measured by log N period = 6.56 cents

Safety block removed getting ready for burst

2:05 AM Burst rod inserted for period excess reactivity appears to be 98.5¢ since burst still not prompt

4

Run 6

Chamber "D" has been moved outside door of 108

12^{18} Am FBR fast level safeties have been put back in system

2^{54} Critical
MA = 3.451

MA rod set at 3.57 for neg. period
ρ = -4.2 cents

3^{12} MA rod moved back in to raise power.
MA rod moved to 3.53 for neg period

3^{42} MA rod moved to 3.56 to remove reactivity so that burst rod will give ~ 1¢ above prompt crit.
Safety block removed

Safety block being ~~scrammed~~ inserted when a scram occured on panel in 107

Repeat of delayed crit run (#6)
Critical at MA = 3,45
MA set at 3,56 for burst
4 29 AM Safety block run out

4 43 AM Burst Rod inserted - Building alarm sounded

5

4 45 AM { 6 mr/hr at end of corridor to 108
Zero in control room

No temp rise No airborne activity in 108
Not quite prompt critical

4:50 Run 7

Critical; MA = 3,451

5 20 AM Safety block run down
MA set on 3.52, or added ~2¢ more than last burst
watch ~3 min fast

5 32 AM Burst rod inserted ← 6
5 35 no temp change

10-15 mr/hr in hall (10')

South wing instrumentation registered ~ 2 ½ times more this burst than previous one.

11/17/61 Burst rod stroke checked

7.489 in from bottom of core to bottom of rod when up

.040 " " when down

∴ 7.449 = Stroke

11/17/61 Run 8

6:20 Delayed Critical Run

3 #	21.2	Above steel plate in AIR
4	21	IN AIR
5	21.2	in Lower thermocouple hole
6	21.2	on support rod (5)
9	21.3	under bolt head near RR rod on Bd
18	20.5	in upper thermocouple hole

8 35 PM Delayed Critical obtained in preparation for Burst. Burst rod out, RR in MA = 3.518

~~8 48 PM~~

Burst rod has stroke of 7.449" (see page 143) with bottom of stroke beginning 40 mils from bottom

8 48 PM Safety block run down to get ready for Burst

9 00 Safety being inserted

9 03 PM Burst rod inserted { in reactor at delayed critical

Temp on
#5 – is 1° greater
#11 – rose 1° (20° to 21° C)
#9 – no change (21.5°)

Run 9 — No Fast Scram

9 30 PM Thermocouple Readings

#2	21.5	
#4	21.0	
5	22.0	
6	21.0	66
9	22.0	21.3
18	21.3	447

Delayed Critical (for repeat of Run 8)

RR in

10 03 PM MA = 3.510

10 08 Safety block run down

10 28 Burst rod inserted ← 8

4th Black pm 13:45 85°F

#18 — 66° C on continuous recorder

10 30 PM 4.5 r at end of cavadon of 108

Thermocouple readings:

#2	21.0	59
#4	21.0	21.3
#5	59.5	377
#6	21.5	
#9	31.5	

10 34 #18 - continuous recorder = 59°

21.3

377

Period 1.35 ms

146

11/18/61 Run 10 — Fast Scram in

12^03 Delayed crit run
Fans turned off core
Thermocouple readings

#5	23.3	52.5
18	23	
9	22	
4	20.9	52.5
6	21	
2	21	

Crit at MA = 3.51
MA moved to 3.438 ~~for 3¢ of reactivity~~
2.15¢ or 2.21¢

12^42 Safety block removed

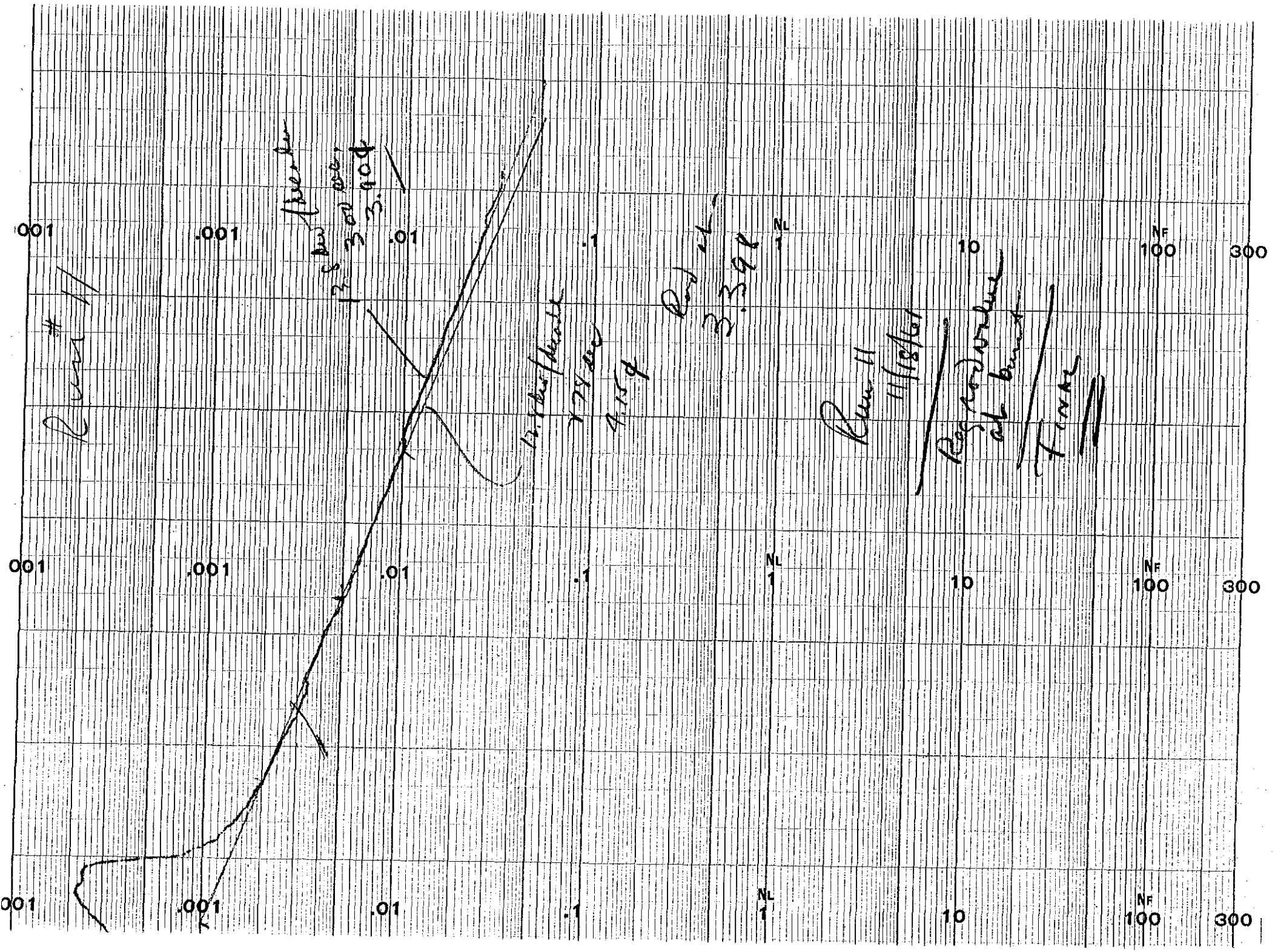
10^06 Start Safety back "in"

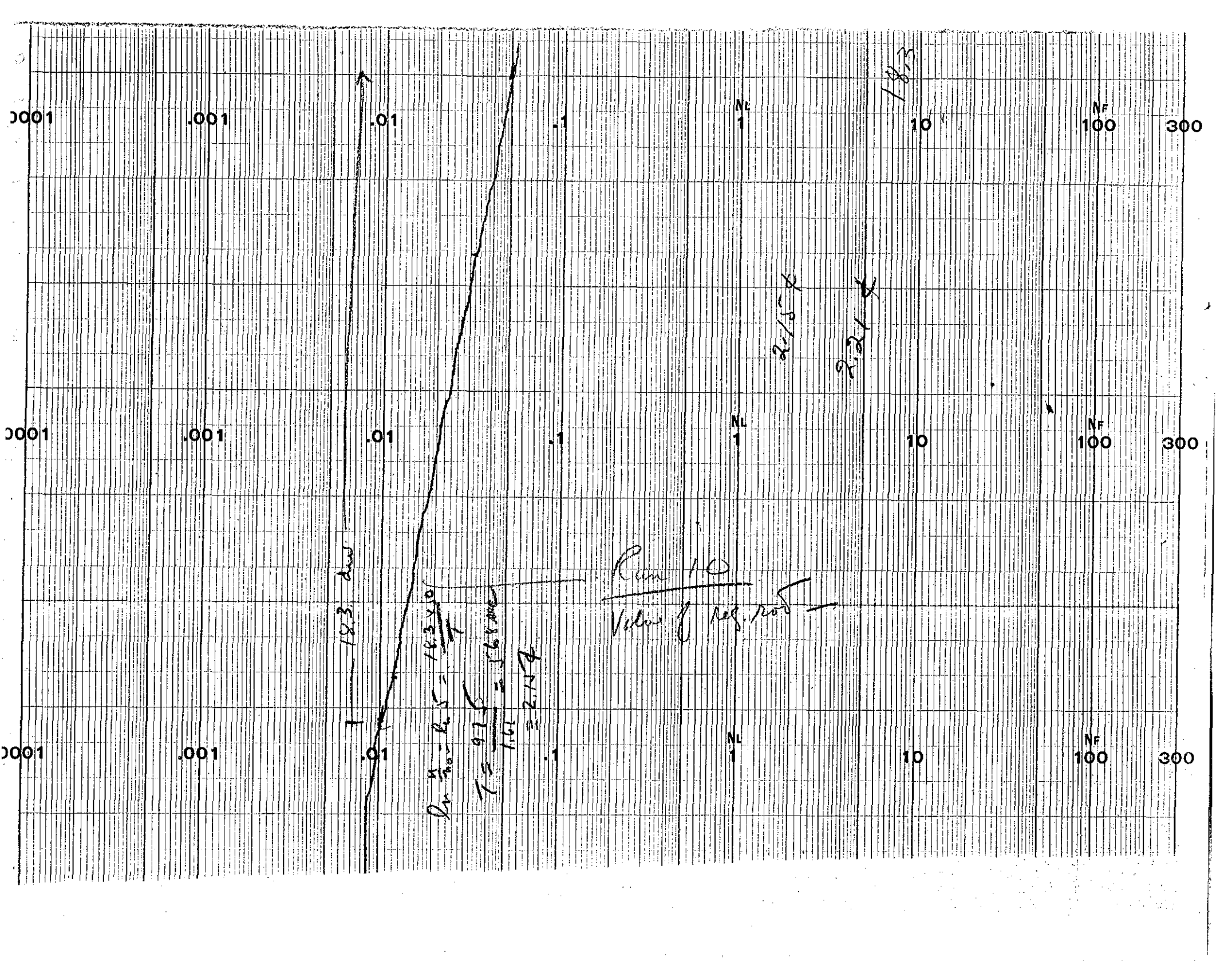
10^55 AM Burst rod inserted

Temp on continuous recorder 58°

1^12 AM Thermocouple readings

#2 - 21		54
4 - 21	52.5	
5 - 52.5	23.3	
6 - 21.8		
9 - 34.5		
16 - 54		


.001
.001
.01
.1
1
10
100
300
NL
NF


.0001
.001
.01
.1
1
10
100
300
N_L
N_F
Rem 10
Velocity Profile

1/18/61 Run 11

Instrument check OK A+D try OK
Plastic scintillator dismantled and poor contact of tube and conductor observed. Fixed and remounted.
Thermocouple readings:

#2	21.0
#4	20.8
#5	21.8
#6	21.3
#9	21.8
#18	21.5

79 ~ 80

38
21.8
(6)²

11¹²/AM Delayed critical
MA = 3.51
RR in
MA rod moved to 3.37 for pos. period
~~period~~ P = 4.73 for above period

11⁴⁰/AM MA rod moved to 3.39 for new period to get excess reactivity for burst

12⁰⁹ MA moved to 3.398 for pos. period
277 sec 4.1 ¢ 390 4.15 Ln

12²⁶ Safety block started out

1³⁵ Safety block reinserted (begin)

1³⁹/ key Milley's watch Burst rod inserted ← 10

Run #8 (continued)

Peak temp = 87°C on continuous chart

1 39 by clock-in 107	2	21.0
	4	20.5
	5	79.0
	6	21.0
	9	38.0
	18	80.0

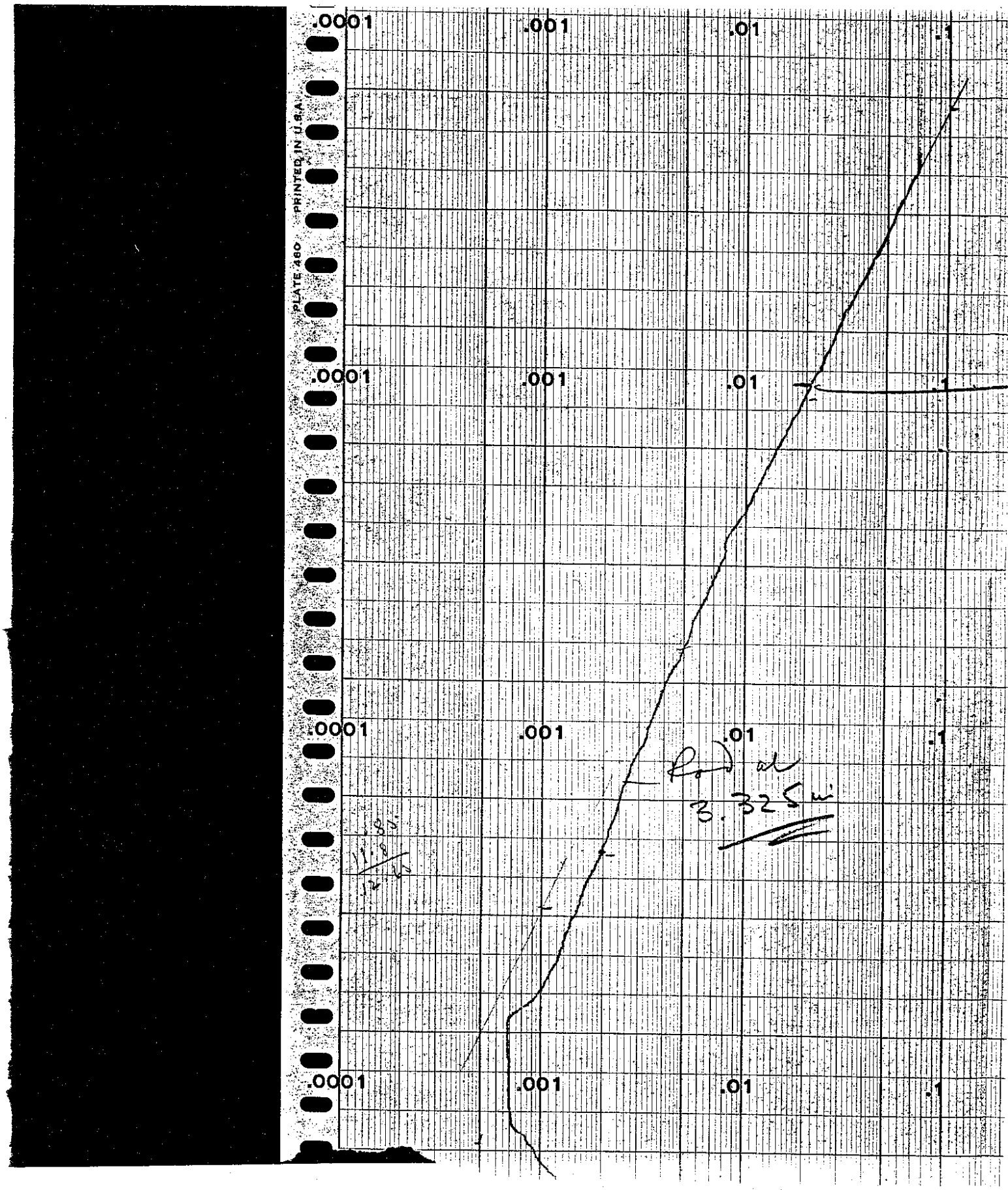
39 / 21.4 / 1.2

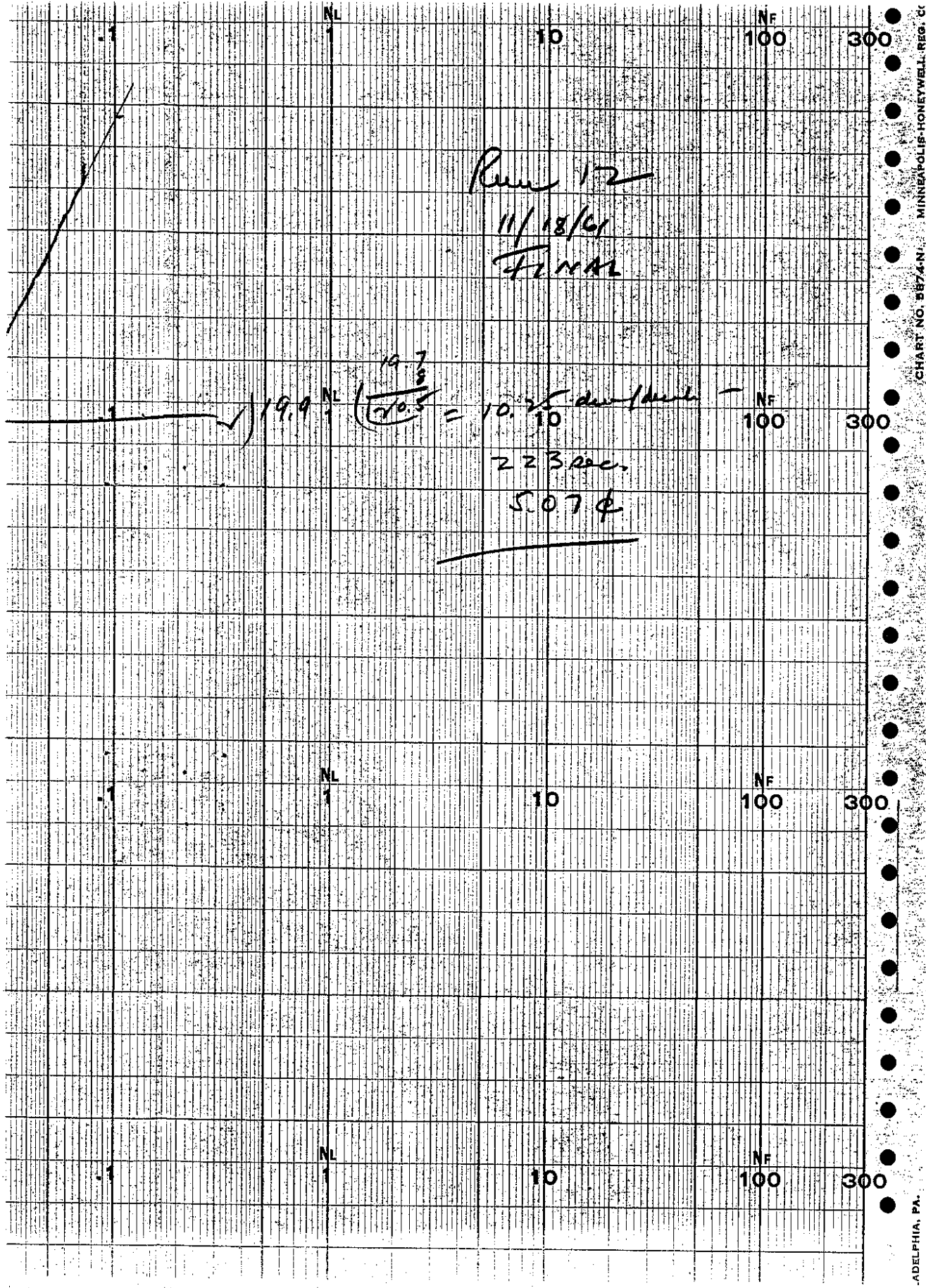
3

3γ / 1.4 / 1.2

87°C / 21.5 / 6.5

48.5 / 24 / 24.5


.0001
.001
.01
.1
PLATE 460 PRINTED IN U.S.A.
Rod at
3.325 in


NL
NF
.1
1
10
100
300
Run 12
11/18/64
41 MAL
19.9
223 sec.
5.07 ¢
CHART NO. 8874-N MINNEAPOLIS-HONEYWELL REG. CO.
ADELPHIA, PA.

11/18/61 Run 12

3 10 PM MA = 3.474 at Cut

Thermocouple

#2 - 21.2
4 - 21.0
5 - 25.5
6 - 21.5
9 - 24.5
16 - 25.5

MA moved to 3.34 for gas period

LN P = 5.4 ; P counter weekend = 5.47

3 42 PM MA moved to 3.325 (withdrawing motion)

~~MA moved to~~ corresponding P = 5.07 {log 2}

3 55 Thermocouples

2	21.0
4	21
5	24.9
6	22.0
9	24.2
18	24.3

~~MA = 5.07 for gas period~~

Safety block moved out

Thermocouples:

2	- 21.0	6	- 23.0
4	- 20.5	9	- 24.0
5	- 24.3	18	- 24.0

Run 12 continued - over

150

11/18/61 Run 12 (continued)

4 20 PM Safety started back in

4 23 PM Burst rod inserted — 11

4 26 PM peak (418) = 111 °C on continuous recorder

2 - 21.0	6 - 22.5
4 - 21.5	9 - 48.5
5 - 101.5	18 - 111 at peak

11

101.5
11

11
2.6
1.4

11/18/61

Run 13

5 39 PM Critical MA = 3.455

MA moved to 3.30 for gas period

5 51 PM MA rod moved to 3.29 for gas period

P = 5.9 scaler from in 101

6 07 PM safety started out

(6 05) → 51 thermocouple readings:

2 - 21.2		9 - 28.5	
4 - 21.0		18 - 29.5	
5 - 30.0			
6 23.0			

6 19 Safety block started in

6 23 Burst rod inserted ← 12

Note: Source was "in"

Source is ~ 10^5 n/sec and 16" away from core

After Burst

2 - 21.5		9 - 47.0	
4 - 21		18 - 111 ← peak	
5 - 101.5		24.5	
6 - 23.5		82	

Before Burst	2	~~21.3~~	21.0	6	21.0	23
	4	21.0	20.5	9	21.4	28.0
	5	21.5	29.0	18	21.2	28.5

1 152

11/18/61 Run 14

Thermocouples

#2	21.3	6	21.0
4	21.0	9	21.4
5	21.5	18	21.2

9 52 PM Critical at MA = 3.53

MA Set at 3.36 for pos period
P = 5.4 ¢ ~~for~~ from Log N (107)
MA set at 3.35 for pos period

10 12 PM MA moved to 3.34 after lowering power

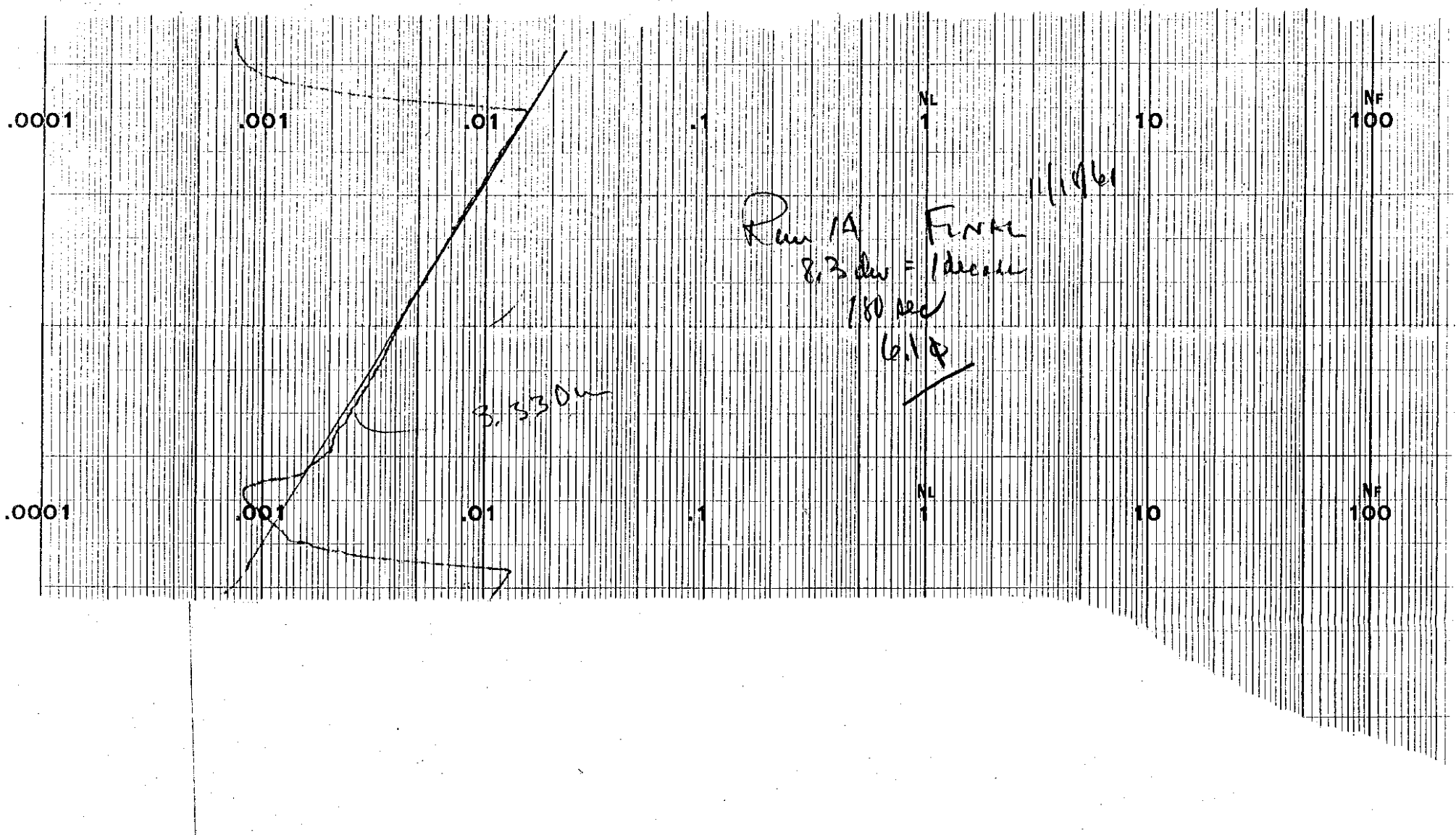
MA moved to 3.332 for pos period
Log N(107) P = 5.98 ¢
MA moved to 3.307

10 43 PM MA moved to 3.319

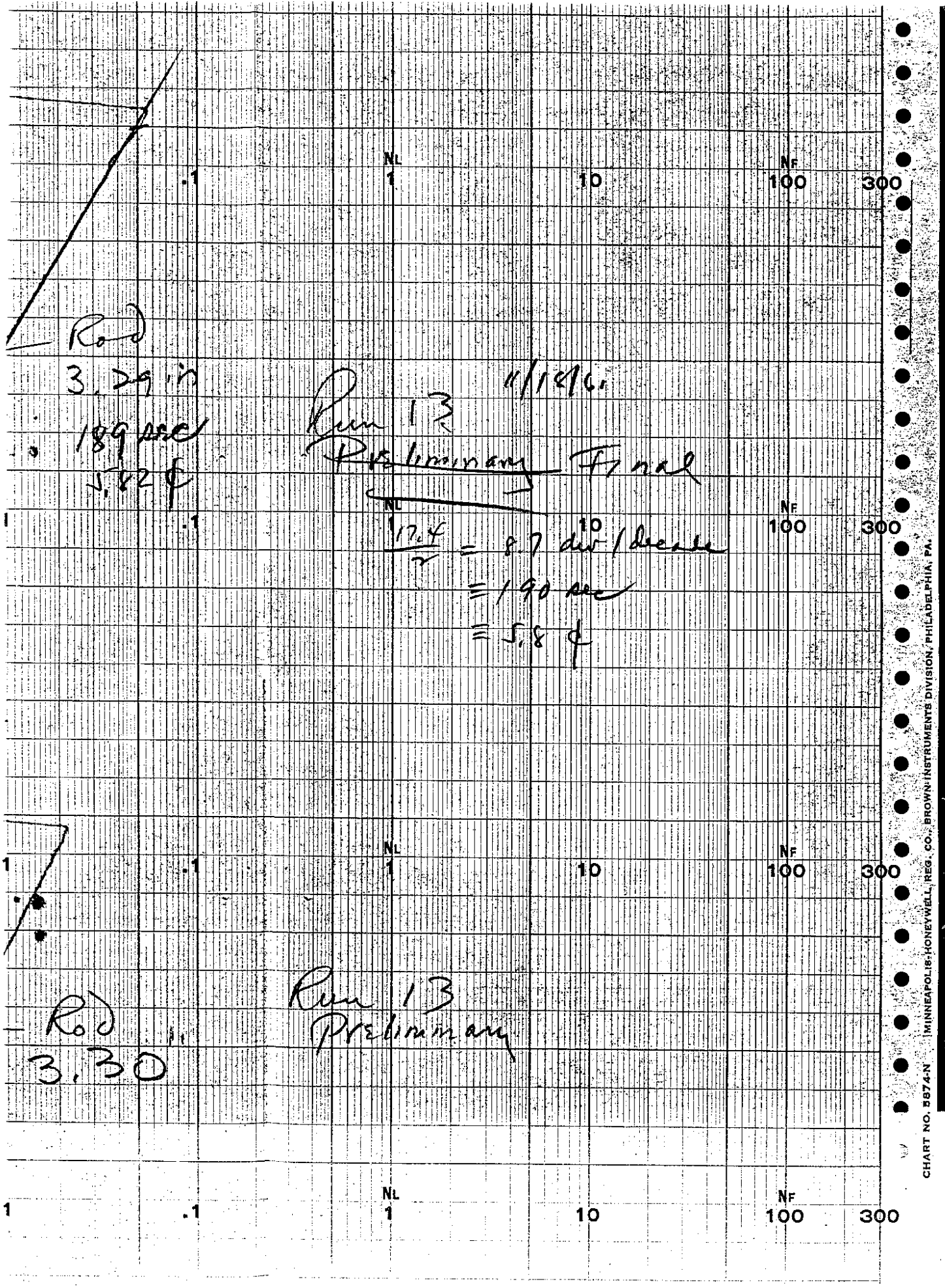
MA moved to 3.330
~~So~~ T = 170 sec ; P = 6.4 ¢ from BF_3 {scaler in 101}
10 55 PM Safely started out

Temp

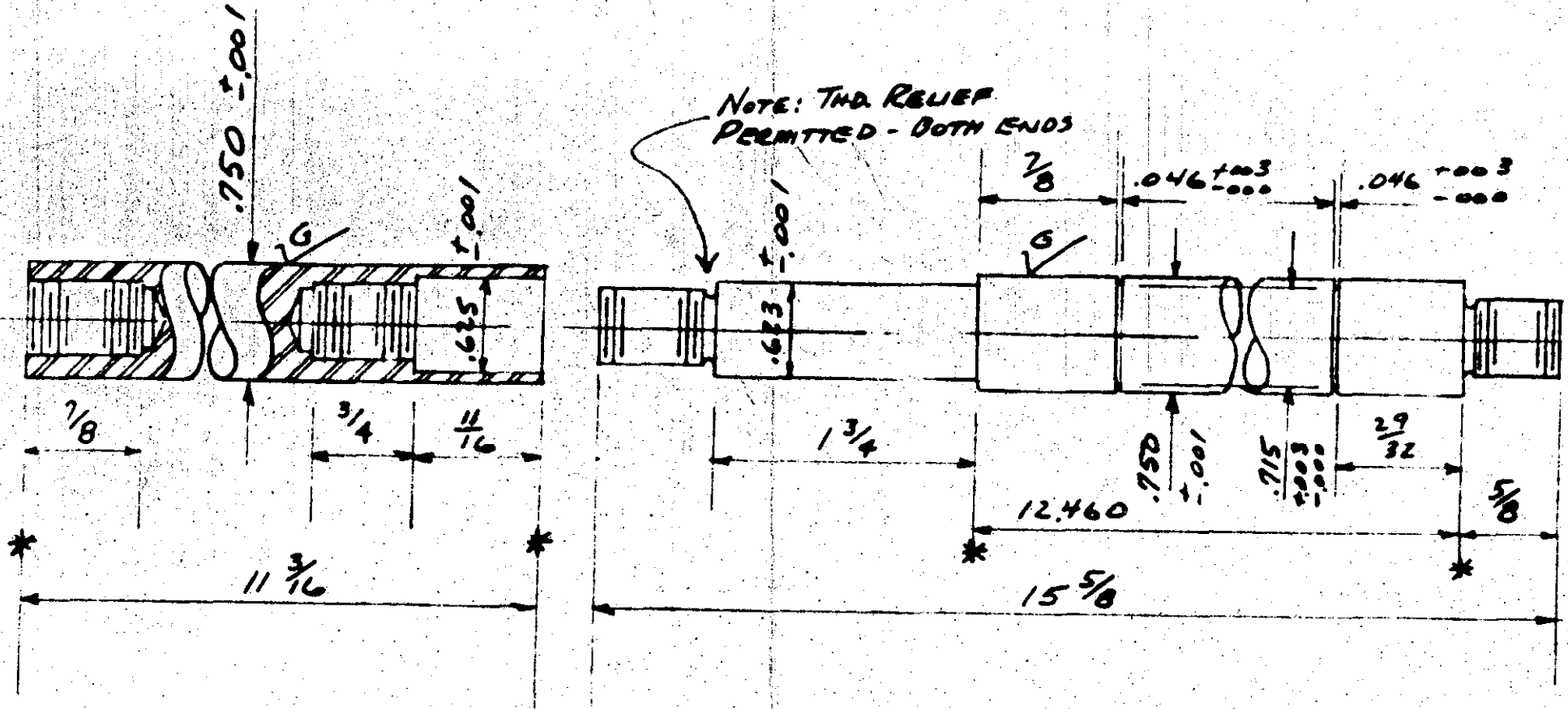
2	21.8	6	21.0
4	21.0	9	21.8
5	21.5	18	21.7
		Br	24.5


.0001
.001
.01
.1
NL
1
10
NF
100
11/19/61
Run 1A
FINAL
8.3 dw = 1 decade
180 deg
6.1 db
3.33 Ohm
.0001
.001
.01
.1
NL
1
10
NF
100

.0001
.001
.01
.0001
.001
.01
.0001
.001
.01
.0001
.001
.01
Rod
3.29
189 A
7.82
Rod
3.32
PRINTED IN U.S.A.
PLATE 460


NL
1
10
NF
100
300
.1
1
Rod
3.29 in
189 sec
5.82 ¢
Run 13
Preliminary
Final
11/1946
17.4
2 = 8.7 div/decade
= 190 sec
= 5.8 ¢
Rod
3.30
Run 13
Preliminary
CHART NO. 5874-N MINNEAPOLIS-HONEYWELL REG. CO., BROWN INSTRUMENTS DIVISION, PHILADELPHIA, PA.

Burst Rod motion from zero (inches)	ρ Cents
0	0
0.694	2.58
1.394	8.15
1.894	14.00
2.148	17.78
2.694	25.94
3.197	34.61
3.694	44.31
4.191	53.97
4.694	64.02
5.226	74.42
5.694	82.78
6.386	94.15
6.894	100.81
7.469	106.98
7.870	110.26
8.739	114.81
9.071	116.01



NOTE: ALL TAPPED & THREADED SECTIONS TO BE ½-20 N.F. & CONCENTRIC WITH ℄

* ALL SURFACES MARKED WITH * MUST BE SQUARE WITH ℄

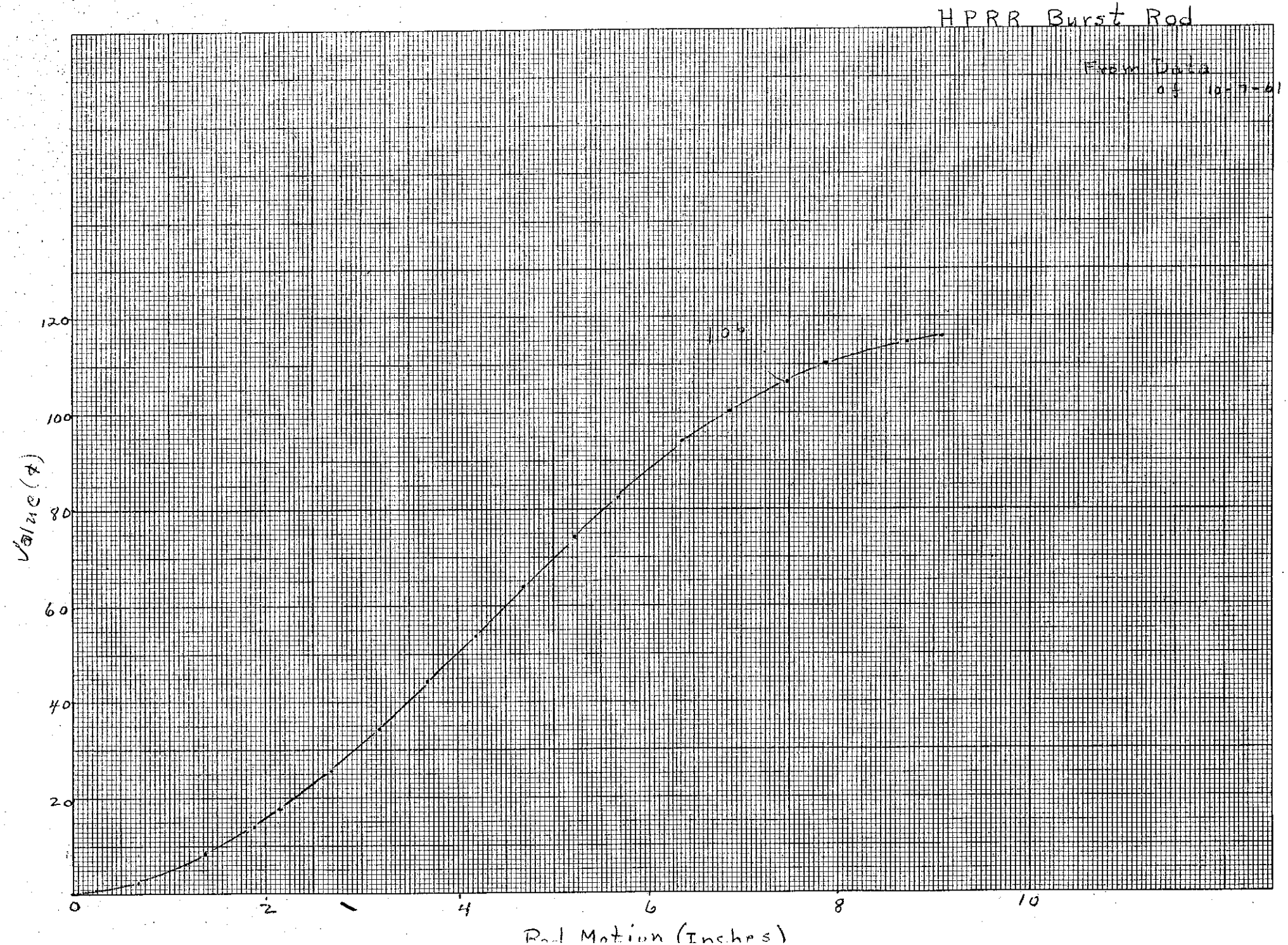
W.D. A-42958-41

FBR.
BURST ROD DRIVE.

DOUBLE END PISTON ROD
BURST ROD AIR CYL - 7.45 STROKE

Burst Rod on M.A. drive ; M.A. Rod on Regulating Rod drive;
Reg. Rod on Burst Rod drive.

	Burst Rod	Mass Adj. Rod	Reg. Rod	Period	Pitts (ℓ)
1)	-0.694" (in)	4.3"	in	+	17.78
2)	0	4.3	in	+	15.20
3)	+0.70	4.3	in	+	9.63
4)	1.20	4.3	in	+	3.78
5)	1.45-4	4.3	in	∞	—
6)	2.00	4.3	in	-	8.16
7)	2.005	3.78	in	+	8.67
8)	2.503	3.78	in	∞	—
9)	3.00	3.78	in	-	9.70
10)	3.00	3.15	in	+	9.66
11)	3.497	3.15	in	∞	—
12)	4.00	3.15	in	-	10.05
13)	4.00	2.53	in	+	10.40
14)	4.532	2.53	in	∞	—
15)	5.00	2.53	in	-	8.36
16)	5.00	1.87	in	+	11.37
17)	5.692	1.87	in	∞	—
18)	6.20	1.87	in	-	6.66
19)	6.20	1.32	in	+	6.17
20)	6.775	1.32	in	∞	—
21)	7.176	1.32	in	-	3.28
22)	7.176	0.89	in	+	5.23
23)	8.047	0.89	in	+	0.68
24)	8.377	—	in	+	1.2



Run 14 (continued)

11 13 pm Burst rod inserted ← 13

Thermocouple readings

11 20

	°C
2 - 21.0	9 - 64
4 - 20.5	18 - 132 — peak
5 - 110.5	
9 - 21.5	Brain weed ppgd
89	110.5
6 - 22.5	21.5
	89 →

64
21.5
4/22

64° C
21.5

cooler
101