BOOK62R

Notes:
"CE-2 Pulsing 1960" on spine

Blank pages: inside front cover sheets, 2, 7, 20, 22, 46-49, 80, 93, 115, 144, 146-152, inside back cover sheets

-page 8 has sheet taped to it
-page 14 has sheet taped to it
-page 50 has sheet glued to it
-pages 62/63 has calendar sheet (4/3/63) between pages

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Preliminary experiments for measuring absolute thermal neutron flux in the center of the HFIR flux trap critical experiment.

Preliminary gold foil Irradiation in Standard Pile

Gold Foil #7 n/cm² 1.11cm OD x 0.0055 in.

weight = 0.2616 gm

1-8-60 5:01 PM Began Exposure Slot #1 Std Pile (thermal flux 1.354x10⁴ neut/cm²/sec

1-12-60 10:57 AM End " " "

Exp Time = 89hr 56 min.

20 Channel Analyzer with 3x3 NaI(Th) Xtal 6363

Photo multiplier voltage ~800V. adj @ gain 8/16

So that Cs^{137} peak at 660 on E dial + channel

For gold counting, set E dial at 295 therefore first channel at .300 Mev and gold 411 kev at channel 11.

3x3 NaI Crystal Efficiency @ 411 kev

	Bell (ORNL	Heath (MTR)
Peak/Total	0.70	0.76
Peak	.50	
Total	.704	
Solid angle	.0373	Total abs 0.026
Peak	01835	Peak 0.01976

av 0.0190

Counting data @ E = 295

start time	1-12-60 2:58 PM	4 10	5 03 PM	8 08 AM 1-13-60
End	3:46 PM	~~4~~ 58	8 03 AM	11 04 stop
Counter	48'	48'	15 hr	176 Min
Dist	9.3 Foil #7	9.3 Foil #7	Bkg	9.3cm Foil #7
Total	210 +60	204 +33	1374 +181	651 +36
1	22 + 8	23 +13	273 +14	78 +9
2	21 +14	23 + 11	282 + 14	77 + 13
3	31 + 1	30 +15	422 +0	108 + 14
4	28 +14	25 +14	367 +2	95 + 1
5	21 + 6	20 + 14	273 +1	81 +15
6	23 +10	27 +10	263 + 12	93 + 1
7	34 + 4	33 + 5	240 +14	151 +15
8	62 +13	61 + 12	317 + 5	305 + 4
9	144 + 13	136 + 3	207 + 7	633 + 0
10	255 +14	256 + 9	204 + 9	1046 + 4
11	380 + 12	393 + 0	300 + 12	1329 + 12
12	452 + 15	436 + 9	201 + 4	1319 + 2
13	373 + 9	367 + 13	201 + 5	898 + 14
14	241 + 7	227 + 14	186 + 4	461 + 7
15	121 + 2	117 + 5	185 + 15	210 + 0
16	48 + 13	44 + 5	185 + 3	83 + 3
17	23 + 15	22 + 8	195 + 13	57 + 12
18	14 + 4	13 + 5	185 + 5	42 + 8
19	14 + 12	13 + 5	205 + 7	45 + 15
20	14 + 14	14 + 13	231 + 15	50 + 8
	21981 + 13537	21594 + 116/10 = 34660	51410 + 3813	6722 + 116/14 = 107657
Surplus	56 + 136	50 + 138	899 + 185	178 + 208

From the plots of net counts, Sum of channels 5–20 give a very good area under peak.

Total Background in channels 5–20 $\frac{51410}{900'} = 57.122$ c/min

~~48' Background~~ 48' Background 2742

176' " 10054

1st Count

$$A_{set} = \frac{(35325 - 2742) \times 2.972 \times 10^{-6} \frac{1}{E}}{.95795 \times .00851903 \times .61779} \qquad \lambda = .00017831/\text{min} = 2.972 \times 10^{-6}/\text{sec}$$

$e^{-\lambda t_w}$ $(1-e^{-\lambda t_c})$ $(1-e^{\lambda t_c})$

$$= \frac{0.096837}{.0050416} \frac{1}{E} = 19.207 \frac{1}{E}$$

2nd Count

$$A_{set} = \frac{(34660 - 2742)}{.94574 \times .00851903 \times .61779} \frac{1}{E}$$

$$= \frac{094860}{004977} = \frac{19.058}{E}$$

3rd Count

$$A_s = \frac{\overset{97603}{107\,657 - 10\,054}}{.797355 \quad \text{~~.202645~~} \times .61779}$$

.0308833

$$A_s = \frac{290076}{015213} \cdot \frac{1}{E} = \frac{19.068}{E}$$

Average 19.058 wt 3
19.207 wt 3
19.068 wt 11

$$A_{S_{at}} = \frac{19.091}{E = .0190} = 1.00_5 \times 10^3$$

Time	Background $9^{09}-10^{09}$ E: 0	$10^{15}-11^{15}$ E:200	$12^{11}-1^{11}$ E:400	$1^{37}-2^{37}$ E:300	Gold #UP $2^{43}-2^{59}$ E:300	$3^{05}-3^{21}$ 300	3^{28} to 4^{00} 300	$4^{06}-4$ 300	38	Bkgr $4^{45}-8^{07}$ AM 8^{12} 9^{00} 300	Gold #UP
Total	594+124	110+165	91+240	103+24	882+53	877+36	1748 +84	1724+87		1425+5	2202+80
1	746+1	23+2	13+3	17+6	60+4	61+1	119 +14	117+4		275+7	163+6
2	409+8	21+13	12+4	18+15	52+15	55+0	110 +10	112+12		276+5	140+8
3	121+10	37+12	21+2	30+10	61+4	59+1	114 +14	119+0		437+3	150+0
4	49+12	29+1	17+6	23+15	58+5	59+12	116 +11	112+1		350+9	146+14
5	50+4	21+14	12+3	19+1	64+6	67+6	124 +2	122+5		265+4	154+9
→ 6	54+9	19+11	12+13	15+9	89+13	95+11	184 +6	176+1		268+1	220+8
7	56+10	18+8	12+1	15+6	190+5	189+0	361 +10	346+0		237+8	399+3
8	55+3	19+11	12+3	14+8	455+15	471+2	937 +1	903+15		227+4	1052+14
9	37+15	17+0	13+9	14+7	1014+12	1075+7	2122 +1	2048+8		212+8	2409+7
10	28+12	16+1	11+13	13+6	1888+12	1946+11	3882 +10	3758+3		207+6	4569+16
11	26+6	24+4	19+12	17+10	2513+10	2543+0	5058 +9	4966+15		268+0	6193+11
12	22+19	17+0	13+9	12+8	2855+2	2830+13	5608 +15	5545+6		195+6	7118+3
13	20+15	18+12	11+13	12+4	2208+14	2099+13	4199 +10	4205+15		192+13	5561+2
14	22+7	18+10	12+12	11+2	1265+14	1203+2	2435 +14	2426+12		188+3	3278+8
15	21+12	19+15	11+2	13+0	566+3	518+7	1038 +12	1067+9		186+11	1485+7
16	19+2	15+15	11+0	11+10	191+15	180+7	342 +7	351+0		175+2	502+11
17	21+0	13+9	11+8	10+12	62+8	54+5	112 +13	117+11		193+1	157+6
18	21+5	15+7	11+8	12+0	23+9	22+3	42 +0	46+0		195+8	58+12
19	23+12	14+2	12+7	13+1	17+6	17+4	33 +9	33+6		219+10	43+6
20	23+8	15+12	12+14	13+15	16+2	14+10	31 +1	32+4		247+3	53+10
Surplus	89+171	66+244	51+214	58+147	26+217	25+189	52 +90	51+249		902+35	72+220
Count Time	60'	60'	60'	60'	16'	16'	32'	32'		922'	48'
Σ 6–20	1823+166	386+149	258+142	195+98	13 332+140	13 256+95	26 384 + 118	26 019 + 94		3 149+84	33044+118
(gold) c/m	488.88	105.42	71.17	3218	213 452	212 191	422,262	416,398		51 278	529,622
IC-3	Red 0.50×10^{-9}			53.633	858	858	1 716	1 716		55.616	2 670
IC-4	Blue 0.070×10^{-9}				212 594	211,333	420 546	414,682			526,952

#65 Gold Foil weight gm

1-19 9⁵⁹ AM Start of Irradiation in center of Annulus. } 211 MINUTES (T_irr)
1³⁰ PM End of Irradiation " " " " . }

ln N(IC-3) = 0.57×10⁻⁹ ln N(IC-4) = 0.07×10⁻⁹

2³⁷-2³⁷ Bkg Count E=300

2⁴³ Start 1st 16' Count E=300 Bkg Corrected Count = 212 594

3⁰⁵ Start 2nd 16' Count E=300 211 333

3²⁸ Start 3rd Ct, 32' Count E=300 420 546

4⁰⁶ Start 4th Ct 32' Count Reverse Side of Foil. 414,682

4⁴⁵ PM Start Bkg Count
1-20 8⁰⁷ AM End Bkg Count } 15 hrs 22' = 922'
8¹² AM Start Foil Count } 18 hr 42'
8⁰⁰ AM Stop " " } 48' 526,952

1-20-60

1st Count $t_c = 16'$ $1-e^{-\lambda t_c} = .00284778$

$t_{cw} = 73'$ $e^{-\lambda t_w} = .98707276$

$t_{exp} = 211'$ $1-e^{-\lambda t_e} = .036910\,33$

$.96842589 \times 9944898 = .96308967$

$$A_{sat} = \frac{212\,594 \times 2.972 \times 10^{-6}}{.103\,754 \times 10^{-3}} \frac{1}{E}$$

$$= \frac{6.0897 \times 10^{3}}{E}$$

2nd Count $t_w = 95'$ $e^{-\lambda t_w} = .9832\,0975 \times .105\,1125 \times 10^{-3}$

$$A_{sat} = \frac{211\,333 \times 2.972}{.103\,348} = \frac{6.0773 \times 10^{3}}{E}$$

3rd Count $t_c = 32'$ $1-e^{-\lambda t} = .005687\,44$

$t_w = 118'$ $e^{-\lambda t} = .979\,187\,32$

$.020\,812\,68 \times 10^{-3} = 5.569\,069 \times 10^{-3}$

$t_e = 211'$ $1-e^{-\lambda t} = .036\,910\,33$

$205\,556 \times 10^{-3}$

$$A_{sat} = \frac{420\,546 \times 2.972 \times 10^{-6}}{205\,556} = \frac{6.0804}{E} \times 10^{3}$$

4th Count $t_c = 32$ $.005\,687\,44$

$t_w = 154'$ $.972\,924\,34$

$t_e =$ $.036\,910\,33$

$.204\,241 \times 10^{-3}$

$$A_{sat} = \frac{414\,682 \times 2.972 \times 10^{-6}}{.204\,241 \times 10^{-3}} = \frac{6.0342 \times 10^{3}}{E}$$

1-21-60

5th Count t_{exp} 211′ 036 910 33

t_c 48′ .008 51903

t_w 18 hr 42′

$e^{\lambda t} = .99254187$

82489438

.81874221 → .257 445 47

$$A_{sat} = \frac{526\,952 \times 2.972^{\times 10^{-6}}}{.257445\,47 \times 10^{-3}} = \frac{6.0832}{\varepsilon} \times 10^{3}$$

Weighted Average

$$A_{sat} = \frac{6.072 \times 10^{3}}{\varepsilon}$$

If $\varepsilon = 0.0190$ $A_{sat} = 0.31958 \times 10^{6}$

Equiv th flux $= \frac{0.31956 \times 10^{3}}{1.005 \times 10^{3}} \times 1.354 \times 10^{4} = 4.3056 \times 10^{6}$ neut/sec

1-28-60 Counted #65 overnight 7:37 to 8:09 am - 1-27-60 - 128

Net cts 1,139,618.

$$A_{sat} = \frac{6.084 \times 10^{3}}{\varepsilon}$$

Data	1-21-60								
TIME	10^{22} AM		10^{41} A		11^{06} A		12^{57} PM		1^{16} PM
Count	16'		16'		16'		16'		16'
Gain	16		16		16		16		16
E	0		200		400		0		0
Total	1072^{+H20}		$632+224$		430^{+217}		$1035+59$		$1030+7$
1	$219+6$		$168+1$		$1572+6$		$215+11$		$253+6$
2	$341+3$		$171+1$		$1700+1$		$328+9$		$341+1$
3	$326+0$		$179+12$		$1548+9$		$275+10$		$279+12$
4	$261+5$		$172+12$		$985+7$		$246+4$		$261+13$
5	$266+10$		$142+14$		$461+14$		$252+10$		$254+2$
6	$554+11$		$105+8$		$167+0$		$552+10$		$548+14$
7	$738+10$		$76+12$		$52+8$		$702+6$		$705+3$
8	$433+15$		$67+1$		$19+9$		$417+9$		$416+7$
9	$211+15$		$53+2$		$12+10$		$214+5$		$207+9$
10	$170+1$		$44+6$		$10+13$		$163+12$		$163+10$
11	$177+4$		$39+15$		$11+2$		$153+15$		$157+14$
12	$152+4$		$38+5$		$10+6$		$152+0$		$154+6$
13	$150+3$		$34+1$		$7+7$		$155+10$		$151+12$
14	$149+10$		$34+12$		$6+7$		$150+4$		$153+7$
15	$162+2$		~~$47+4$~~ $39+11$		$6+5$		$159+1$		$155+1$
16	$171+7$		~~$47+5$~~ $47+4$		$5+6$		$170+10$		$169+2$
17	$173+5$		~~$+11$~~ $99+5$		$6+11$		$170+10$		$169+9$
18	$158+1$		~~$46+10$~~ $94+11$		$6+5$		$158+13$		$161+12$
19	$152+12$		~~$+12$~~ $46+10$		$4+10$		$143+9$		$143+1$
20	$189+7$		$1731+12$		$9+12$		$179+1$		$176+12$
Surplus	$628+14$		$387+86$		$18+88$		$612+97$		$609+33$
	$5152+3$		$3888+187$						$5024+36$
Σ 20	$5144+131$		$3890+155$		$6596+148$		$4953+159$		5015^{+180}
(256)	$328+37$		$243+187$		$412+212$		$310+47$		$314+36$
20+Surplus	$950+17$		$631+17$		$431+20$		$922+144$		$923+69$

1-21-60

Additional data taken with 3" Scin XTL and 20 channel analyzer with #65 gold foil to get peak – Total ratio.

Trouble indicated on 20 channel analyzer with E=0, Total Count ≠ 20 channels + surplus.

		Bkg		
0 - 200	5144 +131	7822		
200 - 400	3890 +155	1687	Add waiting 19'	.99661917
400 - 600	6596 +148	1139	" " 44'	.99218811

Total – Bkg 0 - 200	74 613		
200 - 400	60 708	X .99661917	= 60914
400 - 600	104 545		= 105368

Total Count Rate = 240,895 t_w = 44 hr 52'

t_c = 16' = .00284778

$$A_s = \frac{\frac{715940}{240\,895 \times 2.972 \times 10^{-6}}}{.065\,053\,21 \times 10^{-3}} \frac{1}{\varepsilon}$$

$(1-(e^{-\lambda t_{exp}}) = .03691033$

.99077434

.62465526

.618892

$$\text{Total } A_s = \frac{11,0054 \times 10^{3}}{\varepsilon}$$

$$\frac{\text{Peak}}{\text{Total}} = \frac{6,072}{11,0054} = 0.5517$$

Using data of 1-21-60 only

$$\frac{\text{Peak}}{\text{Total}} = \frac{118\,500}{240\,900} = 0.493$$

1-25-60

Standard Counters on #65 gold foil (Estabrook)

Prop. Gas flow Counter $A_s = 1.79 \times 10^6/\epsilon$ dis/min

Scint $A_s = 3.90 \times 10^6/\epsilon$

Bloser 4π (Scint) $A_s = 1.72 \times 10^6/\epsilon$

4π Scint #7 = 5,423.2 x /E

Telephone Conv. E. Wyatt.

Analysis of Run #6-1 and 6-2 samples

Ba^{140}	2.16×10^9	fissions/ML
Mo^{99}	1.54×10^9	"
Ce^{143}	1.2×10^9	"
Zr^{97}	0.63×10^9	"

λ (gold) = 0.000178 2.4 as per J. Estabrook

But λt and $1-e^{\lambda t}$ factors from Bork are OK

1-28-60

20 channel Analyzer was thoroughly checked by E.R. Rohrer from 1-22 thru 1-27.

Foils #28 and #33, both weigh 0.2410 g.

Thermal flux/unit Power Run #2

~~Start~~ Irradiation	11^{58} AM	1-25-60	$\ln N = 2.4 \times 10^{-9}$
End "	12^{58} PM	1-25-60	2.7×10^{-9}

Thermal flux/unit Power Run #3.

Start Irr.	10^{52} AM	1-27-60	$\ln N = 2.3 \times 10^{-8}$
End	11^{52} AM	1-27-60	$\ln N = 2.4 \times 10^{-9}$

2nd Run Results

	Before	After	
Barium ^{140}	18.66×10^9	6.76×10^9	1.19×10^{16} fiss/ml
Mo^{99}	13.86	1.15	1.27×10^{10} "
Ce^{143}	$(19.4 - .6)K_1$		1.04×10^{10}
Zr Nicks	$(21.3 - .36)K_2$		0.82×10^{10}

Foil # 57 Exposed in Std Pile Slot #1
for 599 hours Time out 9 57 AM Jan 26, 1960
(.99835 exp Factor)

Foil #56 exposed in Std Pile Slot #1
in Cd Cover (0.030 in.)
for 359 hr 12 Min $(1-e^{-\lambda T}) = .97854$
Time out 9:29 A 2-10-60

HFIR CE #2 Φ/MW determinations

Exp #152 Gold Cadmium fraction in target region

#57 (.2407 gm) bare 1" above midplane

#65 (.2407 gm) Cd Covered 0.030 cd

Irradiation 9:20 AM to 10:20 AM 8-18-61

SA-1 and SA-2 used to determine foil ratio of .07368, Cd Ratio = 13.57

Cadmium absorption of 5 ev correction factor = 0.9678 (.030 cd.)

Corrected ratio = $\frac{.07368}{.9678} = .07613$

C.R = 13.14

Instrument Check on 3-6-62 Source —

PM-1 _____ Low Trip O K Alarm Trip O K
PM-2 _____ Alarm Trip O K
IC-1 10×10^{-12} Meter Trip O K Test Trip O K
IC-2 Screamed Meter Trip O K
IC-3 4×10^{-11} Calibration
IC-4 5×10^{-11} Calibration
CRM _____ Meter Trip

Preliminary Check on 3-6-62

Room 113 Pressure Differential 1"
Red Light On and Personnel Check ✓ CC
Scrams and Bldg. Alarm Reset
Source Inserted Accelerator
Safety Withdrawn 21.02
Controls Set Inner 999.93 Outer 0.07
Reflector Water Approx 6" Above Be
Moderator Water 28.26"

Exp # 291 3-6-62 DWM, DEM CC

Purpose: Pulsing At Critical W/o target AND W/o Void

Inner	Outer	Safety	
14.72	44.01	21.02	level

Pulsing using only one BF_3 counter, ② only.
I'm setting up for run around to grad 5 Tuesday
PN-233 Acc 120 KV 0.62 ma 1.9×10^{-5} mmHg 800 μs @ 21 cps
TMC CH 160 MUS Delay 2' BKG 4 DISC 4 MCH 1/1
DET C-2 1750 V. DD2 1.1 X 200 PHS 1.75
INSIDE TUBE BREAKDOWN 1 1 1
Outside TUBE BREAKDOWN 1

"Note" 3 20

level After Run PN-233
Shut Down Insert Safety, Dump fuel H_2O
And outer Control

3-7-62 8^00 AM INSTALLED TARGET ASSEMBLY WITH 0.47 VOID.

Instrument Check on 3-7-62 Source 10 mc/Ra β.

PM-1 _____ Low Trip OK Scrammed / Alarm Trip OK

PM-2 _____ / _____ OK

IC-1 _____ Meter Trip OK / Test Trip OK

IC-2 _____ Meter Trip OK / _____

IC-3 4 x 10^-11 Calibration No — OK DWM / _____

IC-4 6 x 10^-11 Calibration No — OK DWM / _____

CRM ∝ X Meter Trip ∝ X / _____

Preliminary Check on 3-7-62

Room 113 Pressure Differential 1"

Red Light On and Personnel Check ✓ C.C.

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn 28.02

Controls Set INNer 16.0" Outer 0.07"

Reflector Water Approx 6" Above Be

Moderator Water 28.17"

Exp # 292 3-7-62 DWM CC

9^40 AM	INNer	outer	Safety	
	18.30	0.07	28.02"	Pos Per
10^01	18.04	0.07	28.02"	level
	12.00	0.07	(for Pulsing)	Sub crit

Considerable difficulty was experienced with arcing inside (3) and outside (8) the accelerator tube. Acc. was shut down and a 50K resistor put in series with the 101KV supply to focus electrode. (Resistor removed by ERK.)

11^55 In 30 minutes, no arcing has occurred ∴ It is concluded that the resistor stabilizes the beam.

PN-234 WITH TARGET WITH 0.47 void
CRIT AT 18.0 ± and 0.00
INNER 12.00 OUTER 0.00 SAFETY 28.0
ACC 120 KV 0.76 MA 1 MUA 150 MUS AT HOCPS
2×10^{-5} mm Hg Focus Mat SOLENOID MAY
SF 60
TMC CH 30 MUS DELAY 2 BKG 8 DISC 4 MEM 1/1
DET DD2 1.1 x 200 BF_3 HV 1750 PHS 350
Detector showed spurious counts of low amplitude

Above data not recorded because of spurious counts in the BF_3 counter

3-8-62 Target Assembly Removed. 2" BF_3 counter installed at edge of island in thimble. Safety removed. Preparation for Rossi-α measurment with counter in island.

Instrument Check on 3-8-62 Source 10 mc Ra

PM-1 _____ Low Trip OK _____ Alarm Trip OK _____
PM-2 _____ _____ Alarm Trip OK _____
IC-1 _____ Meter Trip OK _____ Fast Trip OK _____
IC-2 _____ ~~Meter Trip~~ Scrammed _____
IC-3 4×10^{-11} A Calibration OK _____
IC-4 6×10^{-11} Calibration OK _____
CRM _____ ~~Preliminary Check on~~ Meter Trip _____
Room 113 Pressure Differential OK Room
Red Light On and Personnel Check OK cc
Scrams and Bldg. Alarm Reset ✓
~~Source Inserted~~ Accelerator Source
Safety Withdrawn No Safety for this experiment only Water drain.
Controls Set Inner 18.50 Outer 0.07"
Reflector Water Approx 6" Above Bc
~~Moderator Water~~ 28.11

Exp # 293 3-8-62

Purpose: Attempt to measure Rossi-α with 2" Counter in Trap.

	Inner	Outer	
12 54 PM	16.22	16.22	Neg Per
	16.20	16.20	Neg Per
12 59	16.11	16.11	Neg Per
	16.00	16.00	Neg Per

Shut Down Insert Outer, Control, Dump fuel H_2O.
No results

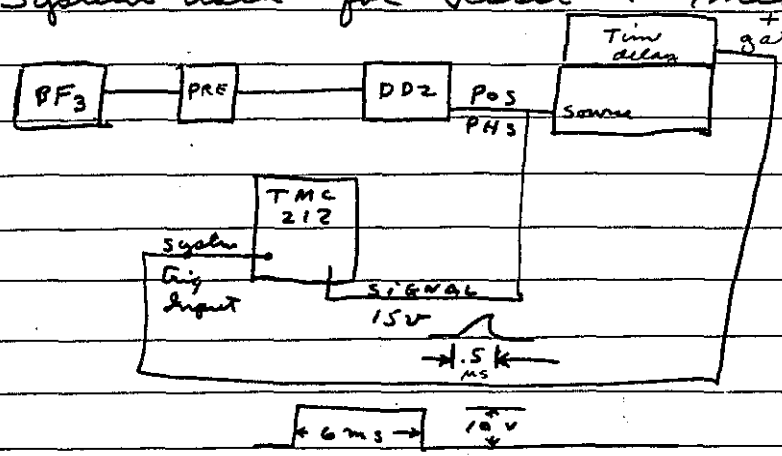
Installed 1" OD BF_3 counter in 2 1/2" OD thimble in flux trap. Removed IC-1 chamber from thimble placed on top of Beryllium.

Exp # 294. Purpose: Attempt to measure Rossi-α with 1" o.d. x 6 in. long BF_3 counter (Model 10502)

Inner	Outer		IC 3	IC 4
15.86	15.86	~ crit	4×10^{-12}	6.5×10^{-12}
15.60	15.60	Sub	5×10^{-13}	8×10^{-13}
15.45	15.45	Sub	2.2×10^{-13}	4×10^{-13}

From the above, it is concluded that there is a source somewhere in the critical assembly. It seems impossible to operate at low enough power to get some results for Rossi-α measurements.

System used for Rossi α measurements



H_2O.

PHS 500, 1.1 X 1 1400 V 2000 C/M PHS NO. 3μs.

PHS 500 1.1 x 1 1400 V 3000 C/M PHS 2μs

3 37 Shut Down Insert outer Control, Dump fuel H_2O

Installed miniature BF_3 counter in island (GE model ⅞" OD) in ½" OD S.S. tubing. Counter works @ 1000 V and accelerator neutrons. ERR will check out on 3-9-62

Instrument Check on 3-9-62 Source 10 mc Ra

PM-1 _____ Low Trip OK _____ Alarm Trip OK

PM-2 _____ Alarm Trip OK

IC-1 _____ Meter Trip OK - Scramm & Fast Trip OK

IC-2 _____ Meter Trip OK

IC-3 4×10^{-11} Calibration

IC-4 6×10^{-12} Calibration

CRM _____ Meter Trip

Preliminary Check on 3-9-62

Room 113 Pressure [illegible] 1"

Red Light On [illegible] ✓

Scrams and Blip [illegible] ✓

Source Inserted Accelerator

Safety Withdrawn No Safety - 3/8" counter in center of island

Controls Set INNer 999.93 Outer 0.07

Reflector Water Approx 16" Above Bc

Moderator Water _____

Note IC-1 was outside tank on ~~South~~ east side.

EXP # 295

Purpose: Subcritical react. meas. with different detectors in diff location. GE 3/8 in. OD BF_3 counter in center of island.

PN-234 INNER = 0.00 OUTER 0.07 Report 225-226
with 3/8 in. BF_3 detector in center of island. Exp #295
Acc 135kv D.V. 55 SF 50 1.2×10^{-5} mm/Hg
0.77 ma ~1 MUA 200 MUS @ 170 cps
TMC CH 10 MUS Delay 2 Bkg 16 Disc 4 Mem 1/1
DET 3/8 BF_3 @ 1300 V DD2 1.1 X 2 PHS = 100

Note: looked for ripple in target current at 60 cps found essentially none! No increase in noise on linear inst.

EXP # 296

INNER = 12.00 Outer 0.07 Safety Removed

No target 3/8" OD counter in 1/2 in. OD SS tube in center of tray

PN-235 Acc 135 kv 0.75 MA <1 MUA

110 CPS 200 MUS BURST

TMC CH 20 MUS Delay 2 Bkg 16 Disc 4 Mem 1/1

Det. See above. IC-4 = 1×10^{-10}

EXP # 297

INNER 17.85 Outer 0.07 Safety Removed

No target

PN-[redacted] 236 Acc 135KV 0.73 MA <1 MUA 200MUS @ 70CPS

TMC CH 40MUS Delay 2 BKG 16 DISC 4 MEM 1/1

Det See above

1[40] Shut Down Dump fuel H_2O

"Note" Installed target Assembly with 0.47 Void (Al Cen) And BF3 Counters Between the fuel Annulus of Core Centered Vertically

① Not working ② 1900 DD-2 1.1 X 100 PHS = 300

EXP # 298 3-9-62

2[58] PM

INNER	Outer	Safety	fuel H_2O
99.93	0.07	17.50	28.51

IC-2 = .45 * 10 x 10^{-10} or 4.5×10^{-10}

3 = 3.5×10^{-11}

4 = 1.8×10^{-12}

PN-237 Acc 135KV 0.77 MA <2 MUA 200 MUS @ 170 CPS

4[30] shutdown TMC 10 MUS Delay 2 Bkg x16 Disc 4 Mem 1/1

Instrument Check on 3-12-62 Source 10 mc 8

PM-1		Low Trip OK	Alarm Trip OK
PM-2			Alarm Trip OK
IC-1	$>10\times10^{-12}$	Meter Trip OK Scrammed	Fast Trip OK
IC-2	$>10\times10^{-12}$	Meter Trip OK	
IC-3	5×10^{-11}	Calibration OK	
IC-4	6×10^{-12}	Calibration OK	
CRM		Meter Trip	

Preliminary Check on 3-12-62

Room 113 Pressure Differential 1" H_2O

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn I 7.50

Controls Set Inner 14.20" Outer 0.07"

Reflector Water Approx 6" Above Be

Moderator Water 28.5"

Installed MIN BF_3 Counter [Ch ①], counter mounted in 5 mil Ni in dD ss tube 4' long. Counters in CH 1 and Ch 2!

EXP # 299 - PN-238 IC 4 1.3×10^{-10} IC-3 6×10^{-11}

Inner 14.20 Outer 0.07 Safety 27.50 IC-2 $.57\times3\times10^{-10}$

Acc 300μs @ 70 cps SF 50 1.5×10^{-5} mm Hg 1351CV

Focus = Max Sol = Max

TMC CH 40 MUS Delay 2 Bkg 16 Disc 4 Mem 1/1

DET ① 1300 DD2 1.1×200 PHS 200 Max P.H. ~75

② 1800 1.1×200 200 " ~75

EXP # 300 PN-239

Inner 10.00 Outer 0.07 Safety 27.50

Acc 1.6×10^{-5} mm Hg 135KV 0.74 MA 200 MUS @ 110 CPS

TMC CH 20 MUS Delay 2 Bkg 16

10^50 AM Exp # 301 PN-240

INNER 14.20" Outer 10.0" Safety 27.50" Sub crit

ACC 135KV 0.69MA 1.4×10^5 mmHg SF 50 Foc Max Sol MAX

400 MUS AT 35 CPS

TMC 80 MUS DELAY 2 BKG 8 DISC 4 MEM 1/1

DET See PN-238

IC-2 $0.28 \times 3 \times 10^{-10}$ IC-3 3.5×10^{-11} IC 4 2.0×10^{-11}

Moderator water 25.7 in.

Increased Mod. Water to 28.8 in.

Exp # 302 3-12-62

INNER	outer	Safety	
14.265	14.265	27.50	Slightly Sub
14.20	14.44	27.50	level
"	"	21.00	Neg Period

7 div → −152.1 sec → −11.9 ¢ (-7.6×10^{-4})

Raise power with acc.

level

IC-1 $\frac{51}{46} \times 3 \times 10^{-11}$ IC-3 4.5×10^{-10}

2 $.51 \times 10 \times 10^{-10}$ -4 3.5×10^{-10}

12^42 14.48 14.48 21.03 level

Pulsing at crit. 200 pulses safety 21.02 → 14.0 and repeated

PN-241 ACC 135 kv 0.67 MA 1000 MUS AT 20 CPS

TMC 160 MUS Delay 2 BKG 4 Disc 4 Mem 1/1

DET see PN-238.

~~Noted that during Run~~

3-12-62

3⁰⁰ PM After run system was subcritical and then noted that the outside reflector water was down about six inches. Pumped H_2O back up And system was supercritical a few cents

-6.7 dn $-132.6 \rightarrow -9.45 \times 10^{-4} \rightarrow -14.8¢$

$+23$ dn $+500 \rightarrow 1,55 \times 10^{-4} \rightarrow +2.4¢$ } 17.1¢

Therefore, crit. run must be repeated.

Inspection of dump valve diaphragm showed no defects, diaphragm replaced anyway. It could be feed valve diaphragm causing trouble.

3-13-62

The new diaphragm on drain valve (Refl H_2O) leaked overnite. Inspection showed no reason. Replaced with original diaphragm, but tightened ¼ turn with pipe wrench — no leak detected.

4⁴⁵ PM No leak detected during operation until 4⁴⁵ PM

Instrument Check on 3-13-62 Source 10 mc γ

PM-1 _____ Low Trip OK _____ Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 >1.8 x 10⁻¹¹ Meter Trip OK Fast Trip screwed OK

IC-2 >10 x 10⁻¹² Meter Trip OK _____

IC-3 4.5 x 10⁻¹² Calibration OK _____

IC-4 5.5 x 10⁻¹¹ Calibration OK _____

CRM _____ Meter Trip _____

IC-1 Keithley seems more unstable than previously

Preliminary Check on 3-13-62

Room 113 Pressure Differential 1" ✓

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn 21.03"

Controls Set Inner 14.20 Outer 0.07

Reflector Water Approx 6" Above Bc

Moderator Water 28.9"

Exp# 303 3-13-62

	Inner	Outer	Safety	
9:30 AM	14.20	15.42	21.03	Pos Per
	6.65 div/sec → +144.5 sec → 4.68 x 10⁻⁴ → +7.3 ¢/.23 = 31.7 ¢/in			
	14.20	15.195	21.03	
	14.20	15.19	21.03	level
10:40	14.46	14.46	21.03	level

Pulsing at Crit. 200 pulses then insert safety to 14.0 to lower neutron level

PN-242 Inner = Outer = 14.46 Safety 21.03

ACC 135 kv 0.67 MA 1000 MUS AT 20 CPS

TMC CH 160 MUS Delay 2 BKG 4 Disc 4 MEM 1/1

DET ① SS 1300 V ② AL 2000 V PHS 200

PULSE HEIGHT MAX 75 V.

SYSTEM CRIT @ LEVEL AFTER 120 cycles.

Exp # 304 3-13-62

	Inner	Outer	Safety	
1[48] PM	19.14	0.07	21.02	Pos Per

5.33 div/decade → +115.8 sec → 5.62×10^{-4} → + 8.8 ¢ on $\frac{8.8}{.28} = 31.4$ ¢/in.

2[04]	18.86	0.07	21.02	level

PN-243 Pulsing at Critical. Inner Control fully inserted
Same conditions as PN-242 except for control positions! ACC 1000 MUS AT 20 CPS
TMC 160 MUS BKG x4

4[15] System Critical And level After PN-243
Shut Down Insert Safety, Dump fuel H_2O

Instrument Check on 2-14-62 Source 10 mr γ

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$>10 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>10 \times 10^{-12}$	Meter Trip	OK scrammed		
IC-3	5.5×10^{-11}	Calibration	OK		
IC-4	6.0×10^{-11}	Calibration	OK		
CRM		Meter Trip			

Preliminary Check on 3-14-62

Room 113 Pressure Differential Down 1" H_2O
Rod Light On and Personnel Check C.C.
Scrams and Bldg. Alarm Reset ✓
Source Inserted Accelerator Neutron Source On
Safety Withdrawn 21.04
Controls Set Inner 999.93 Outer 44.01
Reflector Water 6" Above Be
Moderator Water 29.2

Exp. # 305
Purpose: To pulse at critical with Outer control fully withdrawn (target with 0.47 void)

Exp # 305 Cont

35

	Inner	Outer	Safety	
9[12]	11.47	44.01	21.04	Pos Period

3.3 div/dec → 71.7 sec → 8.12×10^{-4} → +12.7 ¢ on $\frac{12.7}{.135}$ = 94 ¢/in.

9[29]	11.335	44.01	21.03	level

Pulsing at crit for 200 cycles - Safety inverted to 14.0 and repeat 24000 times 120-cycles

PN-244 ACC 1.5 M 2.4×10^{-5} sec 135 KV 0.68 MA 1000 MUS AT 20 CPS
TMC CH 160 MUS BKG 4 Delay 2 Disc 4 Mem 1/1
DET 2 MIN BF3 See PN-238
Critical check after pulsing.

11[40] level After Pulsing PN-244
(Bypassed upper limit (21.03) on safety)

Exp # 306 3-14-62

PN-245 Sub Crit

Inner	Outer	Safety	
10.0"	10.00"	27.5"	Sub Crit

10[58] Start Pulsing for PN-245
ACC 2.2×10^{-4} 135 KV 0.72 MA 200 MUS AT 110 CPS
TMC CH 20 MUS BKG 16 Delay 2 Disc 4 MEM 1/1
DET See PN-238
1 Acc. Arr Inside Tube

12[47] Shut Down Insert outer Control, Dump fuel H_2O
11 Lower Inner. Remove Target and Void.
Note Re-insert Target assembly.

Exp # 307 3-14-62

1 48 PM

INNer	Outer	Safety	
17.50	0.07	28.00	
2 02 16.52	16.52	28.00	level
2 10 16.63	16.63	21.03	level

PN-246

Acc 1000 MUS @ 20 CPS

TMC 160 MUS BKG ~~X2~~

4 06 System Critical And level After PN-246 Shut Down INsert Controls, Safety And Dump fuel H_2O.

Instrument Check on 3-15-62 Source 10mc 8

PM-1 _____ Low Trip OK Scrammed Alarm Trip OK

PM-2 Contact _____ Alarm Trip OK

IC-1 $>10 \times 10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>10 \times 10^{-12}$ Meter Trip OK

IC-3 5×10^{-11} Calibration

IC-4 6×10^{-11} Calibration

CRM _____ Meter Trip

Preliminary Check on 3-15-62

Room 113 Pressure Differential 1" H_2O

Red Light On and Personnel Check C.C

Scrams and Bldg. Alarm Reset Down

Source Inserted Accelerator Source

Safety Withdrawn 21.04

Controls Set Inner 999.93 Outer 0.07

Reflector Water ~6" above Beryllium

Moderator Water 28.71"

EXP 308 PURPOSE: Pulsing at Critical with controls Asymmetric, Outer at 0.07, Inner poison withdrawn to critical (Covered)

	Inner	Outer	Safety	
9 02 AM	35.18	0.07	21.04	Pos Per
9 35	34.74	0.07	21.04	level
9 50	Shut Down to Replace Defective Counter with one mounted in 0.005 in. S.S. tube.			

6 div/decade → 130.45 → 5.1×10^{-4} → 8.0 ¢ ; $\frac{8.0}{.44} = 18.1$ ¢/inch

Exp # 309 3-15-62

INNer	Outer	Safety	fuel H_2O	
34.74	0.07	0.0	28.41"	Sub Crit
11 02 34.69	0.07	21.04	"	level

C ① 1300 [$\times \frac{2000}{1250}$] = 1486 v DD2 1.1x100 PHS-20 Pulses < 75 v

C ② 1950 [$\times 1.0$] = 1950 v 1.1x100 " Pulses < 75 v

CRIT for 200 pulses, reduce neutron and with safety to 14.0, Signal

PN-247 CRITICAL INNER 34.69 OUTER 0.07 Safety 21.03

ACC 1.9×10^{-5} mm Hg 135 kv 0.58 1000 MUS AT 20 CPS

TMC 160 MUS BKG 4 Disc 4 Mem 1/1 Delay 2

DET 2 MIN BF_3 counters

1 11 PM System Critical And level After PN-247

~~Inner Outer Safety~~

Exp # 310 3-15-62

1 30 PM

INNer	outer	Safety	
13.57	44.01	21.00"	Pos Per
13.50	44.01	21.00"	level

11.6 div/dec → 252 sec → 2.91×10^{-4} → 4.5 ¢ → 65 ¢/in.

4 15 System Slightly Super Critical After PN-248 ~~+3960~~ Neg. Reacty

PN-248 Same as PN-247

Instrument Check on 3-16-62 Source 10 mc Ra

PM-1 Zero 300 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 7.0 x10⁻¹¹ Meter Deflection OK Fast Trip OK Scrammed System

IC-2 7.0 x10⁻¹² Meter Deflection OK

IC-3 4 x10⁻¹¹ Calibration OK

IC-4 6 x10⁻¹¹ Calibration

CRM Meter Deflection

Preliminary Check on 3-16-62

Room 113 Pressure Differential 1"

Red Light On and Personnel Check ✓

Screams and Bldg. Alarm Tested ✓

Source Inserted Accelerator

Safety Withdrawn 28.02

Controls Set INNER 999.93 Outer 0.07

Reflector Water Approx. 6" Above Be

Moderator Water 29.0 in

EXP # 311 Pulsing when Subcritical

PN-249 INNER 0.00 OUTER 0.07 SAFETY 28.0

WITH TARGET No VOID

ACC 135 KV ~~0.80~~ 0.77 MA 200 MUS AT 170 CPS

TMC CH 10 MUS BKG 16 Disc 4 Delay 2 Mem 1/1

Det 2 MIN BF3 COUNTER'S PHS 200 ~ 75 V pulses.

Note: 111 H.V. arc in side accelerator tube. 11 during data collection. Pressure was high at that time ~ 3 x10⁻⁵ mm Hg.

IC 2 .39 x10x10⁻¹⁰

3 2.4 x 10⁻¹¹

4 1.4 x10⁻¹⁰

11 15 AM

1 33 PM

EXP 312 PN-~~247~~ 250

PN-~~250~~ INNER 12.00 OUTER 0.07 SAFETY 28.0 WITH TARGET

NO VOID ACC 300 MUS AT 110 CPS

TMC CH 20 MUS BKG 16 Disc 4 Delay 2 Mem 1/1

DET 2 MIN BF3

EXP # 313 PN-25~~1~~ 3-16-62

INNER 12.00" Outer 12.0" Safety 28.0" with target

PN-251 WITH TARGET NO VOID

ACC 400 MUS AT 70 CPS

TMC CH 40 MUS BKG 16 Disc 4, Delay 2 Mem 1/1

DET 2 MIN BF3 ~ 75 V. pulses.

EXP # 314 PN-252

Inner 00.0 Outer 12.0 Safety 28.0

With Target No Void.

ACC 300 MUS AT 110 CPS

TMC CH 20 MUS BKG 16 Disc 4 Delay 2 Mem 1/1

DET 2 MIN BF3 ~75 V. pulses.

EXP # 314 PN-253 3-16-62

INNER 16.60 Outer 0.07 Safety 28.0" with target

ACC 300 MUS AT 110 CPS

TMC CH 20 MUS BKG 16 Disc 4 Delay Mem 1/1

DET 2 MIN BF3 ~75 V. pulses

EXP 315 PN-254

INNER 16.60 OUTER 12.00 SAFETY 28.0

WITH TARGET NO VOID

ACC 500 MUS 70 CPS

TMC 40 MU S BKG 8

~3³⁰ Shut down assembly Remove Target Install Styro foam void in trap.

"Note" Removed target And Replaced with Styrafoam- 3-16-62 4 3/16" DIA Made up with 12 Pcs 2" thick Discs stacked together on A 5/16" OD SS target Rod. Length of Styrafoam 24 3/8" Extending from 1 3/16" Below Core to 3 3/16" Above.

Instrument Check on _____ Source _____

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

Instrument Check on 3-19-62 Source 10 me/r

PM-1	Zero 3.00	Low Trip OK	Alarm Trip OK
PM-2			Alarm Trip OK
IC-1	10×10^{-11}	Meter Trip	Fast Trip OK
IC-2	10×10^{-12}	Meter Trip OK Scrammed	
IC-3	3×10^{-11}	Calibration	
IC-4	5×10^{-12}	Calibration	
CRM		Meter Trip	

Preliminary Check on 3-19-62

Room 113 Pressure Differential 1"

Red Light On and Pennemel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn 28.00"

Controls Set Inner 999.93" Outer 0.07"

Reflector Water Approx 5.75" Above Be

Moderator Water 29.21"

EXP # 316 PN-255 3-19-62

Inner 999.93 Outer 0.07" Safety 28.00 (Styrafoam void)

PN-255 No target assembly 0.67 void

ACC 135KV 0.75 MA 1MVA 170 CPS 200 MUS BURST

TMC 10 MUS BKG 16 Delay 2 Disc 4 Mon 1/1

Det ① 1300 × 1.25/5.00 KV Pulse ~75V PHS 200

① 1950 V. ~75V "

EXP # 317 PN-256 3-19-62

	Inner	outer	Safety	(Styrafoam Void)
10 PM	13.15	13.53	28.0	Pos Per
	13.15	13.27	"	level
	13.175	13.175	"	level
	13.495	13.495	21.05	level

6.2 div/sec → 139.7 → 4.97 × 10⁻⁵

7.8 4/24 = 0.30/hr

PN-256 CRIT 200 Pulse limit Safety to 14.0 & Repeat

ACC 1000 MUS AT 20 CPS TMC 160 MUS BKG 4

(Cont)

Exp # 317 Cont

3[46] Inner outer Safety
13.495" 13.495" 21.04" slightly super After
Pulsing PN-256 ±3000 sec
Negligible

3[55] Shut Down Insert Safety, Outer Control

Instrument Check on 3-20-62 Source 10 mc Ra

PM-1 Zero 310 Low Trip OK Alarm Trip OK
PM-2 Alarm Trip OK
IC-1 >10 x 10⁻¹¹ Meter Trip OK Scram Fast Trip OK
IC-2 >10 x 10⁻¹² Meter Trip OK
IC-3 5 x 10⁻⁶ Calibration by Dwm
IC-4 5.5 x 10⁻¹¹ Calibration by Dwm
CRM × Meter Trip ×

✓ Preliminary Check on 3-20-62
Room 113 Pressure Differential 1"
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn 21.05"
Controls Set INNER 999.93 Outer 0.07"
Reflector Water Approx 5.75" Above Be
Moderator Water 29.37"

Exp # 318 : Pulsing at Critical with Modified Outer control at 0.08. (Styrafoam Void)
INNER 16.30 Outer 0.07 Safety 21.05 Pos Per
6.9 div/decade → +150 sec → 4.55 x 10⁻⁴ → 7.1¢ → 21/16 = 44.4 ¢/inch
9[00] AM Inner 16.14 levels

9[03] PN-257 CRITICAL INNER 16.14 OUTER 0.07
T₀ SAFETY 21.05 AFTER 200 PULSES SAFETY n 14.0
11[02] Acc 1.7 x 10⁻⁵ mm Hg 135 KV 0.67 MA
1000 MUS AT 20 CPS 24004 BURSTS
TMC CH 160 MUS BKG 4 Delay 2 Disc 4 Mon 1/1
DET 2 MIN BF3 ~75 Pulses PHS 200
① 1.3 x 3.0/1.75 V.
② 1950 V.
~11'5 Neg period after pulsing -7.3 div/sec → 1586 → .537 x 10⁻⁴ → 0.84 ¢.
after pulsing ~ 21.03.

Exp # 319 PN-258 3-20-62
11[24] AM INNER 10.0" outer 0.07 Safety ~~21.03~~ 28.00" (Styrafoam void)

[11[31] to 12[07]] PN-258 SUB CRIT INNER = 10.0 Outer 0.07
Safety 28.0 Acc 500 MUS AT 70 CPS (160000)
TMC CH 40 MUS BKG 16
DET 2 MIN BF3

12[42] Exp # 320 PN-259 3-20-62 (Styr-void foam)
INNER 10.36 Outer 44.01 Safety 21.05 Pos Per
6.55 div/sec → 142.3 sec → 4.75 x 10⁻⁴ → 7.42¢ → 83 ¢/in.
In 10.27 Out 44.01
Pulsing at Crit Safety 21.01 → 14.0 [24004 CPS]
Acc 135 KV 0.67 MA 1000 MUS 20 CPS
[100-3[00] PM] TMC 160 MUS BKG 4
DET
Subcritical after pulsing -2400 sec.

Note: During the time of a run pulsing at critical, approx 2 hrs., the position of the safety seems to change more than previously. On the last run special note was made, at beginning it was 21.05, at end 21.00. Changing from 21.00 to 21.05 made reactor ~~more~~ critical or slightly positive period. (3/20 sec

EXP # 321 Pulsing Subcritical

PN-260 IN 0.00 OUT 10.0 Safety 28.0
ACC 135KV 0.72 MA 1.5 m.m Hg X 10^{-5}
~~PRR~~ 300 MUS AT 110 CPS
TMC 20 MUS BKG 16
DET 2 MIN BF3

Instrument Check on 3-21-62 Source 10 mc γ

PM-1 Zero 340 Low Trip OK Alarm Trip OK
PM-2 Alarm Trip OK
IC-1 $>10 \times 10^{-11}$ Meter Trip OK Fast Trip OK Scrammed
IC-2 $>10 \times 10^{-12}$ Meter Trip OK
IC-3 5.5×10^{-11} Calibration by Dwan
IC-4 6×10^{-4} Calibration by Dwan
CRM Meter Trip

Preliminary Check on 3-21-62
Room 113 Pressure Differential 1"
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn 28.00"
Controls Set INNer 13.50 Outer
Reflector Water Approx 5.75 Above Be
ModWater Water 28.77"

Exp # 322 PN-261 3-21-62
INNer 13.50 outer 10.00" Safety 28.0" (styrofoam void)
Acc 135 kv 0.67 MA SF 50 FOC MAX SOL MAX 1.9×10^{5} m.m Hg
800 MUS 40 CPS 80000 cycles.
TMC CH 80 MUS BKG 4
DET 2 M/M BF3 55 Pulse ~75V PHS 200

PN-262 Repeat Above but w. Ch 160 MUS BKg 8
1800 MUS 20 CPS

EXP # 323 PN-263
Inner 13.50 Outer 0.07 Safety 28.0 Styro foam Void
Acc 135 KV 0.70 MA 400 MUS 70 CPS
TMC CH 40 MUS BKG 8 Delay 2 Disc 4 Mem 1/1

TIMER 2056
5-4-62

May 17, 1962
Timer Reading 2071
Rover demnt experiments 2071 - 2056 = 15 hours.

Critical Experiments for Studying HFIR Control Concepts

I -	Put boron solution into moderator system, determine critical conditions with safety, inner and outer fully withdrawn, Set up pulsed neutron equipment.	3 Days
	a) Re calibrate safety up to $5.	1
	b) Re calibrate inner up to $5.	1
	c) Calibrate outer up to $5.	1
	d) Calibrate new safety between fuel annuli up to $5.	1
	e) Installation and removal of new safety.	1
II -	Dilute boron solution until either a desired symmetrical position of inner and outer control, a desired position of the safety, or a desired boron concentration is reached.	1
	a) Calibrate safety up to $5 starting from partially inserted position.	1
	b) Power distribution with safety partially inserted.	1
	c) Calibrate inner up to $5 starting from partially inserted.	1
	d) Calibrate outer up to $5 starting from partially inserted.	1
	e) Calibrate new safety up to $5 starting from partially inserted.	1
	f) Power distribution with new safety partially inserted.	1
III -	Repeat II at x different boron concentrations	7X
Total		15 + 7x

Instrument Check on 5-17-62 Source 10 mcf

PM-1 ____ Low Trip OK Alarm Trip OK
PM-2 ____ Alarm Trip OK
IC-1 $>10 \times 10^{-12}$ Meter Trip OK Fast Trip OK
IC-2 $>10 \times 10^{-12}$ Meter Trip OK
IC-3 4×10^{-11} Calibration OK
IC-4 1×10^{-12} Calibration OK
CRM ____ Meter Trip ____

Source M-229 installed in drive.
Ic-1 located outside tank (HFIR CE 2) at Midplane
-2 " in original thimble at Midplane
-3 " " " " " "
-4 " outside tank in orig thimble at Midplane

Preliminary Check on 5-17-62
Room 113 Pressure Differential OK down
Red Light On and Personnel Check down
Screams and Bldg. Alarm Reset down
Source Inserted M-229 in drive down CC
Safety Withdrawn Set at 28.0
Controls Set Inner 16.50 Outer = 0.07
Reflector Water
Moderator Water No Boron

Exp # 324

Purpose: Check critical positions of sym control (inn & out)
No counters between fuel annuli, Target inserted no voids.
[4 ea S.S V strips used to keep alum spacer between fuel annuli were removed in preparation for insertion of cadmium strips which mock up new safety.]

~~Inner~~ Outer 16.30 Outer 16.30 Level Ic-3 = 7.5×10^{-11}
16.60 Inner 16.30 + Period +145 sec $\rightarrow 4.67 \times 10^{-4}$
+7.30 ¢ → 24.3 ¢/in

IC3

Inner 15.16 Outer 16.30 — negative to drop power

16.45 16.30 Positive Period

16.30 5 16.30 2×10^{-9} level

+22 sec → 5.38×10^{-4} → 8.41 ¢ → 58.0 ¢/in Inner

Shutdown

Installed 4 pieces of cadmium 8 3/4 x 24 in ea x 0.025 in in fuel element water gap. This is a mockup of a new safety. 1/8 in. holes have been drilled so that it can be positioned at 20, 19, 18, 17, 15, 13 10, 5 and 0 in. where 0 refers to the tip at the bottom of the core and 20 refers to the top of core.

Instrument Check on 5-18-62 Source 10 mc γ

PM-1 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 Meter Trip OK Servomex Fast Trip OK

IC-2 Meter Trip OK

IC-3 4×10^{-11} Calibration Dwon

IC-4 7.5×10^{-11} Calibration Dwon

CRM Meter Trip

Preliminary Check on 5-18-62

Room 113 Pressure Differential Dwon

Red Light On and Personnel Check CC

Scrams and Bldg, Alarm Reset Dwon

Source Inserted Dwon Dust Repression

Safety Withdrawn 28.0 New Safety 20.0

Controls Set Inner 16.3 Outer 0.07

Reflector Water Approx 4" Above Be

Moderator Water ~28.0

Exp # 325

Inner 16.30 Outer 19.61 IC-4 Pos Per

+78.8 sec → 11.8 ¢ 1.82 = 14.4 ¢/in.

16.30 18.79 6×10^{-11} Level

16.91 16.91 Level

Drain H_2O, Insert safety, Insert inner then raise outer!

Exp # 326

New Safety @ 19 in. Moderator 27.9 Inner 16.30 Outer 0.07

Safety 28.0 Source inserted

Inner Outer

16.30 28.85 Pos Period

16.30 23.68 97.8 sec → 10.0 ¢ or $\frac{10.0}{5.17}$ Level

17.31 17.31 = 01.93 ¢/in. Level

(IC-3 plugged in Cab 6 IC4 in cabinet 7

May 18, 1962

	Inner	Outer	New Safety	Moderator	Conditions
#327	17.31	0.07	18.0	28.77	Source Inserted
"	17.31	20.90	"		Pos Period 4.03×10⁻⁴ → 6.30 ¢
"	17.31	20.09			6.30/0.81 = 7.78 cents/inch
	17.87	17.87	"	"	Level
	16.08	Lower power level			
	18.00	17.87	"	"	+173 sec 4.03 ×10⁻⁴ → 6.30 ¢ / 48.5 ¢/in
		Ic-4 moved back in tank			
#328	18.00	0.07	17.0	28.4	Source inserted
	18.00	28.02	"	"	+95.9 → 10.2 ¢
	18.00	26.60	"	"	level 1.42 in → 7.2 ¢/in
	18.67	18.67			level Sym.
		16.00			- Period to reduce power
	18.67	19.20			+ Period 6.73 ¢
		Shut down			.53 = 12.7 ¢/in
#329	20.00	0.07	15.0	28.9	Source Inserted Raise safety 28.0
	20.00	31.45	"	"	+96.7 → 9.84 ¢
	20.00	30.81	"	"	Level .64 = 15.5 ¢/in.
	23.21	23.21	"	"	" Sym
		18.00			To reduce power
	23.21	25.00			+ 98.2 → 9.98 ¢ / 1.79 = 5.6 ¢/in.
	21.50	23.21			Reduce Power
	24.11	23.21			+95.2 → 10.2 ¢ / .90 = 11.3 ¢/in
		Shut Down			
#330	29.00	0.12	13.0	28.0	Source Inserted Safety 28.0
	30.00 +	30.0	"	"	+101.5 → 9.75 ¢
	30.00	29.36			Level 9.75/.64 = 15.2 ¢/in
	29.80	29.80			" Sym
	29.72	30.00			" 9.75/.18 = 54.1 ¢/in.

Instrument Check on 5-21-62 Source 10 mc/s

PM-1 _____ Low Trip OC Scram Alarm Trip 375
PM-2 _____ Alarm Trip OC
IC-1 2×10×10⁻¹² Meter Trip OK Fast Trip OC
IC-2 2×10×10⁻¹² Meter Trip OC
IC-3 1.5×10⁻¹² Calibration DWM
IC-4 6×10⁻¹¹ Calibration DWM
CRM XXX Meter Trip XXX

Preliminary Check on 5-21-62

Room 113 Pressure Differential DWM
Red Light On and Personnel Check CC
Scrams and Bldg. Alarm Reset DWM CC
Source Inserted DWM
Safety Withdrawn 28.0 DWM New Safety = 10 in.
Controls Set Inner 38.0 Outer 0.07
Reflector Water ~4" above Be.
Moderator Water 28.0 in.

	Inner	Outer	New Safety	safety	
#331	34.55	34.55	10.0	28.0	+154 sec → 6.95 ¢
	"	34.39	"		Level .16 = 43.44/in
	34.50	34.50	"		Level Sym
	34.47	34.55	"		Level .08 = 86.8¢/in
#332	42.0	0.07	5.0	28.0	Moderator to 27.7
	43.07	44.01	5.0	28.0	+109.3 → 9.20 ¢
	42.59	"	"	"	Level .48 → 19.2 ¢/in.
	43.07	42.35	"	"	" 1.66 → 5.5 ¢/in
	44.00	41.39	"	"	"
	42.86	42.86	"	"	Level Sym.

Instrument Check on 5-22-61 Source 10 mc Ra-Be

PM-1 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 Too Nonlinear on 10 x 10⁻¹² >3 x 10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 >10 x 10⁻¹² Meter Trip Scrammed

IC-3 4 x 10⁻¹¹ Calibration Dwn

IC-4 6 x 10⁻¹¹ Calibration Dwn

CRM Meter Trip

~~Preliminary Check on 5-22-61~~

Room 113 Pressure Differential Dwn

Red Light On and Personnel Check Dwn

Scrams and Bldg. Alarm Reset C.C.

Source Inserted C.C.

~~Safety Withdrawn~~ C.C. 28.0

Controls Set Inner 28.0 Outer 0.07

Reflector Water ~6¼ in above Be

Moderator Water 28.3 in - 27.4 (range of values)

~~Exp. 333 Purpose: Pulsing at critical with Inner and Outer controls removed and with New Cadmium safety inserted 15 in into core, position = 5 in. Drilled hole every inch on safety.~~

Exp 333

Reassembled New Safety with polyethylene tape installed 6810 ± 2" plastic saint in aluminum can over on top of core.

#333	Inner	Outer	New Safety	
	27.75	27.75	14.0	+113, → 5.73×10^{-4} → 8.95 ¢
	"	27.00	"	level 8.95/.75 = 11.9 ¢/in
	27.50	27.50	"	level
	27.34	27.75	"	" 1.41 = 21.8 ¢/in

	Inner	Outer	New safety	Plastic Scint. Removed
#334	33.0	0.07	11.0 in	
	33.60	33.60	"	+83.7sec → 7.25×10^{-4} → 11.3 ¢
	33.60	33.32	"	Level 11.3/.28 = 40.4
	33.50$_5$	33.50$_5$	"	Level
	33.45$_5$	33.60	"	Level 11.3/~~.145~~ .14 = ~~77.9~~ 80.7
335	36.00	36.00	9.0 in	+79.7sec → 7.5×10^{-4} → 11.7 ¢
	36.00	35.70	"	level 11.7/.3 = 39 ¢/in.
	35.90$_5$	35.90$_5$	"	level
	35.87	36.00	"	level 11.7/.13 = 90 ¢/in.
#336	40.85	40.85	6.0 in	+272sec → 2.72×10^{-4} → 4.25 ¢
	40.85	40.59	"	Level 4.25/.26 = ~~16.3~~ 16.5
	40.78	40.78	"	level Sym.
	40.75	40.85	"	Level 4.25/.10 = 42.5
	Drop Safety to shut down, Safety still worth perhaps $5 + 10 dollars. (Pulled later to be -5.66			
#337	Installed 6810A + 2" plastic Scint. in Alum housing			
	44.19	44.01	5.0 in	Sub critical 8^{7} -.25¢ Reactivity worth
	Typical safety slightly greater than #332!!			
				Safety to 21.05! Mod = 27.¢
338	42.00	39.03	6.0 in	+10.5 ¢
	41.72	39.03		level 10.5/.28 = 37.5 ¢/in.
	40.82	40.82		level Sym.
4[17]	Shut Down			

Instrument Check on 5-23-62 Source 10 mc Ra 8

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 10 \times 10^{-12}$	Meter Trip	OK		
IC-3	3×10^{-11}	Calibration	Duran		
IC-4	6×10^{-11}	Calibration	Duran		
CRM		Meter Trip			

Preliminary Check on 5-23-62

Room 113 Pressure Differential Duran

Red Light On and Personnel Check C. C

~~Scrams and Bldg. Alarm Reset~~ C. C

Source Inserted Duran

Safety Withdrawn To 21.05 New Safety at 6.0 in.

Controls Set In 44.19 Outer 8.8

Reflector Water ~6-7 in above Be.

Moderator Water

EXP 339 - Measure decay constant at critical

New Safety at 6.0 (Cd inserted 14.0 in) 6810A+2 in. Plastic scintillator on top of fuel element inner annulus @ 1400 v HP-460A - HP 460B pulse height on scope max ~0.6 v & pulses from fuel element ~ 3 v. Disc on TMC set at 2 1/2.

Ion chamber on IC-3 was flooded chamber replaced and put in dry thimble formerly used for IC-1.

	Inner	Outer	Safety	New Safety		
339	44.00	37.81	21.05	6.0	+81 sec	11.6 ¢
	"	37.42	"	"	11.6/39 =	29.7 ¢/in
	40.835	40.835	"	"	level Sym.	

PN-264 EXP 339 D.V. 65 → 5.4 KV S.F.V = 72

ACC 140 KV .71 MA 1.7×10^{-5} mm Hg 1000 MUS @ 10 CPS
2203 cycles

SAFETY AT 21.05 FOR 100 CYCLES, INSERTED TO 12.0

IC-3 0.005 → 1.0 IC-4 006 → 1.2

DET 6810A 1400 V + 460 A + 460 B PH max 6 volt

TMC CH 320 MUS DELAY X2 BKG X4 DISC 2.5

Level after Run INNER 40.83 OUTER 40.83 SAFETY 21.05

λ est = 91.8 λ_{comp} = 91.8 ± .2 New Safety 6.0

EXP 340

PN-265 Inner 40.83 Outer 36.83 Safety 21.08

New Safety 6.0

ACC Timed for max Background ratio $\eta \sim 8$

140 KV 500 MUS @ 20 CPS SF = 65

Focus Max

(4032 cycles)

TMC CH 160 MUS Delay x2 BKG x4 DISC 2.5

[DISC 4 same BKG Ratio at reduced counting rate]

λ est = 191 # 1.08

λ_{comp} = 190 ± .4 # 1.07

EXP 341

PN-266 Inner 40.835 Outer 34.835 Safety 21.04

New Safety 6.0

ACC 400 MUS @ 40 CPS Total 15006

TMC CH 80 MUS BKG 8

λ est = 275 # 2.00

= 266.6 ± .6

1.90

EXP	PN	Inner	Outer	Safety	New Safety	CH WIDTH MUS	BKG	Burst MUS	Rep Rate CPS	Total Cycles
342	267	40.835	32.835	21.04	6.0	80	16	400	39	15007
3	268	36.835	40.835	21.05	6.0	80	16	400	39	20000
4	269	37.835	"	"	"	"	8	"	39	20000
5	270	38.835	"	"	"	160	8	600	21	10000
6	271	39.835	"	"	"	"	"	"	"	9002
7	272	40.835	"	17.05	"	"	4	600	21	8501
8	273	"	"	14.05	"	"	4	"	"	10000
9	274	"	"	12.05	"	80	8	400	39	35574
350	275	"	"	10.05	"	"	"	"	"	30000
1	276	"	"	6.05	"	40	16	200	74	60000
2	277			0.00	"	20	16	100	110	100 000
		5-24-62		Inst Check		next Page.	of approach to			Crit.
353	278	40.84	40.84	21.05 (21.03)	6.0	320	4	1500	10	4502
		Super crit at end of run [20 to 30 in 12 MIN on (…								
		40.83	40.83	Critical.						
354	279	38.83	38.83	21.03	6.0	80	8	400	39	12527
355	280	37.83	37.83	"	"	"	"	"	"	14000
356	281	36.83	36.83	"	"	40	16	200	71	23018
7	282	35.83	35.83	"	"	20	16	100	110	60000
8	283	34.83	34.83	"	"	10	16	50	175	120000
9	284	33.83	33.83	"	"	"	"	"	"	14000
360	285	33.83	40.83	"	"	20	"	100	110	60000
1	286	34.83	"	"	"	40	16	200	71	32603
2	287	35.83	"	"	"	40	"	"	"	30000
3	288	40.83	28.83	"	"	"	"	"	"	"
			See p 62 for details of new Safety change —							
364	289	44.0	44.0	28.0	0.0	80	16	400	39	20000
365	290	40.83	40.83	21.03	"	"	"	"	"	"
366	291	44.0	44.0	28.0	3.0	"	8	"	"	"
367	292	40.83	40.83	21.03	"		"			

	EST Decay Const	EST #	λ comp	#	
007	366	3.0	363 ± .7	2.95	
000	343	2.7	336 ± .6	2.65	
000	272	2.0	264 ± .6	1.87	
000	196	1.1	198 ± .4	1.15	
002	140	.53	139 ± .5	.51	
0P	133	.45	132 ~~135~~ ± .4	.43	
1000	208	1.27	206 ± .5	1.24	
574	275	2.00	274 ± .5	1.98	
000	351	2.8	351 ± .6	2.82	
000	512	4.6	506 ± 1.1	4.50	
000	651	6.1	633 ± 1.7	5.88	
t.			.2*		
4502	93	0	92.2 ± .3	Safety Inserted 12.0 after 100 cycles.	
on	(EC-2)	$e^{+\lambda t}$ =	$1+\lambda T$	$\frac{\pm}{\pi} = \frac{.10}{.25}$ $T = 2.5 \times 12 = 30\,MIN = 1800\,sec \rightarrow \pm .1¢$	
				$\lambda_c = (91.8 + 92.2)/2 = 92.0$	
2527	246	1.7	240 ± .5	1.61	
4000	346	2.8	338 ± .7	2.67	
3018	461	4.0	455 ± .9	3.95	
0000	619	5.7	580 ± 30	5.3	
20000	817	7.9	750 ± 50	1 arc 7.15 during run.	
4000	936	9.3.			
0000	604	5.6	578 ± 1.5	5.28	
2603	501	4.5	494 ± 1.	4.37	
0000	426	3.6	416 ± .9	3.52	
"	598	5.5	579 ± 1.8	5.29	
—	and	approach to sub crit)			
0000	400	3.4	398 ± .7	3.33	
"	478	4.2	476 ± .8	4.17	
"	288	2.1	288 ± .6	2.13	
	382	3.2	376 ± .6	3.09	

✓62

Instrument Check on 5-24-62 Source 10 mc Ra β

PM-1		Low Trip	OC	Alarm Trip	OC
PM-2				Alarm Trip	OC
IC-1	7×10^{-11}	Meter Trip	OC	Fast Trip	OC
IC-2	7×10^{-12}	Meter Trip	Scrammed		
IC-3	5×10^{-11}	Calibration	Awgn		
IC-4	6×10^{-11}	Calibration	Awgn		
CRM		Meter Trip			

Preliminary Check on 5-24-62

Room 113 Pressure Differential Awgn

~~Red Light On and Personnel Check~~ C.C.

Scrams and Bldg. ~~Alarm~~ Reset Awgn.

Source Inserted Awgn

Safety Withdrawn 21.0 "New Safety" 6.0 in.

~~Controls Set~~ ~~Inner~~ ~~44.00~~ Outer 30.000

Reflector Water ~~5-6 above Be~~

Moderator Water 27.3 in.

EXP.	Inner	Outer	Safety	New	
~~278~~	41.20	40.82	21.0	6.0	+
353	40.85	40.82	"	"	level
	40.84	40.84	"	"	level Sys

EXP 364. ~~Progress~~ New Safety at 0.0 (20 in Cd inserted)

44.00 44.00 28.0 0.0 Mod → 27.0

Pulsing for PN-289 See p 60.

Check for niggle after 292 shows that it is still with us!

APRIL						1963
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				
*	*	*	*	*	*	*

93

WEDNESDAY

3

APRIL

272

$5.88

Instrument Check on 5-25-62 Source 10 mc Ra-Be

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$>10\times10^{-12}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>10\times10^{-12}$	Meter Trip	Scrammed System		OK
IC-3	5×10^{-4}	Calibration	Dwn		
IC-4	7×10^{-11}	Calibration	Dwn		
CRM		Meter Trip			

Preliminary Check on 5-25-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check OK CC

Scrams and Bldg. Alarm Reset Dwn CC

Source Inserted M-229 used.

Safety Withdrawn 28.0 (New Cd. Safety Removed

Controls Set 44.00 0.07 (

Reflector Water 5½ above Be

Moderator Water 27.6 (Contains B solution used previously

EXP 365

Purpose: Check critical position of Inner and Outer Controls with boron solution in moderator water.

Inner	Outer	Safety	
44.00	40.00	28.0	+ 10.9 ¢
"	39.51	"	Level 10.9/.49 = 22.2 ¢/in
41.10	41.10	"	Level Sym.

Drain H_2O and repeat. lower outer Control 36.00

EXP 369

41.45	41.10	28.0	+ 6.73 ¢
41.12	41.10	28.0	level 6.73/33 = 20.4 ¢/in
41.21	41.21	21.0 ¢	Level Sym.

Pulsed Crit see next page.

EXP	PN	Inner	Outer	Safety	New Safety	
369	293	41.21	41.21	21.05 .01	Removed	B+H=27.0 Safety to 12.0 after each 1000 cycles
		Level	after	pulsing !		
370	294	41.21	41.21	16.00	x	
371	295	"	"	13.00	x	
372	296	"	"	10.0	x	
373	297	"	"	7.0	x	
374	298	"	"	4.0	x	
5	299	"	"	99 8. ~~.05~~	x	
6	300	"	"	0.0	x	
7	301	"	37.21	21.04	x	
8	302	"	33.21	"	x	
9	303	"	29.21	"	x	
380	304	39.21	41.21	"	x	
381	305	37.21	"	"	x	
	~~306~~		"	"	x	
		Printer Punch			205	James
5-28-82		Dist Check on page 67				
382	306	41.37	41.37	21.04 .02	x	Safety to 12 after 1000 cycles
383	307	37,21	41,21	21.02	x	
384	308	35,21	"	"	x	
385	309	33,21	"	"	x	
386	310	33,21	33,21	"	x	
5-29 389	311	33.21	33.21	21.04	x	
390	312	36.21	36.21	21.04	x	
391	313	38.21	38.21	21.04	x	
392	314	39.21	39.21	"	x	

Channel width	BKG RATIO	BURST µS	REP RATE	Total CYCLES	Est λ	Est Dollars	Comp λ	λ
~~170~~ 320	~~16~~ 4	1500	10	4302	101	0	101.3 ± .3	
160	4	800	21	8105	181	.79	180.0 ± .5	0.78
80	8	400	39	15008	288	1.85	284 ± .6	1.81
80	16	400	39	12576	409	3.05	402 ± .8	3.18
40	16	200	71	~~30000~~ 31150	518	4.13	510 ± 1.4	4.04
20	16	100	110	61651	595	4.89	580 ± 2	4.74
20	16	100	116	60000	619	5.13	620 ± 2	5.13
"	"	"	"	"	626	5.22	618 ± 2	5.11
160	8	800	21	6249	215	1.13	213 ± .5	1.11
40	8	200	71	30500	408	3.04	409 ± 1	3.05
20	16	100	116	80000	640	5.34	630 ± 2	5.23
160	4	800	21	6900	165	0.63	166.6 ± .5	.65
80	8	400	39	12596	275	1.72	1	
~~40~~								
--	3 channels	incorrect	from	power	failure -	don't	use 305	!
320	4	1500	10	3599	99.7		100.9 ± .3	and 101.1
80	8	400	39	17490	275	1.75	273 ± .7	1.70
40	8	200	71	27729	419	3.19	407 ± 1	3.03
40	8	200	71	27288	569	4.69	558 ± 13	4.52
20	16	100	110	98051	903	8.03	895 ± 5	7.85
20	16 (Bkg) 32 (Delay)	100	100	80000	903	8.03	893 ± 3	7.83
40	8 16	200	67	28277	536	4.36	511 ± 1.5	4.05
80	8 4	400	40	13935	305	2.05	302 ± .7	1.99
160	4 2	800	21	6532	220	1.20	222 ± .6	1.20

5-28-62

Wheeling (Monrad) suspected that the connector 205 was out of adjustment. (Quick release mechanism?) Actual cause of stopping print cycle not determined.

Power failure dropped one channel and caused errors in 2 others of the 128 channels that could be compared. Additional manipulation to output caused errors in nearly all channels probably from turning power on and off repeated.

Boron samples taken 4a 4B

4B analyses 1.16 mg B/gm

Instrument Check on 5-28-62 Source Ra β 10 mc

PM-1 _____ Low Trip o/c Alarm Trip o/c

PM-2 _____ Alarm Trip o/c

IC-1 $>10\times10^{-12}$ Meter Trip o/c Fast Trip o/c

IC-2 $>10\times10^{-12}$ Meter Trip o/c

IC-3 4×10^{-11} Calibration

IC-4 6 Calibration

CRM _____ Meter Trip

Preliminary Check on 5-28-62

Room 113 Pressure Differential ~1" down

Red Light On and Personnel Check C.C

~~Screams and Bldg. Alarm Reset~~ down

Source Inserted down

Safety Withdrawn C.C 21.04

Controls Set Δ = 41.21 Ont. 0.07 → 30.0

~~Reflector Water~~ 5 1/2 in above Rx.

Moderator Water 27.1 in

Exp 382

Purpose: Check crit pos of control - pulse at critical with boron solution in fuel element.

Bank	Outer	Safety	
41.21	42.40	21.04	+ 8.03 ¢
41.21	41.62	" in	level 10.3 ¢/in
41.37	41.37	"	level Sym

See p 64 for pulsed crit data.

41.37 41.37 21.02 level After PN 306

Instrument Check on 5-29-62 Source 10 mc Ra

PM-1		Low Trip OK	Alarm Trip OK
PM-2			Alarm Trip OK
IC-1	$>10 \times 10^{-11}$	Meter Trip Scrammed	Fast Trip OK
IC-2	$>10 \times 10^{-12}$	Meter Trip OK	
IC-3	6×10^{-11}	Calibration Down	
IC-4	2×10^{-11}	Calibration Down	
CRM		Meter Trip	

Preliminary Check on 5-29-62

Room 113 Pressure Differential Down

Red Light On and Personnel Check OK

Scrams and Bldg. Alarm Reset C. C

Source Inserted C. C.

Safety Withdrawn 21.04

Controls Set Inner 41.37 Outer 0.07 → 30.

Reflector Water ~5½ in above Be

Moderator Water 27.0

Exp. 387 Purpose check critical position of Inner and Outer controls with boron solution as moderator in fuel element.

Inner	Outer	Safety	
41.37	42.55	21.04	+ 8.84 ¢
41.37	41.63	21.04	level 8.84/.92 = 9.6 ¢/in
41.47	41.47	21.04	level
9 38	Shut Down		

(Time 2-3 PM) Exp # 388 - Purpose Same as Exp # 387

Inner	Outer	Safety	
41.47	42.50	21.04	+ Period 11.5 ¢
41.47	41.55	"	Level 11.5/95 = 12.1 ¢/in

Exp 389-392 See p 64

Instrument Check on 6-4-62 Source 10 mc(γ)

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 3×10^{-4} Meter Trip OK Fast Trip OK

IC-2 ~~3×10^{-4}~~ 3×10^{-4} Meter Trip OK _____

IC-3 2×10^{-4} Calibration Drum _____

IC-4 5×10^{-4} Calibration Drum _____

CRM _____ Meter Trip _____

[illegible] Check on 6-4-62

Room 113 [illegible] Drum

Red Light On [illegible] C. C

Scrams and Bldg. [illegible] C. C

Source Inserted C. C

Safety Withdrawn 21.04

Controls Set Inner 41.47 Outer 12.3

Reflector Water ~ 5 1/2 " down Be

Moderator Water 27.3 in

EXP. 393 Purpose --check crit pos. for changes.

time	Inner	Outer	Safety	
	41.47	12.0	21.04	
	41.47	42.55	"	+ Period 9.81 ¢
	41.47	41.64	"	limit 1.91 = 10.84
~~41.54~~	~~41.54~~	~~41.54~~	~~"~~	~~level~~

Shut Down

70

Instrument Check on 6-5-62 Source 10 mc Be

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ Alarm Trip OK

IC-1 7 3x10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 > 3x10⁻¹¹ Meter Trip Scrammed _____

IC-3 3x10⁻¹¹ Calibration DWM _____

IC-4 5x10⁻¹¹ Calibration DWM _____

CRM _____ Meter Trip _____ _____

Preliminary Check on 6-5-62

Room 113 Pressure Differential OK

~~Red Light On and Personnel Check~~ C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted DWM M-229

Safety Withdrawn 21.04

Controls Set Inner 41.55 Outer 30.00

Reflector Water Approx 6" Above Be

Moderator Water 27.35 in.

Exp # 394 Purpose: Check Crit Pos for Changes

	Inner	outer	Safety	
	41.55⁻	42.55⁻	21.04	+ Period 6/6
9:10 AM	41.55⁻	41.825	"	level .725 → 8.5 ¢/in
	41.66	41.66	"	level

Shut Down to insert Cd Safety between fuel Annuli

Exp # 396

Inner	outer	Safety	(New Safety)	
41.66	41.66	21.04	20.0 -	Sub Crit

6-7-62

Difficulty with accelerator - pressure unstable - Disassembled Diff pump which was full of tar - Pumping still not good but accelerator works at 28 μa beam current IC-4 = 1.5×10^{-8} IC-3 1×10^{-9}

Beam defletes 3×10^{-12} 5×10^{-8}

and pint still decaying Bkg ratio ~10⁴

Instrument Check on 6-7-62 Source 10 m - γ

PM-1		Low Trip	Scrammed	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	3×10^{-11}	Meter Trip	OK	Fast Trip	OK
IC-2	3×10^{-11}	Meter Trip	OK		
IC-3	3×10^{-11}	Calibration	DWM		
IC-4	6.5×10^{-11}	Calibration	DWM		
CRM		Meter Trip			

~~Preliminary Check on~~ 6-7-62

Room 113 Pressure Differential DWM

Red Light -On and Personnel Check C.C

Scrams and Bldg. Alarm Reset C.C M-229

~~Source Inserted~~ C.C. M-229

Safety Withdrawn 21.04

Controls Set Summer

Reflector Water 5 1/2 above Be

~~Moderator Water~~ 27.4"

Exp # 397 New Safety at 20.0 (#0.0 Cf function)

Purpose - Reactivity of Cd inserted to 0.0

See p 72-73 for pulsing

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DATE	EXP	Inner	Outer	Safety	New Safety		
6-7-62	397	41.66	41.66	21.04	20.0		Safety to 12 in after 100 cycles
	Measured Neg Period after pulsing.						
	398	41.66	41.66	21.04	19.0		
	399	"	"	"	18.0		
	400	"	"	"	17.0		
	401	"	"	"	16.0		
	402	"	"	"	15.0		
	403	"	"	"	13.0		
	404	"	"	"	11.0		
	405	"	"	"	9.0		
			Pulsing	with	Boron solution		
6-8-62	408	32.00	30.00	20.00	X		
	9	"	28.00	"	x		
	410	"	26.00	"	x		
	1	"	24.00	"	x		
	2	"	22.00	"	x		
	3	"	20.00	"	x		
	4	32.00	31.57	21.03	x		Safety to 12 in after 100 cycles
6-13-62	415	31.88	31.88	21.03	x		
	416	30.00	32.00	20.11	x		
	417	28.00	32.00	"	x		
	418	26.00	"	"	x		
	419	24.00	"	"	x		
	420	22.00	"	"	x		
	421	20.00	"	"	x		
	422	18.00	"	"	x		
	423	20.00	20.00	"	x		
	424	23.00	23.00	"	x		

PN #	Ch width	BKG	Delay	Neutron Burst μs	REP RATE	Total CYCLES	ESTIMATED λ	ESTIMATED #	COMPUTED λ	COMPUTED #
315	320	4	2	1600	10	3802	120	.20	121.5 ±.3	.20
316	160	4	2	800	21	6002	146	.46	142.4 ±.6	.41
317	160	4	2	800	21	6748	176	.76	171.6 ±.5	.70
318	160	8	2	800	21	7655	208	1.08	210 ±.6	1.08
319	80	8	2	400	38	18995	256	1.56	254 ±.6	1.51
320	80	8	2	400	38	17004	305	2.05	306 ±.6	2.03
321	80	16	2	400	38	15929	426	3.21	425 ±.9	3.20
322	40	16	8	200	69	42549	555	4.55	551 ±1.2	4.45
323	20	16	16	100	100	53764	698	5.98	675 ±2	5.68
~0.5 g liter										
324	160	4	2	800	10	7848	204	.32	204 ±.7	.31
325	80	4	2	400	38	19677	248	.60	245 ±.8	.57
326	80	4	2	400	38	22680	275	.77	275 ±.9	.76
327	80	4	2	400	38	16849	289	.86	293 ±.8	.88
328	80	4	2	400	38	16877	324	1.09	319 ±.9	1.04
329	80	8	2	400	38	18704	382	1.46	369 ±1	1.37
330	320	4	2	1600	10		155	0	155.8 ±.6	average 156.0
331	160	4	2	800	20	10004	156	0	156.2 ±.4	
332	80	4	2	400	38	18148	291	.87	296 ±.9	.90
333	80	8	2	400	38	13918	416	1.67	419 ±1	1.69
334	40	8	4	200	69	33779	518	2.32	516 ±1.2	2.31
335	40	8	4	200	69	31734	569	2.65	575 ±1.4	2.69
336	40	8	4	200	69	33094	640	3.10	618 ±1.5	2.96
337	20	8	8	100	100	67797	731	3.69	718 ±2	3.60
338	20	8	8	100	100	68515	853	4.47	860 ±3	4.51 ?
339	20	8	8	100	100	66623	914	4.86	928 ±3	4.95 ?
340	20	8	8	100	100	64483	817	4.24	808 ±3	4.18

Instrument Check on 6-8-62 Source 1.0 mc ✓

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	OK		
IC-3	6×10^{-11}	Calibration	DWM		
IC-4	6×10^{-6}	Calibration	DWM		
CRM		Meter Trip			

Preliminary Check on 6-8-62

Room 113 Pressure Differential DWM

Red Light On and Personnel Check DWM

Scrams and Bldg. Alarm Reset DWM

Source Inserted DWM Response noted

Safety Withdrawn 21.04

Controls Set IN 32.0 3/4 OUT 0.08

Reflector Water 5½ in. above Be.

Moderator Water

Exp # 406

Removed half of the boron solution, filled to original level with water. Check critical position of inner and outer controls.

Inner	3/4 Mod Outer	Safety	New Safety	
33.95	33.95	21.04	Removed	12.9 ¢
33.95	33.66	"	level	.29 = 43.8 ¢/in
33.77	33.95	"	"	.18 = 70.6 ¢/in
33.84	33.84	"	level	

"Note" 2 samples of boron taken 5A & 5B

6-25-62 5B = 0.602 mg B/ml

EXP # 407

Added water to barrell from 14 in. to 18 7/8 in. to dilute boron solution approx 3/4.

Inner	Outer	Safety		
32.0"	32.0"	21.04 + Period		8.13 ¢
32.0	31.50	21.04	level	8.13/.5 = 16.2 ¢/in
31.82	32.0	"	level	
31.86	31.86	21.04	level	
31.765	31.765	28.00 +	level	
32.00	32.00	20.00	level	

EXP 408 Down to 30 for pulsing

EXP 414 Critical pulsing run

32.00 31.57 21.03 level

32.00 31.57 21.03 Slightly After PN 330 Shut Down

"Note" 4 PM

2 Samples of Boron taken #6A & 6B After EXP # 408

6-25-62 6B = 0.457 mg B / ml

Instrument Check on 6-13-62 Source 10 mc γ

PM-1	Low Trip	OK	Alarm Trip ✓
PM-2			Alarm Trip ✓
IC-1	Meter Trip	Scrammed	Fast Trip ✓
IC-2	Meter Trip	OK	
IC-3 4×10^{-11}	Calibration		
IC-4 6×10^{-11}	Calibration		
CRM	Meter Trip		

Preliminary Check on 6-13-62

Room 113 Pressure Differential Down

Red Light On and Personnel Check CC

Scrams and Bldg, Alarm Reset C.C

Source Inserted Accelerate

Safety Withdrawn 21.04

Controls Set Inn 31.8 Out 0.07

Reflector Water 5 1/2 in. above Be

Moderator Water 27.5 in

Exp 415

Purpose Critical pos. of Inn and Outs control prior to pulsing at critical.

INNer	Outer	Safety	
31.88	31.88	21.04	level

PN-331 Pulsing at Critical see p 72

Check crit after pulsing, level OK

31.88	31.88	21.03	level After PN-331
31.85	32.00	21.03	level
32.00	32.00	20.11	

EXP # 427

(Drained H_2O after 426 to install Cd at 18.0 in pos.)

See p 78 for pulsing Cd insertion Mod → 27.5 in

428 - 428 - 429 - 430 pulsed Cd Safety.

Instrument Check on 6-14-62 Source 10 mc R

PM-1 _____ Low Trip ✓ Scram Alarm Trip ✓

PM-2 _____ Alarm Trip ✓

IC-1 7×10^{-11} Meter Trip ✓ Fast Trip ✓

IC-2 7×10^{-11} Meter Trip ✓

IC-3 ~~3×10^{-11}~~ Calibration OK Dwn

IC-4 6×10^{-11} Calibration OK Dwn

CRM _____ Meter Trip _____

Preliminary Check on 6-14-62

Room 113 Pressure Differential Dwn

Red Light On and Personnel Check C.C

~~Scrams and Bldg. Alarm Reset~~ Dwn

Source Inserted Accelerator Source

Safety Withdrawn 21.04

Controls Set ↓ 32.00 Out 12.10

Reflector Water ~~5½" dwn 8x~~

Moderator Water 27.2"

Exp # ~~428~~ 431

Purpose: Cal Safety by Pulsing Sub Crit

Inner	Outer	Safety	New Safety	
32.00	31.68	21.04	Removed	level
32.00	31.68	18.00	"	Sub crit

4 11⁰⁵ AM Shut Down

DATE	EXP	INNER	OUTER	SAFETY	NEW SAFETY	
6-13-62	425	26.00	26.00	20.11	x	
	426	29.00	29.00	"		
	427	32.00	32.00	20.11	18.0	
	428	"	"	20.11	15.0	
	429	"	"	"	12.0	
	430	"	"	"	9.0	
	431	32.00	31.68	21.04	Removed Critical (not pulled)	
	432	"	"	18.00	x	
	433	"	"	16.00	x	
	434	"	"	14.00	x	
	435	"	"	12.00	x	
	436	"	"	10.00	x	
6-26-62	439	32.0	32.0	20.50	x	Critical
	440 B	32.0	21.0	20.50	x	
	441 C	32.0	18.0	20.50	x	
	442 D	32.0	[illegible]	20.50	x	
	443 E	32.0	14.0	20.50		
	444 F	32.0	15.0	20.50		
6-29-62	448	33.27	33.27	21.04		Crit before & after No Target
	449	31.62	31.62	28.0		
	450	28.73	28.73	"		
	451	25.47	25.47	"		
	451	24.37	24.37	"		

PN-	CH WIDTH	BKG	DELAY	BURST WIDTH	REP RATE	TOTAL CYCLES	ESTIMATED λ	ESTIMATED ϕ	cos² λ	
341	40	8	4	200	68	32090	668	3.28	656 ± 2	3.21
342	40	8	4	200	68	33442	439	1.81	437 ± 1	1.80
343	80	4	2	400	38	17864	312	1.00	303 ± .8	.94
344	40	8	4	200	68	33285	569	2.65	555 ± 1.4	2.56
345	20	16	8	100	100	61108	1146	6.35		
346	10	16	16	100	160	136665	1107		750	3.81 ?
347	160	4	2	800	21	10653	226	.45	222 ± .8	.42
348	80	8	4	400	38	20000	324	1.08	316 ± .8	1.03
349	40	8	8	200	68	47921	456	1.92	442 ± 1	1.83
350	20	8	8	100	100	69809	608	2.85	593 ± 2	2.80
351	20	8	8	100	107	71943	738	3.73	730 ± 7	3.68
Not pressed										
352	80	8	4	400	38	16007	341	1.20	339 ± .8	1.17
353	40	8	8	200	70	32582	470	2.03	460 ± 2	1.95
354	20	8	16	100	110	59522	629	3.06	600 ± 6	2.85
355	20	8	16	100	110	76958	753	3.86	750 ± 7	3.81
356	20	8	16	100	110	75127		3.46	675 ± 7	3.33
357	160	4	2	800	7	7800			140.6 ± .4	
358	80	8	4	400	38	16416			337 ± .8	1.40
359	40	16	8	200	69	35796			588 ± 2	3.18
360	20	16	8	100	110	81933			820 ± 20	4.83
361	20	16	8	100	110				870 ± 20	5.19

Instrument Check on 6-25-62 Source 10 mc Ra

PM-1	Low Trip Scrammed	Alarm Trip OK	
PM-2		Alarm Trip OC	
IC-1 23×10^{-11}	Meter Trip OC	Fast Trip OC	
IC-2 23×10^{-12}	Meter Trip OC		
IC-3 3×10^{-11}	Calibration		
IC-4 6×10^{-12}	Calibration		
CRM	Meter Trip		

Preliminary Check on 6-25-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check ✓ CC

Scrams and Bldg. Alarm Reset ✓

Source Inserted Response OK

Safety Withdrawn 21.04"

Controls Set Inner 31.86 Outer 0.08

Reflector Water Approx 5½" Above Be

Moderator Water 57.01"

exp # 437

Purpose: Critical Position of Controls with safety at 21.04 and at 15.00. (Foil Power dist. to be made with safety inserted to 15.0 in.)

Inner	Outer	Safety	New Safety	[illegible]
31.86	32.14	21.04	Removed	level
	[Boron conc 6B 0.457 mg B/ml]			
31.94	31.94	21.04	"	level
33.53	33.53	15.00	"	"
29.77	44.00	15.00	"	"

) Shut down (

Exp 438: Foil Run

Plate F 2 in a-1

F 4 in a-37

P 1 in b-1

P 2 in b-78

Sx inner @ 29.0 Outer @ 15.00 Safety 15.00 Mod 27.

Inner Outer Safety

30.00 44.01 15.0 Pos Period

IC-2 = 3.0×10^{-9} Start Timing foil exp. 20'

Level at 8.1×10^{-9}

29.80 Level

Dropped Safety at 1 25 PM (Watch)

Inner control $\frac{14.6\ \#}{0.2\ in} = 73\ \#/in$

Instrument Check on 6-26-62 Source 10 mc/ Ra Be

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	Scrammed		
IC-3	3×10^{-11}	Calibration	Down		
IC-4	5×10^{-11}	Calibration	Down		
CRM		Meter Trip			

Preliminary Check on 6-26-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check ✓ CC

Scrams and Bldg. Alarm Reset ✓ CC

Source Inserted Response OK

Safety Withdrawn 21.04"

Controls Set Inner 999.85 Outer 0.08"

Reflector Water Approx 5½" Above Bc

Moderator Water 17.3"

Exp # 439 Check critical position before entering

In 32.0 out 32.0 Safety 20.50 (0.457 g B/l

See page 28 for entering, experiments.

84

Instrument Check on 6-28-62 Source 10 mc V

PM-1	Low Trip OK	Alarm Trip	OK
PM-2		Alarm Trip	OK
IC-1	$>3 \times 10^{-11}$	Meter Trip Scrammed	Test Trip OK
IC-2	~~$>18 \times 10^{-12}$~~	Meter Trip OK	
IC-3	5×10^{-11}	Calibration OK	
IC-4	6×10^{-11}	Calibration OK	
CRM		Meter Trip	

Preliminary Check on 6-28-62

Room 113 Pressure Differential ~ OK

Red Light On and Personnel Check ~ cc

Scrams and Bldg. Alarm Reset ~ cc

Source Inserted Response OK

Safety Withdrawn 20.50"

Controls Set Inner 35.0" Outer 0.08"

Reflector Water Approx 5½" Above Be

Moderator Water 27.38"

Exp # 440 6-28-62

"Note" Target Removed - "H_2O Only in target Region"

Purpose: Check Crit ~~Pos~~ with target Removed

Inner	outer	Safety (new safety Removed)	
34.75	30.70	20.50	Pos Period
34.75	30.32	>40,041.38 " = 26.3 ¢/in.	level
33.185	33.185	"	level

Exp # 441

Inserted styrofoam void to top edge of fuel!

~~33.20~~		20.50	Pos Period.
33.41	33.51	" "	" "
33.41	33.185	>13.41 ¢/32.5 "	41.2 ¢/in level
33.24	33.24	28.00	level

Exp # ~~441~~ 442

S.S. Rod in target region

33.36	33.36	28.0"	Pos Per

442

EXP # ~~447~~ Cont

INNer	outer	Safety		
33.21	33.21	28.00"	15.9 / .15 = 106 #/in	level

443

EXP # ~~447~~ : Styrofoam void into core 4".

INNer	outer	Safety		
33.15	33.15	28.0"		Pos Per
33.02	33.02	28.0"	11.5 / .13 = 88 #/in	level

444

3:40 PM EXP # ~~447~~ . Styrofoam void into core 8"

INNer	outer	Safety		
31.85	31.85	28.0"	13.8 / .23 = 60 #/in	Pos Per
31.62	31.62	28.0		level

EXP 445

Instrument Check on 6-29 Source 10 mc γ

PM-1		Low Trip	OK	Alarm Trip	OK
~~PM-2~~				Trip	OK
IC-1		Meter Trip	OK	Fast Trip	OK
IC-2		Meter Trip	OK		
IC-3	~5x10⁻¹¹	Calibration	Dwn		
~~IC-4~~	~6x10⁻¹¹	Calibration	Dwn		
CRM		Meter Trip			

Preliminary Check on 6-29

Room 113 Pressure Differential OK

Red Light On and Personnel Check ~ CC

Scrams and Bldg, Alarm Reset ~ CC

Source Inserted Response OK

Safety Withdrawn 28.00"

Controls Set: INner 29.90" Outer 0.08

Reflector Water Approx 5½" Above Be

Moderator Water 27.3"

6-29-62

Exp # 445 cont Styrofoam void into core 12"

Inner	Outer	Safety	
28.95	28.95	28.0" + 8.47¢ / .22 = 38.5	6 Pos Per
28.73	28.73	"	level

9 40

Exp # 446 Styrofoam void into Core 16"

Inner	outer	Safety	
25.90	25.90	28.00" + 11.1¢ / .43 = 25.8	Pos Per
25.47	25.47	28.00"	level
	43		

Exp # 447 Styrofoam void into Core 20"

24.85	24.85	28.0" + 8.5¢ / .48 = 17.7	Pos Per
24.37	24.37	"	level

"Note" Remove Styrofoam void and Insert target Rod with 14 1/2 OD SS tubing in target Region

12 35

Exp # 448 6-29-62

Inner	Outer	Safety	
33.36	33.36	28.0" + 16.0¢ / .15 = 107	Pos Per
33.21	33.21	28.0"	level
33.27	33.27	21.04	level

See page 78 for pulsing for Exp 448 — 452.

July 2, 1962

Added 11 liters of H_2O to moderator to get controls to 25.0 at critical. ~~Replaced~~ target Assembly inserted in target region. Beckman Ionex amplifier (upa) replaced with E-H Research Lab Electrometer Amplifier and connected in scram ckt. Meter trip on amplifier chassis!

Instrument Check on 7-2-62 Source _____

PM-1		Low Trip	✓	Alarm Trip	✓
PM-2				Alarm Trip	✓
IC-1	10×10^{-11}	Meter Trip	OC	Fast Trip	✓
IC-2	E-H 10×10^{-12}	Meter Trip	Scrammed		
IC-3	3×10^{-11}	Calibration	Down		
IC-4	5×10^{-11}	Calibration	Down		
CRM		Meter Trip			

Preliminary Check on 7-2-62

Room 113 Pressure Differential ✓

Red Light On and Personnel Check CC

~~Scrams and Bldg. Alarm Reset~~ ✓ CC

Source Inserted ✓ Response OK

Safety Withdrawn 28.0"

Controls Set Inner 22.0 Outer 2.0"

Reflector Water Approx 5½" Above Be

Moderator Water _____

Exp 453

Inner 30.02 Outer 30.0 Source stuck

Critical position prob. greater than 30.0

30.5 30.5 Power Rising on Crit.

July 2, 1962

EXP 454

Added 4 l H_2O to Moderator H_2O (Boron)

	Inner	Outer	Safety		
~10^{30}A	31.00	31.00	28.00	+ Period	8.47 ¢ = 49.8
	30.83	30.83	"	Level	.17

EXP 455

Added 10 l H_2O to Moderator H_2O (Boron)

~11^{25}	30.40	30.40	28.0	+ Period	10.4 ¢ = ~~50.7~~
	30.195	30.195	"	level	.20 ¢ 5V

EXP 456

Added 15 l H_2O to Moderator H_2O (Boron)

~1^{13}	29.~~45~~ 50	29.~~45~~ 50	28.0	+ Period	9.09 ¢ = 53.5
	29.33	29.33	28.0	~ Level	.17

EXP 457

Removed 75 l ~~then~~ added 25 l of H_2O.

~2^{43}	27.15	27.15	28.0	+ Period	10.3
	26.85	26.85	"	level	.30 = 34.3

EXP 458

Added ~12½ l H_2O to Moderator H_2O

~3^{33}P	25.80	25.80	28.0	+ Period	9.38 = 25.4
	25.43	25.43			.37

Instrument Check on 7-3-62 Source 10 mcRa

PM-1 Low Trip OK Alarm Trip OK
PM-2 Alarm Trip OK
~~IC-1 $>10\times10^{-11}$~~ Meter Trip OK Fast Trip OK
IC-2 $>10\times10^{-12}$ Meter Trip OK
IC-3 5×10^{-11} Calibration Dwn
IC-4 6×10^{-11} Calibration Dwn
CRM Meter Trip

Preliminary Check on 7-3-62

~~Room 113 Pressure Differential~~ Dwn
Red Light On and Personnel Check ✓ CC
Scrams and Bldg. Alarm Reset ✓ CC
Source Inserted M-229 - Response on IC-2, 3 & 4
~~Safety Withdrawn~~ 28.00
Controls Set Inner 25.0 Outer 10.0"
Reflector Water ~5 1/2 above Be
Moderator Water

Exp# 459 7-3-62

Inner	outer	Safety	
25.80	25.80	28.01"	Pos Per
25.41	25.41	28.01	level

[Changed ranges on IC-2 (E-4) and tripped IC-2 meter]

EXP #460: Cnt 459 To determine cnt pos with safety at 21.04.

	Inner	Outer	Safety	
	25.72	25.72	21.04	level
10^{40} AM	25.72	25.72	21.01	After PN. 362 level

	EXP	CONTROL POSITION (IN)				
		INNER	OUTER	SAFETY	NEW SAFETY	
7-3-62	460	25.72	25.72	21.04	X	CRITICAL, Target Installed
	461	"	22.72	"		BORON CONC ~.2429 ℓ
	462	"	20.72	"		
	3	"	18.72	"		
	4	"	16.72	"		
	5	"	14.72	"		
	6	"	12.72	"		
	7	"	10.72	"		
	8	23.72	25.72	"		
	9	21.72	"	"		
	470	20.72	"	"		
	1	19.72	"	"		
	2	18.72	"	"		
	3	17.72	"	"		
	4	15.72	"	"		
	5	25.72	25.72	18.00		
	6			16.00		
	7			14.00		
	8			12.00		
	9			10.00		
	480	25.72	25.72	21.04		Check Crit Not Pulsed ? Sub Crit -285 sec
7-10-62	481	25.68	25.68	21.04	X	CRIT. W. Target Boron ~0.2 g/k
	482	23.68	23.68	"		
	483	21.68	21.68	"		
	484	19.68	19.68	"		
	485	18.68	18.68	"		
	486	17.68	17.68	"		
	487	16.68	16.68	"		

PN	C CHANNEL WIDTH μs	B BKG	D DELAY	B BURST μs	REP RATE cps	TOTAL CYCLES	ESTIMATED λ	ESTIMATED #	CALCULATED λ	CALCULATED	
362	160	4	2	800	20	9000			186 ±.5		186.6
3	160	4	2	800	20	9921			220 ±1	.18	
4	80	4	4	400	38	20911			264 ±.9	.46	
5	80	8	4	400	38	22763			338 ±3	.81	
6	40	8	8	200	71	54997			410 ±1.0	1.20	
7	40	8	8	200	71	32609			500 ±1.0	1.68	
8	40	8	8	200	71	33463			605 ±1.5	2.24	
9	40	8	8	200	71	43936			715 ±5	2.83	
370	160	4	2	800	20	8023			247 ±8	.32	
1	80	4	4	400	38	17239			303 ±.7	.62	
2	80	8	4	400	38	19190			344 ±.8	.84	
3	40	8	8	200	71	39167			400 ±1	1.14	
4	40	8	8	200	71	37569			473 ±1	1.53	
5	40	8	8	200	71	37047			555 ±2	1.98	
6	40	8	8	200	71	29471			758 ±5	3.02	
7	160	4	2	800	20	8535			269 ±.8	.44	
8	80	8	4	400	38	18776			386 ±1.0	1.07	
9	40	8	8	200	71	41359			550 ±2	1.95	
380	40	8	8	200	71	33662			730 ±7	2.91	
1	20	16	16	100	100	67651			920 ±20	3.93	
											186.6 aver
Neg	Rectifier										
382	160	4	2	800	20	8002			187.2 ±.5		Scin Pulses ~ 5 V. max
3	80	4	4	400	30	17341			270 ±.7	.45	Disc 2.5
4	80	4	4	600	41	23032			342 ±.8	.84	
5	40	8	8	200	68	32295			458 ±1	1.45	
6	40	8	8	200	68	34464			550 ±1.4	1.95	
7	40	8	8	200	68	35163			665 ±1.5	2.56	
388	20	8	16	100	100	80227			810 ±2	3.34	

92

7-9-62 8 45 AM

0.242 mg/ml

"Note" 2 Samples of Boron taken #7A - 7B 7-11-62

Instrument Check on 7-10-62 Source 10 mc Ra β

PM-1	Low Trip OK	Alarm Trip OK	
PM-2		Alarm Trip OK	
IC-1 > 10 x 10⁻¹¹	Meter Trip OK	Fast Trip OK	
IC-2 > 10 x 10⁻¹²	Meter Trip OK		
IC-3 5 x 10⁻¹¹	Calibration Dwn		
IC-4 5 x 10⁻¹¹	Calibration Dwn		
CRM	Meter Trip		

Preliminary Check on 7-10-62

Room 113 Pressure Differential DWN

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset ✓ C.C.

Source Inserted Response OK

Safety Withdrawn 21.04"

Controls Set Inner 25.40" Outer 0.08"

Reflector Water ~5½ in. above Be.

Moderator Fater 27.45 in.

EXP 481

Purpose: Determine crit pos of controls and det crit decay constant. (see page 90)

	Inner	Outer	Safety			
	26.10	26.10	21.04	11.6 / .42 = 27.6		Pos Per
9 30 AM	25.68	25.68	21.04			level
10 47 AM	25.68	25.68	21.01	After PN 382		level

Slightly subcrit after turning off acc.

481 - 487 pulsing see p 90

EXP 488. Install new Safety @ 18.0 in (2 in Cd Inserted)

		Control Position (in)					
		Inner	Outer	Safety	New Safety		
7-10-62	488	25.68	25.68	21.04	18.0		
	489	"	"	"	16.0		
	490	"	"	"	14.0		
	493	13.75	13.75	21.47	Removed		0.242 g Born
	494	"	13.25	"	"		
	5	"	12.75	"	"		
	6	"	12.25	"	"		
	7	"	11.75	"	"		
	8	"	11.25	"	"		
	9	13.25	13.75	"	"		
	500	12.75	"	"	"		Rod 13.25
	1	12.25	"	"	"		
	2	11.75	"	"	"		
	3	11.25	"	"	"		
	4	12.75	"	"	"		
		Two		Section Control			Critical w. .24 g B/l
8-1-62	509	12.60	12.60	28.00	~~20.0~~ 21.0		No Boron in Moderator
	511	"	"	"	~~17.0~~ 18.0		Two Section Control
	513	"	"	"	15.0		
	515	"	"	"	13.0		
	5						
8-2-62	521	12.625	12.625	31.48	Removed		
	522	12.60	12.10	28.0	"		
	523	"	11.60	"	"		
	524	"	11.10	"	"		
	525	"	10.60	"	"		
	526	"	10.10	"	"		

PN	μs	Dly	Dly	Burst	Rep Rate	TPut				
389	80	4	4	400	38	20932			329 ± 1	1.03
390	40	8	8	200	68	31668			565 ± 1.4	2.03
391	20	8	8	100	100	36127			810 ± 2	3.34
							EST λ	HE	λ	S
392	160	4	2	800	20	5403	149		146.4 ± .3	0
3	160	4	2	800	20	9645	256	0.72	250 ± .6	0.71
4	80	8	4	400	38	18092	366	1.46	358 ± .8	1.45
5	40	8	8	200	68	39094	475	2.19	470 ± 1	2.21
6	40	16	8	200	68	39568	583	2.91	587 ± 1.5	3.01
7	20	16	8	100	100	77995	711	3.77	717 ± 2	3.90
8	160	4	2	800	20	10168	261	0.75	260.3 ± .7	.78
9	80	8	4	400	38	18159	261	0.75	260.9 ± .7	.78
400	80	8	4	400	38	20639	502	2.37	504 ± 1	2.44
1	40	16	8	200	68	32819	640	3.29	625 ± 2	3.27
2	40	16	8	200	68	35246	755	4.07	755 ± 2	4.16
3	80	8	4	400	38	19758	381	1.56	387 ± .9	1.64
404	160	4	4	800	21	7129	266	.67	269 ± 1	0.65
405	80	4	8	400	38	16305	337	1.12	331 ± 1	1.03
406	40	8	16	200	70	51809	606	2.87	513 ± 1.5	2.64
407	40	8	16	200	70	43169	822	4.17	825 ± 3	4.06
408	160	4	2	800	20	10003	159	0	162.9 ± .5	0 6.139×10^{-3}
409	160	4	2	800	21	9748	279	.77	281 ± .8	.73
410	80	8	8	800	40	24649	400	1.52	405 ± 1	1.49
411	80	8	8	400	40	17685	517	2.25	528 ± 1.5	2.24
412	40	18	16	200	68	43398	667	3.20	655 ± 1.5	3.02
413	40	8	16	200	68	39462	743	3.67	770 ± 2.2	3.73

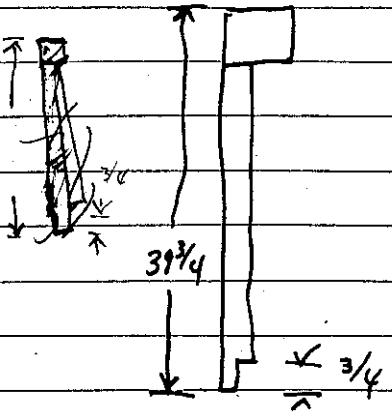
July 19, 1962

ADJUSTMENT OF 2 SECTION CONTROL PLATE

ORIG Meas. Inner control Top 39 1/4 above Be when @ 22.0
Outer " " 26 " " " @ 23.0
Controls adjusted the same.

Measured length of Alum (Inner)

39 3/4
(3/4 in shorter than DWG)
E-42473



July 20,
Reset Inner so that top of control is 39 in above beryllium when selsyn drive reads 22.0

Inner Adjust up limit switch to stop at ~~20.50~~ 20.45
Down at 44.

Outer Adjust outer up limit switch to stop at ~~25.0~~ 25.05
Down "

Changed selsyns on outer (2") Fully Inserted 99808
Fully With 23.05
Poison Rigidity Check 20.00

Changed selsyn on Inner (24") Fully inserted 996.45
with 20.00

Instrument Check on 7-20-62 Source 10 mc/ Ra

PM-1	Low Trip ✓	Alarm Trip ✓	
PM-2		Alarm Trip ✓	
IC-1	Meter Trip ✓	Fast Trip ✓	
IC-2	Meter Trip Scrammed		
IC-3	Calibration DWM		
IC-4	Calibration DWM		
CRM	Meter Trip		

Preliminary Check on 7-20-62

Room 113 Pressure Differential 0.1 in H_2O

Red Light On and Personnel Check X

Scrams and Bldg, Alarm Reset X

Source Inserted X Response noted

Safety Withdrawn X 21.47

Controls Set ~~In 996.45~~ Out 998.08 (May Abo. Inserted)

Reflector Water 5" above Be

Moderator Water 27.1 in

Exp 491.

Purpose: Determine crit pos of drum and outer 2 section control at delayed critical with ~ 0.242 g/l boron in moderator water.

Inner	Outer	Safety	
13.76	13.84	21.47	+56.1 → 15.1 ¢ / 11 = 1.37 ¢/in
13.76	13.73	21.47	level
12.75	Reduce power to measure + period with inner.		
13.84	13.73	21.47	+ per 69.5 → 13.0 ¢. / 9 = 1.44 ¢/in
13.75	13.73	"	level
13.725	13.725	27.0	level.

Shut down by dropping safety, draining Moderator and inserting inner and outer.

EXP 492

Purpose: Repeat #491 for reproducibility check

Inner Outer Safety

13.78 13.78 27.00 +88.7sec 10.8 ℓ

Shut down by inserting ~~rod~~ outer & Inn & Safety and drain H_2O

Instrument Check on 7-23-62 Source 10 mc Be

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

Preliminary Check on 7-23-62

Room 113 Pressure Differential Dwn

Red Light On and Personnel Check Dwn

Scrams and Bldg, Alarm Reset Dwn

Source Inserted Inserted Dwn

~~Safety~~ Withdrawn ~~0~~ CB 27.0

Controls Set In 99.5 Outer 97.80?

Reflector Water ~5" above Be

Moderator Water 97.0

Check P Height from Plastic Scintillator on 6810A HPA HP B → Gv. Max with PuBe source. 1500 v. on ~~Scintillator~~ 6810A

Exp. 493

Purpose: Critical position of controls w 0.242 g Boron per liter in target assembly, and then control calibrations.

Inner	Outer	Safety	
13.82"	13.72	27.0	+88.7 on 492 → 10.8
	↓ 13.66		level. 6 = 180
13.82"	13.70"	21.47	"
13.75	13.75	21.47	"

Pulsed at critical PN-392 see page 94-95

Level after pulsing at critical

See pages 94-95 for rod calibration

Instrument Check on 7-24-62 Source 10 mc γ

PM-1 _____ Low Trip Scrammed Alarm Trip OK

PM-2 _____ Alarm Trip OK

IC-1 $>10\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>10\times10^{-12}$ Meter Trip OK

IC-3 3×10^{-11} Calibration

IC-4 6×10^{-11} Calibration

CRM _____ Meter Trip

~~Preliminary~~ Check on 7-24-62

~~Room 113 Pressure Differential~~ 0.1" H_2O Down

Red Light On and Personnel Check Down

Scrams and Bldg. Alarm Reset Down

Source Inserted Down

~~Safety Withdrawn~~ 27.02

Controls Set In 7.00 Out 7.00

Reflector Water ~5' above Be

Moderator Water 27.21

Exp 50

Purpose: Power dist. with 2 section control and 0.242 g Boron in Moderator

Inner	P-1 in	a-37
~~Outer~~ Inner	P-2	a-1
Outer	F-2	b-28
Outer	F-4	b-1

15.1 #/06 = 2.5 1/4 in

Inner Outer Safety

13.80 13.80 27.02 27.21 + period w. source in!

$10^{43'45''}$ Start timing foil exposure 3.1×10^{-9} on IC-2

13.74 13.74 Scram @ 8.15×10^{-9} on IC-2

$11^{03'45''}$ Stop foil Exp $(4.4\times10^{-9}$ IC-3$)$ $(1.45\times10^{-8}$ IC-4$)$

July 30, 1962

Drained out 0.24 g/liter boron solution, sampled 8A and 8B. Moderator refilled with tap water to rinse system. Reassembled roller guides after inserting fuel plates.

Vol of 5 ft tank 3 ft hi) $\pi/4 \times 5^2 \times 3 = 58.9 \text{ ft}^3 \rightarrow 1667 \text{ l} \rightarrow 440 \text{ gall}$ (28.3, 3.785)

or 463¼ inch

Instrument Check on 7-30-62 Source 10 mc Ra Be

PM-1	Low Trip OK	Alarm Trip	OK
PM-2		Alarm Trip	OK
IC-1	$>10 \times 10^{-11}$ Meter Trip OK	Fast Trip	OK
IC-2	$>10 \times 10^{-12}$ Meter Trip Screammed Safety only		
IC-3	Calibration OK		
IC-4	Calibration OK		
CRM	Meter Trip		

Preliminary Check on 7-30-62

Room 113 Pressure Differential	0.1" H_2O
Red Light On and Personnel Check	O.C.
Scrams and Bldg. Alarm Reset	C. C
Source Inserted	C. C
Safety Withdrawn	C. C
Controls Set	996. 998.
Reflector Water	~5 in above Be
Moderator Water	27.5 in

Exp # 506

Purpose: Position of controls with tap water and to rinse fuel element of traces of boron.

12.65 12.65 + with Source not removed

Dropped safety & shutdown

~4.25¢ Excess react.

IC-4)

July 30-31. Drained H_2O from 5' tank in order to remove the "tower" fission counter. (And barrels and 3 c in xylene for storage) a large amount of flocculent material drained out; probably $Al(OH)_3$. Filtered water when returned to tank after counter hole sealed with gasket and flange.

Instrument Check on 7-31-62 Source 10 mr

PM-1	Low Trip scrammed OK	Alarm Trip	OK
PM-2		Alarm Trip	OK
IC-1	Meter Trip OK	Fast Trip	OK
IC-2	Meter Trip OK		
IC-3	4×10^{-11} Calibration		
IC-4	6×10^{-11} Calibration		
CRM	Meter Trip		

Preliminary Check on 7-31-62

Room 113 Pressure Differential OK.
Red Light On and Personnel Check C C.
Scrams and Bldg. Alarm Reset C C.
Source Inserted C. C.
Safety Withdrawn 28.0"
Controls Set Inner 996.45" Outer 998.08"
Reflector Water Approx 5½" Above Bc
Moderator Water Approx 27.5"

Exp # 507 7-31-62

Position of Controls with Demineralized H_2O in fuel System

Inner	outer	Safety		
12.65	12.65	28.00	12.24	Pos Per
12.65	12.56	"	.09 = #1.36/in.	level
12.60	12.60	"		level

Shut Down

7-31-62

Sample 9488 taken from moderator H2O C.C.

10 " from Reflector H2O C.C.

Instrument Check on 8-1-62 Source 10 mc γ

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 >10 x 10⁻¹¹ Meter Trip OK Fast Trip Scrammed

IC-2 >10 x 10⁻¹² Meter Trip OK _____

IC-3 _____ Calibration Down _____

IC-4 _____ Calibration Down _____

CRM _____ Meter Trip _____ _____

Preliminary Check on 8-1-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg, Alarm Reset C.C.

Source Inserted Response 2 3 4 Down

Safety Withdrawn 28.0 Down

Controls Set Inner 99644 Outer 99804

Reflector Water Approx 5½" Above Bc

Moderator Water Approx 17"

Exp 508 Cad cylinder at ~~20.0~~ 21.0 position (-1 oscillation) between fuel assemblies No BORON

Inner	Outer	Safety	New Safety (Cal. Corr.)		
12.85	12.85	28.00	~~21.0~~	11.4 ¢	Pos Per
12.85	12.775	"	+21.0	.075 = 1.52 ¢	level
12.81	12.81				level

Exp 509

12.60	12.60	~~28.00~~	~~21.0~~ 20.0	See page 94-95 for pulsing details

10[03] AM Exp # 510 — 8-1-62

	Inner	outer	Safety	New Safety		
	13.00"	13.00"	28.0"	18"	13.1¢	Pos Per
	13.00"	12.90	..	..	¢1.31¢/in	level
	12.94	12.94	..	..		level
(Exp 511)	12.60	12.60	..	..	Subcrit	Pulsing

Exp # 512

	Inner	outer	Safety	new Safety		
	13.60	13.60	28.0"	15"	9.7¢	Pos Per
	13.60	13.52	..	..	×1/.08 = ¢1.21/in	level

11[25] Magnet dropped safety — ceiling fan stopped also. ~~false scram.~~

13.56	13.56	28.00	15"		level

Exp # 513

12.60	12.60	28.00	15"		Sub Crit

Exp # 514

14.32	14.32	28.00"	13	13.8	Pos Per
14.32	14.20	..	..	= ¢1.15/in	level
14.27	14.27	..	..		level

Exp # 515

12.60	12.60	28.0"	13	(Pulsing)	Sub Crit

Exp # 516

15.36	15.36	28.0"	11	+10.3¢	Pos Per
15.29	15.36	..	..	.07	level
15.31	15.31	..	..	= 147¢/in	..

Exp # 517 8-1-62

Inner	Outer	Safety	new Safety	
16.77	16.77	28.0	9"	+10.5¢ Pos Per
16.69	16.77	"	"	05 level
16.71	16.71	"	"	= 131 ¢/hr level
Shut Down				

Exp # 518

18.75	18.75	28.0"	7"	+10.6¢ Pos Per
18.75	18.50	"	"	.25 level
18.67	18.67	"	"	= 42.4 ¢/hr level
Shut Down				

Note 6" Dwn 8-10-63

Exp # 519

20.17	21.31	28.0"	5"	+0.8 Pos Per
20.17	20.59	"	"	.72 level
4 20 PM Shut Down				= 15,0 ¢/hr

Instrument Check on 8-2-62 Source 10 mc Ra

PM-1 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 >10 x 10⁻¹¹ Meter Trip Screwed Fast Trip OK

IC-2 >10 x 10⁻¹³ Meter Trip OK

IC-3 5 x 10⁻¹¹ Calibration Dwn

IC-4 6 x 10⁻¹¹ Calibration Dwn

Preliminary Check on 8-2-62

Room 113 Pressure Differential Dwn

Red Light On and Personnel Check C. C.

Screams and Bldg. Alarm Reset C. C.

Source Inserted Dwn Instrument response OK

Safety Withdrawn 28.00"

Controls Set INNer 10.14 Outer 998.08

Reflector Water Approx 5½" Above Be

Moderator Water ~27.0

8-2-62 EXP 520 Purpose: Power Distribution Meas with 2 section control and one boron in moderator

[P-1 in a 37, P2 in a-1
F-2 in b 78 F4 in b-1]

Scim. Out moved from Top of one!

Inner	Outer	Safety		IC-2
12.66	12.66	28.0	Pos Period	+ 12.7 ¢
9 05:20				3.0×10^{-9}
12.62	12.61		Level at	8.1×10^{-9} Start timing foil exp.
9 25:20				8.1 Stop Foil.

$\frac{12.7}{.045} = 282$ ¢/in

8-2-62

Exp # 521 New. Safety Removed

Pulsing At Critical with H_2O in fuel Section

Inner	Outer	Safety		
12.65	12.65	28.01	Pos Period	+ 12.2 ¢
12.55 ↓	12.65	28.01 ↓	Level	.10
12.595 ↓	12.65 ↓	21.48	"	= 130 ¢/in
12.625	12.625		"	Pulsed at crit.

Level After PN -408

Exp # 522 - 526 see p 94-95

527 - 531 see p 108-109

Aug 3, 1962 Timer 2206

Instrument Check on 8-3-62 Source 10 mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	710×10^{-11}	Meter Trip	OK	Fast Trip	OK
IC-2	710×10^{-12}	Meter Trip	OK		
IC-3	4×10^{-11}	Calibration	Dwn		
IC-4	5×10^{-12}	Calibration	Dwn		
CRM		Meter Trip			

Preliminary Check on 8-3-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Test C. C.

Source Inserted Accelerator

Safety Withdrawn 28.0"

Controls Set Inner 12.60 Outer 998.08

~~Reflector Water~~ Approx 5½" Above Be

Moderator Water 27.21"

Exp # 532 8-3-62

Inner	outer	Safety	New Safety	
12.60	12.60	28.0"	Removed	level

See page 108-109 for # 533 - 537

"Note" Drained H_2O Moderator and refilled with unknown boron solution < 0.45 g/liter (75 l)

Exp 538 Purpose crit pos with ___ boron solution in fuel.

Inner	Outer	Safety		
14.21	14.21	28.0	Pos Period	+ 10.8 ¢
14.21	14.12	28.0	level	09
Shut Down				= 120 ¢/in

Date	EXP	INNER	OUTER	SAFETY	
8-2-62	527	10.10	12.60	28.0	TWO SECTION CONTROLS
	528	10.60	"	"	— NO BORON
	529	11.10	"	"	
	530	11.60	"	"	
	531	12.10	"	"	
8-3-62	533	12.60	12.60	18.0	
	4	"	"	16.0	
	5	"	"	14.0	
	6	"	"	12.0	
	7	"	"	10.0	
8-6-62	541	15.25	15.25	21.47	Boron cm ~.566 g/l Crit
	542	"	14.75	"	
	543	"	14.25	"	
	544		13.75	"	
	545		13.25	"	
8-7-62	548	15.26	12.75	"	
	549	"	12.25	"	
	550	"	11.75	"	
	551	14.75	15.26	"	
	552	14.25	"	"	
	553	13.75	"	"	
	554	13.25	"	"	
	555	12.75	"	"	
	556	12.25	"	"	
	557	11.75	"	"	
	558	14.75	14.75	"	
	559	14.25	14.25	"	
	560	13.75	13.75	"	
	561	13.25	13.25		

PN	CH μs	BKG	DELAY	BURST	Rep Rate	Total	EST. λ	EST. ς		
414	40	16	16	200	68	39491	-845	4.31	840 ± 3	4.16
415	40	8	16	200	68	51318	-709	3.46	714 ± 1.5	3.38
416	80	8	8	400	39	19345	-569	2.58	576 ± 1.7	2.54
417	80	8	8	400	39	18117	426	1.68	437 ± 1.	1.68
418	160	4	4	800	19	12208	298	.87	299 ± 0.9	.84
419	160	4	4	800	19	11418	258	.62	258 ± .9	.58
420	80	8	8	400	39	26109	368	1.31	366 ± .9	1.25
421	80	8	8	400	39	21804	522	2.28	514 ± 1.5	2.16
422	40	16	16	200	67	54579	698	3.39	690 ± 1.6	3.24
423	40	16	16	200	67	52044	853	4.37	863 ± 3	4.30
424	160	4	4	800	12	10002	130	0	200 (21.4) → 12.0) 7.73944 -0.58	129.2 263.6 ± .7
425	160	4	4	800	19	9331	213	.64	Disc ~ 2 no change in	
426	80	8	8	400	39	24395	294	1.26	Bkg Ratio -1.20	284 ± .8
427	80	8	8	400	39	20895	375	1.88	-1.85	368 ± 1
428	80	8	8	400	39		465	2.58	-2.51	454 ± 1.4
429	40	8	8	200	68	50438	565	3.35	Disc 3 To improve Bkg after Fit -3.29	554 ± 2
430	40	8	8	200	68	40453	663	4.10	expense and exit Run. -3.95	(Disc 2.7) 640 ± 2
431	40	8	8	200	68	42870	737	4.67	-4.65	730 ± 2
432	160	4	4	800	19	10875	215	.65	Disc. 2.4 -0.68	216.5 ± .6
433	80	8	8	400	38	30278	297	1.28	-1.34	302 ± .8
434	80	8	8	400	38	24913	394	2.03	-2.03	391 ± 1
435	80	8	8	400	38	19504	483	2.71	-2.76	486 ± 1.6
436	40	16	16	200	68	58379	583	3.48	-3.53	585 ± 2
437	40	16	16	200	68	65503	667	4.13	-4.28	682 ± 3
438	40	16	16	200	68	41087	794	5.11	-5.00	775 ± 3
439	80	8	8	400	38	19542	296	1.28	-1.24	296 ± .8
440	80	8	8	400	38	24628	453	2.48	-2.58	462 ± 1
441	40	16	16	200	68	62551	649	3.99	-3.95	640 ± 2
442	40	16	16	200	68	41742	808	5.21	-5.35	820 ± 5

"Note" 8-3-62 - Samples #10A-10B taken from Mod H_2O Added 100 g Boric Acid to Mod H_2O System And Mixed by Circulating.

[10 B = 0.354 g/liter] 8-7-62

8-2-62

Exp # 539

Inner -	Outer	Safety		
14.21	998.08	28"		
15.28	15.28	"	+11.7 C	Pos Per
15.28	15.17	"	.11	level
Shut Down			= 106 #/in	

N.B. thru Beam tube filled with H_2O

Exp #540 Purpose: Measure react change from flooding thru Beam tube.

15.28	15.28	28.0	11.7	Pos Per
15.28	15.17	28.0	"	level
Shut Down			= 106 #/in	

"Note" 8-6-62 - Samples #11A-11-B taken from Mod. H_2O

(11B 0.566 g/liter 8-7-62)

Instrument Check on 8-6-62 Source 10 mc γ

PM-1	Low Trip OC	Alarm Trip	OC
PM-2		Alarm Trip	OC
IC-1	$>10 \times 10^{-11}$ Meter Trip OK	Fast Trip	OC
IC-2	$>10 \times 10^{-12}$ Meter Trip OC		
IC-3	4×10^{-11} Calibration Dwon		
IC-4	5×10^{-12} Calibration Dwon		
CRM	Meter Trip		

Preliminary Check on 8-6-62

~~Room 113 Pressure Differential~~ Dwn

Red Light On and Personnel Check OC.

Scrams and Bldg. Alarm Reset Dwn

Source Inserted Occ

Safety Withdrawn 28.0"

Controls Set Inner 996.44 Outer 998.08

Reflector Water Approx 5½" Above Be

Moderator Water Approx 27:0

Exp# 541 8-6-62

Check Crit Position of Controls

Inner	Outer	Safety	New Safety
15.28	15.28	28.0"	Removed 7.0 ¢ Pos Per
15.28	15.215	"	" 0625 level
15.24	15.24	"	" 1084/in level
15.255	15.255	21.47"	" level

See pag 108 pulsing @ Crit

level After PN-424

542-545 on p 108-109

Instrument Check on 8-7-62 Source 10 mc Ra

PM-1 _____ Low Trip Scrammed Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 7×10^{-9} Meter Trip OK Fast Trip OK

IC-2 7×10^{-12} Meter Trip OK _____

IC-3 50×10^{-11} Calibration OK Dwn _____

IC-4 5×10^{-11} Calibration OK Dwn _____

CRM _____ Meter Trip _____ _____

Preliminary Check on 8-7-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check DWM

Scrams and Bldg. Alarm Reset CC

Source Inserted Accelerator

Safety Withdrawn 28.0

Controls Set dn = 15.0 Cnt 99 808

Reflector Water Approx 5½" Above Be

Moderator Water _____

Exp # 546 8-7-62

Foil Exposure

Inner	Outer	Safety	New Safety
15.34	15.34	28.00"	Removed +13.3" Pos Per

Start timing 20 min foil Exposure 3×10^{-9} on IC-2

level at 8.1×10^{-9} on IC-2

15.27	15.27	28.00"	1.07 = 190 #/in level

9[28] Shut Down - Scrammed System

Exp # 547 8-7-62

10[30] AM Purpose: Check Crit Pos After Power Run

15.31	15.31	21.48	Removed + 10.0 # Pos Per
15.26	15.26	"	r1 x 1.05 = 20 level

#548 - 561 See page 108-109

3[00] PM Checked Bldg alarm using source on PM-2!

Aug 7

Note: Removed Boron solution of ~0.5–0.6 g/l added ~45 liters of 1.16 g/l Boron solution
Added 23½ liters of + 163 g of H_3BO_3 & Mix

Instrument Check on 8-8-62 Source 10 mc γ

PM-1		Low Trip	o/c	Alarm Trip	o/c
PM-2				Alarm Trip	o/c
IC-1	>10x10" (Noisy)	Meter Trip	o/c	Fast Trip	o/c
IC-2	>10x10" 12	Meter Trip	Scramme d		
IC-3	5 x10"	Calibration	Down		
IC-4	6 x10"	Calibration	Down		
CRM		Meter Trip			

Preliminary Check on 8-8-62

Room 113 Pressure Differential OK CC
Red Light On and Terminal Check CC
Scrams and Bldg. Alarm Reset CC
Source Inserted ✓
Safety Withdrawn 28.0
Controls Set Inner 996.45 Outer 998.08"
Reflector Water Approx 5½" Above Be
Moderator Water ~27½

Exp # 562 8-8-62

Purpose: Check Crit Pos of Controls After Changing Boron Conc. (Nil.2g/l) Target ass. installed

Inner	Outer	Safety	New Safety
20.18	23.05"	28.0"	Removed +6.54 p.s Per
20.18	21.76	"	" $\frac{6.5}{1.24}$ = 5 1/4" level
20.18	23.05"	20.46	" "
20.18	22.03	21.48	" level
19.834	23.05"	28.00"	" $\frac{6.5}{3.5}$ = 1 1/2" level

Exp # 563 8-8-62

Re-Check Crit Position in Exp # 562

Inner	Outer	Safety		
20.18"	23.05"	28.0"	+5.3	Pos Per
20.18	23.05	2.49 21.48"	+2.9	Pos For
20.18	22.26	21.48	2.11.79 =	level

Level after Pulsing PN-443

	EXP No	INNER	OUTER	SAFETY	
8-8-62	563	20.18	22.26	21.48	BORON ~1.2 g/l CRIT.
	4	"	20.00	"	147 KV 65 S.F.
	5	"	19.00	"	
	6	"	18.00	"	
	7	"	17.00	"	
	8	"	16.00	"	
	9	"	15.00	"	
	570	"	14.00	"	
	1	"	13.00	"	
	2	19.00	22.26	"	
	3	18.00	"	"	
	4	17.00	"	"	
	5	16.00	"	"	
	6	15.00	"	"	
	7	14.00	"	"	
	8	13.00	"	"	
8-9-62	580	20.18	21.66	"	
	1	20.18	21.66	20.60	Not pulsed
	2	19.00	19.00	"	
	3	18.00	18.00	"	
	4	17.00	17.00	"	
	5	20.18	21.66	18.0	
	6	"	"	16.0	
	7	"	"	13.0	New Safety
8-10-62	589	20.18	21.71	28.00	15.0 (5.0)
	590	"	"	"	13.0 (9.0)
	591	"	"	"	18.0 (2.0)
	592	19.0	19.0	19.0	21.0

PN	CH	BKG	DELAY	DISC	BURST	REP RATE	Total	EST: λ	EST: S		
443	320	4	4	2.4	1600	10	10001	103	0	101.8 ± .5	0
4	320	4	4	2.4	1600	10	6930	140	.36	138.6 ± .7	.38
5	160	4	4	2.4	800	19	13805	167	.62	179.5 ± .6	.78
6	"	"	"	"	"	"	15718	220	1.14	233 ± .7	1.31
7	80	8	8	"	400	38	33726	284	1.76	285 ± .7	1.83
8	"	"	"	"	"	"	25050	366	2.55	363 ± 0.8	2.60
9	"	"	"	"	"	"	31694	449	3.36	452 ± 1.2	3.49
450	40	16	16	"	200	68	51844	555	4.39	551 ± 1.5	4.47
1	"	"	"	"	"	"	48843	668	5.48	655 ± 3	5.50
2	160	4	4	"	800	19	12815	133	.29	138.4 ± .5	.37
3	"	"	"	"	"	"	11748	191	.85	192.7 ± .5	.91
4	"	"	"	"	"	"	11445	256	1.49	261 ± .7	1.59
5	80	8	8	"	400	38	25548	343	2.33	343 ± .8	2.41
6	"	"	"	"	"	"	25089	434	3.21	440 ± 1.2	3.37
7	40	16	16	"	200	68	41069	555	4.39	540 ± 1.5	4.36
8	"	"	"	"	"	"	54268	658	5.39	649 ± 2	5.44
459	320	4	4	"	1600	10		100	0		
									0	99.6 ± .3	100.7
460	160	4	4	"	800	21	12441	208	1.02	208 ± .6	1.07
461	80	8	8	"	400	38	27881	314	2.05	316 ± .7	2.14
462	40	8	16	"	200	67		465	3.51	461 ± 1	3.58
463	160	4	4	"	800	15		135	0.31	135.0 ± .5	.34
464	160	4	4	"	800	15	9806	181	0.76	182.5 ± .4	.81
465	80	8	8	"	400	38	28456	287	1.79	285 ± .6	1.53
466	80	8	8	"	400	38	24819	308	1.99	307 ± .7	2.05
467	80	8	8		400	38	26279			428 ± .9	3.25
468	160	4	4	Mem	800	19	13919			169.1 ± .4	.68
9	160	8	8	1	800	19				232.8 ± 1.5	
470	320	4	4	1/2	"	"				232.6 ± 1.3	232.3 ± 1.31
471	640	2	2	1/4	"	"				231.5 ± 1.2	

Instrument Check on 8-9-62 Source Ic

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$>10\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>10\times10^{-12}$	Meter Trip	OK		
IC-3	5×10^{-11}	Calibration	Down		
IC-4	6×10^{-11}	Calibration	Down		
CRM		Meter Trip			

Preliminary Check on 8-9-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted C.C.

Safety Withdrawn 28.0"

Controls Set: Inner 996.45 Outer 998.08"

Reflector Water Approx 5½" Above Be

Moderator Water 27.3"

Exp # 579 8-9-62

Check Critical Position of Controls

	Inner	Outer	Safety		
9:30 AM	20.18	23.05	28.0	+2.3 ¢ change 3.0 ¢	Just Slightly Super crit

Shut Down - And Added 500 ML H_2O (And Mixed)

Exp # 580 8.9-62

Check Crit Pos After Adding 500 ML to Mod H_2O

Inner	Outer	Safety		
20.18	23.05	28.0"	10.0 ¢	Pos Per
20.18	21.44	28.0		level
20.18	21.66	21.48		level

level After PN-459

Exp # 581

20.18	23.05	28.0	+8.6	Pos Period
20.18	22.26	28.0	> +5.8	Pos Period
20.18	22.26	20.6		Out level

8-9-62 Exp II 582 - 587 Pulsing PN - 460 - 465

~~Instrument Check on~~ 8-10-62 ~~Source~~ 10 mc γ

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

~~IC-1~~ 7 10 x10^-11 ~~Meter Trip~~ OK ~~Fast Trip~~ OK

~~IC-2~~ 7 10 x10^-12 ~~Meter Trip~~ OK

IC-3 4 x10^-11 Calibration Dwn

IC-4 5 x10^-11 Calibration Dwn

CRM _____ Meter Trip _____

~~Preliminary Check on~~ 8-10-62

Room 115 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg, Alarm Reset CC

Source Inserted Inst Response OK

Safety Withdrawn 28.0"

Controls Set Inner 995.60 Outer 998.08

Reflector Water Approx 5½" Above Be

Moderator Water _____

Exp # 588 8-10-62

Check Crit Pos of Controls

Inner	Outer	Safety	
20.18	23.05	28.0"	+2.0 ¢ Pos Per
20.18	21.71	28.0	level

"Note" Shut Down - Install New Safety

Exp # 589 8-10-62

Inner	Outer	Safety	New Safety	
#589 20.18	21.71	28.0	15.0"	Sub crit

(Pulsing)

Exp # 592 8-10-62

	Inner	Outer	Safety	New Safety	
592	20.18	23.05 - 6.4	28.0"	21.0"	(A) Sub Crit
592	20.18	21.71 - 9.8	28.0"	21.0"	Neg Per (B)
	See p 116 for pulsing				
593	19.0	19.0	19.0	21.0	

"Note" 8-10-62 Samples # 12A - 12B taken from Mod H_2O
1.173

~~Instrument Check~~ on 8-13-62 Source 10 mc Be

PM-1 _____ Low Trip OC Alarm Trip OC
PM-2 _____ Alarm Trip OC
IC-1 > 10×10^{-11} Meter Trip ~~Screwmed~~ Fast Trip OC
IC-2 > 10×10^{-12} Meter Trip OC
IC-3 5×10^{-12} Calibration Dum
IC-4 6×10^{-12} Calibration Dum
CRM _____ Meter Trip _____

Preliminary Check on 8-13-62
Room 113 Pressure Differential OK cc
Red Light On and Personnel Check cc
Scrams and Bldg. Alarm Reset cc
Source Inserted Response OK
Safety Withdrawn 28.0"
Controls Set Inner 12.0" Outer 998.08"
Reflector Water Approx 5½" Above Be
Moderator Water Approx 27.0"

"Note" 8-13-62 - Added 250 ml H_2O to fuel system and Mixed
~~@ 30 m Add 500 ml~~

Exp # 593 8-13-62

Inner	Outer	Safety	
20.18	23.05	28.0"	Slightly Super Crit

8-13-62

"Note" Add 500 ml H_2O to fuel H_2O System and Mix

Foil Exposure: P-1 in a-37
P-2 in a-~~37~~ 1
F-2 in b-78
F-1 in b-1

Exp # 59H 8-13-62

Inner	Outer	Safety	
20.18	22.60	28.00"	Pos Per

start timing 20 min foil Exposure at 3×10^{-9} on IC-2

20.18	21.15	28.00"	8.1×10^{-9} on IC-2 level

Scram System to shut Down

"Note" Sample # 13 - Crud that was collected from Island Refl H_2O when it was Drained to Remove Counter: emptier

8-13-62 Samples # 14A - 14B taken from Mod H_2O 1153

"Note" 8-30-62 - H_2O Samples for Spec Analysis should be taken to (Pritchard) Spec lab in Bldg 4500-S E-159.

Mean of 3 reactor centers (plated prec.)

	Outer	Inner			
I.D. Top	18.036	18.018	—	17.317	17.321
O.Tu	18.056	18.035	—		
Bottom	18.038	18.033	—	17.285	17.256

Sept 6, 1962

Machine installed 3 section controls with plated grey sections 4 3/4 in.

Outer Control		Inner Control	
Upper	27.49	Down	24.81
Grey outer core	24.75	Grey outer core	24.75
Blk outer core	20.00	Blk outer core	20.00
~~Blk~~ Blk @ Mid	10.00	Blk Mid	10.00
Blk inner	998.63	Upper	998.04

N.B. Keithley Repaired IC-1
E-H electrometer replaced with Linear Beckman on IC-2

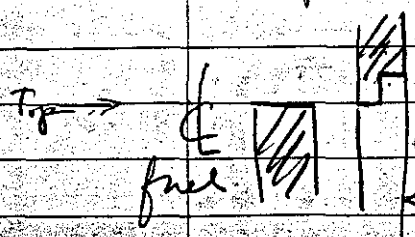
thickness mass on 4 pc of stripped Ag plate from outside of Inner Control

21.0	18.6	13.4	14.5
22.5	18.0	13.4	14.9
13.8	13.5	13.5	14.9
14.5	13.1	17.1	19.2
15.5	15.8	17.2	16.6

4-23-63

My memory says that the black tip of the 3/4 overlapping grey and blk sections was at the top of fuel when selsyn read 20.0.

Dw Magnuson



Instrument Check on 9-6-62 Source 10 mc/8

PM-1	Low Trip OK	Alarm Trip	OK
PM-2		Alarm Trip	OK
IC-1 $>10 \times 10^{-12}$	Meter Trip OK	Fast Trip	OK
IC-2 $>10 \times 10^{-12}$	Meter Trip Drop Safety		
IC-3 3×10^{-11}	Calibration Dwgm		
IC-4 6×10^{-11}	Calibration Dwgm		
CRM	Meter Trip		

Preliminary Check on 9-6-62

Room 113 Pressure Differential Dwgm

Red Light On and Personnel Check C.C

Screams and Bldg. Alarm Reset C.C

Source Inserted Dwgm.

Safety Withdrawn 28.0"

Controls Set Inner 24.81 Outer 998.63

Reflector Water Approx 5½" Above Be

Moderator Water 27.385"

Exp #595 (Time Reads 2240 hrs)

Purpose: Det exit pos. with 1.17 g Boron/liter.

Inner	Outer	Safety		
24.81	25.05	28.01	+10.6¢	Pos Per
24.81	24.40	"	.65 = 16.3¢/in	level
24.56	24.56	"		level

Exp # 596 (9-6-62)

Purpose: Reproduce Exp # 595

Inner	Outer	Safety		
24.56	25.00"	28.01	9.8	Pos Per
24.56	24.49	"	.51 = 19.2¢/in	level
24.51	24.51	"		"

3:45 PM Shut Down

Instrument Check on 9-7-62 Source 10 mc γ

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 ~~>10 x 10⁻¹²~~ Meter Trip OK ~~Fast Trip OK~~

IC-2 >10 x 10⁻¹² Meter Trip OK _____

IC-3 4 x 10⁻¹¹ Calibration Dwn _____

IC-4 5.5 x 10⁻¹¹ Calibration Dwn _____

CRM _____ Meter Trip _____ _____

~~Preliminary Check on~~ 9-7-62

Room 113 Pressure Differential Dwn

Red Light On and Personnel Check C. C

Scrams and Bldg, Alarm Reset C.C.

Source Inserted C.C.

Safety Withdrawn 28.0"

Controls Set Inner 998.05 Outer 998.62

Reflector Water Approx 5½" Above Be

Moderator Water 27.02"

9-7-62 Exp# 597 - Check Critical

Inner	Outer	Safety	
24.51	25.10	28.0"	+6.4 ¢ Pos Per
24.51	24.67	"	/.43 = 14.9 ¢/in level
24.61	24.61	"	level

See p 126-127 for exp 597 - 69¢

Shut down by using acc source to trip IC-2

Instrument Check on 9-10-62 Source 10 mc Ra Be γ

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 >10 x 10⁻¹² Meter Trip OK Fast Trip OK

IC-2 >10 x 10⁻¹¹ Meter Trip OK _____

IC-3 4.5 x 10⁻¹¹ Calibration OK Dwn _____

IC-4 5.0 x 10⁻¹¹ Calibration OK Dwn _____

CRM _____ Meter Trip _____ _____

Preliminary Check on 9-10-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted Response OK

~~Safety~~ Withdrawn 28.0"

Controls Set Inner 24.61 Outer 998.62

Rerlector Water Approx 5½" Above Be

Moderator Water

Exp # 612 Pulse @ Critical 9-10-62

Inner	Outer	Safety		
24.61	25.45	28.0"	7.94	Pos Per
24.61	24.84	28.0"	.61 = 13.0 ¢/in	level
24.61	25.18	20.76		level
24.81	25.03	20.76		level

Started gassing - limit stop became erratic shut down and found limit switch wound twisted.

Checked safety position, found setsyn reading +0.31 when top of safety even with top of central water hole tube which is 10 in above the fuel. Therefore at +0.31 cadmium tip is ¼ above the fuel.

Reset setsyn to read ~~[illegible]~~ 0.25.

Up limit switch is now stopping at reading of ~~[illegible]~~ 24.10

Down " " " " " " " " " ~~[illegible]~~ 998.35

Exp # 613 Pulse @ Critical

Inner	Outer	Safety		
24.81	26.00	21.11	11.6 ¢	Pos Per
24.81	24.93	21.11	1.07 = 10.8 ¢/in	level
24.81	24.93	21.11	level After PJ 487	

Date	Exp No	Inner	Outer	Safety	
9-7-62	597	24.61	24.61	28.00	Not Pulsed ~1.16 g B /liter
	598		23.61	"	Press 1.5×10^{-5} GE/in² [illegible]
	599	"	22.61		147 KV pulse ~6 V. max
	600	"	21.61		Disc 2.5
	601		20.61		
	602		19.61		
	603		18.61		
	604		17.61		
	605		16.61		
	606	22.61	24.61		
	607	20.61			
	608	18.61			
	609	16.61			
	610	22.61	22.61		
	611	20.61	20.61		
9-10-62	612	24.81	25.03	20.76	
	613	24.81	24.93	21.11	
9-11-62	615	14.97	14.97	28.00	Crit (not Pulsed) No Boron
	616	"	14.47	"	
	617	"	13.97	"	
	618	"	12.97	"	
	619	"	11.97	"	
	620	"	12.47	"	
9-17-62	623	14.98	14.98	21.10	CRIT (Pulsed)
	624	14.97	14.97	21.31	
	625	14.47	"	"	
	626	13.97	"	"	
	627	13.47	"	"	

PN	CH μs	BKG	Delay	Burst	REP RATE CPS	Total CYCLES		Value	±	σ	
~~472~~	~~320~~	~~4~~	~~4~~	~~1600~~		~~3851~~					
472	320	4	4	1600	10	3851	119	119.6	±.5	0.16	115 ± 1
3	320	4	4	1600	10	5833		150.2	±.6	0.52	150 ± 2
4	160	8	8	800	20	14520		190.8	±.5	0.93	191 ± 2
5	160	8	8	800	20	13043		244.6	±.6	1.48	245 ± 2
6	80	8	8	400	39	24353		309.1	±.7	2.13	309 ± 3
7	80	8	8	400	39	20944		384	±1	2.89	384 ± 4
8	40	16	16	200	65	51131		474	±1	3.80	474 ± 5
9	40	16	16	200	65	36745		570	±2	4.77	570 ± 6
480	320	4	4	1600	10	7986		139.4	±.5	0.41	139 ± 2
1	160	8	8	800	20	10629		218.5	±.5	1.22	219 ± 2
2	80	8	8	400	39	33446		345.2	±.7	2.49	345 ± 3
3	40	16	16	200	65	63041		522	±1	4.28	522 ± 5
4	160	8	8	800	20	14571		194.0	±.5	0.96	191 ± 2
5	80	8	8	400	39	11		372.0	±.7	2.77	
486	320	4	4	1600	10	2356		98.0	±.5	>	98.8 ± 1.0 (10/21
487	320	4	4	1600	10			99.5	±.3		
488	160	4	4	800	21	11601		263.5	±.8	.61	264 ± 3
9	80	8	8	400	39	24321		356	±.8	1.17	356 ± 4
490	40	8	8	200	71	43397		541	±1	2.30	541 ± 6
1	40	8	8	200	71	36172		723	±2	3.41	723 ± 9
2	40	8	8	200	71	42391		634	±1	2.87	634 ± 6
493	160	4	8	800	18	10001		163.8	±.4	.00610	Tape 163.8 ± 1.6
494	160	8	8	800	18	9519		267	±.7	.63	Tape 267 ± 3
495	80	8	8	400	39	20412		374	±.8	1.28	No Tape
496	80	8	8	400	39	23313		475	±1	1.90	No Tape

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Instrument Check on 9-11-62 Source 10 mc γ

PM-1 Low Trip OC Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 $> 3 \times 10^{-11}$ Meter Trip Scrammed Fast Trip OK

IC-2 $> 3 \times 10^{-12}$ Meter Trip OC

IC-3 3×10^{-11} Calibration Down

IC-4 5×10^{-11} Calibration Down

CRM Meter Trip

Preliminary Check on 9-11-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted ✓ C.C.

Safety Withdrawn 28.0"

Controls Set INNER 998.05" Outer 998.62

Reflector Water Approx 5½" Above Bc

Moderator Water Approx 27.0"

EXP 614 Purpose: crit pos no known

INNER	OUTER	SAFETY		
15.08	15.08	28.01	14.99	Pos. Per.
15.08	14.95	"	1.13 = 1.1/in	Level
14.98 ~~14.88~~	14.98 ~~14.99~~	"	~~1.2~~ =	Level
14.88	15.08	"	1.2 = 75 ¢	Level

Assembly guide rollers on control rods are sticking and rubbing. Assembly difficult to level. Drain H2O in fuel assembly.

EXPERIMENT #615 Repeat 614

14.96	15.08	28.0"	12.3	Pos Per
14.96	14.975"	28.0"	1.1 = 1.23/in	level
14.85"	15.08	28.0"	1.11 = 1.12/in	level
14.965	14.965	28.0"		level

Exp# 621 9-11-62

Purpose: Control Calibration

Inner	Outer	Safety	
14.97	15.06	28.0"	+11.1 Pos Per
14.97	14.96	"	1.1 = 111f/c level
15.89	14.00	"	"
16.965	13.00	"	"
18.29	12.00	"	"
19.92	11.00	"	"
22.44	10.00"	"	"
24.81	9.52 ~~9.56~~	"	"
14.04	16.00"	"	"
13.23	17.00"	"	"
12.52	18.00"	"	"
11.92	19.00	"	"
11.38	20.00"	"	"
10.48	22.00"	"	"
9.94	24.00"	"	"
9.70	26.00	"	"
9.56	27.49	"	"

3 22 Shut Down

Instrument Check on 9-13-62 Source 10mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	>10 x 10^{-11}	Meter Trip	OK	Fast Trip	OK
IC-2	>10 x 10^{-12}	Meter Trip	OK		
IC-3	4 x 10^{-11}	Calibration	Down		
IC-4	5 x 10^{-11}	Calibration	Down		
~~CRM~~		Meter Trip			

130

Preliminary Check on 9-13-62

Room 113 Pressure Differential OK

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted Response OK

Safety Withdrawn 28.0"

Controls Set INNer 10.54 Outer 998.62

Reflector Water Approx 5½" Above Be

Moderator Water 27.+

Exp. 622 Power Dist with new plated silver control plates and no boron in moderator. Plates P-1 and P-2 only in a-37 and b-78 resp. Each plate has six extra foils for add. power dist data

± INNer	Outer	Safety		
15.00	15.06	28"	17.3	Pos Per

q 23 start timing 20 MIN foil Exposure at $3X10^{-9}$ on IC-2

14.94	14.94	IC-2 $8.1X10^{-9}$	level

q 43 Scram System to Shut Down

17.3/12.5" = 1.92 1/in

9-14-62 Checked control plates for sticking or rubbing and no apparent difficulties noted.

Instrument Check on 9-17-62 Source 10 mc/s

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

Preliminary Check on

Room 113 Pressure Differential

Red Light On and Personnel Check C.C

Scrams and Bldg. Alarm Reset C.C.

Source Inserted Awan response OK

Safety Withdrawn 28.0"

Controls Set INNer 14.95 Outer 998.63

Reflector Water Approx 5½" Above Be

Moderator Water 27.5"

Exp #No 623, No Boron in Moderator.

Purpose: Pulse at critical.

Inner	Outer	Safety	
14.94	15.10	28.0"	15.6 ¢ Pos Per
14.94	14.96	28.0" 1/4 = 111 ¢/in	level
14.98	14.98	21.10"	level

Pulsed at crit level after run

Exp 624	14.97	14.97	21.31	Level

Exp 625-627 see p 126-127 PV

Instrument Check on 9-18-62 Source 10 mc Ra

PM-1		Low Trip	OK (scrammed)	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$>10\times10^{-11}$	Meter Trip	OK	Test Trip	OK
IC-2	$>10\times10^{-12}$	Meter Trip	OK		
IC-3	3×10^{-11}	Calibration	OK		
IC-4	6×10^{-11}	Calibration	OK		
CRM		Meter Trip			

Preliminary Check on 9-18-62

~~Room 113 Pressure Differential~~ OK

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted Down

~~Safety Withdrawn~~ ~~Down 14.97~~ 28.0 cc

Controls Set Inner 14.98 Outer 998.62

Reflector Water C.C. ~5 in above Be or 27

Moderator Water C.C ~27 1/2

Exp 628 Check Crit Position before pulsing.

In	Out	Safety	
14.97	15.05	28.0 > 8¢/08 = 100 ¢/in	13.2 ¢ + Per A
14.97	14.97	28.0	5.2 ¢ + Per B
"	"	21.64	level

DATE	EXP	Inner	Outer	Safety	
9-18	628	14.97	14.97	21.64	Crit (Not Pulsed)
	629	12.97	"	"	
	630	12.47	"	"	
	631	11.97	"	"	
	632	14.97	13.47	"	
	633	14.47	14.47	"	
	634	13.97	13.97	"	
	635	13.47	13.47	"	
9-19-62	637	16.16	16.16	21.10	Pulsing at Crit. 0.269/R
					Rec arced at 6400 cycles
	638	16.16	15.66	21.10	
	639	"	15.16	"	
	640	"	14.66	"	
	641	"	14.16		
	2	"	13.66		
	3	"	13.16		
	644	15.66	16.16		
	5	15.16			
	6	14.66			
	7	14.16			
	8	13.16			
9-20-62	649	16.15s	16.15s	21.10	Crit
	50	15.65s	15.65s	"	
	1	15.15s	15.15s	"	
	2	14.65s	14.65s	"	
	3	14.155s	14.155s	"	
	4	13.655s	16.16	"	
	5				

PN No	Channel width μs	BKG	Delay	Burst width μs	Rep rate CPS	Total cycles			
497	80	8	8	400	39	25985	2.148	570±1.5	570±6
498	40	8	8	200	70	51180	3.12	675±2	675±8
499	40	16	8	200	70	51896	4.76	780±2	780±9
500	80	8	8	400	39	28576	1.77	453±1	453±5
501	80	8	8	400	39	25278	1.20	Tape 360±1	360±4
2	80	8	8	400	39	22522	2.31	542±1.5	542±6
3	40	16	8	200	70	50002	3.49	Tape. 735±7	735±9
504	160	4	4	800	20	6402	148.9±.6	0	
cmd	HV	now	gone	!			(Pleat cap off V1 in H.V.P.S.)		
505	160	4	4	800	20	11576	247±1	0.65	
506	80	8	4	400	39	23088	343±.8	1.30	
507	80	8	4	400	39	23054	443±1	1.97	
508	40	8	4	200	71	46492	544±2	2.64	
509	40	8	4	200	71	59031	640±2	3.29	
510	40	8	4	200	71	52411	730±2	3.88	
511	160	4	4	800	20	13258	248.8±.7	.64	
512	80	8	4	400	39	20959	355±.8	1.38	521 / 264 / 257
513	80	8	4	400	39	20301	450±1	2.01	
514	40	8	4	200	71	56076	560±2	2.75	
515	40	8	4	200	71	49325	760±2	4.09	
516	160	4	4	800	20	12802	149.5±.4	0	
517	80	8	4	400	39	21877	352±1	1.36	
518	40	8	4	200	71	50154	540±2	2.62	
519	40	8	4	200	71	55412	733±2	3.91	
520	40	8	4	200	71	46814	905±5	5.06	
521	40	8	4	200	71	50872	668±2	3.47	

"Note" Drained H_2O from fuel H_2O System, And Added Boron Soln 0.24 g/l

2[17] PM Exp # 636 9-18-62

Purpose: Check Crit Position of Controls with 0.24 g/l Boron in fuel H_2O System

Inner	Outer	Safety	
16.20	16.20	28.0	13.0 ¢ Pos Per (A)
16.20	16.08	28.0	½ = 108 ¢/in level
16.05	16.20	28.0	½ = 87 ¢/in "

2[39] Dump fuel H_2O And Repete

16.20	16.20	28.0	13.7 ¢ Pos Per (B)
16.20	16.09	28.0	½ = 125 ¢/in level

Shut Down

"Note" 9-18-62 Samples # 15A-15B taken from ~~Demineralized H_2O~~ Demineralized H_2O Drained from fuel H_2O System. 0.022 g/liter 9-26-62

9-18-62 Samples # 16A-16B taken from Fuel H_2O System Approx 0.24 g/l Boron 0.244 g/liter 9-26-62

~~Instrument Check on~~ 7-19-62 ~~Source~~ 10 mc γ

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$>16\times10^{-11}$	~~Meter Trip~~	OK	~~Fast Trip~~	OK
IC-2	$>10\times10^{-12}$	Meter Trip	Scrammed Safety		
IC-3	4.5×10^{-4}	Calibration			
IC-4	6×10^{-11}	Calibration			
CRM		Meter Trip			

Preliminary Check on 7-19-62

Room 113 Pressure Differential C.C.

Red Light On and Personnel Check C.C.

Scrams and Bldg, Alarm Reset C.C.

Source Inserted C.C.

Safety Withdrawn 28.0"

Controls Set Inner 16.12 Outer 998.63

Reflector Water Approx 5½" Above Be

Moderator Water Approx 27.25"

Exp # 637 9-19-62

Purpose: Check Critical (Pulse At Crit)

Inner	Outer	Safety	
16.20	16.20	28.0"	+15.6 ¢ Pos Per
16.13	16.13	28.0"	1/07 = 223 ¢/in level
16.157	16.157	21.10"	level

Exp 638 - 648 pulsing at various control settings see p 132 - 133.

Instrument Check on 7-20-62 Source 10 m.

PM-1 0 = 358 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 > 10 x 10⁻¹¹ Meter Trip OK Fast Trip Scrammed Safety

IC-2 > 10 x 10⁻¹² Meter Trip OK

IC-3 5 x 10⁻¹¹ Calibration Dwn

IC-4 6 x 10⁻¹¹ Calibration Dwn

CRM Meter Trip

Preliminary Check on 7-20-62

Room 113 Pressure Differential Dwn

Red Light On and Personnel Check C.C Dwn

Scrams and Bldg, Alarm Reset D. W. M.

Source Inserted Inserted Dwn Just Response.

Safety Withdrawn to 21.10 Dwn

Controls Set Inner 16.20 Outer 998.62

Reflector Water Approx 5½" Above Be

Moderator Water 27.5"

9-20-62

EXP # 649 : Report crit position, and critical decay constant.

INNer	Outer	Safety	
16.20	16.20	21.10	+8.7¢ Pos Per
16.15	16.15	21.10	

11:12 AM level After Pulsing

See pages 132-133 for EXP 650-654

Instrument Check on 10-21-62 Source _____

PM-1 Zero 240 Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 5 10 X10^{-4} Meter Trip Scram Safety Test Trip OK

IC-2 5/0 X10^{-12} Meter Trip OK

IC-3 5 X10^{-11} Calibration Dwn

IC-4 6 X10^{-11} Calibration Dwn

CRM _____ Meter Trip _____

Preliminary Check on 9-21-62

Room 113 Pressure Differential C.C.

Red Light On and Personnel Check C.C.

Scrams and Bldg. Alarm Reset C.C.

Source Inserted C.C.

Safety Withdrawn 28.0"

Controls Set INNer 16.20 Outer 998.62

Reflector Water Approx 5½" Above Be

Moderator Water 27.0+

EXP # 655 : Purpose — Power Dist. P-1 in a 37 F-2 in b 78

16.20 16.20 28.00 + Period

8:46 AM " " " TC-2 = 3.0 X10^{-9} Start exp time

Level at TC-2 = 8.1 X10^{-9}

16.13 16.13 28.0 +14.7¢ level

8:05 Scram and insert inner 70.12 outer 99.07 = 210¢/in

9-21-62

"Note" Drained Boron Soln 0.24 g/l from fuel H₂O System, And Added Boron Soln 0.566 g/l

Exp #65 6

9-21-62

Purpose: Check Critical Position of Controls with 0.566 g/l Boron Soln in fuel H₂O System

Inner	Outer	Safety		
17.90	17.90	28.0"	16.1 ¢	Pos Per (A)
17.90	17.75	28.0"	111 ¢/in	level
17.74	17.90	28.0"	101 ¢/in	level
17.84	17.84	28.0"	268 ¢/in	level
Dump H₂O And Repeat				
17.90	17.90	28.0"	13.2 ¢	Pos Per (B)
17.90	17.77	28.0	101 ¢/in	level

3:10 Shut Down

Instrument Check on 9-24-62 Source _____

PM-1		Low Trip OK	Alarm Trip OK	
PM-2			Alarm Trip OK	
IC-1	10×10^{-11}	Meter Trip OK	Fast Trip OK	
IC-2	10×10^{-12}	Meter Trip OK		
IC-3	5×10^{-11}	Calibration Duon		
IC-4	10×10^{-11}	Calibration Duon		
CRM		Meter Trip		

Preliminary Check on 9-24-62

Room 113 Pressure Differential C.C.

Red Light On and Personnel Check C.C.

Scrams and Bldg, Alarm Reset C.C.

Source Inserted C.C.

Safety Withdrawn 28.0"

Controls Set Inner 17.90 Outer 998.62

Reflector Water Approx 5" Above Bc

Moderator Water 27.0"+

9-24-62

Exp # 65 1/2 Purpose: Power Dist.

P-2 in -a-37, F4 in b-78

Inner	Outer	Safety	
17.92	17.92	28.0"	14.7 ¢ Pos Per

Start timing 20' foil Exposure 3×10^{-9} on IC-2
level 8.1×10^{-9} " "

17.84	17.84	28.0"	184¢/in level

9 36 Scram System to Shut Down

Checked Control Positions
Inner @ 10.00 meas. 31 11/16" above Be.
Outer @ 10.00 " 15 3/8" " "

Note 9-24-62 Samples #17A-17B taken from fuel ~~stor~~ H_2O System Appro 0.57 g/l Boron
9-26-62 0.553 g/liter.

Instrument Check on 9-27-62 Source 10 mc γ

PM-1 Zero 340	Low Trip OK	Alarm Trip OK	
PM-2		Alarm Trip OK	
IC-1 $>10 \times 10^{-11}$	Meter Trip OK	Test Trip OK	
IC-2 $>10 \times 10^{-12}$	Meter Trip OK		
IC-3 4×10^{-11}	Calibration Down		
IC-4 5×10^{-11}	Calibration Down		
CRM	~~Meter Trip~~		

Preliminary Check on 9-27-62

Room 113 Pressure Differential Down
Red Light On and Personnel Check cc Down
Screms and Bldg. Alarm Reset Down
Source Inserted Down
Safety Withdrawn Down 28.0
Controls Set Inner 12.53 Outer 998.63
Reflector Water ~27 in
Moderator Water ~27 in

EXP. 658: Power Dist. with controls asymmetric
|Inner − Outer| = 3.0 in. and with 0.55 g Boron
per liter of Moderator. P-1 in a-37, F-2 in b-78

Inner	Outer	Safety	
16.56	19.56	28.0"	Pos Per
Start timing 20' Exposure		3×10^{-9} on IC-2	
level		8.1×10^{-9} on IC-2	
16.46	19.46	28.0"	level

Scram and Insert Inner & Outer.

Exp # 659 9-27-62
Purpose: Check Critical (Pulsing Sub Crit)

Inner	Outer	Safety	
17.91	17.91	28.0"	Pos Per
17.84	17.84	28.0"	level

Instrument Check on 9-28-62 Source 10 mc

PM-1	Zero: 2.75	Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$> 10 \times 10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 10 \times 10^{-12}$	Meter Trip	OK		
IC-3	3×10^{-11}	Calibration	OK		
IC-4	5×10^{-4}	Calibration	OK		
CRM		~~Meter Trip~~			

Preliminary Check on 9-28-62

Room 113 Pressure Differential C.C.
Red Light On and Personnel Check C.C.
~~Scrams and Bldg. Alarm Reset~~ C.C.
Source Inserted C.C.
Safety Withdrawn 28.0"
Controls Set Inner 17.86 Outer 998.62
~~Reflector Water~~ Approx 5½" Above Be
Moderator Water 27.23

DATE	EXP	INNER	OUTER	SAFETY	
9-27-62	659	17.84	17.84	28.00	Not Pulsed Crit
	660	"	17.34	"	
	661	"	16.84	"	
	662	"	16.34	"	
	663	"	15.84	"	
9-28-62	664	17.84	17.84	"	Not Pulsed Crit
		17.87	17.87	21.11	Crit Pulsed
	665	17.34	17.84	28.00	
	6	16.84	"	"	
	7	16.34	"	"	
	8	15.84	"	"	
	9	15.34	"	"	
	670	14.84	"	"	
	1	17.34	17.34	"	
	2	16.84	16.84	"	
	3	16.34	16.34	"	
	4	17.84	15.34	"	
	5	"	14.84	"	

PN	CH μs	BKG	DEL A	BURST μs	REP RATE CPS	TOTAL CYCLES		
~~521~~								
522	160	4	4	800	20	11639	199.8 ± .6	0.54
523	80	4	4	400	39	24967	276.5 ± .7	1.13
524	80	4	4	400	39	26676	356 ± .7	1.74
525	40	4	4	200	71	54785	438 ± 1	2.37
526	320	4	4	1600	10	6800	129.9 ± .4	1.000 g = 0.
7	160	4	4	800	20	13438	199.7 ± .6	0.54
8	160	4	4	800	20	12093	278 ± .7	1.14
9	80	4	4	400	39	25704	358 ± .8	1.76
530	80	4	4	400	39	30374	442 ± 1	2.40
1	40	4	4	200	71	40309	528 ± 1.5	3.06
2	40	4	4	200	71	40823	615 ± 2	3.73
3	160	4	4	800	20	10088	281 ± .7	1.16
4	80	4	4	400	39	29161	429 ± 1.0	2.30
5	40	4	4	200	71	60577	585 ± 1.5	3.50
6	40	4	4	200	71	62256	530 ± 1.5	3.08
7	40	4	4	200	71		615 ± 2	3.73

142

9-28-62

Exp# 664 (Pulsing at Crit)

Inner	Outer	Safety	
17.92	17.92	28.0"	Pos Per
17.84	17.84	28.0"	level
17.87	17.87	21.11	level

Insert Safety.

17.87 17.87 21.11 level after inducing PIV 526

Trim = 2286

Oct 24, 1962

Calculations of Sb - Be neutron source

Marion and Fowler estimated to be of 10^{12}.

1230 curies gave 1.3×10^{10} n/sec

or 10^7 n/sec per curie

this source is not described.

Neutron energy is 31 kev (th)

$\sigma(\gamma, n) = 20 \times 10^{-28}$ cm^2

V 526

Of the above efficiency can be obtained by putting Sb in a hole in the beryllium. Then a 1 curie Sb pellet should be adequate. The 1.5×10^7 PuBe gave a count rate of $\frac{2757}{300} = 9.19$ c/sec

a 2 curie Sb pellet should be adequate.

Safe distance for 10 mc Ra = 40 in.

" " " 2 c $Ra = \frac{x^2}{40^2} = \frac{2000}{10}$

$x = 40\sqrt{200} = 566$ in

Safe time at 40 in $= \frac{1}{200} \times 8$ hrs $= \frac{8}{200}$

$= .04$ hrs or .24 min or 15 sec

60

A 2 curie Sb source could be handled safely if on the proper stick in the proper shield before transfer to the HFIR CE #2 Be.

Isotope book says 3.5 curies in an Sb-Be source gives 4×10^6 n/sec

Apex 176 $\mu^{(Be)} = 0.079$ cm^{-1}, $1/64 = .44$ cm $\mu x = .035$

Therefore Be may increase yield by factor of 30!

February 25, 1964

Preparations to remove HFIR CE #2 core and installation of HFIR CE #3 core.

Be Smear Results on Beryllium

2/17/64 Top - 17 and 19 μgr
Side - 12 and 3 μgr
Cross Scrubbed surfaces with Fab detergent
2/24/64 Top - 10.6 and 17.4 μgr
Side 21.3 and 15. μgr.

(Trans 2505)

2286
J T Thomas 239 → 30 days @ 8 hrs each)