BOOK59R

Notes:
"CE-2 1961, 62" on spine

Blank pages: inside front cover sheets, 2, 4, 6, 22, 96, 218, 281, inside back cover sheets

-page 56 has small sheet attached
-pages 97, 101, and 248 has graph sheet attached on each
-pages 109, 149, 215, 217(2), 245, 247 have a sheet attached to each
-page 152 has (8.5x11) sheet attached
-pages 204/205 has (8.5x11) sheet between pages
-page 221 has long thin sheet attached

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HFIR CE #2
High Flux Isotope Reactor
Critical Experiment # 2

Contents

Fuel Element.	U	U^{235}
363 alloy plates (outer)	6001 g	5589 g
165 U_3O_8 " (Inner)	2394	2230
	8395	7819 g
6 alloy " (outer)	98	91
6 U_3O_8 " (inner)	87	81
Total	8480	7991 g

Diameters O.D. Inner 10.590

I.D. Outer 11.366

water gap .776/2 = 0.388

water gap was reduced

with 0.062 Al cylinder ∴ water = 0.326"

May 12, 1961

Up limit switch set so that physical tip of counter is 7/32" from bottom of reactor. A Selsyn = 19.13 physical stop also indicates the same position. (Drive motor stalls when drive hits stop)
Bottom of reactor is _____ inches from the reactor midplane.
Inner and Outer control plates rest on bottom when selsyns read zero. Inner changed to read 44.23, 0 999.81
Safety reads zero when down.

May 16, 1961

After Diagonal Bracing lifting outer control cylinder deflects superstructure 1½ thous.
lifting inner also 1½ thou total 0.003 in.

May 17, 1961

Set Inner and Outer control selsyns @ 22.00
when top of Inner Control 39¼ in from Be
Outer Control 26 in. from Be

Source PN 467 Polonium Beryllium
Later source changed to — M-228 Pu-Be

May 12, 1961

Inspection of the center punch out foil from the removable plates (Inner and Outer) revealed that a number were somewhat mutilated (7 out of 27) and all had file marks on them. Tunnell Magnuson Fox, Chevalier, Hopkins, Taborda Cooke Kucera all discussed the poor quality of the foils. This was due to a number of factors. the description of how they were made was ① foils half punched out ② " hand punched remainder ③ Filed to a loose fit and removed burrs ④ Formed the curve.

Although no one would admit a poor job a later telephone conversation with Taborda revealed that they were going to redo the job over with extra plates that they may find. (Max to Min on weights of the 27 were 15%)

3 0.002 in foils ~ 1/8" x 1.5" were cut ~~wide~~ from package reactor scrap.

#1 = 113.4 mg 105.7 mg U^{235} ~~#2 106.4 mg~~ #3 = ~~112.6 mg~~

6-2-61 #2 = 115.1 mg on 107.3 mg U^{235}

PN-467 to be used in HFIR Exp.

MAY-17-1961

Changes in Multiplication without water on core. Clock Reads 1358 hours.

	IC-1	IC-2	IC-3	IC-4	IN ETR	OUT ETR	Conditions
①	$.7\times10^{-12}$	1.5×10^{-12}	6×10^{-13}	4×10^{-12}	22.0	22.0	Safety In 0.44
②	"	"	"	"	"	"	" Withdrawn 3245
							Safety
③	1.3×10^{-12}	2.5×10^{-12}	1.2×10^{-12}	7.5×10^{-12}	44.24	44.02	32.45
④	"	"	"	"	"	"	.45

With no water the effect of safety is negligible.

⑤	$.8\times10^{-12}$	1.3×10^{-12}	6×10^{-12}	3.5×10^{-12}	.05	999.81	32.45

Dropped Safety no change

⑥	"	"	"	"	"	"	0.45

Conclusion

1 there is ~~Block~~ some reactivity associated with the control cylinder and it has correct sign.

Installation IC-2 & IC-4 on ¾ of Be
IC-1 & IC-3 outside Tank at midplane

May 17, 1961

EXPERIMENT 1

HFIR CE #2

INSTRUMENT CHECK W. M-22

IC-1	Fast	10×10^{-12}	OK Trip
IC-1	Meter	"	OK "
IC-2		"	OK "
IC-3	Recorder Only		
IC-4			
PM-1	Lo		OK Trip
PM-1	Hi		Not checked
PM-2			" "

PURPOSE

To check multiplication with control plate

Water height 11.52

Insert Safety 32.45 → 0.45

IC-2 $1.7 \times 10^{-12} \rightarrow 1.7 \times 10^{-12}$

	IC-2 F	Water Ht	
3 20	1.7×10^{-12}	11.52	
30	2.0×10^{-12}	15.56	
34	2.2×10^{-12}	18.07	
37	2.2×10^{-12}	20.10	
40	2.6	21.44	
42	3.1	22.60	
45	3.5	23.55	Insert safety
48	2.7	23.46	.44
58		23.10	

} maybe leak or air bubbles.

	IC-2	Water Ht	
4 02	4.3×10^{-12}	25.64	
07	4.7×10^{-12}	26.30	
10	5.3×10^{-12}	27.35	
	Insert safety	To inspect actual water height	
14	3.9×10^{-12}	27.24	.43
	Drain H_2O		Turn off liq. level selsyn to preserve water Ht meas.
4 18	1.2×10^{-12}	0	

Rim Inner Control Plate down.

No water seen above core, re measured position of max. water Ht and core should have been flooded by more than six inches ~6 in above the Beryllium (lower only.) or 7½" above the fuel.?? The reactivity changes after core should be flooded are not understood.

D.W.H.

Inspection of the core indicates that the water was never over the fuel. The obvious conclusion is that there was an air bubble in the manometer leg causing an erroneous reading. This will be checked tomorrow.

May 18, 1961

C-4 finally working. Set voltage so that pulses on scope max ~ 100 v. Set PHS @ 20 on both C-3 and C-4 1550 - 1750 resp. Overnight count with C-3 in radial Hole C-4 suspended in air near Be.

C-3 70661 x 256 in 15 hours. 0 MIN

C-4 7810 x 256 " " " "

EXPERIMENT #2

HFIR CE#2

INST CHECK

IC-1	Fast Scram	OK
	Meter Trips	OK
IC-2	Meter Trips	OK
PM-1	Lo	OK
"	Hi	OK

PM-2 Response to Gamma Source not adequate, previously a deflection of 10 - 20 μa on meter was observed with 10 mc of radium directly on Scintillator. Now only observable when test button is pushed.

IC-3 and IC-4 response OK

Cable limit lights ok

Under scram the safety rod automatic reverse works, but the lights on the ~~fast~~ drain valves do not indicate valve position. Putting switch to drain also does not light the drain pilot light when programmed.

9⁰⁵ AM Start adding H_2O Control Plates Inner .05 Outer 99.81

IC-2	IC-4	H_2O
	5×10^{-12}	11.9
2.2×10^{-12}	6.5×10^{-12}	15.4
2.9×10^{-12}	9.5×10^{-12}	18.3
4.0×10^{-12}	1.3×10^{-11}	20.6
4.8×10^{-12}	1.6	22.0
5.4	1.8	22.9
5.8	2.0	23.9
6.4	2.2	24.7

Insert Safety ~~and Remove~~ Check bubbles in tube none formed

1.35 24.5

~~Withdraw~~ Safety

6.5 2.2 27.0 Very little change in Multiplication for last 2.5 inches, Consistent with a flooded core

Interlocks that prevent motion of Inner plate when outer is not down are working.

May 18, 1961 EXP #2 (cont)

937 Begin to move Inner Control plate down to observe change in multiplication.

Inner Cont	IC-2	IC-4	
3.51	7.0×10^{-12}	2.4×10^{-11}	Change in Multiplication observed.
6.0	7.8×10^{-12}	2.5×10^{-11}	
9.0	9.4×10^{-12}	3.2×10^{-11}	
11.0	1.15×10^{-11}	4.0	
	Move source outward in H_2O		
12.0	1.25	4.3	
14.0	1.6×10^{-11}	5.5×10^{-11}	26.5
	Insert Safety		
14.0	withdraw Safety .75	2.4	
16.0	2.0×10^{-11}	7.0×10^{-11}	
	Remove and Insert source		
18.0	2.7×10^{-11}	9.0×10^{-11}	
20.0	3.3×10^{-11}	1.1×10^{-10}	
22.0	3.5	1.2	26.0 Leak perhaps!
	Insert Safety		
		3.5×10^{-11}	
	withdraw Safety		
22.0	3.4	1.15	
26.0	3.1	1.00	

This decrease in multiplication

was not expected.

Add water back from 25.8 → 27.5 inches

Inner Control	IC-2	IC-4	H_2O	Safety
30.00	2.4×10^{-11}	8×10^{-11}	27.3	32.45
34.00	1.075	6	27.1	"
38.00	1.5	5	"	"
44.23	1.35	4.4	27.05	"

↓ Cable limit on — not off — Insert Safety to investigate

22.0	needs adjusting — remove Safety			
22.0	3.6×10^{-11}	1.1×10^{-10}	26.6	32.45

Inner constant at 22

Outer

1.0	3.5	1.0†		

On moving outer to 1.0 multi decreased do not understand

2.5	3.5	1.0		
4.0	3.6	1.1		

Multiplication now increasing OK, to proceed,

5.0	4.0	1.3		
6.0	5.0	1.6†	26.5	32.45
7.0	6.9×10^{-11}	2.2×10^{-10}		
	Insert Safety			
7.0		3.4×10^{-10}		.44

Withdraw Safety From the time to equi, we are not much sub crit.

May 18, 1961 EXP# 2 (Cont)
Outer Plate IC-2 IC-4
8.00

After 3' still rising, near critical Jerk Source, from period it indicates that we are only a few dollars subcrit. Proceed to crit with ~~rod~~ control plate and source moving out at constant power.

11[33] AM Source Out, reactor slightly subcritical @ 8!55 on Outer plate

	Inner	Outer	Source	Safety	Ref Delay H_2O	Fuel H_2O
11[41]	22.00	8.56	Out	32.46	None	25.97

22 - 8.56 = 13.44 in. inserted on gray window = 6.56 inches.

Critical condition @ 5×10^{-10} on IC-4

Insert Safety, Reduce power ~~to~~, apparent slight pos. period after waiting 4'.
Move Outer plate for + period
8.71 +111 sec U^{235} $ = 9.06 ¢

Note → Lower Trip setting on IC-2 to 60 to allow Inst to shut down.

$$\frac{9.06¢}{0.15} = 60.4¢/\text{inch}$$

Safety worth more than #5 when island dry

EXP # 3

Purpose: To get critical with control plates more symmetric - set Inner at 15.30

Source In, Safety cocked, Core flooded, and then get critical moving Outer plate from 0,0

IC-2	IC-4	Outer
		5.5×10^{-11} 0
		5.0×10^{-11} 1.5
		5.0×10^{-11} 5.0
		5.5 8.5
		9.0 11.0

Insert Safety and withdraw

~~RM~~

CRIT COND

INNER	OUTER	SOURCE	SAFETY	H_2O Ref Plane	Fuel H_2O
15.30	14.01	OUT	32.46	0	27.00
	⊕ Period	+111 sec		$ = 9.06¢	
	14.16				

Drain H_2O IC-4 = 5×10^{-10} @ critical

22.00	22.00	20.00
15.30	14.01	14.69
6.70	7.99	
	6.70	5.31" — Thickness of Gray
	14.69	6.70 Window
		7.99
		20.00"

May 18, 1961

Note

① Inspection of Tank below core (by Cross) has shown that there is a leak on the pipe threaded into the collar this was to be back welded but wasn't.

~~(2)~~ ② Adjusted S limit switch on Inner control plate cable.

③ Will attempt to repair leak from below Friday A.M when we have to be shut down for delivery and/or removal of PBR materials in EAST Cell.

④ Moved U-233 mini fiss counter to first ring of 1/2" holes in Be.

MAY - 18 - 1961

EXP #4

Purpose: Repeat #3, more symmetrical Insert source, withdraw safety set inner control @ 14.65

at 8.05 in. Outer control plate relay clicks but control plate does not move

Note

Drain water.
Inspection revealed a jammed control plate drive.

May 19-1961

Removed PN 467 Source so that Mihalczo can use it on the FBR materials. Readjust stroke of source drive and use Pu BE source M-228 which can not go down between fuel but must be placed adjacent to top of core when fully inserted. M-228 is several times stronger but can not be replaced as well.

BF_3 Counters detect the source with ease w/o H$_2$O!

May 19, 1961

Inner Control Plate	Up	000.05	
	Down	44.2	
Outer Control Plate	Down	999.82	
	Up	~~44.8~~ 43.96	
		Changed to	
N.P. Safety	Up	32.45	30.29
Rod	Down	0.42	998.25
Fiss. Counter	Up	19.15 Changed	4.84
	Down	999.93+ to	24.08
Fuel liq level	Down	99.	
Ref Island liq lev	Down	992.9	

Outer drive repaired by removing bearing blocks and screw and brass push rod tube. Selsyn reset at limit.

May 22, 1961

Inner control plate reads 22.00 when gray section is at midplane. Up = 0.05 down = 44.24

Outer control plate reads 22.00 when gray section is at midplane (Top of outer control plate is 26.0 inches above beryllium)
999.82 → 43.96

Safety selsyn reset so that cadmium starts to enter core when selsyn reads 20.0 selsyn reads zero when cadmium fills core. Upper limit = 30.29 lower 998.25

Fission counter reads directly distance of tip from core. Up limit = 4.84 lower limit = 24.08

Corrugated flexible hose replaced the hose between tank bottom and core — no interference with counter drive.

May 23, 1961

EXPERIMENT #5

PURPOSE: Repeat #3 with control plates more symmetrical. Set down at 11.65. Source in and response on IC-3 and IC-4 from below 10^{-13} to 5×10^{-13} and 3×10^{-12} respectively, also noted on IC-1 and IC-2 when set on 10×10^{-12} scales.

PM-2 Source in contact ~1 μa
on Test ~3 μa
PM-1 Hi and Lo trips OK
RC-1 Fast trips Screamer of H_2O, ~~Safety~~
IC-1 Meter Trips Trips Safety OK
IC-2 Trips OK
IC-3 and 4 response OK
Red Light On Personnel check OK, Source In
Safety Withdrawn.

Set flow rate on filling with throttle valve in series with feed valve. 8 in / min.

Near crit @ 14.91, go on pos period to min power @ 15.05

INNER	OUTER	SAFETY	Counts	H_2O	Rod	IC-4
14.65	15.05	30.29	1.54	26.89	+	
"	14.905	"	"	"	0	5.5×10^{10}

Lower H_2O to 21 and repeat.

Exp #6

Purpose: Repeat #5 for reproducibility check

Inner	Outer	Safety	Counter	Fuel H_2O
14.65	14.94	30.24	4.84	27.76

Close to critical but not very stable

"Note" Push Scram Button to Shut down

Drained only to ~ 1"

Checked liquid level and discovered some air bubbles.

The line to the liq level can get trapped air in it, and perhaps it should be relocated or made of plastic tubing only.

Aug 2

IC-2 and IC-4 have been placed at mean midplane against East wall ~ 2½" from Tank.

May 23, 1961

IC-1 Scram dropped Safety Fast and Slow OK

IC-2 Scram check damped H_2O Meter OK

IC-3 Response OK

IC-4 " "

PM-1 Lo and Hi Tripped OK

PM-2 ——— N. G.

Exp. #7

Repeat #5 and 6 for reproducibility, liq. level detube leveled so that jet should not get air trapped. Source In, Inner set at 14.70, Safety withdrawn Scrams set. Initial H_2O rate 3.8 in/MIN Water @ 27.38 Insert and withdraw Safety to be certain that it is withdrawn.

	Inner	Outer	Safety	Counter	Fuel H_2O	Rod Pos	IC-3	IC-4	S
	14.70	14.81+	30.29	4.84	27.37	~~Scram~~ Neg	3		
CRIT	"	14.83	"	"	"	∞	3.3×10^{-11}	4.4×10^{-11}	0
10^{48} BM	"	14.98	"	"	"	+120			8.534
CRIT	"	14.84	"	"	"	∞	1.4×10^{-9}	1.6×10^{-9}	0

drain water and repeat for reproducibility

$\frac{8.54}{14} = 0.094$/in

May 23

EXP #8

Purpose Repeat #7 for reproducibility

Source in, Outer critical down, Safety withdrawn

INNER	OUTER	SAFETY	COUNTER	Fuel H_2O	IC-3	IC-4	Resind	React
14.70	14.84	30.29	4.84	27.46	9×10^{12}	1.1×10^{11}	—	Slight Sub.
"	14.99	"	"	"	✕	∝	+219s.	5.16 ¢
"	14.90	"	"	27.35	4.4×10^{10}	4.6×10^{10}	∞	0

5.16/09 = 56 ¢/in

Crit Pos changed .06 in. in 3

EXP #9

Repeat 7 and 8

14.70	14.99	30.29	4.84	27.78	✕	✕	+159s.	+6.77 ¢

Drain H_2O Insert Safety. TO shutdown

EXP ~~Repeat~~ #10

Repeat #9 without moving rods.

Insert source safety, raise H_2O then withdraw Safety.

14.70	14.99	30.29	4.84	27.50	✕	✕	+217s	5.16 ¢
"	14.885	"	"	"	4.6×10^{10} to 14.0	5.0×10^{10}	∞	0

Move Rod in to 14.0 for negative period — withdraw to 15.0 and level for restoring orig power

14.885

Continue this run by inserting safety partially and withdrawing outer rod. Safety to be inserted no further than 10 inches.

	Outer	Safety		
	14.98	24.00		
.18½	15.176	22.01		
.35½	15.51	20.00		
.45½	15.96	18.00		
.34	16.30	16.99		
.45	16.75	16.00		
.55	17.30	15.01		
.74	18.02	13.99	IC-3	IC-4
.93	18.93	13.00	$\sim 3.2\times10^{}$	$4\times10^{}$

~~Drop~~ Safety remaining distance, still worth many dollars #3-5 Insert Source

EXP #11

Withdraw Safety to go critical Insert Outer control to .18 in.

	17.99	13.01	Superit	T	ρ
Crit 14.70	18.88	13.01	1.3×10^{-11} 1.9×10^{-11}	∞		
14.70	19.18			+123s	8.30 ¢	
	18.93		1.1×10^{-9} 1.4×10^{-9}	∞		

$\frac{8.3}{.25}$ = 33.2 ¢/inch

May 23, 1961

EXP #12

Purpose: Approach to crit. with safety in, white control in Insert Source, set inner control to 44.24 (down)
set outer control to 43 (UP)

Safety at 998.25, fully inserted. Water will be added slowly and only to high multiplication. ~~H_2O with Ac~~

H_2O	IC-3	IC-4	
0	$\sim 8\times10^{-13}$	2×10^{-12}	
11.7	4.4×10^{-12}	7.5×10^{-12}	
11.8	7.5×10^{-12}	1.3×10^{-11}	→ Mult ~10
12.2	1.8	2.3	Drain H_2O

It is apparent that the system can be made critical with safety down and control plates with white sections in place

EXP # 13

Purpose: Approach to crit with safety inserted and Outer control plate at 22.00 (gray section inserted) and ~~Outer~~ inner @ 44.24 (white section inserted)

0	2.8×10^{-13}	5×10^{-12}	
14.9	3.5×10^{-12}	5.4×10^{-12}	
15.7	5.5×10^{-12}	8×10^{-12}	
16.3	1×10^{-11}	1.3×10^{-12}	
16.7	1.8	2.4	M = ~10
	Drain		

Concluded that system could be made critical with Outer gray inserted and safety inserted by raised water.

May 24, 1961

Set up dial indicator to check sag of assembly when water added to bottom half of assembly. 21" of H_2O in Bottom of Tank deflected Be 0.004 in., later observed to be 0.005 in.

Re routed line to liq. level indicator, but it is believed that air gets trapped in the 3/8" main feed and drain line to feed system.

Some single exp in betting jar proves that the condition of the surface, i.e. the grease on the alum., was most important to determine whether bubbles collected on the surfaces. Aerosol OT wetting agent did not prevent bubbles from collecting.

Thermo couple put in core! pos. 2 on RG-30-03 recorder temporary

May 24, 1961
Inst Check

PM-1 Lo Tripped Safety and Dump Valve. OK
PM-1 Hi Bldg Alarm trips only.
IC-1 Fast Trips OK
IC-1 Meter Trips OK
IC-2 " " "
IC-3 and 4 Response OK
PM-2 No response.
Cable limits on control plates OK.
Personnel and Light Check OK C.P.
Log N inst Calib. OK

EXP #14

Purpose: To evaluate reproducibility for repeated ~~attempts~~ approaches to get critical by varying H_2O levels.
Set inner control plate @ 14.80, outer @ 999.82
Withdraw safety, Fission counter @ ~~4.84~~ → 10.000
Insert source.
Temp 24.5°C before H_2O pumped into core
" 25.0 after " " " "

INNER	OUTER	SAFETY	ISLAND REFLECTOR	Pool H_2O	IC-4
14.80	14.67	30.29	21" Tank	27.99	1.7×10^{-11}
	Approx. Crit 14.83				+116 8.75¢
14.80	14.67	30.29	21"	27.97	1.0×10^{-9}

Crit and drain H_2O

EXP #15

Purpose: Repeat #14
Insert Source lower control (outer) to 6.35
No bubbles observed in manometer liq-level lines core drained to below 1" but pipes not drained.
Core temp after filling 25°C.

INNER	OUTER	SAFETY	ISLAND REFLECTOR	Pool H_2O	IC-4
14.80	14.83	30.29	21"	27.98	+ Period $.7 \times 10^{-9}$ ↓
					H187s → 5.88¢

Drain and repeat

EXP #16

Insert source, lower outer control and add H_2O.
When Full T = 25 ½ °C

14.80	14.83	30.29	21"	28.06	+202	5.50¢

Drain H_2O Lower outer, Raise inner.

May 25, 1961

Dial Indicator set at zero

Add H_2O to tank $21\frac{1}{2}''$ to $43\frac{1}{2}$ dial Ind - 4 mils

Recirculation line for fuel H_2O temporarily connected with plastic hose down to core.

Inst Check

IC-2 Trips OK Dump H_2O and drop Safety

IC-4 OK

IC-3 OK

IC-1 Trip Meter OK

" Fast Trip OK

PM-1 Lo } Trips OK.

" Hi

10 mc gamma source used CC Down

PM-2 No Response < [illegible] on meter.

EXP #17

Purpose: Critical Position before circulation

Air Temp before run 25.5

H_2O temp 26.0+

Selsyn reads 28.0, H_2O level ~5" above fuel plates or 7" above fuel

Flood core to selsyn reading of 32.5

set circ, valve open [illegible]. Circulate only for a few seconds. 28.47

May 25 EXP #17 cont

Inner	Outer	Safety	Ref Island H_2O	Fuel H_2O	IC-4
14.70	14.54	30.29	$43\frac{1}{2}''$	28.44	1.1×10^{-9}

10^{53} AM approx crit

14.70	14.67	30.29	$43\frac{1}{2}$	28.44	+141 s = 7.50¢ (Max 4×10^{-10})

11^{03} Temp β $25\frac{3}{4}$ Start Circ.

11^{08} temp 26− Stop Circ

(Inserted outer to shut down)

Circulation sucks air in the manometer tube.

EXP #18

PURPOSE: To check reproducibility after circulation. Insert source.

14.70 14.67 30.29 $43\frac{1}{2}$ 28.36 +178 s = 6.16 ¢

temp $25\frac{3}{4}$ Insert rod

max IC 4 8.5×10^{-10}

Pinch plastic tube

11^{37} Start circulation $25\frac{3}{4}$ °C - No bubbles seen. JKF.

11^{47} Stop circ $26\frac{1}{4}$ °C, Unpinch tube

EXP #19

Purpose: To check reproducibility after circulation

14.70	14.58	30.29	$43\frac{1}{2}$	28.43	2.4×10^{-11}
"	approx. 14.67	"	"	"	+282 sec → 4.11 ¢

Temp = $26\frac{1}{4}$ °C Max 2.2×10^{-10}

May 25, 1961

Inner Outer Safety Refl. Island Fuel H_2O IC-4

Insert control Outer to 11.5′, remove To 14.67 for repeat period.

14.70 14.67 30.29 43½ 28.42 Max .5×10⁻¹⁰

Temp 26¼⁻ 267 +[redacted]s → [redacted] 4.31 ¢

lower outer control Insert source

12^28 Start circ. T = 26.0⁺

38 Stop " T : 26½

EXP #20

14.70 14.63 30.29 43½ 28.42 2.6×10⁻¹¹

Approx crit.

14.70 14.67 30.29 43½ 28.40 Max

[IC-4 = 1.7 ×10⁻¹⁰ 0.233 in Be = 1920 C/MIN]

T : 26¼ °C +424 sec ρ=2.81 ¢

1^13 lowered control blade

Pinched sight glass line

1^15 started circulating pump

2^15 Stopped " " T = 29.5

2^17 started " " T = 29.5

2^32 Stopped " " T ≥ 30¼ °C

May 25, 1961

EXP #21

Purpose: Check Temp coef and Reproducibility

Inner	Outer	Safety	Island Refl	Fuel H_2O	IC-4
14.70	14.67 Subcrit	30.29	43¾	28.34	2×10⁻¹¹
14.70	14.82	"	"	"	+173 sec = 6.30 ¢ Max 4.3×10⁻¹⁰

14.705 (Critical) 4.3×10⁻¹⁰

T = 30.0° C

14.67 (Negative period) −978 → −1.3 ¢

Drain and mix with Barrel and pump back up.

EXP 21

Purpose: Reproducibility and Temp effect.

T = 27.5 °C

14.65 approx crit 1.9×10⁻¹¹

14.70 14.67 30.29 43¾ 28.29 + 761 sec +1.6 ¢ Max 4×10⁻¹¹

EXP # ~~22~~ 21A

Purpose: Reproduce after circ for ¾ MIN.

14.70 ~14.65 ~critical T = 27.5 °C

14.67 critical (10′ wait) 27¼ °C

may be fraction of cent super crit. Drain.

Conclusions:

① overall coe temp coeff is negative

② Either (A) if circulation adds bubbles ~~then~~ a negative void coeff

(B) if circulation removes bubbles ~~then~~ a positive void coeff.

③ Control plate motion only is very reproducible, less than a cent (~0.2 ¢) change in reactivity from plate motion from crit and returning

④ Perhaps a single thermocouple in the middle of the core is insufficient but no indications were present that showed otherwise It is believed that the single temp measurement is representative of the core.

May 26, 1961

Inst Check

IC-1 Fast OK Tripped drain & Safety.

IC-1 Meter Trip OK

IC-2 Meter Trip OK

IC-3 Response OK

IC-4 Response OK

PM-1 Hi Trip OK

PM-1 Lo Trip OK

PM-2 ~ 1/sec response.

EXP #21B

PURPOSE: Critical position.

	INNER	OUTER	SAFETY	ISL.REFL	FUEL #28	IC-4
Initial	000.05	999.51	998.25	993.	993.	
	↓		↓			
	22.00		30.29.			
					↓	
					28.	
Check safety OK						
			↓			8×10^{-12}
			3.00			1.1×10^{-11}
			6.17			$.9 \times 10^{-11}$

Decrease in multiplication or leakage

		C_4	10.00	~~28.36~~ 28.55	5.5×10^{-11}
C-4 neu Trip	Be	65 x256+47	12.00		4.0×10^{-11}
		55 +136	14.07	28.55	3.6×10^{-11}
		46 +34	16.12		3.0×10^{-11}
		32 +8	21.00	28.97	2.2×10^{-11}
		23 +139	24.00		1.2×10^{-11}
			26.10	29.30	$.7 \times 10^{-11}$

By Measurement H_2O covers the Be 4"
when delayn read 26.10.

Drain system requires 30-40 sec.

Removed Island-Reflector feed and drain system from scram bus.

Moved IC-1 and IC-3 to the top of the Be.

EXP # 21

Purpose: The next series of approaches to critical are being made to evaluate the multiplication due to the Island-reflector water.

① Raise Island-Reflector water to 22"
very little change in multi.
IC-3 $9 \times 10^{-13} \rightarrow 1.2 \times 10^{-12}$
IC-4 $1.5 \times 10^{-12} \rightarrow 1.0 \times 10^{-13}$ - change in leakage.

Drain

21 Cont

② Raise Fuel H_2O to 11.0 in.
Raise Refl Isl. H_2O to 20.0 in
IC-1 and IC-3 increased
IC-4 decreased
Raise Fuel to 18.4 IC-1 and IC-3 increase.
Drain Refl H_2O 20.1 → ⓒ
IC-1 decreased then increased.

IC 1	IC 2	IC-3	IC 4	Ref	Fuel
7.5×10^{-12}	$.9 \times 10^{-12}$	8×10^{-12}	5.5	0	24.7
9.0	1.1	9.5	6.5	1.0	
	Slight increase in Mult.				
9.5	1.0	10.0	6.2	4.0	24.3
	Slight decrease Mult				
7.5	.75	7.8	4.8	7.0	24.4
	Decrease in Mult				
10^{-12} 5.0	.5	5.5	3.3	11.0	24.5
4.0	.25	4.0	1.5	22.0	

~~Remove~~

Now move outer rod only until mult. increases to 8×10^{-12} on IC-3

			OUTER	
	1.5	1.3	5.0	
	4.5	1.4	10.0	Safety
8.5	8.5 +		12.25	30.24
	1.2			998.25

Safety appears to be worth
more than the Island Reflector H_2O
withdraw Safety, Insert Outer, drain H_2O Island
Repeat this previous series
start with higher multiplication

Inner	Outer	Safety	Island Refl	Fuel H_2O	IC-1	2	3	4
22.00	999.81	30.29	0	26.1	10.	1.1	10	7.5 $\times 10^{-12}$
22.0	7.00	30.29	0	26.1	23	3.5	25	20

Start to add Island - Refl. H_2O but
this added too much reactivity, must Too hi
Drain and set Outer plate home

	6.00				15	2.2	16	14
"	"	"	1.3	"	26	3.4	27	22
"	"	"	2.5	"	26	3.3	27	22
"	"	"	7.45	"	10	1.3	11	8.5
"	"	"	15.14	"	4	.4	4.4	2.5
"	"	"	22.09	"	3.8	.25	4.0	1.3

Drain, Increase in power

Note Scrammed system (OK)

"	6.00	998.24 ~~998.24~~	0	26.9	2.5	.5	2.5	2.5
"	"	30.29						

Magnet wire is not located properly
and will have to be changed.

Safety is worth more with island empty

~~than~~ Reflector island ~~outside~~ when filled.

IN	OUT	SAF	ISL REF	FUEL H_2O	IC 1	2	3	4
				25.4	12.5	1.9	12.5	10.5×10^{-12}
22.00	6.00	30.28	0	27.6	13.5	2.1	14.	1.3
"	"	"	2.03	"	27	3.8	29	2.3
"	"	"	22.08	28.2	3.5		4	1.3
"	12.85	"	"	"	14		14	2.6
"	13.50	"	"	"	30		32	4.5

~~Out Safe~~

Remove Source, not far from
critical Insert Source

Approx Critical Conds

22.00 13.93 30.28 24.01 28.17 @ IC-3 = 2.0×10^{-11}
@ IC-4 = 1.2×10^{-12}

22.00
13.93
8.07" Black insertion — Insert Outer, Drain Fuel, Drain Island Refl

20
8.07
11.93" gray window.

May 26, 1961

The 3" air operated drain valve on the Island-Reflector system was replaced with a manually operated valve. System can be drained remotely through the feed valve if pump is off.

Magnet leads changed for a coil headphone type. Upper limit on safety changed to 28.27". Safety now 8" above one when withdrawn.

EXP #22

PURPOSE: Determine control plate position at critical. Set inner @ 17.50 outer @ 19.81 Safety @ 28.27 Source In Add Reflector Island H_2O to 26.04", add Fuel H_2O to 23.0" Withdraw Safety to 10.0. Insert Safety and withdraw.

Approx Crit Cond

INNER	OUTER	SAFETY	Island	Fuel	IC-3
17.50	17.65	28.27	25.44	27.7	1.2×10^{11}
	18.00				+Period
	17.76	level	T = 27°C		166 sec 6.53 ¢
			Shut down.		

$\frac{6.53}{.24} = 27.2$ ¢/inch

22.00	22	
17.50	17.76	20
4.50	4.24	8.74

Gray Window 11.26"

6.53 =

May 29, 1961

		Encl. Check
IC-1	Fast	OK
-1	MTR	OK
2	MTR	OK
IC 3	Response	OK
4	"	OK
PM-1	Ni	OK
-1	Lo	OK use to trip safety & drain H2O
-2	L/μa	response.

Moved IC-1 and IC-3 new 1" plastic between chamber and Beryllium
Moved IC-2 and IC-4 into thimble located chambers at reactor midplane and ~ 1 5/8 inches from beryllium.
IC-2 is between radial and Tangential holes IC-4 is between radial and Through hole.

May 29, 1961 EXP # 23

Purpose: Check reproducibility of #22

INNER	OUTER	SAFETY	ISLAND REFL.	FUEL H2O	IC-4
17.50	17.75	28.27	26.19	26.77	Level 3×10^{-11}
	18.00	↓			15 2.5 7.03 ¢ Max 1×10^{-11}
		17.00			

Insert safety to Shut down, insert source $\frac{7.03}{.25} = 28.1$ ¢/in.

EXP #24

Purpose: Comparison of Safety to Outer Control

17.50 28.07 17.00 26.14 26.77 level 3×10^{-11}

Insert outer control to 0
Insert source

EXP #25

Purpose: Comparison of Safety to Outer and Inner. Set Inner at 22.00

22.00 15.86 17.00 26.24 26.78 level 3×10^{-11}.

Insert safety, [redacted]

"	16.93	16.03	3.5×10^{-11}
"	18.70	15.02	3.5×10^{-11}
"	21.87	14.29	3.3×10^{-11}

Insert Safety Outer and Source.

EXP # 26

Purpose: Check multiplication with safety fully inserted. Position inner ~~width~~ at 4 (down white in)

Inner	Outer		IC-3	IC4
22.00	999.81		1.15	2.2×10^{-12}
44.24	999.81		1.2	2.1×10^{-12}
44.24	22.00		2.2	3.2×10^{-12}
44.24	28.67	T=23.5	6.0	12×10^{-12}

Mult ~10

System can be made critical with white sections pulled into core and safety In. One gray section is subcritical.

EXP # 27

Purpose: Repeat # 23 and # 22

Inner	Outer	Safety	Refl Island	Fuel	IC-4
17.50	18.00	28.27	26.22	26.79 + 148sec	May 1×10^{-9}
T = 23.5°C	Pos period			7.19 ¢	

Drain H_2O Insert Outer

EXP # 28

Purpose: Reproducibility on draining.

17.50	18.00	28.27	26.26	27.02 + ~~148sec 7.19~~	
T = 23.5+°C				+ 283 sec	9.42 ¢

$\Delta\rho = 2.77$ ¢

Push scram button to shut down

Return Inner up

Outer down

Drain Refl. Island H_2O

DWB

May 31, 1961

17 ml of wetting agent Triton X-100 added to Fuel H_2O. A scum of grease was visible in storage tank, and tank should probably be cleaned. Dwdn.

Triton X-100 has only C-H and O.

May 31, 1961

Instrument Check

IC-1 Fuel OK

-1 Mtr OK

IC-2 Mtr OK Scrammed H_2O & Safety

PM-1 Hi

" Lo

PM-2 </μa response

~~Ftz~~-3' ~~an~~ Out for repair

IC-4 Response OK

EXP #29

Close Refl. Island drain valve, Insert source, withdraw safety, fill reflector island

fill fuel, withdraw outer, check safety for react change.

IC-4 Calib Check OK.

Purpose: To check reproducibility with wetting agent in Fuel water.

Inner	Outer	Safety	Refl.-Isl.	Fuel H_2O	Temp	IC-4	React
17.50	17.70 ↓	28.27	27.02	27.22	26¼°C	3.8×10^{-11}	Level + 111 sec
"	18.00	"	27.00	27.21	26¼°	2×10^{-9} Max	+9.06¢

Drain H_2O, Insert Outer, Insert source.

$\frac{9.06}{.30} = 30.2$ ¢/in

EXP #30

Purpose: Reproducibility of react with draining Fuel H_2O

17.50	17.82 ↓	28.27	27.01	27.28	26.0°C	2.5×10^{-11}	Level + 209
"	18.00	"	27.03	27.21	25¾°C	2×10^{-9} max	+5.34 ¢

Insert outer, drain H_2O (fuel); Insert source

$\Delta\rho = -3.72$

$\frac{5.34}{.18} = 29.7$

May 31, 1961

EXP #31

Purpose: Repeat react. @ outer plate setting of 18.00 after draining & filling

Inner	Outer	Safety	Refl-Island	Fuel	Temp	IC-4	React
17.50	17.82 ↓	28.27	27.~~04~~	27.65	25¼°C	2.2×10^{-11}	Level
"	18.00	"	27.04	27.33	25¼°C	1 $\times 10^{-9}$ max	+~~304~~ 233 +4.88 ¢

Insert Outer Drain H_2O Insert Source, open pinch clamp on line to Fuel H_2O Manometer. $\frac{4.88}{.18} = 27.1$ ¢/in.

EXP #32

Purpose: Repeat #31

17.50	17.82 ↓	28.27	27.04	27.70	25¼°C	2.7×10^{-11}	Level
"	18.00	"	27.08	27.70	25.0°C	1×10^{-9} max	+224 + 5.03 ¢

Insert outer & safety. But not drained.

$\frac{5.03}{.18} = 27.9$ ¢/in.

Circulate Fuel H_2O for 10'

EXP #33

Purpose: React after circulation.

17.50	17.81 ↓	28.27	27.07	27.70	25°C	2.5×10^{-11}	level
"	18.00	"	"	"	"	1×10^{-9} Max	+222 s + 5.08 ¢

Insert outer control plate, Insert safety, Insert source

$\frac{5.08}{.19} = 26.7$

Add more Triton X-100 and circulate and heat.

May 31, 1961

Add ~ 30 ml Triton X-100

3[28] Circulate for 12'

3[40] T = 25½ Start heating Variac @ 10

3[46] 26°C " @ 100

Discovered no power to heaters.

3[55] Stop circ.

EXP# 34

Purpose: Repeat react check with more X-100 and circ.

Inner	Outer	Safety	Ref-Isl.	Fuel	IC-4	T	React
17.50	17.80 ↓ 18.00	28.27	27.09	27.66	1.8×10⁻¹¹	26¼	~ level
"	18.00	"	"	"		26°C	+ 226 sec +5.00

Shut down by inserting outer, safety draining Fuel H_2O

Drain Refl Isl. H_2O and Raise inner control to 000.05.

Summary

		Run #	Run	¢/in
			22	27.2
Initial react @ 18.00	9.06 ¢	29	23	28.1
Lower H_2O & Raise H_2O	5.34 ¢	30	29	30.2
" "	4.88 ¢	31	30	29.7
			31	27.1
" "	5.03 ¢	32	32	27.9
After circ	5.08 ¢	33	33	26.7
" " and more X-100	5.00 ¢	34	35	27.9
			av.	28.1 ¢/in

The initial change in reactivity of ~ 4 ¢ is not understood.

DWM.

May 31, 1961

The H_2O in the fuel system appears to have considerable particulate matter in suspension

The H_2O in the reflector-Island system appears to have considerable fine crystalline material in suspension.

DWM.

June 1, 1961

Start Check

Ic-1 MTR Trip OK Scrammed Safety and drain H_2O

-1 Fuel " "

-2 Mtr " "

-3 Out for repair

-4 Response OK

PM-1 Hi Trip OK

-1 Lo Trip OK

PM-2 <1/ma response.

Exp # 35

Purpose: Determine worth of fuel plates, react with all plates in, Close drain valve, refl H_2O. Insert source, raise safety, set inner control to 17.50, raise reflector island H_2O

Inner	Outer	Safety	Refl. Isl	Fuel	Fuel Temp	IC-4	React.
17.50	17.79	28.27	26.91	~~30.42~~ ~27.	25½	3.4×10^{-11}	Level
"	↓ 18.00	"	"	"	"	1×10^{-9} Max	+189 s. +5.86

Insert control plate, source and drain H_2O

$\frac{5.86}{.21}$ = 27.9 ¢/in.

Exp #36 (Repeat of 35)

17.50	18.00	28.27	26.94	~27	25½+	1×10^{-9} max	+224 s	+5.03 ¢

Remove 6 inner plates.

Average react of control 28.1 ¢/in

EXP #37

Purpose: React with 6 removable plates.

Inner	Outer	Safety	Refl Isl	Fuel	Fuel Temp	IC-4	React.
17.50	17.09	28.27	26.94	~27	24¾	2.4×10^{-11}	Level
"	↓ 17.29	"	"	"	24½	$1.\times10^{-9}$ Max	+199 s	+5.59

Drain H_2O Insert outer, insert safety, raise inner

$\frac{5.59}{.20}$ = 28.0 ¢/in.

$\frac{5.59}{28.1}$ = 0.20" ∴ crit pos. = 17.09 w.o. plate

$\frac{5.03}{28.1}$ = 0.18 ∴ crit pos = 17.82 w. plate

Δ = 0.73 in or 20.5 ¢

Worth of inner removable plate

3.42 ¢/plate.

Remove 6 outer removable plates

EXP #38 (React w. 12 plates removed)

17.50	16.44	28.27	26.99	~27	24°C	3.0×10^{-11}	Level
"	↓ 16.64	"	"	"	"	1×10^{-9} Max	+172 s.	+6.33

Insert outer control & safety, and drain Fuel H_2O

$\frac{6.33}{.20}$ = 31.7 ¢/inch.

17.09 − 16.44 = .65 in × 29.9 = 19.4 ¢ or 3.23 ¢/plate

28.1 + 31.7 = 59.8 ÷ 2 = 29.9

All plates were cleaned. (Fluorthene grease removed)

June 1, 1961

	IN	OUT	SAF	REFL ISL	FUEL TEMP	IC-4	REACT

EXP #39 Insert inner removable plates

Purpose: React with only 6 outer plates removed.

17.50	16.99 ↓ 17.19	28.27	27.01	>27	24°C	3.3×10^{-11} Level
"		"	"	"	"	1×10^{-9} +185 5.94

Insert outer control & safety and drain fuel H_2O

$\frac{5.94}{2} = 29.7$ ¢/in.

Insert outer removable plates.

EXP #40 Purpose: React with all plates inserted, repeat of 35'-36.

17.50	17.68 ↓ 17.88	28.27	27.04	>27	23¾°C 23¾°C	4.6×10^{-11} Level 1×10^{-9} max + +

Insert control, set valves for circulation

3' 13:30 start circ. 3' 17 30 Stop

EXP #41 Purpose: Repeat #40 after circ.

17.50	17.69	28.27	27.04	>27	24.0°C	3.3×10^{-11} Level.

3' 26 Set voltage at 25° start heat - doesn't work

3' 50 Circ valve to temp to 25°C

17.76 25°C Level

51 Start Circ to increase T to 25°C

17.76 25½ Level

17.76 26°C Level

	INN	OUT	SAF	ISL REFL	FUEL TEMP	IC-4	
		17.76			26¼		
3'19		Start Heat w. variac @ 25					
3'20		" " @ 50					
23		" " @ 100					
24					28 ¼		
25					29 ¾		
26					30 ½		
28					32		
32		~18.06 Heat off			35	2.3×10^{-11}	~Level
34		~18.07			34¼		~ Level
36					33½+		

Temp. change is rapid, ~~not so~~ difficult to maintain power constant.

37	~17.94	33½		~ level.
38	17.93	33¼		

Turn heat on to 25, attempt to hold T = 33

44	~17.83	32½+	~ level.

The temperature will take 10-15 to change 5-10° and at least 15-20 to equilibrate.

June 5, 1961

The distribution header for circulation of the island-reflector water has been installed. The fuel water was drained and system flushed with water from the island reflector system. The bottom of the 55 gal drum was painted with glyptal after drying, and the glyptal dried over the weekend. The pipe welds on barrel bottom were badly rusted.

Deionized water fresh from the column was added to the fuel system, 132.88 kg, and 12 g of Triton X-100 wetting agent, so that the concentration of wetting agent is 90 ppm.

132.88 kg = 21 1/4 in. in barrel

133.3 ... l/in. $\frac{132.88}{.997} = 133.3\ l = 21\ 1/4$ in.

Measured ID of Barrel 22 1/2 in.

$\frac{\pi}{4} D^2 = 397.6\ in^2$

... .215 l/in.   or $\frac{397.6 \times 16.387}{1000} = 6.515\ l/in.$

Circulate thru barrel for 30' to mix wetting agent.

.215 × 21 = 4.4 l in plumbing

Swan, C.S.

Safety now has a limit switch to indicate when safety is dropped down.

June 5, 1961

Check of recorders

25°C = 25 on #1

25°C = 23.5 on #2

Boiling H_2O (Bar = 29.16 → 740.7 mm Hg → 99.3 °C)

= 99.14 on #1

= 97.6 on #2   Swan

EKR Adjusted #2 to agree with #1

Moved Inner control plate from down to up observed ~12" scratch on gray section Southside. No other scratches found.

Moved Inner down and Outer up. with source in and safety withdrawn. Slight change in multiplication observed. IC-3 $1 \times 10^{-12} \rightarrow 1.2 \times 10^{-12}$

IC-4 $2.2 \times 10^{-12} \rightarrow 3.5 \times 10^{-12}$

6-28-61 – Water sample taken in A.M of 6-6-61, water was murky but analysis says 12.8 Σ solids
8.1 Ig. solids
Orig H_2O 7.0 Σ solids, 5 Ig. Sol.

June 6, 1961

① IC-1 -2 -3 -4 all in thimbles around the core, IC-2 & 4 4" above midplane.

② Reset ~~East~~ Island Reflector liq level - (off 1/4") measured depth 2 3/4" above Be (read 25.03) set liq. level to 24.73.

June 6, 1961 Instrument Check: IC-1 ... & Intr OK
IC-2 mtr ok, last scrammed H_2O & safety; PM-1 high & low OK.
IC-3 and IC-4 ok.

Gr	T	Net
29.12	2.22	26.90
28.65	2.20	26.45
28.6	2.20	26.40
28.85	2.22	26.63
28.65	2.25	26.40
		132.88

Weighed 12 g of Triton X-100

132.88

133.[illegible]

[illegible]

Avg = .26

.215x21 =

Filled system island-reflector to 27.00 in.
— 26.93
set valves for circulation, none thru dist header
11^{59} AM Turn on pump. lower inner control.
-lowered Raise Safety little effect.

1^{05} 2.92 liq level in fuel region
1^{06} 2.85

June 6-1961 Expt. 42
Purpose: preliminary temp. coef. run

Inner	Outer	Safety	Refl. Island	Fuel H_2O	IC-4	Reactivity
17.50	17.94	~28"	26.74	~31.0	$\times .02 \times 10^{-11}$	Level

Shut down for turning on heat

EXP # 43
6-6-61 Purpose: Prelim Temp Coeff Run
See Temp recorder for rod position vs heat.
17.80 ~Critical when started but some heat had been turned on.
Max Outer pos. 18.55
4^{30} Inspection after shutdown showed Be covered with m m bubbles.

Added 42 ml of Triton X-100 to Island H_2O

18.55 − 17.80 → 0.75 in @ 28.1 ¢/in
= 21.4¢ max. reactivity change on rod.

Storage Tank 48" × 48" OD useful ht ~ 42 in

$$\text{Volume} = \frac{\pi}{4} \times \frac{48^2 \times 42}{12^3} \text{ ft}^3 = \frac{\pi}{4} \frac{4^2 \times 14}{4} = 14\pi \text{ ft}^3$$

$= 44 \text{ ft}^3 = 1245 \text{ l}$
3
3735 l → 3735000 cc
100 ppm ~ 374 ml Triton X-100

6-6-61 Start H_2O thru heat exchanger ~ 4^{50} PM and circulation continued all night to cool H_2O.

6-7-61 7^{30} AM T = 21°C in island Reflector H_2O. Stop circulating
no bubbles observed on Be surfaces.

~~| In. | Out | Saf | Refl. | Fuel | Temp | IC-4 |~~
~~| 17.50 | 18.14 | ~27" | 26.7 | ~31 | .24 | 1.3×10^{-10} |~~
~~10^{05} started heating fuel H_2O only at full capacity~~

6-7-61 Instr. check OK

IC-1 Fast & Meter OK, IC-2 MTR Trip Safety and water drain OK

IC-3 & IC-4 response OK, PM-1 Hi & Lo trips OK PM-2 no response.

Stirrer w. ¼ hp motor mounted vertically on South rim of tank. Added 160 ml of Triton X-100 total wetting agent now 200 ml or about 50 ppm. in Island-reflector.

EXP #43 Purpose: Preliminary temp. coeff. determination.

Set inner @ 17.50 safety @ 28.27 add fuel H_2O.

gm	Ant	Neg.	Refl.	Fuel	Temp	IC-4
17.50	18.14	~28	26-7	~31	24	1.3×10^{-10} Level

10[25] started heating fuel H_2O only at full capacity

		outer	
10[11]	~	18.34	at ~ 29° in fuel region
10[15]	~	18.44	at ~ 31° " " "
10[20]	~	18.56	at ~ 32.5 " " "
10[25]	~	18.65	at ~ 34
10[30]	~	18.69	at ~ 34.5
10[35]	~	18.72	at ~ 35.0
10[40]	~	18.74	at ~ 35.5
10[45]	~	18.79	at ~ 35.5+

Started heating Island-refl. water 42 KW

10[50]	~	18.68	~ 36.5° fuel,
10[55]	~	18.74	~ 37.5

		outer	av. Fuel Temp
11[00] AM	~	18.77	38.5°C
11[05]	~	18.79	39.5
11[10]	~	18.79	40.5
11[15]	~	18.82	41.5
11[20]	~	18.82	42.(+)
11[25]	~	18.83	~ 43
11[35]	~	18.86	~ 45(+)
11[45]	~	18.87	~ 46.5(-)
12[00]	~	18.90	~ 48.5

" stopped heating fuel water

12[05]	~	18.65	~ 46
10		18.47	
15		18.40	
20		.35	
25		.33	
30		.30	~ 46
35		~~.35~~ 29	~~47~~
40		18.35	~~46~~ Turn on heat (5KW) for Fuel
~~50~~ 45		18.31	48
12[55]		18.94	50
1[00]		19.06	57.5
1[22]		19.43	63
1[30]		19.50	64.5
1[45]		19.64	67
2[00]		19.74	69

Turned off 5 KW on Fuel heater

2[10]	19.18	65
2[15]	19.10	65+
2[20]	19.02	~65
2[25]	19.03	—
2[35]	19.02	~67
2[40]	19.04	—

2.45

19.09 68.5
turned heat on 5 KW.
2 50 19.46 71.0
2 53 Turned heat off of Isotron 30 KW controller
av. Temp (8-12) was 70.5°
2 55 19.85 Fuel Temp 73.5
3 00 20.04 " 75
Cut back on Variac to 95% on 12 KW
3 03 " " to 90° on 12 KW
3 05 20.10 F. Temp 76
3 12 Turned 12 KW to 87%
3 15 20.15
3 19 Turned 12 KW to 83%
3 20 20.35 77.5° F. Temp.
3 29 Turned 12 KW. to 80%
3 25 " 12 KW to 70%
3 32 20.22
3 36 Turned 12 KW to 64%
3 37 20.38
3 42 Turned 12 KW to 60%
3 45 " " to 55%
3 50 " " to 45%
3 52 20.22
3 57 Turned 12 KW to 35%
4 01 20.30 78.5° F. Temp.
4 04 Turned 12 KW to 30%

4 07 Turned 12 KW to 25%
4 08 20.25
4 11 20.22
4 21 Turned 12 KW to 20%
4 27 " " to 15%
4 27 20.24
4 35 Adjusted position of outer control after allowing it to drift as it shown on chart. These changes may be assoc. with a slight drift in fuel temp.
5 04 20.25
5 09
5 10 → Turned 12 KW to 14%
20.17
5 15 After last adj. continued to rise in react. for ~2 min. and then began to drift down sharply with no change in rod position or any observable change in Temp.
5 38 Reached bottom of react. dip and started up. Rod still at 20.17 – later reversed.
See IC-2 Chart.
5 52 Rainell power level.
" No observable change in any Temp since about 5 15
6 07 20.28
" Noted a slight rise in fuel Temp in the past several minutes.
React went down and then back upward.

EXP #43 (Cont)

6 20 Adjusted Control cyl ; 20.22
6 24 ~~20.18~~ 20.21 Reactivity dropping down
6 31 20.27
6 34 20.29 , 6 35 20.27
6 40 20.25 , 6 50 20.19 , 6 55 20.32
7 00 PM 20.29

Reactivity instability at constant temperature 20.32 — 20.19 Δ CR = .13 in.
Fuel Temp = 79°C

7 00 Turn off 5 KW heat, Increase variac on Refl Island System to 20
7 05 19.67 , 7 10 19.44 Fuel ≈ 72°C Increase Var +25
7 15 19.41 Inc. Variac to 30. → 35
7 20 19.28 → 40. → 50
7 25 19.23 → 70
7 30 19.20 → 100 (To heat up to
35 19.15 ≈ 100 Rising
36 Turn on full heat to increase T ~ 1°C
on for 8 minutes
37 Variac back to 80
7 55 19.28 T ~ const @ 72+
56 Variac to 90
8 00 19.29
05 19.24
10 19.21
15 19.27
20

Refl Island
25.28

Shut down to Inspect Be and start cooling H2O ~~down~~ heat X.
Insert safety and Outer control.
Start Cooling H2O and heat SD.

EXP # 44

Insert Source,

[No bubbles on Be — less than 0.2 mr/hr above reactor nothing detector on floor. on 2610
H2O is rather murky]

8 36 Near crit again (≈ 5')

	Inner	Outer	Safety	Refl Isl	X	Fuel T
8 36	17.50	19.32	28.27	25.07		69°C
8 42		19.22				
8 50		19.14				
9 00		19.10				
9 10		.05				
20		18.99				61°C
30		18.92				
40		.88				
50		.89				58.5°C
10 01		.84				57 + C
10 13		.82				
10 20		18.78				57° C
10 30		18.74				
10 40		18.74				52½°C
50		.73				
11 00		18.70				50.75°
10		.68				50 °C

Shut down insert control, safety source

Turn off cooling water 12 KW Variac to 60

EXP # 45

11 15	Sub crit	~~24.90~~		49½°C
20	Source out. near crit.			
21	Variac → 50			50 °C
30	18.64	25.04		50 °C
35	18.64			53 °C
40	.66			50 °C

 6-7-61 & 6-8-61

EXP # 45 (Cont.)

11:40 Turn on 5KW fuel Heaters Refl Island Variac to 0
#14 point on TR-4 seems to be a defective TC (TC#37) reads 2°C low.

	Outer	Fuel Temp
11:50 PM	19.10	~56°C
12:12 AM	19.38	59°+
12:17 AM	19.38	
12:20	19.42	59.5
12:25	19.42	
12:30	19.42	60°C (Critical)

Shut Down insert Control, Safety, Source
turn off 5KW Heater
12:35 turn on Cooling Water
12:48 Source out Approx Crit

	Outer	Fuel temp
12:55 AM	18.76	51°
12	18.68	50°
1:00	18.63	49°
1:10	18.60	
1:20	18.57	
1:30	18.57	45.5°C
1:40	18.56	
1:50	18.55	44°C
2:00	18.55	
2:10	18.54	42.5+
2:20	18.52	
2:30	18.52	
2:40	18.53	

6-8-61

Exp # 45 Cont

	Outer Control	fuel temp
2:50 AM	18.50	40°
3:00	18.49	
3:10	18.48	
3:20	18.48	38°
3:30	18.48	
3:40	18.47	
3:50	18.47	
4:00	18.49	36°
4:10	18.48	
4:20	18.50	
4:30	18.52	35°
4:40	18.55	
4:50	18.54	
5:00	18.52	
5:10	18.55	33°
5:20	18.54	
5:30	18.55	
5:40	18.54	
5:50	18.54	
6:00	18.56	31.5°
6:10	18.54	31°
6:20	18.54	
6:30	18.54	30.5°
6:40	18.54	
6:50	18.54	
7:00	18.55	30

Cont Next Page

6-8-61

EXP #45 Cont

	Outer Control	Fuel temp
7 10 AM	18.55	30
7 20	18.54	29.5°
7 30	18.55	
7 40	18.55	~28.5°
7 50	18.53	~28.5°
8 03	18.55	~28.5°
8 12	18.55	~~~28.0~~
8 22	18.55	~28.0°
8 30	18.55	~27.5°
8 40	18.55	~27.5°
8 50	18.55	~27.0°
9 00	18.56	~26.5°
9 10	18.55	~26.5°
9 20	18.55	~26.0°

9 23 Shut down: insert control, safety.
9 35 Fuel water level at 30.45
Refl. " " " 24.92

EXPT 46 Shut off water to control header, Mixer on
Raised Island-refl. H_2O to 27.65"
10 56 Crit with outer control at 17.98 Temp ~ 25.5
out control to 18.25 for period, T = 172 → 4.05×10⁻⁴ → 6.334
Level at 18.03 after period 6.33/.22 = 28.8 ¢/in
Inadvertently left fuel H_2O pump on while changing valving and found that water squirts out at top of source guide tube

Expt. 47.

set valves for recirculation of fuel and island-refl H_2O

Inner	Outer	Ref	Refl-island	Fuel 16-4	React.
17.50	18.33	~28	27.98	~33	

Av. temp about 25.5°C
Valve to main island-refl. header closed & in-control header wide open
Reactivity seems to be oscillating
12 07 Turned on 5KW to ~25% / 100% after 3 min at 25%

	Outer Control		Fuel Temp.
12 20	18.33		26.5°C ",120067"
12 30	18.57		~~26.5°C~~ 31.5°C
12 40	18.74		33.8°C ~~34.8°C~~
12 52	18.74		34.6°C
1 00 PM	18.79		35.0°C
1 10	18.79		35.5°C
1 11	Turned on all heat.		Fuel av.
1 13	18.37	strong positive effect	39.5
1 16	18.49		
1 20	18.65		41.5°C
1 25	18.73		43.0°C
1 30	18.80		45.0°C
1 35	18.85		46.0°C
1 40	18.89		47.5°C
1 45	18.90		48.5°C
1 50	19.01		49.5°C
1 55	18.95		50.5°C

over

		Outer Control	H_2O Island Refl.		Fuel Temp
	2 00 PM	18.98			51.6 Be = 35.5 c
	10	19.02			1-R-W = 47¢
	20	19.12	27.7		
	30	19.18			57.0 °c
		Heat off to Bellows			
2	31	5Kw off.	30Kw off.	12 Kw at 90%	
2	41	30 Kw on.	5Kw off	12 Kw at 90%	
2	53	30Kw off.	5Kw off	12 Kw at 90%	
3	10	18:67			51.0 °c
3	20	18:61			51.0 °c
3	30	18:65			51.0 °c
3	47	18:64	Island Refl · 27.62		51.0 °c Be = 49 c
4	00 PM	19.08	5Kw On at 3:48 : 12Kw off		55.0°c fuel.
4	11	19.16			56.0 °c
	20	19.16			
	4 30	19.23	27.6		56 3/4 °c
	40	19.20	27.6		57 °c
4	50	Turn on all heat (5 + 12 + 30) kw			
		Immediate change of react is positive and control rod position changes rapidly for the next 5 minutes max chang ~ 0.4 in			
4	50	19.26	27.6	Be = 52°c	64°c
5	02	19.53			67.5
5	10	19.65			
5	25	19.74	27.6	57+	76.5
5	41	19.90			
5	50	20.00	27.55	61.5	75.5
6	00	20.06			
6	15	20.32		66	79.5

Turn off 30 KW and 5KW and set 12KW Variac @ 90 in order To level

6-8-61		Control Outer	Reflector Island H_2O	Be T (+16)	Fuel Temp 1,
EXP 46	6 20 PM	19.80	27.50	67°c	74.5°c
	6 30	19.34	27.47	67.5	71.5
	6 35	Variac	90 → 75		
	6 40	19.26	27.44	68	70.5
	45	.20		68.3	70.0
	50	.22		68.5	70.0
	55	.19		68.5	70.0
	7 00	.24	27.40	68.6	70.0

5KW On 12KW Variac To zero

7	10 PM	19.74	27.39	69.0	73.5
	20	.85			74.3
	30	.95		69.0	74.5
	35	.90			
	40	.95			
	45	.93	27.36		

Shut down to start cooling cycle. Start Cooling H_2O Heat off Insert Outer rod, safety and source

EXP #47

Withdraw safety and outer rod to get crit, (and source)

Shut down again to

Open manual valve on Heat Exch (cooler) and close air operated feed Valve.

7	58	Start approach to Critical			
8	05	Source out approx crit @ 19.04			
8	25	18.65	27.30	67	58.0
	30	.64			
	40	.62		65	56
	54	.58			
9	20	.56	27.30	52	60

6-8-61 EXP #47 (Continued) June 8, 1961

		Be	Fuel	
9^{36} PM	18.55	58.5	51	

Shut down (to level at 55°C) Insert outer and safety
Shut off cooling H_2O Variac at 50

EXP #48

9^{45} PM Source Out and near crit @ 18.42

950	Outer	Refl-Id H_2O	Be °C	Fuel °C	
9^{50}		27.31	58.0	54	
9^{55}	Turn on Fuel heat 50% for 2 minutes				
	Temperatures should stabilize @ ~57°C				
10^{00}	18.86	27.31	57.5	57.+	
05	18.78	"	57.5	57.3	Temps Stable
10	18.83	"	57.5	57.4	
15	18.82				

10^{15}	12KW 50% → 0		5kw on		
10^{25}	19.27	27.3	525	62	
10^{35}	19.47				
10^{47}	19.47				
10^{55}	19.47				
11^{00}	19.47	27.3	58	64	
11^{05}	19.47				

Shut Down Insert outer control rod and Safety.

11^{08} Start cooling water through heat ex changer.

Since cooling is so slow, and since no real information is gleaned from monitoring at critical. HFIR #2 CE will be shut down until 8 AM. However, the fuel H_2O will be left circulating as well as the Refl. Island H_2O.

Scrams will be left to dump fuel H_2O if necessary.

Exp # 49 6-9-61

8:15 AM Inst Checked Response OK

Purpose: Check level at Critical - After Cooling Cycle fuel temp 32°

8^{40}	Source Out	Approx Crit	
	Control Outer		Fuel temp
	18.37		32+ C
8^{50}	18.36		
9^{00}	18.37		32.5°
9^{10}	18.37	Critical	32.5°
	turn ON	5 KW	Heater

Cont Next Page →

Exp # 49 Cont

6-9-61

	Control Outer			Fuel temp	
9 15 AM	18.54				
9 25	18.74			39°	
9 35	18.80			40.5	
9 50	18.86				
10 00	18.87	Ref. Isl. H_2O	Be	41.5+	Island or Control
10 15	18.86	27.38	34.5	42.0-	~36
10 18	shut down & turned off circulation				

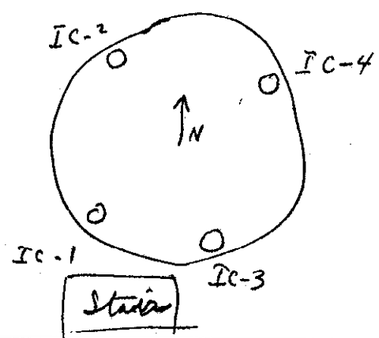
	Ref-Isl	Fuel
Water heights	27.57	33.40

Drain water systems. - Removed Target

6-12-61

Removed all ion chambers, and noted that condensate had gotten into all, with one battery box shorted out and another measured weak. These batteries were replaced. The ion chambers were re-installed in long plastic bags with the opening outside the tank so that no moisture should get in the ion chamber thimbles

Ion chamber locations were checked



6-12-61

Lead bricks in the H_2O were covered with a corrosion deposit, about a greasy or soapy like product. Spectrographic Analysis shows lead, Be, Al. and lots of impurities. Further work is being done. (These lead bricks were holding down the thimbles, now they are inside the thimbles) Dewey.

Exp # 50 6-12-61

(Inst check OK)

Purpose: Critical position with Target Removed

10 28 AM Source in - Inst Response OK

Inner Blade 17.50" Outer Blade 0"

Safety Blade up 28.25"

10 31 Start Pumping up Island Refl H_2O

11 02 Fuel H_2O @ 28.75, Start with drawing outer control.

Outer control @ 18 3° Insert safety for response, OK.

11 18 Outer = 29.87 approx critical

11 24 Outer = 29.93 critical Insert outer

Insert source, set inner control @ 22.00

Fuel-H_2O @ 28.5C, Refl Island @ 27.32

EXP # 51

	Inner	Outer	F.C	Ref Isl	Fuel	IC-4	React
11:47	22.00	17.53	10.01	27.18	28.46	2×10^{-10} Max	+156 s → 4.4×10^{-4} → 6.864
11:54		17.27		T = 26½°C			
11:59		17.27		27.24	28.47	2×10^{-10}	Level 26.54 in

Insert Outer, Insert source set

EXP # 52

6-12-56 Purpose: Critical with plates more symmetrical Source In, set Inner @ 19.75.

	Inner	Outer	F.C	Refl Sel	Fuel	IC-4	React
12^{19} pm	19.75	19.50	10.01	27.20	28.44	~~6×10^{-10}~~ Neg	Set +104.3 → 6.1×10^{-4} → 9.53¢
12^{35}		18.99				6×10^{-10}	Level

9.53/.51 = 18.7 ¢/in.

↓Bypass up interlock on Inner Rod.

19.50 18.99 27.17 28.39 → Negative Period.

Negative periods are curved

19.50 19.25 Nearly Level, $\sim 2\times10^{-11}$

Start 12:51 19.50 19.50 10.01 27.17 28.36 5×10^{-10} +598s → 1.31×10^{-4} → 2.05¢

12^{21} pm 19.50 19.38 10.01 27.22 28.32 5×10^{-10} Level.

T = 25.5°C $\frac{2.05}{.12}$ = 17.1 ¢/in.

Insert control, remove interlock

Drain H_2O in Fuel Region —

EXP # 53

Purpose: Reproducibility of critical position

$\sim 2^{18}$	19.50	19.50	10.01	27.23	27.62	2×10^{-9} Meas	+171 s → 4.07×10^{-4} → 6.36¢
	19.50	19.13	"	"	"	"	Level

$\frac{6.36¢}{.37}$ = 17.2 ¢/in.

Safety R.E. Fuel

19.50 19.50 21.26 2×10^{-9} Level

Drop power to 10^{-11} with outer control

19.50 19.35 2×10^{-11} Approx. Level.

19.50 19.95 21.26 27.24 27.62 2×10^{-9} +133 s → 3.00 → 7.81¢

19.50 17.4 ¢/inch Level

	Inner	Outer	Safety	Refl Sel	Fuel	IC-4
2^{34}	19.50	19.95	20.35	27.25	27.62	2×10^{-9}

T = 25 1/4°C

Lower power to ~ 2×10^{-11}

~ critical

19.50 19.73 Pos Period

4^{04} 19.50 20.45 +139 s. → 4.85×10^{-4} → 7.58¢

T = 25 1/4°C

4^{15} 19.50 19.94 20.35 27.28 27.62 ~2×10^{-9}

Insert control,

$\frac{7.58}{.50}$ = 15.2 ¢/in

6-13-61 IC-4 ion chamber had high leakage current ~ 2.5×10^{-9} at 8 PM last evening it was 2.0×10^{-10}

6-13-61 INST Check
IC-1 Fast & MTR Trip OK
IC-2 MTR Trip OK
-3 7×10^{-11}
-4 6×10^{-11}
PM-1 Lo - Scram dropped safety
1 Hi - Trip OK
PM 2 10 mc RaBe Source on top of detector <1 μa mp.

6-13-61 EXP # 54

Purpose: Temperature coeff without target.
Set Inner control plate @ 22.00, withdraw safety to 28.25
Insert source. IC-3 = 9×10^{-13}, IC-4 = 4.5×10^{-13}
Reflect-Isl H_2O to 27.51 — 5.5×10^{-13} — 2×10^{-12}
All Temperatures printing 25°C ± ½°
Fuel H_2O to 32.0 — 1×10^{-12} — 2.8×10^{-12}
Set valves for circulation in both systems
(Refl-Isl all flow thru the dist. H_2O; Fuel H_2O)

	Inner	Outer	Safety	Refl-Isl	Fuel	Temp	IC-4
9^{00} PM	22.00	999.82	28.25	27.49	31.22	24.8°C	
9^{10}		~16			31.15		

Insert Outer to pinch tubing on Fuel liq. level.
9^{20} Source Out.

9^{31}	22.00	17.12	28.25	27.34	X	25.0°C	2×10^{-10}

Start Circulation in reflector-island only.

9^{40}	17.35	
9^{45}	17.37	25.0°C

6-13-61	Inner	Outer	Safety	Refl.-Isl H_2O	Fuel Temp	IC-4
9^{45} Start circulation in Fuel system.						
9^{50}	22.00	17.37	28.25	27.18	25.4	2×10^{-10}
9^{55}	22.00	17.39	"	"	25.8	

Shut down (Fuel) by inserting Outer Control
9^{55} Start 5KW heat on., start stirrer motor
~~10^{01} Start~~ Insert Source

EXP #55

10^{01} Start withdrawing Outer control plate
10^{12} Source Out.

10^{20}	22.00	17.76	28.25	27.18	34.5°C	2×10^{-10}
10^{25}		.79				
10^{30}		.80			35.2°C	Be Temp = 26.4

17.80 - 17.39 = 0.41   ΔT = 8.8
0.41/8.8 = .0466

Start Heat Refl. Isl. 30KW + 12KW

10^{40}	~17.48	41.0°C
50	.60	45.2°C
11^{00}	.67	47.5°C
10	.68	49.5°C
20	.69	51.0°C
30	.70	52.7°C

Turn off all heat.

				Be (15)
40	17.55		44°C	38°C
50			41	
12^{00}	17.28		39.5	@ 38°C
10	17.25		39.5	@ 38
15	17.245		39.2	38 +
20	17.245		39.0	
25	17.24	27.04	39.0	38.5

12^{35} Turn on 5KW heat in Fuel Region

12^{40} PM	17.61	45.5	
45	17.66	46.2	39°C

Exp #55 (Cont)

		INNER	OUTER	REFL. H_2O	Be Temp	Fuel Temp
6-13-61	12 50 PM	22.00	17.67	27.05	39	46.6
	1 00	"	17.71	27.03	39.1	47.2
	1 10	"	17.74	27.05	39.5	47.5

1 10 All HTRS ON. $\Delta T = 8.0°C$

17.74
17.24
0.50
$\frac{0.50}{8.0} = 0.062$ in/°C

1 25					
40	22.00	17.58	27.03	40.7°C	55.5
1		17.75			
2 00		17.79			
25		17.86			
20	22.0	17.88	26.97	52.2°C	67°C

2 20 pm Heat off except 12 KW @ ~~25%~~ 50%

40	17.41		54	
45	(17.32) ~		54	56.1
3 00	17.25		54.3	55.1
05	17.24	26.89	54.4	55.1
10	17.24		54.4	55.1
15	17.24		54.4	55.1

5KW Heat ON 12KW @ 0

3 30	17.74			
3 45	.82			62.0
55	.85		65.0	~~57.0~~
4 00	.865			
			55.0	62.0

4 30 Turn all heat $\Delta T =$

4 10 PM (Control)	INNER	Outer	Refl H_2O	Be temp	fuel temp
	22.00"	17.72"	26.85		
4 15	"	17.84	26.87	56.5°C	70°C
4 25	"	17.97	26.87	58.5°C	73°
4 35	"	18.03	26.85	60.°	74.5°
4 45	"	18.09	26.80	62.	76.5
4 55	"	18.17	26.80	63.5°C	78.°C
5 05	"	18.20	26.79	65.5	80.
5 15	"	18.25	26.75	67.0C	81.5°C
5 17	"	18.25	26.75	67.5°C	81.5°C
	turn off 5 KW Heater				
	" " 30 KW Heater				
	turn Variac ON 12 KW Heater to 75				
5 25	"	17.92	26.70	68.5°C	75.°C
5 35	"	17.55	26.68	69.3°	72.5°
5 45	"	17.47	26.66	69.8	71.5
5 55	"	17.48	26.64	70.	71.5
6 10	"	17.48	26.62	70.2	71.
	turn ON 5 KW Heater				
	turn Variac ON 12 KW to 0				
6 20	"	17.98	26.59	70.5	74.
6 30	"	18.08	26.57	70.5	76.
6 40	"	18.14	26.56	70.5	76.5
6 45	"	18.14	26.55	70.5	76.5
6 00	"	18.14	26.51	70.8	76.7
~~7 00~~	turn off 5 KW And 12 KW Heaters				

Cont on Next Page

7 03 PM Shut Down - Insert outer Control, Safety + Source
7 08 turn ON Cooling H_2O
7 10 turn off Pump to fuel Region to check H_2O level - 31.5 4
7 14 turn ON Pump to fuel Region
"Note" Island Refl H_2O Ht was checked Just Before H_2O Ht in fuel Region And Measured 6.25" Above Be - liquid level Indicator ↑ Appeared to be OK.

	INNer (Control)	outer	Refl H_2O	Be temp	fuel-temp
8 08	22.0"	17.25	26.46		
	Source out	Approx Crit	EXP # 56		
8 10	22.0"	17.15	26.46	66 °C	57+ C
8 30	22.0"	17.22	26.46	64	56.2
8 45	22.0"	17.22	26.46	63	55.2
9 00	22.0"	17.20	26.45	61.5	54.0
9 15	22.0	17.21	26.44	60.	53.
9 24	22.0	17.20	26.44	59.	52.5

Shut Down INsert outer Control, Safety, Source

10 45 Cooling H_2O turned off
11 03 turn on 5 KW Heater
11 06 " off 5 KW Heater

11 08	22.0	17.31	Source out	Approx Crit	
11 15	22.0"	17.22	26.47	52.5°C	52°C
11 25	22.0	17.22	26.47	52.5	52

Cont Next Page

	INNer (Control)	outer	Refl H_2O	Be temp	fuel temp
11 30 PM	22.0"	17.22"	26.47	52.5°C	52°C
	turn ON 5 KW Heater				
11 40	22.0	17.55"	26.47	52.5	57
11 45	22.0	17.65	26.47	52.5	58
11 55	22.0	17.68	26.47	52.5	59
12 00	22.0	17.72	26.47	52.5	59
12 10 AM	22.0	17.72	26.47	53.	59.3°

Shut Down - INsert outer Control, AND Safety, Dump fuel H_2O - (turn off Pump) turn ON Cooling H_2O (turn off 5 KW Heater

8 10 AM 6-14-61 Cooling H_2O Off
Be Temp ~35°C.

8 40

Just Check.

IC - 1

6-14-61 - 2 MTR Trip OC scrammed Safety & drain

- 3 4.6×10^{-11}

- 4 5.0×10^{-11}

PM - 1 Hi & Lo Trip

PM - 2 Less than 1 μa response.

~~26.50~~ Reading ~ 26¼

9⁰⁰ Measured H_2O = 4.5 in in Reflector
Increased H_2O in Refl Island to 27.50
Restarted circulation 27.41 #

~8³⁰ Fuel Water pumped up and circ started
~~31.52 Fuel H_2O height~~

EXP #57

Purpose: Temp Coeff without target.

Source in, Inner @ 22.00, safety withdrawn, outer control with drum to get critical at

9⁴⁸ am Source Out

	Inner	Outer	Safety	Refl. Isl.	Temps Be(16)	Fuel(1-2-3-4)
	22.00				34.1	34.6
10⁰⁰	17.11		28.25		34.0°C	@ 34.6°C
10¹⁰	17:12		"		34.0°C	@ 34.6°C
10²⁰	17:14		"		"	"

	Inner	Outer	Saf.	Refl. Isl.	Be °C	Fuel
10²⁰	Start Heating Fuel H_2O				5KW ON	
	22.00		28.25	27.25		
10⁴⁰	~~17.13~~	17.53		~~34.3~~	34.3	42.0°C
10⁵⁰	22.00	17.56	28.25	27.21	34.5	43.0
11⁰⁰		17.60			34.5	43.4
11¹⁰	"	17.61	"	27.21	34.6	43.6

11¹⁰	all heat on					
11²⁰		17.47	"	27.25	37.	53
40		56				
50		62				
12⁰⁰		17.65			43.2	59.2

12⁰⁴	all heat off except 12KW @ 43%				
12¹⁰	17.58			44.6°C	@ 53.0°C
20	17.24			45.2	49.0°C
30	17.10		27.13	45.5	47.2°C
45	17.08			45.7	48.0°C
50	.07			"	"
55	.08		27.11	"	"

12⁵⁵	5KW on	12KW → OFF		
1¹⁰	17.55		46.3°C	52.5°C
20	17.62		46.5	54.1°C
30	.65		46.6	54.5°C
40	.66			54.9°C
45	.66		46.9	55.0°C

Exp 57

1 45	all heaters on (5+12+30)KW			
		outer	Be	fuel
1 ~~51~~ ~~54~~		17.53	58.0°c	61.5°c
2 05		17.66	49.0°c	63.5°c
2 18		17.77	51.5°c	66.5°c
2 34		17.85	54.5°c	69.0°c
2 40		17.89	55.5°c	70.5°c
2 48	all heat off except 12 Kw @ 70%			
		outer	Be	fuel
2 55		17.77	58.°c	65.5°c
3 05		17.34	58.6°c	62.0°c
15		17.25	59.1°c	61.5°c
3 25		17.20	59.2°c	61.0°c
30		.22		
35		.22	59.50c	61.0°c
	5 Kw on	12 Kw off.		
3 45		~~17.70~~ 17.70	60.°c	65.°c
3 55		17.82	60.0c	66.1°c
4 05		17.83	59.5	66.5
4 15		17.85	60	67
4 25		17.85	60.5	67
4 27	turn All Heat ON 5, 12, 30 KW			

Cont Next Page

Exp # 57 Cont 6-14-6187

	outer control	Be temp	fuel temp
4 30 PM	17.53	60.5°c	69°c
4 40	17.82	61.2	72
4 50	17.95	62.5	73.5+
5 00	18.00	63.5	75
5 10	18.02	65	76
5 25	18.09	66.5	78.5
5 35	18.14	67.8	79.
	turn off 5 AND 30 KW Heaters		
	turn variac ON 12 KW Heater to 75%		
5 45	17.62	68.8	71.5°
5 55	17.38	69.0	69.0°
5 58	turn variac ON 12 KW Heater to 83%		
6 00	17.37	68.7	68.8°
6 10	17.30	68.5	68.2
6 12	turn Variac ON 12 KW Heater to 95%		
6 27	17.32	68.5	68°
6 40	17.37		67.5+
	turn Variac ON 12 KW Heater to 100%		
	turn ON 5 KW Heater Variac to 15%		
6 45	17.35	68.3	67.5°c
6 55	17.38	68.1 c	67.5 c
7 00	17.36	68.1	67.5
	turn ON 5 KW 100% (12 KW to 0)		
7 10	17.80	68.0°c	72.°c
7 20	17.94	68.0	73.5

cont next Page

Exp # 57 Cont 6-14-61

	Outer Control	Be temp	fuel temp
7 30	18.00"	68	74°
7 35	18.02	68	74.3
7 45	18.05	68.5	74.5
8 00	18.05	68.5	74.8

Shut Down - Insert outer Control, Safety, Source
8 05 turn off 5 KW Heater
turn ON Cooling H_2O
Island Refl H_2O Measured 6¼" Above
Be - liquid level Indicator 26.60"

Exp # 58 6-14-61

Purpose: - Check Point on Cooling Cycle
10 15 turn off Cooling H_2O

	Outer Control	Be temp	Fuel temp
10 25	to Source out	Approx level	
10 28	17.16	53	52.2°C
10 30	17.17	53	52.2°C
10 40	17.19	—	—
10 50	17.20	53	52.5
11 00	17.20	53	52.5
	turn ON 5 KW Heater		
11 10	17.56	52.7	57.5
11 20	17.73	52.7	59
11 31	17.77	52.9	60

Cont Next Page

	Outer Control	Be temp	fuel temp
11 40	17.77	53	60
11 50	17.84	53.2	60.5
12 00	17.82	53.5	60.8

Shut Down - Insert Outer Control, And Safety
turn off Pump And Dump fuel H_2O
turn ON Cooling H_2O (turn off 5 KW Heat)

---

8 20 AM JUNE 15, 1961
Liq. Level = 26.75, Refl. H_2O = 4 3/4 in above Be
Temperature ~ 29.5°C

N.B. The four temperature runs were made with the following flow conditions

① Partial Refl. Sol circ thru dist. Header
② Full circ flow thru dist Header only.
③ " " " " " " "
④ " " " " " " " for crit.

Heaters for cooling on last run circulation through the 1½ lines in tanks aided in cooling faster.

Exp # 59 6-15-61

Purpose: Check Critical at Rm temp

1 05 PM turn off Cooling H_2O
Inst Checked Response OK.
Close Main Circ Value And Direct All Circ through header.
H_2O Above Be Measured 4 5/8".
Liquid level Indicator 26.72
Values Changed to pump H_2O into fuel Region
Source in Inst Response OK

1 25 H_2O in fuel Region 31.63. Set Values to Circulate thru Header And Start Pump

	Source out INNer (Control)	outer	Approx Island Refl	Crit fuel Refl	Be temp	fuel temp
1 42	22.00	17.35	26.55	31.55	24.5 C	26 C
1 52	22.00	17.28	26.55	31.55	24.5	25.8
2 00	22.0	17.30	26.57	"	24.5	25.5
2 10	22.0	17.29	26.58	"	24.5	25.5
2 20	22.0	17.30	26.54	"	24.5	25.5
2 30	22.0	17.31	26.56	"	24.5	25.5
	turn ON 5 KW Heater					
2 40	22.0	17.53	26.55	"	25.0	31.0
2 50	22.0	17.65	26.58	"	25.2	33.5
3 00	22.0	17.69	26.57	"	25.5	34
3 10	22.0	17.68	26.55	"	25.5	34.8
3 15	22.0	17.68	26.57	"	25.5	35.

Shut Down, Insert outer Control, Safety, And Dump fuel Refl H_2O. turn off 5 KW Heater

June 19, 1961

Report on Smears on Wall of Tank and inst thimble for Be content
Tank Wall 1 µg Be
Thimble " 2 µg Be
no hazard from this except for dry brushing which would get the corrosion dust airborne.
Recommends cleaning when wet.
(by Telephone from J. Morehead)
Swan

June 19, 1961

Water systems were drained and the dump tanks cleaned. New water was added, however the purity of the water was not as good as previously obtained, cond. meter on Crouse deionizer read 1 MA at end of cycle. this is not very good H_2O. Analysis on Friday read 4.8×10^{-5} mhos/cm = 1 MA.

Analysis Monday on tank Water (Mixture of all water in our drain tank. 4.7×10^{-5} mho/cm there was about 1/4 in of water added today.
Analysis of H_2O in drain tank 4.7×10^{-5}, 34 1/2, 26 Dg Sld

June 19- 1961

Add 100 ml of triton x-100 to water in the Island Reflector system and mixed

Add 5 ml of triton x-100 to the water in the fuel system and mixed
$\frac{5}{12} \times 90 = 38$ ppm

N.B. The Reflector- Island system seems to foam more than previously ~ 25 ppm of wetting agents.

June 20, 1961

Instrument Check

Ic-1 Fast Trip OK
1 Meter Trip OK
2 Meter Trip OK
3 Response OK
4 " "
PM-1 Hi Trip OK
2 Lo Trip OK – Scrammed – drop Safety & dump H_2O

JUNE 20, 1961 EXP #60

PURPOSE: ROD CALIBRATION – TARGET REMOVED

Scrams set, safety withdrawn, Inner control rod at 22.00. (written at 999.8)
Refl. Island H_2O pumped up, Fuel H_2O pumped up.
Safety dropped light now working, IC-3 & 4 calib OK

7-7-61 (5 thermo couples in Target) (Removed p 102.) DwPM

	INNER	OUTER	SAFETY	Is2 REFL	FUEL	(TR-4) Average Temperature
8[55]	22.00	999.81	28.24	27.53	31.4 ↓ 30.2	
9[07]	add fuel H_2O manometer tubing			27.46	31.1	pumped
9[10]	Start circulation in fuel H_2O and Refl - Isl. H_2O					
9[24]	Source out IC-2 ~ $6.5 \times (3 \times 10^{-11})$ Turn off circulation pumps, system is warming slightly from pumping.					
9[47]	22.00	17.04		27.30	31.20	(Approx Crit)
	"	17.24		"	"	25.4 (Pos Per)
10[11]	"	17.03		"	"	Level
10[32]	"	17.24		(Safety 21.31)		level
10[35]	"	16.77		"	"	Reduce Power
11[06]	"	17.21		"	"	(Approx level)
11[08]	"	17.44		"	"	(Pos Per)
11[25]	"	17.44		(Safety 20.52)		(Approx level
11[34]	"	17.44		"	20.50	(Level)
11[37]	"	16.50		"	20.50	(Reduce Power

Cont Next Page →

Exp # 60 Cont 6-20-61

	Inner	Outer	Safety	1st Refl	fuel Refl	Ave temp
11 59	22.00	17.37	20.50	27.28	X	
12 01	Start Pos Period ↓					24.5
12 14 p		17.64	Start to level in Safety.			
12 31 PM	22.00	17.64	19.97	27.28	X	
31	Start to lower power with Outer control.					
~36	start to	15.98 level (17.57)	with outer control.			
42					IC-4	
1 00	22.00	17.57	19.97	27.28	× 2×10^{-11}	24.1
1 01	22.00	17.84	19.97	27.27	(Pos Per)	
1 30	22.00	17.84	19.58	27.27	level	
1 32	..	16.53	19.58	..	Reduce Power	
1 56	..	17.76	19.58	..	level	
1 58	..	18.04	19.58	..	Pos Per	
2 13	..	18.04	19.27	..	24.1	
2 28	..	18.04	19.26	..	level	
2 30	..	16.75	19.26	..	Reduce Power	
2 59	..	17.98 ↓ 18.24	19.26 Start Pos. Period	..	2.5×10^{-11}	
3 00						
3 16		18.24	19.26	end of period		
3 19		~(17.05)	28.25 ↓			
3 31	22.00	17.025	28.25	27.27	2×10^{-9}	level

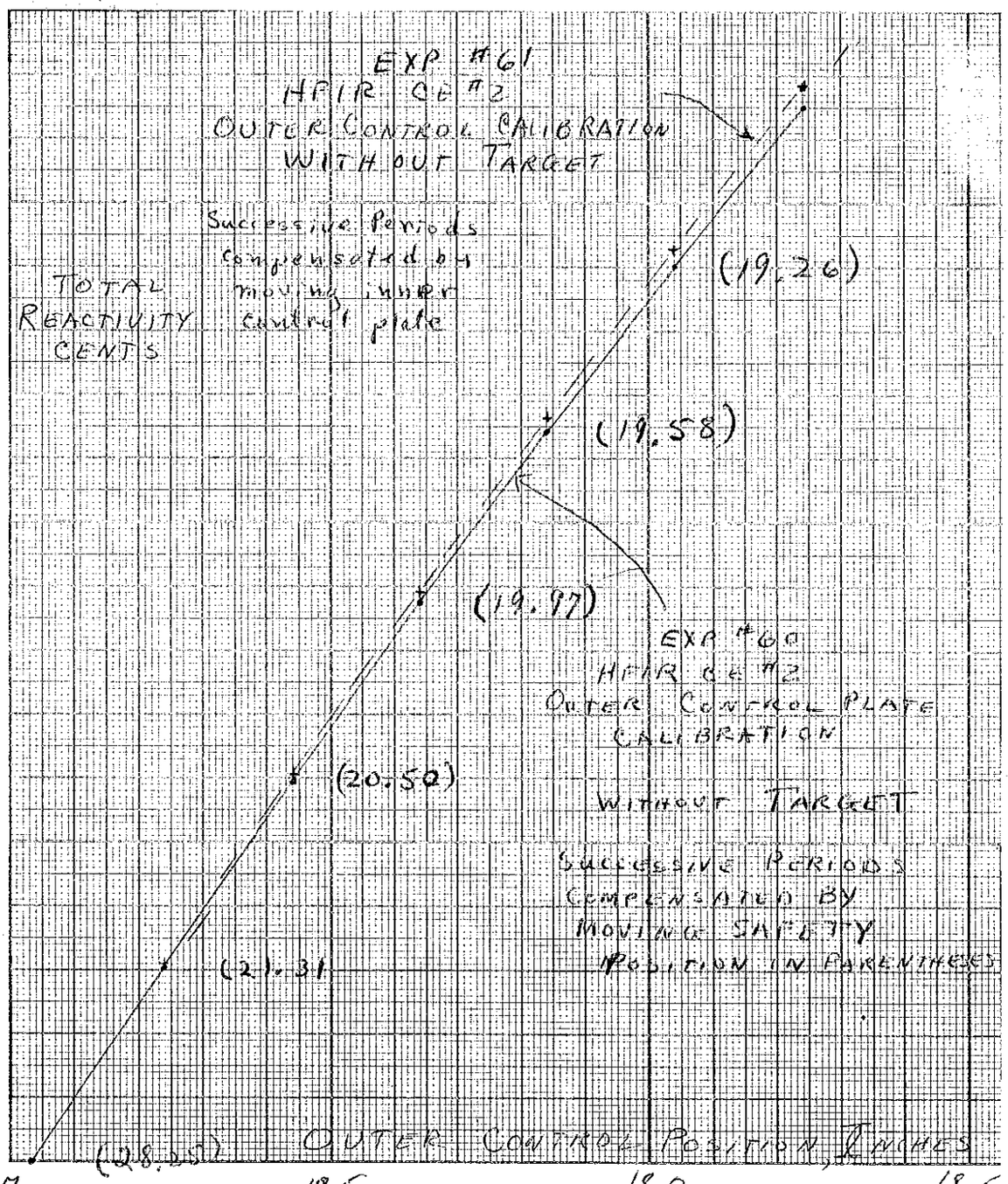
Shut Down Insert Control, Safety, And Dump fuel Refl H_2O

EXP # 60 Rod Calibration Summary

17.24	8.30	D.V/Dt.	180.4sec	3.89×10^{-4}	6.08 ¢	
.44	8.73		189.7	3.73	5.83	11.91
.64	9.10		197.7	3.59	5.61	17.52
.84	9.60		208.6	3.42	5.34	22.86
18.04	9.90		215.1	3.33	5.20	28.06
18.24	10.50		228.2	3.17	4.95	33.01
					33.01 ¢	

For these calculations U^{235} delayed neutrons only were used to determin react. from stable periods.

Dan Hale


EXP #61
HFIR CE #2
OUTER CONTROL CALIBRATION
WITHOUT TARGET
Successive Periods
compensated by
moving inner
control plate
TOTAL
REACTIVITY
CENTS
30
20
10
(19.26)
(19.58)
(19.97)
(20.50)
(21.31)
(28.25)
EXP #60
HFIR CE #2
OUTER CONTROL PLATE
CALIBRATION
WITHOUT TARGET
SUCCESSIVE PERIODS
COMPENSATED BY
MOVING SAFETY
POSITION IN PARENTHESES
OUTER CONTROL POSITION, INCHES
17
18.5
18.0
18.5

June 21, 1961

IC-4 Beckman Log Amp replaced by ORNL Log Amp. Brown 2 pen recorder tubes replaced.

Instr Check

IC-1 Fast OK Tripped H_2O Fuel Drain and Dropped Safety
-1 MTR Trip OK
-2 MTR " OK
-3 Response ~5×10^{-11}
-4 ~6×10^{-11}

PM-1 Hi Trip OK
-1 Lo " "
-2 No response.

EXP #61

PURPOSE: Control Plate Calibration Outer vs. Inner

Set Inner to 22.0

Withdraw safety, insert source, raise reflector H_2O to 27.6, Fuel To 32.6, after pen circ valves Fuel 31.3 inches, pinch tubing to liq. level. set valves on Refl Island for circulation

9^{38} AM Start circulation in Refl Island H_2O and Fuel H_2O

9^{52} Stop Circulation - Bypass interlock on inner control.

9^{53} Source out approx crit.

	Inner	Outer	Safety	Refl H_2O	Ave Temp.	IC-3	
10^{20}	22.06	17.03	28.25	27.44	24.8	3×10^{-11}	level
10^{21}	"	17.24	"	"	"		Pos Per
10^{47}	22.04	17.03	"	"		1×10^{-9}	level
10^{58}	21.51	17.24	"	"	24.5	1×10^{-9}	level
11^{00}	21.51	16.50	"	"			Reduce Power

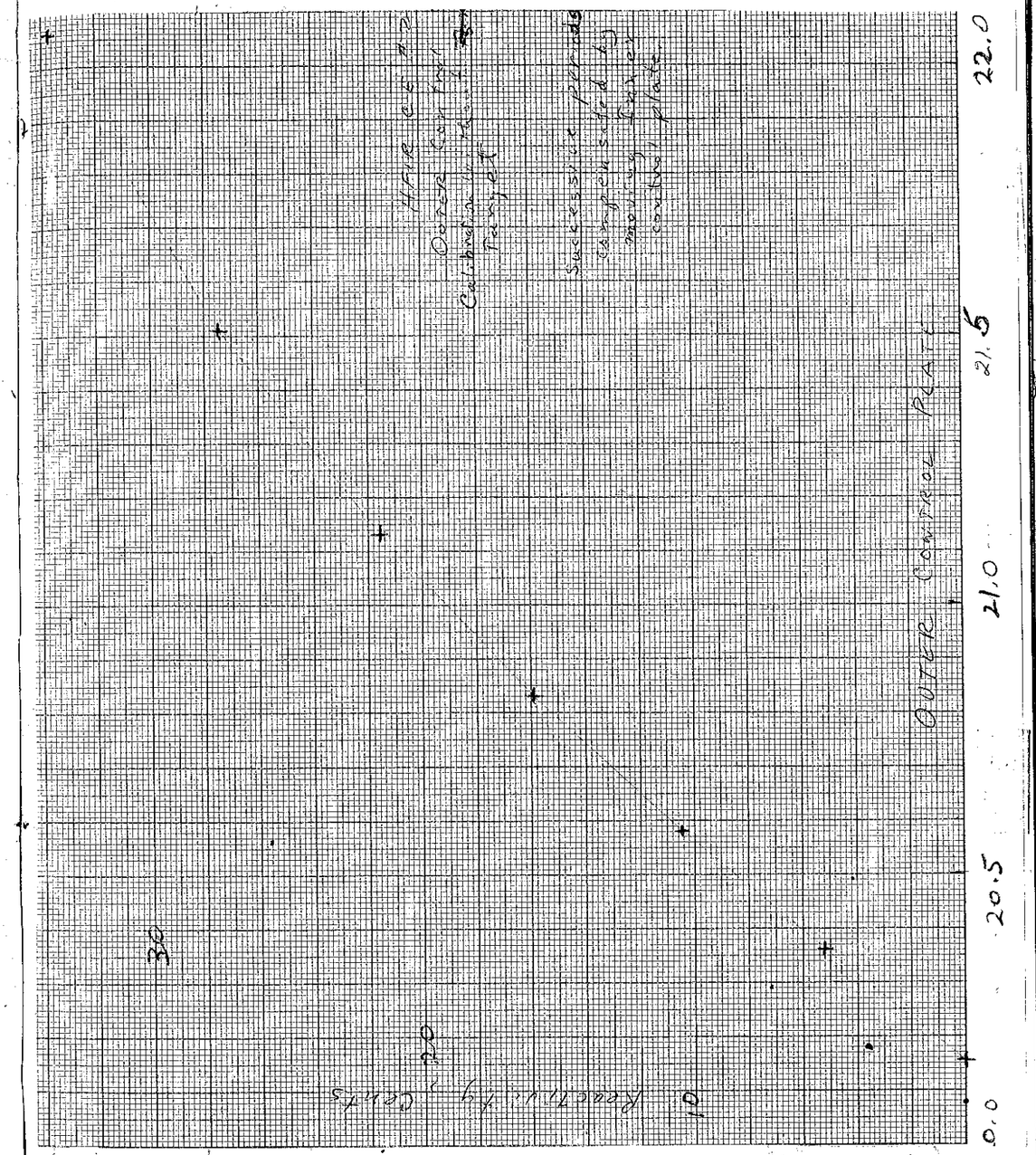
Cont Next Page

	Inner - outer	Safety	Refl H_2O	Ave Temp	IC-3	
11^{26}	21.51 17.19 ↓	28.25	27.42		1.4×10^{-11}	
11^{26}	21.51 17.44	"	"	24.5°C		+ Pos Per.
11^{39}	Start to level with inner control plate.					
11^{52}	21.13 17.44	28.25	27.41		1×10^{-9}	Level
11^{58}	Reduce power with Outer Control to 16.01.					
$11^{56\frac{1}{2}}$	Start to level with outer control.					
12^{14} PM	21.13 17.39 ↓	28.25	27.44		9×10^{-12}	Level
12^{14}	17.64			24.7°C		Start + Period
	21.13 17.64	28.25				End + Period
12^{42}	20.83 17.64	"	27.42		1×10^{-9}	level
12^{44}	20.83 16.34	"	"			Reduce Power
1^{02}	20.83 17.59	"	"		1.2×10^{-11}	level
1^{03}	20.83 17.84	"	"			Pos Per
1^{32}	20.58 17.84	"	"	24.9°	1×10^{-9}	level
1^{33}	" 16.34	"	"			Reduce Power
2^{00}	" 17.80	"	"		1×10^{-11}	level
2^{02}	" 18.04	"	"			Pos Per
2^{30}	20.36 18.04	"	"	24.5°	1×10^{-9}	level
2^{33}	" 16.49	"	"			Reduce Power
2^{58}	20.36 17.99	"	"		1.1×10^{-11}	level
3^{00}	20.36 18.24	"	"			Pos Per
3^{31}	20.155 18.24	"	"	24.1°	1×10^{-9}	level
3^{38}	22.07 17.03	"	"		1×10^{-9}	level

Shut Down - Insert Control and Dump fuel Refl H_2O

EIP #61 Summary

Innen	Outer	React					
22.04	17.03	Div/Dec.	Sec.				Σ S
22.06	17.24	8.10	176.0	3.87×10^{-4}		6.20	
21.51	17.44	8.53	185.4	3.80	27.51	5.94	12.14
21.13	17.64	9.00	195.6	3.63	21.57	5.67	17.81
20.83	17.84	9.40	204.3	3.49	15.90	5.45	23.26
20.58	18.04	9.73	211.4	3.38	10.45	5.28	28.54
20.36	18.24	9.97	216.6	3.31		5.17	33.71
20.15	18.24	0					



June 22, 1961

ORNL-Log Amp removed from IC-4 chamber and Beckman log Amp back in service — trouble was in recorder servo amplifier Tubes bad.

Thermo couples in Target-Island region 8, 9, 11, 12, #14 on TR-4 cut and poked down below target area and Target ~~right~~ re installed in assembly.

Inst Check

IC-1	1 ~~Fast~~ MTR	Trip	OK
	2 MTR	"	"
	3 4×10^{-11}	Response	OK
	4 6×10^{-11}	"	"
PM-1	Hi	Trip	OK
	Lo	Trip	OK
PM-2	No Resp.		

Trips dump rods & Safety.

Depth & cc,

Log N amp. Calib Check OK.

TR-4 and TR-5 checked with TC in control room and TC in H_2O Bath with ~~thermometer~~ TR-5 corrected ● 1/2° and TR-4 3°C off.

EXPERIMENT #62 JUNE 22, 1961

PURPOSE: Control plate calibration for the displacements observed in the temperature coeff. runs with target. Bypass std on inner control plate. (T.C in Fuel Element)

Rad Light on & personnel check OK

Inst screens set, source in, inner control @ 17.50, safety withdrawn

~~Fast~~ Refl-Island H_2O raised to 27.7, Fuel H_2O to .32.

Circulate fuel H_2O for 1 Min., open again H_2O = 30.15.

11^{25} Start circulate Fuel H_2O and Reflector - Island.

11^{45} Stop Circulation in fuel Region 11^{53} S Cop Ref Isl Circ

	inner	outer	Safety	Isl Refl H_2O	Fuel Refl H_2O	Avg temp
	17.50	17.24	28.25	27.53	30.2	

Source out Approx Crit at 11^{54} AM

11^{50}	17.50	17.23	28.25	27.53	30.2	
11^{59}	17.50	17.21	28.25	"	" ~~30.2~~ 23.0	
12^{01}	17.50	17.41	"	"	"	Pos Per
12^{11}	start to level with Outer					
12^{25}	17.50	17.19_3	28.25	27.51	×	1×10^{-9} Level
1230	17.375	17.41			~~30.0~~ 23.0	1×10^{-9} Level

Reduce power 1/100 with outer and level

12^{55}	17.375	17.36	1×10^{-11}	level
12^{57}	"	17.61		Pos Per
1^{24}	17.255	17.61		level
1^{25}	17.255	16.34		Reduce Power

IC-3 Calib OK $7 \times 10^{-12} \rightarrow 7 \times 10^{-9}$ (diode bias shifted)

IC-4 Calib OK

Cont Next Page

Exp # 62 Cont 6-22-61

	Inner	outer	Safety	Island Refl H_2O	Ave temp
1 45	17.255	17.56	28.25	27.48	23°C level
1 47	17.255	17.81	"	"	Pos Per
2 16	17.148	17.81	"	"	level
2 17	17.148	16.50			Reduce Power
2 43	17.148	17.77	"	"	level
2 44	17.148	18.01	"	"	Pos Per
3 12	17.04	18.01	"	"	level
3 15	17.04	16.50	"	"	Reduce Power
3 30	17.04	17.97	"	"	level
3 31	17.04	18.21	"	"	Pos Per
4 08	16.94	18.21	"	"	level
	Cal on IC-3 & 4 OK				
4 17	17.49	17.21	28.25	27.47	level

Shut Down Insert Control, Safety

Fuel H_2O level after run: 30.14

Inst Check on 6-23-61

IC-1 MTR Trip OK
 " Fast Trip OK
 2 MTR TRIP OK Scram Safety and drain Fuel H_2
 3 ~3x10^{-11}
 4 ~6x10^{-11}
DM-1 Hi Trip OK
 " Lo Trip OK

EXPERIMENT #63 – Purpose: CONTROL PLATE CALIBRATION

8 50 Inner Control Moved to 17.50"
Source in Inst Response
Safety Raised to 28.25"
9 00 Island Refl H_2O Raised to 27.76
9 20 H_2O in fuel Region Raised to 30.83
Start Circulating in Island And fuel Regions
9 38 Stop " " " " " "
Source out – Island Refl H_2O 27.60

	Inner – outer		Ave temp	
	17.50 –	17.26	23°	~crit. low power
9 41	17.50 –	17.41		Pos Per
10 08	17.50 –	17.208		level
10 21	16.948 –	18.21		level
10 23	16.948 –	16.22		Reduce Power
45	16.948	18.16		IC-4 ~level 3x10^{-11}
10 45	16.948	~~18.48~~ 18.42		Pos Per
11 14	16.84	18.42		level
11 15	16.84	16.50		Reduce Power
11 34	16.84	18.37		Approx level
11 35	16.84	18.64		Pos Per

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Exp # 63 Cont 6-23-61

11^{36} Island Refl H_2O 27.57 — Ave temp 22.5°C

Time	Inner	Outer		Remarks
12^{01}	16.745 -	18.64		level
	"	17.50		Reduce Power to ~ 2×10^{-11} on IC-4
12^{08}	start to level			
16	16.745	18.57		level at low power.
40	16.745	18.87		Pos Period
12^{54}	16.645	18.87		level
	16.645	17.50		Reduce Power
1^{18}	16.645	18.82		level
1^{19}	16.645	19.10		Pos Per
1^{47}	16.55	19.10		level
	16.55	17.35		Reduce Power
	16.55	19.05		level
2^{08}	16.55	19.38	Ave t 22.3°C	Pos Per
2^{33}	16.45	19.38		level
2^{34}	16.45	17.50		Reduce Power
2^{58}	16.45	19.30		level
2^{59}	16.45	19.68		Pos Per
3^{28}	16.348	19.68		level
3^{29}	16.348	17.50		Reduce Power
3^{45}	16.348	19.61		level
3^{46}	16.348	20.00		Pos Per
4^{12}	16.248	20.00		level
4^{21}	17.50	17.19		level

Island Refl H_2O 27.57 fuel H_2O = 30.00

Shut Down Insert outer Control, Safety

6-26-61 Inst. Check

IC - 1 Fast Trip Scrammed
1 Meter Trip OK
2 MTR Trip OK
3 3×10^{-11}
4 6×10^{-11}
PM - 1 HI Trip OK
1 LO Trip OK

PM - 2 No Response.

Expt 64 6-26-61

Check on reproducibility of Expt 63
Inner control moved to 17.50
safety raised to 28.2cc
source in (first step) inst. response noted
Refl. island water raised to 28.75
Raised fuel H_2O to 32.+
Started circulation of fuel H_2O 11^{06}
Stopped " " " 11^{20}

Time	Inner	Outer	Remarks
~~$11^{??}$~~	17.50		Fuel Temp 22.5
11^{30}	17.50	17.21	Level

shut down by lowering safety and
Outer Control to zero.
Island H_2O 28.73 30.55 Fuel H_2O

Drained fuel H_2O
Raised safety to remove target for
insertion of stopper
Lowered ~~outer~~ inner control

6-26-61

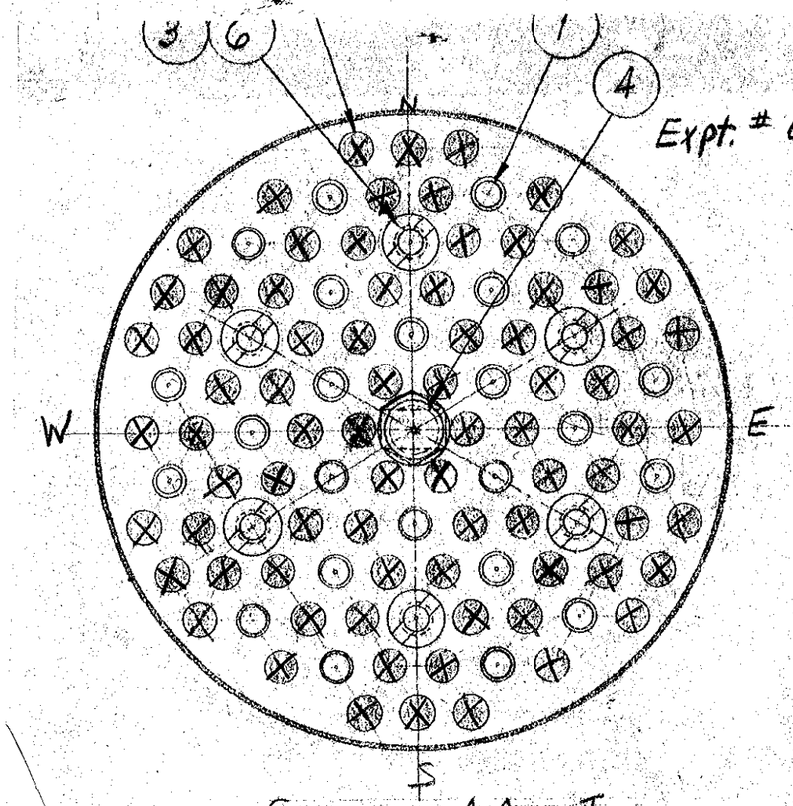
Removed target and put stoppers in each end of 20 tubes uniformly distributed over trap area (see diagram)

Expt 65

Purpose to determine void coefficient of replacing water with air in 20* of ~~approx~~ 78 ~~180~~ open tubes in target assembly.
Island refl. water still at 28.76"
Inner control to 17.50, scram circuit set.
Source in, safety up to 28.13
Fuel H_2O added to ~~32.78~~ 32.70
Started circulation of fuel water at 3 20
Stopped " " " " 3 35

Inner	Outer	Safety	Island-refl.	air fuel temp.
17.50	15.91	28.13	28.64	23.8

* Put corks in each end of open target tubes



SECTION A-A Top

Red crosses refer to Expt 65
Blue " " " " 66 (added corks)
Green " " " " 67 " "
Orange " " " " 68 " "
" " "

6-27-61

Inst. Check.

IC-1 fast trip reramed system
" Meter " ok
IC-2 trips ok.
IC-3 3 x 10⁻¹¹
IC-4 6 x 10⁻¹¹
PM-1 high and low Trips ok, reram reset

Expt 66

Purpose: cont. of void coef. with trapped air in 19 more holes: total of 39
See sketch on page 109
Source in (inst response
Moved inner control to 17.50
Safety up to 28.66.
Inland + Refl. water up to 28.15"
Fuel H2O up to 32.58 Circulation on 9[29]
Circulation off at 9[39]

Inner	outer	safety	Inland-Refl.	Av Fuel Temp	Reactor
17.50	14.87	28.66	28.13	22.2	Level

Safety in, outer control down for shut-down
Drained fuel water.

6-27-61

Expt 67 (Cont. of Void Coef. Expts. (Corks in 20 more tubes – total of 59)

Source in, Safeties set. Red light on circulation of fuel water at 12[21]
Safety up to 28.03"
Inland Refl. H2O still at 28.10
Fuel H2O at ~ 31.9", circulation off at 12[35]

Inner	Outer	Inland Refl.	Av. Fuel Temp	Reactor
17.50"	13.95"	27.99"	22.6	Level

Shut down by inserting outer control and dumping fuel water.

Expt 68

Purpose: Cont. of void Coef. Expts., filled Remainder of tubes with cork Stoppers
Source in, Inner control to 17.50
Safety up to 28.12, Inland-refl. at 28.13
Raised fuel H2O to ~ 32"
Started circulation at 2[05]
Stopped " at 2[20]

Inner	outer	Inland refl	Av Fuel Temp.	Reactor
17.50	13.19	28.01	23.1°C	Level

Shut down with outer control & drained fuel H2O

Expt 69

Purpose: Crit. control cyl. position at Room Temp. with Target assembly Out.

Source in, Inner control to 22.00"
Safety to 28.15", Island Refl. at 28.03".
Fuel H_2O to 32.77", Circulation started 3 30
Stopped circulation of fuel at 3 44

Inner C.	Outer C.	Island Refl.	Av. Fuel Temp.	React.
22.00	16.20	27.94	23.1	Level

Expt 70

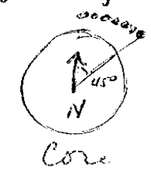
Purpose: Effect of circulating Island-refl H_2O on above expt.

402 Start circulation in Refl-Island
Source in safety at 28.28
Island-refl. circulation off at 4 05

Inner C.	Outer C.	Island-refl	Av. fuel Temp.	React.
22.00	16.18	27.93	22.6	Level
Changed position of inner control stepswise.				
19.50	17.90	"	"	"
18.85	18.85	"	"	"

Shut down with safety and fuel H_2O by ~~Omit~~ outer control

6-28-61
U^{233} Fission Counter now located in 1/2" hole in Be at 45° East of Bldg North. Close to core.



Core

Center of counter at reactor midplane.
L.A. settings 1.0 x 32, 0.2 μs, — Input
PHS = 5. Max pulse height obs. ≈ 20 volts

6-29-61 Inst Check.
IC-1 fast trip scrammed system
" Meter " ok.
IC-2 " " "
IC-3 — 3×10^{-11}
IC-4 — 4×10^{-11}
PM-1 high & low trips ok.

scram Reset.

6-29-61

Expt 71

Purpose: preliminary fuel run O-14 & T-2 Removeable plates in in place of U-9 & O-27

Source in, Inner control ~~to~~ to 17.80

safety set, Refl. at ~~27.87~~ 28.80

Inner	Outer	Is-refl	Control Rod
17.50	16.89	28.24	21.4 Level

IC-3: 1×10^{-9}

IC-4: 4.5×10^{-9}

IC-2 .46 × 3×10^{-9}

Run time 21 min.

N.B. Prior to EXP 71, The distribution header for circ Island reflector H_2O was removed as well as all thermocouples that extended thru this header into the fuel region

TR-4 pts #'s 1, 2, 3, 4, 6, 7

Counting Rates of Fission Counter IC-2 ~.46

24.00	(2 x 256 + 114)/3	= 209
18.01	8 + 87	2135
14.01	42 + 39	10791
13.00	64 + 222	16606
12.01	77 + 35	19747
11.00	125 + 77	32077
9.99	264 + 87	67671

27.87 ≈ 5.5" above Be

Inner	Outer	
P-1	F-2	Pos 2 ~45° from North
P-2	F-4	Pos 1 North
T-2		Pos 4 (4th clockwise from N)

T-2 has U-1-1 foil in ~~foil~~ 4 hole. and T-2-4 in T-2-3 hole

Fuel plate locations for next exp.

T-7 ~~O-36~~	O-36	Removed from Pos 1 (North)
U-9	O-27	
U-13		Removed from 4

On EXP #71 U^{233} Min Counter was in Be, but no counts observed.

Counter now moved to between the fuel annuli ~ 45° E of North. at midplane.

6-30-61 Inst. Check:

1-C-1 Fast trip scrammed system

" meter trip ok.

IC-2 " "

IC-3 $\simeq 5 \times 10^{-11}$

IC-4 $\simeq 5 \times 10^{-11}$

scram Reset, Red light on

 6-30-61

Expt. 72

Purpose: Foil Irradiation in Position 1 and 2 (~~for plate~~

				Removed
F-4	Plate # ~~[illegible]~~ F4	in position	b-1	O-36
P-2	" ~~[illegible]~~ P-2	"	a-1	T-7
F2	" ~~[illegible]~~ F-2 "	"	b-78	O-27
P-1	" ~~[illegible]~~ P-1 "	"	a-37	U-9
	" T-2 "	"	a-97	U-13

L U-1-1 in position 4

Source in, safety up to 28.16"
Inner control to 17.50, Island refl. to 28.46
8:48 Fuel water up to 31.90
9:11 with outer control at 17.43 pos. period
9:14.5 Started clock
Cut at outer control: 17.09
I-C-2 at 8.1 $\times 10^{-10}$, IC-3 1.4 $\times 10^{-9}$
IC-4 at 3.0 $\times 10^{-9}$
U^{233} #2 - 68,900 c in 3 min
9:34.5 Shut down with safety and control
Fuel water dropped to level of top of fuel ~22
With Fuel H_2O covering Fuel plate
above read 22.08 changed to 21.98.
6¼" above Be = 28.37
change to 28.27

6-30-61

Expt. 73

Purpose: to check on the react. value of thermocouples. Put in 5 thermocouples evenly spaced around void between fuel annuli. Each cut to ~24" to reach from bottom to top of core. U^{233} Counter between Fuel Annuli
Put back in original plates: a-1: T-7; b-1: O-36, a-37: U-9; b-78: O-27; a-97: U-13

1:40 Safeties set, red light on, source in, safety up to 28.28, Island refl H_2O: 28.29
Fuel H_2O up to 30.9"

Crit Cond: Inner	Outer	I.R. H_2O	F. H_2O	Control Rod T.	React Level
17.50	17.765	28.29"	30.9	~21.5°	

Shut down with safety & outer control

6-30-61

Expt 74

Purpose: Recheck after removal of 5 thermocouples. Counter between fuel annuli
Source in, safety up to 28.44
Is. refl and Fuel Water unchanged; 28.29 & 30.9

Crit Cond: Inner	Outer	Is. refl.	F. H_2O	Control Rg. Temp.	React. Level
17.50	16.94	28.03	30.67	~21.3	

Shut down using safety and Inner control

Removed U^{233} counter from Fuel region

Expt 75

Purpose: Evaluate effect of removal of U^{233} counter from core

Source in, Safety up to 28.29"

Refl-refl at 28.04, Fuel H_2O at 30.67

Cnt-Cond: Inner	Outer	Control Ref. Temp.	React. Level
17.50	14.84	~21.2	

shut down

5⁰⁴ PM Drained Reflector D₂O and water!

7-3-61 Inst. Check

IC-1 Trips on meter

" scrammed on fast trip

IC-3 - 3×10^{-11}

IC-4 - 5×10^{-11}

PM-1 high and low trips OK.

Scram reset.

Red light on

Purpose: foil Exposure Repete of Exp# 72 for Higher Power level

9⁴⁵ AM Source in Inst Response OK
Safety Raised to 28.86"

9⁵⁵ Inner Control Set at 17.50

10⁰³ Island Refl H_2O 28.65"

10¹⁴ fuel Region H_2O Raised to 31.44

10²² Source out Approx. Crit
outer control
17.12

10²⁵ 17.34 Pos Per to Raise Power level

10³⁰ Start timing ~~foil~~ 20 Min foil Exposure
on Beckman IC-2 3×10^{-9}

10⁴⁷ 16.96 IC-2 8×10^{-9} Avetemp 22.3°C level

Note 10⁵⁰ Sht Down Drop Safety, Insert outer Control
U^{233} counter not in core

11²⁰ Move Inner to 28.00

Drain H_2O to top of fuel ~20 min/in

Exp # 77 7-3-61

Purpose: Fission Counter Traverse

U^{233} Nor. Fis. ctr in core

1:35 Inner Control Set At 17.50"

Safety Raised to 28.26

Island Refl H_2O 28.66

Source in Inst Response ok

1:52 Fuel H_2O Raised to 31.47"

Remove Source to Check Counter

1:54 Source in Inst Response OK

2:05 Source out Super Crit

outer Control

17.06 Super Crit

16.96 Level

Position	Nor. Fis. Ctr	Fis. ctr		C.R / 1 min. counts
4.89*	~~[illegible]~~	81,450 318.16 + 41	x 256 ←	changed power L.
5.00	3630	81,888 319 +178	"	22.54
"	3720	81,200 317 + 52	"	21.83
6.00	3870	50,743 198 +32	"	13.11
"	3640	49,511 193 + 101	"	13.60
7.00	3700	30,159 117 +209	"	8.15
8.00	3760	18,723 73 +33	"	4.98
9.00	3990	11,022 43 12		2.76
10.00	3750	6533 25 133		1.74
11.00	3730	3813 14 229		1.02
12.00	3700	2264 8 216		.612
13.00	3760	1515 5 +235		.403
5.50	3840	69,560 271 184		18.11

* inches from core

5.00	4,180	359 +245	92149	raised Power Level	22,05
13.00	122490	187 +62	47928 ~ 1.3 x 10⁻⁸		.391
14.00	126220	123 +94	31582 ONIC-4		.250
15.00	122680	78 44	20014		.163
16.00	127770	51 213	13209		.104
17.00	128440	34 50	8754		.0679
18.00	130130	22 +27	5659		.0435
19.00	129200	8 173	2221		.0172
20.00	129880	5 219	1499		.0115
21.00	130490	4 62	1090		.0083
22.00	130 650	2 210	722	> 1483 , 0057	.00055
"	130650 > 261300	2 249	761		.0058
23.00	129310	2 15	527	> 1030	> .0040
"	129930 > 25924	1 247	503		
24.00	128710	1 93	349		
"	128080 38538	1 100	356 , 1077		> .0028
"	128580	1 114	372		

3 36 Shut Down Insert ~~Type~~ outer control, Safety, And Dump fuel H_2O

Dumped Inland refl. water

INST CHECK 7-5-61 W. 18 min Ra-Be Source

IC-1	Fast	Trip DC	(10×10^{-12})
1	MTR	" "	
2	MTR	" "	(10×10^{-12})
PM-1	Hi	" "	Scram Safety & dump H_2O
-2	Lo	" "	
IC-3	9×10^{-11}	Calibrated	
IC-4	6×10^{-11}	Calibrated	

after reset. JKE & DWH

EXP #78

PURPOSE: REACT. EFFECT OF FUEL, H_2O and ALUM in Fuel element, U^{233} counter in core

Source in, Safety Cyl. up to 28.26
Inner control Cyl at 17.50
Inland refl. H_2O at 28.84
Fuel H_2O at 31.2
Crit. with Outer control at 16.95"
Pos Period 17.20
Shut down to remove U^{233} counter by insertion of safety and Outer Control

Expt. 79

Purpose: React. effect of ~~original fuel plates~~ removal of U^{233} counter
Source in, safety up to 28.26"
all water heights same as above expt.
Pos. Period 17.10 Level @ 16.84
U^{233} counter ~ 0.12 in on outer control

7-5-61 EXP #79 (Cont)

Adjust Inner and Outer to get a symmetrical rod position at Critical IC-2 = $.68 \times 3 \times 10^{-10}$
Inner 17.24 Outer 17.24
(with target) 7-7-61 DWH

Adjust Inner and Outer to get Outer at 18.00 so that it will be within the calibrated range for plate insertion and removal withdrawal experiment
IC-2 = $0.68 \times 3 \times 10^{-10}$
Inner 16.825 Outer 15.00

Shut down with Outer and Safety, Inner to 26.0
Remove 6 inner fuel plates.

EXP #80

PURPOSE: CRITICAL COND. W.O. 6 Inner fuel plates
Inner 16.825" Outer 17.65" Pos Period
" 16.825 " 17.335" Level @ IC-2 = $.68 \times 3 \times 10^{-10}$
Insert safety and Outer control, then Inner to 30.0
Insert source.

Insert Aluminum Inner Plates, 1 thru 6 in a-1, a-37, a-72, a-97, a-122 a 147

7-5-61

EXP # 81

Purpose: Crit Cond with 6 inner al. plates.

Inner	Outer	Pos Per
16.825	19.45	
16.825	19.075	Level

Shut down by inserting Outer and Safety, Inner to 30

Remove Al Plates, Insert fuel plates

EXP # 82

Purpose: Repeat # 79, Crit Cond. with fuel plates inserted.

1[0] Source in Inst Response OK
INNER Control Set At 16.825"
Safety Raised to 28.26"

1[31] Source out

INNER Control	outer Control	
16.825	18.00	Approx Crit
16.825	17.99	" " level

1[43] Shut Down Insert outer Control and Safety

Removed 6 outer Fuel Plates

Exp # 83 7-5-61

2[02] INNER Control Set At 16.825"
Source in Inst Response OK

cont next Page

2[07] PM
2[17] Safety Raised to 28.26
Source out

INNER	Control	outer	
16.825		17.61	Pos Per to Raise Power
16.825		17.26	Level

Shut Down with safty and outer control

Inserted 6 Al Plates in Outer Ring

Expt 84

Purpose: Determine Effect of Insertion of 6 Al Plates in Outer Fuel Ring

Water: is-refl = 28.8; Fuel = 31.2

Source in, Safety up to 28.26

Inner control	Outer control	
16.825	18.067[5]	W. Temp. 21.2°

4[25] Shut Down Insert outer Control, Safety And Dump fuel H_2O

Inst check
IC-1 fast trip scrammed system
" Meter " ok
IC-2 " " "
IC-3 out for repair.
IC-4 ~ 2×10^{-11}
PM1 - high & low trips ok.
scram circuits set.

Expt 85 7-6-61

Purpose: React. effect of filling all steam holes with water
all removable fuel plates back in core
source in, safety to 28.26"
10^{23} AM Inner control at 17.50.
Island Refl H_2O 28.41"
Fuel H_2O 31.24"
10^{42} Source Out

INNer (control)	outer	
17.50	16.82	Approx Crit
10^{46} 17.50	17.00 T=207.5 ρ=3.145×10⁻⁴ ≈ 5.39¢	Pos Per
11^{06} 17.50	16.83	level

Shut DOWN INSert Outer Control And Safety

7-7-61 Inst. Check;
IC-1 fast trip ok
" Meter " "
IC-2 " " "
IC-3 out for repair
IC-4 ~ 3×10^{-11} response
PM-1 low level trip scrammed system
" high " " ok.
Insts set.

"

Expt 86

Purpose; Irradiation of 0-32 reverse plate in position b-78 & T-2 in a-37 for flux data.
Source in, safety up to 28.26
Inner control set at
Island Refl H_2O 28.63"
9^{19} AM fuel H_2O 31.33
9^{29} Source out

INNer (control)	outer	
17.50	17.16	Pos Per to Raise Power level

9^{37} ◆ Start timing 20' foil Exposure at 3×10^{-9} on IC-2
9^{52} 17.50 16.865 (crit) 7.8×10^{-9} " "
9^{57} Shut DOWN INsert outer control, Drop Safety

"Note"

Exp # 87 7-7-61

Remove target & Installed 5/16 O.D. ss. target rod Containing 4 - ½ OD Al Spacing rings

Origonal removeable plates all back in fuel

Island Refl H_2O 28.52

Source in, Safety to 24.08

Inner Control cyl. at 18.50

1 32 PM Fuel H_2O 31.70

1 45 Source out Approx Crit

Inner (Control)	outer	
18.50	19.535	~ Level
1 52 20.45	17.21	Pos Per to Raise Power level
2 10 20.195	17.21	level

Shut Down Insert outer Control, Dump fuel H_2O

Expt 88 7-7-61

Added 6 - ½" O.D. Polystyrene tubes filled with air around central target rod. Tubes ≈ 24" long centered vertically in core

Source in, Safety up to 24.08"

3 08 PM Inner control set at 20.195

Source out

Inner (Control)	outer	
20.195	16.42	Pos Per

Cont Next Page

Inner (Control)	outer	
3 21 20.195	16.18	$\frac{8.0}{24} = 33$ #/in level

Raise Safety to 28.26" Slight ~~Raise~~ increase in Reactivity.

1 20 lower Safety to 24.08" level

1 28 Raise Safety to 28.26

20.195	16.17	level

1 30 Shut Down Insert outer Control, Dump fuel H_2O

Exp # 89 7-7-61

Added 12 - ½" OD Tubes Filled with Air to previous 6 - Total of 18

Source in, Safety up to 24.08

Fuel H_2O at 31.46

Inner control at 20.195

4 06

Inner (Control)	outer	Source Out
20.195	14.425	$\frac{9.5}{22} \approx 43$ #/Pos Per
4 15 20.195	14.265	2 in Level

Shut down with Safety & Inner Control & Fuel H_2O

7-10-61

Inst check.
IC-1 system scrammed with fast trip
" meter trip ok.
IC-2 " " "
IC-3 out for repair
IC-4 ~ 4.5×10^{-11}
PM-1 high & low trip ok.
scrams reset.
Increased Magnet current to 50 ma 90 V DC 119 o maniac

Expt 90 7-10-61

Void Coef using 36 air filled ½" OD plastic tubes

Source in, Safety up to 24.08
Inner control to 20.195⁻
Island-refl. 28.53
Fuel H_2O 33.02

9^{10}	Source out			Approx Crit
	Inner (Control)	Outer		Slightly Super "
	20.185	11.525⁻		
9^{12}	20.185⁻	11.70	10.3 ¢	Pos Per
9^{26}	20.185⁻	11.473		level
9^{34}	20.195⁻	11.47	$\frac{10.3¢}{.227} = 45.4$ ¢/inch	level

Shut Down Dump fuel H_2O, Insert outer Control

7-10-61

Expt. 91

Void coef. using 40-½"OD plastic tubes filled with air

Source in, Safety up to 24.08
Inner Control Set At 20.195⁻

10^{22}	fuel H_2O	32.34"	
10^{29}	Source out		Approx Crit
	Inner (Control)	Outer	
	20.195⁻	8.11	Slightly Super Crit
10^{31}	20.195⁻	8.30	$\frac{8.81¢}{.232} = 38.0¢$ Pos Per
10^{46}	20.195⁻	8.068	in. level

Shut Down Insert outer Control, Dump fuel H_2O

Exp # 92 7-10-61

Void coef. using central cyl. of styrafoam 4 5/16" in Dia. made up of 2" Discs stacked together on 5/16 OD S.S. target rod. Lenth 24 9/16 centered vert.

source in, Safety at 24.08, scrams set,
Inner control at 20.195⁻,
Fuel water 31.96

1^{29}	Source out	Slightly Super Crit

Cont Next Page

Exp # 92 Cont 7-10-61

1 29	Inner (Control)	outer	
	20.195	5.96	Slightly Pos
1 31	20.195	6.10 (180.4 sec 388 ¢ 6.06)	Pos Per
1 44	20.195	5.87	level

Shut Down Insert outer Control, Dump Fuel H_2O

$\frac{6.06}{.23} = 26.3$ ¢/in

2 30 PM Exp # 93 7-10-61

Void Coef. using a central cyl. of styrofoam 3 7/8 in. in dia. & 24 1/2" long

Source in, safety set at 24.08
Inner control set at 20.195
Fuel water at 31.34

2 50 Source out Approx Crit

	Inner (Control)	Outer	" "
	20.195	6.73	
2 52	20.195	6.90 (T 164 P = 6.59 ¢ / .21)	Pos Per
3 18	20.195	6.69 (= 31.4 ¢/in)	level

Shut Down Insert Outer Control, Dump fuel H_2O

Target re-installed in trap region for fast run

7-11-61

Inst. Check.

IC-1	Fast trip scrammed system
"	meter " ok.
IC-2	" " "
IC-3	out for repair
IC-4	5x10^-11
PM-1	high & low trips ok.

Alarm reset.

Exp # 94 7-11-61

Purpose: Foil exposure: P-1 in a-91, P-2 in a-72, T-2 in a-37, F-2 in b209 & F-4 in b-155

P-1-4 in T-2 Center & U-1-1 in center of P-1

	Inner Control Set At	17.50"
	Safety Set At	28.86
	Island Refl H_2O	28.56
9 15	Source in	Fuel H_2O 31.72"
9 25	Source out	
	outer control 16.95	Crit

Shut Down to install Counter -
Insert outer Control, Safety, Source

Expt 95

~~Repeat~~ Cont. of above after preliminary critical pt.

9 49	Source out	Approx level
	outer Control 17.05"	
	17.05"	Approx level
9 51	17.25	Pos Per to Raise Power level

Cont Next Page

outer Control
9[57] 17.25" Pos Per to Raise Power level
10[08] Start timing foil Exposure 3×10^{-9} on IC-2
U^{233} Counter Jammed Scaler on x25k -
had to turn off
Counted on U^{235} Fis. ctr at 15.00" for 20 min.
during Irradiation; Total Counts = 2621 x25k
10[22] 17.058 IC-2 8×10^{-9} level
pitch 10[28] Shut Down Drop Safety, And Insert outer
Control

Expt 96

Void Coef. Using central Cylinder of Styro foam 3¼" in Dia. & 24½" long

	Inner Control	20.195"
	Safety	24.08"
	Island Refl H_2O	28.51"
	Source in Inst Response OK	
	Fuel H_2O	31.21"
1[30]	Source out	Super Crit
	Outer Control	
	9.24"	" "
9[32]	9.38	5.4 div → 117.3 → 5.56 → 8.69 Pos Per
1[53]	9.182 .198 → 43.9 ¢/in	level

Shut Down Insert Outer Control, Dump fuel H_2O

Void Coef. Using a central Cylinder of styrofoam 2 3/16" in dia

Source in, Inner Control at 20.195"
Safety up to 24.08"
Island Refl H_2O 28.49
Fuel H_2O 31.58
3[33] Source out
outer Control
13.155" Approx Crit
3[35] 13.30 $7.2_3 \rightarrow 15.15 \rightarrow 4.36 \rightarrow 6.81$ ¢ Pos Per
H[02] 13.15" 15 → 45.4 ¢/in. level
Shut Down Insert Outer Control, And
Dump fuel H_2O

7-12-61

Removed M-228 Source to return for re-canning; 1.14×10^6 N/sec
Installed M-43 " ; 1.28×10^6 N/sec

Mr. Whitehead Lubricated screw on safety drive to eliminate chattering.

7-12-61

Inst Check:

IC-1	Fast trip	ok
"	Meter "	"
IC-2	" "	Scrammed system
IC-3	~ 4.3×10^{-11}	
IC-4	~ 4.3×10^{-11}	
PM-1	high & Low trips OK.	

Scram Circuits Reset

Expt 98

Void Coef Using central cyl. of styrofoam 4¾" in dia.

It is not possible to use the safety for this expt. because of the large dia. of the styrofoam. Must use extreme care in approach to critical.

Source in, Island-refl H_2O 28.51
Fuel H_2O at 31.51
Inner control at 20.195

$10^{\underline{54}}$ Source out — Slightly Super Crit

Outer Control

7.32"

$10^{\underline{57}}$ 7.50" — Approx Crit Pos Per level

$11^{\underline{16}}$ 7.28

Shut Down Insert outer Control, Dump Fuel H_2O

6.1 div 132.6 sec 504 → $\frac{7.88¢}{.22}$ = 35.8 ¢/in

7-12-61

Expt 99 ×

Void Coef. with Target in + 24-½" OD polystyrene tubes filled with air & forming a ring around outside of target assembly. <u>Water in all Al tubes in target.</u>

Again Safety cannot be used because of Lack of space

Source in, Island-refl. 28.34"
Inner Control at 17.50
Fuel water at 31.40

$1^{\underline{46}}$ Source out

Outer Control

13.94 — Approx Crit

$1^{\underline{48}}$ 14.10 6.1 div → 132.65 → 5.04 $\frac{7.88¢}{.18}$ = 43.8 ¢/ Pos Per

$2^{\underline{07}}$ 13.92 — level

Shut Down Insert Outer Control, Dump fuel H_2O

Corr't, Crit ~~pos~~, corrected for removal of T.C 14.19

Expt. 100 ×

Void Coef. with Target in + 24-½" OD Polystyrene tubes filled with air. All Al. tubes in target filled with air.

Source in, Safety out of Assembly
Inner Control at 17.50
Water: Island-refl = 28.22; Fuel = 32.00

Cont Next Page

Expt # 100 Cont 7-12-61

3:25 PM Outer Control
Source out — Approx crit

11.19" — " "

3:27 11.35 — 6.45 div → 140.2 s → 9.8 x 10^4 — Pos Per

3:45 11.18 — = 7.5 ¢ / .17 = 44.1 ¢/in — level

Shut Down Insert Outer Control, Dump fuel H_2O

~~Eff Crit pos corrected for ...~~ 11.45

7-13-61

Inst. check:

IC-1 Fast trip scrammed system

IC-1 meter " ok.

IC-2 " " "

IC-3 ~ 5x10^-11

IC-4 ~ 5x10^-11

PM-1 high & low trips ok.

Red light on, scram reset.

Expt 101

Recheck of previous rod positions

Source In, Inner Control = 17.50, Safety @ 28.28

Tol. Ref = 28.45 Fuel H_2O = 32.78.

9:11 Source out
outer Control

16.85 — Approx Crit

9:15 17.05 152 sec — 7.03 ¢ / .23 = 30.6 — Pos Per
14.82
.23

Cont Next Page

9:35 outer Control — Temp ~ 21.6°C

16.82 — level

Shut Down Insert Outer Control, Safety, And Dump fuel H_2O

Expt # 102 7-13-61

Removed Al Spacer from annulus between Inner and outer fuel annulus

Spacer is 0.051" thick & 25" high + 4 V shaped Spacers 25" Long

Source in, Inner control at 17.50

Safety up to 28.24, Is.-refl = 28.35

Fuel water.

10:37 Source out
outer Control

14.55 — Approx Crit

10:39 14.75 130 sec — 7.97 ¢ / .20 = 39.9 — Pos Per

14.55
.20 — Level

Shut Down Insert Outer Control, Safety And ~~Dump fuel H_2O~~

7-13-61

Expt 103

Foil Exposure radially with Al. spacer cylinder out

Source In, Safety at 28.28
Island-refl at 28.32, Fuel H_2O at 31.39
Inner Control at 17.50

11^{49} Source out
Outer Control

	14.63	Slightly Super
11^{51}	14.78	Pos Per
11$^{59.5-}$	Start timing foil Exposure on IC-2 $.3 \times 3 \times 10^{-9}$	level
12^{17}	14.58	
12$^{19.5-}$	Shut Down IC-2 $7.8 \times 3 \times 10^{-9}$	

Note Drop Safety, Insert Outer Control

7-13-61

Expt. 104

Target out as in Expt #9 & 10 but with thermocouples removed from fuel region. Control positions symmetrical.

Source In, Safety at 28.08
Island-refl. at 28.23", Fuel H_2O = 31.56
Inner control Preliminary position 18,80

2^{31} Source out

	Inner (Control)	Outer	
	18.80	18.56	Approx Crit
2^{40}	18.695-	18.695-	" "
2^{42}	18.695-	18.90	Pos Per
3^{03}	18.69	18.69	level

Shut Down Insert outer Control, Safety

~~Exp # 105~~ ~~7-13-61~~

7-14-61 Inst. Check

IC-1 Fast trip scrammed system
" Meter " ok
IC-2 " " "
IC-3 ~ 4×10^{-11}
IC-4 ~ 4×10^{-11}
PM-1 high and low trips ok.

12 25 Island Refl H_2O 13.77 to check Counters
Source in

Exp # 105 7-14-61
Purpose: Fission Counter traverse, And Flux Normalization

1 33 Source in Inst Response ok
Island Refl H_2O 28.52". fuel H_2O 31.23"
INner Control 18.70"
Safety 17.00"

1 52 Source out
Outer Control
18.96
1 59 18.85
2 00 19.05
2 05 18.33 Reduce Power level
2 42 18.54
Shut Down to Move Counter ~~U-233~~ (BF3)
INsert Outer Control, Safety

Super Crit Approx level Pos Per Neg

C-4 Miniature Counter BF_3 placed at ¼ and at center of island L.A = 16 × 0.5 μs PHS = 3.0 HV = 1600 Y-100370 in C3
C-3 Traversing F.C. ×16 × 0.2 μs PHS = 3.0
U^{233} Min Counter ×32 × 0.2 μs PHS = 5
C-1 U^{233} between fuel annuli at mid plane

Cont Time	U^{233}	Pos	F.C.	BF_3		IC-2
5'	2510	5.00	4 × 256 + 125	1608 × 256 + 239		.32 × 3 × 10^{-11}
5'	10730	5.00	4 × 256 + 88	1602	+17	.22 × 3 × 10^{-11}
5'	1210	5.00	5 × 256 + 55	1828	+183	.24 × 3 × 10^{-11}
	1250	5.00	4 × 256 + 217	1878	159	.25
	1290	5.00	5 × 256 102	1884	+ 61	.25
	3750 × 5/3		22 + 2,293	8800	2.57	

$\frac{6250}{256} = 24.41$ $\frac{F.C}{BF_3} = 0.002760$

$\frac{BF_3}{F.C} = 362.35$

Exp # 106 Counts

5'	20700	5.00	103	+ 3	1452	+220	.50 × 3 × 10^{-10}
5'	21650	5.00	105	+50	1490	37	.51 × 3 × 10^{-10}
5'	20410	5.00	101	+ 16	1436	+84	.49
5'	19810	5.00	98	+ 110	1380	134	.48
	20643 / 256	= 80.63	407	+ 0.70	5258	+ 1.85 r	

$\frac{BF_3}{F.C} = 14.13$ 25.6 r

or 0.0390

Exp # 106 7-14-61

Purpose: Fission Counter traverse AND Flux Normalization with BF3 Counter in Contact With Be (outside) Vertical Center line

3^00 PM Source in
Inner Control 18.70" Safety 27.01"
Island Refl H_2O 28.41" Fuel H_2O 31.24"

3^12 Source out
outer Control
19.05

		Pos	Pen
3^23	18.85	$.47 \times 3 \times 10^{-10}$ JC-2	Approx level
3^54	18.81	$.45 \times 3 \times 10^{-10}$	level
3^55	18.91		Pos Pen
4^17	18.84		near level

4^22 Shut down Start Data, drain Fuel H_2O

July 17, 1961

9^00 AM Found limit of counter travel @ 23.68
reset to 24.08 on selsyn, change of 0.4 in.

	C_1 U^{233}		C_3 Fiss Count Pos	Count	C_4 BF^3	
5'	18770	8.00	17+233	4585 .244	1327 +147	
5'	28940	11.00	5+244	.0527	2050 + 5	
5'	63380	14.00	3+152		920 —	.0145
5'	186780	18.00	1+210		466 —	.00249
5'	575250	19.00	8+18		1042 —	.00181
5'	926390	20.00	4+171		1195 —	.00129

Level $.45 \times 3 \times 10^{-10}$ + Period

185000 c/m

3100 c/sec if $\tau = 10$ μsec $\therefore \tau N = .03$

Last Check on July 17

IC-1	MTR TRIP OK	
-1	Fast " OK	
2	MTR TRIP Aux and Safety OK	
3	5×10^{-11}	
4	6×10^{-11}	
PM 1	TRIP HI OK	
1	TRIP LO OK	
2	<1 μa response	

Expt 107

PURPOSE: REPEAT #106 COUNTING RATIOS.

Source In, Scrams Reset

Safety at 27.01, Inner Control at 18.70

Isl and-refl. 28.53, Fuel Water 32.95

10[00] AM Source Out + Period Inner 18.70 Outer 18.91

MIN.	U^{233} between Fuel Annuli @ ℄	32×1	0.2μs, —,	PHS = 5
MIN	BF_3 outside Beryllium	16×1	0.8μs ←	PHS = 20
	Fission Counter (Tower) Movable	16×1	0.2μs +	PHS = 30

System Level with Outer Control at 18.77

	U^{233}	Mov. U^{235} Counts	$\frac{U^{235}}{U^{233}}$	BF_3	$\frac{BF_3}{U^{233}}$
5'	2460	5.00	179 x 256 + 141 45965	18.68	147 x 256 + 193	15.38
5'	6940	8.00	17308 67x + 156	2.49	112 477 439 x + 93	16.21
5'	15620	11.00	14012 54 + 188	.897	262 586 1025 + 186	16.81
5'	33410	14.00	7495 29 + 71	.224	—	
5'	70050	17.00	2543 9 + 239	.036	—	
5'	154070	20.00	3090 12 + 18	.020	1891	Ic-2 Mult .35 x 10x10^{-9}
5'	375640	24.00	1781 6 + 245	.0047	1864	
5'	231370	22.00	2055 8 + 7	.0089		
5'	100860	18.00	3755 14 + 171	.0372		
5'	44250	14.00	5438 21 + 62	.123		
	20550	10.00	61 + 61			
		7.00				

Movable Fission counter stopped counting!
ERR investigating. Found cable to preamp snagged! also found 15 pin connector loose & Limit at 23.78
Shut down with Safety & Outer Control

Reset Allsyn for limit of 4.84 ↔ 34.08
ran up and down 3X

ERR replaced L.A on C-3 (Mov Fiss Counter)

7-17-61 Expt 108

Repeat of Fis. Ctr. traverse in Bottom refl.

Source in, Safety up to 27.60
15-refl 28.39, Fuel/H2O 32.80
Inner control at 18.70
Slightly super at 18.90 on outer control
Outer C. at 18.78 Level

Shut down with Safety, Fuel water & Outer control

5' Counts

IC-2	U^{233}	Pos	Scaler $\times 256$	Counts	Scaler $\times 256$			
6.1×10^{-11}	1.9090 $^{6.71}$	5.00	640 +1.9	163859	573 +101	146 789	18.03	16.15
$.42 \times 3 \times 10^{-10}$	17910 $^{7.04}$	8.00	180 +134	46214	1185 +28	303 388	2.58	16.93
2.8×10^{-10}	38540 $^{7.24}$	11.00	130 +225	33505	—		0.869	
5.5×10^{-10}	77420 $^{7.10}$	14.00	64 +228	16612	—		0.215	
$.38 \times 3 \times 10^{-9}$	156600	17.00	24 + 1	6145	—		0.0392	
$.72 \times 3 \times 10^{-9}$	315900	20,00	13 +103	3431	—		0.0109	
4.4×10^{-9}	640130	24.00	7 +148	1940	—		0.00303	
3.2×10^{-9}	481900	22.00	11 +204	3020			0.00627	
	204040	18.06	32 +17	8209			0.0402	
	87190	14.00	76 +109	19565			0.224	
	37370	10.00	215 +65	55105			1.475	
	17080	7.00	447 +155	114587			6.71	
	8450	5.00	595 +207	152527			18.05	
		4.84 ↓						
	8370	5.00	449 +74	115018			13.74	
✓		5.5 ↓						
	6690	5.0	450 +89	115289			17.23	

7-18-61

Inst. Check

IC-1 Fast trip scrammed skipped
" Meter " ok
IC-2 " " "
IC-3 ~ 4×10^{-11}
IC-4 ~ 6×10^{-11}
PM-1 high & low trips ok.
scram reset.

Expt 109

7-18-61 To provide neutron source for inst Check-out

Source in, Inner control 18.70
safety 27.15 Inland-exp 28.~~78~~ 5.4
Fuel H_2O = 31.2
outer control 18.82 level

Shut down with safety outer control & Fuel water.

ERR finds no reason for erratic counts recommends changing settings on Small U^{233} counter. P.D.L Knob fixed.

Inst Check on 7-19-61

IC-1 Fast Trip OK
-1 Meter Trip OK Scrammed Safety & drain H_2O.
-2 Meter Trip OK
-3 6 x 10-11 } Calibration OK
-4 5 x 10-11 }
PM-1 Hi
-1 Lo

PM-2 < 1 μa Response.

EXP #110

PURPOSE: Counter Normalization (Repeat) and Traverse of Tower F.C.

Source In, Inner @ 18.70 Outer 999.82, Refl Rel → 28.44 Fuel H_2O → 32.4

9[25]	out	18.70	19.15	Pos Per.
9[34]	"	"	18.83	~ Level
9[50]	"	"	18.82	Level
	"	"	18.90	for traverse outward
	"	"	18.79	" Part of inward Trav.
11[27]	"	"	to 18.73	" 12" downward
12[08]	"	"	18.81 to 18.76	
12[22]			to 18.81	

Note ~12[33] Shut down by scramming reactor

2[30] Noted that H_2O not completely drained level at ~28.5, concluded that the reset button was pushed too soon and stopped draining after ~4 in. were drained. Dwn

EXP #110

TOWER F.C.

Traverse -

5" — 24"

C-1	Y-119060	x16	0.8μs − 20	U^{233}
3	123800	x16	0.2μs + 30	U^{235}
4	119059	x16	0.8μs − 20	BF_3

U^{235}

	U^{233}	MOVING U^{235}			BF_3		$\frac{U^{235}}{U^{23}}$	$\frac{BF_3}{U^{233}}$
IC-2		Pos	x256	INT Counts	x256 + INT	Counts	av 18.77	
6.6×10^{-11}	9440	5.00	674	+168 172712	632 + 44		18.30	17.14
6.7×10^{-11}	9370	"	681	+132 174468	647 +23	165655	18.62	17.68
6.7×10^{-11}	9160	"	681	+103 174439	646 +226		19.04	18.08
6.8×10^{-11}	9210	"	685	+ 33 175393	650 + 55	166455	19.04	18.07
"	9420	"	686	+107 175723	656 + 56	167992	18.65	17.83
~~$5 \times 3 \times 10^{-11}$~~	13780	7.00	373	+104 95592	983 + 65	251713	6.94	18.27
$65 \times 3 \times 10^{-11}$	25990	9.00	262	+144 67216	1889 + 49	483633	2.59	18.61
	45690	11.00	168	+79 43087	—		.943	
	78060	12.99	112	+ 1 28673			.367	
	135040	15.00	80	+224 20704			.153	
$5 \times 3 \times 10^{-9}$	225000	17.00	56	+88 14524			.0646	
	368310	19.00	28	+15 7183				
+ →	657230	21.00	37	+83 9555			.0445	
−	288250	24.00	15	+71 3911			.00496	
-	723160	22.00	29	+121 7545			.0104	
	673230	20.00	53	+303			.0205	
	620550	18.00	104	+148 26772			.0431	
	571270	16.00	218	+214 56022			.0981	
18.79	527680	14.00	480	+120 123000			.233	
18.73	372270	12.00	842	+255 215807			.580	
	224400	10.00	1365	+152 349592			1.558	
	58540	8.00	987	+113 252785			4.318	
	24250	6.00	1116	+31 285727			11.78	
21 30	18230	5.00	1351	+65 345921			18.98	
90	18890	"	112	+61 28733			1.52	
80	19580	"	175	+210 45080			2.30	
76 70	16990	"	207	+225 53217			3.13	
5.0	13160	"	376	+ 12 96268			7.32	
881 20	12500	"	1062	+129 272001			21.76	
15	12760	"	1155	+159 295839			23.18	
40	15800	"	770	+179 197299			12.49	
60	20880	"	388	+46 99374			4.76	

July 19, 1961

Foils T-3

1	Beryllium Contact
2	2" from Be
3	4"
4	In T-2 cartridge 4 — A-37
5	6" from Be
6	Center of Island on 52
7	5" from fuel

For foil normalization!

Inst Check for July 20, 1961

IC-1 Fast Trip OK
-1 Mtr " "
-2 Mtr " "
-3 4 x 10⁻¹¹ } Calibrated DWN/
-4 8 x 10⁻¹¹ }
PM1 Hi Trip OK
Lo " "
PM 2 < 1/μa reqd Scram H₂O and Safety.

EXP #111

PURPOSE: FOIL IRRADIATION FOR FLUX NORMALIZATION

Foil locations are given above.

Safety = 28.13

Source In, Rfl. Sol = 28.5, Outer to 18.70, Fuel H_2O to 32.4

(Rfl-Sol H_2O to 30.0+, no evidence of filled thimbles for inst, drained imm to 28.5)

Source out Outer to 19.17 on Positive Period

108.6 sec → 9.38/44 = 21.3 ¢/in

Outer $\frac{1}{2}$ = 19.25 − 18.81 = .44

9:09:45 Start timing foil Exp. Run @ .3 x 10 x 10^{-9}

9:19 Outer 18.81 5 level at .8 x 10 x 10^{-9}

9:29:45 Drop Safety, lower Outer

Instrument Check on July 31 1961 Source 10 mc 8

PM-1 OFF SCALE Low Trip OK Alarm Trip OK
PM-2 <1/μa response source in contact Alarm Trip
IC-1 10 x 10⁻¹² Scale Meter Trip OK Fast Trip OK
IC-2 10 x 10⁻¹² Meter Trip OK Scrammed safety & Moderator drain.
IC-3 5 x 10⁻¹¹ Calibration
IC-4 6 x 10⁻¹¹ Calibration
CRM Meter Trip

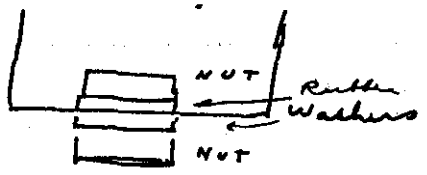
Preliminary Check on 7-31-61

Room 113 Pressure Differential 0.5 in H_2O Good
Red Light On and Personnel Check ✓ C.C
Scrams and Bldg. Alarm Reset ✓ C.C
Source Inserted Use Accelerator for source
Safety Withdrawn 28.10
Controls Set Inner 17.50 Outer 99.82
Reflector Water 28.55
Moderator Water 33.40

EXP # 112

3⁰⁸ Accelerator Source off
Outer Control
11.54" Approx level
3¹⁸ 11.63 Pos Per
3⁴⁸ 11.54 Very unstable Shut Down to ~~investigate~~ investigate
Insert outer control, Safety, Dump fuel H_2O
4⁰⁰ PM Found leak in target, loose Nut on Bottom of Rod (~1/2 liter of H_2O poured from can surrounding target assembly.
Positive period was not stable, showing an increase in reactivity with time.

Before #112, a can to surround the target and keep it dry was fabricated 4.75" OD from .040 (Meas. .042 wall alum, a hole in the bottom of the can for the target rod was to be sealed with rubber and nuts. ~~Nuts for~~ threads were ground to reduce leakage there.
Plastic for the top reflector a right was not yet available.



/

Aug 1, 1961

Upon inserting target in assembly, thread was stripped.

Instrument Check on Aug 1, 61 Source 10 mc C

PM-1	OFF SCALE	Low Trip OK	Alarm Trip Ran Below Test
PM-2	10×10^{-12}	No Response	Alarm Trip
IC-1	10×10^{-12}	Meter Trip OK	Fast Trip OK
IC-2	10×10^{-12}	Meter Trip OK	
IC-3	5×10^{-11}	Calibration	
IC-4	5×10^{-4}	Calibration	
CRM		Meter Trip	

Preliminary Check on 8-1-61

Room 113 Pressure Differential 0.5" C.C.

Red Light On and Personnel Check ✓ C.C.

Screams and Bldg. Alarm Reset ✓ C.C.

Source Inserted Use Accelerator for Source

Safety Withdrawn 28.10"

Controls Set Inner 17.50, Outer 999.81

Reflector Water 28.54"

Moderator Water 32.54"

Exp# 113

Purpose: Positive Period to check counter saturation before going up.

11[10] Inner Control Moved to 22.00"

Accelerator off

Outer Control

	16.11	Approx Crit
11[13]	16.25	Pos Per
12[07]	16.15	$3.25¢/0.10 = 32.5¢/in$ level

Shut Down Insert Outer Control, Safely

Aug 1, 1961

Printing scalers indicated approx 10% losses at 5,000,000 counts in 0.9 min. This reduces to ~1% losses at 10^4 cps. This was on Li I + DD-2 and on BF_3 + 0.2 RS on 204-B L.A. DWH

When starting positive period at 5×10^{-12}, there is evidence of source in room.

Exp II 114 – PN-90

1 12/PM Inner Control 22.00"

Safety 28.10"

Island Refl H_2O 27.97 Fuel H_2O 32.51"

Use Accelerator for Source

"Note" M-43 Source Removed from Assembly and Put in Corridor Source well on Long Rod

Inner	Outer	Crit at	Rfl H_2O	Fuel H_2O	Safety
22.00	999.82	16.15	27.95	32.51	28.10

Neutron Target Source in Radial Beam hole 130 kv

200 μs 100 cps 256 Ch. 20 μs wide Bkg x 16 Delay x 2

Total number of pulses X, 10^5

Li I 6292 @ 800 V

DD-2 Amp X 1.1 X 5 PHS @ 750

IC-3 5×10^{-12} IC-2 9.7×10^{-11}

IC-4 1.9×10^{-11}

Exp# 115 PN-91

Inner 22.00

Outer 8.15 (16.15 @ Crit)

No changes on accelerator TMC

IC-2 = 3.1×10^{-11} IC-3 = 8.5×10^{-12} IC-4 = 2.5×10^{-11}

2:50 PM Start Pulsing for 260000 pulses

3:31 PM Stop "

W.O. target

Exp # 116 PN-92

Inner 22.00

Outer 12.15 (16.15 @ Crit) (L.I)

200 μs, 40 cps, 40 μs Ch Dly ×16 Delay ×2

IC-2 = 1.3×10^{-11} IC-3 = 6.5×10^{-12} IC-4 1.5×10^{-11}

Pulsed for 1.3×10^5 cycles @ 40 cps

W.O. target

Instrument Check on Aug 2, 61 Source 10 mc Ra

PM-1	off Scale	Low Trip OK - Scram	Alarm Trip
PM-2	X		Alarm Trip
IC-1	$>10 \times 10^{-12}$	OK	OK
IC-2	$>10 \times 10^{-12}$	OK	
IC-3	5×10^{-11}	Calib OK	
IC-4	5×10^{-11}	Calib OK	
CRM		Meter Trip	

Door C.C.

Preliminary Check on 8-2-61

Room 113 Pressure Differential 0.05" C.C.

Red Light On and Personnel Check ~ C.C.

Scrams and Bldg. Alarm Reset ~ C.C.

Source Inserted Use Accelerator for Source

Safety Rod 28.10

Controls Set Inner 22.0" Outer 999.82

Reflector Water 28.58"

Moderator Water 32.49"

Exp #117 - PN-93

Accelerator @ 130 kv - 100 RPS 200 μs Burst

Disc @ 4

TMC Adg x16 Delay x2 Ch W 20 μs 256 Ch, 2'6 Preset Count

Detector Li I @ 800 v DD-2 x1.1 x5 PHS 750

(Data discarded. Discovered a gain shift in Pulse Height) IC-2 @ 3.1×10^{-11}

Detector Li I @ 800 v DD-2 x 0.8 x10 PHS = 750

Gain adjusted so that neutron pulses between 80 - 100 v on Oscope

IC-2 @ 2.6×10^{-11}

Inner @ 22.00 Outer @ 5.15 Safety 28.10

Fuel H_2O 32.4 Refl. H_2O 28.07

Aug 2, 1961
EXP #118 — PN-94

Inner 22.00 Safety @ 28.10
Outer 10.15 Fuel 32.40 Refl 28.08

Accelerator @ 130 kv 200 μs @ 100 RPS
TMC 20 μs Ch Bkg x8 Delay x2 Disc 4
2^{16} preset count.
Det. LiI @ 800v DD-2, 0.8 x 10 PHS @ 750
Pulse height on scope 80-100 volts.
Ic-2 = 2.75×10^{-11}
Ic-3 = 8.00×10^{-12}
Ic-4 = 3.0×10^{-11}

W.O Target

EXP #119 PN-95

Inner 22.00 Safety 28.10
Outer 14.15 Fuel H_2O 32.40 Refl 28.04
Accelerator @ 136 kv 200 μs @ 100 PPS
TMC 40 μs Ch Bkg x4 Delay x2 Disc 4
LiI @ 800v DD-2 0.8 x 10 PHS @ 750
Scope P.H. 80-100 Volts.

W.O Target

Aug 2, 1961

PN-96 EXP # 120

Same as EXP # 119 except 80μsec ch and lower Rep Rate

Inner 22.00 Safety 28.10
Outer 14.15 Fuel H_2O 32.78 Refl. 28.02

Accelerator 130kv 200μs @ ~~100~~ 25 RPS

TMC @ 80μs ch. Bkg x8 Delay x2 Disc 4

L:I @ 800V @292 DD-2 @ x0.8 x10 PHS@ 750

PHon scope 80-100 V. W.O. Target

PN-97 EXP # 110

Inner 22.00 Safety 28.10

Outer 15.15 Fuel & Refl H_2O Unchanged

Accelerator @130 kv 200μs @ 10 RPS

TMC @ 80μs Ch Bkg x8, Delay x2, DISC @ 4

Det L:I 6292 @ 800 v (80-100 PA on scope)

DD-2 x0.8 x10 PHS @ 750 W.O. Target

H 10 Shut Down Insert Outer Control, Safety, And Dump fuel H_2O

Instrument Check on Aug 3, 1961 Source 10 mc γ

PM-1 OFF SCALE Low Trip OK Alarm Trip OK
PM-2 No Response Alarm Trip
IC-1 >10x10⁻¹² Meter Trip OK Fast Trip OK Scrammed OK
IC-2 >10x10⁻¹² Meter Trip OK
IC-3 ~5x10⁻¹¹ Calib. Down
IC-4 ~5x10⁻¹¹ Calib Down.
CRM

Preliminary Check on Aug 3, 1961
From 115 Pressure Differential Down
Red Light On and Personnel C.C
Scrams and ✓
Source Use Accelerator for Source
Safety Withdrawn 28.10"
Controls Set Inner 17.50" outer 999.81
Reflector Water Selsyn zero OK 28.57"
Moderator Water " " " 32.64"

Experiment #111 P
Target Inserted — Critical Run before pulsing for rod calibration.

9:20 Accelerator off
9:31 Outer Control 17.04 Approx level
Inner 17.50
9:36 outer 17.20 IC-3 =1.25x10⁻¹¹ Approx level
Inner 17.41
Insert Safety to make Reactor sub crit

EXP # 112 Pulsing with safety Inserted
PN-98 target Inserted. Inner 17.41 outer 17.20
Acc 150 kv 200 μs Burst 150 cps Rep Rate, TMC 10 μs channels
Amp x64 Delay x16 Disc x4 LiI 6292 @ 800 v. DD-2 750 (90-100 volt)
x0.8 x10. PHS 750

EXP # 113 PN-99 Safety Removed Outer = 00.00
Inner = 17.41

Outer Control fully inserted Safety removed to 28.10.
Inner at 17.41, the value when crit. was determ at 17.20
on the Outer. (Outer Crit = 17.20)
Accelerator @ 130 kv, 200 μs burst, 110 cps rep rate
TMC 20 μs Ch Bkg x 32 Delay x2 Disc x4
Det L:I, 6292 @ 800v DD-2 x 0.8 x10 PHS = 750 (80-100v)
Accelerator tripped ?? and there are two channels of data that must be eliminated! 75 and 149
IC-3 5×10^{-12} IC-4 1.9×10^{-11}
IC-2 = $1 \times 3 \times 10^{-10}$

EXP # 114 PN-100 Safety @ 28.10 Outer @ 6.20
(Outer at Crit ≠ 17.20) Inner @ 17.41
IC-2 = 2.5×10^{-11} IC-3 = 5×10^{-12} IC-4 = 1.8×10^{-11}
Acc 130 kv, 200 μs burst 110 cps Rep Rate
TMC 20 μs Bkg x16 Delay x2 Disc x4
Det. L:I 6292 @ 800V DD2 x0.8 x10 PHS = 750, (80-100 pulses)

EXP # 115 PN-101 Safety @ 28.10 Outer 10.20 Inner 17.41
IC-2 = 2.2×10^{-11} 6.5×10^{-12} 2.0×10^{-9}

Acc @ 130 kv, 200 μs burst 100 cps Rep Rate TMC 20 μs x16 Delay x2
Det L:I 6292 @ 800V DD-2 x0.8 x10 PHS = 750 (80-100 pulses)

750 volts

Exp # 116 PN-102 Inner 17.41 Outer 14.20 (Crit @ 17.20)
Safety 28.10 Refl H_2O 28.31 Fuel Mod H_2O 32.62
IC-2 = 1.4×10^{-11}, IC-3 0.95×10^{-11} IC-4 = 2.4×10^{-11}
Acc @ 130 kv 200 μs Burst 50 cps Rep Rate TMC 40 μs Dkg x 8 Delay 2
Det L:I, 6292 @ 800 DD2 x 0.8 x 10 PHS = 750 (80-100 v pulse)

Exp # 117 PN-103 Inner 17.41 Outer 16.20 (Crit @ 17.20)
Safety 28.10 Refl H_2O 28.31 Fuel Mod H_2O 32.64
IC-2 = 1.9×10^{-11} 1×10^{-11} 1.9×10^{-11}
Acc @ 130 kv 200 μs Burst 20 cps TMC 80 μs Dkg x 4 Delay x 2 Disc 4
Det L;I 6292 @ 800 DD2 x 0.8 x 10 PHS = 750 (80-100 v. pulse)

Instrument Check on Aug 4, 61 Source 10 mc/s

PM-1	Recorder OFF Scale	Low Trip OK	Alarm Trip OK
PM-2	No Response		Alarm Trip
IC-1	$> 10 \times 10^{-12}$	Meter Trip OK	Fast Trip OK
IC-2	$> 10 \times 10^{-12}$	Meter Trip OK Scrammed	
IC-3	5×10^{-11}	Calibration	
IC-4	6×10^{-11}	Calibration	
CRM		Meter Trip	

Preliminary Check on Aug 4, 61

Room 113 Pressure Differential 0.05 in H_2O

Red Light On and Personnel Check C.C.

Scrams and Flig, Alarm Reset ✓ C.C.

Source Inserted Use Accelerator for Source

Safety Withdrawn 28.10"

Controls Set Inner 17.41 outer 999.81

Reflector Water 28.58"

Moderator Water 32.89"

After liq N_2 on accelerator pressure dropped to 5×10^{-6}

Exp # 118 PN-104 Outer at 00.00, Inner @ 17.41

(Same as PN-99) Acc 130 kev. 200 μs burst 150 cps

TMC 10 μs Channels, Bkg x16 Delay x2 Disc @ 4

Det LiI 6292 @ 800 v DD-2 @ 0.8 x 10 PHS = 750 (80–100 v Pwr)

Safety 28.10 Refl 27.88 Fuel 32.90

added two after PN-104

Exp 119 PN-105 Outer @ 00.00 Inner @ 22.00

Safety 28.10, Refl. 28.58 Fuel 32.90

Acc 130 kv 200 μs burst, 100 cps TMC 20 μs Bkg x16 Delay x2 Disc 4

Det LiI 6292 @ 800 v DD-2 @ 0.8 x 10 PHS = 750 (80-100 v)

EXP #120 PN-106 Outer @ 00.0
Inner @ 44.00

Note: Moving Inner control from 22.00 → 44.00 (Gray → white) decreased reactivity when Outer black section is in core!

Acc @ 130 kv 200 μs burst 100 cps TMC 20 μs Ch. Bkg x 32 Disc 4 Delay x2
Det L:I 6292 @ 800 v DD2 @ 0.8 x 10 PHS = 750 (80-100 v pulse)

Rad N_2 Gas OK

Exp. #121 PN-107 Outer @ 00.0 Inner 12.00
Disc 4 Delay x2
Acc @ 132 kv 200 μs Burst 160 cps Rep Rate TMC 10 μs, Bkg x 32
Det. L:I 6292 @ 800 v PHS @ 750 (80 v - 100 v pulse)

EXP #122 PN-108 Outer 00.0 Inner 00.05
Acc. @ 132 kv 200 μs Burst 300 cps TMC 10 μs Bkg x 32
Delay x 2 Mem = 1/2, Det. L:I 6292 @ 800 V DD-2
x 0.8 x 10 PHS = 750 (80 - 100 v)

EXP #123 PN-109 Outer 22.0 Inner 0.05
Acc @ 132 kv 200 μs Burst 150 cps TMC 10 μs Bkg x 32
Delay x 2 Mem 1/1 Det L:I 6292, 800 v DD-2 0.8 x 10
PHS = 750 (80-100 v pulse)

Aug 7, 1961 6.3×10^{-6} mm Hg w.o. Liq. N_2
5.0×10^{-7} mm Hg w. Liq N_2

Instrument Check on Aug 7, 61 Source 10 mc / 8

PM-1	Low Trip OK	Alarm Trip OK
PM-2	No Response	
IC-1	2.0×10^{-12}	OK
IC-2	2.0×10^{-12}	OK
IC-3	5×10^{-11}	OK
IC-4	6×10^{-11}	Calibration OK
CRM		Meter Trip

Preliminary Check on Aug 7, 1961

Room 113 Pressure Differential .06"
Red Light On and Personnel Check C.P
Scrams and Bldg. Alarm Reset ✓ C.C.
Source Inserted Use Accelerator for Source
Safety Withdrawn 28.10
Controls Set Inner .05" Outer 43.95"
Reflector Water 28.46"
Moderator Water 32.46"

Exp #124 — PN-110 Outer 43.95, Inner @ 00.05
Safety 28.10 Rfle H_2O 28.43, Mod. Fuel H_2O 32.50
Acc 135 kv 200 μs Burst 150 cps Rep Rate
TMC 10 μs Ch, Bkg x 32 Delay x2 Disc 4 Mem 1/1.
Det L:I 6292 @ 800 v DD2 Gain x 0.85 x 10 PHS 750 (80-100 v. pulse)
Acc. Tripped 2 x, one channel in TMC dropped to zero on last trip.

10 Lower both cylinders with Acc. Source on.
Put Min BF_3 Counter on DD-2 amp.

Exp #125 PN-111 Inner @ 44.00 Outer = 00.00
Acc 132 kv. 200μs 150 cps
TMC 4μs Ch, Bkg x32, Delay x 2 Disc 4
Det. Min BF_3 @ 1700v DD-2 @ 1.1 x 200 PHS = 450
(Pulse ~40-100V) LiI Removed

Exp #126 PN-112 Inner @22.00 Outer = 00.00
Acc 135 kv 200μs 150 cps Beam Def 200 S.F = 55
TMC Ch. 4μs Bkg x16, Delay x2 Disc = 4
Det Min BF_3 @1700v DD-2 @ 1.1 x 200 PHS = 450
(Pulse 40 - 100 v)

Exp #127 PN-113 Inner 12.00 Outer = 00.0
Acc 135 kv 200μs 150 cps D.Deff. 200 S.F = 55
TMC Ch W. 4μs Bkg x32 Delay x 2 Disc = 4
Det Min BF_3 @1700v DD-2 @ 1.1 x 200 PHS = 450
(Pulse 40 - 100 v)

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added liq. N_2 M.D Section of Inner control is magnetic!

Exp #127 PN-114 Inner 00.05 Outer 00.00
Acc. 135 kv 200μs 300 cps B.D. 200 SF 55
TMC Ch 4μs Bkg x32 Delay x2 Disc = 4 Mem 1/2
Det Min BF_3 @1700 v. DD-2 @ 1.1 x 200 PHS = 450
Pulse (40-100 v) IC-2 = 2.7×10^{-10}.
Target current ~ 3μa $\frac{200}{3333}$ = 6% Duty Cycle

Exp #128 PN-115 Inner 00.05 Outer 00.00
Acc 135 kv 1.1 ma $\frac{50}{333}$ μs 300 cps B.D. 200
SF 55 Target 3μa $\frac{50}{3330}$ = 1.5% Duty Cycle
TMC Ch. 4μs Bkg x 32 Delay x 2 Disc 4 Mem 1/2
Det Min. BF_3 @ 1700 v DD-2 @ 1.1 x 200 PHS = 450

4[21] Shut Down Insert Safety, Dump fuel H_2O

Instrument Check on Aug 8, 61 Source 10 mc/s

PM-1	off Scale	Low Trip OK	Alarm Trip OK
PM-2	No Response		Alarm Trip
IC-1	$>10\times10^{-12}$	Meter Trip OK	Fast Trip OK
IC-2	$>10\times10^{-12}$	Meter Trip OK Scrammed	
IC-3	5×10^{-11}	Calibration	
IC-4	6×10^{-11}	Calibration	
CRM		Meter Trip	

Preliminary Check on Aug 8, 61

Room 113 Pressure Differential 0.05 in H_2O Dwn
Red Light On and Personnel Check CC & Dwn
Screams and Bldg. Alarm Reset ✓ CC.
Source Inserted Use Accelerator for Source
Safety Withdrawn 28.0"
Controls Set INNer 6.0" Outer 6.0"
Reflector Water 28.61"
Moderator Water 32.86

CC and Dwn

Exp #129 PN-~~115~~ 116 Inner = Outer = 6.00 in.
Acc. 135kv 1.0 ma 100μs burst @ 300 cps 4½ μa Target
TMC 10μs Bkg x32, Delay x2 Disc @ 4 Mem 1/2
Det Min BF_3 counts @ 1700 v DD-2 1.1 x 200 PHS 450
(40-100 v pulses) IC-2 = .2×5× x 3 x 10^{-9}

EXP 130 PN-117 Inner = Outer = 10.00 in.
Acc 135kv 0.85 ma <2 μa target 150μs burst @ 150 cps
TMC 10μs Bkg x32 Delay x2 Disc @ 4 Mem 1/1
Det Min BF_3 @ 1700 v DD2 1.1 x 200 PHS 450
IC-2 = 4.0 x 10^{-10}
Inadvertantly cleared cycles after acc kicked off.

Exp 131 PN-118 Inner = 0 Outer = 14.00
Acc 135 kv 0.78 ma 1 μa target 200μs 150 cps
TMC Ch 10μs Bkg x16 Delay x2 Disc 4 Mem 1/1
Det Min BF_3 @ 1700 v DD2 @ 1.1 x 200 PHS = 450
IC-2 = 3.35×10^{-10}

Exp # 132 PN-119 Inner = Outer = 16.0"
Acc 135 Kv 0.74 ma 200μs 50 cps
TMC Ch 40μs Bkg 8 Delay x 2 Disc 4 Mem 1/1

Exp #133 PN-120 Inner = Outer = 17.0"
Acc 135kv 0.70 ma Target < 1 μa 200μs 30 cps
TMC Ch 80μs Bkg 4 Delay x2 Disc 4 Mem 1/1
Det Min BF_3 @ 1700 v DD-2 @ 1.1 x 200 PHS = 450
IC-2 = 4.1×10^{-10}

4 18 PM Shut Down Insert Outer Control, Safety And Dump fuel H_2O

Instrument Check on Aug 9, 61 Source 10 mc 8

PM-1		Low Trip	350 x 1 [Side 1/4"]	Alarm Trip	Trip OK Source IN To No Trip on side
PM-2	No Check			Alarm Trip	
IC-1	$>10 \times 10^{-12}$	Meter Trip	OK Screened	Test 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 Aug 9, 61

Room 113 Pressure Differential 0.06"
Red Light On and Personnel Check ✓ C.C.
Screams and Bldg. Alarm Reset ✓ C.C.
Source Inserted Use Accelerator for Source
Safety Withdrawn 20.58" Changed to 28.80"
Controls Set INNER 17.30" Outer 2.0"
Reflector Water 28.77"
Moderator Water 32.52"

Note: New instrument installed for PM-1 ! 750 v.
Condenser installed in Philips gauge on Acc.
Exp #134

Purpose crit pos of controls with counts U^{233} and BF_3 in core.

	Inner	Outer	Safety	Fuel Mod. H_2O	Refl H_2O	
14c	17.33	17.33	28.10	32.53	28.61	Crit
	17.488	17.488	20.58	32.53	28.63	Crit

Exp #135 RN-121
Pulsing at Critical Inner = Outer = 17.488
Safety @ 20.59, Insert safety to ~15.0
to reduce neutron level, pulse for
500 cycles and repeat
Acc 135kv 320μs 40 cps
TMC Ch 80μs Bkg x8 Delay x2 Disc 4 Mem 1/1
Det Min BF_3 @ 1700 v DD-2 @ 1.1 x 200 PHS = 450
Pulse ~(40-100 v)
System critical at end of run, level for 5'
4 23/PM Shut Down Insert Outer Control, Safety.
Dump fuel H_2O.

Instrument Check on Aug 10 61 Source 10 mc δ

PM-1 350 Low Trip 2" Alarm Trip Contact

PM-2

IC-1 7/6 X10⁻¹² Meter T OK Scram OK

IC-2 7/10 X10⁻¹² Me OK

IC-3 5X10⁻¹¹ Calibrat Duran

IC-4 5X10⁻¹¹ Calibration Duran

CRM Meter Trip

Preliminary Check on Aug 10, 1961

Room 113 Pressure Differential 0.05" H₂O DWM

Red Light On and Personnel Check 9:00 AM C.C.

Scrams and Bldg. Alarm Reset ✓ C.C.

Source Inserted Use Accelerator Source

Safety Withdrawn 20.59"

Controls Set INNer 17.488" Outer 999.81

Reflector Water 28.75"

Moderator Water 32.70"

EXP 136 PN-122

Critical at 17.49 on both Safety 20.59"

Pulsing at crit; inserting safety to 15.0, withdraw to 20.59
200 pulses between shutdowns.

Acc 135 kv S.F=65 0.66ma 640μs 20cps

TMC Ch 160μs Bkg x8 Delay X2 Disc 4 Mem 1/1

Det Min BF_3 @ 1725 v DD2 1.1 X200 PHS = 450 (40-1000 v)

Start @ 10⁰⁷ approx 1 cycle/min of 200 pulses

	INNer	Outer	Safety	Island H_2O	fuel	
12⁵⁹	17.49	17.49	20.595	28.58	32.66	Crit

Shut Down Insert Safety

EXP 137 PN-123

Inner = Outer = 17.33 Safety Inserted to 998.28 (worth of Safety)

Acc 135 kv 0.82 ma 1½μa Target 100μs 330 cps

TMC Ch. 10μs Bkg X32 Delay X2 Disc 4 Mem ½

Det Min BF_3 @ 1726 v DD2 1.1X200 PHS 450 (40-1000 v)

[Approx. Refl. 28.74 Fuel 33.02]

8-10-61

EXP #138

	INNer	outer	Safety	Refl H_2O	Mod H_2O	
2¹⁵	22.00"	999.81"	28.10	28.74	33.02	
	"	13.43	"	"	"	Crit

INSert Safety for Pulsing

EXP #139 PN-124

Inner 22.00 Outer 13.43 Safety 28.10

(Worth of Safety for controls asymmetric

Acc 135 kv 0.82 ma ~1.4 μa Press 1.8×10^{-5}

S.F. 66 B.D. 200 (5KV) 100 μs, 170 cps

TMC Ch 10 μs Bkg X 32 Delay X2 Disc. 4 Mem 1/1.

Det Min BF_3 @ 1725 v DD2 1.1X200 PHS 450 (40-1000 v)

EXP #139 PN-125

100 cps repetition rate (everything else same as PN-124

4²⁷ Shut Down INSert Outer Control, Dump fuel H_2O

Instrument Check on Aug 11, 1961 Source 10 mc Ra

PM-1	350	Zero 347 Low Trip 2" scrammed	Alarm Trip	O/C	
PM-2	—		Alarm Trip		
IC-1	$>10 \times 10^{-12}$	Meter T	O/C	Trip	O/K
IC-2	$>10 \times 10^{-12}$		O/C		
IC-3	5×10^{-12}		Dwn		
IC-4	5×10^{-12}	Calibration	Dwn		
CRM		Meter Trip			

Preliminary Check on Aug 11, 1961

Room 113 Pressure Differential 0.07"

Red Light On and Personnel Check ✓ C.C.

Scrams and Bldg. Alarm Reset ✓ C.C.

Source Inserted USC Accelerator

Safety Withdrawn 20.59"

Controls Set Inner 22.0" Outer 999.81

Reflector Water 28.60"

Moderator Water 32.46"

EXP #140 Purpose: Determine critical position prior to pulsing with inner at 22.00 (assumed critical position) and safety at 20.59

Inner	Outer	Safety	Mod Fwd	Refl.
22.00	13.68$_6$	20.59	32.47	28.44

EXP 14 # PN-126

Pulsing at critical, Inner 22.00 Outer 13.686

Safety 20.59

Acc 135 kev ma μa target.

640 μs burst at 20 cps, 200 cycles between shut down.

TMC Ch 150 μs Bkg 8 Delay x2 Disc 4 Mon 1/1

Det. Min BF_3 @ 1725 DD-2 x1.1 x200 PHS 450

Recheck Crit Outer 13.686

12^40 Shut Down Insert Outer Control, Safety and Dump fuel H_2O

Aug 11, 1961

#2 standard cut in half } all sent to
0-16-3 " " " } Blosser.

Results from Blosser

0-16	34.36	U	
III	35.05	U	Counting
	69.41	xU	$\frac{65.89}{.9314} = 70.74$ Total U
#2	57.02		
#2	61.20		
	118.22		weighed 115.1

Instrument Check on Aug 14, 1961 **Source** 10 mc γ

PM-1		Low Trip 350 2"	Alarm Trip OFF SCALE 1/4" (zero 380)
PM-2			Alarm Trip
IC-1	$>10 \times 10^{-12}$	Meter Trip OK	Scrammed Test Trip OK
IC-2	$>10 \times 10^{-12}$	" " OK	
IC-3	4×10^{-11}	Calibration	
IC-4	6×10^{-11}	Calibration	
CRM		Meter Trip	

Preliminary Check on 8-14-61

Room 113 Pressure Differential 0.07"
Red Light On and Personnel [illegible] — C.C.
Scrams and [illegible] — C.C.
Source [illegible] Use Accelerator
Safety [illegible] 20.575"
Controls [illegible] Inner 22.00" Outer 999.81
Reflector Water 28.63"
Moderator Water 33.19"

EXP # 142

8 57 AM Source Removed

	Inner	Outer	
	22.0"	16.48"	Approx Crit
9 11	22.0"	16.465	Crit

EXP # 143 PN-127

Pulsing at Crit without Target

Inner: 22.00 Outer 16.465 Safety 20.575" to 15.00" (pulsing at crit for 200 cycles, then shut down.

Acc 135 KV 0.67 ma 0.2 μa Target S.F = 65

640 μs 20 cps Total

TMC 160 μs Bkg 8, Delay 2 Disc 4 Mem 1/1

Det BF3 @ 1725 DD2 [illegible] (40-100)

12 17 Re-Check for Critical, After Pulsing

	Inner	Outer	Refl H_2O	fuel H_2O	Safety	
12 21	22.00"	16.465"	28.43"	33.05"	20.575	Crit

Shut Down Insert outer Control, Safety, And Dump fuel H_2O. - Insert inner Control, Drain Refl H_2O.

Exp # 144 8-14-61

Purpose - Checkout of RHOETTE #1 from Brookhaven (Reactor Analog Computer)

	Inner	Outer	Safety	Refl H_2O	fuel H_2O	
2 17	22.00"	16.465"	20.57	—	33.55"	~ crit

RHOETTE #1 IC-2 Outer

0.0 ± 2.0 4.55×10^{-9} 16.49 Level

16.49

6.5 ± 0.2 ¢ 16.69 Pos Per

($1K \approx 4.5 \times 3 \times 10^{-8} \overset{IC \cdot 2}{\approx} 2.8 \times 10^{-8}$ IC·3)

2 45 Neg 9.5 ¢ 16.20

Pos 9.8 ¢ 16.79 Pos Per

0 $6.0 \times 3 \times 10^{-8}$ 16.475 ¢ Level

Insert Safety 15.00

- ¢ 1.6

Change Rod Positions so that Inner at 17.50 at Crit Outer ~ 28.40

+ ¢ 0.15 17.75

+ 0.01 17.52

0.00 17.50 28.35

Rhotte	Inner	Outer
0.79	16.25	28.35
	(Rod Calibration 71 ¢)	
+ ~~17.5~~ ¢	17.75	28.35

15.0
14.5
14.2

Leveled at high Power

Dropped Safety, worth more than ¢ 9.999.

Adjust Outer to 20.00 at Crit.

Inner = 18.55

Neg period Outer to 37.5 Calib 40 ¢

Ready to Crit at high Power

Inner	Outer	Rhotte	Calib Power
19.56	18.21	0.00	level
	17.20	-28.2	-30.0
	19.34	+25.	+27.4
	16.97	-36.	~~-40.0~~
	19.0	+18.5	+20
	17.53	-18.7	-20
	18.58	+8.9	+10

"Note"
8 30

8-15-61
Inserted target in Reactor and
Greased Control Rod on Safety Drive

Instrument Check on Aug 15, 61 Source 10 mc γ

PM-1	Low Trip ✓	Alarm Trip ✓	
PM-2 No check		Alarm Trip	
IC-1 > 10 x 10^{-12}	Meter Trip OK	Fast Trip OK	
IC-2 > 10 x 10^{-12}	Meter Trip OK		
IC-3 ~ 5 x 10^{-11}	Calibration OK Down		
IC-4 ~ 6 x 10^{-11}	Calibration OK "		
CRM	Meter Trip		

Preliminary Check on 8-15-61

Room 113 Pressure Differential 0.07"

Red Light On and [illegible] Check ✓ CC

Scrams and Bldg. [illegible] ✓ CC

Source Inserted Use Accelerator

Safety Withdrawn 28.10"

Controls Set Inner 17.50" Outer 999.81"

Reflector Water Approx 6" Above Be

Moderator Water 33.50"

Exp # 145 — Check Out Rhoette # 1

Time	Inner	Outer	Rhoette	Period	Calc		
10^{10} AM			Source off				
	17.50	17.10				Slightly Super crit	
	17.50	17.06				Crit	
10^{25}	16.72	18.50				Crit	(A)
	"	18.70	.050 00	.0517 00	.055	Pos Per	(B)
	"	18.485	-.064	-.0673	-.064	level	(C)
	"	18.25				Neg Per	(D)
	"	18.90	.102	.101	.104	Pos Per	(E)
11^{25}	"	18.48	00	00		level	(F)
	"	18.00	-.130	×	-.134	Neg Per	(G)
11^{38}	"	19.00	.126	.126	.127	Pos Per	(H)
11^{43}	"	17.20	-.383		-.374	Neg Per	(I)

11^{49} Shut Down Insert Outer Control, and Safety

Exp # 146 8-15-61

Purpose - Period Meas. to check Rhoethe # 1
use Accelerator for Source

1 20 PM	INNer.	Outer	Safety	Refl H_2O	fuel H_2O	
	16.72	999.81	28.10"	6" Above Be	33.48"	
2 24	16.72	18.498			~ Crit	
2 31	16.72	18.485			level	
	16.72	18.73		Pos Per		A
	16.72	18.48		level		B

Trouble with Rhoethe # 1

3 58	16.72	18.88	+ .094 ¢	.098	Pos Per	C
	"	17.20	- 0.380 ¢		Neg Per	D
4 10	"	18.90	+0.100	.104	Pos. P.	E

Note 4 17 Shut Down Drop Safety, Insert outer control and Dump fuel H_2O

"Note"

8-16-61
8 30 AM Installed Source M-43 on Source Drive. (on Assembley) RM # 113
Removed BF_3 counter from between fuel annuli so that source could be used!

Instrument Check on 8-16-61 Source 10 Mc X

(Zero 337)

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 Not tested _____ Alarm Trip _____

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

IC-2 > 10×10^{-10} Meter Trip _____

IC-3 ~ 5×10^{-11} Calibration ok Dwm

IC-4 ~ 4×10^{-11} Calibration " "

CRM _____ Meter Trip _____

Preliminary Check on 8-16-61

Room 113 Pressure Differential 0.07"

Red Light On and Personnel Check ✓ C.C.

Scrams and Bldg. Alarm Reset ✓ C.C.

Source Inserted ✓ Inst Response OK

Safety Withdrawn 28.10"

Controls Set Inner 16.72 outer 999.81

Reflector Water Approx 6" Above Be

Moderater Water 32.70"

Exp # 147 8-16-61

Purpose: Check Out of Rhoette #1

1[15] Source out

Outer Rho

18.535

18.90 +0.134¢ Super crit

Pos Per A

1[29] 18.36 0.00 level B

Note " −$10.30 Dropped safety

1[30] Raised safety

1[32] 19.00 0.168 Pos Per C

17.20 0.35 Neg Per D

19.10 0.180

Expt 147 cont.

	outer	Rho	
147	18.36	0.00	Level
202	19.10	0.180	Pos Per E
	18.36		level
212	7.32		Neg
252	19.358	Safety 20.58	Pos Per F
	18.95		level
	lower Safety to Measure Reactivity		
255	Shut Down Insert outer Control, Dump fuel H_2O		

→ Neg. Reactivity on Driving in outer control cyl.

Position in.	Time from start — sec	Rho dollars	Repeat
17.26	15	0.33	0.33
16.14	30	0.74	0.73
15.03	45	1.20	1.20
13.92	60	1.70	1.70
12.81	75	2.30	2.21
11.70	90	2.80	2.81
10.59	105	3.30	3.45
9.48	120	3.60	4.00
8.37	135	3.85	—

→ Neg. Reactivity on driving in safety from 20.58"

Distance into core in.	Time sec.	−Rho dollars	
2.8	10	0.57	20.6 − 2.8 = 17.8
5.7	20	1.79	− 5.7 = 14.9
8.5	30	3.70	− 8.5 = 12.1
11.4	40	6.20	− 11.4 = 9.2
14.2	50	7.8	− 13.2 = 6.4
17.0	60	8.7	− 17 = 3.6

Instrument Check on 8-17-61 Source _____

PM-1 _____ Low Trip OK Alarm Trip OK
PM-2 _____ _____ Alarm Trip _____
IC-1 $>10\times10^{-11}$ Meter Trip OK Fast Trip OK
IC-2 $>10\times10^{-11}$ Meter Trip OK _____
IC-3 $\sim 5\times10^{-11}$ Calibration ok JK7 _____
IC-4 $\sim 6\times10^{-11}$ Calibration ok " _____
CRM _____ Meter Trip _____ _____

Preliminary Check on 8-17-61

Room 113 Pressure Differential 0.07"
Red Light On and Personnel Check ✓ C.C.
Scrams and Bldg, Alarm Reset ✓ C.C.
Source Inserted ✓ Inst Response OK
Safety Withdrawn 28.10"
Controls Set Inner 17.50 Outer 999.81
Reflector Water 6.75" Above Be
Moderator Water 32.82"

Expt 148

Put target into Al can before insertion in trap region. Then filled can with water for zeroing in expt. with outer control at 17.21

Outer	Inner	Safety	P	Fuel H_2O
17.21	17.095	28.11"	0.0	33.2"

Refl water ~ 7 in above Be

8-17-41

Expt. 149
Target in Al. can - dry middle

	Inner	Outer	Safety	ρ	Fuel H_2O	Refl
11:50 AM	17.095"	12.28	28.10	0.0	32.70	cap ~7" above Be

Shut Down Insert outer Control, Safety And Dump fuel H_2O

Expt 150

Air in all Al tubes in target (stoppers in each end), Al can surrounding target filled with Water.

1:45 Source out

Inner	Outer	Safety	Refl H_2O	Fuel H_2O	
17.095"	13.25"	28.10"	6.75" Above Be	32.80"	~ Crit
1:53 "	13.45"				Pos Per
"	13.25				Crit

Shut Down Insert outer Control, Dump fuel H_2O

20.93 % U soln

188 8-17-61

Expt 151

Repeat 3 Expt. 149 except that 6" reflector added on top of al can containing target (no water inside

P	Inner	Outer	Safety	fuel H_2O	Refl H_2O
	17.095	12.14	2.610	33.70	up Crit
3 39	"	12.135	"	"	Crit

Shut Down Insert Outer Control, Safety And Dump fuel H_2O

47.27 % Void

Instrument Check on 8-18-61 Source _____

PM-1 _____ Low Trip ok. Alarm Trip ok

PM-2 _____ Alarm Trip _____

IC-1 $>10\times10^{-10}$ Meter Trip ok Fast Trip ok.

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

IC-3 $\sim 5\times10^{-11}$ Calibration ok JK7

IC-4 $\sim 6\times10^{-11}$ Calibration ok "

CRM _____ Meter Trip _____

Preliminary Check on _____

Room 113 Pressure Differential 0.68"

Red Light On and Personnel Check ✓ C.C

Scrams and Bldg. Alarm Reset ✓ C.C

Source Inserted ✓ gmt. response noted

Safety Withdrawn 28.01

Controls Set _____

Reflector Water 5.75" above Be

Moderator Water 32.42"

Experiment: 152 Gold Foil Fission Foil

Irradiation without Target:

1.1 cm dia 5 mil gold foils

In trays # 57 .2407 g bare 1" below ℄

65 .2407 g .030" cd 1" above ℄

In T-2-4 U-2-5 in position a-37

9[05] Source out

Inner - Outer

18.80 18.80 Approx Crit

" 19.20 Pos Per

9[20] Start timing 1hr Exposure IC-2 1×10^{-9}

10.[20] 18.83 18.83 IC-2 = 2.8×10^{-9} Crit

Shut Down Insert outer Control, And Safety to 8.73"

Removed foils from target Area And Inserted Safety to 0.

8-18-61

Expt. 153

Target in Al can Dry inside except that 39 3/8 OD Al tubes filled with water and corked.

Preliminary Check on

Room 113 Pressure Differential 0.08

Red Light On and Personnel Check ✓

Screams and Bldg, Alarm Reset ✓ JKT

Source Inserted ✓

Safety Withdrawn 28.00"

Controls Set Inner at 17.095

Reflector Water Up 5.75" above BC

Moderator Water 32.80"

1 10 Source Out

Inner	-	Outer	
17.095"	-	12.17	Approx Crit
"		12.37	Pos Per
1 29 "		12.162	Crit

Shut Down Insert outer Control and Safety

Dump fuel H_2O % Air Void 36.80%

Al can 0.042 in by Meas

subtract ~ .001 for curvature error

thickness ~ 0.041

Removed U^{233} fis. ctr from core

Instrument Check on 8-21-61 Source 10 mc Ra

PM-1 750 V. Zero 380 Low Trip 350 Alarm Trip OFF SCALE
PM-2 _____ _____ Alarm Trip _____
IC-1 10×10^{-12} Meter Trip OK Fast Trip OK
IC-2 10×10^{-12} Meter Trip OK _____
IC-3 5×10^{-11} Calibration OK Dwm _____
IC-4 5×10^{-11} Calibration " " _____
CRM _____ Meter Trip _____ _____

Preliminary Check on _____

Room 113 Pressure Differential 0.08"
Red Light On and Personnel Check OK, Dwm
Scrams and Bldg, Alarm Reset OK JK7
Source Inserted ✓
Safety-Withdrawn ✓
Controls Set
Reflector Water up ~6" above Be
Moderator Water 33.8"

"Note"

EXP #154 : Purpose: GoCo Foil in target, Fuelplate Irradiation for Flux per fission.

Gold Foil # 14 0.2407 g

T-5 0-26 fuel Plates.

Start timing exposure IC-2 @ 3×10^{-9}

Level at IC-2 @ 8×10^{-9}

9⁰³ AM Source out Inner 18.80 Outer 19.30 + Period.

9⁰⁸ Start Clock
9 13 Inner: 18.72 Outer: 18.72 Level
10⁰⁸ Insert Safety Outer and Inner
10⁰⁴ Drain fuel H_2O.

Foil Calc

0-26 $1.0 \times 10^{+11}$ total fissions per plate 15.30 g
T-5 $1.7 \times 10^{+11}$ total fissions per plate 13.40 g

$\frac{2311}{13.4} \times 1.7 \times 10^{11} = 2.93 \times 10^{13}$

$\frac{5680}{15.30} \times 1.0 \times 10^{11} = 3.71 \times 10^{13}$

Total fissions $= 6.64 \times 10^{13}$ $= 1.84 \times 10^{10}$ fission/sec
$= .584$ watts
3.15 fiss/watt

Gold Foils

Exp #152 $\frac{Bare}{Cd}$ Ratio $= 13.57$

$\frac{Cd}{Bare}$ Ratio $= 0.07368$ $- 1 = .92632$

#Exp #154

Using 3" xtl Counting time 10' $= .00178081$

8625 Walker PN-98 12^{58} Decay time $= 150'$ $e^{-\lambda T} = .973618$

exposure time $= 60'$ $1 - e^{-\lambda t} = .01063742$

$$SA = \frac{\overset{1.8202}{1.965 \times 10^5} \times .9263 \times \overset{\lambda =}{2.972 \times 10^{-6}}}{\underset{1.84495}{1.781 \times 10^{-3} \times .9736 \times 1.064 \times 10^{-2}}} = 0.9866 \times 10^{10} \times 2.972 \times 10^{-6}$$

$2.932 \times 10^4 = \varphi N \sigma$

$$\varphi = \frac{2.932 \times 197 \times 10^4}{\epsilon \, .2407 \text{ gm} \times .6025 \times 10^{24} \times 98.8 \times 10^{-24}} = 40.31 \times 10^4$$

59.527 $\epsilon = .019$

14.328 $= 2.12 \times 10^7$

$\varphi = 3.63 \times 10^7$/watt $= 3.63 \times 10^{15}$/100 MW

Foil Calc

$\frac{3.63 \times 10^{17}}{.8432} = 4.31 \times 10^{15}/100$ mw.

flux dep and of shielding factor for 0.005 gold in H_2O.

2nd Foil Run Exp # 161 p 203 #21 Au Foil

Exp. time 3" – 4" pm 8-29-61 $1-e^{-\lambda t} = .0106\,3742$

Count time 5' $1-e^{-\lambda t} = .000\,89080$

Decay time 4" pm → 3:3 pm = 23hr 12 Min $e^{-\lambda t} = .997\,8634 \times .781\,944 = .780\,273$

$$S.A. = \frac{1\,163\,041 \text{ c/MIN} \times \text{[illegible]} \times 2.972 \times 10^{6}}{.73932 \times 10^{-5}\ 10^{-5}} \qquad 0.73937 \times 10^{-5}$$

$$= \frac{4.675 \times 10^{5}}{\text{[illegible]}} \qquad \%E = .019$$

$S.A. = 2.4605 \times 10^{7}$

this counting rate is probably too high so that there are some counting losses. ——— count later.

Foil Calc

Count Foil 9³'AM 9-5-61 20' count

1,076,949 Total Counts Bkg subtracted

3.2008

$$SA = \frac{1.077 \times 10^{6} \times 2.972 \times 10^{-6}}{.00355845 \times .178107 \times .910637 \times 42}$$

6.742×10^{-6}

$t_{decay} = 161$ hr 20'

$t_{count} = 20'$

$t_{exp} = 60'$

3 11 - 9 11 PM 8-29

$e^{-\lambda t}$ .17874325

= .996441 55

= .178107

$SA = 0.4748 \times 10^{+6}$

Average

$SA = 24.74 \times 10^{6}$ (411 hrs)

Self absorption correction 0.975

Flux depression and filter self shielding 0.8432

Cadmium Ratio .9263

Corrected for abs in Cd .9263 × .9678 = .8965

$$\frac{.8965}{.975 \times .8432} = 1.0905$$

.8221

$S.A. = 26.98 \times 10^{6} = \varphi N \sigma_{2200} \times .8862$ $N = \frac{.2407 \times .6025}{197}$

$$\varphi = \frac{26.98 \times 10^{6}}{0.0007362 \times 10^{24} \times 98.8 \times 10^{-24} \times .8862}$$

64.46×10^{-3} $= 0.0007362 \times 10^{24}$

$\varphi = 0.4186 \times 10^{9}$ $\frac{\varphi}{watt} = \frac{0.4186 \times 10^{9}}{8.69} = 4.82 \times 10^{7}$ 4.91

$$\frac{\varphi}{Fission/sec} = \frac{0.4186 \times 10^{9}}{.2783 \times 10^{12}} = 1.506 \times 10^{-3}$$ 1.533 X3.2

$\times 3.2 \times 10^{18}$ fission / 100 MW 4.68

$\varphi = 4.82 \times 10^{15}$

4.91

Foil Calc.

Phone 8-5-61 from Wyatt

0-18	Ba	1.65 $\times 10^{12}$	
	Mo	1.53	"
	Ce	1.46	"
		$\frac{4.64}{3} = 1.55 \times 10^{12}$	
G-5 (T-4)	Ba	2.81	"
	Mo	2.41	"
	Ce	2.35	"
		$\frac{7.57}{3} = 2.52 \times 10^{12}$	

Total fissions Inner annulus $\frac{2311}{13.45} \times 2.52 \times 10^{12} = .433 \times 10^{15}$

analyses (14.35) .406

Outer annulus $\frac{5680}{15.49} \times 1.55 \times 10^{12} = .568$ .576

analyses (15.28) 1.001×10^{15}

.982

fissions/sec $= 0.278 \times 10^{12}$ .273

watts $= 8.69$ watts 8.53 watts

2d foil count $= 1.0011 \times 10^{6}$ in 20' 2' 21" PM

t decay = 166 hr 10' .169436 50 x .998219 19 = .169 135

$$SA = \frac{1.0011 \times 10^{6} \times 2.972 \times 10^{-6}}{3.5585 \times 10^{-3} \times .169135 \times 10.6374 \times 10^{-3}} = 0.4647 \times 10^{6}$$

6.4023×10^{-6}

3rd foil count $= 0.991\,152 \times 10^{6}$ in 20' @ 4' 25"

$$SA = \frac{.991\,15 \times 10^{6} \times 2.972 \times 10^{-6}}{3.5585 \times 10^{-3} \times 10.6374 \times 10^{-3} \times .165\,438} = 0.4704 \times 10^{6}$$

37.8532×10^{-6}

6.2624×10^{-6}

Av = 0.4700 $SA = \frac{0.4700}{.019} \times 10^{6} = 24.74 \times 10^{6}$

Counter Eff = .019

Instrument Check on 8-25-61 Source 10 mc Ra

PM-1 Zero @ 350 Low Trip OK @ 350 Alarm Trip OK

PM-2 _____ Low Trip _____ Alarm Trip _____

IC-1 $> 10 \times 10^{-12}$ Meter Trip OK Fast Trip OK

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

IC-3 5×10^{-11} Calibration OK

IC-4 6×10^{-11} Calibration OK

CRM _____ Preliminary Check on 8-25-61

Room 113 Pressure Differential OK

Red Light On and Personnel Check ok

Scrams and Bldg. Alarm Reset ✓ JK7

Source Inserted ✓

Safety Withdrawn ✓ 28.12

Controls Set Inner to 1721

Reflector Water ~ 6" above Be

Moderator Water 333

Expt 155

Added 3 Cd strips to target outer ~~Periphery~~ Periphery: .025" th. x 1/2" wide x 24.5" long and 120° apart.

Inner Outer

20.46 20.15 T=138 $\rho = 48.7 \times 10^{-4} \sim 7.6¢$ + period just out

20.14 20.15

$$\frac{7.6¢}{0.32 \text{ in on Inner}} = 23.8¢/\text{in}$$

Expt. 156

Pulsing of Assembly used in Expt 155
Inserted. BF_3 ctr. in core

Fuel H_2O at ~~28~~ 32.7, Safety at 28.00

Inner	Outer	
17.33	17.23	– to correspond to critical position without Cd. in Target.

Inner 17.33 Outer 17.23 – React of 3 ea ½" x 24 x .025 Cd strips on Target

PN-128 arc 135 kv SF 67 ~/μa

200 μs @ 70 cps

TMC Ch 40 μs Delay × 2 Bkg × 8 Disc 4

DET MIN BF_3 @1725 DD-2 @ 64 × 200 PHS 450 (40-1000)

Instrument Check on 8-28-61 Source X

PM-1		Low Trip ok	Alarm Trip ok.
PM-2	—		Alarm Trip
IC-1	> 10 X 10^{-11}	Meter Trip ✓	Fast Trip Scrammed
IC-2	> 10 X 10^{-11}	Meter Trip ✓	
IC-3	~ 4 X 10^{-11}	Calibration ok JKJ	
IC-4	~ 6 X 10^{-11}	Calibration " "	
CRM		Meter Trip	

Preliminary Check on

Room 113 Pressure Differential 0.09" Hw

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted out of room, use accel.

Safety Withdrawn 28.07

Controls Set Inner at 17.33, Outer 17.23

Reflector Water ~ 6" above Be

Moderator Water 32.87

Exp #157 Pulsing with 6 pc Cd 1/2" x 24" x 0.025

PN-129 Pulsing with 6 pc Cd 1/2" x 24" x 0.025

Outer @ 17.33 Inner @ 17.23 Safety @ 28.11 Refl ~ 28.0

Fuel 33.69 IC-2 = 2.3 x 10^{-10} 110 cps 100 μs Burst

TMC 20 μs

System arced over 3 times, on the third the isolation power went off. Investigation of this revealed infinite a bad contact of the binding post screw to the female banana plug on the output of the filter unit. (J2)

2nd decade of Monroe fried

EXP #158 Repeat #157

PN-130 Pulsing with 6 pc ½" x 24" x 0.025"
Cd around target assembly.
Acc = 135 KV 0.93 ma ~0.5 μa
100 μs @ 110 cps
TMC Ch 20 μs Bkg 8 Delay 2 Disc 4

Det Mu BF_3 @ 1725 V DD2 1.1 x 200 PHS 450
pulses 40-100 v

accelerator tripped 11 Cut a channel in the
(Cadmium on top of the three void tubes
closely spaced on target)

8-28-61 Expt 158

Pulsing 9 pcs. ½"x24"x.025" cd strips.

Island Refl. ~6" above Be, Fuel H_2O = 33.2"

Safety 28.10

Inner C. 17.33" Outer Control - 17.23

PN-131 9pc Cd ½ x 24 x 0.025

Inner 17.33 Outer 17.23

Acc 135 kv 1 ma 1.5 μa 100 μs @ 150 cps

TMC Ch 10 μs Bkg 16 Delay X2 Disc 4

Det Min BF_3 @ 1725 @ PHS 450 Pulses.

Exp # 159 8-28-61

3:39 PM Pulsing 12 Pcs ½"x.24"x.025" cd strips

Island Refl H_2O 6" Above Be, fuel H_2O 33.72

Inner	Outer	Safety
17.33"	17.25"	28.10"

PN-132 12pc Cd ½ x 24 x 0.025

Inner 17.33 Outer 17.23

Acc 135 KV .96 ma μa 100 μs @ 150 cps

TMC 10 μs Bkg 16 Delay 2 Disc 4

Det Mn BF_3 @ 1725 V DD 2 1.1 X 200 PHS 450

pulses (60 - 120 V on Sil + copper)

Instrument Check on 8-29-61 Source X

PM-1 _____ Low Trip ok Alarm Trip ok

PM-2 _____ — _____ Alarm Trip _____

IC-1 $> 10^{-11}$ Meter Trip ok Test Trip ok

IC-2 $> 10^{-11}$ Meter Trip ok

IC-3 $\sim 4 \times 10^{-11}$ Calibration ok 7+7

IC-4 $\sim 5 \times 10^{-11}$ Calibration ok "

CRM _____ Meter Trip _____

Preliminary Check on 8-29-61

Room 113 Pressure Differential .09" H₂O

Red Light On and Personnel Check not on sub-crit test

Scrams and Bldg, Alarm Reset ✓

Source Inserted _____

Safety Withdrawn 28.03

Controls Inner 0.00 Outer 0.00

Reflector Water ~6" above Be

Moderator Water 33.3"

Expt. 160

Check on effectiveness of M-22c in bottom of 1 radial beam hole at a start-up source using fis. ctr in bottom refl.

Target out, all water up & safety up

A. Counts/10 min = 497 x 10 + 13 = 7965 counts/min

IC-4 ~ .009, IC-3 = .0015

Put safety down to zero; IC-4 = .007, IC-3 = .0008

B. Counts/10 min = 198 x 10 + 14 = 3182 counts/min

Removed source:

C. counts/10 min = 9

Expt 160 cont

With safety still down put normal M-43 back in with large source M-22c out of room. (against to of fuel element)

IC-3 = .001" , IC-4 = .0005

Counts/10 min = 25 X 16 = 400 = 40 counts/min.

Raised safety to 28.06"

IC-4 = .0025
IC-3 .0008

Counts/10 min = 99 X 16 + 14 = 1598 = 159.8 cts/min

Min. BF^3 cts removed from core before Expt 160

M-43 Back on source rod drive

8-29-61

Expt 161

Gold foil in target region (target out). Fuel Plate irradiation for short per fission

Gold foil No. 21, 0.2407 gm Au.

T-4 in for 37

O-18 " for 78

Refl. H_2O ~ 6" above Be, Fuel H_2O = 33.5"

Safety at 28.00, alarm reset

3^00 pm Inner 18.70 Outer 18.70 ~ crit.

" " " 19.3" for por. period

Start at 3^4 3×10^{-8} on IC-2

level at 8×10^{-5} " " ; IC-1 @ $3.6 \times 3 \times 10^{-7}$

Both in units of scale

10 mr. 6 ft straight out from center of Rm 108 door, negligible in Rm 217

1/2 mr at center of water window in Rm 112

Inner 18.70 outer 18.76 at level.

±^07 18.70 " 18.755 level

IC-2 = 8×10^{-8} IC-1 $3.6 \times 3 \times 10^{-7}$

Ins back on scale at ~ $3\text{-}4 \times 10^{-8}$ on IC-2 ~~0.70~~ risk

4^11 Shut Down Insert ~~Inner And~~ Outer Control lower Safety to 2" And Dump fuel H_2O

4^24 Ins near level at ~ 10^{-10} Refl. up

Note increase to ~ 1.5×10^{-10} after draining

Refl 4^25 0.8 r at plywood cover adj. to control

204
8-31-61

Exp # 162

With Inner Control at zero and Outer Control at 22.00" Inserted 5-9" wide strips of .025" Cd + 1-10" wide strip between Inner and Outer Controls leaving approx. a 1" gap in the annulus. Strips were 48" long with top edges attached ~ 1/4" above top of outer control cylinder. In this position the strips reached to about 1/4" above fuel zero.

"Note" → Removed Source M-43 from Assembley and Installed BF-3 ctr

Instrument Check on 8-31-61 Source 8

PM-1		Low Trip	ok	Alarm Trip	ok
PM-2	—			Alarm Trip	
IC-1	> 10^{-11}	Meter Trip	ok	Fast Trip	ok
IC-2	> 10^{-11}	Meter Trip	ok		
IC-3	~ 5×10^{-11}	Calibration	ok gkz		
IC-4	~ 6×10^{-11}	Calibration	ok gkz		
CRM	—	Meter Trip			

Preliminary Check on 8/31-61

Room 113 Pressure Differential 0.08"
Red Light On and Personnel Check ✓ C.C.
Scrams and Bldg. Alarm Reset ✓ C.C.
Source Inserted USc Accelerator
Safety Withdrawn 28.02"
Controls Set Inner 00.04 Outer 22.0"
Reflector Water 6" Above Bc
Moderator Water 34.07"

Without Target

3PN-92

NUMBER OF POINTS 116

ESTIMATE 3

	PARAMETERS	VARIANCES
B 1	2 18866193	73752937
B 2	5 12636702	5 66815240
B 3	4-19227582	3 29874945

VARIANCE Y 1 21686130

PN-133 Pulsing with 0.025" Cd between contacts
Inner 0.04 Outer 22.00
Acc 135KV 1.06 ma 3μa Target
100μs @ 330 cps (3000μs) 3%
TMC CH 10μs BKG 16 DELAY 2 DISC 4 MEM 1/2
DET MIN BF_3 1725 DD-2 1.1X200 PHS = 450
(Pulses 40-100+ volts) W.O Target

PN-134 Repeat of above
Acc 135kv 0.97 ma 2μa Target
100μs @ ~~330~~ 170 cps
TMC ch 10μs Bkg 16 Delay 2 Disc 4 Mem 1/1
DET MIN BF_3 1225 DD-2 1.1X200 PHS 450
(Pulses 40-100+ volts)
W.O. Target

3[59] Shut Down Insert Safety, Dump fuel H_2O

"Note" Salvage obtained from Dissolving foils #0-16-1, 0-16-2, U-2-1, And U-2-2 for Chemical Analysis, (By Mr Cooper), was Added too U/235 Salvage on West End. total U Approx 0.25 g Date 9-1-61 C.C.

9-1-61 Target Inserted

Instrument Check on 9-1-61 Source γ

PM-1		Low Trip	ok	Alarm Trip	ok.
PM-2	—			Alarm Trip	
IC-1	$>10^{-11}$	Meter Trip	ok	Test Trip	Scrammed
IC-2	$>10^{-11}$	Meter Trip	"		
IC-3	$\sim 5\times10^{-11}$	Calibration	ok		
IC-4	$\sim 4\times10^{-11}$	Calibration	ok		
CRM		Meter Trip			

✓ Preliminary Check on 9-1-61

Room 113 Pressure Differential 0.09"
Red Light On and Personnel Check ✓ C.C.
Scrams and Bldg, Alarm Reset ✓ C.C.
Source Inserted Use Accelerator
Safety Withdrawn 28.04"
Controls Set INNer 0.04" Outer 22.0"
Reflector Water 6" Above Be
Moderator Water 33.77"

Exp # 163 9-1-61

9¹²AM Same As Exp # 162 Except target Inserted

PN-135 Inner 0.04 Outer 22.0 with .025 Cd
Acc 135kv 1.0ma 2½μa 100μs @330cps
TMC Ch 10μs, Bkg x 16 Delay 2 Disc 4 Mem 1/2
Det Min BF_3 at Midplane @ 1725v
DD-2 1.1 X 200 PHS 450
Pulses 40-100v.

Exp # 164 9-1-61

10 20 Inner 22.0" Outer 0.00"
Refl H_2O 6" Above Be fuel H_2O
Safety 28.04"
Inserted Cd-strips as in Expt. 162, with top edges of strips at top of outer C. in its new position (0.00). This means that strips extend ~22" below bottom of fuel & ~8" above, Target in.

PN-136 Inner 22.0 Outer 00.0
with 0.025 Cd between
Acc 135 ker 1.0 ma/μa 100 μs 170 cps
TMC ch 20 μs Bkg 16 Delay 2 Disc 4 Mon 111
OET Mic BF_3 @ 1725 DD2 1.1 x 200 PHS 4 50

11 50 Drain H_2O

 Exp # 165 9-1-61

1^04 PM Inner 0.04" Outer 00.00"
Refl H_2O 6" Above Be Fuel H_2O 33.19"
Safety 28.09"

6-Cd strips between Inner & Outer
Control cyls as in Expt. 164

PN-137 Inner = 00.04 Outer 00.00
Cd between controls
HALF Mummery
135 KV 1.1 ma 100 μs 330 cps
TMC Ch 20 μs Bkg x16

1^53 Shut down: Safety inserted.

Fuel Water slightly below top of Fuel plates
at a reading of 22.02"

After draining 25.1 kg water selsyn
reads 5.24"

22.02
5.24
16.78

16.78" ≈ 25.2 l, ~~1.496~~ 1.500 l/in.; 30 l in core

0.591 l/~~cm~~ in core 21.12" water in barrel
x 6.515 = 137.6 l
+ d.V = 4.41 l Total = 142 l

9-5-61

Drained fuel water out into a 30 gal drum and weighed back into system *100 ℓ. kg

Added 57 gm H_3BO_3 and stirred

Instrument Check on 9-5-61 Source _____

PM-1		Low Trip	ok	Alarm Trip	ok.
PM-2				Alarm Trip	
IC-1	$> 10^{-11}$	Meter Trip	ok	Fast Trip	Jammed
IC-2	$> 10^{-11}$	Meter Trip			
IC-3	$\sim 4 \times 10^{-11}$		ok JK7.		
IC-4	$\sim 6 \times 10^{-11}$		OK.		
CRM					

Preliminary Check on _____

Room 113 Pressure Differential 0.09"

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted ✓

Safety Withdrawn 28.0"

Controls Set Inner 17.50" Outer 999.81"

Reflector Water ~6" above Be

Moderator Water ~280"

Expt 166

Critical Conditions after adding 57 gm H_3BO_3 to 100 ℓ Fuel Water ≈ 0.100 g/ℓ B, ≈ 3 g B total

T = 102, 9.7 ℓ/s²

Inner	19.40	Outer	19.60	↑ Por. period
"	19.40	"	19.08	Level
	19.275		19.276	" 18.7 ℓ/in

2 25 Shut Down Insert Outer Control, Safety And Dump fuel H_2O

* Lost ~ 5.7 ℓ thru sight. Glass; Left 94.3 ℓ

Exp # 167 9-5-61

~~2~~ 40 PM Added 54 gm H_3BO_3 to fuel H_2O And Stirred, Total now ~ 108 gm in 94 l. a 201 % B. (6.039. Total)
Purpose: Check Critical Conditions
Refl H_2O 6" Above Be - fuel H_2O 28.40"
Safety 28.05"

	Inner	Outer		
3 57	19.225"	999.81"	Source out	
	24.80"	28.80"		
	24.80	25.50"	$\rho = 6.73$	Approx Crit Pos Per
	24.80	26.00" $T = 92$	$\rho = \frac{10.5¢}{1.09 \text{ inch}}$	Pos Per
4 12	24.80	24.91	9.6 ¢/inch	level
4 17	24.84	24.84		level

Shut Down Insert Outer Control, Safety And Dump fuel H_2O

Measured height in drum after adding 100 kg water was 15 1/8".
After spill over of sight glass height in drum was 14 1/4".
See p. 56 for 6.5 ¢/in mean dia of barrel

Instrument Check on 9-6-61 Source 8 211

PM-1 _____ Low Trip Scrammed Alarm Trip ok

PM-2 — _____ Alarm Trip _____

IC-1 $>10^{-11}$ Meter Trip ok Fast Trip ok.

IC-2 $>10^{-11}$ Meter Trip ok.

IC-3 $\sim 5 \times 10^{-11}$ Calibration ok Dan

IC-4 $\sim 5 \times 10^{-11}$ Calibration " "

CRM _____ Neutron Survey Check on _____

Room 113 Pressure Differential 0.09 "H_2O" ✓

Red Light On and Personnel Check _____

Screams and Bldg. Alarm Reset ✓

Source Inserted ✓

Safety Withdrawn 2802

Controls Set Inner 25.0" Outer 999.81"

Reflector Water ~6.5" above Be

Moderator Water 28.31"

Exp # 168 9-6-61

Purpose: Repeat of Exp # 167

8 52 AM

Inner	outer	Source Out
24.84	24.84	Approx crit
24.84	25.75	5.9 div/min → 128 sec = 8.09 ¢/.89 Pos Per
24.85	24.85	Level

9 15 Shut Down Insert Outer Control, Safety And Dump fuel H_2O 9.1 ¢/inch

Since Inner was moved, period does not give us a rod sensitivity point! Duh

Water temperature measured 23¼°C in dump barrel

212
9-6-61

Exp # 169

Added 98 gm H_3BO_3 to the ~94 l fuel water storage. Total now 206 gm ≈ 0.3835 gm B; 11.5 g B in core

9 48 Source in Safety 28.03"
Refl H_2O 6" Above Be Fuel H_2O 28.03"

	Inner	Outer	
	25.0"	999.81"	
Inner	31.54	outer 31.54	~ Level
	31.54	32.00" T=97, ρ = 10.1¢/43	Pos Per
10 30	31.54	31.57	level
10 35	31.555	31.555	level

Shut Down Insert outer Control, Safety And Dump fuel H_2O

Rod Scrs 23.5 ¢/in

Added 65g Boric acid to fuel water storage; Total now 271 g. 0.504 gm/l

Exp 170 9-6-61 15,129 g B Total

12 25 Source in Safety 28.01"
Refl H_2O 6" Above Be Fuel H_2O 28.15

	Inner	Outer	
	35.00"	999.81"	
12 40	33.32	33.32	Source out Approx Crit
	33.32	33.51	76.1 sec → 7.75×10^{-4} = 12.1¢ Pos Per
1 05	33.32	33.32	level with outer only level

Shut Down Dump fuel H_2O, Insert outer Control, And Safety.

$\frac{12.1¢}{.19}$ = 63.7 ¢/inch

Exp # 171 9-6-61

Added 120 gm H_3BO_3 to fuel water system and mixed. Total now 391 gm
0.7288 g/l B. ≈ 21.82 g in core

2 14	Source in	Safety 28.02		28.16 ~~27.72~~
"	Refl H_2O 6" Above Be	fuel H_2O		
	Inner	outer		
	33.50"	999.81		
2 30	35.31"	35.31	Source out	Approx level
	35.31	35.47	89.1 Sec 6.9×10^{-1}	Pos Per
2 45	35.31	35.29	10.8 ¢	level

Shut Down Insert outer Control, Safety, Dump fuel H_2O

Exp # 172 9-6-61

Added 120 g H_3BO_3, Total 511 g
0.957 g B/l ≈ 28.53 gm B in core

3 37	Source in	Safety 28.01		
	Refl H_2O 6" Above Be	fuel H_2O 28.47"		
	Inner	outer		
	36.00"	999.81"		
3 55	37.41	37.41	Sour out	Approx Crit
	37.41	37.61 $\tau = 95$, $\rho = 10.2$		Pos Per
	37.41	37.385	$S_{cm} = \frac{10.2}{2.25} = 45.3$	level
	37.40	37.40		level
4 17	Shut Down Dump fuel H_2O, Insert outer Control, And Safety			

Instrument Check on 9/8-7-61 Source γ

PM-1 ______ Low Trip ok Alarm Trip ok.
PM-2 ______ Alarm Trip ______
IC-1 7 10⁻¹¹ Meter Trip ok Fast Trip scrammed
IC-2 7 10⁻¹¹ Meter Trip ✓
IC-3 ~5 × 10⁻¹¹ Unstable
IC-4 ~4 × 10⁻¹¹ ok JKT
CRM ______ Meter " "
Preliminary Check on ______
Room 113 Pressure Differential 0.09" H₂O
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted ✓
Safety Withdrawn 28.10
Controls Set INNER 37.40" Outer 999.81"
Reflector Water 6" Above Be
Moderator Water 28.53"

Expt 173

Replaced Original plates as follows; for Flux traverse in fuel

A-1 - P2
B-1 - F4
A 37 P1
B 78 F2

9⁴⁷ Source Out

INNER - Outer

37.40" 37.90" T=60, P=144 ÷ .26 = 91/m (?) Pos Per

9⁵² Start timing 20 min foil Exposure, IC-2 3 × 10⁻⁹

37.40 37.62 level

IC-2 = 7.8 × 10⁻⁹ IC-4 1.6 × 10⁻⁸

Note 10¹² Shut Down Drop Safety, INSERT outer Control

"Note" Exchanged Source M-~~228~~ 43 for Source M-228

8-7-61

Expt. 174

Normalizing U^{233} counts / 5 min.	Fis. Ctr. Position	Fis. Ctr. counts × 256 / 5 min.	Fis. Ctr ~~Ratio~~	U^{235}/U^{233} Ratio		
12,800	5.00"	1067+48	273,200	21.34	1	
12,220	7.00	387+85	99,100	8.12	2	
11,840	9.00	135+179	34,725	~~2.93~~ 2.93	3	
12,010	11.00	51+57	13,112	1.092	4	
~~12,450~~	~~13.00~~	~~[illegible]+148~~	~~4,20[illegible]~~	~~0.341~~		
3 min	(Increased	Power) 3 min				
(594970) -	13.00	(956+189)	~~244,990~~	0.420	5	
355,180 [illegible]	15.00	231+111	59,260	0.167	6	
353,930 [illegible]	17.00	97+59	24,880	0.070	7	
587850	19.00	43+84	11,096	0.0189	8	5 min.
584200	21.00	24+41	6,180	0.0106	9	
582,200	24.00	11+215	3,030	0.0052	10	
577,930	22.00	24+188	6,333	0.0081⁴	11	
574,860	20.00	29+149	7,570	0.0132	12	
572500	18.00	69+35	17,695	0.0309	13	
345,720	16.00	88+80	22,610	0.065⁴	14	3 min.
344730	14.00	206+118	72,840	0.211	15	
345120	12.00	512+50	131,150	0.381	16	
103,780	10.00	407+241	104,450	1.004	17	
23,570	8.00 ~~8.00~~	249+28	63,830	2.71	18	

Instrument Check on 8-7-61 Source γ

8-7-61

Expt. 174

Fission Ctr. Traverse in Bottom Reflector with U^{233} at ~ Center of Core Annulus

Island refl. H₂O ~ 6" above Be; fuel water at 26.4"

Safety 28.1 , Source in., Safeties set.

	Inner	Outer	
	37.50	999.81	
1 35	37.50	37.53	Source out slightly Pos
2 01 PM	37.495	37.495	level
4 27	Shut Down Insert outer Control, Safety And Dump fuel H_2O		

NOTE Exchanged Source M-~~228~~ for Source M-228

216

Instrument Check on 8-8-61 Source Y

PM-1		Low Trip ok	Alarm Trip ok
PM-2	—		Alarm Trip —
IC-1	$> 10^{-11}$	Meter Trip ok	Fast Trip Screamed
IC-2	$> 10^{-11}$	Meter Trip "	
IC-3	$\sim 5 \times 10^{-11}$	Calibration ok	
IC-4	$\sim 6 \times 10^{-11}$	Calibration ok.	
CRM		Meter Trip	

Preliminary Check on 8-8-61

Room 113 Pressure Differential 0.09" H_2O

Red Light On and Personnel Check ✓

Screams and Bldg, Alarm Reset ✓

Source Inserted ✓

Safety Withdrawn 28.12

Controls Set 37.5 inner 37.5 outer

Reflector Water ~6" above Be

Moderator Water 28.6"

Exp 175

9-8-61 Repeat of Exp # 174

10 00 AM Source out

Inner	Outer		
37.50	37.70		Pos Per
37.55	37.55	IC-2 $\sim 5 \times 3 \times 10^{-10}$	Level
37.55	37.55	IC-2	7.5×10^{-9} Level
37.55	37.55	IC-2	$2.6 \times 3 \times 10^{-9}$
37.55	37.55	IC-2	$2.8 \times 3 \times 10^{-9}$

12 30 Shut Down Insert Outer Control, Safety And Dump fuel H_2O

Note Found Bad Selsyn on fission Counter Drive. (Replaced by Mr Richard)

Exp. 1755

U^{233} Total	Fis. Ctr. Position	Fis. Ctr. Counts X256	Fis. Ctr. Counts total	$\frac{U^{235}}{U^{233}}$ Ratio	Time	IC-2
12960	5.00	1110^{+14}	284,176	21.93	5 min.	0.15×10^{-9}
12,430	7.00	393^{+147}	100 755	8.11	"	
12,450	9.00	143^{+94}	36,702	2.95	"	
12,960	11.00	54^{+186}	14 010	1.081	"	
431,630	13.00	736^{+37}	188,453	0.437	3 min	7.5×10^{-9}
435,770	15.00	296^{+153}	75,929	0.174	"	
432,230	17.00	127^{+108}	32,620	0.0755	"	
430,940	19.00	57^{+153}	14,745	0.0342	"	
430,310	21.00	28^{+17}	7,185	0.0167	"	
714,590	"	46^{+217}	11,993	0.0168	5 min	
719010	23.88	16^{+218}	4,314	0.00600	"	
719,570	22.00	32^{+220}	8,412	0.0117	"	
714,640	20.00	65^{+155}	16,790	0.0235	"	
713,880	18.00	139^{+153}	35,750	0.0501	"	
706,470	16.00	307^{+169}	78, 770	0.112	"	
422,850	14.00	436^{+5}	111, 600	0.264	3 min	
420,220	12.00	1056^{+99}	270, 600	0.644	"	
38,830	"	98^{+165}	25, 240	0.650	"	$.66 \times 10^{-9}$
48,910	10.00	447^{+157}	114,560	1.68	5 min	
72,390	8.00	1254^{+207}	321,300	4.44	"	
9930	6.00	471^{+27}	120,600	12.15	"	
10340	5.00	776^{+176}	198,880	19.22		

Expt 176

U^{233}	Fis. ctr. Pos.	Fis. ctr X 256	Fis. ctr Total counts	U^{235}/U^{233}	
13160	5.00	1194^{+109}	305,773	23.24	5 min
13530	9.00	159^{+242}	40,946	3.03	
711,480	13.00	1251^{+168}	320,424	0.450	
733,940	17.00	228^{+84}	58,452	0.0796	
766500	21.00	47^{+243}	12,275	0.0161	
678080	24.00	16^{+1}	4,097	0.00604	
469,220	19.00	93^{+176}	23,984	0.0358	
672,440	15.00	488^{+102}	125,030	0.186	
753530	11.00	327^{+244}	83,956	1.11	
14020	7.00	475^{+40}	121,690	8.68	
13990	5.00	1251^{+116}	320,372	22.90	

Exp # 176 9-8-61 217

1 48 Repeat of Exp # 175

Source IN Safety 28.04"

Refl H_2O 6" Above Be fuel H_2O 28.42

1 52 Inner - Outer fission ctr

37.55 37.75 5.0" Pos Per

37.55 37.55 Ic-2 = $5 \times 3 \times 10^{-10}$ level

37.55 37.55 Ic-2 = $7.2 \times 3 \times 10^{-10}$ level

37.55 37.55 Ic-2 = $2.8 \times 3 \times 10^{-9}$ level

3 30 Shut Down Insert outer control, Safety And Dump fuel H_2O

September 11, 1961

Foils punched from the HFIR CE #2 fuel plates had been counted for their natural background from the uranium, a 0.18 mev gamma in U^{235}. The counters SA 1 and 2 were set with at $E = 75$ $\Delta E = 1000$, (gain adjusted so that peak of Cs^{137} occurred at $E = 400$.) This setting of the analyzers did not count the lower mass peak observed in this uranium and believed due to other isotopes of uranium. By comparison to a weighed metal piece in SA 1 and SA 2, then the uranium was determined after correcting for the self abs. of the 0.18 Mev gamma ray in uranium and also the abs. in the aluminum of the foil. This calibration was completed in June.

On ~ Sept 6-7, Cluverton reported by phone that Beaver had said that there was a possibility that the HFIR uranium was partially irradiated uranium because the isotopic analysis was different - how different not specified. As a result of this the 3x3" NaI crystal was used with the S.A. of the 20 channel analyzer and the TMC 256 channel analyzer CN-110 and Plug in 210 with high level input

gain on phototube was adjusted so that with LA. gain of X4 the Cs^{137} peak occurred in channel 66 Gain was increased to for counting the uranium and 0.18 mev occurred in channel 71. The details of the spectrum under high resolution showed four peaks in both standard and foil U-2-4 (Baseline at 30)

U-2-4		Std Metal	
16	5418	144-128 = 16	5414
31	16304	161-128 33	19243
54	8749	182-128 54	8382
71	31657	149-128 71	32191

Background has been subtracted by the TMC by counting in the subtraction mode for a live time equal to the time needed to collect 32768 counts in peak at Ch 71 Although there are significant differences in the peak at Ch 31 - 33, This region was excluded in counting in SA1 and 2 the slight differences in 54 and 71 peaks are partly statistical and part real, but it is hard to find anything that would be larger than 1%. For details see tape p221

Back submitted

U-2-4

73	900000
1	7
2	655500
3	16
4	3642
5	3759
6	2048
7	1582
8	1429
9	1753
10	2022
11	2275
12	2600
13	3517
14	4583
15	5132
16	5418
17	5033
18	4[illegible]0
19	4[illegible]4
20	4[illegible]3
21	5[illegible]1
22	5[illegible]
23	5[illegible]
24	6[illegible]
25	7[illegible]
26	8[illegible]7
27	[illegible]
28	1[illegible]
29	1[illegible]6
30	[illegible]
31	[illegible]6
32	1[illegible]4
33	1[illegible]6
34	1[illegible]4
35	1[illegible]1
36	1[illegible]5
37	999[illegible]
38	9012
39	7858
40	6971
41	6179
42	5176
43	4376
44	3596
45	3435
46	2867
47	3038
48	3280
49	4037
50	5074

48	2600
49	4037
50	5074
51	6419
52	7646
53	8508
54	8749
55	8714
56	8285
57	7528
58	6866
59	6303
60	6297
61	6523
62	7261
63	8551
64	10549
65	13358
66	16938
67	21311
68	25345
69	28407
70	30945
71	31657
72	31096
73	28297
74	25319
75	21152
76	17156
77	13262
78	10391
79	7808
80	5979
81	4440
82	3251
83	2312
84	1833
85	1378
86	924
87	600
88	492
89	384
90	235
91	108
92	156
93	104
94	155
95	86
96	29
97	124
98	27
99	114
100	63
101	65524
102	50
103	5
104	79
105	17
106	36
107	19
108	1
109	76
110	91
111	65420
112	5
113	86

113	86
114	35
115	47
116	39
117	26
118	60
119	113
120	66
121	65517
122	7
123	65530
124	54
125	14
126	65532
127	22
128	66

Bkg Subt. Standard U Metal

129	14
130	32
131	9
132	3163
133	3357
134	2001
135	1735
136	1594
137	1759
138	2051
139	2335
140	2618
141	3546
142	4427
143	5171
144	5414
145	5145
146	4997
147	4891
148	4864
149	5155
150	5948
151	6761
152	7670
153	8443
154	9383
155	10709
156	12687
157	14310
158	16188
159	17683
160	18830
161	19243
162	18831
163	17512
164	15685
165	13802
166	11662
167	10172
168	8577
169	7246

169	7246
170	6393
171	5232
172	4222
173	3363
174	2918
175	2830
176	2989
177	3718
178	4580
179	5911
180	6982
181	7955
182	8382
183	8070
184	7999
185	7193
186	6683
187	6306
188	5807
189	6268
190	6867
191	8337
192	10454
193	12934
194	16445
195	20577
196	24895
197	24569
198	30839
199	32191
200	31429
201	29433
202	25736
203	21699
204	17802
205	13988
206	10979
207	8485
208	6321
209	4683
210	3568
211	2635
212	1960
213	1396
214	1068
215	782
216	510
217	421
218	289
219	225
220	197
221	130
222	178
223	79
224	79
225	209
226	99
227	62
228	116
229	104
230	51

230	51
231	100
232	40
233	60
234	54
235	30
236	65
237	103
238	73
239	97
240	125
241	78
242	78
243	73
244	41
245	43
246	85
247	41
248	27
249	56
250	77
251	65533
252	79
253	74
254	48
255	43
256	44

collected in
½ transferred
to 2/2

3x3 XTL NAI 9.3 cm
sample distance. 20 ch
L.A. Hi level output on
TMC.

222 9-11-61

Instrument Check on 9-11-61 Source Y

PM-1 _____ Low Trip ok Alarm Trip ok

PM-2 ~~[illegible]~~ Alarm Trip _____

IC-1 > 10^{-11} Meter Trip _____ Fast Trip _____

IC-2 > [illegible] $\times 10^{-11}$ Meter Trip _____

IC-3 ~ 4 $\times 10^{-4}$ Calibration _____

IC-4 ~ 6 $\times 10^{-11}$ Calibration _____

CRM ~ Meter Reading _____

Preliminary Check on 9-11

Room 113 Pressure Differential 0.09"

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Test ✓

Source Inserted ✓

Safety Withdrawn 28.00

Controls Set _____

Reflector Top ~ 6" above Be

Moderator Level 28.03"

Expt. 177

Foil Irradiation for flux Normalization

Target out

T-3-6 In center of island

T-3-4 " " " a-37 (T-2 plate)

T-3-1 Contact with Be

T-3-2 2" from Be

T-3-3 4" " "

T-3-5 6" " "

T-3-7 - 5" above fuel next to island

U-1-3 - 7" " " " " "

Inner Outer

38.56 38.56 ~ Level

Cont Exp # 177

10 41 Start timing 20 min foil Exposure IC-2 3×10^{-9}

11 01 Stop foil Exposure IC-2 7.6×10^{-9}

Shut Down Insert Outer Control, Dump fuel H_2O

And lower Safety to 8.5"

Analyses 0.95 mg B/ml Removed two samples of Fuel Water for B anal. #151A

Sp Gr. = 1.0042 @ 24°C Added 60 gm H_3BO_3 Total 570

10-9-61 this addition of H_3BO_3 was from Lot No 22105 Baker Boric Acid Crystal Pwd

Instrument Check on 9-12-61 Source ✓

PM-1		Low Trip	ok	Alarm Trip	ok
PM-2	—		—	Alarm Trip	—
IC-1	$> 10^{-11}$	Meter Trip	ok	Fast Trip	Scrammed
IC-2	$> 10^{-11}$	Meter Trip	✓		
IC-3	$\sim 5 \times 10^{-11}$	Calibration	ok ok		
IC-4	$\sim 5 \times 10^{-11}$	Calibration	" "		
CRM	—	Meter Trip	—		

Preliminary Check on

Room 113 Pressure [illegible] 0.09" water

Red Light [illegible] ✓

Scrams and [illegible] ✓

Source [illegible] ✓

Safety [illegible] 28.60

Controls (3) [illegible] 39.80 Outer -

Reflector [illegible] ~6" above Be

Moderator Water 28.2

Target replaced in island.

229-12-61 Expt. 178

Test for crit control rod position after adding 60 gm H_3BO_3. ~~Total 571~~ 570

(10-9-61 (Lot No. 22105) Dwn) ≈ 1.062 gB/l; 31.9 gB in core

	Inner	Outer		
	38.90	38.90	Source Out	Approx level
8 53	38.90	39.22	T = 77, ρ = 12.03/3.2 ¢ = 37.6 ¢/in. Pos	Per
9 06	38.90	38.90		level
9 14	44.245	36.61		level
9 28	36.92	43.95		level

Shut Down Insert Outer Control, Safety And Dump fuel H_2O

(10-9-61 Lot No 22105 Dwn) → Added 60 gm. Boric Acid to fuel water and mixed. 6.7 g/l ≈ 1.173 gB/l; 35.2 g Total in core

Total 630 g

Exp # 179 9-12-61

11 21 Source in Safety 28.02

Refl H_2O 6" Above Be Fuel H_2O 28.02

	Inner	Outer		
	39.75	25.83		
	40.83	40.83	Source out	Approx Crit
~11 40 AM	40.83	41.30	Positive Period	
			99.3 sec 9.9 ¢ or 23.6 ¢/in	
	40.83	40.88		

Evidence that the reactivity is not stable — position changes from .86 to .88 in ~ 5 minutes.

Moderator H_2O @ 27.71, pumped to 28.42
no change in crit.
+0.86" +0.86" level @ 5.7×10^{-10} on IC-2

10-9-61
Lot No 22104
DWM

Added 60 gm Boric Acid and mixed.
Total Gd – 7.34 g/l

Experiment # 180 Determine Crit Pos w. 60 gm Boric Acid. Reflector H_2O ~ 28.9", Source In (outer = 0)
Moderator H_2O → 28.54 Safety ~ 28.03 (Inner = +0.86)
Inner 43.90 outer 43.95
Subcritical

Added 3l of water to fuel water storage 7.12 g/l Total Vol ~ 97l

Expt # 181
Source in Safety 28.04"
fuel H_2O 6" Above Be fuel H_2O 28.23"
Inner - Outer "
43.97 - 43.95" Source Out Sub Crit
Shut Down

Added 1l water to fuel water storage. Total vol ~ 98l.
~ 7.05 g/l .175 x 7.05 = 1,234 g B/l
(36.67 Dwg) ≈ 3.70 g in Core

Expt# 182 9-12-61

Source in — Safety 28.00"

Refl H_2O 6" Above Be — fuel H_2O 28.74"

Inner	Outer	
43.90	32.81	
43.90	43.95	T=123 sec 8.44/1.37 = 6.14/in. Source out — Pcs per Super Crit Level
43.90	42.58	
43.06	43.06	level

I^{33}

Shut Down

Inserted: a-1, - P2, a-37, - P-1
b-1, - F-4, b78, F-2

Instrument Check on 9-13-61 Source 8

PM-1		Low Trip	ok	Alarm Trip	ok rescrammed
PM-2	—		—	Alarm Trip	
IC-1	$>10^{-11}$	Meter Trip	ok	Fast Trip	ok
IC-2	$>10^{-11}$	Meter Trip	ok		
IC-3	$\sim 5\times10^{-11}$	Calibration			
IC-4	$\sim 5\times10^{-11}$	Calibration			
CRM	—	Meter Trip			

Preliminary Check on 9-13-61

Room 113 Pressure Differential 0.09"

Red Light On and Personnel Check ✓

Scrams and Bldg, Alarm Reset ✓

Source Inserted ✓

Safety Withdrawn 28.07"

Controls Set Inner 43.90" - Outer 30.00"

Reflector Water 6" Above Be

Moderator Water 28.58"

9-13-61 Expt. 183

Flux traverse in Fuel. For plate positions see opposite Page

8[52] Inner 43.33 Outer 43.33 ~ Level

43.90 43.95 [259 sec 4.45¢] Pos Per

9[16] start timing 20 min foil Exposure IC-2 3×10^{-9}

9[30] 43.35 43.35 IC-2 7.8×10^{-9} level

9[36] Stop Exposure IC-2 7.8×10^{-9}

Note Drop Safety Insert Outer Control

Note

9-13-61 Samples #2 AND 2A taken from fuel H_2O System Approx 100 g Per Sample

9-14-61 SAMPLE #2 sent to (Mr Laing x-10) for Analysis

Analysis 1.19 mg/ml Sp Gr. = 1.0040 @ 24°C

Exp # 184 9-13-61

2[45] Purpose:

use Accelerator for Source - Safety 28.04

Refl H_2O 6" Above Be fuel H_2O 28.68"

INNer - Outer

22.00" - 00.00"

PN-138 Inner 22.00 Outer 00.0 Boron Poisoned

CORE CRIT AT 43.36 EXP#184 TOTAL 558 390

ACC 135KV 1.07 ma 4.5 MVA 100 MUS 330 cps

TMC 10 MUS BKG x32 DELAY x2 DISC 4

DET MINBF$_3$ @1750 DD 2 1.1 x 20 PHS 450

2 Breakdown

EXP = 185

PN-139 EXP 185 INNER 0.05 OUTER 0.00 BORON
POISON CORE CRIT AT 43,36
ACC 135KV 1.10 MA 5MUA 100MUS 330 CPS
TMC CH 10 MUS BKG 32 DELAY 2 DISC 4
DET MIN BF3 AT 1750V DD2 1.1X200 PHS 450
/ Breakdown

Instrument Check on 9-14-61 Source 8

PM-1		Low Trip	ok	Alarm Trip	Scrammed
PM-2				Alarm Trip	
IC-1	$>10^{-11}$	Meter Trip	ok	Fast Trip	ok
IC-2	$>10^{-11}$	Meter Trip	ok		
IC-3	$\sim 5\times10^{-11}$	Cal	ok		
IC-4	$\sim 5\times10^{-11}$	Cal	ok.		
CRM					

Preliminary Check on

Room 113 Pressure Differential 0.09"
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted Acc. source
Safety Withdrawn 28.10
Controls Set
Reflector Water ~ 6" above Be
Moderator Water 28.59"

Expt 186 A

Pulsing at critical

Inner	Outer	
44.0	43.95	Pos. Period
	237 sec	→ 4.80 ¢

Inner	Outer	Safety 28.1	
43.36	43.36	level @ 6.0×10^{-10} amp-2	
43.90	43.95	20.58	slightly sub
43.90	43.95	20.68	level.

Shut down to move limit switch.

Exp # 186B 9-14-61

Use Accelerator for Source
Safety 21.04"
Refl H_2O 6" Above Be fuel H_2O 28.60

INNER	-	Outer	Safety	
43.74	-	43.74	21.04	level

11:15 Shut Down Insert Safety And outer Control to 35.0"

EXP # 187 — React @ 32.0 d.

~~Inner 32~~

PN-140 INNER 32.00 OUTER 32.00 SAFETY 28.10

CRIT AT 43.36 TOTAL 643055

ACC 135 KV ~~200~~ 9.96 MA 1MUA SF 60 100 MUS 170 CPS

TMC CH 10 MUS BKG = 16 DELAY 2 DISC MEM 111

DET MIN BF3 AT 1750 DD2 #1.1 X 200 PHS 450

Poss / Breakdown

230
9-14-61

Expt 188

~~Continuation of Expt 188a~~ for pulsing at Critical

INNer	Outer	Safety	
43.85	43.85	20.99	Above

Insert safety to 14.0 for shutdown
withdraw to 20.99 pulse for 200 cycles
and repeat many times.

PN-141 INNER OUTER 43.85 SAFETY 20.99 CRIT
Acc 135kv 0.7MA 400 ~~45~~ MUS 20CPS
TMC CH 160 MUS BKG 4 DELAY 2 DISC 4 MEM 1-1
DET MINBF3 AT 1750 DD2 1.1X 200 PHS 450

3 29

Check Critical After Pulsing PN-141

INNer - Outer	Safety	Ref H_2O	fuel H_2O
43.85 43.85	20.99	6" Above Be	28.58

Shut Down INsert outer Control, Safety
and Dump fuel H_2O

level on IC-34

Instrument Check on 9-15-61 Source 10 mc/ Y

PM-1	>50 μa	Low Trip	OK	Alarm Trip	OK
PM-2	—		—	Alarm Trip	—
IC-1	>10 x 10^{-12}	Meter Trip	OK	Fast Trip	OK
IC-2	>10 x 10^{-12}	Meter Trip	OK		
IC-3	~5 x 10^{-11}	Calibration	OK		
IC-4	~5 x 10^{-11}	Calibration	OK		
CRM	X	Meter Trip	X		

Preliminary Check on 9-15-61

Room 113 Pressure Differential — OK

Red Light On and Personnel Check OK C.C.

Scrams and Bldg. Alarm Reset ✓ C.C.

Source Inserted — Acc

Safety Withdrawn 20.99

Controls Set Inner 22.0" Outer 22.0"

Reflector Water 6" Above Be ~~28.81~~

Moderator Water 28.81"

EXP # 189 A

PN-142 HFIR EXP 189 INNER-OUTER 22.00

SAFETY 20.99

ACC 135 KV 1.03 MA 3.0 MUA SF 60 100 MUS

330 CPS [redacted] CRIT AT 93.36

TMC CH 10MUS BKG 16 DELAY 2 DISC 4 MEM 1/2

DET MIN BF3 AT 1750 DD 2 1.1x200 PHS 450

BETWEEN FUEL ANNULI AT MID PLANE

Breakdown

EXP 189 B

PN-143 HFIR EXP 189 INNER - OUTER 12.00

SAFETY 28.0

ACC 135 KV 1.0 MA 3.0 MUA 100 MUS 330 CPS

CRITAT 43.3 C

TMC CH 10 MUS BKG 16 DELAY 2 DISC 2 MEM 1/2

DET MIN BF3 AT 1750 DD 2 1.1 X 200 PHS 450

No Breakdowns

EXP 190

PN-144 HFIR EXP 190 INNER 0.05 OUTER 22.0 SAFETY 28.0

Same as 189

1 Breakdown

EXP 191 A

PN-145 HFIR EXP 190 INNER OUTER 7.00

1 Breakdown

EXP 191 B

PN-146 HFIR EXP 191 INNER OUTER 17.00

3 Breakdown

EXP 192

PN-147 HFIR EXP 192 INN = OUT 27.00

No Breakdown

EXP 193

PN-148 HFIR EXP 193 INN = OUT = 27.0

Bkg 8 CH 40 μs (110 CPS 100 μs)

No Breakdown

Preliminary Check on 9-18-61

Room 113 Pressure Differential 0.09"

Red Light [illegible] ✓

Screams and Bldg [illegible] ✓

Source In[illegible] accel. S.

Safety With[illegible] 28.01

Controls Se[illegible] Inner 43.90 Outer 00.00"

Reflector Water ~~28.6~~ 6" Above Be

Moderator Water ~~~ 6" above Be~~ 28.68

Instrument Check on 9-18-61 Source Accelerator

PM-1		Low Trip	ok	Alarm Trip	~~[illegible]~~ ok
PM-2				Alarm Trip	
IC-1	$\gtrsim 10^{-11}$	Meter Trip	ok	Fast Trip	Jammed
IC-2	$\gtrsim 10^{-11}$	Meter Trip			
IC-3	$\sim 4 \times 10^{-11}$	Calibration	ok		
IC-4	$\sim 4 \times 10^{-11}$	Calibration	ok		
CRM		Meter Trip			

EXP 194

PN-149 HFIR EXP 194 INNER 43.90 OUTER 0.00

ACC 135KV 1.1MA ~4MUA 100MUS 330CPS

TMC CH 10 MUS BKG 8 DELAY 2 DISC 4 MEM 1/2

DET MINBF3 DD2 1.1x200 PHS = 450

5 ACC Breakdowns Ch ~~19~~ 20 last during run.

Ch 38 - 62

EXP 195

PN150 HFIR EXP 195 INNER 43.90 OUTER 12.00

ACC 135KV 1.05MA ~4MUA 100MUS 330CPS

TMC CH 10 MUS BKG 16 DELAY 2 DISC 4 MEM 1/2

DET MINBF3 @ 1750

EXP #196 (Repeat 194)

PN-151 EXP 196 IN 43.90 OUT 0.0

ACC 135KV 1.1MA 100MUS 330CPS

TMC 10MUS BKG16 DELAY2 DISC4 MEM1/2

EXP #197

PN152 EXP 197 IN=43.90 OUT = 22.00

ACC 135KV 1.05MA 2MUA 100MUS 220 CPS

TMC 20 MUS CH BKG16 MEM 1/2

EXP 198

PN153 HFIRCE2 EXP198 IN 43.90 OUT 32.00

ACC 135KV 0.9MA 1MUA 200MUS 130CPS

TMC 40 MUS BKGX16 MEM1/2

EXP #199

PN154 HFIRCE2 EXP198 IN 43.90 OUT 32.00

ACC 135KV 0.8MA 0.5MUA 400MUS 35 CPS

TMC 160 MUS BKG 16 MEM 1/2

EXP #200

PN 155 HFIRCE2 EXP 200 IN 22.00 OUT 43.95

ACC 135KV 1.0MA 2.5MUA 100 MUS 330CPS

TMC 10MUS BKG 16 MEM 1/2

EXP 201

PN-156 HFIRCE2 EXP 201 IN 00.05 OUT 43.95
ACC 135KV 1.0MA 3.5MUA 100MUS 330CPS
TMC 10MUS BKG/6 DELAY 2 015C4 MEM 1/2
Total 868526

EXP 202

PN-157 Total 120000 cycles
ACC 135KV 1.0MA 9.5MUS 300MUS 330CPS
(Memory overflowed in many channels
Same as PN 156 IN 0.05 OUT 43.95

Instrument Check on 9-19-61 Source γ

PM-1 ________ Low Trip Scrammed Alarm Trip ok
PM-2 ——— ——— Alarm Trip ________
IC-1 7 10^-11 Meter Trip ✓ Fast Trip ✓
IC-2 7 10^-11 Meter Trip ✓
IC-3 ~5×10^-11 Calibration ok
IC-4 ~6×10^-11 Calibration ok.
CRM ________ Meter Trip ________

Preliminary Check on ________

Room 113 Pressure Differential 0.09"
Red Light On and Personnel Check ✓
Scrams and Bldg, Alarm Reset ✓
Source Inserted Accel. S.
Safety Withdrawn 20.99
Controls Set Inner 43.90 Outer 00.00"
Reflector Water 6" Above Be
Moderator Water 28.32"

Exp # 202 9-19-61

Pulsing at Critical

9:10 AM Inner Outer
43.90 43.95" Sub Crit
Increase Power level with Accelerator (IC-2 4.5×10^-?)
And Measure Neg Per. T=217, 734

9:23 Shut Down to Add H_2O to fuel H_2O system

9:32 Added 1/2 l of water to fuel water storage tank and mixed.

Use Accelerator for Source Safety 20.99"
Refl H_2O 6" Above Be fuel H_2O 28.52"

	INNER	–	OUTER	
	43.90	–	28.49	
$10^{\frac{08}{}}$	43.90	–	43.95	Approx Crit
$10^{\frac{35}{}}$	43.75	–	43.75	level

Insert Safety to make Sub Crit
$10^{\frac{40}{}}$ Raise Safety to make Crit
43.75 43.75

PN-158 HFIR EXP 203 INNER OUTER 43.75
SAFETY 20.99 AT CRITICAL. SAFETY TO 14.0
AFTER 200 CYCLES TOTAL
ACC 135 KV 0.85 MA 600 MUS 10 CPS
TMC CH 320 MUS BKG 4 DELAY 2 DISC 4 MEM 1/1
DET MIN BF3 AT 1750 DD2 1.1 X 200
PHS 450

$1^{\frac{33}{}}$ Stop Pulsing AND Check Critical Cond
INN[illegible] Outer Safety
43.7[illegible] 43.75 20.99" Slightly Sub Crit
−1150 sec −1.2 ¢
Shut Down Insert Safety, Outer Control
Dump fuel H_2O

Exp # 204 9-19-61

Safety 28.11"
Refl H_2O 6" Above Be fuel H_2O 28.52
INNer - Outer
00.05 43.95

PN-159 HFIR EE2 EXP 204 INNER 00.05
OUTER 43.95
ACC 135KV 1.1MA 100 MUS 330CPS
TMC 10 MUS BKG 16 DELAY 2 DISC 4 MEM 1/2
DET 4/8 in above MID Plane

EXP 205

PN-160

ACC 135KV 1.1 MA 14 MUA
DET 4 1/8 in. ABOVE MID PLANE

N.B. Fourth digit on MC-205 printed 4 for 8 on channel 15 and a 4 for 9 on ch 28.

Monroe adjusted core on 4 [illegible] in 4th column.

Instrument Check on 9-20-61 Source ~~S~~

PM-1	Low Trip ok	Alarm Trip ok	
PM-2	—	Alarm Trip	
IC-1 > 10^{-11}	Meter Trip ok	Test Trip screamed	
IC-2 > 10^{-11}	Meter Trip ✓		
IC-3 ~ 4×10^{-11}	Calibration ok		
IC-4 ~ 4×10^{-11}	Calibration ok.		
CRM —	Meter Trip		

Preliminary Check on 9-20-61

Room 113 Pressure Differential 0.1" H_2O

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accel. S.

Safety Withdrawn Safety removed for min. BF_3 counter insertion

Controls Set INNer 0.04" Outer 43.95"

Reflector Water 6" Above Bc

Moderator Water ~~6" Above Bc~~ 28.37"

Exp # 206

Target out; Safety out

BF_3 counter in center of island

PN-161 HFIRCE #2 EXP 206 INNER 0.05 OUT 43.95

SAFETY Removed ~~INTO~~ TARGET REMOVED

ACC 135 KV 0.9 MA 100 MUS 330 CPS

TMC 10 MUS BKG 32 DELAY 2 DISC 4 MEM 1/2

DET MIN BF3 @ 1750 AT CENTER OF

TARGET REGION

No breakdowns

Exp # 207 9-20-61

INNer - Outer
43.90 43.95

PN-162 EXP 207 INNER 43.90 OUTER 43.95 SAFETY 20
Removed Target Removed.
ACC 135 KV 0.75 MA 400 MUS 17 CPS
TMC 160 MUS BKG 8 DELAY 2 DISC 4 MEM 1/1
DET MIN BF3 CENTER OF TARGET REGION
No Breakdowns
Shut down

Instrument Check on 9-21-61 Source Y

PM-1 _____ Low Trip ok Alarm Trip ok.
PM-2 — — Alarm Trip
IC-1 $> 10^{-11}$ Meter Trip ok Fast Trip ok
IC-2 $> 10^{-11}$ Meter Trip ok
IC-3 $\sim 4 \times 10^{-11}$ Calibration ok
IC-4 $\sim 6 \times 10^{-11}$ Calibration ok
CRM — Meter Trip —

Preliminary Check on 9-21-61

Room 113 Pressure Differential 0.1 "H_2O
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset —
Source Inserted Accelerator
Safety Withdrawn Removed from System
Controls Set Inner 00.04" Outer 00.00"
Reflector Water 6" Above Be
Moderator Water 28.25"

Installed 2nd min. BF_3 counter in central target region. Each ~ 3/4" on opposite sides of center of reactor

11 22 AM Exp # 208 9-21-61

PN-163 HFIRCE #2 EXP 208 INNER 0.05 OUTER 0.00
SAFETY REMOVED TARGET REMOVED Total 750000
Acc 135 KV 0.9 MA 1.5 MUA SF 55 100 MUS 330 CPS
TMC 10 MUS BKG 16 DELAY 2 DISC 4 MEM 1/2
DET 2 MIN BF3 IN TARGET REGION PHS OUTPUT
PARALLELED ON DD-2 AMPLIFIERS.
DD2 1.1X200 PHS 450 Pulse Ht ~ 40 -100 V
on BOTH VOLTAGE 1750

PN-164 Same as PN-163 EXCEPT BURST WIDTH = 300 NUS
Acc. has + spikes on neutron grid ?

EXP 209

PN-165 INN = OUT = 12.0

ACC = 135KV 0.9 MA 1.5 MUA 100 MUS 330 CPS

TMC = 20 MUS BKG16 DELAY2 DISC 4 MEM 1/2

EXP 210

PN-166 IN = OUT = 22.0

ACC = 135KV 0.88 MA 0.8 MUA 200 MUS 220 CPS

TMC = 20 MUS BKG16 DELAY2 DISC 4 MEM 1/2

EXP 211

PN-167 IN = OUT = 32.0

ACC = 135KV 0.85 MA 0.5 MUA 200 MUS 220 CPS

TMC = 20 MUS BKG16 DELAY2 DISC 4 MEM 1/2

(Punched & Printed ~~EXP 212~~ twice — punched tapes agree)

PN-168 Same as above but ~~256~~ 128 channels @ 110 cps

(long wait at end)

EXP 212

PN-169 IN = OUT = 37.0

ACC 135KV 0.80 MA 300 μs 70 CPS

TMC 40 MUS BKG16 DELAY2 DISC 4 MEM 1/1

4:30 PM Shut down by draining H_2O

and IN = OUT = 0

Instrument Check on 9-22-41 Source γ

PM-1		Low Trip	ok	Alarm Trip	ok
PM-2	—	—	—	Alarm Trip	—
IC-1	$> 10^{-11}$	Meter Trip	ok	Fast Trip	ok
IC-2	$> 10^{-11}$	Meter Trip	ok		
IC-3	$\sim 5 \times 10^{-11}$	Calibration	ok		
IC-4	$\sim 6 \times 10^{-11}$	Calibration	ok		
CRM	—	Meter Trip	—		

Preliminary Check on 9-22-61

Room 113 Pressure Differential 0.1"

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn Safety Removed from System

Controls Set Inner 32.0" Outer 3.45"

Reflector Water 6" Above Be

Moderator Water 28.50"

Exp # 213 9-22-61

With accelerator on not pulsed and 2 μa. on target 1

Target	IC-1	IC-2	IC-3	IC-4	IN	OUT
135KV 2 μa	1.6×10^{-11}	3.6×10^{-10}	1.4×10^{-11}	1.4×10^{-10}	32.0	3.45
@ 20 μa	1.5×10^{-10}	3.3×10^{-9}	1.2×10^{-10}	1.25×10^{-9}	32.0	3.45
@0.85MA 60 μa	35×10^{-9}	0.80×10^{-8}	3.2×10^{-10}	3.2×10^{-9}	"	"

6

PN-170 EXP 214 IN = 0 OUT = 32.0 SAFETY AND TARGET REMOVED
ACC 135KV 0.83MA 1 MUA 2×10^{-5} MM HG 300 MUS 70CPS
TMC 40 MUS BKG16 DELAY 2 DISC 4 MEM 1/1

EXP 215

PN-171 EXP 215 IN = 0.05 OUT 93.95 SAF & TAR Removed
ACC 135KV 0.93 MA ~1 MUA 2×16^{-5} MM HG 150 MUS 110 CPS
TMC 20 MUS BKG16 DELAY 2 DISC 4 MEM 1/1

EXP 216

PN-172 EXP216 IN = 43.96 OUT = 0.00 SAF & Target Removed
ACC 135 KV 0.93 ~1 MUA 1.8 $\times 16^{-5}$ MM HG 150 MUS 110 CPS
TMC 20 MUS BKG16 DELAY 2 DISC 4 MEM 1/1

PN-173 1500 MUS Burst 110 CPS 20 MUS ch 256
Target = 11 MUA

PN-174 Same as above but run 3X longer and includes above data Total data 4 X PN-173

EXP 217

PN-175 IN = 43.90 Jitter = 22.0 Saf. and Tar Rem.
Acc 135KV 150 MUS 100 CPS
TMC 20 MUS BKG 64

Instrument Check on 9-25-61 Source Y

PM-1 _____ Low Trip ok Alarm Trip ok

PM-2 _____ _____ Alarm Trip _____

IC-1 710 -11 Meter Trip ok Fast Trip ok

IC-2 > 1.0-11 ok

EXP # 218 and 219

Counting Data

M-226

7.50×10^6

M-227

7.96×10^6

1.55×10^7

IC-1	IC-2	IC-3	IC-4	Inner	Outer	Reflector	Moderator	Time pos	Scaler	counts	M
4.3×10^{-11}	4.0×10^{-11}	4.6×10^{-11}	1.4×10^{-10}	43.90	0.00	0	0	5' (500)	445 x256 +115	114 035	
3.7×10^{-11}	3.6×10^{-11}	4.2×10^{-11}	1.2×10^{-10}	0.04	0.00	0	0	5'	402 + 4	102 916	
2.1	1.5	2.5	4.2×10^{-11}	0.04	0.00	~28	28.7	5'	146 + 6	37 382	
2.7	1.9	3.6	5.6	12.0	12.0	"	"	5'	166 +217	42 713	1.14
5.0	3.3	6.0	1.0×10^{-10}	22.0	22.0	"	"	5'	261 + 241	67 057	1.79
4.1	2.75	5.5	0.85	17.0	17.0	"	"	5'	213 +16	54 544	1.46
5.4	3.6	6.0	1.2	~~27.0~~	~~27.0~~	"	"	5'	283 + 218	72 666	1.94
7.1	4.6	8.5	1.4	32.0	32.0	"	"	5'	328 + 53	84 021	2.25
9.3	6.1	1.1×10^{-10}	1.8	34.0	34.0	"	"	5'	402 + 27	102 939	2.75
1.5×10^{-10}	9.6	1.7	3.0	36.0	36.0	"	"	5'	586 + 115	150 131	4.02
2.8	1.8×10^{-10}	3.1	5.5 6.8	38.0	38.0	"	"	5'	1022 +205	261 837	7.00
6.5	4.2	7.5	1.3×10^{-9}	40.0	40.0	"	"	5' 8.00	658 +123	168 571	21.06 787,227
										x4.67	
			Sources in Radial Beam Hole.					time Pos.			
0.2×10^{-11}	$.6 \times 10^{-10}$	2.3×10^{-12}	1.7×10^{-11}	43.90	00.00"	"	"	5' 5.00	17 +206	4 558	000362.7
.1	.55	1.0	1.3	0.04	00.00"	"	"	5'	10 +197	2757	
0.2	.60	2.0	1.8	12.0	12.0	"	"	5'	14 + 113	3697	1.34
0.35	.6	4.0	2.2	17.0	17.0	"	"	5'	24 + 18	6162	2.24
.4	.6	6.0	2.5	22.0	22.0	"	"	5'	33 +5	8453	3.07
.55	.65	6.	2.6	27.0	27.0	"	"	5'	39 +210	10194	3.70
.93	.68	1.1×10^{-11}	3.6	32.0	32.0	"	"	5'	57 +156	14 748	5.35
1.5	.75	1.6	4.8	34.0	34.0	"	"	5'	82 + ~~259~~ 210	21 202	7.69
2.85	.85	3.4	8.3	36.0	36.0	"	"	5'	140 + 42	35 882	13.01
5.6	1.05	6.5	1.4×10^{-10}	38.0	38.0	"	"	5'	259 + ~~179~~	66 483	24.11
1.15×10^{-10}	1.45×10^{-10}	1.3×10^{-10}	2.6	40.0	40.0	"	"	5'	512 + 154	131 226	47.60
1.65	1.75	1.9	3.6	41.0	41.0	"	"	5'	728 + 60	186 428	67.62
			Source removed from Rm 113.			6" above Be	⊙	5'	+14		

Instrument Check on 9-25-61 Source 8

PM-1 Low Trip ok Alarm Trip ok

PM-2 — — Alarm Trip —

IC-1 $> 10^{-11}$ Meter Trip ok Fast Trip ok

IC-2 $> 10^{-11}$ Meter Trip ok

IC-3 $\sim 5 \times 10^{-11}$ Calibration ok

IC-4 $\sim 2.4 \times 10^{-11}$ Calibration ok

CRM — Meter Trip —

Preliminary Check on

Room 113 Pressure Differential OK

Red Light On and Personnel Check OK

Scrams and Bldg. Alarm Reset OK

Source Inserted M-226 - M-227 Cntr of Target Region

Safety Withdrawn Not Installed

Controls Set IN 0.05 OUT 0.00

Reflector Water To 6" above Rx

Moderator Water To 28.

EXP # 218

Purpose - Counting rate (source Multiplication) vs. Control Plate Position.

M-226 and M-227 at midplane of target region each approx 1/2 from axis of fuel element (or target region)

EXP #219

Source moved to Radial Beam Hole.

Exp # 220 9-25-61

BF-3 Counters located in Be

use Accelerator for Source Safety 28.07
Refl H_2O 6" Above Be fuel H_2O 28.3#
INNer - Outer
43.90 00.00"
Purpose: Source Multiplication using 14 MEV neutron source.

EXP #221

PN-176 Counts in Beryllium. IN 0.05 OUT 0.00
ACC 135KV 1.1 MA 300 MUS ~~57~~ CPS
TMC 40 MUS BKG 64 DELAY 2 DISC 0
DET BF3 TWO EA 90° From Source
in 2nd row of 1/2 holes in Be.

On The morning of 9-25-61, the press without liq N_2 was 1×10^{-5} and would pump down to 2×10^{-6} only.

9-26-61 9×10^{-6} w. @. liq N_2
1.5×10^{-6} w. liq N_2

#220

EXP 220

With Target Installed

6 μa on accelerator @ 135 kv.

2' Count time
Moderator H_2O 28.2
Reflector H_2O 6" above Be

Ic-1	Ic-2	Ic-3	Ic-4 Counter at 5.0"	Inner	Outer	Scaler x256		
1.7×10^{-11}	6.4×10^{-10}	1.7×10^{-11}	2.2×10^{-10}	0.04	0.00	42 +10	10 762	1.0
2.2	6.3	2.4	2.4	12.0	12.0	48 +112	12 400	1.15
5.6	7.0	6.8	3.5	22.0	22.0	100 +87	25687	2,39
8.8	6.4	1.0×10^{-10}	4.0	32.0	32.0	144 +186	37050	3.44
3.6×10^{-10}	8.0×10^{-10}	4.5	$9.5 \times$ ~~10~~	37.0	37.0	470 +87	120 407	11.19
~~1.5×10^{-9}~~ 4.8×10^{-9}	1.5×10^{-9}	1.7×10^{-9}	Counter @ 8.00 in. 3.2×10^{-9}	40.0	40.0	643 +165 x4,67	769 490	71.5

Instrument Check on 9-26-61 Source 10 mc Ra Be γ source

PM-1	Low Trip OK	Alarm Trip OK	
PM-2 X		Alarm Trip	
IC-1 $>10\times10^{-12}$	Meter Trip OK	Fast Trip OK	
IC-2 $>10\times10^{-12}$	Meter Trip OK		
IC-3 $\sim 6\times10^{-11}$	Calibration OK		
IC-4 $\sim 6\times10^{-11}$	Calibration OK.		
CRM —	Meter Trip —		

Preliminary Check on 9-26-61

Room 113 Pressure Differential OK

Red Light On and Personnel Check ✓

Scrams and Bldg, Alarm Reset PM-1 only

Source Inserted Accel S.

Safety Withdrawn 28.00

Controls Set In 0.05 Out 0.00

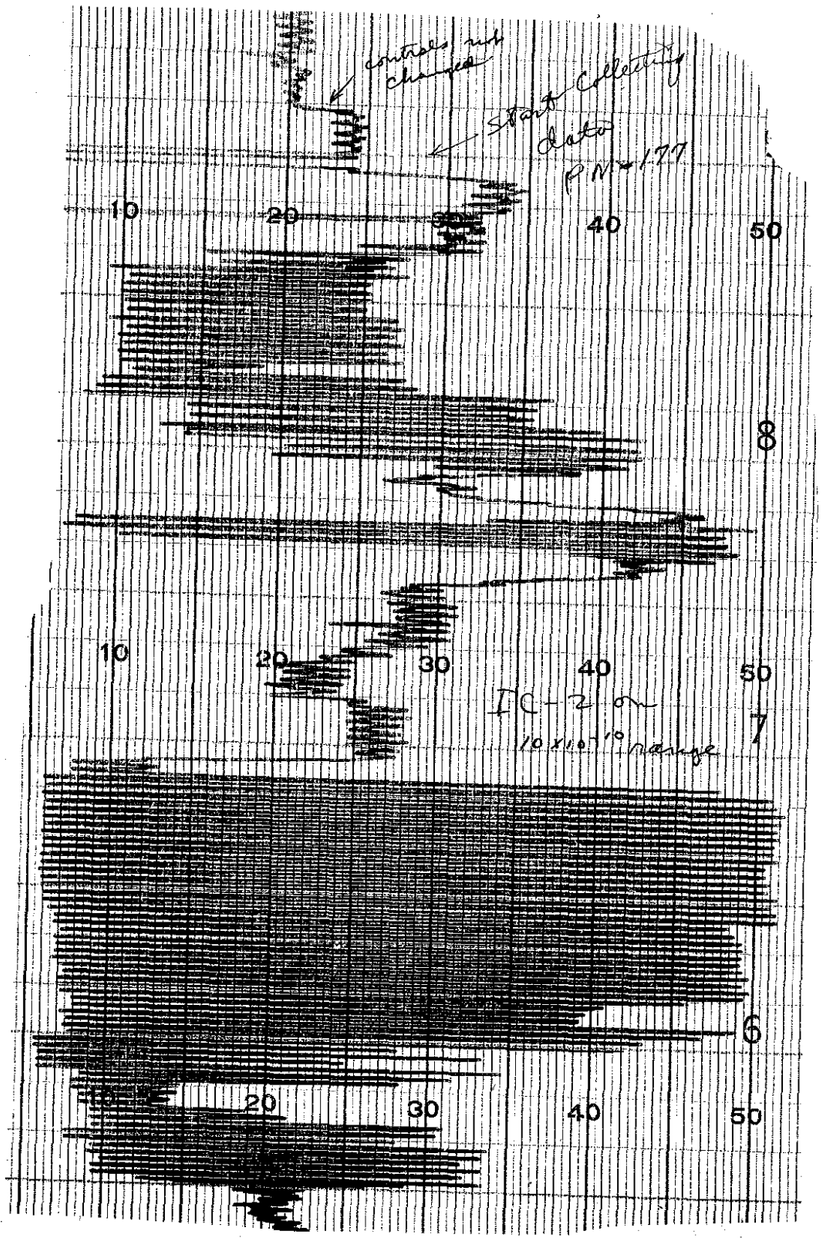
Reflector Water ~ 6" above Be

Moderator Water 28.7 "

Expt. 222

Repeat of Expt 221 with both controls in & counter in Be

In turning up the accelerator the pulsing frequency was set close to 60 cps (~59.4) and the neutron yield varied with the beat frequency of ~.1 cps The response of IC-2 is on next page this tuning was not a deliberate attempt to achieve large modulation but to peak the accelerator and seems to be very sensative to the varions combinations of the voltages. See



PN-177 HFIR EXP #222 PULSING BERYLLIUM

IN 0.05 OUT 0.00 TARGET INSERTED SAFETY 28.0

ACC 133KV 1.05MA 1.2 MUA 200 MUS 58.6 CPS

(Beat Frequency ~ 0.1 CPS) Press ~ 1.6×10^{-5} mm Hg

TMC 40 MUS BKG 64 DELAY 2 DISC 0.5

DET 2 ea MIN BF3 DET IN BE @ AT 1750

2 ea DD2 1.1 X 200 PHS = 450

EXP #223

PN-178 HFIR #2 EXP 223 PULSING BERYLLIUM

IN = OUT = 22.00 TARGET INSERTED SAFETY 28.0

ACC 133KV 1.05MA 1.2 MUA 200 MUS 58.6 CPS

(60~ Beat Freq =) 60 cycle modulation has decreased to non detectable amplitudes.

Pressure 1.6×10^{-5}

TMC 40 MUS BKG 64 Delay x 2 DISC 0.5

DET 2 ea MIN BF3 IN BERYLLIUM AT 1750 VOLTS

2 ea. DD2 1.1 x 200 PHS 450 outputs paralled.

Exp # 224 9-26-61

BF-3 Counters Inserted Between Inner And outer Fuel Annulus At Mid Plane
Accelerator for Source Safety 28.08"
Refl H_2O 6" Above Be fuel H_2O 28.56"
Inner – Outer
43.83" 0.0"
1[36] PM 43.90 43.95 Sub Crit
-543 Neg period -1.65×10^{-4} or −2.6¢

EXP # 225

PN-179 ASSEMBLY −2.6¢ SUBCRIT No breakdown
INNER = OUTER = 32.0 SAF = 28.0
ACC 135 KV 0.88 MA 0.4 MUA 1.7×10^{-5} mm Hg
100 MUS 100 CPS
TMC 20 MUS BKG 64 DELAY 2 DISC 0.5
DET 2 ea BF3 COUNTERS Pulse Amplitudes matched at 20 to 50 volts - Ch 1 0.9 X 100 PHS 200
Counters between Fuel Annuli Ch 2 1.1 X 100 PHS 200
EXP #226

PN-180 ASS. −2.6¢ Subcrit
IN = OUT = 22.0 SAFETY 28.0
ACC 135 KV 1.05 MA 2.0 MUA 1.7×10^{-5} mm Hg
100 MUS 150 CPS
TMC 10 MUS BKG 64 DELAY 2 DISC 0.5
DET 2 ea BF3
No Breakdown

9-27-61

8[10] AM Added 500 ml H_2O (Demineralized) to fuel H_2O System And Mixed

Instrument Check on 9-27-61 Source ✓

PM-1		Low Trip	ok	Alarm Trip	ok
PM-2	—		—	Alarm Trip	
IC-1	$>10^{-11}$	Meter Trip	ok	Fast Trip	scrammed s.
IC-2	$>10^{-11}$	Meter Trip	ok		
IC-3	$\sim 5 \times 10^{-11}$	Calibration	ok		
IC-4	$\sim 4 \times 10^{-11}$	Calibration	ok		
CRM	—	Meter Trip	— Check Ch.		

Room 113 Pressure Millimeters 0.1"
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Test ✓
Source Inserted Accelerator
Safety Withdrawn 28.01
Controls Set Inner 43.90 Outer 0.0"
Reflector Water 6" Above Be
Moderator Water 28.32"

Exp # 227 9-27-61

Purpose: Check Crit Pos on Controls

Inner	Outer	Accelerator off	
43.90	43.95		Super Crit
11[15] AM 43.35	43.35		level
43.90	43.95 T=239 ≈	4.77¢	Pos Per
37.0	37.0 (see next page)		for Pulsing

Expt 228 9-27-61

27.0 27.0

PN-181 HFIR EXP 227 INNER = OUTER = 37.00
WITH TARGET ~~DET~~ +4.84 excess CRIT A 43.35
ACC 135KV 1.0 MA 200 MUS 70 CPS
TMC 40 MUS BKG 16 DELAY 2 DISC 0.5 MEM 1/1
DET 2 EA MIN BF3 IN FUEL ANNULUS
PHS = 200 No Breakdown

PN-182 HFIR EXP 228 IN = OUT = 27.0
ACC 135KV 1.0 MA 200 MUS 160 CPS (256 ch)
TMC 10 MUS BKG ~~32~~ 16 Delay 2 DISC 0.5 MEM 1/1
~~DET~~ No Breakdown

PN-183 HFIR EXP 229 IN = OUT = 17.0
ACC 135KV 1.0 MA 200 MUS 160 CPS (256 ch)
TMC 10 MUS Bkg 32 Delay 2 Disc 0.5 Mem 1/1

PN 184 HFIR Exp #230 IN = Out 12.0"
ACC 135 KV 1.0 MA 300 μs 325 CPS
TMC 10 MUS Bkg 32 Delay 2 Disc 0.5 Mem 1/2

Instrument Check on 9-28-61 Source ✓

PM-1 ____ Low Trip ok ____ Item Trip ok
PM-2 ____ Trip
IC-1 7 10⁻¹¹ ok ok
IC-2 7 10⁻¹¹ ok
IC-3 ~ 5 X 10⁻¹¹ ok
IC-4 ~ 5 X 10⁻¹¹ ok
CRM ——
Room 113 ____ 0.1"
Rod Light ____ ✓
Scrams ____ ✓
Source ____ accel 5.
Safety ____ ✓ 28.04"
Controls ____ In & out at 7.00"
Reflector Water ____ ~6" above Be
Moderator Water ____ 28.02"

Expt ~~229~~ 231 PN-185

PN-185 HFIR EXP 231 IN = OUT = 7.0
ACC 135KV 1.07 MA 5.5 MUA 200 MUS 320 CPS
DUTY CYCLE 200/3125 = 0.064
Total Beam 5.5/.064 = 86 MUA
TMC 10 MUS BKG 32 DELAY 2 DISC 0.5 MEM 1/2

PN-186 HFIR #2 EXP 232 IN = 0.05 OUT = 0.0
Same as 185

PN-187 Use Time of flight Logic 211
with 8 μs channels

PN-188 211 with 16μs channels

EXP # 233

PN-189 212 with 10μs channels
IN = 22.00 OUT = 0.00
ACC 135KV 1.0MA 5.0MUA 1.9×10^{-5} mm Hg
TMC 10 MUS BKG 32 200 MUS 320CPS
Mem 1/2

#234

PN-190 IN 43.9 OUT = 0.00
ACC 135KV 1.0MA 5MUA 1.9×10^{-5} mm Hg
200 MUS 320CPS
TMC 10 MUS BKG 32 MEM 1/2

#235

PN-191 IN = 43.9 OUT = 22.0
Acc 135KV 0.9 MA 1 MUA 1.7×10^{-5} mm Hg
200 MUS 100 CPS
TMC 40 MUS BKG 32 MEM 1/2

#236

PN-192 IN = 43.9 OUT = 32.0
Acc 135 0.95MA 1.7×10^{-5} mm Hg
200 MUS 65 CPS (256 ch)
TMC 40 MUS BKG 32 MEM 1/1

#237

PN-193 In = 43.9 Out 37.0
Acc 135KV 0.9MA 1.6×10^{-5}
400 MUS 35 CPS
TMC 80 MUS BKG 16

#238

PN-194 In 37.0 Out 43.95
Acc 135KV 0.9mA 1.6×10^{-5}
400 MUS 35 CPS
TMC 80 MUS BKG 16

Instrument Check on 9-29-61 Source γ

PM-1	Low Trip	ok	Alarm Trip	ok
PM-2		—	Alarm Trip	—
IC-1	> 10^-11	Motor Trip	ok	Fast Trip ok scrammed
IC-2	> 10^-11	Motor Trip	ok	
IC-3	~5 x 10^-11	Calibration	ok	
IC-4	~5 x 10^-11	Calibration	ok	
CRM		Motor Trip		

Preliminary Check on 9-29-61

Room 113 Pressure Differential 0.1"

Rod Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn 28.06

Controls Set Inner 43.90 Outer 22.0"

Reflector Water 6" Above Be

Moderator Water 28.48"

Exp # 239 9-29-61

Adjusted accelerator at near 60 cycle so that the peak to peak 1.1 ... on log N, then changed frequency to 100 CPS. Acc could be adjusted so that the peak to peak was ~10 to 1.

PN-195 EXP #239 Inner 43.9 Outer 22.0

Acc 135KV 0.95MA 1 MUA 200 MUS 100 CPS

TMC 20MUS BKG 32 1.5 x 10^5 ...

EXP # 240

PN-196 HFIR EXP #240 In. 22.0 Out 43.95

Same as 195

EXP # 241

PN-197 HFIR EXP # 241 In = 0.05 Out 43.95

ACC 135KV 0.97MA 3.5MUA 150 MUS

320 CPS TMC 10 MUS BKG 32 MEM 1/2

EXP # 242

PN-198 HFIR EXP # 242 In = 0.05 Out = 22.0

TMC & ACC Same as above

Exp 243 9-29-61

1^25 Check Crit Position on Control Rods

Safety 28.06

Refl H_2O 6" Above Be fuel H_2O 27.83"

Inner – Outer

43.90" 43.95" Slightly Super crit

1^35 Shut Down Insert outer Control, Safety And Dump fuel H_2O.

9-29-61 "Note" Samples # 3, And 3A taken from fuel H_2O System Approx 100g ea - H_3BO_3 Conc 1.2 g/l

Sample # 3 Sent to X-10 for Analysis

Boron Analyses 1.23 mg/g ml Sp.G. = 1.0040 @ 23.0°C

Oct 9, 1961

Results from Mass Spect Lab on Isotopic Analysis of the new batch of Boric Acid

B-10 19.80 atom per cent

B-11 80.20 " "

Telephone call revealed no comparison to standard boron. (If these results are compared to some in 1958, Std Boron was 19.66 and sample was 19.60)

They will re run analyses with Argonne Std.

A check of notebook revealed that no entry was made to denote when new batch of boric acid was used.

By comparison to a full bottle of boric acid, 187 g of boric acid have been removed (Bottles may weigh differently also)

It is therefore concluded that the last 180 g added (in 3 additions) were from the new batch labeled J.T. Baker lot No 22105. (crystal

Previous was lot K-252 ^powder (Manufacturer B&A the. Chem Div Allied Chem and Dye Corp.)

Dale Magnuson

"Note" 10-9-61 Source M-228 Installed in Source Drive on Assembley

Instrument Check on 10-10-61 Source 10 mc/8

PM-1 Contact Zero Drift OK Alarm Trip OK

PM-2 ~ Contact OK

IC-1 >10x10⁻¹² OK OK

IC-2 >10 x10⁻¹² OK

IC-3 Not so good Very Instable

IC-4 " "

CRM

Preliminary Check on 10-10-61

Room 113 Pressure Differential 0.05"

Red Light On and Terminal Check ✓ C. C.

Scrams and Bldg ✓

Source Inserted M-228

Safety Withdrawn 28.01"

Controls To INNER 22.0" Outer 22.0"

Reflector Water Approx 5 7/8" Above Be

Moderator Water 28.5"

The 3/4 partial outer control plate has been installed and the selsyns set at 22.00 when the inner and outer controls measure 39 1/4 and 26 in. above the Be see page 5. (These were 39 5/16 and 26 1/16 ^with selsyns at 22.00 when the millwrights finished their work)

Limit switch on bottom changed so that outer does not rest on bottom.

No fission or BF_3 counters are in core.

EXP # 244 10-10-61

9[28] AM Source ~~out~~ IN Sub crit

INNER	Outer	
44.20	44.01	-289 sec → -5.2 ¢

Source out Sub Crit Neg Per

Shut Down INSert ~~Sour~~ Outer Control, Safety

Accelerator developed a leak in the target section when moved back to Rm 213. Min press without trap cold ~1.5×10^{-5}, min press with trap cold 6×10^{-6}

min press w.o. target section ~ 10^{-7} mm Hg. Leak found in Bellows flange → 3×10^{-7} mm Hg entire system down

9 55 AM Added 500 Ml H_2O to fuel H_2O System And Mixed with pump for 10 Min.

Exp # 245 10-10-61

Purpose: Check Critical Pos of controls

12 57 Source iN Safety 28.05"

Refl H_2O 5 7/8" Above Be - fuel H_2O 29.19

	Inner	outer		
	44.20	29.97		
1 12	44.20	44.01	source out	Pos Per
1 26	43.02	43.02		level

Note Shut Down - trip with IC-2, lower outer Control.

Oct-11-1961

Press in Acc 1.0×10^{-5} no liq N_2

" " " 4.0×10^{-7} w. liq. N_2

Diff. Pump probably needs cleaning and oil replaced.

Instrument Check on 10-11-61 Source 10 mc/Ra Be γ

PM-1	[illegible] OK		[illegible] OK
PM-2			[illegible] OK
IC-1	Meter	OK	OK
IC-2	Meter	OK	Dropped safety.
IC-3	Calib.		
IC-4	Calib.		
CRM			

[illegible] Check on 10-11-61

Room 113 [illegible] OK

Red Light [illegible] ✓

Sevens and [illegible] ✓

Source [illegible] Use accelerator.

Safety [illegible] 28.09

Controls [illegible] Inner 43.91" Outer 00.07"

Reflector Water Approx 6" Above Be

Moderator [illegible] 28.46"

"Note" 10-11-61 2 BF-3 counters mounted between fuel annuli, output checked 20-50 volts impulses PHS set at 200

Removed Source M-228 from Assembley

Exp # 246 10-11-61

Purpose: Check Crit Pos on Controls
Source - Accelerator Safety 28.69
Refl H_2O 6" Above Be fuel H_2O 28.36

	Inner	Outer	
	43.91	44.01	(Accel off) Slightly Super Crit
10 54 AM	44.20	32.0"	for Pulsing Sub Crit
11 06	Shut Down to Check Accelerator		

Exp # 247 10-11-61

12 47 Accelerator for Source Safety 28.01"
Refl H_2O Approx 6" Above Be fuel H_2O 28.34

Inner ~~44~~	Outer
44.20"	32.0"

Shut Down - (Dump fuel H_2O) to Change BF-3 Ctr

Exp # 248 10-11-61

Accelerator for Source Safety 28.01"
Refl H_2O Approx 6" Above Be fuel H_2O 28.30

Inner —	Outer
44.20"	32.0"

PH ~10-30 volts on Scope
PHS set at 100

PN-199 HFIR EXP 248 IN 44.20 OUTER 32.0

3-4 OUTER CONTROL

Acc 135 KV 0.75 MA 1.8×10^{-5} mm Hg 0.5 MOA

S.F. 65, ~~TMC~~ 400 MUS AT 70 CPS

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

DET West BF3 Ch #1 1750 0.9×10 PHS=100
Delay → East BF3 Ch #2 2000 0.9×100 PHS=100

EXP # 249

PN-200 HFIR EXP 249 Inner 44.20 ~~Outer 22.0~~
3/4 Outer Control 22.0 ∫ 200 MUS AT 110 CPS
~~ACC~~ ACC 135 KV 0.85 MA 1 MUA
TMC 20 MUS BKG 16 Delay 2 Disc 4 Mem 1/1
DET Same as ~~EXP~~ 199
Monroe printing 9 for 3 in 2nd decade
(Xtal.)

10-12-61

8⁰⁰ AM Acc Runs 1.0×10^{-5} mm Hg w.o. liq. N_2
8¹⁵ 1.2×10^{-6} " " w. liq. N_2
8²² 7×10^{-7} " " " "

Instrument Check on 10-12-61 Source 10 mc PuBe

PM-1 ____ Low Trip OK ____ Alarm Trip OK
PM-2 ____ ____ Alarm Trip OK
IC-1 $>10 \times 10^{-12}$ Meter Trip OK Proposed Safety Fast Trip OK
IC-2 $>10 \times 10^{-12}$ Meter Trip OK ____ ____
IC-3 4×10^{-11} Calibration ____ ____
IC-4 6.5×10^{-11} Calibration ____ ____
CRM ____ Meter Trip ____ ____
Preliminary Check on 10-12-61

Room 113 Pressure Differential ✓
Red Light On and Personnel Check ____
Scrams and Diag. Alarm Reset ✓
Source Inserted Accel
Safety Withdrawn 28.05"
Controls Set Inner 44.20" Outer 12.0"
Reflector Water Approx 6" Above Be
Moderator Water 28.5"

Exp # 250   10-12-61

Accelerator for Source   Safety 28.05"
Refl H_2O 6" Above Be   fuel H_2O 28.54"
INNER   outer
8 3/4 AM   44.20   12.0"

PN-201   HFIR EXP 250   INNER 44.20 ~~OUTER~~ 3/4 OUTER 12.0.
Acc 135 KV 0.95 MA 3.5 MUA 200 MUS AT 170 CPS
1.7×10^{-5} mm Hg
TMC CH 10 MUS BKG 16 Delay 2 Disc 4 Mem 1/1
Det same as 200 and 199

EXP # 251   Inner 44.20 Outer (3/4) 17.00
PN-202   HFIR EXP 251 IN 44.20 3/4 Outer 17.00
Check 60 cycle ±10% counting rate ~10,000 CPS.
Acc 135 KV 0.93 MA 1.5 MUA 200 MUS AT 110 CPS
$1.7 - 2.0 \times 10^{-5}$ mm Hg
TMC CH 20 MUS BKG 16 Delay 2 Disc 4 Mem 1/1
Det same as 201, 200, 199.

Exp # 252
PN-203   HFIR CE No. 2 252   IN 44.20   3/4 Outer 27.00
Acc 135 KV 0.93 MA 1.5 MUA 200 MUS AT 110 CPS
1.2×10^{-5} mm Hg (unchanged)
TMC CH 20 MUS Bkg 16, Delay 2, Disc 4, Mem 1/1
Det same

EXP 253
PN-204   HFIR EXP 253   Inner 44.20   3/4 Outer 37.00
Acc 135 KV 0.83 MA <0.5 μa 500 MUS AT 19 CPS
TMC CH 160 MUS BKG 16 Delay 2 Disc 4 Mem 1/1

EXP 254
PN-205   HFIR EXP 254   Inner 44.20   3/4 Outer 40.00
Acc 135 KV 0.80 MA <0.5 MUA 500 MUS AT 10 CPS
TMC CH 320 MUS BKG 8 Delay 2 Disc 4 Mem 1/1

EXP 255   Inner 44.20 3/4 Outer 0.08
Inst. → Scram   False scram from PM-1
low trips — Restarted run
(In order to get high current press ~ 2×10^{-6} needed)
PN-206   HFIR EXP 255   In 44.20   3/4 OUT 0.08
Acc 135 KV 1.0 MA 2.5 MUA 100 MUS AT 340 CPS
TMC CH 10 MUS BKG 16 Delay 2 DISC 4 MEM 1/2

Reduce counting rate or power by a factor of 10 and use time of flight unit 256 Ch 8 μs, everything else the same.

PN-207   TF unit 8 μs Channels 100 μs Burst 340 cps

N.B. Only Ch 2 Counter used for PN-199-207
ERR did not disconnect both counters

Instrument Check on 10-13-61 Source 10 Mc Ra Be

PM-1	>50 μa	Low Trip OK	Alarm Trip OK	
PM-2			Alarm Trip OK	
IC-1	$>10 \times 10^{-12}$	Meter Trip OK	Fast Trip OK	Dropped safety
IC-2	$>10 \times 10^{-12}$	Meter Trip OK		
IC-3	Very Unstable	Calibration		
IC-4	" "	Calibration		
CRM		Meter Trip		

Preliminary Check on 10-13-61

Room 113 Pressure Differential ✓
Red Light On and Personnel Check
Scrams and Bldg, Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn 28.10
Controls Set INNer 44.20" Outer 0.08"
Rerlector Water Approx 6" Above Be
Moderator Water 28.80"

Checked pulses from both miniature fission counters, gains set on both DD2 amplifiers at 1.1 X100 and high voltage adjusted to give "neutron" pulses from about 10 v to 30 volts PHS set at 100 on both amplifiers.

EXP #256

PN-208 HFIR#2 EXP # 256 INNER 44.20 3/4 Outer 0.08
Same as PN-207 and PN-206
Acc 135KV 0.93 MA 1.5 MUA 1.7 - 2.0 mm Hg
100 MUS AT 170 CPS
TMC CH 10 MUS BKG 16 Delay 2 Disc 4, MEM 1/1

EXP #257

PN-209 HFIR #2 EXP 257 In 44.20 3/4 Out 12.00
Acc 135KV 0.9 MA 1MUA 2.2×10^{-5} mm Hg
100 MUS at 170 CPS
TMC 10 MUS BKG 16 Delay 2 Disc 4 Mem 1/1

Instrument Check on 10-16-61 Source 10 Mc Ra Be

PM-1		Low Trip OK Trip Defeated	Alarm Trip OK	
PM-2			Alarm Trip OK	
IC-1		Meter Trip OK	Fast Trip OK	
IC-2		Meter Trip OK		
IC-3		Calibration OK ?		
IC-4		Calibration Out for Repair		
CRM		Meter Trip		

Preliminary Check on 10-16-61

Room 113 Pressure Differential ✓
Red Light On and Personnel Check ✓
Scrams and Bldg, Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn 28.03
Controls Set INNer 8.46" Outer 0.08"
Reflector Water Approx 6" Above Be
Moderator Water 28.48"

10-16-61

On Friday Oct 13, the Boric acid solution was drained from the moderator system and stored in a Barrel. The system was flushed with tap water and rinsed down with deionized water and allowed to drain over the weekend. ~78 liters (78.08kg) of distilled water from 9201-3 was added, the ~~distilled~~ water purifying system in 9213 not in good condition for making pure water

Exp # 258

Purpose: To determine critical control position with pure H_2O and 3/4 Outer control. 2 BF_3 counters in Fuel element.

9 45 Source - Accelerator

Inner	Outer		
17.40	0.08"		Sub Crit
9 50 17.40	15.67	Slightly	Super Crit
17.40	15.85	150 S. → 7.1 ¢	Pos Per
10 15 17.40	15.615		Crit

Shut Down Insert Outer Control, And Dump fuel H_2O

Exp # 259 (Check Crit Pos.)

Inner	Outer	(Acc. power, Mod H_2O to 28.7)	
17.40	15.615	Sub Crit	Ic-3 = $7.\times10^{-11}$
17.40	15.85	195 S. → 5.7 ¢	Pos. Period.
17.40	15.65		Crit
↓ 17.24	15.95		Crit

11 11 Shut Down

10-16-61

These experiments #258 & 259 indicate a control plate change of ~1.6 in from full to 3/4 plate which corresponds to only 4 5¢ if we use the original control calibration. However, if we assume that the boric acid solution has coated the fuel element with boron, that has not been removed then this critical plate position is an indication that the amount of boron on the fuel element surfaces is a sizeable amount. Perhaps some nitric acid in the water will help remove this boron.

"Note" 10-16-61 Sample #4 (Approx 100ml) taken from fuel H_2O System And Sent to Mr Norris Bldg 9734 for Analysis. Boron Analysis $0.4 \pm .4 \pm .2$ µg/ml

$0.4 \times 10^{-6} \times 3.0 \times 10^{4} = 0.012$ g in fuel element.

Instrument Check on 10-17-61 Source 10 meKa Be

PM-1 ~~>10x10^-12~~	Low Trip OK	Scrammed Safety & Dump	Alarm Trip OK
PM-2			Alarm Trip OK
IC-1 >10x10^-12	Meter Trip OK		Fast Trip OK
IC-2 >10x10^-11	Meter Trip OK		
IC-3	Calibration		
IC-4	Calibration Out for Repair		
CRM	Meter Trip ✓		

Preliminary Check on 10-17-61

Room 113 Pressure Differential OK
Red Light On and Personnel Check ✓
Scrams and Bldg, Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn Dush
Controls Set Inner 17.24 Outer 00.08"
Reflector Water Approx 6" Above Be
Moderator Water 28.34

Exp # 260 10-17-61

	Inner	Outer		
	17.24	00.08"		Sub crit
9 57	17.40	15.85	[illegible] 5.91	Pos Per
9 15	17.40	15.60	IC-2 6.8×10^{-10}	level

EXP 261

PN-210 HFIR EXP 261 INNER 17.40 Outer 0.08

ACC 135KV 0.95 MA 1MUA 100MUS at 110 CPS
1.6×10^{-5} mm Hg
TMC Ch 20 MUS Bkg 16 Delay 2 Disc 4
Det 2 Mev BF_3 Saunders Pulser 10-60 volts
PHS = 100

EXP # 262

PN-211 HFIR EXP # 262 INNER 17.40 / Outer 10.00
ACC 135 KV 0.75 MA 100 µs @ 70 CPS
TMC CH 40 MUS Delay 2 Bkg 16 Disc 4 MEM 1/1

Exp # 263

PN-212 HFIR Inner 17.40 Outer 12.0"
ACC 138 KV 0.75 MA 400 µs 35 CPS
TMC Ch 80 MUS Delay 2 Bkg 8 Disc 4 Mem 1/1

Exp # 264

PN-213 Same As Exp # 263

Exp # 265

PN-214 HFIR # 265 Inner 17.40 Outer 6.0"
ACC 135KV 200 µs 70 CPS
TMC Ch 40 MUS Bkg 8

EXP # 266

PN 215 HFIR # 266 Inner 17.40 Outer 14.0
ACC 135 KV 0.75 400 µs 20 CPS
TMC Ch 160 MUS Bkg 8

Shut down,

Instrument Check on 10-18-61 Source 10 mc RaBe

PM-1		Low Trip OK	Alarm Trip OK
PM-2			Alarm Trip OK
IC-1	$>10\times10^{-12}$	Meter Trip OK	Fast Trip
IC-2	7.10×10^{-12}	Meter Trip OK	Dropped Safety
IC-3	$\sim 5\times10^{-11}$	Calibration	
IC-4	$\sim 5\times10^{-11}$	Calibration	
CRM		Meter Trip	

Preliminary Check on 10-18-61

Room 113 Pressure Differential 0.07

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn 28.0"

Controls Set INNer 17.40 Outer 0.08"

Reflector Water Approx 6" Above Be

Moderator Water 28.22"

"Note" Added 26.35 Kg Demineralized H_2O to Refl H_2O System.

Exp # 267 10-18-61

Purpose: Check Crit Pos of Controls with Safety At 28." + 21.6

	INNer	Outer	Safety	
	17.40	14.90	28.0"	lower Power level
	17.40	15.85	28.0	Pos Per
9[07]	17.40	15.58	28.0	level
9[18]	17.40	15.90	20.99"	level

INSert Safety to Make Sub Crit

$\frac{8.3}{.27} = 30.7$ 1/m

Exp # 268 10-18-61

Purpose: INNER and OUTER Position at crit. changing both

INNer	Outer	Safety	
17.40	0.08	28.0"	
17.40	15.58	"	Crit.
18.40	13.95		
20.00	12.14		
22.00	10.86		
25.	10.36		
28.	10.07		
30.	9.71		
32.00	9.16		
35.	8.07		
38.	6.45		
41.	4.74		
44.	3.92	←	
17.4	15.58		
16.0	18.98		
15.4	23.80		
15.0	31.66		
14.6	34.03		
14.0	37.86		
13.6	43.00		

12[05] Shut Down INSert outer Control And Safety

Exp # 269

Purpose: Pulsing At Critical

	INNer	Outer	Safety	
12[48]	17.40	15.90	20.99	Crit
3[54] shutdown 3[55]	17.40	15.90	20.99	After Pulsing Crit

PN-216 EXP # 269 Safety 20.99 to 14.00 after 200 pulses from accelerator

Acc 135KV 1.8×10^{-5} mm Hg 400 μs @ 20 CPS

TMC CH 160 MUS Delay 2 Bkg 4 Dia. 4 Trans 1/1

Det 2 Mcw BF3 10-60 v pulse PHS = 100

Instrument Check on 8-19-61 Source 10 mc Ra Be 8

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 Dropped Safety
IC-3 Out for Repair Calibration ——
IC-4 5 x 10⁻¹¹ Calibration OK
CRM ______ Meter Trip ______

Preliminary Check on 8-19-61
Room 113 Pressure Differential 0.06"
Red Light On and Personnel Check ✓
Scrams and Bldg, Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn 20.99"
Controls Set Inner 44.20" Outer 0.08"
Reflector Water Approx 6" Above Be
Moderator Water 28.92

Exp #270 10-19-61

	Inner	Outer	Safety	
	44.20	4.21"	20.99	Approx Crit
8:55	44.20	4.57		Pos Per
9:08	44.20	4.22		Crit
	44.20	0.08 for Pulsing		Sub crit

5.03 div/decade → 109.3 s → 5.88x10⁻⁴ → 9.2¢ → 26.3 ¢/in.

PN-217 INNER 44.20 ¾ OUTER 0.08 SAFETY 20.99
CRIT AT 4.22
ACC 135KV 1.7x10⁻⁵ mm Hg 400μs @ 20CPS
TMC CH 160 MUS Delay 2 Bkg 4 Disc 4 MEM 1/1
DET 2 ea Min BF₃ Pulses 10-60 V PHS 100

EXP # 271

Purpose: Pulsing at critical with ¾ at 4.23 and In at 44.20

PN-218 INNER 44.20 ¾ OUTER 4.23 SAFETY 20.99
MOVED TO 14.00 AFTER 200 PULSES.
ACC 135KV 400μs 20CPS
TMC 160 MUS Delay 2 Bkg 4 Disc 4 Mem 1/1
DET 2 ea BF3 in Fuel element.

10:18 Check crit before run level at 4.23
12:51 after run 4.23 level
Shut Down Insert outer Control, Safety And Dump fuel H_2O

Removed target And Placed in Al can 4 5/16 ID x 40" High (47.27% void in target) with 5ea 1" Plastic Disc Placed on top of target 4¼" DiA

Exp # 272 10-19-61

Purpose: ... [illegible]

	Inner	outer	Safety	Refl H_2O	fuel H_2O	
	20.34	0.08"	28.08	6" Above Be	28.59	Approx Crit
	20.75	0.08 145.6 div/decade → 4.65x10⁻⁴ → 7.27¢.				Pos Per
3:23	20.36	0.08		18.6¢/in		level
	17.40	8.98				level

~~Some indication that the reactor is not stable now, but is stable during the leveling at 20.36 and 0.08.~~

No water in 4 5/16 cylinder. Did not leak.

Instrument Check on ~~10 mc (ac~~ ~~Scaling~~ 10-20-61

PM-1 ~40 μa @ 1.4 Ma Trip Setting Low Trip OK Alarm Trip OK
PM-2 Alarm Trip OK
IC-1 Meter Trip OK Fast Trip OK Dropped Safety Dump H2O
IC-2 Meter Trip OK
IC-3 OUT FOR REPAIR Calibration
IC-4 6x10⁻¹¹ Calibration OK
CRM Meter Trip

Preliminary Check on 10-20-61

Room 113 Pressure Differential 0.07"
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted Accelerator
Safety Withdrawn 28.01"
Controls Set INNER 999.93 Outer 0.08
Reflector Water 6" Above Be
Moderator Water 28.58"

Exp # 273 10-20-61

PN-219 HFIR #273 INNER 999.93" Outer 0.08"
With 47.27% Void in target Safety 28
Acc 135 kv 0.85 MA 1.5 MUA 1.6-20 x10⁻⁵ mm Hg
70 MUS at 110 CPS
TMC CH 10 MUS delay 2 Bkg 16 Disc 4 Mem 1/1
Det 10-60 volt pulses on 2 BF3 counters & HS = 100

EXP #274

PN-220 HFIR #274 Inner = 12.00 Outer 0.08
with 47.27% Void Safety 28
ACC 135 KV 100 MUS AT 110 CPS
TMC CH 20 MUS Delay 2 Bkg 16 Disc 4 Mem 1/1

EXP # 275

PN-221 HFIRCE #2 EXP 275 Inner 17.00
3/4 Outer 0.08 with 47.27 % void. Safety 28
ACC 135 KV 0.85 MA 100 MUS AT 70 CPS
TMC CH 40 MUS Bkg 8 delay 2 Disc 4 Mem 1/1

EXP #276

PN 222 HFIRCE #2 EXP 276 Inner 0.00
3/4 Outer 8.98 Safety 28.
ACC 135 KV 0.88 MA 100 MUS AT 110 CPS
TMC CH 20 MUS Bkg 16 delay 2 disc 4 Mem 1/1

1:45 Shut Down

10-20-61 Removed target And Replaced with Styrafoam - 4 3/16" DIA Made up of 2" Discs stacked togeather on 5/16" OD SS target Rod. Length 24 3/4". Styrafoam Extends from 1" Below Core to 3 3/4" Above.

Instrument Check on 10-23-61 Source 10 mc RaBe Source

PM-1 _____ Low Trip >500μa Alarm Trip OK

PM-2 _____ _____ Alarm Trip OK

IC-1 7 10 x 10⁻¹² Meter Trip OK Fast Trip OK Dropped Safety

IC-2 7 10 x 10⁻¹¹ Meter Trip OK

IC-3 Out for Repair Calibration

IC-4 5 x 10⁻¹¹ Calibration

CRM _____ Meter Trip

Preliminary Check on 10-23-61

Room 113 Pressure Differential 0.07"

Red Light On and Personnel Check ✓

Scrams and Bldg, Alarm Reset ✓

Source Inserted Accelerator

Safety Withdrawn 24.07

Controls Set INNer 17.40 Outer 0.08"

Reflector Water 6" Above Be

Moderator Water 28.63"

Exp # 277

Void Coef - with Styrofoam in target Region 4 3/16" DIA Discs by 2" thick - length 24 3/4"

INNer	Outer	Safety	
16.84"	0.08	24.07	level
10⁰⁵ AM 17.00"	0.08	7.5 Div/decade → 162.98 sec → 4.24 x 10⁻¹⁰ → Pos 6.6	Per
16.85"	0.08	"	level

Plate (Rod) Intercalibration

16.74	3.00
16.37	6.00
15.90	8.00
15.14	10.00
14.28	12.00
13.42	14.00
12.65	16.00
12.01	18.00
11.54	20.00

Inner	Outer
11.30	22.00
11.22	26.00
11.20	29.00
11.15	32.00
10.82	36.00
10.38	40.00
10.23	44.01

Exp # 278 10-23-61

Purpose: Pulsing At Sub-Crit

INNer	Outer	Safety
999.93	0.08	24.07

11²⁵ AM PN-223 INNER 999.93 3/4 OUTER 0.08 SAFETY 24.07

WITH 70.9% ~~Void~~ 4 3/16 IN. Dia STYROFOAM VOID IN TARGET REGION

ACC 135 KV 0.9 MA 1 MUA 1.7×10^{-5} mm Hg

100 MUS at 170 CPS

TMC CH 10 MUS BKG x16 Delay 2 Disc 4 Mem 1/1

DET 2 BF3 COUNTERS IN FUEL ELEMENT

10-60 volt pulses PHS on DD2 @ 100

"Note" Remove Styrofoam from target Region - target Region is Now Empty (Except for H2O)

Exp # 279

INNer 17.40 Outer 0.08" Safety 24.07"

PN-224

ACC 100 μs @ 110 CPS

TMC 20 μs Bkg x16 Delay x2, Disc 4 Mem 1/1

"Note" Placed target in Al Can 4 5/16" ID, By 3 1/2" High and Inserted in target Region 5 Plastic Disc (1" thick) Placed on top of target 4 1/4" Dia

Exp # 180

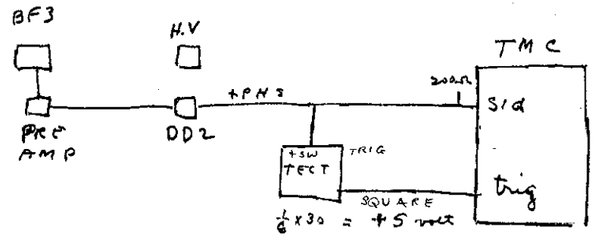
10-23-61	INNer	outer	safety	
3 24 PM	20.80	0.08"	28.02"±	Pos Per
	11.2 Div decade ⇒ 91.35cc ⇒ 6.78 X 10^-10 ⇒ 10.6 #			
	20.25	0.08"		level
	19.96"	3.00"		
	18.90	6.0		
	17.88	8.0		
	16.81	10.0		
	15.76	12.0		
	14.81	14.0		
	13.29	18.0		
	12.57	22.0		
	12.47	24.0		
	12.38	32.0		
	11.92	36.0		
	11.45	40.0		
	11.30	44.01		

4 28 Shut down, drain H2O

10-26-61

Rossi Alpha Measurements.

An attempt to measure Rossi α with one of the miniature counters is described below



TMC doesn't work if extra triggers come in during sweep time of the 256 channels. Therefore the sweep time of the Tect. 543 scope will be set longer than the time involved in the 212 logic unit.

$Pu\,Be^{228}$ Source was remounted in assembly and counter on east removed.

TMC 160 μs Bkg = Delay = 2 Disc 0.5 180 x 256 ≃ 40 msec

Tect 543 5 msec/cm or 50 m sec/sweep

IC-4 = 3.0×10^{-12} only a slight indication of correlated counts. Min BF3 detector probably not sensitive enough.

Shut down

Instrument Check on 10-26-61 Source 10 mc

PM-1		Alarm Trip	ok
PM-2		Alarm Trip	ok
IC-1	Meter Trip ok	Test Trip	ok
IC-2	Meter Trip ok	Dropped Safety	
IC-3 Out for Repair	Calibration		
IC-4 5 x 10-11	Calibration		
CRM	Meter Trip		

Preliminary Check on 10-26-61

Room 113 Pressure Differential 0.07

Red Light On and Personnel Check ✓

Screams and Bldg. Alarm Reset ✓

Source Inserted # M-228 Installed in Source Drive ← "Note"

Safety Withdrawn 28.06"

Controls Set Inner 14.40 Outer 0.08"

Reflector Water 6" Above Bc

Moderator Water 28.39"

3 PM 00

3 29

Exp # 281 10-26-61

Purpose: Check Counting Equipment - Rossi Alpha

Inner	Outer		
14.40"	14.61"	Source Out	Slightly Sub Crit
14.40	14.63	"	"

Shut down and place Li I and 6292 detector above fuel element, gain x50

- 500 V on ~~detector~~ 6292 - check later for pulse height with thermal neutrons.

Instrument Check on 10-27-61 Source 10mc Ra-Be

PM-1 >500μ Low Trip OK Dropped Safety 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 OUT FOR REPAIR Calibration
IC-4 5.5×10^{-11} Calibration Dwn
CRM Meter Trip

Preliminary Check on 10-27-61

Room 113 Pressure Differential Dwn
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted Dwn
Safety Withdrawn DWM Do Not raise above 26.5 (Counter Preamps)
Controls Set INNER - 14.00 OUTER 0.08
Reflector Water C.C.
Moderator Water 28.72"

Exp # 282

	INNER	Outer	
9[20]	14.40	14.63	(Source out) Slightly Sub Crit
	14.40	14.00"	Lower Power level
9[29]	14.40	14.63	Slightly Super
	14.40	14.00"	Lower Power level IC-2 IC-4
	14.40	13.50"	" " " $.08 \times 3\times10^{-12}$ 5×10^{-13}

INSert Outer Control

Removed M-228 from 113. Still some counts on Li I detector, dropped from 8 to 2×10^{3}. IC-4 below $\times10^{-13}$ - CRM ~ 6×10^{3} C/MIN

14.40	13.50	IC-4 = 3×10^{-13}	IC-2 $.05$ 3×10^{-12}

11[03] Shut Down

12-4-61 Noted ranges and [illegible]

This reactor has a source internally that perhaps is making the background counts ~~extremely~~ high for the Rossi-α measurements. It is not known whether this source is a γ-n on Be, from previous runs or perhaps an α-n reaction in the fuel element. Crit position not known exactly but Inner = 14.40 Outer = 14.63 was sub crit. 14.40 – 13.50 the power level became constant and was 5×10^{-13} on IC-4 with source in room. this dropped to 3×10^{-13} when the source was removed from 113, and no attempt was made to go critical under these conditions of one CRM and one log N and one linear instrument responding only when there was appreciable multiplication.

Nov 22, 1961 $2\frac{1}{2}\times10^{-4}$ Water and dff Pumps off for ~5 mins on acc. open valve to acc

Note Smears taken on Control Cylinders for Be Contm.
Results Clean - Readings .5 Micrograms
.5 "
.3 " "

Instrument Check on 1-26-62 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 >10 x10^{-12} Meter Trip OK, Scrammed Safety and water drain
IC-3 Out for Repair Calibration _____
IC-4 ~5 x10^{-11} Calibration Down
CRM Not in use Meter Trip Not in use

Preliminary Check on 1-26-62

Room 113 [illegible] Differential OK
Red Light [illegible] Personnel Check ✓ CC
Scrams and [illegible] Alarm Reset ✓
Source Inserted ✓ Resp OK
Safety Withdrawn 28.0"
Controls Set Inner 10.05" Outer 10.0"
Reflector Water 6" Above Be
Moderator Water 29.79"

EXP. 283

Purpose: Determine critical position of control plates 3/4 outer control and inner control plates have been modified (according to drawing) to represent more accurately the controls in the reactor. Holes were drilled in the nickel and silver sections and slots were cut in the 3/4 outer control to simulate the 4 section control in the reactor (Controls were checked for interference before start of Exp #283)

Target Installed, Source M-228
Ni Vol

(over)

Exp # 283 Cont 1-26-62
DWM cc

1 29 PM	Source out		
	INNer	Outer	
	16.42	16.42	Approx Crit
1 34	16.42	16.67	to increase Power level
2 00	16.47	16.43	Crit
2 15	33.87	00.07	Crit
2 20	33.88	00.07	Crit
	32.84	4.00"	"
	27.51	8.00"	"
	20.95	10.00"	"
	~~17.68~~	~~11.00~~	"
	17.61	14.00	"
	16.09	17.30"	"
	15.37	20.00"	"
	14.88	30.00"	"
	13.69	38.00"	"
	13.30	44.00	"

4 15 Shut down. Insert control safety drain H2O.

1-29-62

Installed 0.67 (4 3/16 O.d.) void in target region, approx centered, stgr from 1 3/8 below and 3/8 in. above fuel.

Instrument Check on 1-29-62 Source 10 mc Ra β

PM-1 Low Trip Meter Off scale Alarm Trip Meter Off scale
PM-2 Alarm Trip Meter Trip at 100
IC-1 >10 x10⁻¹² Meter Trip at 100 Fast Trip >10 x10⁻¹²
IC-2 >10 x10⁻¹² Meter Trip at 100 Safety dropped, Pump off water drain open
IC-3 Out for repair Location
IC-4 Calibration OK Dwm, (Recorder zero has shifted)
CRM Meter Trip

Preliminary Check on 1-29-62

Room 113 Pressure Differential 1" H_2O
Red Light On and Personnel Check OK C C
Screams and Bldg. Alarm Reset Dwm
Source Inserted M-228, Inst response ok IC-1 2 4 Dwm
Safety Withdrawn Dwm (28.0)
Controls Set Mod. Inner @ 0.00, 3/4 Outer (M.d.) @ 0.00 Dwm
Reflector Water 6" Above Be
Moderator Water 29.01

Exp # 284

10 44 AM Source out (0.67 void)

INNer	Outer	
15.43	00.07"	Approx Crit
14.99	00.07"	lower Power level Sub Crit
11 04 15.70	00.07	Pos Per

3.13 divided → 68.0 sec → 8.4×10^{-4} → 13.1 ¢

13.1/.27 = 48.5 ¢/inch

15.43	00.07"	level ($@ 4 \times 10^{-10}$ IC-4)
15.29	4.0"	
14.76	8.0"	
14.29	10.0"	
13.145	13.145	
11.74	17.30	

(Cont)

Exp # 284 Cont 1-29-62

Inner	outer	
11.11	20.00	level
10.74	30.00	"
10.18	38.00	
9.84	44.00"	level

12[29] Shut Down - Insert outer Control, Dump fuel H_2O lower safety

---

Exp # 285

Preliminary Check on 1/29/62

Room 113 Pressure Differential 1" H_2O Down

Red Light On and Personnel Check Down

Screams and Bldg, Alarm Reset Down

Source Inserted C.C.

Safety Withdrawn to 28.0

Controls Set Both Inner and Outer fully inserted 0.0 and 0.0

Reflector Water ~28.0 in. (6 in above Be)

Moderator Water

Target assembly with 0.47_3 void installed
(with 4 5/16 O.D. aluminum container)

2[32]

Source Out

Inner	Outer	
18.35"	00.07"	Pos Per

4.0 div/decade → 86.9 sec → 7.04×10^{-4} → 11.0 ¢

11.0/0.32 = 34.7 ¢/in

18.03	00.07"	Level
17.79	4.00"	
16.81	8.00	

Exp # 285 Cont

Inner	Outer	
15.97	10.0"	
14.20	14.20	level
13.10	17.30	
12.49	20.00	
12.12	30.00	
11.355	38.00	
11.02	44.00"	level

4[27] Shut Down - Insert outer Control, Safety And Dump fuel H_2O

Instrument Check on 1-31-62 Source 10 mc/Ra δ

PM-1 Low Trip OK Scram Check OK Alarm Trip OK

PM-2 Alarm Trip OK

IC-1 $7/6 \times 10^{-12}$ Meter Trip OK Fast Trip OK

IC-2 $7/0 \times 10^{-12}$ Meter Trip OK

IC-3 Out for Repair Calibration

IC-4 $\sim 5 \times 10^{-12}$ Calibration Down

CRM Not in use. Meter Trip

Preliminary Check on 1-31-62

Room 113 Pressure Differential 1" H_2O

Red Light On and Personnel Check C C

Screams and Bldg, Alarm Reset C.C.

Source Inserted Inst Response

Safety Withdrawn 28.0"

Controls Set Inner = 0.00 Outer = 0.06

Reflector Water 6" Above Be

Moderator Water 28.36"

Exp #286 : Purpose Control inter comparison w.o. target no voids.

Exp # 286 1-31-62

9[18] AM

Inner	Outer	Source Out
44.19	0.06	Pos Per

3.4 div/decade → 183 sec → 3.84×10^{-4} → 6.0 ℓ

6.0/2.81 = 2.14 ℓ/in

41.38	0.06	Level
39.09	4.0"	
34.59	8.0"	
31.63	10.0"	
26.58	12.0"	
20.38	14.0	
17.85	17.85	
17.18	20.00	
16.43	30.00	
14.96	38.00	
14.56	44.00"	

11[19] Shut Down Drop Safety, Dump fuel H_2O

Total Running Time - 1926

Exp

Instrument Check on 3-1-62 Source 10 mc/Ra.

PM-1	Low Trip OK	Alarm Trip OK	
PM-2		Alarm Trip OK	
IC-1	$>10 \times 10^{-12}$	OK	Scram Trip OK
IC-2	$>1 \times 10^{-12}$	OK	Scrammed System
IC-3	4.5×10^{-11}		
IC-4	5.5×10^{-11}		
CRM			

Preliminary Check on 3-1-62

Room 113 Pressure Differential 1"

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Use Accel for Source

Safety Withdrawn 28.0"

Controls Set Inner 0.0 Outer 0.0

Reflector Water Approx 6" Above Be

Moderator Water 29.1"

"Note" Source # 228 Removed from HFIR Rig Target Removed

Exp # 287 3-1-62

Purpose: Pulsing At Sub Crit with Control Rods At "Zero". Target Region without Any Void. BF3 Counters located between fuel Annulus of Core in Approx this Pos  Centered Vertically

PN-225 EXP # 287 INN = OUTER = 0.00 Target removed

ACC 2.9×10^{-5} mm 115KV .98 ma ~3μa SF 55

Focus = Sol = Max. 100μs @ 150 cps.

TMC CH 10μs Bkg x 32 Delay x2 MEM 1/1 Disc 4

DET 2 ea BF_3 counters between fuel element annuli

PHS=200 ⓓ DD-2 1.1 x200 HV= 1750

PHS=200 ⓒ " " " HV= 1900

PN-226 Same as PN-225

ACC 117KV .820 ma ~2μa 2.2×10^{-5} mm

100μs @150 cps

TMC & DET Same as PN 225

Acceleration was much more stable during this run.

Shutdown by drain Mod. H_2O, Reflector H_2O

Instrument Check on 3-2-62 Source Co 60

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	OK
IC-1	$>3 \times 10^{-11}$	Meter Trip	Scrammed	Fast Trip	OK
IC-2	$>10 \times 10^{-12}$	Meter Trip	OK		
IC-3	4.5×10^{-11}	Calibration	Dwn		
IC-4	5.5×10^{-11}	Calibration	Dwn		
CRM	X	Meter Trip	X		

Preliminary Check on 3-2-62

Room 113 Pressure Differential 1"

Red Light On and Personnel Check ✓

Scrams and Bldg. Alarm Reset ✓

Source Inserted Use Accelevator

Safety Withdrawn 28.01"

Controls Set Inner 17.85 Outer 0.0"

Reflector Water Approx 6" Above Be

Moderator Water 28.6

EXP # 288

PN-227 - Inner = 17.85 Outer 0.00 No Target

While setting up conditions for pulsing the accelerator (at 115 kv) arked twice the latter upset the pulsing system so that the beam was on target. the increase in neutron level scrammed the system.

Acc 115 kv 0.73 ma ~1μa 200μs @ 70 cps

TMC CH 40 MUS BKG X16 DELAY X2 MEM 1/1 Disc 4

DET See P 294 PN 225.

Press 2.5×10^{-5} mm source on 2.5×10^{-5} .60 ma PS current

EXP # 289

PN-228 Pulsing at critical

while turning on accelerator scrammed system with too many neutrons.

Critical positions 18.02, 18.02, Safety 21.0

Insert safety to shut down. (for lunch)

after 4456 cycles, the accelerator gave an extra large burst of neutrons and scrammed system — background ratio less than 4. Print out. and start over

PN-228 Acc 115 kv 400 μs @ 21 cps
TMC CH 160 μs Bkg x 4, Delay x 2 Disc 4 Mem 1/1

Repeat - at Critical

PN-229
ACC 1.5×10^{-5} SF = 50 Foc Max Sol Max 115 KV 0.62 ma
~~TMC~~ 400 μS @ 2~~1~~0 CPS
TMC CH 160 μs Bkg x 4 Delay x 2 Disc 4 Mem 1/1
DET See 225
Arcing in accelerator shut down
Scrammed —

EXP #. 290

PN-230
Inner 17.85 Outer 12.00 Safety 28.00
Acc 116 KV .67 ma SF 50 ~/ma 250 μs 39 cps
2.0×10^{-5}
TMC CH 80 MUS BKG x 16 Delay x 2 DISC 4 MEM 1/1
DET See 225

Instrument Check on 3-5-62 Source ________

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

Preliminary Check on 3-5-62

Room 113 Pressure Differential 1"
Red Light On and Personnel Check ✓
Scrams and Bldg. Alarm Reset ✓
Source Inserted Accel ON
Safety Withdrawn 21.01"
Controls Set Inner 999.93 Outer 0.07
Reflector Water Approx 6" Above Be
Moderator Water

Exp # 290

Purpose: Check Crit Pos with out Void And outer control At "Zero"

Accel off — Sub crit

	Inner	outer	Safety	
10:00 AM	44.19	0.07	21.01"	Sub Crit
10:02	44.19	1.81	(to increase Power level)	Pos Per
10:31	44.19	1.43		level

PN-231 EXP #290 Inner 44.19 Outer 1.43 Saf 21.01
Acc 1.6×10^{-5} mmHg 115 KV 0.60 ma 1000 MUS @ 11 cps
SF = 50 Sol = Foc = Max.
TMC CH 320 MUS BKG x 4 Delay x 2 MEM = 1/1 DISC 4

Detectors N in BF_3 ① 1550 DD2 1.1 x 200 PHS 150
② 1750 " " "

Output pulses ~ 30 volt.

At end of Run Reactor not critical
— 77 div — Period of 1673 sec, .509 x 10^{-4} = ¢ 0.008

New Critical Position 44.19 Inner
1.51 Outer
21.01 Safety

PN-232 Repeat 231
① False scram accelerator turning on from switching Transient,
② 2nd false scram, acc turning on from Switching transient
Found cable on initial pulse loose.

PN 232 EXP # 290 continued.
ACC 1.3 x 10^{-5} mm Hg 117 kv 0.610 ma 55 SF
800 μs Burst 21 cps
TMC 160 MUS Bkg x4 Delay x2 Mem 1/1 Disc 4
DET PHS changed to (175)
4[10] PM. Inner outer Safety
44.19 1.51 21.0" level
Shut Down Insert Safety, Dump fuel H_2O

For PN-232, 231, 229, 228, the accelerator was pulsed for 200 cycles, neutron level reduced by inserting safety to 14.00 in and then withdrawing to critical, This was repeated at various —

~ June 1, 1961 sample taken from Island-refl Storage tank: Total solids ~ 7.0 PPm, ignited ~ 5 PPm