BOOK23R

Notes:

-On front cover of book - 2 pieces of masking tape stating "interaction" and "5604".
-On back cover of book - 2 pieces of masking tape with "secret" scribbled out on them.

Blank pages: 132, 226, 241-300, inside back cover.

-page 40 has a square space cut out of it
-page 48 has a square space cut out of it with a piece of paper taped over it stating "position. The"
-there are two 8.5x11 graph sheets between pages 126 & 127
-pages 183, 194, 200, and 205(small) has a graph sheet taped to each of them
-8.5x11 sheet of paper between pages 226 & 227
-sheet of paper between pages 240 & 241
-calendar sheet (Dec. 2, 1960) between pages 292 & 293 (writing on back).

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
August 3, 1999

~~SECRET~~

SOME INSTRUCTIONS FOR USE OF THIS NOTEBOOK

This notebook is assigned to personnel performing research and development work and must be used for all original calculations, notes and abstracts from reports.

Assignee is responsible for the safeguarding of this notebook in accordance with security regulations.

This notebook must be returned to issuing office whem completed or upon termination of assignee.

Every page or entry should bear a date and the signature of the person who made the entry.

Entries should be made in ink whenever it is reasonable to do so.

Alteration or amplification of entries made on previous dates should be made as separate entries under their own dates and cross referenced to the previous entries.

Charts, drawings and graphs drawn on special paper should be glued or otherwise securely fastened in place and should individually bear a date and signature. Do not obscure any information.

The notebook should be periodically reviewed by one or more independent persons in the department and should be signed and dated by them. Likewise, they should make a statement that they have "read and understood the foregoing material." Witnessing stamps for this purpose are available in your department's office.

It is advisable to preface each new item, such as a heat treatment, process or reaction, etc., with a very brief description of the purpose, objective or approach.

Description of the invention or discovery should be complete enough to be understood by anyone skilled in the art.

Reference to name or catalogue number should be made when standard items are being discussed, i.e., Westinghouse pump.

In cases where work is conducted in cooperation with others, it is often necessary to meet with them from time to time and discuss new developments. The occurences of such conferences should always be entered in your notebook regardless of recording elsewhere, giving the date, who was present (if possible), and an outline of the subjects discussed. This often will establish error in occasional claims of other parties that you have appropriated information from them revealed during an interview, and thus provide you with patent protection.

~~SECRET~~

~~SECRET~~

10-9-20?

OAK RIDGE NATIONAL LABORATORY

OPERATED BY

UNION CARBIDE NUCLEAR COMPANY

A DIVISION OF UNION CARBIDE AND CARBON CORPORATION

UCC

POST OFFICE BOX X

OAK RIDGE, TENNESSEE

Classification Cancelled w/dcn

By Authority Of DOE Oak Ridge NMO

By [illegible] Date 3-26-76

NOTEBOOK NO. 5-604

Assigned to: D. T. Thomas B.E.W. / A. D. Callihan

Department: Appl. Nuclear Physics

Location: Bldg. 9213 Y-12

Date: April 3, 1957

INVENTORIED FEB 27 1975

This notebook is assigned to personnel performing research and development work and must be used for all original calculations, notes and abstracts from reports.

Assignee is responsible for the safe-guarding of this notebook in accordance with security regulations.

Do not use scrap paper.

Be sure to record all personal conferences.

This notebook must be returned to Laboratory Records-Bldg. 4500 when completed or upon termination of assignee.

"This document consists of 300 pages. No. 1 of 1 copies, Series A."

Subject Page

Interaction Exps.: Book #2

RESTRICTED DATA

"This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited."

~~SECRET~~

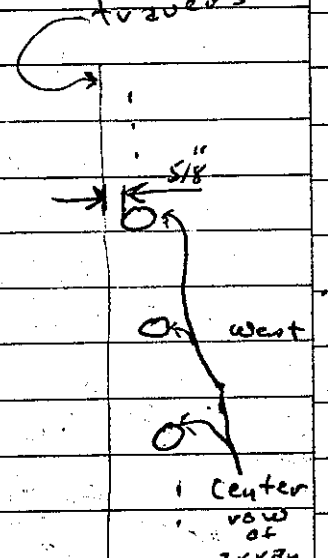
3" dump valve in solution line on
"Big Sid": opens in .360" sec:

9/20/60 V-12 5 3/8" OD bottle exps. continued from Interjection book #1

Exp. 21 : Run 1

Bare ~~B~~ BF_3 Traverse. The line traversed by the center of the counter is 5/8" from (east of) nearest point of bottles in center row

Temp. = 22.8 °C @ 830 mm



Solenoid	Counter Selsyn (in)	Counter Position (in)	C_1	C_3	C_1/C_3	Log w	σ/c
9 33 AM (initial count) 43.77	0.06	-19.77	33621	140189	.2398		.008
"	"	"	33605	137567	.2443 .2421 .2438		
9 40 43.61	6.66	-13.18	43845	153893	.2849		
"	"	"	45368	157871	.2862 .2874		
9 45 43.44	9.96	-9.88	40777	152212	.2679		.002
"	"	"	40504	149932	.2691 .2702		
9 52 AM 43.28	13.25	-6.59	41374	155081	.2668		
"	"	"	41437	155296	.2668 .2648		.013
9 56 43.19	16.54	-3.30	41155	150102	.2742		
"	"	"	39692	146033	.2730 .2718		
43.05	19.84	0.0	43517	148388	.2933		
"	"	"	43617	150119	.2913 .2904		.012

2
9/20/60

	Soln ht	Counter Selsyn	Counter Position	C_1	C_3	C_1/C_3	
Cal	43.02	20.84	1.0"	43756	150994	.2898	
	"	"	"	43858	150452	.2857 .2915	.002
10^{12}	"	21.84	2.0	42593	153089	.2782	"
	"	"	"	43116	154730	.2784 .2787	"
	43.02	22.84	3.0	41502	154600	.2685	"
10^{18}	"	"	"	41858	154168	.2700 .2715	"
	43.02	23.84	4.0	42045	155287	.2708	
10^{21}	"	"	"	42606	156219	.2717 .2727	
	43.02	24.84	5.0	43236	160832	.2688	
10^{28}	"	"	"	44324	165272	.2685 .2682	
	42.78	25.84	6.0	42200	157503	.2679	
10^{30}	"	"	"	40206	149118	.2687 .2696	
10^{32}	42.78	26.84	7.0	38264	143519	.2666	
	"	"	"	37799	141337	.2665 .2674	
10^{35}	42.78	27.84	8.0	37299	138458	.2694	
	"	"	"	36366	134756	.2696 .2699	
	42.83	28.84	9.0	36021	132322	.2722	
10^{41}	"	"	"	36279	131947	.2731 .2750	
	42.86	29.84	10.0	36667	131257	.2794	
10^{45}	"	"	"	36068	132427	.2752 .2724	
10^{49}	42.86	30.84	11.0	38150	135459	.2816	
	"	"	"	39026	137967	.2817 .2829	
10^{55}	42.86	31.84	12.0	41468	143834	.2883	
	"	"	"	42763	148084	.2885 .2888	
10^{59}	42.74	33.04	13.2	42595	147483	.2888	
	"	"	"	41602	143582	.2884 .2897	

	Solar dec	Counter reading	Counter Position	C_1	C_2	C_2/C_1	Δ_n
							.012
	42.74	36.32	16.98	24465	124851	.2556	"
11[02]	"	"	"	33088	129380	.2556 .2557	"
	42.77	39.61	19.71	30427	126151	.2412	"
11[07]	"	"	"	30490	124956	.2421 .2440	"
	42.81	42.90	23.06	30592	123659	.2474	.011
	"	"	"	30208	122502	.2465 .2466	
	42.81	46.20	26.36	31342	124249	.2523	
	"	"	"	31778	125547	.2522 .2531	.012
11[15]	42.81	49.50	29.66	27059	127226	.2127	
	"	"	"	27029	127992	.2114 .2112	
11[23]	42.81	52.79	32.95	26529	130622	.2031	
	"	"	"	27455	133076	.2042 .2063	
	42.81	56.08	36.24	27739	134799	.2058	
11[28]	"	"	"	28394	137350	.2057 .2067	.015
	42.81	59.38	39.54	27777	139410	.1992	
11[33]	"	"	"	28466	141112	.2004 .2017	
	42.81	65.97	46.13	21864	144720	.1511	
11[36]	"	"	"	22212	148302	.1454 .1498	
	42.81	69.26	49.42	22784	152873	.1490	
	"	"	"	22964	153459	.1493 .1496	.012
11[41]	42.81	72.56	52.72	18951	155206	.1221	
	"	"	"	18909	156429	.1215 .1209	
~~11[50]~~	42.81	46.20 Check Point	26.36 Base	41000 ~~40162~~	1.00087 ~~460~~	.2561	.013
Note { C_3 which is multiplier } is not counting register.							
11[59]	42.81	46.20 Check Point	26.36	36893	145234	.2540	
	"	"	"	34738	137700	.2531 .2523	

	Solution in	Counter voltage	Counter Position	C_1	C_3	C_1/C_3	$\log_{10} C_3$
			Check Point				.0
1201	42.68	33.04	13.2	37232	128122	.2906	
	"	"	"	36207	125214	.2844 .2892	
			Check Point				
1206	42.96	19.84	0.0	31409	107098	.2916	
	"	"	"	30399	104689	.2905 .2904	
1210	Shut down.						

9/20/60

Exp. 22 : Run 1

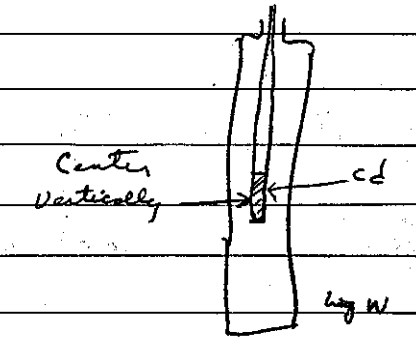
Measurement of count rate in center of center bottle (same BF_3 counter and preamp) Counter centered vertically and radially. Same ~~counter~~ set-up as exp 21 otherwise. In this exp. the ½" plastic tube extends all the way to the bottom of the bottle.

	Soln setup	C_1	C_3	C_1/C_3		$\log_{10} C_3$
305 PM	42.64	14604	56361	.2591	.004	.004
	"	14818	56503	.2623 .2610		"
change power cord		14784	56733	.2606		"
	42.71	36832	135824	.2712		.004
		36217	135446	.2674		"

	Soln	C_1	C_3	C_1/C_3	Log W
	Selsyn	36518	135635	.2692 (.2692)	.012
2 min count:	42.7	72724	267734	.2716	.012
1 min Counts	42.91	74070	273334	.2710	.021 (raised power level)
1 min Counts	"	78329	290124	.2700	"
	42.63	14170	53001	.2674	(raised power level)
3 VS PM	"	13674	51878	.2636 } .2655	"

Exp 23 : Run 1

9/21/60 Cd covered BF_3 count rate in center of center bottle. 30 mil cd tube put inside ½" lucite tube at end and counter put inside this. Tube does not extend to bottom of bottle. Counter centered vertically and radially



2 min counts .02

	Soln Selsyn	C_1	C_3	C_1/C_3	
CM 2 PM 30	42.79	21685	431425	.05026	
	"	21158	439283	.04816	Something
	"	27253	447506	.06090	is wrong with
	42.74	19588	401486	.04879	C_1. Erratic
		23475	392326	.05983	count rate can
					be seen

9/21/60

Exp. 28 : Run 2

Set up same as Run 1. Counter was removed (but preamp was not) and checked. No evidence of solution getting in tube. Connections were tightened good.

	Soln wt	C_1	C_3	C_1/C_3	
4 10 PM	42.75'	17151	369767	.04638	1 min counts .05
	"	17135	369270	.04640	
4 14	"	17127	365853	.04681	

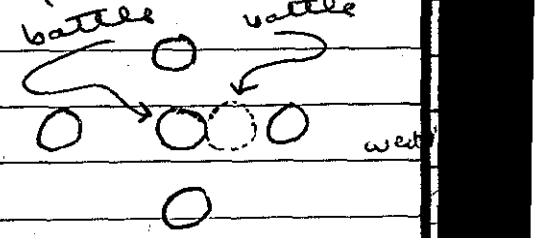
9/22/60 8 25 AM The BF_3 counter used in the above experiments was again not counting correctly. Removed for repair

Counter to be repaired so a bare count can be obtained with plastic tube only in bottle as far as necessary to get counter in center (as in Cd case).

Exp. 24 : Run 1

9/22/60

A full 4-12 bottle was placed adjacent to the center bottle of the 9×9 array, as shown. Spacing was 7.80" except for east and west most rows, which were 7.60", i.e. set-up same as in experiment # 19, Run 4, including board. The "extra" bottle was placed against the center bottle



Soln ht in remotely filled bottles = 28.90" just Crit (log N = .001)

Exp. 25 : Run 1

Determination of the "worth" of the board used in the above experiments. Board has been removed in this experiment (but extra bottle is still in the array).

Soln ht in remotely filled bottles = 29.51 (log N = .001)

Temp 23.5°C

Run 2

Board replaced i.e. centered vertically against west face of array.

Soln ht in remotely filled bottles = 28.84" just Crit (log N = .001)

Fuel ht = 29.52" Pos Per. ~~(log N~~

Fuel ht = 28.98" just Crit (log N ≅ .01)

T = 157.5 : ρ = 4.36×10^{-4}

9/22/60 Exp. 26 ; Run 1

The purpose of this exp. is to determine $2P/2h$ at heights near full for the clean 9x9 array, therefore the "extra" bottle has been removed (but the east most and west most rows are still spaced 7.6". Board not present [also 1/2" counter tube is inserted well below vertical center in center bottle]. Also we wish to measure the "worth" of the board under these conditions. From these facts and previous experiments we can get a better estimate of the critical soln ht corresponding to 7.8" spacing (and hence a more exact spacing for the 9x9 array).

3^{01} Soln ht = 44.80 , just crit $\log W \cong .002$

Soln ht = 47.8" , slightly sub $\log W \cong .005$

Run 2

Same as Run 1 except a 1/2" thick x 7.8" x 8' board centered on south face to increase reactivity

Soln ht = 42.92 just crit , $\log W \cong .004$

4^{06} Fuel ht = 43.83" Pos Period.

$T = 204$ sec : $P = 3.50 \times 10^{-4}$

4.18 Shut down.

9/23/60 BF_3 counter repaired. New and slightly longer (~5") al tube used in refabricating it. Counts-rate should not be changed appreciably

Exp. 27, Run 1

Bare BF_3 counter centered in center bottle.

t	Soln ht	C_1	C_3	C_1/C_3		log w
1	9:30 42.85"	33160	133446	.02485	← very slightly sub-Crit	.01
	"	33901	132819	0.2552		
2	"	33535	129085	0.2598		
	9:35 "	33109	126663	0.2614		
	42.90	32798	126476	0.2593	just Crit	
	"	32780	126143	.2599		
	power level raised					
tg	42.99	52940	200958	.2634		
	9:50 42.88	51193	195417	.2620	sub-Crit	
	"	49906	191123	.2611		
				ave = .2590		

Exp. 27 ; Run 2

9/23/60 Cd covered BF_3 counter (corresponding in location etc to bare count rate in Run 1)

	Soln Ht	C_1	C_3	C_1/C_3		log w
2 min counts 10^{47}	43.13	24376	478282	.05097	slightly subcrit	~.02
	43.09	25368	490579	.05171	"	"
10^{52} KW	43.00	24888	482955	.05152	& slightly subc.	"
	43.07	24472	468928	.05219	~ crit	"
				ave = .05159		

10^{51} Shut down

Counter put back on guide track in center of array, corresponding to traverse 5/8" from center row. Reg zero of counter, setscrew = 81.85 when tip of al container is at edge of north face (as before)

9/23/60

Exp. 27 : Run 3

Background counts: 1 min counts (no source in away

	C_1	C_3
1 05 PM	191	89
"	197	97
"	206	105
"	208	98
"		

This experiment is merely to check to see if counter is still counting at the same rate as when traverse was first taken, hence counter is centered vertically and is 5 1/8" from ~~entrance~~ row as before

	Soln ht	C_1	C_3	C_1/C_3	Counter Setting	Counter Position*
	43.28	38547	126350	.3051	24.71	0.0
	"	40877	131953	.3098	"	"
~Crit	43.20	43170	138017	.3128	"	"
	"	44705	143082	.3124	"	"
1 53 PM	crit 43.03	46408	150289	.3088	37.89	13.18
	"	46331	149072	.3108	"	"
	"	45760	149998	.3051	"	"
	42.96	40241	150702	.2670	51.05	26.36
	"	39874	147797	.2698	"	"
	"	39320	145700	.2699	"	"
	"	30598	144864	.2112	64.25	39.54

* from center

	Soln ht	C_1	C_3	C_1/C_3	Counter Selsyn	Counter Position
	42.96	30154	142982	.2109 .2101	64.25	39.54
	"	30058	143677	.2092	"	"
2 12 PM	42.98	42859	138997	.3083	~~37.89~~ 37.89	13.18 (repeat)
	"	41613	136412	.3051 .3072	"	"
	"	41456	134749	.3077 .3072	"	"
	"	41063	133519	.3075	"	"
2 21	"	32717	128476	.2547 .2540	44.48	19.77
	"	32350	127636	.2535	"	"

2 25 Shut down

Background 1 min (Cs source is away)

C_1	C_3
38	257
19	144
17	135

2 30 A check after shut down showed the ~~first~~ north of center battle pts to have been moved (in 1/4" or so) toward line of traverse. Hence this accounts for the ~~coarse~~ count rate of counter being high at this point.

above data indicates counter was counting ~ 5% higher in exp 27 than exp 21
Cd fraction from data of above exp = 80.1

Exp. 28 ; Run 1

9/27/60

4×4 array of full 4-12 bottles spaced 3.50" edge to edge

11 AM Soln ht in remotely filled bottles = 45", sub crit

Run 2

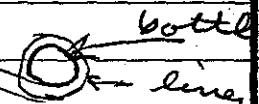
4×4 array 3.30" edge to edge

Soln ht in remotely filled bottles = 43.80 just crit

9/28/60 Exp. 29 ; Run 1

1st Point 3×4 array of 4-12 bottles with ½" plastic wrapped around each bottle spaced 4.00" edge to edge

Soln in remotely filled bottles = 44" - not crit



~~Run 2~~

2nd Point 4×4 array of full 4-12 bottles with ½" (nominal) "oatsers" 4.00" edge to edge. ~~44~~

3:20 PM Soln ht in 5 bottles 45" - not crit

Exp. 29: Run 2

9/29/60 4×4 array of full 4-12 bottles with nominal 1/2" plastic "outsets" spaced 3.70" edge-to-edge (of plastic)

10[45]AM Soln ht in 5 remotely filled bottles = 42.40 just crit

Run 3

4×4 array of full 4-12 bottles 1/2" plastic outsets
3.65" edge to edge spacing

1[45]PM Soln in 5 remotely filled bottles = 38.65 just crit

9/30/60 Dimensions of plastic "outsets" checked:

ave OD of several checks of bottles containing fuel = 16.38"

Measure of several thicknesses of plastic = 0.50 ± 1/64"

10/3/60

8:30 Sample was taken from a batch of solution which had been drained from the manifold into a graduate on 9/30/60 and allowed to settle over the weekend. The reason for this was that some precipitate had been seen to settle out in the plastic tubes of the manifolds. Sample (# Y-6) was taken from the upper, clear solution. Then the precipitate was stirred up and another sample (# Y-5) taken.

just Cut

# Y-5	Req # 593110	Y-6	Req # 593111
G 91.1	g U/g = .269100	G 80.0	g U/g = .270200
T 20.0		T 20.1	

Checked:

Results: Y-6

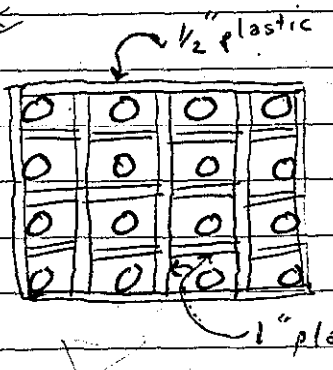
g U/g = 0.2702

10/3/60 Due to corrosion in al. slab tank, it was removed and 15" dia stainless cyl. was connected to pump. Rashig rings were put in cyl above level of soln.

10/4/60

Exp. 30; Run 1

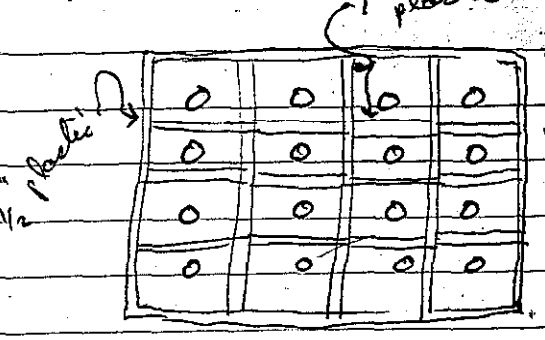
4 x 4 array of full 4-12 bottles spaced 4.75" edge to edge and with 1/2" thick plexiglass placed on four faces of array as shown and with 1" thick plastic (plexiglass) used to partition array into boxes, with 1" pieces centered between bottles as shown. Note that outside boxes are not same size as four inside boxes



10:06 AM Soln in 5 remotely filled bottles = 26.2 just ppt

Run 2

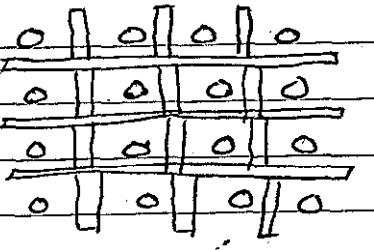
Same array and spacing as above except plastic strips used to extend above pieces so that all boxes are now the same size as four center boxes as shown →



2:38 PM Soln ht in remotely filled bottles = 26.8 4"

Run 3

Same array and spacing as Run 2 except the four 1/2" sheets were removed from each face giving array as shown →

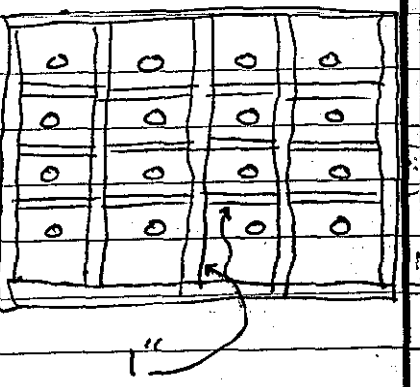


3 40 PM Solution in remotely filled bottles = 39.22"

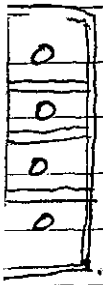
Crt ?

10/7/60 Exp. 30, Run 4

4x4 array spaced 5.2" edge-to-edge with "egg crate" assembly of plastic insulator and reflector as shown



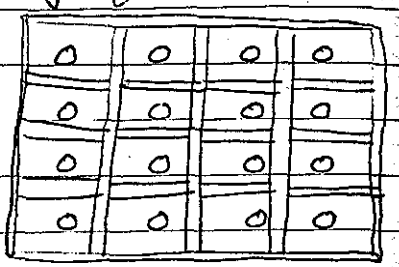
3 40 PM Solution in remotely filled bottles = 34.90 just rid



Exp. 31, Run 1

10/11/60
10/4/60

Plastic moderator and reflector assembled in "egg crate" fashion for 4×4 array of full 4-12 bottles as shown. The four sheets of outside reflector plastic were 1/4" thick and the remaining plastic is 1/2" thick. Bottles are spaced 4.75" edge to edge



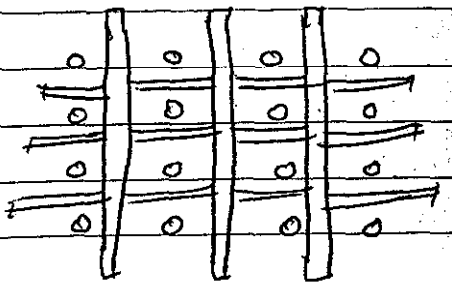
2 35'

Soln ht in remotely filled bottles = 36.24" just crit

10/14

Run 2

1/4" plastic reflector removed from above array as shown →

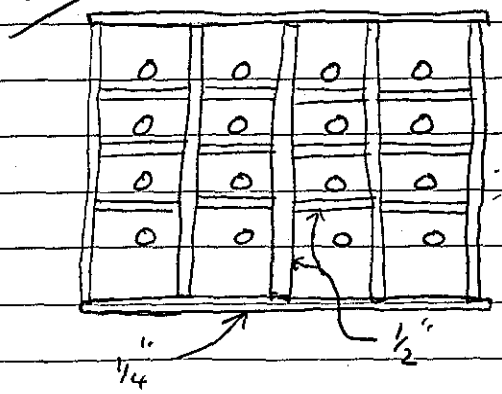


Soln in remotely filled bottles = 42.8" very sub. crit

(out of solution)

Exp. 31, Run 3 just crit

10/13/60
10/16/60 4 x 4 array of full 4-12 bottles spaced 5.0" edge to edge, with "4" and "2" plastic positioned as before



Soln in remotely filled bottles = 44" very sub.

Exp. 31, Run 4

10/14/60 4 x 4 array as above except now spaced 4.85" edge to edge

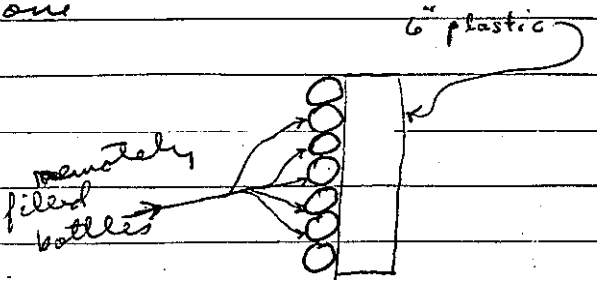
Soln in remotely filled bottles = 39.95 just crit.

Omit
see page 23

Exp 32, Run 1

10/17/60

Seven bottles in line sitting adjacent to each other (zero edge to edge spacing), with 6" of plexiglass reflector on one side

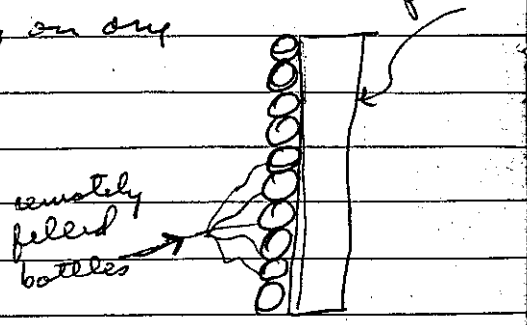


11^{04} AM Soln in remotely filled bottles = 45", very sub.

Exp. 32, Run 2

10 bottles (full, 4-12) in line as above with 6" of plastic reflector on one side

Soln hit in remotely filled bottles = 45"
still quite sub.



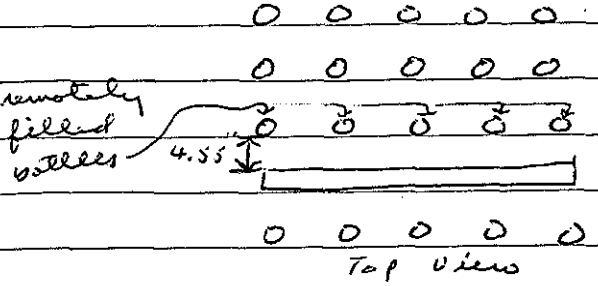
From log count rate meter, the addition of the last 3 bottles gave a multiplication of ~ 2

Exp. 33

11/18/60

25 bottles (4-12, full) spaced 4.55" edge to edge with one row of bottles rotated 90° as shown i.e. the row of bottles shown were spaced 4.55" vertically, as if the row had been rotated 90° about center-line

t.c



Soln in fine remotely filled bottles = 45" very sub. crit.

plastic

11/19/60

Exp. 34, Run 1

Same bottles still spaced 4.55" edge to edge but with all bottles vertical, as usual

Soln in remotely filled bottles = 41.66" just Crit

Exp. 34, Run 2

Purpose is to determine dP/dh by filling bottles in same array as run 1 i.e. from 41.64 to 44.25"

1.20 Full bt = 42.63" Po Pr.

" " = 41.68 just Crit $\log W = \sim .01$

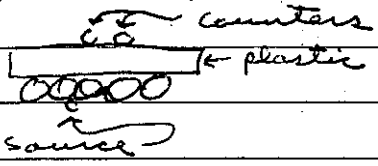
T = 90.8 sec, $P = 6.8 \times 10^{-4}$

Exp. 35

11/20/60

Multiplication curve for 4-12 bottles adjacent (zero edge to edge spacing) and in line with 6" of plastic (or Hydrogen) reflector on one side only.

	1st Counts	C_2	C_3	here source is fixed (Topped) near center of center bottle
8:30 AM	2 min counts	91609	8324	solution consists of
		91516	8362	the five remotely filled bottles
		91981	8518	i.e



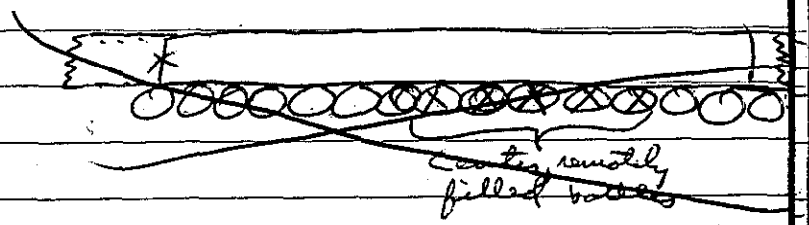
2nd Counts. 9 bottles in line, two added to each end of above array of 5

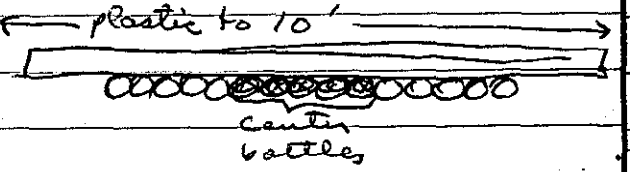
	2 min counts	C_2	C_3
		245752	18132
		248702	18710
9:30 AM		249566	19095
		249834	18731

Note: Changed procedure and therefore multiplication curve must be begun again. Reason for change was to build 6" thick reflector 10' long to begin with, ~~then~~

then add enough bottles to occupy 10' length and, if not critical, take multiplication curve as bottles are removed (with plastic left intact.) This procedure allowed better utilization of available plastic

3 30 at the present time there are five full bottles on each side of the five remotely filled bottles. (15' total when full)
~~not~~ Crit when all bottles are full





3 45 6 bottles on each side of 5 remotely felled bottles
Sub Crit with all bottles full

4 00 Shut down

Exp. 35 (continued)

11/21/60

7 bottles on each side of remotely filled bottles.

Solution remotely filled bottles = 41.7 just crit.

9[02]

One bottle removed from above array, leaving 7 on one side and 6 on the other, for a total of 18 (11)

Just slightly sub. with all bottles full 44.750"

Multiplication Curve for this in-line array

1st point (18 bottles)

	C_2	C_3
11[30]	Too near critical to get count.	

2nd Point

12[45] PM One bottle removed, 17 left, for counts

	C_2	C_3
	192546 .0193	138881 .0163
	192905 .0193	139514 .0163
ave =	1927	1392

3rd Point one bottle removed, 16 left

C_2	C_3
65282 .1087	50097 .1836
65580	50317
6543	502

4th Point one bottle removed, 15 left

C_2	C_3
41479	33701 .175
41751 .171	33316
4161	3351

5th Point two bottles removed, 13 left

C_2	C_3
20645	19493 .472
20647 .345	19602
2045	1955

6th Point four bottles removed, 9 left

C_2	C_3
7101	
6980	9348
7271	9287
7123	9228
7111	9049

Background 7117 four bottles removed, 5 left 9228

C_2	C_3
2155	

Note: C_3 started throwing in counts, use 6th counts as background

Exp. 36

10/24/60 8^{30} 19 bottles spaced 1" edge to edge in line with 6" reflector on one face. System very sub crit with all bottles full. Count-rate too low for good M^{-1} curve

Exp. 37

9^{30} 19 bottles spaced ½" edge to edge in line with 6" reflector on one face. System very sub. crit (not enough count-rate for good curve in reasonable length of time.

Exp. 38

20 bottles spaced 0.30" edge to edge in line with 6" reflector on one face.

1st Point of M^{-1} curve, 20 bottles

underlined M^{-1} numbers were obtained using background with no soln.

2 min counts	C_2		C_3	
10^{45} AM	39510	.492	4357	.646
	39575	.320	4183	.147
	39336		4223	
	ave = 39473		4254	

2nd Point, 18 bottles

C_2		C_3	
39404	39515	4110	4118
38801	ave = 39333	3889	ave = 4134
39051	.494 .671	4160	.667 .141
39543		4134	

3rd Point, 16 bottles

	C_2		C_3	
	38857		4066	
	38929	.498	4127	.681
	39096	.577	4049	.154
	38957		4047	

4th Point, 14 bottles

	C_2		C_3	
	38272		4326	
	38424	.517	4211	.654
	37846	.098	4212	.148
	37574		4213	

5th Point 10 bottles

35172		4017	
34954	.160	3968	.684
34720	.011	4102	.155
34662		4029	

6th Point, 5 bottles

19447		2753	
19412	.116	2939	.226
19403		2765	
19414		2756	

Background count with no bottles

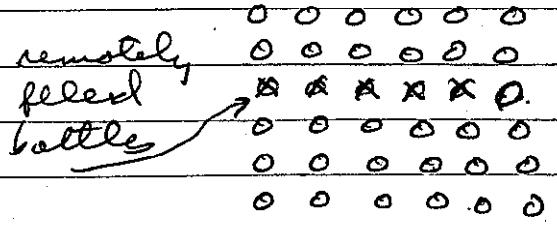
C_2	C_3
2329	643
2265	603
2247	623
2247	623

Exp. 39, Run 1

11/26/60 6×6 array of full (44.25") 4-12 bottles (single tier) spaced 5.40" edge to edge

11½ AM Soln in 5 remotely filled bottle = 32.79 ; just Crit

NOTE: The five remotely filled bottles are in line



Run 2

Same array as above to determine $\partial k / \partial H$

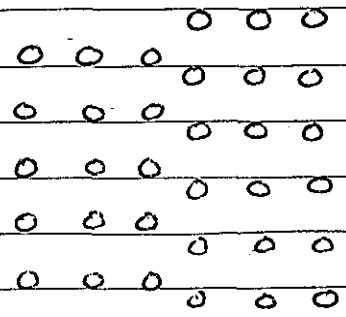
Soln ht in remotely filled bottles for period = 33.29"

" " " " " " " just Crit = 32.80"

T = 86.9 sec. , P = 7.02×10^{-4}

Run 3

36 bottles spaced 5.4" edge to edge but with 3 rows offset from the other 3 as shown, i.e. three rows are moved so as to be midway between other rows



Soln ht in remotely filled bottles 41.08" just crit.

For pos period for 2P/2H
Soln ht = 42.11"
T = 101 ; P = 6.25×10^{-4}

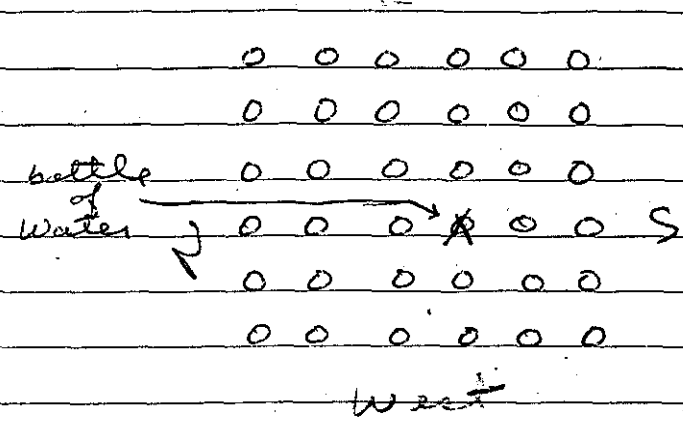
Run 4

11/27/60
3:00 PM

6×6 array spaced 5.50" edge to edge
Soln in remotely filled bottles = 37.78" just crit

Exp. 40, Run 1

11/28/60 6×6 array spaced 5.50" edge to edge. i.e. same as last run except bottle of water (full) replaced bottle of fuel as shown →



Soln in remotely filled bottles = 4.5", not crit

Run 2

a ½" sheet of plastic was placed on east face of above array and a 3/8" sheet was placed on west face.

10[10] Selsyn did not operate properly at beginning of run, repaired and leveled. The cd-covered for the BF_3 counter was removed from center of remotely filled bottle where it had been left.

not crit when full

Run 3

Same array but with additional ½" plastic sheet placed on north side.

10:45 AM Soln ht for period = 34.56"
Just Crit = 34.14"
T = 113 ; ρ = 5.72 × 10⁻⁴
2P/2H = 13.61 × 10⁻⁴ in⁻¹

S

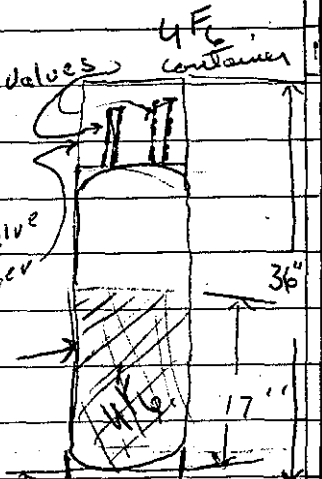
Exp 41

6 × 6 array at 5.5 with all bottles fueled and with same plastic reflector as Exp 40, Run 3

2:04 PM Par Per - Soln ht = 23.59"
Just Crit - Soln ht = 23.33"
T = 116 ; ρ = 5.61 × 10⁻⁴
2P/2H = 21.57 × 10⁻⁴ in⁻¹

Exp. 42, Run 1

11/31/60 6 × 6 array with standard 5" UF_6 container (with fuel) replacing same fuel & bottle as water bottle did. The UF_6 container was set in position up side down.



Soln ht for pos period = 37.80"
Soln ht for crit = ~~30.~~ 30.40

5.2 × 21.72 × 5 = 113.9 pp
ρ = 5.72 × 10⁻⁴

The UF_6 container had 55 lbs. of UF_6 in

~~Run 2~~

it. a survey of the outside of the container with a ~~x~~ survey meter indicated little change in count rate along the sides ~~but~~ the until meter was very near top of cylinder, but there was a definite increase in count rate on ~~bottom~~ of cyl. Therefore could not determine exactly the distribution of UF_6 in this manner

Run 2

Same array and conditions as Run 1 above except plastic reflector removed

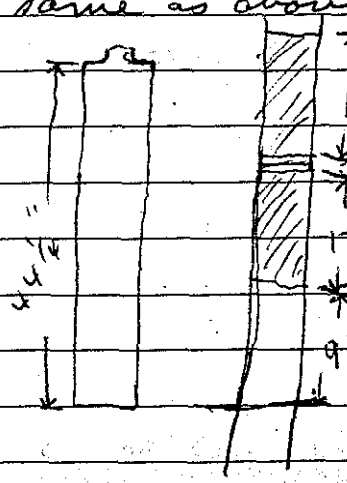
Soln ht = 45" not Crit.

Run 3

a second UF_6 container has been positioned immediately above the first, but ~~right~~ top side up. Otherwise the conditions are same as above (Run 2)

4:0
3 PM

Soln ht
= 45", not crit



Exp. 43, Run 1

11/2/60

6×6 array of full 4-12 bottles spaced 5.30" edge to edge (remotely filled bottles in line as shown on page 28)

not 3 1/2 PM Soln ht in remotely filled bottles = 29.69" for gas. period

3 2/2 PM just Crit = 29.42"

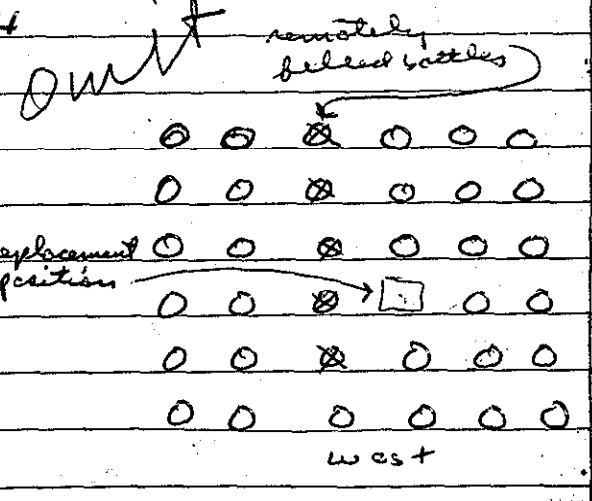
$6.45 \times 21.12 = T = 140.1$ min

ρ 4.8×10^{-4}

Exp. 44

bottle removed from "replacement position", from above array i.e 35 bottles as shown spaced 5.3"

3 45 Soln ht = 45", not crit.



11/3/60 45

The "replacement position" has been moved to position shown. Spacing 5.30" (void)
Soln ht = 38.39 for pas period
8 45/AM Crit ht = 37.51

3.05 X 21.72 = T = 66.3
ρ = 8.5 X 10⁻⁴

O O X O O O
O O X O O O
O O X O O O
O O X O □ O ← replacement position
O O O O O O

Exp 46 6 X 6 - at 5.30"

12 3C/PM Same array as above, but void filled with 12 l (V-12) bottle of H_2O.
Pas Per = 36.42
Just Crit = 35.99

6.6 X 21.72 = T = 143.4 sec
ρ = 4.72 X 10⁻⁴

$\frac{\Delta\rho}{\Delta h} = \frac{4.72 \times 10^{-4}}{.43} = 10.97 \times 10^{-4}$ in⁻¹

Second period
Soln ht for period = 36.51
Soln ht for Crit = 36.01
T = 105.3 ; ρ = 6.05 X 10⁻⁴
$\Delta\rho/\Delta h = 6.05/.5 = 12.10 \times 10^{-4}$ in⁻¹

The purpose of the repeat runs was to check reproducibility

3rd Period
Soln ht for Period = 36.50
2 45/AM Soln ht for Crit = 36.00
T = 102.1 ; ρ = 6.20 X 10⁻⁴
$\Delta\rho/\Delta h = 6.20/.50 = 12.40 \times 10^{-4}$ in⁻¹

Exp. 47

Same 6x6 array (5.30" STS) with 4.0" x 4.0" x 44" column of 3% enriched UF_4-paraffin in "replacement position".

Soln ht for pos period = 34.46"

Soln ht for crit = 34.11

$T = \frac{119.5}{166.2}$; $\rho = \frac{5.48}{4.16} \times 10^{-4}$

$\frac{\Delta\rho}{\Delta h} = \frac{5.48 \times 10^{-4}}{.35} = 15.65 \times 10^{-4}\ in^{-1}$

2nd Period

Soln ht for period 34.37"

Soln ht for crit 34.10

$T = \frac{166.2}{119.5}$; $\rho = \frac{4.16}{5.48} \times 10^{-4}$

$\frac{\Delta\rho}{\Delta h} = \frac{4.16 \times 10^{-4}}{.27} = 15.41 \times 10^{-4}\ in^{-1}$

48

Same 6x6 array of bottles (with a regular fuel bottle in replacement position) Purpose: check on reproducibility

Soln. ht for pos. period = 29.69

" " " crit . 29.43

Exp. 48

11/4/60 Same 6×6 "replacement" array, with 4"×4"×44" column of 2% UF_4-paraffin in replacement position

8 45/AM Soln ht for pos. period = 34.82" $\frac{\Delta P}{\Delta h} = \frac{5.48 \times 10^{-4}}{.42} = 13.04 \times 10^{-4}$

Soln ht for crit = 34.40"

$T = \frac{119.5}{166.2}$; $\rho = \frac{5.48}{4.16} \times 10^{-4}$

2nd Period

Soln ht for pos. period = 34.72

Soln ht for crit = 34.41 $\frac{\Delta P}{\Delta h} = \frac{4.16}{.31} = 13.41 \times 10^{-4}$

$T = \frac{166.2}{119.5}$; $\rho = \frac{4.16}{5.48} \times 10^{-4}$

11/4/60

Exp. 49

Same 6 x 6 replacement array, with 4 1/4" x 4 1/4" x 44" column of graphite in replacement position

Soln ht for pos period = 35.08"

Soln ht for crit = 34.69

T = 136.8 ; ρ = 4.82 X10^{-4}

2nd Period $\frac{\Delta\rho}{\Delta h}$ = 4.82/.39 = 12.35 X10^{-4} in^{-1}

Soln ht for pos period = 35.20

Soln ht for crit = 34.69 $\frac{\Delta\rho}{\Delta h} = \frac{6.89}{.51} = 13.50 \times 10^{-4}$

T = 89.1 ; ρ = 6.89 X10^{-4}

Note: Average density of graphite = 1.542 gm/cm^3

Exp #50

Same 6 x 6 replacement array, with 4 1/4" x 4 1/4" x 44" Be column in replacement position

Soln ht for pos period = 34.39"

Soln ht for crit = 33.98"

T = 116.2 ; ρ = 5.60 X10^{-4}

$\Delta\rho/\Delta h$ = 5.60/.41 = 13.65 X10^{-4} in^{-1}

2nd period

Soln ht for pos period = 34.26"

11 45 AM Soln ht for crit = 33.98

T = 181.4 ; ρ = 3.87 X10^{-4}

$\Delta\rho/\Delta h$ = 3.87/.28 = 13.82 X10^{-4} in^{-1}

Average Density of Be = 1.699 gm/cm^3

Impurities in C and Be reported in ORNL 1770 — negligible

Exp. 5-1

Same 6×6 array of bottles, with a regular fuel bottle in the replacement position as a check on reproducibility

Soln ht for pos period = 29.69"

Soln ht for crit = 29.43

T = 146.6 ; P = 4.63×10^{-4}

Exp 5-2

Same 6×6 array of bottles, with a 4-12 bottle filled with D_2O

The D_2O was 99.7 atom % D

Soln ht for pos period = 34.62"

Soln ht for crit = 34.34

T = 175.9 ; P = 3.97×10^{-4}

$\Delta P/\Delta h = 3.97/.28 = 14.17 \times 10^{-4}$ in^{-1}

2nd Period

soln ht for pos period = 34.78

Soln ht for crit = 34.34

T = 102.1 ; P = 6.20×10^{-4}

$\Delta P/\Delta h = 6.20/.44 = 14.09 \times 10^{-4}$

Exp. 53

Same 6x6 array of bottles, with a X-10 bottle filled to 22.745" in the replacement position, containing ~~21.405~~ kg of UO_2F_2 solution in which the U is (enriched) U-235

Sp gr 1.595

3,235 mgU/g soln

1st Period

Soln ht for pos. period = 29.94"

Soln ht for crit = 29.68

T = 136.8 ; ρ = ~~3.97 x 10⁻⁴~~ = 4.92×10^{-4}

$\Delta\rho/\Delta h = 4.92/1.26 = 18.92 \times 10^{-4}$

2nd Period

Soln ht for pos period = 30.01"

3 04 PM Soln ht for crit = 29.68" $\frac{\Delta\rho}{\Delta h} = \frac{6.36}{.33}$

T = 98.8 ; ρ = ~~6.20 x 10⁻⁴~~ = 6.36×10^{-4} = 19.27×10^{-4}

Bottle Dimensions: O.D. = 5.59"

I.D. ≈ 5.25"

Exp. 5-4

11/7/60 6x6 array with a nominal 6" schedule 40 carbon steel pipe in the replacement position

Soln ht for pos period = 36.65"

Soln ht for crit = 36.15"

T = 110.8 ; $\rho = 5.82 \times 10^{-4}$

$\Delta\rho/\Delta h = 5.82/.50 = 11.64 \times 10^{-4}$ in^{-1}

2nd Period

Soln ht for pos period = 36.52

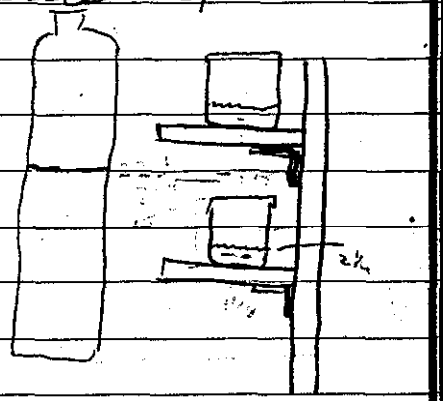
9 OS/AM Soln ht for crit = 36.15

T = 161.8 ; $\rho = 4.27 \times 10^{-4}$

$\Delta\rho/\Delta h = 4.27/.37 = 11.54 \times 10^{-4}$ in^{-1}

Exp. 5-5

Same 6×6 array. This is the first of a series of experiments in which two 1/16" wall stainless beakers (with covers) 6 3/4" O.D by 7 1/2" tall (without cover on) are placed in the replacement position. The beakers will contain various materials and will be positioned so that the centers of the reacting material are 15" apart and spaced equidistant (7.5") above and below the vertical of the array. The beakers are ~~on~~ positioned by sitting on al. "shelfs" attached to two pieces of al. unistrut.



For this experiment two empty beakers were positioned ~~of~~ as if they contained 2 1/4" height of material (the height of oxide powder to be used next)

Soln ht for pos period = 37.61" $\frac{\Delta\rho}{\Delta h} = \frac{4.02}{.41}$

Soln ht for crit = 37.20" = 9.80

T = 173.8 ; $\rho = 4.02 \times 10^{-4}$

2nd Period

Soln ht for pos period = 37.75 $\frac{\Delta\rho}{\Delta h} = \frac{5.66}{.55}$

Soln ht for Crit = 37.20 = 10.29

T = 110.8" ; $\rho = 5.66 \times 10^{-4}$

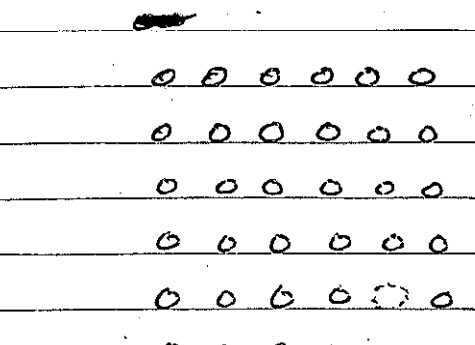
56

Exp. 60

11/7/60

Run 1

6×6 array except one outside bottle missing in addition to the replacement bottle but with the two beakers of oxide powder placed on same shelfs as empty beakers in Exp. 56.



Beaker #3 contains 6654 gm of UO_2 powder

Beaker #4 contains 6519 gm of UO_2 powder

See page 41 for beaker description

$2\frac{08}{pm}$ Soln ht = 32", not crit, ∴ the "missing" bottle can be added safely

Measured depth of powder = 2 1/4" in each beakers

Run 2

One bottle added to complete the 6×6 array (except for replacement position) Same beakers of UO_2 powder as Run 1.

Soln ht for pos period = 36.21 $\frac{\Delta\rho}{\Delta h} = \frac{5.10}{.42}$

$2\frac{40}{pm}$ Soln ht for crit = 35.79 = 12.14

T = 130.3 ; $\rho = 5.10 \times 10^{-4}$

2nd Period

Soln ht for pos. period = 36.03 $\frac{\Delta\rho}{\Delta h} = \frac{2.64}{.24}$

" " " crit = 35.79

T = 280.2 $\rho = 2.64 \times 10^{-4}$ = 11.00

11/8/60

Exp. 57

Run 1

6x6 array with ~~two~~ one beakers of UF_4 in lower replacement position and with one soln bottle missing (see diagram for exp 56, run 1).

Each (of two) stainless beakers has ~ 7" depth of UF_4 powder. Same size beakers as before. The two shelfs were positioned so center of fuel will ~~be~~ be 7.5" from center of array

Soln Ht = 41.04, crit.

Run 2

Both beakers of UF_4 in replacement position and all other bottles are in place.

Beaker # 7 contains 13905 gm of UF_4

" #8 " 14500 gm " "

Soln Ht for pos period = 34.47" $\frac{\Delta P}{\Delta h} = \frac{3.02}{.21}$

" " " crit = 34.26" $= 14.38$

$T = \frac{3.42.2}{3.02}$; $P = 3.02 \times 10^{-4}$

2nd Period

Soln ht for pos period = 34.60" $\frac{\Delta P}{\Delta h} = \frac{4.81}{.35}$

" " crit = 34.25" $= 13.74$

$T = 140.1$; $P = 4.81 \times 10^{-4}$

11/8/60

Exp. 58

Both beakers of metal scraps were placed in replacement position and positioned so that centes of metal in the beakers was placed 7.5" above and below cente. of array respectively.

#1 beaker containing 14,843 gm metal } 93%64 ppm.
#2 " " 14 858 " " }

The depth of the metal scraps in the beakers was appropimately 4 1/2"

These pieces of metal scrap are ~1/8" thick having various areas of the order of 2"x2".

Soln ht for pas period = 35.11
Soln " " Crit = ~~35.69~~ 34.69

T = 118.4 ; P = 5.52 x 10^{-4}

$\Delta P/\Delta h$ = 5.52 / .42 = 13.14 x 10^{-4}

2nd Period

Soln ht for pas period = 35.25
" " " Crit = ~~35.67~~ 34.67

11 26/pm

T = 80.4 ; P = 7.49 x 10^{-4}

$\Delta P/\Delta h$ = 7.49 / .58 = 12.91 x 10^{-4}

Exp. 59

Two beakers of "pellet" in replacement positions. Pellets are 93.2% metal pieces in shape of parallelepiped ~ 1/8" to 1/4" on edge. The depth of the pellets in the beakers is 2 3/4"

= 3 liters : 10996 gr
= 4 " = 15000 gr

13%4⁵

Soln Wt for pos period = 35.31 $\frac{\Delta\rho}{\Delta h} = \frac{5.25^-}{.42}$

" " for crit = 34.89

T = 126 ; $\rho = 5.25 \times 10^{-4}$ $= 12.50 \times 10^{-4}$

2nd Period

Soln Wt for pos period = 35.22

" " " crit = 34.89

T = 168.3 ; $\rho = 4.12 \times 10^{-4}$

$\Delta\rho/\Delta h = \frac{4.12}{.33} = 12.48 \times 10^{-4}$

11/9/60 Exp. 60

Two stainless beakers filled with $UO_2(NO_3)_2$ The solution was taken from that which is used to fill the five remotely filled bottles. 4 liters were put in each. Ht. of soln in beakers = 7⅛"

Soln ht for pos. period = 33.05" $\frac{\Delta P}{\Delta h} = \frac{5.56}{.36}$

9 25/60 AM Soln ht for crit. = 32.69"

T = 117.3 ; $P = 5.56 \times 10^{-4}$ $= 15.44 \times 10^{-4}$ in^{-1}

2nd Period

Soln ht for pos period = 33.18 $\frac{\Delta P}{\Delta h} = \frac{7.26}{.49}$

Soln ht for crit. = 32.69

T = 83.6 ; $P = 7.26 \times 10^{-4}$ $= 14.81 \times 10^{-4}$ in^{-1}

Contents of above beakers:

Gross = 7.295 Soln Gross = 7.301

Tare = 1.051 Soln Tare = 1.062

6.244 kg Soln 6.239 kg Soln

11/9/60 Exp. 61

4-12 bottle filled with 20.067 kg of UO_2F_2 at 4-235 assay. This soln is taken from same soln used in Exp. 53.

10 in

Soln ht for pos. period = 30.77

Soln ht for crit = 30.48

$T = 119.5$; $\rho = 5.47 \times 10^{-4}$

$\Delta\rho/\Delta h = 5.47/.29 = 18.86 \times 10^{-4}$ in^{-1}

2nd Period

Soln ht for pos period = 30.64"

Soln ht for crit = 30.47"

$T = 258.5$; $\rho = 2.85 \times 10^{-4}$

$\Delta\rho/\Delta h = 2.85/.17 = 16.76 \times 10^{-4}$ in^{-1}

Note: U-metal is 93.4 wt % U^{235}

11/9/60

Exp. 62

A column of 93.4% U metal was inserted in replacement position. The column ~~was~~ is 1" x 2" x 40" and was assembled from four pieces 2" x 10" x 7/8" and four pieces 2" x 10" x 1/8". The column was centered vertically as well being centered in replacement position.

Soln ht for pos period = 35.53

Soln ht for crit = ~~35.24~~ 35.23 $\frac{\Delta\rho}{\Delta h} = \frac{3.62}{.30}$

$= 12.06 \times 10^{-4}\ in^{-1}$

T = 196.6 ; $\rho = 3.62 \times 10^{-4}$

2nd Period

Soln ht for Pos period = 35.61" $\frac{\Delta\rho}{\Delta h} = \frac{4.95}{.39}$

$4^{0}/_{pm}^{3}$ Soln ht for crit = 35.22 $= 12.69 \times 10^{-4}$

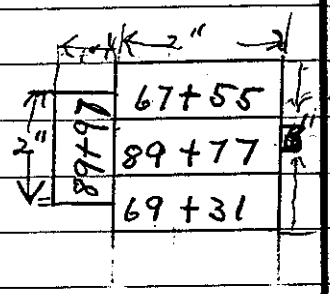
T = 135.8 ; $\rho = 4.95 \times 10^{-4}$

The weights and dimensions of the above pieces of metal

Metal Piece #	Vault Position #	Dimensions (in)	Weight
883-17-1058	67	2x10x7/8 ✓	5.351 kg
883-46-1077	55	2x10x1/8	0.771 "
883-17-1036	69	2x10x7/8 ✓	5.344 "
883-46-0998	31	2x10x1/8 ✓	0.769 "
883-17-1050	89	2x10x7/8 ✓	5.357 "
883-46-1045	77	2x10x1/8 ✓	0.775 "
883-17-1057	89	2x10x7/8 ✓	5.399 "
883-45-1041	97	2x10x1/8 ✓	0.768 "

11/10/60 Exp. 63

The eight pieces of 93.2% metal used in Exp. 62 were assembled in replacement position as described by top view shown at right. The assembly was 10" tall and was centered vertically. The assembly was centered in the replacement position also (horizontally)



Soln ht for pos period = 34.94 " $\frac{\Delta\rho}{\Delta h} = \frac{5.82}{.44}$

1:05 PM Soln " " Crit = 34.50" $= 13.22 \times 10^{-4}$

T = 110.8 ; $\rho = 5.82 \times 10^{-4}$

2nd Period

Soln ht for pos period = 35.08

Soln ht for crit = ~~35.50~~ 34.50

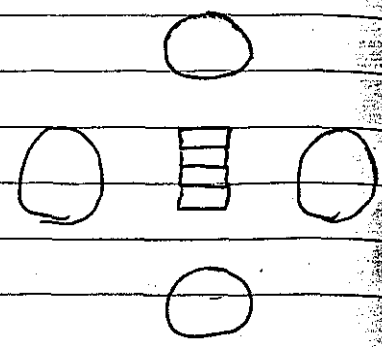
T = 79.3 ; $\rho = 7.58 \times 10^{-4}$

$\frac{\Delta\rho}{\Delta h} = 7.58/.58 = 13.06$

11/12/60

Exp. 64

The eight pieces of metal were placed in line in replacement positions of 6x6 array as shown, and centered both horizontally and vertically



Soln ht for pos period = 34.96" $\frac{\Delta P}{\Delta h} = \frac{4.95}{.37}$

Soln ht for Crit = 34.59"

T = 134.7 ; P = 4.95×10^{-4} = 13.37

2nd Period

Soln ht for pos period = 35.26" $\frac{\Delta P}{\Delta h} = \frac{9.2}{.67}$

Soln ht for Crit = 34.59"

T = 63.0 ; P = 9.2×10^{-4} = 13.73

Exp. 65

11/11/60 The same eight pieces of metal were placed in the configuration shown at right (top view) and was centered in replacement position of the 6 x 6 array

Soln ht for pas. period = 35.02" $\frac{\Delta P}{\Delta h} = \frac{6.35}{.47}$

" " " crit = 34.55"

T = 98.8 ; P = 6.35×10^{-4} = 13.51

2nd Period

Soln ht for pas period = 34.93

" " " crit = 34.55

T = 124.9 ; P = 5.28×10^{-4}

$\frac{\Delta P}{\Delta h} = \frac{5.28}{.38} = 13.89$

11/11/60 Exp. 70

a K-25 battle ~~was~~ appear same fuel ht as other battles with G = 26.91 T = 3.86 and net = 23.05' of nitrate solution taken from same batch as other.

Soln ht for pos. period = 28.36

1 2.5' PM " " " Crit 28.13

T = 161.8 ; P = 4.65' x 10⁻⁴

$\Delta P/\Delta h$ = 4.65'/.23 = 20.21

2nd Period

Soln ht for pos. period = 28.55'

" " " Crit. = 28.13

T = 77.1 ; P = 7.75' x 10⁻⁴

$\frac{\Delta P}{\Delta h}$ = 7.75'/.42 = 18.45

11/11/60

Exp. 71

4"x4"x44" column of blocks consisting of UF_4 mixed with CF_2

gm U/cc = 3.114

gm of Total Mixture (UF_4-CF_2)/cc = 4.78 ± .07 gm/cc

gm U per block = 616.6, where each block = 2"x2"x3"

% U-235 = 0.20

gm C per block = 9.44

The column is assembled from 58 blocks 2x2x3" and two blocks 2x2x1", having same constituents

Soln ht for pos. period = 35.45'

Soln ht for crit = 35.04'

T = 131.4 ; ρ = 5.07 x 10^{-4}

Δρ/Δh = 5.07/.41 = 12.36 x 10^{-4}

2nd Period

Soln ht for pos period = 35.58'

4 00 pm Soln ht for crit. = 35.04'

T = 96.7 ; ρ = 6.46 x 10^{-4}

Δρ/Δh = 6.46x/.54 = 11.96 x 10^{-4}

Exp. 72; Run 1

11/14/60 6×6 array with regular 4-12 bottles in replacement positions. Purpose is to check reproducibility

Temp = 23.5°C

Soln ht for pos. period = 29.54
Soln " " Crit = 29.20
T = 105.3 ; P = 6.07 ×10⁻⁴
ΔP/Δh = 6.07/.34 = 17.85×10⁻⁴

Run 2

Same array after checking for spacing. Only small changes in position of 2 or 3 bottles were made. two pieces of iron unistrut bracing were removed from above array near replacement positions

Soln ht for pos period = 29.58
10 20 AM Soln ht for Crit = 29.33" $\frac{\Delta P}{\Delta h} = \frac{7.40}{.25} = 29.6 \times 10^{-4}$
T = 81.5 ; P = 7.40×10⁻⁴

Run 3

Same array except here the two pieces of iron unistrut brace were put back in place.

Soln ht for pos period = 29.55
Soln ht for Crit = 29.19"
T = 95.6 ; P = 6.53×10⁻⁴
ΔP/Δh = 6.53/1.36 = 18.13×10⁻⁴

Run 4

Same as Run 3 – just drained back and then got crit again

11/17 AM crit ht = 29.19"; pos period = 29.58

T = 148.8; P = 4.57 x 10⁻⁴

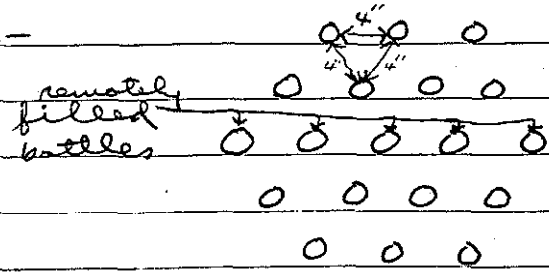
$\Delta P/\Delta h = 11.72$

.6 x 10⁻⁴

Exp. 73

11/15/60 Run 1

19 bottles (4-12) in hexagonal array spaced 4.0" edge-to-edge



Soln ht for pos. period = 25.22"

1 00 PM " " " crit = 25.03"

T = 116.2 ; P = 5.60 X 10⁻⁴

Run 2

11/16/60 Same array except spaced 4.4" edge to edge

Soln ht for period = 34.92 $\frac{\Delta\rho}{\Delta h} = \frac{5.9}{.27} = 21.85$

" " " crit = 34.65

T = 100.9 ; P = 5.9 X 10⁻⁴

Run 3

11/16/60

1 30 PM Solution ht = 45.00". Sub crit (spacing = 4.6" E to E.

11/16/60 Same array except spaced at 4.5" edge to edge

3 10 PM

Pos Per = 40.30" $\frac{\Delta\rho}{\Delta h} = \frac{5.3}{.53} = 10.0 \times 10^{-4}$

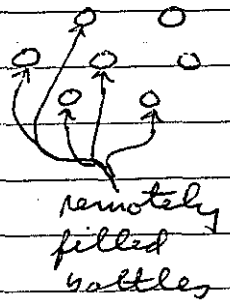
Crit = 39.77"

T = 123.8 ; P = 5.3 X 10⁻⁴

Exp. 74

11/17/60 Run 1

Hexagonal array of 4-12 bottles.
Seven bottles spaced
1.50" edge to edge



Soln ht for pas. period = 42.51"
" " " Crit = 41.34"

$T = 97.1$; $\rho = 6.4 \times 10^{-4}$

$\Delta\rho/\Delta h = 6.4/1.17 = 5.47 \times 10^{-4}$

Run 2

Same array as above except 1.40" spacing

Soln ht for pas period = 32.12"
Soln ht " Crit = 31.71

$T = 79.3$ $\rho = 7.55 \times 10^{-4}$

$\Delta\rho/\Delta h = 7.55/.41 = 18.41$

11/18/60 Exp. 75

Same array as exp. 74, Run 2. The purpose of this experiment is to check reproducibility of crit ht and $\Delta P/\Delta h$

1st Period

10 25 AM Soln ht for gas period = 31.96

Soln ht for Crit = 31.66

T = 95.6 ; $P = 6.52 \times 10^{-4}$

2nd Period

Soln ht for gas period = 31.97"

" " " Crit 31.57"

T = 81.5 ; $P = 7.4 \times 10^{-4}$

The reason for the difference in recorded crit heights is that the float in the manometer apparently "drags", at least at this particular height. This probably accounts for the lack of consistancy in the $\Delta P/\Delta h$ measurements

Begining of Two Tier Exps.

11/23/60

Exp. 76, Run 1

1st point of 4x4 array spaced 5.60" edge to edge between bottles and also 5.6" between tiers. For this point upper tier is completed (16 bottles) but lower tier contains only five remotely filled bottles plus one more. The remotely filled bottles form a cross

Soln Ht = 44" not Crit

2nd Point

Lower tier now has 12 bottles, including 5 remotely filled bottles.

1 30 PM Soln ht = 44" not Crit

3rd Point

Full two tier array of full 4-12 bottles spaced 5.60" edge to edge and 5.6" between tiers

Soln ht = 44", not Crit.

11/25/60 Exp. 76, Run 2

In view of the low reactivity of the 4×4 at 5.6" STS, we decided to try to run a 5×5 at 5.60" STS

1st Point — 37 bottles, i.e. 4×4 + 5 bottles added to one face of upper tier

Soln ht in remotely filled bottles = 44", not Crit

2nd Point

completed 5×5 array on top and 4×4 on bottom i.e. 41 bottles

10 20 AM Soln ht = 44", not Crit

3rd Point

completed 5×5 on top and 21 bottles of 5&5 on bottom

Soln ht = 44", not Crit

4th Point Full 5×5 array in both tiers spaced 5.6" edge to edge and 5.6" between tiers (between fuel)

Soln ht in remotely filled bottles = 44", not Crit

11/25/60 5th Point

5×5 array, two tiers but with extra row of 5 bottles added to lower tier at 5.6" spacing i.e. 55 bottles

Soln ht in remotely filled bottles = 37.45" pos period

Soln ht = 37.09 just Crit

6th Point

3 bottles removed from "extra" row described above, leaving 2 nearest center of face i.e. 52 bottles

Soln ht = 45", not Crit

7th Point

One bottle put back on, giving 53 bottles, i.e. two tiers 5×5 + 3

Soln ht for pos period = 43.15"

Soln ht for Crit = 42.61

no. of bottles when crit and full determined from above data = 52.5 (at 5.6" spacing)

11/28/60 Exp. 76, Run 3

Two tier, 5×5 array (i.e. 50 bottles) spaced 5.50" edge to edge (with same spacing between tiers as before).

3^25 PM Soln ht = 44.6, not crit

2nd Point

Same array as above (Run 3) except one bottle added to center of fo one face on lower tier

Soln ht = 45", not crit

3rd Point

Same array except one bottle add on same face (near center) making 52 bottles

Soln ht = 43.32 for pos period

Soln ht = 42.78 for crit

No. of bottles when crit and full determined by drawing parallel curve to data in Run 2 through above point (5.5" spacing) = 51.5

11/30/60 Exp. 76, Run 4

1st Point

Two tier 5×5 array spaced 5.25" edge-to-edge but still spaced ~5.6" between tiers as before

Soln ht in remotely filled bottles for pos period = 39.07

10^30 AM " " for crit = 38.49 "

2nd Point

The two end bottles (or "corner" bottles) were removed from one row of lower tier, leaving 48 bottles

Soln ht = 45", not crit

3rd Point

One bottle added back to corner, giving 49 bottles

Soln ht for pos period = 42.40"

11^22 AM Soln ht for crit = 41.78"

No. of bottles when crit and full from above data = 48.25 (5.25" spacing)

∴ From a plot of no. of bottles vs spacing the critical spacing for 50 bottles = 5.36"

12/1/60 Exp. 77, Run 1

Point 1

4X4 array, two tier spaced 3.65" edge-to-edge

Soln ht for pos period = 42.25"

Soln ht for crit = 41.69

2nd Point

one bottle removed from corner of lower tier.

~~Soln ht for pos period~~

Soln ht = 45", not crit

3rd Point

Still 3.65" spacing. A bottle containing 23 3/8" of soln was put back on corner position

3:00 PM Soln ht = 45", not crit

4th Point

Bottle containing 23 3/8" soln removed from corner and replaced with bottle containing 40 1/8" of soln.

Pos Per: 42.47

3:45 PM Soln ht in remotely filled bottles = 41.95, just Crit.

Exp. 78, Run 1

12/7/60

1st Point two tier 7×7 array spaced 7.70" edge to edge and 5.6" between tiers. For this point upper tier (49 bottles) is complete and lower tier contains 5 complete rows + two more bottles, i.e. 37 bottle (when remotely filled bottles are included)

2:35 PM Soln ht in remotely filled bottles = 45", not crit

2nd Point

6 bottles added to complete next row giving complete upper tier and 6 rows of lower tier + one bottle

3:12 PM Soln ht in remotely filled bottles = 32.76, crit.

3rd Point

One row was removed from upper tier and one bottle from lower tier leaving a 6×7 array (including remotely filled bottles) i.e ~~84~~ 84 bottles.

Soln ht in remotely filled bottle = 45" not Crit

12/8/60 4th Point

four bottles added ~~as near to~~, two to upper tier and two to lower tier, as near to center of faces as possible i.e. on in center row and one adjacent to it, in both tiers. Total no. of bottles = 88

Soln ht = 39.45 / ~~39.47~~ @ crit

5th Point

two bottles removed, one from center row of upper tier and one from center row of lower tier, leaving 86 bottles

9:30 AM Soln ht = 44.27 (full), not crit

6th Point

one bottle put back on (centre row of lower tier) giving 87 bottles

Soln ht in remotely filled bottles = 42.41 just Crit

Exp. 78, Run 2

12/13/60

1st Point

Six bottles missing from lower tier of two tier 7×7 array spaced 8.20" edge to-edge giving total of 92 bottles

1 45 pm Soln ht in remotely filled bottles = 45", sub crit

2nd Point

Complete two tier 7×7 array of full 4-12 bottles spaced 8.20" edge to edge and 5.6" between tiers

2 55 pm Soln ht in remotely filled bottles = 40.55" just crit

3rd Point

two corner bottles removed from west face of lower tier leaving 96 bottles

3 33 pm Soln ht in remotely filled bottles = 46", barely sub.

4th Point

One bottle put back on corner, giving 97 battles

Soln ht in remotely filled bottles = 42.30 just Crit

12/14/60
8 30 am A spacing of 8.31 inches edge-to-edge ~~spac~~ was obtained for the complete two tier array (98 bottles). The value of the number of bottles necessary to be critical at the given spacing of 7.7 or 8.2 in Runs 1 & 2 were obtained by plotting no. of bottles vs crit ht in remotely filled bottles and taking no. at 44.25". These two values of no. of bottles were plotted vs spacing and spacing corresponding to 98 bottles was 8.31 (checked @ 8.33 on 1/5/61)

1-17-61 Transfered solution from 15" S.S. cyl. storage system into new permenent storage system. Then pumped from cyl. to cyl. for mixing and to check on whether there was any water left.

Sp. gr. by hydrometer 1.565

Expt 79

Reedy, Dyer, JK7.

1/20/61 9:15 AM a 5X5 array in "Big Lid" spaced at 5.64" S. to S. This is the final point in building a 6X6 at the same spacing.

Fuel ht = 33.84". Due to hold-up in new storage system, must add more fuel to be able to fill five center bottle. "System Sub Crit."

1/20/60 Added @ 24 liters of solution to new storage system.

12:55 P.M. Liquid level manometer (that uses no float) installed + zeroed.

1/20/60 5X5 array at 5.64" S. to S. Solution ht = 44.283" ~~Sub~~ Sub Crit. Slight ~~multiplication~~ multiplication.

1-20-61 5X5 array with water reflector

Water at bottom of bottles at 39.5 cm on rule scale. With all bottles full water was raised to a reading of 165 cm, about 5 cm above the fuel top. System dead - no appreciable reactivity, near background.

Drained 5 center bottles to zero and then drained water back to bottle zero

With water at zero added fuel to 5 center bottles. Moderate increase in reactivity when all bottles full

Expt. 80

1/23/61 a 6X6 array in Big Lid, spaced 5.64" S to S. Critical at 29.83"

" Drained out of 5 center bottles to near zero and added refl.- mod water. After water was above fuel zero fuel and water were added alternately so as to keep the two levels nearly the same.

Water raised to 170 cm with fuel at 44.7+ so as to have system fully reflected. No appreciable multiplication

Drained fuel to near zero and started water drain

Expt 81

1-23-61 5x6 array with 5.64" spacing
not crit. when 5 center battles full

Drained fuel back to ~30 in. & added
bottom refl. to zero. Then added to
5 battles. Crit at 34.67"

Run 2

1-23-61 5x6 + 2 battles centered in row
on So. face. Slightly sub when
all battles full.

Run 3

1-24-61 5x6+2 full 8 1 battles with 25¾ in fuel
Critical with 5 battles at 39.70".

Expt 82

1-24-61 5x6+2 full + 25¾ in fuel in 3rd battle
With 5 center battles empty turned fog
spray on (spray mounted up about
3 ft above center of array). Very slight
increase on K-2
Began filling 5 center battles
Crit. at 35.00"
Fuel at 35.61 for positive period; 260 sec
Crit at 35.35" for $\Delta h = 0.26" \approx 2.9 \times 10^{-4} \Delta k$
Stopped pump for neg. period: 39 sec.

12 50 PM approximately ½ inch of water in tank when in
equilibrium — fog nozzle on hose & dump well open —

Spray flow rate calibration

1-24-61
Start at 6.3 cm in battery
After 9 min. 14.5
Δh = 8.2 cm Area std = 59 l/cm
Flow rate 53.8 l/min
After cleaning nozzle, second flow test!

Start at 4.8 cm
after 9 min: 15.0
Δh 10.2
Flow rate 66.8 l/min

Expt 82, Run 2

1-24-61 5x6+2 full battles.
Test for crit with spray on.
Crit at —
Fuel at 4007 for positive period
Crit at 39.14 after leveling
Turned off spray for neg. period
Δh = 0.91", Δk = 8.7×10^{-4} (67. sec)
Neg period 54 sec

Expt 82 Run 3

F-25-61 Repeat of Run #1

Cex 5 + 2 full + 1 - 25 3/4" after re-clean w/spray nozzle.

Cut at ~ 35"

Fuel at 35.85 for positive period

Cut at 35.39

$\Delta h = 0.46$

Spray pump off for neg. period.

Pos Per : T = 106.4 sec

Neg Per : T = 93.4 sec

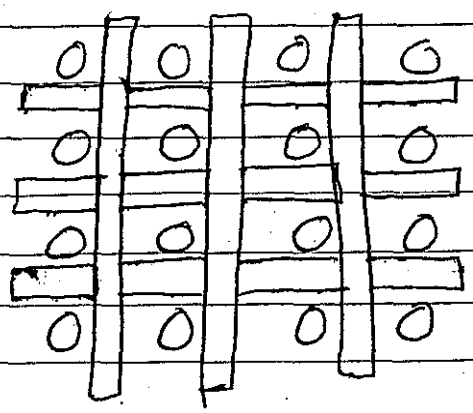
Expt. 83 run 1

33.2-5

5 x 5 Array of 3/4 full Y-12 Bottler outside of Sid. Edge to Edge spacing 3.90"
Fuel zero – .01"
slightly super at 31.85"
Fuel at 32.26" for positive period
Crit at 31.84
Δh 0.42
ρ = 7.0 x 10⁻⁴

Expt 84 run 1

4x4 Array of full Y-12 Bottler
Separated 4.75" edge to edge.
Egg-crate of plexiglas as shown 1½" thick. Each piece centered between bottler. No outside refl. pieces

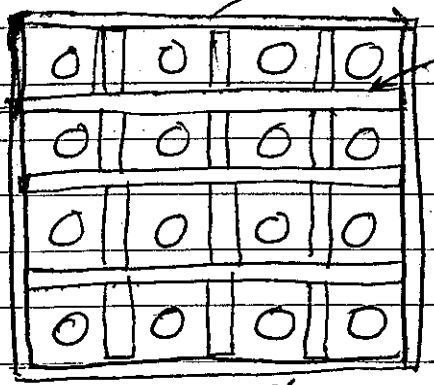


Sub-critical - sharp decrease on count removal when system full

Expt 85 run 1

Same as previous Expt. except 3/4 in. thick outside refl. added around "egg-crate"

4 x 4 array seperated 4.75"



Fuel at 28.70" for positive period.
Crit at 28.46"
Δh 0.35"
$\Delta\rho = 6.73 \times 10^{-4}$

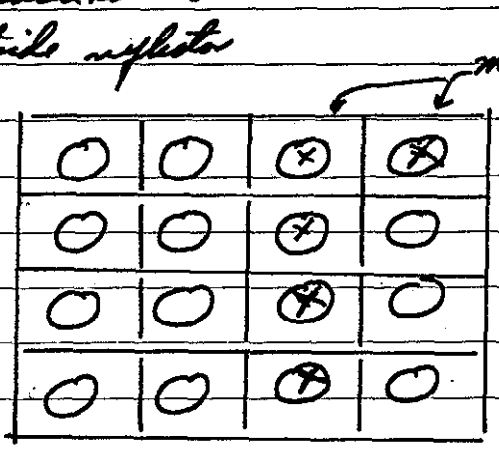
2/3/61 Exp. 86 - Run 2

8 25 AM Full 12 liter polyethylene bottles in "egg crate" 4×4

5.2" edge to edge spacing

1½" thick lucite between bottles

¾" " " outside reflector



8 42 AM Fuel Ht 39.81" pos period ~ 100 sec

8 50 AM Fuel Ht 39.21" just critical

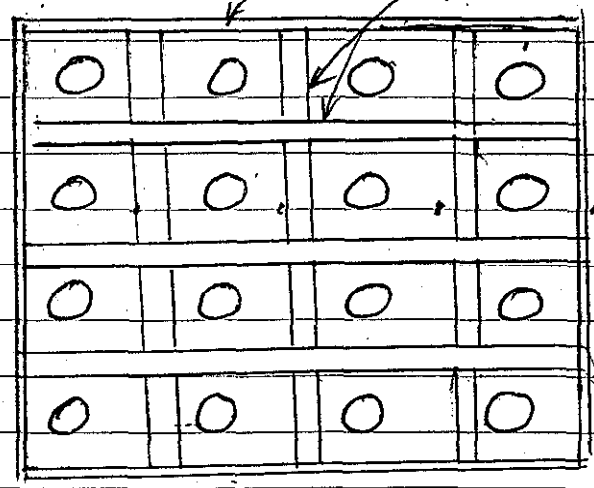
δh 0.60

$\delta \rho = 5.72 \times 10^{-4}$

Expt 87 run 1

4 x 4 array using 5.6 m. edge to edge & 1" thick plexiglas "egg-crate"
Full Y-12 Bottles used
All Expt 30

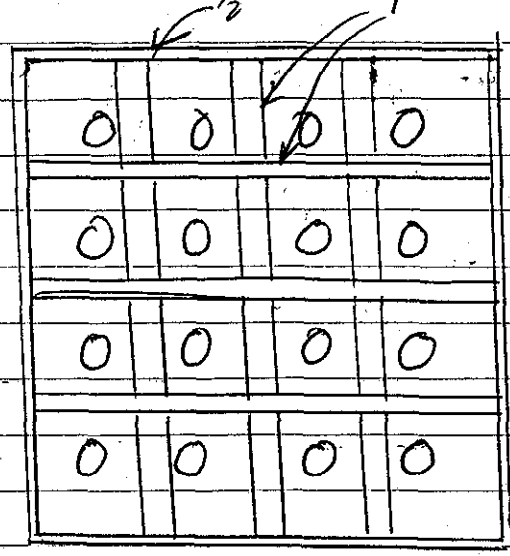
Sub-critical when full. Fairly high multi.



Expt 88 run 1

4 x 4 array using 5.4 m. edge to edge & 1" thick plexiglas egg-crate

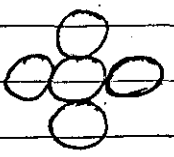
Very slightly sub-crit when full. Approx. 40 sec. neg. period on removal of source.



2-8-61

Expt. 89 run 1

Test of 5 Y-12 Bottles in contact in the shape of a cross:

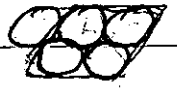


Small all multiplications when full.

Expt. 89 Run 2

" Test of 5 Y-12 Bottles in contact as shown below:

~~slightly~~ Cut at 15.70



" Expt 89 Run 3

Test of 4 - Y-12 bottles in contact with a square outline:

very out-cut when full

small multiplication

80
2-7-61

Expt 89 run 4

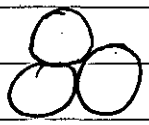
4 - Y-12 bottles in contact using triangular array as shown!

Giving parallelogram outline

Critical at 34.56"

Expt 89 run 5

3 - Y-12 bottles in contact in a triangular array



Very little increase on mich. when full

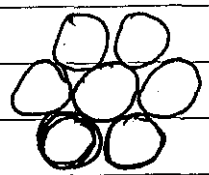
2-13-61
Ready
Enrichm
for

6" Dia. Al. Cylinder Interaction Expts.

93.2% En. $UO_2(NO_3)_2$ H/X = 59.8

Expt # 1

" 7-6" Dia Al. Cylinders in Hexagonal Array ~ 0.15" Edge to Edge



Selsyn zeroed
3/4" Dia. Safety rod in

Slightly super 9.77"
Just. crit 9.76

Expt # 2

2-13-61 7-6" Dia. Al. Cyls. in Hex.
Separation ~ 1.0" Edge to Edge
Safety up ~ 25" when cocked

~~Slightly sup 15.40~~"
Just crit 15.40
Dropped safety - worth more than 1 dollar

2-13-61 Expt. 3

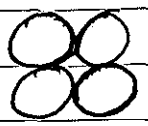
7-6" Dia. Al. Cyls. in Hex. pattern
Separation 2.0" Edge-to-Edge
Safety cocked up ~~3~~ 34
just cut at 27.47"

2-14-61 Expt # 4
Reedy
Fox 7-6" Dia. Al. Cyls in Hex. pattern
Separation 2.5" Edge to Edge
Selsyn re-zeroed - max. manometer stroke 50"
Safety removed because of high expected C_4H_8
just cut at 39.16"

Note: Checked dead Volume = 18 l.

2-14-61 Expt # 5

Reedy Cronin For 4-6" Dia. Cyls. in Square Array
Separation 0.15" Edge to Edge



Just Crit at 26.33

Expt # 6

50" C.H. 2-14-61 4-6" Dia. Cyls in Square Array
" " Separation 0.50" Edge-to-Edge

Not Crit. at 50"

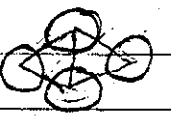
Raised Manometer 18"

2-15-61 Expt. 6B
" 4-6" Cyls in Square Array, Separation 0.50
" After Raising Manometer
sub. Crit at 68"
High multiplication.
Neg. Period ~ 50 μs on Source removal

2 - 15 tel
Reedy
Fox

Expt 7

4 - 6" Dia. Cyls. in ~~Hex.~~ Tri.
Sep. 0.38" Edge-to-Edge
Mano. zero at 18"



Just Crit. $24.8 + 18.0$
18.0
42.8"

Expt 7B.

Repeat of above for Reproducibility
Time between Expts. Approx. 1 hr.
Cylinders not moved between Expts.

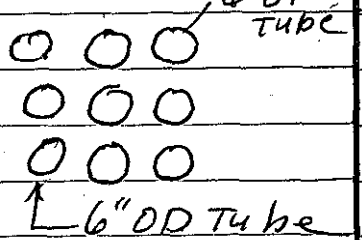
Just Crit $24.8 + 18.0$
18.0
42.8

Plore check on critical height

2-17-61

Expt 8A

9-6" Dia. Al. Cyls. in Square Array
Using 2-6" O.D. Tubes
Spacing 1.70 in. Edge-to-Edge
2-6" OD Tubes filled to 20"



Crit with 7-cyl at 22.02"

bility

Expt 8B

Repeat of above after re-stacking at the same spacing of 1.70", for check on error in spacing

Crit with 7-cyl at 22.09

22.09
21.98
.47

2-20-61
Ready for X-ray

Expt. 8C

Filled 2-6" OD. Tubes to 22"
at 1.70 Edge-to-Edge
Remaining seven cylinders not moved

just crit at 21.58 in seven remotely
Interpolated V. 21.67 — filled cylinders

Ht. = 21.67 for Por. period
just crit at 21.58

$21.67 - 21.58 = .09$

$T = 85.4\ \mu c = 7.1 \times 10^{-4}\ \Delta k$

$\frac{\Delta P}{\Delta h} = -7.9 \times 10^{-3}$

Expt. 9A

2-20-61
"

9-6" cylinders in Square Array
Sep. 2.30" In Edge-to-Edge

2-6" OD cylinders at 30.0
just crit at 30.77

Fuel ht = 31.01 for Por. period
just crit at 30.77

$31.01 - 30.77 = \Delta h = 0.24$

$T = 106.4\ ,\ 6.0 \times 10^{-4}\ \Delta K$

$\frac{\Delta K}{\Delta h} = 2.50 \times 10^{3}$

2-20-61 Expt 9B

Repeat of Expt 9A for reproducibility of Crit. ht. and period.

Fuel ht. 31.12 for pos. period
Just crit. 30.72"
T = 85.4 mc ≈ 7.1×10^{-4} δK

31.12 − 30.72 = δh 0.40

$\frac{\delta k}{\Delta h} = 1.775 \times 10^{-3}$

Found that manometer had trapped some soln. in a loop above manometer. Some soln. squirted out of end of tube. Fuel heights above may be off.

EXPT. 9C

2-23-61 Ready for X-1

Repeat of Expt 9B after installing probe manometer and Probe selsyns zeroed. Ion N calibrated. One thermocouple in feed line (#4) 1 thermocouple in reactor (#12)

Fuel ht for pos. period: Mano: 31.03 Probe: 31.08

Just crit: Mano: 30.83 Probe 30.87

Thermo. #4 − 21°C #12 − 20°C

δP = 5.73×10^{-4}

.21

$\frac{\delta k}{\Delta h} = 2.73 \times 10^{-3}$

Fuel ht for 2nd Pos. Period:

Mano. 30.99 Probe 31.03

Just crit 30.83 / .16 30.87 / 0.16

δP = 4.85

$\frac{\delta P}{\Delta h} = 3.03 \times 10^{-3}$

2-23-61
Reedy
Fox

Expt 9D

Repeat for period measurement

	Mass	Probe
7 or 8 per period	31.03	31.11
cut cut	30.84	3092
	0.19	0.19

Temp 21.5°C [redacted] $\rho = 5.68 \times 10^{-9}$

Log η = T = 114.0 sec

C-1. T = 116, C-2, T = 114

Av. T = 115, $\rho = 5.65 \times 10^{-4}$

$\frac{\Delta\rho}{\Delta h} = 2.97 \times 10^{-3}$

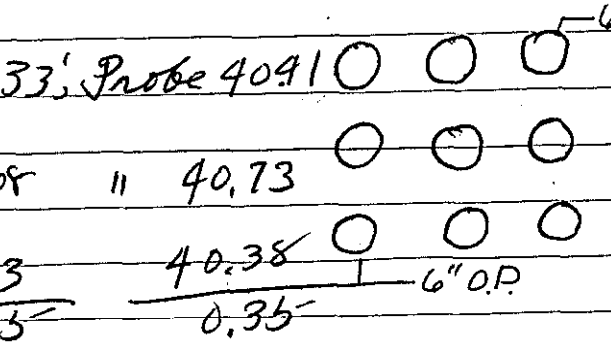
Av. cut ht in 7 cyl ~ 30.86"

Interpolated cut ht. = $\frac{.19}{30.66}$

2-24-61 Reedy Fox

Expt 10A

3X3 array of 6" Dia. Cylinders at separation of 2.70"
With 2-6" O.D. Tubes filled to 40"



Low Power crit: Mano. 40.33; Probe 40.91

For Por. Period: " 40.68 " 40.73

Higher Power Crit: 40.33 / 0.33 — 40.38 / 0.35

Ln $T = 107.8$, $\rho = 5.92 \times 10^{-4}$, $\frac{\Delta\rho}{\Delta h} = 1.69 \times 10^{-3}$

C-1 $T = 104.8$, $\rho = 5.98 \times 10^{-4}$, $\frac{\Delta\rho}{\Delta h} = 1.71 \times 10^{-3}$

2-27-61 Reedy Fox

Expt 11A

3X3 array of 6" cylinders at 3.0 in. rep. with 2-6" OD cyl. at 50"

Raised fuel ☐: Mano. 12.14; Probe 12.17

Raised mano. & Probe reads	0.27	0.63
Add ☐ readings Δh	11.87	11.54
Por Period	37.97	38.37
	11.87	11.54
	49.84	49.91
Jmf Crit. at	37.38	37.78
	11.87	11.54
	49.25	49.32
Δh	49.84 / 49.25 = 0.59	49.91 / 49.32 = 0.59

Ln $T = 84.8$ sec $\simeq 7.02 \times 10^{-4}\,\Delta\rho$

C-1 $T = 84.6$ $\simeq 7.05 \times 10^{-4}$ of

$\frac{\Delta\rho}{\Delta h} = 1.19 \times 10^{-3}$

49.29

Temp ≈ 21.5°C

90
2-27-61

Expt. 11B

Repeat of Expt 11A with 2 - 6" OD cyls filled to 49.5 inches. Spacing checked. 3.0"

Por. period Mano. 38.32 Probe 38.70

	11.87	11.34
	50.19	50.24
just cut.	37.79	38.15
	11.54	11.54
→	49.64	49.69
	50.19	50.24
	49.64	49.69
Δh	0.55	0.55

For 1-cyls

Av. Cut ht = 49.66"
49.50
.16

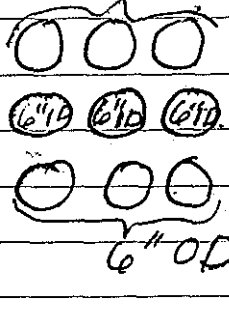
$\frac{\Delta\rho}{\Delta h} = 1.105 \times 10^{-3}$

$L_R - \frac{T = 104.9}{\Delta\rho = 6.08 \times 10^{-4}}$

2-25-61 Expt 12A

Reedy Grinder FOX

3X3 Array using 6 - 6" OD Tubes & 3 - remotely filled 6" I.D. Cylinders 20" high



Edge-to-edge separation 1.50" for all cylinders

Array outline not exactly square due to some cylinders being smaller

Por Period; Mano. 20.65 Probe 20.64

Just Cut

Δh $\frac{20.52}{.13}$ $\frac{20.52}{.12}$

Ln C-3 $T = 145.5$, ΔP 4.66×10^{-4}

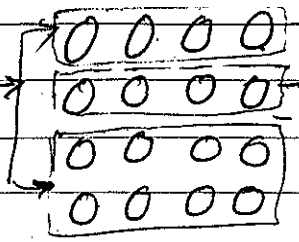
$T = 144.3$ $\Delta P = 4.70 \times 10^{-4}$

3-2-61
Reedy
Cronvich
TTX

Expt. 13A

4 X 4 Array of 6" cylinders at 3.25 in. edge-to-edge using 4 remotely filled in one row as shown.

9-6"OD cyls filled to 20"



Not cut. at 27 in in four remotely filled.

Exp. ~~13~~ 13B

20" fuel in fueled cyl.

3-3-61 Reedy Cronvich TTX — 4X4 Array – 6" diam cylinders at 2.90" Edge to Edge using same 4 remotely filled cylinders as 13A

Comparison { Mano. 2.62"
Probe 2.61"

not cut at 36"

3-7-61 Sample of H_2O in Outside tank sent for Analysis: Rep 393/20

3-3-66
Reedy
Front
Fox

Expt 13C

4 x 4 Array at separation of 2.70" edge-to-edge. Same four remotely filled cylinders as in 13A

Comparison: mano. 9.30" Probe 9.29"

Cut at 25.16"

Expt. 13D

3-6-66
Reedy
Fox

4 x 4 Array at sep. 2.60" edge-to-edge
One row of four cyls remotely filled.
as in 13A.

Comparison: mano. 1.51", Probe 1.49"

Full ht for Por. period: 21.75" on both $\Delta h = .23$
Just cut: mano. 21.52"; Probe 21.52"
2nd Por. period mano. 21.77" $\Delta h = .25$ 21.76

Ln T = 90.4, ~~[illegible] 2.0~~ C-1, T = 92.0; C-3, T = 93.8

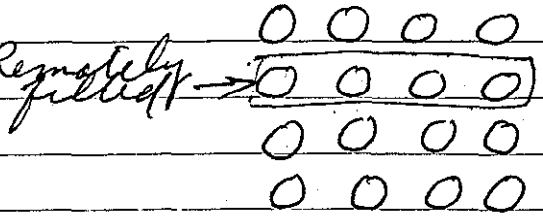
Interpolated spacing for 20 C.H. = 2.56"

→ Ln, T = 95.6, C-1: T = 96.0, C-3; T = 97.4

3-7-61
Ready for

Expt 14A

4x4 array of 6" Al. Cylinders at 3.25" separation with 30" fuel in 12 6" OD cylinders. 4 remotely filled 6" I.D c/s in one row.



Crit. at 21.69 mano.
21.70 Probe

3-7-61
Ready for

Expt 14B

Same as 14A except separation set at 3.45"

Mano. 7.45 Probe 7.44

Just Crit: Mano. 24.59
Probe 24.60

3-8-61

Expt 14 C

same as 14A except seperation now 3.70"

Comparison: Probe 1.25" , Mano. 1.26"

For Positive period " 29.07 Mano. 29.05"

just crit 28.85 / .22 28.84 / .21

Ln, T = 139, C-1 T = 138, C-3, T = 140.4

Av. T = 139.2 $\delta\rho = 4.85 \times 10^{-4}$

Interpolated spacing = 3.77" for 30" high

3-9-61 Ready room 7 PM

EXpt 15A

4 x 4 array with remotely filled cylinders in one row only. 12 - 6" O.D. cylinders used with fuel ht. at 40.0" Separation 4.50" edge to edge

mono. re-zeroed.

Comparison	Mano. 8.09	Probe 8.08
"	25.17	" 25.17
pos period	41.14	41.18
just crit	40.41 / .73	40.40 / .78

Ln, $\delta\rho = 7.1 \times 10^{-4}$ C-1, $\delta\rho = 6.95 \times 10^{-4}$ C-3 $\delta\rho = 6.85 \times 10^{-4}$

T = 84 T = 88.4 T = 90.0

Interpolated Crit. ht = 40.17

reduced = 40.08

3-15-61

Ready

Expt 16A

Crop

T+X

4 x 4 array with 6" O.D. cylinders filled to 50.0 in. and with 4-6" I.D. remotely filled cylinder in one-row as before

Edge-to-edge spacing 5.00 inches

P_{oo} Per = 50.42 on probe (manometer not used).

gust crit. = 49.70

Δh 0.72.

L_{x_i}, T = 123 ~~5.35~~ 5.4 $\frac{\Delta P}{\Delta h} = 0.75 \times 10^{-3}$

C_1, T = 122 "

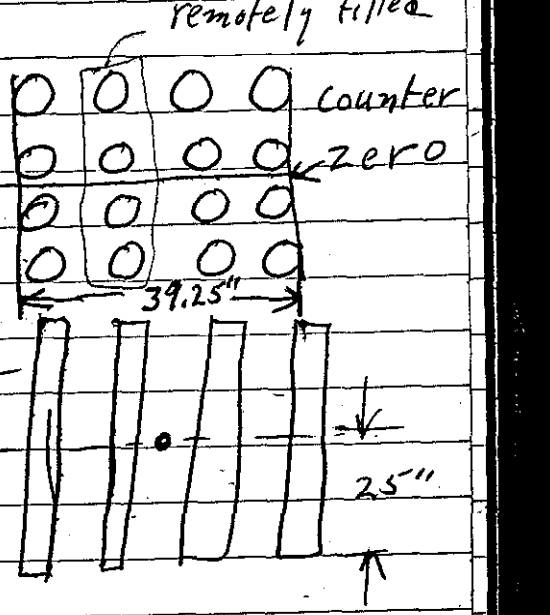
C-3 T = 122 "

3-16-61
Reedy
room
for

Expt 16B

Repeat of 16A with miniature BF_3 counter set up to take a horizontal traverse thru the midplane and center of the array horizontally

Counter zero in with end of counter tube (container) against South edge of array.
Active center of counter approx. 1 3/4 in. on from zero.
Total distance from edge-to-edge of array approx. 39.25"
crit at ~ 49.4 in
4 remotely filled cyl. 50" ~ 12



Counter Position	~~C_T~~	C_1	C_T/C_1
19.67	222,780	136,065	~~1.638~~ 1.611 (2 min count σ_n = .02)
"	226,902	136394	~~1.663~~ .002
18.00	239184	135978	~~1.76~~ .568
16.00	213475	117208	~~1.82~~ .530
14.00	211260	120033	~~1.76~~ .568
12.00	231951	123495	~~1.856~~ .539
9.00	207077	100709	~~2.035~~ .487
6.00	211470	99982	~~2.115~~ .473
3.00	212925	92674	.435
0.0	236110	69413	.307
5.0	214621	93838	.438 .425
~~3.0~~	208417	85399	.410
8.0	217008	92742	.428

98

Positions	C_1	C_2	C_2/C_1
10.0	216778	97683	.450
13.0	216227	113953	.527
~~15.0~~	171320	98037	.572
17.0	199808	103504	.518
19	212728	110322	.518
21	218713	113398	.512
19	208825	106925	.512
23	219577	112494	.512
25	228434	109127	.477
27	229066	99822	.436
29	221521	92962	.42
31	216829	84106	.39
34	213745	71057	.33
37	218536	48673	.22
19	230744	118900	.516
17	227980	113516	498
15	202274	100705	.497
13	202377	100030	.494
11	194843	86533	.444
8	177847	82835	.466
5	205766	77100	.375
3	208951	70425	.338
9	215122	89663	.417
12	238750	112697	.472
14	231691	114054	.493

3-17-61
Reedy
Cronemeyer
FHY

Expt. 16 C

Same as Expt 16B except Miniature BF_3 Counter is Cd-covered. (3 min counts)

Position	C_1	C_2	C_2/C_1
19.0	661296	67605	.101
16.0	654306	69402	.106
13.0	625933	67372	.108
10.0	624377	59220	.095
7.0	670526	57742	.086
13.0	730918	76829	.105
19.0	657292	70434	.107
22.0	684279	68361	.108
25.0	633,767	62683	.099
28.0	609,204	54865	.090
31.0	630,386	50171	.080
34.0	674,836	48386	.072
37.0	670,207	31,539	.047
24.0	673084	71433	.106
20.0	679378	72242	.107
16.0	628112	64951	.103
3.0	687867	52680	.077

Ln .04

100

3-20-61
Reedy
Cronkite
FOX

16D

Expt ~~17A~~ Vertical Traverse

4x4 Array at ~~4.50~~ 5.00" separation.
Same as 16A except set-up for vertical traverse with miniature BF_3 counter in approx Center of Array in air. Counter Bare.

Counter zero at array zero

O O O O
O O O O
counter →
O O O O
O O O O

Cut at 49.57 in R.F. Cyls.

Position	C_1	C_2	C_2/C_1
25.0	176,817	67463	.381
23.0	194,040	62984	.325
21.0	174081	58207	.334
19.0	195264	55237	.283
17.0	172109	53191	.309
"	186740	50023	.268
"	184298	46647	.253
"	181618	46538	.257
"	179 234	44611	.249
"	176 023	41312	.234
	173357	39291	.226

Expt stopped to work on counter

25	102871	37550	.365
"	104840	37550	.358
"	104200	3648	351
"	102527	36170	.357

25.0	103,199	36349	.352
23.0	299 990	91583	.305
21.0	278 656	87432	.314
17.0	202210	56628	.279
"	201797	56909	.282
"	203078	54890	.270
"	197216	50616	.257
"	195 265	49420	.253
	Replaced Pre-amp		
25.0	67024	38,303	.637
"	5754	3444	.634
"	5732	3672	.641
"	57783	3639	.630
"	60421	37183	.616
"	61389	37555	.612
"	61587	36902	.600
"	61876	38204	.618
"	62265	38079	.612
"	63344	38354	.606
"	64120	38608	.602
"	Changed Pair		
"	54342	39512	.701
"	55259	38710	.700
"	54462	37641	.692
	52774	37129	.704

3-21-61
Ready
Chamber
for

Expt 16D Cont.

(2 min counts)

Crit at 49.83

Position	C_1 Nor.	C_2	C_2/C_1	Ln-.02
25.00	208680	123224	0,590	
"	2090	1236	0.591	
"	2067	1216	.589	.587
"	2035	1192	.586	
"	2012	1173	.583	
23.0	→ 1956	11354	.646	.580
21.0	1942	1115	.574	
19.0	1934	1088	.562	
17.0	1958	1046	.532	
15.0	1922	1022	.532	
13.0	→ 1982	1003	.568	.505
11.0	→ 1946	931	.479	
9.0	1917	866	.452	
9.0	1995	823	.413	
5.0	1924	717	.373	
3.0	1903	626	.329	
1.0	1974	559	.283	
15.0	1848	967	.524	
25.0	1793	1004	.558	
27.0	1804	995	.554	
29.0	1802	1019	.566	
"	1818	1005	.555	
adj HV.	1798	1153		
"	1767	1120	.634	
"	1748	1005		
"	1742	1056	.607	
"	173	1038	.599	

Por	C_1	C_2	C_2/C_1
25.0	1715	986	.575 } .576
"	1687	968	.574 }
~~1.~~	~~1687~~	~~968~~	
27.0	1685	954	.566
29.0	1714	9507	.555
31.0	1769	952	.539
33.0	1698	8870	.522
35.0	1638	811	.495
37.0	1631	768	.471
39.0	1628	7021	432
43.0	1645	5799	352
49.0	1659	3572	.215
25.0	1593	9231	.580
23.0	1557	8832	.568
19.0	1624	9097	.560

Interpolated av. out let. $\simeq$ 49.87

$H = 67.25''$

49.87

$2\overline{)17.38}$

$8.69'' = \delta$

104
3-21-41
Reedy
Cronemeyer

Expt 16E

Cd-covered Vertical Traverse for Expt 16 in Air

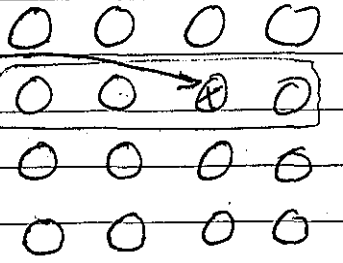
Position	C_1	C_2	C_2/C_1
26.0	674,987	97783	.145
"	69028	9920	.144 .144
"	710	1014	.143
21.0	4896	700	.143
16.0	484	653	.135
9.0	5055	563	.111
25.0	477	693	.145
29.	4914	682	139
35	470	576	.122
41	484	462	.096
47	500	358	.071

3-22-61

Ready for Exp 16 F

Same array with small BF_3 counter centered in primary feed cylinder ~25 inches ± ¼ in from bottom of cyl. counter in ½" OD × 1/16" wall plexiglass tube and ○ Counter Bare

Cnt at 4.996 in from remotely filled.



C_1	C_2	C_2/C_1	
72,688	98,821	1.359	2 min counts $L_H = .005$
73,938	102,928	1.393	
75,047	104,014	1.385	
74490	102,646	1.378	
73445	100053	1363	

(Rock pod. 29.47 in)

5 | 4.899

Av. 1.3798 → 1.38

Expt 16 G

Same as above except miniature BF^3 counter cd-covered ~30 mil

Cnt at ~ 50.24

C_1	C_2	C_2/C_1
221,454	60,530	0.273
223,949	60,822	.2715
224,912	60872	.271
228978	61,583	.269
229,027	61337	.268

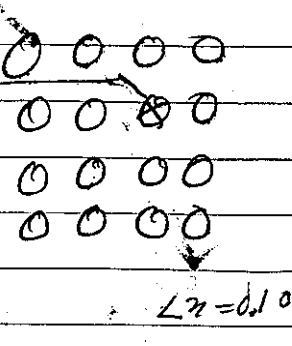
3-22-61
Reedy
Cronkite
Fox

Expt 16 H

Vertical traverse in center of cylinder adjacent to center of Array #1 using Tracerlab U233 miniature fission counter in S.S. container

Counter zero at .06 in above bottom of cylinder

Center of det up 1 9/16" from top of container



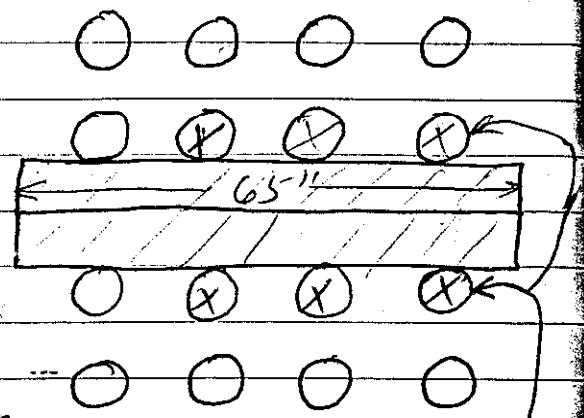
Position	C_1	C_2	C_2/C_1	
25.0	1,043,098	40653	.0390	.0387
"	1039564	39863	.0384	
22.0	1016—	40855	.0394	
~~19.0~~	~~990859~~	~~39254~~	~~.0397~~	
16.0	1015748	38734	.0381	
13.0	1062152	38089	0359	
10.0	1069394	34176	0320	
7.00	1049675	29496	.0281	
4.0	1025924	23978	.0234	
1.0	1001978	17331	.0173	
10.0	973881	30907	.0317	
~~19.0~~	~~1008273~~	~~32484~~	~~.0322~~	Out at
25.0	1064967	41104	.0386	49.33
22.0	1089092	43594	.0400	
19.0	1080823	42812	.0394	
28.0	1111605	41838	.0375	
31.0	1155748	40644	.0352	

Position	C_1	C_2	C_2/C_1
34.0	1132041	36540	.0323
37.0	1065776	31138	.0292
40.0	1052528	25914	.0246
42.50	1059045	20315	.0192
35.0	1033167	32617	.0316
30.0	993224	35334	.0356
25.0	996460	38878	.0390

108
3-24-61
Reedy
Cronin
FRX

Expt. 17 A

4 x 4 Array of 6" dia. Cylinders with an 8" Concrete slab thru the center. Separation of Cyls is 3.0"



Two rows in contact with concrete slab.
two 4" thick slabs Hung from Crane

Slab of concrete 55/16" high with bottom even with soln. zero.

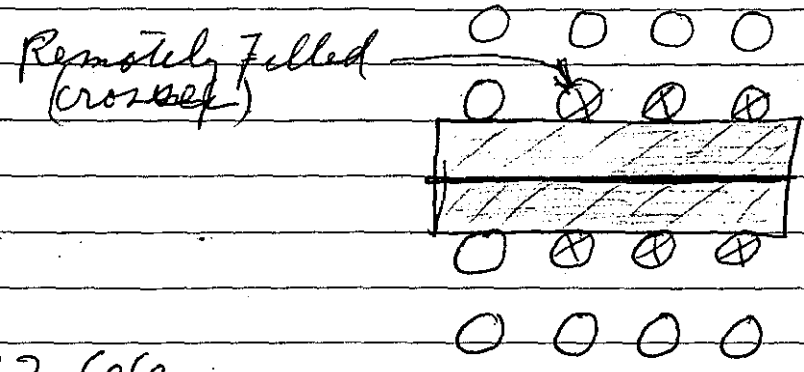
Cut at 21.86" in 6 remotely filled cylinders in positions shown

Fuel ht in fitted units = 50.0"

3-24-61
Reedy
Cronin
Fox

Expt 17B

4 x 4 Array: same as Expt 17A except separation = 4.00"



Out at 32.6ℓ

3-24-61
Reedy
Cronin
Fox

Expt 17C

Same as above except spacing is 5.0"

Slightly sub out at 57.1" in ℓ remotely filled cylinder

3-27-61
Reedy
Cronin
for

Expt 17D

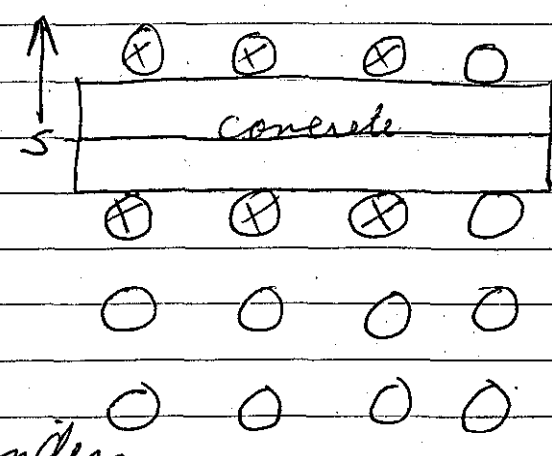
Same as 17A→C except spacing now 4.85"

Just Cut at 49.95 in 6 remotely pulled cylinders

5.0
1
4.7

Expt 18A

Removed one row from So side of slab and placed it on North side



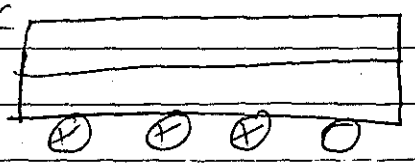
Just Cut at 28.50"
in 6 remotely pulled cylinders

3-27-61
Reed
Cronin
for

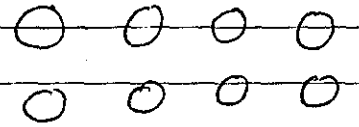
Expt. 19A

Removed row of cylinders from S. side of 8" concrete ~~slab~~ slab

Now have three rows of 4 cyls. each. separation = 4.85"



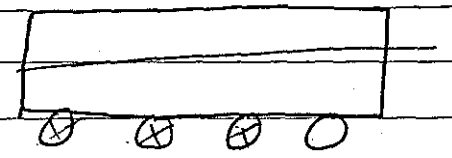
Only 3 cyls remotely filled as shown in sketch!



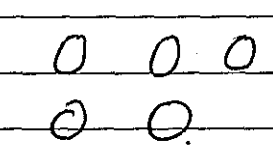
just critical at 28.88

Expt. 19B

Removed two cylinders from Expt above as shown



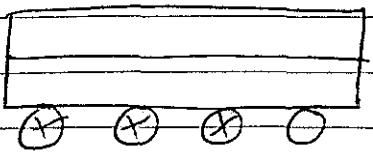
just critical at 38.68"



3-27-01

19C

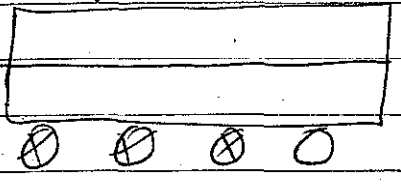
Removed one more cylinder as shown. Otherwise same.



slightly out-of-round at 56.8"

19D

Added one-half filled cylinder in position shown.



Just cut at 43.95"

4-4-61
Reedy
Cronin
Fox

Expt 20A

Removed concrete slabs; Spacing at 9.85" edge-to-edge. Test of no. of cyls critical without concrete slab at this spacing
14 cyls. in array as shown:

empty cyl → ⊕ ○ ○ remotely filled ⊗

○ ⊗ ⊗ ⊗
○ ⊗ ⊗ ⊗
○ ○ ○ ○

not crit at 54.0"

Expt 20B

" "
" "

Drained back partially to add to 15th cyl in position shown to 30.05" & valved off

30.05"
⊕ ○ ○
○ ⊗ ⊗ ⊗
○ ⊗ ⊗ ⊗
○ ○ ○ ○

Not crit at 53.2
High multiplication

4-5-61
Reedy
Cronin
Fox

Expt 20C

Opened #15 cyl to manifold

Pos. Period 50.94"
Just crit $\frac{50.60}{0.36} = \Delta h$

$T = 155.5$
$\rho = 9.4 \times 10^{-4}$

⊗ ○ ○
○ ⊗ ⊗ ⊗
○ ⊗ ⊗ ⊗
○ ○ ○ ○

$\frac{\Delta \rho}{\Delta h} = 1.22 \times 10^{-3}$

4-5-61
Ready Cromwell

Expt 20D

Added 10.18" to 16th cyl. & valved off. Separation ~ 4.85"

10.18" → (X) O O O
O ⊗ ⊗ ⊗
O ⊗ ⊗ ⊗
O O O O

Just Crit. at 49.39

Expt 20E

Lowered fuel in 16th cyl. to 5.00" & valved off.

Just crit at 50.04
Per. period 50.48
0.44 = δh = 130 mm
5.1×10^{-5}

$\frac{\delta \rho}{\delta h} = 1.16 \times 10^{-3}$

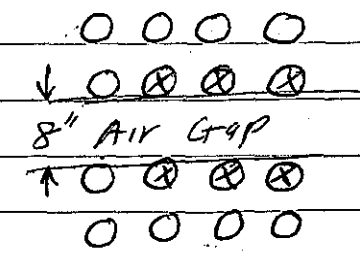
.00045
.0066

14-5-61
Reedy
Cronemiller

Expt 21 A

4x4 Array of 6" Dia. cyls with an 8 in. Gap thru the middle. Other spacing = 4.50"
Fixed cyl. 50" tall

Sub-crit at 56.5" (high multi.)

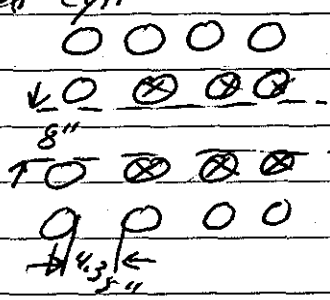


14-6-61
Fox
Reedy

Exp. ~~#~~ #21B

4x4 Array of 6" Diam cyl with 8" Air Gap
Edge to Edge = 4.35" Fuel = 50" in fixed cyl.

Crit at 53.22



14-6-61
Expt 21 C

" "
" "
Same as Above except spacing now 4.25"

Just Crit 49.63"
Pos. period 50.08
0.45 = Δh

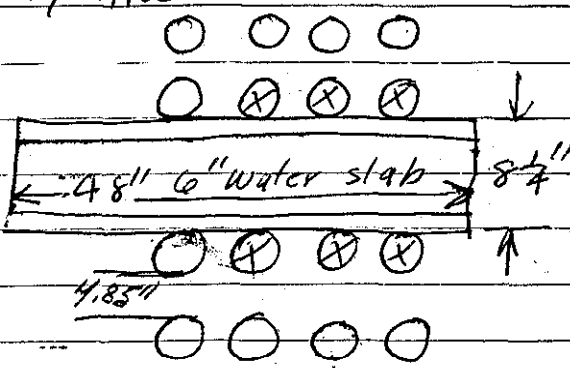
$\rho = 5.2 \times 10^{-4}$

$\frac{\Delta\rho}{\Delta h} = 1.156 \times 10^{-3}$

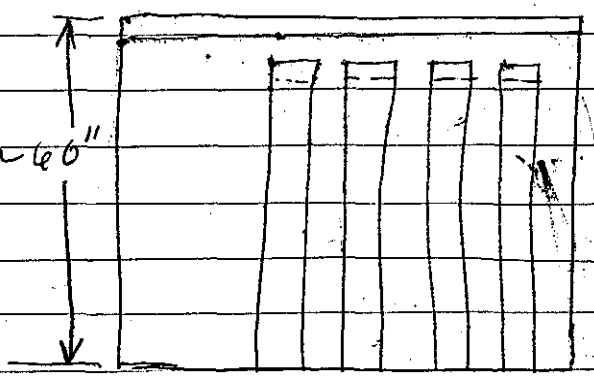
116
4-7-61
Reedy Ground for

Expt. 22 A

4x4 array with 8" slab thru the center: slab is made up of 6" water slab in aluminum case across center with 1" thick plexiglas sheets on each side
Fixed cyls 6.50" tall, Spacing 4.85"



Walls of Al. slab water tank is 1/8" thick



Quite sub-crit. at 56.5

Expt 22B

Same as above except spacing now 4.50"

Crit ht 54.69"

4-7-61
Reedy
Cronin
Fox

Expt 22C
Same as above except spacing
Now 4.40"
Just cut at 49.93
Poz. period = 50.60
0.67 = Δh

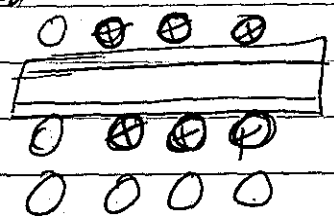
T 112.9, 5.7×10^{-4} $\frac{\Delta P}{\Delta h} = 0.85 \times 10^{-3}$

↓
-¼"
↑

Expt 23A

4-10-61
Reedy
Fox

At same spacing removed 1 row from S. side of array
mano. and probe telsyns checked

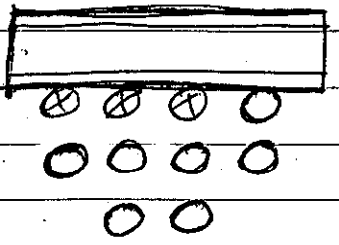


Very sud- cut at 56.15"

4-10-61
Reedy
Fox

Expt 24 A

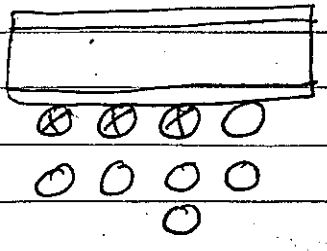
Removed all cylinders from South face of water + plastic slab. & added 2 cyl to North face at 4.40" separation



Supr-crit at 33,34
sub-crit at 33.00

Expt 24 B

Removed 1 cyl. in 3rd row leaving only 1



just crit at 43.84"

4-10-61 Sample Taken from Manifold
Reg. No. 59315

gr 9.1
1.9
net 7.2 gm

$g^0/g = .259100$
$\delta_{pg} = 1.5496$

4-10-61
Reedy
Fox

Expt 24 C

Replaced Fixed cyl. in 3rd row with remotely filled one and valved it off after filling to 33.2"

Cut at 46.49

Expt 24 D

" 9th cyl. filled ~~to~~ 20.2"

"

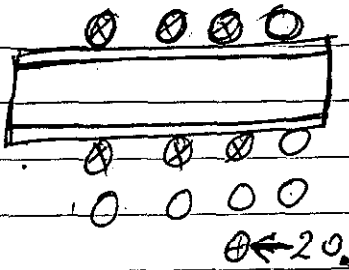
Cut at 54.10

Interpolated value for 50" is 25" or ½ full in 9th cyl.

Expt 25 A

Replaced 1 row on S. side of water + plastic slab with 20.2" solution in 9th cyl. on North side

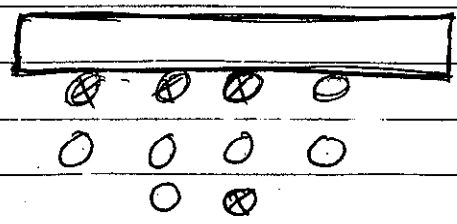
Just cut at 53.13.



120-61
Reilly
Fox

Expt 26 A

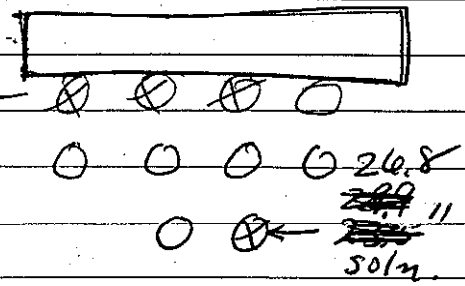
With cyl only on North face of Hzot plastic slab changed spacing to 4.85"
One cyl in 3rd row remotely filled:



Out at 92.33

" Expt 26 B
" Valved off 10th cyl with ~~24.9~~ ~~25.5~~ 26.8" soln.

With 23.5 in. in 10th cyl C. Ht was above 50"



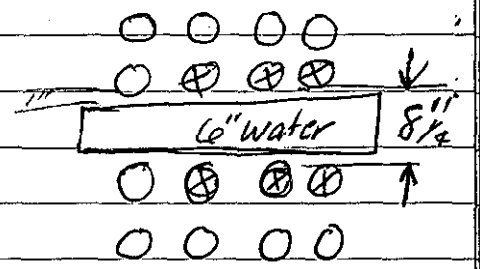
Out at 48.71

Interpolated value - 25"

4-11-61
Reedy
Fox

Expt. 27 A

Removed 1" plexiglas from each side of 6" water slabs and spaced 4 x 4 with 4.85" edge to edge as shown:



Quite sub-cut at 53.53"

Expt 27 B

" " Same as above except spacing now **4.40"** except for central gap

4.85
1
.70

Quite sub-cut at 56.40

Expt 27 C

" " Same as above except spacing now 4.00 in.

Cut at 44.97

122
4-12-61
Reedy
Fox

Expt 27D

Same as above except spacing now 4.15".

Per period 50.~~48~~

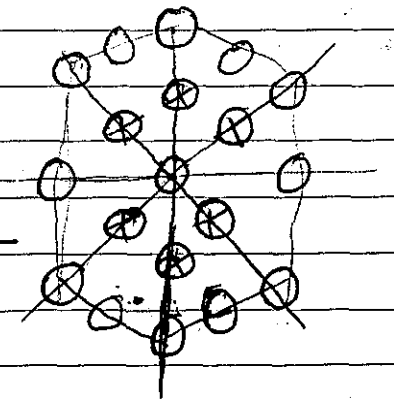
Cnt at 49.98

4-13-61
Reedy
70X

19 – 6" AL. Cylinder Hex.

Expt. #28A

19 cyl. Hex. at 7.8" edge to edge separation Central cyl. and 1st ring are 6" I.D remately fitted cyls. Outer ring of 12 cyls are 6" O.D. cyls filled to 5.0" height.



Very low multiplication at 5.3" (out of 20in)

4-14-61
Reedy
70X

Expt 28B

Same as Above except spacing now 7.10"

Small multiplication at 5.1.4"

4-14-61 Sample taken from manifold
Reg. No 593154 net = 40.2 gm.
g/g = .267000
η_{gas} = 1.5466

4-14-61
Reedy
FOX

Expt 28C

Same as above except spacing now 6.50 in

Crit at 46.32"

4-17-61
Reedy
FOX

Expt 28D

Same as above except spacing now 6.60" edge-to-edge (slightly more between 6"OD cyls in outer ring).

Poz. Period 49.35" $\bar{T} = 113$

$\delta\rho = 5.72 \times 10^{-4}$

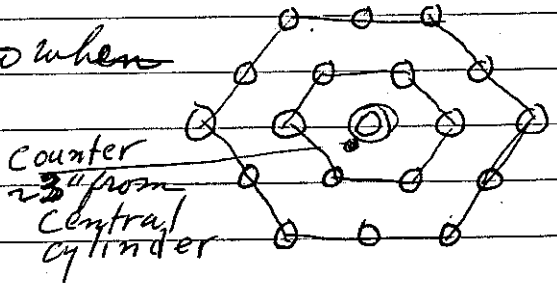
Just crit. at 48.96
,39

$\frac{\Delta\rho}{\Delta h} = 1.47 \times 10^{-3}$

Interpolated

Expt 29 A

Vertical Traverse on Array of Expt 28D
Using miniature BF_3 counter
End of counter tube at zero when
Zelyn reads zero



Por. Period: 49.30 T = 169, $\Delta\rho = 4.20 \times 10^{-4}$
Just Critical: ~~49.02~~ 49.28 $\frac{\Delta\rho}{\Delta h} = 1.5 \times 10^{-3}$

Height	C_1 (2 min)	C_2	C_2/C_1	Av.
~~23.5~~	~~285712~~	~~54304~~	~~0.241~~	~~0.242~~
"	223427	54414	0.243	
27.0	218963	53413	0.244	0.245
"	215146	52910	0.246	
31.0	210754	49,283	0.234	0.234
"	206671	48310	0.234	
35.0	202447	43176	0.213	0.213
"	197777	42247	0.2135	
39.0	197410	36292	0.184	0.184 ~~0.183~~
"	199007	36387	0.183	
45.0	199462	25229	0.1265	0.127
"	199663	25630	0.128	
32.0	201740	46460	0.230	0.230
	204896	47270	0.231	
25.0	206898	52,476	0.254	~~0.253~~
"	211423	53454	0.253	0.254
"	215535	54888	0.255	
21.0	223129	526798	0.2545	0.254
"	228050	57831	0.2535	

Height	C_1	C_2	C_2/C_1	
16.0	239,900	58195	0.2425	0.243
"	249459	60950	0.2448	
12.0	267,308	60723	0.227	0.227
"	283312	64312	0.227	
8.0	283,555	58626	0.207	0.206
"	279639	57273	0.205	
4.0	284764	49330	0.173	0.173
"	293184	50677	0.173	
23.0 (C.H 18.98)	273815	69354	0.253	
"	251658	63652	0.253	

4-18-61
Reedy
70X

Expt. 29B

Cd-ratio determination

Using miniature BF_3 counter in Cd sleeve

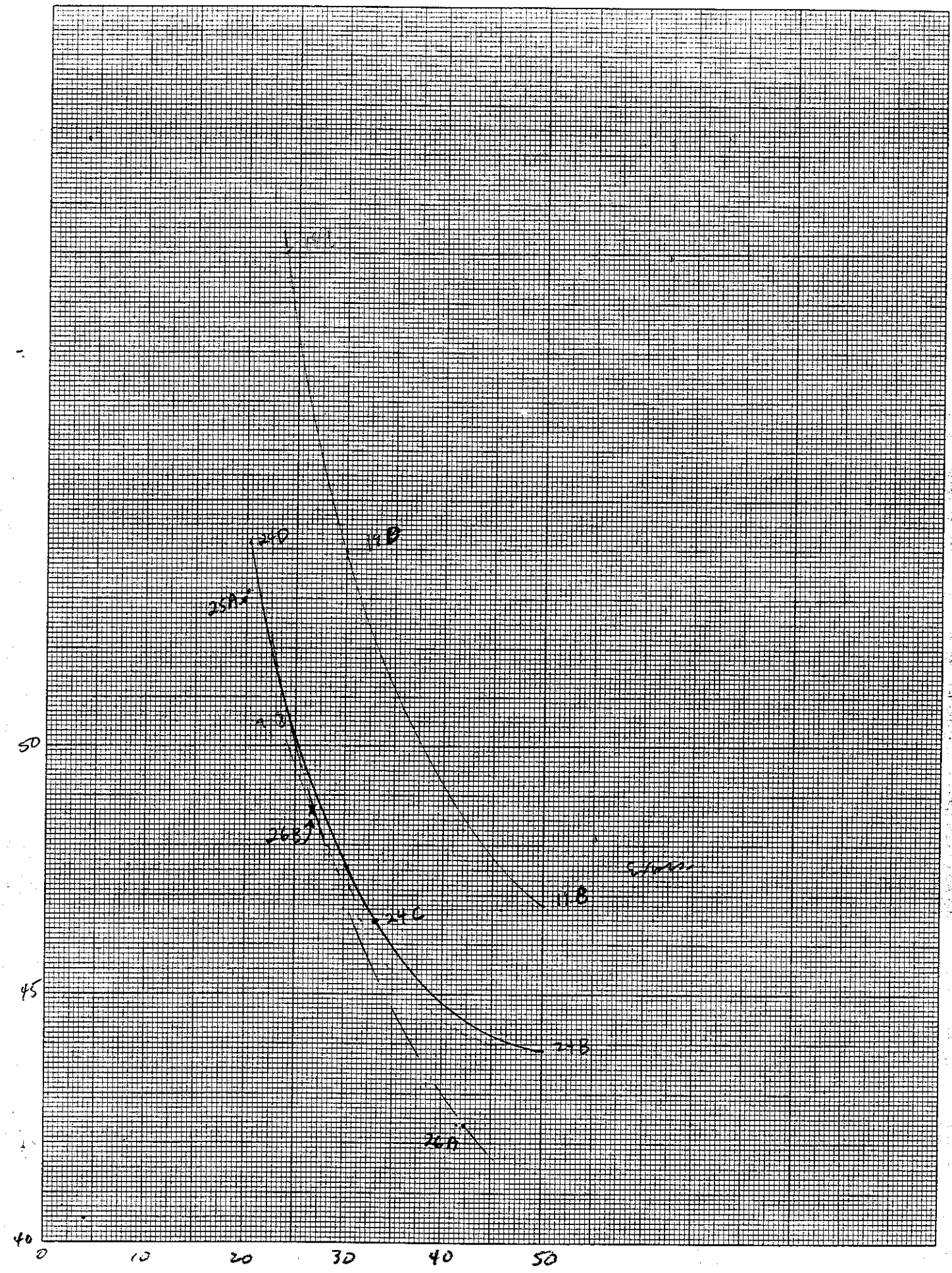
Pos. period: 49.28 just out at. T = 140, ΔP = 4.8 #13

Height	C_1	C_2	C_2/C_1	
23.0	~~548417~~	~~52909~~	~~.0964~~	
"	~~544018~~	~~54264~~	~~.0997~~	
20.0	809706	53075	.0656	
"	780287	5517	.066	
23.0	737741	49205	.0667	.0676
"	697051	46922	.0674	
"	664533	44948	.0676	
25.0	630757	41801	.0662	
"	636045	43068	.0676	

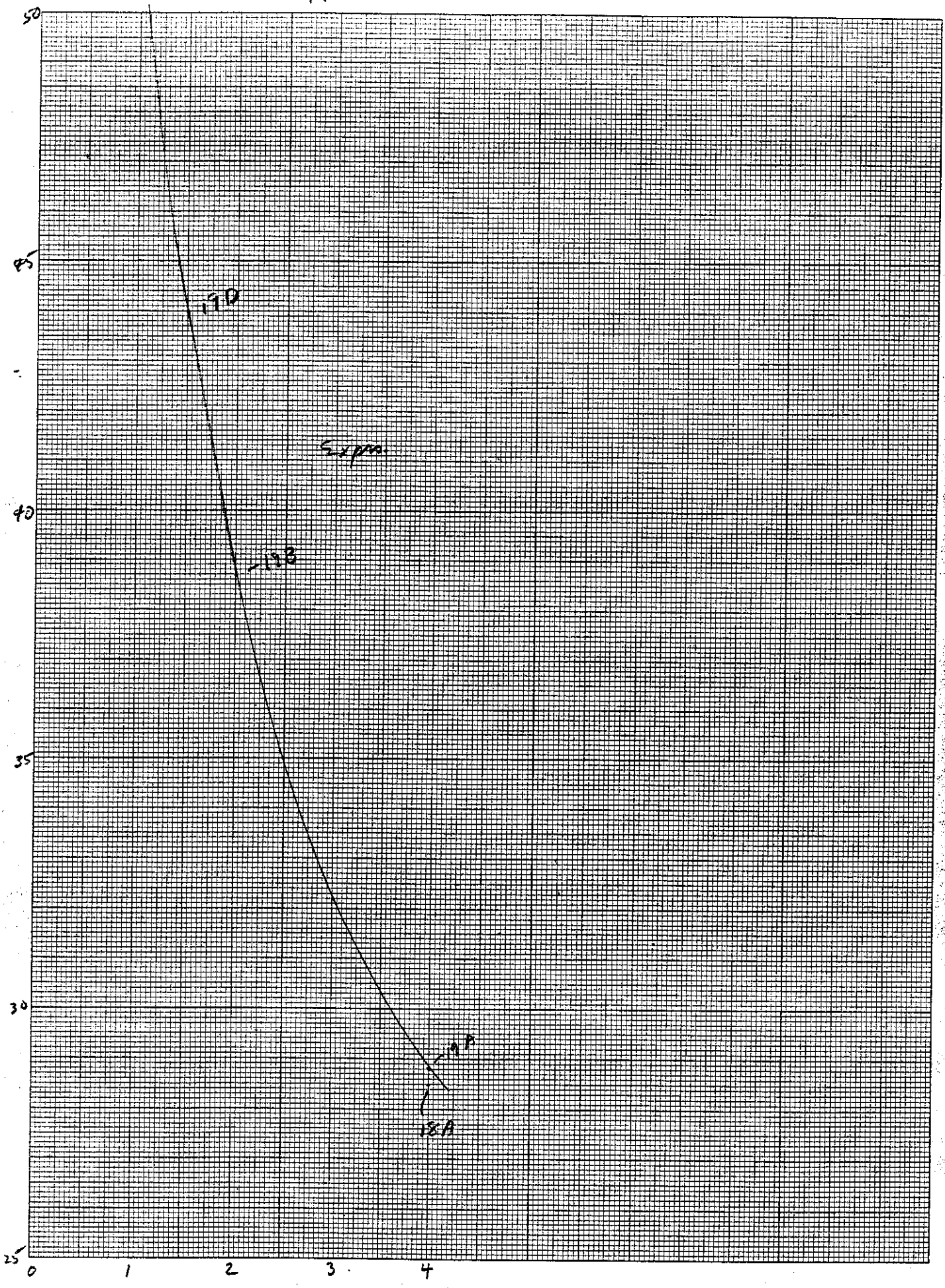
$$\text{Cd ratio} = \frac{.256}{.0676} = 3.8$$

pp 110-120

6-13-62



pp 110-120 6-13-62



MADE IN U. S. A.

MILLIMETER

4-19-61
Reedy
Fox

Expt 30A

19 cyl. Hex array of 6" Al. cyls with 12 Fixed cyls filled to 40.0". There cyls used in outer ring as before. Spacing 5.190"

just crit 39.00 "

START-UP CHECK LIST

Equipment Checked by RKRJr. Personnel Check by RKRJr.
Instrument and Safetiss Checked and Reset by RKRJr.
"Source In" Checked by RKRJr. Source No. Pu-Be-413
Emergency Equipment in Control Room Checked by RKRJr.
Red Light On by RKRJr.
Start-Up OK'd by RKRJr. Time 5:30 AM Date 4-20 1961

4-20-61
Reedy
Fox

Expt 30B

Same as 30A except that spacing now 5.95"

Por. Period: 40.~~485~~ 49
just crit at 40.~~417~~
Δk 0.32

T = 95°
P = 6.55

START-UP CHECK LIST

Equipment Checked by RKRL — Checked by RKRL

Instrument and S... — RKRL — Pa-GO-MF3

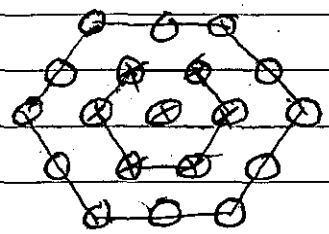
"Source In" ... — Emergency ... — RKRL

Red Light ... RKRL

Start-Up O.K'd by RKRL Time 1020 A.M. Date 5/21 1961

31A

19 Cyl. 6" Dia. in Hex. Array with 12 6" O.D. Cyl. filled to 30" and in the outer ring. Spacing = 4.95"



Poz. period: 30.18"

Just Crit 30.00

$\tau = 84.2$

$\rho = 7.10 \times 10^{-4}$

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties Checked and Reset by RKR

Source In Checked by RKR Source No. Pc-80 1463

Emergency Equipment in Control Room Checked by RKR

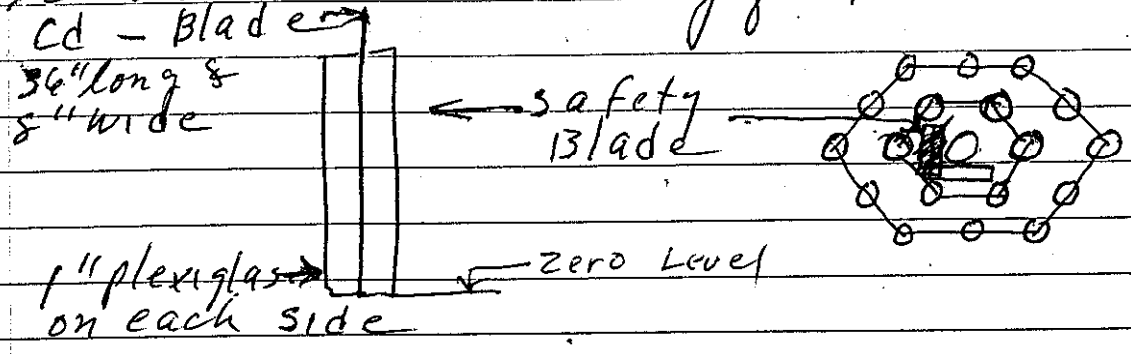
Red Light On by RKR

Start-Up OK'd by RKR Time 8 40 AM Date 5/29 19 61

4-24-61
Reedy
Fox

Expt 31-B

Effect of safety blade in plexiglas cadmium in array of 31A



Cut at 30.71"

" Expt 31-C

" Effect of safety Blade without plexiglas in Array of 31A & in position same as 31B.

Cut. at 31.10"

4-24-61
Ready for X

Expt 31 D

Same as expt 31 B except plexiglas thickness now 1/4" on each side of Cd-plate.

Cut at 30.64

START-UP CHECK LIST

Equipment Checked by RKK Personnel Checked by RKK

Instrument and Safeties Checked and Reset by RKK

"Source In" Checked by RKK Source No. Pu-Be - M43

Emergency Equipment in Control Room Checked by RKK

Red Light On by RKK

Start-Up OK'd by RKK Time 1025 AM Date 5/25 1961

Expt 32 A.

4-25-61
Ready for X

19 cyl. in Hex. array with 12 fixed cyl. filled to 20"
3 spacing 3.40"

Just cut at 19.24"

4-25-61
Reedy
Fox

Expt 32 B

Same as 32A except spacing now 3.45"

Cut at 19.58

Interpolated for 20" high spacing 3.50

5/4/61 Sample taken from manifold after mixing.
Reg 593157
$g^0/_g$ = .267860
sp. g. = 1.5561

J. Π
R. KR.

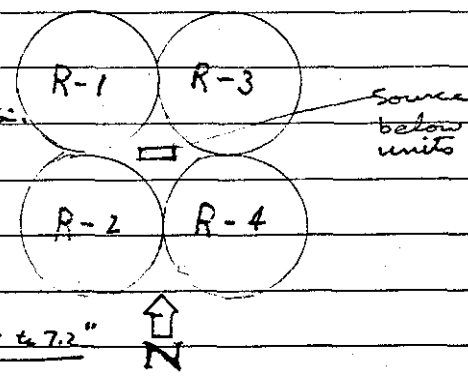
Exp. 1-A [what can be done with Control units?]

START-UP CHECK LIST

Equipment Checked by J. Π. Personnel Check by J. Π.
Instrument and Safeties Checked and Reset by JΠ
"Source In" Checked by J Π Source No. Π-43
~~Emergency Equipment in Control Room Checked by~~ JΠ
Red Light On by JΠ
~~Start-Up O.K'd by~~ JΠ Time 3 ~~4~~ PM Date 5/24/1961

Purpose: To determine critical spacing for 4-control units
Control units in contact are shown in diagram.

Solution ~ 1" in vent tube. System subcritical with very little multiplication.



Units are full when scalogram reads 7 & 7.2"

Using the ½" Feed line to drain:
time required to drain from 7.2" to 1.2" is 1.57 min.
rate = 3.18 in/min.

Using the dump valve $\frac{\text{Feed rate}}{\text{drain rate}} = 4$

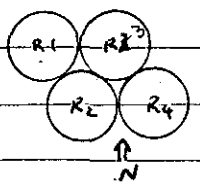
Feed rate ~ 2"/min ⇒ drain rate ~ 8"/min.

Exp 1-B

JTT
RkR

Experiment Conducted by	JTT	JTT
		JTT
Shift	JTT	M-43
Start Up OK'd by JH	Time 1330	Date 5-24-1961

Check geometry shown in fig:



Selsyn at 7.34 in.

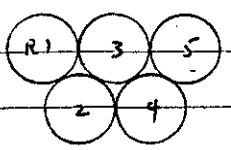
System very subcritical

Reading on K-2 ~30 at beginning (at 1.2") 3×10^{-12}

~42 at 7.34"

Exp 1-C

Check geometry shown in fig.



Selsyn at 7.41"

System very subcritical

Reading on K-2 ~31 at beginning

~50 at 7.41"

time req'd to feed from 3.11" to 6.83" is 2.54 m. Rate $= \frac{3.62}{2.54} = 1.43$

" " " drain " ~7. to .42" is 2.07 m. " $= \frac{6.54}{2.07} = 3.18$

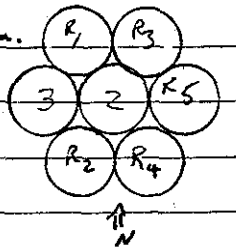
JTT
RKR

Exp 2. [what can be done with 7 units in triangular pattern?]

START-UP CHECK LIST

Equipment Checked by JTT — Instrument Check by JTT
Instrument and Safeties Checked and Reset by JTT
Source In Checked by JTT — Source No. M-43
Emergency Equipment in Control Room Checked by JTT
Red Light On by JTT
Start-Up OK'd by JTT Time 1137 AM Date 5-29 1961

7 units in triangular pattern as shown.



Subcritical soln ~1"2 in vent tubes.

Reading on K-2 at start ~30 (3×10^{-12})
at end 20 (3×10^{-11})

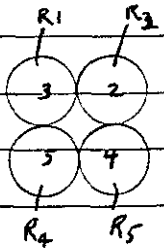
time to drain from ~7" to .6" 2.02 min.

units 2 and 3 have 7.790 kg of solution.

Exp. 3. A [8 units unreflected in cubic array]

8 units in two tier arrangement.
4 control units on top of 4 fixed units

1554 pm.



Unit 2, 3, 4, and 5 have 7.790 kg of solution.

Slightly supercritical 3.13" } Soln lvl. in
" subcritical 3.10" } control units.

43

18

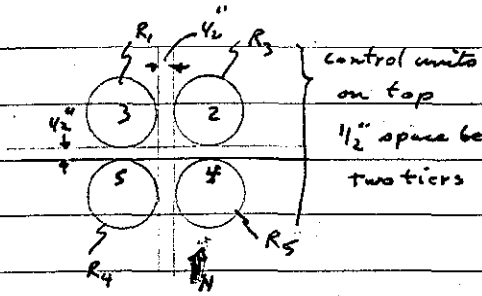
JTT
RKR

Exp 3B

START-UP CHECK LIST

Equipment Checked by JTT Personnel Check by JTT
Instrument and Safeties Checked and Reset by JTT
"Source In" Checked by JTT Source No. M-43
Emergency Equipment in Control Room Checked by JTT
Red Light On by JTT
Start-Up OK'd by JTT Time 910 AM Date 5-31 1961

8 units arranged as shown with 1/2" spacing in three dimensions.



Note: changed tube in PM-1 - will not use for a few days until tube has "aged."

Slightly supercritical at 14.63 (source out) Zero: 8.00"
" " " " 14.62
" " " " 14.61
QSR/A ⇒ just critical at 14.60

Exp 3C

Repeat 3B but with spacing now 3/8" instead of 1/2".

Super critical at 13.19" (source out)
1/2 P just critical at 13.16 Zero 7.88"

Interpolated spacing for 8 units is 9/16"

JII

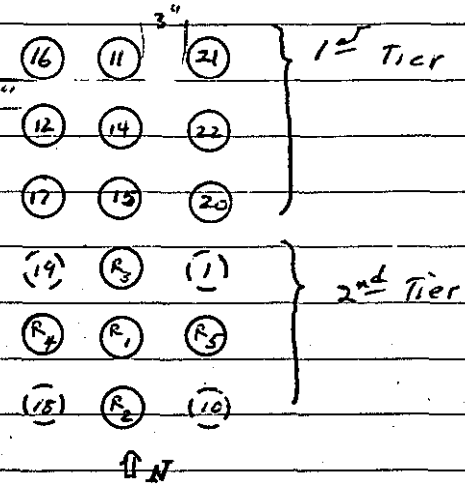
RKR

Exp. 4-A [27 units in cubic array, unreflected]

ST★RT-UP CHECK LIST
Equipment Checked by JII — Check by JII
Instrument and Safety Check and [illegible] JII
Source [illegible] JII — No. M-227
Emergency Equipment [illegible] Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 215 PM Date 6-2 1961

Each unit contains 7.790 kg of solution.

Test of 27 unit cubic array: SIS. = 3 inches.



14 units present as shown in diagram. dashed circles absent.

~ No multiplication when full

3:00 p

Ex 4-B

Units 1, 10, 18, and 19 added to 2nd tier in dashed positions.

K-2 increased from 16 to 26 on the 3×10^{-4} scale.

~ No multiplication.

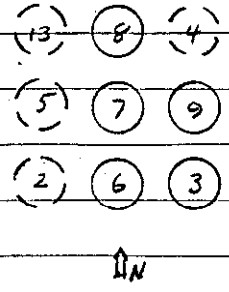
JII
RKR

Exp. 4E

START-UP CHECK LIST

Equipment Checked by JII Personnel Check by JII
Instrument and Safeties Checked and Reset by JII
"Source In" Checked by JII Source No. PM-467
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 1000 AM Date 6-9 1961

Continuing Exp. 4A. by addition of units 3, 6, 7, 8, and 9 to the third tier.
Spacing S.T.S. = 3"
Units are full when system reads 17.5"
System @ 20.00" system subcritical



K-2 increased from 32 to 50 on 3×10^{-12} scale.

10⁴⁵ AM Exp 4D

Completion of third tier by addition of units 2, 4, 5, and 13 in the dashed positions of the diagram above.

System subcritical @ 17.5"

K-2 increased from 35 to 68 on 3×10^{-12} scale.

6-9-61

JH
RKR

Exp 4-E

1⁴⁰ PM. Repeat Exp 4-A, units now separated by 2.50"

Control units full at 17.00"

System subcritical system at 19.47"

K-2 increased from 30 to 35 on 3×10^{-12} scale.

tier

Exp 4-F

2²⁰ PM Repeat Exp. 4-B with S.T.D. = 2.50"

System subcritical; system at 20.90"

K-2 increase from 33 to 53 on 3×10^{-12} scale.

Exp. 4-G

Repeat Exp 4-C with units 6, 7, 8, 5, and 13 in third tier.

System subcritical at 22"

K-2 increased from 35 on 3×10^{-12} to 25 on 10^{-11} scale.

JII
RKR

Exp. 4H

START-UP CHECK LIST

Equipment Checked by JII — Equipment Check by JII
Instrument and Safeties Checked and Set by JII
"Source In" Checked by JII — Source No. PM-467
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 925 AM Date 6-12 1961

Repeat Exp 4D @ S.T.S. = 2.5" — Suspect 3rd tier 1/4" too close.
Super critical @ 16.46" source out
" " " 16.45"
Slightly sub critical @ 16.44"
9:52 just critical @ 16.44" (backs ~1/2" being full.)

Exp 4-I

9:18 A Same as Exp 4-H with unit No. 2 removed
Slightly subcritical when full.
K-2 increased from 30.63×10^{-12}) to $18 (10 \times 10^{-11})$

Exp 4-J

2:25 PM Repeat Exp 4-H with S.T.S. = 2.6"

System subcritical when control units are full.

JTT
RKR

4-K

START-UP CHECK LIST

Equipment Checked by JTT Personnel Check by RKR
Instrument and Safeties Checked and Reset by JTT
"Source In" Checked by JTT Source No. PM-667
Emergency Equipment in Control Room Checked by JTT
Red Light On by JTT
Start-Up O.K'd by JTT Time 1515 PM Date 6-15 1961

Repeat of Exp 4-H S-T-S set at 2.50"

13 1/P System super critical at 16.63
" sub critical " 16.60
" critical at 16.61 control units bucks-in .4" being full.

Since STS of 2.6" is subcritical and 2.5 super a value of 2.55" is a reasonable interpolation (since the spacing cannot be known to better than .05"). Therefore, continued experiment with 27 units unreflected and unmoderated are not necessary.

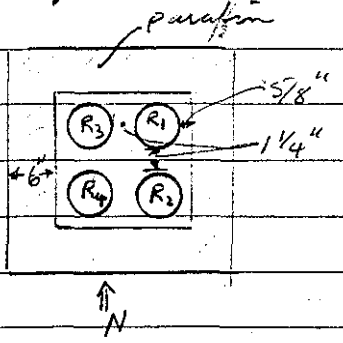
JII
RKR

Exp 5-A [4-units in 6" thick vault, paraffin]

START-UP CHECK LIST

Equipment Checked by JII Personnel Check by JII
Instrument and Safeties Checked and Reset by JII
"Source In" Checked by JII Source No. PM-467
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 12^20 PM Date 6-19 1961

To determine critical spacing with 4 control units surrounded on all sides except top with at least 6" paraffin.



System zero at 6.316"

Subcritical with units full.
definite multiplication.
K-2 increased from 20 (3×10^{-14}) to 25 (10×10^{-12})

Exp 5-B

Have added partial top reflector: slab of paraffin 6" thick
1^20 P.M. 12 x 18 inches centered over units. ~1/3 area uncovered (top)
Slightly subcritical!

Exp 5-C

1^45 P.M. Complete top reflector present
System at 12.85" source out super critical
just critical at 12.84" lack ~1/2" solution to be full.

JII
RkR

Exp 5-D

START-UP CHECK LIST

Equipment Checked by JII Personnel Check by JII
Instrument and Safety Circuits Checked and Reset by JII
"Source In" Checked by JII Source No. PM-467
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 9 00 AM ~~PM~~ Date 6-20 1961

Have increased spacing a2", now S.T.S. = 1.45"
System zero at 6.416"
Slightly super critical at 13.28"
" sub " " 13.14"
just " " 13.16" bucket ~ 0.26" being full.

Exp 5-E

10 15 AM. Repeat Exp 5-D for reproducability check.

Slightly sub critical at 13.17"
critical at 13.175" estimate system ≤ 1 being full
The air trapped in the top of the control units indicates the units may be full. Need to recheck zero!
Removed top and three sides. Units full at 13.28"
System zero at essentially 6.4 in.

full.

JTI
RKK 6/20/61 Exp 5-F

Have removed 4½" of paraffin from top and four sides.

12³⁵/PM Repeating exp. 5-D.

Very high multiplication but subcritical.

Exp 5-G

2⁴⁵/PM S.T.S. increased to 1.80" - 6" paraffin Reflector on all sides.
Units full - system subcritical with high multiplication
Log N reading .0004, with source present, compared to a
reading of .0005 attained in exp. 5-F. Recall that
paraffin thickness between detector and units is different in
these two experiments.

take k = 1 at S.T.S. = 1.855"

Exp. 5C to Tom Continuing 6-9-61

Δh = .44" at STS = 1.25"

JH
RKR

Exp 6-A [8-unit - cubic array - paraffin reflected]

START-UP CHECK LIST

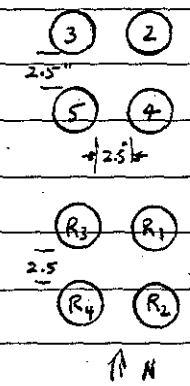
Equipment Checked by JH — Safety Checks by JH
Instrument and Safety Checks by JH
"Source In" Checked by JH — Log No. PH-467
Emergency Equipment Checked by JH
Red Light On by JH
Start-Up OK'd by JH Time 845 A.M. Date 6-22-1961

S.T.S. = 2.50" System completely paraffin reflected except for top.

distance between unit surfaces and paraffin reflector walls is 1.25"

System zero at 16.76"

system critical at 22.54"



Exp 6-B

10 35/A Same as 6-A - have added top reflector.

system critical at 20.64"

3.88

Exp 6-C

12 45/P Same as 6-B except have replaced wooden spacers between tiers with aluminum.

system critical at 20.85"

4.09

RKR
JJL

START-UP CHECK LIST
Equipment Checked by RKR — Personnel Check by RKR
Instrument — RKA
"Source In" — RKR — PM 467
Emergency — Checked by RKR
Red Light On by RKR
Start-Up O.K'd by RKR — Time 1130 — Date 6-23 1961

Exp 6-D

Spacing now 2.80. Same as Exp 6-A
Zero = 17.78"

11:45 AM
22.82 Super ; Source out
22.79 Sub
22.80 Level 5.02

RKR
JJL

START-UP CHECK LIST
Equipment Checked by R.K.R. — Personnel Check by RKR
Instrument — Checked by RKR
"Source In" — R.K.R. — Source No. PM 467
Emergency — Checked by RKR
Red Light On by RKR
Start-Up O.K'd by RKR — Time 1110 AM — Date 6-26 1961

Exp 6-E

Spacing now 3.2" Same as Exp 6-A
Zero = 18.313

1 00 PM
24.21 Super Crit. ; Source Out K-2-40 10 KD
24.19 Sub
24.20 Level 5.89

RKR
JJL

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and [illegible] by RKR
"Source In" Checked by RK Source No. PM 467
~~Emergency Equipment in Control Room Checked by~~ RKR
Red Light On by RKR
~~Start Up OK'd by RKR~~ Time 10 55 AM ~~P.M.~~ Date 6 ~~2~~ 27 ~~10~~ 61

6-F

Spacing now 3.6" S.T.S. Same as Exp 6-A
Zero = 18.95 with 6" paraffin refl.

11:16 AM 25.76 Super Crit; Source out ; K-2 = 40 10×10^{-10}
25.74 Level .79

6-G

Spacing 3.6" S.T.S.
Zero = 18.95
Reflector 1½" on 5 sides (Removed 4½" paraffin)
Reflector 6" on Bottom

Remote filled Units full ; ¼" into tubes
Sub Critical

40 10×10^{-10}

Exp 7-A

RKR
JJL

START-UP CHECK LIST

Equipment Checked by RKR Personnel Checked by RKR

Instruments and Safeties Checked and Reset by RKR

"Source In" Checked by RKR Source No. PR 467

Emergency Equipment in Control Room Checked by RKR

Red Light On by RKR

Start-Up OK'd by RKR Time 10^20 AM Date 6/28 19 61

Spacing 2.8" S.T.S 2X2X2 Array
1" plexiglas Reflector on 5 sides
6" paraffin reflector on bottom

Zero = 17.83

Remote units full ; 6" into tubes
Sub Critical

Exp 7-B

Spacing 2.5" 2X2X2 Array
Reflector same as Exp 7-A.

Zero = 17.38

1:50 PM Remote units full 3" into tubes
Sub Critical

Exp. 7-C

Spacing 2.5" S-T-S Same
1" Reflector on 4 sides
2" Reflector on Top
6" Reflector on Bottom

Zero = 17.38
2:20 PM Remote Units full ; 2" into tubes
Sub Critical

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by RKR Source No. PM 467
Emergency Equipment in Control Room Checked by RKR
Red Light On by RKR
Start-Up OK'd by RKR Time 9:30 AM Date 6/29 1961

JDL
RKR.

Exp 7-D

Spacing 2.0" S,T,S Same
1" Reflector on 5 sides
6" Reflector on Bottom

Zero = 16.68
Super Critical = 22.91 Source out K-2 = $36 \times 10 \times 10^{10}$
Level : 22.90
16.68
6.22

Exp. 7-E

Spacing 2.2" S.T.S. Same

Reflector Same as for 7-D

Zero = 16.99

1:30 PM Slightly Sub Critical

Remote Units full, 2" into tubes.

JH
RKR

Exp 8-A [3×3×3 cubic array - 1" Plexiglas Refl.]

START-UP CHECK LIST

Equipment Checked by JH Personnel Check by JH
Instrument and Safety Circuits Tested by JH
"Source In" Checked by JH Source No. PM-467
Emergency Shutdown Tested Room Checked by JH
Red Light On by JH
Start-Up O.K'd by JH Time 11^25 AM Date 7-5 1961

S.T.S = 5.0 6" paraffin bottom reflector
1" Plexiglas side reflectors
no Top reflector

[units arranged as in Exp. 4]

System zero at 8.13".
Control units full - system subcritical.
Multiplication on K-2 indicated by increase from 27 to 38 on 1×10^{-12} scale.

Exp. 8-B

12^45 PM. Plexiglas added 1" plexiglas top reflector.
Control units full, system subcritical
K-2 Increase from 27 10×10^{-12} to 27 on 3×10^{-11} scale.

JII
RKR

Exp 8-C

START-UP CHECK LIST		
Eq...	JII	JRKR
In...		JII
...	JII	PM 4-7
Em...		JII
Re... JII		
Start-Up Co... JII	Time 12:20 PM	Date 7-6 1961

Repeat Exp 8-B with S.T.S. = 4.8"
System zero 7.855 mi
System subcritical
K-2 increased from 15 on $B \times 10^{-11}$ scale to $25 \times 10 \times 10^{-10}$ scale

Exp 8-D Repeat 8-C

1:55 PM Have inserted Plexiglas between unistrut to complete side reflector.
System almost critical - slight neg. period.

EK

Exp 8-E Repeat 8-D

2:35 PM Have added 1/4" Plexiglas to top.
System still subcritical
Increase on K-2 20 (3×10^{-11}) to 68 (3×10^{-10}) scale

Estimate critical spacing to be 4.75" from results of Exps 8-B and 8E. Try S.T.S. of 4.70"

JH
RKR

Exp 8-F

START-UP CHECK LIST

Equipment Checked by JH Personnel Check by RKR

Instrument and Safeties Checked and Reset by JH

"Source In" Checked by JH Source No. PM-467

Emergency Equipment in Control Room Checked by JH

Red Light On by JH

Start-Up OK'd by JH Time 11 AM Date 7-7 1961

Repeat Exp 8-B with S.T.S. = 4.70"

CRITICAL with solution 2.88" into vent tubes.

JH
RKR

Exp 9 A

START-UP CHECK LIST

Equipment Checked by JH — Tested by JH
Instrument [illegible] — JH
Source [illegible] JH — PM-462
Emergency [illegible] — JH
Red Light [illegible] JH
Start-Up OK Given JH — Time 955 — Date 7-28 1961

27 unit cubic array with S.T.S. = 7.2" completely reflected by min. of 6" paraffin + Plexiglas.
North face partially reflected
Sylsen zero 10.48"

10[15] Control units full system subcritical.
K-2 increase from 24 to 55 on 10×10^{-12} scale

10[30] Have completed placing paraffin reflector on North face.
Units full system subcritical
K-2 increase from $27 \times (10 \times 10^{-12})$ to 26 (3×10^{-11})

JII
RKR

9-B

START-UP CHECK LIST

Equipment Checked by JII — Instrument Check by RKR
Instrument as [illegible] Checked and [illegible] JII
"Source In" Checked by JII — Source No. PR 467
Emergency Personnel in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 906 AM Date 8-1 1961

27 cubic assay : S.T.S. = 7.0" completely reflected by min. of 6" paraffin and plexiglas.

Sylsen Zero 10.17 in.

Control units full system subcritical.
K-2 increase from 25 (10 x 10^{-12}) to 40 (3×10^{-11})

JH
RKR

Exp 9C

START-UP CHECK LIST

Equipment Checked by JH Personnel Check by RRR
Instrument and Safeties Checked and Reset by JH
"Source In" Checked by JH Source No. PM-467
Emergency Equipment in Control Room Checked by JH
Red Light On by JH
Start Up OK'd by JK Time 1038 AM Date 8/-2 1961

27 unit cubic array - fully reflected with
min of 6" paraffin + plexiglas (South face)
S.T.S. = 6.80".
Sylsem zero 9.86 in.

Control units full system subcritical
K-2 increased from 30 (10×10^{-12}) to 50 (3×10^{-11})

3'15 Repeat of above: But with BF-3 counter in center of array.
K-2 = 50 (3×10^{-11}) when full

	C-1	(C-2 BF-3)	5 Min counts
3:45P	891	7067	
	770	7167	
	833 = avg	7117 = avg	

JTS
RKR

Continue Exp 9c.

Have removed top and North face reflectors

845 AM	C-1	C-2 (BF-3')	5 min. count.
	1249	538	} units full.
	1206	524	
	1228 ave	531 ave.	
	979	302	} unit empty
	1016	335	
	997 ave	318 ave.	

JN
RKR

Exp 9-D

START-UP CHECK LIST

Equipment Checked by JN Personnel Check by RKR
Instrument and Safeties Checked and Reset by JN
"Source In" Checked by JN Source No. PM-467
Emergency Equipment in Control Room Checked by JN
Red Light On by JN
Start-Up OK'd by JN Time 10^28 AM Date 7-4 1961

27 unit cubic array : STS = 6.30 in.

1. all except top + North face reflected by 6" paraffin + Plexiglas. .3/4" plexiglas on top

Sylsen zero 8.20. 27
9.11 "

BF-3 counter centered between units R-1 and R-3 in 2nd tier.
Units full system subcritical.-- sylsen 22.65 in.
K-2 increased from 18 to 34 on 10×10^{-12} scale.

Counting: (5 min.)

	BF-3	
East + West faces only.	228	units empty
	230	
	229 ave.	
E. W. + S ± 3/4" all typ faces only.	789	units full
	786	
	788 ave.	
↓	476	units empty
	450	
	463 ave.	

1208 Have completed addition of Reflectors.
① addition of North face brought K-2 from 22 to 34 on 10×10 scale.
② " of Top " " " " 18 to 22 " " "

Source out: Sylsen 14,893 system critical $k > 1$.
14.879 " " $k = 1$.

Exp 9-E

K-2

START-UP CHECK LIST

Equipment Checked by JH Personnel Check by JH ERR
Instrument and [illegible] Checked by JH = C
"Source In" Checked by JH Source No PM467
Emergency Equipment [illegible] Room Checked by JH
Red Light On by JH
Start-Up OK'd by JH Time 1215 PM Date 8-7 1961

27 unit cubic array; STS 6.40"; 6" paraffin & Plexiglas surrounding the array

System zero 8.794 in.

System critical $k > 1$ at 15.34
" 15.33
$k < 1$ 15.30
$k = 1$ 15.32

15.32
8.79
6.53

Period reassessment Sylsen 15.39
Return to $k = 1$ 15.32

Control unit K-4 "locked" 1/4".

JH
RRR

Expr. 9 F

START-UP CHECK LIST

Equipment (Shielded) by JH Checked by JH

Instruments (Unshielded) by JH

Source Installed by JH Log No. PM 467

Emergency Circuit Checked by JH

Red Light Installed by JH 8:50 AM

Start-Up OK'd by JH Time Date 8-8 1961

Repeat Exp. 9E.

Sylsen zero 8.80" 15 34

Sylsen 15.41, R > 1, ~100 sec period.

15.34 R = 1.

$P_{\infty} P_{sr}$ = 99.91 cm.

$P = 6.3 \times 10^{-4}$

JII
RKR

Exp. 9G

START-UP CHECK LIST

Equipment Checked by JII Personnel Check by JII
Instruments and Location Checked and Operated JII
"Source In" Checked by JII Source No. PM467
Emergency Equipment in Control Room Checked by
Red Light On by JII 1038 AM
Start-Up O.K'd by JII Time Date 8-9 1961

34 Repeat Exp 9-F with S.T.S. 6.50 in. { BF-3 counter removed
Sylsen zero 8,973 in.
Sylsen 15.759 ; R>1
15.824 R>1 positive period ~ 90 sec.
15.73 R=1

15.73
8.97
6.76

12 3 2 Make cd-fraction determination BF-3 counter replaced as in Exp. 9-D.
Sylsen 15.73$_4$ R=1 $\ln N$ = .0078

	C-1 (normal)	BF-3	(2 min. counts)
BF-3 bare	17130	280188	
	16949	278559	
	17040	279,374	average

1 2 2 Placed Cd-cover on BF-3.
Sylsen 15.74$_9$ R=1 $\ln N$ = .0074

	(C-1)	(BF-3)	
BF-3 Cd-covered	16.016	10212	
	— Back. Count.	10,139	Cd Fraction = .961
	16.016	10176	aver.

KK
RR
DM

Exp 10 A

START-UP CHECK LIST

Equipment Ck'd	JH	RKR
Instrum		JH
Source		PN 467
Engr		JH
Red Light	JH	
Start Up Cond	JN Time 932	Date 8-17 1961

— faulty cathode pot.

Kinetic experiments

8 unit cubic array S.T.S ~ ½". see p 168 for units + arrangement

Sylvania:

	old	new	tod		
	6.763	6.79	5.42	k = 1	

Have placed detector for Rhotte directly under array.

					chart	Rhotte
6.	6.771	8.61	5.24	k = 1		0
	6,846	8.66	5.39	k > 1	+.184	+.163
	6.686	—	.98	k < 1		-.145

Have placed X-10 detectors on Rhotte

	—	—	7.39	k << 1	
	6.845	8.67	9.52	k >> 1	+.148 +.140
	6.762	8.60	5.02	k ≅ 1	∠0
	6.763	8.58	5.22	k = 1	0
	6.698	8.51	0.01	k < 1	-.162

JH
RKR

Exp 10 B 8 units 2" × 2" × 2" unreflected

START-UP CHECK LIST

Equipment Checked by RKR Instruments and Shields Checked and Locked JH
Source In Checked by JH Source No. PN-467
Emergency Equipment and Control Room Checked by JH
Red Light on by JH
Start-up OK'd by JH Time 930 AM Date 8-22 1961

Purpose: To check reproducibility and effect of solution stored in Y-12 bottles.

Systems	old	new	Tau		Counts	ln N
Zero	~~.007~~	1.93	—			
1st period	6.776	8.71	7.33	K > 1	129.01 (8.04)	125.32
2nd period	6.780	8.72	8.11	K > 1	91.775 (10.53)	91.22
10 40/4 Critical	6.737	8.68	5.10	K = 1		

Exp. 10 C

12 20/8 Check critical

1st period	6.781	8.73+	17.72	K > 1		
Critical	6.732	8.68	14.07 / 3.65	K = 1	75.75 (12.33)	70.59
Zero	- ~~.058~~	+ .09	—	—		

Exp 10-D

Have removed 22 Y-12 bottles.

Zero	0	1.81	20.58	—		
~ level	6.835	8.675	14.44	K ~ 1		
Period	6.853	~~8.70~~ 8.69	18.59	K > 1	285.72	268.46
Critical	6.841	8.68	13.39	K = 1		

↑ lab adder Cma has an in Cma.

JII
RKR

START-UP CHECK LIST

Equipment Checked by RKR Check by RKR
Instrumentation JII + RKR
Systems JII PN-467
Emergency Equipment Check by JII
Reactor Set-up by JII
Start-Up Ordered by JII Time 856 AM Date 8-27 1961

Exp. 10 E

Repeat Exp 10-0

	old	Sylsens new	tad		chart
Zero	.024	1.84	36.79		
Period	6.890	8.735	19.99	K > 1	99.91
Critical	6.846	8.69	17.27 / 2.82	K = 1	

10^5

Exp 10-F

Have removed 16 Y-12 units.

	old	Sylsens new	tad		chart
Zero	.024	1.84	36.79		
Period	6.889^-5	8.735	21.64	K > 1	91.22
10^5 Critical	6.837^5	8.69 / 1.80 / 0.85	18.68 / 2.96	K = 1	

Exp 10 G

12^0 Have replaced 16 Y-12 units

Zero	.024	1.84	36.79		
Period	6.914	8.725	19.055	K > 1	90.14
Critical	6.870	8.69	16.16 / 2.895	K = 1	

JTL RKR

Exp 10-H

12 2/P Have replaced 22 Y-12 units

	Systems old	new	Tad		
Zero	.024	1.84	3679		
Period	6.914	8.717	17.125	K > 1	96.23 sec
Critical (Tad)	6.855	8.69	14.20	K = 1	
Critical (pump)	6.865	8.69	12.585	K = 1	

Conclusion: Presence of Y-12 units does not affect critical height measurements.

Note: After scribing a mark on one control unit corresponding to 1 inch of solution it is determined that the zero is 0.1 in. too high for Exp [redacted] 10.

JII
RKR

Exp II - A

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by JII
"Source In" Checked by JII Source No PN 467
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time ~~P.M.~~ A.M Date 8-24 1961

Purpose: To determine reactivity as a fcn of change in Tab-addn height. Array is same as in Exps 9+10. no changes in array have been ~~made~~ made. Also to check operation of Rhoette (change in Sylsen settings.) with a measured 1 inch of solution in control units:

	sylsens new	sylsens old	sylsens tub
before change	2.97	1.130	20.02
after change	1.00	1.000	20.02

detector for Rhoette located on floor, inside frame, against the ~~south~~ west frame.

Data Summary

	Remarks	new tad	old tad	k	Rhoette	Δtad
	~ Critical	6.67	16.52	6.667	~1	—	—
	+ Period 1	$6.70^{.03}_{.05}$	18.01	6.899	>1	.060	+1.63
	~~Critical Period 2~~	6.67^{5}	16.38	6.674	1	0	
	- Period 2	6.65	14.74	6.663	<1	-.049	-1.63
height	10^{18} + Period 3	$6.70^{.03}$	18.38	6.701	>1	.065	+2.00
	10^{40} Critical	6.67^{7}	16.54	6.678	1	0	—
	10^{41} - Period 4	6.65^{-}	14.54	6.664	<1	-.063	-2.00
	10^{58} + Period 5	$6.71^{.04}_{.5}$	19.04	6.726	>1	+.081	2.50
	11^{11} Critical	6.68^{1}	16.61	6.688	1	0	—
	11^{12} - Period 6	6.63^{5}	14.11	6.656	<1	-.080	-2.50
	11^{24} + Period 7	$6.72^{.04}$	19.61	6.735	>1	.099	+3.00
	11^{35} Critical	6.68^{1}	16.71	6.687	1	0	—
	11^{36} - Period 8	6.64^{-}	13.71	6.653	<1	-.098	-3.00
	11^{50} Critical	6.68	16.72	6.692	1	0	—

11^{55} Cutie-pie reading against 4 stationary counts 600 mr/hr.

Summary of Positive Periods ($\beta = .0064$)

Period	Δtad	T (shut)	$\frac{\Delta k}{\beta} = \sum \frac{P_i}{100 T_i} - \frac{1}{\beta}$	T counter	$\frac{\Delta k}{\beta}$
1	1.625	176.06	6.203	—	—
3	1.840	155.33	6.890	163.64	6.59
5	2.43	117.65	$8.\overset{671}{\cancel{44}}$	124.68	8.63
7	2.40	96.09	10.156	92.64	10.45

JII
RKR
ER
D Mc

Exp 12

START-UP CHECK LIST

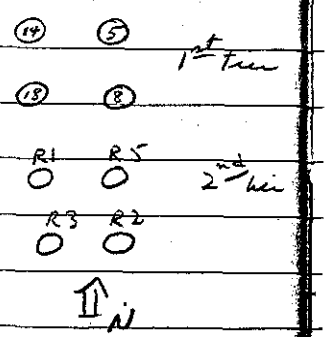
Equipment Checked by RKR — Control Check by RKR
Instrument [illegible] — JII
"Source In" JII — Area No. PN-467
Emergency [illegible] — Lights Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 11:25 AM PM Date 8-28 1961

8 unit cubic array: STS 0.57" arranged as in Exp 3B ?

Safeties removed.

Safeties

Remarks	new	tried	old	R
Subcritical	7.3	20.36	7.3+	<1



8-30-61 Reg # 593164 = sample #2 from manifold.
G = 166.2 by phone:
T = 20.0 gH/g = .26688
N = 146.2 lf.gr. = 1.5553

8-30-61 Reg # 593168 = sample #1 from bottle #1.
G = 131.0 by phone
T = 20.0 gH/g = .26728
N = 111.0 lf.gr. = 1.5561

JH
RKR
DM

Exp 13 A

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and [illegible] JH · RKR
"Source In" Checked by JH Source No. PN467
Emergency Equipment [illegible] Checked by JH
Red Light On by JH
Start Up OK'd by JH Time 920 AM Date 9-5 1956

cubic pic – low batt.

8 unit cubic array - unreflected. Purpose to check effect of cloudy solution in manifold and lower density in some units. S.F.S. = 1/2"

	new	tap	wed
Sylsens			
at 1" soln	0.98	39.65	0.994
k = 1	6.62	19.71	6.632
corrected lt. at k=1	6.64		6.638

1st tier (51) (53)
(52) (54)
2nd tier (R1) (R5)
(R3) (R4)

Exp 13 B

Have replaced 4 units in first tier by 4 units of previous experiments (

1st tier
(1) (18)
(17) (16)
2nd tier
(R1) (R5)
(R3) (R2)

Remarks	new	tap	old	
Sylsens				
1" solution	1.035	–	1.055	k < 1
	6.64	18.80	6.684	k = 1
Repeats				
1"	1.045	34.55	1.080	k < 1
	6.66	34.55	6.695	k = 1

Conclusion: difference in densities lost in ability to read gross.

JH
RKR

Exp 14A

START-UP CHECK LIST

Equipment Checked by JH Personnel Check by RKR
Instrument and Safety Check and Test by JH
"Source In" Checks Up JH Source No. M-43
Emergency Equipment in Control Room Checked by JH
Red Light On by JH
Start-Up OK'd by JH Time 1:25 ~~AM~~ PM Date 9-7 1989

Stacking 64 unit cubic array, unreflected.

S.T.S = 3.90 in.

		Systems new	Systems mid	Systems old	
K-2					
~~4~~ 2 (10×10⁻¹²)	1" solution	1.05	52.07	1.003	Bkgd.
		9.41	52.07	4.387	count.
53 (3×10¹¹) + Full		9.30	52.07	9.2+	count.

		C_1	C_2
kt = 4.41	M =	1.29	1.63
kt = 9.3	M =	2.85	3.77

50	16	11	21	
51	12	14	22	1st Tier
52	17	15	20	
53	43	36	44	
56	19	R_3	1	
33	R_4	R_1	R_5	
55	18	R_2	10	
57	37	49	54	2nd Tier
35	13	8	4	
23	5	7	9	
32	2	6	3	3rd Tier
24	38	46	47	

N

Exp 14B

Have added 4 units to 4th Tier.

K-2				
18 (3×10¹¹)	1" solution	1.01	42.63	.996	Bkgd.
43 (10×10⁻¹¹)	Full	8.75	42.63	8.719	Count

		C_1	C_2
Full	M	6.3	10

39	27
28	58

JII
RKR

Exp 14C

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RHR
Instrument and Safeties Checked and Tested by JII
Source Inserted by JII Source No. M-43
Emergency Equipment and Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 8 45 AM PM Date 9-8 1966

N

Have added 2 more units to 4th tier.

K-2

16:(3×10^{-11})

21(3×10^{-10}) K<1

	new	Tub	old	
	10.70	42.63	10.670	count

full M C_1 12.7 C_2 16

39 27 30
28 58 31
4th tier

Exp 14D

Have added 2 more units to 4th tier.

N

19(3×10^{-11})

33( ) K<1

	new	Tub	old
	9.47	25.40	9.38

Tier

32 29
39 27 30
28 58 31
26 25

Exp 14E

Have added 2 units to 4th tier.

Tier

K=1 6.54 23.22 6.522

38 29
39 27 30
28 58 31
26 25

Exp 14-D

10:20 AM
Have removed 1 unit from 4th tier.

K=1 6.81 18.71 6.796

38
39 27 30
28 58 31
26 25

JH
RKR

Exp 14-E

START-UP CHECK LIST

Equipment Checked by JH Personnel Check by RKR
Instrument and Safeties Checked and Reset by JH
"Source In" Checked by JH Source No. M-45
Emergency Equipment in Control Room Checked by JH
Red Light On by JH
Start-Up OK'd by JH Time 853 AM Date 9-11 1961

Portable Inst. not operated

64 unit cubic array unreflected

S.T.S. = 4.15 in.

	41	29	48	40
	59	39	27	30
	45	28	58	31
	34	26	25	42

Sylsens

	new	Tad	old
1" solution	1.24	54.00	1.213
K=1	6.965	20.07	6.961--

Exp 14-F

Period measurement.

Sylsens

		new	Tad	old		R Lattice	Counters chart
	Period 1.	7.03	20.49	7.029	K>1	.069	6.87
9SD/A	level	6.98	16.69	6.965	K=1		

Exp 14-G

2 5/8 p Reset S.T.S. to 4.25 in.

unit arrangement same as Exp 14-F

	new	Tad	old
1" solution	1.31	50.75	1.292
K≈1	8.95	21.86	8.95

Exp 14-H

JH
RKR
DMS

START-UP CHECK LIST

Equipment Checked by JH RKR Personnel Check by RKR

Instrument and Safeties Checked by JH

Source In Checked by JH Log No. M-43

Emergency Equipment in Control Room Checked by JH — no operable

Red Light On by JH

Start-Up OK'd by JH Time 923 ~~AM~~ Date 9-12-1961

64 unit cubic array - unreflected

S.T.S. = 4.22 in. unit arrangement same.

	New	Tank	old	
1" soln.	1.31	—	1.292	
~~soln~~	10.18	20.00	10.164	K<1.

neg. period ~100 - 120 sec.

operation

chart

ment

14-F

ADC
JII
RKR

Exp 15 A.

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by JII - RKR
"Source In" Checked by JII Source No. M-43
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by ~~JII~~ JII Time 255 PM Date 9-21 1961

Unit Arrangement =>

5×5×5 cubic array with 120 units – Check to see if abright to
Zero ~ 15.65 on rem S.T.S. = 5.6 in. add 5 remaining units.
~~grams~~ ~1" soln in 5 control units is 15.65 on rem system.
System critical with system at ~ 2 1/3 in.

15-B

JI
RKR

START-UP CHECK LIST

Equipment Checked by R-K-R Personnel Check by RKR
Instrument and Safeties Checked and Reset by JII
"Source In" Checked by JII Source No. M-43
Emergency Equipment in Control Room Checked by JII
Red Light On by JII
Start-Up OK'd by JII Time 8 57 ~~PM~~ AM Date 9-22 1961

5×5×5 array, unreflected, at STS 5.6 in.

		Rem	Red	Rod	
	1/4 solution	~1.0	44.46	~1.0	air in lines
8 54	1" solution	1.000	44.46	1.00	
	~~6.2~~ R~1	6.2	37.64	6.2	Sola Valve leaks slightly.
1 30 PM	Have replaced valve				
	R=1	6.33	42.90	6.309	
	R>1	6.44 5	42.90	6.434	Period meas. 113.60 sec

50	2	30	48	52
16	40	34	31	12
15	58	42	26	14
11	28	25	45	51
21	17	75	36	22

1st tier

=>

to

15.

93	91	41	92	88
95	38	59	39	73
90	32	29	47	86
94	9	24	3	89
96	97	100	98	99

2nd tier

N

107	105	27	106	69
71	6	R-3	4	120
70	R-4	R-1	R-5	119
108	46	R-2	8	118
102	101	109	117	87

3rd Tier

110	103	23	104	113
112	10	7	54	111
66	37	35	5	67
68	1	13	57	64
114	85	84	115	116

4th Tier

61	60	19	83	80
65	53	55	18	81
63	93	56	33	78
62	20	49	44	82
74	72	76	77	79

5th Tier

0 sec

RKR
JTT

Exp 16

START-UP CHECK LIST

Equipment Checked by RKR — Procedure Checked by RKR
Instrument [illegible] — JTT - RKR
"Source In" [illegible] — Source No. H-43
Emergency [illegible] — Form Checked by JTT
Red Light On by JTT
Start-Up OK'd by JTT Time 1[illegible] AM PM Date 9/26 1961

Determine Cd-fraction in 5×5×5 array - unreflected

Units positioned as in Exp 15.

		Sybsens New	Tub	old	BF_3 counter location
Solution at ~.8 in:		.86	29.45	.859	o o o o o
1[40]	K=1	6.28+	28.68	6.242	o o o o o
1[55]	K=1	6.285	28.45	6.241	o o o × o o 3rd Trial
	Normalizer		BF-3		o o o o o
	C-1		C-2		o o o o o
Bare	58888		13716	13716	⇧ N
Bare	58207		13557	13716	$\ell_n N = .005^+$
Bare	58053		13375	13567	K-2 = 54 (10×10^{-10})
ave	58888			13666	

2[10] PM Have placed cd-cover on BF-3 chamber.

		Sybsens New	Tub	old	
K = 1		6.287	2326	6.242	
	C-1		C-2		
	58949		1940	1940	$\ell_n N = .005^+$
Cd-Covered	58500		1863	1877	K-2 = 53 (10×10^{-10})
	57356		1837	1888	
ave	58949			1902	
Norm to	58888			1900	

$$CF = \frac{B-C}{B} = .861$$

JKF
RKR
JTT

Exp 17

START-UP CHECK LIST

~~Equipment Checked by~~ RKR-JKF Personnel Check by RKR
Instrument and Safeties Checked and Recorded JTT JKF
Source In Checked by JTT Source No. M-43
Emergency Equipment in Control Room checked by JTT
Red Light On by JTT
Start-Up OK'd by JTT Time 1355 ~~AM~~ PM Date 10-3 1961

9 unit, unreflected array, square pattern, Plane array.

	New	Tod	old	
1" solution	1.01	5111	1.002	K<1
units full	7.72	37.25	7.706	

K-2 increase from 16 to 32 on 10×10^{-12} scale.

N ↑

28	R-3	17
R-4	R-1	R5
14	R-2	3

Expt 18 A

12 unit unreflected square array. Planar with cans in Contact

New Tod old
Unit full 8.85 90.19 5.782

Sub-critical K<1

K-2 increase from 16 to 47 10×10^{-12}.

1	28	R3	17
23	R4	R-1	R5
9	14	R-2	3

Expt 18 B

160 unit planar array in square pattern
Each via contact

↑N

1	25	R-3	17
23	R-4	R-1	R-5
9	14	R-2	3
27	32	47	10

	new	old	Fed.
Units full	8.14	8.080	40.69

2nd - critical

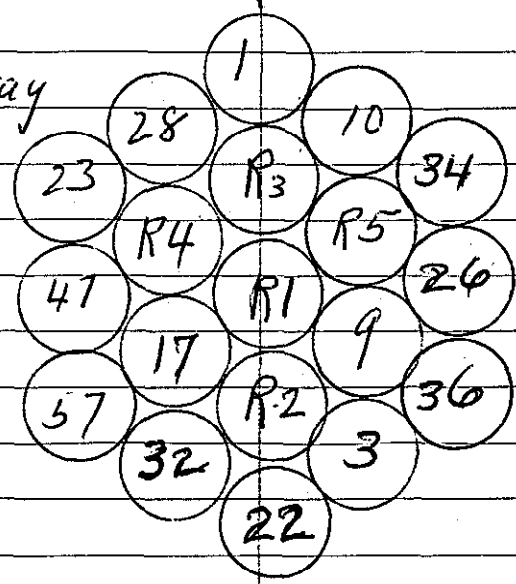
K-2, $20 \times (10 \times 10^{-14}) \rightarrow 40\ (3 \times 10^{-11})$

Cut separation ~ 0.53

Exp 19

START-UP CHECK LIST
Equipment Checked by JKF.RKR Personnel Check by JKF
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by RKR Source No. M-3
Emergency Equipment in Control Room Checked by RKR
Red Light On by RKR
Start-Up OK'd by RKR Time 8:30 AM Date 10-4 1961

19 Can Planar Hexagonal Array
Cans in Contact



K	old	new	Zed
1.00	4.89	4.89	35.00

Exp 19-A

S-T-S in above array = 0.50"

K	old	new	Zed
1	6.64	6.64	45.44

Expt 19-B

S-T-S in array = ~~0.5~~ 0.56, same otherwise

K	old	new	Zed	
<1	8.46	8.48	45.44	Out-Cut

K-2 start: $2.5 \times 10^{-12} \rightarrow \frac{31}{23} \times 10 \times 10^{-12}$

180

Expt 20

START-UP CHECK LIST

Equipment Checked by RKR — Personnel Check by RKR

Instrument and Safeguard Circuits Checked by RKR & JKT

"Source In" Checked by JCKR — Source No. _____

Emergency Lantern and Control Room Checked by RKR

Red Light On by RKR — AM

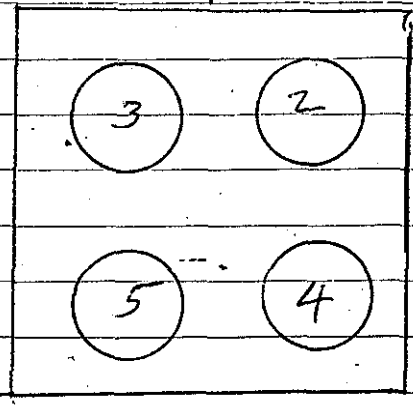
Start-Up OK'd by RKR — Time _____ PM Date 10-6-61

S.T.S. 3.72" 3" Paraffin Reflector on Sides
6" " on Bottom

Telsyn at 0.50":

new	old
.470	.502

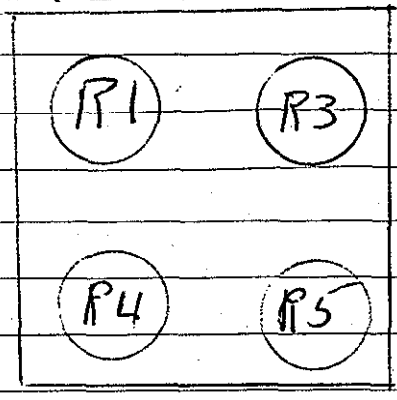
K<1 9.# 9+



K-2 at start: 37 (3×10^{-11})

K-2 at full: 56 (3×10^{-10})

Multiz $1.5 \times 10 \cong 15$



Expt 20A

Same as Expt. 20 except that 4½" paraffin on 5 sides instead of 3"
(some paraffin protruded further than 4½" on corners)
K-2 at start 12 (3×10^{-11})

K	old	new
<1	8.64	8.40

K-2: at full; 34 (10×10^{-11})
multi ~ 4.5 × 3 = 13.5

10-9-61
Ready for X

Expt 21 A

same as expt 21 except spacing changed to S.TS = 3.00"

	old	new
	7.50	7.82 not crit.

K-2 at full	44 (3×10^{-10})
" at zero	38 (3×10^{-11})

START UP CHECK LIST

Equipment Checked by RKR
Instrument [illegible] by RKR
Source In JKT
Emergency [illegible] RKR
Red Light [illegible] RKR
Start Up OK'd by JKT 10-10-1961

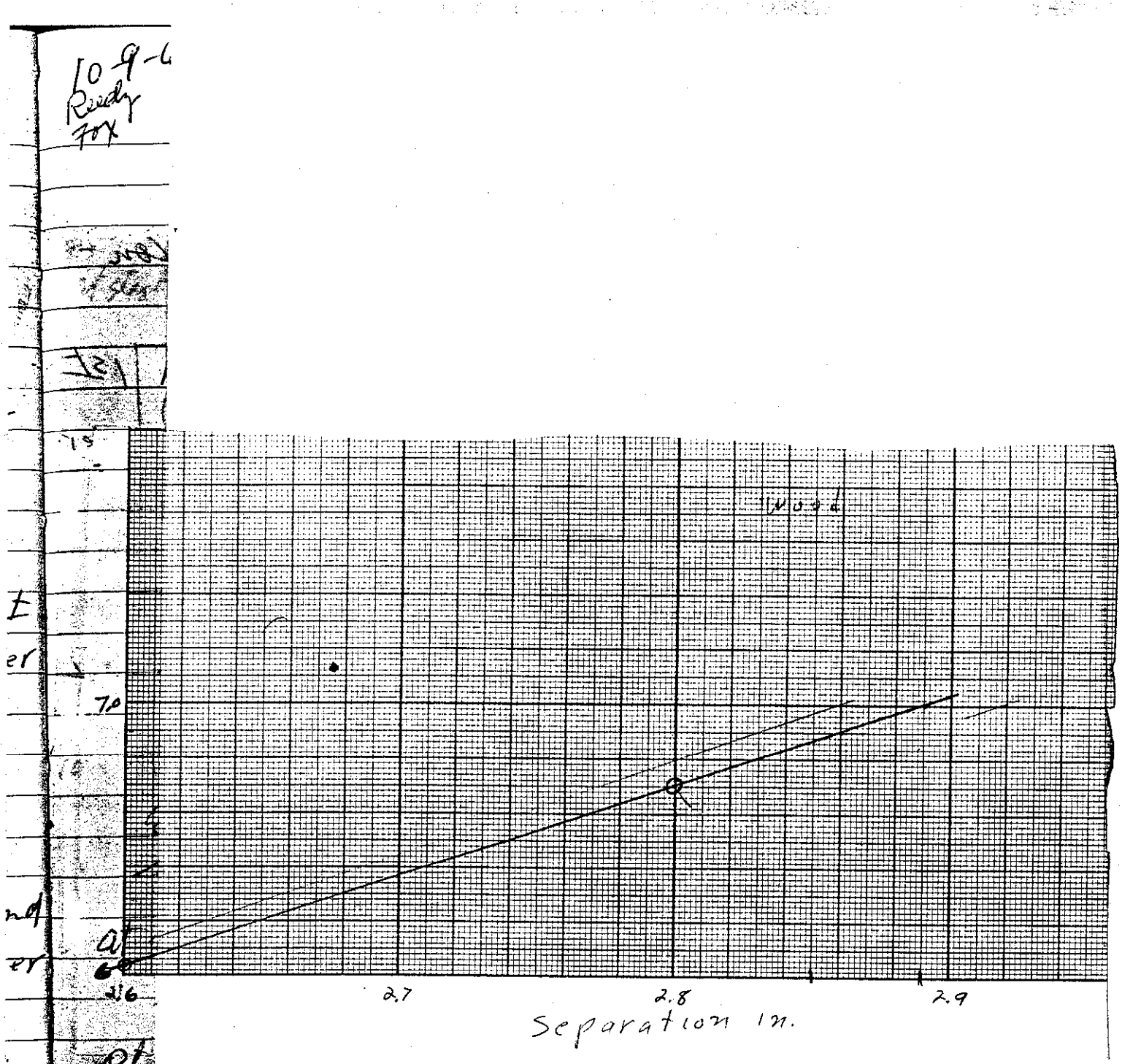
Expt 21 B

Same as above except that S.TS. spacing is now 2.80 in.

start: old setsyn = .50, new = .51 at 0.50"
" K-2 = $2.2(10^{-11})$

crit.
old S = 6.~~69~~ .70 new S. = 6.68

Interpolated crit. separation = ~~2.89~~ 2.90"


2.7
2.8
2.9
Separation in.

182

Expt 21

START UP CHECK LIST

Equipment Checked by RKR Personnel Check by FKT

Instruments Checked by RKR

"Source in" Check by M-43

Emergency RKR

Red Light RKR

Start Up FKT 10-9 1961

S.T.S. Spacing: 2.60"

~~Expt 21~~

2 X 2 X 2 array

Zero: old: 0.50 new: 0.49 (Zero mark on Bottler is 0.50 above true zero.)

6" Paraffin bottom Refl.

1½ " Refl. on 5-sides

New: 6.05 Super

New: 6.02 Just crit.

Old: 6.08 " "

↑ N

3	2	1st Tier
5	4	

R1	R3	2nd Tier
R4	R5	

184
10-10-61 Words Expt 22

2 X 2 X 2 array Reflected with 3" paraffin on 5 sides & 6" on bottom
S.T.S. Spacing 3.40".
Telsyn zeroed to correspond to container bottom

54 44

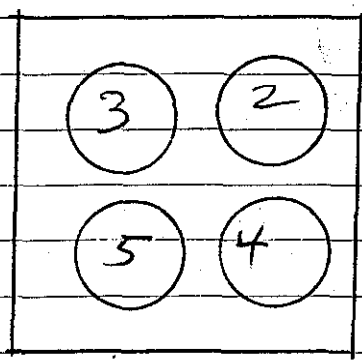
Just Crit: old s. 6.87 new s. 6.84

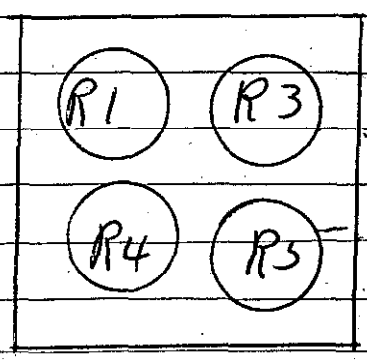
Per. period " 6.90 " 6.87

7.95 t/da. 173 mc.

$P = 4.03 \times 10^{-4}$ ~6.3 d

.03" = 6.3 d





Interpolated spacing at crit full = 3.43"

10-11-61
Ready for K

Expt 23

Wood

2 X 2 X 2 Array

Same pattern as above with 4½" paraffin on 5 sides & 6" on bottom

S.T.S. Spacing = 3.65"

at start K-2 3.1 (3×10^{-11}) new zero 45° old 1.50

Equipment Checked by	RKR	RKR	$.93 \times 10^{-11}$
Instrument and	JK-7		2.7×10^{-16}
"Source In"	✓		
Emergency Eq		M-43	M = 30
Red Light On by	RKR		
Start-Up OK'd by	JK-7	10-11-61	

old s.	new s.	
9.95	9.92	Subcrit

K-2 27 10×10^{-10}

10-11-61

Expt 24

2 X 2 X 2 array; same pattern as above with S.T.S spacing 3.65"

start K-2 1.6×10^{-11}; zero zone as above

Reflector: 4" plexiglas on 5 sides & 6" paraffin on bottom

Critical at:	old s. design	new s.
	6.49	6.46

Interpolated Spacing for just crit full = 3.80"

186
10-11-61
Ready for 1

Expt 24A

2 x 2 x 2 array same as Expt 24 except that Reflector on 5 sides now 3.0" plexiglas
K-2 at start = 1.2x10⁻⁷

	old S.	new S
Critical at	6.84	6.82

Interpolated just crit S.T.S. spacing 3.70

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and [illegible] RKR
"Source In" Checked by RKR [illegible] M-43
Emergency Equipment in Control Room [illegible]
Red Light On by RKR
Start-Up OK'd by RK7 Time [illegible] Date 10-12-61

Expt 25

2 x 2 x 2 array; same pattern of core as before.
Reflector: 2½ in. plexiglas on 5 sides & 6" paraffin on bottom
S.T.S spacing: 3.40"

Delayed at 0.50" — 0.45" on new — 0.485 on old

Interpolated just crit rep = 3.48"

Critical at	6.663	6.47
	.015	.015
	6.678	6.685

10-12-61
Reedy
Fox

Expt 25A

Same as preceding expt. except that plexiglas reflector on 5th rider is 2.0".

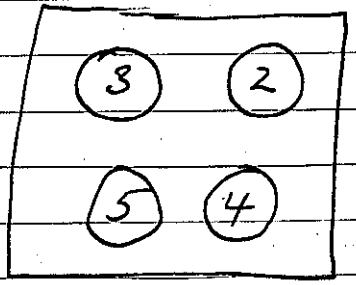
K-2 at ~ 1.0" fuel : 8 (10×10^{-12})
" " full 62 (11×10^{-12})
old s. 8.81" new s. 8.78" not crit.

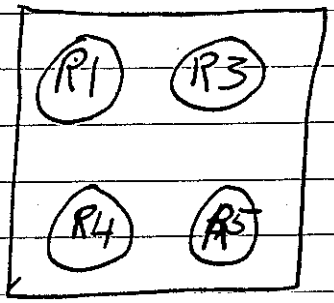
start on Expts - using Unistrut Supports

START-UP CHECK LIST
Equipment Checked by RKR ... k by RKR
Instrument and Safeties Ch... JKT
"Source In" Checked by RKR M-43
Emergency Equipment in ...
Red Light On by RKR
Start-Up OK'd by JKT Time ... Date 10-13 1961

Expt 26

unistrut
Same Array pattern as before.
5. TS spacing 4.0"
6" plexiglas on 5 rider —
except that slots between unistrut supports not filled on 2 faces.
Bottom: 6" paraffin.
K-2 at ½" fuel 18 (3×10^{-11})
at full 35 (10×10^{-11})





news. 9.57 old s. 9.48

M = 8

188
10-13-61
Ready
FOX

Expt 26A

Same as Expt 26 except slots between unistrut supports roughly filled. (some small shales not filled)
S.T.S. spacing same (4.0")

Unistrut

K-2 at start 20 (3×10^{-11}) 6.5×10^{-12}
" " full 58 (10×10^{-11}) Sub. crit
M ≥ 10

Expt 27

Ready
FOX

START-UP CHECK LIST
Equipment Checked by RKR Check by JKZ
Instrument and Safeties Checked and JKZ
"Source In" Checked by RKR Source No. A 43
Emergency Equipment in Control Room Checked by
Red Light On by RKR AM
Start-Up OK'd by JKZ Time PM Date 10-17 1961

at 0.5"0 new. 0.47 old 5.2.5"0

Unistrut

Same array and pattern as previously
S.T.S. spacing now 3.90"

at start K-2 ~45 (10×10^{-12})
at full ~65 (10×10^{-11})

Expt 28

START-UP CHECK LIST

Equipment Checked by RKR. Personnel Check by XKF.
Instrument and Safeties Checked and [illegible] by RKR
"Source In" Checked by RKR [illegible] No. M-43
Emergency Equipment [illegible] by
Red Light On by RKR
Start Up OK'd by XKF [illegible] Date 10-18 1961

unstruct

same pattern and array as previous expts. S, TS spacing 3.80" Reflected on 5 sides by 4" plexiglas – 6" paraffin on bottom.

at K-2 at 48 (3×10^{-11}) 1.5×10^{-11}
K2 – " full 30 (1.6×10^{-10}) 3.0×10^{-10}

$M \simeq 20$

10-18-61 Ready for unstruct

Expt 28A

same as above except plexiglas Refl. on 5 sides now 6" thick (approx.)
S.T.S. spacing 3.80"

K-2 at start 25 (3×10^{-11}) 1.25×10^{-11}
" " full 70 (3×10^{-10}) 2.1×10^{-10}

$M \simeq 18$

190
10-18-61
Ready for Critical

Expt 28B

Same as above except plexiglas on 5 sides now ~ 6" thick
S.T.S. spacing 3.80"

at start K-2 = 20 (3×10^{-11}) 6×10^{-11}
at full " 18 (10×10^{-10}) 1.8×10^{-10}

Expt 29

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Read by RKR
"Source" Checked by JKZ Form No. M-43
Emergency
Red Light
Start Up RISR
JKZ 10-19-61

Critical

Same pattern and array as above except that spacing is S.T.S. ± 3.70"
6" plexiglas on 5 sides, 6" paraffin on bottom

at full = 0.50 old S. 0.50 new S. 0.46

" " = " K-2 19 (3×10^{-11})

Crit at 10.58 10.58

Essentially just crit full 3.70"

Expt. #30

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by RKR Source No. M-43
Emergency Equipment in Cont[illegible] Checked by
Red Light On by RKR
Start-Up OK'd by JKT Date 10-20-1961

wood

Same array and pattern as before.
S.T.S. spacing 3.90"
Wooden spacers used in this array.
6" plexiglas on 5 sides; 6" paraffin on bottom
Zero not rechecked; Selsyns read 0.30" higher than true value because top tier was raised 0.30" relative paraffin base.
2 Al. Unistruts used to support top

	old s.	new s.
Critical at	7.18	7.12
	-0.30	-0.30
	6.88	6.82

Interpolated crit. at full S.T.S. = 3.96"

10-20-61

Expt 30A

Same as above except removed 1" of plexiglas; total now 5" on 5 sides
(crit at just full STS = 3.90")

	old s.	new s.
Crit at	8.17	8.11
	-.30	-.30
	7.87	7.81

(in vent tubes

was slightly sub at ~ 7.5"

Expt. 31

START-UP CHECK LIST
Equipment Checked by PKR & JKT Person-in-Charge Check by PKR
Instrument and Safeties Checked and Reset by PKR
"Source In" Checked by PKR Source No. M-43
Emergency Equipment in Control Room Checked by
Red Light On by PKR
Start-Up OK'd by JKT Time 1115 ~~AM~~ PM Date 10-23 1961

Measurement Assistant Specific

Same pattern and array as previous expts.
S.T.S. spacing 3.40"
Reflector: 3" plexiglas on 5 sides + 6" para- [ffin on bottom

at 0.50" fuel: new s = 0.45 ; old s = 0.49
" " " K-2 = 20 (10 x 10^{-11})

	old s.	new s.	
	6.85	6.83	super crit
just crit	6.83	6.81	

Interpolated just full S.T.S = 3.45

Expt 31A

Same as above except plexiglas refl. on 5 sides now 2.50"

at fuel = 0.50", K-2 = 21 (10 x 10^{-11})

sub. crit at full

Expt 32

START-UP CHECK LIST

Equipment Checked by RKR — Instrument Check by RKR

"Source" Installed by RKR — RKR & JKT

Emergency — M-43

Red Light — RKR

Start Up Initiated by JKT — 10-26 1961

3 X 3 X 3 cubic Array using cans listed below.

Spacing 5.6" S.T.S.

1½" parkaffin on 5 sides & 6" on bottom

↑ N

16	11	21	1st Tier
12	14	22	
17	15	20	

at fuel = 1.00" Refls = 1.00 Blds = 0.98

Critical at 6.78 6.74

19	R-3	1	2nd Tier
R4	R1	R5	
18	25	10	

13	8	4	3rd Tier
5	7	9	
2	6	3	

194
10-24-61
Ready for X.

Expt. 32A

Same as Expt 32 except. S.TS spacing now 5.65"

Selsyn zero is now ~ 0.10" Too low — raised center bar ~ 0.10" without re-gearing.

slightly sub-crit at 8.10"

Crit. S.T.S spacing ~ 5.65"

take 3/27/62 3.T. 5.62

Expt. 32B

START-UP CHECK LIST

Equipment Checked by JKZ Personnel Check by RKR

Instrument and Safeties Checked and Reset by RKR

"Source In" Checked by RKR Source No. M-43

Emergency Equipment in Control Room Checked by

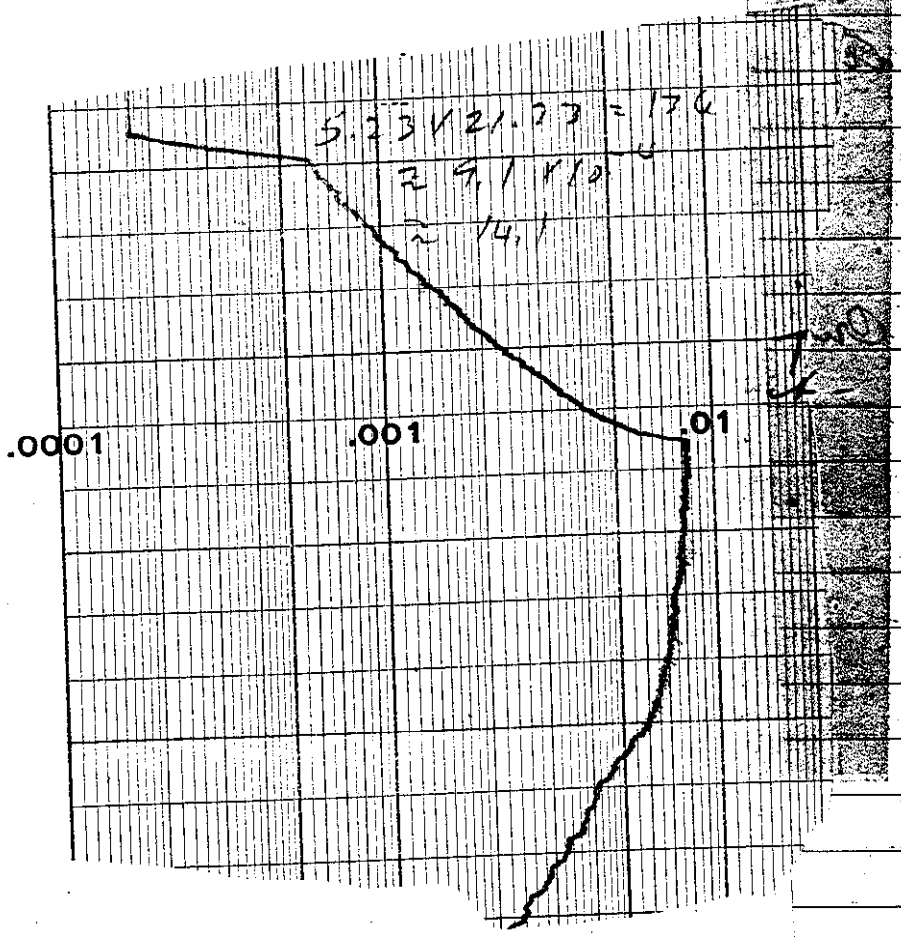
Red Light On by RKR

Start-Up OK'd by JKZ Time AM PM Date 10-27-1961

Repeat ϱ above to check degree of sub-critical at full. at 10"+

Neg period - 136 sec $\approx 9.1 \times 10^{-4}$

≈ 14.2 ¢

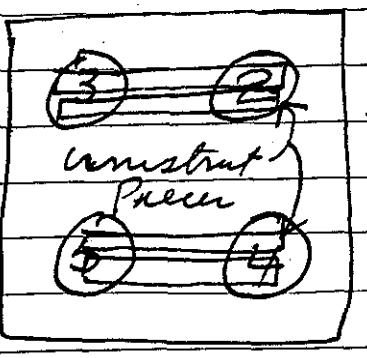

.0001
.001
.01

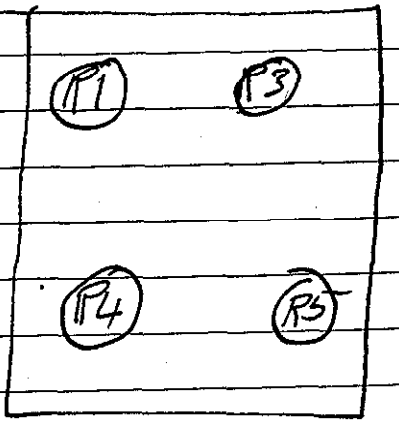
START-UP CHECK LIST
Equipment Checked by RKR — Instrument Check by RKR
Instruments and Safeties Checked and Logged by RKR
"Equipment" Checked by RKR — Log Book No. RKR M-43
Emergency Equipment in Control Room Checked by ←
Red Light On by PKR
Start-Up Okayed by JKT — Date 10-30 1961

Expt 33

2 X 2 X 2 array with 1½" paraffin on 5 sides and 6" on bottom
S.T.S spacing 2.80"
No ~~[illegible]~~ moderator thru array; spacing held by small pieces of Al construct designed to zero

	News	olds
Crit at:	6.80	6.84





Interpolated crit at full S.T.S = 2.86"

1/96-30-61

Ready for

Expt 33A

Same as above expt. except that refl. on 5 sides now 1½ plexiglas instead of paraffin. Array not taken down - same spacing: 2.80"

appreciably sub. crit at 9.3" on xlsym

START-UP CHECK LIST

Equipment Checked by JKT & RKR Clock by RKR

Instrument and Source Checked and Clock by JKT

"Source" RKR Uranium No. M-43

Emergency Equipment and Procedures Explained by

Rod Withdrawal RKR

Start Up On (Date) JKT Time A.M. Date 10-31 1961

Expt. 34

Same as above except. now have 1 3/4" plexiglas on 5 sides

	New S	old S
Crit at	6.57	6.61

Interpolated just crit 5.75 = 2.91 (2.90)

START-UP CHECK LIST
Equipment Checked by RKR Person Check by PKT
Instrument and Safeties Checked and RKR
Source In Checked by RKR Sources No. M-43
Emergency Equipment in Control Room Checked by
Red Light On by RKR AM
Start-Up Off'd by PKT Time PM Date 11-6-61

Expt. 35
Same array as in Expt 33 except S.T.S spacing is 3.40" and 3.0" paraffin on 5 rods
Selsyn re-zeroed

Appreciably sub. crit at full — but not a sharp drop indicating that system is not far from critical

Expt 36
Same as above except S.T.S. spacing now 3.35". Same 3" paraffin.
Selsyn not rezeroed — System lowered about 0.075"

	New S.	Old S.
Scram	(6.79)?	6.74
Crit at	~~6.80~~ 6.79	6.72

Interpolated just crit. full S.T.S = 3.38" (3.39) ~~3.45~~

Expt 37

START UP CHECK LIST

Equipment Checked by RKR Check by RKR

Instruments RKR

"Source In" Checked by RKR Log No. M-43

Emer... by

Red Light ... RKR

Start Up OK'd by JKT ... Date NOV. 6 1961

Same Array and Pattern as previous expts. S.T.S. spacing 3.60" using Wood spacers.

4 1/2 paraffin reflector on 5 sides & 6" " " " bottom

Selsyns re-geroed. new s. 0.44
old s. 0.50

No unistruts thru or adjacent to array

Slightly sub crit at full + 10.0"

Neg period = 103 μsec. ≈ 1.4×10^{-3} ρ

≈ −25¢

From previous pos. period data ≈ 6¢ is equiv. to ≈ .03" in rod height; or 25¢ is equiv. to 0.12". This is equiv. to a change in spacing of 0.04" as seen from Expts 21 & 21a

~~Interpolated~~ value of S.T.S. at crit. full = 3.55"

37A

START UP CHECK LIST

Equipment Checked by RKR Check by RKR

Instrument [illegible]

"Source In" [illegible] RKR [illegible]

Emergency [illegible] Locked by —

Red Light [illegible] RKR

Start Up OK'd by JKF Time [illegible] A.M. P.M. DATE NOV. 7 1961

Same as Expt. 37 except S.T.S spacing = 3,55

when News = 0.66 olds ≅ 6.83* Δh = 6.17

News assumed to read correctly for Expt 37, hence zero is 0.08" for this array.

System crit at: News = 7.20 + .08 = ~~7.28~~ 7.28

olds = 13.46 + .08 = ~~13.54~~ 13.13 − 6.17 = 6.96

Adding ~ 0.5" caused very little change on reactivity, hence system in full at critical

During the experiments using 4½" Paraffin attempts were made to hold the amount of paraffin "over-hang" on the edges constant.

→

* ground shift for unknown reason.

START-UP CHECK LIST
Equipment Checked by RKR & JKT — Personnel Check by RKR
Instrument and Safeties Checked and ... by RKR
"Source In" Checked by RKR — Source No. M-43
Emergency Equipment in Control Room Checked by —
Red Light On by RKR — AM/PM Date Nov. 8 1961
Start-Up OK'd by JKT — Time —

Expt 38

Same as previous several expts except S, T, S spacing now 3.50" using Al spacers
Reflector 4½" paraffin on S sides
6" " " " Bottom

Alsyn at 0.50": news. 0.49 old s. 0.495

at ~ 8.0" (full) reg. period ~ 79 sec.
≈ -37.5¢

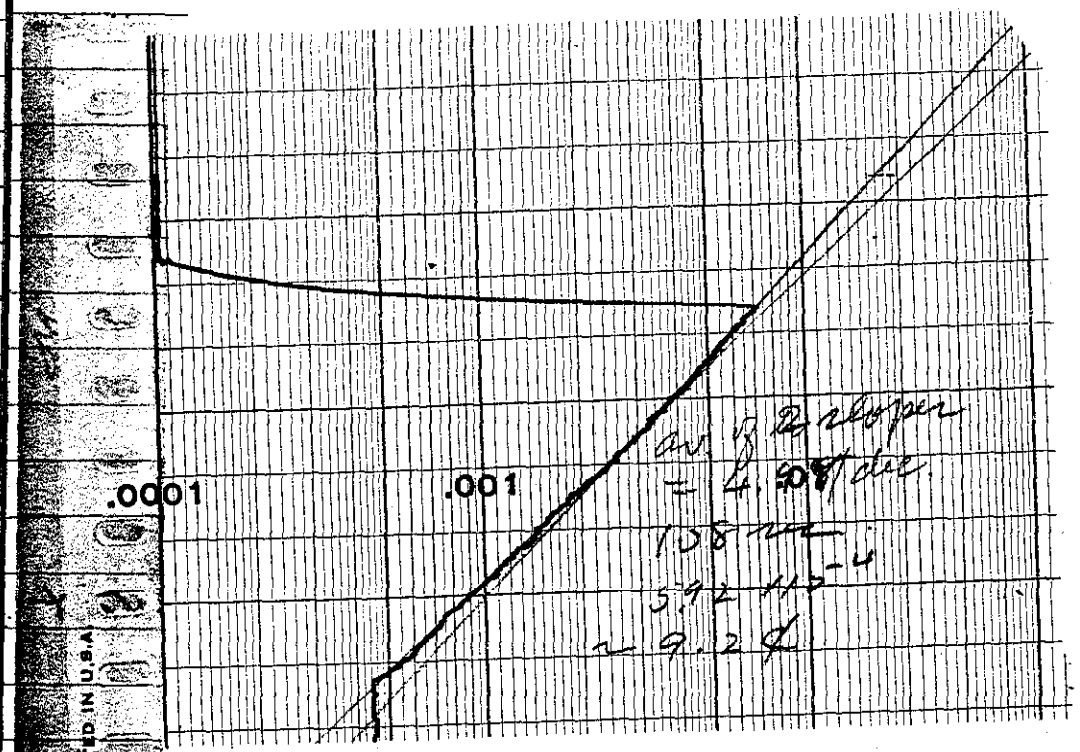
Expt 38A

START-UP CHECK LIST
Equipment Checked by RKR — Personnel Check by JKT
Instrument and Safeties Checked and ... by —
"Source In" Checked by RKR — Source No. M-43
Emergency Equipment in Control Room Checked by —
Red Light On by RKR — AM/PM Date 11-9 1961
Start-Up OK'd by JKT — Time —

Same array as above, except S T S, spacing now 3.40" with Al. spacers
At 0.50" fuel news. = .53 olds. .506

Crit at	6.88	6.86	Interpolated
Pos. period	6.94	6.90	value at full
	.06" ≈ 9.2¢		S. T. S. = 3.43

200



C
Po

Expt 39

START UP CHECK LIST
Equipment Checked by RKR
Instrument and Safety Checked by RKR
"Source" Installed by RKR Source No. M-43
Emergency Equipment in Control Room Checked by —
Red Light On by RKR
Start-Up OK'd by JKZ Time AM PM Date 11 - 10 1961

Same array pattern as above.
S.T.S. spacing 3.85 using wood spacers.
Reflector: 4½ plexiglas on 5 inches and 6" paraffin on bottom
Selsyns at 0.50 = new: ~~.53~~ .41 old: ~~.51~~ .47

Cut at 6.77 + .09 = 6.84 6.82 + .03 = 6.85

Expt 39A

Same as above except STS spacing now 3.90" using wood
Selsyns not re-zeroed; raised zero 0.10"

Cut at ~ 9.40 on selsyn - 2.2"
½ inch vernier Tracker.

Just full cut value ≅ 3.89

START-UP CHECK LIST

~~Equipment~~ Checked by RKR Personnel Check by RKR

Instrument and Safeties Checked and Reset by RKR & JKT

"Source In" Checked by RKR Source No. —

Emergency Equipment in Control Room Checked by —

Red Light On by RKR

Start Up OK'd by JKT Time ____ AM PM Date 11-13 1961

Expt 40

Same pattern and Array as previously. S.T.S. spacing 3.625" using Unistrut spacers. Not Unistrut extending thru reflector.

Reflector 4½ Plexiglas on 5 sides 8' 6" paraffin on Salton

selsyns Re-zeroed ; 0.50 ; 0.50

~~Slightly under~~ 6.64 6.64

Crit. at →

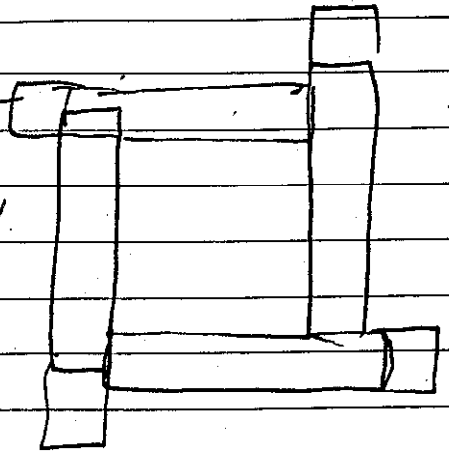
SET-UP CHECK LIST
Equipment Checked by RKR Check by JKT
Instrum RKR
Source RKR Source No. M-43
Emerg
Red Light
Start Up Ok'd by JKT Time Date 11-14 1961

Expt 41

Same as above except. S.TS. spacing = 3.75"
using al. spacer. 4½" plexiglas on
5 rubber & 6" paraffin on bottom
Olympus at 0.50; New 0.50 Old 0.50
Attempt was made to minimize "overhang"
of long piece on corners.

System cut at: 7.42 (7.5") 7.43 (7.5")
just full and cut S.TS = 3.75"

Expt 41 A



Same as above except that
more plexiglas was added
to extend the "overhang" beyond
4 of the edges of the box
surrounding the array to test
this effect.

Cut at 7.50 7.54

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Insurument and Safeties Checked and Reset by RKR
"Source In" Checked by RKR Source No.
Emergency Equipment in Control Room Checked by —
Red Light On by RKR
Start-Up OK'd by JKZ Time AM PM Date 11-15 1961

Expt. 41B

Same as above (41 & 41A) except added plexiglas. Now 6" plexiglas on 5 sides.
Old relays out of order
super at 6.83"
just out 6.81

Expt 42

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Insurument and Safeties Checked and Reset by JKZ
"Source In" Checked by RKR 11-63
Emergency Equipment in Control Room Checked by —
Red Light On by RKR
Start-Up OK'd by JKZ Time AM PM Date 11-17 1961

Same array & pattern as above
0.50" plexiglas refl. on 5 sides
+ 6" paraffin on bottom
S.T.S. spacing 1.40"
New relays set at 0.50; old S. out of order
Out at 6.50

11-17-61

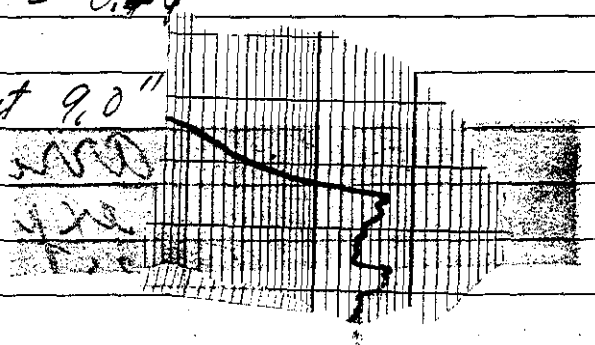
Expt. 43

Same as above except. S.T.S. spacing now 1.50"

1/2" plexiglas on 5 faces & 6" paraffin on bottom

new s. at 0.50" fuel = 0.49

Appreciably sub crit at 9.0"



#6 Bottle fell off of 3x3x3 array and broke

206

Expt 44

START-UP CHECK LIST

Equipment [illegible] by RKR — Check by RKR RKR

Ins[illegible] JKF — Sht No. M-43

Date RKR

Start JKF — 1-13 62

3X3X3 array using same battle as previous expts except that #6 was replaced by #25 S.T.S. = 3.65

Bottom refl. 6" paraffin
1/2" plexiglas on 5 sides minus 3 - 1 5/8" wide slots on each of two faces.

Array dimensions:

N - bottom	(E to W)	23 5/16	.31	Center to center of outside batter
N - top	(E to W)	23 9/32	.22	
23.3 S - bottom	(E to W)	23 7/32	.22	
S - top	(E to W)	23 9/32	.28	

Top to bottom	SE corner	29 9/16	.54	top of array to bottom
29.80 " " "	SW "	29 19/32	.60	
" " "	NE	29 21/32	.65	
	NW.	29 21/32	.65	

Cut at 6.56"

After above expt one battle was found to be out of position ~ 1/2" (up and sideways)

1-13-62

Expt 44A

Repeat of above expt. after re-positioning Battle R-5

Crit at 6.45"

Expt 45

Removed the ½" plexiglas top refl.
Otherwise same as above

Equipment Checked by	RKR	Work by RKR
Instrument and Safety		RKR
"Source In" Checked by	RKR	M43
Emergency Equipment		
Rod [illegible]	RKR	
Start-Up Ordered by	JKT	1-15-62

Sub-crit when full (fast neg. period)

208
1-15-62

Expt. 46

Same as expt. 44 except S.T.S. = 3.80"
6-1.9" slots across faces of array
Sub-Crit when full (appreciable
multiplication

Expt 47

Equipment	RKR	...	RKR
Instr.			RKR
Sh.			M-43
Emer.			
Red.			
Start Up Tested by	RKR JK7		1-16-62

Same array as above. 6 slots filled except array inside liner strut

High multiplication but apparently sub-crit. when full

1-16-62

Expt #48

Same as above except added 1/2" Paraffin on top of array. S.TS = 3.80"

Cut at 5.84"

Expt 49

START UP CHECK LIST

Equipment Checked by RKR — Check by RKR

Instrument and Safeties Checked and RKR

"Source In" Checked by RKR — Log No. M-43

Emergency Equipment on Control Room checked by

Red Light On by RKR

Start Up OK'd by FKS Time AM Date 1-17 1962

Same as Expt. 47 except S.TS. spacing 3.72 ~~3.75~~" slats on side refl. pulled. (see next page)

Cut at 6.80"

1-10-62 Expt 49A

Repeat of Expt 49 after removing ½" plexiglas pcs. from 6 slots in sides of array.
Light multiplication tubes full

Measured Array Dimensions:

Center-to-center of outside battles horizontally:

N bottom	23.44
N middle	23.50
N top	23.50
E bottom	23.31
E top	23.38
W. bottom	23.34
W. middle	23.44
W top	23.41
S bottom	23.41
S top	23.44
Av.	23.42

C to C. = 11.71

or S.T.S. = 3.71

Overall heights.

29.88
29.91
29.88
29.97
29.88
30.00
30.00
29.97

Av 29.94
− 22.50 ht. of 3 battles
2 | 7.44
3.72 = S.T.S. vertically

Rough interpolation using expts 44 & 49A indicate 3.77 as just crit. full. Since av. S.T.S in ~ .03 low, the corrected value is 3.74 ± .03

Expt. #50

START-UP CHECK LIST

Equipment Checked by RKR — Back by RKR

Instrument and Source Tube — RKR

"Source In" Time — M-43

Emergency

Red Light — RKR

Start Up OK'd By RKR — Date 195

~~Expt~~ 0.46 = 0.50 above zero

3X3X3 array with ½" plexiglas on te sides. S.T.S = 3.50" (slots unfilled)

Sub-crit when full, but high Multiplication

Expt 50 A

Same as above except 6 slots in faces filled

Only slightly sub-crit when full

Crit S.T.S. spacing ~ 3.48" ± .03

Expt. 51

START-UP CHECK LIST
Equipment Checked by RKR by RKR
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by RKR
Emergency Equipment and General Room Checked by
Red Light On by RKR
Start Up OK'd by JKT Time AM PM Date 1-23 1962

3 X 3 X 3 array with 1½" paraffin refl on all sides. Several slots in refl are not filled
5 ¾ S spacing 5.2".
Sub-crit but high multiplication when full.

Expt 51 A

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by JKT
"Source In" Checked by JKT Source No. M-43
Emergency Equipment and General Room Checked by
Red Light On by RKR
Start Up OK'd by JKT Time AM PM Date 1-24 1962

Repeat of above after filling slots between unistrut

Crit at 5.79"

1-24-62

Expt 51 B

Repeat of above to check if there was air in feed liner during Expt 51A.

Crit at ~ 5.80

compare with Exp 32 on pp. 175-1

Extrapolation using Expt 32 indicates ~~5.30 + .05 = crit separation~~ (see below)

Measured dimensions:

N bottom	26.38
N middle	26.25
Center Top	26.15
S. bottom	26.25
E bottom	26.19
W. bottom	26.31
Av	26.26

Av S.TS = 5.13

Heights:

SE	32.94
SW	32.75
NE	32.75
SW	32.75
4 | 131.19	
	32.80

Av. Vert S.TS = 5.15

Interpolated Crit S.T.S. 5.35 ± 0.05 JTT 3/27/62

Expt 52

START-UP CHECK

Equipment Checked by RKR
Instrument and Safeties Checked and "Source In" Checked by RKR by RKR
RKR & HKJ
Emergency Equipment in Control Room Checked by M-43
Red Light On by RKR
Start-Up OK'd by RKR Time ~~AM~~ PM Date 2-19 1962

3 X 3 X 3 array of 5 l. battler at ~3.75" STS separation with ½" paraffin refletor on all sides - Unistrut slots not filled
selsyn zeroed

Appreciable multi. when full

Expt 52A

Same as above except slots between Unistrut supports filled. Refletor complete except for inside of Unistrut channels.

Appreciably sub-crit when full

Expt. 53

START-UP CHECK LIST

Equipment Checked by RKR — Checked by RKR

Instrument and Safeties Checked by RKR — RKR

Source Installed Checked by RKR — 1343

Emergency Equipment — Checked by

Red Light On by RKR

Start Up OK'd by JKT — Date 2-20-1962

3X3X3 array at S.TS spacing = 3.95"

½" paraffin on six sides except

uranium slots not filled

aluminum shroud.

appreciably sub-crit when full.

START-UP CHECK LIST

Equipment Checked by RKR & JKT — Checked by RKR

Instrument and Safeties Checked and RKR

Source Installed Checked by JKT

Emergency Equipment

Red Light On by RKR

Start Up OK'd by JKT — Date 2-21-1962

Expt 53A

Same as above except slots between uranium filled

slightly sub-crit when full

216
2-21-62

Expt 53B
added ½" additional refl. to top of above array
Cut at 6.38"

Expt 53C
Removed 2/3 of added ½" on top of array.
cut at 6.77

Interpolated sq. ft. of added ½" on top = to full in ~ 1.5
If this is smeared out over the ~54 sq. ft. of refl. it is equiv. to ~ .015" additional refl.

Av horiz. mean spacing = .05"
" " " " ± .03
∴ Av. S.T.S spacing = 3.63
correcting for added top refl
Interpolated cut S.T.S. spacing = 3.61 ± .05

take 3.55 ± 0.05 3/27/64 J.T.

Expt 54

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by JKT Source No. M-43
Emergency Equipment in Central Room Checked by ✓
Red Light On by RKR AM
Start Up OK'd by JKT Time PM Date 2-23 1962

3X3X3 array with ½" paraffin refl on 5 sides & 4" paraffin on Bottom Slots unfilled.
Selsyn zeroed.
Very slightly sub-crit when full

Expt 54A

Same as above except slots between construct filled

Crit at 6.53"

Av. Vertical S.T.S. = 3.85
Av Horiz. " = 3.79
Overall av. " ≃ 3.81

Comparing above with Expts 44-49 the change in spacing corresponding to 6.53 → 7.00 is .08

∴ Crit S.T.S. spacing is 3.89 ± .05

Expt 55

START-UP CHECK

Equipment Checked by PKR — by RKR
Instrument and Safeties Checked and — RKR
"Source In" Checked by JK7 — M-43
Emergency Equipment — Control Room
Red Light On by RKR — At
Start Up OK'd by JK7 Time — Date 2-27 1962

3X3X3 Array at S.T.S. = 6.25"
6" Paraffin rel. on Bottom & 3" paraffin on Sides. Slots between Unistrut Not filled.
Scaler used.
Appreciable multi but far from critical when full.

?

Expt 55A

START-UP CHECK

Equipment Checked by PKR — RKR
Instrument and Safeties Checked — RKR
"Source In" Checked by JK7
Emergency Equipment
Red Light On by RKR
Start-Up OK'd by JK7 Time — 2-28 1962

Same as above except slots between Unistrut filled

Very slightly sub-crit ~3-5¢

Taken STS = 6.24 ± 0.05" for uniform refl. thickness SET 3/23/64

Mean Av Horiz. Spacing = 6.19"
" " Vert. " " = 6.29 "
Overall Av. Spacing = 6.22

Expt. 56

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by JKT
Instrument and Safeties Checked and Reset RKR
"Source In" Checked by RKR Film No. ✓
Emergency Equipment Checked by ✓
Red Light On by RKR
Start-Up OK'd by JKT Time Date 3-1-1962

2X2X2 battle array reflected on 5 sides with ½" paraffin & with 6" paraffin on the bottom, using Al. spacers
STS. spacing ~ 1.52"
Delayed period
No unstable thru array

just crit. full

Expt 56A

Same as above except ½" paraffin now against battle of array on 5 sides
6" bottom still 0.76" from battle.

crit at 6.20"

Av. Horizontal spacing 1.54 "
" Vertical " 1.54

Expt 57

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties ~~Logged~~ and ~~Checked~~ RKR

"Source In" Checked by JKT Core No. —

Emergency Equipment in ~~Control~~ Room ~~Checked~~ by —

Red Light On by RKR AM

Start-Up OK'd by JKT Time ~~Initiated~~ PM Date 2-5 1962

2 X 2 X 2 array, S.T.S. spacing = 1.30" with ½" paraffin on all sides.

Selsyn zeroed.

Slightly sub when full

take 1.29 ± 0.05 J.T.T. 3/22/62

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties Logged and Checked by RKR

"Source In" Checked by RKR Core No. —

Emergency Equipment in Control Room Checked by —

Red Light On by RKR AM

Start-Up OK'd by JKT Time ~~Initiated~~ PM Date 2-6 1962

Expt 58

2 X 2 X 2 array at 2.50" S.T.S. spacing with 1½" paraffin refl. on 4 sides

Selsyn zeroed

Critical at 6.35"

Expt 58A

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties Checked and [illegible] RKR

"Source In" Checked by JKT Source No. N-63

Emergency Equipment in Control Room Checked by [illegible]

Red Light On by RKR AM

Start-Up OK'd by JKT Time [illegible] Date 2-7-62

Same as Above except S.T.S. spacing now 2.62"
Selsyns re-zeroed.

Crit at 6.64

Expt. 58B

Repeat of above to check accuracy of C, Ht.
Selsyn rezeroed.

Crit 6.60

Expt. 58C

Repeat of above after adjusting manometer.

Crit at ~ 6.60

AV. Horiz spacing : 2.60" } overall av. ~ 2.61"
" Vert " " 2.63 }

Expt 58 D

Same as above except S.T.S. spacing now ~2.72" 1½" Pa on 6 sides
M. selsyn re-zeroed.

Crit with rabbit up in vent Thudex: Actual 0"

Av. Horiz. spacing = 2.75" } meas.
Av. Vert spacing = 2.75"
take crit S.T.S. 2.72 ± 0.05 J.T. 3/27/62

Expt #59

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by RKR
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by RKR Counter No. M43
Emergency Equipment in Control Room Checked by
Red Light On by RKR
Start-Up OK'd by RKR Time ~~A.M.~~ PM Date 2-8-1962

2X2X2 Array with 3" paraffin on all six sides. S.T.S. spacing ~ 3.32"

M. Selsyn zeroed

Crit at 6.84"

Av. Horiz. Spacing 3.32 } overall Spacing
Av. Vert " 3.37 } ~ 3.33

Interpolated S.T.S. Spacing = 3.34 ~~3.30~~

Expt. 60

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties Checked and Reset by JKT

"Source In" Checked by JKT Source No. 1-43

Emergency Equipment in Control Room Checked by ✓

Red Light On by RKR

Start Up OK'd by JKT Time AM Date 3-9 1962

2 X 2 X 2 Array of 5L bottles with 1/2" plexiglas on all sides. S.T.S. spacing ~1.25"

Man. Selsyn reported

Appreciably sub. crit when full.

T. 27/62

Expt 60 A

Same as above except added 2nd 1/2" plexiglas 11" wide across center of top.

Slightly sub. crit when full.

224
39-4r

Expt 60 B

2 X 2 X 2 ~~Staggered~~ Array with ½" plexiglas on 6 sides. STS. Spacing ~ 1.20"

Neutron Multiplication reserved.

Appreciably sub. crit at full

Expt. 60 C

Same as above except added 2 - 3" wide pcs. of ½" th. plexiglas on tops - one on each side of vent tubes

Av. Horiz. spacing = 1.22
" Vert " " ~ 1.00 ??

Slightly sub when full

Expt 60 D

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties Checked and Reset by RKR.

"Source In" Checked by RKR Source No. _____

Emergency Equipment in Control Room Checked by ✓

Red Light On by RKR

Start Up OK'd by RKR Time _____ AM PM Date 3-12 1962

2 x 2 x 2 Array with ½" Plexiglas on all six sides. S. TS. spacing ≈ 1.10"

M. Selsyn reads .45 at 0.50

Crit at. 6.55 +.05

Corrected — 6.60

Horizontal spacing: Av = 1.10

Vert. 1. Av. = 1.08

Interpolated S. TS. spacing ≈ 1.15 ± .05

N

W 1372
notified.

21	23	54
29	2	56
42	5	24
	2nd	
43	R2	28
R-3	R-1	R5
14	R4	59
	3rd	
51	3	47
32	8	35
31	58	7

5 liter Bottle Expts at H/X ≈ 90

Expt. 61

8 - bottles in cubic Array at S.T.S. ≈ 0.56" Tower tier ≈ 1 above floor

1 PC
RKR
JKT

K-1, K-2,
PM-1, PM-2
in trip

START UP CHECK LIST
Equipment Checked by JKT — Personnel Check by JKT
Instrument and Safeties Checked by RKR — Source No. RKR
Emergency Equipment in Control Room Checked by RKR
Red Light On by RKR
Start Up OK'd by JKT Time ____ AM PM Date 8-6-62

Delsyn zeroed to zero at bottom of top tier of four remately filled bottles

Feed rate = 1.90" per min.

~~Slightly super at 6.91~~"
Cut at 6.91
Taken to full for period

Expt. 61A

Repeat of above to check on reproducibility
Delsyn re-zeroed.

~~Slightly super at 6.99~~
Cut at 6.99

~~225~~
228
RKR
JKT

Expt 62

2 x 2 x 2 array Refl with 4½" paraffin on 5 sides & 6" paraffin on bottom

K-2, PM-1 in
PM-2 trip

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by JKT
Instrument and Safeties Checked and Reset by RKR JKT
"Source In" Checked by RKR Source No.
Emergency Equipment ... Control Room Checked by ←
Red Light On by RKR
Start-Up OK'd by JKT Time ... PH Date 8-8-1962

Some parts of slots for unistrut supports are not filled completely, leaving small hole in refl.

Delsyn rezeroed

Dud. crit values full

After this expt. it was found that to check previous data at H/X = 59 we should not use unistrut supports thru refl.

Expt 62 A

2X2X2 Array Refl. with 4½" para-

START-UP CHECK LIST
Equipment Checked by JKZ — Final Check by JKZ
Instrument and Safeties Checked and "Source In" Checked by RKK — Source No. —
Emergency Equipment in Control Room Checked by —
Red Light On by RKK
Start-Up OK'd by JKZ Time — AM PM Date 8-4-62

K-1, K-2
PM-1, PM-2
in trip

Run on 5 diles & 6" on bottom. S.T.S. Spacing = 3.43". Spacers made from pieces of unistrut cut. Refl. is quite tight & uniform in comparison to previous expt.

Crit at full. (after feeding some up-vent tubes to help displace air)

230 #/x = 90

Expt 63

3x3x3 Array Bare : 5 cyls. re motely filled

Dep = 2.50" S.T.S.

K-1, K-2
PM-1, PM-2
in Trip

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by JDC
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by _____ Source No. M-43
Emergency Equipment in Control Room Checked by ✓
Red Light On by RKR
Start-Up OK'd by RKR Time _____ AM PM Date 8-13-62 196

Feed rate = 1.02" per min

Delsyn zeroed
Out. at 6.80"

Expt 63A

K-1, K-2
PM1, PM-2
in Trip

START UP CHECK LIST
Equipment Checked by RKR Check by RKR
Instrument and Safeties Checked and Reset by RKR
"Source In" Checked by M-43
Emergency Equipment Checked by ✓
Red Light On by RKR
Start Up OK'd by RKR Time _____ AM PM Date 8-14-62 196

Repeat of above
at sdn = 0.5" Delsyn read = 0.54"

Out at 6.84
-.04
corrected 6.80"

Expt 64

3X3X3 Array bare at S.T.S = 2.50"

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties Checked and Reset by JKT

"Source In" Checked by JKT Source No. M-43

Emergency Equipment in Control Room Checked by

Red Light On by RKR AM

Start Up OK'd by JKT Time PM Date 8-16 1962

PM-1, PM-2 K-1, K-2 in trip

22 units (fixed) are at H/X = 59 & 5 remote filled units are at H/X = 91. This gives a better check on crit S.T.S. at H/X = 59 vs crit S.T.S at H/X = 91

design zero re-checked, ok: ~~zero~~ = .04

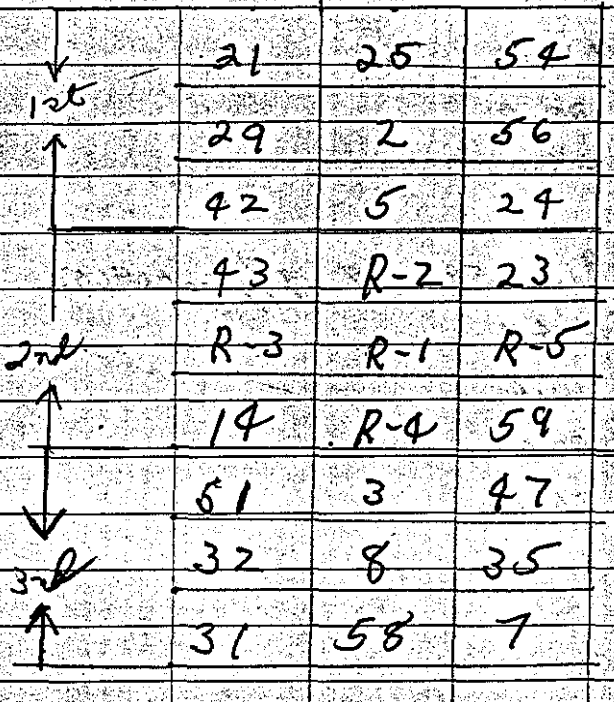
Slightly sup 6.85

Crit at 6.83

.04

corrected 6.79

Feed rate = 1.02" per min



232

$UO_2(NO_3)_2$ Salvage. (1999)

9-28-62

Req - 593175	γ^{U}/g = .036960	Req - 593179 γ^{U}/g = .00231
✓ #16		✓ #505
G 143.0		124.0
T 20.0		20.0
N 123.0		104.0
Req - 593176	γ^{U}/g = .008260	Req - 593180 γ^{U}/g = .03419
✓ #131		✓ II 129
G 130.0		82.4
T 20.0		20.0
N 110.6		62.4
Req - 593177	γ^{U}/g = .015170	Req - 593181 γ^{U}/g = .019470
✓ #15c		✓ #118
G 114.0		95.1
T 20.0		20.0
N 94.0		75.1
Req - 593178	γ^{U}/g = .009632	Req - 593182 γ^{U}/g = .04654
✓ II 47		✓ II 136
G 96.4		97.7
T 20.0		20.0
N 76.4		77.7

Ext. 65

11/19/62 2×2×2 5-Liter Bottles

My = 445

.002317

START-UP CHECK LIST

Equipment Checked by RKR Personnel Checked by RKR

Instrument and [illegible] Logged and Tagged by EJ

Source In [illegible] Source No. M-43

Emergency Equipment in Control Room Checked by EJ

Red Light On by EJ AM

Start Up OK'd by RKR EJ 1515 PM Date 11/19 1962

Setting:
PM-1, PM-2
K-1, K-2

Side-to-side spacing = 0.5 in. Lead reflector.

=.034190 PM-1 required ~~1300~~ 780 v for Hi-level trip

PM-2 " 1300 " " " " "

K-1 & K-2 tripped at 10×10^{-12}

Leads: 0.046 in., 15,000 in. (½" saline in bottle)

>19470 Feed rate: 0.93 in/min.

Deng indicated with saline in tubing

=.046540

234 Expt. 66

11/20/62 2x2x2 Array of 5-Liter Bottles

$k_{eff} = 440$

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by RKR

Instrument and Safeties [illegible]d and Reset by EJ

"Source In" Checked by RKR Source No. 14-43

Emergency Equipment [illegible] Room Checked by IDC

Red Light On by EJ

Start-Up O.K.'d by EJ Time 10 AM PM Date 11/20 1962

Bottles in contact. No reflector.

In trip: K-1, K-2, PM-1, PM-2.

Trip levels: K-1 & K-2 on 12x15 sec, PM-1 = 500 V, PM-2 1300 V.

Feed rate: 0.74 in and 0.73 in/min.

Zeros (½" salt in 6 tubes)

Subcritical with salt in tubes.

Expt. 67

11/21/62

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by FDC

Instrument and Safeties Checked and Reset by RKR

"Source In" Checked by RKR Source No. M-43

Emergency Equipment in Control Room Checked by FDC

Red Light On by RKR

Start-Up OK'd by RKR Time 1125 AM PM Date 11-21 1962

Run Tags: K-1, K-2, PM-1, PM-2

9 - 5 liter bottles in bottom layer and the 5 remotely-filled bottles in second layer; Spacing 1.125 in. side-to-side.

K-1 & K-2 on 10 x 10^12, PM-1 on 500 V, PM-2 on 950 V. Subcritical.

1300 Added 4 filled bottles to middle layer. Subcritical.

1545 5 filled bottles in third tier.

Zeros (0.5 in. of soln in bottles) 0.45 in; 15.455 in.

Subcritical with soln in tubes

Both manometers failed to follow. Sick.

Expt. 67B

11/23/62 3x3x3 Array of 5-Liter Bottles
w/ reflector

START-UP CHECK LIST

Equipment Checked by [illegible] Date 10/ [illegible]

Instrument and Electronic Equipment Checked by [illegible] Date 10/ [illegible]

Source in" (Chemical Type) Loaded by [illegible] Date 10/ [illegible]

Emergency Equipment Checked and Found Operable by [illegible] Date 10/ [illegible]

Read Above Items by [illegible] Date 11/23 1962

Start-Up OK'd by [illegible] 0750 PST Date 11/23 1962

H/x 3440

Zeros: 000.47, 00.458 ("h" up in remote bottle)

Inst. chans: K-1 & K-2 on 10x10-12, PM-2 1000 V, PM-1 780 V. Meter level to go down to ≈ 0.3 mA to trip. K-1 bi level trips before low level.

Low Trip: K-1, K-2, PM-1, PM-2

Not critical.

1345 Same as above, with spacing 1.025 in. side-to-side.

Subcritical. ~~Mg~~ Mg T = 31.8 sec.

Expt. 67C

11/26/62 3x3x3 Bare array of 5-liter Bottles

START-UP CHECK LIST

Equipment Checked by RKR Personnel Check by EDC

Instrument and Safety Circuits Tested by RKR

Source In Checked by RKR Source No. M-43

Emergency Equipment and Room Checked by EDC

Red Light On by RKR AM

Start-Up OK'd by RKR 1322 PM Date 11/26 1962

Side-to-side separation 0.95 in.

Reads 0.000.47 in, 15-500 in. ½" inside bottles.

Banks: K-1, K-2, PM-1, PM-2

Critical with foils ≈ 1" into tubes.

Inner tubes still foils, K-1 subcritical reversed.

Repeat:

Critical with foils slightly (?½" into tubes)

238 Expt. 68

12/4/62 Same Array as expt. 67

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by IDC
Instrument and Safety Checked and Reset by EJ
"Source In" Checked by IDC Source No. 47-43
Emergency Equipment in Control Room Checked by IDC
Red Light On by RKR
Start Up OK'd by RKR at the 1515 PM Date 12/4 1962

PM-1 required 800 volts to trip. Set 500
PM-2 " " 1300 " " " " Set 1000
K-1 & K-2 checked 10×10⁻¹², left for startup.
K-1, K-2, PM-1, PM-2 in trip.
2 errors (0.5" into bottle) 0.46", 0.497"
Accelerator and associated equipment installed to pulse array. Blade installed to travel between center and center row of bottles in Top Layer. Speed ≈ 7½"/min.

Plumbing changes resulting in loss of a few liters of soln. Therefore there is not sufficient left in manifold to fill bottles.

1545 - Lamp
Probe light still on @ 1700.
12/5/62 Cleaned ½" filter several times. Rotometer has much "paint" in it. Probably needle valve also.

Expt. 68D

17576w Repeat of Expt. 68

START-UP CHECK LIST
Equipment Checked by RKR Personnel Check by EDC
Instrument and Survey Checked and Reset by RKR
"Source In" Checked by RKR Source No. M-43
Emergency Equipment and Control Room Checked by EDC
Red Light On by RKR AM
Start-Up OK'd by RKR Time 1130 PM Date 12/5 1962

K-1 & K-2 tripped for instr. check on 10×10⁻⁶.
PM-1 required 810 V to trip
PM-2 required 1200 V to trip, which is
near the limit of the power
supply.
In Trip: K-1, K-2, PM-1, PM-2.
Did not attempt to completely fill bottle
because of evidence of filter plugging
(Pump will [illegible] pulse light comes on &
during "feed" with drain valve open;
when level does not increase when
feeding.) Cleaned all 3 filters.
Gear off motor (transmitter) on chan. humidity

1330 Starting.
1415 Critical with adjustment at twelve.
Established period for DWM.
1440 Data
1) Evidence of clogging filters.
2) Blade (probably Cd sprayed on Fe) is a
poison, but not sufficient for pulsing;
will add short Cd to blade.
3) Array more reactive with the addition
of reflectors & accelerator around it.
4) Count rate just back to 7100 cps at bottom

Expt #68C

START-UP CHECK LIST

Equipment Checked by RKR — Personnel Check by E.D.C

Instrument and Safeties [illegible] by RKR

"Source In" Checked by RKR — Source No. M-43

Emergency Equipment [illegible] Checked by I.D.C

Red Light On by RKR — 8:30 AM

Start-Up OK'd by RKR — Date 12-6 1956

K-1 K-2 Trip at 10×10^{-12} amps about 3" away.

PM-1 Trip at 510 v

PM-2 Trip at 1250 v

all on in Trip; Probe light on dump valve ok.

All blade drive in & out ok.

0927 Just critical in tubes.

After pulsing array and repeating, shut down at 12:52

After shut down Victoreen reading 20 mR @ contact.

1330 Start up after changing to BF^3 Counter.

Just critical at 1400

1450 Shut down - Array was reading less than 20 mR at shut down.

	h	h	
R-1	= 17.8	= 7.01	= 6.995 or 7.00
R-2	17.75	= 6.99	
R-3	17.8	7.01	
R-4	17.7	6.97	
R-5	17.8	7.01	= 6.998 or 7.00

I. D.

R-1 - 7.50

R-2 - 7.50

R-3 - 7.54

R-4 - 7.48

R-5 - 7.48

avg I.D. = 7.49

C-1 M-1 0,812

BF-3 0,80

LAST MONTH

NOVEMBER

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

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3		
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

NEXT MONTH

JANUARY

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

ENGAGEMENTS — FRI. 2 DEC. — MEMORANDA

5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00
12:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30