UCRL-MI-135701-PH-1-VOL-1

Array Experiments (Phase 1) Volume 1 (with Deletions)

September 2002 (date of release)

U.S. Department of Energy

Lawrence
Livermore
National
Laboratory

This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

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Conference with R. Hughey and E. Hill from USAEC-SAN on 8/30/64.

Purpose of this meeting was for the AEC people to find out what our intentions were in assays area. (They had been shown our proposal memo., COPP-64-28, by A. Bladen, who has begun procedures for obtaining allocation of the plutonium.)

Their interests were generally: Hughey - materials allocation and Hill - operational safety.

I described our plans in the light of the description beginning on page 4.

I told them that we regard this program as a weapons related program, which, we understood, was exempt from the formal hazards analysis requirements of reactor-oriented programs.

They recommended that we perform a minimal study to evaluate the credible accident:

1) If the yield is within the scope of the Bldg 110 hazards summary report, prepare a statement to that effect; or

2) if the yield exceeds the scope of the existing hazards summary report, prepare an addendum to the Bldg 110 hazards summary report to cover the assay experiments.

Conference with A. Williams, A. Bladen, M. Harris 8/3/64

A. Williams went to Hanford 7/31/64 to discuss procurement of the assay units.

Their current position is that "weapons grade" Pu is in short supply currently ($Pu^{240} \sim 6\%$). They suggested that if we could use "unclassified" Pu ($Pu^{240} > 6\%$) the procurement problems might be greatly eased. The product which would be available would ~~be~~ be $7\frac{1}{2} - 8\frac{1}{2}\%$ Pu^{240}. From operational viewpoint this should be satisfactory; however, must evaluate from Oscar Kolar's viewpoint.

The proposed unit for the assay is a 3 kg cylinder in a can 2.59" ($2\frac{19}{32}$) I.D. ~~There~~ would be ~ 5 mils clearance laterally. This would permit pretty accurate indexing of location of the Pu part. The can would be sealed in the usual manner, cleaned of smearable α-contamination and painted with acrylic paint.

Latest estimate on price and availability is a change from previous time:

1) \$30,000 cost of processing

2) Availability 90 days after release of material. (Need clarification: full delivery in 90 days or partial delivery earlier?)

8/11/64

O. Kolar agreed that the "unclassified" Pu would be adequate for our needs for the simple assays. Informed Max Harris of this decision.

Discussed the program support generalities with Dick Adelmann. Still is considerable uncertainty about what division will sponsor this program; Dick suggested that the various key figures concerned would have to work this out.

9/23/64

Conference with Z. Zauchvalter, W. Miller, M. Harris, O. Kolar, A. Williams.

What are cost requirements?

What magnitude of cost for Pu units?

Custom can should cost ~ $2,000

1) Cost estimate for Hanford proposal.

2) Cost estimate for custom can approach.

Getting Pu material.

1) Off-spec. availability not good; hence will require an order for "weapons quality" material.

Nov 6 1964

Comparison between Lab BF_3 and Westinghouse BF_3

Source - ~~Pu~~Be MRC-52 $> 10^6$ n/sec

#1 Chambers 3" away from source

Lab. Spade Beckman BF_3	6.5×10^{-13}
Lab. BF_3	8×10^{-13}
Westinghouse BF_3	1.2×10^{-10}

#2 Chambers $23\frac{1}{4}$" away from source

Lab BF_3	8×10^{-14}
Westinghouse BF_3	1.2×10^{-11}

Westinghouse more sensitive than Lab BF_3 by a factor of 150 with a PuBe source energy spectrum

Louis Sherman
Arnold Reyenga

11/24/64

Array unit storage racks. The storage racks are designed to provide a minimum of 8 inch center-to-center spacing for storage of array units. The framework is shown in LRL Drawings #

~~66~~ 64-119656
64-119637
64-119623
64-119597

In addition each unit will be contained in a watertight box with a gasketed lid held on with snap fasteners.

Misc. Information 1/18/65

Project responsibilities: DMA Ofc. Project Officer: F. Fairbrother

W-Div Project Manager: Don Gath 8202

Account Numbers: Personnel Time 5110-65

All procurement 5110-85

Accountability requirements for billets (per O. Meadors)

Need way to check wt. of each unit:

1. Tare wt. for can
2. Net wt. of Pu

Need individual unit number reasonably permanently attached.

Also need total Pu and net Pu^{239}

Based upon Williams trip to Hanford 1/15/65, we should expect the following:

1. Chemical analysis of all billets (see next pages
2. Isotopic analysis of every 5th billet.
3. Density variation within 19.40 - 19.60 g/cc.

Because of insufficient wheelbase in dollys on machine it was decided to build new assembly machine instead of using current one. Overall extent for array structure set at 7 ft on each edge of a cube.

Will also get a weighed (~5g) sample of same lot of material as billet #1 for use in determining self-multiplications in total immersion counter.

GENERAL ELECTRIC
COMPANY

RICHLAND, WASHINGTON . . . TELEPHONE WHitehall 2-1111
Extension: 2-7504

HANFORD ATOMIC PRODUCTS OPERATION
CHEMICAL PROCESSING DEPARTMENT
234-5 Bldg., 200-W Area

December 31, 1964

Mr. M. E. Harris 7101
University of California
Lawrence Radiation Laboratories
Building 102, Room 2458
P. O. Box 808
Livermore California

Dear Mr. Harris:

PLUTONIUM ANALYSIS

The following information is forwarded in response to your telephone inquiry concerning analyses performed at Hanford on plutonium. The following elements are analyzed routinely by emission spectrograph methods:

ELEMENTS	LOWER DETECTION LIMIT (ppm)	ELEMENT	LOWER DETECTION LIMIT (ppm)
Al	5	Mn	5
As	20	Mo	10
B	1	Ni	5
Be	1	P	100
Bi	5	K	5
Ca	5	Si	20
Cd	20	Ag	1
Cr	2	Na	2
Cu	1	Ti	20
Ge	2	Sm	2
Fe	50	Tl	2
Pb	2	V	50
Li	1	Zn	20
Mg	2		

(cont. next page)

GENERAL ELECTRIC

The method used in film reading at this location is visual comparison of film densities to standard lines. Readings are therefore accurate within a factor of two except for iron which, by virtue of applying densitometric procedures, is precise to ± 20%.

Details of our emission spectograph methods are outlined in HW-53368, "Analytical Technical Manual, Chemical Processing Department, Hanford Atomic Products Operation". It is up to date except for the fact that the cupferron procedure for determining Al, Ca, Be, and Ti has been replaced with a sodium-fluoride carrier technique similar to the gallium-carrier technique. Our engineering Files records indicate that two copies were sent to LRL. You may want to inquire in typical places at LRL to locate a copy and refer to it.

Another document which you may want to examine is HW-68159, Revision 1, "Plutonium Product Specifications Analyses". Copy 6-A was forwarded to Dr. M. D. Martin. This document describes briefly analyses that are performed on plutonium metal at Hanford. You will note that analytical procedures other than those we have discussed are presented.

If you require additional information, we shall be happy to try to provide it.

L. I. Brecke
Manager
Weapons Fabrication Operation

LI Brecke:RAZ:jdw

Accident situations for Hazards Review

1. Magnitude of accident with 2% reactivity step increase.

2. Startup accident - I:
   a. Lattice spacing for 64 - 6 kg units is 0.5 cm less than critical value. (error #1)
   b. Period channel fails to provide scram (error #2)
   c. Scram occurs on power channels at 3×10^{-9} amp (0.5 watt).
   d. Closure speed for final 3 inches is 1 in./min.
   e. Max. response time for scram 5 sec
      (1) Max. for meter 5 sec (Meter response time 2.3 τ)
      (2) Circuit response 0.06 sec
      (3) Table motion sec
   f. Source level $60 \times 3.84 \times 10^5 = 2.3 \times 10^7$ n/sec
   g. Closure continues until scram occurs (error #3)
   h. Overshoot depends upon instantaneous period at time scram initiates.

3. Startup accident - II:
   a. All conditions of 2. are applicable except c.
   b. Scram occurs on power channels which are erroneously set on their least sensitive ranges - 3×10^{-7} (~~150~~ 50 watt) (errors #4 and #5).

1/22/64

Further examination of RC circuit characteristics shows that in range of 0.1 to 5 sec periods, the Beckman meter response time goes as 2.3 × Period. Total time

when table begins to move will then be $2.3\tau + 0.06$ sec. Various calculated values are then:

τ_{sec}	t_{resp} (sec
0.1	0.3
0.5	1.2
1.0	2.4
5.0	11.5

3/5/65

Had meeting with Special Material Staff: Harris and Bladen, Williams, and a man from ALOO Materials Staff about plutonium procurement.

We derived a schedule which we believed would be workable from our viewpoint:

Assy. Machine	Array	#Units	Total kg. Pu	Date Required	Increment of Pu Mass
Small	2^3	8	24	5/1/65	27 (+ some spares)
Large	3^3	27	81	8/1	63
"	4^3	64	192	10/1	114
"	5^3	125	375	12/1	187

Man from ALOO ~~thought that~~ first two dates could be met; latter would ~~~~ probably come in smaller increments. All material would be weapons grade, not high Pu^{240}. This is not a firm commitment, of course.

WEAPONS MANUFACTURING SECTION
ANALYTICAL LABORATORY REPORT
6-10-65

Customer: Lawrence Radiation Laboratory
SANL-235000

Material: Plutonium Metal

Spectrographic Analysis - parts per million parts plutonium

Serial No.	Ag	Al	As	B	Be	Bi	Ca	Cd	Cr	Cu	Fe	Ge	K	Li	Mg	Mn
LRL-001	L1	L2	--	L2	--	--	2	--	L1	L5	L25	--	2	--	5	5
002	L1	L2	--	L2	--	--	500	--	20	L5	L25	--	2	--	5	10
003	L1	2	--	L2	--	--	10	--	1	L5	L25	--	2	--	5	20
004	L1	2	--	L2	--	--	20	--	50	5	L25	--	2	--	5	10
005	L1	2	--	L2	--	--	50	--	20	L5	L25	--	2	--	10	20
006	L1	L2	--	L2	--	--	2	--	L1	5	L25	--	2	--	10	5
007	L1	2	--	L2	--	--	5	--	L1	L5	L25	--	2	--	5	5
008	L1	L2	--	L2	--	--	L2	--	2	L5	L25	--	10	--	5	10
009	L1	L2	--	L2	--	--	5	--	L1	L5	L25	--	2	--	L2	2

Serial No.	Mo	Na	Ni	P	Pb	Si	Sn	Ti	Tl	V	Zn	TMI*	C	Percent** Purity
LRL-001	--	2	20	--	L1	L15	2	L2	--	--	--	92	80	99.98
002	--	1	100	--	L1	L15	2	L2	--	--	--	693	100	99.92
003	--	5	20	--	L1	L15	2	L2	--	--	--	118	130	99.98
004	--	L1	100	--	L1	L15	2	L2	--	--	--	143	120	99.97
005	--	2	20	--	L1	L15	2	L2	--	--	--	179	110	99.97
006	--	2	20	--	L1	L15	2	L2	--	--	--	97	70	99.98
007	--	50	20	--	L1	L15	2	L2	--	--	--	143	80	99.98
008	--	10	20	--	L1	16	2	L2	--	--	--	115	95	99.98
009	--	20	L1	--	L1	L15	2	2	--	--	--	88	120	99.98

* Total Metallic Impurities
** 100% - $\sum$ (TMI + carbon)

Receiving Inspection of Pu Slugs - Phase I

Tare = 27.0 g

Identifying Marks	Contamination Status	Container Condition	Slug Wt. kg	Tare Wt. kg	Net Pu Wt. kg
1. LRL-001-3026	N.D.	OK	tare weighed	with wts.	3.026
2. LRL-002-3036	N.D.	FAIR wrinkle in edge of can bottom	"	Tare 27.0 g	3.037
3. LRL-003-3032	N.D.	OK	"		3.043
4. LRL-004-3019	N.D.	OK	"		3.020
5. LRL-005-3004	ND	OK	"		3.004
6. LRL 006-3029	N.D.	OK	"		3.029
7. LRL 007-3013	ND	ok	"		3.013
8. LRL 008-3020	ND	OK	"		3.021
9. LRL-009-3030	N.D.	OK	tare weighed	with wts.	3.032
10 HS-001	—	—			9.620 g

Remarks:

Billet temp.: 94°F
Room temp.: 66°F

Ave. Billet Wt., kg = 3.025

Standard Deviation, kg = .012
= 0.4%

WEAPONS MANUFACTURING SECTION
ANALYTICAL LABORATORY REPORT 6/10/65

Uncertainty not known

Isotopic Analysis - weight percent

Serial No.	Mass Spectrometer Pu 239	Pu 240	ngs*	Pu 241	Pu 242	ngs	Neutron Counter Pu 240	ngs	Net Weight	Plutonium wt.
LRL-001	93.675	5.871	59.9	0.440	0.014	0.2	5.93	60.5	3,026	3,025.4
002	93.579	5.978	61.0	0.425	0.018	0.3	5.96	60.8	3,036	3,033.6
003	93.539	5.968	60.9	0.477	0.016	0.3	5.98	61.0	3,032	3,031.4
004	93.702	5.837	59.6	0.447	0.014	0.2	5.82	59.4	3,019	3,018.1
005	93.782	5.759	58.8	0.445	0.014	0.2	5.80	59.2	3,004	3,003.1
006	93.643	5.894	60.1	0.450	0.013	0.2	5.90	60.2	3,029	3,028.4
007	93.700	5.844	59.6	0.442	0.014	0.2	5.80	59.2	3,013	3,012.4
008	93.639	5.894	60.1	0.453	0.014	0.2	5.88	60.0	3,020	3,019.4
009	93.656	5.887	60.1	0.445	0.012	0.2	5.91	60.3	3,030	3,029.4
		Ave	60.0				Ave	60.1		

* See page 31 in this log

(These numbers from HANFORD)

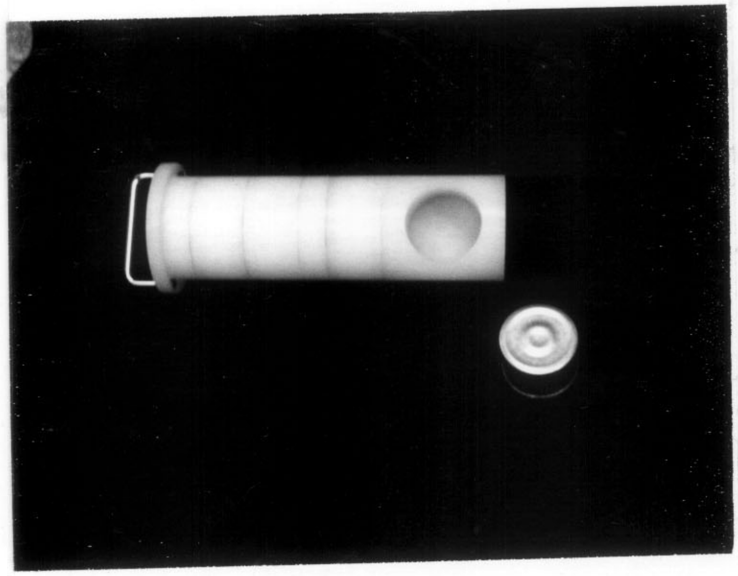
* Calculated ngs based on Pu^{240} only

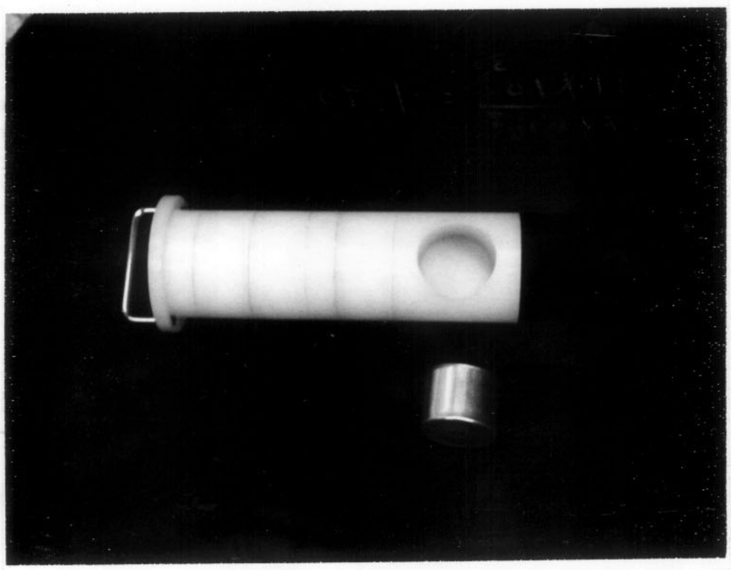
Approved: R. J. Sorenson

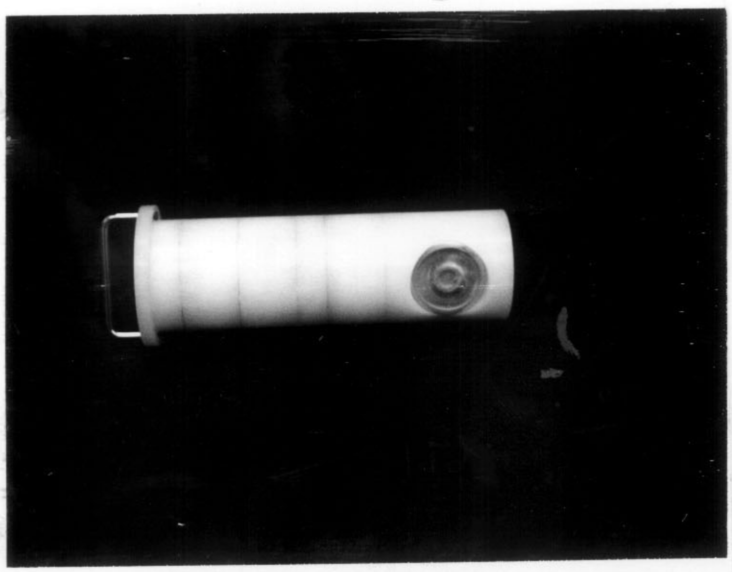
By p 715 ANL 5800 Pu^{240} is $1.01 \pm 0.02 \times 10^{3}$ n/g sec; Pu^{242} is 1.7×10^{3} n/g sec, Pu^{239} 3×10^{-2}

Determination of Neutron Emission Rates

Photographs of Slug, Sample Holder, and Counter Setup: ↓ P-38







B.G.

314
313
627 c / 45 min = 13.7 c/m

Ball
1282.1 c/min

Ball − B.G = 1268.4 c/min

~~eff = $\frac{2.25}{\frac{2.4 \times 10^3}{1.2684 \times 10^{+3}}}$ = 1.77 = 1.89 × 10⁶~~ Wrong JRMW

Conversion factor = $\frac{2.41 \times 10^3}{1.268 \times 10^3}$ = 1.90

Wt. of historical sample 9.620 grams.

7-7-65
B.G. 17.4 c/min
Ball 32,454 c/25.2 min = 1288 c/min

Ball − BG = 1270.5 c/min

Sample
26126 c / 75 min 357.9 c /min
−BG = 340.5 c

Conv. factor = ~~$\frac{2.25 \times 10^3}{1.2705 \times 10^3}$ = 1.77~~ = $\frac{2.41 \times 10^3}{1.270 \times 10^3}$ = 1.90

$\frac{340.5 \times 1.90}{9.62}$ (1.90 replaces ~~1.77~~) = 67.1 ~~62.7~~ ngs

Emission Rates (cont.)

Room Temp.: 66°F

Billet Temp: 94°F (ΔT = 28°F)

Std Pu sample = ~~2.4 × 10^3 n/sec~~ 2.41 ± 5% × 10^3 n/sec   n/sec = c/m × 1.77 × 10^5

Sample	c/m	Bkg c/m	Net c/m	N (n/sec)	n_o (n/g sec) *	m Sample mass kg	$m n_o$ Sample Base Rate	M_s $(= \frac{N}{m n_o})$
009	0.5 min: 102847, 97217	13 c/m	4.00×10^5	7.58×10^5	66.9	3.032	2.028×10^5	3.74
004	99922, 98567	↓	3.97×10^5	7.52×10^5	65.9	3.020	1.990×10^5	3.78
007	99538, 94200	↓	3.87×10^5	7.33×10^5	65.7	3.013	1.980×10^5	3.70
002	103206, 100368	↓	4.07×10^5	7.70×10^5	67.4	3.037	2.047×10^5	3.76
001	101278, 96623	↓	3.96×10^5	7.50×10^5	67.1	3.026	2.030×10^5	3.69
005	97844, 95075	↓	3.86×10^5	7.31×10^5	65.7	3.004	1.974×10^5	3.70
006	101118, 98640	↓	4.00×10^5	7.58×10^5	66.8	3.029	2.023×10^5	3.75
008	101559, 98387	↓	4.00×10^5	7.58×10^5	66.5	3.021	2.009×10^5	3.77
003	104016, 100377	↓	4.09×10^5	7.75×10^5	67.6	3:043	2.057×10^5	3.77
HS001	12981, 13145 (75 min)	17	340	644	67.1	9.620 g	(<±1% for this value)	

From Hanford data and Pu^{240} emission rate of $1.02 \pm 0.02 \times 10^3$ ngs we calculate should be 60.5;

* All normalized to fit part 1 and HS1

Average N = 7.53×10^5 ; S.D. of N = 0.15×10^5 (2.0%) ; Average $\frac{N}{m}$ = 2.49×10^5 ; S.D. of $\frac{N}{m}$ = 5%

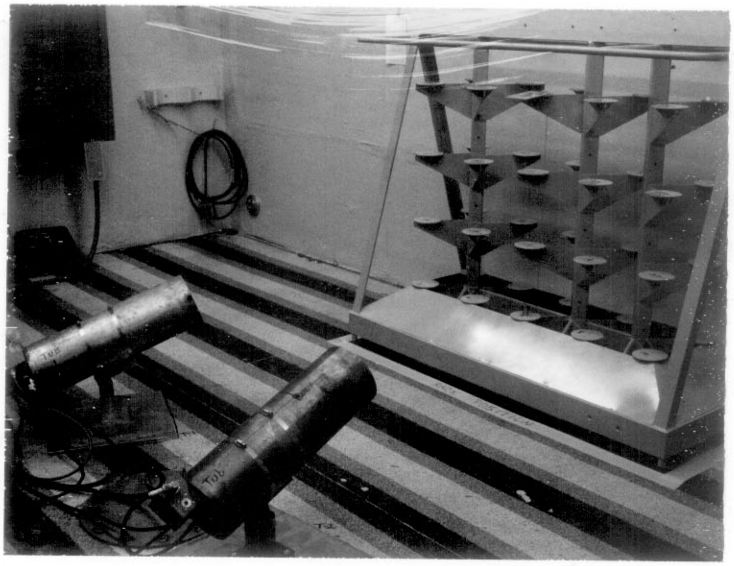
Source P-11 = 1.42×10^7 n/sec
Source M-253 = 7.51×10^6 n/sec

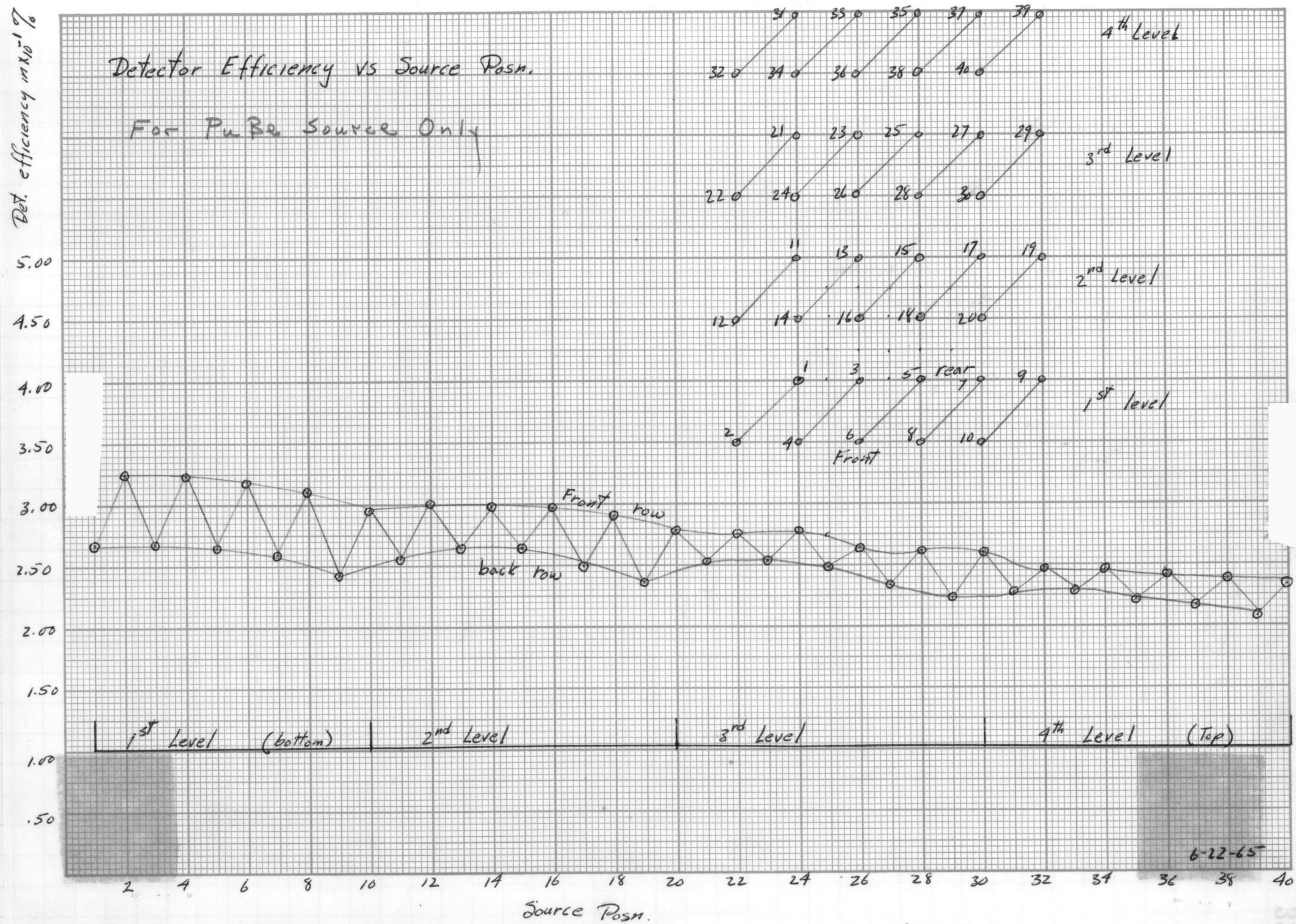
6-22-65

DATA IN THIS TABLE VALID ONLY FOR PuBe Source Spectrum

Source posn	Tub 1	Tub 2	Total	Eff $\times 10^{-3}$
1	20839 /min	17192 /min	38031	2.68
2	25972	20226	46198	3.25
3	19110	18878	37988	2.68
4	23374	22586	45960	3.24
5	17749	19886	37635	2.65
6	21302	23846	45148	3.18
7	16152	20766	36918	2.60
8	18884	25275	44159	3.11
9	13253	21123	34376	2.42
10	16488	25444	41932	2.95
11	19351	16996	36347	2.56
12	23440	19313	42753	3.01
13	18698	18969	37667	2.65
14	21506	20889	42395	2.99
15	18062	19588	37650	2.65
16	19775 19782	22390 22242	42165 42024	2.97
17	16105	19185	35290	2.49
18	18153	23193	41346	2.91

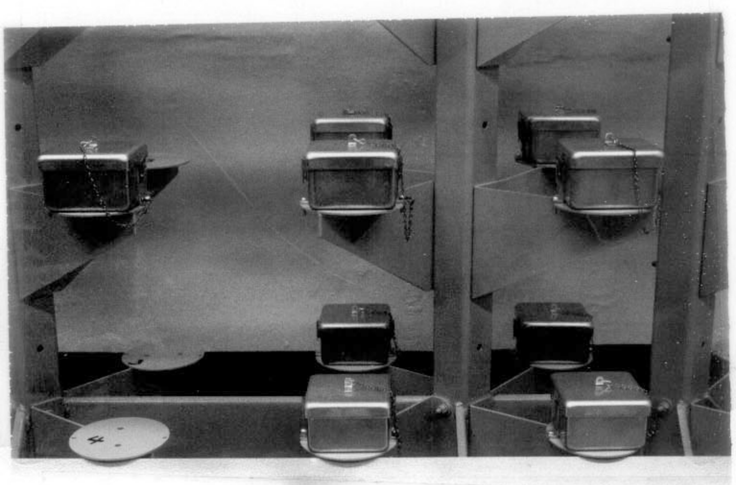
Source Posn	Tub 1	Tub 2	Total	Eff × 10^{-3}
19	13397	20099	33496	2.36
20	16008	23544	39552	2.79
21	19578	16401	35979	2.53
22	{ 20980	{ 17745	38725	2.75
	{ 21049	{ 18213	39262	
23	17714	18154	35868	2.53
24	19636	19866	39502	2.78
25	17115	18249	35364	2.49
26	17786	19680	37466	2.64
27	13981	19180	33161	2.34
28	16669	20508	37177	2.62
29	12362	19355	31717	2.23
30	15537	21582	37119	2.61
31	17574	14833	32407	2.28
32	18642	16424	35066	2.47
33	16104	16444	32548	2.29
34	17705	17323	35028	2.47
35	15258	16183	31441	2.21
36	16108	18274	34382	2.42
37	13269	17612	30881	2.17
38	15229	18616	33845	2.38
39	11638	17936	29574	2.08
40	{ 13965	{ 19070	33035	2.34
	{ 14078	{ 19098	33176	





Detector Efficiency vs Source Posn.
For PuBe Source Only
Det. efficiency in x10^-1 %
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
.50
4th Level
3rd Level
2nd Level
1st level
rear
Front
Front row
back row
1st Level (bottom)
2nd Level
3rd Level
4th Level (Top)
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
Source Posn.
6-22-65

Billet Posn For Phase 1



Increase base rates by 1.11

7/7/65

Counting Multiplications in Storage Rack

Part #	Position	cts	Δt	c/m	c/s	M
003	5	13453 15064	20	1425	23.7	

wt 3.043 kg ngs 61.0

base rate = 1.85×10^5 d/s × 2.65×10^{-3} = 4.90×10^2 = 490 c/s

Part #	Position	cts	Δt	c/m	c/s	M
008	7	12345 14668	10	2702	45.0	

wt 3.021 ngs 59.2

base rate = 1.79×10^5 d/s × 2.65×10^{-3} = 465 c/s

Since the above numbers are ridiculously low there is obviously some problem somewhere. Array parts put away.

1. Check efficiency factors again with PuBe sources P-11 and M-252 for position #26. Checked out exactly the same for these sources.

2. Since PuBe sources have quite a bit faster neutron spectra than a nominal fission distribution, check efficiency factor for position #26 with Pu plug ball

7/8/65

	Position	cts	Δt	c/m	c/s
Plug ball	26	4670 5870	100.1	8.50	0.142
Bkg	—	55 67	60	2.04 (Pu not in entry to A Cell today)	

Efficiency factor for #26 for this spectrum is then

$$\frac{1.42 \times 10^{-1}}{2.41 \times 10^{3}} = 5.90 \times 10^{-5} \text{ or}$$

$$\frac{6.31 \times 10^{-5}}{2.64 \times 10^{-3}} = 2.56 \times 10^{-2}$$ of efficiency factor for PuBe source

Check Proportionality of Eff. Factors for both Pu spectrum and PuBe source spectrum:

$\frac{1}{26}$:	$\frac{6.18}{6.31} = 0.979$	$\frac{2.68}{2.64} = 1.02$	$\frac{6.18}{2.68} = 2.30$
$\frac{2}{26}$:	$\frac{7.50}{6.31} = 1.19$	$\frac{3.25}{2.64} = 1.23$	$\frac{7.50}{3.25} = 2.30$
$\frac{39}{26}$:	$\frac{5.03}{6.31} = 0.797$	$\frac{2.08}{2.64} = 0.788$	$\frac{5.03}{2.08} = 2.42$ } top level
$\frac{40}{26}$:	$\frac{5.51}{6.31} = 0.873$	$\frac{2.34}{2.64} = 0.886$	$\frac{5.51}{2.34} = 2.36$ } top level
$\frac{25}{26}$:	$\frac{5.73}{6.31} = 0.908$	$\frac{2.49}{2.64} = 0.943$	$\frac{5.73}{2.49} = 2.30$
$\frac{3}{26}$:	$\frac{6.18}{6.31}$ 0.979	$\frac{2.68}{2.64} = 1.02$	$\frac{6.18}{2.68} = 2.30$
$\frac{5}{26}$:	$\frac{6.10}{6.31} = 0.967$	$\frac{2.65}{2.64} = 1.00$	$\frac{6.10}{2.65} = 2.30$
$\frac{6}{26}$:	$\frac{7.31}{6.31} = 1.16$	$\frac{3.18}{2.64} = 1.20$	$\frac{7.31}{3.18} = 2.30$
$\frac{7}{26}$ =	$\frac{6.02}{6.31} = 0.954$	$\frac{2.60}{2.64} = 0.985$	$\frac{6.02}{2.60} = 2.32$
$\frac{8}{26}$ =	$\frac{7.20}{6.31} = 1.14$	$\frac{3.11}{2.64} = 1.18$	$\frac{7.20}{3.11} = 2.32$
$\frac{26}{26}$ =	$\frac{6.26}{6.31}$ 0.992	$\frac{2.64}{2.64} = 1.0000$	$\frac{6.26}{2.64} = 2.37$

(Values above can all be corrected by dividing eff. factors by 1.07; ratios stay constant. JRM 7/28/65)

Recheck Efficiency Factors for Storage Racks with Part #003

Vault Temp 66 °F.

Position #	cts	Δt	c/m	c/s	d/s	eff. factor
26	13230 14964	20	1410	23.5	~~3.72~~ 3.98 × 10^5	~~6.31~~ 5.90 × 10^{-5} (normal. point)
base rate is 1.85 × 10^5 d/s,			$M_s = 2.15$			
1	15096 12486	20	1379	23.0		~~6.18~~ 5.78 × 10^{-5}
2	18740 14777	20	1676	27.9		~~7.50~~ 7.01 × 10^{-5}
39	9199 13291	20	1124	18.7		~~5.03~~ 4.70 × 10^{-5}
40	10492 14098	20	1229	20.5		~~5.51~~ 5.15 × 10^{-5}
25	12275 13280	20	1278	21.3		~~5.73~~ 5.36 × 10^{-5}
3	13641 13902	20	1377	23.0		~~6.18~~ 5.78 × 10^{-5}
5	12735 14490	20	1361	22.7		~~6.10~~ 5.70 × 10^{-5}
6	15088 17533	20	1631	27.2		~~7.31~~ 6.83 × 10^{-5}
7	11489 15402	20	1344	22.4		~~6.02~~ 5.63 × 10^{-5}
8	13589 18503	20	1605	26.8		~~7.20~~ 6.73 × 10^{-5}
26	12990 14908	20	1395	23.3		~~6.26~~ 5.85 × 10^{-5}

Part is very much cooler to the touch than when removed from birdcage this morning.

7-12-65

Posn. #	Counts	Δt	c/m	c/sec	d/s	eff factor
					3.98 ~~3.72~~ $\times 10^{5}$	
4	16846 16372	20	1661	27.7		~~7.45~~ $\times 10^{-5}$ 6.96
9	9947 15565	20	1276	21.3		~~5.73~~ $\times 10^{-5}$ 5.36
10	12107 18841	20	1547	25.8		~~6.94~~ $\times 10^{-5}$ 6.49
11	13091 11523	18	1367	22.8		~~6.13~~ 5.73
12	17229 13715	20	1547	25.8		~~6.94~~ 6.49
13	13838 14047	20	1394	23.2		~~6.24~~ 5.83
14	15880 15569	20	1572	26.2		~~7.04~~ 6.58
15	10534 11227	16	1360	22.7		~~6.10~~ 5.70
16	14375 16245	20	1531	25.5		~~6.85~~ 6.40
17	10358 12988	18	1297	21.6		~~5.81~~ 5.43
18	10457 14067	16	1533	25.6		~~6.88~~ 6.43
19	9946 14728	20	1234	20.6		~~5.54~~ 5.18

Posn #	Counts	Δt	c/m	c/sec	d/s	eff factor
					3.98 ~~3.72~~ $\times 10^{5}$	
20	10619 15800	18	1468	24.5		~~6.59~~ $\times 10^{-5}$ 6.16
21	30849 26297	44	1299	21.7		~~5.83~~ 5.45
22	15532 13364	20	1445	24.1		~~6.48~~ 6.06
23	12945 13274	20	1311 ~~1415~~	21.9 ~~23.6~~		~~5.89~~ ~~6.34~~ 5.50
24	667930 676212	940	1430	23.8		~~6.40~~ 5.98
25	12385 ~~13593~~ 13514	~~22.5~~ 20	1295	21.6		~~5.81~~ 5.43
26	13429 14867	20	1415	23.6		~~6.34~~ 5.93
27	12139 15893	22.5	1246	20.8		~~5.59~~ 5.22
28	12333 15247	20	1379	23.0		~~6.18~~ 5.78
29	10051 14909	21	1189	19.8		~~5.32~~ 4.97
30	11206 ~~9896~~ ~~16404~~ 15983	20	1359	22.7		~~6.10~~ 5.70
31	13229 11157	20	1219	20.3		~~5.46~~ 5.10

36 ✓

Posn. #	Counts	Δt	c/min	c/sec	c/sec	eff. Factor
32	13746 12265	20 min	1301	21.7	3.98 ~~3.72~~ $\times 10^{-5}$	~~5.83~~ 5.45
33	11723 12564	20	1214	20.2		~~5.43~~ 5.07
34	13063 13201	20	1313	21.9		~~5.89~~ 5.50
35	11396 12259	20	1183	19.7		~~5.30~~ 4.95
36	12233 13795	20	1301	21.7		~~5.83~~ 5.45
37	10035 13030	20	1153	19.2		~~5.16~~ 4.82
38	11658 14175	20	1287	2.15		~~5.78~~ 5.40
39						
40	10629 14432					
7/13-14						
Plug Ball Shelf 26	4516 5645	1000	10.16	6.95 c/m 0.116 ~~.169~~		
BG	362 513	273	3.21			

Eff factor $\frac{11.6 \times 10^{-2}}{2.41 \times 10^{-3}} = 4.82 \times 10^{-5}$

Essentially same as on p 34
(Suspect spurious contributions to Bkg count in this case)

All multiplications in this series must be revised downward by dividing by 1.11

Part #	Posn	c/s	Δt	c/m	c/sec	Σ d/s	~~M~~ Σ d/s Base Rate	M
.003	5	13131 14499	20	1382	23.0	4.03 ~~3.77~~ $\times 10^5$	1.85×10^5	~~2.18~~ ~~2.04~~ 1.96
.008	7	12177 14847	10	2702	45.0	7.94 ~~7.42~~ $\times 10^5$	3.64×10^5	~~2.18~~ ~~2.04~~ 1.96

B.R. 8 1.79×10^5 n/s

006	6	19617 24022	10	4364	72.7	12.0 ~~11.2~~ $\times 10^5$	5.46×10^5	~~2.19~~ ~~2.06~~ 1.97

B.R. 60.2 × 3029 = 1.82×10^5 n/s

7/14/65

002 Temp in B.C. is 104°F after overnight in B Vault at ~~room~~ temp 70°F. ΔT = 34°F

Repeat with 3, 6, and 8 as above

006	6	11889 14157	6	4341	essentially same as before			
002	8	13338 15682	5	5804	96.7	15.5 ~~14.5~~ $\times 10^5$	7.30×10^5	~~2.13~~ ~~1.99~~ 1.92

BR = 60.8 × 3.037 = 1.84×10^5 n/s

004	15	13361 15583	4	7236	120.6	19.7 ~~18.4~~ $\times 10^5$	9.09×10^5	~~2.17~~ ~~2.03~~ 1.95

BR = 59.4 × 3.020 = 1.79×10^5 n/s

009	17	11697 14050	3	8582	143.0	23.9 ~~22.3~~ $\times 10^5$	10.9×10^5	~~2.19~~ ~~2.05~~ 1.97

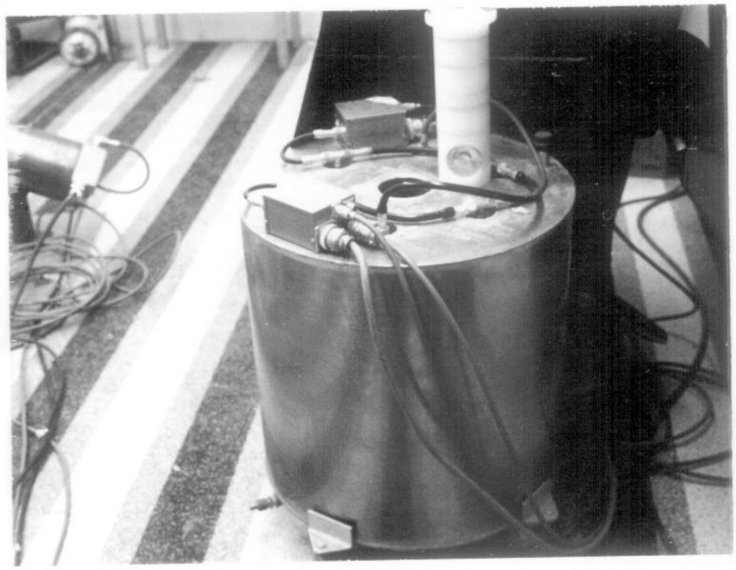
BR = 60.3 × 3.032 = 1.83×10^5 n/s

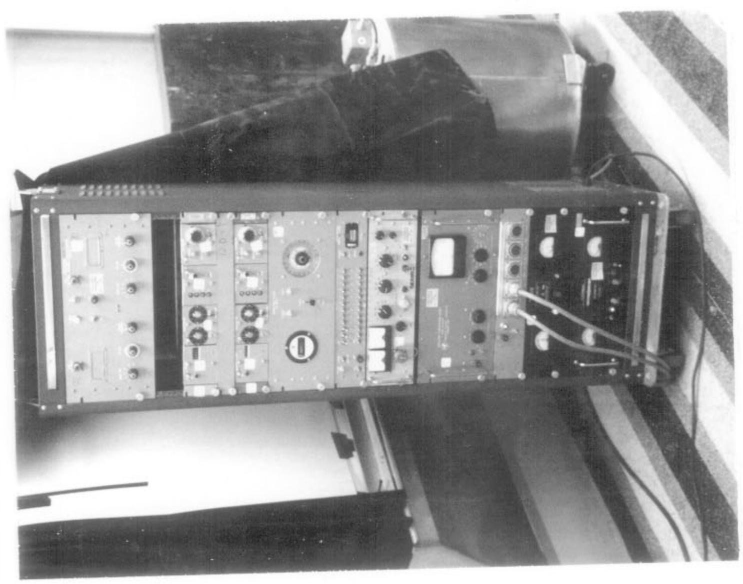
005	16	14191 16409	3	10200	170.0	28.0 ~~26.2~~ $\times 10^5$	12.7×10^5	~~2.20~~ ~~2.06~~ 1.98

BR = 59.2 × 3.004 = 1.78×10^5 n/s

001	18	16313 19014	3	11776	196.3	32.1 ~~30.0~~ $\times 10^5$	14.5×10^5	~~2.21~~ ~~2.07~~ 1.99

BR = 60.5 × 3.026 = 1.83×10^5 n/s





(cont from p 37)

Part #	Posn	cts	Δt	c/m	c/sec	Σ d/s	Σ Base Rate	M
007	3	11917 14166	2	13041	217.4	~~33.4~~ 35.7 $\times 10^5$	16.3×10^5	~~2.19~~ ~~2.05~~ 1.97

B.R. $59.2 \times 3.013 = 1.78 \times 10^5$

Hence there is essentially no multiplication due to loading in rack.

7/15/65

After parts had been in A Vault overnight at room temp. of 68°F the indicated temperature of the instrumented part was 95°F : $\Delta T \sim 27°F$

7/21/65 Critical Examination of n/gs Situation

The Pu^{240} emission rate given in ANL 5800 p 715 is $1.02 \pm 0.02 \times 10^3$ n/gs. This was calculated from the partial fission half life and the measured ν for spontaneous fission. Check this calculation:

Fission half life given for Pu^{240} is 1.22×10^{11} yrs

Neutrons/fission (ν) is 2.23 ± 0.05 (this value is in good agreement with data from several sources)

Then $\lambda_f = \dfrac{6.93 \times 10^{-1}}{1.22 \times 10^{11} \text{ yrs}} = 5.68 \times 10^{-12} \text{ yrs}^{-1}$

Convert to sec $\lambda_f = \dfrac{5.68 \times 10^{-12} \text{ yrs}^{-1}}{3.15 \times 10^{7} \text{ sec yrs}^{-1}} = 1.80 \times 10^{-19} \text{ sec}^{-1}$

Atoms/g $= \dfrac{6.02 \times 10^{23}}{2.40 \times 10^{2}} = 2.51 \times 10^{21}$

$\dfrac{dN}{dt} = \lambda_f N = (1.80 \times 10^{-19} \text{ sec}^{-1})(2.51 \times 10^{21} \text{ atoms/g}) = 4.52 \times 10^{2}$ fiss./g.s.

$\dfrac{dn}{dt} = \nu \dfrac{dN}{dt} = 4.52 \times 10^2 \times 2.23 = 1.01 \times 10^3$ n/g.s which agrees with ANL-5800 number and checks their calculation error $\pm 2\%$ (± 0.02)

Using fission rate 4.61×10^2 fiss/g sec [O. Chamberlain et al Phys Rev 94 156 (1954)] and

$\bar{\nu}_{240}$ (s.f.) = 2.189 ± 0.026 [Hopkins & Diven Nuc. Phys 48 433-42 (Oct 63)] we get

$$\frac{dn}{dt} = (4.61 \times 10^2 \text{ fiss/sec g})(2.189 \text{ n/fiss}) = \underline{\underline{1.01 \times 10^3 \text{ n/g sec}}}$$

this is best value I can derive ($\sim \pm 1\%$)

Counter eff. for incline table Source P-11 1.42×10^7 n/sec

Posn ind.	Counts / 2 min Tub 1	Tub 2	c/m T-1	T-2
full out 3972	23681	30570	11840	15285
full in 15	14851	20233		

Cross check with Cf[252] fission source 1.04×10^6 n/sec ± 4%
Source belonged to S. Block

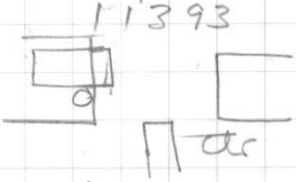
ctr 10.00 min

full out 3973.5	10788	13022	1079	1302

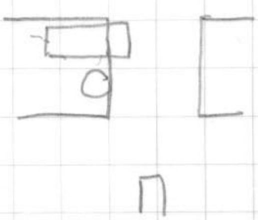
Ratio PuBe/Cf 10.97 11.74

Recheck with fission source and polyethylene block alongside the source

full out 3973.5	11393	13786	1139	1379



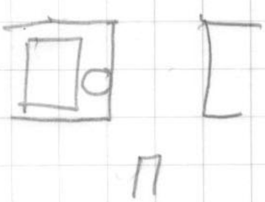
full out 3973.5	13025	3218	1303	322



Source P11

full out 39735	28335/2 min	9581/2 min	14168 c/min	4791/m

Ratio PuBe/Cf 10.87 14.88



P11

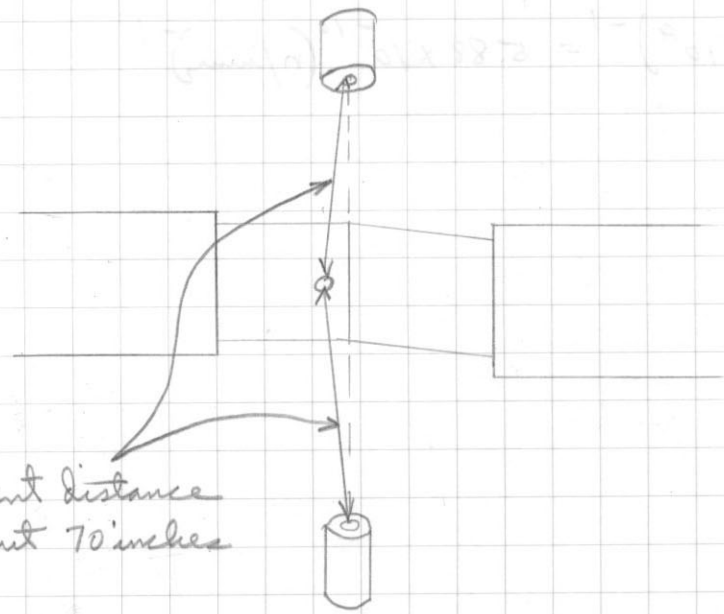
full out 39735	25857	32741	12979/min	16371/min

Ratio PuBe / Cf 11.40 11.87

Ratio of emission rates as known is 14.2

Block will let us know calibration of fission source when done.

8/2/65 Considerable experimenting was required to obtain an arrangement of counters which provided a reasonably flat counter efficiency during the closure of the horizontal table. A suitable arrangement was as shown below:



A schedule of counter efficiency factors was measured for the travel of the table sections.

Horizontal Table Efficiency vs Position

Position, cm	Count Rate T-1 / 2 min	Efficiency T-1	Norm. to Pos. 0.00=1.00	Count Rate T-2 / 2 min	Efficiency T-2	Norm. to Pos. 0.00 = 1.00
0.00	12713	7.48×10^{-6}	1.00	15374	9.04×10^{-6}	1.00
5.00	12534	7.37	0.985	15334	9.02	0.997
10.00	12768	7.51	1.00	15265	8.98	0.993
15.00	12761	7.50	1.00	15455	9.09	1.02
20.00	13058	7.68	1.03	15564	9.15	1.01
25.00	13216	7.77	1.04	15709	9.24	1.02
30.00	13218	7.77	1.04	15700	9.23	1.02
40.00	13500	7.94	1.06	15758	9.27	1.03
50.00	13424	7.89	1.05	15935	9.37	1.04

(Vertical table was fully down)

To convert emission rate - source P-11 to counts / 2 min.

1.20×10^2 sec / 2 min $\times$ 1.42×10^7 n/sec = 1.70×10^9 n/min

Iscom. factor = $(1.70 \times 10^9)^{-1}$ = 5.88×10^{-10} (n/min)$^{-1}$

Incline Table Efficiency vs Position

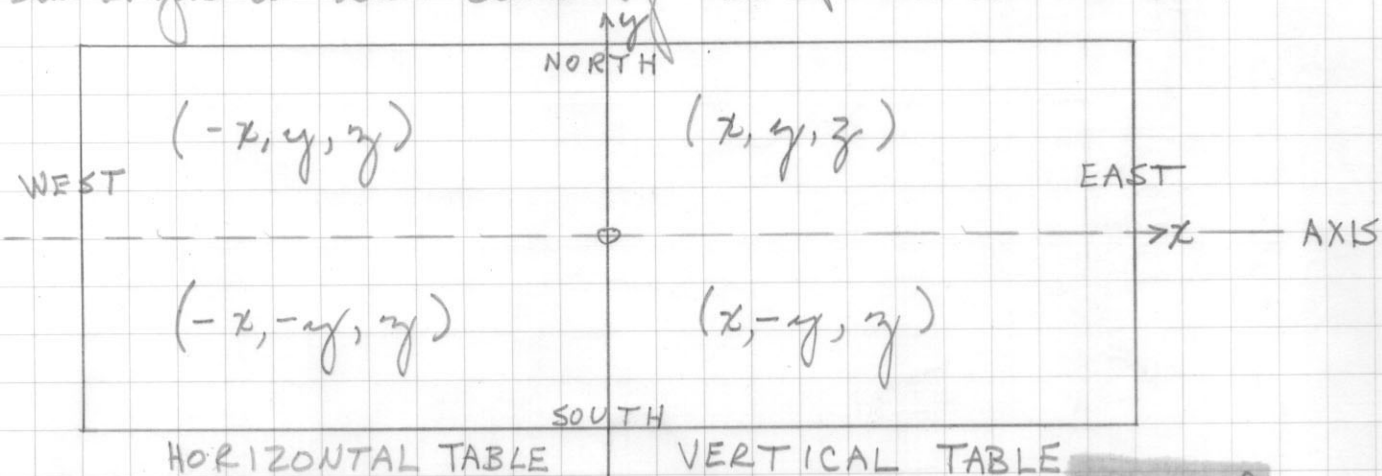
Position cm	Count Rate T-1 / 2 min	Efficiency T-1	Norm. to Pos. 0.00 = 1.00	Count Rate T-2 / 2 min	Efficiency T-2	Norm. to Pos. 0.00 = 1.00
39.73	15160	8.91×10^{-6}	1.19	17972	10.57×10^{-6}	1.17
35.00	15125	8.89	1.19	17687	10.40	1.15
30.00	14729	8.66	1.16	17544	10.32	1.14
25.00	14128	8.31	1.11	17198	10.11	1.12
20.00	14225	8.36	1.12	16834	9.90	1.09
15.00	14048	8.26	1.10	16529	9.72	1.07
10.00	13578	7.98	1.07	16021	9.42	1.04
5.00	13175	7.75	1.04	15702	9.23	1.02
0.14	12682	7.46	1.00	15386	9.05	1.00

(Horizontal table was fully back)

8/2/65

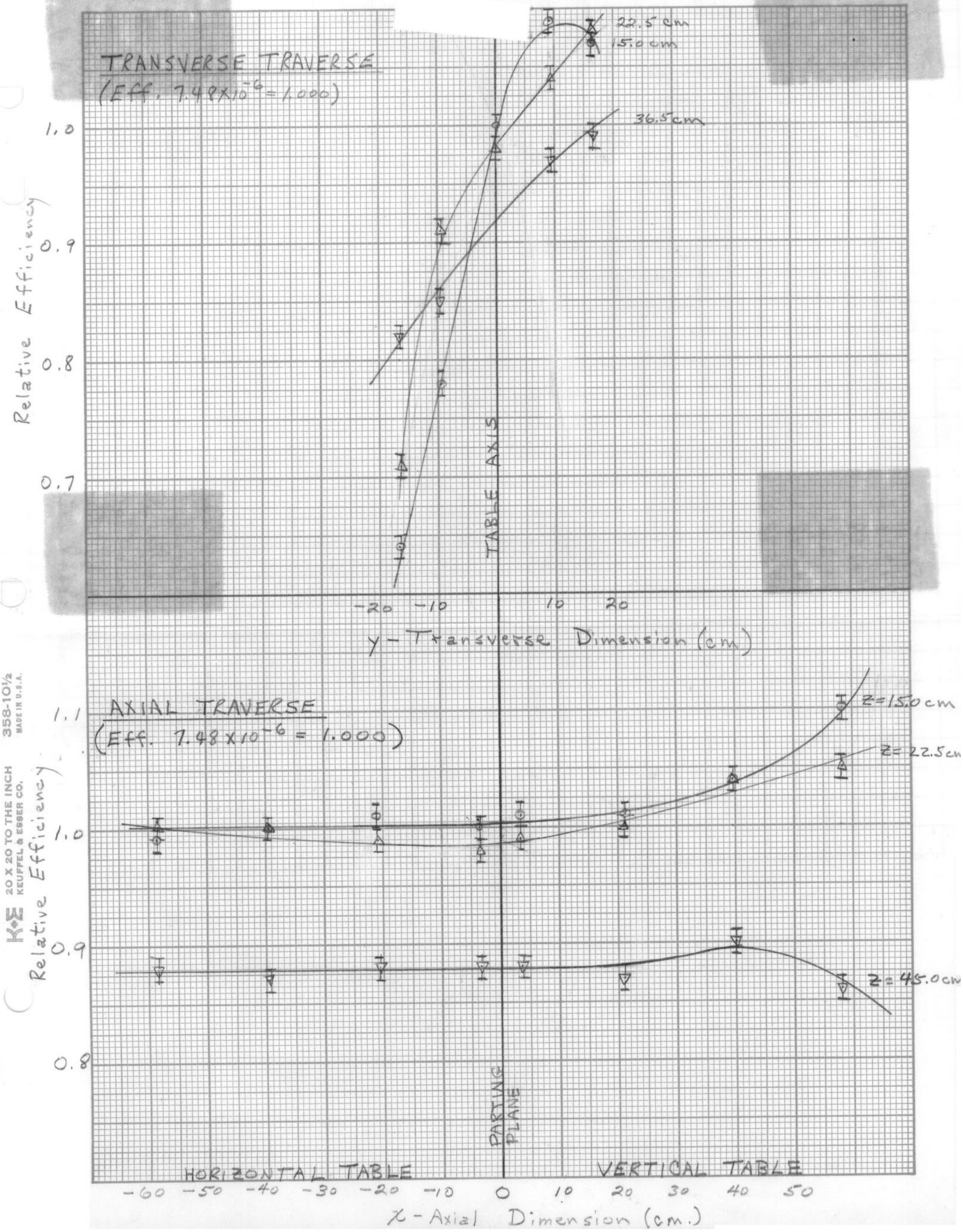
In order to describe the location of the source on the table, the following convention was adopted:

The table was divided into four quadrants with the origin at the center of the assembled halves.



The coordinates reported are the centers of the tube bases in centimeters. This orientation was selected because it coincided with the perspective view of the table through the TV monitor. For the z dimension the measurement given is from the table top to the base of the source or part. A fourth coordinate will be the indicated position of the table indicated by the sign of x.

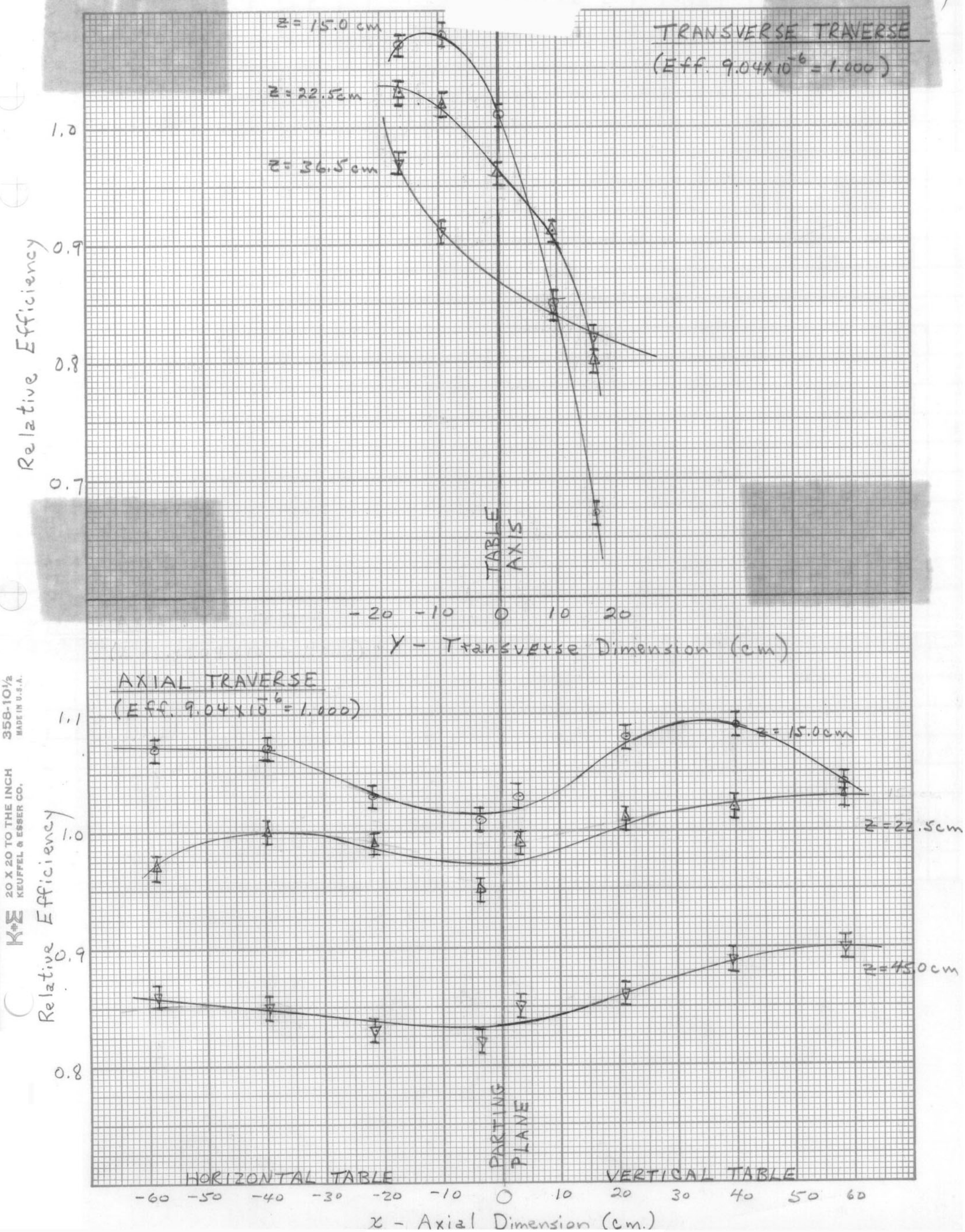
Counter 1 Transverse & Axial Variations in Counter Efficiency



A study was then made of the geometry down the axis of the table with both parts fully closed together.
Horizontal table: 0.00, Vertical table 0.14.
Note both the x and y positions of the source were varied.

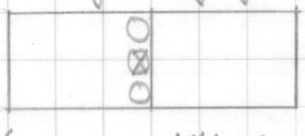
Source Position cm	Count Rate T-1/2 min	Efficiency T-1	Normalized to (-3.5,0,15) = 1.00	Count Rate T-2/2 min	Efficiency T-2	Normalized to (-3.5,0,15) = 1.00
-3.5, 0, 15	12739	7.49×10^{-6}	1.00	15546	9.14×10^{-6}	1.01
-21.1, 0, 15	12903	7.59	1.01	15896	9.35	1.03
-39.7, 0, 15	12717	7.48	1.00	16475	9.69	1.07
-58.3, 0, 15	12607	7.41	0.99	16387	9.64	1.07
-3.5, 0, 22.5	12542	7.37	0.98	14718	8.65	0.96
-21.1, 0, 22.5	12636	7.43	0.99	15394	9.05	0.99
same	12581	7.40	0.99	15399	9.05	0.99
-39.7, 0, 22.5	12694	7.46	1.00	15488	9.11	1.00
-58.3, 0, 22.5	12737	7.49	1.00	15133	8.90	0.97
-3.5, 0, 45	11212	6.59	0.88	12753	7.50	0.82
-21.1, 0, 45	11058	6.50	0.88	12846	7.55	0.83
-39.7, 0, 45	11131	6.55	0.87	13236	7.78	0.85
-58.3, 0, 45	11197	6.58	0.88	13300	7.82	0.86
8/3/65						
-3.5, 0, 15	12854	7.56	1.01	15676	9.22	1.01
same	12654	7.44	0.99	15802	9.29	1.02
same	12712	7.47	1.00	15519	9.13	1.00
3.5, 0, 15	12843	7.55	1.01	15774	9.28	1.03
21.1, 0, 15	12799	7.53	1.01	16534	9.72	1.08
39.7, 0, 15	13262	7.80	1.04	16682	9.81	1.09
58.3, 0, 15	13969	8.21	1.10	16056	9.44	1.04
3.5, 0, 22.5	12562	7.39	0.99	15183	8.93	0.99
21.1, 0, 22.5	12777	7.51	1.00	15466	9.09	1.01
39.7, 0, 22.5	13207	7.77	1.04	15736	9.25	1.02
58.3, 0, 22.5	13334	7.84	1.05	15774	9.28	1.03
3.5, 0, 45	11187	6.58	0.88	13195	7.76	0.85
21.1, 0, 45	11042	6.49	0.87	13345	7.85	0.86

Counter 2 - Transverse & Axial Variations in Counter Efficiency



Source Position cm	Count Rate T-1/2 min	Efficiency T-1	Normalized to (-3.5,0,15) = 1.00	Count Rate T-2/2 min	Efficiency T-2	Normalized to (-3.5,0,15) = 1.00
39.7, 0, 45	11480	6.75×10^{-6}	0.90	13822	8.13×10^{-6}	0.89
58.3, 0, 45	10920	6.42	0.86	13961	8.21	0.90
39.7, 0, 45	11520	6.77	0.90	13782	8.10	0.89

Following series evaluated effect of having empty tubes near source



-3.5, 0, 15	12261	7.21	0.96	14639	8.61	0.94
Empty tubes removed						
-3.5, 0, 15	12662	7.45	0.99	15332	9.02	0.99
same	12885	7.58	1.01	15693	9.23	1.01
Single D-38 part placed in tubes beside one containing source						
-3.5, 0, 15	12689	7.46	1.00	15248	8.97	0.98
same	12630	7.43	0.99	15103	8.88	0.97
The fissions of U^{238} may have contributed to increase with D-38						
-3.5, 0, 15	12154	7.14	0.95	14783	8.69	0.95
same	11943	7.02	0.94	14945	8.79	0.96

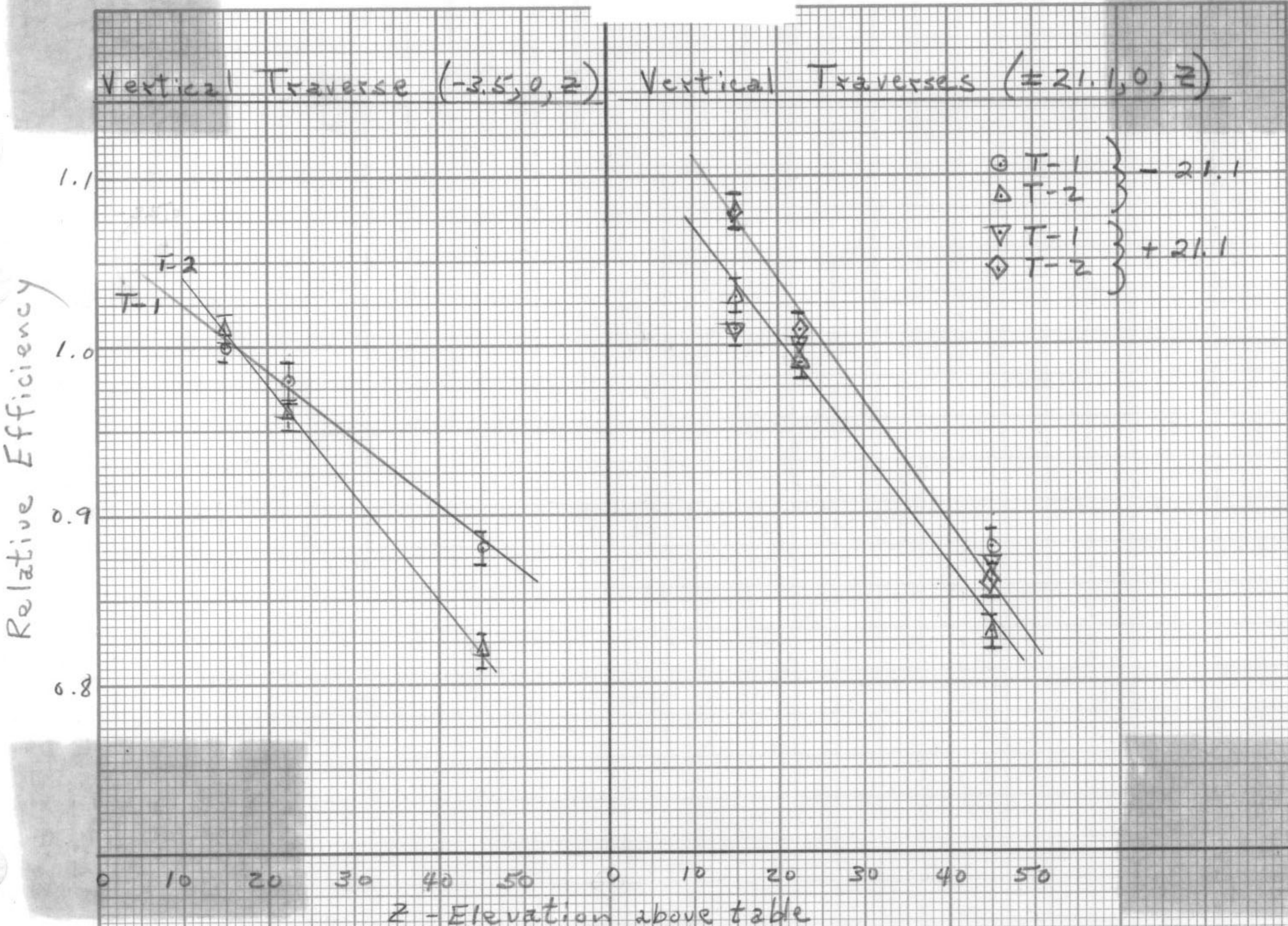
Tentative conclusions from above:

1. Presence of vertical table does not seem to alter the counter efficiencies of the source on the horizontal table, but not vice versa.
2. The counting efficiency is essentially constant for same source elevations to $z = \pm 20$ cm.
3. A high degree of symmetry is not achieved through the plane of separation.

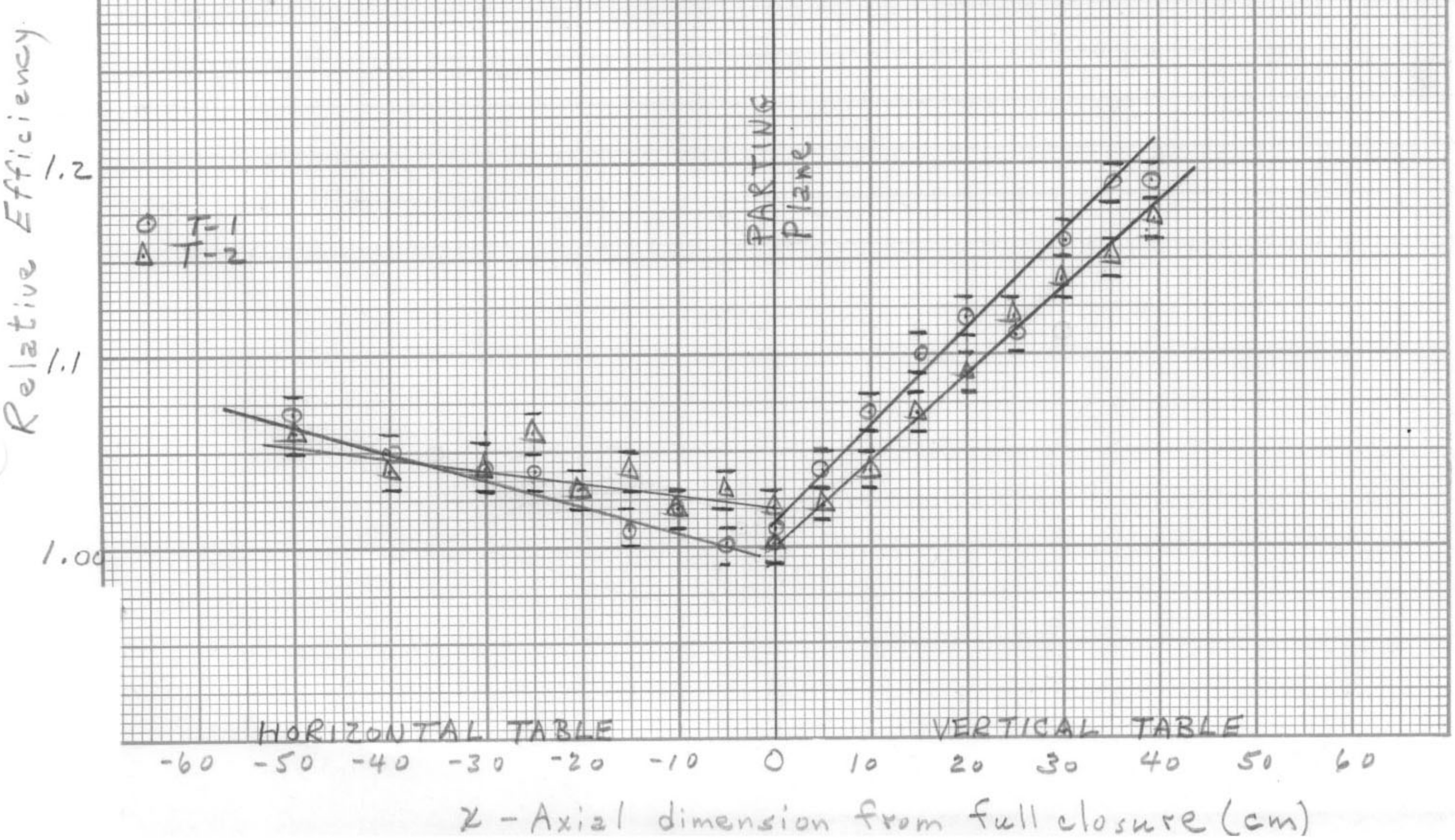
8/3/65

Following series evaluated effects of having source off the axis:

-3.5, 9.3, 15	13954	8.20	1.09	13032	7.66	0.85
-3.5, -9.3, 15	9925	5.84	0.78	16622	9.77	1.08
-3.5, 16.5, 15	13559	7.97	1.06	10378	6.10	0.67
-3.5, -16.5, 15	12216/3 min (8144)	4.79	0.64	24781/3 min (16521)	9.71	1.07
-3.5, -16.5, 22.5	13568/3 min (9046)	5.32	0.71	23736/3 min (15825)	9.31	1.03
-3.5, -16.5, 36.5	10450	6.14	0.82	14944	8.79	0.97
-3.5, 16.5, 36.5	12693	7.46	0.99	12596	7.41	0.82



Counter Efficiency Variation with Motion of Tables in Sequence ① Vertical Table ② Horizontal Table

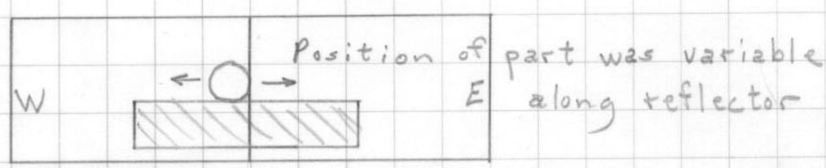


Source Position cm.	Count Rate T-1 /2 min	Efficiency T-1	Normalized to (-3.5, 0, 15) = 1.00	Count Rate T-2 /2 min	Efficiency T-2	Normalized to (-3.5, 0, 15) = 1.00
-3.5, 16.5, 22.5	13712	8.06×10^{-6}	1.08	12274	7.22×10^{-6}	0.80
-3.5, 9.3, 22.5	13296	7.82	1.04	13938	8.20	0.91
-3.5, 9.3, 36.5	12404	7.29	0.97	12909	7.59	0.84
-3.5, -9.3, 36.5	10859	6.39	0.85	13953	8.20	0.91
-3.5, -9.3, 22.5	11528	6.78	0.91	15650	9.20	1.02

Following series is for determination of efficiencies for some of configurations to be used in Assembly Procedure 4:

-3.5, 0, 15	12197	7.17	0.96	15443	9.08	1.00
same	12175	7.16	0.96	15279	7.16	0.79
-3.5, 0, 22.5	12047	7.08	0.95	14235	8.37	0.93
-3.5, 0, 36.5	11167	6.57	0.88	13006	7.65	0.85

-3.5, 0, 36.5	11521	6.77	0.90	13495	7.94	0.88
same	11725	6.89	0.92	13264	7.80	0.86
-3.5, 0, 15	12995	7.64	1.02	15709	9.24	1.02
-3.5, 0, 22.5	12651	7.44	0.99	14733	8.66	0.96



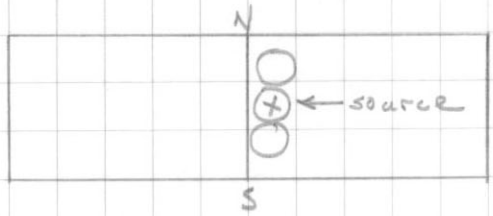
-3.5, 9.3, 22.5	17005	10.00	1.34	4851	2.85	0.315
same 8/4/65	16894	9.93	1.33	4801	2.82	0.312
same	17187	10.11	1.35	4827	2.84	0.314
same	17324	10.19	1.36	4813	2.83	0.313
same	17156	10.09	1.35	4839	2.85	0.315
-3.5, 9.3, 25.75	16924	9.95	1.33	4816	2.83	0.313
-3.5, 9.3, 36.5	15414	9.06	1.21	4530	2.66	0.294
-3.5, 9.3, 15	17800	10.47	1.40	5404	3.18	0.352
-11.0, 9.3, 15	17469	10.27	1.37	5433	3.19	0.353

Position cm	Count Rate T-1 /2 min	Efficiency W-1	Normalized to (-3.5, 0, 15) = 1.00	Count Rate T-2/2 min	Efficiency W-2	Normalized to (-3.5, 0, 15) = 1.00
-18.0, 9.3, 15	17023	10.01×10^{-6}	1.34	5471	3.22×10^{-6}	0.356
18.0, 9.3, 15	18026	10.60	1.42	5660	3.33	0.368
11.0, 9.3, 15	17896	10.52	1.40	5348	3.14	0.347
3.5, 9.3, 15	17873	10.51	1.40	5424	3.19	0.353
3.5, 9.3, 25.75	16855	9.91	1.32	4679	2.75	0.304
3.5, 9.3, 36.5	15350	9.03	1.21	4708	2.77	0.306

Following series has same arrangement as above but reflector is absent:

3.5, 9.3, 36.5	12466	7.33	0.98	12958	7.62	0.84
-11.0, 9.3, 15	13871	8.16	1.09	14142	8.32	0.92
-18.0, 9.3, 15	13589	7.99	1.07	14571	8.57	0.95
11.0, 9.3, 15	13808	8.12	1.08	14969	8.80	0.97

Following series was to investigate the effect of the presence of D-38 parts positioned between counters and source:



both lateral tubes empty						
-3.5, 0, 15	11515	6.77	0.90	14149	8.32	0.92
D-38 in south tube						
-3.5, 0, 15	12386	7.28	0.97	14199	8.35	0.92
D-38 in both tubes						
-3.5, 0, 15	12605	7.41	0.99	15408	9.06	1.00
D-38 in north tube						
-3.5, 0, 15	11878	6.98	0.93	14476	8.51	0.94
same	12284	7.22	0.96	14857	8.74	0.97

Following series was to check counter efficiency for motion of horizontal table, vertical table up:

-3.5, 0, 15, 0	12814	7.53	1.01	15618	9.18	1.02
5	12787	7.52	1.00	15784	9.28	1.03
10	12964	7.62	1.02	15674	9.22	1.02
15	12922	7.60	1.01	15933	9.37	1.04
20	13133	7.72	1.03	15873	9.33	1.03
25	13307	7.82	1.04	16038	9.59	1.06
30	13279	7.81	1.04	15921	9.36	1.04
40	13437	7.90	1.05	16061	9.44	1.04
50	13758	8.09	1.08	16225	9.54	1.06

Obviously, for neutron counting purposes, the position of the vertical table interacts with the counters observing the variations in count-rate while the horizontal table moves; therefore the preceding values will apply in practical situations rather than those on page 41.

8/5/65

Recheck of billet self-multiplication on assembly table.

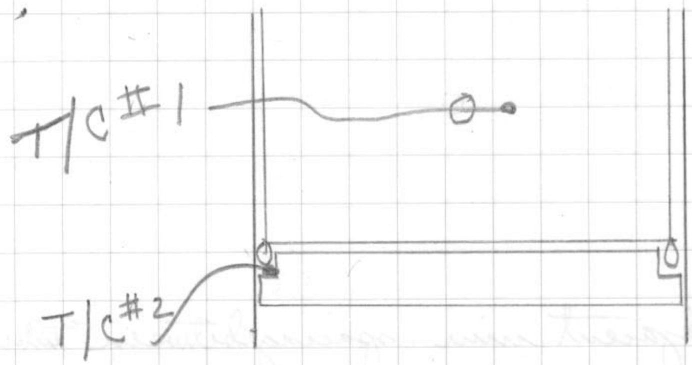
Billet	Position	T-1 Count/50 min	n/sec	M_s	T-2 Count/50 min	n/sec	M_s
001	-3.5,0,15,0,0	10873	4.83×10^5	2.38	13651	4.98×10^5	2.45
002	-3.5,0,15,0,0	11212	4.98×10^5	2.43	14169	5.17×10^5	2.53
004	-3.5,0,15,0,0	10935	4.87×10^5	2.45	13388	4.88×10^5	2.45
005	-3.5,0,15,0,0	10599	4.72×10^5	2.39	13233	4.83×10^5	2.45
006	-3.5,0,15,0,0	11110	4.95×10^5	2.45	13754	5.02×10^5	2.48
007	-3.5,0,15,0,0	10682	4.75×10^5	2.40	13339	4.87×10^5	2.46
8/6/65							
008	-3.5,0,15,0,0	11290	5.02×10^5	2.49	13938	5.08×10^5	2.53
009	-3.5,0,15,0,0	11029	4.91×10^5	2.42	13074	5.00×10^5	2.47

8/6/65

Thermocouples # 1 and 2 were calibrated to 32°F in an ice water bath and then checked at room temperature (73°F) using a mercury thermometer as a secondary standard. They were in good correlation as indicated on the thermocouple strip chart recorder.

8/9/65 Study of Billet Temperature in Support Tube

The following series of measurements was performed to determine the adequacy of the heat transfer properties of the billet support tubes. Part number 008 was used for this purpose. It was placed in the tube ~6 in. above the table top. The tube was open above it. The T/C's were located as shown in the sketch.



Initially indicated temperatures were 73°F at assembly machine.

Time	T/C 1	T/C 2
0850	93.5	94
1100	91	92
1300	90	91

This shows gradual cooling over about 2 hrs after taking out of box. Then essentially constant. At about 1320 we decided to see how much additional help in cooling would be provided by an electric fan.

1400	81	82

After this level was reached, the temperature essentially stabilized.

When tubes are adjacent min. spacing between tubes is 0.05 cm.

Outer can surface is ~0.30 cm within outer tube surface

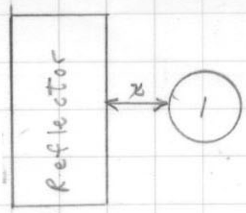
So min. distance laterally can to can is ~0.65 cm

with can wall thickness of 0.010 in (0.025 cm)

we then have min. spacing part-to-part of ~0.70 ± 0.02 cm.

(See page 67 vol 2 for more correct values of these dimensions)

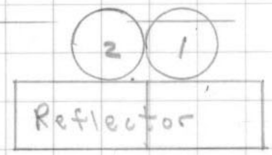
8/10/65 First Assembly (A-1)



Part 001, position 3.5, 0, 15; Base rate = 2.030×10^5
T/C's as shown p48 #1, 92°F; #2, 88°F; Room temp 72°F

Table Pos. cm	T-1 Cts/50 min	Eff Factor	n/sec	M	T-2 Cts/50 min	Eff Factor	n/sec	M
Vert. 39.73	13005	8.91×10^{-6}	4.86×10^5	2.39	17063	10.57×10^{-6}	5.37×10^5	2.65
0.14 } Horiz 65.9	11058	7.46	4.95	2.44	13814	9.05	5.08	2.50
9.555	11149	7.64	4.87	2.40	13970	9.24	5.04	2.48
0.000	8396/38	7.64	4.82	2.37	10391/38	9.24	4.94	2.44

8/11/65
2d Assembly (A-2)



x = distance between parts

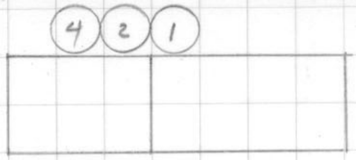
Parts 001, position 3.5, 9.3, 15; Base rate = 2.030×10^5 } 4.077×10^5
002, position −3.5, 9.3, 15; Base rate = 2.047×10^5 }
T/C's still on 001, #1 = 86°F; #2 = 86°F, Room temp 71°F

Table Pos.	T-1 Cts	Eff Factor	n/sec	M	T-2 Cts	Eff Factor	n/sec	M
−39.73 V, 65.9 H	15560/25	(001) 10.60×10^{-6}; (002) 10.01; Ave. 10.3	10.07	2.47	7219/25	(001) 3.33×10^{-6}; (002) 3.22; Ave. 3.27	14.70	3.61
−0.14 V, 65.9 H	14509/25	(001) 10.51; (002) 10.01; Ave. 10.25	9.43	2.31	6449/25	(001) 3.19; (002) 3.22; Ave. 3.20	13.44	3.30

8/12/65

Table Pos.	T-1 Cts	Eff Factor	n/sec	M	T-2 Cts	Eff Factor	n/sec	M
−0.14 V, 9.569	15512/25	(001) 10.51; (002) 10.27; Ave. 10.39	9.95	2.44	5027/25	(001) 3.19; (002) 3.19; Ave. 3.19	10.5	2.58
−0.14 V, 0.00	20048/25	(001) 10.51; (002) 10.47; Ave 10.49	12.74	3.12	5112/25	(001) 3.19; (002) 3.18; Ave. 3.19	10.68	2.62

3d Assembly (A-3)

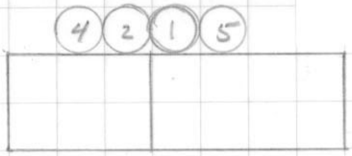


Parts 001, position 3.5, 9.3, 15, base rate = 2.030×10^5
002, −3.5, 9.3, 15, 2.047×10^5
004, −11, 9.3, 15, 1.990×10^5
Total 6.067×10^5

T/C's on #1 as before #1 86°; #2, 87°; Room temp. 71°F

Table Pos cm	T-1 cts/15 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/15 min	Eff Factor	n/sec $\times 10^{-5}$	M
39.7 V	16085	(001) 10.60×10^{-6}			6473	(001) 3.33×10^{-6}		
65.9 H		(002) 10.01×10^{-6}				(002) 3.22×10^{-6}		
		(004) 10.01×10^{-6}				(004) 3.22×10^{-6}		
		Ave. 10.21	17.5	2.89		Ave. 3.26	22.1	3.65
0.14 V	15463	(001) 10.51			5977	(001) 3.19		
65.9 H		(002) 10.01				(002) 3.22		
		(004) 10.01				(004) 3.22		
		Ave. 10.14	16.94	2.80		Ave. 3.21	20.7	3.42
0.14 V	16171	(001) 10.51			4931	(001) 3.19		
9.569 H		(002) 10.27				(002) 3.19		
		(004) 10.01				(004) 3.22		
		Ave. 10.26	17.50	2.89		Ave. 3.20	17.12	2.83
0.14 V	20122	(001) 10.51			4745	(001) 3.19		
0.00 H		(002) 10.47				(002) 3.18		
		(004) 10.27				(004) 3.19		
		Ave. 10.42	21.46	3.55		Ave. 3.19	16.52	2.73

4th Assembly (A-4)

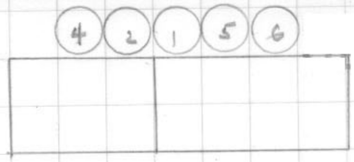


Parts	position	base rate
001,	3.5, 9.3, 15,	$= 2.030 \times 10^{5}$
002,	−3.5, 9.3, 15,	2.047
004,	−11, 9.3, 15	1.990
005,	11, 9.3, 15	1.974
	Total	8.041×10^{5}

T/C's on 001 as before #1 = 94°F; #2 = 86°F; Room temp

Table Posn. cm –	T-1 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M
39.7V 65.9H	23277/15	(001) 10.60×10^{-6}			8528/15	(001) 3.33×10^{-6}		
		(002) 10.01×10^{-6}				(002) 3.22×10^{-6}		
		(004) 10.01×10^{-6}				(004) 3.22×10^{-6}		
		(005) 10.60×10^{-6}				(005) 3.33×10^{-6}		
		Ave. 10.3	25.11	3.12		Ave. 3.27	28.99	3.61
0.14V 65.9H	14646	(001) 10.51×10^{-6}			5085	(001) 3.19×10^{-6}		
		(002) 10.01				(002) 3.22		
		(004) 10.01				(004) 3.22		
		(005) 10.51				(005) 3.19		
		Ave. 10.25	23.81	2.96		Ave. 3.20	26.50	3.30
0.14V 9.56H	15577	(001) 10.51×10^{-6}			4454	(001) 3.19×10^{-6}		
		(002) 10.01				(002) 3.22		
		(004) 10.27				(004) 3.19		
		(005) 10.52				(005) 3.14		
		Ave. 10.33	25.13	3.13		Ave. 3.19	23.26	2.89
0.14V 9.03H	18987	(001) 10.51×10^{-6}			4455	(001) 3.19×10^{-6}		
		(002) 10.47				(002) 3.18		
		(004) 10.27				(004) 3.19		
		(005) 10.52				(005) 3.14		
		Ave. 10.44	30.32	3.77		Ave. 3.18	23.36	2.90

5th Assembly (A-5)



Parts	001	position 3.5, 9.3, 15, base rate =	2.030×10^5
	002	−3.5, 9.3, 15	2.047
	004	−11, 9.3, 15	1.990
	005	11, 9.3, 15	1.974
	006	18, 9.3, 15	2.023
		Total	10.064×10^5 n/sec

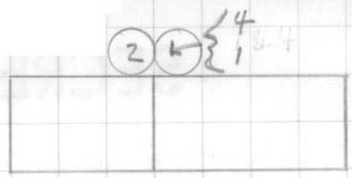
T/C's on #001 as before: #1 = 94°, #2 = 90°F, Room temp. 71°F

Table Pos. cm	T-1 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M
39.7V	21844	1 10.60×10^{-6}			7081	1 3.33×10^{-6}		
65.9H		2 10.01				2 3.22		
		4 10.01				4 3.22		
		5 10.60				5 3.33		
		6 10.60				6 3.33		
		Ave. 10.23	35.37	3.52		Ave. 3.26	35.11	3.49
0.14V	19731	1 10.51			6648	1 3.19		
65.9H		2 10.01				2 3.22		
		4 10.01				4 3.22		
		5 10.52				5 3.14		
		6 10.60				6 3.33		
		Ave. 10.33	31.83	3.16		Ave. 3.22	34.41	3.42
0.14V	21069	1 10.51			5782	1 3.19		
9.56H		2 10.01				2 3.22		
		4 10.27				4 3.19		
		5 10.52				5 3.14		
		6 10.60				6 3.33		
		Ave. 10.38	33.83	3.36		Ave. 3.21	30.03	2.99

8/13 T/C's #1 97°F, #2 92°F, Room temp 71°F

Table Pos. cm	T-1 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M
0.14V								
0.00H	24859	1 10.51			5774	1 3.19		
		2 10.47				2 3.18		
		4 10.27				4 3.19		
		5 10.52				5 3.14		
		6 10.60				6 3.33		
		Ave. 10.47	39.57	3.93		Ave. 3.21	29.97	2.98

6 th Assembly (A-6)

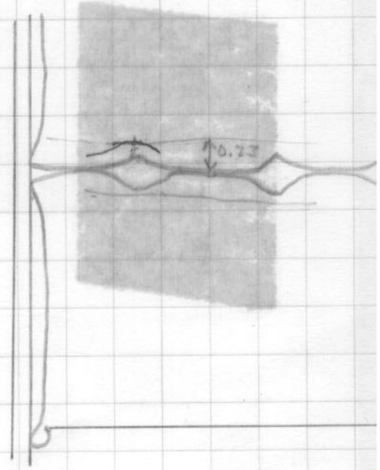


Parts 001, position 3.5, 9.3, 15, base rate 2.030 x 10^5
002 -3.5, 9.3, 15, 2.047 x
004 3.5, 9.3, 19.6, 1.990
Total 6.067 x 10^5 n/sec

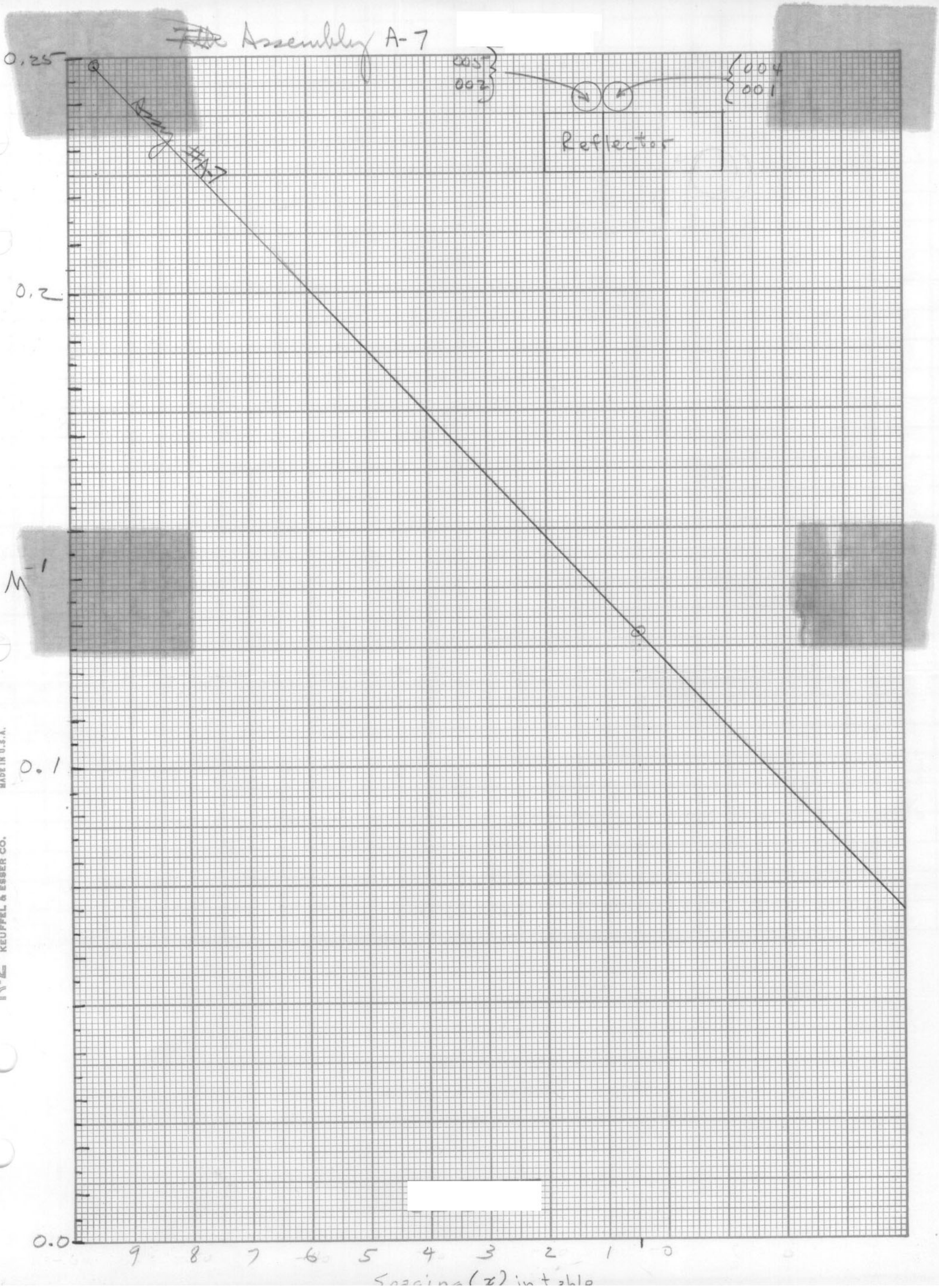
T/C's on 001 with 004 above it: #1 - 102°F, #2 - 93 F, Room temp. 71°F

Table Pos. cm	T-1 cts/15 min	Eff Factor	n/sec x10^{-5}	M	T-2 cts/15 min	Eff Factor	n/sec x10^{-5}	M
0.14 V	17585	(1) 10.51 x 10^{-6}			6771	(1) 3.19 x 10^{-6}		
65.9 H		(2) 10.01				(2) 3.22		
		(4) 10.51				(4) 3.19		
		Ave 10.34	18.89	3.11		Ave 3.20	23.50	3.87
	T/C's #1 - 103°F, #2 - 94°F							
0.14 V								
9.55 H	19461	(1) 10.51			6064	(1) 3.19		
		(2) 10.27				(2) 3.19		
		(4) 10.51				(4) 3.19		
		Ave 10.43	20.59	3.39		Ave 3.19	21.13	3.48
	T/C's #1 - 104°F, #2 - 94°F, Room 71°F.							
0.14 V	27172	(1) 10.51			6428	(1) 3.19		
0.00 H		(2) 10.47				(2) 3.18		
		(4) 10.51				(4) 3.19		
		Ave 10.50	28.75	4.74		Ave 3.19	22.38	3.69

The cans loaded in tandem were arranged as shown - bottom to bottom. This caused no. 001 (on the bottom) to heat up more than before



Part-to-part separation is 0.46 cm (see B. Elliott's notes)


~~File~~ Assembly A-7
0.25
0.2
0.1
0.0
M^{-1}
005
002
004
001
Reflector
Assy #A-7
9
8
7
6
5
4
3
2
1
0
Spacing (x) in table

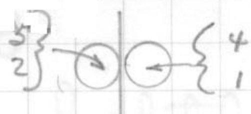
7 Assembly (A-7)

Parts 001, position 3.5, 9.3, 15, dose rate 2.030 $\times 10^5$
002 -3.5, 9.3, 15 2.047
004 3.5, 9.3, 19.6 1.990
005 -3.5, 9.3, 19.6 1.974
Total 8.041 $\times 10^5$ n/sec

T/C's still on part 001, readings as below

Table Pos. cm	T-1 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M
T/C's #1 - 104°F, #2 - 94°F, Room 71°F								
39.7 V	18367	(1) 10.60 $\times 10^{-6}$			8496	(1) 3.33 $\times 10^{-6}$		
65.9 H		(2) 10.01				(2) 3.22		
		(4) 10.60				(4) 3.33		
		(5) 10.01				(5) 3.22		
		10.30	29.71	3.70		3.28	43.17	5.37
T/C's #1 - 105°F, #2 - 94°F, Room 71°F								
0.14 V	17334	(1) 10.51			7488	(1) 3.19		
65.9 H		(2) 10.01				(2) 3.22		
		(4) 10.51				(4) 3.19		
		(5) 10.01				(5) 3.22		
		Ave 10.25	28.19	3.51		Ave. 3.20	39.00	4.85
T/C's #1 - 104°F, #2 - 93°F, Room 71°F								
0.14 V	20181	(1) 10.51			6370	(1) 3.19		
9.56 H		(2) 10.27				(2) 3.19		
		(4) 10.51				(4) 3.19		
		(5) 10.27				(5) 3.19		
		Ave 10.39	32.38	4.03		Ave. 3.19	33.29	4.14
T/C's #1 - 105°F, #2 - 94°F, Room 71°F								
0.14 V	39430	(1) 10.51			9355	(1) 3.19		
0.484 H		(2) 10.47				(2) 3.18		
		(4) 10.51				(4) 3.19		
		(5) 10.47				(5) 3.18		
		Ave 10.49	62.65	7.79		Ave. 3.19	48.83	6.07
0.14 V 0.00 H	23422/5	same	74.42	9.26	5306/5	same	55.45	6.90

8th Assembly (A-8)
(Same as A-7 but reflector absent

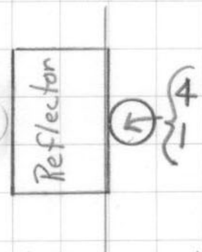


Parts 001, 002, 004, 005 Positions (same as 7th)
Base rate 8.041×10^5 n/sec

T/C's still on part 001, #1 - 100°F, #2 - 95°F Room - 71°F

Table Pos cm	T-1 cts/5 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/5 min	Eff Factor	n/sec $\times 10^{-5}$	M
0.14 V		(1) 8.20×10^{-6}				(1) 7.66×10^{-6}		
0.00 H		(2) 8.20				(2) 7.66		
		(4) 7.82				(4) 8.20		
		(5) 7.82				(5) 8.20		
		Ave. 8.01	47.71	5.93		Ave. 7.93	50.18	6.24

9th Assembly (A-9)



Parts 001, position 3.5, 0.0, 15.0, base rate 2.030×10^5 n/sec
004, 3.5, 0.0, 19.6 1.990×10^5
Total 4.020×10^5

T/C's on 1 and 4 : #1 - 101°F, #2 - 97°F (May not have been in good contact)
Room Temp. 71°F

Table Pos. cm	T-1 cts/15 min	Eff. Factor	n/sec $\times 10^{-5}$	M	T-2 cts/15 min	Eff. Factor	n/sec $\times 10^{-5}$	M
0.14 V	10349	(1) 7.64×10^{-6}			12099	(1) 9.24×10^{-6}		
0.00 H		(4) 7.12				(4) 8.67		
		Avg. 7.38	15.58	3.88		Avg. 8.95	15.02	3.74

Used round tube bases.
Have surface to surface contact for tubes - min. can separation 0.60 cm. ± 0.02 →

Use same geometry factor for entire group (This is for units centered at 15 cm elevation inside plastic block.) →

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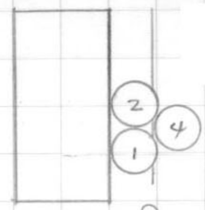
10th Assembly (A-10)

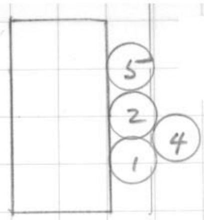


Part	001	, position	−2.5, −7, 15, base rate	2.030×10^{5}
	002	,	−2.5, 0, 15	2.047
	004	,	3.5, −35, 15	1.990

T/C #1 on part 001, T/C #2 on part 004; Total 6.067×10^{5} n/sec

Table Pos cm	T-1 Cts/15 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 Cts/15 min	Eff Factor	n/sec $\times 10^{5}$	M
	T/C's #1 − 82°F, #2 − 82°F, Room 71°F							
0.14 V 65.9 H	12084	Ave. 7.64×10^{-6}	17.58	2.90	15462	Ave 9.24×10^{-6}	18.60	3.07
0.14 V 9.55 H	11287	Ave. 7.64×10^{-6}	16.41	2.70	14866	Ave 9.24×10^{-6}	17.87	2.95
	T/C's #1 82°F #2 82°F Room 71°F							
0.14 V 0.00 H	14446	Ave 7.64	21.01	3.46	20157	Ave. 9.24	24.24	4.00

11 Assembly (A-11)

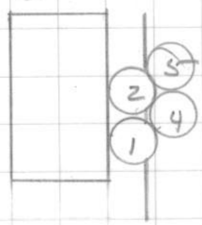


Part 001, position -2.5, -7, 15, base rate 2.030
002 -2.5, 0, 15 2.047
004 3.5, -3.5, 15 1.990
005 -2.5, 7, 15 1.974
Total 8.041 X10^5 n/sec

T/C's same as for 10th assembly

Table Pos. Cm	T-1 cts/10min	Eff Factor	n/sec X10^-5	M	T-2 cts/10min	Eff Factor	n/sec X10^-5	M
0.14 V 65.9 H	11892	Ave. 7.64x10^-6	25.94	3.23	14173	9.24x10^-6	25.56	3.18
T/C's #1-83°F. #2-83°F. Room 71°F								
0.14 V 9.55 H	11129	7.64	24.26	3.02	13572	9.24	24.48	3.04
0.14 V 0.00 H	13572	7.64	29.61	3.68	17427	9.24	31.43	3.91
T/C's #1-83; #2-83; Room 71°F								

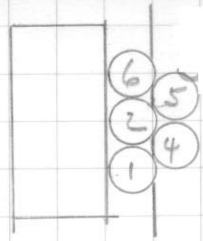
12th Assembly (A-12)



Same as 11 except part 005 at 3.5, 3.5, 15

Table Pos. Cm	T-1 cts/10min	Eff Factor	n/sec X10^-5	M	T-2 cts/10min	Eff Factor	n/sec X10^-5	M
0.14 V 65.9 H	10417	7.64	22.72	2.83	13143	9.24	23.71	2.95
0.14 V 9.55 H	10674	7.64	23.29	3.04	13649	9.24	24.62	2.66
0.14 V 0.00 H	15647	7.64	34.14	4.25	20309	9.24	36.63	4.56
T/C's #1-85°F; #2-85°F; Room 71°F								

13th Assembly (A-13)



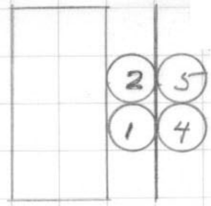
Part 001, position -2.5, -7, 15, base rate 2.030 x 10^5
002 -2.5, 0, 15 2.047
004 3.5, -3.5, 15 1.990
005 3.5, 3.5, 15 1.974
006 -2.5, 7, 15 2.023

10.064 x 10^5 n/sec.

T/C's on parts #001, 004

Table Pos cm	T-1 cts/1min	Eff factor	n/sec x 10^-5	M	T-2 cts/1min	Eff factor	n/sec x 10^-5	M
39.7 V	10691	Ave 7.64 x 10^-6	33.31	3.31	12684	Ave 9.24 x 10^-6	32.68	3.25
65.9 H	T/C's #1 - 84°F, #2 - 84°F, Room 71°F							
0.14 V	10133	7.64	31.58	3.14	12330	9.24	31.77	3.16
65.9 H	T/C's #1 - 84°F, #2 - 84°F, Room 71°F							
0.14 V	10250	7.64	31.94	3.17	12404	9.24	31.96	3.18
9.55 H	T/C's #1 - 83°F, #2 - 84°F, Room 71°F							
0.14 V	17120	7.64	53.35	5.30	20815	9.24	53.64	5.33
0.00 H	T/C's #1 - 83°F, #2 - 84°F, Room 71°F							

8/18/65
14 th Assembly (A-14)

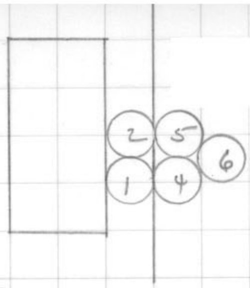


Part 001, position −3.5, −7, 15, base rate 2.030×10^5
002, −3.5, 0, 15, 2.047
004, 3.5, −7, 15, 1.990
005, 3.5, 0, 15, 1.974
Total 8.041×10^5

T/C's on parts 001 and 004

Table Pos. cm	T-1 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M	T-2 cts/10 min	Eff Factor	n/sec $\times 10^{-5}$	M
0.14 V		Ave 7.64×10^{-6}				Ave 9.24×10^{-6}		
65.9 H	T/C's #1, #2, Room							
0.14 V	10473	Ave 7.64×10^{-6}	22.85	2.84	13686	Ave 9.24×10^{-6}	24.69	3.07
9.55 H	T/C's #1 - 95°F # 2 - 87°F, Room - 73°F							
0.14 V	14483	Ave 7.64×10^{-6}	31.60	3.93	19277	Ave 9.24×10^{-6}	34.77	4.32
0.00 H	T/C's #1 95°F # 2 82°F, Room 71°F							

15 th Assembly (A-15)

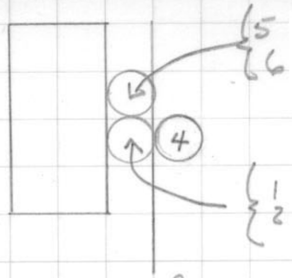


Parts 001	position -3.5, 7, 15,	base rate	2.030 x10^5
2	-3.5, 0, 15,		2.047
4	3.5, -7, 15,		1.990
5	3.5, 0, 15,		1.974
6	10, -3.5, 15,		2.023
		Total	10.064 x10^5 n/sec

Table Pos cm	T-1 cts/7 min	Eff Factor	n/sec x10^-5	M	T-2 cts/7 min	Eff Factor	n/sec x10^-5	M
0.14 V	15101/10	Ave 7.64 x10^-6	32.95	3.27	19470/10	Ave 9.24 x10^-6	35.11	3.49
65.9 H	T/C's #1 - 95°F, # 2 - 86°F, Room 71°F							
0.14 V	10686	Ave 7.64	33.30	3.31	14180	Ave 9.24	36.56	3.63
9.55 H	T/C's #1 - 95°F, # 2 - 86°F, Room 71°F							
0.14 V	14943	Ave 7.64	46.57	4.63	19865	Ave 9.24	51.19	5.09
0.00 H	T/C's #1 - 95°F, # 2 - 87°F, Room 71°F							

16th Assembly (A-16)

Square tube base



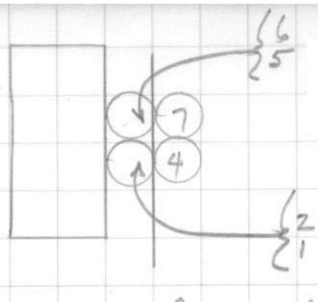
Parts 001, position -3.5, -3.5, 15, base rate 2.030 x 10^5

Part	Position	Base rate
001	-3.5, -3.5, 15	2.030 x 10^5
2	-3.5, -3.5, 19.6	2.047
4	3.5, -3.5, 15	1.990
5	-3.5, 3.5, 15	1.974
6	-3.5, 3.5, 19.6	2.023
	Total	10.064 x 10^5 n/sec

T/C's on #001 and 004

Table Pos cm	T-1 cts/3 min	Eff Factor	n/sec X10^{-5}	M	T-2 cts/3 min	Eff Factor	n/sec X10^{-5}	M
39.7 V 65.9 H	11455	Ave 7.64x10^{-6}	83.29	8.28	13300	Ave 9.24x10^{-6}	79.97	7.95
0.14 V 65.9 H	11404	Ave 7.64	82.93	8.24	13568	Ave 9.24	79.41	7.89
	T/C's #1-95°F, #2-87°F Room-71°F							
0.14 V 9.55 H	10578	Ave 7.64	76.92	7.64	12312	Ave 9.24	74.02	7.35
	T/C's #1 - 95°F, #2 - 88°F, Room - 71°F							
0.14 V 0.00 H	14812	Ave 7.64	107.70	10.7	18223	Ave 9.24	109.56	10.9
	T/C's #1 - 100°F, #2 - 87°F, Room - 71°F							

17 Assembly (A-17)



Parts	position	base rate
001	-3.5, -3.5, 15	2.030 x10^5 n/sec
2	-3.5, -3.5, 19.6	2.047
4	3.5, -3.5, 15	1.990
5	-3.5, 3.5, 15	1.974
6	-3.5, 3.5, 19.6	2.023
7	3.5, 3.5, 15	1.980
	Total	12.044 x10^5 n/sec

T/C's on 001 and 004

Table Pos cm	T-1 cts/3 min	Eff Factor	n/sec x10^-5	M	T-2 cts/3 min	Eff Factor	n/sec x10^-5	M
39.7 V 65.9 H	12079	Ave 7.64x10^-6	87.84	7.29	14569	Ave 9.24x10^-6	87.60	7.28
0.14 V 65.9 H	11993	7.64	87.21	7.24	14065	9.24	84.57	7.02
	T/C's #1 - 102°F, #2 - 88°F, Room - 71°F							
0.14 V 9.55 H	12038	7.64	87.53	7.27	14323	9.24	86.11	7.15
	T/C's #1 - 102°F, #2 - 89°F, Room - 71°F							
0.14 V 1.396 H	20694	7.64	150.47	12.5	24880	9.24	149.61	12.4
	T/C's #1 - 103°F, #2 - 89°F, Room - 71°F							

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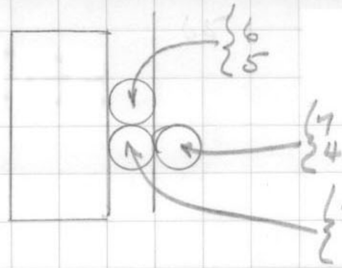
Table Pos cm	T-1 cts/3 min	Eff Factor	n/sec x10^-5	M	T-2 cts/3 min	Eff Factor	n/sec x10^-5	M
0.14 V 9.55 H	12467	7.64	90.65	7.53	14500	9.24	87.18	7.24
	T/C's #1 - 106°F, #2 - 89°F, Room - 71°F							
0.14 V 3.00 H	16262	7.64	118.25	9.83	19450	9.24	116.95	9.71
	T/C's #1 - 106°F, #2 - 89°F, Room - 71°F							
0.14 V 1.392 H	20789	7.64	151.16	12.55	24868	9.24	149.52	12.41
	T/C's #1 - 106°F, #2 - 89°F, Room - 71°F							
0.14 V 0.00 H	35397	7.64	257.40	21.37	41928	9.24	252.09	20.93
	T/C's #1 - 106°F, #2 - 89°F, Room - 71°F							

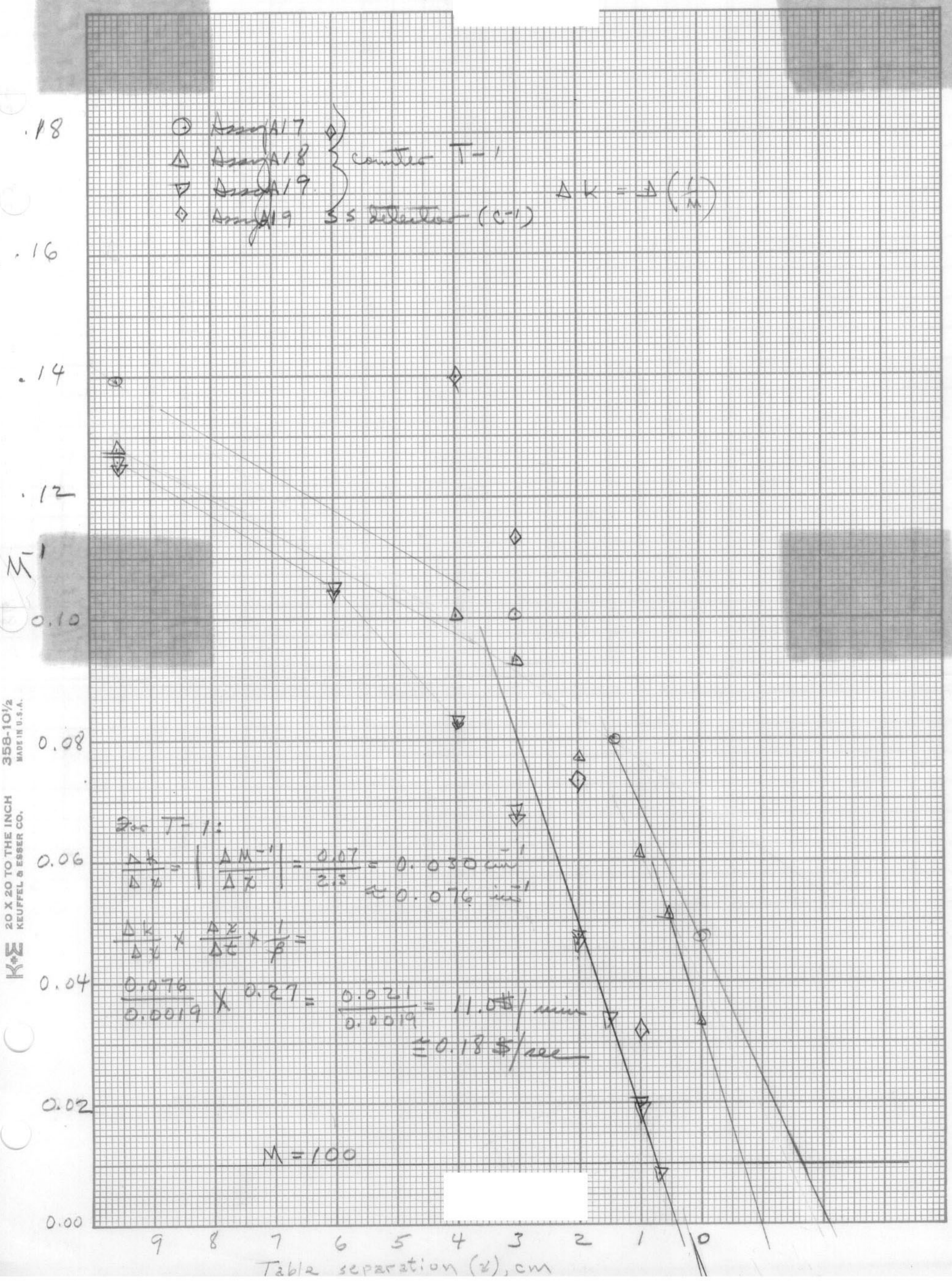
18th Assembly (A-18)



Pots	position	dose rate
001	-3.5, -3.5, 15	2.030×10^5 n/sec
2	-3.5, -3.5, 19.6	2.047
4	3.5, -3.5, 15	1.990
5	-3.5, 3.5, 15	1.974
6	-3.5, 3.5, 19.6	2.033
7	3.5, -3.5, 19.6	1.980
	Total	12.044×10^5 n/sec

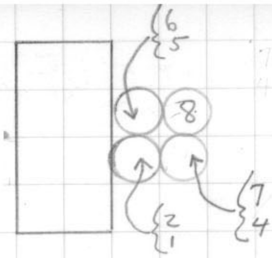
T/C' on 001 and 004

Table Pos cm	T-1 cts/2 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
39.7 V 65.9 H	T/C's	Ave 7.64×10^{-6}				Ave 9.24×10^{-6}		
0.14 V	8259	7.64	90.09	7.48	9887	9.24	89.17	7.40
65.9 H	T/C's #1 - 106 °F, #2 - 89 °F, Room - 71 °F							
0.14 V	8616	7.64	93.98	7.80	10521	9.24	94.89	7.88
9.55 H	T/C's #1 - 105 °F, #2 - 90 °F, Room - 71 °F							
0.14 V	10859	7.64	118.44	9.83	13359	9.24	120.48	10.00
4.006 H	T/C's #1 - 105 °F, #2 - 91 °F, Room - 71 °F							
0.14 V	11873	7.64	129.50	10.75	14789	9.24	133.37	11.07
3.002 H	T/C's #1 - 105 °F, #2 - 90 °F, Room - 70 °F							
0.14 V	14254	7.64	155.47	12.91	17446	9.24	157.34	13.06
2.000 H	T/C's #1 - 105 °F, #2 - 91 °F, Room - 71 °F							
0.14 V	18086	7.64	197.28	16.38	22722	9.24	204.92	17.01
1.000 H	T/C's #1 - 105 °F, #2 - 92 °F, Room - 71 °F							
0.14 V	23489	7.46	262.39	21.79	28698	9.24	258.82	21.48
0.500 H	T/C's #1 - 105 °F, #2 - 92 °F, Room - 71 °F							
0.14 V	32172	7.46	359.38	29.84	40315	9.24	363.59	30.19
0.000 H	T/C's #1 - 106 °F, #2 - 93 °F, Room - 71 °F							



⊙ Assay A17
Δ Assay A18
▽ Assay A19
counter T-1
◊ Assay A19 SS detector (C-1)
Δk = Δ(1/M)
.18
.16
.14
.12
M⁻¹
0.10
0.08
0.06
0.04
0.02
0.00
For T-1:
Δk/Δx = |ΔM⁻¹/Δx| = 0.07/2.3 = 0.030 cm⁻¹
≐ 0.076 in⁻¹
Δk/Δx × Δx/Δt × 1/β =
0.076/0.0019 × 0.27 = 0.021/0.0019 = 11.0$/min
≐ 0.18 $/sec
M = 100
9 8 7 6 5 4 3 2 1 0
Table separation (x), cm
K+E 20 X 20 TO THE INCH KEUFFEL & ESSER CO.
358-10½ MADE IN U.S.A.

19th Assembly (A-19)



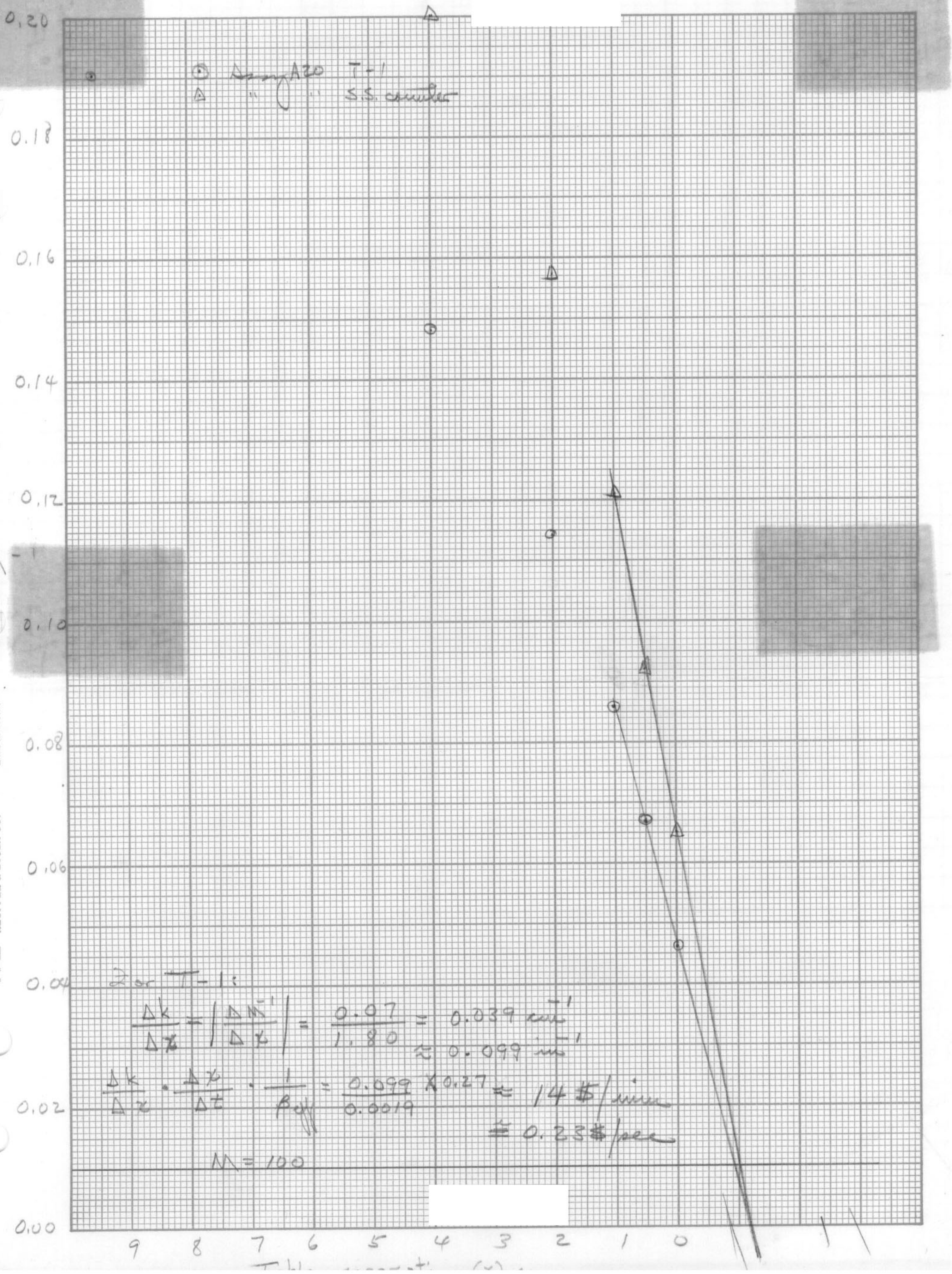
Part	Position	Base rate
Parts 001, position	-3.5, -3.5, 15 base rate	2.030 $\times 10^{5}$ n/sec
2	-3.5, -3.5, 19.6	2.047
4	3.5, -3.5, 15	1.990
5	-3.5, 3.5, 15	1.974
6	-3.3, 3.5, 19.6	2.023
7	3.5, -3.5, 19.6	1.980
8	3.5, 3.5, 15	2.009
	Total	14.053 $\times 10^{5}$ n/sec

T/C's on 001 and 004

Table Pos cm	T-1 cts/2min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2min	Eff	n/sec $\times 10^{-5}$	M
39.7 V	9158	Ave 7.64 $\times 10^{6}$	99.88	7.11	11360	Ave 9.24 $\times 10^{6}$	102.46	7.29
65.9 H	T/C's #1- °F, #2- °F, Room - °F							
0.14 V	8806	7.64	96.05	6.83	11187	9.24	100.89	7.18
65.9 H	T/C's #1-105°F, #2-95 °F, Room - 71 °F							
0.14 V	10219	7.64	111.47	7.93	13061	9.24	117.79	8.38
9.55 H	T/C's #1-105 °F, #2-96 °F, Room - 71 °F							
0.14 V	12313	7.64	134.29	9.56	15712	9.24	141.70	10.08
6.001 H	T/C's #1-105 °F, #2-96 °F, Room - 70 °F							
0.14 V	15557	7.64	169.68	12.07	20016	9.24	180.51	12.84
4.002 H	T/C's #1-105 °F, #2-97 °F, Room - 70 °F							
0.14 V	19111	7.64	208.12	14.81	24549	9.24	221.40	15.75
3.000 H	T/C's #1-105 °F, #2-98 °F, Room - 71 °F							
0.14 V	27870	7.64	303.99	21.63	35619	9.24	321.23	22.86
2.003 H	T/C's #1-105 °F, #2-98 °F, Room - 71 °F							
0.14 V	38217	7.64	416.23	29.62	48593	9.24	438.25	31.17
1.500 H	T/C's #1-105 °F, #2-98 °F, Room - 71 °F							

Table Pos cm	T-1 cts/2 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
0.14 V	34678/1	7.64	756.49	53.83	43893/1	9.24	791.72	56.34
1.00 H	T/C's #1 - 106 °F, #2 - 98 °F, Room - 71 °F							
0.14 V	79188/1	7.64	1726.4	122.8	100982/1	9.24	1821.1	129.6
0.70 H	T/C's #1 - 105 °F, #2 - 99 °F, Room - 71 °F							
	Same as above, solid state detector mounted beside part 008. Spacers set on "in" limit switches to prevent full closure.							
0.14 V	10241	7.64	111.70	7.95	12798	9.24	115.42	8.21
9.55 H	T/C's #1 - 105 °F, #2 - 100 °F, Room - 71 °F							
	S.S. counter 4.00 619 cts (?)							
0.14 V	12395	7.64	134.93	9.60	15624	9.24	140.90	10.03
6.001 H	T/C's #1 - 104 °F, #2 - 99 °F, Room 70 °F							
	S.S. counter 4.00 557 cts							
0.14 V	15627	7.64	170.46	12.13	19738	9.24	178.00	12.67
4.000 H	T/C's #1 - 105 °F, #2 - 99 °F, Room 70 °F							
	S.S. counter 4.00 726 cts							
0.14 V	19233	7.64	209.77	14.93	24210	9.24	218.34	15.54
3.000 H	T/C's #1 - 104 °F, #2 - 99 °F, Room 70 °F							
	S.S. counter 4.00 879							
0.14 V	27051	7.64	295.05	21.00	34677	9.24	288.97	20.56
2.000 H	T/C's #1 - 104 °F, #2 - 99 °F, Room 70 °F							
	S.S. counter 4.00 1358							
0.14 V								
1.000 H	64083	7.64	698.99	49.74	81947	9.24	739.05	52.59
	T/C's #1 - °F, #2 - °F, Room °F							
	S.S. counter 4.00 3113							

∴ S.S. detector a little better than Tubs for M^{-1} measurement probably; agrees very well for crit. position.


0.20
0.18
0.16
0.14
0.12
M^{-1}
0.10
0.08
0.06
0.04
0.02
0.00
⊙ A20 T-1
Δ " " S.S. counter
For T-1:
$\frac{\Delta k}{\Delta x} = \left|\frac{\Delta M^{-1}}{\Delta x}\right| = \frac{0.07}{1.80} = 0.039\ cm^{-1} \approx 0.099\ in^{-1}$
$\frac{\Delta k}{\Delta x} \cdot \frac{\Delta x}{\Delta t} \cdot \frac{1}{\beta_{eff}} = \frac{0.099 \times 0.27}{0.0019} \approx 14\ \$/min \doteq 0.23\ \$/sec$
M = 100
9
8
7
6
5
4
3
2
1
0

20th Assembly (A-20) Same as A-19 but reflector absent

Base rate 14.053 X 10^5 n/sec

Table Pos cm	T-1 cts/3 min	Eff	n/sec X 10^-5	M	T-2 cts/3 min	Eff	n/sec X 10^-5	M
39.7 V	9427	Av. 7.49 x 10^-6	69.92	4.98	11958	Ave. 9.14 x 10^-6	72.68	5.17
65.9 H	T/C's #1 - 102°F, #2 - 99°F Rm 70°F							
	S.S. Counter 4.00 293							
0.14 V	9033	7.49	67.00	4.77	11254	9.14	68.40	4.87
65.9 H	T/C's #1 - 101 °F, #2 - 99 °F, Rm 70 °F							
	S.S. Counter 4.00 287							
0.14 V	9910	7.49	73.51	5.25	12809	9.14	77.86	5.54
9.55 H	T/C's #1 - 100 °F, #2 - 99 °F, Rm 70 °F							
	S.S. Counter 4.00 365							
0.14 V	12797	7.49	94.91	6.75	16454	9.14	100.01	7.12
4.00 H	T/C's #1 - 100 °F, #2 - 99 °F, Rm - 70 °F							
	S.S. Counter 4.00 482							
0.14 V	16612	7.49	123.21	8.77	21793	9.14	132.46	9.42
2.00 H	T/C's #1 - 100 °F, #2 - 99 °F., Rm - 70 °F							
	S.S. Counter 4.00 635							
0.14 V	14674/2	7.49	163.26	11.62	19185/2	9.14	174.92	12.45
1.00 H	T/C's #1 - 100 °F, #2 - 99 °F., Rm - 70 °F							
	S.S. Counter 4.00 820							
0.14 V	18892/2	7.49	210.18	14.96	24429/2	9.14	222.74	15.85
0.50 H	T/C's #1 - 100 °F, #2 - 99 °F., Rm - 70 °F							
	S.S. Counter 4.00 1085							
0.14 V	27362/2	7.49	304.43	21.66	36315/2	9.14	331.11	23.56
0.00 H	T/C's #1 - 100 °F, #2 - 98 °F., Rm - 70 °F							
	S.S. Counter 4.00 1530							

0.345
0.027
0.318

0.25 cm
.195
2) .055
.027

2.40
−.69
1.71

Study of 8-Member Quasi-Cubic Array

Set up Assembly B-1: Pu to Pu initial separation 2.78 cm. (ave.)

Breakdown of lateral spacings:

Fixed	Can wall thickness 0.025 cm (0.010 in) × 2	= 0.05 cm
Fixed	Can surface within tube 0.32 cm × 2	= 0.64 cm
Variable	Tube to tube separation	= 2.23 cm
	Total lateral separation	= 2.92 cm

Vertical spacing:

Variable	Al spacers 0.483 cm + 2.07 cm	= 2.55 cm
Fixed	Can lid thickness 0.020 cm (0.008 in)	= 0.02 cm
Fixed	Can bottom surface to Pu slug surface (0.026 in)	= 0.07 cm
	Total vertical spacing	= 2.64 cm

9/2/65

Spacing of reflector control element to tube = 0.008 cm (0.003 in) on inner limit

Part #	Position x	y	z	
1	− 6.0	−3.5	15	T/C #1 in place
2	− 6.0	−3.5	22	
4	3.5	−3.5	15	T/C # 2 in place
5	3.5	−3.5	22	
6	− 6.0	6.0	15	
7	− 6.0	6.0	22	
8	3.5	6.0	15	
9	3.5	6.0	15	

16.081×10^5 n/sec = base rate

Table Pos cm	T-1 cts/4 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/4 min	Eff	n/sec $\times 10^{-5}$	M
0.14 V	9592	7.5×10^{-6}	53.29	3.31	11155	9.0×10^{-6}	51.64	3.21

9.592 H S.S. counter

Act 15.00 T/C's #1 - 98°F, #2 - 91°F, Room 71°F

Act 0.00	9703	7.5×10^{-6}	53.91	3.35	11601	9.0×10^{-6}	53.70	3.34

T/C's #1 - 99°F, #2 - 91°F, Room 71°F

0.14 V	9650/3	7.5×10^{-6}	71.48	4.44	11133/3	9.0×10^{-6}	68.72	4.27

0.00 H T/C's #1 - 100°F, #2 - 92°F, Room 71°F

15.0 Act

0.00 Act	9778/3	7.5×10^{-6}	72.43	4.50	11362/3	9.0×10^{-6}	70.13	4.36

T/C's #1 - 101°F, #2 - 93°F, Room 71°F

~~Assembly~~ B-2 Pu-to-Pu separation 2.34 cm (ave.)

Lateral spacing: 0.69 cm fixed + 1.71 cm variable = 2.40 cm

Vertical spacing: 0.57 cm fixed + 1.65 cm variable = 2.22 cm

Ave. spacing = 2.34 cm

Positions

Part #	x	y	z	
1	-3.5	-3.5	15	T/C in place
2	-3.5	-3.5	21.5	
4	5.0	-3.5	15	T/C in place
5	5.0	-3.5	21.5	
6	-3.5	5.5	15	
7	-3.5	5.5	21.5	
8	5.0	5.5	15	
9	5.0	5.5	21.5	

Base rate = 16.081×10^{5} n/sec

Base rate 16.081 × 10^5 n/sec

Position cm	T-1 cts/4 min	Eff.	n/sec × 10^{-5}	M	T-2 cts/4 min	Eff.	n/sec × 10^{-5}	M
0.14 V	10356	7.5×10^{-6}	57.53	3.58	11974	9.0×10^{-6}	55.43	3.45
9.55 H	S.S. Counter 228/5 = 45.6 c/m							
15.00 A	T/C's 1 - 95°F, 2 - 94°F, Room 71°F							
0.14 V	11150/3	7.5×10^{-6}	82.59	5.14	13098/3	9.0×10^{-6}	80.86	5.03
0.00 H	S.S. Counter 223/4 = 55.8 c/m							
15.00 A	T/C's 1 - 97°F, 2 - 96°F, Room 71°F							
0.14 V	11374/3	7.5×10^{-6}	84.25	5.24	13500/3	9.0×10^{-6}	83.33	5.18
0.00 H	S.S. Counter 221/4 = 55.2 c/m							
0.00 A	T/C's 1 - 97 °F, 2 - 96 °F, Room 71 °F							

Assembly B-3 Pu-to-Pu separation 1.74 cm

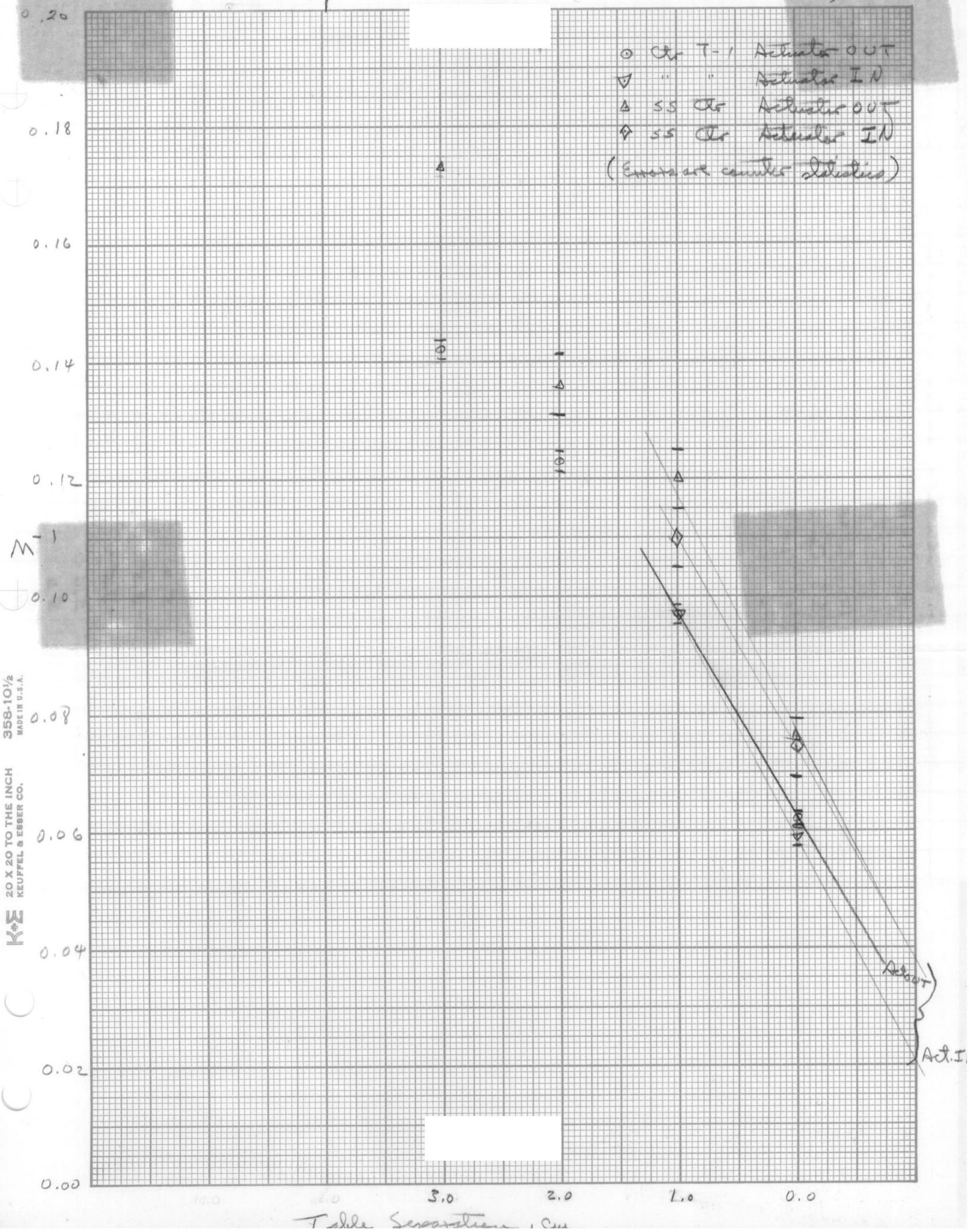
Lateral spacing: 0.69 cm fixed + 1.11 cm variable = 1.80 cm

Vertical spacing: 0.57 cm fixed + 1.05 cm variable = 1.62 cm

Position

Part #	x	y	z	
1	-3.5	-3.5	15	T/C #1 in place
2	-3.5	-3.5	21	
4	5.0	-3.5	15	T/C #2 in place
5	-5.0	-3.5	21	
6	-3.5	5.0	15	
7	-3.5	5.0	21	
8	5.0	5.0	15	
9	5.0	5.0	21	

Assembly B-4 9/7/65 Counter T-1, S.S. Ctr.



Base rate 16.081 n/sec

Position cm	T-1 cts/4min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/4min	Eff	n/sec $\times 10^{-5}$	M
0.14V	11721	7.5×10^{-6}	65.12	4.05	13381	9.0×10^{-6}	61.94	3.85
9.55H	S.S. Counter - 291/5 = 58.2 c/m							
15.00 A	T/C's #1 - 93°F., #2 - 92°F., Room 71°F.							
0.14V	15676/3	7.5×10^{-6}	116.1	7.22	18234/3	9.0×10^{-6}	112.6	7.00
0.00 H	S.S. Counter - 405/4 = 101 c/m							
15.00 A	T/C's #1 - 96°F, #2 - 95°F, Room 70°F							
0.14V	16057/3	7.5×10^{-6}	118.9	7.39	18721/3	9.0×10^{-6}	115.6	7.19
0.00 H	S.S. Counter - 363/4 = 91 c/m							
0.00 A	T/C's #1 - 96°F, #2 - 95°F, Room 70°F							

9/7/45

Assembly B-4   Pu-to-Pu separation 1.14 cm (Ave.)

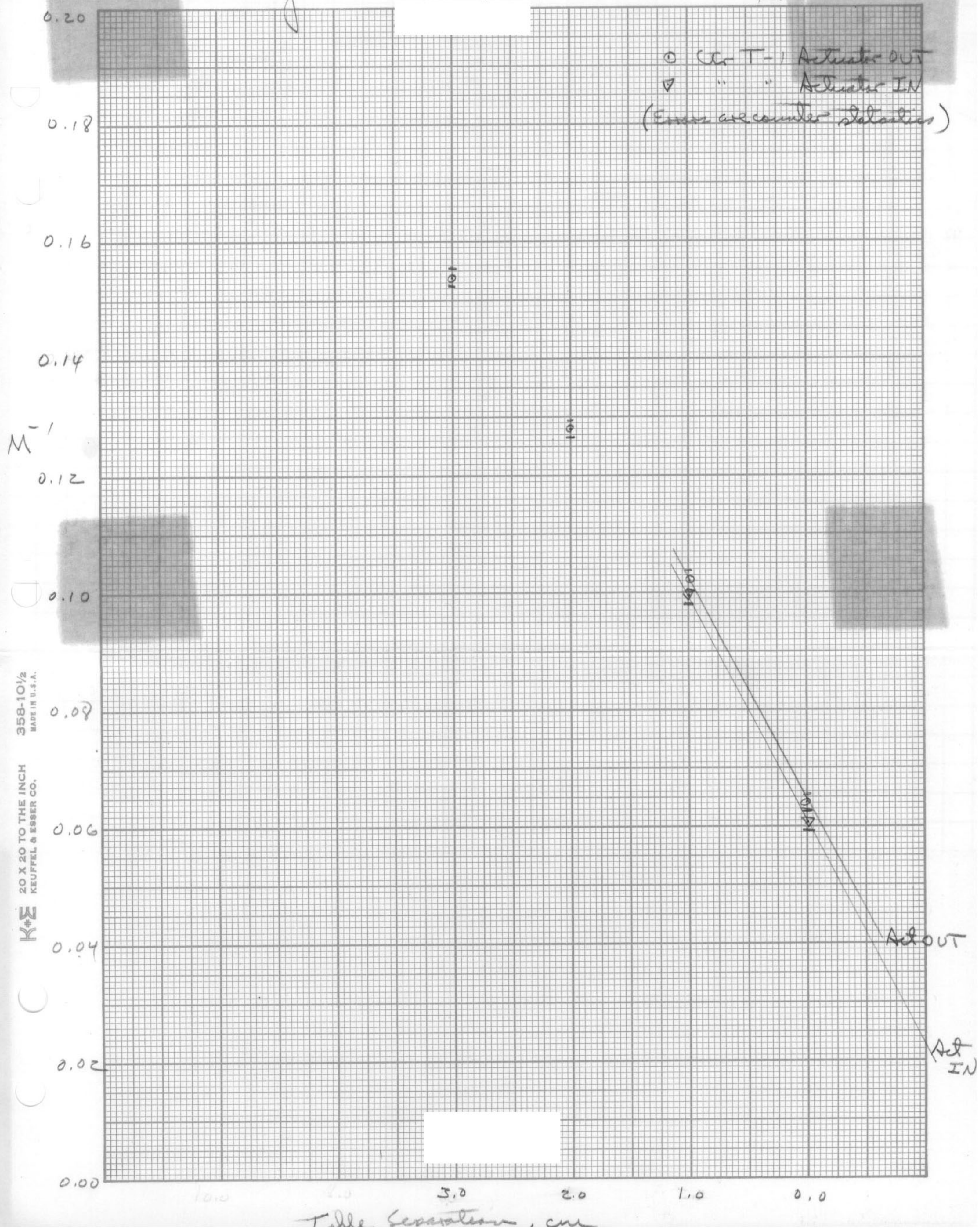
Lateral spacing: 0.69 fixed + 0.51 variable = 1.20 cm

Vertical spacing: 0.57 cm fixed + 0.45 variable = 1.02 cm

Position

Part #	x	y	z	
1	-3.5	-3.5	15	T/C #1 in place
2	-3.5	-3.5	22.5	
4	4.5	-3.5	15	
5	4.5	-3.5	22.5	T/C #2 in place
6	-3.5	4.5	15	
7	-3.5	4.5	22.5	
8	4.5	4.5	15	
9	4.5	4.5	22.5	

Assembly B-4 9/7/65 Counter T-2

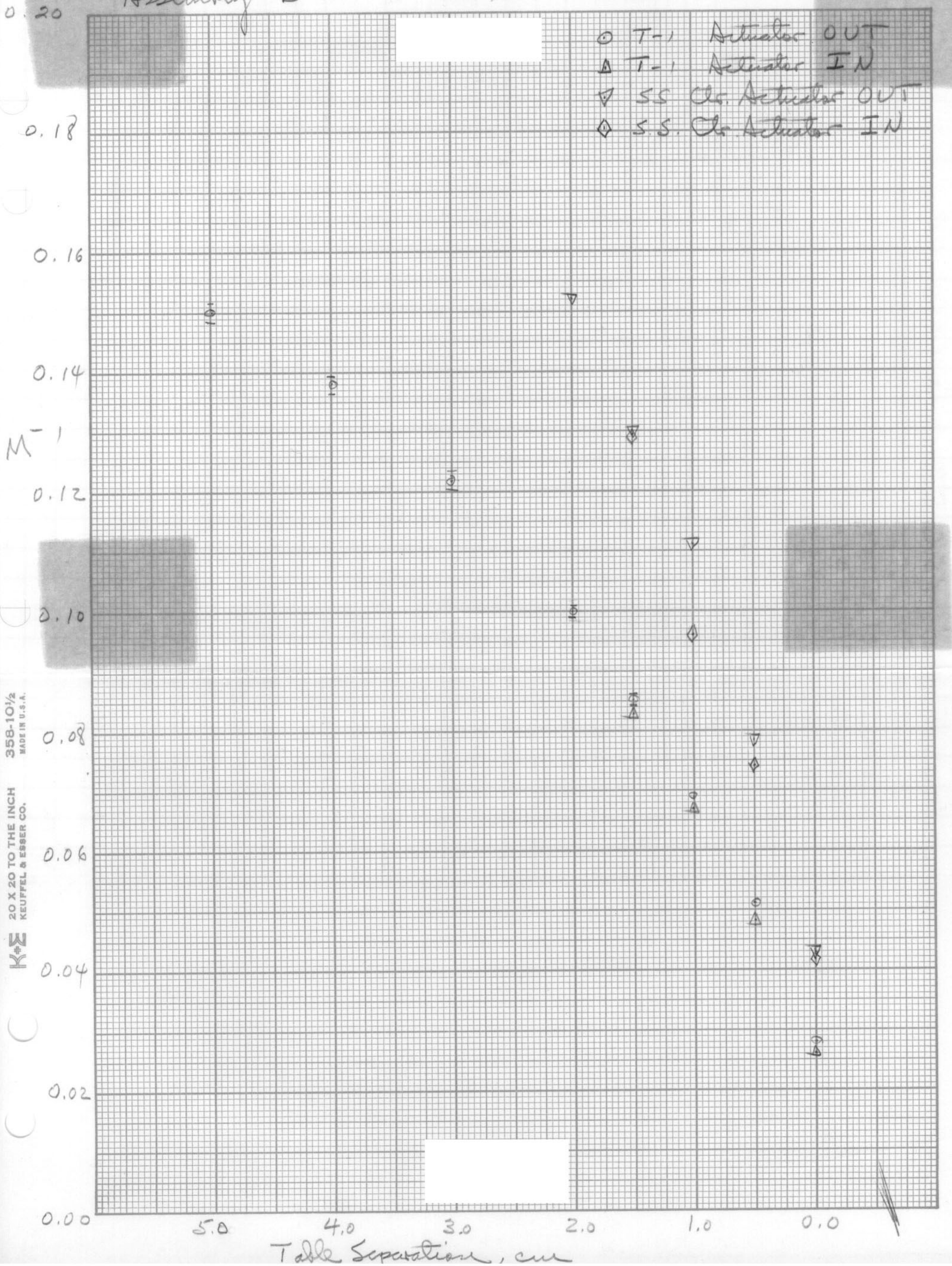


Base Rate 16.081 $\times 10^5$ n/sec

Position cm	T-1 cts/3 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/3 min	Eff	n/sec $\times 10^{-5}$	M
0.14V	10650	7.5×10^{-6}	78.89	4.91	12208	9.0×10^{-6}	75.36	4.69
9.55H	T/C's #1 - 92 °F, #2 - 99 °F, Room 71 °F							
15.00A	SS Counter 280/4.00							
0.14V	10181/2	7.5×10^{-6}	113.12	7.03	11237/2	9.0×10^{-6}	104.04	6.47
3.00H	T/C's #1 - 94 °F, #2 - 102 °F, Room 71 °F							
15.00A	SS Counter 288/3.00							
0.14V	11724/2	7.5×10^{-6}	130.27	8.10	13579/2	9.0×10^{-6}	125.73	7.82
2.00H	T/C's #1 - 95 °F, #2 - 103 °F, Room 71 °F							
15.00A	SS Counter 367/3.00							
0.14V	14929/2	7.5×10^{-6}	165.88	10.32	17085/2	9.0×10^{-6}	158.20	9.84
1.00H	T/C's #1 - 95 °F, #2 - 103 °F, Room 71 °F							
15.00A	SS Counter 414/3.00							
0.14V	14977/2	7.5×10^{-6}	166.41	10.35	17513/2	9.0×10^{-6}	162.15	10.07
1.00H	T/C's #1 - 96 °F, #2 - 104 °F, Room 71 °F							
0.00A	SS Counter 452/3.00							
0.14V	24522/2	7.5×10^{-6}	272.46	16.94	28650/2	9.0×10^{-6}	265.27	16.50
0.00H	T/C's #1 - 98 °F, #2 - 106 °F, Room 71 °F							
0.00A	SS Counter 674/3.00							
0.14V	23428/2	7.5×10^{-6}	260.31	16.19	27084/2	9.0×10^{-6}	250.77	15.59
0.00H	T/C's #1 - 100 °F, #2 - 106 °F, Room 71 °F							
15.00A	SS Counter 658/3.00							

9/7/65

Assembly B-5 Ctrs, T-1 and S.S.



Assembly B-5   Pu-to-Pu spacing 0.94 cm (Ave.)

Positions

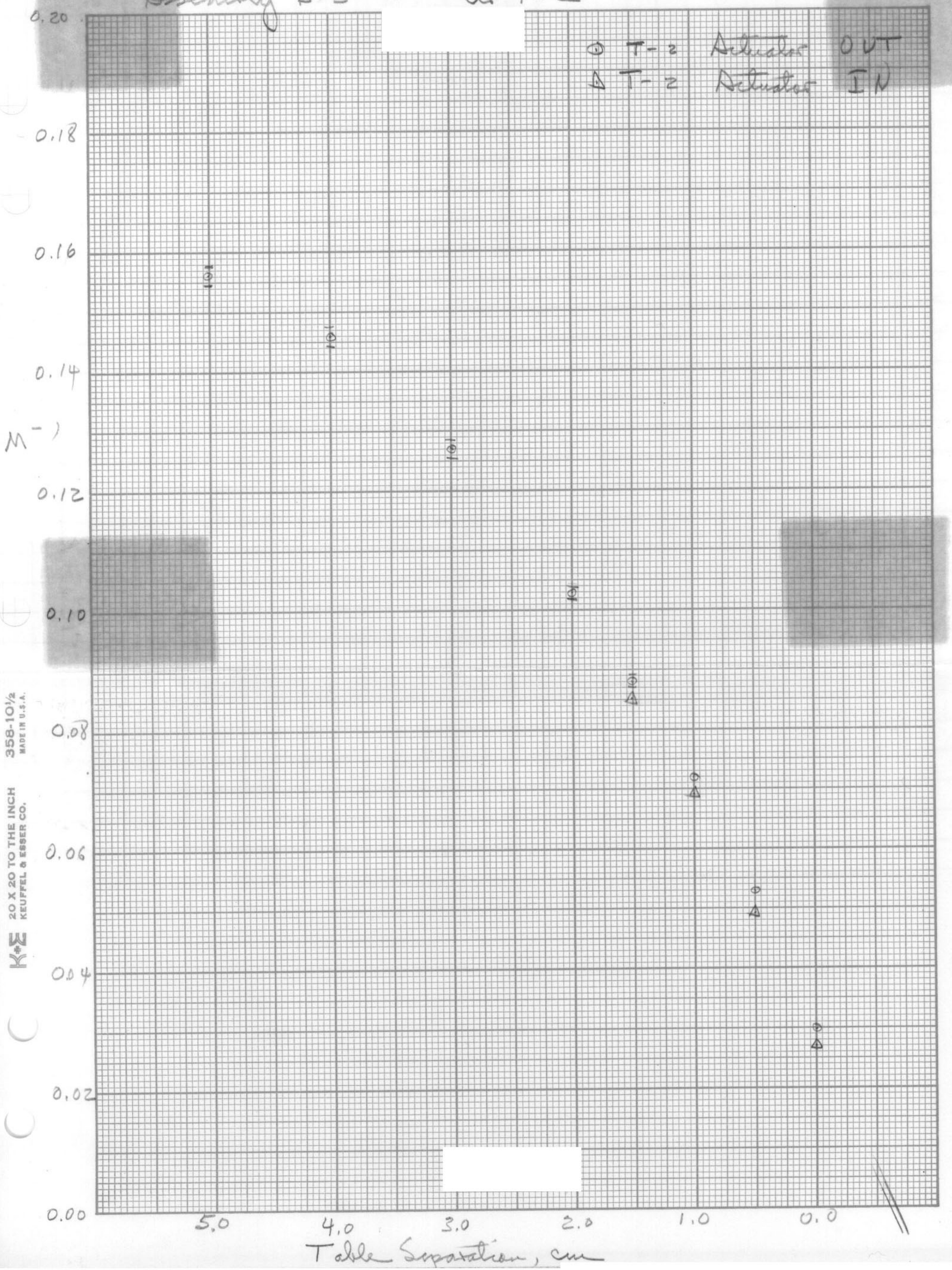
Lateral spacing: 0.69 fixed + 0.31 variable = 1.00 cm
Vertical spacing: 0.57 fixed + 0.25 variable = 0.82 cm

Part #	x	y	z	
1	−3.5	−3.5	15	T/C #1 in place
2	−3.5	−3.5	22	
4	4.0	−3.5	15	
5	4.0	−3.5	22	T/C #2 in place
6	−3.5	4.0	15	
7	−3.5	4.0	22	
8	4.0	4.0	15	
9	4.0	4.0	22	

Base Rate 16.081×10^5 n/sec

Position cm	T-1 cts/2 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
0.14V	11580/3	7.5×10^{-6}	85.77	5.33	13285/3	9.0×10^{-6}	82.01	5.10
9.55H	T/C's Room 70 °F, #1 – 95 °F, #2 – 109 °F							
15.00A	SS Counter 221/4.00							
0.14V	9645	7.5×10^{-6}	107.16	6.66	11122	9.0×10^{-6}	102.98	6.40
5.00H	T/C's Room 70 °F, #1 – 95 °F, #2 – 109 °F							
15.00A	SS Counter 228/3.00							
0.14V	10526	7.5×10^{-6}	116.96	7.27	11856	9.0×10^{-6}	109.78	6.83
4.00H	T/C's Room 70 °F, #1 – 96 °F, #2 – 110 °F							
15.00A	SS Counter 251/3.00							
0.14V	11835	7.5×10^{-6}	131.51	8.18	13714	9.0×10^{-6}	126.98	7.90
3.00H	T/C's Room 70 °F, #1 – 96 °F, #2 – 110 °F							
15.00A	SS Counter 268/3.00							
0.14V	14496	7.5×10^{-6}	161.07	10.02	16796	9.0×10^{-6}	139.97	9.67
2.00H	T/C's Room 71 °F, #1 – 96 °F, #2 – 110 °F							
15.00A	SS Counter 330/3.00							

9/7/65 Assembly B-5 Cr T-2

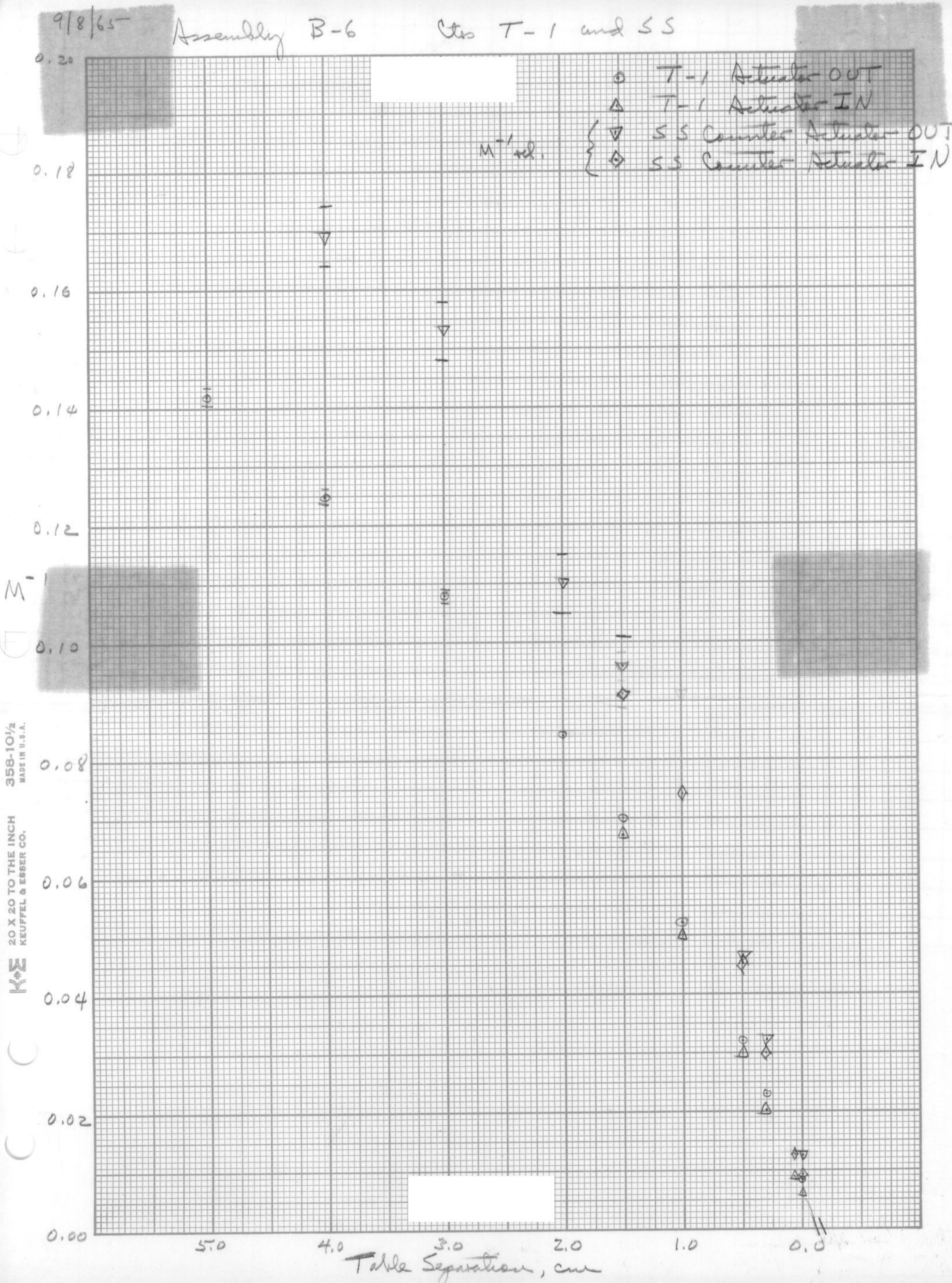


Position cm	T-1 cts/2 min	Eff	n/sec X10^{-5}	M	T-2 cts/2 min	Eff	n/sec X10^{-5}	M
0.14V	16978	7.5×10^{-6}	188.64	11.73	19721	9.0×10^{-6}	182.60	11.36
1.50H	T/C's Room - 71 °F, #1 - 97 °F, #2 - 111 °F							
15.00A	SS Counter 386/3.00							
0.14V	21028	7.5×10^{-6}	233.64	14.53	23990	9.0×10^{-6}	222.13	13.82
1.00H	T/C's Room - 70 °F, #1 - 97 °F, #2 - 110 °F							
15.00A	SS Counter 449/3.00							
0.14V	28206	7.5×10^{-6}	313.40	19.49	32594	9.0×10^{-6}	301.79	18.77
0.50H	T/C's Room 70 °F, #1 - 97 °F, #2 - 111 °F							
15.00A	SS Counter 637/3.00							
0.14V	50954	7.5×10^{-6}	566.16	35.20	58788	9.0×10^{-6}	544.33	33.85
0.00H	T/C's Room 70 °F, #1 - 98 °F, #2 - 112 °F							
15.00A	SS Counter 1160/3.00							

9/8/65

Repeat to check normalization

0.14V	11545/3	7.5×10^{-6}	85.52	5.32	13411/3	9.0×10^{-6}	82.79	5.15
9.55H	T/C's Room 71 °F, #1 - 101 °F, #2 - 111 °F							
15.00A	SS Counter 231/4.00							
	Practically identical count rates							
0.14V	55921	7.5×10^{-6}	621.35	38.64	65430	9.0×10^{-6}	605.83	37.67
0.00H	T/C's Room 71 °F, #1 - 100 °F, #2 - 111 °F							
0.00A	SS Counter 1193/3.00							
0.14V	29975	7.5×10^{-6}	333.05	20.71	35275	9.0×10^{-6}	326.62	20.31
0.50H	T/C's same							
0.00A	SS Counter 672/3.00							
0.14V	21604	7.5×10^{-6}	240.70	14.97	25346	9.0×10^{-6}	234.69	14.59
1.00H	T/C's same							
0.00A	SS Counter 522/3.00							
0.14V	17511	7.5×10^{-6}	194.56	12.10	20514	9.0×10^{-6}	189.94	11.81
1.50H	T/C's same							
0.00A	SS Counter 386/3.00							



9/8/65
Assembly B-6 Ctrs T-1 and SS
T-1 Actuator OUT
T-1 Actuator IN
SS Counter Actuator OUT
SS Counter Actuator IN
M⁻¹ rel.
M⁻¹
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
5.0
4.0
3.0
2.0
1.0
0.0
Table Separation, cm
20 X 20 TO THE INCH
KEUFFEL & ESSER CO.
358-10½
MADE IN U.S.A.

Assembly B-6   Pu-to-Pu spacing 0.84 cm (Ave.)

Lateral spacing: 0.69 fixed + 0.21 variable = 0.90 cm
Vertical spacing: 0.086 fixed + 0.63 variable = 0.72 cm

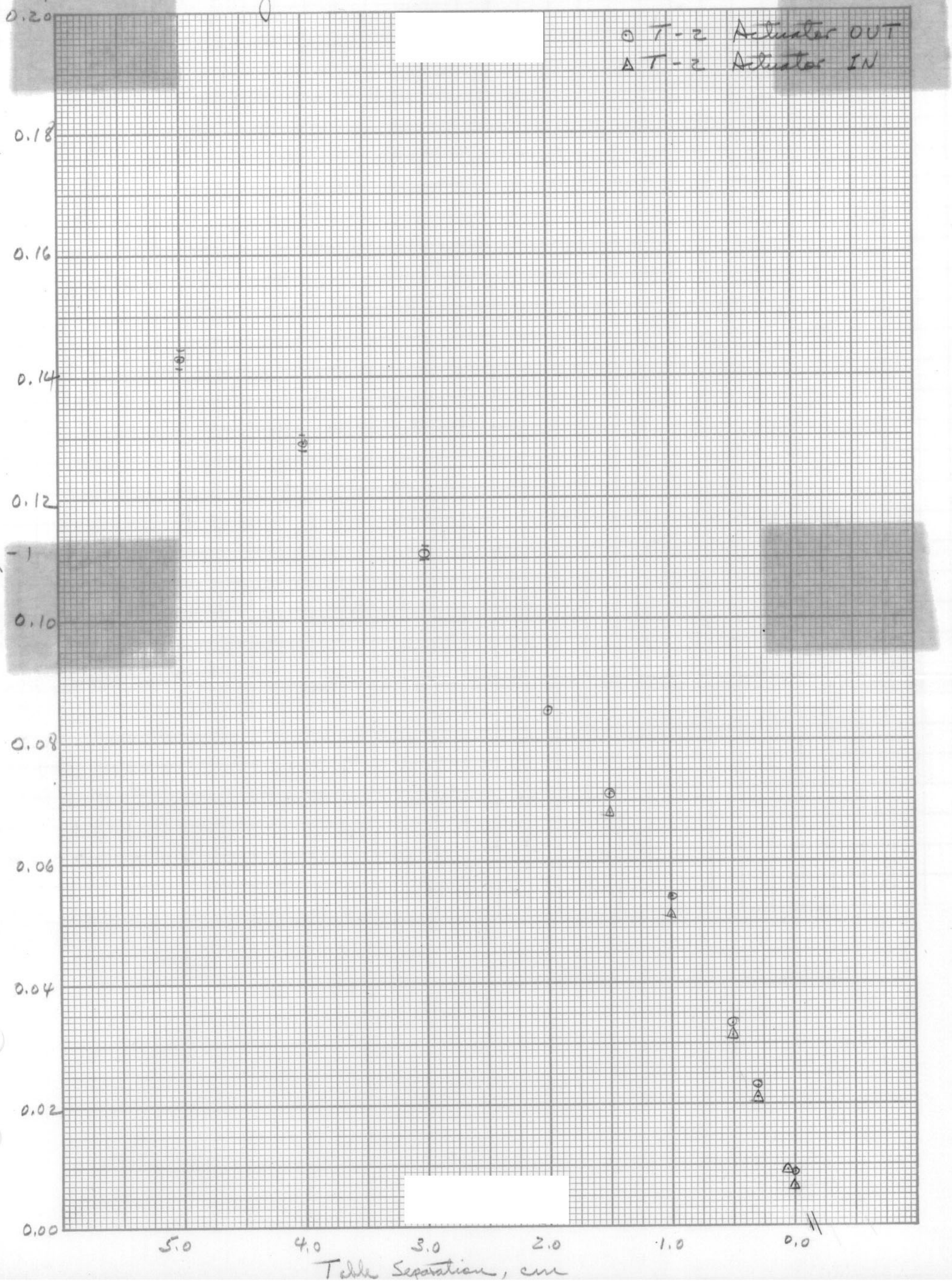
Positions

Part #	x	y	z	
1	-3.5	-3.5	15	T/C #1 in place
2	-3.5	-3.5	21.5	
4	3.7	-3.5	15	
5	3.7	-3.5	21.5	T/C #2 in place
6	-3.5	3.7	15	
7	-3.5	3.7	21.5	
8	3.7	3.7	15	
9	3.7	3.7	21.5	

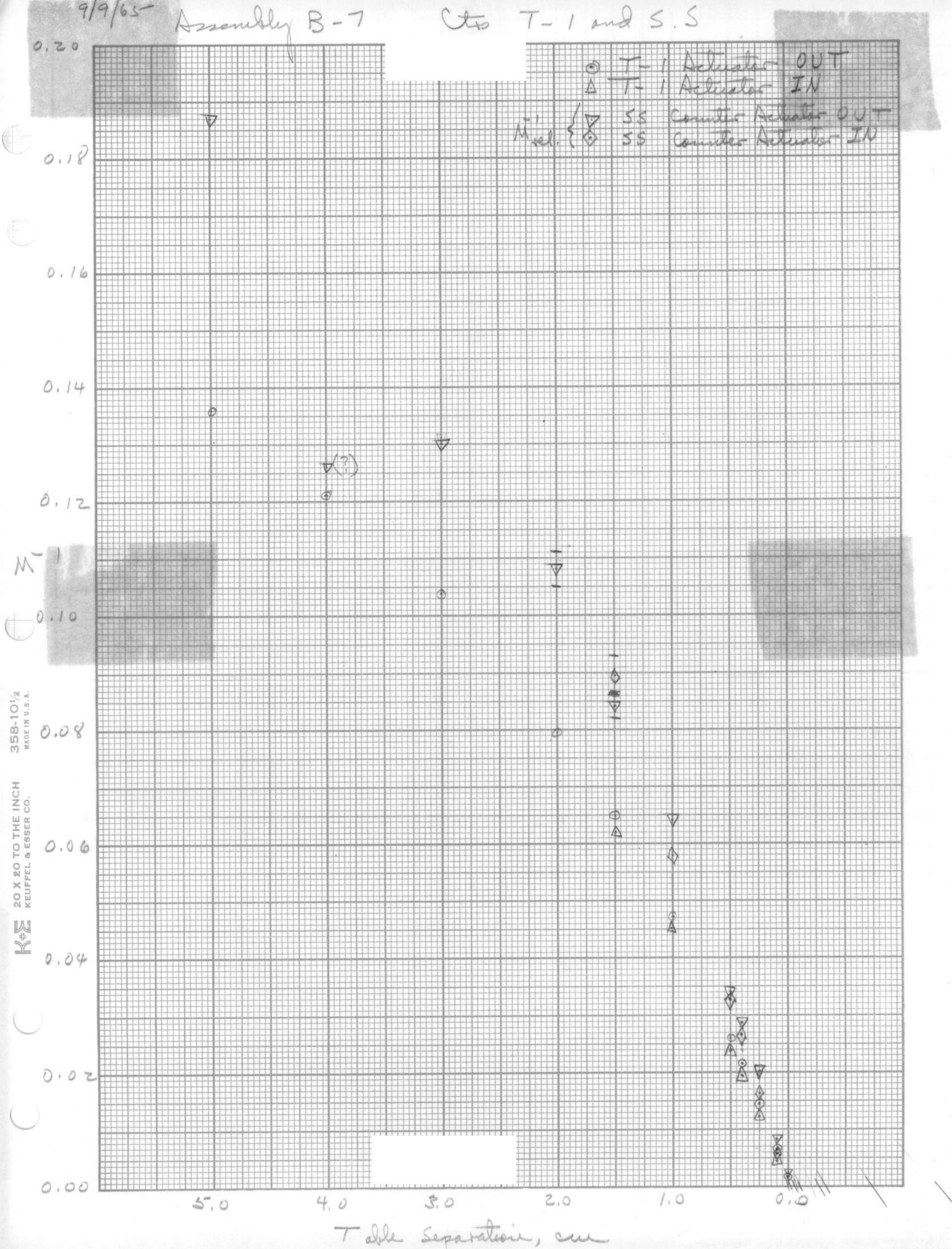
Base rate 16.081×10^5 n/sec

Position cm	T-1 cts/2 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
0.14 V	12275/3	7.5×10^{-6}	90.92	5.65	14328/3	9.0×10^{-6}	88.44	5.50
9.55 H	T/C's Room - 71 °F, #1 - 93 °F, #2 - 102 °F							
15.00 A	S.S. Counter - 262/4.00							
0.14 V	15287/3	7.5×10^{-6}	113.24	7.04	18235/3	9.0×10^{-6}	112.57	7.00
5.00 H	T/C's Room - 71 °F, #1 - 96 °F, #2 - 103 °F							
15.00 A	S.S. Counter 345/4.00							
0.14 V	11609	7.5×10^{-6}	128.99	8.02	13487	9.0×10^{-6}	124.88	7.77
4.00 H	T/C's Room - 71 °F, #1 - 96 °F, #2 - 104 °F							
15.00 A	SS Counter - 295/3.00							
0.14 V	13439	7.5×10^{-6}	149.32	9.29	15651	9.0×10^{-6}	144.91	9.01
3.00 H	T/C's Room - 71 °F, #1 - 97 °F, #2 - 105 °F							
15.00 A	SS Counter - 326/3.00							
0.14 V	17230	7.5×10^{-6}	191.44	11.9	20518	9.0×10^{-6}	189.98	11.8
2.00 H	T/C's Room - 70 °F, #1 - 98 °F, #2 - 105 °F							
15.00 A	SS Counter 456/3.00							

9/8/65 Assembly B-6 Ct T-2



Position cm	T-1 cts/2min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2min	Eff	n/sec $\times 10^{-5}$	M
0.14 V	20805	7.5×10^{-6}	231.17	14.58	24328	9.0×10^{-6}	225.25	14.01
1.50 H	T/C's Room - 71 °F, #1 - 99 °F, #2 - 107 °F							
15.00 A	SS Counter - 519/3.00							
0.14 V	21572	7.5×10^{-6}	239.68	14.90	25545	9.0×10^{-6}	236.52	14.71
1.50 H	T/C's Room - 71 °F, #1 - 101 °F, #2 - 108 °F							
0.00 A	SS Counter - 552/3.00							
0.14 V	27711	7.5×10^{-6}	307.90	19.15	32276	9.0×10^{-6}	298.85	18.58
1.00 H	T/C's Room 71 °F, #1 - 99 °F, #2 - 106 °F							
15.00 A	SS Counter							
0.14 V	28740	7.5×10^{-6}	319.33	19.86	34026	9.0×10^{-6}	315.06	19.59
1.00 H	T/C's Room 71 °F, #1 - 101 °F, #2 - 107 °F							
0.00 A	SS Counter - 680/3.00							
0.14 V	44643	7.5×10^{-6}	496.04	30.84	52912	9.0×10^{-6}	489.92	30.47
0.50 H	T/C's Room 70 °F, #1 - 102 °F, #2 - 109 °F							
15.00 A	SS Counter - 1094/3.00							
0.14 V	48258	7.5×10^{-6}	536.20	33.34	56423	9.0×10^{-6}	522.43	32.49
0.50 H	T/C's Room 71 °F, #1 - 102 °F, #2 - 109 °F							
0.00 A	SS Counter - 1104/3.00							
0.14 V	63346	7.5×10^{-6}	703.84	43.77	74210	9.0×10^{-6}	687.12	42.73
0.30 H	T/C's Room 71 °F, #1 - 102 °F, #2 - 109 °F							
15.00 A	SS Counter - 1541/3.00							
0.14 V	70886	7.5×10^{-6}	787.63	48.94	83222	9.0×10^{-6}	770.58	47.92
0.30 H	T/C's Room 71 °F, #1 - 103 °F, #2 - 109 °F							
0.00 A	SS Counter - 1648/3.00							
0.14 V	164794	7.5×10^{-6}	1831	113.9	191649	9.0×10^{-6}	1774	110.3
0.04 H	T/C's Room 71 °F, #1 - 103 °F, #2 - 109 °F							
0.00 A	SS Counter - 3927/3.00							
0.14 V	231103	7.5×10^{-6}	2568	159.6	264707	9.0×10^{-6}	2451	152.4
0.00 H	T/C's Room 71 °F, #1 - 103 °F, #2 - 109 °F							
0.00 A	SS Counter - 5437/3.00							



9/9/63
Assembly B-7
Ctrs T-1 and S.S
T-1 Actuator OUT
T-1 Actuator IN
SS Counter Actuator OUT
SS Counter Actuator IN
$M^{-1}_{rel.}$
M^{-1}
(?)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
5.0
4.0
3.0
2.0
1.0
0.0
Table Separation, cm

Position cm	T-1 cts/2 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
0.14V	171737	7.5×10^{-6}	1908	118.7	194788	9.0×10^{-6}	1803	112.1

0.00H T/C's Room – 70 °F, #1 – 104°F, #2 – 109°F

15.00A S.S. Counter – 3952/3.00

Assembly B-7 Pu-to-Pu spacing 0.79 cm (Ave)

Lateral spacing: 0.69 fixed + 0.16 variable = 0.85 cm

Vertical spacing: 0.086 fixed + 0.58 variable = 0.67 cm

Positions

Part #	x	y	z	
1	−3.5	−3.5	15	T/C #1
2	−3.5	−3.5	21	
4	3.5	−3.5	15	
5	3.5	−3.5	21	T/C #2
6	−3.5	3.5	15	
7	−3.5	3.5	21	
8	3.5	3.5	15	
9	3.5	3.5	21	

Base rate 16.081 $\times 10^{5}$ n/sec

0.14V	8329	7.5×10^{-6}	92.55	5.76	9817	9.0×10^{-6}	90.90	5.65

9.55H T/C's Room – 70 °F, #1 – 102 °F, #2 – 111 °F

15.00A S.S. Counter – 236/3.00

0.14V	10641	7.5×10^{-6}	118.24	7.35	12559	9.0×10^{-6}	116.29	7.23

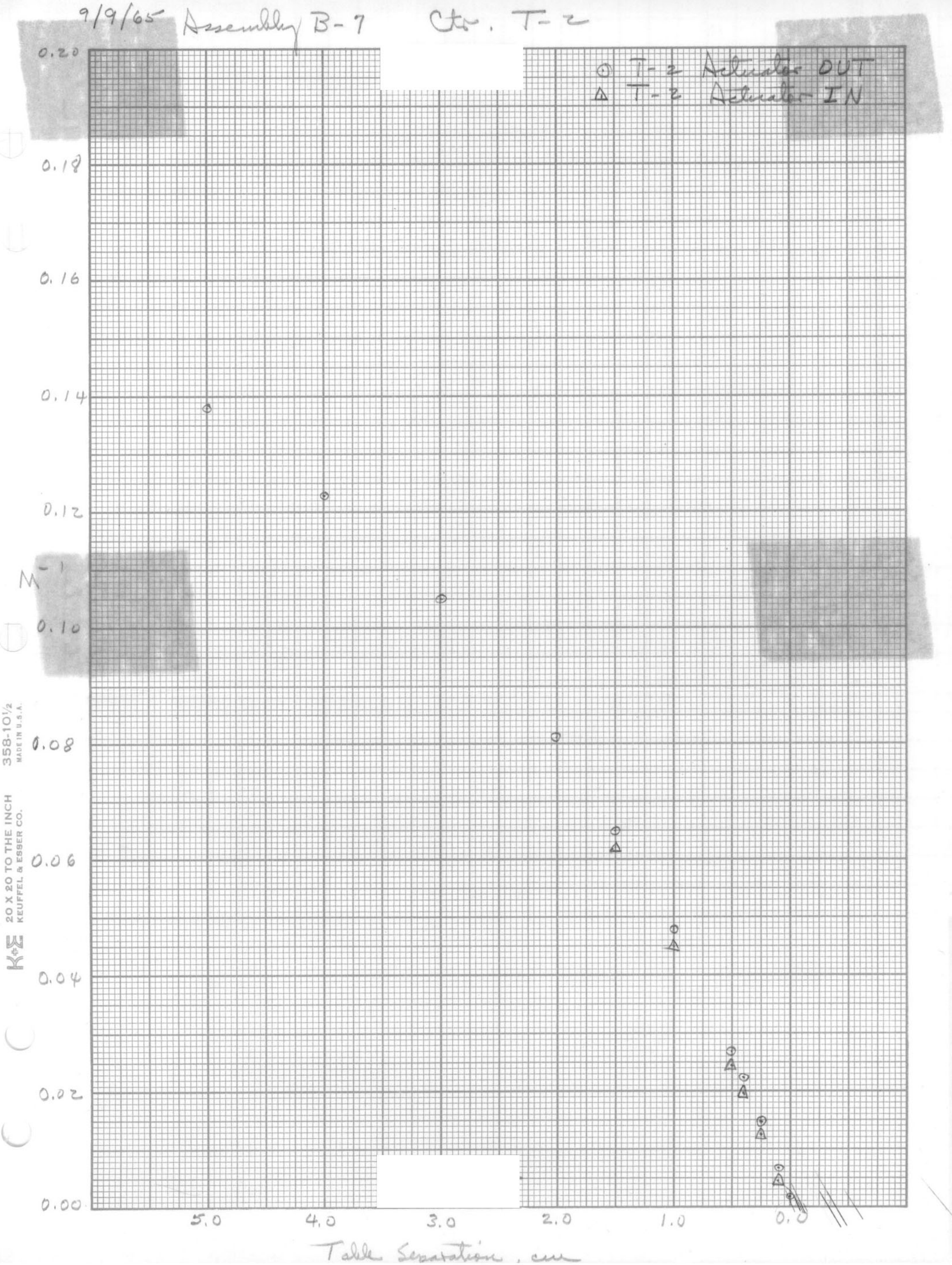
5.00H T/C's Room – 71 °F #1 – 104 °F, #2 – 112 °F

15.00A S S Counter – 268/3.00

0.14V	11972	7.5×10^{-6}	135.03	8.27	14101	9.0×10^{-6}	130.57	8.12

4.00H T/C's Room – °F, #1 – °F, #2 – °F

5.00A S S Counter – 396/3.00 (?)



9/9/65 Assembly B-7 Ctr. T-2
T-2 Actuator OUT
T-2 Actuator IN
0.20
0.18
0.16
0.14
0.12
M^-1
0.10
0.08
0.06
0.04
0.02
0.00
5.0
4.0
3.0
2.0
1.0
0.0
Table Separation, cm

Position cm	T-1 cts/2 min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
0.14V	13947	7.5×10^{-6}	154.97	9.64	16608	9.0×10^{-6}	153.77	9.56
3.00H	T/C's Room 71°F, #1 - 104°F, #2 - 112°F							
15.00A	S.S. Counter - 386/3.00							
0.14V	18210	7.5×10^{-6}	202.33	12.58	21540	9.0×10^{-6}	199.44	12.40
2.00H	T/C's Room 71°F, #1 - 104°F, #2 - 112°F							
15.00A	S.S. Counter - 459/3.00							
0.14V	22302	7.5×10^{-6}	247.80	15.41	26621	9.0×10^{-6}		15.33
1.50H	T/C's Room 71°F, #1 - 104°F, #2 - 112°F							
15.00A	S.S. Counter - 594/3.00							
0.14V	23367	7.5×10^{-6}	259.63	16.15	27940	9.0×10^{-6}	258.70	16.10
1.50H	T/C's: Room 71°F, #1 - 105°F, #2 - 113°F							
0.00A	S.S. Counter - 559/3.00 (?)							
0.14V		7.5×10^{-6}		21.45		9.0×10^{-6}		20.97
1.00H	T/C's: Room 71°F, #1 - 105°F, #2 - 113°F							
15.00A	S.S. Counter - 778/3.00							
0.14V	32026	7.5×10^{-6}	355.84	22.13	38843	9.0×10^{-6}	359.65	22.36
1.00H	T/C's: Room 71°F, #1 - 105°F, #2 - 113°F							
0.00A	SS Counter - 859/3.00							
0.14V	55118	7.5×10^{-6}	612.41	38.08	64770	9.0×10^{-6}	599.72	37.29
0.50H	T/C's: Room 71°F, #1 - 105°F, #2 - 113°F							
15.00A	S.S. Counter - 1464/3.00							
0.14V	60478	7.5×10^{-6}	671.97	41.79	71498	9.0×10^{-6}	662.02	41.17
0.50H	T/C's: Room °F, #1 - 105°F, #2 - 113°F							
0.00A	S.S. Counter - 1516/3.00							
0.14V	66904	7.5×10^{-6}	743.37	46.26	77977	9.0×10^{-6}	722.01	44.90
0.40H	T/C's: Room 71°F #1 - 105°F, #2 - 113°F							
15.00A	S.S. Counter - 1738/3.00							
0.14V	74303	7.5×10^{-6}	825.58	51.34	87355	9.0×10^{-6}	808.84	50.30
0.40H	T/C's: Room 71°F #1 - 105°F, #2 - 113°F							
0.00A	S.S. Counter - 1857/3.00							

0.14V	792506	7.5×10^{-6}	8805.61	547.58	888387	9.0×10^{-6}	8225.80	511.52
0.00	T/C's : Room 71°F #1 - 105°F #2 - 113°F							
15.00	S.S. Counter - 21377/3.00							

Repeat same on 9/10/65

0.14V	830671	7.5×10^{-6}	9229.66	573.95	945433	9.0×10^{-6}	8754.00	544.37
0.00								
15.00	S.S. Counter 21790/3.00							

Ave mult. = 559

Position cm	T-1 cts/2min	Eff.	n/sec $\times 10^{-5}$	M	T-2 cts/2min	Eff.	n/sec $\times 10^{5}$	M
0.14V	99907	7.5×10^{-6}	1110.08	69.03	116295	9.0×10^{-6}	1076.80	66.96
0.25	T/C's : Room 71°F #1 - 105°F #2 - 113°F							
15.00A	S.S. Counter - 2490/3.00							
0.14V	118794	7.5×10^{-6}	1319.93	82.08	139198	9.0×10^{-6}	1288.86	80.15
0.25	T/C's : Room 71°F #1 - 105°F #2 - 113°F							
0.00A	S.S. Counter - 3082/3.00							
0.14V	225132	7.5×10^{-6}	2501.46	155.55	256037	9.0×10^{-6}	2370.71	147.42
0.10	T/C's : Room 71°F #1 - 105°F #2 - 113°F							
15.00A	S.S. Counter - 6175/3.00							
0.14V	335930	7.5×10^{-6}	3732.54	232.11	385945	9.0×10^{-6}	3568.93	221.94
0.10	T/C's : Room 71°F #1 - 105°F #2 - 113°F							
0.00A	S.S. Counter - 8740/3.00							

At closure CRM's were overflowed, but still was level - no persisting period.

9/10/65

Recheck count rate at fast stop to verify uniformity

0.14V 128172/3 14805/3

9.55H T/C's R - 72°F 1 - 106°F 2 - 113°F

15.00A S.S. Counters - 282/4.00

Same as previously

0.14V	830671	7.5×10^{-6}	9229.66	573.95	945433	9.0×10^{-6}	8754.00	544.37
0.00	T/C's R - 72°F #1 - 106°F #2 - 113°F							
15.00A	S.S. Counter - 21790/3.00							
0.14V		7.5×10^{-6}				9.0×10^{-6}		
0.00	T/C's R - °F #1 - °F #2 - °F							
0.00A	S.S. Counter - /3.00							

did not get actuator fully in.

Period: $\frac{\phi_1}{\phi_0} = e^{\alpha t}$

$$\ln \frac{\phi_1}{\phi_0} = \alpha t$$

$$t = \frac{1}{\alpha} \ln \frac{\phi_1}{\phi_0}$$

for period $\tau = t$, $\ln \frac{\phi_1}{\phi_0} = \ln e = 1.00$

hence $\tau = \frac{1}{\alpha}$

for 1.5 fold time

$$t = \frac{1}{\alpha} \ln 1.5 = \frac{1}{\alpha} (0.405) = 176.5 \text{ sec}$$

$$\frac{\tau}{t} = \frac{\frac{1}{\alpha}}{\frac{1}{\alpha} \ln \frac{\phi_1}{\phi_0}} = \frac{1}{\ln \frac{\phi_1}{\phi_0}}$$

$$\tau = \frac{t}{\ln \frac{\phi_1}{\phi_0}} = \frac{176.5 \text{ sec}}{0.405} = 435.8 \text{ sec}$$

≈ 3.1 ¢ of reactivity

At rod position 0.495 cm we got a period which persisted:

Checked with stop watch 1.5-fold time was 176.5 sec.
hence doubling time was 352 sec.

Then the period (e-fold) was 435.8 sec ≐ 3.1 ¢ reactivity

Flux level mostly on 10×10^{-9} amp scale; at this level steady state was attained with actuator set at 0.540 cm

Re-checked that the same period above could be achieved by going back to 0.500 cm. It confirmed. Then ran in the actuator to obtain faster periods as indicated on the period meter.

Actuator Pos. cm	Period (meter) sec	Beck 1 10^{-8} amps	Beck 2 10^{-8} amps	Victoreen, RAMS, r/hr 1	2	3	4	5
0.17	100	1.7	5.0	0.1	10	0.2	0.3	2
0.10	70-80	1.7	5.0	0.3	20	0.22	0.5	2

Apparently a minimum spacing of 0.10 cm will provide an adequate amount of excess reactivity for power control. We should probably move the actuator back to limit the approach to that amount.

Re-checked critical position at level of 0.6×10^{-7} amps on Beckman 1: 0.47 cm. Looks like old problem of presence of source (Then there is ~ 4.2 ¢ error due to presence of source at ~10^{-9} amps)

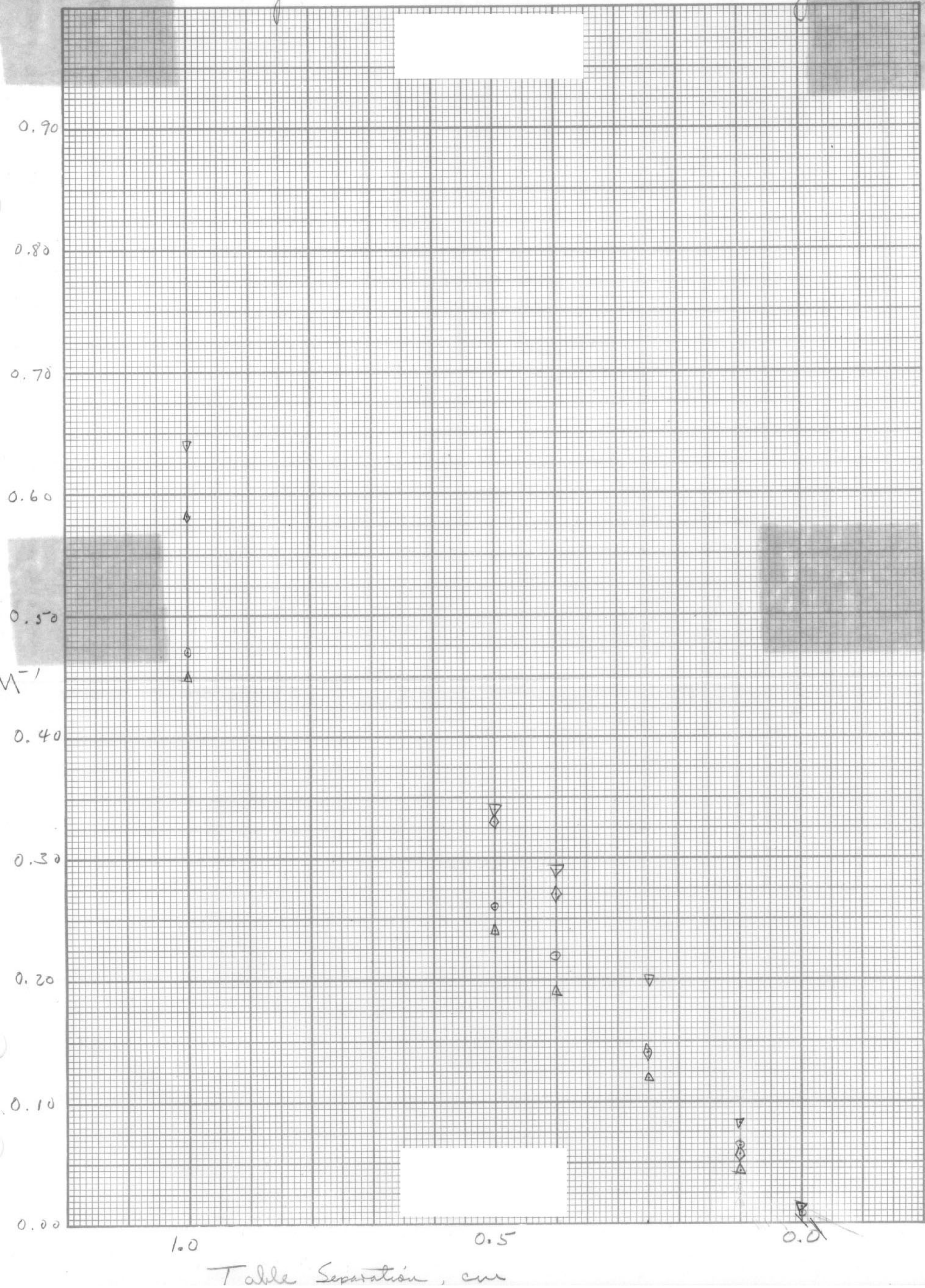
From single period calibration above, we get worth of actuator motion:

$\Delta\rho / \Delta x$ (10×10^{-9} amp scale) 3.1 ¢ / 0.045 cm ≅ 69 ¢/cm

During entire sequence maximum temperatures were Room 71°F, #1 - 105°F, #2 - 114°F.

Discovered that vertical spacing was actually 0.18 cm less than was believed - error in figuring the components in the vertical dimensions on p 67. This error was present in assemblies B-1 thru 7. Corrected in all previous notes. The following assemblies will be isotropic.

9/9/65 Assembly B-7 Ctrs T-1 and SS (Larger scale)



Assembly B-8 Pu-to-Pu spacing 0.85 cm

Lateral spacing: 0.69 fixed + 0.16 variable = 0.85 cm

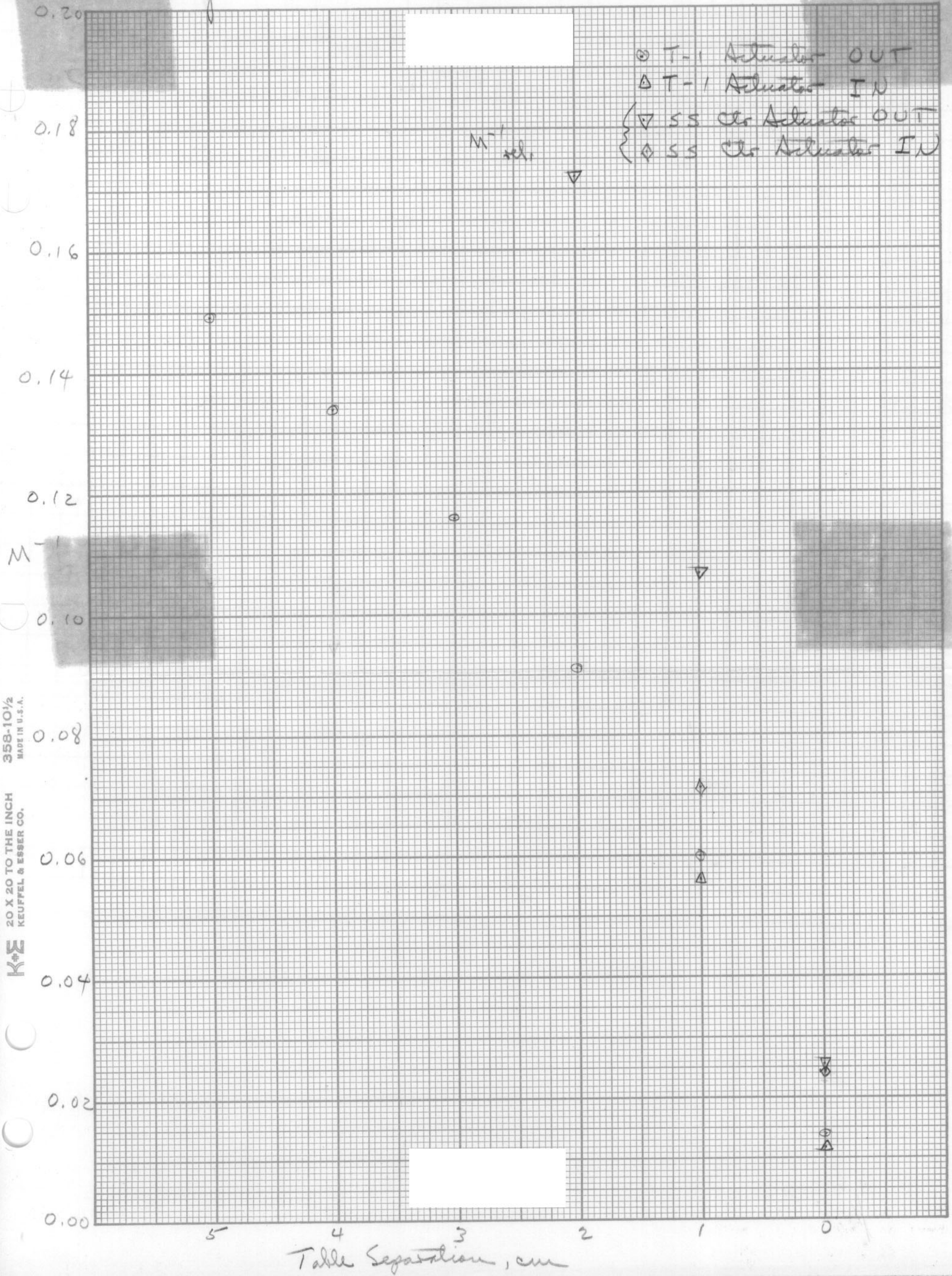
Vertical spacing: 0.086 fixed + 0.765 variable = 0.851 cm

Positions: Essentially as shown for Assembly B-7. T/C's on parts #1 and 5.

Base rate 16.081 x 10^5 n/sec

Position cm	T-1 cts/2 min	Eff	n/sec x 10^-5	M	T-2 cts/2 min	Eff	n/sec x 10^-5	M
0.14 V	11817/3	7.5 x 10^-6	87.53	5.44	12646/3	9 x 10^-6	78.01	4.85
9.55 H	T/C's Room - 70 °F, #1 - 98 °F, #2 - 99 °F							
15.00 A	S.S. Counters - —							
0.14 V	9709	7.5 x 10^-6	107.88	6.71	10522	9.0 x 10^-6	97.42	6.06
5.00 H	T/C's Room - 70 °F, #1 - 100 °F, #2 - 100 °F							
15.00 A	SS Counter -							
0.14 V	10842	7.5 x 10^-6	120.47	7.49	11516	9.0 x 10^-6	106.63	6.63
4.00 H	T/C's Room - 70 °F, #1 - 101 °F, #2 - 101 °F							
15.00 A	SS Counter -							
0.14 V	12476	7.5 x 10^-6	138.63	8.62	13492	9.0 x 10^-6	124.92	7.77
3.00 H	T/C's Room 70 °F, #1 - 102 °F, #2 - 101 °F							
15.00 A	S.S Counter -							
0.14 V	15850	7.5 x 10^-6	176.11	10.95	16924	9.0 x 10^-6	156.70	9.74
2.00 H	T/C's Room 70 °F, #1 - 102 °F, #2 - 104 °F							
15.00 A	SS Counter - 290/3.00							
0.14 V	24090	7.5 x 10^-6	267.67	16.65	26248	9.0 x 10^-6	243.03	15.11
1.00 H	T/C's Room 70 °F, #1 - 102 °F, #2 - 105 °F							
15.00 A	SS Counter - 469/3.00							
0.14 V	102400	7.5 x 10^-6	1137.77	70.70	108666	9.0 x 10^-6	1006.17	62.57
0.00 H	T/C's Room 70 °F, #1 - 103 °F, #2 - 105 °F							
15.00 A	SS Counter - 1965/3.00							

Assembly B-8 9/13/65 Ctrs T-1 and SS



Position cm	T-1 cts/2 min	Eff	n/sec ×10^-5	M	T-2 cts/2 min	Eff.	n/sec ×10^-5	M
0.14V	122519	7.5×10^{-6}	1361.3	84.65	129299	9.0×10^{-6}	1197.21	74.45
0.00H	T/C's #1 - 104, #2 - 105, Room - 70 °F							
0.00A	S.S. Counter - 2099/3.00							
0.14V	25762	7.5×10^{-6}	286.24	17.80	27571	9.0×10^{-6}	255.28	15.87
1.00H	T/C's Room 70°F, #1 - 105°F, #2 - 107°F							
0.00A	SS Counter - 704/3.00							

Assembly B-9: Pu - to - Pu distance 0.80 cm

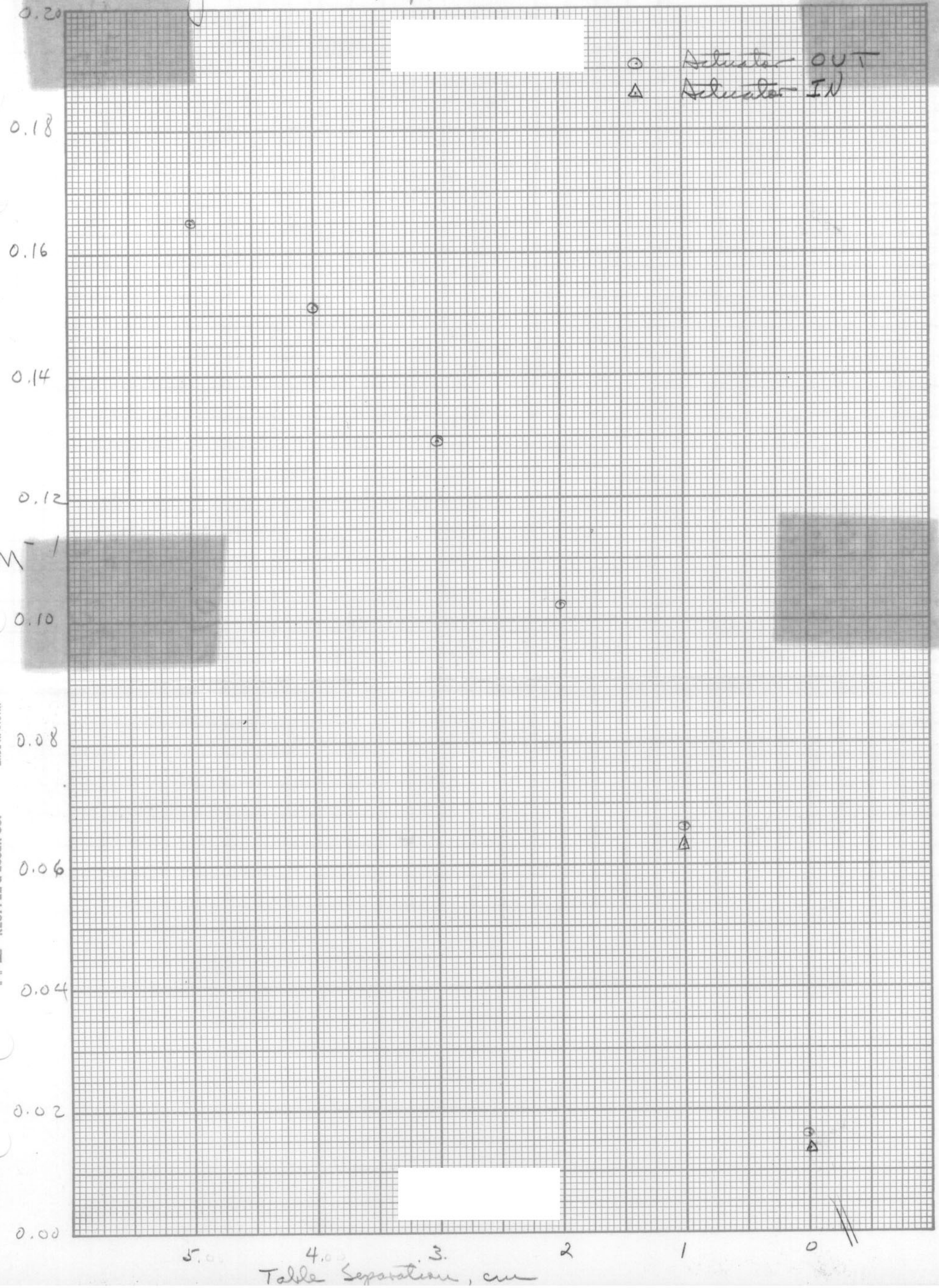
Lateral spacing: 0.69 fixed + 0.11 variable = 0.80 cm

Vertical spacing: 0.086 fixed + 0.714 variable = 0.80 cm

Positions Essentially as before. T/C's on parts #1 and #5.

Position cm	T-1 cts/2 min	Eff	n/sec ×10^-5	M	T-2 cts/2 min	Eff.	n/sec ×10^-5	M
0.14V	8208	7.5×10^{-6}	91.20	5.67	8428	9.0×10^{-6}	78.03	4.85
9.55H	T/C's Room - 70 °F, #1-105 °F, #2 - 107 °F							
15.00A	S. S. Counter - 293/3.00							
0.14V	10316	7.5×10^{-6}	114.63	7.13	10712	9.0×10^{-6}	99.19	6.17
5.00H	T/C's Room - 70 °F, #1 - 104°F, #2 - 107°F							
15.00A	S. S. Counter - 354/3.00							
0.14V	11426	7.5×10^{-6}	126.96	7.90	11704	9.0×10^{-6}	108.37	6.74
4.00H	T/C's Room - 70 °F, #1 - 104 °F, #2 - 106°F							
15.00 A	SS Counter - 393/3.00							
0.14V	13472	7.5×10^{-6}	149.69	9.31	13678	9.0×10^{-6}	126.64	7.88
3.00H	T/C's Room - 70 °F, #1 - 104 °F, #2 - 107 °F							
15.00A	SS Counter - 454/3.00							
0.14V		7.5×10^{-6}		11.72		9.0×10^{-6}		10.23
2.00H	T/C's Room - 70°F, #1 - 104 °F, #2 - 107 °F							
15.00A	SS Counter -							

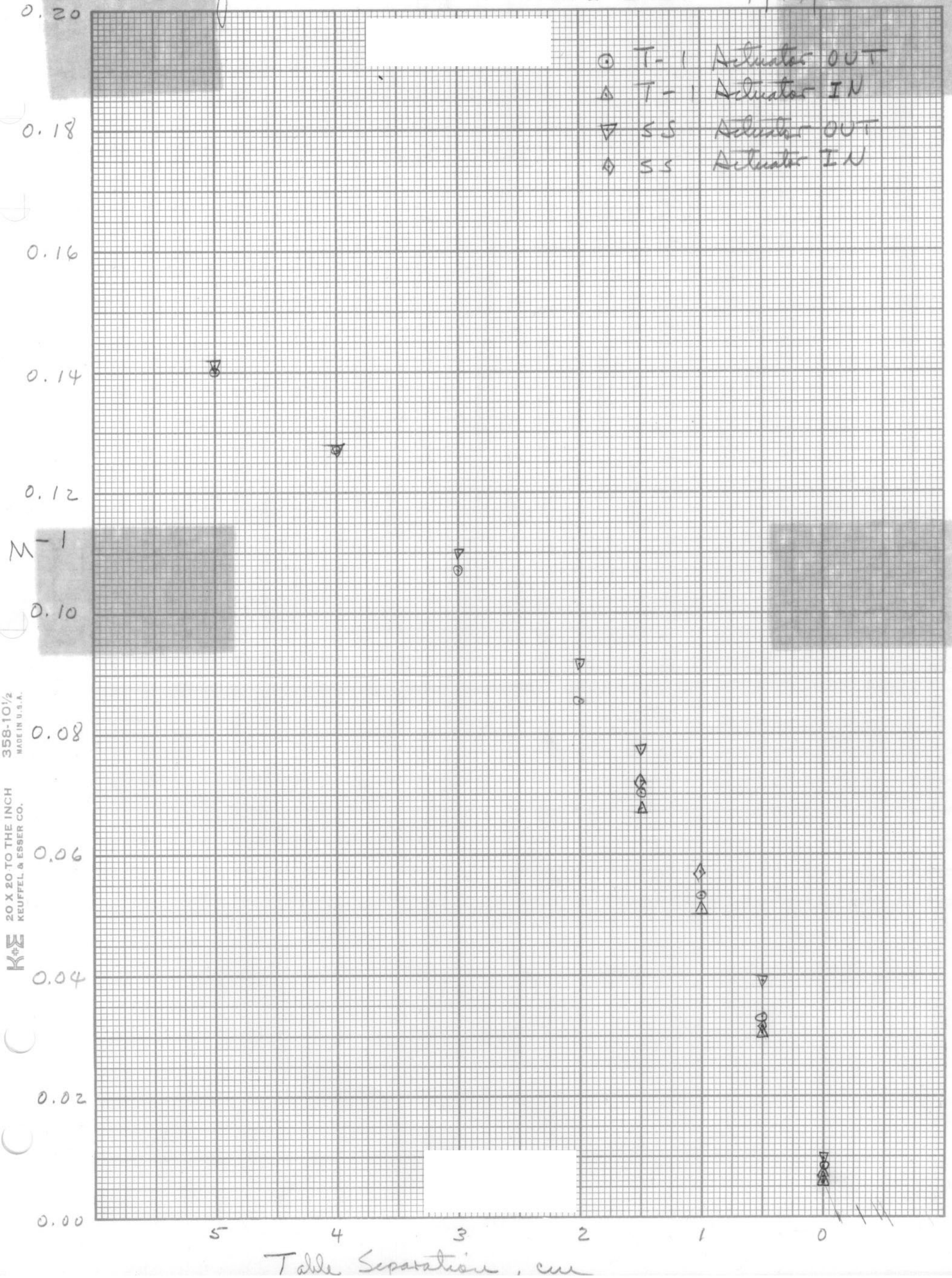
Assembly B-8 9/13/65 Ct T-2



Position cm	T-1 cts/2min	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2min	Eff.	n/sec $\times 10^{-5}$	M
0.14V	20657	7.5×10^{-6}	229.52	14.27	21161	9.0×10^{-6}	195.93	12.18
1.50H	T/C's Room – 70 °F, #1 – 104 °F, #2 – 107 °F							
15.00A	SS Counter – 647/3.00							
0.14V	21390	7.5×10^{-6}	237.67	14.78	22194	9.0×10^{-6}	205.50	12.78
1.50H	T/C's Room – 70 °F, #1 – 104 °F, #2 – 107 °F							
0.00A	SS Counter – 691/3.00							
0.14V	27177	7.5×10^{-6}	301.97	18.78	27867	9.0×10^{-6}	258.03	16.05
1.00H	T/C's Room – 70°F, #1 – 104°F, #2 – 107 °F							
15.00A	SS Counter – 2211(?)/3.00							
0.14V	28194	7.5×10^{-6}	313.27	19.48	29308	9.0×10^{-6}	271.37	16.88
1.00H	T/C's Room – 70 °F, #1 – 105 °F, #2 – 107 °F							
0.00A	SS Counter – 884/3.00							
0.14V	43608	7.5×10^{-6}	484.53	30.13	44370	9×10^{-6}	410.83	25.55
0.50H	T/C's Room – 70 °F, #1 – 105 °F, #2 – 107 °F							
15.00A	SS Counter 1289/3.00							
0.14V	47167	7.5×10^{-6}	524.08	32.59	47953	9.0×10^{-6}	444.01	27.61
0.50H	T/C's Room – 70 °F, #1 – 105°F, #2 – 108 °F							
0.00A	SS Counter 1584/3.00							
0.14V	176211	7.5×10^{-6}	1957.89	122.37	175715	9.0×10^{-6}	1626.98	101.17
0.00H	T/C's Room – 70 °F #1 – 105 °F #2 – 108 °F							
15.00A	SS Counter – 5197/3.00							
0.14V	240194	7.5×10^{-6}	2668.81	165.96	240769	9.0×10^{-6}	2229.33	138.63
0.00H	T/C's Room – 70 °F #1 – 105 °F #2 – 108 °F							
0.00A	SS Counter – 7674/3.00							

Attempted some Rossi-α measurements here – the count rates were still much too low.

Assembly B-9 Cto T-1 and S.S. 9/14/65



Assembly B-10: Pu-to-Pu spacing 0.725 cm

Lateral spacing: 0.69 fixed + 0.035 variable = 0.725 cm.

Vertical spacing: 0.086 fixed + 0.64 variable = 0.726 cm.

Positions: Essentially same as before; T/C's on #1 and #5

Base rate 16.081 X 10^5 n/sec

Position cm	T-1 cts/2min	Eff	n/sec X10^{-5}	M	T-2 cts/2min	Eff	n/sec X10^{-5}	M
0.14V	12675/3	7.5×10^{-6}	93.89	5.84	13481/3	9.0×10^{-6}	83.20	5.17
9.55H	T/C's Room - 70 °F, #1 - 109 °F, #2 - 107 °F							
15.00A	SS Counter - 354/4.00							
0.14V	10816	7.5×10^{-6}	120.17	7.48	11409	9.0×10^{-6}	105.64	6.57
5.00H	T/C's Room - 70 °F, #1 - 110 °F, #2 - 108 °F							
15.00A	S.S Counter - 325/3.00							
0.14V	12533	7.5×10^{-6}	139.25	8.66	12904	9.0×10^{-6}	119.48	7.43
4.00H	T/C's Room - 70 °F, #1 - 110 °F, #2 - 108 °F							
15.00A	SS Counter - 415/3.00							
0.14V	14578	7.5×10^{-6}	161.97	10.07	15465	9.0×10^{-6}	143.20	8.90
3.00H	T/C's Room - 70 °F, #1 - 110 °F, #2 - 108 °F							
15.00A	S.S Counter - X							
0.14V	19624	7.5×10^{-6}	163.53	13.56	20610	9.0×10^{-6}	190.83	11.87
2.00H	T/C's Room - 70 °F, #1 - 110 °F, #2 - 108 °F							
15.00A	S.S. Counter - 646/3.00							
0.14V	24474	7.5×10^{-5}	271.93	16.91	25760	9.0×10^{-6}	238.52	14.83
1.50H	T/C's Room - 70 °F, #1 - 111 °F, #2 - 108 °F							
15.00A	S.S. Counter - 781/3.00							
0.14V	25861	7.5×10^{-5}	287.34	17.87	26930	9.0×10^{-6}	249.35	15.51
1.50H	T/C's Room - 70 °F, #1 - 110 °F, #2 - 108 °F							
0.00A	S.S. Counter - 829/3.00							

Assembly B-9 Ctr T-2 9/14/65

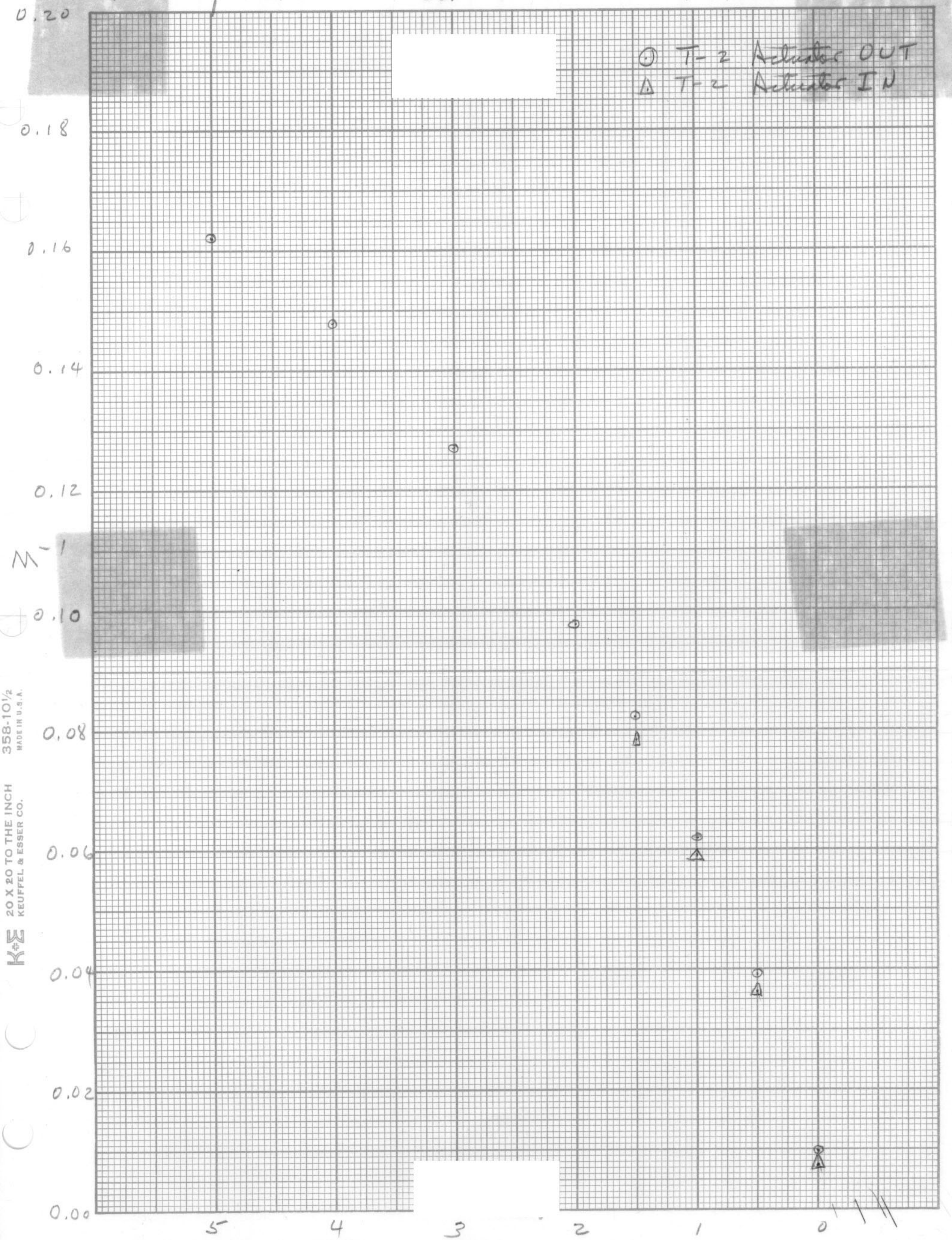


Table Separation, cm

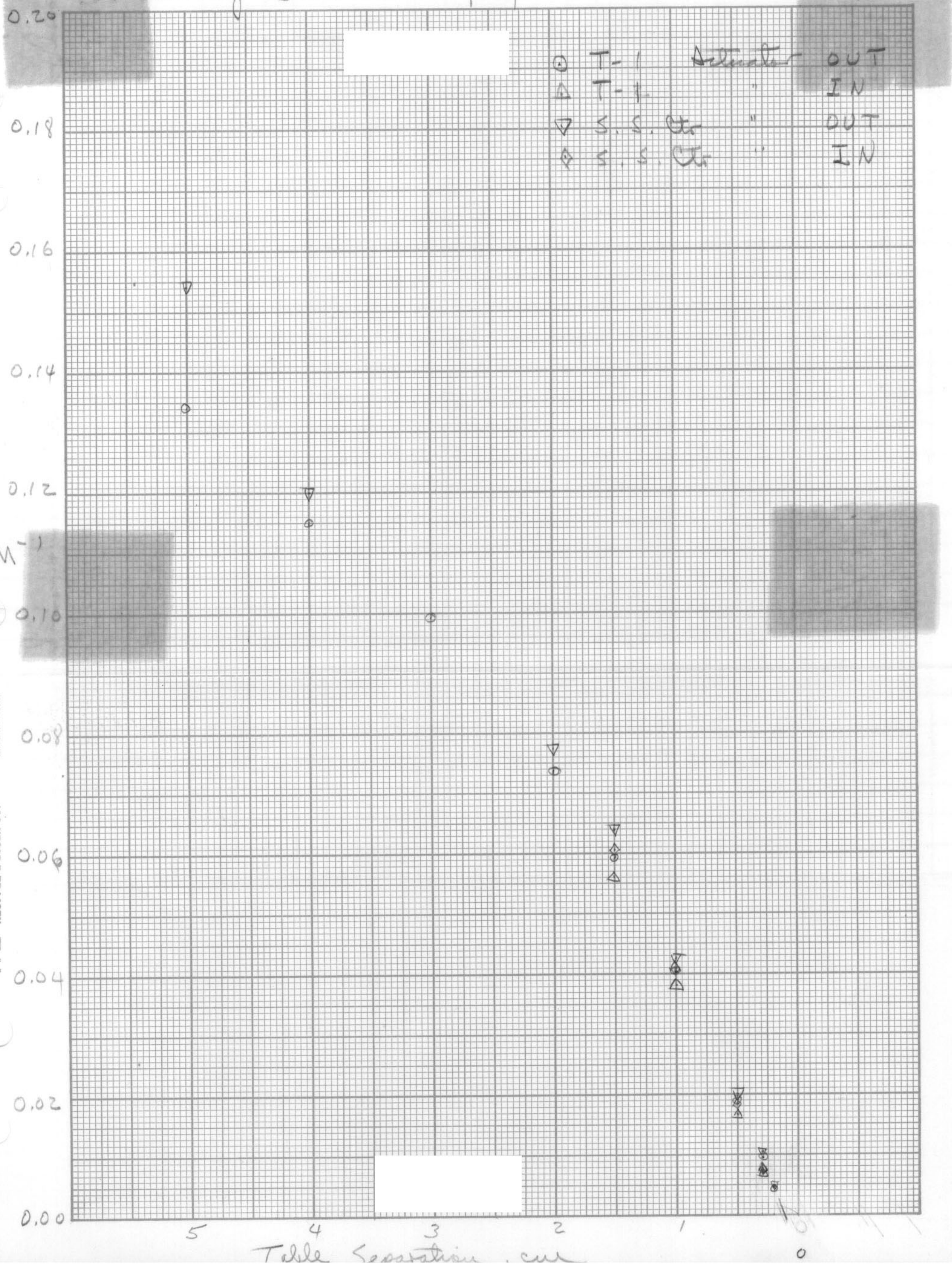
Position cm	T-1 cts/2 mins	Eff	n/sec $\times 10^{-5}$	M	T-2 cts/2 min	Eff	n/sec $\times 10^{-5}$	M
0.14V	35630	7.5×10^{-6}	395.89	24.62	37172	9×10^{-6}	344.19	21.40
1.00H	T/C's Room - 70 °F, #1 - 110 °F, #2 - 108 °F							
15.00A	S.S. Counter - 1175/3.00							
0.14V	37770	7.5×10^{-6}	419.67	26.10	39502	9×10^{-6}	365.46	22.74
1.00H	T/C's Room - 70°F, #1 - 110°F, #2 - 108 °F							
0.00A	SS Counter - 1224/3.00							
0.14V	75349	7.5×10^{-6}	837.21	52.06	78879	9×10^{-6}	730.37	45.42
0.50H	T/C's Room - 70 °F, #1 - 111 °F, #2 - 109 °F							
15.00A	SS Counter - 2489/3.00							
0.14V	85963	7.5×10^{-6}	955.15	59.40	89580	9×10^{-6}	829.44	51.58
0.50H	T/C's Room - 70 °F, #1 - 111 °F, #2 - 109 °F							
0.00A	SS Counter - 2688/3.00							
0.14V	156507	7.5×10^{-6}	1738.97	108.14	158276	9×10^{-6}	1465.51	91.13
0.30H	T/C's Room - 70 °F, #1 - 111 °F, #2 - 109 °F							
15.00A	SS Counter - 4936/3.00							
0.14V	203659	7.5×10^{-6}	2263.86	140.78	208134	9×10^{-6}	1927.17	119.84
0.30H	T/C's Room - 70 °F, #1 - 111 °F, #2 - 109 °F							
0.00A	SS Counter - 6571/3.00							
0.14V	345734	7.5×10^{-6}	3841.48	238.88	345574	9×10^{-6}	3199.76	198.98
0.20H	T/C's Room - 70 °F, #1 - 111 °F, #2 - 109 °F							
15.00A	SS Counter - 11251/3.00							

Went to crit. at 8.00A, ~0.128 H, w/~400 sec period

Deduce critical spacing by interpolation of plot of lattice spacing versus extrapolated critical separations as near crit as possible

Assembly	Lattice Spacing, cm	Critical Table Separation, cm
B-8	0.85	+0.32
B-9	0.80	+0.18
B-10	0.725	-0.10

Assembly B-10 9/15/65 Ctr T-1 and SS



9/17/65

Starting temperatures Room – 70°F
#1 – 104°F
#2 – 109°F

Started up with actuator at 2.00 cm

Went to about crit with moving table motion; to 0.152 cm

Set up positive period with actuator at 0.730 cm
(pretty long – 1.5 folding time 630 sec)
so τ = 1556 sec (see p 79) ≅ 1.3 ¢
The system levelled itself off and went slightly subcritical at ~ 4×10^{-8} amps. Thermocouple readings were

Room – 70°F
#1 – 106°F
#2 – 109°F

Could temperature coefficient have done this?

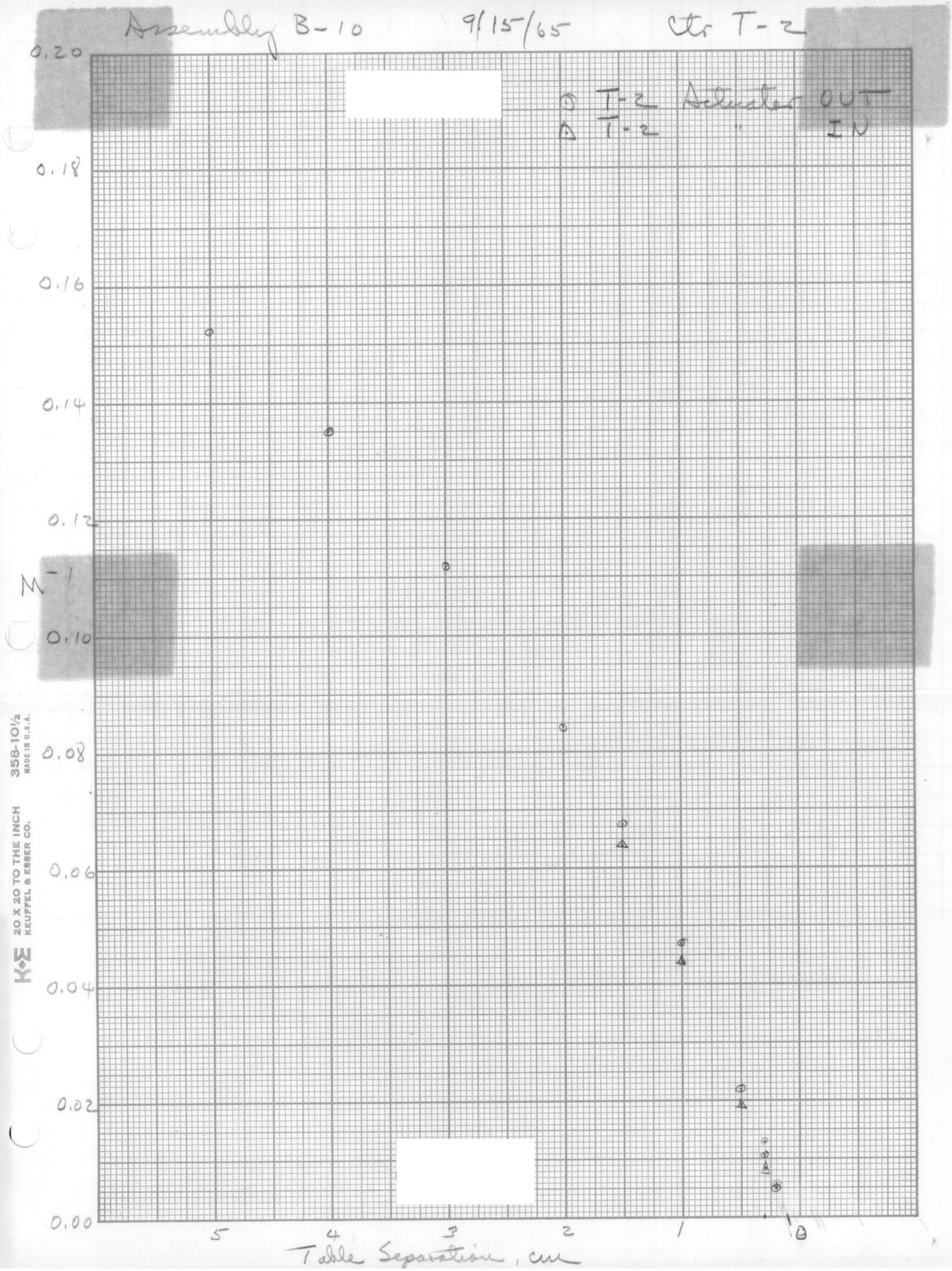
Levelled at A 0.691 cm
N 0.152 cm

Shutdown 1600PM, RAMS #2 – 10 R/hr

9/20/65
Starting temperatures Room – 71°F
#1 – 102°F
#2 – 108°F

Take a few multiplications for comparison with previous measurements.

S.S. Counter removed to test its neutronic worth on the measurements.


Assembly B-10
9/15/65
Ctr T-2
⊙ T-2 Actuator OUT
△ T-2 " IN
0.20
0.18
0.16
0.14
0.12
M^{-1}
0.10
0.08
0.06
0.04
0.02
0.00
5
4
3
2
1
0
Table Separation, cm
K+E 20 X 20 TO THE INCH
KEUFFEL & ESSER CO.
358-10½
MADE IN U.S.A.

Position cm	T-1 cts/2 min	Eff.	n/sec x 10^{-5}	M	T-2 cts/2 min	Eff	n/sec x 10^{-5}	M
0.14V	12383/3	7.5×10^{-6}	91.72	5.70	11998/3	9×10^{-6}	74.07	4.61
9.55H	T/C's Room – 70 °F, #1 – 98 °F, #2 – 104 °F							
15.00A								
0.14V	151701/2	7.5×10^{-6}	1685.60	104.82	135076/2	9×10^{-6}	1250.70	77.78
0.30H	T/C's Room – 70 °F, #1 – 98 °F, #2 – 105 °F							
15.00A								
0.14V	357341/2	7.5×10^{-6}	3970.45	246.90	306133/2	9×10^{-6}	2834.55	176.27
0.20H	T/C's Room – 71 °F #1 – 99 °F #2 – 106 °F							
15.00A								

(Selsyn 0.14$_5$)

Set up with 0.152 H and took to critical on the actuator. Got ~900 sec period with actuator ~1.20 cm. Apparently it is not feasible to locate the horizontal table with high accuracy from one day to the next because of drifts in the DVM value. Levelled with 1.182 H at ~ 3×10^{-8} amp

Check worth of table motion

0.152 H
0.149 H
0.003 cm

$\Delta x = 0.003$ cm $\doteq$ 2-folding time 111 sec
$\doteq$ period of 160 sec
$\doteq \frac{\rho}{\beta} = 7.6$ ¢

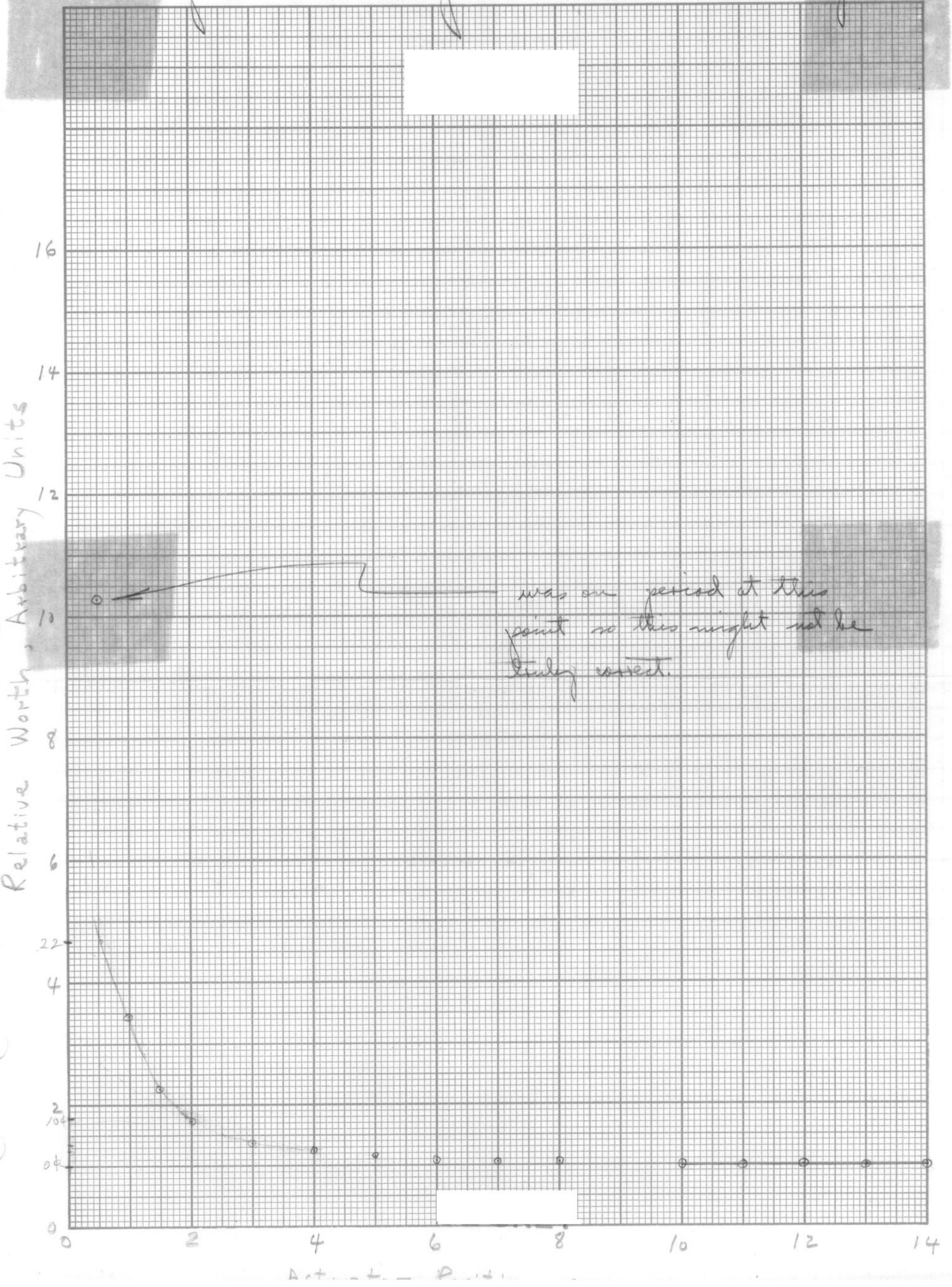
Recheck crit. with Veeder register at 0.15 H (DVM 0.154)
Found level power at 0.681A (2×10^{-8} amps)

Hence the S.S. counter seems to have no measurable neutronic effect upon the array.

Horizontal table motion worth:

$\Delta\rho/\Delta x = 0.076\$/0.003$ cm $= 25$ \$/cm

Plot of relative worth of control actuator Assembly B-7



9/21/65

Made some adjustments on the linear pot on the horizontal table. This reduced the binding and greatly improved its action. Re-calibrated.

Starting temps Room - 71°F
#1 - 97°F
#2 - 105°F

Position cm	T-1 cts	Eff.	n/sec $\times 10^{-5}$	M	T-2 cts	Eff	n/sec $\times 10^{-5}$	M
0.14 V	12761/3 min	7.5×10^{-6}	94.52	5.88	12799/3	9×10^{-6}	79.01	4.91
9.55 H	T/C's	Room - 71 °F		#1 - 100°F		#2 - 105 °F		
15.00 A								

Start up with actuator at 2.00 cm

Ran up to power of 4.3×10^{-8} amps. Min. period with positions
H 0.166 (0.15 Veeder)
A 0.289

2-folding time 142.5 sec ≅ 206 sec period ≅ 6¢

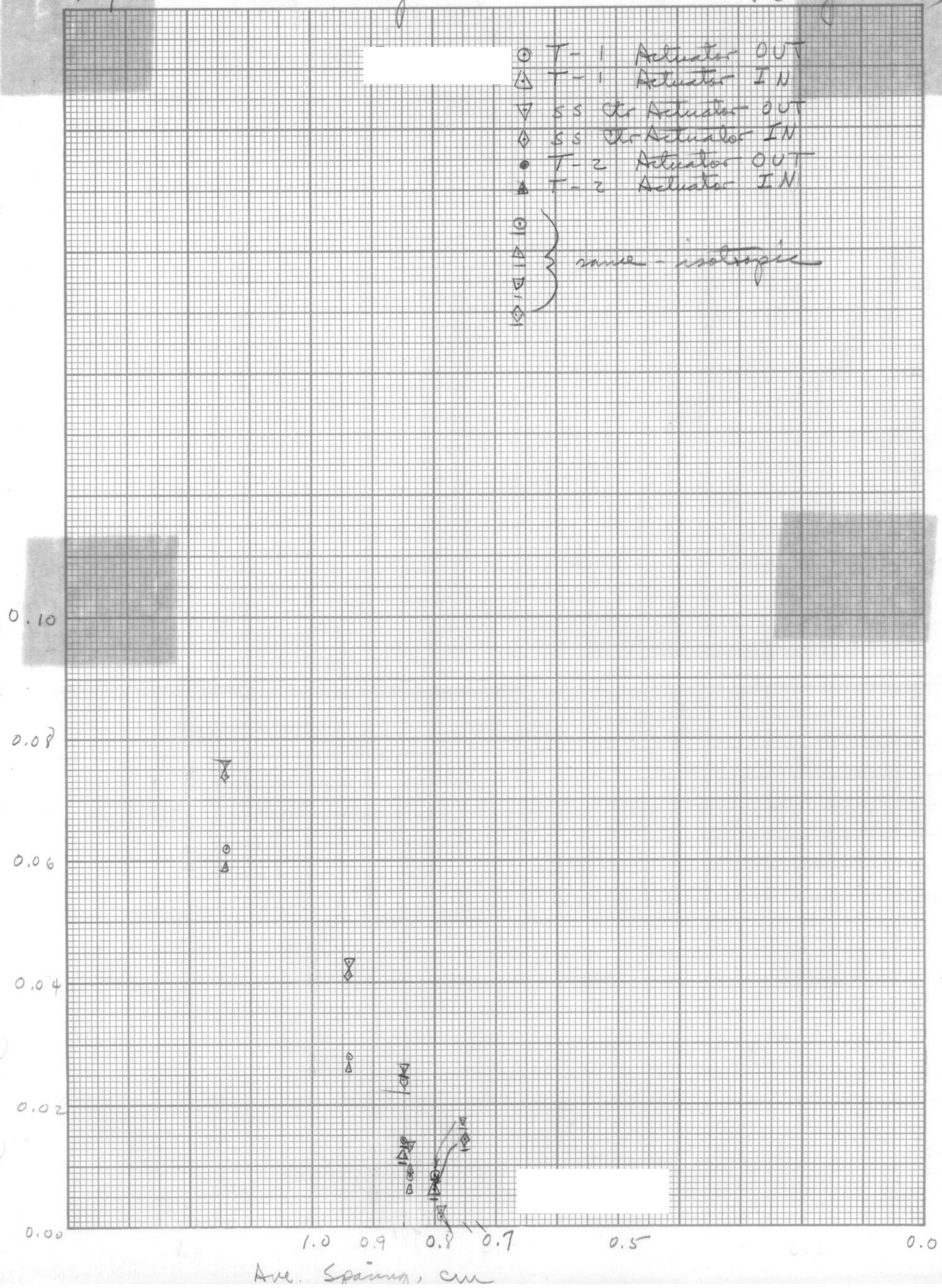
Levelled at above level H - 0.166 (0.15 Veeder)
A - 0.429
To maintain level A → 0.362

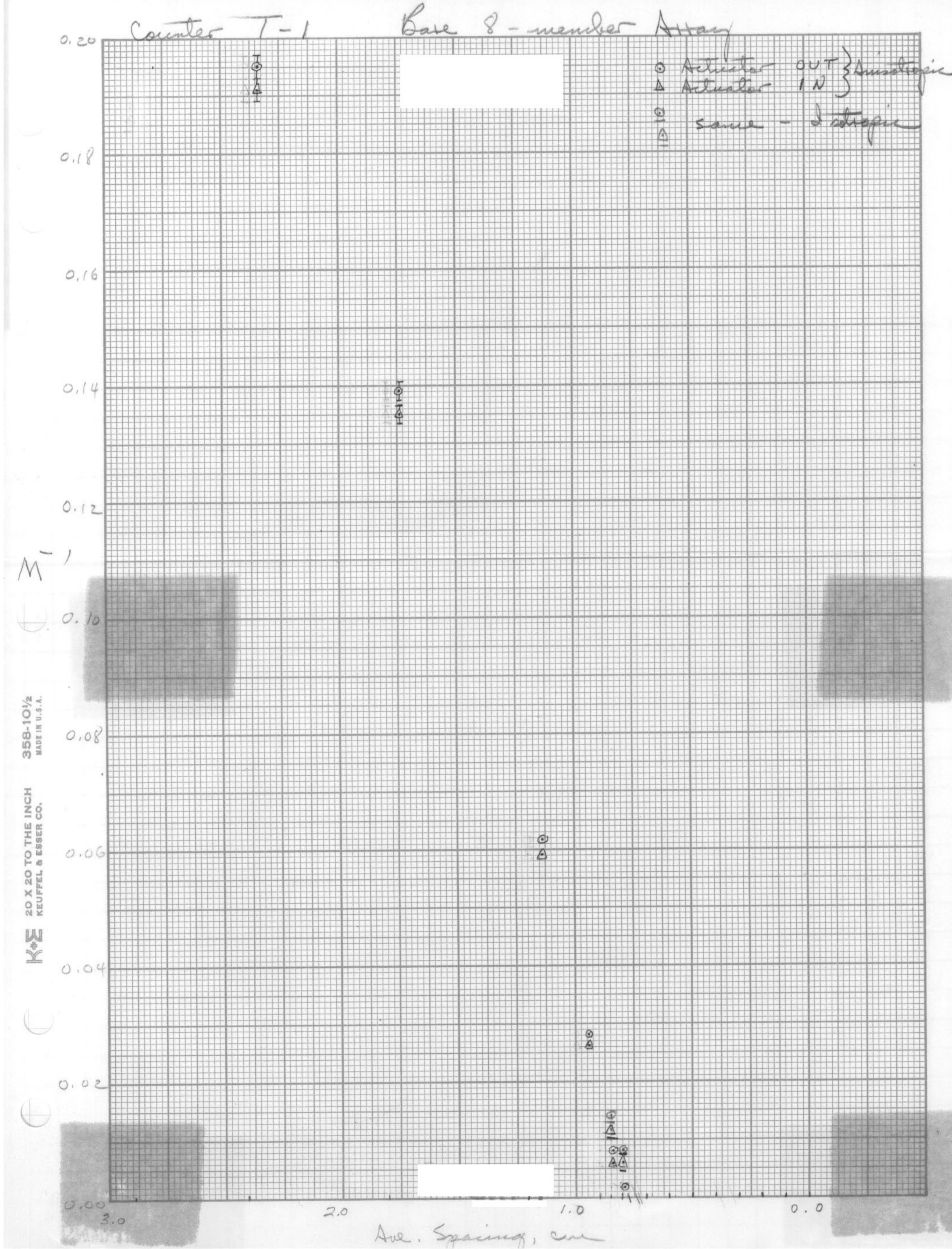
} $\Delta x = 0.067$ cm ≅ $1.88

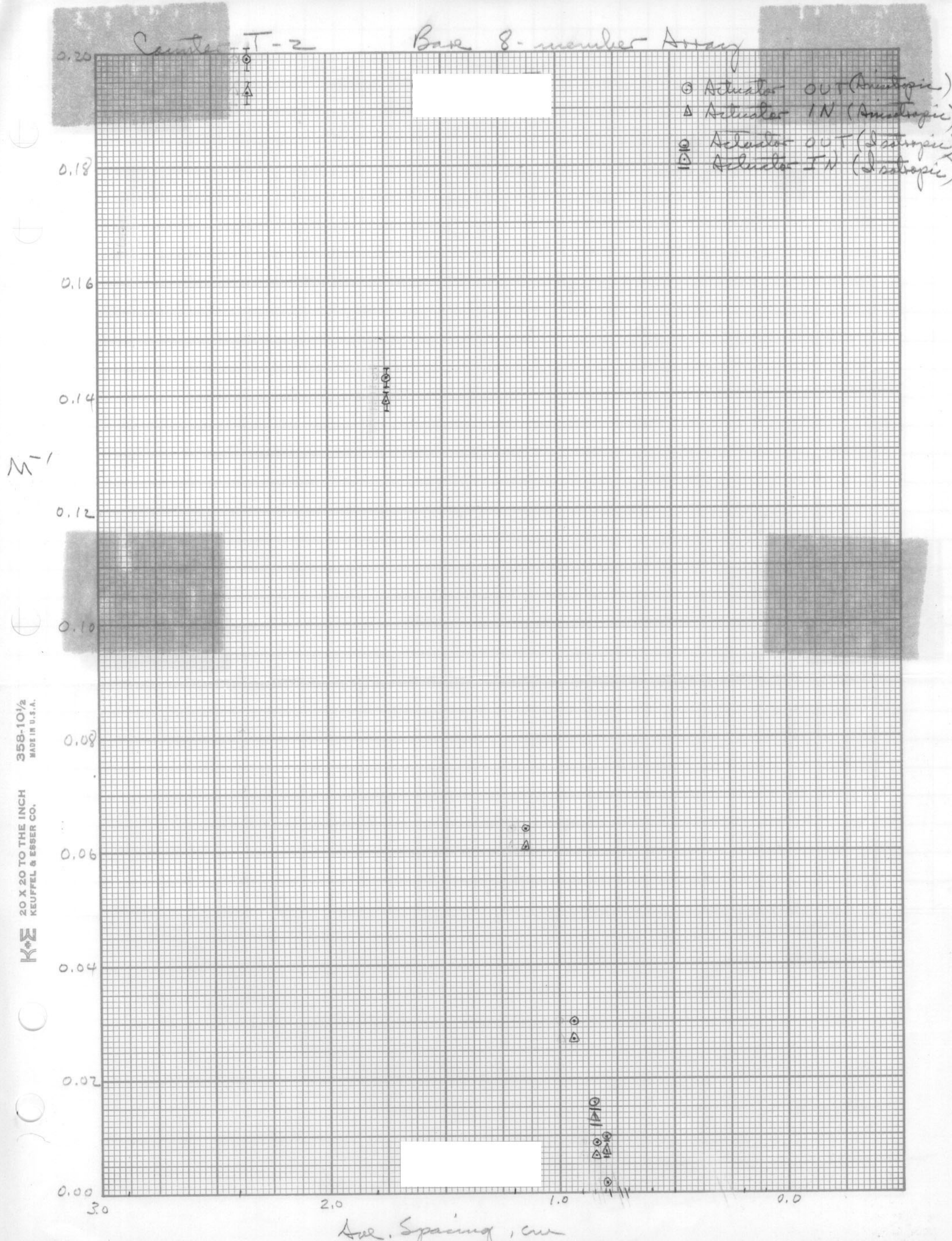
Temps. at power Room - 70°F
#1 - 102°F
#2 - 105°F

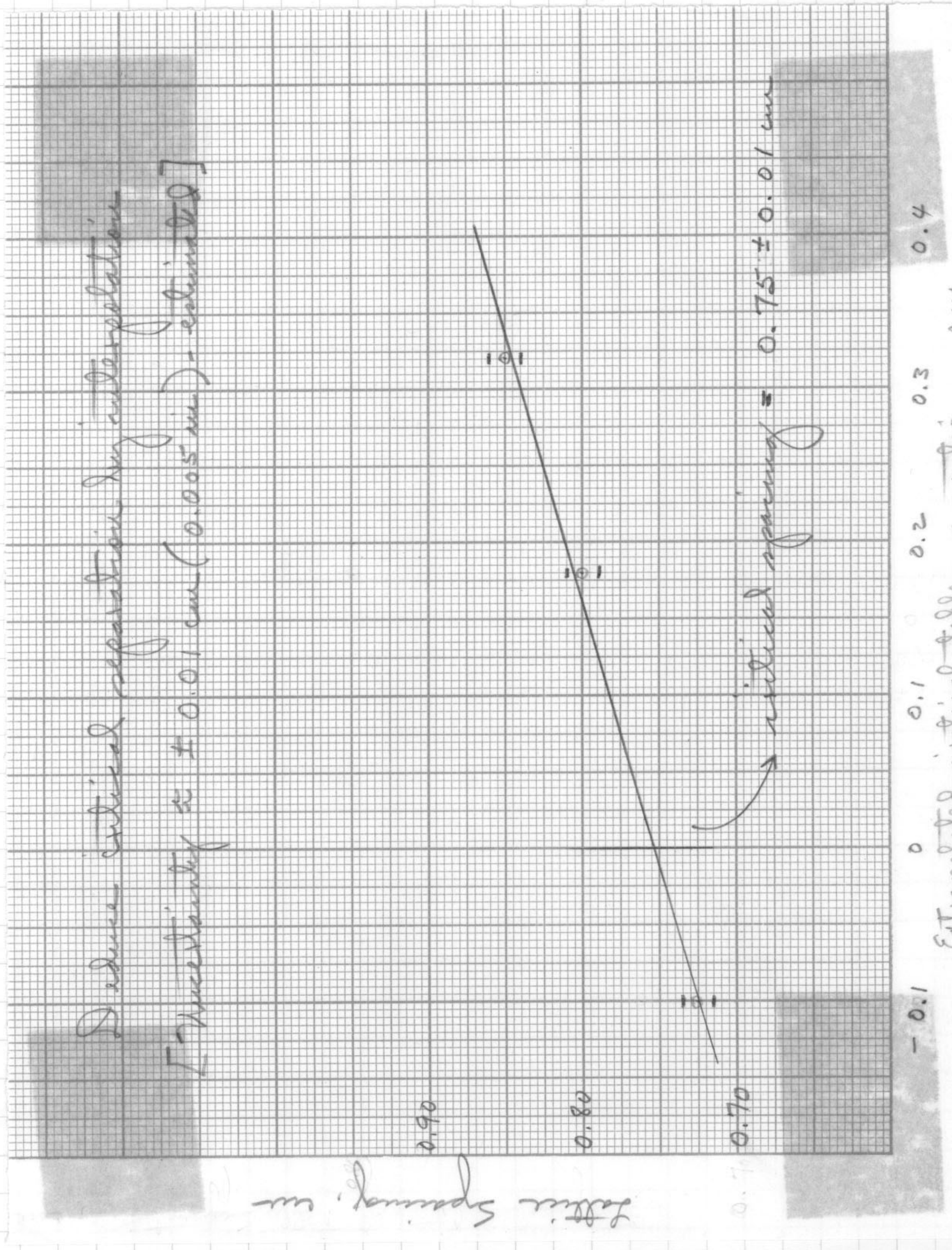
Temp of #1 varied ~ 2-3°F during operation at power.

9/9/65 Base 8-member Array Ctrs T-1 and SS (Larger Scale)




Counter T-1
Base 8-member Array
Actuator OUT
Actuator IN
Anisotropic
same - Isotropic
M⁻¹
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
3.0
2.0
1.0
0.0
Ave. Spacing, cm
K+E 20 X 20 TO THE INCH KEUFFEL & ESSER CO. 358-10½ MADE IN U.S.A.


Counter T-2
Base 8-member Array
Actuator OUT (Anisotropic)
Actuator IN (Anisotropic)
Actuator OUT (Isotropic)
Actuator IN (Isotropic)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
3.0
2.0
1.0
0.0
Ave. Spacing, cm
20 X 20 TO THE INCH
KEUFFEL & ESSER CO.
358-10½
MADE IN U.S.A.



(Succeeding measurements will be recorded in Vol 2, which is not classified. The remainder of this notebook will be reserved for classified notes.)