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Array Experiments
Phase 2
Volume 2

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ARRAY EXPERIMENTS PHASE II

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97	H-8		"
97	H-9		"
99	H-10		Safety Exp.
100	H-11		"

Bkg T-1 = 991 T-2 = 1096

Assembly D-9 Safety Array: Pu to Pu $STS_x = 16.500$ cm
$STS_y = 16.062$ cm

Lateral: .718 cm fixed + 15.786 cm = 16.500 cm

Vertical: .108 cm fixed + 15.954 cm = 16.062 cm

Parts: 1 - 65 less #7

Base Rate = 129.16 $\times 10^5$ n/s

③ 3	⑦ 7	⑧ 11	④ 15
② 2	⑥ 6	⑤ 10	① 14

Pos.	T-1	T-1'	Eff Factor	10^5 n/s	M	T-2	T-2'	Eff Factor	10^5 n/s	M
7.896	1301 n/s	53.77	19.886×10^5	1109.0	8.59	10214 n/s	38.48	26.703×10^5	1027.5	7.96
	4337					3403				
	-991					-1096				
	3346					2309				
0.005	2391 n/s	63.18	19.886×10^5	1256.4	9.73	1845 n/s	43.25	26.703×10^5	1154.9	8.94
	4782					3691				
	-991					-1096				
	3791					2595				

The T-1 Multiplication seems O.K. but the T-2 number is much too low. Of all the previous work with backgrounds, the most suspicious number is the re-determination of the T-2 cadmium ratio, which dropped 24% to 9.16. If we use the old cd ratio, 12.059, The T-2 Bkgrnd is 832, and $M_2 = 9.85$

Then $\nu M_1 = .1028$, $\nu M_2 = .1015$

5-31-67

A Source (corrected)

T-1 17541

T-2 17064

Assembly D-10 : P_n to P_n $SIS_{xy} = 16.500$ $SIS_z = 16.062$ cm

Lateral : .714 cm (fixed) + 15.786 cm = 16.500 cm

Vertical : .108 cm (fixed) + 15.954 cm = 16.062 cm

Parts : 1-129 less #7

Base Rate = 259.38 x 10^{-3}

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.851	6269/s	208.7	19.886 x 10^5	4150.2	16.00	45995/s	168.8	26.703 x 10^3	4400.7	16.97
	12522					9885				
				Y_m = .625					Y_m = .589	
									$\bar{M}$ = 16.49	
									Y_M =	
0.000	10204/s	341.6		6793.1	26.19	82372/s	275.3		7357.3	28.38
	20410			Y_m = .3818		16474			Y_m = .3529	
	→ 20494					→ 16515				
									$\bar{M}$ = 27.27	
									Y_m = .3667	

T/C's Room 70 #1 = 110 #2 = 91

6-13-67

We have not been in operation since 5-31-67 due to procedure problems concerning $M \leq 10$ for the half-array assembly. A new policy for loading half-arrays is described in CSM #66. During shutdown the disaster alarm was modified. Also it was decided that we would change the BF_3 tube of Tub #2 to see if this would stop the up-drift of our counts.

We will re-run Assembly D-10 and use it for normalization when we change BF_3 tubes.

6-20-67

Changing BF_3 tubes did not correct the drift problem. We have returned to the original setup and we will check this out by a re-run of Assembly D-10. We are also determining a new source location for source counts.

We should will get new BF_3 tubes!

	T-1	T-2
Bkg	75-15	5770
With Sources MRC 8-7 & M-246	11965	13112
Source Worth	4450	7342

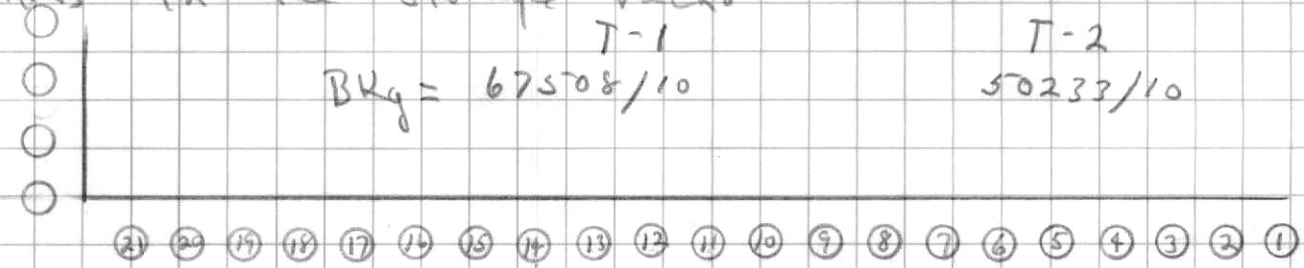
I don't like low counts. Will move sources later.

Assembly D-10 : As described on page 5

Pos.	T-1	T-1'	Eff. Factor	$10^5/t_k$	$\bar{M}$	T-2	T-2'	Eff. Factor	$10^5/t_k$	$\bar{M}$
7.842	70555/5 - 23518 14111		18.187×10^5	42772	16.89	53957/5 - 17985 10791		23.782×10^5	42772	16.89
0.000	115106/5 - 23100 23021 → 385.00		18.372×10^5	707329	27.27	88552/5 - 17715 17710 → 295.25		23.957×10^5	707329	27.27

The new Eff Factors are | T-1 = 18.372×10^5 T-2 = 23.957×10^5

We will now play games to determine the background worth of different locations in our storage rack. We removed col. 13 from the previous assembly and removed it from the room so we could determine our background for this game. We will then put Col. 13 in different locations in the storage rack.



Pos.	T-1	T-2	(T-1) - BKg	(T-2) - BKg
21	68894/10	50754/10	138	52
20			137	92
19	68889/10	51536/10	135	131
18			104	130
17	68231/10	51521/10	72	129
16			94	158
15	68660/10	52085/10	115	186
14			140	192
13	69150	52203	164	197
12			129	211
11	68893	52993	94	226
10			113	280
9	68818	53559	131	333
(6-21-67 check)	69314	52967		

6-21-67

Pos.	T-1	T-2	(T-1) - Bkg	(T-2) - Bkg
8			151	338
7	69220/10	53655/10	171	342
6			160	436
5	69001/10	55526/10	149	529
4			153	559
3	69067/10	56130/10	156	590
2			164	657
1	69227/10	57403/10	172	724

All the col. were put in the storage rack. They are located in positions 21-11, 9, 7, 5, 3, 1. With the tubes in these positions a background was taken.

	T-1	T-2
Bkg	62480/30 2083	176568/30 5885
$\sum_{\text{Pos.}}$ Bkg =	2101	4222 ? I don't like this!

6-22-67

	T-1	T-2
Bkg	62386/30 2080	181058/30 6035

Eff. Factors for D-11 from p. 95 & 83 Vol. I

$T\text{-}1 = \frac{18.372}{1.82} \times 1.95 \times 10^{-5} = 19.684 \times 10^{-5}$

$T\text{-}2 = \frac{23.957}{2.29} \times 2.37 \times 10^{-5} = 24.795 \times 10^{-5}$

Bkg for D-11

T-1 = 2083 − 328 = 1755

T-2 = 5885 − 1314 = 4571

6-23-64

It was determined that the power conversion factor from the small table to the large table is 2.3 therefore using the data from the 2nd power run (page 28, vol. 2, phase I) 38 watts now equals 1.5×10^{-7} amps.

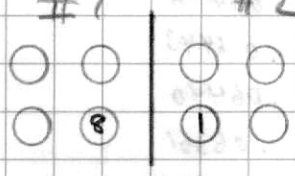
We will now set up for our safety array work as described in CSM #66. $STS_{x,y} = 18.000$ cm. We will do the 8 col. safety array first without the 2 reflectors and use this to normalize two new tubs that we will place at the north and south sides of our table. We are adding the two tubs because with 2 reflectors between our existing tubs the source level is too low for an eff. factor determination.

Assembly D-11 : Pu to Pu $STS_{x,y} = 18.000$ cm $STS_z = 16.062$ cm

Calculated : .714 cm (fixed) + 13.286 cm = 14.000 cm

Vertical : .108 cm (fixed) + 15.954 cm = 16.062 cm

Parts : Col. 1 & 8



Base Rate = ~ 32.47 $\times 10^5$ n/s

Pos	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.8+2	12226/5	11.50	19.684×10^{-5}	226.4	6.97	2344/5		28.795×10^{-5}		
	2445					4688				
	−1755					−4571				
	690					117				
0.000	12387/5					2324/5				

Something is wrong!! We will remove the 2 cols. (1 & 8) from the vault and check the background.

6-27-69 Note on Storage Rack Backgrounds:

Since a Safety experiment is done in steps, when 16 columns are loaded in C-VAULT, a safety experiment has a background due to 14, 12 + 8 columns during the steps of 2, 4, + 8 columns on the Assembly table. The Complicated question then is: What is the background for these different situations? A point source falls off like $1/r^2$, a plane source like $1/r$. Since our wall storage represents something inbetween these extremes, We will Assume the columns fall off like $1/r^{1.5}$ and calculate the effect of the individual columns to be given by: $\text{TOTAL 16 COLUMN RACK BACKGND} = \sum_{i=1}^{16} C/d_i^{1.5}$, where C_i is an appropriate constant. We can also consider that each position has a fraction of the total background F_i where $F_i = \frac{1/d_i^{1.5}}{\sum_i 1/d_i^{1.5}}$.

We can measure the d_i's for each counter + calculate the F_i's:
($1/16 = .0625$)

Pos	F_i - (T-1)	F_i - (T-2)	F_i (T-3)	F_i (T-4)
1	.06502	.1729	.10312	.03407
3	.06499	.1508	.09115	.03825
5	.06446	.1202	.08247	.04399
7	.06443	.0888	.07473	.04903
9	.06440	.0690	.06842	.05603
11	.06361	.0551	.06274	.06258
12	.06305	.0481	.06091	.06544
13	.06201	.0447	.05778	.06858
14	.06198	.0401	.05572	.07185
15	.06195	.0374	.05398	.07479
16	.06122	.0345	.05200	.07479
17	.06069	.0317	.05045	.07409
18	.05997	.0294	.04865	.07409
19	.05994	.0276	.04712	.07329
20	.05990	.0256	.04608	.07122
21	.05921	.0239	.04467	.06788

Thus if: Bkd_{16} T-1 = 2082 Bkd_{14} = 1811

Bkd_{16} T-2 = 6030 Bkd_{14} = 4078

	T-1	T-2
Bkg	55715/30	128165/30
	1857	4272

Using this background we will computer assembly D-11

Assembly D-11 : As described on page 9

Pos.	T-1	T-1'	Eff Factor	10^5 c/s	M	T-2	T-2'	Eff Factor	10^5 c/s	M
7.892	17226/s − 1857 = 588	9.80	19.668×10^5	192.9	5.94	23442/s − 4272 = 416	6.93	24.795×10^5	171.83	5.29

0.000 12397/s ~ 5.94 2321/s ~ 5.29

2479 − 1811 = 668 → 11.13 219.1 6.75 4642 − 4078 = 564 → 9.40 233.1 7.18

We will now replace one col. in the storage rack and take a background count.

	T-1	T-2
Bkg	32718/17	83764/17
	1925	4927

6-26-67

We have placed 2 more Tubs in our system. They are located on the north and south sides of the array. The Tub located on the north side will be Tub 3 and the south will be Tub 4.

We will now check the background again with one col. out of the vault.

	T-1	T-2	T-3	T-4
Bkg.	28580/15	75687/15	227833/15	807929/15
	1905	5046	15189	53862

6-27-67 Note on Bldg, Continued

Now to Compute 12 Column Bldgs for Assembly D-12

If: $B_{16}^{T-1} = 2053 \rightarrow 2086$ then: $B_{12}^{T-1} = 1546$

$B_{16}^{T-2} = 6026 \rightarrow 5859$ $B_{12}^{T-2} = 2738$

$B_{16}^{T-3} = 17,037 \rightarrow 17,278$ $B_{12}^{T-3} = 11,205$

$B_{16}^{T-4} = 56,291 \rightarrow 57,247$ $B_{12}^{T-4} = 47,781$

Background with all cols. in storage rack

	T-1	T-2	T-3	T-4
BKg	30796/15	90397/15	255559/15	884361/15
	2053	6026	17037	56291

We will set up the next safety array of 4 cols.

We will check background with this array set up.

	T-1	T-2	T-3	T-4
BKg	27060/10	37808/10	190518/10	593687/10

6-27-67

change in efficiency of counters

We will check background with the 4 cols. on the table.

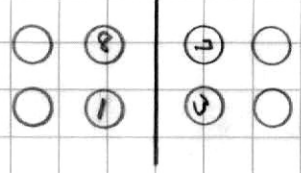
	T-1	T-2	T-3	T-4
BKg	27498/10	36758/10	193209/10	603769/10

We will try to determine a good background for the 4 Col. array, and do the run.

Assembly D-12: Pu to Pu STS_{xy} = 18,000 cm STS_z = 16.062 cm

Lateral: .718 + 13.282 = 18.000 cm

Vertical: .108 + 15.954 = 16.062 cm



Parts: Col. 1, 8, 7, 3.

Base Rate = ~68.98 x 10^5 #/s

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.849	14478/s	22.50	19.684×10^5	442.9	6.82	11219/s	18.47	28.795×10^5	457.0	7.04
	2896					3844				
	-1546					-2738				
	1350					1106				

$\bar{M} = 6.93$

Pos.	T-3	T-3'	Eff. Factor	10^5 n/s	M	T-4	T-4'	Eff. Factor	10^5 n/s	M
7.849	102693/s		2.892×10^5	450.0	6.93*	27590 1/s		3.650×10^5	450.0	6.93*
	20,539	155.6				55,180	123.3			
	-11,205					-47,781				
	9,334					7,399				

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
0.000	15005/s	24.25	19.664×10^5	477.3	7.35	19878/s	20.62	28.795×10^5	511.3	7.87
	3001					3975				
	-1546					-2738				
	1455					1237				

$\bar{M} = 7.61$

Pos	T-3	T-3'	Eff. Factor	10^5 n/s	M	T-4	T-4'	Eff. Factor	10^5 n/s	M
0.000	324,041/s		2.852×10^5	494.2	7.61*	842,734/s	140.0	3.530×10^5	494.2	7.61*
	21,602	173.3				56,182				
	-11,205					-47,781				
	10,397					8,401				

* BY DEFINITION

Therefore, the efficiency factors for T-3 & T-4 are:

$\text{Eff Fact}_{T-3} = 2.852 \times 10^5$

$\text{Eff Fact}_{T-4} = 3.530 \times 10^5$

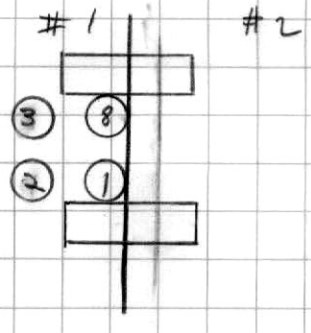
Assembly D-13 : Pu to Pu STS_{xy} = 14.000 cm STS_z = 16.062 cm

Lateral : .714 + 13.286 cm = 14.000 cm

Vertical : .108 + 15.954 = 16.062 cm

Parts : Cols. 1, 8, 7 + 3

Base Rate = ~68.94 $\times 10^{-5}$ n/s



Pos.	T-3	T-3′	Eff. Factor	10^{-5} n/s	M	T-4	T-4′	Eff. Factor	10^{-5} n/s	M
7.849	119532/s	1952.0	2.852×10^{-5}	556.1	8.56	270571/s	105.6	3.530×10^{-5}	3728	57.4
	22906					54114				
	-11205					-47781				
	11701					6333				

$\bar{M}$ = 7.15

0.000	117893/s	206.2	2.852×10^{-5}	587.5	9.05	273284/s	119.6	3.530×10^{-5}	408.5	6.23
	23579					54657				
	-11205					-47781				
	12374					6876				

$\bar{M}$ = 7.68

The next step will involve a background due to 8 columns which will be:

T-3	6,888
T-4	33,319
T-1	1,024
T-2	1469

6/28/67

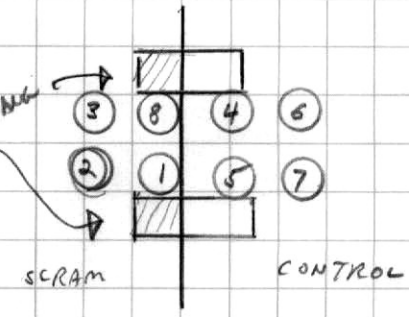
Assembly D-14 : P_w to P_w STS_{xy} = 14.000 cm, STS_2 = 16.06 cm

Lateral : .714 + 13.286 = 14.000 cm

Vertical : .108 + 15.954 = 16.062 cm

Part : Cols: 1, 8, 7, 3, 2, 6, 4, 5

Base Rate : ~ 130.2 x 10^5 n/s



P_{00}: 7.847

T-3	T-3'	Eff Fac	10^5 n/s	M_3	T-4	T-4'	Eff Fac	10^5 n/s	M_4
190,647/5	520.7	2.852x10^5	1485.0	11.41	315,636/5	496.8	3.530x10^5	1753.7	13.47
38,129	(cps)				63,127	(cps)			
- 6,888					33,319				
31,241 (cpm)					29,808 (cpm)				

$\bar{M}$ = 12.44

P_{00} 7.001

T-3	T-3'	10^5 n/s	M_3	T-4	T-4'	10^5 n/s	M_4
311452/5	93.3	2633	20.22	431,332/5	882.4	3115	23.92
62,290				86,266			
- 6,888							
55,402				52,947			

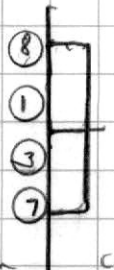
$\bar{M}$ = 22.07

Assembly D-15

Spacing as above.

Part : Cols. 1, 3, 7, 8

Base Rate, ~ 64.94 x 10^5 n/s



P_{00} 7.861

T-1	T-1'	eff fac	10^5 n/s	M_1	T-2	T-2'	eff fac	10^5 n/s	M_2
13,968/5	17.80	19.684x10^5	350.4	5.39	18,060/5	14.567	24.795x10^5	361.2	5.56
2,614					3,612				
-1,546					- 2,738				
1,068					874				

T-3	T-3'	eff fac	10^5 n/s	M_3
113,481/5	191.5	2.852x10^5	546.2	8.41
33,696				
- 11,205				
11,491				

$\bar{M}_{1,2}$ = 5.47 ($\bar{M}_{1,2,3}$ = 6.45)

D-15 (cont.)

Poo	T-1	T-1'	10^5 m/s	M_1	T-2	T_2'	10^5 m/s	M_2
-.012	13,115/5	17.95	353.3	5.44	18,769/5	16.93	419.8	6.46
	2,623				3,754			
	- 1,546				- 2,738			
	1,077				1,016			

T-3	T-3'	10^5 m/s	M_3
121,002/5	216.6	617.7	9.51
24,200			
11,205			
12,995			

$\overline{M}_{12} = 5.95$ $\left(\overline{M}_{123} = 7,14\right)$

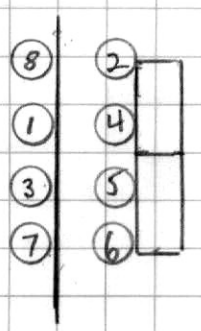
Assembly D-16 : Pu to Pw $STS_{xy} = 14.000$, $STS_z = 16.06$

Lateral : .714 + 13.286 = 14.000 cm

Vertical : .108 + 15.954 = 16.062 cm

Parts : Cols 1, 2, 3 4, 5, 6, 7 & 8.

Base Rate : ~130.2 $\times 10^5$ m/s



Poo.	T-1	T-1'	eff Fac	10^5 m/s	M_1	T-2	T-2'	eff Fac	10^5 m/s	M_2
7.853	24,888/5	65.90	19.684x10^5	1297.2	9.96	21,940/5	48.68	24.795x10^5	1207.0	9,27
	4,978					4,388				
	- 1,024					-1,467				
	3,954					2,921				

$\overline{M}_{12} = 9.62$

T-3	T-3'	eff Fac	10^5 m/s	M_3
228,611	647.2	2.852x10^5	1846	14.2
45,722				
6,888				
38,834				

$\left(\overline{M}_{123} = 11.14\right)$

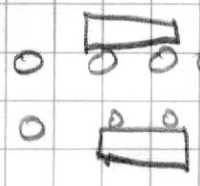
Poo	T-1	T-1'	10^5 m/s	M_1	T-2	T-2'	10^5 m/s	M_2
-.013	35603/5	101.6	1999.9	15.36	31251/5	79.72	1976.6	15.18
	7,121				6,250			
	- 1,024				- 1,467			
	6,097				4,783			

$\overline{M}_{12} = 15.27$

$\left(\overline{M}_{123} = 17.8\right)$

T-3

$\left(348,571/5 \rightarrow 69,714 - 6,888 = 62,826 + 1,046 = 2986 \times 10^5 \text{ m/s} \quad M_3 = 22.9\right)$

Thus,  is definitely most reactive.

We will now continue the 4^3 Array. The new bases are now being used which changes our fixed Lateral dimension to.

Assembly D-17: Pu to Pu $STS_{x,y} = 15.326_{cm}$ $STS_z = 16.062_{cm}$

Lateral: .721cm (fixed) + 14.605cm = 15.326 cm

Vertical: .108 + 15.954 = 16.062 cm

Parts: 1-125 less #7

Base Rate = 259.38×10^{-5} n/s

Pos.	T-1	T-1'	Eff Factor	10^{-5} n/s	M	T-2	T-2'	Eff Factor	10^{-5} n/s	M
7,851	96992/5	323.3	18.372×10^{-5}	5939.7	22.9	30957/5	236.5	23.957×10^{-5}	5668.2	21.8
	19398			$\frac{1}{m} = .0937$	14191				$\frac{1}{m} = .04587$	
									$\bar{M} = 22.4$	

T/C's Room = 69 °F #1 = 102 °F #2 = 105 °F

1.485	20219/5 →	40250	18.372×10^{-5}	12998.3	48.1	151529/5 →	30493	23.557×10^{-5}	12153.8	46.9
	40429	679.2		$\frac{1}{m} = .0208$	30326		507.4		$\frac{1}{m} = .02132$	
									$\bar{M} = 47.5$	
0.000	30032/5 →	60917		18603.1	71.9	228151/5 →	45980 / 45877		18312.5	70.6
	60186	1015.3		$\frac{1}{m} = .0139$	45638		764.6		$\frac{1}{m} = .01416$	
									$\bar{M} = 71.2$ M	
									$\frac{1}{m} = .0140$	

for a comparison with tomorrow, we will take a long background (with control element on control table in out position) count on all counters (20 min)

1	2	3	4
161,667	121,020	1,270,181	1,242,765

6/30/67

Morning background count (20 min)

1	2	3	4
162,430	119388	1269654	1241453

Assembly D-17

We will re-run D-17 with the Control element installed. To get an accurate measure of the worth of the control element, we will even normalize the efficiency factors to take into account the overnight change in background.

Counter	Efficiency factor
T-1	18.286×10^5
T-2	24.284×10^5

Pos.	T-1	T-1'	Eff. Factor	10^5 1/s	M	T-2	T-2'	Eff. Factor	10^5 1/s	M
2.879	99783/s					79184/s				

The scram table droped off for some reason. We (75) checked the voltage to the magnet and found it was down slightly (from 80) so we connected this and we will try to close the tables again.

Pos.	T-1	T-1'	Eff. Factor	10^5 1/s	M	T-2	T-2'	Eff. Factor	10^5 1/s	M
7.830	10003/s - 2007	333.5	18.286×10^5	608.8	23.5	75499/s - 15098	251.6	24.284×10^5	6109.9	23.6

$\bar{M} = 23.6$

		(63,801)					(49,108)			
-.012	31466 1/s	63223		1982.6	78.9	29325 1/s	48580		1982.0	76.4
A=15.239	62597	1062.1		(1984.5)		48750	816.3		(1987.8)	(76.64)
		1063.14			(74.97)		818.5		$\bar{M}$ = 75.7	
									(75.80)	

LAST FEW POINTS,

TABLE FULLY CLOSED

4^3, 6 Kg, 1" MODERATORS

1/M

.04

.03

.02

.01

◇ CONTROL ELEMENT OFF TABLE

⊙ CONTROL ELEMENT ON TABLE (OUT POSITION)

NOTE:

Δ STS, cm / $\Delta \frac{1}{M}$ = +41.11

$\Delta \frac{1}{M}$ CONTROL ELEMENT OFF − ON = .000839

$\therefore \Delta$ STS CONTROL ELEMENT CORRECTION (OUT POSITION) = .0345 cm

16.5 16 15.5 15

X-Y STS

KEUFFEL & ESSER CO. MADE IN U.S.A.

Pos	T-1	T-1'	Eff. Factor	10 secs	M_1	T-2	T-2'	Eff. Factor	10 secs	M_2
Open	316343/5	64079		1952	75.29	248916/5	50,157		2029	78.26
A .004	63,268	1,068.0				49,783	835.9			

$\bar{M} = 76.77$

∴ for this array the control element is not worth anything.

$\left(\Delta \frac{1}{m} = .000164\right)$

After completion of the count, we turned down the magnet voltage slowly to see where it would drop off ⟶ 68 volts. Why magnet dropped off earlier is still unexplained.

Friday Nite Background – 30 min – Monday Morning Background

T-1	42,279	42,001
T-2	106,986	105,729
T-3	340,953	335,758
T-4	1,212,254	1,217,935

⟶ 7/3/67

the difference is negligible.

Assembly 0-18 $P_a + P_e$: STS_{x-y} 15.01 , STS_z 16.06

Lateral : .721 (fixed) + 14.288 = 15.009 cm

Vertical : .108 (fixed) + 15.954 = 16.062 cm

Ports : 1-129 less #7

Base Rate 259.38

7/3/67

Phase II

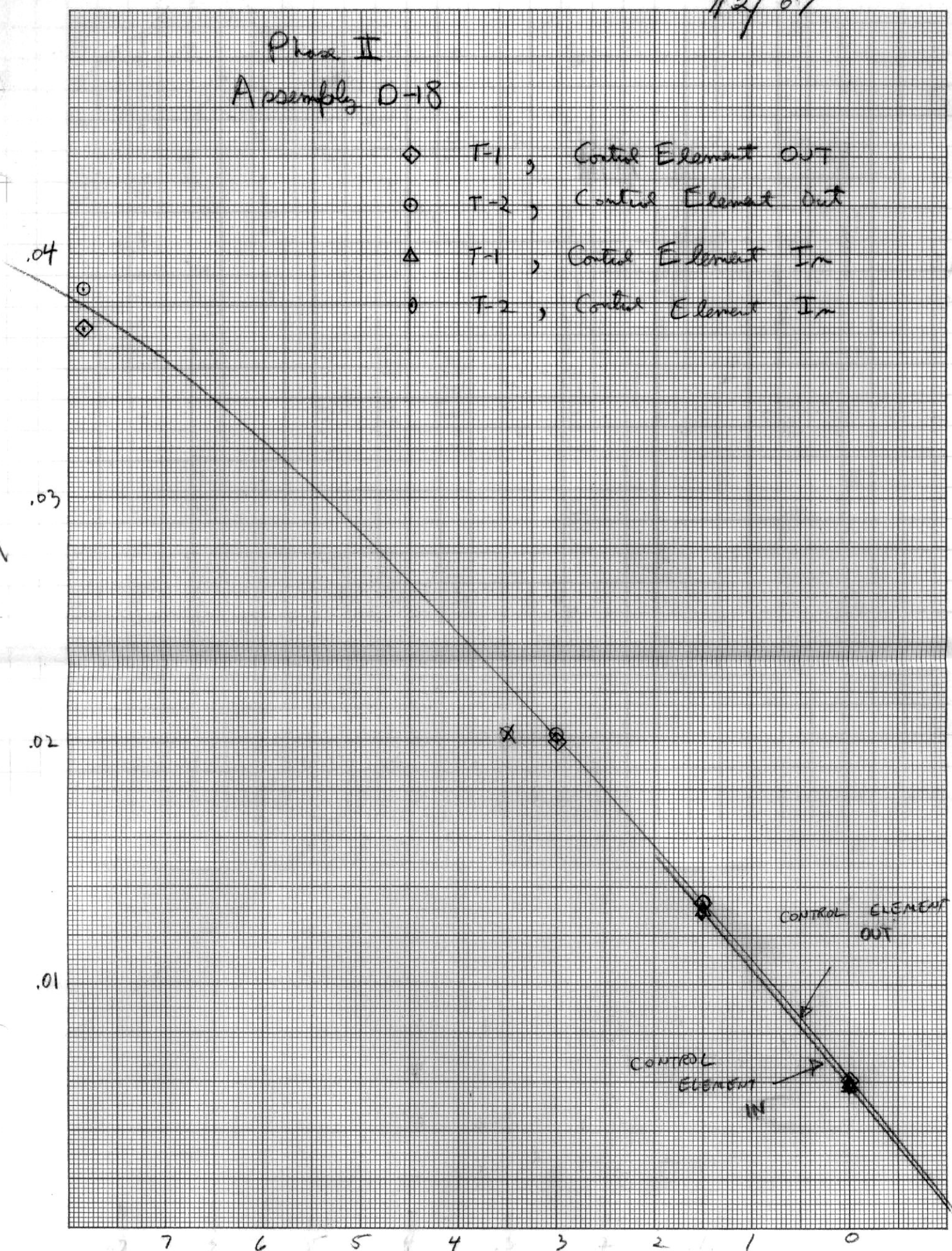
Assembly 0-18

◇ T-1 , Control Element OUT

⊙ T-2 , Control Element Out

△ T-1 , Control Element In

0 T-2 , Control Element In



K&E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. MADE IN U.S.A.

(Base Rate: 259.38)

P_∞	T-1	Eff Fac	10^5 n/s	M_1	T-2	Eff Fac	10^5 n/s	M_2
T 7.850	114,215/5	18.372×10^5	7026.0	27.09	84,223/5	23.957×10^5	6743.2	26.00
A 15,243	22,842		$1/m_1 = .03691$		16,845		$1/m_2 = .03846$	
	22,946	[note $M_1 = 1.1805 \times 10^3$ C in cpm]			16,888	[note $M_2 = 1.5394 \times 10^3$ C in cpm]		
	382.43				281.47			

[Temp #1 = 98, Temp #2 = 97½, Temp #3 (Room) = 70]

P_∞	T-1	T-1'	M_1	$1/M_1$	T-2	T-2'	M_2	$1/M_2$
T: 3.001	210,612/5	42,480	50.148	.01994	159,425/5	32,038	49.322	.02027
A 15.243	42,122				31,885			

[T-1 98, T-2, 99, T-3 70]

P_∞			M_1	$1/m_1$			M_2	$1/m_2$
T: 1.500	314,129/5	63,625	75.109	.01331	241,282/5	48,607	74.826	.01336
A: 15,243	62,826				48,256			
T: 1.500	320,102/5	64,850	76.555	.01306	247,734/5	49917	76.842	.01301
A: 1.005	64,020				49,547			

[T-1, 98½, T-2, 100] NOTE $\Delta \frac{1}{M} = .00030$

T: +.002	699,088/5	143,840	169.80	.00589	555,438/5	112,970	173.91	.00575
A: +.005	139,817				111,088			
T: +.002	683,348	140,510	165.87	.00603	553,610	112,592	173.32	.00577
A: 15,243	136,670				110,722			

NOTE: $\Delta \frac{1}{m} = .00008$

Note that $\Delta \frac{1}{m} = .00019$, comparable to .000164 obtained 6/30/67

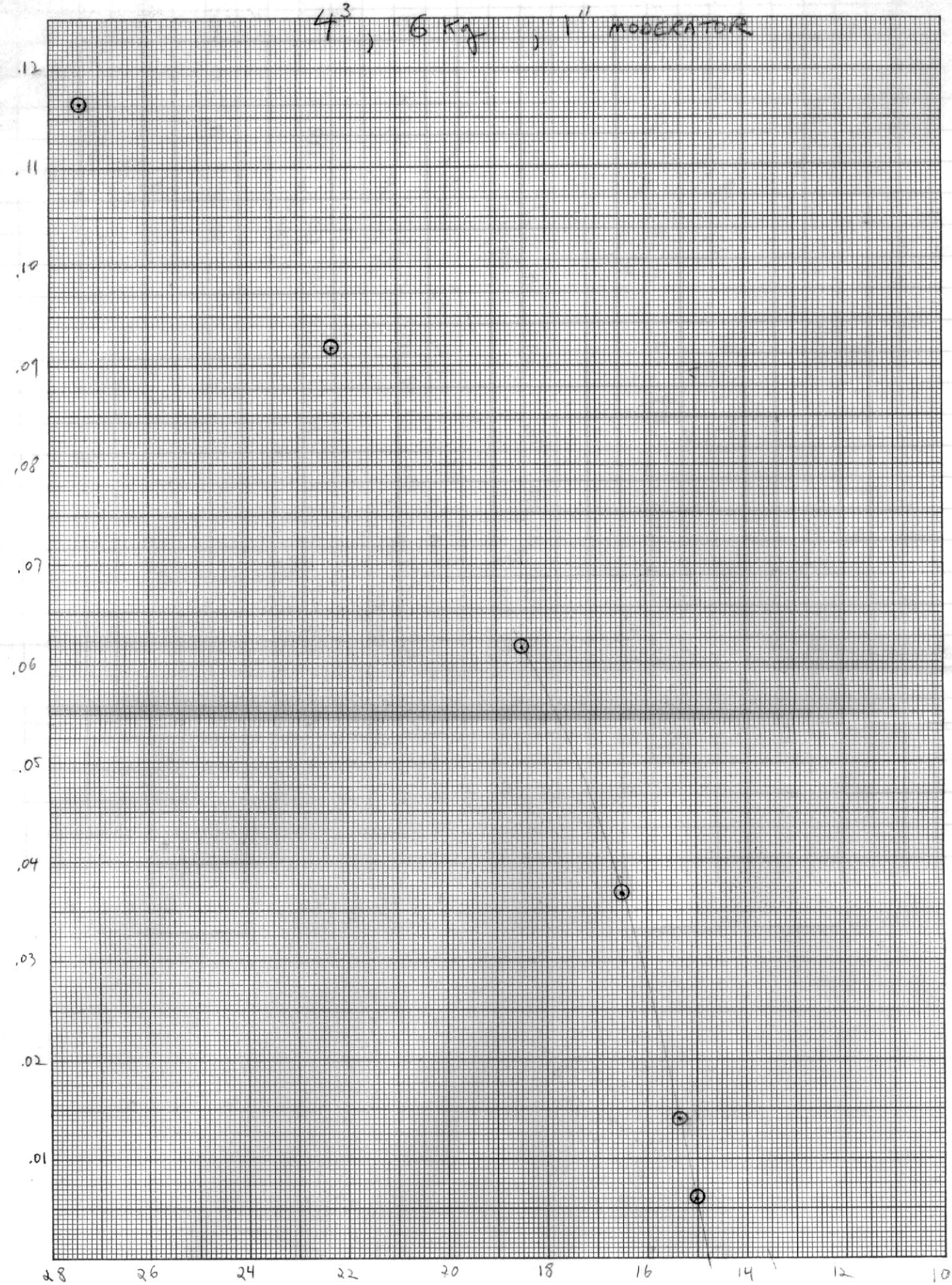
Take down 12 columns + take Background

(20 MIN COUNTS)

T-1	T-2	T-3	T-4
53,742	94,642	470,321	1,031,860

FULL ARRAY 1/M

4^3, 6 Kg, 1" MODERATOR



K+E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. MADE IN U.S.A.

7-5-67

	T-1	T-2	T-3	T-4
Background	52840/20	90264/20	463393/20	1020568/20

Assembly D-19: Pu to Pu $STS_{x,y}$ = 14.739 cm STS_z = 16.062 cm

Lateral: .721 cm (Fixed) + 14.016 cm = 14.737 cm

Vertical: .108 cm (Fixed) + 15.954 = 16.062 cm

Parts: 1-125 Loss #7

Baseline = 259.38×10^5 n/s

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.859	128109/5	9270	14.372×10^5	78498	30.2	93574/5	313.3	23.567×10^5	75057	28.9
	25621			$\bar{Y}_m$ = .03311					$\bar{Y}_m$ = .03860	

$\bar{M}$ = 29.6

$\bar{Y}_m$ = .03378

T/C's Room = 69 #1 = 109 #2 = 108

2.698	318909/5	64607	197830	76277	241698/5	48679	19436.3	74.93
	62781	1076.8	$\bar{Y}_m$ = .01311		48329	811.3	$\bar{Y}_m$ = .01335	

$\bar{M}$ = 75.60

$\bar{Y}_m$ = .01322

T/C's Room = 69 #1 = 108 #2 = 103

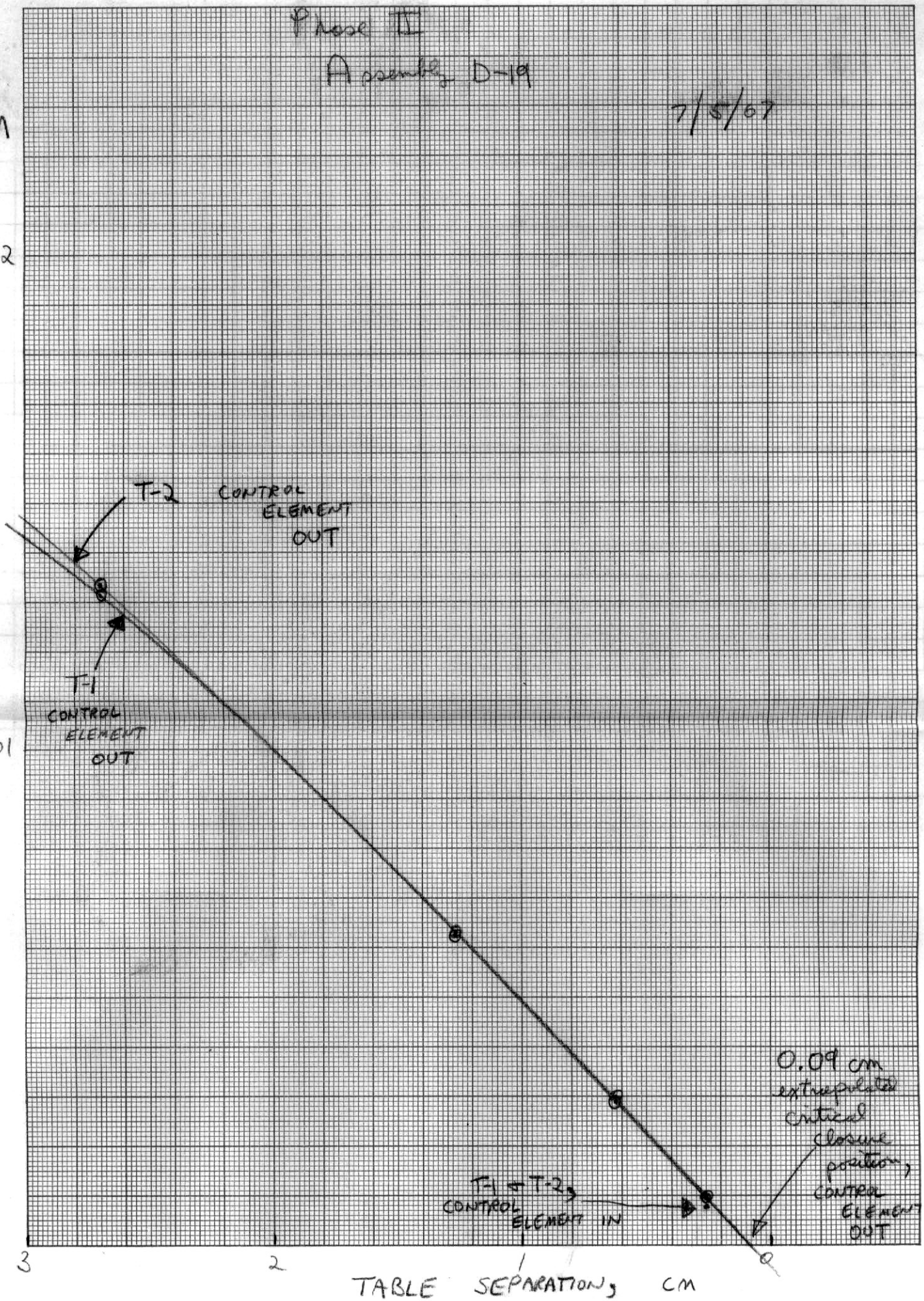
1.271	655577/5	131457	402531	155.25	734705/5	102898	4106.5	158.3
	131115	2191.0	$\bar{Y}_m$ = .00678		102694	1714.1	$\bar{Y}_m$ = .00632	

$\bar{M}$ = 156.8

$\bar{Y}_m$ = .00638

T/C's = Room = 70 #1 = 107 #2 = 102

0.626	267433 →	268858	823249	317.4	217197 →	217516	87009.4	335.5
	44810		$\bar{Y}_m$ = .00315		36319		$\bar{Y}_m$ = .00298	



K&E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. MADE IN U.S.A.

Pos.	T-1	T-1'	Eff. Factor	10^5 c/s	M	T-2	T-2'	Eff. Factor	10^5 c/s	M
.260	720150	730672	18.372×10^{-5}	223734	862.6	613390 → 619035.		23.957×10^{-5}	247164	952.9
A=out	12178		$\gamma_m = .00116$			10317			$\gamma_m = .00105$	

.260 885706 757719
A = IN

(will calculate data tomorrow)

OPEN TABLE

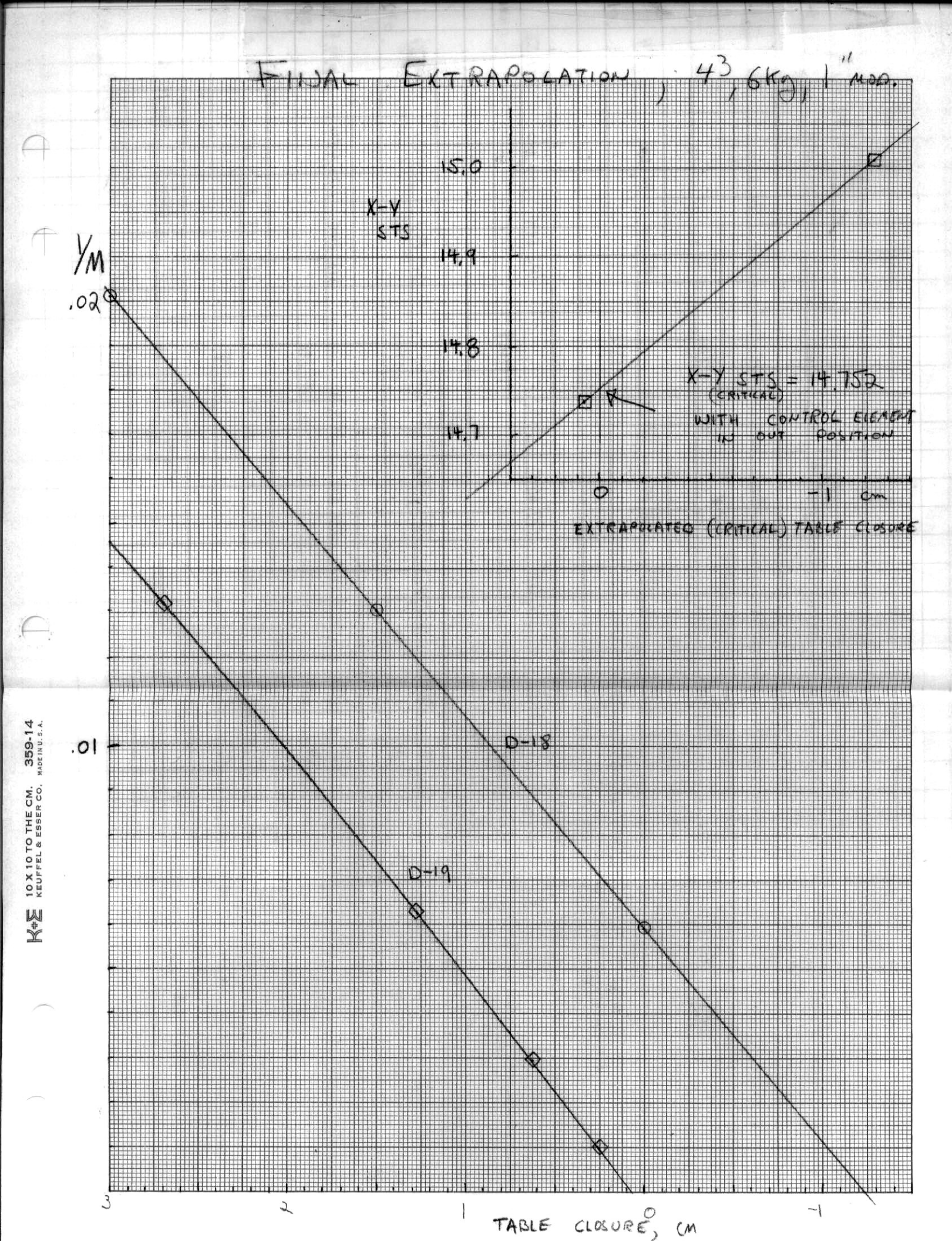
7/6/67

Error discovered in dead time correction of last 4 counts. They are re-calculated here

Position	C_1	C_1'	M_1	γ_{M_1}	C_2	C_2'	M_2	γ_{M_2}
T .260	2.698	63,782	64,606	76.27		48,330	48,682	74.94	
A OUT				.01311				.01334
T .260	1.271	131,115	134,645	158.95		102,694	104,300	160.56	
A OUT				.00629				.00623
T .260	.626	267,433	282,546	333.55		217,197	224,511	345.61	
A OUT				.00300				.00289
T .260	.260	720,150	841,326	993.2		613,340	675,484	1,039.8	
A OUT				.00101				.00096
T .260	.260	885,706	1,076,375	1270.7		757,719	854,885	1,316.0	
A IN				.00079				.00076

NOTE: CONTROL ELEMENT OUT−IN $\Delta\gamma_M = .00021$, ~10 ¢

previously estimated at .00019, .00016



K&E 10 X 10 TO THE CM. 359-14
KEUFFEL & ESSER CO. MADE IN U.S.A.

FINAL CRITICAL CONTROL EXTRAPOLATION ELEMENT OUT

D-18 : STS_{XY} = 15.009

TABLE POS	$\overline{M}$	$Y/\overline{M}$
3.001	49.735	.02011
1.500	76.698	.01304
+.002	169.60	.00590

D-19 : STS_{X-Y} = 14.737

TABLE POS	$\overline{M}$	$Y/\overline{M}$
2.698	75.605	.01323
1.271	159.76	.00626
.626	339.6	.00294
.260	1016.5	.00098

THE ABOVE DATA EXTRAPOLATES TO 14.752 cm

To this we must subtract .034 cm which represents effect of control element + support structure in withdrawn position.

$\therefore$ $X\text{-}Y_{STS}$ "CLEAN CRITICAL" = 14.718

$\approx$ 14.72 cm

Set up of the 1.5" spacing:

a) Lower spacers: 25 + 15 + 2 cm spacers, + H.E.
(1" was 25+15 + 2 + .5 + .2 + H.E.)

b) Intermed spacers (3 cm + 4 cm + .2 cm + .011")

1	6.2815" Base	24	.002
2	+.002	25	.000
3	+.001	26	.000
4	+.001	27	−.002
5	−.002	28	−.002
6	−.002	29	−.002
7	−.001	30	−.001
8	+.002	31	.001
9	−.002	32	−.001
10	.000	33	−.001
11	.0005	34	−.001
12	.001	35	−.002
13	.002	36	.000
14	−.002	37	.000
15	.001	38	.000
16	.001	39	−.001
17	.000	40	.000
18	.000	41	.001
19	−.001	42	−.001
20	.000	43	.000
21	.001	44	−.001
22	−.001	45	.000
23	−.001	46	.000

∴ AVG SPACING = 6.2811"
= 15.954 cm

The 4^3, 6 Kg, 1.5" MODERATED SERIES

1st We changed Internal spacing to be:

$Z_{STS} = 15.954 + .108 = 16.062$

Bottom spacers in columns are: 42cm Al + 1.5" mod.

Next we arranged 16 columns to correspond with calculations facing page 10, This log book, + took 30 min background.

T-1 $72,745/30 = 2,425$ T-2 $204,936/30 = 6,831$

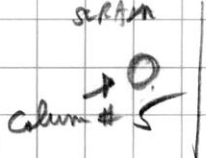
Then the appropriate backgrounds are:

T-1 $^{BKgd}_{14} = [.86999]\,2,425 = 2,110$ T-2 $^{Bkgd}_{14} = [.6763]\,6,831 = 4,620$

T-1 $^{BKgd}_{12} = [.74110]\,2,425 = 1,797$ T-2 $^{Bkgd}_{12} = [.4673]\,6,831 = 3,192$

1st Safety Exp

Assembly E-1 Pu to Pu: 16.1 cm z, 15.6 xy



Lateral: .721 fixed + 14,923 = 15.644 cm
Vertical: .108 fixed + 15,954 = 16.062 cm

Parts: Columns and

Back Rate ~ 32.5×10^5 m/s

[ON 5/3/67 we determined that the source count through 1.5" mock H.E. was on an average 96.3% that through 1.0" mock H.E. On this basis we will divide the current efficiency factors by .963 to obtain new efficiency factors. Thus

EFFICIENCY FACTORS:

$T_1 = 19.08 \times 10^5$ $T_2 = 24.88 \times 10^5$]

P_{50}	T-1	Eff Fac	10^5 m/s	M_1	T-2	Eff Fac	10^5 m/s	M_2
7.850	14,290/5	19.08×10^5	237.9	7.32	26,675/5	24.88×10^5	296.6	9.13
	2,858				5,335			
	− 2,110				− 4,620			
	748				715			
	= 12.47 cps				= 11.92 cps			$\bar{M} = 8.22$

The above multiplications don't agree too well but this is probably because the array is offset on the tube. + Questionable background treatment

+.000	14,320/5	239.8	7.37	27,019/5	324.9	9.99	
	2,864			5,404			
	− 2,110			− 4,620			
	754 → 12.57			784 → 13.06			

$\bar{M} = 8.68$

Assembly E-2 P_{50} to P_{50} 16.1 cm z, 15.6 x-y

SCRAM	CONTROL
50	06
70	08

Lateral : .721 fixed + 14.923 = 15.644 cm
Vertical : .108 fixed + 15.954 = 16.062 cm

Ports: Columns 5-8

Base Rate: ~64.9 $\times 10^5$ in/s

P_{in}	T-1	Eff Fac	10^5 in/s	M_1	T-2	Eff fac	10^5 in/s	M_2
7.869	16,825/s	19.08×10^5	498.56	7.68	22,999/s	24.88×10^5	583.93	9.00

3365
− 1,797
1,568
26.13 ips

4600
− 3,192
1,408
23.47 ips

$\overline{M} = 8.34$

.000	17,959/s	570.9×10^5 in/s	23,984/s	665.5×10^5 in/s
	3,592		4,797	
	− 1,792	$M_1 = 8.80$	− 3,192	$M_2 = 10.25$
	1,795		1,605	
	29.92 ips		26.75 ips	

$\overline{M} = 9.53$

7-19-67

$T\text{-}1_g^{Bkg} = (.48803)\ 2425 = 1183$

$T\text{-}2_g^{Bkg} = (.2504)\ 6831 = 1710$

Assembly E-3: Pin to Pin $STS_{xy} = 15.644$ in $STS_y = 16.062$ in

Lateral: .721 fixed + 14.923 = 15,644

Vertical: .108 fixed + 15.954 = 16.062

#1		#2	
①	⑤	⑥	③
②	⑦	⑧	④

Parts: Column 1–8.

Base Rate ~ 130.2×10^5 in/s

Pos.	T-1	T-1′	Eff. Factor	10^5 in/s	M	T-2	T-2′	Eff. Factor	10^5 in/s	M
7.861	31022/s	83.5	19.08×10^5	1593.2	12.2	28170/s	65.9	24.88×10^5	1627.2	12.5

6209
− 1183
5011

5638
− 1710
3928

$\overline{M} = 12.35$

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
0.000	3700 c/s	1036	15.0×10^5	1976.7	15.2	33022/5	81.6	24.88×10^5	2030.2	15.5
	7401					6604				
	-1183					-1210				
	6218					4894				

$\bar{M} = 15.4$

$1/\bar{M} = .0650$

We will now increase the spacing to find out where $M_{1/2} = 10.0$

We will go out to 17.866 cm XY STS (Base to Base = 6 3/4")

Also, another Bldg with 16 columns in rods T-1,

72,694/30 = 2,423 206,289/30 = 6,876

E-4, another 1/2 table exp. P_w to P_w 17,87 x-y, 16.062

Lateral: .721 + 17,145 = 17,866 cm

Vertical: .188 + 15.954 = 16,062 cm

SCRAM		CONTROL	
(1)	(5)	(6)	(3)
(2)	(7)	(8)	(4)

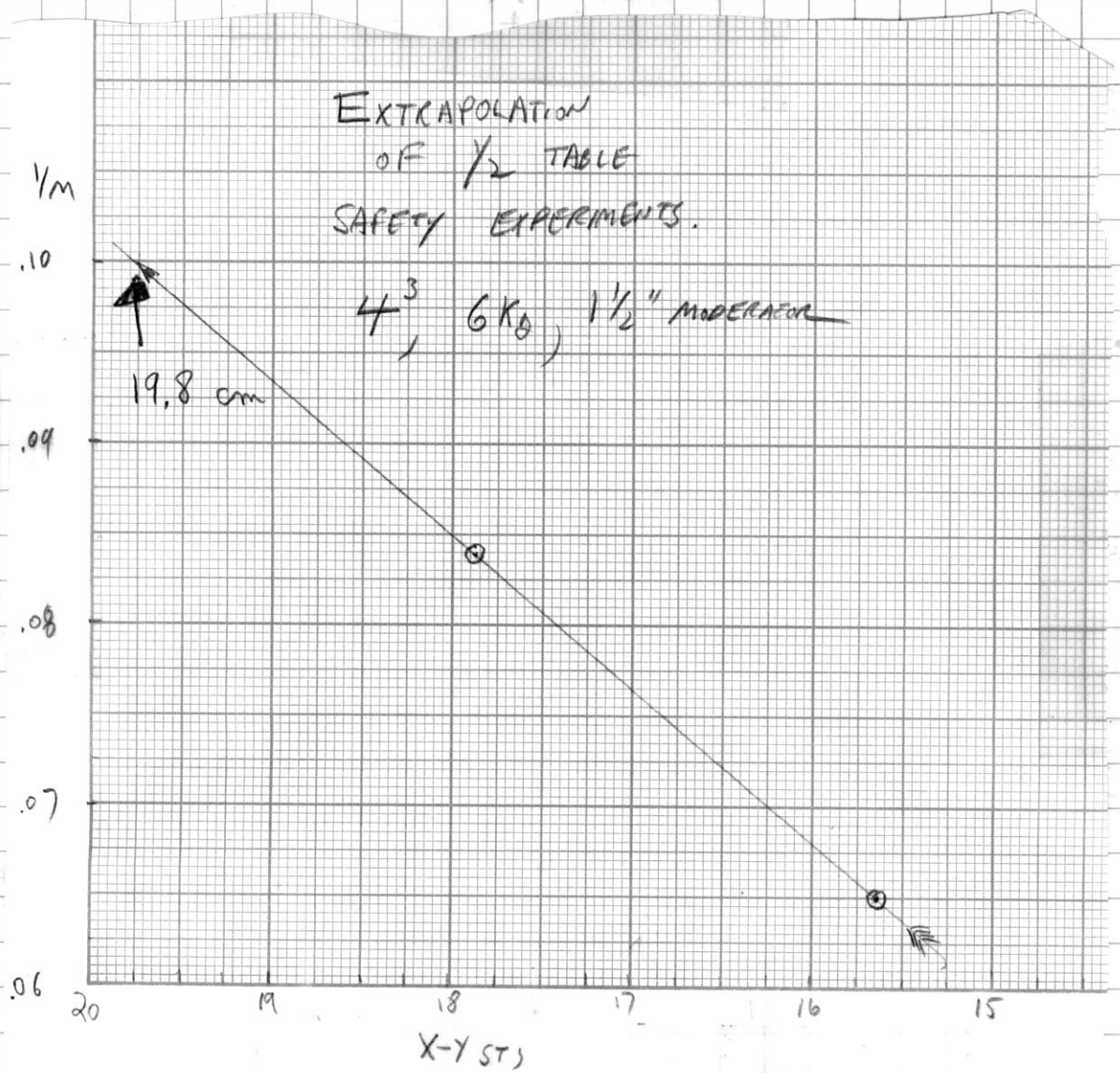
Parts: Column 1-8 ; Base Rate ~ 130.2×10^5 n/s

P_{00}	T-1	Eff Fac	10^5 n/s	M_1	T-2	Eff Fac	10^5 n/s	M_2
7,863	27,278/5	19.08×10^5	1359.1	10.44	25,032/5	24.88×10^5	1361.7	10.46
	5,456				5,006			
	-[.4880] 2,423 = 1,182				-[.2504] 6,876 = 1,722			
	4,274 = 71.23 cps				3,284 = 54.73 cps			$\bar{M} = 10.45$

Scrammed within .010" of full closure (due to mike on table - which was removed)

.0.012 (closed)	30170/5	1543.0	11.85	27358/5	1558.2	11.97
	6034			5480		
	-1182			1722		
	4852			3758		
	80.87 cps			62.63 cps		

$1/\bar{M} = .08396$ $\bar{M} = 11.91$


EXTRAPOLATION
OF ½ TABLE
SAFETY EXPERIMENTS.
4³, 6K_B, 1½" MODERATOR
1/M
.10
.09
.08
.07
.06
19,8 cm
20
19
18
17
16
15
X-Y STS

7/13/67

We Extrapolate the previous two runs and determine that $M_{\frac{1}{2}} = 10$ @ 19.8 cm. Thus we will run the full array to these + extrapolate to where critical should be and run the plastic man experiment with the ½ table at that point.

The current "calculated"* critical point is 15.88 cm STS$_{xy}$. ∴ Twice this is 31 3/4 cm and we will set up ~ 31.2 cm (12.000 base to base) as our first experiment

1st Full Array

E-5 P_w to P_w ~ 31.2 x-y STS ; 16.1/2 STS

Lateral: .721 fixed + 30.480 = 31.201
Vertical: .108 fixed + 15.954 = 16.062

Parts: #5 1-129 except #7

Back Rate 259.38 $\times 10^5$ n/s

R_{oo}	T-1	Eff Fac	10^5 n/s	M_1	T-2	Eff Fac	10^5 n/s	M_2
7,868	36,186/5	19.08 $\times 10^5$	2301.4	8,873	27,108/5	24.88	2248.3	8.668
	7,237				5,422			
	120.62				90.37		$\bar{M}$ = 8.77	

if $M = \chi C$
$\chi_1 = 1.226 \times 10^{-3}$ $\chi_2 = 1.599 \times 10^{-3}$

.006	37,592/5	9.22	28,310/5		9.05	
	7,518		5,662		$\bar{M}$ = 9.135	
				1/$\bar{M}$ =		

2-14-67

Assembly E-6 : Pu to Pu STS_{xy} = 23.581cm STS_z = 16.062cm

Lateral : .721cm (fixed) + 22.860cm = 23.581 cm

Vertical : .108cm (fixed) + 15.954cm = 16.062cm

Parts : 1-129 less #7

Base Rate = 259.38 $\times 10^5$ n/s

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.865	50219/5	169.4	19.08×10^{-5}	3194.0	12.3	38912/5	129.7	28.58×10^{-5}	3226.9	12.4
	10043					7782				

$\bar{M}$ = 12.35

T/C's Room = 69 #1 = 59 #2 = 85

0.014	59473/5	198.2		3781.7	14.6	45785/5	152.5		3794.2	14.6
	11891					9157				

$\bar{M}$ = 14.6

$\frac{1}{M}$ = .06849

We will now go to our M=10 limit ~ 19.8 cm to run the next assy. The easiest set-up to make ≥ 19.8 is

7.5" + .015" = 7.515 (2.54) = 19.088
+ .721
= 19.809 cm

This we will set up.

7/17/67

Assembly E-7: Ratio Pc xy = 19.8, z = 16.1

Lateral : .721 + 19.088 = 19.809 cm
Vertical : .108 + 15.954 = 16.062 cm

Parts 1-129 less # 7

Base Rate = 259.38 x10^5 m/s

$M_1 = C_1 \times 1.226 \times 10^{-3}$ $M_2 = C_2 \times 1.599 \times 10^{-3}$

Po	C-1	M_1	C-2	M_2
7.929	81,662/5	20.0	63,733/5	20.4
	16,332		12,747	
CLOSED	137,984	34.02	109,182	35.03
	27,597		21,836	
	27,750		21,908	

$1/M_1 = .0294$ $1/M_2 = .0285$

$\bar{M} = 34.52$, $1/\bar{M} = .02897$

also $C_3 = 1043,306/5$
208,662

$C_4 = 1,011,121/5$
202,224

assume $\rho = .2 \times 10^{-6}$ MIN
dead time

217,740
= 3,629 gpo

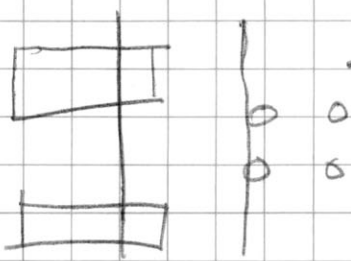
210,746
= 3,512 gpo

if we assume $M_{3,4} = 34.52$, 10^5 gpo = 8,955.1

Then the efficiency factors are:

eff Fac$_3$ = 2.468 x10^5 **eff Fac$_4$ = 2,550 x10^5**

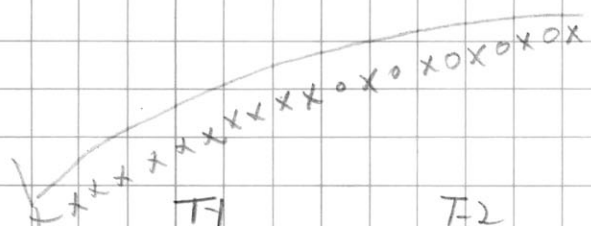
Using a "French curve" made from the data of the last full array, the critical point should be around 17.92. If we set the banks at 6 3/4", then X-Y$_{STS}$ is 17.86, conservative for a safety experiment (we would like to miss in the reactive direction, so as not to have to extrapolate forward). We did a non-reflected safety experiment here early in this array series, so we can go directly to the



experiment.

7/18/67

20 MINUTE BACKGROUND COUNTS WITH 16 COLUMNS IN RACK IN SAME POSITIONS AS WERE USED FOR CALCULATIONS ON PAGE 10a)



T-1	T-2	T-3	T-4
48,400/20	141,129/20	403,233/20	1329,459/20
2,420	7,056	20,162	66,473
		↓ 20,244	↓ 67,368

4 column backgrounds (12 in rack)

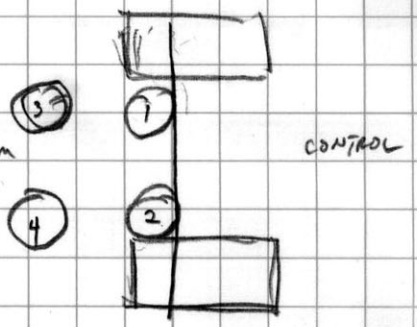
T-3 = .64853 (20,244) = 13,129 T-4 = .83466 (67,368) = 56,229

8 column backgrounds (8 in rack)

T-3 = .39868 (20,244) = 8,071 T-4 = .58203 (67,368) 39,210

Assembly E-8

Pin to Pin: X-Y 17.9 cm, Z - 16.1 cm



Lateral: .721 + 17.145 = 17.866 cm

Vertical: .108 + 15.954 = 16.062 cm

Ports: Columns 1–4

Due to off center set-up we do not expect $M_3 \neq 4$ to agree, but will believe average.

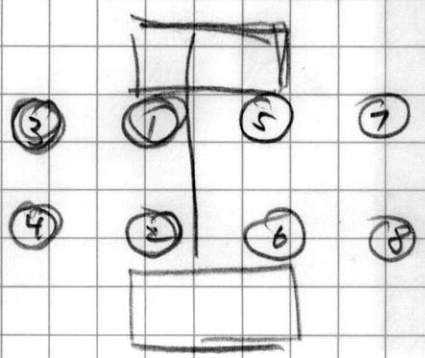
Base Rate: ~ 64.9×10^5 n/s

P_∞	T-3	Eff Fac	10^5 n/s	M_3	T-4	Eff Fac	10^5 n/s	M_4
CLOSED	133,737/5	2.468×10^5	566.2	8.724	323,577/5	2.550×10^5	396.8	6.114
	26,747				64,715			
	↓ 26,891				↓ 65,503			
	− 13,129				− 56,229			
	13,762				9,334			
	= 229.4 cps				= 155.6 cps			

$\bar{m} = 7.42$

Assembly E-9

Pin to Pin X-Y 17.9 cm, Z - 16.1 cm



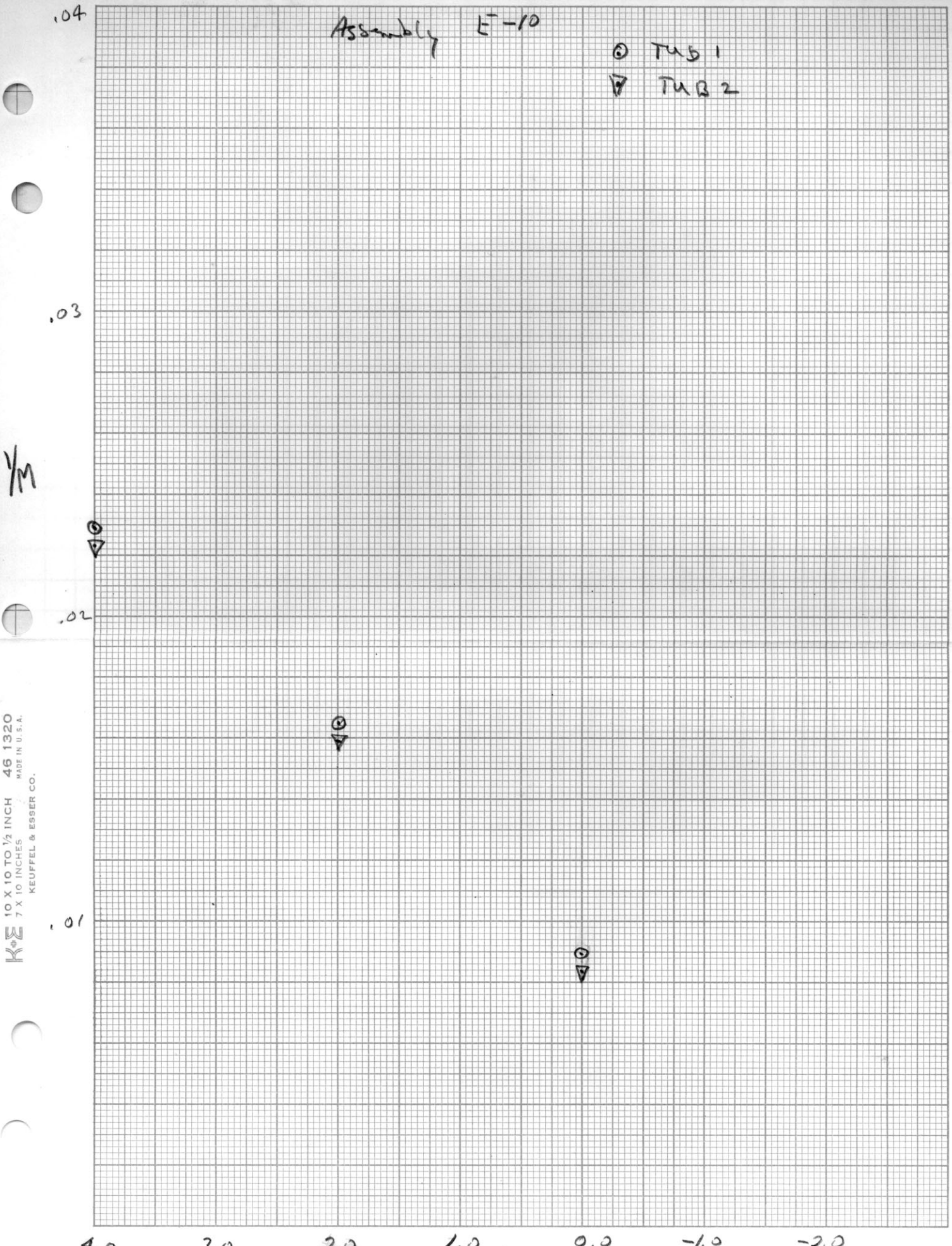
Lateral: .721 + 17.145 = 17.866 cm

Vertical: .108 + 15.954 = 16.062 cm

Ports: Columns 1–8

Base Rate: ~ 130.2×10^5 n/s

P_∞	T-3	10^5 n/s	M_3	T-4	10^5 n/s	M_4
7.854	184,021/5	1193.0	9.16	330,813/5	1183.2	9.09
	36,804			66,162		
	↓ 37,077			67,049		
	− 8,071			− 39,210		
	29,006			27,839		



K&E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

	T-3	M_3	T-4	M_4
Position	231,146/5	12.17	373829/5	11.98
	46,229		74764	
	+46,661		+75,899	
	−8,071		−39,210	
	38530		36,689	

$\overline{M} = 12.08$

$Y_{\bar{M}} = .08282$

Note that $\Delta Y_{M^{\frac{1}{2}}\ \text{REFLECTOR}} = .00114$

Thus if $M^{\frac{1}{2}}_{\text{BARE}}\ [STS_{x-y} = 15.64] = 15.39$

we can assume $M^{\frac{1}{2}}_{\text{REFLECTED}}\ [STS_{x-y} = 15.64] = 15.66$

+ we safely load at least to this (15.64)

7-20-67

Assembly E-10 : Pu to Pu $STS_{x-y} = 18.501$ cm $STS_3 = 16.062$ cm

Lateral : .721 cm (fuel) + 17.780 cm = 18.501

Vertical : .108 cm (fuel) + 15.954 cm = 16.062

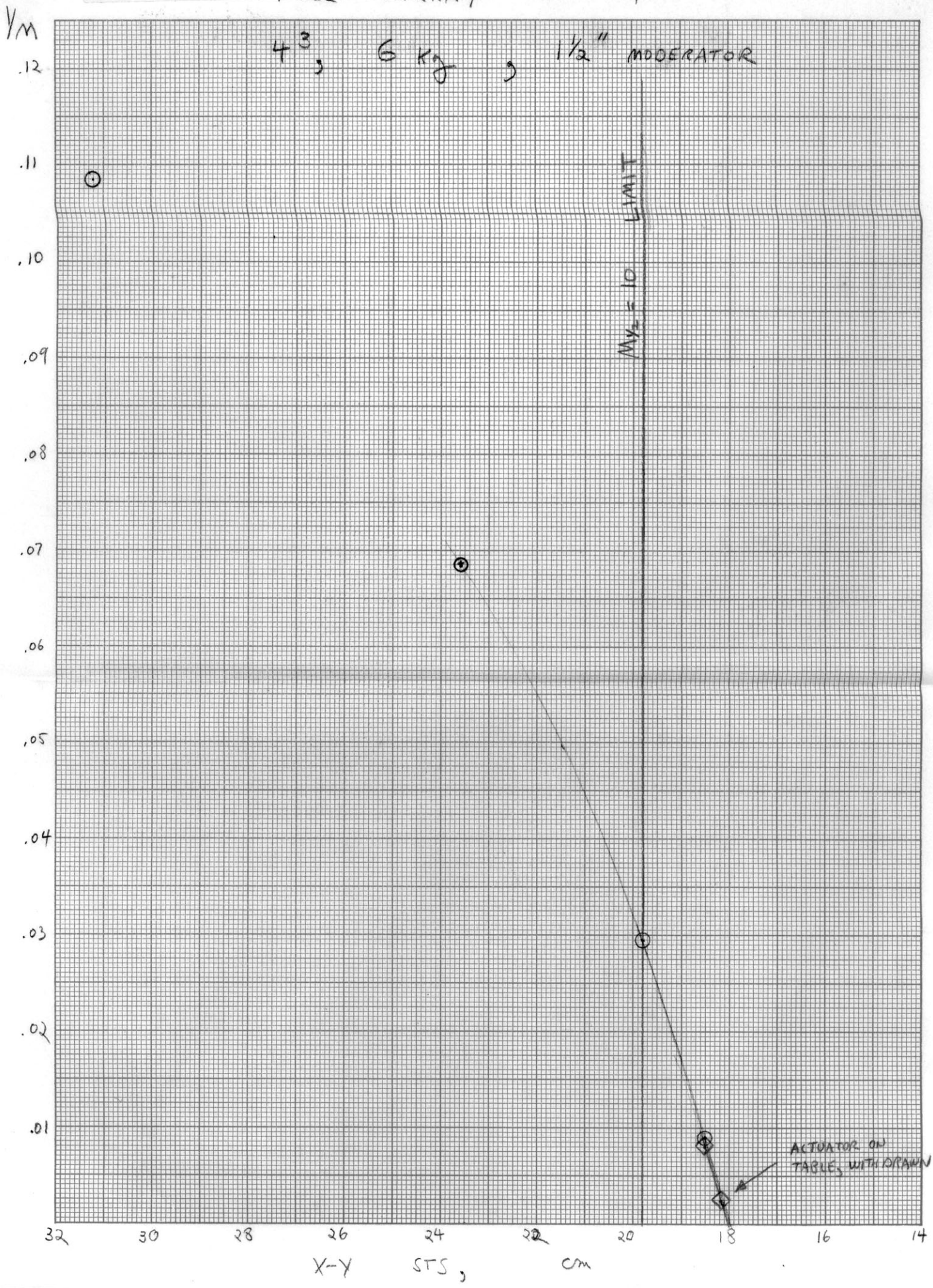
Parts : 1-129 less #7

Base Rate = 259.38 X 10^5 n/s

Pos	T-1	T-1′	Eff. Factor	10^5 n/s	M	T-2	T-2′	Eff. Factor	10^5 n/s	M
7.856	24221	→24338	19.08×10^{-5}	7738.8	29.8	18365	→18417	24.88×10^{-5}	7638.2	29.4
	+105.6			$Y_M = .03356$			3020		$Y_M = .03801$	
									$\overline{M} = 29.6$	

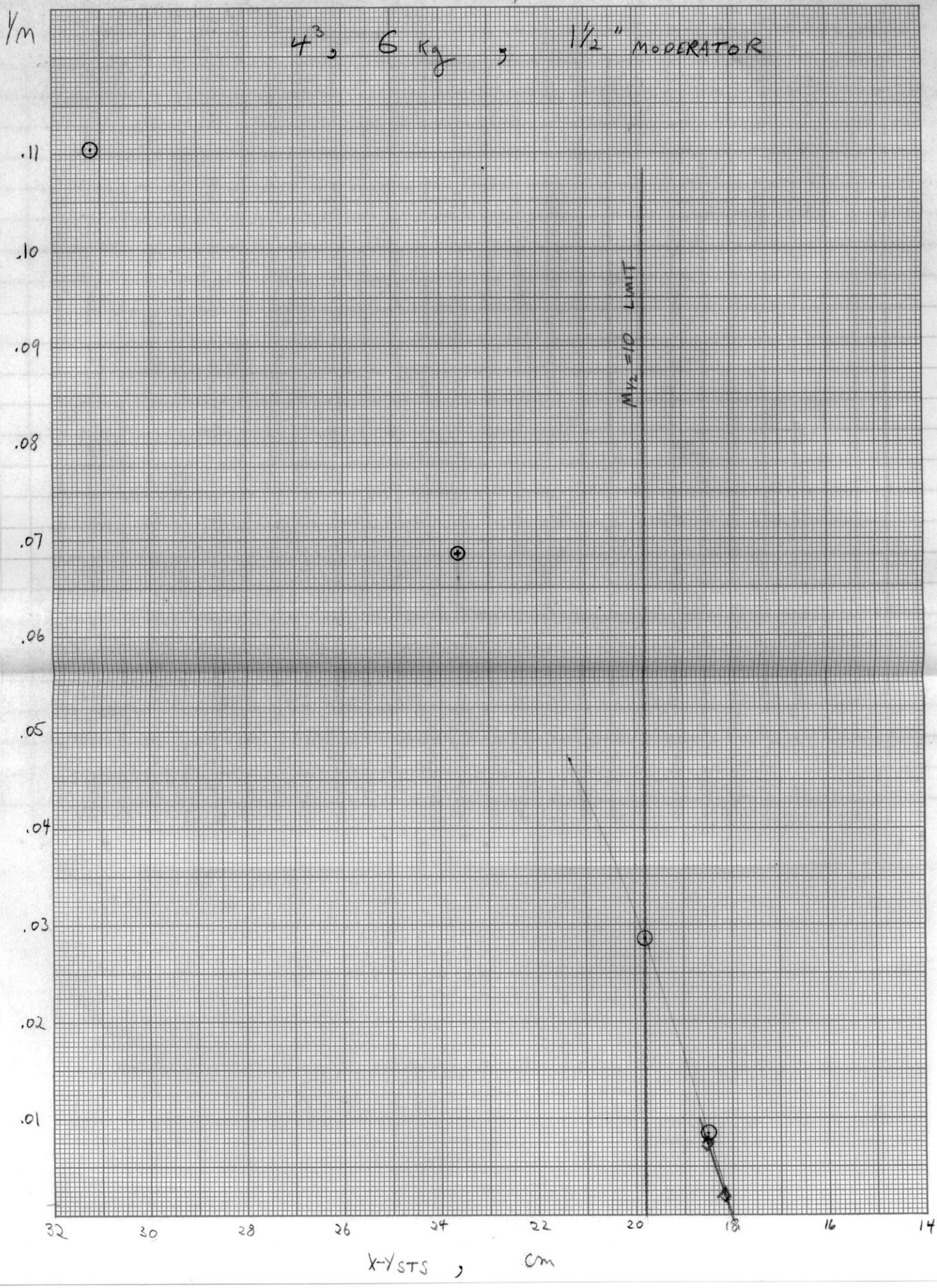
T/C's Room = 69 #1 = 110 #2 = 105

FULL ARRAY - T-1



K+E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. MADE IN U.S.A.

FULL ARRAY - T-2



K&E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. MADE IN U.S.A.

Pos	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
4.001	35409	594.4	19.08×10^{-5}	11391	43.7	27925	467.4	24.88×10^{-5}	11630	44.8
	↓35662			$1/m = .02288$		↓28043			$1/m = .02232$	

T/C's Room = 68 #1 = 108 #2 = 104

2.001	49160	827.4	15788	60.9	39180	656.9	16344	63.0	
	↓49646		$1/m = .01682$		↓39413		$1/m = .01587$		

T/C's Room = 68 #1 = 107 #2 = 103

0.000	88399	1499.9	28618	110.3	71562	1205.6	29995	115.6	
	↓89992		$1/m = .00907$		↓72335		$1/m = .00865$		
0.000	89502	1518.9	28981	111.7	73687	1241.9	30898	119.15	
	↓91133		$1/m = .00855$		↓74514		$1/m = .008396$		

$\bar{m} = 121.1$ $1/\bar{m} = .00822$

The (new) lucite control element was placed on the control table (4.25" x 4.25" x 1.0 in). We will now check the worth of the new element on the previous array.

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
#2 = 2.000	53092	899.4	19.08×10^{-5}	17065.	65.8	42875	719.2	24.88×10^{-5}	17894	69.0
A = 15.000	↓53661			$1/m = .01520$		↓43151			$1/m = .01449$	
#2 = 2.000	53953	909.0		17394	66.9	43266	742.7		18478	71.2
A = 0.000	↓54542			$1/m = .01495$		↓44560			$1/m = .01404$	

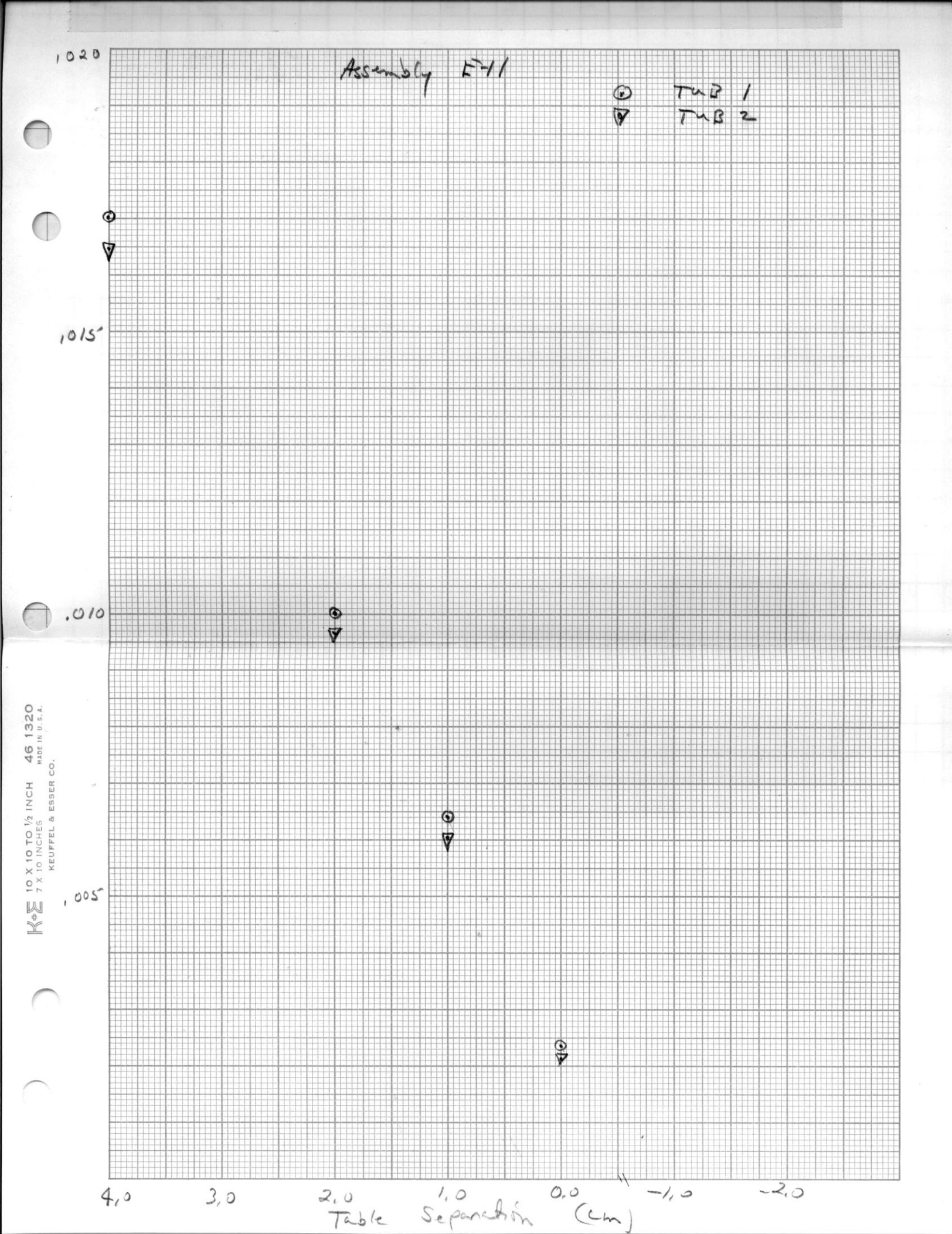
($\Delta 1/\bar{m} = .00035$, ~18¢) CONTROL ELEMENT

T/C's Room = 69 #1 = 101 #2 = 98

#2 0.000	102,842	1/1	128.73	86,261	1/1	139.74		$1/\bar{m} = .0715$	
A = 0.000	↓105,002			↓87,392					

($\Delta 1/\bar{m} = .00025$, ~13¢)

#2	99,031		123.87	84,067		136.14			
A 15268	↓101,032		$1/m_1 = .00807$	↓85,141		$1/m_2 = .00734$			



K&E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

7-21-67

Assembly E-11 ; Pu to Pu STS_{xy} = 18,184 STS_z = 16.062 cm

Lateral : .721cm (fixed) + 17.463 = 18,184

Vertical : .108 cm (fixed) + 15.954 = 16.062 cm

Parts : 1-129 less #7

Base Rate = 259.34 X 10^5 n/s

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
	2.865	28762	982.2	19.08 X 10^5	9200.4	35.5	22793	381.2	24.66 X 10^5	9468.3	36.6
A=1500		28930			Ym = .02817		22870			Ym = .02732	

T/C's Room = 70 #1 = 105 #2 = 109

4.000	87515	799.5	15258.	58.8	37725	632.4	15738	60.7
A=15.00	87971		Ym = .01701		37941		Ym = .01648	

T/C's Room = 70 #1 = 101 #2 = 106

2.000	79129	1340	25562.	98.6	63977	1071.6	26786.	103.3
A=15.00	80399		Ym = .01014		64597		Ym = .009681	

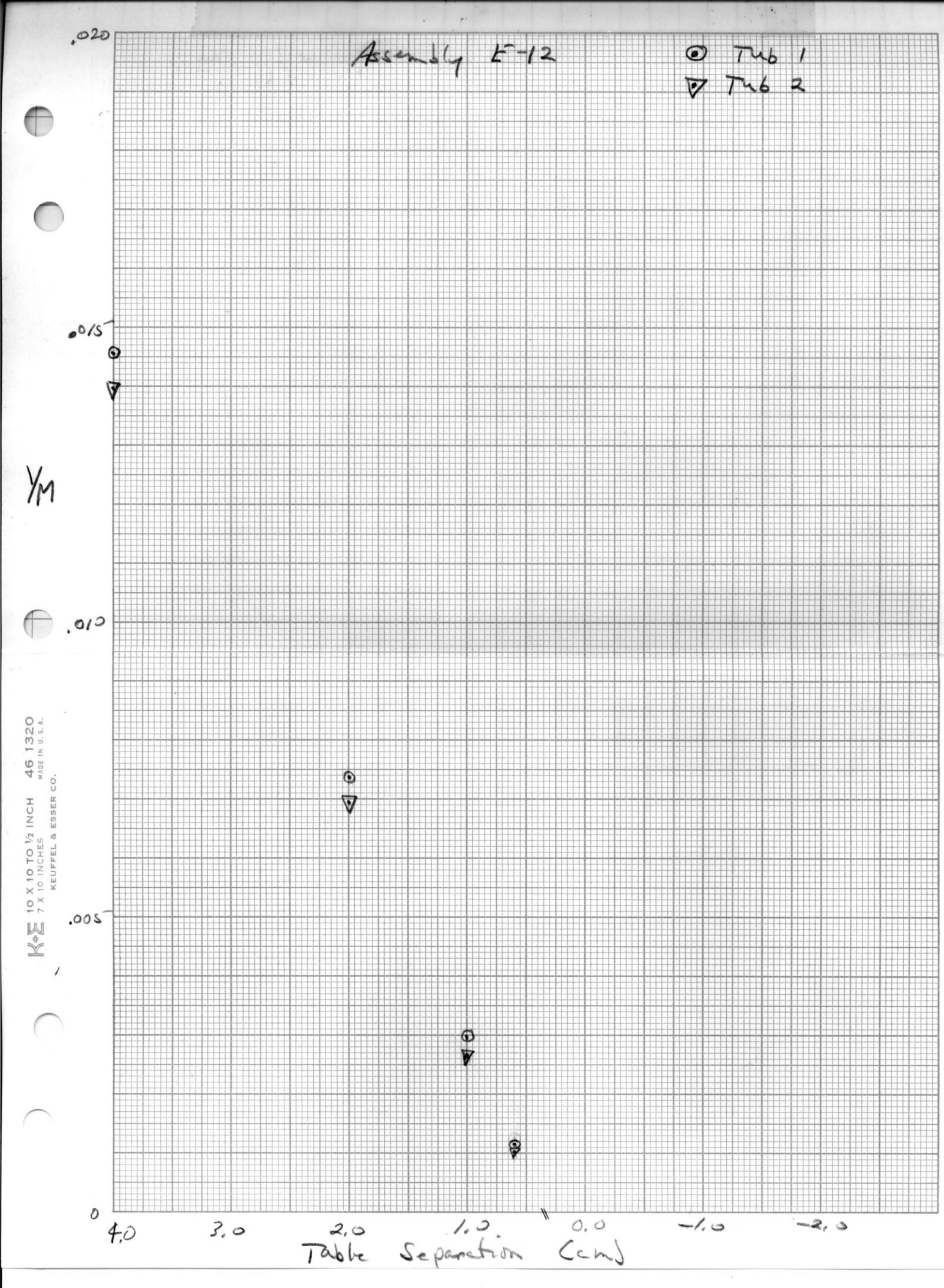
T/C's Room = 69 #1 = 110 #2 = 105

1.180	124020	2120	40450	155.9	101993	1725.4	42928	165.5
A=15.00	127170		Ym = .00641		103526		Ym = .00604	

T/C's Room = 69 #1 = 98 #2 = 105

0.000	324029	5774.7	110181	424.8	281654	4901.1	121939	470.1
A=15.00	346480		Ym = .00235		299063		Ym = .00213	

T/C's Room = 69 #1 = 97 #2 = 104


Assembly E-12
Tub 1
Tub 2
.020
.015
.010
.005
0
Y/M
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
Table Separation (cm)

7-24-67

Assembly E-12: Pu to Pu $STS_{x,y}$ = 17.988 cm STS_z = 16.062 cm

Lateral: .721 cm (fixed) + 17.267 cm = 17.988 cm

Vertical: .108 cm + 15.954 = 16.062 cm

Parts: 1-129 less #7

Base Rate = 259.38 $\times 10^{-5}$ n/s

Pos	T-1	T-1'	Eff Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
.880	31254	5242	19.08×10^{-5}	10001.	38.6	24619	911.8	28.88×10^{-5}	10246.	39.5
A=15.00	31752			Ym = .0259		24709			Ym = .0253	

T/C's Room = 69 #1 = 115 #2 = 113

1.000	55849	935.2		17844.	68.8	44531	747.2		18590.	71.7
A=15.00	56111			Ym = .01453		44831			Ym = .01385	

T/C's Room = 69 #1 = 113 #2 = 110

1.999	108069	1840.9		35124.	135.4	89095	1507.3		37427.	144.2
A=15.00	110454			Ym = .00739		90258			Ym = .00698	

T/C's Room = 69 #1 = 111 #2 = 108

1.000	258527	4544.		86200.	334.3	227438	3928.5		97682.	376.8
A=15.00	272621			Ym = .00259		235467			Ym = .00266	

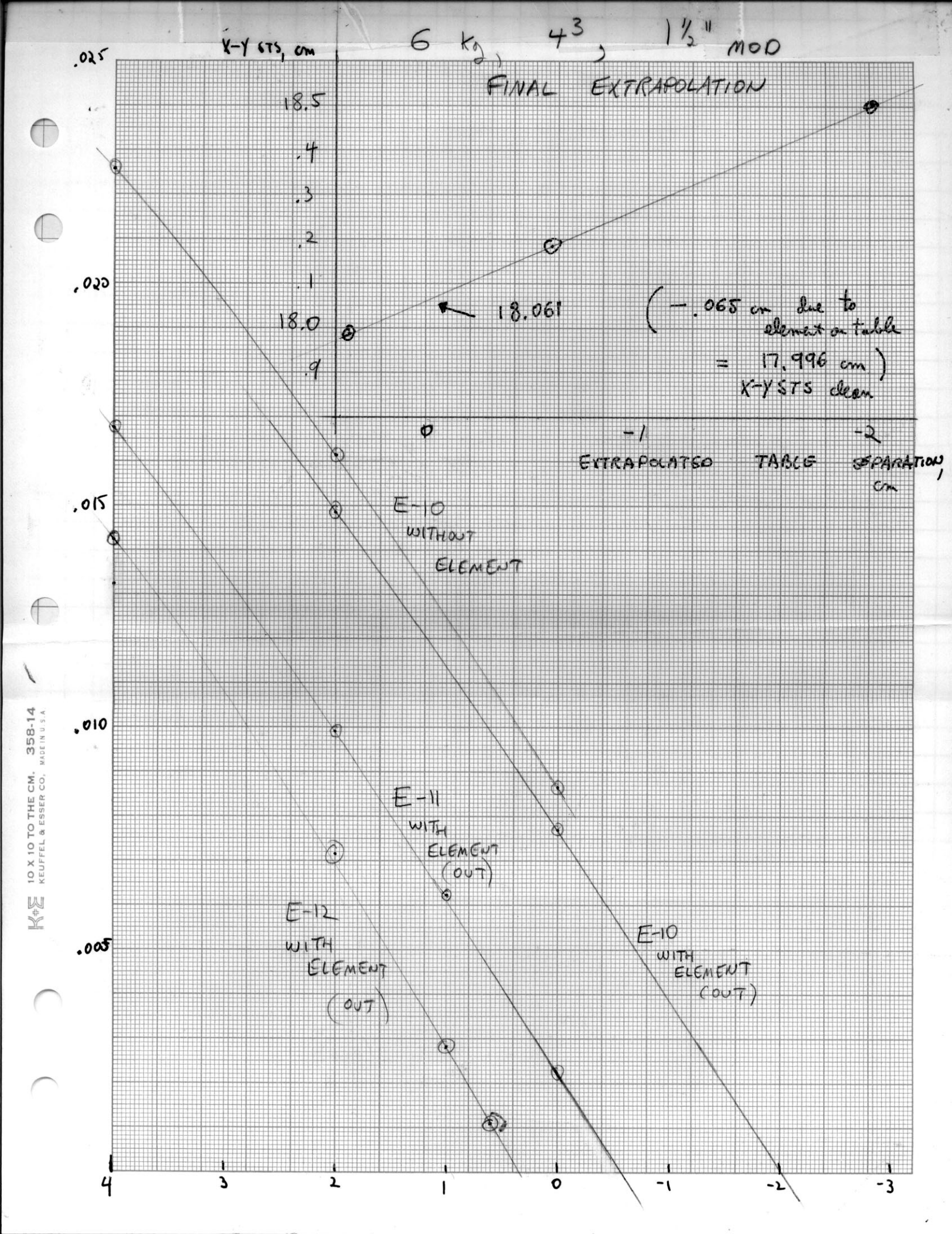
T/C's Room = 69 #1 = 108 #2 = 107

.601	558415	11072.		211254	814.5	524746	9457.		235290.	907.1
A=15.00	664342			Ym = .00123		567434			Ym = .00110	

T/C's Room = 69 #1 = 104 #2 = 103

Continued to go up ∴ we will count again

.601	618242	11778.6		228736	866.8	552770	10046.		299584.	963.6
	706713			Ym = .00115		602736			Ym = .00104	



10 X 10 TO THE CM. 358-14
KEUFFEL & ESSER CO. MADE IN U.S.A.

FINAL EXTRAPOCATION OF E-SERIES DATA

TABLE POSITION	M_1	M_2	$\bar{M}$	$1/\bar{M}$
E-10, Y-Y STS = 18.501				
NO ELEMENT ON TABLE				
4.001	43.72	44.84	44.28	.0258
2.001	60.87	63.02	61.94	.01614
0.000	111.7	119.2	115.4	.00866
CONTROL ELEMENT ON TABLE, IN OUT POSITION				
2.000	65.79	69.00	67.39	.01484
0.000	123.9	136.1	130.0	.00769

NOTE AVG WORTH OF ELEMENT IS .001132 ± (.000185)

E-11 Y-Y STS = 18.184, CONTROL ELEMENT, OUT POSITION				
4.000	58.81	60.67	59.74	.01674
2.000	98.57	103.29	100.9	.00991
1.000	155.9	165.5	160.7	.00622
0.000	424.8	470.2	447.5	.00223

NOTE: AVG SLOPE NEAR 0 CLOSURE IS −.01734 ΔY_m/cm; THUS ΔY_m OF .001135 IS WORTH .065 cm IN STS ± .00

E-12 Y-Y STS = 17.988, CONTROL ELEMENT, OUT POSITION				
4.000	68.79	71.69	70.24	.01424
1.999	135.4	144.3	139.9	.00715
1.000	334.2	376.5	355.4	.00281
.601	866.4	963.8	915.1	.00109

8-4-67

We will look at dead times for the new BF_3 tubes.

Source M-248 $T^{-1} = 65055^{-}$ $= r_1$

Source MRC 8-7 $T^{-1} = 272789^{-}$ $= r_2$

Both Sources $T^{-1} = 332621^{-}$ $= r_{12}$

$$\rho = \frac{r_1 + r_2 - r_{12} - r_0}{2(r_1 - r_0)(r_2 - r_0)} \qquad r_0 = 0$$

$$\rho = \frac{65055 + 272789 - 332621}{2(.65055)(2.72789) \times 10^{10}}$$

$\rho = .187 \times 10^{-6}$ for T-1

Source M-248 $T^{-1} = 55915^{-}$ $= r_1$.

Source MRC-8-7 $T^{-1} = 323335^{-}$ $= r_2$

Both Sources $T^{-1} = 373213^{-}$ $= r_{12}$

$$\rho = \frac{55915 + 323335 - 373213}{2(55915)(323335)}$$

$$= \frac{6037}{3.6159 \times 10^{10}}$$

$\rho = .167 \times 10^{-6}$ for T-1

We will continue dead time studies. We will separate the sources by about 1.5 - 2. feet and check T-1 again.

Source M-248 T-1 = 25832

Source MRC 8-7 T-1 = 138253

Both Sources T-1 = 158812

$$\rho = \frac{r_1 + r_2 - r_{12} - r_b}{2(r_1 - r_b)(r_2 - r_b)}$$

$$= \frac{25832 + 138253 - 158812}{2(25832)(138253)}$$

$$= \frac{1673 \times 10^3}{.6936 \times 10^{10}}$$

$\rho = .241 \times 10^{-6}$ for T-1

We will now look at T-2

Source M-248 T-2 = 17753

Source MRC 8-7 T-2 = 96477

Both Sources T-2 = 116378

$$\rho = \frac{17753 + 96477 - 116378}{2(17753)(96477)}$$

I don't understand this. We will check this again. This may have been due to source interaction.

Source MRC 8-7 T-2 = 211254

Source M-248 T-2 = 27654

Both Sources T-2 = 237203

$$\rho = \frac{27654 + 211254 - 237203}{2(27654)(211254)}$$

$$= \frac{1.705 \times 10^{3}}{11.684 \times 10^{10}}$$

$$\rho = .146 \times 10^{-6}$$

Source MRC 8-7 T-2 = 328688

Source M-248 T-2 = 80305

Both Sources T-2 = 403188

$$\rho = \frac{80305 + 328688 - 403188}{2(80305)(328688)}$$

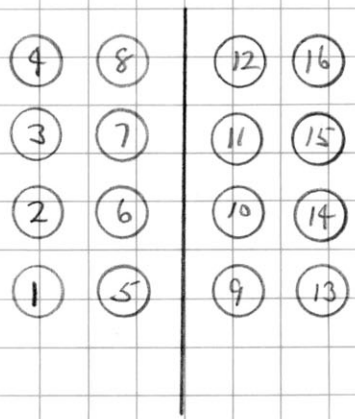
$$= \frac{5.805 \times 10^{3}}{5.279 \times 10^{10}}$$

$$= .111 \times 10^{-6}$$

8-16-67

We will do eff. factors for the 4^3 Modended 3 Kg annay. $STS_{x,y} = 7.4\,cm$ $STS_z = 5.0\,cm$

The source holder position indicator will be reading 88, 103, 117, 132 for this study.



Eff. Factor Determinations (Source: MRC 8-7, 1.03×10^7 n/s)

Col. 11 (Only) Count Rates:

		T-1	T-2
Position #88	c/m	52896/5	46509/5
	c/s	176.15	155.03
	Eff.	13.55×10^{-6}	11.925×10^{-6}
	Eff. Factor	$.738 \times 10^5$	$.839 \times 10^5$
#103	c/m	53381/5	46982/5
	c/s	177.98	156.61
	Eff.	13.688×10^{-6}	12.047×10^{-6}
	Eff. Factor	$.731 \times 10^5$	$.830 \times 10^5$
#117	c/m	53738/5	47737/5
	c/s	179.13	159.12
	Eff.	13.779×10^{-6}	
	Eff. Factor	$.726 \times 10^5$	$.817 \times 10^5$
#132	c/m	53926/5	47937/5
	c/s	179.75	159.79
	Eff.		
	Eff. Factor	$.723 \times 10^5$	$.814 \times 10^5$

		T-1	T-2
Col. 11 Avg. (Only)	Eff. Factor	.730 x 10⁻⁵	.825 x 10⁻⁵

We placed an empty column at pos. 10 and counted pos. #132. T-1 = 58179/s- T-2 = 49857/s-

		T-1	T-2
Col. 10 (Only)	Count Rates:		
Pos. 88	C/m	51690/s-	49712/s-
	C/s	170.30	165.71
	Eff. Factor	.763 x 10⁻⁵	.785 x 10⁻⁵
Pos. 103	C/m	51179/s-	50217/s-
	C/s	170.50	167.39
	Eff. Factor	.763 x 10⁻⁵	.777 x 10⁻⁵
Pos. 117	C/m	51559/s-	50462/s-
	C/s	171.86	168.21
	Eff. Factor	.756 x 10⁻⁵	.773 x 10⁻⁵
Pos. 132	C/m	51460/s-	51078/s-
	C/s	171.53	170.26
	Eff. Factor	.758 x 10⁻⁵	.764 x 10⁻⁵
Col. 10 Avg	Avg. Eff. Factor	.760 x 10⁻⁵	.775 x 10⁻⁵

Col. 14 (Only)			
Pos. 88	C/m	57626/s-	57199/s-
	C/s	192.09	190.66
	Eff. Factor	.677 x 10⁻⁵	.682 x 10⁻⁵
Pos. 103	C/m	58086/s-	57732/s-
	C/s	193.65	192.44
	Eff. Factor	.671 x 10⁻⁵	.676 x 10⁻⁵

Col. 14 (Cont.)

		T-1	T-2
Pos. 117	#/m	57958/s	58653/s
	#/s	193.19	195.51
	Eff. Factor	.673 X 10^{5}	.665 X 10^{5}
Pos. 132	#/m	58074/s	58191/s
	#/s	193.58	193.97
	Eff. Factor	.672 X 10^{5}	.670 X 10^{5}
Col. 14 Avg.	Avg.	.673 X 10^{5}	.673 X 10^{5}

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		T-1	T-2
Col. 14			
Pos. 132	#/m	59361/s	59266/s
Col. 15			
Pos. 88	#/m	61275/s	55358/s
	#/s	204.25	184.65
	Eff. Factor	.636 X 10^{5}	.704 X 10^{5}
Pos. 103	#/m	62099/s	55870/s
	#/s	207.00	186.23
	Eff. Factor	.628 X 10^{5}	.698 X 10^{5}
Pos. 117	#/m	62823/s	55714/s
	#/s	209.60	185.72
	Eff. Factor	.620 X 10^{5}	.700 X 10^{5}
Pos. 132	#/m	62255/s	55903/s
	#/s	207.52	186.34
	Eff. Factor	.626 X 10^{5}	.698 X 10^{5}
Col. 15 Avg.		.628 X 10^{5}	.700 X 10^{5}

We will now place .5" Mock HE @ positions 88, 103, 117, 132 and check eff. factors!

Col. 10 (cont'd)		T-1	T-2
Pos. 88	c/m	50164/s	49618/s
	c/s	167.21	165.38
	Eff. Factor	.777 x10^{-5}	.786 x10^{-5}
Pos. 103	c/m	51423/s	50565/s
	c/s	171.41	168.55
	Eff. Factor	.758 x10^{-5}	.771 x10^{-5}
Pos. 117	c/m	51556/s	51197/s
	c/s	171.99	170.66
	Eff. Factor	.756 x10^{-5}	.762 x10^{-5}
Pos. 132	c/m	51505/s	51165/s
	c/s	171.68	170.62
	Eff. Factor	.757 x10^{-5}	.762 x10^{-5}
Col. 10 Avg.		.762 x10^{-5}	.770 x10^{-5}

Col. 10 with Col. 11 in place

Pos. 88	c/m	40733/s	50488/s
	c/s	135.78	168.30
	Eff. Factor	.957 x10^{-5}	.772 x10^{-5}
Pos. 103	c/m	42358/s	51469/s
	c/s	141.19	171.56
	Eff. Factor	.921 x10^{-5}	.758 x10^{-5}
Pos. 117	c/m	42140/s	51750/s
	c/s	140.47	172.50
	Eff. Factor	.926 x10^{-5}	.754 x10^{-5}

Col. 10 with Col. 11 in place (Cont.)

		T-1	T-2
Pos. 132	c/m	42315/5	51898/5
	c/s	141.05	172.98
	Eff Factor	.922 X10^5	.752 X10^5

Avg. Col. 10 with Col. 11 in place — .932 X10^5 — .759 X10^5

Col. 11 with Col. 10 in place

Pos. 88	c/m	53285/5	38,295/5
	c/s	177.62	127.65
	Eff. Fact.	.732X10^5	1.018 X10^5
Pos. 103	c/m	54801/5	39,175/5
		182.67	130.58
	Eff. Fact.	.712 X10^5	.996 X10^5
Pos. 117	c/m	55,199/5	39,355/5
		184.00	131.18
	Eff. Fact.	.706X10^5	.991X10^5
Pos. 132		54,783/5	39,870/5
		182.61	132.90
	Eff. Fact.	.712 X10^5	.998 X10^5 ?

Column 11 Averages with col. 10 in place — .716X10^5 — .996 X10^5

Column 10 with columns 6, 7 & 11 in place

	T-1	T-2
Pos 88	42273/5 min	51,893/5 min
	140.91 cps.	172.98 cps
Eff Fac	.923 X10^5	.752 X10^5

	T-1	T-2
Po 103	43,619/5 min 145.40 cps Eff Fac .894 X 10^5	53,089/5 min 176.90 cps .735 X 10^5
Po 117	44,242/5 min 147.47 cps Eff Fac .882 X 10^5	53,474/5 min 178.25 cps .729 X 10^5
Po 132	44,793/5 min 149.31 cps Eff Fac .871 X 10^5	53,347/5 min 177.82 cps .731 X 10^5
Column 10 averages Colms 6,7 +11 in place	.893 X 10^5	.737 X 10^5

Column 11
with 6,7+10 in Place

Po 88	55142/5 min 183.81 .707 X 10^5	39496/5 min 131.65 .987 X 10^5
Po 103	56338/5 min 187.80 .692 X 10^5	40451/5 min 134.84 .968 X 10^5
Po 117	57663/5 min 192.21 .676 X 10^5	41107/5 min 137.02 .949 X 10^5
Po 132	57421/5 191.40 .679 X 10^5	41788/5 139.29 .933 X 10^5
Avg. Col. 11 with Cols. 6,7 & 10 in place	.689 X 10^5	.958 X 10^5

		I-1	I-2
Col. 11 with Cols. 2, 3, 6, 7, 10, 14 & 15 in place			
Pos. 88	$\dot{q}_m$	58216/s	42082/s
	$\dot{q}_s$	198.05	140.27
	Eff. Factor	$.670 \times 10^5$	$.927 \times 10^5$
Pos. 103	$\dot{q}_m$	60525/s	44606/s
	$\dot{q}_s$	201.75	148.69
	Eff. Factor	$.632 \times 10^5$	$.874 \times 10^5$
Pos 117	$\dot{q}_m$	61900/s	45124/s
	$\dot{q}_s$	204.67	150.40
	Eff. Factor	$.635 \times 10^5$	$.868 \times 10^5$
Pos. 132	$\dot{q}_m$	61164/s	44797/s
	$\dot{q}_s$	203.88	149.32
	Eff. Factor	$.638 \times 10^5$	$.871 \times 10^5$
Avg. Col. 11 with Cols 2, 3, 6, 7, 10, 14 & 15 in place		$.644 \times 10^5$	$.884 \times 10^5$
Col. 10 with Cols. 2, 3, 6, 7, 10, 14 & 15 in place			
Pos. 88		45153/s	58705/s
		150.51	182.35
		$.864 \times 10^5$	$.713 \times 10^5$
Pos. 103		47113/s	56537/s
		157.04	188.46
		$.828 \times 10^5$	$.690 \times 10^5$
Pos. 117		47902/s	57679/s
		159.67	192.23
		$.814 \times 10^5$	$.676 \times 10^5$

Col. 10 (Cont)	T-1	T-2
Pos. 132	47927/5 159.76 .814 X 10^{5-}	57080/5 190.27 .683 X 10^{5-}
Avg. Col. 10 with Cols. 2, 3, 6, 7, 10, 11, 14 + 15 in place.	.830 X 10^{5-}	.691 X 10^{5-}
Col. 14 with Cols as above in place		
Pos. 88	47815/5 159.38 .816 X 10^{5-}	60441/5 201.47 .685 X 10^{5-}
Pos. 103	49809/5 166.03 .783 X 10^{5-}	62615/5 208.72 .623 X 10^{5-}
Pos. 117	50552/5 168.51 .771 X 10^{5-}	62504/5 208.35 .624 X 10^{5-}
Pos. 132	49896/5 166.32 .782 X 10^{5-}	61778/5 205.91 .631 X 10^{5-}
Col. 14 Avg.	.788 X 10^{5-}	.631 X 10^{5-}

Col. 15 with Cols. in place as above	T-1	T-2
Pos 88	63625/s 212.08 .613x10⁻⁵	45821/s 151.38 .859x10⁻⁵
Pos 103	65558/s 218.66 .595x10⁻⁵	47857/s 159.52 .815x10⁻⁵
Pos 117	67297/s 224.32 .580x10⁻⁵	47688/s 158.83 .818x10⁻⁵
Pos 132	6532 s/s 217.75 .597x10⁻⁵	46782/s 155.94 .834x10⁻⁵
Col. 15 Avg.	.596x10⁻⁵	.832x10⁻⁵

We will now place all 16 Cols. on the table and determine eff. factors for the full array.

Col. 9 with all 16 Cols. in place	T-1	T-2
Pos. 88	33427/s 111.42 1.167x10⁻⁵	58607/s 195.36 .665x10⁻⁵
Pos. 103	34830/s 116.10 1.120x10⁻⁵	61871/s 206.24 .630x10⁻⁵
Pos. 117	35558/s 118.53 1.097x10⁻⁵	63102/s 210.34 .618x10⁻⁵

Col. 9	T-1	T-2
Pos. 132	36357/s⁻ 121.18 1.073 x 10⁻⁵	61229/s⁻ 204.10 .637 x 10⁻⁵
Col. 9 Avg.	1.114 x 10⁻⁵	.638 x 10⁻⁵
Col. 10 with all 16 cols. in place		
Pos. 88	40665/s⁻ 135.55 .959 x 10⁻⁵	46765/s⁻ 155.88 .837 x 10⁻⁵
Pos. 103	42484/s⁻ 141.61 .918 x 10⁻⁵	49691/s⁻ 165.97 .786 x 10⁻⁵
Pos. 117	43794/s⁻ 145.98 .891 x 10⁻⁵	50628/s⁻ 168.75⁻ .770 x 10⁻⁵
Pos. 132	43018/s⁻ 143.39 .907 x 10⁻⁵	50416 168.05 .774 x 10⁻⁵
Col. 10 Avg.	.919 x 10⁻⁵	.791 x 10⁻⁵

Col. 11	I-1	I-2
Pos. 88	59848/s 166.16 .782 x10⁵	38478/s 128.05 1.015 x10⁵
Pos 103	53163/s 177.21 .734 x10⁵	40104/s 133.67 .973 x10⁵
Pos 117	53675/s 178.92 .727 x10⁵	41509/s 138.35 .940 x10⁵
Pos 132	52791/s 175.97 .739 x10⁵	41680/s 138.93 .936 x10⁵
Col. 11 Avg.	.746 x10⁵	.966 x10⁵
Col. 12 with 16 Cols in place		
Pos. 88	63152/s 210.51 .618 x10⁵	31855/s 106.53 1.220 x10⁵
Pos. 103	65852/s 219.51 .592 x10⁵	33128/s 110.41 1.178 x10⁵
Pos 117	66435/s 221.45 .587 x10⁵	34375/s 114.58 1.135 x10⁵
Pos 132	64993/s 216.64 .600 x10⁵	34789/s 115.83 1.122 x10⁵
Col. 12 Avg.	.599 x10⁵	1.164 x10⁵

Col. 13 with 16 Cols in place	T-1	T-2
Pos. 88	33716/5 112.39 cps 1.157 x 10^{-5}	67126/5 223.75 cps .581 x 10^{-5}
Pos. 103	34656/5 115.52 cps 1.125 x 10^{-5}	67607/5 225.36 cps .577 x 10^{-5}
Pos. 117	35494/5 118.31 cps 1.099 x 10^{-5}	68056/5 226.85 cps .573 x 10^{-5}
Pos. 132	35-297/5 117.66 1.105 x 10^{-5}	67126/5 223.75 .581 x 10^{-5}
Col. 13 Avg.	1.122 x 10^{-5}	.578 x 10^{-5}

Col 12 with 16 Cocs in place		
Pos. 88	41069/5 136.90 cps .950 x 10^{-5}	49511/5 165.04 cps .788 x 10^{-5}
Pos 103	42893/5 142.98 cps .909 x 10^{-5}	51152/5 170.51 cps .762 x 10^{-5}
Pos 117	43525/5 145.25 cps .895 x 10^{-5}	52271/5 174.24 cps .746 x 10^{-5}
Pos 132	43273/5 144.24 cps .901 x 10^{-5}	51321/5 171.07 cps .760 x 10^{-5}
Col. 14 AVG.	.914 x 10^{-5}	.764 x 10^{-5}

Col 15 with 16 cols in place

	T-1	T-2
88	52066/5 173.55 cps .749 x10⁵	39458/5 131.53 cps .988 x10⁵
103	53947/5 179.82 cps .723 x10⁵	41187/5 137.29 cps .947 x10⁵
117	55391/5 184.64 cps .704 x10⁵	42277 140.92 cps .922 x10⁵
132	54373/5 181.24 cps .717 x10⁵	42217/5 140.72 cps .924 x10⁵
Col 15 Avg.	.723 x10⁵	.945 x10⁵

Col. 16 with 16 cols in place

88	69437/5 231.46 cps .562 x10⁵	32636/5 108.79 1.195 x10⁵
103	72500/5 241.67 .538 x10⁵	33316/5 111.05 1.171 x10⁵
117	72467/5 241.56 .538 x10⁵	34117/5 113.72 1.143 x10⁵
132	70507/5 235.02 .553 x10⁵	35047/5 ? 116.82 1.113 x10⁵
Col 16 Avg.	.548 x10⁵	1.156 x10⁵

8-21-67

Col. 16 with 16 Cols. in place

	T-1	T-2
Pos. 132	70751/5⁻	34980/5⁻

The eff. factors for the safety arrays will now be computed with also the eff. factor for the Crit. Array.

Safety Array

Eff. Factors

	T-1	T-2
⑥ ⑩	Col. 10 only $.762 \times 10^{5^-}$	Col. 10 only $.770 \times 10^{5^-}$
⑦ ⑪ ⑥ ⑩	Avg. Cols. 10 & 11 $.791 \times 10^{5^-}$	 $.848 \times 10^{5^-}$
③ ⑦ ⑪ ⑮ ② ⑥ ⑩ ⑭	Avg. Cols. 10, 11, 14, & 15⁻ $.715 \times 10^{5^-}$	 $.760 \times 10^{5^-}$
Full Array Crit. Array $STS_{x,y} = 7.4$ cm $STS_z = 5.0$ cm	Avg. Cols. 9, 10, 11, 12, 13, 14, 15⁻ x 16 $.836 \times 10^{5^-}$	 $.875^- \times 10^{5^-}$

We will now start the 4^3 Mod (.5") safety array. Spacers in bottom of tubes: 25 cm, 25 cm, 5 cm, 4 cm, 2 cm, & Heatsink

Assembly F-1: Pu to Pu $STS_{x,y} = 7.4$ cm $STS_z = 5.0$ cm

.5" Mod.

(6) | (10)

∴ Lateral: .721 cm + 6.679 cm = 7.4 cm

Vertical: .108 cm + 4.887 = 4.995 cm

Parts: 1 - 9 less #7

Base Rate: ~16.25 $\times 10^5$ n/s

Pos	T-1	T-1'	Eff Factor	10^5 n/s	M	T-2	T-2'	Eff Factor	10^5 n/s	M
7.865	22603/s	76.3	.762 $\times 10^5$	57.38	3.54	22364/s	78.6	.770 $\times 10^5$	57.44	3.54
-.001	24220/s	80.7		61.50	3.78	24611/s	82.0		63.18	3.89

Assembly F-2: Pu to Pu $STS_{x,y} = 7.4$ cm $STS_z = 5.0$ cm

.5" Mod.

(7) | (11)
(6) | (10)

Lateral: Same as above = 7.4 cm

Vertical: Same as above = 4.995 cm

Parts: 1 - 17 less #7

Base Rate: ~32.5 $\times 10^5$ n/s

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.857	18338/2	182.8	.791 x 10^{-5}	120.87	3.72	17726/2	148.1	.848 x 10^{-5}	125.59	3.86
.003	22257/2	185.4		146.68	4.51	20459/2	173.8		147.4	4.54

8-22-67

Assembly F-3 : Pu to Pu STS_{xy} = 7.4 cm STS_z = 5.00 cm

.5" Mod.

(3)	(7)	(11)	(15)
(2)	(6)	(10)	(14)

Lateral : Same as F-1 = 7.400 cm

Vertical : Same as F-1 = 4.995 cm

Parts : 1-33 less #7

Base Rate = 65.19 x 10^{-5} n/s

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.862	59530/2	496.1	.715 x 10^{-5}	3547	5.44	57655/2	480.5	.760 x 10^{-5}	365.2	5.60
.003	75727/2	631.1		455.2	6.92	73605/2	613.4		466.2	7.15

8-23-67

1st Fuel assy in 4^3, 3 kg, 1/2" moderator rings

Assembly F-4 : P_u to P_u 14.8 x-y, 5.0 z

Lateral : .721 + 14.082 = 14.803 cm

Vertical : .108 + 4.887 = 4.995 cm

P_{counts}: 1-65 less 7

Base Rate : 129.11 $\times 10^5$ n/s

P_∞	T-1	M_1	T-2	M_2
7.863	84470/2		82014/2	
	42,235	4.597	41,007/1	4.660
dead time correct ↓	42 594		↓41,260	
	= 709.9 cps		= 687.7 cps	
	= 593.5 $\times 10^5$ n/s		= 601.7 $\times 10^5$ n/s	
	if eff fact = .836 $\times 10^5$		if eff fact = .875 $\times 10^5$	

note: $M_1 = 1.079 \times 10^{-4} C_1$

$M_2 = 1.129 \times 10^{-4} C_2$

P_∞	T-1	M_1	T-2	M_2
1.004	91,471/2		88,423/2	
	= 45,736	4.980	44,212	5.02
	46,158		44,507	

$\nu_{M_1} = .201$ $\nu_{M_2} = .199$

$\bar{m} = 5.00$

We will now insert cadmium & recount

P_{oo}	T-1	T-2
7.831	31,447/10 = 3146.7 cpm corrected = 52.445 cps	23,427/10 = 2343.5 cpm = 39.058 cps corrected

if $\bar{M} = 4.629$, $10^5 n/s = 597.65$

then at first stop, eff fac $_{T-1}$ = $11,396 \times 10^5$ (11.4×10^5); eff fac $_{T-2}$ = 15.302×10^5 (15.3×10^5)

P_{oo}	T-1	T-2
t.004	33,829/10 = 3,341 cpm corrected = 55.683 cps	25,171/10 = 2,518 cpm corrected = 41.967 cps

if $\bar{M} = 5.002$, $10^5 n/s = 645.81$ and

eff fac T-1 = 11.598×10^5 (11.6×10^5) eff T-2 = 15.389×10^5 (15.4×10^5)

to convert counts per min directly to Multiplication:

$$M_1 = 1.497 \times 10^{-3} C_1$$

$$M_2 = 1.986 \times 10^{-3} C_2$$

if we use individual multiplications from previous runs instead of average Multiplication

$$M_1 = 1.491 \times 10^{-3} C_1$$
$$M_2 = 1.996 \times 10^{-3} C_2$$

Assembly F-5: Pu to Pu $STS_{x,y}$ = 10.881 cm STS_z = 5.0 cm

Lateral: .721 + 10.160 = 10.881 cm

Vertical: .108 + 4.887 = 4.995 cm

Parts: 1-65 less #7

Base Rate = 129.11 $\times 10^5$ n/s

Pos.	T-1	Factor	M	T-2	Factor	M
7.862	20445/s 4089	1.497×10^{-3}	6.12	15087/s 3017	1.986×10^{-3}	5.99
.005	25498/s 5700		7.63	18839/s 3768		7.48

ν_M = .1311 ν_M = .1337

$\bar{M}$ = 7.56 $\bar{M}^{-1}$ = .1323

T/Cs Room = 68 #1 = 85

8-28-67

Assembly F-6: Pu to Pu $STS_{x,y}$ = 9.139 cm STS_z = 5.0 cm

Lateral: .721 + 8.418 = 9.139 cm

Vertical: .108 + 4.887 = 4.995 cm

Parts: 1-65 less #7

Base Rate = 129.11 $\times 10^5$ n/s

Pos.	T-1	Factor	M	T-2	Factor	M
2.871	27404/s 5481	1.497×10^{-3}	8.21	20858/s 4172	1.986×10^{-3}	8.29
.000	45891/s 9176		13.74	33922/s 6784		13.47

$\bar{M}$ = 13.61 $\frac{1}{M}$ = .0735

ν_M = .0728 ν_M = .0742

T/Cs Room = 68 #1 = 87

8-29-67

Count with all Cols. on wall

T-1 = 15,233/15" T-2 = 24858/15"

Assembly F-7: Pu to Pu STS_{x-y} = 8.087 cm STS_3 = 5.0 cm

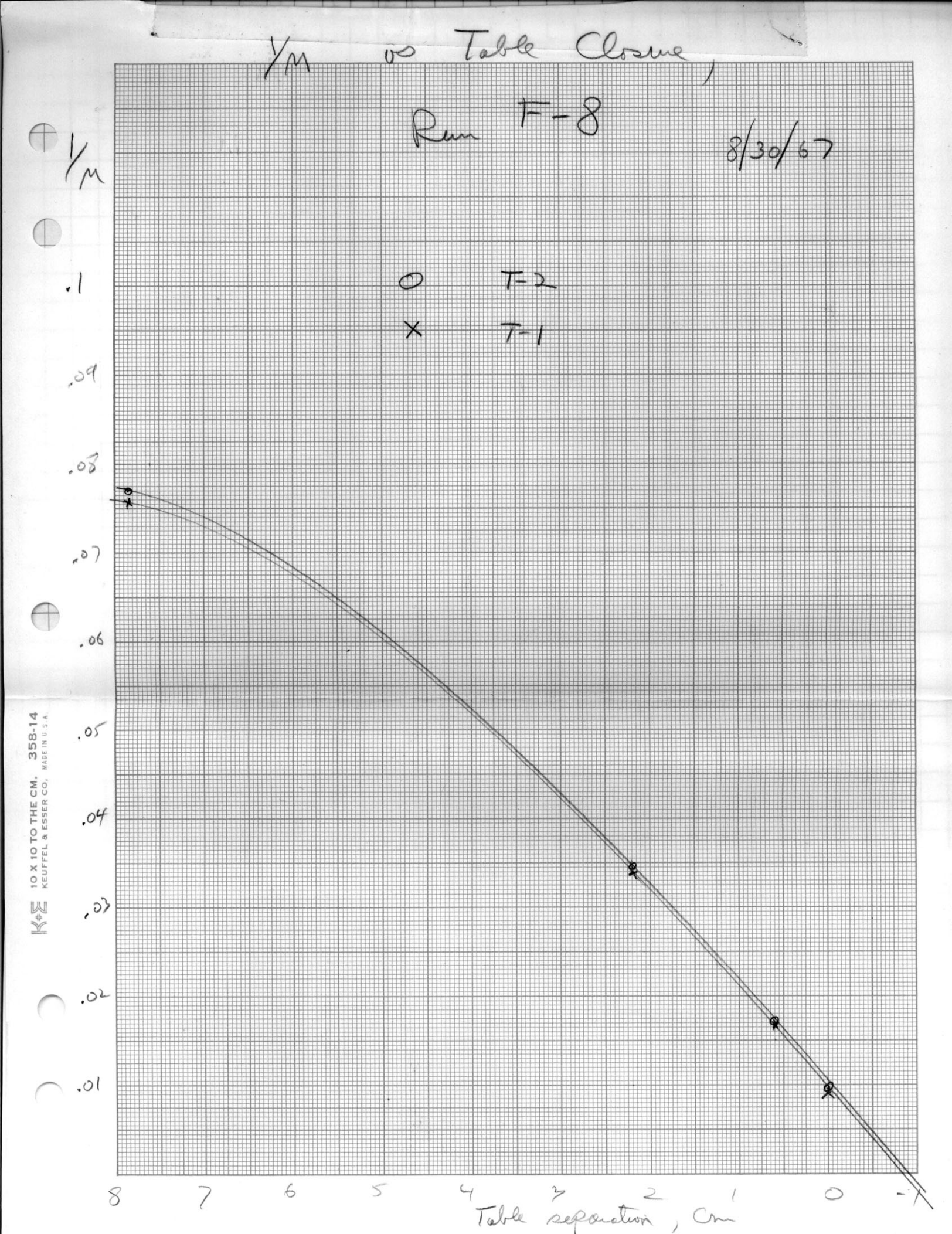
Lateral: .721 + 7.366 = 8.087 cm

Vertical: .108 + 4.887 = 4.995 cm

Parts: 1-65 less #7

Base Rate = 129.11×10^{-5} n/s

Pos	T-1	Factor	M	T-2	Factor	M
7.848	46277/6 7713	1.497×10^{-3}	11.55	34321/6 5720	1.986×10^{-3}	11.36
			$\bar{Y}_M$ = .0866			$\bar{Y}_M$ = .0880
1.001	55785/3 18598		27.58	40545/3 13648		27.10
				$\bar{m}$ = 27.32		$\bar{Y}_{\bar{m}}$ = .03660
.000	52810/2 26405 (26545)		39.53	38408/2 19458 (19511)		38.67
			$\bar{Y}_M$ = .0253			$\bar{Y}_M$ = .0259
			$\bar{M}$ = 39.09			$\bar{Y}_{\bar{M}}$ = .02558


1/M vs Table Closure
Run F-8
8/30/67
1/M
.1
.09
.08
.07
.06
.05
.04
.03
.02
.01
O T-2
X T-1
8
7
6
5
4
3
2
1
0
-1
Table separation, cm
10 X 10 TO THE CM. 358-14
KEUFFEL & ESSER CO. MADE IN U.S.A.

8-30-67

Assembly F-8 : P_w to P_w $STS_{xy} = 7.8$ $STS_z = 5.0$

Lateral : .721 + 7.082 = 7.803 cm

Vertical : .108 + 4.887 = 4.995 cm

Parts : 1-65 less 7

Base Rate = 129.11×10^5 n/s

Pos	T-1	Factor	M	T-2	Factor	M
7.850	44,050/5	1.497×10^{-3}	13.19	32,733/5	1.986×10^{-6}	13.00
	8810			6547		
		$1/M_1 = .0758$			$1/M_2 = .0769$	

T.C's: 105½ °F on Con, 69½ °F in room

2.200	97,974/5	29.45	72,749/5	28.96	
	19,595 → 19,672	$1/M_1 = .0339$	14,550 → 14,582	$1/M_2 = .0345$	
	101° F on Con			$1/\bar{M} = .0342$	
0.598	199,179/5	60.11	146,637/5	58.50	
	39,836 → 40,156		29,327 → 29,457		
		$1/M_1 = .0166$		$1/M_2 = .0171$	
				$1/\bar{M} = .0169$	
				106.87	
-.004	368,336/5	111.93	269,071/5		
	73,668 → 74,769	98° F on the Con	53,814 → 54,252		
		$1/M_1 = .0089$		$1/M_2 = .0094$	
		$\bar{M} = 109.40$		$1/\bar{M} = .00914$	

Evening counts :

T-1	T-2
70,092/15	51,936/15

From This Data &

$\Delta^1/_n$ control element on table = .00081 ± .00006

$\Delta^1/_n$ control element in — out = .00238 ± .00008

= $1.19

in 6 minutes of travel

= 20 ¢/MINUTE

8-31-69

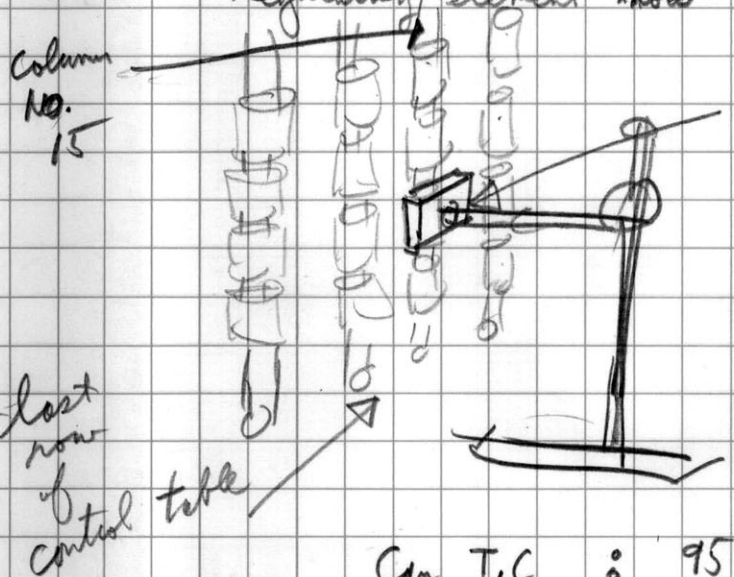
Morning Counts

T-1	T-2
70,612/15	52,605/15
70,971/15	52,193/15

Assembly F-8

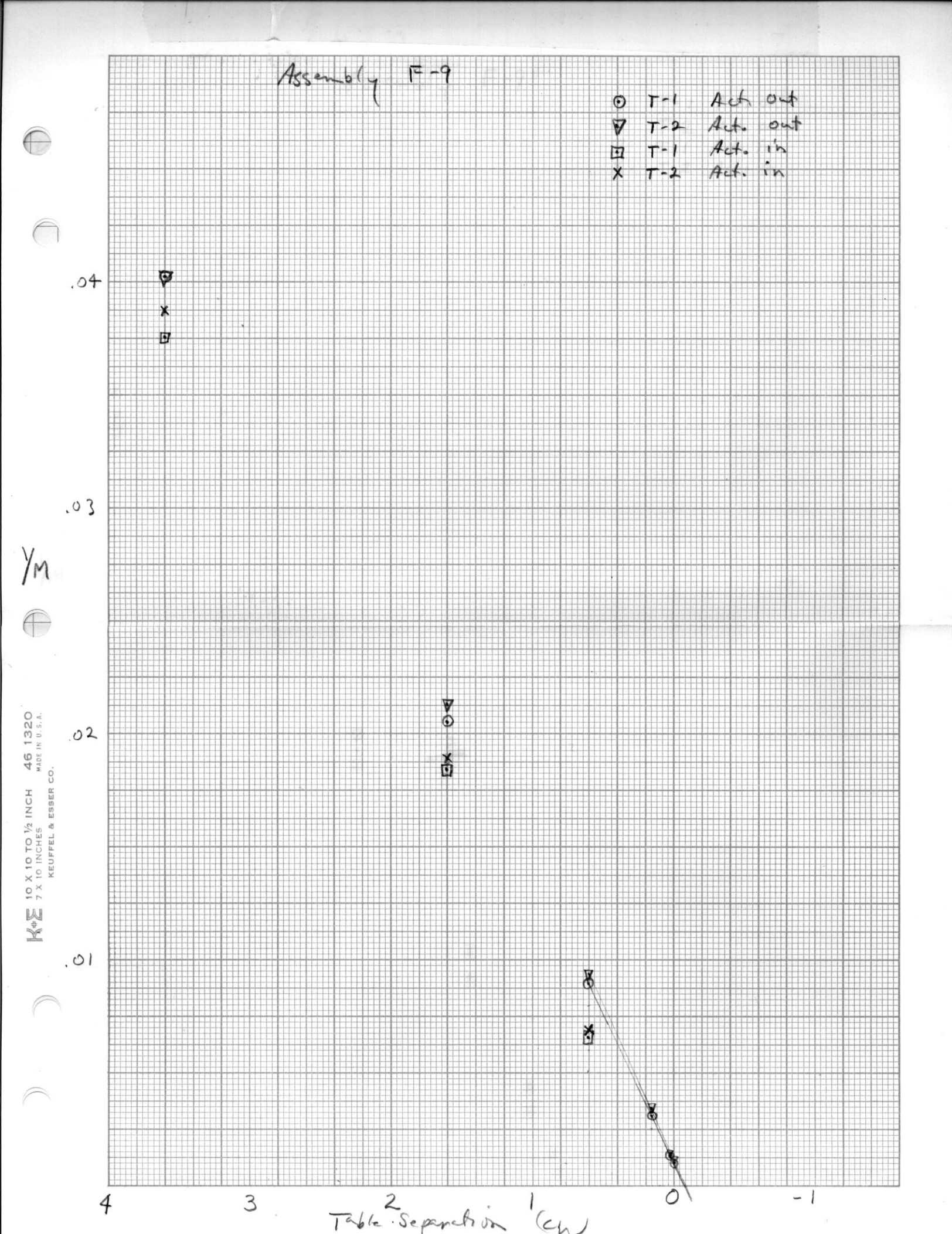
spacings same as previous run

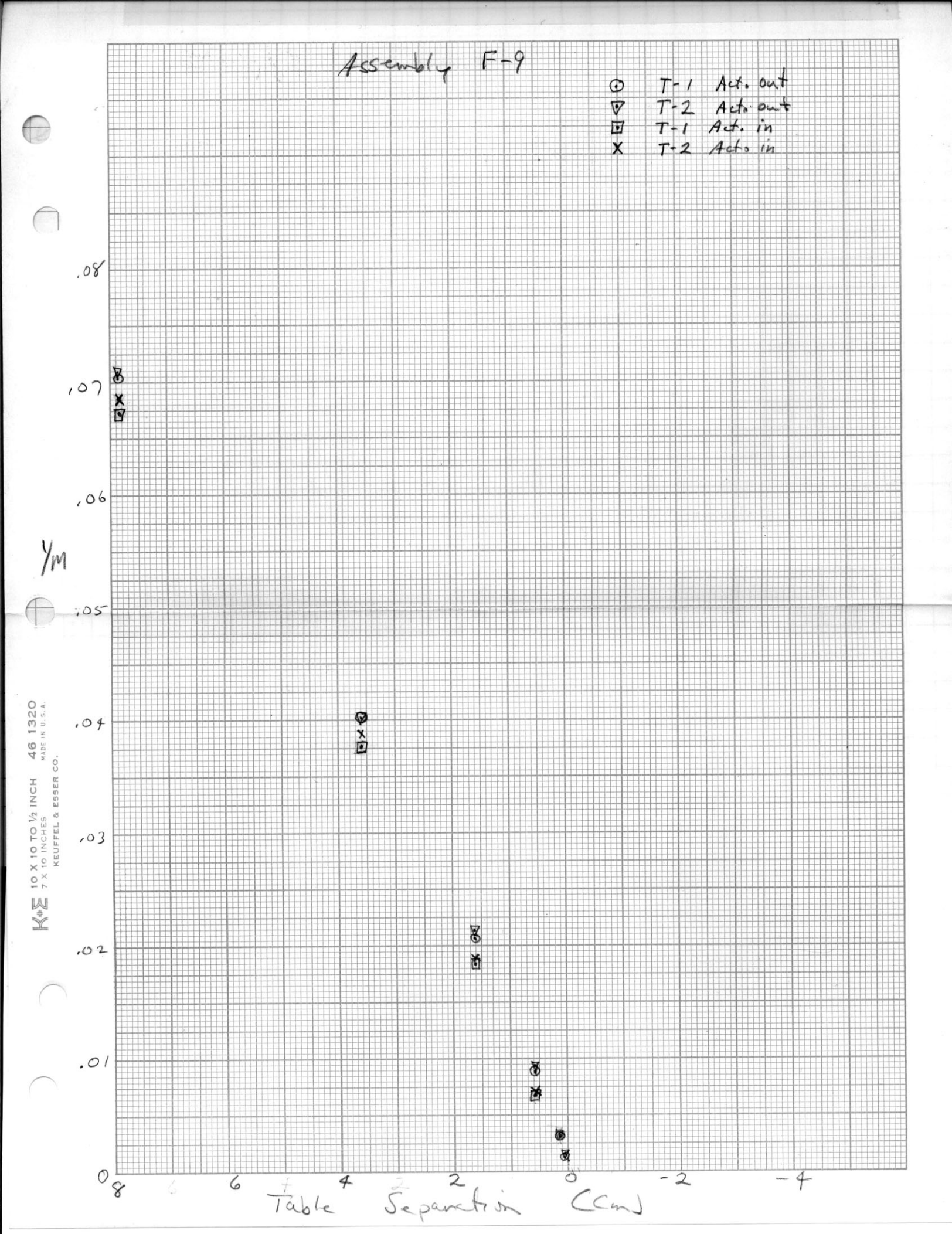
Regulating element now on the table.



Can T.C. : 95°F Room 69½°F

		T-1	M_1	T-2	M_2
Table Position	.598	247 673/5		181 071/5	
Actuator Pos.: (IN)	0.000	49,535	74.90	36,214	72.31
		↓ 50,031	$1/M_1 = .0133$	↓ 36,412	$1/M_2 = .0138$
Table	.598	210,044/5		153,346/5	
Actuator	15.251 (OUT)	42,009	63.42	30,609	61.19
		↓ 42,365	$1/M_1 = .0158$	↓ 30,811	$1/M_2 = .0163$
					$1/\overline{M} = .0161$
Table	−.006	404,201/5	123.01	294,621/5	118.07
Actuator	15.251 (OUT)	80,840		58,924	
		↓ 82,169	$1/M_1 = .0081$	↓ 59,450	$1/M_2 = .085$
					$1/\overline{M} = .0083$
		$\overline{T} = 94\frac{1}{2}$°F at finish			
Table	−.006 (closed)	559,383/5	171.31	403,843/5	162.37
Actuator	0.00 (IN)	111,877		80,769	
		↓ 114,438	.0058	↓ 81,760	.0062


Assembly F-9
T-1 Act. out
T-2 Act. out
T-1 Act. in
T-2 Act. in
.04
.03
.02
.01
Ym
4
3
2
1
0
-1
Table Separation (cm)


Assembly F-9
T-1 Act. out
T-2 Act. out
T-1 Act. in
T-2 Act. in
.08
.07
.06
Y/M
.05
.04
.03
.02
.01
0
8
6
4
2
0
-2
-4
Table Separation (Cm)

9-5-67

Assembly F-9: Pu to Pu STS_{xy} = 7.691 STS_z = 5.0 cm

Lateral: .721 + 6.970 = 7.691 cm

Vertical: .108 + 7.887 = 7.995 cm

Parts: 1-65 less #7

Base Rate = 129.11 $\times 10^{-5}$ g/s

Pos.	T-1	Factor	M	T-2	Factor	M
7.858	19854/2	1.497×10^{-3}	14.86	14629/2	1.986×10^{-3}	14.58
A = 0.000	9927		Ym = .0673	7339		Ym = .0686

T/C's Room = 69 #1 = 98

7.857	19013/2	14.23	14195/2	14.10
A = 15.250	9507	Ym = .0703	7098	Ym = .0709

Room = 69 #1 = 92.5

3.600	16614	24.87	12524	24.87
A = 15.250		Ym = .0402		Ym = .0402

Room = 69 #1 = 92.5

3.600	17771	26.60	12986	25.71
A = 0.000		Ym = .0376		Ym = .0389

#1 = 92.5

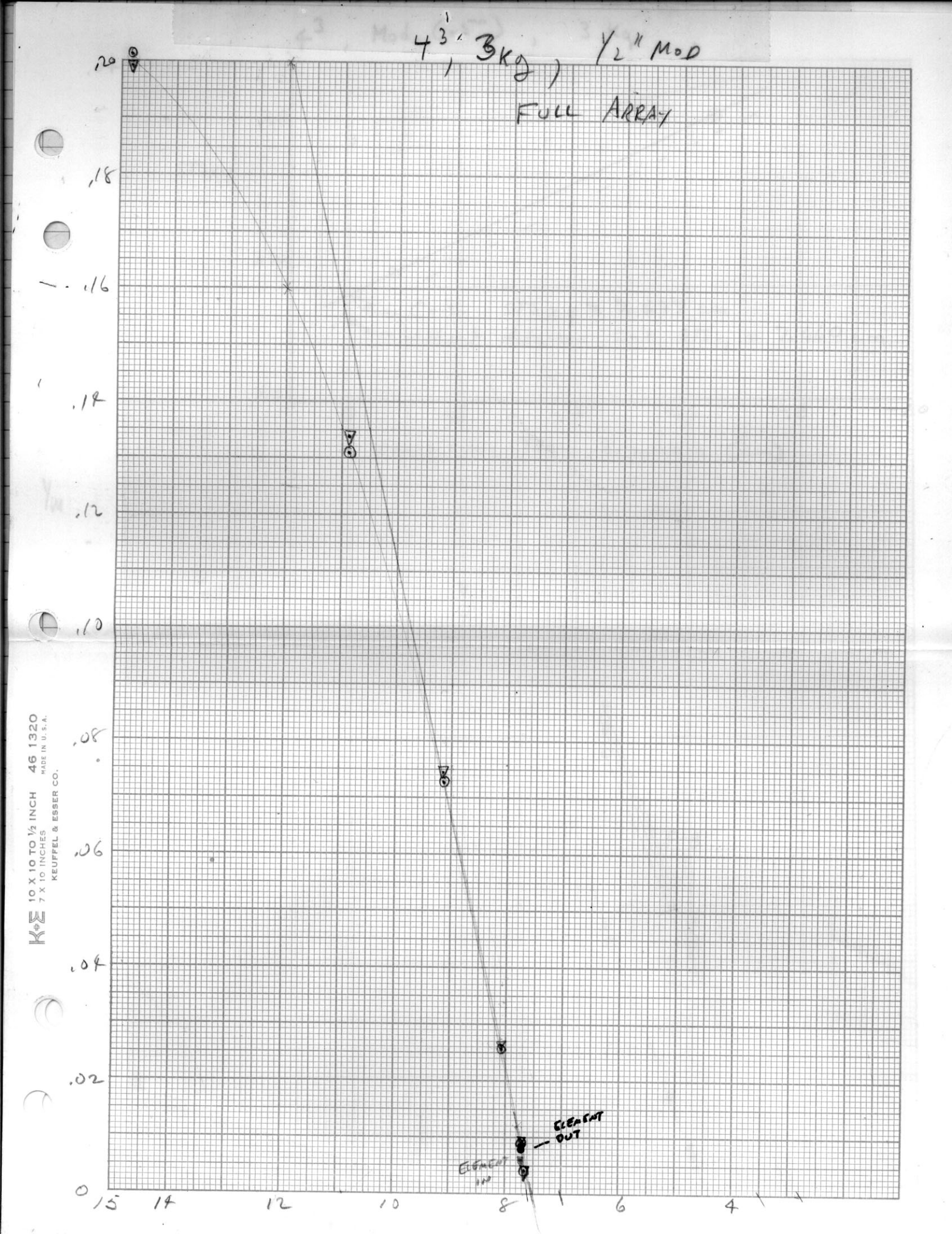
1.600	36324→36591	54.38	26851	53.33
A = 0.000		Ym = .0184		Ym = .0188

T/C's Room = 69 #1 = 92.5

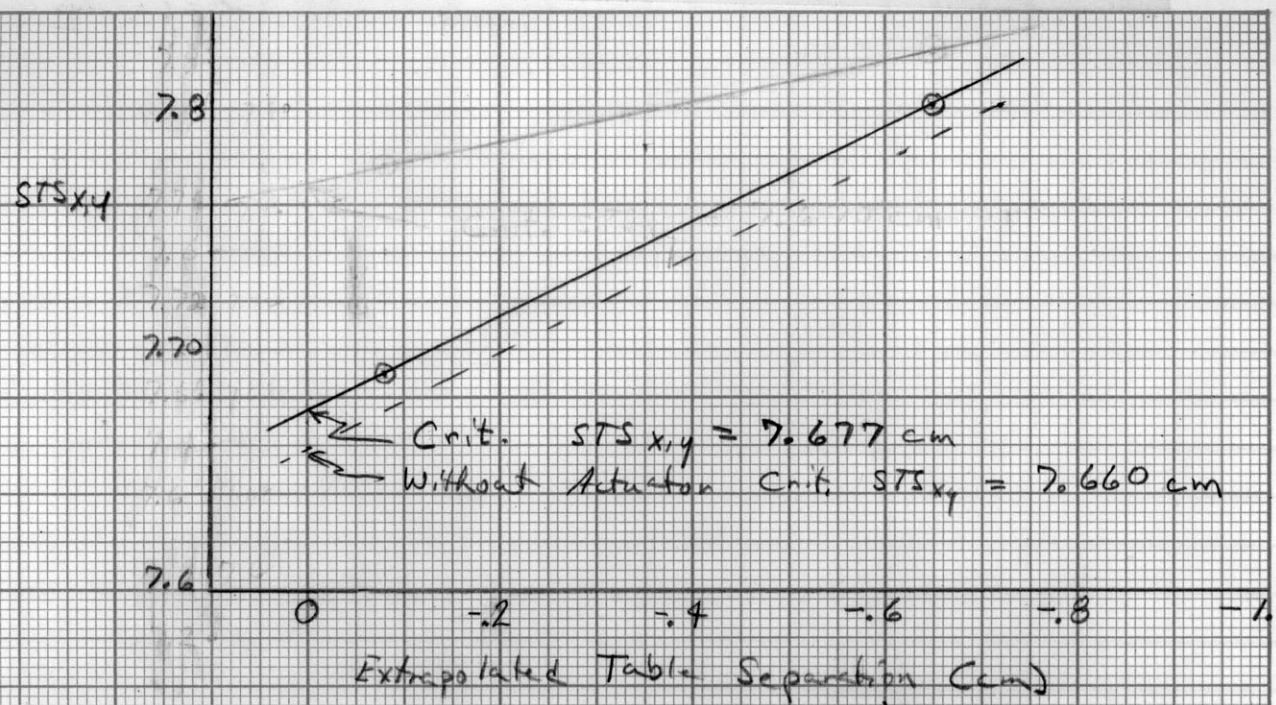
1.600	32367	48.77	23568	46.97
A = 15.248	↓ 32599	Ym = .0205	↓ 23650	Ym = .0213

$\overline{1/m}$ = .0209

T/C's Room = 69 #1 = 92.5

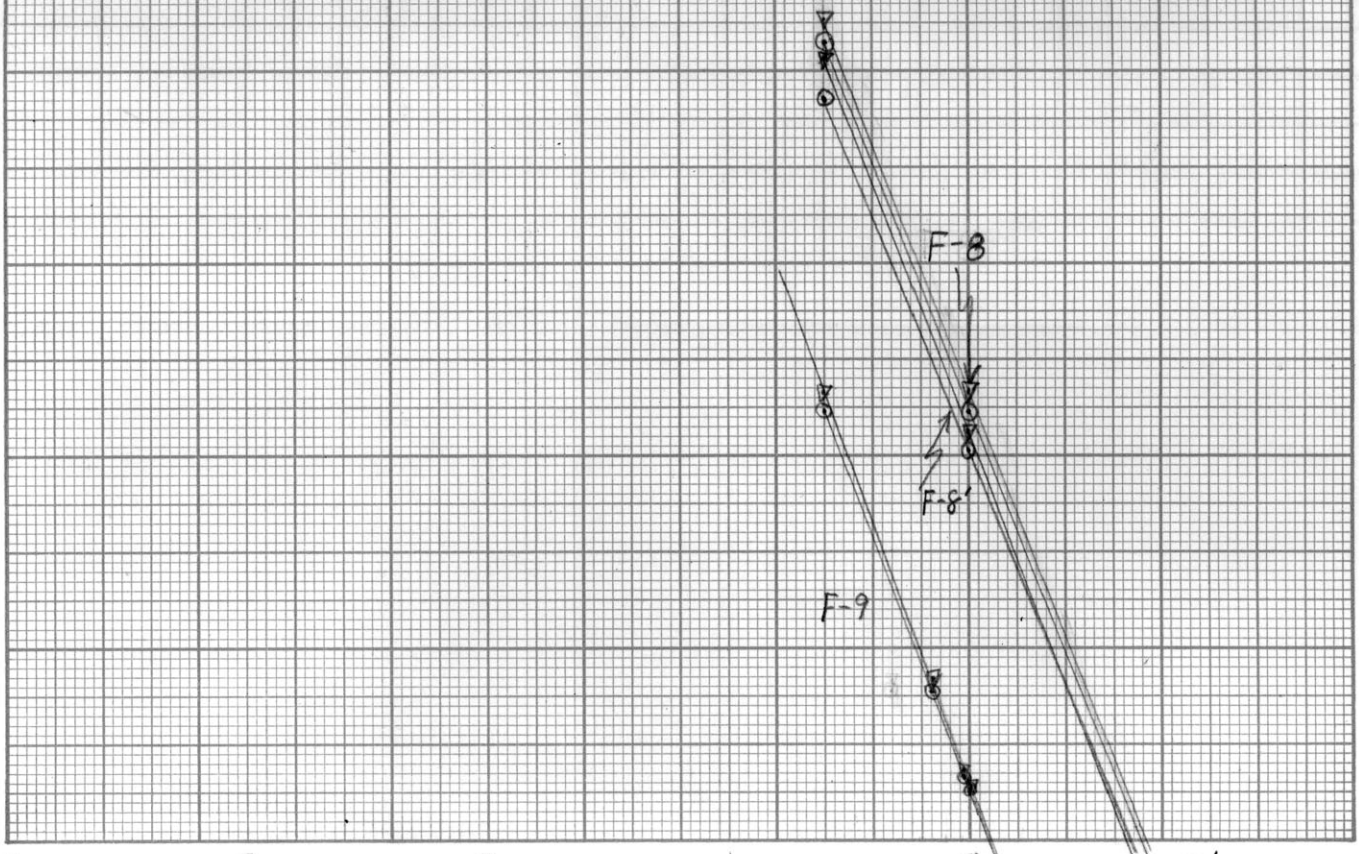

4 3/4, 3Kg) 1/2" MOD
FULL ARRAY
.20
.18
.16
.14
.12
.10
.08
.06
.04
.02
0
15
14
12
10
8
6
4
CLEANAT OUT
ELEMENT IN
10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES
KEUFFEL & ESSER CO.
MADE IN U.S.A.

4^3, Mod. (.5") , 3 Kg



Y/M

.04
.03
.02
.01



4 3 2 1 0 -1

Table Separation

358-10½ MADE IN U.S.A.
20 X 20 TO THE INCH KEUFFEL & ESSER CO.

Ros	T-1	Factor	M	T-2	Factor	M
.599	73582	1.497×10^{-3}	111.80	53367	1.986×10^{-3}	106.84
A = 15.248	78680	$\gamma/m = .00894$		53797		$\gamma/m = .00936$
						$\boxed{1/\bar{m} = .00915}$
.599	100172	158.02		72607		145.79
A = 0.000	102216	$\gamma/m = .00654$		73807		$\gamma/m = .00686$

T/C's Room = 69 #1 = 92.5-

.162	203928	318.27		146811		298.12
A = 15.248	212602	$\gamma/m = .00314$		150113		$\gamma/m = .00335$
						$\boxed{1/\bar{m} = .00325}$
.030	447938	736.56		331651		693.11
A = 15.248	492023	$\gamma/m = .00136$		348996		$\gamma/m = .00144$
T/C's					#1 = 92.5-	$\boxed{1/\bar{m} = .00140}$
.000	574371	971.45		429478		911.65-
A = 15.248	648933	$\gamma/m = .00103$		459040		$\gamma/m = .00110$
					$\bar{M} = 941.55$	$\boxed{1/\bar{M} = .00106}$

↑ These numbers were taken a number of times and repeated.

9-6-67

We will now do Eff. Factors for the 4^3 Mod. (1.0") 3 kg Array. $STS_{x,y}$ = 9.1 cm ← Bad number 9-7-67

STS_z = 9.0 cm

The source holder position indicator will be reading 79, 100, 121, and 142

All cols. .5" mod on wall: T-1 = 61,225/60
T-2 = 99,771/60

9-7-67

All cols, .5" mod. on wall: T-1 = 15589/15
T-2 = 24843/15

Background:	T-1	T-2
γ_m	1039	1656
γ_s =	17.3	27.6

(4)	(8)	(12)	(16)
(3)	(7)	(11)	(15)
(2)	(6)	(10)	(14)
(1)	(5)	(9)	(13)

Eff. Factor Determinations (Source: MRC 8-7 $1.3 \times 10^7 \gamma/s$)

Col. 10 bare (only)

		T-1	T-2
Count Rates:	γ_m	9143/5	11398/5
Pos. 79	γ_s	30.5	37.99
	γ_s - Bkg	13.2	10.39
	Eff. Factor	$.980 \times 10^6$	1.25×10^6

Pos 100

γ_m
γ_s
γ_s - Bkg
Eff. Factor

Forget This Bad Number G. Petty

9-8-67

We will begin again on Eff. Factors. The new spacing from G. Petty is
STS$_{xy}$ = 8.8 cm STS$_3$ = 9.0 cm

Background :	T-1 = 15665/1s	T-2 = 24989/1s
Cols on wall	c/m 1044	1666
with .5 mg/cm^2	c/s 17.40	27.77

Power Outage we will try again

Eff. Factor Determination (Source MRC 8-7 1.3 X 10^7 n/s)

Col. 10 bare (only col.)

		T-1	T-2
		Count Rates	
Pos. 29	c/m	9054/s	11165/s
	c/s		
	c/s - BKg		
	Eff. Factor		
Pos. 100	c/m	9216/s	11248/s
	c/s		
	c/s - BKg		
	Eff. Factor		
Pos 121	c/m	9137/s	11192/s
	c/s		
	c/s - BKg		
	Eff. Factor		
Pos. 142	c/m	8986/s	11158/s
	c/s		
	c/s - BKg		
	Eff. Factor		

Col. 10 (1" Mod.) (Only) T-1 T-2

Count Rates

Pos 79

c/m
c/s
c/s - BKg
Eff. Factor

9 /s 11 /s

Pos 100

c/m
c/s
c/s - BKg
Eff. Factor

9 /s 11 /s

Pos. 121

c/m
c/s
c/s - BKg
Eff. Factor

9[illegible]6/s 11358/s

Pos. 142

c/m
c/s
c/s - BKg
Eff. Factor

9113/s 11076/s

Col. 10 (1" Mod.)
Col 2 shy here

Pos 79

c/m
c/s
c/s - BKg
Eff. Factor

Pos 100

c/m
c/s
c/s - BKg
Eff. Factor

Pos 121

c/m
c/s
c/s - BKg
Eff. Factor

We will continue this week next month!

9-11-67

We will now try to determine the Eff. Factors again. With nothing but luck we may be able to succeed.

Eff. Factor Determinations (Source MRC 8-7 1.3×10^7 γ/s)

Col. 10 C1'' mod.) (only)

		T-1	T-2
	Count Rates		
Pos. 79	γm	8580/s	10861/s
	γs	28.60	36.20
	γs - BKg		
	Eff. Factor		
Pos. 100	γm	8849/s	11088/s
	γs	29.50	36.95
	γs - BKg		
	Eff. Factor		
Pos. 121	γm	8732/s	11211/s
	γs	29.11	37.37
	γs - BKg		
	Eff. Factor		
Pos. 142	γm	8845/s	11108/s
	γs	29.48	37.03
	γs - BKg		
	Eff. Factor		

	T-1	T-2
Background with Cols. on well (0.5'' mod.)	14588/15	24284/15

Col. 10 (Bare) (Only)

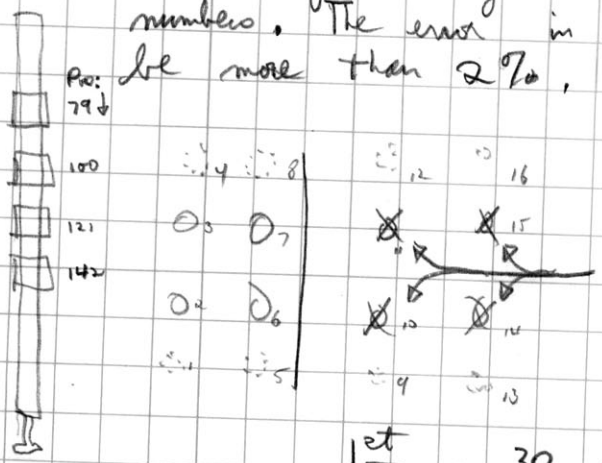
		T-1	T-2
Count Rates:			
Pos. 79	γ_n	8571/s	11139/s
	γ_s	24.60	37.13
	γ_s-BK		
	Eff. Factor		
Pos. 100	γ_n	8701/s	11197/s
	γ_s	29.00	37.32
	γ_s-BK		
	Eff. Factor		
Pos. 121	γ_n	8793/s	11232/s
	γ_s	29.31	37.44
	γ_s-BK		
	Eff. Factor		
Pos. 142	γ_n	8803/s	11188/s
	γ_s	29.34	37.29
	γ_s-BK		
	Eff. Factor		

Note: spacer combination (for 1" moderated array) from bottom of Column to bottom of 1st H.E. disc is: internal tapped bottom part + 25, 25, 10, 2, 2 cm spacers.

64 cm.

9/12/67 [1" moderator]

We are going to set up 8 columns and measure the efficiency factors for this case and will derive the efficiency factors for the 2, 4, & 16 column cases by using the complete set of 1/2" moderator numbers. The error in doing it this way should not be more than 2%.



1st, 30 min Bkgd with table closed:

T-1: 29,248 / 30 = 974.9 gpm

T-2: 48,939 / 30 = 1,631.3 gpm

Column 10

Pos	T-1	T-2
79	7878/5	11,504/5
100	8,088/5	11,642/5
121	8,141/5	11,585/5
142	8,123/5	11,552/5

avg is 8,057.5/5 - bkgd = 1,611.5 - 974.9 = 636.6 gpm

avg is 11,570 3/4/5 = 2,314.2 - 1,631.3 = 682.9 gpm

Column 11

Position	T-1	T-2
79	9,152/5	10,367/5
100	9,619/5	10,695/5
121	9,710/5	10,339/5
142	9,265/5	10,378/5

avg is 9,439 ~~9,324/5~~ - bkgd = 1,864.8 - 974.9 = 889.9 gpm

1887.3 - 974.9 = 912.4

avg is 10,444 3/4/5 - bkgd = 2,089.0 - 1,631.3 = 457.7 gpm

Column 14

Position	T-1		T-2	
79	7,808/5		11,765/5	
		Avg:		Avg:
100	8,059/5	8001½/5 - bkgd	11,879/5	11,766/5 - bkgd
		= 1,600.3 cpm		= 2,353.2
121	8,080/5	- 974.9	11,843/5	-1,631.3
		= 625.4 cpm		= 721.9 cpm
142	8,059/5		11,577/5	

Column 15

Position	T-1		T-2	
79	9,615/5		10,270/5	
		Avg:		Avg:
100	10,068/5	9,845¾/5 - bkgd	10,452/5	10,402½/5 - bkgd
		= 1,969.2		= 2,080.5
121	10,084/5	- 974.9	10,401/5	- 1,631.3
		= 994.3 cpm		= 449.2 cpm
142	9,616/5		10,487/5	

4 column averages

T-1 792.3

786.6 cpm

= 13.11 cps (13.21)

T-2

577.9 cpm

= 9.63 cps

4 Source puts out 1.3×10^7 n/s

efficiency factors are for 8 columns

T-1: 9.916×10^5 T-2: 13.500×10^5

and applying ratios from page 53, we have:

For 2 columns: (No 6+10)	10.568×10^5	13.678×10^5
For 4 columns:	10.970×10^5	15.063×10^5
For 16 columns:	11.594×10^5 (was 11.598×10^5)	15.543×10^5 (was 15.389×10^5)

Background Factors

Previous experience has shown that the neutron emission from columns on the well can be represented to a fair approximation as falling off like $\frac{K}{d^{1.5}}$ where K is an arbitrary constant. We can now take a background count for 16 columns in the nacle and apportion the total count among the various columns according to this relation. Listed Below is the computed Fraction-of-Total background factor for the 1st 16 column positions computed from the distance from column to detector

Position	T-1 distance, feet	T-1 Factor	T-2 distance, feet	T-2 Factor
1	27.17	.06597	9,50	.12394
2	27,33	.06542	10,50	.11079
3	27,42	.06515	11,42	.09762
4	27,42	.06515	12,33	.08725
5	27,50	.06487	13,33	.07758
6	27,67	.06435	14,50	.06844
7	27,83	.06368	15,50	.06193
8	28,00	.06312	16,58	.05597
9	28,08	.06282	17,67	.05085
10	28,25	.06244	18,75	.04653
11	28,50	.06146	19,83	.04279
12	28,83	.06035	21,00	.03927
13	29,00	.05985	22,08	.03640
14	29,17	.05931	23,17	.03388
15	29,42	.05857	24,25	.03164
16	29,75	.05759	25,33	.02963

Thus, if the first		columns are removed, the fraction remaining is:	T-1	T-2
	2		.8686	.7603
"	4	"	.7383	.5754
"	8	"	.4824	.3115

9-13-67

We will now begin the 4^3 Mod. (1.0"), 3kg safety array. Spacers in bottom of tubes: 25cm, 25cm, 10cm, 2cm, 2cm, + heatsink

Assembly G-1: Pu to Pu $STS_{x,y} = 8.8$cm $STS_z = 9.0$cm

1.0" Mod.

⑥ | ⑩

Lateral: .721 + 8.079 cm = 8.800 cm

Vertical: .108 + 8.894 cm = 9.002 cm

Parts: 1 - 9 less #7

Base Rate = ~16.25 $\times 10^{-5}$ q/s

Background = T-1 = 29142/30 = 971.4 = 971.4 × .8686 = 843.8 T-2 = 48,959/30 = 1632.0 = 1632 × .7703 = 1240.8

Pos.	T-1	T-1'	Eff. Factor	10^5 q/s	M	T-2	T-2'	Eff. Factor	10^5 q/s	M
7.854	11231/10	4.66	10.568×10^{-5}	49.2	3.03	15165/10	4.60	13.678×10^{-5}	62.9	3.87
	1123.1					1516.5				
BKg	- 843.8					- 1240.8				
	279.3					275.7				
-0.003	11700/10	5.84		57.5	3.54	15285/10	4.73		64.7	3.98
	1170.0					1528.5				
	843.8					- 1240.8				
	326.2					283.7				

Assembly G-2 : Pu to Pu $STS_{4} = 8.8\,cm$ $STS_{3} = 9.0\,cm$

1.0" Mod.

Background: T-1 = 971.4 × .7383 = 717.2

T-2 = 1632 × .5759 = 939.1

(7)	(11)
(6)	(10)

Lateral: 8.800 cm

Vertical: 9.002 cm

Parts: 1 - 17 less #7

Base Rate = ~32.5 × 10^{-5} 1/s

Pos.	T-1	T-1'	Eff. Factor	10^{5} 1/s	M	T-2	T-2'	Eff. Factor	10^{5} 1/s	M
7.868	12924/10	9.59	10.970×10^{-3}	105.2	3.28	17253/10	8.10	15.063×10^{-5}	122.0	3.75
	1292.6					1725.3				
	− 717.2					− 939.1				
	575.4					486.2				
+.014	13919/10	11.25		123.4	3.80	14849/10	9.10		137.1	4.22
	1391.9					1484.9				
	− 717.2					− 939.1				
	674.7					545.8				

9-14-67

Assembly G-3: Pu to Pu $STS_{x,y}$ = 8.8 cm STS_z = 9.0 cm

1.0" Mod.

#1		#2	
(3)	(7)	(11)	(15)
(2)	(6)	(10)	(14)

Background: T-1: 471.4 × .4829 = 468.6; T-2: 1632 × .3115 = 508.4

Lateral: 8.800 cm

Vertical: 9.002 cm

Parts: 1–33 less #7

Base Rate: 65.19×10^5 n/s

Pos.	T-1	T-1'	ETR Factor	10^5 n/s	M	T-2	T-2'	ETR Factor	10^5 n/s	M
7.868	1088 n/s	28.48	9.916×10^{-5}	282.41	4.33	9220/s	22.26	13.500×10^{-5}	300.57	4.61
	2172.6					1848.0				
	− 466.6					− 508.4				
	1709.0					1335.6				
.000	1262 n/s	34.90		341.11	5.23	1070/s	26.43		356.8	5.47
	2532.4					2098.0				
	− 468.6					508.4				
	2063.8					1585.6				

$\bar{M}$ = 4.47, $1/\bar{M}$ = .2237

$\bar{M}$ = 5.35, $1/\bar{M}$ = .1869

Factor for T-1 = $\frac{11.594}{60 \times 129.11} = 1.497 \times 10^{-3}$

Factor for T-2 = $\frac{15.593}{60 \times 129.11} = 2.006 \times 10^{-3}$

9-15-67

We will now begin the full 43, 1.0" mod, 3 kg array.

Assembly G-4: Pu to Pu STS$_{xy}$ = 19.136 cm STS$_z$ = 5.000 cm

Lateral: .721 + 18.415 = 19.136 cm

Vertical: .108 + 8.894 cm → 5.002 cm

Parts: 1-65 less #7

Base Rate: 125.11 $\times 10^5$ n/s

Pos	T-1	T-1'	Eff Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.852	1265/s 2523.8	42.06	11.598×10^5	487.6	3.78	970.2/s 1940.4	32.39	15.573×10^5	502.7	3.89

T/C's Room = 69 II = 100

-.008	1286.7/s 2573.4	3.85	988.8/s 1996.8	4.01
	γ/m = .2597		γ/m = .2494	
	$\bar{m}$ = 3.93		$1/\bar{m}$ = .2545	

9-19-67

Assembly G-5: Pu to Pu STS_{xy} = 13.421 cm STS_z = 9.00 cm

Lateral: .721 + 12.700 = 13.421 cm

Vertical: .108 + 8.894 cm = 9.002 cm

Parts: 1-65⁻ less #7

Base Rate: 129.11 $\times 10^{-5}$ n/s

Pos.	T-1	Factor	M	T-2	Factor	M
7.854	14718/5⁻	1.497×10^{-3}	4.41	11244/5⁻	2.006×10^{-3}	4.51
	2943.6			2248.2		
-.005⁻	16463/5⁻	4.93		12660/5⁻	5.08	
	3292.6	γ/m = .2028		2532.0	γ/m = .1969	
				$\bar{M}$ = 5.005	$\gamma/\bar{m}$ = .1998	

T/C's Room = 69 # / = 56

9-20-67

Assembly G-6: Pu to Pu STS_{xy} = 11.110 cm STS_z = 9.00 cm

Lateral: .721 + 10.387 cm = 11.110 cm

Vertical: .108 + 8.894 cm = 9.002 cm

Parts: 1-65⁻ less #7

Base Rate: 129.11 $\times 10^{-5}$ n/s

Pos.	I-1	Factor	M	I-2	Factor	M
7.854	17682/5⁻	1.497×10^{-3}	5.29	13558/5⁻	2.006×10^{-3}	5.45
	3536.4			2717.0		
-.005⁻	21691/5⁻	6.49		16688/5⁻	6.70	
	4338.2	γ/m = .1541		3337.8	γ/m = .1493	
				$\bar{M}$ = 6.60	$\gamma/\bar{m}$ = .1515	

T/C's Room = 69 # / = 95⁻

9-21-67

Assembly G-7: Pu to Pu STS_{x-y} = 9.865 cm STS_z = 9.002 cm

Lateral: .721 + 9.144 cm = 9.865 cm

Vertical: .108 + 8.894 cm = 9.002 cm

Parts: 1-65 less #7

Base Rate: 129.11 $\times 10^5$ n/s

Pos.	T-1	Factor	M	T-2	Factor	M
7.847	21582/s 4316.4	1.497×10^{-3}	6.46	16521/s 3304.2	2.006×10^{-3}	6.63
-.007	31398/s 6279.6		9.40	23959/s 4791.8		9.61
		γ/m = .1064				γ/m = .1041
			$\bar{M}$ = 9.51			$\gamma/\bar{m}$ = .1052
	T/C's	Room = 65.5		#1 = 98		

9-22-67

Assembly G-8: Pu to Pu STS_{x-y} = 8.930 cm STS_z = 9.002 cm

Lateral: .721 + 8.209 cm = 8.930 cm

Vertical: .108 + 8.894 cm = 9.002 cm

Parts: 1-65 less #7

Base Rate: 129.11 $\times 10^5$ n/s

Pos	T-1	Factor	M	T-2	Factor	M
7.958	26673/s 5338.6	1.497×10^{-3}	7.99	20892/s 4178.4	2.006×10^{-3}	8.38
-.015	54691/s 10,938.		16.37	41867/s 8373.4		16.80
		γ/m = .0610				γ/m = .05952
			$\bar{M}$ = 16.59			$\gamma/\bar{m}$ = .0603
	T/C's	Room = 69		#1 = 150		

9-25-67

To continue the arrays we will have to do a new series of safety arrays with $STS_{x,y} = 8.468$ cm $STS_z = 9.002$ cm

Assembly G-9: $STS_{x,y} = 8.468$ cm $STS_z = 9.002$ cm

10" Mod.

(6)	(10)
6	7

Lateral: .721 + 7.747 cm = 8.468 cm

Vertical: .107 + 8.895 cm = 9.002 cm

Parts:

Bracket: ~ 16.25×10^{-5} g/s

Background: T-1 = 913.85 × .8686 = 793.8
T-2 = 1528.45 × .7603 = 1162.1

Pos.	T-1	T-1'	Eff. Fact.	10^5 g/s	M	T-2	T-2'	Eff. Factor	10^5 g/s	M
7.866	5580/5		10.538×10^{-5}			7225/5		13.678×10^{-5}		
	1116					1445				
7.014	11543/10	6.00		63.4	3.90	14750/10	5.30		72.5	4.8
	1154.3					1475.0				
	− 793.8					1162.1				
	360.2					312.9				

9-26-67

Assembly G-10 : $STS_{x,y} = 8.468$ cm $STS_z = 9.002$ cm

1.0" Mod.

(7)	(11)
(6)	(10)

Lateral : 8.468 cm

Vertical : 9.002 cm

Parts :

Base Rate : $\sim 32.5 \times 10^{-5}$ n/s

Background : T-1 = 913.85 × .7383 = 674.5
T-2 = 1528.45 × .5754 = 879.5

Pos.	T-1	T-1'	Eff Factor	10^{-5} n/s	M	T-2	T-2'	Eff. Factor	10^{-5} n/s	M
7.863	6382/5	10.03	10.970×10^{-5}	110.0	3.39	6702/5	7.68	15.063×10^{-5}	115.68	3.55
	1276.4					1340.4				
	− 674.5					− 879.5				
	601.9					460.9				
−.014	13398/10	11.09		121.7	3.74	14302/10	9.18		138.3	4.25
	1339.9					1430.2				
	− 674.5					− 879.5				
	665.4					550.7				

Assembly G-11: $STS_{x,y} = 8.468$ cm $STS_z = 9.002$ cm

10" Mod

③	⑦	⑪	⑮
②	⑥	⑩	⑭

Lateral: 8.468 cm

Vertical: 9.002 cm

Parts: Cells 2, 3, 6, 7, 10, 11, 14, 15

Base Rate: $\sim 65.19 \times 10^{-5}$ 1/s

Background: T-1 = 913.85 × .4824 = 440.8
T-2 = 1528.45 × .3110 = 476.1

Pos.	T-1	T-1'	Eff. Factor	10^{-5} 1/s	M	T-2	T-2'	Eff. Factor	10^{-5} 1/s	M
8.850	1088 1/s	28.55	8.916×10^{-5}	287.1	4.40	924 3/s	22.88	13.580×10^{-5}	308.9	4.74
	2177.8					1848.6				
	− 440.8					− 476.1				
	1737					1372.5				

$\bar{M} = 4.57$ $1/\bar{M} = .2188$

−.014	1252 6/s	38.41		341.2	5.23	1017 8/s	25.98		350.7	5.38
	2505.2					2039.8				
	− 440.8					− 476.1				
	2064.4 →					1558.7				

$\bar{M} = 5.31$ $1/\bar{M} = .1885$

half table, 8.8 → 8.47

$\Delta \frac{1}{M}$ ⊙ just stop $= -.0049$

can go to 7.8 cm with complete confidence

$\Delta 1/M_{\text{full closed}} = +.0016$ ← implies could go to 0, but we know better

Control Element worths

$\Delta \frac{1}{m}$ Element on (but out), element off

	T-1	T-2
7,856	−,000 54	.00122
1,290	+.00070	.00108
0,000	.00100	.00091

$\overline{\Delta \frac{1}{m}} = .00092$

$\Delta \frac{1}{m}$ Element in, element out

7,856	.00200	.00132
1,290	.00122	.00052
0.000	.00090	.00100

$\Delta \frac{1}{m} = .00091$

(at a glance)

element is worth 46 ¢

at 60 sec travel less than

1 ¢/sec. average recr. insertion

We will now continue the fall away

Assembly G-12: Parts Run $STS_{x,y} = 8.468$ cm $STS_z = 9.002$ cm

Lateral: .721 + 7.747 = 8.468 cm

Vertical: .108 + 8.894 = 9.002 cm

Moderation = 1.0"

Parts: 1-6 S less #7

Base Rate: 129.11 $\times 10^{-3}$ n/s

Pos	T-1	Factor	M	T-2	Factor	M
7.858	32038/5 6,407.6	1.497×10^{-3}	9.592	24353/5 4870.6	2.006×10^{-3}	9.770
1.290	67324/5 13464 (→ 13500		20.16 20.210)	50920/5 10184.0 (→ 10,200		20.43 20.461)
					$1/\bar{m}$ =	.04926
−.014	102698/5 20,539.6 (→ 20,624		30.75 30.814)	77858/5 15571.6 (→ 15,508		31.08 31.109)
		$\bar{X}_M$ = .0325			$\bar{X}_M$ = .0322	
					$1/\bar{M}$ = .0324	

T/C's Room = 70 #1 = 97

We will now place the actuator on the control table, & re-run away

9/28/67

	T-1			T-2		
Table 7,858	32495/5 6499.0	Factor $1,497 \times 10^{-3}$	M 9.729	24,973/5 4994.6	Factor $2,006 \times 10^{-3}$	M 10.019
Element 0,000						
Element 15.329	31,879 6,375.8		9,543	24,647 4,929.4		9,888

Table	T-1	M-1	T-2	M-2
1.290	68,286			
Actuator	68,286/5		51,932/5	
15.329	13,657.2 → 13,695	20.501	10,386.4 → 10,403	20.923
			$\bar{M}$ =	$\bar{Y}/\bar{m}$ = .04828
Actuator	70,031/5		52,646/5	
0.000	14,006.2 → 14,046	21.027	10,529.2 → 10,546	21.155
Table				
0.000				
Actuator	105,734/5		79,585/5	
15,329	21,146.8 → 21,237	31.792	15,917.0 → 15,955	32.006
			$\bar{M}$ = 31.90	$\bar{Y}/\bar{m}$ = .0313
0.000	108,846/5		82,114/5	
	21,769.2 → 21,864	32.730	16,442.8 → 16,484	33.067

9-28-67

Assembly G-13 : $STS_{x,y}$ = 8.178cm STS_z = 9.002 cm

Lateral: .721 + 7.457 = 8.178 cm

Vertical: .108 + 8.894 = 9.002 cm

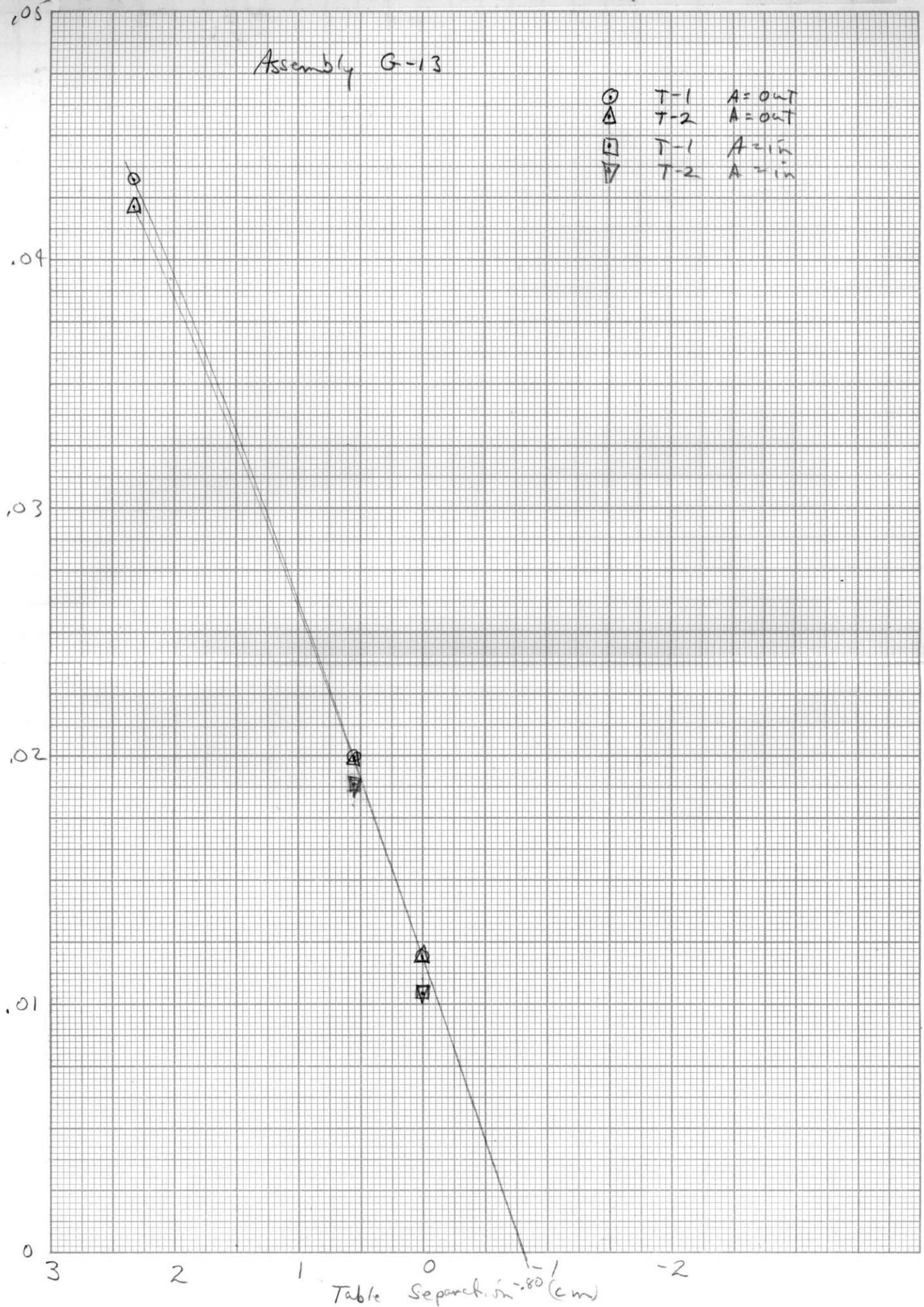
Parts: 1-65 less #7

Base Rate: 129.11×10^{-5} h/s

Moderator = 1.0"

Pos.	T-1	Factor	M	T-2	Factor	M
7.877	3683/5	1.497×10^{-3}	11.04	2857/5	2.006×10^{-3}	11.86
A=15.324	7378.6		$\bar{Y}/\bar{m}$ = .0906	5714.8		$\bar{Y}/\bar{m}$ = .0873

4³ 1.0" Mod 3K₈



K&E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
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Pos.	T-1	Factor	M	T-2	Factor	M
2.314	77268/s⁻	1.497×10^{-3}	23.13	59083/s⁻	2.006×10^{-3}	23.70
A=15.324	15452.8	$\gamma/m = .04323$		11816.6	$\gamma/m = .09218$	
					$\gamma/\bar{m} = .04271$	
.550	166082/s⁻		50.05	124862/s⁻		50.28
A=15.324	33216 → 33436	$\gamma/m = .01998$		24972 → 25068	$\gamma/m = .01989$	
					$\gamma/\bar{m} = .01994$	
.550	176671/s⁻		53.27	132737/s⁻		53.47
A=0.000	35334 → 35586	$\gamma/m = .01877$		26547 → 26653	$\gamma/m = .01870$	
.002	283681/s⁻		85.89	210361/s⁻		84.93
A=15.324	56728 → 57376	$\gamma/m = .0119$		42072 → 42338	$\gamma/m = .0118$	
					$\gamma/\bar{m} = .01185$	
.002	318867/s⁻		96.57	235420/s⁻		95.12
.000	63693 → 64512	$\gamma/m = .0104$		47084 → 47420	$\gamma/m = .0105$	
				$\gamma/\bar{m} = .0105$		

T/C 5 Room = 70 #1 = 90

We will now remove the control element and do the run again.

Pos.	T-1	Factor	M	T-2	Factor	M
2.863	37556/s⁻	1.497×10^{-3}	11.24	28624/s⁻	2.006×10^{-3}	11.48
	7511			5725⁻		
2.314	76681/s⁻		22.96	58415/s⁻		23.44
	15336	$\gamma/m = .04355$		11684	$\gamma/m = .04266$	
					$\gamma/\bar{m} = .04311$	
.550	162068/s⁻		48.84	123184/s⁻		49.60
	32413 → 32625⁻	$\gamma/m = .0205$		24637 → 24728	$\gamma/m = .0202$	
					$\gamma/\bar{m} = .0204$	
.000	274170/s⁻		83.00	206538/s		83.38
	54834 → 55443	$\gamma/m = .01205$		41307 → 41584	$\gamma/m = .01200$	
					$\gamma/\bar{m} = .0120$	

Actuator movement would = $\frac{\Delta \gamma/m}{\beta} = \frac{.0018}{.00197} = .74$ #
@ closed table position

On table actuator would in $\Delta \frac{1}{m}$'s Avg. = .000175
@ closed table position

Background:

	T-1	T-2
	13570/15	23229/15
	904.7	1548.6

9-29-67

We will now do more safety experiments for
$STS_{xy} = 8.024$ cm $STS_z = 5.002$ cm

Assembly G-14: $STS_{xy} = 8.024$ $STS_z = 5.002$ cm

1.0" Mod.

⑤ | ⑩

Lateral: .121 × 7.303 = 8.024

Vertical: .108 × = 5.002

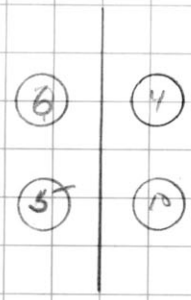
Parts: Col. 5 & 10 Bkg. T-1 = 908.7 × .8686 = 785.8
T-2 = 1578.6 × .7603 = 1177.4

Base Rate: ~16.25 × 10^{-5} n/s

Pos	T-1	T-1'	Eff. Factor	10^{-5} n/s	M	T-2	T-2'	Eff. Factor	10^{-5} n/s	M
2.858	1911/3	4.99	10.566 × 10^{-5}	52.73	3.27	1605/3	3.57	13.678 × 10^{-5}	48.80	3.00
	1085.4					1395.5				
	− 785.8					− 1177.4				
	299.6					218.1				
.007	1106/10	5.35		56.54	3.48	1887/10	4.50		61.55	3.79
	1106.7					1887.1				
	+ 785.8					1177.4				
	320.9					269.7				

Assembly G-15' $SIS_{xy} = 8.024$ cm $SIS_z = 9.002$ cm

1.0" Mod



Lateral: 8.024 cm

Vertical: 9.002 cm

Parts: Col, 5, 6, 10, & 11

Base Rate: ~ 32.5 $\times 10^{-5}$ in/s

Bkg. T-1 = 908.7 × .7383 = 667.9
T-2 = 1548.6 × .5764 = 891.1

Pos	T-1	T-1'	Eff. Factor	10^{-5} in/s	M	T-2	T-2'	Eff. Factor	10^{-5} in/s	M
7.875	12528/10	9.25	10.870×10^{-5}	106.96	3.29	13618/10	7.84	15.063×10^{-5}	118.09	3.63
	1252.8					1361.4				
	- 667.9					- 891.1				
	584.9					470.3				
.000	13809/10	11.88		130.3	4.01	14380/10	9.13		137.53	4.23
	1380.9					1438.7				
	- 667.9					- 891.1				
	713.0					547.6				

Assembly G-16: STS_{x_4} = 8.024 m STS_3 = 9.002 m

1.0" Mod.

(8)	(6)	(11)	(12)
(7)	(5)	(10)	(9)

Lateral: 8.024 m

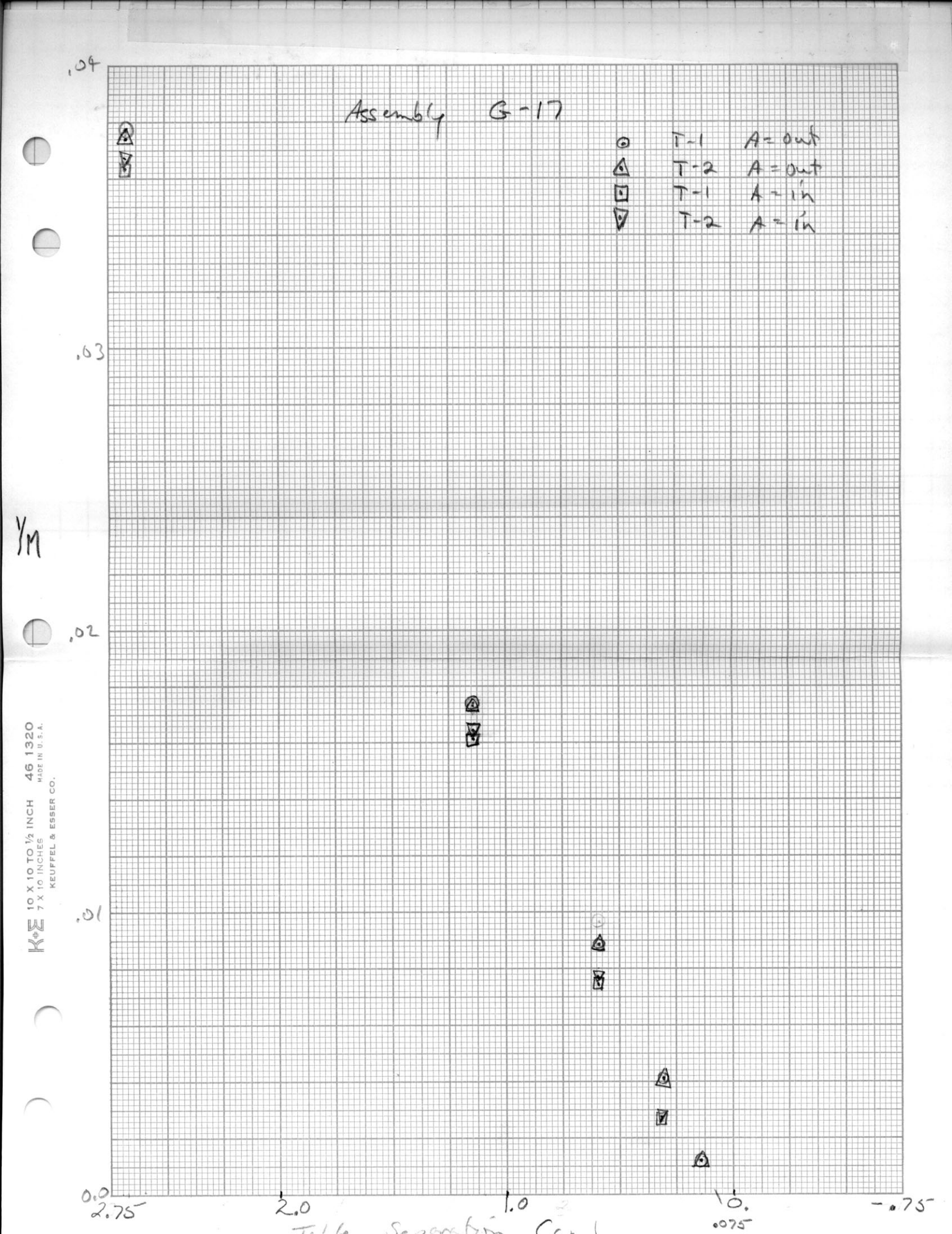
Vertical: 9.002 m

Parts: Cols 5, 6, 7, 8, 9, 10, 11, 12

Base Rate: ~65.19 $\times 10^5$ n/s

BKg. T-1 = 908.7 × .4824 = 436.4
T-2 = 1548.6 × .3115 = 482.4

Pos	T-1	T-1'	Eff. Factor	10^5 n/s	M	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
9864	11627/s	3159	9.916 $\times 10^5$	3124	4.79		9578/s	25.22	13.500 $\times 10^5$	340.5	5.22
	2325.4						1995.8				
	-436.4						482.4				
	1889.0						1513.4				
.001	27279/s	38.14		378.45	5.81		23159/s	30.56		412.57	6.33
	2727.9						2315.9				
	-436.4						-482.4				
	2291.5						1833.5				



K+E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
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10-2-67 We will now do the full array.

Assembly G-17: $STS_{x,y}$ = 8.024 cm STS_z = 9.002 cm

Lateral: .721 cm + 7.303 = 8.024 cm

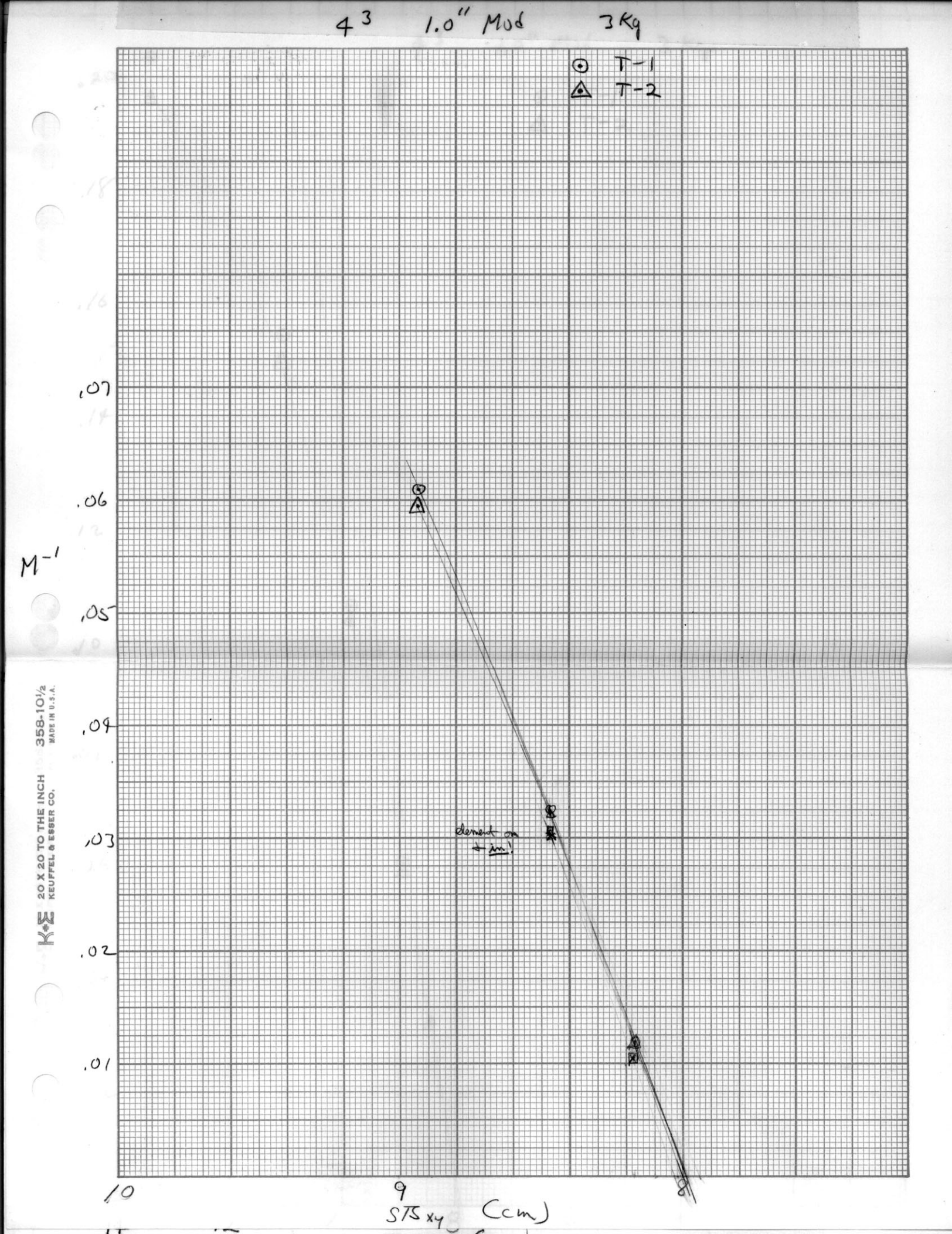
Vertical: .108 cm + 8.894 = 9.002 cm

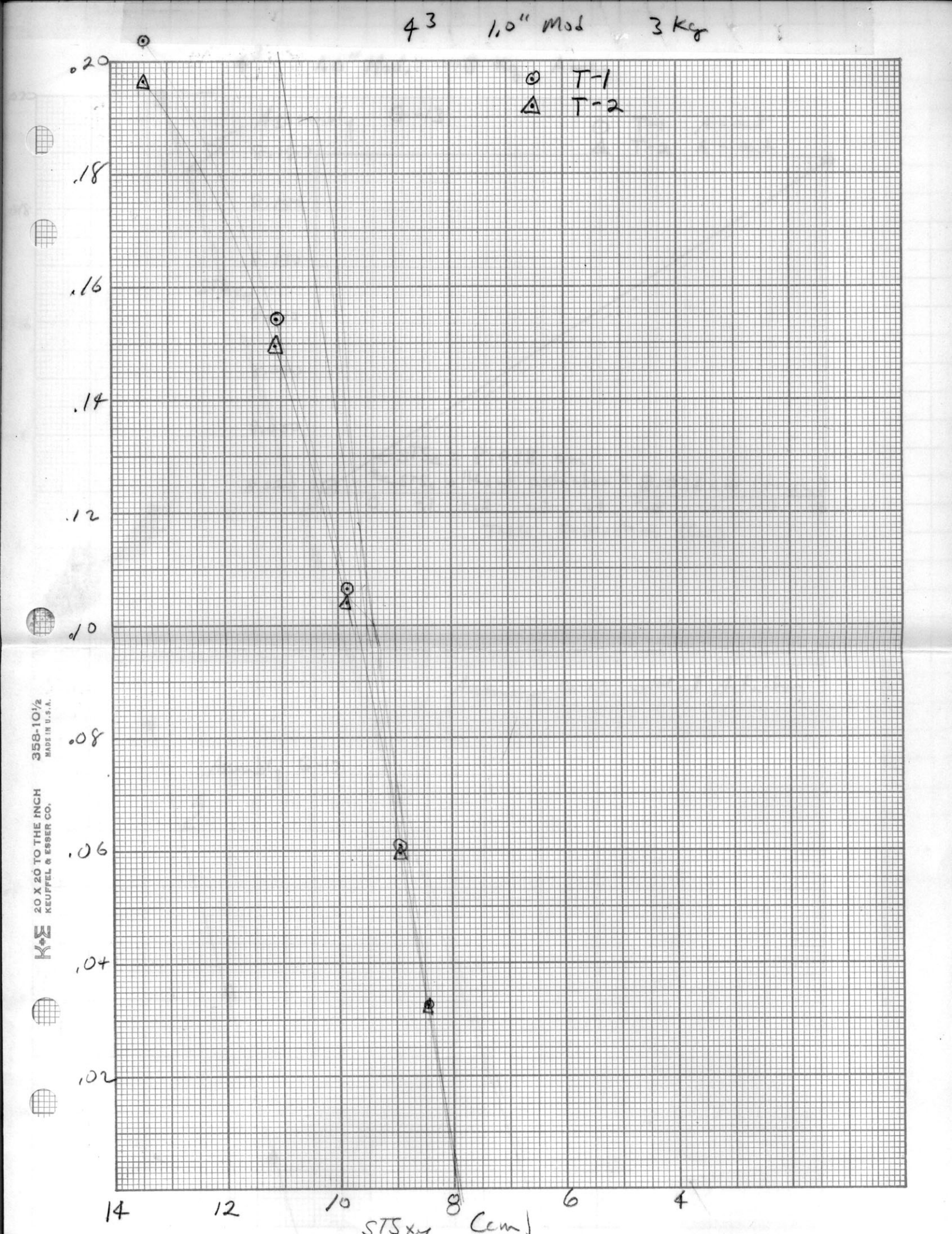
Parts: 1-65- less # 7

Base Rate: 129.11 $\times 10^{-5}$ 1/s

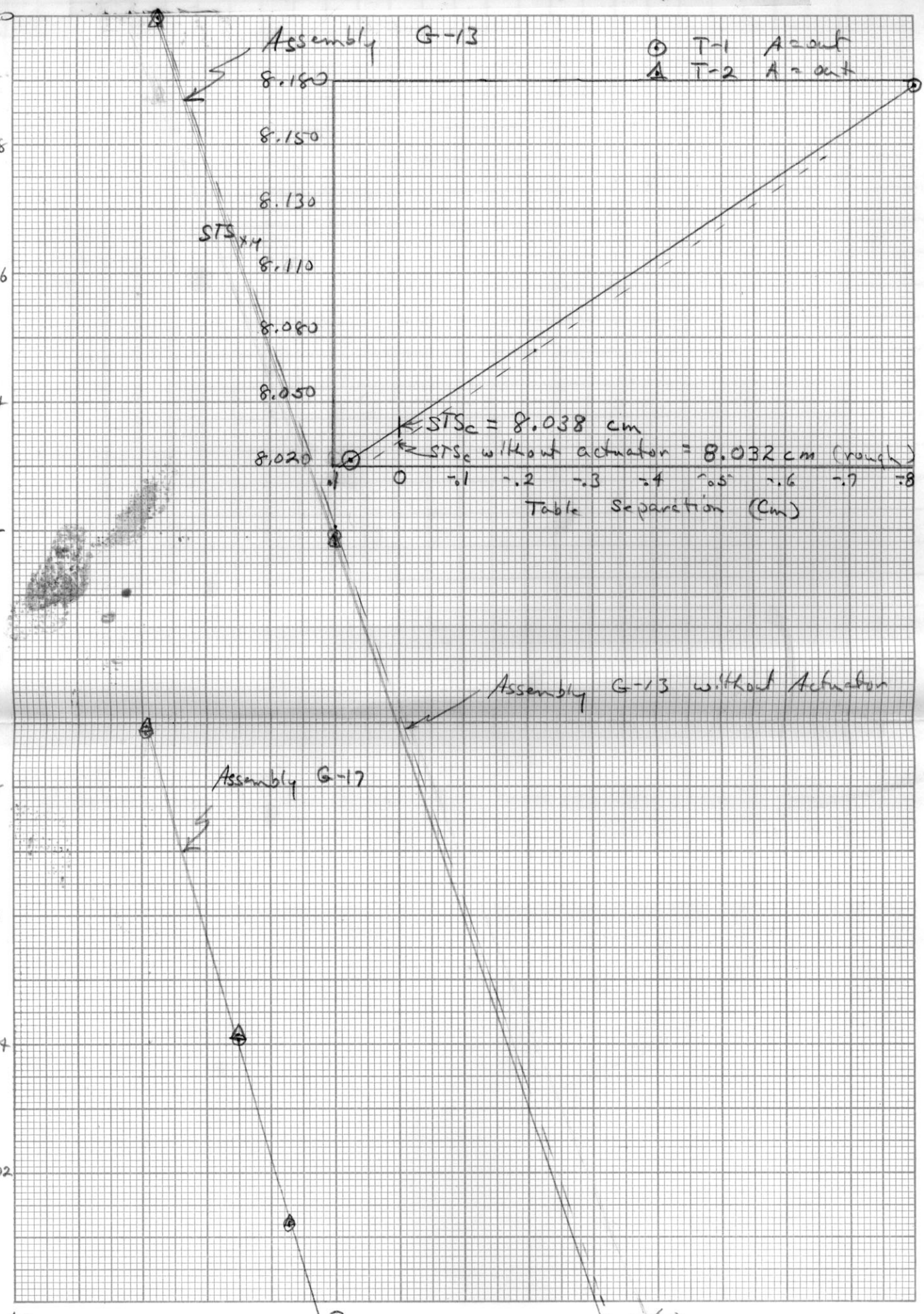
Moderations: 1.0 11

Pos.	T-1	Factor	M	T-2	Factor	M
7.872	39410/s-	1.497×10^{-3}	11.80	30708/s-	2.006×10^{-3}	12.32
A=15.339	7882.0		γ_m = .0847	6140.8		γ_m = .0812
7.872	40665/s-	1.497×10^{-3}	12.18	30588/s-	2.006×10^{-3}	12.27
A=0.000	8133.0		γ_m = .0821	6117.6		γ_m = .0815
	T/C's	Room =	70	#1 =	90	
2.676	17785/	1.497×10^{-3}	26.56	13392	2.006×10^{-3}	26.76
15.339			γ_m = .0377			γ_m = .0374
						$\bar{\gamma_m}$ = .0376
2.676	18900	1.497×10^{-3}	27.54	13567	2.006×10^{-3}	27.22
0.000			γ_m = .0363			γ_m = .0367
1.143	38084-	1.497×10^{-3}	57.46	28736	2.006×10^{-3}	57.89
15.339	↓38385-		γ_m = .0174	↓28860		γ_m = .0173
						$\bar{\gamma_m}$ = .0174
1.143	41048	1.497×10^{-3}	61.96	30250	2.006×10^{-3}	61.03
0.000	↓41387		γ_m = .0161	↓30426		γ_m = .0164
		T/C's	Room = 70	#1 =	89	
.587	74608	1.497×10^{-3}	113.38	55286		111.83
15.339	↓75736		γ_m = .00882	↓55798		γ_m = .00894
						$\bar{\gamma_m}$ = .00888
.587	88458	1.497×10^{-3}	134.80	64699		131.06
.000	↓90051		γ_m = .00742	↓65332		γ_m = .00763
		T/C's	Room = 70	#1 =	89	


4³ 1.0" Mod 3Kg
T-1
T-2
.07
.06
M⁻¹
.05
.04
.03
.02
.01
denend on
+ Δm!
10
9
8
STS xy (cm)
20 X 20 TO THE INCH
KEUFFEL & ESSER CO.
358-10½
MADE IN U.S.A.


4³ 1.0" Mod 3 Kg
T-1
T-2
.20
.18
.16
.14
.12
.10
.08
.06
.04
.02
14
12
10
8
6
4
STS x M Cm
KE 20 X 20 TO THE INCH KEUFFEL & ESSER CO. 358-10½ MADE IN U.S.A.

4^3 1.0" Mod. 3 Kg Array



K+E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

Pos.	T-1	Factor	M	T-2	Factor	M
.301	158103	1.497×10^{-3}	248.4	117591	2.006×10^{-3}	240.1
15.339	↓163262		$\gamma_m = .00409$	↓119698		$\gamma_m = .00416$
						$\bar{\gamma_m} = .00413$
.301	239281		376.2	176048		362.7
.000	↓251325		$\gamma_m = .00266$	↓180822		$\gamma_m = .00276$

T/C's $R_{room} = 70$ $\quad$ $\# 1 = 88.5$

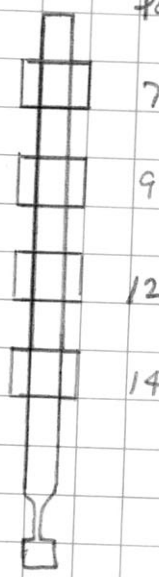
.184	501900	1.497×10^{-3}	835.2	381370	2.006×10^{-3}	811.4
15.339	↓557915		$\gamma_m = .00120$	↓404508		$\gamma_m = .00123$
						$\bar{\gamma_m} = .00122$

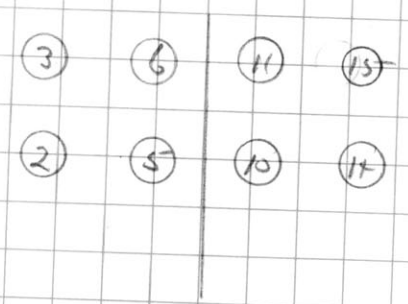
We will look at the actuator worth for this array.

$$\$ = \frac{\Delta\frac{1}{M}}{\beta} = \frac{.001425}{.0019} = .75$$

10/3/67

We will begin the Eff. Factor determinations for the 4³, 1.5⁻¹, 3 Kg arrays.
Eight columns were set up as shown below and Eff. Factors will be determined.





	T-1	T-2
BKg: c/m	1796.7/20	3081.7/20
c/m	898.4	1540.9

Eff. Factor Determinations (Source: MRC 8-7 1.3×10⁻⁴ c/s)

Col. 10

	T-1	T-2
Pos. 74 Count Rates: c/m	14077/10	22237/10
c/s	23.46	37.06
c/s-BKg	8.49	11.38
Eff. Factor		
Pos 98 c/m	14199/10	22735/10
c/s		
c/s-BKg		
Eff. Factor		
Pos 122 c/m	14341/10	22506/10
c/s		
c/s-BKg		
Eff. Factor		
Pos 146 c/m	14438/10	22225/10

Avg. Col. 10

c/m	1426.38	2242.58
c/m-BKg	527.98	701.68
c/s	8.80	11.69
Eff. Factor	1.477×10^6	1.112×10^6

Col. 11

		T-1	T-2
	Count Rates		
Pos. 74	c/m	175-26/10	19010/10
	c/s		
	c/s - BKg		
	Eff. Factor		
98	c/m	18540/10	19184/10
	c/s		
	c/s - BKg		
	Eff. Factor		
122	c/m	18464/10	19707/10
	c/s		
	c/s - BKg		
	Eff. Factor		
146	c/m	18147/10	195-21/10
Avg. Col. 11	c/m	1816.93	1935.43
	c/m - BKg	918.53	394.03
	c/s	15.31	6.58
	Eff. Factor	.849 x 10^6	1.976 x 10^6

10/5/67

Col. 14

Pos. 74	c/m	13544/10	22282/10
98		13978/10	22682/10
122		13933/10	22627/10
146		13984/10	22264/10
Avg. Col 14	c/m	1385.88	2245.38
	c/m - BKg	487.98	709.48
	c/s	8.12	11.74
	Eff. Factor	1.601 x 10^6	1.107 x 10^6

Note on $1\frac{1}{2}$" internal spacing set-up.

a) spacer combination from taped bottom piece to first moderator disc is:
25, 25, 7, .5, 3, 2
= 59.8 cm

Dial indicator set at 4.287". Deviations on internal set-up as follows, (in .001") mils.

	1	2	3	4	5	6	7	8
TOP	0	+1	-1	0	1	-1	-1	0
mid	0	0	+1	+½	-½	+1	+1	0
Bott	0	+1	-1	+1	0	-1½	+1	0

	9	10	11	12	13	14	15	16
TOP	0	-1	+1	0	-1	-1	0	-1
MID	+1	+1	-1	0	-1	+1	+1	0
BOT	+1½	-1	0	0	0	0	0	-1

Note: Complete cancellation!

Thus horizontal ~~Sets~~ is 4.287" = 10.889 cm
+ .108
10.997 cm

Col. 15		T-1	T-2
Pos 74	q_m	18198/10	19276/10
98		18694/10	19316/10
122		18523/10	19080/10
146		17715/10	18993/10
Avg. Col. 15	q_m	1828.25	1916.63
	$q_m - q_s$	929.85	375.73
	q_s	15.50	6.26
	Eff. Factor	$.839 \times 10^6$	2.077×10^6

∴ The Eff. Factors for the 8-member safety array are:

Avg. Eff. Factor	T-1	T-2
	1.192×10^6	1.568×10^6

We will ratio the other safety and full array Eff. Factors to the ones on page 53.

	T-1	T-2
For 2 columns:	1.270×10^6	1.589×10^6
For 4 columns:	1.319×10^6	1.750×10^6
For 16 columns:	1.3937×10^6	1.8053×10^6

---

30 minute background counts.

26,164/30 — 872.1 cpm

44,677/30 — 1489.2 cpm

from page 70 a), if we pull 2 columns off well the background is:

757.5 cpm — 1132.2 cpm

dec 10/5/67 ? Button Spacing = .25", .25", 2, 7, .3, .5 cm

4^3, 3 K_g, 1½" Molecular Array

G.V.P. Predicts 11×10.57^2

we will set up less on x-y safety experiment to prevent additional late safety runs in case he is wrong again.

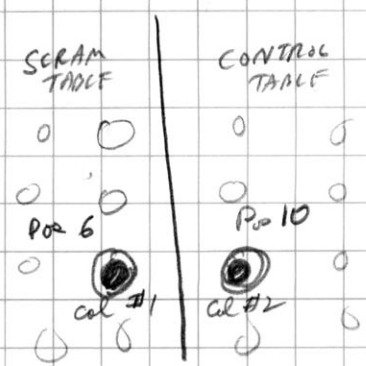
Assembly H-1 : P_a to P_a − STS_{x-y} = 9.50, STS_z = 11.00

Lateral : .721 + 8.778 = 9.499 cm

Vertical : .108 + 10.889 = 10.997 cm

Parts: 1-9 less #7

Base Rate : 16.25×10^5 m/s



Pos:	T-1	eff fac	m/s	M_1	T-2	eff fac	m/s	M_2
7.880	5252/5				6860/5			
	1050,4 rpm				1372 rpm			
	− 757,4				−1132			
	293 rpm				240 rpm			
	↓ 4.883 rps				↓ 4,000 rps			
			$1,27 \times 10^6$	62.01×10^5			$1,589 \times 10^6$	63.56×10^5
				3.816				3.911
					$\bar{m} = 3,86$			
± .014(IN)	16,055/15				20,499/15			
	1070,3				1367 rpm			
	− 757,3				1132			
	313 rpm				235 rpm			
	↓ 5,217 rps				↓ 3.916 rps			
			$66,25 \times 10^5$ m/s				$62,22 \times 10^5$ m/s	
				$m = 4.077$				$m = 3,829$

$\bar{m} = 3,95$

10/6/67

16 columns on wall Background

T-1 22,514/26.032 = 864.9 cpm

T-2 37,398/26.032 = 1436.6 cpm

∴

from Page 70a) 4 column backgrounds are:

638.6 cpm 826.6 cpm

Assembly H-2 : P_w t P_a – STS $\frac{xy}{2}$ 9.50 / 11.00

Lateral : .721 + 8.778 = 9.499 cm

Vertical : .108 + 10.889 = 10.997 cm

Parts : 1 – 17 less #7,

Base Rate 32.5×10^5 n/s

P_∞	T-1	eff fac	10^5 n/s	M_1	T-2	eff fac	10^5 n/s	M_2
7,873	5995/5		123.2	3.79	6421/5		133.5	4.11
	1199.0 cpm	1.319×10^6			1284.2	1.750×10^6		
	– 638.6				– 826.6			
	560.4 cpm				457.6 cpm			
	↓9.34 cps				↓7.63 cps			
								$\bar{M} = 3.95$
P_∞	12742/10				13350/10			
	1274.2 cpm		139.7	4.30	1335 cpm		148.2	4.56
+.012	638.6				826.6			
	635.6 cpm				508.4			
	10.59 cps				8.47 cps			$\bar{M} = 4.43$

(7) 2	(11) 4
(8) 1	(10) 3

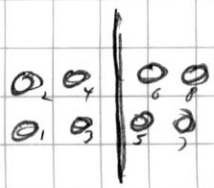
8 column backgrounds are, using p. 70 a),

T-1	T-2
417.2 cpm	447.5 cpm

Assembly H-3 : P_t to P_w — STS $\begin{matrix} x\text{-}y & 9.5 \\ z & 11.0 \end{matrix}$

Lateral : .721 + 8.778 = 9.499 cm

Vertical .108 + 10.889 = 10.997 cm



Ports : 1 – 33 less 7

Base Rate: ~ 65.2×10^5 m/s

P_∞	T-1	eff for 10^5 m/s	M_1	T-2	eff for 10^5 m/s	M_2
7.884	10,041/5	1.192×10^6	316.1	4.85	8594/5	1.568×10^6	332.3	5.10
	2008.2 cpm				1718.8 cpm			
	417.2				447.5			
	1591.0 cpm				1271.3			
	265.2 cps				211.9 cps			
.013	22054/10				18,431/10			
	2205.4 cpm		355.2	5.45	1843.1 cpm		364.7	5.59
	− 417.2 cpm				− 447.5 cpm			
	1788.2 cpm				1395.6 cpm			
	29.80 cps				23.26			

$\bar{M} = 4.97$

$\bar{M} = 5.52$

10/9/67

Assembly H-4

Pu to Pu : x-y : 21.04
z : 11.00

Horizontal .721 + 20.320 = 21.041

Vertical .108 + 10.889 = 10.997

Parts ; 1-65 less #7

Base Rate : 129.11 $\times 10^5$ n/s

$M_1 = 1.799 \times 10^{-3}$ /rpm $M_2 = 2.330 \times 10^{-3}$ /rpm

P_{00}	T-1	M_1	T-2	M_2
7,875	11,397/5		8805/5	
	2,279 rpm	4.100	1,761	4.103
+.015	11,687/5		9,047/5	
	2,337.4 rpm	4,205	1,809.4 rpm	4,215

$\bar{m} = 4,210$ $1/\bar{m} = .2375$

10/10/67

Assembly H-5

Pu to Pu : x-y : 15.80
z : 11.00

Horizontal : .721 + 15,083 = 15,804 cm

Vertical : .108 + 10,889 = 10.997 cm

Parts : 1-65 less # 7

Base Rate : 129.11 $\times 10^5$ n/s

P_{00}	T-1	M_1	T_2	M_2
7.872	12,336/5	4.438	9,473/5	4.413
	2,467.2 rpm		1894.6 rpm	$\bar{m} = 4.426$
+.012	13,197/5	4,748	9935/5	4.630
	2,639.4		1,987	

$\bar{m} = 4.689$

$1/\bar{m} = .2133$

10/11/67

Assembly H-6 P_n to P_n X-Y 13.19 cm
2 11.00

Horizontal .721 + 12,466 = 13,187

Vertical .108 + 10,889 = 10,997

Parts : 1-65 less #7

Base Rate : 129.11×10^5 m/s

P_{50}	T-1 (1.799×10^{-3})	M_1	T-2 (2.330×10^{-3})	M_2
7,870	13555/5	4,985	10532/5	4,907
	2771 cpm		2106.4	
				$\bar{M} = 4.946$
.010	15059/5	5,358	11698/5	5.451
	3011.8		2339.6	
	T = 86°			$\bar{M} = 5.405$
				$1/\bar{M} = .1850$

---

120 MIN BACKGROUND COUNT
WITH 16 COLUMNS ON WALL

T-1 100,652/120 175,703/120

838.76 cpm 1464.19 cpm

10/13/67

Assembly H-7 P_1 to P_2 x-y 2 11.88 11.00

Horizontal .721 + 11.156 = 11.877 cm

Vertical .108 + 10.889 = 10.997

Parts: 1-65 lead #7

Base Rate: 129.11 x 10^{-5} m/s

P_∞	T-1 (1.799×10^{-3})	M-1	T-2 (2.330×10^{-3})	M-2
7.876	14,697/5	5,288	11,369/5	5,298
	2939.4		2273.8	$\bar{m} = 5.293$
+.016	16,916/5	6,086	13,471/5	6.277
	3383.2		2694.2	$\bar{m} = 6.182$
				$1/\bar{m} = .1618$

Go min Brgd with 16 colums on wall

T-1

51,539/60

858.98 cpm

up 2.4% from 10/11

T-2

87,616/60

1460.26

down .3% from 10/11

10/16/67

Array H-8 P_m to P_4: x-y : 10.70, z : 11.00

Horizontal : .721 + 9.977 = 10.698

Vertical : .108 + 10.889 = 10.997

Parts : 1-65 less #7

(T = 90°F)

P_o	T-1	(1.799×10^{-3}) M-1	T-2	(2.33×10^{-3}) M-2
7.881	16,419/5	5.908	12,721/5	5.928
	3,284		2,544	

$\bar{m} = 5.918$

(T = 90°F)

+.011	20,385/5	7.335	15,647/5	7.291
	4,077		3,129	

$\bar{m} = 7.313$

$\sqrt{\bar{m}} = .1367$

10/17/67

Array H-9 P_4 to P_m x-y 9.50 cm, z 11.00 cm

Horizontal : .721 + 8.778 = 9.499

Vertical : .108 + 10.889 = 10.997

Part 1-65 less #7

(T = 95°F)

P_o	T-1	M-1	T-2	M-2
7.861	19,293/5	6.942	14,820/5	6.906
	3,858.6		2,964.0	

$\bar{m} = 6.924$

(T = 94 °F)

+.014	27,100/5	9.751	20,833/5	9.708
	5,420		4,166.6	

$\sqrt{\bar{m}} = .1028$ $\bar{m} = 9.729$

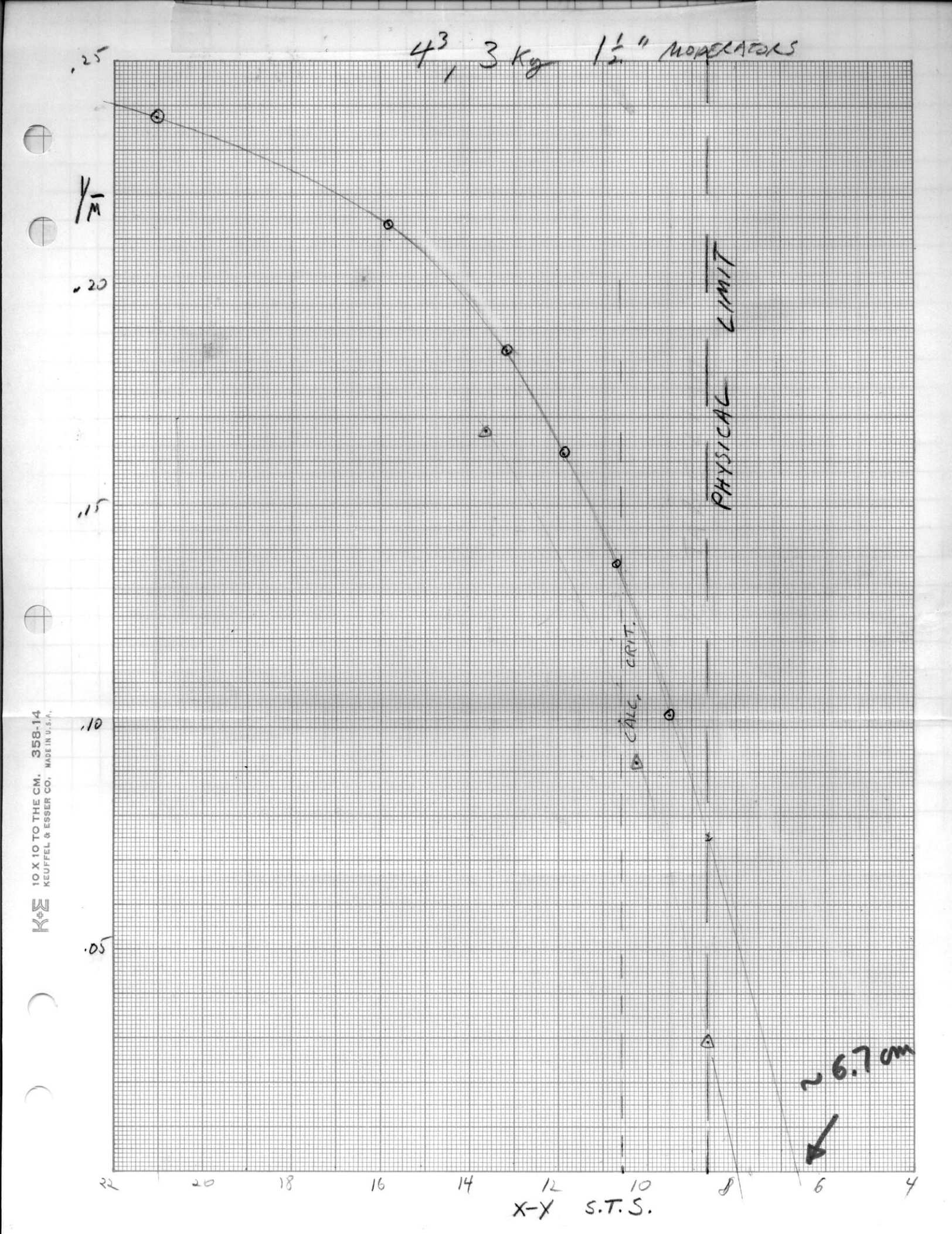
10/17 Bkgd with 16 columns on wall

50,091/60

834 cpm

87,530/60

1458 cpm


4³, 3 Kg 1½" MOPERATORS
.25
1/M
.20
.15
.10
.05
PHYSICAL LIMIT
CALC. CRIT.
~6.7 cm
22
20
18
16
14
12
10
8
6
4
X-X S.T.S.
10 X 10 TO THE CM. 358-14
KEUFFEL & ESSER CO. MADE IN U.S.A.

We have stopped because a graph of $1/M$ vs. S.T.S. indicate $STS_{x,y}$ (CRIT) ~ 6.7.

and on the conservative side ~ 7.0

However, the physical limit ~~is~~ ~ 8.72 cm due to the Mock H.E. rings touching as we shrink in. We will change the array as follows: We will remove a 2.0 cm and a 0.1 cm spacer from between each billet. The bottom of the array will be raised by 3.2 cm so that the centerline of the array gets raised by .05 cm. ~~The 2.1 cm is accurately measured to be _____ so that~~ the new spacing is 8.786 cm + .108 = 8.894 cm

Assuming $STS_{x,y}$ CRIT is 7.0 cm,

on an equivalent volume basis, the new crit. is 8.012

on a $z = x = y$ basis, the new crit. is 8.05 cm

on a $z = x - y$ basis, the new crit. is 9.1 cm

If we go to 1.5 times the most conservative guess, we should start the new array at 13.65 cm base-to-base of 5.090"

10/24/67

We will continue with new safety arrays with $STS_{x,y} = 8.722$ cm $STS_z = 8.994$ cm for the 4 lb, 1.5" Mod., 3 kg array.

? Bottom Spacing = 25 cm, 25 cm, 10 cm, 2 cm, 1 cm

Assembly H-10: $STS_{x,y} = 8.722$ cm $STS_z = 8.994$

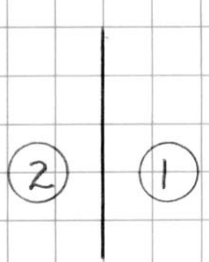
Lateral: .721 + 8.001 cm = 8.722 cm (Min. Spacing)

Vertical: .108 + 8.786 = 8.994 cm (Min. Spacing)

Parts: Cols 1 & 2

Base Rate: ~ 16.25×10^5 n/s

Moderation = 1.5"



BKg: T-1 = .8686 × 901.5 = 783.0 (54008/60) T-2 = .7603 × 1557.6 = 1184.2 (93456/60)

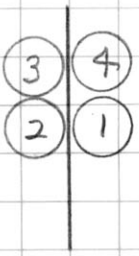
Pos.	T-1	T-1	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.879	1117.9/10	5.42	1.27×10^6	68.77	4.23	1438.6/10	4.24	1.589×10^6	67.37	4.15
	1117.9					1438.6				
	−783.0					−1184.2				
	334.9					254.4				

T/C's Room ~ 69°F #1 = 117°F

0.000	1155.6/10	6.21	1.27×10^6	78.87	4.85	1433.4/10	4.15	1.589×10^6	65.94	4.06
	1155.6					1433.4				
	−783.0					−1184.2				
	372.6					249.2				

Assembly H-11: $STS_{x,y}$ = 8.722 cm STS_3 = 8.994 cm

Parts: Cols 1, 2, 3 & 4



Baseplate: ~32.5 $\times 10^{-5}$ n/s

Moderation: 1.5"

Bkg: T-1 = .7353 × 901.5 = 665.6 T-2 = .5754 × 1557.6 = 896.2

Pos.	T-1	T-1'	Eff. Factor	10^5 n/s	M	T-2	T-2'	Eff. Factor	10^5 n/s	M
7.861	12826/10	10.28	1.319×10^6	135.59	4.17	13357/10	7.33	1.750×10^6	128.28	3.95
	1282.6					1335.7				
	−665.6					−896.2				
	617.0					439.5				
0.003	14131/10	12.96	1.319×10^6	168.35	5.06	14215/10	8.76	1.750×10^6	153.30	4.72
	1413.1					1421.9				
	−665.6					−896.2				
	747.5					525.7				