UCRL-MI-135701-PH-2-VOL-5

Array Experiments
Phase 2 - Volume 5
Phase 3 - Volume 1

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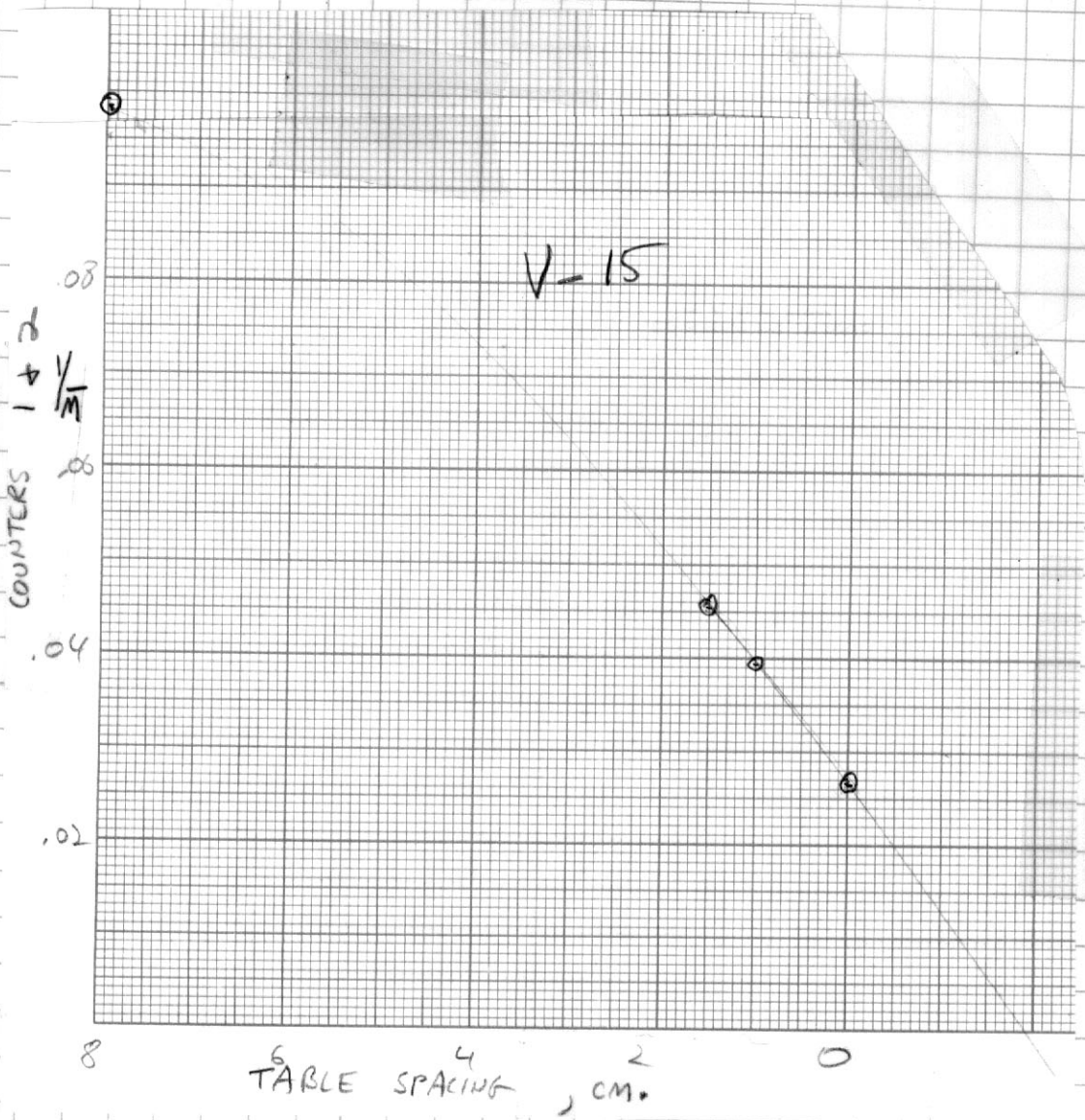
ARRAY EXPERIMENTS PHASE II

VOLUME 5

Phase III Pg. 5-1

PHASE III

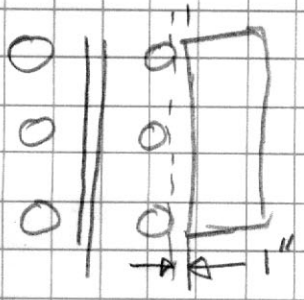
VOLUME 1


V-15
.08
.06
.04
.02
COUNTERS
8
6
4
2
0
TABLE SPACING, CM.

Continuing experiment on 3^3, 6 Kg Base Array

Main series completed; experiment are proceeding on effect of body reflector (simulator) on 2/3 Array (1 table) loading

V-16 STS = 8,24



Lateral .721 + 7,518 = 8,239 cm
Vertical .108 + 3,810 = 3,918 cm

Ports: 1-37 less #7, Base Rate 7.316×10^{6} n/s

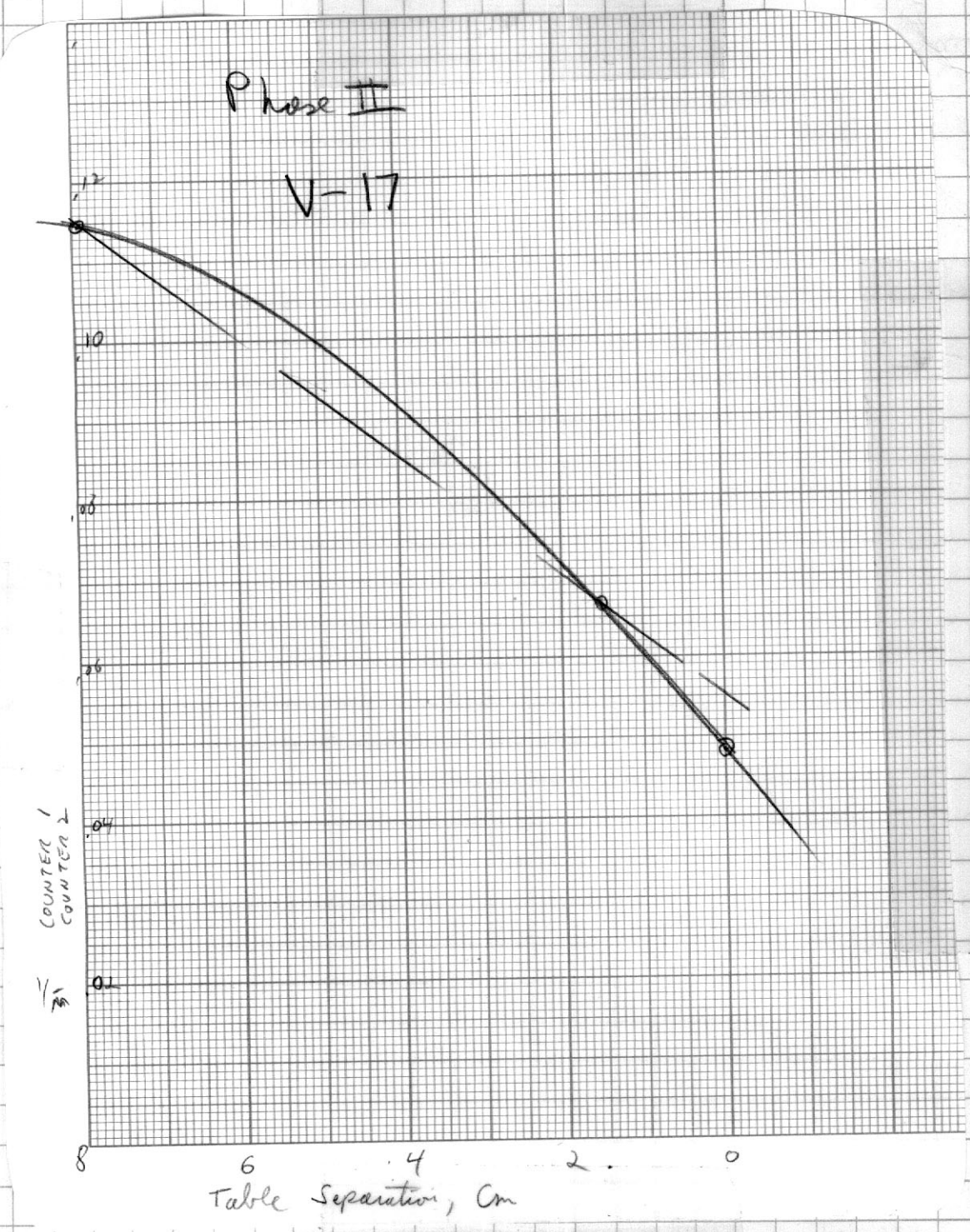
Ports 38-55 on wall giving BKgd: T-1: 240 cpm, T-2: 387 cpm

Body Simulator is 1" from column on control table

Pos, cm	T-1	Factor 1	M-1	T-2	Factor 2	M-2
7.941	8109/2	2.641×10^{-3}	10.07	9740/2	2.304×10^{-3}	10,29
	4055 cpm			4852 cpm		
	-240 cpm			-387 cpm		$\bar{M}$ = 10,18
	3815 cpm			4465 cpm		
1.500	17050/2		21.88	20,095/2		22.26
	8525			10,048		
	-240			-387		$\bar{m}$ = 22.07
	8285			9661		
1,000	19604/2		25,25	23043/2		25,65
	↓9802			↓1522		
	9562			11135		$\bar{m}$ = 25,45

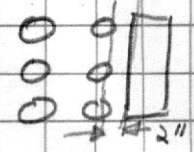
[Temps: 70, 90, 85]

0.000	28,325/2		38,09	33,327/2		37,50
	14,663			16,664		
	↓ 14,423			↓ 16,277		$\bar{m}$ = 3780


Phase II
V-17
1.2
1.0
.8
.6
.4
.2
8
6
4
2
0
COUNTER 1 / COUNTER 2
Table Separation, Cm

XBG-67/1-125

Assembly V-17 STS = 8.24



Lateral: 8.239, Vertical STS 3.918 cm

Body Simulator: 2" from columns on control table.

P_∞	T-1	Factor 1	M-1	T-2	Factor 2	M-2
7.941	6939/2	2.641×10^{-3}	8.53	8529/2	2.304×10^{-3}	8.93
	3470			4265		
	-240			-387		$\bar{M} = 8.73$
	3230			3878		
1.500	11895/2		15.07	13918/2		15.14
	5948			6959		
	-240			6572		$\bar{M} = 15.11$
	5708					
0.000	40271/5		20.64	47535/5		21.01
	8054			9507		
	7814			9120		$\bar{M} = 20.82$

Temps: 70, 83, 87

In an effort to have more reliability in the multiplications of the runs we just finished, we are going to 1) check the effect of the Reflector on efficiency factors and 2) check our dead-time. The dead-time was last checked on 1/19/68. See Page 69, Volume 3. At that time we decided to use $.2 \times 10^{-6}$ min as dead time for both counters.

7/22/68 Efficiency Factors with reflector.

$S.T.S._{x-y}$ = 8.24 cm.

(same as runs V-14 through V-17)

(10 MIN COUNTS)

Col. #	Pos	T-1	T-2
1	89	6486	8249
	110	6452	8429
	131	6381	8416
2	89	6776	7598
	110	6930	7757
	131	6966	7945
3	89	7145	7102
	110	7294	7234
	131	7499	7318
4	89	6213	8557
	110	6276	8837
	131	6392	8735

Col	P_{02}	T-1	T-2
5	89	6795	7793
	110	6963	7808
	131	7025	7866
6	89	7532	7103
	110	7498	7119
	131	7755	7078

* less BKgd

T-1 AVG = 691.0 cpm − 4.0 = 688.0 cpm
T-2 AVG = 783.0 cpm − 3.0 = 780.0 cpm

(* 60 MIN BKGD CT. T-1 : 243 , T-2 : 183)

∴ Efficiency Factor : T-1 : 1.134×10^6 , T-2 : 1.000×10^6

(We Had been using T-1 : 1.159×10^6 T-2 : 1.011×10^6)
(so we weren't too bad off)

7/24/63

Real Time Study

Bkgd. T-1 4.0 cpm ; T-2 3.0 cpm

Counter # T-2

	MCR-8-7	427,659/5 =	85,531.8 cpm
P-11 +	MCR-8-7	733,212/5 =	146,642.4 "
P-11		314,642/5 =	62,928.4 "

From Evans, Atomic Nucleus Page 789 $\rho = \dfrac{C_1 + C_2 - C_{12} - B}{2 C_1 C_2}$

$$\rho_{\text{COUNTER 2}} = \frac{85,531.8 + 62,642.4 - 146,642.4 - 3.0}{2(85,531.8 \times 62,928.4)} = .1685 \times 10^{-4} \text{ min}$$

Re-do T=2 to check for repeat-ability

	MRC-8-7	474,685/5	= 94,937.0
P-11	& MRC-8-7	800,581/5	= 160,116.2
P-11		337,767	= 67,553.4

$$\rho = \frac{94,937.0 + 67,553.4 - 160,116.2 - 4.0}{2(94,937.0 * 67,553.4)} = .1848 \times 10^{-6}$$

∴ We can say

$$\rho_1 = .175 \times 10^{-6} \text{ sec}$$

Counter #1

	MRC 8-7	505,120/5	= 101024.0
P-11 +	MRC 8-7	923,546/5	= 184709.2
	P-11	431,448/5	= 86286.6

$$\rho = \frac{C_1 + C_2 - C_{12} - B}{2 C_1 C_2}$$

$$\rho = \frac{101024.0 + 86286.6 - 184709.2 - 4.0}{2(101024.0 \times 86286.6)} = \frac{2597.4}{2(.8717 \times 10^{10})} =$$

$$\rho = \frac{.25974 \times 10^4}{1.7434 \times 10^{10}} = 0.148984 \times 10^{-6}$$

RE-do T-2 to check for REPEATABILITY:

MRC 8-7	305,530/5	= 61106.0
MRC 8-7 + P-11	731,737/5	= 146347.4
P-11	437,990/5	= 87598.0

$$\rho = \frac{61106.0 + 87598.0 - 146347.4 - 4.0}{2(61106.0 \times 87598.0)} = \frac{2352.6}{2(.53528 \times 10^{10})}$$

$$\rho = \frac{.23526 \times 10^4}{1.07056 \times 10^{10}} = 0.2197 \times 10^{-6}$$

The discrepancy is a bit too much, lets try it again

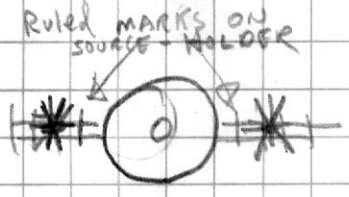
then* $\rho_{T-2} = .1825 \times 10^{-6}$

7/25/68

Question: is this just scatter or is there a systematic error, such as dead time being a function of count rate, or source to source distance? To investigate both of the above at once we will do a dead time series as a function of distance from the counter

T-2

DISTANCE FROM COUNTER



	ρ_{T-2}
1"	.2102
2"	.2040
3"	.1918
4"	.2243

It appears there is no reason to believe we have anything but scatter.

SUMMARY OF MEASUREMENTS OF ρ

T-1: .1490, .2197, .1825 } $\rightarrow .184 \times 10^{-6}$ MIN

T-2: .1685, .1848, .2102, .2040, .1918, .2243 } $\rightarrow .197 \times 10^{-6}$ MIN

$.193 \times 10^{-6}$ min/count

Since we are only .007 away from what we having been using for dead-time ($.2 \times 10^{-6}$), there is no compelling reason to change

* We are going to eliminate recording the calculations.

7/29/68

We Have Changed Counters and are now counting with Reuter Stokes RSN-7A-MG

T-1 K-232
T-2 K-228 (1500 Volts)

We are going to Run dead time determinations on these Counters

T-1
.3187 X10^{-6}
.3191 X10^{-6}
.3189 X10^{-6}
} .3189X10^{-6}

T-2
.3081 X10^{-6}
.3090 X10^{-6}
.3083X10^{-6}
} .3085 X10^{-6}

good repeatability!

7/30/68

Repeat with sources far from counter

.3000 X10^{-6} O.K.!

AS DEAD TIME WE WILL USE .3 X10^{-6}

60 MIN. BKGD.'s

T-1 T-2
57 55

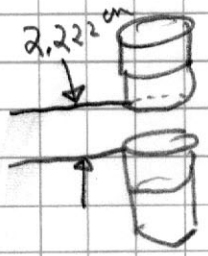
2^3 6 Kg Array:

Density Analog technique predicts critical volume of 2^3 6Kg array at 1.1101 liters. This would imply a cube, 10.354 cm. on a side. However, at this z spacing we cannot even get a regular heat sink between double-packs so we will have to live with a some-what larger z spacing than $x\text{-}y_{CRIT}$. The minimum spacing we care to use is .108 cm (CAN ENDS)

+ .479 cm (TOP HEAT SINK & ON TOP OF BOTTOM DOUBLE PACK)
+ .635 cm (BOTTOM HEAT SINK & BOTTOM OF TOP DOUBLE PACK)
+ 1.000 cm SPACER (WE WANT SOME AIR-SPACE BETWEEN PACKS!!!) = 2.222 cm; We will measure what we do use.

$\therefore Z_{CTC} \approx 11.982$ cm

To see if we can safely load:

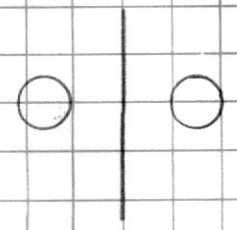


We are going to run:

Base-to-base for this experiment is .590"

We will determine Eff. Factor for the geo. below

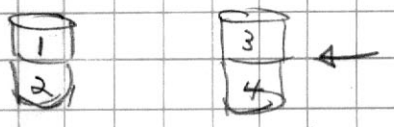
BKg = less than 1 g/m



Source Pos (MRC 8-7)		T-1	T-2
110	g/m	2848.0	2796.1
	g/s	47.47	46.60
	Eff. Factor	2.739×10^5	2.790×10^5

Assembly W-1 1st Safety Experiment
(to determine safety of loading 1 column)

Lateral: .721 + 1.499 = 2.220 cm →
Vertical: NONE

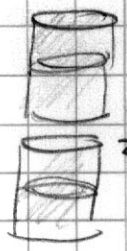


Parts: 1-4, Base Rate 8.124×10^5 n/s

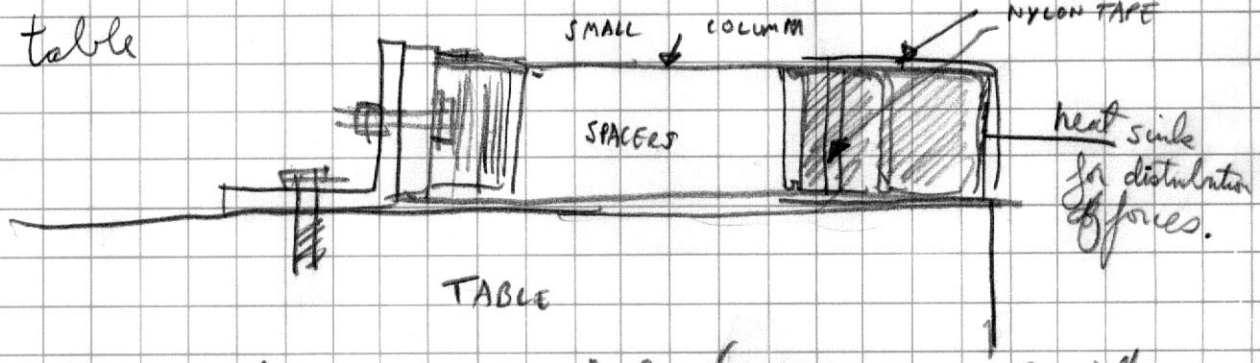
Pos	T-1	Eff Fac	10^5 n/s	M-1	T-2	Eff Fac	10^5 n/s	M-2
7.931 cm	3712/5	2.739×10^5	33.881	4.17	3659/5	2.790×10^5	34.038	4.19
	1237 cps				12.20			
						$\bar{M} = 4.18$		
.000	9326/10		42.56	5.24	8994/10		41.82	5.15
	15.54				14.99			
						$\bar{M} = 5.20$		

We can therefore load one col. with two 6-kg parts with a STS_z of 2.222 cm. We will now continue with the safety experiments with
$STS_{xy} = 3.100$ cm $STS_z = 2.222$ cm

The preceding should demonstrate that



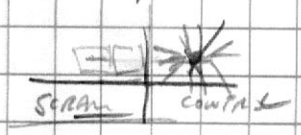
is safe. However, we have decided to do the experiment that is really the correct proof. We are going to load double-billets horizontally, one one each table. The test set-up will be the same as was used on the small assembly table



This set-up was viewed (and sandwiched with 6.2 Kg of lead, brass, + steel cylinders) and approved by S. Kreseritch of Hazards Control + J. Padgett of M.E. J. Hovey " " since all our Assembly Procedure 2 says is that the P_u would be loaded "into columns" The regular method of loading had been implied. This approval keeps us honest.

We are going to do source counts to develop efficiency factors.

I) For Horizontal tube experiment



Bkgd: (2 columns on well)

T-1	T-2	T-3	T-4
5734/20	19332/20	13185/20	6613/20
286.7 cpm	966.6 cpm	659.3	330.7

1) Source with table full closed

35324/10	40255/10	33674/10	17326/10
3532.4	4025.5	3367.4	1732.6
-286.7	-966.6	-659.3	-330.7
3245.7 cpm	3058.9 cpm	2708.1 cpm	1401.9 cpm
= 54.095 cps	50.982 cps	45.135 cps	23.365 cps

2) Source with table open 1 cm

35745/10	39867/10	33600/10	17378/10
3574.5	3986.7	3360.0	1737.8
-286.7	-966.6	-659.3	-330.7
3287.8 cpm	3020.1 cpm	2700.7 cpm	1407.1 cpm
= 54.797 cps	50.335 cps	45.012 cps	23.452

∴ Efficiency Factors are for tables closed

2.403×10^5 2.550×10^5 2.880×10^5 5.564×10^5

and for 1 cm separation (combination of 1 & 2)

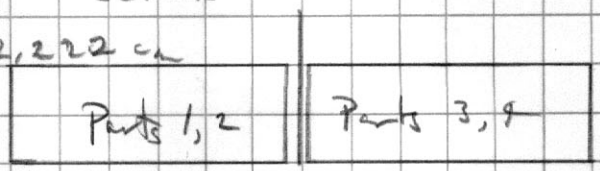
2.388×10^5 2.566 2.884×10^5 5.553×10^5

8/5/68

We will begin the horizontal tube experiments

Assembly W-2

Spacing = .108 + 2.114 = 2.222 cm



Parts 1, 2, 3, 4

Base Rate: 8.124×10^{-5} n/s

Pos	T-1	E.T.F. factor	10^{-5} n/s	M	T-2	E. F.	10^{-5} n/s	M
2.938	4045/s 138.8	2.385×10^{-5}	32.19	3.96	3689/s 122.7	2.516×10^{-5}	31.44	3.88
1.000	9536/s 152.53		36.42	4.48	9264/s 142.13		36.87	4.49
0.000	9675/10 161.25	2.403	38.75	4.77	8553/10 149.88	2.550	38.22	4.70

8/6/68

We will now repeat the above assembly but with as close a spacing as possible.

Assembly W-3

Spacing = .460 + .036 (tape) + .025 (safety spacer) + = .521

Parts 1, 2, 3, 4

Base Rate: 8.124×10^{-5} n/s

Pos	T-1	E. F.	10^{-5} n/s	M	T-2	E. F.	10^{-5} n/s	M
2.930	3999/s 133.3	2.388×10^{-5}	31.83	3.92	3856/s 128.5	2.586×10^{-5}	32.97	4.06
2.000	4664/s 155.5		37.13	4.57	4524/s 150.7		38.67	4.75

$\bar{m}$ = 4.66

$\sqrt{m}$ = .2146

Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
1.000	5226/s	2.388	41.60	5.12	4655/s	2.566	39.82	4.90
	179.2				155.2		$\bar{M}$ = 5.01	1/$\bar{M}$ = .1996
0.000	116.15/80	2.903	46.52	5.73	11054/10	2.550	46.98	5.78
	193.58				184.23		$\bar{M}$ = 5.733	
							1/$\bar{M}$ = .1738	

T/C's R = 71 #1 = 83 #2 = 98

We will now load 4 parts on the control & 2 on the screw for a total of 6 parts with a spacing of ~.460 cm between them.

Assembly W-4

Spacing = .460 + .036 (tape) + .025 (safety spacer) = .521 cm

Parts 1, 2, 3, 4, 5, 6

Base Rate: 12.121×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.585	8180/s	2.388×10^3	65.12	5.37	7206/s	2.566×10^3	65.80	5.44
	272.7				256.83			
1.000	9813/s		78.11	6.44	9587/s		78.31	6.46
	327.1				305.2			
0.000	22036/10	2.903	88.49	7.30	20749/10	2.550	88.18	7.27
	368.26				345.81			

T/C's R = >0 #1 = 86 #2 = 98

8/7/68

We will now put 2 6-Kg parts in a large Col. with the spacing of 0.46 cm
Bottom spacing: 25, 25, 25, 3, .3 cm

Scram | Control

Assembly W-5:

Spacing SF_3: .46 cm

Parts 1, 2, 3, 4

Base Rate = 8.124×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
0.000	9769/10	2.606×10^5	42.42	5.22	9294/10	2.8×10^5	43.37	5.33
	16.28				15.49			

T-3	E.F.	10^5 n/s	M	T-4	E.F.	10^5 n/s	M
8756/10	3.038×10^5	48.32	5.46	8704/10	3.114×10^5	45.18	5.54
14.59				14.51			

Scram | Cont

Assembly W-6:

Spacing SF_3: .108 + 2.114 = 2.222 cm

Parts: 1, 2, 3 & 4

Base Rate: 8.124×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
0.000	7969/10	2.606	34.61	4.26	7507/10	2.8	35.03	4.31
	13.28				12.51			

T-3	E.F.	10^5 n/s	M	T-4	E.F.	10^5 n/s	M
7260/10	3.038	36.76	4.52	7143/10	3.114	37.09	4.57
12.10				11.91			

Eff. Factor determination for Assembly W-7
from opposite page 16

		T-1	T-2	T-3	T-4
Avg	c/m	1460.3	4050.4	2972.8	2938
	c/s-Bkg	19.87	51.93	38.82	43.69
	Eff. Fac.	6.573×10^{-5}	2.503×10^{-5}	3.348×10^{-5}	2.976×10^{-5}

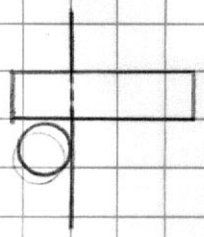
Eff Factor for Assembly W-8

		T-1	T-2	T-3	T-4
Avg.	c/m	1431.2	4114.7	3039.4	2818.9
	c/s-Bkg	19.39	53.00	39.93	41.77
	Eff. Factor	6.704×10^{-5}	2.453×10^{-5}	3.254×10^{-5}	3.112×10^{-5}

Assembly W-7:

Spacing STS_z: .108 + 2.114 = 2.222 cm

Spacing between col. & reflector = 1/8"



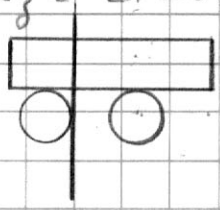
Parts 1, 2, 3, F

Base Rate = 8.124×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
0.000	2680/10	6.543×10^5	29.10	3.58	9863/10	2.503×10^5	39.87	4.86
	4.87				15.77			

	T-3	E.F.	10^5 n/s	M	T-4	E.F.	10^5 n/s	M
	7732/10	3.348×10^5	43.17	5.31	8268/10	2.896×10^5	41.01	5.05
	12.89				13.78			

Assembly W-8: STS_{xy} = 3.098 cm STS_z = 2.222 cm



Lateral: .721 + 2.377 = 3.098 cm

Vertical: .108 + 2.114 = 2.222 cm

Parts: 1, 2, 3, 4, 5, 6, 8, 9

Base Rate: 16.158×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.948	6425/5	6.704×10^5	143.60	8.89	12128/5	2.453×10^5	99.13	6.13
	21.42				40.41			

	T-3	E.F.	10^5 n/s	M	T-4	E.F.	10^5 n/s	M
	7735/5	3.356×10^5	84.00	5.20	7653/5	3.112×10^5	79.45	4.92
	25.8				25.53			

Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
0.000	632 c/s	6.704	14.32	8.75	24729/s	2.45-3	202.2	12.51
	21.08				82.93			

T-3	E.F.	10^5 n/s	M	T-4	E.F.	10^5 n/s	M
15-104/s	3.256	163.94	10.15	16208/s	3.112	168.14	10.41
50.35				54.03			

We will now determine Eff. Factor for the full array.

BKg = 18718/60 = 5.20 cps 12055/60 = 3.36 cps

Source Pos.		T-1	T-2
Col. 3			
101	c/m	31370/10	30253/10
119	c/m	31729/10	29956/10
Avg.	c/m	3154.9	3010.45
	c/s-Bkg	47.38	46.81
	E.F.	2.744×10^{-5}	2.777×10^{-5}
Col. 4			
101		33611/10	28188/10
119		33775/10	28884/10
Avg	c/m	3349.3	2833.6
	c/s-Bkg	50.62	43.87
	E.F.	2.568×10^{-5}	2.963×10^{-5}
Avg. Eff. Factor		2.656×10^{-5}	2.870×10^{-5}

We will now begin the full array 2^3 6-Key Series

Assembly W-9: STS_{xy} = 6.436 cm STS_z = 2.222

Lateral: .721 + 5.715 = 6.436 cm

Vertical: .108 + 2.114 = 2.222 cm

Parts: 1-17 less #7

Base Rate: 32.460×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2345	21261/s	2.656×10^{-5}	188.23	5.80	20260/s	2.870×10^{-5}	193.81	5.97
	70.87				67.53			
.000	62029/10		274.58	8.46	58176/10		278.28	8.57
	103.38				96.96			

T/C's R = 65 #1 = 95 #2 = 87

8/9/68

Assembly W-10: STS_{xy} = 4.785 cm STS_z = 2.222 cm

Lateral: .721 + 4.064 = 4.785 cm

Vertical: .108 + 2.114 = 2.222 cm

Parts: 1-17 less #7

Base Rate: 32.460×10^5 n/s

Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.936	25408/s	2.656×10^{-5}	224.94	6.93	23816/s	2.870×10^{-5}	227.85	7.02
	84.69				79.39			
-0.006	52238/s		462.99	14.25	49424/s		472.83	14.57
	174.13				164.70		$\bar{m}$ = 14.41	$1/\bar{m}$ = .0694
			R = 70		#1 = 96		#2 = 91	

Assembly W-11 : STS_{xy} = 3.943 cm STS_z = 2.222 cm

Lateral : .721 + 3.222 = 3.943 cm

Vertical : .108 + 2.114 = 2.222 cm

Parts : 1-17 less #7

Base Rate : 32.460×10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.950	28612/5	2.656×10^5	253.30	7.80	27004/5	2.870×10^5	258.33	7.96
	95.37				90.01			
1.000	13161		582.57	17.95	12103		578.91	17.83
	219.35				201.71			
0.000	15987		8847	27.26	18784		898.48	27.68
	333.11				313.06			

$\bar{m}$ = 27.47

$\frac{1}{\bar{m}}$ = .0364

R = 70 #1 = 54 #2 = 55

8/12/68

Assembly W-12 : STS_{xy} = 3.576 cm STS_z = 2.222 cm

Lateral : .721 + 2.855 = 3.576 cm

Vertical : .108 + 2.114 = 2.222 cm

Parts : 1-17 less #7

Base Rate : 32.460×10^5 n/s

Actuator On

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.949	12301/2	2.656×10^5	272.27	8.39	11752/2	2.870×10^5	241.05	8.66
A=15.39	102.57				97.93			

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
1.000	14268	2.653	631.60	19.71	13136	2.870	628.32	19.36
A=15.	237.80				21853			
.270	29477		1308.97	40.20	27529		1316.78	40.57
A=15.	491.28				45881			
+.010	37056		1656.75	51.10	34948		1689.37	52.09
A.15.	37472				35318		$\bar{M}$ = 51.57	
	624.53				588.63		$\gamma_{\bar{M}}$ = .01939	

T/C's R = 70 #Z = 105

We will now remove the control element and re-run

Assembly W-13: Same as W-12 but without control element

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
-.000	37283	2.653	1669.04	51.42	34955	2.870	1689.77	s-2.06
	37705				35326		$\bar{M}$ = 51.74	
	628.91				588.77		$\gamma_{\bar{M}}$ = .01933	

T/C's R = 70 #125 #Z = 105

Assembly W-14: STS_{xy} = 3.403 STS_8 = 2.222

Lateral: .721 + 2.682 = 3.403 in

Vertical: .108 + 2.114 = 2.222 in

Parts: 1-17 less #7

Base Rate = 32.96 $\times 10^5$ n/s Actuator On

Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.998	12976/2	2.656	287.19	8.85	12266/2	2.870	293.31	9.0
A=15.305	108.13				102.22			

Pos.	T-1	E.F.	10^5 in/s	M	T-2	E.F.	10^5 in/s	M
2.000	14530	2.656	653.18	19.81	13718	2.870	656.57	20.21
A=15.305	242.16				228.5			
.647	30005		1340.24	41.29	27816		1391.61	41.33
A=15.3	30277				28048			
	504.6				467.46			
-.002	82681		3753.06	115.62	77851		3817.56	117.62
A=15.3	84783				79818		$\bar{M}$ = 116.62	
	1413.05				1330.3		$Y_{\bar{m}}$ = .00857	

T/C's R = 70 #1 = 98 #2 = 80

We will now remove actuator

Assembly W-14': Same as W-14 but without actuator

Pos.	T-1	E.F.	10^5 in/s	M	T-2	E.F.	10^5 in/s	M
-.006	81527	2656	3699.54	113.97	77431	2.870	3751.73	116.81
	83574				79270		$\bar{M}$ = 115.39	
	1392.90				1321.16		$Y_{\bar{m}}$ = .00866	

T/C's R = 70 #1 = 97 #2 = 77

8/13/68

Assembly W-15: STS_{xy} = 3.327 cm STS_{θ} = 2.222 cm

Lateral: .721 + 2.606 = 3.327 cm

Vertical: .108 + 2.114 = 2.222 cm

Parts: 1-17 less #7

Base Rate: 32.46 x 10^5 in/s

Pos.	T-1	E.F.	10^5 in/s	M	T-2	E.F.	10^5 in/s	M
2.898	13205/2	2.656	292.27	9.00	12614/2	2.870	301.69	9.29
A=15.305	110.04				105.12			

Pos.	T-1	E.F.	10^5 γ/s	m	T-2	E.F.	10^5 γ/s	m
2.300	135770	2.657	600.68	18.51	130455	2.870	623.97	19.23
A=15.305	22616				21741		$\bar{m}$ = 18.87	
							$Y_{\bar{m}}$ = .05299	
.800	28694		1267.57	39.06	26832		1283.76	39.54
A=15.3	47740				44720		$\bar{m}$ = 39.30	
							$Y_{\bar{m}}$ = .02545	
.250	57592		2594.25	79.92	54368		2643.68	81.48
A=15.3	58605				55268		$\bar{m}$ = 80.68	
	97675				92113		$Y_{\bar{m}}$ = .01239	
-.008	112892		5172.51	159.35	105969		5235.31	161.28
A=15.3	116850				109848		$\bar{m}$ = 160.32	
	194750				182815		$Y_{\bar{m}}$ = .006238	

R=20 $\bar{R}$ = 99 R_2 = 76

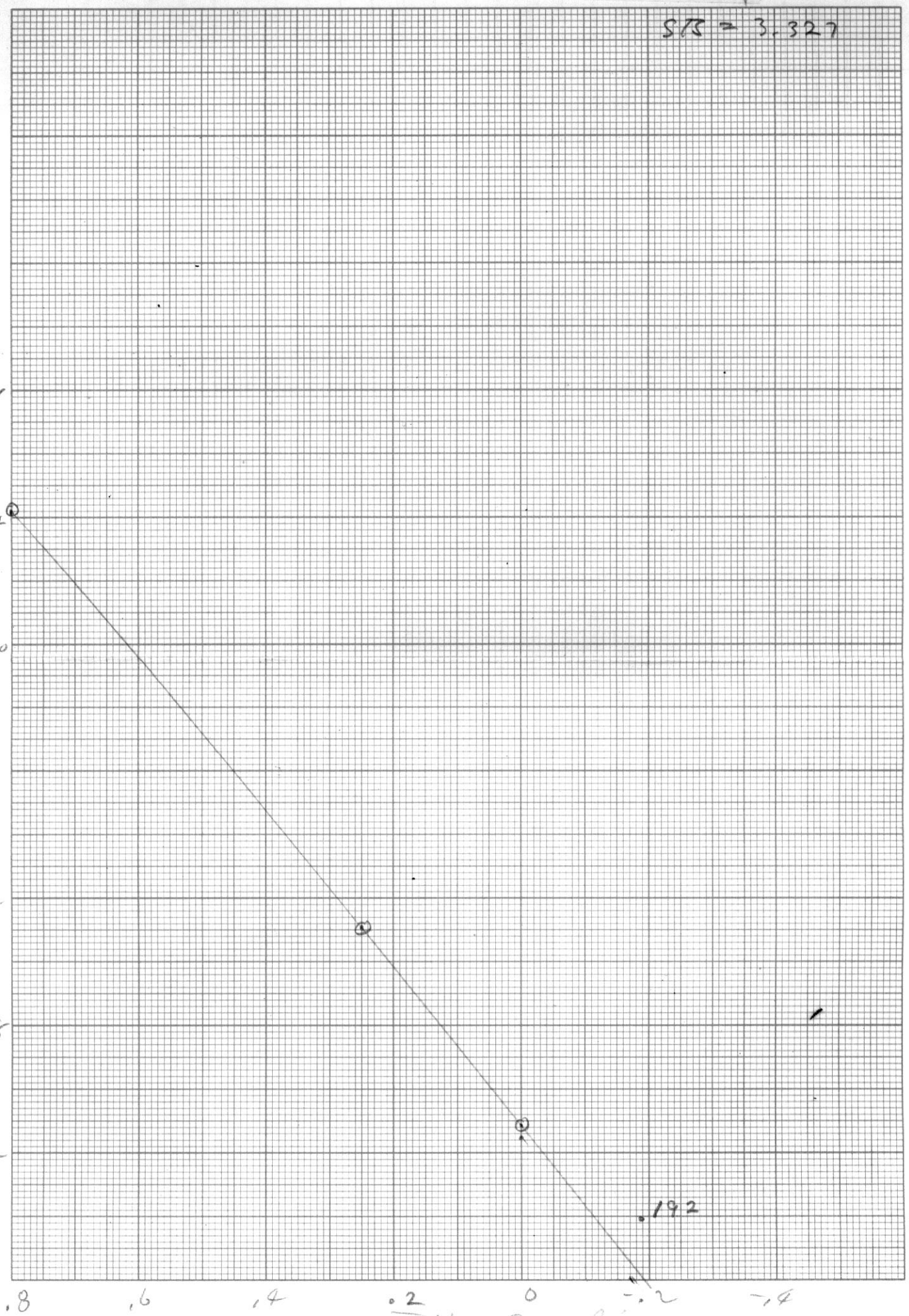
There seems to be some problem with the last run since the mult. should have been ~ 220. We checked the array & all seemed correct so we will re-run.

Pos.	T-1	E.F.	10^5 γ/s	m	T-2	E.F.	10^5 γ/s	m
2.930	133212				124242			
A=15.								
2.300	14078				12783			
.800	28808				27012			
.250	57953				54804			
.000	113855				105925			

We will try to determine our problem

Assembly W-16

SG = 3.327



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8/14/68

Because of our new threaded bases there are four starting points and therefore there can be a change in col. bowing. We checked this by rotating the cols. 180°. We picked up ~ 6 mils on the screen table. On the control table we picked up ~6 mils by only rotating one col. 180°. When we rotated both cols. the spacing went the wrong direction (longer) We will now re-run the previous array with cols. 1, 2 & 3 rotated 180°. We checked between tables & E-W and found only one dimension different by about 8 mils (E & NS)

Assembly W-16: Same as W-15 but with cols. 1, 2, 3, ~~rotated~~ 180°

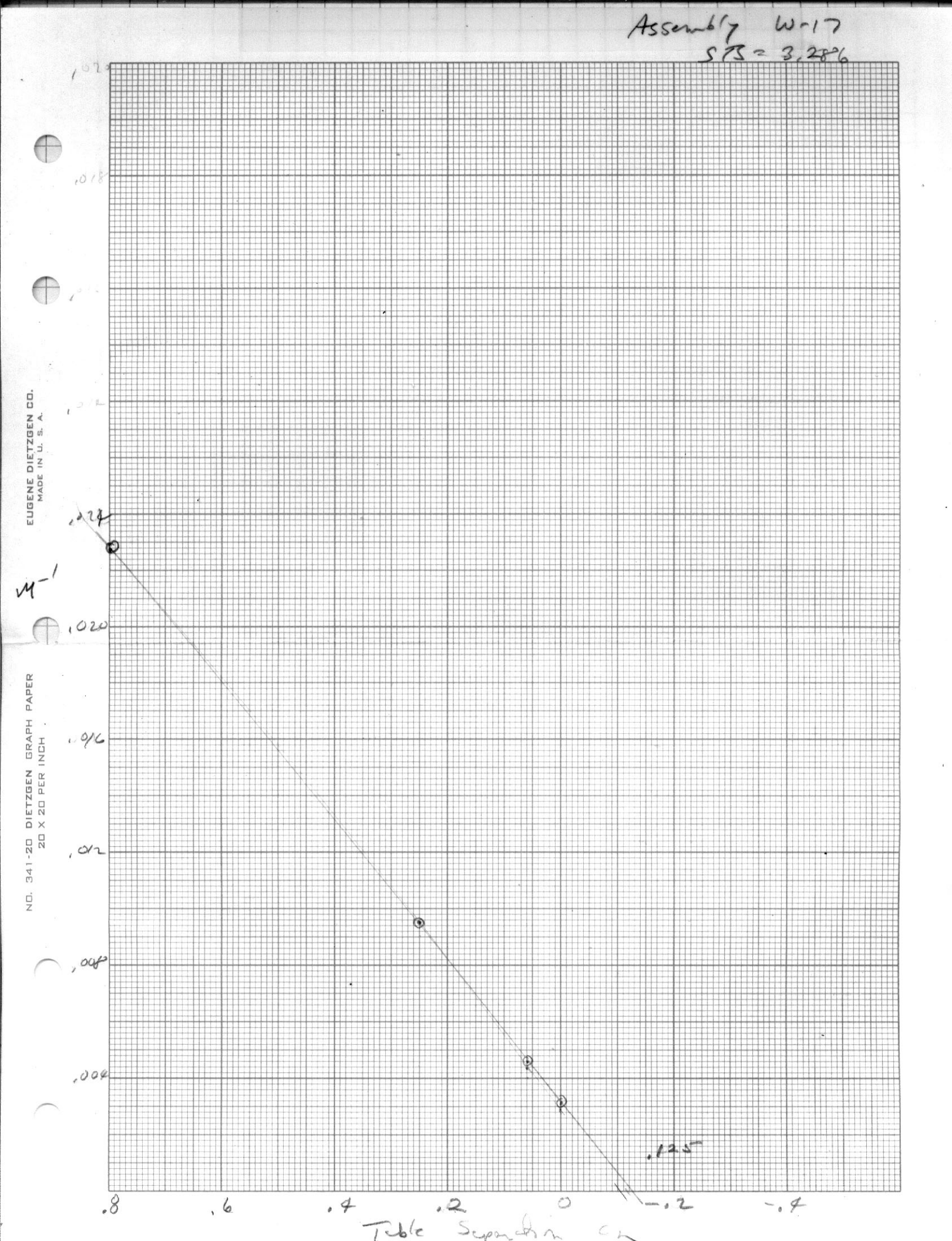
Pos.	T-1	E, F.	10^5 T/S	M	T-2	E, F.	10^5 T/S	M
29.84	13320/2	2.657			12538/2	2.670		
A=15.								
2.300	14131				13088			
A=15.								
.800	30123		1333.44	41.08	28141		1346.09	41.47
	503.05				469.02		$\bar{M}$ = 41.28	
							$1/\bar{M}$ = .02422	
.250	63957		2886.54	88.93	60838		2568.38	91.32
	↓65-209				↓61970		$\bar{M}$ = 90.13	
	1086.8				1032.87		$1/\bar{M}$ = .01110	
-.009	143854		6655.90	205.03	136681		6817.90	210.02
A=15.	↓15-03F9				↓142524		$\bar{M}$ = 207.53	
	25-05.8				2375.40		$1/\bar{M}$ = .00481	

This must have been it!

This R-70 #1 = 124 #2 = 88

Assembly W-17

SS = 3,286



W-1

Table Separation

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Assembly W-17 : $STS_{x_1} = 3.286$ $STS_3 = 2.222$ in

Lateral : .721 + 2.565 = 3.286 in

Vertical : .108 + 2.114 = 2.222 in

Parts : 1-17 less #7

Base Rate : $32,460 \times 10^{-5}$ in/s

Pos,	T-1	E, F.	10^{-5} in/s	M	T-2	E, F.	10^{-5} in/s	M
2.947	13403/2	2.656	296.65	9.14	12529/2	2.870	299.93	9.22
A=15.297	111.69				104.33			
2.300	14131		625.54	19.27	13402		641.10	19.75
A=15.3	235.52				223.38		$\bar{M}$ = 19.51	
							$\gamma_{\bar{m}}$ = .05126	
.800	31740		1418.99	43.70	29692		1433.05	44.15
A=15.3	32044				29559		$\bar{m}$ = 43.93	
	534.07				499.32		$\gamma_{\bar{m}}$ = .02276	
.250	79382		3367.25	103.75	70078		3423.97	105.49
A=15.3	76079				71512		$\bar{m}$ = 104.62	
	1267.98				1193.02		$\gamma_{\bar{m}}$ = .009558	

T/C's R = 70 #1 = 81 #2 = 86

.060	150853	6994.58	215.48	141650	7076.30	218.00
A=15.3	158010			147937	$\bar{M}$ = 216.74	
	2633.50			2465.61	$\gamma_{\bar{m}}$ = .004614	
-.008	216031	10225.55	315.01	205825	10492.66	323.24
A=15.3	230999			219359	$\bar{m}$ = 319.13	
	3849.98			3655.98	$\gamma_{\bar{m}}$ = .003139	

T/C's R = 70 #1 = 87 #2 = 87

8/15/68 There seems to be a problem with this series so we will re-check assembly W-14.

Assembly W-14: Re-run Actuator off

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.987	12856/2	2.651			12938/2	2.870		
2.000	14347/				13350/			
.600	30699				25148			
.090	63880				60356			
-.006	78962	3580.23	110.3		78681	3652.13	112.57	
	80879				76357	$\bar{M}$ =	111.4	
	1347.98				12725-2			

T/C's R = 70 #1 = 82 #2 = 97

This array reproduced to within 3.5%

There is a problem with the pulses to the Tubs. The pulses are being clipped by the amplifier. We can correct this by reducing the H.V. from 1500 v. to about 1200 volts. It doesn't appear that this is our major problem but we will make this change and then continue.

8/19/68

We will re-run Assembly W-14' to check electronics. We will then lower H.V. to Tubes + then normalize to this array.

Assembly W-14': Re-run Acts off.

Pos.	T-1	E.F.	10^5 T/s	M	T-2	E.F.	10^5 T/s	M
7.932	13066/2	2.656	289.21	8.91	12252/2	2.870	293.03	9.03
	105.89				102.10			
2.000	14435		638.58	19.685	13581		649.62	20.01
	290.58				226.35			
.600	30697 → 31180		1380.67	42.53	28917 → 29086		1391.29	42.86
	519.83				488.77			
0.000	79901 → 81200		3594.44	110.73	75811 → 76581		3682.27	113.38
	1353.33				1283.02			

$M = 112.085$, $Y_{in} = .00892$

This compares with the run of 8/15/68. We will now reduce the H.V. and take a disc. plateau and re-run & normalize.

Normalization for Eff. Factor

Pos.	T-1	E.F.	10^5 T/s	M	T-2	E.F.	10^5 T/s	M
7.945	12701/2	2.733			12041/2	2.920		
	105.84				100.34			
2.000	14320	2.677			13281	2.93		
	238.67				221.35			
.600	30313	2.716			28523	2.910		
	↓30499				↓28687			
	508.32				478.12			
0.000	79665	2.664			75016	2.901		
	↓80952				↓76158			
	1349.20				1269.30			

No change in EFF. FACTORS. GOOD

8/20/68

We will re-run Assembly W-16

Assembly W-16: Re-run $STS_{xy} = 3.327$ $STS_s = 2.222$

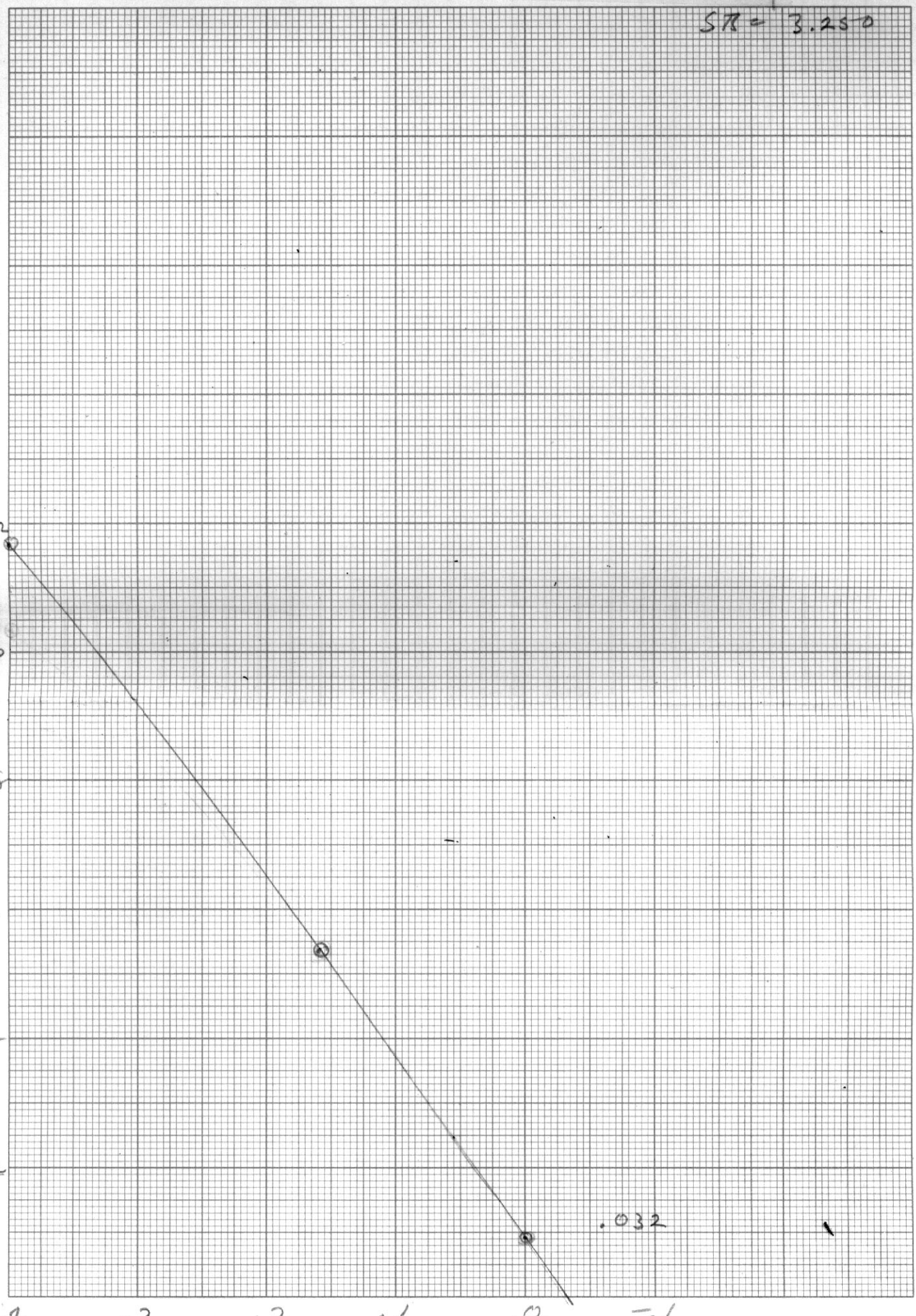
Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.993	12994/2	2.65×10^5	2855.95	8.81	12412/2	2.870×10^5	296.84	9.14
A=15.302	107.66				103.43	$\bar{M} = 8.98$	$\gamma_M = .11136$	
2.300	13636		603.62	18.60	12828		618.61	18.80
A=15.3	227.27				213.80	$\bar{M} = 18.75$	$\gamma_M = .053333$	
.800	30175		1335.76	41.15	28054		1341.93	41.38
A=15.3	502.92				467.57	$\bar{M} = 41.25$	$\gamma_M = .02424$	
.250	45504		2938.12	90.52	60887		2948.41	90.83
A=15.3	66373				61639	$\bar{M} = 90.68$	$\gamma_M = .01103$	
	1106.22				1027.32			
.000	155867		7121.88	219.4	147883		7268.89	223.94
	160886				151965		$\bar{M} = 221.65$	
	2681.43				2532.75		$\gamma_M = .00451$	

Assembly W-17: Re-run $STS_{xy} = 3.286$ $STS_s = 2.222$

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.936	13024/2	2.658×10^5			12535/2	2.870×10^5		
A=15.300								
2.300	14096				13101			
A=15.3								
.800	31801		1407.73	43.37	29827		1426.73	43.96
A=15.3	530.02				497.12	$\bar{M} = 43.67$	$\gamma_M = .02290$	
.250	78878		3365.07	103.67	71077		3488.82	106.25
A=15.3	76018				72108			
	1266.97				1201.68	$\bar{M} = 104.96$	$\gamma_M = .009527$	
.060	160160		7323.92	225.63	151187		7456.98	229.73
A=15.3	165455				155895			
	2757.50				2598.25	$\bar{M} = 227.68$	$\gamma_M = .004382$	

Assembly W-18

SR = 3.250



H-1

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Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
-.005	239389	2.656	11130.05	382.89	227645	2.870	11803.08	351.29
A=15.3	251432				238391			$\bar{M}$ = 347.09
	4150.53				3993.18			$\sqrt{\bar{m}}$ = .002881

T/C's R = 71 #1 = 8% #2 = 9%

8/21/68

Assembly W-18: $STS_{x,y}$ = 3.250 cm STS_{θ} = 2.222 cm

Lateral: .721 + 2.529 = 3.250 cm

Vertical: .108 + 2.114 = 2.222 cm

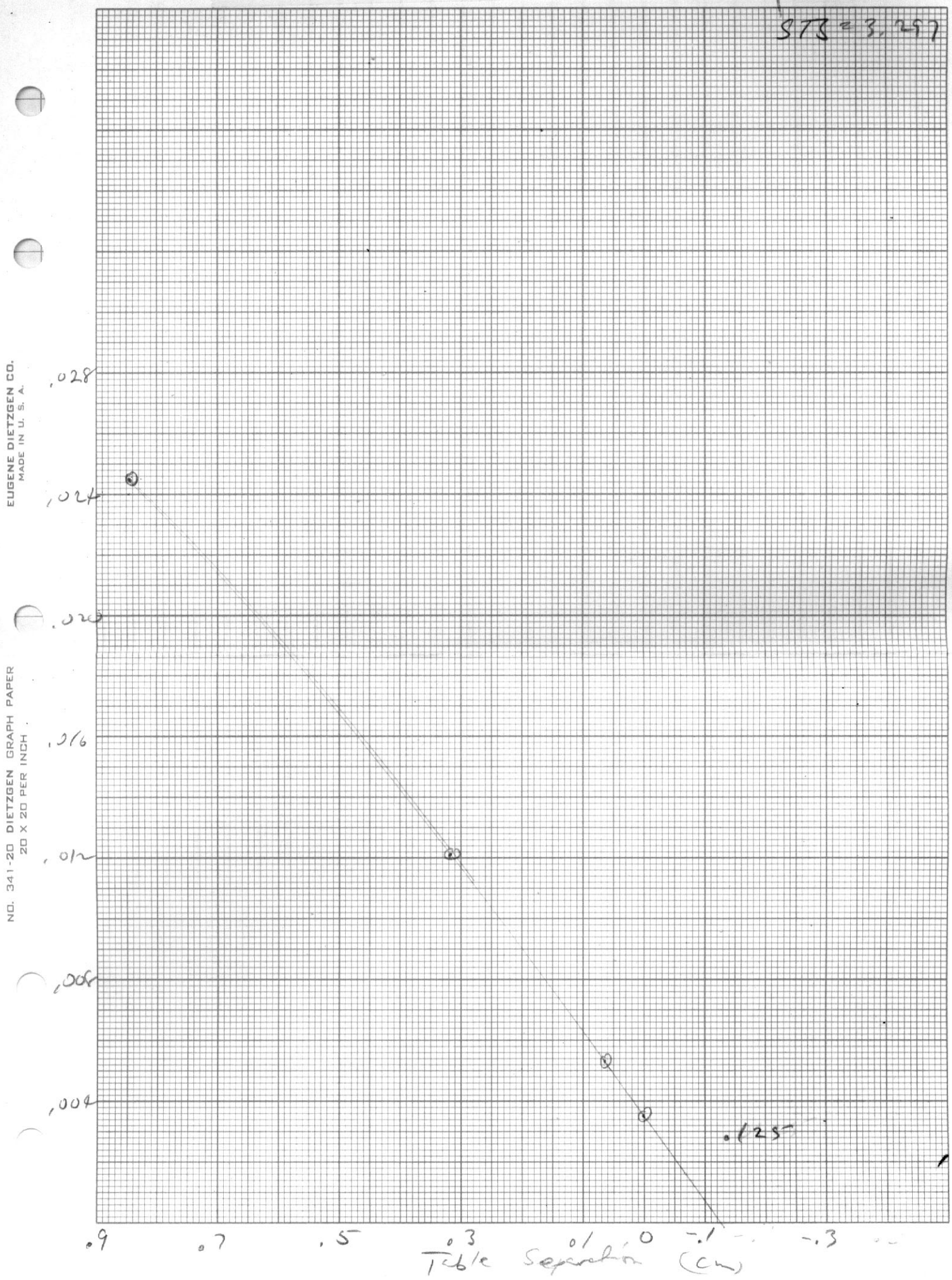
Parts: 1-17 less #7

Base Rate: 32.46×10^{-5} n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.587	133541/2	2.656	299.60	9.23	126071/2	2.870	301.52	9.29
A=15.297	111.28				105.06			
2.400	13885		614.05	18.94	13295		635.93	19.55
A=15.297	231.42				221.58			
.960	29389		1300.96	40.08	27342		1307.86	40.29
A=15.297	489.82				455.70			$\bar{M}$ = 40.19
								$\sqrt{\bar{m}}$ = .02488
.900	61357		2748.76	84.71	58165		2815.70	86.74
A=15.297	62120				58865			$\bar{M}$ = 85.73
	1035.3				981.08			$\sqrt{\bar{m}}$ = .01166
.160	133424		6068.24	186.95	125682		6166.51	188.97
A=15.3	137084				128917			$\bar{M}$ = 188.46
	2284.73				2148.61			$\sqrt{\bar{m}}$ = .005306

Assembly W-19

STS = 3.297



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Pos.	T-1	E.F.	10^5 #/s	M	T-2	E.F.	10^5 #/s	M
-0.001	682117	2.651	34564.11	1077.1	661398	2.870	36458.28	1123.2
A=15.3	78985				62185		$\bar{M}$ = 1100.2	
	131642				127031		$Y_{\bar{M}}$ = .000905	
	T/CS	R = 70			#1 = 84		#2 = 85	

8/22/68

Assembly W-19: SS_{xy} = 3.297 SS_δ = 2.222

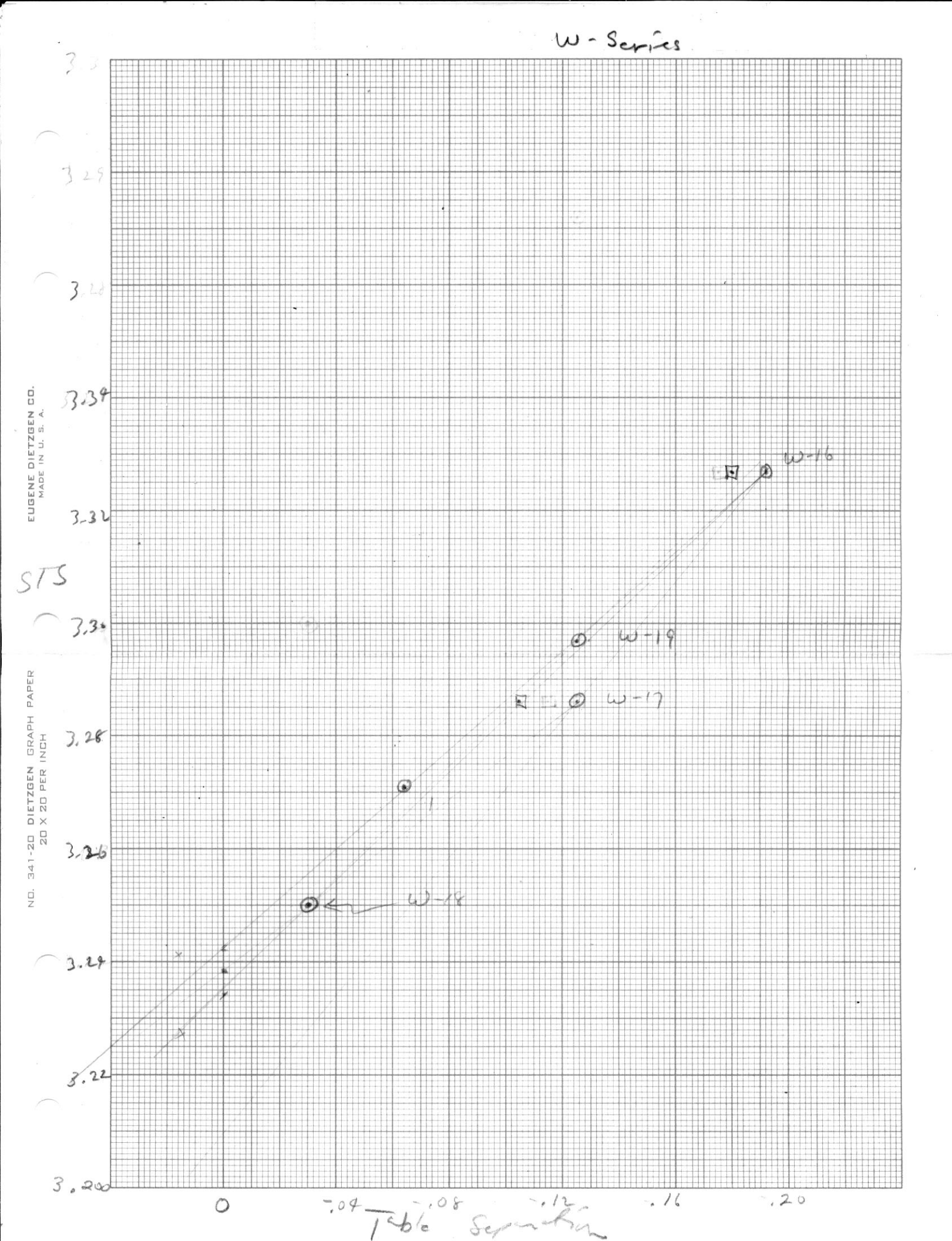
Lateral: .721 + 2.576 = 3.297 cm

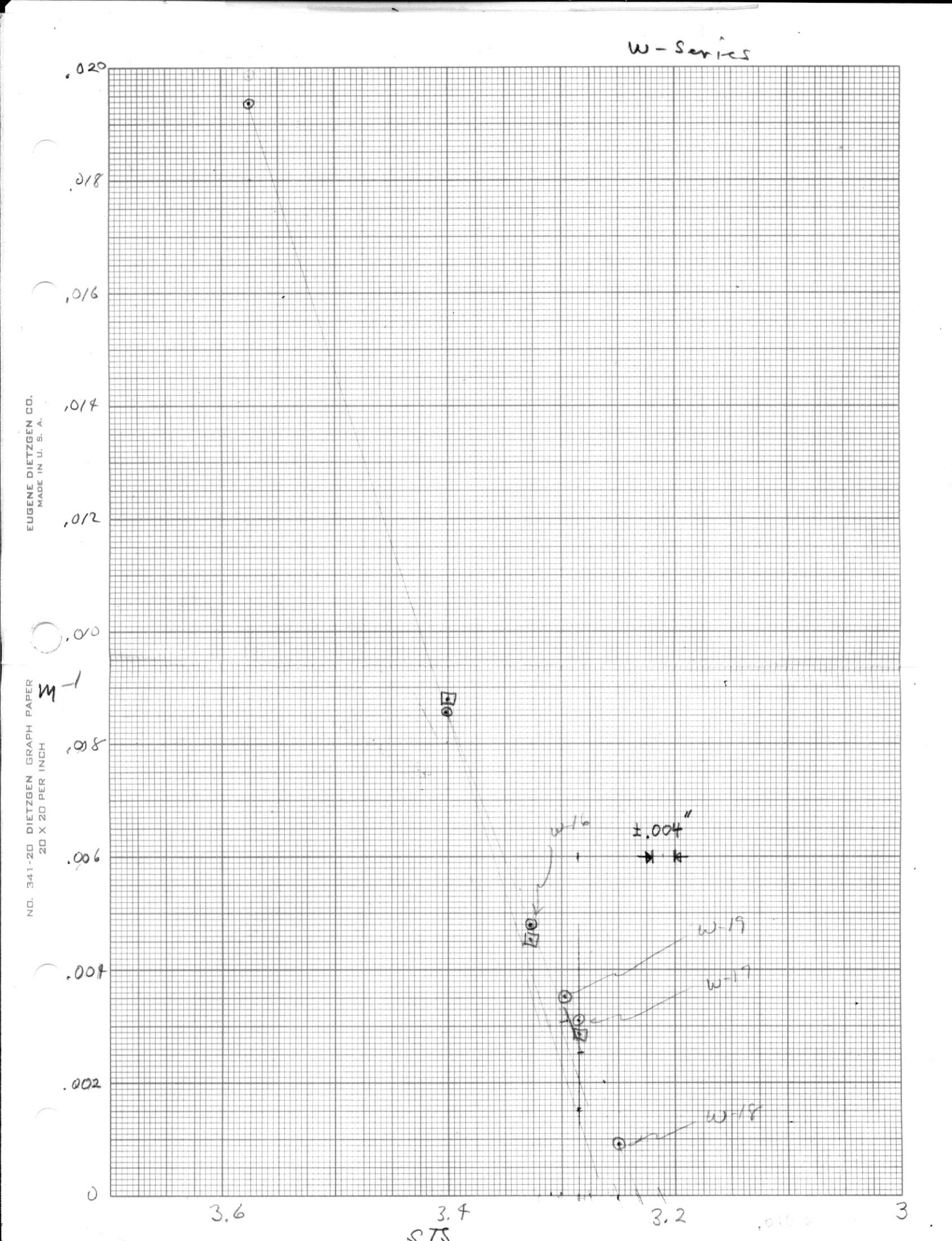
Vertical: .108 + 2.114 = 2.222 cm

Parts: 1-17 Less #7

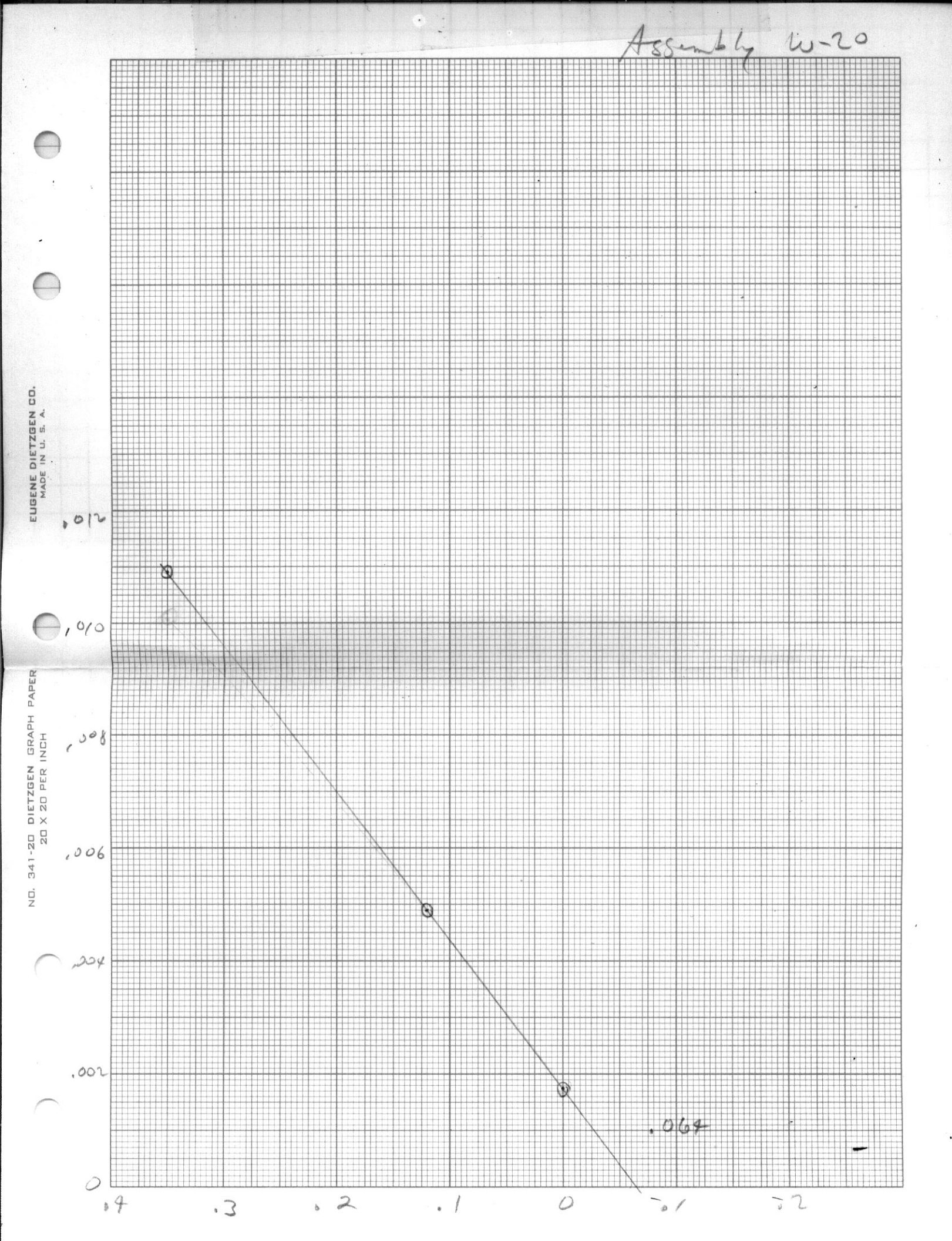
Base Pk: 32.86×10^5 #/s

Pos.	T-1	E.F.	10^5 #/s	M	T-2	E.F.	10^5 #/s	M
7.921	128022	2.658	283.34	8.03	123262	2.870	299.41	9.08
A=15.298	106.68				102.72			
2.300	13816		611.60	18.84	12959		621.75	19.16
A=15.298	230.27				216.65			
.849	29651		1312.58	40.44	27913		1335.18	41.13
A=15.298	494.18				465.22		$\bar{M}$ = 40.79	
							$Y_{\bar{M}}$ = .02452	
.318	59768		2647.86	82.50	55930		2705.64	83.35
A=15.298	60494				56564		$\bar{M}$ = 82.93	
	1008.23				942.73		$Y_{\bar{M}}$ = .01206	
.066	13172		5987.90	184.47	123953		6081.85	187.36
A=15.3	135269				127146		$\bar{M}$ = 185.92	
	2257.48				2119.11		$Y_{\bar{M}}$ = .005379	
-.003	19841		9146.07	281.76	187561		9342.02	287.80
A=15.3	206613				195304		$\bar{M}$ = 284.78	
	3443.55				3255.06		$Y_{\bar{M}}$ = .003411	
T/CS	R = 71		#1 = 85				#2 = 85	


W - Series
3.34
3.32
3.30
3.28
3.26
3.24
3.22
3.200
0
.04
.08
.12
.16
.20
W-16
W-19
W-17
W-18
STS
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH


W-Series
.020
.018
.016
.014
.012
.010
.008
.006
.004
.002
0
M-1
3.6
3.4
3.2
3
±.004"
W-16
W-17
W-17
W-18
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

Assembly W-20



EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

8/23/68

Assembly W-20 : STS_{xy} = 3.271 STS_8 = 2.222 cm

Lateral: .721 + 2.550 = 3.271

Vertical: .108 + 2.114 = 2.222 cm

Parts: 1-17 less #7

Base Rate: 32.46 $\times 10^5$ #/s

Pos,	T-1	E.F.	10^5 #/s	M	T-2	E.F.	10^5 #/s	M
7.933	13591/2	2.656	291.26	8.97	12463/2	2.870	298.08	9.18
A=15.256	109.66				103.56			
2.300	18321		633.58	19.53	13460		643.87	19.83
A=15.3	238.68				224.33			
.900	30367		1352.30	41.66	28126		1352.92	41.68
A=15.3	30599				28288		$\bar{M}$ = 41.67	
	509.15				471.90		$\gamma_{\bar{M}}$ = .02395	
.350	65618		2943.25	90.67	62022		3003.94	92.57
A=15.3	66485				62800		$\bar{M}$ = 91.61	
	1108.15				1046.67		$\gamma_{\bar{M}}$ = .01062	
.120	18425 3		6575.59	202.58	136257		6700.53	206.42
A=15.3	17858 5				140081		$\bar{M}$ = 204.50	
	2475.75				2334.68		$\gamma_{\bar{M}}$ = .004890	
-.308	380074		18208.82	560.95	361065		18614.91	573.47
A=15.3	411335				389162		$\bar{M}$ = 567.21	
	6855.58				6486.03		$\gamma_{\bar{M}}$ = .001763	

T/cs R = 70 #1 = 75 #2 = 83

9/9/68 We will now begin Eff. Factor determinations for The 3^3 6-Kg ½" Mod. Array. STS_{xy} = 8.908 cm STS_z = 5.762 cm

Source positions: 90, 113, 136

Mock HE Pos. = 94.9 cm from table to bottom HE with 1.26 cm spacer between HE

Col. 1 only

		T-1	T-2
Pos.	90	13200/s⁻	14561/s⁻
	113	13477/s⁻	15266/s⁻
	136	13858/s⁻	15210/s⁻
Avg.	$\bar{x}$	2702.3	3002.5⁻
	s_x	45.04	50.04
	E.F.	2.886×10^5	2.598×10^5

Col. 1 with Col. 4 in place

Pos.	90	13427/s⁻	14894/s⁻
	113	13797/s⁻	15498/s⁻
	136	13906/s⁻	15498/s⁻
Avg.	$\bar{x}$		
	s_x		
	E.F.		

9/10/68

Col. 4 with
Col. 1 in place

		T-1	T-2
Pos.	90	13532/s	15098/s
	113	14142/s	15518/s
	136	14106/s	15437/s
Avg. Cols. 1+4		ω_n 2763.7	3063.0
		ω_s 46.06	51.0 s^{-1}
		E.F. 2.822×10^5	2.547×10^5

Col. 1 with Cols
4 & 7 in place

Pos.	90	13732/s	14862/s
	113	13821/s	15229/s
	136	14206/s	15373/s

Col. 4 with Cols
1 & 7 in place

Pos	90	14144/s	15708/s
	113	14460/s	16075/s
	136	14209/s	15559/s

Col. 7 with Cols 1 & 4 in place

		T-1	T-2
Pos.	90	15724/5	17652/5
	113	16337/5	18170/5
	136	15322/5	17437/5
Avg. Cols 1, 4, & 7	$\dot{q}_m$	2932.3	3245.7
	$\dot{q}_s$	48.87	54.09
	E.F.	2.660×10^{-5}	2.403×10^{-5}

9/11/68

Col. 4 with Cols 1, 2, 3, 5 & 6 in place

Pos.	90	9092/5	15523/5
	113	9580	16062
	136	9718	15936

Col. 5 with Cols 1, 2, 3, 4, & 6 in place

Pos	90	11662	11569
	113	12199	12189
	136	12153	11929

Avg. Eff. Factors for Cols 1, 2, 3, 4, 5-X6

	T-1	T-2
q_m	2496.77	2458.48
q_s	41.61	40.97
E.F.	3.124×10^5	3.173×10^5

Col. 6 w. 1k Cols 1, 4, 3, 8, 5 in place

Pos	T-1	T-2
90	15726/5	9147/5
113	16331	9913
136	1605-F	9565

Col. 1 w. 1k Cols 2, 3, 4, 5 & 6 in place

Pos		
90	9006	15-350
113	95-35-	15-715-
136	9581	15-863

Col. 2 w. 1k Cols, 1, 3, 4, 5 & 6 in place

Pos		
90	115-06	11273
113	12366	11892
136	12161	11983

Col 3 w. 1k Cols 1, 2, 4, 5 & 6 in place

Pos		
90	15650	8893
113	16139	9903
136	16231	9983

← See page for Avg. Eff. Factors

9/12/68

Full Array

		T-1	T-2
Col. 1			
	Pos. 90	9911/5	15458/5
	113	9931	16307
	136	9994	16170
Col. 2			
	Pos 90	11764	11558
	113	12480	12348
	136	12453	12344
Col. 3			
	Pos 90	16044	9,319
	113	16,405	9,692
	136	16,523	9,870
Col. 4			
	Pos 90	9651 (9614)	16306
	113	10259 (10278)	16542
	136	10389 (10272)	16569
Col. 5			
	Pos 90	12317	12513
	113	13339	13183
	136	12948	13074

Full Array

		T-1	T-2
Col. 6			
Pos	90	16449/5	9529/5
	113	17064	10057
	136	16784	10244
Col. 7			
Pos	90	10033	18234
	113	10242	19174
	136	10347	18426
Col. 8			
Pos	90	13191	13238
	113	13859	13622
	136	13491	13683
Col. 9			
Pos	90	18341	9943
	113	18700	10412
	136	17825	10380

Full Array Avg. Eff Factors

$\bar{y}_m$	2668.4	2652.88
$\bar{y}_s$	44.47	44.21
E.F.	2.923×10^5	2.941×10^5

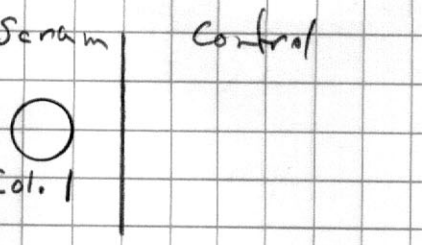
9/16/68 We will now begin the 3³ 6-kg ½" Mod. Safety Array. Bottom spacing = 25", 25", 15", 3"

Assembly X-1: STS_3 = 5.762 cm

Vertical = .108 + 5.654 = 5.762 cm

Parts: 1 - 6 Moderator = .5"

Base Rate: 12.121 X 10^{-5} n/s



Pos.	T-1	E. F.	10^5 n/s	M	T-2	E. F.	10^5 n/s	M
.000	12600/10 22.30	2.886X10^{-5}	64.36	5.31	13925/10 23.21	2.578X10^{-5}	60.30	4.98
							$\bar{M}$ = 5.15	

Assembly X-2: STS_{xy} = 8.908 cm STS_3 = 5.762 cm

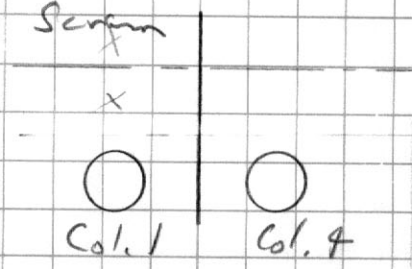
Lateral: .721 + 8.187 cm = 8.908 cm

Vertical: .108 + 5.654 = 5.762 cm

Parts: 1 - 13 less #1

Base Rate: 24.268 X 10^{-5} n/s

Moderator = .5"



Pos.	T-1	E. F.	10^5 n/s	M	T-2	E. F.	10^5 n/s	M
7.943	14584/5 48.98	2.822X10^{-5}	136.81	5.64	16060/5 53.53	2.547X10^{-5}	136.34	5.62
0.000	16103/5 53.68		151.48	6.24	18436/5 61.45		156.51	6.45

9/17/68

Assembly X-3: STS_{xy} = 8.908 cm STS_z = 5.762 cm

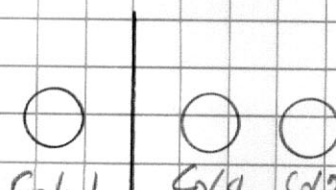
Lateral: .721 + 8.187 = 8.908

Vertical: .108 + 5.654 = 5.762

Parts: 1-19 less #7

Base Rate: 36.597×10^5 n/s

Moderator: 0.5"



Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.943	26969/s	2.660×10^5	239.13	6.53	30351/s	2.403×10^5	243.11	6.64
	89.90				101.17			
.003	29590/s		261.93	7.16	33561/s		268.89	7.35
	98.47				111.94			

Assembly X-4: STS_{xy} = 8.908 cm STS_z = 5.762 cm

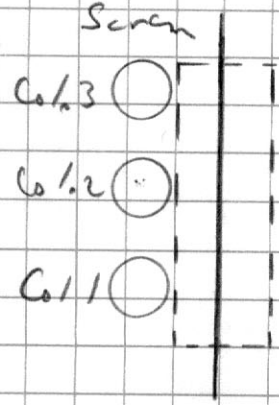
Lateral: .721 + 8.187 = 8.908

Vertical: .108 + 5.654 = 5.762

Parts: 1-19 less #7

Base Rate: 36.597×10^5 n/s

Moderator: 0.5"



Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.943	21153/s	3.154×10^5	232.39	6.08	21219/s	3.252×10^5	230.01	6.29
	70.51				70.73			
.001	28014/s		294.52	8.05	27733/s		300.61	8.21
	93.38				92.44			

Assembly X-5: STS_{xy} = 8.508 cm STS_3 = 5.762 cm

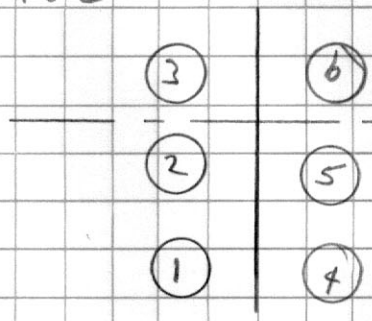
Lateral: .721 + 8.187 = 8.908

Vertical: .108 + 5.654 = 5.762

Parts: 1-37 less #7

Base Rate: 73.158 $\times 10^{-5}$ n/s

Moderator: 0.5"



Pos.	T-1	E.F.	10^{-5} n/s	M	T-2	E.F.	10^{-5} n/s	M
7.953	74057/s 246.86	3.124		10.54	74408/s 248.01	3.173		10.76
.000	194753/s 649.18		2028.00	27.72	194336/s 647.79		2055.44	28.10

$\bar{M}$ = 27.91

$\gamma_{\bar{M}}$ = .03583

Assembly X-6: STS_{xy} = 8.908 STS_3 = 5.762

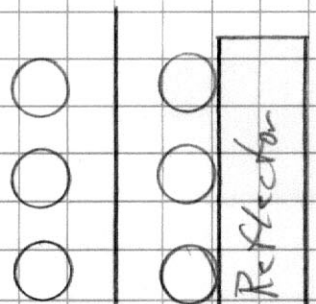
Lateral: .721 + 8.187 = 8.908

Vertical: .108 + 5.654 = 5.762

Parts: 1-37 less #7

Base Rate: 73.158 $\times 10^{-5}$ n/s

Moderator: 0.5"



Pos.	T-1	E.F.	10^{-5} n/s	M	T-2	E.F.	10^{-5} n/s	M
7.945	235991/s 147198 47646 794.10	3.124	2480.77	33.91	237933/s 475861 48043 800.71	3.173	2580.65	34.73

$\bar{M}$ =

$1/\bar{M}$ =

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
5.650	101610	3.124	5400.08	73.8	102231	3.173	5518.83	75.4
	103715				104359			
	1728.58				1739.31			
4.781	206473		11213.44	153.3	208781		11522.62	157.50
	215367				217888			
	3589.45				3631.46			

9/18/68

Assembly X-7: Same as X-6 but with the reflector 0.5" from the array

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.946	31378	3.124	1649.10	22.47	31227	3.173	1661.70	22.71
	31597				31422			
	526.28				523.70			
3.500	92600		4912.24	67.15	93169		5020.48	68.63
	94385				94935			
	1572.42				1582.25			
3.000	211054		11472.98	156.8	211808		11696.82	159.88
	220352				221182			
	3672.53				3686.36			

7/19/68

Assembly X-8: Same as X-6 but with the reflector 1.0" from the array.

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.945	27247	3.124	1439.48	19.68	27437	3.173	1450.95	19.83
	46078				45726			
4.000	59003		3108.79	42.49	58819		3142.68	43.03
	59708				59521			
	995.13				992.02			

Pos.	T-1	E.F.	10^4 n/s	M	T-2	E.F.	10^5 n/s	M
2.550	131496	3.124	2031.94	96.11	131268	3.173	2125.35	97.75
	135047				134813			
	2250.78				2246.88			

Assembly X-9: Same as X-6 but with the reflector 2.0" from the array

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.950	220158	3.124	1146.66	15.67	222458	3.173	1176.39	16.08
	366.92				370.78			
3.000	49033		2578.24	35.24	49508		2611.75	35.70
	49518				49388			
	825.30				823.13			
1.400	107097		5698.05	77.89	106828		5772.96	78.91
	109438				109164			
	1823.96				1819.80			
1.000	157613		8473.66	115.82	157886		8621.59	117.86
	162739				163038			
	2712.31				2717.30			

Assembly X-10: Same as X-6 but with the reflector 3.0" from the array

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
2.952	19979	3.124	1040.23	14.22	19780	3.173	1086.55	14.31
	332.98				329.83			
2.000	51268		2696.88	36.86	50549		2701.02	36.92
	51797				51075			
	863.28				851.25			
.575	107349		5712.08	78.08	107298		5798.51	79.27
	109707				109655			
	1828.45				1827.58			

Pos.	T-1	E.F.	10^5 psi	M	T-2	E.R.	10^5 psi	M
.063	199579	3.124	10541.09	144.05	198312	3.173	10691.74	146.6
	↓ 202458				↓ 202176			
	3379.23				3368.60			
.000	↓ 213607		11617.84	158.80	↓ 218232		11838.59	161.77
	223134				223787			
	3718.90				3729.78			

We will now set up the last safety assy without the reflector with the spacing increased to 10.881 cm (STS$_{xy}$)

Assembly X-11 : STS$_{xy}$ = 10.881 cm STS$_z$ = 5.762

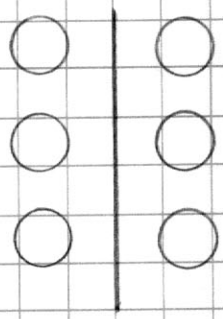
Lateral : .721 + 10.160 = 10.881 cm

Vertical : .108 + 5.654 = 5.762

Parts : 1 – 37 less #7

Base Keff : 73.158 $\times 10^{-5}$ $\Delta\rho/\rho$

Moderator : 0.5 – 11



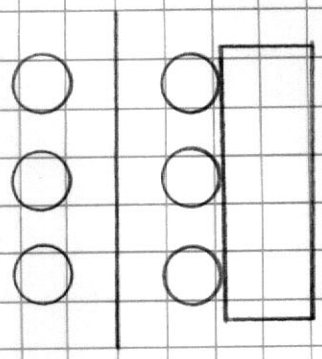
Pos.	T-1	E.F.	10^5 psi	M	T-2	E.F.	10^5 psi	M
7.980	11403	3.124	5793.72	8.12	11241	3.173	5798.46	8.13
	190.05				187.35			
.003	17606		916.68	12.53	17118		904.94	12.37
	293.43				285.20		$\bar{M}$ = 12.45	
							$\sqrt{M}$ = .08032	

9/20/63

Assembly X-12: Same as X-11 but with the reflector on.

STS_{xy} = 10.881 cm

STS_z = 5.762 cm



Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.945	18933	3.124	985.78	13.47	17990	3.123	951.36	13.00
	315.55				299.83			
1.300	41322		2169.46	29.65	40245		2146.12	29.34
	41667				40582			
	694.45				676.37			
.000	62691		3303.3	45.15	59746		3197.93	43.71
	63346				60465		$\bar{M}$ = 44.43	
	105 7.4				1002.7		$1/\bar{M}$ = .02251	

Assembly X-13: STS_{xy} = 12.151 cm STS_z = 5.762 cm

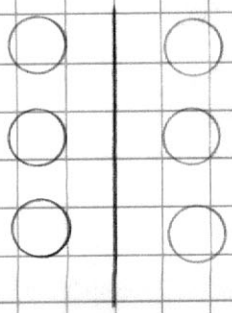
Lateral: .721 + 11.430 = 12.151 cm

Vertical: .108 + 5.654 = 5.762 cm

Parts: 1-37 less #7

Baseline = 73.158 $\times 10^5$ n/s

Moderator = 0.5"



Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.990	10637	3.124	553.82	7.57	10333	3.173	546.95	7.47
	177.28				172.22			

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
1.000	14178	3.124	738.2	10.09	13877	3.173	733.85	10.03
	236.30				231.28			

Assembly X-14: Same as X-13 but with the reflector on

STS_{xy} = 12.15 1/cm

STS_z = 5.762 cm

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.950	14862	3.124	773.81	10.58	14666	3.173	775.58	10.60
	247.70				248.43			
.000	28116		1463.91	20.01	27385		1448.62	19.80
	468.60				456.42		$\bar{M}$ = 19.91	
							$1/\bar{M}$ = .050223	

9/30/68

We will now begin the 3.6-kg .5" Mod. full array.

Assembly X-15: STS_{xy} = 24.216 cm STS_z = 5.762 cm

Lateral: .721 + 23.495 = 24.216 cm

Vertical: .108 + 5.654 = 5.762 cm

Parts: 1-55 (less #)

Base Refs: 109.009 $\times 10^5$ n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.950	15611	2.923×10^{-5}	760.50	6.98	15158	2.941×10^{-5}	784.54	6.83
	260.18				253.30			
.000	15963		777.66	7.13	15894		779.07	7.15
	266.05				264.90			

T/C's R = 70 #1 = 100 #2 = 107

Assembly X-16: STS_{xy} = 18.181 cm STS_z = 5.762 cm

Lateral: .721 + 17.460 = 18.181 cm

Vertical: .108 + 5.654 = 5.762

Parts: 1-55 less #7

Base Rate: 109.009 X 10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.933	17648	2.923	859.74	7.89	17337	2.941	849.80	7.80
	294.13				288.95			

T/C's R = 70 #1 = 111 #2 = 106

0.000	19249	8.60	19083	935.39	8.58
	320.82	937.76	318.05	$\bar{M}$ = 8.59	
				$1/\bar{m}$ = .1164	

T/C's R = 70 #1 = 110 #2 = 104

10/1/68

Assembly X-17: STS_{xy} = 18.691 cm STS_z = 5.762 cm

Lateral: .721 + 13.970 = 18.691 cm

Vertical: .108 + 5.654 = 5.762 cm

Parts: 1-55 less #7

Base Rate: 109.009 X 10^5 n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.839	22442	2.923	109.33	10.03	21842	2.591	107.06	9.82
	374.03				364.03			

0.000	28041	136.61	12.53	27364	134.13	12.30
	467.35			456.07	$\bar{M}$ = 12.42	
					$1/\bar{m}$ = .08052	

T/C's R = 70 #1 = 113 #2 = 115

10/2/68

Assembly X-18: STS_4 = 13.421 cm STS_3 = 5.762 cm

Lateral: .721 + 12.700 = 13.421 cm

Vertical: .108 + 5.654 = 5.762 cm

Parts: 1-55 less #7

Basic Rate: 109.009 $\times 10^5$ n/s

Pos.	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.938	26167	2.923×10^{-5}	1274.78	11.69	25836	2.944×10^{-5}	1266.39	11.62
	936.12				930.60			
0.000	37132		1822.43	16.70	36411		1797.89	16.49
	37409				36679			$\bar{M}$ = 16.59
	623.58				611.32			$\gamma_{\bar{M}}$ = .06028

Vcs R = 70 #1 = 113 #2 = 118

10/3/68

Assembly X-19 STS = 12.151 cm, STS_2 = 13.421 cm

Lateral: .721 + 11.430 = 12.151 cm

Vertical: .108 + 12.700 = 13.421 cm

Parts: 1-55 less #7

Basic Rate: 109.009 $\times 10^5$ n/s

Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F.	10^5 n/s	M
7.944	33419/1		1639.01	15.04	33,194/1		1637.93	15.02
	33,644				33,416			
	560.73				556.93			$\bar{M}$ = 15.03
+0.091	61,232		3019.994		59965		2974.968	
	61,991			27,704	60,693		27,291	
	1033.183				1011.550			$\bar{M}$ = 27.498

$\gamma_{\bar{M}}$ =

10/4

We are pulling apart the snubber to see why it failed to come out twice in the past month.

10/7

Snubber dismantled and inspected + re-assembled. Only visible possible cause of snubber problem may be nylon wiper which may be taking a 'set'. We will watch it on every turn - (on TV).

10/8

We have decided to go further if we can. We will ck. the applicability of the $M \leq 50$ rule. First we will ck background by re-running safety assy with 3 columns on wall. Difference in counts from run X-13.

Assembly X-20 STS X-Y = 12.15 cm, STS Z = 13.42

Lateral : .721 + 11.430 = 12.151 cm
Vertical : .108 + 12.700 = 13.421 cm

Parts : 1-37 less #7
Base Rate: $73,158 \times 10^5$ n/s

Pos	T-1			T-2		
7.926	12054,	12310,	12357	13161,	13480,	13462
	− 10637	from X-13		− 10333		
Bkgd:	1417	1673	1720 Bkgd:	2828	3147	3129

Pos				
−.001	16073,	15891	16590,	17086
	− 14178		− 13877	
	1895,	1713	2713	3209

Avg: Background

T-1 : 1684 T-2 : 3005

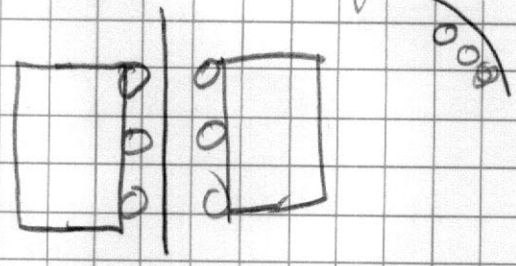
10/9 We are now going to try the double reflected, 2/3 array case. We have strengthened the tie-down on the body simulators under the direction of the M.E. dept. so that now they will withstand acoum. They were acoum-tested ~ 5 times successfully.

A memo from D. Horning will be on file.

Assembly X-21

STS x-y = 12.15
STS z = 13.42

Lateral : .721 + 11.430 = 12.151 cm
Vertical : .108 + 12.700 = 13.42 cm



Parts: 1-37 less #7
Base Rate: $73,158 \times 10^5$ m/s

Pos.	T-1	E.F.	10^5 m/s	M-1	T-2	E.F.	10^5 m/s	M-2
7.922	31,461 -1684 29,777 496.3	3.124×10^5	1,550.4	21.19	32,159 -3005 29,154 485.90	3.173×10^5	1,541.8	21.07
							$\bar{m}$ = 21.13	
							$1/\bar{m}$ = .04732	
3.899	67,737 -1,684 66,053 1100.8		3,438.9	47.00	67,051 -3,005 64,046 1067.43		3,386.9	46.30
							$\bar{m}$ = 46.65	

No need to go further, we obviously cannot use $M \leq 50$ criteria

We will go on to the next array

10/10 Today we shut down for repairs on the crane which needs a new bearing or two.

We may also take the time to give the M.E. dept., which has now been alerted to our snubber problem, a look at the device. They are going to contact the Mfg.

We decided we could modify the snubber ourselves by just putting a spring around the snubber shaft to help it slide out. This was done and works fine. Screw tries were checked and found to be unchanged as expected. We will run like this unless something else develops. The problem appears to have been the nylon wiper in the snubber. It didn't look bad but there is nothing else according to MechTech that would cause our problem. If we just replaced it we would probably have the same problem later therefore we decided to modify it as described.

12/3

33.6 Kg, ½" mod. array taken down & parts put in storage racks. Childers found one NMC out of order.

4/1/69

During the shut down period, the snubber stopped working. It appeared the cause was the seal & wiper were binding on the shaft & would not let the snubber come out even with the spring that was added (pg. 50). New seals & wipers were ordered & replaced. This helped the problem, but the shaft still sticks slightly after not being in use for short periods of time, but it does release with out too much work (running the table back out). It is by far not fixed!!! The snubbing action is still good once it is in the out position. This problem of sticking should be fixed!!! A new shaft with seal & wiper may be the answer.

Replacement of entire spring was tried & the problem fixed!!!

4/2/69 We will now begin Phase III.*

A- Series

This set of experiments will be the one col. - 2 body reflected with arms (3" x 5"). There is ~ .25 in gap between reflectors and col. No col. modification. There is ~ 10 mil gap between col. on the screw table & col. on control table. The lip of each col. is .074 in. Therefore there is a built-in spacing of .158 in. between the parts on the control table & the screw table.

* Discussion and assembly set-up in "Plutonium Array Studies - Phase III, Assembly Procedure No. 2"

A-2 Fast Stop E.F.

T-1 = .320 + .2/2 = .260

T-2 = .305 + .18/2 = .247

T-3 = 6.3 + 2.2/2 = 4.25

T-4 = 7.35 + 2.2/2 = 4.78

A-2 Full in E.F.

			corrected
T-1	= .2 + .250/2	= .225	.222
T-2	= .180 + .250/2	= .215	.209
T-3	= 2.00 + 2.55/2	= 2.28	2.24
T-4	= 2.25 + 2.55/2	= 2.40	2.39

Assembly A-1:

One part (3 Kg) on the control table w.HR a heat sink (.250 in) in place.

Part: # 1

No Moderator

Control | Scram

1

Base Rate: 2.03×10^5 n/s

Pos.	T-1	E.F(10⁵)	10⁵ n/s	M	T-2	E.F(10⁵)	10⁵ n/s	M
0.000	2208/15	.200	4.906	2.42	2492/15	.182	5.041	2.48
	% 29.53		1/M = .8132	27.70			1/M = .4032	

T-3	E.F(10⁵)	10⁵ n/s	M	T-4	E.F(10⁵)	10⁵ n/s	M
2000/15	1.96	4.355	2.15	1657/15	2.05	3.774	1.86
2.2222		1/m = .4651	1.841			1/m = .5376	

T/C's #1 = 80 °F #2 = 86 °F R = 71 °F

Assembly A-2:

One part (3 Kg) on the scram table w.HR a heat sink (.189 in) in place. Control table same as A-1.

Spacing: .480 + .635 + .401 + .108 = 1.624 cm

Parts: 1 and 2

Control | Scram

1 | 2

Part No.

Base Rate: 4.077×10^5 n/s

No moderator

Pos	T-1	E.F(10⁵)	10⁵ n/s	M	T-2	E.F(10⁵)	10⁵ n/s	M
7.924	28024/0	.260	12.14	2.98	30450/0	.247	12.55	3.08
	% 46.71				50.82			

A-3 Fast Stop ETF. Factors

Scram:

	2nd part	1st part	
T-1 =	.545 +	.320	= .433
T-2 =	.545 +	.305	= .425
T-3 =	12.4 +	6.3	= 18.7
T-4 =	18.2 +	7.35	= 25.55

Control:

T-1 = .200

T-2 = .180

T-3 = 2.00

T-4 = 2.25

Total:

			corrected
T-1 =	.545 + .320 + .200 / 3 =	.355	.301
T-2 =	.545 + .305 + .180 / 3 =	.343	.281
T-3 =	12.4 + 6.3 + 2.00 / 3 =	6.900	
T-4 =	18.2 + 7.35 + 2.25 / 3 =	7.933	

Pos	T-3	EF	10^5 n/s	M	T-4	EF (10^5)	10^5 n/s	M
7.924	2171/10	4.25	15.39	3.77	1827/10	4.78	14.58	3.58
	3.62				3.05			

T/C's #1 = 80 #2 = 80 R = 70

0.000	T-1	.223	21.95	5.38	T-2	.209	22.61	5.56
	5937/10			γ_m = .1855	6506/10			γ_m = .1799
	98.86				108.97			

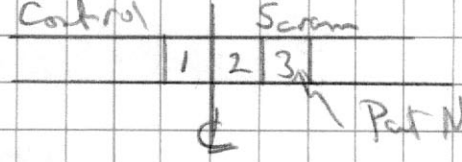
T-3	2.24	18.51	4.54	T-4	2.39	15.31	3.76
4871/10			γ_m = .2203	3830/10			γ_m = .2660
8.12				6.38			

Assembly A-3:

Another 3-Kg part added to scram table with a STS of 1.624 cm. Control table same as A-1

Spacing: .980 + .635 + .401 + .108 = 1.624 cm

Parts: 1, 2, & 3



Base Rate: 6.134×10^5 n/s

No Mod.

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.926	50232/10	.355	29.72	4.85	5335/10	.343	30.50	4.97
	83.72				88.93			

T-3					T-4			
3237/10	6.900	37.24	6.09	2763/10	7.933	36.57	5.96
5.40				4.61			

T/C's R = 70 #1 = 81 #2 = 88

Pos = 1.998 c_k Eff. Factor

Scram Table

T-1 = .255 + .335 = .59

T-2 = .215 + .320 = .535

T-3 = 3.15 + 6.70 = 9.85

T-4 = 3.35 + 7.95 = 11.3

	Total Scram	control		
T-1 =	.59	+ .200	= .793	= .263
T-2 =	.535	+ .180	= .715/3	= .238
T-3 =	9.85	+ 2.000	= 1.185/3	= 3.95
T-4 =	11.3	+ 2.25	= 13.55/3	= 4.52

Pos. = 0.000 Eff. Factor

Scram Table

T-1 = .185 + .295 = .48

T-2 = .210 + .280 = .49

T-3 = 2.55 + 5.35 = 7.90

T-4 = 2.55 + 6.30 = 8.85

	Total			corrected ↓
T-1 =	.48	+ .200/3	= .227	.219
T-2 =	.49	+ .180/3	= .223	.216
T-3 =	7.90	+ 2.00/3	= 3.30	2.780
T-4 =	8.85	+ 2.25/3	= 3.70	3.014

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
1.998	102674/10	.263	44.98	7.33	105375/10	.238	43.39	7.07
	171.02				182.25			
	T-3				T-4			
	6268/10	3.95	41.28	6.73	5239/10	4.520	39.41	6.43
	10.45				8.72			

0.000

We lost our cost count, so we will re-run this assembly.

4/3/69

Pos.	T-1	T-2
7.925	50223/10	53820/10
	T-3	T-4
	3199/10	2783/10
	T-1	T-2
1.998	101674/10	105318/10
	T-3	T-4
	6275/10	5054/10

	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000	156407/10	.217	56.57	9.22	168807/10	.216	60.77	9.91
	260.68			Ym = .1085	281.35			Ym = .1009
	T-3	EF	10^5 n/s	M	T-4	EF	10^5 n/s	M
	10020/10	2.78	46.43	7.57	7586/10	3.014	49.12	6.57
	167.00			Ym = .1321	133.10			Ym = .1529

T/C R = 71 #1 = 84 #2 = 91

Fast Stop Eff. Factor for 4 parts A-4

Scram Table

	1st part	2nd	3rd
T-1 =	(.320	+ .545	+ 1.095)
T-2 =	.305	+ .545	+ 1.065
T-3 =	6.3	+ 12.4	+ 21.35
T-4 =	7.35	+ 18.2	+ 23.30

Total

T-1 = 1.959 + .200/4 = .540

T-2 = 1.935 + .180/4 = .529

T-3 = 40.95 + 2.00/4 = 10.513

T-4 = 44.85 + 2.25/4 = 11.775

Pos 3.149 in Eff Factor

Scram Table + Control Table

T-1 = .245 + .365 + .55 + .2/4 = .340

T-2 = .230 + .350 + .55 + .18/4 = .328

T-3 = 3.65 + 8.00 + 15.00 + 2.0/4 = 7.163

T-4 = 4.05 + 9.10 + 16.90 + 2.25/4 = 8.075

4/4/69

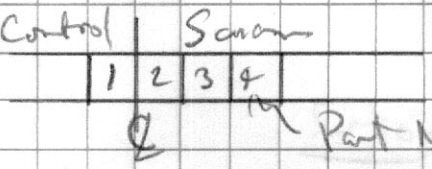
We added one more part (3kg) to the screen table

Assembly A-4:

Spacing: .480 + .635 + .401 + .108 = 1.624 cm

Parts: 1, 2, 3 & 4

Base Rate: 8.124×10^{-5} m/s



No Modification:

Pos.	T-1	ET² (10^5)	10^5 m/s	M	T-2	ET (10^5)	10^5 m/s	M
7.924	90529/10 1502.88	.5790	81.98	10.03	94506/10 1527.51	.5529	87.32	10.26
	T-3				T-4			
	5225/10 867.75	10.573	91.62	11.28	4673/10 776.88	11.775	91.70	11.29

T/C's R = 20 #1 = 78 #2 = 85

	T-1				T-2			
3.149	17594.2/10 2922.38	.390	99.91	12.24	18459/10 3067.75	.328	100.98	12.43
	T-3				T-4			
	9818/10 1630	7.163	112.19	14.42	8389/10 1392	8.075	112.40	13.84

T/C's R = 70 #1 = 80 #2 = 87

ATR Reactor for 4 parts closed table

Screen Table

T-1 = .185 + .295 + .965 / 3 = .322

T-2 = .210 + .280 + .965 / 3 = .325

T-3 = 2.55 + 5.35 + 10.900 = 6.267

T-4 = 2.55 + 6.30 + 12.7 = 7.183

Total

corrected ↓

5.905 + 3.350 + 2.062 + 5.000 / 4 = 3.964 / 3.56 = .252

T-1 = .185 + .295 + .965 + .200 / 4 = .281

T-2 = .210 + .280 + .965 + .180 / 4 = .289 .251

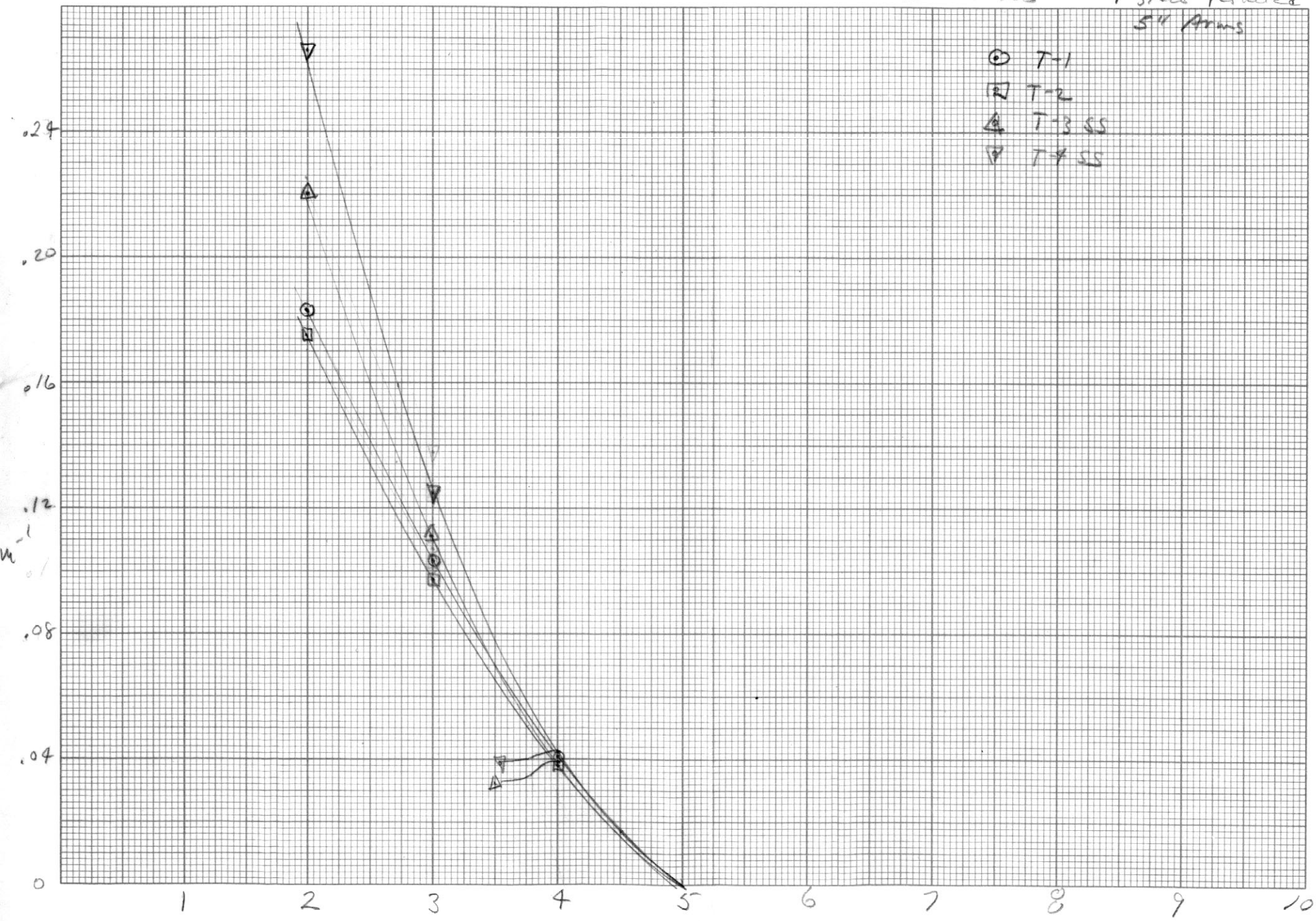
T-3 = 2.55 + 5.35 + 10.900 + 2.00 / 4 = 5.200 3.916

T-4 = 2.55 + 6.30 + 12.7 + 2.25 / 4 = 5.950 3.729

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

STS = 1.628 cm A-Series 4 sided reflected 5" Arms



Pos	T-1	EF	10^{-5} in/s	m	T-2	EF	10^{-5} in/s	m
0.00	41562/10	.252	179.52	21.49	44575/10	.251	184.89	22.76
	692.70			1/m = .0465	736.63			1/m = .0439
	T-3				T-4			
	23855/10	3.416	136.06	16.75	15605/10	3.724	121.00	14.88
	39.83			1/m = .0597	32.68			1/m = .0668

T/C's R = 70 #1 = 82 #2 = 85

4/7/69 The S.S. appears to be low about 30%

We will now look at the same series we just finished but we will now reflect the ends with .5" of Poly. This will show how many parts can be placed on the control table (M < 20 2 body reflected)

Assembly B-1:

One part (3Ks) on the control table with a .250 in heat sink in place.

Part: 1

Base Rate: 2.03×10^{-5} in/s

No Modulator

Control	Sum
1	

Pos	T-1	EF	10^{-5} in/s	m	T-2	EF	10^{-5} in/s	m
0.000	17526/10	.200	5.842	2.88	19310/10	.182	5.857	2.89
	29.21				32.18			
	T-3				T-4			
	1612/10	1.96	5.272	2.60	1309/10	2.05	4.45	2.19
	2.69				2.17			

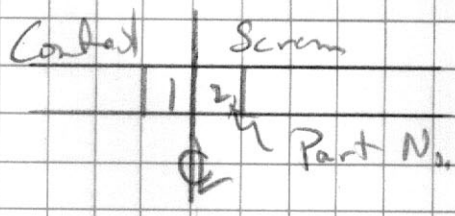
T/C's R = 70 #1 = 94 #2 = 81

Assembly B-2:

One part (3 kg) placed on the Screen Table with a .188 in lucite sink & 5" of Poly so that we now have a six sided reflected array.

Spacing: .480 + .635 + .401 + .108 = 1.624 cm

Parts: 1 & 2



Base Rate: 4.077×10^5 n/s

No Moderator

Ras	T-1	EF(10⁵)	10⁵ n/s	M	T-2	EF(10⁵)	10⁵ n/s	M
7.92+	30896/10	.260	13.39	3.28	37191/10	.247	14.05	3.95
	5.195				56.90			
	T-3				T-4			
	21705/10	4.25	15.91	3.78	18555/10	4.78	14.78	3.63
	3.625				3.092			

TC's R = 70 #1 = 93 #2 = 80

	T-1				T-2			
0.000	71169/10	.222	26.33	6.46	77863/10	.209	27.12	6.65
	118.62		Y_M = .1548		129.77			Y_M = .1504
	T-3				T-4			
	5318/10	2.24	19.85	4.87	4393/10	2.39	17.49	4.29
	8.86		Y_M = .2053		7.32			Y_M = .2331

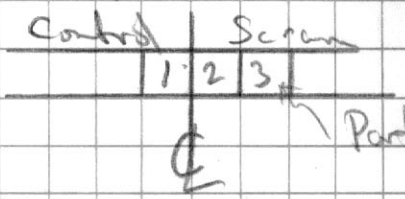
R = 70 #1 = 90 #2 = 83

Assembly B-3:

another part (3kg) placed on screen table.

Spacing: .480 + .635 + .401 + .108 = 1.624 cm

Parts: 1, 2, & 3



Beckels: 6.134×10^{-5} n/s

No Moderator

Pos.	T-1	EF	10^{-5} n/s	M	T-2	EF	10^{-5} n/s	M
7.924	54137/10	.355	33.21	5.41	59579/10	.393	39.06	5.55
	93.56				99.30			
	T-3				T-4			
	3478/10	6.900	40.02	6.52	3058/10	7.933	40.46	6.60
	5.80				5.10			

T/C's R = 70 #1 = 53 #2 = 79

	T-1				T-2			
1.998	119686/10	.263	52.96	8.55	129559/10	.238	51.39	8.38
	199.98				215.92			
	T-3				T-4			
	7350/10	3.55	48.39	7.89	5805/10	4.52	43.73	7.13
	12.25				9.675			

T/C's R = 70 #1 = 94 #2 = 80

	T-1				T-2			
0.000	19698/10	.217	71.06	11.58	213258/10	.216	76.77	12.52
	327.47		γ_M = .0864		355.43		γ_M = .0799	
	T-3				T-4			
	12024/10	2.78	55.21	19.08	5349/10	3.014	46.96	7.66
	20.04		γ_M = .110		15.58		γ_M = .1305	

T/C's R = 70 #1 = 96 #2 = 83

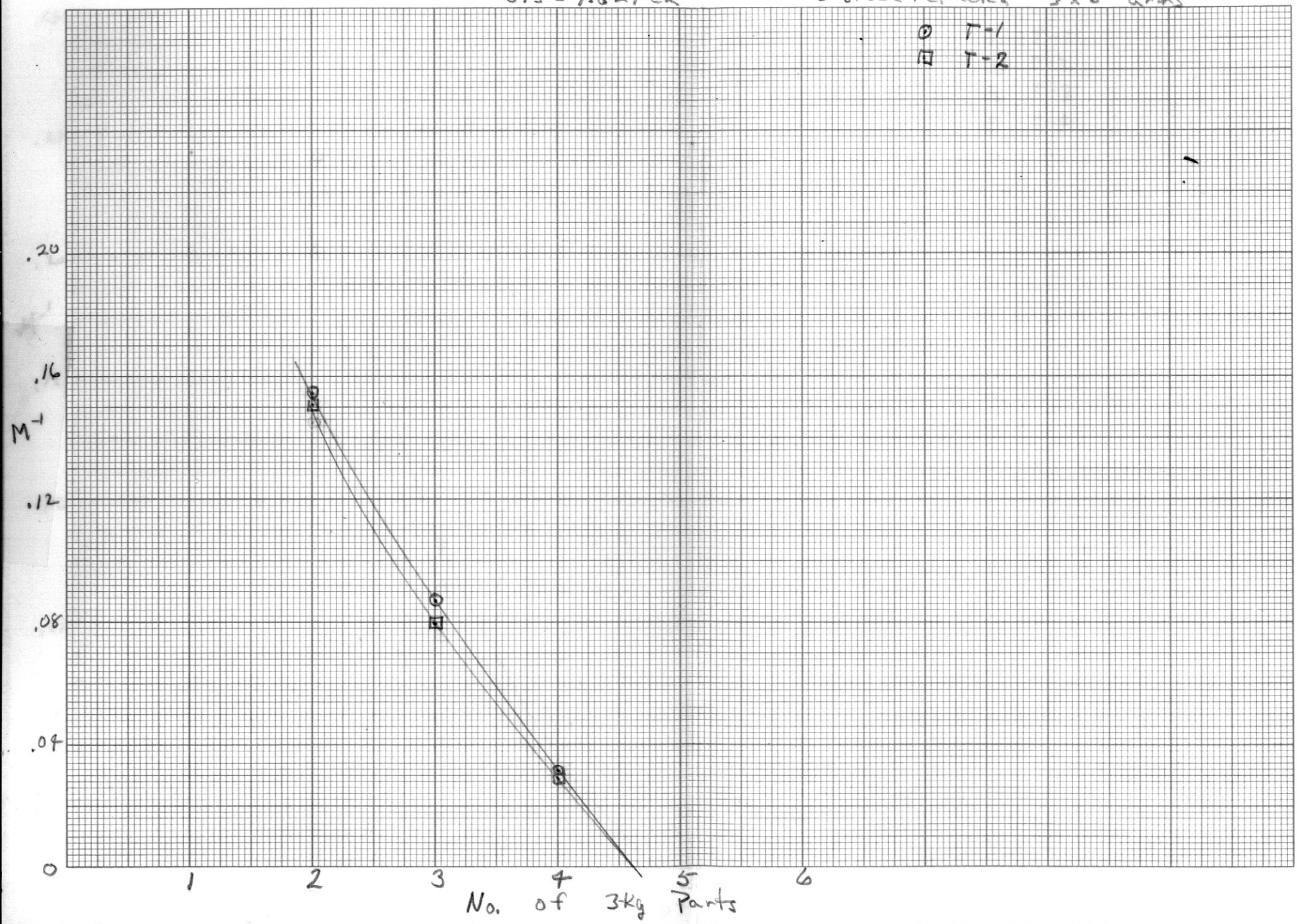
NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

B-Series - Connected

STS = 1.624 cm

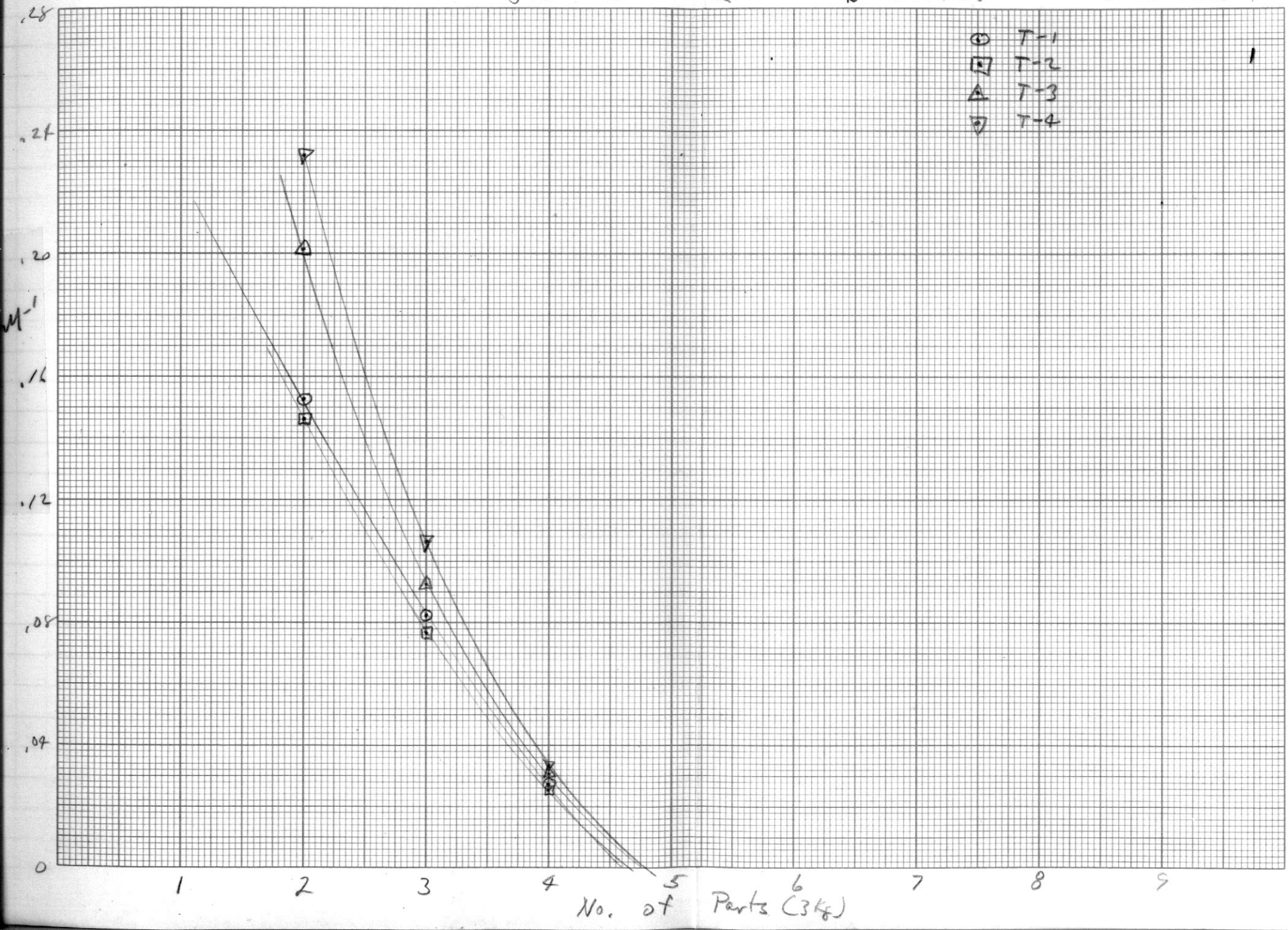
6 sided reflected 2"x5" grams



NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

STS = 1.624 cm B-series 6sided reflected 5" Arms



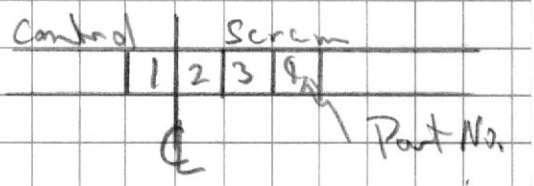
4/8/65

Assembly B-4:

Another part (3 kg) added to screen table

Spacing: .480 + .635 + .401 + .108 = 1.624 cm

Parts: 1, 2, 3, & 4



Base Rate: 8.124×10^{-5} n/s

No Moderator:

Pos	T-1	E.F.	10^{-5} n/s	M	T-2	E.F.	10^{-5} n/s	M
7.927	101278/10	.590	91.15	11.22	107980/10	.529	95.20	11.72
	168.80				179.97			
	T-3				T-4			
	59538/10	10.513	109.29	12.84	84470/10	11.775	95.14	11.71
	9.92				8.08			
	T-1				T-2			
3.148	209046/10	.390	118.96	14.58	221776/10	.328	121.07	14.90
	348.41				369.13			
	T-3				T-4			
	112147/10	7.163	133.88	16.48	91166/10	8.075	122.66	15.10
	186.9				151.9			
	T/C's	R = 72			#1 = 89	#2 = 80		
	T-1				T-2			
0.00	606374/10	.252	258.68	31.35	650268/10	.251	272.03	33.48
	1010.62			Y_m = .0319	1083.78			Y_m = .0299
	T-3	3.716	176.98	21.79	T-4	3.724	151.75	18.68
	310855/10			Y_m = .0459	249495/10			Y_m = .0535
	51.81				40.75			

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

A & C - Series - Corrected

STS = 1.624 cm

4 sided reflected 3"x5" arms

⊙ T-1 } A-Series 3"x5" arms
⊡ T-2 }

× T-1 } C-Series 3"x3" arms
△ T-2 }

.24
.20
.16
M^{-1} .1
.12
.08
.04
0

1 2 3 4 5 6

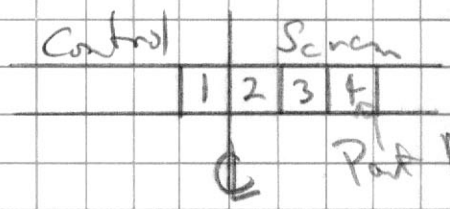
No. of 3-Kg Parts

We will now look a the A-series with 3" x 3" arms which is a more realistic arm.

Assembly C-1 :

Spacing : .480 + .635 + .401 + .108 = 1.624 cm

Parts : 1, 2, 3 & 4



Base Rate : 8.124 $\times 10^{-5}$ m/s

No Moderator

Pos.	T-1	EF	10^{-5} m/s	M	T-2	EF	10^{-5} m/s	M
2.915	83415/10	.540			88587/10	.529		

T-3 10.513 4838/10

T-4 11.775 3596/10

T-1 3.148 158219/10

T-2 168455/10

T-3 8410/10

T-4 6913/10

T/C 5 R = 71 #1 = 82 #2 = 91

	T-1				T-2			
0.000	390998/10	.252	143.22	17.63	366129/10	.251	153.16	18.85
	568.33		1/m = .0567		610.20			1/m = .0531

	T-3				T-4			
	19150/10	3.416			15613/10	3.724		
	31.92		1/m =		26.03			1/m =

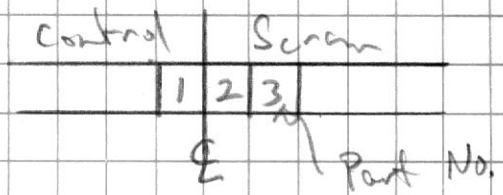
T/C 5 R = 71 #1 = 84 #2 = 94

We will now remove one part (3kg) from the scram table.

Assembly C-2:

Spacing: 1.624 cm

Parts: 1, 2 & 3



Base Rate: 6.138 $\times 10^{-5}$ n/s

No moderator

Pos.	T-1 EP	10^5 n/s	M	T-2 EP	10^5 n/s	M
2.915	48754/10	.355		52453/10	.343	

T-3	T-4
3131/10 6.900	2591/10 7.233

T-1	T-2
1.998 96213/10 .263	10356-22/10 .234

T-3	T-4
5797/10 3.55	9221/10 8.52

T/C's R = 71 #1 = 83 #2 = 92

T-1				T-2			
0.000	142366/10	.217	61.99	8.39	154559/10	.216	55.64	9.07
	237.28			Y/M = .1192	257.58			Y/M = .1103

T-3				T-4			
	9161/10	2.78			7268/10	3.014	
	15.27			Y/M =	12.11			Y/M =

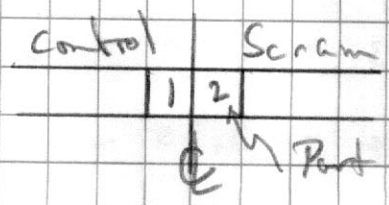
4/9/69

We will remove one part (3 kg) from the scram table.

Assembly C-3:

Spacing: 1.624 cm

Parts: 1 & 2



Beam Rate: 4.077×10^5 n/s

No Moderator

Pos.	T-1 EP	10^5 n/s	M	T-2 EF	10^5 n/s	M
2.915	27508/0.260			30368/0.297		

T-3		T-4	
1937/0	8.25	1631/0	4.78

	T-1				T-2			
0.000	57656/0.222	21.33	5.23		63091/0.209	21.54	5.39	
	96.09		Ym = .191		105 n/s		Ym = .185	
	T-3				T-4			
	4186/0 2.24	15.64	3.83		3.05/0 2.39	18.36	3.52	
	6.98				6.08			

R = 73 #1 = 89 #2 = 93

E.F. Fast Stop D-1

T-1 = .310 + .200/2 = .255

T-2 = .35 + .180/2 = .265

T-3 = 8.00 + 2.00/2 = 5.00

T-4 = 9.35 + 2.25/2 = 5.80

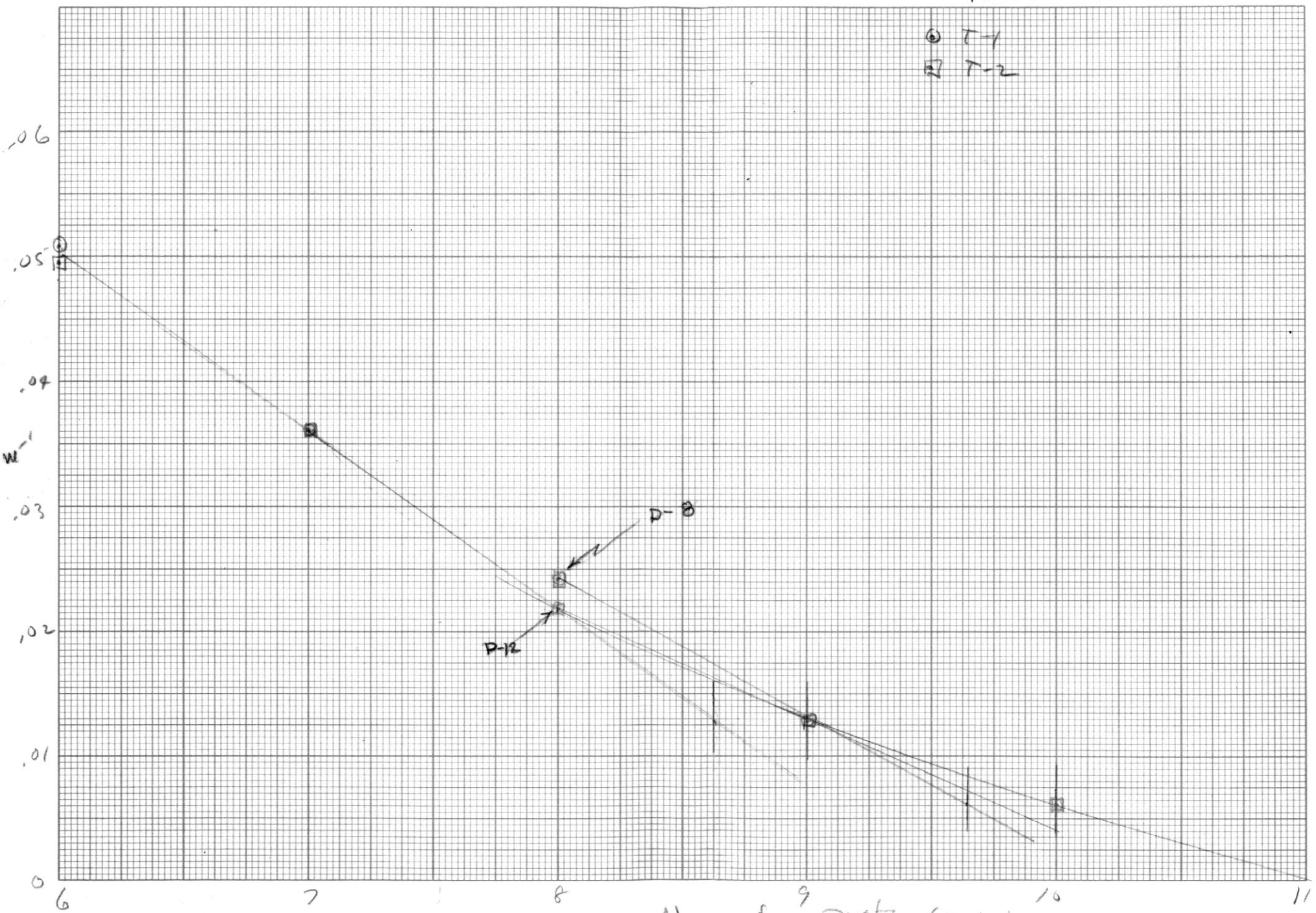
E.F. Full in D-1

		Corrected
T-1	= .225 + .2 /2 = .213	.212
T-2	= .20 + .18/2 = .19	.189
T-3	= 2.85 + 2.0/2 = 2.400	2.333
T-4	= 2.85 + 2.25/2 = 2.525	2.495

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

D. Series $S/\lambda = 2.62$ 4s. tel reflected 3×3" trans

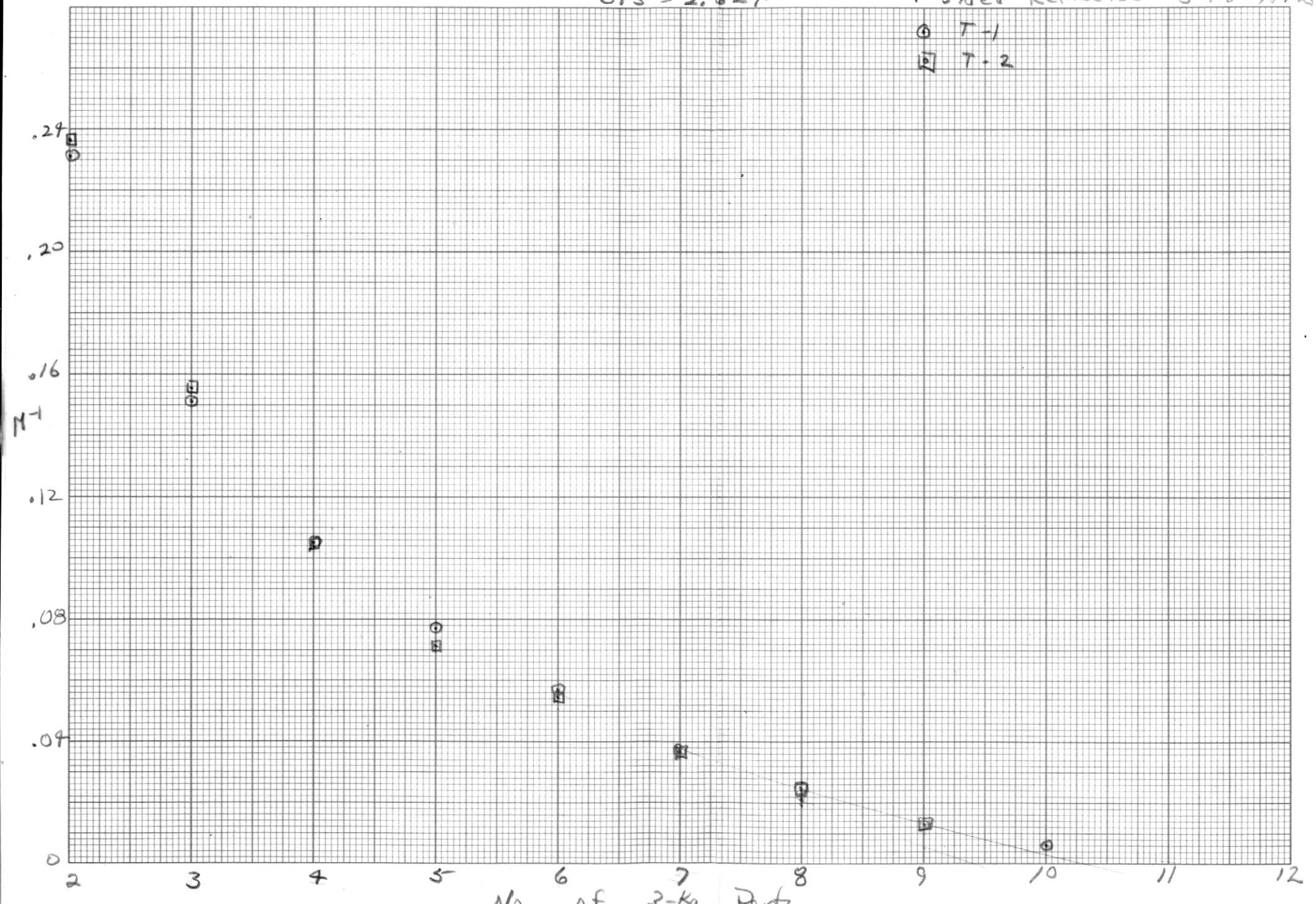


NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

D-Series - Corrected
STS = 2.629

4 sided Reflected 3"x3" Arms



We will now begin a spaced series. We added 1 cm to the 1.624 cm we had on the screw. Total STS = 2.624 cm.

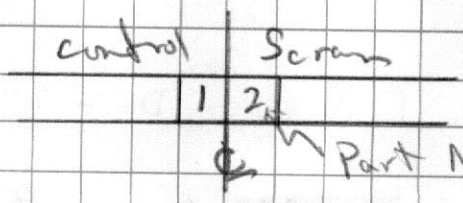
Assembly D-1:

Spacing: .480 + .635 + .901 + .108 + 1.000 = 2.624

Parts: 1 4 2

Base Rate: 4.077 $\times 10^5$ n/s

No Moderator



Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.924	26613/0	.285	12.64	3.10	28784/0	.265	12.71	3.12
	44.36				47.97			
	T-3	~~5.25~~			T-4	~~5.98~~		
	1750/0	5.00	14.85	3.64	1597/0	5.60	15.43	3.78
	2.92				2.66			
	T-1				T-2			
0.000	49557/0	.212	17.59	4.32	54495/0	.188	17.26	4.23
	82.60		γ_m = .2315		90.83			γ_m = .2367
	T-3				T-4			
	3376/0	2.33	13.39	3.28	2528/0	2.52	12.32	3.02
	5.56		γ_m = .3049		4.88			γ_m = .3311

E.F. Fast Step D-2

T-1 = .200 + .345 + .65/3 = .398

T-2 = .180 + .33 + .65/3 = .387

T-3 = 2.00 + 7.10 + 15.3/3 = 8.13

T-4 = 2.25 + 8.25 + 17.3/3 = 9.27

E.F. Full in D-2

T-1 = .200 + .225 + .345/3 = .257

T-2 = .180 + .20 + .330/3 = .237

T-3 = 2.00 + 2.8 + 7.15/3 = 3.98

T-4 = 2.25 + 2.8 + 8.45/3 = 4.50

Corrected

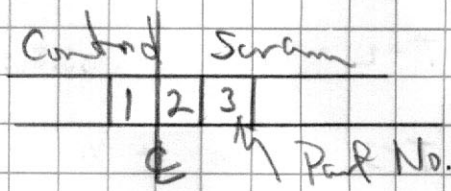
.243

.221

Assembly D-2: One part added to scram table

Spacing = 2.624 cm

Parts: 1, 2 + 3



Base Rate: 6.13×10^{5} n/s

No Moderator

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.925	40755/10	.398	27.04	4.41	43945/10	.387	28.34	4.62
	67.98				73.24			
	T-3				T-4			
	2488/10	8.13	33.72	5.50	2288/10	8.27	35.35	5.76
	41.47				38.13			
	T-1				T-2			
0.00	99782/10	.243	40.40	6.586	106503/10	.221		6.719
	166.24		Y_m = .1518		176.17			Y_m = .1555
	T-3				T-4			
	5675/10	3.98	32.65	6.17	4844/10	8.40	34.32	5.92
	9.46		Y_m = .1628		8.07			Y_m = .1682

E.F. Fast Stop D-3

					Corrected
	5.	+ 2.859 + 1.534 + .633 /4 =		X	X
T-1 =	.200	+ .345 + .85 + 1.58 /4 =	.6[illegible]4	2.517	.397
T-2 =	.180	+ .33 + .65 + 1.56 /4 =	.680	2.491	.372
T-3 =	2.00	+ 7.10 + 15.3 + 26.0 /4 =	12.60		
T-4 =	2.25	+ 8.25 + 17.3 + 27.75 /4 =	13.89		

E.F. Full in D-3

			Corrected ↓
T-1 =	.200 + .225 + .345 + .65 /4 =	.355	.288
T-2 =	.180 + .20 + .330 + .65 /4 =	.340	.264
T-3 =	2.00 + 2.8 + 7.15 + 14.95 /4 =	6.725	
T-4 =	2.25 + 2.8 + 8.95 + 16.90 /4 =	7.60	

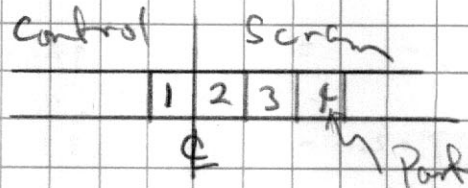
Assembly D-3: One part added to scram fuel

Spacing: 2.624 cm

Parts: 1, 2, 3, & 4

Base Rate: 8.124×10^{5} n/s

No Moderator



Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.525-	57149/10	.387	37.81	9.65-	61036/10	.372	37.82	9.66
	95.25-				101.73			
	T-3				T-4			
	3377/10				3041/10			
	5.63				5.14			
	T-1				T-2			
0.000	155855/10	.288	76.73	9.95-	172093/10	.264	75.72	9.32
	266.43		$\gamma_m = .1050$		286.83			$\gamma_m = .1039$
	T-3				T-4			
	8398/10				7151/10			
	13.91				11.92			$\gamma_m = .0897$

T/C: R = 72 #1 = 85 #2 = 90

L.F. Foot Step D-4

T-1 = .200 + .345 + .65 + 1.58 + 3.55/5 = 1.265

T-2 = .180 + .33 + .65 + 1.56 + 3.55/5 = 1.254

T-3 = 2.00 + 7.1 + 15.3 + 26. + 36.7/5 = 17.42

T-4 = 2.25 + 8.25 + 17.3 + 27.75 + 38.25/5 = 18.76

Pos 2.539 E.F. D-4

Corrected

T-1 = .200 + .24 + .35 + .615 + 1.39/5 = .559

T-2 = .180 + .22 + .335 + .615 + 1.37/5 = .544

T-3 = 2.00 + 3.45 + 7.2 + 14.1 + 24.4/5 = 10.23

T-4 = 2.25 + 3.7 + 8.6 + 16.0 + 26.2/5 = 11.35

Full in E.F. D-4

Corrected

T-1 = .200 + .225 + .345 + .65 + 1.03/5 = .490 .337

T-2 = .180 + .20 + .33 + .65 + 1.03/5 = .478 .343

T-3 = 2.00 + 2.8 + 7.15 + 18.95 + 30.7/5 = 9.52

T-4 = 2.25 + 2.8 + 8.45 + 16.9 + 22.6/5 = 10.60

XBG-67/1-125

4/10/69

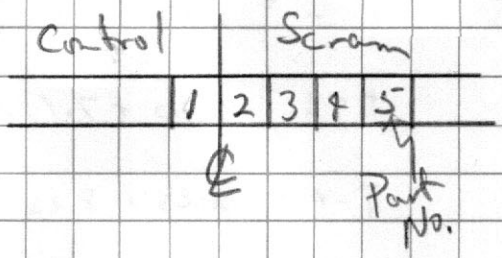
One part added to scram table

Assembly D-4

Spacing: 2.624 cm

Parts: 1, 2, 3, 4, & 5

Bare Rods: 10.098×10^{-5} n/s



No moderator

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.910	75087/10	1.265	158.32	15.67	80632/10	1.258	168.31	16.67
	125.08				134.22			
	T-3	1.282	127.69	12.65	T-4	1.276	118.14	11.78
	73557/10				37537/10			
	7.33				6.32			

T/C R=71 #1=81 #2=90

2.539	T-1				T-2			
	190765/10	.559	136.75	13.59	157696/10	.578	182.07	18.07
	244.64				261.16			
	T-3				T-4			
	78867/10	10.23	134.12	13.28	66955/10	11.35	126.67	12.58
	13.11				11.14			
	T-1				T-2			
0.00	232698/10	.337	130.70	12.94	250161/10	.343	143.01	14.16
	387.83		Y_M = .0773		16.94		Y_M = .0706	
	T-3				T-4			
	12469/10	9.52	133.07	13.12	101/8/10	10.60	175.12	17.20
	20.28		Y_M = .0523		16.86		Y_M = .0571	

T/C's R=71 #1=84 #2=98

Fast Stop ET D-5

T-1 = .200 + .345 + .65 + 1.58 + 3.55 + 5.52/6 = 1.974

T-2 = .180 + .33 + .65 + 1.56 + 3.55 + 5.54/6 = 1.968

T-3 = 2.00 + 7.1 + 15.3 + 26. + 36.7 + 48.4/6 = 22.58

T-4 = 2.25 + 8.25 + 17.3 + 27.75 + 38.25 + 48.75/6 = 23.76

Pos 2.570 ET D-5

T-1 = .2 + .25 + .41 + .83 + 1.96 + 4.2 /6 = 1.308 ✓

T-2 = .18 + .235 + .415 + .83 + 1.91 + 4.2/6 = 1.294 ✓

T-3 = 2. + 3.85 + 7.2 + 18.1 + 28.4 + 35.5/6 = 14.44

T-4 = 2.25 + 3.7 + 8.6 + 16.0 + 26.2 + 37.55/6 = 15.72

Full in ET D-5

T-1 = .2 + .223 + .335 + .625 + 1.47 + 3.32/6 = ~~1.025~~ .394 corrected

T-2 = .18 + .205 + .32 + .625 + 1.48 + 3.32/6 = ~~1.057~~ .374

T-3 = 2. + 2.9 + 6.8 + 14.4 + 25.2 + 41.6/6 = 15.48

T-4 = 2.25 + 2.9 + 8.15 + 16.3 + 26.9 + 46.6/6 = 17.18

4/14/69

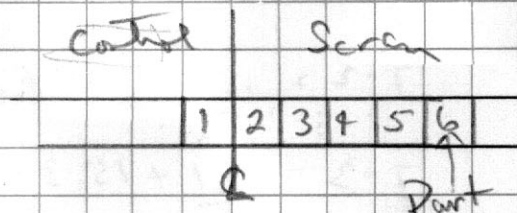
Assembly D-5: One part added to scram table

Spacing: 2.624 cm

Parts: 1, 2, 3, 4, 5 & 6

Base Rate: 12.121 $\times 10^{-4}$ 1/s

No Moderator:



Pos.	T-1	EF	10^4/s	M	T-2	EF	10^4/s	M
7.825	97513/10				103655/10			
	162.52				172.76			
	T-3				T-4			
	5573/10	22.58	208.64	17.21	9619/10	23.26	182.71	15.07
	9.28				7.69			
	T/C's	R = 71			# 1 = 81		# 2 = 90	
	T-1				T-2			
2.54	198565/10				211783/10			
	331.61				352.91			
	T-3				T-4			
	10047/10	18.44	281.87	19.95	8681/10	15.72	227.93	18.77
	16.75				14.47			
	T-1				T-2			
0.000	326383/10	.398	214.32	17.68	348730/10	.374	217.38	17.93
	543.97			Y/m = .0566	581.22			Y/m = .0558
	T-3				T-4			
	16614/10				13767/10			
	27.69				22.95			
	T/C's R = 71				#1 = 84		#2 = 93	

Past Stop EF D-6

T-1 = .345 + 2.65 + 1.58 + .24 + .29 + .525 / 6 = .502

T-2 = .33 + .65 + 1.56 + .180 + .245 + .47 / 6 = .573

T-3 = 2.1 + 15.3 + 26. + 2. + 5.9 + 13.2 / 6 = 11.58

T-4 = 8.25 + 17.3 + 27.25 + 2.25 + 6.3 + 14.4 / 6 = 12.71

Pos. 2.5# EF D-6

T-1 = .24 + .35 + .615 + .2 + .29 + .525 / 6 = .37

T-2 = .22 + .335 + .615 + .18 + .245 + .47 / 6 = .344

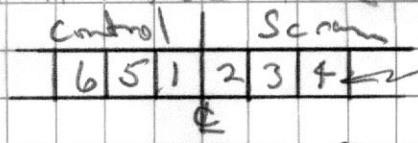
T-3 = 3.45 + 7.2 + 14.1 + 2.0 + 5.9 + 13.2 / 6 = 7.64

T-4 = 3.7 + 8.6 + 16.0 + 2.25 + 6.3 + 14.4 / 6 = 8.54

Full in EF D-6

		corrected
T-1 = .2 + .29 + .525 + .225 + .345 + .65 / 6 =	.378	.307
T-2 = .18 + .245 + .47 + .20 + .33 + .65 / 6 =	.346	.286
T-3 = 2. + 5.9 + 13.2 + 2.9 + 6.8 + 14.4 / 6 =	7.53	
T-4 = 2.25 + 6.3 + 14.4 + 2.9 + 8.1 + 16.3 / 6 =	8.38	

Assembly D-6: Same as D-5 but parts 5 & 6 have been transfered to the control table. We now have 1, 5 & 6 on the control table and 2, 3 & 4 on the screen table. After placing 5 & 6 on the control table the temp. went up to #1 = 100 #2 = 105 since now they are enclosed in the poly. all the time.



Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.825	138784/10	.502	116.1k	9.58	154421/10	.573	147.97	12.17
	231.32				257.37			
	T-3				T-4			
	61744/10	11.58	115.1k	9.83	5013/10	12.71	106.13	10.61
	10.29				8.35			

T/C's R = 71 #1 = 100 #2 = 105

	T-1				T-2			
2.5#	253584/0.37		156.62	12.92	278504/0	.34#	159.85	13.19
	423.31				464.68			
	T-3				T-4			
	108007/0	7.6#	132.60	11.35	8268/10	8.5#	117.6#	9.7#
	18.01				13.78			

T/C's R = 71 #1 = 101 #2 = 106

	T-1				T-2			
0.000	465211/10	.307	238.03	19.64	512294/10	.286	244.17	20.14
	775.35		Y_M=.0505		853.74			Y_M=.07965
	T-3				T-4			
	17929/10				14424/10			
	29.88				23.37			

T/C's 71 #1 = 106 #2 = 111

E.F. Fast Stop D-7

Control | sorm → 1/2.24

T-1 = 5. + 3.448 + 1.905 + 2.899 + 1.538 + .633 + .286/7 = 2.24 .446

| sorm →

T-2 = 5.556 + 8.082 + 2.128 + 3.03 + 1.538 + .641 + .286/7 = 2.466 → 1/2.466 = .406

T-3 =

T-4 =

E.F. Pos = 2.54 D-7

X 1/X

T-1 = 5. + 3.448 + 1.505 + 4.167 + 2.857 + 1.626 + .511/7 = 2.748 .359

T-2 = 5.556 + 8.082 + 2.128 + 4.545 + 2.585 + 1.626 + .526/7 = 3.068 .326

T-3 =

T-4 =

E.F. Full in D-7

X 1/X

T-1 = 5 + 3.448 + 1.505 + 4.444 + 2.845 + 1.538 + .680/7 = 2.845 .351

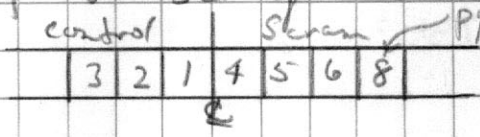
T-2 = 5.556 + 8.082 + 2.128 + 5.0 + 3.03 + 1.538 + .49/7 = 3.176 .318

T-3 =

T-4 =

4/18/69 There was an error in the averaging of Eff. Factors which has been corrected. We will now continue the D-series.

Assembly D-7: We now have 3 3-Kg parts on the control table & 4 3-Kg parts on the scram table. Same spacing & setup as before (D-series).



Spacing: 2.624 cm

Parts: 1, 2, 3, 4, 5, 6, & 8

Base Rate: 14.189×10^5 n/s

No Moderator

Pos.	T-1	EF(10^3)	10^5 n/s	M	T-2	EF(10^3)	10^5 n/s	M
7.927	33041/2	.496	122.82	8.68	30797/2	.406	128.89	8.80
	& 225.39				306.62			

T-3
1332/2

T-4
1138/2

T/C: S R = 72 #1 = 106 #2 = 107

	T-1				T-2			
2.538	64957/2	.359	194.33	13.73	71986/2	.326	198.20	13.73
	541.31				595.72			

T-3
2356/2

T-4
2047

E.F. Fast Stop D-9

control | scram

T-1 = 5. +3.498+1.905+2.899+1.538+.633+.286+.129/8 = 1.980 .505

T-2 = 5.556+4.082+2.128+3.03+1.538+.69/+.286+.129/8 = 2.174 .460

T-3 =

T-4 =

E.F. Pos. 2.5% D-8

T-1 = 5+3.498+1.505+4.167+2.857+1.646+.5-1+.238/8 = 2.969 .405

T-2 = 5.556+4.082+2.128+4.575+2.985+1.626+.526+.238/8 = 2.711 .369

T-3 =

T-4 =

Pos	T-1	$E_T(10^5)$	10^5 n/s	M	T-2	$E_T(10^5)$	10^5 n/s	M
0.000	183979/2	.351	391.89	27.7	147656/2	.318	391.02	27.6
	7116.99			$Y_m = .0361$	1225.63			$Y_m = .0362$

T-3
4291/2

T-4
905 8/2

T/C's R = 71 #1 = 110 #2 = 111

We shut down and Hazard Control D.O.P.ed our C-vault air filters and replaced all that didn't meet min. standards.

4/23/69

We will now continue the D-series by adding one more 3-Kg part to the screen table

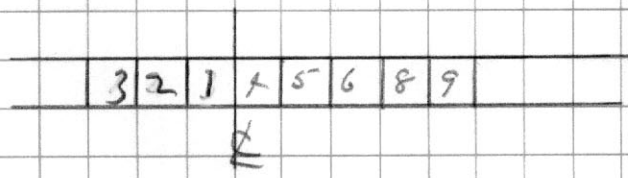
Assembly D-8:

Spacing: 2.624 cm

Parts: 1, 2, 3, 4, 5, 6, 8, 9

Base Rate: 16.177 $\times 10^5$ n/s

No Moderator



Pos	T-1	$E_T(10^5)$	10^5 n/s	M	T-2	$E_T(10^5)$	10^5 n/s	M
2.933	19979	.505	168.15	10.39	22233	.460	170.85	10.57
	332.98				370.55			

T-3
775

T-4
627

E.F. Full in D-8

T-1 ~ 5 + 3.448 + 1.905 + 8.484 + 2899 + 1.538 + .68 + .301/8 = 2.527 .396

T-2 ~ 6.555 + 8.082 + 2.128 + 5.0 + 3.03 + 1.538 + .69 + .301/8 = 2.790 .358

T-3 ~

T-4 ~

Pos	T-1	ε-F	10^5 n/s	M	T-2	ε-F	10^5 n/s	M
2.538	42575	.805	287.38	17.77	46825	.369	288.31	17.82
	709.58				781.32			
	T-3				T-4			
	1455				1142			

T/Cs K=.70 #1=110 #2=110

	T-1				T-2			
0.000	95883	.356	672.68	41.58	105398	.358	674.82	41.71
	101921			ν_m=.02405	113098			ν_m=.02398
	1698.68				1884.97			
	T-3				T-4			
	3311				2583			

4/24/69

We will now investigate placing 4 3-kg parts on the control table. There are 3 3-kg parts on the control & one 3-kg part on the scram table. Poly plugs (2" thick) are used to give 6 sided reflection. The arms are 3" x 3". If M ≤ 20, we will put 4 3-kg parts on the control table. SIS = 2.624 cm

Assembly D-9: Safety for loading control table

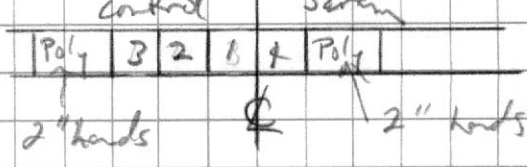
Spacing: 2.624 cm

Parts: 1, 2, 3, 4

Basekate: 8.124×10^5 n/s

No Moderator

6 Sided reflection 3x3 arms, 2" hands



E.F. Fast Step D-9

		X	± X
T-1	= 5 + 3.448 + 1.905 + 2.899 / 4	= 3.313	.302
T-2	= 5.556 + 4.082 + 2.128 + 3.03 / 4	= 3.699	.270
T-3	=		
T-4	=		

E.F. Full in D-9

T-1	= 5 + 3.998 + 1.905 + 4.494 / 4	= 3.699	.270
T-2	= 5.556 + 4.082 + 2.128 + 5 / 4	= 4.152	.239
T-3	=		
T-4	=		

Pos.	T-1	ER	10^5 n/s	M	T-2	ER	10^5 n/s	M
7.927	9918	.302	50.01	6.16	11478	.270	51.65	6.36
	165.80				191.30			

T-3
351

T-4
305

T/C's R = 71 #1 = 100 #2 = 108

	T-1	T-2
2.540	13658	15374

T-3	T-4
532	376

	T-1				T-2			
	18931	.270	85.19	10.49	21460	.235	85.74	10.52
0.000	315.52				357.67			

T-3
204

T-4
345

T/C's R = 71 #1 = 105 #2 = 112

EF Fast Stop D-10

		X	1/X
T-1	= 5 + 3.488 + 1.905 + 2.899 + 1.538/5 =	2.858	.338
T-2	= 5.558 + 8.082 + 2.128 + 3.03 + 1.538/5 =	3.267	.306
T-3	=		
T-4	=		

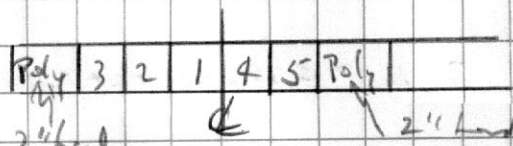
EF Pull in D-10

		X	1/X
T-1	= 5 + 3.488 + 1.905 + 4.499 + 2.859/5 =	3.539	.283
T-2	= 5.558 + 8.082 + 2.128 + 5 + 3.03/5 =	3.959	.253
T-3	=		
T-4	=		

Assembly D-10: Safety for loading of 3 kg parts in the control hole

spacing: 2.624 cm

Parts: 1, 2, 3, 4, 5⁻



Base Rate: 10.05×10^{-5} 1/s

No. Moderator

6 sided reflection 3×3 arrays, 2" Lands

Pos.	T-1	k eff	10^{-5} 1/s	M	T-2	k eff	10^{-5} 1/s	M
7.925	12227	.338	6F/FF	6.82	13541	.306	71.30	7.06
	203.8				233.02			

T-3: 902

T-4: 329

T/L's R = 72 #1 = 100 #2 = 108

	T-1				T-2			
0.000	32971	.283	155.51	15.4	36676	.253	154.63	15.3
	549.5				611.27			

T-3: 1021

T-4: 804

T/L's R = 72 #1 = 103 #2 = 110

Fast Stop E.F. D-11

		x	$\frac{1}{x}$
T-1	= 5 + 3.948 + 1.905 + .758 + .331 + 2.855 + 1.538 + .633/8	= 2.061	.484
T-2	= 5.556 + 4.082 + 2.128 + .853 + .368 + 3.03 + 1.538 + .641/8	= 2.273	.440
T-3	=		
T-4	=		

Pace 2.54 EF D-11

T-1	= 5 + 3.948 + 1.905 + .758 + .331 + 4.167 + 2.857 + 1.626/8	= 2.512	.398
T-2	= 5.556 + 4.082 + 2.128 + .855 + .368 + 4.545 + 2.985 + 1.626/8	= 2.768	.361
T-3	=		
T-4	=		

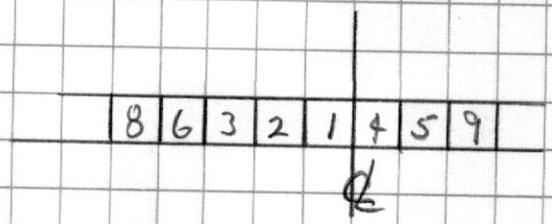
Full in E.F. D-11

T-1	= 5 + 3.948 + 1.905 + .758 + .331 + 4.444 + 2.855 + 1.538/8	= 2.54	.394
T-2	= 5.556 + 4.082 + 2.128 + .855 + .368 + 5 + 3.03 + 1.538/8	= 2.820	.355
T-3	=		
T-4	=		

Assembly D-11: Same as D-8 but with 5 3-Kg parts on the control table and 3 3-Kg parts on the screw table. This is just a check on Eff. Factors.

Spacing: 2.624 cm

Parts: 1, 2, 3, 4, 5, 6, 8, 9



Base Rate: 16.177×10^{-5} n/s

No Moderator

4 sided reflection 3X3" array

Pos	T-1	EF(0⁵)	10^5 n/s	M	T-2	EF(0⁵)	10^5 n/s	M
2.917	27049	.984	218.19	13.49	30564	.990	228.14	13.86
	450.81				509.40			

T-5: 592

T-4: 884

T/Cs R = 73 #1 = 112 #2 = 108

	T-1				T-2			
2.54	68524	.398	335.18	20.72	56377	.361	339.20	20.97
	842.97				935.62			

T-3: 1085

T-4: 847

	T-1				T-2			
0.000	118687	.394	805.27	49.78	133456	.353	811.85	50.16
	122630			Y_M = .0201	137138			Y_M = .0198
	$ 2093.83				$ 2285.90			

T-3: 2343

T-4: 2052

T/Cs R = 73 #1 = 115 #2 = 110

There is a 15-20% increase over D-8. We will remove one from the control table and check another point. Same as D-11

Assembly D-12: Same as D-11 but with part loading as shown below.

9	8	6	5	4	1	2	3	

℄

Pos.	T-1	EF	10⁵ n/s	M	T-2	EF	10⁵ n/s	M
2.920	26052				25964			

	T-3	T-4
	832	628

T/C's 72 105 97

	T-1	T-2
2.54	47874	53603

	T-3	T-4
	1384	1154

T/C's 72 112 103

	T-1				T-2			
0.000	109714 .354	736.66	45.54		123675 .355	750.27	46.38	
	112154			Δm = .02196	126807			
	1869.7				2113.45			

	T-3	T-4
	3251	2583

T/C's 72 116 106

This is within ~10% of D-8, We will continue.

Fast Stop E.F. D-13

control

| | | |

Assembly D-13:

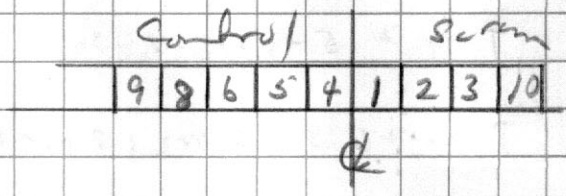
Spacing: 2.624 cm

Parts: 1, 2, 3, 4, 5, 6, 8, 9, +10

Base Rate: $18,226 \times 10^5$ n/s

No Mod.

4 sided reflector 3×3" arms



Pos.	T-1	EF(0°)	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.822	29745	.536	2651.2	14.58	33436	.887	271.39	14.89
	995.75				5571.27			
							$Y/\sqrt{n}$ = .0678	
	T-3				T-4			
	795				660			
	T/C's		R = 72		#1 = 118		#2 = 105	
	T-1				T-2			
2.54	61709	.437	949.96	28.69	65973	.397	456.37	25.04
	1069.65				1188.53			
							$Y/\sqrt{n}$ = .0402	
	T-3				T-4			
	1569				1213			
	T/C's		R = 72		#1 = 120		#2 = 107	
	T-1				T-2			
.400	138773	.432	1027.78	56.39	154219	.391	1036.53	56.89
	14274				15912.0			
	2379.02				2652.0		$Y/\sqrt{n}$ = .0177	
	T-3				T-4			
	3117				2579			

Full in EF D-13

T-1 = 5+3.498+1.505+.758+.331+8.498+2.899+1.538+.68/5 = 2.322 .431

T-2 = 5.556+4.082+2.128+.855+.368+5+3.03+1.538+.69/5 = 2.557 .391

T-3 =

T-4 =

Fast Stg EF D-13

control

T-1 = 5+3.498+1.505+.758+.331+2.899+1.538+.633+.286+.129/10 = 1.692 .591

T-2 = 5.556+4.082+2.128+.855+.368+3.03+1.538+.691+.286+.129/10 = 1.860 .538

T-3 =

T-4 =

Pos-2.5T EF D-13

T-1 = 5+3.498+1.505+.758+.331+4.167+2.857+1.626+.571+.238/10 = 2.085 .48

T-2 = 5.557+4.082+2.128+.855+.368+4.595+2.985+1.626+.526+.238/10 = 2.291 .436

T-3 =

T-4 =

Pos. - 0.8T0 EF D-13

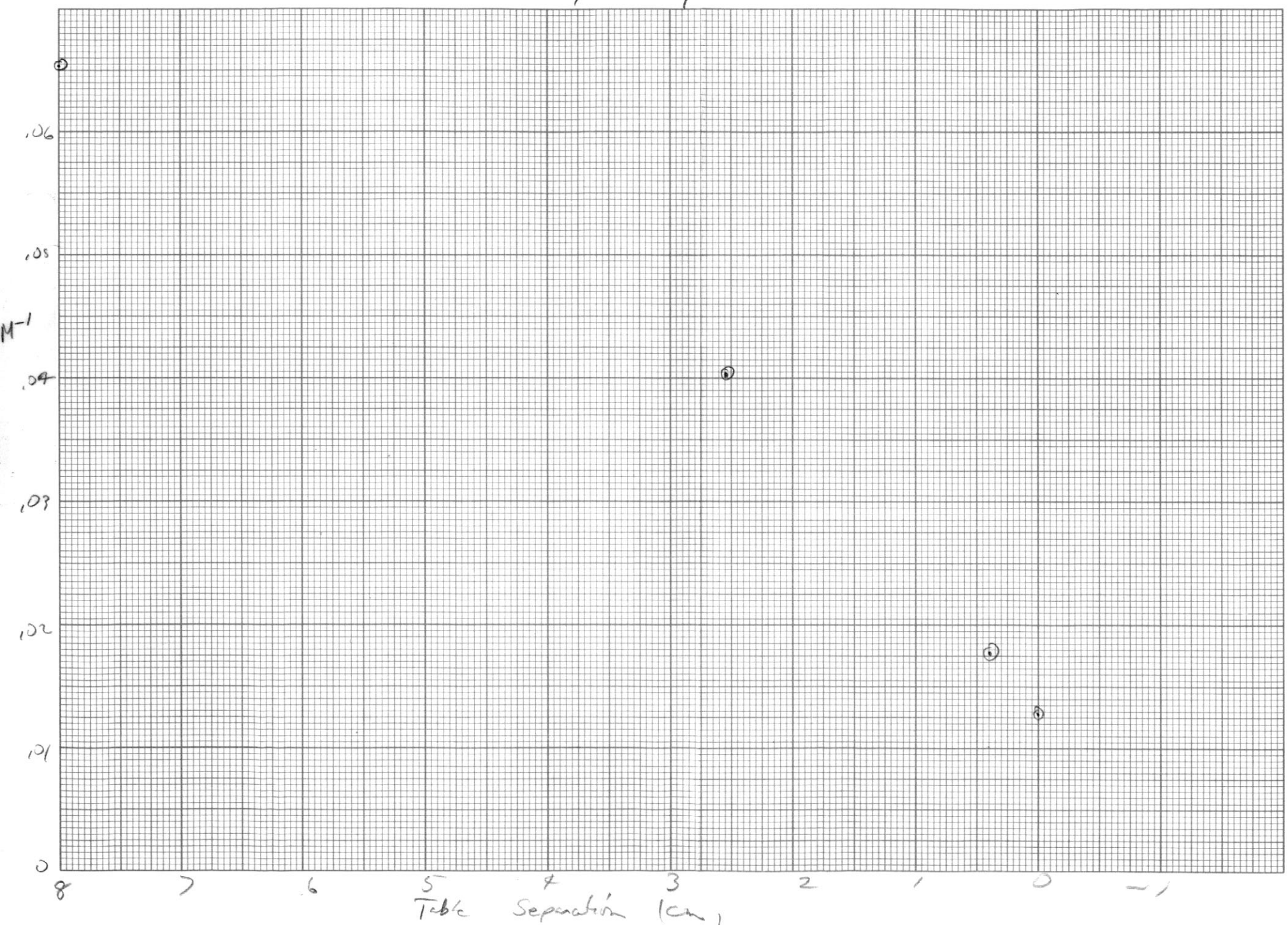
T-1 = 5+3.498+1.505+.758+.331+4.255+2.778+1.471+.625+.278/10 = 2.085 .48

T-2 = 5.558+4.082+2.128+.855+.368+4.657+2.941+1.471+.633+.278/10 = 2.296 .436

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

Assembly D-13



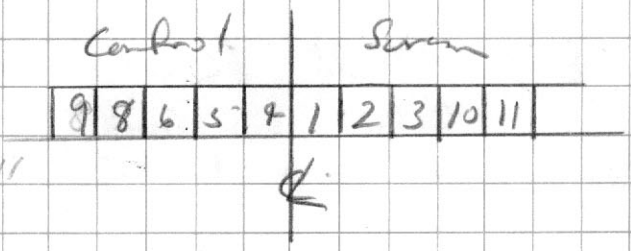
Pos	T+1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000	189055	.431	1811.80	77.94	210151	.391	1425.54	78.43
	196482			Y_M=.0129	218368			Y_M = .0127S-
	3209.7				3656.1			
	T-3				T-4			
	3809				3871			

T/Cs R = 72 #1 = 124 #2 = 106

We will now added one more 3-Eg part to the screen table.

Assembly D-14

Spacing: 2.629 cm



Parts: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11

Base Rate: 20.235- x 10^5 n/s

No Mod.

4 sided reflected

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.921	34418	.591	338.98	16.75-	38201	.538	342.53	16.83
	573.57				636.68			
								Y_M = .0584
	T-3				T-4			
	867				681			
	T-1				T-2			
2.54	81472	.480	651.78	32.21	90257	.436	655-5.83	32.81
	1357.87				1508.24			Y_M = .0310
	T-3				T-4			
	1746				1513			
	T/Cs		R = 71		#1 = 124		#2 = 110	

Full in EF D-14

				X	$\frac{1}{X}$
T-1	=	5 + 3,498 + 1,505 + .705 + .331 + 8,448 + 2,898 + 1.538 + .68 + .301	/10	= 2,120	.472
T-2	=	5.556 + 4.042 + 2.125 + 1.585 + .368 + 5 + 3.03 + 1.538 + .69 + .301	/10	= 2.331	.429

E.F. Rest Step E-1

	Control	Serum		X	$\frac{1}{X}$ = E.F.
T-1 =	5	+ 2.985	/2 =	3.993	.250
T-2 =	5.556	+ 3.125	/2 =	4.341	.230

E.F. Full Exp E-1

	Control	Serum		X	$\frac{1}{X}$ = E.F.
T-1 =	5.	+ 4.545	/2 =	4.773	.210
T-2 =	5.556	+ 5.	/2 =	5.278	.189

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

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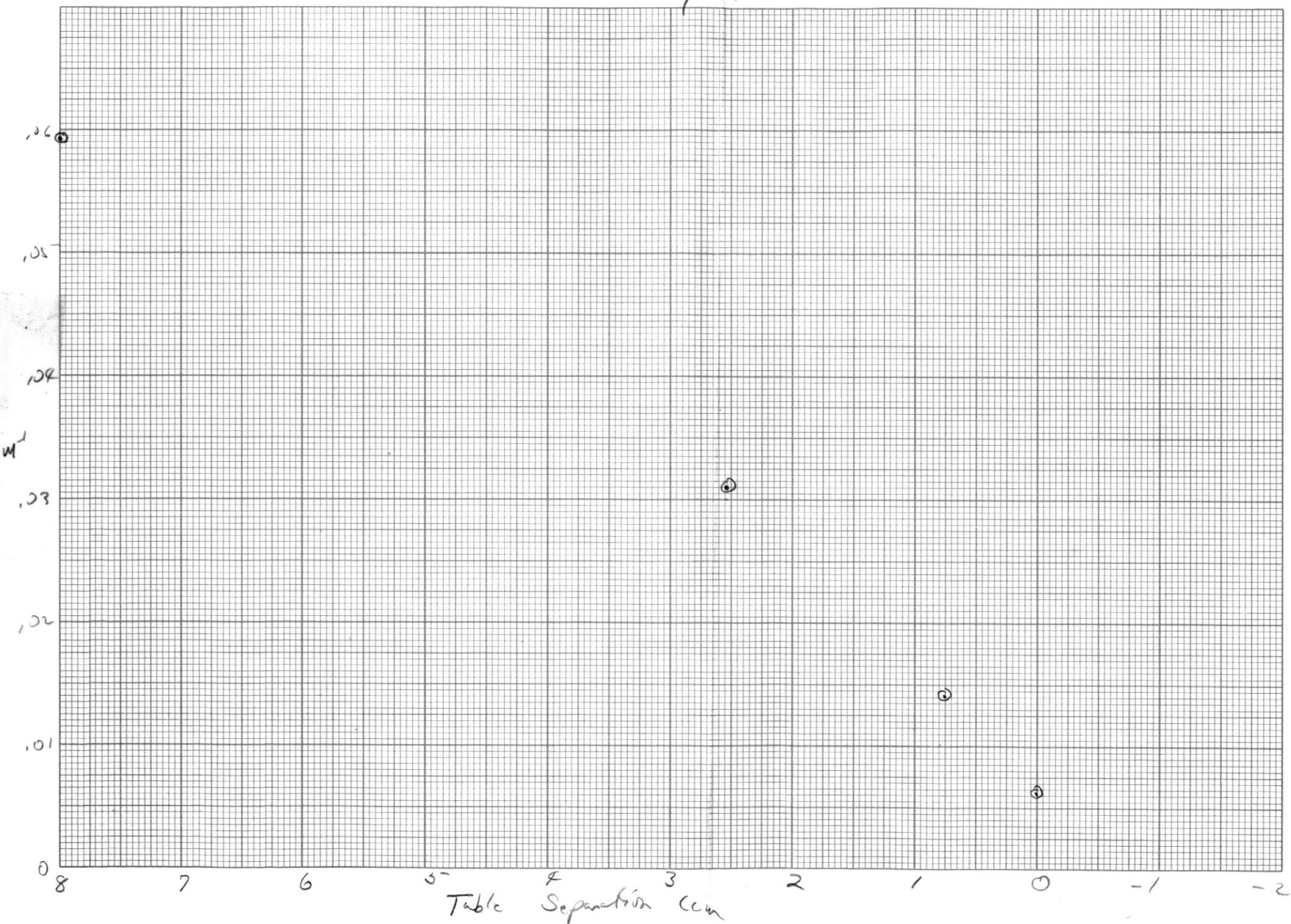
Assembly D-1R



Pos	T-1	ET	10^5 n/s	M	T-2	ET	10^5 n/s	M
.800	120511	.480	1442.4	69.79	159119	.436	1428.26	70.58
	196531				196579			
	2982.18				3275.82			

$1/\sqrt{m} = .0142$

T-3
3355

T-4
2584

T/C's R = 72 #1 = 125 #2 = 112

	T-1					T-2				
0.000	385036	.472	3281.64	162.2	427160	.429	3335.37	165.03		
	417157				$1/\sqrt{m} = .00470$85				$1/m = .00606$	
	6952.62				7784.08					

T-3
6585
T/C's R = 71 #1 = 127 #2 = 113

4/28/64

We will now decrease the spacing by .5 cm and run the new series.

(D-Series Curves a Page 63)

Assembly E-1:

Spacing: 2.124 cm

Parts: 194

Base Rate: 4.02×10^5 n/s

No Mod.

4 sided reflector 3 x 3" arms

Control	Scram
4	1

Pos	T-1	ET	10^5 n/s	M	T-2	ET	10^5 n/s	M
2.933	13003/5	.250	10.535	2.20	14934/5	.230	11.07	2.75
	43.34				48.11			

T-3
597

T-4
644

Post Step	E.P.	E-2		
	1		X	$\frac{1}{X} = \overline{E.P.}$
T-1 =	5	+ 2.985 + 1.626/3 =	3.204	.312
T-2 =	5.556	+ 3.125 + 1.626/3 =	3.458	.289

Full In	E.P.	E-2		
	1		X	$\frac{1}{X} = \overline{E.P.}$
T-1 =	5	+ 3.575 + 3.175/3 =	4.29	.236
T-2 =	5.556	+ 5 + 3.333/3 =	4.63	.216

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000	10332/2	.210	18.08	8.80	11363/2	.189	17.90	9.45
	86.10		Ym = .2222		99.69			Ym = .2247

T-3
522/2

T-4
444/2

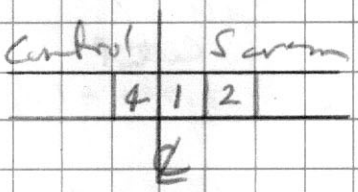
T/C's R = 71 #1 = 82 #2 = 90

Assembly E-2

Spacing: 2.124 cm

Parts: 1, 2, & 4

Base Rate: 6.067×10^5 n/s



No Mod

4 sided reflection 3 x 3 arms

Pos	T-1	E.F.	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.926	21582/2	.312	22.42	3.70	23384/2	.285	22.53	3.71
	71.87				77.55			

T-3
1059/2

T-4
965T/2

T-1

T-2

0.000	22514/2	.236	44.28	7.30	24249/2	.216	43.65	7.19
	187.62		Ym = .1370		202.08			Ym = .1391

T-3
1040/2

T-4
884/2

T/C's R = 71 #1 = 81 #2 = 88

E. F. Fast Stop E-3

	Control		Screen			$\frac{1}{X} = E\bar{F}$
T-1 =	5	+ 3.448 + 1.961 +	2.988	/ 4 =	3.349	.299
T-2 =	5.556	+ 4.0 + 2.198 +	3.125	/ 4 =	3.720	.269

E. F. Full IN

	Control		Screen			
T-1 =	5	+ 3.448 + 1.961 +	4.545	/ 4 =	3.739	.267
T-2 =	5.556	+ 4.0 + 2.198 +	5	/ 4 =	4.189	.239

Assembly E-3

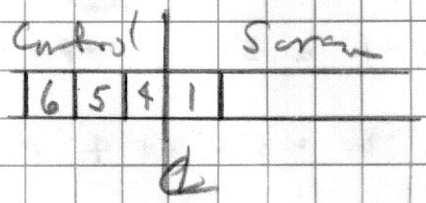
Spacing: 2.124 cm

Parts: 1, 4, 5, & 6

Base Rate: 8.017×10^5 n/s

No Moderator

4 sided reflection 3x3 arrays



Pos.	T-1	EF(0?)	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.830	20632	.299	51.91	6.49	23546	.269	53.[illegible]	6.66
	173.6				198.55			
	T-3				T-4			
	723				625			

T/C's R = 71 #1 = 98 #2 = 105

	T-1				T-2			
0.000	20966	.267	93.30	11.64	23541	.235	93.77	11.70
	349.93			ν_m = .0859	392.35			ν_m = .0850
	T-3				T-4			
	735				628			

T/C's R = 71 #1 = 101 #2 = 106

E.F. Fast Stop E-4

	Control			Scram			X	$1/X = \overline{EF}$
T-1	= 5 +	3.448 +	1.961 +	2.985 +	1.626	/5 =	3.094	.333
T-2	= 5.556 +	4 +	2.198 +	3.125 +	1.626	/5 =	3.301	.303

E.F. 2,540 cm E-4

	CONTROL			Scram			X	$1/X = \overline{EF}$
T-1:	5 +	3,448 +	1,961 +	4,132 +	2,632	/5 =	3,435	.291
T-2:	5,556 +	4 +	2,198 +	4,444 +	2,740	/5 =	3,788	.264

E.F. 2,000 E-4

	CONTROL			SCRAM				
T-1:	5 +	3,448 +	1,961 +	4.545 +	3,195	/5 =	3,630	.275
T-2:	5,556 +	4 +	2,198 +	5 +	3,333	/5 =	4,017	.249

NO. 341-20 DIETZGEN GRAPH PAPER
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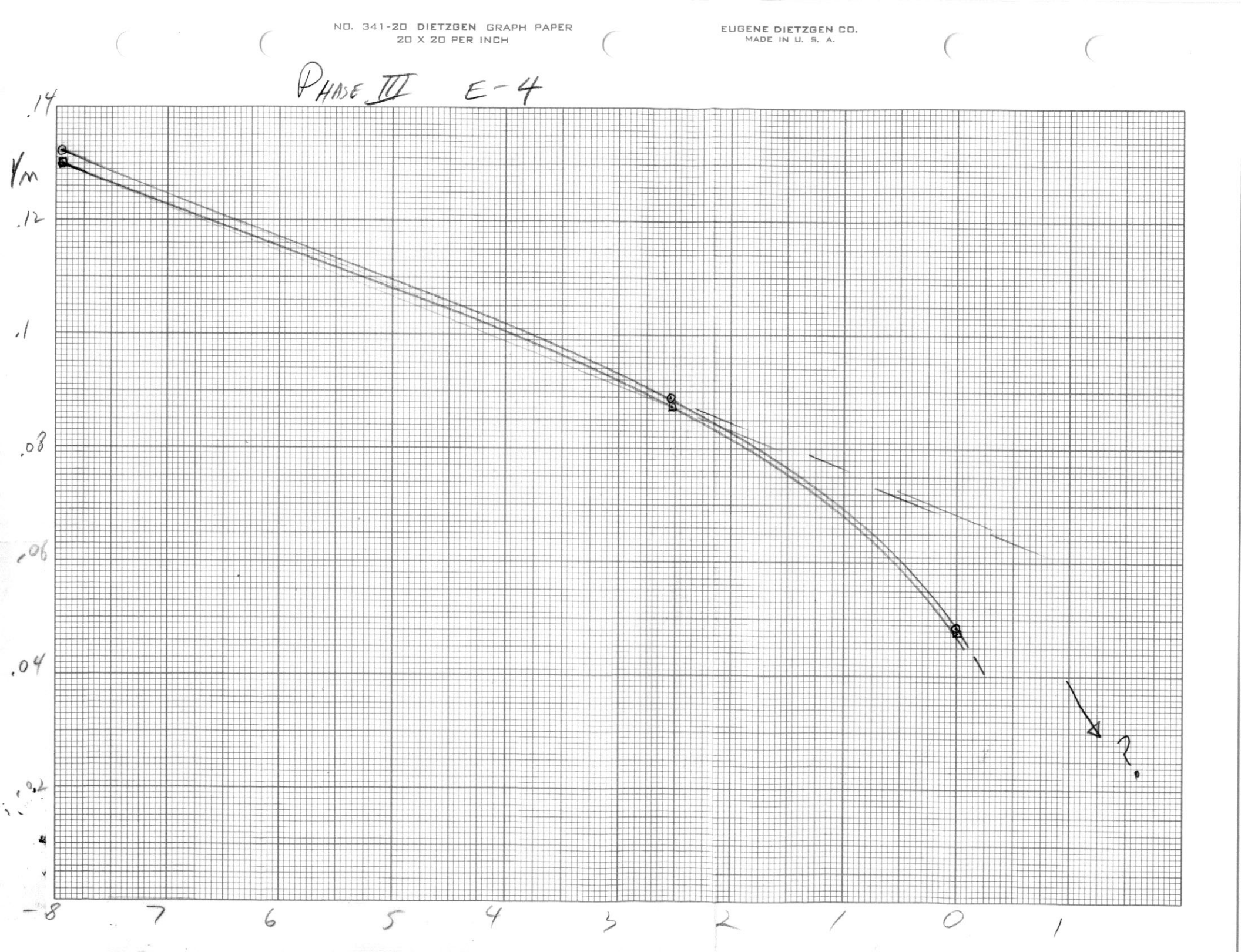

Assembly E-4

Spacing: 2.124 cm

Parts: 1, 2, 4, 5-6

Base Rate: 10.068 x 10^{-5} 1/s

No Moderator

4 sided reflected 3x3" arms

Control			Scram		
6	5	4	1	2	

Pos	T-1	EF(10)	10^{-5} 1/s	M	T-2	EF	10^{-5} 1/s	M
7.924 cm	13701/1	.333	76.06	7.56	15324/1	.303	77.39	7.69
	228.4				255.4			
	T-3 458/1				T-4 445/1			
	T.C.'s 70, 99, 105							
2.540 cm	23,297/1	.291	113.00	11.23	26,235/1	.264	115.46	11.47
	388.3				437.3			
	T-3 746				T-4 685			
0.000	45,212/1	.275	207.52	20.62	51,275	.249	212.79	21.14
	753.53			Y_{m_1} = 0485	854.58			Y_{m_2} = 0473
	T-3 1496				T-4 1339			($\bar{m}$ = 20.88)
	T-C's: 70, 100, 106							

Fast Stop E.F. E-5

Control | Scram × $\bar{X}=\overline{E.F.}$

T-1 = 5 + 3.498 + 1.961 + 2.985 + 1.626 + .741/6 = 2.627 .381

T-2 = 5.556 + 4 + 2.198 + 3.125 + 1.626 + .752/6 = 2.876 .348

Pos = 2.539 EF E-5

T-1 = 5 + 3.498 + 1.961 + 4.132 + 2.632 + 1.389/6 = 3.094 .323

T-2 = 5.556 + 4 + 2.198 + 4.444 + 2.780 + 1.389/6 = 3.388 .295

Pos = .254 EF E-5

T-1 = 5 + 3.498 + 1.961 + 4.444 + 3.125 + 1.754/6 = 3.289 .304

T-2 = 5.556 + 4 + 2.198 + 5 + 3.279 + 1.754/6 = 3.631 .275

Full in EF E-5

T-1 = 5 + 3.498 + 1.961 + 4.545 + 3.195 + 1.781/6 = 3.323 .301

T-2 = 5.556 + 4 + 2.198 + 5 + 3.333 + 1.781/6 = 3.646 .274

4/29/69

Assembly E-5

control			screen			
	6	5	4	1	2	3

Spacing: 2.124cm

Parts: 1, 2, 3, 4, 5, 6

Base Rate: 12,121 $\times 10^{-5}$ n/s

No Mod

4 sided reflection 3"x3" arms

Pos	T-1	EF	10^{-5} n/s	M	T-2	EF	10^{-5} n/s	M
2.928	17364	.381	110.26	9.10	19544	.388	113.35	9.35
	289.4				325.73			
	T-3				T-4			
	635				994			

T/C's R = 71 #1 = 97 #2 = 100

	T-1				T-2			
2.539	36299	.323	195.14	16.10	40412	.295	196.68	16.39
	604.15				673.5			
	T-3				T-4			
	1068				978			

T/C's R = 71 #1 = 99 #2 = 101

	T-1				T-2			
.254	83481	.304	422.99	34.90	93228	.275	427.30	35.25
	1391.4				1555.38			
	T-3				T-4			
	3977				3198			

T/C's R = 71 #1 = 102 #2 = 105

Post Stop EF F-1

Control | Scram

T-1 = 5.39 + 4.082 + 3.226 + 2.151/4 = 3.645 .277

T-2 = 5.556 + 4.762 + 3.333 + 2.151/4 = 3.951 .253

Pos. = 5.080 EF F-1

T-1 = 5.39 + 4.082 + 3.846 + 2.740/4 = 3.917 .255

T-2 = 5.556 + 4.762 + 4. + 2.857/4 = 4.294 .233

Pos = 2.54 EF F-1

T-1 = 5 + 4.082 + 4.255 + 3.279/4 = 4.154 .241

T-2 = 5.556 + 4.762 + 4.651 + 3.390/4 = 4.590 .218

Pos = 1.297 EF F-1

T-1 = 5 + 4.082 + 4.444 + 3.509/4 = 4.259 .235

T-2 = 5.556 + 4.762 + 5 + 3.636/4 = 4.739 .211

Pos = .968

Scram | control

T-1 = 4.545 + 3.636 + 5 + 4.082/4 = 4.316 .232

T-2 = 5 + 3.774 + 5.556 + 4.762/4 = 4.773 .209

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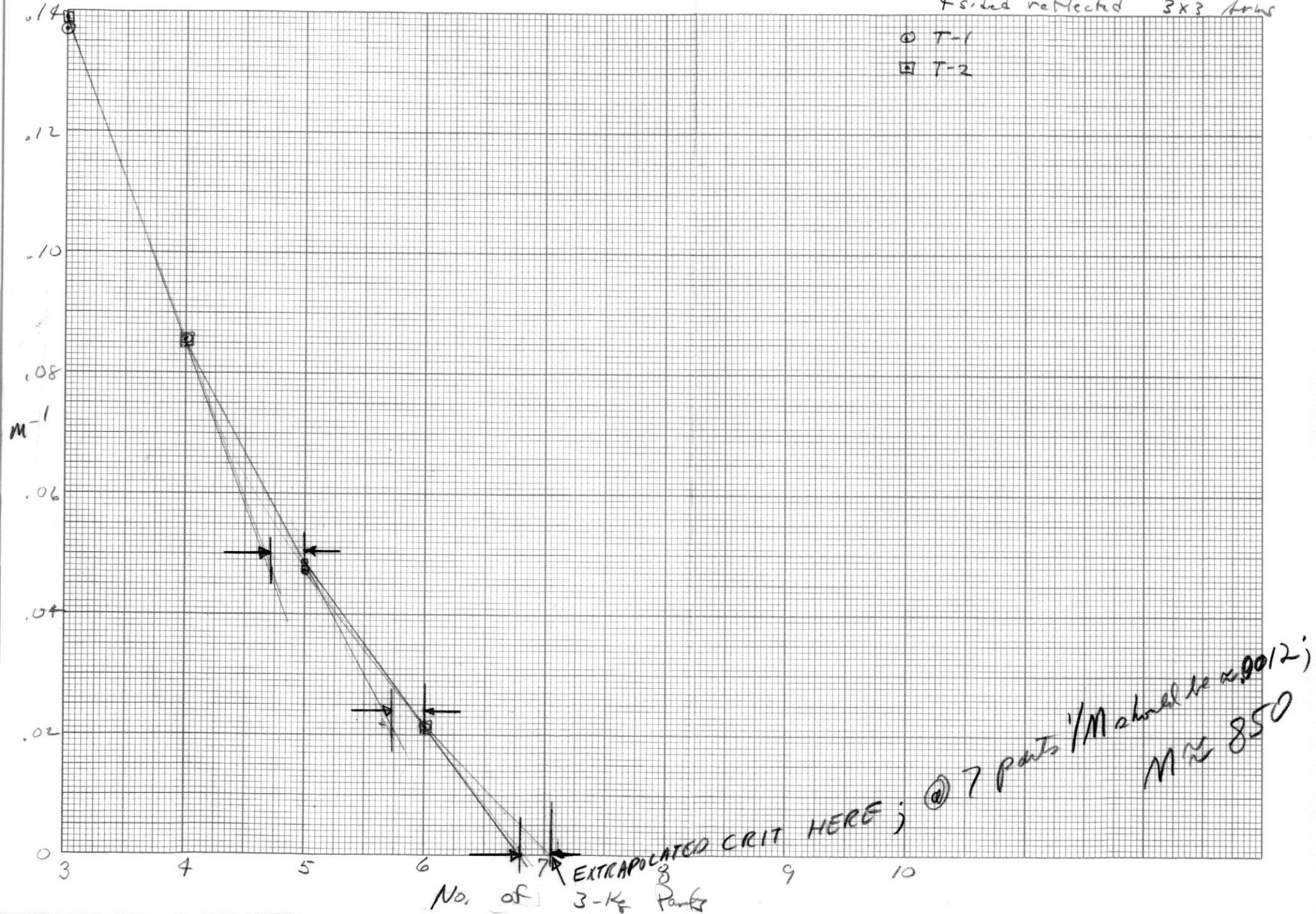
E-Series STS = 2.124 cm

4 sided reflected 3x3 Arrays

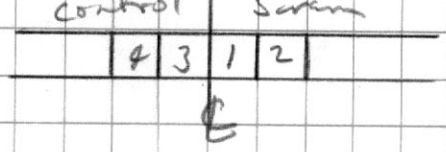


Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000	101715	.391	5.2068	42.96	112718	.274	5.2660	43.98
	103791			$\bar{\nu}_m$ = .0233	115313			$\bar{\nu}_m$ = .0230
	1729.85				1921.88			
	T-3				T-4			
	2950				2542			

We will now look at 2 6-Kg units in our next series. We will place one 6-Kg unit on each table. The only spacing between units will be the col. lips and the can dimensions. The total STS between units is .850 cm. Extrapolating from the 3 Kg series this STS is subcritical. (Avg. STS = .591 cm for 4 3-Kg units) STS_c = .55 cm

Assembly F-1:

Spacing: .4 cm + .45 cm = .850 *



Parts: 1, 2, 3, 4

Book Calc: 8.128×10^5 n/s

No Mod

4 sided reflection

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.931	16417	.277	75.78	9.33	18265	.253	72.02	9.98
	273.62				364.42			
								$\bar{\nu}_m$ = .1064
	T-3				T-4			
	716				751			

* Possibly .840 = .401 + (1.997" − 1.824") 2.54 = .401 + .439
GAP SPACING

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Assembly F1

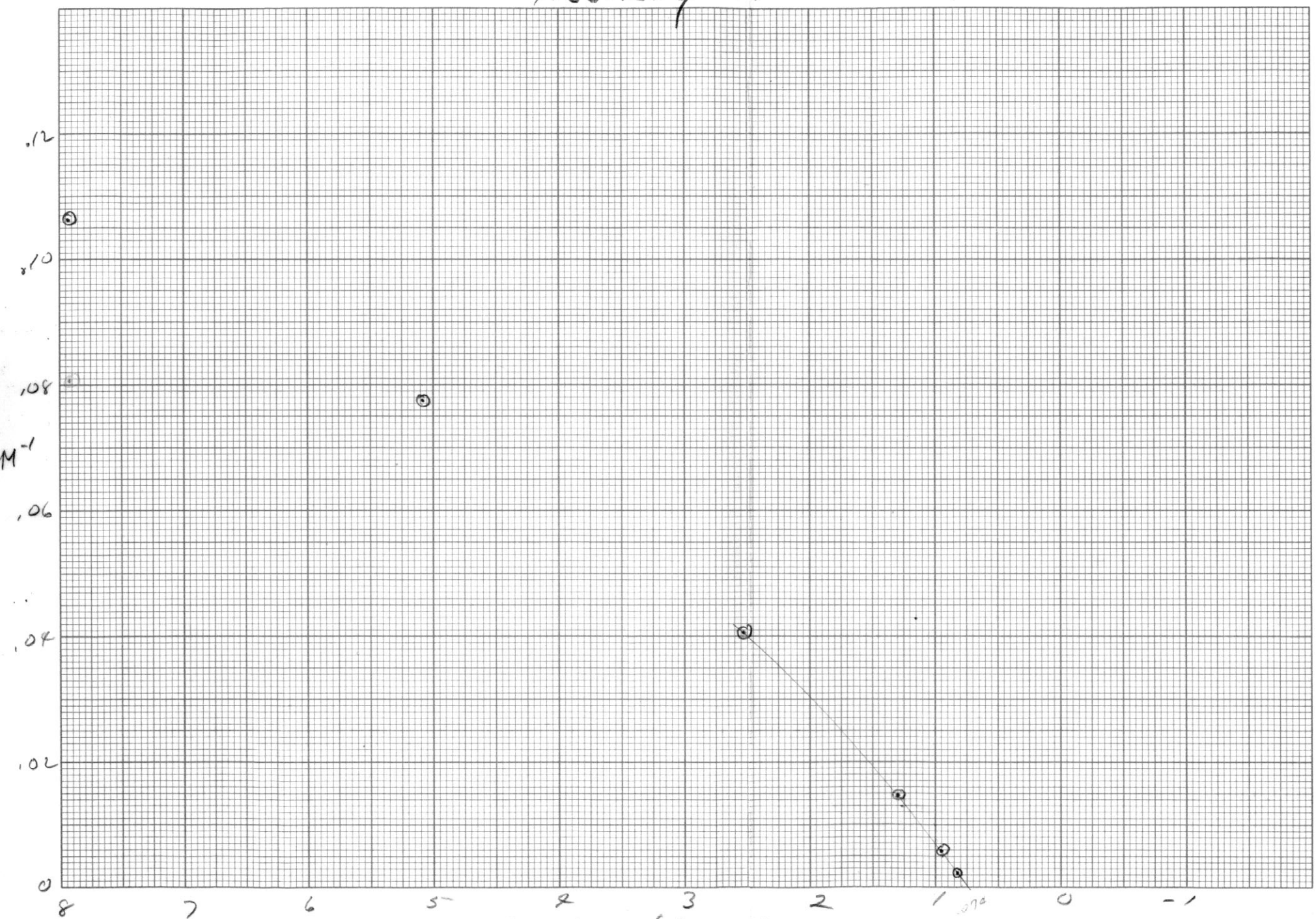

Table Separation Goal

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
5.08	24331	.253	103.41	12.73	20222	.233	105.71	13.01
	405.51				453.70			

$1/\sqrt{m} = .0777$

T-3 1097 T-4 989

T/C's R = 72 #1 = 54 #2 = 81

	T-1					T-2				
2.54	49516	.241	198.89	24.48		55215	.218	200.63	24.20	
	825.27					920.32				

$1/\sqrt{m} = .04068$

T-3 2250 T-4 1538

	T-1					T-2				
1.292	135622	.233	546.85	67.31		154919	.211	549.80	67.06	
	2327.03					2581.98				

$1/\sqrt{m} = .01485$

T-3 6208 T-4 5250

	T-1					T-2				
.968	326900	.232	1351.89	166.4		363758	.209	1366.87	168.25	
	395626					392403				
	5827.1					6540.05				

$1/\sqrt{m} = .00598$

T-3 15102 T-4 13255

Post Stop ET F-2

T-1 = 5. + 4.082 + 2.985 + 2.151/4 = 3.555 .281

T-2 = 5.556 + 4.762 + 3.125 + 2.157/4 = 3.899 .256

Pos 2.5 ft ET F-2

T-1 = 5 + 4.082 + 4.255 + 3.279/4 = 4.154 .241

T-2 = 5.556 + 4.762 + 4.651 + 3.350/4 = 4.590 .218

Pos .96 ft ET F-2

T-1 = 5 + 4.082 + 4.358 + 3.390/4 = 4.205 .238

T-2 = 5.556 + 4.762 + 4.878 + 3.509/4 = 4.676 .214

Pos .300 ET F-2

T-1 = 5 + 4.082 + 4.545 + 3.571/4 = 4.300 .233

T-2 = 5.556 + 4.762 + 5 + 3.704/4 = 4.756 .210

Full in ET F-2

T-1 = 5 + 4.082 + 4.545 + 3.571/4 = 4.300 .233

T-2 = 5.556 + 4.762 + 5 + 3.774/4 = 4.773 .210

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
.839	710788	.232	3203.5	3944	788209	.209	3249.53	399.95
	↓ 828625				↓ 932454			
	13810				155-28			$\frac{1}{m}$ = .0025-2
	T-3				T-4			
	38568				39279			

This assembly would be critical if fully assembled ∴ we will increase STS to 1.918 cm and run. We will also look at a 4 3-kg series with min. spacing to improve our extrapolation data.

5/2/69

Assembly F-2:

	Lips	Spun	Plastic	Bottom	cm clip
Spacing:	.4 +	.6 +	.48 +	.108 +	.330 = 1.918 cm

Parts: 1, 2, 3, 4

control		scram	
4	3	1	2

Base Rate: 8.124×10^5 n/s

No Mod.

4 sided reflection

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7528	14760	.281	69.13	8.5-1	120485	.256	72.72	8.95
	246.00				28x.28			
	T-3				T-4			
	5851				605			

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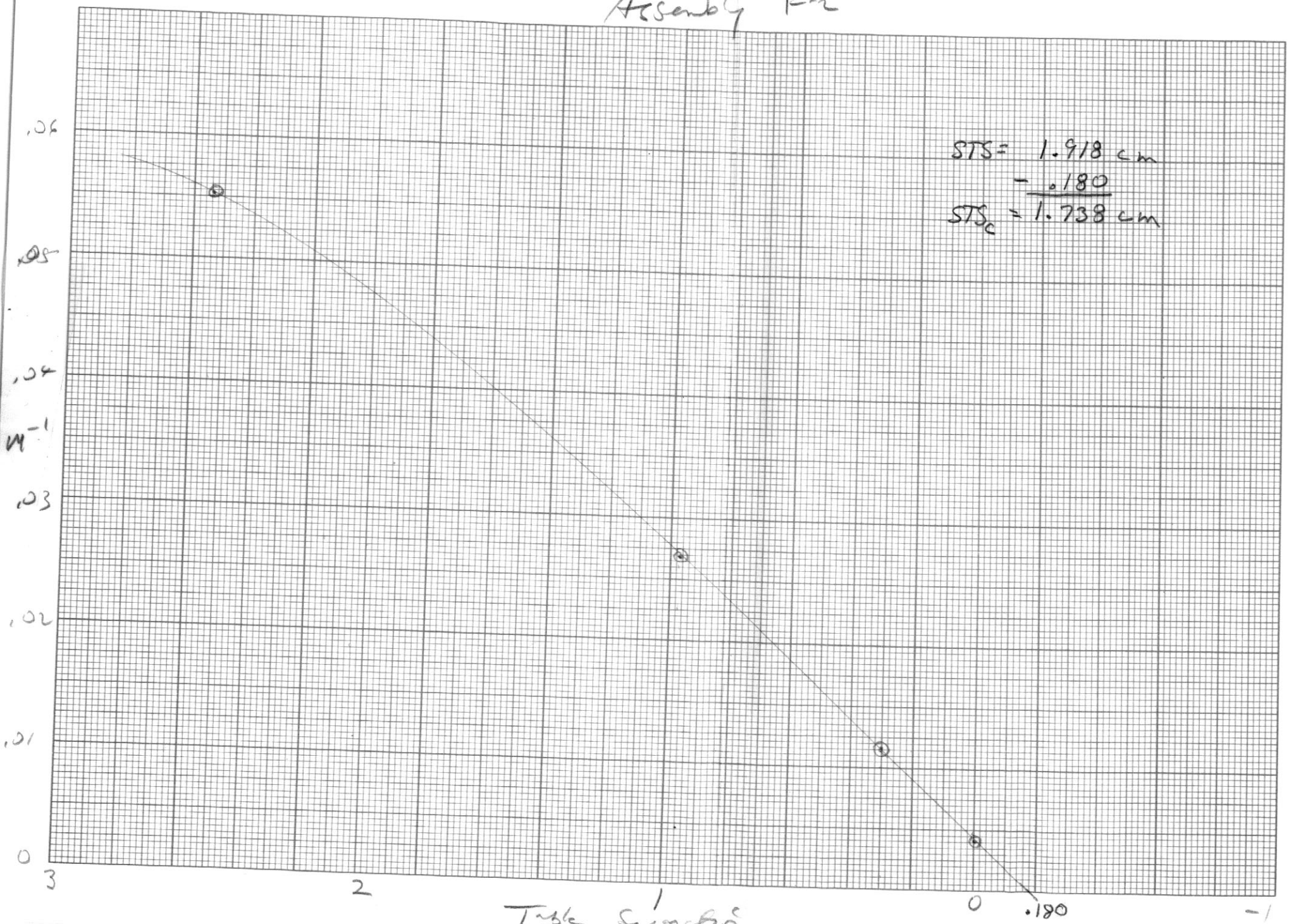
Assembly F-2



STS = 1.918 cm
− .180
STS$_c$ = 1.738 cm

Pos	T-1	ER	10^5 g/s	μ	T-2	ER	10^5 g/s	μ
2.580	35768	.241	143.67	17.68	91336	.218	150.19	18.49
	596.13				685.53			

$\sqrt{\mu}$ = .0553

T-3 1437

T-4 1377

T/C's R = 71 #1 = 77 #2 = 79

	T-1					T-2			
.964	75272	.238	298.58	36.25	85732	.214	305.78	37.64
	1254.53				1428.87			

$\sqrt{\mu}$ = .0269

T-3 3109

T-4 2585

	T-1					T-2			
.300	170820	.233	686.84	84.54	193714	.210	705.30	86.82
↓	176869				201573			
	2947.82				3358.55			

$\sqrt{\mu}$ = .01167

T-3 6855

T-4 6703

	T-1					T-2			
0.00	463488	.233	1883.82	244.2	524909	.210	2052.72	252.67
↓	510855				586891			
	8514.25				9778.85			

$\sqrt{\mu}$ = .00403

T-3 20170

T-4 15778

T/C's R = 71 #1 = 80 #2 = 81

Post Stop EF F-3

T-1 = 5. + 4.082 + 3.03 + 1.98 / 4 = 3.523 .284

T-2 = 5.557 + 4.762 + 3.175 + 1.98 / 4 = 3.868 .259

Pos. 3.174 EF F-3

T-1 = 5 + 4.082 + 4.255 + 3.145 / 4 = 4.116 .243

T-2 = 5.556 + 4.762 + 5.000 + 3.52 / 4 = 4.702 .212

We will now remove .2 cm spacer and replace with a .0279 cm spacer. STS = 1.746 cm

5/5/69

Assembly F-3:

Spacing: .4 + .4279 + .48 + .108 + .330 = 1.746 cm

Parts: 1, 2, 3, 4

Base Buckl: 8.124×10^{-5} n/s

No Mod.

4 sided reflection

control rod: 4, 3 | 1, 2 scram

Pos.	T-1	EF	10^5 n/s	M	T-2	E-R	10^5 n/s	M
7.918	14834 247.23	.284	70.21	8.64	16580 283.00	.259	73.30	9.02

$Y_{\bar{m}} = .0883$

T/C's R = 70 #1 = 79 #2 = 81

3.174	30781 513.01	.243	124.66	15.34	38685 570.82	.212	122.41	15.07

$Y_{\bar{m}} = .0658$

1.257	64386 1073.1	.235	252.18	31.04	73258 1221.63	.211	257.26	31.72

$Y_{\bar{m}} = .0319$

T/C's R = 71 #1 = 82 #2 = 83

.0551	138267 138013 2300.2	.232	533.65	65.69	153044 152875 2631.25	.208	548.93	67.69

$Y_{\bar{m}} = .0150$

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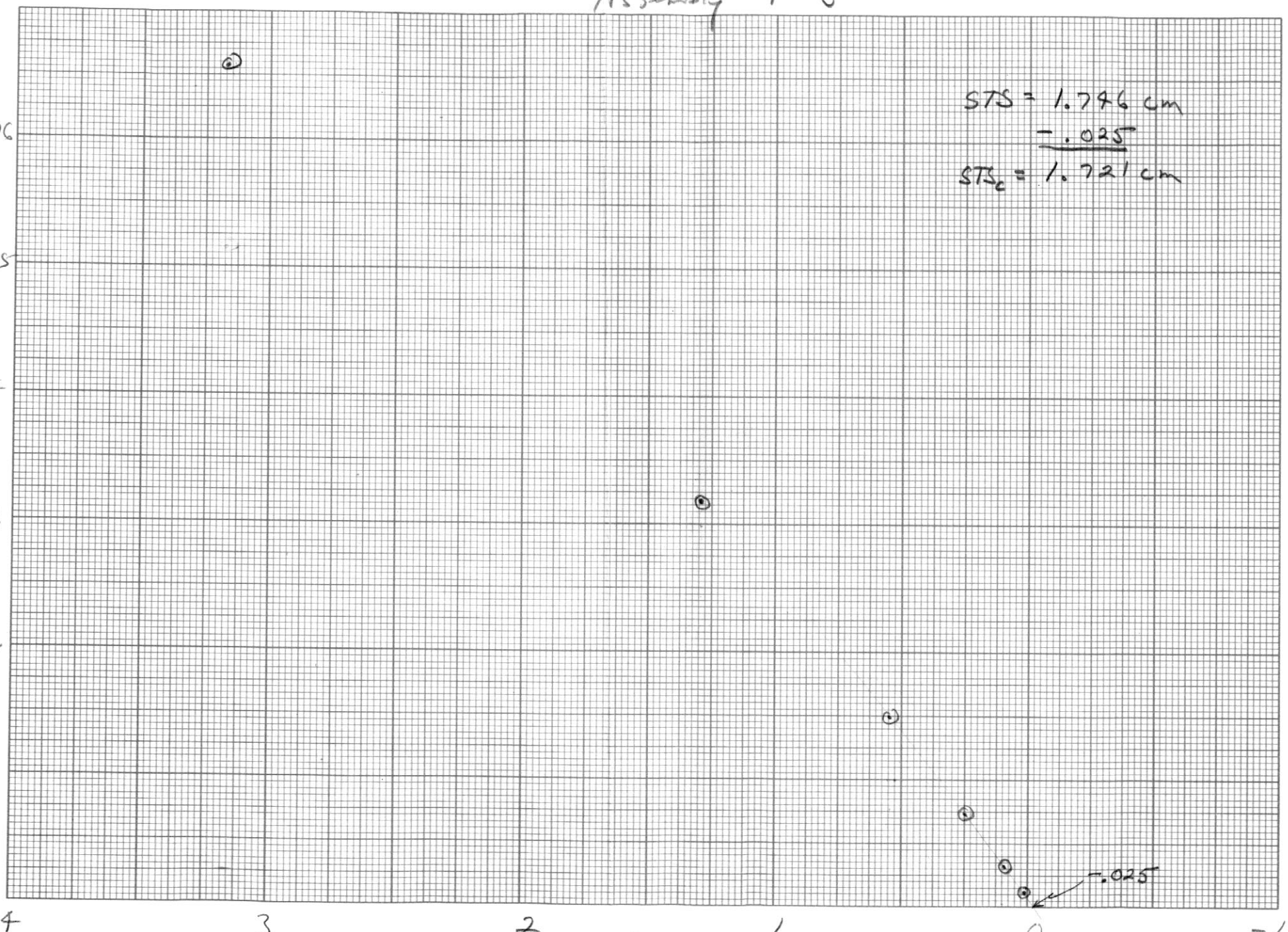
Assembly F-3



Pos	T-1	ETR	10^5 psi	M	T-2	ETR	10^5 psi	M
.249	266933	.230	1055	138.75	308658	.210	1131.5	135.3
	281591				323261			
	4698.85				5386.02			

$\gamma/\sqrt{M} = .00780$

.091	5786519	.230	2507.8	306.7	6547251	.210	263.71	324.6
	6542211				7538513			
	10903.5				125.57			

$\gamma/\sqrt{M} = .00316$

T/C's		21		29		29	
.014	1277681	.230	6578.5	809.8	1400993	.210	6810.3	838.3
	1716166				1985823			
	28602				32430			

$\gamma/\sqrt{M} = .00121$

Assembly F-2 gives a $STS_{crit} = 1.738$ cm and

Assembly F-3 gives a $STS_{crit} = 1.721$ cm $\therefore$

Avg $\underline{STS_{crit} = 1.730 \text{ cm}}$ for $\underline{2 \text{ 6-kg parts.}}$

Fast Stop EF G-1

	Control Value		Sum	
T-1 =	5.	+ 3.125 + 1.449 + .571 + .231	+ 3.125	/6
T-2 =	5.714	+ 3.636 + 1.613 + .645 + .257	+ 3.209	/6

	$\bar{X}$	$\frac{1}{\bar{X}} = EF_1$
=	2.250	.444
=	2.523	.396

Full in EF G-1

	Control	Sum		$\bar{X}$	$\frac{1}{\bar{X}} = EF$
T-1 =	10.376	+ 4.545	/6 =	2.487	.402
T-2 =	11.859	+ 5.128	/6 =	2.831	.353

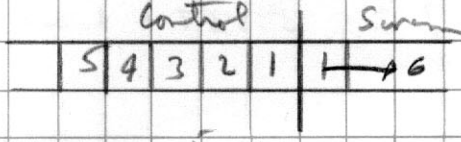
We will now go back to the 3-kg parts and increase the spacing to 3.623 cm between parts and also look at unit misplacement.

We will load 5 3-kg parts on the control table with STS = 3.623cm and 1 3-kg part on the screw with only 1.623 cm between the parts on the control & the part on the screw

Assembly G-1 : STS = 3.623 with unit misplacement

Spacing : .635 + .480 + .8 + .108 + 2.000 = 3.623 cm

Parts : 1, 2, 3, 4, 5, 6



Base Rate : 10,058 X 10^{-5} m/s → 12,121 X 10^{-5} m/s

No Mod

4 sided reflection with 3X3 arms

Pos	T-1	EF	10^{-5} m/s	M	T-2	EF	10^{-5} m/s	M
2.917	11450	.484	8 8.73	8.39	13243	.396	8 7.41	8.66
	190.83				220.72			

Magnet released due to lower setting 5/5/6? We will raise voltage to normal setting.

We will now re-run G-1

Pos	T-1	EF	10^{-5} m/s	M	T-2	EF	10^{-5} m/s	M
2.917	11324				13763			
0.000	22396	.402	150.05	12.86	26386	.353	105.21	15.37
	373.27			↓ 12.38	439.77			↓ 12.81

$\bar{M}$ = 12.59

T/C's 72 108 113

ER Post Stop H-1

Control 1 × 1/4 = ER

T-1 = 4.878 + 3.448 + 3.175 + 1.786/4 = 3.322 .301

T-2 = 5.556 + 4.000 + 3.337 + 1.786/4 = 3.669 .273

Full in ER H-1

Control 1 Sum

T-1 = 4.878 + 3.448 + 4.585 + 3.333/4 = 4.051 .247

T-2 = 5.556 + 4.000 + 5.000 + 3.509/4 = 4.516 .221

Pos. 1.85 ER H-1

Control 1

T-1 = 4.878 + 3.448 + 4.348 + 2.885/4 = 3.915 .255

T-2 = 5.556 + 4.000 + 4.762 + 3.125/4 = 4.361 .229

We have decided to discontinue this series since the data is of no great value at this time. We would rather look at another series with 4 3-Kg parts with uniform spacing smaller than the series already finished. We can do this by setting the spacing in each column to a pre-determined spacing and extrapolating the table closure spacing to make uniform spacing. We will begin this series with a uniform spacing of 2.024 cm. We need not extrapolate until we get smaller than 1.624 cm which is min. spacing of the parts at the seperation plane of the two columns with heat sinks in place!

5/13/69

Assembly H-1:

Control		Scram		
	2	1	3	4

Spacing: .635+.48+.4+.108+.4 = 2.023cm

Parts: 1, 2, 3, 4

Base Refc: 8.124×10^{-5} 1/s

No No 6.

4 sided reflected 3x3 arms

Pos.	T-1	EF	10^5 1/s	M	T-2	EF	10^5 1/s	M
2.925	17269/2.301 143.67		93.30	5.33	19036/2 158.63	.273	93.31	5.33
1.85	16797 279.95	.255	71.35	8.79	18624 310.40	.225	71.08	8.75
0.000	26045 434.08	.247	107.22	13.29	29340 488.00	.221	108.07	13.30

T/C's R = 72 #1 = 106 #2 = 100

Post Stop EF Control | H-2

T-1 = 5. + 3.704 + 3.125 + 1.867/4 = 3.429 .292

T-2 = 5.551 + 4.398 + 3.226 + 1.867/4 = 3.754 .266

Pos. 2.6 EF Control | H-2

T-1 = 5 + 3.704 + 4.167 + 2.941/4 = 3.953 .253

T-2 = 5.556 + 4.398 + 4.586 + 3.125/4 = 4.394 .228

Pos. .35 Control |

T-1 = 5 + 3.704 + 4.545 + 3.448/4 = 4.174 .240

T-2 = 5.556 + 4.398 + 5.00 + 3.636/4 = 4.648 .214

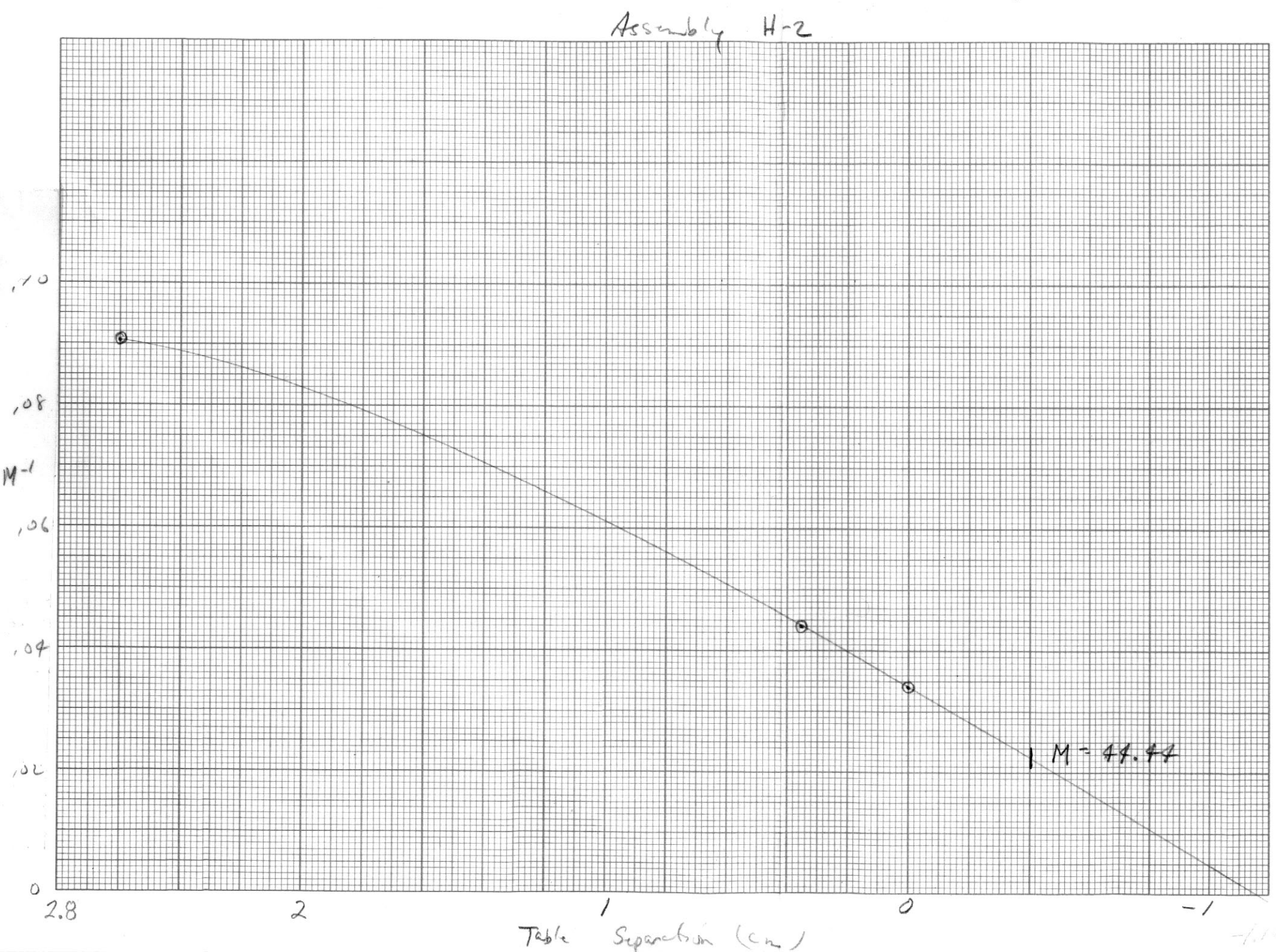
Full in 6.000

T-1 = 5. + 3.704 + 4.651 + 3.571/4 = 4.232 .231

T-2 = 5.556 + 4.398 + 5.128 + 3.704/4 = 4.684 .213

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



Assembly H-2

Spacing between parts 1 & 2 and between parts 3 & 4
= .635 + .48 + .108 = 1.223 cm

Spacing at full closure between parts 1 & 3
= .635 + .48 + .401 + .108 = 1.624 cm

We will extrapolate to 1.223 cm so there will be uniform spacing.

control		screw		
	2	1	3	4

Parts: 1, 2, 3, 4

Base Rate: 8.124 $\times 10^{-5}$ 1/s

No Mod

4 sided reflection 3 x 3 arrays

Pos.	T-1	EF	10^5 1/s	M	T-2	EF	10^5 1/s	M
7.931	10143 179.05-	.292	52.28	6.48	12309 205.15	.266	59.57	6.72
2.600	21114 354.90	.253	89.03	10.96	23801 396.68	.228	90.48	11.13
							γ_m = .0906	
.35-	45762 762.70	.240	183.05-	22.53	51618 860.30	.216	185.62	22.87
							γ_m = .0981	
0.000	60085 1001.42	.236	236.38	29.09	67863- 1124.42	.213	239.50	29.48
							γ_m = .0342	

T/C's R = 72 #1 = 97 #2 = 103

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH
EUGENE DIETZGEN CO.
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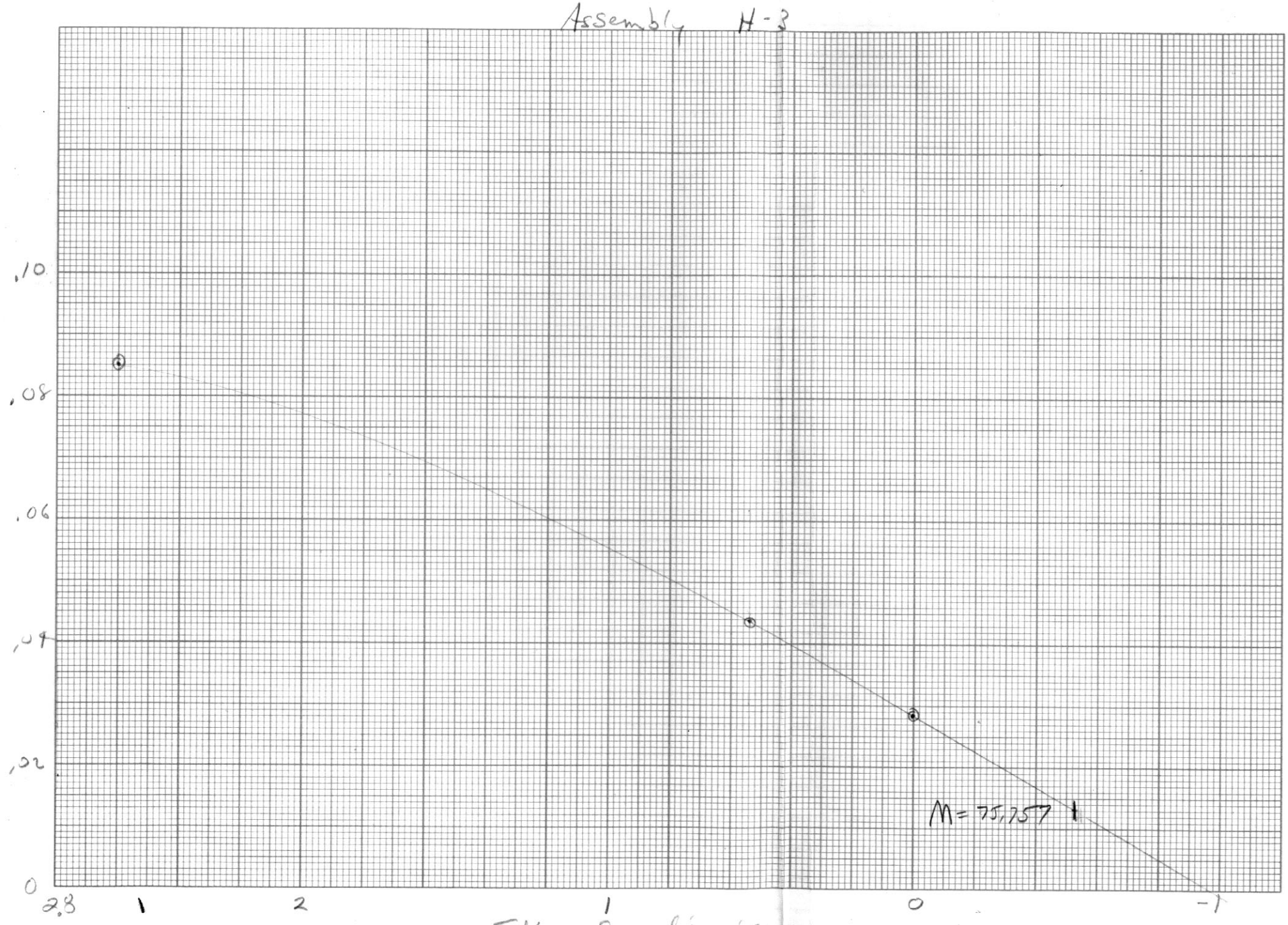
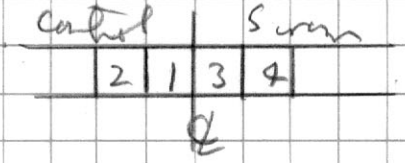


Assembly H-3

Spacing between parts 1+2 and between parts 3+4 = .635 + .356 + .108 = 1.099 cm

Spacing between parts 1 & 3 = 1.624 cm

We will extrapolate to 1.099 cm so there will be uniform spacing.



Parts: 1, 2, 3, 4

Base Rate: 8.124×10^{5} n/s

No Mod.

4 sided reflected 3x3 array

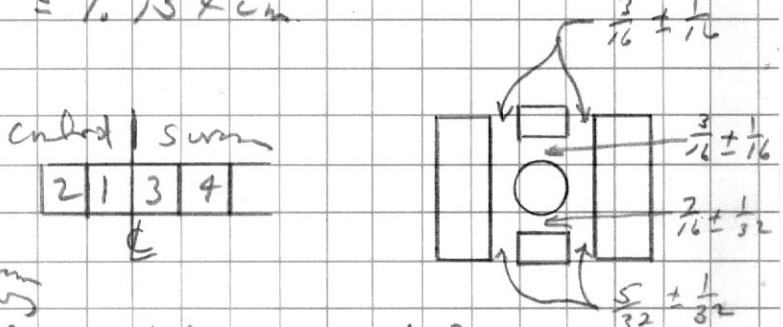
Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.917	11163	.292	58.33	6.69	13136	.266	58.24	7.17
	186.05				218.93			
2.606	22504	.253	94.89	11.68	25381	.228	96.30	11.85
	375.07				422.35			
							$1/\bar{M}$ = .0850	
.540	46098	.240	184.39	22.7	51802	.216	186.49	22.95
	768.30				863.36			
							$1/\bar{M}$ = .0438	
0.000	70912	.236	282.94	34.8	79146	.213	285.62	35.16
	↓71933				↓80957			
	1198.88				1340.95		$1/\bar{M}$ = .0286	

E. R. Same as used for Assembly F-3

5/14/69

We will go back to the 6-kg series and run a spacing of 1.754 cm and then do a study of reflector worth vs reflector distance from the column.

Assembly I-1 : STS = 1.754 cm



Spacing: .635 + .130 + .48 + .108 + .401 = 1.754 cm (control: .635 + .130; sum: .48 + .108 + .401)

Parts: 1, 2, 3, 4

Boc Rate: 8.124 x 10^{-5} 1/s

No Mod

4 sided reflection 3 x 3 arrays

Pos.	T-1	EF	10^5 1/s	M	T-2	EF	10^5 1/s	M
2.917	15282	.284	72.33	8.90	17458	.259	75.36	9.28
	254.70				290.97			
	T/G's	R = 72		#1 = 86		#2 = 93		
3.173	31669	.243	128.25	15.79	35652	.212	125.97	15.51
	527.78				594.20			
								1/m = .0639
	T/G's		72		87		96	
1.297	66226	.235	259.35	31.93	74917	.211	263.46	32.43
	1103.77				1248.62			
								1/m = .0311
	T/G's		72		88		97	

NO. 341-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

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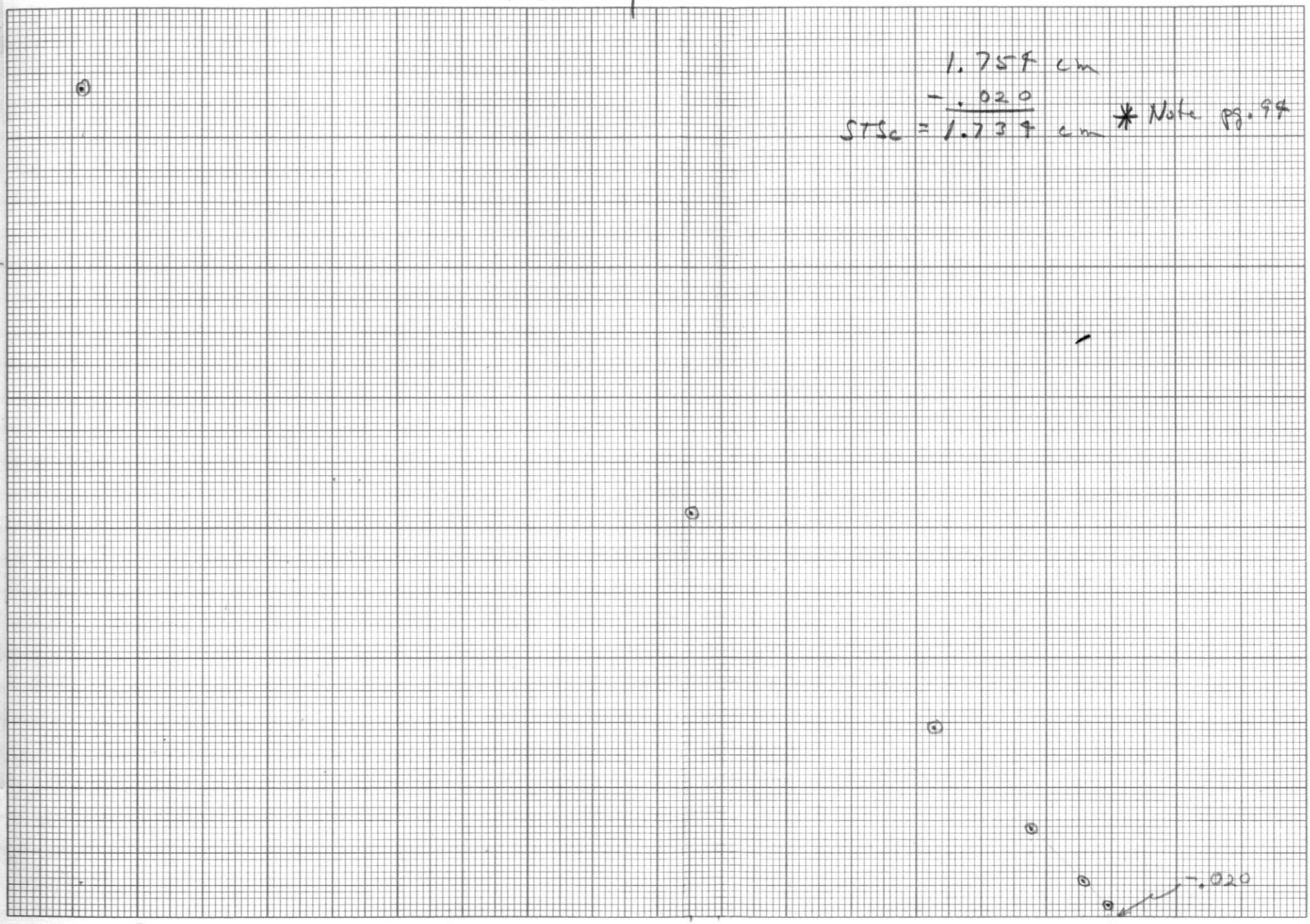
Assembly I-1



Pos	T-1	E-1	10^5 n/s	M	T-2	E-2	10^5 n/s	M
.550	138611	.232	551.23	67.85	155563	.209	560.63	69.03
	142560				161006			
	2376.				2683.4		$1/\sqrt{n}$ = .01461	
T/C's			72		90		99	
.299	280270	.233	1153.07	141.53	318372	.210	1178.15	144.63
	286928				335473			
	4988.8				5581.2		$1/\sqrt{n}$ = .00698	
			72		90		100	
.091	616865	.230	2697.44	332.0	687497	.210	2785.9	343.41
	703701				797098			
	11728.				13285.0		$1/\sqrt{n}$ = .00296	
			72	51	100			
.012	1561937	.230	8707.7	1072	1664857	.210	8732.7	1075
	2271577				2495062			
	37859.6				41584.4		$1/\sqrt{n}$ = .00093	
			72		91		101	

* Note: STS_{crit} for this array is 1.738 cm which is in very good agreement w.th the F-Series which gave an Avg STS_{crit} = 1.730 cm pg. 88

Fast Stop EF I-2

	Control	1	Sum		$\overline{EF}$
T-1 =	3.143 +	2.755 +	2.402 +	1.828 / 4 = 2.532	.395
T-2 =	3.484 +	3.087 +	2.564 +	1.948 / 4 = 2.771	.361

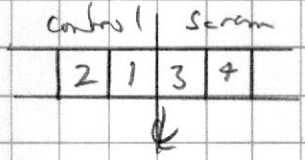
Full EF I-2

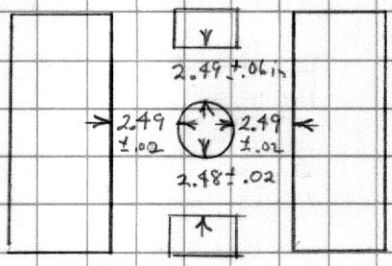
	control	/	scram		
T-1 =	3.143 +	2.755 +	3.103 +	2.709 / 4 = 2.928	.342
T-2 =	3.484 +	3.087 +	3.476 +	2.941 / 4 = 3.247	.308

5/15/69

We will now move the reflectors to the dimension as shown below while keep the same Pu STS as Assembly I-1. The only change is in reflector location.

Assembly I-2: STS = 1.754 cm





Spacing: .635 + .130 + .48 + .108 + .401 = 1.754 cm

Parts: 1, 2, 3, 4

Base Rate: 8.124 $\times 10^5$ n/s

No Mod.

4 sided reflection 3 x 3 arms

Pos	T-1	E.F.	10^5 n/s	M	T-2	E.F	10^5 n/s	M
2.921	8611/2	.395	28.35	3.49	9582/2	.361	28.85	3.55
	71.76				79.93			
T/C's		72			104		104	

Table Scramed due to both air lock doors being opened at the same time. We had better look into this. We will begin again.

2.921	8336/2				9420/2			
0.000	13926/2	.342	39.69	4.89	15601/2	.308	40.04	4.93
	116.05				130.08			

1/M = .2037

Full in ER I-2

T-1 = 12.41 + 10.73 /2 = 11.57 .0864

T-2 = 12.15 + 10.65 /2 = 11.40 .0877

Fast Stop ER I-3
Control 1

T-1 = 3.746 + 3.062 + 2.638 + 1.923/4 = 2.842 .352

T-2 = 4.469 + 3.738 + 3.166 + 2.252/4 = 3.906 .293

~~Pos~~. 1.257 ER I-3
Control 1

T-1 = 3.746 + 3.062 + 3.538 + 2.915/4 = 3.315 .302

T-2 = 4.469 + 3.738 + 4.377 + 3.552/4 = 4.034 .248

Full in ER I-3

T-1 = 3.746 + 3.062 + 3.642 + 3.1 /4 = 3.388 .295

T-2 = 4.469 + 3.738 + 4.441 + 3.654/4 = 4.076 .245

5/16/69

We will re-run Assembly I-2 with the BF_3 tubes moved to the inside holes.

Assembly I-2': Same as I-2 but with BF_3 in inside holes

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.921	26979				26312			
0.000	44290	.0864	69.50	7.94	43550	.0877	69.24	7.91
	746.5				732.5			$1/M = .1261$

T/C's R = 72 #1 = 107 #2 = 105

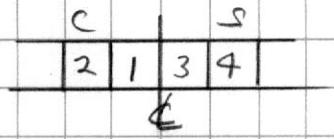
5/19/69

The reflectors were moved to 1" from the columns, and everything else the same. BF_3 tubes outside hole

Assembly I-3: Reflectors spaced at 1"

Spacing: .635 + .130 + .48 + .108 + .401 = 1.754 cm

Parts: 1, 2, 3, 4



Base Rate: 8.124×10^5 n/s

No Mod.

4 sided reflected

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.922	13859/2	.352	40.77	5.02	16470/2	.293	40.21	4.95
	115.83				137.25			

T/C's R = 74 #1 = 102.5 #2 = 96.5

Post Stop LF I-4

T-1 = 4.292 + 3.461 + 2.931 + 1.977 / 4 = 3.165 .316

T-2 = 4.987 + 4.027 + 3.369 + 2.292 / 4 = 3.669 .273

Pos. = 3.173 LF I-4

T-1 = 4.292 + 3.461 + 3.831 + 3.779 / 4 = 3.841 .260

T-2 = 4.987 + 4.027 + 4.443 + 3.310 / 4 = 4.192 .239

Pos = .550 LF I-4

T-1 = 4.292 + 3.461 + 4.235 + 3.373 / 4 = 3.840 .260

T-2 = 4.987 + 4.027 + 4.924 + 3.913 / 4 = 4.463 .224

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
1.297	24435/2	.302	61.80	7.57	25702/2	.248	61.38	7.58
	203.63				247.52			

7R 10R 8F

0.000	15575	.295	76.68	9.84	19087	.245	77.78	9.57
	259.52				317.85			

1/M = .1053

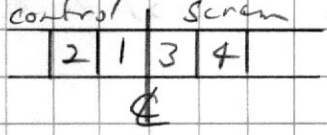
5/20/69

The reflectors were moved to .5" from the Columns, and everything else the same. BF_3 tubes outside hole.

Assembly I-4: Reflectors spaced at .5"

Spacing: .635 + .130 + .48 + .108 + .401 = 1.754 cm

Parts: 1, 2, 3, 4



Base Rate: 8.128 X-5^{-} n/s

No Mod

4 sided reflection 3x3 arms

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7930	10551	.316	55.57	6.84	12284	.273	53.71	6.86
	175.85				208.07			

3.103	17106	.260	79.13	9.12	20669	.239	82.33	10.13
	285.10				348.48			

T/C's R = 72 #1 = 97 #2 = 97

.550	32884	.260	142.50	17.54	39623	.224	147.93	18.21
	548.07				660.38			

T/C's R = 72 #1 = 101 #2 = 98

Fast Stop EF I-5

T-1 = 4.744 + 3.798 + 3.063 + 2.071 / 4 = 3.418 .293

T-2 = 5.204 + 4.121 + 3.430 + 2.298 / 4 = 3.764 .266

Pos = 3.173 EF I-5

T-1 = 4.744 + 3.798 + 4.157 + 3.000 / 4 = 3.924 .255

T-2 = 5.204 + 4.121 + 4.612 + 3.385 / 4 = 4.331 .231

Pos = 1.293 EF I-5

T-1 = 4.744 + 3.798 + 4.479 + 3.459 / 4 = 4.119 .243

T-2 = 5.204 + 4.121 + 5.005 + 3.653 / 4 = 4.546 .220

Pos = .550 EF I-5

T-1 = 4.744 + 3.798 + 4.585 + 3.597 / 4 = 4.180 .239

T-2 = 5.204 + 4.121 + 5.081 + 4.056 / 4 = 4.623 .216

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000	43527	.260	190.35	23.83	52896	.224	157.55	28.31
	732.11				881.60			

$1/\bar{M} = .0419$

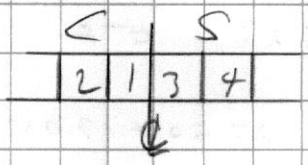
5/21/69

We will now move the reflectors to .25" from the columns, and everything else the same. BF_3 Tubes outside holes

Assembly I-5 : Reflectors spaced at .25 in

Spacing : .635 + .130 + .48 + .108 + .401 = 1.754 cm

Parts : 1, 2, 3, 4



Base Rate : 8.124×10^5 n/s

No Mod

4 sided reflection 3 x 3" arms

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.932	19820	.293	72.37	8.91	16832	.266	74.62	9.19
	292.00				280.53			
		72		103		103		
3.173	31169	.255	132.97	16.31	35318	.231	135.87	16.74
	519.98				588.63			
							$1/\bar{M} = .0605$	
		72		104		104		
1.297	65483	.243	265.21	32.64	73563	.220	271.20	33.38
	1091.38				1232.71			
							$1/\bar{M} = .0303$	
		72		104		105		

Fast Stop EF I-5'

T-1 = 22.30 + 17.05 + 13.48 + 7.93/4 = 17.2475 .05512

T-2 = 21.59 + 16.60 + 13.09 + 7.73/4 = 18.6975 .05355

Pos = 3.173 EF I-5'

T-1 = 22.30 + 17.05 + 18.83 + 12.36/4 = 17.635 .05671

T-2 = 21.59 + 16.60 + 18.66 + 12.26/4 = 17.278 .05788

Pos = 1.297 EF I-5'

T-1 = 22.30 + 17.05 + 20.88 + 18.54/4 = 18.68 .0535

T-2 = 21.59 + 16.60 + 20.57 + 18.33/4 = 18.27 .0547

Pos = .550 EF I-5'

T-1 = 22.30 + 17.05 + 21.50 + 16.13/4 = 19.245 .05196

T-2 = 21.59 + 16.60 + 21.21 + 15.30/4 = 18.675 .05355

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
.548	140476	.239	575.7	70.86	159599	.216	593.6	73.05
	↓ 145530				↓ 164850			
	2408.8				2797.5			$1/\sqrt{M}$ = .0139
		72		108		109		
.249	298113	.239	1244.7	153.21	332400	.216	1281.85	157.75
	↓ 312480				↓ 356090			
	5208.0				5938.5			$1/\sqrt{M}$ = .00643
.102	689635	.239	2974.4	366.1	726326	.216	3059.3	376.6
	↓ 746700				↓ 849800			
	12445.0				14163			$1/\sqrt{M}$ = .00270
		72		110		110		
.030	1587165	.239	9261.7	1140.	1678903	.216	9099.7	1120.
	↓ 2325175				↓ 2527707			
	38752.9				42128.4			$1/\sqrt{M}$ = .000885

5/22/69

We will move the BF_3 tubes to the inside hole and re-run Assembly I-5

Assembly I-5': Same as I-5 but with BF_3 tubes in the inside holes.

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.931	105458	.0582	93.24	11.76	104410	.05355	92.[illegible]	11.72
	↓ 107731				↓ 106639			
	1795.5				1777.3			$1/\sqrt{M}$ = .00[illegible]
	T/C's		72		102		102	
3.173	218464	.0567	215.89	26.57	216619	.0579	218.50	26.90
	↓ 228447				↓ 226423			
	3807.5				3773.7			$1/\sqrt{M}$ = .0378
	T/C's		102		102		102	

Fast Stg ET² I-5"

T-1 = 13.21 + 10.16 + 8.11 + 5.20 / 4 = 9.17 .1091

T-2 = 12.34 + 9.58 + 7.90 + 5.07 / 4 = 8.72 .1147

Pos. 3.173 EF I-5"

T-1 = 13.21 + 10.16 + 11.32 + 7.92 / 4 = 10.67 .0937

T-2 = 12.34 + 9.58 + 10.96 + 7.72 / 4 = 10.15 .0985

Pos 1.297 EF I-5"

T-1 = 13.21 + 10.16 + 12.34 + 9.27 / 4 = 11.25 .0889

T-2 = 12.34 + 9.58 + 12.04 + 8.95 / 4 = 10.73 .0932

Pos .550 EF I-5"

T-1 = 13.21 + 10.16 + 12.65 + 9.70 / 4 = 11.43 .0875

T-2 = 12.34 + 9.58 + 12.90 + 9.45 / 4 = 10.98 .0914

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
1.287	442377	.0536	4328	53.27	438773	.0547	4385	53.98
	485329				881005			
	8088.8				8016.8			$1/\sqrt{M}$ = .01865
	T/C's		72		103		103	
.549	838578	.0519	8735	107.4	836578	.0535	8968	110.4
	1007542				1004827			$1/\sqrt{M}$ = .00918
	16792				16787			
	T/C's		72		104		104	
.249	1372698	.0519	16365	201.7	1380578	.0535	17021	209.5
	1892066				1907133			$1/\sqrt{M}$ = .00786
	31534				31785			
	T/C's		72		106		106	
.030	2909313	.0519	602.6		2164996	.0535		
	6955891				3818335			
	115974		Pulses were DCd @ Hi counts					
	T/C's		72		107		107	

We will do same assembly but with BF_3 tubes in the center holes.

Assembly I-5": BF_3 in center holes

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7.933	508170	.109	92.41	11.37	48483	.115		
	847.8							
			72		105		105	
3.173	108709	.0937	173.6	21.37	103038	.0985	172.71	21.26
	111120				105205			
	1853				1753.8			$1/\sqrt{M}$ = .0467

over

Pos	T-1	EF	10^8 n/s	M	T-2	EF	10^8 n/s	M
1.297	226717	.0889	351.87	43.3	216698	.0932	351.83	43.3
	↓ 237775				↓ 226506			
	3958				3775			$1/\sqrt{M} = .0231$
		72				106	106	
.598	465236	.0875	748.04	92.1	446328	.0914	746.66	91.9
	↓ 512939				↓ 490093			
	8549				8168			$1/\sqrt{M} = .0109$
		72				106	106	
.250	885-031	.0875	1568.3	193.0	85-8992	.0914	1579.9	194.5
	↓ 1075372				↓ 1037179			
	17923				17286			$1/\sqrt{M} = .00516$
		72				107	107	
.030	2558782	.0875	7646	941.2	2137169	.0914	5685.7	699.9
	↓ 5243905				↓ 3732394			
	87390				62207			
	Bad Pulses							
		72				109	109	