UCRL-MI-135701-PH-3-VOL-2

Array Experiments
Phase 3
Volume 2

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Lawrence
Livermore
National
Laboratory

DISCLAIMER

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" "

ARRAY (SINGLE COLUMN) EXPERIMENTS

PHASE III

VOLUME 2

Fast Stay EF J-1

T-1 = 18.24 + 13.44 + 10.89 + 6.43/4 = 12.15 .0823

T-2 = 4.585 + 3.938 + 3.218 + 2.153/4 = 3.38 .0296

T-3 = .479 + .485 + .497 + .480/4 = .484 2.066

Full in EF J-1

T-1 = 18.24 + 13.44 + 18.28 + 13.82/4 = 15.95 .0627

T-2 = 4.585 + 3.938 + 4.575 + 3.584/4 = 4.173 .0239

T-3 = .474 + .485 + .453 + .476/4 = .482 2.075

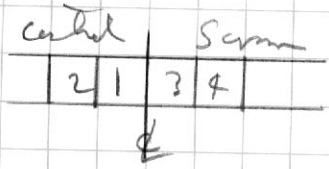
5/28/64

We will now remove one large reflector and leave everything else the same as the I-series. We move the BF_3 tubes to the same side (West) and placed them in inside & outside holes. We also added the TuB on the east side.

Assembly J-1: Reflectors spaced at .25 in

Spacing: .635 + .130 + .48 + .108 + .801 = 1.754

Parts: 1, 2, 3, 4



Base Rate: 8.124×10^{5} n/s

3 sided reflected 3X3 arms

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
7,9,10	309110/8	.0823	53.00	6.52	56815/8	.258	34.79	8.28
	643.98				117.53			

	T-3	EF	10^5 n/s	M
	10101/8	2.066	43.47	5.35
	21.04			

T/C's (pt 1) R = 73 #1 = 83 #2 = 82

	T-1				T-2			
0.000	490670/5	.0627	102.55	12.62	83088/5	.228	62.05	7.64
	1635.6				2770.0			

	T-3			
	10197/5	2.075	70.53	8.68
	33.99			

T/C's R = 74 #1 = 84 #2 = 83

Fast Stop ETF J-1'

T-1 = 11.13 + 8.638 + 6.933 + 8.338/4 = 7.775 .1286

T-2 = 4.860 + 3.531 + 8.200 + 2.074/4 = 3.516 .2844

Full in ETF J-1'

T-1 = 11.13 + 8.638 + 11.15 + 8.139/4 = 9.914 .1009

T-2 = 4.860 + 3.531 + 4.892 + 3.523/4 = 4.402 .2272

Assembly J-1': T-1 moved to center hole
everything else same as J-1

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
2.917	153853/8	.1286	41.22	5.07	55677/8	.2584	32.55	4.06
	320.5				115.98			

	T-3	EF	10^5 n/s	M
	10241/8	2.066	44.09	5.43
	21.38			

0.000	236135/5	.1009	79.82	9.78	82725/5	.2272	62.65	7.71
	787.12				275.76			

	T-3	EF	10^5 n/s	M
	10325/5	2.075	71.42	8.79
	34.42			

TC's R= 73 #1: 83 #2: 82

6/3/69

We will look at detector eff. using a Cf-252 source (like a fission spectrum) and compare the runs J-1 + J-1' with the two different Eff. (PuBe & Cf-252)

Cf-252 = 7.3×10^5 n/s

Full in Eff. Factor for J-1'

		E.F.
T-1	= 9.99 + 7.38 + 10.10 + 7.39 /4 = 8.72	.1147
T-2	= 3.59 + 2.77 + 3.62 + 2.69 /4 = 3.17	.315
T-3	= .530 27 + .57 23 + .53 29 + .52 97 /4 = .51 8	1.93

Assembly J-1'

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000	S 787.12	.1147	90.25	11.11	S 275.71	.315	86.86	10.69

	T-3			
S	38.42	1.93	66.43	8.18

Full in Eff Factor for J-1

		E.F.
T-1	= 20.70 + 15.29 + 20.34 + 14.43 /4 = 17.69	.0565
T-2	= 3.68 + 2.92 + 3.63 + 2.72 /4 = 3.24	.309
T-3	= .532 + .516 + .510 + .524 /4 = .520	1.923

Assembly J-1

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.002	n/s 1635.6	.0565	92.41	11.38	2770.	.309	85.59	10.54

T-3				
n/s	33.99	1.923	65.36	8.05

We will re-determine the Eff. Factors for the Assemblies I-5', I-5', I-5''

Fill in I-5' EF Cf-252 Source

T-1 = 2.919 + 2.280 + 2.911 + 2.271 / 4 = 2.585 .387

T-2 = 3.914 + 3.021 + 3.858 + 2.959 / 4 = 3.438 .291

Assembly I-5

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.249	5208	.387	2015.5	248.1	5535	.291	1727.1	212.6

Fill in I-5' EF Cf-252 Source 2.3×10^5 n/s

T-1 = 25.37 + 19.25 + 25.75 + 19.05 / 4 = 22.36 .0847

T-2 = 25.55 + 19.35 + 25.16 + 18.96 / 4 = 22.26 .0849

Assembly I-5'

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
.249	31534	.0847	1409.6	173.5	31785	.0849	1427.1	175.7

Full in I-5" ETF Cf-252 Source

T-1 = 11.03 + 8.41 + 11.33 + 8.58 /4 = 9.84 .102

T-2 = 11.82 + 8.78 + 11.84 + 9.09 /4 = 10.38 .0963

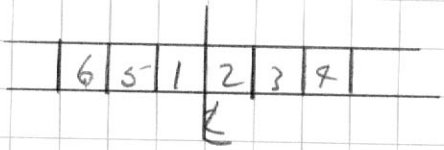
Assembly I-5"

Pos,	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
.250		.102	1828	225		.0963	1665	205
	17923				17286			

6/5/69

We will re-calculate some of the D-series with Eff. Factors determined using the Cf-252 source 7.3 x 10^5 n/s

Assembly D-6



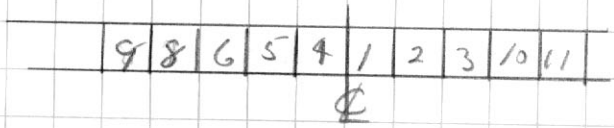
Eff. Factor Determination

T-1 = 3.37 + 1.8 + .75 + 2.98 + 1.65 + .67 /6 = 1.87 .535

T-2 = 4.05 + 2.3 + .88 + 3.8 + 2.03 + .85 /6 = 2.32 .431

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000		.535	414.81	34.22		.431	367.96	30.36
	775.35				853.74			

Assembly D-14



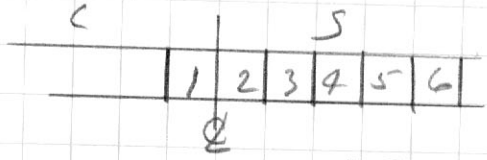
Eff. Factor Determination

T-1 = 3.37 + 1.8 + .75 + .28 + .1 + 2.98 + 1.65 + .67 + .25 + .1 /11 = 1.20 .833

T-2 = 4.05 + 2.3 + .88 + .4 + .18 + 3.8 + 2.03 + .85 + .35 + .16 /10 = 1.50 .667

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000		.833	5191.5	286.2		.667	5192.0	256.6
	6952.6				7788.1			

Assembly D-5



E. F. Determination

EF

T-1 = 3.37 + 2.98 + 1.65 + .67 + .25 + .1 / 6 = 1.50 .667

T-2 = 4.05 + 3.8 + 2.03 + .85 + .35 + .16 / 6 = 1.87 .535

Pos.	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M
0.000		.667	362.8	29.9		.535	310.0	25.7
	543.97				581.22			

6/10/69

We will determine Eff Factor for the I-series (I-2, I-2') using the Cf 252 source 7.3×10^5 n/s

Assembly I-2

Eff Factor Determination

Fast stop

T1 = 2.3 + 2.04 + 1.58 + 1.06 / 4 = 1.74 .575

T-2 = 2.84 + 2.54 + 1.87 + 1.33 / 4 = 2.15 .465

Full in

T1 = 2.3 + 2.04 + 2.15 + 1.76 / 4 = 2.06 .485

T-2 = 2.84 + 2.54 + 2.73 + 2.23 / 4 = 2.59 .386

Fast stop M-1 = $\frac{.575}{.395}$ (3.49) = 1.456 (3.49) = 5.08 (add M)

M-2 = $\frac{.465}{.361}$ (3.55) = 1.29 (3.55) = 4.58 (add M)

Full in M-1 = $\frac{.485}{.342}$ (4.64) = 1.418 (4.64) = 6.93

M-2 = $\frac{.386}{.308}$ (4.93) = 1.253 (4.93) = 6.18

Assembly I-2'

~~Eff.~~ Factor Determination
Fast Stop

T-1 = 15.75 + 18.12 + 10.74 + 7.75/8 = 12.10 .0826

T-2 = 15.79 + 13.88 + 10.82 + 7.91/8 = 12.10 .0826

Full in

T-1 = 15.75 + 18.12 + 14.96 + 12.19/8 = 14.26 .0701

T-2 = 15.79 + 13.88 + 15.11 + 12.22/8 = 14.25 .0702

Fast Stop M-1 = .0826

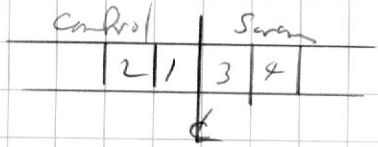
M-2 = .0826

Full in M-1 = $\frac{.0701}{.0826}$ (7.94) = .811(7.54) = 6.44

M-2 = $\frac{.0702}{.0677}$ (7.91) = .800(7.91) = 6.33

6/12/69

We will re-determine Eff Factor for ~~Assembly~~ I-2 using the Cf 252 source 7.3×10^5 n/s and run the Assembly I-2. We will also use the Pu-Be Source 1.3×10^6 n/s



Assembly I-2

~~Eff Factor~~ Determination Cf-252 Source

T-1 = 2.52 + 2.21 + 2.37 + 1.52/8 = 2.26 .492

T-2 = 2.85 + 2.51 + 2.69 + 2.15/8 = 2.56 .391

Pos	T-1	EF	10^5 n/s	M	T-2	EF	10^5 n/s	M	Cf252
0.000	13637/2	.492	50.23	6.18	15357/2	.391	50.04	6.16	
	113.64				127.98				

T-3 = 492/2

Eff. Factor - Determination Pu-Be 1.3×10^7 n/s

T-1 = 3.09 + 2.85 + 2.55 + 2.49/4 = 2.85 .351

T-2 = 3.42 + 3.15 + 3.26 + 2.76/4 = 3.15 .317

Assembly J-2

Pos.	T-1	Eff	10^5 n/s	M	T-2	Eff	10^5 n/s	M
0000		.351	39.89	4.91		.317	40.57	4.99
	113.64				127.58			

6/13/69

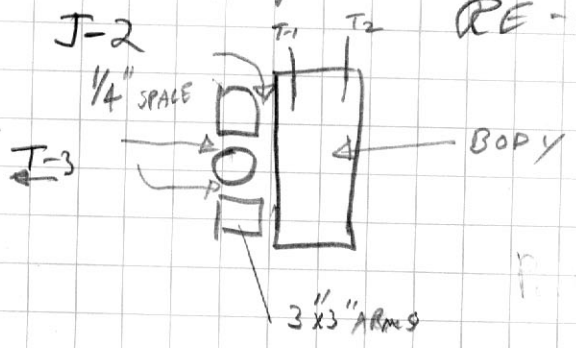
The ratios of Cf-252 to Pu-Be Eff. are

$$T\text{-}1 = \frac{.442}{.351} = 1.259$$

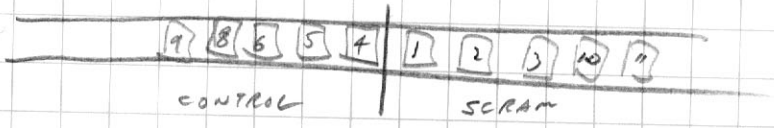
$$T\text{-}2 = \frac{.391}{.317} = 1.233$$

6/13/69 ONE SHOT EXPERIMENT

RE-RUN OF D-14 EXCEPT / BIG REFL.



Spacing: 2.624 cm
parts exactly centered.



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

Base Rate: $20,235 \times 10^{5}$ m/R

No. Moderator

One Side reflector and arms (3 X 3)

P_{02} & 7,992

	T-1	T-2	T-3
	38,476 / 1 min	7,651 / 1 min	3,476 / 1 min

Temp: Room 73° F Parts: 96° F

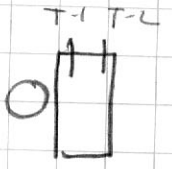
P_{01}: −0.002

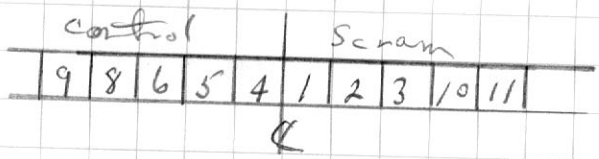
		75,849 / 1.00	14,447 / 1.00	4,084 / 1.00
	ℓ_s	1264.2	240.78	68.07
	$E \cdot F_1$	.144 $\times 10^{-5}$	.475	1.938
	$1/\ell_s B_s$	182.04	114.37	131.92
for Parts Source	M	8.997	5.65	6.52

6/18/69

We will remove the arms and run

Assembly J-3 :





Parts : 1, 2, 3, 4, 5, 7, 8, 9, 10/1

Spacing : 2.624 cm
Parts centered

Base Rate : 20.235 $\times 10^{-5}$ n/s

No Mod

1 sided reflection

Pos	T-1 EF	10^{-5} n/s	M	T-2 EF	10^{-5} n/s	M
7.992	36144/2			9989/2		

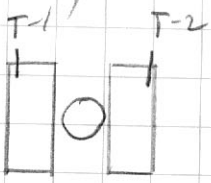
T-3
4698/2

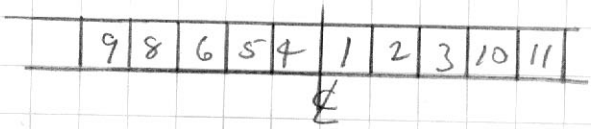
0.000	150496/5	.221	118.86	5.98	38878/5	.514	66.61	3.29
	501.65				129.59			

T-3
12445/5 1.945 80.68 3.99
41.48

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

Assembly J-4 : Two reflectors





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

Spacing: 2.624 cm
Parts centered

Base Rate: 20.235×10^{-5} 1/s

No Mod

2 sided reflection

Pos.	T-1	EF	10^{-5} 1/s	M	T-2	EF	10^{-5} 1/s	M
8.001	14904/2				16845/2			

T-3
1037/2

0.000	67095/s	.514	118.56	5.68	71368/s	.459	116.84	5.77
	223.65				254.56			

T-3
2938/s 8.065 78.56 3.90
9.79

TR's R = 12 #1 = 105

Fast Step Efficiency:

T-1 $3,157 + 2,035/2 = 2.596 \times 10^{-5}$

T-2 $3,746 + 2,297/2 = 3.022 \times 10^{-5}$

T-3 $0.052 + 0.060/2 = 0.056 \times 10^{-5}$

Fill IN Efficiency

T-1 $3,157 + 3,310/2 = 3,234 \times 10^{-5}$

T-2 $3,746 + 3,428/2 = 3,587 \times 10^{-5}$

T-3 $0.052 + 0.054/2 = 0,053 \times 10^{-5}$

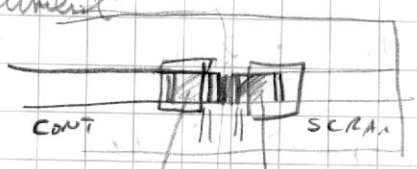
7/10/69

We are now going to go to a new source: ~36 μg Cf^{252} made for us by Mel Coops Group and calibrated * 6/25/69 to be 8.66×10^7 n/s. Rotation of Source Holder 15° a) changes counts ~4½%, b) shows source lower than centerline.

* By V. Boggs, LRL Standards Lab.

Assembly K-1 : 1st step in ½" Mock H.E. Moderated, no spacing, 3" Experiment

Center Spacing of Parts is:



Reflector space ¼" from Mock H.E.

$.401 + .108 + 2 \times (1.278) + 1.114 = 4.179$ cm

GAP; lid + bolt; M.H.E.; Heat Shield

Parts: 1+2; Base rate n/s = 4.077×10^5

	T-1	T-2	T-3
Pos: 8.003	9320/5	10440/5	198/5
	31.07 cps	34.80 cps	.66 cps
Eff	2.596×10^{-5}	3.022×10^{-5}	$.056 \times 10^{-5}$
n/s	11.97×10^5	11.52×10^5	11.78×10^5
M	2.94	2.83	2.89

Temp: Air - 71°F, Pu - 81°F

Pos -.001	11369/4 min	13021/4	173/4
	47.37 cps	54.25 cps	.72 cps
Eff	3.234×10^{-5}	3.587×10^{-5}	0.053×10^{-5}
n/s	14.65×10^5	15.12×10^5	13.58×10^5
M	3.593	3.709	3.33

$\bar{M} = 3.652 \pm 1\%$

$1/\bar{M} = .274$

Fuel Step Efficiency.

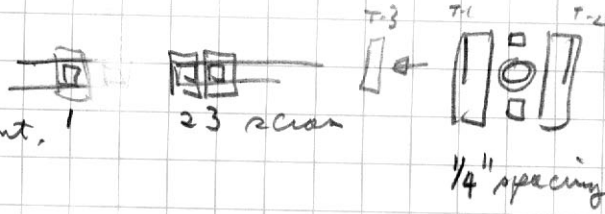
T-1	$3,157 + 2,085 + ,768 / 3 = 1,987$	$\times 10^{-5}$
T-2	$3,746 + 2,297 + ,817 / 3 = 2,287$	"
T-3	$0,052 + 0,060 + ,054 / 3 = 0,0553$	"

Full Im Efficiency

T-1	$3,157 + 3,310 + 1,749 / 3 = 2,739$	
T-2	$3,746 + 3,428 + 1.845 / 3 = 3.006$	
T-3	$0,052 + 0,054 + 0,053 / 3 = 0,053$	

K-2 — 3 parts —

(½" Mock HE, 3 Kg, close packed series)



Center spacing : 4,179 cm. (no spacing between mock H.E. discs.)
Regular spacing : 3,778 cm

Parts 1, 2, 3, ; Base rate 6.134 $\times 10^{-5}$ m/s

P_0	T-1	T-2	T-3
7,983	9881/4	10993/4	305/4 min
	41.17 cps	45,80 cps	1,27 cps
Eff	1,987 $\times 10^{-5}$	2,287 $\times 10^{-5}$	0,0553 $\times 10^{-5}$
m/s	20.72 $\times 10^{5}$	20,03 $\times 10^{5}$	22,97 $\times 10^{5}$
M	3,38	3,27	3,74

P_∞ -.001			
	13552/3	15 024/3	237/3
	75.29 cps	83,47	1,32 cps
Eff	2,739 $\times 10^{-5}$	3,006 $\times 10^{-5}$	0,053 $\times 10^{-5}$
m/s	27,49	27,77	24,91
M	4,49	4,53	4,06

$\bar{M} = 4,51 \pm ½\%$

$1/\bar{M} = .222$

Fast Stop Efficiency:

T-1 $3,157 + 2,035 + 0,768 + 0,289 / 4 = 1,562 \times 10^{-5}$

T-2 $3,746 + 2,297 + 0,817 + 0,297 / 4 = 1,789 \times 10^{-5}$

T-3 $0,052 + 0,060 + 0,054 + 0,055 / 4 = 0,0525 \times 10^{-5}$

Full Im Efficiency

T-1 $3,157 + 3,310 + 1,749 + 0,671 / 4 = 2,222 \times 10^{-5}$

T-2 $3,746 + 3,428 + 1,845 + 0,733 / 4 = 2,438 \times 10^{-5}$

T-3 $0,052 + 0,054 + 0,053 + 0,054 / 4 = 0,0535$

K-3 – 4 parts, ½" Mark H.E, 3 kg, Close Packed Series.

Center Spacing: 4.179 cm
Regular spacing: 3.778 cm

Ports: 1, 2, 3, 4; Base Rate: 8.124×10^{5} m/s

Pr:	T-1	T-2	T-3
7.984	11630/4	12660/4	488/4
	48.46 cps	52.75	2.03
Eff	1.562×10^{-5}	1.789×10^{-5}	0.0553×10^{-5}
m/s	31.02	29.49	36.74
M	3.82	3.63	4.52

Temps: 72°F Air, 81°F Pr → 83°F

−.001	11386/2	12583/2	230/2
	94.88 cps	104.86 cps	1.917 cps
Eff	2.232×10^{-5}	2.438×10^{-5}	0.05325
m/s	42.70×10^{5}	43.01	36.00
M	5.256	5.294	4.431

$\bar{M} = 5.205$

$1/\bar{M} = .1895$

Fast Step Efficiency:

T-1 3.157 + 2,035 + 0,768 + 0,289 + 0,113/5 = 1,272

T-2 3,746 + 2,297 + 0,817 + 0,297 + 0,120/5 = 1,455

T-3 0,052 + 0,060 + 0,054 + 0,055 + 0,054/5 = 0,055

Full Im efficiencie

T-1 3.157 + 3,310 + 1,741 + 0,671 + 0,243/5 = 1,826

T-2 3,746 + 3,428 + 1,845 + 0,733 + 0,273/5 = 2,005

T-3 0,052 + 0,054 + 0,053 + 0,054 + 0,055/5 = 0,0536

Fast Step Efficiencies:

T-1 5/6 1,272 + 1/6 0,055 = 1.069

T-2 5/6 1.455 + 1/6 0,057 = 1,222

T-3 5/6 0,055 + 1/6 0,058 = 0,0555

Full Im Efficiencies

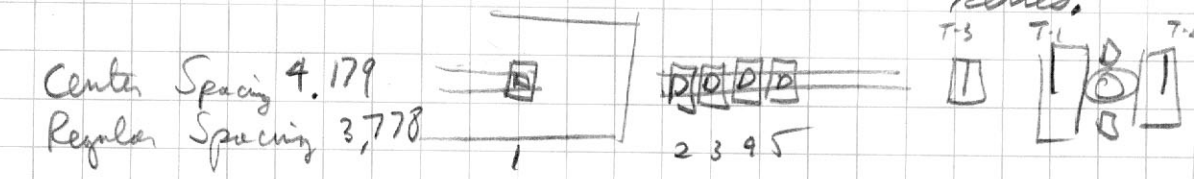
T-1 5/6 1.826 + 1/6 0.100 = 1.538

T-2 5/6 2,005 + 1/6 0,119 = 1.690

T-3 5/6 0,0536 + 1/6 0.056 = 0.054

7/11/69

K-4 5 parts, ½" Mock HE, 3 kg, close spaced series.



Center Spacing 4.179
Regular Spacing 3,778

Parts 1 – 5; Base Rate 10.098×10^5 m/s

Pos.	T-1	T-2	T-3
8,003	12421/4	13847/4	626/4
	51,75 cps	57,70 cps	2,61 cps
Eff	$1,272 \times 10^{-5}$	$1,455 \times 10^{-5}$	$0,055 \times 10^{-5}$
m/s	40.68×10^5	$39,66 \times 10^5$	47,45
M	4,03	3,93	4,70
-,002	12521/2	13660/2	363/2
	104,34 cps	113,83 cps	3,025
Eff	1,826	2,005	0,0536
m/s	57.14×10^5	$56,77 \times 10^5$	$56,44 \times 10^5$
	5,659	5,622	5,589

$\bar{m} = 5,641 \pm 1/3\%$

$1/\bar{m} = 0.1773$

Temp: 80°F P_a
71°F Air

K-5 As above except 6-parts: #1 – 6

Base Rate: 12.121×10^5

Pos	T-1	T-2	T-3
8,002	13151/4	14206/4	802/4
	54,80	59,19	3,342
Eff	1,069	1,222	0,0555
m/s	51,26	48,44	60,22
M	4,23	4,00	4,97
-,002	13274/2	14654/2	423/2
	110,62	118,38	3,525
Eff	1,538	1,690	0,054
m/s	71,92	70,05	65,28
M	5,935	5,779	5,38

$\bar{m} = 5,857$

$1/\bar{m} = 0,1707$

Fast Stop Efficiency:

T-1 $3.157 + 2.035 + .768 + .289 + .113 + .055 + .032 / 7 = 0.9213 \times 10^{-5}$

T-2 $3.746 + 2.297 + .817 + .297 + .120 + .057 + .033 / 7 = 1.0524 \times 10^{-5}$

T-3 $0.052 + 0.060 + .054 + .055 + .054 + .058 + .058 / 7 = 0.05586 \times 10^{-5}$

Full In Efficiency:

T-1 $3.157 + 3.310 + 1.749 + .671 + .243 + .100 + .051 / 7 = 1.326 \times 10^{-5}$

T-2 $3.746 + 3.428 + 1.845 + .733 + .273 + .114 + .056 / 7 = 1.456 \times 10^{-5}$

T-3 $0.052 + .054 + .053 + .054 + .055 + .056 + .056 / 7 = 0.05428 \times 10^{-5}$

Fast Stop Efficiency

T-1 $7/8 (.9213) \times \frac{1}{8} (.022) = .8089 \times 10^{-5}$

T-2 $7/8 (1.0524) + \frac{1}{8} (.022) = .9236 \times 10^{-5}$

T-3 $7/8 (.05586) + \frac{1}{8} (.064) = .05688 \times 10^{-5}$

Full In Efficiencies

T-1 $7/8 (1.326) + \frac{1}{8} (.032) = 1.164 \times 10^{-5}$

T-2 $7/8 (1.456) \quad 1/8 (.032) \quad 1.278 \times 10^{-5}$

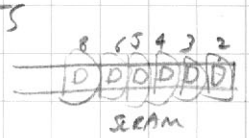
T-3 $7/8 (0.05428) \quad 1/8 (.058) \quad .05475 \times 10^{-5}$

7-14-69

K-6 ; ½" Mock H.E., Close Spaced, 3 Kg, 2 Body Refl / 3×3 Arms Control

T- Parts

Last part spaced @ 4.179 cm
all others @ 3,778 cm



Parts 1-6 + #8, Base Rate = $14,130 \times 10^5$

Por	T-1	T-2	T-3
8,003	13188/4	14800/4	1026/4
	54.95 cps	61.67 cps	4,275 cps
Eff	$.9213 \times 10^{-5}$	$1,0524 \times 10^{-5}$	$.05586 \times 10^{-5}$
n/s	59.64×10^5	58.60×10^5	76,58
M	4,22	4,14	5,42

Temps 71°F Air, 108°F on Cente Pu Part → 115°F, 81°F on end Pu Part → 85°F

-,001	27,372	29,964	1061/4
	114.05 cps	124.85 cps	4.421 cps
Eff	1.326×10^{-5}	1.456×10^{-5}	0.05928×10^{-5}
n/s	86.01×10^5	$85,75 \times 10^5$	$81,45 \times 10^5$
M	6.087	6,067	5,76

$\bar{M} = 6.077$ $Y_{\bar{M}} = .1646$

K-7 As Above but 8 parts, (#9 added)

Base Rate now $16,158 \times 10^5$ n/s

Por	T-1	T-2	T-3
8,003	13678/4 → 56,99 cps	15144/4 → 63,10 cps	1217/4 → 5,071
	$70,45 \times 10^5$ n/s	$68,32 \times 10^5$ n/s	$89,15 \times 10^5$ n/s
	$M_1 = 4,36$	4,22	5,52

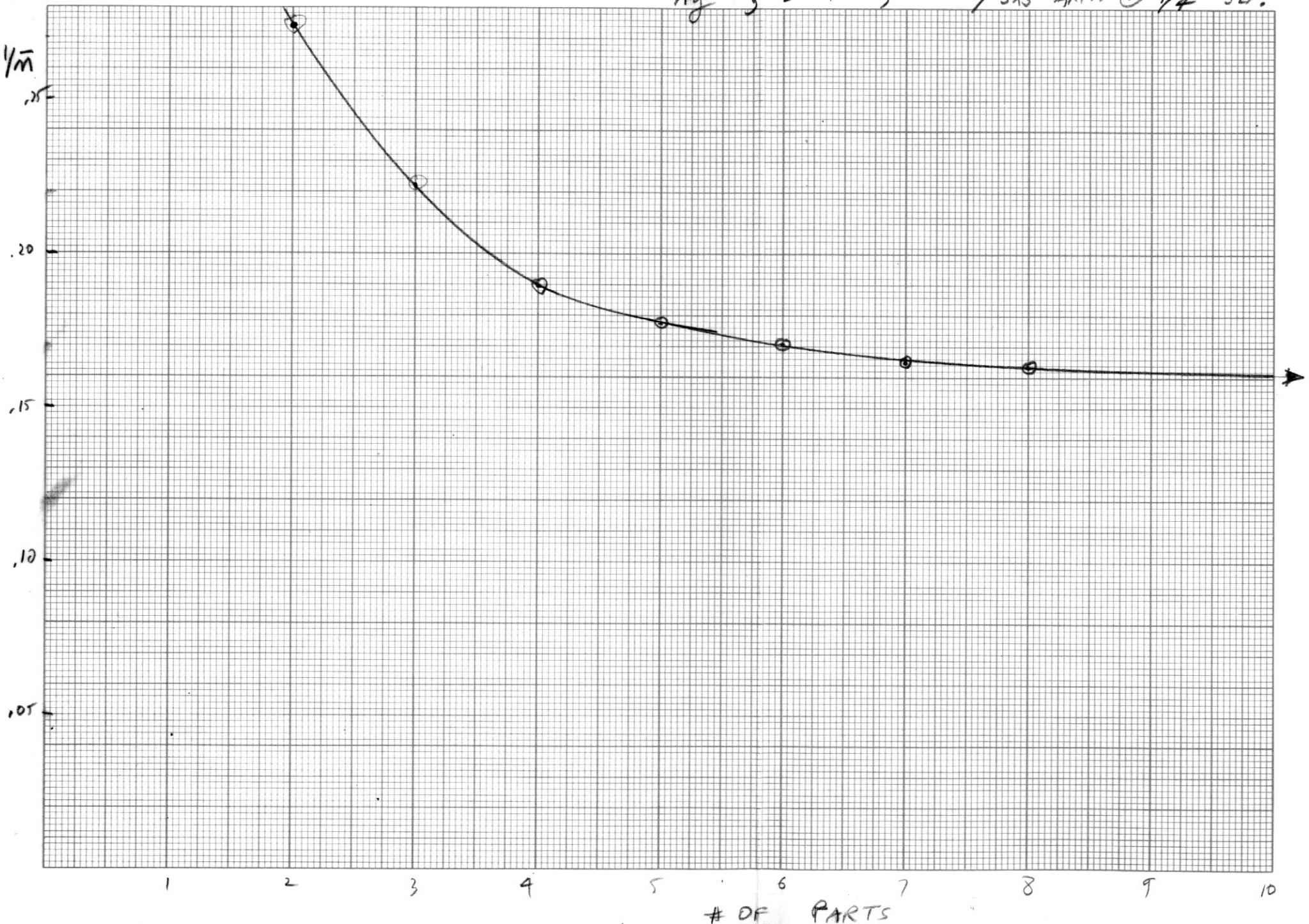
Air Temp: 72°F, Cente Pu 111°F, End Pu 81°F

-,001	20771/3 → 115,39 cps	22668/3 → 125,60	952/3 → 5,289 cps
	99,13 $\times 10^5$ n/s	$98,28 \times 10^5$ n/s	$96,60 \times 10^5$ n/s
	$M_1 = 6,135$	$M_2 = 6.082$	$M_3 = 5,98$

$\bar{M} = 6,109$ $Y_{\bar{M}} = .1637$

83 120 72

CLOSE SPACED 3Kg, $\frac{1}{2}$" MOD, REFL/3"x3" ARMS @ 1/4" SEP.



We are terminating this series because it is apparent that:

1) Normal 3 Kg loading (5 parts) is safe: $M = 5.64$

2) Full loaded tube appears to have multiplication less than 7.

All Double Reflected.

Fast Step Efficiency

T-1 $2.734 + 1,715/2 = 2.225 \times 10^{-5}$

T-2 $2,955 + 1,865/2 = 2,410 \times 10^{-5}$

T-3 $0.045 + 0.050/2 = 0,0475 \times 10^{-5}$

Full Im Efficiency

T-1 $2,734 + 2,505/2 = 2,620 \times 10^{-5}$

T-2 $2,955 + 2,960/2 = 2.958 \times 10^{-5}$

T-3 $0.045 + 0.044/2 = 0.0445 \times 10^{-5}$

Fast Step Efficiency

T-1 $2,734 + 1,715 + 0,449/3 = 1,631 \times 10^{-5}$

T-2 $2,955 + 1,865 + 0,469/3 = 1,763 \times 10^{-5}$

T-3 $0.045 + 0.050 + 0,044/3 = 0,0463 \times 10^{-5}$

T-1 $2,734 + 2,505 + 1,053 = 2.097 \times 10^{-5}$

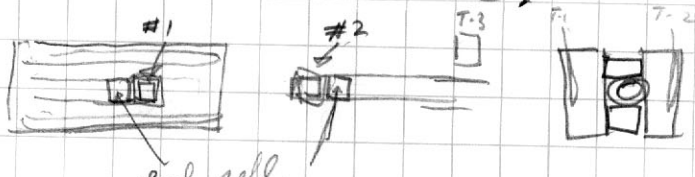
T-2 $2,955 + 2,960 + 1,157 = 2,359$ "

T-3 $0,045 + 0,044 + 0,043 = 0,044$ "

7/16/69 , Moon Launch Day!

We are now going to run the 1" close-packed series but are going to do some safety exp'r first to allow us to load more than 1 part on the reflected control table.

L-1 Close-Packed
1" Mock H.E., 3 kg
6-side reflector spaced (except for end refl) @ 1/4"



Center Spacing:

Spacing: .401 cente gap + .108 lid + bott + 1.114 heat sinks + 2x(2.555) mock H.E. = 6.733 cm

Parts: #1 & 2, Base Rate = 4.077×10^5 n/s

	T-1	T-2	T-3
Por: 7.997	10410/7	11605/7	221/7
	24.79 cps	27.63 cps	.526 cps
Eff.	2.225×10^{-5}	2.410×10^{-5}	0.0425×10^{-5}
n/s	11.14×10^5	11.96×10^5	11.07×10^5
M	2.73	2.81	2.72
-.001	10057/5	12266/5	154/5
	36.19 cps	40.89 cps	.513 cps
Eff	2.620×10^{-5}	2.958×10^{-5}	0.0445×10^{-5}
n/s	13.81×10^5	13.82×10^5	11.53×10^5
M	3.387	3.390	2.83

$\bar{M} = 3.388$ $\gamma_{\bar{M}} = 0.2952$

L-2 Same as above but 2 parts on Scram table, total of 3 parts.

Spacing between Scram table parts = 6.733 - .401 = 6.332 cm

Parts 1-3; Base Rate = 6.134×10^5 n/s

	T-1	T-2	T-3
Por: 7.997	12168/7 → 28.97 cps	13799/7 → 32.85 cps	370/7 → .881 cps
	17.76×10^5 n/s → 2.90 = M_1	18.63×10^5 n/s → 3.04 = M_2	19.03×10^5 n/s → 3.10 = M_3

Air = 71°F, Cente P_H = 97°F → 99°F

-.002	11489/4 → 47.87 cps	13115/4 → 54.65 cps	197/4 → .821 cps
	22.83×10^5 n/s → 3.722 = M_1	23.19×10^5 n/s → 3.781 = M_2	18.66×10^5 n/s, 3.04 = M_3

$\bar{M} = 3.752 \pm 1.8\%$, $\gamma_{\bar{M}} = 0.2666$

Fast Stop Efficiencies

T-1 : $2,734 + 1,095 + 1,715 + 0,449/4 = 1,498 \times 10^{-5}$

T-2 : $2,955 + 1,286 + 1,865 + 0,469/4 = 1,644 \times 10^{-5}$

T-3 : $0,045 + 0,043 + 0.050 + 0.044/4 = 0,0455 \times 10^{-5}$

Fuel Im Efficiencies:

T-1 : $2,734 + 1,095 + 2,505 + 1,053/4 = 1,847 \times 10^{-5}$

T-2 : $2,955 + 1.286 + 2,960 + 1,157 = 2,090 \times 10^{-5}$

T-3 : $0,045 + 0.043 + 0,044 + 0,043 = 0,0438$

L-3

Reflectors spaced @ 1/4" from M, 4, E,

Final step in 6-side Reflector Safety Exp for 1" MHE, Close packed, 3 Kg series

Spacing: 6.733 cm center gap + 6.332 cm other gaps
Parts: 1 – 4, Base Rate: 8.124×10^5 n/s

P_{sr} 7.982

	T-1	T-2	T-3
	11727/5 + 39.09 gps	13578/5 + 45.26 gps	346/5 + 1153 gps
Eff:	1.498×10^{-5}	1.644×10^{-5}	0.0455×10^{-5}
n/s:	26.09×10^5	27.53×10^5	25.34
M:	3.21	3.39	3.12

−.001

	18099/5 + 60.33 gps	20543/5 + 68.48 gps	406/5 + 1.355 gps
Eff:	1.847×10^{-5}	2.090×10^{-5}	0.0438×10^{-5}
n/s:	32.66	32.77	30.94
M:	4.020	4.034	3.81

$\bar{n}_{1,2} = 4.027 < 20$

∴ safe to hard load four parts on reflected (control table)

Fast Stop Efficiencies

T-1 (2.530 + 1.104 + .330 + .107 + 1.763)/5 = 4.071/5 = 1.167 $\times 10^{-5}$

T-2 (3.083 + 1.338 + .384 + .127 + 1.908)/5 = 4.932/5 = 1.368 $\times 10^{-5}$

T-3 (.059 + .057 + 0.061 + .060 + .162)/5 = .237/5 = .0798 $\times 10^{-5}$

Full Im Efficiencies

T-1 4.071 + 2.670/5 = 1.348 $\times 10^{-5}$

T-2 4.932 + 2.894/5 = 1.565 $\times 10^{-5}$

T-3 .237 + .059/5 = .0592 $\times 10^{-5}$

Fast Stop Efficiencies:

T-1 4.071 + 1.763 + .484/6 = 1.053 $\times 10^{-5}$

T-2 4.932 + 1.908 + .531/6 = 1.228 $\times 10^{-5}$

T-3 .237 + .162 + .059/6 = .076 $\times 10^{-5}$

Full Im Efficiencies

T-1 4.071 + 2.670 + 1.137/6 = 1.313 $\times 10^{-5}$

T-2 4.932 + 2.894 + 1.220/6 = 1.508 $\times 10^{-5}$

T-3 .237 + 0.059 + 0.058/6 = 0.0587 $\times 10^{-5}$

7/18/69

L-4

1st Real Run in 1" Mock H.E., Close Packed, 3 Kg reds

Spacing: 6,332 cm ⊥ 6,733 cm between parts & adjacent tables

Parts: 1-5 ; Base Rate: $10,098 \times 10^{-5}$ m/s

P_{00}	T-1	T-2	T-3
8,001 cm	13991/6 → 38,86 cps	16287/6 → 45,24 cps	706/6 → 1,961 cps
E/6	$1,167 \times 10^{-5}$	$1,368 \times 10^{-5}$	$0,798 \times 10^{-5}$
m/s	33,30	33,07	24,57
M	3,30	3,27	2,43

Temps: 71°F Room, 99°F Pu #3 (*103½), 92°F Pu #5 (*94)

−.001			
	12240/4 → 51,00 cps	14124/4 → 58,85 cps	567/4 → 2.363 cps
m/s	$37,83 \times 10^{-5}$	$37,60 \times 10^{-5}$	$39,92 \times 10^{-5}$
	3,746	3,724	3,95
	$\bar{m} = 3,735$	$1/\bar{m} = ,2677$	

L-5

As above, but with 6 parts

6,332 cm / 6,733 cm Spacing

Parts 1-6 ; Base Rate: $12,121 \times 10^{-5}$

P_{002}	T-1		
8,005	13034/5 → 43,45	15329/5 → 51,10	758/5 → 2,527
m/s	$41,26 \times 10^{-5}$	$41,61 \times 10^{-5}$	$33,25 \times 10^{-5}$
M	3,40	3,43	2,74
−.001	18883/5 → 62,94 cps	21825/5 → 72,75 cps	792/5 → 2,640
m/s	47,55	48,24	44,97
M,	3,923	3,980	3,71
	$\bar{m} =$ 3,951	$1/\bar{m} =$,2531	

Temperatures: 72°F AIR, 97°F #5, 110°F #3

72 94 100

Fuel Stop Efficiency:

T-1: 4.071 + 1.736 + .484 + .147/7 = $.9197 \times 10^{-5}$

T-2: 4.932 + 1.908 + .531 + .158/7 1.0755×10^{-5}

T-3: .237 + .162 + .059 + .061/7 $.0791 \times 10^{-5}$

Full Im Efficiencies:

T-1: 4.071 + 2.670 + 1.137 + .338/7 = 1.174×10^{-5}

T-2: 4.932 + 2.894 + 1.220 + .368/7 = 1.345×10^{-5}

T-3: .237 + 0.059 + 0.056 + .059/7 = $.0587 \times 10^{-5}$

July 22, 1969
Continuation of L-Series: 1" Mock H.E., 3 Kg, Close-Packed series

L-6

6,332 cm Pu to Pu spacing / 6,733 cm spacing in "center"

Parts 1-6 + 8, Base Rate: $14.130 \times 10^{+5}$ m/s

Pos.	T-1	T-2	T-3
8,000 cm	10600/4 → 44,17 gps	12515/4 → 52.14 gps	792/4 3,30 gps
Eff	,920 $\times 10^{-5}$	1.075×10^{-5}	$.074 \times 10^{-5}$
m/s	48,01 $\times 10^{5}$	48,48 $\times 10^{5}$	44 59 $\times 10^{5}$
M	3,40	3,43	3,16
Tempo:	72	94 → 99 (#6)	100 → 105 (#3)
0,000	11903/3 → 66.13 gps	13757/3 → 76,43	543/3 → 3,017
m/s	56,33	56,83	51,4
M	3,986	4,022	3,64

$\bar{M} = 4.004$ $1/\bar{n} = .2497$

L-6' Same as above — We had left out the M.H.E. disc on the 7th + last billet (part No 8). We will Re-Run!

July 23, 1969

Pos.	T-1	T-2	T-3
8,009	10856/4 → 45,23	12339/4 → 51,41	740/4 → 3,083
Eff:	,920 $\times 10^{-5}$	1.075×10^{-5}	$.074 \times 10^{-5}$
m/s	49,18 $\times 10^{5}$	47,80 $\times 10^{5}$	41,61 $\times 10^{5}$
M	3,48	3,39	2,94
Temps°	72°F AIR	99 → 100 °F #6 Pu	107 → 107 °F #3
0.000	12029/3 → 66,83	13857/3 → 76,983	599/3 → 3,328
m/s	56,925	57,236	56,695
M	4,029	4,051	4,012
	$\bar{n} = 4.040$	,2475	

L-7 Fast Stop Efficiency

T-1 4.071 + 1.736 + .484 + .147 + .056 / 8 = 0.812 $\times 10^{-5}$

T-2 4.932 + 1.908 + .531 + .158 + .061 / 8 = 0.949 $\times 10^{-5}$

T-3 .237 + .162 + .059 + .061 + .063 / 8 = 0.073 $\times 10^{-5}$

Full In Efficiency

T-1 4.071 + 2.670 + 1.137 + .338 + .109 / 8 = 1.0406

T-2 4.932 + 2.894 + 1.220 + .368 + .118 / 8 = 1.1915

T-3 .237 + .059 + .056 + .059 + .060 / 8 = = 0.0589

L-8 Fast Stop Efficiencies

T-1 : 4.071 + 1.736 + .484 + .147 + .056 + .030 / 9 = .725 $\times 10^{-5}$

T-2 : 4.932 + 1.908 + .531 + .158 + .061 + .031 / 9 = .847 $\times 10^{-5}$

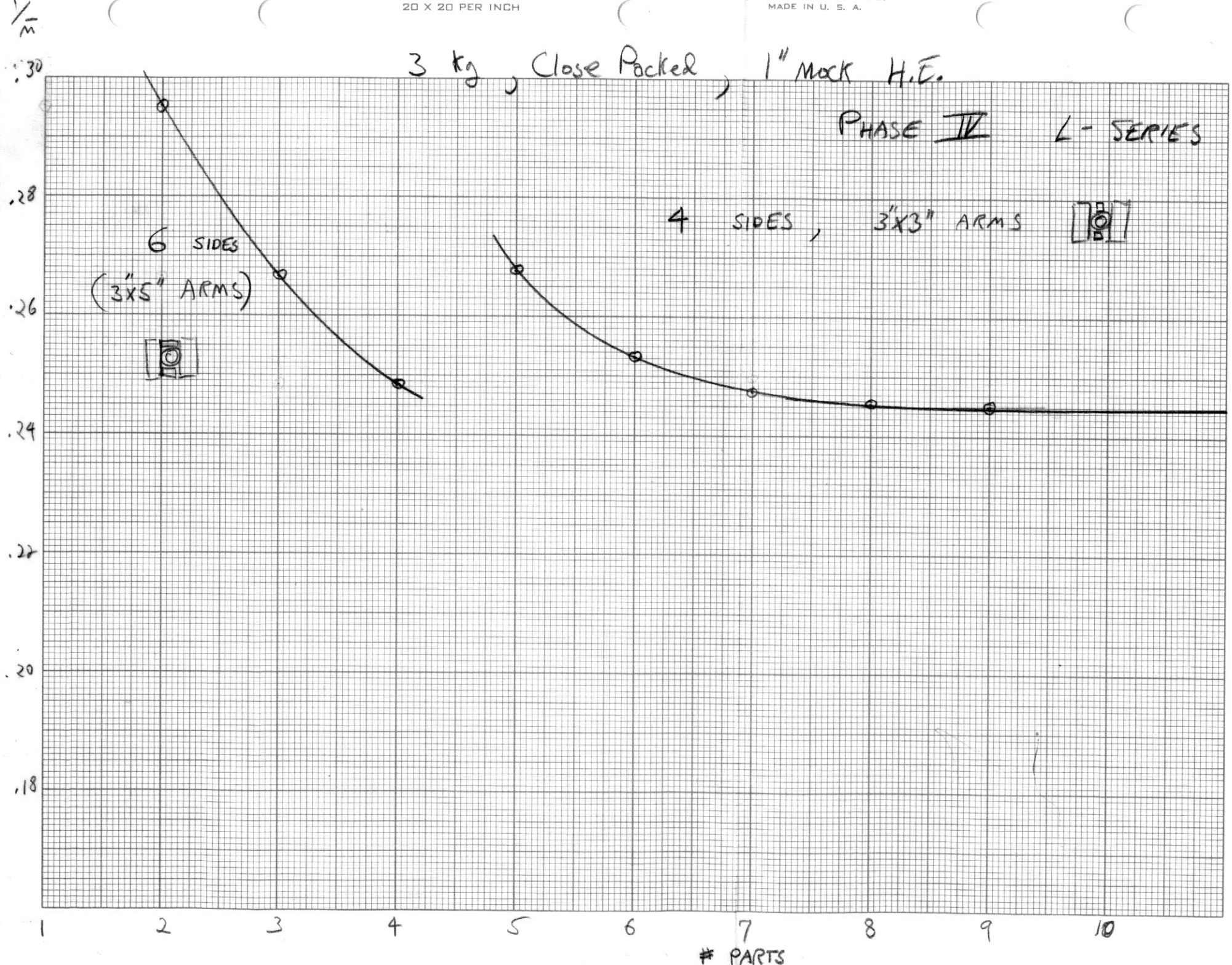
T-3 : .237 + .162 + .059 + .061 + .063 + .067 / 9 = .0721 $\times 10^{-5}$

Full In Efficiencies :

T-1 : 4.071 + 2.607 + 1.137 + .338 + .109 + .046 / 9 = .9231 $\times 10^{-5}$

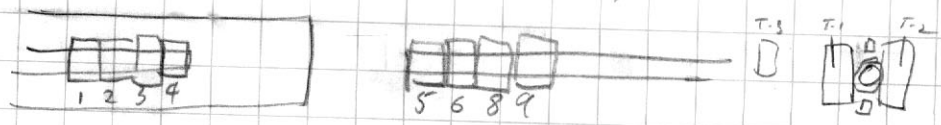
T-2 : 4.932 + 2.894 + 1.220 + .368 + .118 + .051 / 9 = 1.0647 $\times 10^{-5}$

T-3 : .237 + .059 + .056 + .059 + .060 + .065 / 9 = 0.0596 $\times 10^{-5}$



7/23

L-7 8 parts in 1" M.H.E., 3 Kg, Close Packed



6,332 cm P_n-P_n / 6,733 cm spacing in "center"

Parts 1-6, 8+9, Base Rate: $16,158 \times 10^5$ m/s

P_{02}	T-1	T-2	T-3
8,009	10876/4 → 45,32 gpo	12586/4 → 52.44 gpo	862/4 → 3,59 gpo
m/s	55,81	55,26	49,18
M	3,45	3,42 → 99	3,04 → 107
Tempo:	72°F	97°F #6	107°F #3
+0,002	12254/3 → 68.08	14201/3 → 78,89	661/3 → 3,67
m/s	65.42	66,21	62,31
M	4,048	4,098	3,86

$\bar{M} = 4,073$, $1/\bar{M} = .2455$

L-8 9 parts, same as above

Parts 1-6, 8-10; Base Rate: $18,207 \times 10^5$ m/s (.05492)

P_{02}:	T-1	T-2	T-3
8,001	10879/4 → 45,33 gpo	12809/4 → 53,37 gpo	980/4 → 4,08 gpo
eff	.725 $\times 10^{-5}$	.847 $\times 10^{-5}$	.0721 $\times 10^{-5}$
m/s	62,52	63,01 $\times 10^5$	56,59 $\times 10^5$
M	3,43	3,46	3,11
Tempo:	72°F Air	107°F #6 P_n	107°F #3 P_n
+0,001	12497/3 → 69,93	14065/3 → 78,14	751/3 → 4,17
eff	.923 $\times 10^{-5}$	1,065 $\times 10^{-5}$	.0596 $\times 10^{-5}$
m/s	75,21	73,39	59,97
M	4,131	4,031	3,84

$\bar{M}$ 4,081 ± 1,2%, $1/\bar{M} = .2450$

Series Terminated!

because we have reached asymptote in M vs #, ~ 4,1

Fast Step Efficiencies

T-1 : $1,371 + 1,970/2 = 1,671 \times 10^{-5}$

T-2 $1,536 + 2,412/2 = 1,974 \times 10^{-5}$

T-3 $0,064 + 0,044/2 = 0,054 \times 10^{-5}$

Full In Efficiencies

T-1 $2,071 + 1,970/2 = 2,021 \times 10^{-5}$

T-2 $2,300 + 2,412/2 = 2,356 \times 10^{-5}$

T-3 $0,059 + 0,044/2 = 0.0515 \times 10^{-5}$

Fast Step Efficiencia :

T-1 $1,371 + .276 + 1,970/3 = 1,206 \times 10^{-5}$

T-2 $1,536 + .301 + 2,412/3 = 1,416 \times 10^{-5}$

T-3 $0.064 + 0,067 + 0,044/3 = 0,0583 \times 10^{-5}$

Full In Efficiencies

T-1 $2.071 + .648 + 1.970/3 = 1.563 \times 10^{-5}$

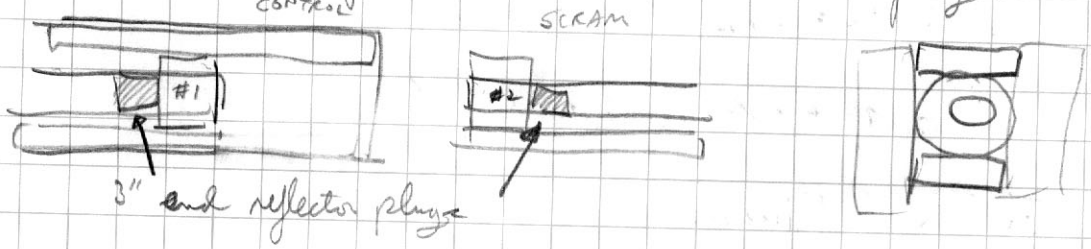
T-2 $2,300 + .703 + 2.412/3 = 1,805 \times 10^{-5}$

T-3 $0,059 + 0,065 + 0.044/3 = 0,056 \times 10^{-5}$

July 29, 1969

M - series start. $1\frac{1}{2}$", 3 Kg close packed

M-1 The first step is to do some FFT reflected experiments to show that we can load as many as 5 units on the (reflected) control table safely.



Spacing: .401 table sep. + 7.626 M.H.E. + 1.114 Heat Shields + .108 lid + top = 9.249 cm

Parts: 1+2 ; Base Rate: 4.077×10^5 n/s (.2453)

Poo		T-1	T-2	T-3
7.983		10280/9 → 19.04 cps	11824/9 → 21.90 cps	270/9 → .500 cps
	Eff	1.671×10^{-5}	1.979×10^{-5}	0.054×10^{-5}
	n/s	11.39×10^5	11.09×10^5	9.26×10^5
	M	2.79	2.72	2.27
-.001		11280/7 → 26.86	13036/7 31.04	214/7 .509 cps
	n/s	13.29	13.17	9.88
	M	3.26	3.23	2.42

$\bar{M} = 3.245$

M-2 Same as Above except part #3 added to screen table

Spacing 9.249 cm center gap, 8.848 cm elsewhere

Parts: 1,2+3 ; Base Rate: 6.134×10^5 n/s (.1630)

Poo		T-1	T-2	T-3
8.001		10279/8 → 21.41 cps	11511/8 → 23.98 cps	398/8 → .829 cps
	n/s	17.75	16.94	14.22
	n	2.89	2.76	2.32
-.001		11389/6 → 31.64 cps	13255/6 36.82 cps	205/6 → .791 cps
	n/s	20.24	20.40	14.13
	M	3.30	3.33	2.30

$\bar{M} = 3.313$

Temps: AIR : 74°F ; Part #2, 99°F

Fast stop Efficiency:

T-1 : 1.970 + 1.371 + .276 + .078 / 4 = .924 $\times 10^{-5}$

T-2 : 2.412 + 1.536 + .301 + .083 / 4 = 1.083 $\times 10^{-5}$

T-3 : 0.049 + .064 + .067 + .068 / 4 = 0.06075 $\times 10^{-5}$

Full In Efficiency

T-1 : 1.970 + 2.071 + .648 + .152 / 4 = 1.210¼ $\times 10^{-5}$

T-2 : 2.412 + 2.300 + .703 + .162 / 4 = 1.394 $\times 10^{-5}$

T-3 : 0.049 + 0.059 + .065 + .067 / 4 = 0.05875 $\times 10^{-5}$

Fast Stop Efficiency

T-1 (.8) .92375 + (.2) 0.034 = .7458 $\times 10^{-5}$

T-2 (.8) 1.083 + (.2) 0.035 = .8734 $\times 10^{-5}$

T-3 (.8) 0.0607 + (.2) 0.070 = .0626 $\times 10^{-5}$

74 107

Full In Efficiency

T-1 (.8) (1.210¼) + (.2) 0.049 = .9780 $\times 10^{-5}$

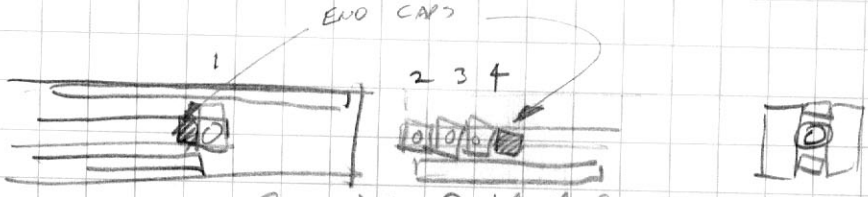
T-2 (.8) (1.394) + (.2) 0.052 = 1.1256 $\times 10^{-5}$

T-3 (.8) 0.05875 + (.2) 0.068 = 0.0606 $\times 10^{-5}$

7/29/64 (cont)

M-3

4 parts



6-side Reflected Case

1½" Mock H.E., 3 Kg ~~Total~~ Reflection

Spacing: 8.848 / 9.249 cm

Parts: 1-4; Base Rate 8.124 x10⁵ (.123)

Pos	T-1	T-2	T-3
8,003	10505/8 → 21.89 gps	11976/8 → 24.95 gps	511/8 → 1.06 gps
m/s	23.70 x10⁵	23.04 x10⁵	17.45
M	2.92	2.84	2.15
-.004	11978/6 → 33.27 gps	13922/6 → 38.67 gps	355/6 → .986 gps
m/s	27.49 x10⁵	27.74 x10⁵	16.78
	3.38	3.41	2.07

$\bar{m}$ = 3.399

Temps: 74°F Air; 108°F part #3

M-4 (5 parts)

5 parts in a row

6-side Reflection

Spacing: 8.848 / 9.249 cm

Parts 1-5; Base Rate: 10.098 x10⁵ m/s (.09902)

Pos	T-1	T-2	T-3
8,007	10525/8 → 21.93 gps	12069/8 → 25.14 gps	590/8 1.23 gps
m/s	29.40 x10⁵	28.78 x10⁵	19.65 x10⁵
M	2.94	2.85	1.95

Temps 74°F, Air 108°F Pu #3

-.001	14237/7 → 33.90 gps	16176/7 → 38.51 gps	550/7 → 1.31
m/s	34.66	34.21	21.62
M	3.43	3.39	

$\bar{m}$ = 3.410

5 parts totally reflected < 3½ ℔ will terminate series

Blank Page - go on

Efficiency

Fast Step

T-1 $31,298 + 22,678 + 17,830 + 10,225/4 = 20,245 \times 10^{-5}$

T-2 $30,024 + 22,632 + 15,437 + 8,992/4 = 19,271 \times 10^{-5}$

3.1 cm

T-1 $31,298 + 22,678 + 27,588 + 17,703/4 = 24,554 \times 10^{-5}$

T-2 $30,024 + 22,632 + 23,549 + 15,186/4 = 22,848 \times 10^{-5}$

1.25 cm

T-1 $\overbrace{31,298 + 22,678}^{13,232} + 30,746 + 21,353/4 = 26,257 \times 10^{-5}$

T-2 $\overbrace{30,024 + 22,632}^{13,164} + 26,219 + 18,360/4 = 24,309 \times 10^{-5}$

.55 cm

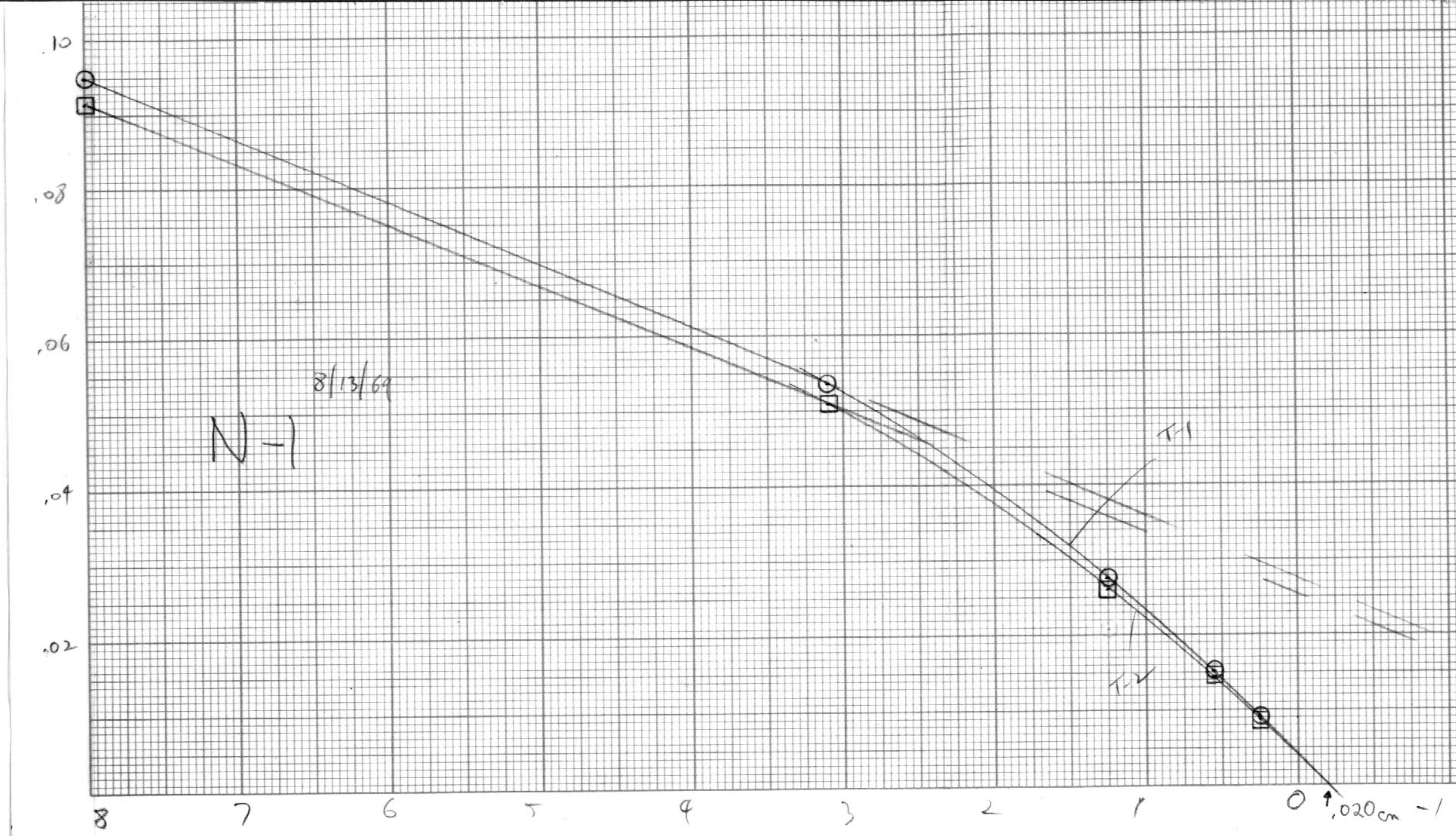
T-1 $13,232 + 31,829/4 + 22,779 = 26,884 \times 10^{-5}$

T-2 $13,164 + 27,142/4 + 19,554/4 = 24,838 \times 10^{-5}$

.25 cm

T-1 $13,232 + 32,220/4 + 23,353/4 = 27,125 \times 10^{-5}$

T-2 $13,164 + 27,500/4 + 19,949/4 = 25,026 \times 10^{-5}$



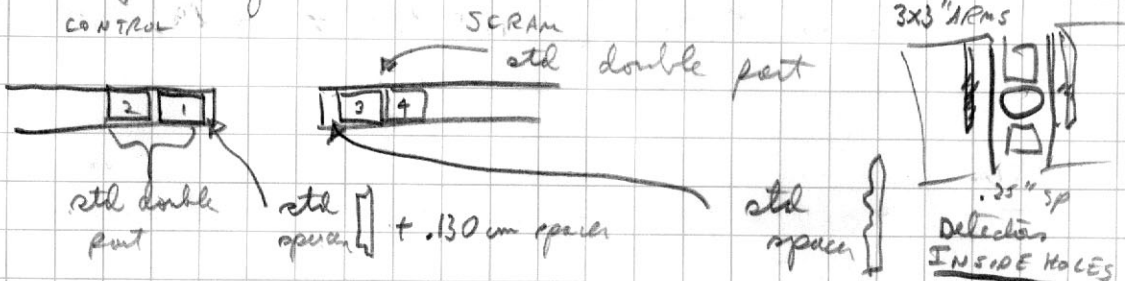
.10
.08
.06
.04
.02
8/13/69
N-1
T-1
T-2
8
7
6
5
4
3
2
1
0
.020 cm
-1

8/13/69

Re-Run of I-5 to Ck.

Diffrence in Measured Multiplication as a function of Counter Location. See Vol I, Pluett Pages 95 & 98 for description of Original.

N-1



Spacing .401 + .479 + .635 + .130 + .108 = 1,753 cm

(.401: grup; .479 + .635: Heat Sinks; .130: spacer; .108: lid & bottom)

Parts: 1-4 ; Base Rate $8,124 \times 10^5$ n/s

Pos	T-1	eff/n/s	M	T-2	eff/n/s	M
8.000 cm	102070/1	$20,295 \times 10^{-5}$	10,53	100806/1	$19,271 \times 10^{-5}$	10.92
	1,701.1 cpo	85,51		cpo 1680.1	88,70	
	↓ 1,731,1 corrected			↓ 1,7093 corrected		
3.099	212365/1	$24,554 \times 10^{-5}$	18,67	207750/1	22.848×10^{-5}	19.60
	3,539,4 cpo	$151,66 \times 10^5$		3,462,5 cpo	$159,26 \times 10^5$	
	↓ 3,723,9 cpo			↓ 3638,9 cpo		
1.250	415191/1	26.257×10^{-5}	36.34	406110/1	$29,309 \times 10^{-5}$	38,29
	6,919.8	$295,20 \times 10^5$		6,768.5	$311,07 \times 10^5$	
	↓ 7,751,1			↓ 7,561,8		
.551	707009/1	$26,889 \times 10^{-5}$	66.20	690,292/1	$24,838 \times 10^{-5}$	69,58
	11,783,5	$537,791 \times 10^5$		11,509.9	$565,303 \times 10^5$	
	↓ 14,458			↓ 14,041		

Temps: 72 ± 1 °F Room, 90°F Pu #2

.251	1,062,609/1	$27,125 \times 10^{-5}$	111,32	1,034,892/2	25.026×10^{-5}	116.38
	↓ 17,710.	904.37		↓ 17,248,	945.51	
	24,531			23,653		

Extrapolate to Crit @ −.020 cm ∴
Crit @ 1.733 cm

Efficiency:

Fast Stop

T-1 $1.7517 + 2,549/4 + 1.480/4 = 2,759 \times 10^{-5}$

T-2 $2,025 + 2,509/4 + 1,482/4 = 3,023 \times 10^{-5}$

3.1 cm

T-1 $4,060 + 2,947 + 3,689 + 2,494/4 = 3,293 \times 10^{-5}$

T-2 $4,710 + 3,390 + 3,649 + 2,442/4 = 3,545 \times 10^{-5}$

1,25 cm

T-1 $4,060 + 2,947 + 4,084 + 2,922/4 = 3,503 \times 10^{-5}$

T-2 $4,710 + 3,390 + 4,019 + 2,856/4 = 3,744 \times 10^{-5}$

.55 cm

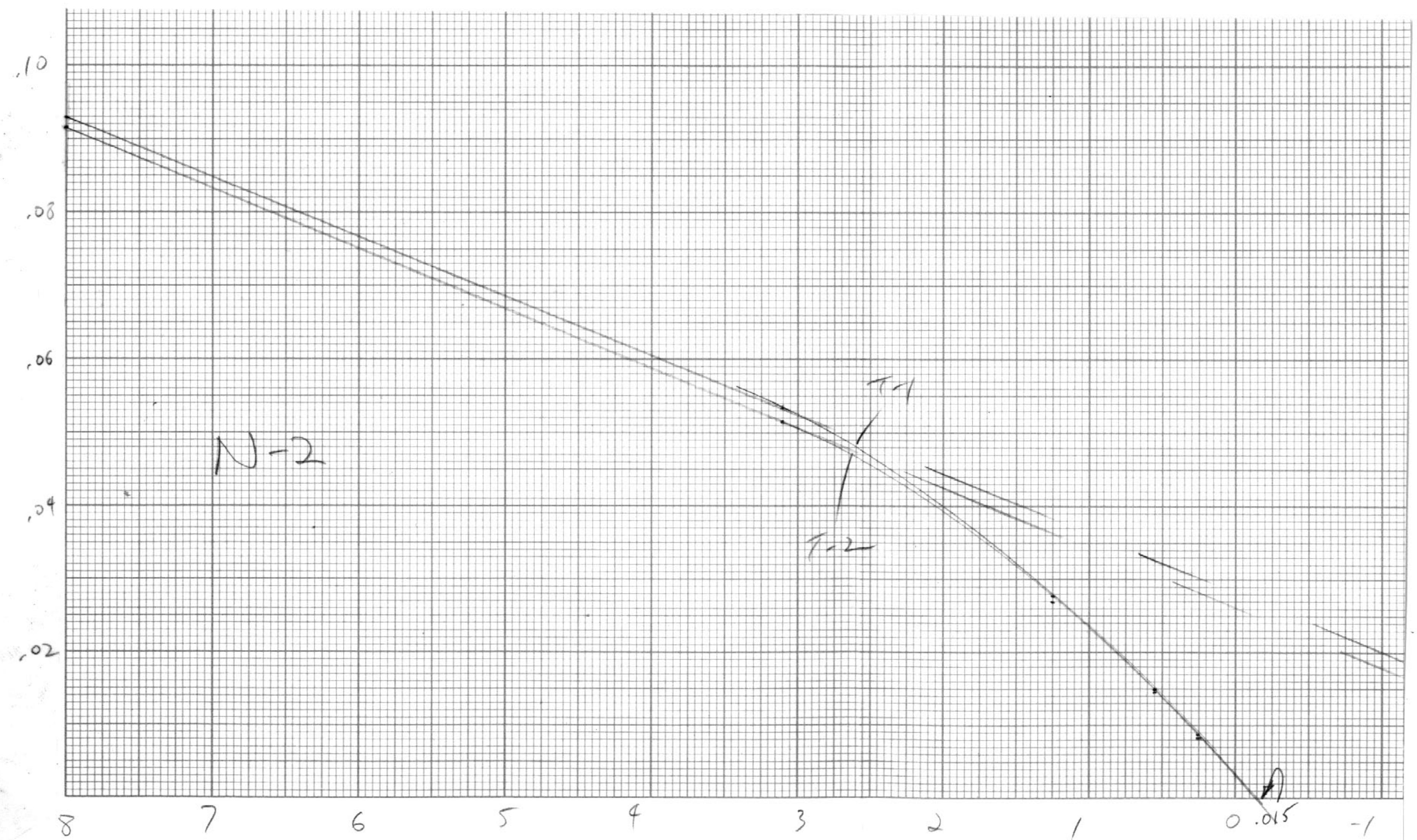
T-1 $4,060 + 2,947 + 4,236 + 3,088/4 = 3,582 \times 10^{-5}$

T-2 $4,710 + 3,390 + 4,142 + 3,024/4 \quad 3,817 \times 10^{-5}$

,25 cm

T-1 $4,060 + 2,947 + 4,287 + 3,068/4 = 3,589 \times 10^{-5}$

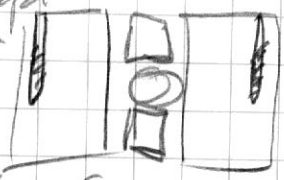
T-2 $4,710 + 3,390 + 4,211 + 2,947/4 = 3,815 \times 10^{-5}$


.10
.08
.06
.04
.02
N-2
T-1
T-2
A
8
7
6
5
4
3
2
1
0
.015
-1

7, 83
72 84 ½
7, 85

8/19/69

N-2 Same as preceding run except Counter in Outside Holes →



Spacing 1.753 cm #1 — #3
Parts 1-4; Base Rate 8.124×10^5 n/s (12309

Pos	T-1	Eff/n/s	M	T-2	Eff/n/s	M
8.001 cm	14459/1	2.759×10^{-5}		16114/1	3.023×10^{-5}	
	240.98 cps	87.42×10^5	10.76	268.57 cps	188.94	10.95
	↓ 241.18			↓ 268.86		
3.048 cm	30039/1	3.293×10^{-5}	18.77	33444/1	3.545×10^{-5}	19.42
	500.65 cps	152.51×10^5		557.40 cps	157.80×10^5	
	↓ 502.2			↓ 559.4		
1.251 cm	61060/1	3.503×10^{-5}	36.10	67271/1	3.744×10^{-5}	37.26
	1017.67	293.3×10^5		1121.2	302.7×10^5	
	↓ 1027.3			↓ 1133.3		
.599 cm	114,254/1	3.582×10^{-5}	66.98	125451/1	3.817×10^{-5}	69.23
	1904.2 cps	544.14×10^5		2090.8 cps	562.46×10^5	
	↓ 1949.1			↓ 2146.9		

Temp: Air 72°F, Pu #2, 85°F

.125 cm	192365/1	3.589×10^{-5}		213163/1	3.815×10^{-5}
	3206.1 cps	935.27×10^5		3552.7 cps	979.97×10^5
	3356.7			3738.6	
	$M_1 = 115.1$			$M_2 = 120.6$	

Extrapolates to +.015 cm Crit

∴ Crit @ 1.738 cm

Fast Stop:

T-3 $(.5187 + .5022 + .5079 + .4949)/4 = .5057 \times 10^{-5}$

T-4 $(.4553 + .4415 + .4490 + .4336)/4 = .4449 \times 10^{-5}$

Fuel Im

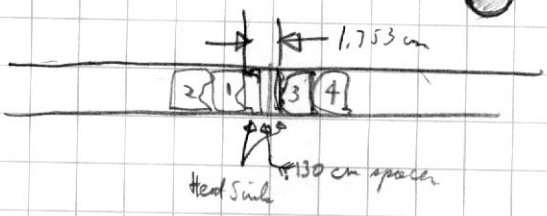
T-3 $(.5195 + .5079 + .5079 + .4949)/4 = .5176 \times 10^{-5}$

T-4 $(.4572 + .4485 + .4490 + .4336)/4 = .4471 \times 10^{-5}$

8/29/69

N-3 Same as N-1 & N-2 except Reflectors Removed

Double Pair Each Side



Spacing .401 (gap) + .479 + .635 (Heat Sinks) + .130 (spacers) + .108 (lid + bottom) = 1.753 cm

Parts: 1-4 ; Base Rate: 8.124×10^5 m/s

P_{cr}. 8.050 cm

T-3 11465/15 = 764.3 cpm = 12.738 cps; eff $.5057 \times 10^{-5}$; m/s 25.19×10^5; $M_3 = 3.101$

T-4 10230/15 = 682.0 cpm = 11.367 cps; eff $.4499 \times 10^{-5}$; m/s 25.55×10^5; $M_4 = 3.145$

Lower Sorenson Voltage Regulator Tripped (unexplained) & Power-Loss to neg. instruments SCRAMMED us, (of course).

Repeat Fuel Stop: 11564 ; 10230

P_{cr}. -.012

T-3 13940/15 = 15,489 cps; eff $.5176 \times 10^{-5}$; m/s 29.925; $M_3 = 3.684$

T-4 12045/15 = 13.383 cps; eff $.4471 \times 10^{-5}$; m/s 29.933; $M_4 = 3.685$

$\bar{M} = 3.684$

$K = 1 - \frac{1}{M} = .7286$

Circuit breaker feeding Sorenson had tripped — it felt loose & possibly defective. We replaced it.

Fast Stop Efficiencies:

T-1:

$2,968 + 2,639 + 3,595 + 3,594/4 = 3,199 \times 10^{-5}$

T-2:

$2,926 + 2,578 + 3,538 + 3,537/4 = 3,145 \times 10^{-5}$

T-3: $.188 + .188 + .185 + .189/4 = .186 \times 10^{-5}$

T-4: $.172 + .169 + .172 + .170/4 = .171 \times 10^{-5}$

Full I_m efficiencies

T-1: $3.181 + 3.412 + 3,595 + 3.594/4 = 3.446 \times 10^{-5}$

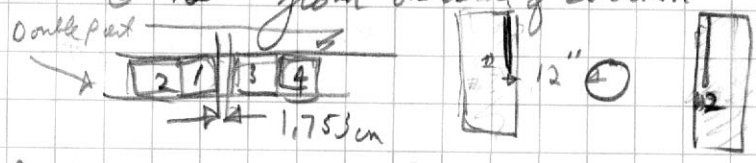
T-2: $3.448 + 3.119 + 3.538 + 3.537/4 = 3.411 \times 10^{-5}$

T-3: $.187 + .187 + .185 + .184/4 = .186 \times 10^{-5}$

T-4: $.166 + .168 + .172 + .170/4 = .169 \times 10^{-5}$

9/2/69
N-4

Same Hourglass set-up (inside column)
2 body reflection @ 12" from outside of column



Spacing : 1.753 cm Counters 3 & 4 in std. pos.

Parts : 1-4 ; Base Rate 8.124×10^{5} m/s (.12309)

	T-1	T-2	T-3	T-4
PR	8.0535			
	29,673/5	29012/5	1408/5	1511/5
	82,243 cps	80,040 cps	4,693 cps / $.186 \times 10^{-5}$	5,037 cps / $.171 \times 10^{-5}$
	82,337 / 3.199×10^{-5}	80,130 / 3.145×10^{-5}		
eff				
m/s	25.738×10^{5}	25.478×10^{5}	25.231×10^{5}	29.456×10^{5}
M	3.168	3.136	3.106	3.626
	3.152		3.366	
-.011	198937/30	196397/30	9827/30	10339/30
	110,521 cps	109.109	5.459	5.744
	110,693	109,276		
eff	3.446×10^{-5}	3.411×10^{-5}	$.186 \times 10^{-5}$	$.169 \times 10^{-5}$
m/s	32.122×10^{5}	32.036×10^{5}	29.349×10^{5}	33.988×10^{5}
M	3.954	3.943	3.613	4.183

3.949 ← 1.3% SPREAD → 3.898

3.924

K = .7952
ΔK = .0166 !!!!

Fast Stop Efficiencies:

T-1: $12,057 + 8,462 + 6,972 + 4,029 / 4 = 7,879 \times 10^{-5}$

T-2: $11,043 + 8,056 + 6,906 + 3,861 / 4 = 7,467 \times 10^{-5}$

Full Im Efficiency:

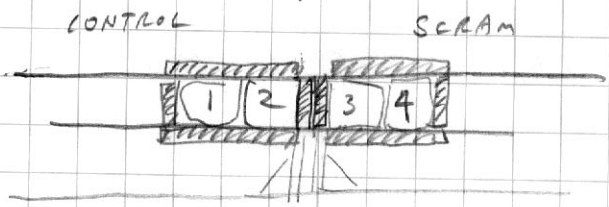
T-1 $12,057 + 8,462 + 11,158 + 8,040 / 4 = 9,929 \times 10^{-5}$

T-2 $11,043 + 8,056 \quad 11,280 + 8,105 / 4 = 9,621 \times 10^{-5}$

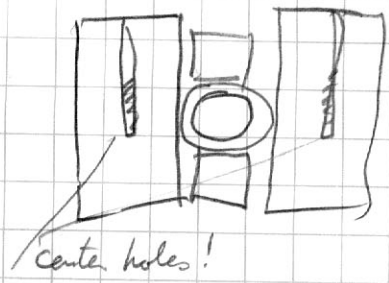
Efficiency taken at wrong Spots

Disregard 0-1

9/5/69 Beginning of 6 Kg, ½" Moderated Close-Packed Array



3x3" ARMS



O-1 ; 2 Double Parts

S spacing: .404 gap + .635 + .479 (Heat Sinks) + 2.5-5% (Mock HE) + .108 (lid + bottom) = 4.179 cm

Parts: 1-4 ; Base Rate : 8.129×10^5 n/s

For 8,057

T-1: 27124/1 → 452.1 cps → 455.0; eff 7.879×10^{-5}; n/s 57.748×10^5; $M_1 = 7,108$

T-2: 26834/1 → 447.2 cps → 450.0; eff 7.467×10^{-5}; n/s 60.265×10^5; $M_2 = 7,418$

$\bar{M} = 7,263 \pm 2,1\%$

Temps 71°F (Air), 107°F (Control Rx Part), 86°F (Scram Rx Part)

-.010

T-1: 58,248/1 → 970.8 cps → 989.2 cps; $9,929 \times 10^{-5}$; 99.123×10^5; $M_1 = 12.201$

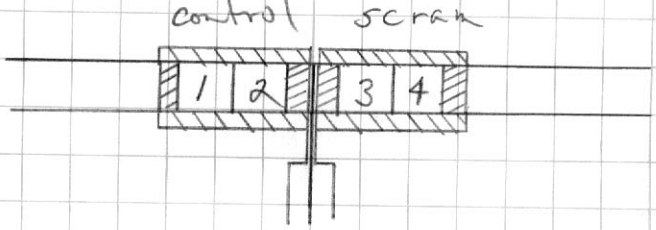
T-2: 58,031/1 → 967.2 cps → 980.5 cps; $9,621 \times 10^{-5}$; 101.912×10^5; $M_2 = 12,544$

$\bar{M} = 12,373 \pm 1,4\%$

Temps: 71 109°F 90°F

9/9/69

We will re-run O-1 with corrected E.F. and with the end supports milled to .078 in which is the same as the lip of the columns.



Base Rate = 8.124×10^5 n/s

O-1'

Fast Stop Efficiencies

T-1: 11.64 + 8.32 + 8.06 + 4.57 / 4 = 8.148 $\times 10^{-5}$

T-2: 12.27 + 8.96 + 7.59 + 4.17 / 4 = 8.298 $\times 10^{-5}$

Full In Efficiencies

T-1: 11.64 + 8.32 + 12.68 + 9.57 = 10.55 $\times 10^{-5}$

T-2: 12.27 + 8.96 + 12.14 + 8.86 = 10.56 $\times 10^{-5}$

Assembly O-2 Eff. Determinations

Fast stop Eff.

control / Screw

T-1 = 1.164 + .832 + .806 + .457 + .169 + .092/6 = .587 $\times 10^{-4}$

T-2 = 1.227 + .896 + .759 + .417 + .153 + .081/6 = .589

Full In Eff

control / Screw

T-1 = 1.164 + .832 + 1.268 + .957 + .429 + .230/6 = .813 $\times 10^{-4}$

T-2 = 1.227 + .896 + 1.214 + .886 + .365 + .208/6 = .803

Pos.	T-1	Eff	n/s	M	T-2	Eff	n/s	M
8.057	27535	8.148×10^{-5}	56.65	6.98	26886	8.248×10^{-5}	54.67	6.73
	% 458.9				448.1			
	461.9				450.9			

T/C's R = 72 88 103

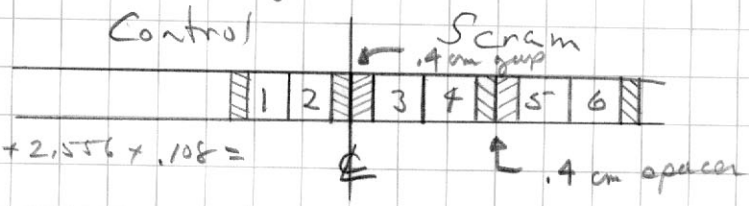
-.011	59736	10.553×10^{-5}	95.67	11.78	57557	10.558	92.56	11.39
	955.6				965.95		$\bar{M}$ = 11.59	
	1005.6				977.28		$y_{\bar{M}}$ = .0863	

$\bar{M} = 11.59 \pm 1\frac{1}{2}\%$

T/C's 73 92 107

9/10/69

Assembly O-2: 3 6 Kg units .5" Mod.



Spacing = .401 + .635 + .479 + 2.556 × .108 =
= 4.179 cm

Parts: 1 – 6, 3 6 Kg units

Base Refl: 12.121 $\times 10^5$ n/s

Mod = .5"

4 sided reflected

Pos.	T-1	Eff	10^5 n/s	M	T-2	Eff	10^5 n/s	M
8.057	39745	5.67×10^{-5}	113.9	9.40	38504	5.89×10^{-5}	105.9	9.07
	% 662.4				% 641.7			
	668.6				647.5			

T/C's R = 73 #1 = 107 #2 = 110

1.608	81296	7.68×10^{-5}	178.8	14.8	76855	7.60×10^{-5}	171.6	14.2
	% 1358.9				% 1280.9			
	1381.1				1308.3			

T/C's 73 113 111

As before:

	Fast Stop Efficiencies	Full Im Efficiencies
T-1:	5.87×10^{-5}	8.13×10^{-5}
T-2:	5.89×10^{-5}	8.03×10^{-5}

EFF. @ .900

T-1 = 8.02×10^{-5}

T-2 = 7.92×10^{-5}

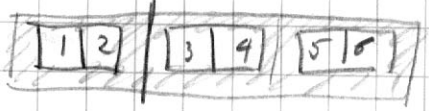
Pos.	T-1	Eff	10^5 n/s	M	T-2	Eff	10^5 n/s	M
-.011	109533	8.13×10^{-5}	231.06	19.06	104963	8.03×10^{-5}	223.32	18.42
Baseline	1839.5				1745.4			
cut to .000	1878.5				1793.3			

$\bar{M} = 18.74$

T/C's R = 73 #1 = 115 #2 = 112

We will remove the .4 cm spacer from the screen table and re-run Assembly 0-2'

0-2



Pos.	T-1	Eff	10^5 n/s	M	T-2	Eff	10^5 n/s	M
8.068	41210	5.87×10^{-5}	118.18	9.75	35504	5.85×10^{-5}	112.8	9.31
Bs	686.8				658.4			
	693.7				664.4			

T/C's R = 73 #1 = 112 #2 = 111

.900	107681	8.02	225.5	18.43	102518	7.92	221.9	18.31
Bs	1794.6				1715.3			
	1840.8				1757.4		$\bar{M} = 18.62$	
							$\frac{1}{M} = .0537$	

T/C's	73	115	112	
.000	117278	8.13	247.18	20.39
Bs	1954.6			
	2009.6			
	111921	8.03	23851	19.68
	1865.3			
	1915.2		$\bar{M} = 20.04$	$\frac{1}{M} = .0499$

T/C's 73 117 113

if we could run to −.900 & get rid of gap)

$\Delta \frac{1}{M} = .0037$

$\frac{1}{M'} = .0462$ $M' = 21.645$

Assembly 0-3 : 2 6 Kg units .5" Mod
6 sided reflected.

To check the loading of 2 6 Kg units on the control table.
Same as 0-1 re-run but with poly plugs in the ends to give 6 sided reflection

Base Rate = 8.128 $\times 10^{-5}$ n/s

Pos.	T-1	Eff.	10^5 n/s	M	T-2	Eff	10^5 n/s	M
8.076	28002	8.198 $\times 10^{-5}$	57.66	7.10	28188	8.248	57.34	7.06
	¾ 466.7				¾ 469.8			
	469.8				472.5			

T/C's R = 73 #1 = 108 #2 = 110

.700	55099	10.434	95.73	11.78	58499	10.444	94.95	11.63
	¾ 985.0				974.2			
	958.8				986.4			

T/C's 73 109 113

.000	63589	10.553	101.3	12.47	62721	10.538	100.5	12.37
	¾ 1053.2				1045.4		$\bar{m}$ = 12.42 (<20)	
	1068.5				1060.8		$1/\bar{m}$ =	

73 110 118

We will now put 2 6 Kg units on the control table and run the 4 6 Kg unit assembly.

Assembly 0-4 Eff. Determination

Fast Stg Eff.
(not all)

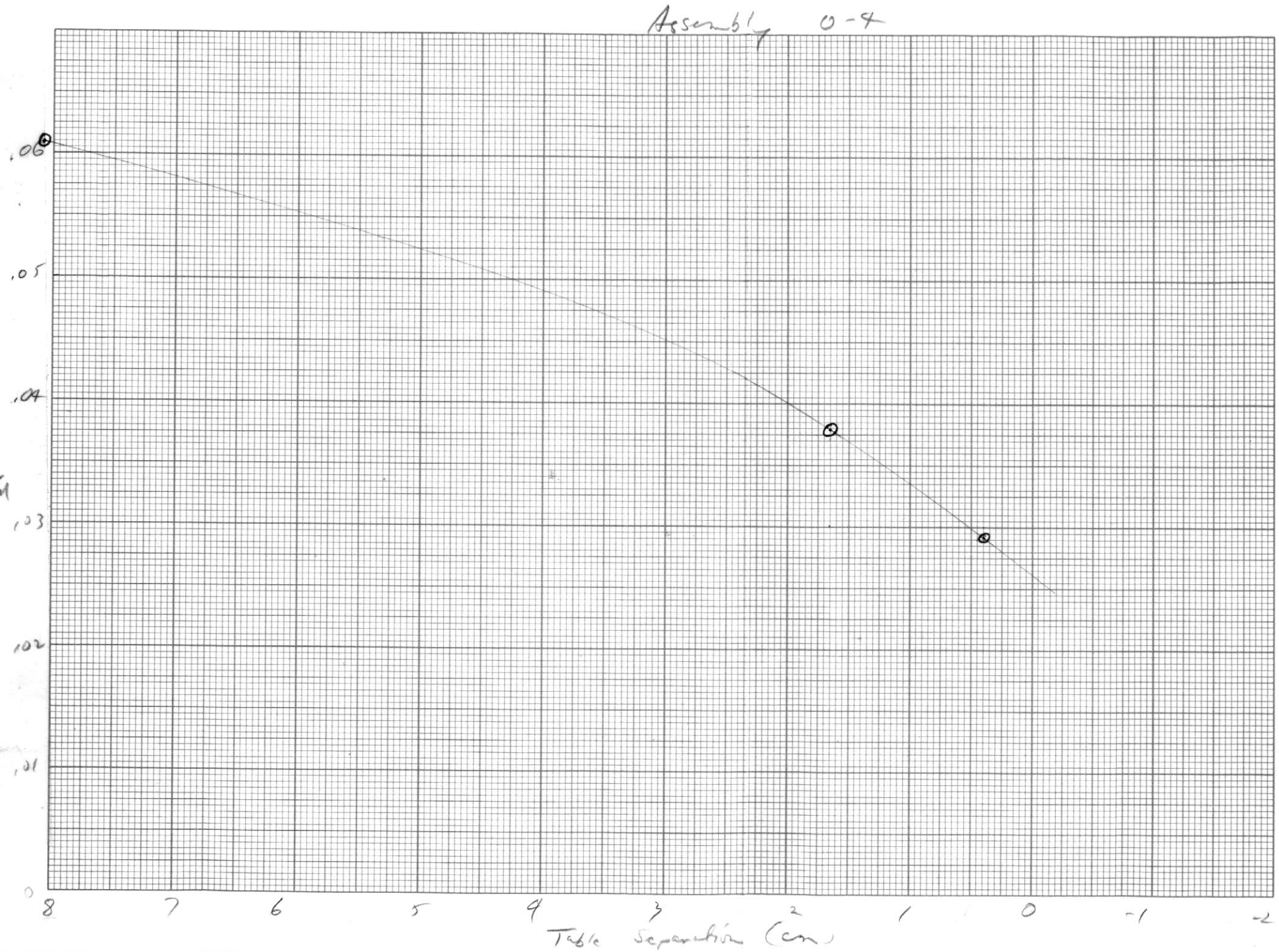
T-1 = 1.164 + .832 + .806 + .457 + .169 + .092 + .0369 + .0225 / 8 = .448 $\times 10^{-4}$

T-2 = 1.227 + .856 + .759 + .417 + .153 + .819 + .0335 + .0206 / 8 = .445

Full in Eff.

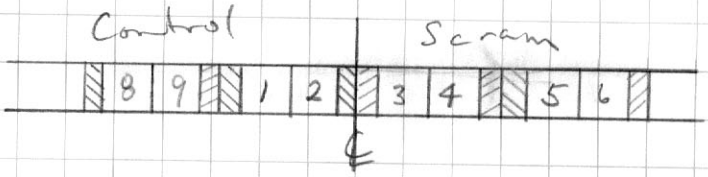
T-1 = 1.164 + .832 + 1.268 + .557 + .929 + .230 + .0867 + .0503 / 8 = .627 $\times 10^{-4}$

T-2 = 1.227 + .856 + 1.219 + .886 + .385 + .208 + .0788 + .045 / 8 = .618



9/11/69

Assembly 0-4: 4 6 kg units .5" mod
4 sided reflected



Spacing:

Parts: 1-9 less #7

Base Rate: $16.15 \pm x \cdot 10^{-5}$ n/s

Mod = .5"

4 sided reflected 3 x 3 arrays

Pos.	T-1	Eff	10^5 n/s	M	T-2	Eff	10^5 n/s	M
8.079	70638	4.98×10^{-5}	267.2	16.53	70306	4.95×10^{-5}	265.32	16.42
	σ_s 1122.2				σ_s 1171.8			
	1196.5				1191.3			

$\bar{M} = 16.48$ $\frac{1}{\bar{M}} = .0609$

T/C's R = 73 #1 = 123 #2 = 125

1.653	146842	5.90×10^{-5}	426.2	26.50	184102	5.83×10^{-5}	426.3	26.38
	σ_s 2440.2				2401.7		$\bar{M}$ = 26.84	
	25-26.6				2465.2		$\frac{1}{\bar{M}}$ = .0378	

T/C's R = 73 #1 = 126 #2 = 131

.400	197015	6.19×10^{-5}	556.03	34.41	183322	6.10×10^{-5}	553.1	34.23
	σ_s 3283.5				3222.0		$\bar{M}$ = 34.32	
	3441.8				3374		$\frac{1}{\bar{M}}$ = .0291	

T/C's 73 125 131

The table dropped off for unknown reason. We will re-run

re-run : O-A

Pos.	T-1	Eff	10^5 n/s	σ	T-2	Eff.	10^5 n/s	σ
8.069	70116	4.48×10^{-5}			70325	4.49×10^{-5}		
	T/C's	73			128	130		
1.653	147604	5.90×10^{-5}			144740	5.83×10^{-5}		
	T/C's	73			125	131		
.900	197338	6.19×10^{-5}			153205	6.10×10^{-5}		
	DC's	73			129	131		
.000		6.27×10^{-5}				6.14×10^{-5}		

Counts repeat; no need to re-calc. multiplications

Table Dropped off again!

We made some changes in the support bracket on the screw table + the Poly on the screw just in case they were causing the problem.

We will re-run

8.069	71018				69636			
	T/C's	73			109	129		
1.653	197820				144230			
	T/C's	73			113	129		
.900	196986				192117			
		73			113	130		

Counts repeat

Pos. T-1 Eff 10^5 n/s M T-2 Eff. 10^5 n/s M

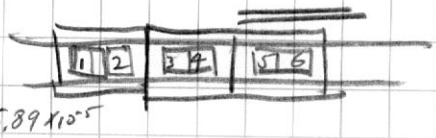
6.27x10⁻⁵ 6.18

Dropped off Again!

We will unlock screw column to clamp table and lock!

9/12/69

The .010 in. gap between the columns closed due to temperature expansion of the Al columns. We increased the spacing to .017 in. and re-run O-2.



Pos T-1 Eff n/s M T-2

8.065 45395/1 5.87x10⁻⁵ 40884/1 5.89x10⁻⁵

Cl.

T/C's R = 73 #2 = 97 #3 = 115 #4 = 108

1.605 93552/1 7.68x10⁻⁵ 83734/1 7.60x10⁻⁵

T/C's R = 73 #2 = 98 #3 = 117 #4 = 109

.400 115806/1 8.02x10⁻⁵ 106023/1 7.92x10⁻⁵

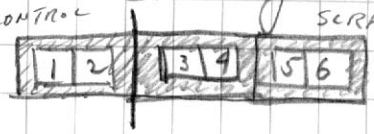
T/C's R = 73 #2 = 99 #3 = 120 #4 = 110

0.000 126157/1 8.13x10⁻⁵ 116009/1 8.03x10⁻⁵

T/C's R = 73 #2 = 101 #3 = 122 #4 = 111

9/15 Electronic problems with counting system #1. Found gain switch on Pre-amp #2 - way between X2 and X10, was placed in proper position ( ) and problem cleared up.

9/16 Re-Run 0-2' to check for Consistency



Parts: 1-6, Base Rate: 12.12×10^{5} m/s

Pos	T-1	E/I	T-2	E/I
8.051 in	40824/1	5.87×10^{-5}	40811/1	5.89×10^{-5}
1.608	84972/1	7.68×10^{-5}	84191/1	7.60×10^{-5}

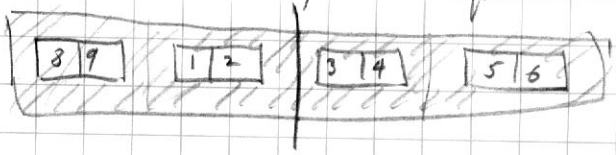
Temps: 73, 98, 110, 110
Air / Column / Scram Pu / Control Pu

.400	105947/1	8.02×10^{-5}	225.76×10^{5} m/s	105361/1	7.92×10^{-5}	227.31×10^{5} m/s	
	↓ 1,765.8		$m_1 = 18.625$	↓ 1,756.0			18,753
	1810.6 cps			1800.3			$\bar{m} = 18.689$
							$1/\bar{m} = .05351$
.000	116 166/1	8.13×10^{-5}	249.78×10^{5} m/s	115,461/1	8.03×10^{-5}	246.29×10^{5} m/s	
	↓ 1,936.1		$m_1 = 20.194$	1,924.4			20,319
	1990.1 cps			↓ 1977.7			$\bar{m} = 20.257$
							$1/\bar{m} = .04937$

Temps: 73 Air, 99 Column, 112 Scram Pu, 111 Control Pu

[at −.400, extrapolate to $1/\bar{m}' = .04523$, $m' = 22.11$

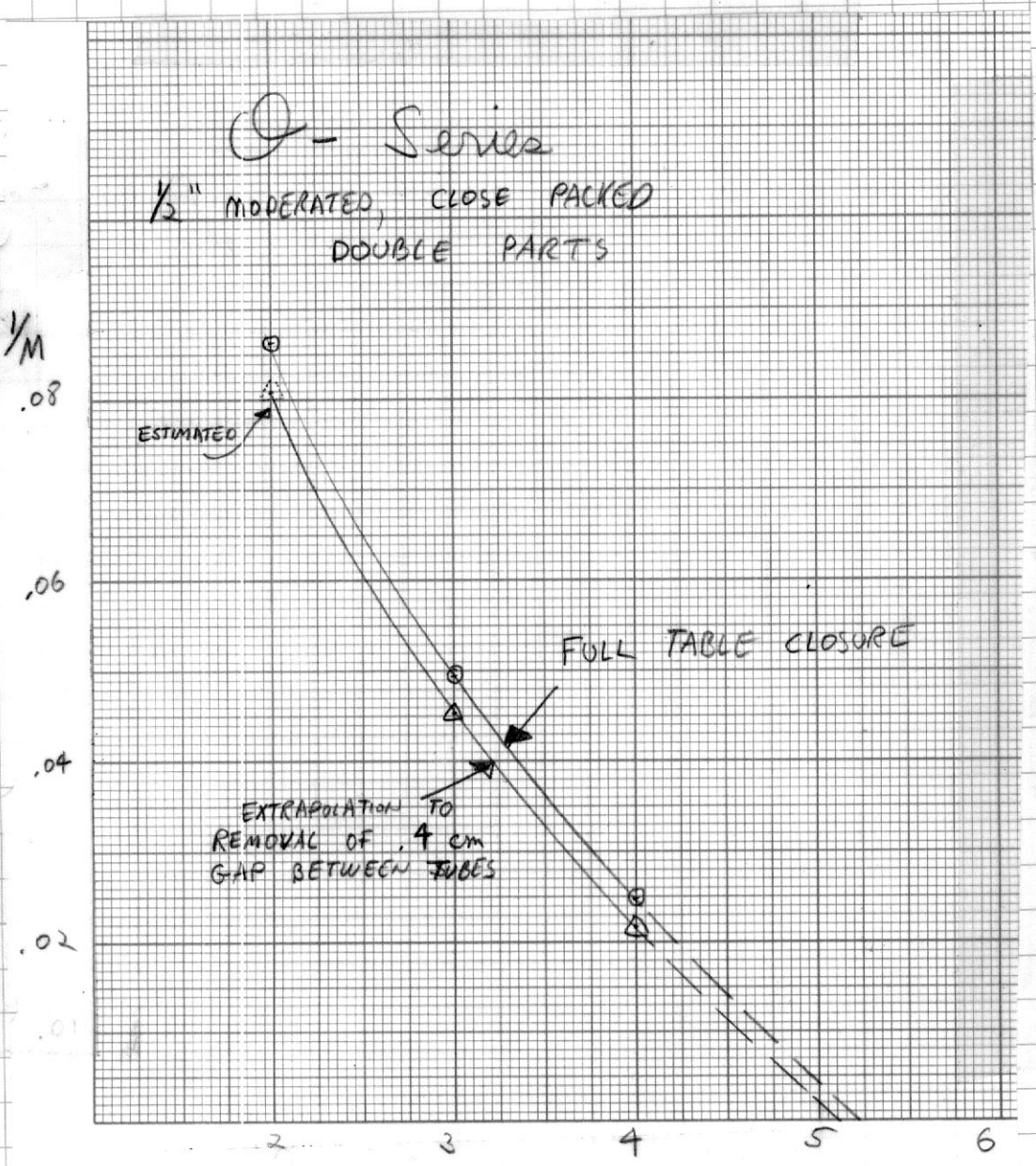
Re-Run Q-4 now that gap has been widened
6 Kg parts, 1/2" mock H.E., close packed



Parts; 1-9 less #7; Base Rate: 16.158×10^{-5} n/s

P_{02}	T-1	E/6	T-2	E/6
8,065	73 616/1	4.48×10^{-5}	72, 101/1	4.49×10^{-5}
Temps:	73	96	114	106
1.650	151,373/1	5.90×10^{-5}	148, 912/1	5.83×10^{-5}
.400	203, 678/1	6.19×10^{-5} 575,77	199, 547/1	6.10×10^{-5} 571, 80
	↓3,394.6 qps	$M_1 = 35,63$	↓3,325,8 qps	$M_2 = 35,38+$
	↓3,564 qps		↓3,488	$\bar{M} = 35.51$
Temp:	73	102	117½	110 $Y_{\bar{M}} = .02816$
.000	231 813/1	6.27×10^{-5} 651, 52	226 270/1	6.18×10^{-5} 644, 17
	↓3,863.6	$M_1 = 40.32$	↓3,771.2	$M_2 = 39,87-$
	↓4085 qps		↓3981 qps	$\bar{M} = 40,09$
				$Y_{\bar{M}} = .02494$
Temps:	73	103	118	112

'Extrapolate' to $\bar{M} = 46.04$
if no ~~gap~~ $1/\bar{M} = .02172$
($\Delta \frac{1}{M} = .00322$)


Q- Series
½" MODERATED, CLOSE PACKED
DOUBLE PARTS
1/M
.08
.06
.04
.02
ESTIMATED
FULL TABLE CLOSURE
EXTRAPOLATION TO
REMOVAL OF .4 cm
GAP BETWEEN TUBES
2
3
4
5
6

From the existing data we can construct the following table

m	$M^{\text{FULL CLOSURE}}$	$1/M^{\text{FULL CLOSURE}}$	$\Delta 1/M$ [+.400 ↔ .000]	$1/M$ IF GAP REMOVED	$M^{\text{IF GAP REMOVED}}$
2	11.59	.0863			
3	20.26	.0494	.00414	.0452	22.11
4	40.09	.0249	.00322	.0217	46.04

Note that we did not measure $\Delta \frac{1}{M}$ between .4 cm and full table closure for run 8-1; 2 double parts.

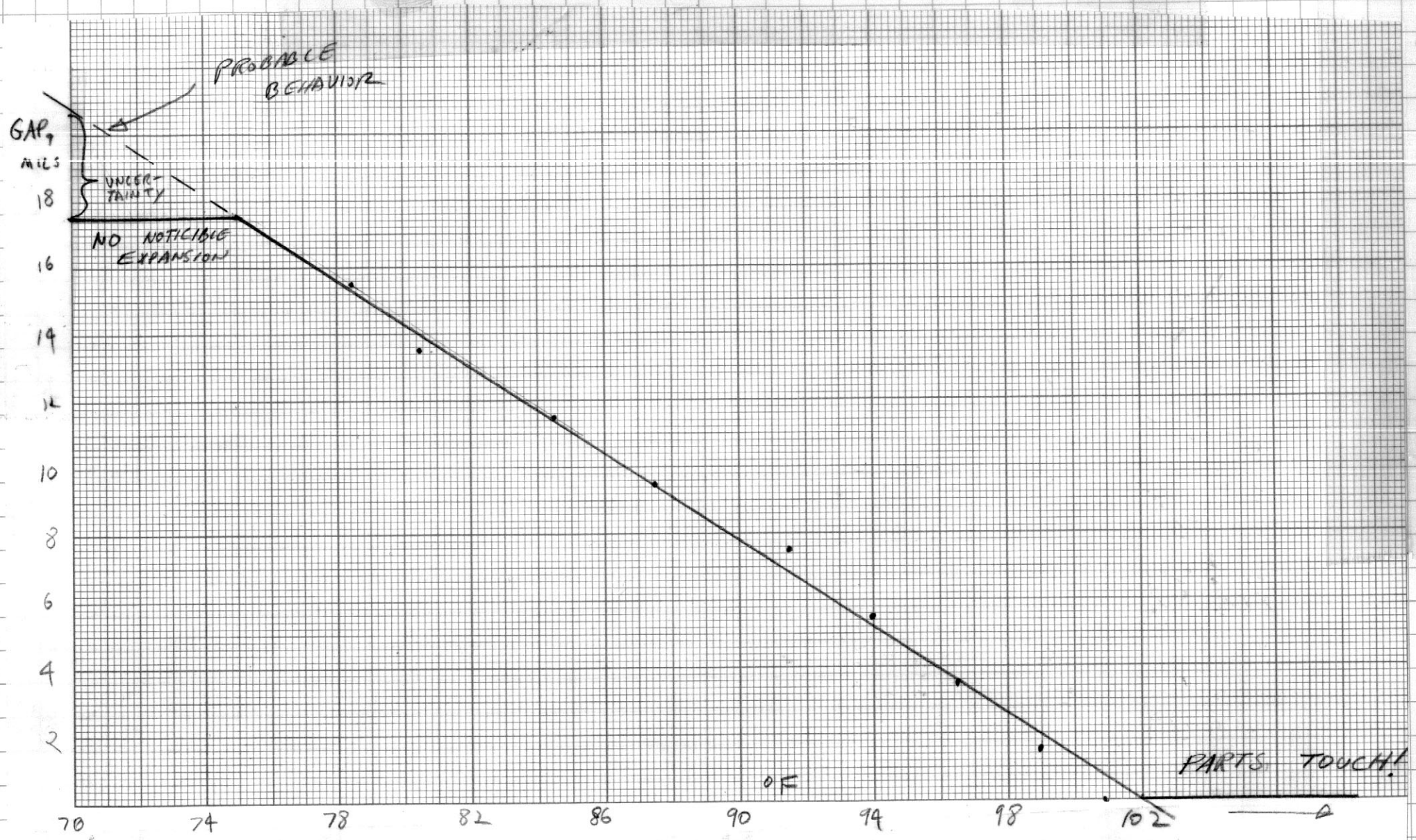
If we plot $\Delta \frac{1}{M}$ (measured) vs $\frac{1}{M}_{\text{full closure}}$ we can extrapolate to an estimated value of $\Delta \frac{1}{M}$ for the two-part case. This gives $\Delta \frac{1}{M}_{\text{est.}} = .00547$ @ $\frac{1}{M} = .0863$.

Then $1/M^{\text{NO GAP}}_{m=2} = .0808$ and $M^{\text{NO GAP}}_{m=2} = 12.37$

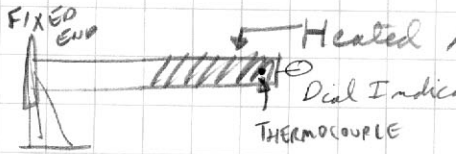
and the final table becomes:

m	$M_{\text{full closure}}$	$M_{\text{no gap}}$
2	11.59	12.37
3	20.26	22.11
4	40.09	46.04

Extrapolation of the above data shows that 5 close-packed would be just critical or near-critical.


PROBABLE BEHAVIOR
GAP, MILS
UNCERTAINTY
NO NOTICIBLE EXPANSION
18
16
14
12
10
8
6
4
2
70
74
78
82
86
90
94
98
102
°F
PARTS TOUCH!

9/18/69



To Better See What the gap was during Runs O-2' and O-4 re-runs, with 17½ mil gap @ 72°F. We heated one column and watched it expand. Partial results were:

Temp	Expansion, mils	Gap, mils
72	0	17½
75	0	17½
78½	1	15½
80½	2	13½
84½	3	11½
87½	4	9½
91½	5	7½
94	6	5½
96½	7	3½
99	8	1½
101½	9	0 @ 101°F
104½ 107½	10	
110	11	
112	12	
114½	13	
116½	14	
121	15	
124	16	
125	17	
	18	

} in this range, if both columns expand uniformly, columns would touch, & might push magnet off

Fast Stop Efficiencies:

T-1 $1.037 + 0.716 + 0.641 + 0.350 / 4 = 6.86 \times 10^{-5}$

T-2 $0.974 + 0.705 + 0.625 + 0.336 / 4 = 6.60 \times 10^{-5}$

DATA TAKEN SEPT 29

T-1 looked erratic

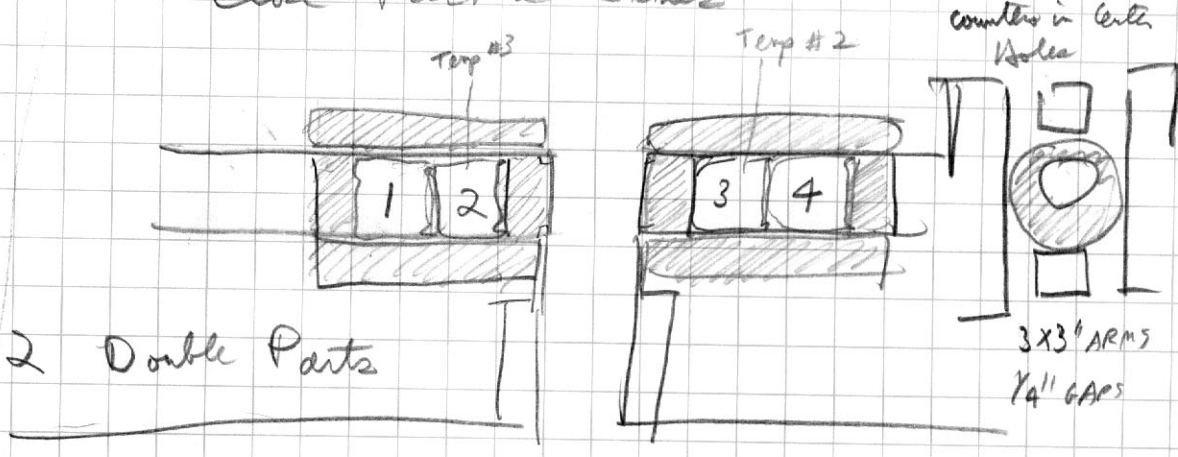
Full In Efficiencies:

T-1 $1.037 + 0.716 + 0.993 + .716 / 4 = 8.66 \times 10^{-5}$

T-2 $0.974 + 0.705 + 1.038 + .723 / 4 = 8.60 \times 10^{-5}$

10/8/69 Beginning of 6 kg, 1" Moderated Close Packed Series

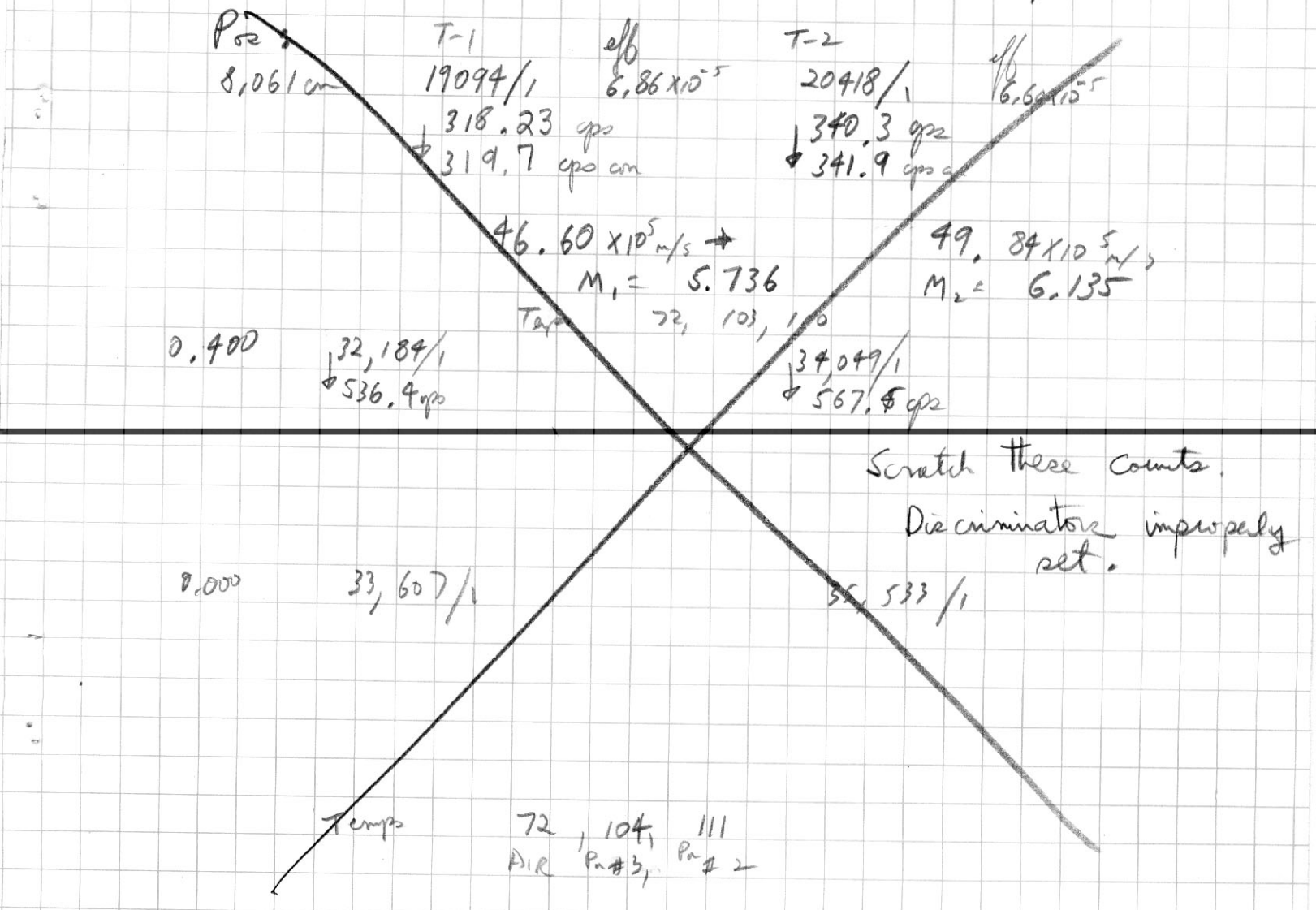
P-1



2 Double Parts

Spacing: .401 gap + .635 + .479 Heat Sinks + 5.110 Mode H.E. + .108 lid + bolt = 6.733 cm

Parts 1-4: Base Rate: 8.124×10^5 n/s



Fast Stop Efficiencies

T-1 $6,254 + 3.430 + 9,810 + 7.106/4 = 6.650 \times 10^{-5}$

T-2 $6,153 + 3.423 + 10.447 + 7.451/4 = 6.868 \times 10^{-5}$

Full Im Efficiencies

T-1 $10,599 + 7,504 + 9,810 + 7,106/4 = 8.755 \times 10^{-5}$

T-2 $9,902 + 7.135 + 10.447 + 7451/4 = 8.734 \times 10^{-5}$

.400 Eff (Interpolated) T-1 : $8,651 \times 10^{-5}$

T-2 8.641×10^{-5}

10/9/69

P-1 Re-Run

P_{02}	T-1		T-2	
8,061	20829/1	6.650×10^{-5}	21000/1	6.868×10^{-5}
	↓ 347.15 cps	↓	↓ 350.00 cps	↓
	↓ 348,84	52.457×10^{5} m/s	↓ 351,72	51.211
		$M_1 = 6.457$		$M_2 = 6,305$
			$\bar{M} = 6,381$	
.400	34,713/1	$8,651 \times 10^{-5}$	35,277/1	$8,641 \times 10^{-5}$
	578.55 cps	↓	587.95 cps.	↓
	↓ 583.27	67.422	↓ 592,82	68.605
		$M_1 = 8,299$		$M_2 = 8,445$ (.11944)
		$\bar{M}$ 8.372		
+.001	36,338/1	$8,755 \times 10^{-5}$	36,302/1	$8,734 \times 10^{-5}$
	↓ 605,63	↓	↓ 605,03	↓
	↓ 610,80	69.766×10^{5} m/s	↓ 610,20	$69,865 \times 10^{5}$ m/s
		$M_1 = 8.588$		$M_2 = 8,600$
			$\bar{M} = 8,594$	(.11636)

$\Delta \frac{1}{M} = .00308$

Temp: 72°F (AIR) / 103°F (CONTROL) / 100°F SCRAM

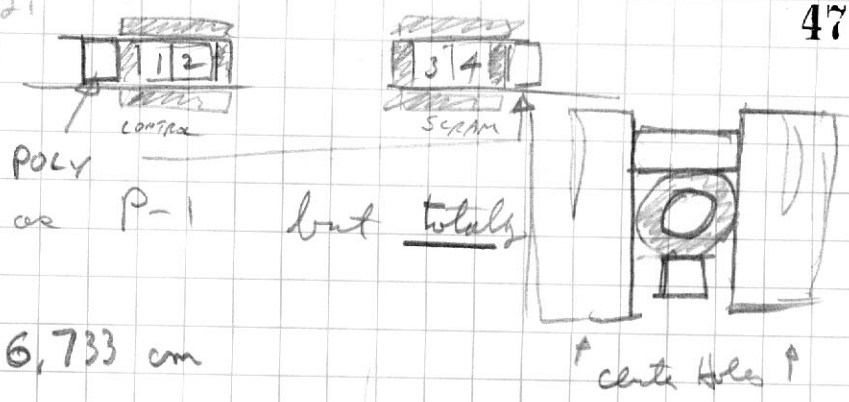
$\frac{1}{\bar{M}}_{.4} = .11328$

$\bar{M}_{-.400\ cm} = 8.828$

Efficiency same as P-1

10/10/69

2 units, 6 K_2, 1" mod



P-2

same as P-1 but totally reflected

Spacing = 6,733 cm

Bents; 1-4 ; Base Rate: $8,124 \times 10^{-5}$ m/s

Pos.	T-1		T-2	
8,067	21182/1	6.650×10^{-5}	21090/1	6.868×10^{-5}
	353.03 gpa		351.50 gpa	
	354.78	53.350×10^{-5} m/s	353.23	51.431×10^{-5} m/s
		$M_1 = 6.567$		$M_2 = 6.331$
			$\bar{M} = 6.499$	
.400	36913/1	8.651×10^{-5}	37022/1	8.641×10^{-5}
	615.22 gpa		617.03 gpa	
	620.56 gpa corr	71.733×10^{-5} m/s	622.40	72.021×10^{-5} m/s
		$M_1 = 8.830$		$M_2 = 8.866$
			$\bar{M} = 8.848$	$Y_{\bar{M}} = .11302$
-.001	38621/1	8.755×10^{-5}	38768/1	8.734×10^{-5}
	643.68 gpa		646.13 gpa	
	649.53 gpa corr	74.180×10^{-5} m/s	652.03 gpa corr	74.654×10^{-5} m/s
		$M_1 = 9.131$		$M_2 = 9.181$
			$\bar{M} = 9.160$	$Y_{\bar{M}} = .10917$

$\Delta Y_{\bar{M}} = .00405$

Temps: 71°F (Air), 109°F Scream, 111°F Control

Y_M at -.4cm = .10522 (no gap)

M @ NO GAP = 9.504

P-3 Effecting Factors:

Fast Step

T-1: 6.254 + 3,430 + 0,971 + 0,562 + 9,180 + 7,106 / 6 = 4,584 $\times 10^{-5}$ m/s

T-2 6,153 + 3,423 + 1,009 + 0,597 + 10,447 + 7,451 / 6 = 4,847 $\times 10^{-5}$ m/s

Full Im

T-1 10,599 + 7,504 + 2,447 + 1,365 + 9,180 + 7,106 / 6 = 6,367 $\times 10^{-5}$

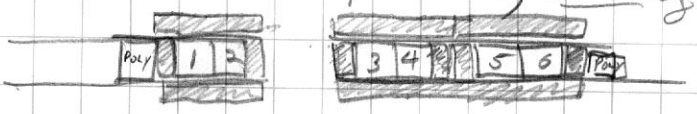
T-2 9,902 + 7,135 + 2,911 + 1,385 + 10,447 + 7,451 / 6 = 6,455 $\times 10^{-5}$

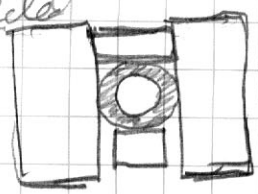
@ .4 cm T-1 = 6,278 $\times 10^{-5}$

T-2 = 6,375 $\times 10^{-5}$

10/13/'69 6 Kg ; Close Spaced, 1" Mark HE series

P-3 3 double parts, 'totally' reflected





Spacing between 2 + 3 = 6,733 cm
4 + 5 = 6,332 cm

Parts : 1-6 ; Base Rate 12,121 $\times 10^5$ n/s

Por:	T-1	ef // n/s	T-2	ef // n/s
8,053 cm	25372/1	4,589 $\times 10^{-5}$	25,889/1	4.847 $\times 10^{-5}$
	↓ 422,85 cps	92.792 $\times 10^5$	↓ 431,48 cps	89.561 $\times 10^5$ n/s
	425,36 cm	M_1 = 7,655	↓ 434.10 cps cm	M_2 = 7.389
			$\bar{M}$ = 7,522	
.400	49229/1	6.278 $\times 10^{-5}$	49615/1	6.375 $\times 10^{-5}$
	↓ 820,48 cps	132,209 $\times 10^5$ n/s	↓ 826,92 cps	131,231 $\times 10^5$ n/s
	↓ 830.01	M_1 = 10.907	↓ 836.60	M_2 = 10.827
			$\bar{M}$ = 10,867	$1/\bar{M}$ = .09202
-.007	51972/1	6,367 $\times 10^{-5}$	52106/1	6.451 $\times 10^{-5}$ ($\Delta_{1/M}$ = .00512)
	↓ 866,20 cps	137.715 $\times 10^5$ n/s	↓ 868,43 cps	136,192 $\times 10^5$ n/s
	↓ 876.83 cps cm	M_1 = 11,362	↓ 879,12 cps cm	11.236
			$\bar{M}$ = 11,299	$1/\bar{M}$ = .08850

Temps: 70° AIR 71° COLUMN 99°F SCRAM 110°F CONTROL

∴ @ -.4cm $1/M$ = 08498 , $\boxed{M = 11,767}$

60° safe to load 3 double parts on Cont. Table.

Efficiency Factors same as P-3

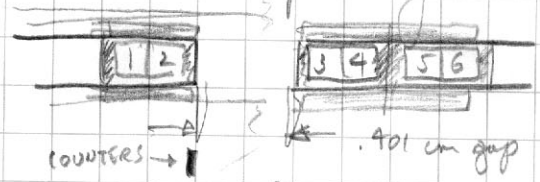
Eff. Factor for P-4'

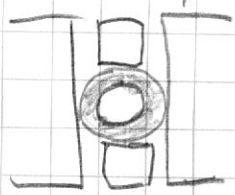
T-1 : 9.811 + 7.106 + 2.261 + 1.269 + .389 + .230 / 6 = 3.511×10^{-5}

T-2 10.947 + 7.451 + 2.352 + 1.298 + 0.400 + 0.238 = 3.698×10^{-5}

70 94½ 70 105
AIR COLUMN AIR Pu (#4)

P-4 3- double parts, As previous run but without end caps + 3"x5" top reflector





Parts : 1-6 ; Base Rate = 12,121 $\times 10^{-5}$ n/s

Pos: 8,045

T-1

29 913/1 4,584 $\times 10^{-5}$
415,22 cps 91,108 $\times 10^{-5}$ n/s
417,64 cps corr $M_1 = 7.517$

T-2

25,162/1 4,847 $\times 10^{-5}$
419.45 cps 87.047 $\times 10^{-5}$ n/s
421.92 cps corr 7,182
$\bar{M} = 7,349$

.400

46394/1 6,278 $\times 10^{-5}$
773,23 cps 129.51 $\times 10^{-5}$
781.68 cps corr $M_1 = 10,272$

45 814/1 6,375 $\times 10^{-5}$
763.57 121.070
771,82 cps corr $M_2 = 9,988$
$\bar{M} = 10,130$ $1/\bar{M} = .09872$

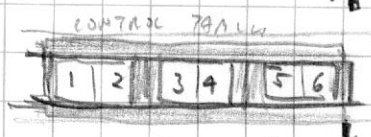
48 403/1 6,367 $\times 10^{-5}$
806,72 cps 128,150
815,93 cps corr $M_1 = 10,533$

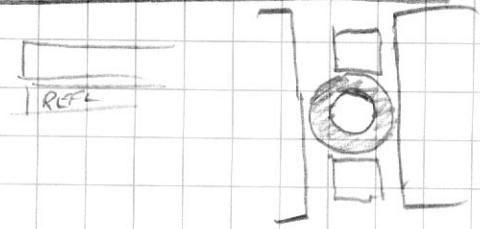
48 126/1 6,455 $\times 10^{-5}$
802,10 cps 125,670
811,20 cps corr $M_2 = 10.368$
$\bar{M} = 10,470$ $1/\bar{M} = .09551$

Temps:	AIR	COLUMN	SCRAM	CONTROL
	70	71	92	119

$1/m$ @ -.4cm .09230 M @ -.4 = 10,834

P-4'





Spacing: 6.332 cm

Parts 1-6 ; Base Rate 12,121 $\times 10^{-5}$

Table open 21 774/1 3.511 $\times 10^{-5}$
362,90 cps 102.718 $\times 10^{-5}$
364.75 cps corr $M_1 = 8,474$

22 827/1 3,698 $\times 10^{-5}$
380,45 cps 103,429
382,48 cps corr. $M_2 = 8,533$

Table B-.006 22,459/1 107,174 $\times 10^{-5}$
374,32 cps $M_1 = 8,842$
376,29 cps corr

23,460/1 106,309
391,00 $M_1 = 8,771$
393.13 $\bar{M} = 8,807$
down 19% from results ↓ P-4

Temps:	70	100	70	112
	AIR	COLUMN	AIR	Pu #4

Eff Factors:

Fast Stop:

$$T\text{-}1: \quad \left(\frac{6,254 + 3,430}{2}\right).25 + .75(3,551) = 3.874 \times 10^{-5}$$

$$T\text{-}2: \quad \left(\frac{6,153 + 3,423}{2}\right).25 + .75(3,698) = 3,971 \times 10^{-5}$$

Full I_m

$$T\text{-}1 \quad \left(\frac{10,599 + 7,504}{2}\right).25 + .75(3,551) = 4,926 \times 10^{-5}$$

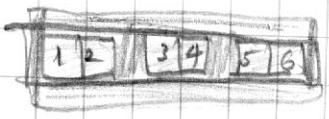
$$T\text{-}2 \quad \left(\frac{9,902 + 7,135}{2}\right).25 + .75(3,698) = 4,903 \times 10^{-5}$$

② .400 cm	T-1	4874
	T-2	9.857

10/14/69

P-5

6 Kg, 1" Mark H.E. mod, "close preload."
4 double parts



Spacing between 2+3, 4+5 = 6.332 cm

Spacing between 6+8 = 6.733 cm

Parts: 1-9 except #7, Bore Rate 16.158×10^{-5} m/s

Por: 8.059 T-1: 31,886/1 T-2 32,665/1

Array terminated because of unusually hi (133°F) temperature.

Temps	70°F	122°F	98°F	133°F
	Air	Al tube outside #4	Part #8	Part #4

Although this exp. has no hi temp limit, we will see if we can do something to lower temperature of system.
(Reflector + "Solid" Mock HE outer cylinder really limits heat removal)!

Hookup blower to rear end & control table. Temps now:

70	95	107	108
Air	Al Tube	Part #8	Part #4

Por:	T-1		T-2	
8.061 cm	31,713/1	3.874×10^{-5}	32,591/1	3.941×10^{-5}
	528.55	137.452×10^{-5} m/s	543.18	137.83×10^{-5} m/s
	532.49	$M_1 = 8.507$	547.33	$M_2 = 8.530$
				$\bar{M} = 8.519$
.400 cm	50104/1	4.879×10^{-5}	50290/1	4.857×10^{-5}
	↓ 835.07 gps	↓ 173.358×10^{-5}	↓ 838.17	↓ 174.618×10^{-5}
	↓ 844.95 gps cm	$M_1 = 10.728$	848.12	$M_2 = 10.806$
		$\bar{M} = 10.767$		$1/\bar{M} = .09288$
-.001 cm	51,827/1	4.926×10^{-5}	52,262/1	4.903×10^{-5}
	↓ 863.78 gps	↓ 177.496	↓ 871.03 gps	↓ 179.899
	↓ 874.35 gps cm	10.985	881.78 gps cm	11.130
				$\bar{M} = 11.057$ $1/\bar{M} = .09044$

	Air	Tube	#8	#4
Temps:	71	98	110	108

@ -.4 cm, $1/\bar{M} = .08800$, $M = 11.363$

Efficiencies:

Fast Stop: 2.804

T-1 $\left[\frac{6,254 + 3,430 + .971 + .562}{4}\right].4 + .6\left[3,551\right] = 3,252 \times 10^{-5}$

T-2 $\left[\frac{6,153 + 3,423 + 1,009 + .597}{4}\right].4 + .6\left[3,698\right] = 3,337 \times 10^{-5}$

2,796

Full I_m:

5.479

T-1 $\left(\frac{10,599 + 7,509 + 2,447 + 1,365}{4}\right).4 + .6(3,551) = 9,322 \times 10^{-5}$

T-2 $\left(\frac{9,902 + 7,135 + 2,411 + 1,385}{4}\right).4 + .6(3,698) = 9,302 \times 10^{-5}$

5,208

@ .4 cm T-1 = $9,269 \times 10^{-5}$

T-2 $9,254 \times 10^{-5}$

P-6 6 Kg, 1" Mode HE modulated, close spaced series

5 - double parts

Spacing between 2&3, 4&5, & 9&10 : 6,332 cm
Spacing between 6&8 : 6,733 cm (.401 cm gap)

Parts: 1-11 less #7, Base Rate: 20.235×10^5 m/s

P_5	T-1		T-1	
8,067	36 798/1	$3,252 \times 10^{-5}$	38101/1	$2,337 \times 10^{-5}$
	613,30 gps	$190,229 \times 10^5$ m/s	635,02 gps	$192,005 \times 10^5$ m/s
	↓ 618,61	$M_1 = 9,401$	↓ 640,72	$M_2 = 9,489$
			$\bar{M} = 9,445$	
.400	62 344/1	$4,269 \times 10^{-5}$	62,891/1	$4,254 \times 10^{-5}$
	1039,07 gps	$296,992 \times 10^5$ m/s	1048,18 gps	$250,066 \times 10^5$ m/s
	↓ 1054,41	$M_1 = 12,206$	↓ 1063,78	$M_2 = 12,358$
			$\bar{M} = 12,282$	$1/m = .08142$
-.001	65,915/1	$4,322 \times 10^{-5}$	65,529/1	$4,302 \times 10^{-5}$
	1090,25 gps	$256,166 \times 10^5$ m/s	1092,15 gps	$257,813 \times 10^5$ m/s
	↓ 1107,15	$M_1 = 12,659$	↓ 1109,11	$M_2 = 12,741$
			$\bar{M} = 12,700$	$1/m = .07874$

Temps: 71 (AR) 97 (Metal out mid #9) 110 (Part #8) 107 (Part #4)

IF NO GAP:

@ -.4 cm $1/m = .07606$, $M = 13,148$

Efficiencies:

Fast Step

$$T\text{-}1 \quad \left[\frac{6,054 + 3,930 + .971 + .562 + .190 + .125}{6}\right].5 + .5(3.551) = 2.737 \times 10^{-5}$$

$$T\text{-}2 \quad \left[\frac{6,153 + 3,423 + 1,009 + .597 + .201 + .130}{6}\right].5 + .5(3.698) = 2.809 \times 10^{-5}$$

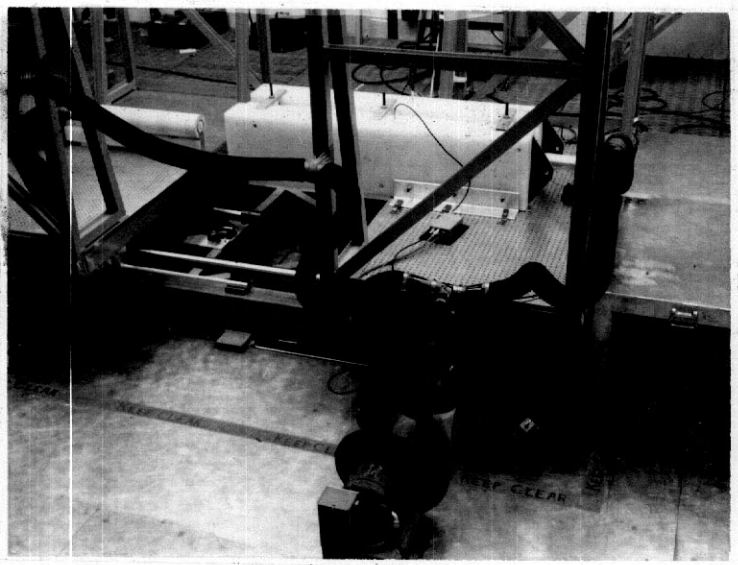
Full Im

$$T\text{-}1 \quad \left(\frac{10,599 + 7,509 + 2,497 + 1,365 + .915 + .250}{6}\right).5 + .5(3.551) = 3.658 \times 10^{-5}$$

$$T\text{-}2 \quad \left(\frac{9,902 + 7,135 + 2,411 + 1,385 + .920 + .253}{6}\right).5 + .5(3.698) = 3.641 \times 10^{-5}$$

@ .4 $\quad T\text{-}1 = 3.612 \times 10^{-5}$

$T\text{-}2 = 3.600 \times 10^{-5}$



10/15/89

P-7

6 - K_g, 1" Mock H.E. moderated close spaced rods
6 double packs

Spacing : 6.332 cm except 6.733 cm center (.4 cm gap)

Packs 1 – 13 less #7, Base Rate : 24,268 $\times 10^{-5}$ m/s

Pos: T-1 T-2

8.063

39 024/1 2.737×10^{-5} 39 730/1 2.809×10^{-5}
650.40 gps. 239.817×10^{5} m/s 666.17 gps. 239.388×10^{5} m/s
656.38 gps cm $M_1 = 9.882$ 672.49 gps cm $M_2 = 9.864$
$\bar{M} = 9.873$

.400 cm

67,779/1 3.612×10^{-5} 68309/1 3.600×10^{-5}
1129.65 gps 317.777×10^{5} m/s 1138.98 gps 321.367×10^{5} m/s
1147.81 gps cm $M_1 = 13.099$ 1156.92 gps cm $M_2 = 13.242$
$\bar{M} = 13.168$, $1/\bar{M} = .07594$

Temps: 72°F Air | 98°F Air tube | 123°F PART #10 | 109°F PART #4

−.001

70,275/1 3.658×10^{-5} 71,135/1 3.691×10^{-5}
1171.25 gps 325.528×10^{5} m/s 1185.58 gps 331.115×10^{5} m/s
1190.78 gps cm $M_1 = 13.914$ 1205.59 gps cm $M_2 = 13.699$
$\bar{M} = 13.529$ $1/\bar{M} = .07392$

$\therefore$ @ −.4 cm, $1/\bar{M} = .07190$, $\bar{M} = 13.908$

We have installed a "Tee" on the blower hose so that we can cool screen tube too.

Efficiencies:
Fuel Step

T-1: $\left[\frac{.056 + .041}{2}\right]_{.0985} + 6\,(2.7365) \,//\, 7 = 2.353 \times 10^{-5}$

T-2 $\left[\frac{.059 + .043}{2}\right]_{.051} + 6\,(2.8085) \,//\, 7 = 2.415 \times 10^{-5}$

Full I_M

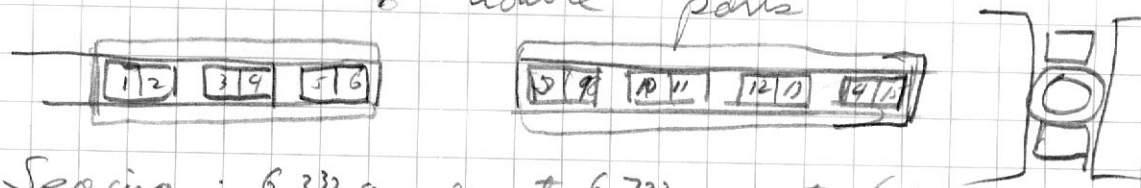
T-1 $\left[\frac{0.098 + 0.068}{2}\right]_{.083} + 6\,(3.6575) \,//\, 7 = 3.147 \times 10^{-5}$

T-2 $\left[\frac{0.101 + 0.070}{2}\right]_{.0855} + 6(3.641) \,//\, 7 = 3.133 \times 10^{-5}$

@ .4 cm T-1 = 3.108×10^{-5}
T-2 = 3.097×10^{-5}

6-Kg, 1" Mode A.E. Mod., close Packed Series
7 double parts

P-8



Spacing: 6,332 cm except 6,733 cm center (.401 gap)

Parts: 1-15, less #7; Base Rate: 28.348×10^5 m/s

P.R.	T-1	f/f	T-2	f/f
8.063	39 675/1	2.353×10^{-5}	40437/1	2.415×10^{-5}
	661.25 cps	283.651×10^5 m/s	673.95 cps	281.727×10^5 m/s
	667.43 cps	$M_1 = 10.006$	680.37 cps	$M_2 = 9.938$
			$\bar{M} = 9.972$	
.400 cm	69,630/1	3.108×10^{-5}	70,291/1	3.097×10^{-5}
	1160.5 cps	379.559×10^5 m/s	1170.68 cps	383.252×10^5 m/s
	1179.67 cps	$M_1 = 13.389$	1186.93	$M_2 = 13.520$
			$\bar{M} = 13.454$	$1/m = .07437$

Temp. 71 Air | 93 Altitude | 92 Part #12 | 103 Part #4

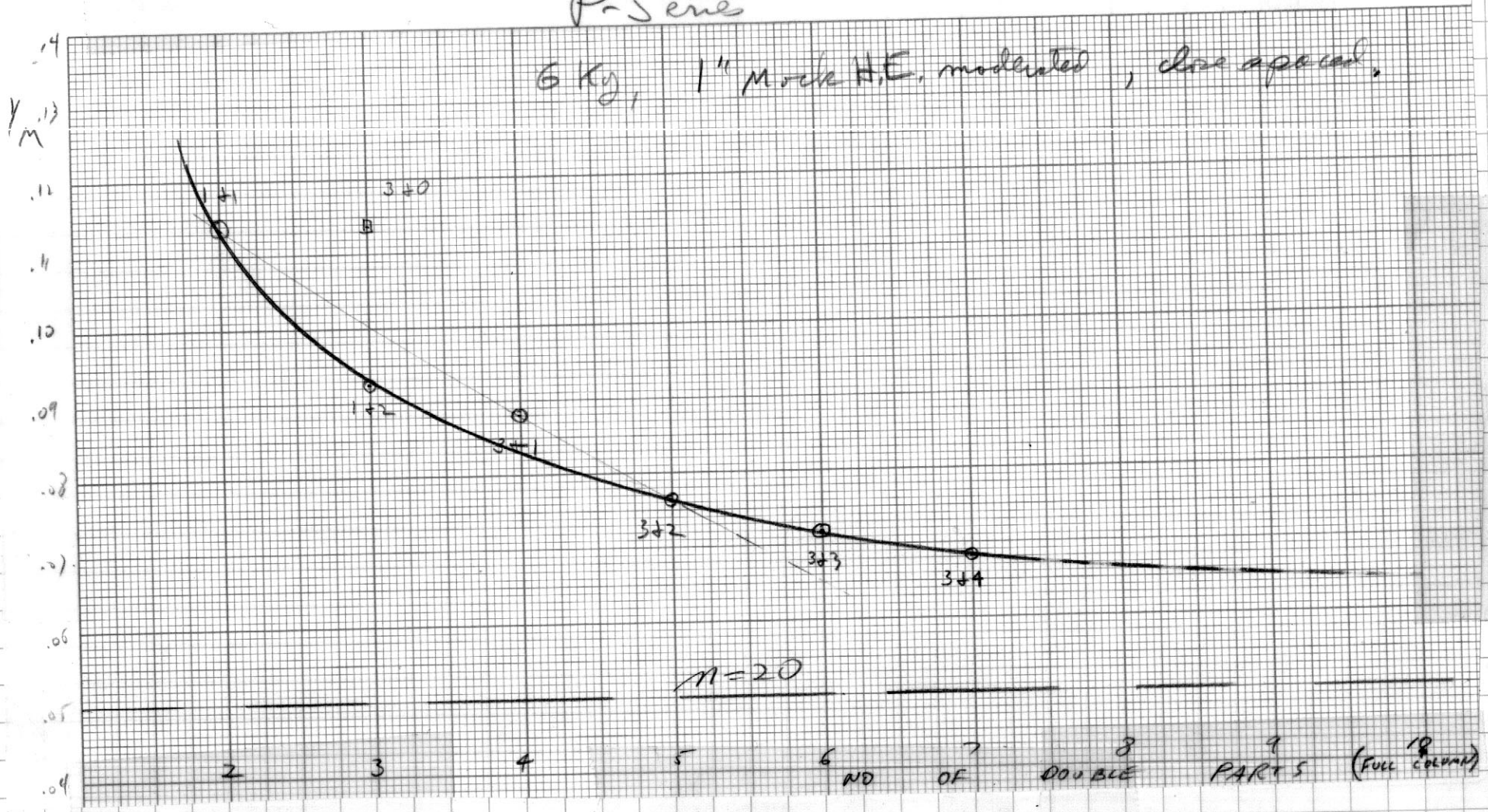
$\Delta \frac{1}{m} = .00305$

-.006	73,432/1	3.147×10^{-5}	73892/1	3.133×10^{-5}
	1223.87 cps	395.678×10^5 m/s	1231.53 cps	399.978×10^5 m/s
	1245.20	$M_1 = 13.958$	1253.13	$M_2 = 14.110$
			$\bar{M} = 14.030$	$1/m = .07128$

$\therefore$ ⓐ −.4 (no gap), $1/m = 14.656$ $m = .06823$

Series Concluded as it appears as M FULL COLUMN, DOUBLE REFLECTED < 20 (~ 15.6)

P-Series


6 Kg, 1" Mock H.E. moderated, close ape coal.
Y/M
.14
.13
.12
.11
.10
.09
.08
.07
.06
.05
.04
1 ± 1
3 ± 0
1 ± 2
3 ± 1
3 ± 2
3 ± 3
3 ± 4
n = 20
2
3
4
5
6
7
8
9
10
NO OF DOUBLE PART S (FULL COLUMN)

go on

Efficiencies :

Fast Step

T-1 : 11,612 + 6,762 + 18,121 + 12,114 / 4 = 12,152 x10^{-5} c/m

T-2 : 11,521 + 6,768 + 17,728 + 12,336 / 4 = 12,088 x10^{-5} c/m

Full Im :

T-1 17,576 + 12,387 + 18,121 + 12,114 / 4 = 15,049 x10^{-5} c/m

T-2 18,537 + 12,813 + 17,728 + 12,336 / 4 = 15,353 x10^{-5} c/m

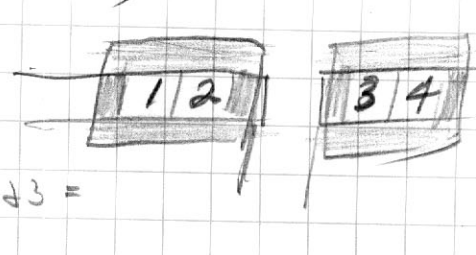
② .4 , T-1 = 14,905 x10^{-5} c/m

T-2 = 15,191 x10^{-5} c/m

6 Kg, 1/2" Mock HE moderated, Close Packed Series.

10/21/69

Q-1



Spacing between 2 & 3 =

Parts: 1-4, Base Rate: 8.124×10^5 n/s

	T-1	eff $\sqrt{n/2}$	T-2	eff $\sqrt{n/2}$ Top & Bottom
P.O. 8,065	40,254/1	12.152×10^5 c/m	41,802/cm	12.088×10^5
	670.90 cps	55.732×10^5 n/s	696.70 cps	58.203×10^5 n/s
	677.25 cps cm	$M_1 = 6.860$	703.56 cps cm	$M_2 = 7.164$
			$\bar{M} = 7.012$	
.4" cm	62,022	14.905×10^5 c/m	64,607	15.191×10^5 c/m
	1033.7 cps	70.372×10^5	1076.8 cps	71.964
	1048.9 cps cm	$M_1 = 8.662$	1093.2 cps cm	$M_2 = 8.858$
		$\bar{M} = 8.760$	$1/\bar{M} = .11416$	
-.001 cm	64,145	15.049×10^5 c/m	66,554	15.353×10^5 c/m
	1069.1 cps	72.117×10^5 n/s	1109.2 cps	73.386×10^5 n/s
	1085.3 cps cm	$M_1 = 8.877$	1126.7 cps cm	$M_2 = 9.033$
		$\bar{M} = 8.955$	$1/\bar{M} = .11167$	

Temps:

71	88	107	102
AIR	Column	PART #4	PART #1

$\Delta M = .00249$

$\therefore 1/M @ -.4\text{ cm} = .10918, \quad M = 9.159$

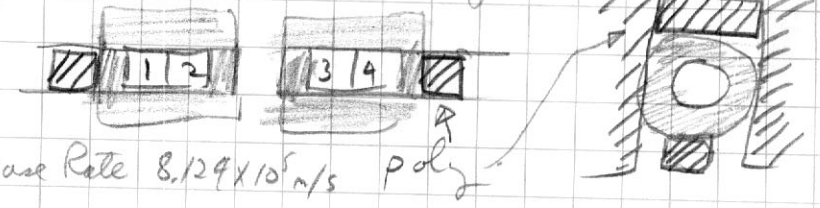
MULTIPLICATION IF NO GAP

Efficiency Factor are in Q-1

10/22/69

Q-2 Ao in Q-1, but "total reflection case"

Spacing =



Parts 1-4; Base Rate 8.129×10^5 m/s

Pr	T=1		T=2	
8.065	41,536/1 min	12.152×10^{-5} c/m	43,675/1 min	12.088×10^{-5} c/m
	692.27 gpm	57.521×10^5 m/s	727.92 gpm	60.837×10^5 m/s
	↓ 699.0 gpm con $M_1 = 7.080$		735.4 gpm con	7.488
		$\bar{M} = 7.284$		
.4	68,267/1	14.905×10^{-5} c/m	70,301/1	15.191×10^{-5} c/m
	1137.8 gpm	77.571×10^5 m/s	1171.7 gpm	78.415×10^5 m/s
	↓ 1156.2 gpm con $M_1 = 9.548$		↓ 1191.2 gpm con	$M_2 = 9.652$
		$\bar{M} = 9.600$	$1/m = .10417$	
−.001	70010/1	15.049×10^{-5} c/m	72293/1	15.353×10^{-5} c/m
	1166.8 gpm	78.823×10^5 m/s	1209.9 gpm	79.828×10^5 m/s
	↓ 1186.2 gpm con $M_1 = 9.702$		1225.6 gpm con	$M_2 = 9.826$
		$\bar{M} = 9.764$	$1/m = .10242$	

Temps	72	81	102	100
	AIR	COLUMN	PART #4	PART #1

$\therefore \Delta 1/m = .00175$

AND AT −.900 cm $1/m = .10067$ $m = 9.933$
(AT NO GAP)

∴ 2 double parts can be safely loaded on control table

Efficiencies:

Fast Stop:

T-1: 11.612 + 6.762 + 1.647 + 1.000 + 18.121 + 12.114 / 6 = 8.542×10^{-5} c/m

T-2 11.521 + 6.768 + 1.671 + 1.020 + 17.728 + 12.336 / 6 = 8.507×10^{-5}

Full Im:

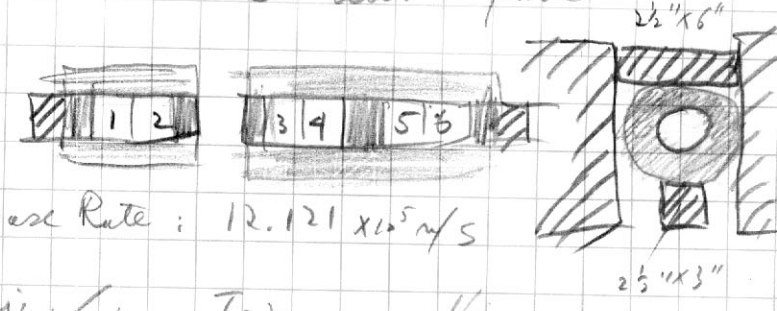
T-1: 17.576 + 12.387 + 3.257 + 1.923 + 18.121 + 12.114 / 6 = 10.896×10^{-5} c/m

T-2: 18.537 + 12.813 + 3.231 + 1.922 + 17.728 + 12.336 / 6 = 11.095×10^{-5} c/m

@ .4 m T-1 = 10.779×10^{-5} c/m

T-2 = 10.967×10^{-5} c/m

Q-3 6 kg, 1½" Mode HE moderated, Close-Packed Series
Total Reflector with 3 double parts



Parts: 1-6; Base Rate: 12.121×10^5 n/s

Pos:	T-1	effic. / n/s	T-2	effic.
8.066	96,400 /,	8.542×10^{-5} c/n	48,351 /,	8.507×10^{-5} c/n
	773.33 cps	91.718×10^5 n/s	805.85 cps	95.803×10^5 n/s
	↓781.8 cps con $M_1 = 7.567$		↓815.0	$M_2 = 7.904$
		$\bar{M} = 7.735$		
.900 cm	79,724 /,	10.779×10^{-5} c/n	82,179 /,	10.967×10^{-5} c/n
	1328.7 cps	125.605×10^5 n/s	1369.6 cps	127.327×10^5 n/s
	↓1353.9 cps con $M_1 = 10.363$		1396.4 cps con	$M_2 = 10.505$
		$\bar{M} = 10.434$		$1/m = .095193$
−.001 cm	82,050 /,	10.890×10^{-5} c/n	84,919 /,	11.095×10^{-5} c/n
	1367.5	127.955×10^5 n/s	1415.3 cps	130.140×10^5 n/s
	↓1394.2 cps con $M_1 = 10.556$		↓1443.9 cps con	$M_2 = 10.737$
		$\bar{M} = 10.646$		$1/m = .093932$

Temps: 72 (AIR) 84 (COLUMN) 104 (PART #5) 104 (PART #1)

$\Delta 1/m = .001261$

$\therefore 1/m @ .400 a = .09267$, $m = \underline{10.791}$

∴ 3 double parts can be safely loaded on CONTROL TABLE

Efficiency:

Fast Step

T-1: $11,612 + 6,762 + 18,121 + 12,114 + 2,928 + 1,712 / 6 = 8,875 \times 10^{-5}$ c/m

T-2: $11,521 + 6,768 + 17,728 + 12,336 + 3,158 + 1,853 / 6 = 8,894 \times 10^{-5}$

Full Im

T-1: $17,576 + 12,387 + 18,121 + 12,114 + 2,928 + 1,712 / 6 = 10,806 \times 10^{-5}$

T-2: $18,537 + 12,813 + 17,728 + 12,336 + 3,158 + 1,853 / 6 = 11,071 \times 10^{-5}$ c/m

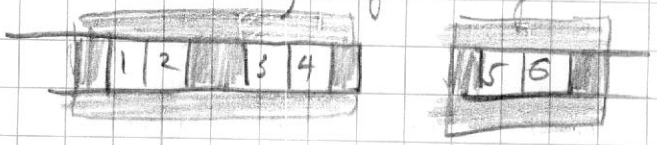
② .4: T-1 = 10,710

T-2 = 10,963

98246

10/23/69

Q-4 3 double pants, regular reflection



Parts: 1-6; Base Rate = 12.121 x 10^{-5} m/s

Pos.	T-1		T-2	
8.046	49 718/1	8.875 x 10^{-5}	52401/1	8.874 x 10^{-5} c/m
	828.63 gps	94.462 x 10^{-5} m/s	873.35 gps	99.411 x 10^{-5} m/s
	↓ 838.35 gps corr	M_1 = 7.793	↓ 884.16 gps corr	M_2 = 8.202
			$\bar{M}$ = 7.997	
ⓐ .400	73124/1	10.710 x 10^{-5} c/m	75194/1	10.963 x 10^{-5} c/m
	1218.7	115.760 x 10^{-5} m/s	1253.2	116.346 x 10^{-5} m/s
	↓ 1239.8	M_1 = 9.550	↓ 1275.5	M_2 = 9.599
			$\bar{M}$ = 9.574	$1/\bar{M}$ = .10445
-.001 corr	74981/1	10.806 x 10^{-5}	77383/1	11.071 x 10^{-5}
	1249.7 gps	117.712 x 10^{-5} m/s	1289.7 gps	118.639 x 10^{-5} m/s
	↓ 1272.0 gps corr	M_1 = 9.711	↓ 1313.4 gps	M_2 = 9.787
			$\bar{M}$ = 9.749	$1/\bar{M}$ = .10257

Temperatures: 72 AIR 92 COLUMN 94 PART #2 (screw table thermocouple part damages

$\Delta \frac{1}{m}$ = .00188 $\frac{1}{m}$ ⓐ .4 cm = .10069

AND M@ NO GAP = 9.931

Efficiencia:

Fast Stop

T-1: 11,612 + 6,762 + 1.647 + 1.000 + 18.121 + 12.114 + 2,928 + 1.712/8 = 6.987×10^5 c/m

T-2: 11,521 + 6,768 + 1,671 + 1.020 + 17,728 + 12,336 + 3,158 + 1,853/8 = $7,007 \times 10^5$ c/m

Full Im

T-1: 17,586 + 12,387 + 3,257 + 1,923 + 18,121 + 12,114 + 2,928 + 1.712/8 = $8,752 \times 10^5$ c/m

T-2: 18,537 + 12,813 + 3,231 + 1,922 + 17,728 + 12,336 + 3,158 + 1,853/8 = $8,947 \times 10^5$ c/m

∴ @ .4 cm T-1 = $8,664 \times 10^{-5}$ c/m

T-2 = $8,851 \times 10^5$ c/m

Q-5 4 double parts: regular reflection

Parts 1-9 less #7 ; Bare Rate 16.158 $\times 10^5$ n/s

P_o	T-1	T-2
8.069	54166/1 6.987×10^{-5}	56880/ 7.007×10^{-5}
	902.77 gps 130.860 $\times10^5$ n/s	948.00 gps 137.113 $\times10^5$ n/s
	↓914.32 gps cm $M_1 = 8.099$	↓960.75 gps cm $M_2 = 8.486$
		$\bar{M} = 8.292$
.400	84,855/1 8.669×10^{-5}	87,769/ 8.851×10^{-5}
	1414.3 gps 166.540 $\times10^5$ n/s	1462.8 gps 168.727 $\times10^5$ n/s
	↓1442.9 gps cm $M_1 = 10.307$	1493.4 gps $M_2 = 10.442$
		$\bar{M} = 10.375$ $1/\bar{M} = .09639$
-.010	87,483/ 8.752×10^{-5}	90,671/ 8.947×10^{-5}
	1458.1 gps 170.075 $\times10^5$ n/s	1511.2 gps 172.561 $\times10^5$ n/s
	↓1988.5 gps $M_1 = 10.526$	↓1593.9 gps $M_2 = 10,680$
		$\bar{M} = 10.603$, $1/\bar{M} = .09431$

Temps: 72 AIR 93 COLUMN 95 PART #2

$D/M = .00208$

% $1/m$ @ -.4 cm = .09223

AND $M_{no\ GAP} = 10,842$

Efficiencies:

Fast Step:

T-1: $(.8)\ 6.987 + (.2)\ \frac{.467 + .302}{2}\ (.349) = 5.659 \times 10^{-5}$

T-2: $(.8)\ 7.007 + (.2)\ \frac{.507 + .335}{2}\ (.422) = 5.690 \times 10^{-5}$

Full Im

T-1: $(.8)\ 8.752 + .2(.349) = 7.071 \times 10^{-5}$

T-2: $(.8)\ 8.947 + .2(.422) = 7.242 \times 10^{-5}$

(a) .4 T-1 = 7.001×10^{-5}

T-2 = 7.165×10^{-5}

Q-6 5 double Pairs, 'regular' reflection.

Pairs: 1-11 less #7, Base Rate: 20.235×10^5 m/s

Pair	T-1	T-2
8.068	56338 / 5.659×10^{-5} c/m	58767 / 5.690×10^{-5} c/m
	938.97 168.136×10^5 m/s	979.45 gps 174.527×10^5 m/s
	↓951.48 $M_1 = 8.309$	993.06 gps $M_2 = 8.625$
		$\bar{M} = 8.467$
.400	87591 / 7.001×10^{-5} c/m	90517 / 7.165×10^{-5} c/m
	1459.9 712.883	1508.6 gps 215.087×10^5 m/s
	↓1490.4 $M_1 = 10.521$	↓1541.1 gps cm $M_2 = 10.629$
		$\bar{M} = 10.575$ $1/m = .09456$
−.002	90477 7.071×10^{-5} c/m	93649 7.242×10^{-5} c/m
	1507.9 gps 217.847×10^5 m/s	↓1560.8 gps 220.340×10^5 m/s
	↓1540.4 gps cm $M_1 = 10.766$	↓1595.7 gps $M_2 = 10.889$
		$\bar{M} = 10.827$ $1/m = .09236$

Temp 72 Air 87 COLUMN 97 Pair 3

$\Delta\ 1/m = .00220$

$\therefore\ 1/m @ -.4\text{ cm} = .09016$

AND $M_{\text{NO GAP}} = 11.091$

Efficiencies.

Fast Stop

T-1 $11,612 + 6,762 + 1,647 + 1.000 + .308 + .209$
$+ 18,121 + 12,114 + 2,928 + 1,712 + .467 + .302 = 4,765 \times 10^{-5}$ c/m
($18,121 + 12,114 + 2,928 = 35,644$)

T-2 $11,521 + 6.768 + 1,671 + 1.020 + .317 + .212$
$+ 17.728 + 12,336 + 3.158 + 1.853 + .507 + .335 = 4.786 \times 10^{-5}$ c/m
($17.728 + 12,336 + 3.158 = 35,917$)

Full Im

T-1 $17.576 + 12.387 + 3.257 + 1.923 + .536 + .340 + 35,644 = 5,972 \times 10^{-5}$ c/m

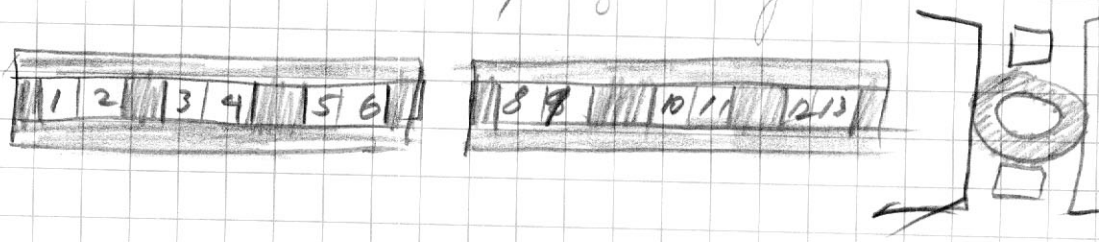
$18.537 + 12.813 + 3,231 + 1,922 + .538 + .342 + 35,917 = 6.108 \times 10^{-5}$ c/m

(@) .4 cm T-1 = $5,912 \times 10^{-5}$ c/m

T-2 = $6,042 \times 10^{-5}$ c/m

6 Kg, 1½" Mock HE moderated, Close Packed Series

Q-7 6 Double Parts, regular reflector



Parts: 1-13 less #7, Base Rate: 24.268×10^5 n/s

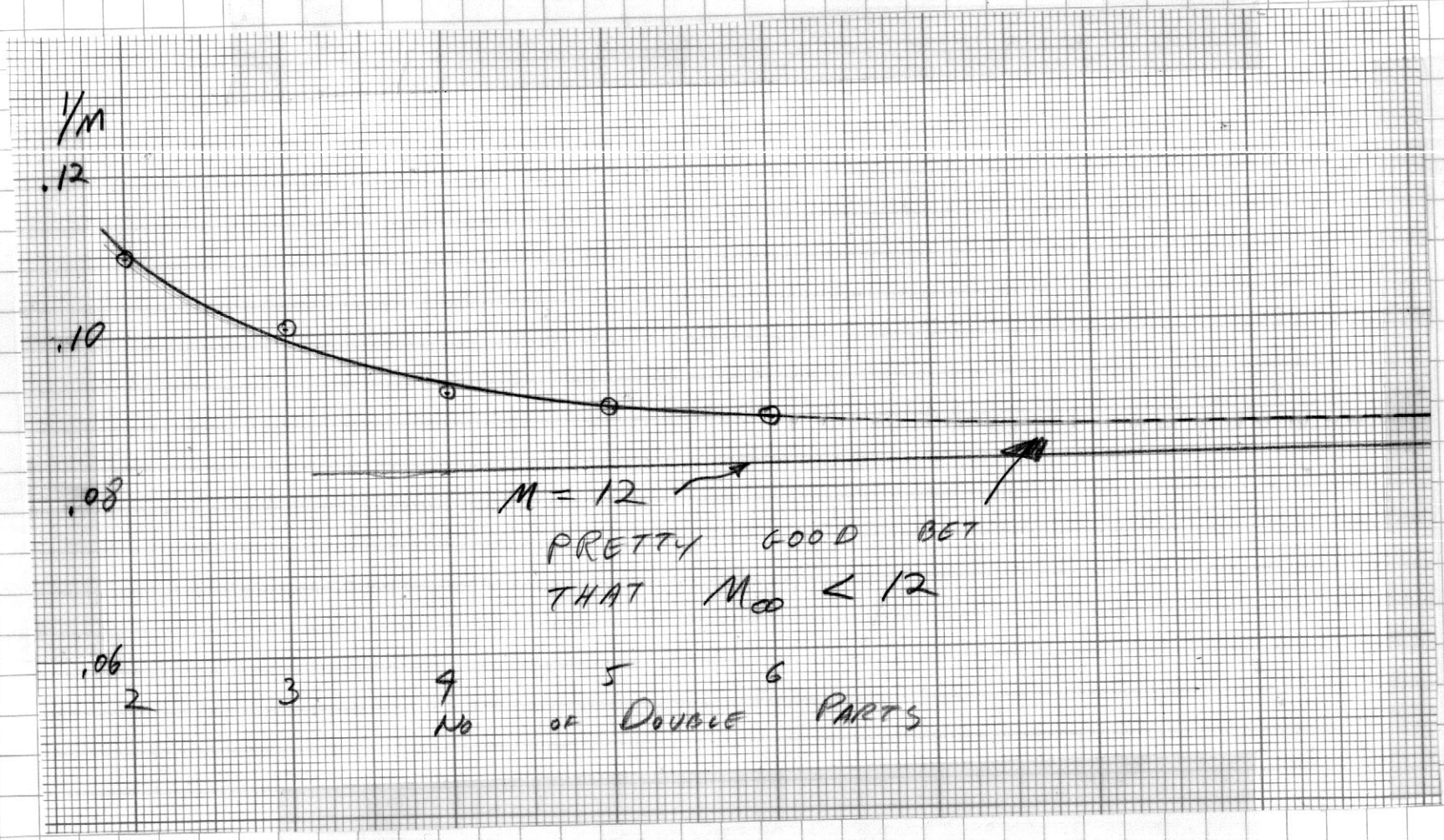
	T-1		T-2	
P_{so} 8.073 cm	57585/1	4.765×10^{-5}	60291/1	4.786×10^{-5} c/n
	959.75 gps	204.159×10^5	1004.8 gps	212.934×10^5 n/s
	↓ 972.82 gps cm	$M_1 = 8.413$	↓ 1019.1 gps cm	$M_2 = 8.774$
			$\bar{M} = 8.594$	
.400 cm	90370/1	5.912×10^{-5} c/n	93178/1	6.042×10^{-5} c/n
	1506.2 gps	260.267×10^5 n/s	1553.0 gps	262.744×10^5 n/s
	↓ 1538.7 gps	$M_1 = 10.725$	↓ 1587.5	$M_2 = 10.827$
			$\bar{M} = 10.776$	$1/m = .09280$
.010 cm	93003/1	5.972×10^{-5} c/n	96362/1	6.108×10^{-5} c/n
	1550.1 gps	265.322×10^5 n/s	1606.0 gps	268.975×10^5 n/s
	↓ 1589.5 gps	$M_1 = 10.933$	↓ 1642.9 gps	$M_2 = 11.084$
			$\bar{M} = 11.008$	$1/m = .09084$

Temps: 72 (Air) 85 (Column) 95 (Pu #3)

$\Delta 1/m = .00196$

$\therefore 1/m$ @ $-.4$ cm $= .08888$

$\downarrow M$ @ no tamp $= 11.251$


1/M
.12
.10
.08
.06
2
3
4
5
6
No OF DOUBLE PARTS
M = 12
PRETTY GOOD BET
THAT $M_\infty < 12$