A.P. INSTRUMENT DESIGN

A.P. RUNS.

E.M. PLATES

Dessicatorbox

①

④ } ?

5 Φ → ⑨

A3q+onty. ⑤

60hrs ⑨

⑧ gold.

② = 10hrs after bake.

Stage Co-ordinates

Change co-ords   cold   @ 14.~~02~~.78

68.3   68.5
69.6   69.4
@ 14.5°, -4.6°.

≃ warm   @ 12.12.~~77~~.

69.1   67.7
70.4   69.1
@ 17°, -4.6°

Alignment co-ords   @ 15.~~08~~.77.
Tip 5.3kV
Lens 2.3kV.

75.3   70.2
78.7   73.3
@ 0°, -4.5°.

Alignment @ 11.~~07~~.78.
72.3   74.7
76.6   77.9
@ ½°, 37.3.

Alignment @ 14.~~0~~9.78 (Mehmed's spec).
74.6   76.2
77.4   79.3
@ 4°, 27.5..

Way different from before?

Alignment @ 26. ~~0~~9.78.

72·1 73·4
75·2 76·6
@ 355, -3·2°.

Alignment of quenched binary taken out for exam^n after outgassing.

72·7 74·4
75·9 77·6
@ 359°, 22·1°

72·9 74·0
76·4 77·7
@ 7°, 22·2°

Alignment @ end of probing 60hrs 26.10.78.

72·9 73·2
75·4 76·3
@ 353°, 30·7°.

This was after a considerable realignment for last probing session (whole moved inwards).

Alignment 29 ~~0~~1.79
73·4 76·0
76·5 75·9 @ 22·7, 3·5

Polishing conditions

Ni – 7.0%Al (wt).

FIM

General polish:

1) 15% perchloric / acetic
   @ ~25V to rough polish.
   Lacomit and polish to fine neck.
   Wash in methanol.

2) 2% perchloric / butoxy.
   @ ~10V to finish.
   Relacomit if necessary.
   Wash in methanol.

SM

2% perchloric in 2-butoxy ethanol.
@ – 5°C
70V D.C.
Time ~ 15 mins.
Init. disc thickness = 15μ.

73.0	74.2	76.2	76.2
75.0	76.5	76.0	76.0

@ 194, 357°   0°, 20.3°

Ni - Al Inco specimens

Analysis

Chemical

Al %	
7.0	~7.0 wt % Al.
7.2	
7.0	
6.9	

Mg % 0.022

Heat Treatments (103)

Hours

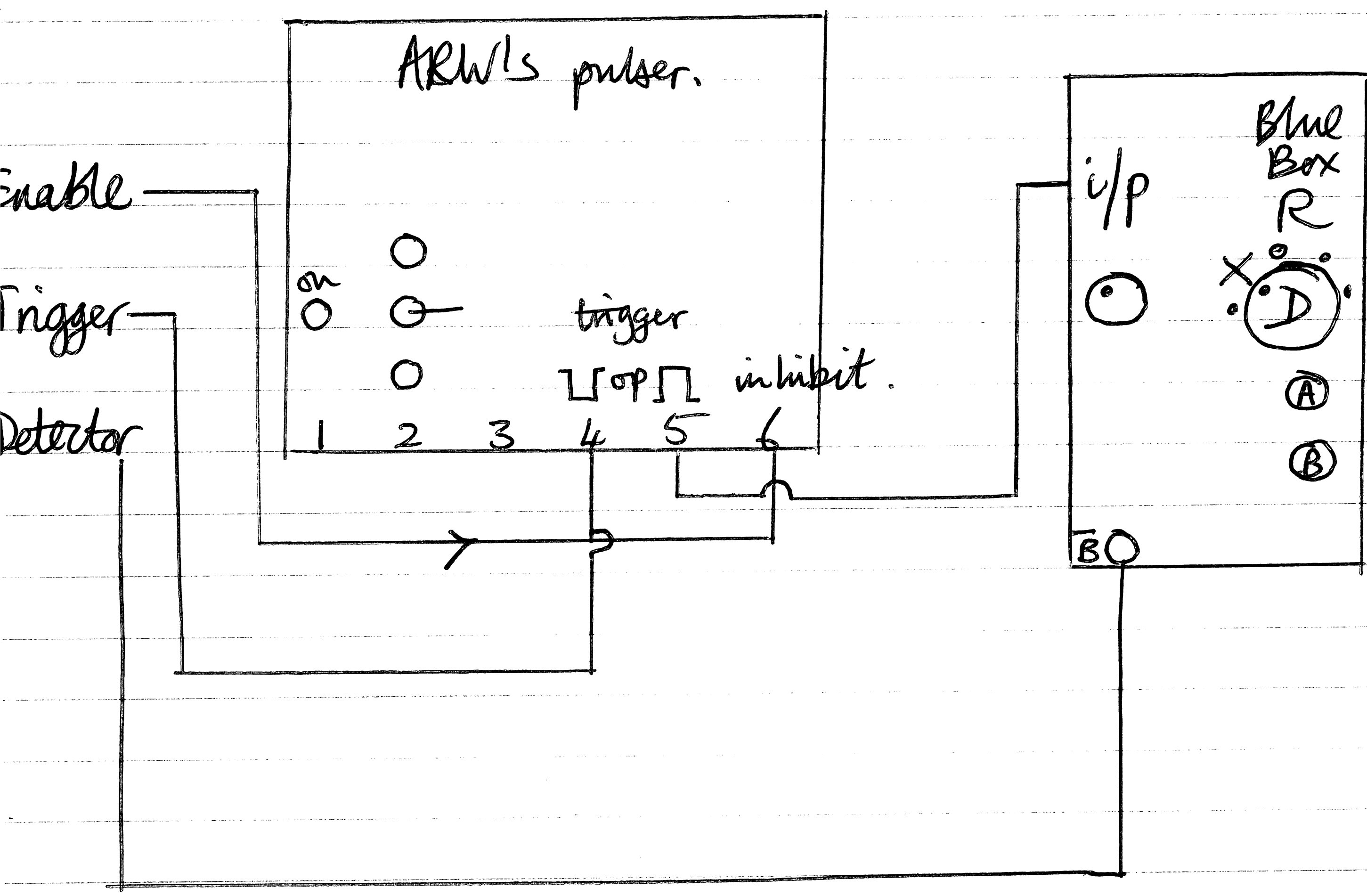
1, 5, 10, 50, 150, 1000.

Summary of results @ 24.05.78

EM : as received
annealed
1, 5, 10, 50, 150.

Probe :
(for spinodal) 150
begun 1000.

ARW's pulser connections



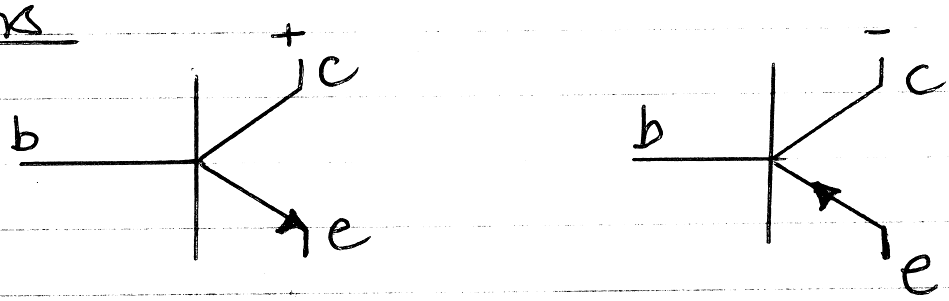
Fast Pulser for A.P.

After ARW 1978.
Lay-out after PFM 1978.

Construction begun 23.05.78.

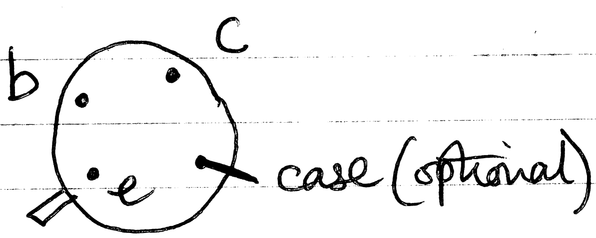
List of symbols

Transistors

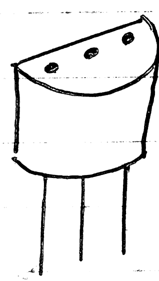


NPN PNP.

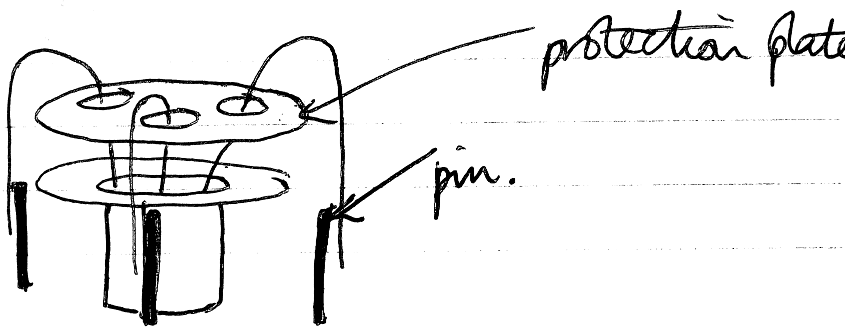
underside:



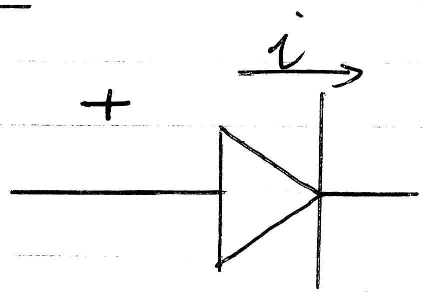
alternative forms:

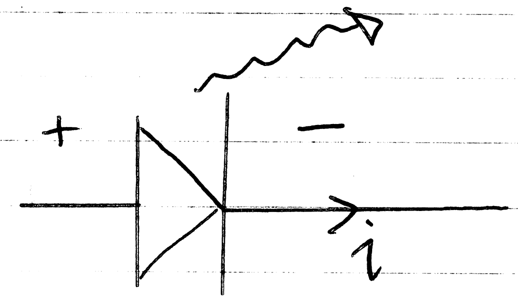


suggested mounting:

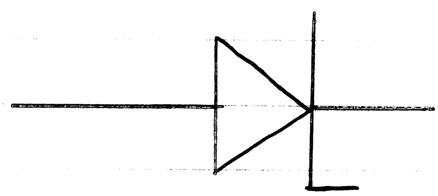


Diodes



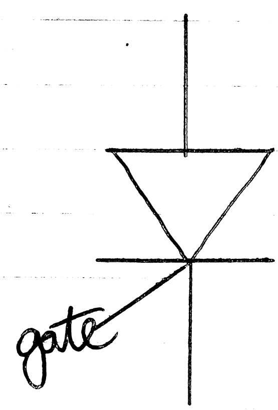


not reverse LED.



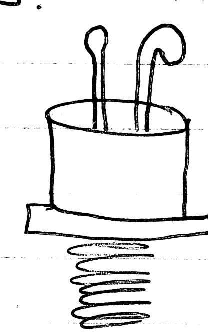
zener diode.

Thyristor



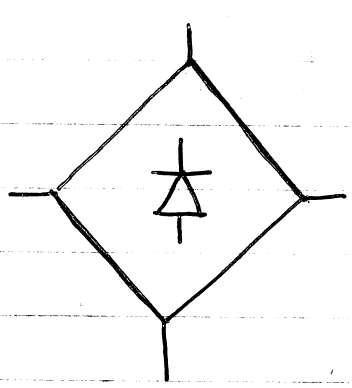
various shapes and sizes.

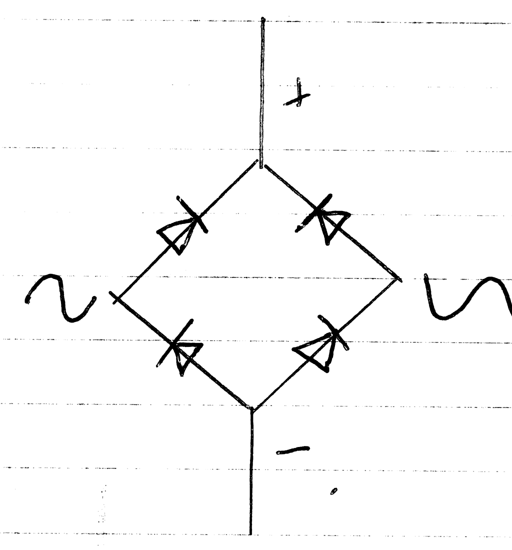
e.g.

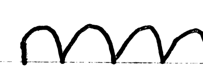


Use gate to discharge thro' 1° of transformer.

Rectifiers – bridge

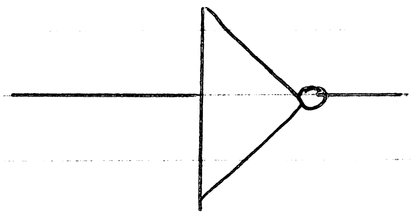




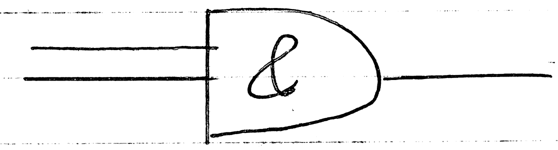


output,

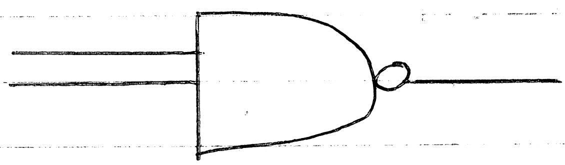
Gates etc



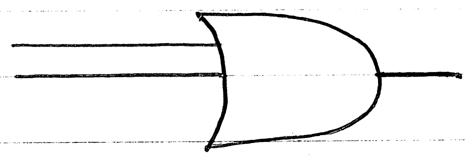
Inverter.



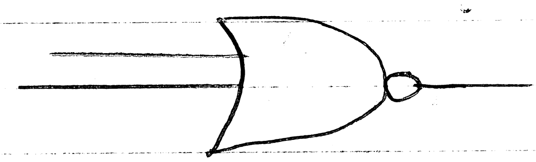
AND



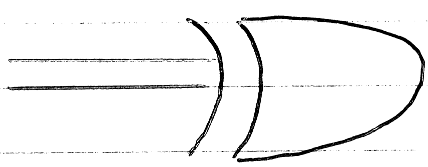
NAND



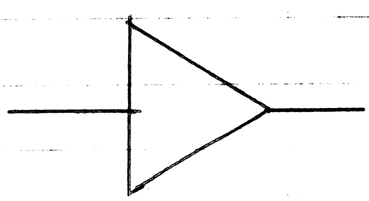
OR



NOR



EOR.



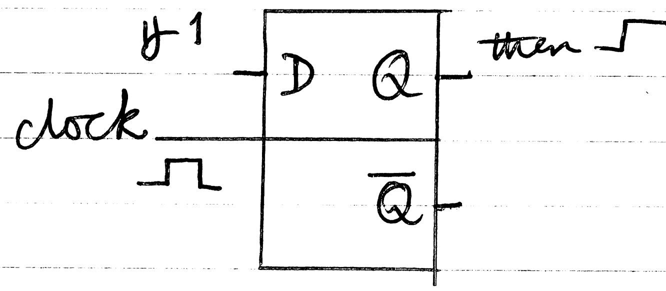
buffer.

Can be as many inputs as required – just enlarge ~~truth table~~.

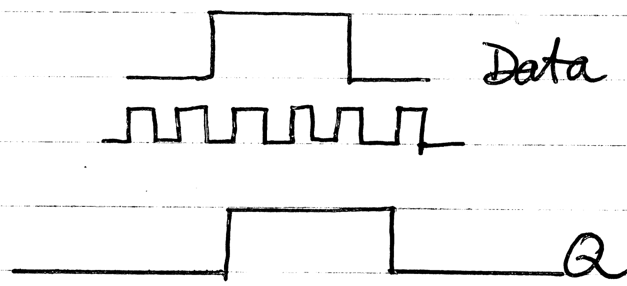
i/ps		o/p
0	0	1
0	1	1
1	0	1
1	1	0

NAND.

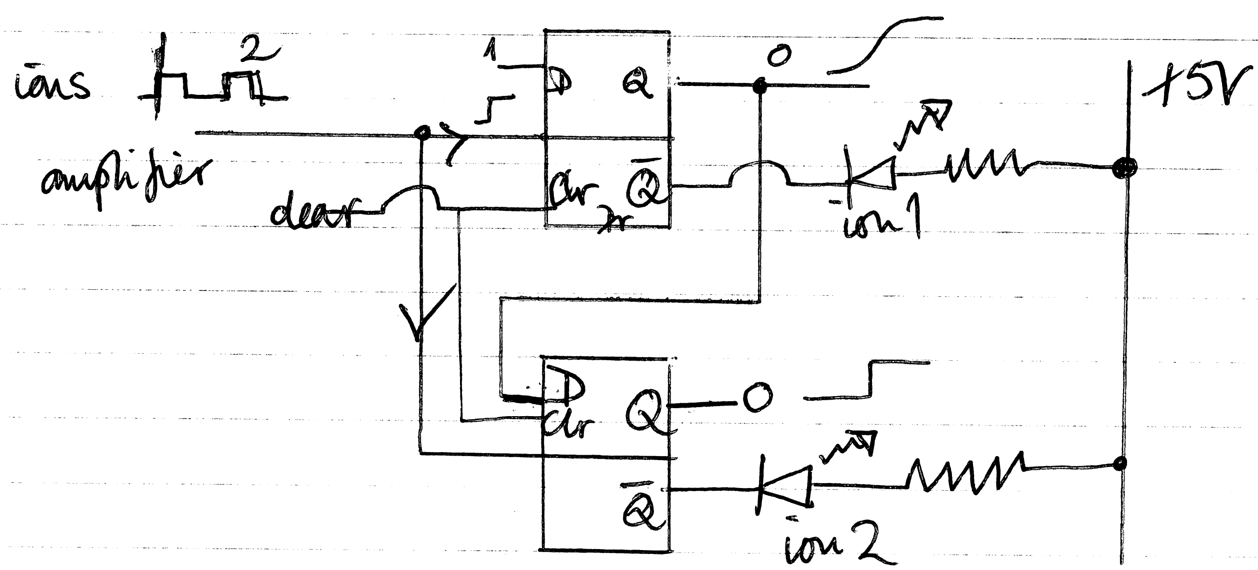
Flip-Flop



if clock = ⊓
works on trailing edge

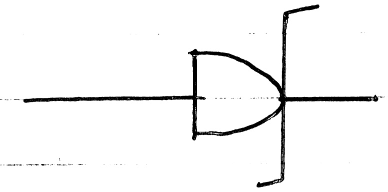


example – AP timer

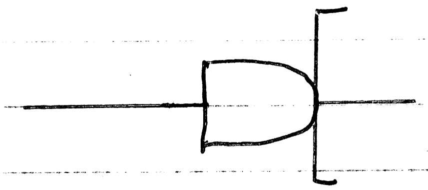


If two ions arrive together: 1st clock pulse — ion 1 ∴ D_1 high ∴ Q_1 rises. 2nd pulse ∴ D_2 still zero as 1st leading edge saw Q_1 ∴ zero, for first pulse. But by the time 2nd clock pulse comes D_2 has risen. ∴ Q_2 goes up and 2nd ion LED lights.

Other diodes

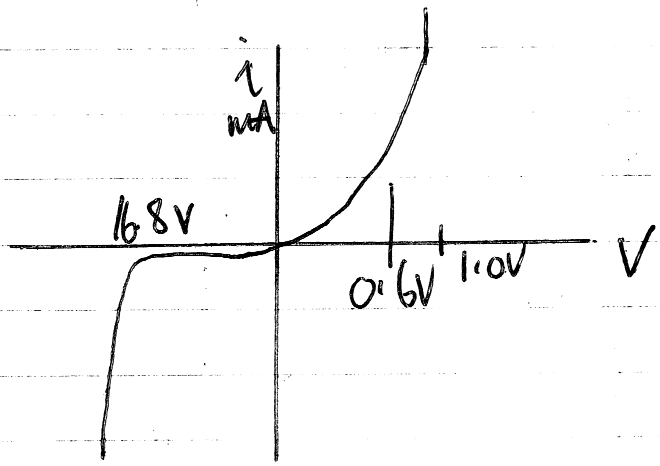


Shottky diode



tunnel diode.

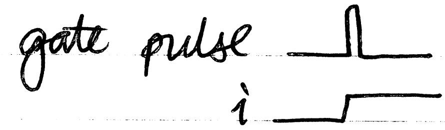
i.e. $\frac{di}{dV}$ is -ve.



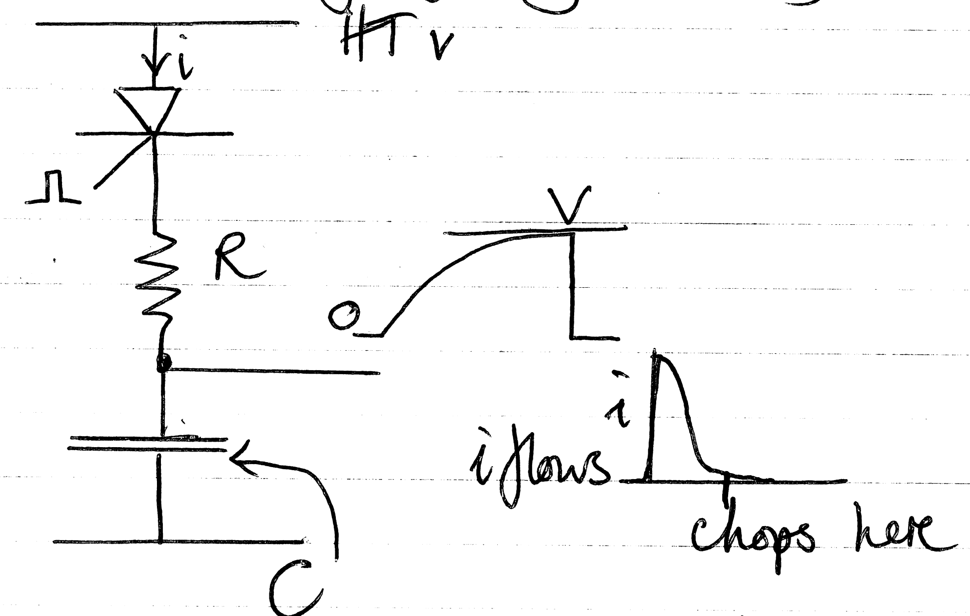
normal i/V characteristic 

Application to pulser

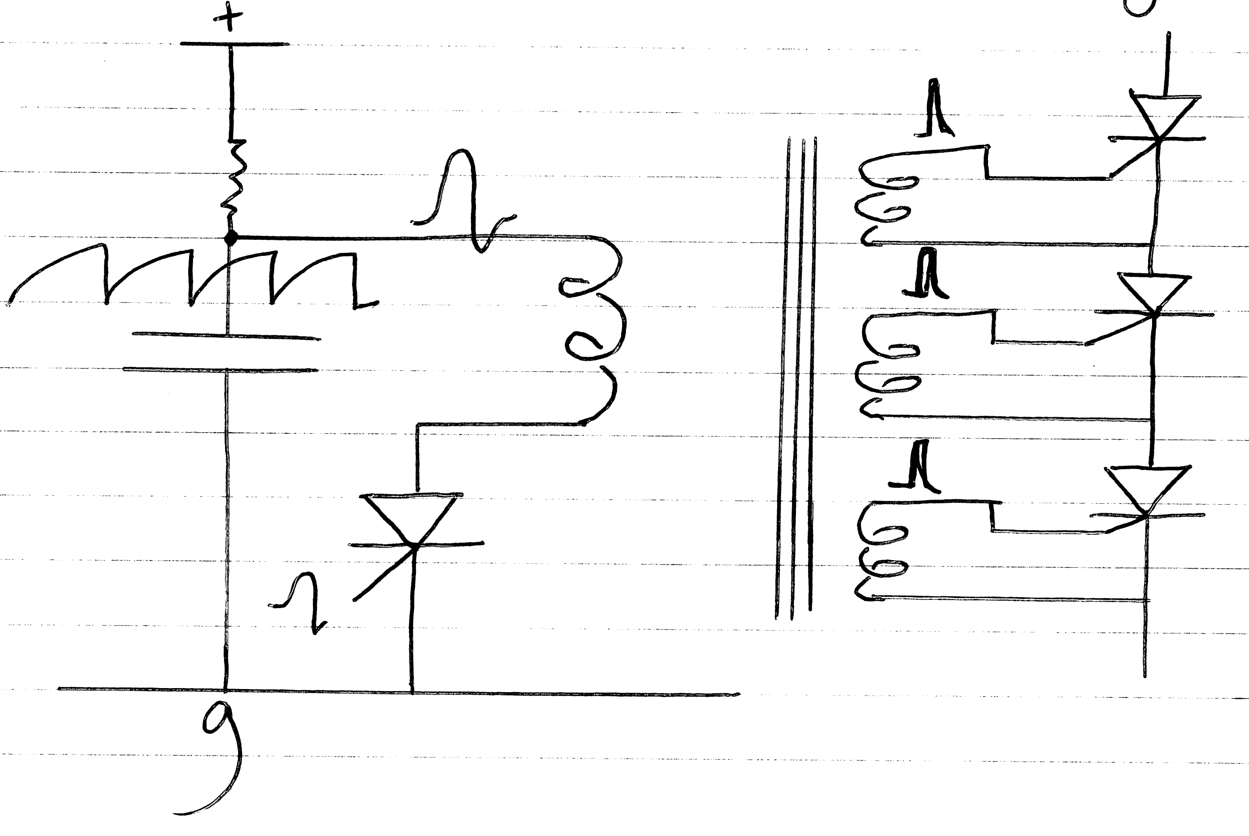
Using thyristor:

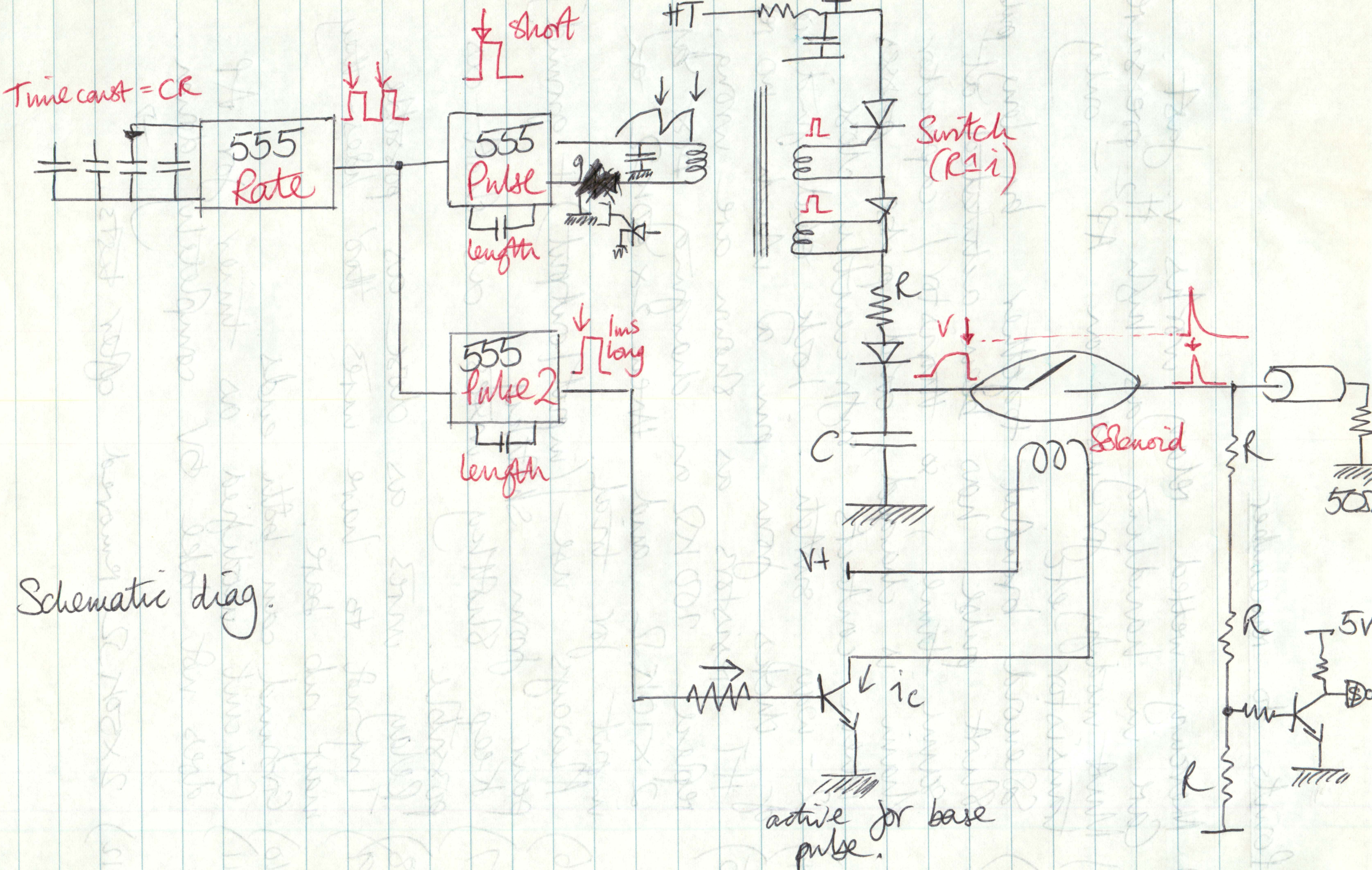


so that charge is built up on a capacitor, and then released by gating a thyristor:



This is used to activate the transformer:





Schematic diag.

Points to remember

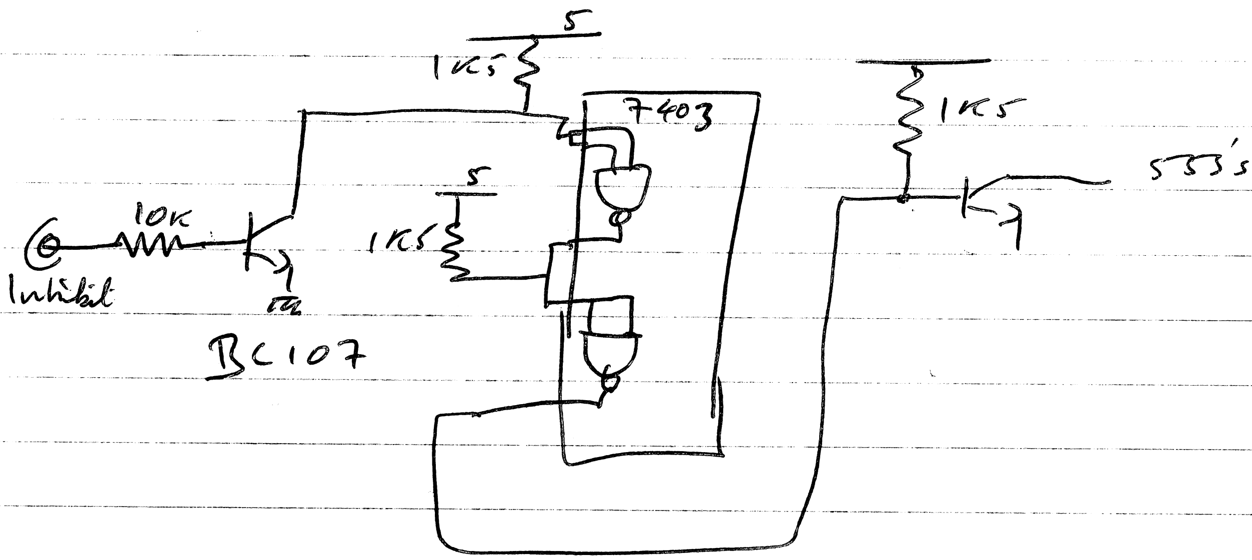
1) Mercury-wetted relay works v. fast.
Care in handling as high H_2 pressure.
2) ~~Must~~ modify for use on AP - only transistor etc.
3) Solenoid brought together by long pulse
Short pulse has been ~~activated~~ at same time, so thyristor / capacitor chain is charged, and pulse passes when contacts sufficiently close.
4) 2-way switch. Lock ~~and~~ find no of clicks from pin @ which no res.
5) HT resistors as shown are wrong. replace 100KΩ on charging box by 2×10KΩ and then 2×50KΩ on input for trial.
6) Always use [(input/output) + ground] pair from Skottky.
7) Keep Shottky wires as short as possible.
8) Relay wires as close as possible.
9) Try not to have wires thro' holes - they may rub bare.
10) Ground can both ends.
11) Circuit modified as timer for AP does not take 5V completely down.
→
12) 2×50KΩ removed after tests.

IC Functions

555	Timer.	
7400	TTL P.62	Quadruple 2-input Positive-nand gates +ve logic : $Y = \overline{AB}$
74S00	TTL p.62	~ as above.
7403	TTL p 63	Quadruple 2-input Positive-nand gates with open collector outputs. +ve logic : $Y = \overline{AB}$
7404	TTL p.63	Hex inverters. +ve logic : $Y = \overline{A}$.
7474	TTL p.76	Dual D-type positive-edge-triggered flip-flops with preset and clear. ↑ Function table.
74121	TTL p.82	Monostable multivibrators. ↖ Function table and notes.
7493	TTL p.224	Vcc = 5V supply. → 4-bit binary counters. (7493A). +ve logic ↖ Function table.

Construction finished 29.06.78.

Circuit board modification:



Transistor stops conducting even if not down to 0V.
Then reinvert using next inverter.

29th June 1978.

Ternary Alloy Melts

Present binaries: Ni – 12 at% Ti
Ni – 14 at% Al.

Some work on Ni – 14 at% Ti.
∴ Try to keep 14% (12%)

Hence, using Betteridge and Heslop P40:
These diags. are for 750°C, 1150°C and show ~~that~~ the following "sensible" suggestions may fall within the γ/γ' region; or may not, at lower temperatures:

i) Ni – 3 at% Ti – 9 at% Al
ii) Ni – 6 at% Al (7) – 6 or 7 at% Ti
iii) Ni – 9 at% Ti – 3 at% Al.

In all cases homogenis'n is complete, given time, @ ≥ 1150°C.

Actual posn of the proposed alloys @ 750°C:
i) 9% Al should lie in γ/γ'
ii) so should 6% Al 6% Ti
iii) posn of 3% Al less certain – may be in γ + γ' + η.

However, fields of single phase smaller @ 625°C and others have moved so try these alloys.

Actual Weighings

Alloy 1 – 9%Al 3%Ti

Wt NiAl/gms	Wt Ni+Ti req/gms	Wt Ni req	Wt Ti req
[illegible]	[illegible]		

See over.

$$\text{wt\%} = \frac{\text{moles Al} \cdot M_{Al}}{\text{moles Al} \cdot M_{Al} + \text{moles Ni} \cdot M_{Ni}}$$

6·99 wt% Al

Hence for ternaries:

$$\text{wt\%} = \frac{n_a M_a}{n_a M_a + n_b M_b + n_c M_c}$$

$M_{Al} = 27$
$M_{Ni} = 58.7$
$M_{Ti} = 48.$

→

[illegible]

04.07.78.

Testing of new pulser and CE after service: see computer log for + ~~tests~~.

Pulse height ~~tests~~.

Input	Output		Calc
1kV }			
2kV }			
3kV }			
500v on helipot	26×16V		416
1kV	52/53 ×16V	top	832/848
1kV	~same	~~bot~~ next.	"
1500V	80 × 16V		1280
2kV	108 ×16V	top.	1728
2kV	~ same.	~~bot~~ next	"
2500V	135 ×16V		2160
3kV	160/165 ×16V	top.	2560/2640

Pulse height :- ~ 13.3 % down on advertised. This seems to be a function of all Hg-wetted relays (full pulse to relay). PPM, ARW, BJR, AJW's boxes of various sorts + relay sizes all show ~ this drop.

See graph.
i.e. pulse = 86.7 % of ~~that~~ supposed.

New Alloys

5th July 1978

Alloy 1 9at% Al, 3at% Ti

$$wt\%\,Al = \frac{9.27}{9.27 + 3.48 + 88.58.7} = 4.38$$

$$wt\%\,Ti = \frac{3.48}{9.27 + 3.48 + 88.58.7} = 2.59$$

Alloy 2 6at% Al, 3at% Ti

$$wt\%\,Al = \frac{6.27}{6.27 + 6.48 + 88.58.7} = 2.88$$

$$wt\%\,Ti = \frac{6.48}{6.27 + 6.48 + 88.58.7} = 5.13$$

Alloy 3 3at% Al, 9at% Ti

$$wt\%\,Al = \frac{3.27}{3.27 + 9.48 + 88.58.7} = 1.43$$

$$wt\%\,Ti = \frac{9.48}{3.27 + 9.48 + 88.58.7} = 7.61$$

wt% Al	wt% Ti	wt% Ni
4.38	2.59	93.03
2.88	5.13	91.99
1.43	7.61	90.96.

Size of piece = 15.30 gms.
If this is 7.0 wt% Al then it contains 1.07 gms Al.

Piece wt	% Al = 7.0% ∴ gms Al	
15.30	1.071	0.72
17.44	1.221	1.44
31.28	2.190	2.19
38.06	2.664	

If the melt is ~ 50 gms req= ↗

Take piece for [redacted]at% Al

Al = 2.19 gms
Ti = [redacted] 1.30 gms
Ni = 46.51 gms.

Loose bar Ni = 21.84 gms = 12.4 cm
rest ^ = 27.60 gms (with plastic).
= 15.1 cm.

∴ wt = 1.76, 1.83 gms cm^{-1} ≈ 2 gm cm

So for 46.51 gms takes 23.26 cm.
Of this ([redacted]) = [redacted] gms
(31.28 − 2.19) = 29.09 gms.

from Ni-Al
Hence need 46.51 − [redacted] 29.09
= [redacted] = 13.42 gms
= [redacted] = 8.2 cm.
71

<u>Actual weights</u>.

Ni-Al	size	31.27
Ni	[redacted]	16.73
Ti.		1.30

paper 5.29
Ti 1.30
total 6.59

Total wt melt = 49.30 gms.

For 17.44 gms Al. = <u>6at%Al</u>

		rec
Al =	1.44	1.22
Ti =	2.57	2.18
Ni =	46.00	38.97

Of the Ni (17.44 − 1.22) in NiAl
= 16.22
Hence needed = 38.97 − 16.22
= 22.75
This ≏ 11.4 cm.

<u>Actual wts</u>:

Ni-Al	17.42
Ni	22.65
Ti	2.18
Total wt melt.	42.25

For 15.30 gms ≡ <u>3 at% Al</u>

		act
Al	0.72	1.07
Ti	3.81	5.66
Ni	45.48	67.59

of 15.30 gms Ni-Al (15.30 − 1.07) Ni
= 14.23

Hence need (67.59 − 14.23)
= 53.36 gms Ni
≈ 26.68 cm.

<u>Actual weights</u>

Ni-Al	15.30 gms
Ti	5.66 gms
Ni	52.35
Total melt.	73.31

Given to J. Leader 06-07.78.

10th July 1978

Film of ppts cont.
Begin @ frame no 12

t	No	
Image bright		~~12.82kV~~ 12.93kV
3 x10^-5 Torr Ne.		
Ni-Al	ppts as above.	~~ppt in centre~~ No ppts visible.
1/4	1	
1/2	2	
1	3	
2	4	
4	5	
1/4		
1/2		
1		
2		
4		

Data to data disc 6
@ ØØ ØØ.
New program writes just times.
Started @ NI reading ~ 330.
Lots of high mass nos at ~ 1000.
Could be cmd.
Writing ~ 45 ions per sector now. As there are a lot of 2nd ions this is probably ~ correct.
Using old 16% pulse for comparison see MJS.
Lots of 5-6 —— carbon.

@ 8 000 lots of 58's noted
I mean lots, like ~ 40%.
mostly 2nd ions,
Still lots of 2nd ions after
lowering + raising pulse + HT.
Probably a touch of the creeping crud
giving nickel hydrides.
36, 000 lots of Al^{2+}
38, 200 ? ordered region?

Stopped @ 363 on counter ~ 50,000.
End after 487 sectors on data disc 6.

t	No	
		@ 4 x10⁵ for Ne. 12.67 kV Octodiadically diced.
1/4		
1/2		
1		
2		
4	15	
1/4		12.81 kV,
1/2		
1		
2		
4	20	
4		
2		
1		
1/2		
1/4	25	

Hydrogen image ~ 4kV

11th July 1978.

Specimen from Allan Melmed.
Mo ternary.
$\underline{t}$ $\underline{No}$

~2.5 x10^{-5} He.

Conditions:
Standard are useless.
Do 10% in vacuo @ 80K
15% "
5% "
and as many as poss @ 60K.
Image first @ 60K.
Align and allow to warm up.

?	26	1.4 torr x10^{-5} He.
1/4	27	@ 60K.
1/2	28	B/V 6.44
1	29	6.46 kV.
2	30	Image medium
4	31	bright.
1/4	32	
1/2	33	
?	34	
2	35	
4	36	

New film.
Set probe hole to what is ~(110)
Aligned in image gas above.
Cryostat ⟶ 98K.

?, Hydrogen image ~4kV

1	1/4
2	1/2
3	1
4	2
5	4

B/V 6.53
Poorer image resoln.

Evacuated.
V. slow evapn 6.53 Hence ~~try~~ 6.60
i.e. Tip 6.0 pulse 0.6 i.e. 10%.

Data to data disc 1 ØØ ØØ
Pulse 10%.
Pressure (vacuo)
T = 78K.
N = 59

HT	P	
6.00	0.60	6.60
6.10	0.61	6.71
6.20	0.62	6.82
6.30	0.63	6.93
6.40	0.64	7.04

Misaligned.

Pulse.

kN	New	5%	New	10%	New	15%	Total 5%	Total 10%	Total 15%
5.00	0.288	0.250	0.577	0.500	.865	0.750	5.25 (5.29)	5.50 (5.58)	5.75 (5.86)
5.10	0.294	0.255	0.588	0.510	.883	0.765	5.36	5.61	5.86
5.20	0.300	0.260	0.600	0.520	0.900	0.780	5.46	5.72	5.98
5.30	0.306	0.265	0.612	0.530	.918	0.795	5.56	5.83	6.10
5.40	0.312	0.270	0.624	0.540	0.936	0.810	5.67	5.94	6.21
5.50	0.317	0.275	0.634	0.550	.951	0.825	5.78	6.05	6.32
5.60	0.323	0.280	0.646	0.560	.969	0.840	5.88	6.16	6.44
5.70	0.328	0.285	0.656	0.570	.984	0.855	5.98	6.27	6.56
5.80	0.335	0.290	0.670	0.580	1.005	0.870	6.09	6.38	6.67
5.90	0.340	0.295	0.680	0.590	1.020	0.885	6.20	6.49	6.78
6.00	0.346	0.300	0.692	0.600	1.038	0.900	6.30 (6.35)	6.60 (6.69)	6.90 (7.04)
6.10	0.352	0.305	0.704	0.610	1.056	0.915	6.40	6.71	7.02
6.20	0.358	0.310	0.716	0.620	1.074	0.930	6.51	6.82	7.13
6.30	0.363	0.315	0.726	0.630	1.089	0.945	6.62	6.93	7.24
6.40	0.369	0.320	0.738	0.640	1.107	0.960	6.72	7.04	7.36
6.50	0.375	0.325	0.750	0.650	1.125	0.975	6.82	7.15	7.48
6.60	0.381	0.330	0.762	0.660	1.143	0.990	6.93	7.26	7.59
6.70	0.386	0.335	0.772	0.670	1.158	1.005	7.04 (7.09)	7.37 (7.47)	7.70 (7.86)
6.80	0.392	0.340	0.784	0.680	1.176	1.020	7.14	7.48	7.82
6.90	0.398	0.345	0.796	0.690	1.194	1.035	7.24	7.59	7.94
7.00	0.404	0.350	0.808	0.700	1.212	1.050	7.35	7.70	8.05
7.10	0.410	0.355	0.820	0.710	1.230	1.065	7.46	7.81	8.16
7.20	0.415	0.360	0.830	0.720	1.245	1.080	7.56	7.92	8.28
7.30	0.421	0.365	0.842	0.730	1.263	1.095	7.66	8.03	8.40
7.40	0.427	0.370	0.854	0.740	1.281	1.110	7.77	8.14	8.51
7.50	0.433	0.375	0.866	0.750	1.299	1.125	7.88	8.25	8.62
7.60	0.438	0.380	0.876	0.760	1.316	1.140	7.98	8.36	8.74
7.70	0.444	0.385	0.888	0.770	1.332	1.155	8.08	8.47	8.86
7.80	0.450	0.390	0.900	0.780	1.350	1.170	8.19	8.58	8.97
7.90	0.45[illegible]	0.395	0.912	0.790	1.368	1.185	8.30	8.69	9.08
8.00	0.462	0.400	0.924	0.800	1.386	1.200	8.40 (8.46)	8.80 (8.92)	9.20 (9.39)

8%

	New
8.1	0.467
8.2	0.473
8.3	0.479
8.4	0.485
8.5	0.490
8.6	0.496
8.7	0.502
8.8	0.508
8.9	0.513
9.0	0.519

10%

Tip	~~[illegible]~~
7.5	0.866
7.6	0.876
7.7	0.888
→ 7.8	0.900
7.9	0.912
8.0	0.924
8.1	0.935
8.2	0.946
8.3	0.958
8.4	0.969
8.5	0.981
8.6	0.992
8.7	1.004
8.8	1.015
8.9	1.027
9.0	1.038

12th July 1978

Realigned. (see P1).
Imaged in 1 x10^{-5} torr He.

1/4	6
1/2	7
1	8
2	9
4	10

Image only medium.
Temp. 78K.
Resn quite poor
centre 110.

BIV 6.55.
Begin probing with 10% Pulse -
in vacuo (background = 2x10^{-8} torr).
Data to data disc 1 ØØ ØØ
Nearest is 5.90 + 0.680 = 6.58
6.00 + 0.690 = 6.69.
6.10 0.704 = 6.80
6.20 + 0.716 = 6.92
6.30 + 0.726 = 7.03
Begun here — plus about 30 ions.
6.40 + 0.738 = 7.14
Rate much less than 1 ion in 20 pulses.
% 2nd ions : various, <10%.
6.50 + 0.750 = 7.25
6.60 + 0.762 = 7.36
6.70 + .772 = 7.47
Greater rate 1700 then more 2's per pulse.
Stopped @ just > 2000.
After 24 sectors.
Now 28 sectors = 1 track.
Hence start @ Ø4 ØØ

15% pulse start total 7.47
6.40 + 1.107 = 7.51
Rate is rapid to begin with, lots of 2nd ions — some missed!

6.45 =	1.116	7.57
6.50 +	1.125	7.62
6.55 +	1.134	7.68
6.60 +	1.143	7.74

3A - 2A sectors.
Begin again as pulse wrong. Ø5 ØØ
6.55 + 1.134
Awful lot of 2nd ions

6.65	1.151	7.80
6.70	1.158	7.86
6.75	1.168	7.92
6.80	1.176	7.98
6.85	1.186	8.04
6.90	1.194	8.09
6.95	1.203	8.15
7.00	1.211	8.21

End @ total = 7.92.
So for 5% pulse. 7.50 + 0.433 = 7.93
End after 7.60 + 0.438. 8.04
68 sectors
68 - 3A ≈ 3Ø sectors

∴ begin @ Ø8 ØØ
Less 2nd ions, ? after-pulses
~ 400
Stopped @ ~ 2000 end after 92.

10% checked start @ ØC ØØ
total = 8.67
Begin @ 7.6 + 0.876 = 8.48
7.7 0.888 = 8.59
7.8 0.900 = 8.70
I think this was rather fast.
Maybe repeat after lunch.
End after C9 sectors.
This last = C9 − 92 so 3~~8~~7 sectors ≃ 23ØØ

Begin after lunch, standard cond^ns @ 1Ø ØØ

Detector checked for opt^m detection efficiency.

¼	11	7.83kV
½	12	Image just medium
1	13	1×10^{-5} Torr He.
2	14	8.07
4	15	

Slow evap^n 8.10 total in He.
Hence for 10% pulse.
7.~~4~~3 + 0.842 = 8.142
10% pulse.
In 1×10^{-5} He
78K.
No second ions ∴ not after pulses.
Stopped @ 4000.
Errors on vdu so change disc to data disc 3
After 1BC sectors.
Stopped @ 7.6 + 0.876 = 8.48
27Ø sectors.

Try now without gas but probably have to up slightly.
@ 8Ø 8Ø on data disc 3.
Began 7.90 + 0.912 = 8.812
Many more 2nd ions.
Ended @ 8.10 + 0.935 = 9.04
After 188 sectors ?
2000 ions ≏ 3Ø sectors.
Cryostat pumped.
Prog reloaded.
Data to 7Ø 8Ø data disc 3

Began @ 8.10 + 0.935 = 9.04 kV.
@ 60K.

Finished @ 29 sectors.

H_2 image 3.6 kV ?
Res 60K Image bright. 8.7 kV

1/4	16
1/2	17
1	18
2	19
4	20
4	21
2	22
1	23
1/2	24
1/4	25

Abundances in atlo for probable elements:

Z	Element	A	Rel. abdnce.	Form
1	H	1	99.9851	H^+
		2	0.0149	
2	He	3	0.000.13	He^+
		4	99.9999	
6	C	12	98.892	C^{++}
		13	1.108	
7	N	14	99.635	N^+
		15	0.365	
8	O	16	99.758	O^+
		17	0.0373	
		18	0.2039	
12	Mg	24	78.60	Mg^+
		25	10.11	
		26	11.29	
13	Al	27	100	$Al^{++} = 2+$
10	Ne	20	99.92	Ne^+
		21	0.257	
		22	8.82	
22	Ti	46	7.95	Ti^+
		47	7.75	
		48	73.45	
		49	5.51	
		50	5.34	
		23	15.3	$Ti^{++} = 2+$
		23.5	15.6	
		24	16	
		24.5	16.3	
		25	16.6	

23	V	50	0.24		V^{+}	
		51	99.76			
		25.5			V^{++}	
28	Ni	58	67.76		Ni^{+}	
		60	26.16			
		61	1.25			
		62	3.66			
		64	1.16			
		29			$Ni^{++} = 2+$	
		30				
		30.5				
		31				
		32				
42	Mo	92	15.86		Mo^{+}	
		94	9.12			
		95	15.70			
		96	16.50			
		97	9.45			
		98	23.75			
		100	9.62			
		46	30.6	23	Mo^{2+}	Mo^{3+} Mo^{4+}
		47	31.3	23.5		
		47.5	31.6	23.75		
		48	32	24		
		48.5	32.3	24.25		
		49	32.6	24.5		
		50	33.3	25		

73	Ta	181	100	Ta^{+}	
		90.5		Ta^{2+}	
		60.3		Ta^{3+}	
		45.25		Ta^{4+}	
74	W	180	0.135	W^{+}	
		182	26.4		
		183	14.4		
		184	30.6		
		186	28.4		
		60	45	W^{3+}	W^{4+}
		60.6	45.5		
		61	45.75		
		61.3	46		
		62	46.5		

24th July 1978.

EM specimens prepared and slice for FIM thinned.
Specimen disc of Ni-Ti-Al 1st alloy prepared.

Nom comp. 9at% Al, 3at% Ti balance Ni.
Analysis 8·6at% Al 2·6at% Ti ..

Polishing brew 2% perchloric butoxy as for Ni-Al

Plates DF of ppts of γ'.
Orientation — 113 probably. SADP.

Specimens EM:

A	E1	} 1000hrs	625°C	25.07.78
	E2	}		26.07.78.

New alloy.

B	A1	as quenched
	A2	5hours @ 625°C.

NB Plates: 300 { 91 CDF 18 } 1000hrs @ 625°C
92 SADP }

400
380 WB 13.5K 5hrs @ 625°C
81 Tweed }
?80K? 82 SADP }
83 Faults
84 Binary CDF } 1000hrs @ 625°C
85 SADP }
86 CDF }
87 BF }

Ternary	88	CDF	} As quenched
	89	SADP	}
	90	BF	5hrs @ 625°C

ANALYTICAL REPORT

To:	Description of Sample(s):
Miss S. A. Hill	Ni/Al/Ti Alloy marked HILL (ANT)

Date received: 21/7/78 Serial number: 1221 Date of report: 24/7/78

	% by mass	% atomic
Aluminium	4·3	8·9
Titanium	2·3	2·6

J M Stanton

Miss S.A. Hill

1st August 1978

<u>New specs</u>
Box 3 A1 as 9
A2 1 hrs @ 625°C
A3 5hrs @ 625°C.

433	BF 28K	NiAl 1000hrs @ 625°C
434	SADP above 5secs	
35	" 10secs	
36	28K	
37	SADP	
38	"	
39	28K.	
40	28K same area as above	
41	SADP	
42	"	
43	28K	montage.
44	"	montage.
45	"	montage.
46	"	montage.
47	"	montage.
48	28K diff area	
49	SADP	
50	"	
51	37K	As quenched Ni/Al/Ti
52	"	

2nd August 1978
PRH.

455	37K	Ni/Al/Ti as 9.
56	37K same slip band.	
57	8AOP above	
58	"	
59	BF 22K ?	
60	BF 22K	} looking at tangle.
61	"	
62	"	
63	"	
64	37K	
65	22K	} faulted loop?
66	22K (change S)	
67	28K	
68	22K	} twin boundary common 111 reflection
69	"	
70	"	
71	"	

2nd August 1978.

System discoveries from Mehmed's runs:

1) 1B∅ — 1BF cycle still occurs. It seems that there is a problem if there is a vdu interrupt in this counting region.

2) Spectrum @ 60K shows considerable peak at 14 — ? nitrogen or CO^{++}. Leak or dirty system.

3) Why are there so many ions below the spectrum which otherwise plots OK? Suspect CE as some of them come out OK on IBM, so why should IBM make mistakes.

Action on leak/muck:

1) Sprayed around with He cylinder with quadrupole tuned to He (gas bottle). @ 1×10^{-6} Torr 3½ unit deflections on maxm scale of quadrupole — not a lot of use.

PRH's <u>new</u> mics

[illegible]433 | BF | 28K | Ni/Al 1000 hrs @ 625c showing strain field contrast
434 | SADP of above 5s | CL 750 mm Å (printed where mag in image) Superlattice and sideband Superimposed from mismatch of 2 lattices.

435	SADP above 10s	
436	28K BF	Overexp.
437	Same area	Corr. exp. Same g. Strain field contrast etc.
438	SADP as 436 5s	
439	" " 10s	
440	28K Same area + tilt. different g	
441	SADP above 5s	
442	SADP " 10s	
443	28K BF	Twin (109° apart) No evidence coarsening.
444	"	montage (443–447)
445	"	
446	"	
447	"	
448	28K BF	Thin area depth fringes contrast.
449	SADP above	Good superlattice.
450	"	

Ni/Al/Ti
as g.

451 series of overlapping faults @ 37K
452 "
453 SADP of above — Split diffraction spots - probably from faulting.
454 " — ? Superdisloc" spacing? Get xtms out.
455 ~~BF~~ 37K — Different foil shows prd dislocns.
456 BF 37K — Same slip band. Disl. appear to be single. 2nd slip band coming in also.
457 SADP above 5s — Top is original no sidebands
458 SADP above 10s
459 22K — Overexp.
460 22K BF — disloc" interns. lead of slip band doubling also some other places. Same g as 458 montage.
461 as above
462 "
463 "
464 37K — more knots
465 22K BF — Faulted loop, same g.
466 " — Same loop, Change in s. Are fault fringes

467	28K BF	Same g. Multipole.
468	Montage 22K BF	Transgran. slip across of twin
467	"	
468	"	montage.
469	"	
470	"	
471	"	
472	28K BF	Ni/Ti/Al shrs @628C
		OD of 472. Tweed.
473	SADP 5s	underexp.
474	SADP 10s	Sideband
475	SADP diff area	? str-through beam
476	as above.	Discount 475 (discharge) 476 shows good str. through + superlatt + sideband.
477	BF corr to 476 @ 80K	Tweed.
478	BF @ 80K	Tweed.
479	60K BF	Dislocns
480	SADP above	
481	@ 80K BF	Long dislocn trail
482	@ 80K same area	Paired dislocns. Hard to see in 2-beam try weak-beam.
483	@ 60K	Very long dislocn - strange contrast changes at kink.

484 STDP above } g 1^r tweed
485 "
486 @28K BF Strange disloc[n] trail.

Things to do

1) Weak beam on disloc[n] in spin. dec. material.
2) Lattice imaging.
3) As g ——— is there any order? Take DF where superlatt. diffraction should be. Try tilt.
4) ~~Examine~~ multipoles. (low sf). Form in early stage creep instead of sub-boundary.
5) Look at composi[n] on 400.
6) Look at tweed with change in g.

10 hr heat ~~treat~~ 9th August 1978.
Out @ 19.08.
Problem - furnace 625°C ± ~ 8 deg C.
Trial in 300 if possible.

Specimens to box 4:

A1 1hr
A2 10hrs.

21st August 1978.

Further work:
1) finally debug data collection program.
2) Bake system.
3) See J. Leader about specimen material.

1) Program debugging.
   i) Edit in LDP # LEN+1 cf. Vanner.
   ii) Check rest of program for same error
   iii) Check IBM output for zeros
   iv) find where data is lost – try 1000 ions with blue box if necessary noting how many of each time.
   v) Go over stat and find where asking for unobtainable store.

2) i) Drill holes for ionizn guage and make bakeable leads of Ni wire plus glass fibre.
   ii) Put on neon bottle to manifold
   iii) Take off Ne ~~bottle~~ from sub. pump
   iv) Fix sub. pump heaters.
   v) Back oven with Al foil and fibre packing
   vi) ~~Bake~~ sub. pump
   vii) Check ion pump heaters and bake ion pumps ~~into~~ diff. pump.

3) i) Take 1st Ni/Al/Ti alloy for remelting
   ii) Check on toughness of new alloys

iii) Check up on BR's zero coeff^t alloys.

14th September 1978.

1) Runprog finally OK with Vanner's modific^n
2) IBM prog finally copes with data, removing zeros.
3) RL11 changed PDP end to cease block termin^n with zeros.

Summary: basically two sets of data on binary alloy
1) 150hrs @ 625°C 14. Dec. 1977.
2) 1000hrs @ 625°C begun Apr 1978
data 10. July 1978.

Now begin serious look at the other 4 binaries, may have to repeat ~~these~~ two.
Then look at 6 spec. of each of 3 ternary.

Important then to look at zero coefft alloys.

15th Sept. 1978

Exp to data disc 4 @ 88 8Ø
162 pulse   start 5.4kV + 0.864 pulse.
New film   @ 6.44kV

1 1/4   Image medium bright
2 1/2 2×10^{-5} Ne.
3 1   Solid N_2 @ 60K.
4 2
5 4
1/4
4
2
1
1/2

Begin filing to disc @ 5.5kV + 0.880
15th Sept.
1/4   @ 6.83 kV.
1/2   60K
1   3×10^{-5} Ne.
2   Medium bright
4   f 1.8
Same order.

Begin to DD4 @ 5.9kV + 0.944

End @ 27,591 End [IDE] sectors.
@ 12.00kV
1.920 pulse
Lens. 2.50 kV,

"082 $\times 10^7$, 470×10^7 "
Binary aged 1hr @ 625°C.   Flashed.

20th Sept. 1978.

Data to DD5. @ 88 88
Ni - Al binary aged 5hrs @ 625C
More order visible.
4 x10^-5 Ne

¼
½
1
2
4
4
2
1
½
¼

@ 6.70 kV B/V
Image bright.
f 1.8.

Begin 5.8kV + 0.928 Pulse.
Note that, again, Al + Ni coming off as 1st and 2nd ions.

groupings of 2nd ions @ 1,000 noted here, as previously, but not note on 15.09.78. Has this a connection with the ordering r^n or the spinodal?

6,100 preponderance of 6, 9.
6,380 lots of 9.
6,500 more 6.
6,600 2nd ions.
6,724 Sub pump. fired.
7,300 free from 2nd ions c.100.
9,000 Low Al
17,000 No 6 etc for long time.
18,280 Sub pump fired.
26,680 More (x2) 9 - Sub pump fired. Does this help?

29,600 tots of 2nd ions
Stopped @ 43,502
@ 13.30 kV
Pulse 2.128 kV
Lens 2.78kV on helipot.

2F8 sectors

60K.

1/4
1/2
1
2
4
4
2
1
1/2
1/4
1/2
1

end of exp. Large change in mag.
Ordered regions

BIV betw 11.00 - 12.80 kV

3×10^{-5} Ne.
Image medium bright.

New film

1/4
1/2
1
2
4
4
2
1
1/2
1/4

some order
3×10^{-5} Ne
Image medium
Ni-M binary as above
11.56kV,
@ 60K.

Data 30 DDI begin @ ~~[illegible]~~ 12.80 kV
to 88 8Ø
Funnily enough loads of 6, 9! (Muck).

Estimate : missed no more than 10 atomic planes between runs.

Have used 14% pulse Stopped 2002, | 27 Sept

Begin again @ Ø4 8Ø
3,440 6+12.
Sub pump fired ~ 2,500 but still 6's.
25,450 again some 6, but sub pump fired ~ 15 min's before
27,265 2nd ions.
36,100 2nd ions
36,500 Is this to do with faster rate?
37,400 Increment voltage → 2nd ions.
Probably too much. High Al – is Ni being lost?

Ended @ 15.10 kV standing
2.416 kV pulse
Lens helipot 3.18
Ion count (meter) 39, 639
Length (total) 2DØ

? Creeping H's?

14·86
3×10^{-5} Ne
Image medium

1/4
1/2
1
1
2
4
4
2
1
1/2
1/4

Exp begun again 25.09.78.
To test pulse height effect.
Begin with 10% 1
BIV = 12.5 (v. slow evapn.)
Alignment checked.

1/4 @ 13·00 kV
1/2 3.5×10^{-5} Ne
1 Image not v. bright
2 unstable
4 @ 60K.

Start with nominal 10%.
Say 11·9 + 1·19 = 13·09 total
Trouble starting
2nd run
56's
First 03 sectors rubbish.
Comes in burst + odd answers
Stupid idea – not homogenous!

Exp stopped after ~ 1000 ions?

18% - lots of extraneous bodies.
Otherwise have destroyed concatenation.

26th September 1978

Exp on as-quenched, "as-received" alloy

1/2	6.82kV. B/V	Note some order and large central pole — DARK?! which was avoided.
1	3.5×10^{-5} Ne	
1/4	Image medium	
2	f 1.8.	
4	@ 60K.	
4		
2		
1		
1/2		
1/4	End of film.	

Total 6.82kV.

Begin true pulse % exps. ~~80~~ ~~80~~ ~~RD3~~

20% → 10% → 20%.

Begin total = 6.9

Take kV = 5.70

P = 1.140 = 1.33[redacted]0 setting (see chart).

Count + 11

Some 50' 60 so over-run a little.

~~20%~~ kV 5.80

P = 1.16 use. 1.35 setting.

H = 5.90 P = 1.18 u = 1.37

6.00 1.20 u = 1.40

Damage which was noted initially seems to have gone after some pulsed evapn. — just a few Ni^+ (or hydride) left

6.10	1.22	1.42
6.20	1.24	1.44
6.30	1.26	1.47
6.40	1.28	1.49

5 sectors at least of failure

6.50	1.30	1.51
6.60	1.32	1.53
6.70	1.34	1.56
6.80	1.36	1.58

Try to keep rate such that 1 con in 40 pulses, but problem as erratic.

6.90	1.38	1.60

Stopped @ 4004 4B sectors (−ϕ5)

Next do 18%.

Old total 8.28

New:			
	6.9	1.24	1.44
	7.0	1.26	1.47
	7.1	1.28	1.49
	7.2	1.30	1.51
	7.3	1.31	1.52
	7.4	1.33	1.54

After 4B sectors ⚠ 3 tracks begin @ ϕ4
Sub pump fired shortly after starting.
1650 Lots of Al? inhomogeneity or diffl detection?

Stopped @ 2002
after 6E sectors.

Begin @ ϕ8 8ϕ 16% pulse.

7.4	1.18	1.37
7.5	1.20	1.40
7.6	1.22	1.42
7.7	1.23	1.43
7.8	1.25	1.45

Abortive 6F.

Go to Ø9 8Ø ← Lost 2 sectors due to error!
@ 800 ~~tots~~ of 2nd ions.
1740 2nd ions again.
Stopped @ 2005 and 95 sectors.

Begin @ ~~[illegible]~~ OA 8Ø 14% pulse.

7.70	1.08	1.25
7.80	1.09	1.27
7.90	1.11	1.29
8.00	1.12	1.31
8.10	1.13	1.32
8.20	1.15	1.34
8.30	1.16	1.35

OB 8Ø after 96 (97 when corrected)
20 ions out,
More second ions seen.

8.40	1.18	1.37

Stopped @ 2032 CØ after sectors

12%

8.30	1.00	1.17
8.40	1.01	1.18
8.50	1.02	1.19
8.60	1.03	1.20
8.70	1.04	1.21
8.80	1.06	1.23

Begun at 1Ø 8Ø

8.90	1.07	1.25
9.00	1.08	1.26

Stopped @ 2006 after E9 sectors

Begin @ 14 ØØ

8.80	0.88	1.03
8.90	0.89	1.04
9.00	0.90	1.05
9.10	0.91	1.06
9.20	0.92	1.07
9.30	0.93	1.08
9.40	0.94	1.10
9.50	0.95	
9.60	0.96	
9.70	0.97	
9.80	0.98	
9.90	0.99	
10.00	1.00	

380 Rather fast!
Lots of 2nd ions.
Sub pump @ 650

1400 — 2nd ions
and how!

End @ 2003 after 10F sectors
H = 9.30
P = 0.93 setting 1.08
L = 1.88 helipot

Last increment was a little too rapid, I think!!

1/4 — BIV 8.75kV
1/2 — (slow evap^n)
1 — 3.5 x10^-5 Ne
2 — medium image
4 — @ 60K+
4 — f 1.8.
2
1
1/2
1/4

Experiment resumed 27.09.78.

1/4 — 8.32kV
1/2 — @ 60K
1 — 3.5x10^-5 Ne
2 — image not v. bright.
4

Still as q binary alloy
alignment checked.

Begin with 10% pulse and work up again.
start @ 9.10 kV
0.91 setting 1.06

Data to ~~88~~ 08 ~~80~~ 00 — Data Disc ~~6~~ 7
EKW's ~~program~~ disc
Skip ~~1st~~ 08 as may
be program.

Begin @ 9.00 kV
0.90 setting 1.05

10% Lost about 20 ions + imaging.
(21 on counter).

9.20	0.92	1.07
9.30	0.93	1.08
9.40	0.94	1.10
9.50	0.95	
9.60	0.96	
9.70	0.97	
9.80	0.98	
9.90	0.99	
10.00	1.00	

Ended after 2002 ions and 23 sectors.
@ H = 9.40
P = 0.94 S = 1.10

12%

9.10	1.09	1.27
9.20	1.10	1.28
9.30	1.12	1.30
9.40	1.13	1.31

10% ended on DD7 @ 2002 ions and 23 sectors after disc over-run on sector writing @~ 1700.

12% begun @ ØØ 8Ø on DD8
H = 9.00 Old "Ian's Disc"
P = 1.08 prog FIM.CE:IANS
S = 1.26.
Writing to DD7 terminated for checking
Supposedly extra ~7 sectors, but not

in count. Is this a disc error?
Program quized ok. Quiz on VDU and PDP.

9.10	1.09	1.27
9.20	1.10	1.28
9.30	1.12	1.30
9.40	1.13	1.31
9.50	1.14	1.33
9.60	1.15	1.34

Ended after 2200 cons and 49 sectors
= sectors 12% data

H = 9.40
P = 1.13 S = 1.31

14% to Φ4 ΦΦ DD8

14%

	9.00	1.26	1.46
HT =	9.10	Real P. 1.27	P. setting helipot 1.47
	9.20	1.29	1.50
→	9.30	1.30	1.51
	9.40	1.32	1.53
	9.50	1.33	1.54

Extra 25 before count reset.
320 count 2nd cons.

Stopped @ 2320 and 73 sectors.
H = 9.30 kV
P = 1.30 kV S = 1.51

Total = 10.60 kV.

16% to DD8 @ Ø8 ØØ

9.00	1.44	1.67
9.10	1.46	1.70
9.20	1.47	1.71
9.30	1.49	1.73
9.40	1.50	1.74

1620 lots of 2nd ions.

End after 2040 and 96 sectors.
H = 9.10
P = 1.46 Total = 10.56
S = 1.70

18% to DD8 @ ØC ØØ

8.70	1.57	1.82
8.80	1.58	1.84
8.90	1.60	1.86
9.00	1.62	1.88
9.10	1.64	1.90

Begin @ H = 8.70
P = 1.57
One sector to ØC — no const

begin @ ØD ØØ ~ 8 ions wrong on count
Riddled with hydrogen.
Lost ~140 ions — mistake!

Lots of hydrogen, and losing Ni?
480 lots of Ni

1600 really loads of hydrogen.

Finished @ 2012 ions, BB sectors
= sectors data.

H = 8.90
P = 1.60 S = 1.86
total = 10.50

20% to DD8 @ 10 00

8.30	1.66	1.93
8.40	1.68	1.95
8.50	1.70	1.97
8.60	1.72	2.00
8.70	1.74	2.02

Begin @ H = 8.50
P = 1.70
S = 1.97

~10 ions out. Lots of Hydrogen after a rest.

Stopped after 2014 ions, DE sectors
= sectors

H = 8.60
P = 1.72 S = 2.00
total = 10.32

Single point for <u>22%</u>

8.00	1.76	2.04
8.10	1.78	2.06
8.20	1.80	2.09
8.30	1.83	2.12
8.40	1.85	2.14
8.50	1.87	2.17
8.60	1.89	2.19
8.70	1.91	2.21
8.80	1.94	2.25
8.90	1.96	2.27
9.00	1.98	2.29

Begun @ 14 ~~00~~

Begin @ H = 8.30
P = 1.83   S = 2.12
S = 2.12

20 extra ions - missed!

Finished after 2007 ions, 102 sectors
sectors data

H = 8.40
P = 1.85   S = 2.14
Total = 10.25

?!! Why is total kV going down?

Is it because pulse at tip is large than pulse output, because of reflections etc?

Now just fix end points by doing 16% and 10% again.

16%.

8.70	1.39	1.62
8.80	1.41	1.64
8.90	1.42	1.65
9.00	1.44	1.67
9.10	1.46	1.70
9.20	1.47	1.71
9.30	1.49	1.73

to DD8 @ 18 ØØ
Hydrogen does not seem to have decreased.

What to do

1) Transfer all of today's data inc. DD7. ERW's if room.
2) Plot and get composn of each set.
3) Plot comp. v. pulse ratio.
4) Find no. of H in each.
5) ~~Plot H against total~~.
6) Plot no H. v. pulse height.

Could simply be change in shape of tip
or hydrogen etching of i) occluded hydrogen
ii) creeping H_2 from chamber.

Sub. pump does seem to have little effect.
Fire @ 278.

Also note ~~that~~ cryostat does not seem to be as cold as before — water included? Does this affect tip T and ∴ hydrogen? (I don't ~~think~~ so much, just image resol^n, so look at end of exp).

? Is hydrogen pulled up tip by oscill^n in high field of high pulse??

Ended @ 2004 ions, 128 sectors
= sectors data

H = 9.10
P = 1.46
Total = 10.56

18b.

9.10	0.91	1.06
9.20	0.92	1.07
9.30	0.93	1.08
9.40	0.94	1.09
9.50	0.95	1.11
9.60	0.96	1.12

to DD8 @ 1C ØØ
Note v. few 50's.
Begin @ H = 9.40
P = 0.94
S = 1.09

9.70	0.97	1.13
9.80	0.98	1.14
9.90	0.99	1.15
10.00	1.00	1.17

10·10	1·01	1·18
10·20	1·02	1·19
10·30	1·03	1·20

HT also seen to drift ∓ 0·02/0·03. (PVM a little out, is this it?)

Stopped after 2026 ions, 150 sectors = sectors data

H = 10.20
P = 1·02
Total = 11·22
S = 1·19
Lens Lelipot = 2·05

Towards end of chain here does seem to be less hydrogen. Some carbon – have not fired sub. pump for some time.
Why does C also appear (at least "6" does) in AKW's clean IAP, then? – some must be real?

¼ — 3.5×10^-5 Ne
½ — Image medium–good
1 — 60K.
2 — 9.62kV.
4 — "Some" order.
4 — Background 8/9 ×10^-9 torr
2
1
½
¼

Make sure ~ same orientn each time
What? Probably try {100}. Look at pics.

16th October 1978.

Specimen outgassed 1min @ 200°C.
Then slow-cooled over 15 mins.
Returned to chamber.
Data to Data Disc 9 (old data read disc).
Probing @ 8×10^{-9} Torr
60K.

1/4
1/2
1
2
4

BIV = 10 kV.
3×10^{-5} Ne.
Image.

Previous exp ended @ # = 10.20
P = 1.02 P = 10%
S 1.19
Total = 11.22

Begin @, say 10.90.
and start 16%.
# = @ 9.40
P = 1.51
S = 1.75

	#	P	S
16%	9.40	1.51	1.75
	9.50	1.52	1.76
	9.60	1.54	1.79
	9.70	1.55	1.80
	9.80	1.57	1.82

Begin to ØØ ØØ DD9 01 sectors out and ~3Ø more needed on counter

Ended @ 2078 cm, 27 sectors
(−3x) = 26 sectors data

@ 365 "may" have been a disc error.

H = 9.80
P = 1.57
S = 1.82
Total = 11.37

Now fix end-points — do 22%.
Say end @
H = 9.80 P = 1.57 total = 11.37
Then for 22%.
begin 9.30.

	H	P	S
22% Use	9.10	2.00	2.32
	9.20	2.02	2.34
	9.30	2.05	2.37
	9.40	2.07	2.40
	9.50	2.09	2.42
	9.60	2.11	2.44
	9.70	2.13	2.46

Start @ H = 9.10 @ 84 00
P = 2.00
S = 2.32
Excess of 24 cons.
after 2009 cons, 48 sectors
= 24 data sectors
@ H = 9.10
P = 2.00
S = 2.32
Total = 11.10

<u>10%</u> H = 9.90
P = 0.99
total = 10.89

H	P	S
9.90	0.99	1.15
10.00	1.00	1.17
10.10	1.01	1.18

@ ~~0~~8 ~~00~~

10.20	1.02	1.19
10.30	1.03	1.20
10.40	1.04	1.21
10.50	1.05	1.22

Plane stability change @ 1600?

10.60	1.06	1.24
10.70	1.07	1.25

H = 10.70
P = 1.07
S = 1.25
total = 11.77

@ 2002 cuts and after 6F sectors
= 24 data sectors.

L = 2.15

¼
½
1
2
4 Marker

BIV 10.0?
3×10^{-5} Ne
Image only medium.

New film.

1/4	BIV 9.9
1/2	8.5 x 10^5 Ne
1	Bright
2	60K
4	

Data to ΦC ΦΦ

total 11.40 kV

H = 9.50

P = 1.90

S = 2.20

20% 9.500 } begin (forgot lower total at higher)
1.90

Rather fast!

9.5	1.90	2.20
9.6	1.92	2.22
9.7	1.94	2.25
9.8	1.96	2.27
9.9	1.98	2.29
10.0	2.00	2.32

Stopped @ 2007 cm3 24 sectors = 24 data sectors

H = 9.50

P = 1.90

Total = 11.40

S = 2.20

TO	10	00	
18%	9.50	1.71	1.99
	9.60	1.73	2.01
	9.70	1.75	2.03
	9.80	1.76	2.04
	9.90	1.78	2.06

4 out on counter.
stopped @ 2006 ins, 48 sectors
= 24 data sectors

H = 9.90
P = 1.78
Total = 11.68
S = 2.06

Rather rapid after 1540 or so!

14%	9.90	1.39	1.62
	10.00	1.40	1.63
	10.10	1.41	1.64
	10.20	1.43	1.66
	10.30	1.44	1.67

Begin @ H = 10.00
P = 1.40
S = 1.63

to 14 ~~00~~

10.40	1.46	1.69
10.50	1.47	1.71

End @ 2011 ins, 6C sectors
= 24 data sectors

H = 10.5
P = 1.47
Total = 11.97
S = 1.71

12% begun @ H = 10.50
P = 1.26
S = 1.47

10.50	1.26	1.47
10.60	1.27	1.48
10.70	1.28	1.49
10.80	1.30	1.51
10.90	1.31	1.52
11.00	1.32	1.53

TO 18 8Ø

Stopped @ 2010 cms, 90 sectors
= 24 data sectors

H = 10.90
P = 1.31 S = 1.52
Total = 12.21

16% Begun at total = 11.90

10.30	1.65	1.92
10.40	1.66	1.93
10.50	1.68	1.95
10.60	1.70	1.97
10.70	1.71	1.98

TO 1C 8Ø 6 out.

Stopped @ 2003 cms, B4 sectors
= 24 data sectors

H = 10.50
P = 1.66
Total = 12.16
S = 1.95

20%. Begin @ total of [illegible] 11.80

9.8	1.96	2.27
9.9	1.98	2.29
10.00	2.00	2.32
10.10	2.02	2.34
10.20	2.04	2.36
10.30	2.06	2.39

To 20 00

Stopped @ 2005 wins, D7. sectors
= 23 data sectors.

H = 10.00
P = 2.00
Total = 12.00
S = 2.32
L = 2.23

1/4
1/2
1 ——— BIV 10.6 kV
2
4
4
2 ——— BIV 10.7 kV
1
1/2
1/4

@ 60K
3×10^{-5} Ne
medium

Tests for H_2 creeping as HT ↑ again.
No hydrogen increase seen this time.

Analysis of Pulse Height Results.

%	Label	Outgassed	Up/down	I	Comp.	NAL	NN1	+
~~10~~	~~17~~	~~No~~	~~Down~~					
~~10~~	~~28~~	~~No~~	~~Rising~~					
~~error~~	~~30~~	~~"~~	~~"~~					
20	11	no	↓	4160	17.73	761	3531	6
18	12	no	↓	2069	17.14	364	1760	3
small ~~(16~~	~~13~~	~~no~~	~~↓~~					)
16	14	no	↓	2063	27.02	591	1569	ϕ
14	15	no	↓	2333	32.94	830	1690	2
12	16	no	↓	2255	33.28	820	1644	2
10	17	no	↓	2226	24.52	573	1764	3
12	18	no	↑	2244	16.30	371	1905	6
14	19	no	↑	2467	16.71	423	2108	18
16	20	no	↑	2107	17.71	379	1761	29
~~(18~~	~~21~~	~~no~~	~~↑~~					)
18	22	no	↑	2108	18.18	387	1742	69
20	23	no	↑	2101	17.32	362	1728	79
22	24	no	↑	2122	19.33	409	1707	9
16	25	no	↓	2173	24.84	566	1713	4
10	26	no	↓	2215	30.33	715	1642	5
small ~~(14~~	~~27~~	~~no~~						)
10	28	no	↑	1649	17.40	297	1410	2
error ~~(10~~	~~30~~	~~no~~					zero width	
16	40	yes	↑	2220	17.58	410	1925	3
22	41	yes	↑	2146	18.33	411	1831	6
10	42	yes	↓	2075	16.36	350	1789	0
22	43	yes	↑	2103	17.27	379	1816	2

%	Label	Outgassed	Up/down	I	Comp	MA2	MN1	#
18	44	yes	↓	2091	16·81	364	1801	1
14	45	yes	↓	2095	17·22	375	1802	0
12	46	yes	↓	2085	16·73	359	1787	ϕ
16	47	yes	↑	2107	16·67	366	1830	1
20.	48.	yes	↑	2067	15·57	330	1789	7

Start today's experiment to ØØ ØØ DD6.

Film at no 16.

Try with corrected 16%.
(May be ~ AJW's 28% as his was just under 20% out on pulse ht).

Various average compositions

For outgassed specimens only.
14 — 20 only = av = 16·85 at% Al.
10 — 20 av = 16·77
10 — 22 av = 16·95

To find error use $(nC)^{1/2} + n$.

Take 2100 ions as representative, and take mean composn as 16.85 at% Al.

error ± 0.89(6) at% Al.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

~~7th~~ October 1978

To 88 8ϕ Data Disc 6.

3.3 x 10⁻⁵ Ne.
@ ~60K.
Image rather faint.
¼
½
1
2
4
} ordering RHS visible.

BV = 10.72 kV
As-9.

Try with new 16% pulse.

Exp ended @ ~~total~~ of 12.00 kV.

So begin at ~11.80
use 16%. real.

H	P	S
10.20	1.63	1.89
10.30	1.65	1.91
10.~~60~~	1.66	1.92
10.50	1.68	1.95
10.60	1.70	1.97
10.70	1.71	1.98
10.80	1.73	2.01
10.90	1.74	2.02
11.00	1.76	2.04

Watching the rate-meter @ ~ 8000 showed that bursts seemed to come rather regularly.

Could this be connected to plane stability ratio measurements?

Seen 9,350
10,000 — 650
10,750 — 750
11,050 — >300
11,950 — >300
12,330 — >900
12,650/12,700
? 12,834
~ 13,000
? 13,000

11.10	1.78	2.086
11.20	1.79	2.087
11.30	1.81	2.10
11.40	1.82	2.11
11.50	1.84	2.13
11.60	1.86	2.15
11.70	1.87	2.17
11.80	1.89	2.19
11.90	1.90	2.20
12.00	1.92	2.22

17,400 more Ni?
21,900 low ~~Al~~, high Ni.
~~Despite~~ Just rate going quite nicely.
Going ~~to~~ speed limit after 24,000

33,000 lots of Ni.

38,200 high Ni again.
39,000 Still high Ni. Few 2nd ions despite high rate.

Finished @ 41,003 1st ions, 2E4 sectors.

H = 11.80 kV
P = 1.89 kV
total = 13.69 kV

S = 2.19
L = 2.52

21	1/4
22	1/2
23	1
24	2
25	4

Hydrogen @ 40,080 1st appearance.

Background $8 \times 10^{-9} / 1 \times 10^{-8}$
Image on 4×10^{-5} Ne, bright.
@ probably lq N_2 78.
BIV. = 11.97 kV

26	4
27	2
28	1
29	1/2
30	1/4

Can see some poles to RHS of probe hole.
Rather fuzzy, TA.

18th October 1978.

Specimen aged 50hrs @ 625C
Ni–Al binary as-received comp.
Background 7×10⁻⁹ Torr.
4×10^{-5} Torr Ne
60K.
(111) oriented.

1	1/4
2	1/2
3	1
4	2
5	4
6	4
7	2
8	1
9	1/2
10	1/4

BIV = 5.10 (slow evap^n if anything)
only medium bright.

Specimen not really "probabable" but begin @ ~ 5kV and work up (no alb' plane difficult).

5.0	0.80	0.93
5.1	0.82	0.96
5.2	0.83	0.97
5.3	0.~~85~~	0.99
5.4	0.86	1.00
5.5	0.88	1.03
5.6	0.90	1.05
5.7	0.91	1.06
5.8	0.93	1.09
5.9	0.94	1.10

6.0	0.96	1.12
6.1	0.98	1.14
6.2	0.99	1.15
6.3	1.01	1.18
6.4	1.02	1.19
6.5	1.04	1.21
6.6	1.06	1.23
6.7	1.07	1.25
6.8	1.09	1.27
6.9	1.10	1.28

Data to DD1 @ 08 80

Begin @ total of 5.20kV → 5.34kV

4.5	0.72	0.84
4.6	0.74	0.87
4.7	0.75	0.88
4.8	0.77	0.90
4.9	0.78	0.91

3920 6 again.
7580 several 11 (12 when recalib).

7.0	1.12	1.31
7.1		
7.2		
7.3		
7.4		

stopped @ 14,489

H = 7.00
Pl = 1.31
P = 1.12
1Ø3 sectors.

total = 8.12 kV.

Continued 19th October 1978

to DD9

@ ØC ØØ

11	1/4
12	1/2
13	1
14	2
15	4

try not to evap more than 1 or 2 planes.
@ 6.34 kV
~60K.
medium ~~cunage~~
4 × 10⁻⁵ Ne.
Background 7/8 × 10⁻⁹ Torr.

Began @ 6.70 kV

New 16% pulse.

6.7	1.07	1.25
6.8	1.09	1.27
6.9	1.10	1.28
7.0	1.12	1.31
7.1	1.14	1.33
7.2	1.15	1.34
7.3	1.17.	1.36

@ 2490 lots of 2nd ions etc.

HT =	P =	setting =
7.4	1.18	1.37
7.5	1.20	1.4Ø
7.6	1.22	1.42
7.7	1.23	1.43
7.8	1.25	1.45

7.9	1.26	1.47
8.0	1.28	1.49
8.1	1.30	1.51
8.2	1.31	1.52
8.3	1.33	1.54
8.4	1.34	1.56
8.5	1.36	1.58
8.6	1.38	1.60
8.7	1.39	1.61
8.8	1.41	1.64
8.9	1.42	1.65
9.0	1.44	1.67

@ 13,000 and around this area v. low Al count noted.
17,300 v. fast!
32,000 2nd cons!

9.1	1.46	1.70
9.2	1.47	1.71
9.3	1.49	1.73
9.4	1.50	1.74
9.5	1.52	1.77
9.6	1.54	1.79
9.7	1.55	1.80
9.8	1.57	1.82
→ 9.9	1.58	1.84
10.0	1.60	1.86

37,000 ↑ great Ni again.
42,000 went rather fast. Careful — afraid I took a risk ~~that~~ it might break. Advise more caution next time, whatever!

Ended after 44,233 cons
312 sectors data from ØC ØØ.

H = 9.30 kV
P = 1.49 kV   setting = 1.73
Total = 10.79 kV

It does not look as if high Ni / low Al region is through yet.

2Ø sectors = 1 track
312 sectors = 48/2 tracks + 12 sectors.
= 24 tracks + 12 sectors.
= 18 hex tracks + 12 sectors.

ØC ØØ
to 23 + 12 sectors.

~~20th~~ October 1978

to DD4

Start @ H = 9.00
P = 1.44
tot = 10.44
s/u = 1.67.

1/4, 1/2, 1/4, 1, 2, 4 } 8.60 kV
3.5 × 10^{-5} Ne
medium (bit spotty).
60K.

Background 7 × 10^{-9}.

Lost 36 cons plus a few on graph so say one extra plane more.
Realigned.

Very slow to start with.

Finished after 40,529 counts

= 209 sectors.

H = 9.90 kN
P = 1.58 kN
Total = 11.48 kN S/u = 1.84

1/4
1/2
1
2
4 BW ~~8~~ 9.4 kN

Background 1.5×10^{-8} Torr.

Images @ 2×10^{-5} Me
60%
Bright.

21st October 1978.

Data to DD5 @ ~~08~~ 80

Ended @ H = 9.90kV
P = 1.58kV
total = 11.48kV

Begin @ 9.60:

9.60	1.54	1.79
9.70	1.55	1.80
9.80	1.57	1.82
9.90	1.58	1.84
10.00	1.60	1.86
10.10	1.62	1.88
10.20	1.63	1.89
10.30	1.65	1.91

1/4 8.98 kV
1/2
1
2
3) 4
New John
1/4
1/2 } 9.17kV
1
2
4

} nearly 1x10^5 Ne bright 60K.

H = 9.60
P = 1.54
S/u = 1.79.

19,700 a bit fast!
28,450 lots of 2nd cons, rapid
(28,580 ?)
28,720 ditto
(28,915)
29,070 ditto
?(29,140
29,280 ditto
?(29,460)
29,600 ditto

} ? 180 ats/plane again if 2 planes = 1 period.

33,600 low Al again. Gone thro' ppl region.

Ended after 45,843 cons
= 36f. sectors

H = 10.30kV
p = 1.65kV
Total = 11.95kV δ/u = 1.91

1/2
1/2
1
1/4
2
4

} 10.08kV
Lowo 5Ne.
Bright

on turning up
Bg ~~[illegible]~~ 1×10^{-7}
? 60K.

1×10^{-8} after pumping.

25th October 1978

Data to DD3 @ 8880

Stop @ H = 10.30kV
P = 1.65kV

Begin @ H = 10.00kV
P = 1.60kV

S/u = 1.86.

H	P	Setting
10.00	1.60	1.86
10.10	1.62	1.88
10.20	1.63	1.89
10.30	1.65	1.91
10.40	1.66	1.93
10.50	1.68	1.95
10.60	1.70	1.97.

1/4
1/2
1
2
4

} {111}.

3.2×10^{-5} Ne
60K
BW = 10.00kV
Background = 8×10^{-9} torr

10.70	1.71	1.99
10.80	1.73	2.01
10.90	1.74	2.02
11.00	1.76	2.04
11.10	1.78	2.06
11.20	1.79	2.08
11.30	1.81	2.10
11.40	1.82	2.11
11.50	1.84	2.13

11.60	1.86	2.15
11.70	1.87	2.17
11.80	1.89	2.19
11.90	1.90	2.20
12.00	1.92	2.22

62,000 – swung on helipot.

12.10	1.94	2.25
12.20	1.95	2.26

Warp 10! @ 80,000

Stopped after 88,301 cons
= 622 sectors.

H = 12.20 kV
~~P = 2.26~~
~~Total = 14.46 kV uts~~ P = 1.95 kV
Total = 14.15 kV
U/S = 2.26

BW = 11.61 kV
3.~~5~~ × 10^-5 Nε
@ 60K (higher!)
background 8×10^-9
medium.

1/4
1/2
1
2
4
evap ——
4
2
1
1/2
1/4

Seemed 80,000 – 87,000 to go thro' higher Al region
More settled around 88,000

28th October 1978

10hrs Ni-Al @ 625°C binary.

5.0	0.80	0.94
5.1	0.82	0.96
5.2	0.83	0.97
5.3	0.85	0.99
5.4	0.86	1.01
5.5	0.88	1.03
5.6	0.90	1.05
5.7	0.91	1.06
5.8	0.93	1.08
5.9	0.94	1.09
6.0	0.96	1.12
6.1	0.98	1.14
6.2	0.99	1.15
6.3	1.01	1.18
6.4	1.02	1.19
6.5	1.04	1.21
6.6	1.06	1.24
6.7	1.07	1.25
6.8	1.09	1.27
6.9	1.10	1.28

Data to DD 8. ~~88~~ ~~89~~

Background 9 x10^-9
4x10^5 Ne
60K.

(220) centred

	1/4	old filter
	1/2	
	1	
	2	
	4	
(3)	4	
	2	

@ 7.03kV
almost slow evapn
shows planes.
medium

1	10	new filter
2	2	
3	1/8	
4	1	
5	~~1/2~~	
6	1/4	

7.0	1.12	1.31
7.1	1.14	1.33
7.2	1.15	1.34
7.3	1.17	1.36
7.4	1.18	1.37
7.5	1.20	1.40
7.6	1.22	1.62
7.7	1.23	1.63
7.8	1.25	1.65
7.9	1.26	1.67
8.0	1.28	1.68

Total 7.03 begin @ 6.0kV + 0.96kV }

750 suddenly very quiet.
Then gave several 38's.
Look at tip after ΦF sectors, 763 ions.

Ended @ 7.50.

Now BW ~ 8.18 – flashed?

Check alignment
Alignment OK.

1/4
1/2
1
2
4

4x10⁻⁵ Ne
60K.
medium
8.42kV.

Begin @ Φ1 ΦΦ
total = 8.4 begin @

7.3	1.17	1.36
8.1	1.30	1.51
8.2	1.31	1.52
8.3	1.33	1.55
8.4	1.34	1.56
8.5	1.36	1.58
8.6	1.38	1.60
8.7	1.39	1.61
8.8	1.41	1.64
8.9	1.42	1.65
9.0	1.44	1.67
9.1	1.46	1.70
9.2	1.47	1.71

9.3	1.49	1.73
9.4	1.50	1.74
9.5	1.52	1.76
9.6	1.54	1.79
9.7	1.55	1.80
9.8	1.57	1.82
9.9	1.58	1.84
10.0	1.60	1.86
10.1	1.62	1.88
10.2	1.63	1.89
10.3	1.65	1.91
10.4	1.66	1.93
10.5	1.68	1.95
10.6	1.70	1.97
10.7	1.71	1.98
10.8	1.73	2.00
10.9	1.74	2.01
11.0	1.76	2.04
11.1	1.78	2.06
11.2	1.79	2.07
11.3	1.81	2.10
11.4	1.82	2.11
11.5	1.84	2.13
11.6	1.86	2.15
11.7	1.87	2.17
11.8	1.89	2.19
11.9	1.90	2.20
12.0	1.92	2.22
12.1	1.94	2.25
12.2	1.95	2.26
12.3	1.97	2.28
12.4	1.98	2.29

12.5	2.00	2.32
12.6	2.02	2.34
12.7	2.03	2.35
12.8	2.05	2.37
12.9	2.06	2.39
13.0	2.08	2.41

Exp ended after 42,765 ions
= 2EA. sectors

24s = 1t
18t = 24t.
2EAS = 15t

H = 12.70 kV
ρ = 2.03 kV
total = 14.73 kV

s/u = 2.35.

Background =

1/4
1/2
1
2
4
4
2
1
1/2
1/4
} poles.

BIV = 12.17
60-78K
Image. bright
4×10^{-5} Ne.

2nd November 1978

Ni-Al aged 10hrs @ 625°C
Data to DD4. @ 80 8φ

1/4
1/2
1
2
4

Background = 9x10⁻⁹
4x10⁵ Me
~60K
11.48 kV.
Bright.

Exp ended @ H = 12.70 kV
P = 2.03 kV
TA = 16.73 kV   S/U = 2.35 kV.

Begin @ 12.40 kV

12.40	1.98	2.29
12.50	2.00	2.32
12.60	2.02	2.34
12.70	2.03	2.35
12.80	2.05	2.37
12.90	2.06	2.39
13.00	2.08	2.41

Begin @ 12.00 after 03 sectors ~ 100 ions or so

Begin @ φ1 8φ

12.00	1.92	2.22
12.10	1.94	2.25
12.20	1.95	2.26
12.30	1.97	2.28

~ 3,000 ions various things like 32 — probably

nickel hydrides etc. Also some 90's (NiO_2^+)
Very odd things!

Initial very fast (03) sectors and I mean very fast. Then down and <u>dreadful</u> hydrogens. Slowly decreasing, but has this dragged H_2 up the shank (a known high-field effect) and water etc with it? Is it a plain creeping sludge problem. Has it popped? Will it pop? (knowing my luck it will!).

13.10	2.10	2.43
13.20	2.11	2.44
13.30	2.13	2.47
13.40	2.14	2.48
13.50	2.16	2.50
13.60	2.18	2.52
13.70	2.19	2.53
13.80	2.21	2.55
13.90	2.22	2.57
14.00	2.24	2.59

25,900 high Al.
26,030 and 9's
26,100 high rate, high Al
26,300 high Al
26,470 " - 26490
26,630
26,800
26,920
27,020

} try to measure fast rate

? 27,200 } judg by 2nd cons
? 27,250 }
27,320 rate
27, 350 2nd cons.
27, 480
27, 630 ???
27, 800 2nd cons + some Al.
? 27,890 }
? 28,000 }
28,190 2nd cons + Al.
28,350 fast.
* 28, 700 }
? 28,920 more hydrogen again
29,000 fast + Al
29,240
29,500 Creeping hydrogens.
* 29,930 fast + Al.
? 30,012 may or may not be significant.
(30,070 very high Al (not in rate count).
30,320 high rate + high Al.
31,200 may be high Al + rate
31, 480
31,850? may be, but I was stopped by!!!

Much slower @ 37,000 and 13kV.
– very low Al again.

Lost 3 frames.

exp ended after 70,030 cnts
= 4B2 sectors
-03= 4AF sectors data

A= 14.00 kV
P= 2.24 kV
Total= 16.24 kV s/u = 2.59

1/4
1/2
1
2
4

6×10^{-5} Ne
probably liq N_2 but cold
12.68 kV
Background 7×10^{-7} - poor
~~Bright but spotty~~ image

HT inside arcing @ ~ 10kV - 12kV.

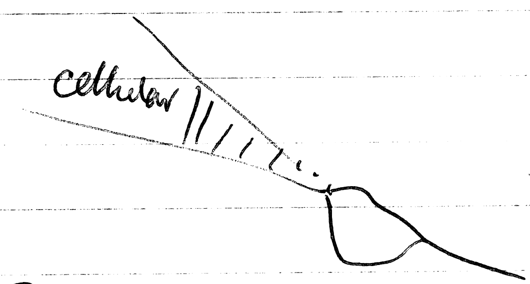
Drift @ ~13.7 kV ~ HT set.

22 ~~8ADP~~ Supperlatt 112
23 8s 001 8ADP
24 16s " "

24.11.78. ~~Stdlbs~~.

CTEM 120CX
Ni-Al binary 5hrs @ 625°C

Taken plates showing LRO regions and lattice 220 | 110 to show up singly ordered regions
1 × 3
2 × 1
Then cellular at gb with gb orient^n rel^n. Larger amount of cellular ~~than~~ before in 3hr gb area. Also see small extra grain?



BF
DF.

1hr @ 625°C
Using 010 evidence of some order found LRO regions.
1 × 3 DF.

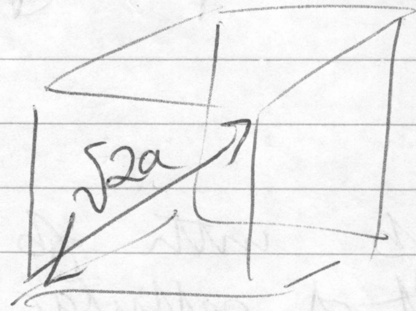
Shows that the LRO would bear investig^n by this method. See Brian about it.

5hrs @ 625°C ~~..~~300 BF boundary 02~~6~~269
BF boundary 270

Handbook of chem + phys.

$Al - Al = 2.863$ Å ($25°C$)
$Ni - Ni = 2.4916$ Å ($18°C$)

Nickel is fcc.



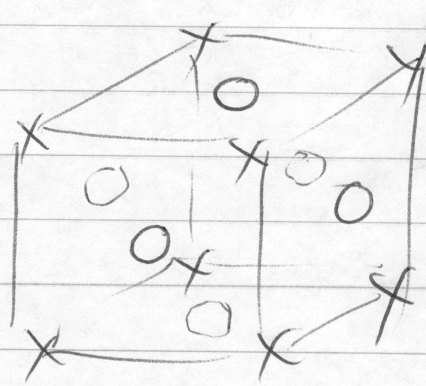
Hence $\sqrt{2}a = 4r$

$a = 2\sqrt{2}r$

$= \frac{7.0473}{2}$ Å

$\therefore a =$ [redacted] 3.52

for Ni_3Al Ni's in face centres, Al's at corners.



Now $\sqrt{2}a = 2r_{Ni} + 2r_{Al}$ $a = \frac{5.81}{2}$ Å

if cubic, but tries to match still

$\therefore a = 2.91$ Å

24th November 1978

AP investign cont. of Ni-Al 10hrs @ 625°C

End probe H = 14.00kV
P = 2.24kV
TA = 16.24kV s/n = 2.59.
BIV = 12.68.

Suggest begin @ 13.00, 2.08, 2.41
See tables

TO DD9 @ ØØ ØØ

mfilm ¼ Ne = 4x10^{-5}
(4). ½ Background 1x10^{-8} falling
1 12.55
2 Image bright
4 f1.8

Lost 60 ions
Loads of hydrogen.

14.10	2.26	2.61
14.20	2.27	2.63
14.30	2.29	2.65
14.40	2.30	2.66
14.50	2.32	2.68
14.60	2.34	2.70
14.70	2.35	2.72

77,080 lots Al. 79,140
77,980 " 79,860
78,680 " 80,300

Exp ended after 81,502 ions, 557 sectors dat

H = 14.60
P = 2.34
total = ~~21.70~~
16.94

S/u = 2.70

Pictures

1/4
1/2
1
2
4

BW = 13.57
Background = 3×10^{-8}
Ne = 4×10^{-5}
Intensity = bright
f = 1.8.

? shape change 80,400? - v fast then perhaps more Ni (or, again, perhaps not!).
80,600 2nd ions.
680
770

1) valve off tops of diff. pump. finger tight
2) valve off rotary pump at bottom (don't swing).
3) Switch off diff pump

4) Watch ion pump.

If works go home

if switches off:

a) switch off heater + sub pump.

b) Wait 10 mins

c) Try reset on ion pump (x2)

d) if operates switch on sub pump

If not go home

Have you switched your own machine off?

international field emission symposium
Founded in 1952

STEERING COMMITTEE
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ADDRESS CORRESPONDENCE TO
Dr. A. J. Melmed
National Bureau of Standards
Room B248, Chem. Bldg., Wash., DC
20234 U.S.A.

October 6, 1978

Miss S. A. HILL
Dept. of Metallurgy and
Materials Science
University of Cambridge
Pembroke Street, Cambridge CB2 3QZ, ENGLAND

Dear Miss Hill:

The IFES Steering Committee is conducting an election to fill the present vacancy in the committee. Those people who attended the Oxford IFES (1977) and/or the Albuquerque IFES (1978) are eligible to take part in the election. We are now trying to complete the nomination process. Thus far, three nominations have been made (at the Albuquerque meeting). They are:

Professor J. J. Hren, University of Florida
Professor N. Igata, University of Tokyo
Professor T. T. Tsong, Pennsylvania State University

You have been identified as an attendee of the Oxford meeting who did not attend the Albuquerque meeting. You are, therefore, eligible to make a nomination. If you wish to make a nomination, please send it to me postmarked before November 15, 1978.

We realize that this is a complicated election procedure, and hope to simplify future elections. In this regard, it may be of interest to you to know that it was decided (1978 IFES) to replace two steering committee (SC) members each year, starting in 1979. Henceforth, SC members will serve a 4-year term of office.

Sincerely,

Allan J. Melmed

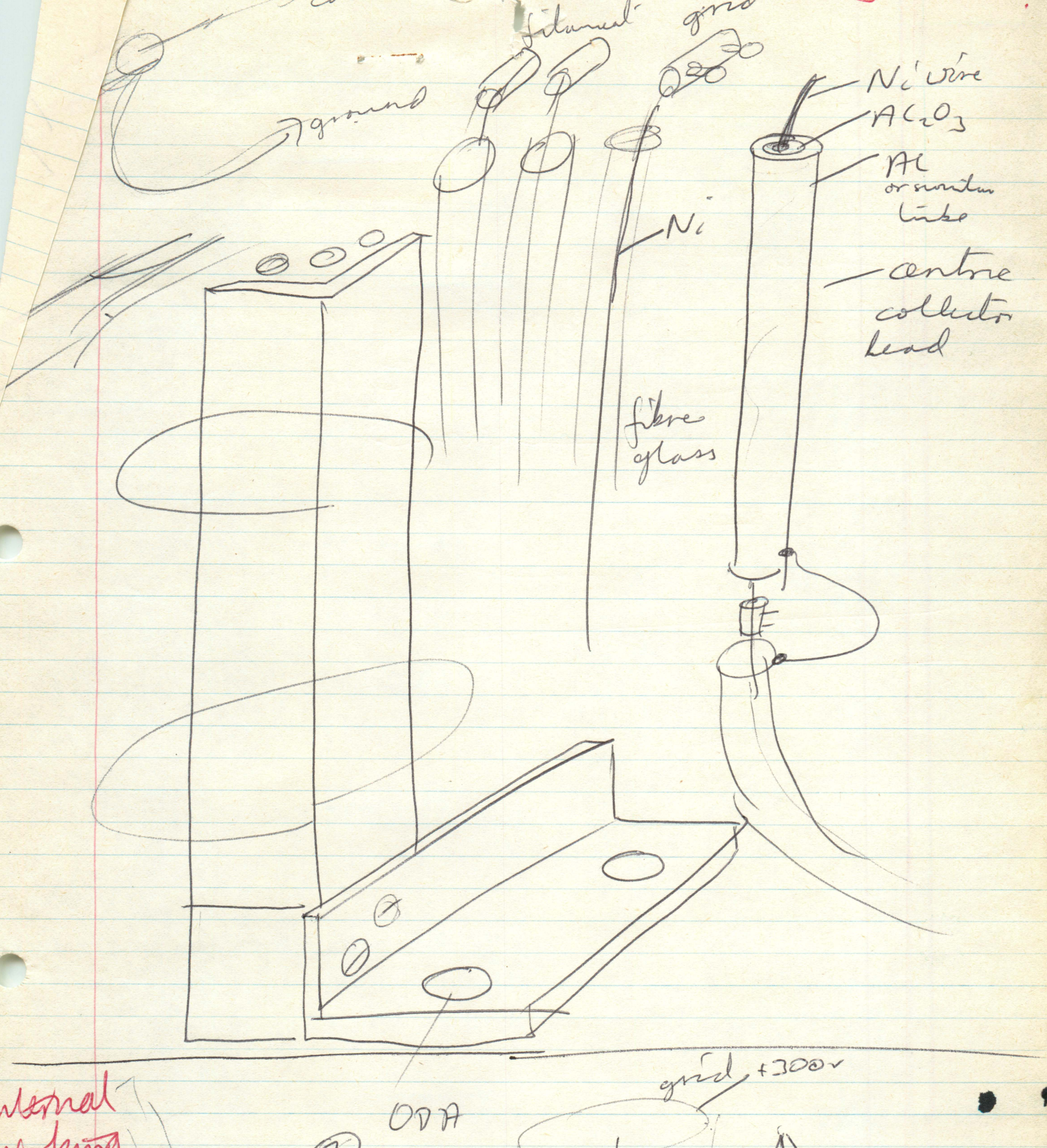
A. J. Melmed, Secretary
IFES Steering Committee

Switching off Arew's machine after back-out.

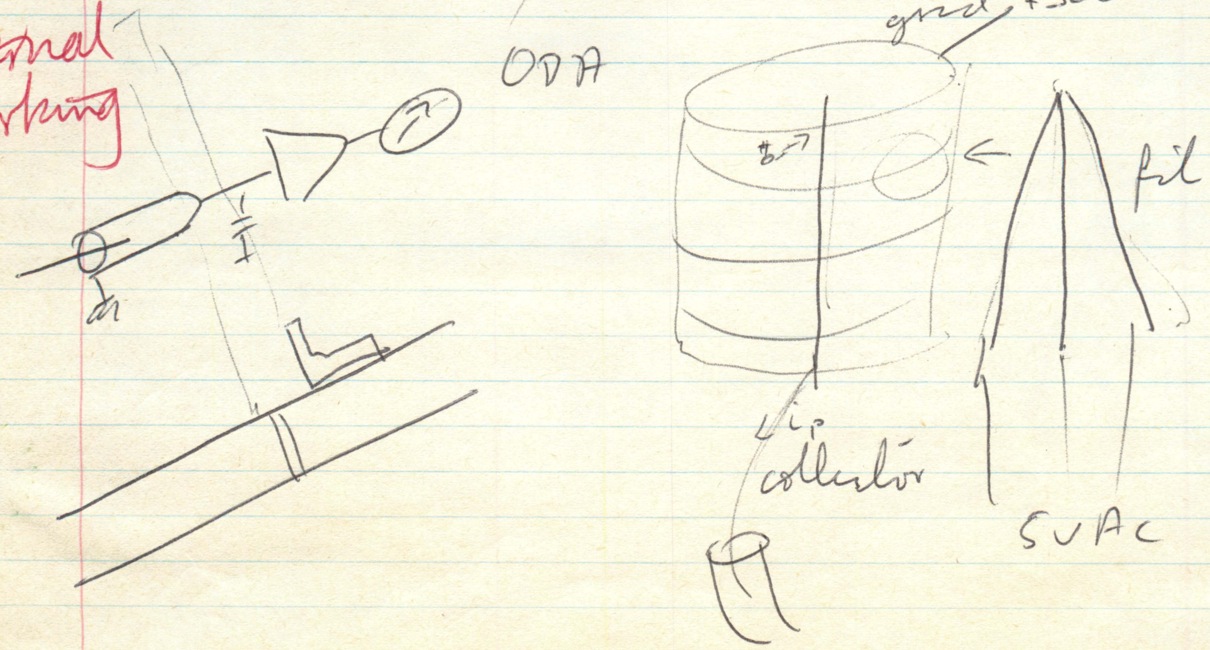
Design for bakeable ion gauge leads

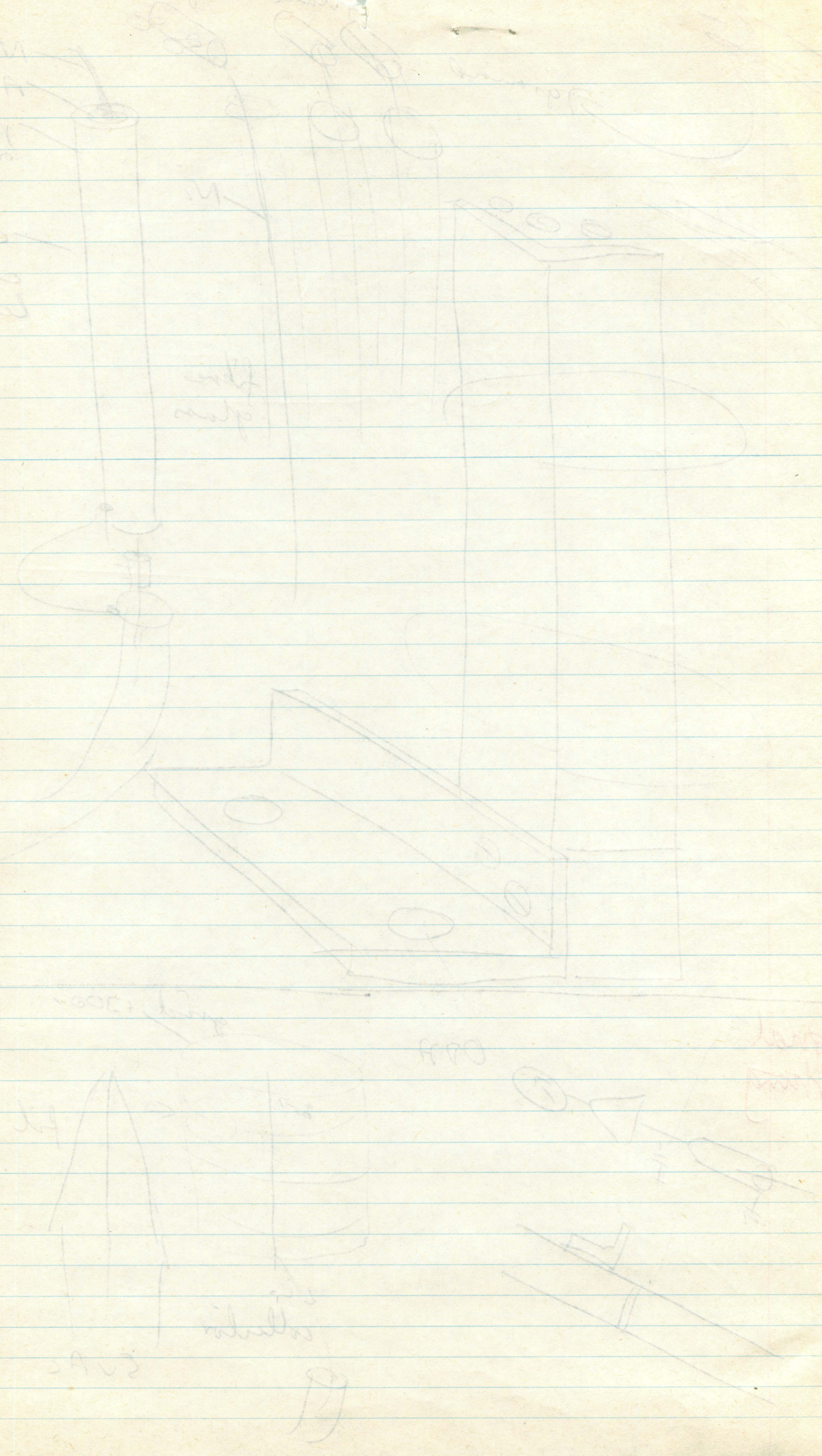
ARW.

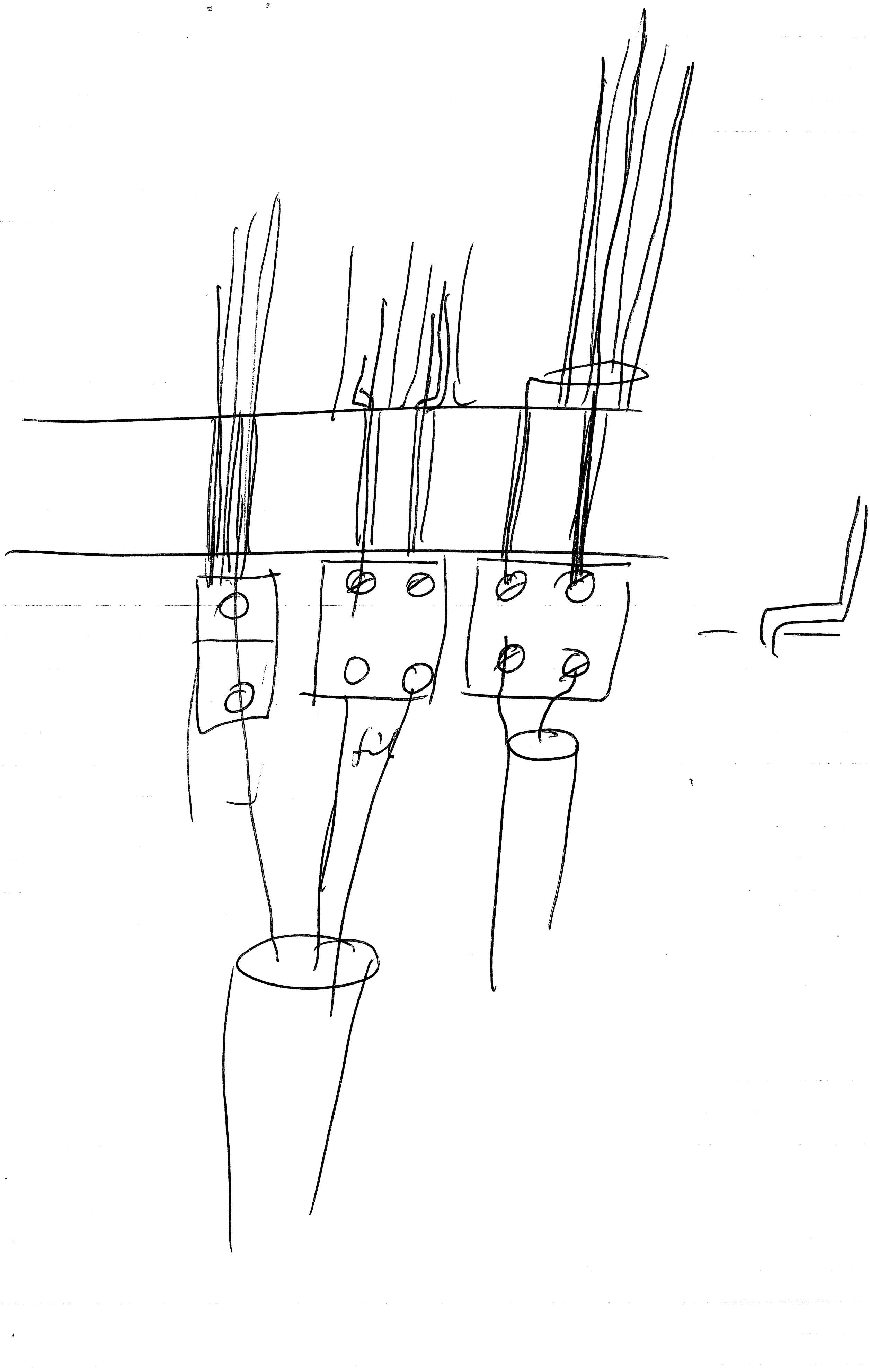
Bakeable Ion Gauge Leads



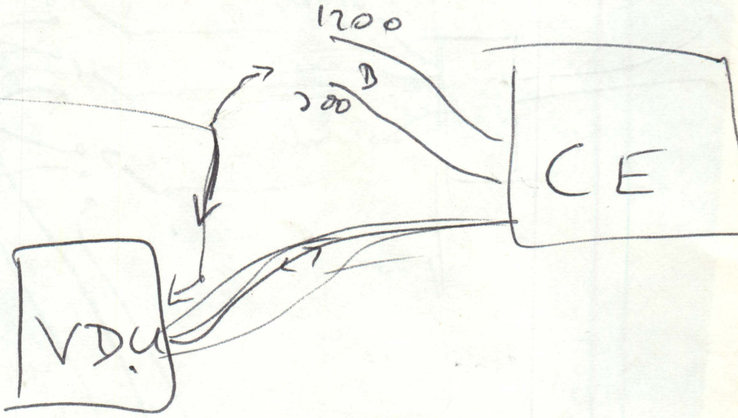
Internal Working



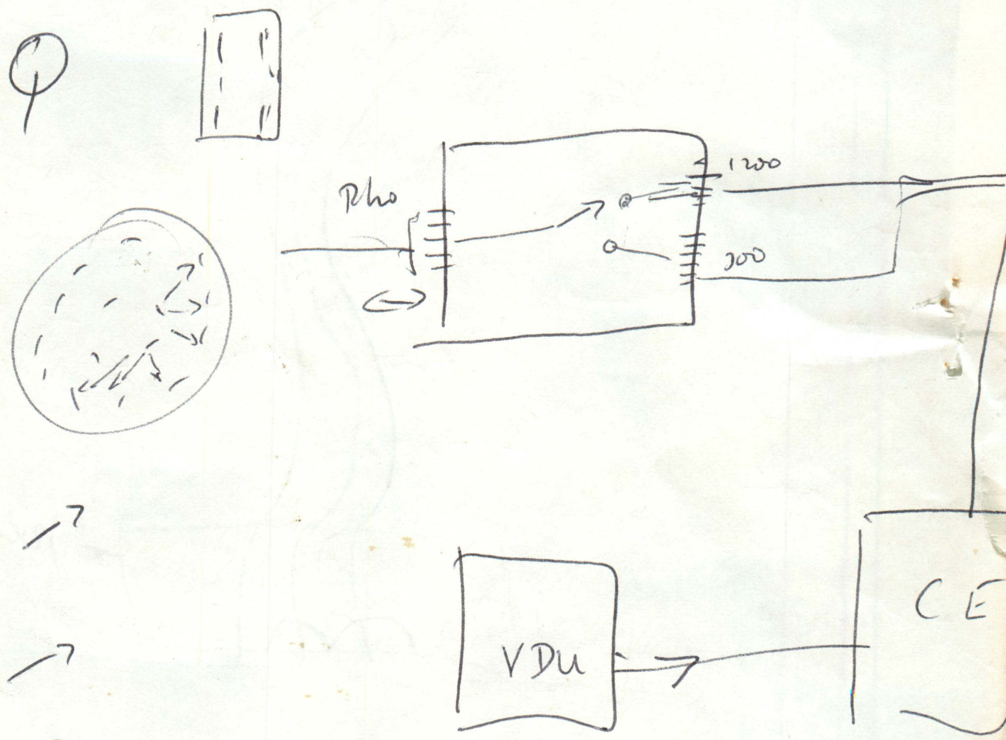




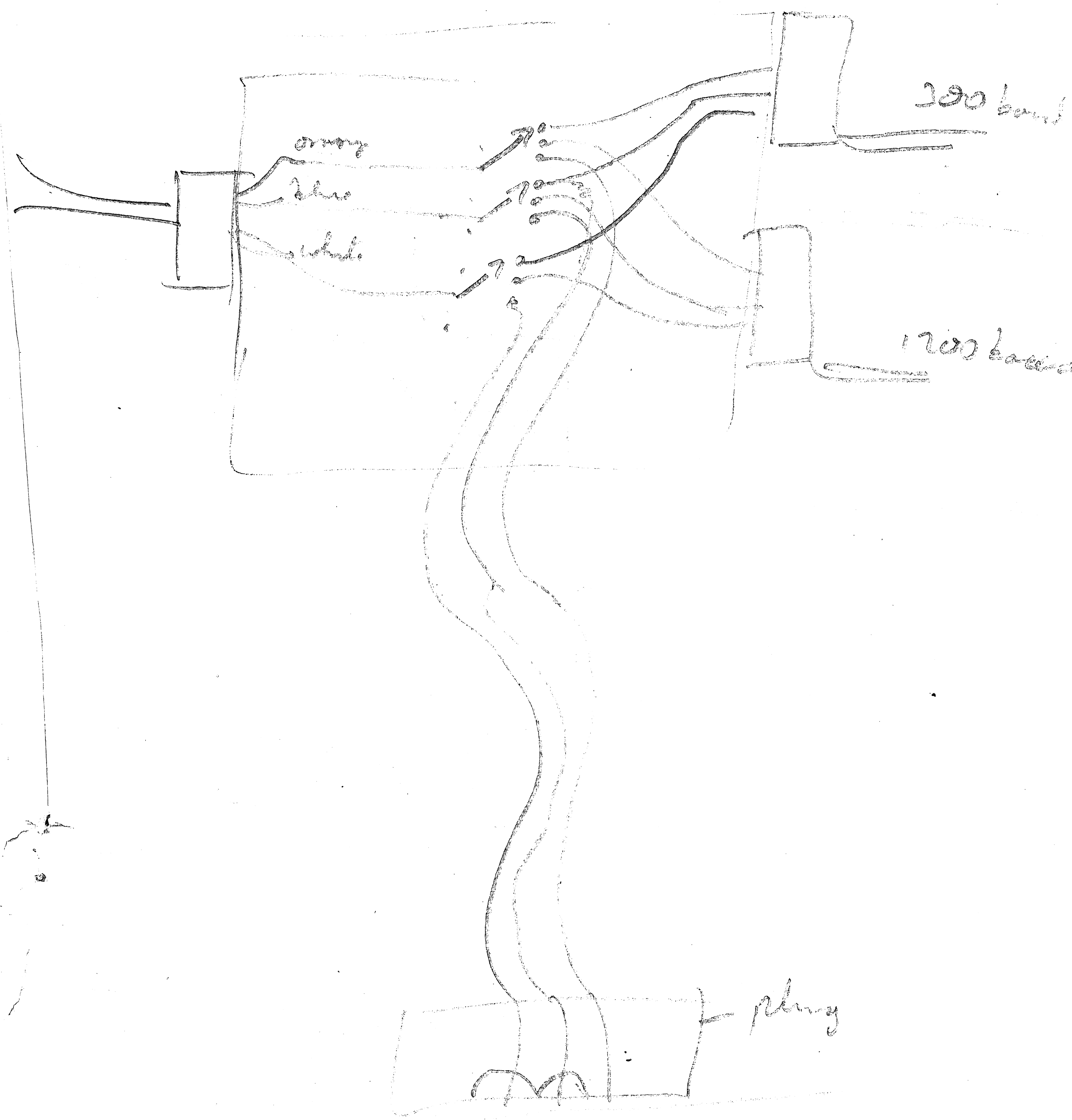
Phoenix



4 pole 3W



C06AAF


plug

January 1979.

New PHX 300b/1200b connection box.

tested 16.01.79.
Works on PHX
1200b.

Attempt on 300b to change b. acceptance rate 131 → 111 on { 11030
111036

Not successful but same error messages as before 24.01.78 when b. rate wrong, so assume ~~that actually~~ sending OK from CE or else old corrupted CE program, which is unlikely.

Transfer DD4 01 80 22.
NiAl 10hrs 628°C.
Compare with original of time.

17th January 1978

Data Analyses

i) Where the project is going:

a) Look at various ageing times @ 625°C (see previous records).
Deduce spinodal wavelengths (harmonics) and at long times ppt spacings.

small λ AP
longer λ and radial distribution EM
Spatial IAP.

Also tip-over in EM.

b) Look at 2 other ageing times above and below (at least) for kinetics and rate-determining step.

c) Compare $\bar{c}$ Ni/Ti

d) do ternaries i) with zero coeff alloys
ii) with across ternary phase diag members

e) Simple superalloys.
Do the kinetics hold, is the thing still spinodal, what are ppts, how do various element affect rate and amplitude?

Practically:

1) Look up zero coeff^t alloys and get them made up.

2) Slit and heat treat more Ni/Al binaries.

3) Get polishing condns for ternaries

4) Compare analyses for best

5) Do on data as is

6) Fill in gaps for York paper.

Ternary heat treatments

Say 3 times at each ± 25°C

Size $\propto \sqrt{Dt}$. Look up D.

7) Correlate gradients and spacings of gradient changes on ordinary or statistically treated data.

Data Analysis Procedure

Surveys of

Measures of Dispersion

Averaging.
Running mean destroys less spacial informⁿ.

Correlⁿ and Regression

Relationships between data and its n'th nearest neighbours,
tests for randomness if var is large.

General Statistics and Distributions

Binomial
Normal
Gaussian
Poisson

Time Series

Trend
Periodic Oscillⁿ
Random oscillⁿ.

Fourier Analysis

Given a series of data can be written as a series of sin and cos for which fourier ~~transforms~~ provide coeffts/series. These are related to wavelengths present.
Harmonic analysis.

Conclusions.

1) Go over ASW's binomial probability. Stuck on Watts and Ralph.

eqn.

2) Data is a time series representation as there is dependence on events preceding particularly in an ordered alloy. Best method at present for analysis is U value of sepn of n and (n+1)th Ai by oc Nils

3) Fourier analysis shows wavelengths so try this.

4) Statistical analysis stat3 provides running means to preserve information, gives variance as a means of error determn and checks this for randomness. Also does some correln towards wavelengths

Questions.

1) What about removing random time-series osclln.
2) What are error bars (? significant).
3) What Fourier wavelengths
4) Harmonic?

Steps to be taken

Fourier program works numerically. Now check:

1) Sin function
   $\frac{1}{2}\lambda$, 1λ, $\geq 5\lambda$.
2) Cos fn
3) Square about $x = 0$ $= 1\lambda$
4) square $= n\lambda$
5) square with various spacing
6) Combn of the two.

This gives:

1) which end, if these can be determined, is long λ / low ν } and short λ / high ν }

2) If reflections are present

3) Is an ∞ series assumed

4) Normalisation present

5) Fractional noise

6) Absolute λ, i.e. whether absolute wave-no or fraction of sampling.
   So check against know wavelength

7) Plots against which transforms of data can be compared directly. (data = sin + sq) spin. pptn

See folder for results, comparison, conclusions.

On general analytic comparisons

1) Look at running means of U over 5, 19, 59, 99, 129.
↑ approach 250 as comp.

What do they show?
What happens to averaging over these
– is comp smoothed?
is inform^n lost?

2) Select optimum and send '*' to printer to check

3) Take an HJ with 4 or 5 runs on ~~the~~ same spec.
Are the λ's the same?
Or at least must reproduce the basic results.

4) Do the same lengthy processes for 5 different specimens.
These must produce different λ's in different amounts.

5) Concate~~nate~~ same spec. runs with and without various forms of spaces.
Need the same λ's in the same

proportions as for each sin alone.

6) Look up autocorreln fn in terms of variance and FFT can this be applied.

7) Look up time series applicn and see if there is any way here of removing randomness.

8) take some U-smoothed data and ~~transform~~ again — only a few X's, so probably ~~the soln~~, if valid.

Progress

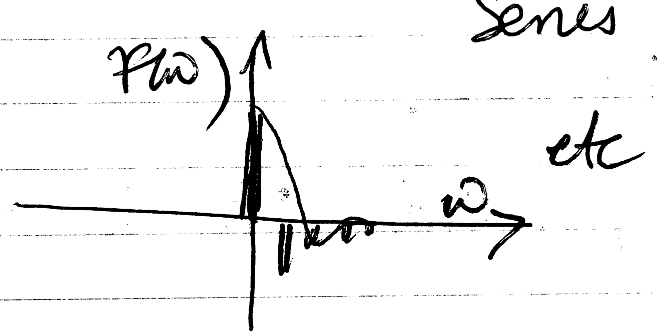
Know function solutions completed.

1) ½ sine wave

fn = $A|\sin y_0 x|$

soln rapidly decaying in ampl. of coeffts.

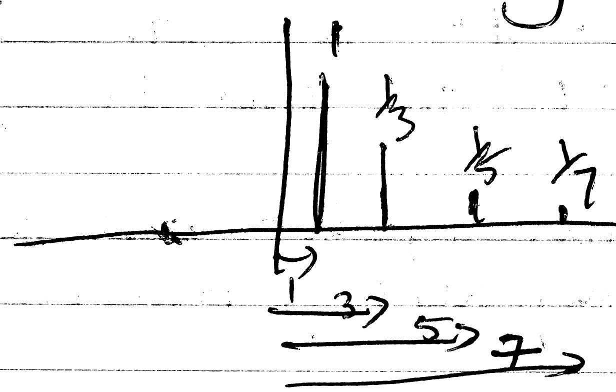
Series is cos (rectified sin wave)



2) ~~Single~~, multiple sin waves.
δ fns @ ω = multiple. Asymm.

3) cos waves
δ fns @ ω = multiple. Symm.

4) Sq wave $\frac{\sin y x}{y}$ + Gibbs.



5) Multiple waves → terms @ ω = multiple.

6) Rectangular waves — fⁿ solⁿ $\frac{\cos Sy \sin Ly}{y}$

satisfied — sepⁿ dep't on ω
absences on S, L.

7) Complex. See below.

These can be written out as drawings for comparison if required

C06AAF v. F0URG

1) C06AAF simpler provided ok to round up data

2) ACF not investigated fully
Check

3) Because of Gibbs need even series so turn on tail.
Check

Next steps

1) Put masses to 8AH102 as data → 8AH101

2) see changes effected by

real data
- i) ~~term.~~ transform with mean
- ii) term " " random about mean
- iii) mirror imaging data
- iv) changing bin size

v) Could try FT with data after running mean and greater average. Both cases will lose harmonics.

vi) ~~concatenate~~ direct
vii) add in a few values and betry.

Results of various terminations.

1) Put in beginning again
2) Turn on mirror reflection.

Both 1) and 2) to value 2^n.

1) Turn on tail completely, then add beginning
2) Put in beginning on.

These then to 2^m by
- i) mean
- ii) oscillation

Also: consider "does result depend on starting posn in chain"?
Ans, No, to 1st approxm (see file)

The low ϖ, long λ end is approx. correct, while bits 20 upwards are more worrying.
But peaks still occur in correct posns, and ~ correct shape.

1) Cut-off @ $\varpi = 5$
2) Long periods OK
3) Reanalyse for $\varpi \geq 20$.
Consult BR.

Try multiply data x10.

29th January 1979.

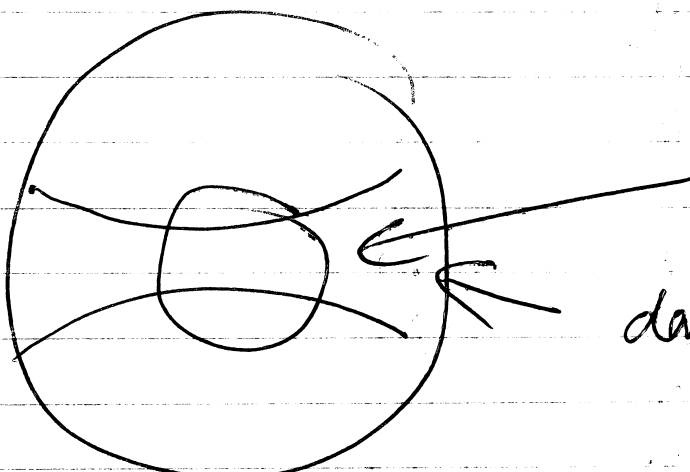
Cooling unit has no compressor.
Diff pump : not pumping.
1) Heater screw tighten on base
2) Ice put into cooler.

Specimen 1HR put in after baking @ 200°C for ~ 60 secs, but cannot be pumped OK.
3) Leave on ion pump and leave diff pump running overnight on both ~~traps~~.

1) Top bottom trap and top ~~trap~~.
2) Dry out cryostat
3) Cool cryostat
4) See what diff pump does.
5) Image specimen static.
6) Crack open diff pump carefully. Then shut off.
7) Put on ion pump.
8) Run with ion pump on of winning.

30th January 1978.

Ni-Al binary aged 1hr @ 625°C
Data to 00 00 DDI:



What is odd lump - try probing to see.
Just hope for the best!

1/4
1/2
1
2
4
4
2
1
1/2
1/4

@ 10.32kV
3×10^{-5} Nc
image medium but spotty.

total = 10.32 16% pulse.

8.90kV+H	P = 1.424	setting = 1.65
9.00	1.44	1.67
9.10	1.46	1.70
9.20	1.47	1.71
9.30	1.49.	1.73

9.40	1.50	1.74
9.50	1.52	1.76
9.60	1.54	1.79
9.70	1.55	1.80
9.80	1.57	1.82
9.90	1.58	1.84
10.00	1.60	1.86
10.10	1.62	1.88
10.20	1.63	1.89
10.30	1.65	1.91
10.40	1.66	1.93

See previous work

High Al 14∅8, 1452, 149∅
" Ni 191∅, 2∅92, 229∅, 238∅, 245∅
26 3∅

High Al 29∅∅ LABS of 2nd curve also.
Higher Ni 298∅
High Al 332∅ (v)
High Ni 386∅, 444∅, 479∅, 516∅

5670 Al
626∅ Ni, 6610, 6790?, 7.1∅∅ (7190)
724∅

7260 zero Al for nup
Definitely low Al and 738∅

! Completely Al denuded 743∅!

v. slow increment again

14.50	2.32	2.68
14.60	2.34	2.70
14.70	2.35	2.72
14.80	2.37	2.74
14.90	2.38	2.75
15.00	2.60	2.77
15.10	2.62	2.79
15.20	2.63	2.80
15.30	2.65	2.82
15.40	2.66	2.84
15.50	2.48	2.86

11,380 ~~dearth of~~ Al again.

15.60	2.50	2.88
15.70	2.51	2.89
15.80	2.53	2.91
15.90	2.54	2.93
16.00	2.56	2.95
16.10	2.58	2.97
16.20	2.59	2.98
16.30	2.61	3.01
16.40	2.62	3.02
16.50	2.64	3.04
16.60	2.66	3.07
16.70	2.67	3.08
16.80	2.69	3.10
16.90	2.70	3.12
17.00	2.72	3.14

14,523 blip on vdu.
Also beginning to get more Al again

19,720 High AL

19 9~~5~~9 ? decreasing AL
20,031 Dec AL
20,120 may be low
20190 AL high
20,684 Ni high
20,740 ½ ½
20,760 lots Ni and cont → 820
20,~~8~~80 lower AL
?1 900 Ni lots of
21 946 high AL

21,953 HT set stopping
~~2~~2,040 low AL
22,110 still (v) low AL.
22,180 v.v. low AL (exist not!).
22,990 <u>and</u> slow rate!

2~~3~~3,120 AL rising.
23,300 High AL
fast 23,500 – 23,600 then slow
23,680 slow. (low AL 23,700)).
(high rate/AL 23,710)

23,780 ≈ 1:1
3,900 1:3
(3,980 1:5 maybe).
4,320 1:1
4,420 fast.
4,540 fast, lots and cont, high AL.

1.6 24,660
v. low 24,710
24,800 just more Al.
25,090 low Al.

17.10	2.74	3.16
17.20	2.75	3.17

25,240 hi high
26,190 hi v. high

17.30	2.77	3.19
17.40	2.78	3.21
17.50	2.80	3.23
17.60	2.82	3.25
17.70	2.83	3.27
17.80	2.85	3.29
17.90	2.86	3.30
18.00	2.88	3.33

28,640 ✓ low Al
30,320 " " "

36,934 — ~ 15 ions
sectors gave 5 ticks — 5 trials to write.

Stopped filing to DD1 after 276 sectors
This last had a bug too.
Was it 4 ticks.

Put in new disc. DD6 @ 80 80
Six ticks on running sector.
4 on term 278 - 276
Sprayed with clean air on head ? Dust.

(Ø1 wrong)

Data to DD6 @ 1Ø ØØ 279

36,990 begun again

Program ran out on disc error @ 37,594
Assume ≈ 10 sectors
as 60 rows/sector and 600 rows = ØA sectors

to 2Ø ØØ ended after 39 sectors

and 41,Ø26 rows.

@ H = 18.6 kV
P = 298 kV
U = 3.44 kV
total = 21.58 kV.

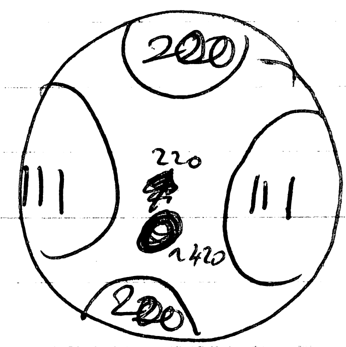
16.6 kV
3×10^{-5}
Bright

1/15
1/8
1/4
1/2
1

} probably 400 taken after exp.

Camera shifted - no focus as using edge of window
right way forward 1/15
1/8
1/4
1/2
1

Convertor 5.8kV
to focus centre but not outside
(above outside focussed not centre).
Blank Camera to sq. 1.
→ Painter
½
½
|



31st January 1979.

Further analyses:

1) Check data of same treatment → same λ.
Negative (10hrs).
Try 50hrs where no long periods.

2) Tried running 0 → 150
48 → 198
96 → 246
} could average these

10H0 no real change.
Try on other 10hrs.
Try on 50hrs.

3) Sort out effect of doing running mean on compose and putting this in. Again, how terminate chain?
What about
J3 − MEM = no empty elements

$1 \to \frac{(J3-MEM)}{2}$ = mean Elements $1 \to MEM$ $MEM + \left(\frac{J3-MEM}{2}\right) \to J3$ = mean.

4) Edit all comp + brenner progs to accept .MASS. Problem is that then only Ri and Al. Fine for Brenner but not comp.

Tabulated results so far: need to do 1HRØ, 1HR1 when ~~transferred~~, 5HRØ and 5HR1.

MB17

1) ~~Results~~ agree to well within background ~0.04, say.

2) Represent any one ds but average.
{ 0 – 150
{ 48 – 198
{ 96 – 246

∴ take arrays, sum them. Could do 3 more if req.

3) Represent any heat tmt by doing same but sum over all ds for that heat tmt.

4) What is effect of mult. data ×10?

5) To find background treat ~~transform~~ as a time series and find variance.

6) Write PLX jobs to take data from tape, do various FT's, sum and send result to DS

7) Plot above

8) PLX for comp and brenner as is or change to take mass. Which is better?

00	0HR0	0HR1	5HR0	5HR1	10HR0	10HR1	10HR2	50HR0	50HR1	50HR2	50HR3	50HR4
2	2	2					1	1	1	1	2	
4 spm	5	8					7	4	5	3	5	
8	10	(11)					9	(13)	10	6	7	
	15						12	16	12	9	9	
(18)	19							19	14	(13)	11	
27	23						(21)	22	17	18	14	
35	25						(26)	25	(19)		16	
	(28)						(60)	(28)	(21)		18	
53	(35)	(36)					63	33	32		28	
	43	(39)					64	38	36			
(81)	(47)						95	41	54		62	
87	(53)						97	44	56		(64)	
99	(64)	(74)					102	47	(63)		72	
ordering	(81)	81					103	(52)	74		85	
139	(97)	88						(55)	(78)			
142	129	119					140	58				
	155	(130)						(104)	111			
171	(174)	134					169 170		(114)			
184									(116)			
(187)		146										
(195)		167					(205)		165	148	180	
215	214						(207)		175	149	151	
229	216	153							189	151	155	
		155					212				156	
200	(220)	(162)							198	180	168	
201	229						223		(199)	may have to changing	169	
(210)	(253)	166										
(227)		167					(236)		223		216	
245		174					(240)				234	
252		(178)					250				253	
253		186					(255)					
		193										

[illegible]

19th February 1979.

See below for discussion of changes:

Now 1) FFT to produce A_n, B_n.
2) $D'_{new} = D - A_n \cos n\omega t - B_n \sin n\omega t$ effectively $\omega = 1 \rightarrow 20$ to subtract off dominant wavelengths.
3) Retransform data, now using new data.
4) sum over 3 bins.
5) Work out $(2m+1)$ $m = 2$ to plot actual transform.

Program to do this   extra sum S(256)

```
      DO 6 I = 3, 254
      I3 = I-2
      I4 = I-1
      I5 = I+1
      I6 = I+2
      S(I) = (A(I3)+A(I4)+A(I)+A(I5)+A(I6))/5
    6 CONTINUE.
```

Having done this which datasets fit already?

$2^m = 512$, read loop = 256

fits
- QD
- 5HRØ A
- 5HR1 B
- 10HØ C
- 10H1 D
- 50H1 E
- 50H2 F
- 50H3 G

For 1HRØ use 256, 128
50H0 use 128, 64
100H2 use 1024, 512

* Affected by data length.

So first journeys ≡ RES1

INITFOUR (0-150) (RES1) → UNIT 1
FURINIT2 (48-150) (RES12) " 12
FURINIT3 (96-150) (RES13) " 13

Data new.

* (RES 2) from DATANEW ~~RES18~~ UNIT 1S
~~RES128~~ 12S
~~RES138~~ 13S

Re FFT
* FOURNEW (RES3) UNIT 1SF
12SF
13SF.

Sum and running mean
* RUNMEAN (RES4) RESMEAN TRNS.

Compute to FFT X.

Changes
~~Datanew~~ → W2 RES 2128
W3 264
W4 2512

Fournew W2 RES 3128
W3 364
W4 3512

RUNMEAN N2 RES MEAN 2 4128 3
N3 464 4
N4 4512

send these new ones to LOAD2
LOADPRG2 I think

1st May 1979.

New alloy selected on basis of Taylor and Floyd 1150°C, 750°C isothermal ternary sections.

87.0 at% Ni
4.5 at% Ti
8.5 at% Al.

Put in 5% and 9%
i.e. make 101%.

for ~~5~~/101 Al in 14 at% Al, Ni Al alloy.

$M_{Al} = 27.0$
$M_{Ni} = 58.7$
$M_{Ti} = 48.0$

Using 4.5 and 8.5 to start with

$$wt\% \; Al = \frac{8.5 \times 27}{8.5 \times 2.7 + 4.5 \times 48 + 87 \times 58.7}$$
$= 4.13$

$$wt\% \; Ti = \frac{4.5 \times 48}{8.5 \times 2.7 + 4.5 \times 48 + 87 \times 58.7}$$
$= 3.89$

$$wt\% \; Ni = \frac{87 \times 58.7}{8.5 \times 2.7 + 4.5 \times 48 + 87 \times 58.7}$$
$= 91.98$

	Real (of 100gms)	Weighed (for 101gms)
Al	4.13	4.37
Ti	3.89	4.32
Ni	91.98	91.98

Al	4.37	} highest. for 100gms.
Ti	4.32	
Ni	91.98	

For 4.37 gms Al in 100gms.
But need 50gms melt.

Hence need 2.185 Al
2.160 Ti
45.990 Ni

For 2.185 Al. Ni-Al 14 at% Al
≈ 7.0 wt% Al
~~[illegible]~~ = 6.97 wt% Al.

so 100gms Ni-Al → 6.97 gms Al.

we need 2.185gms Al.
Hence take 31.349 gms Ni-Al.
of which 29.164 is Ni.

Thus weigh approx. 2.160 gms Ti
31.349 gms Ni-Al.
(45.990 − 29.164) gms Ni
= 16.826 gms Ni.

~~[illegible]~~ WA bar 506.17 − 0.02 = 506.15
for 34.6cm. = 346mm

$\therefore \frac{31.35}{506.15} = 21.43$ mm.

Weight Ni-Al:

Balance 0.50
+Ni-Al 30.64
Ni-Al 30.14

Wanted 31.35

Thus	Old	New
Ni-Al	31.35	30.14
Ti	2.16	2.077
Ni	16.83	16.18.

Weight Ni bar

pan 0.51
+bar 26.93
bar 26.42 for 150 mm

∴ 16.18 gms ≡ 91.86 mm.

Actual 16.85
−0.51
16.34

Titanium −0.51
+ 2.08
Full wt. 2.59.

[illegible]

3rd May 1979.

Last specimen attempt on 1 hour binary Ni-Al @ 625°C.

Background pressure ~ 9×10^{-9}

Data to Data Disc 5.

Gas 4×10^{-5}

3 test sectors of 661×10^{7}

0070 flight time 87sub

71.5 73.8

72.5 74.5

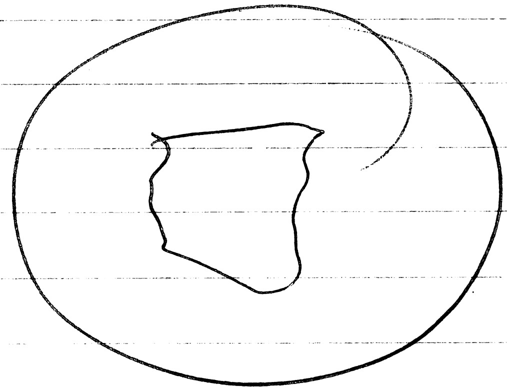
Slow evap^n 10.3kV

Bright image ? 220

γ' in centre

1/4
1/2
1
2
4
4
2
1
1/2
1/4

} 1 5 10



10.3kV.

Begin @ total 9.8

8.40   1.34   1.56

773 on counter peculiar – [illegible]

End after 10 sectors as peculiar
symbol written to screen
Reading 1646

Reset, reload program   152 kV

+04 sectors   10 00

Stopped 695 on 20 00   OE sectors.

Absolute failure.

Stopped @ 16.60 standing   15.93

1/4
1/2
1
2
4

7th May 1979

Specimen 2 as-quenched.

Photo No		
16	Blank	
17	1/4	4×10^{-5} Ne
18	1/2	Medium image
19	1	@ 6.5 kV
20	2	
21	4	Possibly 420

Data to DD8 @ ~~00~~ 8 ~~0~~

Background $< 1 \times 10^{-8}$

Begin @ T = 6.5 kV

kV 5.60 ~~set~~ 1.05

22 4
↓ 2
1
1/2
26 1/4

1051 18 sectors Trig after pulse.
TO 01 50

1300 Al high

Nudged @ 32,800

Stopped @ 2FC sectors
= 2E4 sectors on ØF ØØ

and @ 37,708 cnts

@ Standing = 10.80
Pulse = 1.73 total = 12.53
Setting = 2.00

1/4 27
1/2 ↓
1
2
4 31

4×10^{-5} Ne
Image bright
Background 3×10^{-8}
10.53 kV

Alignment.

1/4
1/2
1 } evap 32 ↓ 37 ? orient.
2
4

end of film.

8th May 1979.

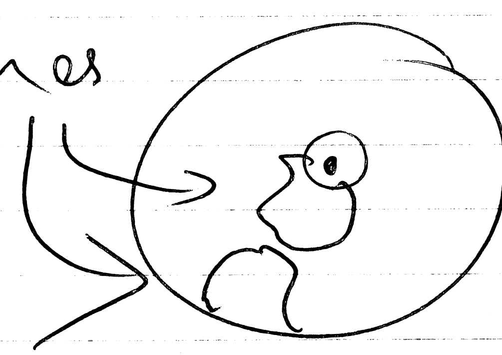
Data to DD5 @ 80 80
Cont. as-q spec. above.

Begin @ 10.60kV
Pulse 1.70 total 12.30.
Set 1.97

New film.

1/4	1	10.60kV
1/2	↓	
1		
2 ← mistake.	6	Image medium 1×10^{-5} Ne dirty
4		
4	7	
2	↓	10.65kV
1		
1/2		
1/4	11	

Ordered patches



Try to probe.

Alignment checked.

1st 1000 horribly fast.

39,610 Kr in abundance!

43,550 high Al again.
Lots of carbon.

44,300 high Al

Evap stopped @ 3EC sectors
50,264 counts

ΔT = 12.40
Pulse = 1.98
S = 2.28 kV

total = 14.38

1/4
1/2
1
2
4

4
2
1
1/2
1/4

evap

12:30 + evap
Bg 2×10^{-8}
Ne 1×10^{-5}
bright

?

Alignment

78.4 74.4
75.6 77.8
@ 20, 357°

9

1-hr 6.8 kV

1/4

1/2

1

2

4

---

4 6.7 kV.

2

~~1/2~~

1/2 (111)

1/4

Begin @ DD9 ~~00~~ ~~00~~

5.60 0.90 1.05 11

Stopped after 7 88 cm3.

01 00 (+7 Ni)

11.5	2.65	2.30	28% pulse.
.6	2.68	2.32	
.7	2.70	2.34	(23) 12
.8	2.72	2.36	
.9	2.75	2.38	
12.0		3.00	

02

Begin 02 00 20% pulse. (25)

(1540)

Useless. Turns up @ 14 kV now,

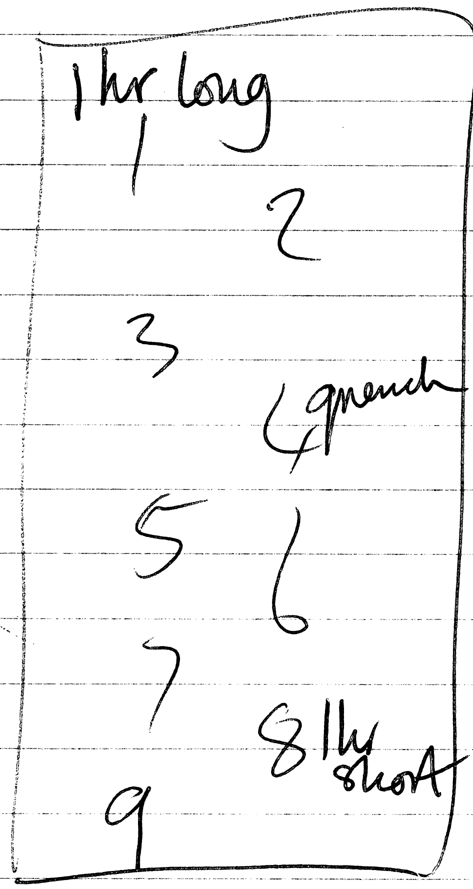
Aligned

75.3 76.4

76.4 77.1

@ 359°, 25.6

Specimens



Polished ½ hr

12th May 1979

Exp begun on ½ hr @ 625C.

1) Problems polishing newly heat treated 1hr, and to some extent ½ hr. Due to falling apart — internet at boundaries ? low T phase.

2) Noted that 2 failures on spec. (1hr) were both in poor vacuum.
Note how BIV inc markedly after sitting in field.
Poor to align and no ions released.
Probably not specs.
Try today, but if same problems quit and wait until vacuum better.

Data to DD9 @ ø3 øø.

½ new specimen Background 1×10^{-8}

¼ 5.7kV @
½ ~~4~~$\times 10^{-5}$ Ne
1 1×10^{-8}
2 ? (220) Image bright.
111
4
4
2 5.9kV
1
½
¼ ~~[illegible]~~

Begin total 5 80 10% P

~~[illegible]~~

Estimate no/increment of 100V standing to decide

to kV	Reading	difference
8.8	3868	
8.9	4235	367
9.0	4510	275
9.1	4835	325
9.2	5116	281
9.3	5230	114
9.4	5571	341
9.5	5748	177
9.6	6143	395
9.7	6771	628
9.8	7292	521

7480 2nd cons.

Compare				
	5	5.8	13.3	43,502
	~~[illegible]~~		~~[illegible]~~	
	Q	10.20	11.8	41,003
	80	6.20	9.3	44,233

9.9	7783	499
10.0	8139	356
	8777	638
10.1	8914	775
10.2	~ 9200	

Slcant	9.0	9.9	60,529
	9.6	10.3	65,543
	10.0	12.2	88,301
10	5.0		
	8.1	12.7	42,765
	12.7	14.00	70,030
	14.00	16.60	81,502
Q	10.60	12.60	43,550

10.3	9859
10.4	10859
10.5	11541
10.6	12275
10.7	12700
10.8	13220
10.9	13909
	13958

} 49 coins.

13958 — hung up.

Press test ~~[illegible]~~ start.

Reply 'Reset'

1000 ~~x10~~ 6

~140 sector EO

? sectors. 1CØ will stop

Try again to 10 ØØ

14 271

Assume this is if 313 coins, say 10 sectors — will not encounter DDDD so run to PDP

Use ZED X+ to edit.

Begin again to 2Ø ØØ

1222 on end 15 sectors
end 11·00kV
+ 1·76kV S = 2·04
12·76 kV.

1/4
1/2
1
2
4 } 2 bad shots where shutter jammed

BIV = 10·90 kV
2×10^{-8} background
4×10^{-5} Ne
Bright.

Turn up → dark centre — !!!?
<u>Very</u> dirty.

15th May 1979.

Continuing with spec. aged ½hr @ 625°C.

Data to 88 88 DD8.
Ended @ 11.00kV
1.76 pulse S = 204
12.76 kV

Try BIV — begin @ 10.50kV?

Problems with DIFF pump blowing rather than sucking — condensibles, but takes away what ion pump does not want! Will have to scrub + bake. See if eats specimen.

	¼		BIV
	½	10.86	1×10⁻⁸ Bg
	1		4×10⁻⁵ Ne
	2		Image bright
8 shots	4	11.05	slow evap.
	4		
	2		
	1		
	½		
	¼		

Begin @ 10.00kV.

6100 onwards high Al

18,900 high Al + more pps and faster

bad disc? check with floppy sometime.

Disc error @ 21,327 ~ try 1~~30~~C first 10 tracks
∴ write to 20 000 ~ ~~200~~ 1 suppose secs sectors

Keep getting 454~~[illegible]~~ × 10~~[illegible]~~9
Seems to be overflow time coming up. Watch this.
Check @ 13.80 kV + 2.21 pulse
∴ V = 16.01

Use $V \times C \times t^2$ where t = 20 μs
⇒ 4512
? why out of sequence before? suggestive ~~that~~ gating wrong

23,000 also noted a double in 1/2 of this type! and an increasing variety of others!

Do something about wait loop on disc error e.g. cycle ~~teletype~~/vdu or something.

exp end @
15.60 kV
kV 2.66 S = 284
total = 17.86 kV.

after 40,004 ions
140 sectors from restart.

~~H~~ set drifting at end.

1/4
1/2
1
2 — 14.86 — Background 3×10^{-8} 6×10^{-5} Ne image bright @
4

new film.

2
2
4
1
1/2
1/4 — 15.08

Alignment. Spec needed moving down a little. No surprise over that lot.

trouble fixing where ion chain ends. Must add 1st coils until reach correct no. That will teach me to write zero's to discs each time. Now must go thro' rigmarole several times.

Alignment.

77.1	77.5
79.0	80.1
@ 356;	24.4

No but can't undo it! 1 Find Ne bottle or get one done.

2 Let air under leak valve to check if valve leaks

3 Stage

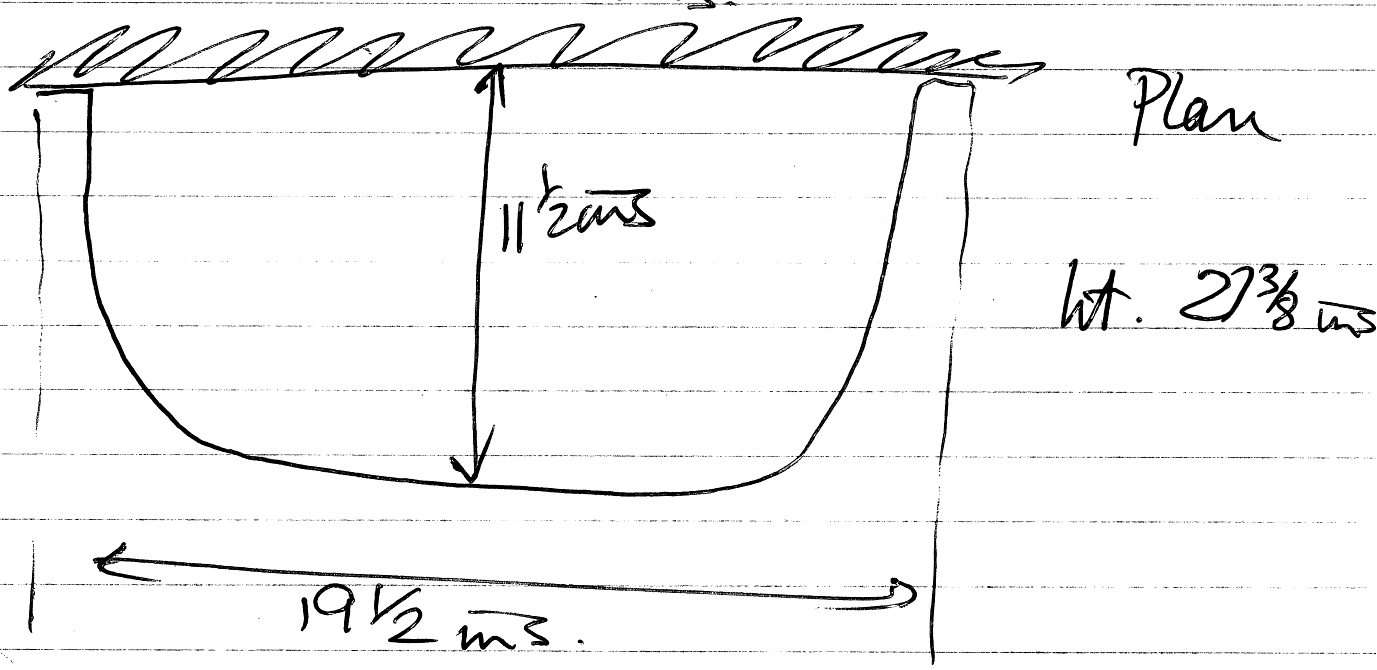
4 sub pump - inspect chamber & scrub if necessary - clean Ti off & fit new filaments - care!

5 fit gas bottle & remember to pump out neck.

6 Mass spec off

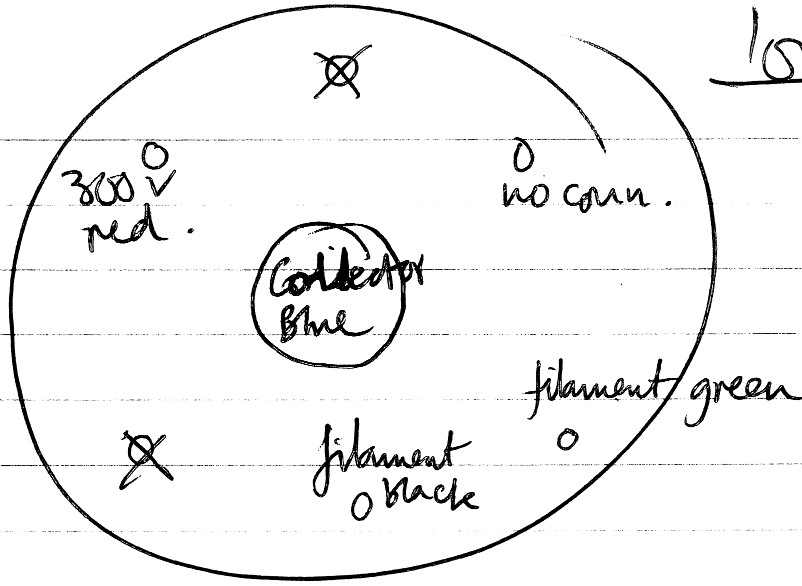
7 Ion gauge leads.

Measurements for new gas bottle shield:
bottle 5½ centre - 5 + 3 for gas bottle
= 8 ins.

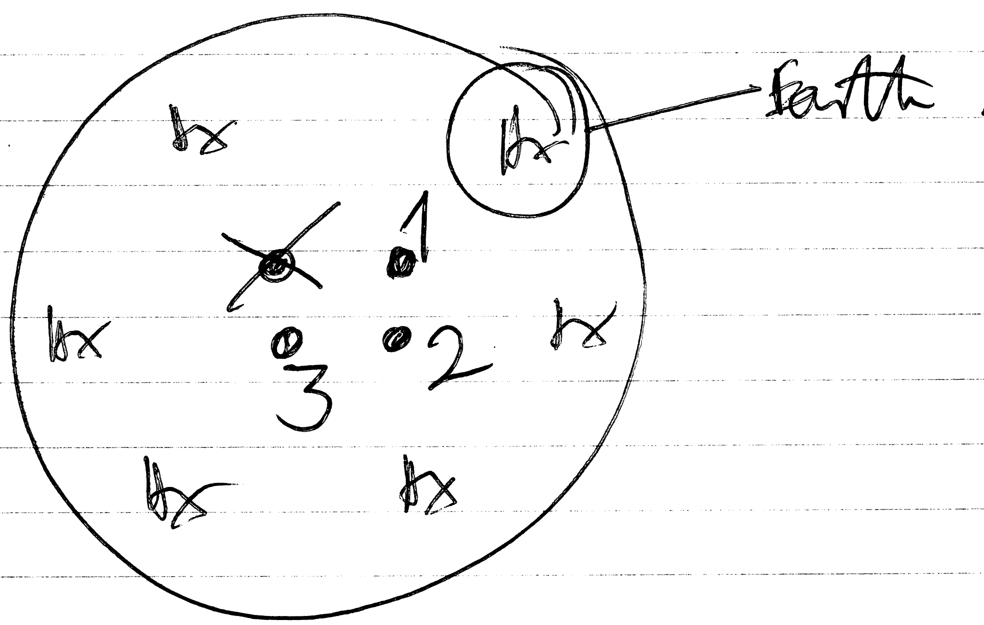


Ion gauge reading 4.1×10^{-8}

Ion gauge.

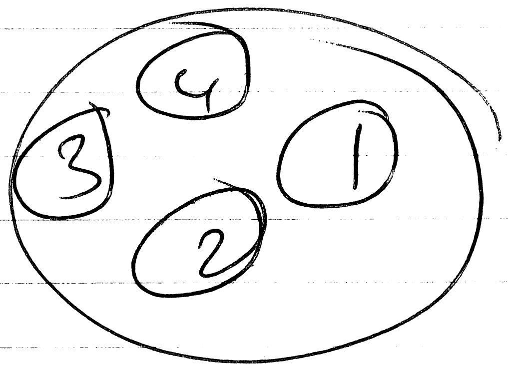


Sub pump



Heat put in @ 18,07.5 Wed
out. 18,07.5 Sat.

temp 1250°C ± 5°C.



Sub pump.

19/21st ~~June~~ 1978

Autochanger examⁿ

1) Spec. 8 1hr short.
Difficult to index, but flash → v. small ppts of γ!
26 frames. 21kV
Transfer to IAP.
Vacuum dessicator (no 9) next to gold.

2) Spec 1 long — probably 110 maybe 200 but not really [4] symm.
Def. 110
end of film ① put in vacuum (no 3)

3) New film ② + ~~6~~ 1hr +3 14kV.
frame 10 → ②

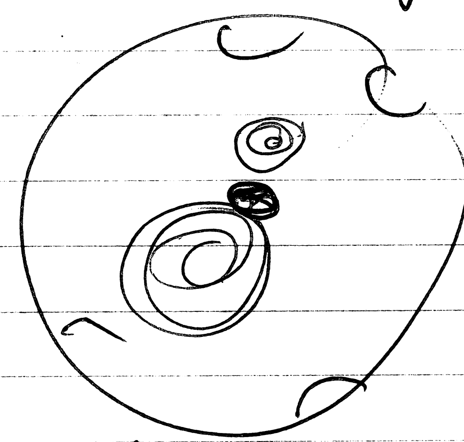
29th June 1979

Exp on quenched Ni — 8Al – 4Ti (or something)
Data to DD3 at ~~08~~ ~~80~~

Photo to film 2

Background 4×10⁻⁹
Neon 4×10⁻⁵
Image poor, centre bright

1/4
1
1/2
4
4
7
1/2 6.40
1/4



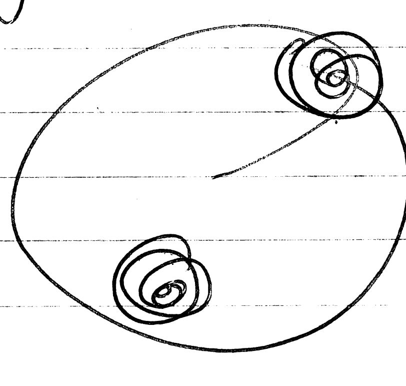
@ 6.25kV

Exp end @ 87 cross
ole sectors.

2nd July 1979

New as-q.
Data to DD3 @ ~~08~~ ~~80~~ Background 9×10⁻⁹
4×10⁻⁵ Ne

end of film ~ 10 taken of ppts



Seemed to be ordered
6.3kV

New film 6.5kV ? 2206.6 kV
Finished
Cont next film.

End after 68 sectors 5840 cons
less ~60

760 730
744 756

350°, 082°

3rd July 1979

Same spec repolished.

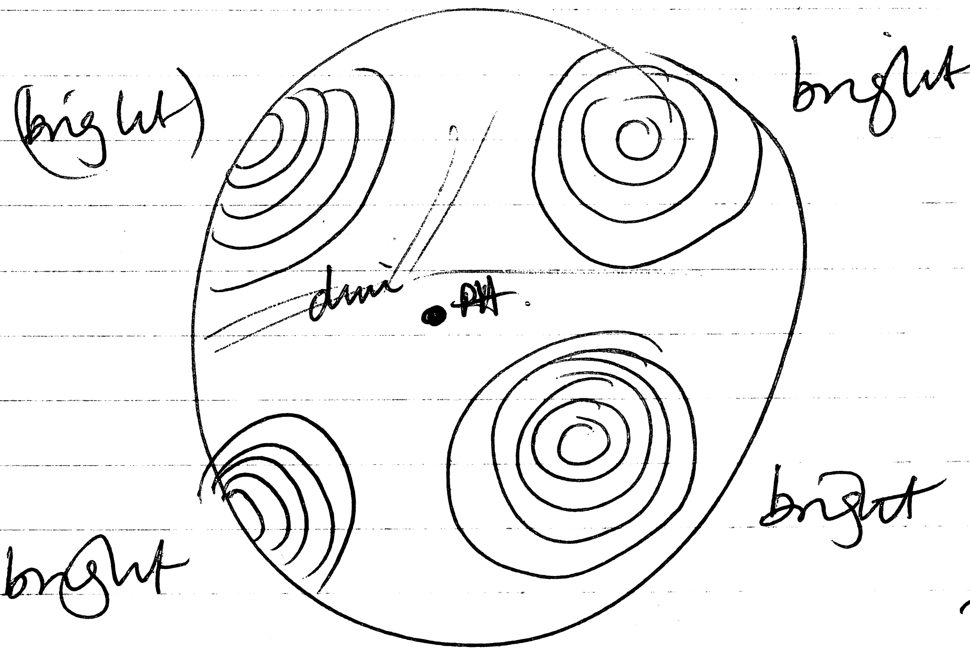
4.00	0.64	0.76
4.10	0.65	0.77
4.20	0.67	0.79
4.30	0.69	0.81
4.40	0.70	0.83
4.50	0.72	0.85
4.60	0.74	0.87 ←
4.70	0.75	0.88
4.80	0.77	0.90
4.90	0.78	0.91

Frame no 11 — Q

Ends @ 5.15 6 overall
then 4+5 up + down

fo 05 00 DD3

This tip is like nothing we have ever seen:



? 220 overall.

311 fits

? hexagonal

? gb at bottom where poles not match.

Several series micrographs taken. Looks beautiful.

Quenched so maybe just ordered. Then + spinodal ? not much } ?

Probably sod's law and much, altho' kinetics will be slower here

2 disc errors @ ~7,000
7,280
13,860
13990 - 16

moves on OK.

15620 high Al
15760/690 highest Ti
15800 lots Al + Ti
15850 especially
15900 3 + Ti + Ni
15960 high Al
16020
6.4kV 16110 Al + Ti
16250 high Al (+Ti) lots.
16270 v. high
16380 ?
16440
16730 quite high Al.
16820 high Al. et seq. + Ti
16870 high + 2nd cons.
16917 " " "
16960 v. "
17420 ~ ~
17560 ~ ~
17570 lots Ti (not so much Al)
18900 high Al (+ some Ti)

22000 roughly! sub pump fixed and
6.6kV etched specimen rather badly -
like rate x2 or x3.
22,830 high Al
23,360 ~
24,360 Ti + Ni prs.
24,870 high Al and Al + Ti pr.
25,160 v. high Al, faster rate
25,250 "
25,370 " " "

25,560 again 4. Less effect
25,690
26,020 Lots ti + Al
26,120
32,860 disc error — runs OK
34,100 " " "

Stopped 256 sectors.
Begin 20 s = 1 track
100 s = 08 tracks
200 s = 10 tracks.
280 s = 14 tracks.
Started 05

Begin 20 00 Complete disc 20s=1track
40 tracks.
= 800 tracks.

25E — problem writing to disc = 78 sectors

to 25 00 34,556.
carry on 35,604

Should I have reloaded? Do this next time.

Exp ended @ ~~[illegible]~~ 7:30 standing kV
~~[illegible]~~ 1:17 Pulse
Setting ~~[illegible]~~
1:36
Total ~~[illegible]~~ kV
8-47

after 100,000 ions
= 2 BC sectors
to various discs. No photos taken.

4th July 1979

Same spec continued.
Attempt pulse height calibrn 12, 14, 16, 18, 20
2000 each.

Total finish 8.47

kV	12	S	14	S	16	S	18	S	20	S
7.0	0.84	0.97	0.98	1.13	1.12	1.29	1.26	1.45	1.40	1.61
7.1	0.85	0.98	0.99	1.14			1.28	1.47	1.42	1.64
7.2	0.86	1.00	1.01	1.16			1.30	1.50	1.44	1.66
→ 7.3	0.88	1.01	1.02	1.18			1.31	1.52	1.46	1.68
7.4	0.89	1.02	1.04	1.20			1.33	1.54	1.48	1.71
7.5	0.90	1.04	1.05	1.21			1.35	1.56	1.50	1.73
7.6	0.91	1.05	1.06	1.23			1.37	1.58	1.52	1.75
7.7	0.92	1.07	1.08	1.24			1.39	1.60	1.54	1.78
7.8	0.94	1.08	1.09	1.26			1.40	1.62	1.56	1.80
7.9	0.95	1.09	1.11	1.28			1.42	1.64	1.58	1.82
8.0	0.96	1.11	1.12	1.29						
8.1	097	1.12	1.13	1.31						
8.2	09.8	1.14	1.15	1.32						

Data to DD1 @ 00 00

Images 7.63 kV Began new film

2
4
2
F
1/2
1/4
1/8

and extra on count stops @ 1994

~~Just do~~ 06 — looks ordered so keep on probing as normal. ~260 cms

H = 7.70   P = 0.920   T = 8.62

Begin @ 7.30 + 1.17 (s = 1.36)
Looks v. ordered.

to 01 50

~780 high Al and ti

~1,200 disc double write again
1600 another disc error

1963 disc error v. bad.
Ended after 2B sectors to DD1

try to DD5. (DD1 seem to be dusty.).
Same problem 2009 1st sector on new disc 2072 ditto 2nd sector
2115 ditto not cleared.
Spec. turned down from 7.50 kV.
Wait.

try DD5 @ 05 80. This time just turn up 7.6 0.91/1.05 and do pulse heights again if poss.

05 00 06 finish after 06 – v. fast

12% 06 00 08–06 = 02 sector

418

12% 07 00 11–08 = 09 sectors

about another 1000 v. ordered.
Stupid experiment. Gave up.

In all lost ~ 3,000 cms ~ 80 planes
@ 6/7 kV.

Transfers DD1 00	00	06	12%	
01	00	28–06 = 25	16%	
DD5 00	00	03	16%	
05	00	06	12%	
06	00	02	12%	
07	00	09	12%.	

Is it worth it?

5th July 1979

try to DD9 @ 00 00
Begin @ TGT = 7.8

Photos 7.65 kV
image brighter

Poles less obvious
– less order here.

1/8
1/4
1/2
1
2
4
4
2
1
1/2 1/4

Sub pump 18,300 — took off!
+ 2 write errors

End @ 19,536 ~~flight time~~ 6.25μs

~~DD~~8 00 00

'just stopped and said 04.06
DOS.2.1 — don't know where or
when. Have to examine using
ZED
Should be OK — here 8kV. Others
10 and 14 kV. What a pain,
though.

3239 iiii lines

23,941 reload again 01.00 DOS2.
Clock going remarkably wrong.

This is 23961
19536
4425 secs say 60/s.
= 73.4 sectors
= 23dec tracks ≈ ~~tracks~~ .02 tracks

~~...~~ Begin @ 03 00
Then 4 ticks — trouble
24,158 must have done 04 sectors
here.
Exited from program
06 00

25790 failed on disc error. exited.
~24 sectors.

Begin 10 00

Carl suggests stereoscan lit. No response to test.

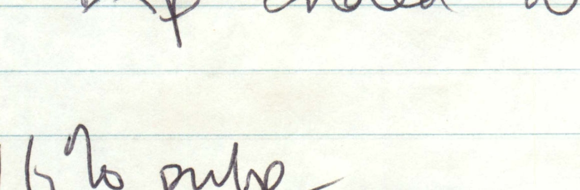
37, 3430 ? order Al present.
38, 670 Al up.
40, 520 — Al again.

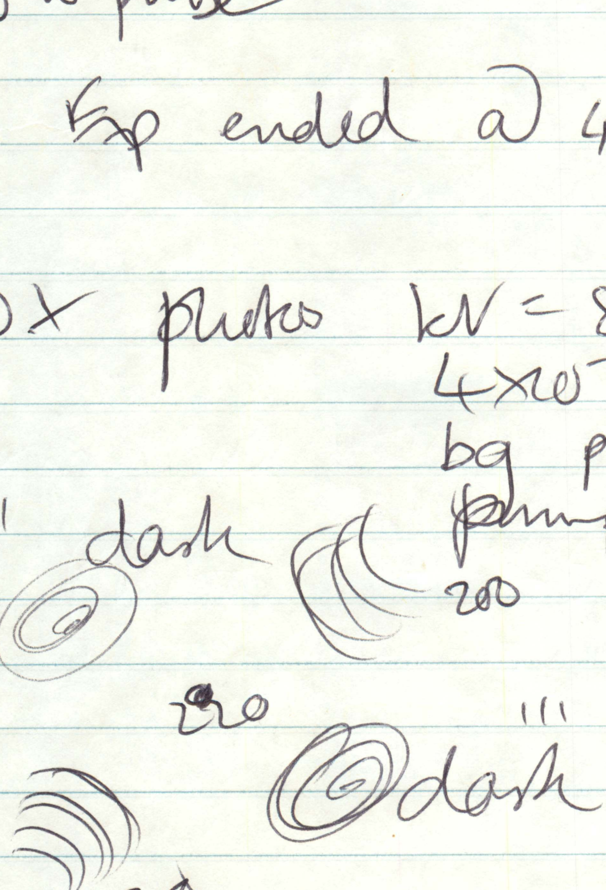
Exp ended @ 8.55kV
1.37 S = 1.59kV
9.92

16% pulse

Exp ended @ 42,255 cms
124 = sectors from reset 10 00

10x photos kV = 8.45
4×10^{-5} Ve
bg pr. 2×10^{-8}.
pumping

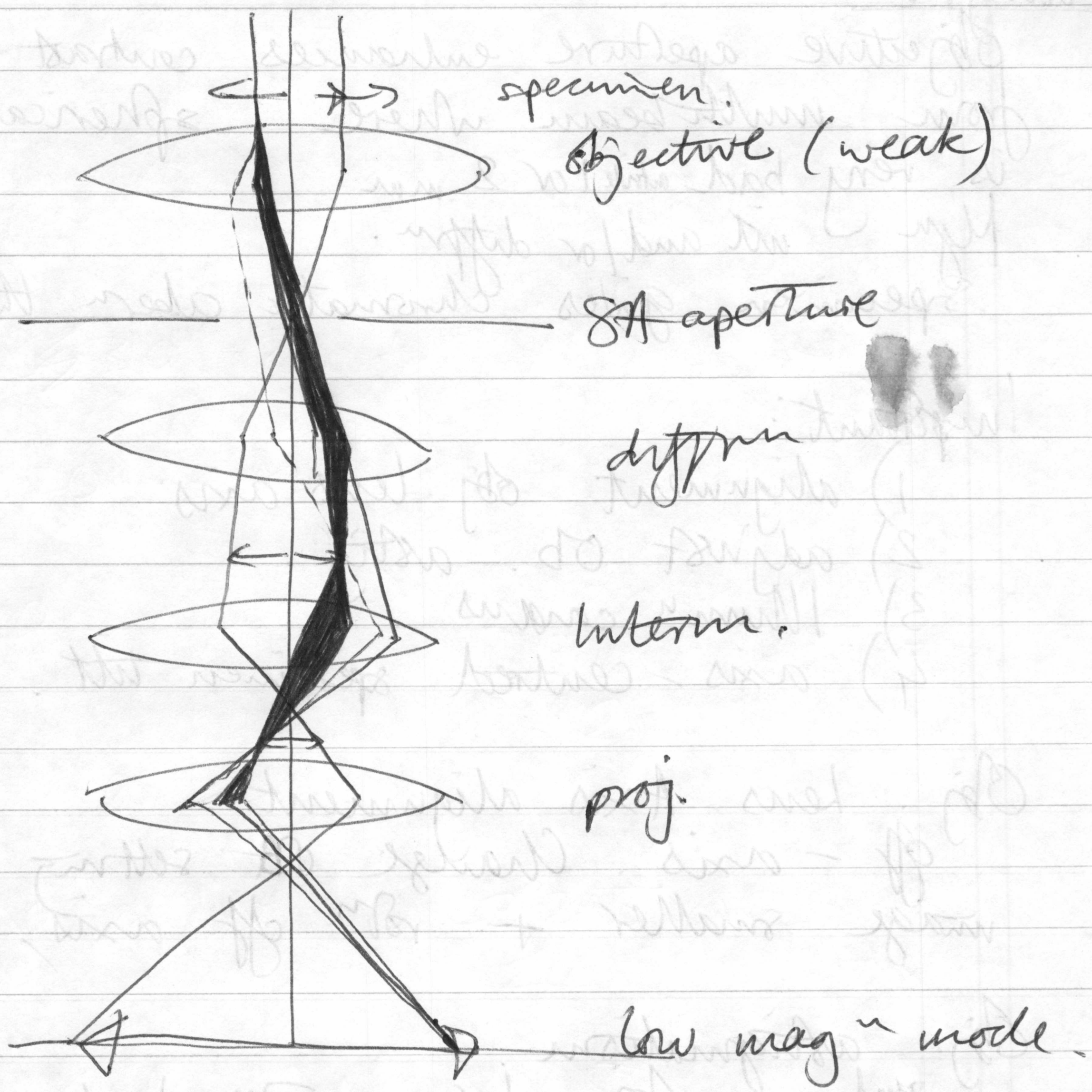




Only remaining disc seems to be DDR4

Try pulse bit tests here.

focussed DP — diffrn lens focussed on back focal plane of objective.



Objective not really correctable

Edington.

Objective aperture enhances contrast — away from multibeam where spherical aberration is very bad outside 1 or 2 mm.
Mgn ∪ int and/or diffrn.
Specimen gives chromatic aberrn thro' scattering

Important:
1) alignment obj. lens axis
2) adjust Ob. astig.
3) Illumn coaxis
4) axis - centred specimen tilt.

Obj. Lens Axis alignment:
off - axis. Change OB setting and image smaller + rotn off axis.

Obj. astigmation
focus obj. for minm background contrast then search for minm but sharp background with astigmators. — extra focus.

OA limits beams from spec.
SA limits DP beams to viewing screen.
Focus SA on screen (OA out) then image on viewing screen, (SA in).

Image at SA level by obj lens. Remove OA and reduce diffrn strength until

What the alignment does:

1) C_2 and using C_1 align gun on OA. For this deflectors obviously off as well.
Add C_2 and deflectors.

2) High apertures.

Check halo symm.

3) Condenser astigmatism.

4) Beam tilt.
Remember for ext channel azimuth is 1 and 2 not 2 and 3.

Mag. alignment

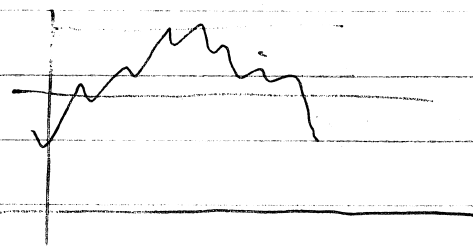
C_2 spread, object underfocus. Image moves and return with tilt

Changing plates

Pull, turn ↻, pull.
Dark and dose boxes ↻.
Afterwards push in draws, raise and clamp. Open boxes ↻.
Turn ↻ and pump. (down to 10)
Push and turn ↻.

Aberrations

Chromatic — inelastically scattered not properly focussed on image as energy spread.
Mainly objective.
∝ aperture angle.
Also one for magnification and change of θ (radial blur).
(tangential blur).



Introd OA.

Set D+1 and focus (with C_2) DP. Introd OA and centre. Set to M and focus for SA.

or Put SAA, switch D+1, put in OA, focus (C_2) DP, remove SAA back to SA.

Set to SA and introd SA aperture (Diff). Remove OA and focus SAA with diff controls. SA. Replace OA and check centring as req. On SA focus spec. Now image + SAA in back focal plane.

Switch to D+1, remove OA, focus DP.

From here add OA, remove SAA, switch to SA for BF.

and add SAA, switch to D+1, remove OA for DP.

12) Push knob fully in. and C ~ ½ turn.
pumps.
when HV est OK.

Changing filament:
1) Filament zero, HT off.
2) If rotary on switch off pumps.
3) Turn airlock handle down. ~ 3/4 turn → rest.
Rotary starts. Clockwise.
4) Pull out.
5) C ~ 45°.

6) Open LH cover.
7) Loosen ring AC
8) Lift assembly with lever, rotate to rest.
9) Pull out Wenhelt.
10) Replace.
11) Raise + lower gun. Tighten.

12) AC to start rotary. Measure PV.
13) PV L at push in + AC.
14) HV at ok for use.

Standard cond^n
1) Filament, HT off
2) tilt = wobble ampl 6 at ϕ
3) Diff 20 Spt 4 cont max, Proj 6 centre
4) OA, DA out
5) mg^n sel M., magn min.
6) C_2 17-20.

time switch to select exposure and set meter reading to req. value. 35 large sreen
65 small.

5) Press T (LH panel)
6) Raise screens.
7) Press exp (RH panel).
8) Press T.
9) Check plate no. Readjust intensity. Adjust exposure time for ½ full scale meter reading.

Changing Plates

1) Vacuum off if rotary running.
2) Transport disc normal posn.
3) Pull knob as far as poss and clockwise ~½ turn to close airlock.
4) Pull out to admit air.
5) ext. lights and rotate both discs under boxes AC to stop.
Pull down camera clamps and pull out drawer.
6) Remove exposed plates LH drawer and put in empty plate box. Full box in RH drawer. Unexp. plates in box with spring-loaded bottom. Check open / close.
7) Open LH box by rotating disc C ½ turn.
8) Push + lift RH draw into posn, clamp.
9) Also RH box rotate disc C ½ turn clockwise to open lid of camera box.
10) knob C ~45°
Select PV and follow pump.
11) on 40 divisions rough off and PVL extinguished. If OFF before vacuum on.

7) Focus spec. Using small screen.
8) use DF1. Remove OA.
9) Focus DP using fine diffraction controls (RH aux).

CL varn use int. lens.
Refocus DP with lens controls.
Return to standard Int 4, cont max, diff 20

Centred Dark Field.

1) Obtain SADP.
2) Ampl = ϕ, az = ϕ.
3) Overfocus C_2 + Z, quad 1, either tilt on or change to ext.
4) inc ampl, decide if spot → axis by varn ampl + az.
5) If not select next quad repeat.
6) Adjust az so that ampl varn moves spot along line connecting it with central spot.
7) Set ampl zero with az set.
8) Introd OA, centre. Centre spot with ampl. Then az if necessary. May have to spread C_2
9) Int - ext or tilt to test
10) select SA and DF appears. Adjust C_2 + deflectors. Can remove Dap.
11) Focus as before.

Exposure: 1) posn image.
2) emulsion = 3, select plate.
3) meter selector ≤ exp. Focus.
4) Adjust intensity of image or

Obj ap:
1) Set DT1.
2) Focus C_2 on diffⁿ pattern
3) Insert OA. Centre on str. thro' beam.
4) select M or SC.
5) Focus C_2, centre beam.
Overfocus!
6) Repeat as magⁿ varies.

Mag spec:
1) centre feature, focus C_2.
2) Remove OA and focus
3) Recentre beam with deflectors. } standard
4) overfocus C_2 1 click, defocus obj to minimum.
5) Return image with tilt by switching on tilt button, selecting quadrant such that ampl + az → centre.
6) Refocus C_2, refocus image, recentre beam.
7) Repeat 2 etc until image central.

Keep tilt depressed for BF
Use ext. channel for DF.
Do not use wobble to focus.

Selected Area Diffraction
1) Int = 4, cont on max.
2) Funct = SA. M any.
3) Introd, centre Diff Ap. Remove OA
4) Focus Dap using selected area control on RH aux.
5) Replace OA, check centre by F = DT1
6) Reswitch to SA.

3) re-engage drive.
4) pin 5 o'clock.
5) Insert, settle pin.
6) 140° ac. Allow to enter and engage.
7) Pump until HV extinguished.
8) Connect motor lead.

Removal: 1) Tilt zero, second 120°.
2) engage drive.
3) Pull out. Rotate 140°C Remove.
4) Check HV.

Image: PVI on, depress vacuum on.
1) Insert spec. kV, filament on put.
2) Mag 10, select scan.
3) Remove obj, diff aps.
4) Overfocus C_2 (17-18)
5) select M.

Focus: Depress wobbler (set on 6). Focus with objective controls. Release.

Height: 1) set to scan. Disengage drive. Tilt = ∅
2) Using stage controls centre a feature.
3) Apply tilt. Adjust knurled knob to bring feature ½ way back. Reduce tilt to zero and feature centred with stage controls.
4) Repeat opp tilt.
5) Repeat until no movt
* 6) Engage clutch.
7) Refocus

12) centre aperture.
13) Refocus C_2, centralise. Repeat.
14) Wind C_2 up and down to test concentric.
15) Introd C_2 aperture. as above.
16) Switch on C_1 focus C_2

17) Centre with deflectors and check halo.

Astigmatism: 1) Unsaturate
2) Using cond. astigmators one at a time + C_2 → beam circular.

Alignment of beam tilt:
1) Depress tilt, focus C_2. Ampl. azimuth = ϕ.
2) Quadrant 1.
Increase ampl. and adjust potentiometers → centre of screen.
3) 1 → 2. Adjust same pots by moving ½ way. until OK in both.
4) Set ampl = ϕ, az = 10, Quad 2.
5) Inc. ampl. and centre using other pots.
2 → 3 as before.
6) Check 1–4.
7) Focus on wobble with wobbler + ampl 5–10. (6).
Release tilt.
Outwards = int.
Repeat for ext channel.

Holder: 1) HV meter
2) release tilt drive, control to ϕ

c) Remove C_2 aperture. If lumens replace and recentre.
d) with C_2 out see that tilt (rear) not wildly off vertical and search with traverse (front). Replace C_2 if successful.

As soon as lumens appears switch to camera screen.

e) If not lumens switch off all lenses except C_1. Find beam with C_1 spread.
f) Switch on lenses one by one down column adjusting C_1 and C_2 for max^m lumens.
g) Replace C_2 aperture.

<u>Screen</u> Use camera screen for alignment.

1) set exposure selector to T
2) Raise large screen – trips shutter.
3) Press expose.

Alignment:
1) ~~deflect~~
2) switch off C_2, focus C_1 to large spot
3) unsaturate, focus C_1, centre
4) switch off deflectors
5) Centralise with traverse (front), focus C_1
6) Find halo.
7) Switch on C_2, return C_1 to 4.
8) Focus C_2, sat. filament, switch on deflectors and centre.

C apertures:
9) Remove C_2 ap. Focus C_2
10) Deflectors to centre.
11) overfocus C_2 until spot 4cm.

Operation of Philips EM 300

Checks:
1) Heating potentiometer zero — R H aux
2) Proj. on 4, cont on M
3) Int on 4, cont on max.
4) Diffrn 20
5) Emulsion 3.0 (plates)
6) Lenses on, wobblers zero.
7) Film selector set.
8) Tilt to wobble — L H aux.
9) Azimuth ϕ
10) Ampl 6.
11) Lens on — Rear
12) Filament low
13) Fuses
14) water > 30psi

Illumn
1) Remove obj and diffrn apertures. C_1, C_2 apertures in.
2) kV on, emission to 2, saturate on μA.
3) Deflectors on, C_2 to 16 +.
4) Magn to 1, function selector M.
5) Focus with C_2.
6) Maximise lumens:

Gun traverse — FRONT
Gun tilt — REAR.

If no illumn search with tilt (rear [crossed out]) only.

If still no illumn:
a) Check obj, diffrn apertures out.
b) check filament