Tapes thrown out (damaged after flood)

552 ab PE16 /20/ 8'
525 part 2 ? PE16
551 PE16/20
572 Southwark TI
534 N. AL Cr /5 min
540 PE16
532 N. AL Cr ab 5 min
555 ab PE16/8 hr/ auto/ 8'

Wed 27 Feb 1980

Continuing assembly lines for Carbon mass gun.

Southwick 2nd alley T 565

New gun 7·9 + 1·3 mm / 60 / 1·0⁻³ from ? dark line @ edge of gun.

~ 5K 190/580 195/586

~ 7·9 + 1·67 - some P.

μ x 3 where ↑ ~8 KV

μ x 3 axial

IAP x 2 bolt left

dark area

Fe 68 = 530

Cr 63 510

Si 45 375

P^2 47 390

C^{12} 42 347

C^6 30 245

Mo 105 690

P^3 40 321

Fe

Cr

Si

P^3 - little

Fe

Cr] ?

Si

Fe prop

Fe

Cr

Si prop

Si prop

Si

Mo

Mo

Ni prop Ni ?

Fe

Cr

Si

P^3

IAP x 3

μ x 3

566 Same Spec

8.8 + 1.5 / −1.7 220/560 vac − dirty!

8.9 + 1.7 − 225

12.1	1
13.7	7
.8	4
.9	6
14	19
14.1	27
.2	112
.3	88
.4	7
.5	4
.6	3
.7	2
.8	8
.9	3
15	5
.1	1
.2	6
.3	2
.4	7
.7	1
.8	1
16.1	1
.2	3
17.5	1
.7	1
.8	1

23.9	1
24.6	1
.8	5
.9	1
25.0	17
.1	21
.2	114

+ Mo
Cr^+
Fe^+
Ni^+

pk × 4

Ar source with scanning lines
i_c 12μA 4·26KV

T 567 020 1K ions

T 568 a 020 2K
b 010 — final 100 or so with 1·8KV not 2KV on detector

— ? error somewhere, tends to stop / lose itself in prog.

ph × 1 — delay amp 5μS/cm
ph Multich
ph × lots " " " "
" " " lin amp " " / ×10 probe, -05
" " " " " ×10
" " " " ×10, less gain on variable

Blank

Sat   T569   Au   10μA 4.05KV
10K words/scan

Mon/Tue
— making slides for UK 7-8 gp mtg in Aston
—(Wednesday)

— give paper on Ga/Au sources.

Thurs — Royal Soc /application

$\frac{\Delta V}{V} = \frac{2\Delta t}{t}$

V = 4.06KV
20μA

	μs	Δt	ΔV
Au^{++}	10	.15	~120
Au^{+}	14	.25	~140
Au_2^{+}	20	.7	~290

Fri 21/3/80

Au ~~T~~ T570 8 μA 3.63 KV

— deflection in , X plates used to decrease
beam current ~ 1 ion pulse or less

— looking for a) more quantitative data
b) to see if peaks wider than 569 shows
(if not saturating bending) as peaks for 569 Au^+ etc
are narrower than Sudraud's energy spreads suggest
(tho Au^{++}, Au_3^{++} are apparently wider)

ph blank
ph × 5 diff amp as ↑ N.B. Drain failure, for Ga read Au.

lin amp, 5μs/50ns/cm Ga^{++} ×4 ½, 1, 10 5
3.63 KV Ga^+ ×4 ½, 1, 5, 10
Ga_2^{++} ×1 10 sec — little
Ga_2^{+} ×1 " " more

@ 3.47 KV, 2 μA Ga^+ ×1 off RHS
×4 ½, 1, 80, 5 centre
3.52 KV ~~3.52~~ ×2 10, 5
3.82 KV, 20 μA Ga^+ ×2 ½, 1
ph Ampl
" " ph × 2
4.06, 30 μA Ga^+ ×4
Ga^{++} ×4
.2μs/cm Ga_2^+ — wider ×4

30 μA 4.4 KV .2μs Ga^{2+}, Ga^+, Ga_2^+, Ga_3^+
ph Ampl

5F1 Southwick" same spec 1×10^{-9}/60/Nc

	9.3 + 1.8 – 1.95	230/560/ vac
10.5K	9.4 + 1.95 –	235
16.2K	9.45 + 2 – 9.5 + 2	240
	at 26K	

Crystallography film, etc ↑↓

Mon 21/2/82 Same spec 10^{-9}/60/Wa

ph Mnfch IAP Mnfch 2

ph x 2 10.1 KV

IAP x 2

56 Fe^{2+} 460

53 Cr^{2+} 440

41 Si 330

42 P^2 340

34 P^3 ~~280~~ 280

25 C_6 210

36 C_2 300

74 Mo 600

Fe 45 s

Cr 5

Si 7

Fe 40 s

Cr 5

Si 5

Fe 30 s

Cr 5

Fe 5

Cr 5

Fe 5

Cr 5

IAP x 2

IAP x 2

Fe 20 s

Cr

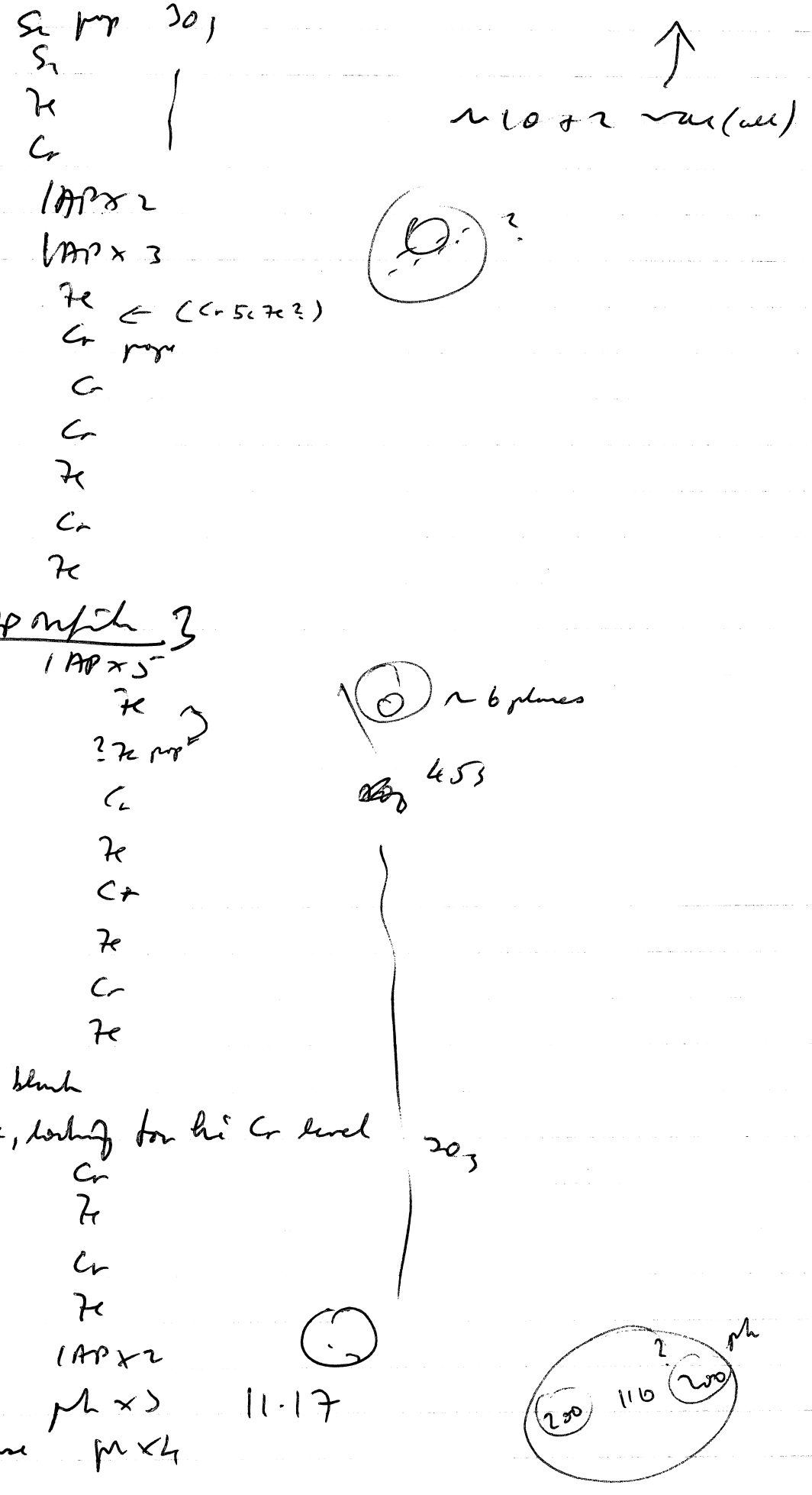
Si

Fe

Cr mp

Cr mp

Cr



nIgnibe — top200 iAP × 2 < DW (circle) ?

Fe (pop)

Cr 20s

Fe

Cr

Si

Fe

Cr

Si

iAP × 2

ph × 2

? bit of poly bag in front of Dallmeyer lens
- sod it
- going home time.

Tues 1 August   Same southward spec   1 10⁹/60/NE

572   290   11.5 + 2.1   run

except 6 (?) 12.3 + 2.1 ~ 15.5 keV

UAP x2

Cr

Fe

Cr

Fe

Cr — purge

UAP Norfolk 4

Cr   20 s run

Fe

Cr

Cr

Cr

Fe

Fe

Fe

Cr faster   37

Cr — purge   12.9 + 2.5   326

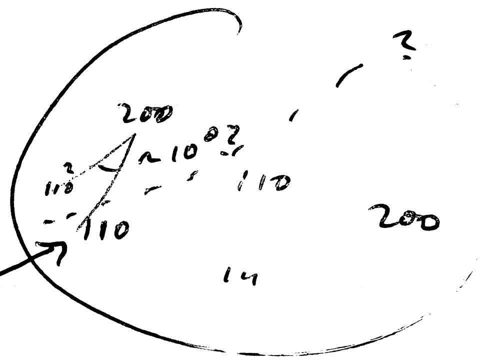
Finished

Wed – still wrestling with computer prog for Culham m-s

Thurs 3 April New Spec   Harry's calibration alloy
– described as $\overset{99.126}{Fe}$ 0.24 V wt% —— .2625 at%
 < 0.024 C wt% .111 at%

1200 @ 1 hr → WQ

– ? gb at LHS



ph blunt
ph × 2 6.45 kV
1 10^{-9}/60/Ne

ph × 4 6.42 – spiral
ph × 2 ? on ? boundary.
573 from ? boundary 150/560 5.87 + 1 $\frac{25}{149}$
– check @ 595 = 230 K, 360 cal
a → 6 + 1.05 867 ions

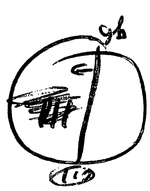
ph × 2 above a
move slightly into matrix, ph × 2
b 6.1 + 1.1 150/560 — 6.15 + 1.15
155 6.2 + 1.15 –
— no c

back to edge ph × 2
574 6.27 + 1.2 160/560 ~ 1K ~ 2%

ph × 2 where ↑

1

IAP blunt
IAP × 2 f1.4
IAP × 2



Fe^{2+} 76	620							
C^{2+} 287	C^{12} 406	C18 497	C24 574	C36 702				
34	50	61	71	106				

Fe 1 min
C^{2+}
Fe

C^{2+} 60s

C^{2+}

C^{+}

C^{+}

C_3^{2+}

C_3^{2+}

Ze

C^{2+}

C^{2+}

C^{2+} 120s

Fast

IAP × 3

IAP × 2

Ze 30s vyjmuto

C_6 30

C_6 60

C_{18} 30

C_{18} 60 or 90

Ze^2 60

C_{12} 20

~~IAP Mn fast~~ 2

C_{12} 60s

C_6 ? 60s

Ze 30s fast

31 C_6 30s fast

27 Noise level 60sec

IAP × 3

Mn × 5 6.44 KV

Manganistan bust – no up-down.

IAP MN/S × 3

Ze 60 sec

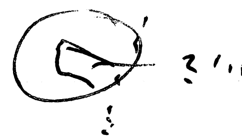
C_6 4

C_6 2 ~ none

C_6

IAP × 2

1AP × 2 LHS



Fe 30s

C 60s – instrument

C 60s

C 60s

1AP × 2

move 1AP × 2

Fe 45s

C_6 60

C_6 "

C_6 "

Fe

1AP × 2

move right 1AP × 2

Fe 60s

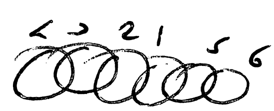
C "

C "

C 120s rapido!

~~1AP [illegible]~~ 3

1AP × ½ day



ph × 3

~~pl [illegible]~~

ph × ½ day

575

T(574) 6.9 + 1.5 180/560 [illegible] 10 K

Tape labelled wrongly.

ph × 6 where T 185 – t ~ 7.3 + 1.7

Easter

— galloping gerlandellar fever –

19 May.

Looking at IAP pulser on H-P Sampling scope (185A) with 188A vert amp

Lots of, wide, various exposures, single sweeps 20nS × 10 = 2nS/cm.

- - . - - , superimposed sweeps, coarser, " .

More, 4nS/cm

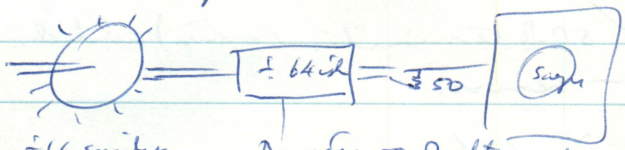
More 2nS ← ? 1 or 2 1nS/cm

- nonlinear, —— on slow sys rate,

looks OK on 50 MHz internal calibrator (500 MHz down-work)

? gets worse when warmer, dips/scan droops.

6 70 v input to pulser - lots of attenuation



÷16 spider

Denotes 50 Ω attenuator ladder.

21/5/80

<u>Same film</u>

345v i/p   Demonstration set of pics 4nS/cm

<u>new film</u>

÷16, ÷125   —   —   —   4nS/cm

20mV/cm vertical   2nS/

1nS/

1nS/

<u>blank</u> ↗ 50Ω termination (extra) added.
— remove

now correctly ~~terminated~~

set 4nS/(?)

2nS/cm

1nS/

1nS/

4nS/

↑ Camera propped on other scope (!)

scope going nonlinear as warms up.

<u>blank</u>

pulse ~ 5nS long, ≤1nS tr, ~2nS tf.

Pulser ht modded — 1K charging resistors replaced by 2K7's to eliminate 2° pulses and to allow full 3KV i/p voltage.

June 5, 6 — visit to Culham*

New

June 10th Ar Source

~ 5 10^-6 at start

T 576a — scan ~ 5.91 KV, 10 μA (tends to stop emitting
0201 ~ 5200 s, 12 μA, N restarts & need to be restarted)

source aligned fairly carefully

Ar+ & Ar++ linear peaks examined with fast sweep

— no obvious gross dependendence of shape on ~~~~ voltage of deflectors, x-deflector, or sweep (some slight sideways shift)

— set up for maximum peak / best noise.

Third spectrum is with first with the Bendix potentials altered to the recommended values (ie -ve bottom end of dynode strip) to see if makes difference to peak shape / noise, etc).

576 b 6.03 KV 30 μA (actually ~26 μA) 6.03 − 5.91 = .12

— to compare shape of peaks, absolute position (120 eV different) appearance of extra peaks, truncation of Ar+, Ar++, etc

timer occasionally stops, apparently after reading in an illegal time from timer (ie outputs b00bb1 - error of 'decimal' subroutine)

~ 2 10^-6 halfway through 'b

* discussions at Culham — Steve Thompson looking at fast neutrals, using TOF, with start of neutrals defined by pulsing emitter on with thyratron

? look at slo neutrals by ionizing them — need lots of electrons, or photons of high enough energy

? use N_2 laser to produce photoelectrons from Na cathode

— accelerate (space charge problems) to give ~1A 10ns ionizing current

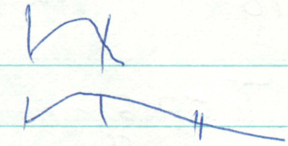
or ? some sort of surface ionization detector.

? What type of ions when negative emission (ie any similarity to vacuum arc, in which -ve electrode emits +ve ions, for unknown reason (ref Prewitts L^+ source)

At 20 μA, Ar^{++} ~ 50-70 ns 7.6 μs

Ar^{+} 200 - 300 11 μs

Ar_2^{+} ~300 ns 15.5 μs



looking with diff amp, Ar^{++} & Ar^{+} are truncated to ~50 ns scatter (i.e. losing last [illegible] in peaks).

—need beam attenuator.

5 7 7 a 30 μA 6.08 / 6.10 kV again 26 μA at end

this time with source moved sideways to use apertures to cut current — much slower collection rate — should get quantitative Ar^{++} & Ar^{+} & realistic peak widths

b 5.97 | 5.98 12 μA ~ same collection rate (~2 c/s) 1.76/sec (over 100 ms)

~

~c

pulsing at 2 ms intervals → 500 Hz

scan of 40 intervals (I think) → 12.5 scans/sec

so ~ 1 Ar^{+} per 10 scans or so.

9K total (= +)

80 760

Oct 4

Ar source

T578 5.99 KV 18 μA i_c 010/

scan

- KM altered so using 40 μs time with full ions resolv (÷2 for previous Ar spectra)
- attempting to look at shapes of Ar_2^+, Ar_3^+ peaks
- collect 3000 ions on scan (high current on detector, ≥1 Ar^{++} or Ar^+ at a time)

then gate out Ar^{++}, Ar^+, no scan. (suspect that scan mode may lead to artefacts, & alter apparent peak shape) - 500Hz,

+ another 1500 - noisy & source quiet, leaving lots of noise still being recorded

- restart & continue gating out Ar^{++} - Ar_2^+ & finally or Ar_3^{3+} I think

- rather too many ions per pulse for comfort.

At 7K, gate out Ar_3^+ as well.

KM arithmetic & hysteresis for some reason. (don't like 12 bit times probably)

stop at 9K

T579 16 μA 5.98 KV scan

Amp gain lowered (less noise) & scan deflected so that Ar^{++} Ar^+ peaks not saturating

gate out Ar^{++} Ar^+ after 4K, continue scanning & decrease deflection slightly so rate high 3-4/sec

→ 10K.

4×10^{-7} T (running)

Beam deflected onto Dendix

Mult	collector current
−2 KV	11 μA
−1.9	8.2
−1.8	4.8
−1.7	2.4
−1.6	1.2
−2.0	10.5
2.helipot → odd −2.1	13.3
−reads +.1 −2.2	15.4
ie 2.4 ⇒ −2.3	17.0

23 μA $i_{collector}$

Maximised −1.8 ⇒ ~~6.0 μA~~ 8 7.9 μA
−2 KV ⇒ 14.0 μA.
−1.7 ⇒ 4.7 μA

Flight-tube straightened, zero deflection
−1.7 KV i_{max} = 4.8 μA
deflection on, ~~i~~ i ⇒ 8.3 nA   ratio 522
maximised as i = 9.2 nA
deflector off   i returns to 5.0 μA

Reduce gain
−1.5 KV   i = 1.05 μA
deflectors on   i = 1.7 10^{-9} A ± .2−.3 nA   ratio 618
" off   i = ~~to~~ 1.04 μA
incr gain
−2.0 KV   i = 14.2 μA
defl on   − 1.7 10^{-7} A   ratio 84. (inc noise)
off   ~~1~~4.1 μA
defl on, tube bent ~~2.5 10^-7~~ ~1.4 10^{-7}, fluctuating
increment ≃ .5−1 10^{-7} from bent to straight ie ratio 140−250
beginning to saturate.

? relation between $i_{collector}$ & $i_{probe-hole}$, for various multiplier gains

Gain ≤ -1.7 kV	$i_c = 22\,\mu A$	$i_{mult} = 3.9\,\mu A$	
	$i_c = 12$	i_m	3.3
	21		4.3
	43		4.7
	5.0		3.0
Gain ≤ -1.5	10		.56
	19		.71
	32		.86
	42		.98
	7		.48
Gain -1.9	7		8.4
	12		8.7
	21		9.2
	32		9.5
	40		9.6
-1.0	12		1.7×10^{-9}
	21		1.33
	32		$1.80\ 10^{-9}$
	40		2.15
	6		.98

$\leq 6 \leftrightarrow 40\,\mu A\ i_c \rightarrow \simeq \times 2\ i_{probe}$.

$i_{fast\ neutral} \simeq 0.2\%\ i_{ions}$ at $23\,\mu A$.

Thurs 12/6/80 Am source again

background at start 1.5×10^{-7} 7 mg = 24 10^{-7} running, allowed

Yesterdays data in saturation regime of multipliers ($< 10^{-8}$ A maximum

off current : dynode current $\sim 25\,\mu A$)

Check noise level, dark current, neutral current as fn of

multiplier voltage :-

Multiplier volts :-

−1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	−2.0	2.1	2.2	
$2\,10^{-12}$			$5\,10^{-12}$	$5\,10^{-9}$	$3\,10^{-8}$								
						$1\,10^{-9}$	$3.3\,10^{-9}$	$1.3\,10^{-9}$	$3.5\,10^{-9}$	$1.35\,10^{-8}$			a Dark current b a − ion light current
$7.5\,10^{-9}$	$5.5\,10^{-8}$	$2.5\,10^{-7}$	$6.8\,10^{-7}$	$1.65\,10^{-6}$	$3.7\,10^{-6}$	$6.6\,10^{-6}$	$9.1\,10^{-6}$	$1.1\,10^{-5}$	$1.3\,10^{-5}$	$1.45\,10^{-5}$			
$5.6\,10^{-9}$	$4.3\,10^{-8}$	$2.1\,10^{-7}$	$5.8\,10^{-7}$	$1.4\,10^{-6}$	$3.2\,10^{-2}$								
$4.3\,10^{-12}$	$3.7\,10^{-11}$	$1.7\,10^{10}$	$6.6\,10^{-10}$	$2.5\,10^{-9}$	$1.2\,10^{-8}$	$1.5\,10^{-8}$	$2.9\,10^{-8}$	$4.5\,10^{-8}$	$7.5\,10^{-8}$	$1.4\,10^{-7}$			neutrals reversed
$4.8\,10^{-12}$	$4.0\,10^{-11}$	$1.8\,10^{-10}$	$7.2\,10^{-10}$	$2.1\,10^{-9}$	$5.4\,10^{-9}$	$1.3\,10^{-8}$	$2.9\,10^{-8}$	$5.7\,10^{-8}$	$9.8\,10^{-8}$	$1.55\,10^{-7}$			
$2\,10^{-13}$	$4\,10^{-13}$	$4\,10^{-11}$	$1.5\,10^{-10}$	$1\,10^{-9}$	$2\,10^{-9}$	$3\,10^{-9}$	$5\,10^{-9}$						noise erratic

a) dark current v. hi at start ($\sim 1\,10^{-7}$ A at −2kV ($\sim 10^{5}$ over spec!)
turn off at −2.3kV → quieter

$$\frac{6\,10^{-9}}{5\,10^{-12}} = 1.1\ 10^{3} \quad \text{1\% photons/neutrals.}$$

Neutral & ion currents versus collector current, as a function of source angle.

Multicusp – 1 KV

Neutral vs $i_{collector} = i_c$ — On axis

i_c = μA	16	10	20	25	30	35	40	5	μA
$i_{neutral}$	$4.7 10^{-12}$	4.2	5.6	6.3	7.3	8.2	9.7		
	5.3	4.4	5.8	6.6	7.4	8.5	9.3	3.5	
i_{ion}	6.8×10^{-9} A	5.7	7.7	9.2	$1.1 10^{-8}$		5.0		
	7.3	5.9	8.0	9.3	$1.12 10^{-8}$		$5.3 10^{-7}$		
ratio $\times 10^{-4}$	7.09	7.46	7.26	7.94	8.26		6.60		

~ 10° off axis

~~Ion current~~

i_c	5	10	15	20	25	30	35	40	mA
ion current	5.5	6.5	7.6	8.5	$9.4 10^{-9}$	1.05	1.1	1.2	10^{-8}
	5.3	6.3	7.5	8.3	9.6	1.02	1.15	1.21	
neutrals	3.7	4.7	5.6	6.2	7.3	7.7	9.1 / 10^{-12}	1.05	10^{-11}
	3.8	4.8	5.7	6.3	7.0	7.8	9.2	1.03	
ratio $\times 10^{-4}$	6.94	7.42	7.48	7.44	7.52	7.44	8.13	8.60	

~ 20° off axis

i_c	5	10	15	20	25	30	35	40
Ions $\times 10^{-9}$ A	5.3	6.2	7.3	8.3	9.6	10.3	11.3	1.21
	5.1	6.4	7.7	8.5	9.7	10.3	11.4	1.22
neutrals	2.2	3.3	4.5	5.3	6.3	7.1	8.4	9.3
$\times 10^{-12}$	2.1	3.2	4.7	5.2	6.0	7.2	8.3	9.7
ratio $\times 10^{-4}$	4.13	5.16	5.86	6.25	6.37	6.94	7.36	7.82

$4 10^{-7}$ Torr

~ 30° off axis

i_c μA	5	10	15	20	25	30	35	40
Ions	$1 10^{-10}$	$1.5 10^{-9}$	5.6	7.3	8.7	9.7	$1.06 10^{-8}$	1.15 / 1.25
neutrals	$2 10^{-13}$	$4 10^{-13}$	$1.1 10^{-12}$	$2.0 10^{-12}$	3.1	4.2	5.5	6.8
						4.0	5.3	7.1
ratio	$8.2 10^{-3}$	$2.66 10^{-4}$	1.96×10^{-4}	2.74	3.57	4.23	5.09	5.79

numbers checked.

~40° offaxis

i_c	5	10	15	20	25	30	35	40 μA
ions	[		3.10^{-13}	2.10^{-12}	1.10^{-11}	6.10^{-10}	$2.6.10^{-9}$	7.5
			2.10^{-12}	$8.3.10^{-12}$	$1.7.10^{-10}$	$2.5.10^{-9}$	$7.3.10^{-9}$	
neutrals	← tends to go -ve even when ignored		$1.5.10^{-13}$	$3.2.10^{-13}$	6.10^{-13}	1.3	$2.3.10^{-12}$	
			1.10^{-13}	2.5	$4.6.10^{-13}$	1.3^{-12}	2.7	
					12.4×10^{-5}	$5.1.10^{-5}$	3.38	

Onaxis again

i_c	5	10	15	20	25	30	35	40 μA
ions	6.2	7.0	8.6	$9.7.10^{-9}$	1.05	1.16	1.26	$1.38.10^{-8}$]
neutrals	4.0	5.3	6.3	6.9	7.6	8.7	9.5^{-12}	$1.1.10^{-11}$]
ratio	$6.45.10^{-4}$	7.57	7.33	7.11	7.23	7.5	7.53	7.97

$\frac{1}{1.4}\ 10^{-3}$

$\frac{2.3.10^{-12}}{7.3.10^{-9}} = \frac{1}{3}\ 10^{-3}$

Tentatively :-

Energetic neutral / hi energy photon content of beam $\simeq$ 0.1%, independent of angle (to 1st approx.)

Gas pressure in machine $\simeq 4.10^{-7}$ Torr. Ion gauge reading.

? scattering probability for Au^+ in $O_2/N_2/CO/CH_4$

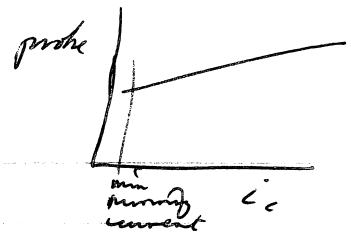
– probability $< 0.1\%$

so real Au neutrals ~~transmitted~~ (originating in source) $\leq 0.1\%$

→ calculate integrated vapour density, assuming σ.

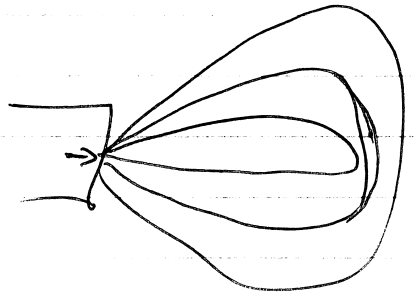
? Most common collision (? charge exchange, ionisation of neutral; ~~energy loss~~ momentum transfer)

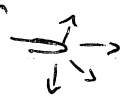
– estimate probabilities – re effect on energy distribution.



Probe current vs. i_c
& lifetime for neutrals

Probe current weak fn of angle, but $\angle$ depends on current drawn



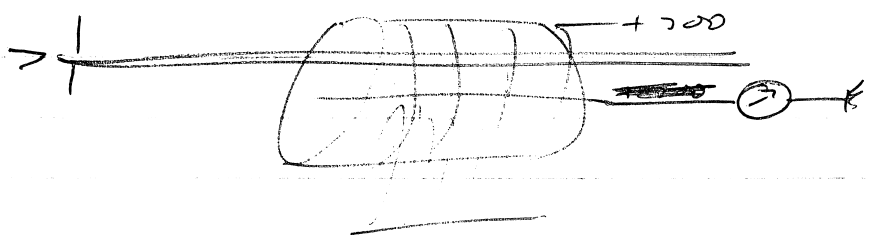
? what is distribution of slow neutrals (ie ? source a thermal source or a jet of some sort) [ or ]

? use electron current to ionize them — N_2 laser + N_a photocathode as in flash x ray tube in RSI 1977.

If neutrals are excited, is energy enough to produce electrons on multiplier cathode, & is lifetime long enough.

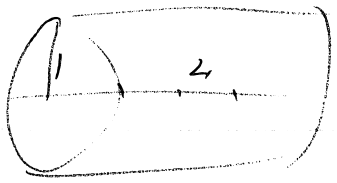
Gas light [near tip] suggests lifetime q. short ($<1\mu s$)
wavelength in visible (bluish) say 4 eV — low bkgd for W (+Au, Ge!) cathode probably.

? Ion gauge as collector



Beam in equiv of say $100\mu A = \frac{10^{-4}}{1.6\,10^{-19}}$ $6\,10^{14}$ atoms/sec.
velocity $= 10^3$ m/sec say $= 10^5$ cm/sec
i.e. N number/cm in beam $= 6\,10^9$.

? What is pressure with this number of atoms per cu cm volume.
At NTP, $6\,10^{23}$ atoms in 22.4 litres



1 Torr $\triangleq 10^{-3}$ Atm

$6\,10^{20}$ atoms in 22,420 cc

$= 3\,10^{16}$ atoms/cc at 1 Torr.

$\therefore$ $3\,10^{6}$ atoms/cc at 10^{-10} Torr.

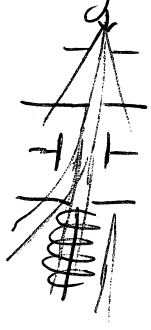
I-g volume $\triangleq \pi r^2 \cdot 3 \times 4$ cm long

If send beam through length of gauge, should get sensitivity equivt to $\triangleq \dfrac{6\,10^{9}}{3\,10^{6}} \dfrac{1}{3} \times 10^{-10} \triangleq \dfrac{2}{3}\,10^{-7}$ Torr.

for 100 μA — $I_1 = 6eV$, equivt to say H_2. (?)

for 10 μA $\triangleq 10^{-8}$ T, 1 μA 10^{-9} T

$\therefore$ Preferably use large slice of beam:-



Acc to Redhead et al, x-section & M.F.P in

	$\sigma_1 \times 10^{15}$	P Torr for $\lambda^* = 10$ cm
He	5.45	$1.05 * 10^{-3}$
Ne	15.4	8.9×10^{-4}
CO	47.3	5.3×10^{-4}
Ar	47.7	5.9×10^{-4}
O_2	44.1	5.8×10^{-4}

(Molecular scattering x-section)

$\therefore$ for $P = 4 \times 10^{-7}$, & $D = 80\text{ cm} = \lambda^* \times 8$,

$\dfrac{4 \times 10^{-7} \times 8}{6 \times 10^{-4} \times 8} \triangleq 5 \times 10^{-3}$ collision per $= .5\%$.

Assuming charge-exchange x-section similar (this will be somewhat lower for non resonant Ar/N_2 collisions)

$\therefore$ 0.1% neutrals (above) likely to be mostly due to residual crud,

$\therefore$ Check % neutrals as fn of residual gas pressure.

? P^n in Sudbrands apparatus = ?

Fri 10/6/80 Ahn

6 kV / ~~48~~ μA

Measure neutral current as function of background pressure in chamber

Multiplier – 1 kV ions → 1×10^{-8} A on multi-collector

neutrals → 9×10^{-12} A " " "

using bachoff on ion gauge

Increase P by baffling diff pump.

Pressure	2×10^{-7}	3	4	5	6.7	9	11	16	4×10^{-7}
Inertial	9×10^{-12}	8.7	8.7	9.0	9.7	9.5	8.9	9.4	9.5

4×10^{-7}	8×10^{-7}	12	16	20	24	28	32	36	40	44
9.5	9.6	9.8	9.9	10.2	10.5	10.7	11.1	11.2	11.5	11.7

~~48~~ 52	56	60	64	68	72	76	80
12.0	12.2	12.5	12.7	13.0	13.0	13.6	14.1	14.5

1×10^{-5}

84	88	92	96	100	→ 4×10^{-7}
14.8	15.1	15.3	16.0	16.3	10.8 reverse 9.8

$i_{ion} = 1.1 \times 10^{-8}$ A ($P = 2\times10^{-7}$ Torr)

1.42×10^{-8}

1.40×10^{-8}

Mean $= 1.307 \times 10^{-8}$

i_o

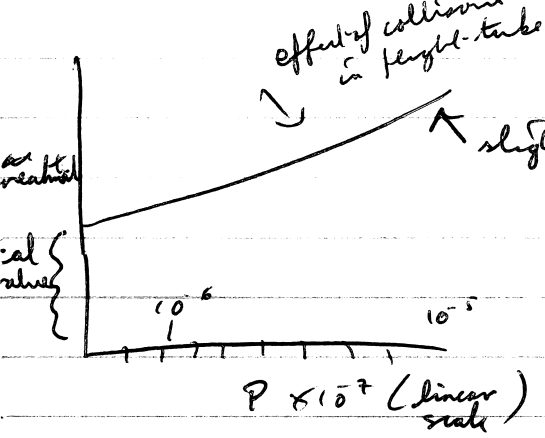
9.8×10^{-12}

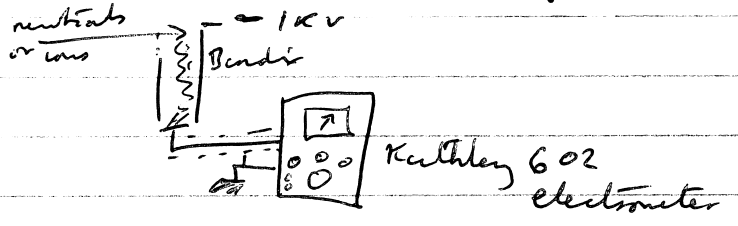
9.7×10^{-12}

9.8×10^{-12}

Mean $= 9.77 \times 10^{-12}$

$\therefore \frac{i_{neutral}}{i_{ion}} = 7.475 \times 10^{-4}$ i_o {photons & neutrals $\simeq .07\%$.





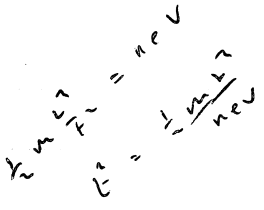
Mon 16

Continuing to try & sort out good layout for E-A.
Found J Physique Letters - Sudraud — see that
a) his source not stable at $i < 100\,\mu A$
b) ∴ spectrum broken at $\sim 100\,\mu A$.

? a) source operating as a sprayer - lots of droplets →
different propagation of ions in beam.
b) is Ar_3^+ double peak a function of i_c — ? how large
a current can be safely drawn from Cathion source.

Need to confirm that TOFMS capable of resolving the 6-energy peak (i.e take 2 spectra >100 v apart & check no instrumental losses of start of peaks).

Check also effect of amplifier threshold - suspect low threshold leads to broader peaks (? trigger on noise + tail of multiplier off?)



Tues 17th

3 10^{-7} while running source.

580 5·92 ± ·01 (drifting 18 μA scan
- set up so Au$^+$ not saturating amp ←
gate out Au^{++}, Au$^+$ after 2500 cons (+ increase current with × plates (ie 2x to mean))
total 7K5
voltage drop 18

581 6·13 ± ·01 40 μA ← also
gate out Au^{++} Au$^+$ after 2500 cns (+ increase current with × plates)
voltage drop 40

582 6·46 70 μA (current dropping sometimes to 60 μA)
gate out Au^{++} Au$^+$ after 2500 & increase signal slightly
[change tape at 3K] → 7K5
— suspect that av. transistors are mistriggering ↑ for 582 (— going with 2 possible delays) so repeat
1MΩ tip resistor → Vdrop = 70 → 60 v

ph camera lin amp, 6·46 / 65 μA
2 μS/cm ph NH fil 1

Au^{++}	+100 nS/cm	\{ ½, 1, 2, 5 + 2
Au$^+$	"	"
Au_2^+	"	"
Au_3^+	" , 200 nS/cm for last 2	" + 2 5 ? ?
Au_3^{2+}	+100 nS/cm	—

(reduce av to volt → slightly longer apparent flight times)

log amp 2 μS/cm
" " Au_3^+ / 200 nS/cm
Au_2^+ / " "
Au_3^{2+}
Au$^+$ / 100 nS/cm
Au^{++} / " , end of film

583 6·46 70 μA (60 to 70) gate out Au^{++}, Au$^+$ after 2K5 cons.

ph Mnfl [illegible] 2

5·91 20μA lin Amp 2μS/cm ×5sch ¼ ½ 1 2 (5)
+ Au^{++} 1·2μS/cm ½ 1 2 4
Au^{+} " "
Au_2^{+} " "
Au_3^{+} " "

6·35/70μA 2μS/cm
then Au^{++}
Au^{+} reduced gain
Au_2^{+}
Au_3^{+} 1·2μS/cm.

70μA Au^{+} at 6·35kV 2μS/cm] δV = 470 v
20 5·88 kV

6·35
5·88
·47

70 Au^{++} 6·33
18 5·87

70 Au_2^{+} 6·33 1

ph Mnfl [illegible] 3

70 Au_2^{+} 6·33
18 5·86

70 Au_3^{+} 6·33 ½ sec, 1 sec
20 5·83 1 sec

dig amp
Au_3^{+} 5·89 1 sec] ·46 kV
6·35

Au_2^{+} 6·35] ·47
5·88

Au_3^{2+} 5-88

6.07

All at ≈ 500Hz

5.89 $t_{\frac{1}{4}}$ ~10 @ Sn S/cm dig amp 20 μA

6.04 " " " " " 70 μA

Au^+ non saturated dig amp 70 μS

" lin amp

dig amp

Au_3^+ 10 dig .2/cm 70/6.06 kHz

20

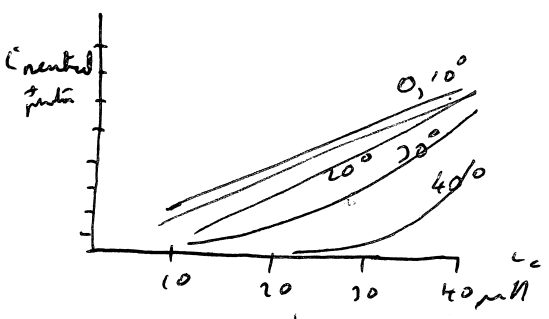
" 1,10 " " 20/5.88

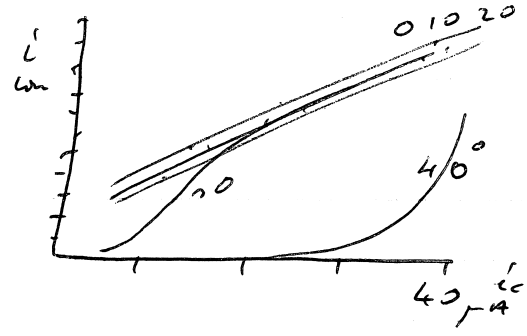
1 blank

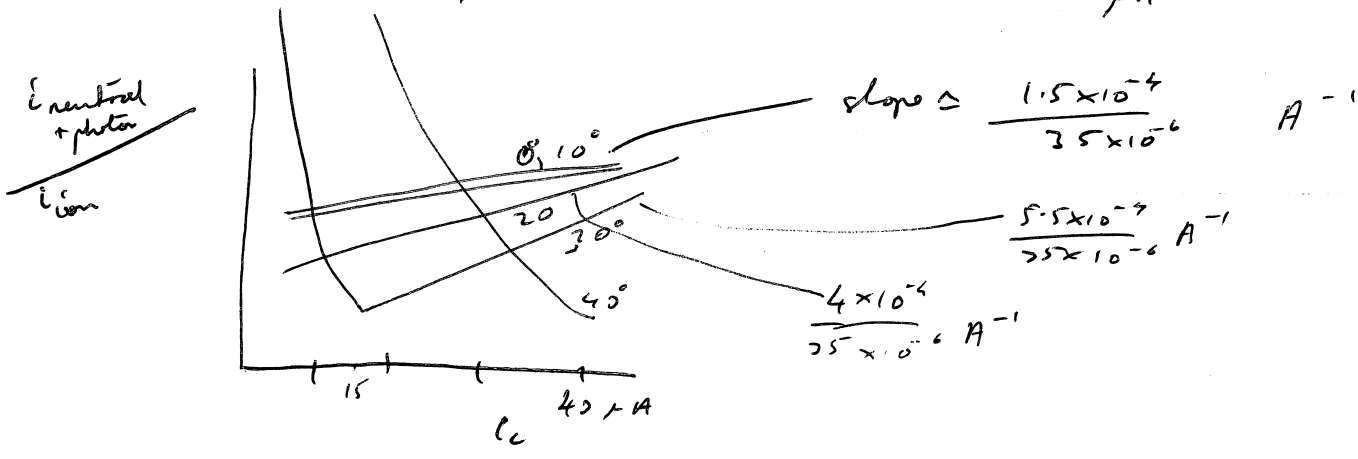
Oed

Plotting graphs etc.

		(wire drop in 1MΩ)	Ar^+ FWHM	Ar_2^+
580	20 μA	5.90 KV	52	~91
581	40 μA	6.09	~~53~~ 49	~190
583	70 μA	6.39	60	~236



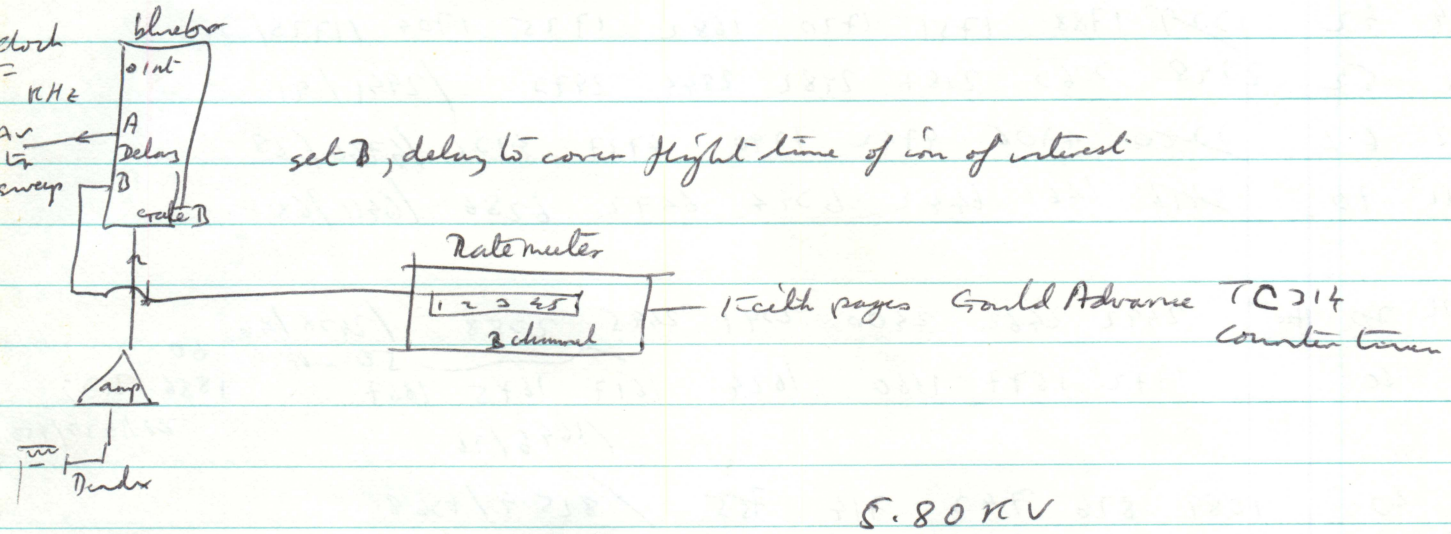




? If peaks in mass-spectrum broaden ~~etc~~ at 60 μA upwards,
no of collisions ? gently rising.
No of neutrals ∝ current density × neutral gas density
Neutral gas density = fn of temperature & metal transport in field, probably ∝ current.
∴ expect no of neutrals to increase more rapidly than current, & to be non-linear, tailing off at ~60 μA.
∴ H more to represent above for higher currents.

Thurs 19th June '80

Require no of eg Au_2^+ as fn of i_e



5.80 KV
24 μA

Au^+	$\frac{1}{2}$ KHz	Au^{++}	Au_3^{++}	Au_2^+	Noise	Au_3^+	Au^+	Au^{++}
596								
590		363	50	49	3	16	459	281
574		370	61	30	4	16	492	270
655		345	48	48	4	12	543	283
676		317	43	41	0	9	576	249
633		346	63	47	9	20	486	255
685	24 μA	342	36	47	8	12	498	301
685		357	42	37	2	16	527	264
666		345	44	38	8	6		
604		364	45	43	6	12		
611		349	40	32	5	9		
584		352	48	33	0	8		
614		340	52	34	6	14		
604		364	37	47	4	10		
650		276	45	47	5	7		
		331						
625 ± 24		344	47	41	4.7	12		
		±22	±8	±7	±2	±4		
59.1		32.3	4.00	3.43		.67		
1049								

i_c 24 μA /mean/σn/

Au+ 520 513 546 554 513 /529/17.4

5.72K 14 μA 222 210 241 217 242 /226/13

5.84 32 797 797 907 913 927 913 897 870 /877/49

5.94 42 ~~1329~~ 1788 1751 1720 1682 1725 1704 /1728/34

6.01 52 2798 3063 2987 2982 2844 2973 /2941/91

6.12 62 ~~3320~~ 4706 4742 4790 4727 4736 /4740/28

6.22 70 ~~5416~~ 6461 6442 6394 6472 6286 /6411/68

6.22 70 Au++ 2492 2462 2400 2391 2495 2388 /2438/46

60 1772 1677 1660 1624 1617 1675 1667 /1646/26 — 50 μA — 60 1886 2032 20/1930/150

40 1089 826 743 714 755 /825.4/136.8

30 487 452 428 444 411 /444.4/25.5

20 225 237 227 255 241 /237/10.8

10 106 112 91 89 105 /100.6/9.0

i_c	10	20	30	40	50	60	70
Au++ / Au+	.63	.58	.474	.50	.57	.447	.405

Move gun off axis (defl = 0 now)

68 70 μA Au+ 4209 4257 4218 4293 4133 /4222/54

59 [3170 3176 3010 2998 2483 /3067/87] not set up properly

50 3816 4004 4100 4234 4134 /4058/141

60 4341 4467 4443 4321 4413 /4397/57

40 3791 3696 3736 3745 3752 /3744/30

30 ~~2981~~ 3364 3373 3378 3411 3367 /3379/17

20 2949 2925 2908 2958 2972 /2942/23

10 2310 2328 2333 2385 2327 /2336/25

70 4225 4234 4160 4287 4141 /4209/53

60 4514 4623 4494 4609 4705 /4588

80 4015 4146 4134 4140 4141 /4136/64

5 2214 2095 2061 2101 2216 /2137/65

Au^{++}

i_e 80	1383	1302	1296	1327	1239	/1309/47			
70	1464	1454	1486	1447	1419	~~16~~1454/22			
mA 60	1629	1609	1601	1620	1532	1617	/1601/32		
50	1606	1565	1587	1605	1670	//1606 35			
40	1520	1620	1583	1627	1705	1620	1604	/1605/56	
30	1527	1523	1533	1534	1539	1563	/1536/12.9		
20	~~1389~~	1457	1425	1491	1504	1446	1511	/1472/32	
10	1252	1167	1253	1310	1242	1231	/1242/42		
5	1004	1012	1079	1026	1024	/1029/26			

Au^{++}/Au^{+}	5	10	20	30	40	50	60	70	80	i_e
	.48	.53	.50	.45	.42	.39	.36	.34	.32	

Au_2^{+} mA — longer gate time — 1-22

80	~~885~~ 778	790	781	817	/791		
70	726	834	923	838	856	/835/ 63	
60	766	781	786	751	/771/13		Noise 44 59 44 51 62
50	621	708	647	651	687	/662/ 31	
40	509	440	583	536	519	/523/ 25	
30	480	508	507	539	489	/505/ 20	Noise 23 19 21 16 21
20	410	418	410	433	431/	420/ 10	
10	328	298	330	328	327	/322/ 12	
5	203	244	264	264	230	/241/ 23	Noise 5 ~~32~~ 67 13 9 8 12

Au_3^{+} mA — gate wider

80	438	442	445	450	/444/ 5	
70	448	474	451	489	/466/ 17	Noise 74 80 71 68 69 88
60	342	453	463	421	/432/ 28	2nd set 57 57 47 46 46 37
50	418	384	426	358	411 /399/25	Noise 93 85 80 78 79
40	342	371	390	394	/375/ 22	2nd set 50 42 44 49 50 34 / 45
30	339	346	363	318	/342/ 16	Noise 60 74 64 50 68
20	310	318	311	319	/315/ 4	? 1st noise on tail of Au_3^{+}
10	300	230	287	274	(273) 26	
5	188	211	192	211	(201) 11	Noise 21 30 21 20 23/23

1×10^{-7} running

Gate narrower again

Au_3^{++} 80	261	241	230		/ 244/13	Noise	48	70	60	67	75		/ 64/9.3
70	226	209	200		/ 212/11								
60	157	168	181	186 188	/ 174/15	Noise	39	35	42	36			/ 38/3
50	169	171	168	189	/ 174/9								
40	138	142	134	117	/ 132/9								
30	127	113	122	98	/ 115/11	Noise	10	18	12	20	17	23	/ 16.6/4.5
20	64	87	96	86	/ 83/12								
10	78	62	59	67	/ 67/7								
5	53	57	66	60	/ 59/4	Noise	2	5	4	7	8		/ 5.2/2

Defl amp

set 80 µA × 400 s
60 "
40 "
20 "
10 "

~2.5 ns/cm usual.

Lin amp 10 µA secs
20
40
60
80 ↓

At 5µA	Au^{++}	Au^{+}	Au_2^{+}	Au_3^{+}
FWHM	~25 ns	50 ns	~100 ns	100-150
Start	25 ns	50 + tail	150-200	250

neutrals vs. i_c at higher currents than before :-

Mult⁻ -1KV

i_{ion} / i_c	5	10	20	30	40	50	60	70	80
10^{-7}	2.0	2.9	3.6	4.5	5.2	6.0	6.9	7.8	8.4
i_{mult}	1.8	2.4	3.1	~~4.4~~ 3.8	4.9	6.3	8.8	10^{12} 1.24	1.64×10^{-11}
	.78		.86		.9.4	1.05	1.27	1.58	1.95
	7.8×10^{4}	8.27	8.61	8.44	9.42	10.5	12.75	15.89	19.52

$\frac{10^{-9}}{10^{-12}} = 10^{3}$

Mult⁻ down to -900

i_{ion}	.85	~~1.5~~ 1.20 ~~3.4~~	1.47 ~~5.2~~	1.7 ~~8.26~~ 10^{-9}
i_{mult}	$2.5\,10^{-12}$	3.1	3.9	5.1×10^{-12}
~~ratio~~	1.9	2.1	3.0	4.8
	1.1			
		20.8	20.4	3.00 $\times10^{-4}$

Data from Graphs of i_{x+} vs i_c

i_c / μA	5	10	20	30	40	50	60	70	80
Ar^+	2130	2940	2950	3400	3780	4050	4220 / 4450	4280	4150
Ar^{++}	1050	1280	1440	1530	1600	1610	1600	1470	1260
Ar_2^+	250	320	400	480	550	630	700	770	700
Ar_3^+	180	250	285	310	330	360	380	400	350
Ar_3^{2+}	50	60	75	90	110	125	140	160	180
Total	3660	4300	5150	5810	6370	6775	7040 / 7270	7030	6640
Ar^+ %	58.2	55.2	57.28	58.52	59.34	59.78	59.94 / 61.2	60.17	62.50
Ar^{++}	28.7	29.6	27.96	27.77	25.11	23.76	22.73 / 22.00	20.91	18.98
Ar_2^+	6.83	7.19	7.77	8.26	8.63	9.30	9.94 / 9.67	10.95	10.54
Ar_3^+	4.92	5.77	5.53	5.34	5.18	5.31	5.40 / 5.23	5.69	5.27
Ar_3^{++}	1.37	1.19	1.46	1.54	1.73	1.85	1.99 / 1.93	2.28	2.71

Sundrands data, from graph in J Physique Letters

Species	Peak height (mm)		No, %	Mass, %
Au^+	54.2	882.4	68.22	55.13
Au^{++}	42.5	204.1	15.78	12.75
Au_2^+	39.3	136.7	$10.57 \times 2 = 21.14$	17.08
Au_3^+	30.0	42.7	$3.30 \times 3 = 9.9$	8.00
Au_4^+	16.3	7.69	$0.59 \times 4 = 2.36$	1.91
Au_5^+	15.8	7.22	$0.56 \times 5 = 2.80$	2.26
All_6^+	1.15	1.15	$0.09 \times 6 = .54$	.44
Au_7^+	1.14	1.15	$0.09 \times 7 = .63$	.51
Au_3^{++}	18.6	10.25	$0.79 \times 3 = 2.37$	1.92

$\times 10 = 18.4$ mm

$5.32 = \frac{Au^+}{Au^{++}}$

$4.17 = \frac{Au_3^+}{Au_3^{++}}$

$\log N = m + K^x$

$N = 10^{m+K^x} = 10^m \times 10^{K^x}$

$\log \text{limit} = 2\times10^{-2} \times \frac{i_c \times \log 9 - \log 2}{50\,mA} = .013\, i_c$

$\text{limit} = \frac{1}{.013\, i_c}$

$\log M$

$t = 2\pi \times 10^{-6} = 10^{-5}$

$w = \frac{1}{2\sqrt{L_c}} = 6\times10^{-5}$

$L_c = \frac{1}{36\times10^8}$

Fri $p = 2\,10^{-7}$ @ 20mA $\Rightarrow$ $3.9\,10^{-7}$ @ 80mA.

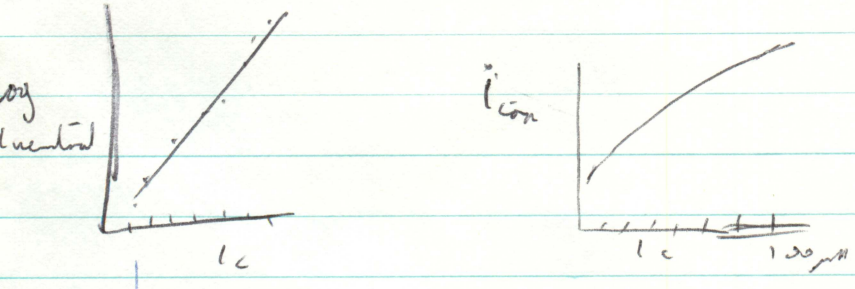
Repeat neutral measurements as fn of i_c : Multiplier = −1 kV

i_c	0	5	10	20	30	40	50	60	70	80	90	100
V		5.60	5.62	5.70	5.74	5.87	5.96	6.05	6.16	6.49	6.76	7.00
$i_{ion} \times 10^{-9}$		3.2	4.4	6.0	7.1	8.7	10.1	11.0	12.1	13.0	14.3	15.9
$i_{neutral} \times 10^{-12}$		2.3	2.8	3.7	4.6	6.2	8.4	11.6	16.2	23.2	33.5	44.0
ratio $\times 10^{-4}$		7.2	6.36	6.16	6.48	7.13	8.32	10.55	13.39	17.85	23.4	

Multiplier ~ −800 ✓ (? nonlinear gain)

	5	10	20	30	40	50	60	70	80	90	100
$10^{10} \times i_n$	9.	1.15	1.55	1.85	2.20	2.58	2.91	3.2	3.4	3.7	4.2
$10^{12} \times i_{neut}$			2.5	2.8	3.3	3.7	4.6	5.7	8.2	10.5	13.6
									7.7		
ratio $\times 10^{-4}$			16.1	15.1	15	14.34	15.8	17.8	23.5	28.4	32.4

unreliable $i_{neutral}$



$\Rightarrow$ as neutral current $\propto e^{ki_c}$, pulsing emitter should make perceptible increase in no of neutrals.

∴ no pulser + TOF should show quantum, giving due to energy spread of neutrals & existence of eg neutral clusters Ar$_n$?

Mon 30 June 80

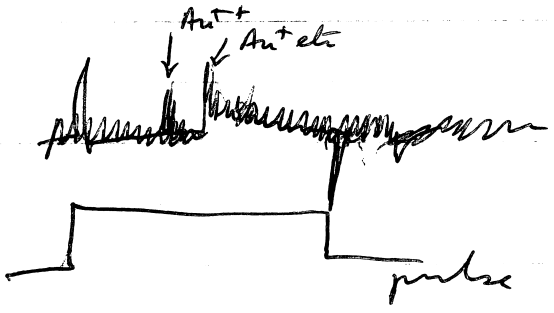
Ion source
pulser connected

Optics

ph Multiplier **1**

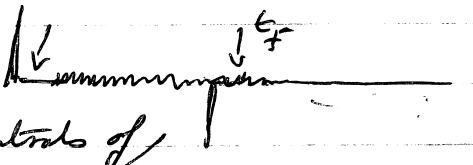
5.69KV 25μA +3KV 70μS pulse (!)

Lin amp .05×10 v/cm, 10μS/cm 1, ½, ¼, 2, 1, ½, ¼ (≃)

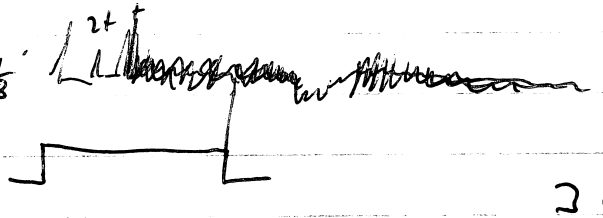


Trace 2a

deflection slightly ¼ ½ 1 2 4 — lose noise before & after pulse
" on full 4, 1, ½ — noise

→ 20μS/cm 50% of noise 

— ie noise due to neutrals of
high energy



20μS/cm, deflection off 1 — ⅛

50μS/cm 1 — ⅛ " "

deflons on ½ — 1

" " 1 ½ ½, with multiplier ↑ — 2.3KV (increased gain)

3×10^{-7} Torr background, typ ion.

ph Multiplier **2**

¼, ½, 1 deflection off 10μS/cm 3KV pulse, 5.67KV / 30μA.

1 ½ ¼ " " 2KV pulse "

¼ ½ 1 " " 1KV pulse " ↑ +1.8

1 ½ ¼ " 20μS/cm 1 KV " " → +4

¼ ½ 1 2 " "

1 ½ ¼ 3 " "

blank

1 ½ ¼ ½	pulsed? kV	20 μA	5-66 KV	deflectors on
1 ½ ½ ¾	"	40	5-79	— neutrals
1 ½ ¼ "	"	60	5-94	

1 sec	20 μA	deflectors off.
"	40	
"	60	
½	20	
"	40	
"	60	
¼	20	
"	40	
"	60	

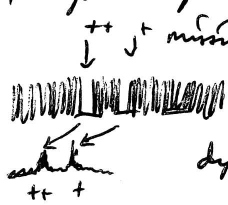
1

½ sec — source off — transients.

(↑ ✱)

— previously, pulsing source with nS pulses (D...) could see ions due to pulse — narrower energy spread than with Ga/capacitor pulser

i.e. ++ + missing ions



noise level, lin amp, with pulser on,

deflectors on, got noisy spectrum.

However, could not detect any sign of fast neutrals due to the pulse.

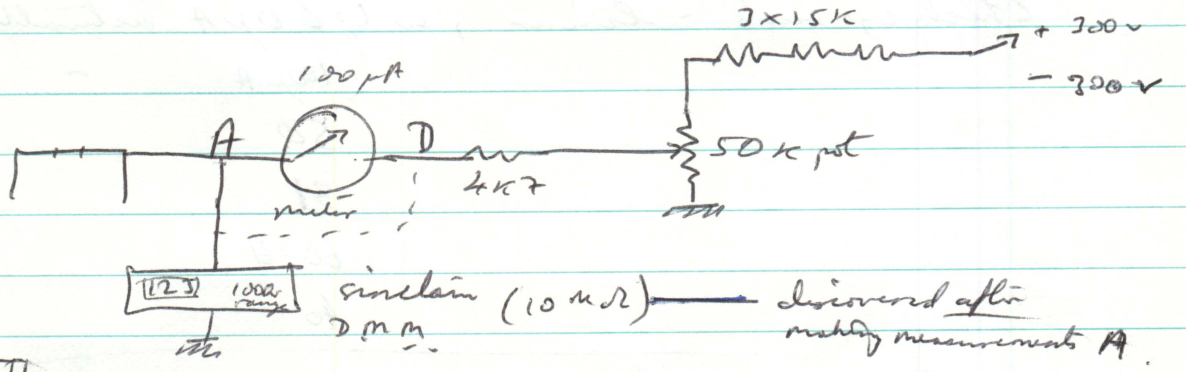
5

Tues 1 July

Arc Source

Effect of biasing the collector to suppress 2° electrons

Circuit



nominal – getting

i_c 30 μA 6·10 KV

V_B	i_c A	B	V_D	A	B
0	30	30	0	29	
+5	29		-5		
10	29	30	-10	32	
20	~~24~~ 26	29	-15	34	
30	~~25~~		-20		
			-25	35	
			-30		
40	25	29	-40	35	30
50			-50	36	
60	22	29	-60	38	
70			-70		
80	20	28·5	-80	38	
90			-90		
100	18	"	-100	41	31
120	16	28·2	-120	43	31·5
140	14	28	-140	45	32
150	12		-150		
			-160	46	

With DMM in position B ±150 v produces ± 2 μA at mean i_c of 30 μA

Position A, DMM current (10 MΩ in pz) = $\frac{150}{10}$ = 15 μA.

(Ie ignore readings at A, as meter crossing!)

Conclusion :- biasing collector makes sfa difference to i_c

? Check Graham Mustard thesis for power of meter ($10\,k\Omega/V \times 1\,kV = 10\,M\Omega$)

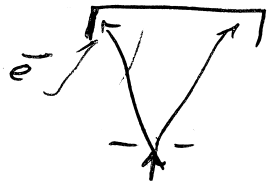
? surprising inconsistency to $V_{collector}$ – why ? cos not nearly 4π solid angle

Check cgs scale – not quite linear, so $i_c = 60\,\mu A$ actually $\simeq 55\,\mu A$.

$100\,\mu A$	$\simeq$ ~~82~~ 88–89
50	46–47
89	73
60–61	56
40	37

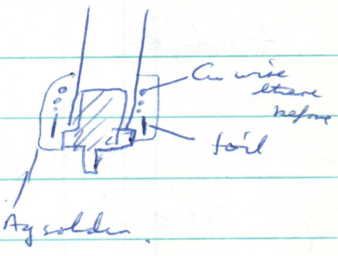
$V_c = 450\,V$

– beam spreading at high i_c

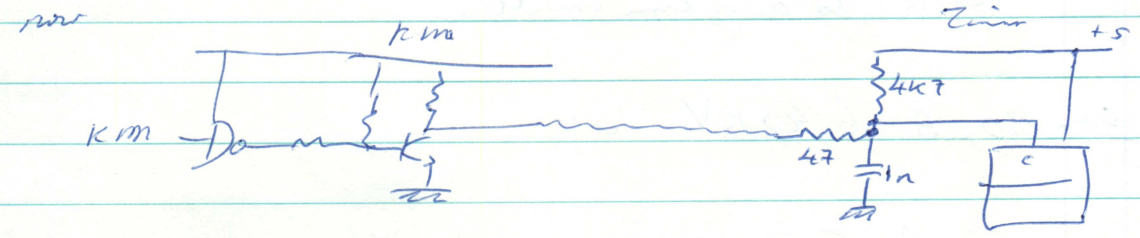


Dad, thanks

fiddling with leaky comparator on IAF again + bake again
- crystal now cleaved with s-s foil



Checking performance of Culham timer
- check phase-lock circuit, OK now.
- slug reset line with capacitor to try to get timer to reset properly - don't quite understand how it manages not to.



- fix KIM prog (12+20) so error in DIVBCT subroutine jumps to BTIMClear, not KIM keyboard routine
- put delay ('SCANS') between reading BTIMFLAG = 1 & reading data

Timer needs to run thro slug but still to minimise jitter from av. transition - delay is ~200 nS (min) 300 nS (max) depending on sig of av. tr. volts

Fri
4 July '80

Ar source

Multiplier at ~2.2kV to get ~100% sensitivity for single ions (eg Ar_1^+)

3×10^{-7} 26 μA with biased collector +150 − 5.73 kV

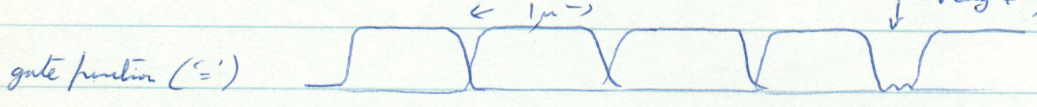
T584, scan, lip moved slightly off centre to reduce saturation of Ar_1^+
~11K, so delay time small.

585 scan 80 μA 6.40 kV 10K

586 50 μA 5.91 kV ~10K — jitter on pulse ~ 5 nS. (must reduce charge Q)
shunt

Spectra show a) Ar^{++} peak v sharp in all
b) Ar^+ peak now has a washed tail extending over ~1 μS
t = 11 μS, so $\Delta E \sim \frac{2T}{t} E = \frac{2 \times 1}{11} \times 6000 \simeq 1200$ v.
However, tail is negligible (<1%) for 26 μA spectrum, ≳3% for 50 μA
~5% (but partly in noise) for 80 μA spectrum.

Spectra show some artifacts, traced to the scan mode of the timer

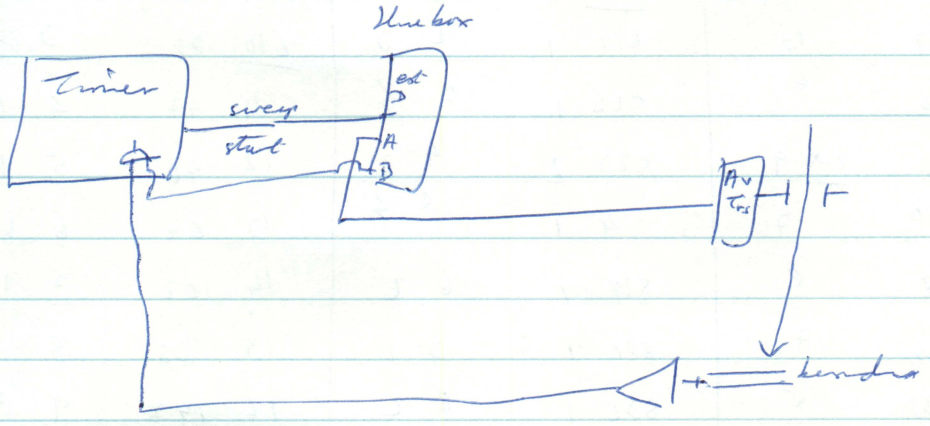


— probably due to non synchronous (7490) counters
— replace by 74190 or 74162 or similar
— alternatively, gate the multiplier o/p via the blue box, to record 1 peak at a time — probably a better way of looking at peak shapes

? also must check that transients aren't making timer prone to stop (or not stop) at certain times.

Curious peak observed on 80 μA spectrum, & first visible on others, at t = ~5 μS, corresponding to ? Ar^{4+}, Ag^{++}, or what? (? C^+, N_2^+ from signal lead material)

Mon Modify timer to allow detector signal to be gated by blue box
Write KIM program to put line spectrum into data store, rapidly,
to allow gathering of TOF data on peak shapes at hi speed.



Should diminish scan errors

Tues 8th July

~ 100/sec.

Ar^+ 20 μA
5.6 kV

128	1	161	189	194	9		
129	3		130		5		
130	3		92		7		
131	3		65		5		
132	6		57		10		
133	5		50		6		
134	4		41	200	9		
135	4		30		7		
65			18		8		
77		170	24		7		
85			33		5		
10.40 μs			23		8	7	
98			19		6		
140	8		20		3		
1	7		20		3		
2	8		15		8		
3	14		24	210	2		
4	14		23		5		
5	16		21		5		
6	27						
7	111	180	17				
8	406		9				
9	1100		8				
150	2177		9				
51	2800		15				
	3103		8				
	2700		14				
	1890		14				
	1254		15				
	877		11				
	628	190	10				
	411		11				
	355		7				
160	227		6				

~ 70 sec

7.98 μs Ar^{++}

2798	1	858	4
9	1	9	1
800	1	860	2
806	1	1	1
819	1	2	3
822	1	3	4
823	1	4	2
4	1	5	4
828	1	6	2
831	1	7	1
832	1	8	2
4	1	9	3
836	13	871	2
837	166	4	4
8	1000	6	2
9	3028	7	1
840	5107	8	2
1	4799	9	1
2	2764	890	1
3	1201	2	3
4	484	5	1
5	156	7	1
6	57		
7	24		
8	18		
9	14		
850	8		
1	6		
2	16		
3	6		
4	6		
5	7		
857	2		

Increase signal a little

Ar_2^+ ~ 60/sec

16.06 μs

606	2	639	372	677	3		
7	10	640	298		32		
8	24	1	238		33		
9	35	2	176		16		
610	24	3	209		20		
11	47	4	141		23		
12	46	5	128		28		
13	67	6	126		19		
14	102	7	117	680	22		
15	138	8	80		15		
16	147	9	91		19		
17	290	650	87		34		
18	472		85		15		
19	535		67		20		
620	681		58		17		
1	670		63		14		
2	765		57		13		
3	779		64		10		
4	772		40	690	15		
5	749		44		15		
6	783		47		14		
7	837	660	41		11		
8	817		43		10		
9	848		45		12		
630	814		35	696	8		
1	781		40	700	1		
2	763		40				
3	757		22				
4	729		26				
5	639		27				
6	533		34				
7	446	6702					
8	424		27				

20,000 ns ~50/sec Ar$_3^+$ + alkali... = 10.24 + 974 = 19.98 μs (19.74 μs) less 200ns delay = 19.96

increase signal more ~60/sec Ar$_3^{++}$

0	130	33	38	974	15	1007	478	366	2	399	1210	433	13
1	110		40		19		586	7	3	400	1025		11
	123		34		27		418	8	7		790		11
	144		36		42	1010	419	9	17		676		8
	107		33		50		316	370	15		546		9
	117		26		80		328	1	23		495		11
	99		38	980	113		281		15		443		8
	85	40	39		111		260		26		427		14
	97		36		123		242		16		334	440	11
	84		37		156		236		19		288		3
10	82		35		181		227		20		235		13
	84		29		181		181		25	410	174		13
	92		38		191		192		18		127		13
	73		32		223	1020	170		32		84		5
	71		20		239		143	380	20		96		9
	91		31		277		138		29		65		9
	76		35	990	321	0	142		24		38		9
	50	50	25		323	1	130		30		43		11
	59		17		375	~~700~~ × ~~6000~~ ~~20000~~ 58			32		22	450	7
	61		8		436				34		14		11
20	65		10		429				33		18		5
	49	54	2		536				72	420	18		5
	46	57	1		527				103		22		12
	48	wrap around			572				190		19		14
	51	965	1		646			390	410		11		9
	44	6	2		622				580		15		5
	53	7	8	1000	654				956		13		2
	57	8	5		621				1261		14		1
	44	9	8		676.				1456		8		
	40	970	16		707				1592		9		
30	31	1	8		618				1550		10		
	39	2	8		564				1450	430	14		
	45	3	11		533				1398		14		

lunchtime

After lunch
Repeat Au+ peak
5.62 KV 21 μA
~58/sec – slower

120 1
122 3
124 1
125 4
6 1
7 2
8 1
9 2
130 3
1 3
2 4
1
6
2
2
6
6
4
140 10
7
16
12
9
7
12
21
48
172
150 319
1159
2170
2702
2712

155 2048
1575
1052
768
681
160 501
349
303
242
168
152
120
93
82
58
170 56
58
46
44
46
37
38
28
42
38
180 35
30
34
31
28
21
34
24

188 25
27
190 17
27
19
15
16
19
20
14
14
14
200 16
9
16
9
13
10
13
11
11
7
210 13
10
12
8
12
8
6
3
6
13
220 7

221 4
8
10
6
5
8
10
5
6
230 8
4
9
2
4
8
7
2
4
5
240 7
3
8
5
5
4

Au+ 20 μA
3rd run ~40/sec

120 2
1 3
2 2
3 1
4 2
5 7
4
1
4
1
130 5
5
3
4
4
2
6
5
4
6
140 7
15
13
11
11
5
13
20
66
239
150 651
1341
2155

153 2595
2428
1886
1401
973
748
625
160 483
390
311
259
175
132
122
96
95
65
170 71
63
66
60
59
58
59
49
48
45
180 43
39
47
33
30
32

186 25
30
30
28
190 25
21
18
33
26
19
22
24
18
15
19
17
21
14
19
22
9
11
14
10
210 11
14
13
16
6
10
16
8
12

11
220 6
8
7
16
9
7
7
4
10
230 9
11
12
~~10~~ 8
9
4
6
7
5
240 9
7
7
11
8
5
2
1

96 μA
6-34 KV
Ar^+ ~ 45/sec

– possibly bringing one of peaks ↙

95

88 μA
6-31
Ar^+
slightly faster
~ 80/sec.

repeat,

1	88/203	120/104	119	74	76	39	43	21	20	105	140/119	65	50	33
3	232	94	122	85	64	250/68	47	31	18	100	92	68	45	37
6	177	112	126	89	82	49	45	27	11	105	114	64	57	30
8	187	105	122	119	82	49	39	26	4	107	89	46	42	21
5	180	94	128	98	63	67	27	21	80/29	101	100	66	47	240/34
4	171	98	120	85	84	45	35	28	32	102	89	64	45	26
5	135	123	128	190/96	68	52	40	220/36	56	100	115	58	210/43	33
3	139	105	120	89	68	45	33	13	107	83	86	73	32	28
12	118	107	160/135	76	65	38	45	7	178	90	103	170/67	31	30
5	107	129	96	84	54	51	39	2	281	102	85	54	57	31
7	92	130/126	110	87	57	46	36	542	387	114	150/102	59	46	35
6	83	108	110	99	61	260/54	26	3	483	111	78	61	48	37
5	87	119	140	85	65	46	41	7	663	120/99	82	52	56	27
8	61	119	100	99	220/79	40	35	5	676	101	69	66	42	29
9/6	54	120	102	69	65	39	17	14	675	98	92	49	34	250/25
4	69	113	90	82	61	57	38	13	678	116	85	46	39	34
11	89	127	114	200/80	70	50	25	60/11	588	100	96	60	220/34	27
5	94	128	116	73	59	45	28	15	456	102	75	50	32	19
6	82	106	130/131	90	56	49	300/45	15	480	117	76	190/50	29	22
11	66	141	96	73	63	38	44	15	352	106	67	60	38	22
12	64	140/129	99	68	37	52	23	11	270	102	160/75	46	31	25
8	74	118	102	67	67	270/36	32	14	245	104	79	50	45	11
10	87	120	108	76	58	43	31	6	181	105	91	54	32	21
11	71	135	102	82	240/65	36	34	10	181	100	80	42	25	16
23	82	132	91	73	66	34	40	8	100/146	111	80	60	35	260/31
20	66	142	104	210/71	53	41	26	6	133	101	88	57	32	19
33	84	128	92	200/70	57	39	28	11	134	79	61	46	220/42	32
63	81	128	107	70/64	55	38	37	13	103	115	71	47	25	22
82	91	115	100	213/90	44	34	210/54	12	135	105	65	200/54	43	22
94	97	141	103	79	46	39	29	7	110	114	79	57	40	23
145	79	150/114	115	83	54	41	28	12	87	106	170/63	48	32	24
77	80	115	84	67	61	250/34	36	5	92	86	61	48	30	25

Au^{++} ~30/sec

6-26
88 μA

~55/sec
87 μA
6-24
Au^{+}

Au_3^{+}

6-26
88 μA

Au_3^{+} repeat
6-30
92 μA

760 5	2414	26	498 1	202	166	73	630 30	10	837 1	870 296	230	87	24	21	21	716	40
6	3229	27	2	270	156	70	33	20	7	273	220	93	970 47	25	27	726	410
8	2527	35	500 6	357	145	55	26	21	8	231	232	73	41	20	860 29	724	434
9	2791	830 33	10	389	174	600 61	24	9	840 9	209	214	72	29	26	30	673	415
6	1743	39	9	460	132	43	43	16	14	244	202	940 80	42	15	24	672	390
9	965	29	15	561	135	48	26	18	15	232	196	53	24	27	22	678	354
5	500 482	20	9	577	570 145	63	24	13	18	203	195	65	37	17	29	609	* 371
8	268	30	12	543	115	47	29	22	15	227	910 231	61	26	21	22	626	346
12	155	25	16	616	115	55	28	16	13	231	171	45	36	26	25	617	352
8	93	21	11	570 619	143	39	30	24	11	216	201	65	34	23	29	600 605	348
770 9	93	27	8	525	113	43	640 31	16	13	208	170	81	38	12	29	604	314
10	54	24	14	561	105	42	25	6	11	226	179	47	980 29	3	24	582	343
8	45	21	570 17	542	113	47	25	2	4	281	158	64	35	1	830 41	563	300
9	41	840 21	18	443	97	54	22		850 19	284	154	950 47	41	838 4	26	532	321
8	59	17	16	461	107	30	23		16	277	154	950 59	38	14	52	524	305
11	48	19	14	429	88	41	23		14	246	154	62	25	22	54	573	308
5	54	15	13	435	580 103	40	24		21	296	161	53	35	14	59	584	255
14	53	21	22	355	84	37	18		11	297	920 142	47	33	25	88	557	245
9	34	17	15	344	77	38	18		20	264	157	55	33	4	89	539	240
780 7	41	12	14	367	79	41	25		24	267	136	57	37	21	115	* 520	261
8	50	13	15	301	94	37	16		36	840 244	115	45	26	15	157	515	231
9	40	8	24	339	74	43	23		31	253	130	56	31	25	192	500	221
2	48	6	540 26	299	78	37	20		45	267	94	39	22	22	* 212	538	233
11	43	850 1	29	294	57	620 39	21		860 51	237	102	43	24	21	283	475	232
11	43		24	238	71	32	30		59	244	119	960 57	19	21	346	495	228
11	45		32	233	81	41	22		78	217	95	43	30	830 18	412	575	231
7	820 37		45	264	74	34	23		126	254	94	24	22	18	452	484	950 199
7	32		38	211	71	32	22		132	240	970 78	50	22	20	440	495	186
7	23		60	229	57	26	18		175	251	100	33	35	25	516	449	180
740 14	36		81	560 203	69	38	26		171	185	89	41	23	23	592	* 457	194
68	42		112	172	57	31	660 21		210	900 247	94	37	31	25	578	422	172
240	36		109	174	60	31	20		229	228	68	40	1000 28	22	643	433	146
1172	28		570 182	203	72	26	19		285	222	77	24	29	26	* 674	462	186

5.57
21, A

162	74
155	77
134	81
133	72
129	97
154	81
128	61
145	80
129	85
120	65
117	59
127	56
133	71
127	75
103	69
116	62
122	61
101	72
89	68
94	59
104	62
97	63
99	62
98	79
86	31
115	5
83	
103	
100	
98	
76	
15	
97	

9 July 80 Au source — fixed sweep generator (inadvertently shorted base of DU105) so sweep was ✓ yesterday — data OK this I think. Now ✓ as should be

Au^+ 60μA 5.080 kV ~40/sec				Au^{++} 60μA 5.80kV ~40/sec seconds.		Au_2^+						Au_3^+ 60μA 5.75 kV		
115 2	960	61	20	507	2	24	650	108	26	720 17	153	60 50	33
8	685	× 51	14	241	× 3	29	571	105	43	8	166	50	27
10	493	45	13	124	3	24	584	111	28	14	162	57	21
8	150 425	46	8	× 67	1	29	620	122	37	9	151	64	23
5	342	38	6	42	2	28	667	× 115	41	6	128	50	27
120 7	326	41	14	20	4	40	658	85	33	784	119	54	27
13	258	38	9	19	2	50	× 644	111	29	751	135	58	18
11	204	30	8	15	1	40	544	91	26	705	116	58	20
13	177	27	11	10	1	600 48	596	84	28	647	115	46	100 26
9	164	46	13	7	0	43	598	97	24	619	116	38	19
19	152	37	12	6	2	50	555	73	29	605	107	× 41	17
17	131	44	12	7	× 2	73	558	101	20	490	127	36	30
16	96	37	4	7	2	74	484	84	× 700 26	510	× 82	41	20
18	× 121	35	9	850 2	1	104	505	81	22	452	101	41	25
14	93	34	2	5		111	459	× 69	21	442	90	32	16
18	86	29	7	6	575 1	136	447	66	23	404	91	33	18
22	90	26	1	8	2	196	× 402	68	26	366	86	45	25
20	82	30		5	9	267	310	68	23	356	99	31	5
14	90	25	810 2	2	16	× 431	314	55	14	349	107	41	22
17	73	19	814 1	2	11	521	289	59	21	304	99	41	16
21	74	24	819 2	7	580 20	758	255	62	14	288	85	× 43	16
39	49	120 27	825 2	5	19	992	230	68	22	270	95	20	12
81	64	12	827 3	1	14	1103	272	66	14	248	× 88	49	18
196	× 52	20	828 23	× 5	20	1186	194	46	16	249	90	38	17
417	65	27	133	4	14	1222	197	× 54	25	× 217	88	34	25
149 840	53	26	830 619	3	20	1203	199	43	16	220	71	30	16
1342	52	16	1938	1	19	1081	211	54	17	190	74	29	17
1833	52	17	3818	7	33	1011	141	40	10	216	60	23	13
2051	58	16	4550	2	25	× 886	146	39	10	183	58	28	× 9
2011	57	8	3689	4	25	723	150	46	14	183	77	28	16
1677	44	16	1958	2	× 24	625	122	50	12	160	63	× 23	15
1389	60	> 13	1138	1	27	665	117	34	9	146	54	28	21

	doublepeak (!*) ↓	A	B	Ar_3^+ (Cayenne!) 5.53 kV 24 μA				repeat 6.2 μA Ar_3^+ 5.76 kV					C	
5	886	1075	218	62	28	18	11	1067	90	31	924 1	12	456	200
7	888	1066	229	51	25	16	8	1045	72	46	2	34	486	192
[illegible]	983	1008	202	58	24	21	14	1218	73	40	2	38	555	181
	917	925	223	57	33	13	990 9	1293	65	39	10	960 42	549	
	887	873	169	54	29	22	9	1338	99	34	10	56	399	
	990 868	859	175	52	27	13	12		74	34	6	62	604	
	741	803	131	48	23	12	12	192	57	36	3	106	622	
3	694	784	169	61	29	13	21	187	60	36	8	173	665	
	655	1338	163	59	27	11	14	178	52	29	10	157	649	
2	594	1307	155	57	20	9	24	163	68	25	7	216	647	
2	616	1053	144	47	20	12	37	151	59	31	3	257	1000 707	
8	607	1014	140	40	25	14	46	157	64	34	7	297	600	
	580	1311	126	52	20	12	58	147	55	29	3	372	643	
	581	1251	117	49	27	16	68	134	56	33	8	399	645	
	656	1245	121	51	29	17	103	129	55	31	13	424	694	
	1000 714	1055	116	42	21	11	130	96	60	25	9	457	627	
	666	1045	103	48	20	16	170	105	67	24	7	473	640	
	731	957	118	49	32	6	188	116	46	33	7	448	559	
	782	870	101	45	27	1	215	109	52	23	4	417	558	
1	841	814	101	41	32	282 1	234	126	51	26	2	397	503	
3	870	780	76	41	21	[illegible]	296	127	49	23	8	426	531	
4	928	673	83	37	18	975 5	294	104	57	28	8	392	449	
02	956	600	85	33	18	3	327	104	53	23	14	339	410	
70	992	548	93	34	29	5	452	96	49	27	6	326	405	
12	1032	519	80	29	17	6	369	81	59	19	4	330	366	
72	1090	437	50 62	43	25	3	453	77	48	21	7	315	360	
205	1006	397	71	31	24	980 8	575	103	50	19	9	317	334	
283	1154	344	82	38	24	10	575	79	43	24	6	367	336	
409	1123	336	77	28	24	9	670	75	46	25	19	353	306	
488	1108	301	66	27	18	8	733	83	42	22	8	392	258	
616	1063	271	73	35	18	4	811	74	42	17	8	372	241	
752	1099	279	81	25	23	5	893	94	45	15	12	421	224	
750	1131	257	61	35	25	9	936	80	41	10	14	443	230	

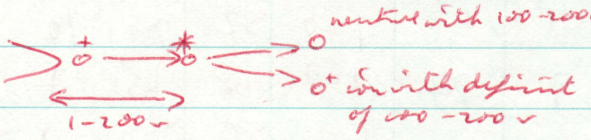
briefly

Phil Prewett & Steve Thompson visiting – discussing neutrals, pulsing, tip etc.

Apparatus was messed around between taking spectra A & B, to fit pulser, look at neutrals etc. – didn't notice double Ar_3^+ peak till afternoon. Reset up apparatus, take new spectra Ar_3^+ 20 μA not 2 peaks, Ar_3^+ 60 μA 2 peaks. ? – Why not 2 peaks at 80 μA yesterday ? Pulser checked looks stable. Apparently something drastic happens to peak at ~ 45 μA – check tomorrow.

Steve pointed out that neutrals should be ~ 100 eV energy

i.e.



So my ~ energetic neutrals must be formed far from tip.

Au^{++} Peaks	20 μA	60 μA	88 μA
	5.64	5.80 KV	6.36
− 1MΩ v drop	5.62	5.74	6.27
Time channel at peak	840	833	796

$$t_1^2 = \frac{K}{V_1} \qquad (t_1-\Delta)^2 = \frac{K}{V_1} \qquad (t_2-\Delta)^2 = \frac{K}{V_2}$$

$$\therefore \frac{t_1-\Delta}{t_2-\Delta} = \sqrt{\frac{V_2}{V_1}} = k \qquad t_1-\Delta = k(t_2-\Delta) = kt_2 - k\Delta$$

$$\Delta(k-1) = k\{t_2 - t_1\}$$

$$\Delta = \frac{kt_2 - t_1}{k-1}$$

$$= \frac{\left(\frac{6.27}{5.62}\right)^{\frac{1}{2}} \times 796 - 840}{\left(\frac{6.27}{5.62}\right)^{\frac{1}{2}} - 1} = \frac{.772}{.0562}$$

$$= 13.75$$

Au_3^+	KV	5.53	5.64	6.30	5.76	
	i	24	20	92	62	
peak		1025	1000	892	983	1000
peak + 1024		2049	2024	1916	2007	2024
−13		2036	2011	1907	1994	2011
V real		5.51	5.62	6.21	5.70	5.70

2014

10 July 80

Au_3^+ 5.61kV, 35 µA

669	147	52	27	926 2	11	20	630	775	602	47	26	962 2	28						
688	114	61	38	3	6	48	719	361	83	52	22	3	47						
655	128	58	27	8	18	24	627	324	68	44	22	7	47						
670	110	63	35	4	960 10	57	697	290	78	51	33	11	71						
605	99	55	31	930 5	8	66	768	254	96	44	26	8	89						
622	112	60	31	9	11	87	669	257	84	30	18	10	102						
645	91	48	38	10	9	123		259	94	39	27	11	141						
516	95	47	39	11	15	113	Hist	232	71	44	29	12	1750						
498	107	40	28	9	13	150	unstable (<20 V)	195	58	47	19	779 13	198						
496	105	51	34	10	9	191	Hg line with α-series or rem	173	60	40	20	6	(9)						
413	97	55	26	11	10	199		204	60	24	30	14	239						
458	102	46	26	5	14	185	Hund	208	77	31	20	7	220						
373	96	40	25	5	19	1000 229		500	179	61	32	28	8	244					
350	89	39	25	10	8	230	495	158	57	33	21	11	272						
352	73	42	29	7	4	242	528	149	53	35	26	11	284						
325	82	42	25	3	8	276	570	150	62	36	18	6	266						
277	87	50	29	12	9	251	579	122	52	33	31	11	217						
241	92	45	31	10	4	257	618	140	52	40	24	9	257						
223	80	49	28	9	16	256	616	121	52	30	25	16	226						
248	81	44	26	10	8	296	563	116	57	100 35 70	26	13	250						
216	69	42	24	14	9	304	542	122	48		29	10	244						
221	68	38	31	7	16	320	609	130	53	33	11	10	241						
203	63	43	22	11	10	358	502	115	62	42	22	14	233						
192	69	45	22	14	13	368	568	101	60	25	27	12	258						
160	80	41	16	11	12	415	529	101	50	28	23	11	292						
162	70	48	12	6	8	492	465	102	45	27	22	8	357						
160	66	44	4	11	13	502	487	86	45	24	30	18	362						
138	63	38	4	8	13	491	469	112	52	28	23	18	411						
128	63	39	1	9	17	529	425	96	46	27	29	14	410						
156	60	39		13	19	650	365	96	42	29	23	19	452						
141	59	38		16	16	650	385	90	45	27	25	27	452						

Au_3^+, 45 µA 5.59kV

500

Am+
5.60
55

Am+
5.71
65

46	135	70	23	29	14	974 7	274	409	84	46	30	23	13	18	289	383 409
56	136	58	26	26	13	7	243	370	92	40	26	17	28	14	308	
50	112	63	26	20	14	8	234	353	82	31	27	28	24	18	258	
29	130	55	51	27	19	10	273	339	96	54	32	26	19	21	286	
97	116	62	25	16	20	9	286	309	73	55	40	24	16	13	287	
513	109	43	35	27	*20	20	*271	320	85	50	27	22	*20	15	286	
549	82	41	41	*22	24	980 17	274	295	85	54	28	20	12	20	302	
55	109	49	35	22	16	20	270	263	88	61	*30	17	15	24	339	
497	104	*44	32	29	17	25	365	259	88	41	30	26	18	17	1.000 716	
498	101	52	25	16	14	30	375	247	*88	55	29	23	19	970 29	357	
442	94	49	24	20	16	29	387	224	74	40	32	22	19	29	344	
490	74	41	25	23	17	36	448	197	61	51	20	28	19	29	372	
493	92	42	29	22	21	53	407	205	69	28	35	27	17	53	371	
445	76	55	35	23	15	63	476	205	66	50	29	22	17	63	407	
505	95	48	34	26	14	87	450	181	86	32	29	21	15	89	419	
507	78	36	25	12	12	83	*548	168	65	24	31	24	*18	104	444	
499	72	40	23	*29	13	990 139	475	185	59	47	21	*18	12	142	442	
528	70	44	*36	20	14	169	564	126	63	52	*31	26	18	170	478	
527	81	45	27	14	14	212	560	159	65	*36	21	14	10	220	481	
538	*79	45	22	20	20	243	546	125	*78	31	27	15	7	*282	470	
522	73	56	24	24	16	272	556	141	61	29	29	20	1 355	273	512	
506	80	44	29	18	15	304		142	78	37	31	14	5	321	473	
526	64	36	32	21	15	303		117	64	29	28	26	952 3	359	492	
501	73	40	19	20	21	347		126	47	40	18	17	5	358	508	
479	78	41	24	23	18	330		113	58 54	42	25	23	13	392	491	
469	78	23	23	14	*23	339		107	59	43	21	22	12	365	497	
471	59	39	20	16	18	*338		138	49	35	17	23	13	330	454	
457	83	34	33	23	12	254		112	56	41	*29	17	16	336	475	
425	58	*44	27	23	11	294		105	58	*48	29	23	13	357	*470	
460	*60	41	27	14	15	262		115	*51	29	25	18	20	715	407	
471	54	37	24	22	11	253		*96	45	25	26	20	*21	255	409	

Au3+ — increase deflection slightly (? losing ions in last system)
75 μA
5.89 kV

Au3+
85 μA
6.04

161	81	57	33	3 [920]	714	626	211	46	28	1 [329]	217	501	246	101
166	70	42	25	2	767	598	186	49	29	1 [890]	322	447	243	101
150	69	44	33	13	746	610	158	52	26	5	374	503	242	84
166	88	34	23	16	691	591	184	27	26	6	371	537	214	76
165	66	27	20	26	766	611	191	42	18	9	409	492	220	85
160	62	44	35	24	730	579	158	58	25	11	452	468	212	92
140	65	36	18	29	682	600	178	39	29	15	494	471	179	73
122	76	47	22	37	680	500	172	40	26	14	535	472	198	80
140	74	31	19	46	662	477	161	44	28	14	561	487	194	
112	60	42	17	57	640	524		34	16	16	602	464	178	
114	67	31	19	84	724	472		37	23	13	558	471	171	
135	61	28	29	81	665	479	80	41	28	15 [900]	630	390	157	
129	71	27	19	97	673	471	85	25	26	23	629	450	140	
103	58	38	32	143	664	411	80	46	19	16	619	421	152	
106	65	31	29 [110]	161	681	404	70	42	15	16	639	455	159	
126	50	41	25	179	683	411	73	46	19	13	624	400	149	
112	55	32	17	209	681	392 [1030]	58	33	19	14	635	395	119	
89	57	33	24	237	724	322	76	35	19	20	580	414	134	
114	44	30	24	287	766	321	74	46	19	14	591	333	128	
114	56	49	21	277	690	329	59	40	22	24	612	352	131	
84	59	29	23	350	722	334	60	38	17	28	550	356	118	
102	49	33	20	375	677	312	68	24	19	45	586	358	124	
103	41	42	21	384	714	288	52	41	34	45	560	339	120	
94	59	30	17	447	661	281	83	23	22	52	568	339	117	
83	44	39	25	533	731	288	74	48	18	76	520	281	100	
105	49	27	19	544	669	275	64	33	29	79	498	304	123	
96	46	29	26	544	726	234	47	20	14	103	535	308	105	
81	44	19	17	616	697	246	57	28	14	120	501	287	83	
87	48	24	16	614	673	241	58	24	21	133	490	289	115	
72	36	24	18	627	653	199	51	33	24	167	506	271	116	
86	40	28	16	745	652	212	49	28	20	207	504	221	107	
78	40	23	10	711	658	219	51	30	14	247	465	242	89	

Au_2^+

40 nA 5.52 kV

Au_2^+

77 nA −78

5.89 kV 5.90

Au^+

5.52 kV

38 nA

04															
1	21	892	100	24	16	927	475	×125	51	107 1	16	901	51	×15	
20 1	27	865	114	25	21	1008	472	117	60	109 4	7	760	57	17	
2	28	811	92	×29	28	1061	×471	127	45	110 3	11	673	×61	8	
3	33	857	101	16	27	1087	266	113	55	112 2	11	530	37	11	
1	42	841	×80	7	25	×1232	400	120	53	113 4	8	×500	35	9	
6	45	853	77	2	21	1229	394	92	51	115 3	11	376	65	11	
7	67	×825	86	×2	24	1426	360	90	52	6 1	×18	333	36	8	
2	95	800	88	336 1	25	1423	347	93	47	7 1	15	319	30	9	
12	×830 100	771	82	530 5	24	1522	329	102	×40	9 3	23	265	29	6	
8	124	761	54	7	37	1506	319	93	26	120 2	18	214	29	8	
3	160	691	62	12	28	1525	277	×117	34	122 2	23	171	36	×4	
11	232	647	59	8	42	1478	282	83	34	123 3	20	162	23	6	
6	246	619	67	9	40	1362	×269	88	40	4 3	21	142	×29	8	
8	284	599	60	15	46	1344	238	86	30	2	20	105	23	4	
5	330	450	×56	11	53	600 1215	250	91	35	1	20	102	22	5	
17	358	464	64	16	57	1150	250	84	32	1	29	101	26	12	
15	459	443	52	18	×77	1076	238	89	33	4	×34	101	21	5	
8	484	350	48	8	90	976	211	80	30	4	31	88	30	6	
14	586	321	61	×18	106	985	175	70	×25	×3	40	81	19	10	
1	562	286	44	12	154	887	192	77	35	4	103	81	21	4	
9	730	259	47	15	200	831	189	×58	22	1	334	87	17	×7	
18	717	235	50	11	231	848	177	61	26	4	797	79	25	5	
11	889	228	31	17	263	816	×182	69	31	5	1761	66	×17	6	
19	974	190	45	15	344	815	166	76	30	5	3012	78 220	10	4	
19	1058	203	×29	19	387	×763	172	60	27	5	4174	71	19	3	
20	1125	165	36	25	450	638	162	57	27	5	4675	71	16	5	
21	1073	×138	32	16	×472 580	637	130	55	11	6	×170 4481	78	10	1	
29	1078	142	26	15	522	622	149	58	16	6	3470	64	15	7	
17	×1075	128	32	×23	660	605	149	51	3	×7	2803	63	12	7	
24	970	125	19	17	687	598	134	48		8	1985	66	9	2	
24	960	115	22	23	775	557	126	×62		4	1471	40	18	×5	
28	912	106	35	25	791	490	142	50		9	1091	50	16	4	

Au⁺⁺

5.52 kV

40 μA

repeat 'cos of overflow

1600
2168
1606

overflowed 1 think
= 10,624

840	1		8	841	1
845	1		2	4	1
6	2		1	7	12
7	67		4		146
	642	8	7		688
	2076		2		1655
	8081		5		2168
	624		1		1606
	8458		1		897
	4759		5		426
	2378		1		184
	994	7	2		80
	470	890	2		48
	220	1	2		16
	129	2	1		19
	65	4	1	x	6
880	25	7			6
	27	8	1		6
	17	9	2		8
	18	906	2		1
	9	909	1		1
	8				1
	10			7	1
	12			9	5
	11			870	4
	4			77	1
x	5			78	1
	7			81	1
	5			84	1
	4			87	2
	5			93	1
	10			94	1

11/7/80 — turn up amp threshold to see lots of amp noise, use to check channel-to-channel spacing: gate set to ~20 μs (10 μs range)

Noise, at ~20 μs.

again.

366	400	366	386	437	390	395	801	767	732	696	782	757	737
405	383	378	370	397	385	376	703	743	782	678	696	772	789
403	422	375	386	406	380	406	760	747	708	720	776	766	779
390	387	358	362	418	416	421	807	770	706	671	797	704	840
370	378	406	354	400	396	423	705	756	757	704	772	765	699
408	376	365	372	389	389	412	766	748	784	725	788	744	808
411	390	400	389	414	388	380	774	757	740	700	783	750	762
409	377	443	357	377	417	398	742	796	702	670	786	760	756
369	396	350	364	369	407	393	755	684	747	709	741	782	762
394	409	379	363	396	385	381	821	759	753	677	785	699	774
369	376	360	335	367	391	365	781	727	763	675	754	765	757
419	383	363	315	366	380	379	761	702	743	598	740	757	761
422	360	406	280	405	382	415	723	783	748	508	756	756	775
414	374	374	330	403	360	380	753	767	711	719	770	788	757
370	393	405	452	390	344	392	766	737	728	732	794	817	771
388	427	345	377	408	395	362	770	770	739	5	791	796	760
369	410	356	34	380	385	380	750	775	688	417	802	760	718
415	363	372	5	412	368	396	729	761	695	1	781	821	770
374	412	369	1	403	389	416	772	716	718	10	786	720	796
359	375	352	2	362	358	409	712	806	723	56	801	748	787
370	383	365	3	386	367	384	725	723	729	159	764	716	757
420	361	364	17	390	370	394	747	712	715	423	724	812	788
384	358	350	30	381	346	414	716	736	719	617	762	742	788
402	373	361	81	393	417	402	748	770	651	765	766	778	756
416	372	379	148	367	387	417	749	724	722	720	728	776	728
378	431	324	228	379	407	417	800	730	702	771	745	740	798
406	396	333	297	402	378	423	777	717	627	787	771	724	765
374	379	351	369	393	406	367	740	780	738	756	751	786	801
373	362	365	383	393	361	386	759	722	725	788	710	772	
348	363	364	398	401	408	390	755	801	659	757	791	718	
383	384	338	410	375	379	366	714	744	677	736	765	791	
369	361	359	428	391	394		765	736	691	784	744	851	

70 μA Au_3^+
5.92

Two long runs, lots of Au_3^+, to try to see if any fine structure in peaks

72 μA
5.95 Au_3^+ — try to shift peak 50 ns to see if structure due to timer

°194	94	52	903 3	566	1124	345	°182	100	63	903 2	932	954	321
149	99	49	12	610	×999	319	144	78	53	8	888	998	281
176	75	61	23	702	1030	329	169	88	55	10	875	957	284
170	98	52	32	757	1030	291	135	92	45	26	950	873	267
173	101	42×	27	796×	1003	303	162	87	×46	29	853×	878	264
182	98	45	34	821	998	297	137	81	58	30	868	873	272
171	88	43	29	839	968	265	167	90	59	43	861	824	218
146	84×	50	910/37	812	1018	238	146	81×	41	900/39	864	828	227
155	73	41	31	883	929	261	132	80	63	38	810	765	×229
130	74	45	27	846	886	218	136	88	52	27	814	716	207
×137	85	50	38	866	867	223	136×	62	54	36	827	691	220
137	79	60	37	816	864×	251	126	62	40	38	841	×717	202
147	69	46	28	868	802	235	117	77	49	32	832	629	203
124	70	57	39	813	824	236	111	79	32	54	832	571	209
125	61	39×	36	866	744	190	119	75	×48	57	×866	575	200
110	62	49	30	850	742	206	130	62	42	76	861	547	207
130	74	38	38	838	675	228	114	72	46	80	869	554	198
125	56×	40	50×	819	662	193	121	73	46	×115	930	516	190
132	77	56	44	843	616	190°	113	68	39	124	963	503	206
106	77	59	66	835	635	175	103	73	57	150	935	447	177
91×	58	35	69	856	582	185	×127	42	37	194	990	463	174
106	54	37	84	895	575×	162	117	49	41	228	1007	×411	183
97	59	43	132	852	553	194	93	58	38	269	1004	420	182
104	55	48	130	856	530		103	65	49	303	993	412	
111	55	24×	164	960/952	499		102	68	×37	401	1014	365	
101	61	33	212	943	427		114	70	32	435	1022	371	
107	52	10	201	972	442		95	56	14	512	1030	350	
84	65×	3	270×	956	457		103	63×	4	×576	1036	370	
88	59	336 1	265	991	407		101	53		629	1017	343	
106	59		329	987	400		98	45		724	961	348	
×96	53		385	1039	395		85×	61		775	1033	293	
93	56		477	1025	1000/366		82	47		820	1021	1000/303	
92	61		502	1058	321		82	64		917	1020	308	

Au_2^+ Date	8th	10th	9	10	8
i_c	20	40	60	77	87
V	5.64	5.52	5.80	5.84	6.04
Low peak	623	648	627	595	540
Hi	629	658	638	?609	
Δ	6	10	11	14	

Au_3^+ Date	8	9			11	9	9	11		
88· i_c	20	24	35	45	55	60	62	75	85	92
6.26 V	5.64	5.53	5.61	5.59	5.67	5.75	5.76	5.89	6.04	6.10
875 Low	~~1030~~ ?987?	~~1025~~ ?1020	~~1023~~ 1002	1007	999	987	~~973~~	955	935	892
895 Hi	1030	1025	1023	1030	1025	1014	1000	975	960	?
20 Δ	?43?	?5	21	21	26	27	27	20	25	

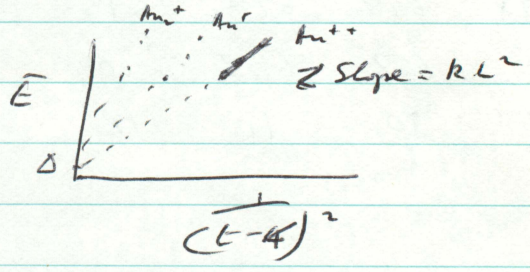
12/7/89 $\frac{1}{2} m \frac{L^2}{t^2} = neE$

so $\frac{1}{2} m \frac{L^2}{(t-\tau)^2} = ne(E-\Delta)$ τ = delay before sweep generator goes, ~ 200 ns

Δ = energy deficit of ions.

$\therefore$ Plot of E vs $\frac{1}{(t-\tau)^2}$ gives Δ

slope = $\left(\frac{m}{2ne}\right) L^2$.



For best results, related ions, work at constant i, in case Δ changes, & plot graph for E from say 1 kV — 7 kV, Unretarded, 5·5 – 6·5 kV range too small to get Δ accurately.

Slope Au^{++} = ~~7.747~~ 7.747 $\times 10^6$

Slope Au^+ = 7.125 7.006

Au^+ kV	5.64	6.36	5.52	5.80
μA	20	88	40	60
kV=	5.62	6.272	5.48	5.74
t-τ	840	796	851	833
	820	776	831	813
$t = 10^{-6} \times$	1.487	1.661	1.448	1.313

assuming τ = 200nS (from sqw) = 20

Slope = $\frac{6.42 - 1.8}{11.7 - 1.29 \times 10^{-6}} = \frac{5.62}{1.5} \times 10^6$ kV/(10⁻⁶s) = 7.747 ×10⁶

Au^+	5.64	5.62	5.52	5.80	6.31
μA	20	20	38	60	88
kV =	5.62	5.60	5.482	5.74	6.22
	152	153	169	144	90
+1024 −20	1156	1157	1173	1148	1094
$t_c / 10^{-6} \times$	.7483	.7470	.7268	.7588	.8355

Slope = $\frac{6.0 - 1.0}{8 - 0} = \frac{5.7}{.8} = 7.125$

Au_2^+	5.64	5.53	5.61		5.59		5.63		5.75	
μA	20	24	35		45		55		60	
	5.62	5.50	5.575		5.545		5.575		5.69	
~1002		0002	1023	1002	1030	1007	1024	998	1015	988
+1004	2006	2026	2027	2006	2034	2011	2028	2002	2019	1992
	.2485	.2476	.2434	.2485	.2417	.2473	.2471	.2495	.2453	.2520

Au_2^+ contd	5.89	6.04	5.76	5.92	5.45	6.36
	75μA	85μA	62	70	72	88
	~5.815	5.955	5.698	5.85	5.878	6.277
	975 957	960 935	1001 973	970 945	965 937	900 875
	1979 1958	1964 1939	2005 1977	1974 1949	1969 1941	1904 1879
	.2553 .2608	.2592 .2660	.2486 .2559	.2566 .6677	.2579 .2654	.2758 .2872

Spacing of Au_2^+ peaks $\frac{2\Delta t}{t}$

t_c	35	45	55	60	75	85	70	72	88
V_{real}	5.575	5.545	5.575	5.69	5.815	5.955	5.85	5.878	6.272
Δt	21	23	26	27	21	25	25	28	25
ΔV	~~234~~ ~~214~~ 117	~~259~~ 127	~~290~~ 145	~~294~~ 154	125	154	150	170	167

Scan ÷4

5-52 kV 28.5 µA

1.4
2.1

5 µA
5.63 kV

7.2 µA
5.87

5.87
71 µA

have selected peaks, different background for between (2^{0}, Pd 2's)

'Complete' spectra, K ion set to ÷ 4, rate set so that Au^+ not saturating; timer set to scan; integrate

~ 7 K counts over ½ hr, to build up spectra to give relative abundances of ions Au^{++} — Au_4^+.

Au_4^+ apparently diminishing bristly with increasing i_e of Au^{++}

Numbers/second to be lower than data taken ~2 weeks ago.

? Specimen hotter (i_{heater} ~ 3.5–3.6 A)

Try spectra as fn of i_{heater} to see if depends on tip temp.

28.5 μA

		at %
Au^{++}	1257	~~20.85~~ 20.90
Au^+	3815	~~63.27~~ 61.00
Au_2^+	~~[illegible]~~ 554	~~9.26~~ 8.86
Au_3^+	~~158~~ 430	~~2.64~~ 6.88
Au_4^+	53	~~.89~~ .85
Au_3^{++}	151	2.47

52 μA

Au^{++}	1165	11.00
Au^+	4759	65.40
Au_3^{++}	165	2.27
Au_2^+	766	10.53
Au_3^+	405	5.57
Au_4^+	17	.23

72 μA

↓	Au^{++}	835	15.86
↑	Au^+	3396	64.49
↓	Au_3^{++}	111	2.11
↑	Au_2^+	619	11.75
↓	Au_3^+	292	5.55
↓	Au_4^+	~13	.25

14th July '80

? existence of Ar^{+++}, Ar^{++++} — expected from electron impact model.

- set up source for minimum heater current, 22 μA .5.52 KV

Gate for ions with $t < Ar^{++}$:— looks from scope as if clumps 4^+, broad 3^+ peaks

- Fe can see something on scope (set up with apertures wide open.

324															
6	0	4	7	27	227	7	2	8	×4	11	92	131	388	34	10
6	4	2	6	17	88	×6	0	4	4	10	82	94	192	38	11
8	1	4	×14	10	64	9	3	0	4	18	107	90	690 116	36	17
15	6 4	5	8	9	35	14	5	7	4	600 12	142	81	121	35	9
20	1	6	2	12	45	20	×6	8	2	6	138	76	94	37	11
7	3	0	6	450 21	96	19	4	0	4	11	119	56	120	×22	9
330 6	3	3	5	21	70	6	7	13	9	13	×102	69	170	20	9
4	× 6	6	2	102	37	7	5	550 10	4	11	120	77	266	25	13
2	4	2	6	263	×11	4	4	16	6	21	125	64	279	32	×11
4	5	990 16	5	390	17	3	4	13	7	17	148	×62	209	30	9
3	4	110	1	216	8	3	4	13	×5	11	132	61	246	19	5
1	7	298	5	54	11	500 3	2	10	10	13	124	64	170	31	9
1	2	326	×4	44	42	3	5	17	13	9	139	67	153	26	7
3	5	76	2	57	32	4	5	17	6	11	186	46	156	30	5
3 5	3	30	3	44	26	2	×7	12	13	11	325	35	148	23	11
	2	22	2	×58	9	3	3	11	8	8	257	42	104	17	16
×6	330 3	13	11	155	4	6	2	11	3	12	57 370	42	69	15	5
3	7	7	3	452 202	6	6	7	×9	5	63	235	46	50	18	10
3 8	5	1	8	108	×4	5	7	9	4	190	194	35	63	21	×11
4	5	400 5	17	88	7	2	7 5	9	10	278	187	×37	57	9	4
4	8	4	12	193	8	2		7	×8	219	173	20	58	16	6
3	5	4	8	279	5	×5	95	7	11	270	168	40	61	15	9
2	3	3	×2	240	10	6	7	8	11	125	132	109	700 33	25	10
1	5	5	2	887	29	5	4	4	14	×82	145	249	47	16	11
5	1	3	6	2145	47	2	×8	9	14	105	138	439	48	21	1
×3	4	3	5	×469 2192	24	2	14	6	9	109	134	536	47	×14	2
4	×5	8	12	963	10	4	11	2	4	115	×159	536	46	1	6

5.52, 24 μA

834 21
5 89
6 397
7 726
8 595
9 171
40 18
} calibn − Au++

59/8	242/7		349	9	11	87	30x	14	12	12	30	282	825	50	22	13	14x
3	3		1	9	10	97	7	14	22	18x	24	273	538	62	22	6	13
7	}		x7	9	10	88	21	14	19	16	80	236	268x	56	19	14	12
4			3	12	11	x450 64	22	8	12	21	272	288	211	45	21	7x	4
8			7	11	10	236	27	5	26x	15	513	285	213	50	17	12	13
6			10	7	14	427	27	5	22	13	648	302x	183	47	21	9	8
1	Au++	\	12	11	x17	287	67	6	28	11	509	265	265	46	18x	13	8
3	835 34	saturating detector	8	10	9	182	101	10x	19	12	280	218	371	52	20	9	7
1	204		15	12	3	317	39	9	23	12	620 163	197	543	28	17	6	11
4	390		8	x22	13	495	15	10	20	19	160	163	564	39x	15	11	7
3	287		8	122	6	430	x21	7	27	14	190	164	517	36	16	4	2
	92		7	529	12	1053	9	7	24	x24	193	151	392	44	16	21	
	840 11		x10	692	12	3341	20	12	18	24	223	136	316x	27	13	9	
			12	302	24	460 4842	35	6	17	20	168	141	304	34	21	13x	
			10	91	21	2921	39	7	17	18	184	124	301	27	10	12	
			5	55	17	707	28	14	15	31	228	660 128x	242	32	21	13	
			7	49	x14	246	14	6	23	20	235	172	206	23	20x	9	
			7	35	13	173	11	15x =	19	13	219	135	131	28	9	12	
			15	22	16	86	11	5	15	20	211x	111	121	29	14	13	
			7	400 14	10	80	7	9	12	24	181	105	109	29x	17	15	
			7	20	12	202	500 15	12	13	35	197	69	115	28	15	11	
			12	13	30	201	7	11	10	600 24	289	88	92	27	6	12	
			x8	10	49	109	11	14	12	27	289	73	700 93	26	17	14	
			7	8	36	x42	9	12	7	21	250	84	91	34	18	11x	
			7	15	23	39	10	11	x15	23	250	85	81	27	18	7	
2			10	9	17	30	8	11	8	46	317	65x –	84	23	(12	7	
			9	12	x37	36	13	11	14	55	525	60	81	20	10x	13	
			7	14	37	48	9	20x	9	58	649	72	64	27	11	20	
2			6	18	92	84	12	21	13	34	676x	145	81	17	16	15	
			9	x22	446	57	12	23	8	25	573	347	80	21x	9	33	
			10	30	780	19	8	(12	8	14	448	699	77	(25	10	33	
9			12	16	504	19	11	12	(17	x24	394	1084	64	27	6	19	
			9x	10	162	12	11	15	16	21	363	1121	54x =	22	18	23	

16 μA
5.44
3.4A heater

5.44
21 μA
3.52 Amps

40 C 28

5.44 kV
2.7 A 28 μA

heater to 2.9 A
i_c → 35 μA &c
but V at 5.46
i_c → 21 μA at 5.44

16 μ, 7.4

Ar^{++} 841 28.1
Ar^{+} 1698 56.7
Ar_2^{++} 42 1.40
Ar_2 205 6.85
Ar_3 178 5.95
Ar_4 9 .3
Ar_5 20 .67

21 μA, 5.52
Ar^{++} 2400 24
Ar^{+} 5898 58.98
Ar_2^{++} 150 1.5
Ar_2^{+} 847 8.47
Ar_3^{+} 596 5.96
Ar_4^{+} 44 .44
Ar_5^{+} 65 .65

28 μA 5.44 kV
Ar^{++} 588 20.46
Ar^{+} 1754 61.05
Ar_2^{++} 61 2.1
Ar_2^{+} 242 8.42
Ar_3^{+} 187 6.37
Ar_4^{+} ~24 .84
Ar_5^{+} 21 .73

15, 16, 17 Workmen varnishing the Babbage floor again (Skyline floors).
Go & reading literature in basement uninhabitable.

Fri 18th July

Check Dunnlein pulser again to try to get more linear pictures for T.P.E.

Series of pics 2nS/cm 300v/in various apertures f3.5-f8

? 1nS/cm rising edge
? 4nS/cm

(in some order or other)

Up pulse to 680v

repeat 2nS, 4nS/cm (scope t-gain lower)

Up pulse to 1000v

repeat 4nS/cm

At Mapleton

1KV 4nS/cm, 2nS/cm.

+ superposed 2nS/cm

Sat 19th ? Is energy spread a fn of T – Measure spectrum as fn of i_{heater} at constant i_e

Au_3^+

Au_2^+ Timer set to scan 5.71 kV $i_h = 3.4A$ $i_e = 60\mu A$. Au_3^+

$i_h = 3.7$ 5.71 ⇒ 64 μA, reduce to 5.66 kV, 60 μA

100 2	6	17	⊙ 413	73	46	25	17	506	655	0 146	39	36	24	25	x 33	114
2	12	9	355	86	49	24	10	444	590	129	41	35	32	32	44	140
5	22	13	348	79	37	17	11	474	593	136	45	32	17	31	52	141
3	77	9	340	79	35	21	16	441	583	129	46	31	30	15	54	129
9	202	10 x7	327	69	47	26	7	369	547	156	40	33	24	20	62	139
3	420	11	261	68	35	21	13	383	510	136	47	30	22	20	74	139
102 4	x606	12	266	64	37	100/9	8	398	452	136	28	22	24	15x	91	159
2	793	7	227	71	34	6 5445 55	12 x15	361	481	97	37	32	29	3	116	172
5	836	11	262	52	32x	831 1	19	377	406	126	40	27 (70)	23	{	107	175
111 5	762	14 8	196	59	310	928 2	7	388	413	114	x33	16	26	989	128	163
3	673	11	x174	64	29	1	20	373		x105	28	36	23	959 6	990/131	168
2	478	14	180	58	28	x6	17	408		104	44	33	28	x19	137	150
4	310		184	54	23	14	19	432		72	34	39	24	23	129	x155
3	208		174	54	19	10	126	463		90	27	27	72	25	109	146
2	158		162	45	19	7	31	466		71	30	22	21	31	116	
4	118		138	57	36	11	42	551		83	42	33	28	25	102	
3	x82		149	53	29	8	49	575 (1000)		61	25	34	15	31	104	
5	66		136	64	25	12	67 (970)	619		61	37	24	18x	22	98	
120 5	63		135	62	27x	10	69	632		57	29	23x	34	29	100	
2	59		131	x38	30	12	119	645		67	x38	24	28	13	101	
6	36		x140	51	21	11	140	628		x68	32	32	17	21	1000/109	
4	34		122	37	25	940 11	190	652		56	31	27	26	970/19	93	
3	32		119	44	19	6	275	699		64	29	22	20	14	113	
5	36		94	33	25	8	332	726		50	41	30	29	22	84	
5	19		108	60	23	11 13	366	698		43	40	26	120	R	75	
4	26		110	41	23	15	356	705		78	34	22	22	18	103	
3	x16		98	39	18	17	463	x746		52	24	28	17	22	105	
130 4	17		105	32	23 18x	11 10	498x	738		50	34	18	19+	28	125	
2	18		97	50	21	14	499	713		33	42	29x	29	18	107	
5	11		94	x52	23	x10	484	692		44	x29	28	26	32	124	
6	11		x93	33	25	14	539	650		x48	30	24	25	33	147x	

Ag^+

$I_h \rightarrow 4.0\,A$ $5.87 \rightarrow 64\,mA$
reduziert $5.61 = 60\,mA$

Ag^+ I_h 4 A
62.5 mA
ions to 5-6.5 keV to both front faces alternating.

099	244	109	91	51	716	978	°778	199	127	83	48	389	815
978	259	124	76	72	356	1066	772	194	126	72	952 65	486	842
080	269	121	71	72	416	1047	701	181	122	96	59	522	860
074	251	126	85	72	461	1095	692	194	96	79	60	554	819
177	239	124	1000 1080	81	472	1087	652	182	120	72	61	623	872
1074	210	118	75	67	544	1124	620	161	116	66	64	684	850
990	241	130	94	82	615	1045	573	168	100	79	69	727	801
853	233	109	67	82	739	1088	556	188	108	77	87	733	795
816	206	116	92	72	714	1035	562	160	96	71	67	751	767
862	220	110	83	69	827		557	167	107	72	74	740	799
812	190	100	87	72	846		495	166	92	79	80	831	770
818	193	115	65	75	918		491	127	113	63	75	810	778
759	201	107	77	56	937		447	142	85	91	85	777	
708	184	116	76	70	964		420	172	108	78	86	795	
670	195	124	67	71	981		423	176	100	76	81	736	
625	184	100	66	82	956		379	151	89	79	81	692	
641	191	115	76	77	973		369	161	81	71	89	717	
552	158	96	88	91	921 1000		329	176	99	69	89	695	
570	190	98	79	73	879		322	135	105	68	102	693	
618	191	100	73	83	827		240	133	96	73	118	669 1000	
648	146	103	74	85	858		299	139	87	63	125	611	
684	148	87	55	107	804		279	132	89	56	121	674	
709	171	102	72	98	823		262	113	85	46	135	666	
702	164	107	53	110	835		200	134	91	29	156	687	
791	155	94	34	106	820		262	147	75	14	190	745	
755	146	72	8	102	826		241	116	108	5	208	728	
767	134	80	5	139	880		264	112	109	941 2	223	766	
737	157	70	946 1	189	867		216	117	98	269	793		
767	136	112	2	169	815		215	113	97	944 2	277	795	
805	140	76	10	190	901		230	130	84	2	319	839	
775	145	81	41	236	907		196	120	79	947 b	357	753	
768	124	110	952 49	270	932		193	121	88	19	408	850	

Au+ 5.36
i_h = 4A 20 μA

10 mins @ 70/m

Au+ 4 A ih
5.6 9kV 64 μA

115 / 14	41	461	69	35	51	~~3~~	120 / 102	889	152	94	60	57
22	40	×380	37	49	45	25	113	822	145	84	69	61
33	54	283	60	51	57	14×	120	645	177	74	85	77
36	150 / 47	247	44	42	44	4	132	535	162	84	57	67
32	53	208	42	42	50		136	488	148	95	75	69
120 / 35	62	177	36	35	35×	///	131	432	148	83	84×	63
31	60	156	51	46	38	160 / 51	163	400	140	80	76	77
30	64	136	47	32×	40	40	143	348	136	84×	85	64
27	96	91	42	36	33	77	172	328	155×	93	68	67
27	83	114	42×	35	44	90	210	336×	127	84	64	73× 240
30	93	95	40	53	57	127	240×	258	135	87	80	
26	113	×102	35	42	46	170	274	287	129	75	76	
35	135	89	52	59	45	185	365	286	127	74	72	
36	150×	77	49	50	53	218	440	292	112	86	70	
36	262	105	38	44	42	145	544	229	97	63	76	
×38	442	68	53	41	47×	181	842	255	114	77	53×	
28	774	76	47	40	41	165×	1201	253	140	85	72	
31	1233	71	50	33×	44	135	1569	234	103	77×	75	
38	1851	64	35	45	41	95	2147	241	118×	72	63	
32	2739	60	47×	39	42	78	2645	229×	97	69	67	
36	3340	71	48	51	44	62	3217×	199	114	70	73	
25	3832	59×	45	49	55	54	3477	227	94	73	72	
32	4183	58	42	45	43	35	4129	217	105	77	63	
36	4116×	65	50	44	44	29	4307	180	113	64	73	
38	3470	64	48	40	47	30	3987	197	117	68	69	
140 / 32	3027	56	45	45	44×	18	3596	199	102	84	84×	
31	2157	50	47	46	26	23×	3025	179	90	76	57	
29	1591	73	50	45	32	↑	2434	177	95	65×	70	
35	1154	52	47×	45	38	repeat to check	1983	205	90×	62	68	
39	963	44	45	46	33	for overflow	1468	172×	105	71	65	
39	755	36	42	54	37	of main peaks	1232×	175	101	72	55	
36	576	49×	39	46	35					64	66	
					35						86	
											86	
											65	
											77	

$$\frac{\Delta m}{m} = \frac{\frac{1}{4}\Delta E}{E} = \frac{2\Delta t}{t}$$

$$\frac{1}{2} m \frac{L^2}{t^2} = neE$$

For Ga, $m = 69, 71$ $\Delta m = 2$ $\frac{\Delta m}{m} \triangleq \frac{2}{70}$

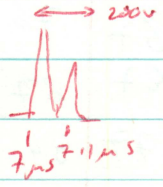
$E = 7000\,V$ say $\Delta E = 200\,V$

$t = 7\,\mu s$ say, $\Delta t = \frac{1}{2} \cdot \frac{2}{70} \times 7000 \approx 100\,ns$.

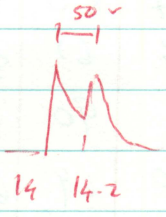
Decrease E by 4, $t \uparrow \times 2$ $\Delta E = 1750 \times \frac{2}{70} = 50\,V$

$\Delta t = \frac{1}{70} \times 14000 = 200\,ns$

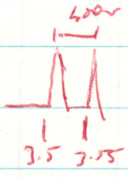
so @ 7kV



@ 1750v



@ 1.75kV



21 July 80

Au_4^+ 20.5 μA 5.395 keV

255							
21	28	61	796	62	22	17	22*
25	28	65*	752	70	25	22	20
21	30	69	697	54	24	25	20
25	35*	74	654	64	19	18*	20
31	22	95	596	56	28	19	20
*40	28	82	586	50	25*	22	19
30	27	100	540	54	28	20	26
20	30	102	485	50*	20	16	10
24	25	129	466	42	21	27	11
22	30	157	393*	36	20	25	3
44	31	152	384	37	34	18	
38	37	206*	310	42	17	20	
30	39	227	319	42	28	21	
47	209	30	251	278	30	21	20*
38	38	272	207	44	15		29
*39	28	242	206	44	19*		24
25	29	344	196	39	10		21
36	32	382	166	47*	22		21
37	29	400	169	37	18		20
39	44	478	145*	30	14		29
35	28	547	128	30	24		21
26	40	524*	129	34	16		14
41	42	591	109	33	20		20
34	42*	625	103	22	29		25*
37	32	677	97	22	20*		19
209 27	47	701	98	28	18*		22
33	40	777	77	30	20		18
40	31	734	96	26*	24		25
21	50	785	84	21	20		17
29	38	762	78*	24	25		16
37	48	840	79	24	26		22
24	49	803*	62	40	10		31
							29

Au_4^+ 5.54 39.5 μA

225							
22	70	322	966	170	61	48	45
43	72	328	914	134	57	40	33
67	56	329	926	135	43	38	36
90	71*	276	939	136	44	38*	26
87	72	370	820	111	77	35	47
86*	84	388	835	121	57	57	43
67	76	391	714	116	40	50	29
87	87	445	694	103*	64	38	40
77	84	424	664	86	47	45	38
57	82	508	622*	100	50	31	35
64	65	541	536	111	56	51	19
71	90	577*	517	88	68	38	13
70	69	613	479	100	54	44	2
83	89*	650	448	108	60	36*	
85	93	737	417	72	52	49	
81*	81	743	385	83	45*	43	
66	86	798	354	74	48	41	
79	106	835	333	90*	43	41	
76	104	884	305	71	50	48	
90	117	919	267*	91	39	36	
66	113	996	272	88	43	43	
83	135	952	282	67	41	39	
67	156	1077	214	62	45	33	
69	138*	1010	286	67	41	48*	
67	170	1077	224	67	40	44	
59*	172	1091	229	65	42*	35	
78	222	1127	218	60	39	46	
83	202	1091	179	78*	47	31	
67	210	999	163	72	57	34	
63	261	1040	158*	55	33	38	
71	273	1041	160	65	44	34	
61	290	1033*	126	64	46	32	

Am_4^+ 5.63
60 µA
−62 nA

Am_4^+
5.95 kV 80 µA

48	58	123	406	209	55	40	33	52	100	292	207	125	72	53	47	
54	53	129	407	171	64	27	30	67	114	287	276	103	79	51	47	
53	53	156	440	190	50	35	29	93	90	283	272	116	69	64	51	
47	62	142	464	176	48	31	28	124	106	281	292	107	78	44	46	
72	59	157	570	157	54	37	27	104	97	274	266	112	61	67	48	
4	53	178	444	162	70	41	28	127	105	290	248	117	65	47	46	
6	59	193	507	138	49	32	20	117	76	290	264	133	65	61	40	
4	49	192	573	134	47	29	26	128	111	291	256	120	71	69	52	
1	65	198	465	113	57	40	20	106	100	306	255	110	73	57	46	
0	59	248	473	124	58	32	24	106	102	295	241	115	73	60	48	
7	59	215	495	119	40	26	26	114	115	310	225	110	72	48	52	
72	54	220	493	92	42	33	29	111	106	270	237	91	75	54	44	
66	53	222	481	114	49	39	35	115	119	297	229	91	70	57	38	
1	42	218	448	109	53	25	14	113	134	317	188	88	67	68	47	
65	51	237	460	73	51	31	23	102	149	306	212	105	61	47	50	
4	55	223	460	124	34	28	19	105	120	325	206	89	65	57	46	
9	55	221	442	101	44	24	27	120	158	319	147	91	72	51	34	
8	68	245	404	96	41	26	17	119	135	297	193	81	77	65	51	
38	50	262	404	78	38	33	25	110	155	315	177	83	60	53	55	
0	56	238	406	85	40	29	28	97	144	329	175	88	55	47	49	
0	64	279	378	96	33	30	19	103	198	300	173	81	68	61	37	
0	51	264	367	74	32	26	19	105	196	318	179	94	68	54	49	
58	72	277	369	76	40	31	15	100	237	328	177	97	67	45	54	
7	76	284	333	77	41	31	7	117	229	318	163	81	55	94	42	
61	73	300	320	65	27	24	6	93	222	330	152	90	61	46	34	
63	61	339	295	70	44	30	2	104	246	319	145	61	58	44	50	
60	73	356	271	70	32	29	1	106	294	309	138	70	59	43	28	
56	74	333	260	67	38	20		97	264	286	132	74	65	55	14	
47	106	356	238	67	41	26		99	264	308	136	62	56	43	2	
80	102	372	257	54	24	21		90	289	321	156	82	49	46	1	
52	104	426	227	58	35	28		100	283	250	147	84	55	32		
59	128	389	201	68	38	26		108	328	301	132	82	53	48		
						27										

Au_3^{++}

5.61 kV
62 mA – 64 μA

364/13					
47	98	696	40	33	23
95	134	619*	26	26	29
137	124	597	40	21 29	24
131	125	581	43	21	25
131	128	586	50	26	35*
370/119	143	475	26	25	23
115	174	472	26	25 500	21
109	197	463	57	19	29
114	285	412	33	25	24
120	454	347	42*	24	20
111	817	332	32	23	28
114	1248	285*	43	25	29
106	2013	247	46	29	32
139	2855	248	48	19	26
96	3677	203	47	30	32*
111*	4401	206	36	18	24
105	5060	144	37	29*	24
123	4962	138	43	23	18
106	4497	105	43	22	18
124	4126	115	41*	28	12
112	3465	90	33	20	1
124	2554	70*	32	20	
117	2030	83	39	37	
105	1494*	65	37	21	
108	1129	72	40	36	
123*	1001	54	23	29	
114	805	33	28	29*	
106	748	46	29	22	
116	702	53	25	25	
97	738	47	28*	24	
116	691	48	24	21	
125	658	41*	29	22	

22/8

FWHM

Heater 4A

I_{H+}										Uh 4A			Uh 4A	4A		
i_c	20	64	20	20	38	60	88	40	40	54	53	78	76	40		
V	5.36	5.69	5.62	5.64	5.52	5.80	6.31	5.44	5.44	5.46	5.43	5.80	5.72	5.37		
V_H	5.34	5.63	5.60	5.62	5.48	5.74	6.22	5.40	5.40	5.41	5.38	5.72	5.64	5.33		
$t_{\mu s}$	11.73	11.46	11.57	11.56	11.73	11.48	10.94	11.76	11.74	11.73	11.77	11.79	11.47	11.79		
$t_{\frac{1}{2}}$ ns	80	100	50	50	60	60	95	70	75	85 95	73	82	110	95		
ΔE_{FWHM}	73 ±4	98	48	49	56	60	108 ±5	64 ±5	69	78	67	82	108	86		
I_{H++}																
$_{nA}$	20	40	60	88												
$_{c}$V	5.64	5.52	5.80	6.36												
$_{c}V_H$	5.62	5.48	5.74	6.27												
$t_{\mu s}$	8.20	8.01	8.13	7.76												
$\Delta E_{\frac{1}{2}}$	30	30	38	42												
V	41	40	57	68												
I_{H_2+}																
$_{nA}$	20	40	60	77	87											
$_{c}$V	5.64	5.52	5.80	5.89	6.34											
V_H	5.62	5.48	5.74	5.81	6.25											
$t_{\mu s}$	16.27	16.57	16.3	15.99	15.43											
$t_{\frac{1}{2}}$	200	270	200	250	290											
V	138	174	141	182	162											
I_{H_3+}							4A									
$_{nA}$	20	24	35	45	55	60	60	60	62	70	72	85	75	92	88	
$_{c}$V	5.64	5.53	5.61	5.59	5.63	5.71	5.61	5.75	5.76	5.92	5.95	6.04	5.89	6.10	6.36	
$_{c}$	19.84	2028	2006	2010	2002											
$_{\frac{1}{2}}$	220	190	190	240	320											
I_{H_2+}	3.6A	3.6 → heater swap → 4.0	4.2	4.2	4.2	4.2	3.6	3.6	3.7	3.7	3.7	4.2	3.55	3.80	3.6	4.1
$_{nA}$	20	20	30	38	19	40	26	12	6	4	2	4	67	85	60	35-40
V	5.40	5.40	5.41		~5.3	5.42	5.41	5.29	5.26	5.24	5.22	5.20	5.72	6.24	5.65	5.40
V_c	5.38 PEU	5.38	5.38	~5.4	5.28	5.38	5.38	5.28	5.25	5.24	5.22	5.20	5.65	6.15	5.59	5.36
t	11.68 12.86	11.62 12.80	11.71 12.89	11.71 12.89	11.83 13.01	11.73 12.91	11.71 12.89	11.82 13.00	11.84 13.02	11.87 13.05	11.93 13.11	11.91 13.09	11.54 12.72	11.04 12.22	11.62 12.80	11.80
$t_{\frac{1}{2}}$	43	46	57	56	48	57	53	40	36	33	30	34	63	77	61	65
ΔE	36	39	48	47	39	48	44	32	29	27	24	27	60	78	53	54
ΔE	40	43	52	52	43	52	49	36	32	29	26	30	62	86	59	59
err																

Thurs 25/7/80 Checking effect of temperature on FWHM of Au^+

Also measure volts on heater, as not sure if emitter connected to live or grounded end of heat-.

Heater = 16.42 volts

At i_h = 3.4A, Vrms (sinclair) = 4.83 v   PP = 2√2 V =

i_h = 3.45A — Au^+ 40 µA 5.44kV

40 µA 5.44 3.45A — repeat Au^+ at ~15/sec

Au^+ 40 µA → 38 µA — i_h → 3.4A, V = 5.37

← slow

4.0A — 5.46 & 150 nA Au^+ — repeat ↓

120					120				120	160			120			120		12[illegible]
3	14	136	31	7	5	1183	67	26×	11	15[illegible]	174	34	38	40	63	12	12	[illegible]
1	9	135	19	6×	7	1652	63	20	12	19	182	33	32	53	92	13	17	96
3	12×	84	28	4	7	1967	59	23	10	22	135	38	32	42	65	5	25	85
6	12	89	26	5	5	2008	73	16	8	33	128×	25	34	53×	70	12	34	99
2	11	68	21	11	4	×2027	59	18	11	75	103	30	43	50	69	11	73	61
2	20	59×	19	4	6 4	1663	49	15	11	105	82	17	34	51	64	9	155	7[illegible]
3	54	60	22	10 6	4	1262	52	23	13	182	80	24×	31	missed	43×	11	383	60
3	135	53	15	7 4 2	7 5×	962	43×	21	16	316	74	17	29	68	56	12	760	57
4	293	54	29×	2×	4	709	44	13	13	405	60	16	35	62	57	12	1268	50
4	570	51	11	7 7	4	583	46	19	12	645	55	17	39	64	48	13	1783×	54
×3	1026	34	16		6 9	480	47	24×	9×	817×	61	17	50×	70	49	9×	2133	43
4	1538	47	11		12	405	43	7	8	998	46	18	28	127	58	10	2248	53
2	×170 2075	39	15		6 14	343	43	12	10	1263	45	12	49	142	56	10	2072	47
8	2134	34	12	←	10	325	45	14	11	1488	53×	8	45	205×	54	12	1596	36
1	2144	40	17	~65/sec	12	284	35	15	7	1681	35	18	22	249	47	12 6	1165	45
6	1911	32×	17	$t_{1/2}$ 80ns	13× 13	218	40	15	7	1858	61	16	44	242	56×	12	858	51
3 5	1522	26	16	[illegible]v warm	15	192	34	14	12	1777	36	16×	34	278	43	14 12	643	40
4	1022	42	9		20 20	195	42×	14	11	1637	38	16	26	251	45	16	457	4[illegible]
1	758	37	13×		14	141	28	11	16	1445	40	11	33	207	59	12×	402	3[illegible]
×6	586	25	15		21	121	32	11	5 11×	1108	41	11	40	154	60	10 12	325×	4[illegible]
10	446	28	12		26 38	111	37	12×	14	897×	30	12	51×	149	43	12	278	34
4	411	30	12		31	100	28	18	12	675	31	16	34	118	35	15	241	4[illegible]
13	306×	43	11		36× 78	97	21	14	15	481	25×	8	33	127	45	14	292	3[illegible]
12	247	21	7		111	91	27	11 19	12 14	353	26	16	37	48×	68	13 9	179	4[illegible]
11	257	35	8		271	62×	33	11	10	279	23	12	52	67	33	11	158	3[illegible]
15	199	28×	14		464	59	33	6	16 14	265	20	7	39	73	47×	15	180	3[illegible]
11	164	32	7		811	62	29	10 7	17	234	33	11×	41	78	43	15×	149	26
								ch				ch						

suspect

too fast

Au+ repeat again 5.46/52 μA/4A

retune spectrometer & reset amp threshold (too insensitive for last spectra)

5.46

52 μA Au+

I_n = 3.55A (uncorrected then)

~~48~~ 53 μA

5248 kV

I_n = 3.6A

78 μA 5.80 kV

120 / 20	20	65	17	120 / 17	206	65	27	130 / 3	60	55	22	100 / 4	1932	127	65	12x
18	25	71	30	12	512	63	19x	5	88	91	24x	4	2248	105	53x	20
16	39	66	18x	17	688	74	14	6	158	68	23	6	2366	105	39	13
16	59	45	20x	6	807	59	17 14	5	344	57x	17	9	2231	118	41x	16
19	189	63	23	7	1143	52	25	5	616	53	21	6	1939	118	45	19
16	348	38	20	14	1480	49	29	3	1035x	71	20	11	1461	112x	47	11
11	675	49x	20	11	1789	57x	26	8	1353	58	17	6	1237	104	39	21
17	1097	42	17	16	1902	36	23	9	1750	58	15	13	995x	104	39	14
11	1728x	45	20	9	1846x	41	22	5	1925	57	19	11	736	94	34	11
12	1962	41	25	10	1630	46	12	4	1820	64	11	9	603	89	44	13
17x	2040	54	21	12x	1786	57	17x	6x	1653	61	18	10x	530	82	36	9x
15	1752	38	14	12	1162	53	16	1	1320	52	14x	8	431	105	40	10
22	1374	42	18x	14	874	54	20	6	1006	63	13	15	398	86	36	11
22	1011	43	16	17	643	61	20	1	740	64x	23	15	356	83	36x	8
13	803	41	18	21	478	45	13	7	580	56	23	9	291	84	28	14
17	602	29	19	14	424	27x	19	4 6	451x	54	13	11	263	85x	27	15
21	425	43x	23	14	376	41x	16	14	391	44	14	16	223	61	27	9
21	368	34	17	13	307	50	17	10	345	49	17	25	225x	87	33	6
26	294x	39	18	18	257x	36	15	11	319	39	9	12	175	71	25	10
13	275	32	12	19	216	46	14	15 (130)	256	42	12	19	138	70	36	14
29x	230	31	21	23x	194	36	18x	5	231	53	10	21x	167	85	19	15x
22	191	30	23	14	181	30	11	18	209	33	9x	21	137	69	31	10
26	189	33	20x	18	154	41	19	18	182	40	7	19	154	78	25	12
25	167	33	19	18	144	42	14	17 23	146	37	4	28	143	80	29x	8
26	148	28	19	27	123	31	12 9	24	166	35	9	48	126	79	28	6
25	140	25	14	22	127	32 33x	14	28	134x	28	10	80	139	80	16 15	5
18	127	37x	13	28	94	32	8	26	141	26	9	147	109	56	22	6
30	98	29	21	34	72	31	10	27 32x	123	22	7	226	138x	65	21	4 7
20	99x	31 39	13	34	82x	30	9 16x	35	102	17	8	352	121	57	18	10
24	76	24	21	62	81	31 25	16	29	94	21	10	556	118	70	30	6x
22x	80	27	13	137x	71	23	6	26	85	30	10	827x	123	44	13	
28	62	30	10x 14	195	62	31	6	40	83	21	8x	1228	108	58	28	
			12									1647				

OE ≈ 66

76 μA
5.72 kV
i_h = 4A

AC, rms
V_{heater} = 5.69 volts
Heater power = 22.76 watts

100/28	117	143	75	35	28
11	177	142	82	41	22
17	332	142	84	33x	24
14	447	136	92	35	28
6	727	115	89x	40	27
20	905	129	72	45	13
16	1153	x137	84	37	9
7	1340	125	73	40	
13	130 1641x	122	75	41	
13	1674	108	71	35	
19x	1736	120	73	27	
18	-1753	126	64	46	
14	1701	118	68	23x	
13	1393	108	52	24	
13	1290	119	64x	29	
12	1045	113	65	34	
11	839	114x	56	24	
18	675	103	49	26	
20	562x	128	43	26	
10	496	102	57	27	
15x	414	114	44	30	
17	355	107	45	37	
20	285	117	60	29x	
25	257	116	63	24	
24	250	89	46x	26	
19	215	120	58	30	
14	186	96x	39	24	
25	194	89	55	27	
15	197x	102	44	31	
22	172	93	37	21	
42x	150	81	49	32	
86	139	87	37	25	

Δt = 105
t = 11.47
V = ~~[illegible]~~ 5.64

Heater power up by 1.139

If $T^4 \propto W$
T up by 1.085

T_m = 1080 ?°C
= 1350 K

=> 1465
up by 115°C

Test 1 AP

587 labelled 586 M_0 3.48 + 0.6 (!) He $2 \cdot 10^{-6}$ 70 K ~10^{-9} (diff property)

scrap — Condon

restart

New pulser.

587 4.4 +.800 $5 \cdot 10^{-6}$ Me / 60 K 211 environs 105/560

500 ms −.860

588 a 4.71 + 1.15 −1.2 125/560 60/ms ~800 ms

see effect of changing EHT with fixed passband

b 4.71 + 1.25 − 125/560 ~ 700

— went too fast — stop

589 4.71 a +1.22 −1.27 1.2K 125/560

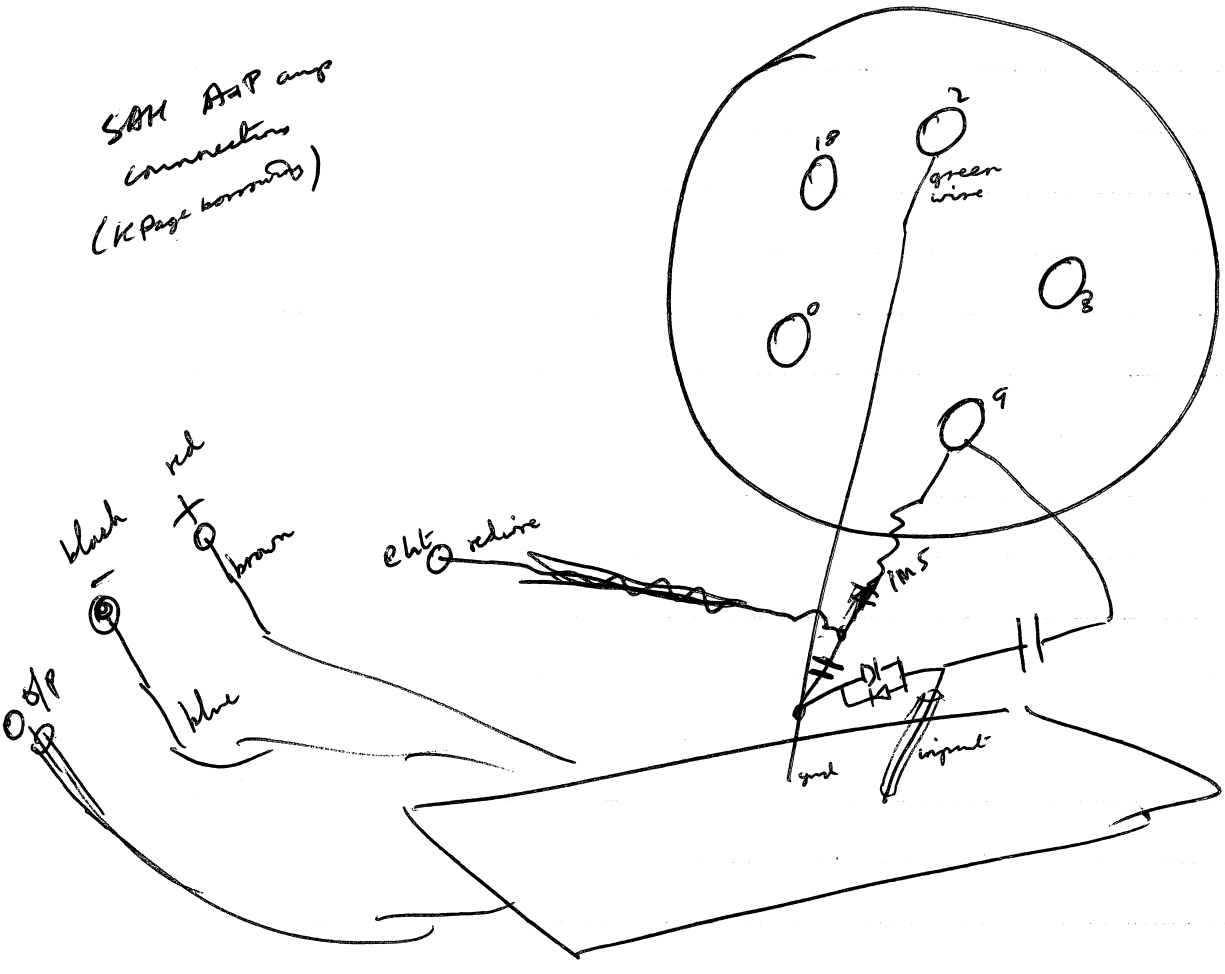
+ b 1.35 − 1.39

590 4.71 +1.5 — fast. 125/560

~ 1K7 all at 1 volts

591 4.71 +1.6 135/560

SBH A+P amp connections (K Page borrowed)



31/3/83 ? Powell visiting re letter to TPhysD on the energy spectra, money for next year (BR closing)
— brought new Ga source

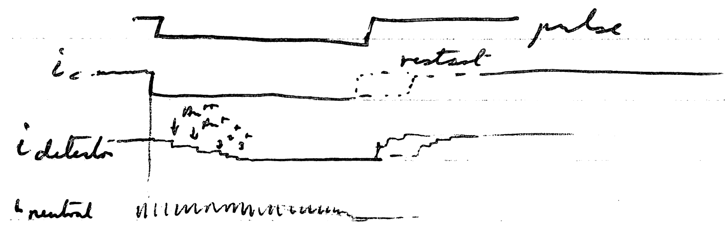
4 August 80   Au source

Reconfigure p.t.S pulse for −ve pulses

(i.e. swap thyristor drives over, change HT resistor to pull up not down).

Test on Au source — looking to see if a) can turn source off & on again controllably

b) ? neutrals of low, but non-zero energy carrying on down tube after source is off



~ 40 μA ~5·3 kV — 3 kV pulse

Collectors current, 1K5 load resistor

20 μS/cm, ·05 v/cm vertical (×10 ÷ 10) single shots × 5

" " digital amp " " × 5

i_c — bottom line of graticule = 0 μA.

1, ½ 400 v pulse

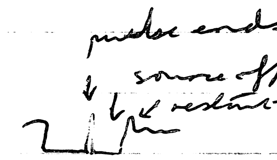
1, ½ 700 v pulse

1, ½ 900 " "

" " 1 kV

" " 1·1 kV

1, ½, ss 1·4 kV



1, ½, ss 2 kV

unsuppressed

i_c → 80 μA   pulse 200 v   ½ sec

500 v   ½ sec

plus N filter ?

500 v ½ sec

700 "

900

1 kV

1·1

1·2

1·3

1·4

1·5

1·6

1·7

1·8

1·9

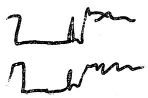
2 kV

blank

2 kV single shot

2.2 ~

2.4

[2.5 
[2.5

3.0 ss

[illegible] ss

4 multiple

? 3.5-4 kV
– meter drift.

Blank

At ~ 20 μA ie, increasing pulse →  as soon as gets to zero; v. long restart time.

300 [probe ×1] .05 ÷ 10 v/cm = .005

500

700

900 ——— flat, zero not at bottom.

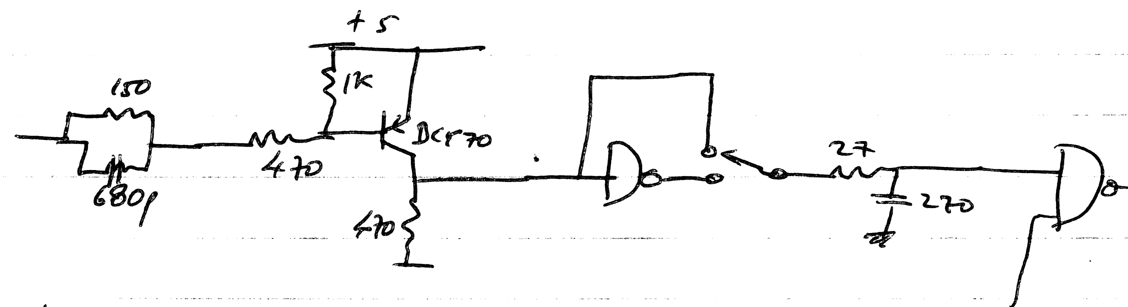
600

[illegible]

Tues 5 / Aug   Increase μ' pulse length to 140μS

Modify blue box so will trigger on +ve or −ve edge of pulse :-

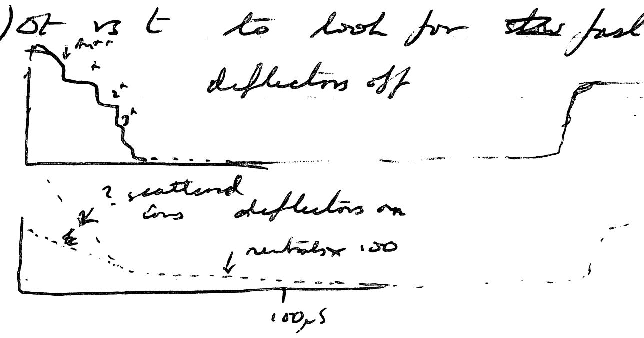
E/p is now



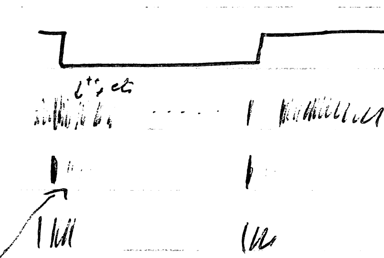
– not all R's & C's are necessary!

Object of mods is to trigger a delayed gate at start of −ve pulse on emitter, use gate to enable detector signal into counter: vary delay, plot $i(t)\delta t$ vs t to look for ~~the~~ fast neutrals (at ~100eV)

i.e. expect



Results



[illegible]0μA Set of pics ½ 1 2 . . . . 40 of diff amp, 20μS/cm

deflectors on, 10, 20, 40 " " " "

[illegible] KV pulse more down, 20, 20 – discharges – <u>spurious</u> pics

Only detect 'neutrals' within 2×20μS = 40μS of beginning of pulse – v few thereafter

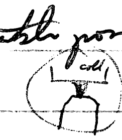
1, ½, 1¼, lin amp.

increase gain, lin amp × 4 or 5   20μS/cm

→ 5μS/cm lin amp × 4 or 5 – steps of 2+, +, ½+ etc

delayed tb switch-on transient " " " 5μS/cm – v stable pos.

4 or 5 pics (hopefully) 10sec – 60 sec of ion source f3.5



at 80μA

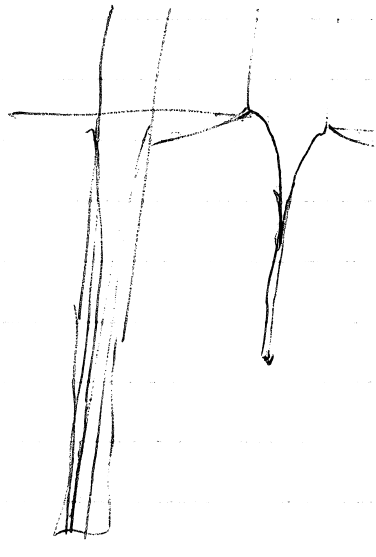
end of pics

Night

Light off as fn of i_c (biased +150 collector)

10 μA 40, 60 sec
30 μA " "
50 μA " "
70 μA " "
90 μA " "
90 μA " " collector at −150 v
90 μA 20 s " +150
70 "
50 "
30 "
10 "
0 μA, 60 s
10 μA, 4 min — source turned slowly off at some stage
20 μA 5 min

Tilt source ~ 30° —— to see if apparent core in beam is 'attached' to source or to collector
60 μA 20 40 60 sec
100 μA 20 40 60 sec



8/8/80 straight tube, 30/sec — Stove being sloppy – duff 5058

①	② Au⁺ 5.40 20 μA i_A 3.6A (reverse heater current)		③ 4.0A / 30 μA 5.41		④ 38 μA 4.2A		⑤ ~5.7 19 μA 4.2A		⑥ 5.42 kV 40 μA 4.2		⑦ 5.41 kV 3.6A 26 μA	⑧ i μA 5.29 kV 3.6A	
ns / 61 A / 4													
7	258 / 24	179	258 / 69	617	258 / 77	917	276 / 77	231	268 / 85	267	280 / 97	270 / 3	569
2?	24	179	75	459x	87	679	63	181		227	423	3	373
7	35	119	77x	415	73	611	71	125	91	223	1087	3	245
+	59	123	53	347	87	481x	73	159	85	205	2205	5	147
-	35x	81	53	317	105	393	63x	137	101	193	2831	3	117
5x	37	107	81	267	83	405	89	119	99	167	3353	3	61
4	25	87	49	223	97	307	65	95	75	163	3007	5	43
5	33	79	85	197	101	309	81	97	103	123	2223	7	29
14	21		87	175	87	275	53	103	93	153	1471	9	17
5	37		65	199	95	253	93	79	109	145	981	7	17x
7	43		67	173	87	225	87	87	97	155	781	3x	13
	43		77	173x	77	223	81	91	135	147x	547	3	11
	43		53x	203	95	209	87	67	123	137	521	9	11
89	37		85	157	77	197x	89	79x	141x	111	379	3	13
26	51		71	141	75x	215	79x	71	191	117	287	3	5
7+x	75		91	141	101	233	107	83	319	105	215	13	9
35	165		91	14	119	209	233	73	507	139	145	9	9
109	543		105	135	117	193	513	75	1003	123	117	11	3
489 / 3	1355		113	157	101	151	1209	87	1563	109	77	9	5
616	2287		121	137	131	187	2203	63	1941	115	103	7	3x
345	3207		169	149	141	213	3049	63	2047	123	67x	19x	11
59	3087		195	155x	161	157	3343	71	1833	99	47	27	1
99	2253		307x	161	195	235	2637	67	1585	97	55	95	1
19	1505		389	173	217	173x	1935	79x	1029x	133	33	415	5
9x	1053		701	141	771x	185	1259x		819	14	37	1383	3 5
4	779		1127	199	389	193	903		647	101	43	3039	5
5	505		1363		679	213	709		507	105	31	4217	5 5
6	429		1519		833	195	569		391	95	41	3981	5x
59	359		1293		1133	183	461		419	101	27	2701	3
17	245		1037		1327	173	397		317	115	27	1595	
25	195		751		1183	161	309		259	93	25x	873x	

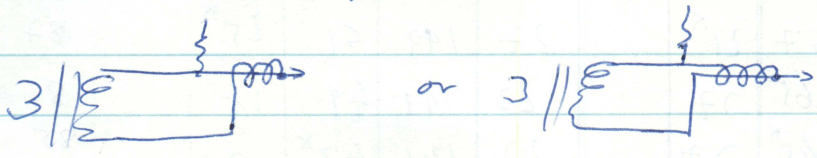
Au^+ still

6 μA 7 μA, 5-26, 3.7A: 280		4 μA, 5-24 RV, 3.7A: 282		2 μA, 5-22, 3.7A: 298	5-20, 4 μA, 4.2A ih: 280
5	13	3	13	3	1
3	5	3	5	1x	1
5	5	3	5	1	1
5	7	1	7	3	1
7	3	3	1	7	1
1	7	7	11	21	3
3	3	5	1	339	1
7	5	3	3x	1909	1
3	3x	3	3	5195	3
5	3	3	3	6333	3x
9x	1	5x	5	4387	5
7	5	9	7	1533	3
15	1	11	5	367x	1
31	3	7	7	85	1
149	3	19	1	33	1
777	1	9	5	9	1
2329	7	11	5	13	3
4311	3	63	1x	5	1
4517	3x	387	3	7	3x
3185	1	1839	3	5	1
1623x	3	4521x	1	7	25
869	1	6665	1	3	107
447	3	5683	7	3x	271
181	1	3045	5	1	559
103	1	1153	1	3	489
55		479	3	1	363
35		243	1x	5	161
21		77	1	1	81
17		43	3	1	15
11x		31	1	3	17
7		17	5	1	5
5		5	1	1	7
		7	3		3
			1		3
					3
					3
					1
					3
					1

Notes for 8 Aug

1) Checking to see if FWHM of Au^{+} really does increase by 25eV for i_h 3.5→4.0 (or today, 3.7 (min current) → 4.2 A)

2) Check to see effect of swapping leads to trap (ie, see whether trap has x√ a-c on it from heater



All but 1 of todays results with leads swapped over.

3) Check FWHM at very low currents 2 - 10μA.

4) Blue store being sloppy:-
initially reading 4 in all channels, wouldn't clear properly
- check chip joints on bit C of LSD - OK
- swap 5058 shift reg from C→A, A→C
- now reads 1 in all channels, ∴ duff 5058 - no spare. re order some.

Store now reading in ? 2n+1 (last question should have been 1K ions acc. to counter, but 2K inside store.
- pack up & go home!

Mon 11 Aug '83 Heater leads still reversed, blue box still +1, ×2.
Au⁺ straight-flight tube

67 mA, 5.72 kV, 3.55 A in ~50/sec
3.6 A 85 mA, 6.24 kV
3.6 A 60 mA, 5.65
4.0–4.1 A 35 mA–40 mA 5.40

241		
17	663	57
13	541	47
13	407	43
27	323	47
21	293	57
15	225	47x
11	195	55
19	161x	45
23	141	57
27x	127	57
17	113	57
19	105	45
23	103	45
15	85	53
21	87	23
29	73	37x
21	85	47
25	69x	39
21	83	41
33x	81	47
57	53	33
123	77	29
233	77	31
541	61	27
1059	61	13
1601	45	11x
2095	71	5
2205	43 (200)	1
2159	57	1
1705	53	1
1283	71	
883	65	

190			
7	1035	83	31
15	807	61	23
13	619	83	33
17	481	63	35
23	383	57	21x
3	289	65	37
19	237	45x	27
7	223	77	31
19	133x	61	25
9	147	69	33
17 (200)	145	61	19
21	113	61	29
25	85	59	9
15	101	53	27
17	77	71	21 (200)
17	107	55	39
19	91	41x	31
19	127	61	19
21	87x	55	9
19	61	49	23
79x	101	43	27
107	101	61	33
239	101	39	25
407	59	59	17
593	65	37	7x
927	69	45	
1145	65	29x	
1541	73	47	
1707	61x	39	
1689	67	27	
1639x	49	31	
1335	71	33	

280			
7	457	49	27
17	369	33	31
13	259	43	19
11	247	55	19
27	199	51	25x
23	199	49	15
23	141	43x	13
23	157	35	11
27	133x	51	19
29	125	27	17
33x	93	35	11
31	95	43	23
29	117	35	13
25	67	29	9
29	71	23	27x
19	87	43	17
19	63	25x	23
17	79	37	11
27	53x	27	13
69	73	31	9
135 (270)	51	23	5
363	51	11	7
731	53	23	1
1183	55	29	
1757	49	19	
2173	59	21	
2229	39	27x	
1931	41	19	
1447	37x	31	
1103	57	21	
847x	35	25	
531	35	15	

265/3		
	1421	163
5	2321	157
35	3069	191
79	3427 (200)	145
87	3409	163
81	2771	157
85	2077	145
61	1707	127
71	1141	161
87	907	123
83	689	151
85	583	157x
109	543	153
107	445x	117
95	415	149
131 (280)	367	131
105	257	153
97	247	105
141	271	119
177	215	113
121	213	14[illegible]
149	203	165
153	157x	151
155	163	89
155	169	141
163x	175	127
161	191	133
143	187	103
149	169	129
235	173	125
383	143	123
801	191	11[illegible]x

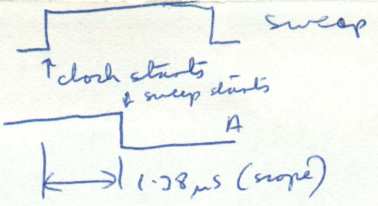
4.7A

~~15μA~~ 24mA

~~5.26~~ 5.37

NB

Times above :
& from now on.



So right times (previously later as ~~1004~~ $(1024 + t - 20) \times 10$ ns

should be $(1024 + t - 138) \times 10$ ns

- offset for adding the two :

$= t + 886$

Ar^+ FWHM Contd, starting 12/8/80)

t_c nA	74	74	74	76	70	6	16
V	5·62	5·62	5·62	5·62	5·49	4·87	4·89
V_r	5·55	5·55	5·55	5·54	5·42	4·86	4·87
t_h	3·5	3·5	3·5	3·5	4·1	4·1	4·1
Δt_{n1}	75	80	75	80	93	48	57
t_r	11·68 71	11·66	11·65	11·67	11·84	12·61	12·56
	71	76	71	74	85	37	40

12/8/80

Change heater bath

13	1499	37
11	1075	61
23	835	49
19	661	43
17	491	51x
7	359	43
41	270 / 349	45
27	247	35
25	213	43
19	203	37
9	147	45
15	169	43
31	121	19
23	95	25
21	107	19x
25	111	17
21	85x	35
27	123	29
29x	85	21
27	71	21
41	83	21
109	57	17
97	71	25
221	85	17x 35
17	67	15
593	47	17
15	51x	21
237	47	25
1677	33	21
1787	39	9
1843	59	13
1771	49	12

74 μA
5.62 kV
3.5 A

&

~50/sec

252/17	943	69
15	769	57
13	561	47
25	455	41
29	365	57x
19	305	59
15	267x	59
21	201	55
19x	157	33
15	177	43
21	123	31
25	147	37
25	119	53
17	101	33
23	113	31x
23	101	51
3	200 / 77	41
19	75	43
37x	93	27
85	59	23
131	77	37
181	83	21 33
301	65	33
523	41	37x
773	77	23
1145	59x 61	13
1421	91	23
1671	65	31
1729x		27
1661	59	15
1423	53	31
1021	69	33 27

&

~30/sec

252/33			
39	737	83	57
29	565	117	55
33	505	95	27x
27	437	85x	45
43	383x	109	71
39x	331	93	55
25	291	99	53
43	277	105	49
33	235	93	37
51	205	91	
49	155	79	
31	139	67	
43	175	79	
45	147	89x	
65	143x	87	
109x	123	69	
155	139	65	
261	129	79	
389	161	69	
677	137	49	
927	107	65	
1283	115	73	
1777	113	63	
2105	97	49x	
2485	121x	53	
2387x	109	35	
2057	101	77	
1821	85	63	
1473	101	63	
1193	93	55	
957	99	49	

3.5 A
5.62 kV
76 μA

252/35	1617	87
23	1427	71
23	1223	85
19	1029	83
21	663	87
15	667	83
127	489	93x
33	437x	77
260 / 21	351	79
21	317	63
21	235	57
23	231	79
29	211	75
21	195	49
23	183	49 55
29	171	57
21	123	77
25	125x	83
37x	119	53
71	141	65
83	117	57
105	105	53
199	107	37
299	97	53
457	127	37
741	89	31x
955	109x 91	27 51
1399	69	25
1639x	87	33
1885	89	
1825		

Rut 4.1A 70μA 5.49 | 4.1A 6μA 4.87 | 4.1A 16μA 4.89

272

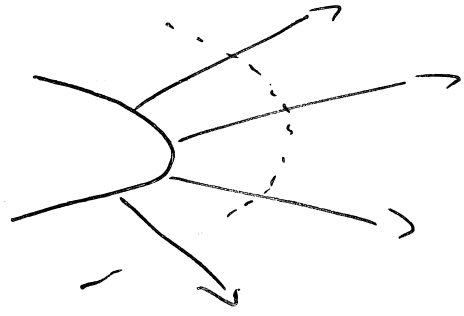
			255			
10			0	8x		
21	255	67	5	0		7
50	261	107	1	5		3
25	200	71	1	3		1
47	267	97	1	0		5
20	257	67x	0 (260)	5	5 (263)	7
21	190x	71	1	1	11	0
29	191	85	3	5	10	0
			0			
45 (8)	171	75	1	0	70	0x
65	147	87	5	5	107	5
29	100	69	1	0 (400)	201	0
						5
50	109	97	11	3	379	5
37	107	85	7	0	299	7
				0		
25	141	79	9	0	255	11
						7
45	19	97	10x	0	209	5
40	99	71x	59	7	165	5
85	89x	65	100	5	181	1
109	101	87	259	5	95	3
171x	99	69	285	5	97	0
260	99	67	453	7x	29	7
						5
257	111	45 (265)	400	0	50	
501	100	85	257	1	27 (280)	
751	120	55	167	5	19x	
				0		
899	81	65	120	0	17	
1057	91	59x	57x	5	10	
				1		
1157	90	75	07		5	
1280	97x	71	15		5	
1207	70	67	15		5	
1129 (2005)	69	75	5		5	
1020	99	70	7		5	
					5	
791	90	60	1		5x	
					9	
607	80	57	5		0	
		70	0		7	
555		57	0			

Conclude that broadening of Ar^+ doublet observed at 1 beam = 4 A originally due in fact a pressure effect & due to outgassing of source (p still rose to $\sim 1.5 \cdot 10^{-6}$ Torr at 4.1 A)

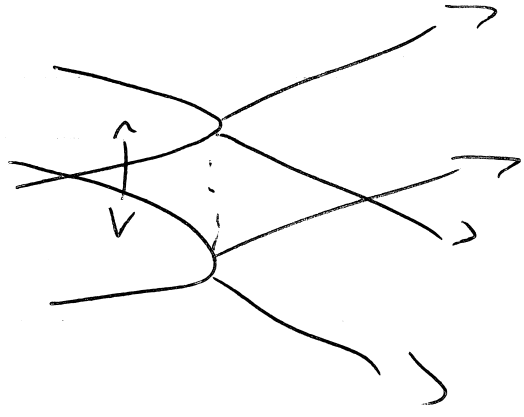
? $(ArH)^+$ formed, $\frac{\Delta m}{m} = \frac{1}{200} = \frac{\Delta E}{E}$, $E = 6000$ $\Delta E = \pm 30$ which is about right.

on 18 Aug 1980

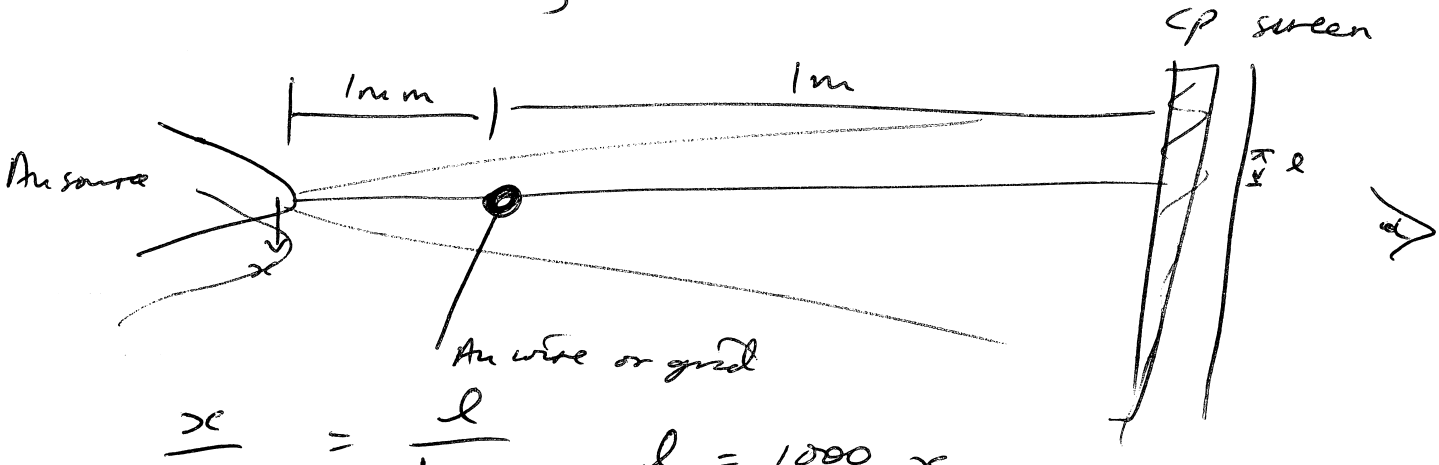
? Considering projection image of L-M ion source :-



Projn as for fringe - not important



Projn as for stability of lip - matters.



$$\frac{x}{1mm} = \frac{l}{1m}, \quad l = 1000\,x.$$

If $x = 1\mu m$

$l = 1mm$.

∴ Should be able to get good idea of stability of emitter

Porch test, Mo Cg, 60 Hz / ±10°

122 at 5.98 kV

1580

140

Test specimen

592 a 6·15 + 1·02 147/580 vac – should be forward on Porch.

~~790~~ ohms

b) 6·15 + 1·12

6·10

Through-focal series, 1 type.

593 6·00 + 1·05 157/580 vac

6·00 + 1·15 " " a bit grainy

594 a 6·40 + 1·15 " "

b + 1·25

595 a 6·50 + 1·25 " "

b 6·50 + 1·25

596 a 6·50 + 1·45 " "

b 6·50 + 1·55 " "

597 a 6·50 + 1·65

b " 1·75

Freezing

No Fris sling onto stage/h, loose, - specimen bent
till

T 598 a [illegible] 1.15 vac 170/560 110 environs

b 7.[illegible] 1.20 " 175/560

599 a 7.07 + 1.25 180/560

b 7.07 + 1.20 185/560

20 Aug 80

Gillrams tensile spec $\overset{.2}{Ti}/\overset{.4}{Mn}/\overset{.08}{C}/Fe$ wt% 800°C/1000s (11/3/80 ①)

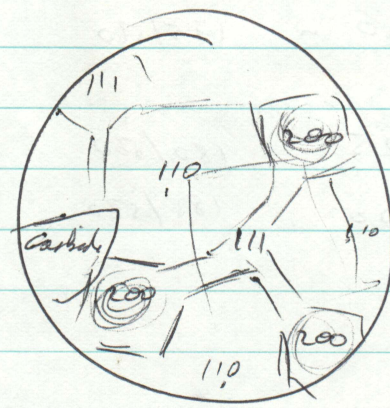
ph Mafisch

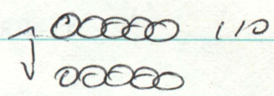
DIV x 2

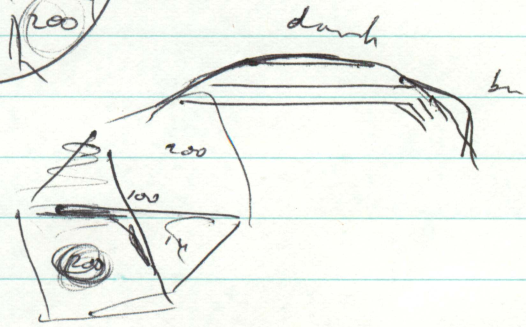
CDIV x 2

empty tablet

DW x 2 5.84kV







600

5.1 + .9 } 130/150 mm

5.16 + 1.09 } ~350 s, v slow, in bursts

– lots of Fe.

DW x 2 – ppt gone.

DIV x 2 axial 5.75kV

empty DC

DW x 2 6.00

ph Mafisch

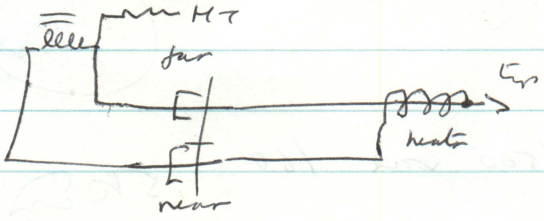
ph x 2 6.75

finished

21

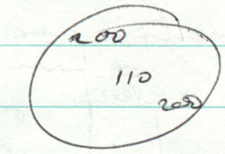
Thus extract Ar source – apparent heater open-circuit
Insert new Ga source & pump out.

Connections are



22nd Aug Fri

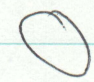
New Gatham gun min / 800 / 1000s
ph x 3   7 · 30 kV



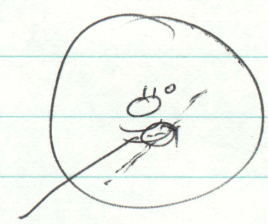
601   7.65 + 1.10   180/560 vac /60
         −1.18

5K em,

ph x 2   7.46



Smaller ap x 10   ? dislocn or l-a g-b



602   8.2 + 1.4 (−1.49)   200/560 va from ? line of kdy
Some C, N
ph x 2 where 602
ph x 2 moved slightly

IAP x 3 or 4   (Old IAP film contd)

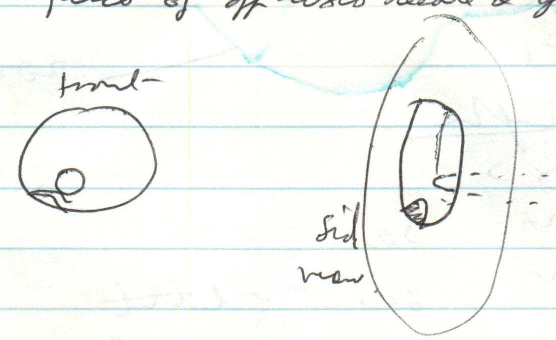
Fe^{2+} 60s   62

C^{2+} -> 201 = 27
C^{1+} -> 327 41
N^{1+} -> 352 42
Ze -> 462 56

C^{++} noisy
Fe 60s
C^{++} ~
42 N ?

Fe   30 sec = 5 planes
diff   60s
~~Max~~ Time 40   60s (Fe = 57·60)
IAP x 2
ph x 2 IAP blank

Mon   Au source - pics of off-axis needle & gold deposit



- sent back to Culham to have heater checked, put back on axis

Culham Fe/Ti/Mn/C /8.20°/1000s
Analysed at Zoco

	Ti	C	Mn	Si	Al	S	P	N	O	Nb
British Steel 2396	0.23	·06	·4	·02	·04	·02	·007	12ppm	38ppm	
Plan Station	0·21	·09	·40	<·02	·03	·013	·004	90ppm		<·02

ph blank

BW ×3   9.2 kV

603 } 9.5 + 1.6 vac   230/560
 −1.75
 235/570
 9.65 + 1.7
 9.9 + 1.95   240/560

ph ×3 where 603
10.3 kV IAP ×3 — after evaporating quite a lot
 200 top left

Fe 56 Fe^{2+} 30s
{C25 212, 36 201} C^{2+} 60s — none
IAP × 1
(220) × 2 IAP
Fe^{2+} 52   10 planes in 60s
something at 34? 60s
" - 60s   perhaps not - nothing cap

ph × 2 11-2 KV

IAP × 1 — 200 top left

IAP [illegible] ph

1 AP × 2

Fe 2x 20s

C 2x 60s ~ [illegible]

IAP × 4 or 5 — carbide energy on 200

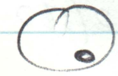
ph × 2 11·4 KV

No time to probe ~ 6:40

– look @ tomorrow if still there.

Wed Same 7e 7c Mn K/800/2000s

ph×1 DW 12.05 KV — carbide

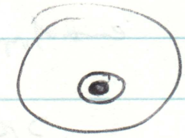


ph shifts

ph×2 DW

ph×2 <DW

ph×2 <DW, ph on carbide



604 11.4 + 1.8 } var 280/560

ppt ~11.5 + 2.0 } "

~700 cnts, v slowly!

ph×3 } <DW where 604

ph×2 }

ph×2 moved — ppt ~ coherent 200-wise

— [illegible]

ph×2 on ppt

605 ppt 11.5 + 2 285/560

↳11.8

11.9 + 2 290

readjust posn @ ~860 cnts — close to edge

12.2 + 2.1 295

adjust at 1600 (cnts) still OK

12.30 + 2.2 300

—1880 cnts — still on ppt OK

amplifier died — pack up.

- rebuild 74500 bit of amplifier

606 280/560 11:1 + 2-2 — 280/560

pptotall 11-2 + 2-3 check OK at 120 ⊙

285 11-3 " " 226

end stopped @ ~ 800

— OK end

— finished

1 - 5 Sept holidays

9th Sept 80 Ga source $i_h \simeq .8$ A

Blue box store repaired (duff 5058 1024 bit shift-register replaced with signetics 2533) (5058 no longer sold)

Ga+ 3.36 KV, 2.5 μA

3.43, 2 μA

All, ÷4, scan 2.5 μA 3.12 KV

→ SFA 3.02 2 μA Ga+

el
et

2 μA 3.04 keV
Ca^+ & Ca_2^+
thoroughly

Wed 10 Sept Ga source 1

14 μA 4.92 kV lin amp, spectrometer 'Beat'

1 ½ ¼ 2 5 f35 Ga^+ peak] 2 μs/cm
½ ¼ 1 2 5 " + gradient
½ ¼ 1 2 5 50 nS/cm Ga^+_{69} & Ga^+_{71}

no sign of diverse or tantalum, or of Ga^{++}
heater at .8 A.

dig amp 2 μs/cm – v little Ga_2 etc (as observed yesterday)

4 μA 4.60 kV 2 μs/cm | dm
50 nS/cm |

dig 2 μ/cm

50 μA 5.68 kV – some diverse & tantalum lin amp
2 μs/cm
50 nS/cm

dig amps 2 μC/cm

mixture 2

dig amp 1 – 10 diverse & tantalum

appears to be a threshold around 45 μA for diverse ele.
– different to last source, but more like obs. of Culberson.
? Mechanism – Ti/Ta to be a temperature effect,
i.e higher T, larger no. of high temp species in region
∴ threshold probably T-dependent.

Note that volts are higher today than yesterday –
some creeping phenomenon as with last Ga source.

Ga_2^+ 5.68, 40μA — dropping to 30, count rate drops too

Ga_3^+ 5296/40

Ga^{++} 6.43 48μA

Ga^+ 6.55/26μA — Ga^+

~~6.77 50μA Ga^+~~ 7.21

Ga^+ in 1.0A 40μA

46

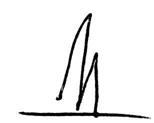
8	152	6x	5	21/4	29	243	33	566/2	460	2x	565/12	6				8.15/60	
13	197	14	10	13	32	281	39	0	226	3	42	4			741/26	676/3	4
5	279x	8	7	23	21	276	18	4	107 (600)	3	38	1			122	678/3	2
13	338	5	1	32	26	264	29	2	237	4	3	0 (800)			309	0	2
8x	328	8	3	22	29	241	23	7 (570)	418	2	0	5			398	1x	727/2
10	386	8	7	21	24	231x	20	5	504		0 (570)	3			279	0	729/3
9	396	5	4	24	20	189	30	7	359			3			119	1, 0	2x
7	391	11	9x	27	25x	199	32	8	187		772/4	1			33	1	736/2
6	405	8	5	31	24	174	18	4	97		107	1			16	0	744/2
9	449	16	8	31x	23	141	29	5	14		710	0			24	0	757/2
14	447	4x	4	29	16	131	22	8	8		1703	1			47x	695/2	
14	462	4	4	29	19	121	21	8	8		1571	2			133	701/4	
13	419x	10	7	24	22	97	19	3	12		678	2			207	5	
12	371	7	5	23	36	69	29x	5	1		129	1			191	5	
13x	324	4	6	30	26	68	24	5x	5		42	0			107	53	
14	261	7	1	19	32	65x	26	5	1		28x	1			40	156	
10	253	8	11	29	28	53	25	1	6		21	3			6	354	
15	190	6	3x	31	35x (260)	51	31	7	3		69	2			2	500	
14	171	5	2	20	39	47	21	2	3		433	2			2	390	
11	142	6x	0	23x	34	36	22	2	1		919	0			0	216	
13	89	7		21	50	43	26	2	4		810	2			1x	57 (710)	
15	106	6	0	24	65	45	22	2	4		357	0			0	21	
6	58x (100)	5		16	64	35	27	6	6		88	0			0	29	
6	52	8		39	114	32	30x	2	2		31	0x			0, 0	89	
15x	22	5		29	123	38	32	4x	3		23	4			1	168	
6	16	11		39	139	39 (700)	30	8	3		18x	0			0	213	
10	15	5		27	195	33	34	4	5		11	3			1	221	
13	18	9		24	199x	36	21	26	7		9	1			1	107	
27	16	9		23x	223	31	24	148	6		11	0			0x	35	
33	9	14x		24	244	35	27	446	2		3	0			0, 0	3	
57	7	7		15	267	26	31	636	4		3	0			0	5x	
117	9	5		20	283	23		719	6		2	2				6	
												0					

Ga_2^+

7-21
24 μA

21/6	176/14
4*	14
5	9
12/2	11
19/4	10
6/2	7*
17/2	9
68/2	2
2	4
0*	4
2	5
4	4
4	1
9	4
8	6
20	5*
25	6
20	2
50	6
08*	2
45	2
47	2
59	0
61	3
75	4
	2 *×200
60	2
65	3
58	2
40	4
50*	0
	2
42	3
41	1
35	1*
25	2
19	1

40 μA 7.95 kV
series of pulses lin amp 2 μS/cm
1 μS/cm
50nS/cm



then 20 μA 2 μS/cm 6.79 kV
peak after running at 50 μA — some Ga_2^+
& 50nS/cm

Fri 12 Sept-80 Ga

Ga^+ 8.02 kV
40 μA ± 3 μA

60 μA V=? ~9.2 gauss

682 / 2	710 / 3	642		
708 6	1	2	269	4
64	4	2	242	1
710 391	0	3	124	2
1158	1	4	50	5
2110	1	4	16	1
2168	0	3	11 (650)	2
1161	1	1	13	4
309	1	1 (650)	8	3
150	2	1	5	1
140	2	0	3	3
267	1	3	5	4
626	2	0	4	3
994	1	1	5	5
1215	0	4	1	2
563	0	1	4	4
214	0	1	6	5
77	1	0	1	4
64	0	3	7	4
41	1	19	2	3
26	1	81	2	6
8	1	214	5	3
7	0	330	3	2
0	1	317	1	2
1	0	473	4	2
0	2	445	6 (700)	3
2	1	243	1	0
0	0	155	4	0
0	0	121	11	0
1	0	206	3	
0	0	201	4	
0	all 0	246	5	

Mon 15 Sept 80

Ga source 12μA, 6.74KV

T607 020/scan/40μs Heater 0.5 A ~1300 scans

– started good q. fast – restarted ↓

T608 " " " 11μA 6.75KV 10K

T609 20μA 7.81 KV ~7K

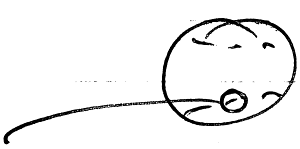
take a bit to stabilise for some reason

blue stove getting 'zero' into multichannels for some reason.

55/75 ph blank
ph × ?
ph × ? moved slightly to ? ppt

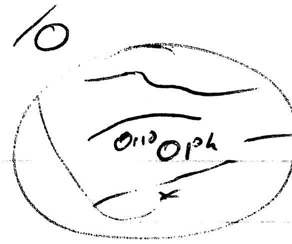
610 here 6.5+1.9 170/580 vac — new type ?
4.17pm 6.55 + ? new 74500, 74511?'s

Thurs 8th/Oct New 55/75
ph blank
ph × ? 9.1 kV
ph × ? on gb



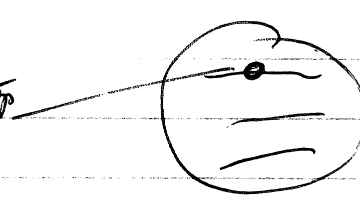
611 8.60 + 1.9 220/580 vac g-b
check at 2700, ok — bit quick on restarting 2700-2870
5-4K 30K
— 9.75+2.10 — 11K 235/580

[just off g-b at end
ph × ?
more onto matrix, ph × 2
ph Mapping
ph × ? 9.92 kV



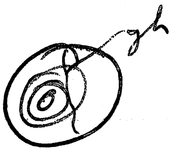
612 matrix 9.3+2.2 240/580 vac
— 9.51 + 2.23 " 10K all at 1 position setting
ph × ? where ? — still on matrix

613 9.9 + 2.23 ph on g-b at top
— 2.29 250/580 — 2K



ph × ? where 613
ph × ? axial , ph × ? 10.3 kV

MAP x > nasal



Fe_{28} 56 =	440	
Cr_{26}	425	= 52
Ni_{29}	450	= 55
Al	310	= 37
C_6	200	24
C_{12}	290	35

Fe 50

Cr

Al

C_6

Ni

Al

IAP x ?

ph x >

Ga source purging out - with Mo collector, reduced slit-widths
refurbished Ar source back from Culham.

Same 53/75

Ari ph x 3 n axial 10.87 kV Ne/60 6 10^-10

matrix

614 a 10.91 + 2.2 ne 275/560
11.1 + 2.3 15k
11.2 + 2.3 280/560
210k

615 b 11.35 + 2.3 280/560 ne same place, unsatisfactory
11.55 + 2.3 285/
11.55 2.4 290/

616 c 11.65 + 2.4 290/ " — —
+ 2.5 295/
— Total ~ 56k at b + c

Ph x 3 where c16 — close to/on g-b at end.

more ph x 3 12.65 kV
1 AP x 3
1 AP x lots ss spiral on (10) (16)
1 AP my li... 2
1 AP x saved — oxygen cyc
Fe 2+ 42-43 — 46-47
C 2+
Al — 32
Cr
Ni + Fe
Fe
Fe
Al
C6
Co
Cr ↑ electronics jittering
Fe — cable loose, hold tight, stable ↓
Ni
Al
Cc
C6

Al

IAP × 4 - pretty (10)

another 9-6 topright (1°)

^ 12-7 IAP × 2

changeable temp

Fe

Cr

Ni

Al

Cu

Cu

Al

IAP [illegible] 3

Fe

Cr

Ni

Al

Cu

- map

IAP × 2

• ph × 2

IAP [illegible]

Fe

Cr

Ni 20s ↑ all for first set (50s)

?Al

Cu 20s

Cu 60s

Al 20s

Al 60s

Fe 20s

Cr |

Pretty!

№ 1

VAP ×3

VAP rewinding ×2 or 50

IAP ×2

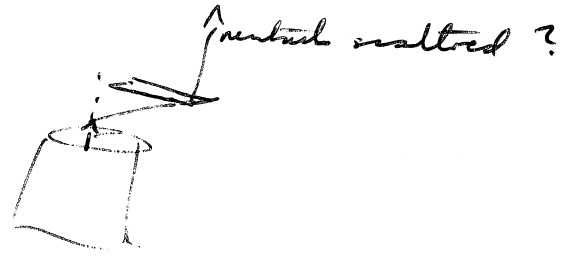
photo 3 13.8 kV

graphene

Mon 13th Oct

Gu source in TOF machine, with Mo collector & smaller apertures.

- source dirty,
- lot of problems aligning it - could detect neutrals but not ions
- ? something charged up or source out of range of the slits :-



Cleaned source up with N2 pulser - cleaner than was, but still sparks over occasionally

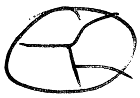
- leave to pump out & log & align again tomorrow.

141 set

Tues Same s+s spec / 7T
810^{-10} / 00 / Ne

ph blank
ph 10-6 ev × 2
1 AP × 2 CDW
1 AP × 2 DIV

1 AP Neufile 33



Fe^{2+}	44 = 360		44
Cr	~~327~~	347	42
C_6	~~157~~	167	20
C_{12}	~~223~~	236	30
Al	~~256~~	250	31
Mo_2	~~436~~	470	57
N_{29}	346	367	45

Fe^{2+} 30s
C^{2+}
Al
C_{12}
Cr -ing
Cr
N_2
Mo_{2+} (?)
Fe 30s
Fe 15s
Al 30
Fe 15
Al 30
(Fe) 15
(Al) 30   (Fe + $\tilde{\tilde{C}}$r)
Fe 15

Fe — Cr
C_6
C_6
Al

Al

Cr

Ni

Ni

IAP × 2 14.6 kV (+ 2.7 var ↑)

small bright area RHS 

Fe dual

Fe 20 s

IAP profile 4

Cr

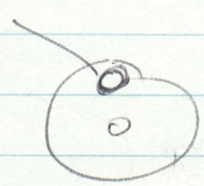
Al

Cr

Ni 1 third.

Fe

Cr

IAP × 2 

ph × 2

ph on bright region

T617 a 14.1 + 2.8 var 350/560 3 K

b adjacent matrix " 4 K

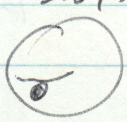
move

lunch ph × 2 ph ~~[illegible]~~ ph profile 8

ph × 2

ph × 2

618 ~~[illegible]~~ 14.48 - reduce to 14.28 + 2.8 355/560 var

from dark hole near gb bottom left 

- bit fast > 400 / minute, 1/20 pulses. -6 K all at 355/fast

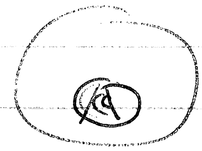
ph × 2 axial 14.6 kV

ph × 2 on bright area, LHS

619 where bright area ? 14.3 → 14.2 + 2.9 355/560 var

pl x4   14.6 kV   axial, pretty .

pl x4   14.7 kV   – .



1AP x 4

Fe   20,

Cr

Ni

Al

? Al

Cu

? Cu

Co

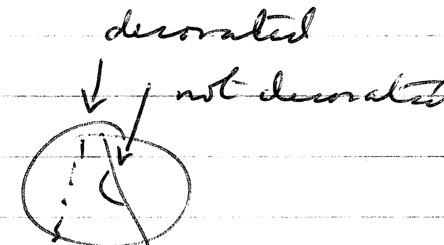
Co   + 2.9 kV, vac

Al

Cr

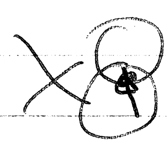
Fe

Ni



1AP x 2

Move up   1AP x 2



14.8 kV

Fe

Cr

Al ← ? Ni

Cu

Cu

Al   hit grid!

Fe

Cr

Ni

Fe

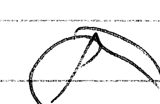
Cr

Al

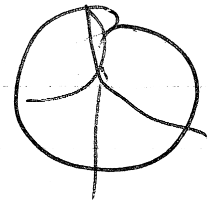
Al

1AP [illegible] 5

1AP x 0

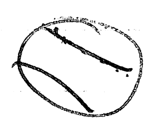


IAPx2



delay line in
pulse to 2kV

Fe 20s
Cr "
Ni "
Al
Al
C6
C6
Al 20s
Al 15s
Fe {20s ?
Fe {15s
Cr 15s
Cr "
Ni 15s
Ni "
iAPx2
IAPx2 RHS



Fe
Cr
Ni
Al
C6
C6
Fe
Cr
Cr
Al orthorecibrates, all 30s ↑↓ 16.1 + 2
C6
C6
IAP x2
ph x4 penalty

IAP x 3 - Laugh

Fe 20s

C6 -

C6 60s

IAP laugh 6

~~Fe~~

Cr

~~Al~~

Al

Ni

C6 20s

C6 60s - fast

Cr 20s 16.6 + 3 ↑ + (delay here)

IAP x 4 16.1 K V

IAP x 3 Just to left

~~Fe~~

Cr

Ni

Al

C6 30s

C6 - 45s, fast

Al 15s

Al 30s

Cr 15s

Cr 15s

Fe

Ni 17.2 + 3 ↑

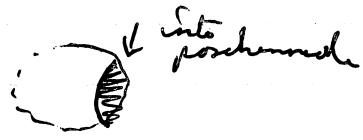
IAP x for 7 ?

ph x for 8 ✓ pretty

Fri

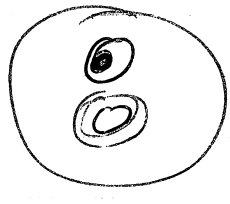
New 55/75

ph axial x3 8-24 vcv

aligned with ph cutoff by apertures ie 

620 1.6 + 8.00 } 205/560/vcv 3
1.7 + 8.07 } 870 cells - popped

621 1.7 + 7.8 — 8.2 205/560 align on dark hole v close to 620
1.7+8.2 — 8.5 210/
1.7+8.5 — 215
220
225
9.1 + 1.9 ——————— 230 speed appx bit, ~12K
~30K
PH x2
ph x2 moved slightly

622 Align on dark area above ~~cecal~~ plane 
a with reduced aperture,
230/560 9.2 + 2.0 vcv —10K (fast-! ~700/min at times)

b another dark hole, reduced 225/560 ~9K

flashed

Monday 20th Oct

Replace Ga source with Au source, to try to locate fault in TOF spectrometer

bdary's martensite — ph Myhm **1**

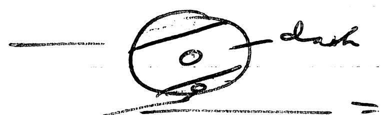
ph × 2 7.5? kV axial

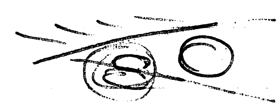
623 — 6.80 + 1.4 — 175/560 vac — where ↑

a — 1.5 — 11 K

ph × 2

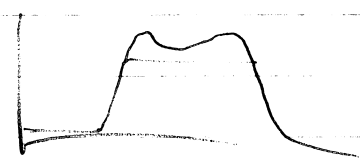
Move to bright area





b — 6.8 + 1.5 — checked OK at 2 K5, 9 K5

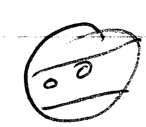
6.96 + 1.6 — 180/560 — lots of bdary's close to ph tho'



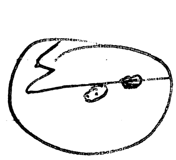
ph × 2

ph × 2 axial

ph × 2 ~ ~ — 7.06 kV



ph × 2



624 — where ↗ — 7.0 8.00 + 1.65 — 185/560 — ~~martensite~~ austenite close to edge of ~~plate~~ film

a — ph × 2 ~ 10 K

ph × 2 on ferrite grain, other side of plate — v. boring so.

b — on ferrite — 7.00 + 1.68 — 185/560

stop @ 6 K as getting C from boundary adjacent

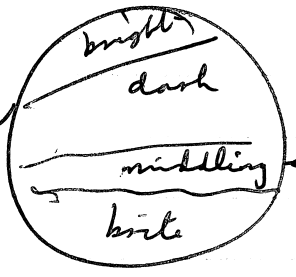
ph × 2

~ 8 K — ph × 2 axial — 7.56 kV

625 — Middle of ~~martensite~~ austenite — 7.00 + 1.65 vac 185/560

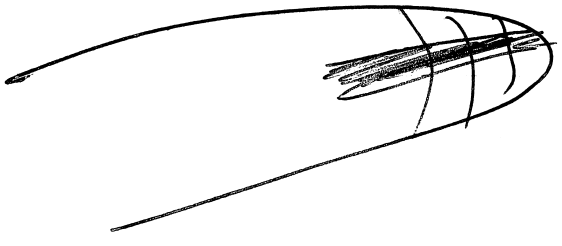
Mx ⊃ where ↑

Mn ⇔ axial – odd 7-7kV



??

1

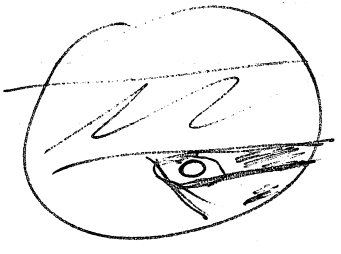


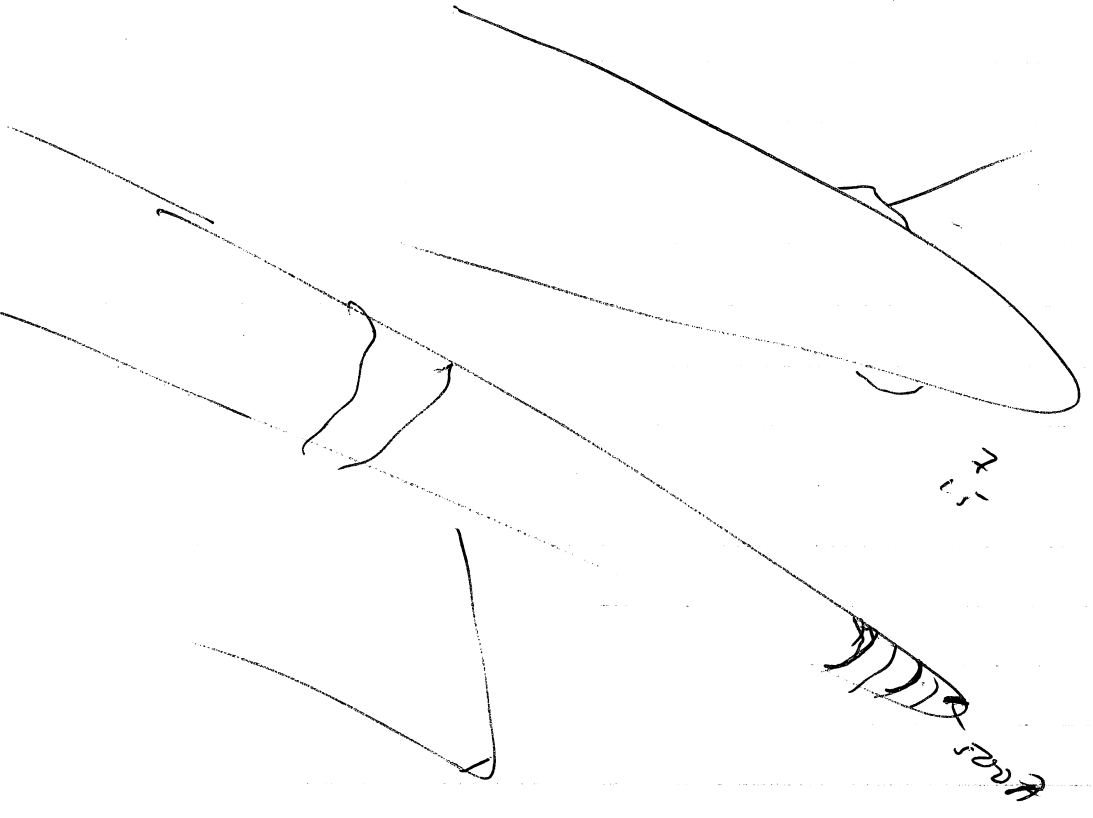
(1800 Å)

10⁻⁵

50,000

400





~~Tuesday~~ Continue pumping out & outgassing the source.

Same Harry's specimen
? structure
- could be very smashed ferrite (C ~ 1.8% from yesterday)

dark areas, ? austenite

ph Profile 2
ph x 2 on edge of dark hole, as far over as will go

626 7 + 1.8 190/560 vac
~ 6K
ph blank
ph x 3 areas on dark ? austenite film

627 a 7 + 2.0 on film - 2.05 190/560 vac @ 250/min
b) same place 7.0 + 2.2 190/560 - @ ~ 400 min
- 10K in 25 min
ph x 2
ph x 2 on bright - ? ferrite

628 7 + 2.2 190/560 vac
8K - checked @ ~ 4K - realigned
stop at 8K as ferrite showing, but ok ! straight now
ph x 2
ph x 2 areal
ph x 2 on dark hole

- knife

629 a -11K 2.25 + 7.05 195/560 from dark area next to bright ferrite
ph x 2 where -> austenite wider
ph x 2 areal

b) from dark hole in top layer of ferrite

7.2 + 2.25 195/500 vac

5K

ph ×3 where ?

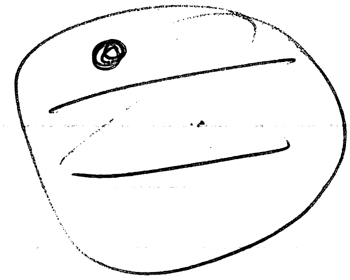
pnh ×3 axial

ph ×1 " reduced mag

ph nofilter

ph ×3

ph ×3 axial ~ –



Check Au source in TOF machine

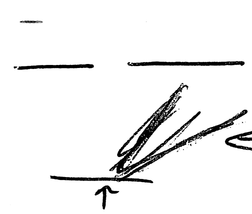
– 30 μA ~ 6 kV , I_h 3.3 A as before.

– Mass Spec works fine! – ~10 seconds to align.

∴ Something odd about Ga source

– most likely sideways emission

∴ –



Possibly affected by charging of insulators on heater, which fluoresce a lot

∴ Fit cosmetic shield & use same arrangement as for Au source

Also fit better heater so can get source hot, & hopefully improve wetting of the needle.

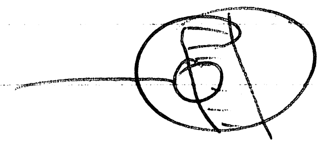
Wed 22 Oct

Same thing's spec FeMnCSi
570-10/Ne/60

ph blank
ph x5 axial

MAP x5

Fe 57	=440	57
C_6	204	24
C_u	288	35
C_{18}	350	40
C_{u}	407	51
S_i	311	37



C

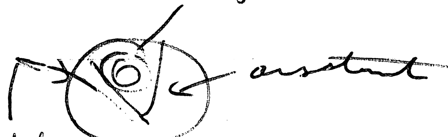
Fe 60s
C_6
S_i
C_{18}

2

1AP Anfil

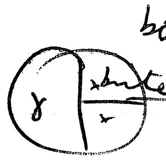
Fe 60s
C_6 "
C_6 "

1AP x5

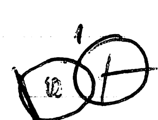


More runs

1AP x5
Fe 60s
C_6 "
C_u "
S_i "



1AP x5
Fe
C_6 – dead
C_6
C_6
Si
MAP x5



|AP⟩

R_c

C_6

G_6

L_6

S_1

|AP⟩

|AP⟩

~~|AP⟩~~ |AP⟩ ⟩

|AP⟩

Z_c

C_c

G_6

S_1

C_6

|AP⟩

|↑⟩

|↓⟩ pretty

dark

(110)

+2.2 kV, vac

−8.76 kV

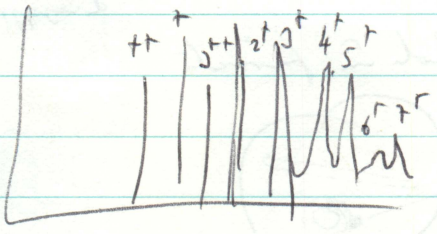
Ar source 24 μA 5.4 KV

630 scan, sensible current, 20 μs time limit (÷2 so we forgot to edit)
10 K 15 mins / 10 K

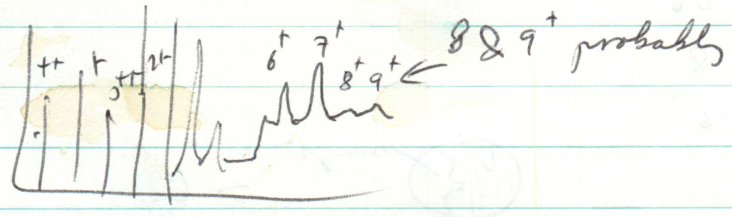
631 5 μA 5-7 KV scan, ÷2 – slower
– set of pics of scope display, 10 K

632 44 μA 5-7 KV hand held 15 K & 20 K, +4 & +1·8

set of pics of scope display after integrating for a long time with progressively increased delay time – can see Ar_7^+ unambiguously ($> Ar_6^+$)

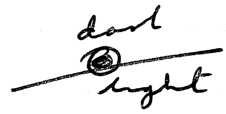


integrate further



Thurs 23 Oct

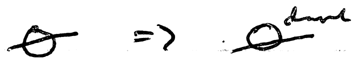
Harrys spec again ph Nylands **184**

ph ×3 aligned on interface 

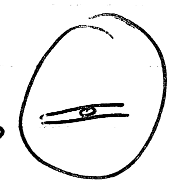
— reduced area

T 633 stop at 1K cos lot of funny ions
— restart 220/560

634 a 8.1 + 2.3 ra 220/560

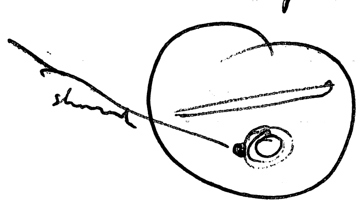
Realign @ 4K 

8!25

— γ apparently disappearing 

b 8.25 + 2.3 on black hole in ferrite

2K

ph ×3 

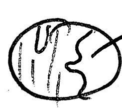
erupted ph×3 9.1 kV

" " " " 9.5 "

" " 10.06

10.8

11.6

IAP ×3 

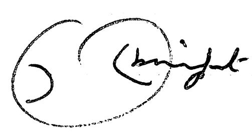
— top

Fe 30,

C^2 1

C^2 1

IAP ×3

erupt a lot ph ×3 

ph ×3 11.59

IAP ×2 top 

Fe^{++}

C^{++}

C^{2+} — v fast — flashed

118 166 001 110 110
119 167 111
122 172 001 111010
123 173 011
126 176 1 111 110
127 177 1 111 111
130 202
131 203 000 010
011
134 206 110

120 170 111 000 00
121 171 111 00100
100 00
101 00
100 00
101 00

~~Attempting~~ to look for Au^{3+}
– Blue box being silly – won't
accept numbers ending in 100 or 000 for
some obscure reason.

meantime, ph x 3 3000 Ir oxidised 800 for – hours ex MPT
ph x 3 400 imaged in He : Ne 1:4

phn ½ dia or so (oxide (core)) 6.25
Straight as pulse 6 + 1.4
ph x1
ph imaged
ph x3 6.97 kV
– flashed trying to probe, when gas removed.

62 4260
5.620 9.260
1.5 7.76
4.12

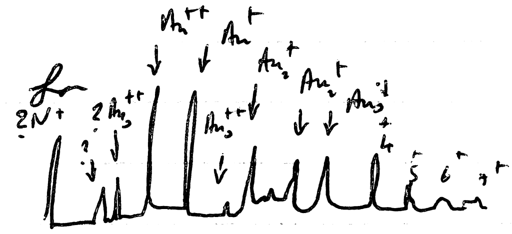
6.34
1.5
7.84
2.84

Eventually fixed electronics (blue box)
– don't quite know how – suspect dry joint / dud IC's
edge connector

Fri Au source 24 μA 5.89 kV

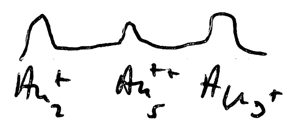
Mfilm **A**

— integrate for long time to look for rarities Au^{2+}, Au_5^{2+}



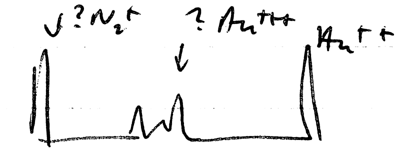
pics of whole spectrum

pics of Au_5^{2+}



pics of whole spectrum + scale

" " ? Au^{+++}



Spectrum with front & end integrated for 10 minutes, middle for 1 minute, to bring up rarities — 30 μA, 6 kV

pics × ~5 whole spectrum

" " " " × 2

A " " " " no graticule

pics × 5 spectrum with beginning & end integrated for × 40 time

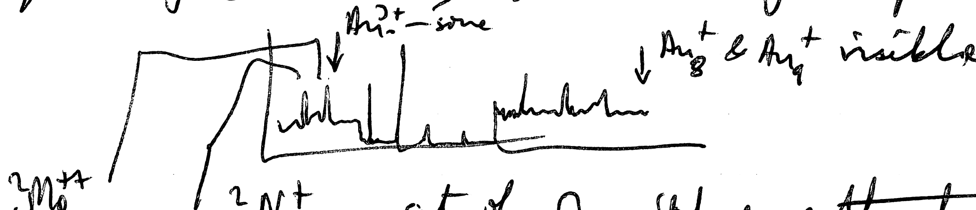
Mfilm **B**

pics × some

Blank

B 2nd spectrum 30 μA 6 kV

then trying opening slits to record rare species quickly (≈ 15 min) then closing to fill in Au^{++} — Au_3^+



sets of pics with & without graticule & @ higher gain.

6.00 kV (counters from A spectrum opposite)

70	89	75*	73	123	4	6	118	115	100	93	124*	71	70	105	87	78	86
92	83	73	93	78	3	11	106	87	67	124	84	79	88	88	91		
79	94	98	77	67	3	11	107	90	71	135	93	80	118	101	87	96*	
81	77	79	88	97	2	19	112	92	79*	121	74	77	100	90	74	98	
70	82	86	78	85	3	25	89	95	68	101	79	68*	100	97	73	93	
73	86	88	71	72	3	19	124	89	72	119	90	61	131	100	84*	111	
85*	73	80	66	90	2	23	82	65*	77	109	69	68	116	81	91	100	
89	81	78	76	81	2	12	80	90	72	128	91*	66	146	82	86	117	
71	85	91	85	74	2	8	94	70	77	104	99	78	140	79*	72	114	
79	87	89	96	77	2	2	95*	71	67	99	78	85	124	84	92	115	
88	81	111	95	66	2	5	86	68	61	89*	97	77	128	83	93	104	
87	94	200	81	96	3	5	94	84	75	97	98	70	136	86	83	103	84
79	83*	158	77	82	2	17	103	77	74	86	104	73	124	85	62	93*	
85	84*	89	99	62	3	7	82	59	75*	96	104	99	126	76	69	111	
108	69	64	97	72*	2	3	105	77	92	92	125	82*	122	98	89	101	
84	102	98	101	89	2	27	91	83	96	91	109	81	115	74	82*	97	
80*	87	81	106	66	2	2	100	77*	96	94	106	81	118	75	80	92	
113	68	87	94*	75	2	2	101	134	81	112	87	142	59	119	84	82	75
88	87	100	83	82	2	4	104	164	75	144	86	123	78	109	85*	86	97
67	95	103	84	78	5	4	118	207*	81	175	78	128	88	96	83	86	90
97	77	79*	112	73	2	11	112	260	82	217	84*	119	92	84	81	81	97
89	90	88	109	87	3	49	119	206	71	257	100	94	87	72	85	94	74
114	94	71	123	80	3	49	117*	433	75	326	106	111	88	70	109	87	95
86	69*	85	86	83	3	44*	115	490	66	436	96	93	69	98	88	92	88
90	114	76	95	83*	5	43	107	448	69	440	89	75	80*	68	96	90*	92
81	80	85	100	59	4	22	90	404	65	426	95	92	89	81	85	91	104
82*	75	114	99	56	250	19	114	288	68*	332	81	84*	80	77	104	87	87
86	87	83	92*	66	1980	8	102	193	96	250	92	85*	77	79	92	79	95
70	90	96	93	3	760	4	114	183	76	200	83	75	78	94	104	75	90
97	82	87	66	2	214	2	107	127*	63	193	93	81	83	83	103	95	86
85	80	89	116	726	74	2	120	127	63	152	86*	94	81	86	89	89	91
77	83	77	107	523	20	2	96	98	60	142	86	64	100	95	84	85	87
120	77	95	102	26	12	5	85*	94	82	131	87	61	94	75	74	89	91

contd
901

81	76	91
84	78	92
89	91	80
85	84	82x
86	91	91
77	79	90
87	77 (990)	86
87	77	94
88	54	77
70	75	85
79	76	90
64	84	94
86	92	82
91	86	90x
77	96	80
84	71	94
79	92x	86
85	88	78
107	87	78
86x	76	70
79	75	74
96	87	69
79	74	81
84	68	92x
94	78	84
75	91x	70
79	88	69
87	68	80
97	87	78
79	85	79
96	88	77
87	94	78
105	71	78

C 60μA /5.59 kV — same (x N (~20 minutes for ends of spectrum, ~1 min for centre) slits closed

pics off other (H-P) oscilloscope x various

Dark to Marconi scope — various pics

[illegible]

?: set of pics of spectrum C ?

Mon 27 Oct

Phil Rosevelt phoned to say grant for coming year OK (phew!)

Au source again – intermittent fault on heater winding, source will work of correct tilt angle.

Another set of pics from lin amp, just to record any differences after the slits were narrowed last week or so

~35 μA 6.08 kV

+ 2nd t-b, Au^{++}, uncalibrated

Thanh

2 μS + 50 ns Au^{++} 35μ 6.08

" " " Au^{+}

" " " Au^{++} 60 μA 7.27 kV

" " Au^{+} c

" – Au^{+} c ND 15 μA 5.79 kV

—— Au^{++}

625 16 μA 5.79 kV scan

@ 4K tape pics of spectrum (from blue store) on scope, so can compare appearance of (linear) mass scale & non-linear lin-amp o/p – 10.5K in 35 mins

626 38 μA 6.10 kV scan

7K

627 60 μA 6.76 kV scan 10K

628 20 μA 5.94 no scan, first 10K all round

next 5K quickscans only

" 4K heavier than Au_3^{+}

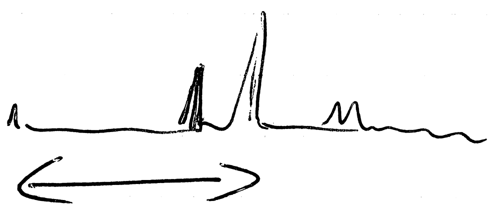
3K " " Au_5^{+}

31/Oct/80 Ga source

−6.2 KV ~ −15 μA on collector

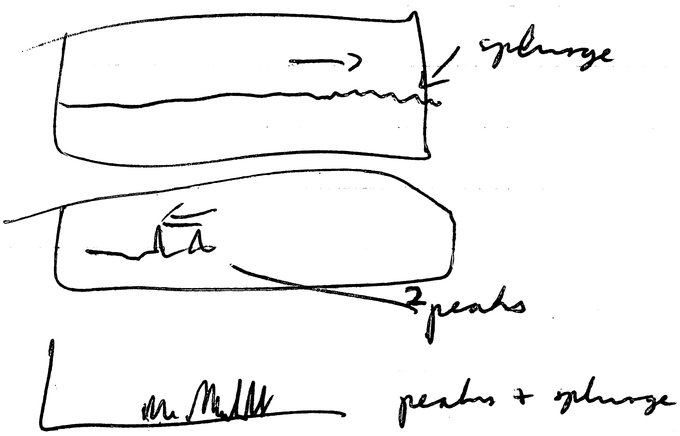
output −80 μA on HT lead.

pics × 10 μS/cm × several, triggered
from E-field around HT lead



~ 30 μS

blank
5.5 KV
blank
6.5 KV ~ 90 μA
blank
6.4 KV



+ve cond 'cos of put normal bend in tube
need normal HT input on deflectors to restore signal
−ve low energy → low defl. volts.

Both hi-energy peaks & low energy splurge (? droplets) are charged.

Mon 3 Nov — Ga source

- connected as per usual
- 10 μA 7.12 kV

2 μS/cm + 100 nS/cm lin amp
probe × 2 or 4 — slightly apertured, bent tube 11 71

Mfilm A — sharp spectrum Ga^+ only

10 μA 7.12 2 μS/cm 50 nS/cm signal maximised
" " × 10 — no Ga^{++}, Ga_2^+ etc
various diff amp

T 639	10 μA	7.12 kV	Nb scan	— 2K ÷ 2
640	"	"	" "	3K
641	"	"	first run, 700 counts	all

10 — 7 5 μA then gate out Ga^+ total 5K ~ 8 min extra

blank

probe
- ~ 1.2 μS/cm Ga^+ only 12 μA 8.5 kV
- 50 nS/cm expanded

v strong signal, .1 v/cm vertical,
×10, .05 (i.e. ×20 overall) no Ga^{++} or Ga_2^+

642 4 μA 8.53 kV scan 0-7K ⇒ 2 μA, v slow

-ve emission

10 μS/cm — 6.72 kV — several,
10 nS/cm — single shots

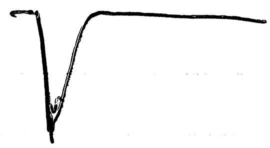
50 v/cm vertical, pick-up from HT lead
50 nS/cm, from collector (load = meter as usual)

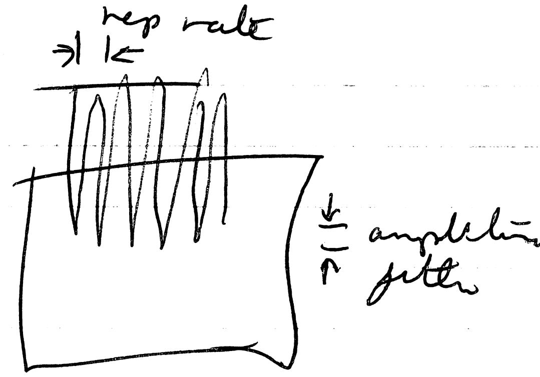
20 v/cm

Mfilm B

1 × 50 nS/cm
lots × 5 nS/cm ~ 5 nS falltime

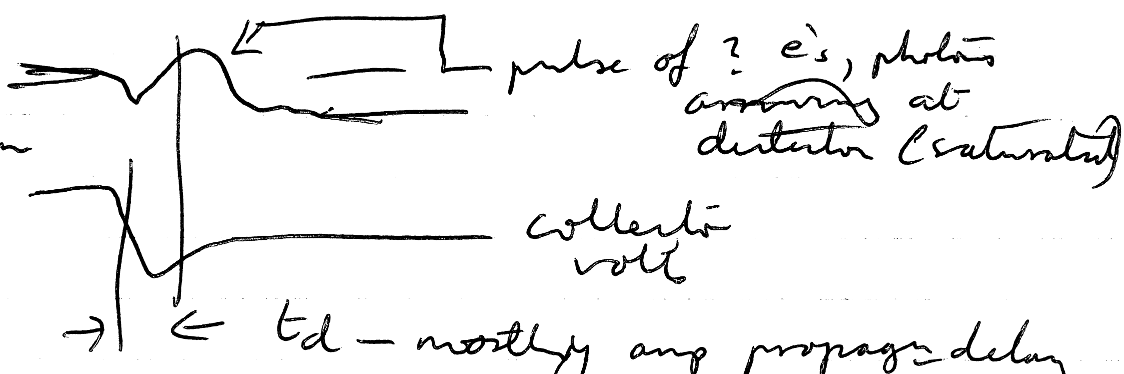
2µS/cm





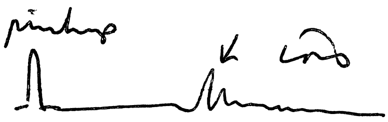
1 V/cm vert, 20 nS/cm horiz
− 7.16 kV, 40 µA i_{det}, 5 µA i_c
10 MΩ HT resistor

10nS/cm



10nS/cm detector off – pulse pickups only

2nS/cm



lot of pickups – corona rare.

10µS/cm — 2nd peak at ~ 40µS / more clearly, −7.65 kV
profile

Mon 3 Nov

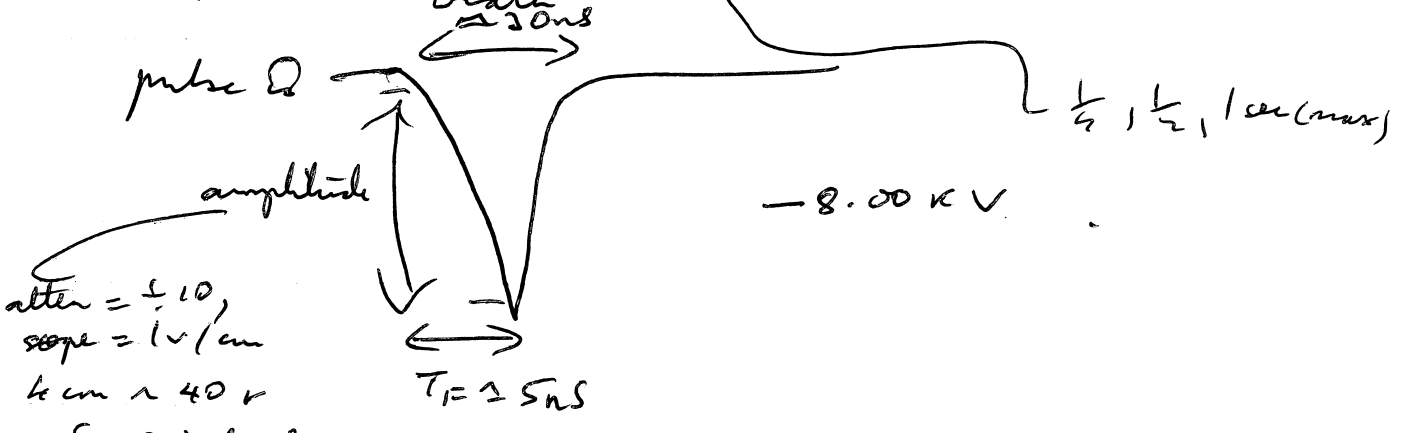
Replace with original Ga source

Tues 4 Nov – original ga source
– won't run in normal mode at < 10kV
⇒ emit electrons from source
⇒ will produce ~ 30 μA/cm² but drops to zero shortly)
& v. large extractor current

– could get proper mass spectrum, with source tilted, when was operating,
– ions produced on collector at ~ 11 kV,

Back to electron emission, ~ 7kV,
– connect collector to 50 Ω terminator

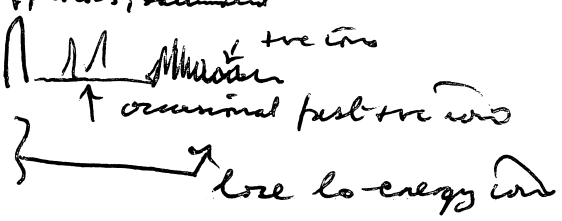
– myster pulse at 5 nS/cm (? 10 nS/cm) & 50 nS/cm
– pulse rep. rate ~ 1 kHz, not very stable



& current thro' probably ~ .8 A, but extraction current 4 or 5 times the collector current,
amplitude increases if Hz raised, approx 2:1 range
– jitter even less at this volts (some jitter in tail)

End of film (short)

Ph Counting
20 μS/cm time comp
20 μS/cm source shifted
5 μS/cm " "

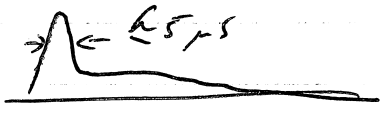


lo-energy ions have v pronounced peak at ~ 30 μs
– shifts to left as HT goes say -8 to -10kV, ~ 5μs - 10μs

Confirm that first (activated/peak) photons as zero delay,
goes off little like.

Not just lo slow ions both +ve charged since
requires same deflector volts (polarity) to restore them,
larger volts for higher energy as expected.

Guesstimate :- 30μs/flight time, of Ga^+, their
energy $\simeq \left(\frac{30}{5}\right)^{-2} \times 6000 \sim 150$ eV

– FWHM of peak of lo energy ions 

$\frac{2\delta t}{t} = \frac{10}{30} = \frac{\delta E}{E}$, $\delta E \sim 50$eV,

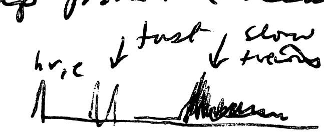
Thurs 6 Nov   MPT's Ir/O specimen   700°C / 12hr

ph blank
ph ×4   7.61
emptabit — ph ×3   8.20
" — { ph ×3   8.52
{ ph ×3   9.56 — defects visible
" — { ph ×3   9.28
9.92 "

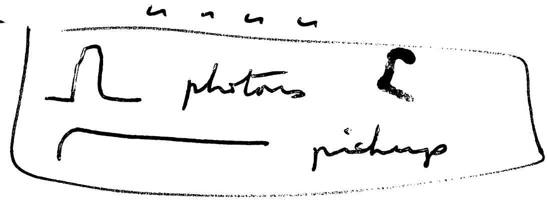
$3\,10^{-5}$ Ne / $1\,10^{-5}$ He

flashed
ph × 3   ~23 kV   remnants.

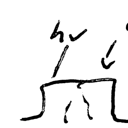
Ga source   — 7.94 kV
Collector grounded, scope triggered by pickup from HT lead
Mult 2
20 μS/cm lin amp   1½ ¼ ⅛   f 25
10 μS/cm " "   " " " "



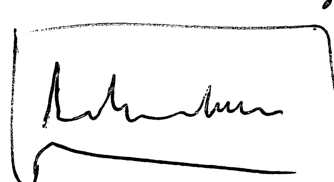
50 nS/cm ×4



50 nS/cm, tube bent, magnet to restore electrons, ×4
" / 5 cm tube straight, " " " + photons ×4



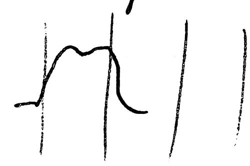
— pickup suggests ht is kicking up from −7.94 to ~ −7.74 (i.e. +200 v) — ? origin of peak in lo-energy ion spectrum,
TOF of e's ~ 20 nS .



10 μS/cm ×4 — all
add 180 pF cap to tip
−5.69 kV   20 μS/cm × 4   all shifted to left
2 μS/cm × 4
1 μS/cm × 4   bent, +ve ions ~4 μS/cm (!*?)
blank
all ×3   20 μS/cm ×
slight electron × field ×1
Multi

20μS/cm × 4   e-field
5μS/cm × 4
5μ/cm × 4   bigger e field – still some grass

electrons 50nS/cm   e field, bent, + B field ⊓
– pulse apparently narrower than photon pulse

photons × 2   50nS/cm 

~ 1/2 day, 2μS/cm single shots of
hi-energy ions
1, 1/2, 1/2   ~ 2μS/cm

alter amp bias, repeat   2μS/cm   single × ~6
1, 1/2, 1/2

? 20μS/cm
Multiple 3

2v/cm   50nS/cm   50Ω load on collector   – 5.92mV
5nS/cm × 2   5, 2 sec   4p

2μS/cm 4 pts of highest-energy ions ~ 5μS TOF
Reduce defln field   => extra 2μS peak, lower E
∴ lower mass, ? H

+ve ~7.6 KV 2.5μA   – some Ga^+
– pics × ~5

643   10μA 6KV   – no scan, lowish current
H.T. res = 10MΩ   – 1K, ÷2 ?

644   10μA 6KV   quite a lot Ga^+ @ 4K ions (in 6 mins!)
– no scan, 40μS   past 4K, no Ga^+

645 22 μA 8.2 KV 4K all, 4K no Ga^+

646 20 μA 8.8 KV Ga^+

G-M-S's Fe Ti Mn C — few pieces of carbide
- flashed when tried to probe,

New chamber fitted to Culham pumping column to allow a) channelplate viewing of ion beam
b) energy analyser to be fitted.

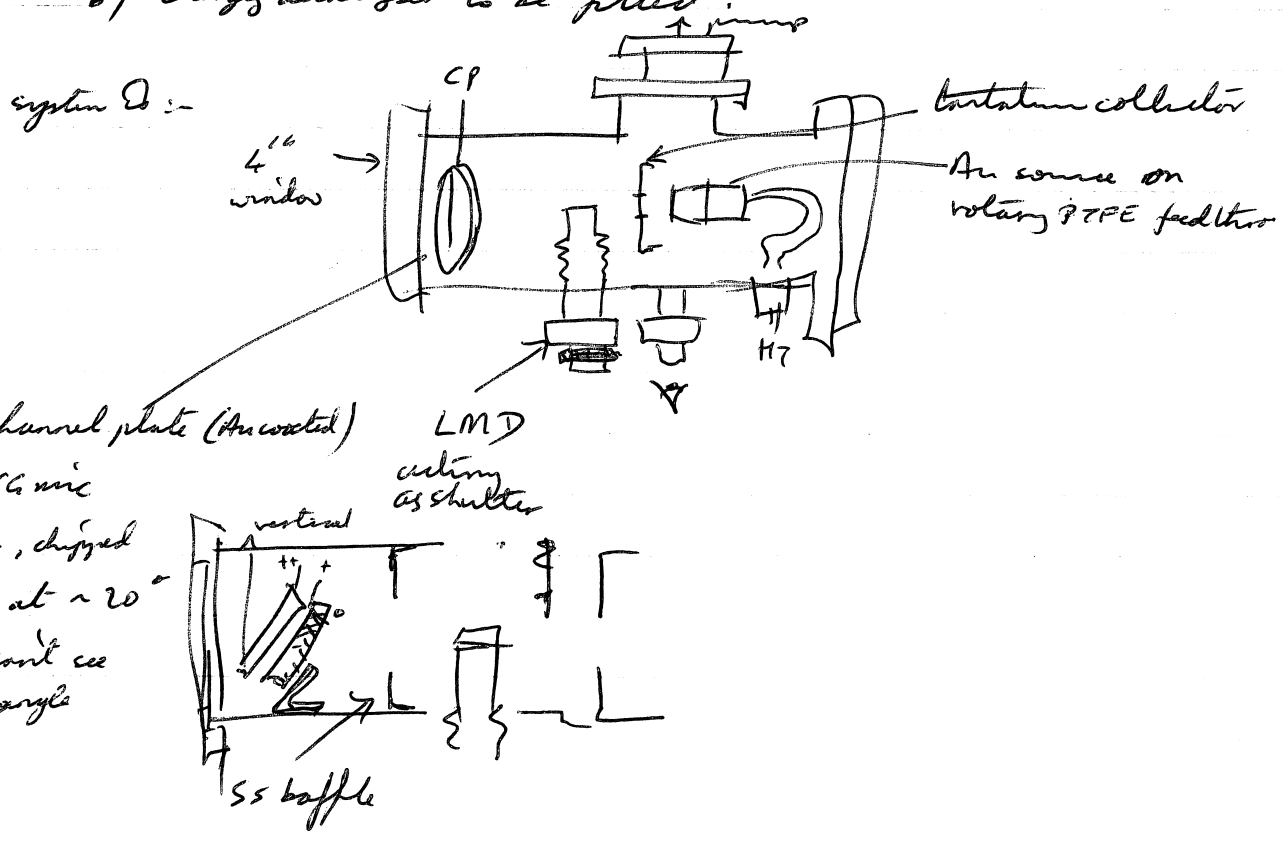


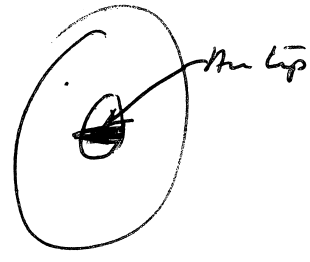
Image of cone (Au) looks just ☐ plane, fades off at edges if source tilted (i.e beam Ø as expected

No structure observable Ø c-plate as pulse (but c-plate doesn't like it, sparks at edges, so not v. sensitive test)
Casts nice shadow of L-M-drive.
Gain of c-plate drops v rapidly if c-plate volts > 400 v.

25 Nov Au source in new chamber.

Note that cone light emission is much less than in old chamber – suspect is mainly due to collisions in gas.
∴ Need even better vacuum ($\lesssim 1.10^{-8}$ for proof)
vac is $\simeq 1.10^{-6}$, source on ($\sim 1.10^{-7}$ off)
i⊖ apparently worse than before,
but now to collector (? SS cone/neutrals emitting?) &
better view of source from pumps.

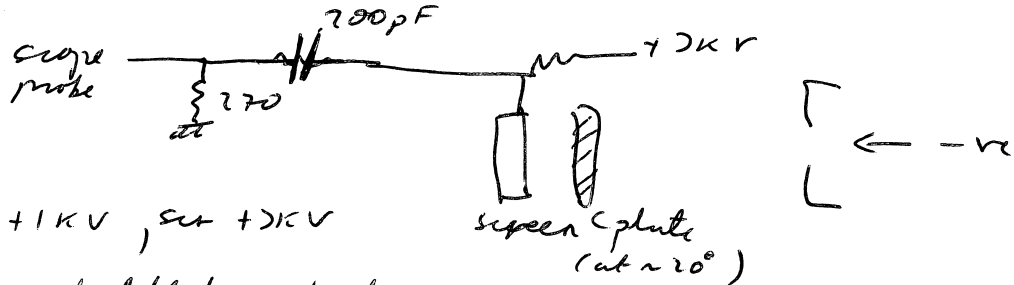
Setup camera to photo light around lip



i_c 2.2
+150 V i_c
10 MΩ R limit

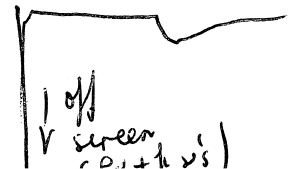
i_c 1 2 5 10 20 ¼ f1.8 20 μA 6.27 kV
¼ i_c 1 2 5 10 20 f8 80 μA 7.98 kV $7.5 10^{-6}$ Torr
" " " " " " " " 60 μA 7.17 kV
i_c 1 2 5 10 20 38 μA 6.59 kV
p now 1.10^{-6} Torr.

A Electron emission
6.2 kV, 4 μA i_c
~40 μA total i_{in}



Magnet deflecting electrons off c-p (still scatter, plotons etc on it)

2 ms/cm .05 V/cm (×10 probe)
single shots, +ve, 1 ms etc
– on ½ of c-plate



triggered by collector

remove LMD, whole c-plate – single slots, ÷ 1 etc

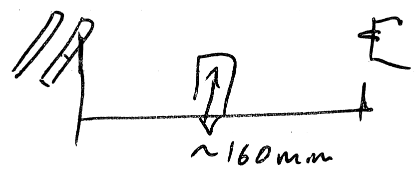
<u>Mfilm</u> **B**

2v/cm ~½ c-plate 50nS/cm electrons on c-plate

<u>Ilford</u> **4**

2v/cm collector 50nS/cm via ÷10 attenuator 50Ω

More pics (possibly) of whole ~~c~~ c-plate)



pics of top 10 5 2 1 ÷ 20

Q moved off axis

i_{heater} (mmmmm) 3.25A.

Wed 26 Nov

Threshold volts ~ 5.80 V/[illegible] +ve ion emission.

blend × 2

Collector pulse [illegible] { 2 v/cm, [illegible] 50Ω [illegible], 200 pF [illegible]

5Dn S/cm × 2 [illegible]

[illegible] S/cm, [illegible] × 50 or 6 [illegible] 10 [illegible] ~ 20–30 [illegible] 50 MHz

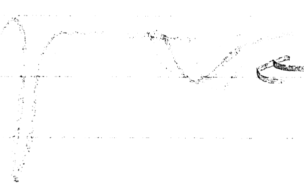
1 per 50–60 [illegible]

[2 μS/cm, ·05 v/cm
[single shots × 2
[illegible] × 1

N[illegible]

[illegible] 1 [illegible] 2 μS/cm
25 × single shots " "
5 × " " 1 μS/cm

{ 2 μS, screen volts, [illegible] ?
[illegible] ·05 v/cm, [illegible]



← goes away if [illegible] of screen volts off. [illegible],
[illegible]
[illegible]
[illegible]

Thurs, Fri, Mon working late for Cathcart
MKC2 mass spec / retarding analyzer

Tues 2nd Dec

1 continuing machining SS - bits for CAMs

SS - 75mins - He cooling

ph [illegible]

ph x ~7 @ 15KV, cold, Ne

- enough DC in Ne - pretty, lots of rings

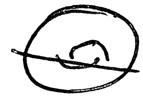
- gbs (visible @ 60K, no [illegible],  , think

ΔS pulse ~14+2 in Ne

DW x 4 ~14.9?

<DW Cont - to 14.4KV DW x 4

1AP x 2

1AP x 2 

Fe 60s

Cr "

Ni "

1AP [illegible] 2

Al

Fe

Cr

Ni

Al

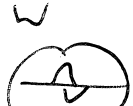
?C

C

1AP x 3

ph x 3

ph x 3) DW

1AP x 2 

down a bit 1AP x 3  ~ 16.1KV

<DW 1AP x 3 14.4KV - ragged still

Fe 30s

Cr

[illegible]

Fe
Cr
Ni
Al
Al mp
Al
Fe
Cr
Ni
Al
Al
Al
Ni mp

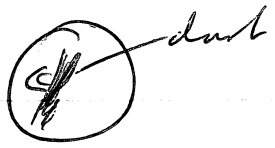
15.96 + 2.7

all IAP ~ var,
but some Ne still
there

+ 2.0

IAP > DW 16.25 keV
< DW 12.39 keV
~ DW x ~ 6
< DW x >
≥ DW x >

IAP x 2
(< DW)
IAP x 2 DW
IAP unfish
IAP x >



Fe
Cr
Al
Ni
Fe
Cr
Ni
Al
Al

B_6 ?

C_6 ?

NTP o.d

{ IAP x> top left <DW

x> DW

Fe

Cr

Ni

Al

Al

(Au) ?

C_6 ? possible one

C_6 ?

(everything v fast)

IAP x>

phos 17.1 keV

[illegible]

ph x> DW

" " <DW

" " <<DW

extract

Ded > rd Der Cu (end) source sent back to Culham ::
Cup broken when trying to straighten it

ph blank

35/Ar recd 8·69 KV DW / 60/We × 4

old – 20K ph × 4 10·06 KV – pulls
× 4 ~ ~

80

IAP × 2 axial, spiral

Fe 2+ 60s

Cr 2+ 60s

IAP Analysis 2

Fe pop

Fe

Cr ~ 10 planes

Ni

Al

Al

C 4+

C 4+ 5

IAP × 4

ph × 2 > DW

ph × 2 11.20 KV

IAP × 2 Chs

Fe

Cr ?

Cr

Ni

Al

Al

C

C pop

C

IAP × 2

Below centre IAP × 2

< BW IAP × 2

Ze

Cu

Mg

Al

Al

C_6

C.

C.

IAP ×2

IAP Mg/Ph 3

IAP ×2

Ph ×2 12-00 DW

Ph ×2 12-00

Ph ×2 10-36 < DL — ragged

Ph blend

Extract-

Mass spec 55/750/cold He/Ar

Ph ×2 DW ~(111) Wash

Ph Mg/Ph

Ph ×4 6 KV

— flashed

Thurs

Pt+I everywhere!

SS/730 ph blank

ph ×5 3W v 10KV/60 – spec bent.

Hecool – not very cold, ph × 3

VAPV3  : 10-5KeV

Zr^{2+}

flushed

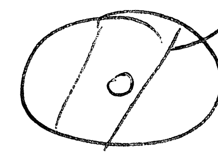
Fri 5th

SS/750/He cooling/Ne

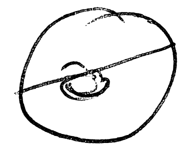
Al blank

Al x 5   13.4 keV

Al x 2   11.4 keV



gls'



^ IAP x 2

IAP x 2   14.2 keV

Fe   Top

Fe

Cr

Ni

Al

Al

C6 ?

C ?

Fe

Cr

Ni

Al

Al

C6 ?

C6 ?

IAP x 3 — cooler

Al x 4 or 5   15.8 keV   DW

Al x 1   <DW   13.8 keV

IAP x 2   bottom right

IAP x 2   <DW

Fe   iss

Cr

Ni

Al

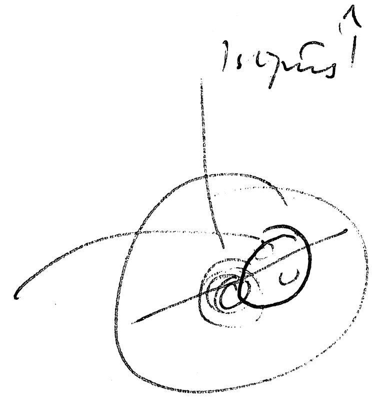
Al

C6 ? — v little of any

Fe 203
Cr 1

IAP Mapping 2

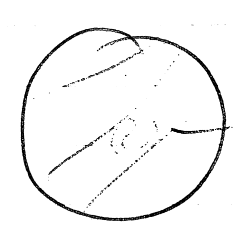
Fe Cr 203
Cr
Mo
Ni
Al
Al
IAP x 2
IAP x 2
Al
Al
Fe
Cr
Mo }
Ni
Al }
Al rapido
flashed



~ 15.0 + 2.9?

New spec PSW/as recd
ph x 2   8-9 kV - cold

- popped to ~ 10 kV - v pretty
flashed before photo'd - sod it!



bdary

ph blank

Mon – [illegible] under legs of CSE papers.

Tues New PSW / as rec'd
9th Dec

$\mu h \times 5$ 8.6 KV 60x
$\mu \times 3$ 8.5 KV ~

– cool.

$\mu h \times 2$ 9.70 KV – not [illegible]

<u>[illegible]</u>

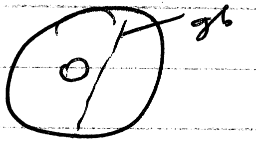
$\mu \times \sim 4$ – –

$\mu \times 4$ after [illegible] ~10 planes)(~10–24 KV

– flashed

SS 175 ph ×4 8.2 kV 160 K

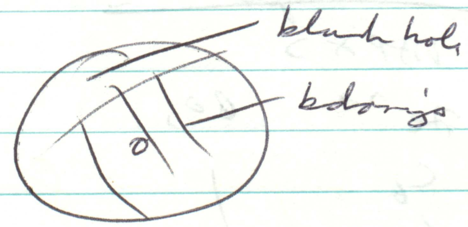
— [illegible] down — [illegible]×? — [illegible]



Fri 12

1

PSW / as reed



ph - on darkarea

T 647 5.25 + 1 - 100/560 /Ne

- 2K3 ⇒ Fe oxide

648 a gub - axial

160/560/vac 6.26 + 1.05

- 2K

ph × 2 where ↑ ; ph × 2 on matrix where !

b 2K5

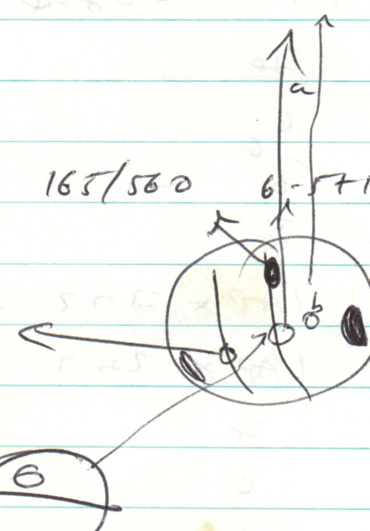
ph × 2

ph × 2 more slightly

649 a of dark hole near top 165/560 6.5 + 1.5 vac

- little C (?!!)

b from dark bdary lhs



ph × 2

1AP × 2 axial

Fe 60 = 80 — Fe 60s

6_6 220 = 26 — C_6

12 314 37 — 6_6

18 384 46 — C 24 or Cr 26 ? — vac

24 444 54 — Fe

26 462 58 — 1AP × 2

1AP × 2

K^{2+} 60s 7.2 + 1.5 vac

C_1

C_6

Fe

1AP × 2

1AP magnet

1AP x 3 

Te ~ 60 s

C_6

6o

Te

1AP x 3

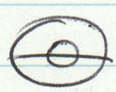
ph x 3   7.7 kV

ph magnet

Cold (with – end of He)

ph x 3 as ↑

ph x lots after evaporating – ~8.5 kV DW

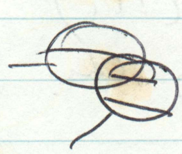
1AP x 2 original 

Te

C_6

C_6

Te

1AP x 3 or 2 

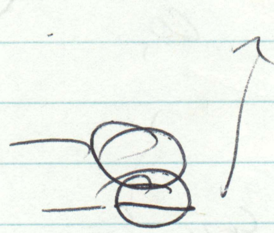
1AP x 2 or 3

Te

C

C

Te

1AP x 3 

1AP x 3

Te 60 s   7.5 + 1.8 ran

C

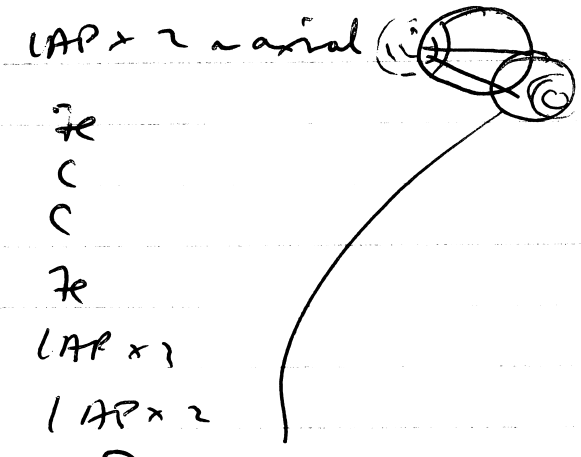
C

Te

1AP x 1   warm – cool down & He gone

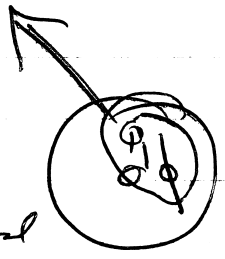
1AP x 2, [pumped N_2]

1AP magnet



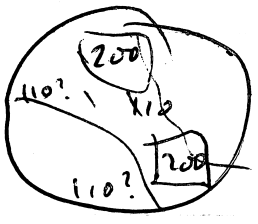
LAP × 2 ~ axial

Fe
C
C
Fe
LAP × 1
LAP × 2
Fe
C
C
C - dual - bright dead.



LAP × 3
μ × 3 - tilted GRMS
8.57 KV μ × 3 axial, specstage forward
μ × 4 tilted, c-p gain down
μ × 4 " " " "

7.77 kμ × 3 < DW

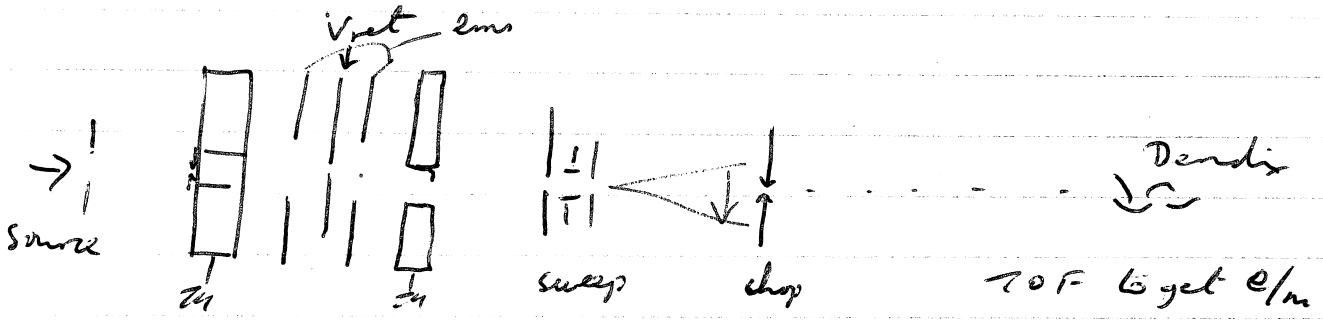


6.89 μ × 2 << DW

≈ single xtal + lo-angle gbs + dislocn array

work off line (20-28) - gun still OK.

Machining bits for EAM 3 :-

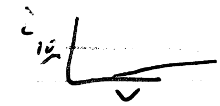


Xmas

Then continuing machining bits

:

14/1/80 New Ga source — v ~~steep~~ shallow i vs V



$3.5 \; 10^{-7}$ 9.62 KV 8 μA i_e (~ 40 μ extraction)

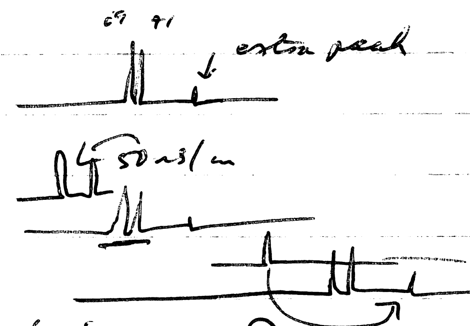
<u>W filter</u>

1 μS/cm, straightline, x10

x ~5

x ~5 + 2nd Eb

x ~5 + 2nd Eb



ie extra peak 2nd single isotope (?)

mass of 2nd peak $\sim \left(\frac{7.7}{6}\right)^2 \times 70 = 115$

? Indium — mass 113 4.23% — some sign of 2nd isotope.
115 95.8%

650 — scan ~4 μA 9.62 KV i_{extr} ~ 20 μA
~1500 ions

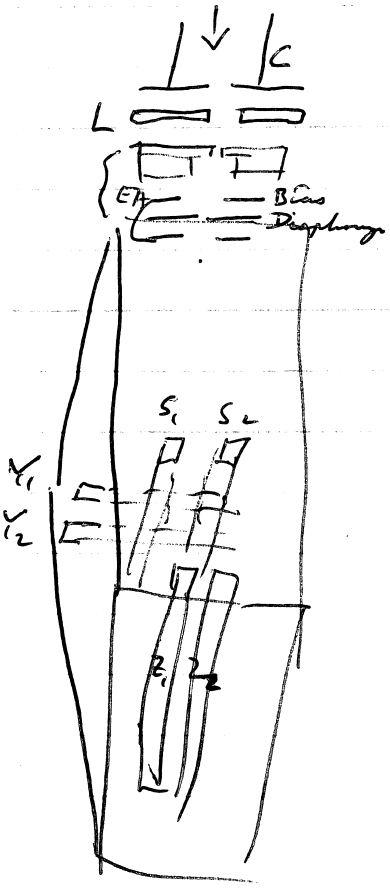
657 first few hundred Ga^+ allowed, then gate out Ga^+ & quit
~ 2500 ions, no scan.

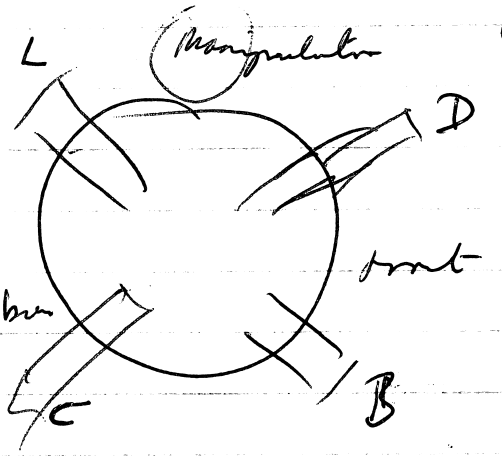
19/1/81

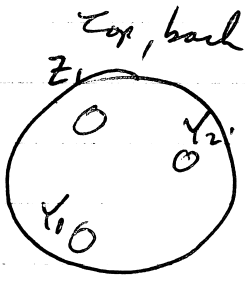
Put EAMs into chamber — pulls of annulus less covers.

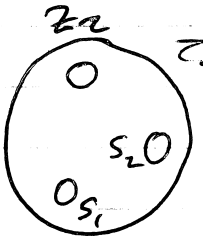
20/1/81 } visit to Culham — Andrew Dixon giving
21/1/81 } seminar on work done with Sudsand etal
— relative spectra of $Au^{+}, ^{++}$, $Ga^{+}, ^{++}$
& Sn (~~Bismuth~~
+ comparison with Sn foreground & Pedal just below Tm
— same energy deficit — suggests
some form of field desorption.

22/1/81 leads to EAM

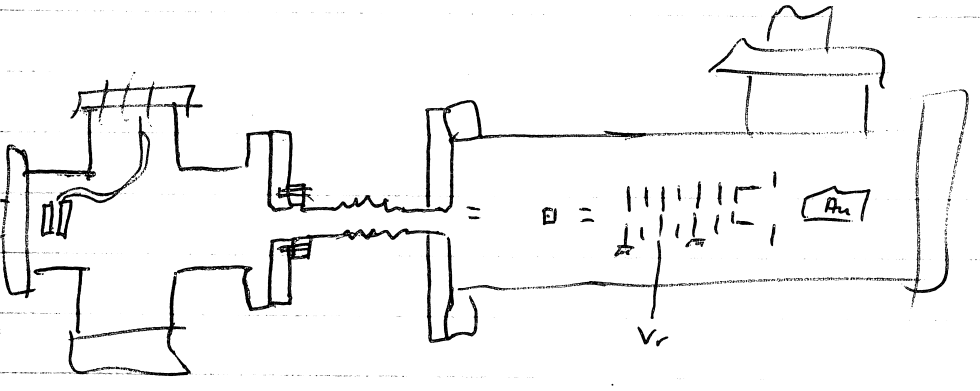








set-up with 1" c-plate, ex ALP, as deflector



– wiring up the deflectors / shutter etc / rebuilt rear manipulation system so can align source with analyser

– lot of trouble with the source –

initial symptoms: zig off axis – loose

– tapping side of machine =>

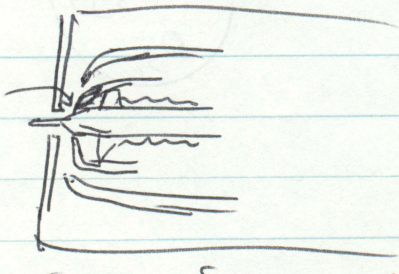
– shorting out

– take out & attempt to realign by starting off 838 nut at back with box spanner & tilting (~ n times)

– eventually give up & dismantle source

– drill out aperture from 1.5 to 2mm, polish, etc

– discover that inner pod is too far forward & is shorting onto extractor! –

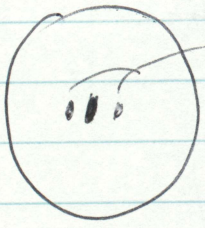


2/1/81 – push back into position, check alignment, pump out

– works OK

– can align OK now

– see on e-plate (print! YCS70 phosphor, esp ALP)



ghosts, ? reflection off deflectors ?

9pm

– position of spot is sensitive to volts on screen (2KV → 4KV ⊖→⊕)

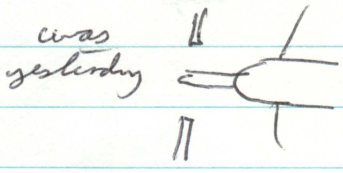
cos leads unshielded inside converter tube.

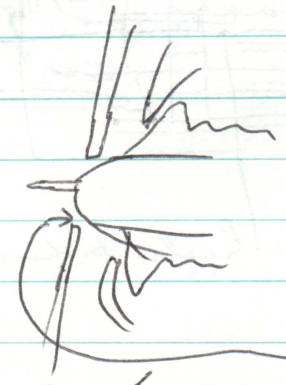
all lenses, etc grounded.

3/2/81 An source, checking (tryout!) volts on deflectors to see what required.

Heater current erratic – apparently going o/c somewhere inside source.
– eventually stabilizes, but can now see to reservoir through extractor

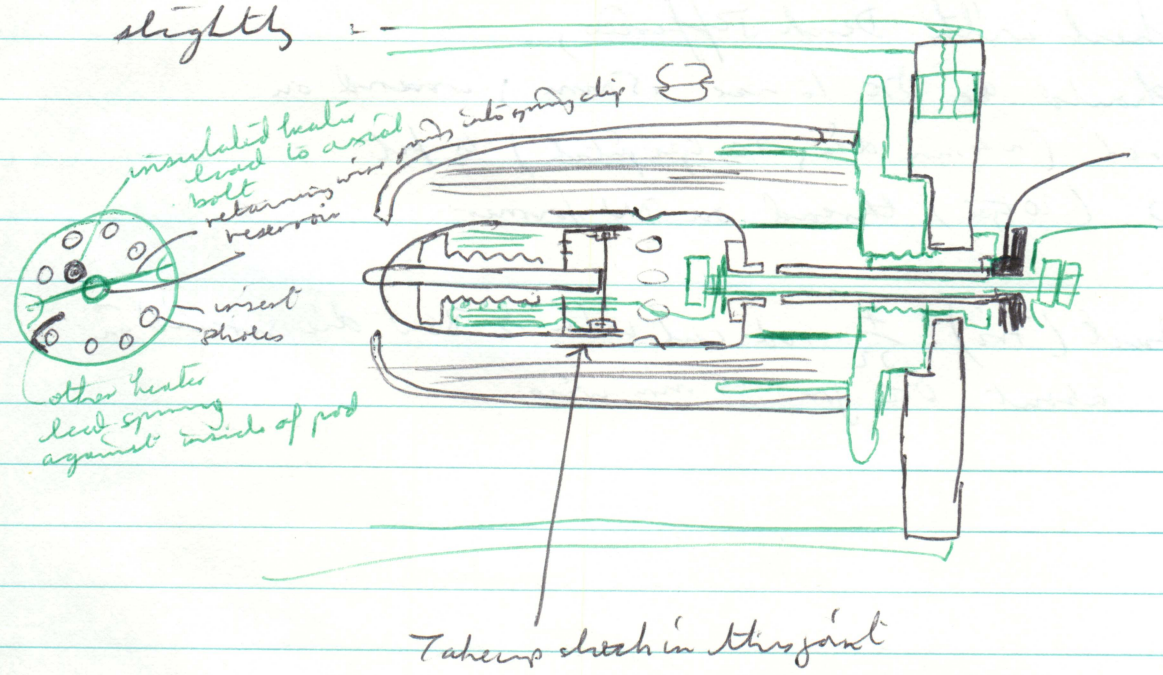
ie



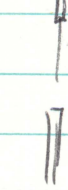


& as soon as gets to Tm for Ta sparks over here & trips HT.
Back to the drawing board, again.

– source dismantled & inner rod compressed slightly :–

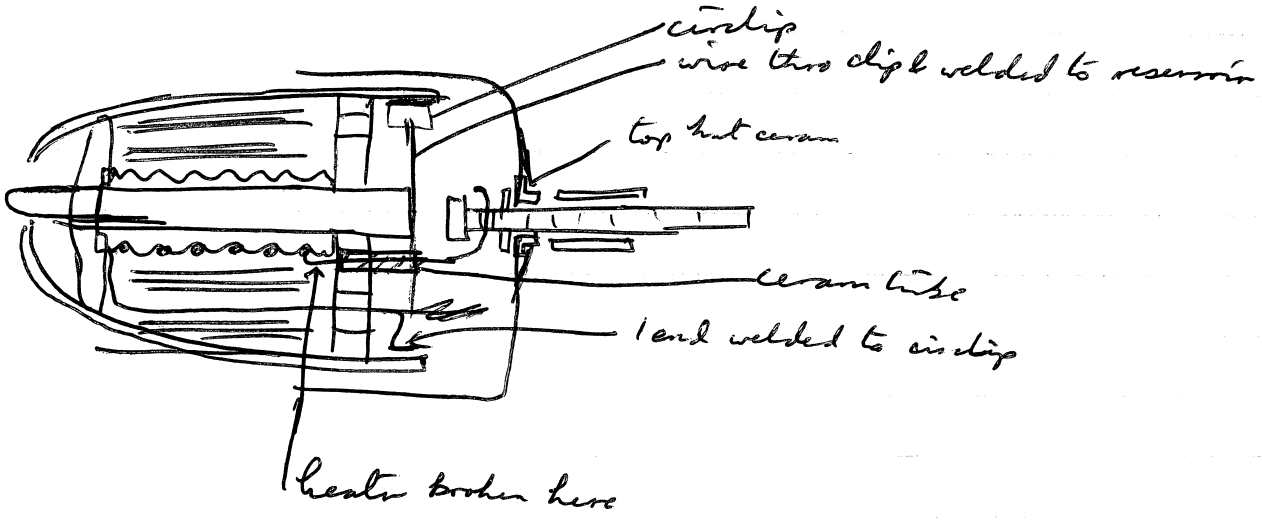


end result to stop well inside (too far?) extractor

ie  whereas pushed out before.

? No lock/spring washer on bolt – OK for vert mounting but ? horizontal.

Thus discover heater o/circuit
– extract source & dismantle



heater Ø 0.3 mm wire (W)
– can't find any

– check with Derek Jeffereds,
should be OK to use .5 mm ; wound on mandrel (~4 mm dia, 20 tpi pitch) to fit ¼ BSW (20 tpi) thread on BN former

– in past (7ri) $\frac{7}{32}$ rod cut with ¼ BSW die screwed in tight is about OK for .5 mm wire.

Fri — Rewind heater coil & reassemble ion source.
Very, very, very fiddly!

Sat — Check source — runs OK(!) at i_e 5 Amps.

Check collision deflectors, X + plates

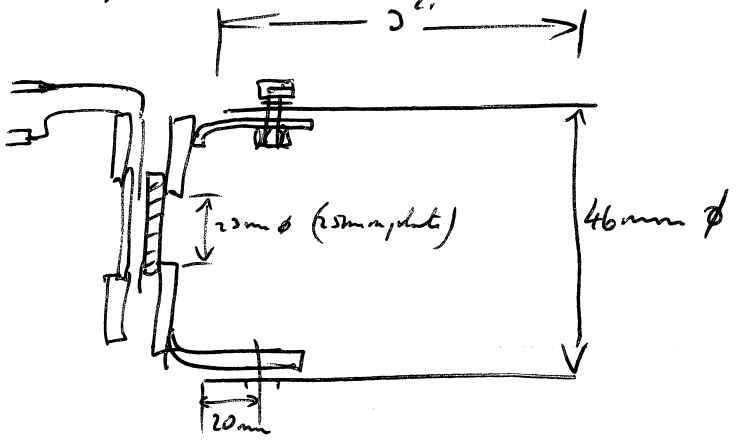
- require ~ ±150 v on chopper (i.e. 7.5 kV)
  & ~ ±300 on deflector

- finicky to align properly cos of field inside RLP converter — need screen tube as V_S 0–4 gives spot

Check operation of analyser — volts on diaphragm alone gives cutoff, v. sharp, at ~ 7 kV
  connecting leads to diaphragm gives cutoff ~ 6·5, but off axis, & can't quite see what's going on.
  Need screen tube in front of converter, & preferably a better phosphor.
  Note that get some glow on screen even with V_S = 0 v (??)

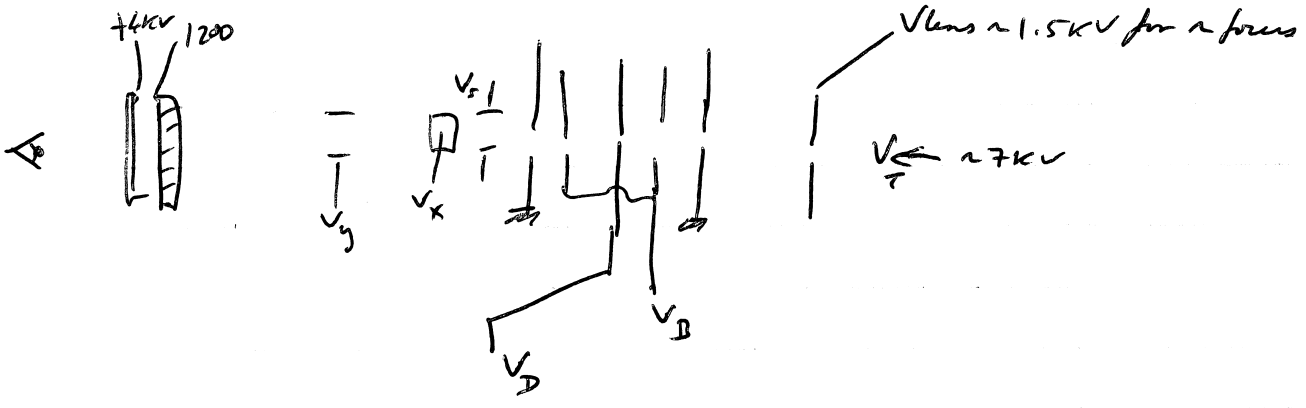
Wed 7 Feb

Put screen tube in front of c-plate – discover bad connection to screen – repair.



Picture now much brighter, & on axis of system – note that can still see faint image even if source not running, (i.e $V_s < V_{run}$) – ? emission from hot-ionised surface, or mercury on blunt (non-Taylor cone) needle.

Experiment with volts:–

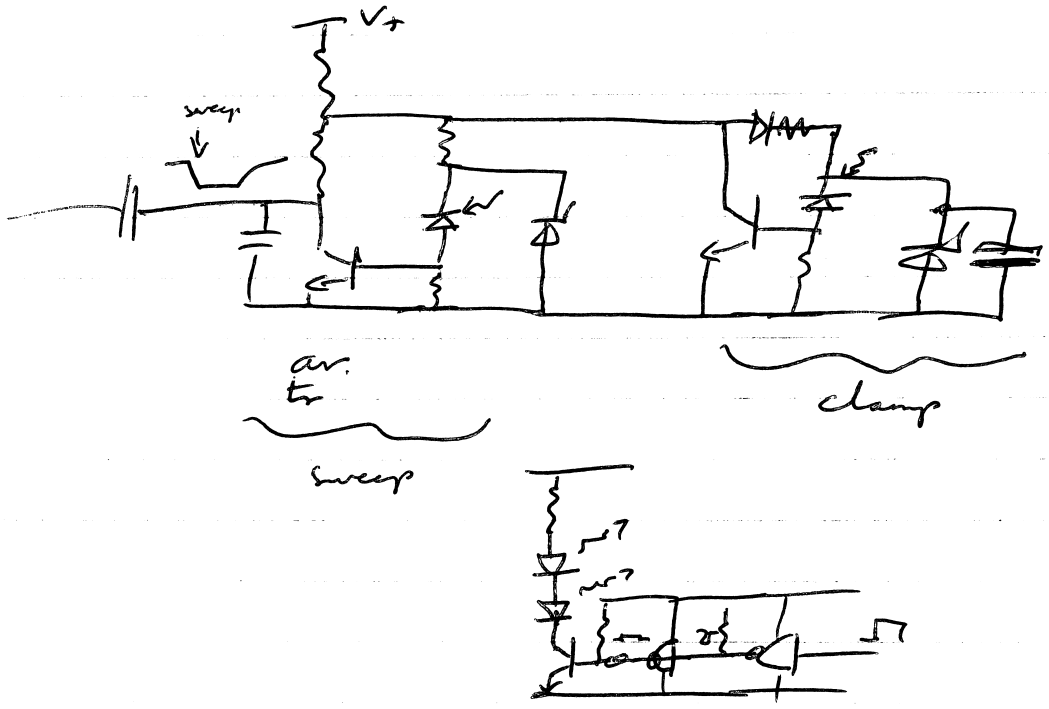


V_x, V_y want ~ ±200 V range (±200 probably OK)

Taking V_D towards V_s leads to shutter action, but lots of astigmatism / change in magnification, etc

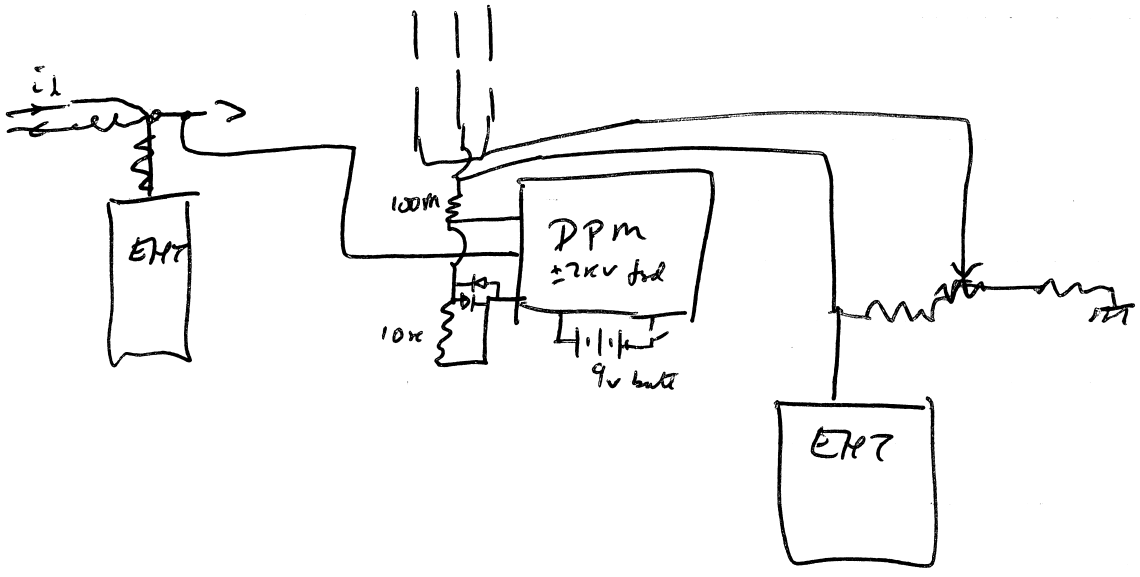
– somewhat improved by taking V_B towards V_D, but can't judge effect accurately without measuring volts accurately (especially $V_1 - V_D$) — float-meter.

considering sweep gen — ? use (R1) 1-R emitter &
P/N diode as fast-ish optoisolator :-



Thurs 10th

Assembling electronics for retarding system
- use resistor chain ex CDB for bias
- floating DPM for measuring retarding volts



- trying to test - Ion source off axis again

- rebuild, including w lockwasher to try & keep reservoir axial even if hot.

- box cyl ht feeds, etc.

① 10^{-6} A — saturation ~ φ 950

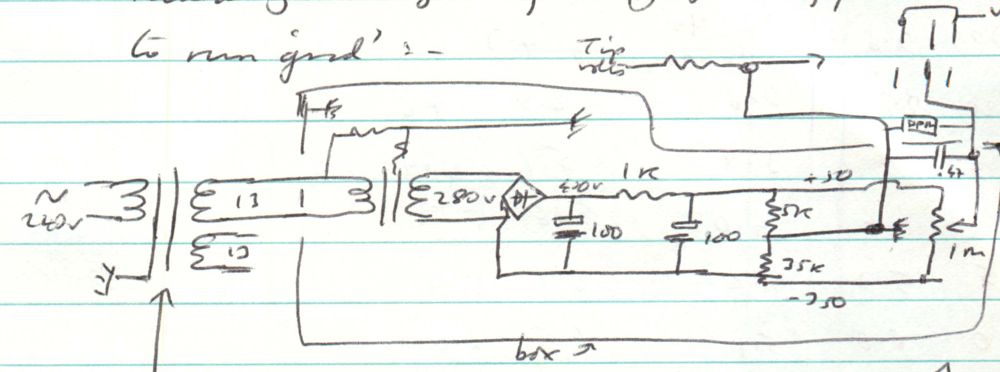
$i_c \sim 20\,\mu A$ V_G 7.63
$i_T \sim 40\,\mu A$ Decrease φ to 600, V_D to 7.05

$V_D \sim 7.3$

		②
48	.24	1.2 10^{-8}
40	.35	1.23
30	.78	1.3
20	1.43	1.6
15	1.80	
10	~~1.80~~ 2.15	2.1
5	2.48	2.25
0	2.75	2.65
-5	2.91	2.85
-10	3.1	3.0
-15	3.2	3.0
-20	3.3	3.1
-25	3.3	3
-30	3.3	3.15
-35	3.25	
-40	3.2	3.1
-45	3.1	
-50	3.1	3.05
55	3.05	
60	3.0	
70	2.8	3.0
80	2.65	
90	2.85	
100	2.80	2.95
120	2.68	
140	2.42	
160	2.25	2.95
180	2.15	
200	2.0	3.0
250	1.9	3.2
300	1.8	3.4
350	1.7	3.45

Fri 13 Feb

Trial experiments Ar source + retarding analyser, using floating psu to run grid':-

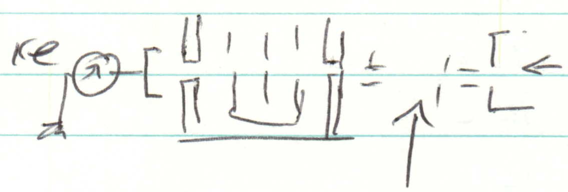


wound on RS 100VA transformer kit, with Si rubber insulation — seems OK up to 10kV.

pot with insulated handle

Problem is that alignment requires deflection voltages to get beam through final aperture, & particularly shape of spot v. dependent on bias voltage. Varying bias voltage can set apparent position of peak in range -10 — +20 v — n.b.g.

Looks as if need to get tip further from, & detector much closer to, analyser



? put deflectors first to allow mass analysis

— pity, as fits well in can as arranged at present.

Au 7.285 keV / 1 mΩ

6.25 V_3

i_c 24 µA

i_c 8 keV

[illegible] µA unsuppressed

= 56 [illegible]

(? ≈ 80 µA total)

set V_3 to $\frac{8}{7.5} \times 6.25$ = 6.75

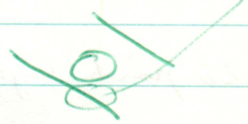
48	3.5 10^{-9}		3.9	
40	3.5		4.1	
30	3.6	22 µA = 16 µA suppressed	4.3	
20	3.8	3.6	4.8	4.6
15	4.1	3.8	5.1	4.9
10	4.6	4.0	5.6	5.2
5	5.3	4.4	6.1	5.7
0	6.0	5.1	6.5	6.0↑ 5.9
-5	6.8	5.8	7.1	6.5
-10	7.6	6.4	7.6	6.8
-15	8.2	6.9	7.9	7.2
-20	8.8	7.3	8.3	7.5
-25	9.1	7.6	8.6	7.8
-30	9.5	7.9	9.0	8.0
-40	10.0	8.3	9.25	8.6
-50	10.2	8.6	9.5 9.4	9.0
60	10.5		9.9 10.1	
70	10.6		10.5	
80	10.9		11.0	
90	11.0		11.5	
-100	11.1		11.9	
125	11.5		12.9	
150	11.6		13.6	
175	11.6		14.2	
-200	11.5		14.5	
225	11.0		14.5	
250	10.4		14.3	
275	9.4		14.0	
300	9.3		13.5	

Mon 23 Feb

Assembling preamps for EAM 3
— ~~bootstrapped~~ AC FET amplifier

Test of IAP electronics using PSW from 12 dec — As recd
~ 2×10^-9 /60 /Ne — new TSP filament
gb ~ [illegible]

T652 200/500 vac gb 8.08 + 1.400 + 1.450 7K
still on gb — ph blank, ph ×2



more on matrix ph ×2

653 8.2 + 1.45 200/500 vac ~ 7K
— some ?N — check for leaks — suspect TSP grotty somehow.
654 matrix on next layer down 8.35 + 1.55 vac 210/500
~10K

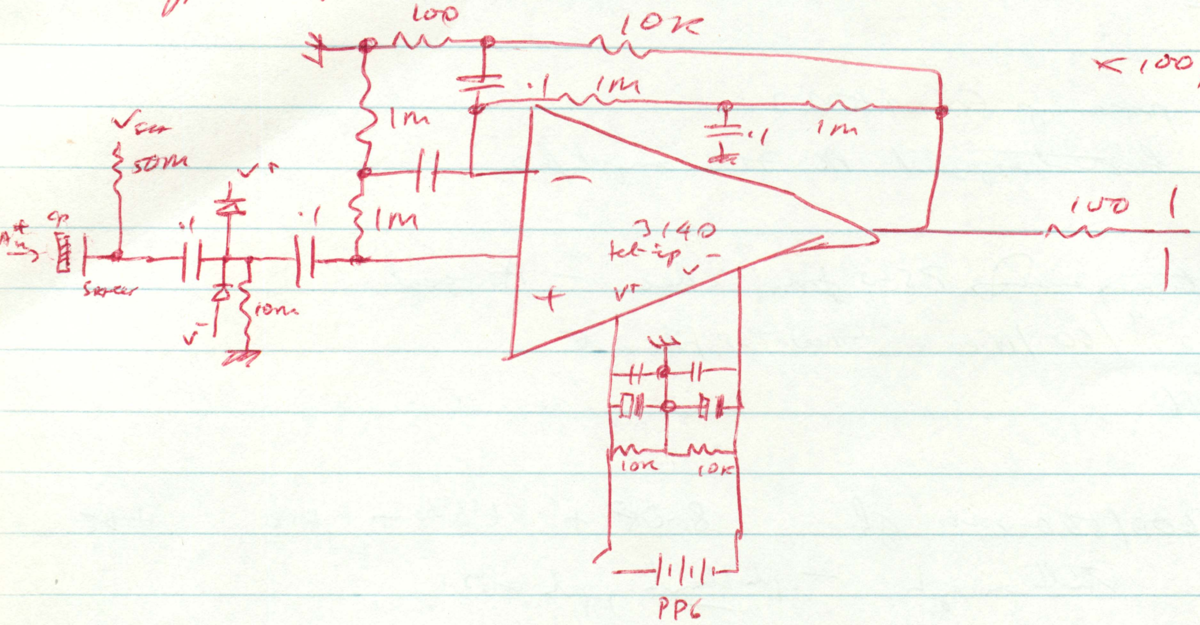
ph taken

ph ×2 where ↑ still (grid on matrix / finish)

655 gb above centre 8.4 + 1.60 vac 210/500
7K — off at end (grid) (stand)
ph ×2 where ↑

Tues 24 Feb

Prototype amp 2b



x100, bootstrap

Amp 2b microphonic, & tends to pick up rotary pumps, etc.

ph blurred
ph x 2

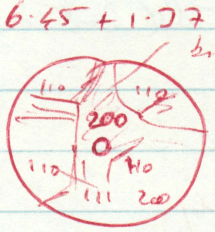
655 Harrys martensite 8.55 + 900 – 1K 145/560 Ne 1K N+ 2 — 8i

b same place, vac 6.05 + 1 145/560 vac – ? pop at start.

656 150/560 same place, contd. – 10.5K lo carbon

–155 – 160/560 — 6.45 + 1.77

ph x 2



ph on 200 emissions

— bec

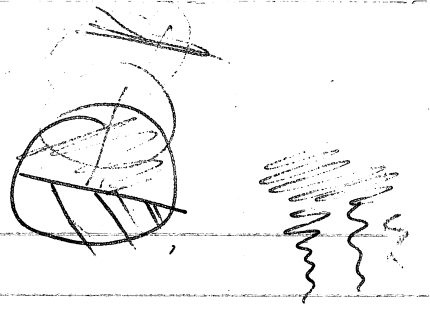
modulated off 2 back to back Si diodes, 50 Hz

Am Source 7.59 / 40 μA i.e. 24 μA

cp 700 v   600   7.46 similar — lens = 6.58 similar

	cp 700 v	600	lens 6.70	6.40	6.20
48	·059	·059	·059	·056	·056
40	·065	·059	·059	·058	·057
30	·139	·070	·059	·056	·0556
20	·427	·137	·061	·060	·060
15	·621	·204	·065	·078	·065
10	·907	·258	·086	·115	·099
5	1·16	·325	·116	·180	·160
0	1·33	·365	·170	·283	·254
5	1·38	·378	·216	·373	·385
10	1·29	·359	·234	·449	·460
15	1·10	·317	·228	·473	·489
20	·905	·262	·144	·457	·480
25	·738	·218	·145	·430	·426
30	·620	·193	·120	·376	·392
35	·596	·180	·121	·316	·352
40	·615	·188	·150	·251	·306
50	·70	·210	·188	·160	·265
60	·76	·220	·188	·116	·190
70	·78	·234	·180	·124	·130
80	·83	·255	·180	·140	·105
90	·86	·250	·180	·155	·098
100	·88	·260	·200	·175	·120
125	·95	·279	·227	·212	·155
150	·99	·298	·260	·235	·187
175	·95	·297	·250	·270	·178
200	1·05	·300	·223	·280	·202

attempt to run at 100 μA — peak ~ -50 v, but dependent on V_{bias} — didn't trust it — won't run at 10 μA & 8·20 μm — dimmer



Gotthard 7c Tc C −2376 UE 2

Tc	C	Mn	Si	Al	S	P	N	O	Nb	
0.23	0.06	0.4	0.02	0.04	0.002	0.002	17 ppm	28 ppm		← Ditch's
0.21	0.09	0.40	<0.02	0.03	0.013	0.004	90 ppm		<0.02	← J.