

Department _____

Subject Lab Techniques IV

Name Jack Segal

Address _____

National® Brand

Computation Notebook

11 3/4" x 9 1/4", 4 x 4 Quad., 75 Sheets

43-648



0 73333 43648 8



**AVEKY
DENNISON**

Office Products
Chicopee, MA 01022

Initial operation of gas test tube
Observation of gain loss in gas test tube

5

Test 3227SOIC amp stability

10

Gain check of tube - blew out 3227SOIC amp
Bench test of 3227SOIC amp replacement

15

Further observations of gain droop

20

HV supply droop over time
EMCO HV supply data sheet
Ohmcraft HV resistor spec sheet

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HAWGS Gas Mix Gain Monitor schematic
Initial operation of tube with new HV supply

Observations of loss of resolution in tube

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Comparison of new and old gain tubes

40

Disassembly of old gain tube

FPP straw tube gain with Ar/CO₂

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Gas gain tube hooked up to mixing system
More gas gain tube work - gas flow problems

55

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Rebuild brass gas gain tube

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Stainless steel gas gain tube

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Quick check of humidity/dry air effect on gas gain tube
Gas gain tube with dry air blowing over it

80

PEC ECL Delay modules quick performance check

85

OKW electronics RF transmitter & receiver (AM)

90

Ultrasonic level switches

91

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Photonis VD202k/01 Base

Photonis VD305kB Base

Amplifier added to VD305kB Base

Comparison of 8854 and 4572 Assemblies

100

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RICH $O_2 + H_2O$ Sensor Performance in the EEL

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125

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VDC Gas Gain Using OPA655

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Wire Tension Measurement Using Audio Speaker

Aborted Check of 5th VDC
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Diode Array with Laser Diode

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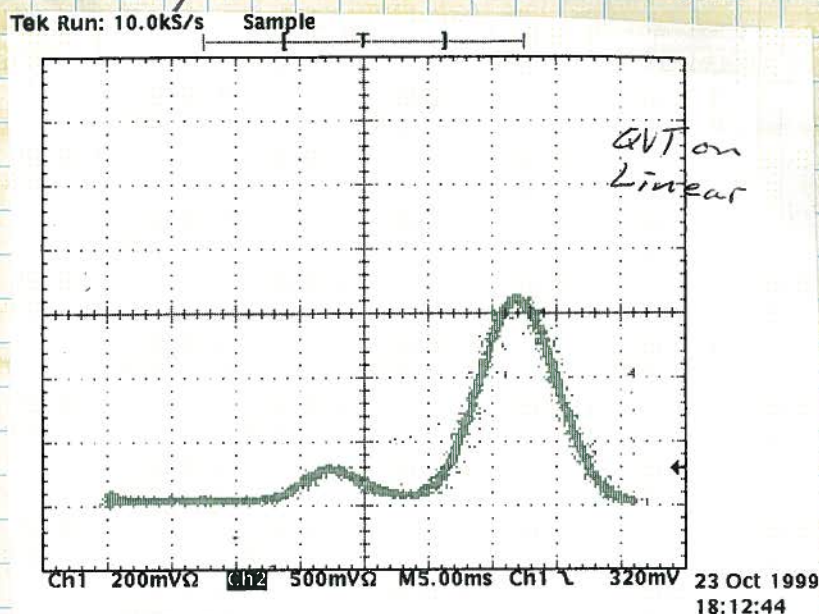
150

152

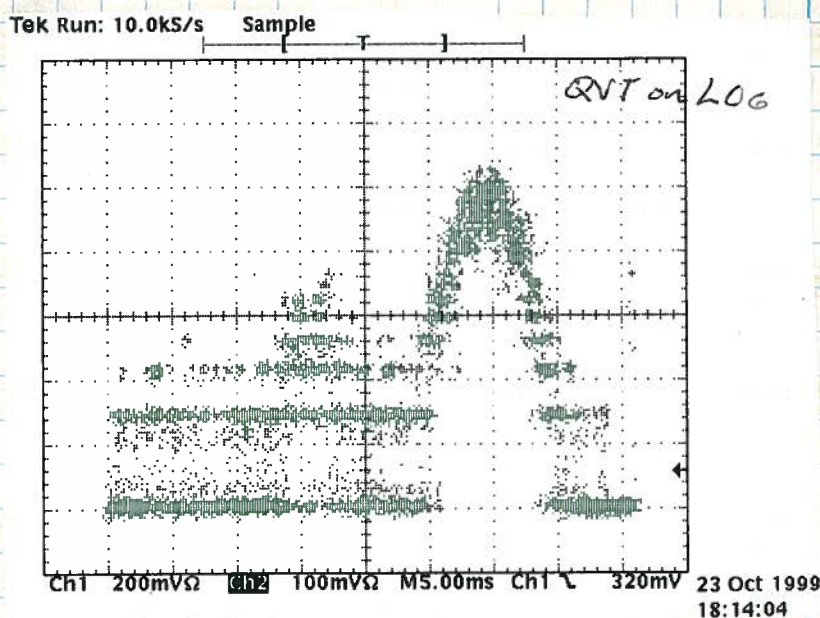
10/27/99
JS

Initial Operation of Gas Test Chamber

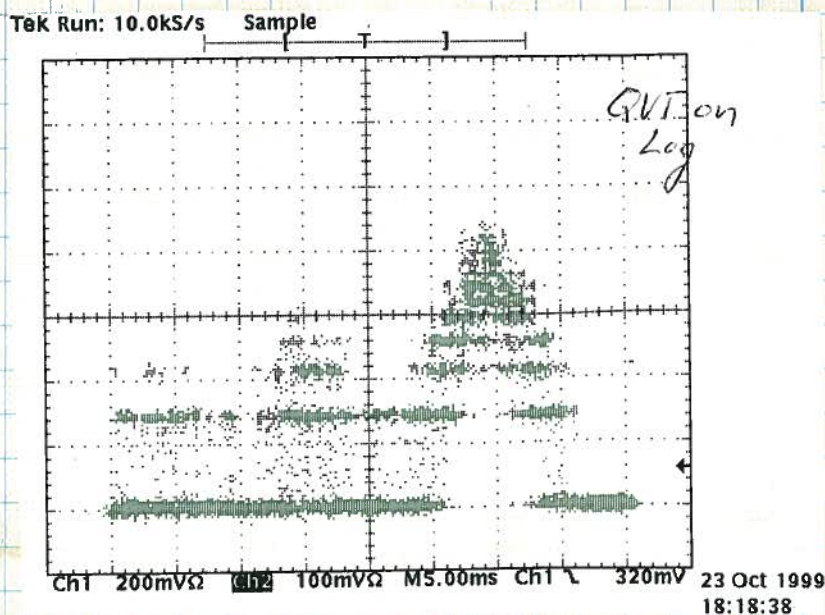
After letting the QVT run overnight



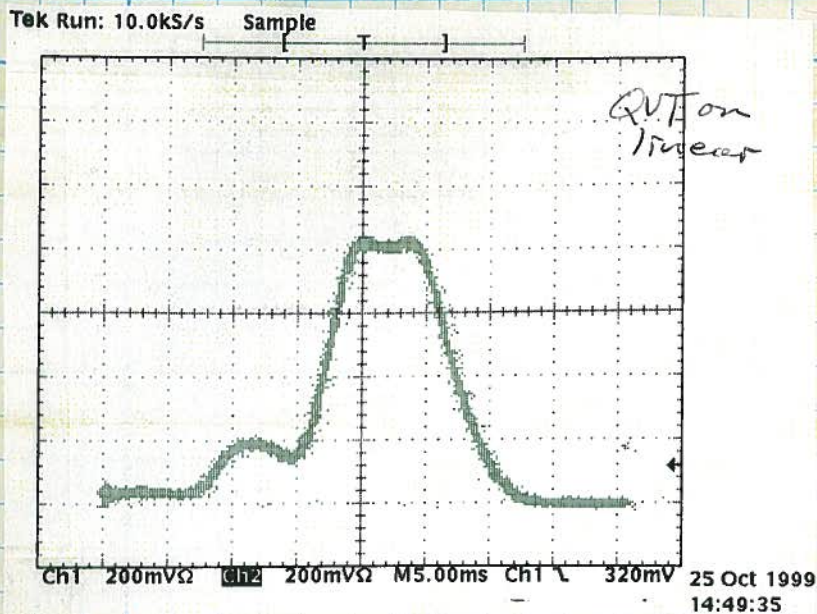
Cleared QVT and did a quick check of the present gain.
Taken during gas flowing from main flow controllers.



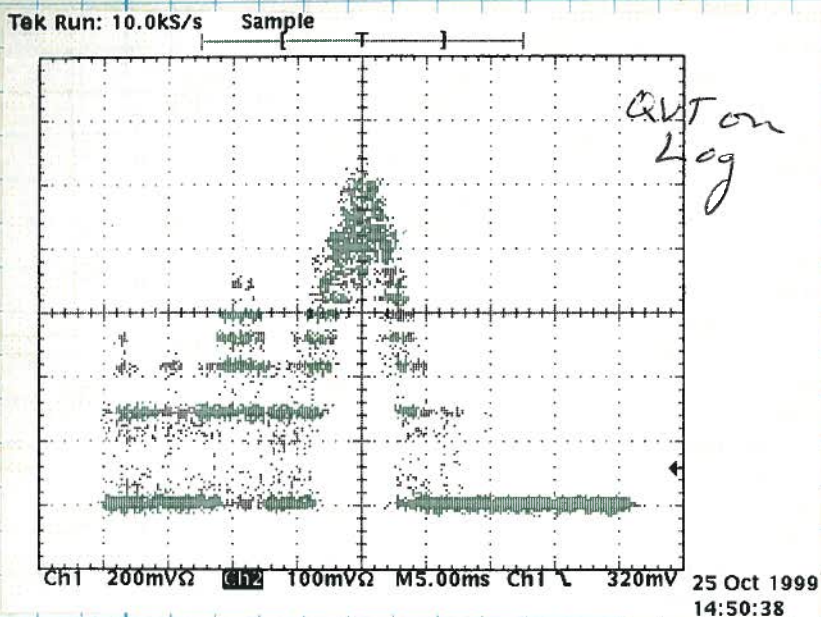
Cleared QVT and did another check.
This was taken just at the end of the flow cycle.



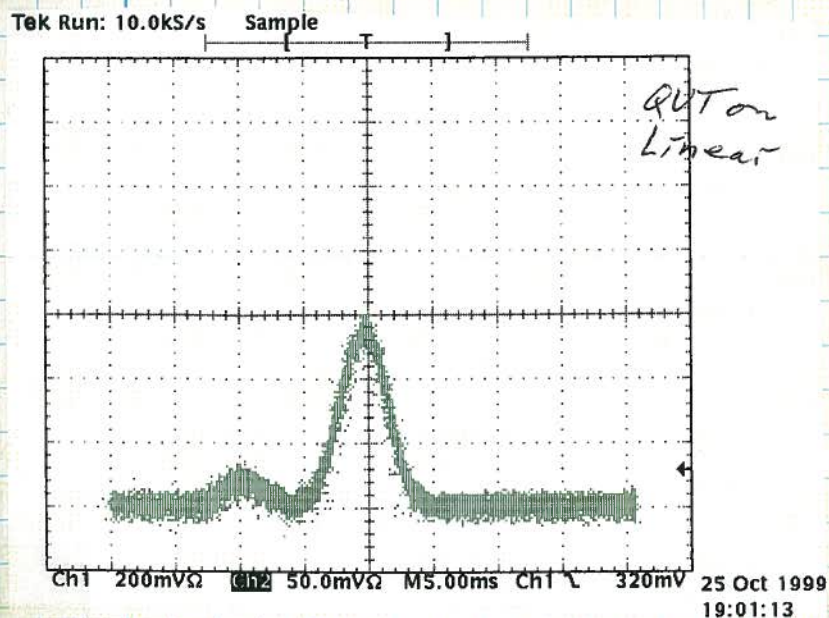
Left QVT running.



There appears to have been a drop in gain.



Cleared the QUT to check the present status of the gain



Left the QUT running. Till I got this one

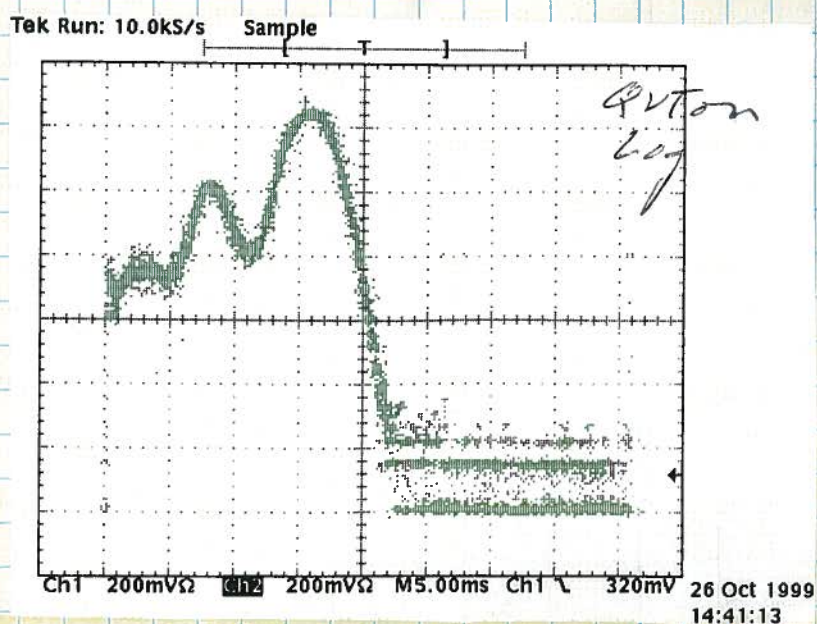
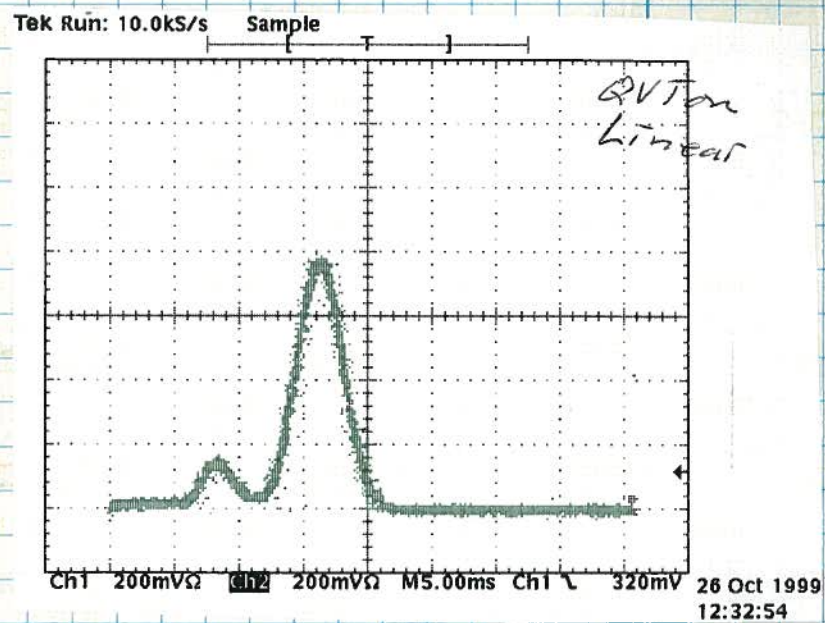
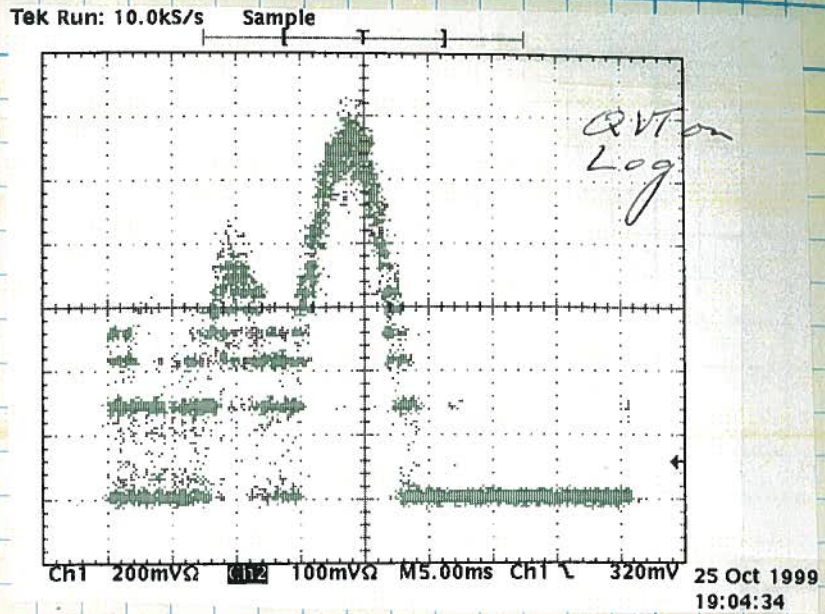
Cleared the QVT to
check the present
gain.

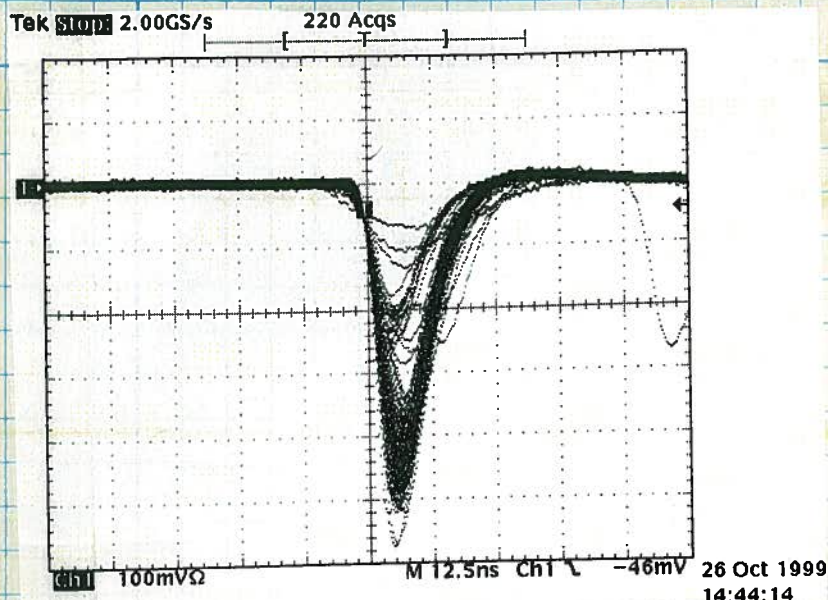
Left the QVT
running.

The QVT spectrum
has shifted down again.

Cleared QVT and
left it running.

Spectrum is
still low.





Check of preamp
output to QVT.

Unfortunately I don't
have any pics of the
amp output from when
it was originally set up.

The separation between primary & escape peaks
~~seems to be~~ is also reduced.

This would be indicative of an overall loss
in gain of the system.

On p. 151 of volume III the separation was
 ~ 2.8 divisions. Main peak at ~ 6.3 div.
from baseline or zero.

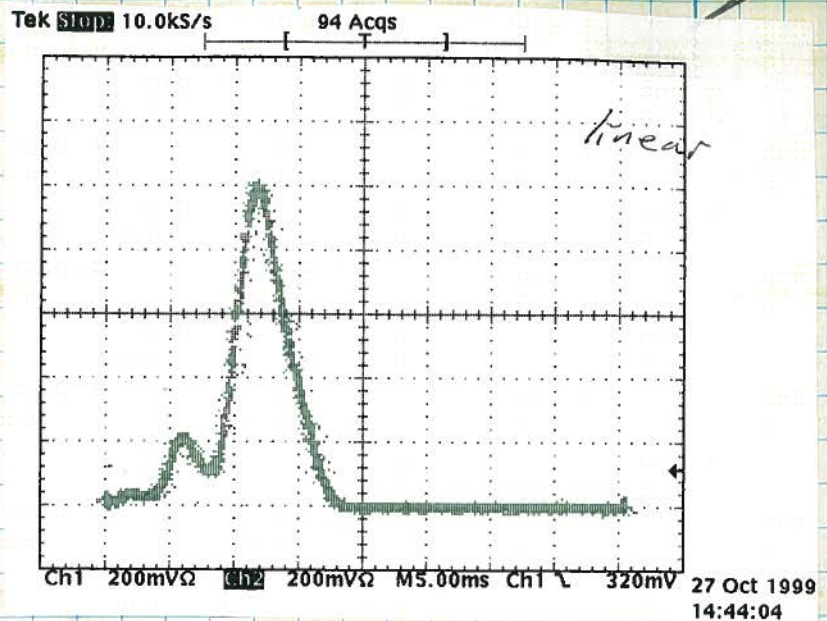
On p. 7 of this volume the separation was
 ~ 1.6 divisions. Main peak at ~ 3.2 div.

$$\frac{6.3}{3.2} = 1.97 \quad \frac{2.8}{1.6} = 1.75$$

Probably within error bars, given the "eyeball"
method of getting the separations.

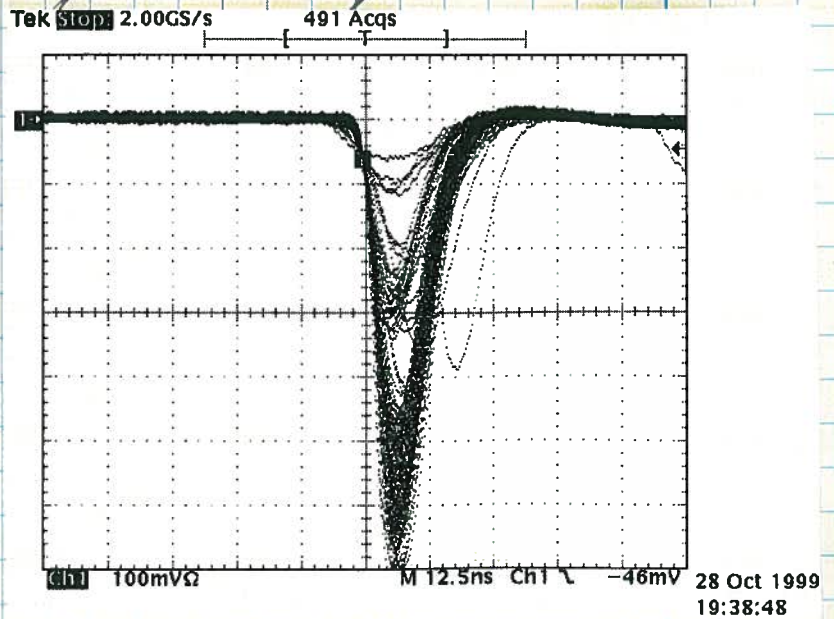
11/1
 [Signature]

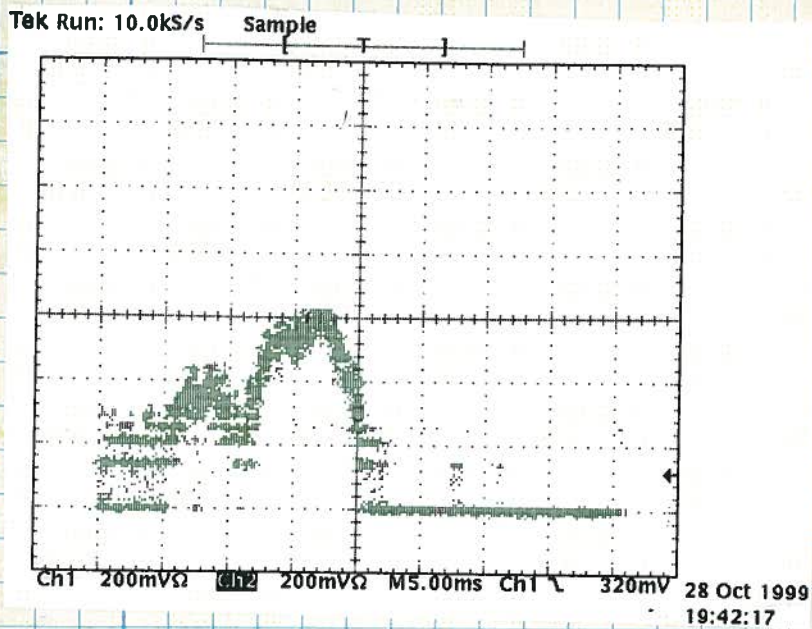
The system gain continued to drop.



I switched to pre-mix gas. The gain was still low.

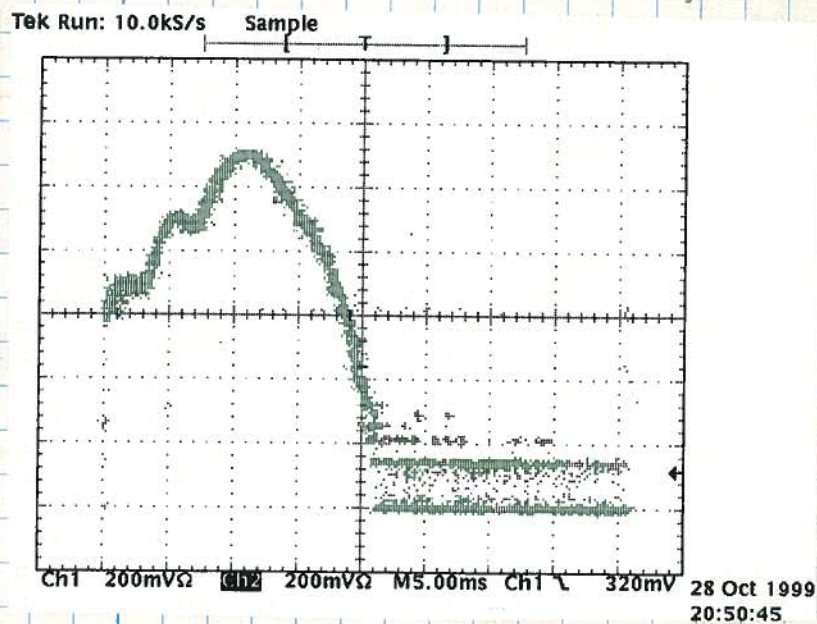
I turned power off on the amp and HV supply. After things had time to cool down I switched them back on. The gain was up.



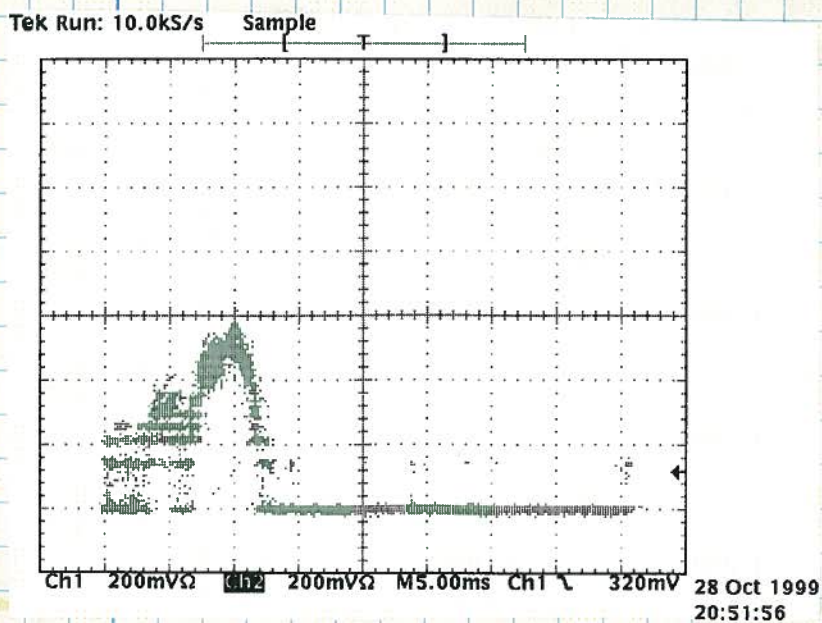


I ran the QVT to get the spectrum.

Left the QVT running.



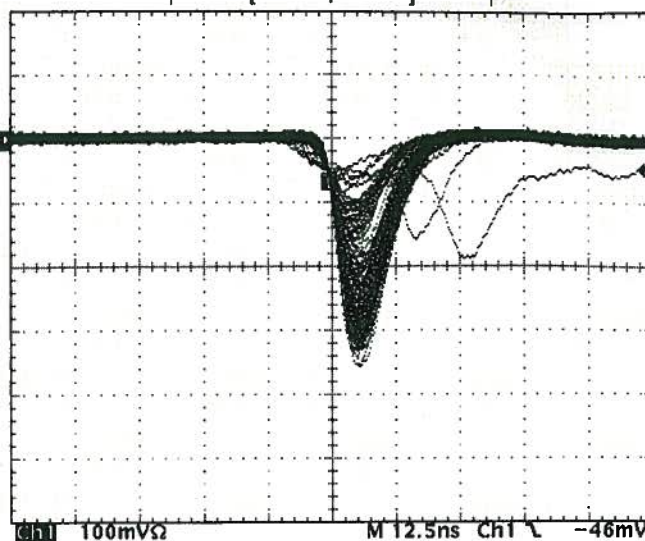
Stopped the QVT.



cleared the QVT and briefly ran it to get the present spectrum.

Looking at the amp
output it would
seem the problem
is not in the QVT.

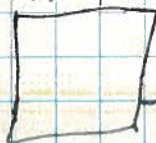
Tek **510D** 2.00GS/s 260 Acqs



28 Oct 1999
20:52:44

set up the "Little Duke" amplifier to check
the amp stability over time.

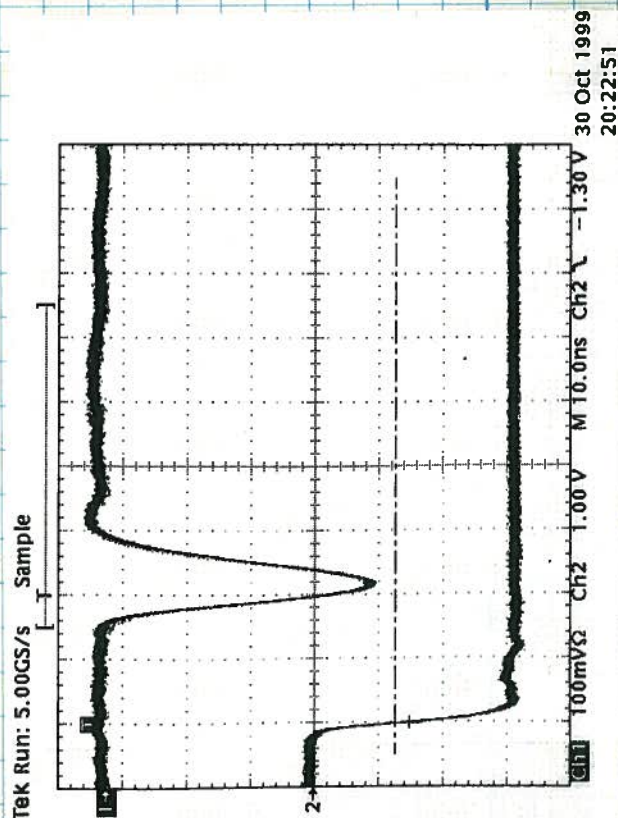
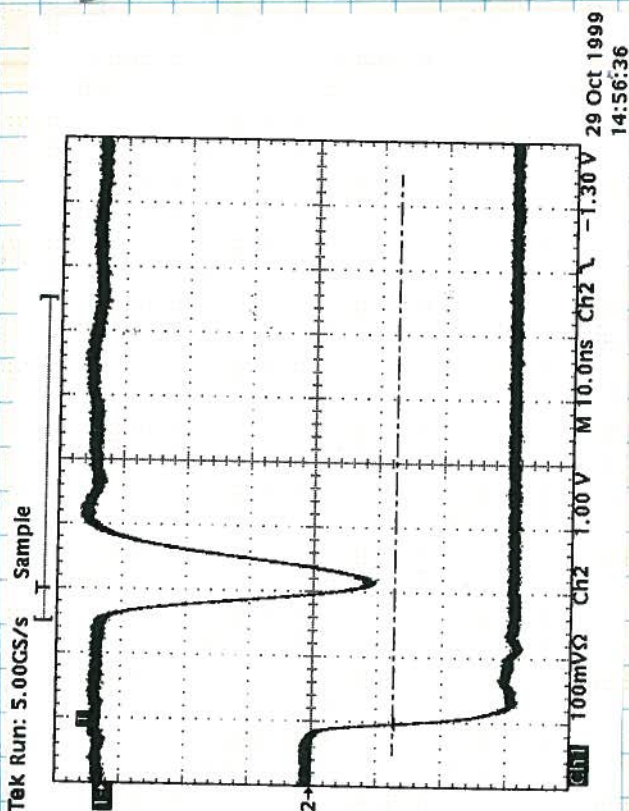
HP8013B



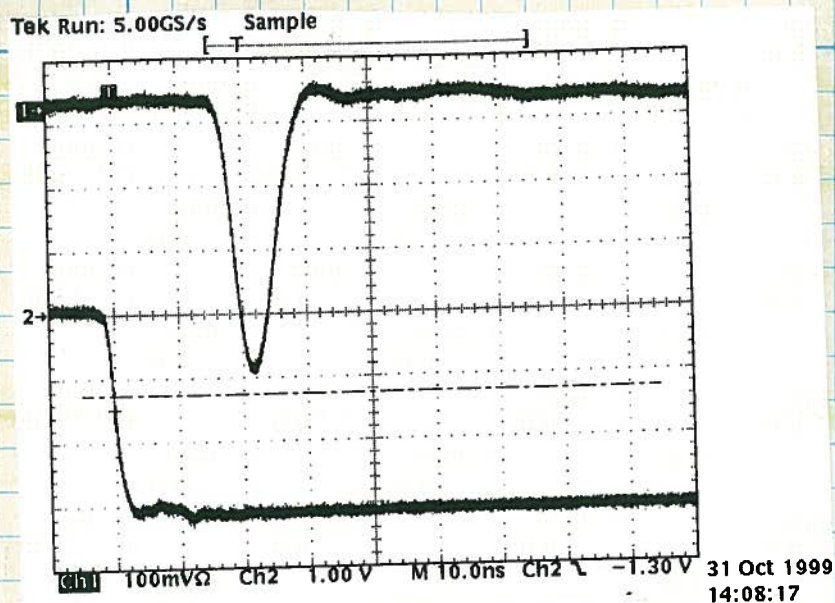
TD5854

40dB 4.7pF

AUT



The amp seems fairly stable.

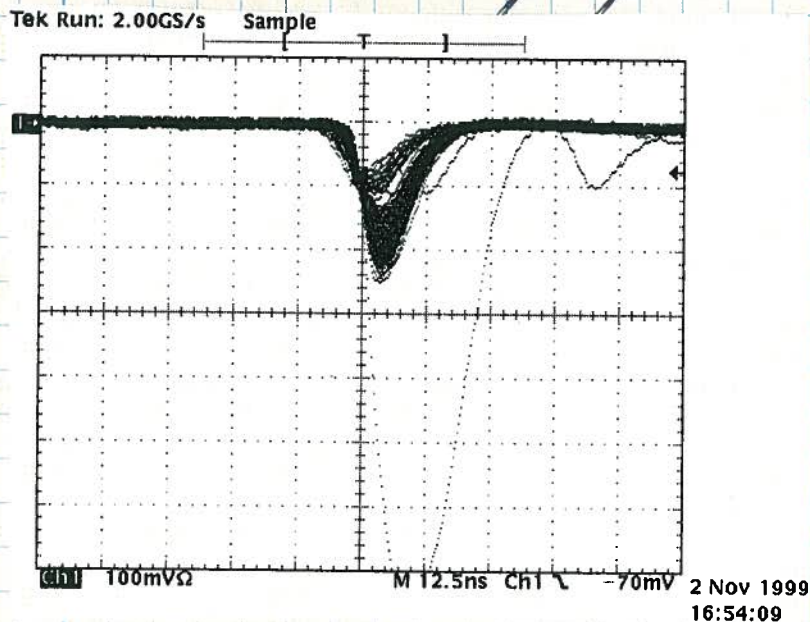


The amp was still
stable at this time.
I turned the setup
off at this point.

Given that the little Duke amp. did not drift I moved on to the conformal coating. I sprayed over the amp and HV supply.

I removed the circuit board, I pulled the HV supply off the board. I used some solvents to remove the coating around the HV connections. I then reassembled the board and locked the test chamber back up.

I flushed the chamber and turned on the power. The Fe^{55} peak was just about at the bottom edge of the scope display.

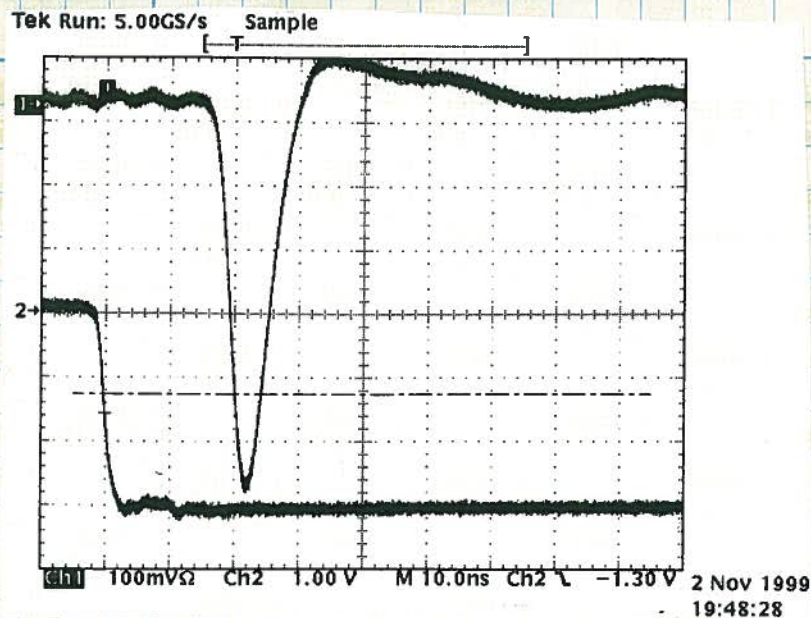


after a while the system gain had dropped to here

A little more poking around made the amp performance much better after I drew a spark and blew something out of the amp.

Taking the circuit board out, again, I took it to the FFL. I disconnected power from the blown amp.

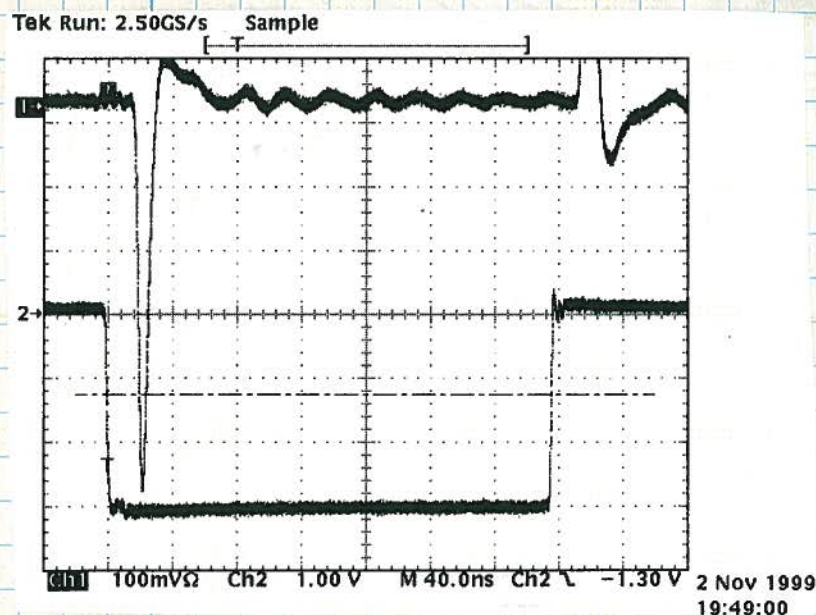
I got another 3227 amplifier. Same setup as on p. 11 of this volume.



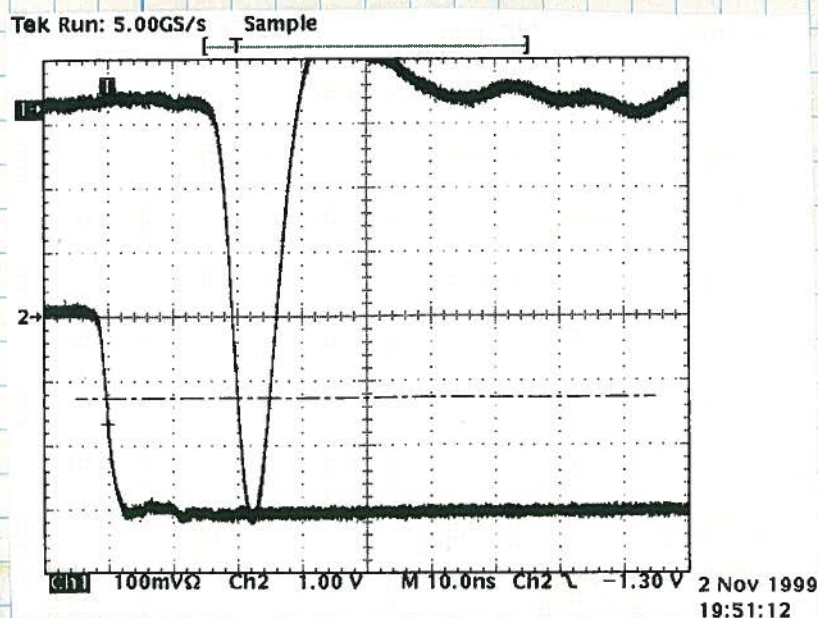
initial amplifier
response.

The HV supply, with
HV capacitors & such,
was not connected.
This was only the
amp.

This could be compared
to the Little Duke
package on p.11.



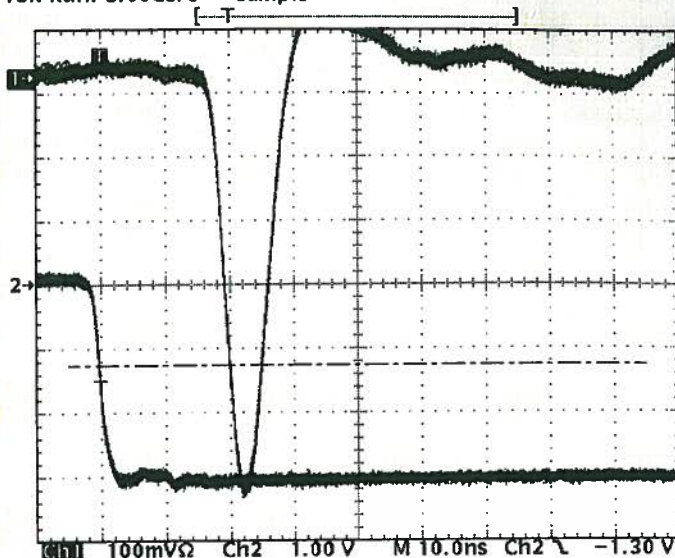
same as above.
different horizontal
scale.



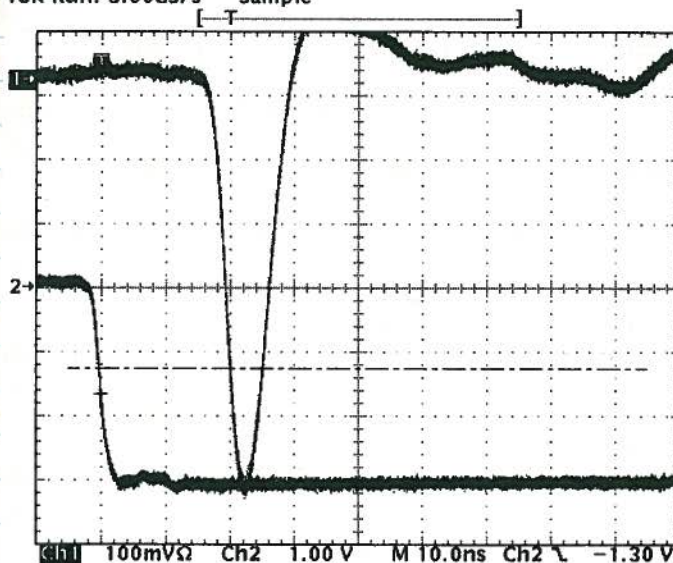
I hooked up the HV to
the amp, but did not
connect 12V power to
the HV supply.

Connected 12V to HV supply.
 Leave it a few
 minutes to see
 if the gain is
 stable.

Tek Run: 5.00GS/s Sample

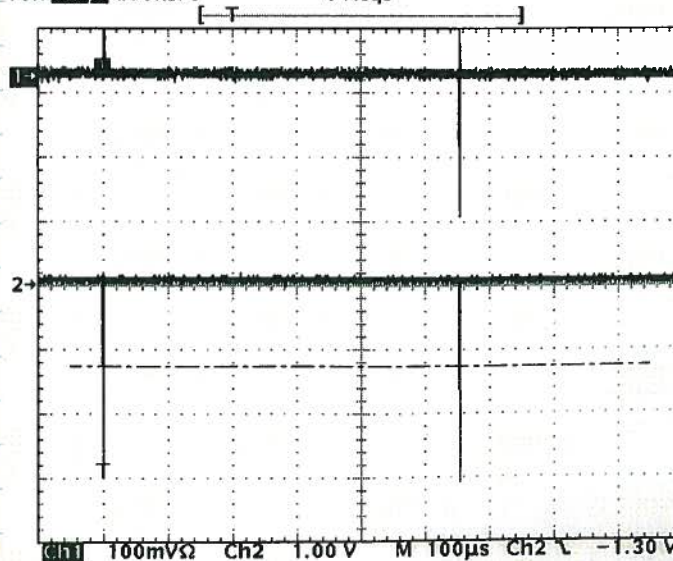
2 Nov 1999
19:53:36

Tek Run: 5.00GS/s Sample

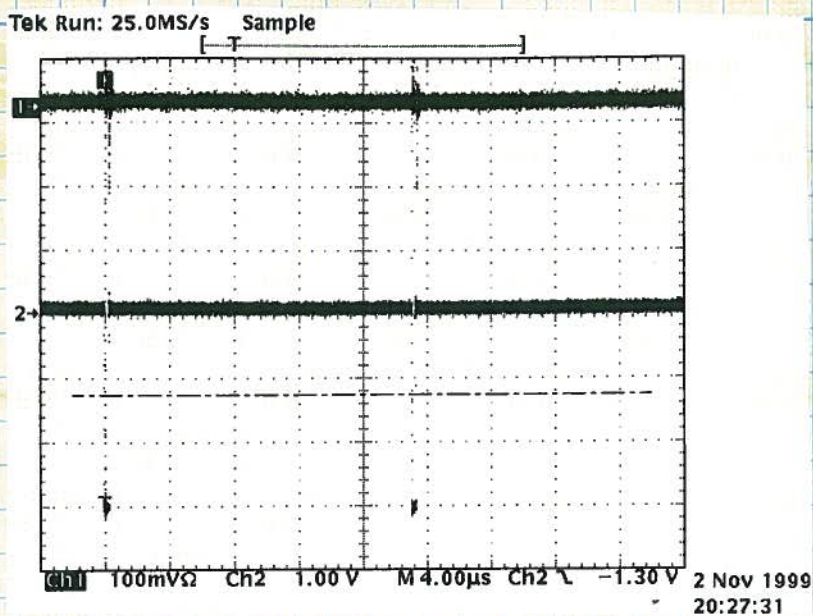
2 Nov 1999
19:58:07

Tek Stop: 500KS/s

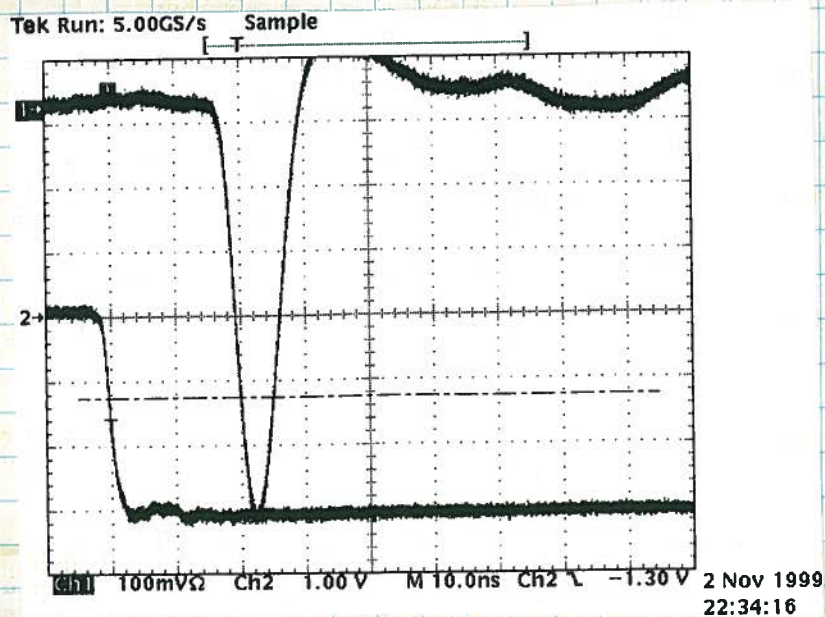
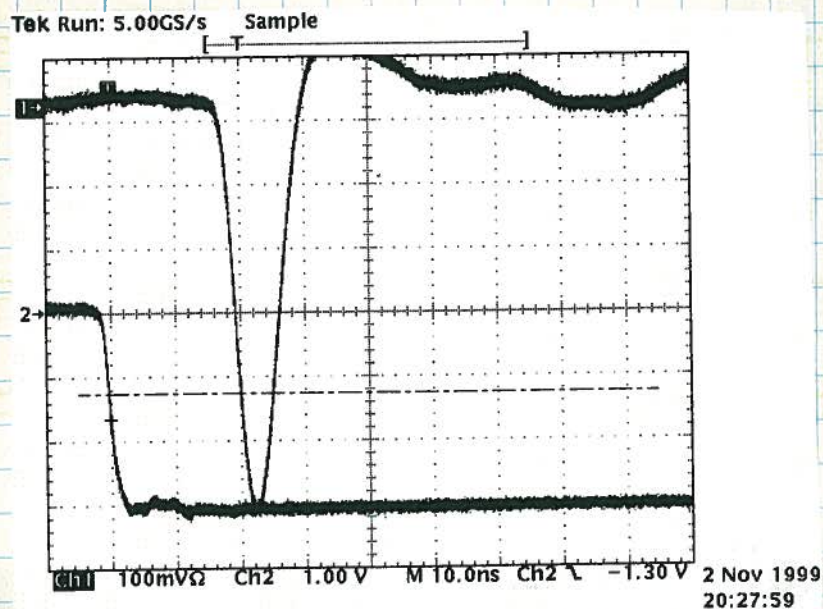
6 Acqs

2 Nov 1999
20:24:51

Present rep. rate.
 Same as from pr. 11
 data setup.



Increased the repetition rate.

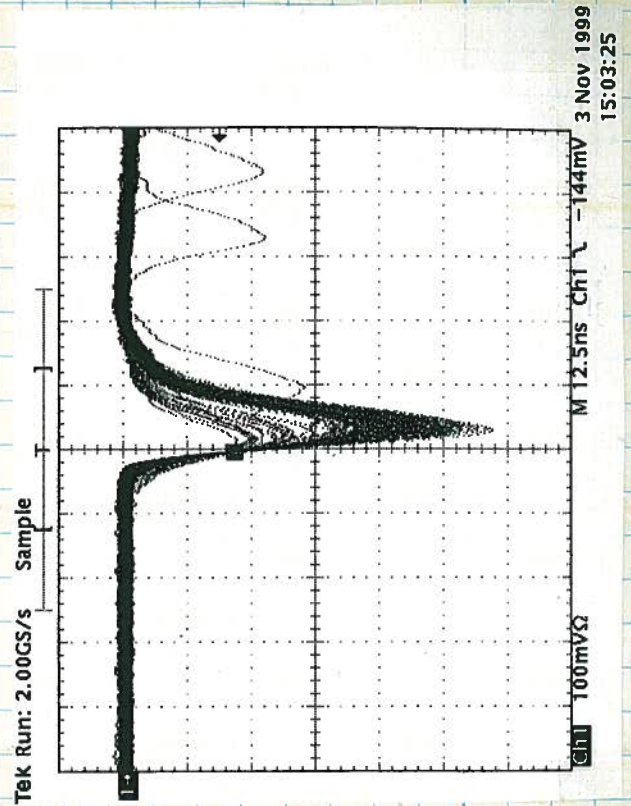
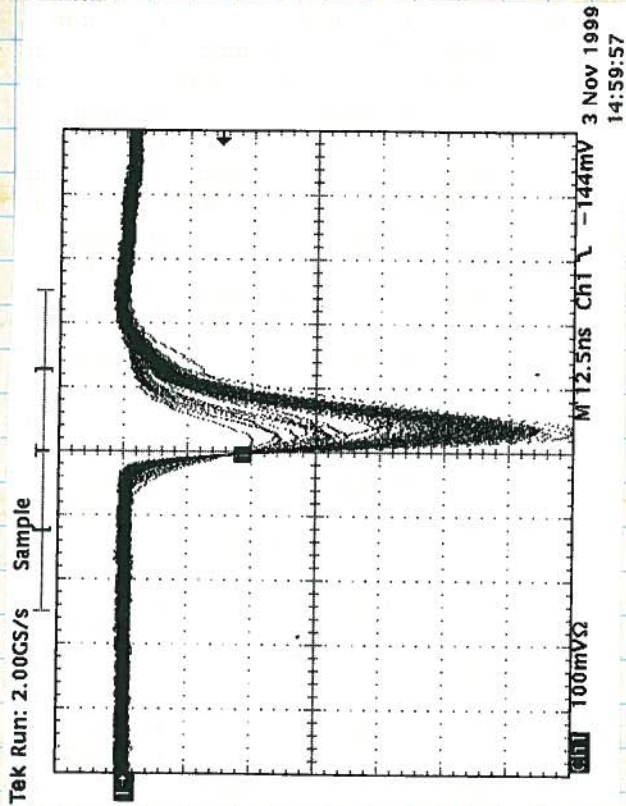


Looks stable over time.

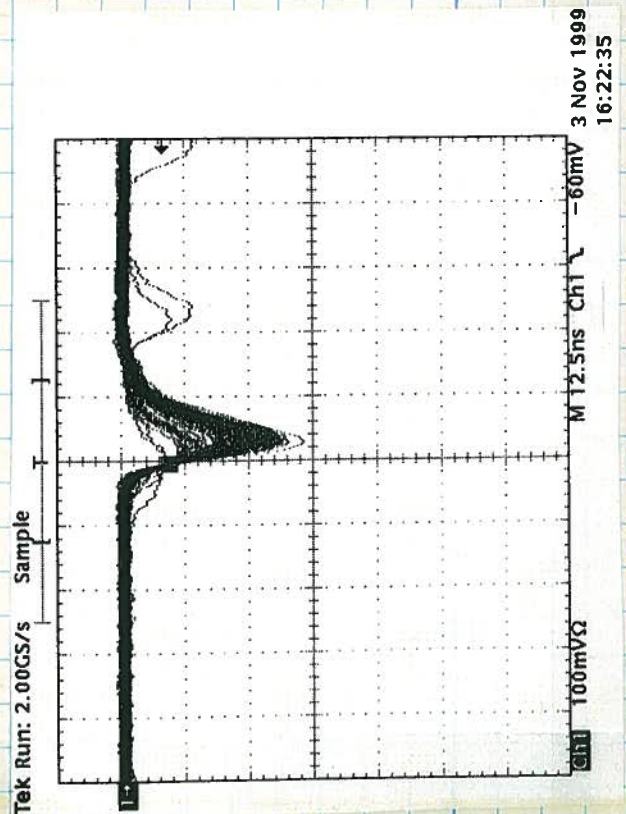
Decrease in gain now would not be due to leakage currents in the amp/4V supply board.

11/3
AJ

Put the circuit board with the output HV supply back in the box with the test chamber.



The gain is again dropping over time.
Perhaps a charge buildup inside the tube. If the front tube has a film inside.



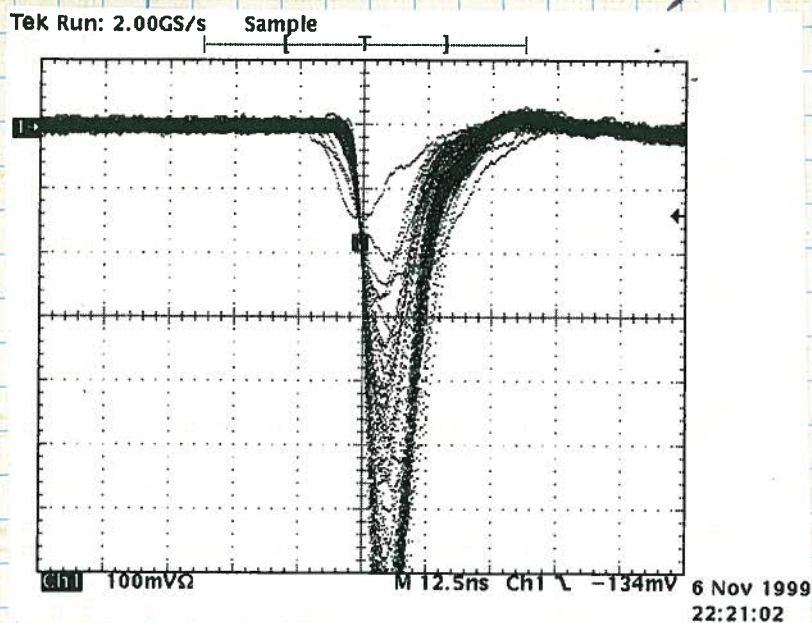
11/8

JH

Saturday I rebuilt the ^{brass} straw tube. I used some abrasive pads to clean the tube inside and out.

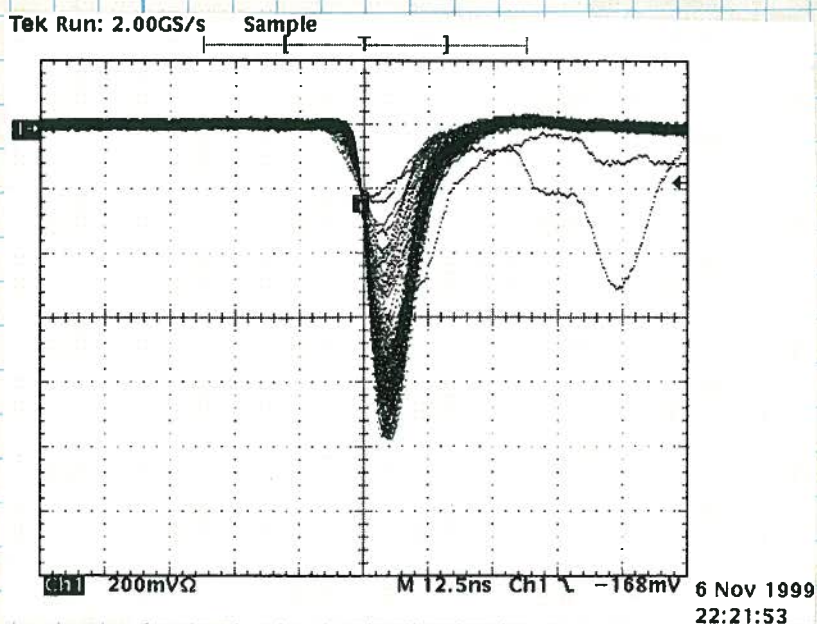
When I restring a new wire it slipped through the top solder joint when I hung the weight on the wire. Thinking this may have been the problem previously, I crimped the wire rather than soldered it.

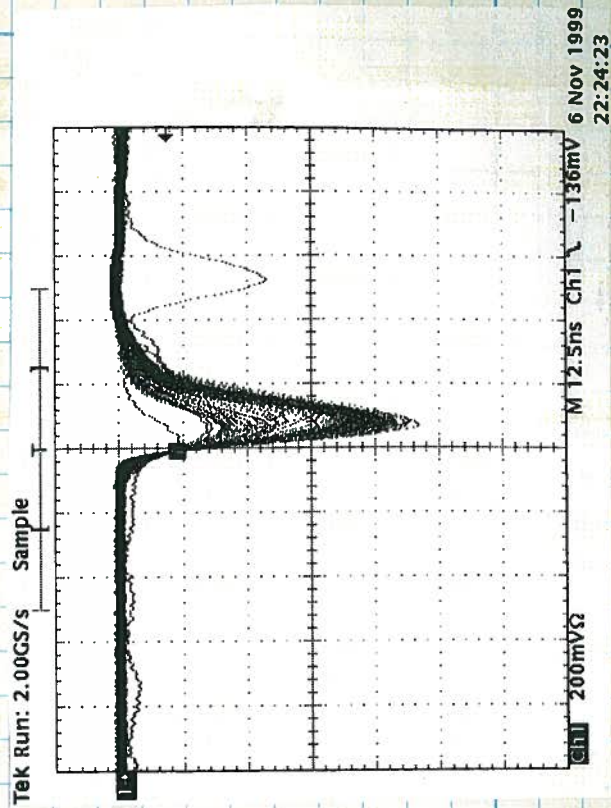
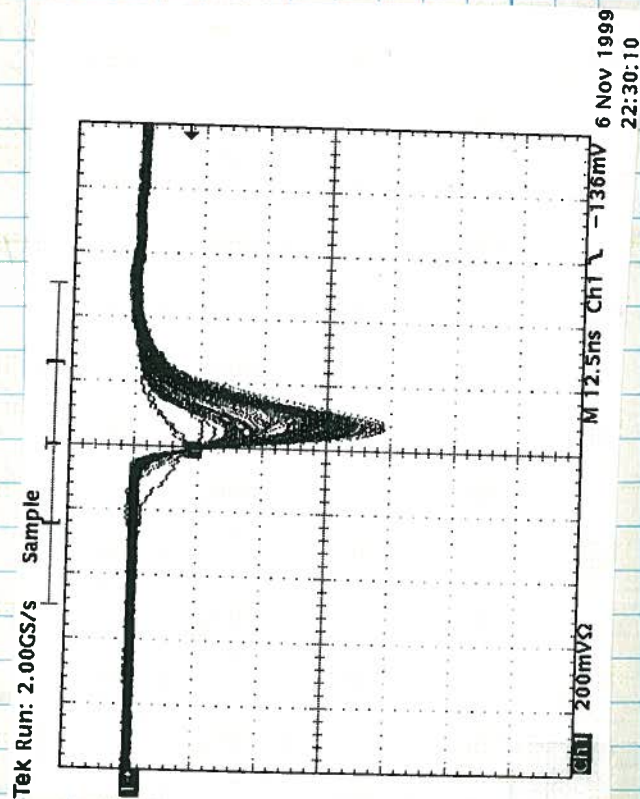
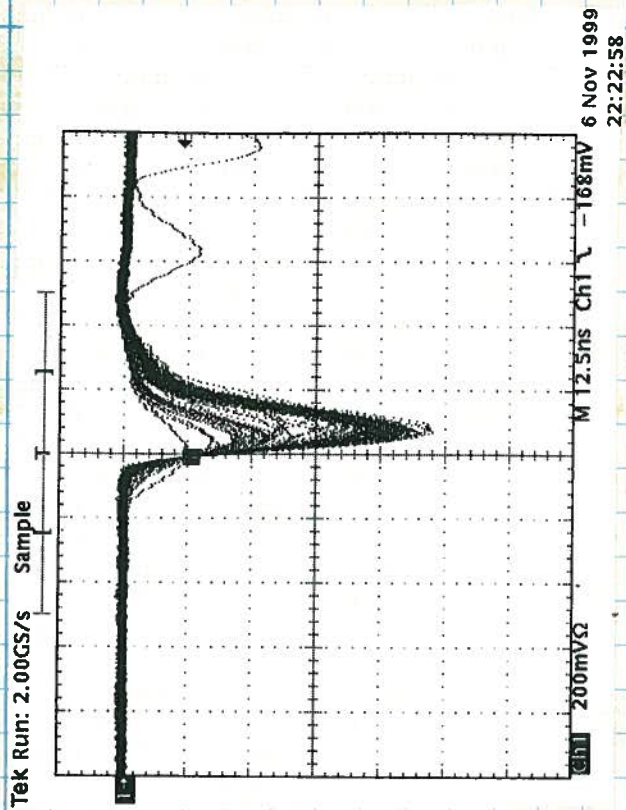
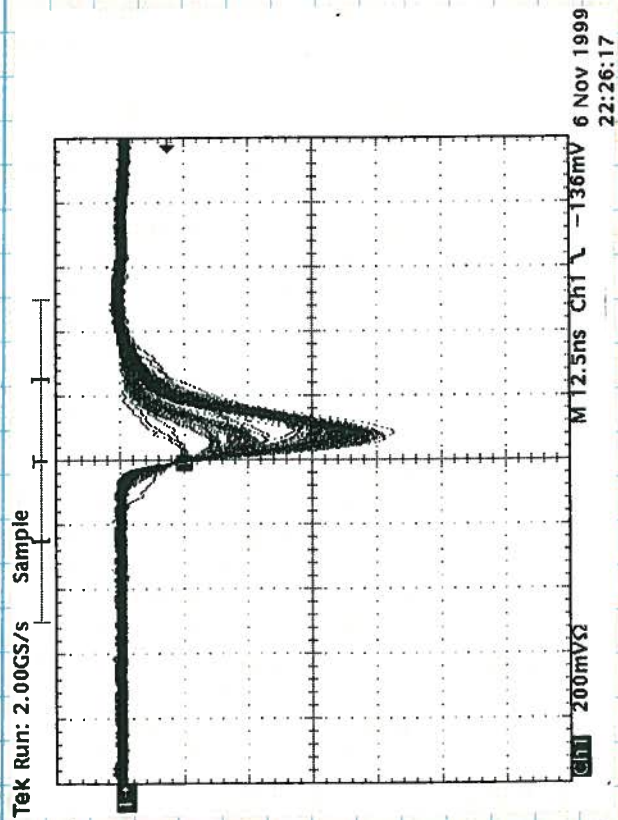
I took the tube back to the gas shed and hooked it all back up.



Initial Fe^{55} pulse height.

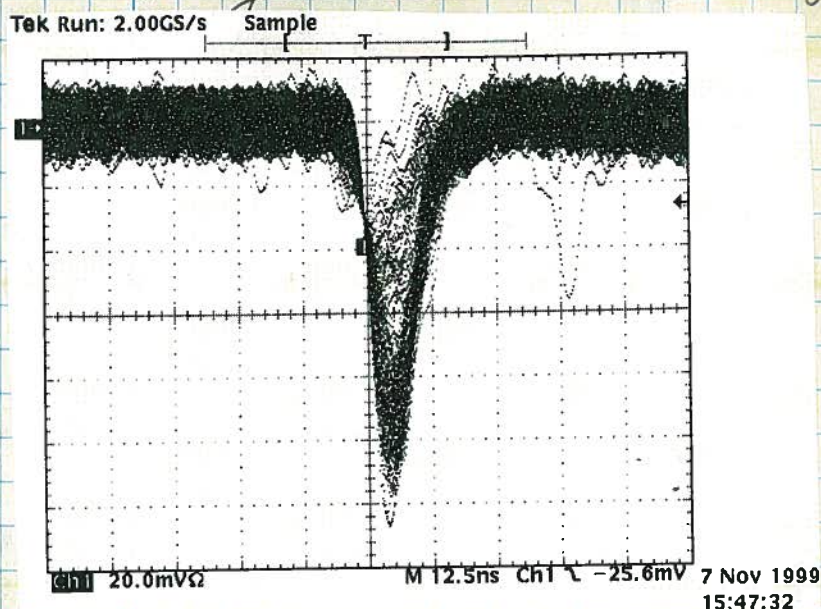
HV control voltage is unchanged from previous work.





*Pulse height is ~~drooping~~ dropping.
I left the tube running overnight.*

When I came in on Sunday the pulse height was way down.



I'd forgotten about the 4 resistors on the HV output. They are to give a small current draw out of the HV supply. $4 \times 7.5 \text{ M}\Omega = 30 \text{ M}\Omega$.
Set voltage in 3.185 V. Control is 0.5 V for 0 to 2500 V. 500 V/V.

$$500 \times 3.185 = 1592.5 \text{ V}$$

$\frac{1592.5 \text{ V}}{4} \approx 398 \text{ V}$ should be read across the last resistor.
The DMM load will reduce the last resistor value, though.

I turned the power off and clipped a DMM across the last resistor. The Fluke 9060A. When I turned the power on I noticed the reading going down slowly. I shut power off for a little time. Trying to let the HV supply cool a little, if that is the problem. When I turned power back on I read 245 V on the DMM. By the time I shut it all down again I read 234 V on the DMM.

Trying to get an idea of the time constant
for the power supply.

time	Voltson DMM	implied HV
8:01	260.5	1656
8:02	260.2	
8:03	258.3	
8:04	257.0	
8:06	254.2	
8:07	253.1	
8:12	249.6	
8:13	249.1	
8:19	246.6	
8:28	243.8	
9:19	237.1	
9:51	235.3	

turned off power

Input impedance of DMM is $10M\Omega$.

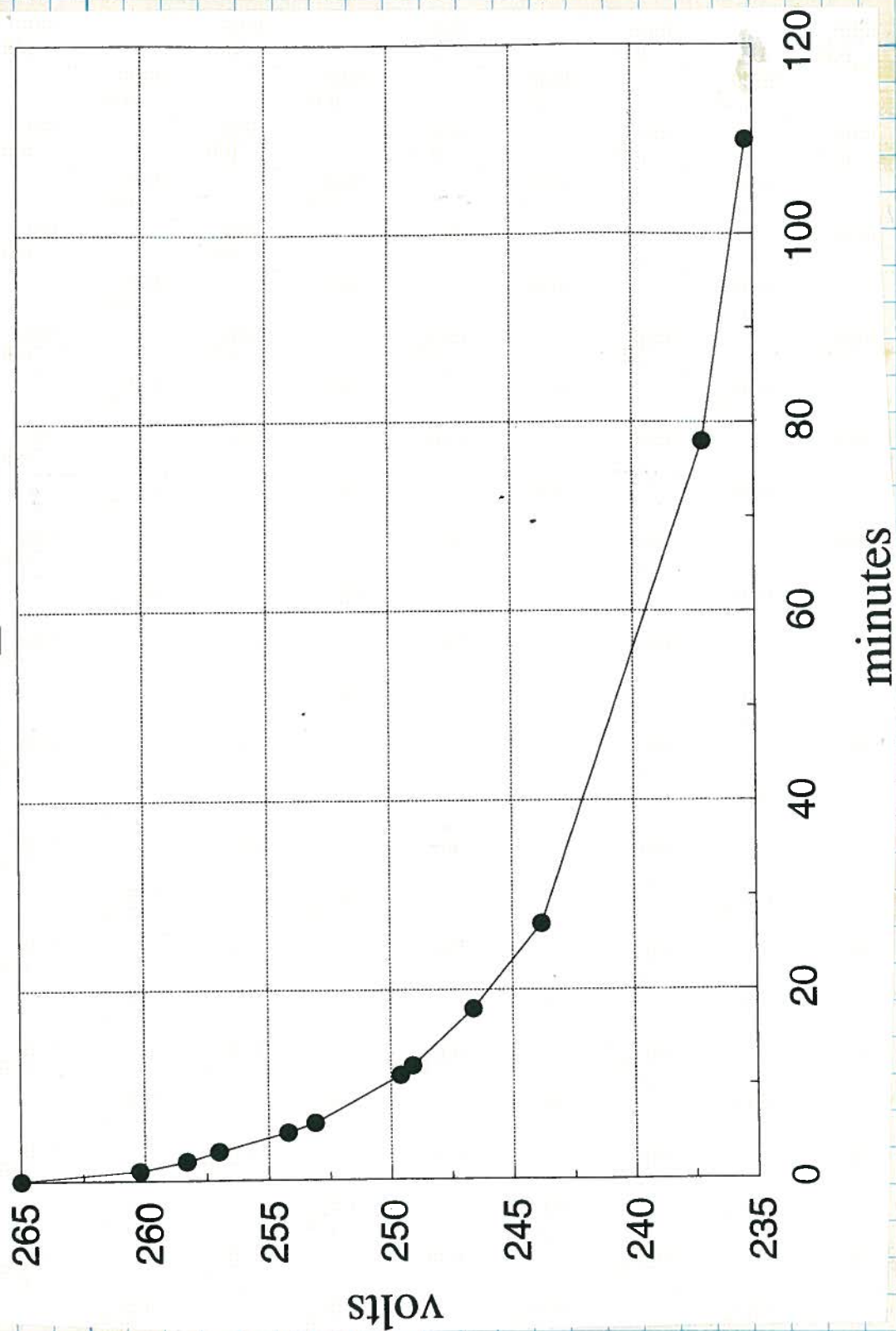
$$10M // 2.5M = 4.3M$$

$$\frac{4.3M}{26.8M} = .16$$

$$HV = \frac{V_{read}}{.16}$$

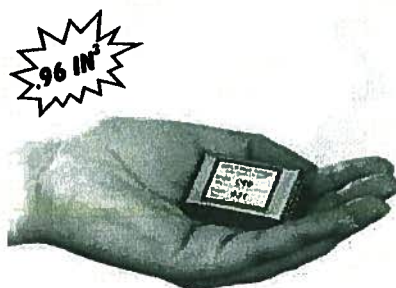
$$\frac{1656V}{30M\Omega} = 55\mu A \quad .1 \text{ Watt}$$

TUBE_HV.PSD



Miniature Precision Regulated HV Supply

0 to $\pm 2,500$ through 0 to $\pm 4,000$ VDC @ 1 Watt
C Series



The C Series is a line of miniature, precision regulated high voltage supplies featuring excellent stability and low ripple. The output voltage is programmable via a 0 to 5 volt programming voltage. Temperature drift is typically less than 50 PPM/ $^{\circ}\text{C}$. These models exhibit very low ripple, noise, and EMI/RFI by utilizing a quasi-sinewave oscillator, excellent filtering techniques and an isolated steel

enclosure featuring a separate grounding pin. An externally accessible potentiometer provides adjustable gain trim allowing for individual calibration of units. Positive and negative outputs are standard. Delivery of small quantities is from stock. Call, fax, or e-mail your requirements for immediate attention. Technical assistance is readily available.

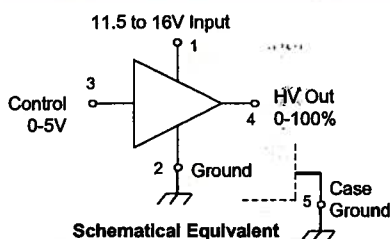
FEATURES

- High Stability, <50 PPM/ $^{\circ}\text{C}$ typically
- 0 to 100% Programmable Output
- Ultra-Miniature Size
- Low Ripple
- External Gain Adjust
- Steel Case with Isolated Ground
- Wide Input Voltage Range
- Very Low EMI/RFI
- PCB Mountable
- High Performance/Low Cost

APPLICATIONS

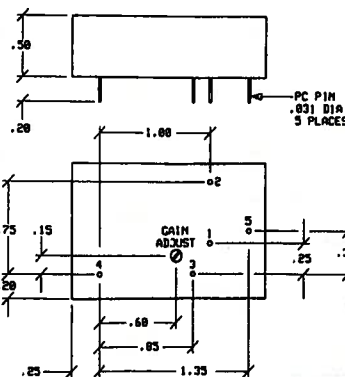
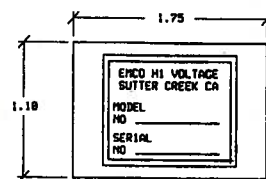
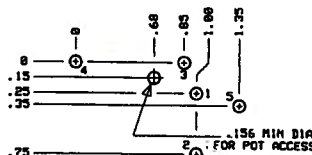
- Photomultiplier Tubes
- Avalanche Photodiodes
- Image Intensifiers
- Electrophoresis
- Q-Switches
- Grid Bias
- Solid State Detectors
- Portable Equipment

MODEL	OUTPUT VOLTAGE	OUTPUT CURRENT	TYPICAL INPUT CURRENT		RIPPLE	
			NO LOAD	FULL LOAD	NO LOAD	FULL LOAD
C25	0 to 2,500	0.4 mA	50mA	160mA	0.02%	0.1%
C25N	0 to -2,500	0.4 mA	50mA	160mA	0.02%	0.1%
C30	0 to 3,000	0.33 mA	60mA	170mA	0.02%	0.1%
C30N	0 to -3,000	0.33 mA	75mA	185mA	0.02%	0.1%
C40	0 to 4,000	0.25 mA	70mA	160mA	0.025%	0.1%
C40N	0 to -4,000	0.25 mA	75mA	190mA	0.05%	0.1%



PIN #	FUNCTION
1	Input
2	Ground
3	Control Volt 0-5 V
4	Output
5	Case

Dimensional Tolerances: ± 0.03



PHYSICAL CHARACTERISTICS

SIZE: 1.75" x 1.1" x 0.5" (44 x 27.5 x 12.5 mm)
WEIGHT: 1.4 Ounce (40 Grams)
PACKAGING: Epoxy Encapsulated
CASE MATERIAL: Zinc Plated Steel
PINS: 0.03" Diameter, 0.2" Long (0.76 x 5 mm)

ELECTRICAL SPECIFICATIONS

INPUT VOLTAGE: 11.5 to 16 Volts
INPUT CURRENT, FULL LOAD: See Table
OUTPUT VOLTAGE: See Table
OUTPUT CURRENT: See Table
CONTROL VOLTAGE: 0 to 5 Volts, <50 μA
RIPPLE: See Table
REGULATION, LINE AND LOAD: 0.25%
OPERATING TEMP: -10° to $+60^{\circ}\text{C}$

11/14/97
JA

I thought the voltage might be dropping because of too much current through the four 7.5M resistors. At ~400V across each, this is much higher than the rating for a 1/4W carbon comp resistor.

I replaced them with an Ohmcraft HV resistor. 60M Ω , 4KV rating.

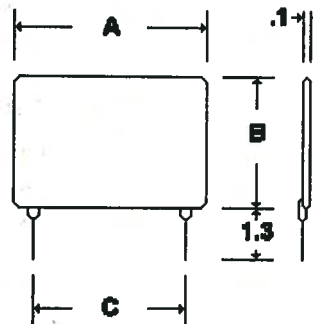
TYPICAL PERFORMANCE	OHMCRAFT Code	Power @25 DegC (W)	Max Voltage Rating	Dimensions (inches)		
				A (+.08)	B (+-.025)	C (nominal)
Overall Tolerance: To 0.1%	39	.5	2KV	.3	.4	0.2
Absolute TCR: 25 & 50 ppm/DegC	29	.5	4KV	.5	.375	0.4
VCR: 0.05 ppm/volt	21	1	10KV	1	.375	0.9
Load Life: 0.15% Max Ratio Change	42	2	20KV	2	.5	1.9
Over voltage: 1.5 X Rating (5 Sec)	43	3	30KV	3	.5	2.9
Derating: To Zero @ 125 DegC	56	6	40KV	4	.75	3.9

STANDARD VALUES

Tolerances to 0.1%

Power ratings to 6 Watts

Voltage Rating	Resistance range
5KV	1Megohm to Gigohms
10KV	100Megohms to Gigohms
20KV	200Megohms to Gigohms
30KV	300Megohms to Gigohms
40KV	400Megohms to Gigohms



ORDERING INFORMATION

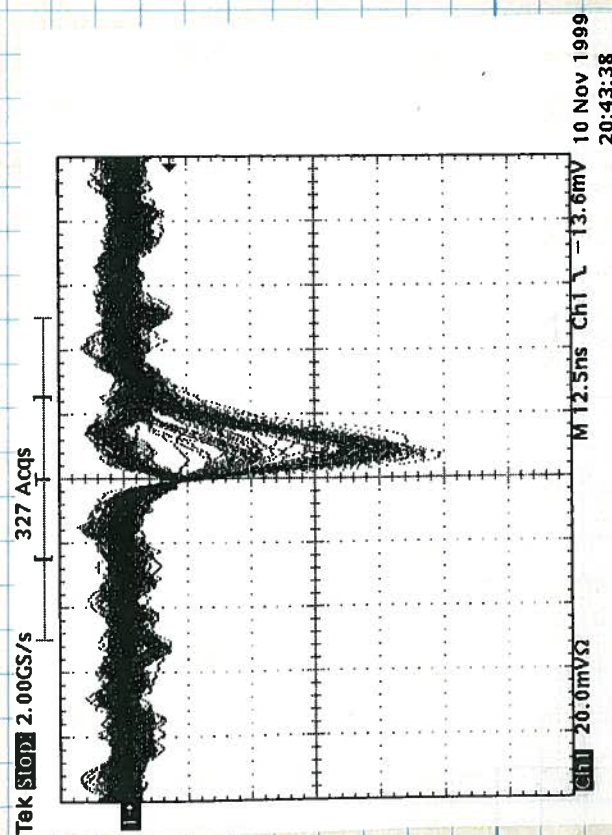
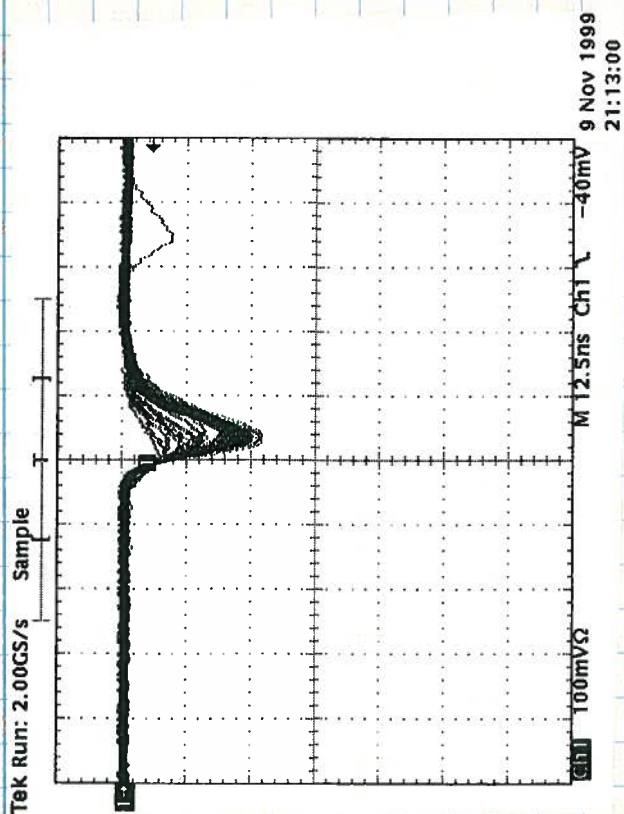
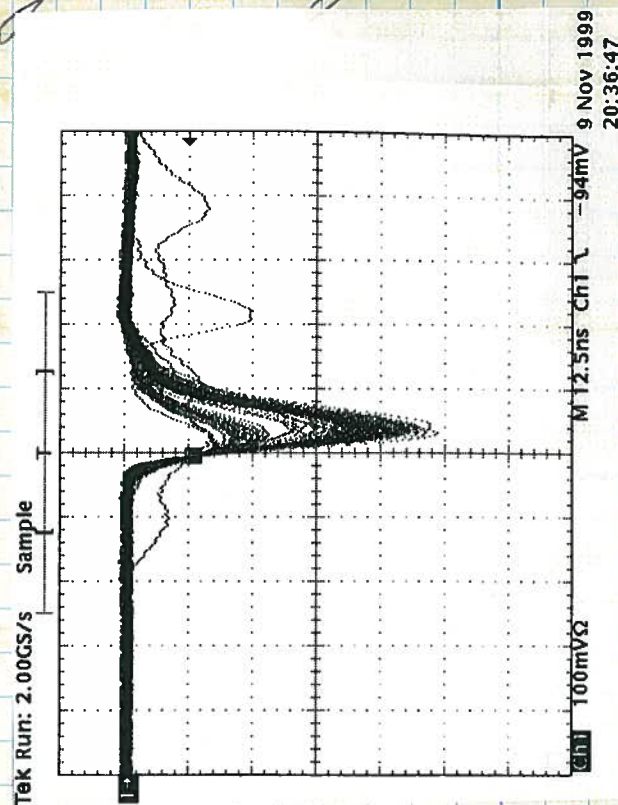
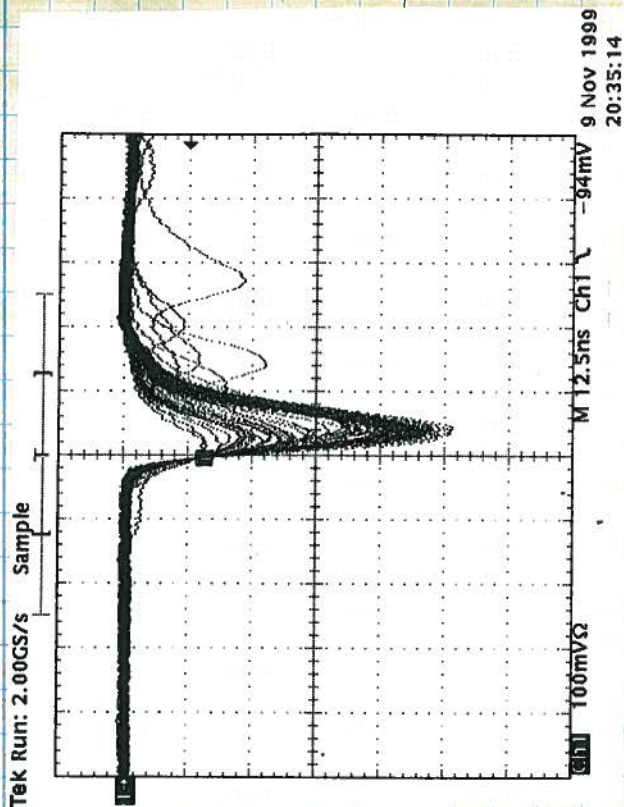
used a HVRW29L6005F Specify, as per example below: 60M Ω

TYPE LEAD STYLE	Code	TCR ppm/DegC	Total R	Tolerance Total %
HVR S	21	A	1006	F

S = Spade See E = +- 25ppm/degC Total Ohmic Value:
 W = Wire Table H = +- 50ppm/degC 1st Three digits are
 Above K = +- 100ppm/degC significant figures
 L = +- 200ppm/degC last digit specifies # of zeros
 M = +- 300ppm/degC

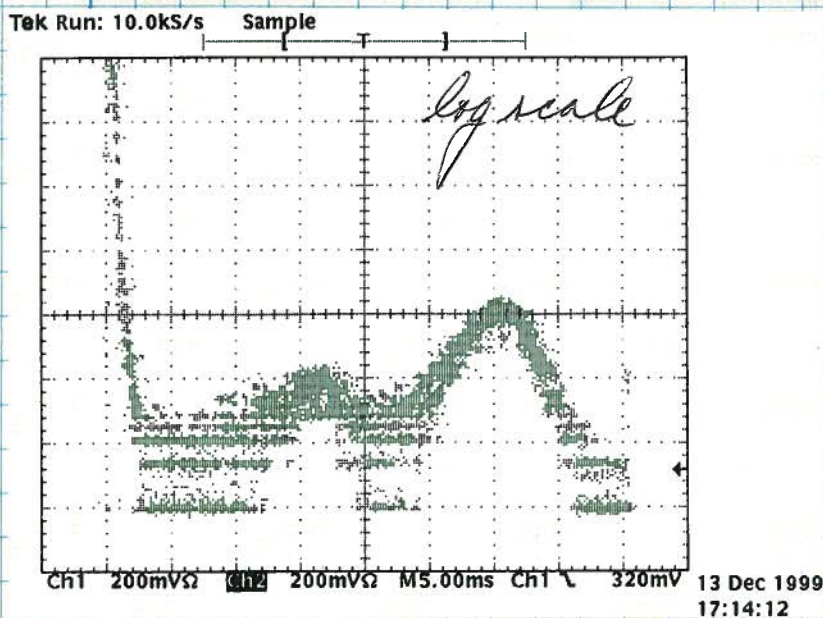
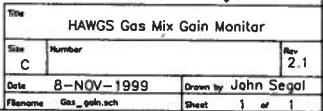
B = +-0.1%
 C = +- 0.25%
 D = +- +0.5%
 F = +-1.0%
 G = +-2.0%
 J = +-5.0%

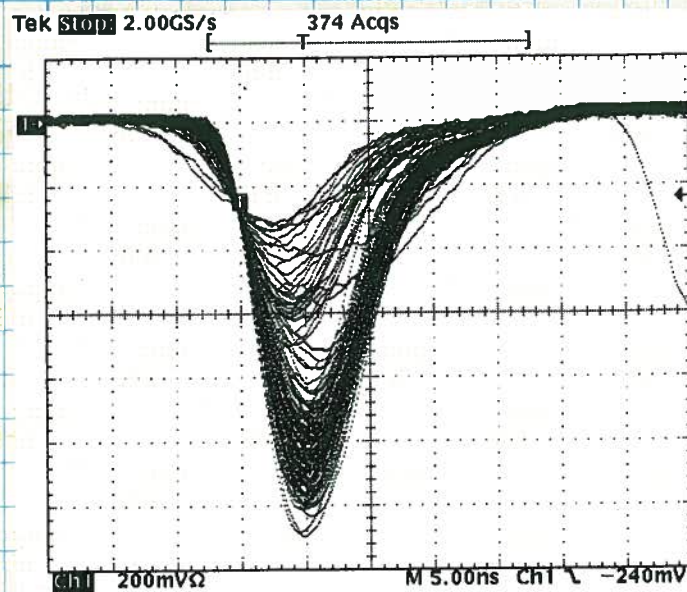
I couldn't put the DMM on the HV, but these Fe^{55} pictures indicate the HV is steadily decreasing.



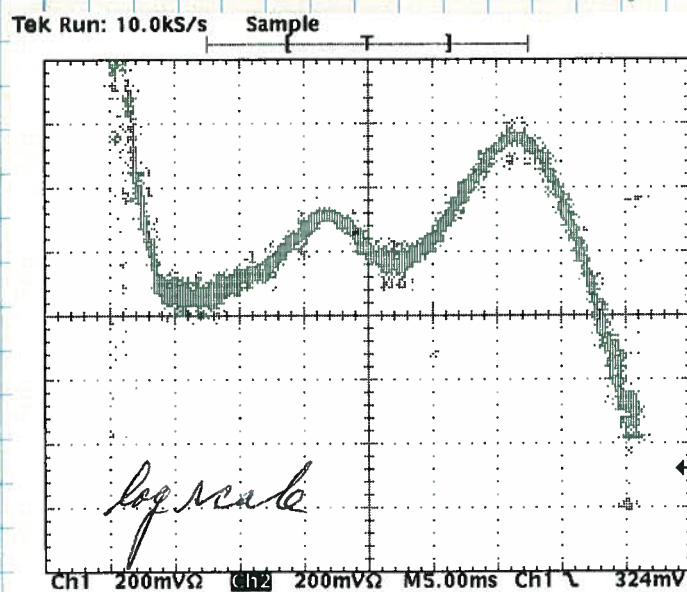
I have replaced the C25 supply with a new one. Everything seems stable after a couple of days of running.

I lifted the circuit board today and verified the parts on the HV circuit. The correct schematic is

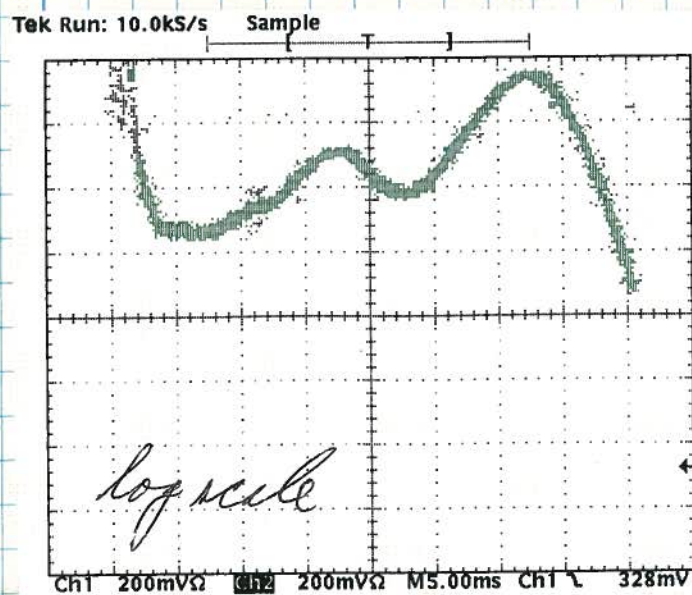




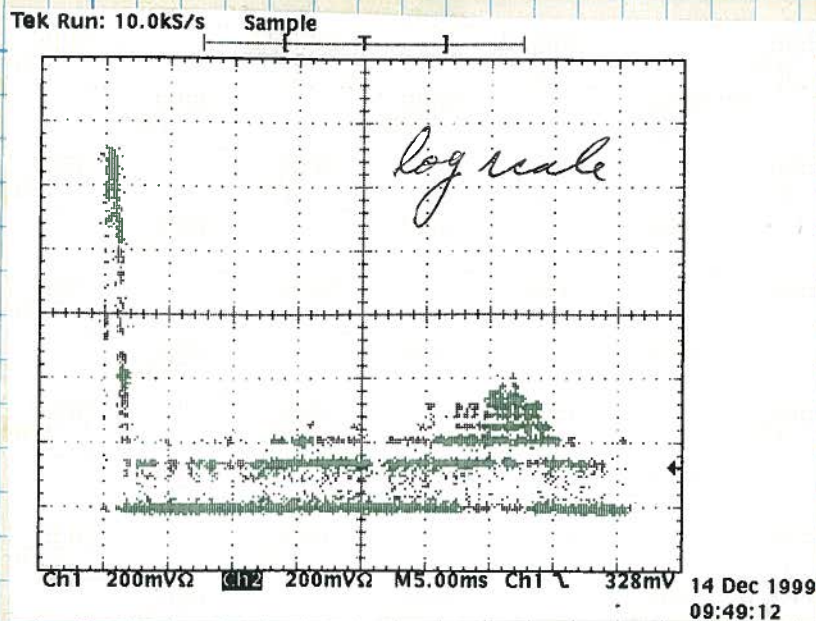
13 Dec 1999
18:09:03



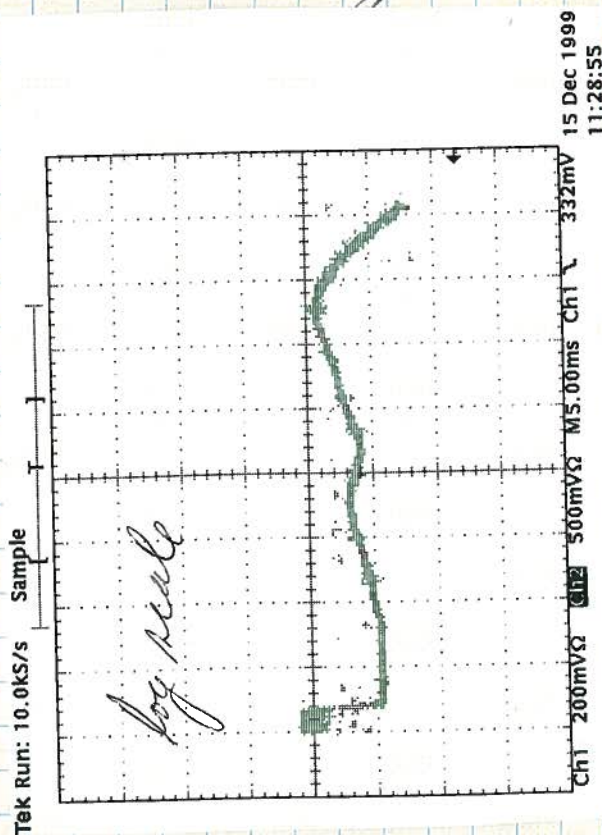
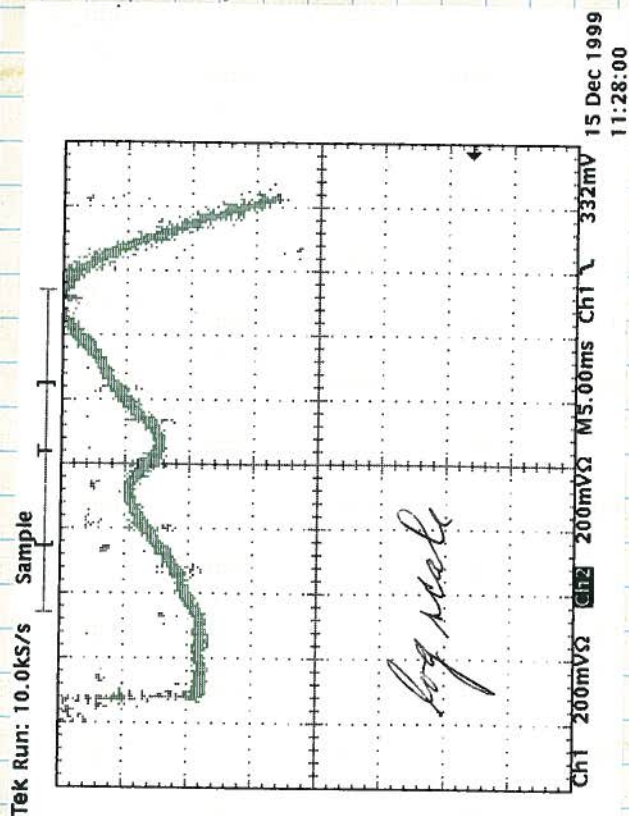
13 Dec 1999
19:55:26



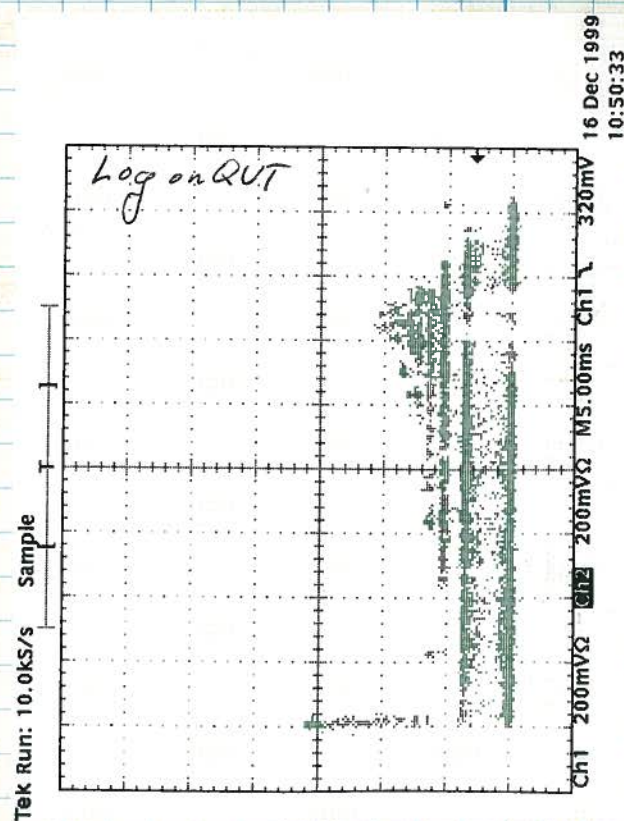
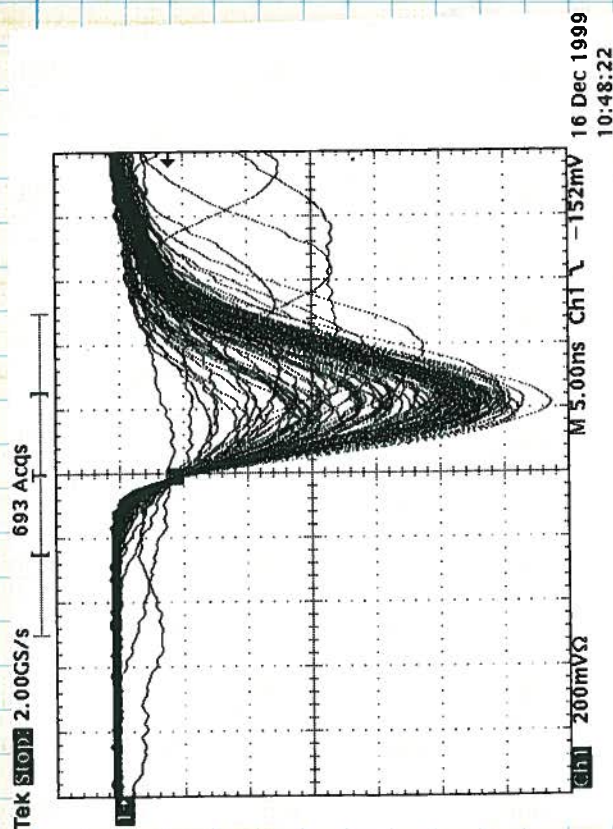
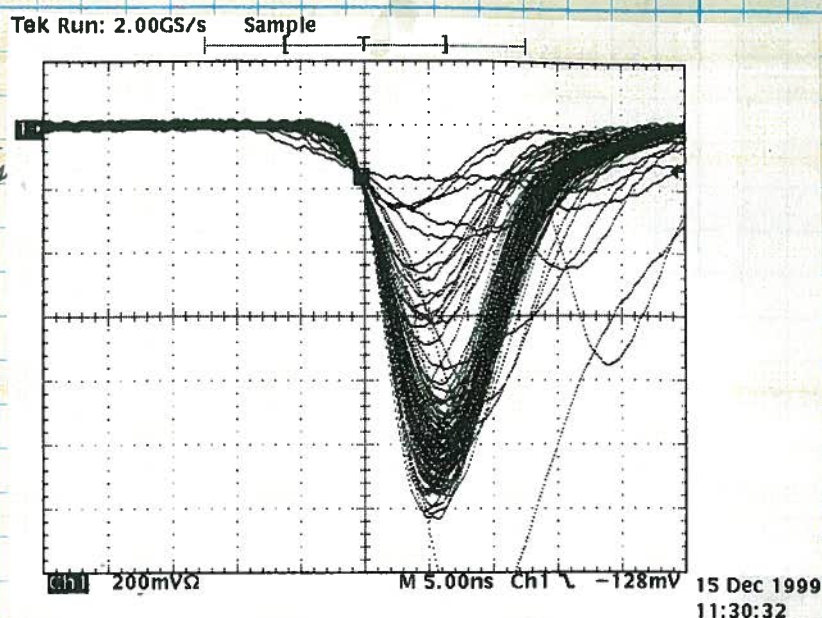
14 Dec 1999
09:47:42



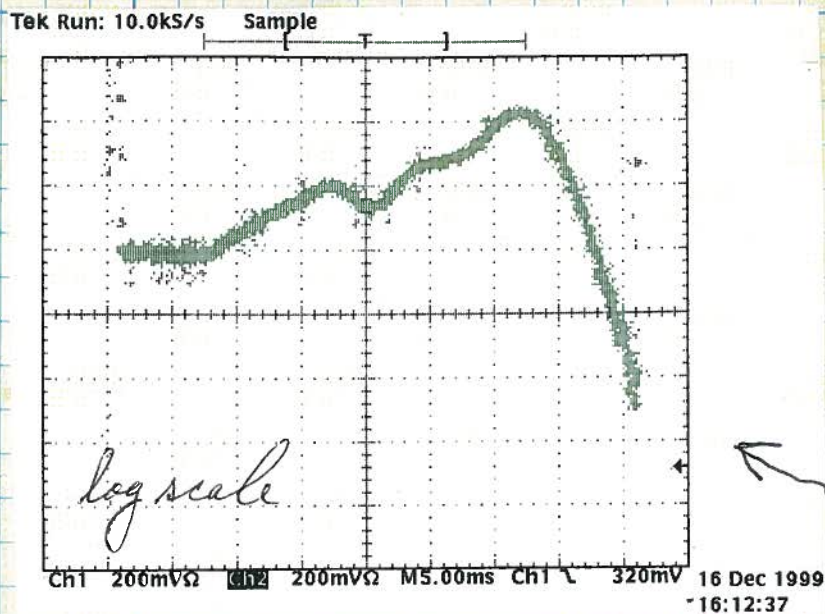
This evening I finally got the last two connectors mounted on the box. The only things left to do are put a "T" in somewhere to get the differential pressure for inside & outside the tube and to cover the HV points with RTV or something.



This pic →
and the two previous
are from in the morning,
before I put the connectors
in place.

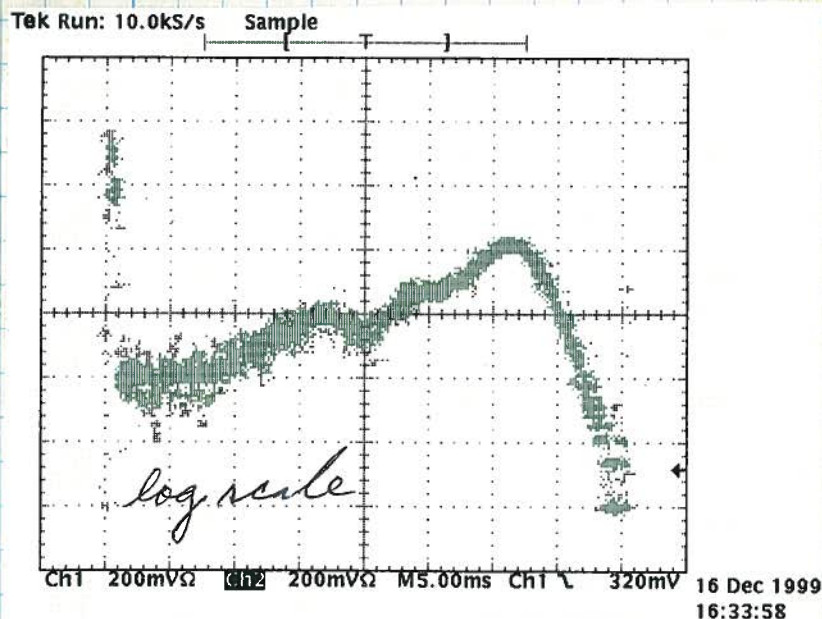


Left gas running & power on all night. turned
on the scope to see if things were ok. Quick
check with the QVT. Left the QVT
running.

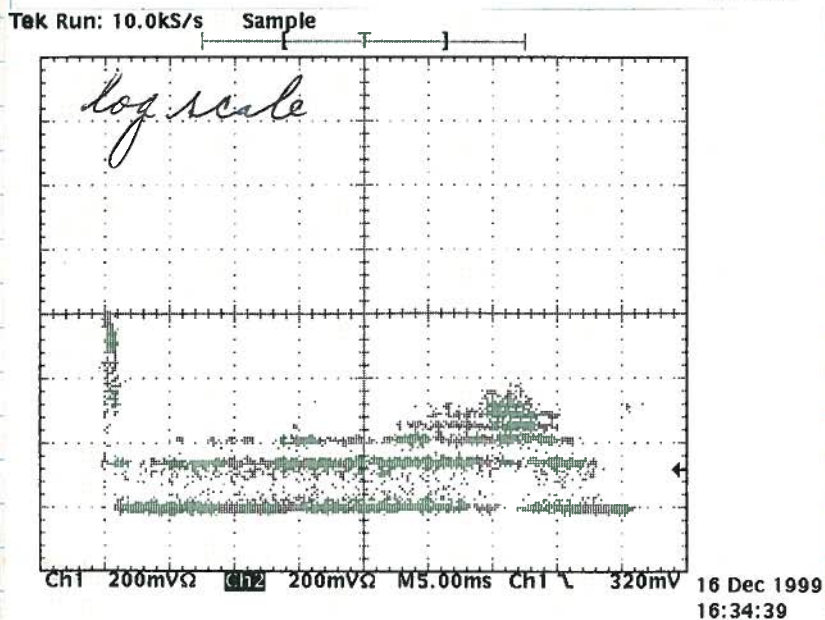


appears to be a shoulder in the QVT spectrum. Perhaps due to a shift of the peak at some time.

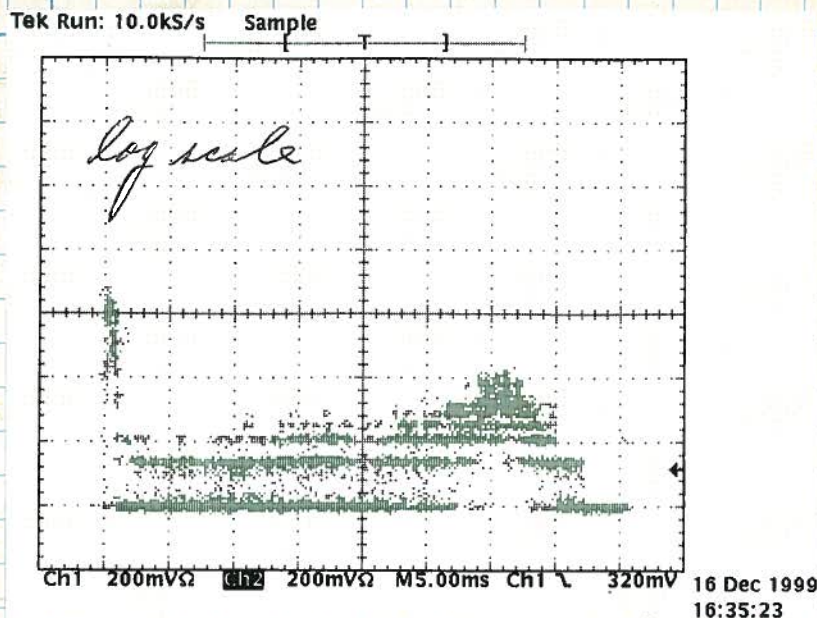
Cleared the QVT and let it run again. Also, ethane bottle had switched over during this run



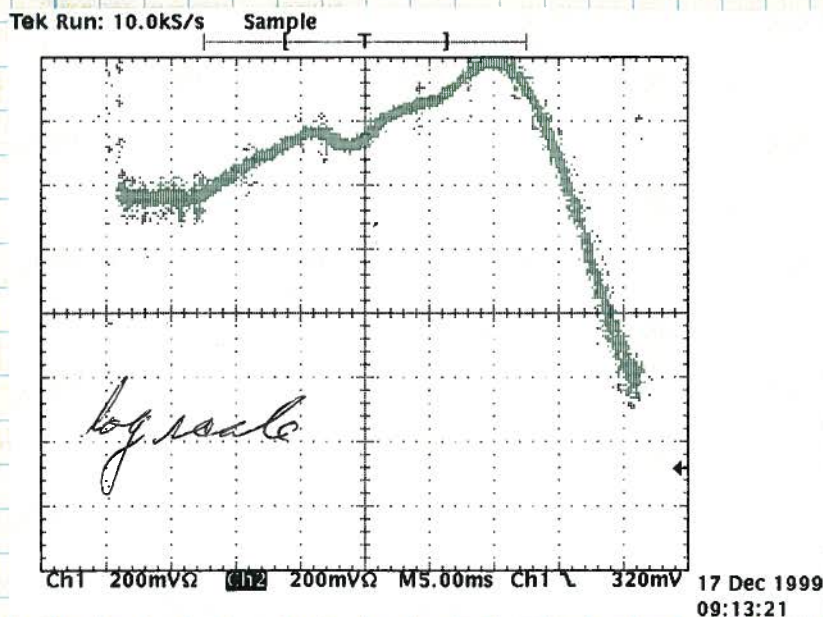
The peak still seems evident.



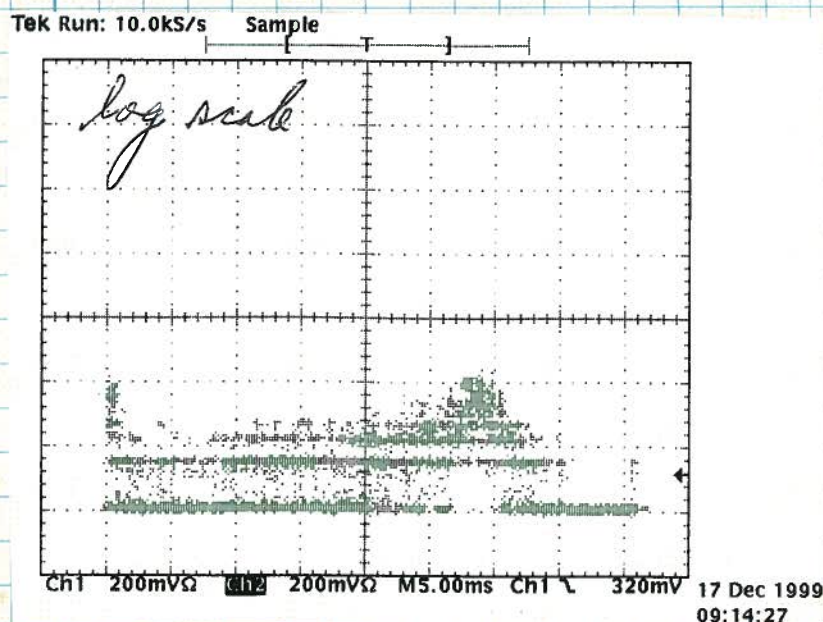
QVT run while Mass Flow Controllers are off. (MFC)



*QVT run while PMFC is on.
No clear shift in peak
position.*



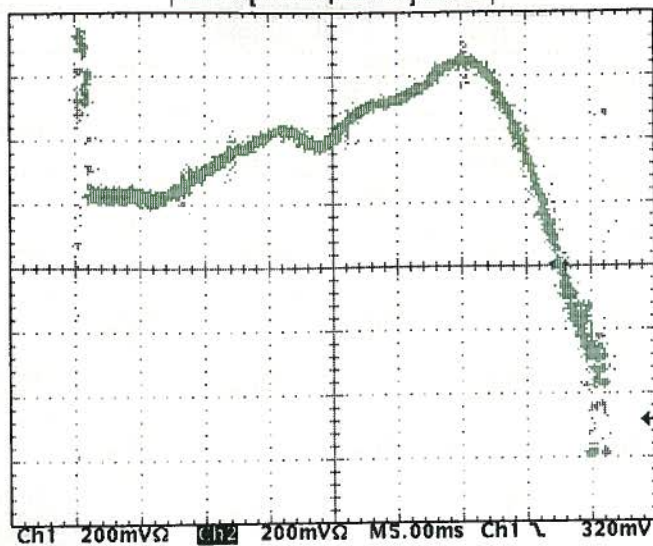
*shoulder appears to be
a consistent problem.*



*current peak position
might be just a little
bit off*

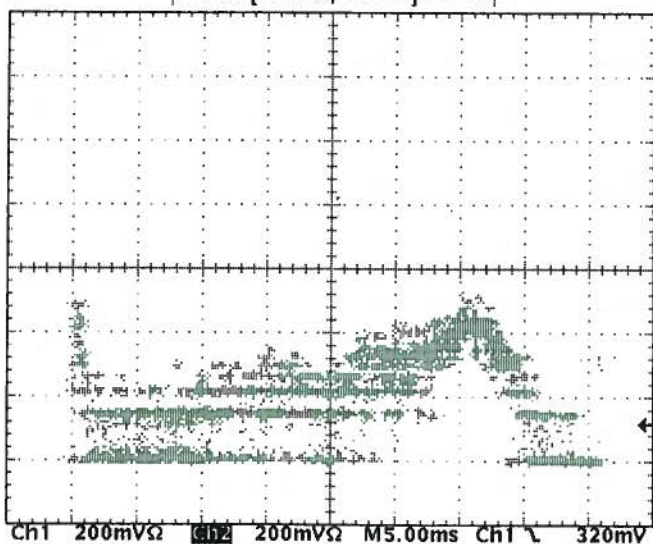
*Played with turning off the
heat & propping open the
door. An 8°F shift in
room temp. did not
affect the peak position
much.*

Tek Run: 10.0kS/s Sample

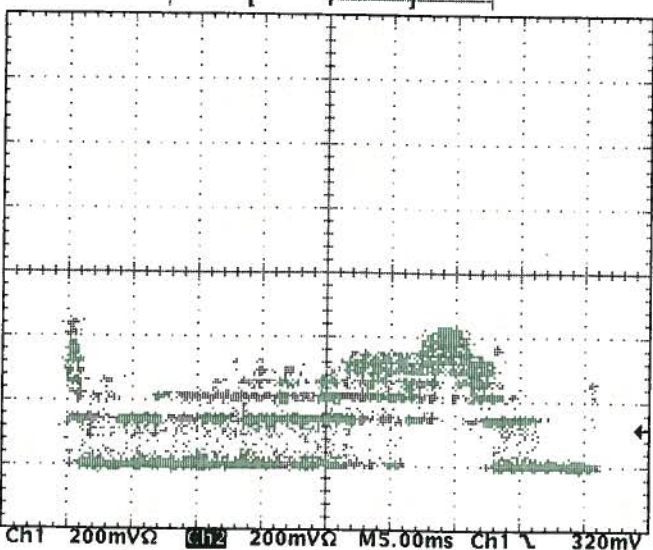
17 Dec 1999
15:48:35

shoulder still there

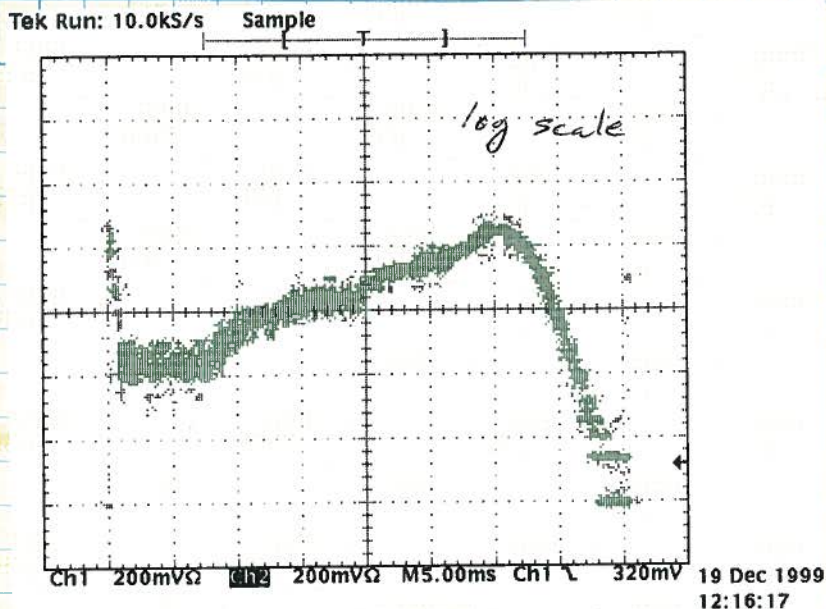
Tek Run: 10.0kS/s Sample

17 Dec 1999
15:50:04

Tek Run: 10.0kS/s Sample

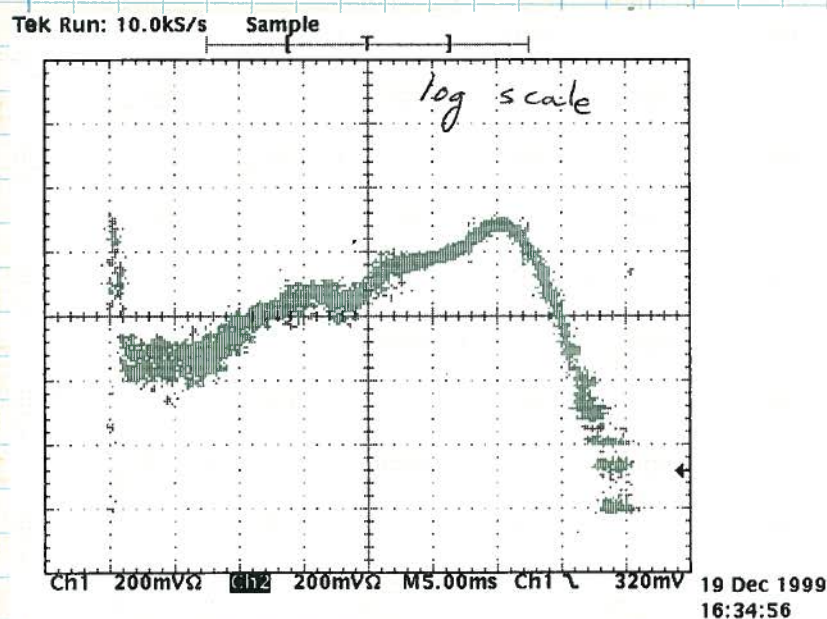
17 Dec 1999
15:51:13

*peaks may shift a little,
but the shoulder
seems to be a real
feature of the
spectrum.*

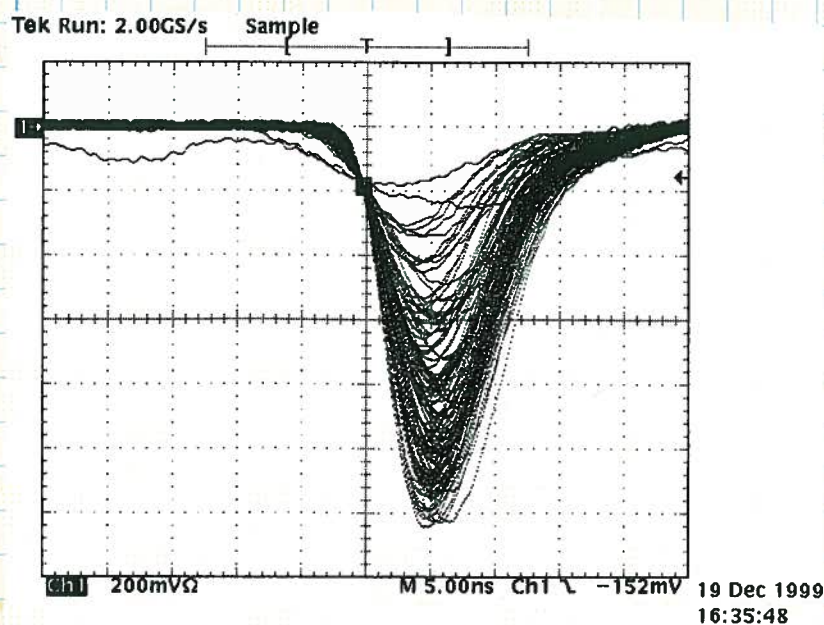


Shoulder still there
this morning.

Shortly after this run
I switched ethane
bottles.

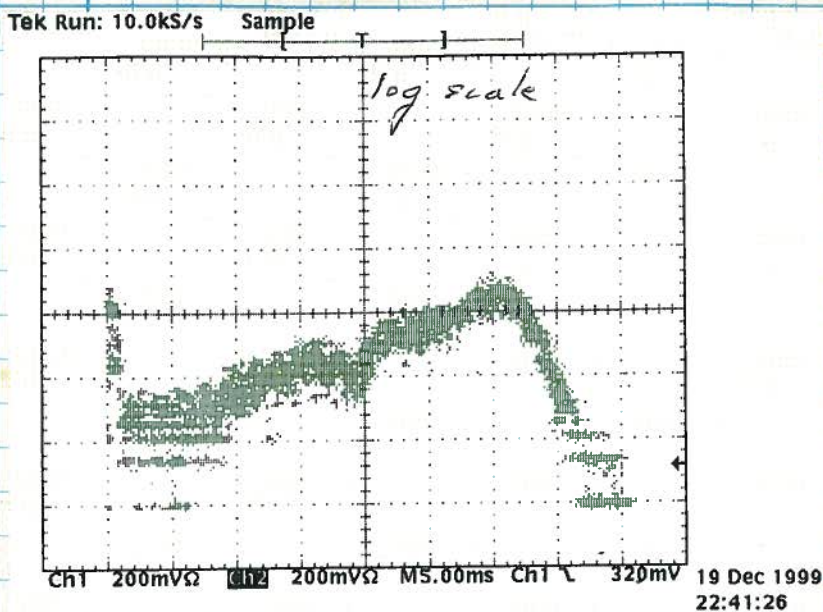


shoulder still there.



Pulse shape is not
unusual

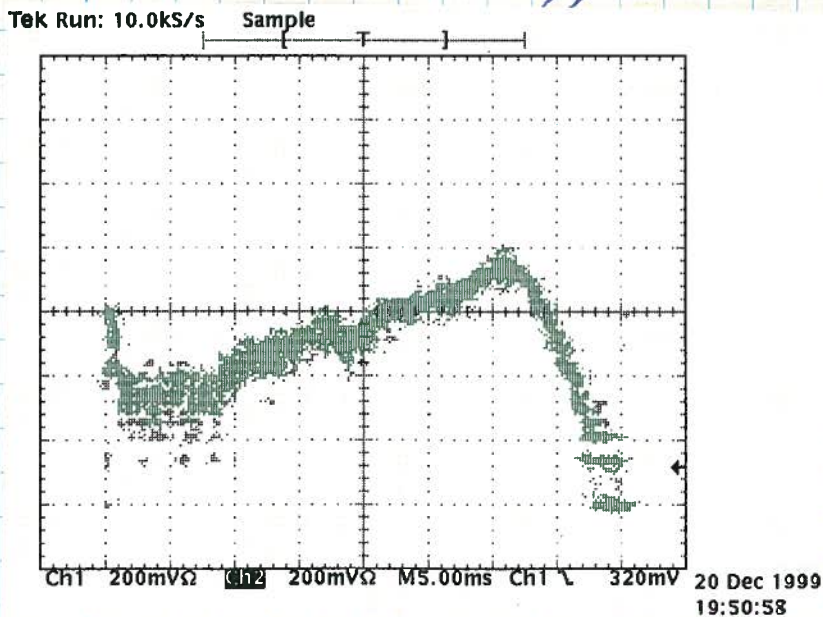
switched back to the
previous ethane cylinder.
(oops. didn't do that yet)



switched back to the original cylinder after this run.

12/20/99

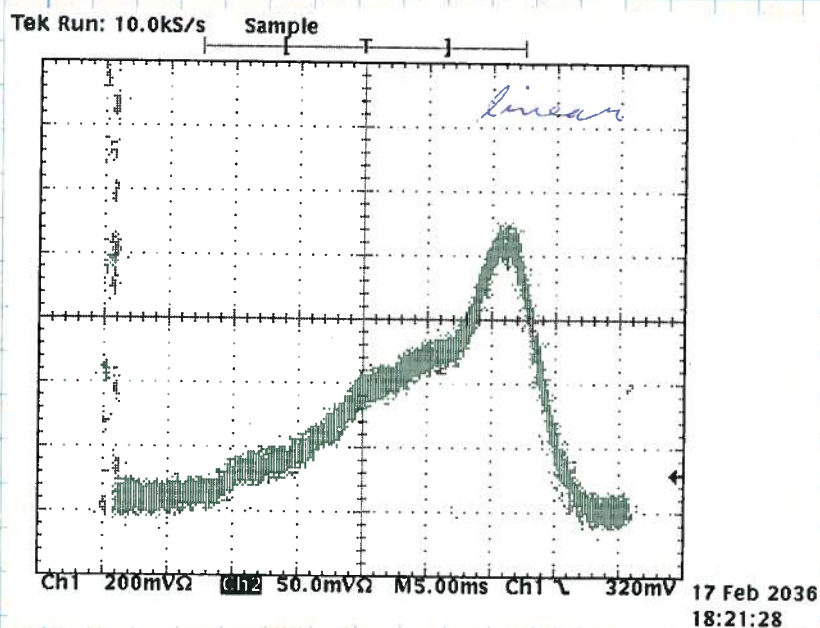
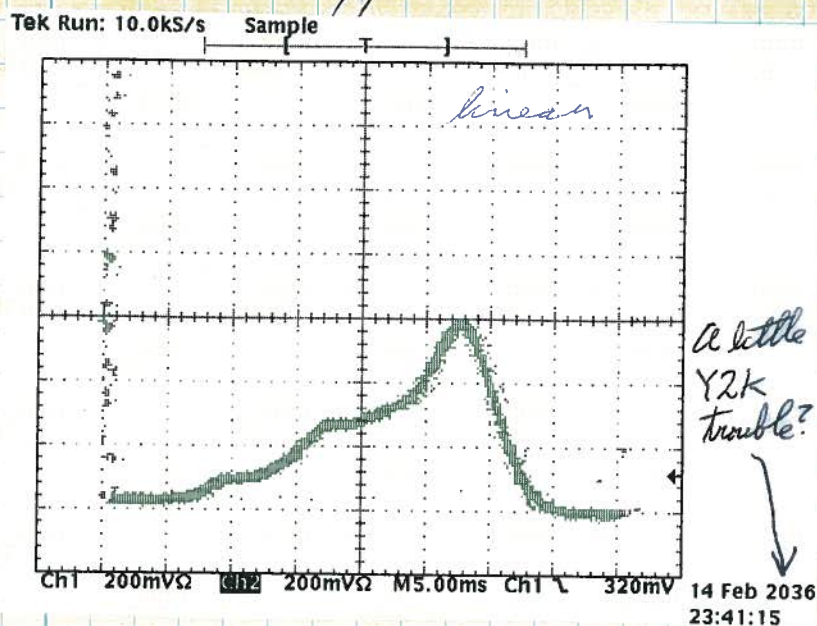
When I came in today the spectrum still had a shoulder. I eventually unplugged the power. The circuit had a good number of hours to cool, if it was too hot. I turned it on this evening and did this run.



Still a shoulder

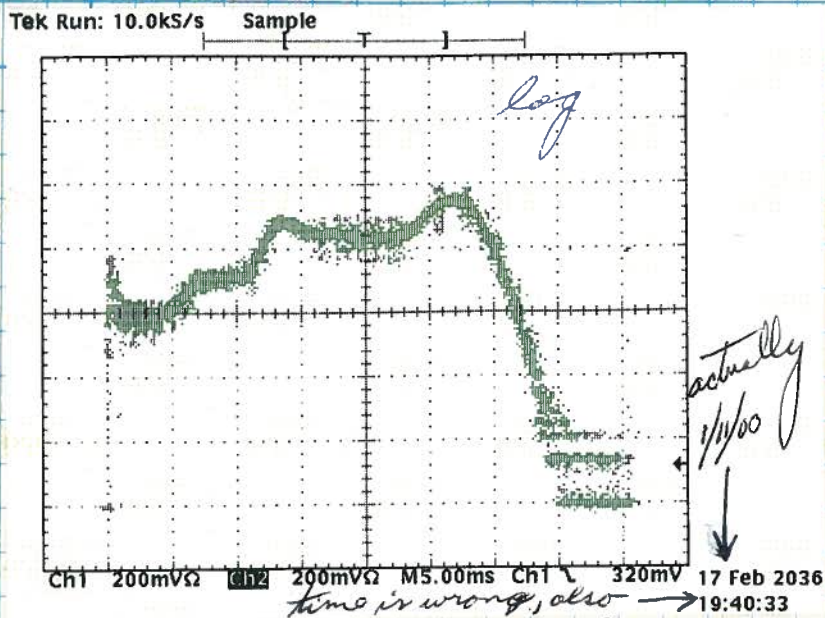
Continuing to look at the straw tube.

1/11/09



another run

seems pretty consistent. Switched gas from the mixing system to the small bottle of pre-mix. Let it flush for a while.

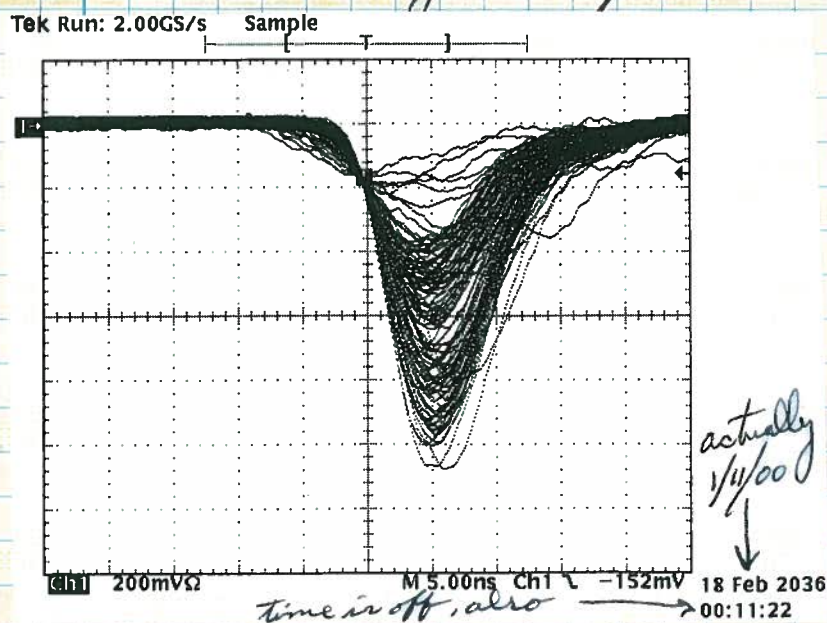


← Premix gas

left the QVT running

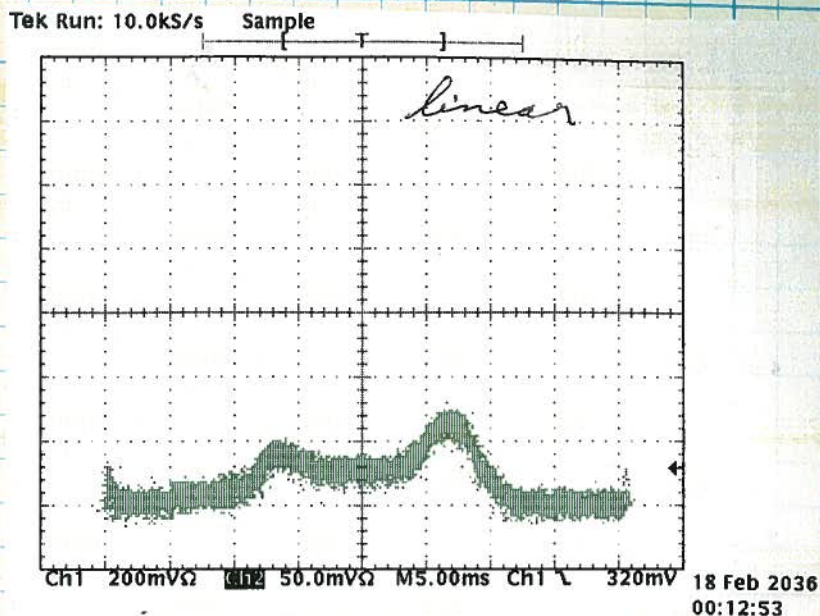
Although there were HV supply problems at the time, the QVT spectrums on pp. 9 and 10 of this volume do not look much like what I'm currently seeing. Also, the QVT spectrums from p. 26 of this volume look "better" than what I see now.

~~When I pump in today the QVT spectrum was not~~
When I checked again this evening the QVT was still looking strange.



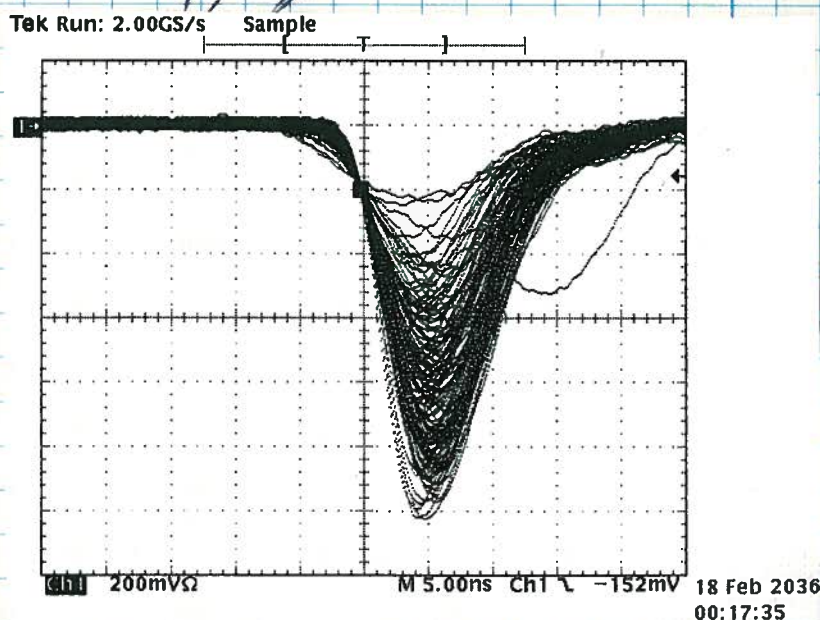
Looking at the analog signal from the analog Premix gas.

This is what the
QVT was looking
like.
Premix gas.



I disconnected the premix cylinder and
reconnected the gas mixing system to the straw tube.

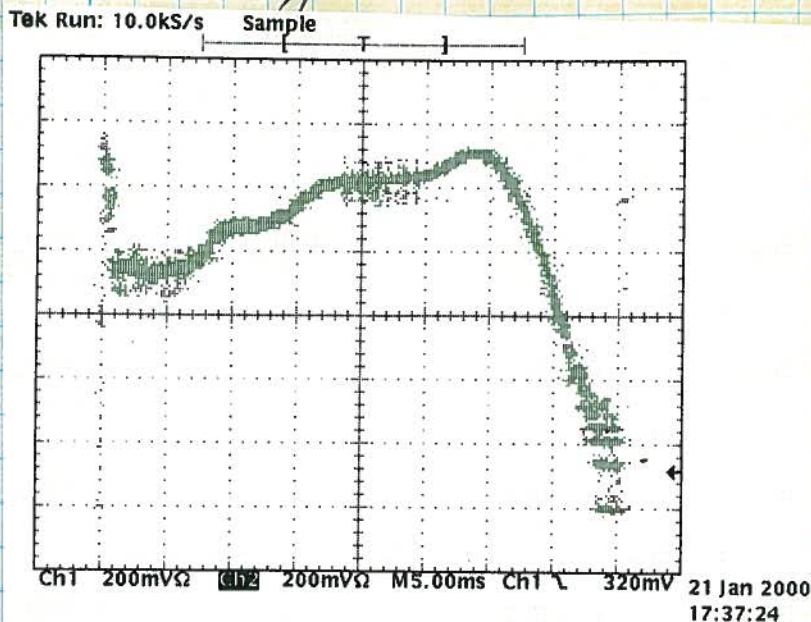
Analog signal from
the tube.
Gas from mixing
system.



This doesn't look too much different from the
signal on p. 27 of this book. Except, the signal's
pulse height is not so well defined on this page.
Even compared to the pulse on p. 29 of this volume.

2/18/00

The brass tube in the gas shed was still having trouble.



I finally got another brass tube assembled. The construction is the same as the previous one.

I used LUMA 20 μ m gold plated tungsten wire old gotten from Steve Christy. I didn't write down what I'd used on the previous tube, but this is the only wire I have so it must have been the same wire.

I took the new tube to the gas shed and hooked it up in series with the old tube. Same gas flowing through both tubes. I connected a "C" size cylinder of pre-mix argon/ethane.

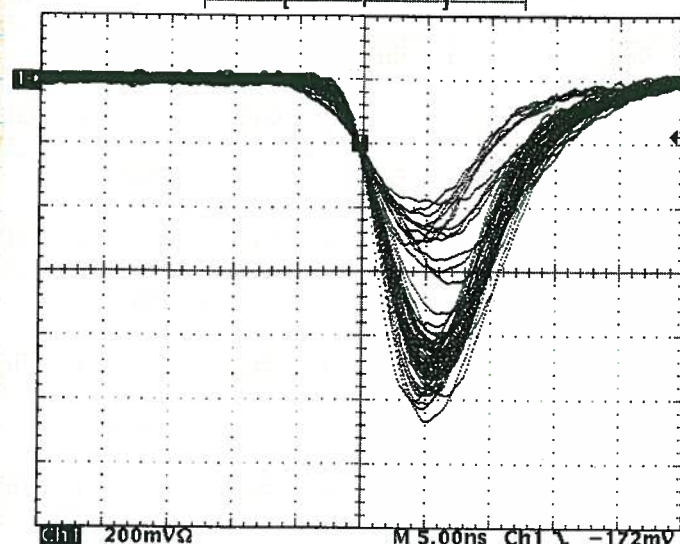
Gas flow @ ~15 SCFH air.

I switched the HV amp connection from tube to tube (same amp & HV for both tubes).

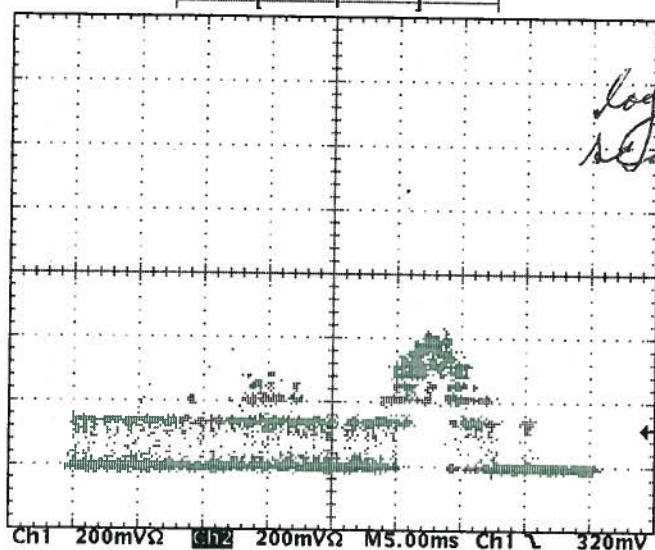
I first hooked up the new ~~tube~~ tube.

Using TDS 754A and Delroy QVT. Some settings for both tubes. Verified that scope time setting is correct.

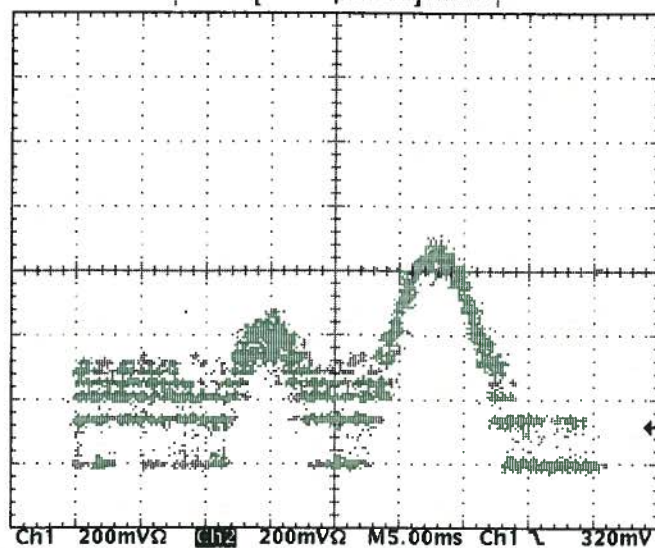
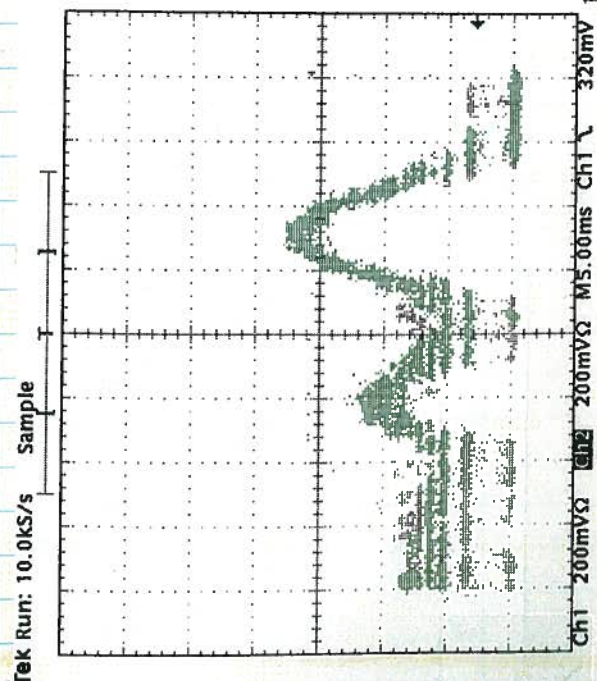
Tek Run: 2.00GS/s Sample

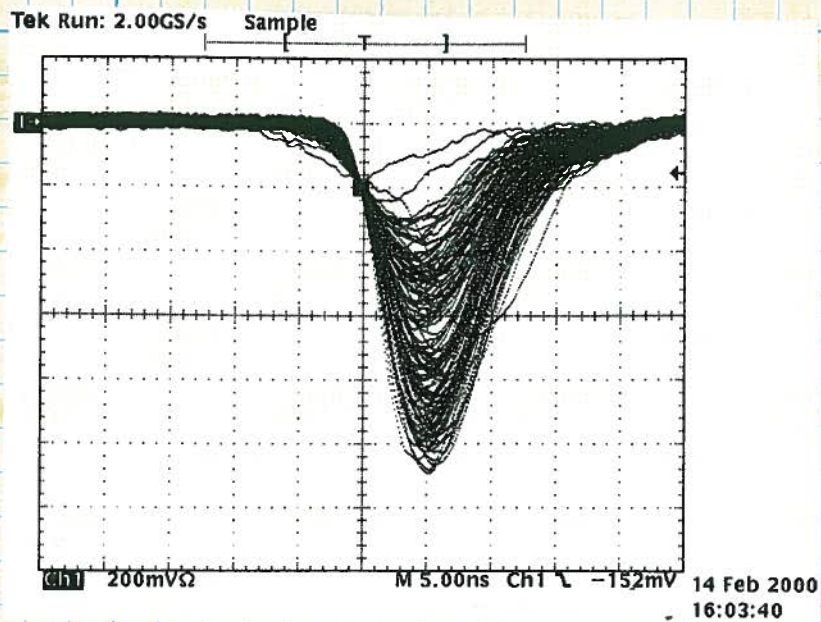
14 Feb 2000
15:05:25*Fe 55 on new tube*

Tek Run: 10.0KS/s Sample

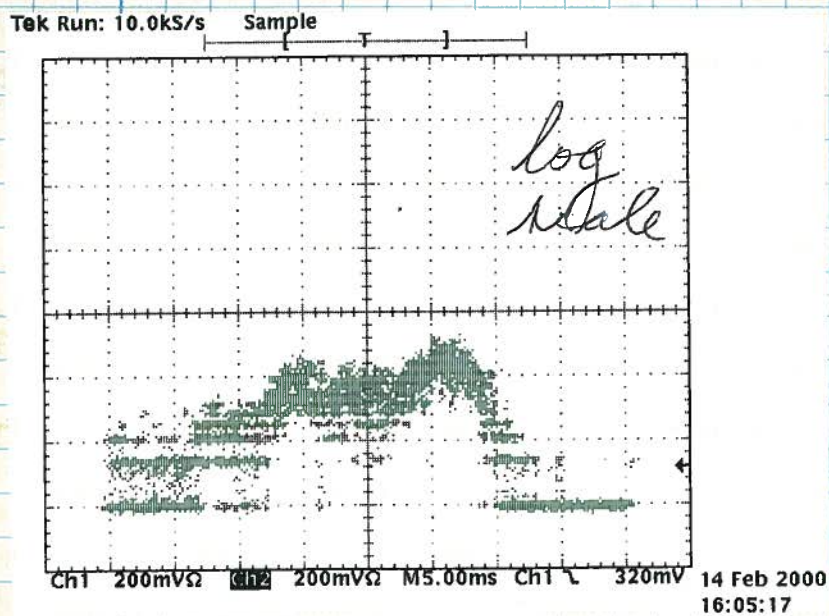
14 Feb 2000
15:06:34*QVT spectrum of new tube*

Tek Run: 10.0KS/s Sample

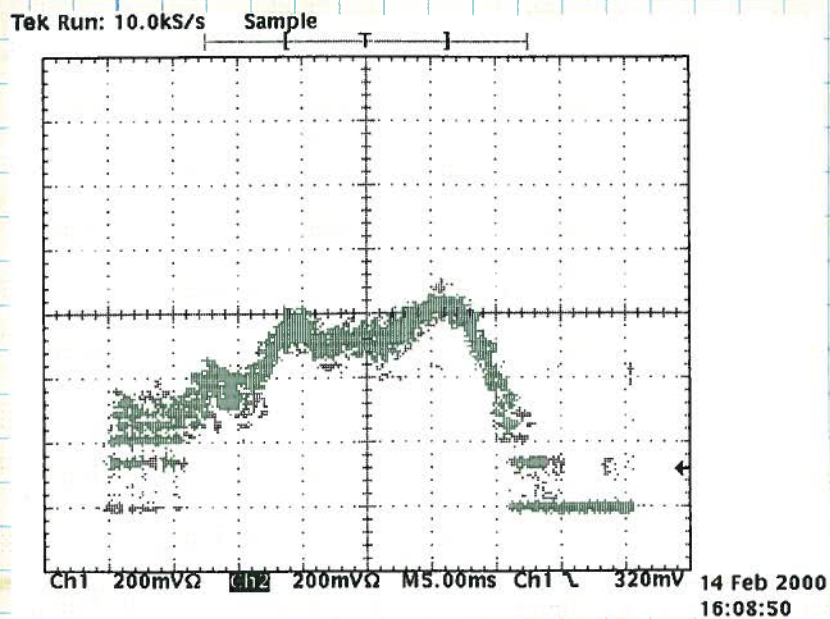
14 Feb 2000
15:14:2814 Feb 2000
15:16:10



Fe^{55} on old tube



QVT spectrum of Fe^{55} on old tube.



The new tube is almost one $\frac{1}{2}$ " swagelok nut shorter than the old tube.

New tube has 51.4Ω across the wire.
Old tube has 53.6Ω across the wire.

I took the old tube out of the Techmar box and replaced it with the new tube. Re-installed the Techmar box and reconnected everything, including the pressure gauge for atmospheric pressure. I left the gas flow turned off (from the mixer system).

2/17/00 I took the old tube to the EEL. I used a $4.7k \Omega$ and Wavetek 19 generator to check the wire tension. Used only strong magnet from Edmund. With amplitude of generator heavy max, I was able to see the resonance point for the wire. For the old brass tube I got 1433 Hz . For the original, longer aluminum tube lying around I got 1450 Hz .

So, it seems the wire is not limp inside the brass tube.

I loosened the nuts on the brass tube and pulled the tube apart. The wire broke at the crimp pin which had been connected to the HV amp.

Steve Christ and I looked at the wire using the CCD camera/microscope. We noted something on the wire about 15.5 cm from the intact crimp. This is also where the wire coiled up on itself when I broke it. There is a kink next to this section of wire. This may only have been from breaking the wire. Looking at the brass tube 15.5 cm is where I soldered copper tape to the outside of the tube, for grounding. The pinhole for the Fe^{55} is at 12.5 cm from the end of the intact crimp. Inspecting the wire around the 12.5 cm section we did not see anything noteworthy.

Looking inside the brass tube I had noticed what

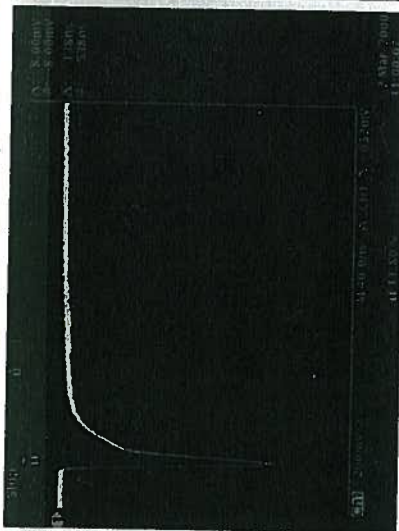
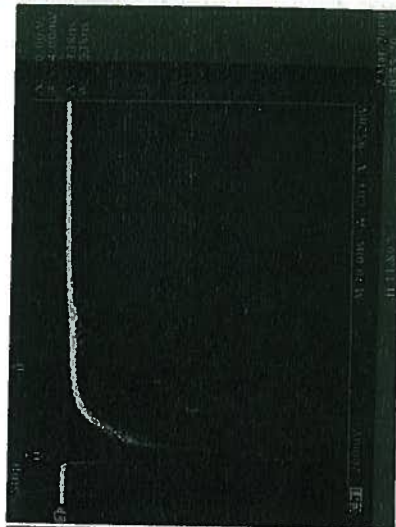
seemed to be a light patch of dust on the inside tube surface under the area where I soldered the copper tape on the outside. Some "dust" was under the solder spot and a little on the far side of the inside of the tube. There wasn't much, so I'm not positive it's not dust that entered after opening. I inspected the tube ~30 sec after opening and noticed it. But, if the tube had a slight charge it could have drawn something in from air. However, the field inside the tube should be ~ 10^5 V/cm.

FPP Straw Tube Gain With Ar/CO₂ 3/19/00

Prior to going on vacation I had looked up the set of prototype tubes to gas & HV (on one of the tubes). I pushed gas through the tube for a sufficient time. I used an Fe⁵⁵ source on the tube to provide a "point" ionization. I used the previous setup of a Bertan HV supply and the 3227501 amplifier (Little D.H.).

Ar/CO₂
HV = 1751 V
↓

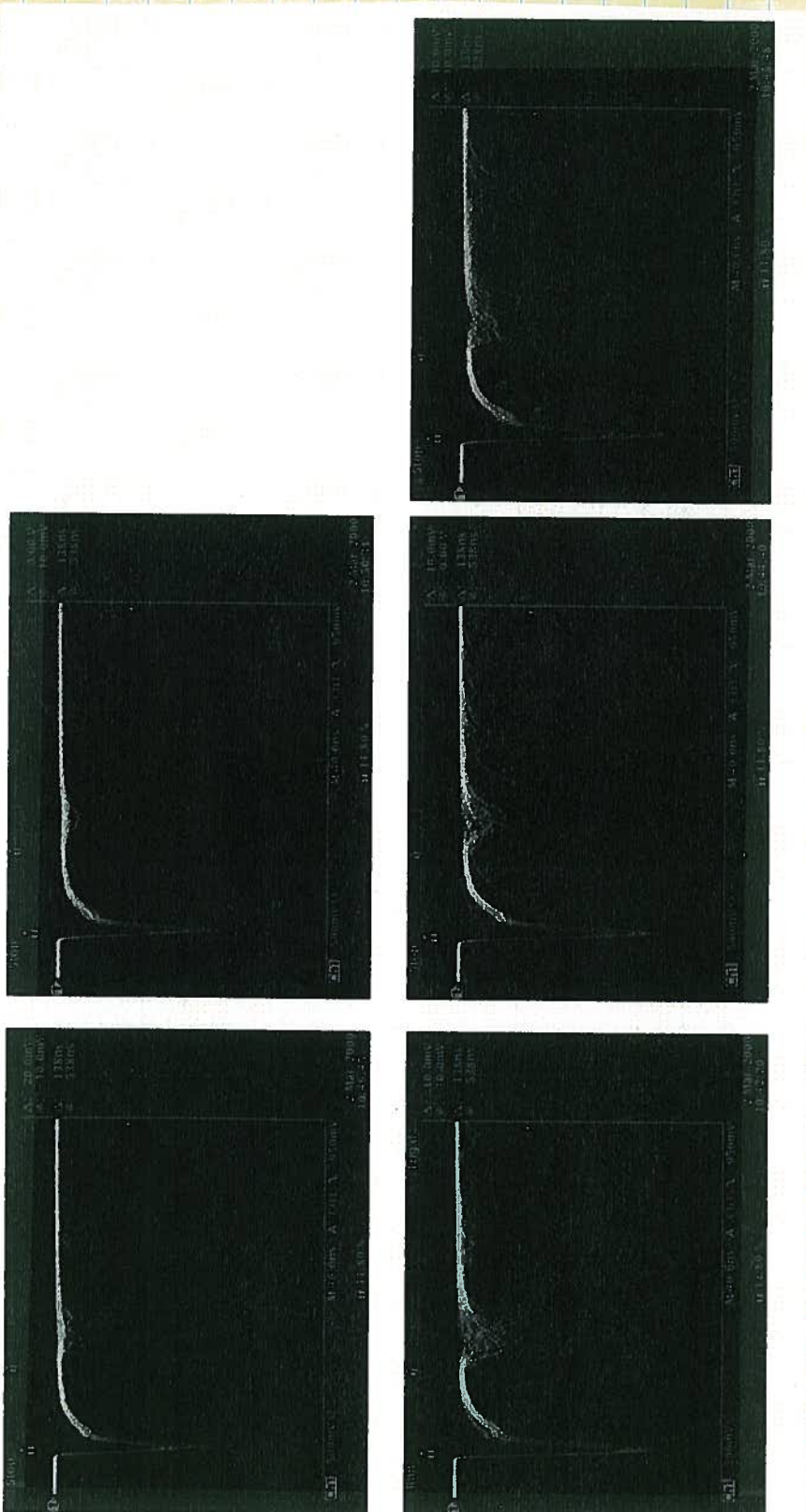
80/20 (Bottle label analysis says 20.1% CO₂)
HV = 1801 V
↓



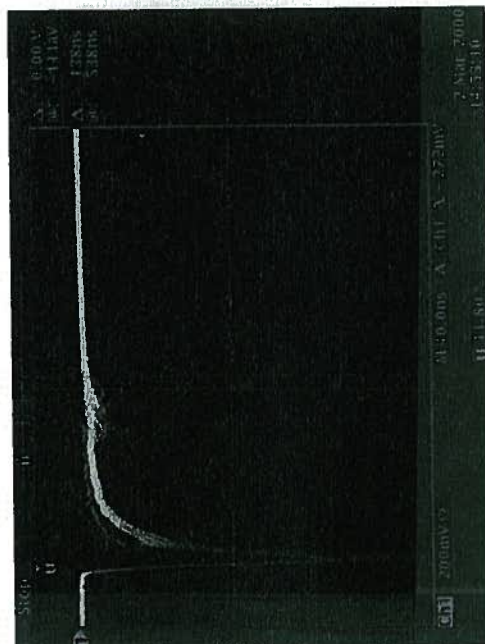
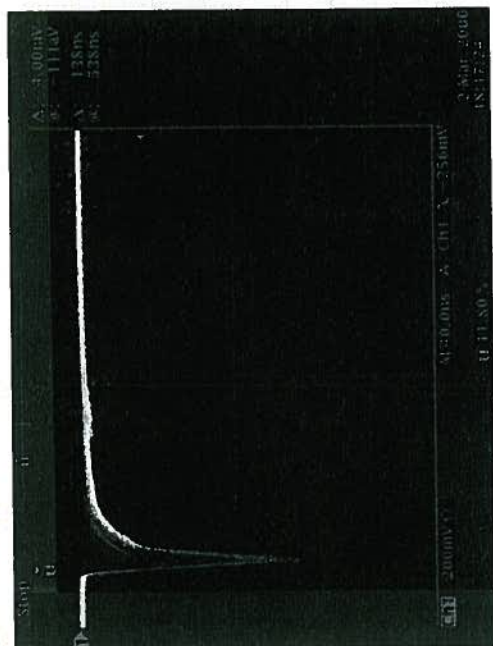
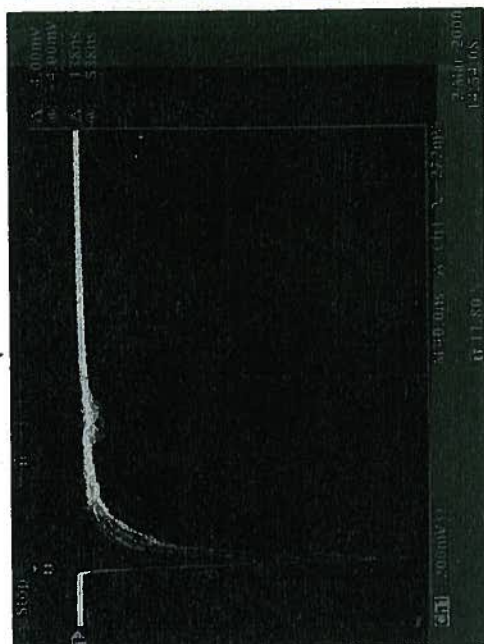
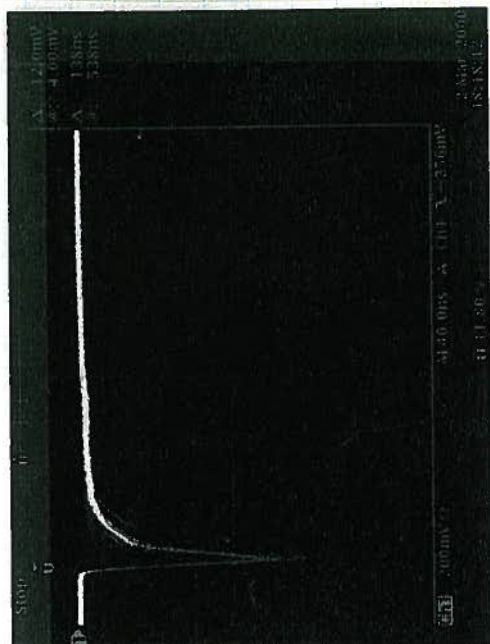
Ar/CO₂
HV=1852V
↓

80/20

1903V
↓



Ar/CO₂ 85/15 (Bottle label says 15-19% CO₂)
 HV = 160kV ↓
 1653V ↓

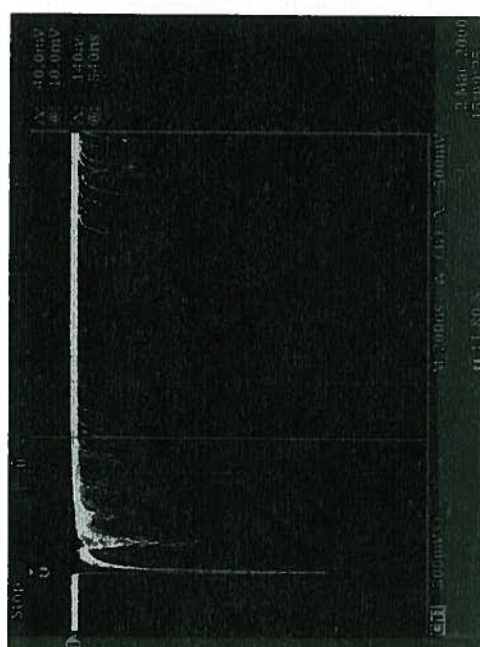
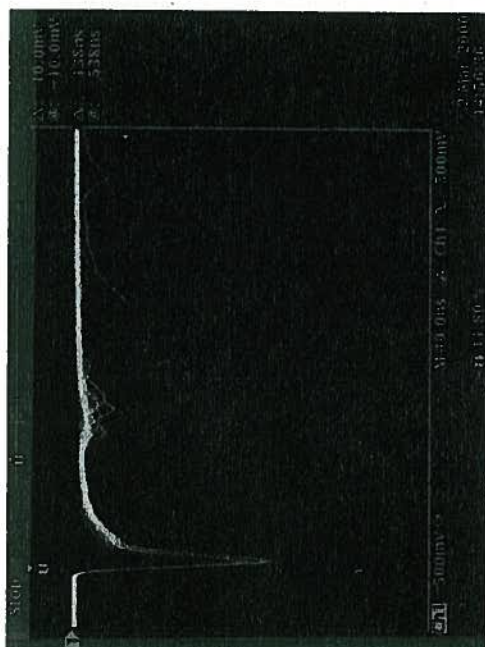
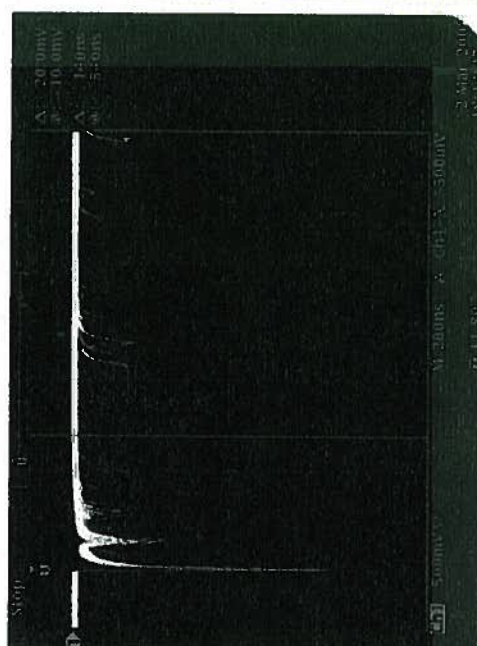
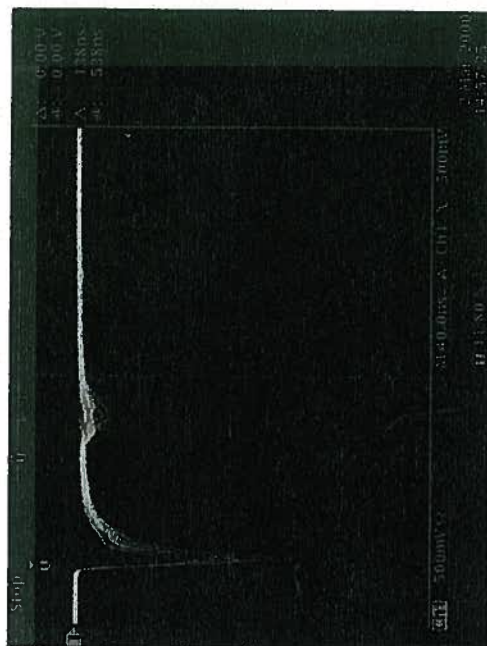


Ar/CO₂ 85/15

HV = 1703 V



1749 V

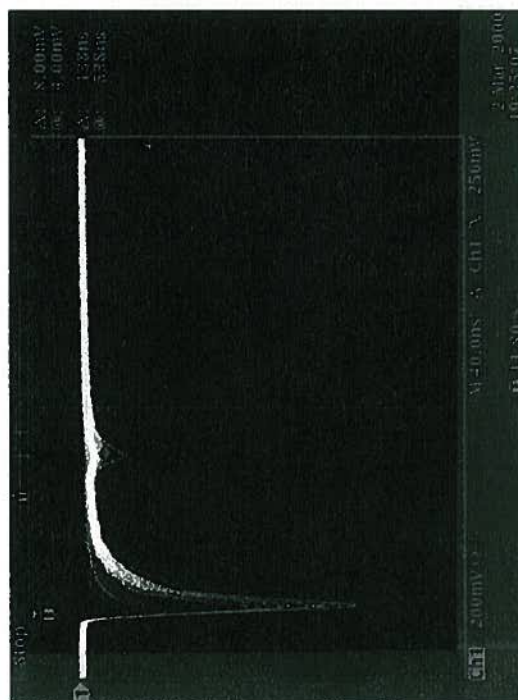
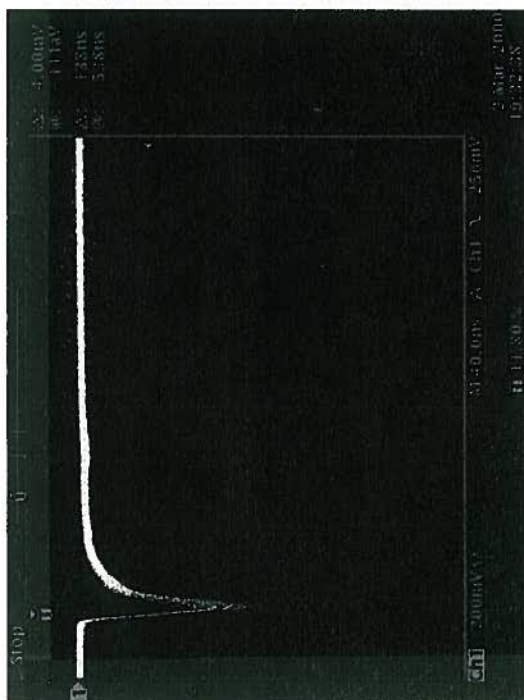
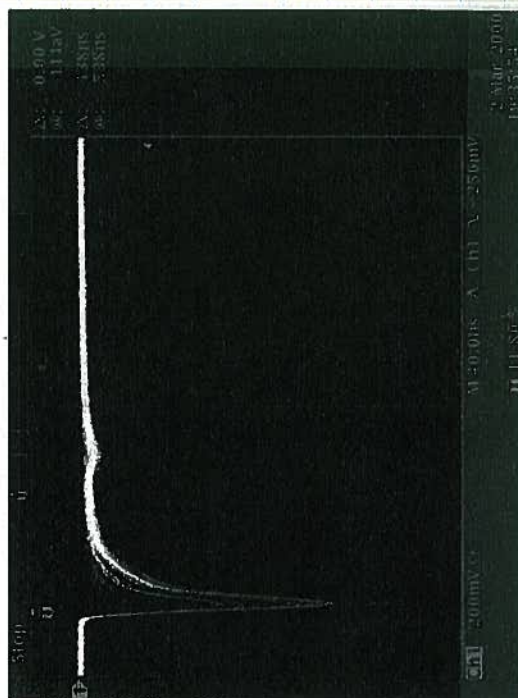
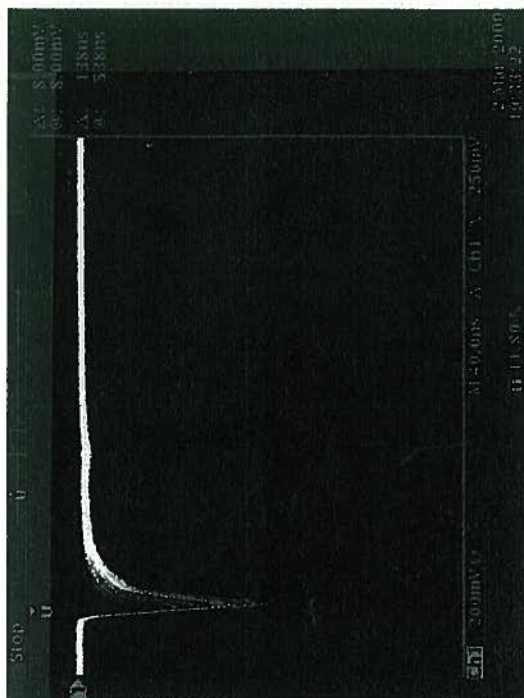


Ar/CO₂ 90/10 (Bottle label says 10.2% CO₂)

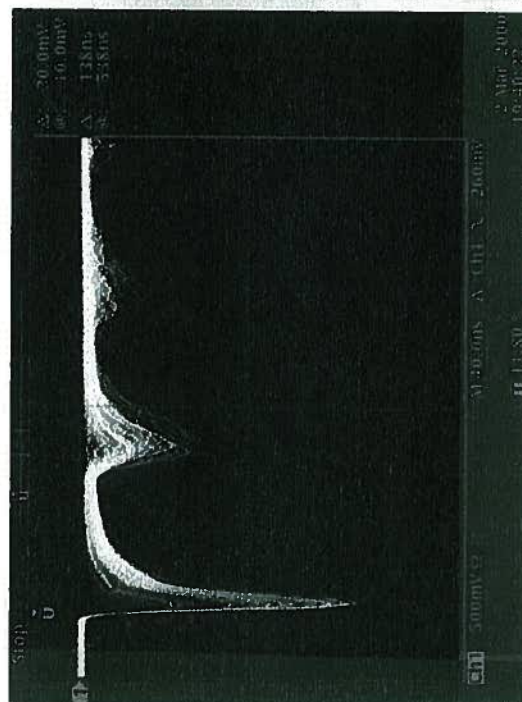
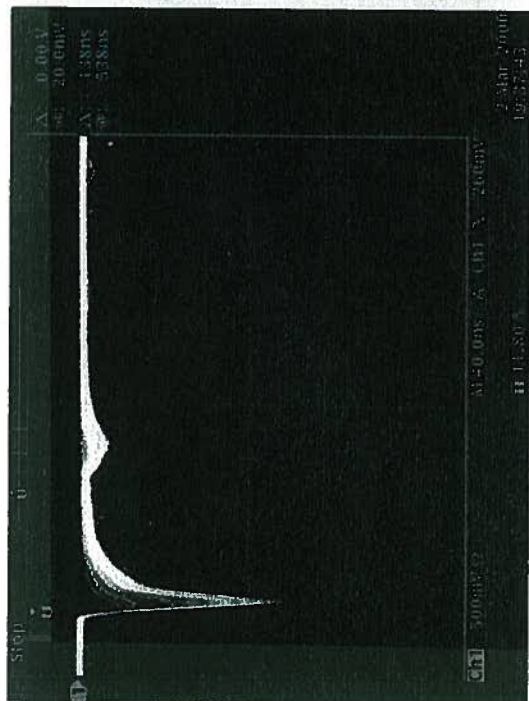
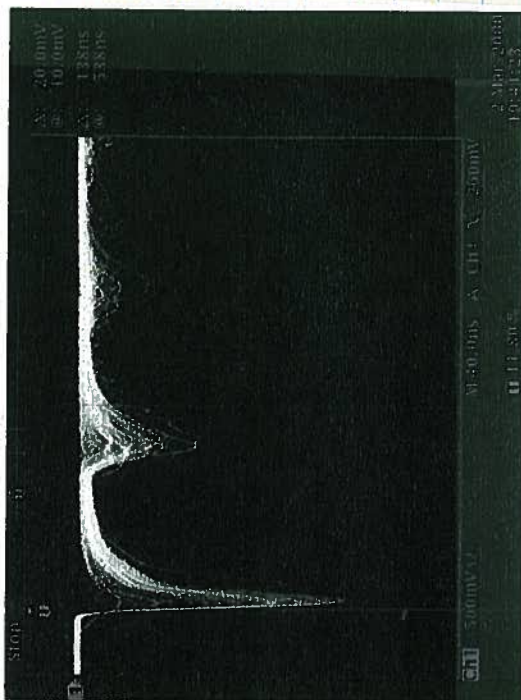
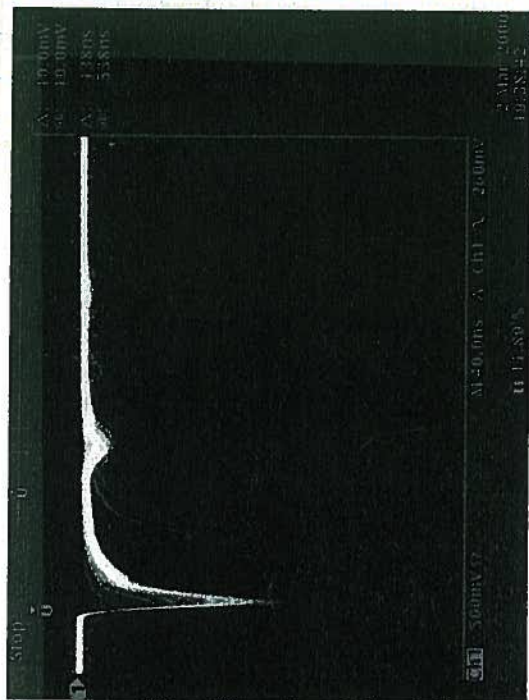
HV = 1504 V



1552 V



Ar/CO₂ 90/10
HV = 1602 V
↓



6/27

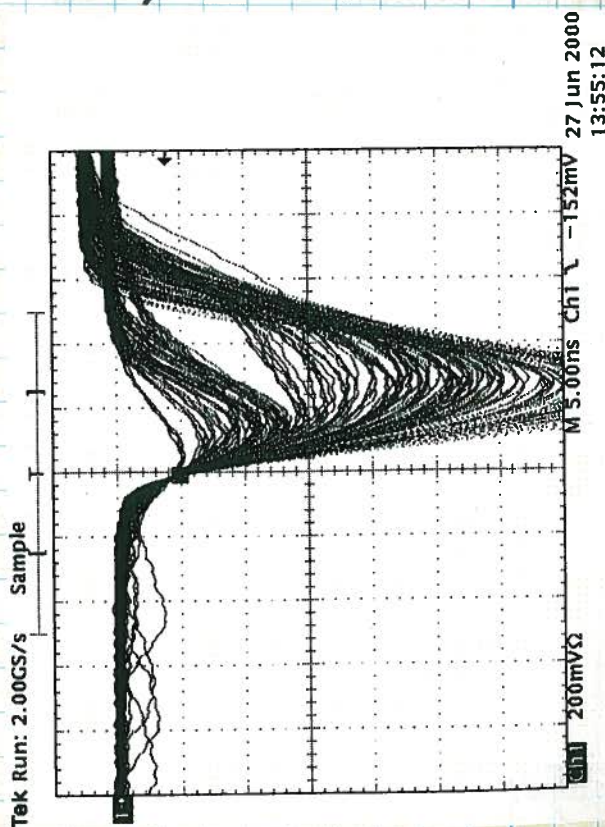
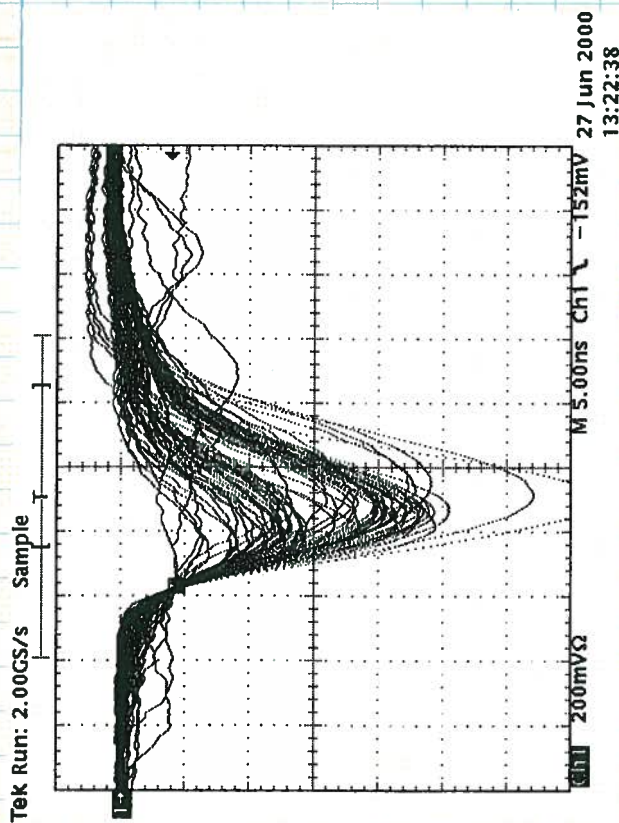
The wire chamber efficiencies have been low today. The gas flow seems to be ok. Hooked up the straw tube for gain monitoring. Spectrum looked bad.

HV monitor points read 3.18V across them.

We played with the mixing system for a while. I replaced the flow controller. We had a fair amount of trouble getting a mix we were happy with. During the course of this I took some pictures of the gain monitoring tube output.

We left the tube running so people on shift could come in and check the mix ratio.

Below are some scope pictures of tube output at various times.



pictures continued on p. 58 (this book)

Display on 4 second persistence.

7/1/00
JS

Excess flow
valve was too
much of a
construction
for the system.
I eventually
removed it.
see gas sheet
log books.
JS 9/4/00

When I came in today the gas system was tripped off. I hit flow-pressure override" and the system came back up. But not the way it left it yesterday. Argon flow was so high the pressure dropped in the line enough to trip off the gas system. The regulator showed a steady 440 PSF. The gauge below the mercury switch showed ~30 PSF.

I played with the flow rates to get something reasonable out of the monitor tube and note the flow rates in the gas logbooks p. 38 which shows

	Argon	Ethane	
present flow setting	820	500	
flow readback when starting flowing	853	522	
flow reading just before flow is tripped off	840	518	
manual meter reading when start to flowing	497	45	} middle of black bead
manual meter reading just before shut off	517	47.5	
			→ middle of stainless steel bead

program "C" → ratio 50.0 50.0
ramp time 0 0

program "A" → flow 500 820
ratio 66.6 99.9
ramp time 0 0
cal .5 1.45
ratio base — —
range 1000 1000
zero set 00 00
opt. 1 1 1

Right now program "A" is set as above except flows are 380 & 620 and zero sets are -4 & -2.
Program "C" has flows of 190 & 480
readbacks are 192 484

This is MUCH more stable than I was seeing last night.

analog signal from gas tube in Tek000000.eps
& tek000001.eps

QVT is tek000002.eps
The bead are at 35.5 for black bead for ethane
67 for stainless steel bead for argon

Middle of Bead on
Manual Flowmeter

Flow Displays

ethane
(black)argon
(stainless)

Ethane

Argon

set

read

set

read

35.5

67

190

192

480

484

← from p. 52

48

52

231

236

383

383

← analog tek00003.eps

QVTO tek00004.eps

76.5

84

350

363

574

592

← analog tek00005.eps

QVTO tek00006.eps

76

84

350

364

574

593

← analog tek00008.eps

pressure on argon line drops to ~38 PSI
rises to ~44 PSI at ϕ flowGauge on argon regulator outside stays at ~43 PSI
for both flow + ϕ flow.

58

85.5

280

291

574

596

← analog tek00009.eps

45

86

230

239

574

594

← analog tek00010.eps

231

383

switched to premix Ar/Ethane 61.6/38.4 ← analog tek00011.eps
QVTO tek00012.eps

46

51

231

232

383

383

← analog tek00013.eps

62.5

69

300

304

492

492

← analog tek00014.eps

Measurements made with flow through gain tube
at ~.15 SCFH air. HV monitor pointer read
3.18V across them.

@ 17:22 on scope (hr:min) tube power off tube circuit.

Perhaps the HV power supply is sagging as noted previously.

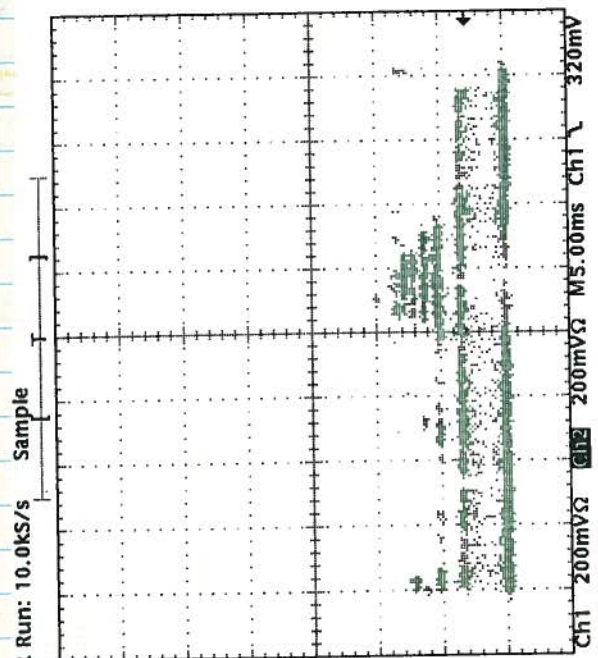
@ 19:03 the pulse height is not much different

→ tek00015.eps

I'm leaving the power on the tube circuit and the
mixed gas flowing through it.

Tek Run: 10.0KS/s

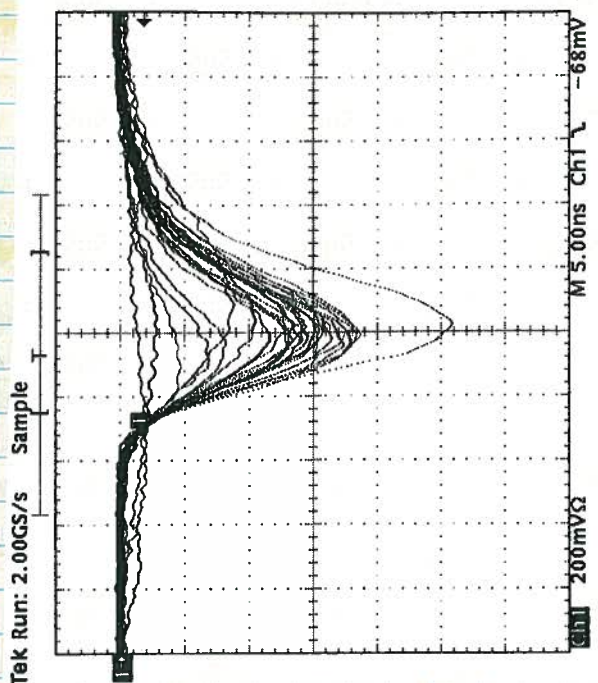
Sample



2

Tek Run: 2.00GS/s

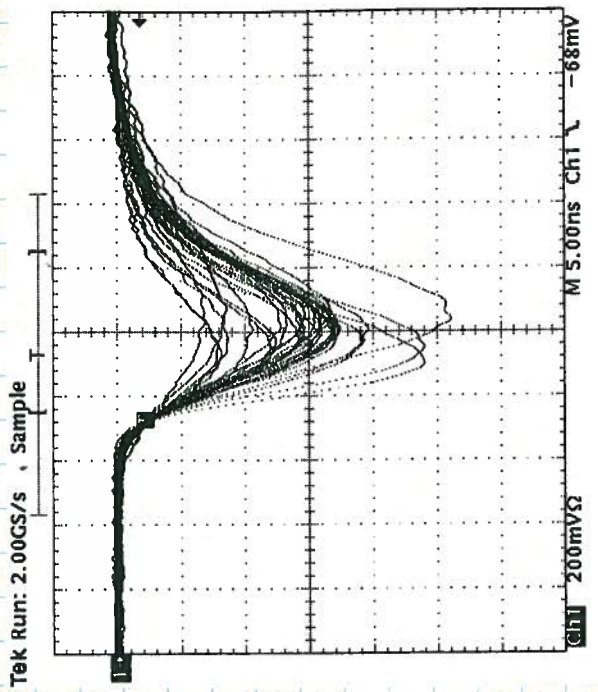
Sample



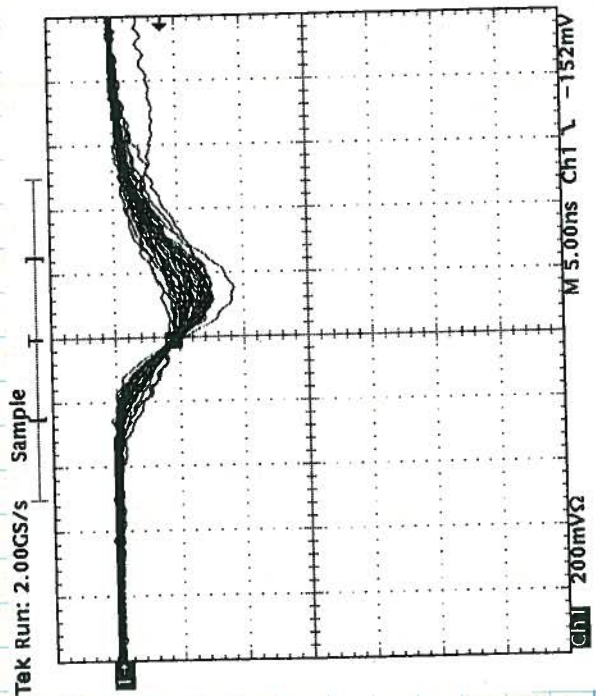
3

Tek Run: 2.00GS/s

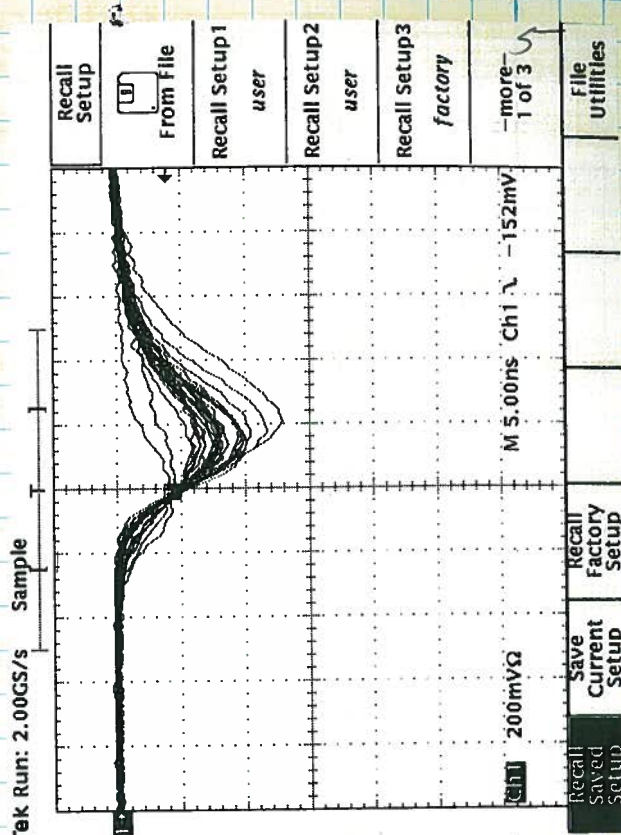
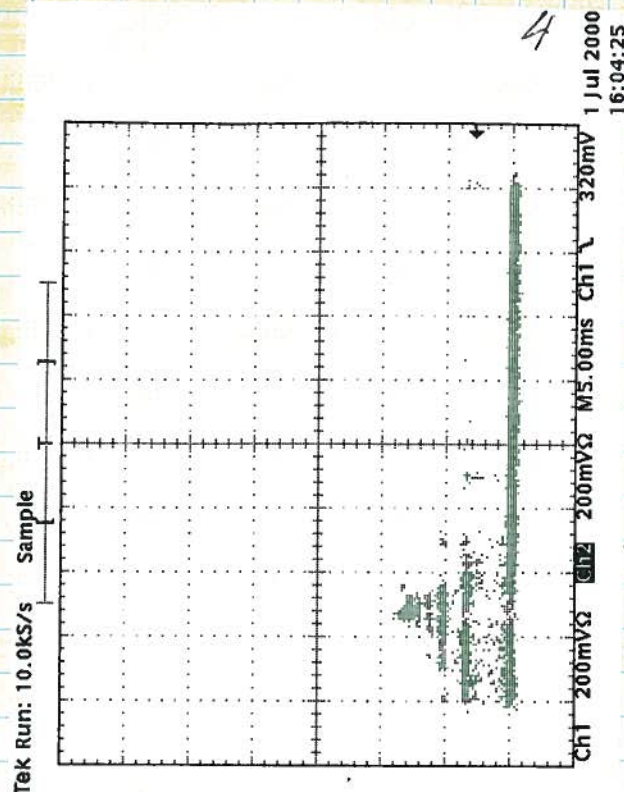
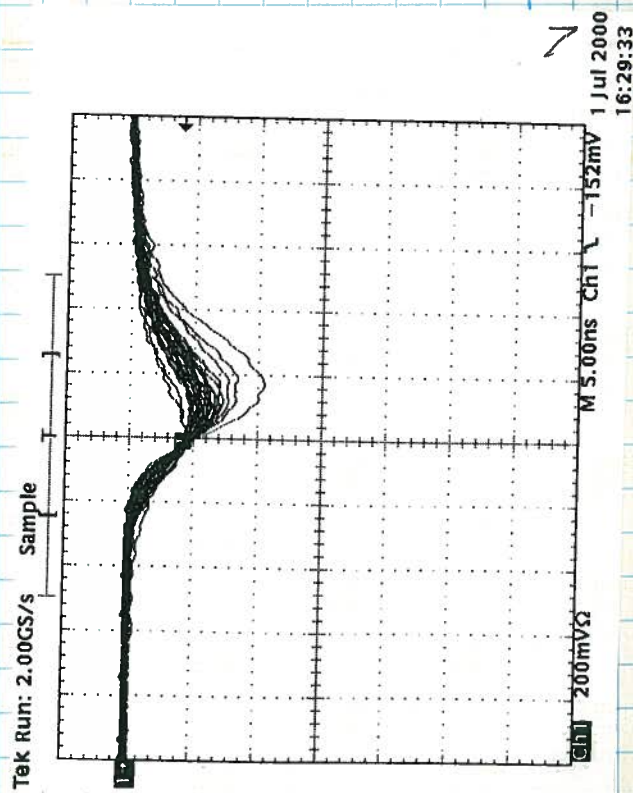
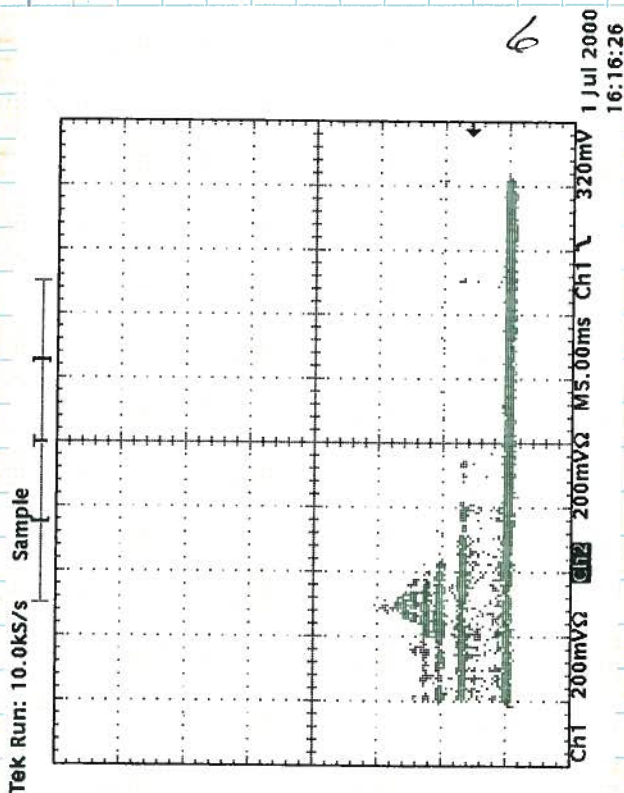
Sample

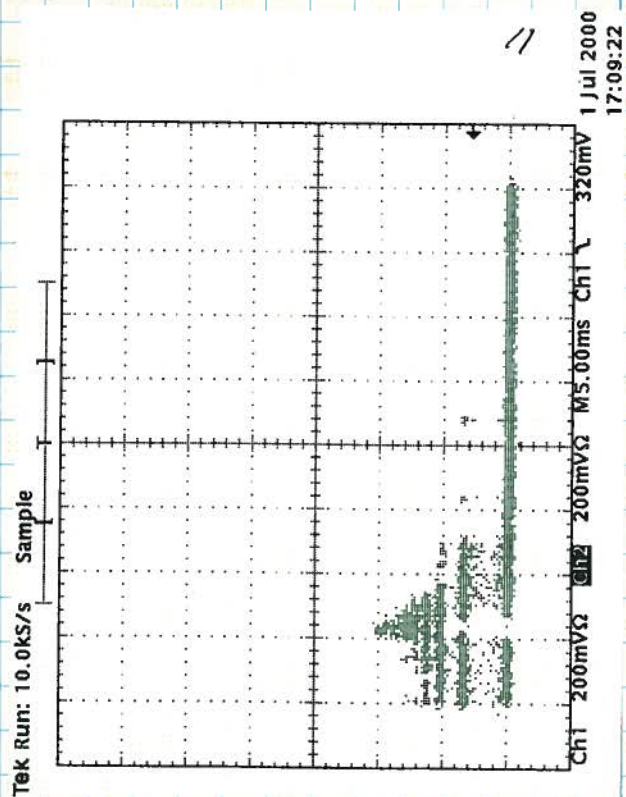
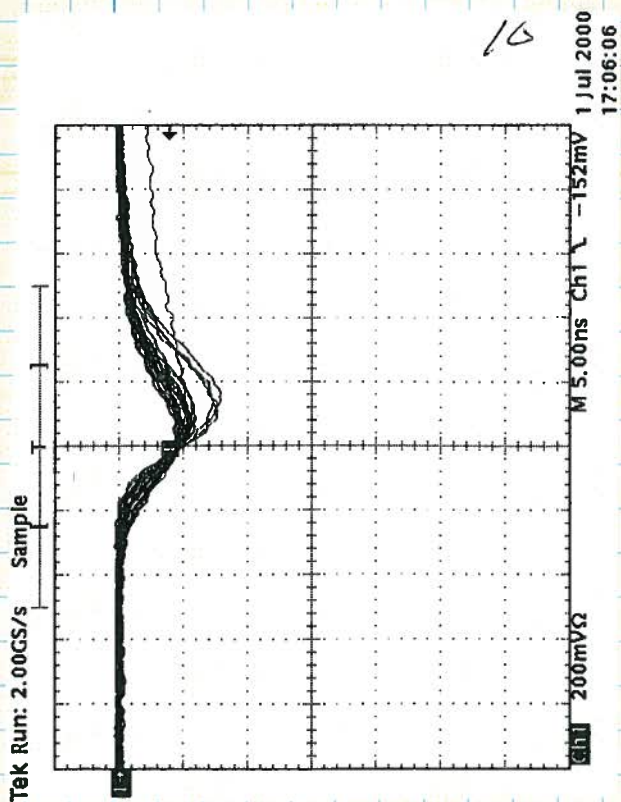
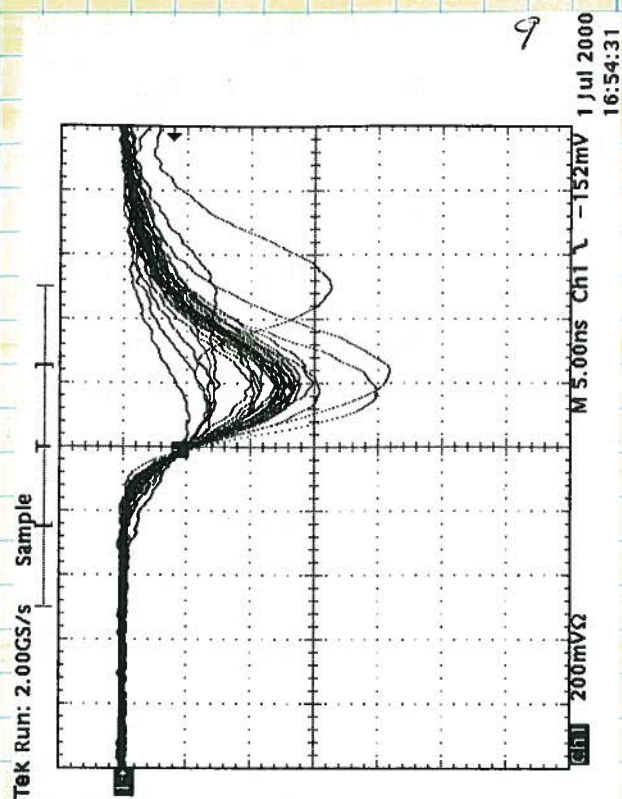
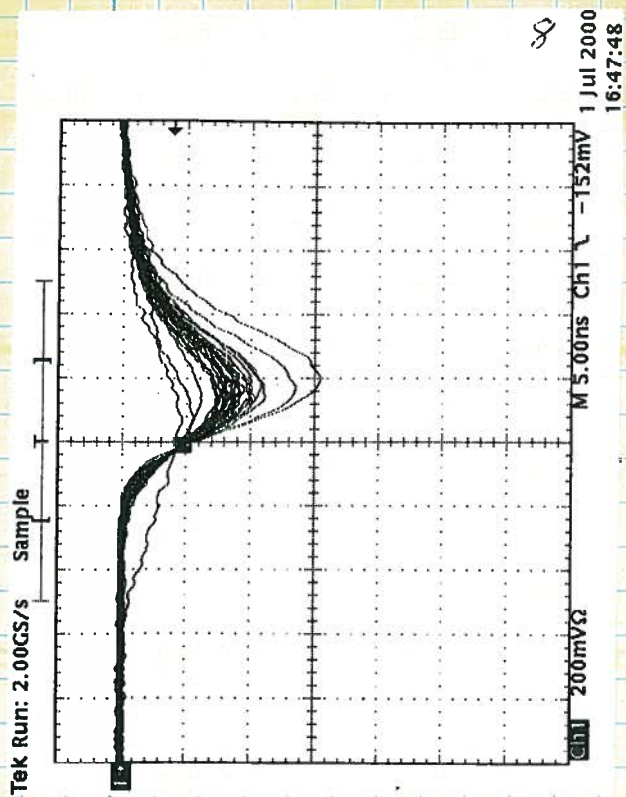


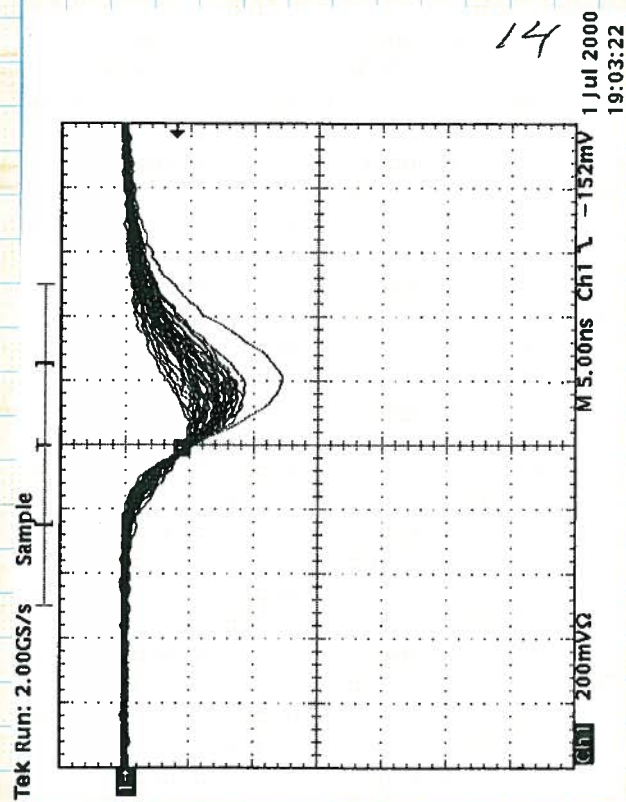
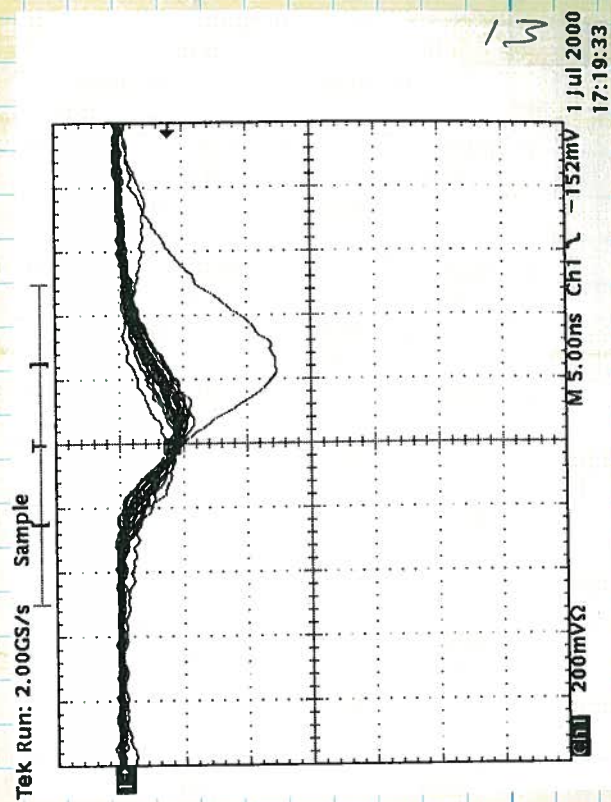
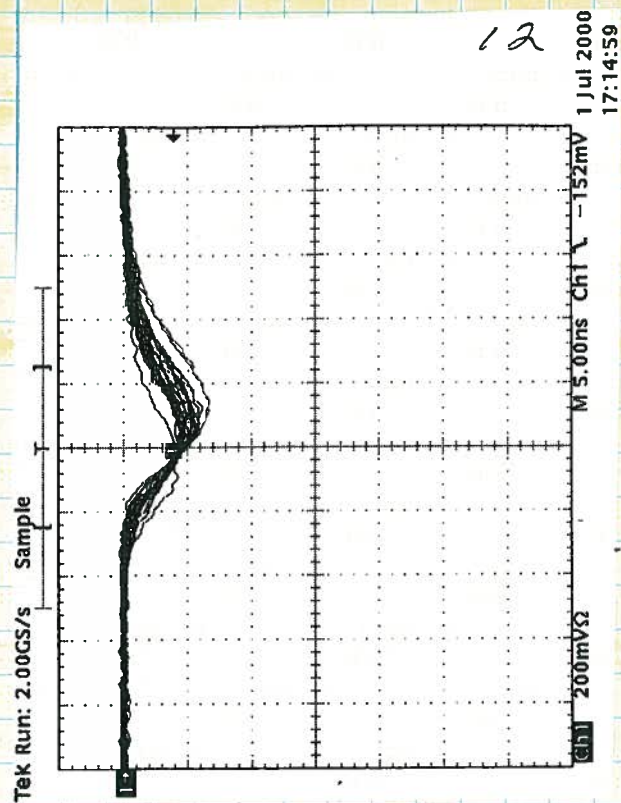
3



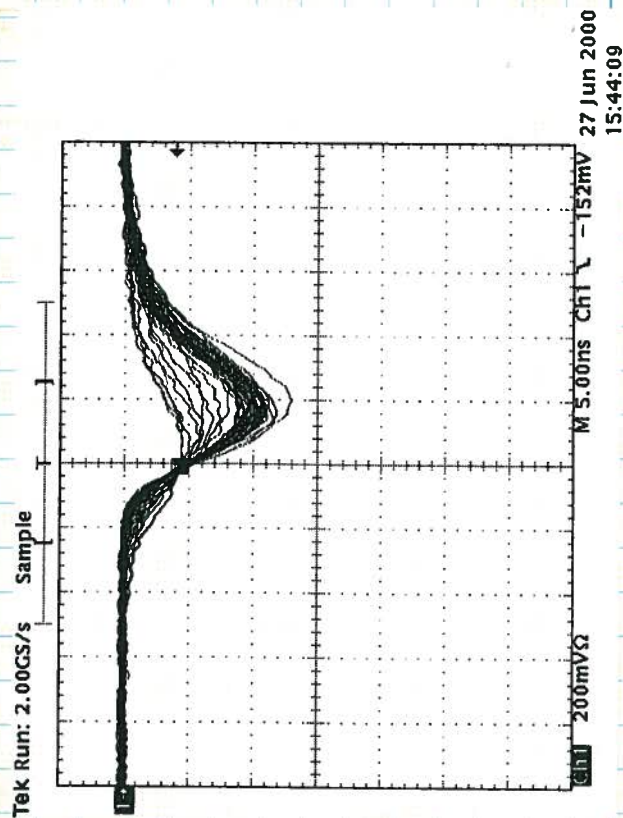
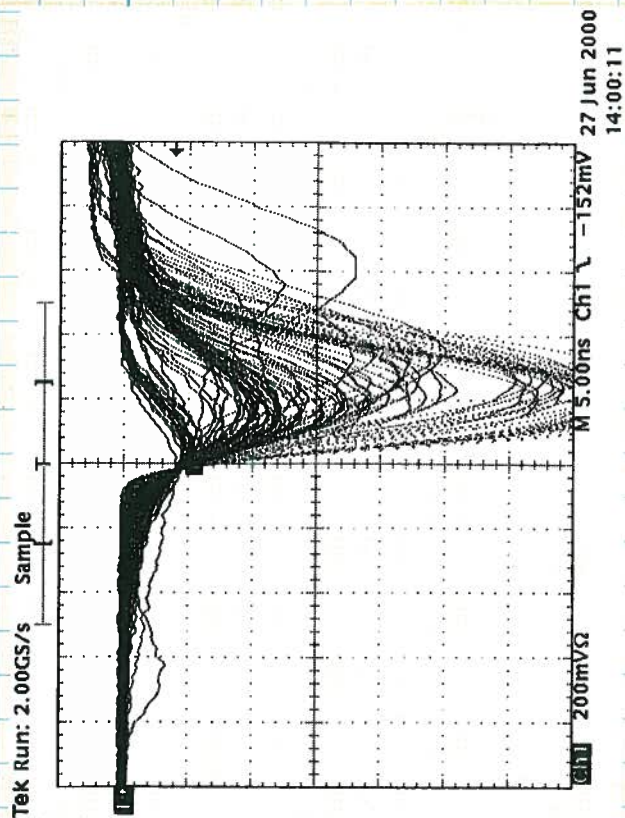
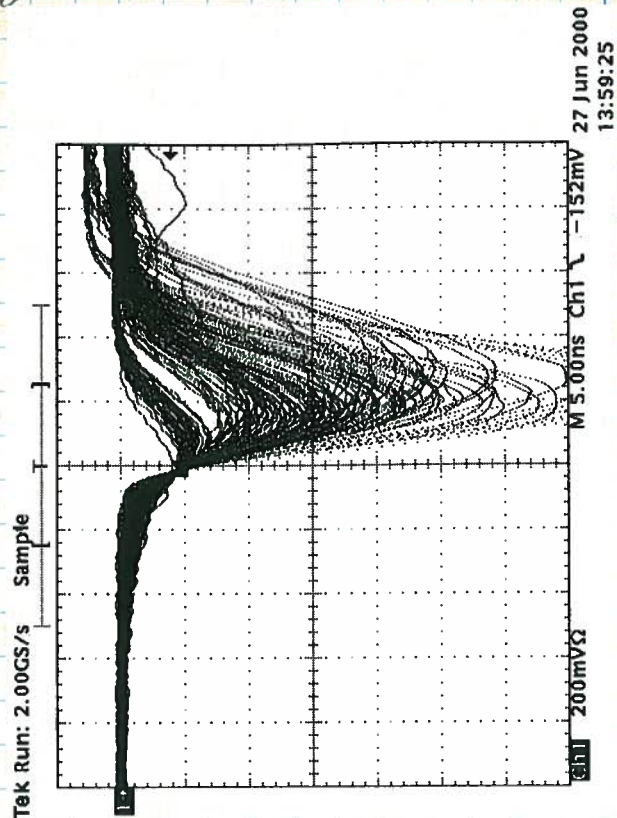
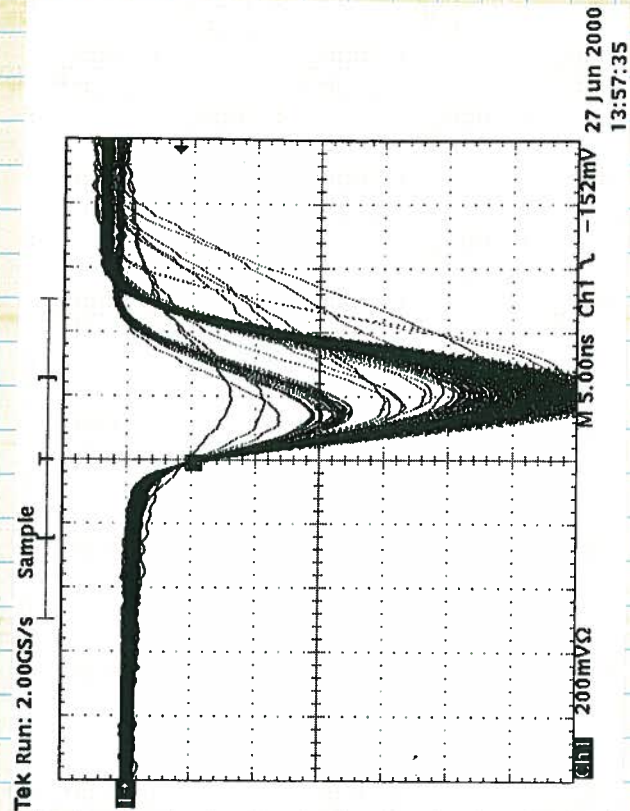
Display on 4 second persistence.







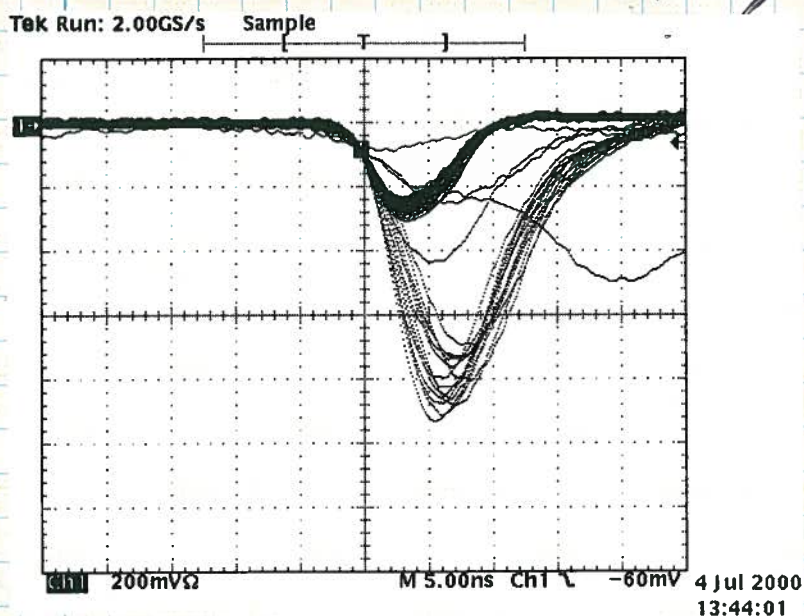
Continued from Page 51 (this notebook)



7/4/00

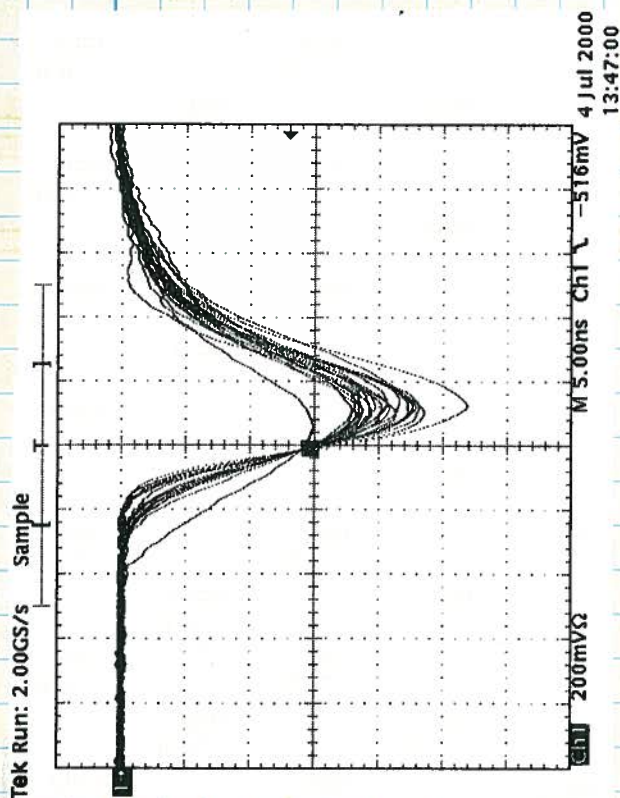
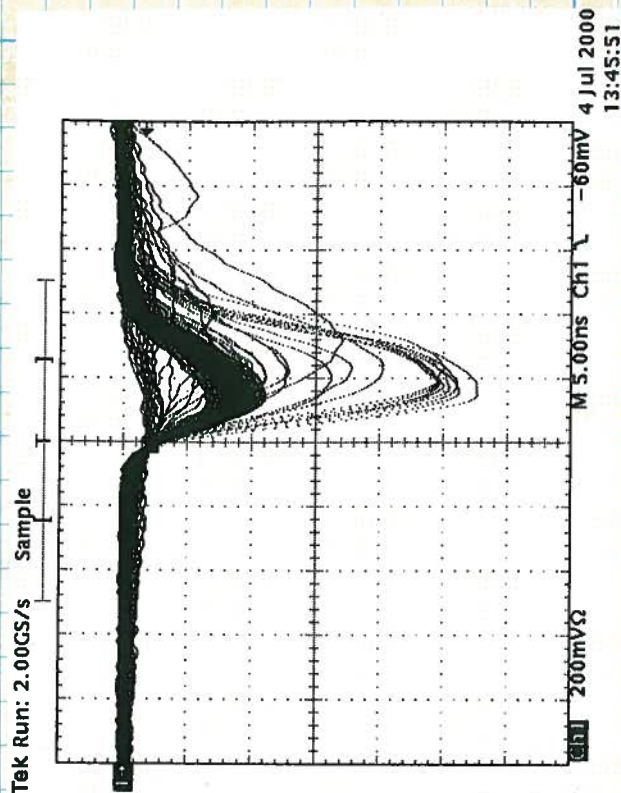
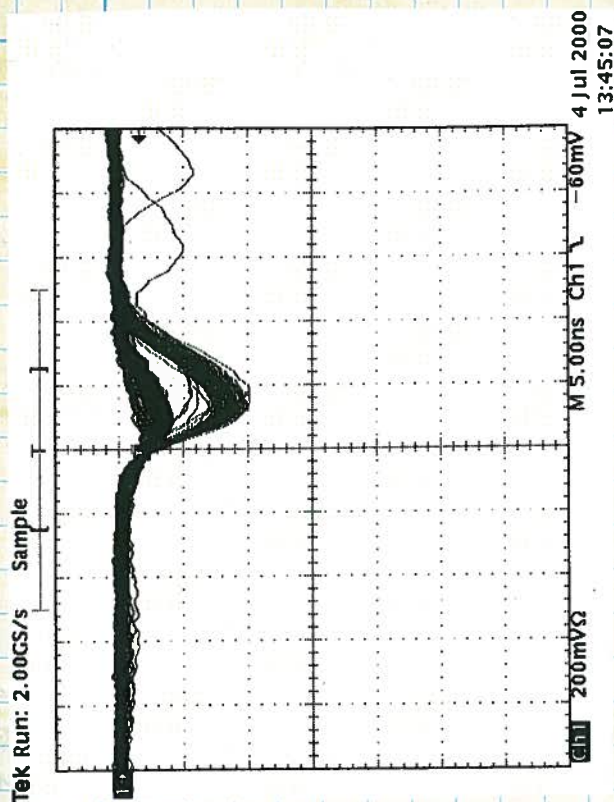
I cleaned out the brass tube and strung a new wire. Did not solder ground foil to the brass tube. I put a cable tie on the copper tape to hold it against the tube. Glue is against the tube. Tube was cleaned with paper towel + isopropyl.

Gas started flowing through tube ~15:37 on scope time. Flow rates are ethane - 66 black bead argon - 71 stainless.
Flow adjusted to ~.15 SCFH Air for the brass tube.
Power on and take the first picture.



for all these pictures
the Display is set
to 4 uSec persistence

The maximum peak did not look too bad. However there was some ~~variable~~ variance of the characteristics on the display. Not only the pulse height, but the frequency of occurrence seemed to vary somewhat. See the 3 pictures on the next page.

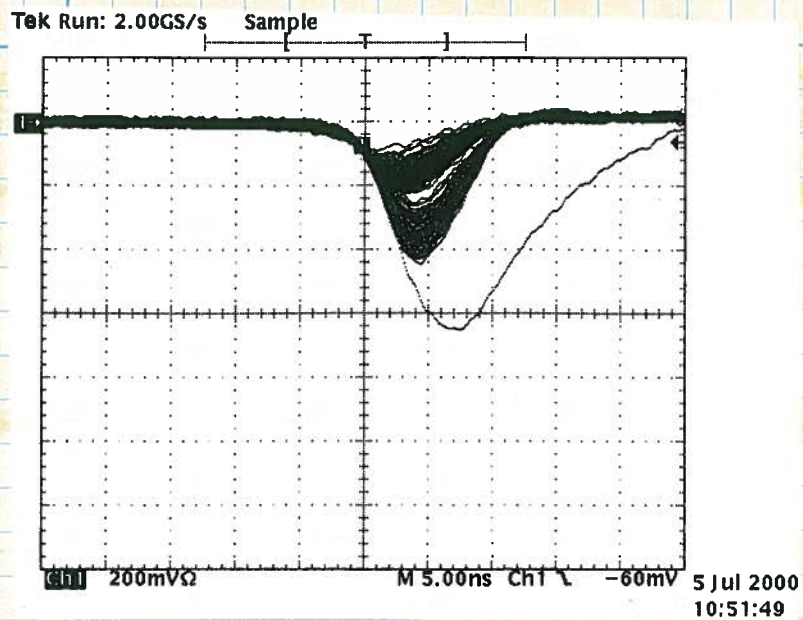


Top left was intentionally taken with no large pulses. It varied a bit between the top left & right type of displays.

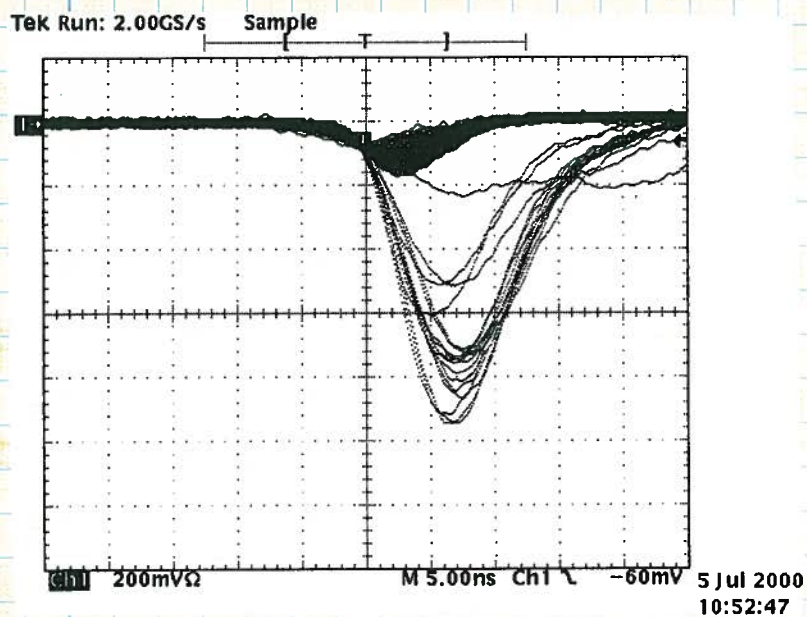
While I was seeing something more like the upper left I raised the threshold and could then see some larger pulses.

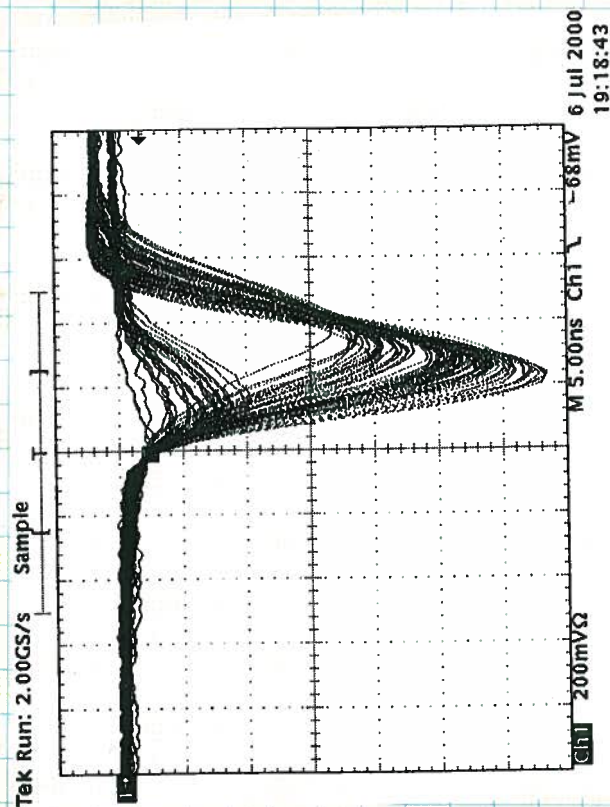
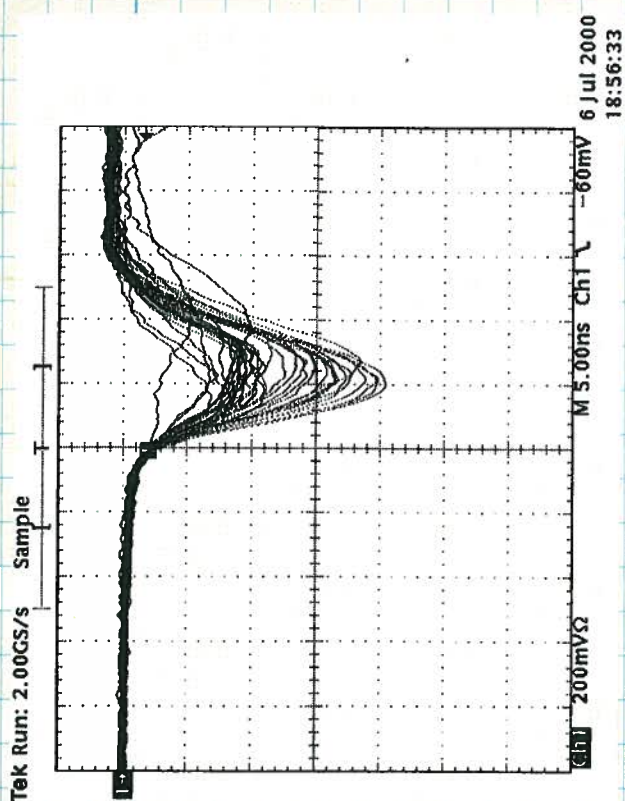
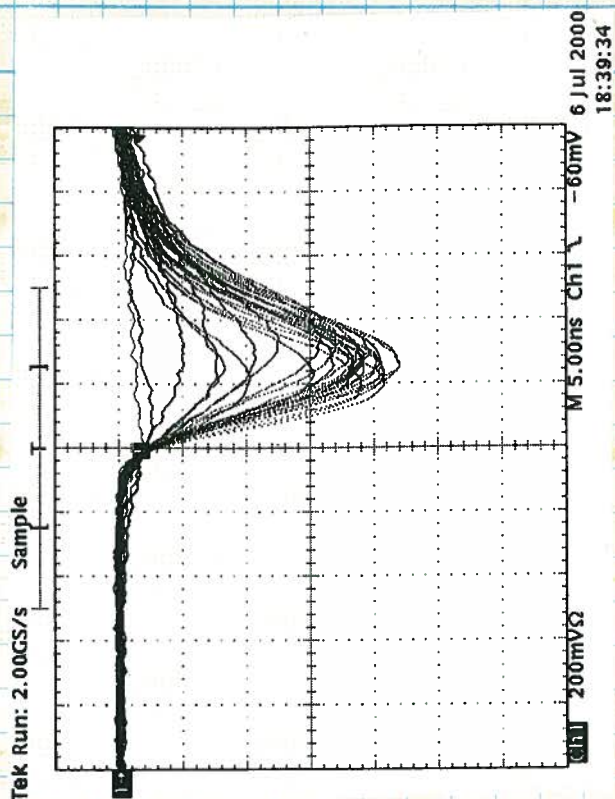
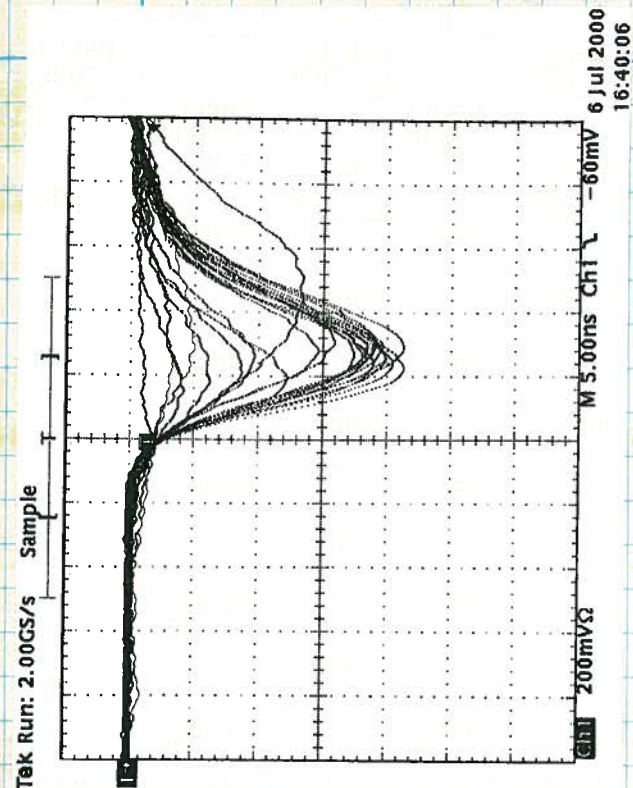
I think the triggering was getting swamped by a lot of small pulses.

Maybe the cleaning only cleaned a little bit of the cathode off and there is still a sizeable "dead" area.



The tube did not seem to be doing much different today.

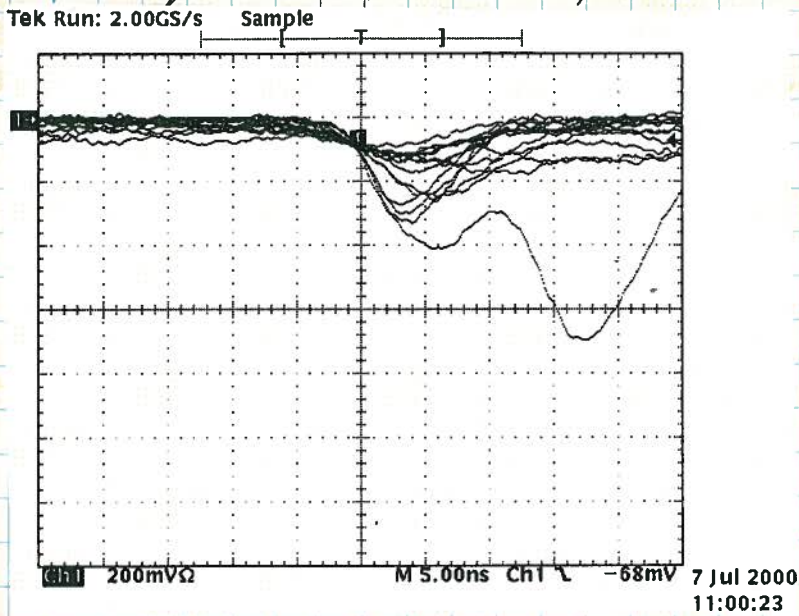




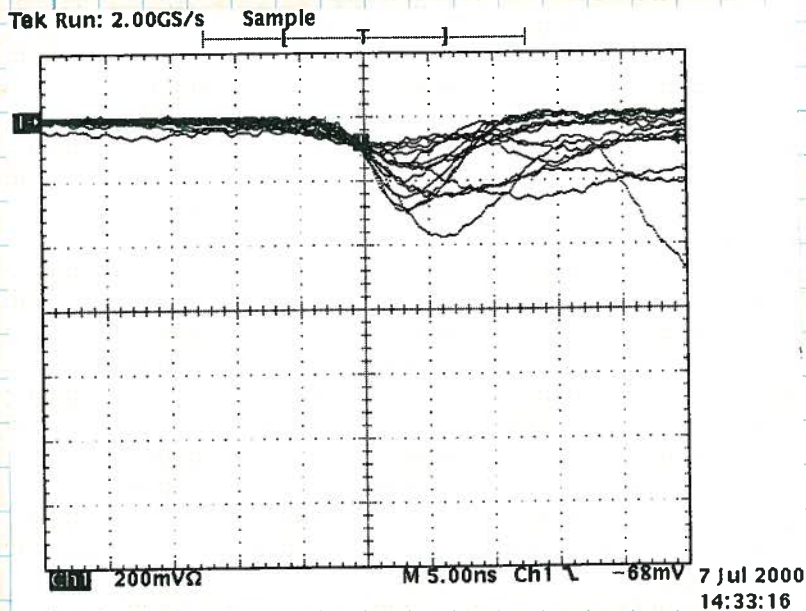
It was still showing variability this day.

The machine shop made 4 stainless steel tubes for me. 6.2" long, $\frac{1}{2}$ " O.D.

I put together one tube and took it out to the gas shed to replace the brass tube out there.



Brass tube just before I turned it off.

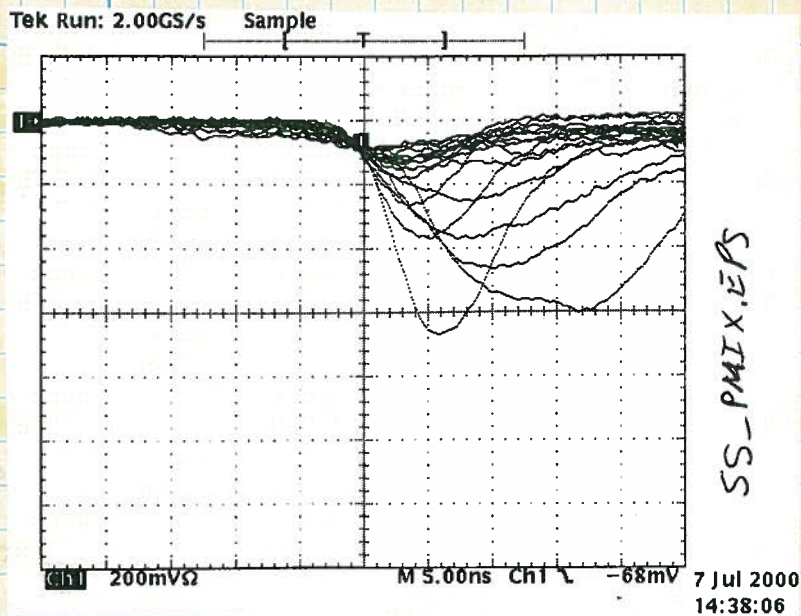


Stainless tube after it had been flowing for just a little while. Flushed out, though.

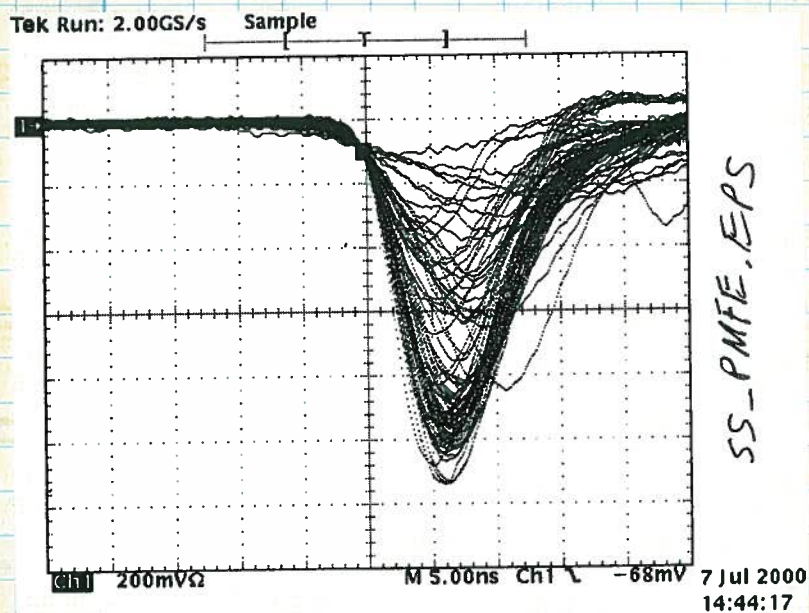
← from file SS_Z.EPS

So, these two pics are both of SS tube. I labeled the one SS_Z, but I had at least two before it.

So, the tube swap must have been done on the 6th.



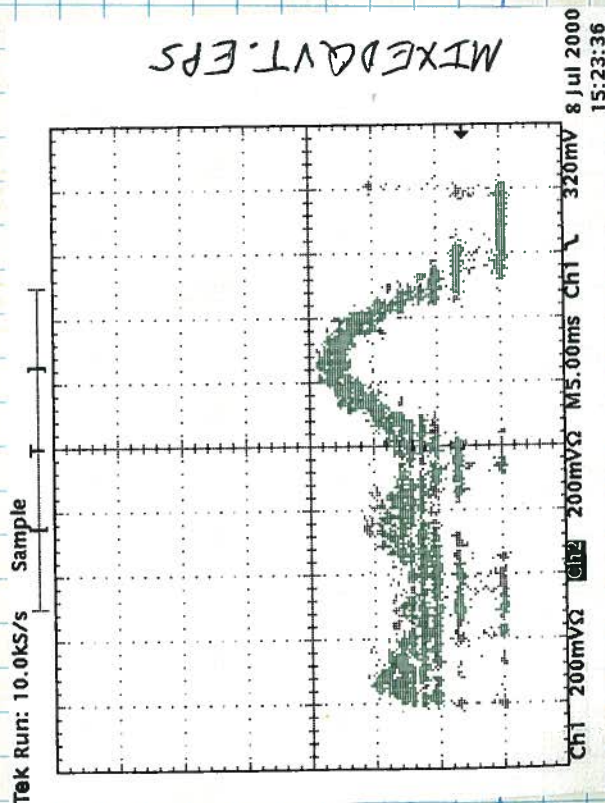
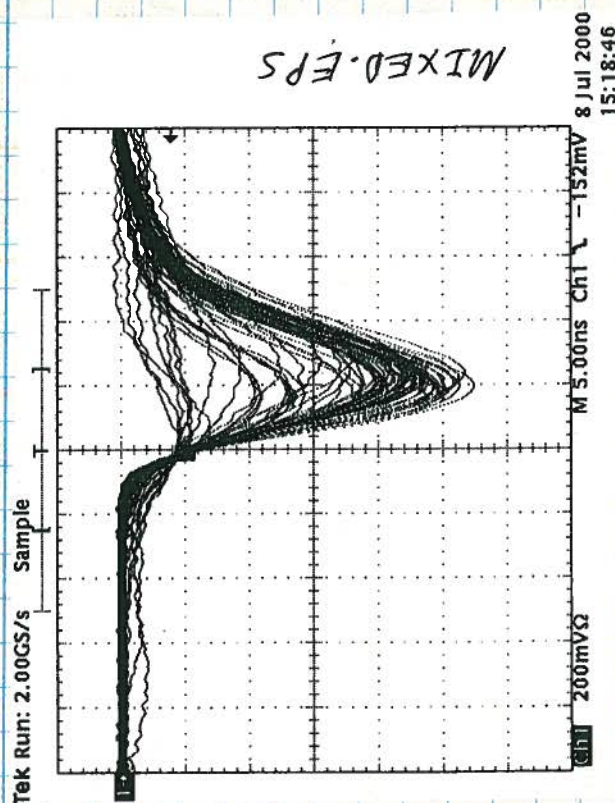
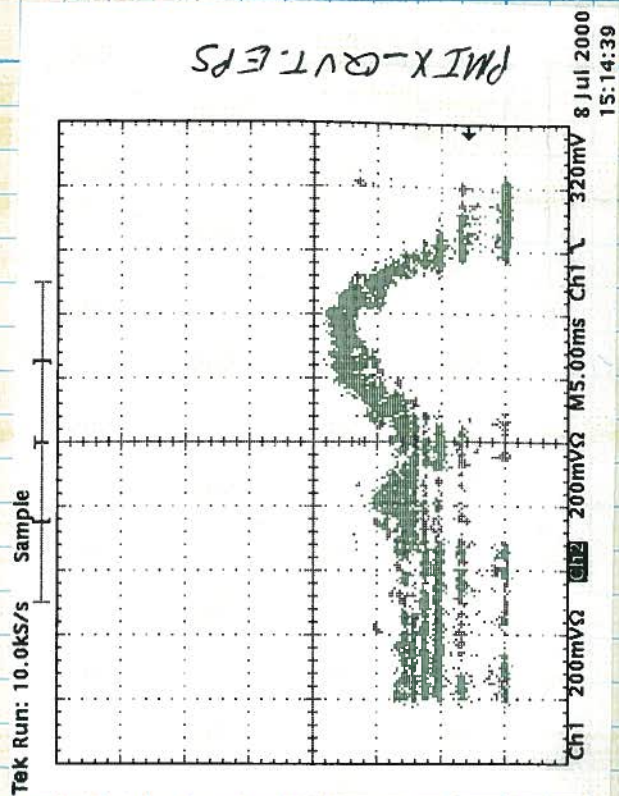
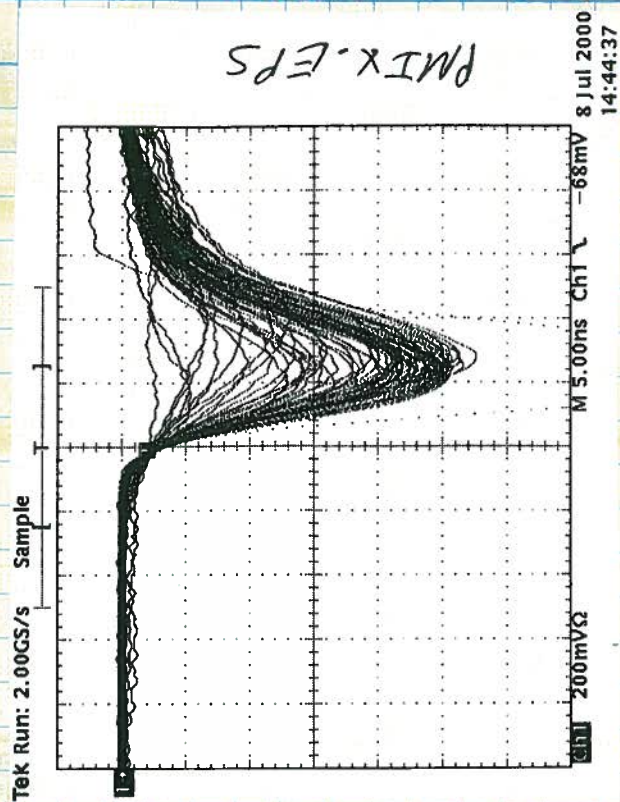
I switched gas. I now
run premix through
the tube @ ~.15 SCFH air.



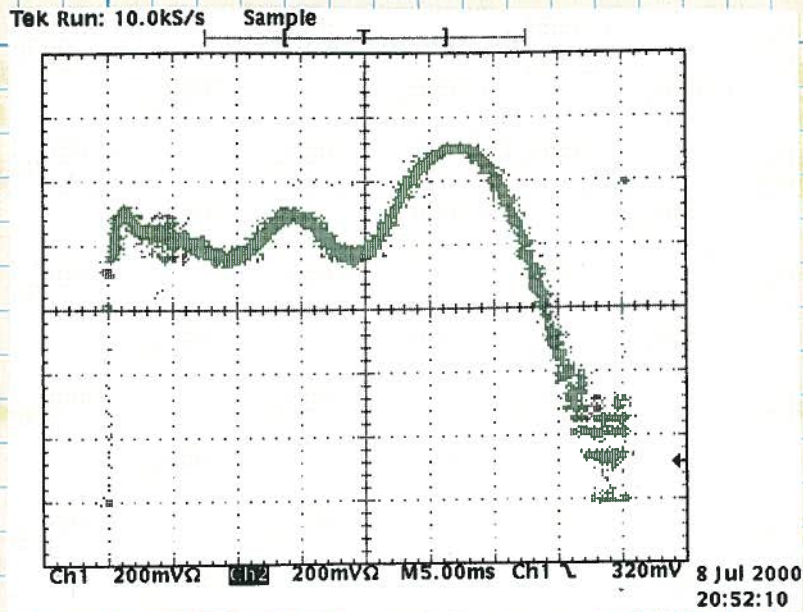
shifting the position of
the Fe^{55} source
changed the character
of the display. This was
over the hole a little
better.

before

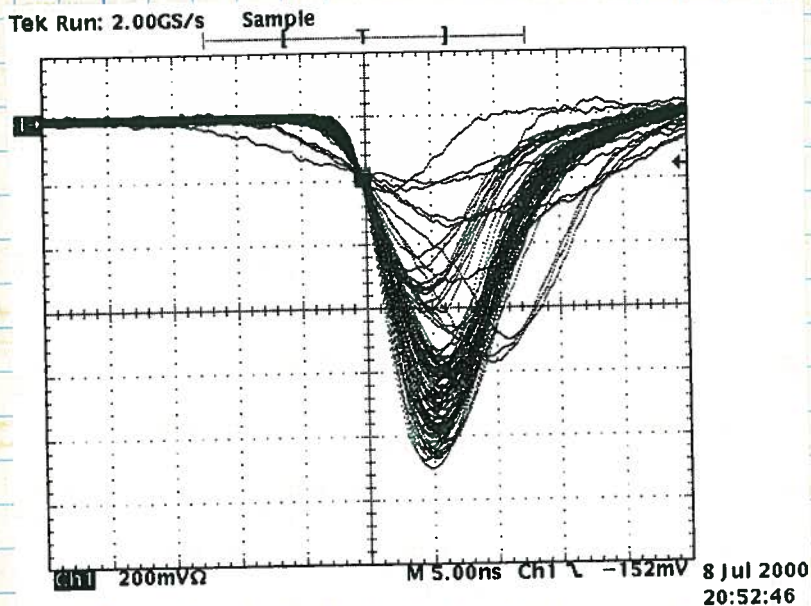
now



Since the Fc^{55} pulser now looked reasonable I switched back to tapping off the mixing system. I took an analog ΔV_T picture before the switch and after the switch. Things were looking pretty good at this point.



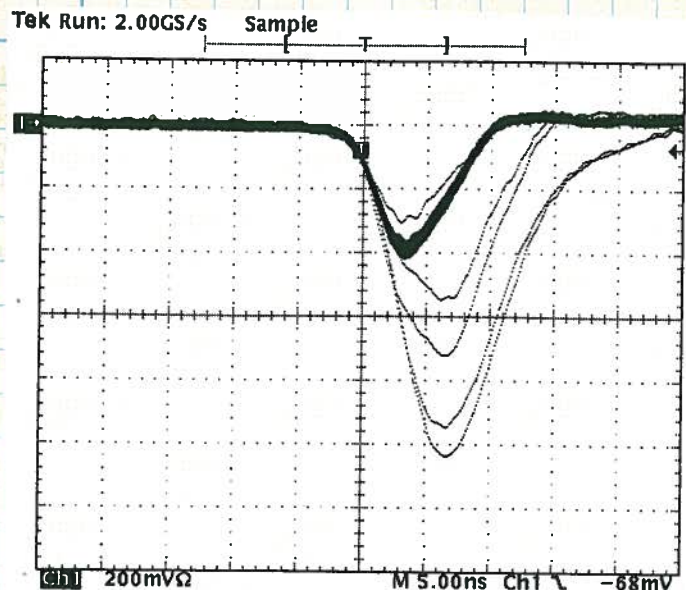
I had left the QVT running after the last picture (p. 65).



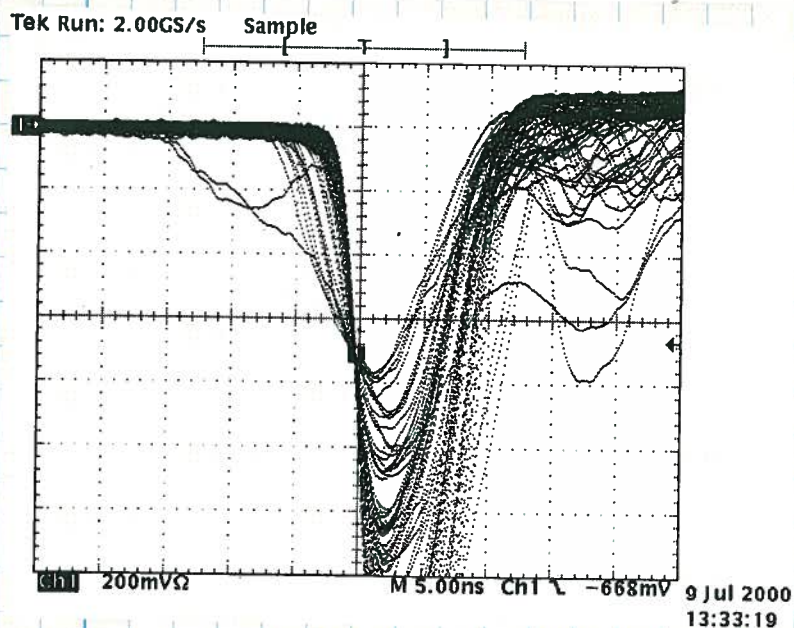
I took another picture of the tube output. Still looks reasonable.

7/9/00

Checking on the
stainless tube today
I found it like this.

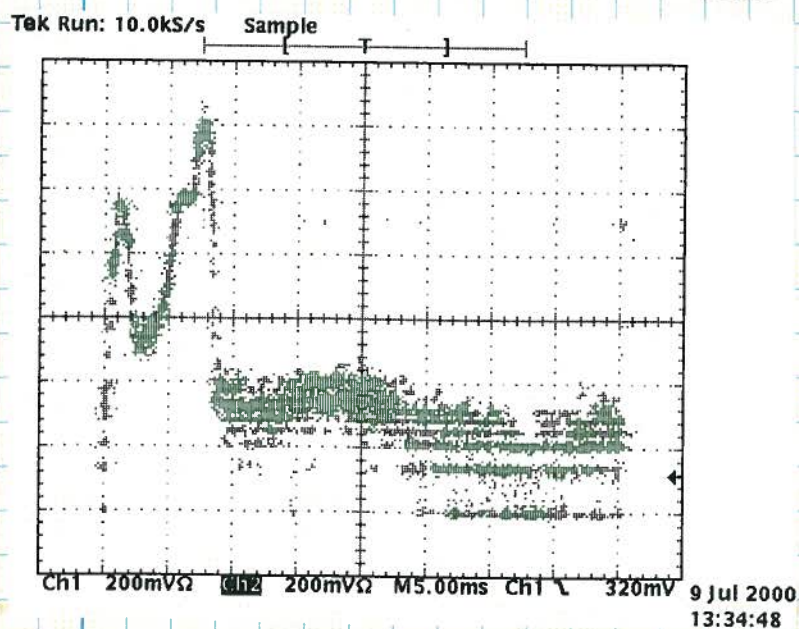


9 Jul 2000
13:28:36



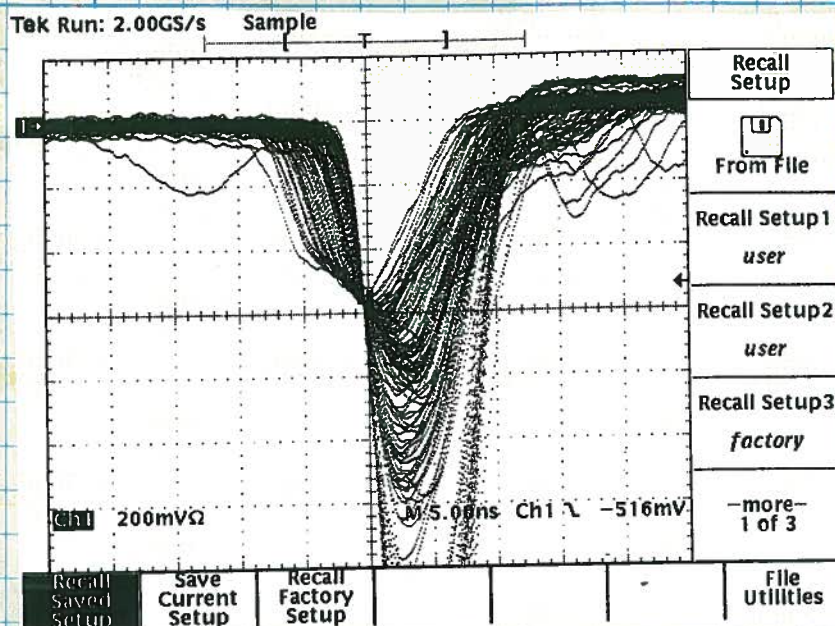
9 Jul 2000
13:33:19

Playing with the threshold
a bit shows there are
some larger pulses.

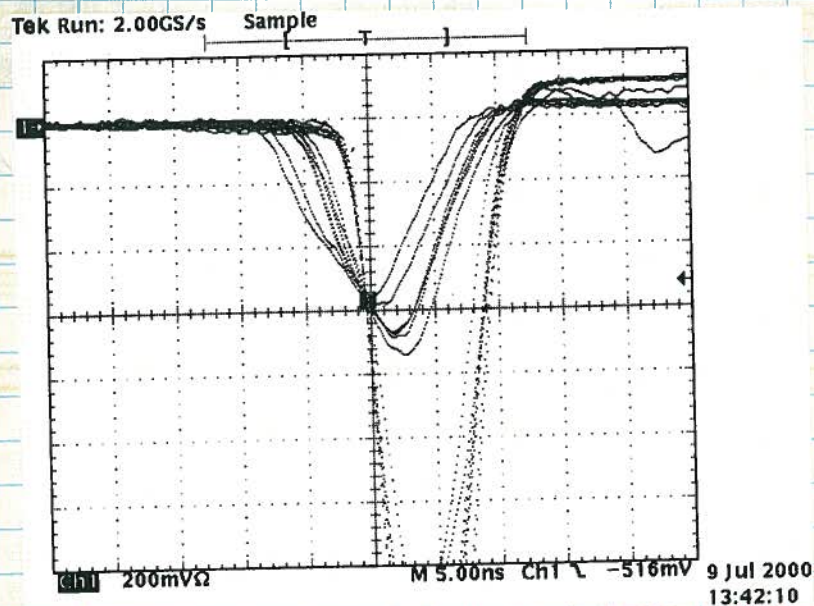


9 Jul 2000
13:34:48

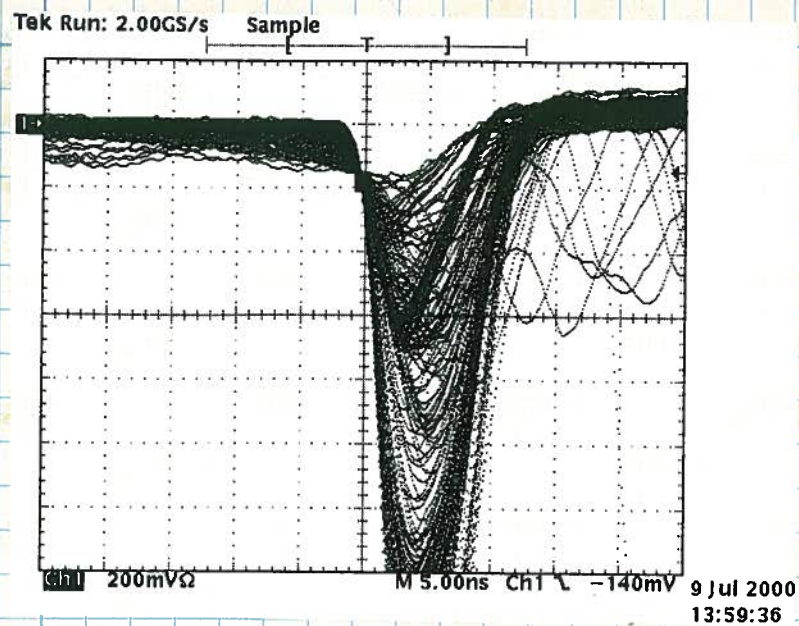
QVT spectrum is
unusual.



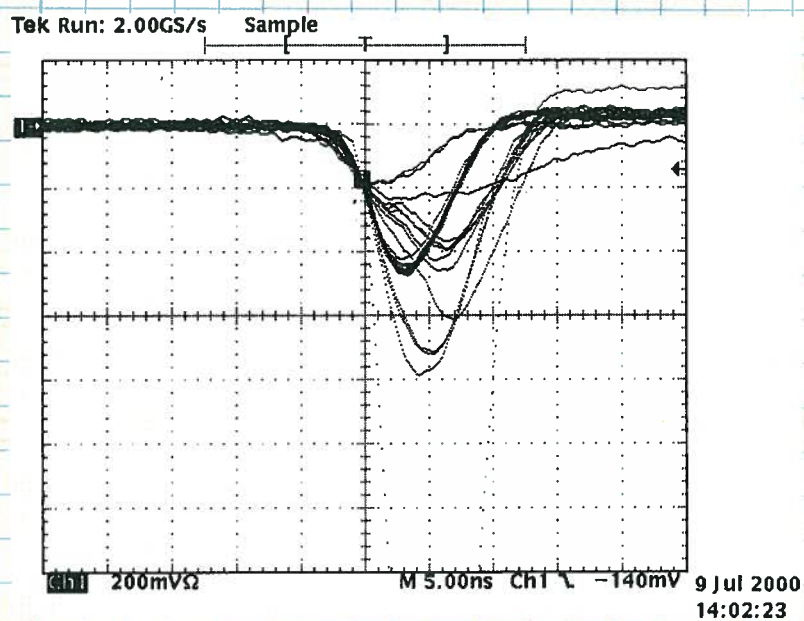
It also seemed the frequency of the pulses would vary with time.



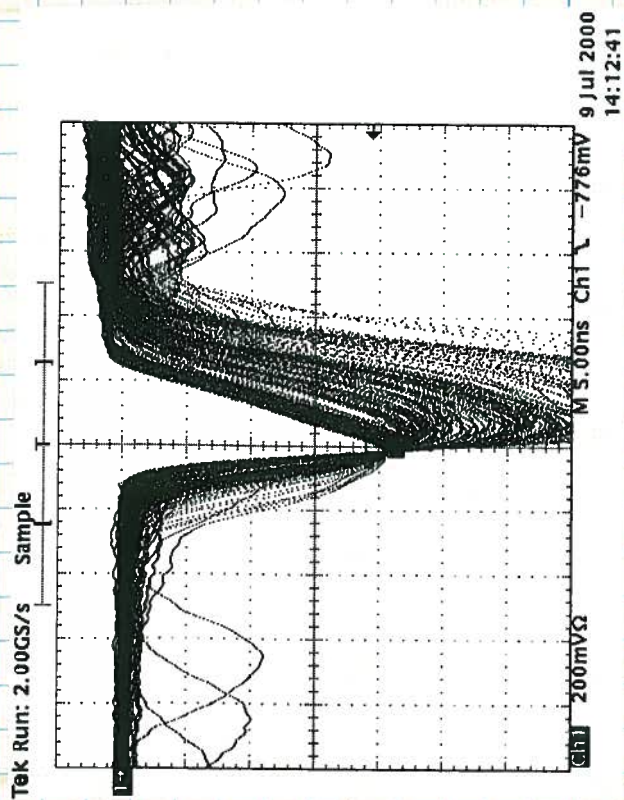
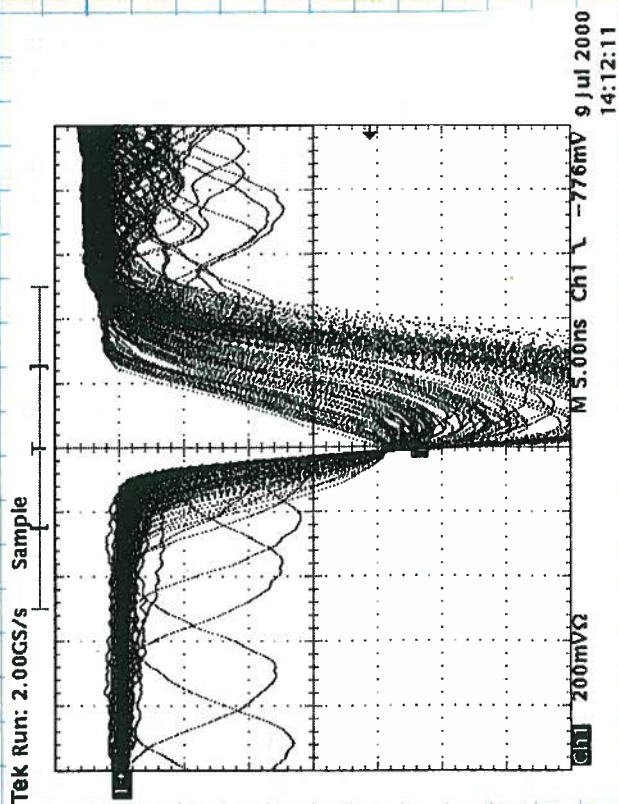
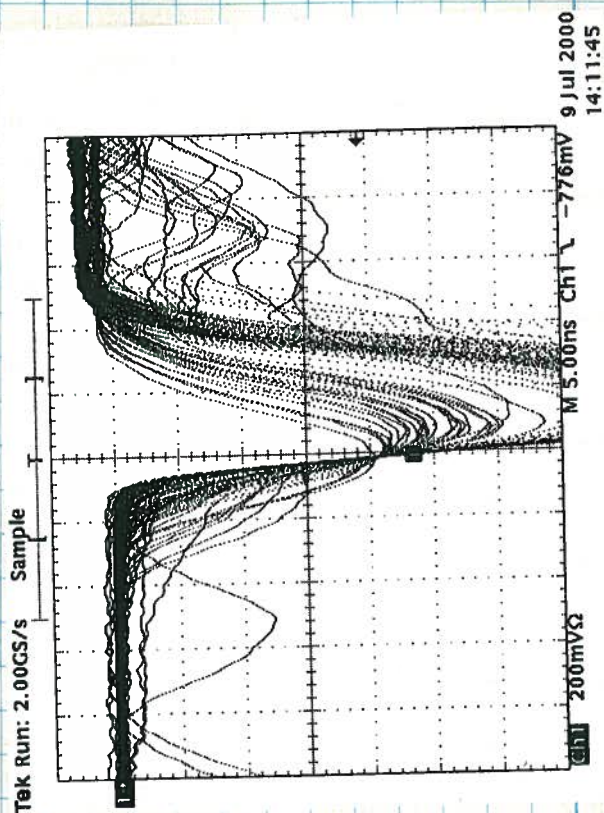
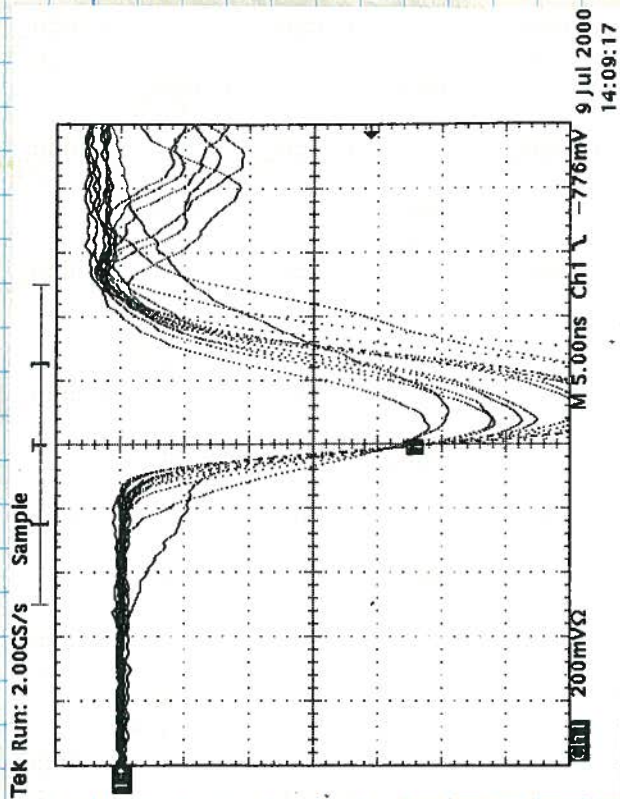
I played with the Fe⁵⁵ positioning a bit and various trigger levels.

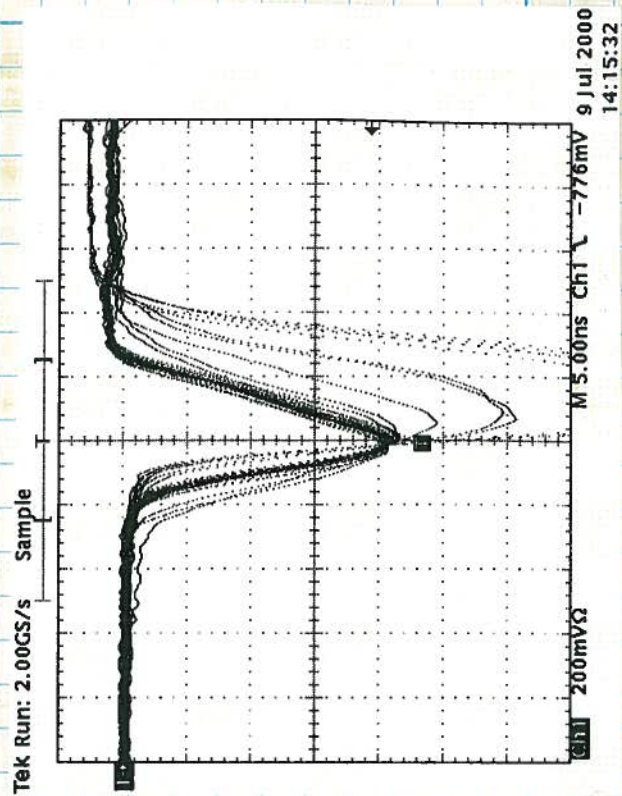
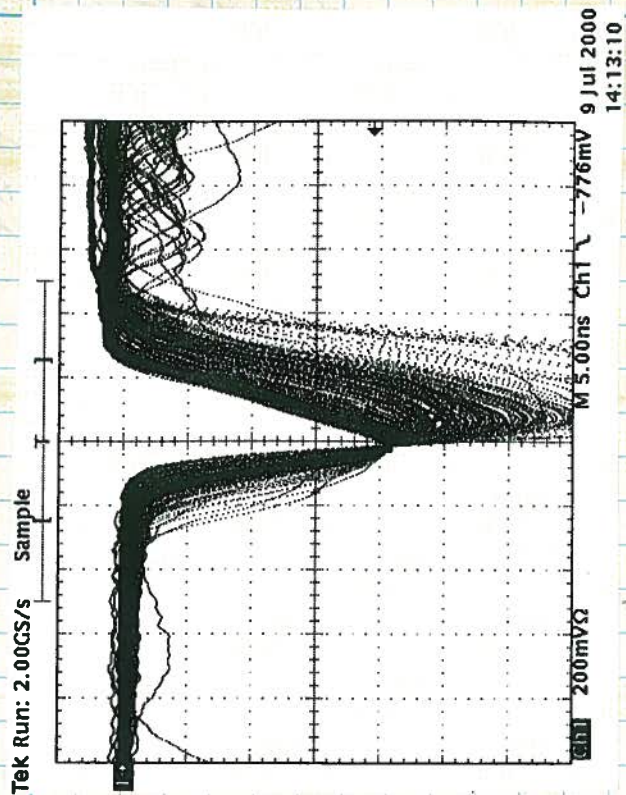


The pulses from the tube are still showing the same variability

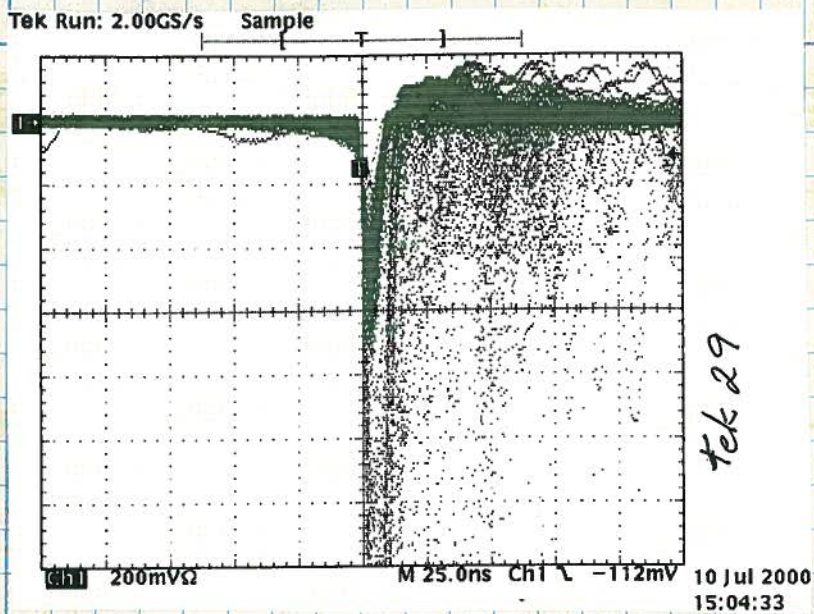


I took some pictures as the output went through what seemed to be a cycle of some sort.

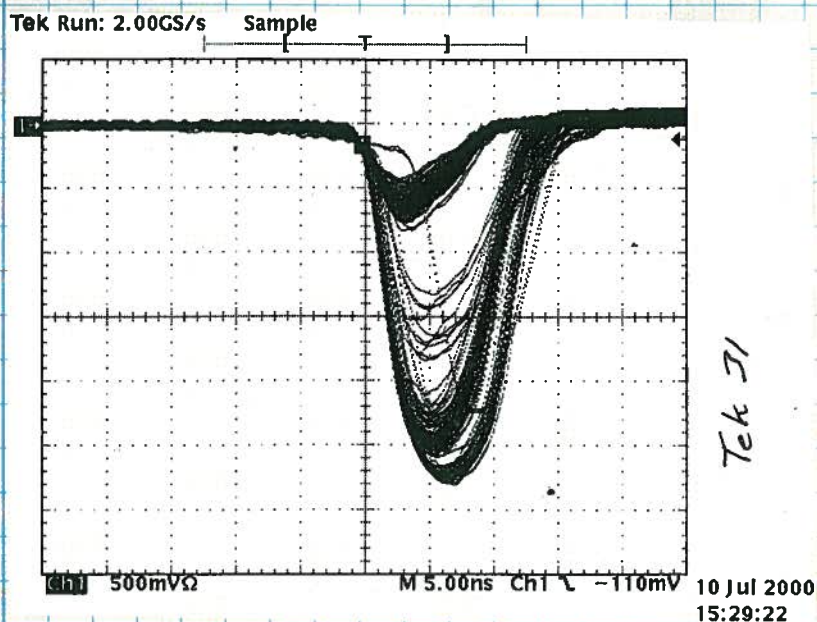
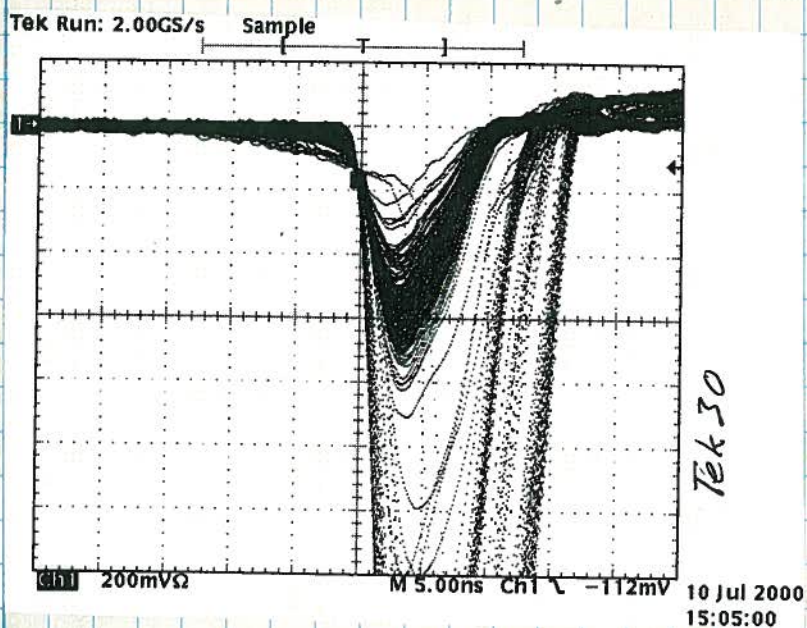




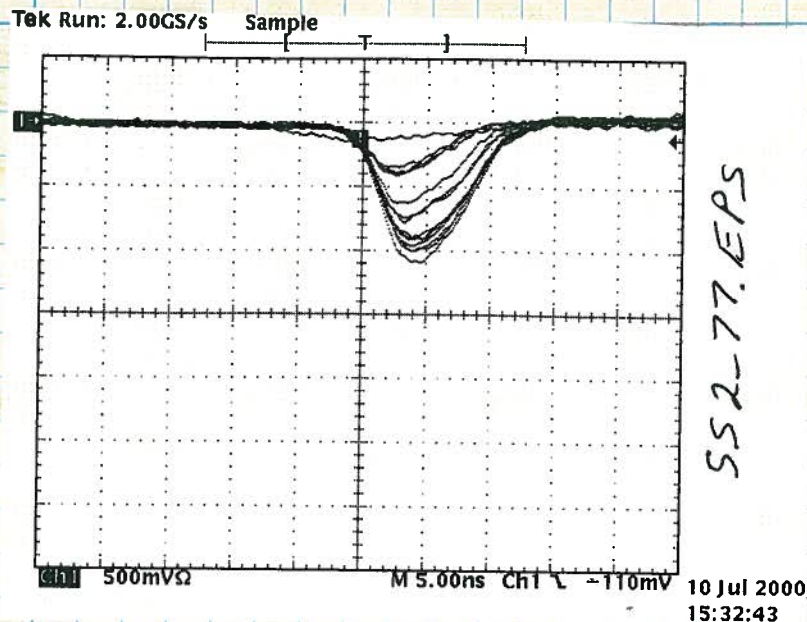
I was not able to find anything that seemed to be in sync with this "cycle." It did not seem the HVAC unit cycled the same. The mixer cycled a few times during this.



Trying to look at it again today. I noticed some afterpulsing. Very noticeable on a larger time base.

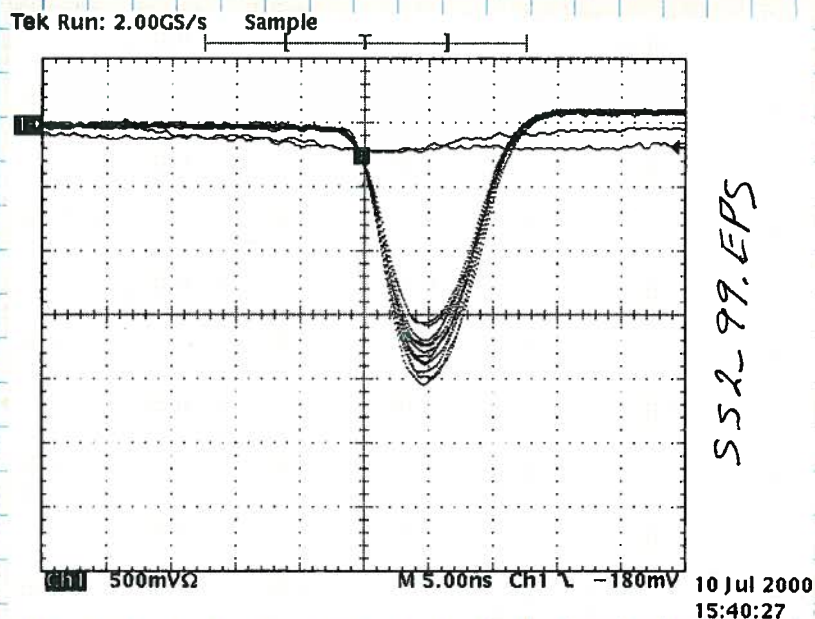


I think these pulses are just about saturating the amplifier.



I tried turning the HV down.

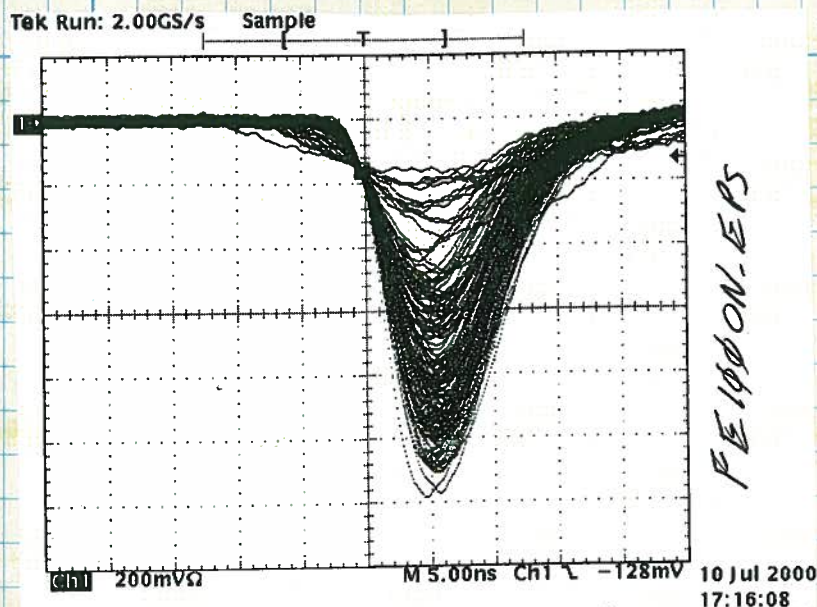
2.77V on monitor points



2.99V on HV monitor points.

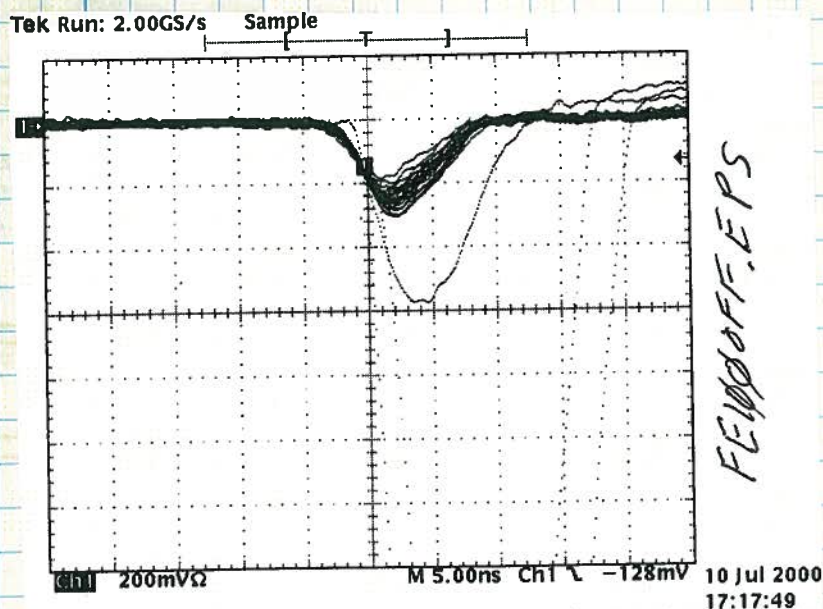
The tube output was very erratic. At one point I was getting almost nothing out of the tube. I went to get my 500 μ Ci Fe^{55} . The source I've been using was 10 μ Ci in 1988.

Using the Fe^{55} of 100 μ Ci it looks like most of what I've been looking at are "noise" pulses. The Fe^{55} pulse height is reasonable at 3.18V on the HV monitor points.

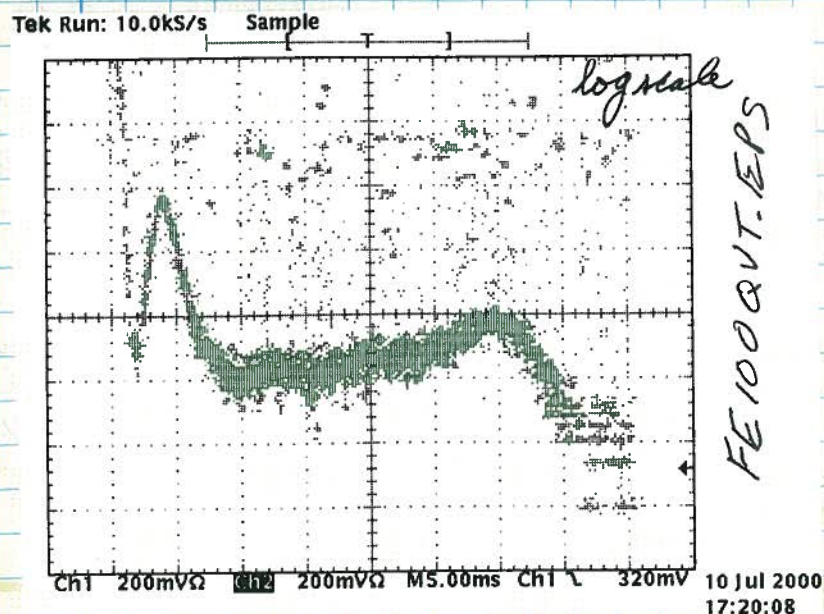


3.18V on monitor points
 ~ 15 SCFH air
 $100\mu\text{Ci Fe}^{55}$ source
 is in place

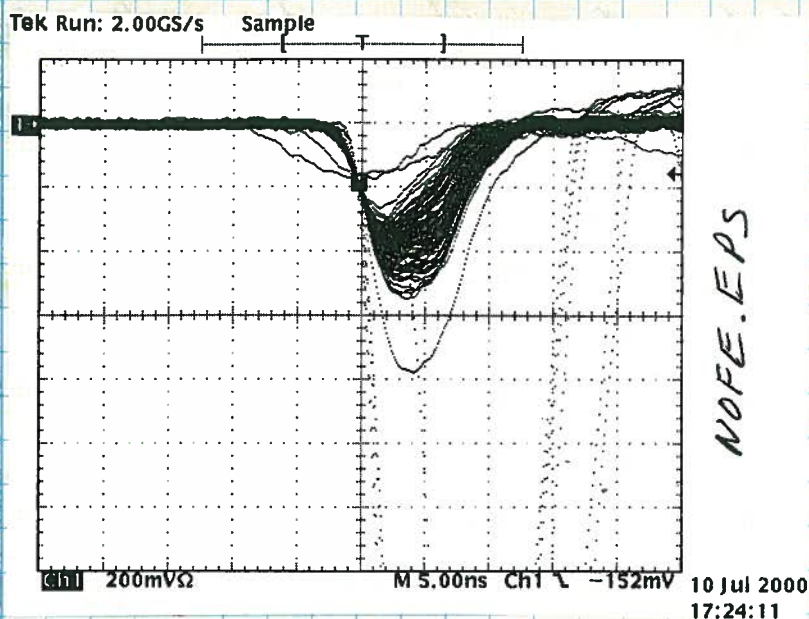
Auto trigger
 2 second persistence on
 the display



no source
 scope settings same as above



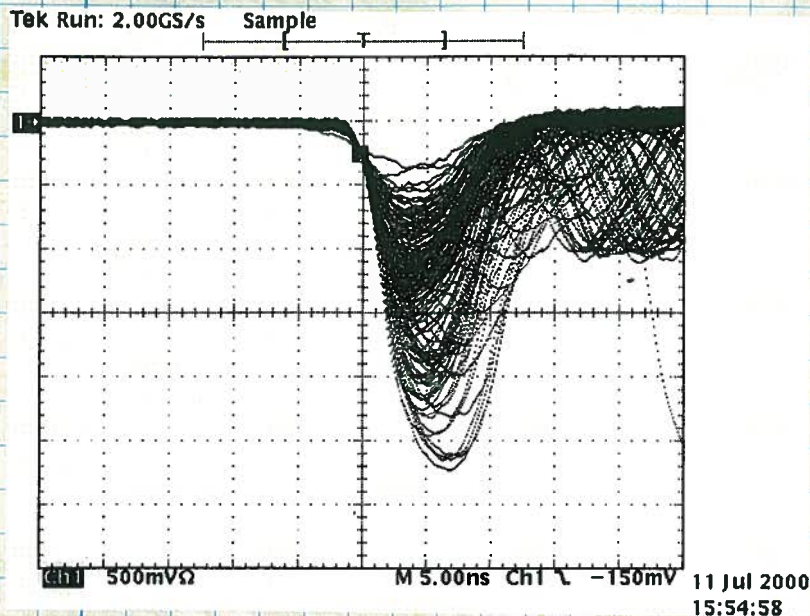
put the $100\mu\text{Ci Fe}^{55}$
 source back on and
 got a QVT spectrum.



took the source off
for one more
picture.
The "noise" is not
much different from
the Fe⁵⁷ pulses.

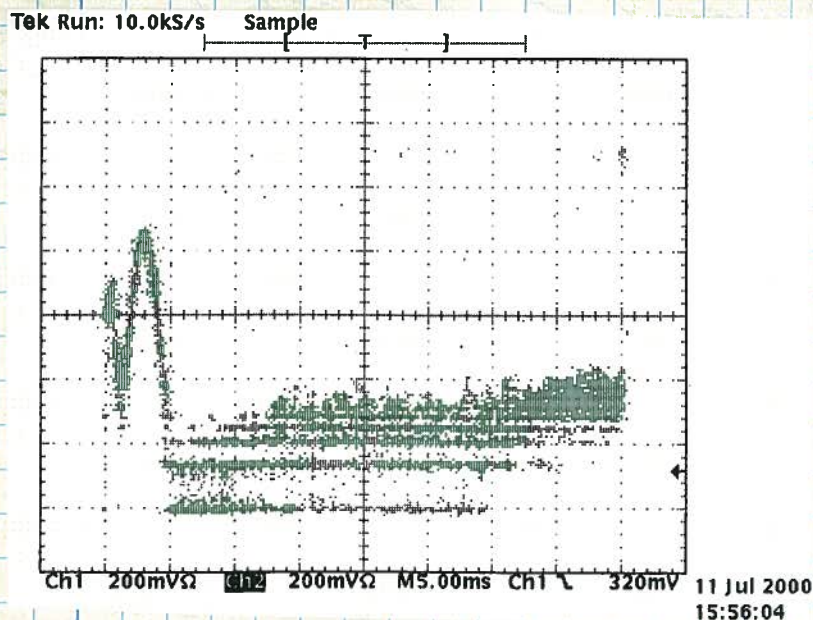
Perhaps the humidity is doing this. We are
having some very humid days right now.
Saturday, the 8th, was not so humid. See p. 66 for
a QVT spectrum. But, with the HVAC running in the
gar shed the relative humidity seemed kind of
high. Of course, the HVAC is not as good today that much
worse.

Trying to see how much of an affect the humidity has on the tube setup. I got some cling wrap from shipping and receiving. I will try wrapping it up a bit and blowing dry nitrogen into the Techmer box.

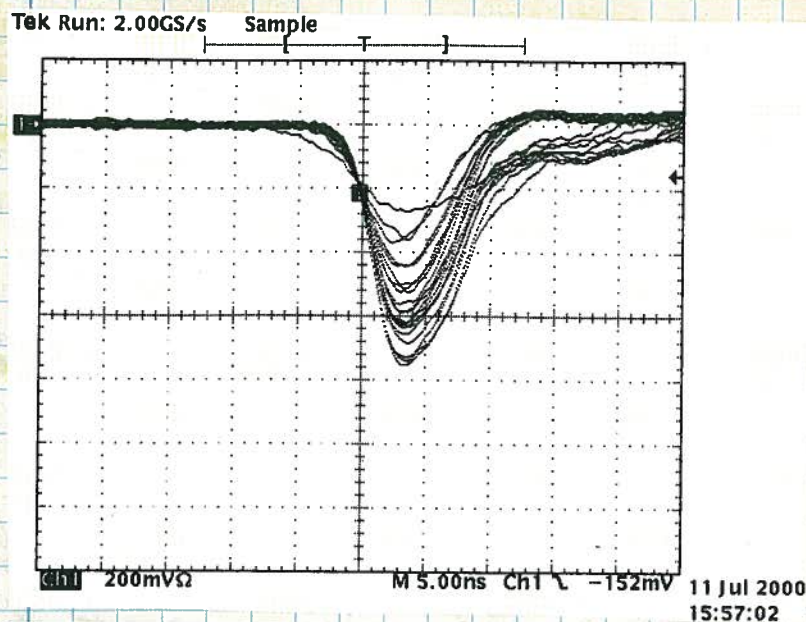


10pCi @ 1988 source
3.18V on monitor points
2.15 SCFH air

I wrapped the box and looked at the output before I turned the nitrogen on.

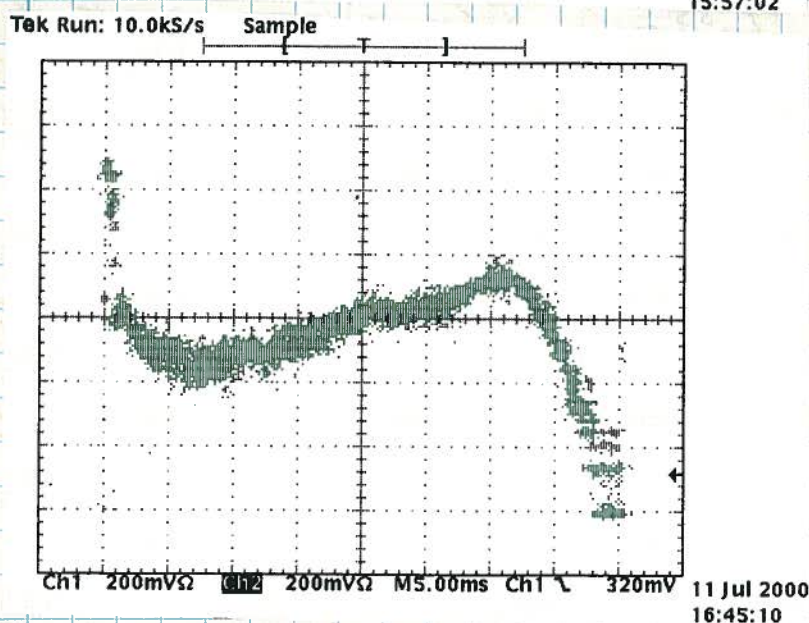


QVT before N_2 turned on



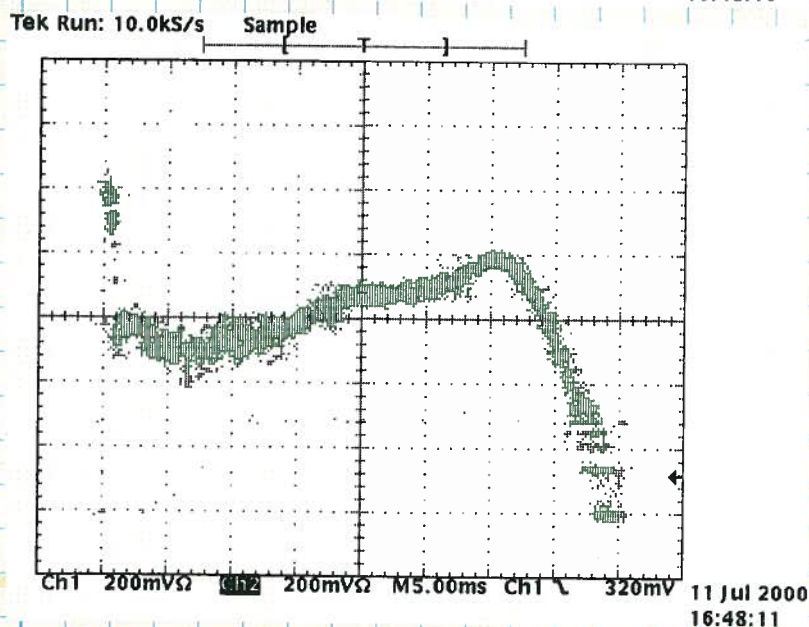
Output was pretty quiet moment to after I turned the N_2 flow on.

I tried to get a QVT spectrum without much success.



I went & got the larger intensity Fe^{55} source.

QVT of higher intensity source

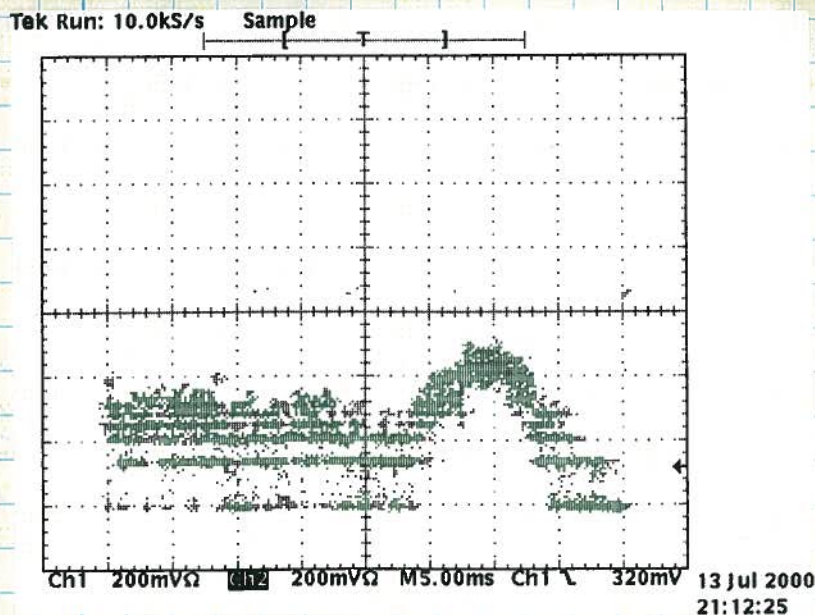


I increased the N_2 flow rate and took another QVT spectrum

7/14

(7/13) I took the chassis with the gain monitoring tube out of the gas shed. I put a solid top and solid bottom on it. It's a Dechmar box. I fastened plastic sheet on the sides. The side panels are perforated. The front panel was already a solid piece. The rear panel left a gap of ~1" at the top & bottom. I covered those with tape. I put a copper tube through the rear panel to about the front 1/3 of the box. I put a valve on the line at the rear panel. This is for dry air input, from the dry air line going to the hall. I put velcro w/ adhesive backing on the tube to hold the Fe^{55} source in place. Made a velcro holder for the Fe^{55} source (10 μ Ci @ 1988). Took the box back to the gas shed and hooked it all back up again. I put a "T" on the dry air line going to the hall and began flowing dry air.

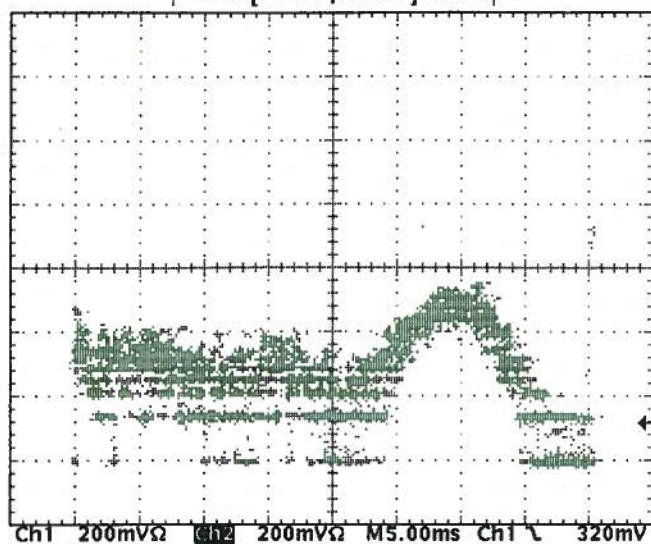
The signal from the tube looked pretty good so I started the QVT running.



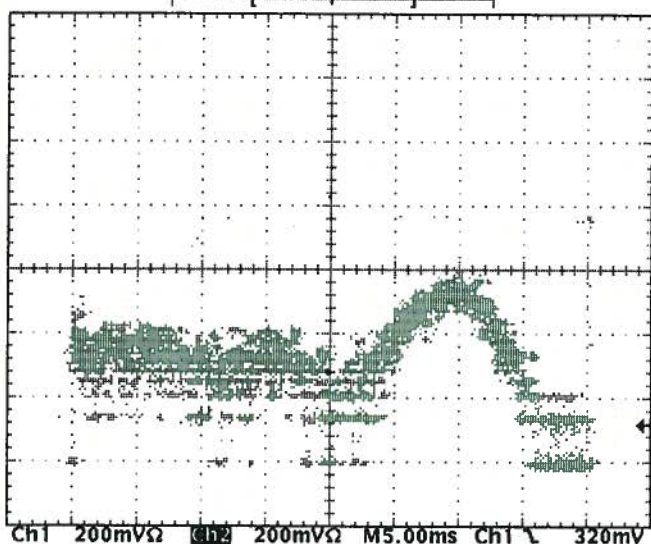
left QVT running

The QVT spectrum does not look so bad. Today well, yesterday, the 13th, was drier than previously.

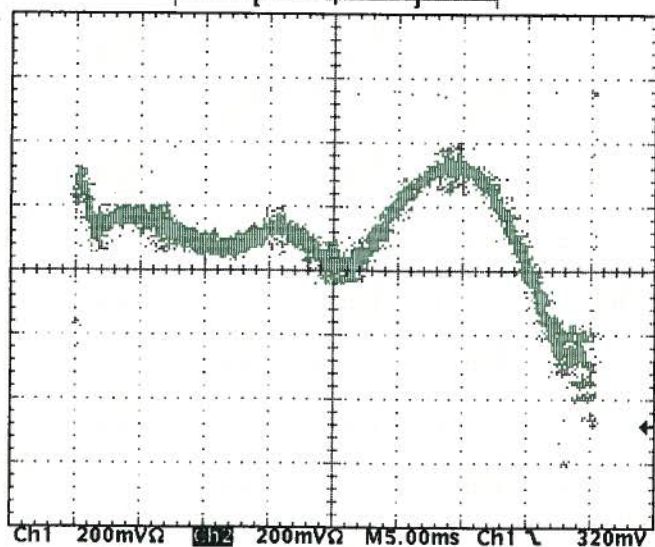
Tek Run: 10.0kS/s Sample

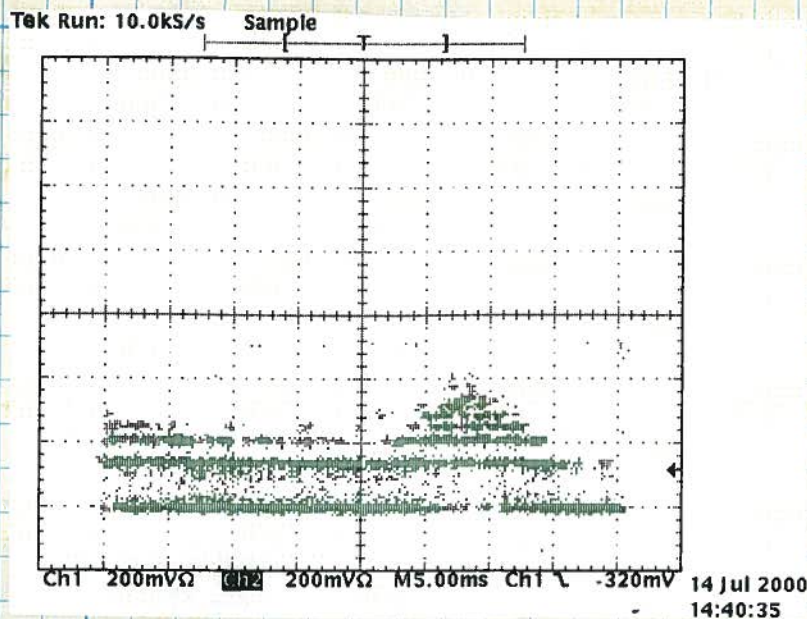
13 Jul 2000
21:25:41*left QVT running*

Tek Run: 10.0kS/s Sample

13 Jul 2000
21:38:21*left QVT running*

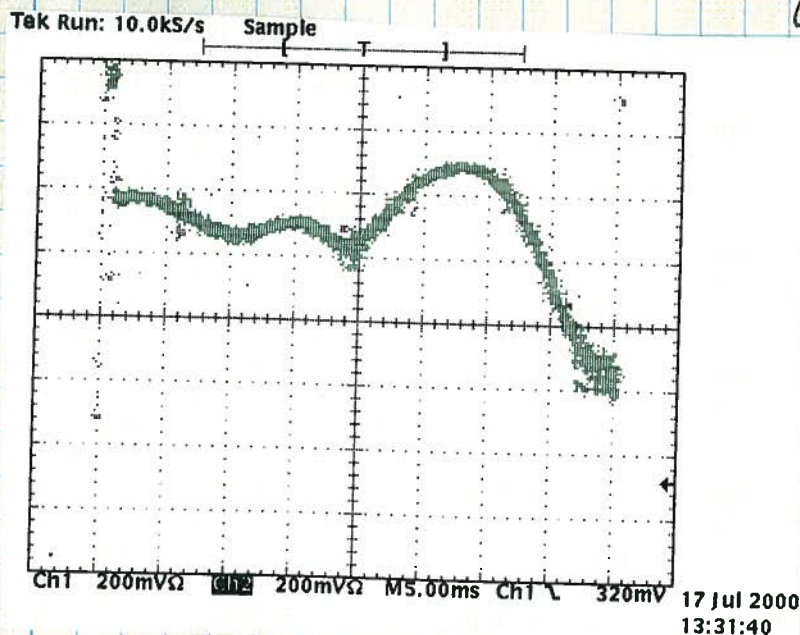
Tek Run: 10.0kS/s Sample

14 Jul 2000
14:33:38*cleared QVT and
restarted it.*



left QVT running

As the day progresses the humidity is increasing.
The QVT has been running since the picture above.

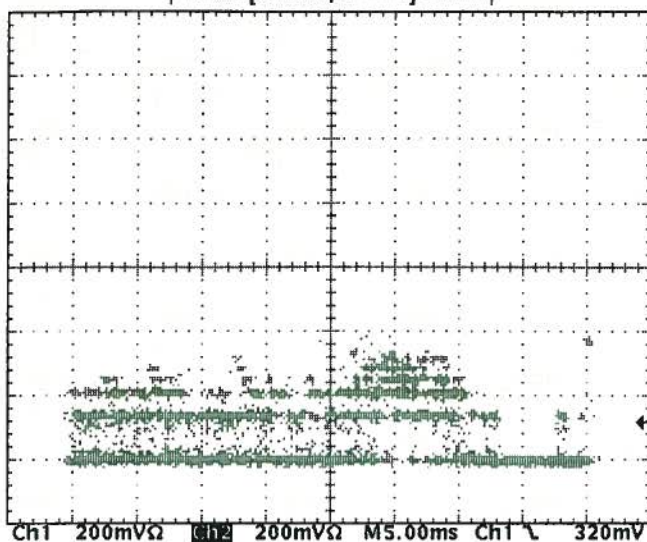


When I first looked at it today this is what I report.

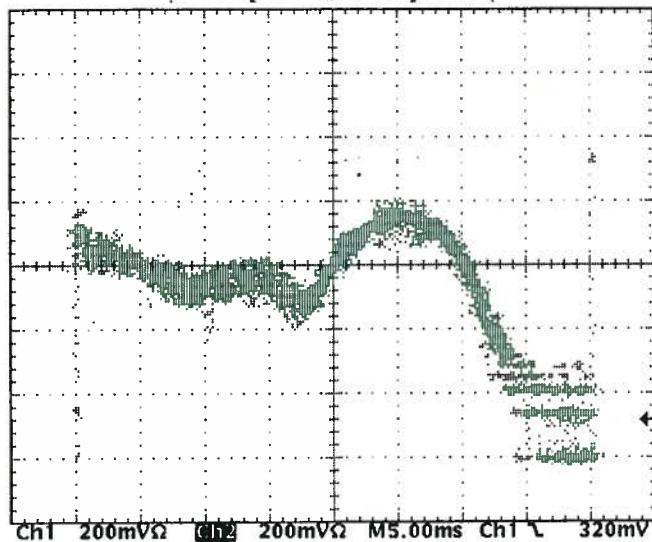
cleaned & restarted the QVT

The picture above is perhaps not quite as nice as the picture on p. 66 of this notebook.

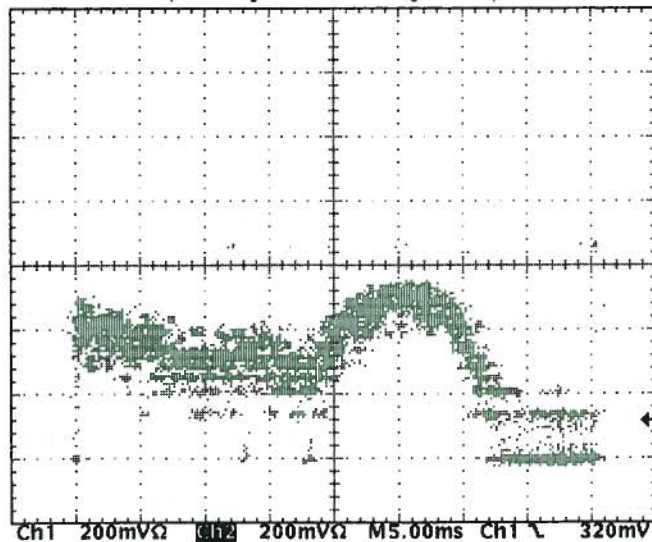
Tek Run: 10.0kS/s Sample

17 Jul 2000
13:37:37*Left the QVT running*

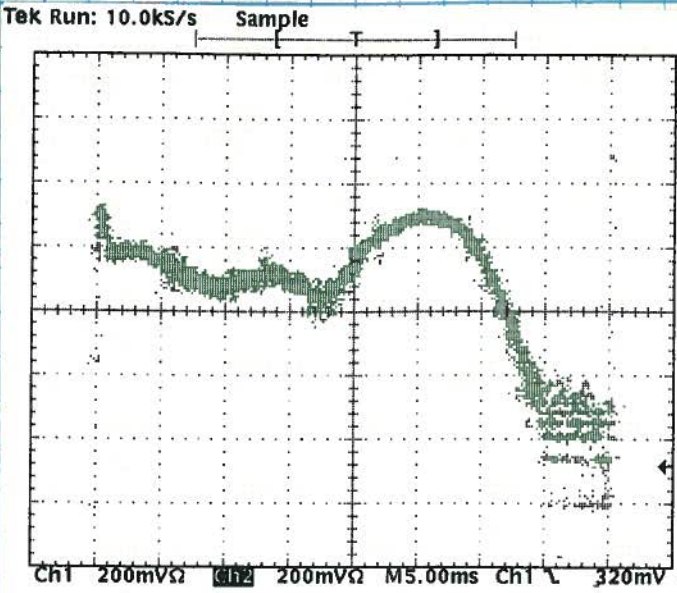
Tek Run: 10.0kS/s Sample

17 Jul 2000
18:58:37*cleared & restarted the QVT*

Tek Run: 10.0kS/s Sample

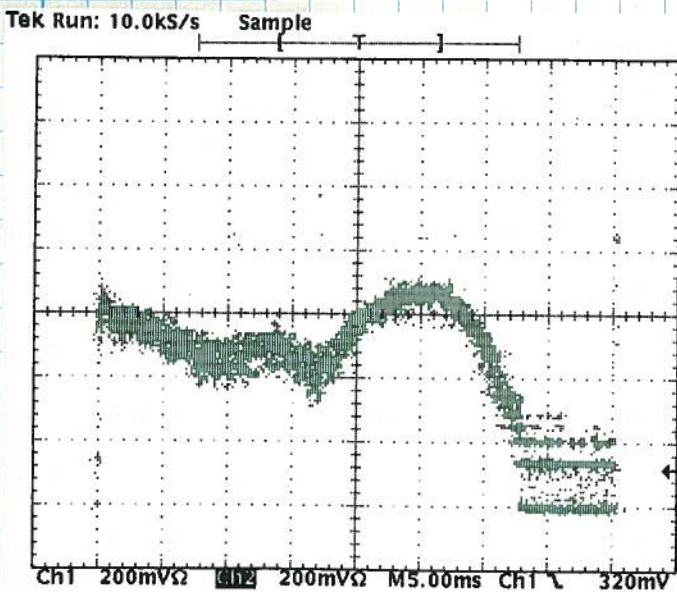
17 Jul 2000
19:50:31*Left the QVT running*

7/18
JS



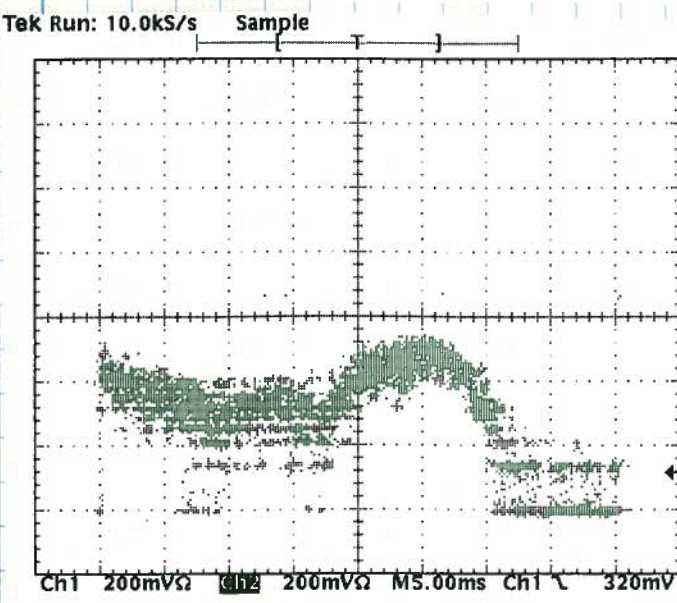
18 Jul 2000
11:39:59

*cleared & restarted
the QVT*



18 Jul 2000
14:47:35

*cleared & restarted
the QVT.*

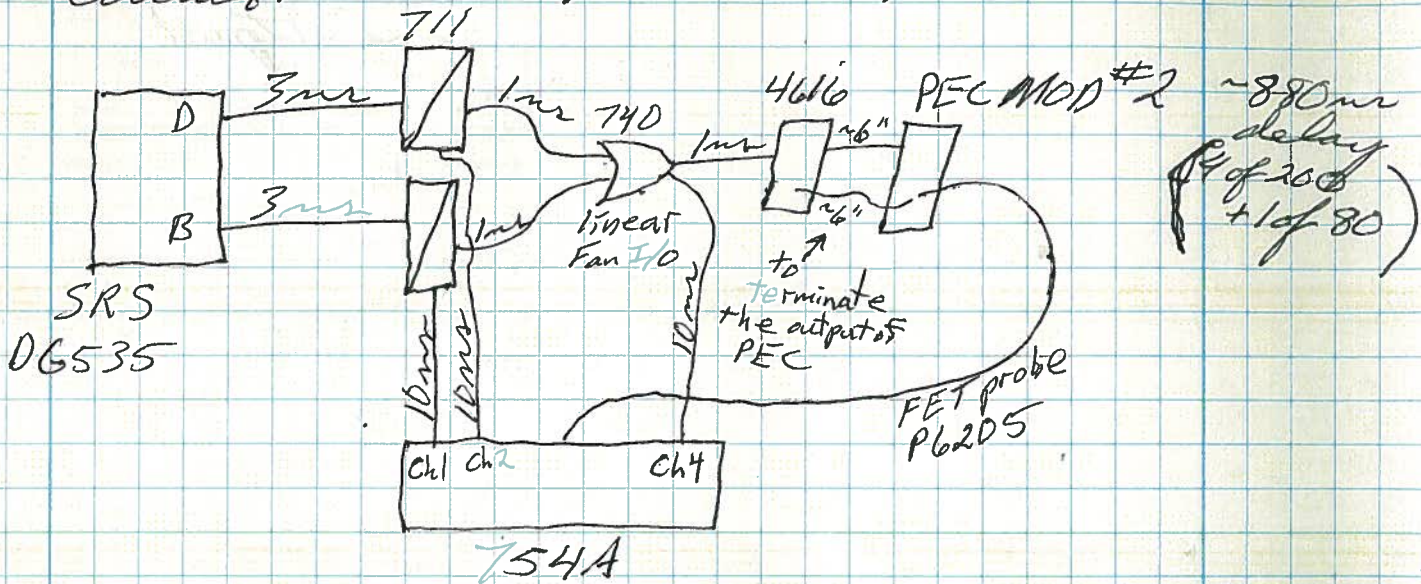


18 Jul 2000
15:34:29

left QVT running

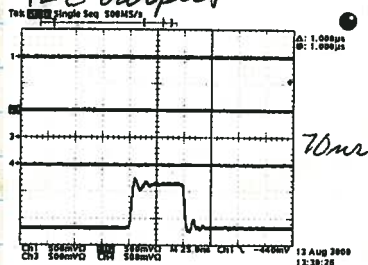
PEC ECL Delay Modules

Trying to get an idea of why we need a long output pulse from the SPST discriminator. Joe Mitchell said Hall C did it because if two pulses came close to each other the first pulse could drop out, being missed entirely. I was under the impression it was because a shorter pulse would fail to trigger the regeneration circuit.

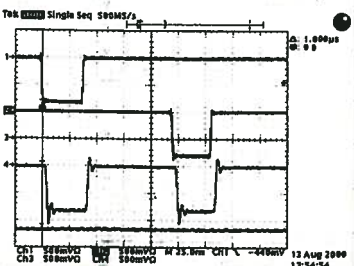
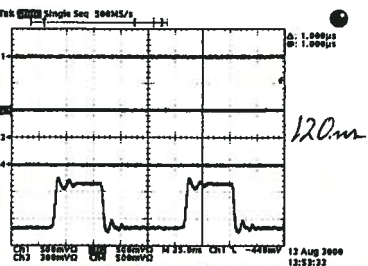
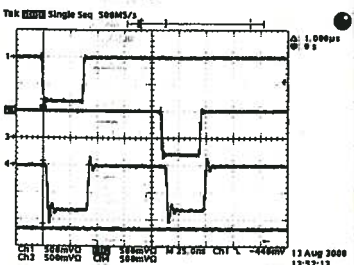
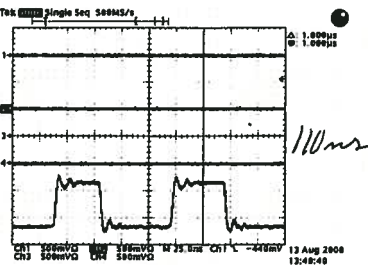
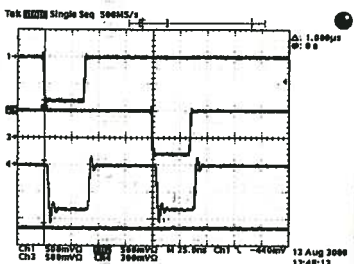
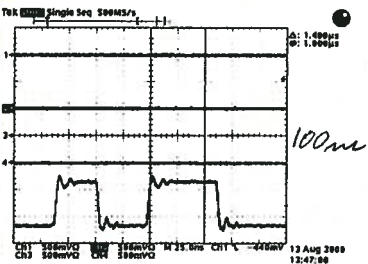
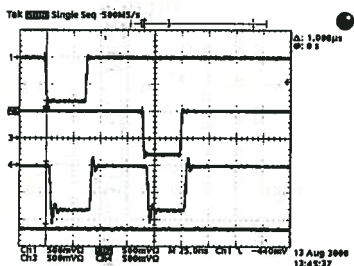
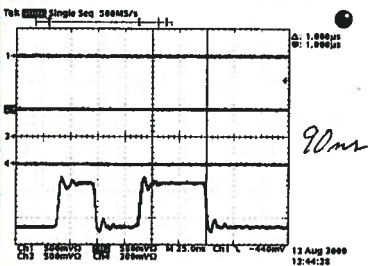
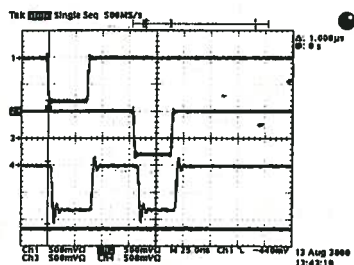
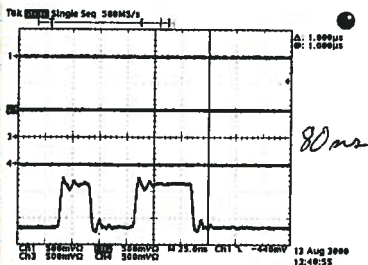
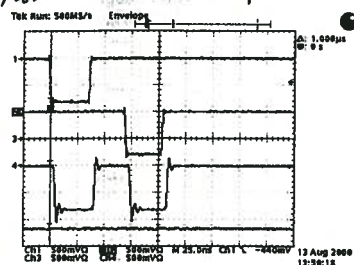


All four channels of SRS are set to NIM, inverted
Channel B, A & C are set to 0 delay with respect
to the internal trigger.
Channel D delay with respect to internal trigger
is varied.
Internal trigger is at 200 Hz
Scope is in ENVELOPE mode set to ~~100~~ 100

PEC output

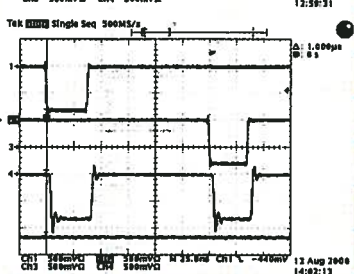
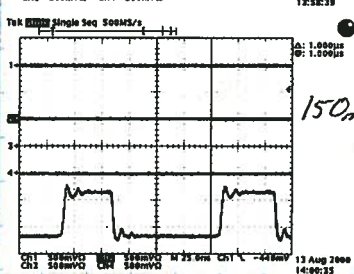
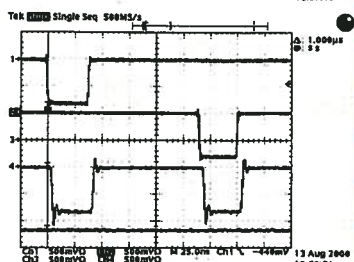
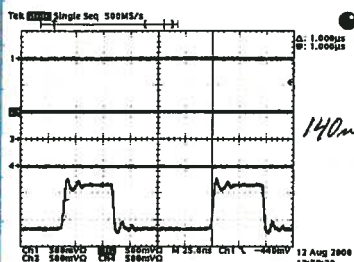
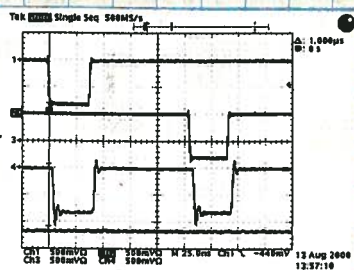
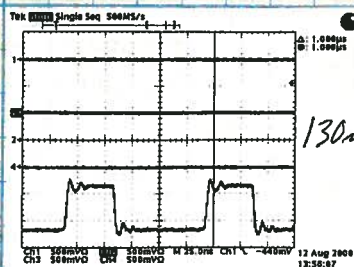


Fan In inputs & output

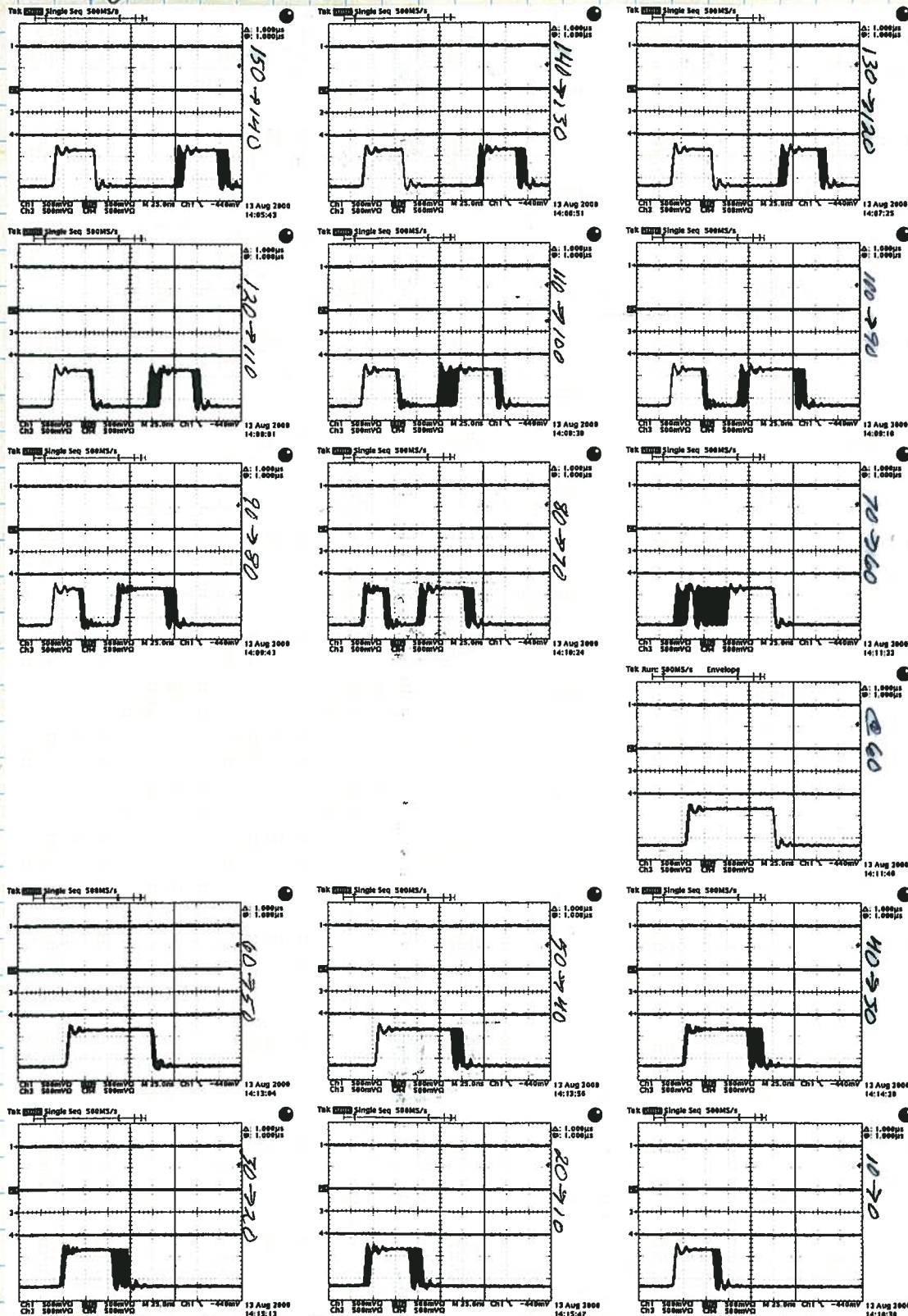


Time noted is 06535
delay setting for D output

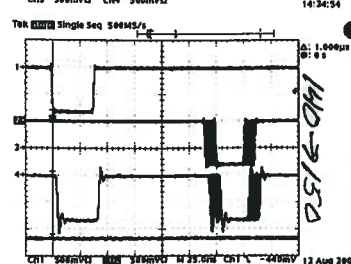
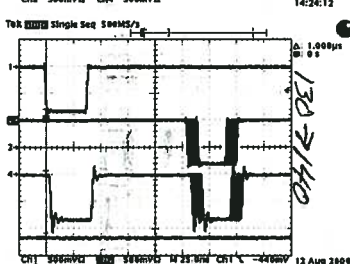
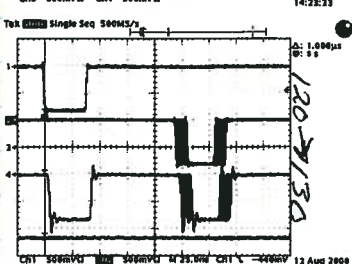
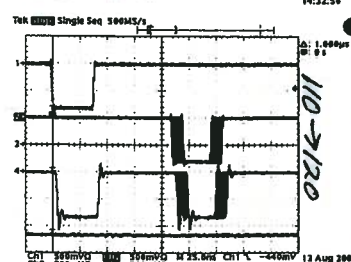
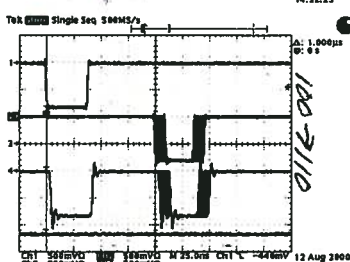
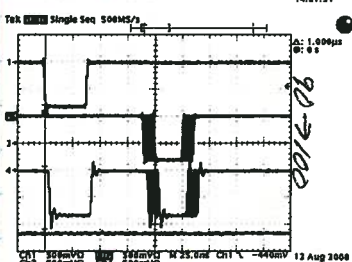
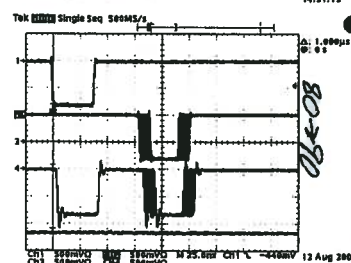
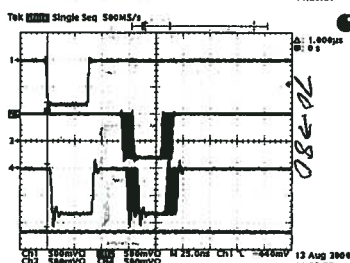
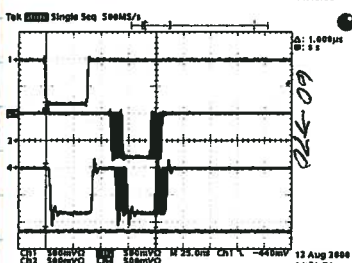
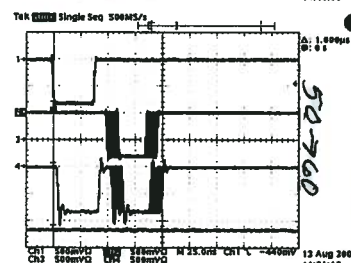
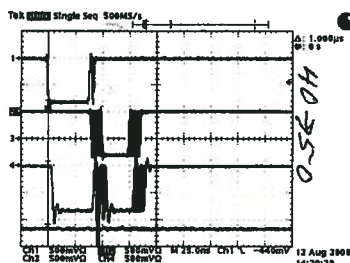
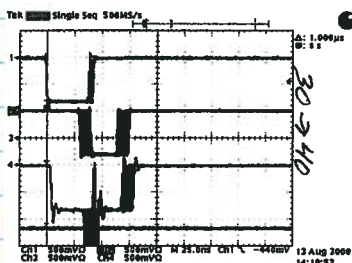
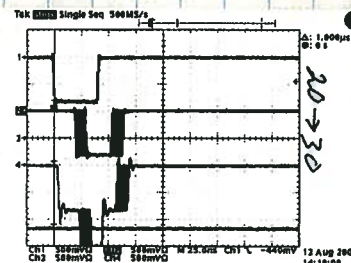
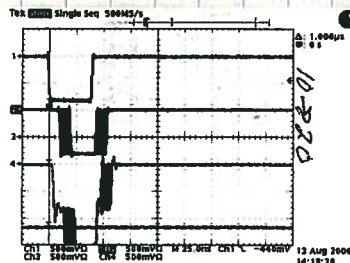
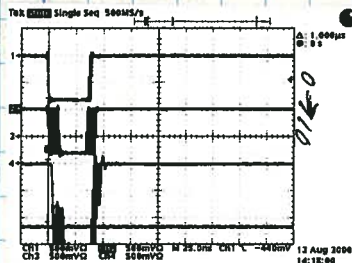
First did a run looking at
the PEC output, then a run
looking at the Fan In inputs
and output



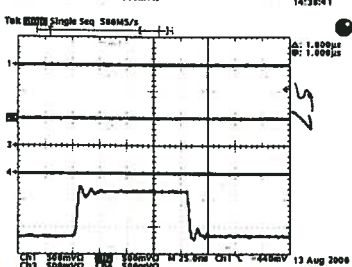
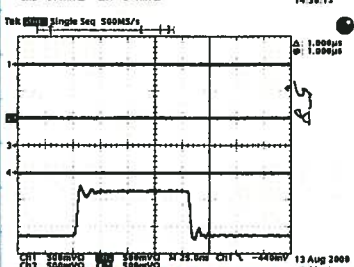
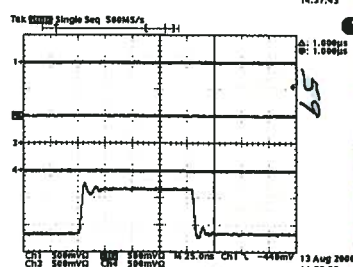
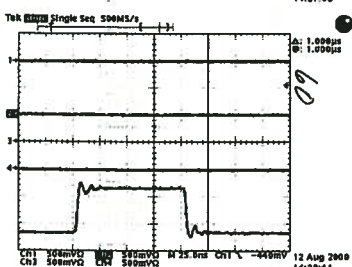
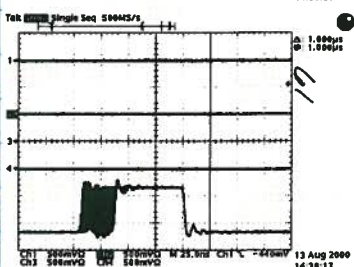
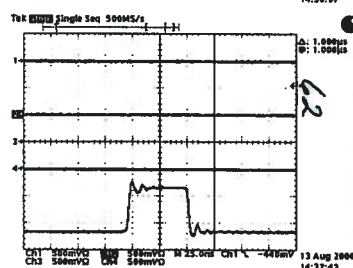
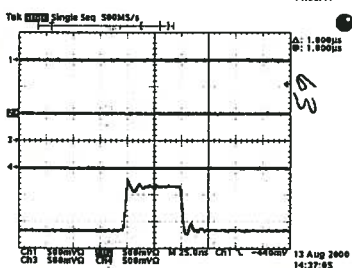
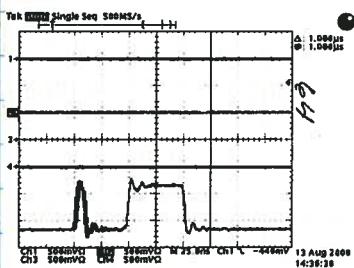
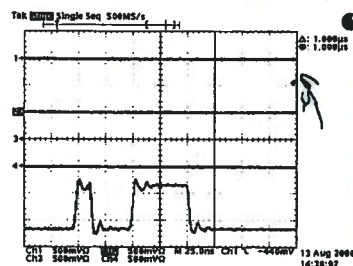
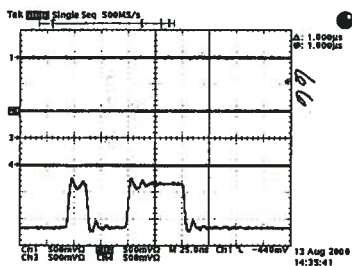
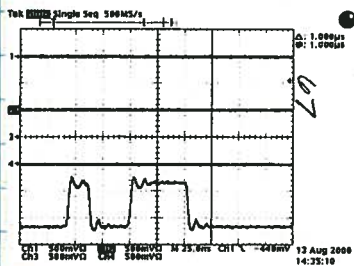
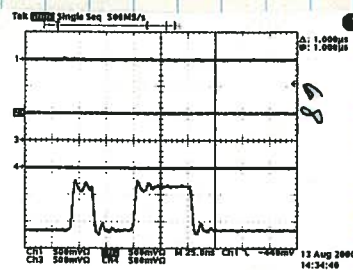
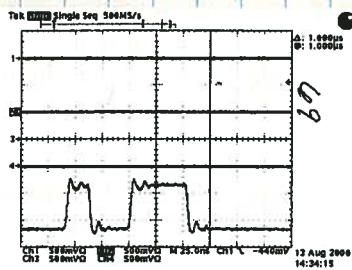
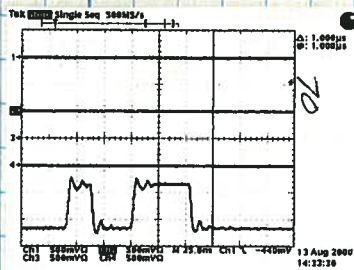
Same setup as on p 84 & 85. This time I changed the delay of D ~~width~~ during the scope acquisition. Thus start & finish are both on the same picture. Delay change as noted. Looking at PEC output.



same as p. 86 except fan in inputs & output.



Envelope mode set to 20 and delay not varied during acquisition. These dark bands indicate the output was not stable.
 PE Outputs
 Delay or not on pic.



Looking at the trigger point for p. 88 setup, I don't see anything strange on Ch1, Ch2, or Ch4 from 57-70ns

When delay is being reduced it starts to have an effect on the first output pulse at ~270ns delay.

With first pulse width set to ~50ns the second pulse does not make the first pulse drop out as seen in 63ns pic on previous page.

Also note a shift in the PEC output as the input pulse width is changed from ~50ns to ~30ns.

PEC output pulse is longer than input pulse. I can understand this!

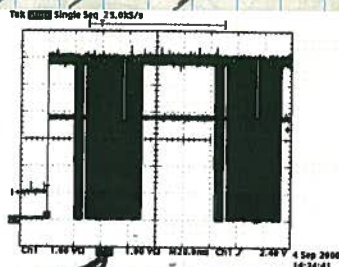
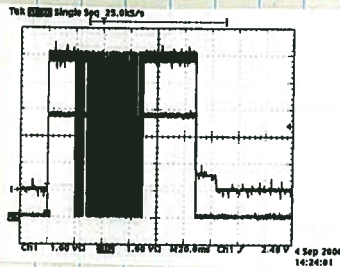
From ~95ns to ~50ns width on the PEC output the delay decreased by ~10⁺ns

With wider first pulses the 2nd pulse seems to affect mainly the trailing edge of the first pulse (till ~170ns delay.)

9/4/00

Okw electronics RF Transmitter & Receiver (AM)

Looking at demo boards from Okw. Scope FET probes are at data in & out pins of transmitter & receiver. Chan 1 of scope, upper trace, is data in of transmitter. Chan 2 is data out of receiver. Waveforms are taken when button, which causes data LED to light, is pushed.



button pressed briefly ↗

when button is held down
the sequence repeats, until
button is released

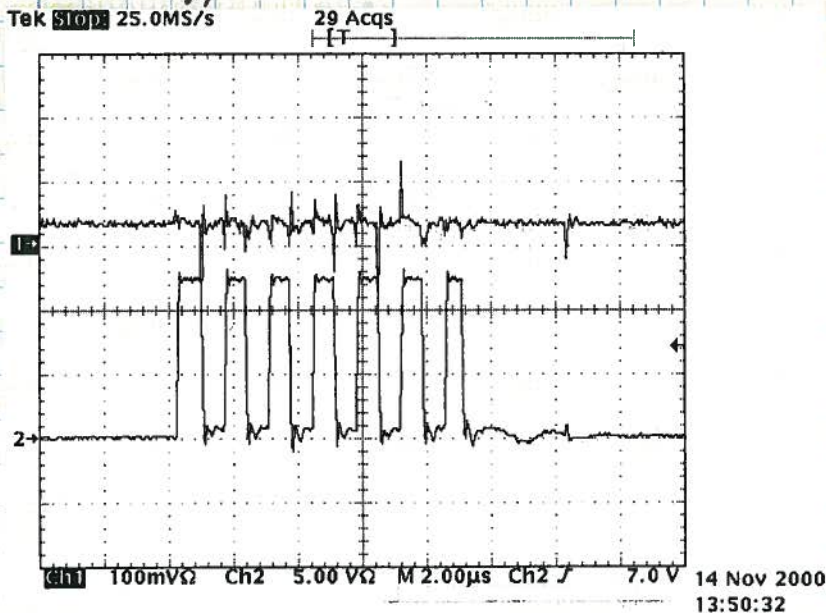
↑ data rate on demo board

Ultrasonic Level Switches

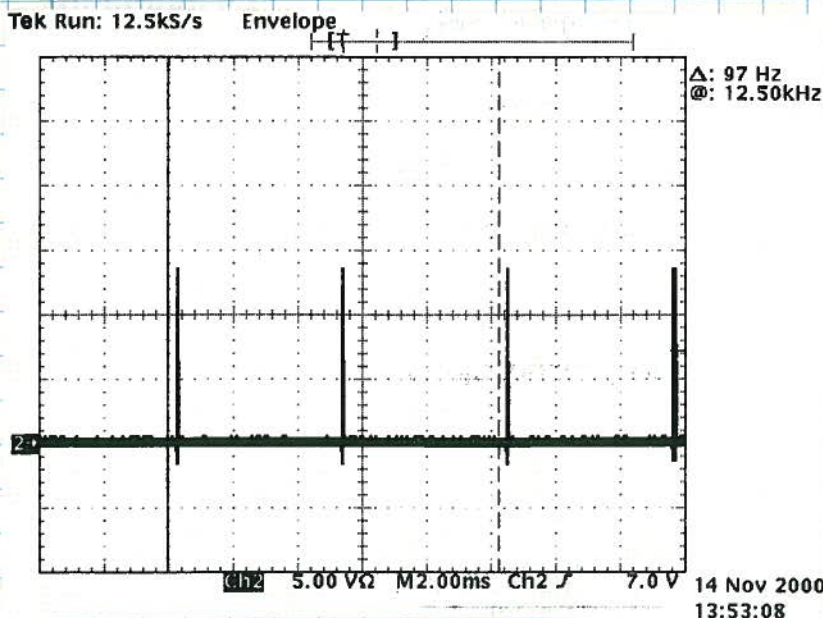
11/15

The other day I tried putting the level switches on the glass sight tube on the ethanol reservoir of the Hall & gas system. The glass tube shattered. I replaced it with a stainless steel $\frac{1}{2}$ " O.D. tube with a .018" wall. The switch sensor fits on the stainless tube ok. Corense says to use a coupling compound (eg. Vaseline). I put vacuum grease on it.

The two rotary switches on the board adjust the time of the window during which the signal is looked for. S2 & S1. S2 does the "big numbers", S1 the "little numbers". As shipped S2 is set at 6 and S1 is set at 0.

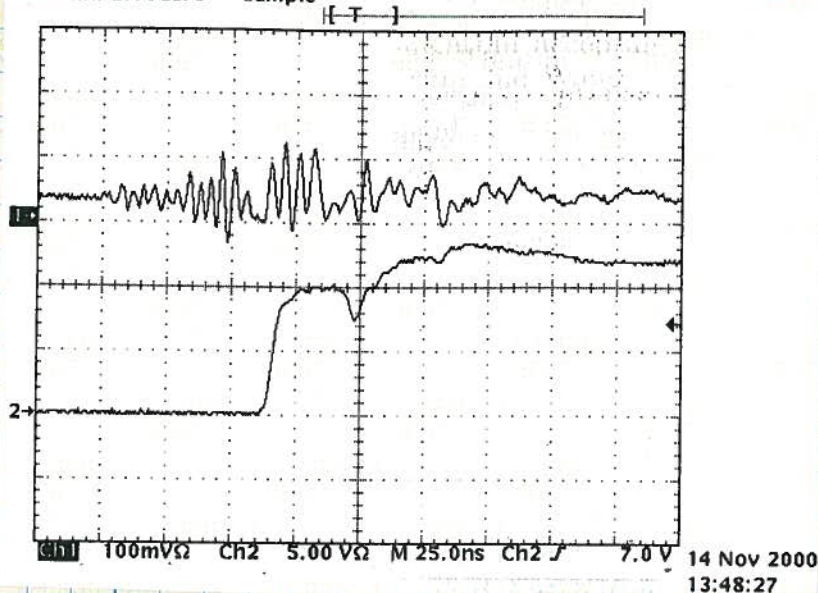


FET probe & TDS 754
Looking at driving signal. Ch1 is receiver.



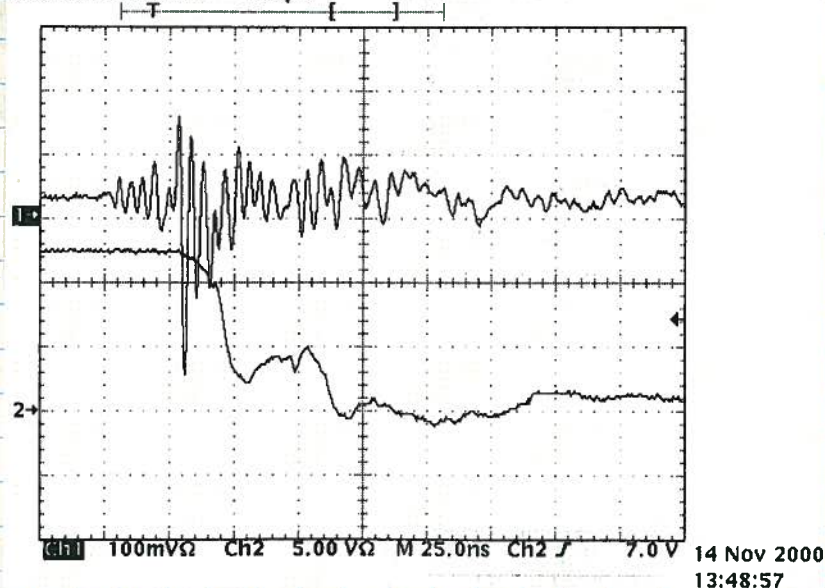
Repetition rate of driving signal.
Envelope set to 2

Tek Run: 2.00GS/s Sample



Leading edge of first pulse.

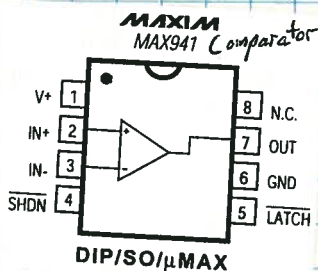
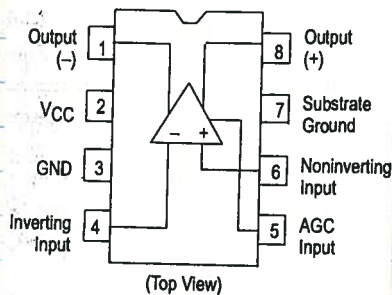
Tek Run: 2.00GS/s Sample



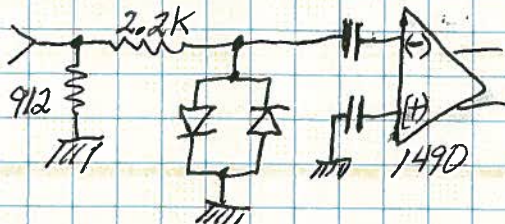
Trailing edge of first pulse.

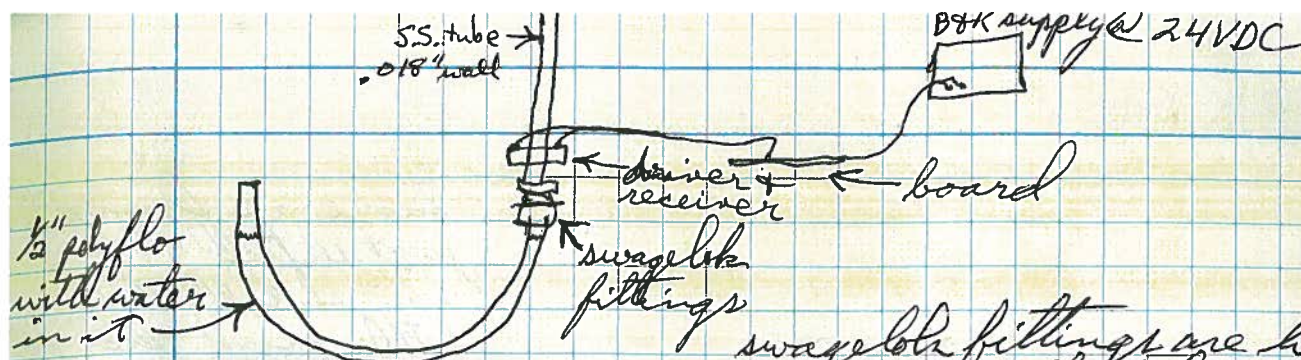
Noise on the receiver line seems to be from switching on the circuit board.

MC1490 PIN CONNECTIONS



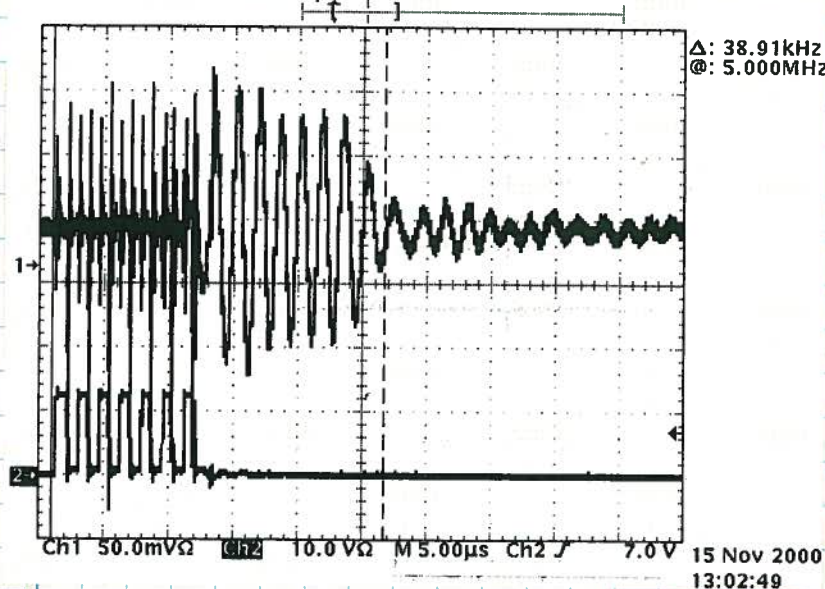
Chips & receiver input circuit.
Resistor values measured with a DMM. Can't make out the color codes.





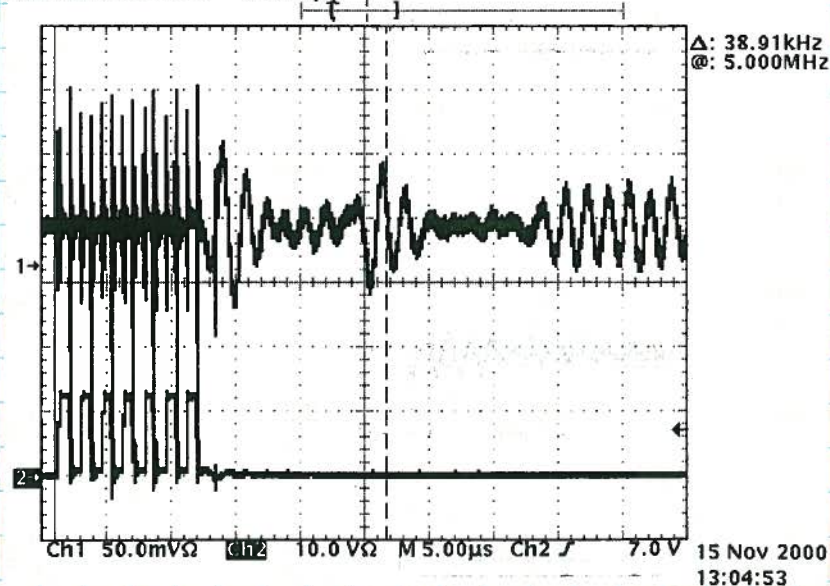
swagelok fittings are held in a vise to keep the tube vertical.
The free end of the polyflo tube is raised & lowered to raise and lower the fluid level in the SS tube.

Tek Run: 5.00MS/s Envelope

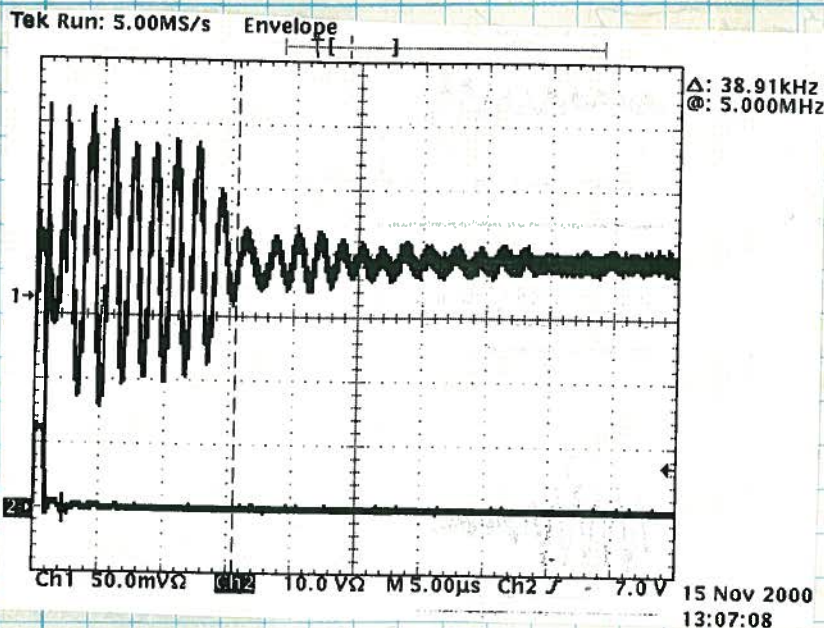


No water at sensor.
Water level below the sensor.

Tek Run: 5.00MS/s Envelope

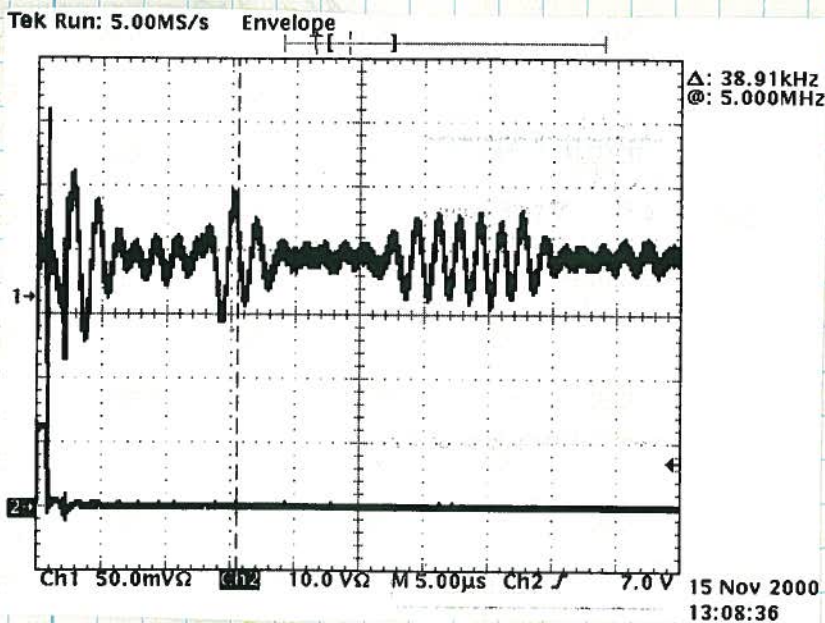


Water level above the sensor.



Same as from p.93.
Just shifted
horizontally to see a
little more after the
driving pulses.

Water level below
sensor.

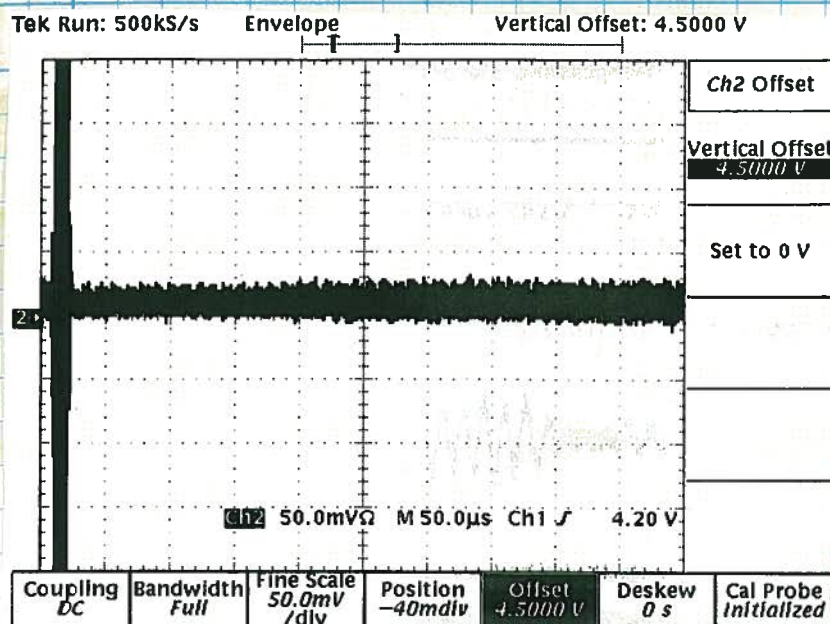


Water level above
sensor.

It looked like I was seeing something, but the circuit
wouldn't trip no matter what S1 & S2 were set to.
Well, it would occasionally trip with both at 0.

I went and got a piece of glass tubing of 1/3 mm
O.D. and 1.27 mm wall thickness. This is what
the board is supposed to be tuned for. Instead of
polyflo & a swage-on connection I clipped 4' of rubber
hose over the end of the glass tube. I got some
petroleum jelly to use for a coupling compound, because
that's what was recommended. S2 @ 6 & S1 @ 0.

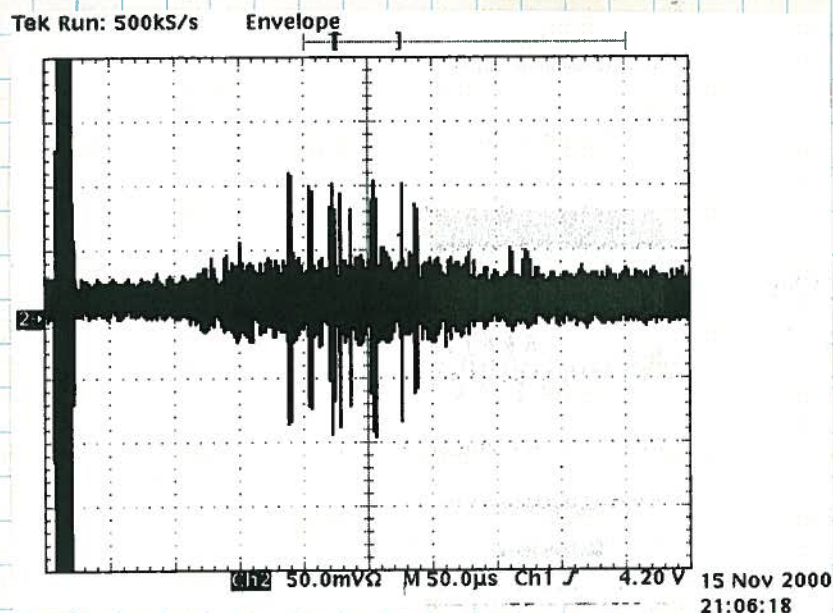
Using water in the hose the circuit would not trip.
Using isopropyl in the hose the circuit tripped reliably!



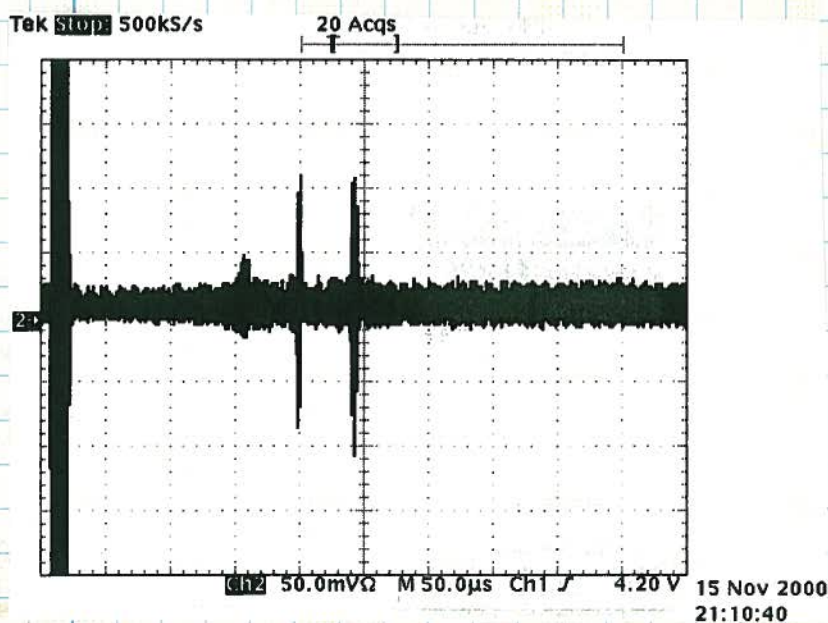
Triggering Ch2 on a test point near the processor on the board.

chlorophyll level below the sensor.

Ch 2 is taken at the input of the second 1490 amplifier (inverting input pin).

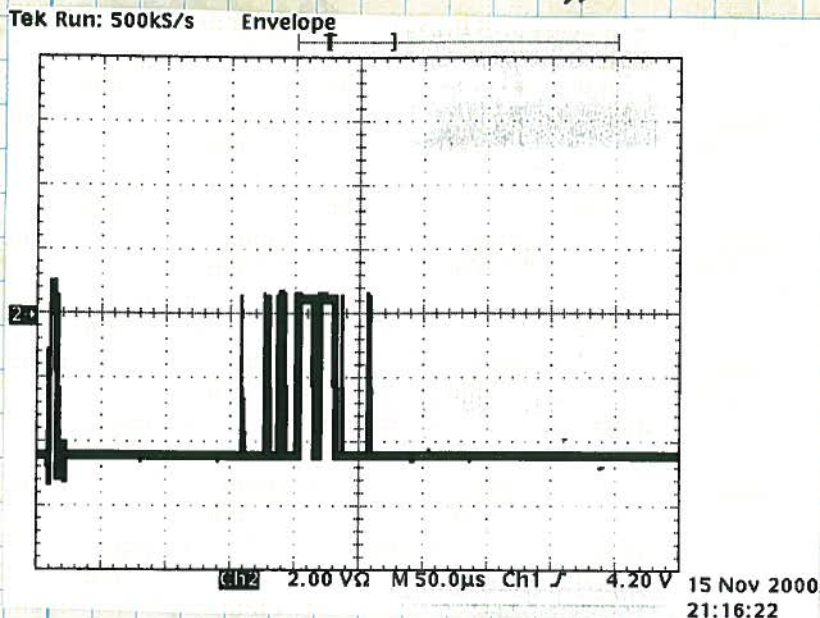


chlorophyll level above the sensor.

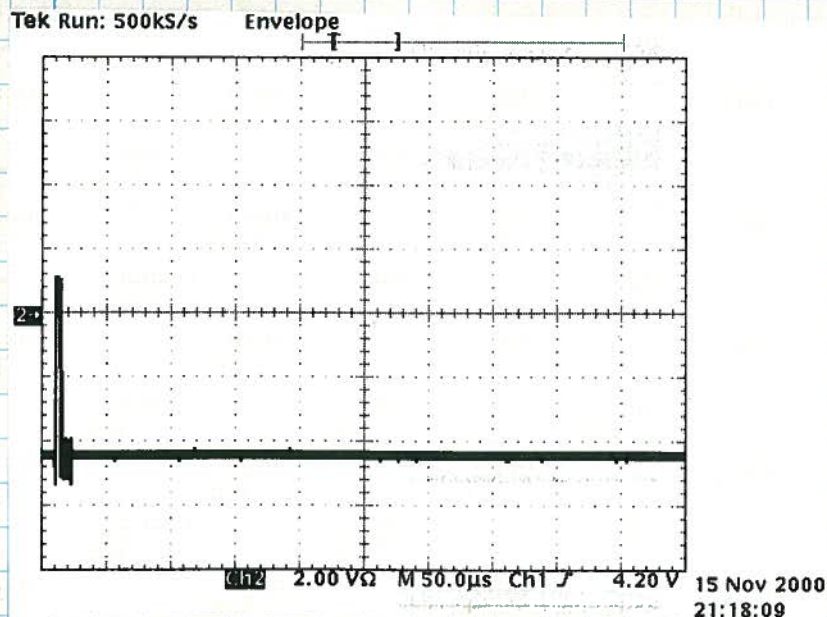


Water level above the sensor.
Peaks are not reliably there. I stopped the scope in order to make sure I got peaks in the picture.

Looking at test point after the comparator.
Ch2 still has the DC offset applied!



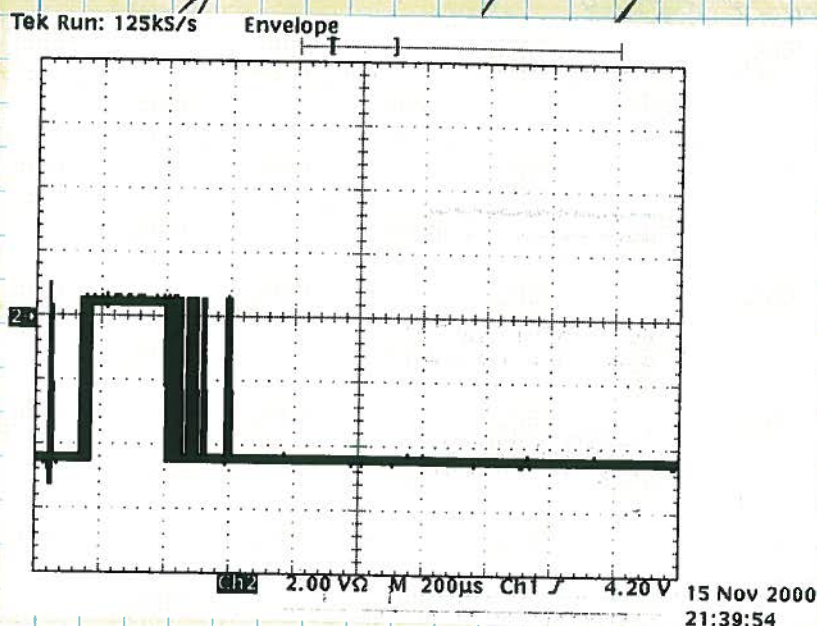
Isopropyl level above
the sensor.
Circuit has tripped
and seems reliable.



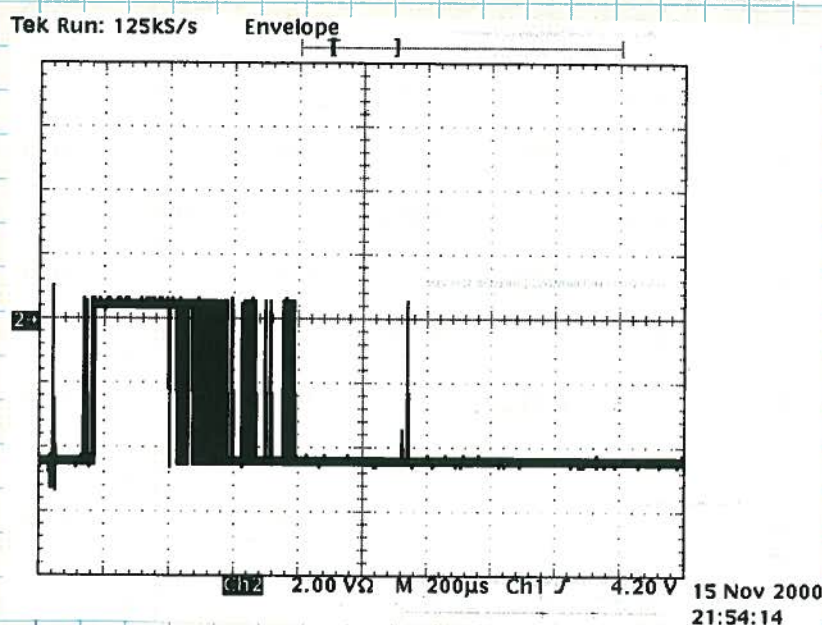
Water level above the
sensor.
Circuit does not trip.

Going back to the thin walled S.S. tube I looked at the signals with isopropyl. It gave nice signals when the level was even with the sensor. But, if the level was above the sensor the signal changed and no longer had an amplitude to trip the circuit! This is a very interesting device. I got some thicker walled $\frac{1}{2}$ " O.D. S.S. tubing. Put a swagelok fitting on one end and attached the polyflo tube. Mounted it in the vise.

Looking at the test point after the comparator



Isopropyl level above
the sensor.
Circuit trips reliably
with S1@5 & S2@3

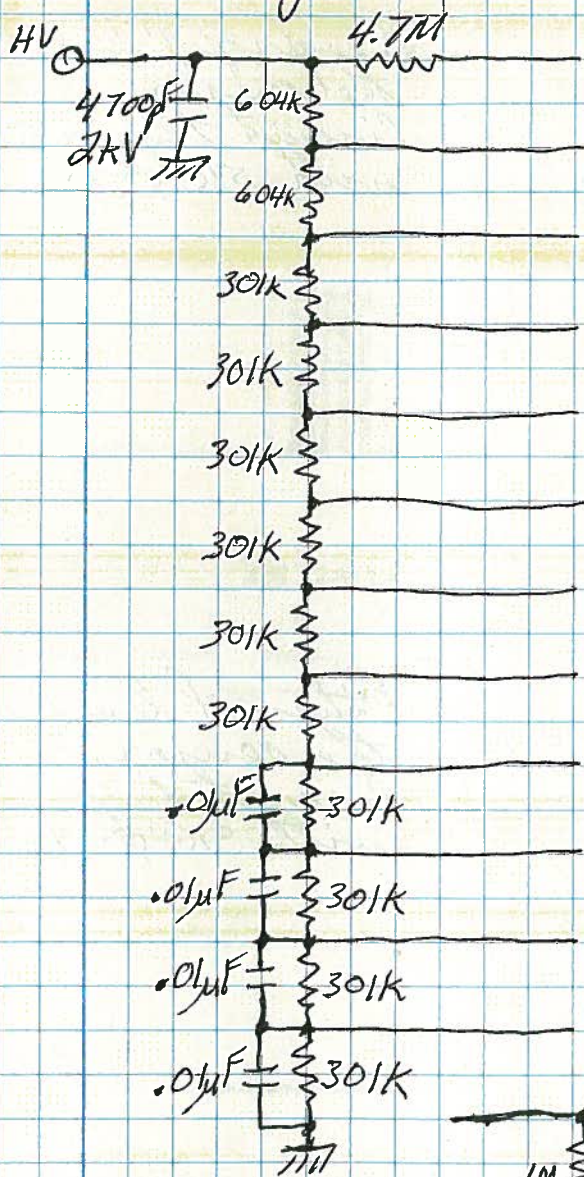


Ethanol level above
the sensor.
Circuit trips reliably
with S1@5 + S2@4

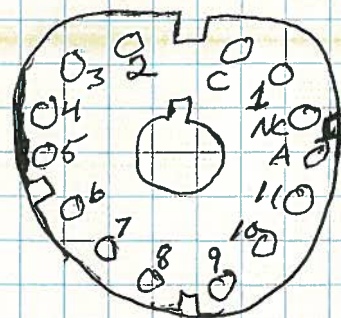
From playing with the S2 setting with the ethanol signal it looks like S2 shifts the timing window by about 50 μs per setting. This is just a rough guess. As the level slowly drops the first spike or two drop out and switching S2 between 3 & 4 seems to make 50 μs of difference somewhere.

1/14/01 Photonis VD202K/01 Base

Looking at SN:00014



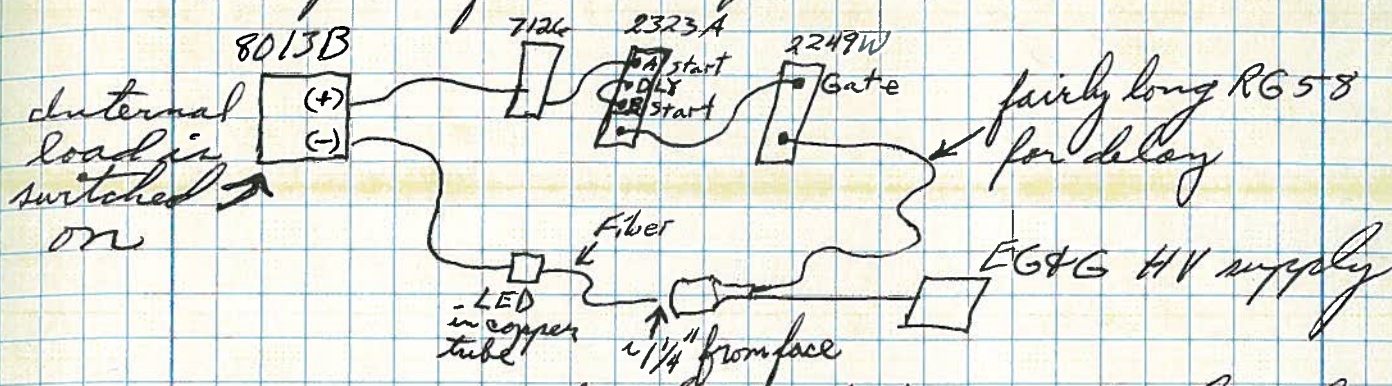
Looking at the face of the socket



This is the base Bogdan bought for the XP2050 tubes for the Pb-glass.

Comparison of 8854 and 4572 Assemblies

I reassembled the dark box setup for looking at the single photoelectron response of the 8854.
(see p. 32 of Lab Techniques III)



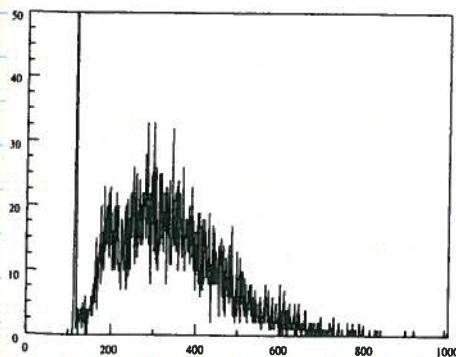
8013B (+) output is set to TTh level and sent into level converter input. This eliminates the 7106 from the previous setup.

The base I used for the 8854 was the one from INEN SN 5A694-00226. I measured 252.5 Ω on the potentiometer on the output.

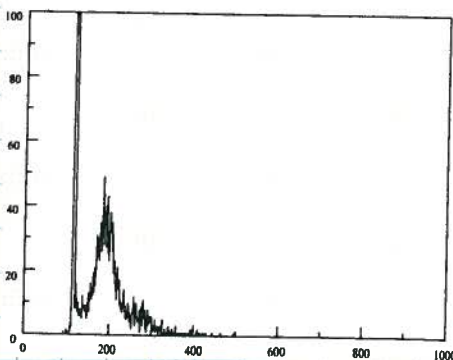
The base I used for the 4572 was SN:14 with the amplifiers added.

I played a bit with the HV and LED driving pulse width and amplitude.

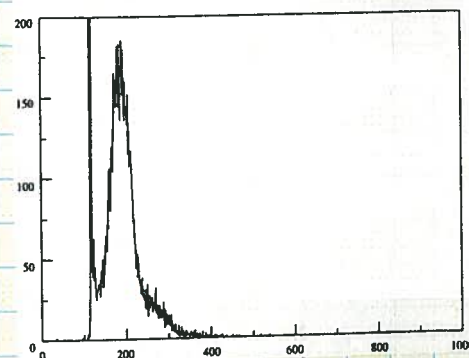
8854_25a.dat



8854_25c.dat

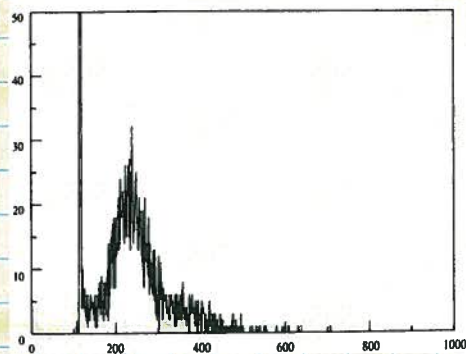


8854_25e.dat

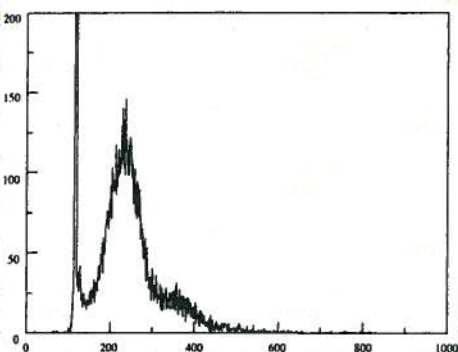


There, and the next, plots are included only to show typical distributions. LED driving pulse width & amplitude was not recorded.

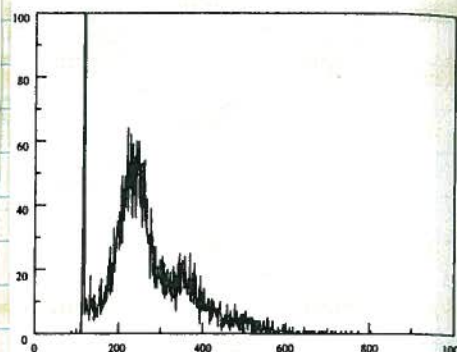
8854_26a.dat



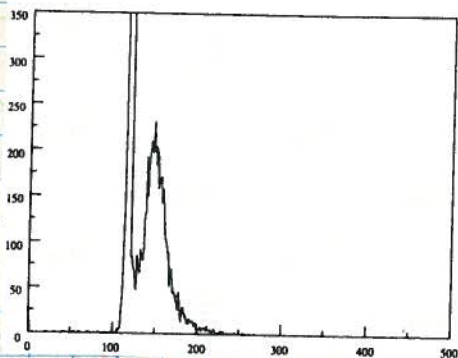
8854_26b.dat



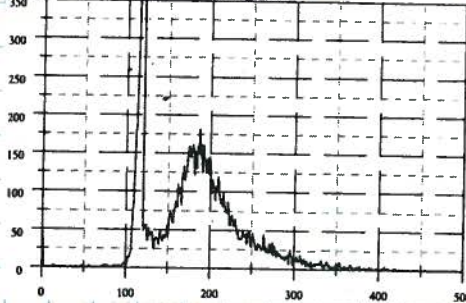
8854_26g.dat



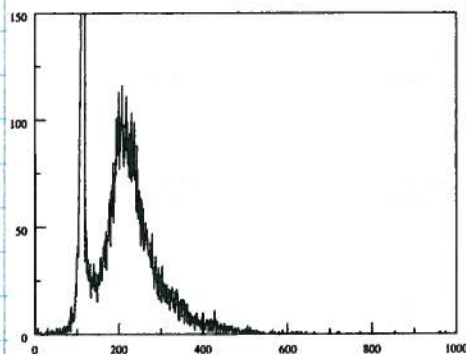
4572_19a.dat



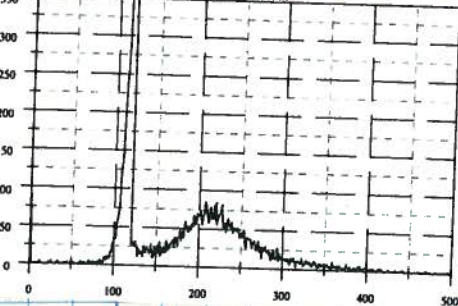
4572_21a.dat



4572_22b.dat

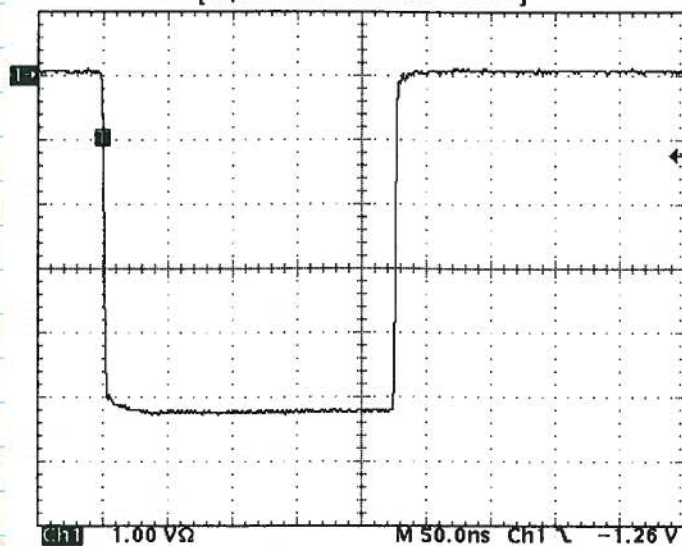


4572_22a.dat



Tek Run: 1.00GS/s

Sample



1.00 V

M 50.0ns

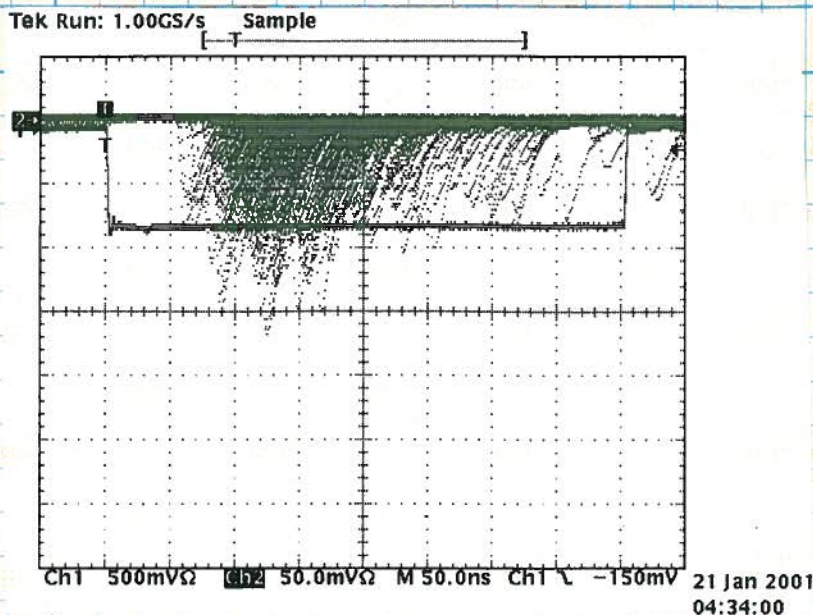
Ch1

-1.26 V

21 Jan 2001

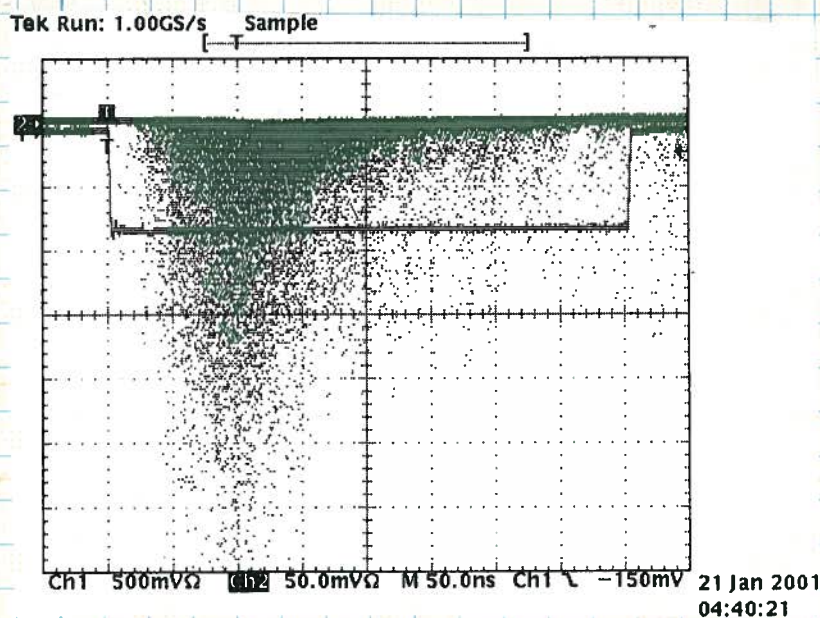
13:36:26

This is the LED driving pulse & settles on.

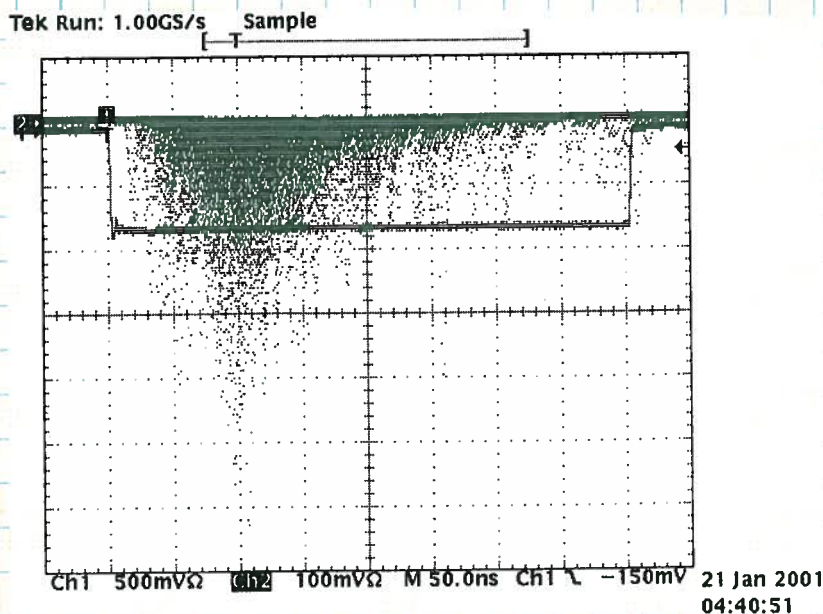


PMT pulse positions
with respect to ADC
gate pulse. Display
was 2 seconds off
persistence.

← 8854 tube

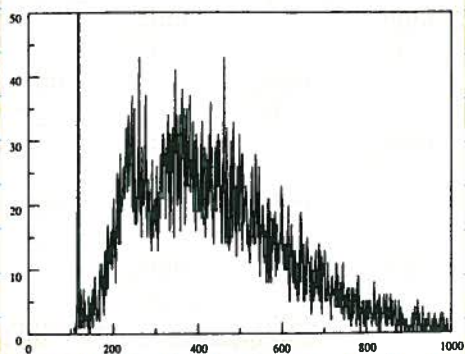


← 4572 tube



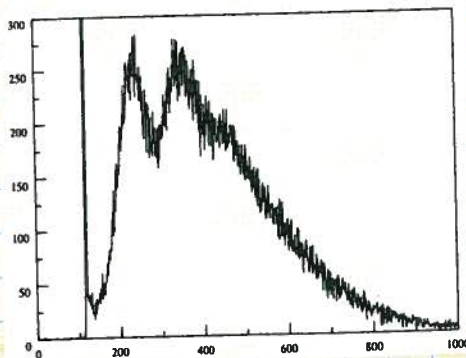
← 4572 tube
vertical peak on scope
was changed.

8854_26h.dat



12,000 pulses

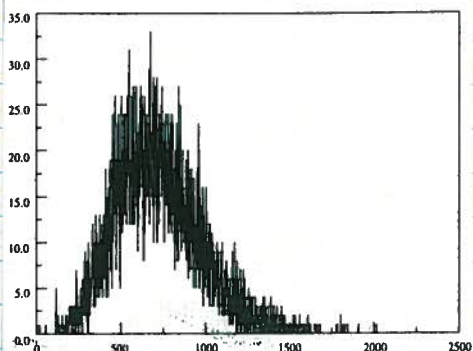
8854_26j.dat



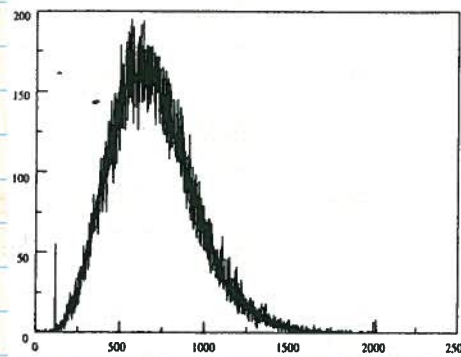
100,000 pulses

8854 tube
at -2600V

4572_22h.dat

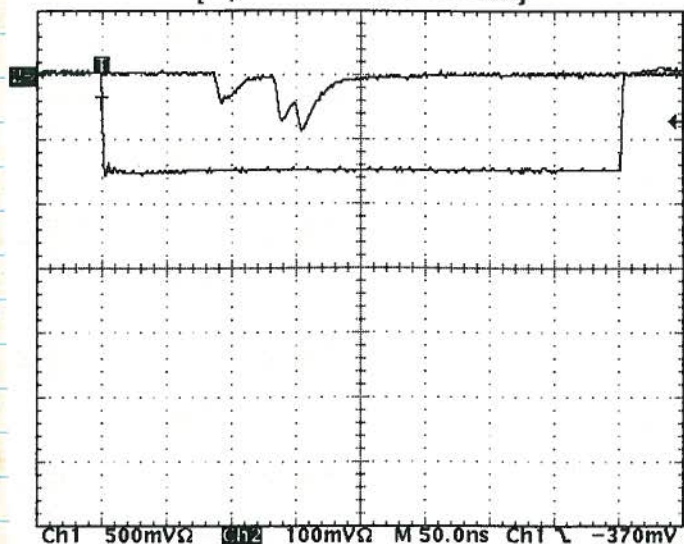


4572_22j.dat

4572 tube
at +2200V

I took some pictures of typical pulses. I pushed the "hardcopy" button at random, i.e. pulses were not "selected".

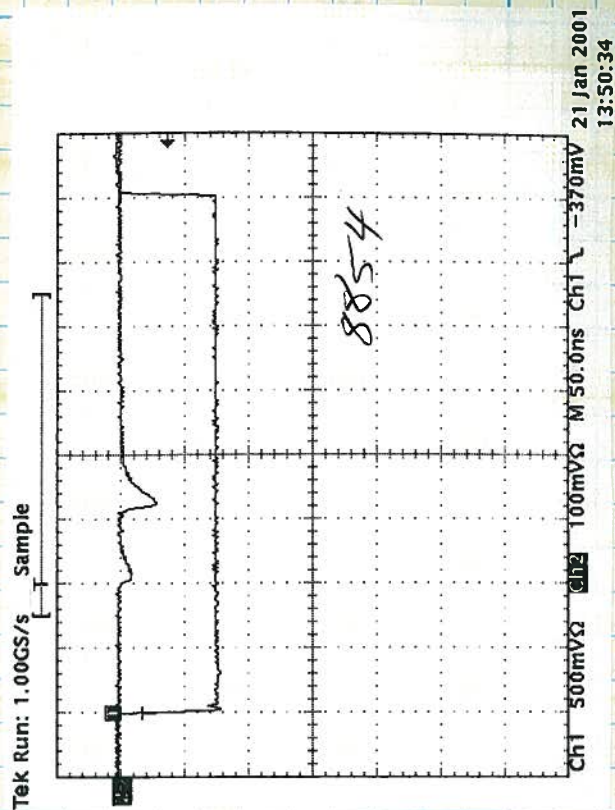
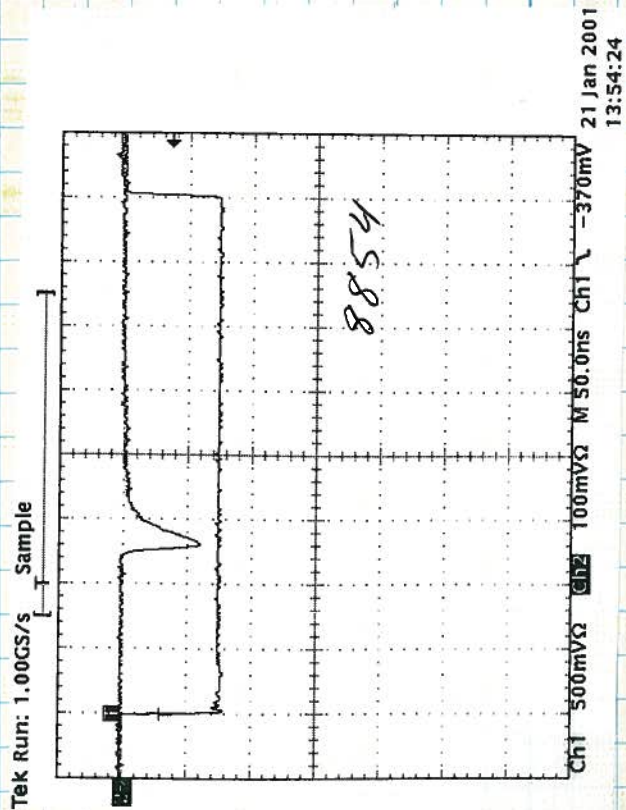
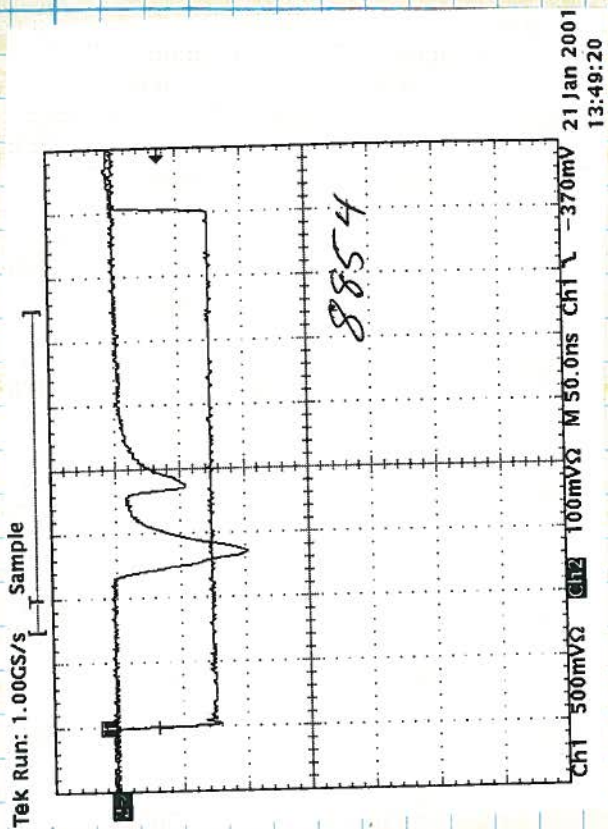
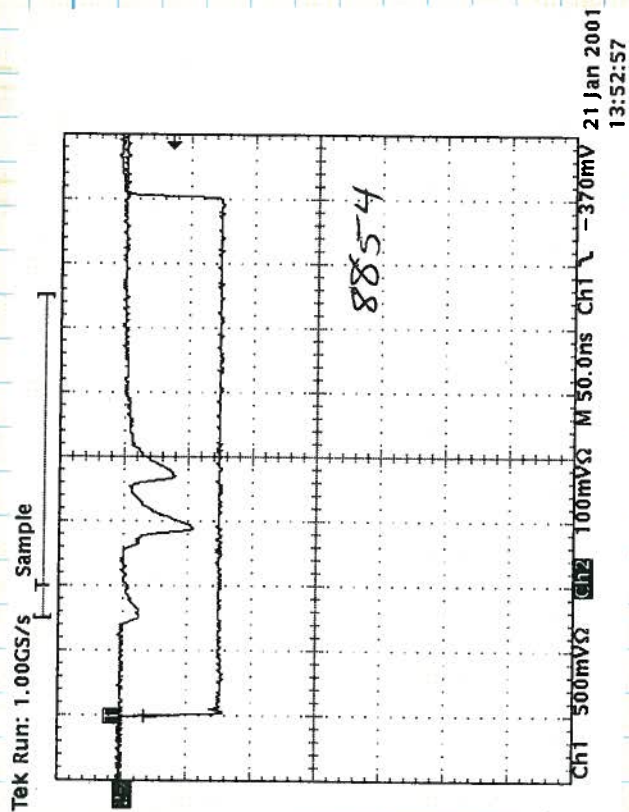
Tek Run: 1.00GS/s Sample

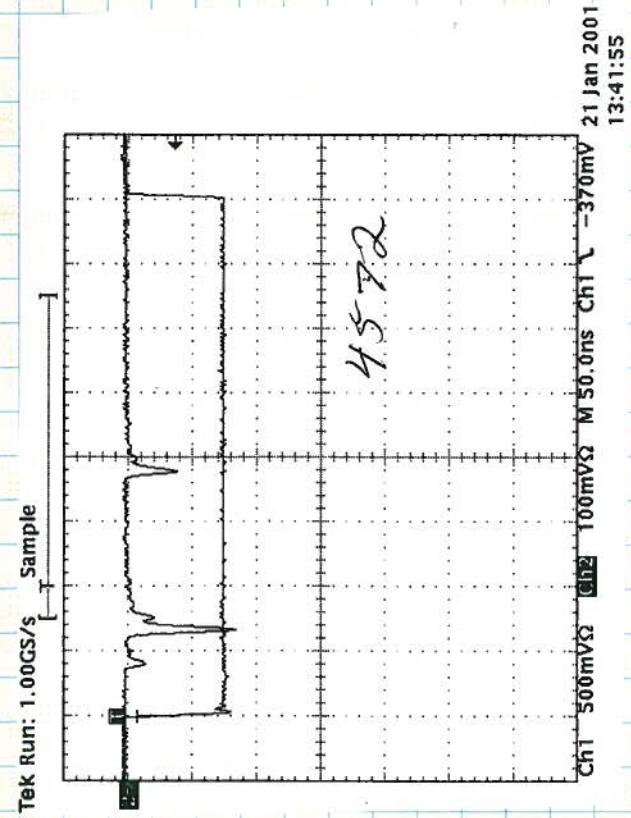
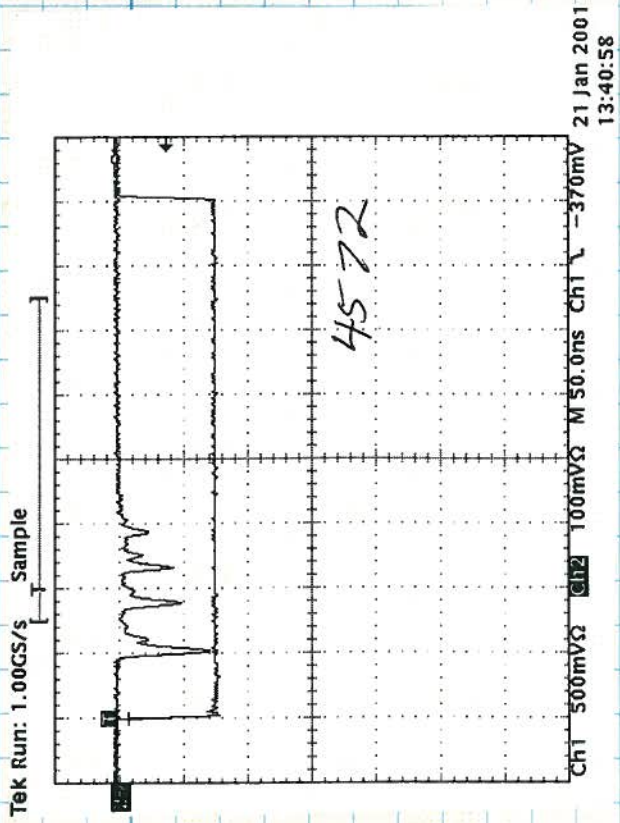
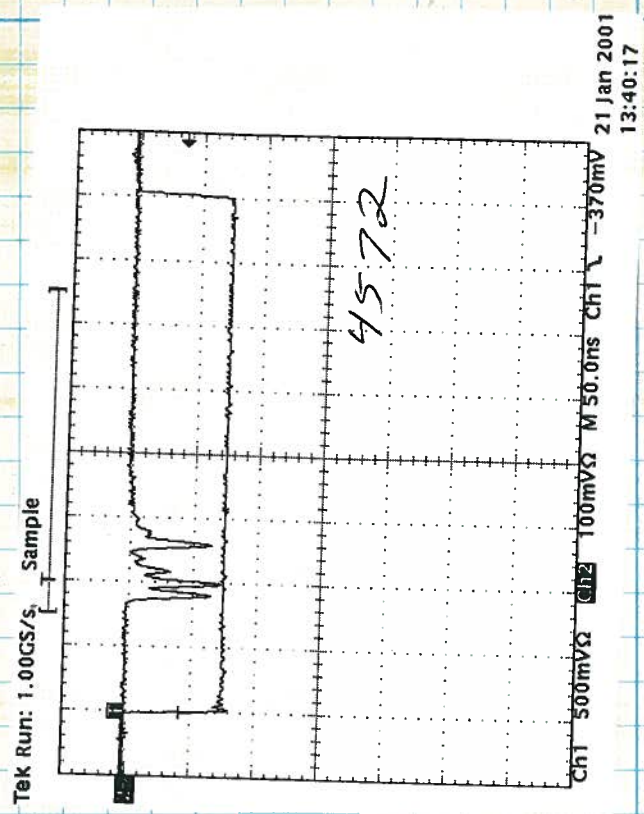
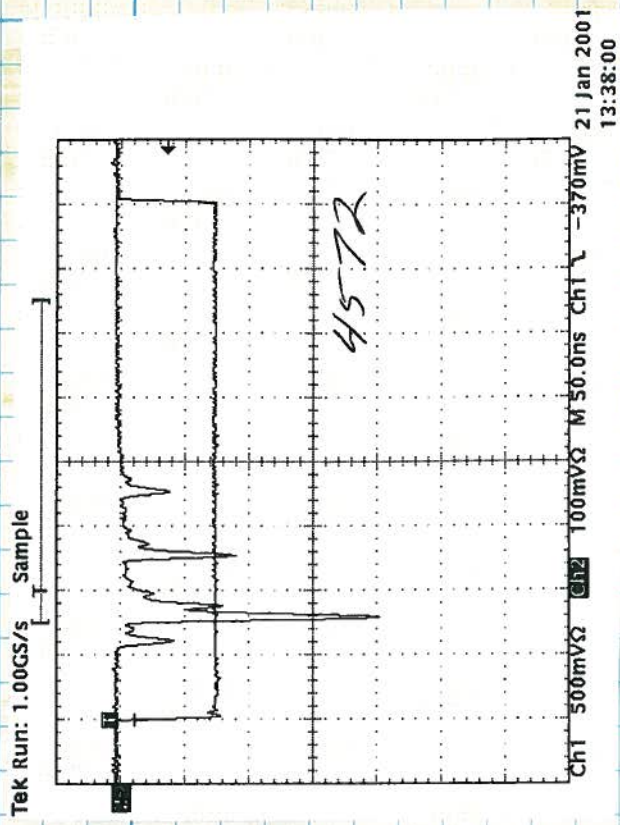


8854

I took 20 pictures of each tube. All 4 for the 4572 had a pulse on them. 3 of those for the 8854 had not discernable pulse on them.

Ch1 500mVΩ 0.52 100mVΩ M 50.0ns Ch1 L -370mV 21 Jan 2001 13:48:23





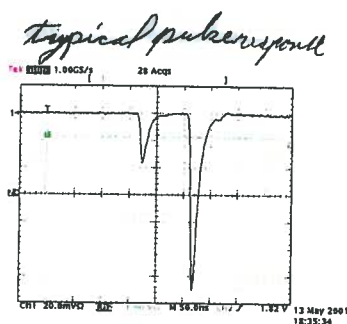
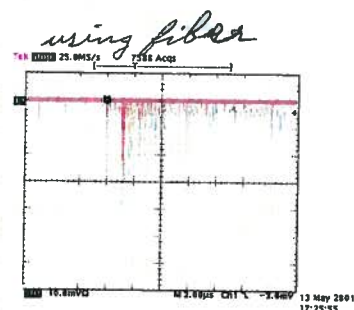
Quick Check of "Noisy" 8854s

5/16

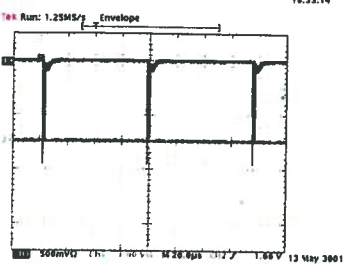
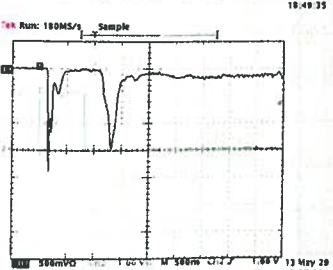
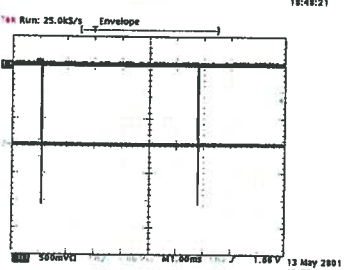
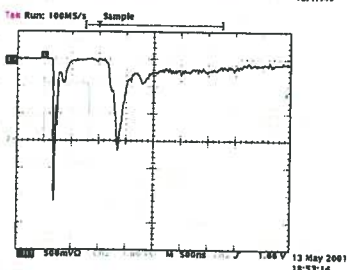
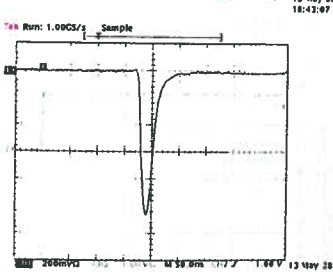
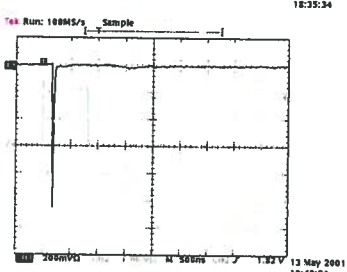
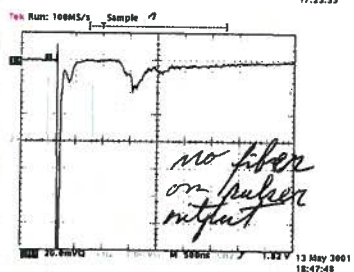
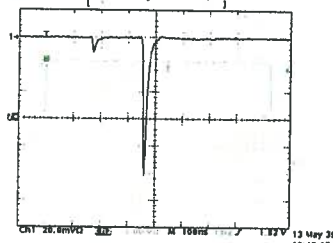
Bogdan had a student looking at the 8854's lying around the lab. He reported that all the tubes were "noisy" and had poor "quantum efficiency." I set up the avalanche pulser in my dark box.

Initially I put a long optical fiber on the output of the pulser. There was a reflection or something in the fiber setup. I ended up just putting the pulser directly in front of the 8854. About 3" from the face of the tube.

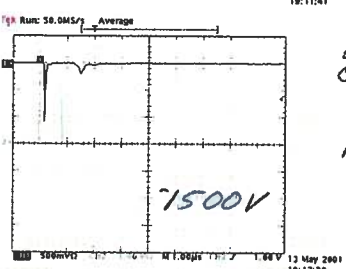
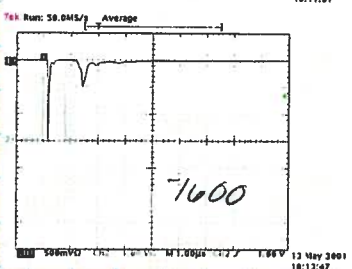
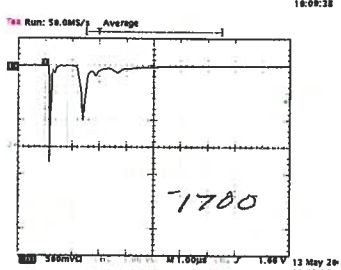
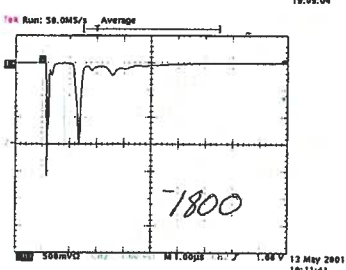
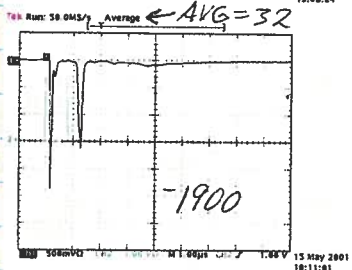
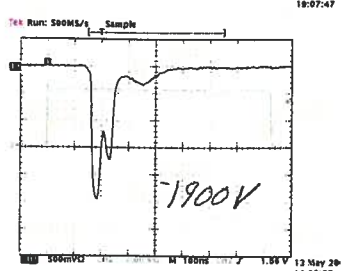
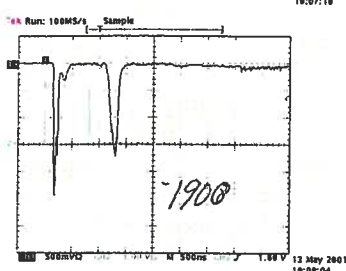
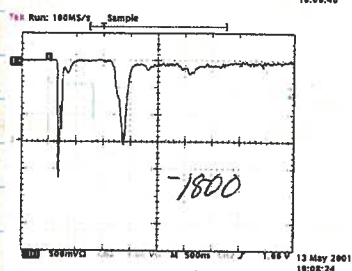
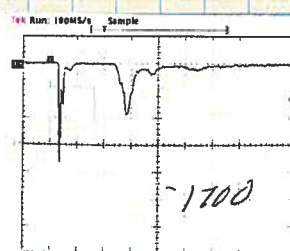
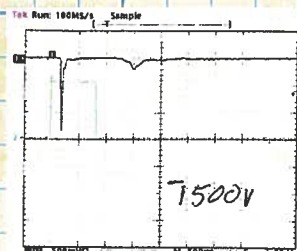
Ch 2 is the (+) channel of the 8013 used to trigger the pulser.



Typ. resp. with extra pulse through fiber

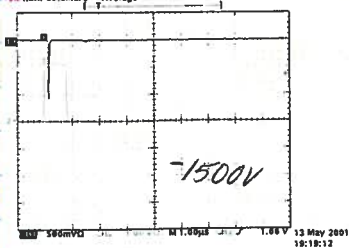


There are from tube N32516

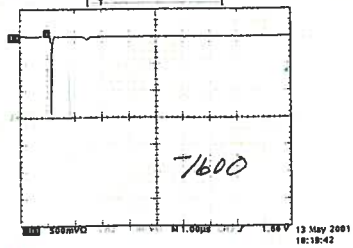


These are from tube
N32158

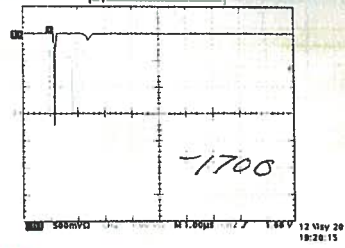
Tek Run: 50.0MS/s Average **AVG=32**



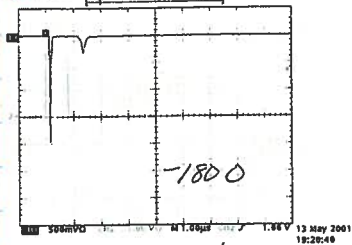
Tek Run: 50.0MS/s Average



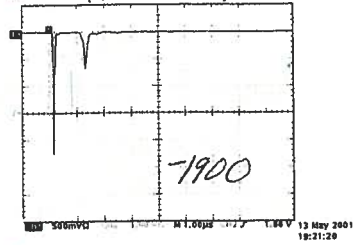
Tek Run: 50.0MS/s Average



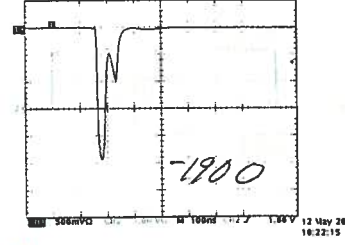
Tek Run: 50.0MS/s Average



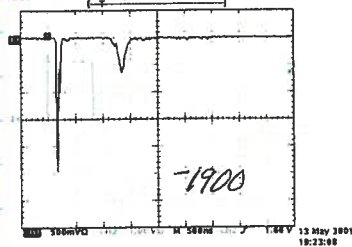
Tek Run: 50.0MS/s Average



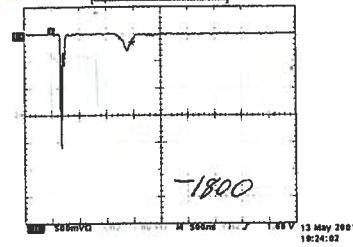
Tek Run: 50.0MS/s Average



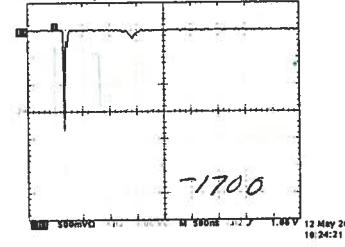
Tek Run: 100MS/s Sample **← note**



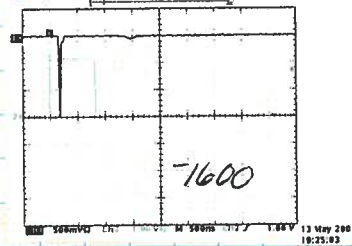
Tek Run: 100MS/s Sample



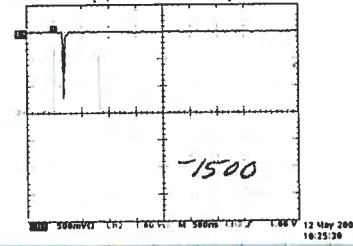
Tek Run: 100MS/s Sample



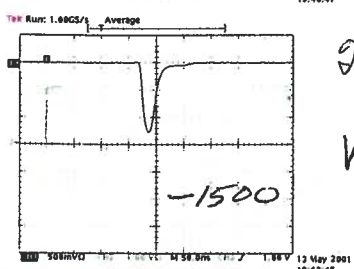
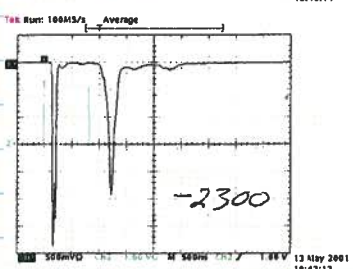
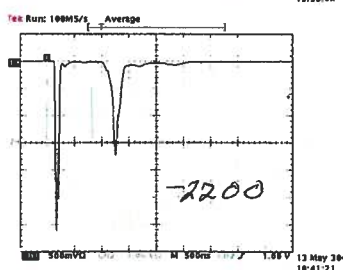
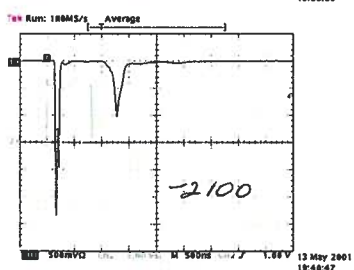
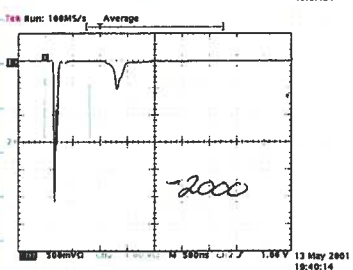
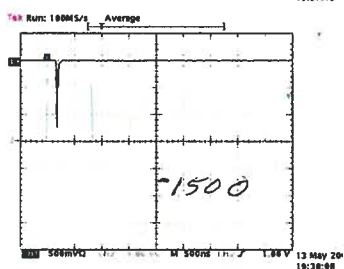
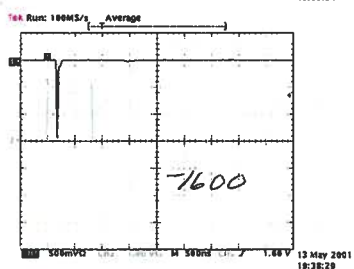
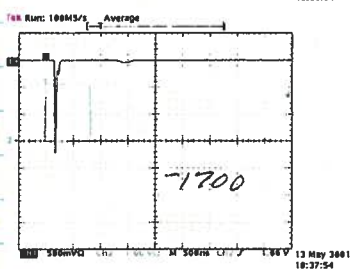
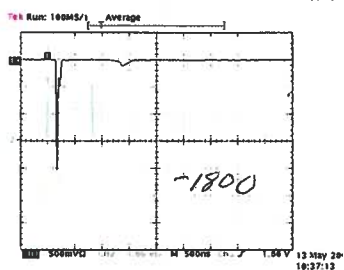
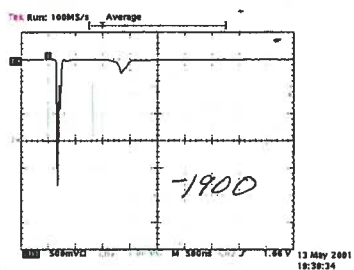
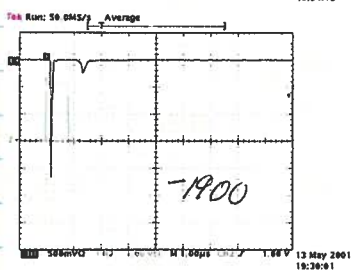
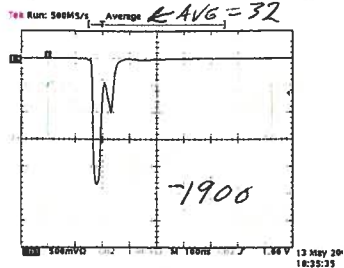
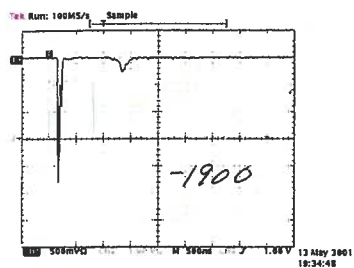
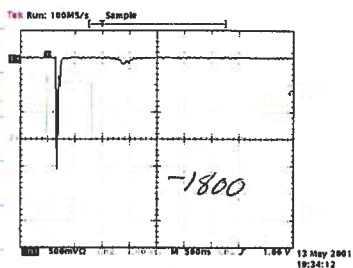
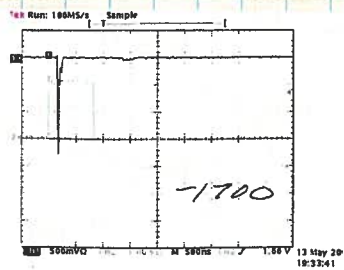
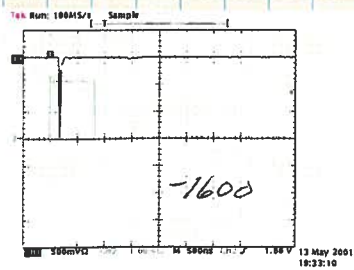
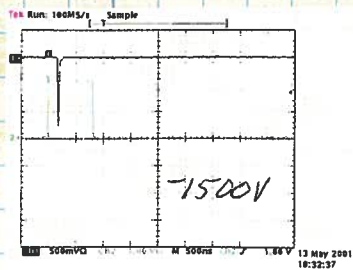
Tek Run: 100MS/s Sample



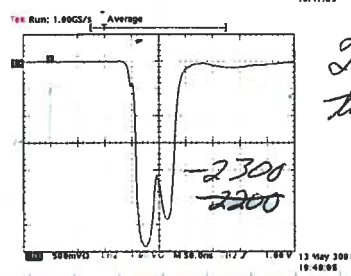
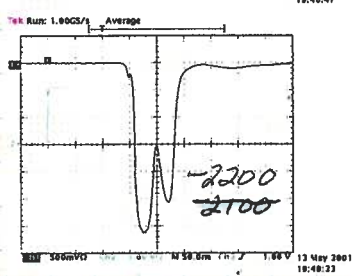
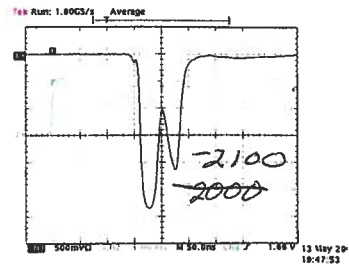
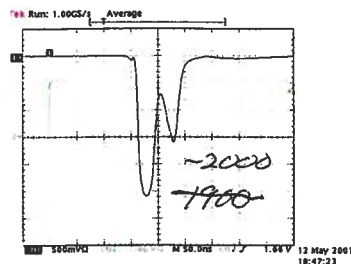
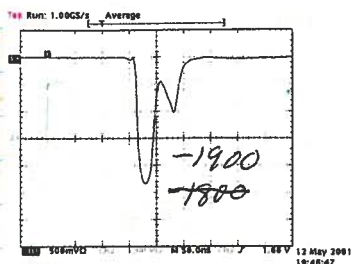
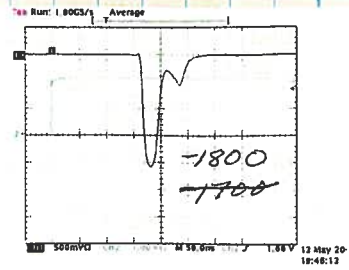
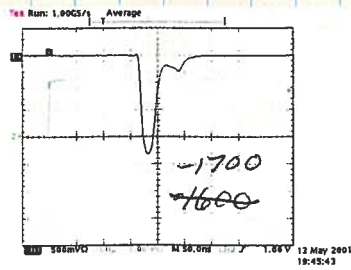
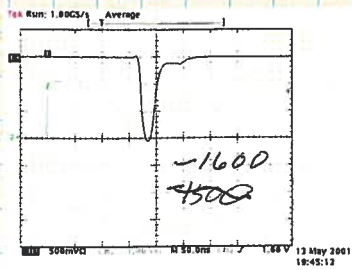
Tek Run: 100MS/s Sample



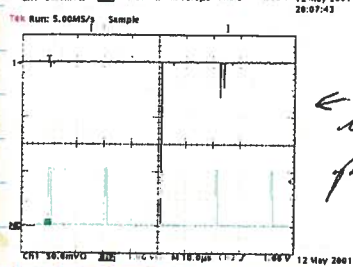
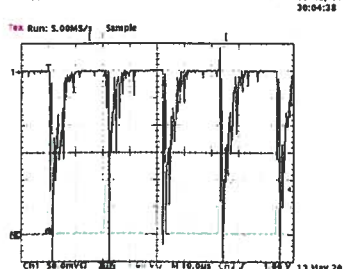
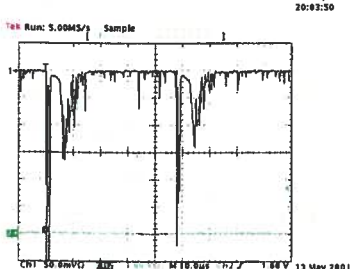
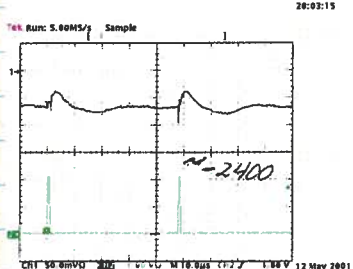
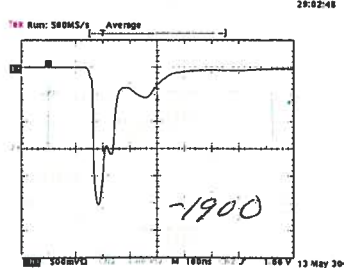
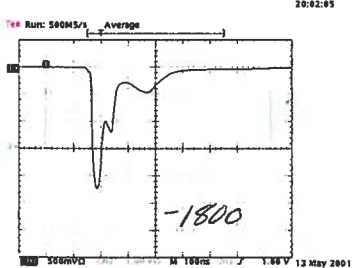
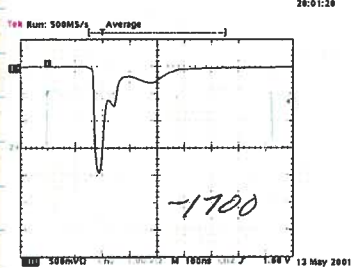
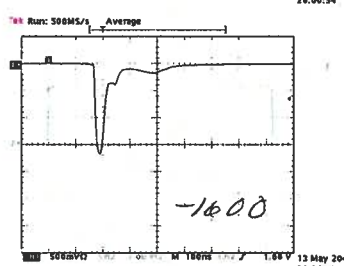
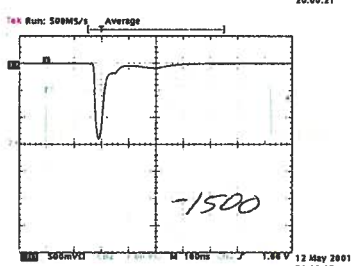
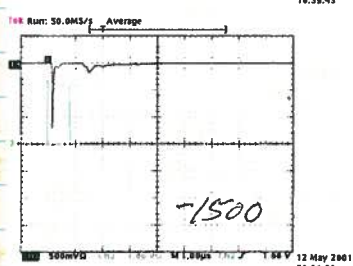
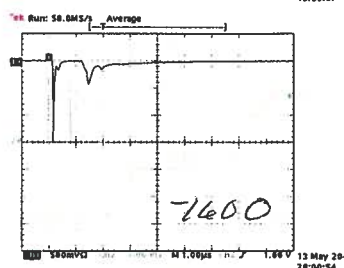
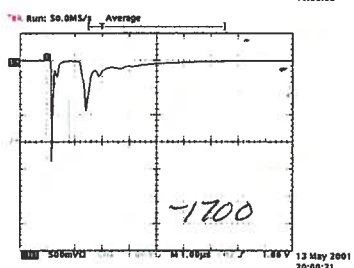
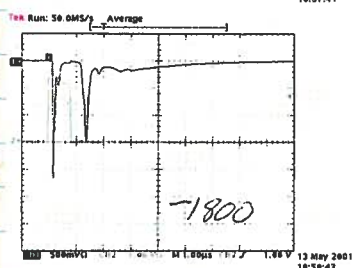
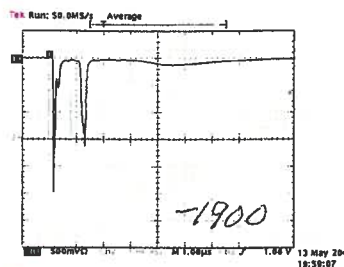
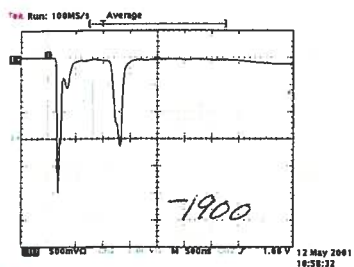
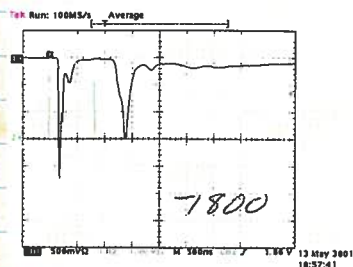
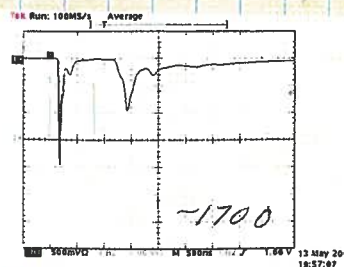
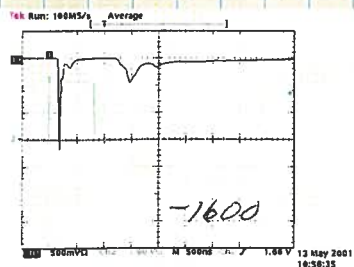
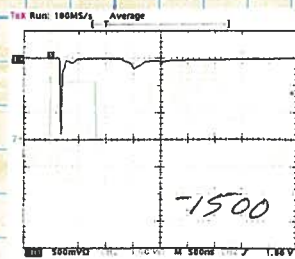
These are from tube
V026393



These are from tube
V026395

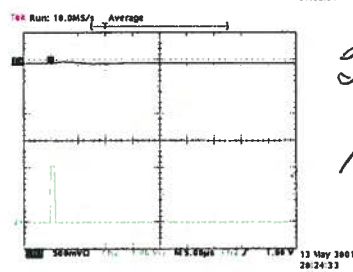
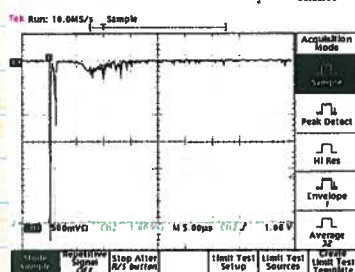
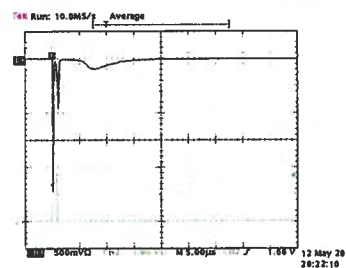
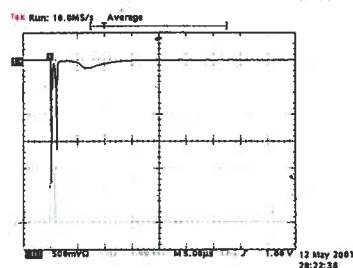
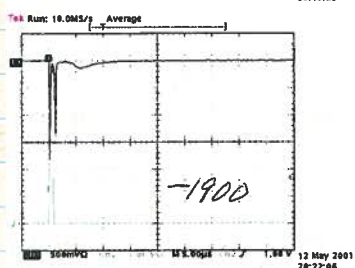
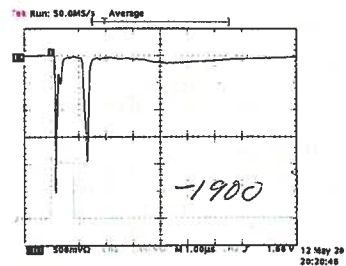
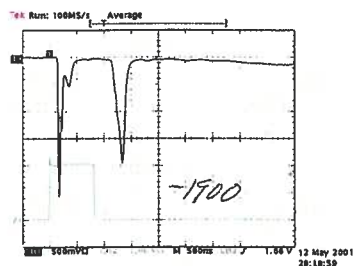
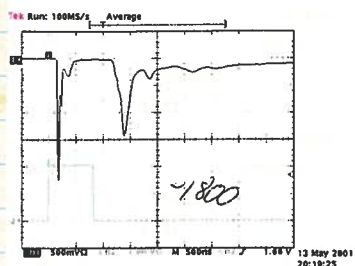
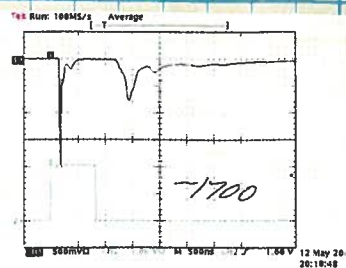
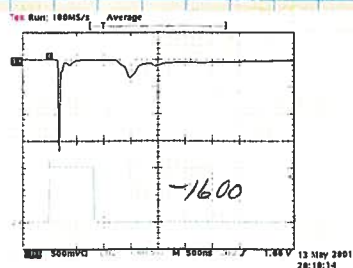
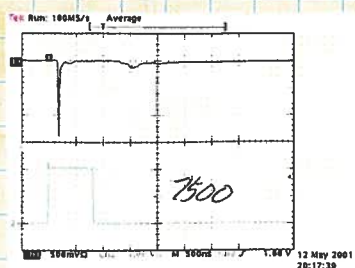


There are also from
tube V026395



← limit of avalanche
pulse repetition
rate?

These are from
tube
N90868



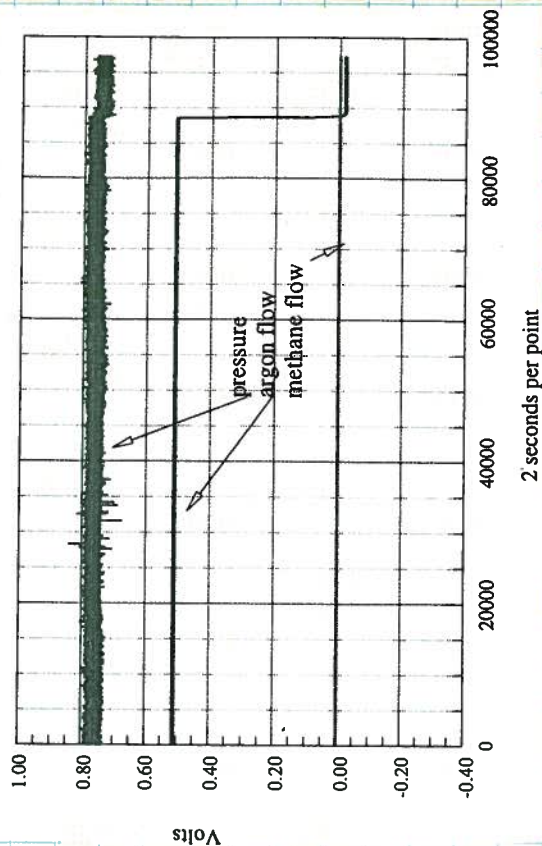
These are from tube
F74219

date	serial number	High Voltage	Single Electron Peak Amplitude (mV) (SEPA)	Signal Amplitude (V) (SA)	Shape	Ratio $\frac{SA}{SEPA}$	Noise Frequency (kHz)
04/02/01	C68335	2400	10	0.850		85	20
"	CO68338	2100	10	0.500	good	50	1
"	VO26393	2200	10	0.420	good	42	0.5
04/04/01	N32158	"	15	1		67	470
04/06/01	N32744	2000	6.8	0.247		36.3	30
"	F72608	2000	11.83	0.403		34	(*04/10/01 : 5kHz)
"	F72603	2000	8.93	0.446		49.9	25
"	VO26395	2200	28.6	0.846	noisy	29.58	33
"	U33859	2000	7.33	0.256	"	34.9	4.2
"	CO69130	1900	6.20	0.155	noisy	25	(*04/10/01 : 0.300kHz)
"	F72592	2000	11	0.596	"	54.18	50
04/10/01	N90868	2000	21.8	0.84	good	38.5	1.3
"	F74219	2100	17.2	0.570		33.1	24
"	N90037	2100	20	0.563	noisy	28.15	6
"	JO81255	2000	10	0.331	"	33.1	20
"	JO94791	2000	12.8	0.231	"	18	5
04/11/01	N90040	2000	15.83	0.72	"	45.48	28
"	CO65094	1900	6.46	0.182	"	28.1	30
"	N32514	2100	19.33	0.826	"	42.73	(*04/11/01 : 0.400kHz)
"	N32163	2000	13	0.52	"	40	285
"	N32516	2000	7.33	0.256	"	35	(*04/17/01 : 29kHz)
"	N93633	2000	8.46	0.376	"	44.4	68
"	J92743	2000	12.5	0.426	"	34	80
*04/13/01	J105409	2000	15	0.523	noisy	34.8	40
"	Z10348	2000	6.8	0.206	noisy	30.29	6
"	J105229	1900	9.86	0.444	noisy	45	(*04/17/01 : 2kHz)
"	J112171	2000	10.13	0.328	"	32.3	150
"	CO62930	"	13	0.56	noisy	43	(*04/13/01 : 10kHz)
"	N88855	2000	13.3	0.556	"	41.7	5
"	J105228	2000	19	0.583	"	30.7	0.400
*04/17/01	FO93878	2000	12.33	0.526	"	42.66	1.4
"	J105226	2000	10	0.22	"	22	0.250
"	J105227	2000	18.33	0.53	"	30	2.7
"	JO99255	2000	12.33	0.316	noisy	25.6	0.400
*04/25/01	X32835	2000	5.46	0.24	noisy	30	0.900
							1.8
							13
							3.8
							3.8
							3
							2.9

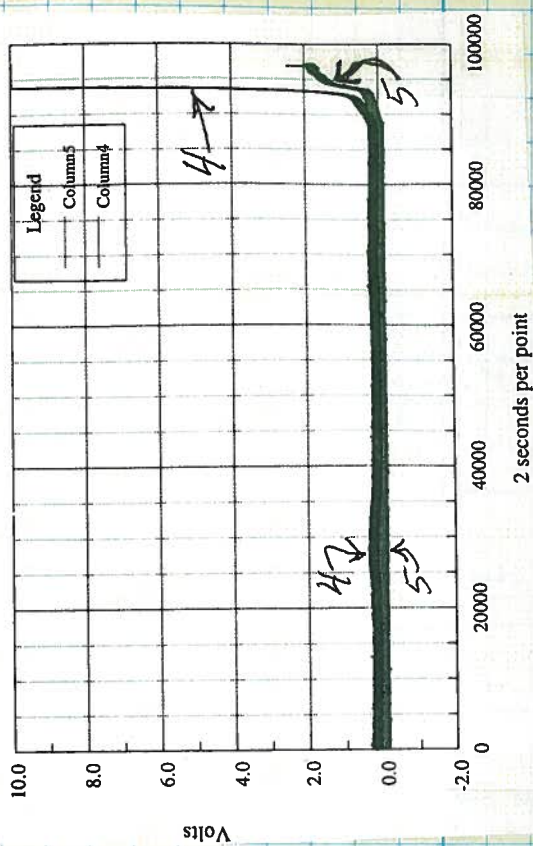
RICH $O_2 + H_2O$ Sensor Performance in the FEL

8/12/6/8/12

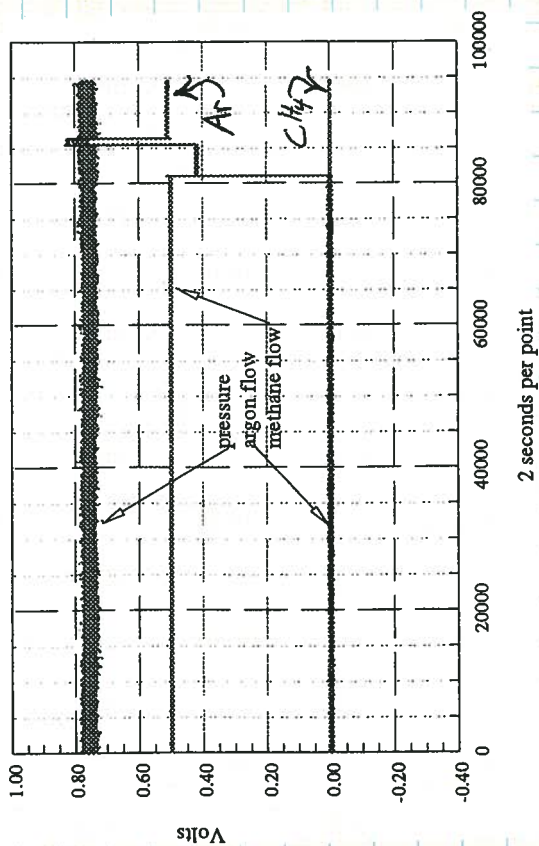
8/9 23:24 to 8/12 5:24



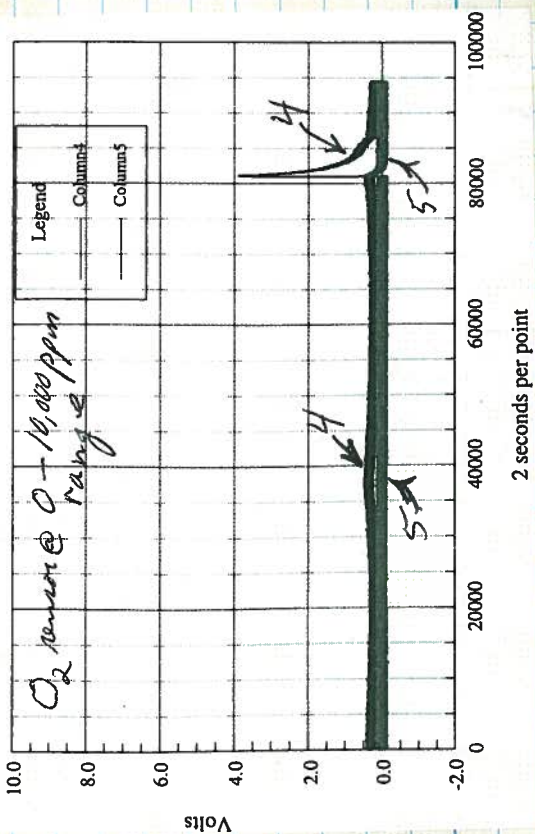
8/9 23:24 to 8/12 5:24



8/7 18:12 to 8/9 23:24

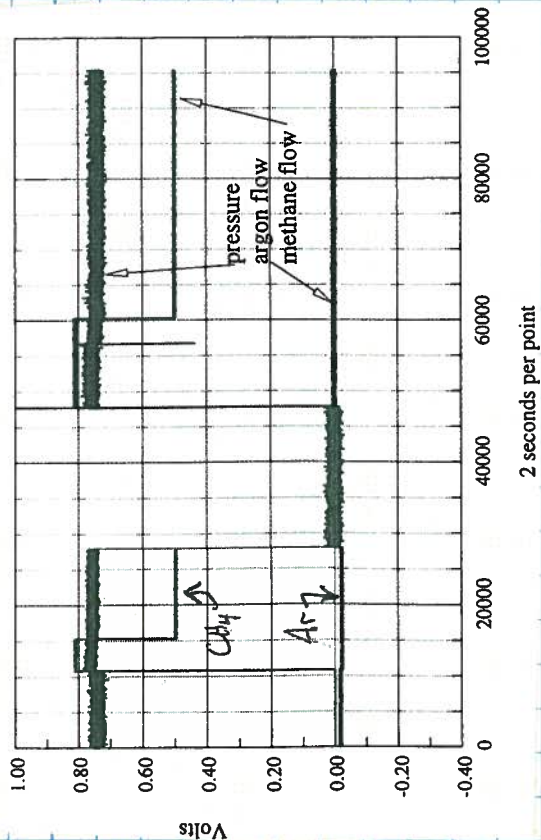


8/7 18:12 to 8/9 23:24

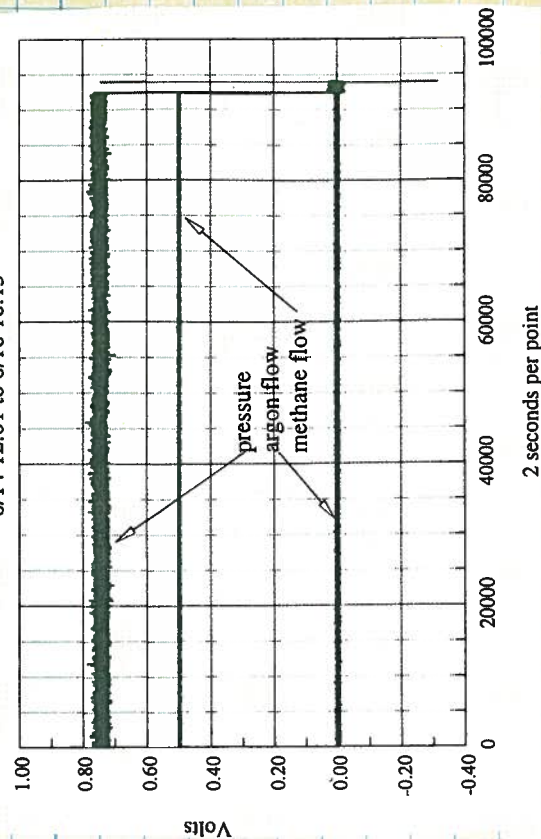


20,000 pts = 11-11 hrs

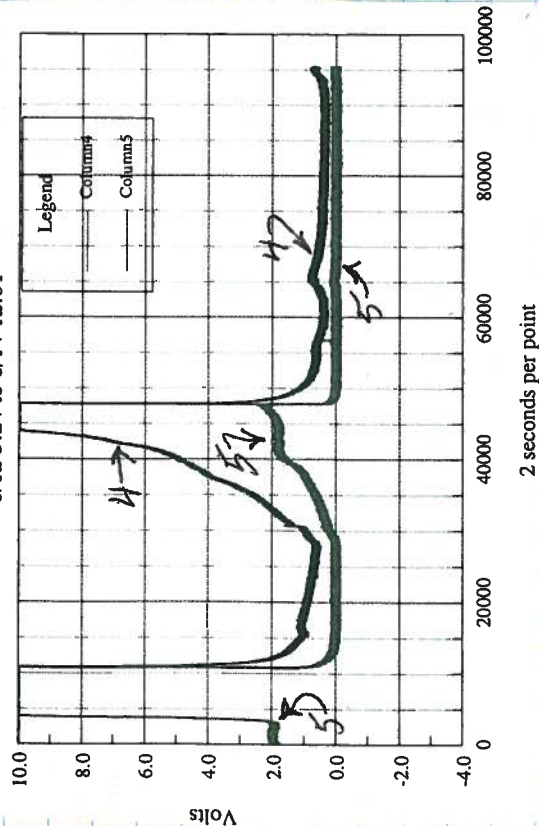
8/12 5:24 to 8/14 12:01



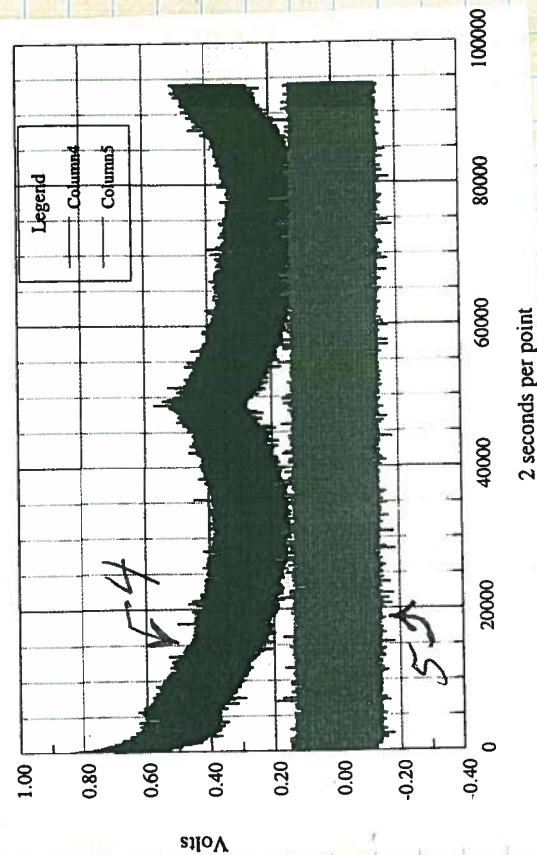
8/14 12:01 to 8/16 16:15



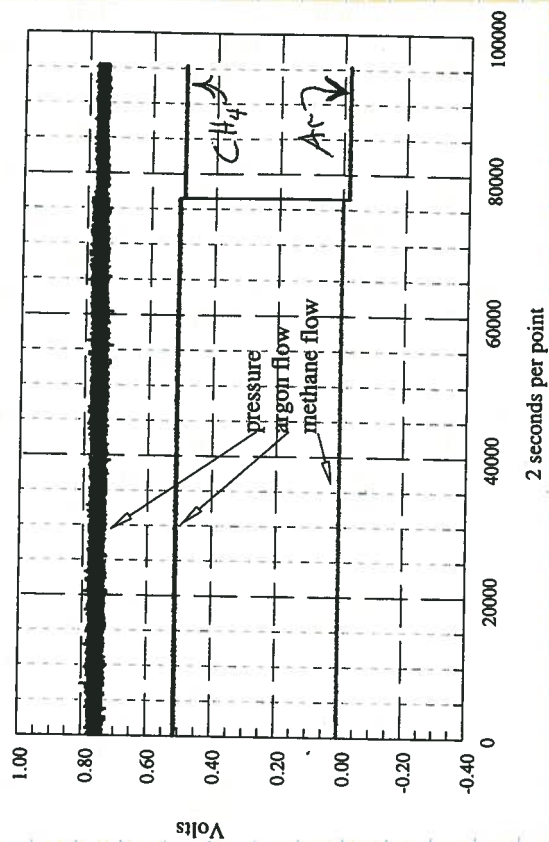
8/12 5:24 to 8/14 12:01



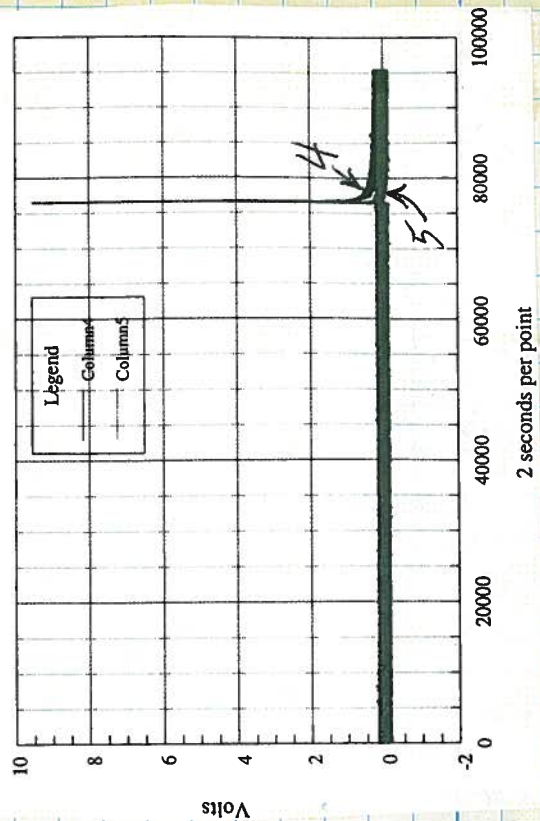
8/14 12:01 to 8/16 16:15



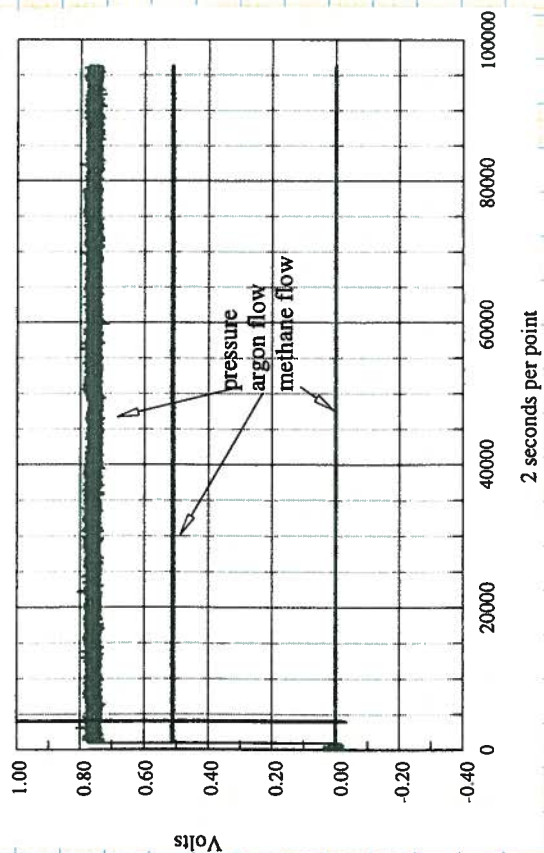
8/18 22:10 to 8/21 3:39



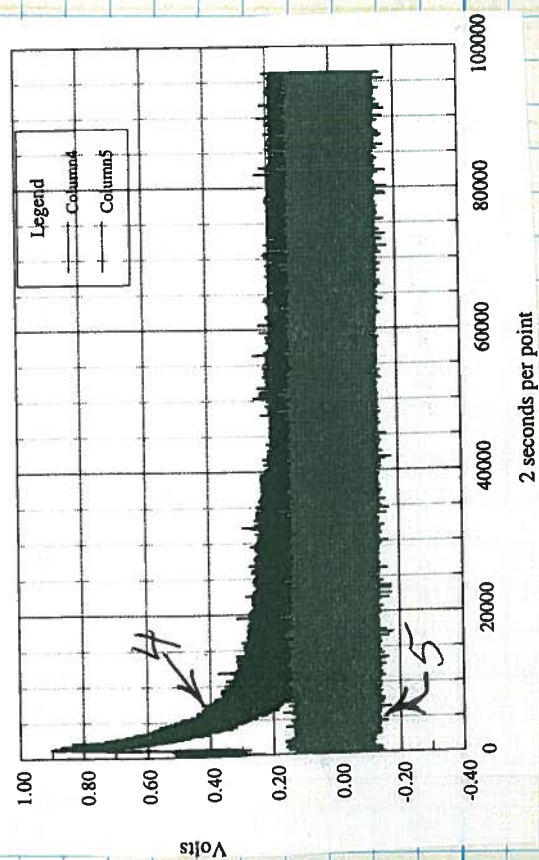
8/18 22:10 to 8/21 3:39



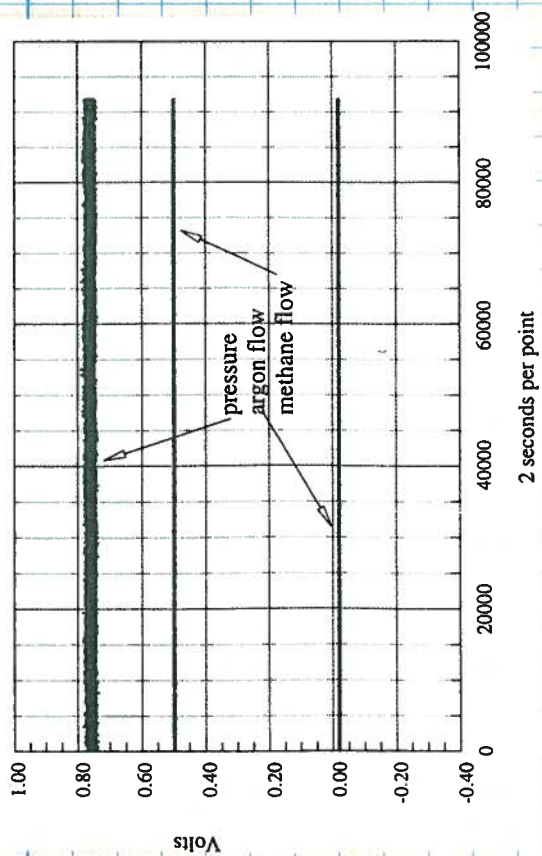
8/16 16:15 to 8/18 22:10



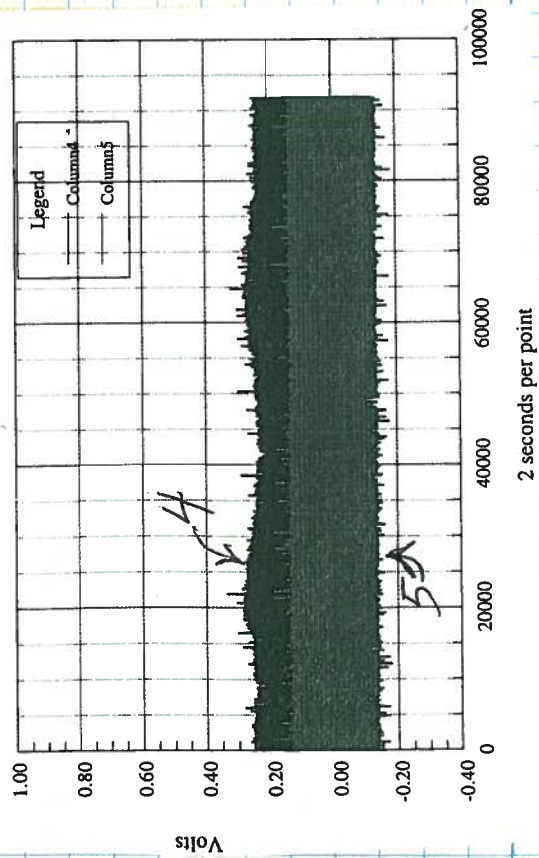
8/16 16:15 to 8/18 22:10



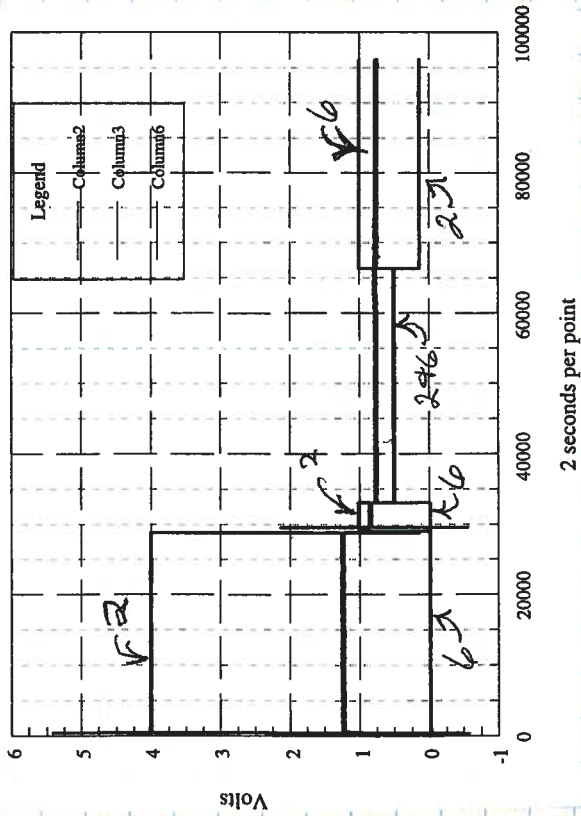
8/21 3:39 to 8/23 6:40



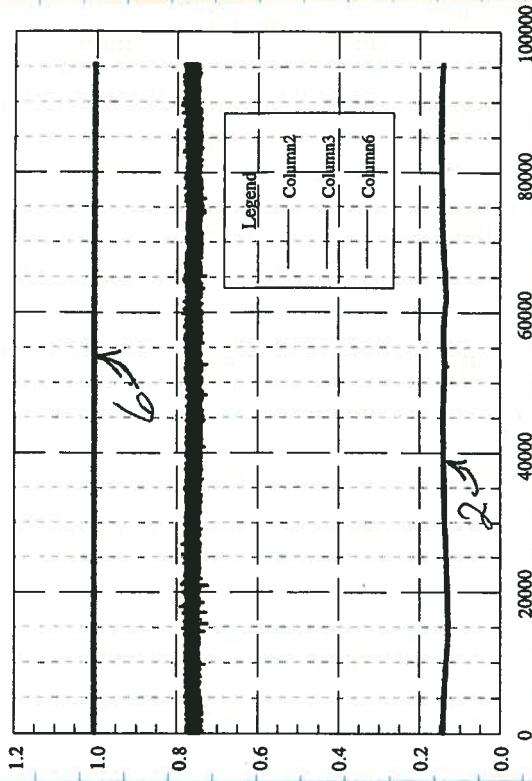
8/21 3:39 to 8/23 6:40



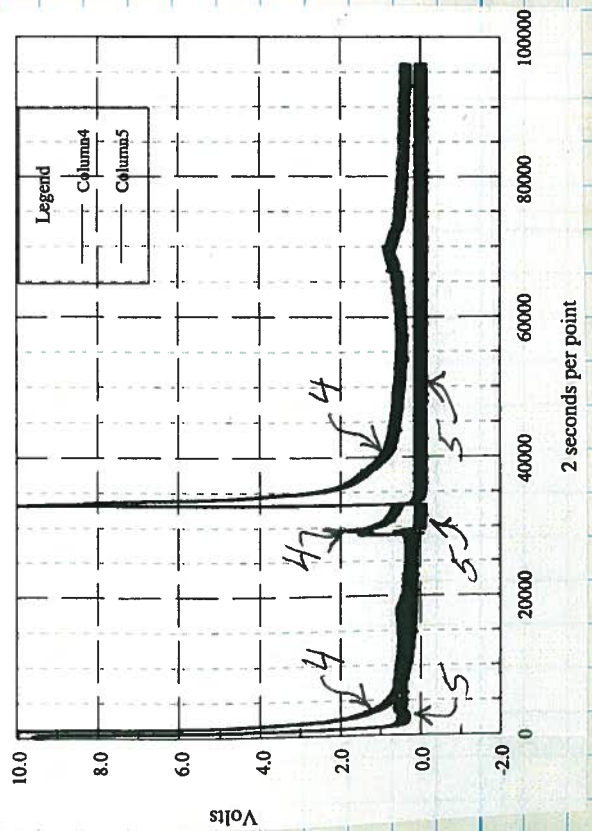
7/22 19:05 to 7/25 5:55



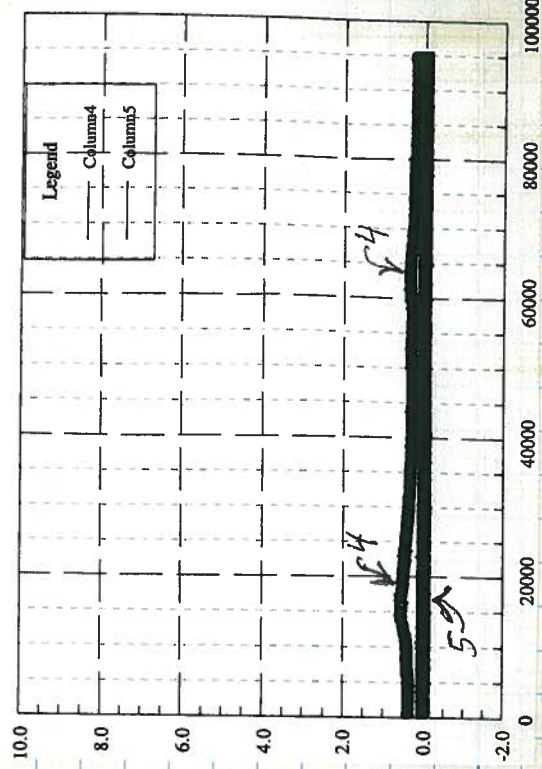
7/25 5:55 to 7/27 10:55



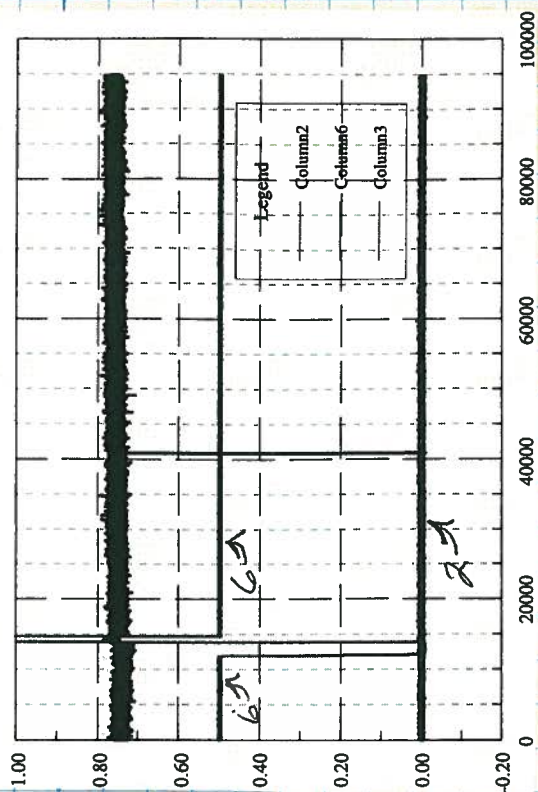
7/22 19:05 to 7/25 5:55



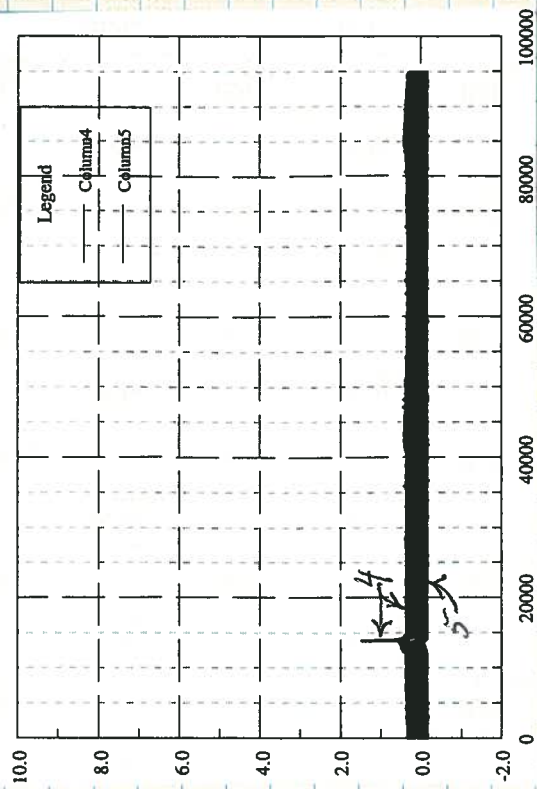
7/25 5:55 to 7/27 10:55



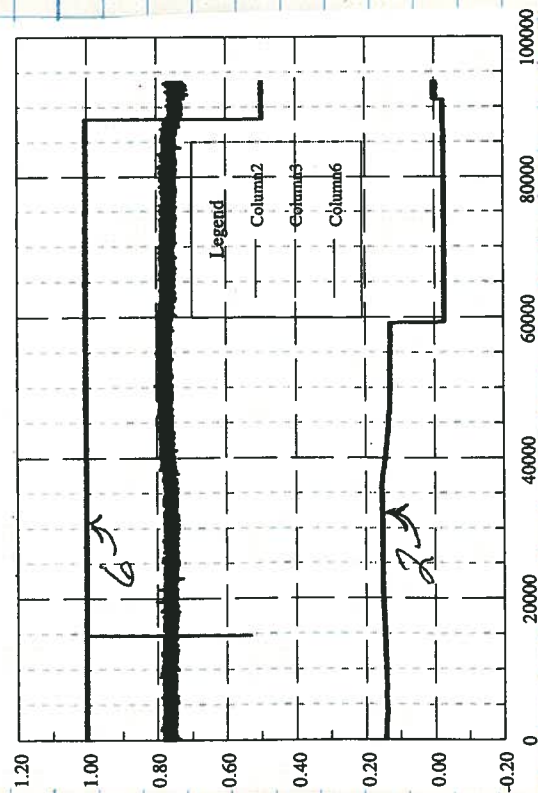
7/29 15:09 to 7/31 20:40



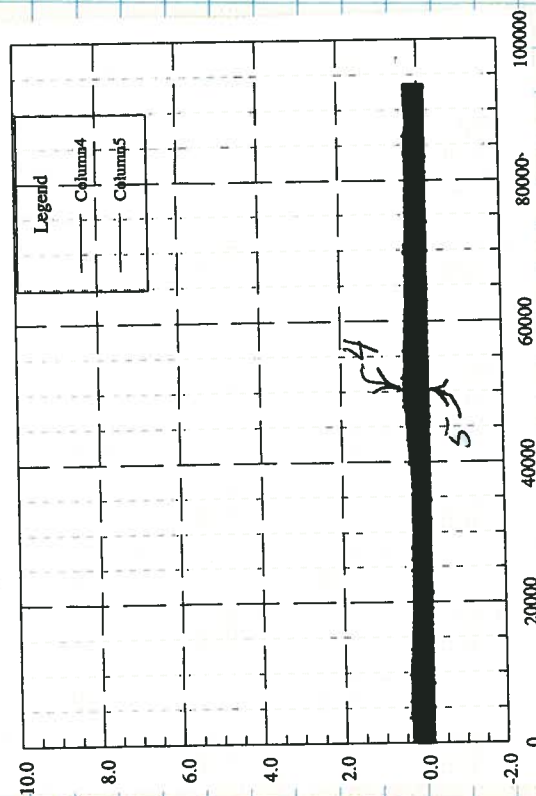
7/29 15:09 to 7/31 20:40



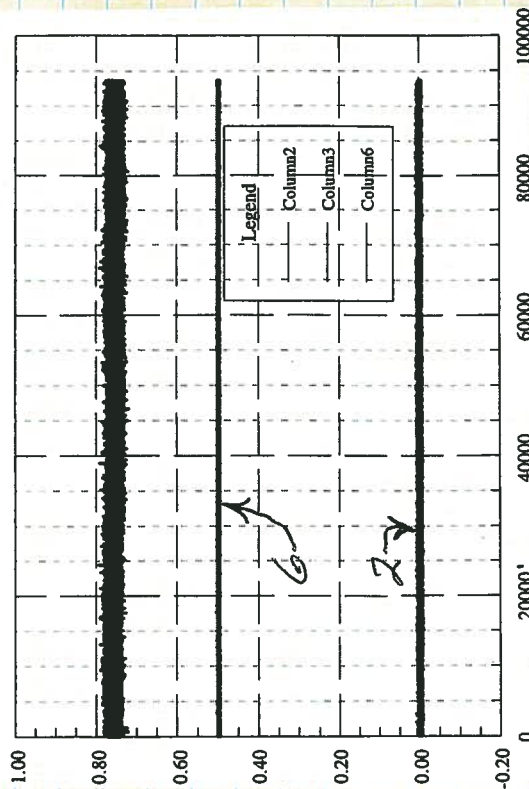
7/27 10:55 to 7/29 15:09



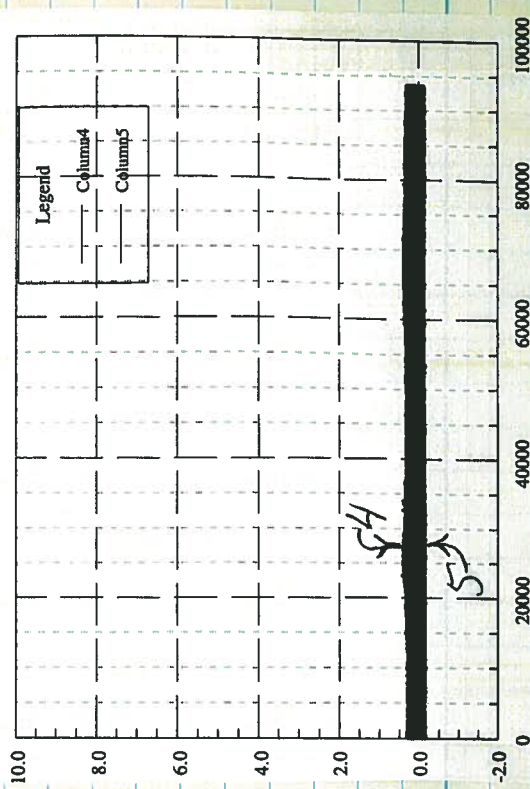
7/27 10:55 to 7/29 15:09



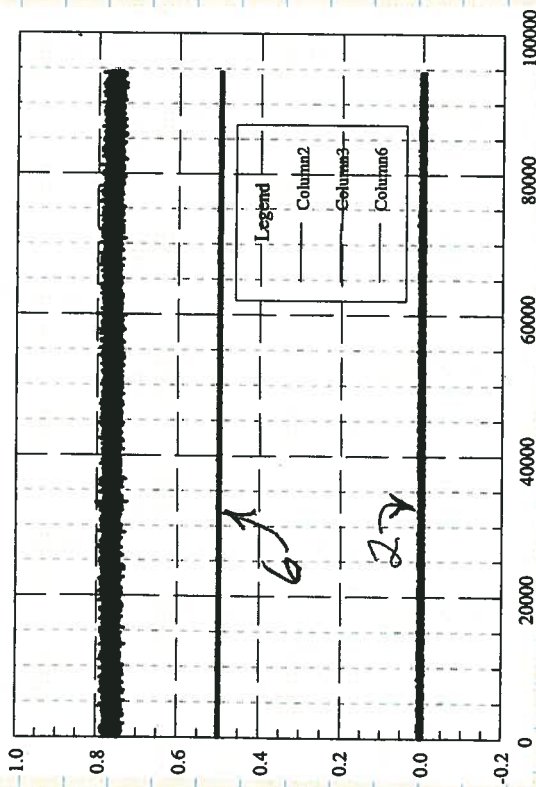
8/3 1:10 to 8/5 5:10



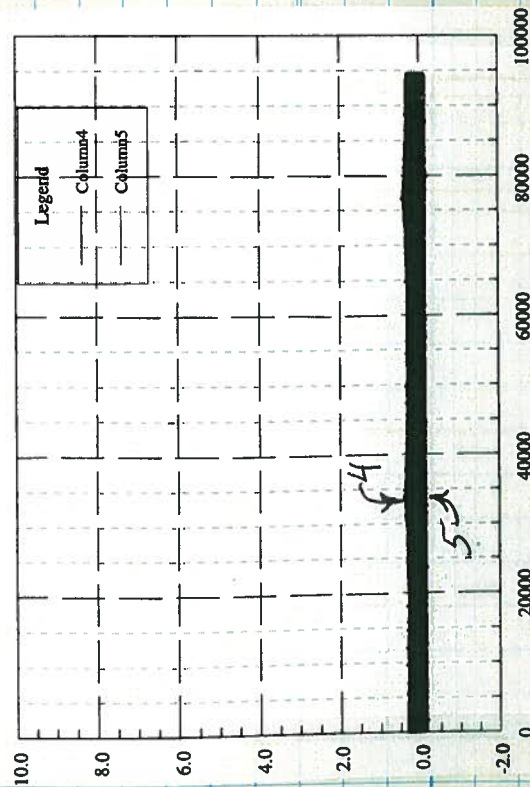
8/3 1:10 to 8/5 5:10



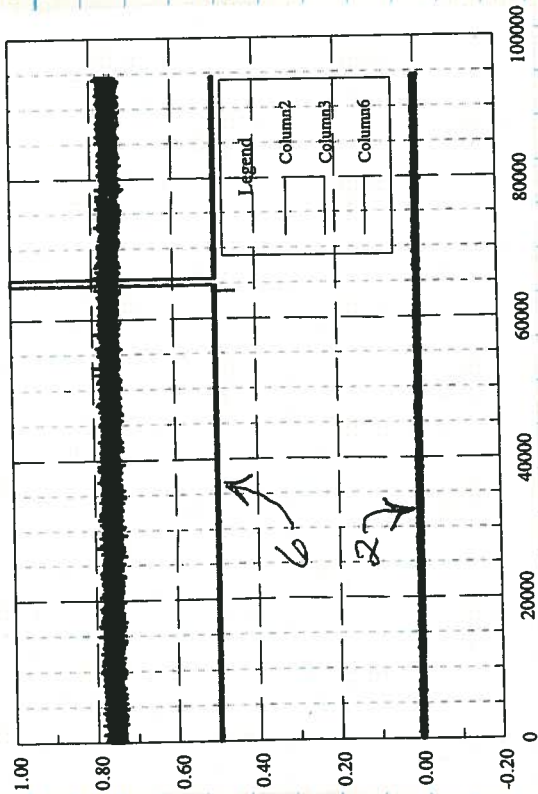
7/31 20:40 to 8/3 1:10



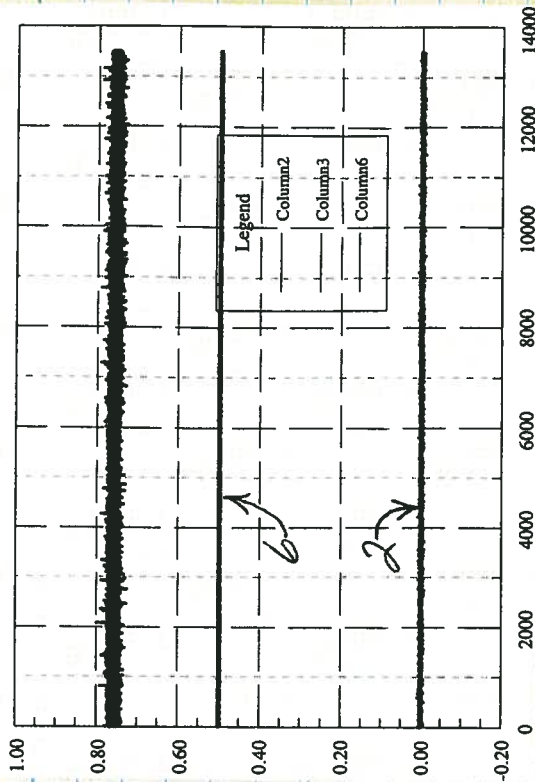
7/31 20:40 to 8/3 1:10



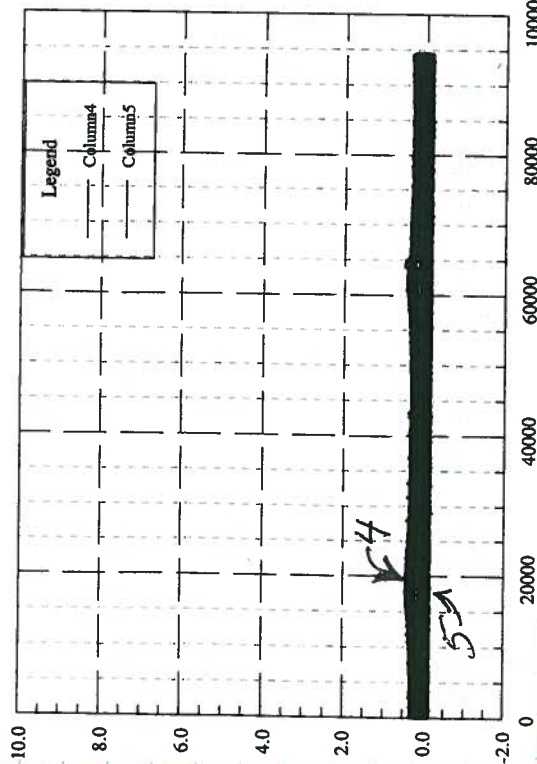
8/5 5:10 to 8/7 10:42



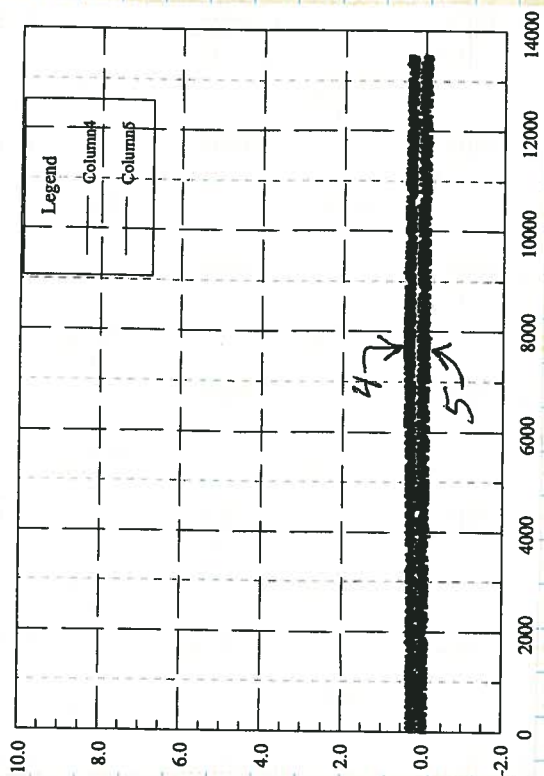
8/7 10:42 to 8/7 18:12



8/5 5:10 to 8/7 10:42



8/7 10:42 to 8/7 18:12



Today, 8/26, I checked the sensor settings.

O₂ sensor is in AUX 1 input as a loop powered device.

REC B output is from AUX 1 input. 0-20mA output. Span is 1000.

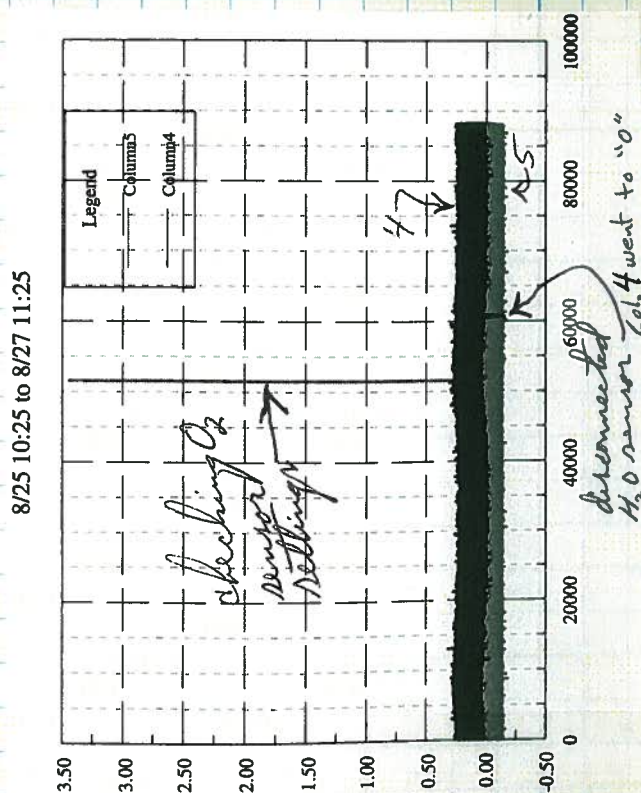
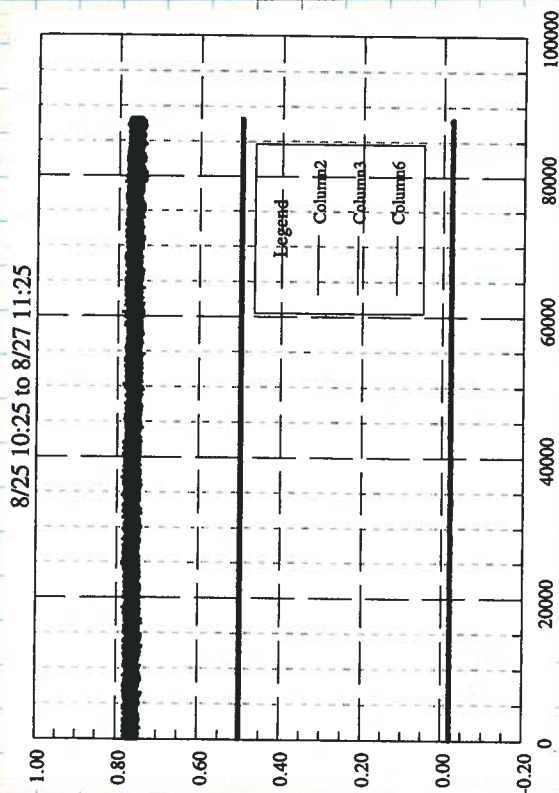
REC B output goes to input 4 of webdaq (Column 5 of plots)

H₂O is measured as ppm of H₂O by volume.

REC A output is for "H" (hygrometer) and 0-20mA output. Span is 1000.

REC A output goes to input 3 of webdaq (Column 4 of plots)

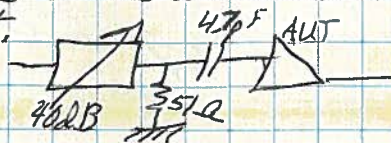
At ~8:09 PM on 8/26 I unplugged the H₂O sensor cable from the Series 3 Moisture Monitor. This does seem to be the way it is hooked up.



9/22/02 First Look At The AD8015

JA

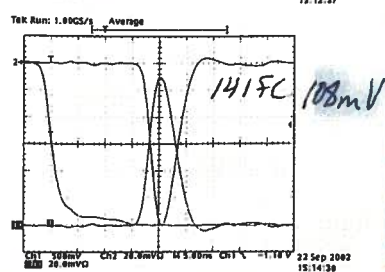
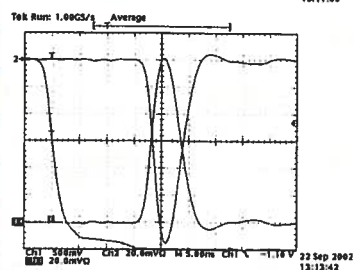
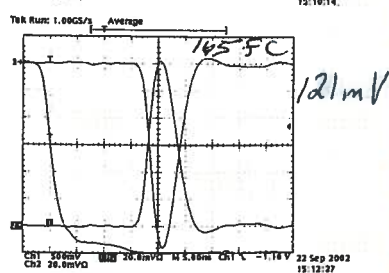
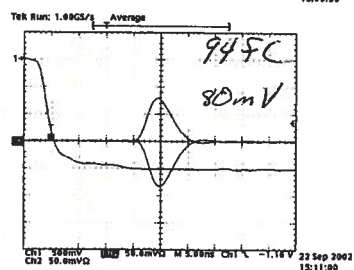
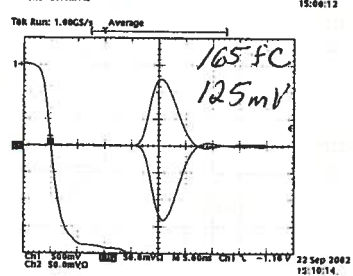
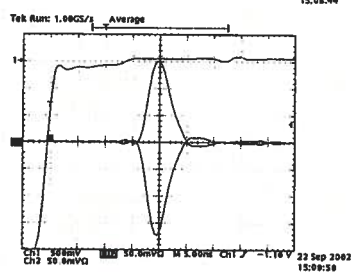
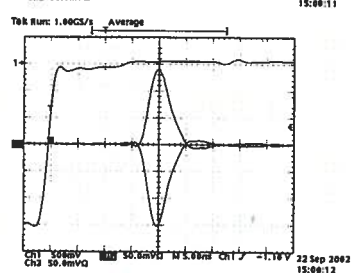
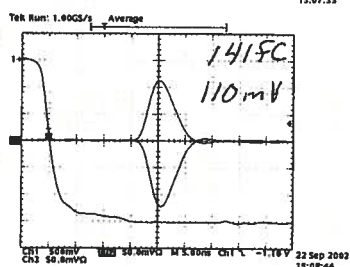
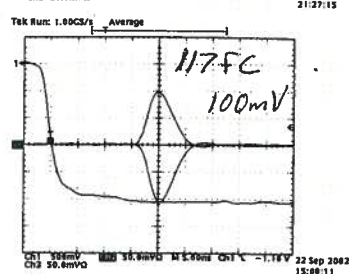
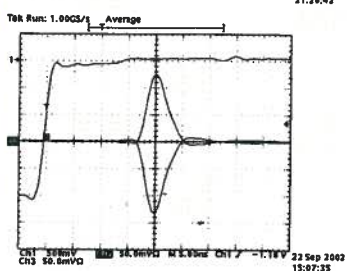
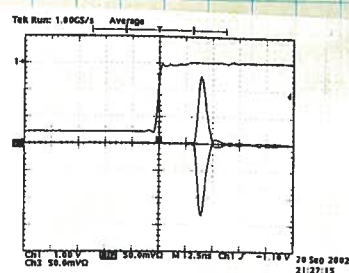
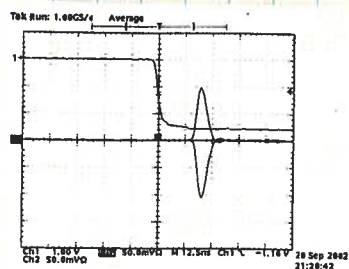
I put the chip on an SMT prototyping board from Pulse Research. +5V and GND. 10 pF for coupling the outputs to the scope. 10 pF & 0.1 μ F to bypass the +5V. 0.1 μ F on the V_{DD} pin, to GND. HP 8013B pulser through 40dB attenuation to 4.7 pF on the chip input.

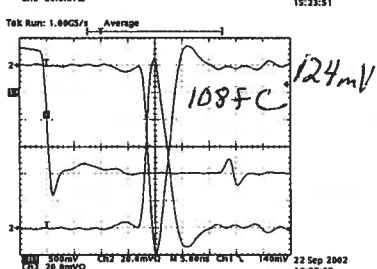
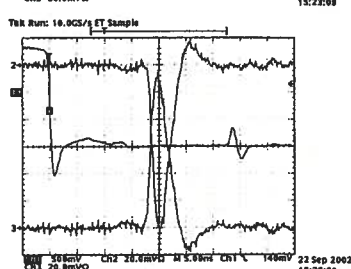
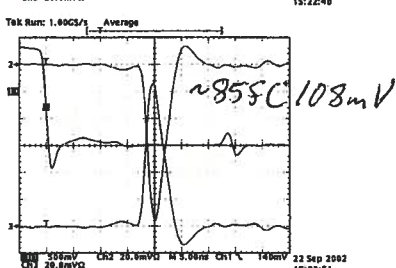
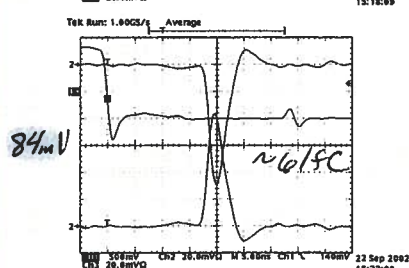
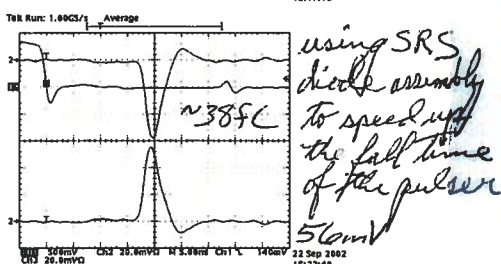
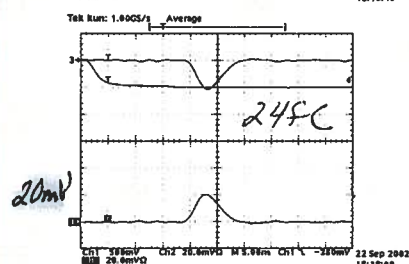
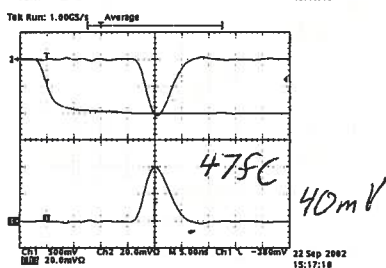
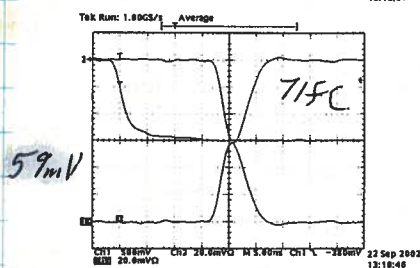
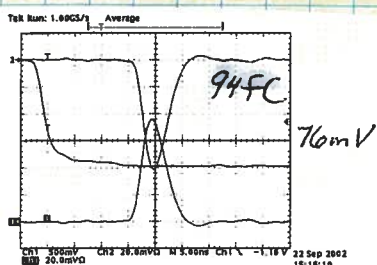
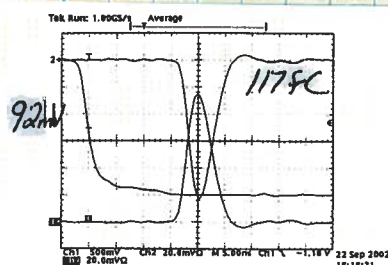


I first got the chip hooked up on Friday. Then came back to check the linearity.

Scope set to Average 16 traces.

Use negative going output on negative input edge to get gain estimates. Seems to be the "worst case" output.





Check of VDC Gas Gain in the Hall 9/23/02

Checking VDC gas gain while it is in the detector stack in the hall. Looking at the Right Arm VDC. Lower VDC, upper plane, first card along the left side. Note one of the cards in front. $\pm 5V$ supplies for the detector turned off. Using "Little Dickey" preamp (CA3227 array). Other 15 wires of the ret are grounded.

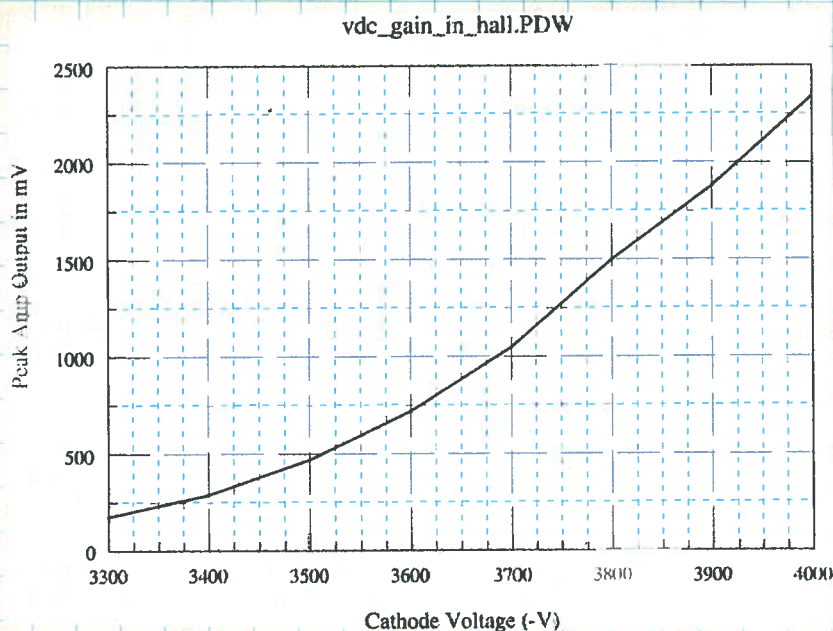
$\sim 1\text{ns}$ RG-174 from connector to preamp. 24ns

RG-58 C/U from preamp to scope.

Fe^{55} source #241 positioned above chamber to give the most number of pulses.

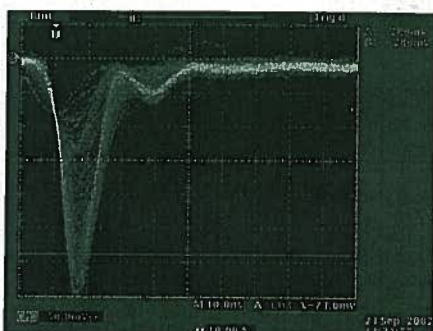
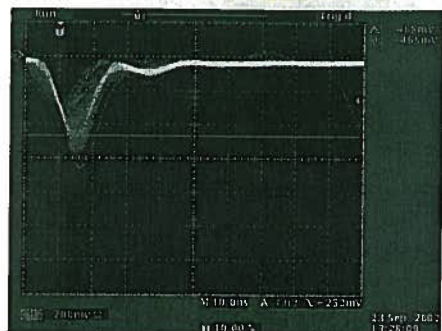
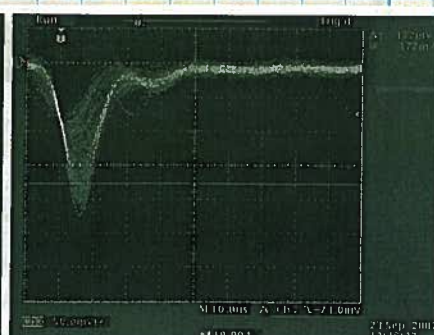
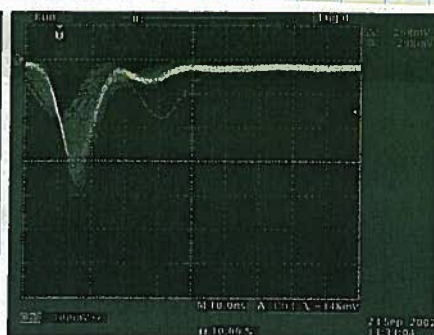
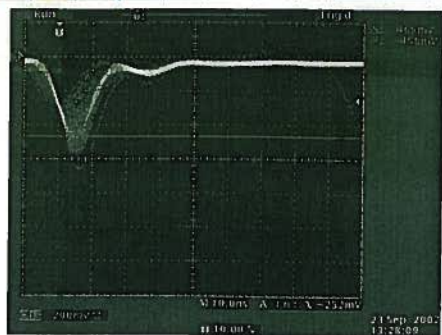
Bertan HV varied for both VDCs at the same time.

Scope display @ 1 second persistence. Sample mode.



Plot of data from the following two pages.

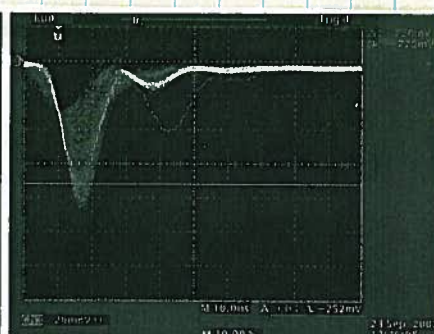
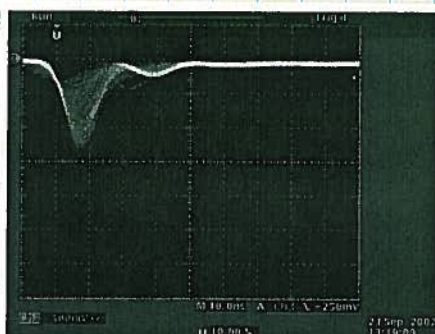
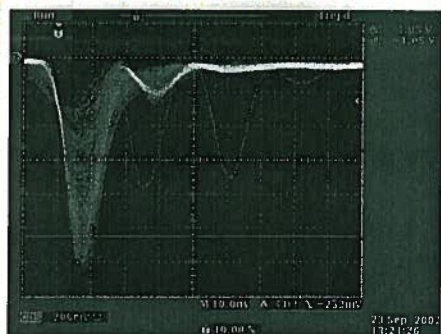
I now understand Ken's comment that the 8015 amp might be too fast. The problem with extrapolating the gas gain from this data and the data on p. 130 is that the peak pulse height for this 3227 amp is very dependent on the risetime of the injected charge. The amp is literally too fast to use without being able to calibrate it with a pulse shape similar to an Fe^{55} pulse from this chamber!



-3300 V
on
cathode
planes
177mV

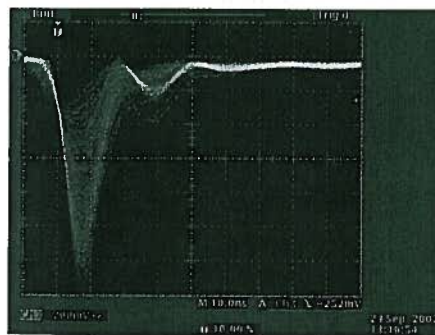
468mV
-3500 V

-3400 V
289mV



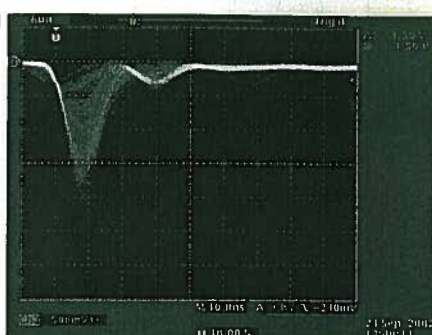
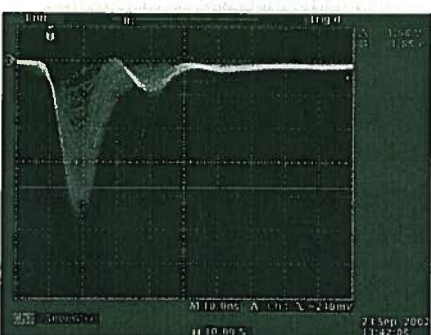
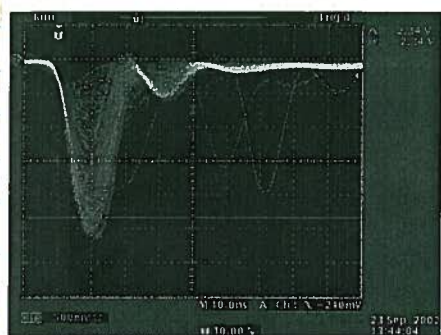
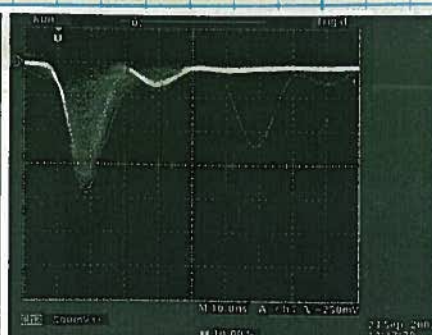
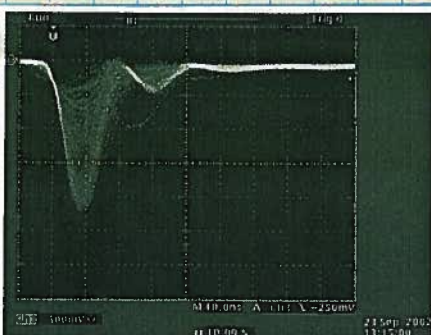
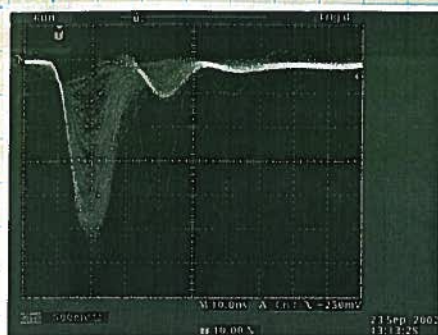
-3700

1050mV



-3700

-3600
720mV



2340mV

1000V

3400V

1880mV

3800V

1500mV

Verifying the Gain of the "Little Duke" Amplifier

I brought the amplifier and scope back to the ITEL building. I set it up to test it with charge injection.

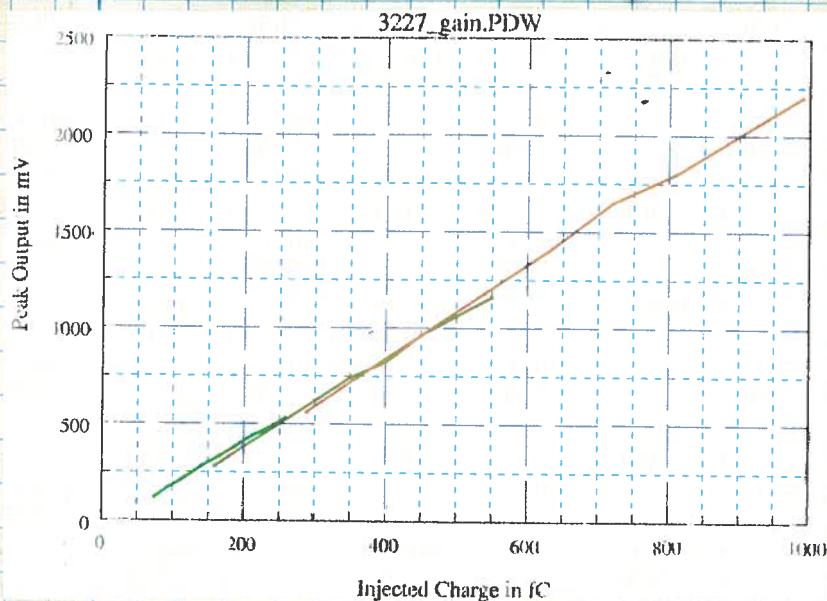
HP 8013B pulser

40dB of attenuation

used 4.7pF, 10pF and 18pF arrangements
short RG-174 stub to amp input. ~1 inch long.

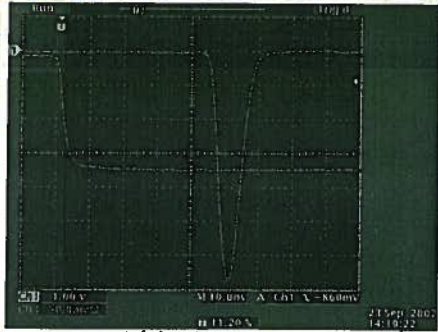
24 in RG-58C/U cable from amp output to scope.

Scope set to average 16 traces.

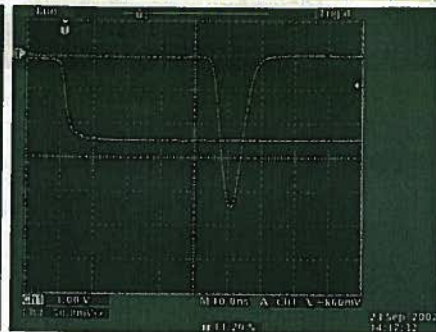


Plot of data from the following three pages.

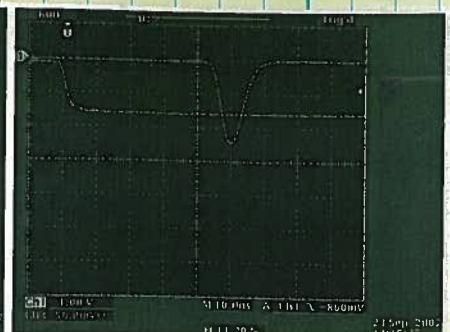
$$\sim 2000 \text{ mV} / 900 \text{ fC} = 2.2 \text{ mV/fC}$$



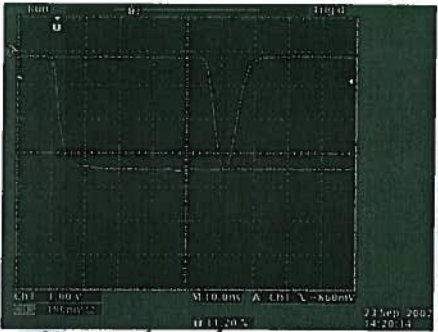
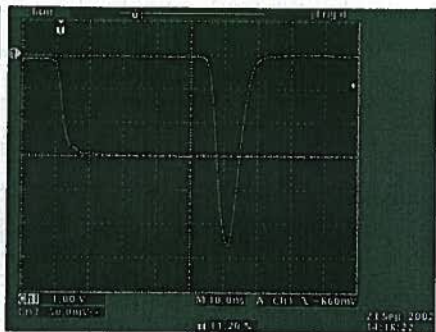
165°C 330mV



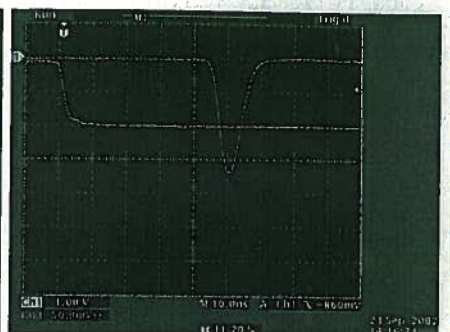
118°C 220mV



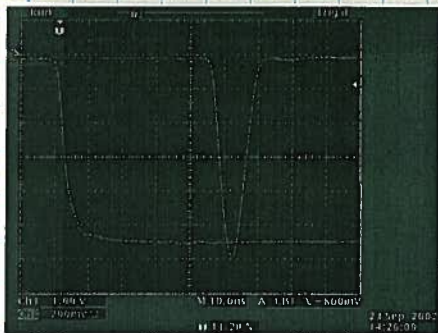
(4.7pF) 75°C 120mV

change of scale
note baseline shift 165°C 320mV

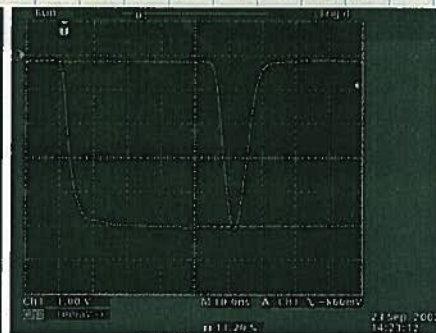
141°C 280mV



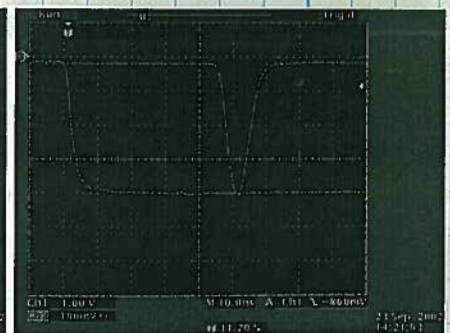
94°C 170mV



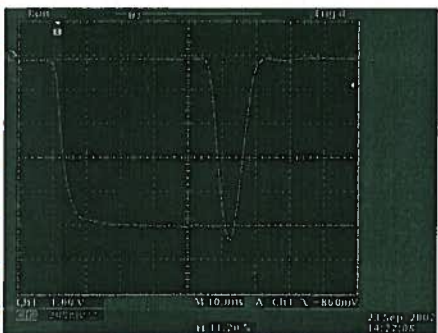
550°C (10pF) 1160mV



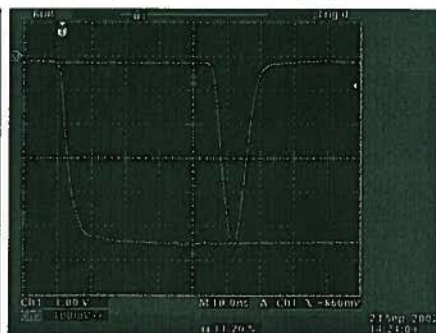
235°C 480mV



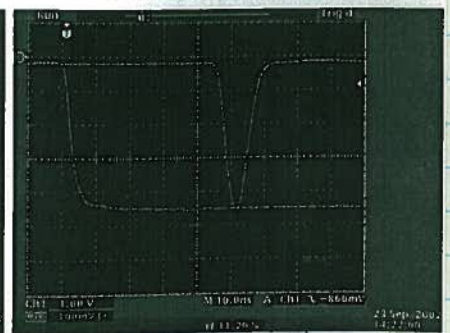
188°C 380mV



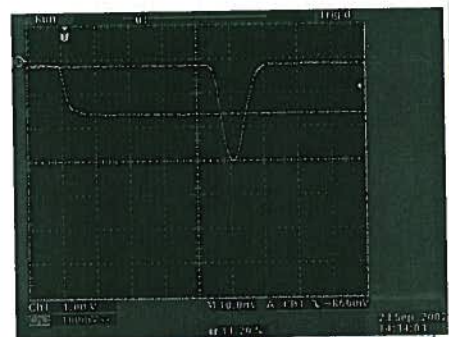
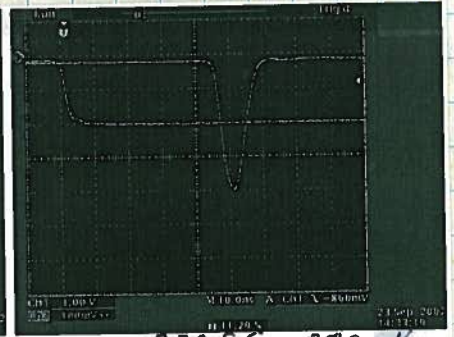
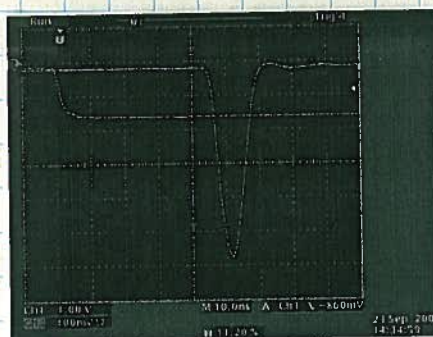
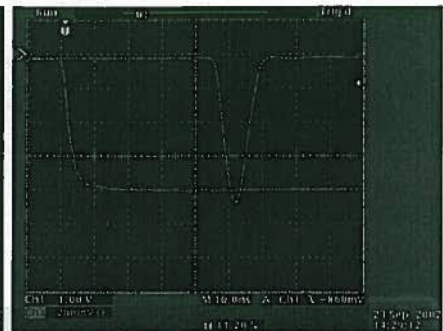
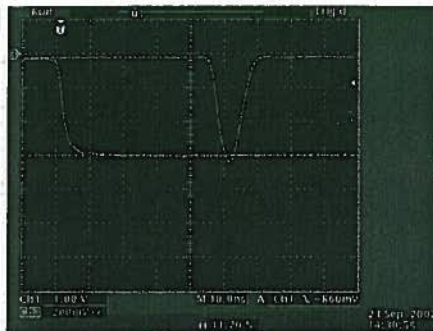
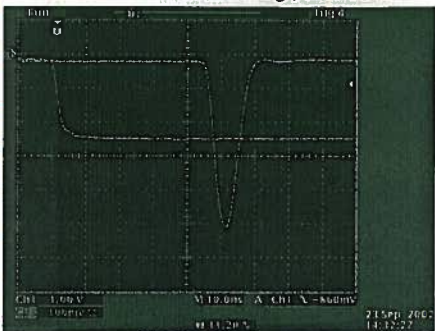
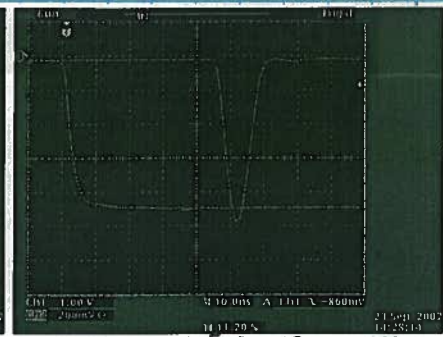
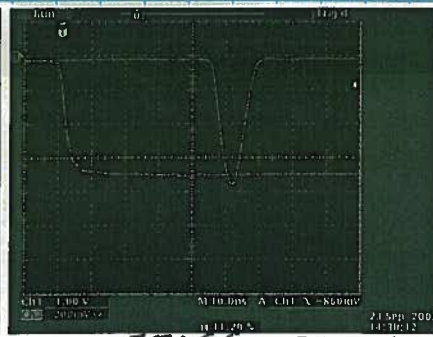
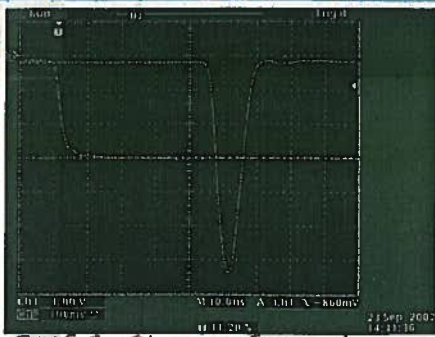
500°C 1060mV

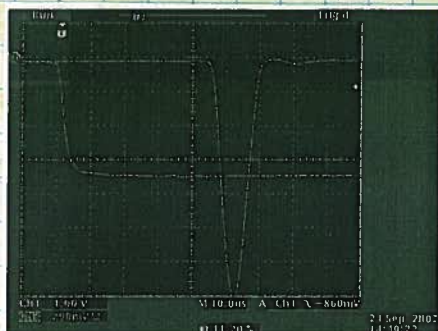


259°C 530mV

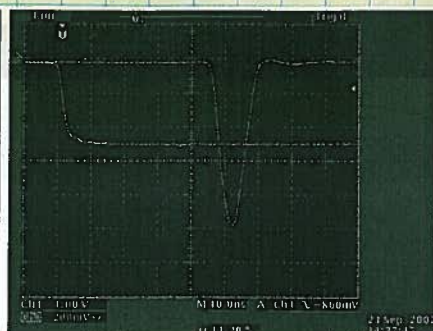


212°C 440mV

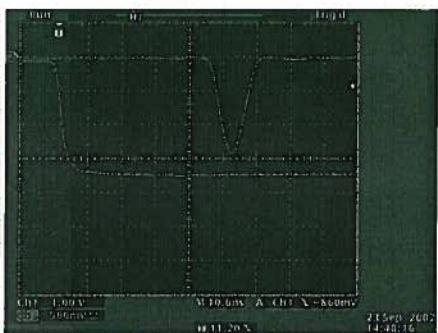




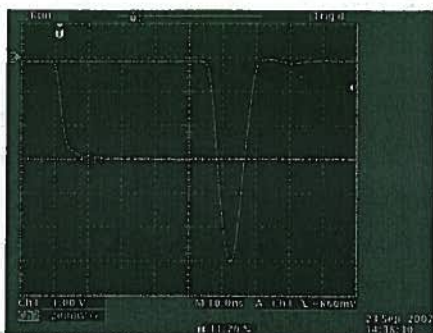
630 FC 1400mV



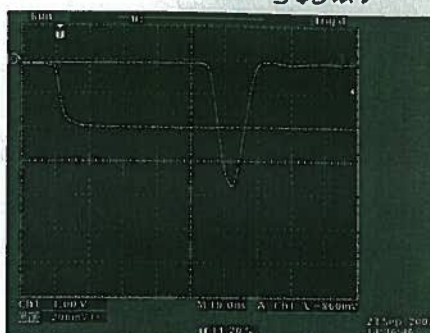
450 FC 960mV

288 FC Change of scale
560mV

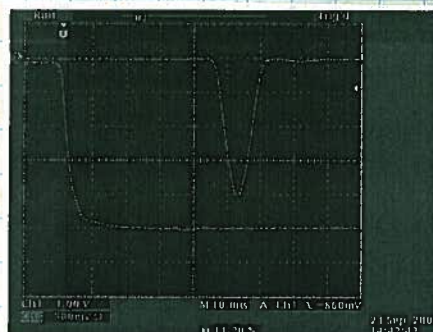
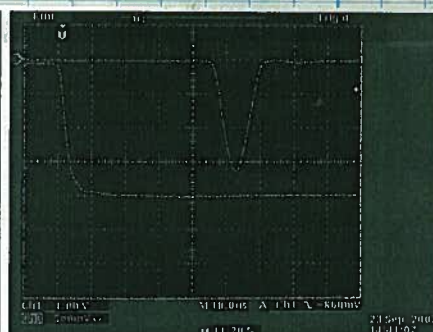
630 FC Change of scale 1400mV



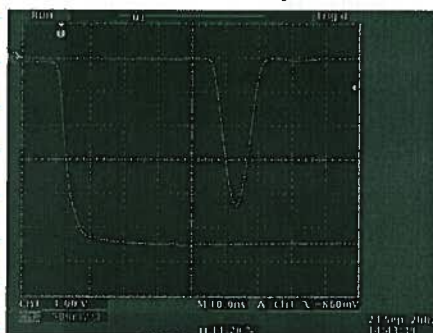
540 FC 1180mV



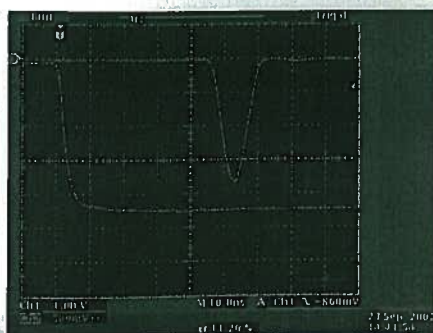
360 FC 740mV

900 FC 2V
2000mV

720 FC 1650mV



990 FC 2.2V 2200mV



810 FC 1.8V 1800mV

9/26 OPA655 as a Transimpedance Amp

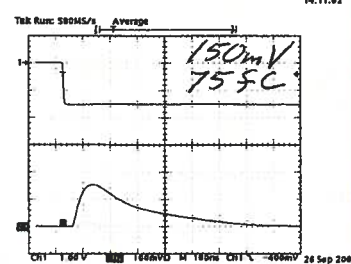
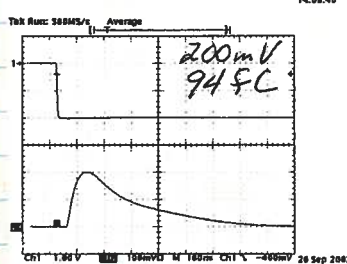
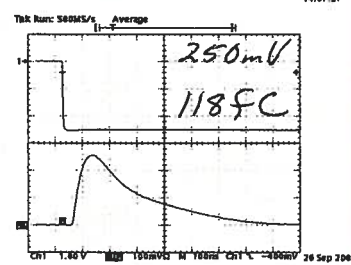
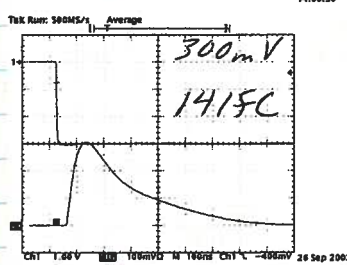
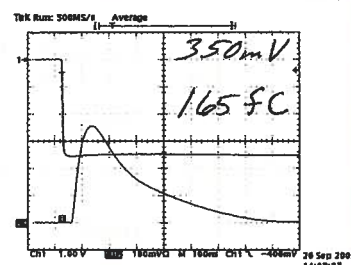
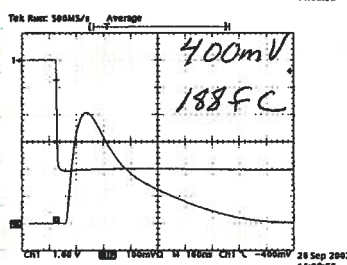
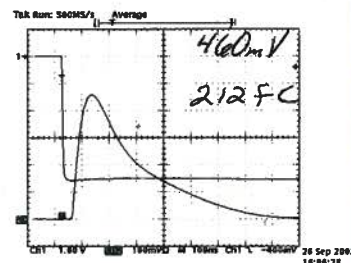
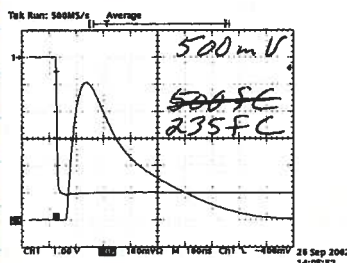
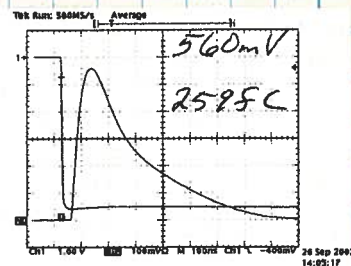
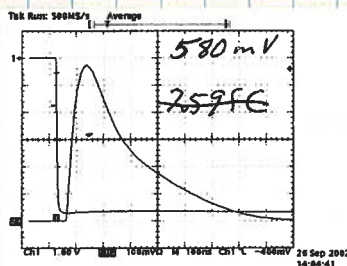
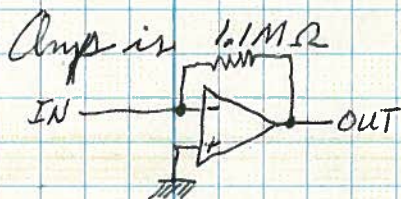
I put an OPA655 on a Pulse Research Lab 508RF SMT prototyping socket.

Using the HP8013, 40dB of attenuation and cap 4.7pF and 15pF caps for charge injection. Δ 40dB $\frac{351.2}{111}$

Amp output is through 16ms of RB-174.

4.7pF capacitor

power supply is a
Topward benchtop
supply. $\pm 5V$

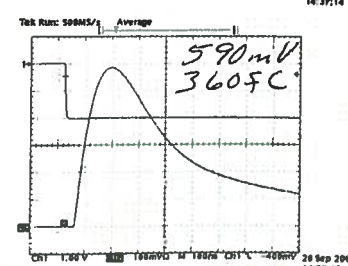
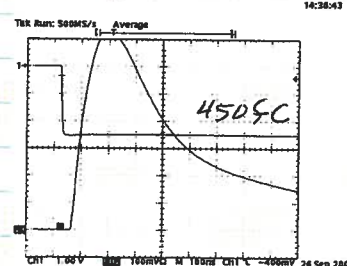
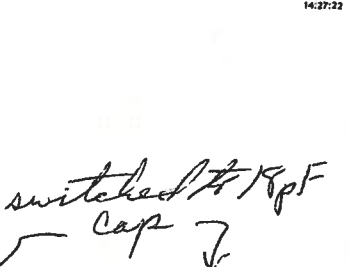
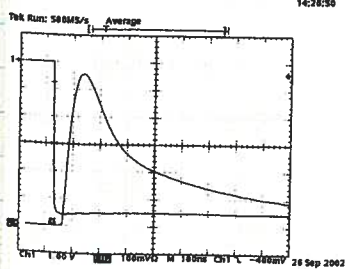
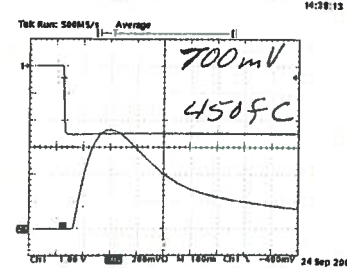
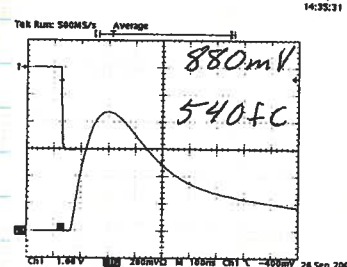
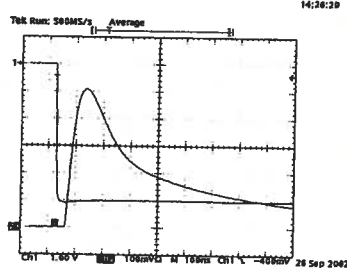
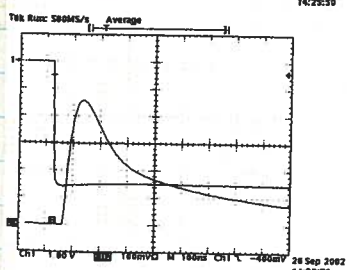
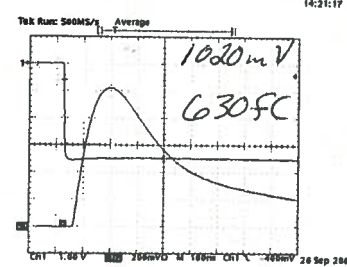
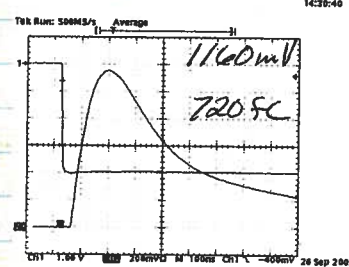
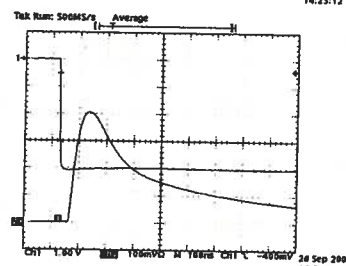
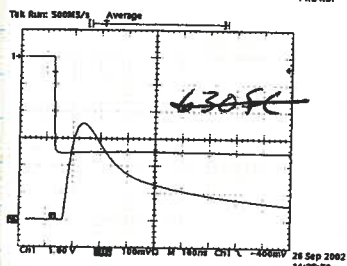
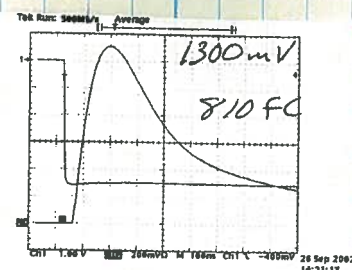
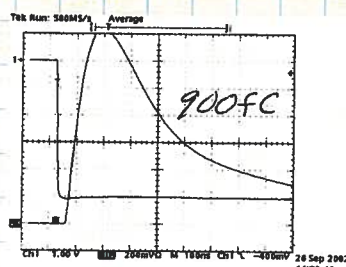
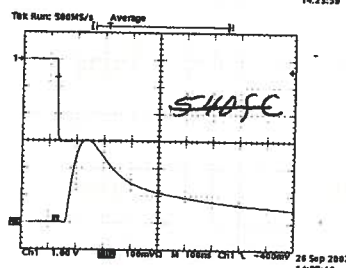
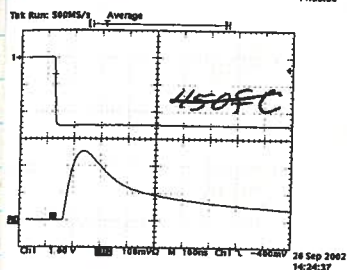
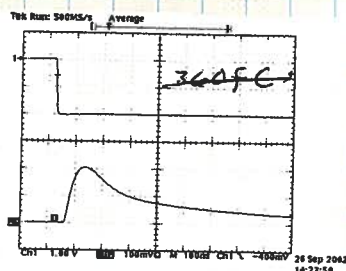
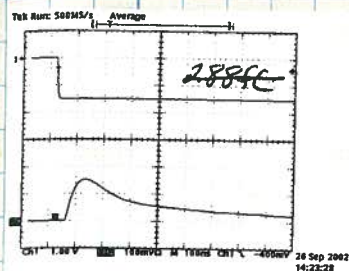


Changed the power supply to a 9V battery

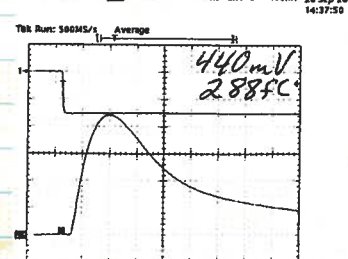
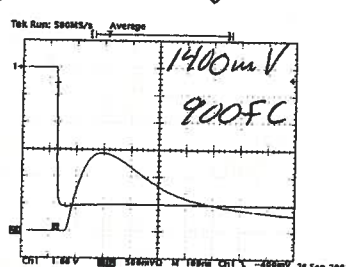
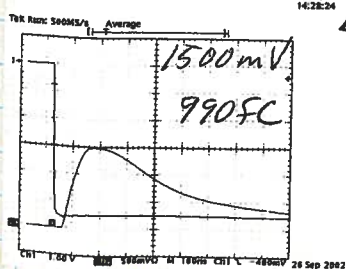
✓ 4.7pF cap. ✓



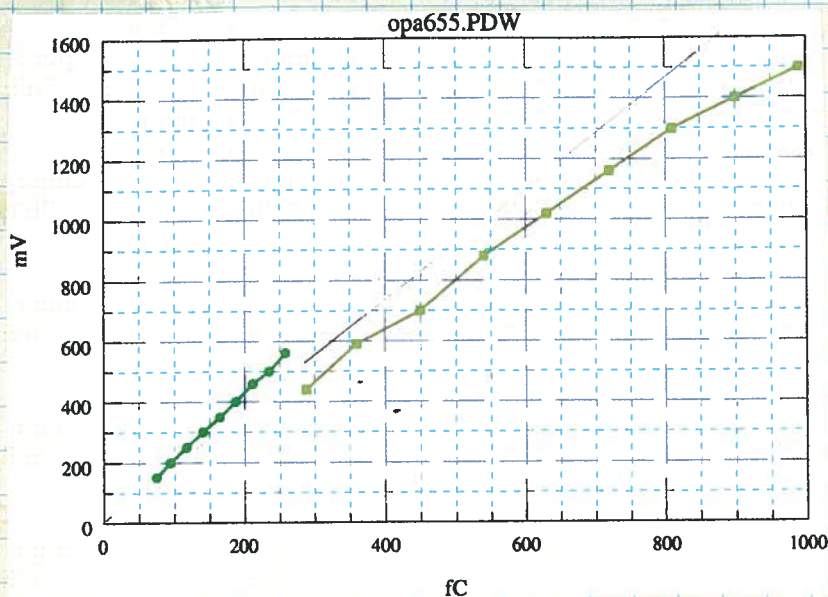
✓ 18pF cap. ✓



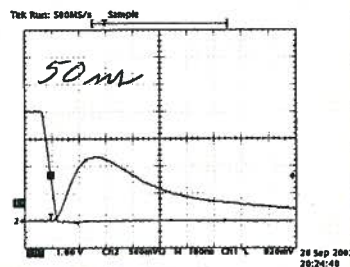
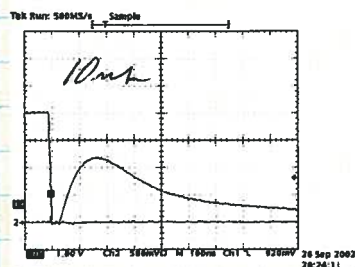
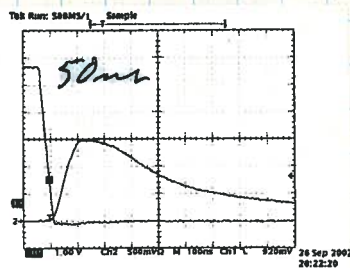
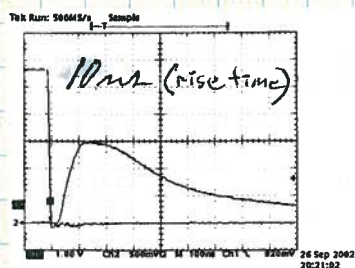
switched to 18pF cap. ✓

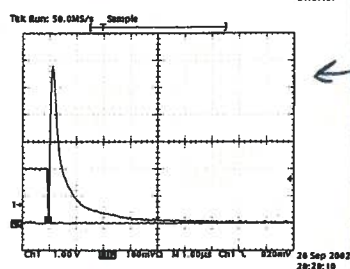
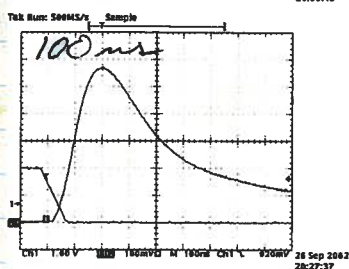
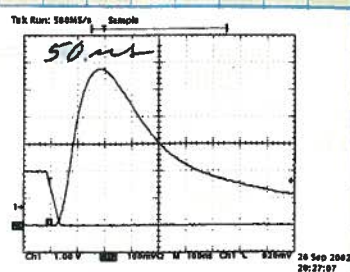
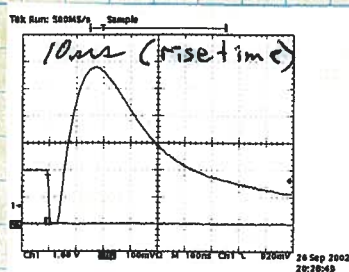


Peak voltage vs. injected charge



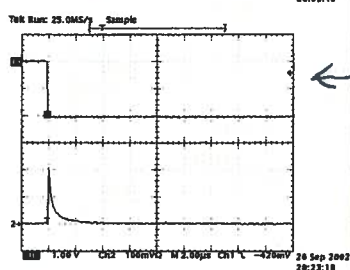
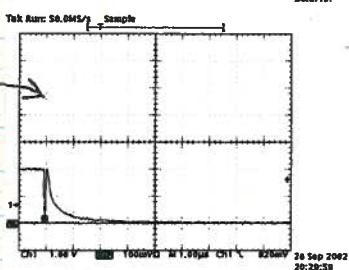
I went and got the PG2012 Tektronix pulse generator. Trying to see how the peak pulse height varies with the rise time of the injected charge. Ch1 is the pulse. As before. BPF for the injection capacitor



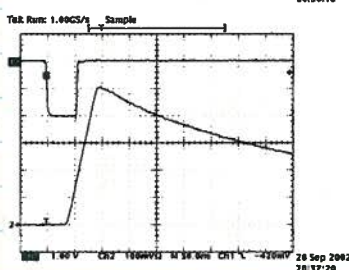
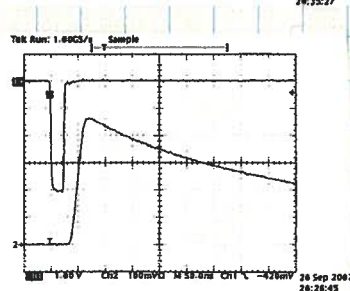
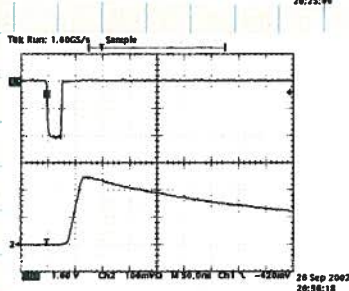
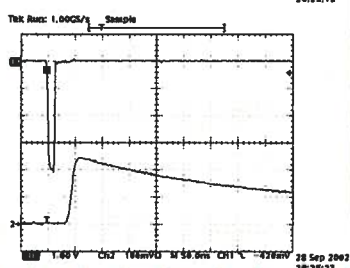
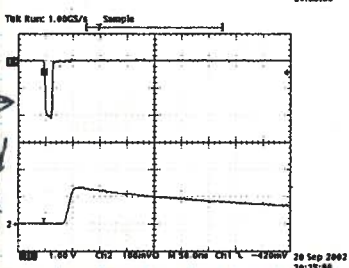
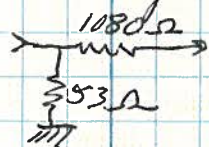


← looking for some ringing, but seen earlier in the day. No ringing now. It's a mystery.

switched to 4.7pF cap. →



switched to resistive divider instead of cap. for charge injection

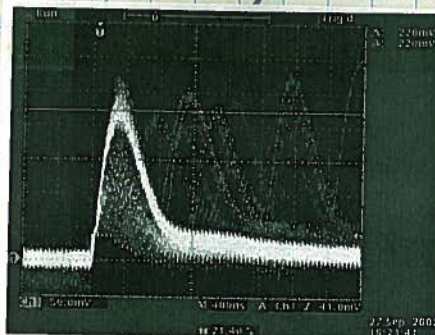


Output looks fairly uniform over a fair range.

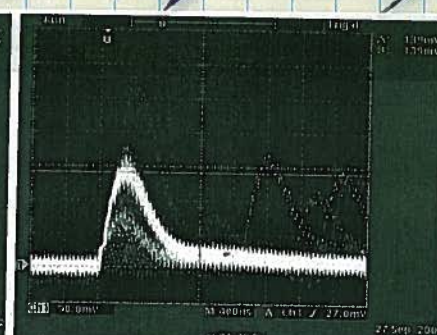
9/27 VDC Gas Gain Using OPA655

RJ

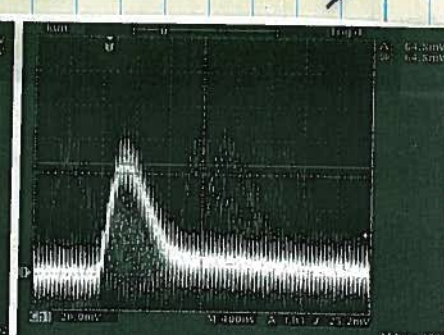
I took the OPA655 amp from p. 134 of this book to the lab to check the gain of the Right Arm lower VDC, upper plane. Same setup as on p. 127. This amp has 16 μ s of R6-174 on its output. Put the 24 μ s of R6-58C in after that to get the signal to the scope.



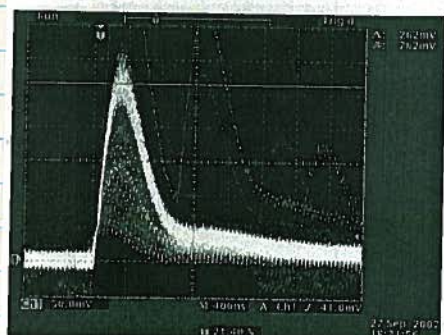
-3100V



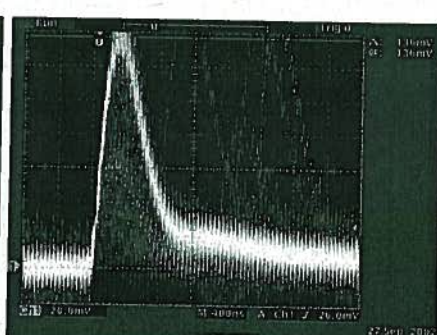
-3000V



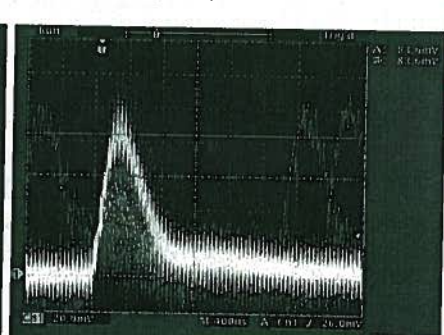
-2850V



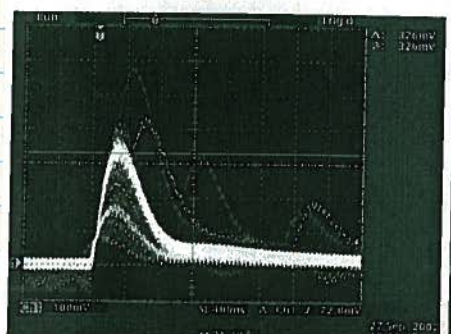
-3150V



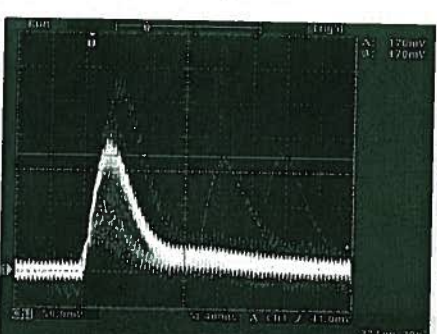
-3000V



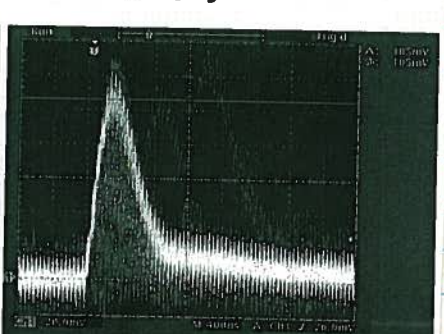
-2900V



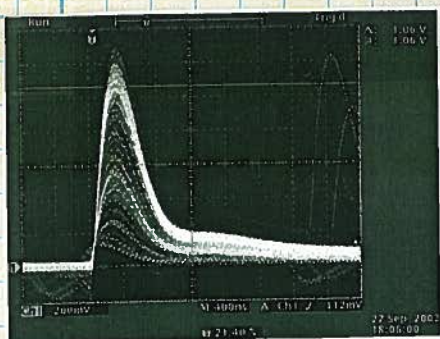
-3200V



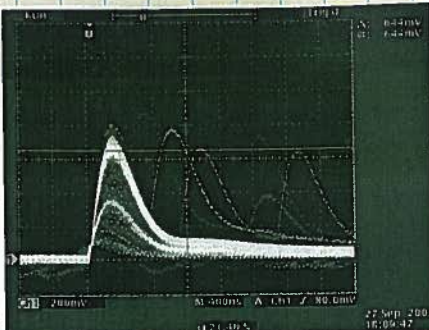
-3100V 3050V



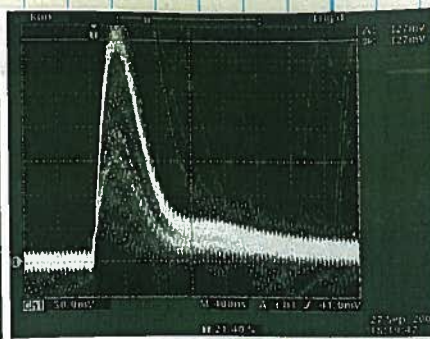
-2950V



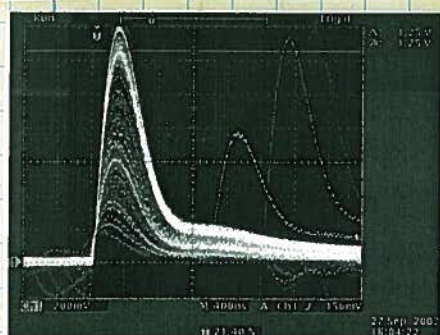
-3450V



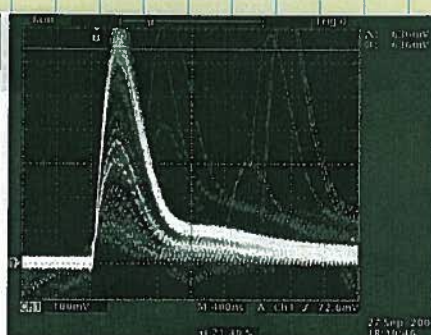
-3350V



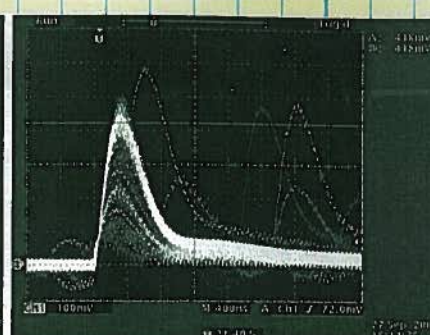
-3200V



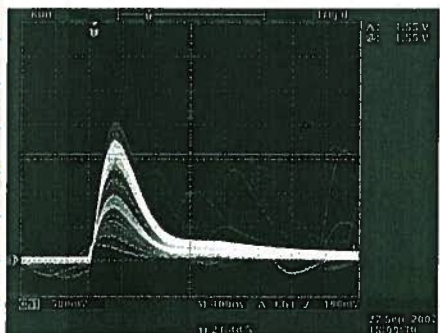
-3500V



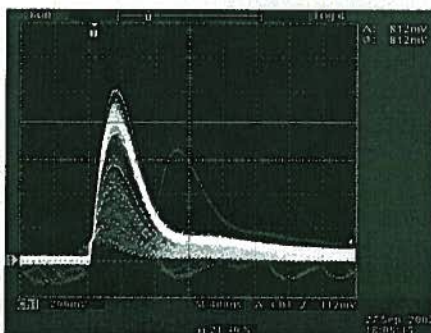
-3400V -3350V



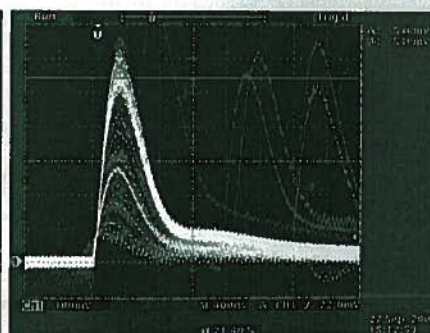
-3250V



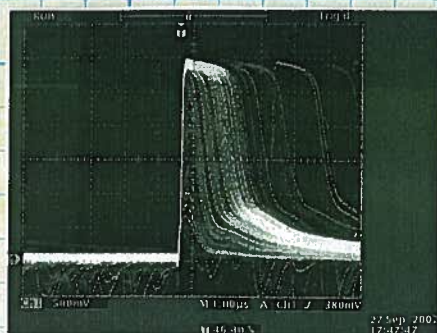
-3550V



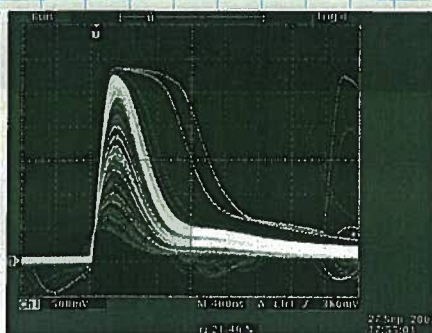
-3450V -3400V



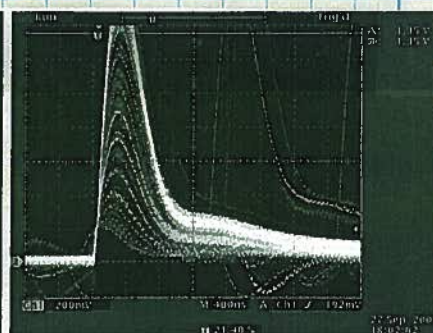
-3300V



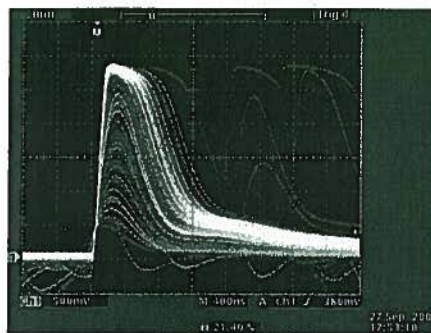
-4000V



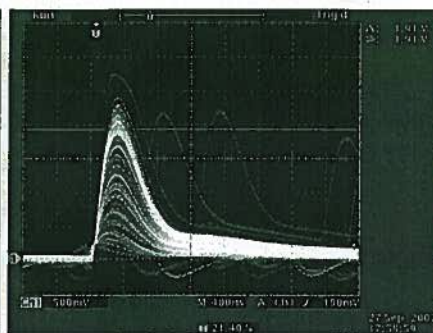
-3700V



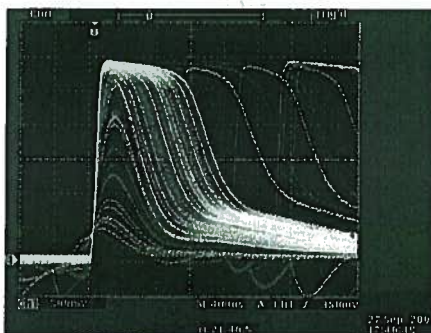
-3550V



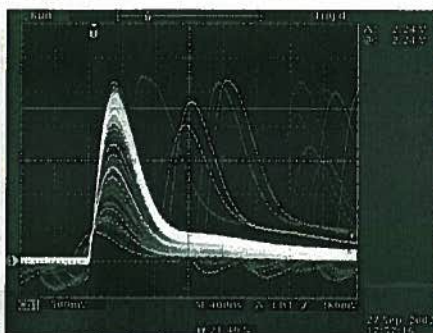
-3800V



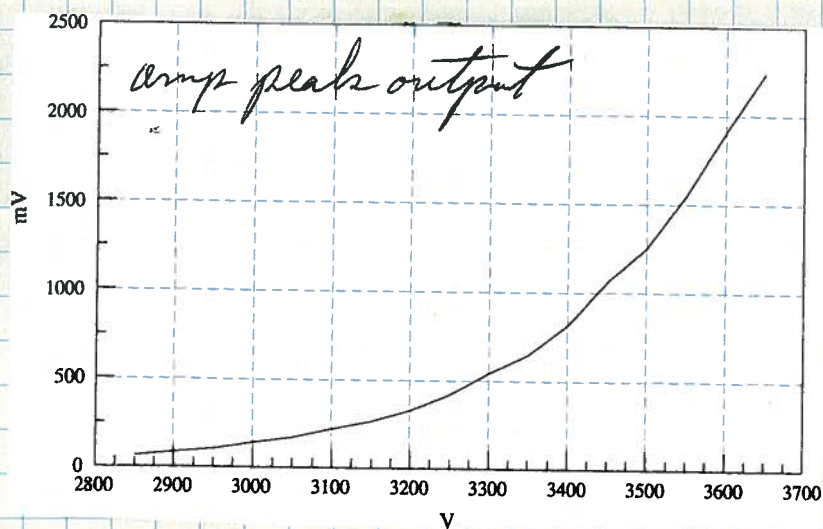
-3600V

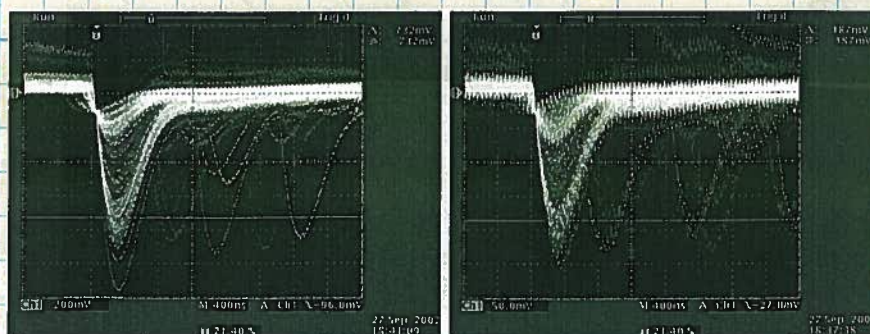


-3900V



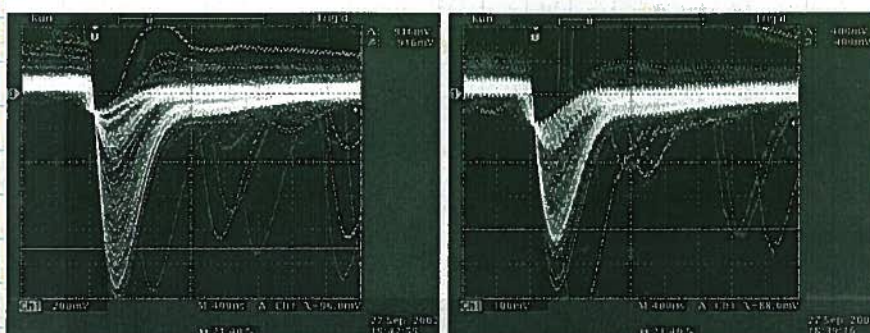
-3650V





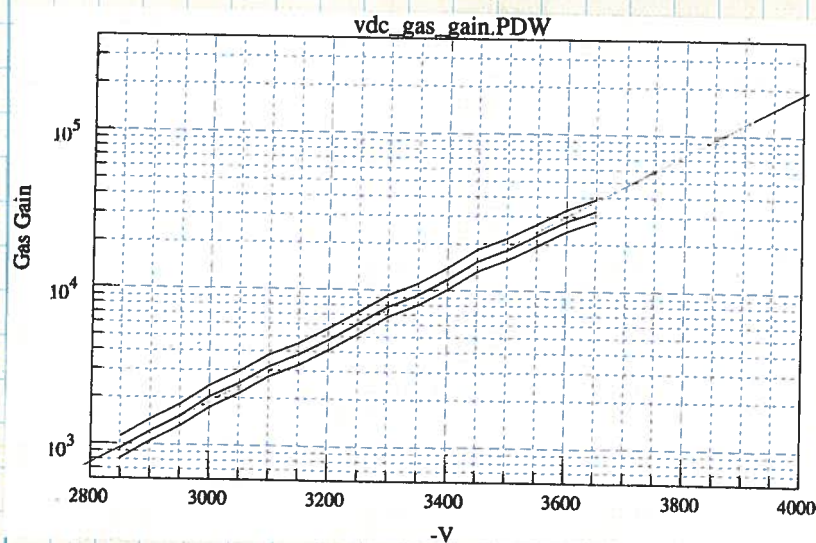
-3900V

-3500V



-4000V

-3700V



The 3 plots are different
m/c values from the
plot on p. 136. sort of
best, worst case & most
likely.

11/25 Wire Tension Measurement Using Audio Speaker

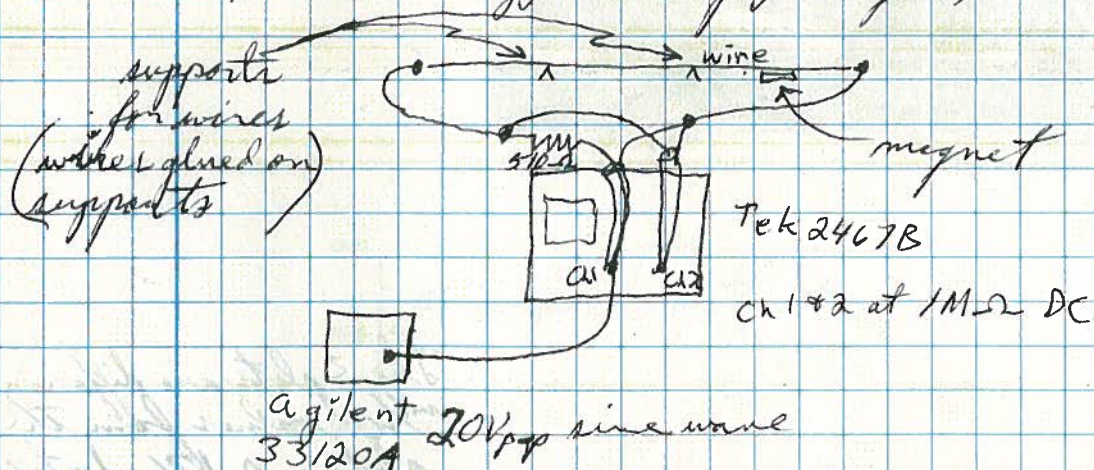
The Italians working on the RICH have attempted to measure the wire tensions using an audio speaker. Apparently they saw the technique used at CERN. They worked on it for a while before asking for an audio amplifier. I bought a JVC model CIA-MXGT700 "Giga-Tube" boom box. Subwoofer supplied by good down to 32 Hz.

After I measured the tension of 3 test wires by using a strong magnet, resistor ^(510 Ω) and function generator, we were then able to set the audio speaker up so we could successfully measure the test wire tensions.

We realized the slot in the plate on the speaker assembly was too narrow. I cut the plate with a hacksaw and slotted the bolt holes on the plate to make the slot width adjustable. It was then easier to measure the tensions of the test wires.

Today the Italians brought out the old plane of anode wires. They had difficulties, but had to leave at noon. I offered to try measuring tensions.

I have again set up a magnet, resistor and ^{510 Ω} gen.



Trying the first sense wire in from one side I get ~ 173 Hz for the resonance frequency. The wire is very visibly vibrating. At ~ 517 Hz I see the wire visibly vibrating with two modes! I can also see the voltage phase shift on the scope at this frequency. So, I believe I am all set up to start.

I am looking down on the wire plane. The 510 Ω resistor is connected to the end which would be the "top" of the detector. It has the socket for the small HV resistor boards to supply HV to the wires. Standing at the "bottom" of the plane, which has the magnet, I will start measuring wires from the left edge (my left).

Looking at the first guard wire I saw a resonance at ~ 503 Hz. However, there seemed to be more than 2 modes. Going down I found another resonance at ~ 185 Hz with two modes. I find the fundamental at ~ 63 Hz.

Continuing:

Wire $\rightarrow$ $\rightarrow$
 (magnet) (speaker)

1	63	61	I am not able to get a wire to resonate with the audio speaker setup. I believe the wire plane is too far away from the slot. I should probably prop up the wire plane & try to rest the cone around the speaker a little better. It's 9 PM. End of this day.
2	91	90	
3	173	171	
4	162	160	
5	154	153	
6	149	171 170	
7	149	147	
8	178	176	
9	157	155	
10	178	176	

$\uparrow$ measured using audio speaker method 11/29

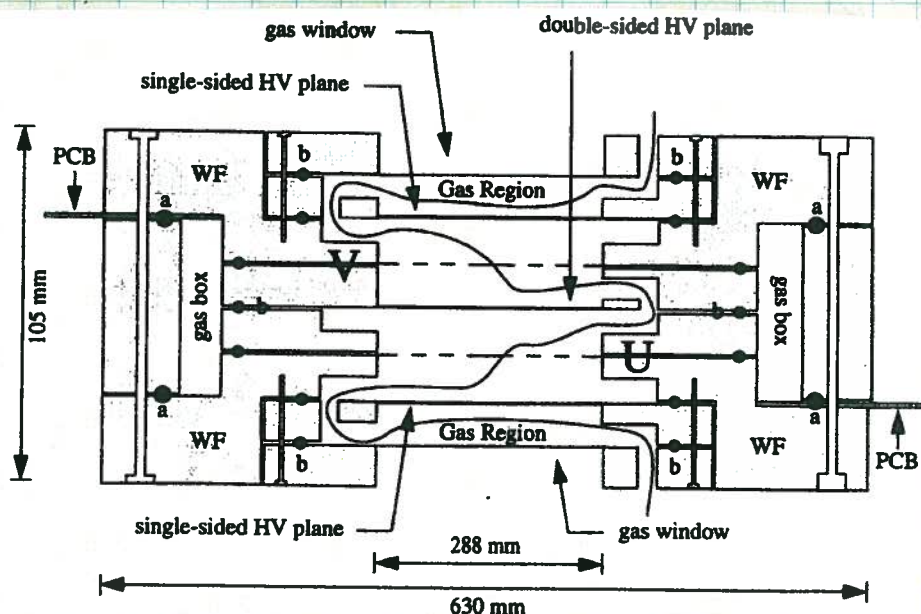
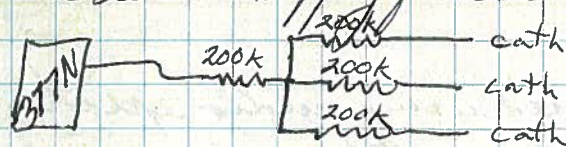
Presently I find I need the receiver volume set to 23, subwoofer at level 3 and sound mode set to "OFF". This gives some small amount of forgiveness in how accurately I need the speaker slot positioned over the center of the wire.

Speaker slot is ~ 23 " above the aluminum frame. Face of frame to face of slot plate.

11/8/03 Aborted Check of 5th VDC

I hooked the 5th VDC up to Ar/CO₂ (75/25). All wires grounded except one set has the E711 Fujitsu preamp on it. Center channel is fed from a balun to the scope. Channel 1 will be from the card in the slot closest to the gas inlet. Ch 2 will be used when the card is in the slot closest to the gas outlet.

Started gas flowing at 16:50, but the rate was ~.03 ft³/hr. I didn't realize it was so low till 17:40. Then increased the flow to ~.15 ft³/hr. I got impatient and cranked the flow up a bit more. Started to bubble at 17:46. Turned the flow back down to .15 ft³/hr. Went home and watched the ~~human~~ ^{core} stripe, till the clouds moved in. Pretty neat! One Bertan supply feeds all three cathodes.



I did not have time to do any more on this. The setup was eventually taken apart. 10/23/04 J.S.

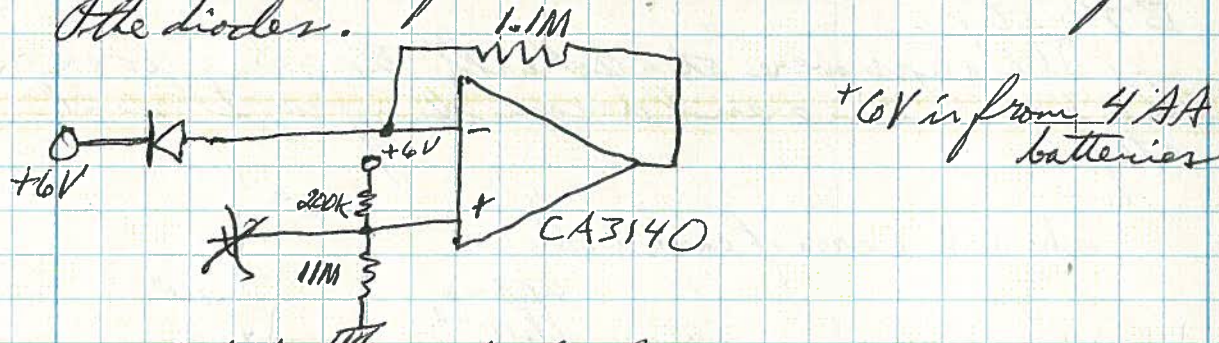
RADFET

Diode Array for Laser Level

4/25/04


Trying to put together a diode array to use with a self-leveling laser diode. I want to use the "center of gravity" of the diode array output to find the height of the laser diode's line above the floor. The main goal is to have a convenient and subjective determination of the flatness of the hall floor.

Just before Christmas I plugged together an amp and one of the planar diodes I'd bought years ago. I could not find a data sheet on the web for the diode.

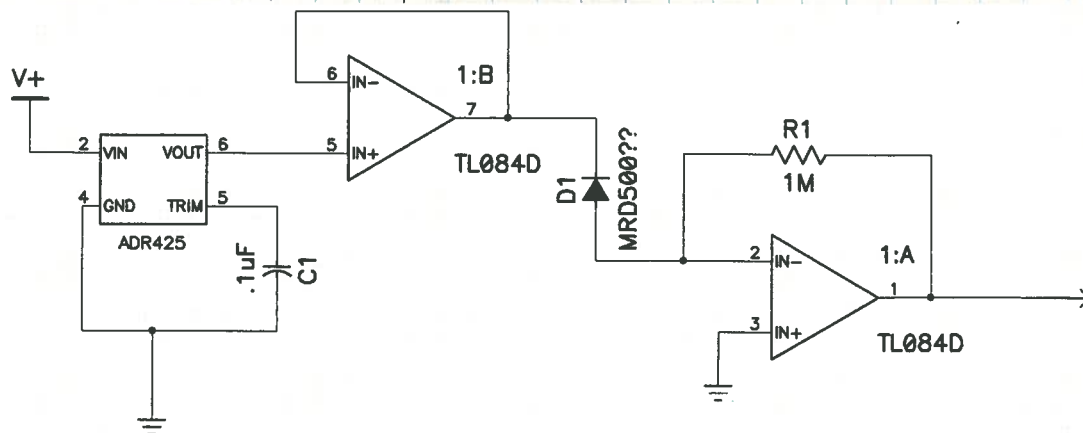


I believe the diodes are MRD500 from Motorola.

The above circuit seemed to give a reasonable response to the laser.

I put together a board with 19 of the diodes in a staggered array. PCAD file in diode-array

The final circuit is on below



The above circuit gives ~1.5-2.0V output to ambient light in the Physics Storage Building. A light shield of some sort is intended.

1/16/05 Diode Array with Laser Diode

After a LOT of problems I have the diode array mounted on a Vilmer slider and readout by a webDAQ scanning ADC. No additional filtering of the photodiode (PD) signals is done.

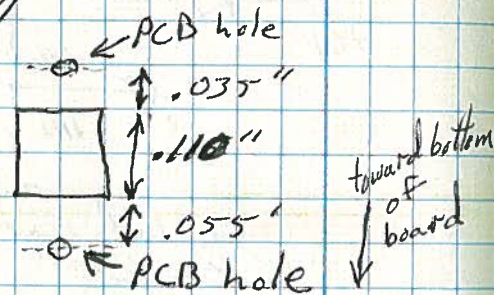
The Vilmer slider was set for 600 steps per move. After each move the webDAQ was set to scan for a few seconds. The webDAQ scan rate was 10Hz.

The plots on the next two pages show the means of the scans for the 21st through 37th steps. After the 37th the laser was turned off and a scan of ~30 seconds was done in the same position as the 37th step.

The steps were started with the array above the laser line and descending with each step.

The active area of each diode is approx $.110''^2$

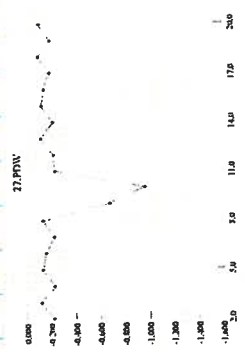
Measurements made with a measuring magnifier



A better drawing of the diode array is on p. 149.

The laser was set up ≈ 12 ft from the PD array. Laser is a Mark 2 cross hair generator.

The basic circuit is as below



same plot?

