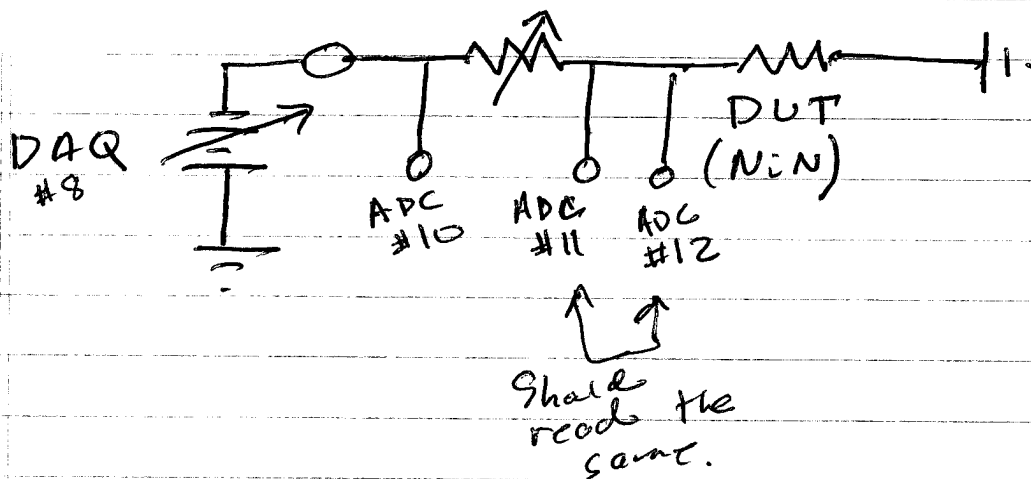
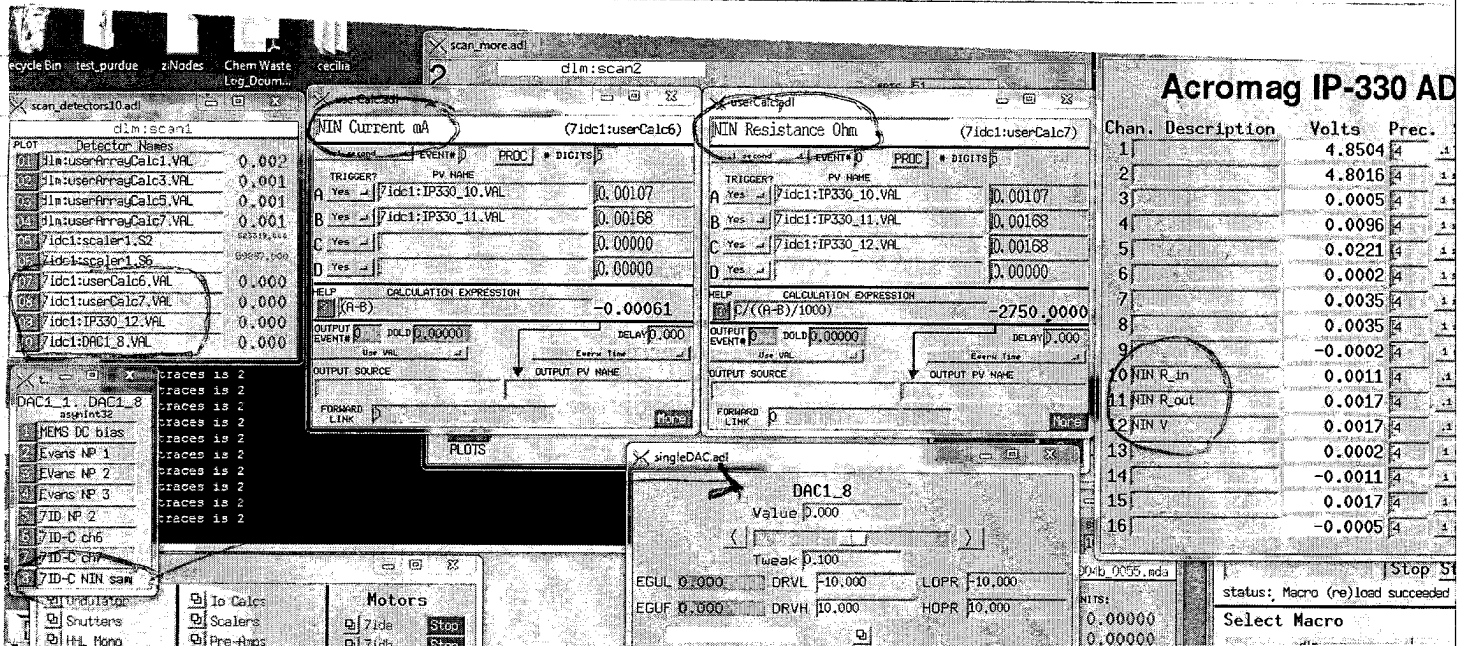


2a
2PM

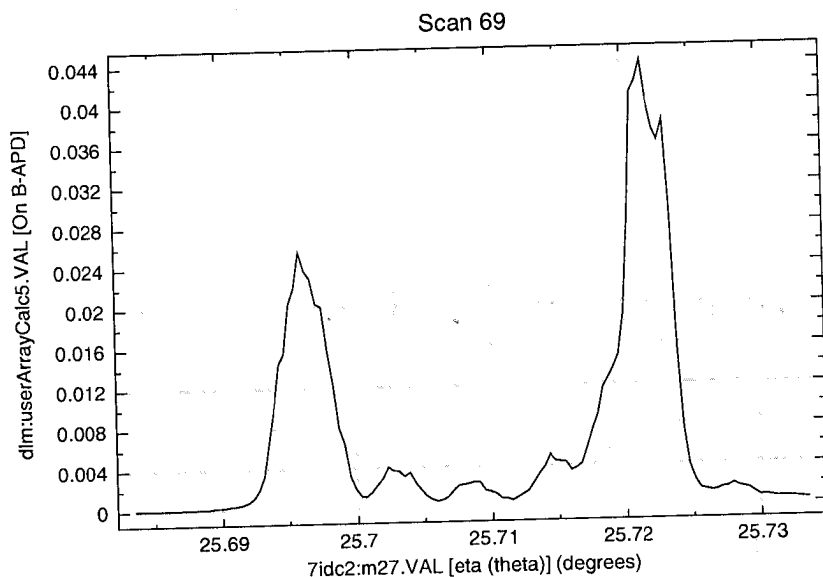
Det #7, current across NiN device in mA
 Det #8, NiN resistance in Ω .
 Det #9, voltage across NiN device in V
 Det #10, Output voltage of DAQ (DAQ #8)



Pot initially set to 1000.0 Ω .
 Range on DAQ is $\pm 10V$

Pot in
Range on

Single photon mode
Amplifier 10.41 V. \leftrightarrow 7.3 V.



~ 0.12

Scan started from $25.7085^\circ = \theta$
-0.025 to +0.025, 126 steps

Saturates

↳

Control Voltage = 7.2 V 0.02 A

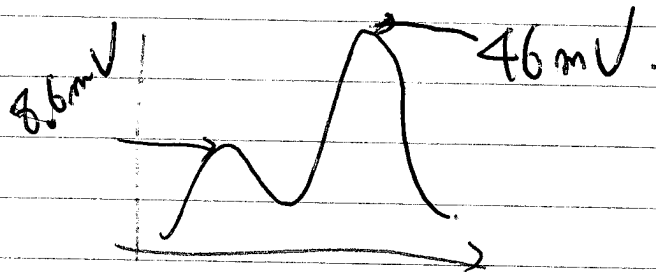
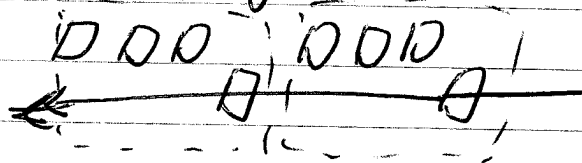
Bias Voltage = ± 211 V

↳

Now saturates at around ~ 0.12 V on Scope.

→ 4th pink-filter inserted for the Scan.

#80. filter change.



DAQ

7ID-C

→ Analog

→ 7ID-C NING

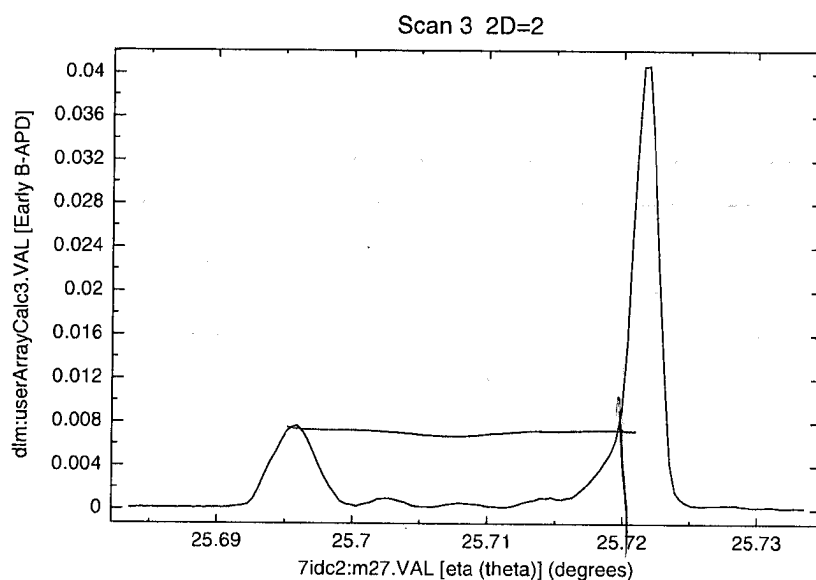
File name changed → NIN.

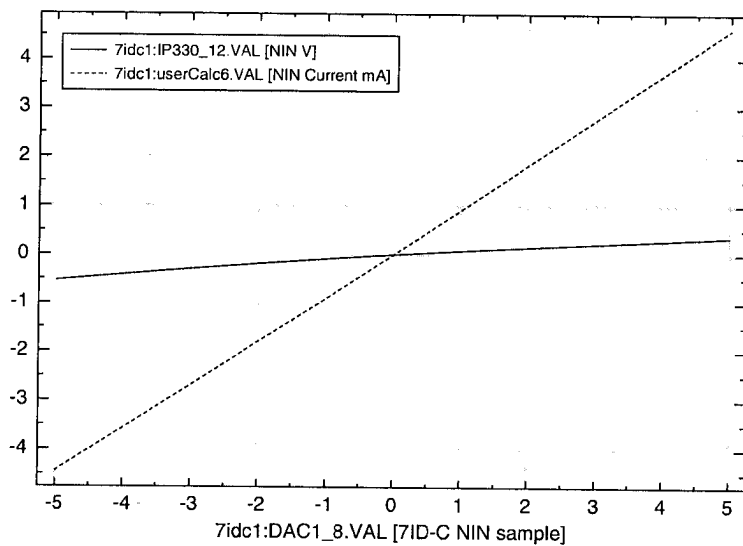
#1. I-V curve.

#2 th scan.

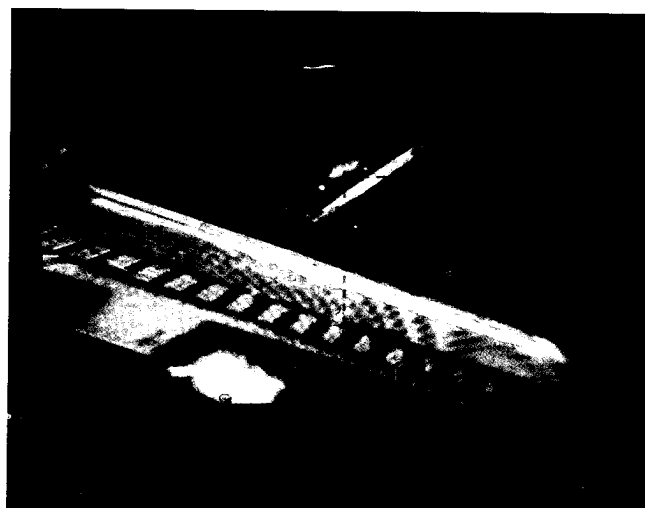
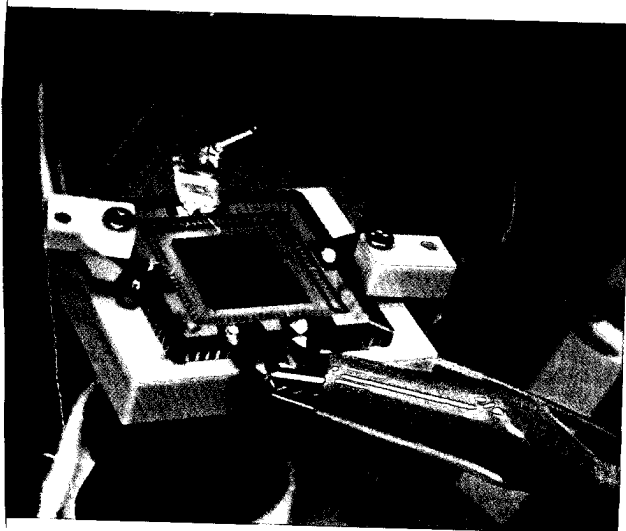
#3 2-D scan.

th = $-0.025 \sim 0.025$ 126 steps, 0.4 mdegree
Vias = $-10 \sim 10$ 11 points, 2 step size

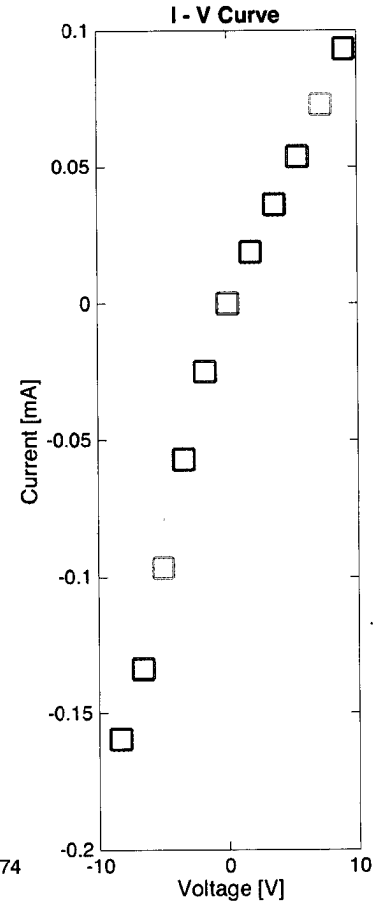
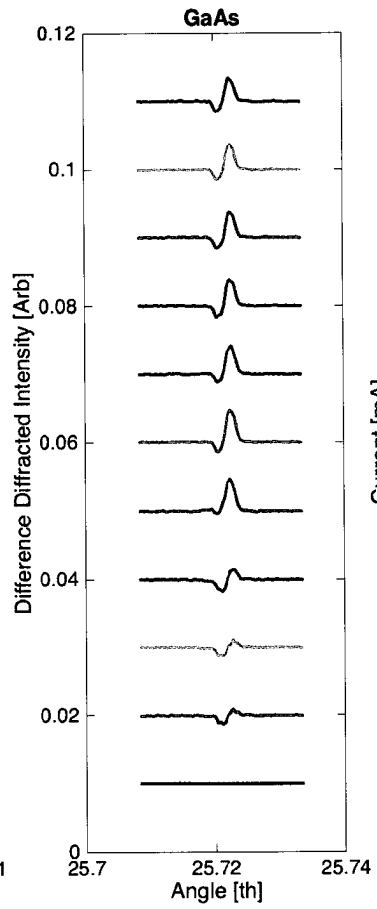
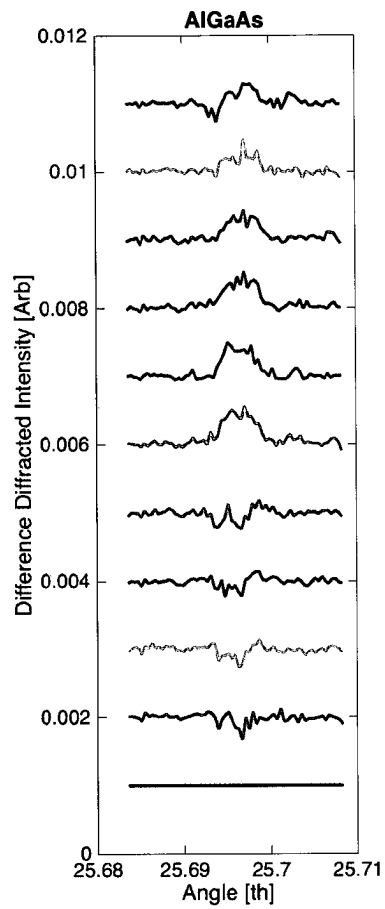
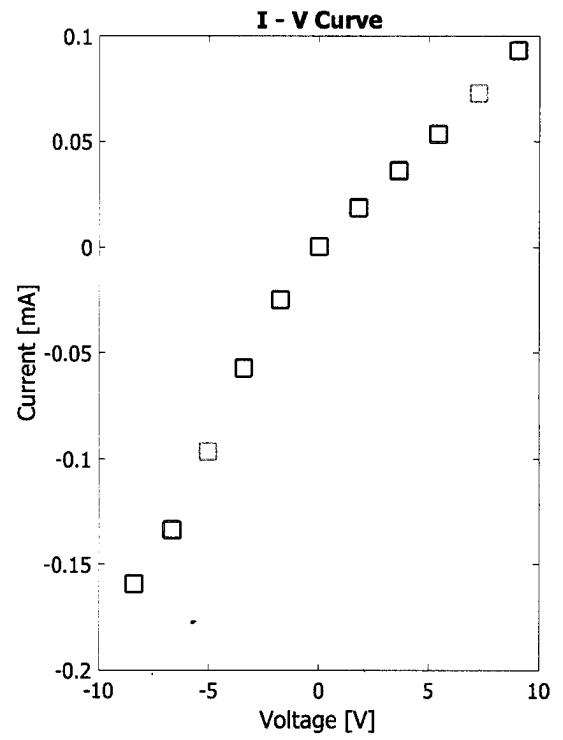
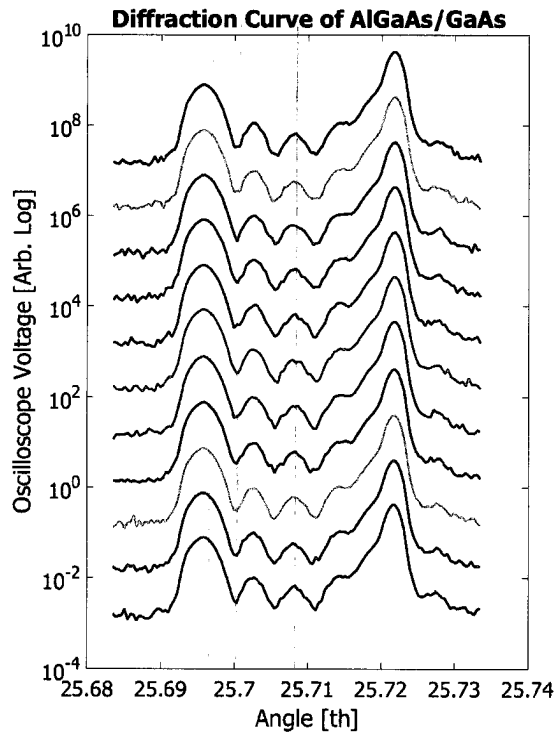


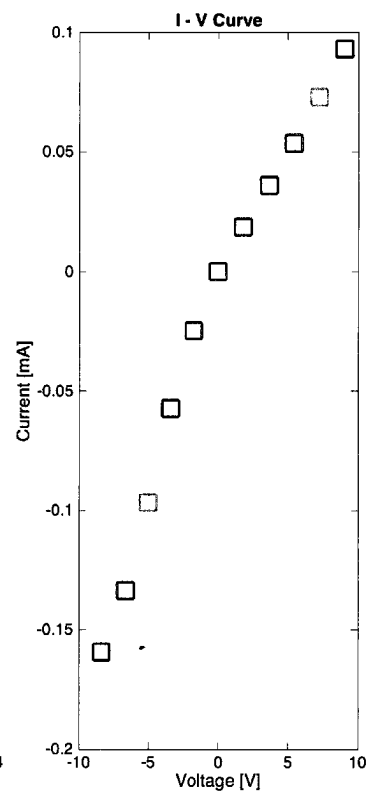
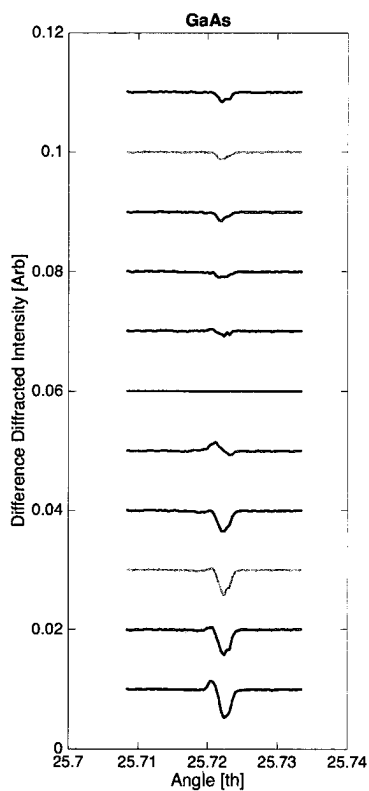
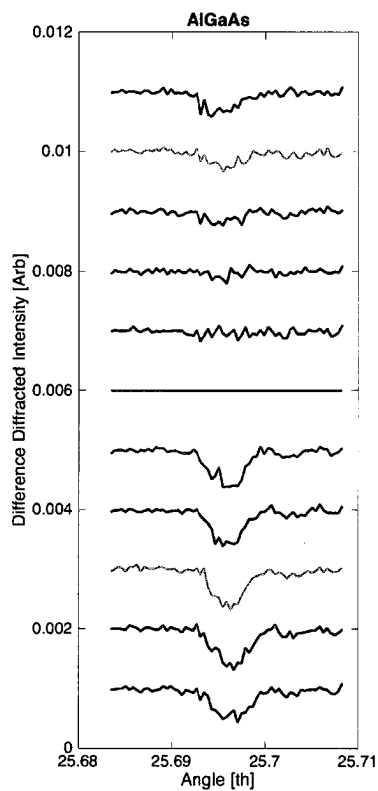


Scan #	AlGaAs Pos.	AlGaAs FWHM	GaAs Pos.	GaAs FWHM
1	$2.569573 \cdot 10^1$	$3.7208 \cdot 10^{-3}$	$2.572161 \cdot 10^1$	$2.1286 \cdot 10^{-3}$
2	$2.569571 \cdot 10^1$	$3.7254 \cdot 10^{-3}$	$2.572164 \cdot 10^1$	$2.1267 \cdot 10^{-3}$
3	$2.569574 \cdot 10^1$	$3.7451 \cdot 10^{-3}$	$2.572165 \cdot 10^1$	$2.1237 \cdot 10^{-3}$
4	$2.569575 \cdot 10^1$	$3.7376 \cdot 10^{-3}$	$2.572167 \cdot 10^1$	$2.1298 \cdot 10^{-3}$
5	$2.569574 \cdot 10^1$	$3.7107 \cdot 10^{-3}$	$2.572169 \cdot 10^1$	$2.1401 \cdot 10^{-3}$
6	$2.569577 \cdot 10^1$	$3.7361 \cdot 10^{-3}$	$2.572172 \cdot 10^1$	$2.1267 \cdot 10^{-3}$
7	$2.569578 \cdot 10^1$	$3.7493 \cdot 10^{-3}$	$2.572170 \cdot 10^1$	$2.1474 \cdot 10^{-3}$
8	$2.569577 \cdot 10^1$	$3.7455 \cdot 10^{-3}$	$2.572171 \cdot 10^1$	$2.1291 \cdot 10^{-3}$
9	$2.569579 \cdot 10^1$	$3.7823 \cdot 10^{-3}$	$2.572171 \cdot 10^1$	$2.1413 \cdot 10^{-3}$
10	$2.569577 \cdot 10^1$	$3.7319 \cdot 10^{-3}$	$2.572171 \cdot 10^1$	$2.1453 \cdot 10^{-3}$
11	$2.569579 \cdot 10^1$	$3.7134 \cdot 10^{-3}$	$2.572170 \cdot 10^1$	$2.1365 \cdot 10^{-3}$



US atomic - spec





Time-Scan / with Bragg ;

→ GaAs angle $\theta = 25.720^\circ$

→ AlGaAs Angle $\theta = 25.694^\circ$

NZV Scan #3 Laser OFF 1p $\theta = -0.025 \sim 0.025$
126 pts.

Scan #4 Pump

Scan #5 Laser ON, NP = 40
 $\theta = -0.025 \sim 0.025$

Scan #6 Laser ON, NP = 28
same angle Scan

2D Scan Time

inner bias; $-10 \sim +10$; [1]

outer Time; $(-4 \sim +1) e^{-9} s$

Single DAC. add \rightarrow C-Hold

\hookrightarrow Anal. I/O

Time start

80.8416×10^{-6}

Scan # ~~10~~ 17

\hookrightarrow DAC out

\rightarrow TIP-C

NEN sample

GaAs - side angle (25.720°)

2D Scan (Bias + Time)

Scan # 21 Same, but at AlGaAs-shift
angle of $\theta = 25.694^\circ$
2D Scan (Bias + Time)

Scan 27 2D (Angle time)

Angle θ : $-0.012 \sim 0.008$, 61 pts

Time $-4 \times 10^{-9} \sim 1 \times 10^{-9}$, 51 pts

\hookrightarrow Zero Bias

Scan # 35

AlGaAs ~~meas~~ measurement.

\rightarrow No attenuator!

Peak curve
time scan,

th: 25.6957.

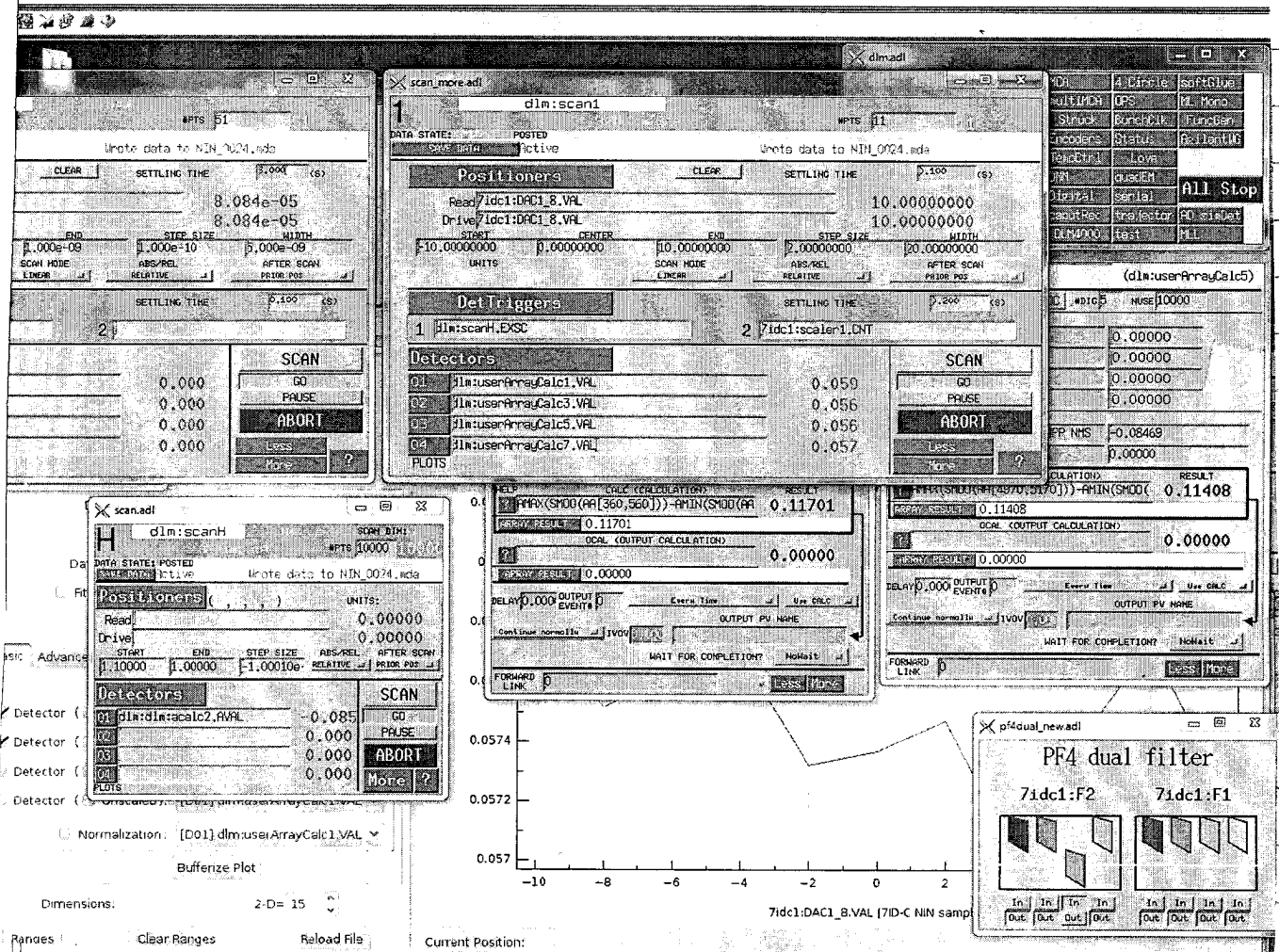
$-0.012 \sim 0.08$, 61 points

No ~~Bias~~ Bias

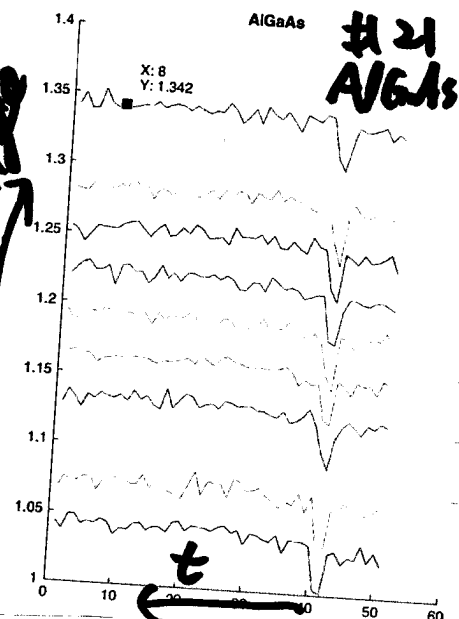
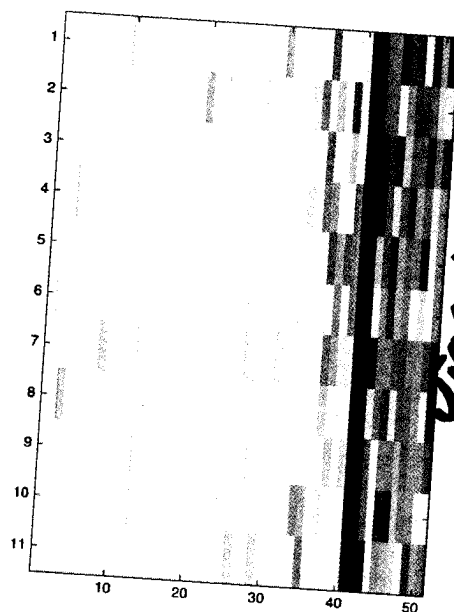
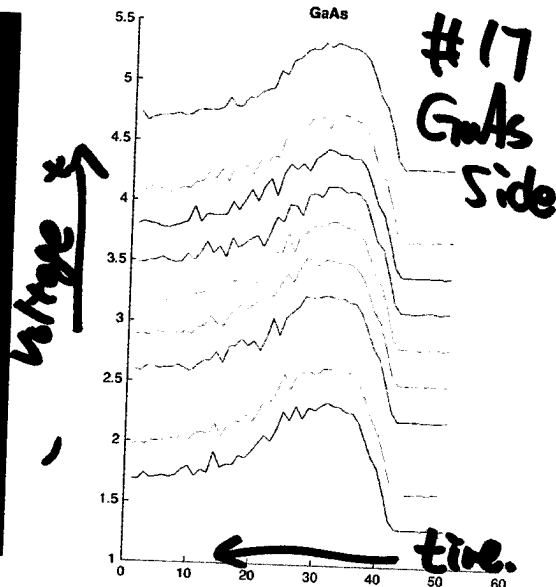
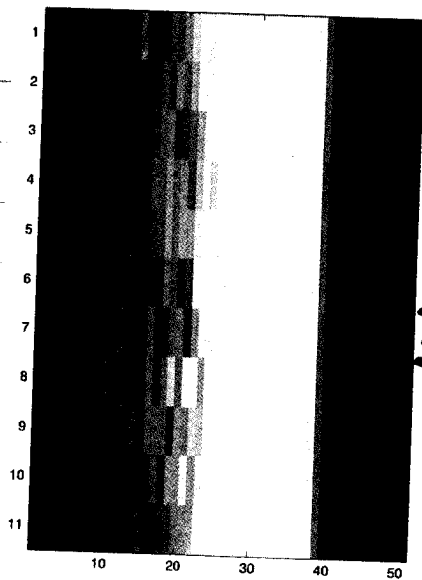
Delay: 80.8416×10^{-6}

$-4 ns \sim 1 ns$, 51 points

↳ user-calc → user array calc.



↳ Scan parameters for Bars vs Time



-10V, AlGaAs peak Time evolution.

DAC1-8 = -10.
 (thscan : -0.012 ~ 0.012 , 6/step
 Delay " : -4ns ~ 1ns , 5/step)
 # 036

⇒ This Data is same with
 which is not apply voltage (#35)
 ABORT IT.

We Reduced Laser power,
Check peak positions again?

#37 th scan. "WP: 0"

#38. th 25.694 (AlGaAs side) ^{Left.}
Tirescan -4ns ~ 1ns, 51. ~~V = -1~~ V = -1

#39 th 25.720 (GaAs Left side)
Tirescan. ~~V = -1~~ V = -1

⇒ #38, #39, at WP 0, GaAs moves but AlGaAs don't

Let's find minimum WP Energy which can make AlGaAs move?

→ WP[scan]
LO Later.

~~#40. delay = 80.8415 × 10⁻⁶
th = 25.694~~

~~#40~~
#42 th: 25.72 (GaAs side)
V = +10 V.

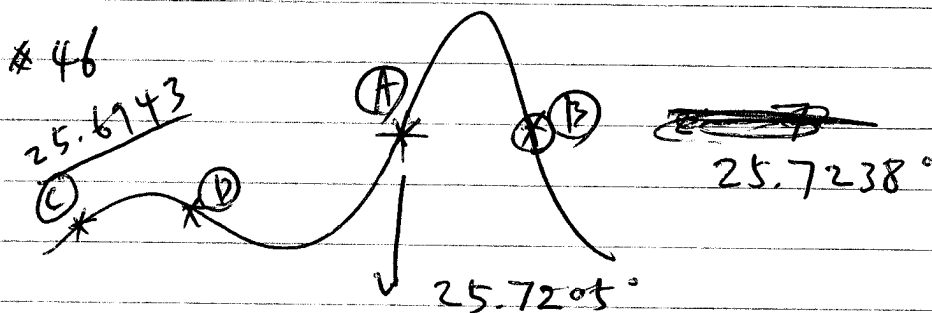
#43 th: 25.72 (GaAs side)
V = 0 V.
"Laser down!!"

For Rev Voltage.

#44.

th : 25.7216 (GaAs) center.

~~th~~. -0.01 ~~x~~ 0.01, 101 x scan / $-V = 0$.



Bias Scan: -10 ~ 10, 51 steps.

A+ (A),

#47 : Repeat

When Bias is on

#48 : Repeat

"Contraction"

#49 : Repeat

#50 : Repeat

A+ (B)

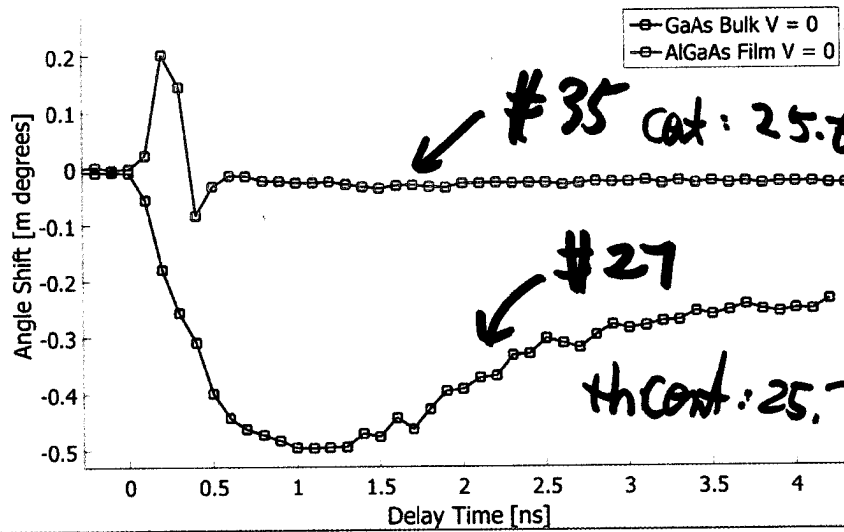
#51 : Repeat

A+ (C)

#52, #53, #54, #55

A+ (C)

#56



~~#35~~ #27. GaAs center shift.

th: 25.7222, delay: 80.8416×10^{-6} , WP: 34, V = 0

th: -0.012 ~ 0.008, 61

del: -4 ns ~ 1 ns, 51 points

#59.02 th: 25.72 (GaAs side)
 V = -10, WP: 44.8
 timescan -4 ns ~ 1 ns, 51st

2-D Scan.

Delay: -6 ns ~ 1 ns 50PS step, 141

Bias: -10 ~ 10 ~ 11 steps.

#63 " "
 V = 0.

#65 th: 25.72.
 Delay: 84.8416×10^{-6}

#64
 V = +10

None changed.

↳ NZN-S002-# mda.

WP: 44.8

1 - V10

$$-6e^{-9} \sim +1e^{-9}$$
$$\# \mathbb{Z} - \sqrt{0}$$
$$\Delta t = 50 \text{ ps}, 141 \text{ pfs}$$

#3 $\rightarrow -10V$

#4 ~~coil~~ → 10V.

#8 → 0V.

13 → -10

#5 \rightarrow 10V.

#9 → @✓

14 -> -100

#6 \rightarrow 10V.

10-20V

#15 → -10V

#9 → 10V

#127-06

#16 → -100

Doc. No. 2, 10/18/80, Vol. 1, Ser. 1, p. 1

1. 200.0 - 210.0
 2. 210.0 - 220.0

2002-2003 2002-2003 2002-2003

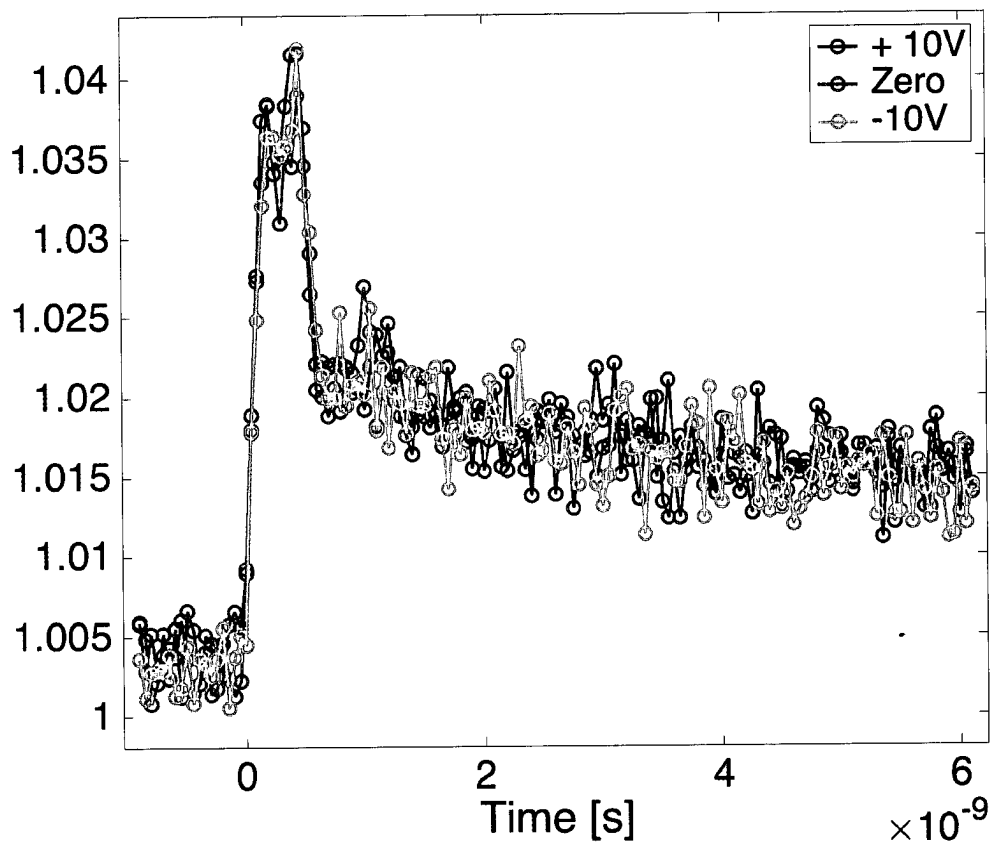
Weeks: 10

[illegible]

2020-2021

2019-2020
 2019-2020

014



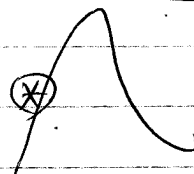
$\frac{1}{2} = 37^\circ$; increased the power

Scan 17

$\theta = 25.720$

$\theta = 25.6943$

AlGaAs



Same time Scan

Bias = 0

Scan 18

Repeat #18: time-range changed

$-6 \times 10^{-9} \sim 1 \times 10^{-9}$

Bias = -10

#20; Repeat 19 with Bias = ± 10

#21: X-rays off (shuttered)

I-V curves as a function of laser power

Scan 1: -10 to $+10$ V_{ADC}, 101 steps.

Scan 2: WP = 45° to 28° , 18 steps.

#22 1D scan of I-V curve,

X-rays ~~on~~^{off}, laser nearly off (WP = 45°)

#23, X-rays on, I-V curve again

Conclusion: Out of ~ 10 mA total current at ~ -1 V, less than 0.2 mA is generated by laser or X-rays.

#24. Align laser only on sample
See large change in R, I
(\sim factor of 2).

#26 $\Theta = \cancel{27.25.270^\circ} 25.720^\circ$
(side of GaAs).

I-V scan with X-rays on
X-rays look same as before

#27 $\Theta = 25.694^\circ$ (AlGaAs)

No pattern during I-V scan.

Next page

Changed Shunt Resistor to 100.0Ω

Changed user Calcs. Can now drive full ± 20 mA through sample.

See I-V curve following pages

Scan 40 2D Scan

Inner Loop: \ominus , 126 pts across peak

Outer loop: $V_{APC} - 5$ to $+5$ 21 pts

At $T = 80.8414 \mu s$ of delay (max effect)

Can compare On vs Off for each peak as a function of bias.

No effect seen from peak shift \odot

WP = 28°

I (mA)	V	GaAs ON	GaAs EARLY	GaAs SHIFT	AlGaAs ON	AlGaAs EARLY	AlGaAs SHIFT
-22.8	-1.87	25.72204	25.72235	-0.00031	25.69667	25.69669	-0.00002
-22.78	-1.86	25.72193	25.72225	-0.00032	25.69658	25.6966	-0.00002
-21.3	-1.81	25.72192	25.72223	-0.00031	25.69654	25.69656	-0.00002
-17.8	-1.67	25.72195	25.72227	-0.00032	25.69656	25.69658	-0.00002
-14.57	-1.5	25.72201	25.72233	-0.00032	25.69657	25.69661	-0.00004
-11.56	-1.31	25.72211	25.72241	-0.0003	25.6966	25.69663	-0.00003
-8.92	-1.08	25.7221	25.72241	-0.00031	25.69662	25.69664	-0.00002
-6.62	-0.82	25.72216	25.72246	-0.0003	25.69665	25.69667	-0.00002
-4.54	-0.54	25.72218	25.72249	-0.00031	25.69666	25.69669	-0.00003
-2.41	-0.25	25.7222	25.72251	-0.00031	25.69667	25.6967	-0.00003
0	0	25.72222	25.72253	-0.00031	25.69668	25.69671	-0.00003
2.76	0.21	25.72223	25.72254	-0.00031	25.69667	25.69671	-0.00004
5.65	0.42	25.72222	25.72253	-0.00031	25.69666	25.6967	-0.00004
8.55	0.62	25.72221	25.72252	-0.00031	25.69667	25.69669	-0.00002
11.46	0.83				25.69664	25.69666	-0.00002
14.45	1.01				25.69663	25.69666	-0.00003
17.65	1.18				25.69659	25.69661	-0.00002

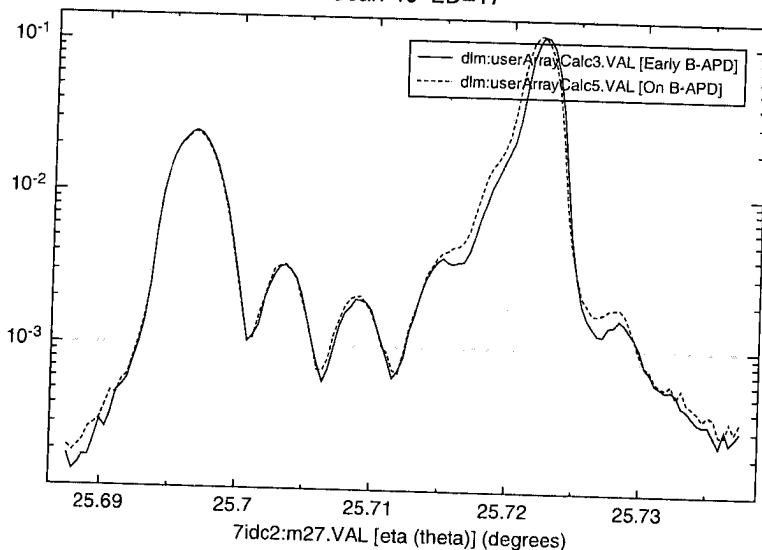
↑

No pattern.

↑

However, this scan does have lots of beautiful rocking curves.

Scan 40 2D=17



Lots of these for each bias,

80.8414 μs delay.

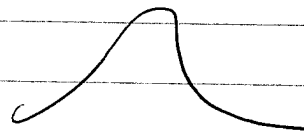
Scan 41. Same as ~~Scan~~ Scan 40, but
different laser delay: $80.8404 \mu\text{s}$,
or $\sim 1 \text{ ns}$ after $T\phi$.
Started 3 pm. Ending $\sim 5 \text{ pm}$.
 $WP = 28^\circ$.

Want to see time-response on lower side
of ALCs once more

Bias = 1

$-1.5 \times 10^{-9} \sim 1 \times 10^{-9}$; 51 pts.

Scan #42



$$\frac{\lambda}{2} = 28^\circ$$

Repeat with Bias = 10
Scan #43

Repeat Bias = -10
Scan #44

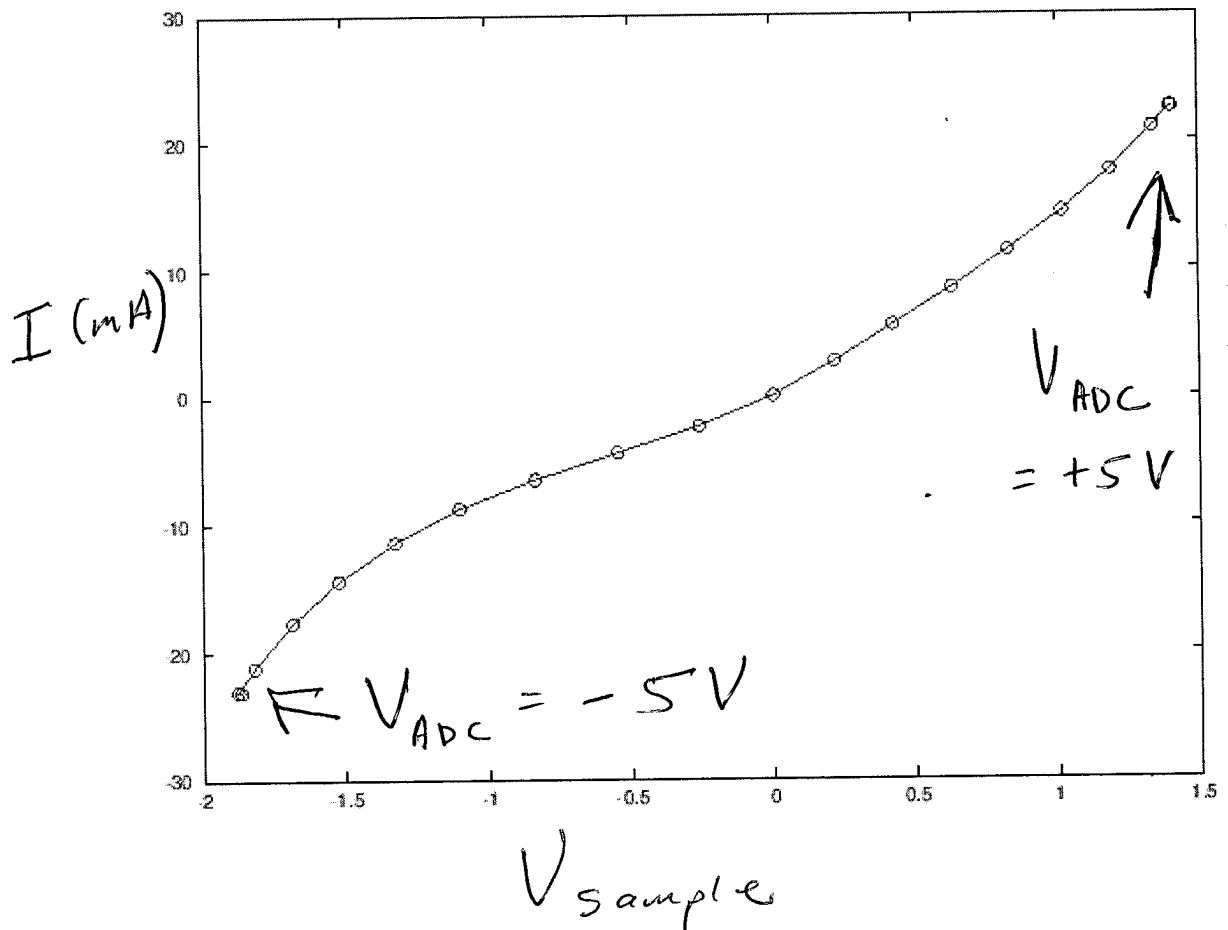
Bias = -10, $-10 \text{ ns} \sim 1 \text{ ns}$
Scan #45

Bias = +10 $-10 \text{ ns} \sim 1 \text{ ns}$
Scan #46
Scan #47

Scan #48

Bias = -10, 101 steps
 $-10 \text{ ns} \sim 1 \text{ ns}$

Note: Current I - V curve:
run V_{ADC} from -5 to $+5$ V.



10^{-7}
 $-4 \sim 1$ ns
 10^{-10} s

Well Nothing is really working out.

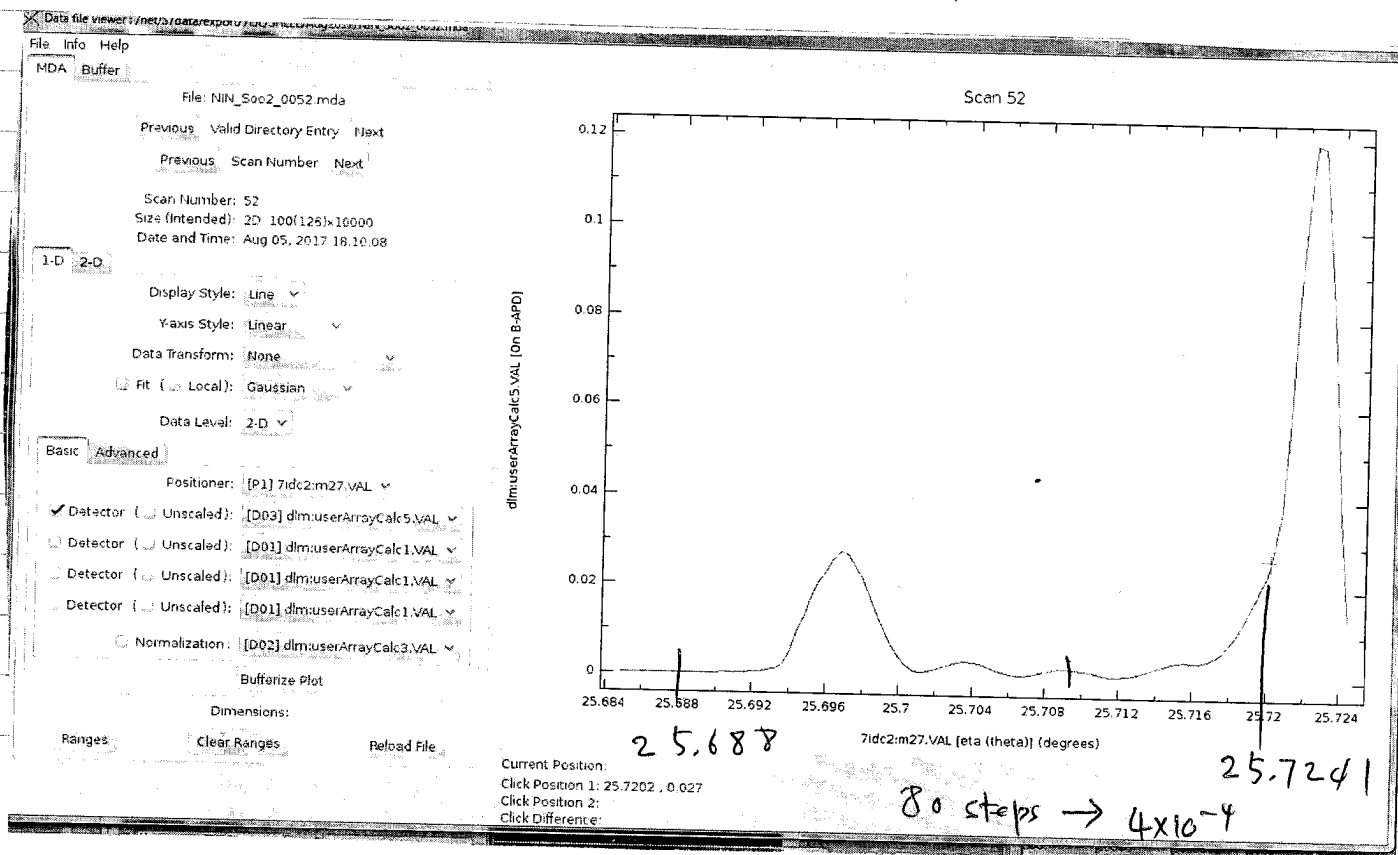
I am going to take a high resolution rocking curve
 Scan with bias = 0
 ± 0.025 , 126 steps.

↳ put filter in-between
 near CaAs peak.

Re-centering

#52 → Re-centering sample
 $\pm 2.5 \times 10^{-2}$, 126 pts

→ 4×10^{-4} step size



#53

Time - Scan at 25.7241

-4 ns ~ 1 ns ; 50 ps resolution

No PF4 filter on.

#54

Repeat @ 25.7182

#55

Repeat @ 25.6942 (AlCnAs)

#57. 2D scan. (th, delay)

start at 7:18 PM

05-08-2017

th center: 25.7040

Delay : 80.8416×10^{-6}

No x-ray filter,

Laser waveplate: 37.

No Bias : 0.

th ~~1.6~~ $1.6 \times 10^{-2} \sim 1.6 \times 10^{-2}$, 81 steps (0.4 mdeg)

Delay : -6 ns \sim 1 ns 51 steps, (100 ps.)

~~Mistake?~~
absolute scan!!

~~#58 2D scan again? WP=35.~~

#64. To check again

#66 2D scan again? @ AlGaAs

GAs scan.

#69. filter.

off on off off off off
□ □ □ □ □ □ □
pink.

th center. , -0.008 \sim 0.008 , 41 points.

#70. th (GaAs scan)

2D scan.

-1.5 ns \sim 0.5 ns , 50 ps , 41 steps.

WP 38

#71 th (AlGaAs) 25.6969

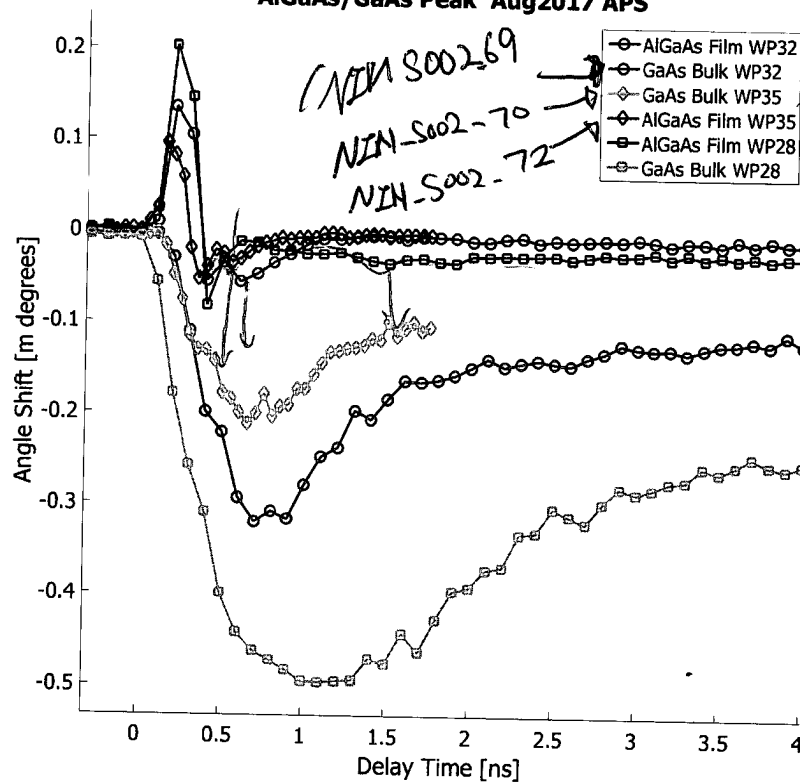
25.6864
25.6789
25.68

#72 th (AlGaAs) scan.

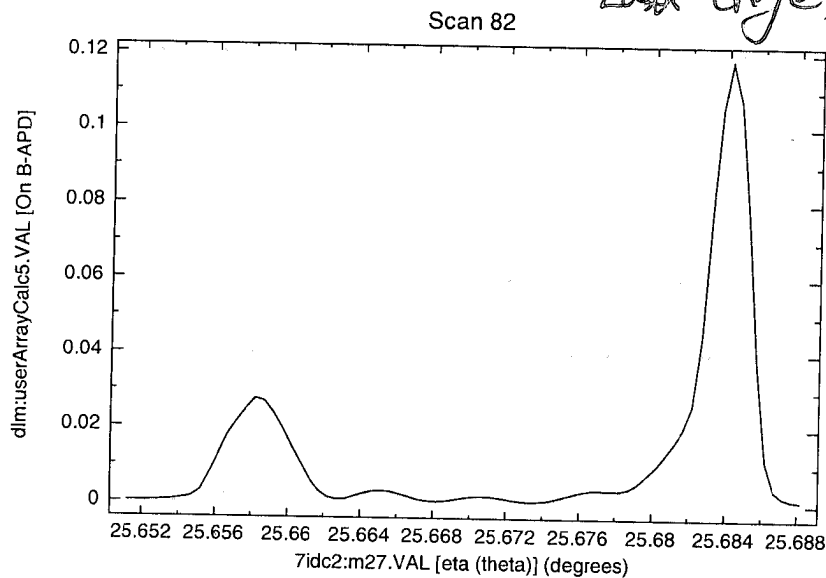
2D

WP 38

AlGaAs/GaAs Peak Aug2017 APS



After sample re-locate. (~~same~~ Laser change)



change over to Second Harmonic
8-6-2017

→ Check timing (Scope)

→ ALGaAs side time-Scan

→ GaAs side time-Scan

→ Quick bias check for both ± 5 .

→ 2D Angle-time Scan → shape analysis will matter (15) 3

$$\text{Current } I_0 = 80.8416 \text{ e}^{-6}$$

$$\text{ALGaAs } \theta_c = 25.697$$

$$\text{GaAs } \theta_c = 25.72256$$

NOT SURE ABOUT LASER CONVERSION EFFC.

AM 07:15.

changed Laser photon Energy $\rightarrow 400 \text{ nm}$
fine X-ray diffraction again.

$$-\text{chi} = 89.7940, \text{ pi} = 91.4955$$

GaAs : #77, Center: 25.6842

ALGaAs : #80, Center: 25.65840.

Find T_0 test shot

#80 (at) side of GaAs. $\text{th} = 25.6830 \quad V = 0$

#89 $-4 \text{ ns} \sim 1 \text{ ns. } \delta = 40 \text{ pps}$

#89 $-20 \text{ ns} \sim 1 \text{ ns } \rho = 1 \text{ ns}$

#90 (at) side of ALGaAs $\text{th} = 25.6562. \quad V' = 0$

#91. AIGAs. $-20\text{ns} \sim 1\text{ns}$, $\Delta t = 1\text{ns}$. (th) 2

Add Bias -5V

#92. same with #91

Add Bias $+5\text{V}$

#93, same with #91

#94. $-150\text{ns} \sim 1\text{ns}$, $\Delta t = 1\text{ns}$

~~#94~~ Bias zero

#95 $-150\text{ns} \sim 1\text{ns}$, $\Delta t = 1\text{ns}$

Add Bias -5V

#96 $-150\text{ns} \sim 1\text{ns}$, $\Delta t = 1\text{ns}$

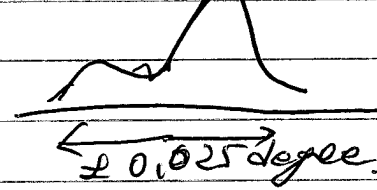
— • — • — • — • —

Add Bias -5V $t_h = 25.6830$: GAs side. LEF ✓

#97 $-150\text{ns} \sim 1\text{ns}$, $\Delta t = 1\text{ns}$

Add Bias 0. Zero.

#98 $-150\text{ns} \sim 1\text{ns}$ $\Delta t = 1\text{ns}$

★ #99 th 1-D scan 

$$\text{Delay} = .808416 \times 10^{-6}$$

#100

$$\text{Delay} : 80.8418 \times 10^{-6} \text{ } (-200 \text{ ps})$$

± 30 m degree th scan.

#101

$$\text{Delay} : -1 \text{ ns before } 80.8416 \times 10^{-6}$$

Rescan.

★ 2D Scan.

$$\text{WP} = 25.$$

#102 delay - 3 ns ~ 1 ns, $\sigma t = 50 \text{ ps}$
 $\Theta = 25.672^\circ$ ± 30 m degree

Start 10 AM.

Scan 103 Same as 102 but
 broad time range

~~+1 to~~ -159 ns to +1 ns 41 steps
 (4 ns / step). $\Theta = 25.672^\circ$ center, 126 ang pts
 (0.4 mdeg). Started 4:30 pm

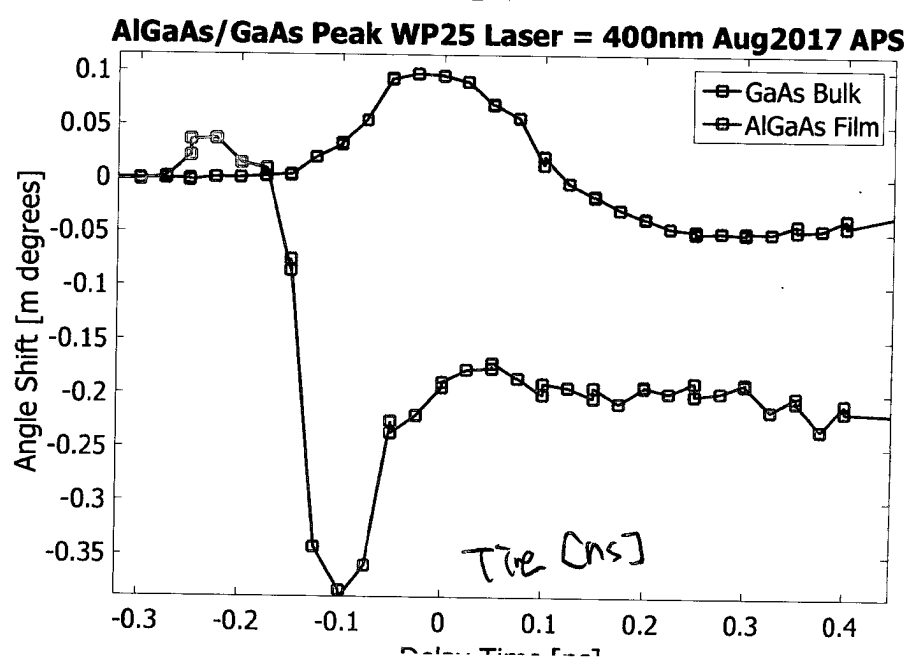
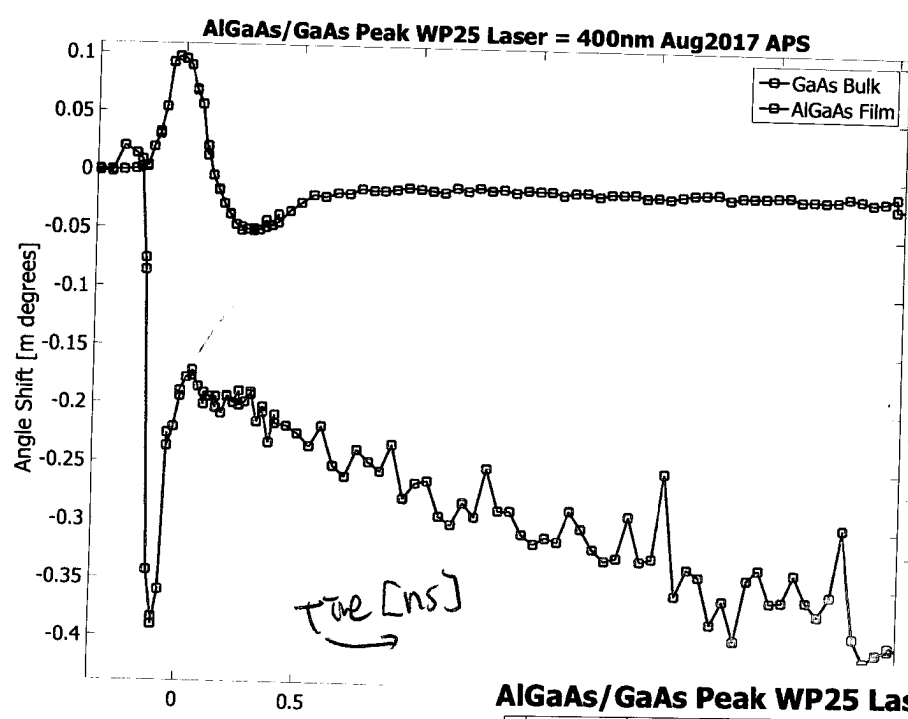
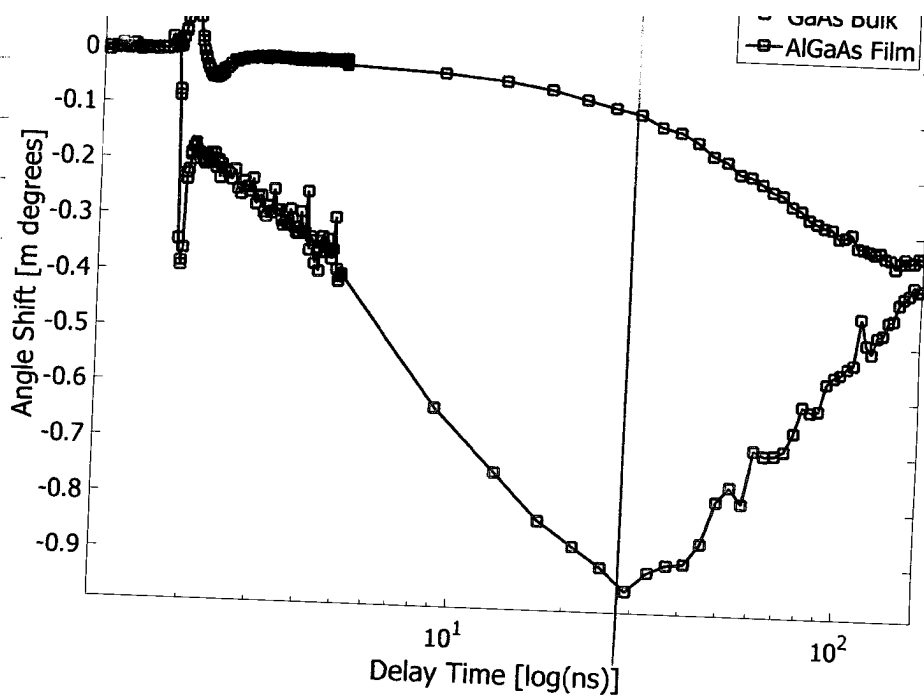
Scan 104

delay $-4 \times 10^{-10} \sim 2 \times 10^{-10}$, $\sigma t = 25 \times 10^{-11}$, 25 steps

Scan 105

delay $+2.25 \times 10^{-10}$ to $+3.00 \times 10^{-10}$, 25 ps steps
 (4 pts on 1/4)

Overlay all of these



Result of 224-5062-#16

Change file name

\Rightarrow NIN-S003-#. ~~2D Scan~~

NIN-S003-1.mda

$\left. \begin{array}{l} th = -0.03 \sim 0.03, \quad oth = 0.0004, \quad 151 \text{ steps.} \\ delay = -3ns \sim 1ns, \quad dt = 100ps, \quad 41 \text{ steps.} \\ WP : 34, \\ th = 25.6720 \end{array} \right\} \text{start at } 11:34 \text{ PM, } 06-08-2017.$
 $delay = 80.8416 \times 10^{-6}$
 \Rightarrow Stopped at 12:02 AM, 07-08-2017.

"X-ray problem."

th: ~~25.684~~ 25.684

only GAs peak scan with time and Laser.

#26.

thc = 25.684, delay = 80.8416×10^{-6}

th = $-0.008 \sim 0.008$, oth = 0.0004, 41 steps

delay = $-3ns \sim 1ns$, dt = 100ps, 41 steps

WP = 30.

start at AM3:19

for better statistic, Avenum 500 \rightarrow 1500.

delay $-3ns \sim 2ns$, Scan.

Laser 400nm

WP (deg.)	reference (mW)	mW at sample	fluence mJ/cm ²				9.491709	sample incident fluence
0	253	0	0	0	0	0	9.379159	0
5	250	0	0	0	5	0	8.741376	0
10	233	0	0	0	10	0	7.503327	0
15	200	4	1.295522532	0.064776	15	0.608210988	6.077695	0.608210988
20	162	11	3.562686964	0.178134	20	1.672580217	4.35193	1.672580217
25	116	20	6.477612661	0.323881	25	3.041054939	2.813748	3.041054939
30	75	32	10.36418026	0.518209	30	4.865687903	1.425632	4.865687903
35	38	41	13.27910596	0.663955	35	6.234162626	0.487716	6.234162626
40	13	47	15.22238975	0.761119	40	7.146479107	0.075033	7.146479107
45	2	50	16.19403165	0.809702	45	7.602637348		7.602637348
	laser x (microns)	laser y (microns)	area (microns ²)	a				
	624	630	308755.726				25	Bragg angle in degrees
			area (mm ²)					
			0.308755726					
			area (cm ²)					
			0.003087557					

#30

$-4ns \sim 1ns$

WP=30

100ps step

GmAs

#31

WP=40

#37 \rightarrow static diffraction peak.

#38 $\rightarrow -4 \times 10^{-9} \sim +1 \times 10^{-9}$

WP=30°

$-0.005 \sim 0.02$, $\Delta\theta = 0.0004$

4/7/17
11 AM

#39

Linearity scan for APD

Moved to $\theta = 25.6834$ (side of substrate)

laser still on at ~~80.816~~ 80.8416 μs

WP=25°. Scan Horiz. JJ slit size, $S_{\text{scan/step}}$
~~Repeat~~

#40

Repeat linearity

~~WP=~~ 80.8416 μs

Now 20 μm /step

#41

Repeat linearity, just for mirror data.

File: NIN_Soo3_0041.mda

Previous Valid Directory Entry Next

Previous Scan Number Next

Scan Number: 41

Size (intended): 2D 53x10000

Date and Time: Aug 07, 2017 11:30:12

1-D 2-D

Display Style: Line

Y-axis Style: Linear

Data Transform: None

☐ Fit (☐ Local): Gaussian

Data Level: 2-D

Basic Advanced

Positioner: [P1] 7idc2:Slit1Hsize.VAL

☒ Detector (☐ Unscaled): [D03] dlm:userArrayCalc5.VAL☐ Detector (☐ Unscaled): [D02] dlm:userArrayCalc3.VAL☒ Detector (☒ Unscaled): [D05] 7idc1:scaler1.S2☐ Detector (☐ Unscaled): [D04] dlm:userArrayCalc7.VAL☐ Normalization: [D05] 7idc1:scaler1.S2

Buffenze Plot

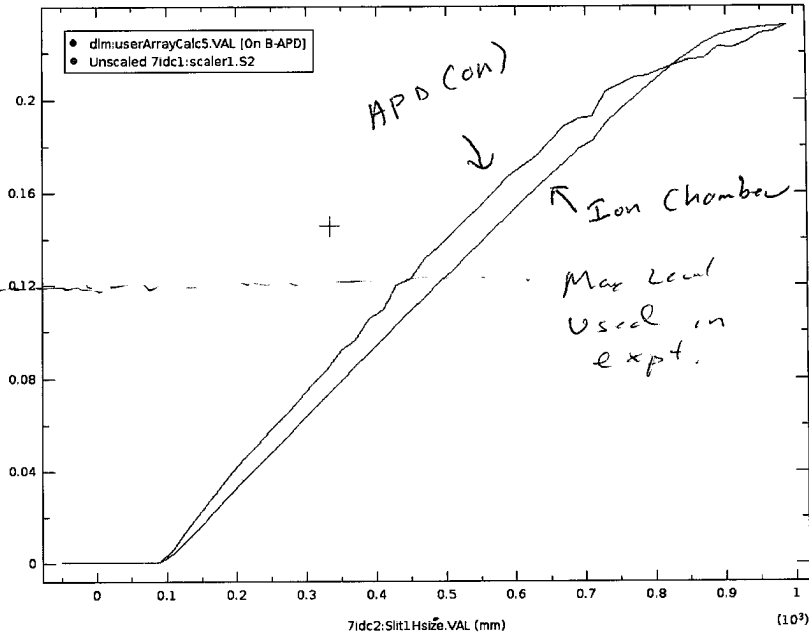
Dimensions:

Ranges

Clear Ranges

Reload File

Scan 41



Note: Strong laser effect