TOPS®

Computation Notebook

Department ______

Subject 05049 #2

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- 75 Sheets, 4 x 4 Quad. Ruling
- 11 3/4" x 9 1/4"
- 29.8 x 23.5cm

0 25932 35126 6

TOPS • Osage, IA 50461

No. 35126
Made in China

April 12, 2009

DAQ Benchmarking

Steps

1 LASSA
   a. Measure Global enable vs. Multiplicity w/ pulser
   b. Measure Actual readout time vs. Multiplicity w/ pulser
      - Use I/O register
   c. Measure Setup and clear times
      - use I/O

2. Miniball
   a. Measure veto vs Multiplicity using pulser system
   b. Measure Readout time vs. Multiplicity w/ pulser
   c. Measure setup + Clear times.

3. CsI
   a. Measure Veto vs. Multiplicit w/ pulser
   b. Readout time vs Multiplicity
   c. Setup + Clear time.

4. Neutron wall
   a. Veto vs. Multiplicity
   b. Readout time vs. Multiplicity
   c. Setup + Clear.

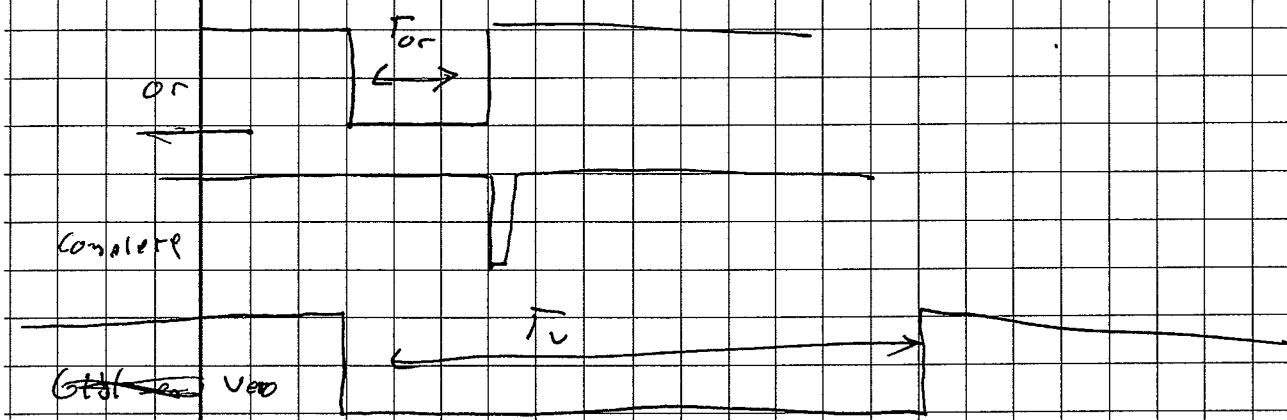
5. FA.
   a. Veto vs. Multiplicity
   b. Readout time vs. Multiplicity
   c. Setup + Clear.

LASSA DAQ time.

- use pulser on tel 3 + 4 (all others off)

16 channels 1 chip.

Triggered MB at OR



T_{or} = time to read Motherboard

$T_{or} \approx 66\ \mu s$

T_v = Total Veto time = $\approx 217\ \mu s$

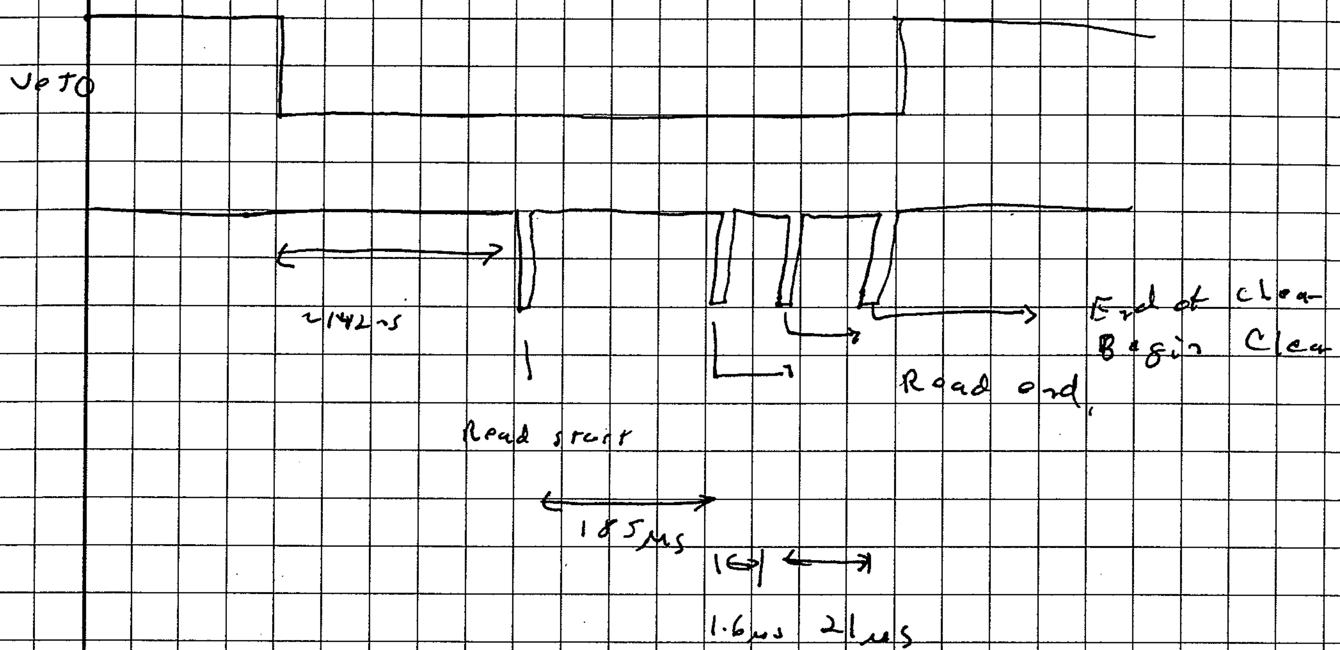
Channels	T_{or}	T_v	$T_v - T_{or}$
1	7.2 μs	90 μs	82.8
16	66 μs	217 μs	~~184~~ 151
32	182 μs	3~~5~~6 μs	224
2	12.0	108	96 μs
4	20.2	122	101.8

about 6 μs to read a channel
- Setup time seems long.

Tried to remove some spurious statements to speed things up

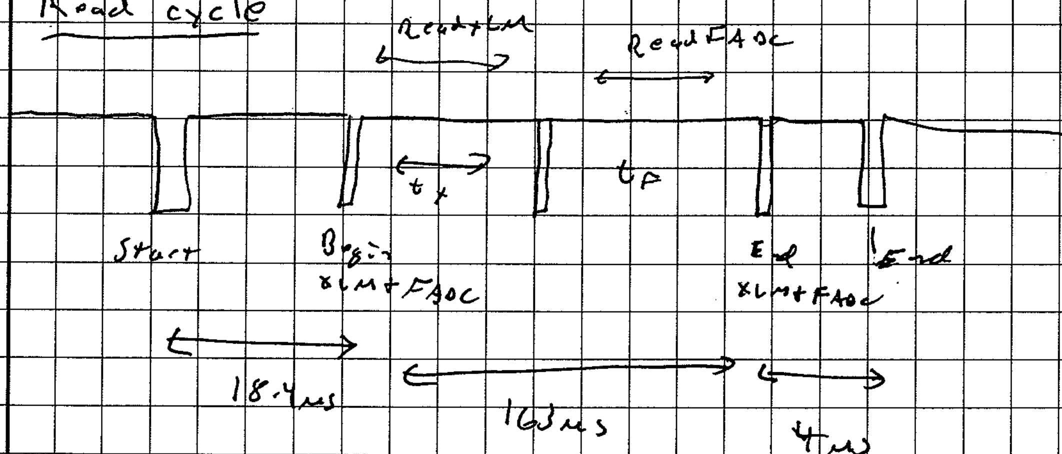
Mult	T_{or}	T_v	$T_v - T_{or}$
1	7.84	86.4	78.56
2	11.9 μs	96.4 μs	84.5
4	19.5 μs	113 μs	93.5

Use a V262 IO Mod For 32 channel Mult



longest time spent in read.

<u>Read cycle</u>

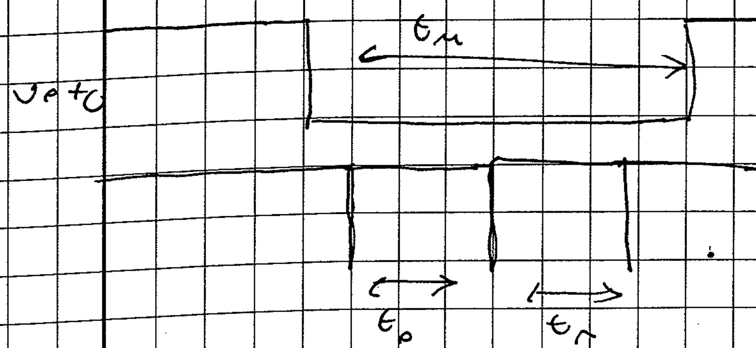


$t_x \approx t_f$

→ take about the same amount of time each.

Mini Ball Read

Multiplicity ~10



$t_m \approx 160\,\mu s$

t_p = polling time
t_r = read time

$t_p \approx 46\,\mu s$
$t_r \approx 47\,\mu s$

Questions For Ron
- is it sufficient to just poll the first module?
- Does Reading clear the modules?
- Spectrodaq problem?
- Mini Ball TDC window

For Multiplicities of ~32, the dead time $\approx$ 350-550 μs

Neutron wall Gain Match
Method

1. Find pedestal X_p
2. Find dynamic range in channels $X_d = 4095 - X_p$
3. Find necessary calibration constant m

$$m = \frac{25\ \text{MeV}}{X_d} = \frac{25\ \text{MeV}}{4095 - X_p}$$

4. Energy of AmBe ~~calibr~~ Compton edge $= E_c = 4.1884$ MeV

~~5. E.~~

5. PuBe Compton Edge channel must be X_B

~~X_B~~

$$(X_B - X_p)\, m = E_c$$

$$X_B - X_p = \frac{E_c}{m}$$

$$X_B = \frac{E_c}{m} + X_p$$

$$= \frac{E_c}{25}\left(4095 - X_p\right) + X_p$$

$=$

Compton Edges

^{60}Co	$E_c \approx 1.00$ MeV
^{137}Cs	$E_c \approx 0.477$ MeV
AmBe	$E_c \approx 4.1884$
^{228}Th	$E_c = 2.3812$

Wall	Tube	Total		AmBe ~~Pedestal~~ Edge	
		L	R	L	R
A	0	164	251	822.584	895.0084
	1	200	294	852.5527	930.8043
	2	188	245	842.5632	890.0136
	3	243	495	888.3487	1098.13
	4	230	324	877.5266	955.7783
	5	212	390	862.5423	1010.721
	6	258	262	900.8356	904.1655
	7	177	311	833.406	944.9562
	8	192	379	845.893	1001.564
	9	233	406	880.024	1024.04
	10	235	375	881.689	998.2339
	11	224	226	872.5319	874.1968
	12	205	369	856.715	993.2391
	13	260	313	902.5006	946.6212
	14	309	257	943.2913	900.0032
	15	274	307	914.1551	941.6264
	16	186	205	840.8982	856.715
	17	215	190	865.0397	844.2281
	18	210	179	860.8774	835.071
	19	272	242	912.4901	887.5162
	20	208	278	859.2124	917.4849
	21	200	237	852.5527	883.3539
	22	247	237	891.6785	883.3539
	23	255	215	898.3382	865.0397
	24				

WallB	0	237	616	883.3539	1198.858
	1	315	199	948.2861	851.7203
	2	249	738	893.3435	1300.418
	3	210	334	860.8774	964.1029
	4	270	490	910.8252	1093.967
	5	252	436	895.8408	1049.014
	6	279	209	918.3174	860.0449
	7	322	188	954.1133	842.5632
	8	287	393	924.9771	1013.218
	9	279	80	918.3174	752.657
	10	279	724	918.3174	1288.764
	11	332	230	962.438	877.5266
	12	260	239	902.5006	885.0188
	13	270	422	910.8252	1037.36
	14	272	422	912.4901	1037.36
	15	290	269	927.4745	909.9927
	16	266	205	907.4953	856.715
	17	266	248	907.4953	892.511
	18	289	234	926.642	880.8565
	19	209	270	860.0449	910.8252
	20	217	235	866.7046	881.689
	21	186	211	840.8982	861.7098
	22	222	174	870.8669	830.9087
	23	268	193	909.1603	846.7255
	24				

Neutron wall pedestals
and
Necessary Constants
Edge For AmBe
source

For dynamic range of

25 MeVee

To do

April

- Proton Vero
  - TDC
  - Disc
  - ADC
- Check FA tubes 2, 9, 12
- Couple CsI + LASSA preamps
  - do on next LASSA source test.
- Recheck timing
- MiniBall discriminator mask

Debuggin MiniBall

Channels to look at

	Ring	tube	Chan	Note
✓	5	0	F	No Signal
✓		1	F	↓ Bad disc = recovered.
✓		2	F	
	6	3	F, S, T	→ No Signal (not used?)
✓	6	18	S	No Sig.
	7	0	F, S, T	No Signal
✓		6 - 12	~~F~~ D, T	No Sig
		7	S	No Sig
		13	S	Low amp.
	8	0	F, T	No Sig
		1	F, S, T	No Sig
		3	F, S, T	No Sig
X	9	0	T	No Sig
		9	F, S	No Sig / Low gain
X	10	4-11	F	No Sig (Bad Pulser / QDC/solder?)
		4	F, S, T,	No Sig

~~Bad pulser~~

	Ring	tube	Chan	Note
X	11	0-7	F	No Sig?
X	5	8	T	Pedestal
		12	F	No Sig

Update

	Ring	# Tube	Chan	Note
	11	0	F, S, T	Low gain
·· –	10	4	F, S, T	Low gain
	10	11	F	No Sig.
	6	3	F, S, T	Really low Signal Amp
	~~4~~	~~0~~	~~F~~	(may be replace y not)
	11	0	F	Nothing
	~~10~~	~~0~~ 4	~~F, S, T~~	Nothing
	9	~~0~~ 6	F, S, T	~~Nos~~ low gain
	~~0~~ 9	9	F, S, T	~~oo~~ Low gain
	8	0	F	No Sig
	~~0~~ 8	3	F, S, T	Low gain
=>	7	0	F, S, T	No Signal at Flange
✓~~0~~	7	5	F	Low gain
	7	6	F	No logic Signal at Disc
	7	7	S	
	7	14	S	
?	6	3	F, S, T	Mirror

Repair Broken Channels

Ring	Channel	Note
6	3	F,S,T ~~seem to be working, but~~ Bad discriminator
8	0 F	No Signal at Flange
8	3 F,S,T	Looks like a Bad splitter
9	5	Bad disc channel input => splitter

Missing discriminator Channels (signals discs may work, but no signal)

~~Disc~~ Ring	Channel	
~~0 5~~	~~15~~	~~(Maybe removed)~~
6	3	Disc is Fine => input must be broken
7	0	Disc is OK => input Must be broken
7	3	Disc is OK => input Must be broken
~~7~~	~~6~~	
~~8~~	~~1~~	
9	5	disc probably works, but input might not
* 9	12	~~(disc is probably OK, but input broken)~~ OR works but ECL out doesn't

Unexplained Missing Slow + Tail channels

	Ring	Chan	
*	7	7S	= No Signal = Bad splitter
OK *	~~7~~	~~14S~~	7 14S = Just a very large gain
*	8	0 S,T	— M
*		3 S,T	
*	9	9S	=> low gain?
*		13S	=> low gain
*	10	4, S, T	=>
OK ✓		5 S	=> OK

=> Maybe bad pulser on this ring

check rule

To do:

- Gain Match MiniBall
  - set so that pulser peaks all line up.
  - MiniBall Fast timing
  - Spliter on MiniBall Ring 8 ⇒ replace
    - remap
- Set FA gains
  - α source at about 1/4 Full scale?
  - Maybe 1/8 Full scale
- Fix MiniBall Mask
- Recheck timing.
  - Si / CsI
  - MiniBall
- ~~CsI + LASSA preamps~~
  - ~~Next Si test~~
- MiniBall Gain Match.
- FA tubes 2, 9, 12.
- Route V1190c Fast Signals
- Cover upstream pot

April 15, 2009

Replaced tel 2 with SD 1140-18

Bias and currents

Tel	V (v)	I (mA)	I_{max}
0	-66	0.9	1.31
1	-60	4.38	5.29
2	-60	0.62	0.96
3	-85	1.33	1.52
4	-65	2.76	3.25
5	-55	0.46	0.92

- Connect Upstream timing Scintillator
  - HV channel 149
  - HV = -1500

α-source test run after replacing SD on tel 2 — Run 157

=> Readout Mode

=> Changed readout so that it only polls the First module of the First Event segment.

WARNING: The First event segment can change, so we will need to change the module status as well.

TDC Maps

MiniBall TDC V1190

Chan	
0	FA OR
1	Upstream Scint
2	XFP Scint
3	RF downscale

TRIGGER = ~~Primary~~ PROMPT Trig (PROMPT)
- FOR 07018 = Si
- FOR 05049 = FA + MB

Chan 16-31 : ~~[illegible]~~ Discriminator Bank 1

Chan 32-~~63~~ 47 : Discriminator Bank 2
Chan ~~64-79~~ : 48 - 63 Discriminator Bank 3
Chan ~~80-95~~ : 64 - 79 Discriminator Bank 4
Chan ~~[illegible]~~ : 80 - 95 Discriminator Bank 5
Chan 96 - 111 Discriminator Bank 6
Chan 112 - 127 Discriminator Bank 7

Triggered on Primary trigger
- Offset should be about -500 ns
- window should be about 2 μs ~~[illegible]~~

Neutron wall TDC

V1190 TDC

Chan	
0	Forward array
1	Upstream Scintillator
2	Neutron OR
3	XFP Scint
4	RF time

5 ~~xit~~

PROMPT ~~PRIMARY~~ TRIG = - Si FOR07018 ? (Maybe Neutrons
- FOR05049 = F1 + 49 Mult

Chan		
16-31	:	unused
32-47	:	Wall AL 0-15
48-63	:	Wall BL 0-15
64-79	:	AR 0-15
80-95	:	BR 0-15
96-111	:	AL 16-23 BL 16-23
112-127	:	AR 16-23 BR 16-23

Triggered on : Primary trigger
- Offset should be about -500 ns
- window width should be ~ 2 μs

Scaler channels

Raw		Live	
0	Si OR	16	~~CsI OR~~ Si OR
1	CsI OR	17	CsI OR
2	FA OR	18	FA OR
3	MiniBall Mult	19	MiniBall Mult
4	Neutron OR	20	Neutron OR
5	Fast Clear	21	Fast Clear
6		22	
7		23	
8		24	
9		25	
10		26	
11		27	
12	Pulser	28	Pulser
13	~~VETO~~ Veto	29	VETO
14	Master Trig	30	Master TRIG
15	Upstream Scint	31	Upstream Scint
16			

To do:

- MB multiplicity => Make wider

checked and updated 4/30/2009 5:11:19 pm

↳ also e05079.tcl updated

Miniwall debug

Ring	Chan	Note
8	3	Signal gets to splitter
8	0	Repaired in-chamber cable
9	9	Signal gets to splitter
	13	Signal gets to splitter
10	4	Signal gets to splitter
	5	Signal gets to splitter
11	0	Signal gets to splitter

More elaborate debugging of miniwall (slow + Tail for now)

	Ring	Chan	Note
✓	5	0 F	No spectrum => OK => low gain
✓		3 S	~~No~~ Pedestal only = OK, low gain.
✓		4 T	Very low gain? OK low gain
splitter! ✱		8 T	No spectrum => only peds = No Signal
✓		12 S	~~No Spectrum~~ Pedestal? = low gain
		Check Fast and Slow gates on Ring 5 & 6	
✱	6	3 F,S,T	No Signal? ~~No Sig at splitter~~ Sig OK
✱	7	0 F,S,T	No Sig or pedestals - ~~No Sig at splitter~~
✓		3 F,S,T	Pedestals low gain
✓		14 S	No Signal
✱	8	0 F,S,T	Low gain + No Fast — No Signal to splitter
✱		3	Pedestals only! — No light pulser
		Recheck slow gates on Ring 8.	
✓	9	5	No Signal low gain
		4 S	Pedestal low gain
		Recheck slow gates on Ring 9.	
✓	10	~~0~~ Recheck slow gates.	
✓		4	Check

8 : 0 ; 1 wrong Mapping => Backwards

Bad channels

Ring	Chan	
5	8 T	Splitter output
✓ 6	3 F,S,T	~~Splitter?~~ No Sig at Flange!
✓ 7	0 F,S,T	Splitter?
7	7 S	⇒ Splitter broke?
	14 S	Must be a bad CF channel
8	0 F,S,T	
~~8~~	~~Bo~~ 3 No light pulser	
10	10 F,S,T	Signal seems ok = Bad disc?
10	4 F,S,T	

✓ 6, 3 = Maybe No power Fixed
(7,0) = Maybe No power
(8,0) = Maybe No power / bad tube

✓ (7,0) Connector for HV Broken!
✓ (6,3) Tube Must be Broken
(8,0) HV Broken!

Tomorrow
- ✓ - Repair (7,0) + (8,0)
- - Check Fast Sigs
  - ✓ - Signal Split
  - - Gates
  - - Disc ⇒ ~~Should work~~ ..
- - Check timing again → use Pulser
  - ✓ - Fast Gate
  - ✓ - Slow gate
  - ✓ - Tail gate
  - ✓ - Trigger
- - Gain Match it time.
- - Fast amps

Things to look out For

- large Discriminator Rates
  - Discriminators may Not be initialized.

Examine Fast Signals

	Rig	Tube	Note
✓	5	1	~~Don't see one~~ Different chan
✓		10	low gain on Fast
✓		12	low gain on Fast
✓		23	low gain on Fast
✓	6	8	No Fast.
/		12	No Fast
* →	7	3	very low gain
* ⇒	7	14	No Sig
✓	8	3	No Sig ~ low gain
✓	9	8	No Sig
✓		10	"
✓		11	"
✓	10	4	low gain
✓		5	low gain
*	10	10	No Sig Fast Signal broken

Bad Splitter channels
(Ring, chan Function)

5, 8 T
7, 7 S
~~10, 10~~
7, 14 F
10, 10 F (maybe S + T)

April 18, 2006 Test Run Trigger

- Since CsI is Gated on Si and we want to trigger on Si, then we just trigger on CsI Singles.
  - veto = X
  - trigger = Y
  - very clean trigger.

FA test
- discriminator Thresholds should be set ~4
- HV ≈ 800 1000 V

Patch Panel channels

1 - Si bias 1
2 - Si bias 2
3 - Si bias 3
4 - Si bias 4
5 - Si bias 5
6 - Si bias 6
7 - CsI bias 1
8 - Interlock
9 - Si Shaper
10 - Si OR
11 - Si TRIG
12 ~~Si Comp~~
12 - CsI Shaper
13 - CsI gate
15 - MiniBall Mult ~~trig~~ dis
16 - MiniBall Mult
17 - Neutron OR
18 - Master TRIG
19 - VETO
20 22 - FA OR
22 - FA Gate / ~~Upstream~~
23 XF p Scint.
24 CsI OR
25 FA Fast
26 MB Gate ~~RF~~
27 FA and MB / RF
30 CsI Bias 2
28 Upstream Scint

Patch Panel	Description
1	Si Bias 1
2	Si Bias 2
3	Si Bias 3
4	Si Bias 4
5	Si Bias 5
6	Si Bias 6
7	CsF Bias 1
8	Interlock
9	Si Shaper
10	Si OR
11	Si Trig
12	CsI Shaper
13	CsI Gate
15	MiniBall Trig
16	MiniBall Mult
17	Neutron OR
18	Master Trig
19	VETO
20	FA OR
22	FA Gate/ XF Port
23	XPF In
24	Col OR
25	FA Fast
26	MB Gate
27	FA and MB
28	Upstream
30	CsI Bias 2

Testing Forward array

- in air source about 20 cm away HV= +800 on all
  - Scaler FA OR ~ 133/s (Background)
-

Neutron wall Final debugging

- AL 8 = No Fast Spectrum. - Cable length
- BR 20 = No Fast. => this one has been a constant problem
  - Needs very low thresh + high gain

PSD Spectra
- AL 11 => Doesn't look very good = Not great but passable
- BR 14 = low counts = Needs low thresh
- BR 20 =

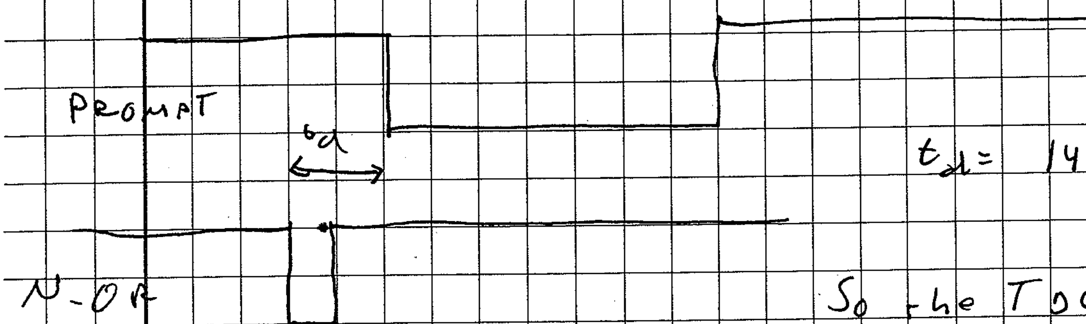
Thresholds
- BR 14
- BR 20 } low thresh

Set up trig

FOR 07018 TRIG = ~~A~~ S_i
FC = $N + \overline{S_i}$

⇒ WARNING: REMOVE MB FROM FC!!

Timing at N wall TDC



t_d = 146 ns FOR γ's

So the TDC must start at least 125 ns earlier

FOR MiniBall prompt occurs ~~prob~~ a bit ~~to~~ sooner
td ≈ 20 ns or so, check during test run

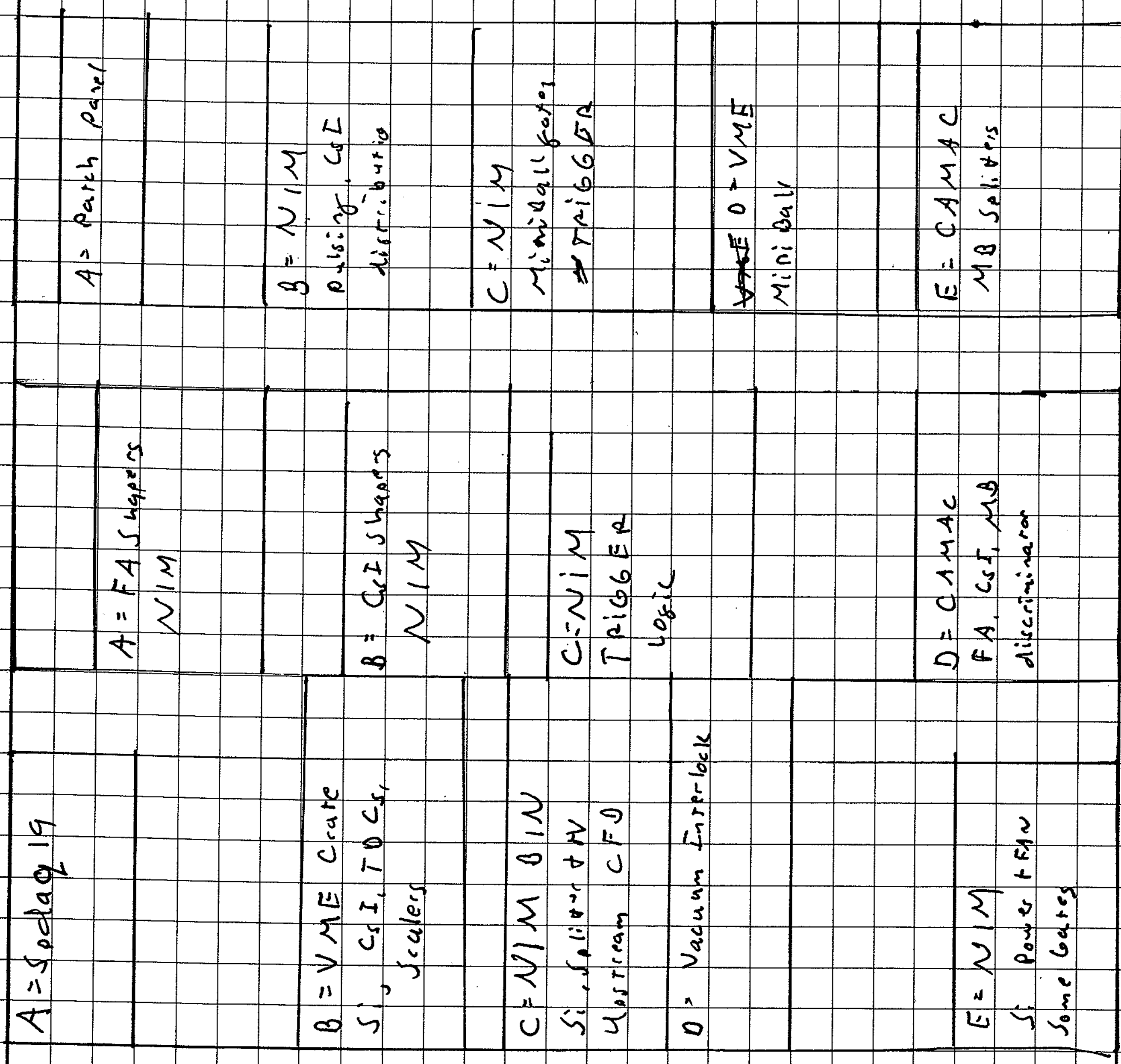
- So we'll set the window offset for the neutron (190 to -500 ns to be safe
width = ~~3~~ 2 μs.

ril 20, 2009 Rack and Crate Maps

Mapping laid out by Rack, crate, slot

(N, L, S)

N = Rack (integer)
L = Crate (A, B, C, ...)
S = Slot (integer)



Rack 1

Slot 22	CAEN V785 ADC	CsI ADC
Slot 20	CAEN V1190 TDC	MiniBall and time refs (XFP, FA, Upstream) (See pg 12)
Slot 16	CAEN V288	CAENNet Controller
Slot 13	CAEN V785 ADC	Forward Array ch 0-16
Slot 11	CAEN V775 TDC	Forward array TDC ch 0-16
Slot 9	Live Scaler LRS 1151	(see pg 14)
Slot 7	Raw Scaler LRS 1151 N	(see pg 14)
Slot 5	FADC	ch 1 = Clock; ch 1: Time; ch 2: Energy
Slot 3	XLM 80M	Silicon Asics control Conn A

B " VME Crate #2

Crate Matrix NIM 1C

Rack 1.C

- Slot 12: Tennelec Quad CFD, Upstream Sint
- Slot 9: Tennelec Bias Si: 4 | Si: 5
- Slot 8: Tennelec Bias Si: 2 | Si: 3
- Slot 7: Tennelec Bias Si: 0, 100 V Setting, Current range = 10 μA orange | Si: 1
- Slot 5: NIM → ECL For Live Scaler (see pg 14)
- Slot 3: Si Cable to LEMO Conversion ASICs Ribbon in
- Slot 2: FIFO FATMB Si Pcompt | FastClear OR CompReady in | Si OR | Si Complete
- Slot 1: ECL-NIM For XLM control input

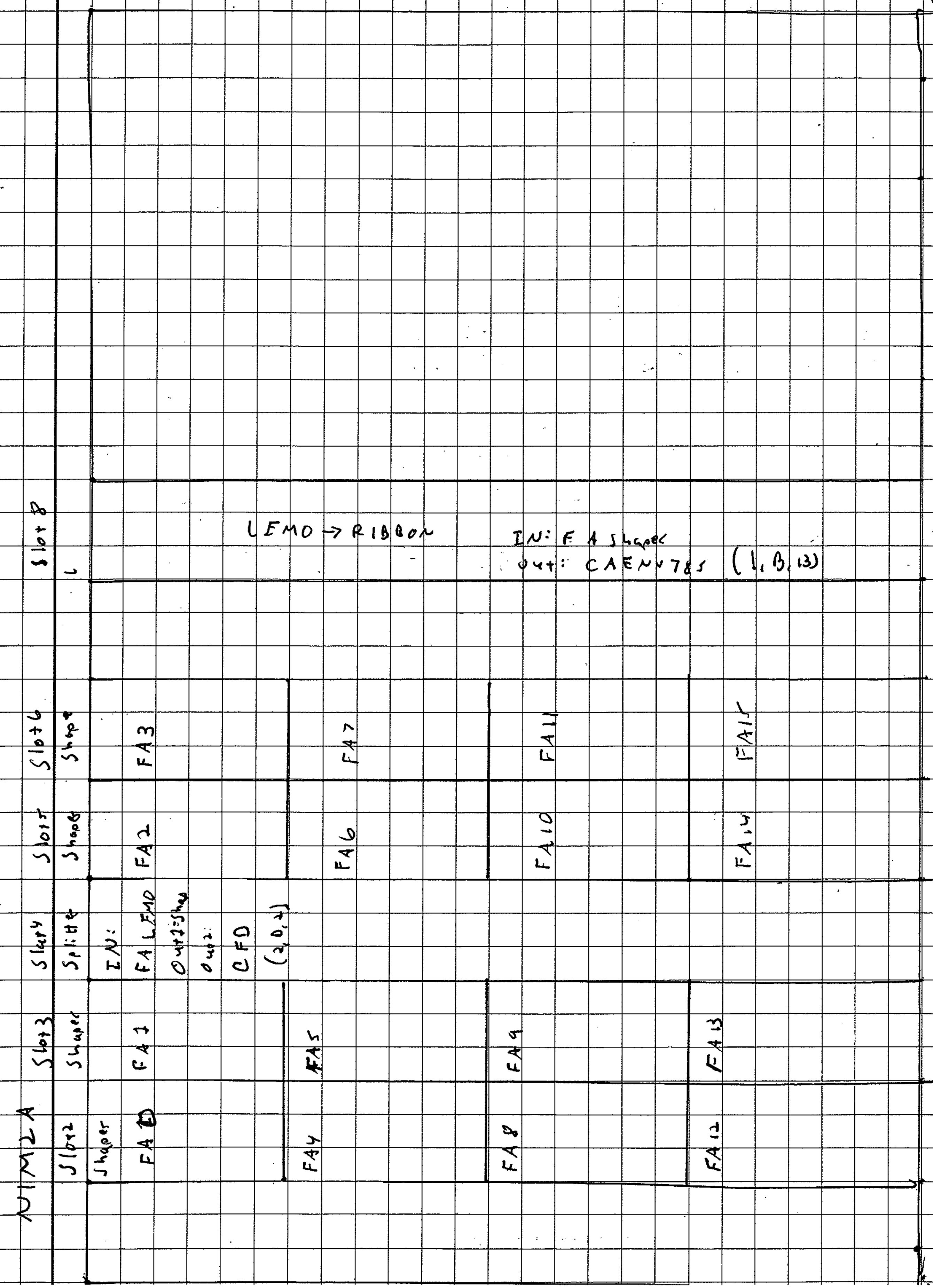
Crate Mapping NIM 1E

Slot 3	Slot 5	Slot 6 + 7	Slot 8 FIFO	Slot 9 FIFO	Slot 10 QGDG	Slot 11 LeCroy GDG	Slot 12 LeCroy GDG
Ribbon to LEMO converter	+/- 12V power +12V For Thermo-couple	ASICs Power Supply	X FA IN out → Scaler and TDC	IN: Ø out: Live Scaler	IN: FA+MB X: FA ADC Y: FA Singles (1,E,10)	IN: Neutron OR delayed Out: Neutron delayed Trig. Used For Neut OR Si Trig	IN: Neut OR delayed OUT: Neut OR $\bar{Si}$ F.C. OUT: Neut Trig
			IN: FA+MB PROMPT OUT: TDC OUT: Scaler OUT: Neut TDC	IN: CsI OR out: Live Scaler Raw Scaler Gate CsI gate For Singles	IN: FA+MB+Si ~~X~~: Patch X: CsI ~~TRG~~ Gate Y: CsI TRIG		
			~~XFA~~ IN: Upstream Scint OUT: Raw Scaler	IN: FA+MB+Si OUT: ~~[illegible]~~ ~~Neut TDC~~ CsI gate (1,E,10)	IN: FA+MB delayed Y=FA singles		
			IN: FA-OR OUT: Patch - GDG (2,C,1)	IN: FA-OR OUT: - FA TDC - N TDC - FA screen (2,C,1) - FIFO (1,E,8)	IN: Neut OR X: Scalers Y: GDG (E,11) Y: N+$\bar{Si}$ (2,C,8)		

Thermo couple in/out to PLC

Crate Mapping

NIM 2A



CRATE Mapping NIM 2B

NIM 2B

Slot: Module:	Slot: 2 Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:
	CAEN 568B 16 chan Shaper CsI 0-1½		RIBBON →Cable converter CsI 0-1½		CAEN 568B Shaper CsI 12-23		~~CAEN~~ ~~568B~~ RIBBON →Cable CsI 12-23				
			IN= CsI Out 1=Shaper Out 2= Disc		~~IN=~~ ~~CsI~~ ~~Out 1=~~ ~~Shaper~~ ~~Out 2=~~ ~~Disc~~		IN=CsI Out 1= Shaper Out 2 Disc				

NIM 1C

Slot: Module: GGOG	Slot: Module: Logic	Slot: Module: FIFO	Slot: Module: GOG	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module: Logic Mod	Slot: Module:	Slot: Module:	Slot: Module: ⊕	Slot: Module:
IN: FA OR x: FA Narrow Y: FA ~~[illegible]~~ delayed	A: FA B: MB x: A + B $\overline{x}$: Patch	IN: FA+MB Prompt out: 2,C,3 2,C,3 1,E,10 (FA gate) Scaler	Master TRIG FA+MB		NIM →ECL ~~→F.C.~~ V1190	NIM →ECL F.C. For Crate 2	Scaler Gate	NIM →ECL F.C. 04		NIM →ECL TDC 1190 For M.B.	
IN: MB Mult x: MB ~~[illegible]~~ log $\overline{x}$: MB Gate → patch	A: FA Narrow B: MB Stretch x: A + $\overline{B}$ = F.C.	IN: FA+MB+Si out: Si Trig	F. C.		WED FOR ~~ret~~ ~~See~~ ~~C5 11~~		Scaler Gate	Crate Ø		Channels 0-16 ~~[illegible]~~ For Ø	
IN: FA OR x: Scaler Y: FA Stretched	A: FA Stretch B: MB Narrow x: $\overline{A}$ + B = FC	IN: F.C. - FA+MB - $\overline{FA}$+MB - $\overline{FA+MB}$ + N - out - FC	Si + FA+MB = Si Gate = X		F.C.		A: Next B = $\overline{Si}$ x = A + B ⇒ F.C.			REF Si rs See p8 12	
IN: MB Mult x: Scaler Y: MB del	A: FA+MB B: Si x: FA+MB + Si = Si gate Y: CsI gate	IN: FC Prompt - FA+ $\overline{MB}$ - $\overline{FA}$ + MB - N + $\overline{Si}$	N + $\overline{(FA+MB)}$ delayed y: F.C.				A: N B: ~~FA+MB~~ F+Bns ~~[illegible]~~ x: N + $\overline{(FA+MB)}$				

CRATE 2D CAMAC

Slot: Module:	Phillips Disc 7 MB
Slot: Module:	
Slot: Module:	Phillips Disc 6 MB
Slot: Module:	Phillips Disc 5 MB
Slot: Module:	
Slot: Module:	Phillips Disc 4 MB
Slot: Module:	
Slot: Module:	Phillips Disc 3 MB
Slot: Module:	P
Slot: Module:	Phillips Disc 2 MB
Slot: Module:	
Slot: Module:	Phillips Disc 1 MB
Slot: Module:	
Slot: Module:	P100 Shaper
Slot: Module:	P100 Disc (SI 12-23)
Slot: Module:	P100 Shaper
Slot: Module:	P100 Disc SI 0-11
Slot: Module:	
Slot: Module:	LeCroy 1806 CFD FA
Slot: Module:	

RACK3 NIM B

Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:
+12 Volts		CsI Distribution		Tennelec power CsI Ø	LED Pulser For MB	BNC PULSER			BNC Pulser		
FOR MB Pulsing System				100V range		BLUE			white		
				CsI 1							
				100V range							

RACK NIM 3C

Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module:	Slot: Module: FIFO	Slot: Module: Slow GDG	Slot: Module: Tail GDG	Slot: Module: FIFO	Slot: Module: GDG	Slot: Module:	Slot: Module: FIFO	Slot: Module: LeCroy GG
MB Summing Amp		Octal disc 1: MB sum 2: MB Disc 1		Disc 1+2 out: slow out: G.G.	Slow gate For MB 1+2	Tail MB 1+2	IN Tail 1-8 out MB OR	MB OR y: veto y: Trig		Si: Complete	TRIG
		3: MB Disc 2 4: MB Disc 3		Disc 3+4 out: → slow out: GG	Slow gate MB 3+4	Tail MB 3+4		Neut OR: y: Trig+veto		TRIG ACK	
Out 1 = MB Sum		5: MB Disc 4 6: MB Disc 5		Disc: 5+6 out: slow out: GG	Slow gate 5+6	Tail MB 5+6	Master TRIG MO+FA			FA Singles	VETO
		7: MB Disc 6 8: MB Disc 7		Disc: 7+8 out: slow out: GG	Slow gate 7+8	Tail MB 7+8	Neut ~~OR~~ TRIG For test Run	CsI/Si: Trig x = veto y = trig		Comp Ready	

ril 21, 2004

Replaced last 32 channels of MB with Fast Amps

- Tp 300 MHz
  - We should test these as they may not work as well as we hope

- Corresponding to channels

  9:1 - 9:15
  10:1 - 10:11
  11:0 - 11:7

⇒ Special time ref set for Upstream Scint

158 One More ^{228}Th Source test
- will also examine pulser amplitude and thresh.

- Find pulser Amp For 8.78 MeV
- Find pulser Amp For 6.778 MeV
- Find minimum triggerable pulser amp.
- Convert to MeV
- Do this for a few channels on Front
- Also re-examine resolution

159 Unplug AB PLC and recheck noise
60 - 161

Sample Channel

Slot 2F 7: FWHM of E = 8.78 MeV channel

With PLC = 26.49
without PLC = 26.73

No discernable difference
- will do a more thorough test

Chip	Channel	Pulser 8.78 MeV	Pulser 6.778 MeV	Pulser @ Thresh	8.78 MeV chan	6.78 MeV
0	3					
	7	1.425	1.089	0.115	4250.98	3393.32
1	~~12~~ 7	1.517	1.158	0.082	4615	3723.3
2	~~3~~ 7	1.412	1.074	0.077	4153	3282.89
3	7.	1.518	1.155	0.057	4267.3	3378.0
4	~~12~~ 7	1.452	1.106	0.080	3856.45	2981.2
~~4~~ 5	~~3~~ 7	1.624	1.237	0.105	3783.04	2940.44
~~5~~	~~7~~					
	~~12~~					
~~5~~	~~3~~					
	~~7~~					
	~~12~~					
~~6~~	~~3~~					
	~~7~~					
	~~12~~					
~~7~~	~~3~~					
	~~7~~					
	~~12~~					

$E = mA + B$ A = pulse Amplitude

Thresh chan 702 on OF7 - lower thresh to 0.081 V chan 817

Thresh	V	Chan
-10	0.081	817
-9	0.076	806
1	0.024	642
0	0.03	654.12

Chip	Chan	m	B
0	7	5.93833	0.289
1	7	5.57660	0.320
2	7	5.923	0.417
3	7	5.515	0.408
4	7	5.803	0.360
5	7	5.173	0.379

$E = mA + B$

A = pulse Amplitude

E = Energy in MeV

Removed Attenuators to try to discriminate lower

Chip	chan	pulse Thresh	MeV	
0	7	0.048	~~0.574~~	0.575
1	7	0.036	~~0.521~~	0.54
2	7	0.049	~~0.678~~	0.707
3	7	0.017		0.501
4	7	0.025		0.505
5	7	0.042		0.596

- Still high ⇒ Maybe try with covers on and the just use x2 attenuators.

Covered detectors and tried threshold settings again

File: e05049_tower0_HG.setup Set Covered thresh
(Set Channel 7 only)

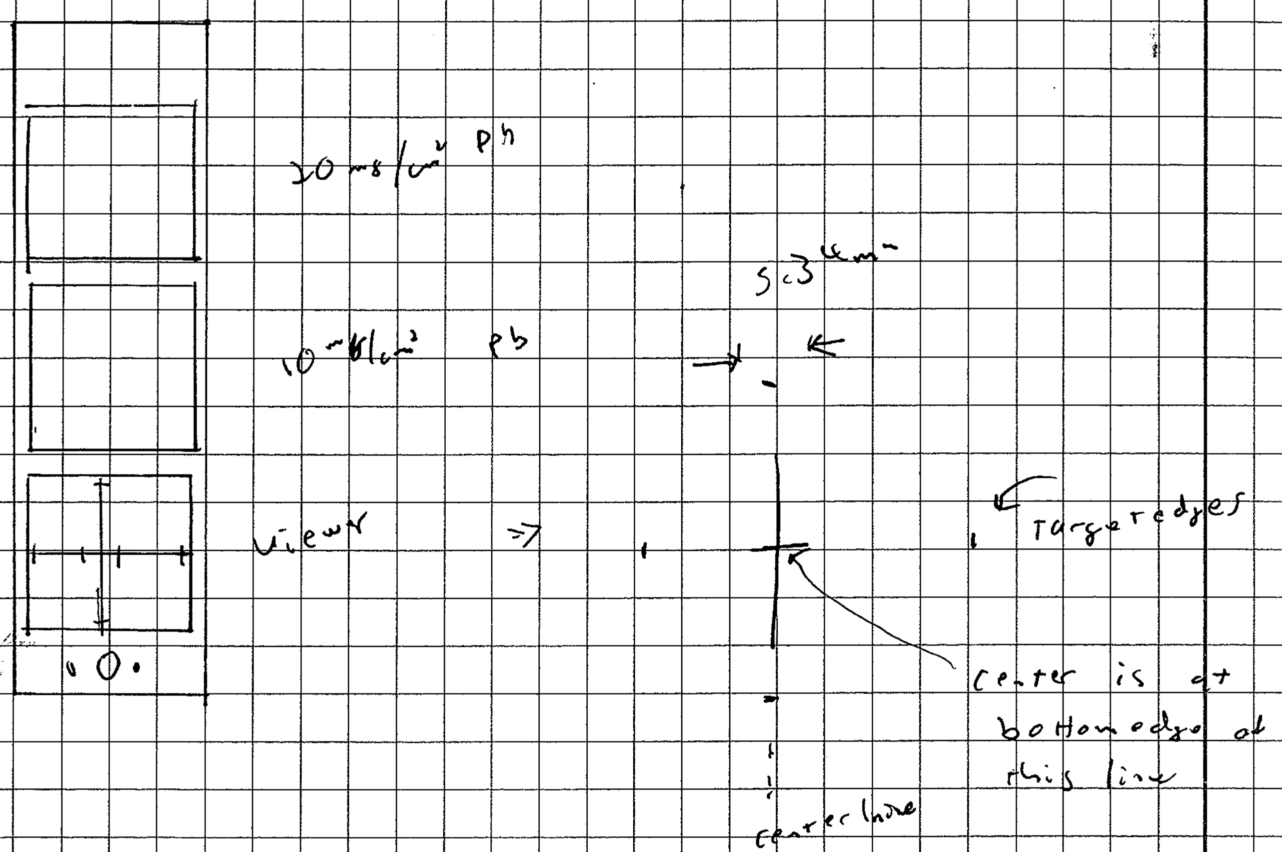
Chip	chan	pulse thresh	MeV
0	7	~~0.057~~ 0.034	
1	7	0.022 ~~0.036~~ ~~0.019 (ch 117)~~	
2	7	~~(ch 117)~~ 0.037	
3	7	0.01	
4	7	0.016	
5	7	0.024	

* It seems we can make thresholds very low

Try
- No γ source and no cover
- Foil covers

This is still ~400 keV
→ let's go to Attn x2 w/ high gain setting.

Target For O 2018



= Installed MiniBall Multiplicity ~~counter~~ disc in C~~aff~~ u4c slot 8, Mult in CH Z

Multiplicity	Thresh
1	~ 0-50
2	~ 51-100
3	~ 101-150
4	~ 151-200
5	~ 200-250
6	~ 251-300
7	~ 301-350
8	~ 351-400
9	~ 401-451
10	~ 451-500

~10 mV / ~~[illegible]~~ trig

Disc was 1 mV/div ~~[illegible]~~.

Placed at Attenuators

Pulsed with 8.78 MeV equivalent & 6.778 MeV equiv.

~~Chan 7~~

Chip 0 chan 7 8.78 MeV ⇒

Chip	chan	8.78	6.778	Thresh	Range	Thresh MeV
0	7	8623.1	6840.76	0.035		
		FWHM: ~24				
1	7	9411.07	7666.98	0.020		
		FWHM=17.75				
2	7	7956.39	6201.77	0.036		
		FWHM: 16.25				
3	7	8208.64	6423.8	~~0.044~~ 0.013 ~~0.020~~		
		FWHM = 15				
4	7	7882.82	6123.63	0.012		
		FWHM ≈ 15.25				
5	7	7836.67	6143.06	0.024		
		14.5				

Set Thresholds independently

Eg.

Chip 0 ch 7

- thresh is very low = 3

Thresh time on Pulser is 0.026
ch 1092<37>

April 24

Setting Threshold on SD

- One channel at a time
- Set above noise

- E-mail Jon
  - what does the threshold number really mean
    - does it matter to have >0 thresh on positive polarity

April 25

Gain Match walls again
- ^{60}Co source
- Compton Edge
- High gain
  - Compton edge ~500 channels above pedestal
  - Pedestal ~

April 26, 2004 Pulser Ramps in Si

0-3V 21 steps 10 s/step

Run 165 Tel 1F 0-3V, 21 steps, 10 s/step
- Channel 1 has crappy resolution
- Probably OK because this channel is missing on Silicon we think

Run 166 Si Pulser Ramp, Tel 2F 0-3V, 21 steps 10 s / step

Run 167 Tel 3F, 0-3V, 21 steps 10 s/step
- Ch 9 removed = Missing From Si

Run 168 Tel 4F
- Channel 4 looks bad
- Missing From Si?

Run 169 Tel 5F

Run 170 Tel 6F

Run 171 Tel 1B

Run 172 Tel 2B
- Chan 13 => Somewhat lower gain

Run 173 Tel 3B

Run 174 Tel 4B
- Chan 0 => really high gain!
=> Slot 12, chip 0, chan 0 => Maybe attenuator

Run 175 Tel 5B
- Channel 15 missing
- Probably Missing From Si

Run 176 Tel 6B
- Ch 0 Missing => expected

Check Si bias Drawn From Data 4

Si	Bias in Data 4		Bias at Patch panel	Scale
0	~~-10~~	-10	-10	
1	~~-20~~	-15	-15	
2	~~-30~~	-20	-20	
3	~~-40~~	-25	-25	
4	~~-50~~	-30	-30	
5	~~-60~~	-35	-35	

Neutron Wall Channel Assignments

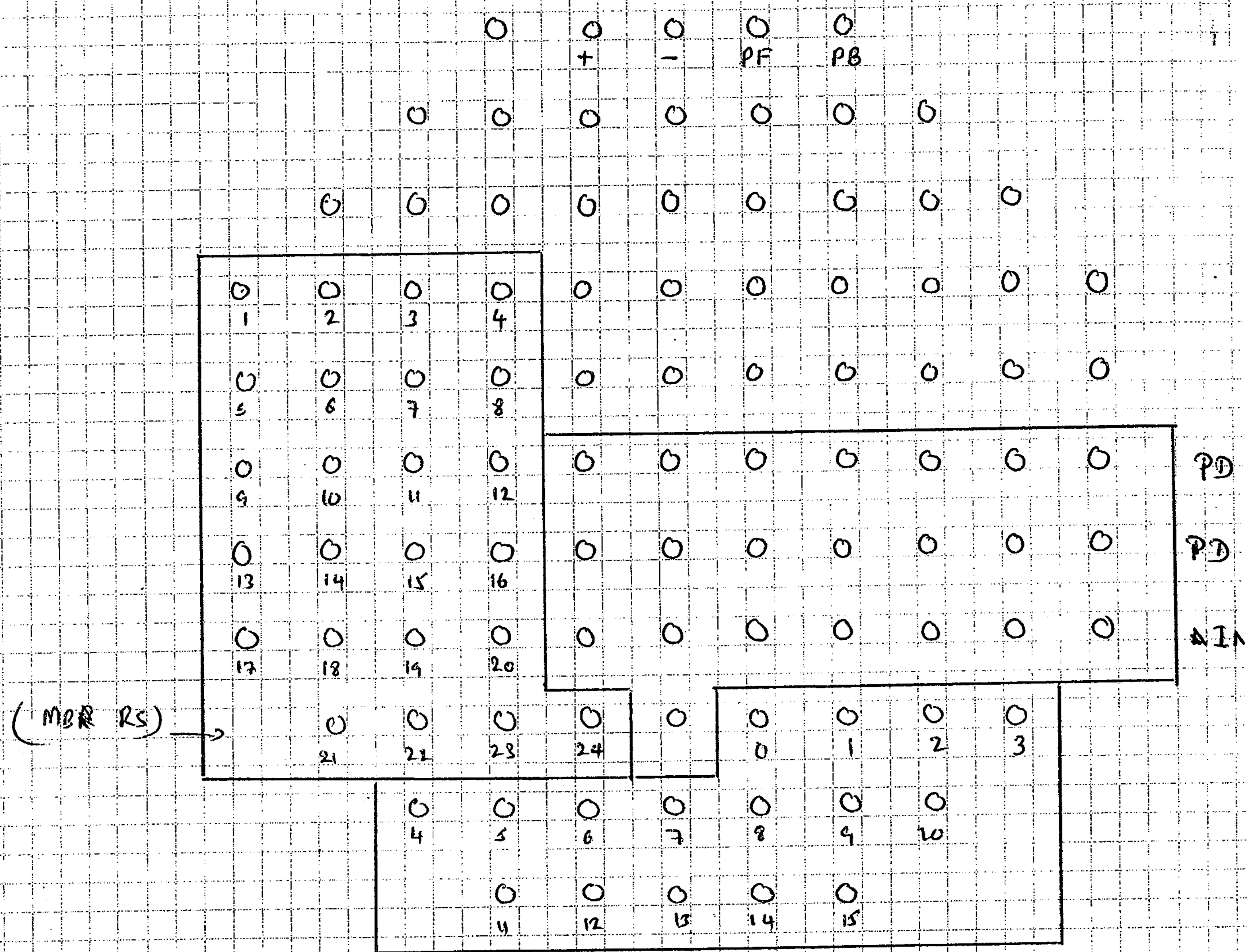
Wall A

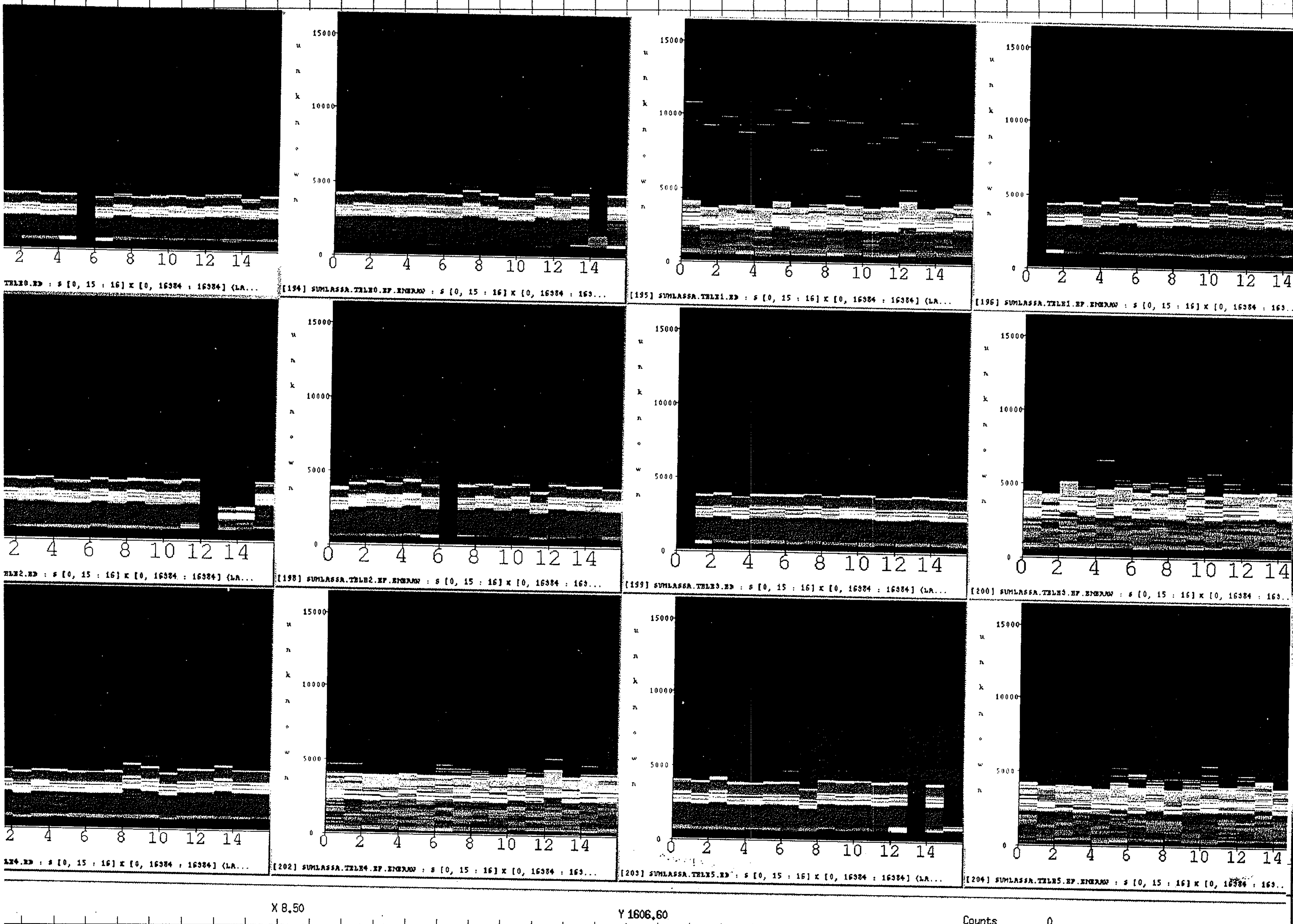
Channel	Left	Right
0	64	0
1	65	1
2	66	2
3	67	3
4	68	4
5	69	5
6	70	6
7	71	7
8	72	8
9	73	9
10	74	10
11	75	11
12	76	12
13	77	13
14	78	14
15	79	15
16	96	32
17	97	33
18	98	34
19	99	35
20	100	36
21	101	37
22	102	38
23	103	39
24	104	40

Wall B

Channel	Left	Right
0	162	105
1	163	106
2	164	224
3	165	108
4	166	109
5	167	110
6	168	111
7	169	128
8	170	129
9	171	130
10	172	131
11	173	132
12	174	133
13	192	134
14	193	135
15	194	136
16	195	137
17	196	138
18	197	139
19	198	140
20	199	141
21	200	225
22	201	143
23	202	160
24	203	161

Neutron wall Power assignment


+
−
PF
PB
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
17 18 19 20
PD
PD
(MBR RS)
21 22 23 24
0 1 2 3
4 5 6 7 8 9 10
11 12 13 14 15


TELE0.ED : $ [0, 15 : 16] x [0, 16384 : 16384] (LA...
[194] SUMLASSA.TELE0.EF.ENERAW : $ [0, 15 : 16] x [0, 16384 : 163...
[195] SUMLASSA.TELE1.ED : $ [0, 15 : 16] x [0, 16384 : 16384] (LA...
[196] SUMLASSA.TELE1.EF.ENERAW : $ [0, 15 : 16] x [0, 16384 : 163...
TELE2.ED : $ [0, 15 : 16] x [0, 16384 : 16384] (LA...
[198] SUMLASSA.TELE2.EF.ENERAW : $ [0, 15 : 16] x [0, 16384 : 163...
[199] SUMLASSA.TELE3.ED : $ [0, 15 : 16] x [0, 16384 : 16384] (LA...
[200] SUMLASSA.TELE3.EF.ENERAW : $ [0, 15 : 16] x [0, 16384 : 163...
LE4.ED : $ [0, 15 : 16] x [0, 16384 : 16384] (LA...
[202] SUMLASSA.TELE4.EF.ENERAW : $ [0, 15 : 16] x [0, 16384 : 163...
[203] SUMLASSA.TELE5.ED : $ [0, 15 : 16] x [0, 16384 : 16384] (LA...
[204] SUMLASSA.TELE5.EF.ENERAW : $ [0, 15 : 16] x [0, 16384 : 163...
unknown
X 8.50
Y 1606.60
Counts 0

Neutron Wall Channel Assignments

Wall A		
Channel	Left	Right
0	64	0
1	65	1
2	66	2
3	67	3
4	68	4
5	69	5
6	70	6
7	71	7
8	72	8
9	73	9
10	74	10
11	75	11
12	76	12
13	77	13
14	78	14
15	79	15
16	96	32
17	97	33
18	98	34
19	99	35
20	100	36
21	101	37
22	102	38
23	103	39
24	104	40

[redacted]

Power Channel	Ring	Tube
[redacted]		
16	5	0
17	5	1
18	5	2
19	5	3
20	5	4
21	5	8
22	5	9
23	5	10
24	5	11
25	5	12
26	5	13
27	5	14
28	5	15
29	5	22
30	5	23

Power Channel	Ring	Tube
31	6	0
32	6	1
33	6	2
34	6	3
35	6	7
36	6	8
37	6	9
38	6	10
39	6	11
40	6	12
41	6	13
42	6	17
43	6	18
44	6	19
[redacted]		

Power Channel	Ring	Tube
[redacted]		
82	9	0
83	9	1
84	9	2
85	9	3
86	9	4
87	9	5
88	9	6
89	9	7
90	9	8
91	9	9
92	9	10
93	9	11
94	9	12
95	9	13

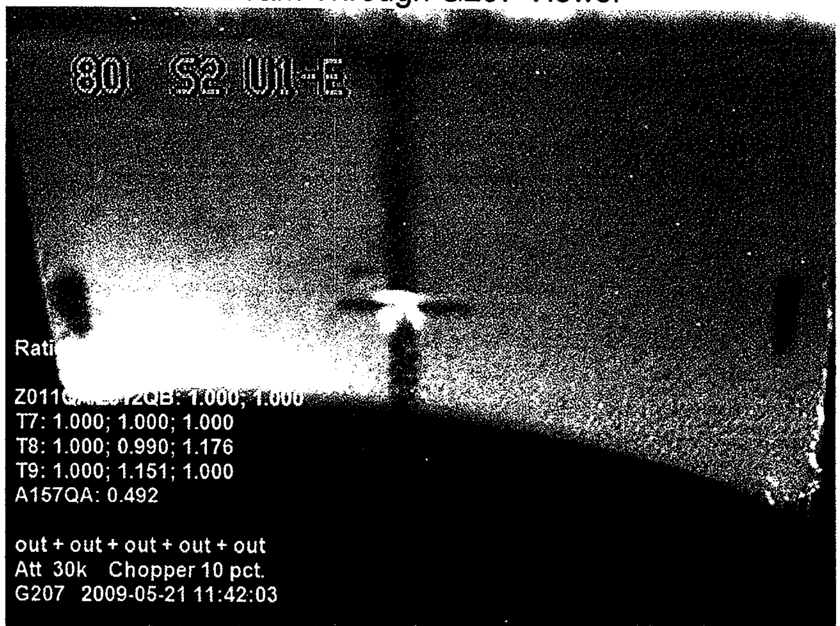
Power Channel	Ring	Tube
96	10	1
97	10	2
98	10	3
99	10	4
100	10	5
101	10	6
102	10	7
103	10	8
104	10	9
105	10	10
106	10	11
107	11	0
108	11	1
109	11	2
110	11	3
111	11	4
144	11	5
145	11	6
146	11	7

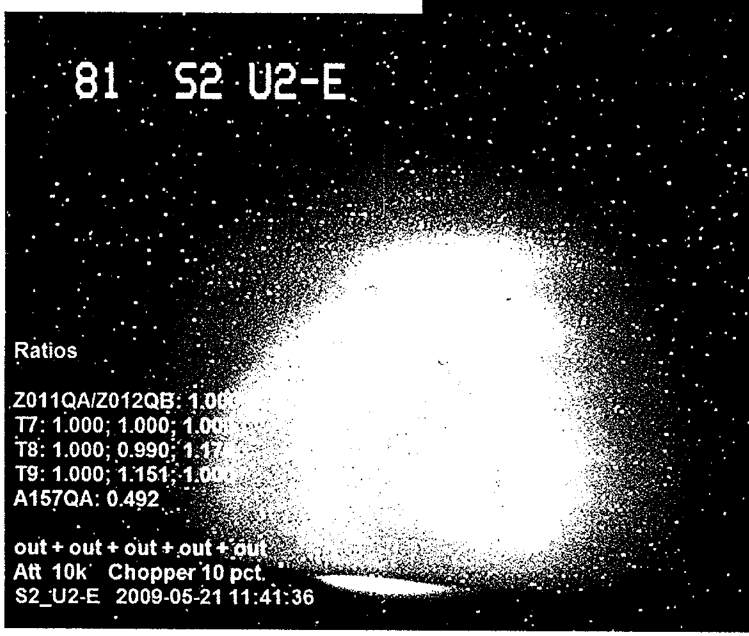
149 Upstream Sci

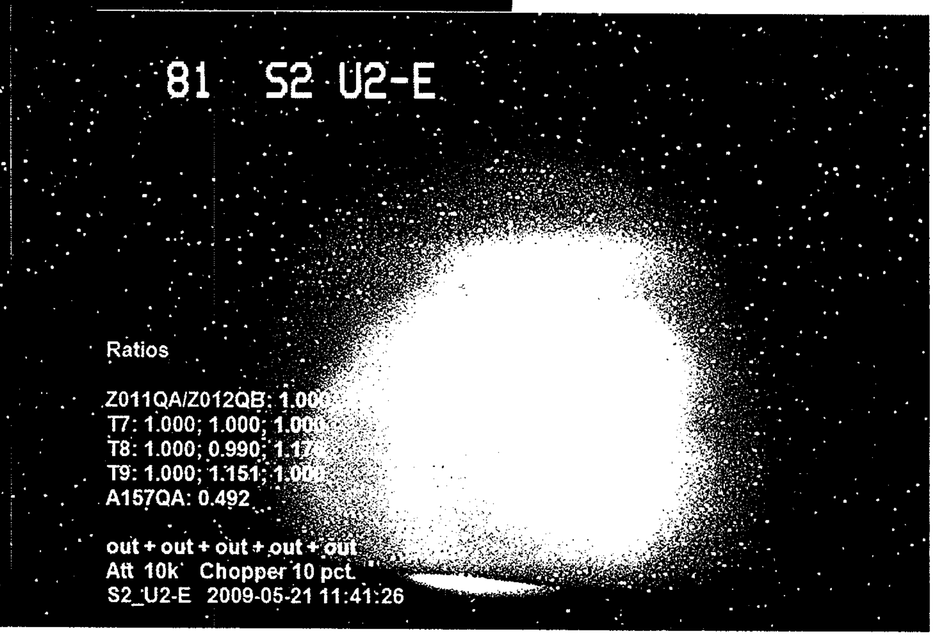
[redacted]

Camera Photos for Exp 05049C

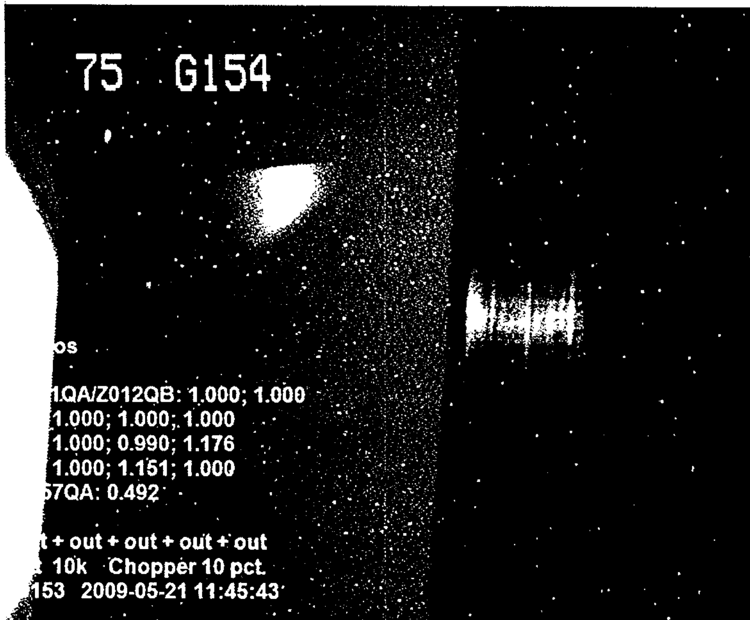
Beam Through G207 Viewer

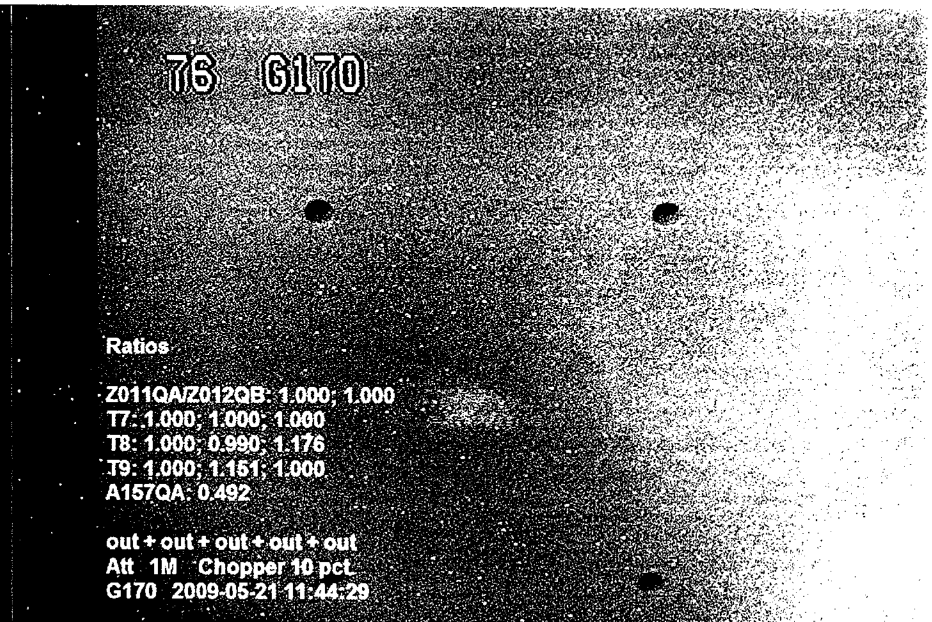


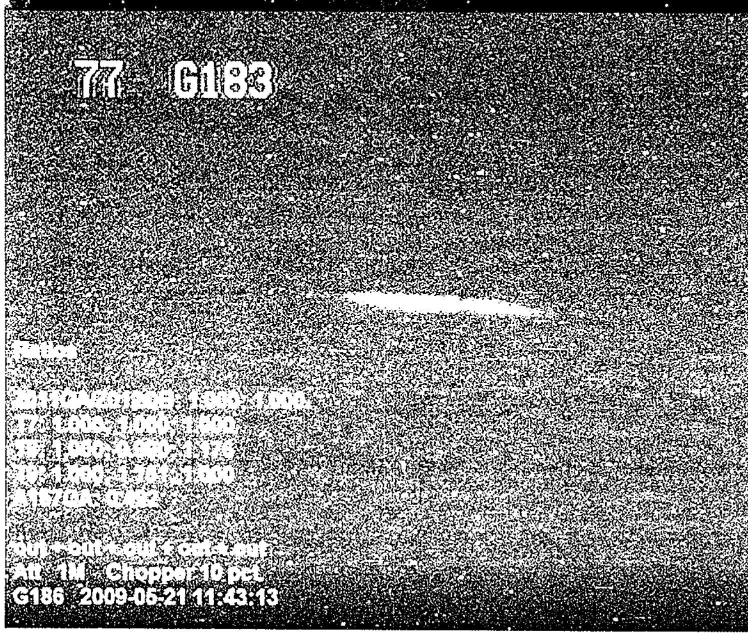




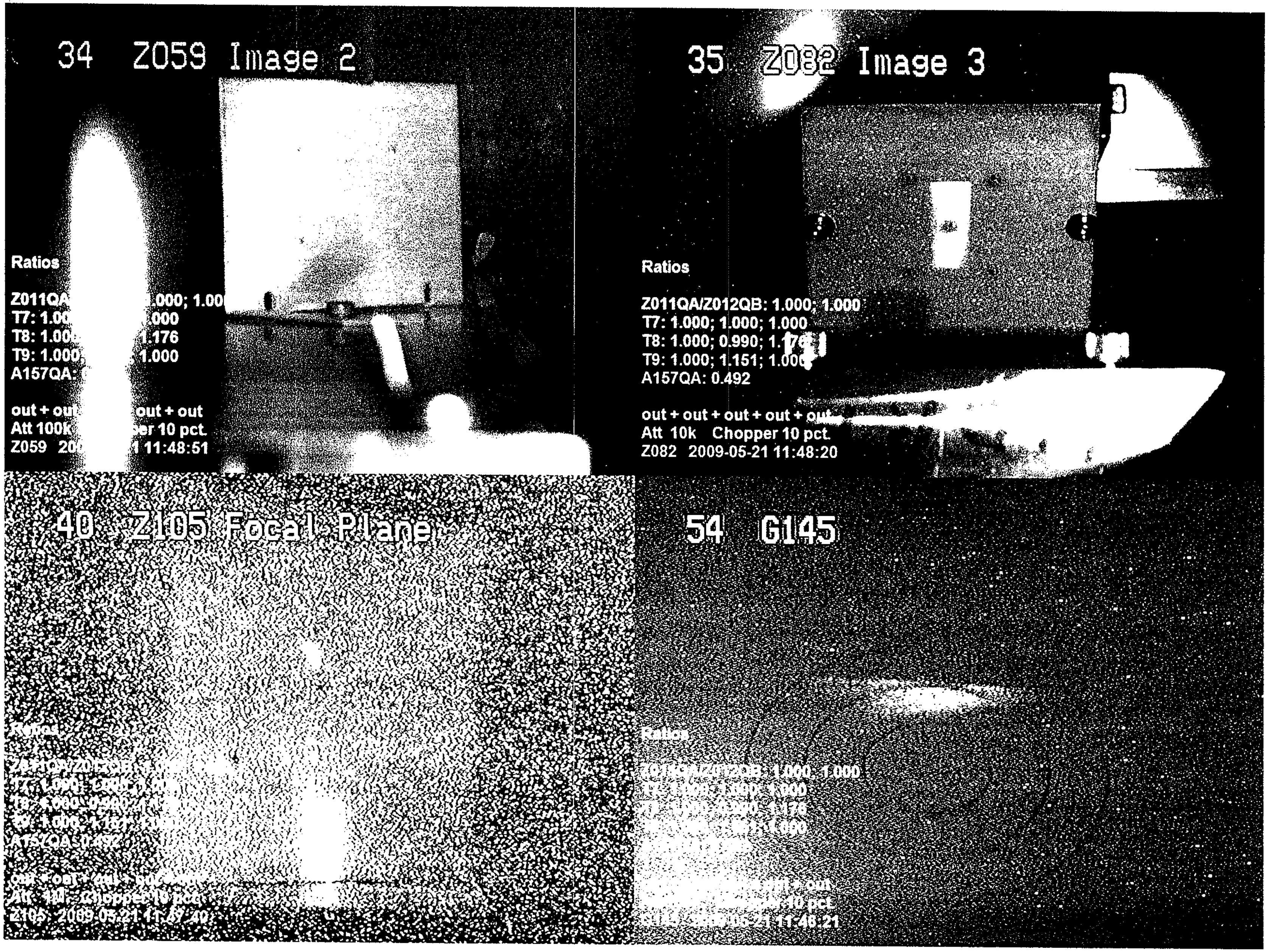
Camera Photos for Exp 05049C



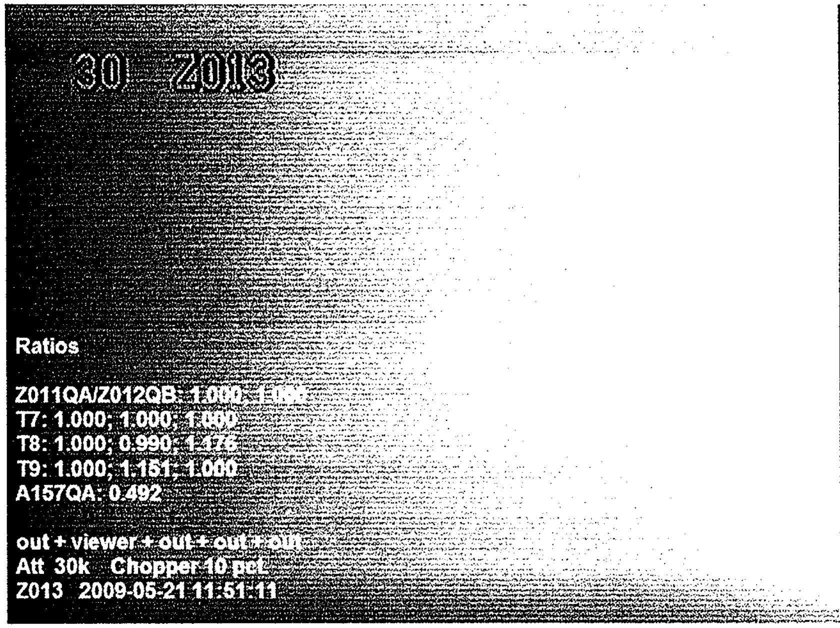


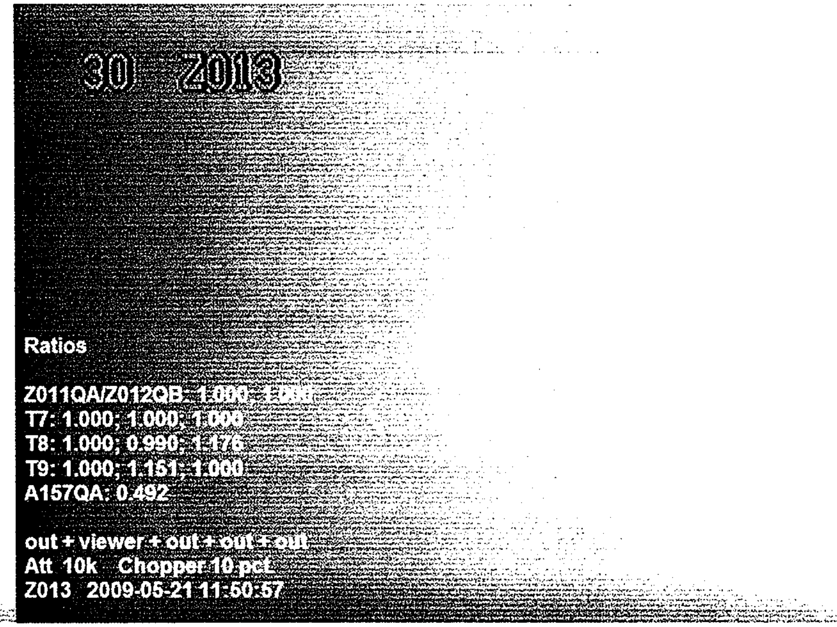


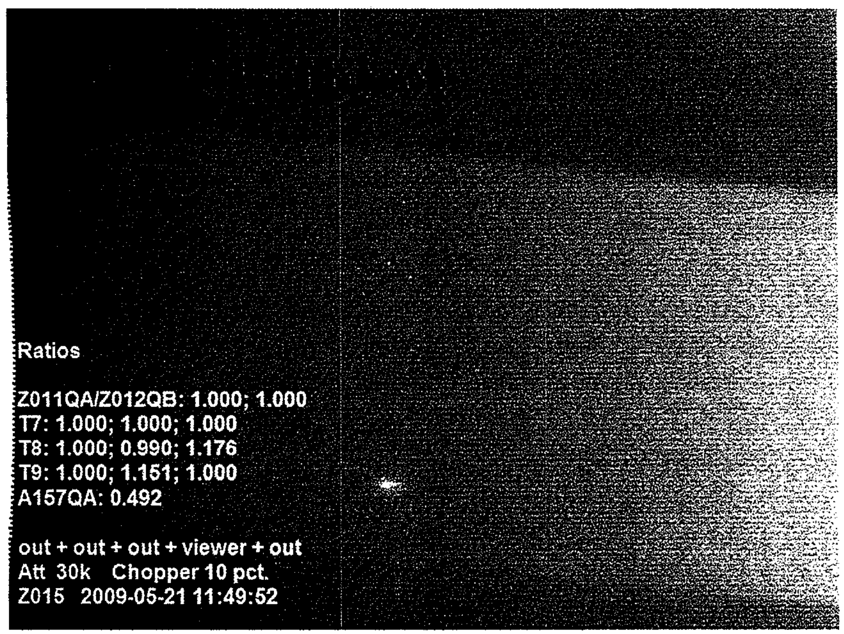
Camera Photos for Exp 05049C



Camera Photos for Exp 05049C

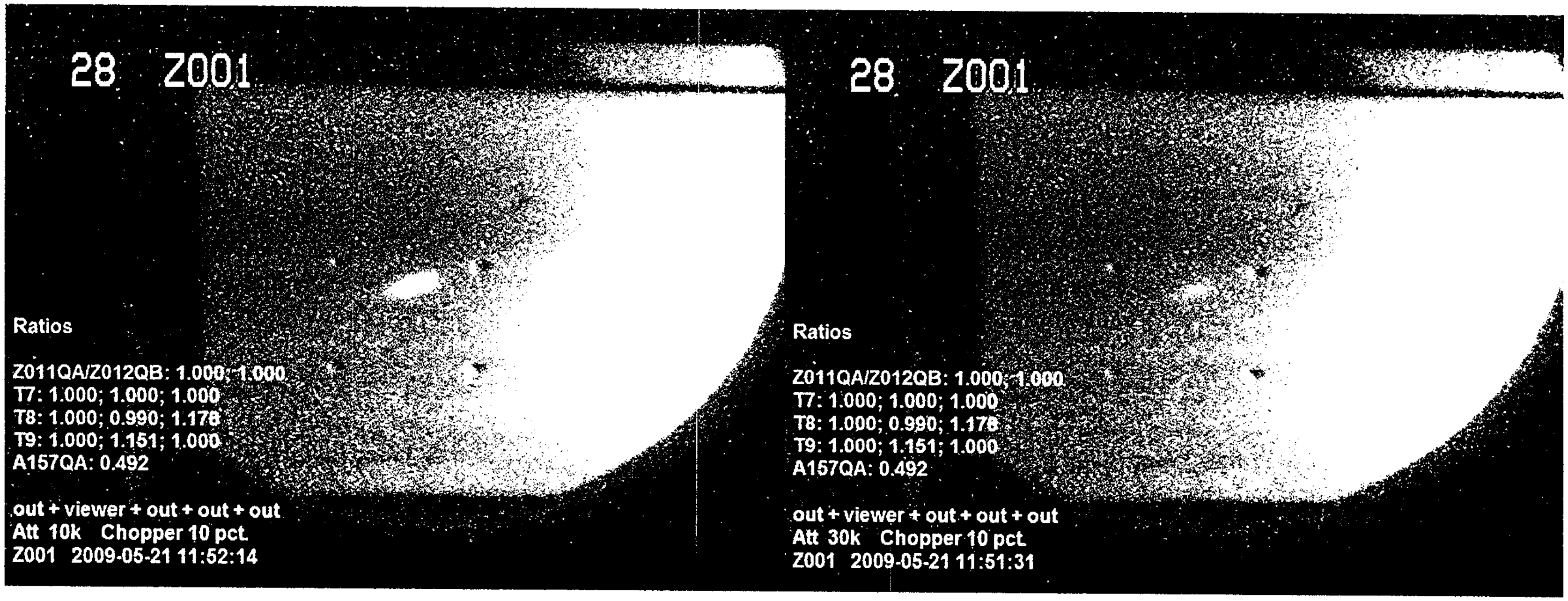






Camera Photos for Exp 05049C

Undegraded Primary Beam



28	301	304	3
29	304	306	2
30	318	320	2
31	328	330	2

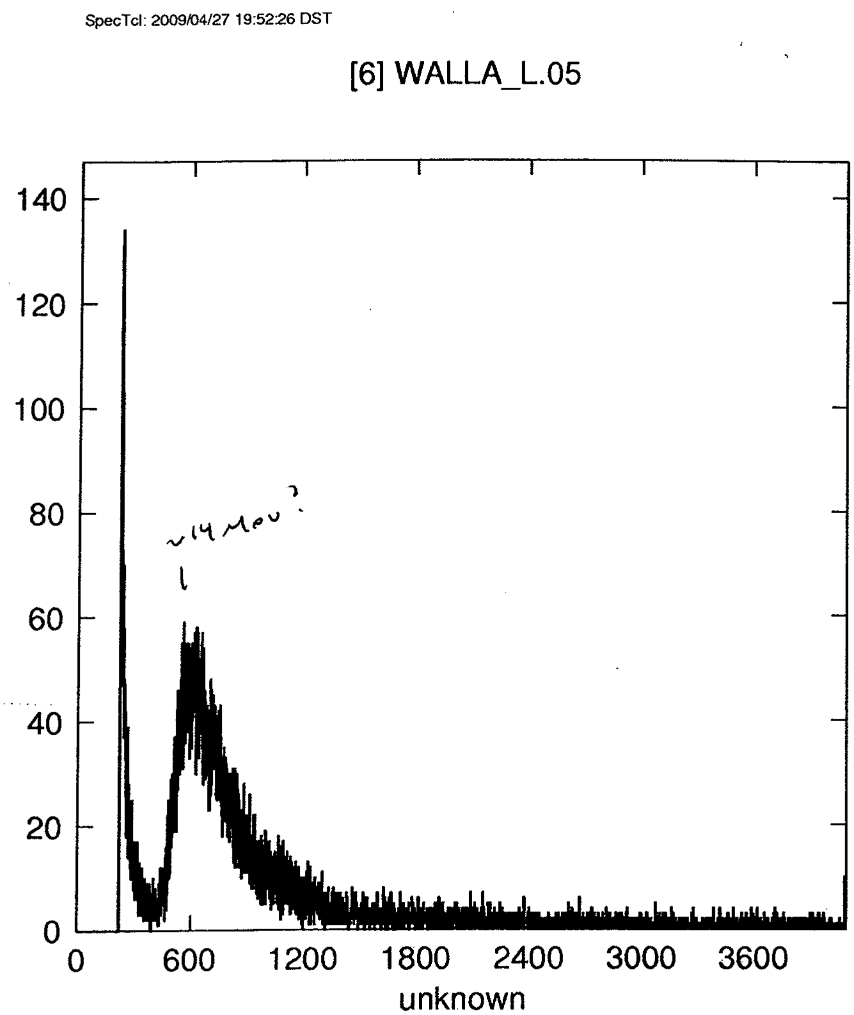
	13	119	194	75
	14	229	230	1
	15	270	272	2
	16	210	212	2
	17	217	218	1
	18	208	210	2
	19	274	276	2
	20	302	304	2
	21	282	284	2
	22	276	278	2
	23	238	240	2
	24	219	220	1
	25	272	274	2
	26	253	254	1
	27	296	298	2
	28	252	254	2
	29	235	236	1
	30	190	192	2
	31	210	212	2
3	0	225	226	1
	1	261	262	1
	2	242	244	2
	3	313	314	1
	4	294	296	2
	5	274	276	2
	6	316	318	2
	7	241	242	1
	8	244	246	2
	9	296	298	2
	10	290	292	2
	11	272	280	8
	12	265	266	1
	13	326	328	2
	14	374	376	2
	15	324	326	2
	16	280	282	2
	17	368	370	2
	18	298	300	2
	19	248	250	2
	20	320	322	2
	21	301	300	1
	22	328	330	2
	23	374	376	2
	24	334	336	2
	25	314	316	2
	26	324	326	2
	27	382	384	2

QDC	Channel	Run 615 Old Numbers	Run 700 ish New Numbers	Difference
10	0	108	109	1
	1	110	111	1
	2	112	113	1
	3	184	185	1
	4	142	143	1
	5	159	159	0
	6	109	109	0
	7	116	117	1
	8	128	129	1
	9	144	145	1
	10	142	143	1
	11	113	113	0
	12	139	139	0
	13	130	131	1
	14	114	115	1
	15	118	119	1
	16	158	159	1
	17	91	91	0
	18	185	185	0
	19	132	133	1
	20	142	143	1
	21	142	143	1
	22	98	99	1
	23	80	81	1
	24	113	113	0
	25	79	79	0
	26	190	190	0
	27	86	87	1
	28	92	93	1
	29	140	141	1
	30	144	145	1
	31	112	113	1
16	0	206	208	2
	1	236	238	2
	2	234	236	2
	3	298	300	2
	4	236	244	8
	5	222	228	6
	6	264	268	4
	7	270	276	6
	8	280	284	4
	9	282	284	2
	10	304	308	4
	11	218	220	2
	12	228	230	2

Neutron wall
Sample Cosmic
ray run
- nice clean
trigger
- Nice cosmic peak

$\frac{dE}{dx} \approx 2\ MeV/gcm^2$

$E_{TOT} \approx 14\ MeV$
- check this.



April 29, 2006

1100 Beam on Viewer

1232 Got good focus on Target, but looking at Focus on downstream dump. => Try to quantify focussing

=> We must know attenuator and intensity for when we are running

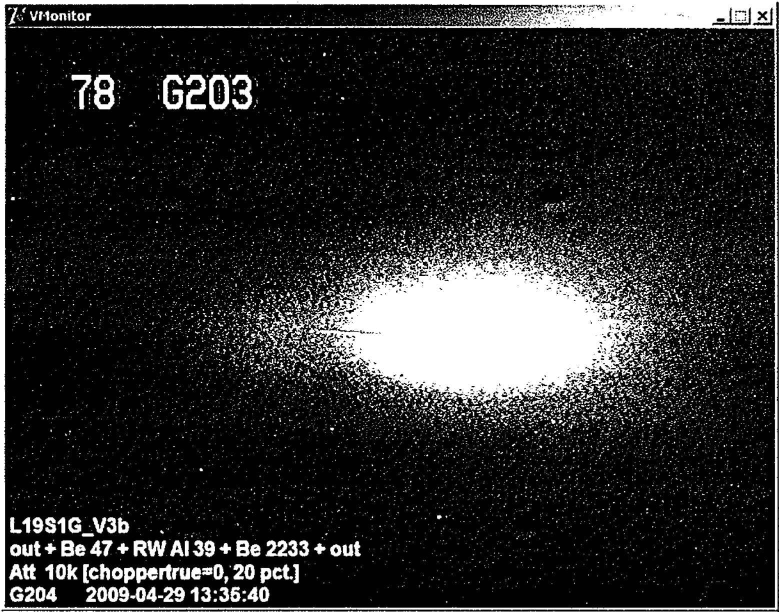
1?35 Go to deuteron beam 10 MeV/u
- Can't see on viewers

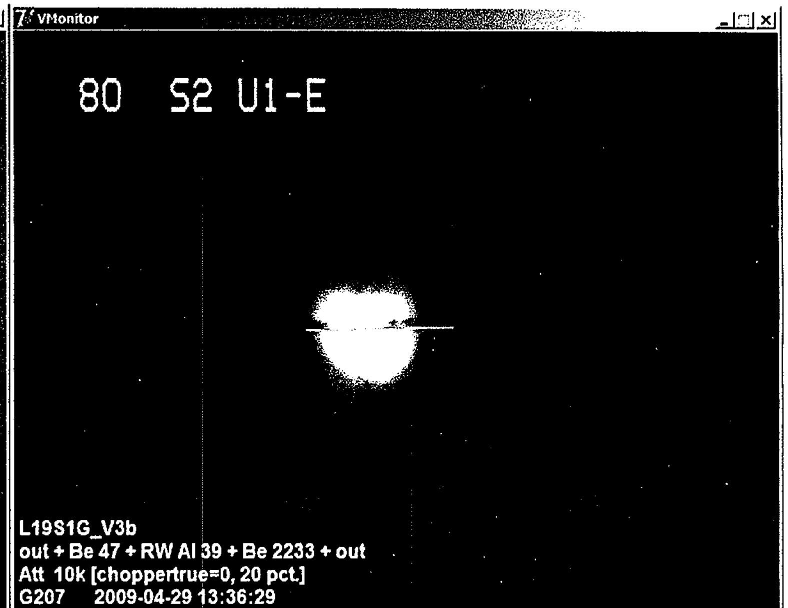
?05 Beam on target (viewer)

With beam on Viewer
CsI =
Neutron Background (No beam) = ~1380

Attn	CsI	Neutrons
100	306	~1566
30	940	~2006

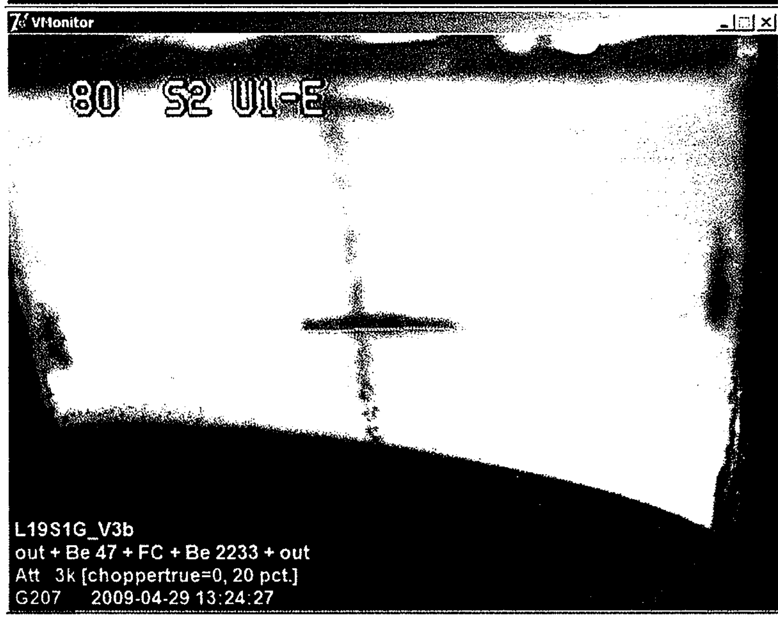
4 x 2   G202QA = 0.981   G20QB = 1.259

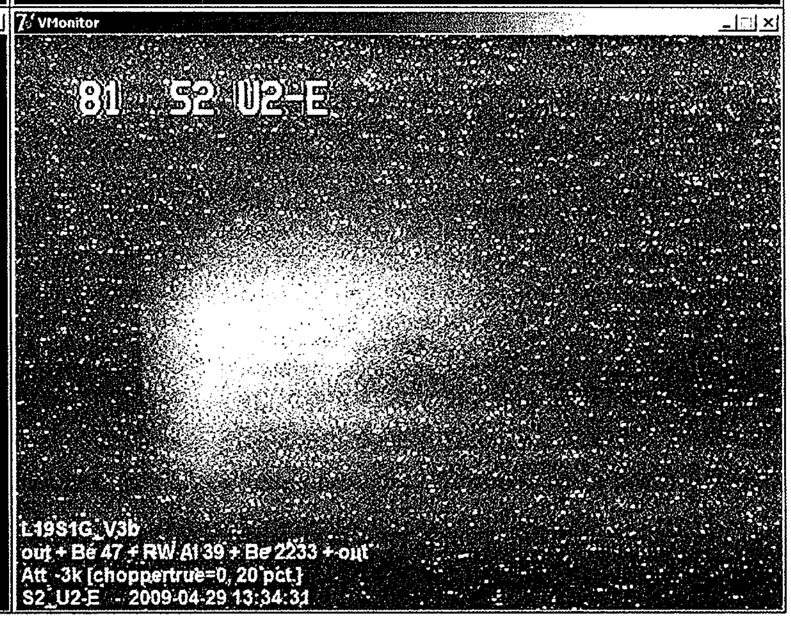




Target

^{16}O pilot beam





Faraday Cup

Beam on Dump

Neutron OR without Beam
(Background) ≈1052

Beam ON : 1443

Getting some Beam scattering off collimator ~~s~~. Mauricio is retuning to try to reduce that.

<u>Transmission</u> after retuning

$\frac{I_{dump}}{~~I_{FC}~~} = \frac{1.1 e\mu A}{}$

- We are ~~go~~ trying a ~~low~~ high Mag low angle setting.
  - Beam spot is much larger (~5–8 mm)

$I_{dump} = 18.7\ e\mu A$

  - We have a greatly improved ~~beam spot size~~ transmission and much lower scattering off collimator.

- Now, we are inserting wedge and going for straight deuterons. + 10% ^3He

$Attn = 0$

$I_{dump} = 0.4 e\mu A = 2.5 \times 10^6$ pps

CsI counts ≈ 200 s^{-1} ⇒ ~~Atte~~ We'll run w/ 10x more attn.

- Now inserting Collimator

$I_{dump} = 2.7 \times 10^6$ pps

Rate at XFP ≈ 5×10^5 pps

Barney printout ⇒ H2 Production part II.

Neutron wall rate background ≈ ~~1000~~ 1100

→ pb target in
- CsI rates ≈ 160/s with beam on target
- N rates ~ 1200

CsI punch through energy

6 cm CsI. density 4.5 gm/cm3

p	146.6 MeV
d	195 MeV
t	231 MeV
3He	521 MeV
α	585.2 MeV

csi_adc_thresh.dat | 4/29/09 - 9:40 pm

channel NEW Threshold(Dec) for each ADC

channel						
0	186	86	1	1	1	
1	243	114	4095	4095	4095	4095
2	247	96	4095	4095	4095	4095
3	194	102	4095	1	1	1
4	250	100	4095	1	1	1
5	205	88	4095	1	1	1
6	217	106	4095	1	1	1
7	210	105	4095	1	1	1
8	303	91	4095	1	1	1
9	197	105	4095	1	1	1
10	223	112	4095	1	1	1
11	202	98	4095	1	1	1
12	247	113	4095	1	1	1
13	252	105	4095	1	1	1
14	279	119	4095	1	1	1
15	233	105	4095	1	1	1
16	236	95	4095	1	1	1
17	213	95	4095	1	1	1
18	215	98	4095	1	4095	4095
19	257	95	4095	1	1	1
20	284	102	4095	1	1	1
21	238	105	4095	1	1	1
22	241	108	4095	1	1	1
23	173	96	4095	1	1	1
24	233	108	4095	1	1	1
25	255	102	4095	1	1	1
26	276	110	4095	1	1	1
27	273	103	4095	1	1	1
28	282	106	4095	1	1	1
29	246	92	4095	1	1	1
30	270	93	4095	1	1	1
31	230	89	4095	1	1	1

S08-----XEmacs: csi_adc_thresh.dat (Fundamental

CsI ADC thresholds

So far the new thresholds do not load properly, we don't know why!! We declare it as not the highest priority and move on!

Run Number: 186 **Run state:** Active

Length of run: 0 00:35:34 **Scaler interval:** 2.000000

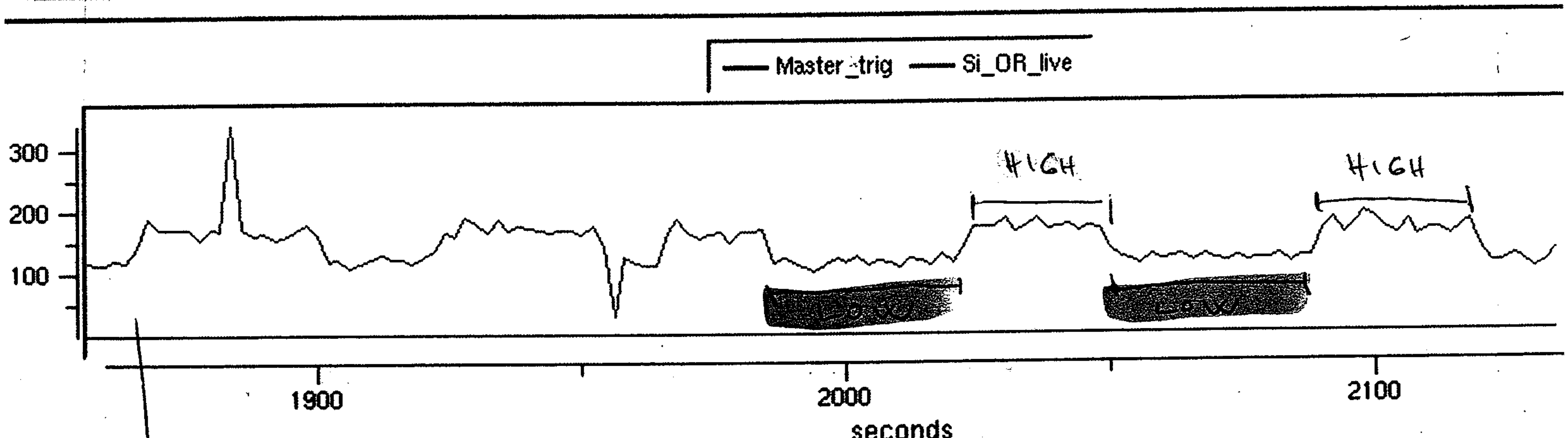
Title: taking data and debugging Neutron wall after failure to fix CsI threshold

RAW` LIVE

Test Scaler Page Two

Numerator	Denominator	Rate(s)	Total(s)	Ratio [rate t
Si_OR_live		126.5	303298	
CsI_OR_live		118.5	257257	
FA_OR_live		0.0	17	
MB_mult_live		0.0	0	
N_OR_live		1390.0	3006563	
Pulser_live		9841.0	20807823	
VETO		125.5	300397	
Master_live		0.0	0	
Upstream_live		126.5	302736	

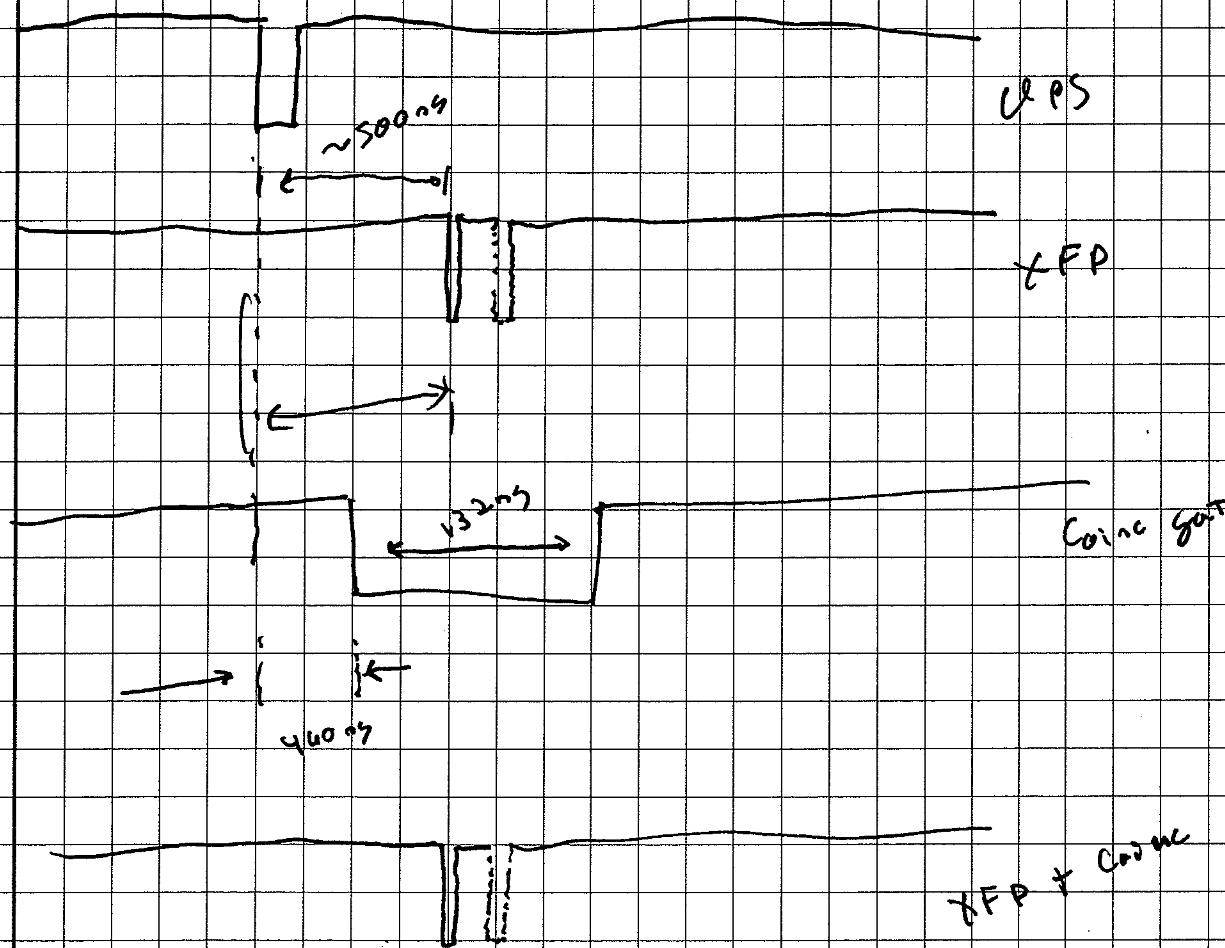
Note: @ 11:15 pm (4/29/09) we observe periodic changes of aparent beam intensity. Operators think it may be related to ion sources, but cannot be sure without taking the beam away for diagnosis. We decide to move on (for now)

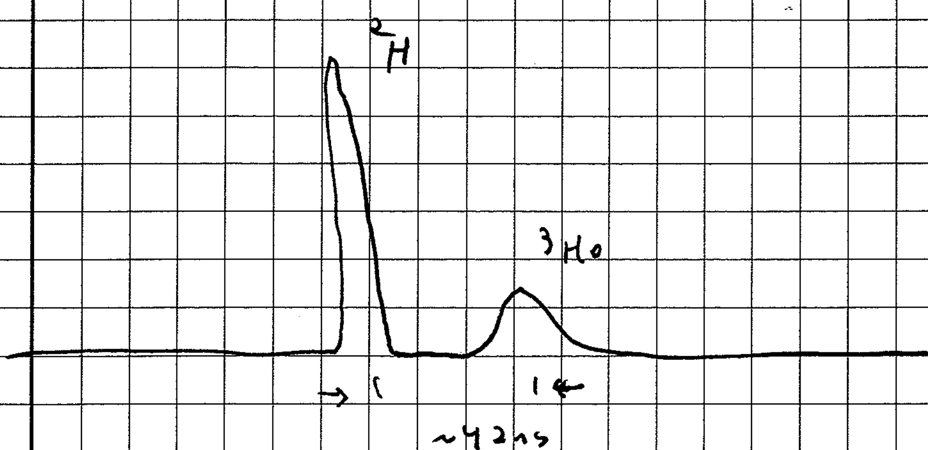


Problem fixed at 11:30pm by the operators.

↳ it was "semi-periodic instability of plasma in the ion source"

↳ fixed by increasing the gas pressure


UPS
~500ns
XFP
~32ns
Coinc gat
~60ns
XFP + Coinc


2H
3He
~42ns

4/30/2009
5:10 pm

scaler list updated and checked

To do

FA

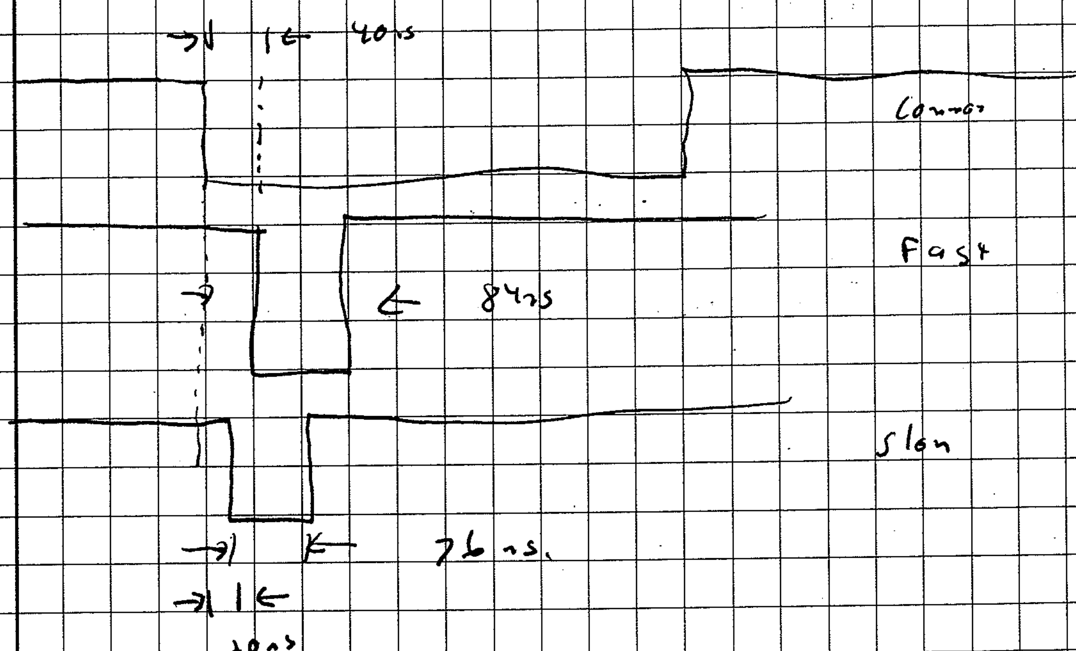
- Fix tube 1
- X-talk between tube 10 + Tube 12

MiniBall

- MiniBall Mapping
- Missing channels
- Ring 6 = Disc 3
- Ring 5 tube 8 tail
- Ring 7 = Disc 3
- = Part of disc 4
= tube 7 slow

Ring 8: OF others
Ring 10 : 7 + 10 (Maybe slow)
Ring 11 : gates Maybe on Disc 7

Routed out signals for ring 5 tube 4



MiniBall debugging

Ring 5
- Slow: we see in one Spec but not other?
Tail - May be missing

Ring 9
: Verify ~~Mapping~~ Routing For 8, 13, 15

Ring 10: Entire Tube Missing? Tube 10

Ring 6: T 4-19: all Missing, - disc?
- Cable?
- Splitters

- Replaced disc 6 = Test

- Ring 6:
- Replaced disc
- Rest of ring 6 should be ok

- Ring 7
: 0-5 Replaced disc
- 6-12 No Fast? } Bad splitter? disc? 7:6 = probably broken
- 14-16 No Fast
- 7 : NO Slow

- Ring 8
- 0 : No Fast => ~~Replaced~~ disc
* - 3 : No Sig? = Broken
- 8 : No Fast (May be NO Slow + Ta = Seems OK (gain?)
- ~~9 : No Fast (" ")~~
- 10 " " Seems OK (gain?)
- 11 No Fast, S, Tair? Seems OK (gain?)

Ring 10
- 7 Bad? - seems OK (low gain)
* 10 : Bad? - No sigh

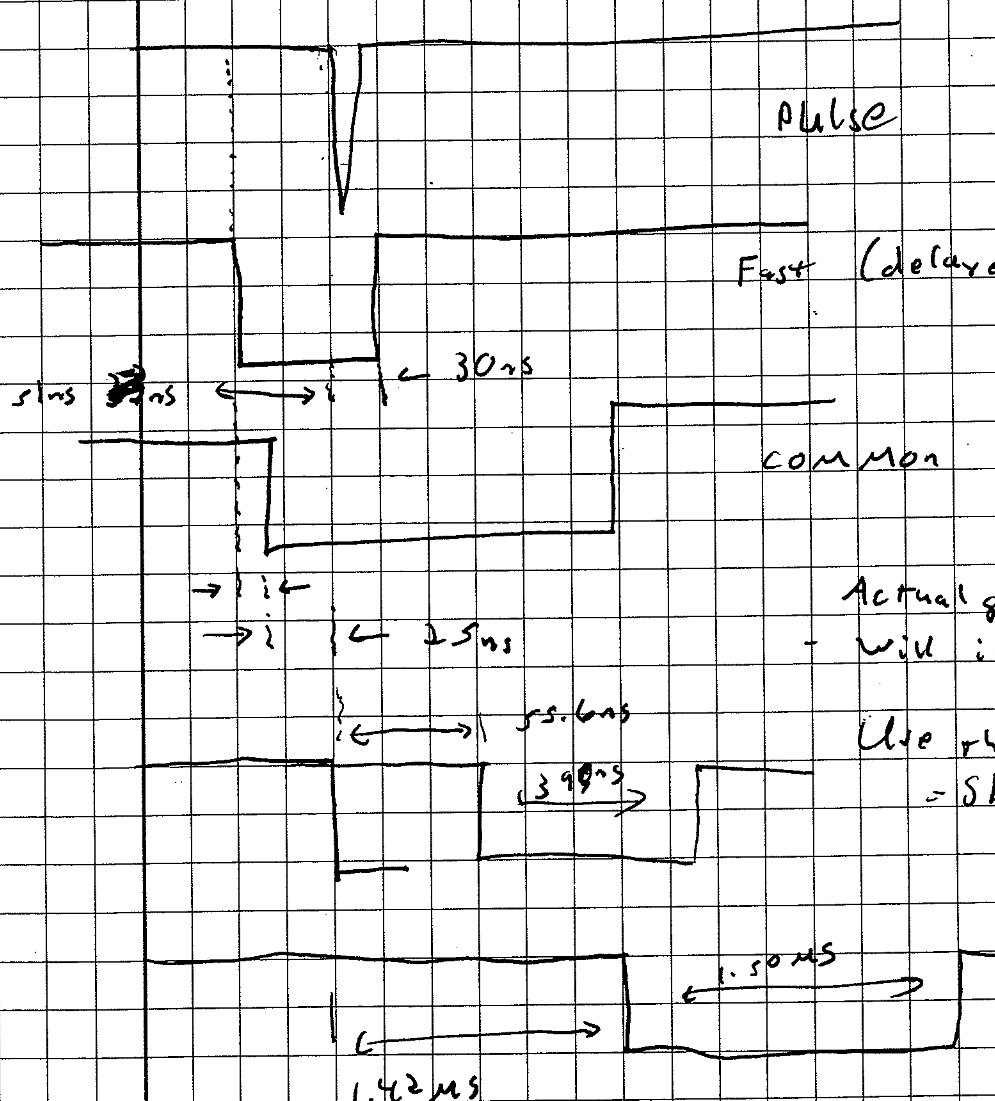
R8 T8 } Botho bad.
R10 T10 }

May 3, 2

Setting gates on MiniBar

- During test run, the M.B. gates looked pretty good for Slow vs. Tail, as determined by 2-D spectra
- We will use R5 as our starting point for fast vs. tail
- Use γ source: Not the best, but it provides a trigger
  - Thresholds set pretty low so γ rising edge is triggered as close to ∅ as possible
  - Could, in principle use a pulser w/a fast rising edge (rocket pulser)

Using a NIM pulser

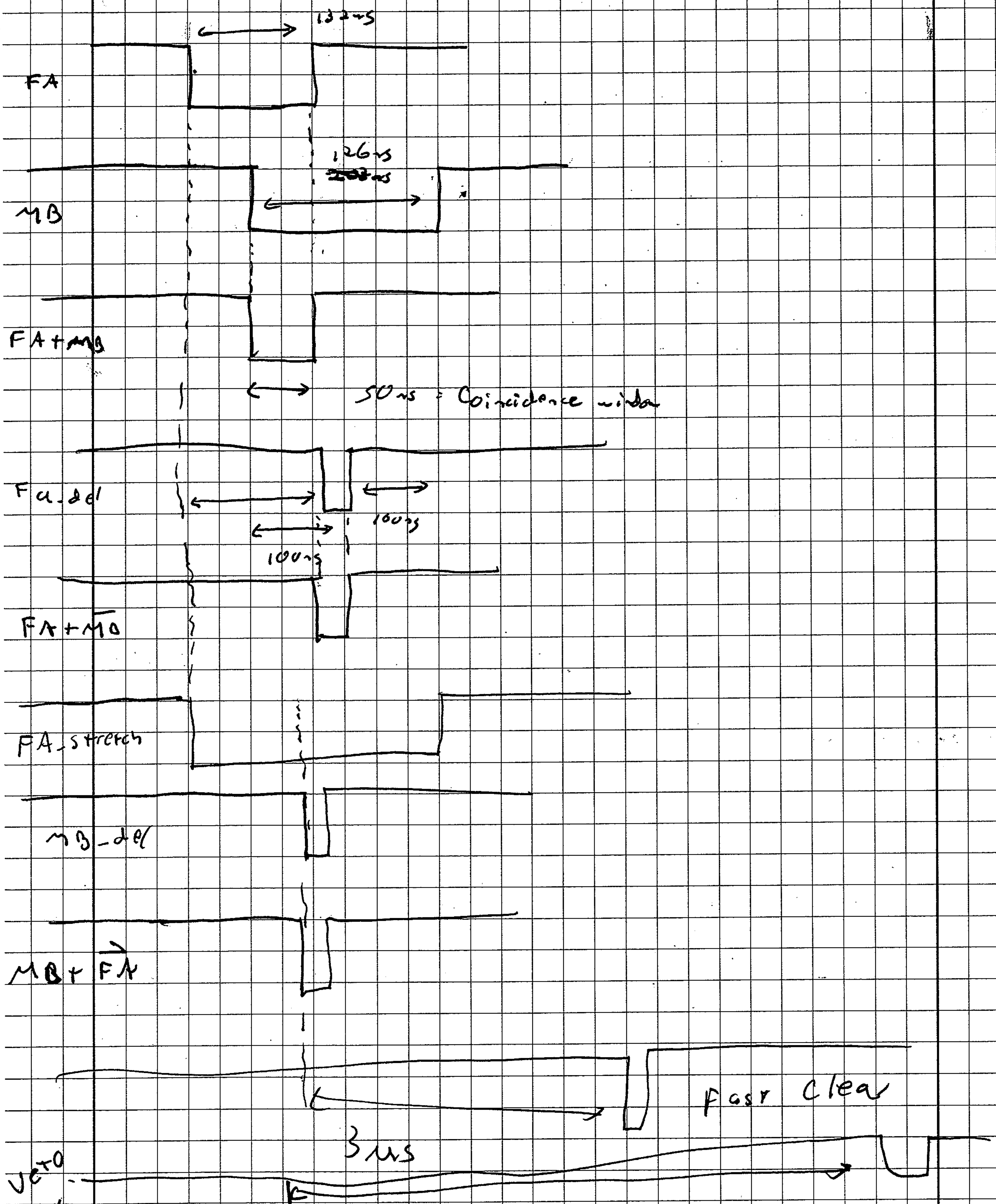


Actual gate is 30ns of integration
- Will increase Fast gate by 10ns

Use this for all channels!! ⇐
- Slow - w.r.t Fast output (since it's easy to see)

Tail - w.r.t Fast output (easy to read

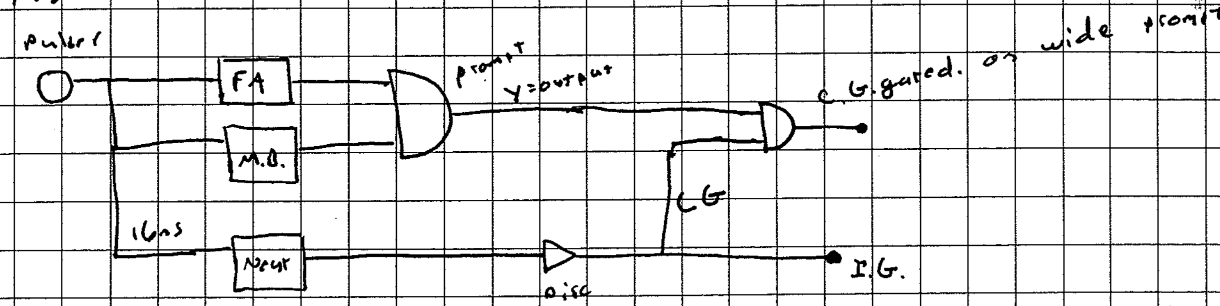
Trigger logic



we need a system veto that is initiated by Master trig ...

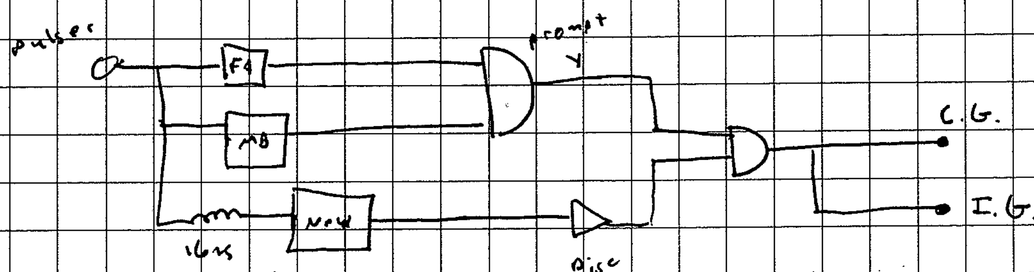
Can we Gate the Neutrons on the prompt trigger?

Test



- Y output of prompt should be ≳ 700 ns wide to be sure that we get all Neutrons gates

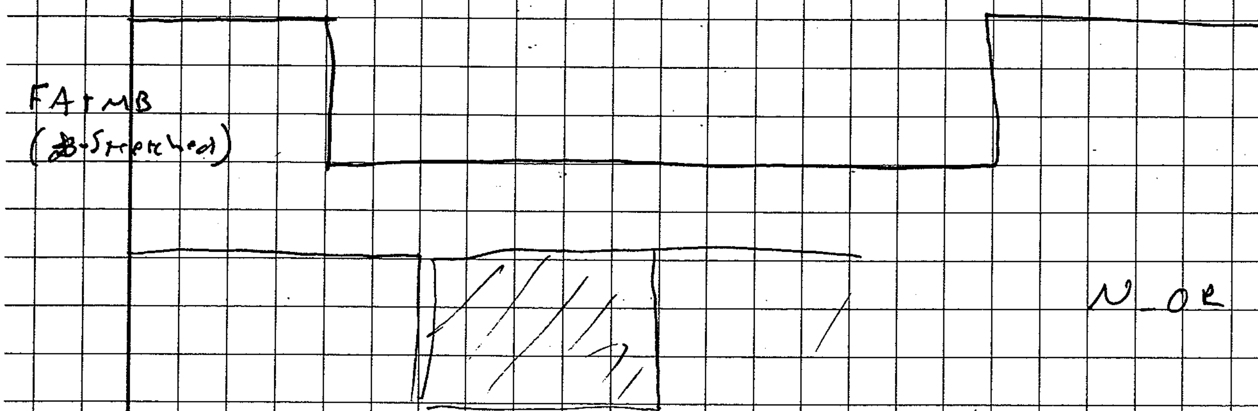
Alternatively



- Y out should be ≈ 400 ns wide to be sure we get all Neutronse (Maybe less, but 400 ns is probably OK).

x5,2009 Neutron Fast Clear

- If we have Neutrons but No Coincidence condition, we generate a Fast clear.



* C_V: Reset Must be set so Si OR
≤ 3 μs

9,2009 Neutron wall position

- Time Measured From Neutron OR time
-

Run Comment

342 Neutron laser pos. wall 3 Tubes 0-6
- Tube 1 seems really offset, this one was originally broken
- Tube 7 no position seen (broken?)

343 Laser calibration
Tube 7: broken Fibel
Tube 8: Multiple peaks (reflection?)
Some tubes have multiple peaks (retriggering probably)
BR 18 doesn't seem to have Signals
BR 20: No really good position
21 " " " "

344 laser calibration wall 1
Tube 10: Broken fiber
Tube 13: No peak.
Tube 14: No peak Tubes 16-19 seem to be

May 10, 2

- May redo pulser ramps after putting foils back on LASSA.
  - pretty noisy.

- Slot 5, chip 1 looks awful ⇒ lots of noise! what's going on?
  - changed reset C.V.?
  - Si has flake of SnSb foil on it?
  - Other?
  - ASICs?
  - preamp?
  - → ~~Did we~~ Is the cable properly grounded? touching chamber
  - Maybe not so bad. A few channels w/ single counts.
  - Should investigate later.
  - lots of low energy noise, however.

Slot 11, chip 1 seems to have similar problems. May reduce CV reset as this might be the problem.
Chip 1 ~~bad~~ strange on both?

May 11, 20

Recheck neutron gains using ^{60}Co source
- this time use pedestal offsets so that E=0 is ~ channel=0
- For dynamic range of ~ 17-20 MeVee, Compton edge should be
  → channel 204-240 at center
- At end, it should be ~ 2x larger ≈ 408-480

File used: e05049_neut_20MeVee.dat

Setting LASSA offsets on Motherboard.

- The offsets on EB are ~~Negative~~ Positive so we will reset them so they are negative.

  - EB Slot 12, chip ϕ is OK.
  - the rest need to be reset.
- we must do a pulser run after this.

Neutron wall thresholds

- Procedure
  1. Set Bias file e05049_neut_mid.txt
  2. Set all thresholds to 35 as in Test run
  3. Use ^{60}Co source and take a several hour run with source at wall center.
  4. Use thresholds to determine G.M. setting in MeVee.
  5. also determine using Left & Right raw.
  6. Redo for Thresh = 25
  7. Redo for thresh = 15
  8. Redo for e05049_neut_20MeVee.txt.
     Thresh = 35
     Thresh = 25
     Thresh = 15
  9. Determine thresh in MeVee

Wall A left. Tube 3.

~~Cfr~~ Thresh	Channel	Ped	Compton edge	Move
5	348			
15	563			
25	738			
35	951			
10	460			
20	637			

Set all thresh to ~~35~~ 10

Wall A Tube left	Th=10 Channel	Th=35 chan	Pedestal	Th=35 ~~Compton edge~~	Compton
0	421		164	919	480
1	431		202	819	466
2	433		191	823	509
3	464		243	767	501
4	465		231	859	430
5	440		212	819	416
6	838		258		502
7	687		180		459
8	478		195	991	452
9	492		234	887	466
10	508		238	983	459
11	446		223	811	473
12	448		210	839	487
13	501		260	867	480
14	596		313	1027	487
15	514		274	823	430
16	536		184	1239	566
17	468		212	903	538
18	441		208	795	566
19	526		268	875	581
20	453		205	903	435
21	427		196	811	462
22	508		241	923	515
23	507	933	251	1046	465

use 2 chns → 6, 7 to one other

Source placed on edge of wall near tube PMT (No atn)

Pedestal off... for Compton ...

Wall A tube Right

Tube	th=35 channel	pedestal	Compton Edge
0	1196		458
1			462
2	817		516
3	645		444
4	652		480
5	595		423
6	695		559
7	609		473
8	645		430
9	745		394
10	810		416
11	745		410
12	709		473
13	867		424
14	767		468
15	681		394
16	795		409
17	817		416
18	724		387
19	652		452
20	731		437
21	946		473
22	666		444
23	817		444
24			

Wall B - right tube #	th=35	Compton edge ~~pedestal~~
0	745	532
1	702	960
2	774	659
3	781	681
4	896	623
5	437	581
6	931	1003
7	559	953
8	774	753
9	702	1361
10	752	566
11	595	789
12	795	595
13	(?) 373 (low gain)	(?) 187
14	(?) 1591	946
15	406	645
16	781	502
17	717	709
18	795	666
19	808	566
20	(?) 896	652
21	724	659 (659)
22	867	609
23	838	738

Wall B - LEFT	th=35	pedestal	Common edge
0	824		688
1	989		645
2	602		724
3	845		838
4	1046		545
5	874		623
6	881		595
7	853		573
8	867		838
9	931		881
10	888		681
11	(?) 974		487
12	996		681
13	781		774
14	831		989
15	939		896
16	917		953
17	609		982
18	795		1003
19	853		960
20	817		[illegible] 1139
21	724		1161
22	810		1096
23	860		903

9 Si Pulser ramps on back

Changed EB offsets so we are redoing pulser ramps

Run 377 starts EB pulse ramp

Neutron thresholds
- use HV: c05049_neut_20MeVee.txt
- use pedestals: Neut.offsetsudef

For this HV file
Channel: 408-480 => 1MeVee at tube or about
~2 MeVee 6 M.

Thresholds for N-walls

Set for ~2 MeVee File

Wall 1 -L -R

Tube	L pedest	Thresh value left	CEdge	R pedest	~~Thresh channel~~ Thresh chan right	CEdge
0	159	453	510	97	~~420~~ 437	485
1	200	437	490	88	481	485
2	190	430	513	96	442	515
3	243	405	507	159	457	445
4	230	421	435	114	409	505
5	212	409	455	126	424	441
6	258			81	413	551
7	180			98	437	501
8	195	449	490	103	463	461
9	234	452	520	121	413	430
10	238	434	453	114	461	395
11	223	423	483	82	429	429
12	210	448	570 (?)	97	417	515
13	260	444	509	86	453	433
14	314	452	513	90	417	491
15	275	452	530	102	426	475
16	186	442	590	200	450	451
17	213	434	525	184	474	461
18	209	447	550	173	428	429
19	269	442	585	239	418	463
20	206	428	445	271	433	477 ~~[illegible]~~
21	197	431	475	236	448	503
22	242	433	480	234	411	489
23	252	423	485	219	440	505

Note:

- pedestals are RAW
- thresholds and Compton edges are taken WITH subtracted SpecTcl pedestals according to sdef-file: "Neut_offset.sdef"

Threshold channels WallB

Tube	ped L	L channel	C Edge	ped R	R channel	C Edge
0	245	460	440	131	442	454
1	315	434	457	79	453	490
2	252	418	439	154	449	560
3	210	458	451	116	457	!! 620 (?)
4	268	452	~~[illegible]~~ 427	118	461	477
5	251	454	445	128	447	472
6	276	454	451	84	456	468
7	319	443	443	69	452	490
8	285	449	467	99	441	477
9	266	462	430	68	433	580 (?)
10	274	453	433	169	435	460
11	328	452	461	76	445	480
12	254	452	471	82	431	513 (?)
13	261	448	415	127	430	570 (?)
14	268	456	473	134	367	465
15	279	449	439	105	446	490 (?)
16	260	442	465	207	435	470
17	262	430	461	255	456	477
18	283	444	459	238	452	482
19	204	450	445	280	436	465
20	213	451	457	239	412	442
21	182	450	459	221	453	463
22	219	449	441	179	451	464
23	256	445	451	202	438	440

Examine CsI 1 signals

In shaper channel 1

Pulser input 50ns rise
500ns Fall

Pulse Amp (V)	Shaper amp (mV)
1	59.6
2	118
3	174
4	228
5	284
6	337
7.0	383
8.0	435
9.0	489
10.0	537
0.5	29.1
1.5	89.6

In Shaper Ch 12

Pulse Amp	Shaper Amp (mV)
0.5	30.5
1.0	61.0
1.5	91.4
2.0	120
3	177
4	232
5	287
6	333
7	386
8	438
9	490
10	540

Camera Photos for Exp 07018

L19S1G_vb3.txt with standard ratios

Tuning beam to S1/S2 vault — May 14

13:36 Beam on viewer in S1 upstream of ~~R~~FFS

A1900 Faraday Cup.

Background: ~2epA (Maybe ∅)

Neutron wall background counts ≈ 2300 s^{-1}

17:54 Done tuning degraded: going to primary beam.

19:47 Beam tune to target ⇒ Start Faraday Cup calibration EXPERIMENT RUNNING

Faraday Cup Calibration $^{40}Ca^{20+}$

- take w.r.t.
  - Z105 F-C : A1900 Focal plan
  - A130 F-C : Right before second switch in transfer Hall
- Measure G 238 F-C

ATTN	Z105 F-C (A)	A130 F-C (A)	G238 F-C (A)	N_OR w/ beam at...
	No beam			2223
10×10^3	8×10^{-12}	4.5×10^{-12}	2.68×10^{-12}	2220
3×10^3	~~35×10^{-12}~~ 8×10^{-12}	15.5×10^{-12}	4.3×10^{-12}	2260
10^3	56×10^{-12}	66×10^{-12}	33×10^{-2}	2654
100	350×10^{-12}	500×10^{-12}	210×10^{-12}	4959
30	950×10^{-12}	1200×10^{-12}	700×10^{-12}	10200
10	4000×10^{-12}	~~8.5×10^{-12}~~ 8500×10^{-12}	2680×10^{-12}	32500
3	~~[illegible]~~ 6000×10^{-12}	~~6500×10^{-12}~~ 11000×10^{-12}	3300×10^{-12}	42700

Recheck TDC reference signals.

Neutron wall 1190

Channel	Signal		
0	FA OR	16	
1		17	
2	Neutron OR	18	5 and 2 are the same sig maybe delayed
3		19	
4		20	
5	Prompt TRIG ⇒ Neutron OR 24-29		

Mini Ball 1190

Channel	Sig	
0	FA OR	
1	MiniBall Mult Trig	1 and 5 are the same - maybe delayed
2		
3		
4		
5	PROMPT Master	

6.7

FA 775

Start = FA OR

Scaler Channels

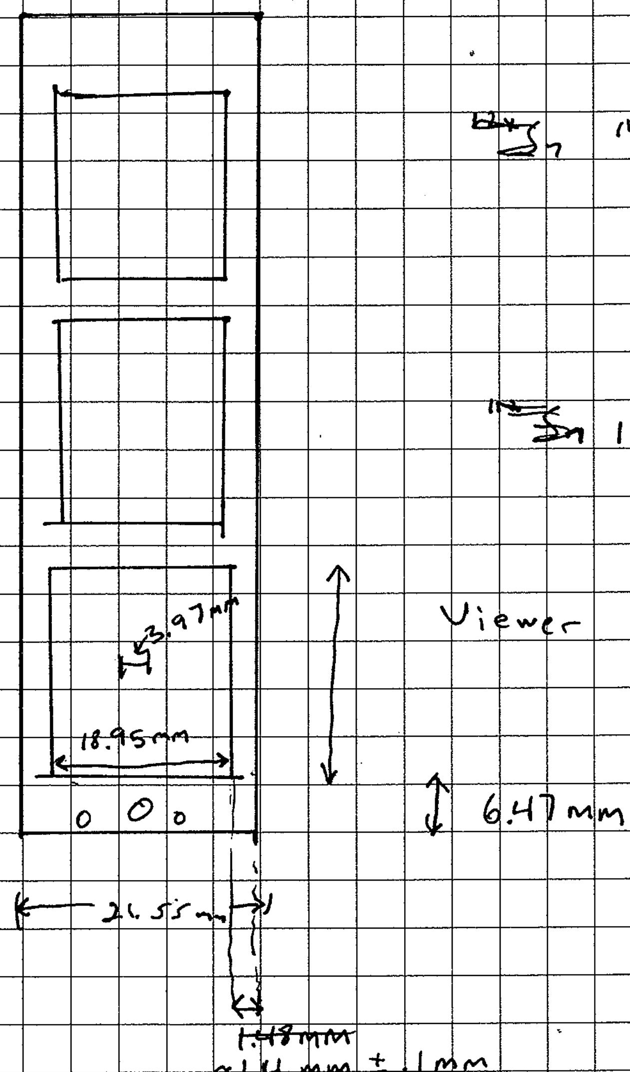
Channel	Raw		Live
0	Si OR	16	Si OR
1	CsI OR	17	CsI OR
2	FA OR	18	FA OR
3	MB Mult	19	MB Mult
4	N-OR	20	N-OR
5	F.C.	21	F.C.
6	Proton veto OR	22	Proton Veto OR
7		23	
8		24	
9		25	
10		26	
11		27	
12	Pulser	28	Pulser
13	Veto	29	Veto
14	Master	30	Master
15		31	

3

Patch Panel

Channel	Signal
1	Si 0 Bias
2	Si 1 Bias
3	Si 2 Bias
4	Si 3 Bias
5	Si 4 Bias
6	Si 5 Bias
7	CsI Bias 0
8	~~Si Shaper~~ Interlock
9	Si Shaper
10	Si OR
11	
12	CsI Shaper
13	CsI gate
14	Broken
15	MB Mult trig
16	MB Mult Analog
17	Neut OR / Singles trig
18	Master
19	Veto
20	FA OR
21	Broken
22	FA ADC gate
23	~~CsI OR~~
24	~~FA Fast~~ CsI OR
25	~~MB Slow Stretch (TTL)~~ FA FAST
26	~~(Fast b)~~ MB STRETCH (TTL)
27	(FA + MB)
28	
29	
30	CsI 1 Bias

Target Configuration For Experiment

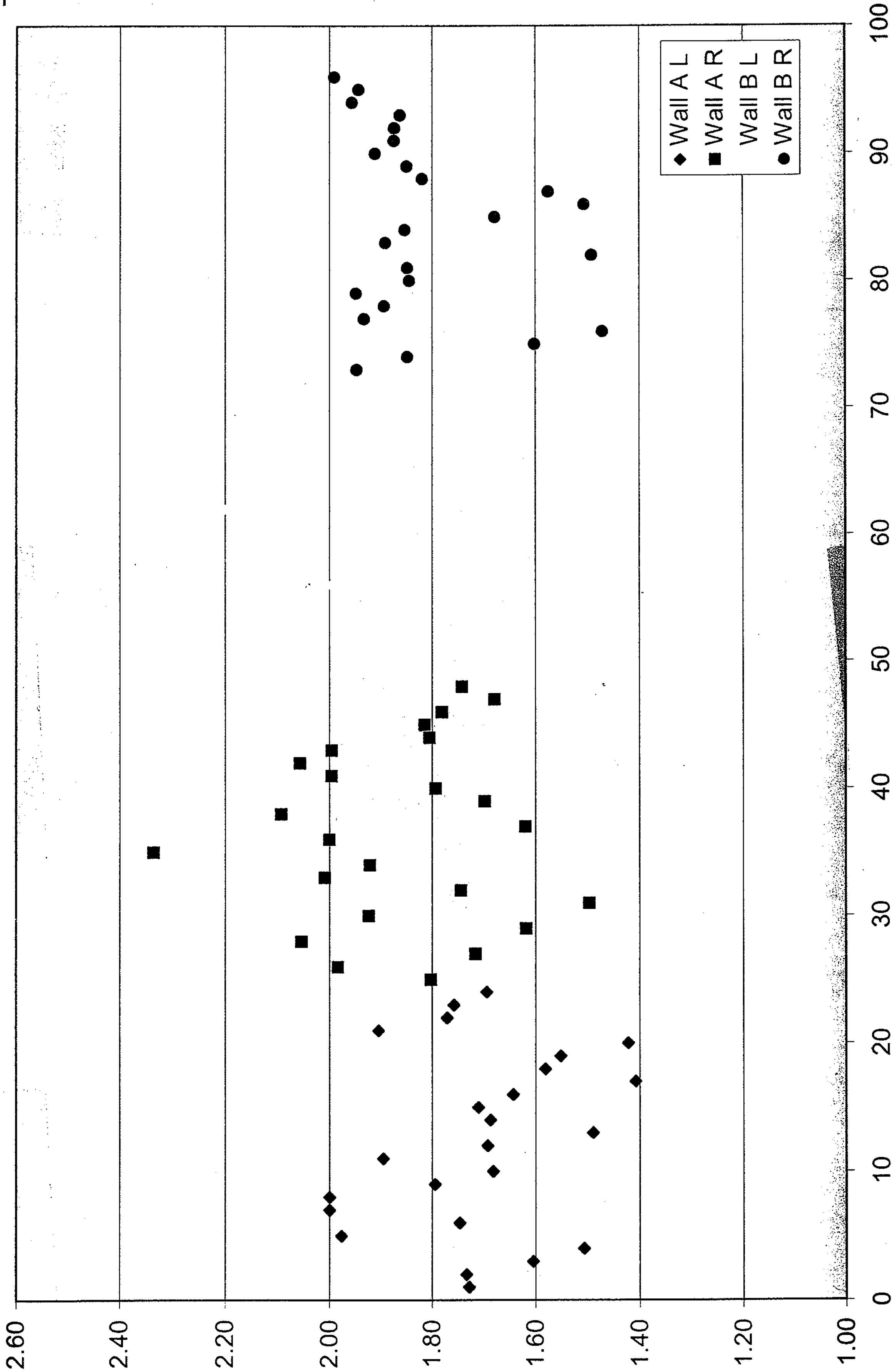


~~124Sn~~ ^{112}Sn : 4.98 ± 0.05 mg/cm²

~~112Sn~~ ^{124}Sn : 5.41 ± 0.05 mg/cm²

Neutron wall threshold settings.

HV File: e05049_neut_20MeVee.txt



Neutron wall threshold settings for 05049

50pm
12/2009

NW with 2 MeVee HV setting

threshold in [MeVee]

Wall A L	Ped	SpTcl Ped	Thresh	CompE	cor th	cor CompE	
0	159	69	453	510	522	579	**1.73**
1	200	108	437	490	545	598	**1.73**
2	190	97	430	513	527	610	**1.60**
3	243	150	405	507	555	657	**1.51**
4	230	138	431	435	569	573	**1.98**
5	212	120	409	455	529	575	**1.75**
6	258	167			167	167	**2.00**
7	180	86			86	86	**2.00**
8	195	104	449	490	553	594	**1.79**
9	234	142	452	520	594	662	**1.68**
10	238	147	434	453	581	600	**1.90**
11	223	131	423	483	554	614	**1.69**
12	210	119	448	570	567	689	**1.49**
13	260	167	444	509	611	676	**1.69**
14	314	223	452	513	675	736	**1.71**
15	275	183	452	530	635	713	**1.64**
16	186	96	442	590	538	686	**1.41**
17	213	123	434	525	557	648	**1.58**
18	209	119	447	550	566	669	**1.55**
19	269	179	442	585	621	764	**1.42**
20	206	116	428	445	544	561	**1.90**
21	197	107	431	475	538	582	**1.77**
22	242	151	433	480	584	631	**1.76**
23	252	162	423	483	585	645	**1.69**

Wall B L	Ped	SpTcl Ped	Thresh	CompE	cor th	cor CompE	
0	245	155	460	440	615	595	**2.11**
1	315	225	434	457	659	682	**1.87**
2	252	163	418	439	581	602	**1.88**
3	210	120	458	451	578	571	**2.04**
4	268	178	452	427	630	605	**2.15**
5	251	161	454	445	615	606	**2.05**
6	276	187	454	451	641	638	**2.02**
7	319	229	443	443	672	672	**2.00**
8	285	196	449	467	645	663	**1.90**
9	266	176	462	430	638	606	**2.19**
10	274	184	453	433	637	617	**2.12**
11	328	238	452	461	690	699	**1.95**
12	254	165	452	471	617	636	**1.90**
13	261	172	448	415	620	587	**2.20**
14	268	179	456	473	635	652	**1.91**
15	279	190	449	439	639	629	**2.06**
16	260	170	442	465	612	635	**1.88**
17	262	172	430	461	602	633	**1.83**
18	283	192	444	459	636	651	**1.92**
19	204	115	450	445	565	560	**2.03**
20	213	121	451	457	572	578	**1.97**
21	182	91	450	459	541	550	**1.95**
22	219	126	449	441	575	567	**2.05**
23	256	172	445	451	617	623	**1.97**

Neutron Wall Thresholds

50 pm
12/2007

NW with 2MeVee HV setting

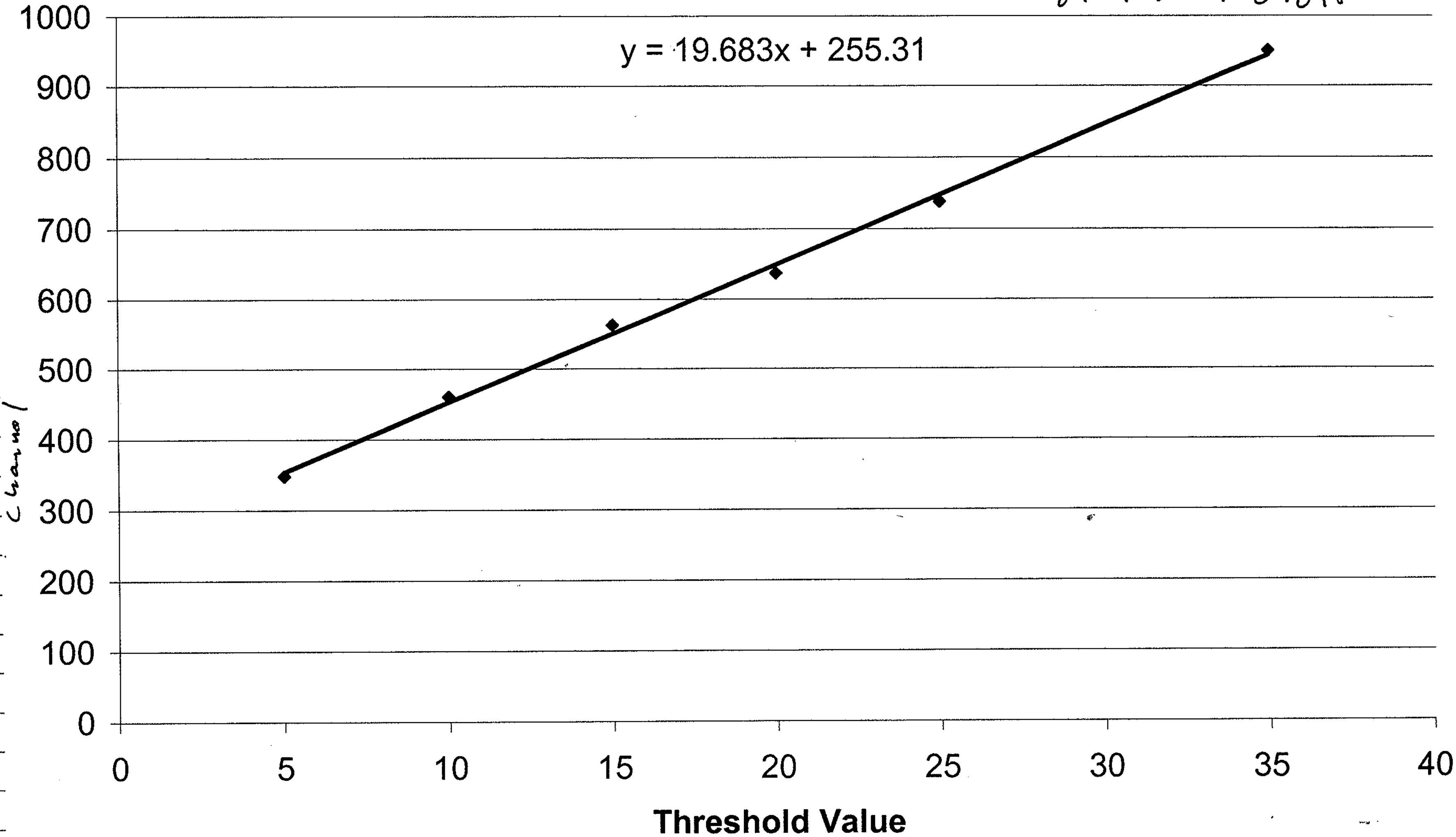
threshold in [MeVee]

Wall A R	Ped	SpTcl Ped	Thresh	CompE	cor th	cor CompE	
0	97	97	437	485	534	582	**1.80**
1	88	88	481	485	569	573	**1.98**
2	96	95	442	515	537	610	**1.72**
3	159	159	457	445	616	604	**2.05**
4	114	112	409	505	521	617	**1.62**
5	126	126	424	441	550	567	**1.92**
6	81	79	413	551	492	630	**1.50**
7	98	97	437	501	534	598	**1.74**
8	103	103	463	461	566	564	**2.01**
9	121	121	413	430	534	551	**1.92**
10	114	113	461	395	574	508	**2.34**
11	82	80	429	429	509	509	**2.00**
12	97	97	417	515	514	612	**1.62**
13	86	85	453	433	538	518	**2.09**
14	90	89	417	491	506	580	**1.70**
15	102	101	426	475	527	576	**1.79**
16	200	197	450	451	647	648	**2.00**
17	184	183	474	461	657	644	**2.06**
18	173	171	428	429	599	600	**2.00**
19	239	238	418	463	656	701	**1.81**
20	271	268	433	477	701	745	**1.81**
21	236	235	448	503	683	738	**1.78**
22	234	231	411	489	642	720	**1.68**
23	219	218	440	505	658	723	**1.74**

Wall B R	Ped	SpTcl Ped	Thresh	CompE	cor th	cor CompE	
0	131	129	442	454	571	583	**1.95**
1	79	77	453	490	530	567	**1.85**
2	154	152	449	560	601	712	**1.60**
3	116	113	457	620	570	733	**1.47**
4	118	117	461	477	578	594	**1.93**
5	128	125	447	472	572	597	**1.89**
6	84	82	456	468	538	550	**1.95**
7	69	68	452	490	520	558	**1.84**
8	99	97	441	477	538	574	**1.85**
9	68	67	433	580	500	647	**1.49**
10	169	168	435	460	603	628	**1.89**
11	76	74	445	480	519	554	**1.85**
12	82	80	431	513	511	593	**1.68**
13	127	125	430	570	555	695	**1.51**
14	134	131	367	465	498	596	**1.58**
15	105	103	446	490	549	593	**1.82**
16	207	204	435	470	639	674	**1.85**
17	255	251	456	477	707	728	**1.91**
18	238	234	452	482	686	716	**1.87**
19	280	275	436	465	711	740	**1.87**
20	239	235	412	442	647	677	**1.86**
21	221	215	453	463	668	678	**1.96**
22	179	174	451	464	625	638	**1.94**
23	202	198	438	440	636	638	**1.99**

Neutron Wall Thresholds

wall A tube 3 L
Voltages for 07018



Switch to ~~MiniBall~~ CsI trig

✓ => Mini Ball CFD for Mult

(Rack 2, Bin B, Slot 10)

=> → Switch From 20ns to 400ns

✓ => Put CsI OR into
(R2, BC, S8, Q2)

✓ => Move CsI gate from (R2, BC, S3, Q2)
to Output of Coincidence.
= (R2, BC, S8, Q2)

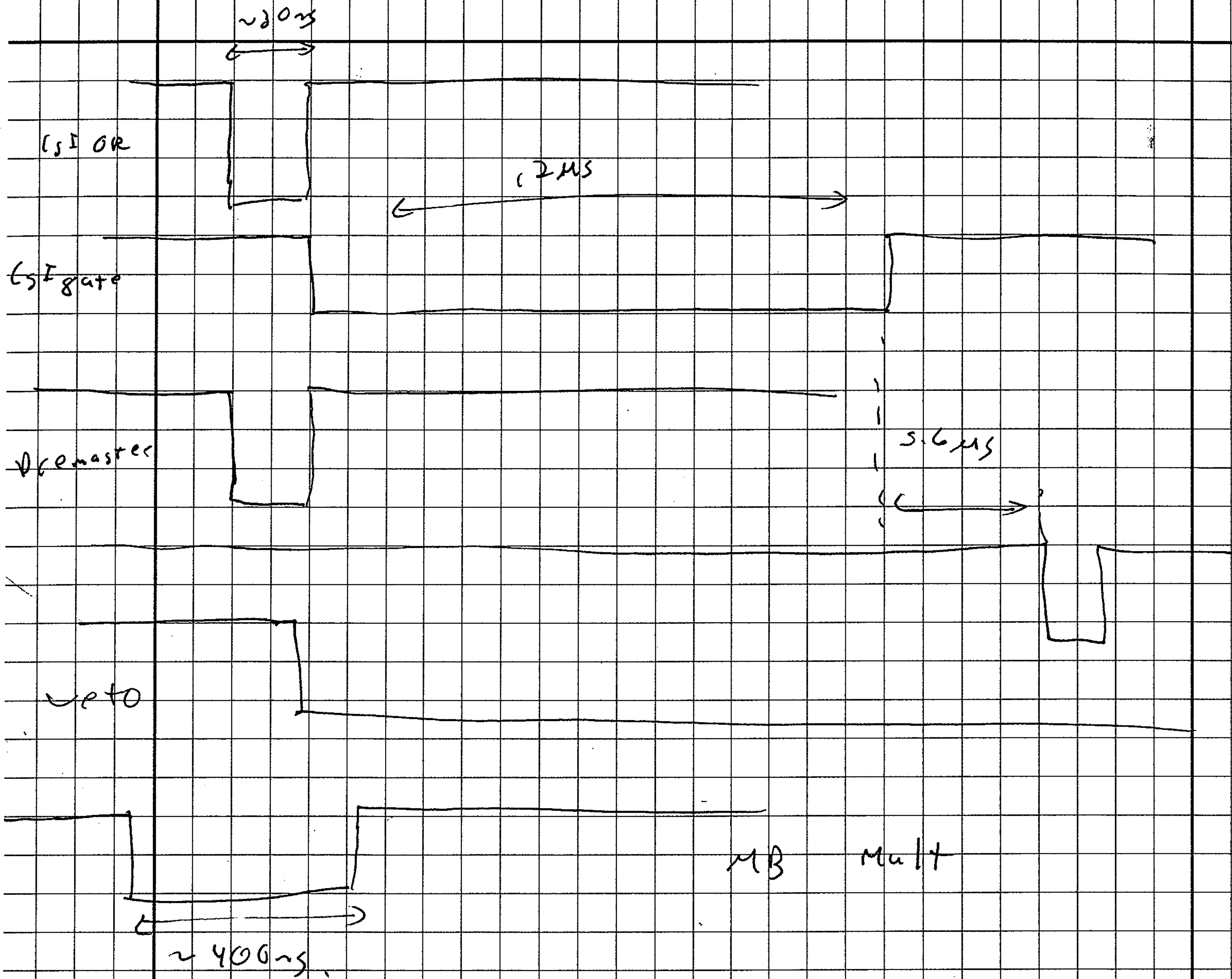
=> Insert Si TRIG

=> Move Si TRIG From (R2, BC, S2, Q2)
to (R2, BC, S ~~8~~ 7, Q2)

✓ => Insert Veto into CsI gate start
✓ => Insert Master TRIG into CsI start
✓ => Set MB veto to 1 (25mV) From 1.21 mV
✓ => Patch Sigs

→ MB veto ~~16~~ ~~21~~ 15
CsI OR Raw ~~23~~ ~~16~~ 24 — CsI ~~Raw~~ OR ⇒ scaler Fn4 10
CsI Gate 13
CsI Monitor 12
~~Si Trig~~
Pre master 11
Master 17
veto 19
MB mult (analog) 16

→ Moved Master trig to ~~FR~~



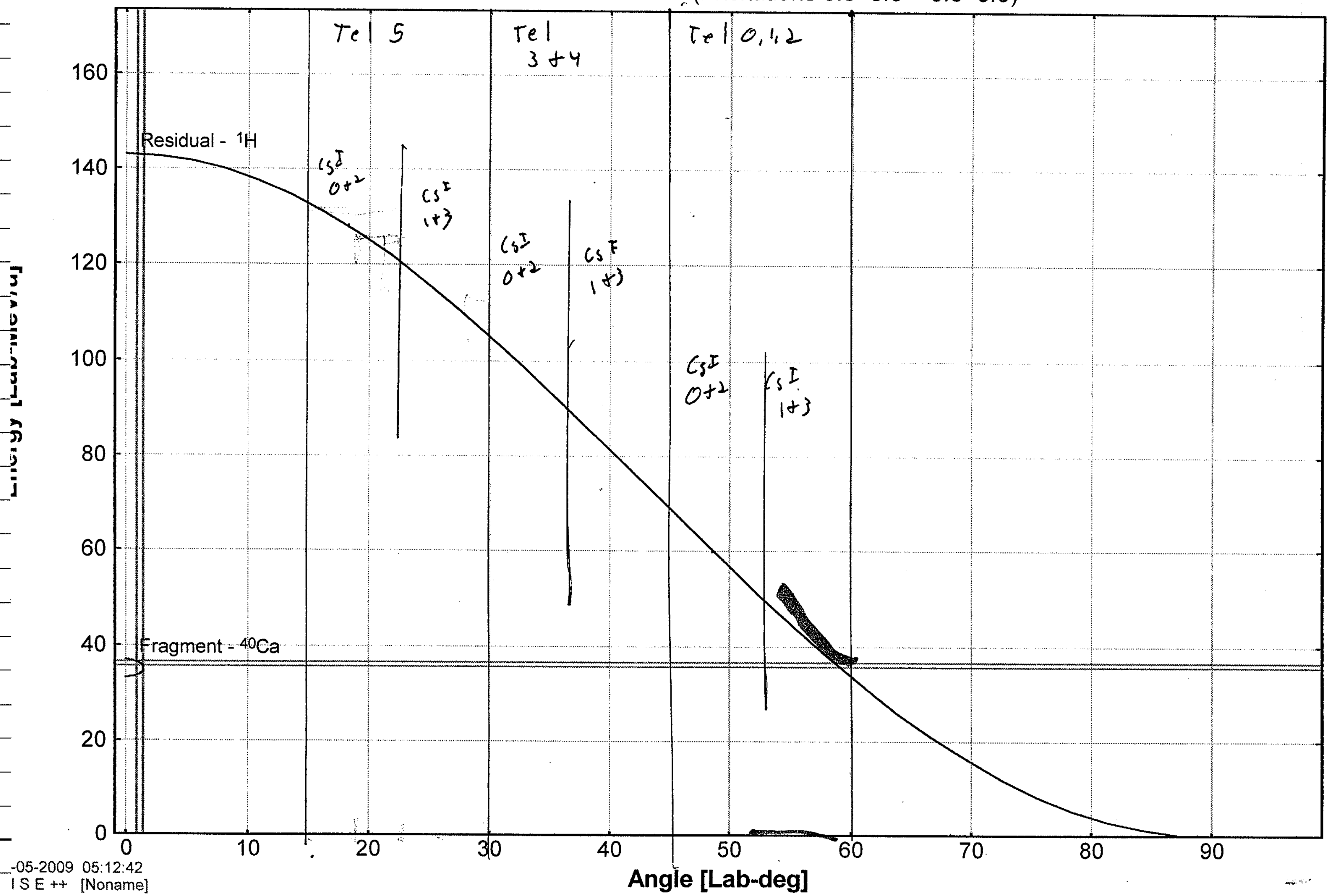
MiniBall multiplicity = 1

Reaction's Kinematics: A_lab & E_lab

$^{40}Ca + ^{1}H \Rightarrow ^{40}Ca + ^{1}H$ $^{1}H(^{40}Ca,^{40}Ca)^{1}H$

Projectile Energy : 36.91 MeV/u   Grazing angle in CMS [$^{40}Ca + ^{1}H$] = 5.99 deg

Q reaction : 0.00 MeV (Excitations 0.0+0.0=>0.0+0.0)



-05-2009 05:12:42
I S E ++ [Noname]

0600 we were using the wrong shaper files.

we **were** using shaper1.r368
we **should** be using shaper1 rest r368

we switched over to the correct one and copied the two files to the backup_5.20.09 directory for further reference.

Mark

→ Beam now under MOT for ^{48}Ca

CsI pulser Ramp
Pulse characteristics
rise time: 50 µs
Falltime: 200 µs

- First CsI 0-3
4-7
8-11
12-15
16-19
20-23

- Then one CsI at a time.

Prepare for beam

Patch Signals

MB ~~Stretch~~ Fast	26
F A ~~Fast~~ Stretch	25
Prompt trig	~~30~~ 22
Master Trig	18
Neutron OR	17
F.C.	23
Veto	19
FA OR	20

Beam Tuning
2:00

Transmission: 1/3 between A1900 to S2

beam Current = 10 μA

Test beam halo and asymmetry

- Turn on F.A.
- check background
- Send beam
- check counts
- If active check which tubes are counting

F.A. Background counts: 1.5/s

ATTN	Counts
1M	~~[illegible]~~ 10
300K	~~[illegible]~~ 0.5
100K	46
30K	196.5
10K	724

At 10 V, counts on various FA elements

Tube	counts
0	0
1	20
2	200
3	192
4	36
5	1
6	0
7	0
8	0
9	0
10	0
11	32
12	117
13	~~8~~ 90
14	24
15	0

1009

Si Pulser ramps : 0-1.5 V, 10s / step 21 steps 100 Hz

810 Tel 0F ⇒ Triggering Si on Pulser since thresholds so low

Tel 1F. Because thresholds so low, there are many accidental coincidences, Much Noise. Lot's of digital cross-talk?

2 Tel 2F ~~(2F?)~~
Tel 3F
14 Tel 4F

5 Tel 5F

16 Tel 0B

817 Tel 1B

18 Tel 2B

~~9 Tel 3B~~

20 Tel 4B

821 Tel 5B

Begin α source Calibration Run
- 228Th source

22 Trigger on EB

23 Trigger on EF = Not good! too Noisy!

24 Triggered on EB

TDC Calibration

For Miniball start goes to Ch2

Miniball Time Cal — Run 825

Range ~~≈ 300ns~~ = 320ns
Increment ≈ 10ns

Forward array / Proton veto Time cal. — Run 8

Range : 160ns
Incr: 10ns

CsI pulser ramps — May2

Run 827
ch 0-3 ~~A~~ 0-2V, 21 steps 10s/step. — Run

Run 828
ch 4-7, 0-2V, 21 steps, 10s/step 100Hz — Run 8

~~CsI~~ Run 829
ch 8-11, 0-2V, 21 steps 10s/step. 100Hz — Run 8

Run 830
ch 16-19, 0-2V, 21 steps 10s/step 100Hz. — Run

Run 831
ch 20-23 0-2V, 21 steps 10s/step, 100Hz — Run 8

Run 832
ch 24-27, 0-2V, 21 steps, 10s/step, 100Hz — Run 8

Sn Pb Foil

Squares 300mm x 300mm
mass : 23.5 g For 5 pieces

"Calculated written on pkg : 5.05 mg/cm²

Composition: Sn 60%
Sb 1%
Pb 39%

Neutron Wall TDC calibration

833 TD Cal.
Range: 320 ns
Incr: 10ns

834 Wall 1 — Thresholds at ~~250~~ 75, V = -2000
B 2 = looks odd
=> Maybe the broken one
B 6 => looks odd } Crosstalk w/ BRL
B 7 => looks odd }
B 10 => looks odd => Bad laser?
B 15 => looks odd } => Bad laser?
B 22 => looks odd }

Run 835 Wall B tube 7

Run 836 Tube 10 => Doesn't show very well.

Run 837 Run 83 >

Wall A position Cal.

A8 = a bit ragged.
A10 = No peak = Broken optics?
A14 = Bad Peak
A16 = Bad. peak
A17 = Bad. peak   Fiber optics?
A18 = No peak.
A19 = No peak
→ A21 : No peak -
~~A23 : Bad Sig~~ ⇒

Neutron wall QDC calibration Run.
- Use ^{60}Co
- Two tubes at a time (disc mask)
- Use Exp thresholds and then lower thresholds.
- place source on each side of the wall.
- pedestal Run = Run 839. 839 Run ~~83~~

Wall A: L Run 84[illegible]

Wall A: R Run 841

Wall B: L Run 84[illegible]

Wall B R Run 8[illegible]

Collect data for L+R looking at 6 M. Wall A Run 84[illegible]

^{60}Co Calibration wall B w/ source in Center looking at Both tubes. Run 84[illegible]

Sr Pulser ramp on individual channels.
using IG pulser

Run 846 Asics Slot 11 chip Ø

Run 846 Redo of ASIC Slot 11 chip Ø
- Raised the thresholds to get good resolution
- Compare to Run 846 to see if there is a gain shift

Run 847 Asic slot 11 chip Ø

~~Run 848 ~~Asic~~ Tel 2 B : Asic slot 12 chip Ø
Channels 1 & 2 pulse together (split signal)~~
Not recorded

Run 848 Tele 1 F : asic slot 5 chip 1
~~This wa~~

Run 849 Tel 2B : Slot 12 ch Ø

Run 850 Tel 2B : Ch 5.

Run 851 Tel 1 B

Run 852 -857 Tel 3F, + 5F Slot 11, ch 2
Slot 14, ch 2

Run 858 Tel 0F + Tel 4F

Run 859 Tel 0 F + 4F continued,

Run 860 Tel 0 ØB + 4B
: Note: Cable into Asic May have been shifted up one pin => Sig 3 → Sig 1
gnd 4 → gnd 2
=> Shift channels up by 1

Run 861 Tel 3B + Tel 5B

0 F	✓
0 B	✓
1 F	✓
1 B	✓
2 F	✓
2 B	✓
3 F	✓
3 B	
4 F	✓
4 B	✓
5 F	✓
5 B	

Absorber Foils LASSA covered w/ Three of these

Absorber Foil Characteristics

Factory Information

Tin (60)/ Lead (39)/ Antimony (1)

Nominal Areal Density :

5.22 mg/cm^2 if you use the total mass (4.7g per sheet) and area (900cm^2) given on the label

5.05, if you use the density (8.42 g/cm^3) and the thickness (.006mm (quoted +/- 25%))

Measured Information

Most accurate →

Areal Density: 4.94 (+/- .04) mg/cm^2 (based on weighing a 7 cm square piece)

* FARADAY Cup Calibration Procedure for ^{48}Ca beam

Procedure:
One cycle is defined as

1. measure for 120 s on A1900 FC, recording FC reading every 10 s.
2. measure for 120 s on S2 FC, recording FC reading every 10 s.
3. measure for 120 s on A1900 FC, recording FC reading every 10 s.
4. measure for 120 s on S2 FC, recording FC reading every 10 s.

For each target: (blank, 112Sn, 124Sn)

1. do 1 cycle for each attn: 1000x, 3000x, 10000x

A1900 FC calibration

5. Insert A1900 FC and 1000x attenuator.
6. Reduce intensity to 20-30 pA and measure for 120 s on A1900 FC, recording FC reading every 10 s.
7. Insert 100x attenuator.
8. Measure for 120 s on A1900 FC, recording FC reading every 10 s.
9. Insert 10000x attenuator and measure for 120 s on XPF scintillator. Record total rate.
10. Insert 100x attenuator
11. Measure for 120 s on A1900 FC, recording FC reading every 10 s.
12. Insert 10000x attenuator and measure for 120 s on XPF scintillator. Record total rate.

Faraday Calibration

Procedure:

1. **Set attn. to 1000 and runs to 120 sec.**
2. Insert 112Sn target
3. Insert A1900 FC and measure for 120 s on A1900 FC, recording FC reading every 10 s.
4. Remove A1900 FC and measure for 120 s on S2 FC, recording FC reading every 10 s.
5. Insert A1900 FC and measure for 120 s on A1900 FC, recording FC reading every 10 s.
6. Remove A1900 FC and measure for 120 s on S2 FC, recording FC reading every 10 s.
7. change to 124Sn target.
8. Insert A1900 FC and measure for 120 s on A1900 FC, recording FC reading every 10 s.
9. Remove A1900 FC and measure for 120 s on S2 FC, recording FC reading every 10 s.
10. Insert A1900 FC and measure for 120 s on A1900 FC, recording FC reading every 10 s.
11. Remove A1900 FC and measure for 120 s on S2 FC, recording FC reading every 10 s.
12. Change attenuation to 3000x
13. Insert A1900 FC and measure for 120 s on A1900 FC, recording FC reading every 10 s.
14. Remove A1900 FC and measure for 120 s on S2 FC, recording FC reading every 10 s.
15. Change attenuation to 10000x
16. Insert A1900 FC and measure for 120 s on A1900 FC, recording FC reading every 10 s.
17. Remove A1900 FC and measure for 120 s on S2 FC, recording FC reading every 10 s.
18. Insert A1900 FC and 1000x attenuator.
19. Reduce intensity to 20-30 pA and measure for 120 s on A1900 FC, recording FC reading every 10 s.
20. Insert 100x attenuator.
21. Measure for 120 s on A1900 FC, recording FC reading every 10 s.
22. Insert 10000x attenuator and measure for 120 s on XPF scintillator. Record total rate.
23. Insert 100x attenuator and A1900 FC.
24. Measure for 120 s on A1900 FC, recording FC reading every 10 s.
25. Insert 10000x attenuator and measure for 120 s on XPF scintillator. Record total rate.

^{60}Co Source position Run

Because some of the laser Fiber position measurements aren't so good, we also employ the ^{60}Co source at the center of each tube.

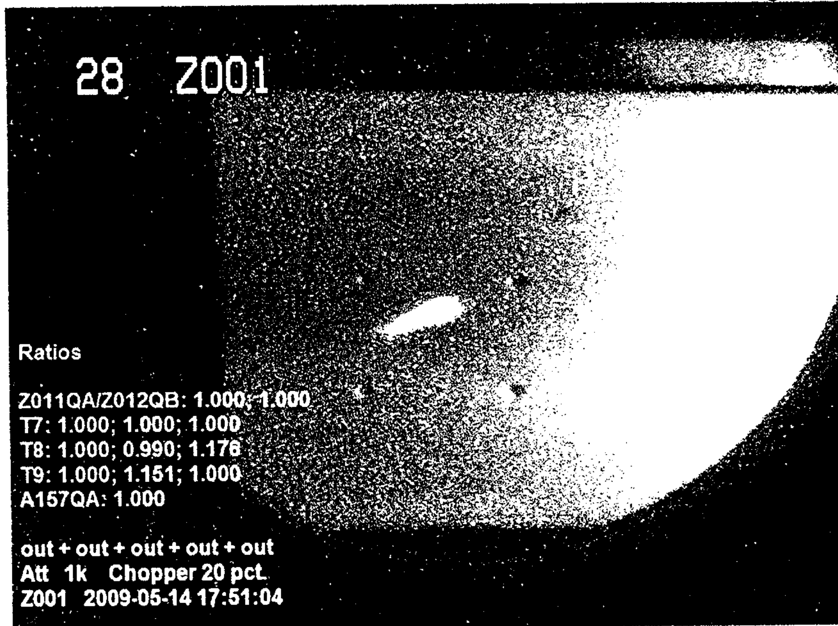
- Place source roughly in center.
- ~~...~~ Enable only two tubes at a time
- Set thresh = 50

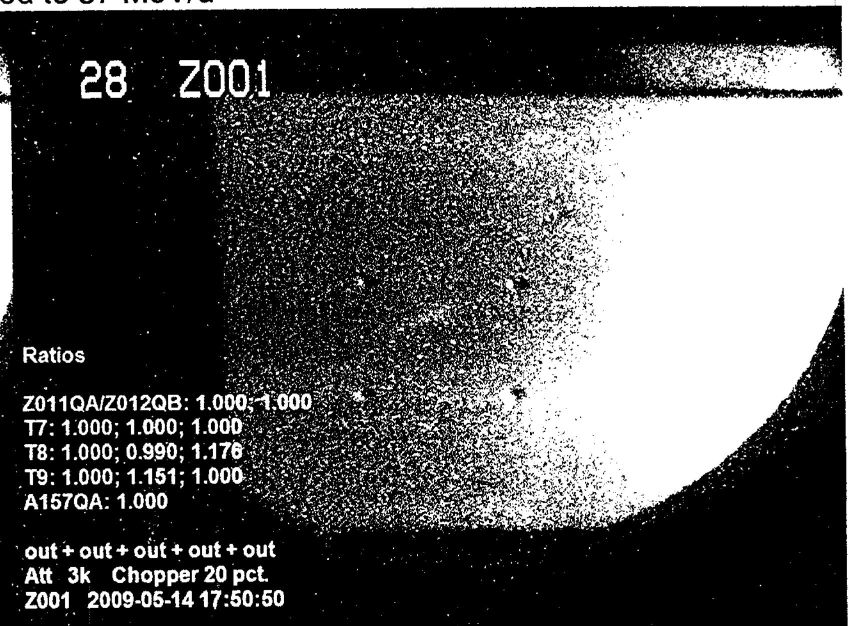
^{60}Co Source run Wall A. Run #68

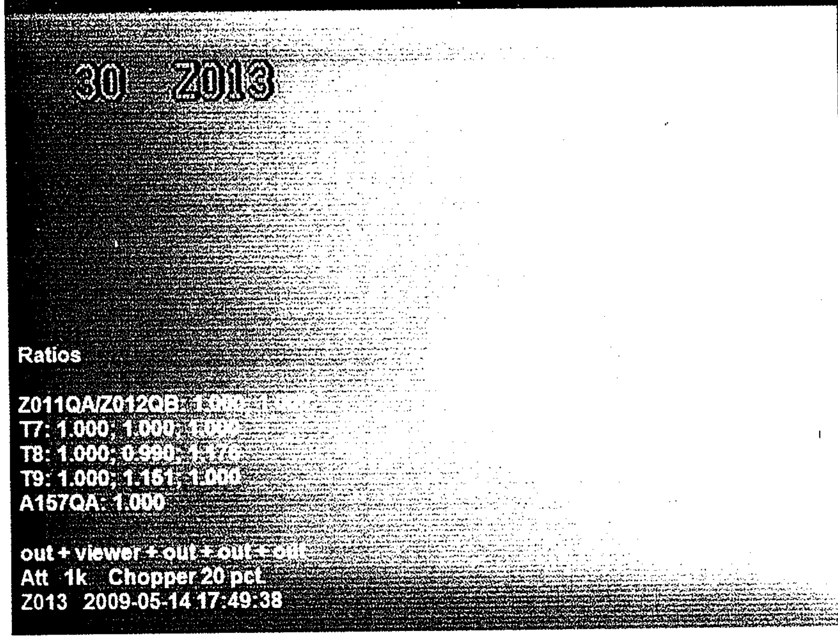
^{60}Co Source run wall A pos Run #69

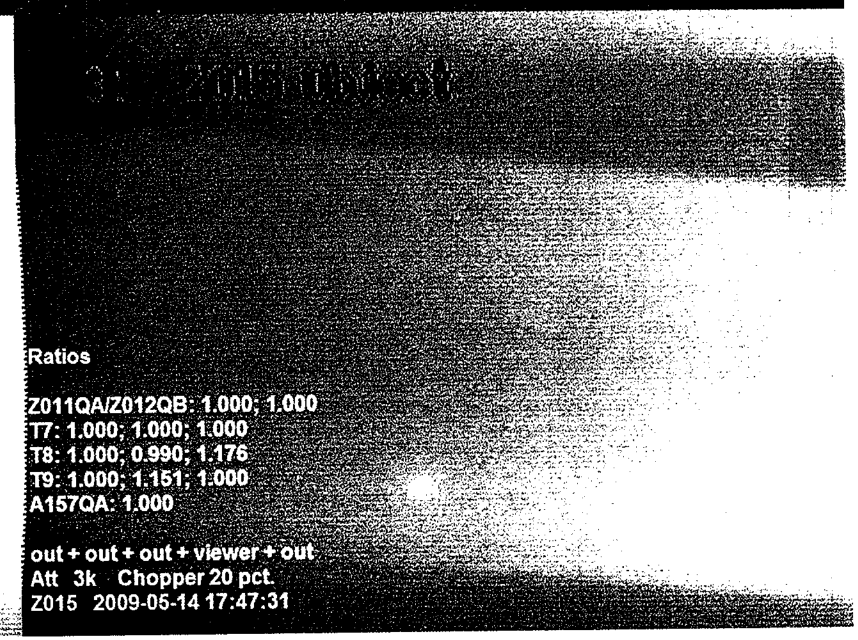
Camera Photos for Exp 05049A

Ca-40 degraded to 37 MeV/u

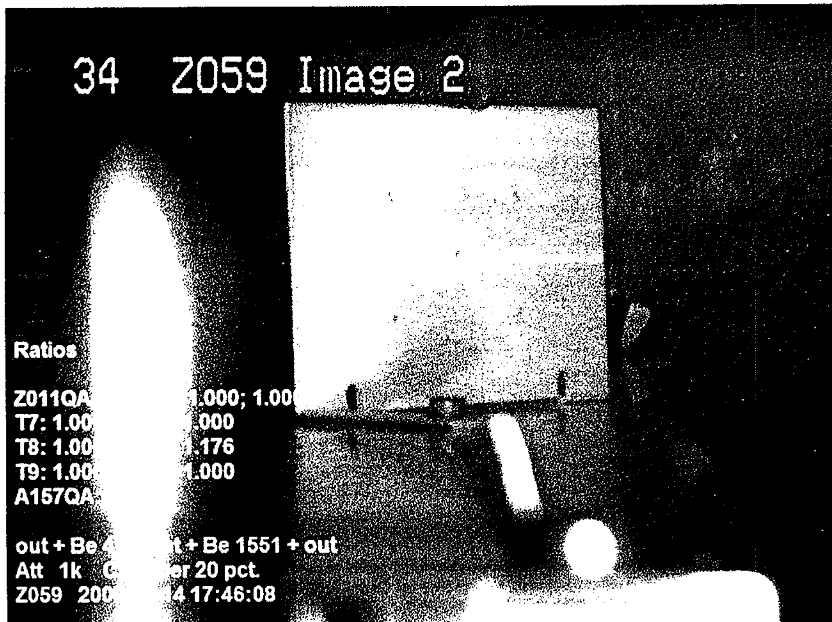


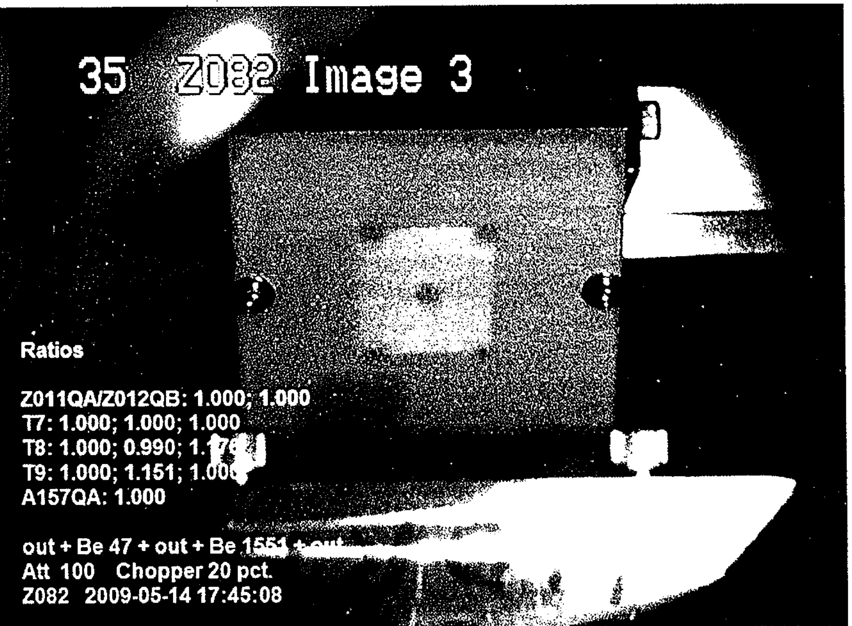


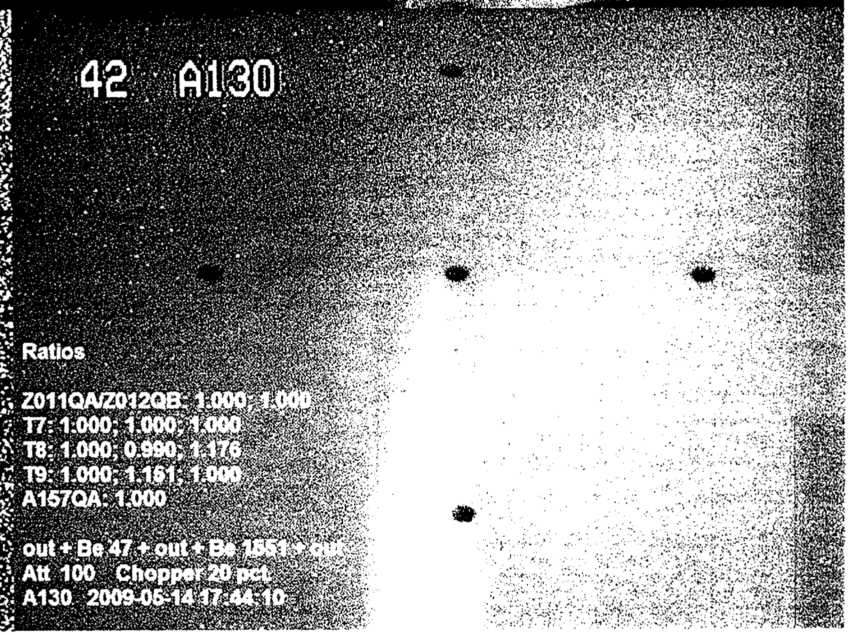




Camera Photos for Exp 05049A







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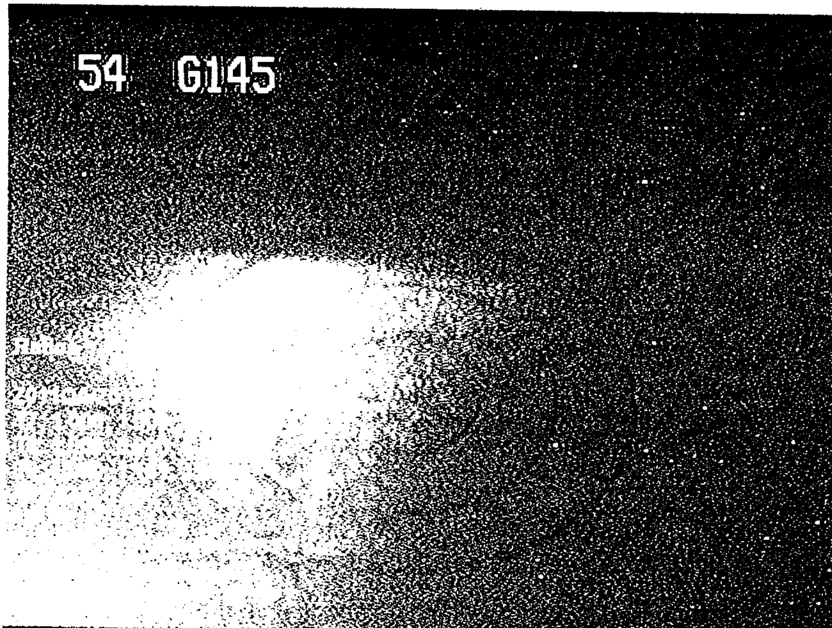

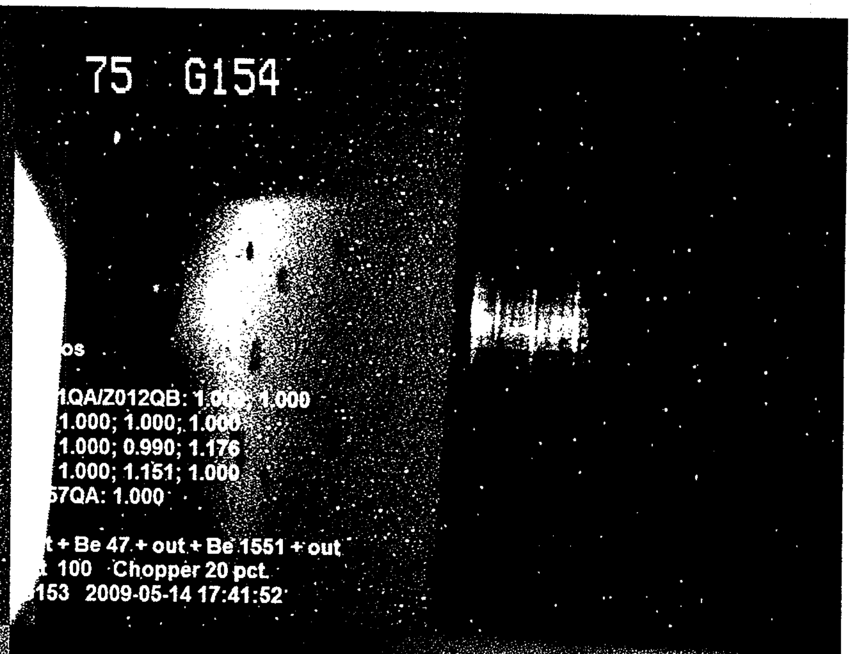

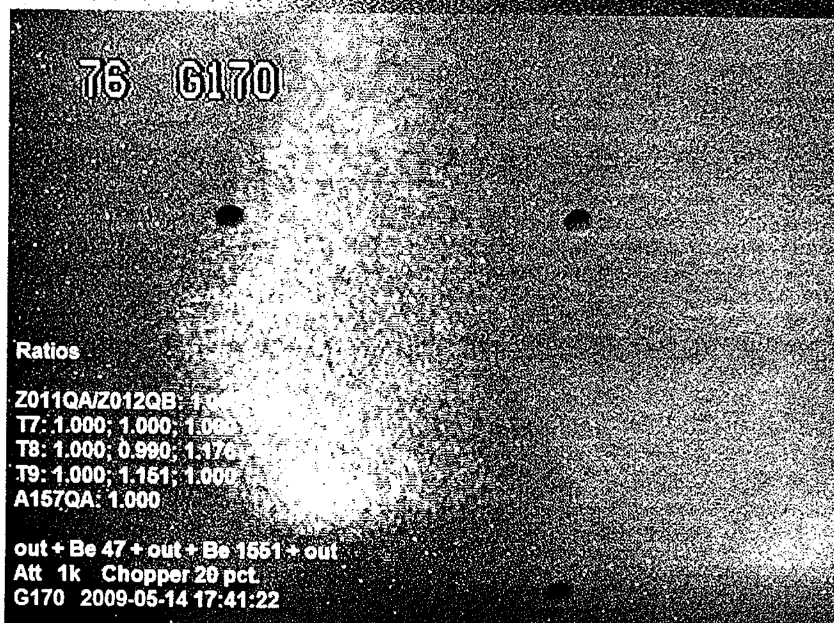

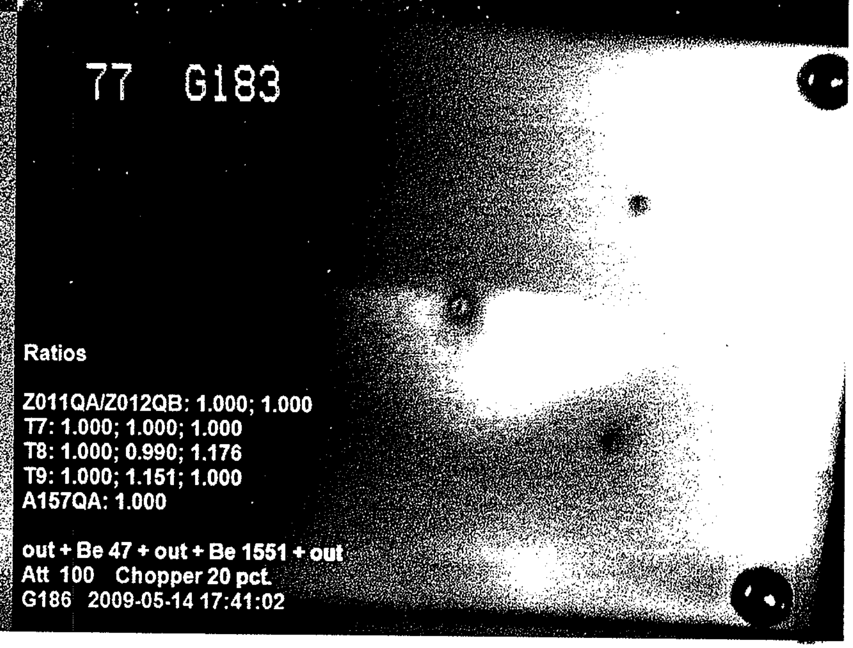

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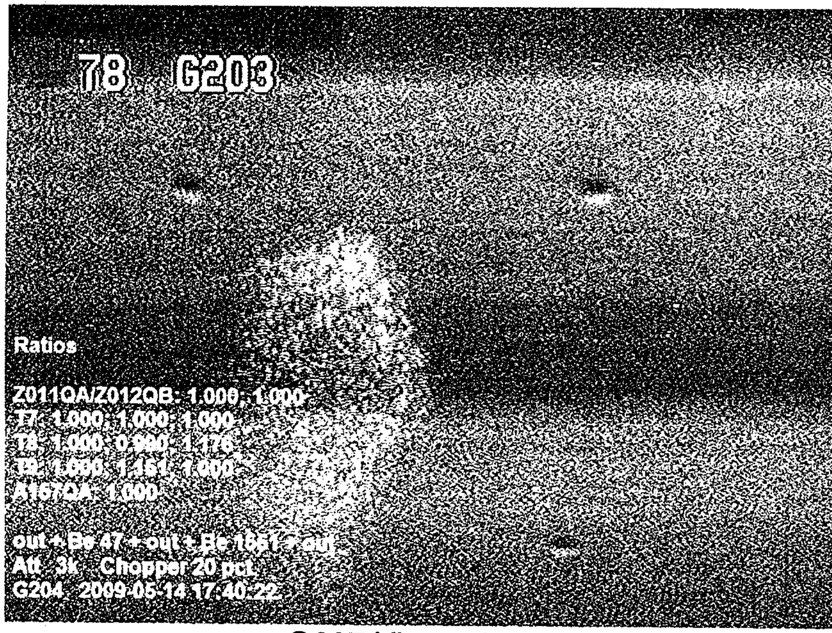
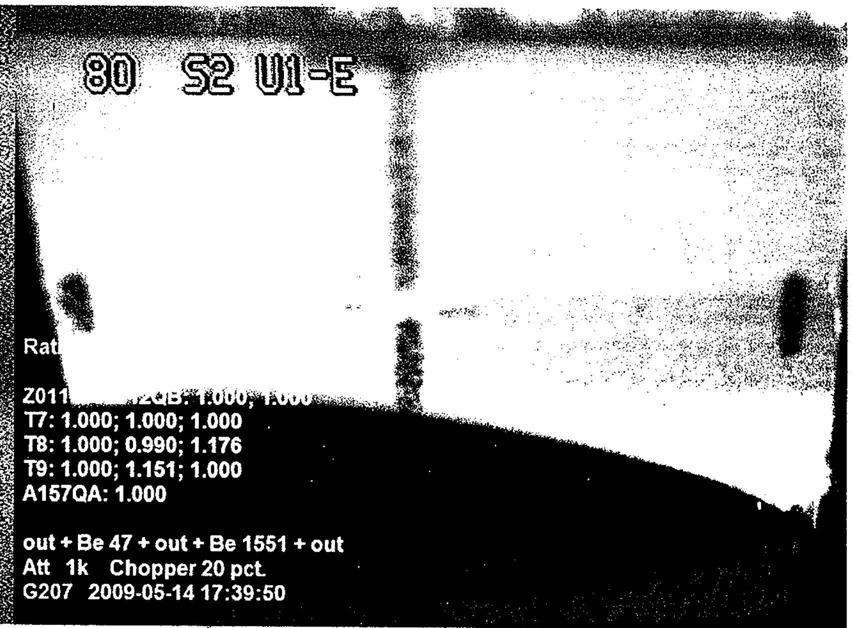
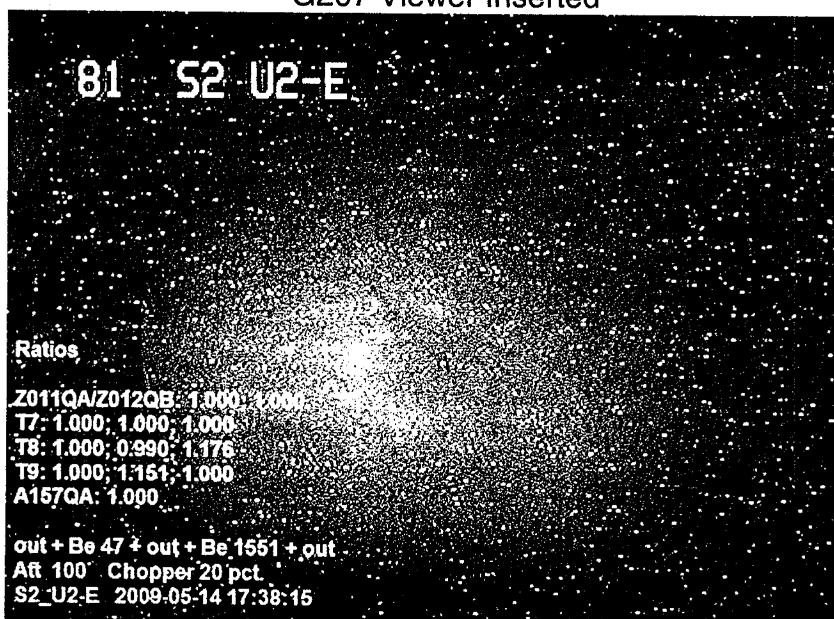
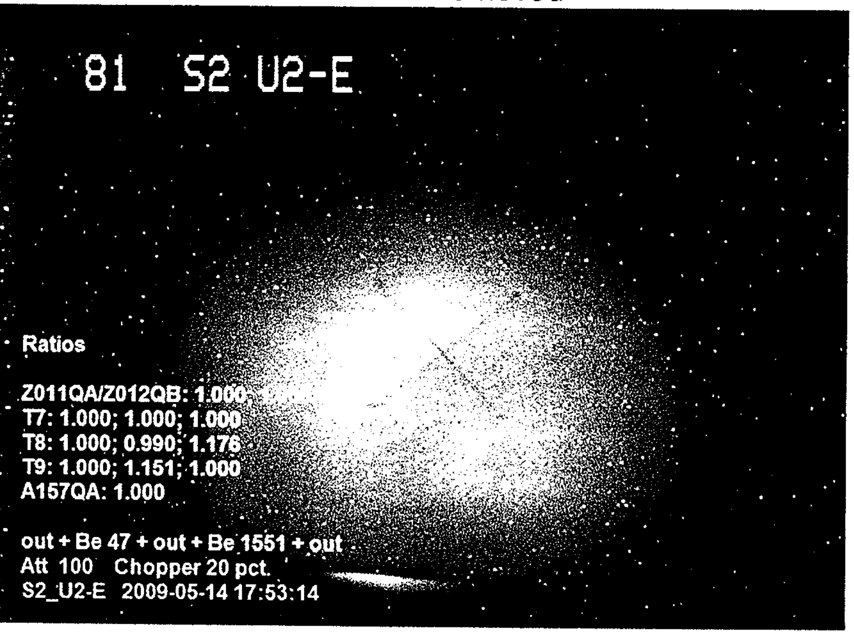




G207 Viewer Inserted

G207 Viewer removed

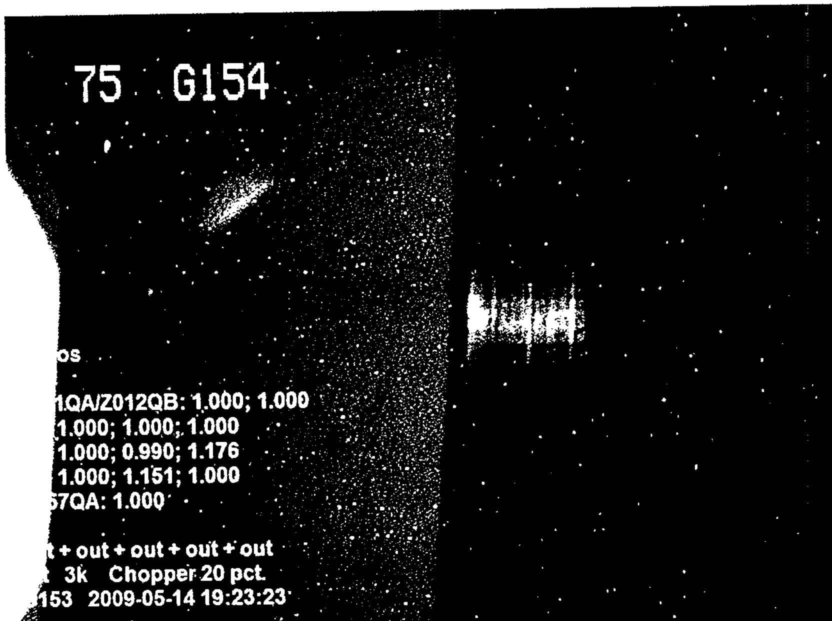


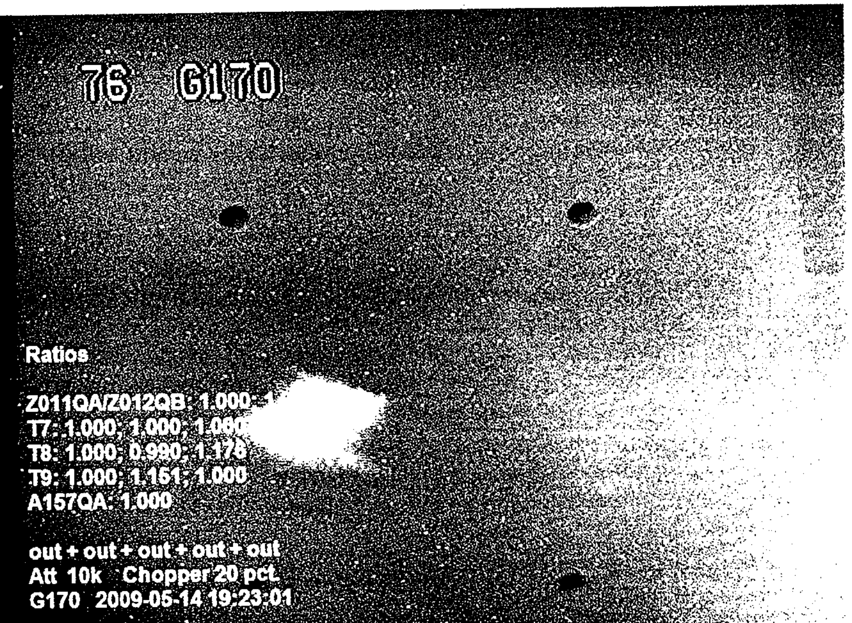


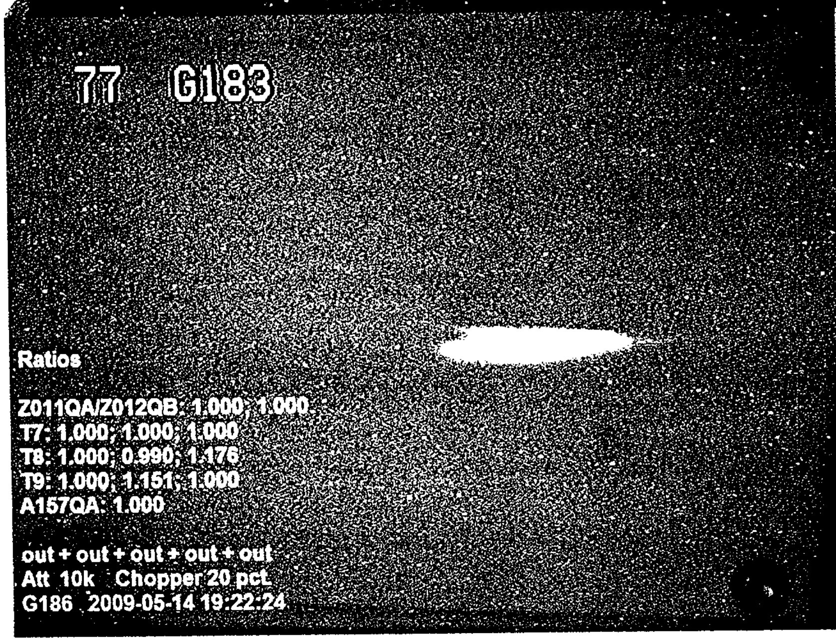
Camera Photos for Exp 05049A

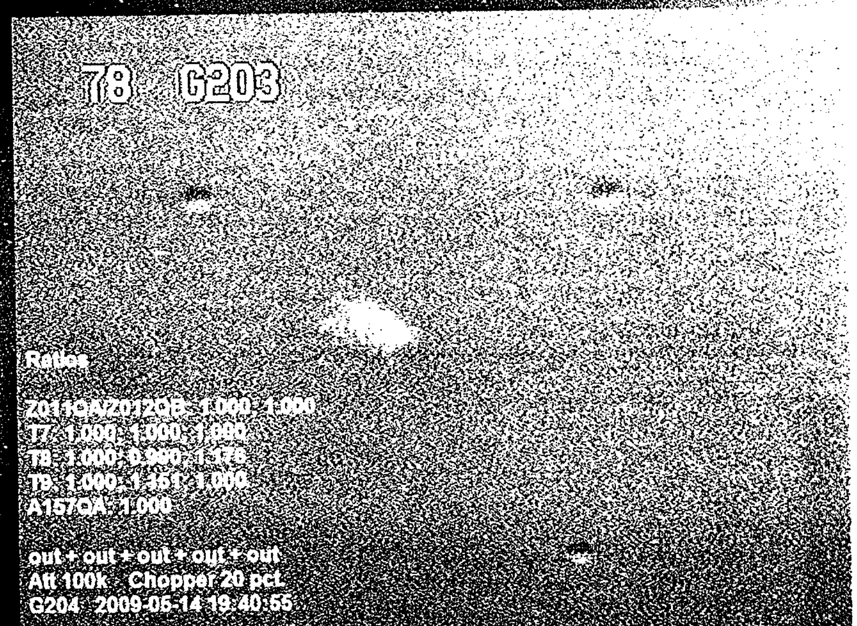
Undegraded Primary Beam

Camera Photos for Exp 05049A

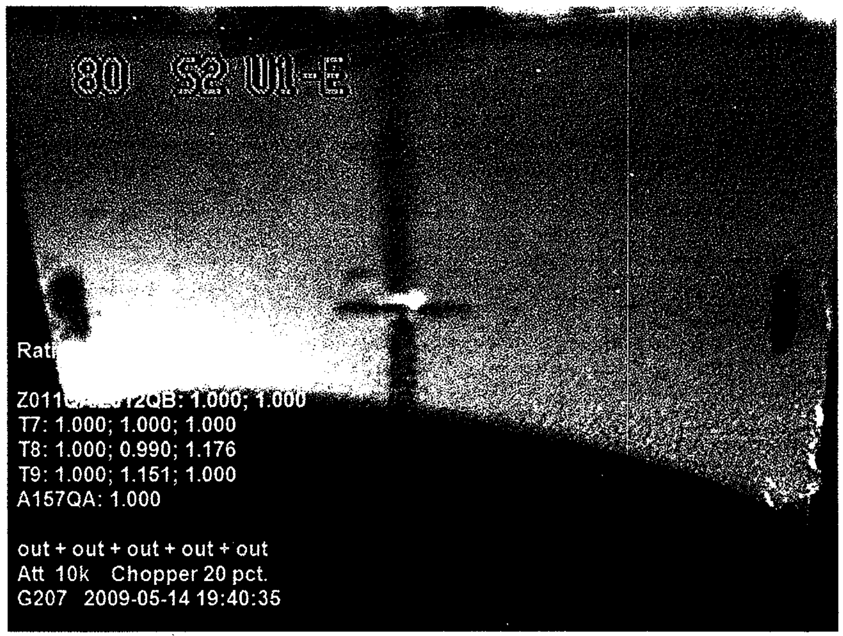




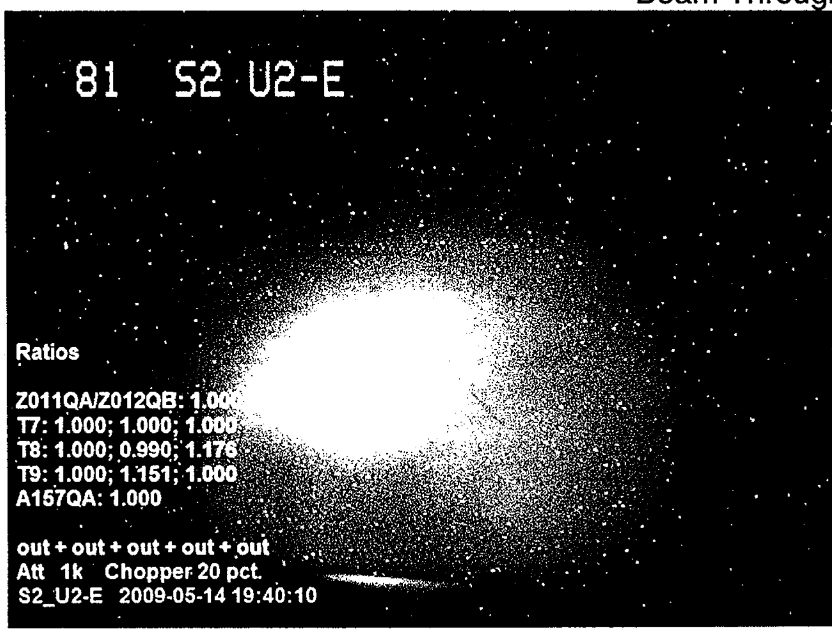


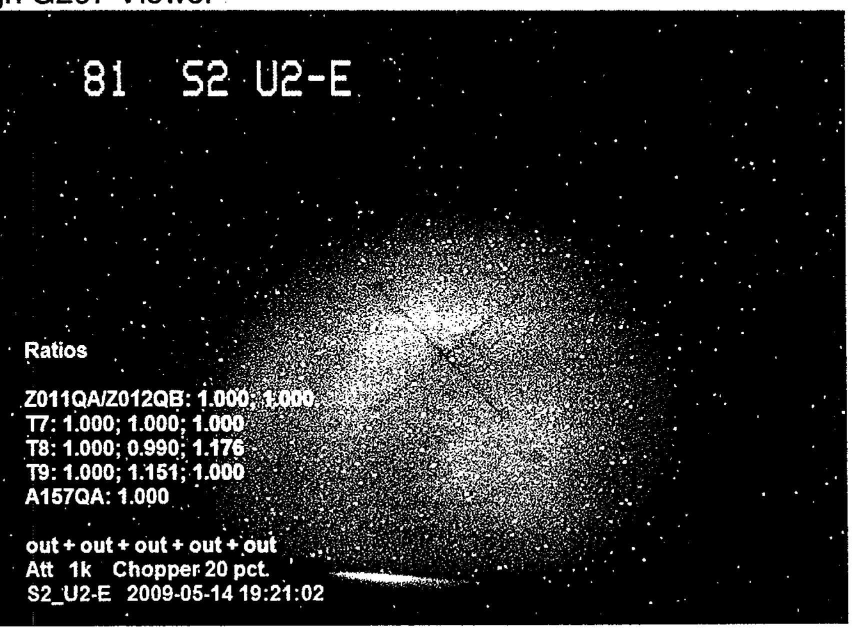


Camera Photos for Exp 05049A



Beam Through G207 Viewer





AmBe Source runs — May 24

- AmBe Source Run 44.5" — R 862
  - Source placed ~~[struck out]~~ From center of wall A
  - Thresh ~ 200
- AmBe Source run — Run 863
  - source placed 33" ~~[struck out]~~ From center of B
  - Thresh ~ 200
- AmBe source run wall B — Run 86
  - Source placed 33 3/4" From center of B
  - thresh = 110
- AmBe Source Wall A — Run 86

33 3/4"

  - soure placed 44.5" From center of A
  - thresholds at 110

AmBe Source run wall A. — Run 86

  - Source placed 91.51 inches from center of A
  - Thresh = 110

AmBe Source placed 77.25" From wall B — Run 86

  - Threshold = 110

LASSA Position Measurements

- Center of viewer
- Corners of All LASS A
- Reference Points
  - Beam axis
  - X
  - Y
  - Z
- LASSA
  - ~~One point~~ Two points on outside edge of Brass Ring.
  - Two or three points on inside edge of Brass ring

..o 18, 2009

Neutron wall TDC Calibration.
ROOT Function: n_tdc_cal.C
ROOT File : Run 833.root
Output File:
NEUTRON_TDC_cal.dat
Uncertainties:
NEUTRON_TDC_cal_ERRORS.dat

File structure time = mx + b x = channel

tube AL_b AL_m AR_b AR_m BL_b BL_m BR_b BR_m

..ar 19, 2009

FA TDC calibration.
ROOT Function: FA.TDC_cal.C
ROOT File: Run 846. root
Output file :
FA_TDC_cal.dat
Structure time (ns) = mx + b.

channel offset slope Error_offset error_slope.

We still need to do the FA mapping.
- Probably more important when we do E_T but not so much t_{start}.

- Find TOF algorithm
  - t_{start} => first start signal from F.A.
  - t_{stop} => first stop signal from each individual N-wall element.

Mini Ball TDC Calibration — June 22

ROOT Function: miniball_tdc_fit.C
Root File: run825.root
Output File:
MINI_TDC_cal.dat
Format:
channel: offset: slope: offset-error: slope-error.

Mini Ball punch through energies exercise

Ring 5 Tube ϕ Example

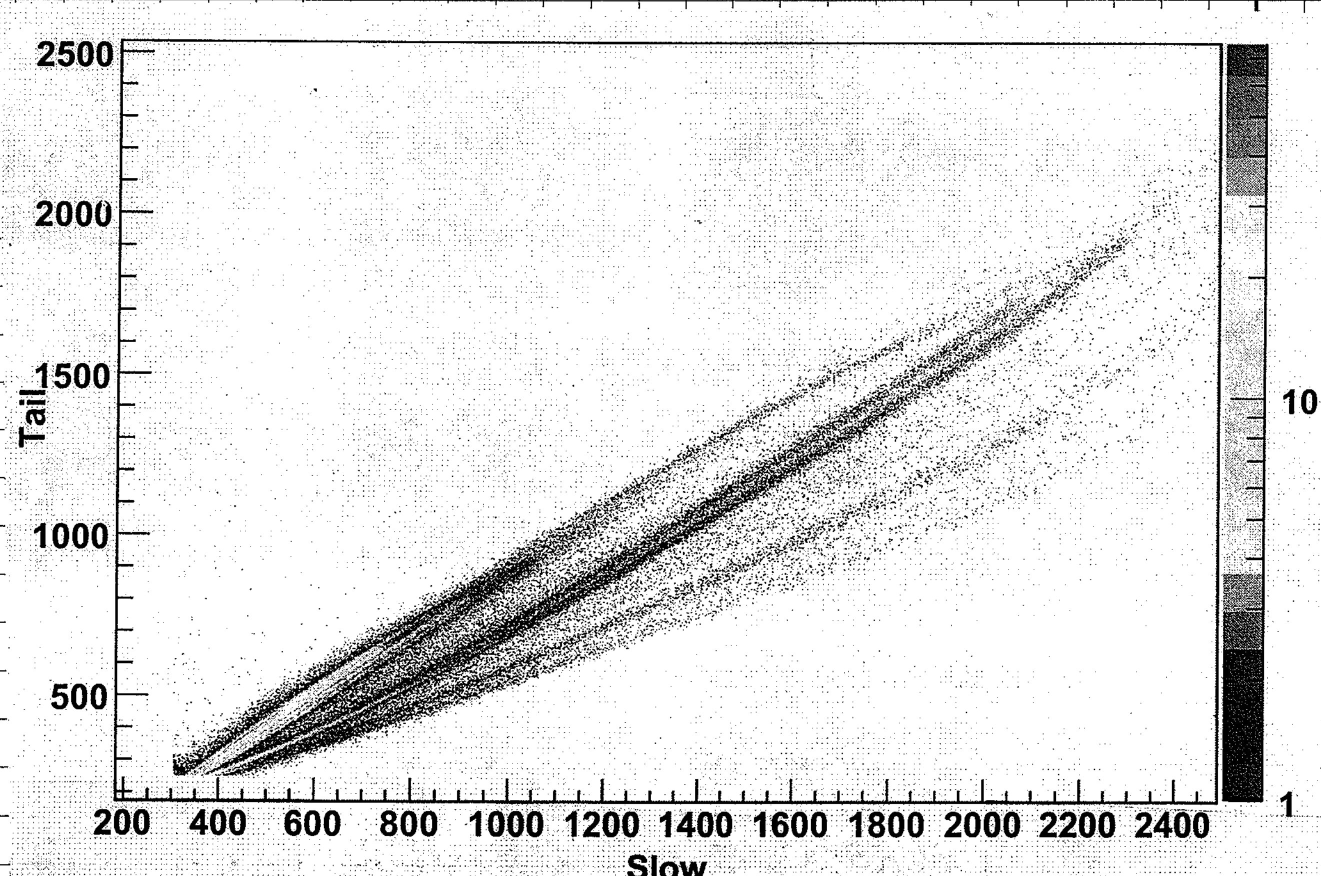
CsI thickness: 2 cm
SnSb: 10 mg/cm² (?)
Al mylar: 12 μm (?)
Plastic: 40 μm

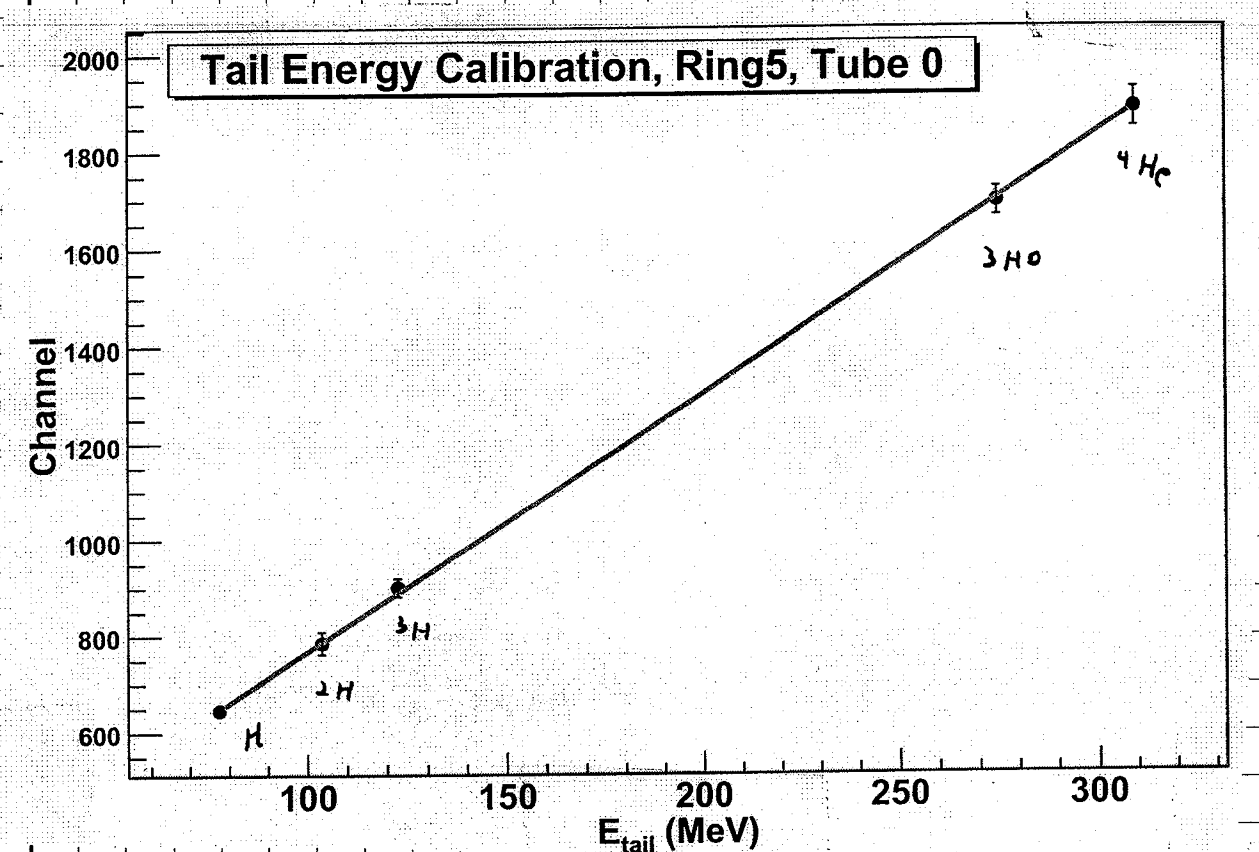
Punch through in CsI + plastic (2cm CsI + 40 μm plastic)

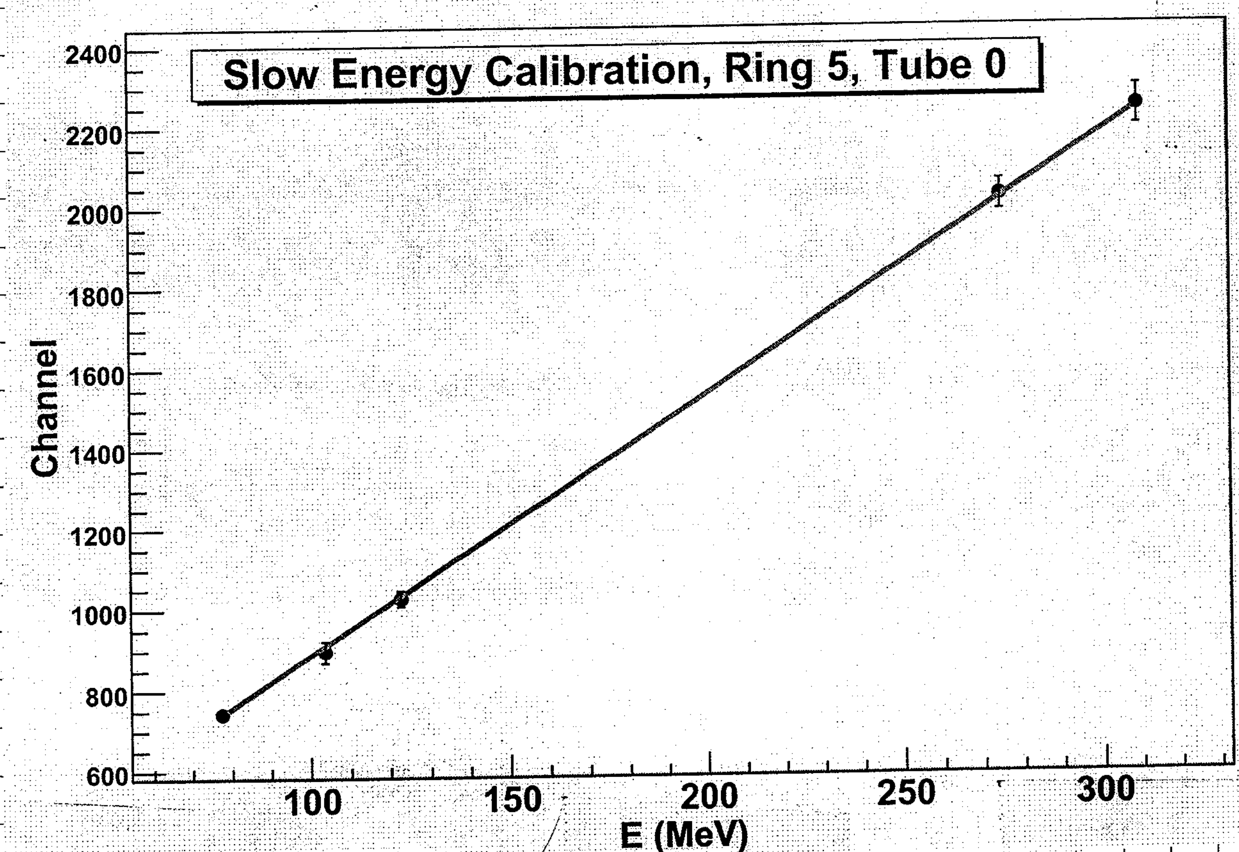
protons: 77.46 MeV
^{2}H: 103.61 MeV
^{3}H: 122.64 MeV
^{3}He: 274.55 MeV
^{4}He: 309.22 MeV

Ring 5 chan 0

Particle	E punch	Slow chan	Tail chan
H	77.46	742 ± 7	646 ± 7
^{2}H	103.61	895 ± 27	786 ± 23
^{3}H	122.64	1026 ± 20	901 ± 19
^{3}He	274.55	2022 ± 38	1695 ± 30
^{4}He	309.22	2243 ± 49	1886 ± 40







Need a good way to calibrate the energies

June 25, 2009

MiniBall Calibrations

If we plot slow and tail (Maybe fast) for each element, we can find the punchthrough edges.

- Record punch through channels + uncertainties
- we only need to record 1 energy to calibrate for E_T
- The tail looks much nicer than the slow.
  - Fast is the worst.
- Perhaps use tail (slow if tail looks bad)

Ring6, T7: No tail

Rin6 T17 Not very good

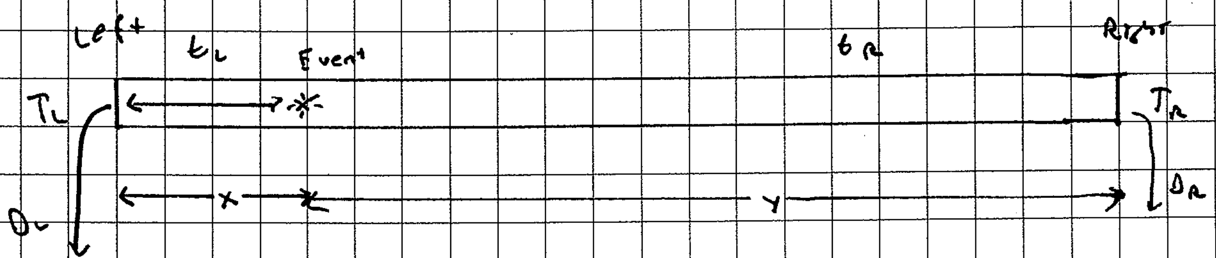
R7 T8 : Poor resolution => May need pedestal
R7 T7 : Bad res: look at 2D.
R7 T11 : Bad res. look at 2D.
R7 T9 : Major
R7 T14 : Bad res
R8 T7 looks funny
R10 T2 : looks bad
R10 T4 looks bad
R10 T5 : Deuteron is not good
T7
} poor deuteron sig
R11 T0 : Re-examine.
3

Neutron Position Measurements

For a tube in the n-wall

$$x \overset{?}{=} \left(\frac{T_L - T_R}{T_{TOT}}\right) L$$

L = tube length
T_{TOT} = Total length of tube in ns
T_L = TDC for left side
T_R = TDC for right side



$x + y = L$ ~~$v T_L = x$~~ v = Velocity of light in vac

~~$v T_R =$~~

$T_L = t_L + D_L$

$T_R = t_R + D_R$

D_L = time cable delay (
D_R = time cable delay (

$v t_L = x$
$v t_R = y$

v = effective velocity of light in tube

$v T_{TOT} = L$

$$y - x = (T_L - T_R - \Delta_{LR}) \frac{2L}{2T_W}$$

T_W = width of tube in time x
= width of TDC signal
L = Length of tube = 2m
Δ_{LR} = offset due to cable length differences

2009 Neutron wall Position offsets

1. Plot $T_L - T_R$ for laser peaks Run 834-838
2. Find Centroid of laser peak
3. Note peaks w/ poor centroids
4. look at edges of position distribution and Find ½ way point. Compare to laser centroids

Bad tubes: lousy peaks or no peaks

B2
A10
B10
A14
A16
B16
A18
A21
B22

2009 Also calibrate tube centers w/ the following:
- ^{60}Co position peak Find
- ^{60}Co position Gauss Fit
- width of distribution

Neutron Wall Position Offset Determination
Values are TL-TR to determine middle of wall in terms of time
Source is middle of wall determined using source
Differences may be due to threshold differences (as in B0-17) and source position differences

	Wall A					Wall B				
Tube	Left Edge	Right Edge	Mid	Source	Difference	Left Edge	Right Edge	Mid	Source	Difference
0	-114	147	16.5	21.9625	[redacted]	5	272	138.5	130.781	[redacted]
1	-124	137	6.5	5.98917	0.51083	-107	154	23.5	10.9808	[redacted]
2	-104	161	28.5	28.9508	-0.4508	-139	125	-7	-10.9825	3.982
3	-130	136	3	2.99417	0.00583	-103	162	29.5	18.9675	[redacted]
4	-114	151	18.5	16.9708	1.5292	-137	135	-1	-7.9875	[redacted]
5	-126	143	8.5	-0.999167	[redacted]	-88	181	46.5	31.9458	[redacted]
6	-139	124	-7.5	-10.9825	3.4825	-136	129	-3.5	-13.9775	[redacted]
7	-124	145	10.5	3.9925	[redacted]	-101	160	29.5	23.9592	[redacted]
8	-111	145	17	14.9742	2.0258	-122	143	10.5	1.99583	[redacted]
9	-200	58	-71	-71.8808	0.8808	-167	96	-35.5	-56.9058	[redacted]
10	-108	149	20.5	24.9575	-4.4575	-111	152	20.5	10.9808	[redacted]
11	-214	41	-86.5	-81.8642	-4.6358	-135	131	-2	-20.9658	[redacted]
12	-204	65	-69.5	-75.8742	[redacted]	-103	164	30.5	21.9625	[redacted]
13	-204	58	-73	-70.8825	-2.1175	-205	64	-70.5	-79.8675	[redacted]
14	-131	133	1	-2.99583	3.99583	-217	55	-81	-91.8475	[redacted]
15	-174	93	-40.5	-43.9275	3.4275	-101	167	33	20.9642	[redacted]
16	-145	121	-12	-15.9742	3.9742	-177	93	-42	-47.9208	[redacted]
17	-157	101	-28	-23.9608	-4.0392	-154	107	-23.5	-27.9542	4.454
18	-153	112	-20.5	-16.9725	-3.5275	-131	136	2.5	4.99083	-2.4908
19	-163	97	-33	-30.9492	-2.0508	-179	94	-42.5	-49.9175	[redacted]
20	-128	135	3.5	4.99083	-1.49083	-137	129	-4	-2.99583	-1.0041
21	-153	111	-21	-18.9692	-2.0308	-148	118	-15	-16.9725	1.972
22	-154	109	-22.5	-26.9558	4.4558	-150	123	-13.5	-16.9725	3.472
23	-163	102	-30.5	-35.9408	[redacted]	-145	127	-9	-9.98417	0.9841

Finding Edges of position distributions
- $T_L - T_R$ and point exactly in the middle!
- Also find midpoint from ^{60}Co source cals.
- Differences larger than 5 channels (~500ps) noted.

Position $x = ((T_L - T_R) - T_0)\, v$

T_0 = offset
v = velocity in tube = 7.65 cm/ns

16, 2009 Forward Array TDC Mapping

FA TDC channel	FA Scintillator
0 ... 15	0 ... 15 (1 → 1 mapping)
	Proton veto
16	0
17	1
18	2
19	3
20	4
21	5
22	6
23	7
24	8
25	9
26	7 ?
27	?
28	?

I think these are ORs Neutrons & MiniDat

Establis N-wall pedestals.

Pedestal runs: 839
156 HV=-2000
178
375
388 (For new H.V. ?)
HV: e05049-neut_30MeVee.dat
496

=> It looks like run 496 has pedestals very close to run 839, so we can probably use these.
File: NEUTRON-PEDESTALS_496.dat

* Incorporating pedestal subtraction into root conversion code.

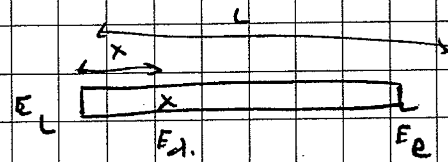
* How does the CFD energy thresholds translate to Energy thresh in the walls?

If $E_{dep}\, e^{-\lambda x} < Th$ then the particle is not seen.

Example Threshold on Left + Right are the same. $= T$

Particle of Energy E_{dep} in the tube at position x

E_L = Energy at left side
E_R = Energy at right side
x = position
λ = attenuation in tube
L = length of tube.



$$E_L = E_d\, e^{-x/\lambda}$$

$$E_R = E_d\, e^{-(L-x)/\lambda}$$

Geometric mean $E_g = \sqrt{E_L E_R} = \sqrt{E_d^2\, e^{-(L-x)/\lambda}\, e^{-x/\lambda}}$

$$= E_d \sqrt{e^{\frac{-L+x-x}{\lambda}}} = E_d\, e^{-L/2\lambda}$$

To record particle
$E_L > T \Rightarrow E_d\, e^{-x/\lambda} > T \Rightarrow E_g e^{L/2\lambda} e^{-x/\lambda} > T$
$E_R > T \Rightarrow E_d\, e^{-(L-x)/\lambda} > T \Rightarrow E_g e^{L/2\lambda} e^{-(L-x)/\lambda} > T$

$$\Rightarrow \boxed{\begin{aligned} E_g\, e^{(L-2x)/2\lambda} &> T_L \\ E_g\, e^{(2x-L)/2\lambda} &> T_R \end{aligned}}$$

So there is a relationship between Threshold and detectable energy and tube position.

but $E_g > \sqrt{T_L T_R}$ from above $\Rightarrow$ Minimum energy
so we define a "geometric threshold"

$$T_g = \sqrt{T_L T_R}$$

$\Rightarrow$ It's conceivable to have $E_g > T_g$ with $E_L < T_L$ or $E_R < T_R$
However. To work
$E_L > T_L$ and $E_R > T_R$

August 13, 2009

Neutron TDC offset

- FA offset for each element of FA
- Offset for γ peak for each tube in FA

- FA offsets found.

Gamma peak offset: offset for AM (arithmetic mean)

Wall A

Tube	Wall A centroid of γ peak		Wall B centroid of peak
0	~~-94~~ ~~-130~~ -138		-120
1	~~-102~~ -116		-155
2	* -119		-162
3	-122		-173
4	-129		-177
5	-107		-153
6	-125		-181
7	-114		-178
8	-75		-205
9	-95		-188
10	~~-100~~ 125		-203
11	-100		-195
12	-91		-172
13	-89		-129
14	-45		-137
15	-110		-167
16	-56	(looks funny)	-159
17	-59		-163
18	-52		-155
19	-171	(low cts.	-154
20	-42		-157
21	-34		-160
22	-50		-143
23	-38		-154

Aug 17

Combined entire wall A into a single peak for offsets
will re-iterate through offsets for individual FA elements.
- Gate on FA element.

WALL A

FA tube	peak ~~offset~~ channel	Offset from ch 3	(x... FA.TD
0	-158	7	20
1	-170	19	54
2	-166	15	43
3	-151	0	0
4	-167	16	46
5	-162	11	31
6	-168	17	49
7	-171	20	57
8	-167	16	46
9	-170	19	54
10	-167	16	46
11	-167	16	46
12	-164	13	37
13	-160	9	26
14	-165	14	40
15	-162	11	31

August 19 2009

Forward array Self-timing peaks

Tube	Peak (channel)
0	1020
1	1040
2	1017
3	1038
4	991
5	957
6	1006
7	1005
8	988
9	963
10	1013
11	981
12	1037
13	982
14	1002
15	1000

August

⇒ FA timing More-or-less OK
⇒ Maybe improve for multiple peaks in window

Now double check γ peak in each Neutron tube for offset

Tube	wallN	wallS
0	-150	-154
1	-150	-151
2	-151	-150
3	-150	-142
4	-150	-150
5	-148	-145
6	-146	-154
7	-146	-150
8	-149	-146
9	-144	-150
10	-146	-142
11	-154	-136 ?
12	-144	-145
13	-150	-146
14	-150	-150
15	-150	-146
16	-146	-154
17	-150	-152
18	-146	-150
19	-26	-148
20	-150	-145
21	-150	-141
22	-145	-151
23	-146	-158
24		

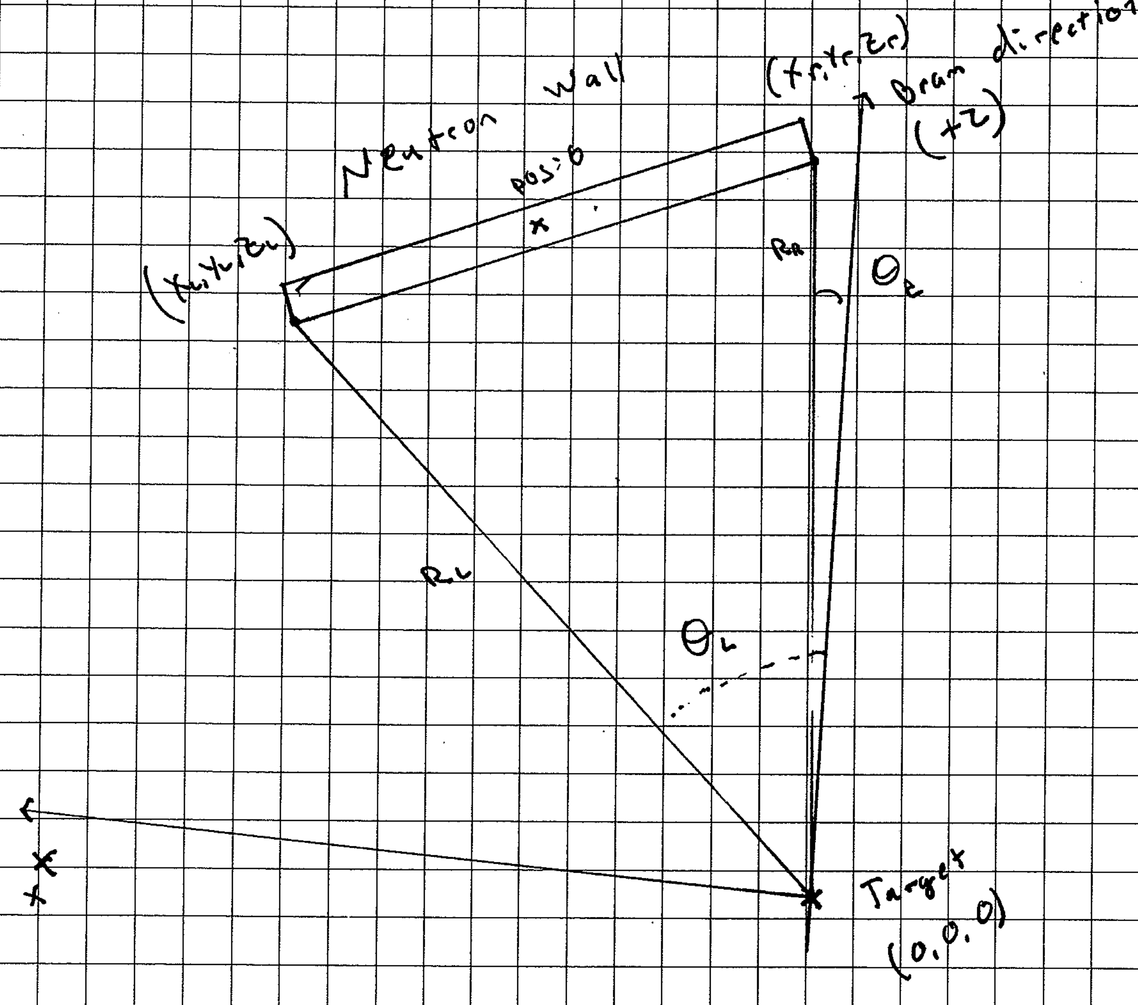
August 26, 2009 Neutron wall position determination

Eff. velocity of light in tubes 7.65 cm/ns

Aug. 31, 2009

Tube positions in cm calculated.

- 0cm is center of tube.
- Must convert tube position to lab position (R, θ, ϕ)



Equations for converting tube position t to lab position

$$x = x_0 + at$$
$$y = y_0 + bt$$
$$z = z_0 + ct$$

when $t = 0 \Rightarrow$ tube position is center.

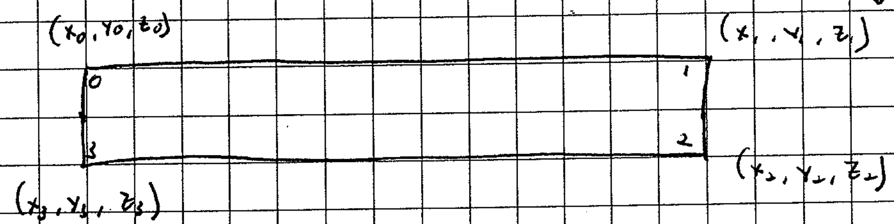
When $t = 1$ then $d = \sqrt{(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2} = 1$

position is at end of tube.

when $t = 0$ $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} x_0 \\ y_0 \\ z_0 \end{pmatrix}$ $\Rightarrow$ at tube center

when $t = \frac{L'}{2}$ $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} \bar{x}_r \\ \bar{y}_r \\ \bar{z}_r \end{pmatrix}$

L' = measured length of tube
$\bar{x}_r\ \bar{y}_r\ \bar{z}_r$ = average positions of (x, y, z) of right side of tube.
$\Rightarrow$ Find a, b, c.



when $t = -\frac{L'}{2}$ $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} \bar{x}_L \\ \bar{y}_L \\ \bar{z}_L \end{pmatrix}$

$\Rightarrow$ Left side of tube
$\Rightarrow$ Find a, b, c
$\Rightarrow$ should be equal to a, b, c from ab

$$\begin{pmatrix} \bar{x}_L \\ \bar{y}_L \\ \bar{z}_L \end{pmatrix} = \begin{pmatrix} (x_0 + x_3)/2 \\ (y_0 + y_3)/2 \\ (z_0 + z_3)/2 \end{pmatrix} \qquad \begin{pmatrix} \bar{x}_r \\ \bar{y}_r \\ \bar{z}_r \end{pmatrix} = \begin{pmatrix} (x_1 + x_2)/2 \\ (y_1 + y_2)/2 \\ (z_1 + z_2)/2 \end{pmatrix}$$

$$\begin{pmatrix} x_0 \\ y_0 \\ z_0 \end{pmatrix} = \begin{pmatrix} \sum_{i=0}^{3} x_i / 4 \\ \sum_{i=0}^{3} y_i / 4 \\ \sum^{3} \ldots \end{pmatrix}$$

Consistency check:

when $t = 1$, $\left[(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2\right]^{1/2} = 1$

when $t = -1$ $\left[(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2\right]^{1/2} = -1$

t = tube position.

Next For Neutron walls

1. Repeat process for rotated reference frame => Final lab frame
2. Convert to (R, θ, ϕ)
3. ~~Use~~ Find TOF From γ-peak

$$TOF = (t - t_\gamma) + T_\gamma$$

t_γ = measured photon time of flight
$(t - t_\gamma)$ = Photon TOF with respect to γ peak.
T_γ: calculated photon TOF

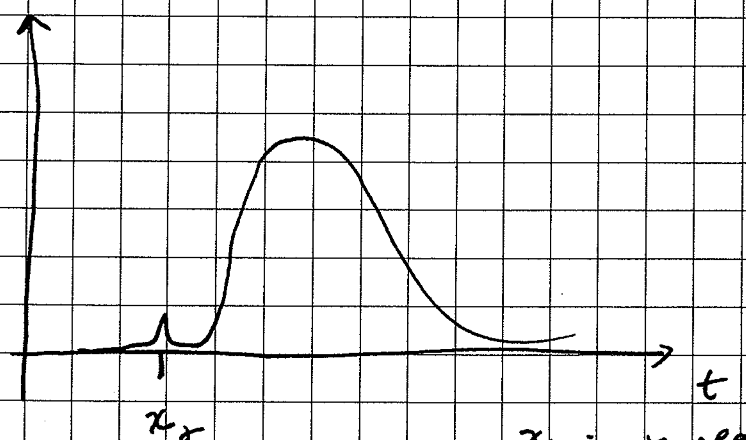
$$T_\gamma = \frac{R}{c}$$

4. Find E_{lab} From neutron TOF
5. Find Y = rapidity.
6. Find Y_{beam}
7. Find Y/Y_{beam}

Tree information For neutrons. (For each neutron)
- PID (neutrons, protons, γ)
- E_{lab}
- E_{cm} (?)
- R
- θ
- ϕ

Also
- Efficiency determination
- MiniBall
  - E
  - Multiplicity
  - R, θ, ϕ
  - PID
- LASSA (For each proton)
  - E
  - (R, θ, ϕ)
  - M

n-Wall TOF Calibration complete:
Raw data files calibrated for time and γ offsets
- γ peaks fall into a specific bin



x_γ: γ peak bin

x_γ is set to be constant for each wall

Wall	x_γ
A	150
B	160 ?

] both set to be the same

Rechecking γ peak after calibration:
- should be very close, but let's recheck.

peak locations

tube	wall A (ns)	wall B (ns)	(AM = $\frac{L+R}{2}$)
0			
1		-14.57	
2		-14.5299	
3		-14.7964	
4		-14.4181	
5		-14.41	
6		-14.06	
7		-14.61	
8		(messed up)	
9			
10			
11			
12			
13			

File to convert to n-wall position.

/raid/e05049/analysis/Calibrate

→ Converts tube position to (R, θ, ϕ) and (x, y, z)

Rapidity calculation.

$$y = \frac{1}{2} \ln \left(\frac{E + p_z}{E - p_z} \right)$$

$$p_z = \gamma m v_z \rightarrow \gamma m \beta_z = \gamma m \beta \cos\theta$$

$$E = \gamma m c^2 \rightarrow \gamma m$$

$$y = \frac{1}{2} \ln \left(\frac{E + p_z}{E - p_z} \right) = \frac{1}{2} \ln \left(\frac{\gamma m + \gamma m \beta \cos\theta}{\gamma m - \gamma m \beta \cos\theta} \right) = \frac{1}{2} \ln \left(\frac{1 + \beta \cos\theta}{1 - \beta \cos\theta} \right)$$

For the beam $\theta = 0$

$$y_b = \frac{1}{2} \ln \left(\frac{1 + \beta}{1 - \beta} \right)$$

- For ^{40}Ca and ^{48}Ca at 140 MeV/u $y_b = 0.5487$ to within 0.01% for both

Things to check:

* Many neutron tdc events unavailable as FA TDC signal does not come in (threshold or other possible problem)
* Try timing off of MiniBall OR (channel 1, 2, or 3 in neutron TDC, check notes)
* Must then calibrate TOF of MiniBall OR
    o Means Calibrating TOF for EVERY MiniBall element (time offset) the same way as the FA elements (to line up gamma flash)
        + Relative timing of MiniBall elements using gamma flash
        + Offset of gamma flash to channel -15 in TDC spectrum
    o Maybe we only need to do forward rings
* Check time resolution this way
* Timing of gamma peak

Assign Neutron 1190 channels

Neutron 1190 TDC

2 : Neutron OR → miniball → m_tdc[2]

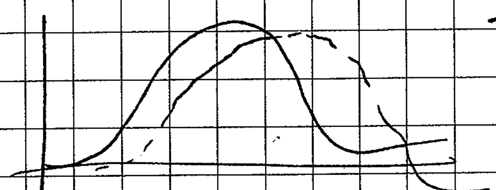
5 = Prompt Trig → miniball → m_tdc[4]

0: FA OR → miniball → m_tdc[3]

Wall A.right.m_tdc[12] → miniball → m_tdc[6]
- fa[0] in miniball

Check time offsets on Miniball From FA. Feb.14

Check a single or two MB TDC channels.
MB Channel 34



Spectrum offset depending on FA channel triggered.

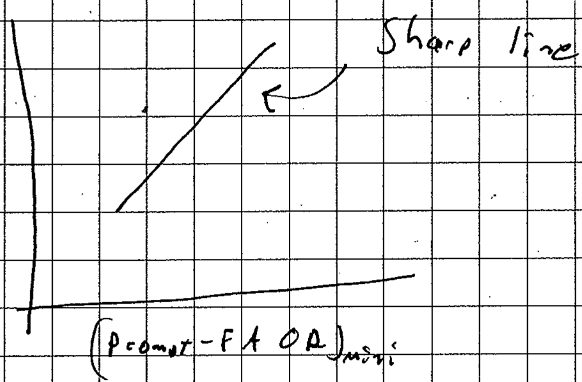
~~FA~~ FA trig	m_TDC low chan			
0	~~50.74~~	56.43	~~29.47~~	~~46.4~~
1	~~[illegible]~~	47.45	~~51.55~~	5[illegible]
2	~~46.4~~	45.45	~~37.46~~	38
3	~~53.16~~	52.44	~~52.42~~	5[illegible]
4	~~41.81~~	44.33	~~29.47~~	[illegible]
5	~~[illegible]~~	49.31	~~29.421~~	5[illegible]
6	~~48.43~~	47.465	~~44.40~~	43
7	~~20.93~~	49.46	~~45.48~~	48
8	~~48.67~~	47.40	~~47.39~~	45
9	49.80		~~44.48~~	45
10	52.35		~~39~~	40
11	53.48		~~48~~	40
12	47.68		40	
13	50.232		~~46~~	52
14	~~[illegible]~~	50.46	~~52~~	43
15	43.38			55

6, 2010 We can't use FA OR on either because of the intrinsic time jitter between FA OR on each TDC.

- we need to plot a <u>common</u> time signal in each case.
- prompt trigger perhaps.

- plot prompt trig - FA OR in each case to see if they match.
- plot raw prompt trig in each case
  → difference is relative time jitter.

what we <u>hope</u>.



<u>If</u> the line is <u>sharp</u> (i.e., <1ns thick)
we can plot <u>RAW</u> prompt trig to see relative time between Neutron TDC and MiniBall TDC on an event-by-event basis.

<u>Procedure</u>

1. Find $(T_P - T_{OR})_N = A$ — T_P = prompt trig time, T_{OR} = FA OR in neutron.
2. Find $(T_P - T_{OR})_{Mini} = B$
3. Plot A vs. B
4. If A vs B is linear with $\sigma \lesssim 1ns$ we can proceed.
5. Find $T_{P,N,Raw}$, $T_{P,M,raw}$
6. Time difference: $T_{PMR} - T_{PNR} = C$
7. Neutron Time $T_N - C - T_{OR,off}$
   ↑ FA offset in MiniBall TDC

It would appear that the N_{TOF} and N_{TDC} has no correlating event in the Miniball TDC. However, it appears that the events for which there is no FA_OR are those which the neutrons are very late, very low E → possibly non-correlated, so we can likely ignore these. That is, they do not occur in the TDC window. Feb 12

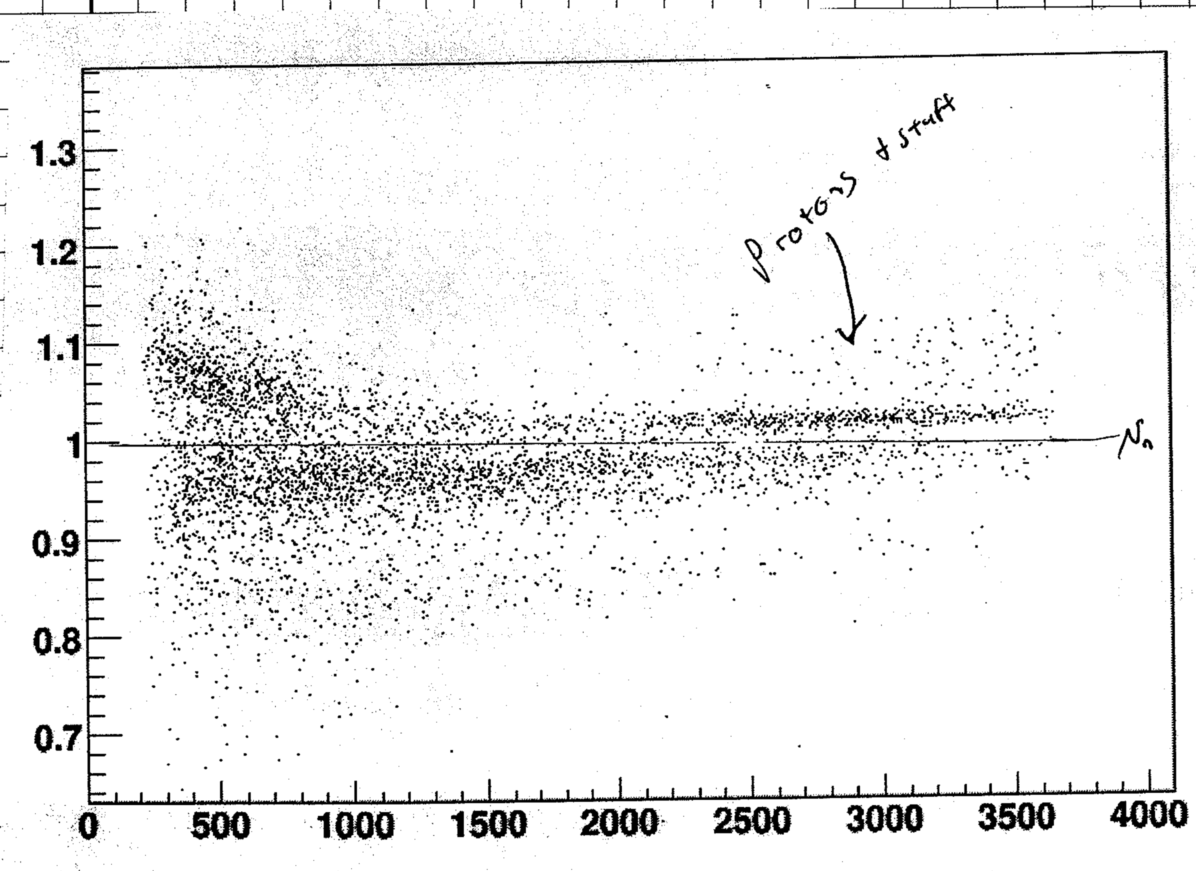
Neutron PID Function Feb 25

G_F = Geometric Mean for fast signal
G_T = Geometric Mean for total signal

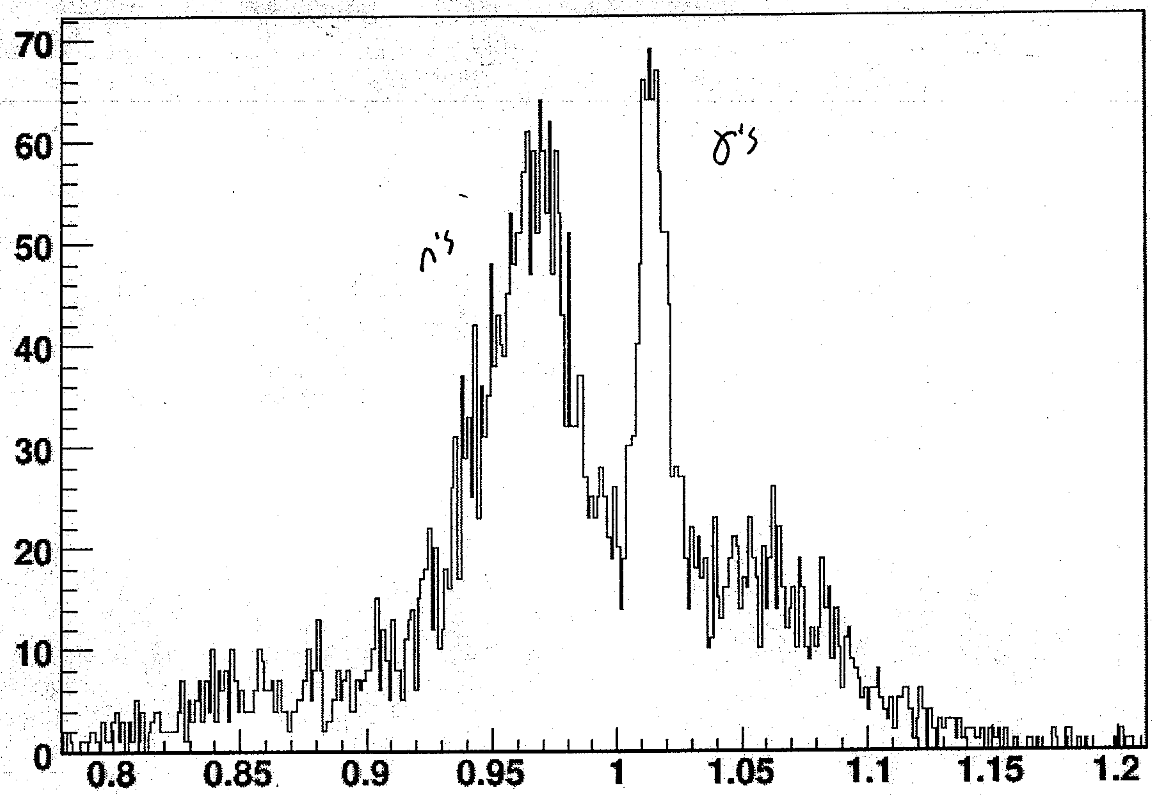
$$PID = \frac{G_F}{A + B\,G_T + C\,G_T^2}$$

A = 20.29475
B = 0.8538659
C = −5.409404 × 10⁻⁶

Then Neutrons ⇒ PID < N_n N_n depends on the tube.



Tube 12 PID



Tube 12
Wall A
P|D for
all n-γ
GMs

see Run 793 **P|O Values** **N_n**

Tube	Wall A	Wall B
0	0.976843	0.991035
1	0.976843	1.02648
2	1.01488	0.966985
3	0.963481	~~0.965747~~ 1.06319
4	0.990051	~~1.06319~~ 1.01547
5	0.992581	0.98716
6	0.976133	1.00092
7	0.992581	0.976678
8	1.05205	1.01251
9	1.04066	1.02727
10	1.00846	1.0363
11	1.01847	1.02983
12	0.986614	1.05306
13	0.982491	1.07127
14	1.04052	1.0363
15	1.00135	1.05702
16	1.01585	1.05314

(cont.)

Tube	wallA	wallB
19	1.04247	1.04349
20	1.02311	1.05018
21	0.989551	1.06739
22	1.03214	1.02724
23	1.04118	1.01959

Note: For values $N_n \gtrsim 1.01$, we may be inaccurate.
It may be better to fit for every tube → difficult

wall B tube 5 could be better.

March 1, 2010

Examining ~~●~~ Proton Veto vs TOF to see proton Contamination
→ actually, we want to see ~~minimum~~ Maximum proton Energy in walls for N-P correlations

Recall: P.V. channels are in FA adc chans 16-~~2~~6
(channel 23 bad, so moved to 24)

16-23, 25-26

Order
16, 17, 18, 19, 20, 21, 22, ~~23~~ 26, 24, 25,

P I D values

$\gamma = 1$
$n = 2$
$p = 3$
$d = 4$
$t = 5$

?4.3.2010

Neutron-γ discrimination

- Many overflow events in QDC spectra. However, these are mostly neutrons so we can ignore them in the PID spectra.
- The true neutron events - after throwing out gammas - will be taken from
- Method
  1. Eliminate γ's from PID plot
  2. Get energy from TDC plot.

Things to check

- Many Events in TDC don't have start sigs.
  - double check
  - Verify
  - Try to find reason
  - Correct in efficiency
- These are mostly low E events.

To do:

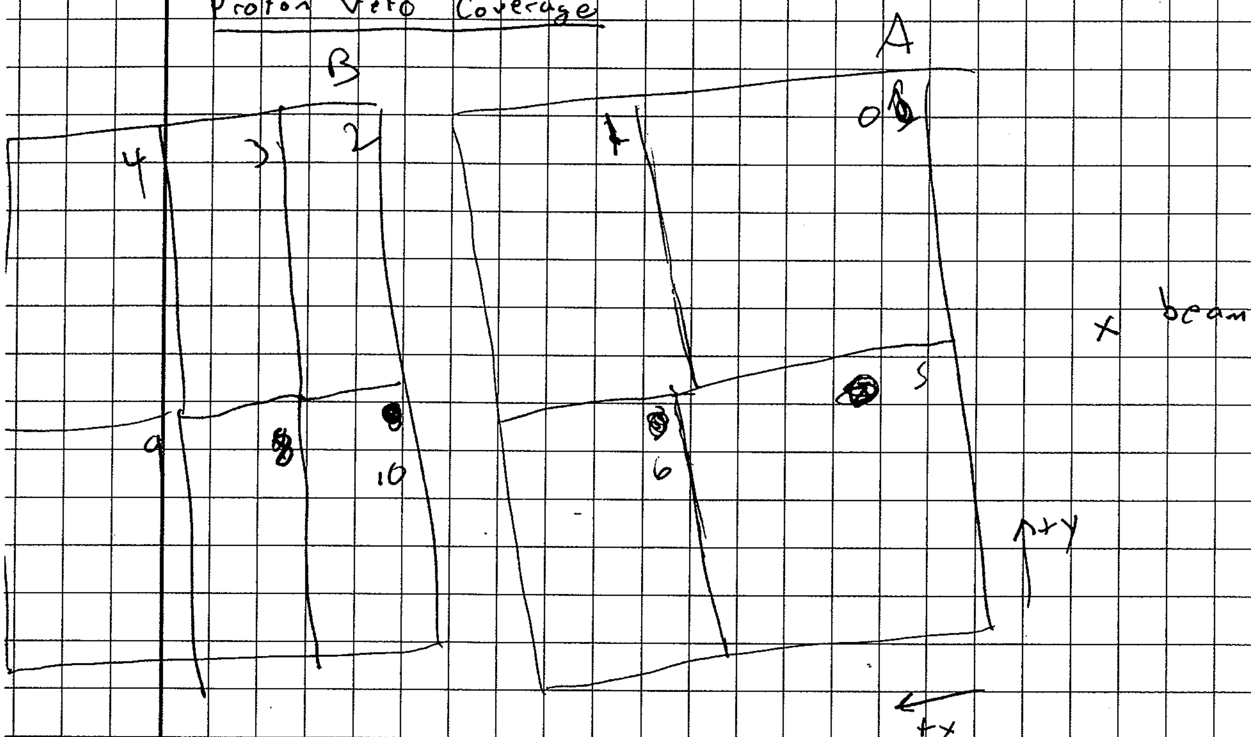
- Get proton, deuteron, triton disc.
  - Veto paddles
  - p, d, t bands
- ~~Cons~~ Don't write all events → only events w/ data
  → must write event number to run number
- I
  - If a bad event then no need to process rest of it.

PID looks pretty good. Could be a bit better, but Not Bad. Algo got scattered γ's.

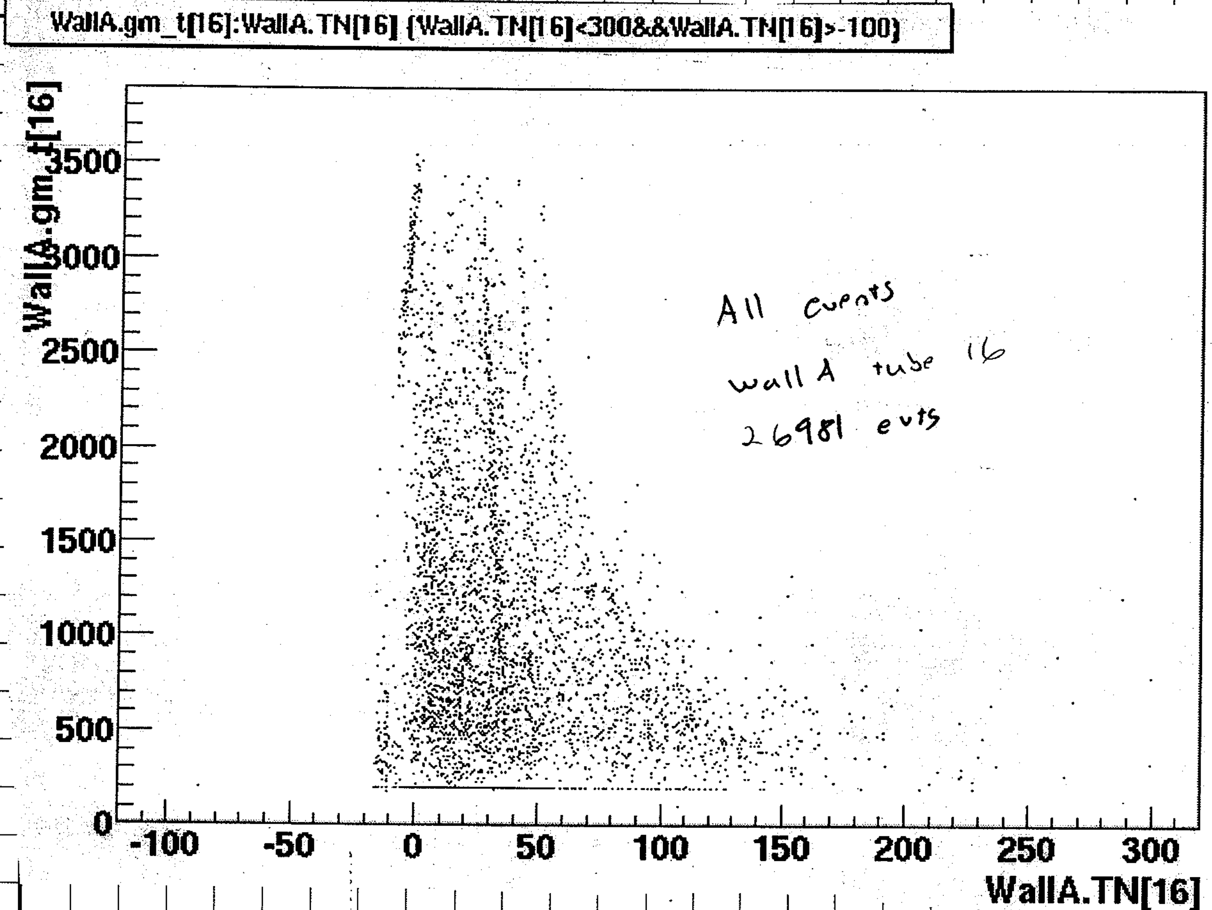
To do:

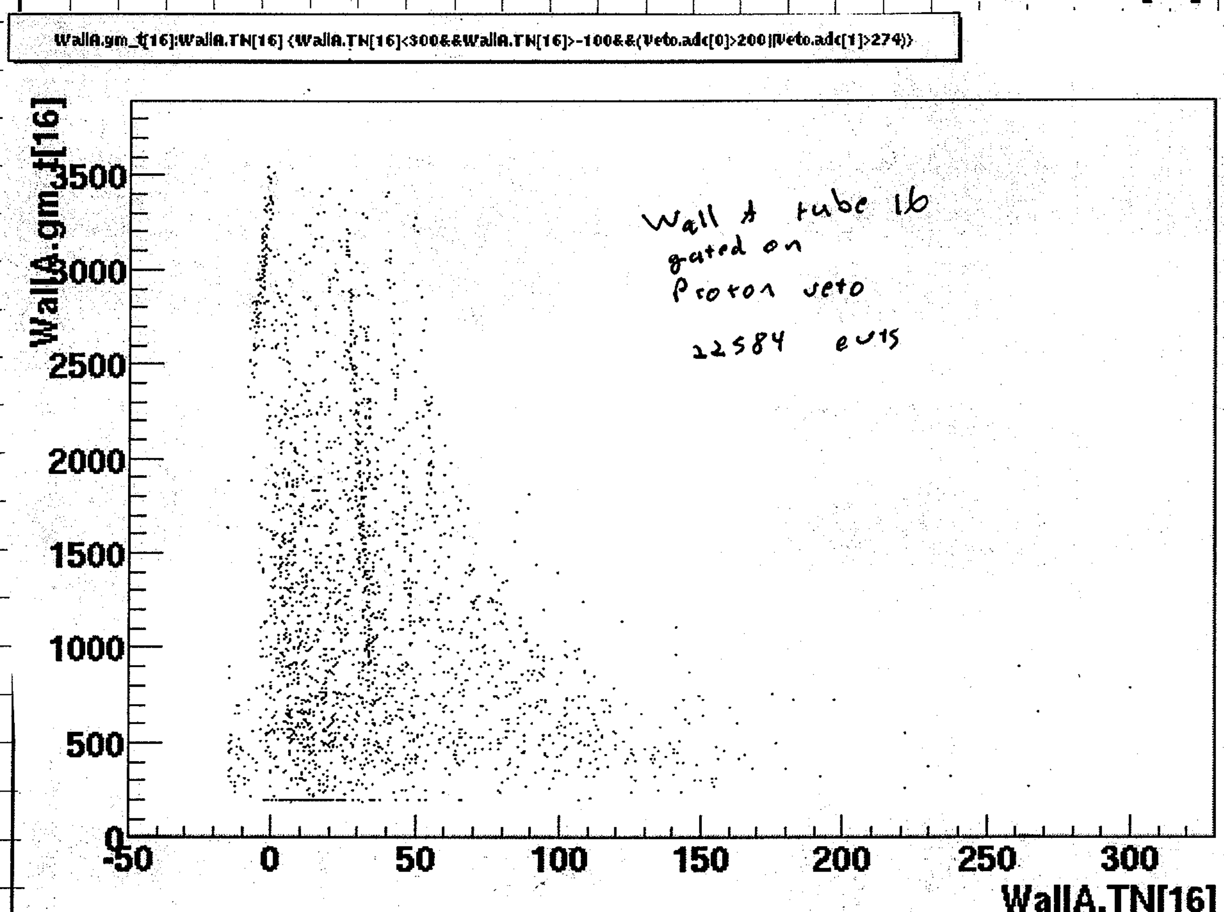
I.D. - protons
- Deuterons
- tritons.

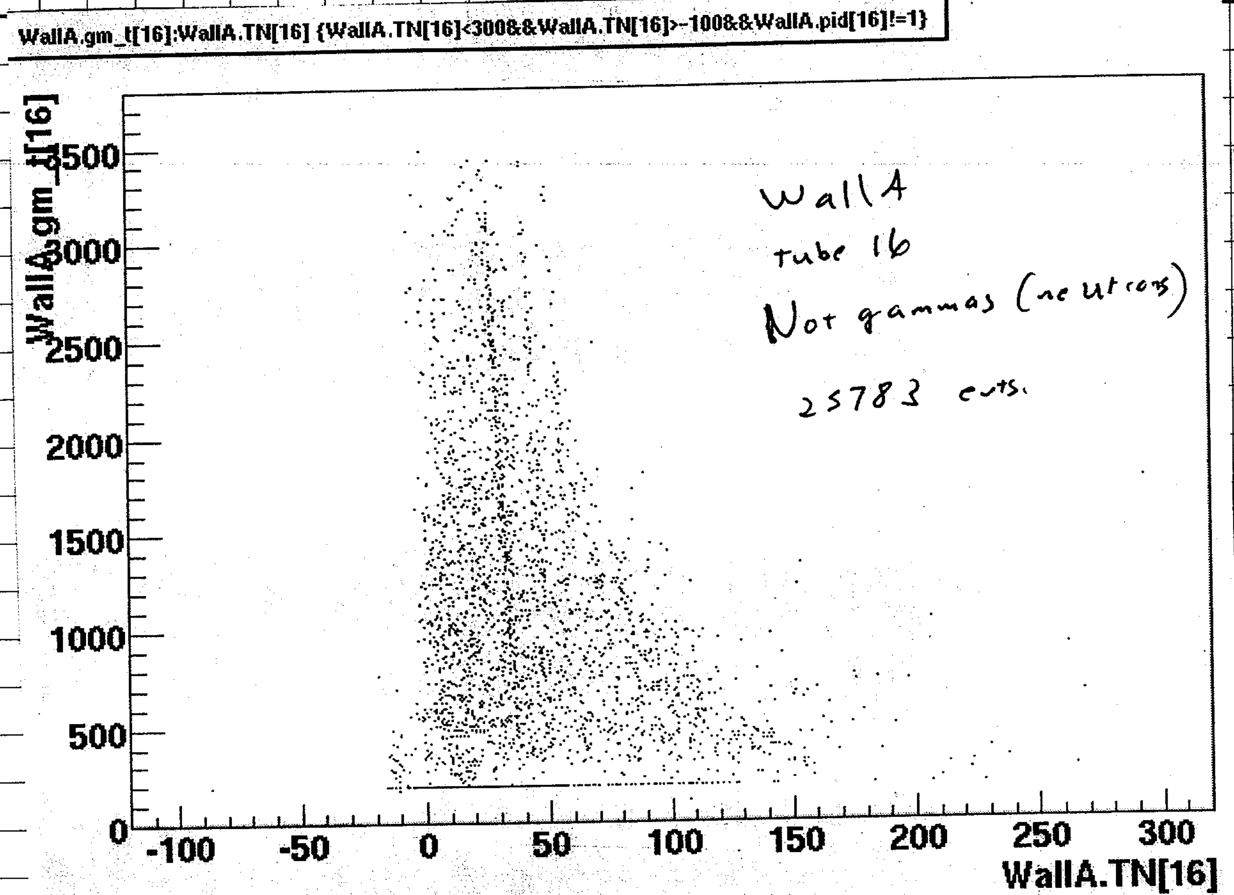
Proton Veto Coverage

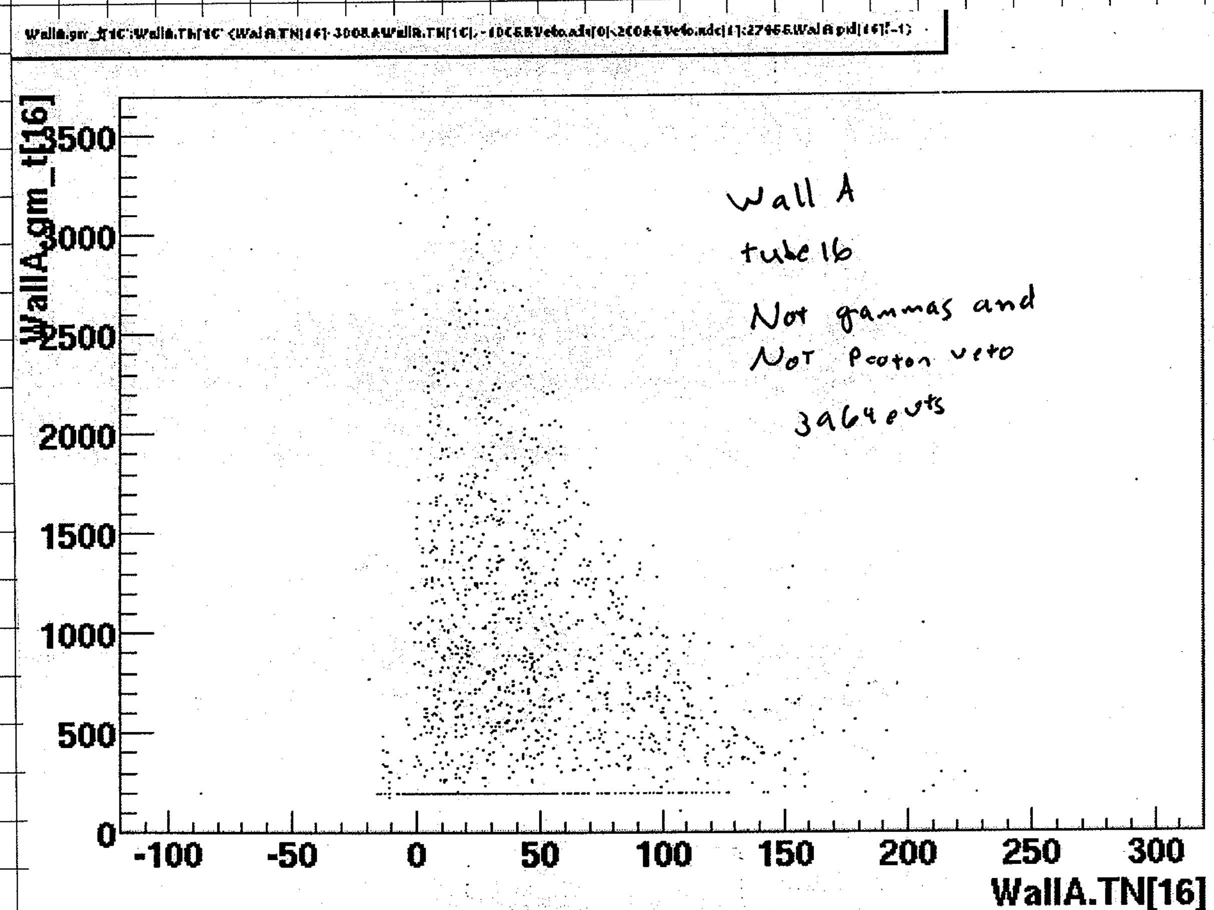


Wall	ADC	X_min	X_max	Θ_min	Θ_max	Y_min	Y_max
						-18cm	
A	0	89	173			0	
A	1	173	273			28	
B	2	297	319			-8	
B	3	319	376			-15	
B	4	376	429			-16	
A	5	83	176				-12
A	6	163	273				0
	7						
B	8	322	369				-15
B	9	369	427				-16
B	10	292	322				-8


WallA.gm_t[16]:WallA.TN[16] {WallA.TN[16]<300&&WallA.TN[16]>-100}
WallA.gm_t[16]
3500
3000
2500
2000
1500
1000
500
0
-100
-50
0
50
100
150
200
250
300
WallA.TN[16]
All events
wall A tube 16
26981 evts

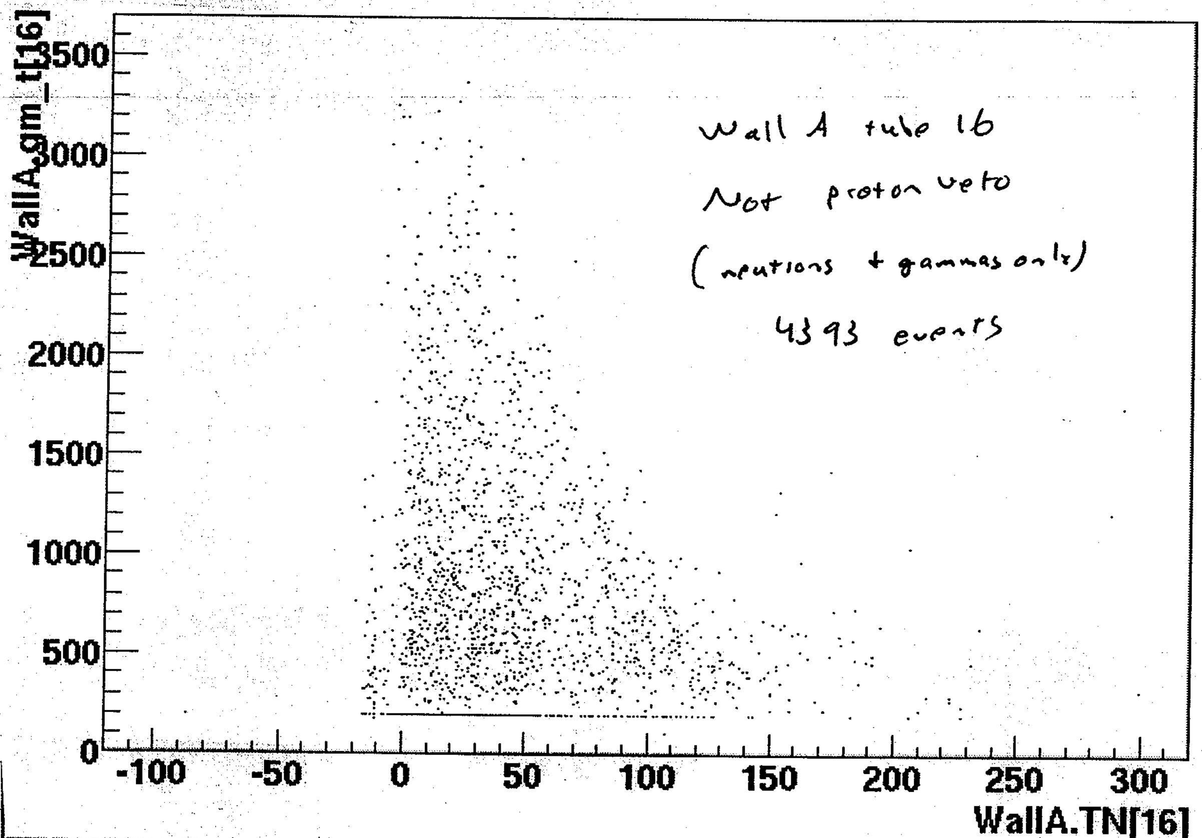

WallA.gm_t[16]:WallA.TN[16] {WallA.TN[16]<300&&WallA.TN[16]>-100&&(Veto.adc[0]>200||Veto.adc[1]>274)}
WallA.gm_t[16]
3500
3000
2500
2000
1500
1000
500
0
-50
0
50
100
150
200
250
300
WallA.TN[16]
Wall A tube 16
gated on
Proton veto
22584 evts



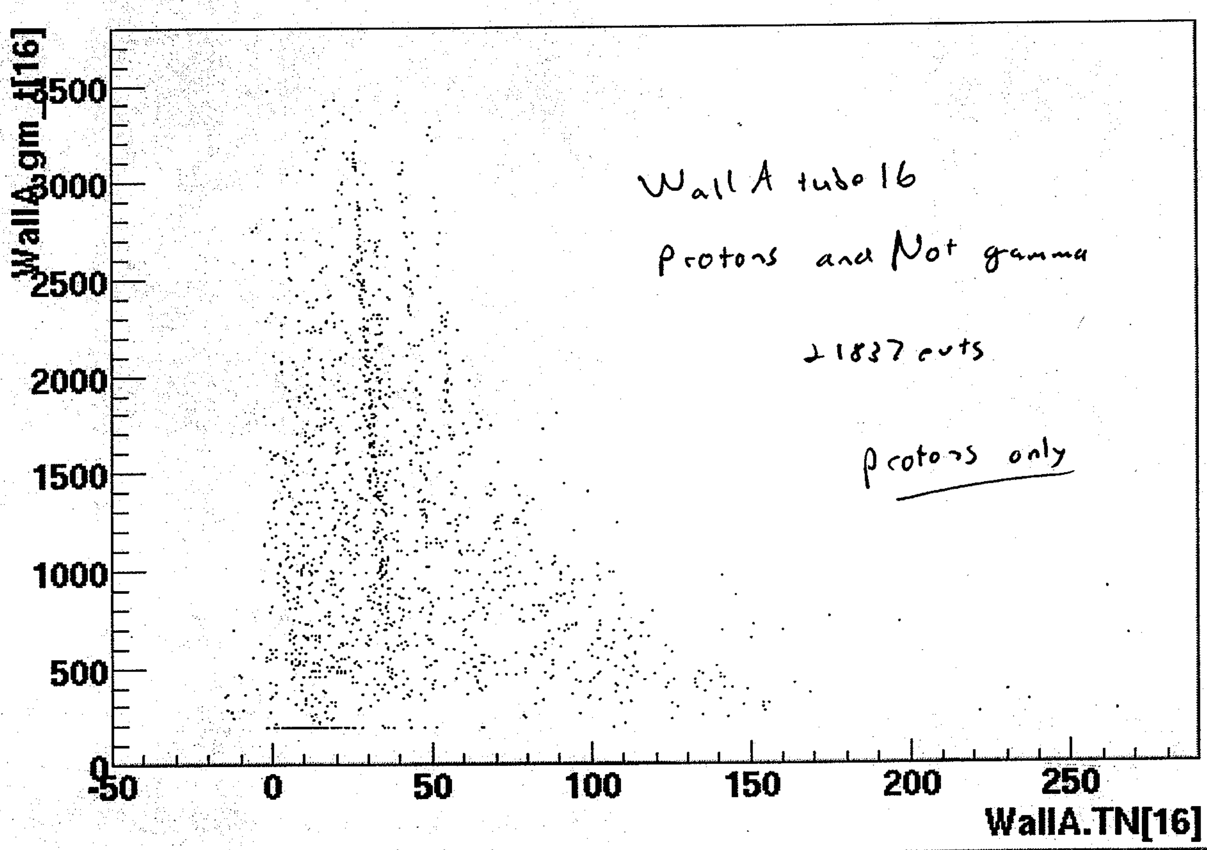


Neutrons only

WallA.gm_t[16]:WallA.TN[16] {WallA.TN[16]<300&&WallA.TN[16]>-100&&(Veto.adc[0]<200&&Veto.adc[1]<274)}



WallA.gm_t[16]:WallA.TN[16] {WallA.TN[16]<300&&WallA.TN[16]>-100&&(Veto.adc[0]>200||Veto.adc[1]>274)&&WallA.pid[16]!=1}



Proton veto Coverage at bottom of page 143

Veto ADC	wall	X range	Y range	Tubes
0	A	(489) - 173	-18 →	
1	A	173 - 273	0 →	
2	B	297 - 319	-8 →	
3	B	319 - 376	-15 →	
4	~~A~~ B	376 - 429	-16 →	
5	A	83 - 176	→ -18 ~~16~~ →	
6	A	163 - 273	→ -18	
7	—			
8	B	322 - 369	→ -15	
9	B	369 - 422	→ -16	
10	B	292 - 322	→ -18	
11				

TO eliminate neutrons

- PV greater than certain value ⇒ γ + n's
- γ line
- Σ 0 γ's, n's, charged particles

Veto adc cuts

- Used for cuts for neutrons + CP's. → anything above is CP's.

ADC	Cut off
0	185
1	227
2	204
3	148
4	73
5	128
6	144
8	89
9	171
10	172

File: neutron_PV_CUTS.dat

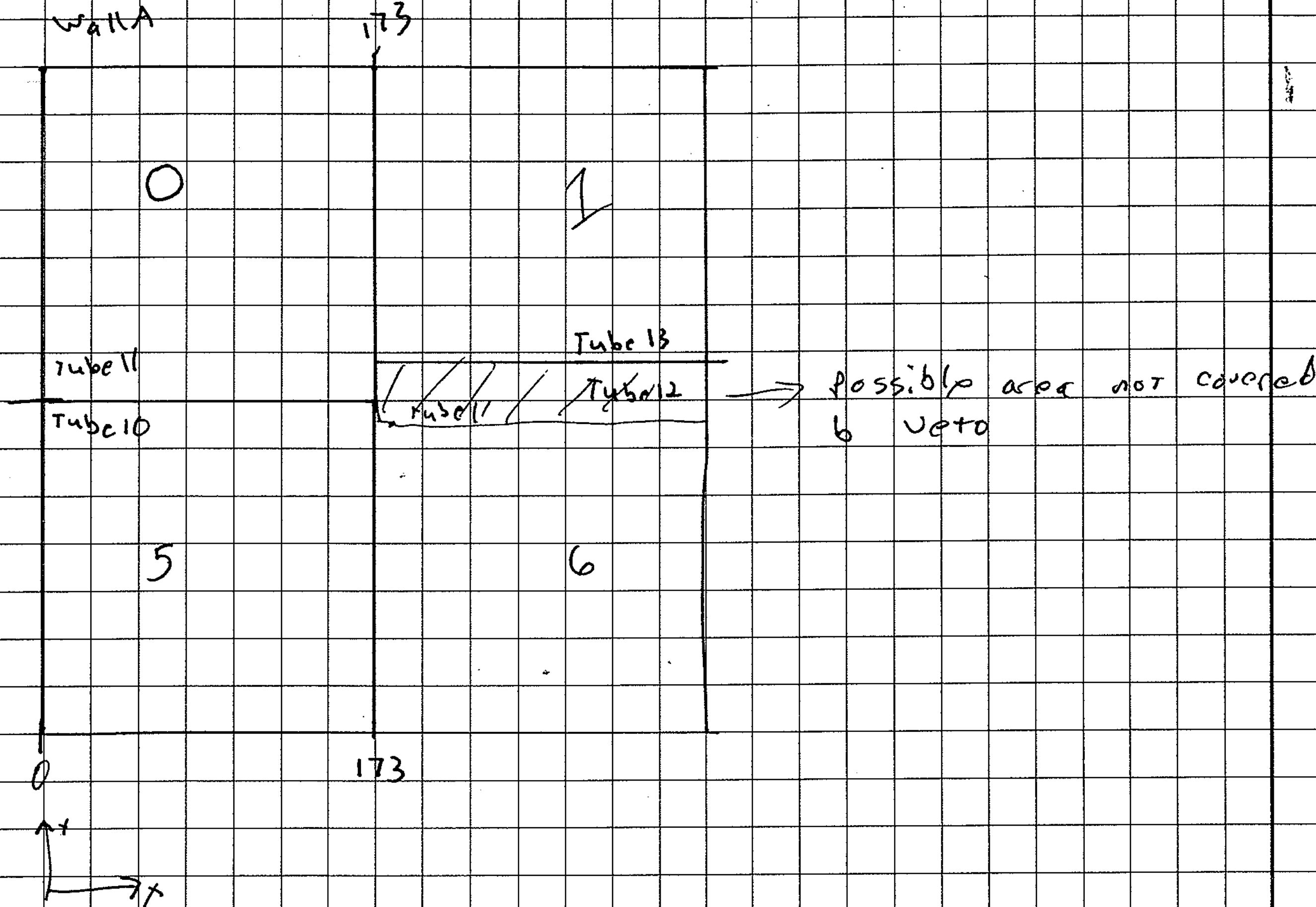
Need to:

- Check each tube for proton contamination
- Adjust coverage of vetos if necessary

11,200 Double-check tubes

Tube	Wall A OK	Wall B OK
0	Y	✓
1	✓	✓
2	✓	✓
3	Very small amount of contamination	✓
4	✓	✓
5	✓	✓
6	✓	✓
7	✓	✓
8	✓	✓
9	Maybe some cont.	✓
10	Some Cont.	✓
11	Some Cont.	✓
12	Some Cont.	✓
13	Maybe some tiny Cont.	✓
14	✓	✓
15	✓	✓
16	✓	✓
17	✓	✓
18	✓	✓
19	✓	✓
20	✓	✓
21	✓	✓
22	✓	Some Cont.
23	✓	Some Cont

Fine tuning of Vetos



Wall B tubes 22 + 23 have a small amount of proton Contamination March 15, 2011

- Maybe from Veto 3 only?
- Maybe eliminate those?
- Maybe ignore, not too much.

Wall A tubes 10 : small amount of contamination

- 11 : Small amount of contamination
- 12 : Some Contamination. A bit more than tube 11
- 13 : Very tiny amount of contamination

It looks like a small section ~~bonded~~ Corresponding to $x > 173$ and tube 11 + 12 may not have good veto coverage

- tube 12 maybe covered ½ by Veto 1 + Half by veto 6
  Same for tube 11

Oct 7, 2010 Many events have TDC time, but NO QDC events. These ~~must be very~~ are all Fast events, ~~Thus~~ and below software thresh on QDC. Thus, they probably aren't neutrons, but maybe Fast protons. we should check this

$T \lesssim 30$ ns

This corresponds to a proton E $\gtrsim$ ⇐

Neutron Energy E $\gtrsim$

For this proton E, the energy deposition in liquid is:

Example: tube 5

Number of events GM_T = ped ~~1744~~ 1629
Number of events ~~At~~ Total 6744
Approx ⅓ of all events are pedestal as expected.

Neutron events

Problem

- Most of the events are overflow, and these are thrown out, i.e. E = 0
- However, Most of the γ events are not overflow, so we can eliminate them

Number of events w/ Conditions   tube 5 A

		Valid T	"Neutrons"	"Charged p"	γ
overflow	G.M. = 0	17478	1544	15934	0
Pedestal	G.M. = Ped	~~1168~~ 1365	1288	74	3
	G.M. = Normal	4262	1168	2421	673
	Total	23133	4007	18450	67[illegible]

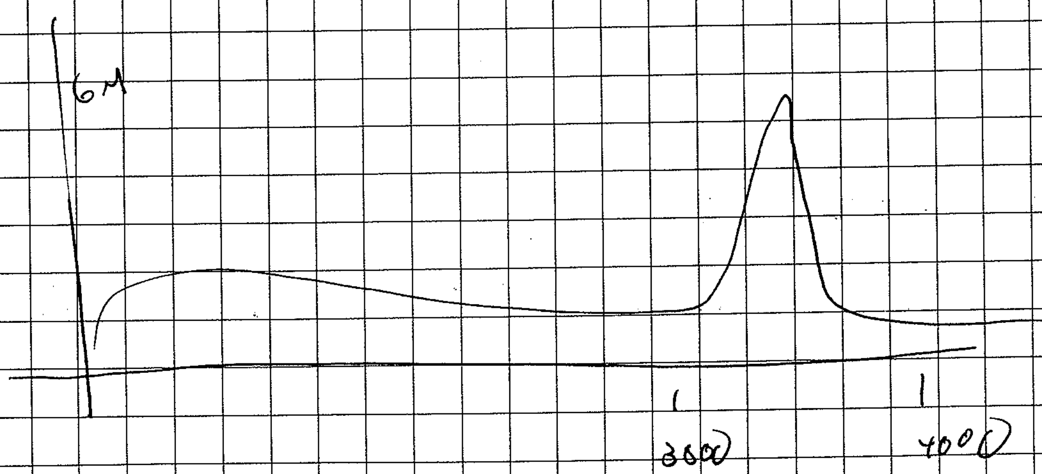
So How can we have so many events w/ G.M. = 0 and T ≠ 0
- those are overflow events
- are we handling overflow events correctly?
- ~~we can~~ That is are we identifying them correctly?

Most - overflow events are charged particles
- we don't expect too many from γ's

Consider GM$_T$ w/ overflow

~~to~~ Plot GM.T

Overflow evst



For all events Number of cts between 3800 + 4000 (78800)
- 2852   X 4173

For only protons
- 2779

	overflow	GM = 500-[illegible] not overflow
All :	1602	14895
p-veto only :	1543	13231
neutrons or gamma :	58	~~1588~~ 166

It looks like at least 96% of all overflow events are charged particles ~~neutrons~~ only. ~~They~~ The rest can then easily be distinguished with PID.

- What about pedestal events (Tube 5A)

	Neutrons	charged p.	γ	Tot
Total	4007	18450	676	23133
ped	1288	74	3	~~[illegible]~~ 1365
Not ped				21768

Most in the pedestal are neutrons. Can this be?
- Maybe.
  - They can't be C.P because the veto
  - Could they be γ's? ← they might be scattered γ's
    - that would be where all our γ's are!
    - below QDC thresh!

⇒ Vetos coverage is not quite right. ~~This~~ Thus some C.P.s are escaping into the wall.

⇒ Might need a 2-D array for veto coverage

Cutoff [tube] [veto]

⇒ To speed things up, we can also ~~assign~~ initialize everything we can to ϕ.

Coordinate Cuts for each tube 6 Al

~~Wall A~~ tube	Wall A cut between Veto	Wall B cut
0	~~171~~ ~~164-181~~ 164-174	
1	~~173~~ 161-181	
2	~~175~~ 168-181	
3	~~175~~ 166-183	
4	~~175~~ 166-184	
5	164-186	
6	169-183	
7	166-185	
8	164-184	
9	166-185	
10	163-183	
11	165-187	
12	161-192	
13	162-191	
14	166-196	
15	168-193	
16	174-194	
17	171-198	
18	175-195	
19	175-193	
20	174-194	
21	176-194	
22	174-188	
23		

Veto ~~tube~~ 5 + 6 (tubes 0–11)

Veto 0 + 1 (tubes 12–23)

- There is a small gap between Veto 5 and 6
- Probably best to eliminate this area

To do

- also check wall B gaps.
- Check beamside wall A cuts
- also cut for TOF to eliminate γ's that way

⇒ It looks like we can safely conclude that almost all overflow events are from charged particles → very hopeful. max cont = 4%

<u>Now</u>

Minimum coverage for edge vetos

Tube	wall veto left
0	0
1	
2	
3	
4	
5	95
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	

Active areas ~~covered~~ NOT covered by vetos

Tube	A		B
0	163-184	(looks odd)	
1	160-187	(looks odd)	
2	161-189		
3	164-194		
4	163-188	~~looks~~	
5	168-188		
6	166-185		
7	162-188		
8	166-188		
9	165-188		
10	167-186		
11		(something wrong)	
12	All		
13	All		
14	171-185		
15	171-190		
16	171-183	(looks funny)	
17	171-193		
18	~~166-188~~ 171-192		
19	170-187		
20	169-190		
21	171-188		
22	171-193		
23	172-191		

Veto Coverage

Veto [5] Veto AdC [6]

Wall A tube	x	
0	168-283	0-168
1	172-283	0- ~~16~~ 172

ril 3, 2010

Identifying neutrons + protons using veto + g-n-t

veto > ped = protons
g-n-t = ped => almost all protons

ril 6, 2010

Final Check on PID-veto
Questionable tubes
Wall A, tube 6
tube 11
tube 12 => shadowing by beamline?
13
14
18
19

To do

- Check PID of all tubes
- Check veto coverage of all tubes.
- Check E vs. θ of all tubes
- Check blocking of wall by ring 6 in Minibar
- look at contamination of n's
  - protons
  - γ's
- look at neutrons lost to protons
- Is the spectrum purely geometric?