2

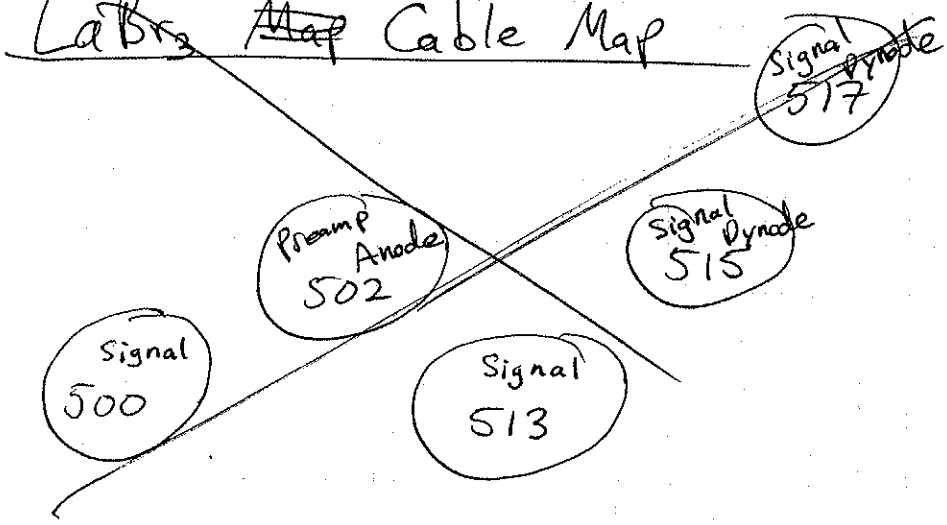
6/23/15

148-152 La β-decay

ANL	ANU	UML		LLNL
MPC	AJM	P-C.	D.H.	K.K.
G.S.	G.L.			
J.C				
S.B.				
H.D.				
R.J.				
D.S.				
D.A.				
T.L.				
~~F~~.K.				

6/23/15

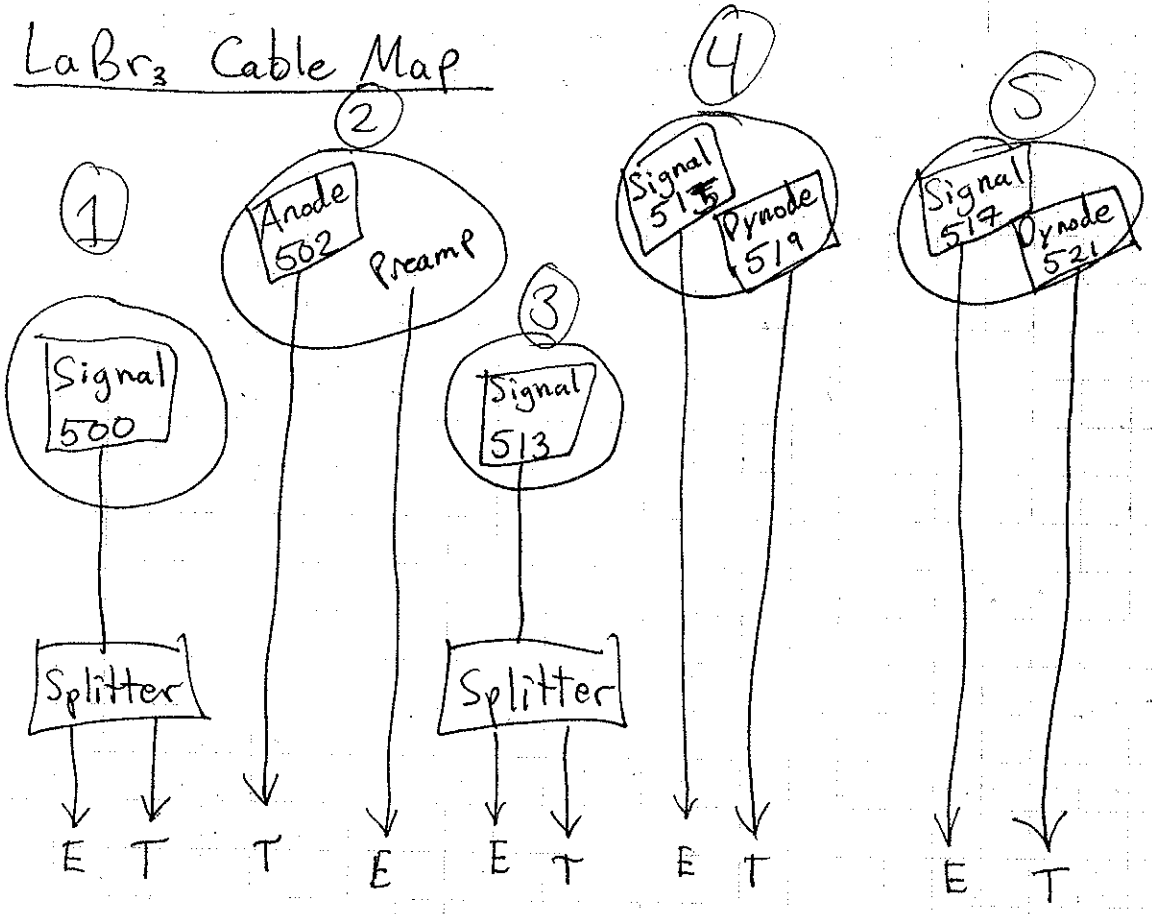
$LaBr_3$ ~~Map~~ Cable Map



ISEG

PMT	HV	MPOD Channel
500	-800	0
513	-800	1
515	-1700	2
517	-1700	3

$LaBr_3$ Cable Map



$^{148}La \longrightarrow {}^{148}Ce$

Trigger β-singles (Laser Cloud)

Beta singles (Bad TTL)

Tape 1 – 5 – 4 – 1 → trigger rate

B6 – bias on | bias off

Start with Run 100

3:21 Start run 100

4:20 Stop run 100

4:34 Start run 101

Rates

C2	C3	C4	C5	β (trigger)	Trigger
500-900	600-900	500-800	660-1040	600-2500	2. 10k 3. 1k

Timestamps synched

Tape system: laptop ✓, LED's ✓, driver ✓

Event rates: IOC1 1000 kB/s, IOC2 3000 kB/s

5:35 Stop run 101

Start run 102

Max Rates

C2	C3	C4	C5	β	Trigger
~750	~800	~750	~850	2500	2. 12.5k 3. 2.6k

Timstamps ✓

Tape system laptop ✓, LED's ✓, driver ✓

Event rates: IOC1 1000 kB/s, IOC2 3000 kB/s

6:36 Stop run 102
Start run 103
Max Rates

C2	C3	C4	C5	p(trigger)	Trigger
~750	~600	~800	-850	2500	2. 12.5k
					3. 2.6k

Timestamps ✓
Tape system: laptop ✓ LED's ✓ drive ✓

Event rates: IOC1 1000 kB/s, IOC2 3000 kB/s

7:39 Stop run 103
Start run 104
Max Rates

C2	C3	C4	C5	p	Trigger
~750	~600	~800	-850	2800	2. 12.8k
					3. 2.8k

Timestamps ✓
Tape system laptop ✓ LED's ✓ drive ✓

Event rates: IOC1 1000 kB/s IOC2 3000 kB/s

8:57 Stop run 104
Start run 105
Max Rates

C2	C3	C4	C5	p	Trigger
~700	~750	~750	-800	2400	2. 12.0k
					3. 2.0k

Timestamps ✓
Tape System laptop ✓ LED's ✓ drive ✓

Events rates: IOC1 1000 kB/s IOC2 3000 kB/s

10:03 Stop run 105
Start run 106

C2	C3	C4	C5	B	Trigger
-750	-750	~800	-850	3100	2. 13.0k
					3. 2.9k

Timestamps - slightly out of sync

Tape system laptop ✓ LED's ✓ drive ✓

Event rates IOC1 1000 kB/s IOC2 3000 kB/s

6/24/15

11:07 Stop run 106
Start run 107

C2	C3	C4	C5	ϕ(Trigger)	$T_{Trigger}$
800	800	800	850	2700	2. 12.9 k
					3. 2.9 k

Timestamps ✓

Tape System laptop ✓ LED's ✓ drive –

Event rate: IOC1 1050 kB/s IOC2 3100 kB/s

11:51 Paused run to switch cables

PAC 11:54 Start run 108
12:04 Stop run
} Not sure this even ran

12:10pm D Got all the TACs working with

Start → $LaBr_3$

Stop → Big Plastic

Delayed individual starts to make valid TAC signals acceptable to the DAQ (≤ 2V max).

Rough guess → we'll have a 10ns range on the DAQ.

6/23/15

"Black Box" Channel Map

Digi 5		Digi 3		Digi 2		Digi 1	
			(Preamp)				
CH0	L.G. β	CH0	LaBr1	CH0	C3	CH0	C1
CH1	H.G. β	CH1	TAC *	CH1	C4	CH1	—
CH2	—	CH2	Preamp 3	CH2	D1	CH2	—
CH3	—	CH3	Preamp 4	CH3	D2	CH3	—
CH4	—	CH4	Preamp 5	CH4	D3	CH4	B1
CH5	β TTL			CH5	D4	CH5	B2
CH6	T0			CH6	E1	CH6	B3
CH7	10 Hz Clock			CH7	E2	CH7	B4
				CH8	E3	CH8	—
				CH9	E4	CH9	C2

TAC * was Start/Stop between $LaBr_3$ 4 and 5 (ANU detectors)

6/24/15

"Black Box" Channel Map

Digi 4		Digi 3		($LaBr_3$)
CH0	TAC 1	CH0	Preamp 1	
CH1	TAC 2	1	Preamp 2	
CH2	TAC 3	2	Preamp 3	
CH3	TAC 4	3	Preamp 4	
CH4	TAC 5	4	Preamp 5	

12:51 PM
Start run 109

Digitizer 4 not reading out any rates

12:54 PM
Stop run 109

1:02 Start run 110

No TAC info → digitizer disabled (see channel map)

1:13 No reading on VME02 - Stop run

1:14 Start run 111

1:54 Start Run 112 - Reboot Crate

2:28 Stop Run 112 - Guy working Carlson Platform.

3:33pm Start run 113 - Guy finished tuning
- TAC digitizer enabled

4:38pm Stop run 113

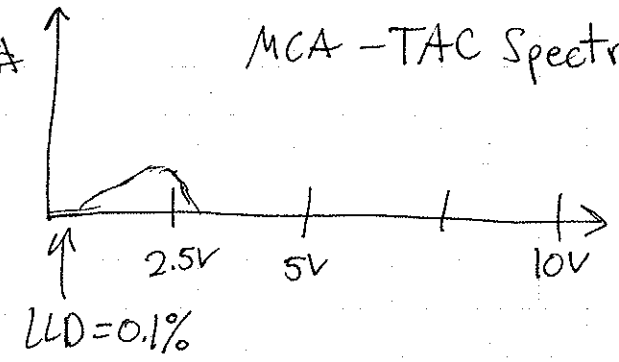
5:00pm Changed beam cycle
Now in dc mode
Beam deflector was changed to read "on" all the time
Motor Controller cycle changed from "wait input signal"
to "Wait 59 seconds"
ie tape used to remove long-lived activity once a minute
^{148}Ce decay $T_{1/2}$ ~ 1 minute
^{148}Pr decay $T_{1/2}$ ~ 2-3 minutes
Nothing was changed in logic box. Will still see
channel B+C red LEDs as before, however they
don't actually do anything now
(makes it easy to change back if we want).
Still reading in T0 and 10Hz clock to DAQ

→ Decided to change T0 to 60s cycle.
now skipping 599 triggers instead of 119.

- TACs are generated with $LaBr_3$ – Start and Big Plastic β – Stop

  Start signals delayed by a few ns to make pulse height of TAC output smaller (digitizer limit is 2V max P.H.).

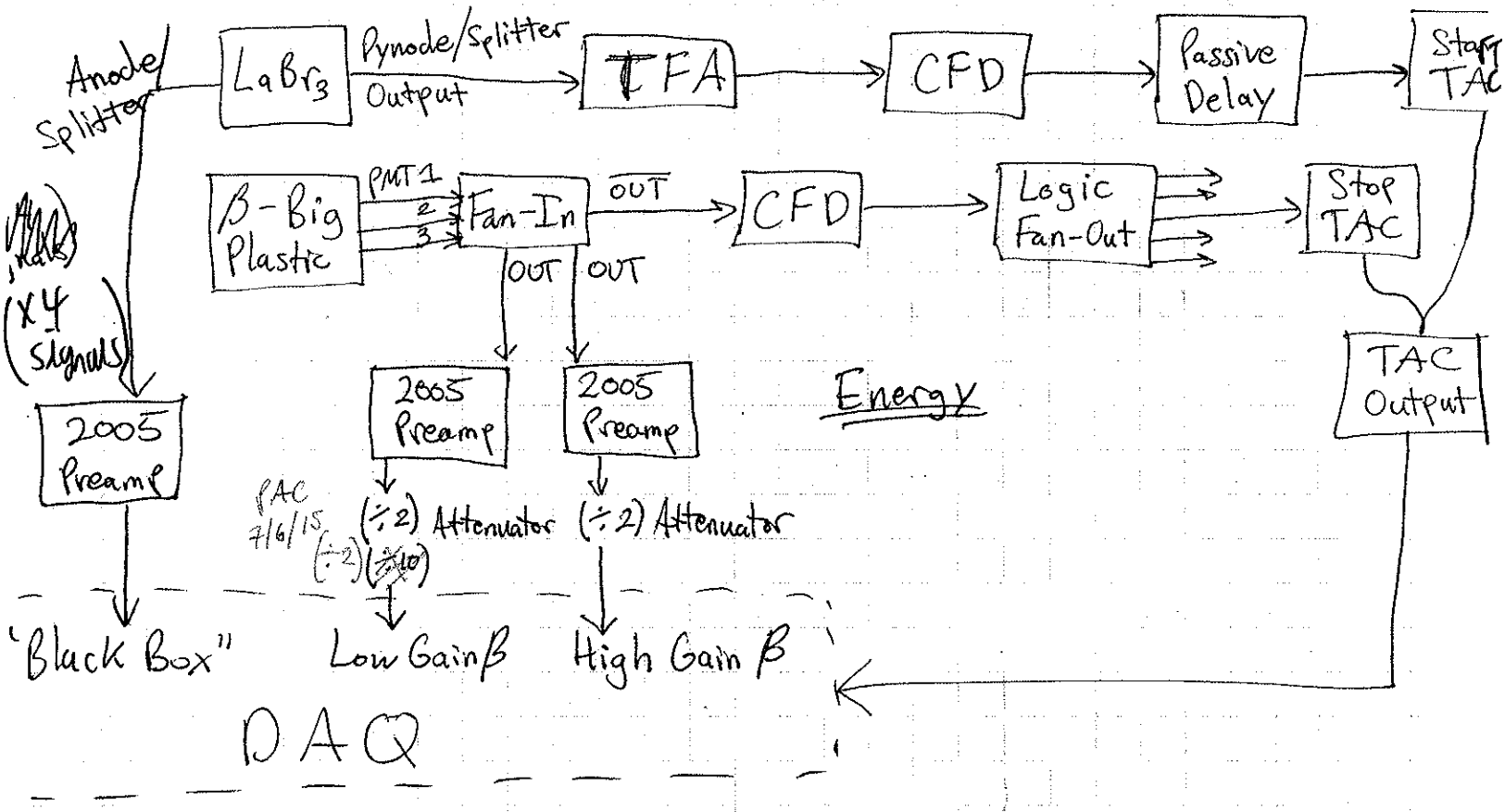
$LaBr_3$ ←	1	16ns	Start Delay
	2	20ns	
	3	12ns	
	4	12ns	
	5	24ns	



~~3~~pm Run 120 Start
6:38PM

- β-TTL increased to 2μs width

- $LaBr_3$ Detector Electronics:



- $LaBr_3$ #2 has its own preamp and power supply

19:40 Stop run # 120
Start run # 121

20:40 Stop run # 121
Start run # 122

21:40 Stop run # 122
Start run # 123

22:40 Stop run # 123
Start run # 124

23:40 Stop run # 124
Start run # 125

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00:00 The tape is not working. The laptop is off
After turning it on, the tape is back.

00:30 Stop run # 125
Start run # 126

Rates: { Ge ≃ 1000
Lab2 ≃ 200-800
B-trigger ≃ 5000

01:30 Stop run # 126
Start run # 127

02:30 Stop run # 127
Start run # 128

03:30 Stop run # 128
Start run # 129

Rates still the same

0444 Stop run 129
Start run 130

Ge rates: ~1000 β(trigger): ~~500~~ LaB, 200-500

Evnt Rate: IOC1: 1700 kB/s IOC2: 1200 kB/s

0555 Stop run 130

Rates have been down by a factor of 2 since 0530.
Called Jason's office + left message

Start run 131

All rates down by factor of 2...

0711 Stop run 131

Found Jason, he'll look at beam.

Start run 132
0743 stop run 132 → beam taken away

0752 Start run 133

Ge Rates: ~400 β(trigger) ~ ~~300~~ LaBr: 120-600

DC voltage on source was lowered, so it's possible molecules from source may get released. If new r's show up in spectra, that's where they are coming from.

0856 Stop run 133

Start run 134

Ge: ~800 β(trigger) 5800 LaBr: 150-650

Checked CEhiBeta pjx spectra from runs 120 and 133 → they look identical, so we may be f.m.

1004 Stop run 134

Start run 135

Rates are the same as above

1108 Stop run 135

Start run 136

Ge: ~750 β(trigger) 2900 Lab. 100-600

11:25 Stop run 136

1:33pm Start run 137

Now using all 5 Ortec TACs

No delay on start signal

TAC Full Range = 100 ns

x2 attenuator on TAC outputs

TAC voltage output is from 250 mV to 2V

TAC spectrum spans 40 ns

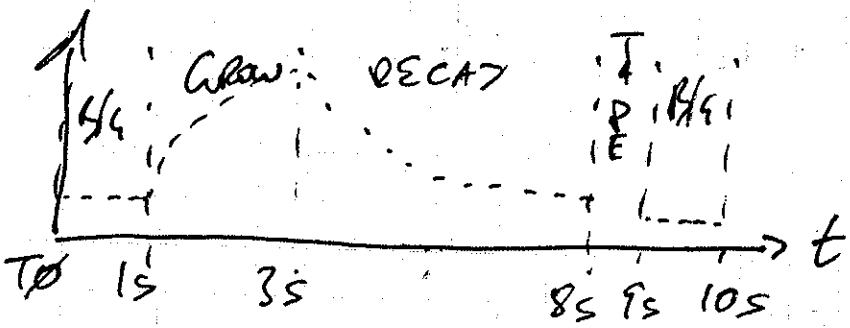
14:56 Stop Run # 137

Lost beam -> something was turned off on CARIBU beam line. Guy returning. Having meeting in 5 minutes to decide action plan.

OK... Decided to finish with 148La

Guy is tuning to mass 150

Run for short while on beam cycling mode:



10s cycle
1s B/G
2s beam ON
5s beam OFF
1s tape move
1s B/G
=10s

$T_{1/2}$ 150La ~ 600 ms

$T_{1/2}$ 150Ce ~ 4-5s

beam on ~3 $T_{1/2}$ (La)

Tape re-set to take input from logic box. Just need to hit execute to start movement.

5:14pm Start RUN # 138

5:20pm start run 139

Power Needed to be recycled on "Black Box"

5:38pm Stop run 139 → data wasn't being written

5:38pm Start run 140

β Trigger (TTL) ~ 1.2 KHz

19:00 β trigger ~ 1.0 kHz

LaBr-4 ~ 250 Hz

Adj

7:45 Stop Run 140

7:45 Start Run 141

8:18 Stop Run 141

Magnet changed to optimize 150 Eu

8:19 Start Run 142

10:00 Tape move ok

β - trigger ~ 1 kHz

LaBr4 ~ 270 Hz

Stop Run #142

10:05 Start Run #143

10:58 Stop Run #143

T1/2		Eγ	Chiller	Chiller	Iγ
0.83	150Eu	97	4800?	6480	0.3
		209	5400	5100	0.25
0.05	150Pr	110	158k	122k	1.0/0.5?
		279	6400	3800	0.04/0.02
6.2s	150Nd	130	121k	98k	0.33
		251	14k	7600	0.05

11:40 Start Run # 144

11:~~48~~ Stop Run # 144

Looks at Gains on LaBr. 2 ADU increased Gain by 5x in black box. Gain on ORTEC from 5 times to 10 times. Started final data run. bi207 - LaBr. LaBr #5 has worse resolution than before. 1, 3, 4 OK. 2 - no peak seen.

11:56pm Start Run # 145

Back to D.C. beam
Tape move every ~~60~~ 57 seconds to remove long-lived activity.

11:58pm Stop Run # 145

Killed DAQ -> NO! Black box dead.

Cycled power -> seems OK in nosave.

06/26

12:09 am Start Run # 146

β-trigger ~ 7400 (Drops to ~820 after tape move)

LaBr4 ~ 500

01:00 β trigger ~ 8k

LaBr 4 ~ 480

~ 1kH after tape move

Sorted all 150La decay data -> La150_Sum.root

	Eγ	Ehi Raw	Chi β	
Ce	97	37k	27k	≡ 2/s
	209	24.5k	22.5k	≡ 2/s
Pr	110	~~1435k~~ 969k	743k	≡ 50/s
Nd	130	1M	785k	≡ 50/s

Say, 4 hours of data?
14.5k seconds

01:18 Stop Run # 146

Black box ~~died~~ dead again...

Tried cycling power to black box
changing power outlet
rebooting DAQ

nothing worked.

02:22 am Put in park until morning...

03:11 am mpc came in. Messed with BLACK BOX
Success!! - saved the day..!

03:11 start run 147:

β-trigger 6.5k

Falls to <1k

0539 Stop Run # 147

Start run # 148

β-trigger 6.5k → 800.

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0752 Stop run #148

0752 Start run #149

β-trigger 6k → 11k.

0911 Stop run #149

Start run 150

1010 Stop run 150

1011 Start run 151

1130 Stop run 151

1131 Start run 152

β-γ trigger 6.4k

☐ Changed $LaBr_3$ electronics at about 6pm 6/25/15:

Ortec TAC outputs were delayed ~~several~~ several μs relative to Start signal. Minimized delay → 500ns.

Removed dynode cable from the two ANU detectors (got rid of ringing in anode signal). Split anode to use for energy and timing, had to increase gain in "Black Box" of DAQ.

Removed TFAs from electronics (for all 5 $LaBr_3$ detectors). Got better timing sending raw PMT signals into CFDs.

Reset CFDs zero cross-over, thresholds set to minimum (saw no noise).

TAC full range still 100 ns, with x2 attenuators on TAC output. Optimized delay of Start to fit entire TAC spectrum b/w 250mV and 2V. TACs peak in same channel on MCA.

$LaBr_3$ #1	#2	#3	#4	#5
Start Delay 20ns	28ns	22ns	18ns	19ns

12:36 Stop run 152
Start run 153

18:37 Stop run 153

Start run 154

14:53 Stop run 154
14:53 Start run 155

16:22 Stop run #155
16:22 Start run #156.

Trigger rates 10.6K
→ 3.8K
Dropped of by ~ x0.5

17:26 Stop run #156
17:26 Start run #157

17:55 Tape has jammed. Turned off tape movement. Will fix when tuning for 152 tomorrow morning.

150La → Ce → Pr → Nd
T1/2 ~0.6s ~45 ~6s Stable.

Shouldn't have much effect if we don't lose tape over [redacted] seconds...

18:31 Stop run #157
Start run #158.

Tape is happy!

19:25 Noticed rates are up...

Trigger now 12K

5.3K

19:26 Stop run #158.

Start run #159.

20:34 Stop run #159

Start run #160.

21:25 Stop run #160.

Greg needs the beam... He says ~20 minutes.

21:48 Start run #161

22:56 Stop Run #161

22:56 Start Run #162

B trigger ~ 7kHz

Saturday June 27, 2015

12:13am Stop Run #162

Start Run #163

B trigger 7.2K

0

* D.A said that the tape stop working, but cannot recall the time this happened?

1:23am Stop Run # 163

1:24am Start Run #164

β-trigger 6.7K

Sorted data and checked spectra; they look similar compared to when tape was ON — note that 150Nd is [illegible] ↑ The background is up, as expected. Stable!

3.30am Stop Run # 164

3 31am Start run # 165 (tape is off - just collecting activity)

5.15am Stop run # 165

5.16am Start run # 166

β-trigger: 4.7K.

6.16am Stop run # 166

6.17am Start run # 167

7.22am Stop run # 167

7.23am Start run # 168

β-trigger: 5.5K

8:02am Stop run 168

No data being collected, recycling power on Black Box

Recycling power did not work

Power Off → Disconnected grey ribbon cable from middle 4 digitizer and recycled power again → still didn't work.

1am Start Run #164

β-trigger 6.7K

Sorted data and checked spectra - they look similar compared to when the tape was ON - note that 150Nd is stable! The background is up, as expected.

Sam Stop Run #164

(tape is off - just collecting actives)

Iam Start run #165

Sam Stop run #165

Sam start run #166

β-trigger: 4.7K.

6am Stop run #166

Sam start run #167

22am Stop run #167

23am Start run #168

β-trigger: 5.5K

:02am Stop run 168

No data being collected, recycling power on Black Box

Recycling power did not work

ower off → Disconnected grey ribbon cable from middle 4 digitizer boards and recycled power again → still didn't work.

10:15am Black Box Still Broken

~17pm Black Box is ok again, no active fix really...

1730 turn on CAEN HV again for mass 152

~~6:00pm~~ 18:00 Signal cables plugged back into Black Box

Preamp 2 signal has small pulse height (~50mV)
Hardly any rate registering in DAQ from background

Background Rate (cps)	LaBr3 #1	#2	#3	#4	#5
	~~200~~	~~1~~	~~200~~	~~300~~ ~~200~~	300

Average Background Rate (cps)	LaBr #1	#2	#3	#4	#5
	125	1	125	225	250

MASS 152

7:17 06/27/2015 7:17 pm

start run 180 cycle to check components of the beam (5s)

8:19 stop 180
start 181

9:27 stop 181
start 182

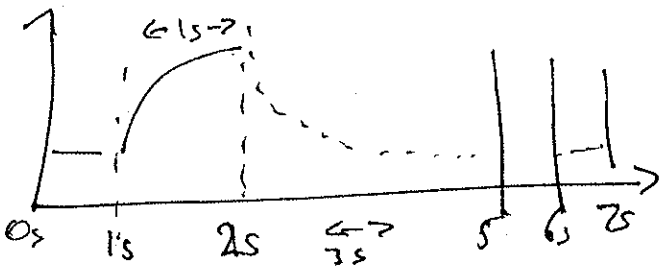
10:12 stop 182
start 183

11:08 stop 183
start 184

11:52 Stop Run# 184

Changing to shorter tape cycle

00:12 Start Run # 185 — LaBr #2 is not triggering & spectrum is rubbish.



new tape cycle

02:11 Stop run # 185

02:11 Start run # 186. β rates 90 → 250 repeat.

04:12 Stop run # 186
Start run # 187

06:16 stop run # 187
start run # 188

0700 β rate fallen off a little 70–180 cycle.

8:10 stop run # 188
8:10 start run # 189

Ge temps OK

9:00 DAQ seems OK

10:05 stop run # 189
start run # 190

12:06 stop 190
start 191

USEFUL MACRO: sub(11, 22, 23, 40, −0.96, 1, 1000)
(beam on gate, beam off gate, norm, display range)

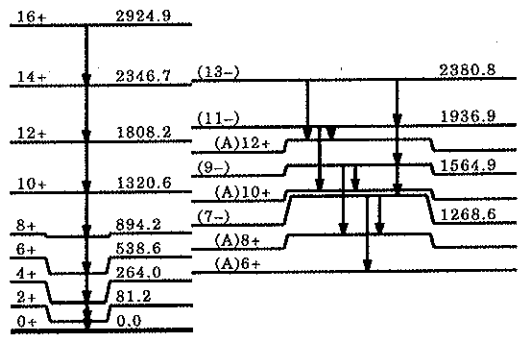
[needs loading .L sub.cc]

generates plot of beam on spectrum (red)
beam off (green)
normalized diff (blue)

$^{152}_{58}Ce_{94}$

^{252}Cf SF Decay: Xundl-1 2012Li54

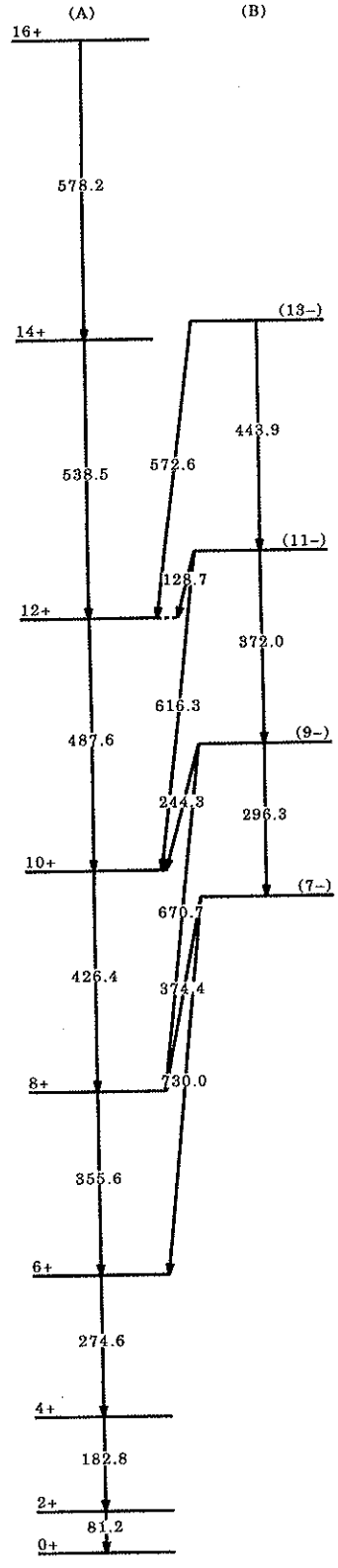
(A) The g.s. band (B) Octupole band



$^{152}_{58}Ce_{94}$

^{252}Cf SF Decay: Xundl-1 2012Li54 (continued)

Bands for ^{152}Ce



$^{152}_{58}Ce_{94}$

12:50 stop 191

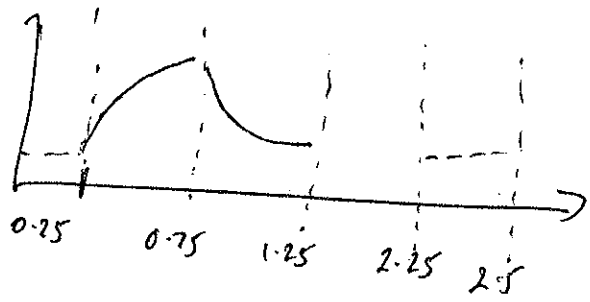
to check LaBr 2 signal

1:07 start 192 without LaBr 2
1:19 stop

1:19 start 193 (no middle LaBr data)
1:43 Stop Run #193

Change to shorter tape cycle

1:50 Start Run #194



B/G 0.25s
Beam on 0.5s
Beam off 0.5s
Tape move 1s
B/G 0.25s
Total 2.5s.

2:12 Stop Run #194

2:28 Start Run #195 ~5

Looking @ individual crystals. Something has some funny in C3 between Run #189 and #190... C3 is compressed into a few channels??? first ↗
Looked @ signal in scope and they look ok - DAQ issue?
Started new run, need to investigate further???

16:34 stopped run 195
16:35 start run 196, checked beam systems OK.

6/28/2015

Stop run 196
Start run 197

20:15 Stop run #197
start run#198

B trigger max ~ 250 Hz

21:26 Stop Run#198
Start Run#199

Laptop had turned off

→ THIS NEEDS TO BE CHECKED ON EVERY COUPLE OF HOURS!!!
else it will turn off if no activity

22:53 Stop Run#199
Start Run#200

B trigger max ~300
min ~90

3:40 Stop RUN#200

change CALIBV SETINGS to try enhance 1172G

00:10 Start Run#201

First hints of something @~81 keV ...? Will see in a.m.

01:39 Stop Run#201

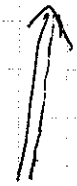
01:41 Start Run#202

B-trigger 407

Greg - 29/6 @0700

Looked at EosTape (effect of "tape laptop" turning off)

run 194 ✓
run 195 ✓
run 196 ✓
? run 197 ? little bit of 244
X run 198 ← extra lines, esp 244
? run 199 ? little bit of 244
run 200 ✓
new CALIBV settings run 201 ✓



02:47 Stop Run # 202

02:48 Start Run #203

β-trigger (max) 356

04:22 Stop Run #203

04:23 Start Run # 204

β-trigger (max) ~ 360

06:08 Stop Run #205 ← see below.

06:08 Start Run #206/5

06:31 Was confused here, think two runs were open at same time. Daniel said start run so I did, but other one had'nt been stopped. If I understand system, the overlap region had both files with same data, so I deleted run 205 (note #'s wrong above) and started it again. So run 204 kept going until 06:31.

06:35 Start run #205

07:17 Stop run # 250

END of ^{152}Eu Data

** CALIBRATIONS **

12:00 Start Run Ta182

13:10 Stop Run Ta182

Took Eu 152
Am 243

During Am243 noted that baseline shifted at some point and due to high rate 2, 11 crystals went below -1 volt. Readjusted Baselines & restook Am & Eu data

New files eu152-2, am243-2

Participants

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F. G. Kondo
R. V. F. Janssons
S. Zhu
J. Lauridsen
D. Seweryniak
S. Bosch
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