Analysis of 6127Performance071230.txt

Analysis of Data using QDAQ.exe

This page represents the statistical analysis of this file done by QDAQ.exe, a Visual Basic program written by me to analyze the data.

File Statistics

C:\AA Classes\Class 07\General Units\QNET Muon Detector\Data\6127Performance071230-split.txt

DAQ Serial Number	Channels Enabled				Coincidence Level	Veto Enabled	PreTrig (ns)	Gate	Post
6127	1	2	3	4	2	False	40	100	60

Begining Date/TIme UTC	301207	231209.018	Elapsed seconds
Ending Date/TIme UTC	301207	235959.019	2870

Record Lines Total	136225		Events Total	43558
- Header Lines	66		- Invalid Event	263
= Data Lines	136159		= Valid Events	43295

					%
- Invalid GPS Status	0				
- No FPGA clock	0		1-fold Coincidences	0	0
- No GPS update	815		2-fold Coincidences	11168	26
			3-fold Coincidences	8601	20
= Valid Data Lines	135344		4-fold Coincidences	23526	54

Total Coincidences	43295

Refresh

Print

					% Difference
Triggers Total	143274		Ch 1 Trigger	32818	-8
- Falling Orphans	0		Ch 2 Trigger	38839	8
- Falling before Rise	53		Ch 3 Trigger	38099	6
- Rising Orphans	747		Ch 4 Trigger	33518	-6
- Multiple Triggers	1031				Avg
= Normal Triggers	141443		Total	143274	35818
Avg Triggers/event	3.31				

Efficiency Studies: Based on all 4 counters stacked. Number of events with one and only one channel missing	Chnl	Events	% Eff
	1	4079	53
	2	209	98
	3	30	100
	4	4283	50
	Total	8601	

Criteria:

Record Line: any text in the input file delimited by a CR

Header Line: any record line that is NOT a data line. Each will be searched for information from commands such as H1 & V1.

Data Line: a record line that fits the format of data created by the CE command (i.e. Words delimited by space character in positions 9, 12, 15, 18, 21, 24, …)

```
CE:  03388491 BC 00 3D 00 00 00 3F 00 0301E553 231211.018 301207 A 07 0 +0084
Word 1        2  3  4  5  6  7  8  9  10       11         12     13 14 15 16
Pos: 12345678901234567890123456789012345678901234567890123456789012345678901234567890012
     0        1         2         3         4         5         6         7
```

<u>Invalid GPS Status</u>: Data line with Word 13 not = "A"

<u>No FPGA Clock</u>: Data Line with Word 1 = 0

<u>No GPS Update</u>: Data line with Word 15 not= "0"

<u>Valid Data Lines</u>: Usable Data Lines (i.e. without Invalid GPS, No FPGA, & No GPS update)

<u>Event Total</u>: All Data Lines with New Event flag (i.e. Bit 7 of Word 2 set)

<u>Invalid Events</u>: Events discarded because Data Line was not valid

<u>Valid Events</u>: Valid Data Lines with New Event flag

<u>n-Fold</u>: Count of any Valid Event with n of the 4 channels triggered. This counts any trigger normal or otherwise. Example: An event records channels 1 & 2 as normally triggered (i.e. rising before falling), nothing for channel 3, and a falling orphan on channel 4 (i.e. falling but no rising); then it would count as a 3-fold coincidence.

<u>Total Coincidences</u>: This is the sum of all 4 n-fold counts. It should equal the Valid Event count.

<u>Triggers Total</u>: Up to 4 triggers (one for each channel) may be counted for each Valid Event. A channel is counted as triggered if either or both of rising edge or falling edge trigger bits (bit 5) was set at any time during an event.

<u>Falling Orphans</u>: A channel records a falling edge without a rising edge during a valid event.

<u>Falling Before</u>: A channel records both a rising and a falling edge. However, the last falling edge occurred earlier than the last rising edge during a valid event.

<u>Rising Orphans</u>: A channel records a rising edge without a falling edge during a valid event.

<u>Multiple Triggers</u>: A channel records more than one rising edge during a valid event. Each additional rising edge beyond the first will be counted with or without any falling edges.

<u>Normal Triggers</u>: All triggers without the above problems.

<u>Ch n Trigger</u>: A channel is counted as triggered if either a rising edge or a falling edge was triggered at least once during an event. At most, one trigger per channel per event can be counted this way. Only Valid Data Lines and Valid Events are included in this.

<u>Total</u>: This is the sum of all 4 Ch n Trigger counts. It should equal the Triggers Total count.

<u>Avg</u>: Total / 4

<u>% Difference</u>: This is the percentage difference between the Ch n Trigger and the Avg. It should indicate any channels that are operating significantly "hotter" or "colder" than the others.

<u>Avg Triggers/event</u>: This is the Total Triggers divided by the Valid Events

Efficiency Studies:
(If all 4 counters are stacked, then it is reasonable to assume that all events should trigger all 4 counters. The discrepancy would be due to the "efficiency" of the counter.
Therefore we count each event where a specified counter did NOT trigger. It makes no difference in what order the channels triggered.)

Events: Count of events for which Chnl n was the only one of four channels that did NOT trigger.

Total: Sum of each of the 4 missing counter Events above.

% Eff: This is the percentage difference between the Total missing-counter events and the Events count for each channel.

Comparison to e-Lab Performance Study

The frequency distribution graph of time-over-threshold is very interesting and useful. I found it very sensitive. Recently it was very helpful in discovering a slight mistake in setting one of the PMT voltages. The following graph of this same data file follows. I see it as showing data that is very good. The Time over Threshold frequencies are very consistent between channels.
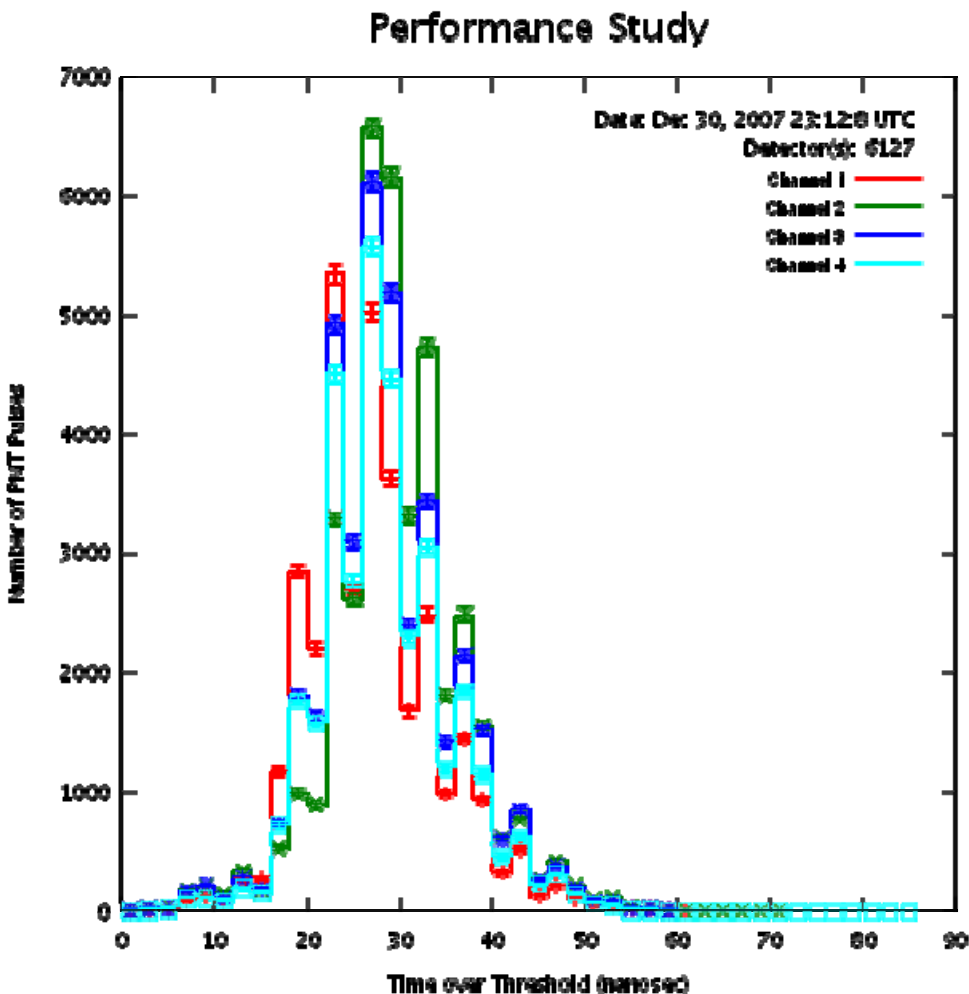
Comparison to e-Lab Statistics page

This page is available on the e-Lab Performance Study page for the file: Paso Robles High School, Dec 30, 2007. A PDF copy is attached.

Section 1:

"Total Events" and "Total Lines" fall below my totals but more than my valids. It appears that our definitions are discrepant.

"Gatewidth" is listed as 240ns even though the data contains text from the V1 command showing that it was set as 100ns.

"Average Hits per Event" is slightly more than my avg of 3.27.

Section 2:

The totals listed for each channel by type of trigger are often wildly discrepant from my totals.

"Total Hits" lists channel 1 as 32770. At the same time "Coincidences within a single channel" lists channel one as having "1: 32561" and "2: 104". Shouldn't 32770 and 32561 be the same?

"Coincidences within a single channel": Shouldn't "2" be the same as what I called multiple triggers.

Section 3:

The section titled "Strings of Coincidences" is very intriguing. However, none of the numbers are what I would expect. Examples for channel 1 follow:

    +   It would seem that "1" should be the number of times that channel 1 triggered alone during an event. Since the DAQ was set for 2-fold coincidence, I would expect this to be zero.

    +   Th number listed for "1" is 32769. Why is this one less than the "Total Hits" listed for channel 1? Does this include times when channel 1 triggered twice within one event?

    +   Apparently this means that "1" includes every time that channel 1 triggered. However, that would imply that it should be the total of all of the two-channel strings that include channel 1 (i.e. 12, 13, 14, 21, 31, & 41). These total to 94,650, clearly not adding up.

Section 4:

The section titled "Total Coincidences" could be useful but the results are not what I expect or can interpret. Examples follow:

    + "1" is listed with 272. From the notes at the bottom of the statistics page, I would assume this means that there were 272 events with only 1 channel triggered. Since the DAQ was set for 2-fold coincidence, this should be zero.

    + Coincidences of more than 4 triggers (i.e. the total of "5", "6", & "7") could only occur if one or more of the channels triggered more than once within an event. This should be a very rare occurrence. According to my Multiple Triggers total and the e-Lab "Coincidences within a single channel" I note that no channel fired more than twice and that the total is ~1000.

+ Please note that the description text for "Total Coincidences" states "Note: that the indicated line number is the END of the event". I do not understand this.

+ Many of the notes at the end of the page show an example of a couple of data lines (apparently not from this data set) and state "Note: the specified line is the *last* line in the file to have this property". I cannot see anything that I can construe as a reference to a line number in this set of data.

Section 5:

- Under "GPS information". It lists statistics for "Datalines" that would indicate that there were NO datalines without valid GPS data. However, a cursory examination of the begining of the data file reveals about 160 lines of header information with no GPS data, and about 80 lines where the GPS timing status flag (word 5) is non-zero indicating a timing error. My Analysis shows 815 such lines throughout the data file.