

Tests of Quarknet scintillator paddles and their mated PMTs

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Cosmic ray coincidence measurements and noise estimates

Paddle 1 (has red colored tape), Paddle 4 (has yellow colored tape)

Trial 1

Counts across ~10 seconds

COUNTER 1	COUNTER 4	COINCIDENCE
885	260	148
931	248	129
905	267	118
942	294	125
870	253	138
AVERAGE = 906.6	AVERAGE = 264.4	AVERAGE = 131.6

Voltage was set to .839V for both counters

Noise Rate for COUNTER 1 = $906.6 - 131.6 = 775/10 = 77.5$

Noise Rate for COUNTER 2 = $264.4 - 131.6 = 132.8/10 = 13.28$

Dark Rate = $2(77.5)(13.28)(150\text{ns}) = 308,760$

The gain was assumed to be 150ns, as the width knob on both discriminators are turned all the way to the right.

The discriminator threshold was set to the minimum value of -25.1mV

Trial 2

Counts across ~10 seconds

COUNTER 1	COUNTER 4	COINCIDENCE
140	104	63
150	114	73
144	101	81
140	93	54
133	98	79
AVERAGE = 141.4	AVERAGE = 102	AVERAGE = 70

Voltage was set to $\sim 0.720\text{V}$ for COUNTER 1 and $\sim 0.777\text{V}$ for COUNTER 4

Noise Rate for COUNTER 1 = $141.4 - 70 = 71.4/10 = 7.14$

Noise Rate for COUNTER 4 = $102 - 70 = 32/10 = 3.2$

Dark Rate = $2(7.14)(3.2)(150\text{ns}) = 6,854.4$

The gain is assumed to be 150ns, as the width knob on both discriminators are turned all the way to the right.

The discriminator threshold was set to the minimum value of -25.1mV

Trial 2 uses the voltages specified in the report for both counters, whereas Trial 1 uses the same voltage for both counters. The voltage was selected since it was the minimum voltage that yielded a semi-consistent rate of muons at 13Hz. The increase in voltage across both paddles increased the Dark Rate by 50x, however appropriate unit conversions are needed.

Counts across ~ 1 minute

PMT 24	PMT 58	COINCIDENCE
10	6	0
11	14	0
8	10	0
14	16	0
6	11	0
AVERAGE = 9.8	AVERAGE = 11.4	AVERAGE = 0

PMT 24 counts/sec = 0.1633Hz

PMT 58 count/sec = 0.19Hz

-2KV Voltage was supplied to both PMT's

Both discriminators thresholds were set to the minimum value of -25.1mV and the gain was set to the max value of 150ns for both.

The voltages sent to both PMT's were set to -2KV , since that Voltage gave the least amount of noise.

Since a coincidence was not achieved in over 10 minutes, it can be concluded that there is an issue either with the scintillators or the PMT's.

LIGHT LEAKAGE TESTING

COUNTER 1 + COUNTER 4

Voltage for Counter 1 set to .777V Voltage for Counter 4 set to .72V

TRIAL	HZ WHEN EXPOSED TO ROOM LIGHTS	HZ WHEN UNDER COVER
1	11.1	11.1
2	12.5	12.5
3	10.5	13.2
4	11.2	10.6
5	8.6	12.2
6	10.1	11.2
7	11.5	11.4
8	11.5	12.7
9	10.2	12.4
10	9.4	11.3
	AVERAGE: 10.66	AVERAGE: 11.86

It can be concluded that there is no light leakage in either of the paddles since the count didn't jump up significantly when uncovered.

COUNTER 4 + PMT 24

Voltage for COUNTER 4 set to .720V Voltage for PMT 24 set to 2002.5V

TRIAL	COINCIDENCE (HZ)
1	.9
2	1.3
3	1.4
4	1.9
5	1.6
6	1.1
7	1.9
8	1.8
9	2.3
10	1.9
	AVERAGE : 1.61

The coincidence rate is much less than what is expected (13HZ). The most likely reason for this is the mating between the PMT and the scintillator plastic. When the PMT is pressed into the plastic or positioned more at an angle with the plastic, the count rate goes up. Further testing is needed/will be done when PMT 24 is properly mated to the plastic.