Lab 2 # Cosmic Rays

- <u>Setup stage</u> :

    objectives :

1) • Set 10mV for threshold
    • Measure individual thresholds

2.) • measure each PMT's count.
• Random $\frac{1}{3}$ true

3.) $\cos^2$ dist of muon count rates

4.) Calibrate the tac
Meas PP → delay
and full range

• <u>Count rate collection</u> :
$t = 20$ sec
• 10 - 20 data points

- 2 PMT $\longleftrightarrow$ all 4 sides
- screw rotate threshold
  10 - 20 times

- $n \to$ counts
  $\dot{n} \to$ count rate
  $V_{Th} \to$ volts threshold

- <u>PMT: Bar #1 Left</u> ;

  - Trial #1
    $n = 227,753$
    $\dot{n} = 11,387.65$
    $V_{Th} = 70.8$

- Trial #2

$$V_{Th} = 75.4$$

$$n = 20,679$$

$$\dot{n} = 1,033.95$$

- Trial #3

$$V_{Th} = 80.2$$

$$n = 20,030$$

$$\dot{n} = 1001.5$$

- Trial #5

$$V_{Th} = 85.8$$

$$n = 19,302$$

$$\dot{n} = 965.1$$

- Trial #6

$$V_{Th} = 90.1$$
$$n = 20,092$$
$$\dot{n} = 1004.6$$

- Trial #7

$$V_{Th} = 97.5$$
$$n = 19,486$$
$$\dot{n} = 974.3$$

- Trial #8

$$V_{Th} = 102.7$$
$$n = 19,790$$
$$\dot{n} = 989.5$$

- Trial #9

  $V_{Th} = 108.1$

  $n = 21,197$

  $\dot{n} = 1059.85$

- Trial #10

  $V_{Th} = 111.7$

  $n = 19854$

  $\dot{n} = 992.7$

- Trial #11

  $V_{Th} = 152.2$

  $n = 18317$

  $\dot{n} = 915.85$

- Trial #12

  $V_{Th} = 261.7$

$$n = 15848$$
$$\acute{n} = 792.4$$

- Trial # 13
$$V_{Th} = 161.9$$
$$n = 17,990$$
$$\hat{n} = 899.5$$

- Trial # 14
$$V_{Th} = 170$$
$$n = 17390$$
$$\acute{n} = 869.5$$

- Trial #15

$$V_{Th} = 181.5$$

$$n = 17,621$$
$$\dot{n} = 881.05$$

- ## Trial #16

$$V_{Th} = 190.1$$
$$n = 1739.9$$
$$\bar{n} = 869.95$$

- ## Trial # 17

$$V_{Th} = 40.3$$
$$n = 386,887$$
$$\dot{n} = 19,344.35$$

- ## Trial # 18

$$V_{Th} = 45.6$$
$$n = 56,657$$

$$\dot{n} = 2,832.85$$

Trial #19:

$$V = 56.2$$
$$n = 27,569$$
$$\dot{n} = 1378.45$$

Trial #20:

$$V = 57.2$$
$$n = 26479$$
$$\dot{n} = 1323.95$$

Trial #21:

$V = 64.7$

$n = 21833$

$\dot{n} = 1091.15$

_ Trial #22:

$V = 71.8$

$n = 23969$

$\dot{n} = 1,198.45$

Day #2:

Cosmics

Bar #1 Right :

- $V = 50 - 100 \text{ V}$ (every 10v)
- $t = 20 \sec$

Trials:	n :	V :
1.)	12,453	51.4V
2.)	13,307	60.4V

3.)   12,400   69.8V

4.)   11,014   81.4V

5.)   11,097   90.2V

6.)   9,562   100.1V

- $V = (100 - 150V)$ (every 10V)

7.)   8,238   110.6V

8.) 7,441 120.1V

9.) 6,374 130.5V

10.) 5,624 139.1V

11.) 4,880 150.8V

• $V = (0 - 45 v) (\frac{aov}{10v})$

12.) 466 0.3V

13.) 306,259   20√

14.) 62,981   30.5√

15.) 41,034   41.0√

16.) 17,676   49.8√

Bar #2   ⎱10/2
Data   Day 3

$$\bullet \; t = 20 sec$$

Bar 2
left

Trials

$(50 - 100)$ $(110 - 160)$
$(20 - 50)$

$V_1 = 50.2$

$n_1 = 11252$

$V_2 = 58.6$

$n_2 = 11284$

$V_3 = 69.5$

$n_3 = 10983$

$V_4 = 81.8$

$n_4 = 11171$

$V_5 = 91.5$

$n_5 = 11951$

$V_6 = 99.2$

MV

$n_6 = 10516$

$V_7 = 111.3$
$n_7 = 10660$

$V_8 = 120.5$
$n_8 = 10690$

$V_9 = 132.6$
$n_9 = 10724$

$V_{10} = 140.2$
$n_{10} = 10814$

$V_{11} = 149.99$
$n_{11} = 10255$

$V_{12} = 171.8$
$n_{12} = 10067$

$V_{13} = 199.1$

$$n_{13} = 9644$$

$$V_{14} = 230.2$$

$$n_{14} = 9288$$

$$V_{15} = 298.9$$

$$n_{15} = 6579 \qquad (20-50)$$
$$\downarrow$$

$$V_{16} = 22.1$$

$$n_{16} = 12414$$

$$V_{17} = 31.3$$

$$n_{17} = 13082$$

$$V_{18} = 40.1$$

$$n_{18} = 12138$$

: **Bar #2 Right**; (50-100mv)
(110-160mv)
(20-50mv)

Trials	V	n
1.)	50.9	14744
2.)	58.1	13962
3.)	71.7	12150
4.)	81.9	12212

5.) 90.7 10323

6.) 100.9 9210

7.) 110.5 7756

8.) 121.4 6433

9.) 130.7 5579

10.) 141.6 4969

11.) 150.4 4612

12.) 20.8   18627

13.) 30.2   17420

14.) 46.0   15977

(10/7/24) Trials (2-fold $^{Bar \#1}_{Left}$)

- $V = 85.8 \, mV$
- $t = 30 \, sec$

trials:	n:	t:
1.) $V = 85.7 mV$	2,942	30 sec

• $V = 150.2 \, mV$ $\left(\begin{array}{l} \text{Bar \#2} \\ \text{2-fold Left} \end{array} \right)$

$t = 30 \, sec$

$(n = 3445)$

2.)

3.) $\left(\text{4-fold trial} \right)$

$V_1 = 85.7 \quad mV$

$V_2 = 110.8 \quad mV$

$V_3 = 150.1 \quad mV$

$V_4 = 75.6 \quad mV$

$t = 30 \, sec$

$n = 139$

Ang Distributions

$t = 30\,sec$

trial #1	Angle θ	N
1.)	40°	106
2.)	80°	135
3.)	70°	115
4.)	60°	87

5.) $50°$ 59

6.) $40°$ 53

7.) $30°$ 33

8.) $20°$ 17

9.) $10°$ 12

10.) $0°$ 11

Tre delay (10/7

1.)
- $\Delta x = 6.44$ ns
- $\Delta x = 6.48$ ms
- $1/\Delta x = 143.3$ kHz

- $x_2 = 8$ ms
- $x_1 = 1.02$ ms

2.)
$\Delta x = 6.3$ ms
$1/\Delta x = 158.7$ kHz
$x_2 = 7.32$ ms
$x_1 \quad 1.02$ ms

3.)

$$\Delta X = 5.14 \, ms$$
$$1/\Delta X = 194.6 \, kHz$$
$$X_2 = 6.16 \, ms$$
$$X_1 = 1.02 \, ms$$

4.)

$$\Delta X = 4 \, ms$$
$$1/\Delta X = 250 \, kHz$$
$$X_2 = 5.02 \, ms$$
$$X_1 = 1.02 \, ms.$$

5.)

$$\Delta X = 2.80 \, ms$$
$$1/\Delta X = 357.1 \, kHz$$
$$X_2 = 3.82 \, ms$$
$$X_1 = 1.02 \, ms$$

6.)
$$\Delta x = 1.5 \mu s$$
$$1/\Delta x = 632.9 \ kHz$$
$$x_2 = 2.60 \mu s$$
$$x_1 = 1.62 \mu s$$

7.)
$$\Delta x = 0.44 \mu s$$
$$1/\Delta x = 2.27 \ MHz$$
$$x_2 = 1.46 \mu s$$
$$x_1 = 1.02 \mu s$$