

Overview

The Cosmic Rack (CRack) consists of ten vertically stacked rows of silicon strip modules. At both the top and bottom of this stack is a rectangular scintillator, roughly the cross-sectional area of the rows of modules. Each scintillator has a photo multiplier tube at each end, giving four total inputs to the CRack trigger system.

Images and schematics of the CRack system can be found at :

http://cms-ul-tmb.web.cern.ch/CMS_TMB/personal/anttila/crack/drawings.htm

Powering the PMTs

To turn on the PMT bias voltage:

- If the crate is not powered, push the button
- Pull the "HV enable" switch slightly toward you, and then up into the enabled position
- Select a channel by pressing F - 0 - # - <channel number> - #. Channels 0,1,2,3 are available.
- Check the target voltage by pressing F - 1 - #. To change the value: <value> - #.
- Check the ramp up rate by pressing F - 8 - #. To change the value: <value> - #.
- Ramp up the HV by pressing F - 10 - #.
- Repeat for the other channels

If you ramp up the HV without the HV switch enabled, nothing will happen. Press F - 12 - # and the channel status will go back to "off". Enable the HV and start again.

To turn off the PMT bias voltage:

- Ramp down the HV by pressing F - 11 - #.
- Repeat for the other channels
- Pull the "HV enable" switch slightly towards you, and then down into the disabled position.

PMT Bias Voltage

The four PMT's are powered by a CAEN forty channel high voltage power supply. The table below includes a signal frequency scan in each channel, in a voltage range of 1700-2100V (Performed on 17/06/2013 by Stephen Sirisky). Channels A/B correspond to the top scintillator, and C/D to the bottom.

Total number of signals / 100 sec.

Channel # / Letter	1700 V	1800 V	1900 V	2000 V	2100 V
O/A	5	325	4874	12457	31736
1/B	39	1694	9140	20786	401845
2/C	45	1279	7295	18045	80792
3/D	47	971	15398	17919	243594

To obtain a trigger rate of ~10 Hz, all four channels should be set to 2100 V. The trigger rate quickly diminishes with any lower voltages (even on individual channels), and higher voltages provide little gain in frequency due to the triple round coincidence required.

Trigger Electronics

The cosmic rack trigger includes the following electronics:

- Quad Discriminator, LeCroy 621AL

- Linear Fan In / Fan Out, LeCroy 428F
- (2) Four-Fold Coincidence Unit, LeCroy 465
- Octal Meantimer, LeCroy 624
- Quad Scaler and Counter Timer, CAEN N145
- Dual Timer, CAEN 2255B

Below is a circuit diagram of these items:



Timing Measurements

Discriminators and First Level Coincidence Units

Channel # / Letter	Length of Discriminator Pulse	Time between Discriminator Start and First Coincidence Start	Length of Coincidence Pulse
O/A	15 ns	25 ns (Disc. A and A/C Coincidence)	20 ns (A/C Coincidence)
1/B	15 ns	25 ns (Disc. B and B/D Coincidence)	10 ns (B/D Coincidence)
2/C	15 ns	15 ns (Disc. C and A/C Coincidence)	20 ns (A/C Coincidence)
2/D	15 ns	15 ns (Disc. D and B/D Coincidence)	10 ns (B/D Coincidence)

Other Coincidence Units

(A/C) / (B/D) Coincidence

- 20 ns pulse width
- Starts 15 ns from the beginning of a B/D coincidence pulse
- Starts 12 ns from the beginning of an A/C coincidence pulse

Mean Timer / [(A/C)/(B/D)] Coincidence

- 5-10 ns pulse width
- Starts 15 ns from beginning of (A/C)/(B/D) coincidence pulse
- Starts 15 ns from beginning of Mean Timer pulse

This topic: Sandbox > CosmicRackDetails

Topic revision: r4 - 2015-08-28 - JulieManaganHogan2



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