Scans

Threshold Scan

In order to test the detectors that we create, it is necessary for us to determine what the "background noise" is that we read from them. If you plug a detector into an oscilloscope you will notice that the frequency of strikes that it reads varies by the trigger level that is chosen. When the trigger level on the scope is very low it is not uncommon to get readings in the kilohertz. If your detector is within a solid building, then the frequency of strikes should be from 80-110 Hz. The rest of these signals are background noise. Put simply, they are voltage jumps within the wire unrelated to what we are measuring. In order to "tune" our detectors so that they will pick up cosmic rays and not this background noise, it is necessary to determine the threshold voltage of the photomultiplier tube. In other words find the voltage level of the background noise produces and only accept signals above that level.

The CROP DAQ software has a method of determining this voltage. In essence, the software takes readings from the DAQ card as you constantly increase the amount of voltage necessary for a signal to get through. You can use up to 4 detectors at a time for testing.

Efficiency Scan

Efficiency testing is a process used to determine how well the detectors function. To do this requires the use of what are called "trigger counters." These are counters whose efficiencies have already been mapped and deemed worth using. The process works via a method of linear strikes. Cosmic rays travel in very quick, straight lines. If you have detectors stacked vertically, it is possible for a particle to pass through all of the detectors. Now let's suppose that the top and bottom detector said that this particle passed through them, but the two detectors in the middle didn't get a reading on it. In this situation, it is very likely that the particle did go through all four detectors, but the center two simply missed it. We calculate efficiency by dividing the number of particles that went though all four detectors by the number that the top and bottom detected.

Experiment Scan

Experiment Scan is one of the five scans that can be done in the DAQ software. This scan is rarely used in CROP. It enables you to do an experiment that requires specific conditions. This usually requires discussing with a professor or someone that knows what they want and attempting to fulfill it with this scan. The experiment scan allows the user to customize a scan with a variety of options. These include repeated runs, setting up specific date and time to run a scan, the length of time for the scan to run, and to record data or not. If record data is chosen, then the data will be stored in a text file. This can be analyzed by using the Scan from Text File option in the software.

Once these options are chosen, additional settings are available. These settings are as follows: Preset DAQ card settings, Veto Settings, Data Delay, Gate Width, Veto Width, and Coincidence level. Within the Preset DAQ card settings, the options that are available are default, muon telescope, muon decay, array scan simulation. The user also has the ability to choose to eliminate specific detector channels and to shut off the GPS data.

Once the scan is configured to the user's specifications, the scan will start. When the scan is active, there are three tabs showing specific information about the data being collected. The first tab, Data Acquisition, displays the raw data collected by the detectors and interpreted by the DAQ card. The second tab, Counts, displays the amounts of counts per detector and the amount of coincidences between different sets of detectors. The third tab, Debugging, displays the first set of information that the DAQ card submits when starting the scan and the threshold levels of each detector.

Air Shower Array Scan

Air shower array scan is one of the five scans that can be done in the DAQ software. This is used to take experimental data from particle showers. The setup usually requires setting up 4 detectors in an array on a roof of a building. This can also be done in many other setups in different locations but the most common is a roof with a detector at each corner. With the current software version 5.2 and older, this scan requires a folder named Crop Data in the C: drive for this scan to work properly. If one does not do this, then a path error will pop up which can be viewed in the Troubleshooting section. This is the path location where all the experimental data is collected. This data is stored in a text file which can be read and analyzed by the Scan from Text File option in the software.

Scan from Text File

Scan from Text File is the only option in the software which is not a scan that deals with the detectors directly. The name of this option describes what it does effectively. It takes a text file from a past scan which would be from the array or experiment scan and it analyzes the data. This analyzing gives the user a variety of options to organize and view the data from the chosen text file.

There are five tabs in this given option: Event Parser, Events & Coincidence Analysis, Event & Coincidence Counts, Singles Counts Analysis, and Debugging. Event Parser tab allows the user to select a range of time to view raw data that fits to the specifics that the user selects. This can be viewing data that has coincidences between any given detectors to only viewing one detector with valid GPS. The Event & Coincidence Analysis tab allows the user to select a range of time to view the number of events in a graph. There is also a histogram showing the coincidences between the detectors. The Event & Coincidence Counts tab is similar to the Counts tab in the experiment scan. It displays the amounts of counts per detector and the amount of coincidences between the detectors while also listing event statistics. The Singles

Counts Analysis tab has two graphs that display the amount of events over time for each specific detector and change in singles counts over time. The Debugging tab is similar to the Debugging tab in the experiment scan. It displays the first set of information that the DAQ card submits when starting the scan and other information such as GPS data.

Singles Rate Scan

Singles rate scan is one of the five scans that can be done in the DAQ software. Single rate scan is a scan where you can look at the detectors at a specific set of conditions such as a set threshold and time. It is very similar to threshold scan but instead of it constantly increasing in voltage increments by manual or electronic (5.0 software) control, it only stays at the condition you set it to until it is stopped. In other words, it is just one of the increments of the threshold scan. This is useful if there is something strange going on at a set threshold and you just want to look at the detector at that value or the threshold scan program is giving you errors. You could do a whole threshold scan manually using this kind of scan if need be. This scan however does not create a excel file such as the threshold, so the user will have to manually copy over the data into a file if one chooses to do a whole threshold scan.