

# Quarknet: Muon Detectors

## Participants

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## Purpose

To collect data and test our hypothesis that changes in some elements of solar wind cause changes in muon flux.

## Equipment

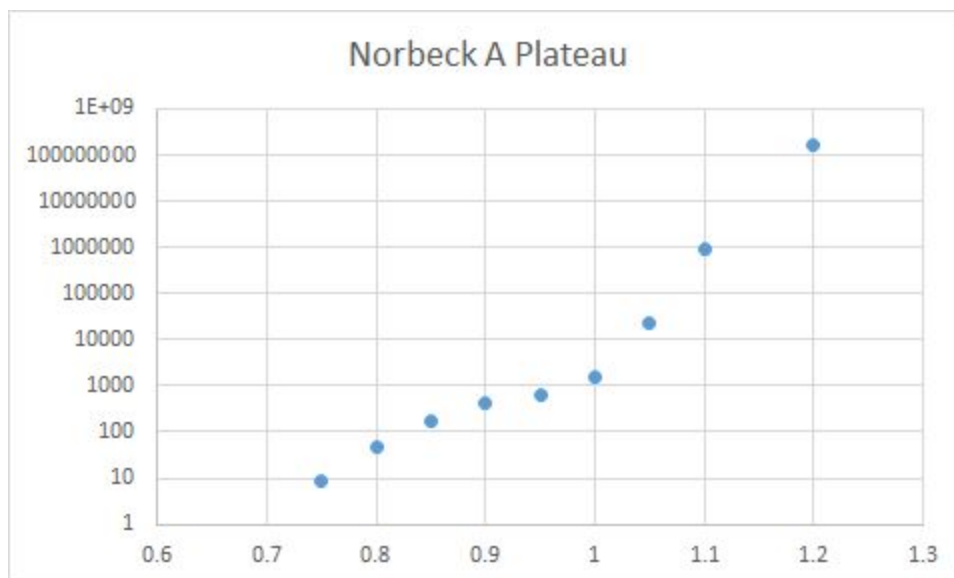
- Muon Detector Panels

## Procedure

Prior to data collection, we needed to test the muon detectors on hand and we needed to calibrate each detector to the correct voltage.

We first tested each detector to see if data were being collected. If one were not working, we isolated the problem with the detector to one of its component parts. This included checking the power supply, all connections among the cables, and the panels themselves.

Once the panels were checked, it was necessary to calibrate the panels to a stable voltage. This process involved collecting data at multiple voltages and comparing the number of muon detections. The goal was to find the voltage at which the detection reached a plateau value while voltages higher and lower than that value were steep when graphed, as seen below (where the plateau is between .9 V and 1 V).

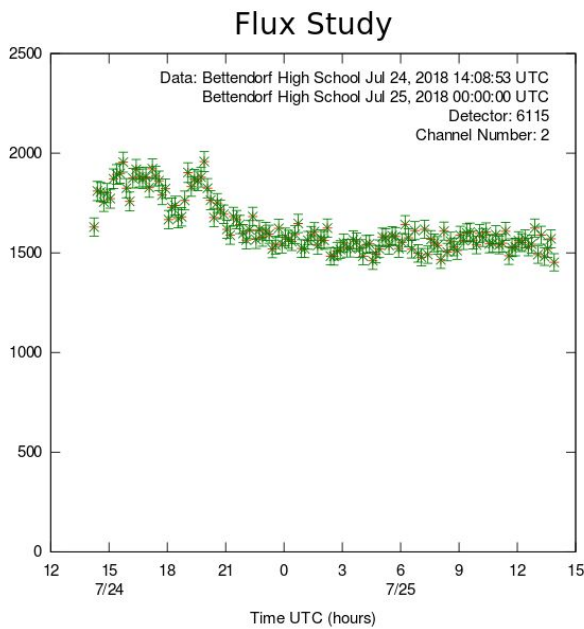


The amount of data collected by the panels and the voltage are positively correlated, and finding the plateau value is critical to controlling whether the panels over- or under-record the number of muons passing through them.

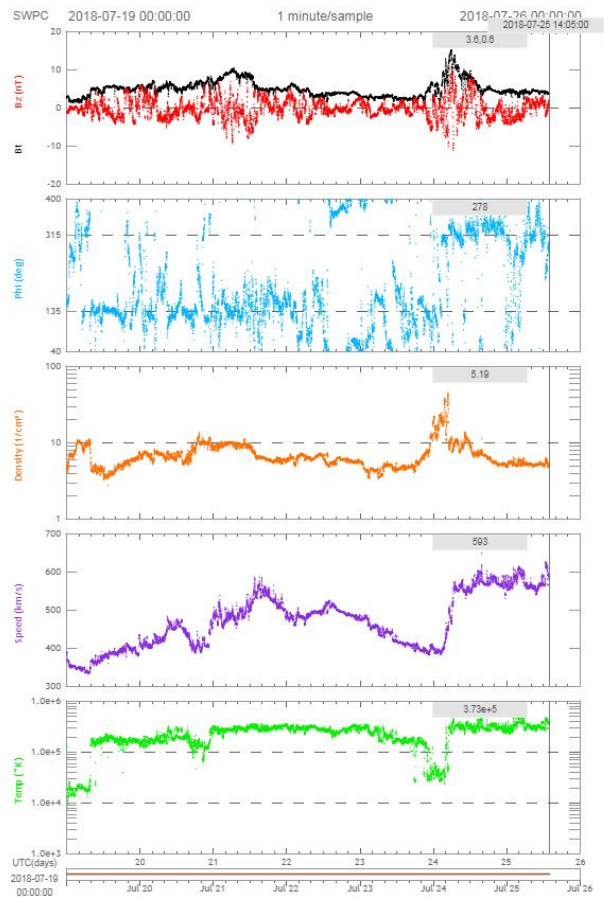
From here, we were able to start reliably tracking muon detection

### Analysis

After running our detectors in a stacked orientation for a few days, we were able to gather enough data to start making hypotheses about relationships between our data and other natural phenomena. After some preliminary research, we decided to investigate links between muon flux and various elements of solar wind. We compared our data to the available data on solar wind at <https://www.swpc.noaa.gov/products/real-time-solar-wind>. There appears to be some relationship between spikes in muon flux and spikes in magnetic field strength, phi, density, temperature, and speed of solar wind (see graphs below).



**Flux Study and Solar Wind**



## **Further Research**

Further inferences about the relationship between muon flux and solar wind could be made with more data. Our setup is capable of collecting more, and would simply need to continue running. Otherwise, running different orientations to do a shower analysis could provide interesting insight into other relationships between solar wind and cosmic rays.