May Status report
Maple Leaf Particle Detector

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1 Activities

The team now has a fully functional prototype. This includes: a fully working PCB, completed and assembled shielding, and working firmware. A second board is completed as well, but is not yet fully functional. Work has begun on machining metal for the flight model, as well as populating additional PCBs for weather balloon flights. Weather balloon flights will be taking place in June and July. The first PCB's high voltage component was encapsulated and the PCB performed well in the low pressure testing at DFL.

The team attended a two-day project management course organized and delivered by the University of Alberta School of Business and learned a number of valuable skills to better coordinate our efforts and to manage the project more effectively.

1.1 David Florida Laboratories Testing

The team flew to Ottawa, Ontario on May 15th to conduct high altitude and thermal testing at the Canadian Space Agency's (CSA) David Florida Laboratories (DFL). The testing was a complete success. We arrived in Ottawa on May 15th and testing was scheduled to begin May 16th. The team was first given a tour of the facilities and began thermal testing at approx. 1:30pm. The testing lasted 4 hours, with the temperature first being dropped at 3°C per minute down to −50°C and held there for 2 hours. The temperature was then increased at the same rate up to 50°C and held there for 30 minutes. The payload was then allowed to cool to room temperature and testing ceased. The payload performed flawlessly during this test, however there were some minor computer issues. On the following day, altitude testing of the payload was performed. The payload was cooled to −50°C and the pressure being dropped from 760 torr to 6.5 torr in 20 minutes. This pressure was held for 2 hours, and then was returned to atmospheric pressure. There were no issues with the payload during the test, and the previously mentioned computer issues had been fixed.

1.2 Testing Results

The payload withstood both the temperature and the vacuum test undamaged. The high voltage only showed minimal fluctuations in the range of $492 - 498$V, which is a result of the high voltage control/modulation circuit. Therefore, the Geiger tubes were operational during the test, and no short circuiting, or arcing in the high voltage part of the PCB was observed. Thus, the team concluded that the coating of the PCB is sufficient to avoid any arcing in low pressure environments.

During the vacuum test the counts per second measured of the Geiger tubes remained approximately constant (within the random fluctuation of radioactive decay). During the temperature test however, the count rates of Geiger tube (#3, #2) spiked during the heating and warm temperature phase (50°C). This, issue will be further investigated by the team in additional testing in the coming weeks.

Due to the earlier mentioned computer problems, gaps are present in the thermal test data corresponding to whenever the computer was unable to save the data. [1].

[1] see appendix for graphs

2 Design/Development Issues

The second board that was populated has had issues since it has been completed, but the error has been identified and replacement parts ordered. All components on the remaining PCB must be hand soldered due to a lack of ventilation, and wiring problems in the new electronics shop, which will slow progress of the assembly of the third and fourth PCB. Additionally, Geiger tubes 4-12 have not arrived yet, which possibly will delay weather balloon test flights.

3 Milestones

Operating prototype	May 9
Project Management course	May 13-14
Successful testing at DFL	May 15-17

Table 1: Completed Milestones

Start of weather ballon launches (testing of components)	(Mid May-June)
Final PSIP document	(Jun 1)

Table 2: Upcoming (June) Milestones

4 Personnel

Nothing to report.

5 HASP questions

Counts given the geometry of Geiger tube? The effective cross sectional area of the Geiger tubes is 346.7mm^2. Using the calculated hadron flux rates at 80000 feet by K. O'Brien et. al. [2], the expected count rates for the Geigers used in the particle detector have been determined as

Energy Range	Expected Counts (counts s^{-1})
$50\text{MeV} - 100\text{MeV}$	0.26
$100\text{MeV} - 150\text{MeV}$	0.13
$> 150\text{MeV} - 1\text{GeV}$	0.09

[2] Atmospheric cosmic rays at aircraft altitudes,K. O'Brien, W. Friedberg, 1994

Appendix

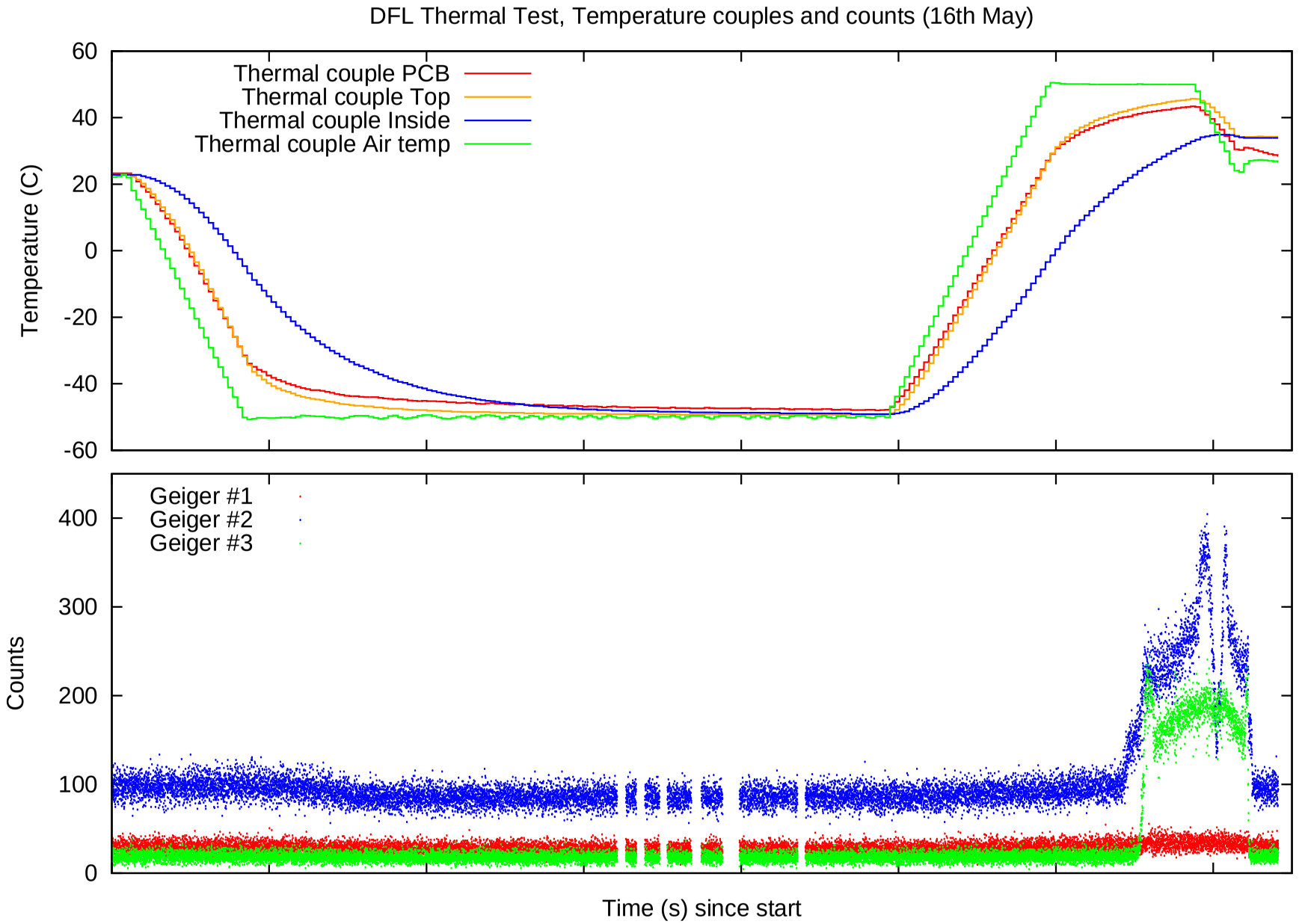

Figure 1: Test results from thermal test at DFL (May 16th)

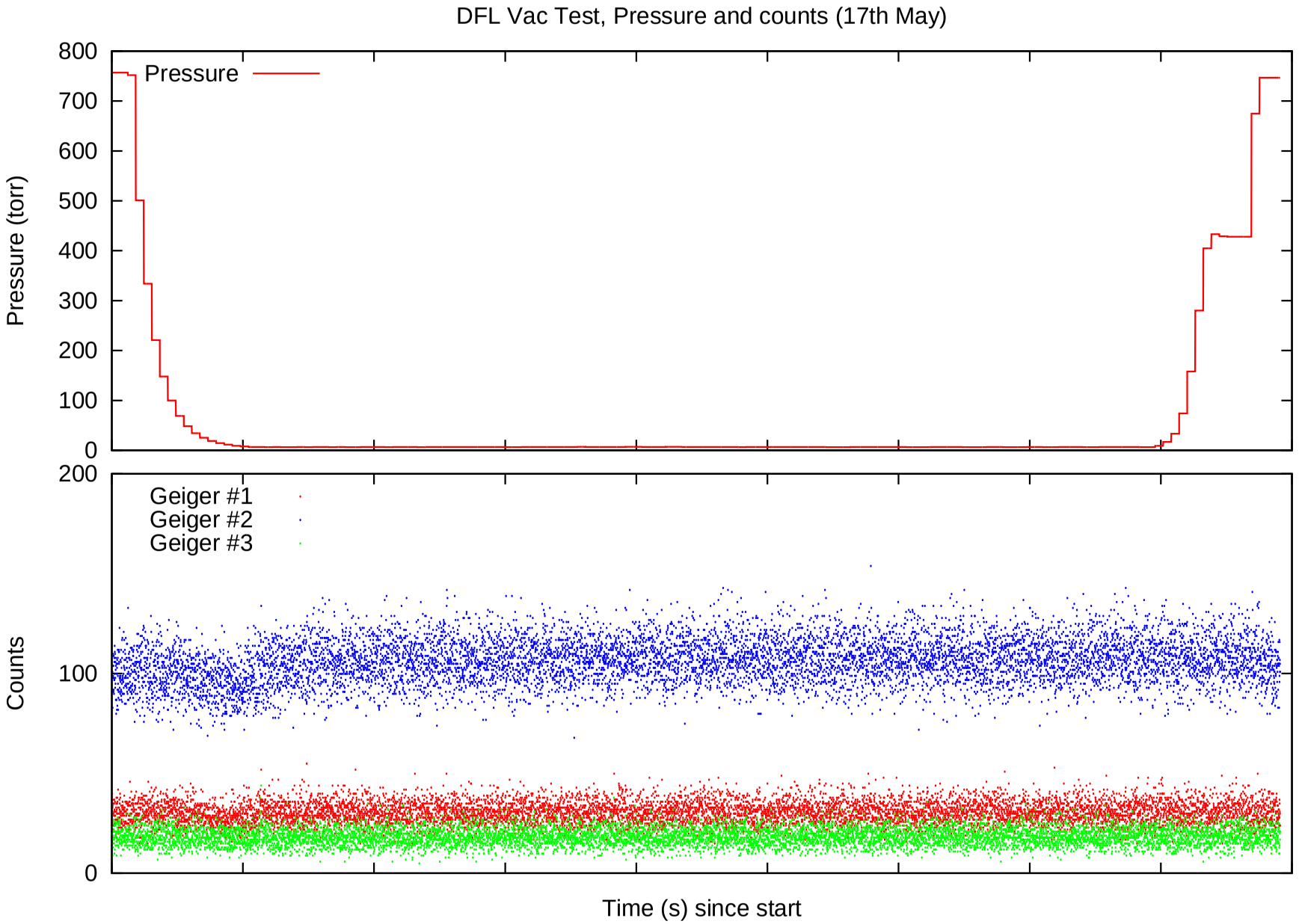

Figure 2: Test results from Vac test at DFL (May 17th)