



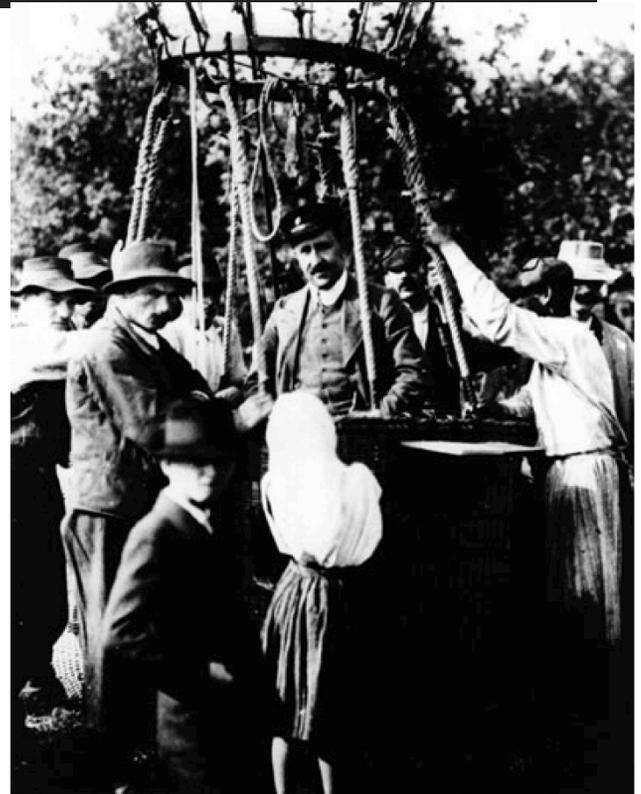
High Altitude Cosmic Ray Radiation Detection

Ben Holland, Lindsey Hart, Will Martin, Doug Smith



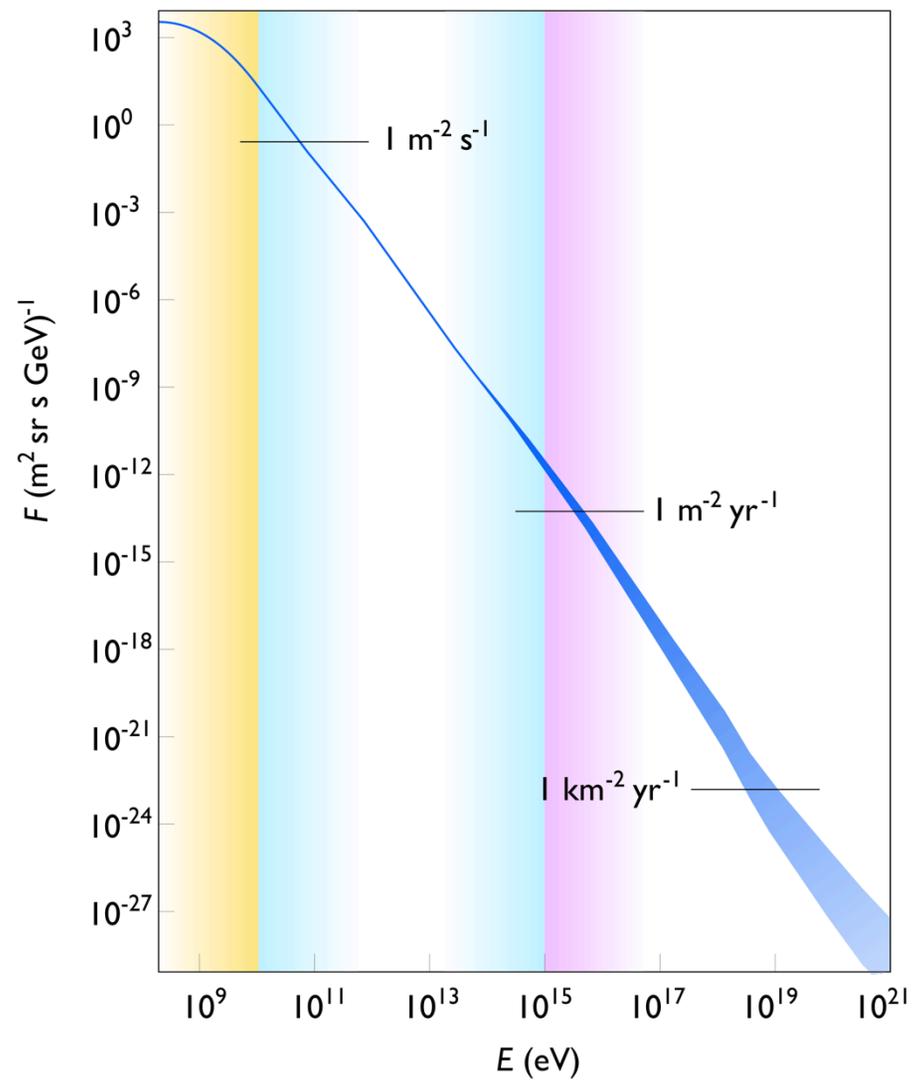
Hess' grand experiment

- Took to the skies between 1911-1913
- Radiation increases with altitude
- Won nobel prize in 1936
 - Opened door to particle and nuclear physics



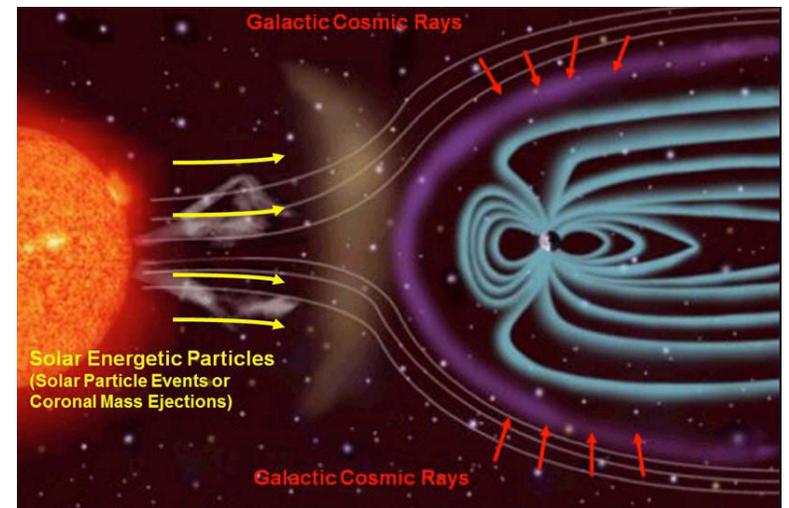
High altitude cosmic ray

- Constantly being bombarded by particles from space
- Most are low energy events



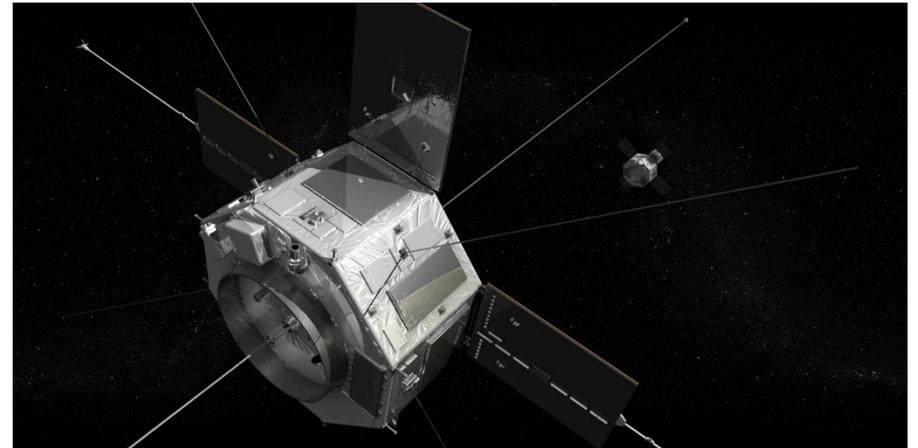
Where do they come from?

- Low energy → Sun, local sources
- High Energy → Extragalactic (?)



Why do we care?

- Effects on electronics
 - Satellites, Probes
- Cause air ionization in the atmosphere



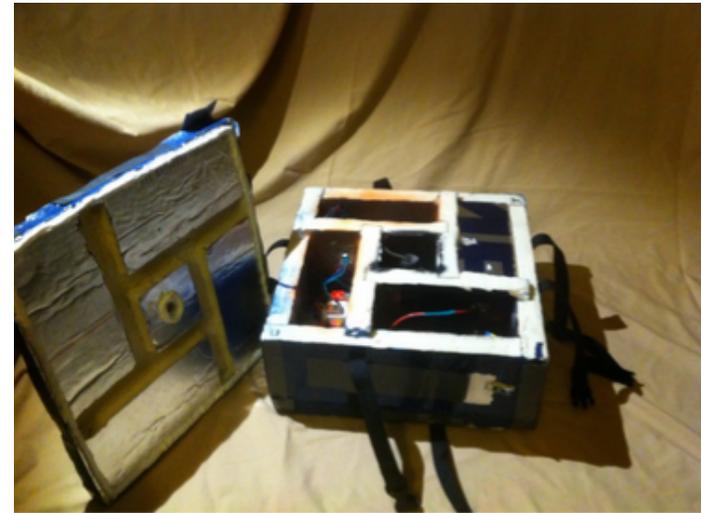
Our Task

- Construct a payload for COSGC
 - <1.5 kg
- Fulfill class requirements
- 8 Weeks



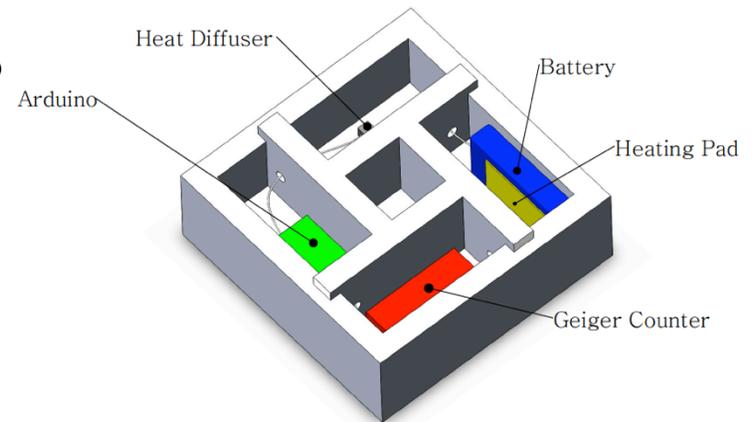
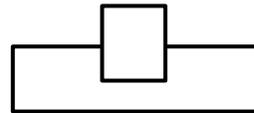
Design - Structure

- Thermally insulate experiment and protect from moisture
- Ensure mass limitations are met and that mass is centered
- Mass limit: 1.5kg
- Protect experiment throughout freefall and landing



Design - Structure

- Laminated, rigid foam ins
- Rabbet jointed
 - Hot glue
- Non-conducting paint
- Silicone Seal
- Strap and buckle design
- PVC tube for flight string

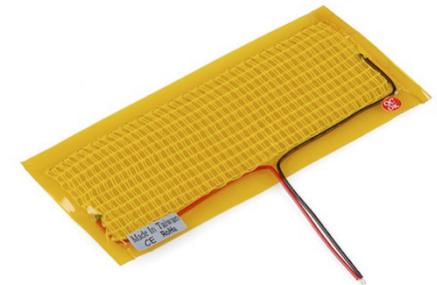


Testing

- **Our testing procedures consisted of those stated in the Demo-Sat information, but we did;**
 - Drop tests
 - Whip testing
 - Shake testing
 - High voltage vacuum test
 - Electric runtime testing
 - Cold temperature testing

Temperature Control

- The testing equipment requires temperatures above 0°F to perform optimally. So to ensure good measurements throughout the flight time, a heating pad was added to the payload.



Data acquisition

- Geiger Counter
 - Accurate events counts
- Arduino based microcontroller
 - Low cost and versatile implementation



Power Supply

- The Power supply chosen was a 11.1v 5500mAh, Lipo, DC Battery.
- Maximum estimated electrical consumption at any given time by the system was 636mA.
- Giving an approximate run time of ~8 Hours.



Launch Day

- Temperature: 18°F
- Wind Speed: East 8 mph
- Humidity: 73%



Launch Day

Launch Site: Windsor,
Colorado

Payload Landed: Farms
outside of Snyder, Colorado

Total Mass: 1.3 kg



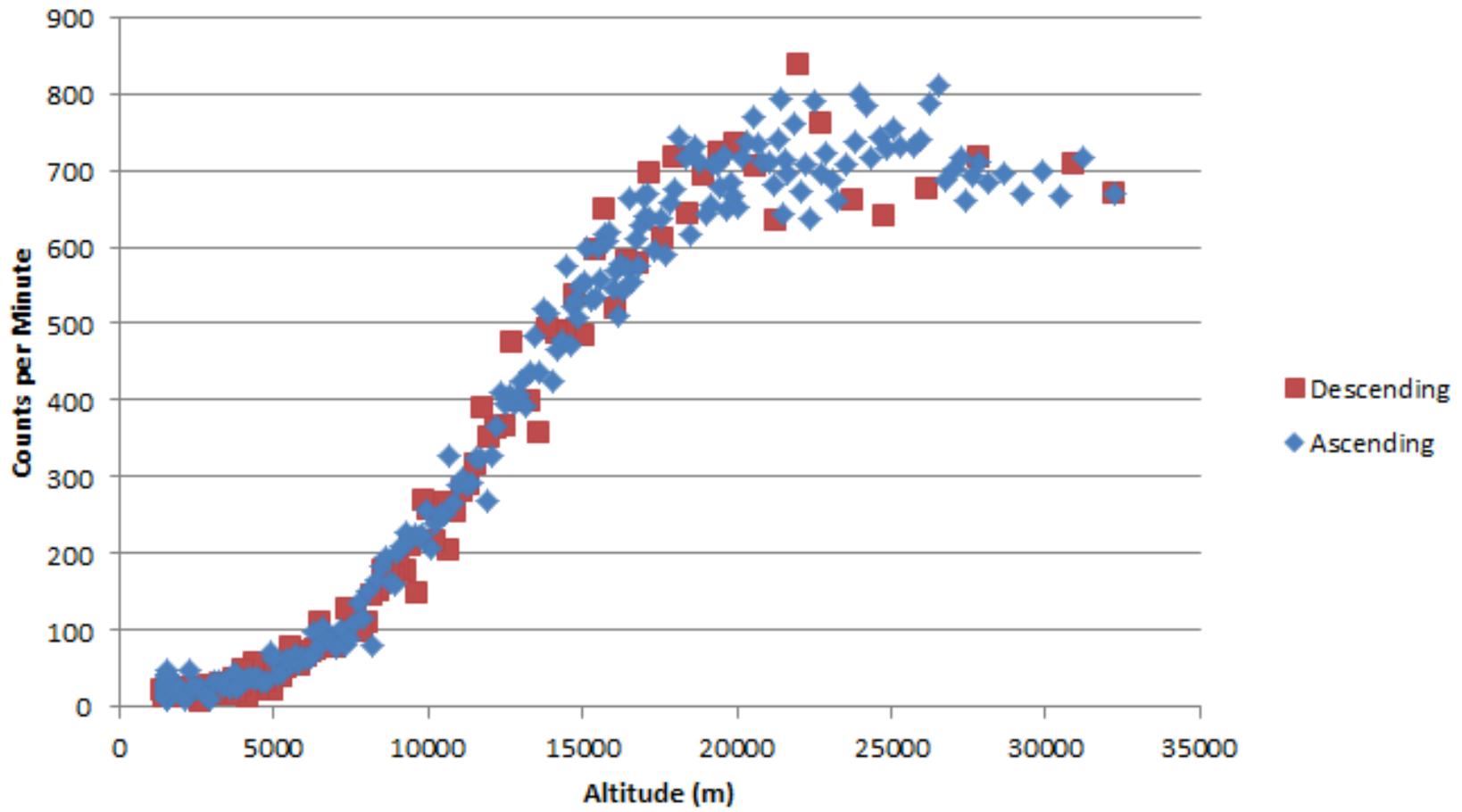
Results - Goals

- data collection
 - Hypothesis: As altitude increases, there will be an increasing number of particles reported by a Geiger counter.
- successful structure
 - thermal insulation
 - protected all components

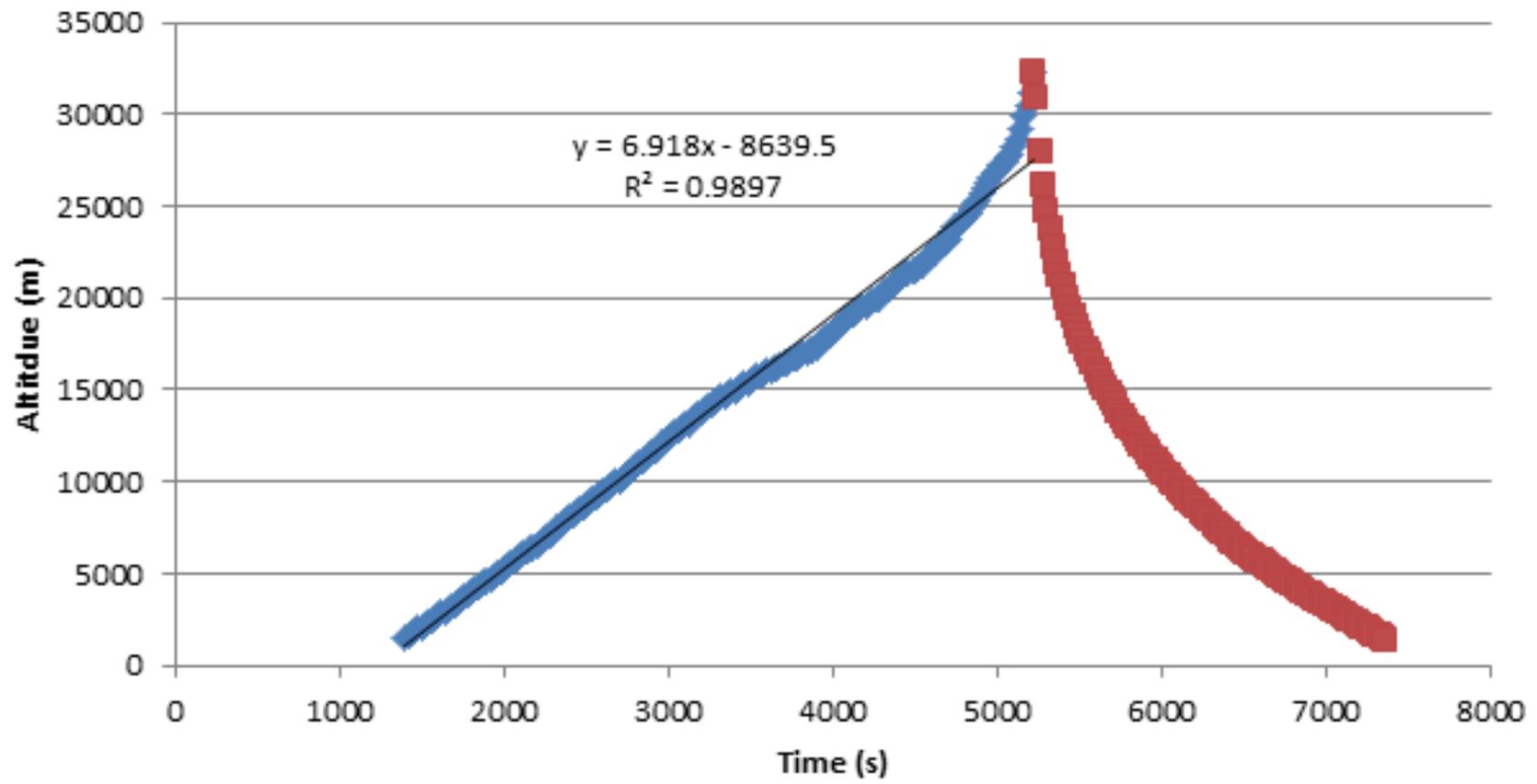
Results - Data Table

CPM	ALT (m)	Pressure (kPa)	Temp (F)	Time (H:M:S)
708	30923.77	5.4	50.8	1:27:20
717	27879.17	5.7	50.8	1:27:40
675	26182.17	6.1	50.8	1:28:00
639	24781.27	6.5	50.8	1:28:20
660	23733.87	6.9	50.7	1:28:40
759	22761.17	7.4	50.9	1:29:00
837	21986.37	7.8	50.9	1:29:20
633	21280.17	8.3	50.9	1:29:40

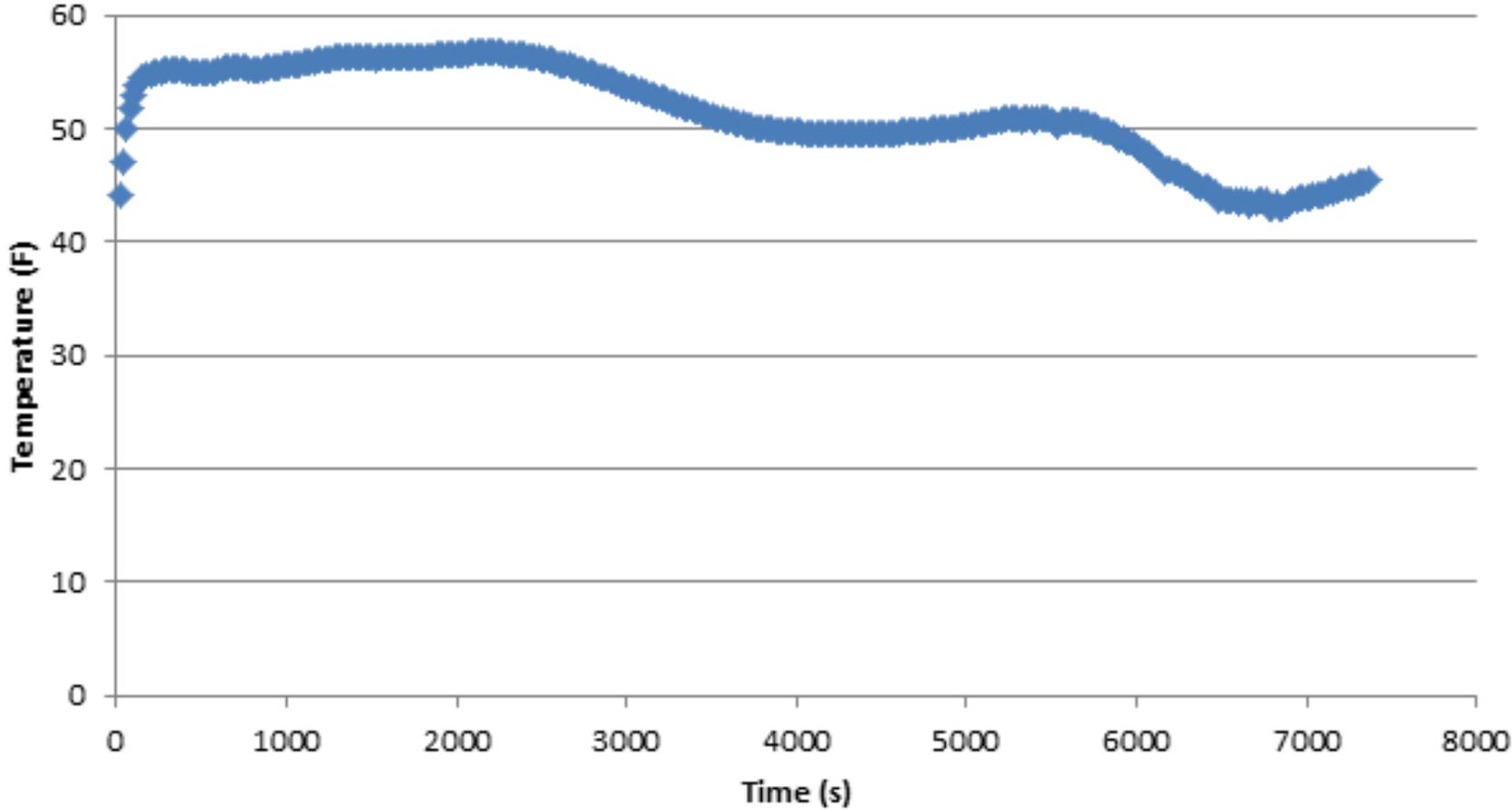
Counts vs. Altitude



Altitude vs. Time



Temperature vs. Time



Goals

- data collection
 - Hypothesis: As altitude increases, there will be an increasing number of particles reported by a Geiger counter.
- successful structure
 - thermal insulation
 - protected all components

Conclusion

- Rapid Development
- Data collection
- Met all design goals
- Low Cost
- Being used as a baseline for other COSGC projects

Thank you to...

- COSGC
- Colorado School of Mines Epics Department
- Our advisors and mentors



Questions?

