

### Overview

a high altitude ballooning Physoon, payload, was designed and built by to investigate cosmic and students terrestrial sources of high-energy Of particular interest are radiation. called terrestrial gamma-ray events flashes (TGFs) and gamma-ray glow, both of which occur in thunderstorms.





flown above Physoon has thunderstorms, through thunderstorms, in the totality of The Great American Solar Eclipse, and during sunny daytime conditions as a control. These flights advance help the can understanding of the different physical processes that lead to increased radiation from thunderstorms.

# **Testing of Instrument**

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0	2 4 6	
	Time After Launch (s)	$\times 10^4$

In addition to drop tests and rain tests, we performed a 24 hour duration test to verify the operation of the instrument. The instrument was left running on the ground in a low radiation environment.

# Radiation Detection in Various High Altitude Environments Christopher Helmerich<sup>1</sup>, Everett Cavanaugh<sup>1</sup>, Sarah Dangelo<sup>2</sup>, Cory Wolfe<sup>2</sup>, Jennifer Miller<sup>1</sup>, Ian Slamen<sup>2</sup>, Sean Widmier<sup>2</sup>

# Instrumentation

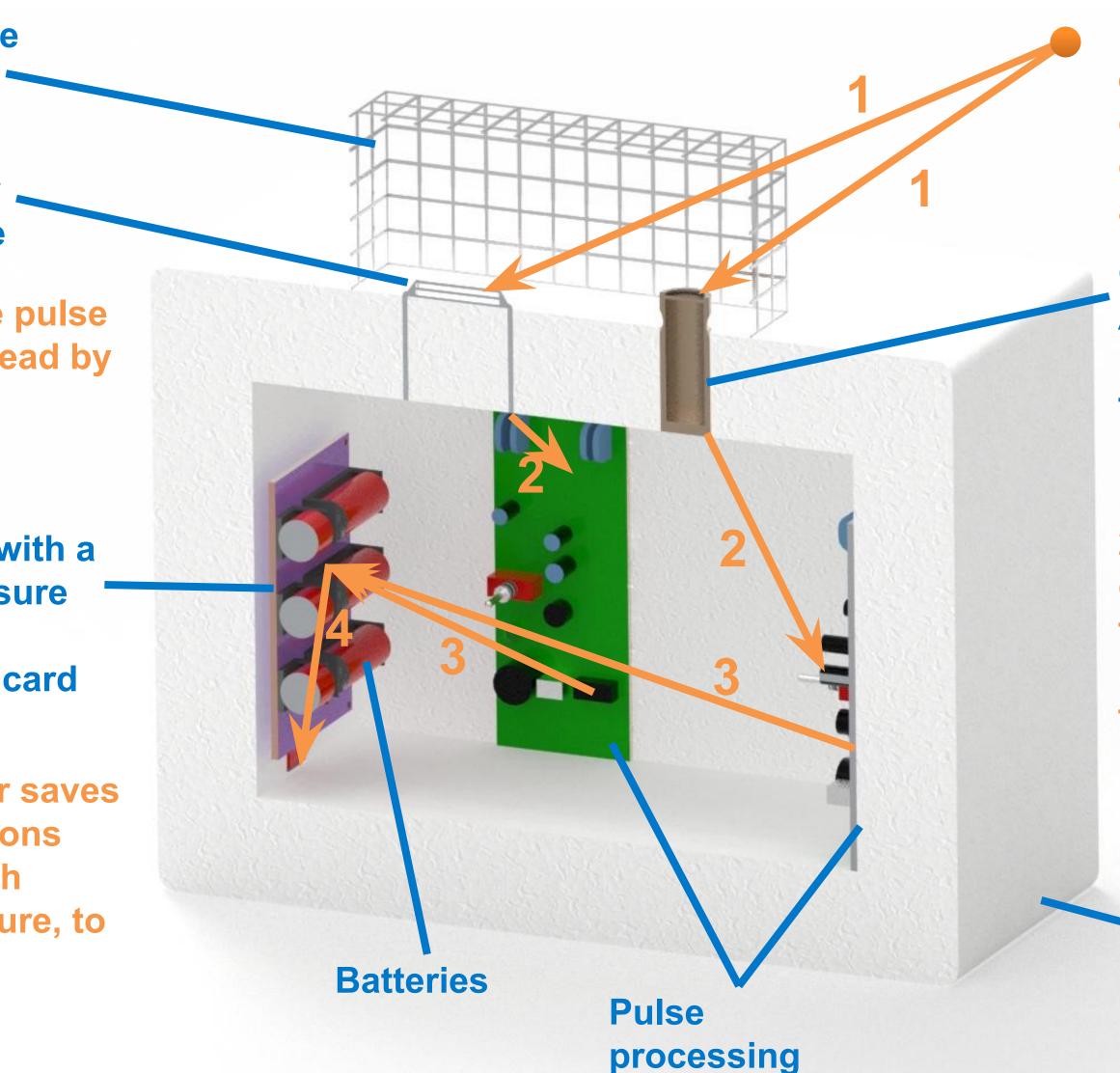
Cage to protect fragile detectors on landing

**GMT-06** Beta-gamma detector **Neon-filled glass tube** 

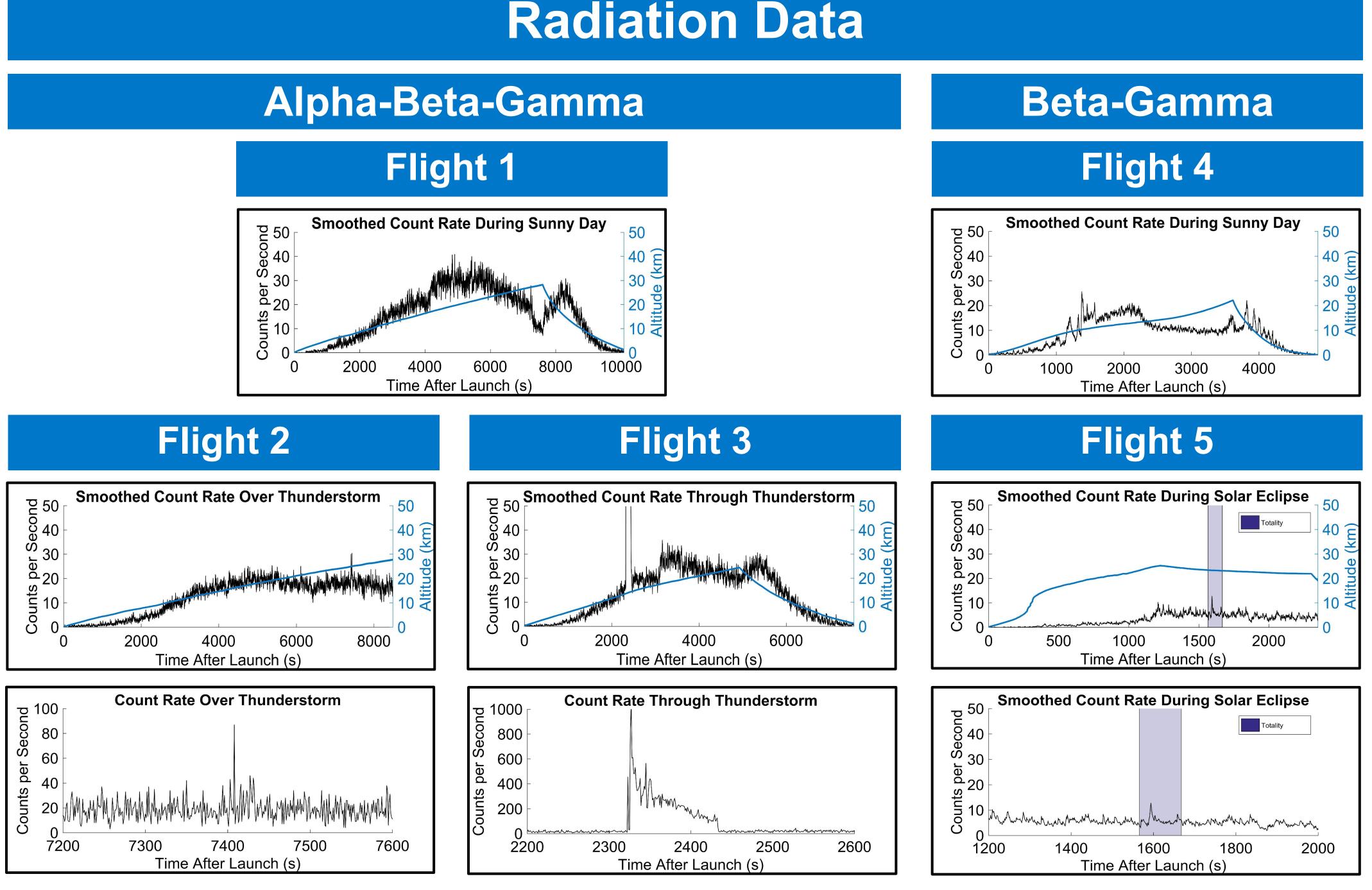
3. The signal from the pulse processing board is read by an analog to digital converter on a microcontroller

Printed circuit board with a microcontroller, pressure sensor, temperature sensor, and microSD card reader

4. The microcontroller saves the number of detections per second, along with altitude and temperature, to a microSD card



boards



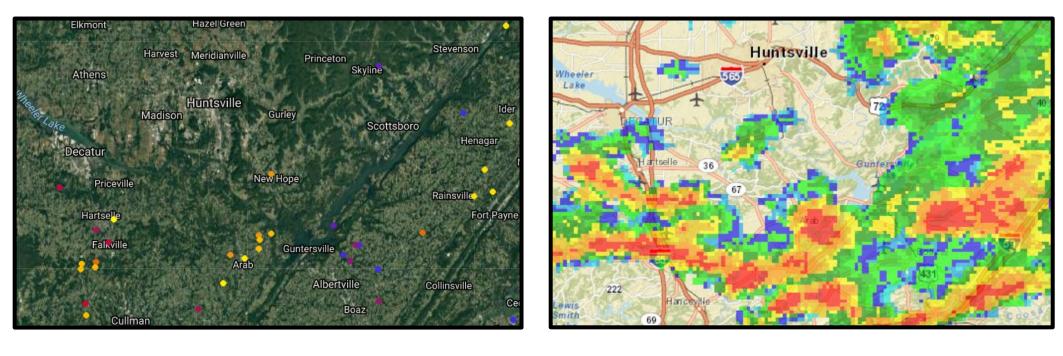
**1. A high energy particle** enters the alpha-beta-gamma detector or beta-gamma detector and starts an avalanche of electrons

**GMT-01** Alpha-beta-gamma detector Neon-filled copper tube with a thin mica window

2. The avalanche of electrons creates an electrical signal that is sent to the detector's pulse processing board, which filters and amplifies the signal

> Styrofoam box for thermal insulation

Radiation events were cross checked with satellite data from SWIFT and FERMI to confirm the events were not of extraterrestrial origin. Event time stamps were correlated with nearby lightning strikes and radar maps. When with data taken comparing control the flights, this during day sunny the high radiation suggests energy events are due to thunderstorm activity.



the promising results from Due to several Physoon flights, a new project named "HELEN" has been formed. HELEN will consist of three payloads with onboard scintillation material and timing to gather spectra, accurate neutron rates, and location information of these events in thunderstorms.

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### Verification of Data

# Conclusions

### Acknowledgements

