

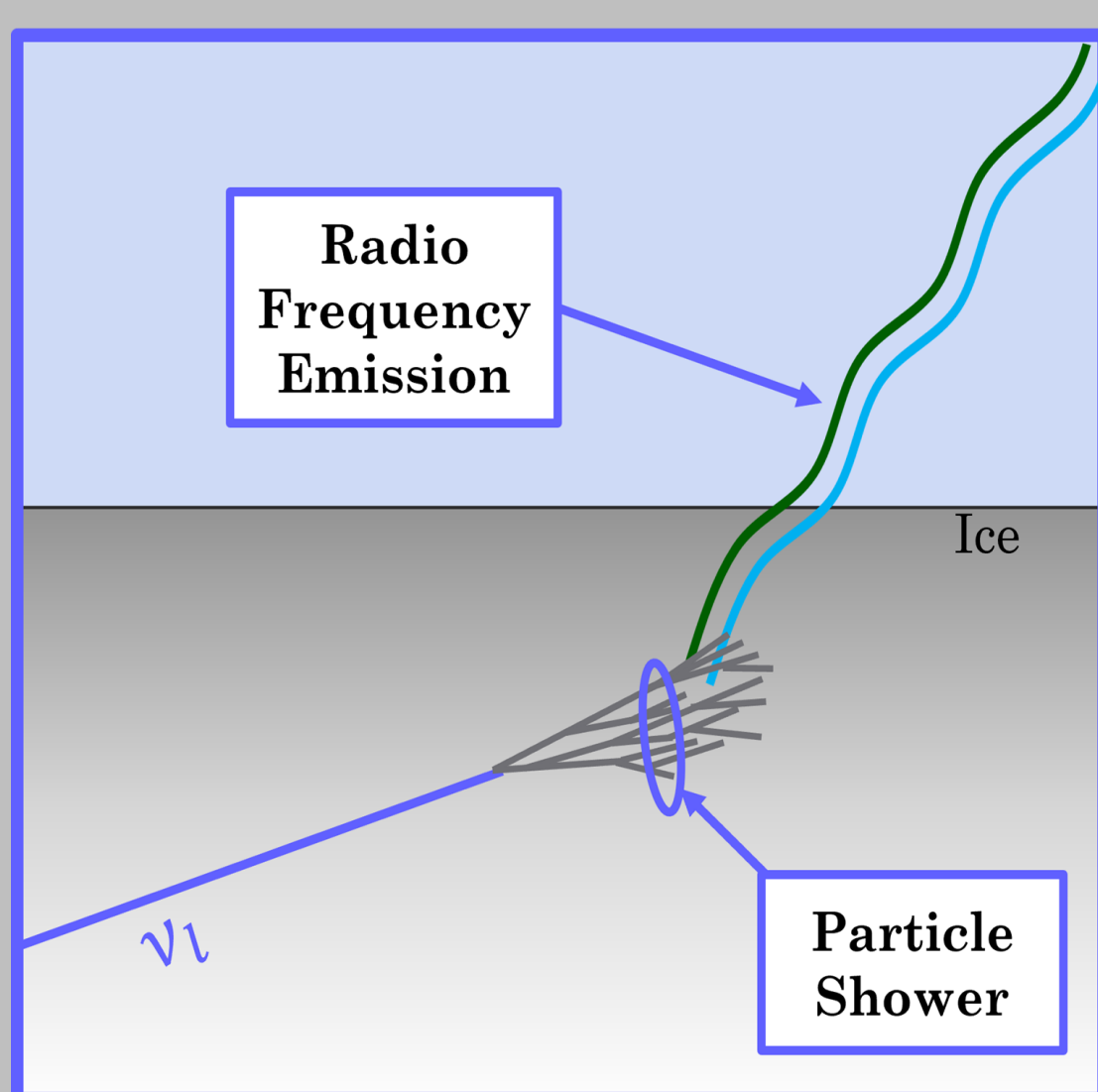
# Towards the Detection of Ultrahigh Energy Neutrinos with PUEO



Taylor Coakley\* for the PUEO Collaboration  
Center for Cosmology and AstroParticle Physics (CCAPP),  
Department of Physics, Ohio State University



## Introduction



### Askaryan Radiation

A particle traveling faster than the speed of light in a medium → Cherenkov radiation

Coherent Cherenkov Radiation → Askaryan

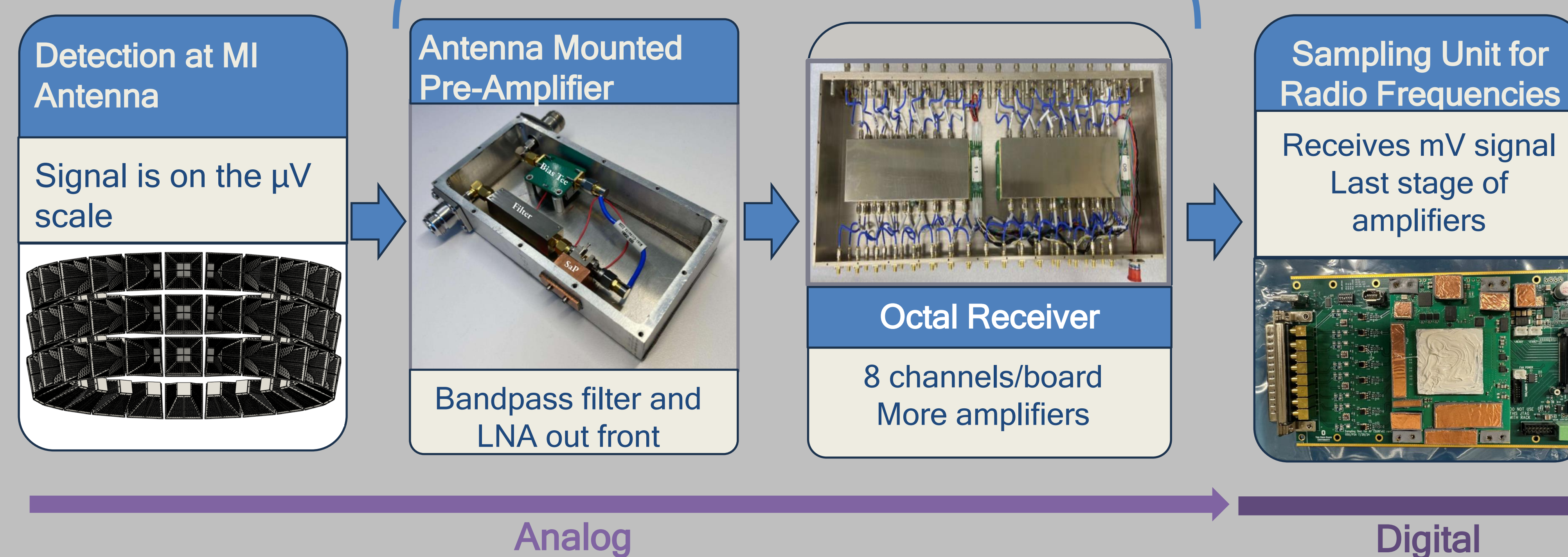
### Payload for Ultrahigh Energy Observations

A long duration balloon experiment launched from Long Duration Balloon (LDB) Facility, Antarctica in December 2025 (see R. Scrandis's poster!)

Aims to study the most distant astrophysical sources

## RF Signal Amplification Chain

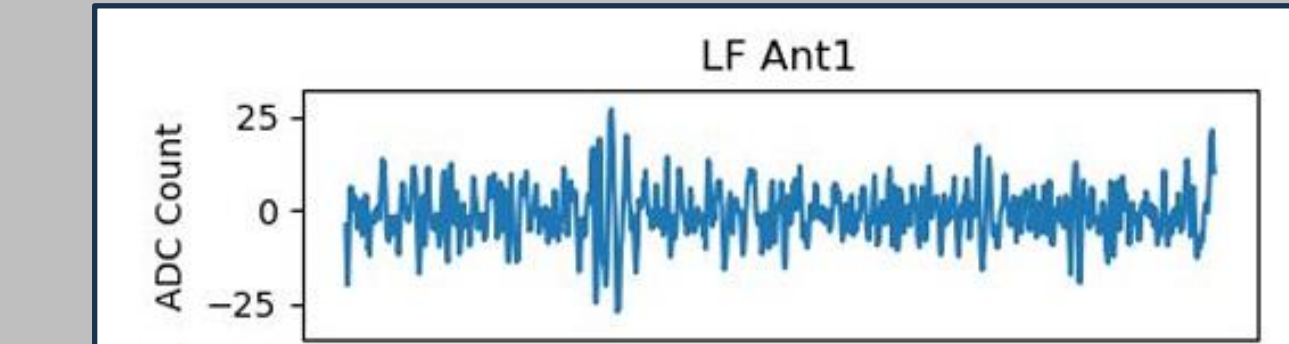
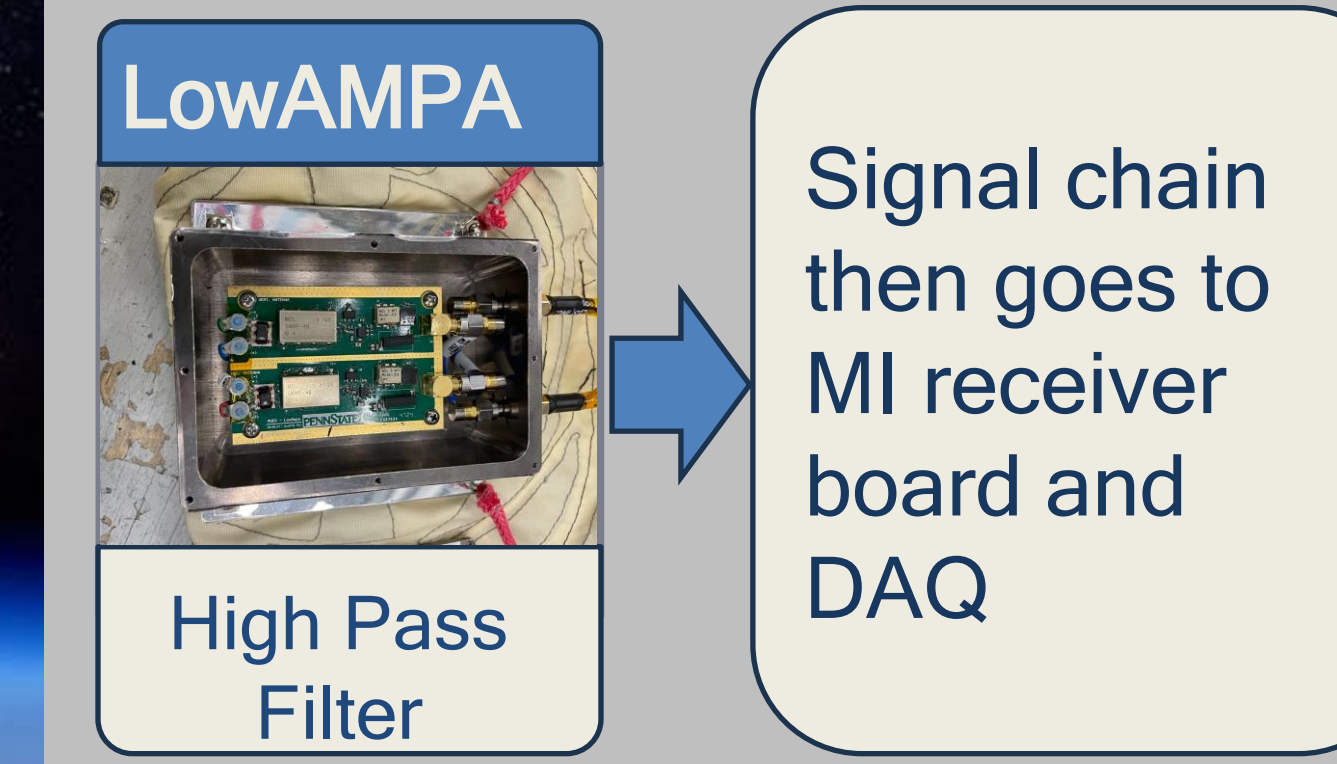
68 dB of amplification



## LF Instrument



The LF instrument helps to reject Cosmic Ray (CR) background from the data



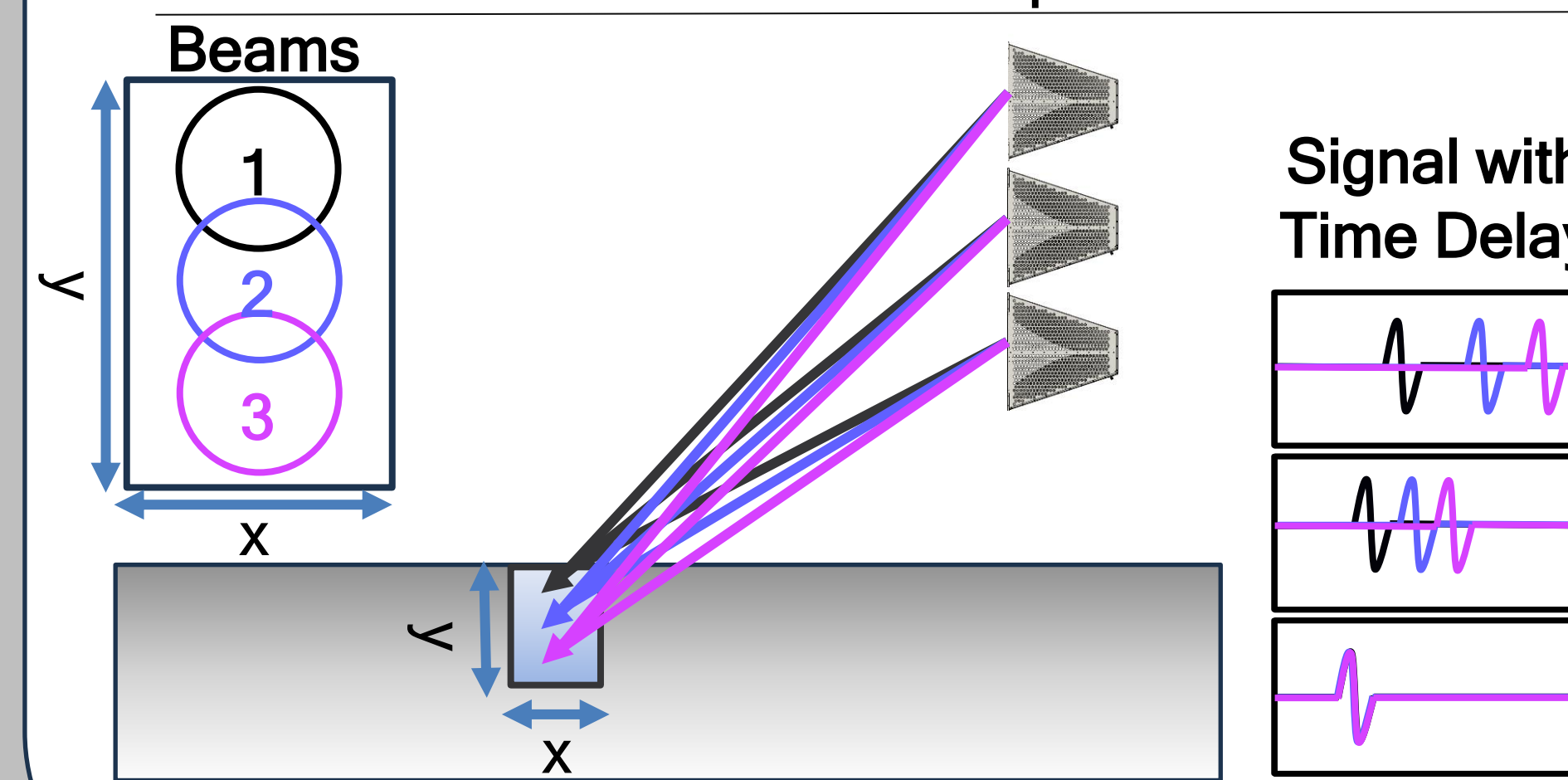
Example of LF Read-Out

## Data Acquisition (DAQ) System

Responsible for real time processing of the data at a 3 Gbps rate  
Used phased array trigger

### L1 Trigger

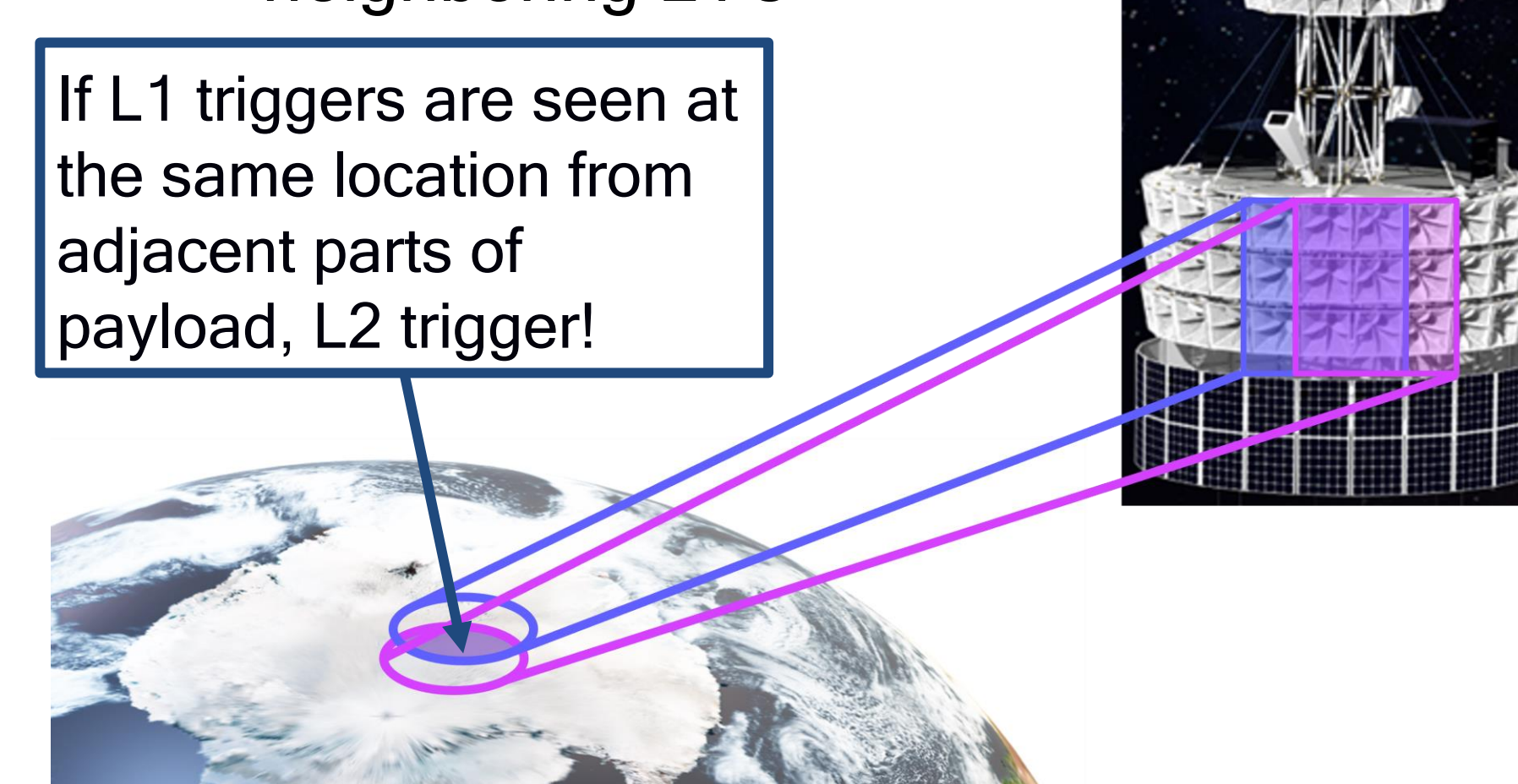
Delay and sum beamforming using known delays based on antenna position



Trigger Rate: ~1 kHz

### L2 Trigger

With a coincidence of neighboring L1's



Trigger Rate: ~100 Hz

## Subsystems

### Phi Sector

- 4 Antennas along the same azimuthal angle

### Main Instrument Antennas

- x96 dual-polarized, quad-ridged horn antennas
- Bandwidth → 300 - 1200 MHz

### Main Instrument Enclosure (MIE)

- Houses all instrumentation
- RF tight
- Covered in reflective tape for passive thermal control

### Deployable Solar Panels

- Photovoltaic (PV) array provided 1800W

### Science Instrument Package (SIP)

- NASA CSBF electronics to control telemetry and commanding
- Covered in reflective tape for passive thermal control

### Deployable Low Frequency Instrument

- x8 Sinuous antennas
- Bandwidth → 50 - 500 MHz

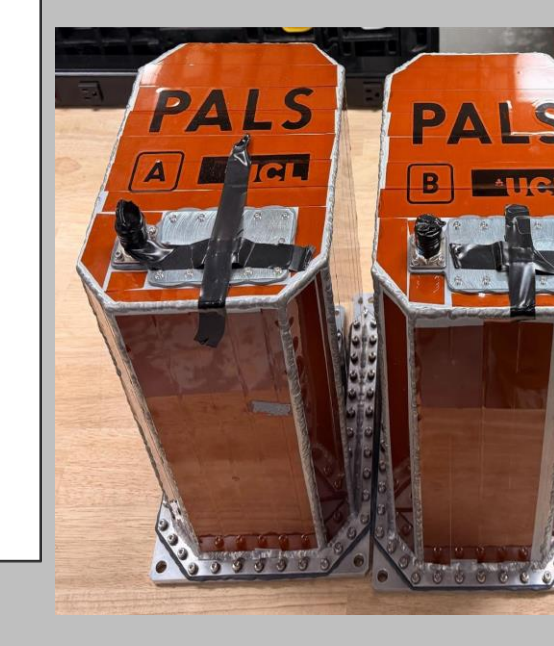
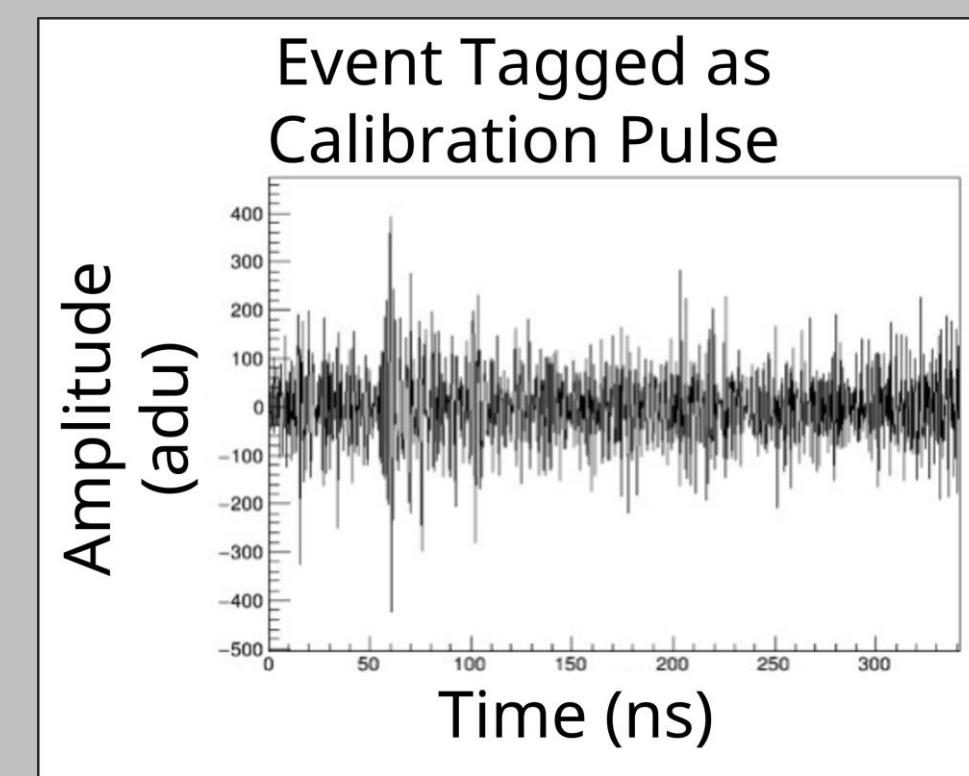
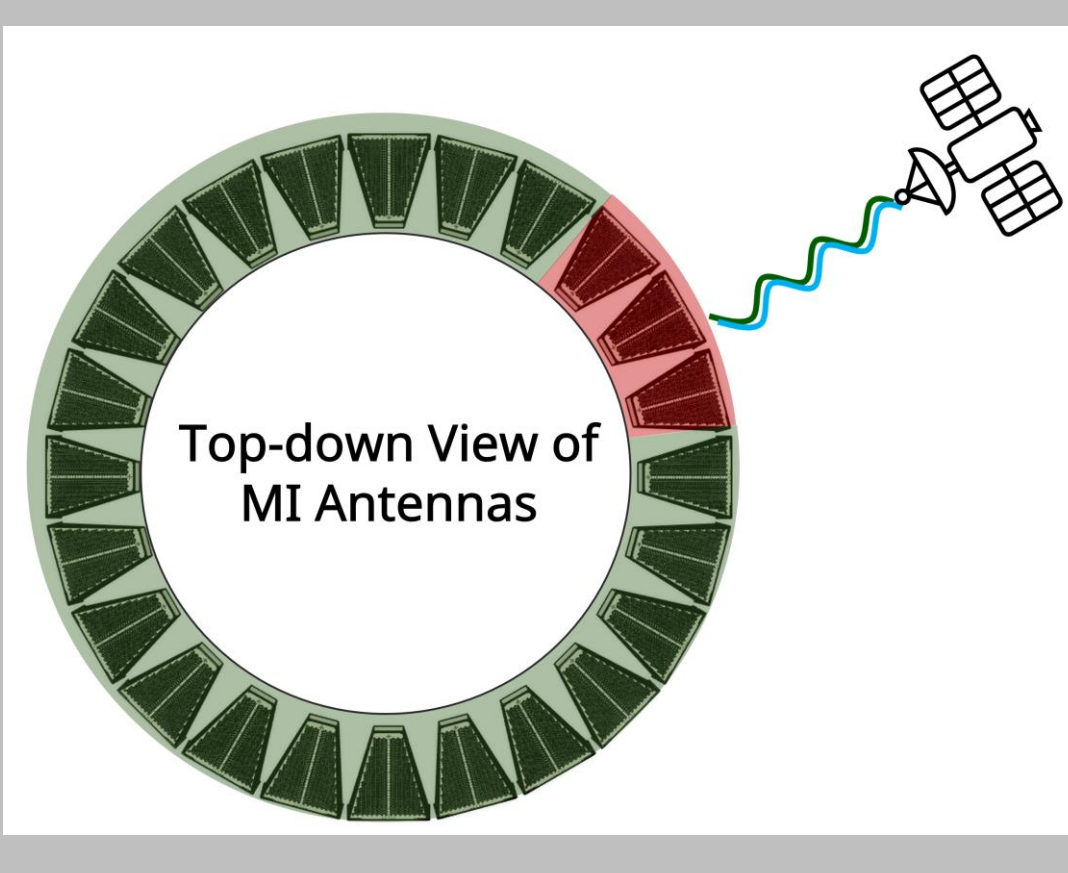
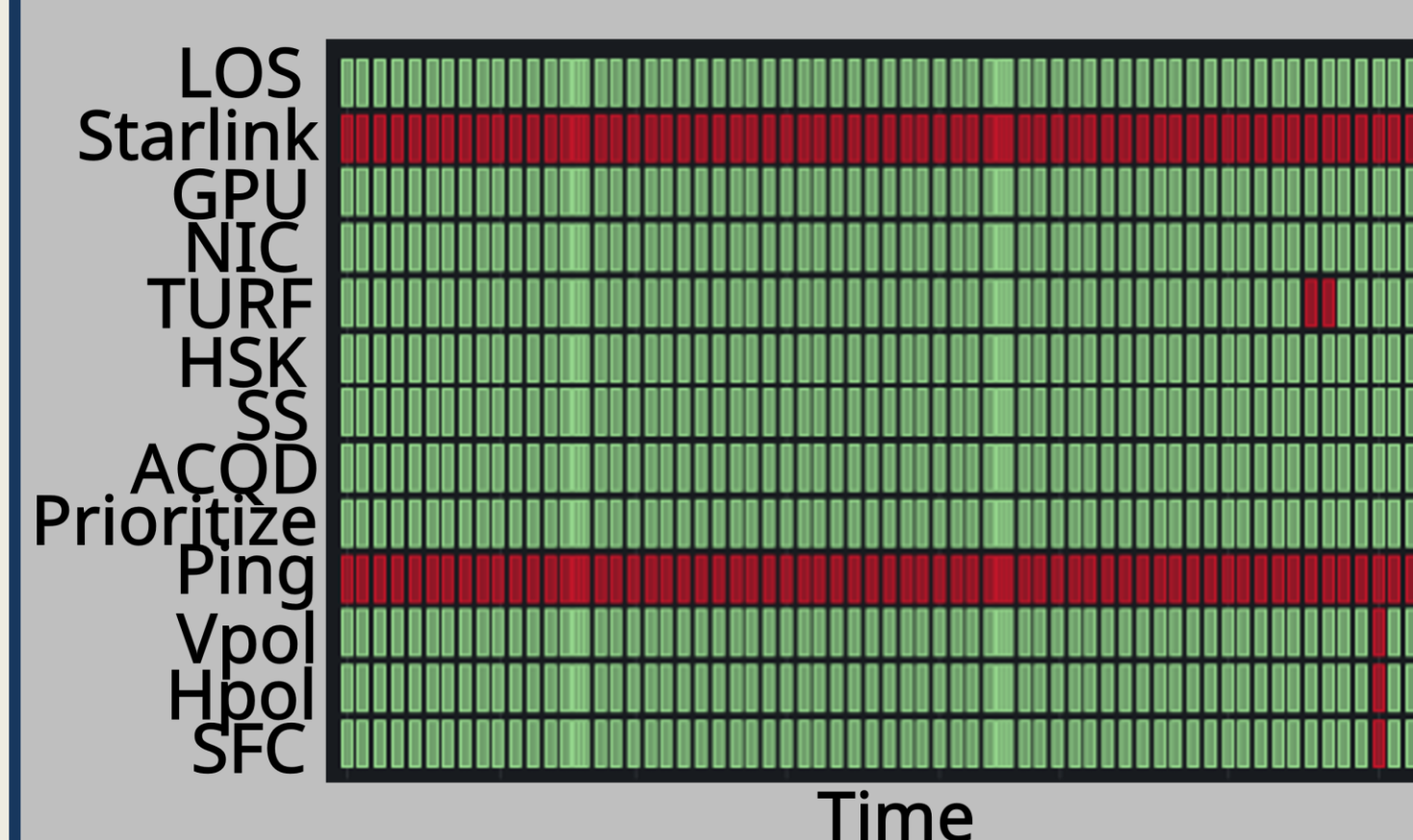
## Science Flight Computer and Storage

Continuous monitoring throughout the flight of all systems

Maintained 100 Hz trigger rate through masking

Prioritized events transmitted during flight

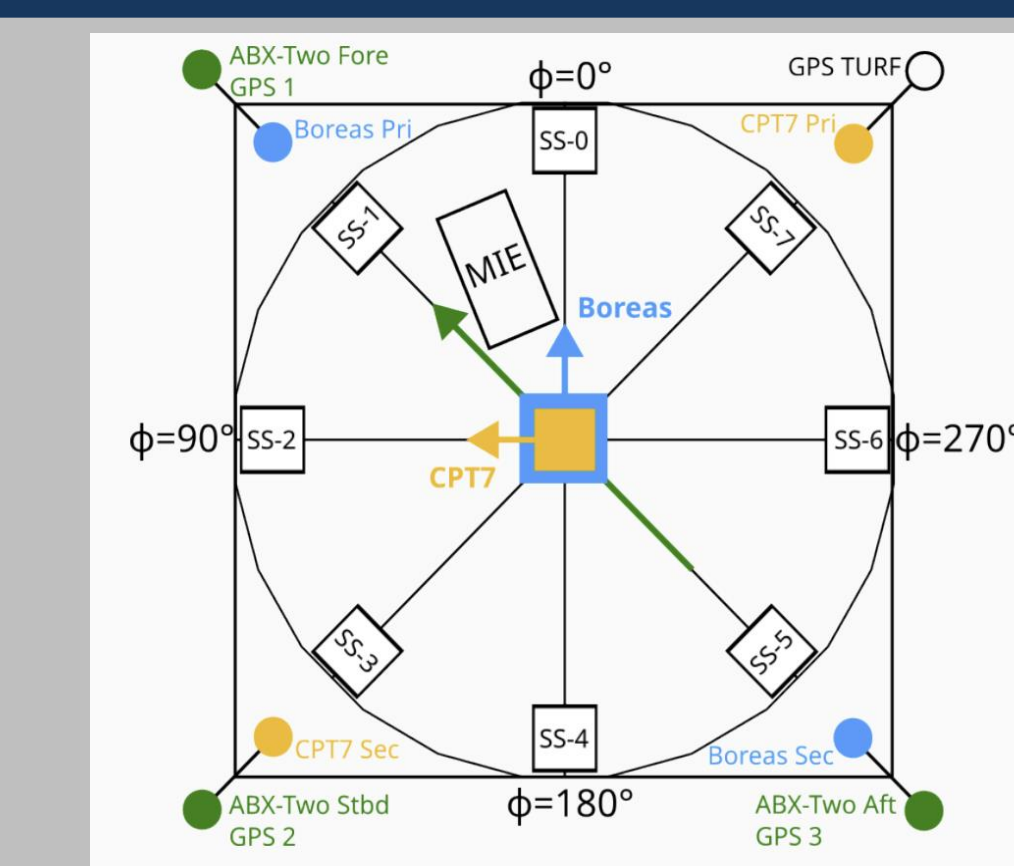
Triply redundant 128 TB of storage



## Navigation Suite

Multiple redundant systems

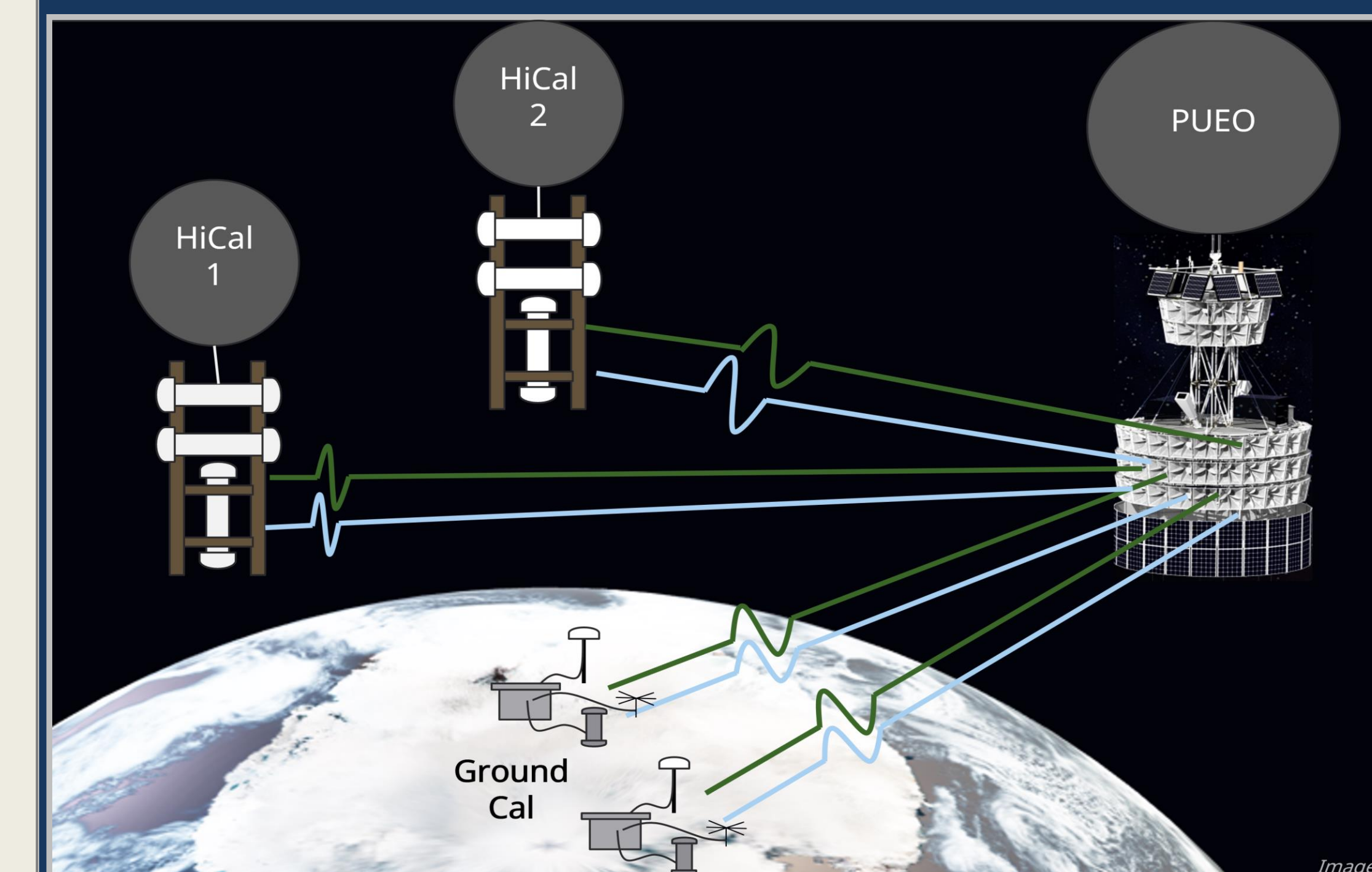
- x2 IMU
- x1 GNSS
- x8 Sun Sensors
- x2 Star Trackers
- x1 Magnetometer



Precision expected to be within 0.05° in heading, pitch, and roll

Shows the locations of the navigation systems on payload from top-down view

## Calibration Systems



We would like to thank NASA, CSBF and ASC in Antarctica for all their support in making this possible!  
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