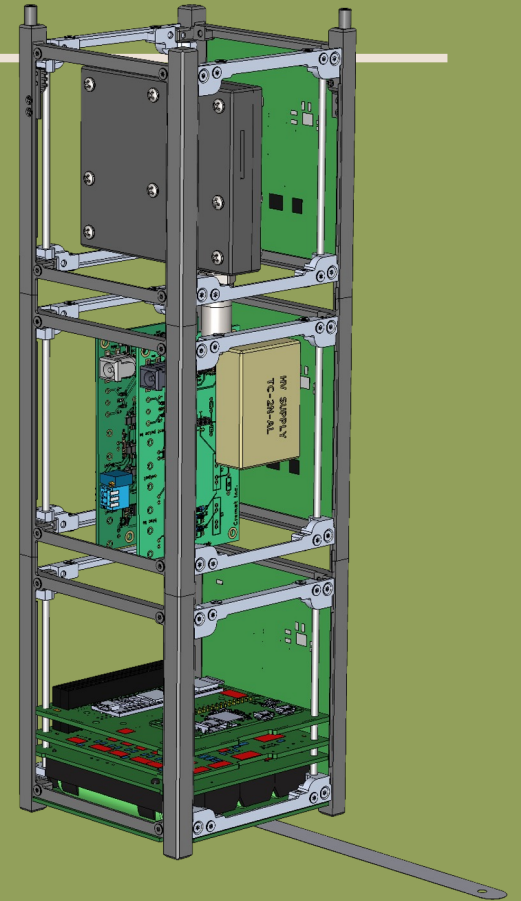
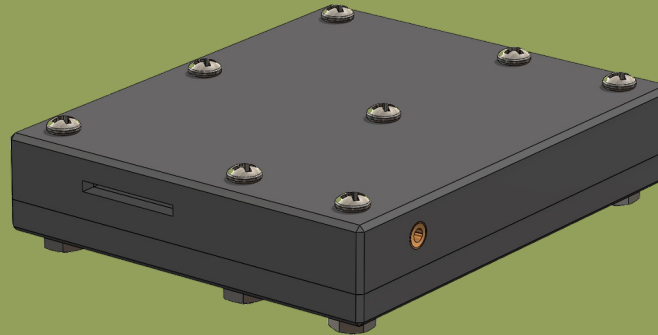
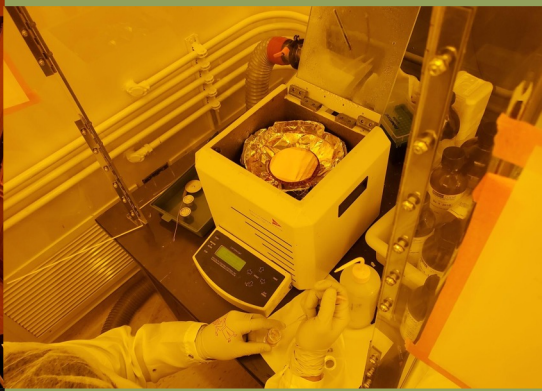
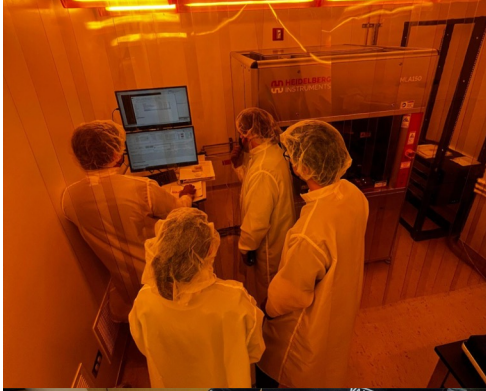


CREPES

CubeSat Relativistic Electron & Proton Energy Separator



Sapphira Akins, Christopher Freitas, Howin Ma, Ian Ogata, Ryan Taylor
University of Hawai'i at Manoa



OUTLINE

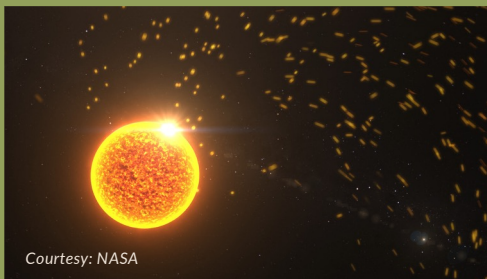
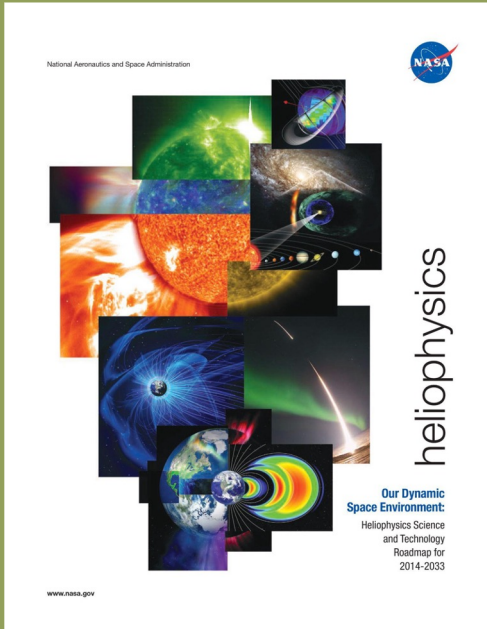


Mission Objective

Mission Operations

Plate Readout GEM Detector
[PRGEM]

Satellite Design



What is the CREPES mission?

The CREPES satellite shall monitor high energy protons and electrons, and their incoming direction, while employing new technology that furthers particle detection in space

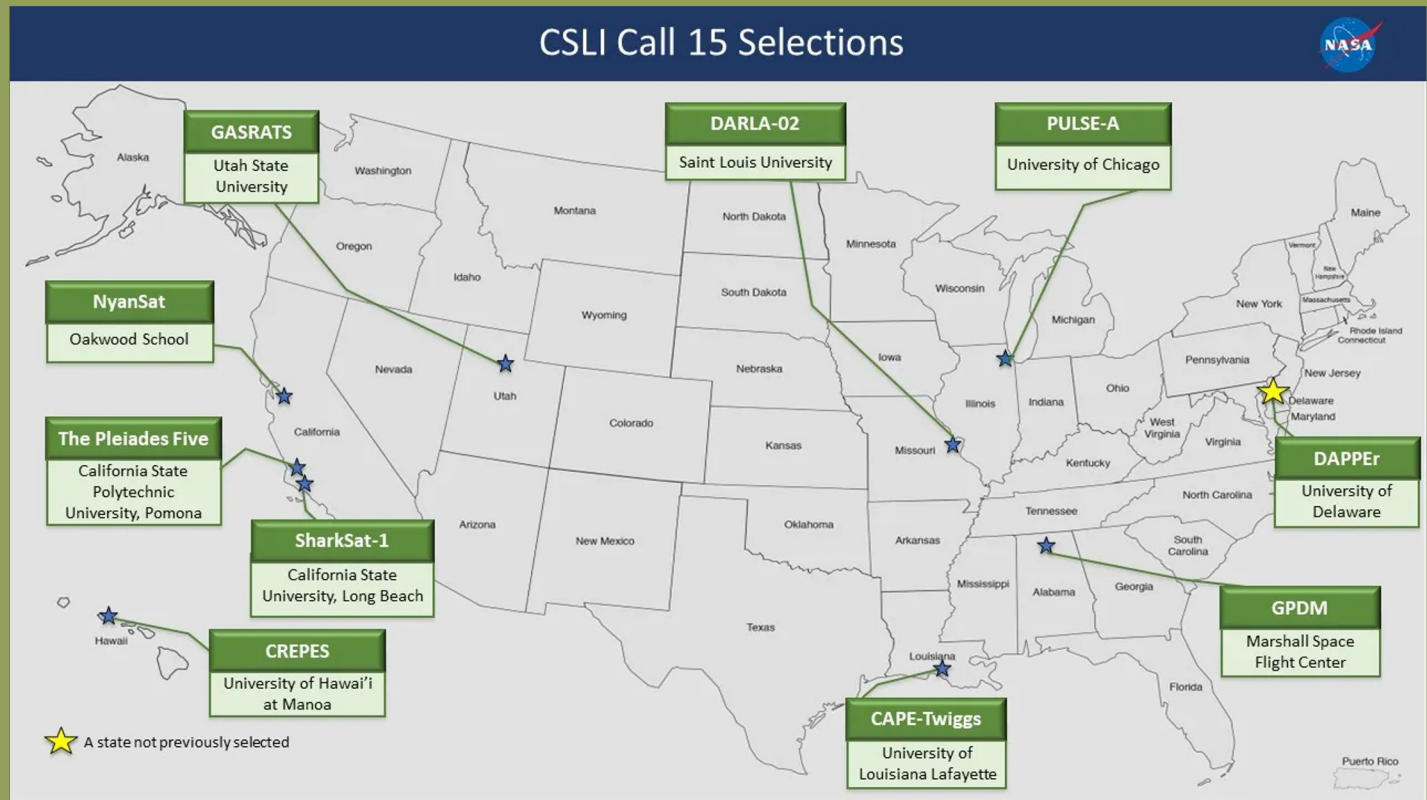
1. **Science Objectives [NASA Heliophysics Roadmap (2014-2033) - F2]**
 - a. Monitor high energy electron and proton fluxes
 - b. Determine the different directions of incoming fluxes
 - c. Collect data within 20-60 min intervals
 - d. Monitor the number of high energy particles during SEP events
2. **Technology Objectives**
 - a. Enable GEMs an opportunity to receive flight heritage

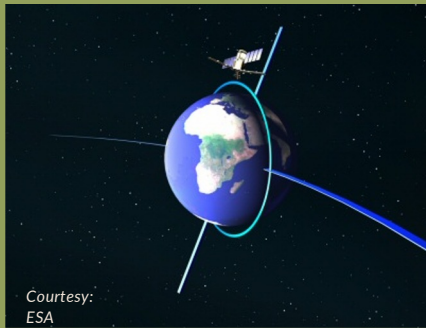
What is the CREPES mission?

Anticipated
Launch: Dec
25 - Jan 26

Mission
Phase: CDR

Priority:
Prototype
Development





Mission Operations

Orbit: SSO Dusk-Dawn; ~530 km; ~90 min orbit length

1. Data Collection

- a. 5x 2 min data collection periods [12 min total per orbit]
- b. Ongoing power generation
- c. Payload requires charge-up time

2. Downlink

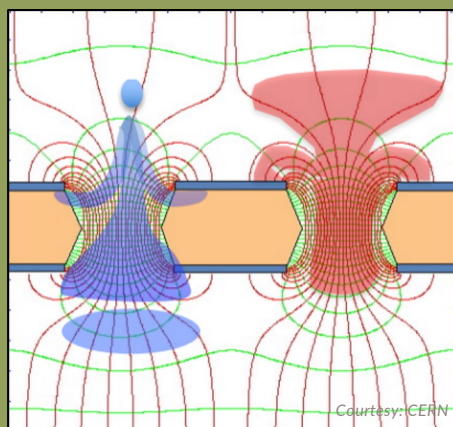
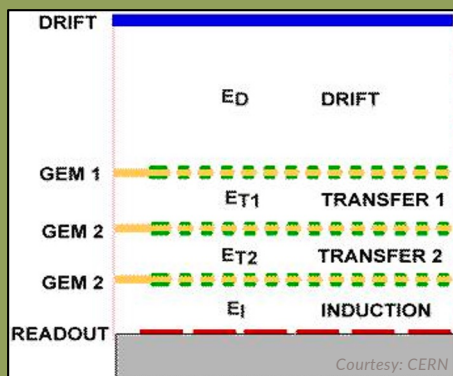
- a. 10 min window over HSFL UHF Ground Station per orbit

3. Lifetime

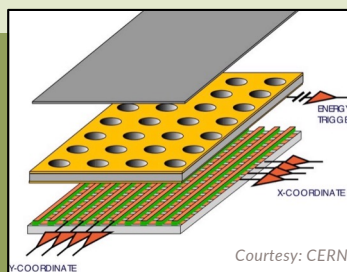
- a. 6 months - 1 year

Plate Readout GEM Detector

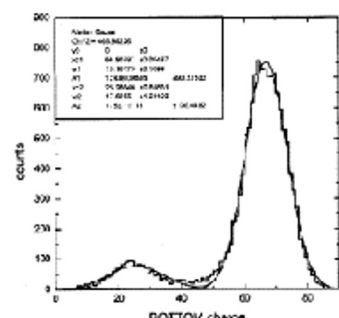
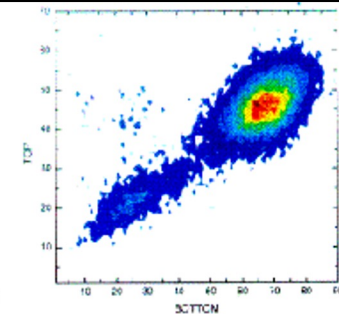
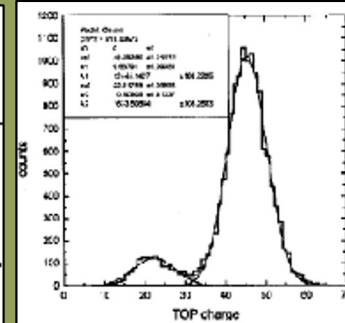
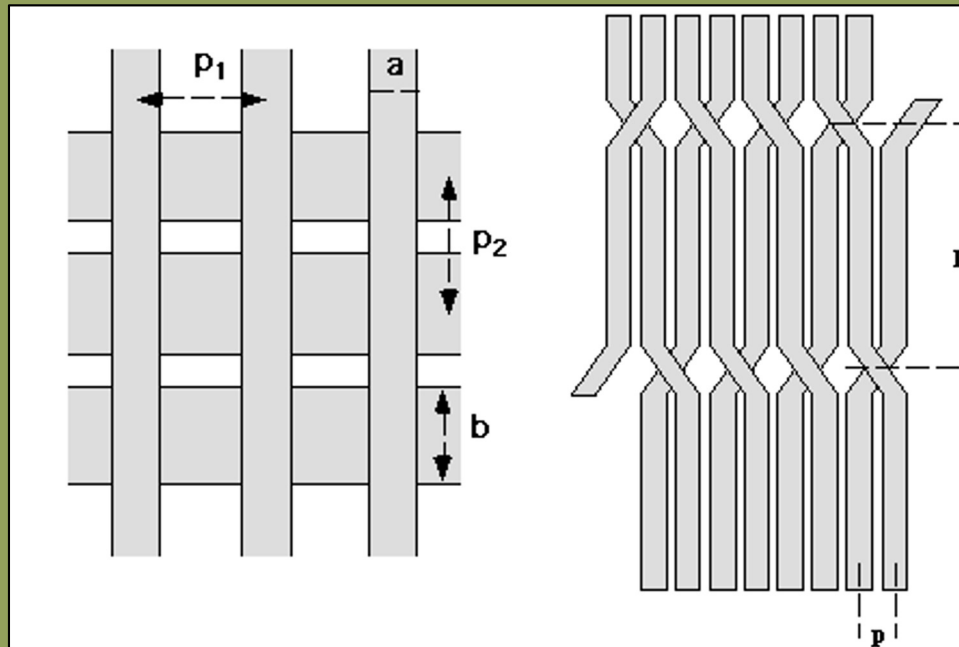
Payload: GEM Detectors



1. Ionization of gas by an ionizing particle or photon
 - a. Energy loss & ion pairs created in gasses from particles can be found with the Bethe-Bloch equation and the excitation energy of the gas
2. Released electrons are accelerated by an applied electric field, giving it enough energy to collide into and ionize other gas molecules creating an electron avalanche
3. All the created electrons can be collected on a R/O board



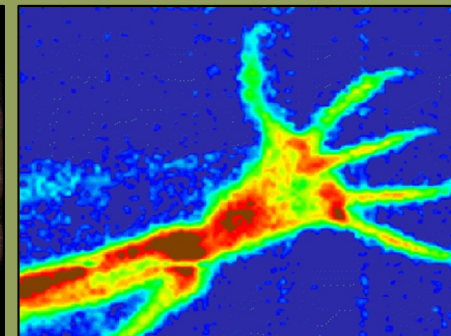
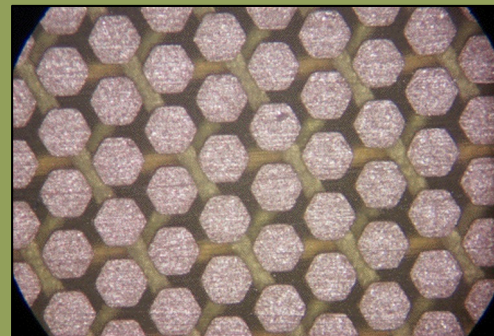
GEM Readout



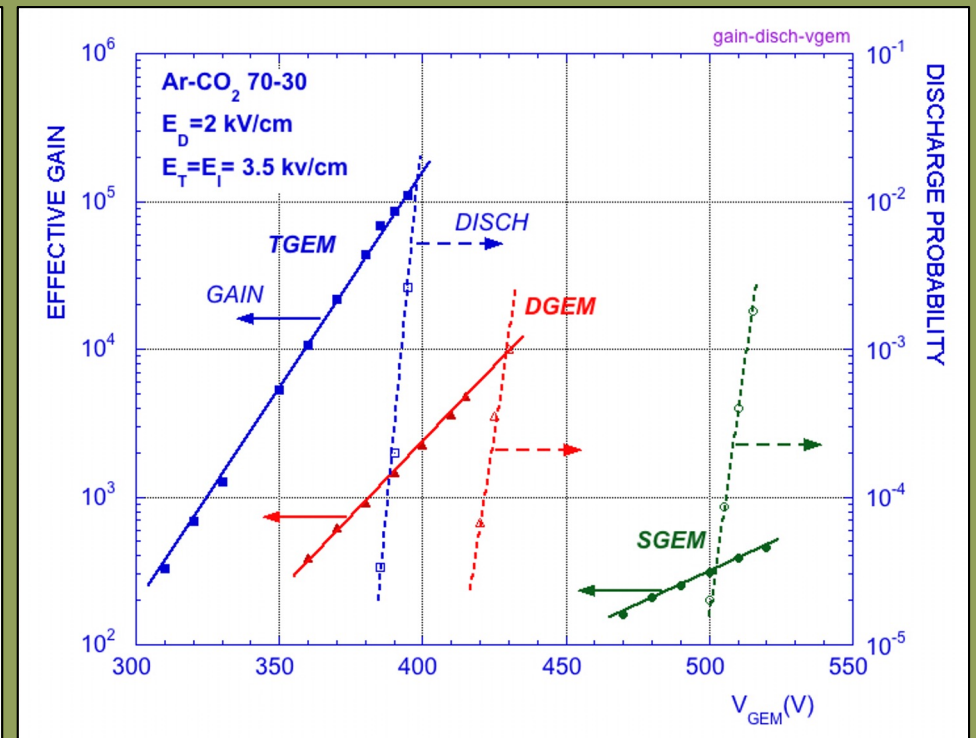
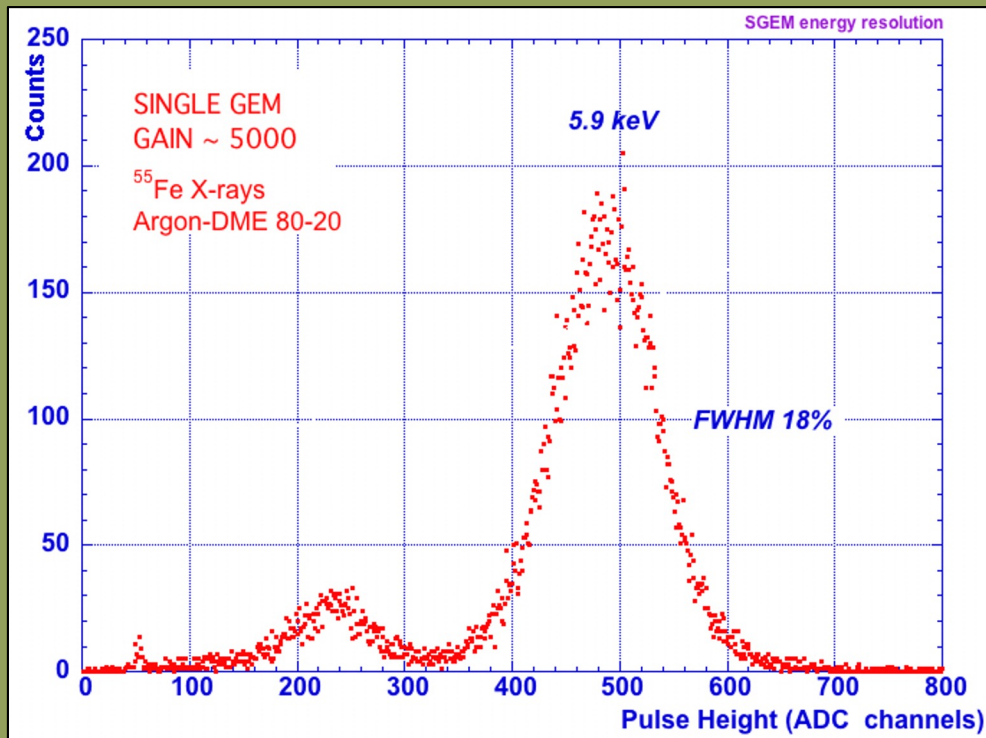
**16 STRIPS
200 μm PITCH
READ-OUT**

X-Y Readout
Hexagonal Pad Readout
Small-angle Stereo Readout

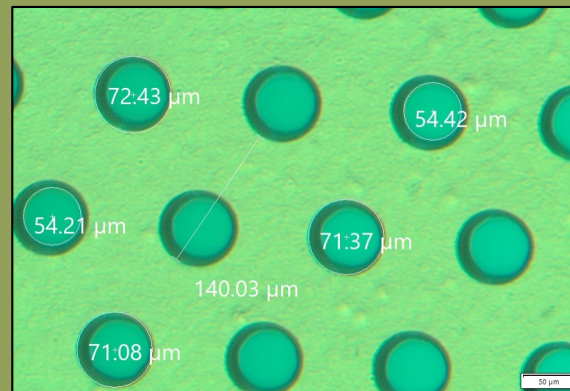
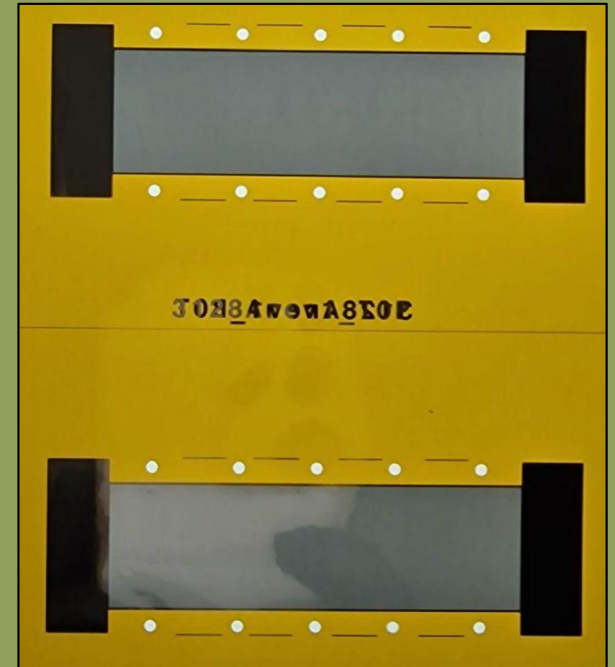
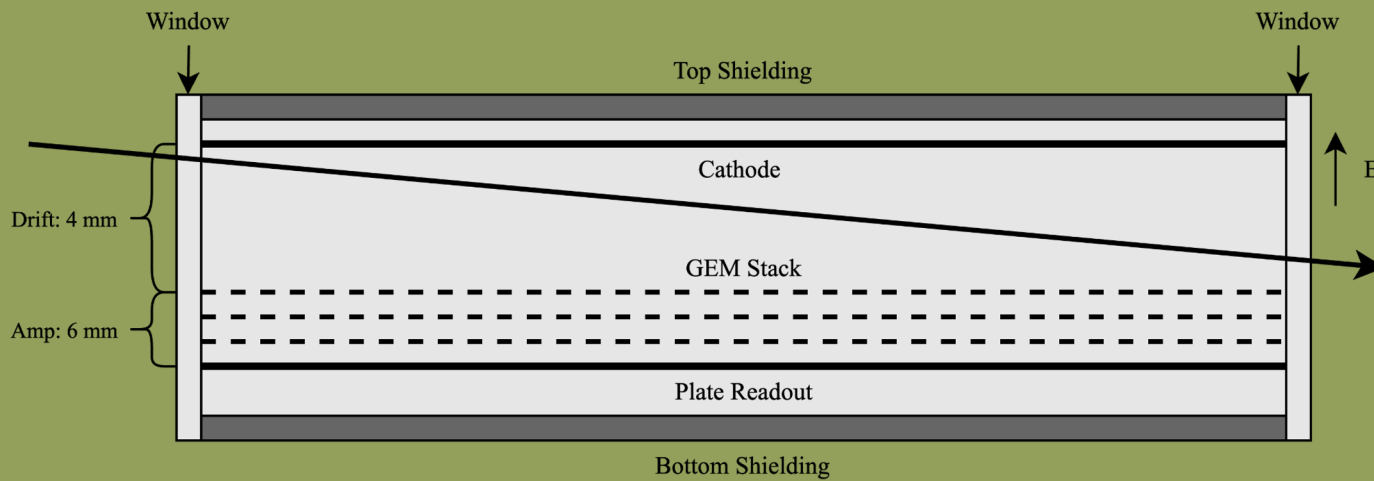
Photos Courtesy of CERN

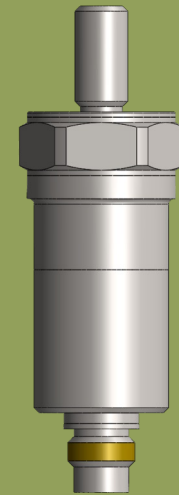
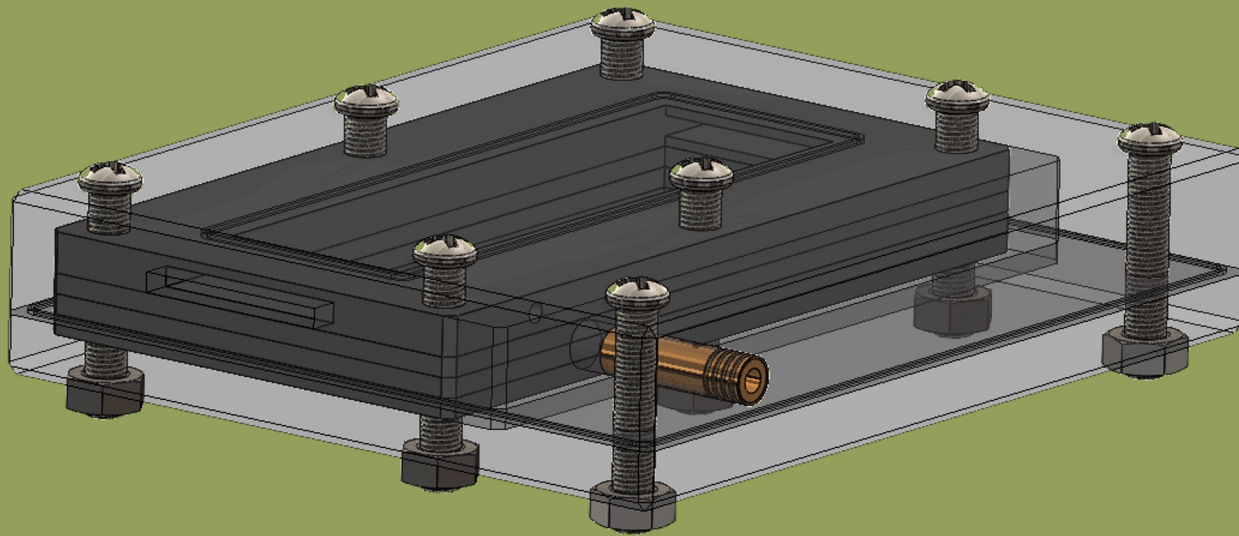


Performance

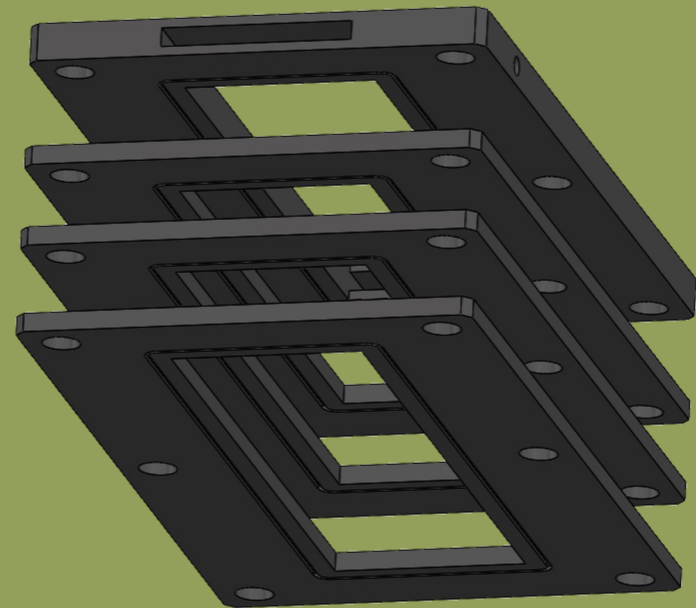
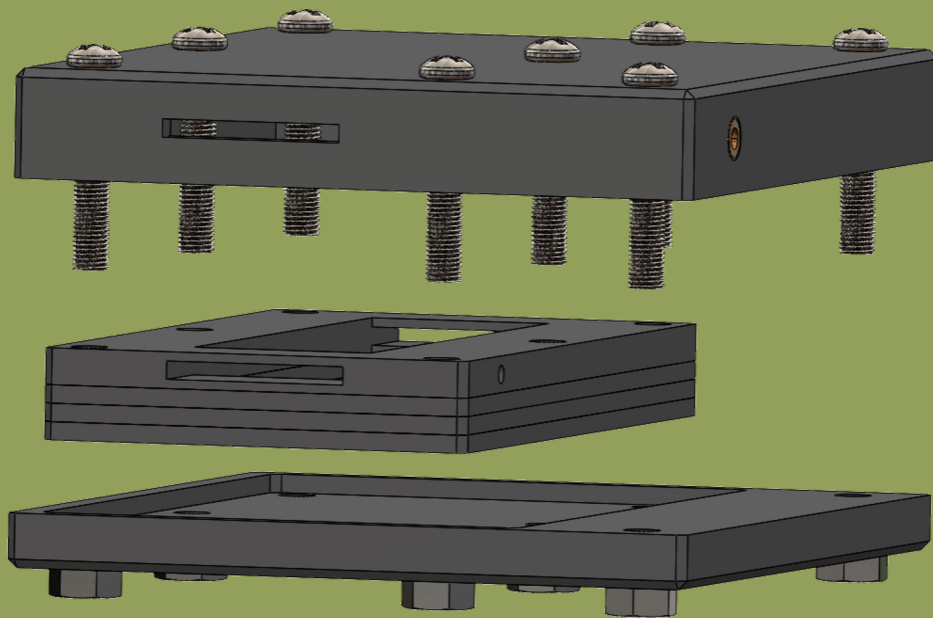


Payload Design



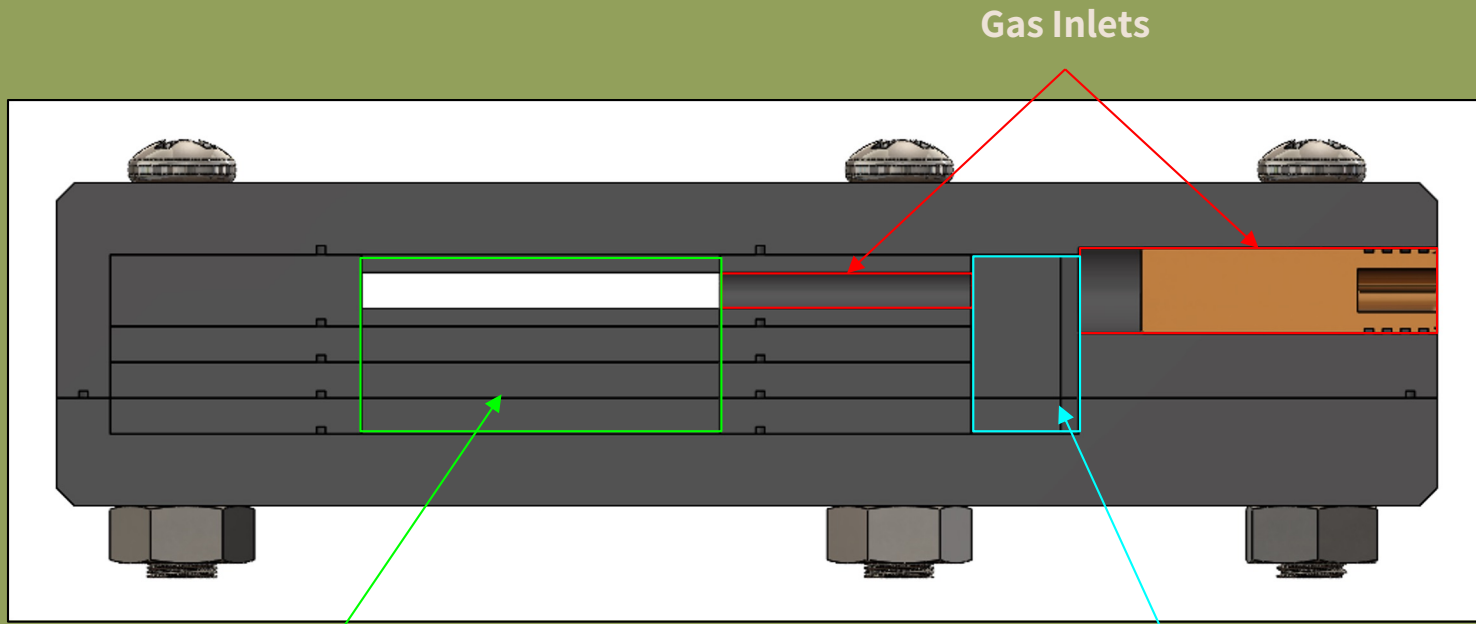


PRGEM Detector Housing



PRGEM Detector Housing

FRAME & CASE: RESARM Engineering Plastics
Material: PERMAGLAS ME (epoxy glass resin)
Properties: low-conductivity & low gas leakage

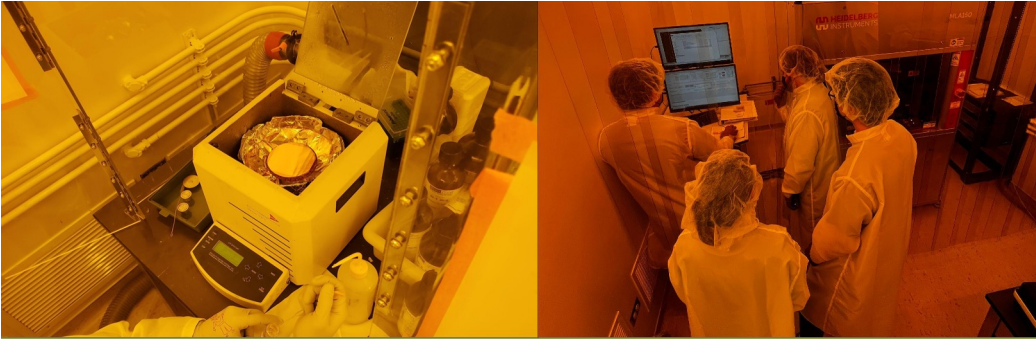


GEM Chamber
Radiation enters here

Temperature Sensor Chamber
Thermocouples installed here

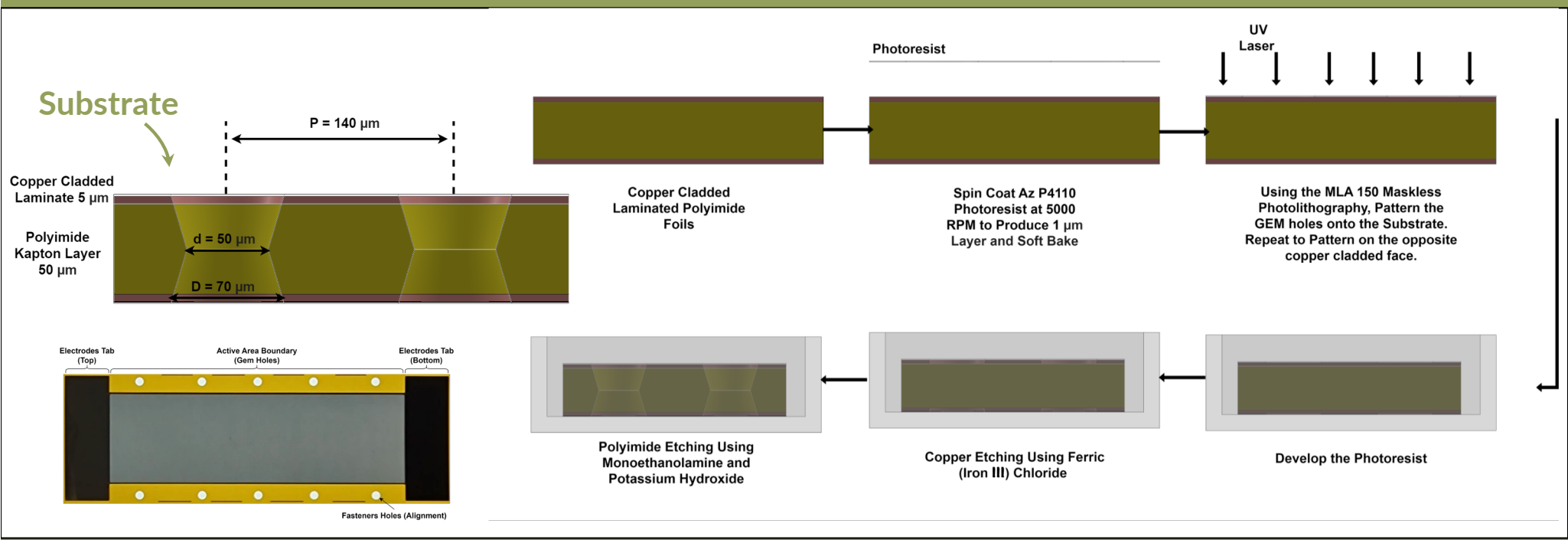
PRGEM Detector Housing

CHECK VALVE: Lee Company
Material: stainless-steel



Foil Manufacturing

Photolithography & Etching Procedures



Satellite Design

PRGEM

HV Divider

Pre-amp & Shaper-amp

Cremat CR-113 rev 2.1
Cremat CR-200-50ns

Particle entry

HV Supply

Matsusada TC-2N-AL

ARTEMIS KIT Subsystems

**Supporting structures to be designed
after finalization of payload and HV
divider board*

CREPES Satellite Diagram

Thank You to Our Sponsors & Mentors!

HSGC, NASA CSLI, HIGP, HSFL, UROP, Dr. Peter Englert, Dr. Miguel Nunes, Dr. Frankie Zhu, Dr. William Edmonson



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