

KUbeSat:

A CubeSat mission proposal from the University of Kansas – A student driven mission

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Mission History

- NASA CubeSat Launch Initiative (CSLI) identified Kansas as an under-represented State and identified an opportunity for mission development.
- 2016 - Dr. Marco Villa (KU MS-2002, KU PhD-2005) of Tyvek International SRL identified University of Kansas Aerospace Department as potential recipient of 3U-6U CubeSat Satellite dependent upon successful CSLI submission.
- Prof. Mark Ewing (KU Aerospace) identified project opportunity to senior aerospace students with Madison Sargent as the Student PI for the mission.
- Payload proposals were presented to team for possible mission including one from Fundamental Technologies.
- Nov 2017 – NASA CSLI proposal submission

Mission Parameters

- Satellite: 3U – 6U CubeSat depending upon included payloads
- Student driven mission (faculty act primarily as advisors)
- Public/Private partnering between University of Kansas and TyVek Corporation/Fundamental Technologies
- Launch in 2019
- Orbit: Alt 200-450 Km, Inclination 70-90 degrees, circumpolar

KUbeSat Payloads:

1. Primary Cosmic Ray Detector (PCRD)
2. Ground Segment Cosmic Ray Calibration Beacon (HiCalc2)
3. AstroBiology Collaboration (ABC)
4. Fundamental Technologies – Energetic Particle Detector (FT-EPD)

Primary Cosmic Ray Detector (PCRD)

Science: Observation of Cosmic Ray Protons and Nuclei

Energy: 100 KeV – 150 GeV

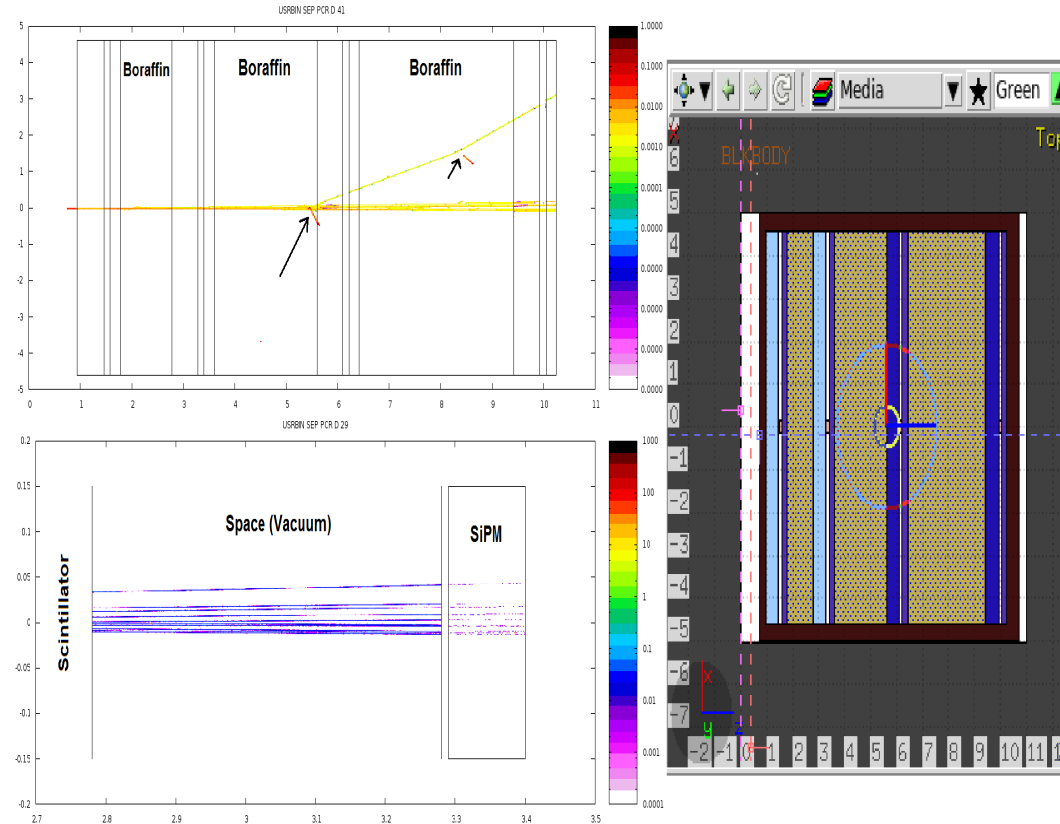
Zenith Orientation

Telescopic fixed geometry

Boron neutron absorber

Scintillation materials: Bicron-408 and Boraffin

Coupled with three Silicon PhotoMultipliers (SiPM) to achieve continuous energy measurements



HiCalc2

- Science Goal: Calibration of terrestrial Ultra High Energy Cosmic Ray (UHECR) Detectors
Measurement of Ice Sheet Thickness and Ice Sheet Migration
- Collaboration: RICE experiment at South Pole
- RICE: Measurement of RF signature of UHECR atmospheric passage along with nine (9) additional similar experiments measuring energy of UHECR.
- Problem: Calibration between all 10 experiments
- Solution: RF Beacon using a Spark Voltage Transmitter observable by all experiments to allow for calibration of all observations
- Additional Science: Comparator Antennae to measure reflectance of signal from ice sheets allowing for determination of thickness in thin sheet areas
- Method: 2 kV potential across antennae gap shorted producing RF pulse

AstroBiology Collaboration (ABC)

- Science: Understand biological processes in ionosphere (400 Km) including biological effects due to long term Cosmic Ray exposure
- Experiment: Dual Inoculated plates of Bacteria and Fungi – one lab based with controlled environment and one space born on KUBEsat 4 bacterial and 4 fungal in 1cm x 1cm isolated grids
- Student based experiment for K-12 student participation in conjunction with KU Biologists
- Relate biological data with particle observations from the other payloads to identify environmental conditions driving changes

Fundamental Technologies Energetic Particle Detector (FT-EPD)

- Science:
Observation of precipitation and outflow of electrons and ions
- Detector: 4 Micron Semiconductor silicon wafers 1 cm^2 (5 μm , 250 μm , 250 μm , and 5 μm) looking Nadir (5 μm , 250 μm) and Zenith (5 μm , 250 μm)
Plus 4x4 APD individually tuned for varied energy level sensitivity
- 2 of 4x4 APD sensor arrays to detect lower energy charged particles
- Energy range: H – 30 KeV, He – 50 KeV, O – 75 KeV in 16 logarithmic energy channels
APD: 50 eV to 50 KeV in 16 logarithmic energy channels
- Ground Software is current KU EECS senior project
- Hardware is current KU EE senior project

