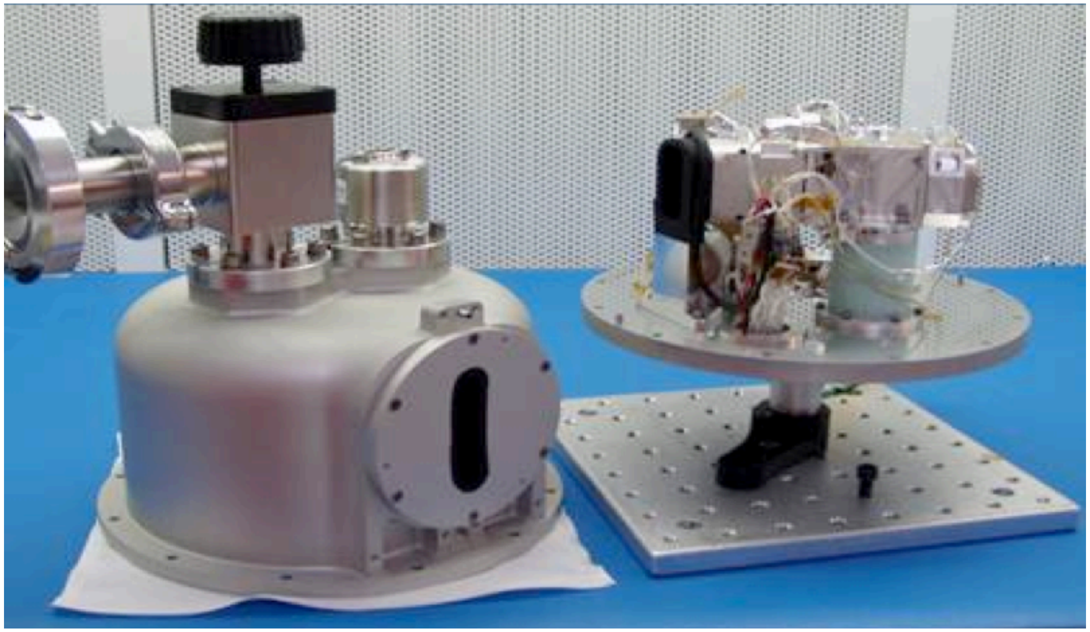
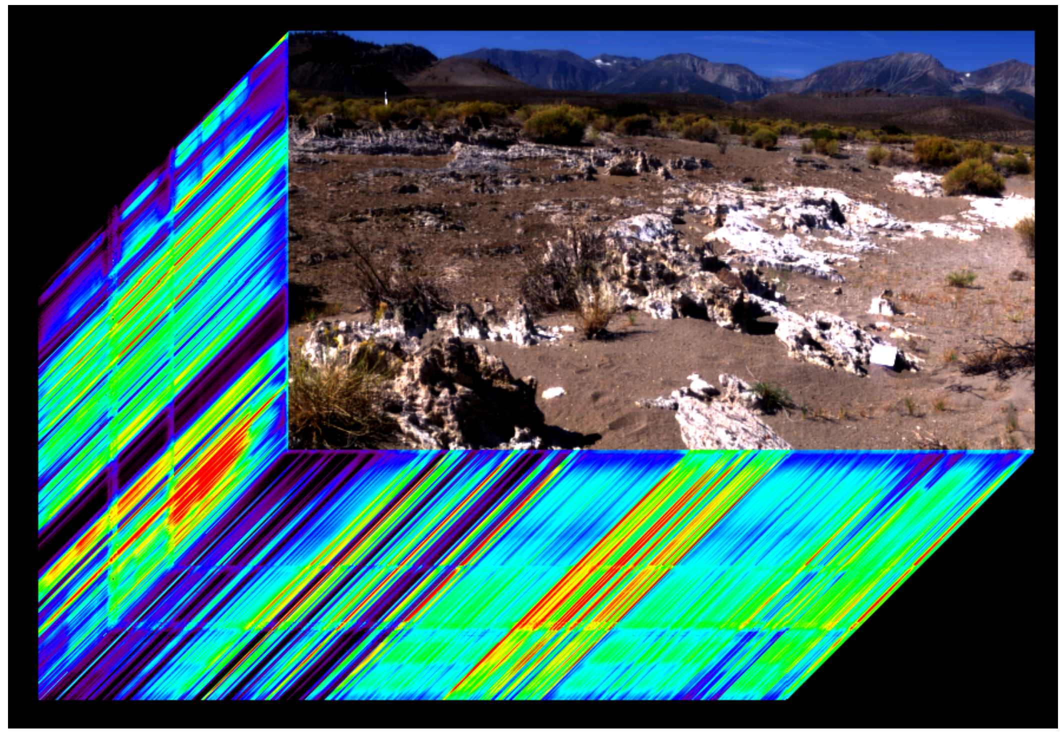
Ultra Compact Imaging Spectrometer (UCIS)

- Technical Challenges of In situ imaging spectroscopy
  - Limited mass, power, and data volume compared to orbiter/fly by spacecraft
- UCIS
  - Partnership between JPL (mast mounted sensor) and APL (electronics and software).
- Heritage
  - Sensor: JPL
  - Electronics/software: APL CRISM



UCIS Approach: In situ imaging spectroscopy

- UCIS uses in situ imaging spectroscopy from 500->2600 nm to determine the mineralogy and composition of planetary surfaces and map their spatial relationships.
- Established technique with well developed mineral libraries and theoretical basis.
  - Used on most bodies in the solar system from orbit/flybys: Links compositions seen from orbit/flyby to in situ with same technique.
- Well understood measurement requirements.



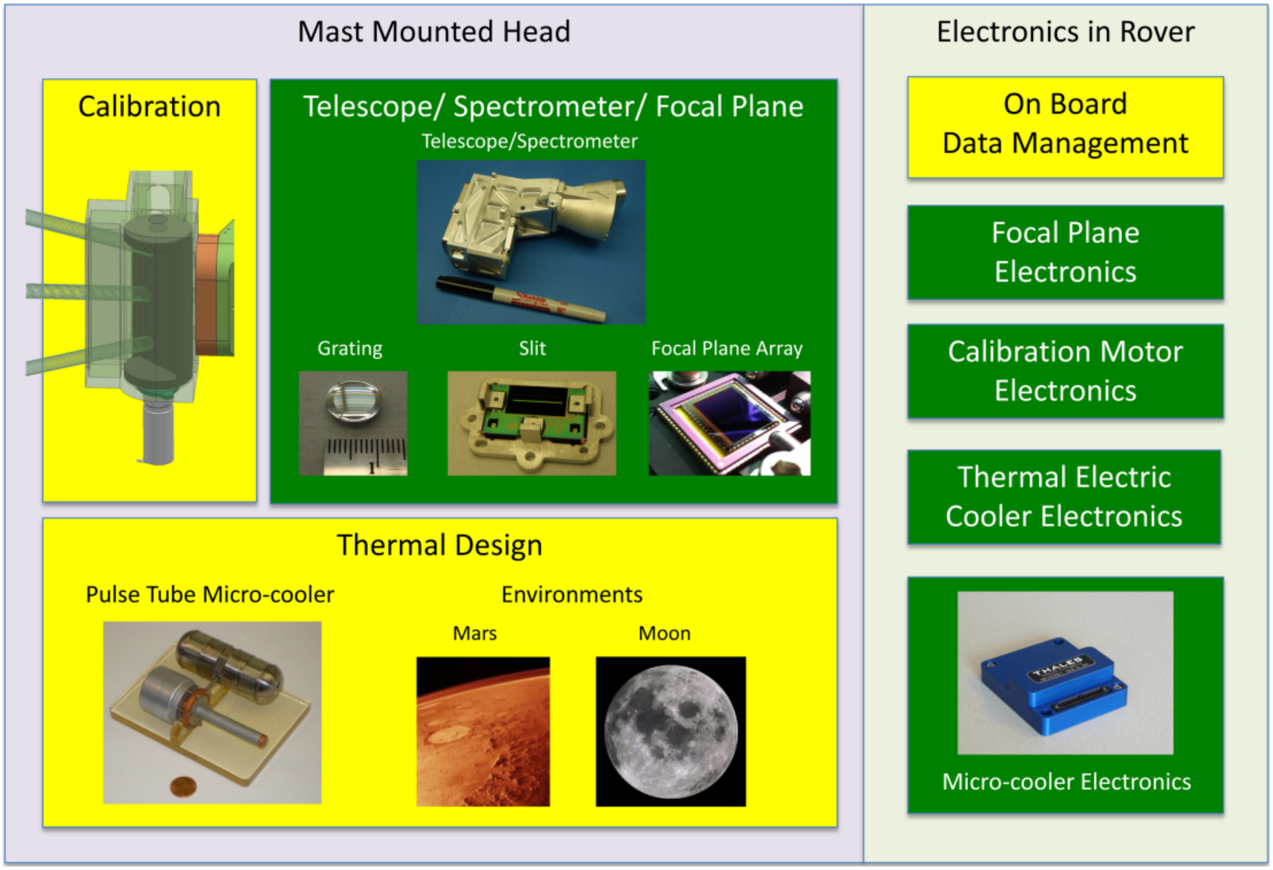
Key Instrument Characteristics

Spectrometer Characteristics

Spectral	Range	500–2600 nm
	Sampling	10 nm
Spatial	Field of view	30 deg
	Instantaneous FOV	1.4 mrad
	Spatial swath	380 pixels
Radiometric	Range	0–100% R
	SNR	>300 *
Uniformity	Spectral cross-track	>97% **
	Spectral IFOV mixing	<3% ***

*Specified through entire spectral range, for typical hematite reflectance;**straightness of monochromatic slit image (smile <3% of pixel width);.*** misregistration of spectrum to array row (keystone)

USIS at Start of MatISSE



Green indicates elements with sufficient maturity for flight (TRL6).

Yellow identifies elements proposed for maturation under MatISSE.

Optical hardware is on the mast, while the electronics are located in the rover/lander body.

All Components are currently TRL 6 or higher.

MatISSE improving subsystem TRL and instrument TRL.

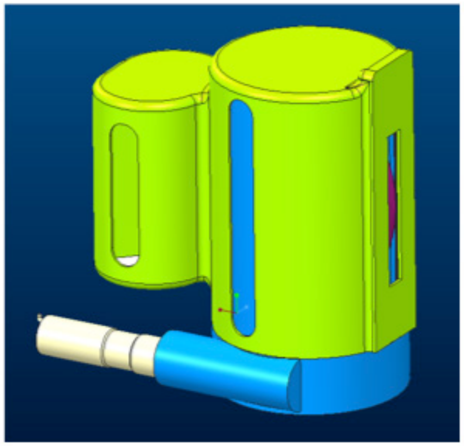
MATISSE Objectives

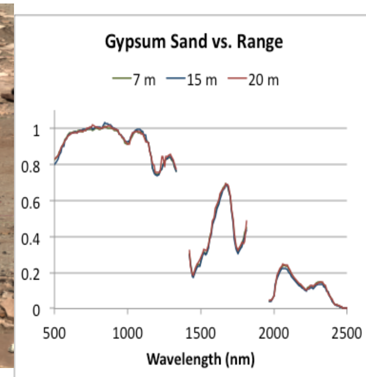
Develop and test to TRL 6:

- Thermal design for Mars and Moon (including pulse tube micro-cooler) and Calibration front end.
- Fully integrate mast unit using existing spectrometer, new thermal design (including micro-cooler) and calibration front end on spectrometer

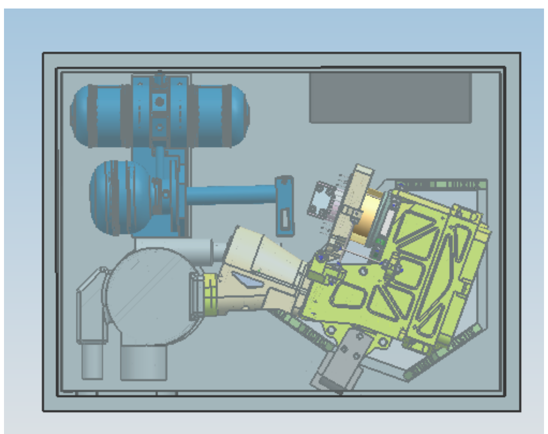
Develop data processing algorithms and test using UCIS measurements. Generate an overall design that can be implemented with flight-qualified parts.

Results of Year 1



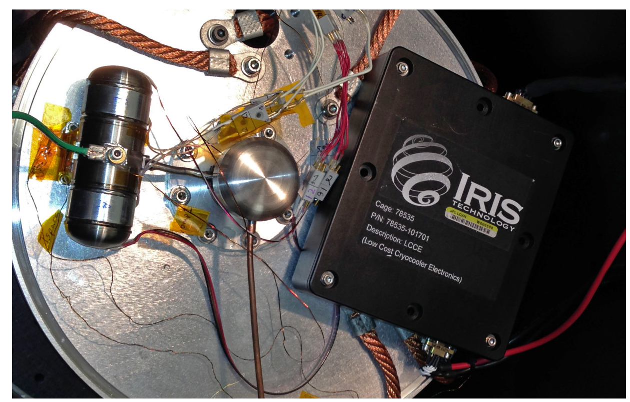


Calibration Assembly Designed and Validated



Integrated mechanical / thermal design.

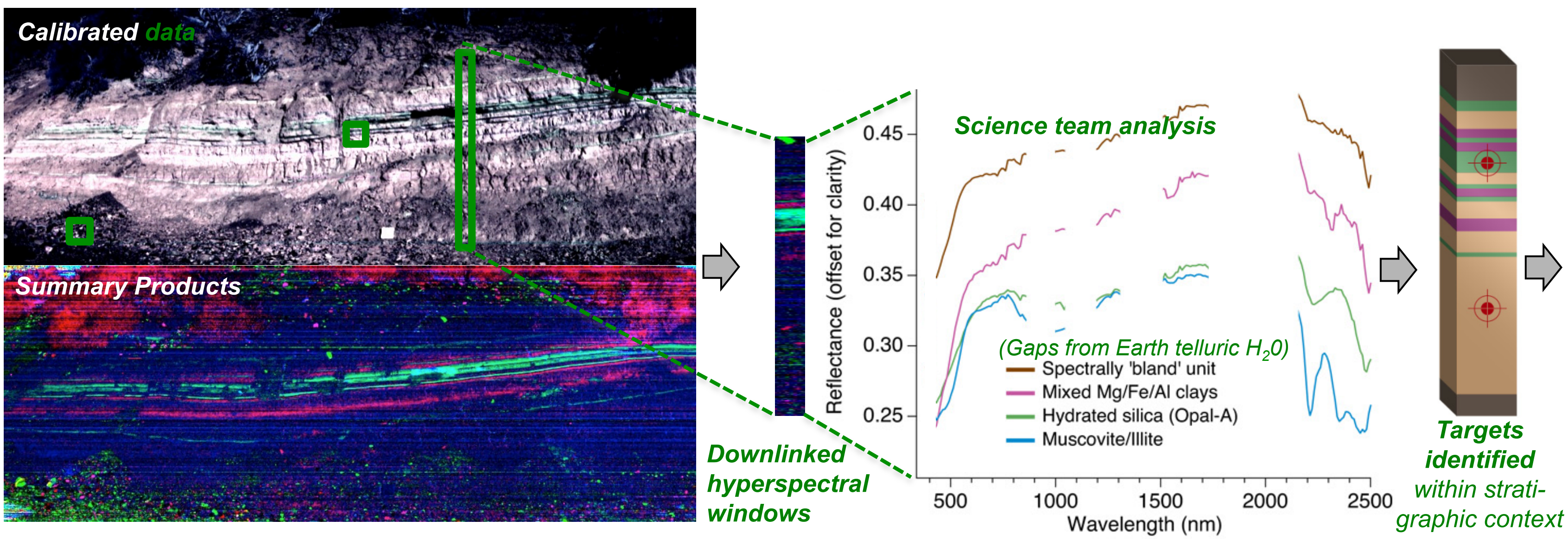
Micro-coolers and electronics
tested together. Micro-cooler now at TRL 6



Jet Propulsion Laboratory
California Institute of Technology

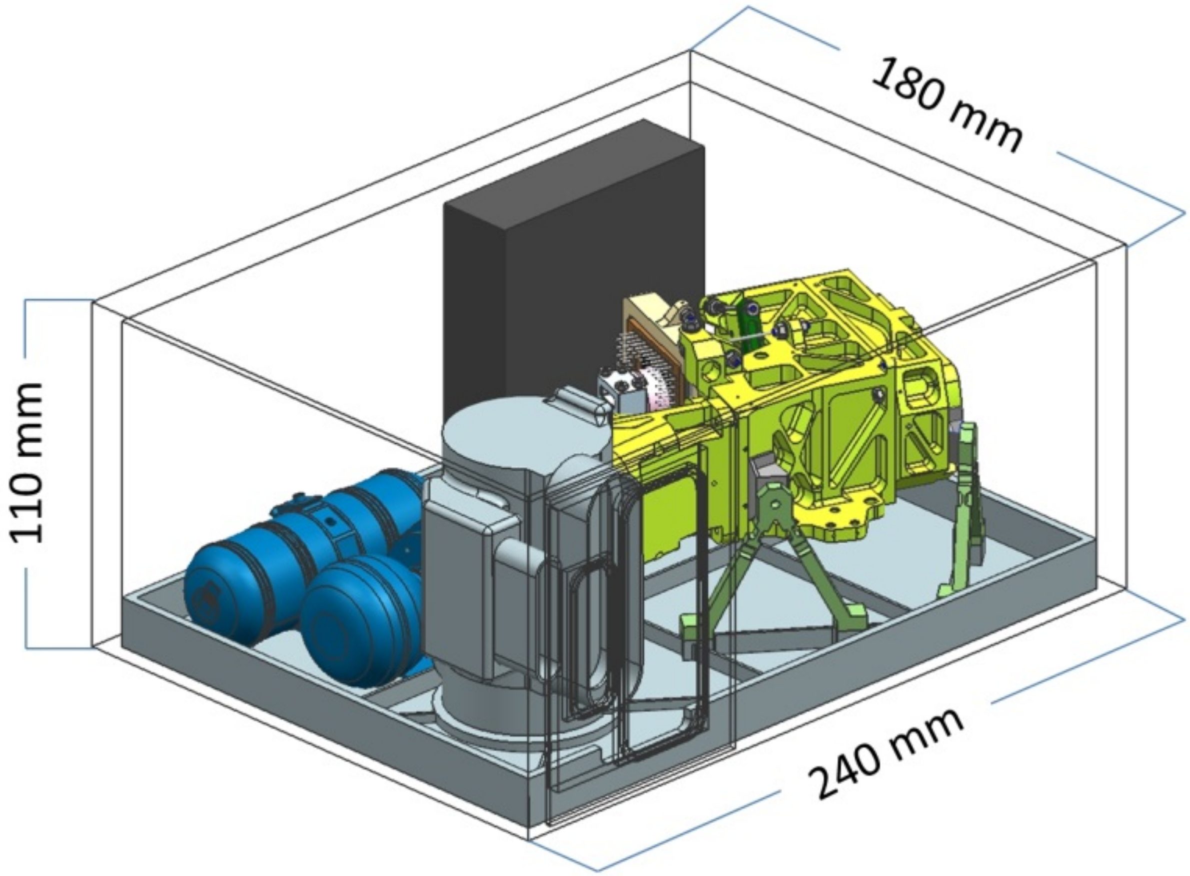
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Data Processing Example: Mills Creek, Mono-Lake, CA



Possible Flight Configuration

Variable	CBE Value
Sensor Head Mass	2.6 kg
DPU Mass	1.2 kg
Sensor Volume	4752 cm^3
DPU Volume (L1)	1345 cm^3
Power (peak)	32 W
Power (average)	28 W



Year 2 and 3

- Year 2:
  - Build Calibration Assembly Qualification Model
    - Test in appropriate
  - Get flight-like micro-cooler, validate thermal design, test micro-cooler.
- Year 3
  - Build flight-like sensor head (includes spectrometer, micro-cooler, and calibration assembly).
  - Test in Martian and Lunar Environments.

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