CERES FM6 – Path To Launch

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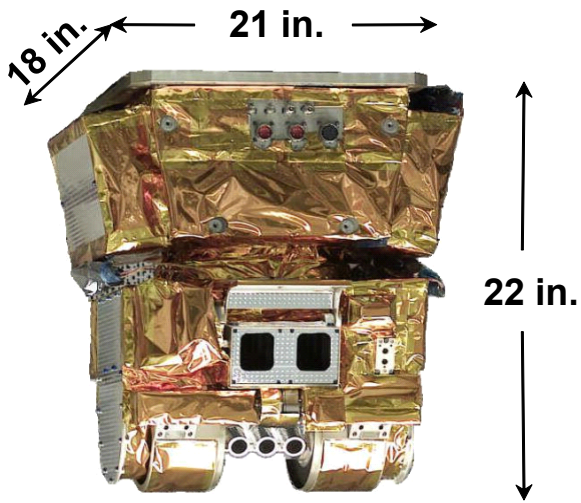
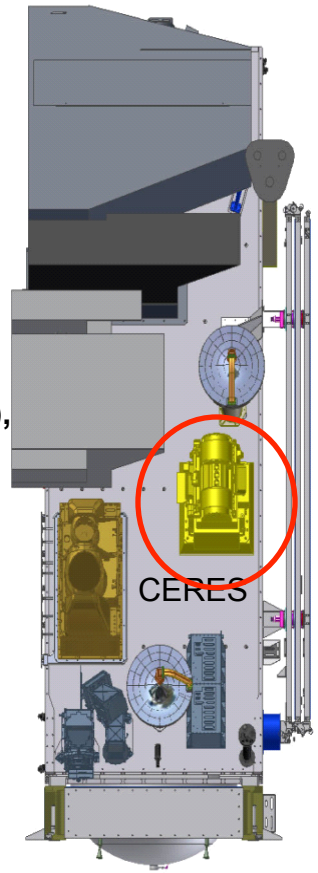
CERES Science Team Meeting
Hampton, VA
May 16, 2017

Contents

CERES FM6 Instrument Overview

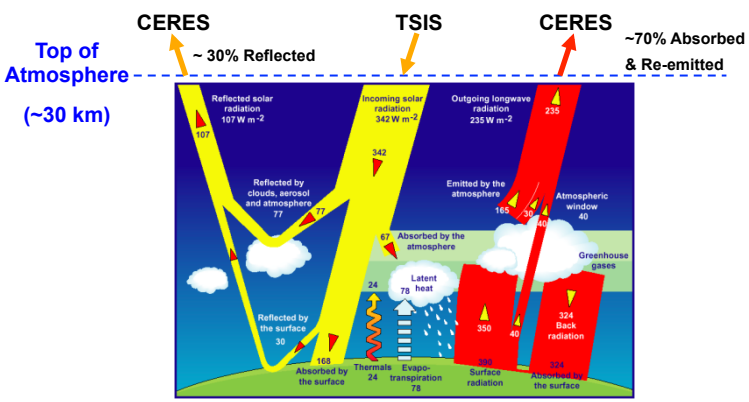


- CERES scanning radiometer measuring three spectral bands at TOA
  - Total (0.3 to >50 μm)
  - Shortwave (0.3 to 5.0 μm)
  - Longwave (5 to 50 μm)
- Operations, Data Processing, Products, and Science are a continuation of experience developed on
  - TRMM (1), EOS Terra (2), EOS Aqua (2), and S-NPP (1)



JPSS-1

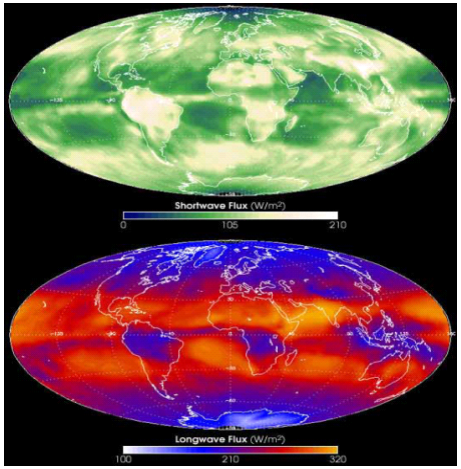
Earth Radiation Budget Components



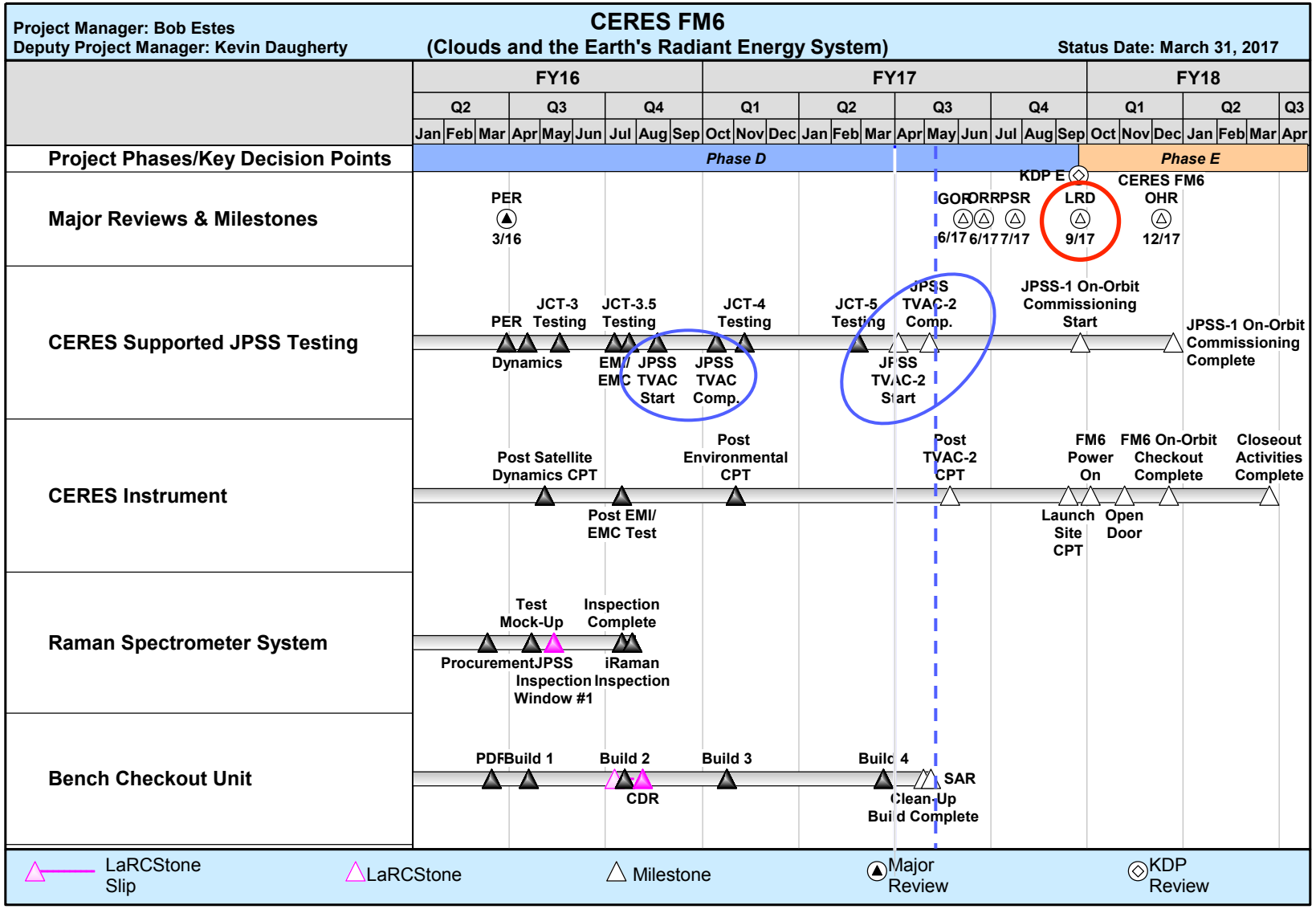
Primary CERES Data Products

Reflected Solar Energy

Emitted Thermal Energy



CERES FM6
Master Schedule



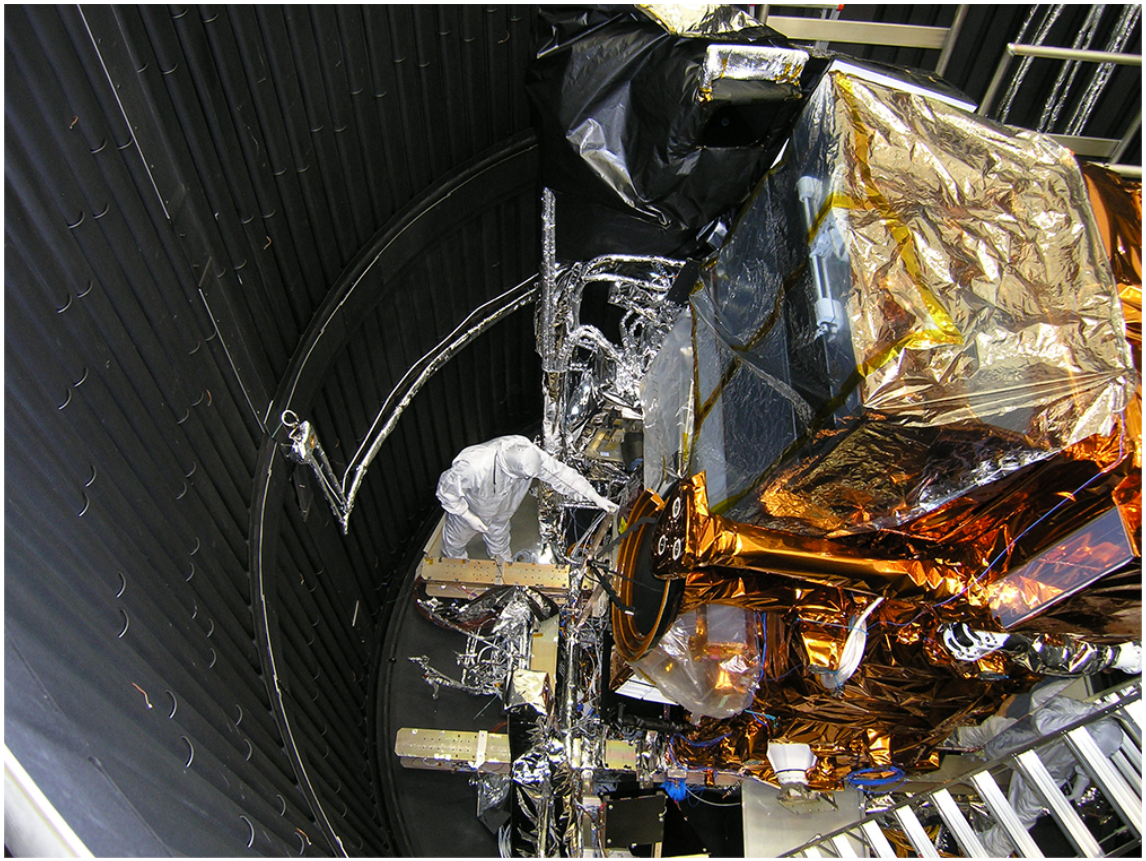
Upcoming Events – Path to Launch

JPSS-1 (2017)

- *J1 TVAC Regression Testing completion (Open Door) - May 17, 2017*
- Post TVAC-2 close-out activities, final Inspection, cleaning - May 24, 2017
- J1 Ground Operations Review (GOR) at VAFB – June 6, 2017
- J1 Operational Readiness Review (ORR) – June 26, 2017
- J1 Observatory Pre-Ship Review (PSR) at BATC - July 26-27, 2017
- J1 Mission Readiness Review (MRR) - Aug. 24, 2017
- J1 Safety & Mission Success Review (SMSR) – Aug. 25, 2017
- J1 Mission Rehearsal 6 & 7 – Sept. 8 & 14, 2017
- J1 Flight Readiness Review (FRR) – Sept. 15, 2017
- J1 Launch Vehicle Readiness Review at VAFB – Sept. 19, 2017
- *J1 Launch Readiness Date (LRD) – Sept. 21 2017*
- J1 Satellite Acceptance Review (SAR) – Dec. 8, 2017

Current Status

- **JPSS-1**
  - **Regression TVAC-2 testing underway, closed chamber door 4/6/2017**
  - **Currently transitioning to ambient. Open door expected ~ May 17, 2017**



TVAC Science Evaluation

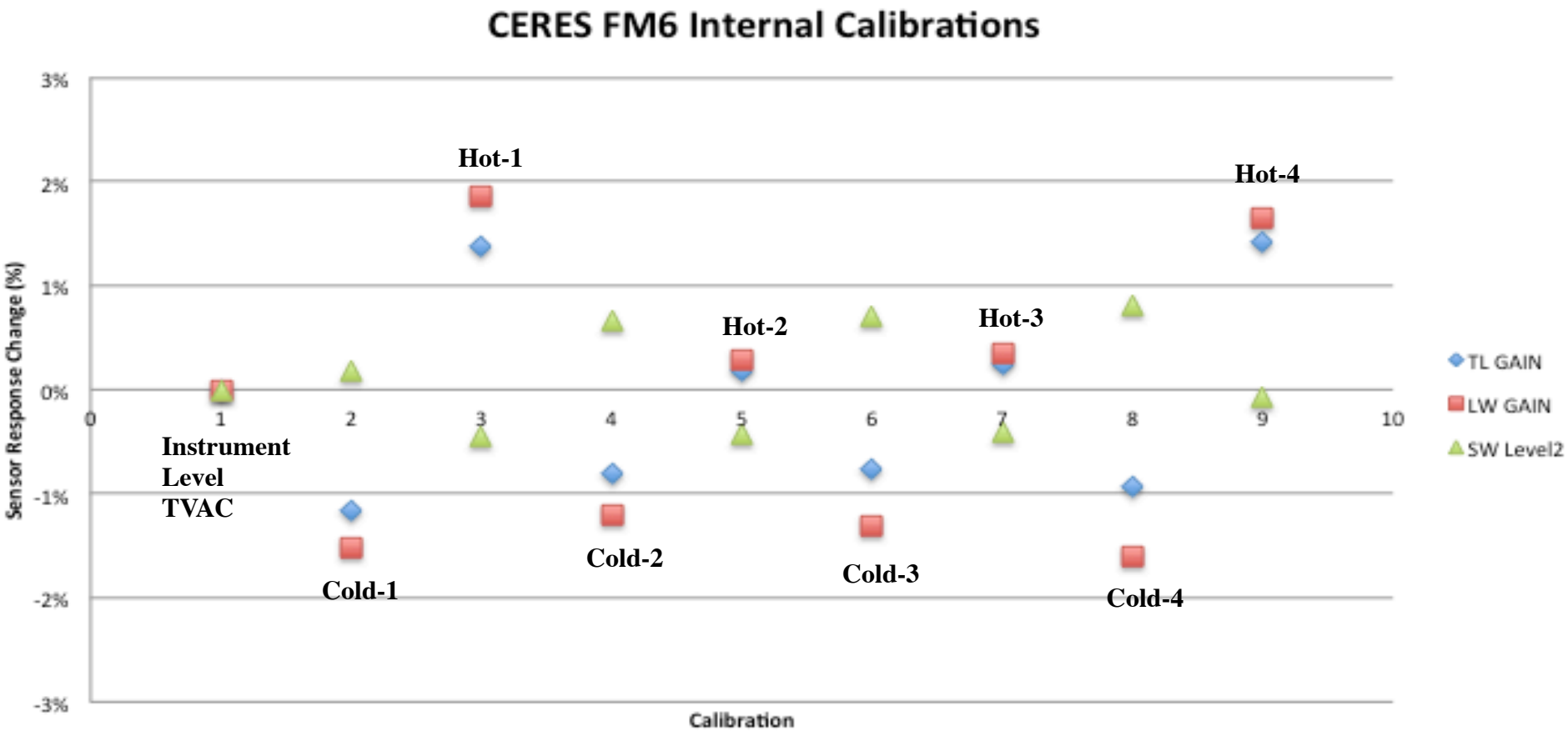
- Analysis of detector response for internal calibrations.
- CERES science goal is +/- 3% compared to instrument level baseline.
- CERES Sensors performances were within expected range during the calibrations.

Response comparison with Instrument Level Calibration Tests

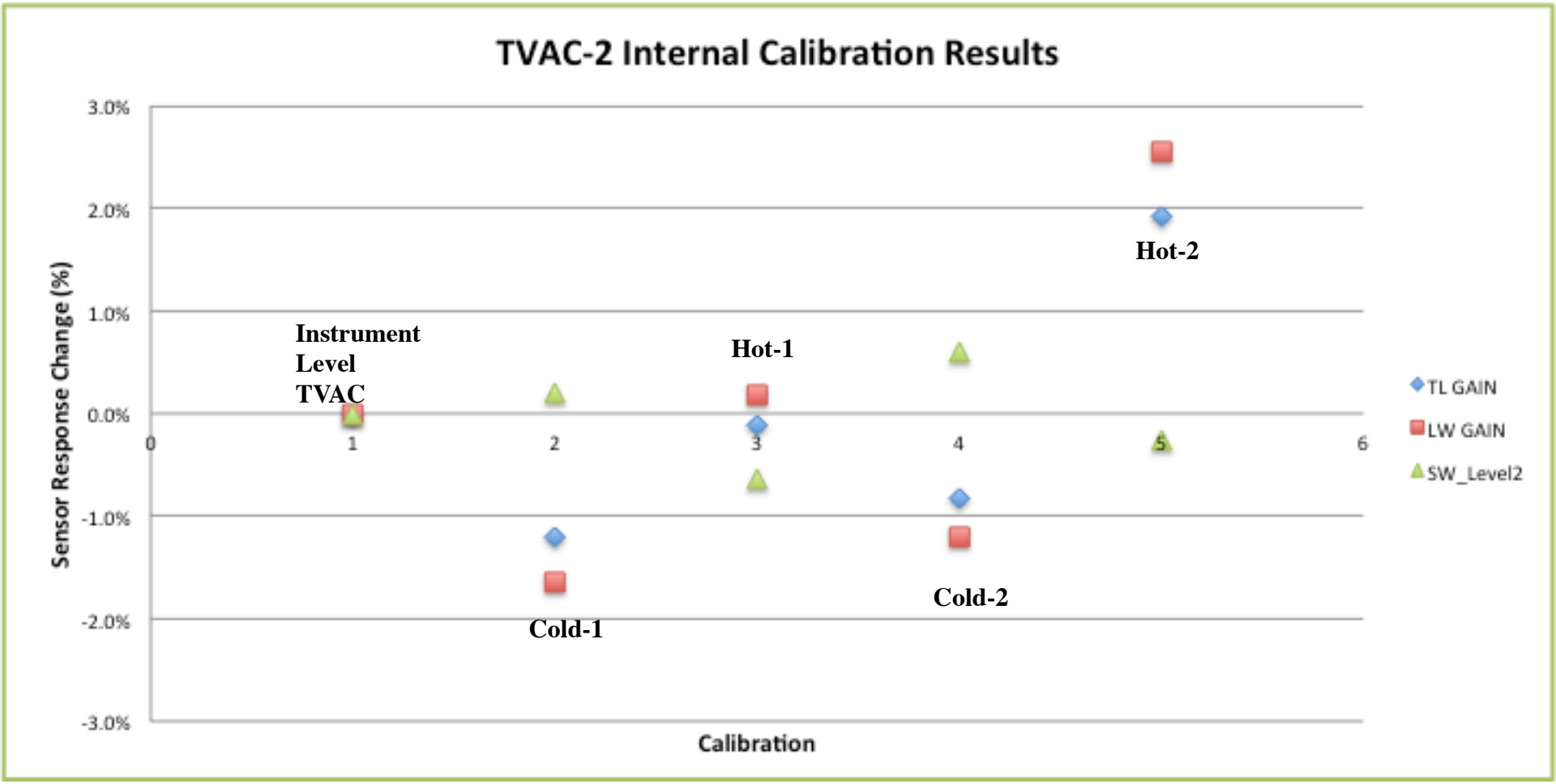
Internal Calibration

Sensor	1-COLD	1-HOT	TVAC #1 2-COLD	TVAC #2 2-COLD	2-HOT	Goal
Shortwave L2	0.21%	-0.65%	0.67%	0.60%	%	<±3%
Total	-1.21%	-0.10%	-0.81%	-0.83%	%	<±3%
Longwave	-1.64%	0.18%	-1.20%	-1.20%	%	<±3%

CERES FM6 TVAC- #1 RESULTS



CERES FM6 TVAC- #2 RESULTS



Technical Concerns (1 of 2)

Contamination on Front Filter of the SW Telescope

- **Non-Conformance:**

  During telescope inspection, potential molecular contamination film was identified on the Short Wave Front Filter metallized area and also id'd a feature on the clear area (<2%) of the filter.

- **Cause of Non-Conformance:**

  Indeterminate.

- **Disposition:**

  Interim is to continue to visually monitor. Visual inspection with both Keyence and digital photography following TVAC-1 on Oct. 28, 2016 showed no discernable difference to contamination. Risk of sampling and cleaning the SW filter outweigh the risk of using-as-is given the current level of knowledge of the contaminate.

- **Preventative Action/Closure Plan:**

  Planned visual and Keyence photographic inspection after regression TVAC-2 testing, May 2017. If contamination continues to remain unchanged, the final disposition will be to *'Use-As-Is'* and will be carried forward as a residual risk regarding possible contamination changes on-orbit. NCR to remain open until last opportunity to inspect prior to launch. Keyence photos taken 1/18/17 show no discernable difference to contamination.

Pre-TVAC

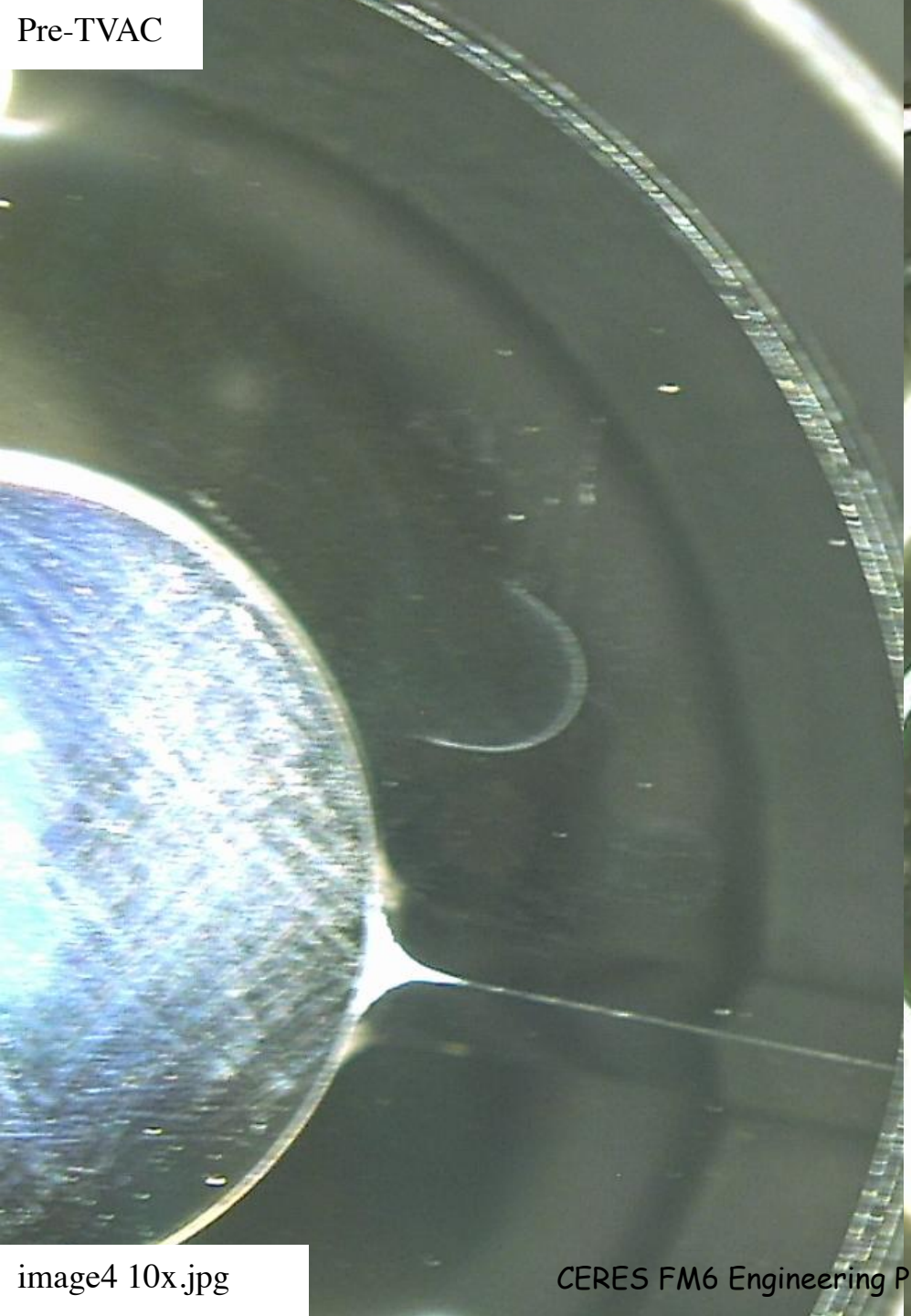
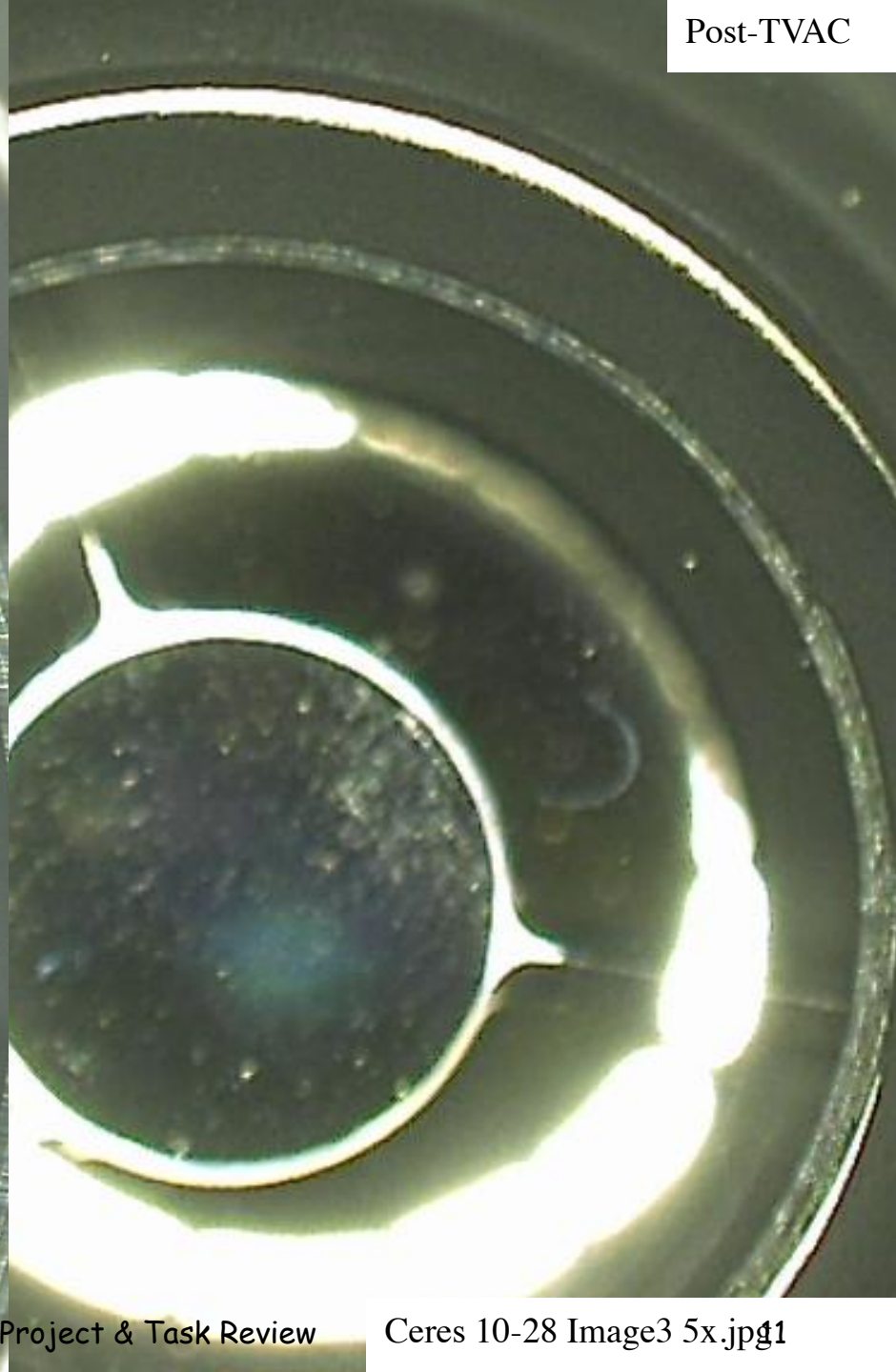


image4 10x.jpg

Post-TVAC



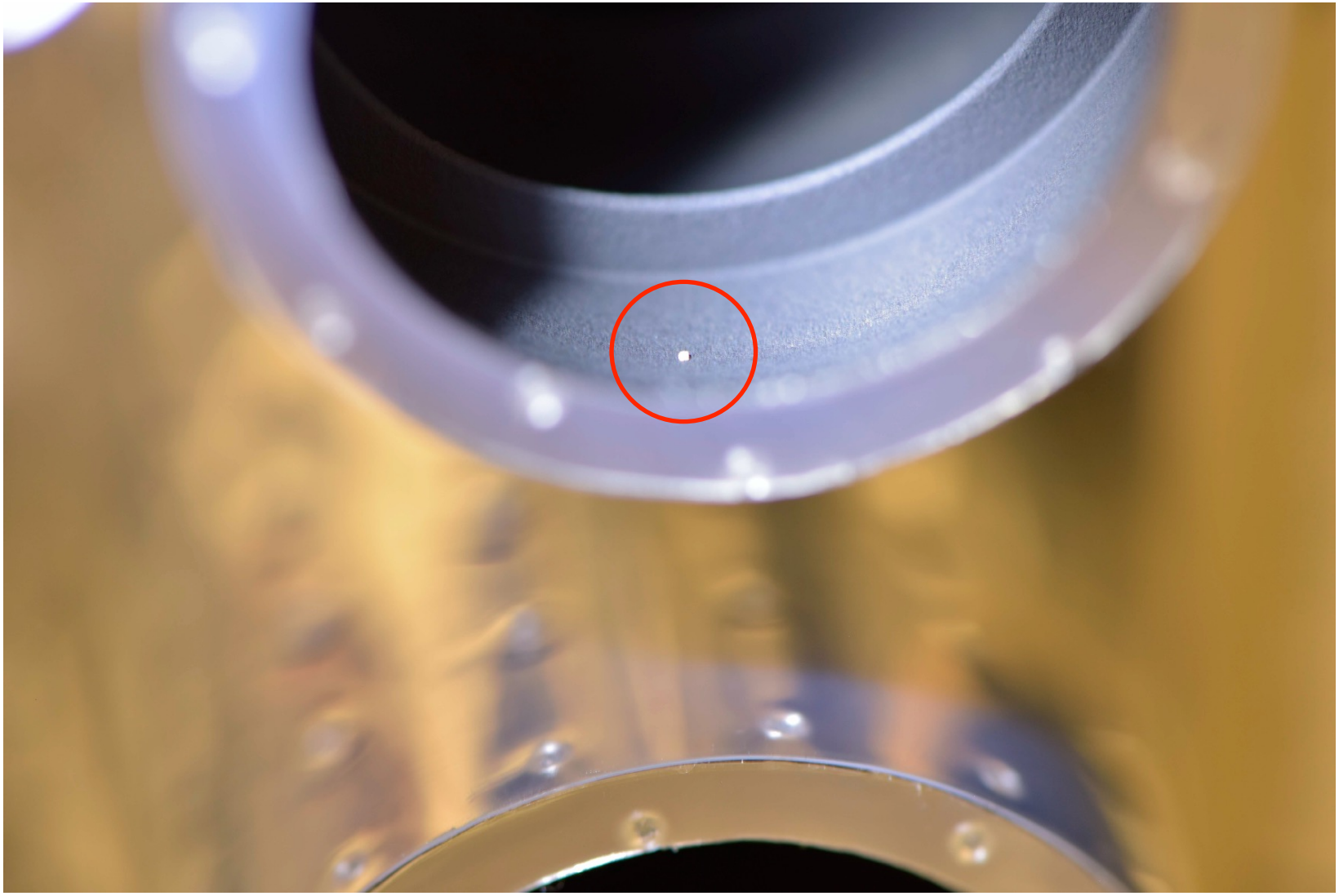
Ceres 10-28 Image3 5x.jpg

Technical Concerns (2 of 2)

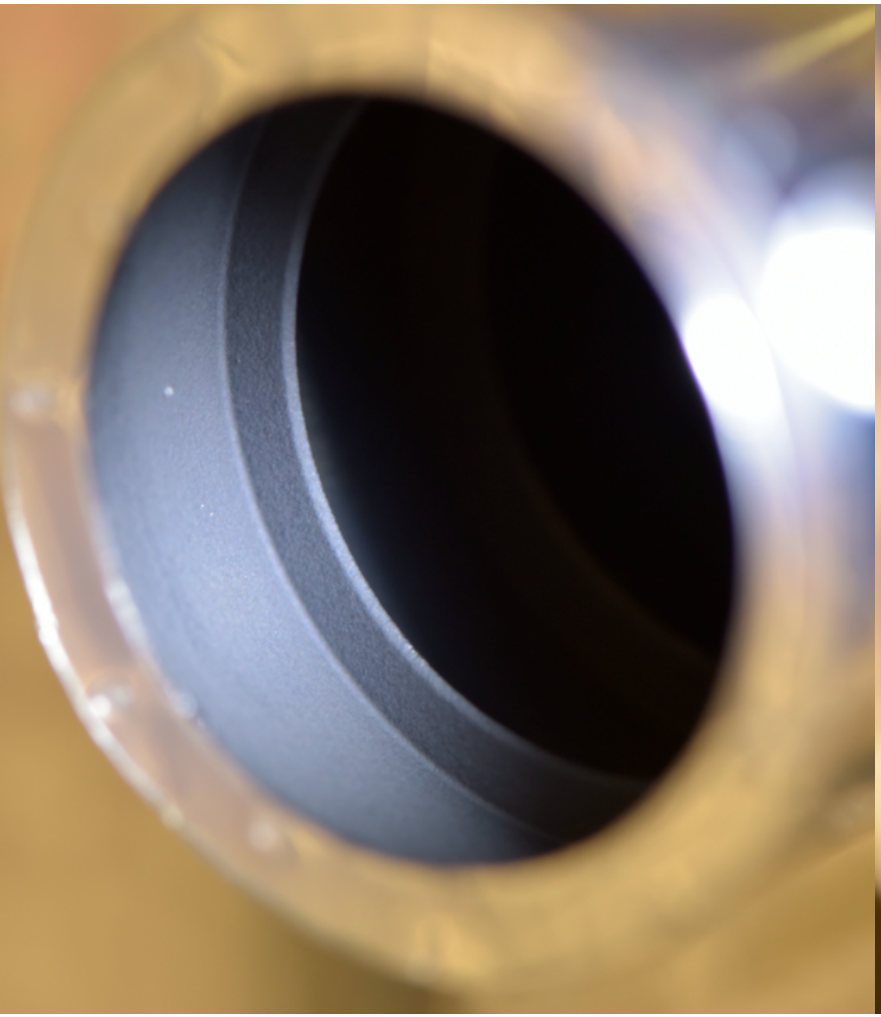
White Particles on Exterior and Interior Surfaces

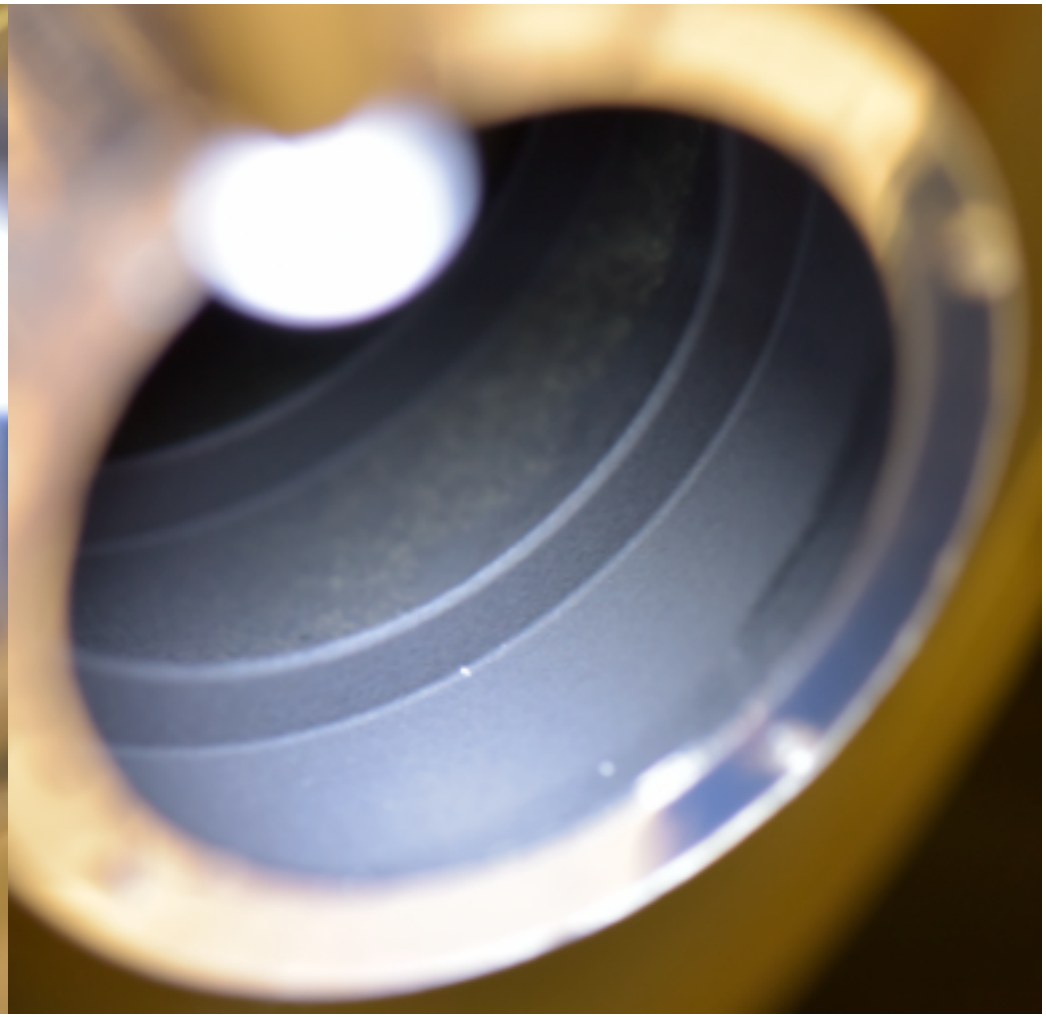
- **Non-Conformance:** White particles were observed on the exterior surfaces of the flight instrument following J-1 TVAC-1. A larger (~600 µm) particle was also found. The Short Wave Telescope Baffle photos revealed apparent particles on the filter and light baffles. (BATC TAR 102335)
- **Cause of Non-Conformance:**
  - SEM/DEX analysis identifies particles as two (2) types of white paint. Two samples were Zn based and three (3) were Ti based. Consistent with white thermal control paint used on other instruments and solar array gimbal on J1.
- **Disposition:**
  - Interim: Quarterly Inspection and Cleaning on March 1. Vacuumed particles on exterior. Removed largest particles on the telescope baffle interiors between vanes 0 and 1 and area in-between.
  - Final: Inspect and clean post TVAC-2. Working with SITB to finalize criteria and procedure to facilitate the removal of agreed upon particles on baffle surfaces.
- **Preventative Action/Closure Plan:**
  - Instrument doors kept closed during TVAC-2. Post TVAC-2: Inspect, clean and remove exterior particles. Inspect, photograph, map, and then remove particles based on stakeholder agreed criteria of particles based on size, location and amount.

Total Telescope – Particle ~ 300 µm



Total Telescope

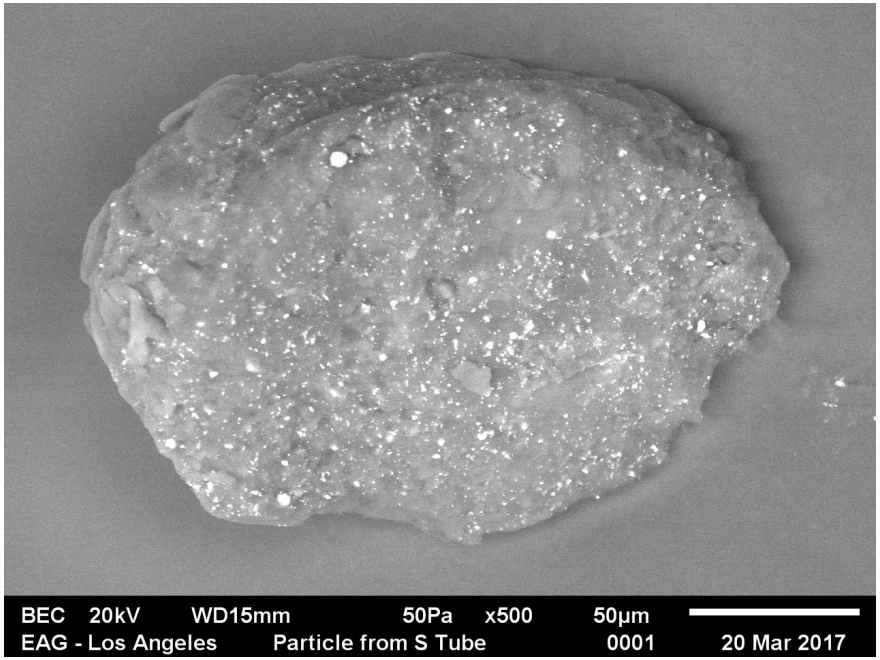




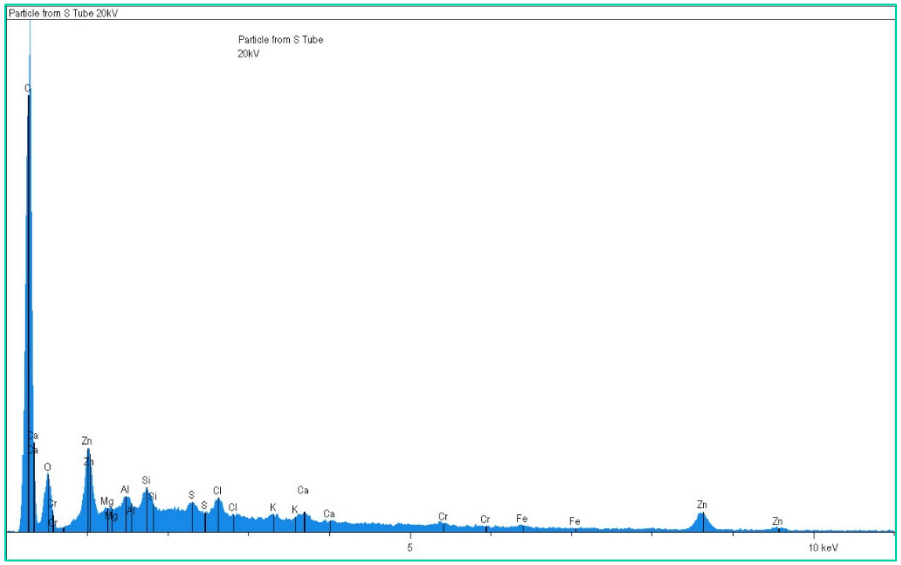
Analysis of Particles

- Captured particles were sent to EAG Laboratories for analysis.
  - Sample results are shown below.

- Measured particle composition is consistent with two types of white paint (zinc based and titanium based).



scanning electron microscope (SEM) image of particle taken from short wave channel baffle



atomic composition of particle taken from short wave channel baffle measured by energy dispersive x-ray (EDX)

Summary

- **CERES FM-6 is ready for launch on 9/21/17.**
- **We look forward to reporting on a successful launch at the Fall Science Team Meeting…**