

Polarimeter to Unify the Corona and Heliosphere



PUNCH 5 Science Meeting
June 20-21, 2023
Boulder, CO

WFI Instrument Status

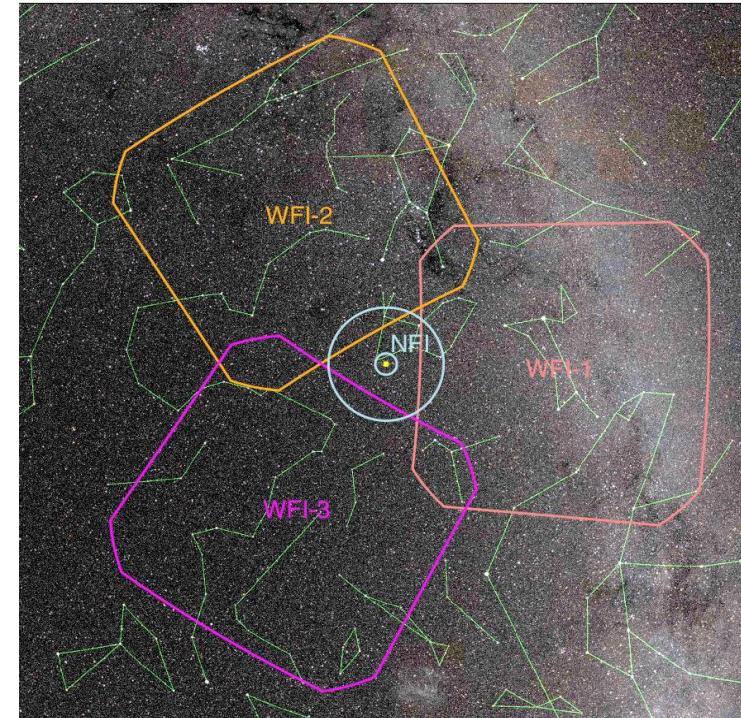
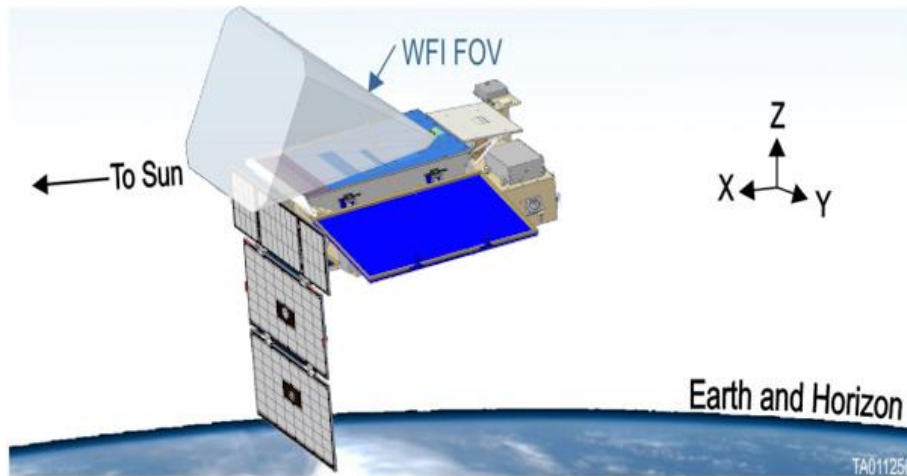
Glenn Laurent
WFI Instrument Lead





WFI Overview

- WFI/NFI provide first complete, photometric, high resolution views of corona/solar wind transition.
 - WFI 5-45°, NFI 1.5-8°
- WFI provides first wide-field polarimetric solar wind images.
- Design based on STEREO/HI, SoloHI - heliospheric imagers.
- 3 observatories in 620 km polar orbit (95.95 min)
- Rotating trefoil pattern orbit separated by 120° ± 30°.
 - Continuous observations 4 min observing cadence (2x per roll)
 - Full coverage in 32 min
 - 30° roll every 8 min

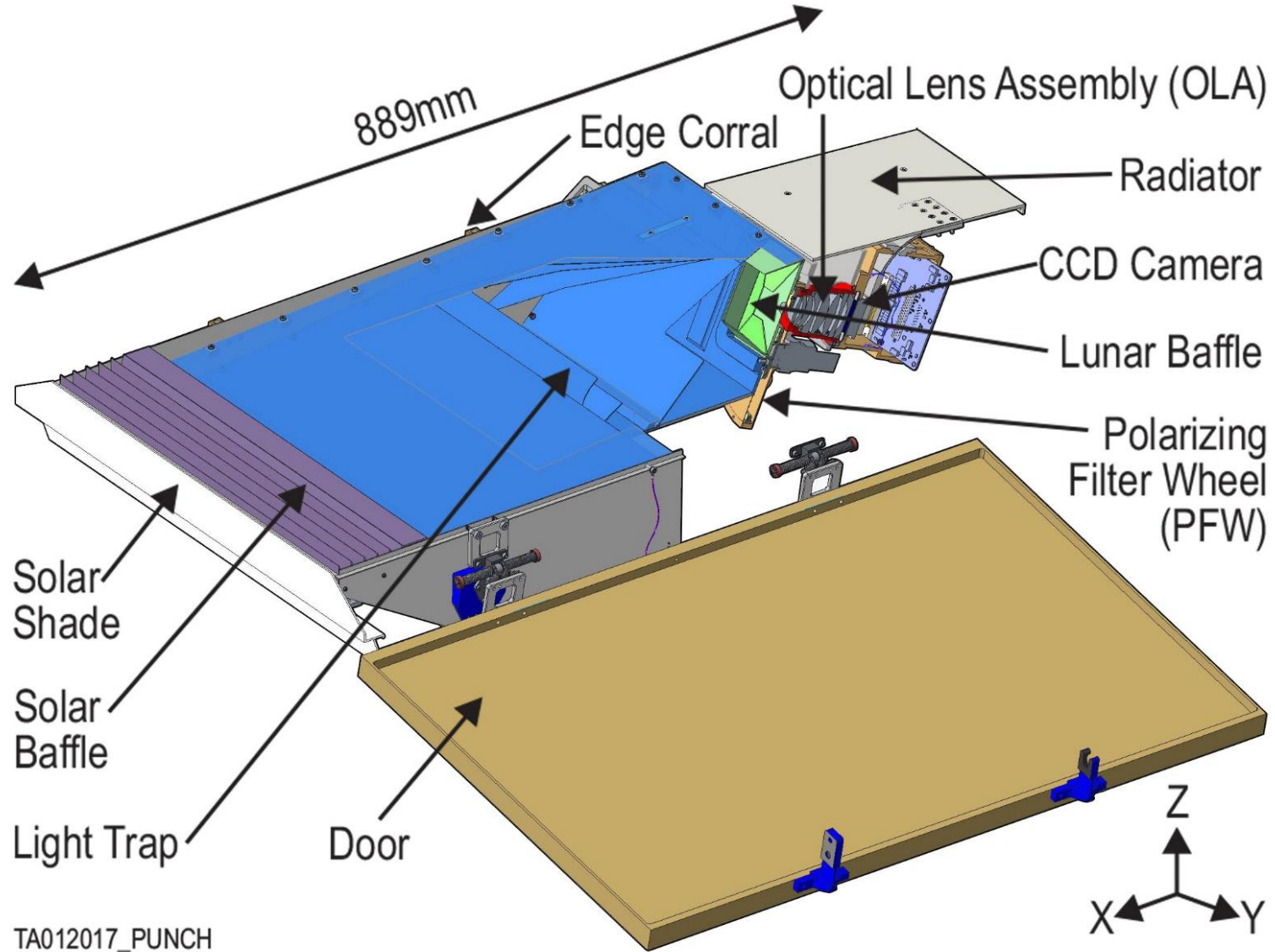


Resource	CBE	Cont.	Total
Mass (kg)	16.88	7.05%	18.07
Power (W)	15.49	12.00%	17.35
Length (mm)	889	-	889
Width (mm)	438	-	438
Height (mm)	149	-	149
Data Rate (GB/day)	1.41	34.20%	

* LV update provides additional margin



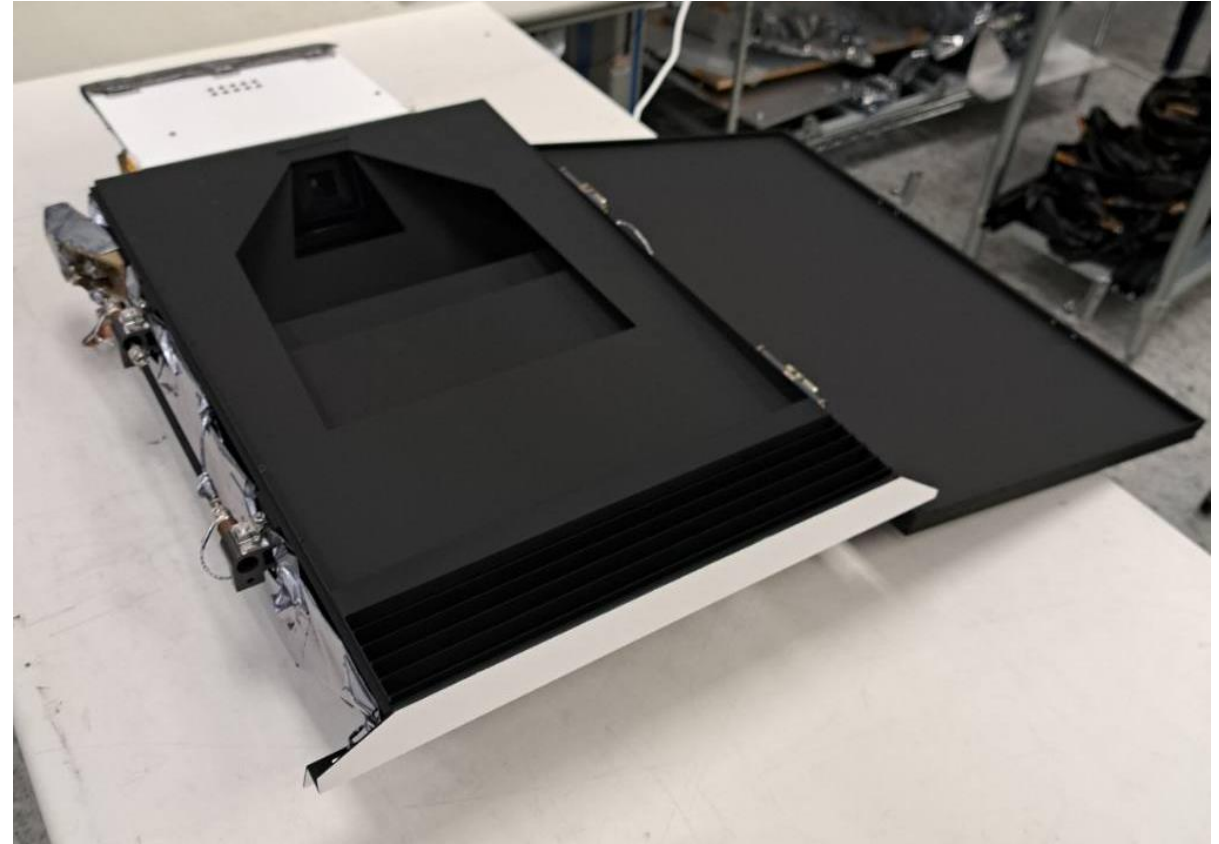
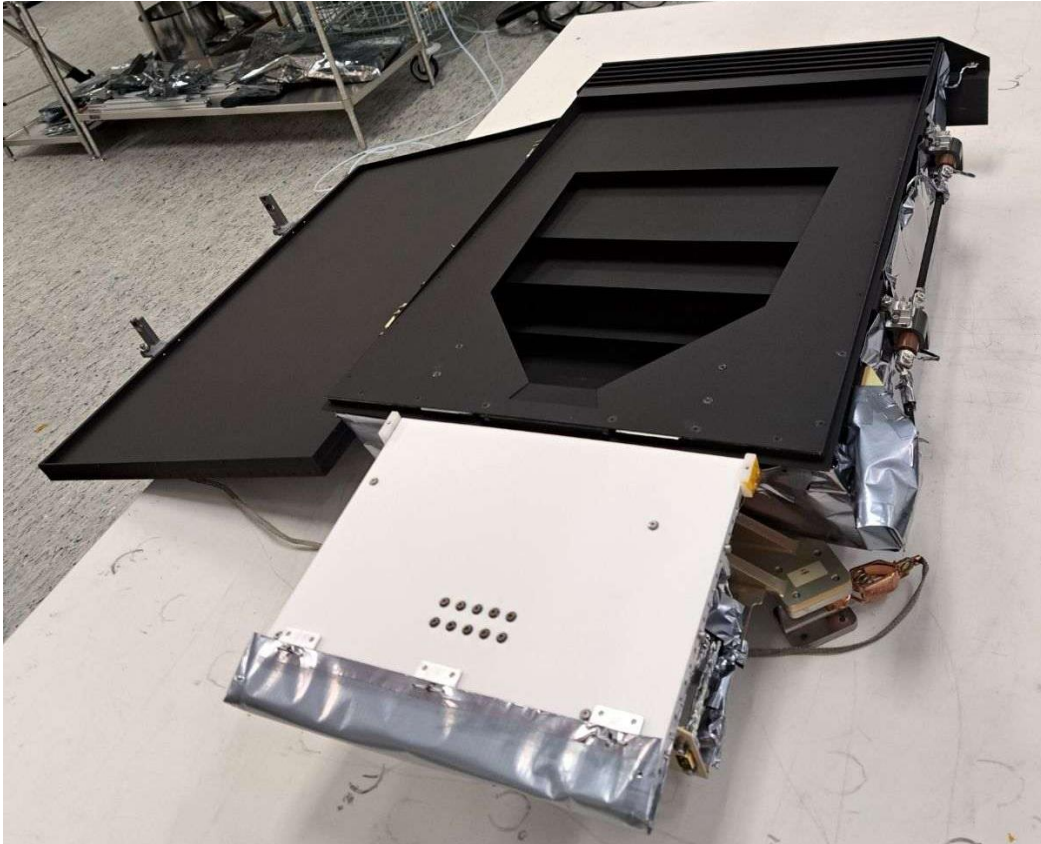
WFI Instrument



TA012017_PUNCH

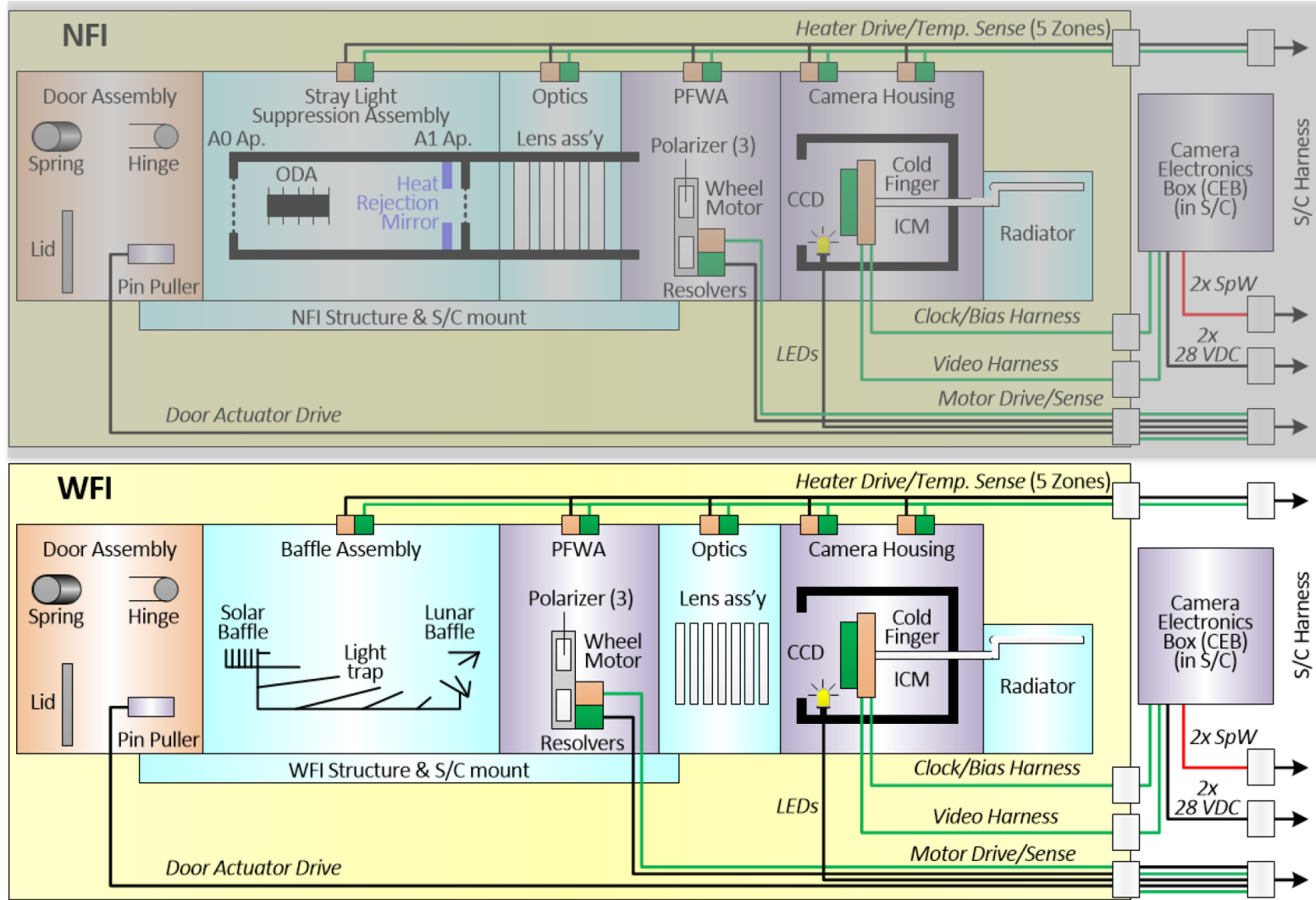
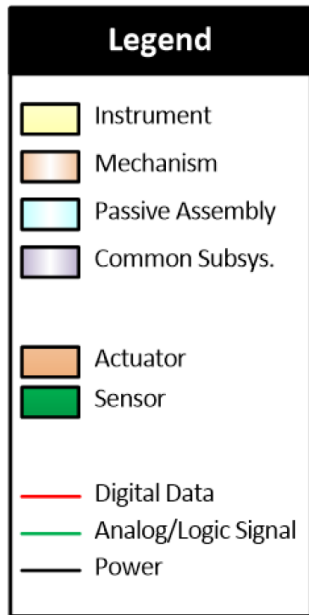


WFI-3 Integrated Instrument





WFI Block Diagram





WFI Level 2 Driving Requirements

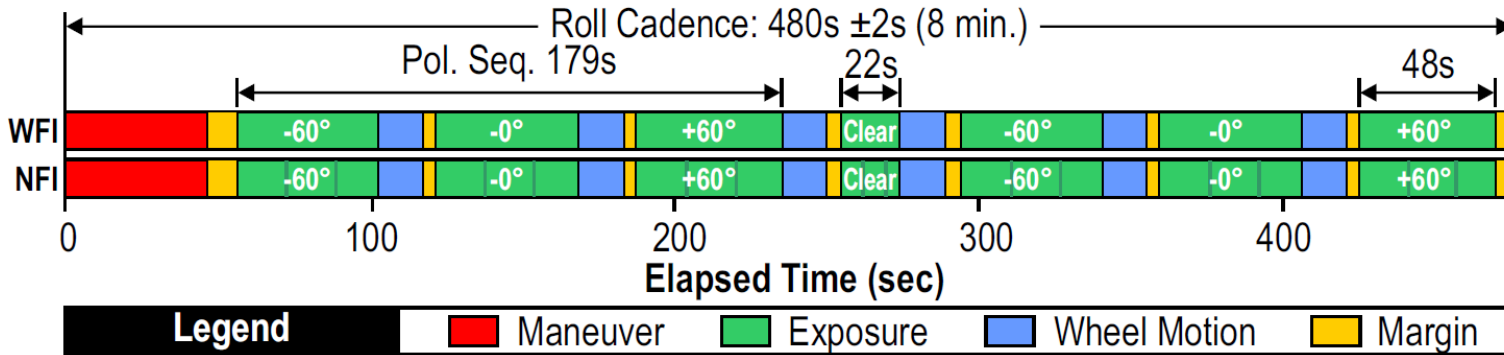
- WFI science requirements have remained unchanged since CDR

ID	Requirement	Value	Performance	Status
1057	Passband	Width: 300+/-100nm Center: 550+/-75nm	450-750nm	PASS
1063	Field of View (FOV)	20 R _☉ – 160 R _☉	17.4 R _☉ – 180R _☉	PASS
1064	Instantaneous FOV	40 deg ^o square truncated by 50 deg ^o circle	40.2 ^o FOV Baffle, >50 ^o OLA FOV	PASS
1068	Angular Resolution	4 arcmin	2.4 arcmin	PASS
1071	Norm. Sensitivity	7E-17 B _☉	3.7E-17 B _☉	PASS
1076	Polarization	3 angles	-60 ^o , 0 ^o , +60 ^o	PASS



WFI Conops

- Conops common to WFI & NFI
- Two sets of polarization sequences per 8 min roll cadence
- 20 seconds PFW rotation time



TA010788-PUNCH

PUNCH Observing Sequence Schedule			
Time (s)	Length + margin	NFI Action	WFI Action
0	47+4	Roll & set PFW to -60°	Roll & set PFW to -60°
51	48+1(*)	Expose 3x13s at -60°	Expose 45s at -60°
98	15+5	Set PFW to 0° & settle	Set PFW to 0° & settle
118	48+1(*)	Expose 3x13s at 0°	Expose 45s at 0°
165	15+5	Set PFW to 60° & settle	Set PFW to 60° & settle
185	48+1(*)	Expose 3x13s at 60°	Expose 45s at 60°
232	15+5	Set PFW to CL & settle	Set PFW to CL & settle
252	22+1(*)	Expose 3x5s at CL	Expose 19s at CL
273	15+5	Set PFW to -60° & settle	Set PFW to -60° & settle
293	48+1(*)	Expose 3x13s at -60°	Expose 45s at -60°
340	15+5	Sep PFW to 0° & settle	Sep PFW to 0° & settle
360	48+1(*)	Expose 3x13s at 0°	Expose 45s at 0°
407	15+5	Set PFW to 60° & settle	Set PFW to 60° & settle
427	48+1(*)	Expose 3x13s at 60°	Expose 45s at 60°
474	1 to 11	Sync for next roll	Sync for next roll

(*) 2-second overlap with following event

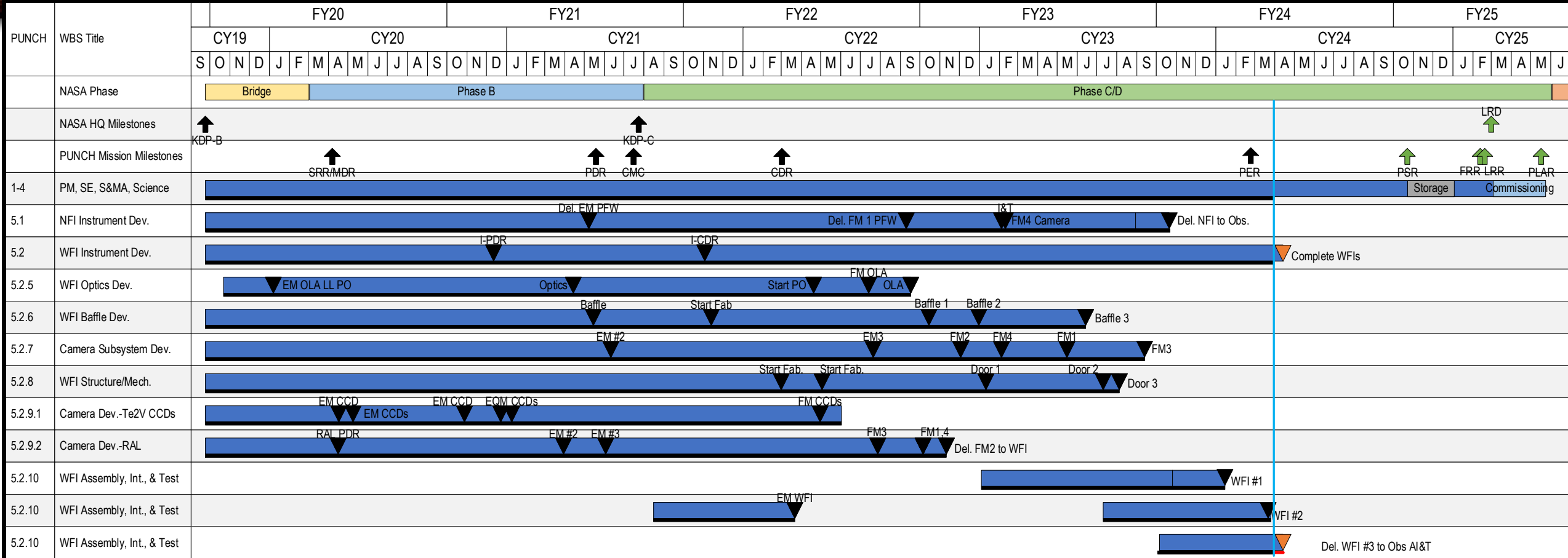


WFI Instrument Status

Milestone	WFI-1	WFI-2	WFI-3
Camera Focus	PASS	PASS	PASS
Vibe	PASS	PASS	PASS
TVAC / TBAL	PASS	PASS	PASS
SCOTCH	PASS	N/A (Descoped)	N/A (Descoped)
Optical Performance	PASS	PASS	PASS
PSR / EIDP	Complete (10/24/2023)	Complete (3/8/2024)	Complete (4/12/2024)
Delivery	Complete (1/22/2023)	Complete (3/22/2024)	Complete 5/14/2024



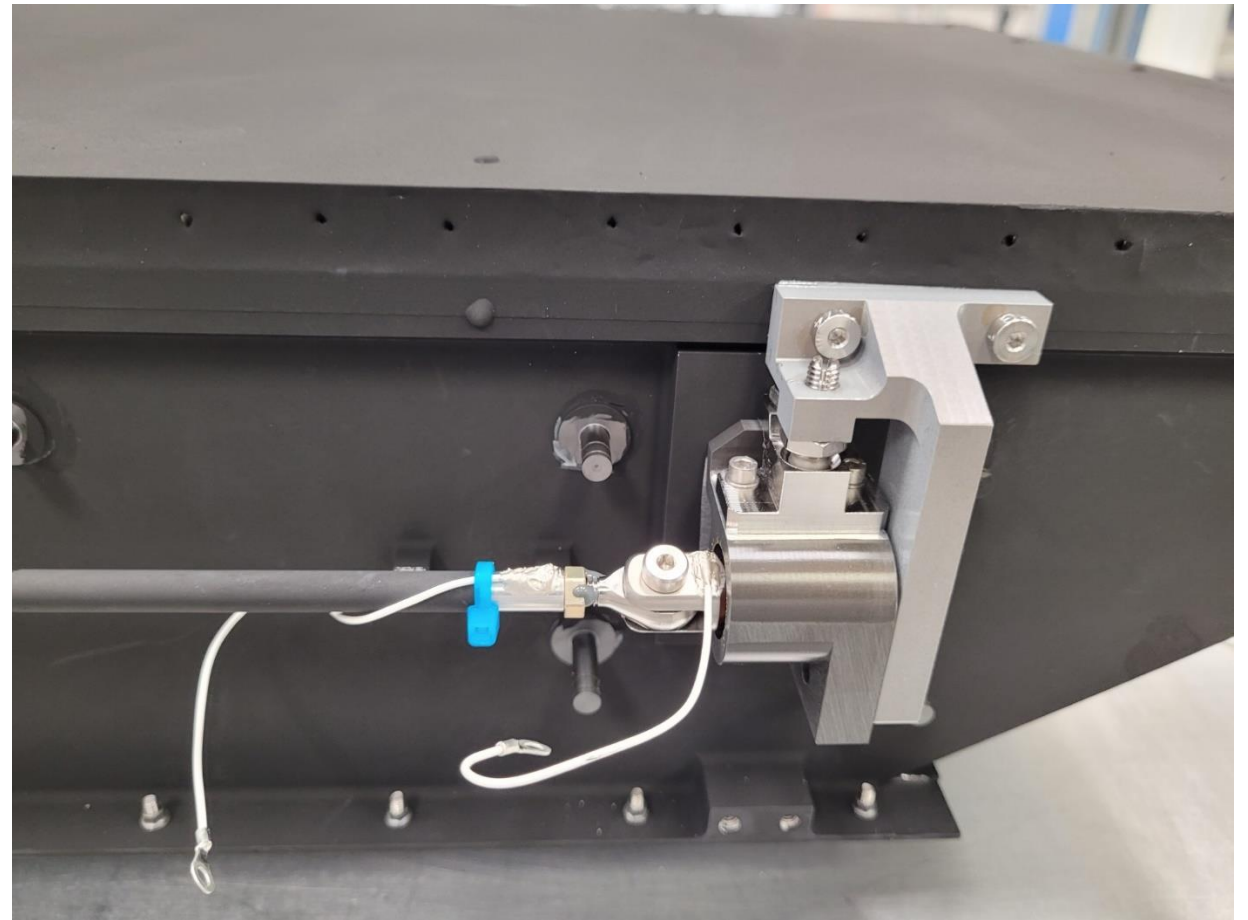
WFI Schedule—Status



WFI Top 3 Critical Paths				
S/C CP	Last month S/C CP Driver	Current S/C CP Driver	Earliest Possible Completion	Need Date
Primary	WFI FM3 Delivery (driven by single string activities)*	WFI FM3 Delivery	4/17/2024	4/25/2024
Secondary	WFI FM2 Delivery (driven by resource constraint)	N/A-- (WFI FM2 Delivered to AI&T 3/22/2024)		
Tertiary	WFI FM1 Delivery (prioritizing WFI 2 & 3)	N/A --(WFI 1 Delivered to AI&T 1/22/2024)		



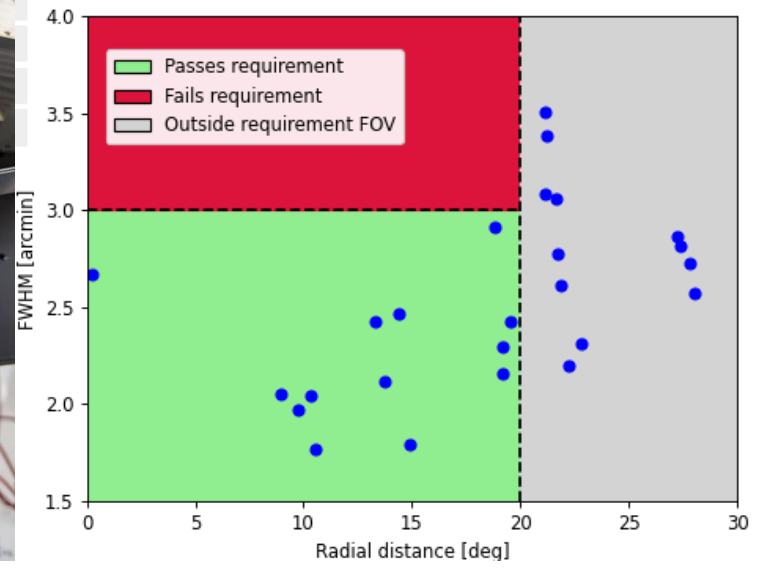
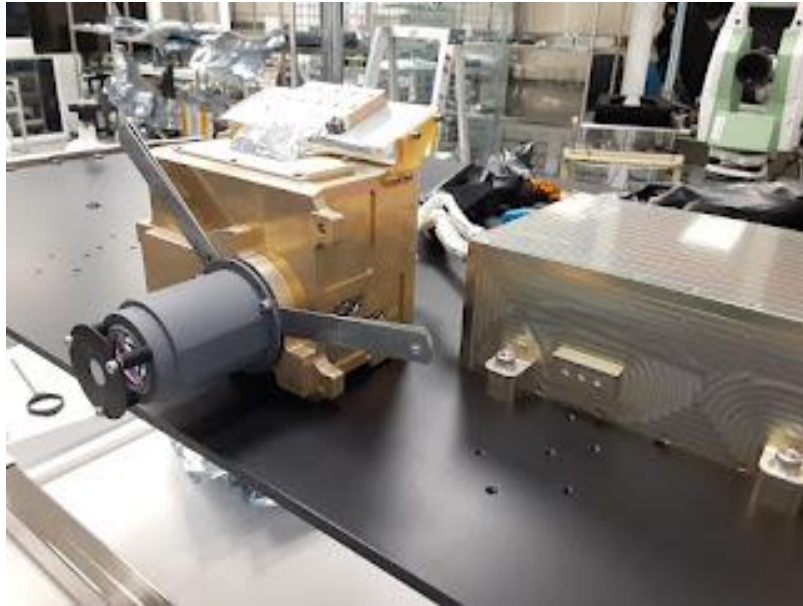
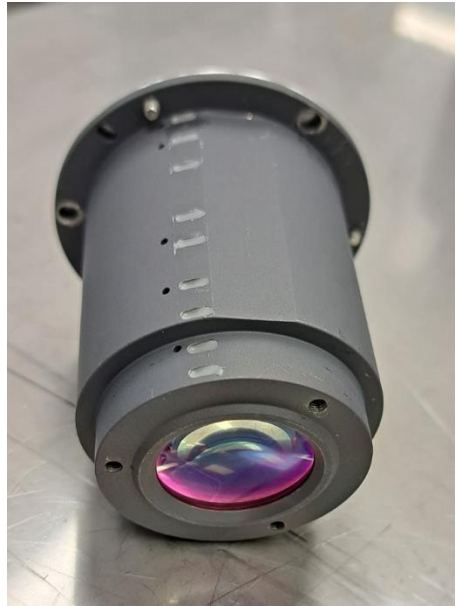
WFI Design Update – Door Latch



WFI Door Latch Modifications & Alignment Complete



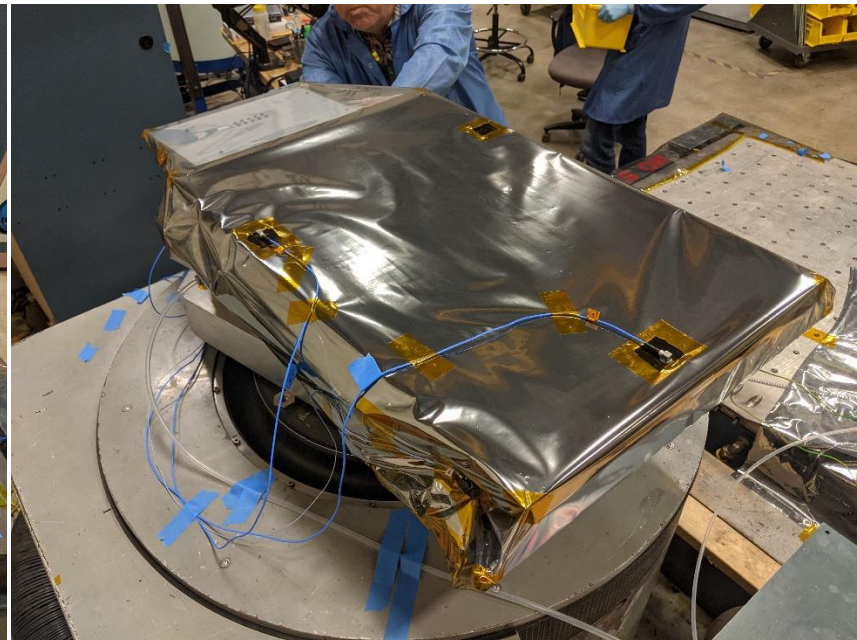
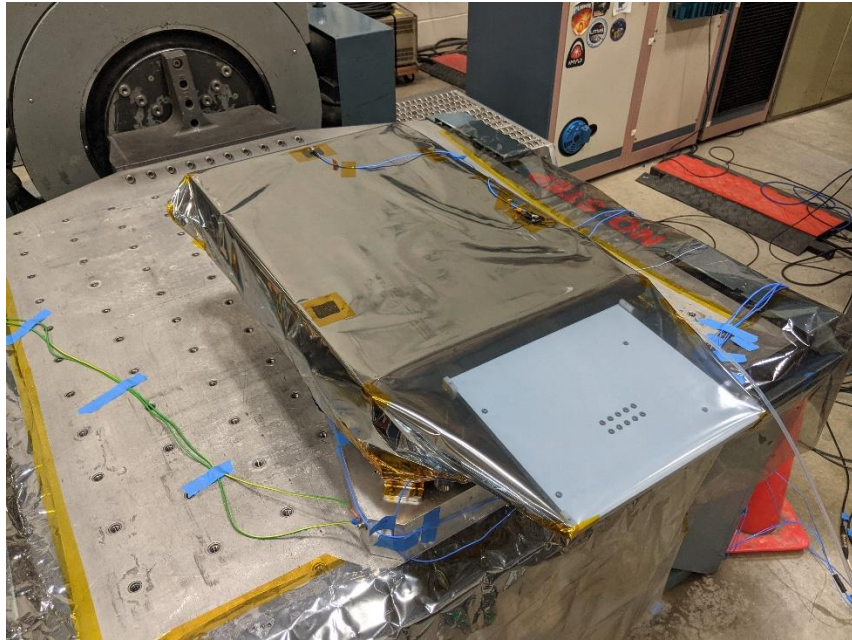
WFI Design Update -- OLA



WFI OLA Modifications & Focus Testing Completed



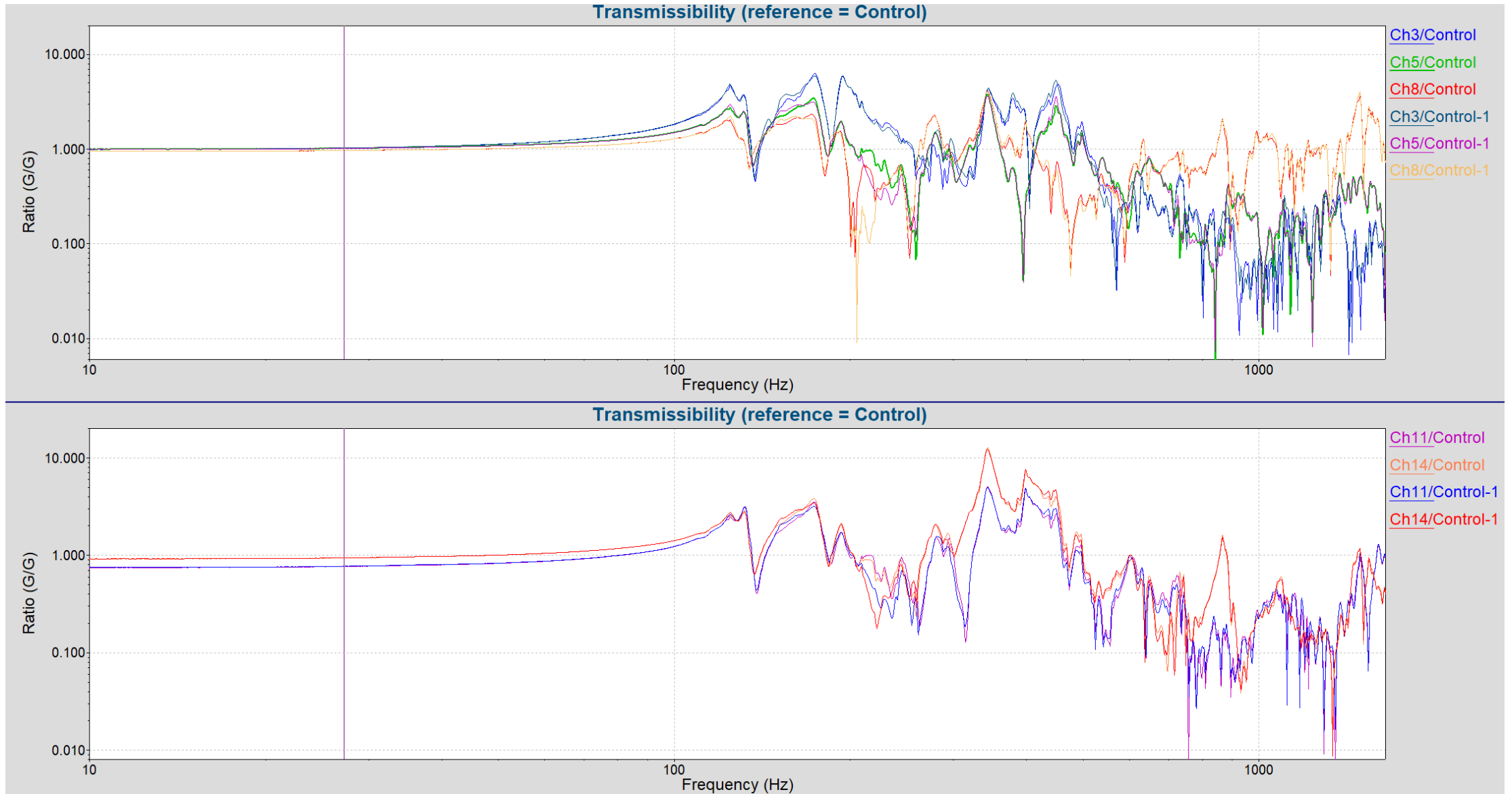
WFI Structural Verification (Vibration Testing)



WFI-3 Vibration Testing Completed

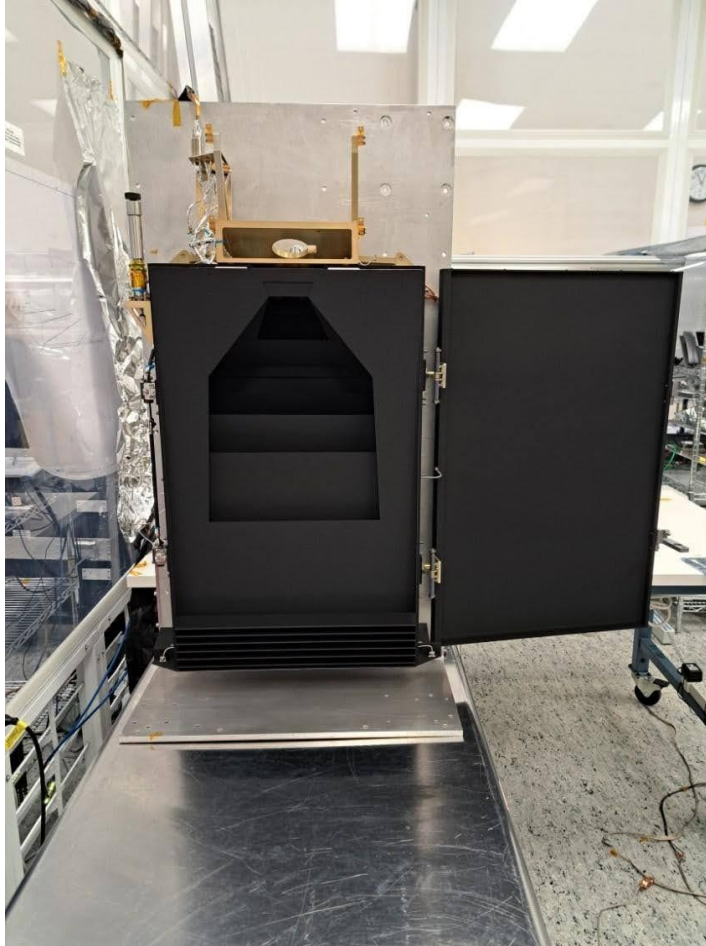


X Axis Post Equivalent Sine Low Level Sine





WFI Post-Vibe Door Testing



WFI-FM003 Post-Vibe Door Functional Testing Complete



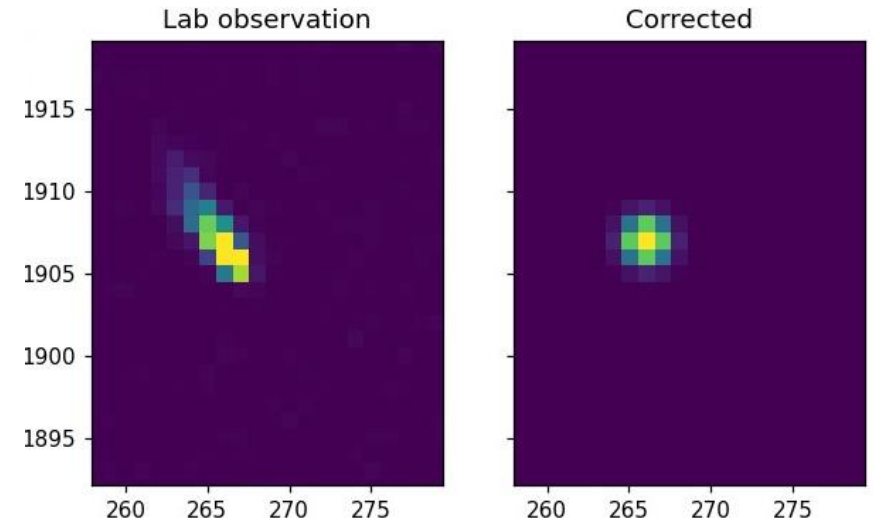
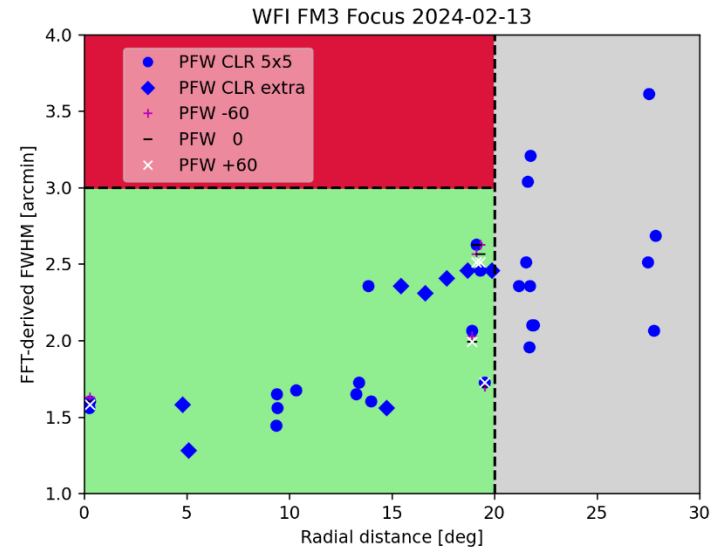
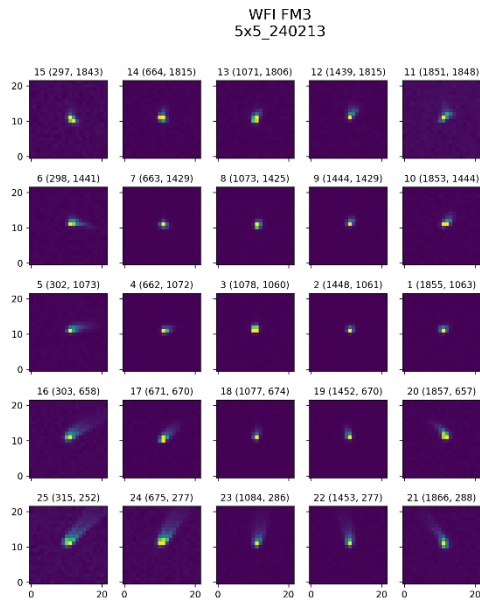
WFI Post-Vibe Optical Testing

3.1.6 Instrument Spatial Resolution

The WFI instrument **shall** have an angular resolution no coarser than 3 arcminutes in the clear (unpolarized) mode.

Rationale: Flows from the MDRA 1068 (section 4.4)

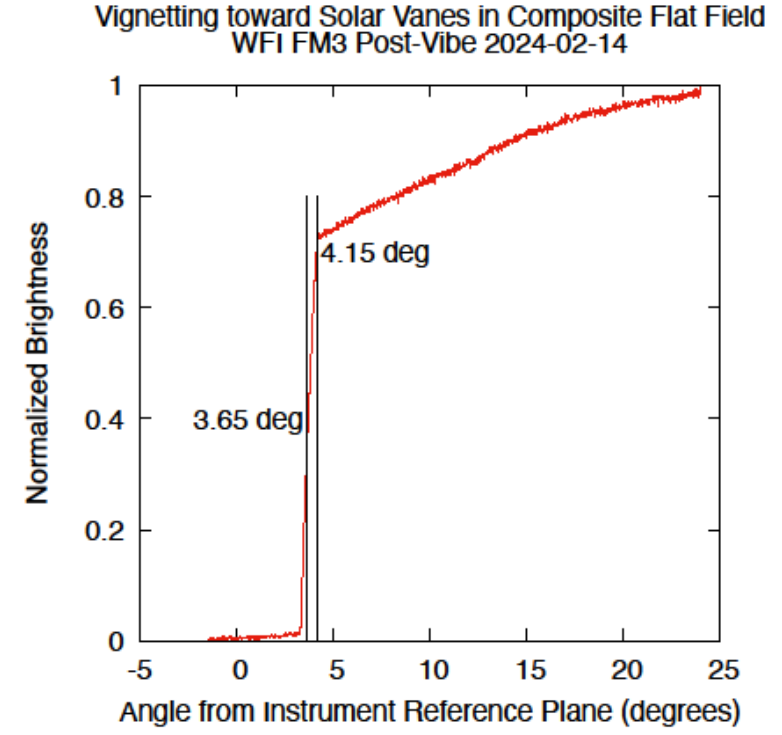
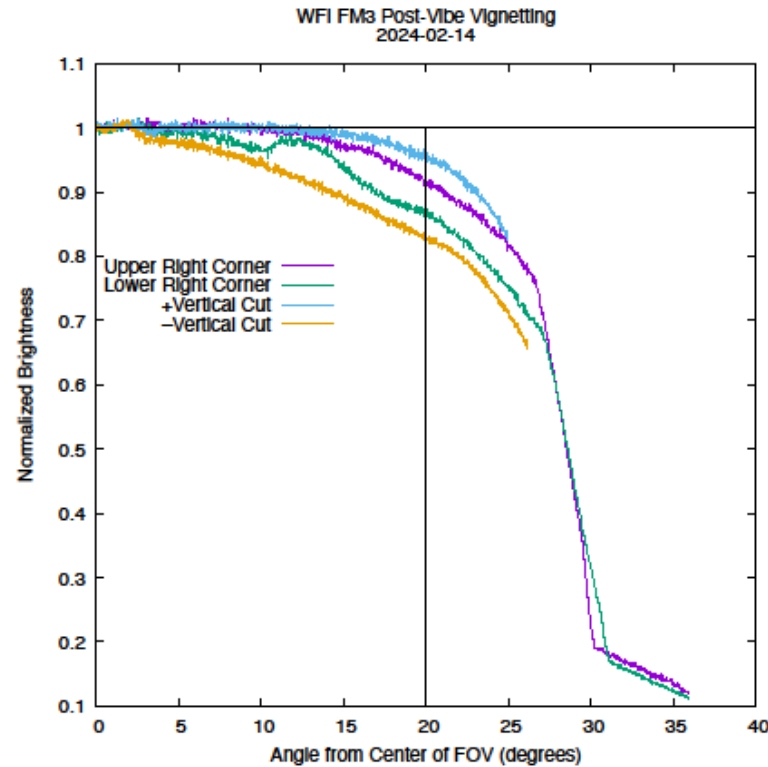
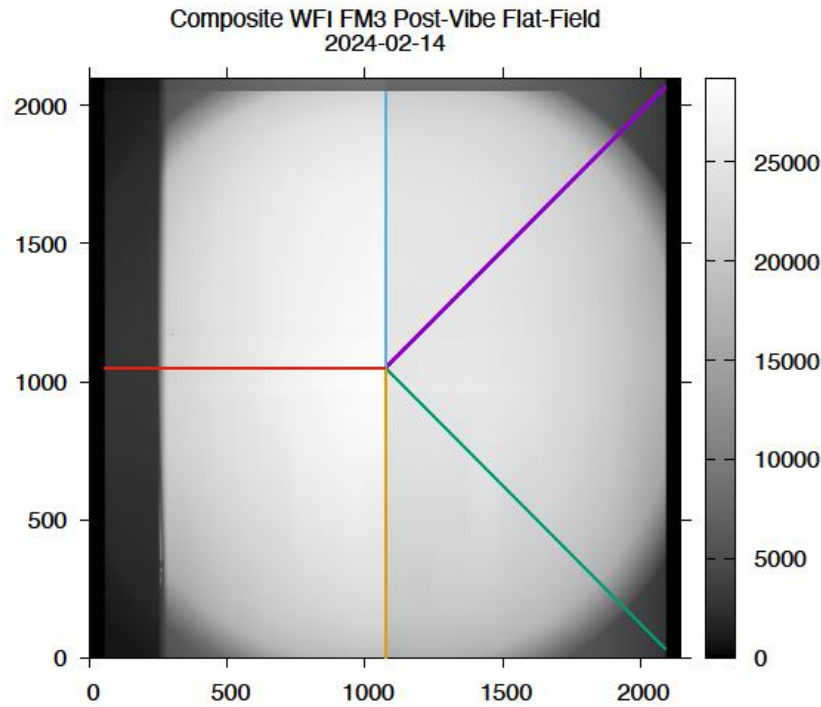
ID: WFI_1009



WFI-3 Post-Vibe Focus Testing Completed – Meeting Requirements



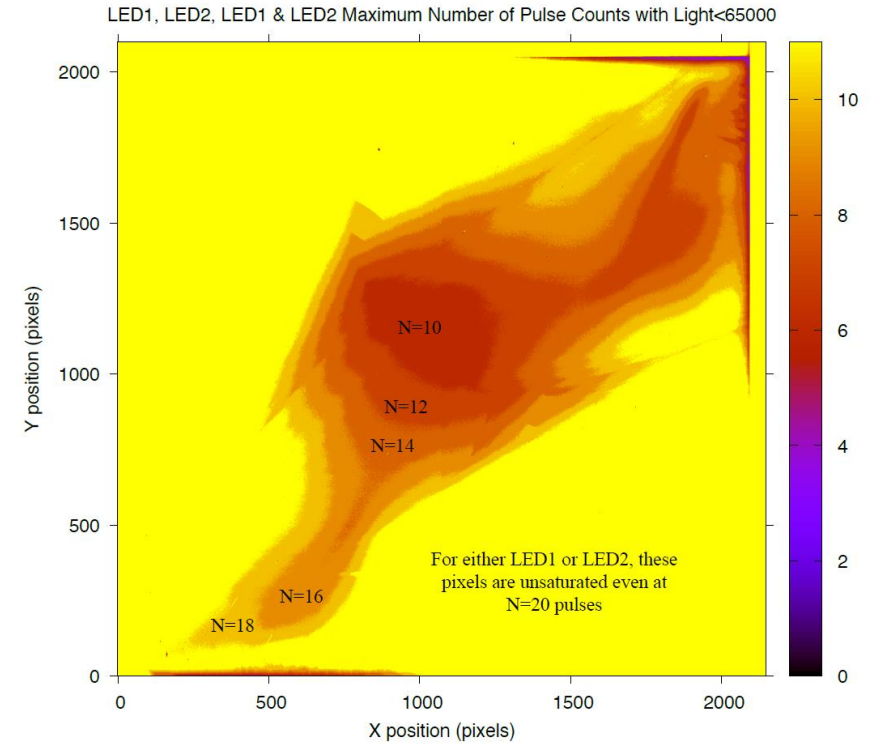
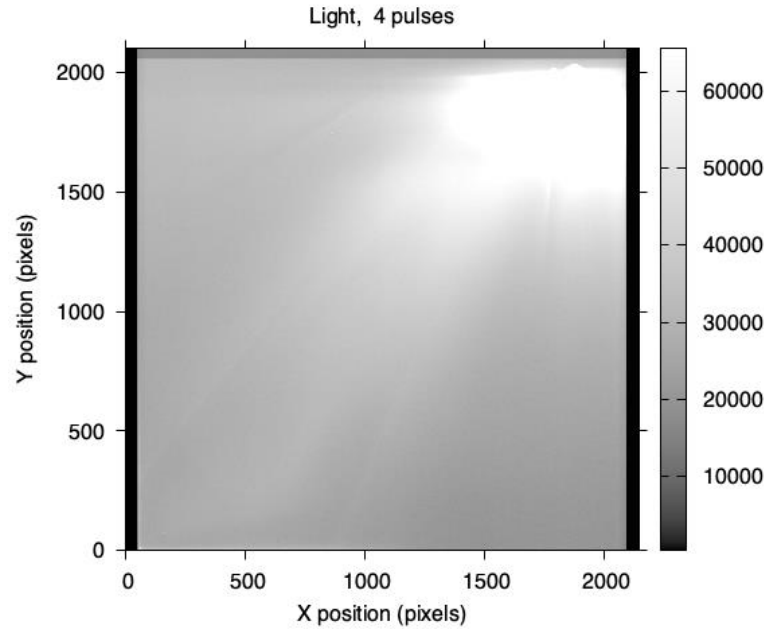
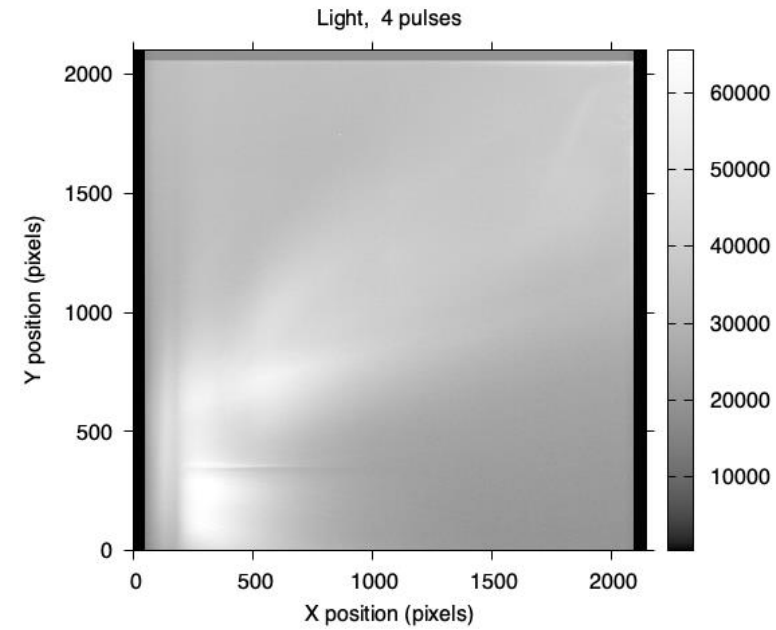
WFI Post-Vibe Optical Testing



WFI-3 Post-Vibe Flat Fields meet Vignetting Requirements



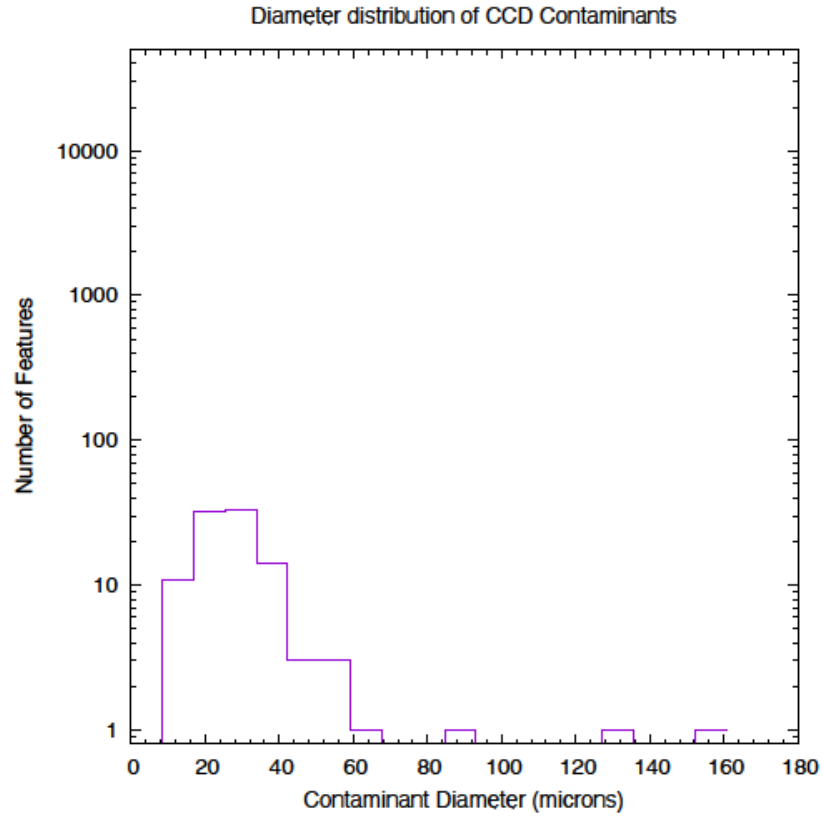
WFI Post-Vibe LED Testing



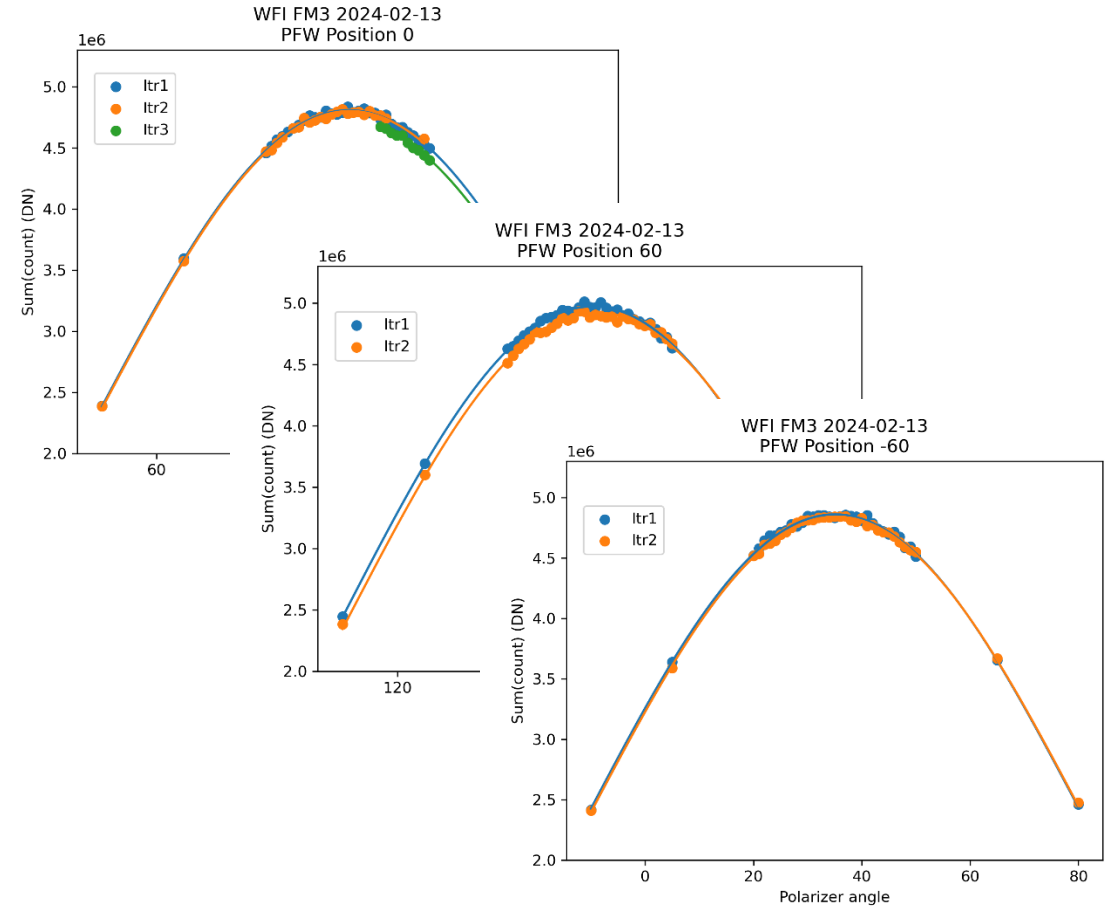
WFI-3 LED Testing completed
(Meets science requirements)



WFI Post-Vibe LED/PFW Testing



WFI-3 LED Testing completed
(Verifies minimal CCD Obscured pixels)

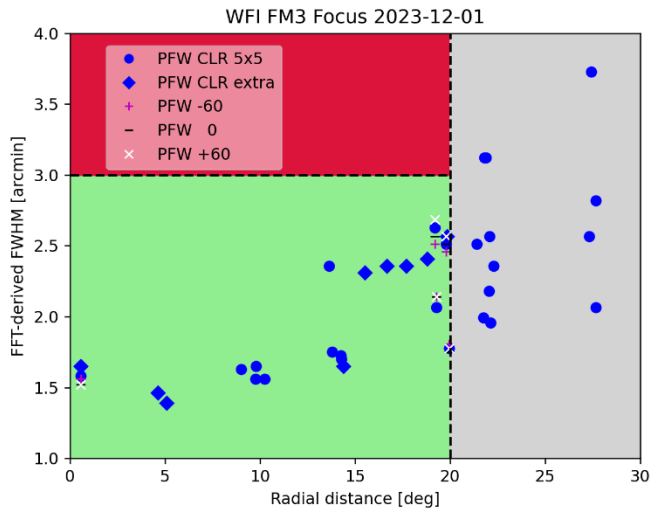


WFI-3 Polarizer Testing completed
(Verifies Polarizer Angles)

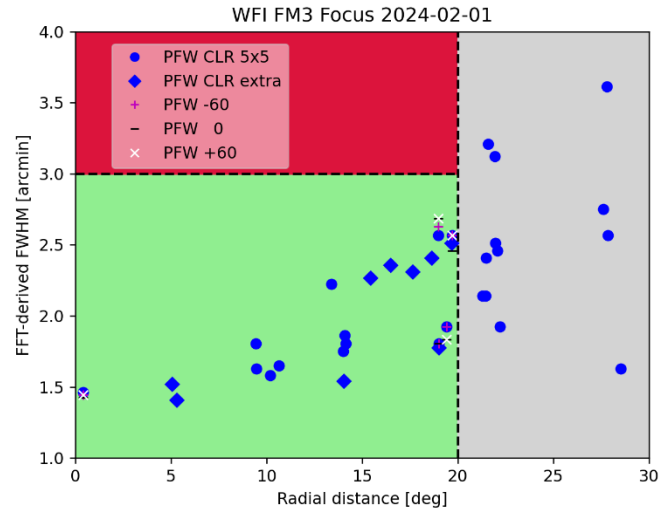


WFI Focus Repeatability

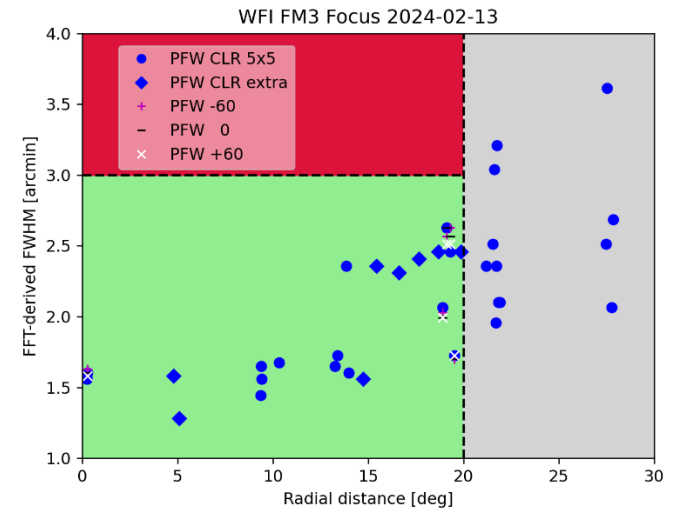
Pre-Environmentals



Post-TVAC



Post-Vibe



WFI-3 Pre-Delivery Focus Consistent with Pre-Environmental Focus



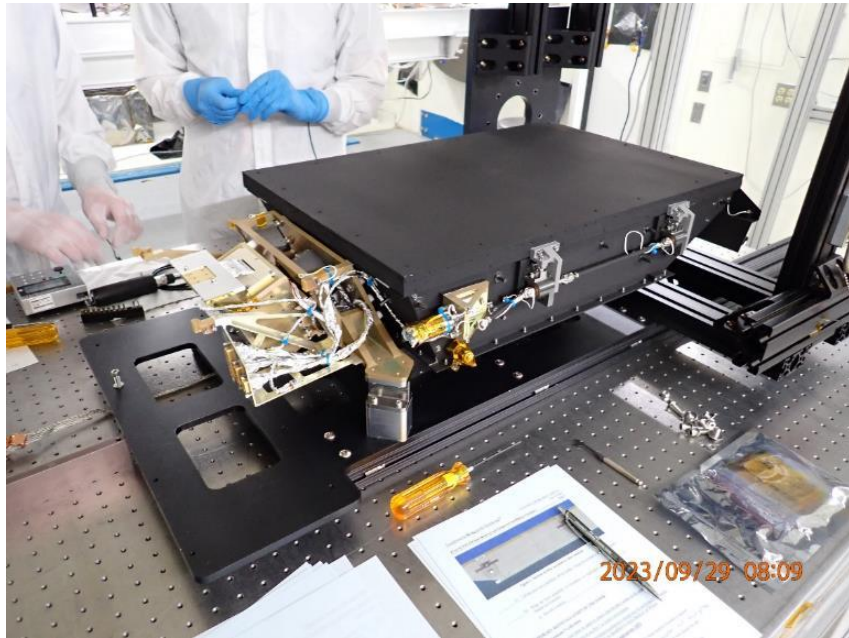
WFI-1 SCOTCH Testing (Design Validation for WFI-2)

3.1.8 Instrumental Background from Stray Light

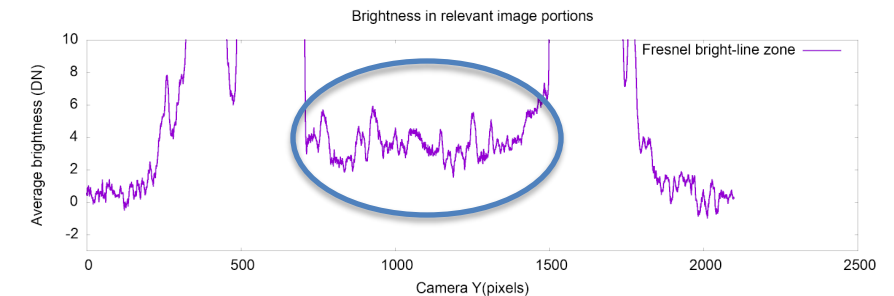
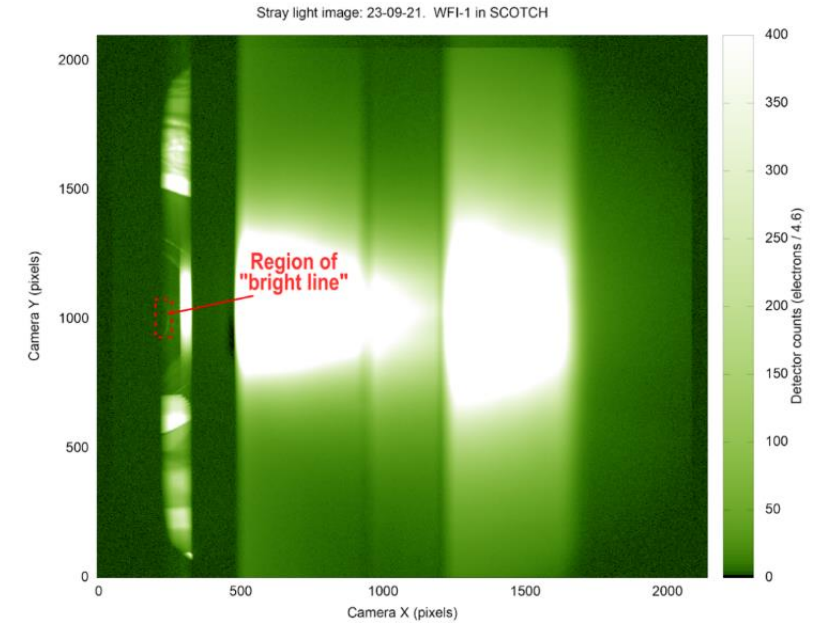
The WFI instrument shall have instrumental background below $2E-16 B_{\odot}$ due to stray light from all sources.

Rationale: Provides sufficient control of light that does not contribute to the science objectives.

ID: WFI_1015



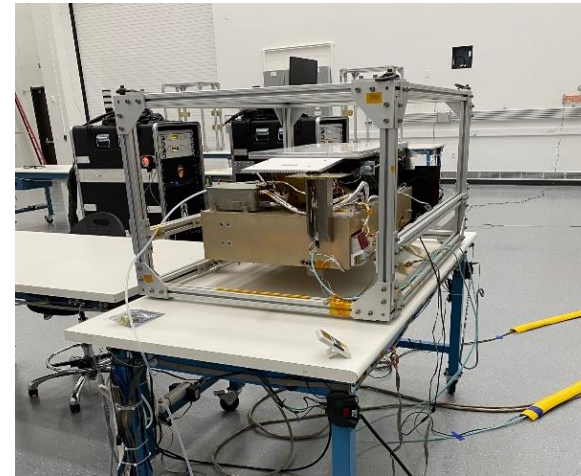
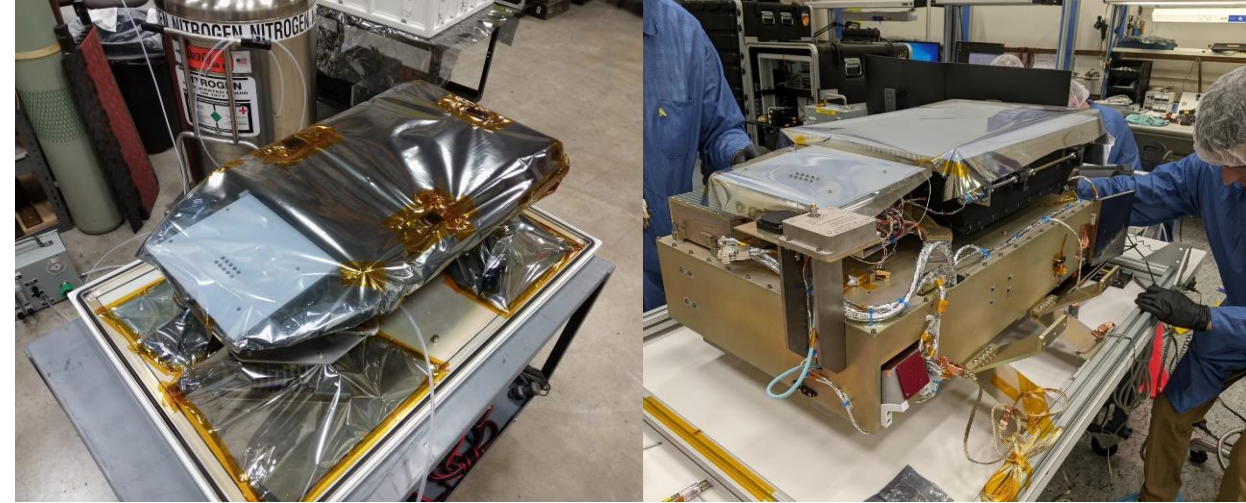
Requirement: $1E-16 B_{\odot}$
Performance: $<1E-18 B_{\odot}$
(100X margin)





WFI-3 Delivery

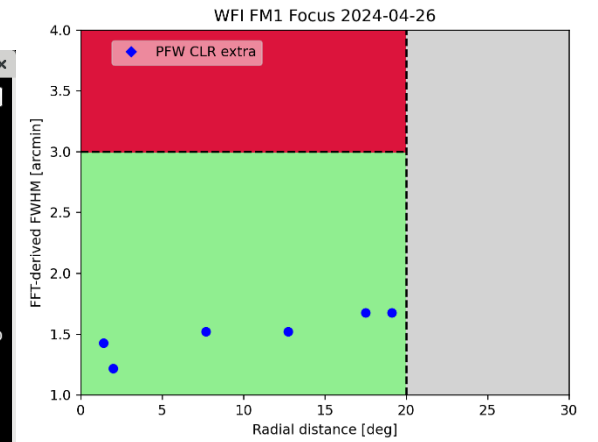
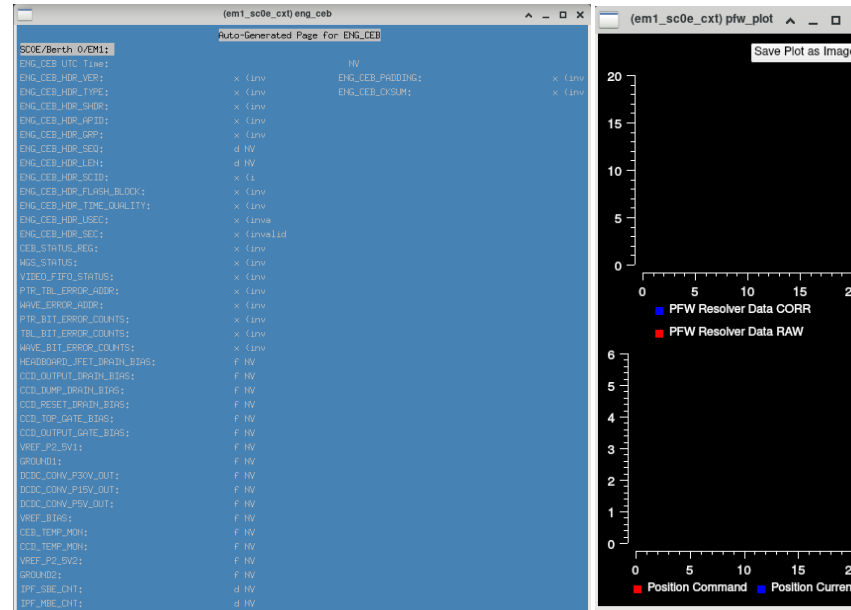
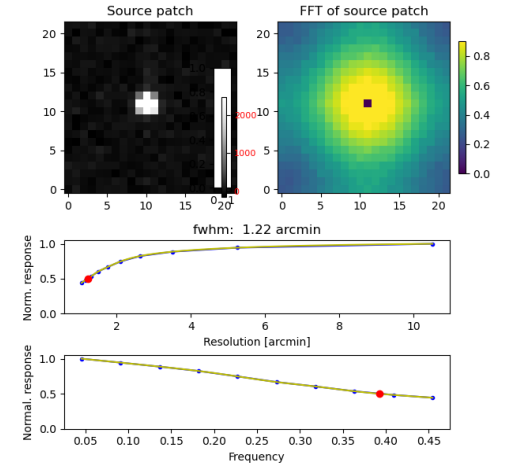
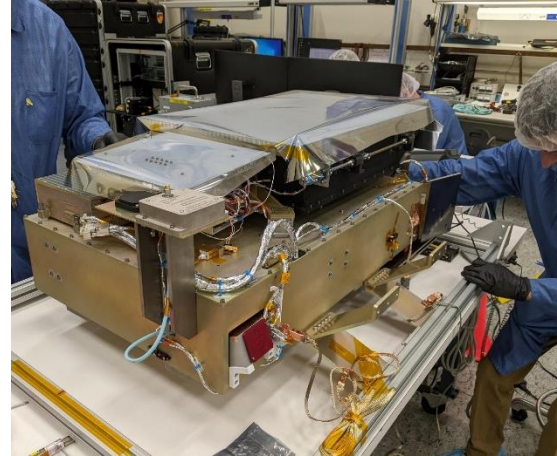
- All WFIs Successfully Delivered to Observatory I&T
 - WFI-1 (1/22/2023)
 - WFI-2 (3/22/2023)
 - WFI-3 (5/14/2023)
- Contamination Control
 - Lumiloy Bagging
 - GN2 Purge
- Observatory I&T Underway
 - WFI-1 Integration, CPT, Vibe, Door Open completed
 - Working issue with SAS / PPT
 - WFI-3 Vibe underway
 - WFI-2 Final integration underway





WFI Ongoing Support

- EM WFI Test Campaign Completed
 - EM WFI Delivered to Observatory for EM test campaign
- Observatory I&T Support
 - WFI Observatory Optical Testing
 - Focus / Vignetting Consistent with instrument-level results
 - WFI Vibe & TVAC support
 - Door testing
 - CPT image review
- MOC / SOC Support
 - Supporting SOC Instrument pipeline
 - Instrument test support personnel transitioning to SOC
 - Defining MOC real-time telemetry data monitoring





Go PUNCH!

