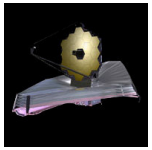

9022 - CAL-NRC-424: NIRCam Persistence Characterization

Cycle: 4, Proposal Category: CAL/NIRCAM

INVESTIGATORS

Name	***Institution***
Brian Brooks (PI)	**Space Telescope Science Institute**
Varun Bajaj (CoI) (CoPI)	Space Telescope Science Institute
Dr. John A. Stansberry (CoI)	Space Telescope Science Institute
Dr. David A. Golimowski (CoI)	Space Telescope Science Institute
Dr. Martha L. Boyer (CoI)	Space Telescope Science Institute
Dr. Anton M. Koekemoer (CoI) (Contact)	Space Telescope Science Institute
Alicia Canipe (CoI)	Space Telescope Science Institute
Mr. Bryan Hilbert (CoI)	Space Telescope Science Institute

OBSERVATIONS

Folder	***Observation***	***Label***	***Observing Template***	***Science Target***
Observation Folder				
	1	Module A - Sub160	NIRCam Engineering Imaging	(1) JUPITER
	2	Module A - Sub320	NIRCam Engineering Imaging	(1) JUPITER
	3	Module B - Sub160	NIRCam Engineering Imaging	(1) JUPITER
	4	Post-illumination darks	NIRCam Dark	NONE
	5	Module A - Sub160	NIRCam Engineering Imaging	(1) JUPITER
	6	Module A - Sub320	NIRCam Engineering Imaging	(1) JUPITER
	7	Module B - Sub320	NIRCam Engineering Imaging	(1) JUPITER
	8	Post-illumination darks	NIRCam Dark	NONE
	9	Residual persistence check	NIRCam Dark	NONE

ABSTRACT

This program characterizes NIRCam persistence (latent images) and checks for changes since ground, Cycle 1 and 3 calibration persistence analysis. Persistence is significant in NIRCam detectors, and its characterization needs to be improved. This measurement strategy involves capturing images of Jupiter on both modules, ensuring coverage across all four SW detectors while enabling efficient well saturation. The imaging sequence includes exposures on Module A followed by Module B, with seven hours of full-frame dark exposures to track persistence decay.

Building on previous findings, this program aims to compare spatial structure to portions of ground test data, enhance current analysis, and strengthen JWST's operational capabilities. The implementation of this calibration program seeks to provide an in-depth understanding of persistence and lay the foundation for effective solutions. Rooted in established HST methodologies, these efforts are essential for optimizing JWST observations.

This calibration program may change in response to system developments and the final Cycle 4 science program.

OBSERVING DESCRIPTION

This persistence measurement strategy involves obtaining images of Jupiter on both modules, ensuring the target is positioned in the extended source aperture (sub160, sub320) so that portions of the disk span all four SW detectors in each module. Filters are selected that reveal discernible structure (higher and lower count rates) on the disk while enabling the wells to fill rapidly, ensuring the target can reach approximately 1000 times the full well depth efficiently. The imaging sequence involves capturing an image first on module A and then on module B, followed by seven hours of full-frame dark exposures to measure the persistence decay. This process requires exclusive use (using APT engineering and dark templates) of the instrument and, potentially, the entire observatory for the seven-hour duration. While it is theoretically acceptable to integrate other instruments' programs during the dark exposures, the feasibility of scheduling such optimization appears low. Sequencing will begin by:
Illuminated exposure (Jupiter):

1. ModuleA(SUB160) -> (F200W + F410M, 6 Groups) -> (F150W + F277W, 6 Groups) ->
a) First filter pair will provide a lower count rate, paired with Sub160 allows several groups to measure the count rate before saturation
b) Second filter pair is a higher count rate, and allows for one group before saturation. This will define scaling from (F200W-> F150W and F410M -> F277W)
2. ModuleA(SUB320) -> (F200W + F410M, 4 Groups) -> (F150W + F277W, 1000 Groups)->

a) First filter pairs will provide one group before saturation, so the count rate can still be measured. This will also expose a much larger portion of the planets disk.

b) Scaling factors derived from Obs 1 are used to compute the fluence for (F150W + F277W, 1000 Groups)

3. ModuleB(SUB320) -> (F150W + F277W, 1000 INTS) ->

a) Scaling factors derived from Obs 1 are used to compute the fluence for (F150W + F277W, 1000 Groups)

Following the illuminated exposure, three set of darks can be taken:

1) First, BRIGHT1 integrations for all detectors; this must be limited to 10 groups each and will be used to capture the initial strong decay of persistence.

2) Second, SHALLOW4 integrations with 10 groups. The first integration, starting after the BRIGHT1 set, captures the more typical case: a delay of a few tens of seconds corresponds to the time needed to dither the telescope.

3) Third, a longer exposure made of 7 MEDIUM8 integrations with 10 groups moving to longer times the persistence becomes lower.

During the darks the telescope can be moved around.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Observation

Proposal 9022, Observation 1: Module A - Sub160

Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Engineering Imaging

Diagnostics

(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Module A - Sub160 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Template

Module	Subarray	No. of Output Channels
A	SUB160	1

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		1

Spectral Elements

#	Short Pupil	Long Pupil	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	CLEAR	CLEAR	F200W	F410M	RAPID	6	1	1	1	1.956	
2	CLEAR	CLEAR	F150W	F277W	RAPID	6	1	1	1	1.956	

Special Requirements

Group Observations 1, 2, 3, 4, Non-interruptible, Exclusive Use Of Instrument

DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY IO FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY EUROPA FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY GANYMEDE FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY CALLISTO FROM JWST
DEFAULT WINDOW: SEPARATION OF JUPITER IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER GANYMEDE FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE JUPITER FROM JWST LESS THAN 0.075

Observation

Proposal 9022, Observation 2: Module A - Sub320

Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Engineering Imaging

Diagnostics

(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Module A - Sub320 (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Template

Module	Subarray	No. of Output Channels
A	SUB320	1

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		1

Spectral Elements

#	Short Pupil	Long Pupil	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	CLEAR	CLEAR	F200W	F410M	RAPID	4	1	1	1	5.366	
2	CLEAR	CLEAR	F150W	F277W	RAPID	1000	1	1	1	1070.13	

Special Requirements

Group Observations 1, 2, 3, 4, Non-interruptible, Exclusive Use Of Instrument

DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY IO FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY EUROPA FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY GANYMEDE FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY CALLISTO FROM JWST
DEFAULT WINDOW: SEPARATION OF JUPITER IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER GANYMEDE FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE JUPITER FROM JWST LESS THAN 0.075

Observation

Proposal 9022, Observation 3: Module B - Sub160 Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Engineering Imaging

Diagnostics

(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Module B - Sub160 (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Template

Module	Subarray	No. of Output Channels
B	SUB320	1

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		1

Spectral Elements

#	Short Pupil	Long Pupil	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	CLEAR	CLEAR	F150W	F277W	RAPID	1000	1	1	1	1070.13	

Special Requirements

Group Observations 1, 2, 3, 4, Non-interruptible, Exclusive Use Of Instrument

DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY IO FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY EUROPA FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY GANYMEDE FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY CALLISTO FROM JWST
DEFAULT WINDOW: SEPARATION OF JUPITER IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER GANYMEDE FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE JUPITER FROM JWST LESS THAN 0.075

Observation

Proposal 9022, Observation 4: Post-illumination darks Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Dark

Diagnostics

(Post-illumination darks (Obs 4)) Warning (Form): PARALLEL requirement expected.

(Visit 4:1) Warning (Form): Data Excess over lower threshold

(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Template

Module	Subarray	Science Template	Occulting Mask	No. of Output Channels
ALL	FULL	Imaging		4

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	BRIGHT1	10	10	1	10	2136.617	
2	SHALLOW4	10	5	1	5	2673.456	
3	SHALLOW4	10	10	1	10	5357.648	
4	MEDIUM8	10	7	1	7	7429.845	
5	MEDIUM8	10	7	1	7	7429.845	

Special Requirements

Group Observations 1, 2, 3, 4, Non-interruptible, Exclusive Use Of Instrument

Observation

Proposal 9022, Observation 5: Module A - Sub160

Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Engineering Imaging

Diagnostics

(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Module A - Sub160 (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Template

Module	Subarray	No. of Output Channels
A	SUB160	1

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		1

Spectral Elements

#	Short Pupil	Long Pupil	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	CLEAR	CLEAR	F200W	F410M	RAPID	6	1	1	1	1.956	
2	CLEAR	CLEAR	F150W	F277W	RAPID	6	1	1	1	1.956	

Special Requirements

Sequence Observations 5, 6, 7, 8, Non-interruptible, Exclusive Use Of Instrument

DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY IO FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY EUROPA FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY GANYMEDE FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY CALLISTO FROM JWST
DEFAULT WINDOW: SEPARATION OF JUPITER IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER GANYMEDE FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE JUPITER FROM JWST LESS THAN 0.075

Observation

Proposal 9022, Observation 6: Module A - Sub320

Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Engineering Imaging

Diagnostics

(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Module A - Sub320 (Obs 6)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Template

Module	Subarray	No. of Output Channels
A	SUB320	1

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		1

Spectral Elements

#	Short Pupil	Long Pupil	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	CLEAR	CLEAR	F200W	F410M	RAPID	4	1	1	1	5.366	
2	CLEAR	CLEAR	F150W	F277W	RAPID	1000	1	1	1	1070.13	

Special Requirements

Sequence Observations 5, 6, 7, 8, Non-interruptible, Exclusive Use Of Instrument

DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY IO FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY EUROPA FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY GANYMEDE FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY CALLISTO FROM JWST
DEFAULT WINDOW: SEPARATION OF JUPITER IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER GANYMEDE FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE JUPITER FROM JWST LESS THAN 0.075

Observation

Proposal 9022, Observation 7: Module B - Sub320 Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Engineering Imaging

Diagnostics

(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

(Module B - Sub320 (Obs 7)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

#	Name	Level 1	Level 2	Level 3
(1)	JUPITER	STD=JUPITER		

Comments: Extended=YES

Template

Module	Subarray	No. of Output Channels
B	SUB320	1

Dithers

#	Primary Dither Type	Primary Dithers	Subpixel Dither Type	Dither Size	Subpixel Positions
1	NONE		STANDARD		1

Spectral Elements

#	Short Pupil	Long Pupil	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	Optional ETC ID
1	CLEAR	CLEAR	F150W	F277W	RAPID	1000	1	1	1	1070.13	

Special Requirements

Sequence Observations 5, 6, 7, 8, Non-interruptible, Exclusive Use Of Instrument

DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY IO FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY EUROPA FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY GANYMEDE FROM JWST
DEFAULT WINDOW: NOT ECLIPSE PENUMBRAL PARTIAL OF JUPITER BY CALLISTO FROM JWST
DEFAULT WINDOW: SEPARATION OF JUPITER IO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER EUROPA FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER GANYMEDE FROM JWST GREATER THAN 10"
DEFAULT WINDOW: SEPARATION OF JUPITER CALLISTO FROM JWST GREATER THAN 10"
DEFAULT WINDOW: ANGULAR RATE JUPITER FROM JWST LESS THAN 0.075

Observation

Proposal 9022, Observation 8: Post-illumination darks Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Dark

Diagnostics

(Post-illumination darks (Obs 8)) Warning (Form): PARALLEL requirement expected.

(Visit 8:1) Warning (Form): Data Excess over lower threshold

(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Template

Module	Subarray	Science Template	Occulting Mask	No. of Output Channels
ALL	FULL	Imaging		4

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	BRIGHT1	10	10	1	10	2136.617	
2	SHALLOW4	10	5	1	5	2673.456	
3	SHALLOW4	10	10	1	10	5357.648	
4	MEDIUM8	10	7	1	7	7429.845	
5	MEDIUM8	10	7	1	7	7429.845	

Special Requirements

9 After 8 by 6 Hours to 2 Days, Exclusive Use Of Instrument
Sequence Observations 5, 6, 7, 8, Non-interruptible, Exclusive Use Of Instrument

Observation

Proposal 9022, Observation 9: Residual persistence check

Mon Apr 27 19:00:10 GMT 2026

Diagnostic Status: Warning

Observing Template: NIRCam Dark

Diagnostics

(Residual persistence check (Obs 9)) Warning (Form): PARALLEL requirement expected.

(Visit 9:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.

Template

Module	Subarray	Science Template	Occulting Mask	No. of Output Channels
ALL	FULL	Imaging		4

Spectral Elements

#	Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Integrations	Total Exposure Time	Optional ETC ID
1	MEDIUM8	10	1	1	1	1052.203	

Special Requirements

9 After 8 by 6 Hours to 2 Days, Exclusive Use Of Instrument