



## 8975 - CAL-NRC-421: NIRCcam Linearity Characterization

Cycle: 4, Proposal Category: CAL/NIRCAM

### INVESTIGATORS

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### OBSERVATIONS

<i>Folder</i>	<i>Observation</i>	<i>Label</i>	<i>Observing Template</i>	<i>Science Target</i>
Observation Folder				
	1	Module A SUB320	NIRCcam Engineering Imaging	(1) Uranus
	2	Module A Full Frame	NIRCcam Engineering Imaging	(1) Uranus
	3	Module B SUB320	NIRCcam Engineering Imaging	(1) Uranus
	4	Module B Full Frame	NIRCcam Engineering Imaging	(1) Uranus
	5	Module A SUB320 Repeat	NIRCcam Engineering Imaging	(1) Uranus
	6	Module A Full Frame Repeat	NIRCcam Engineering Imaging	(1) Uranus
	7	Module B SUB320 Repeat	NIRCcam Engineering Imaging	(1) Uranus
	8	Module B Full Frame Repeat	NIRCcam Engineering Imaging	(1) Uranus

## **ABSTRACT**

This program characterizes the NIRCcam linearity and checks for changes since the ground calibration (CV3) linearity analysis. The primary goal is to obtain images of Uranus across all 10 detectors to verify linearity solutions from ground (CV3 data). Each integration provides sufficient duration to fill the pixels to their full-well depth (saturation). Filters are selected to balance observational efficiency (count rate) with number of groups, allowing for a high number of samples across the fluence range in a short amount of time. The large flat structure of the planetary disk provides both a high number of bright pixels with which to measure linearity, but also provides mitigation of the brighter fatter effect, which leads to systematic errors measuring linearity from point sources, especially in the long wavelength channel.

In addition, acquiring one extra image in full-frame mode (per module) is essential to verify that linearity measurements are consistent and independent of the subarray size. This setup will also facilitate the measurement of on-sky persistence signals as the target is dithered between detectors.

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

EDIT DEC 2025: New observations added (5-8). These observations are repeats for 1-4, but use different filters. The filter change was required as the original filter integration times were derived from the ETC template spectrum, which contained significant errors.

## **OBSERVING DESCRIPTION**

We obtain deep images of Uranus designed to fully fill the pixel wells to verify the linearity calibration solution.

Specifically, we image the planet on each of the detectors first using the SUB320 subarray using READPATT=RAPID to ensure the number of groups gives adequate samples up the ramp. We use  $NGROUPS/INT = 85$  and  $INT/EXPOSURE=5$ . The former ensures the wells are completely full, allowing for measurement of linearity and full well depth, while the latter helps mitigate cosmic ray hits, and allows for better statistics. After the 4 exposures on each subarray are obtained on each module, a single Full module exposure is taken for each module, placing the target on the outer corner of A3 for module A and outer corner of B1 for module B. This allows measurement of the linearity solution on different parts of the detectors and checks for a different read timing.

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

Proposal 8975 - Targets - CAL-NRC-421: NIRCcam Linearity Characterization

Solar System Targets	#	Name	Level 1	Level 2	Level 3
	(1)	Uranus	STD=URANUS		
<i>Comments: Extended=YES</i>					

Proposal 8975 - Observation 1 - CAL-NRC-421: NIRCam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	Proposal 8975, Observation 1: Module A SUB320 Diagnostic Status: Warning Observing Template: NIRCam Engineering Imaging											
	(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module A SUB320 (Obs 1)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnosics</b>												
<b>Solar System Targets</b>	#	Name	Level 1			Level 2			Level 3			
	(1)	Uranus	STD=URANUS									
Comments: Extended=YES												
<b>Template</b>	Module	Subarray					No. of Output Channels					
	A	SUB320					1					
<b>Mosaic</b>	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order					
	2	2	40.0	40.0	0.0	0.0	DEFAULT					
<b>Dithers</b>	#	Primary Dither Type		Primary Dithers		Subpixel Dither Type		Dither Size		Subpixel Positions		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	#	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	F162M	CLEAR	F150W2	F410M	RAPID	105	4	4	1	453.355	

## Proposal 8975 - Observation 1 - CAL-NRC-421: NIRCcam Linearity Characterization

### Special Requirements

Group Observations 1, 2, 3, 4, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075

# Proposal 8975 - Observation 2 - CAL-NRC-421: NIRCam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	<b>Proposal 8975, Observation 2: Module A Full Frame</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCam Engineering Imaging											
	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module A Full Frame (Obs 2)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnostics</b>												
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>				<b>Level 2</b>			<b>Level 3</b>		
	(1)	Uranus	STD=URANUS									
<i>Comments: Extended=YES</i>												
<b>Template</b>	<b>Module</b>		<b>Subarray</b>				<b>No. of Output Channels</b>					
	A		FULL				4					
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>		<b>Subpixel Positions</b>		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Long Pupil</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	F162M	CLEAR	F150W2	F410M	RAPID	11	4	4	1	504.628	
<b>Special Requirements</b>	Offset 57.0 arcsec, -57.0 arcsec											
	Group Observations 1, 2, 3, 4, Non-interruptible DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075											

Proposal 8975 - Observation 3 - CAL-NRC-421: NIRCcam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	Proposal 8975, Observation 3: Module B SUB320 <b>Diagnostic Status: Warning</b> Observing Template: NIRCcam Engineering Imaging											
<b>Diagnostics</b>	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module B SUB320 (Obs 3)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Solar System Targets</b>	#	Name	Level 1			Level 2			Level 3			
	(1)	Uranus	STD=URANUS									
	<i>Comments: Extended=YES</i>											
<b>Template</b>	Module	Subarray					No. of Output Channels					
	B	SUB320					1					
<b>Mosaic</b>	Rows	Columns	Row Overlap %	Column Overlap %	Row shift (deg)	Column shift (deg)	Tile Order					
	2	2	40.0	40.0	0.0	0.0	DEFAULT					
<b>Dithers</b>	#	Primary Dither Type		Primary Dithers		Subpixel Dither Type		Dither Size		Subpixel Positions		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	#	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	F162M	CLEAR	F150W2	F410M	RAPID	105	4	4	1	453.355	

Proposal 8975 - Observation 3 - CAL-NRC-421: NIRCcam Linearity Characterization

Special Requirements

Group Observations 1, 2, 3, 4, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075

Proposal 8975 - Observation 4 - CAL-NRC-421: NIRCam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	Proposal 8975, Observation 4: Module B Full Frame Diagnostic Status: Warning Observing Template: NIRCam Engineering Imaging											
	(Visit 4:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module B Full Frame (Obs 4)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnosics</b>												
<b>Solar System Targets</b>	#	Name	Level 1				Level 2			Level 3		
	(1)	Uranus	STD=URANUS									
Comments: Extended=YES												
<b>Template</b>	Module	Subarray				No. of Output Channels						
	B	FULL				4						
<b>Dithers</b>	#	Primary Dither Type		Primary Dithers		Subpixel Dither Type		Dither Size		Subpixel Positions		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	#	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	F162M	CLEAR	F150W2	F410M	RAPID	11	4	4	1	504.628	
<b>Special Requirements</b>	Offset 67.0 arcsec, 67.0 arcsec Group Observations 1, 2, 3, 4, Non-interruptible DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075											

Proposal 8975 - Observation 5 - CAL-NRC-421: NIRCam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	<b>Proposal 8975, Observation 5: Module A SUB320 Repeat</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCam Engineering Imaging											
	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module A SUB320 Repeat (Obs 5)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnosics</b>												
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>			<b>Level 2</b>			<b>Level 3</b>			
	(1)	Uranus	STD=URANUS									
<i>Comments: Extended=YES</i>												
<b>Template</b>	<b>Module</b>	<b>Subarray</b>				<b>No. of Output Channels</b>						
	A	SUB320				1						
<b>Mosaic</b>	<b>Rows</b>	<b>Columns</b>	<b>Row Overlap %</b>	<b>Column Overlap %</b>	<b>Row shift (deg)</b>	<b>Column shift (deg)</b>	<b>Tile Order</b>					
	2	2	10.0	10.0	0.0	0.0	DEFAULT					
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>		<b>Subpixel Positions</b>		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Long Pupil</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	CLEAR	CLEAR	F140M	F460M	RAPID	900	1	1	1	963.226	

Proposal 8975 - Observation 5 - CAL-NRC-421: NIRCcam Linearity Characterization

Special Requirements

Group Observations 5, 6, 7, 8, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075

Proposal 8975 - Observation 6 - CAL-NRC-421: NIRCam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	<b>Proposal 8975, Observation 6: Module A Full Frame Repeat</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCam Engineering Imaging											
	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module A Full Frame Repeat (Obs 6)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnostics</b>												
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>				<b>Level 2</b>			<b>Level 3</b>		
	(1)	Uranus	STD=URANUS									
<i>Comments: Extended=YES</i>												
<b>Template</b>	<b>Module</b>		<b>Subarray</b>				<b>No. of Output Channels</b>					
	A		FULL				4					
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>		<b>Subpixel Positions</b>		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Long Pupil</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	CLEAR	CLEAR	F140M	F460M	RAPID	90	1	1	1	966.309	
<b>Special Requirements</b>	Offset 57.0 arcsec, -57.0 arcsec											
	Group Observations 5, 6, 7, 8, Non-interruptible DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075											

Proposal 8975 - Observation 7 - CAL-NRC-421: NIRCcam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	<b>Proposal 8975, Observation 7: Module B SUB320 Repeat</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCcam Engineering Imaging											
	(Visit 7:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module B SUB320 Repeat (Obs 7)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnosics</b>												
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>			<b>Level 2</b>			<b>Level 3</b>			
	(1)	Uranus	STD=URANUS									
<i>Comments: Extended=YES</i>												
<b>Template</b>	<b>Module</b>	<b>Subarray</b>				<b>No. of Output Channels</b>						
	B	SUB320				1						
<b>Mosaic</b>	<b>Rows</b>	<b>Columns</b>	<b>Row Overlap %</b>	<b>Column Overlap %</b>	<b>Row shift (deg)</b>	<b>Column shift (deg)</b>	<b>Tile Order</b>					
	2	2	40.0	40.0	0.0	0.0	DEFAULT					
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>		<b>Subpixel Positions</b>		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Long Pupil</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	CLEAR	CLEAR	F140M	F460M	RAPID	900	1	1	1	963.226	

Proposal 8975 - Observation 7 - CAL-NRC-421: NIRCcam Linearity Characterization

Special Requirements

Group Observations 5, 6, 7, 8, Non-interruptible

DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075

Proposal 8975 - Observation 8 - CAL-NRC-421: NIRCam Linearity Characterization

Wed Jan 21 00:00:18 GMT 2026

<b>Observation</b>	<b>Proposal 8975, Observation 8: Module B Full Frame Repeat</b> <b>Diagnostic Status: Warning</b> Observing Template: NIRCam Engineering Imaging											
	(Visit 8:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Module B Full Frame Repeat (Obs 8)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
<b>Diagnostics</b>												
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>				<b>Level 2</b>			<b>Level 3</b>		
	(1)	Uranus	STD=URANUS									
<i>Comments: Extended=YES</i>												
<b>Template</b>	<b>Module</b>	<b>Subarray</b>				<b>No. of Output Channels</b>						
	B	FULL				4						
<b>Dithers</b>	<b>#</b>	<b>Primary Dither Type</b>		<b>Primary Dithers</b>		<b>Subpixel Dither Type</b>		<b>Dither Size</b>		<b>Subpixel Positions</b>		
	1	NONE				STANDARD				1		
<b>Spectral Elements</b>	<b>#</b>	<b>Short Pupil</b>	<b>Long Pupil</b>	<b>Short Filter</b>	<b>Long Filter</b>	<b>Readout Pattern</b>	<b>Groups/Int</b>	<b>Integrations/Exp</b>	<b>Total Integrations</b>	<b>Total Dithers</b>	<b>Total Exposure Time</b>	<b>Optional ETC ID</b>
	1	CLEAR	CLEAR	F140M	F460M	RAPID	90	1	1	1	966.309	
<b>Special Requirements</b>	Offset 67.0 arcsec, 67.0 arcsec											
	Group Observations 5, 6, 7, 8, Non-interruptible DEFAULT WINDOW: ANGULAR RATE URANUS FROM JWST LESS THAN 0.075											