



9032 - CAL-NRC-425: WFSS Background 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	Observation00	NIRCam Wide Field Slitless Spectroscopy	(1) ECLIPTIC-RA00
	2	Observation60	NIRCam Wide Field Slitless Spectroscopy	(2) ECLIPTIC-RA60
	5	Observation120	NIRCam Wide Field Slitless Spectroscopy	(4) ECLIPTIC-RA120
	6	Observation140	NIRCam Wide Field Slitless Spectroscopy	(5) ECLIPTIC_RA140
	3	Observation180	NIRCam Wide Field Slitless Spectroscopy	(3) ECLIPTIC_RA180

ABSTRACT

This program will characterize the global sky background for the WFSS mode for the F277W band. The GO community has accrued many 1000s of WFSS images, primarily with three cross filters: F322W2, F356W, and F444W, from which we could determine global sky images by masking sources and averaging through the entire dataset (see report by Ryan, Pirzkal, & Hilbert 2025). However, there are several filters that receive modest use, but based on how the data have been collected (e.g. small dithers or short exposure times), the global sky images that result from the stacking have significant defects from the small number statistics or poor signal-to-noise. Therefore, this program builds on the tacit investment from the GO community by filling in the gaps, and we begin the effort with the F277W band. It is important to stress, the current global sky images available to the community in CRDS are based on model spectra from Pandeia that are projected through the optical model of the telescope and instrument. The initial analysis of the Archive plus these observations represent the first and only empirical determination of the background image.

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

OBSERVING DESCRIPTION

This program will characterize the global sky background for the WFSS mode for the F277W band. The GO community has accrued many 1000s of WFSS images, primarily with three cross filters: F322W2, F356W, and F444W, from which we could determine global sky images by masking sources and averaging through the entire dataset (see report by Ryan, Pirzkal, & Hilbert 2025). However, there are several filters that receive modest use, but based on how the data have been collected (e.g. small dithers or short exposure times), the global sky images that result from the stacking have significant defects from the small number statistics or poor signal-to-noise. Therefore, this program builds on the tacit investment from the GO community by filling in the gaps, and we begin the effort with the F277W band. It is important to stress, the current global sky images available to the community in CRDS are based on model spectra from Pandeia that are projected through the optical model of the telescope and instrument. The initial analysis of the Archive plus these observations represent the first and only empirical determination of the background image.

The stacking method is described and validated in full detail in Ryan, Pirzkal, & Hilbert (2025), but we give key steps here:

1. divide the rate images by the flat field,
2. use existing sky images to mask spectral traces,
3. remove the $1/f$ signal,
4. normalize each image to some fiducial region,
5. sigma-clip average through the normalized stack,
6. interpolate over bad pixels indicated in the data-quality or with out-of-family S/N, and
7. re-normalize the interpolated image to the fiducial region.

We have largely selected our target fields to be consistent with those used in earlier dedicated sky observations (PID: 4450) and/or sky flats (PID: 1475, 4443). However with the limited observing time for our program, we prioritize one field near the Galactic plane as Pandeia predicts a considerable enhancement to the overall background level from the Milky Way. Since the Galactic background has a different spectral morphology to that of the net extragalactic background, the projected two-dimensional global sky image will have different pattern/structure. Therefore, this field will be used to empirically validate these effects and bracket the extremes for Users that may observe near the Galactic plane.

JWST Proposal 9032 (Created: Monday, December 15, 2025, 11:00:09PM Eastern Standard Time) - Overview

In addition to the disparity in numbers of unique exposures in F277W, there are considerably more observations in GRISM C than GRISM R (approximately 5x more observations in C). Therefore, we prioritize data collection in GRISM R, but the field near the Galactic plane, we collect data in both grisms to further constrain the effective two dimensional structure in the background from the different spectral component (Galactic vs. unresolved extragalactic).

Proposal 9032 - Targets - CAL-NRC-425: WFSS Background Characterization

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	ECLIPTIC-RA00	RA: 00 37 22.6530 (9.3443875d) Dec: +01 25 50.53 (1.43070d) Equinox: J2000 Comments: Category=Calibration Description=[Telescope/sky background]		
(2)	ECLIPTIC-RA60	RA: 07 07 38.0400 (106.9085000d) Dec: +27 33 47.11 (27.56309d) Equinox: J2000 Comments: Category=Calibration Description=[Telescope/sky background]		
(3)	ECLIPTIC_RA180	RA: 18 59 29.4100 (284.8725417d) Dec: -43 53 21.12 (-43.88920d) Equinox: J2000 Comments: Category=Calibration Description=[Telescope/sky background]		
(4)	ECLIPTIC-RA120	RA: 12 03 47.2300 (180.9467917d) Dec: +04 45 23.79 (4.75661d) Equinox: J2000 Comments: Category=Calibration Description=[Telescope/sky background]		
(5)	ECLIPTIC_RA140	RA: 14 02 31.5220 (210.6313417d) Dec: -04 30 44.15 (-4.51226d) Equinox: J2000 Comments: Category=Calibration Description=[Telescope/sky background]		

Proposal 9032 - Observation 1 - CAL-NRC-425: WFSS Background Characterization

Observation	Proposal 9032, Observation 1: Observation00											Tue Dec 16 04:00:09 GMT 2025
	Diagnostic Status: Warning Observing Template: NIRCam Wide Field Slitless Spectroscopy											
Diagnostics	(Observation00 (Obs 1)) Warning (Form): Use of only one of GRISMR or GRISMC may result in spectral overlap from multiple sources that can't be corrected. Users should address this issue in their proposal text. (Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run. (Observation00 (Obs 1)) Informational (Form): Target Placement is a required field.											
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous		
	(1)	ECLIPTIC-RA00	RA: 00 37 22.6530 (9.3443875d) Dec: +01 25 50.53 (1.43070d) Equinox: J2000 Comments: Category=Calibration Description=[Telescope/sky background]									
Template	Module		Subarray				Grism (Long Wavelength)			Target Placement		
	ALL		FULL				GRISMR					
Dithers	#	Primary Dither Type				Primary Dithers			Subpixel Positions			
	1	INTRAMODULEX				4			NONE			
Direct Image	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
	1	F200W	F277W	SHALLOW2	2	1	1	75.157		GRISMR	Direct Image	1
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
	1	F200W	F277W	SHALLOW4	10	1	4	2104.407		GRISMR	Grism (Long Wavelength)	4
	2	F200W	F277W	SHALLOW2	2	1	2	150.315			Out of Field	2

Proposal 9032 - Observation 2 - CAL-NRC-425: WFSS Background Characterization

Observation	Proposal 9032, Observation 2: Observation60											Tue Dec 16 04:00:09 GMT 2025
	Diagnostic Status: Warning											
	Observing Template: NIRCam Wide Field Slitless Spectroscopy											
Diagnostics	(Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
	(Observation60 (Obs 2)) Informational (Form): Target Placement is a required field.											
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous		
	(2)	ECLIPTIC-RA60	RA: 07 07 38.0400 (106.9085000d) Dec: +27 33 47.11 (27.56309d) Equinox: J2000									
	Comments: Category=Calibration Description=[Telescope/sky background]											
Template	Module		Subarray				Grism (Long Wavelength)			Target Placement		
	ALL		FULL				BOTH					
Dithers	#	Primary Dither Type				Primary Dithers			Subpixel Positions			
	1	INTRAMODULEX				4			NONE			
Direct Image	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
	1	F200W	F277W	SHALLOW2	2	1	1	75.157		GRISMR	Direct Image	1
	2	F200W	F277W	SHALLOW2	2	1	1	75.157		GRISMC	Direct Image	1
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
	1	F200W	F277W	SHALLOW4	10	1	4	2104.407		GRISMR	Grism (Long Wavelength)	4
	2	F200W	F277W	SHALLOW2	2	1	2	150.315			Out of Field	2
	3	F200W	F277W	SHALLOW4	10	1	4	2104.407		GRISMC	Grism (Long Wavelength)	4
	4	F200W	F277W	SHALLOW2	2	1	2	150.315			Out of Field	2

Proposal 9032 - Observation 5 - CAL-NRC-425: WFSS Background Characterization

Observation	Proposal 9032, Observation 5: Observation120											Tue Dec 16 04:00:09 GMT 2025	
	Diagnostic Status: Warning												
	Observing Template: NIRCam Wide Field Slitless Spectroscopy												
Diagnostics	(Observation120 (Obs 5)) Warning (Form): By selecting Target Placement = Module Gap the target coordinates will not fall on any detector unless an appropriate Mosaic, set of Dithers or Offset Special Requirement is specified.												
	(Observation120 (Obs 5)) Warning (Form): Use of only one of GRISMR or GRISMC may result in spectral overlap from multiple sources that can't be corrected. Users should address this issue in their proposal text.												
	(Visit 5:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections				Miscellaneous		
	(4)	ECLIPTIC-RA120	RA: 12 03 47.2300 (180.9467917d) Dec: +04 45 23.79 (4.75661d) Equinox: J2000										
	Comments: Category=Calibration Description=[Telescope/sky background]												
Template	Module		Subarray				Grism (Long Wavelength)				Target Placement		
	ALL		FULL				GRISMR				Module gap (large extended source)		
Dithers	#	Primary Dither Type				Primary Dithers				Subpixel Positions			
	1	INTRAMODULEX				4				NONE			
Direct Image	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers	
	1	F200W	F277W	SHALLOW2	2	1	1	75.157		GRISMR	Direct Image	1	
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers	
	1	F200W	F277W	SHALLOW4	10	1	4	2104.407		GRISMR	Grism (Long Wavelength)	4	
	2	F200W	F277W	SHALLOW2	2	1	2	150.315			Out of Field	2	

Proposal 9032 - Observation 6 - CAL-NRC-425: WFSS Background Characterization

Observation	Proposal 9032, Observation 6: Observation140											Tue Dec 16 04:00:09 GMT 2025
	Diagnostic Status: Warning											
	Observing Template: NIRCam Wide Field Slitless Spectroscopy											
Diagnostics	(Observation140 (Obs 6)) Warning (Form): By selecting Target Placement = Module Gap the target coordinates will not fall on any detector unless an appropriate Mosaic, set of Dithers or Offset Special Requirement is specified.											
	(Observation140 (Obs 6)) Warning (Form): Use of only one of GRISMR or GRISMC may result in spectral overlap from multiple sources that can't be corrected. Users should address this issue in their proposal text.											
	(Visit 6:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.											
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections			Miscellaneous		
	(5)	ECLIPTIC_RA140	RA: 14 02 31.5220 (210.6313417d) Dec: -04 30 44.15 (-4.51226d) Equinox: J2000									
	Comments: Category=Calibration Description=[Telescope/sky background]											
Template	Module		Subarray				Grism (Long Wavelength)			Target Placement		
	ALL		FULL				GRISMR			Module gap (large extended source)		
Dithers	#	Primary Dither Type				Primary Dithers			Subpixel Positions			
	1	INTRAMODULEX				4			NONE			
Direct Image	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
	1	F200W	F277W	SHALLOW2	2	1	1	75.157		GRISMR	Direct Image	1
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers
	1	F200W	F277W	SHALLOW4	10	1	4	2104.407		GRISMR	Grism (Long Wavelength)	4
	2	F200W	F277W	SHALLOW2	2	1	2	150.315			Out of Field	2

Proposal 9032 - Observation 3 - CAL-NRC-425: WFSS Background Characterization

Observation	Proposal 9032, Observation 3: Observation180											Tue Dec 16 04:00:09 GMT 2025	
	Diagnostic Status: Warning												
	Observing Template: NIRCam Wide Field Slitless Spectroscopy												
Diagnostics	(Observation180 (Obs 3)) Warning (Form): Use of only one of GRISMR or GRISMC may result in spectral overlap from multiple sources that can't be corrected. Users should address this issue in their proposal text.												
	(Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.												
	(Observation180 (Obs 3)) Informational (Form): Target Placement is a required field.												
Fixed Targets	#	Name	Target Coordinates				Targ. Coord. Corrections				Miscellaneous		
	(3)	ECLIPTIC_RA180	RA: 18 59 29.4100 (284.8725417d) Dec: -43 53 21.12 (-43.88920d) Equinox: J2000										
	Comments: Category=Calibration Description=[Telescope/sky background]												
Template	Module		Subarray				Grism (Long Wavelength)				Target Placement		
	ALL		FULL				GRISMR						
Dithers	#	Primary Dither Type				Primary Dithers				Subpixel Positions			
	1	INTRAMODULEX				4				NONE			
Direct Image	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers	
	1	F200W	F277W	SHALLOW2	2	1	1	75.157		GRISMR	Direct Image	1	
Spectral Elements	#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Exposure Time	Optional ETC ID	Grism (Long Wavelength)	Exposure Type	Total Dithers	
	1	F200W	F277W	SHALLOW4	10	1	4	2104.407		GRISMR	Grism (Long Wavelength)	4	
	2	F200W	F277W	SHALLOW2	2	1	2	150.315			Out of Field	2	