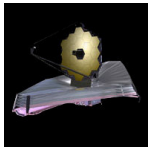

1638 - Securing the TRGB Distance Indicator: A Pre-Requisite for a JWST Measurement of H_0

Cycle: 1, Proposal Category: GO

INVESTIGATORS

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OBSERVATIONS

Folder	*Observation*	*Label*	*Observing Template*	*Science Target*
NGC2403				
	1	NGC2403	NIRCam Imaging	(1) NGC-2403
NGC300				
	2	NGC300	NIRCam Imaging	(2) NGC-300
M81				
	3	M81	NIRCam Imaging	(3) M-81
NGC253				
	4	NGC253	NIRCam Imaging	(4) NGC-253

ABSTRACT

The tip of the red giant branch (TRGB) is arguably one of the most precise and efficient distance indicators for nearby galaxies. TRGB distances are a key rung in the distance ladder, contributing to a precision measurement of the Hubble constant (H_0), independent of Cepheid variable stars. These TRGB distances are measured with HST F814W (i.e., I-band) observations where the luminosity of the TRGB has only a modest and well-

characterized dependence on metallicity.

In the NIR, the TRGB is up to 2 mag brighter offering profound observational gains. Simply put, JWST is capable of measuring TRGB distances out to ~50 Mpc over a 125x greater volume than HST, and reaching galaxies with diverse properties across all morphological types. The TRGB with JWST will become the primary distance indicator in the nearby universe.

However, the luminosity of the TRGB in the NIR is expected to have a greater dependence on metallicity and possibly stellar age. Thus, for JWST to be used for TRGB distance work, it must be empirically calibrated and robustly tested. We propose observing 4 nearby galaxies that have existing HST ACS and WFC3 IR observations from a JWST preparatory program. We will calibrate the TRGB in the F090W, F150W, F277W, and F356W NIRCam filters and the F090W and F150W NIRISS filters in parallel. We will quantify the precision of TRGB distances obtained with simultaneously imaged F090W+F277W filters, which offers a ~50% increase in efficiency of JWST observations for distance work. A calibration in this first cycle of JWST will enable TRGB distances with JWST throughout the mission lifetime and charter a path to reduced uncertainties in the local measurement of H_0.

OBSERVING DESCRIPTION

We target the stellar halos of 4 nearby galaxies with NIRCam with NIRISS in parallel. The prime and parallel fields both overlap with existing HST ACS and WFC3 IR data obtained in a JWST preparatory program, allowing for the identification of stars across both telescopes and multiple instruments. Our primary pointings with NIRCam provide optimal overlap with one of the HST fields. Orient constraints are made to ensure NIRISS in parallel overlaps with a second HST field. We have selected the F090W and F150W SW filters in NIRCam with simultaneous imaging in the F277W and F356W LW filters and the F090W and F150W filters for the parallel observations with NIRISS. We request a combination of shallow2 and shallow4 readout patterns, depending on the distance to each galaxy with 5 (6) groups per integration for NIRCam (NIRISS) to sample the ramps while mitigating against cosmic rays with 1 integration per exposure. We chose 3 and 4-pt-small-with-NIRISS subpixel dither patterns to reduce flat-fielding uncertainties; we do not intend to cover the chip gaps. From the APT, total data volume is <5 GB per visit, well below the total data volume limit of 28.2 GB in a 12 hour period. The data rates are not an issue using the shallow readout patterns.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC-2403	RA: 07 38 20.8972 (114.5870717d) Dec: +65 34 9.61 (65.56934d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Galaxy* *Description=[Galaxy halos, Spiral galaxies]*				
(2)	NGC-300	RA: 00 54 31.8804 (13.6328350d) Dec: -37 31 15.34 (-37.52093d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Galaxy* *Description=[Galaxy halos, Spiral galaxies]*				
(3)	M-81	RA: 09 57 47.2044 (149.4466850d) Dec: +69 01 4.02 (69.01778d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Galaxy* *Description=[Galaxy halos, Spiral galaxies]*				
(4)	NGC-253	RA: 00 46 38.4501 (11.6602088d) Dec: -25 29 24.49 (-25.49014d) Equinox: J2000	Epoch of Position: 2015.5	
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=Galaxy* *Description=[Galaxy halos, Spiral galaxies]*				

Observation

Proposal 1638, Observation 1: NGC2403

Fri Sep 30 18:00:26 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(1)	NGC-2403	RA: 07 38 20.8972 (114.5870717d) Dec: +65 34 9.61 (65.56934d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Galaxy halos, Spiral galaxies]

Template

NIRCam Imaging	NIRISS Imaging
Module: ALL	
Subarray: FULL	

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	NONE			1	4-POINT-SMALL-WITH-NIRISS	NO_DITHERING

Spectral Elements

NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F356W	SHALLOW4	5	1	4	4	1030.73	
2	F150W	F277W	SHALLOW4	5	1	4	4	1030.73	
3	F115W	F444W	SHALLOW4	5	1	4	4	1030.73	

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W		NIS	5	1	4	4	901.889	36213
2	F150W		NIS	5	1	4	4	901.889	36213
3	F115W		NIS	5	1	4	4	901.889	

Special Requirements	
	Aperture PA Range 280 to 282.2 Degrees (V3 280.0713531 to 282.2713531) No Parallel

Observation

Proposal 1638, Observation 2: NGC300

Fri Sep 30 18:00:26 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(2)	NGC-300	RA: 00 54 31.8804 (13.6328350d) Dec: -37 31 15.34 (-37.52093d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Galaxy halos, Spiral galaxies]

Template

NIRCam Imaging	NIRISS Imaging
Module: ALL	
Subarray: FULL	

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	NONE			1	4-POINT-SMALL-WITH-NIRISS	NO_DITHERING

Spectral Elements

NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F356W	SHALLOW4	5	1	4	4	1030.73	
2	F150W	F277W	SHALLOW4	5	1	4	4	1030.73	
3	F115W	F444W	SHALLOW4	5	1	4	4	1030.73	

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W		NIS	5	1	4	4	901.889	36213
2	F150W		NIS	5	1	4	4	901.889	36213
3	F115W		NIS	5	1	4	4	901.889	

Special Requirements	
	Aperture PA Range 16 to 22.88744876 Degrees (V3 16.0713531 to 22.95880186) No Parallel

Observation

Proposal 1638, Observation 3: M81

Fri Sep 30 18:00:26 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(3)	M-81	RA: 09 57 47.2044 (149.4466850d) Dec: +69 01 4.02 (69.01778d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Galaxy halos, Spiral galaxies]

Template

NIRCam Imaging	NIRISS Imaging
Module: ALL	
Subarray: FULL	

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	NONE			1	4-POINT-SMALL-WITH-NIRISS	NO_DITHERING

Spectral Elements

NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F356W	SHALLOW4	5	1	4	4	1030.73	
2	F150W	F277W	SHALLOW4	5	1	4	4	1030.73	
3	F115W	F444W	SHALLOW4	5	1	4	4	1030.73	

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W		NIS	5	1	4	4	901.889	36213
2	F150W		NIS	5	1	4	4	901.889	36213
3	F115W		NIS	5	1	4	4	901.889	

Special Requirements	
	Aperture PA Range 124.88744876 to 129.88744876 Degrees (V3 124.95880186 to 129.95880186) No Parallel

Observation

Proposal 1638, Observation 4: NGC253 Fri Sep 30 18:00:26 GMT 2022

Diagnostic Status: Warning

Observing Template: NIRCam Imaging

Coordinated Parallel Template(s): NIRISS Imaging

Diagnostics

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

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Miscellaneous
(4)	NGC-253	RA: 00 46 38.4501 (11.6602088d) Dec: -25 29 24.49 (-25.49014d) Equinox: J2000	Epoch of Position: 2015.5	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=Galaxy
Description=[Galaxy halos, Spiral galaxies]

Template

NIRCam Imaging	NIRISS Imaging
Module: ALL	
Subarray: FULL	

Dithers

#	Primary Dither Type	Primary Dithers	Dither Size	Subpixel Positions	Coordinated Parallel Subpixel Selector	Dither Direct Images Primes
1	NONE			1	4-POINT-SMALL-WITH-NIRISS	NO_DITHERING

Spectral Elements

NIRCam Imaging	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/Exp	Total Integrations	Total Dithers	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W	F356W	SHALLOW4	5	1	4	4	1030.73	
2	F150W	F277W	SHALLOW4	5	1	4	4	1030.73	
3	F115W	F444W	SHALLOW4	5	1	4	4	1030.73	

Spectral Elements

NIRISS Imaging	Filter	Grism	Readout Pattern	Groups/Int	Integrations/Exp	Total Dithers	Total Integrations	Total Exposure Time	ETC Wkbk.Calc ID
1	F090W		NIS	5	1	4	4	901.889	36213
2	F150W		NIS	5	1	4	4	901.889	36213
3	F115W		NIS	5	1	4	4	901.889	

Special Requirements	
	Aperture PA Range 44.88744876 to 53.88744876 Degrees (V3 44.95880186 to 53.95880186) No Parallel