14758 - The Hydrogen Content of a Rocky Earth-Size Exoplanet

Cycle: 24, Proposal Category: GO

(JWST Initative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) LHS-281	WFC3/IR	4	09-Nov-2016 11:55:50.0	yes
02	(1) LHS-281	WFC3/IR	4	09-Nov-2016 11:56:15.0	yes
03	(1) LHS-281	WFC3/IR	4	09-Nov-2016 11:56:40.0	yes
04	(1) LHS-281	WFC3/IR	4	09-Nov-2016 11:57:05.0	yes
05	(1) LHS-281	WFC3/IR	4	09-Nov-2016 11:57:30.0	yes

20 Total Orbits Used

ABSTRACT

The composition of a terrestrial planet's atmosphere results from a complex interplay of accretion, escape, and outgassing. We have little data on how such processes proceed for planets around stars other than our Sun. The warm, Earth-size planet GJ1132b transits a late M dwarf and offers a unique opportunity for studying the atmospheric composition of a rocky exoplanet. Thanks to this transiting planet's proximity (12pc) and large transit depth (0.3%), possible scenarios for GJ1132b's atmospheric transmission spectrum can be observed with the Hubble Space Telescope. Here, we propose to use WFC3/IR to observe five transits of GJ1132b, to search for absorption features from a cloud-free, hydrogen-rich atmosphere. Such an atmosphere could potentially arise from late outgassing of volatiles from the planetary interior. The detection of molecular absorption in GJ1132b's atmosphere is an important step toward the long-term goal of characterizing the atmospheres of cooler habitable planets, and GJ1132b is a favorable target for JWST observations. The results of this Hubble/WFC3 investigation would inform the optimal strategy to observe GJ1132b with JWST. If we detect deep absorption features with WFC3, JWST should observe GJ1132b across its entire wavelength range. If we do not, JWST may first need to focus more intensely on smaller individual wavelength windows. This planet provides the first chance for WFC3 to study the atmosphere of an exoplanet that almost resembles terrestrial worlds in our own Solar System.

OBSERVING DESCRIPTION

We will observe five transits of the rocky, Earth-size exoplanet GJ1132b with WFC3/IR grism spectroscopy. The core science observations consist of continuous high-cadence spectra, taken at times of transit with the G141 grism. We will use these data to measure the wavelength-dependent transit depth from 1.1 to 1.7 microns.

We will use a spatial scan for the transit observations, to maximize duty cycle and to mitigate flat-fielding uncertainties by averaging over many pixels. The scan rate of 0.2"/second keeps the maximum fluence recorded by the detector from GJ1132 below 24,000 electrons. The scan speed is slow enough that GJ1132's first order spectrum does not overlap with other bright stars within individual NSAMP reads.

Modifications to GO-14758 Phase II:

(1) Based on suggestions from our Contact Scientist, we removed the stare-mode spectra originally planned at the start of each visit. We will instead use the first read of each scan-mode spectrum to construct IR spectra of the other stars near GJ1132. Future observations of this field with NIRISS on JWST will face challenges from many spectra overlapping, and the observations gathered here would aid future planning of those observations (specifically determining the optimal telescope roll angle). After seeing results from the initial visits with this nominal plan, we may modify the final

visits to obtain deep grism spectra over a wider field of view beyond the 256x256 subarray.

(2) In the initial Phase II, we provided a period and epoch that came from the discovery paper for this planet. We update them here, to reflect analyses of the most recently collected observations. The previously specified values were

P = 1.628930
To = 2457184.55786

and the updated values are

P = 1.6289246
To = 2457184.55804

This modification has the effect of shifting the predicted times of transit through June 2017 by up to 3.2 minutes. We also modify the PHASE constraints slightly, so they now amount to 25 minutes of allowed start times per period.

(3) We introduce a new ORIENT constraint, to prevent overlap of the first order spectra between GJ1132 and a faint (but non-negligible) nearby star. According to the Visit Planner, these constraints still leave opportunities to observe about 3/4 of the visible transits.

Visit

Proposal 14758, Visit 01, implementation Wed Nov 09 16:57:32 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 27D TO 133 D; ORIENT 207D TO 313 D; Period 1.6289246 D AND ZERO-PHASE HJD2457184.55804

Comments: There will be five duplicate transit visits for GJ1132b. Each consists of four orbits. In the first orbit, we will start with a direct image. Then, the rest of the first orbit and the other three orbits consist of repeated scan-mode G141 spectra.

Visit ORIENT constraints are included to prevent overlap with a faint but non-neglible star located 6.5" away from GJ1132 (PA=305 degrees). The constraints are designed to create a 32 pixel vertical buffer between the two spectra, allowing a 20 pixel gap beyond the 12 pixel vertical extent each spectrum will create in a single 7.3 second read (256x256, SPARS10).

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LHS-281 Alt Name1: GJ1132	RA: 10 14 51.7700 (153.7157083d) Dec: -47 09 24.10 (-47.15669d) Equinox: J2000	Proper Motion RA: -1046 mas/yr Proper Motion Dec: +416 mas/yr Parallax: 0.08307" Epoch of Position: 2000.0 Radial Velocity: +35 km/sec	V=13.49+/-0.03 U=16.51, B=15.17, V=13.49, Rc=12.26, Ic=10.69, J=9.245, H=8.666, Ks=8.322	Reference Frame: ICRS

Comments: RA, Dec, proper motions, parallax were drawn from RECONS astrometry originally published in Jao et al. (2005; 2005AJ....129.1954J) and restated in Berta-Thompson et al. (2015; 2015Natur.527..204B). We adopt uncertainties on the RA and Dec as those for 2MASS for this object, through which these positions are tied to the ICRS. The RECONS astrometry is more accurate than the positions and proper motions listed in SIMBAD. We confirmed that the quoted position and proper motions match both the epoch 1992.2 position of the star in the APT Target Confrimation Chart and the epoch 2015.8 position of the star in recent MEarth imaging. These coordinates were successfully used for target acquisition with STIS in GO-14462, which has much more stringent
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GJ1132 direct image, phase-constrained	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID	PHASE 0.90322162 TO 0.91387965	Sequence 1-2 Non-Int in Visit 01 Pattern 2, Exps 1-1 in Sequence 1-2 Non-Int in Visit 01 (2)	1.706054 Secs (3.412 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: This is the direct image of the GJ1132 field, to be used as a reference for the scan mode observations. We use the larger 512 aperture to provide references for objects beyond the 256x256 field of view. We take advantage of otherwise unused time to two dithered exposures for this direct image.

According to the ETC, the time saturation for GJ1132 in this direct image (using a Pickles M4V, normalized to H=8.67) is 1.46 seconds with the F130N. This direct image will saturate GJ1132, but enable a centroid to be estimated from the first read.

This exposure is phase constrained to a window 25 minutes in width, meant to center the third orbit of the visit on the transit of GJ1132b.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	GJ1132 scan, grism image	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13.5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 1-2 Non-Int in Visit 01	103.128633 Secs X 10 (2062.573 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]*	***[1]***

Comments: This is the first of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

3	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 3-3 Non-In t in Visit 01	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[2]***

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4	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 4-4 Non-In t in Visit 01	103.128633 Secs X 11 (2268.83 Sec s)	
								[==>(Copy 1, Forward)] *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[3]***

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	5	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 5-5 Non-In t in Visit 01	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[4]***

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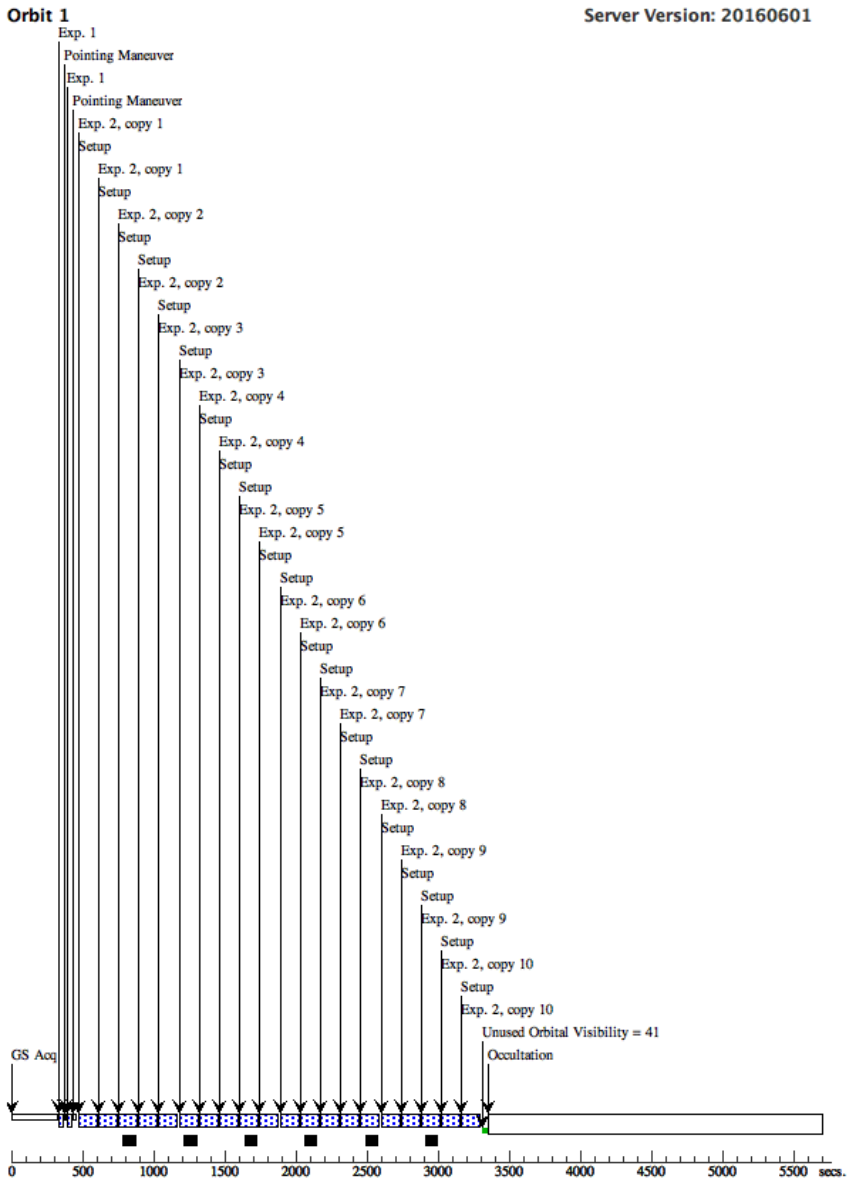
Orbit Structure




Orbit 2
Server Version: 20160601
GS Reacq
Exp. 3, copy 1
Setup
Setup
Exp. 3, copy 1
Exp. 3, copy 2
Setup
Exp. 3, copy 2
Setup
Setup
Exp. 3, copy 3
Exp. 3, copy 3
Setup
Exp. 3, copy 4
Setup
Setup
Exp. 3, copy 4
Exp. 3, copy 5
Setup
Setup
Exp. 3, copy 5
Exp. 3, copy 6
Setup
Setup
Exp. 3, copy 6
Setup
Exp. 3, copy 7
Setup
Exp. 3, copy 7
Setup
Exp. 3, copy 8
Setup
Exp. 3, copy 8
Exp. 3, copy 9
Setup
Exp. 3, copy 9
Setup
Setup
Exp. 3, copy 10
Setup
Exp. 3, copy 10
Setup
Exp. 3, copy 11
Exp. 3, copy 11
Setup
Unused Orbital Visibility = 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
Server Version: 20160601
GS Reacq
Setup
Exp. 4, copy 1
Setup
Exp. 4, copy 1
Setup
Exp. 4, copy 2
Exp. 4, copy 2
Setup
Setup
Exp. 4, copy 3
Setup
Exp. 4, copy 3
Setup
Exp. 4, copy 4
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Exp. 4, copy 4
Exp. 4, copy 5
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Exp. 4, copy 5
Exp. 4, copy 6
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Exp. 4, copy 6
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Exp. 4, copy 7
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Exp. 4, copy 7
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Exp. 4, copy 8
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Exp. 4, copy 8
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Exp. 4, copy 9
Setup
Exp. 4, copy 9
Setup
Exp. 4, copy 10
Exp. 4, copy 10
Setup
Setup
Exp. 4, copy 11
Exp. 4, copy 11
Setup
Unused Orbital Visibility = 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
GS Reacq
Exp. 5, copy 1
Setup
Setup
Exp. 5, copy 1
Setup
Exp. 5, copy 2
Exp. 5, copy 2
Setup
Exp. 5, copy 3
Setup
Exp. 5, copy 3
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Exp. 5, copy 4
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Exp. 5, copy 4
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Exp. 5, copy 9
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Exp. 5, copy 9
Setup
Exp. 5, copy 10
Setup
Exp. 5, copy 10
Setup
Setup
Exp. 5, copy 11
Exp. 5, copy 11
Setup
Unused Orbital Visibility = 6
Reconfig
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14758, Visit 02, implementation Wed Nov 09 16:57:33 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 27D TO 133 D; ORIENT 207D TO 313 D; Period 1.6289246 D AND ZERO-PHASE HJD2457184.55804

Comments: There will be five duplicate transit visits for GJ1132b. Each consists of four orbits. In the first orbit, we will start with a direct image. Then, the rest of the first orbit and the other three orbits consist of repeated scan-mode G141 spectra.

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Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LHS-281 Alt Name1: GJ1132	RA: 10 14 51.7700 (153.7157083d) Dec: -47 09 24.10 (-47.15669d) Equinox: J2000	Proper Motion RA: -1046 mas/yr Proper Motion Dec: +416 mas/yr Parallax: 0.08307" Epoch of Position: 2000.0 Radial Velocity: +35 km/sec	V=13.49+/-0.03 U=16.51, B=15.17, V=13.49, Rc=12.26, Ic=10.69, J=9.245, H=8.666, Ks=8.322	Reference Frame: ICRS

Comments: RA, Dec, proper motions, parallax were drawn from RECONS astrometry originally published in Jao et al. (2005; 2005AJ....129.1954J) and restated in Berta-Thompson et al. (2015; 2015Natur.527..204B). We adopt uncertainties on the RA and Dec as those for 2MASS for this object, through which these positions are tied to the ICRS. The RECONS astrometry is more accurate than the positions and proper motions listed in SIMBAD. We confirmed that the quoted position and proper motions match both the epoch 1992.2 position of the star in the APT Target Confrimation Chart and the epoch 2015.8 position of the star in recent MEarth imaging. These coordinates were successfully used for target acquisition with STIS in GO-14462, which has much more stringent
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GJ1132 direct image, phase-constrained	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID	PHASE 0.90322162 TO 0.91387965	Sequence 1-2 Non-Int in Visit 02 Pattern 2, Exps 1-1 in Sequence 1-2 Non-Int in Visit 02 (2)	1.706054 Secs (3.412 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: This is the direct image of the GJ1132 field, to be used as a reference for the scan mode observations. We use the larger 512 aperture to provide references for objects beyond the 256x256 field of view. We take advantage of otherwise unused time to two dithered exposures for this direct image.

According to the ETC, the time saturation for GJ1132 in this direct image (using a Pickles M4V, normalized to H=8.67) is 1.46 seconds with the F130N. This direct image will saturate GJ1132, but enable a centroid to be estimated from the first read.

This exposure is phase constrained to a window 25 minutes in width, meant to center the third orbit of the visit on the transit of GJ1132b.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	GJ1132 scan, grism image	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	POS TARG -1.5,-13.5; SPATIAL SCAN 0.2,90.0 Degrees,Round trip	Sequence 1-2 Non-Int in Visit 02	103.128633 Secs X 10 (2062.573 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]*	***[1]***

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According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

3	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 3-3 Non-In t in Visit 02	103.128633 Secs X 11 (2268.83 Sec s)	
								[==>(Copy 1, Forward)] *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[2]***

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4	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 4-4 Non-In t in Visit 02	103.128633 Secs X 11 (2268.83 Sec s)	
								[==>(Copy 1, Forward)] *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[3]***

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According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

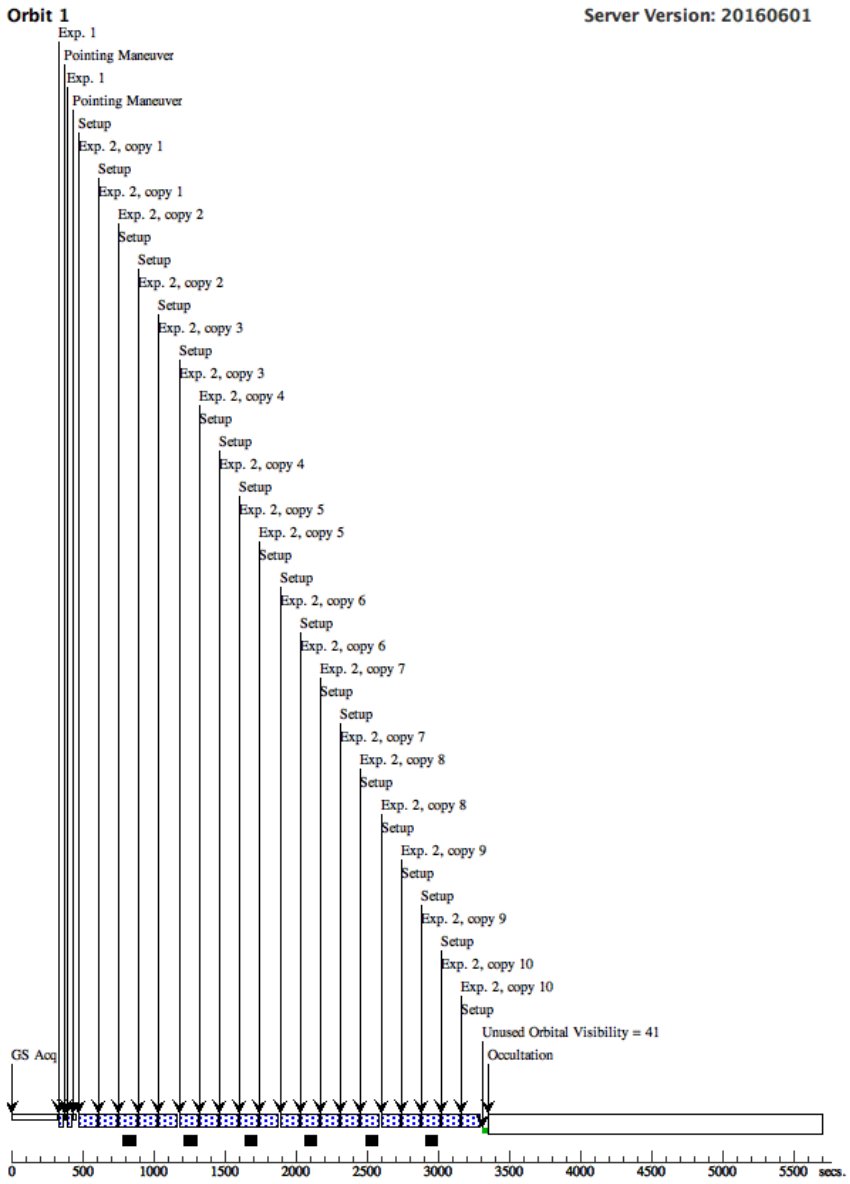
	5	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 5-5 Non-In t in Visit 02	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[4]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

Orbit Structure

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Exp. 3, copy 8
Exp. 3, copy 8
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Exp. 3, copy 9
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Exp. 3, copy 9
Exp. 3, copy 10
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Exp. 3, copy 10
Setup
Setup
Exp. 3, copy 11
Setup
Exp. 3, copy 11
Unused Orbital Visibility = 6
Occultation
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1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
Server Version: 20160601
GS Reacq
Exp. 4, copy 1
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Exp. 4, copy 1
Setup
Exp. 4, copy 2
Setup
Exp. 4, copy 2
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Exp. 4, copy 8
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Exp. 4, copy 8
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Exp. 4, copy 9
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Exp. 4, copy 9
Exp. 4, copy 10
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Exp. 4, copy 10
Setup
Setup
Exp. 4, copy 11
Setup
Exp. 4, copy 11
Unused Orbital Visibility = 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
GS Reacq
Exp. 5, copy 1
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Exp. 5, copy 1
Setup
Setup
Exp. 5, copy 2
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Exp. 5, copy 2
Exp. 5, copy 3
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Exp. 5, copy 3
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Exp. 5, copy 4
Exp. 5, copy 4
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Exp. 5, copy 5
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Exp. 5, copy 5
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Exp. 5, copy 6
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Exp. 5, copy 6
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Exp. 5, copy 7
Exp. 5, copy 7
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Exp. 5, copy 8
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Exp. 5, copy 8
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Exp. 5, copy 9
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Exp. 5, copy 9
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Exp. 5, copy 10
Setup
Setup
Exp. 5, copy 10
Exp. 5, copy 11
Setup
Setup
Exp. 5, copy 11
Unused Orbital Visibility = 6
Reconfig
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14758, Visit 03, implementation Wed Nov 09 16:57:33 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 27D TO 133 D; ORIENT 207D TO 313 D; Period 1.6289246 D AND ZERO-PHASE HJD2457184.55804

Comments: There will be five duplicate transit visits for GJ1132b. Each consists of four orbits. In the first orbit, we will start with a direct image. Then, the rest of the first orbit and the other three orbits consist of repeated scan-mode G141 spectra.

Visit ORIENT constraints are included to prevent overlap with a faint but non-neglible star located 6.5" away from GJ1132 (PA=305 degrees). The constraints are designed to create a 32 pixel vertical buffer between the two spectra, allowing a 20 pixel gap beyond the 12 pixel vertical extent each spectrum will create in a single 7.3 second read (256x256, SPARS10).

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LHS-281 Alt Name1: GJ1132	RA: 10 14 51.7700 (153.7157083d) Dec: -47 09 24.10 (-47.15669d) Equinox: J2000	Proper Motion RA: -1046 mas/yr Proper Motion Dec: +416 mas/yr Parallax: 0.08307" Epoch of Position: 2000.0 Radial Velocity: +35 km/sec	V=13.49+/-0.03 U=16.51, B=15.17, V=13.49, Rc=12.26, Ic=10.69, J=9.245, H=8.666, Ks=8.322	Reference Frame: ICRS

Comments: RA, Dec, proper motions, parallax were drawn from RECONS astrometry originally published in Jao et al. (2005; 2005AJ....129.1954J) and restated in Berta-Thompson et al. (2015; 2015Natur.527..204B). We adopt uncertainties on the RA and Dec as those for 2MASS for this object, through which these positions are tied to the ICRS. The RECONS astrometry is more accurate than the positions and proper motions listed in SIMBAD. We confirmed that the quoted position and proper motions match both the epoch 1992.2 position of the star in the APT Target Confrimation Chart and the epoch 2015.8 position of the star in recent MEarth imaging. These coordinates were successfully used for target acquisition with STIS in GO-14462, which has much more stringent
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GJ1132 direct image, phase-constrained	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID	PHASE 0.90322162 TO 0.91387965	Sequence 1-2 Non-Int in Visit 03 Pattern 2, Exps 1-1 in Sequence 1-2 Non-Int in Visit 03 (2)	1.706054 Secs (3.412 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: This is the direct image of the GJ1132 field, to be used as a reference for the scan mode observations. We use the larger 512 aperture to provide references for objects beyond the 256x256 field of view. We take advantage of otherwise unused time to two dithered exposures for this direct image.

According to the ETC, the time saturation for GJ1132 in this direct image (using a Pickles M4V, normalized to H=8.67) is 1.46 seconds with the F130N. This direct image will saturate GJ1132, but enable a centroid to be estimated from the first read.

This exposure is phase constrained to a window 25 minutes in width, meant to center the third orbit of the visit on the transit of GJ1132b.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	GJ1132 scan, grism image	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	POS TARG -1.5,-13.5; SPATIAL SCAN 0.2,90.0 Degrees,Round trip	Sequence 1-2 Non-Int in Visit 03	103.128633 Secs X 10 (2062.573 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]*	***[1]***

Comments: This is the first of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

3	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 3-3 Non-In t in Visit 03	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[2]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

4	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 4-4 Non-In t in Visit 03	103.128633 Secs X 11 (2268.83 Sec s)	
								[==>(Copy 1, Forward)] *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[3]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

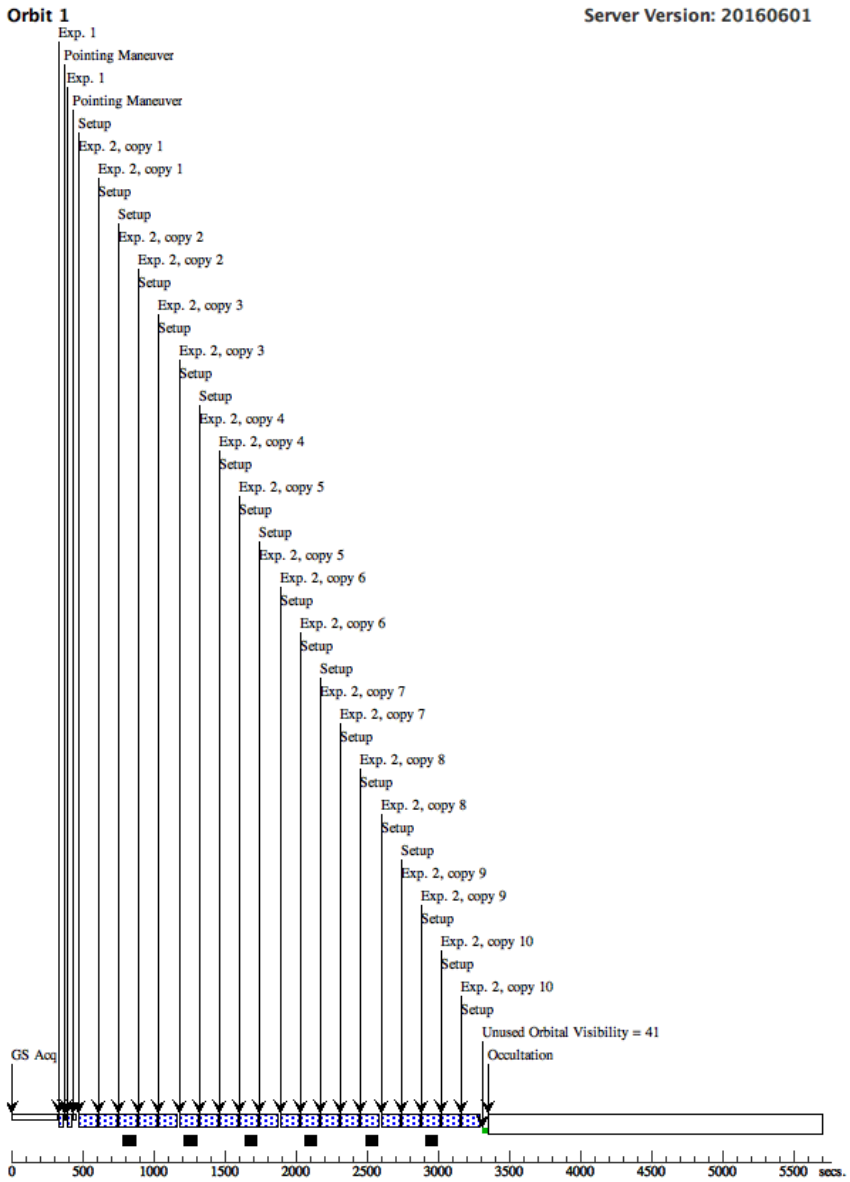
	5	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 5-5 Non-In t in Visit 03	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[4]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

Orbit Structure

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Exp. 3, copy 6
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Exp. 3, copy 8
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Exp. 3, copy 10
Exp. 3, copy 10
Setup
Setup
Exp. 3, copy 11
Setup
Exp. 3, copy 11
Unused Orbital Visibility = 6
Occultation
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
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Exp. 4, copy 2
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Exp. 4, copy 9
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Exp. 4, copy 9
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Exp. 4, copy 10
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Exp. 4, copy 11
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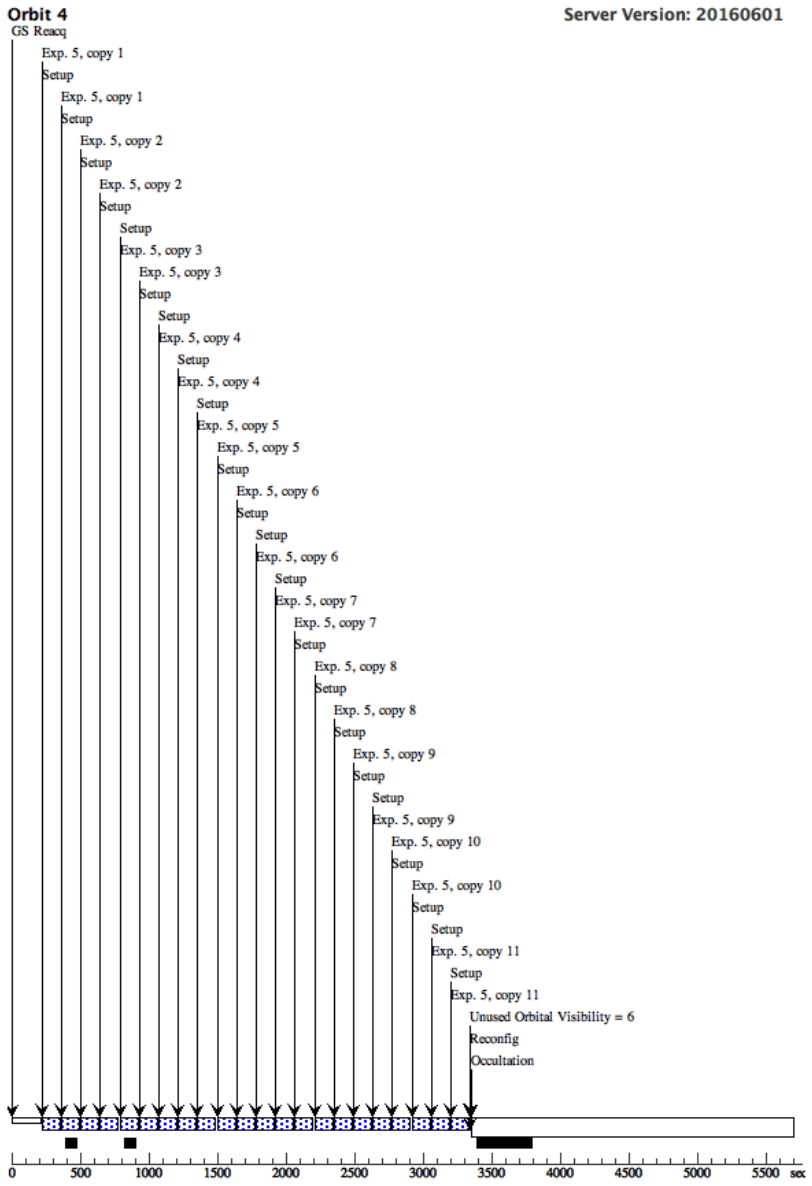
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
GS Reacq
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Exp. 5, copy 5
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Exp. 5, copy 6
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Exp. 5, copy 8
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Exp. 5, copy 8
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Exp. 5, copy 9
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Exp. 5, copy 9
Exp. 5, copy 10
Setup
Exp. 5, copy 10
Setup
Setup
Exp. 5, copy 11
Setup
Exp. 5, copy 11
Unused Orbital Visibility = 6
Reconfig
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14758, Visit 04, implementation Wed Nov 09 16:57:33 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 27D TO 133 D; ORIENT 207D TO 313 D; Period 1.6289246 D AND ZERO-PHASE HJD2457184.55804

Comments: There will be five duplicate transit visits for GJ1132b. Each consists of four orbits. In the first orbit, we will start with a direct image. Then, the rest of the first orbit and the other three orbits consist of repeated scan-mode G141 spectra.

Visit ORIENT constraints are included to prevent overlap with a faint but non-neglible star located 6.5" away from GJ1132 (PA=305 degrees). The constraints are designed to create a 32 pixel vertical buffer between the two spectra, allowing a 20 pixel gap beyond the 12 pixel vertical extent each spectrum will create in a single 7.3 second read (256x256, SPARS10).

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LHS-281 Alt Name1: GJ1132	RA: 10 14 51.7700 (153.7157083d) Dec: -47 09 24.10 (-47.15669d) Equinox: J2000	Proper Motion RA: -1046 mas/yr Proper Motion Dec: +416 mas/yr Parallax: 0.08307" Epoch of Position: 2000.0 Radial Velocity: +35 km/sec	V=13.49+/-0.03 U=16.51, B=15.17, V=13.49, Rc=12.26, Ic=10.69, J=9.245, H=8.666, Ks=8.322	Reference Frame: ICRS

Comments: RA, Dec, proper motions, parallax were drawn from RECONS astrometry originally published in Jao et al. (2005; 2005AJ....129.1954J) and restated in Berta-Thompson et al. (2015; 2015Natur.527..204B). We adopt uncertainties on the RA and Dec as those for 2MASS for this object, through which these positions are tied to the ICRS. The RECONS astrometry is more accurate than the positions and proper motions listed in SIMBAD. We confirmed that the quoted position and proper motions match both the epoch 1992.2 position of the star in the APT Target Confrimation Chart and the epoch 2015.8 position of the star in recent MEarth imaging. These coordinates were successfully used for target acquisition with STIS in GO-14462, which has much more stringent
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GJ1132 direct image, phase-constrained	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID	PHASE 0.90322162 TO 0.91387965	Sequence 1-2 Non-Int in Visit 04 Pattern 2, Exps 1-1 in Sequence 1-2 Non-Int in Visit 04 (2)	1.706054 Secs (3.412 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: This is the direct image of the GJ1132 field, to be used as a reference for the scan mode observations. We use the larger 512 aperture to provide references for objects beyond the 256x256 field of view. We take advantage of otherwise unused time to two dithered exposures for this direct image.

According to the ETC, the time saturation for GJ1132 in this direct image (using a Pickles M4V, normalized to H=8.67) is 1.46 seconds with the F130N. This direct image will saturate GJ1132, but enable a centroid to be estimated from the first read.

This exposure is phase constrained to a window 25 minutes in width, meant to center the third orbit of the visit on the transit of GJ1132b.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	GJ1132 scan, grism image	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	POS TARG -1.5,-13.5; SPATIAL SCAN 0.2,90.0 Degrees,Round trip	Sequence 1-2 Non-Int in Visit 04	103.128633 Secs X 10 (2062.573 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]*	***[1]***

Comments: This is the first of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

3	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 3-3 Non-In t in Visit 04	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[2]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

4	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 4-4 Non-In t in Visit 04	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[3]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

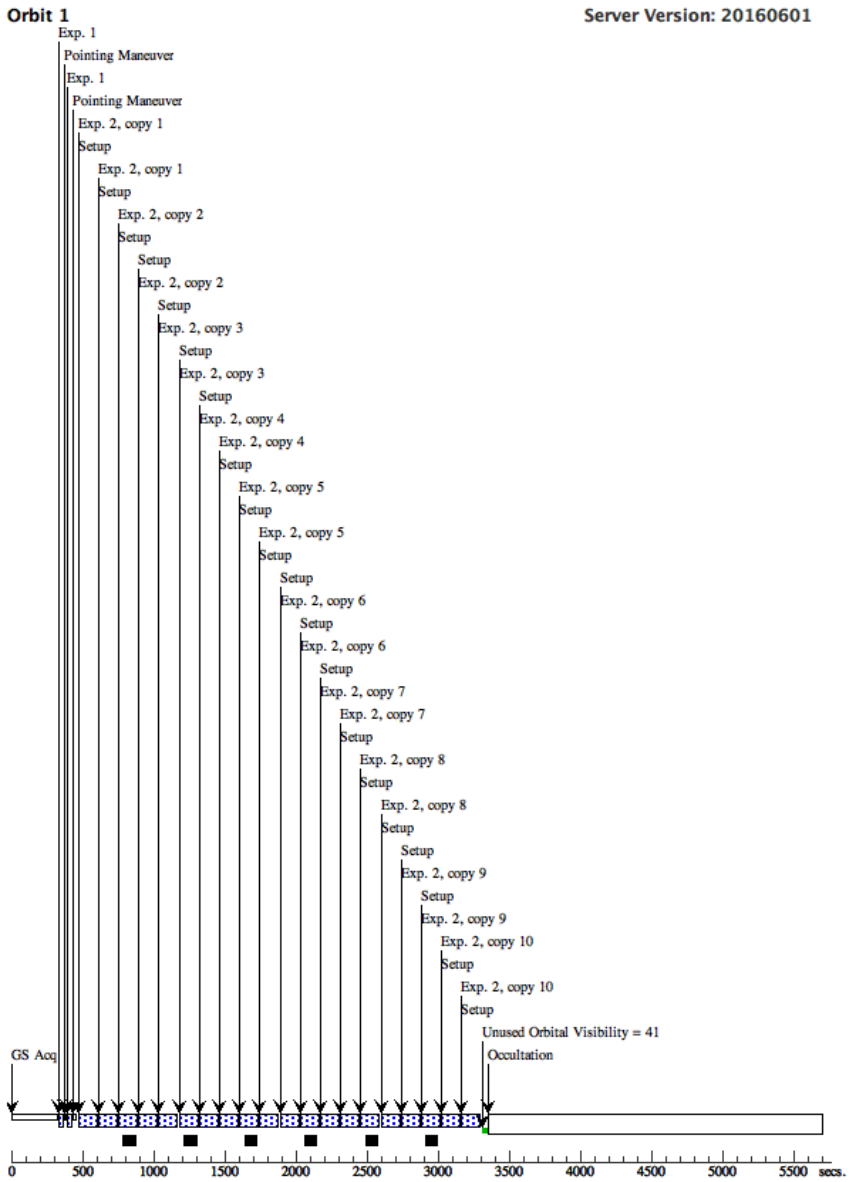
	5	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 5-5 Non-In t in Visit 04	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[4]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

Orbit Structure

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GS Reacq
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Exp. 3, copy 9
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Unused Orbital Visibility = 6
Occultation
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
Server Version: 20160601
GS Reacq
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Exp. 4, copy 1
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Exp. 4, copy 2
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Setup
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Exp. 4, copy 9
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Exp. 4, copy 10
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Exp. 4, copy 10
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Setup
Exp. 4, copy 11
Exp. 4, copy 11
Setup
Unused Orbital Visibility = 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20160601
GS Reacq
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Exp. 5, copy 1
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Exp. 5, copy 2
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Exp. 5, copy 2
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Setup
Setup
Exp. 5, copy 8
Setup
Exp. 5, copy 9
Exp. 5, copy 9
Setup
Exp. 5, copy 10
Setup
Exp. 5, copy 10
Setup
Exp. 5, copy 11
Setup
Setup
Exp. 5, copy 11
Reconfig
Unused Orbital Visibility = 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14758, Visit 05, implementation Wed Nov 09 16:57:33 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 27D TO 133 D; ORIENT 207D TO 313 D; Period 1.6289246 D AND ZERO-PHASE HJD2457184.55804

Comments: There will be five duplicate transit visits for GJ1132b. Each consists of four orbits. In the first orbit, we will start with a direct image. Then, the rest of the first orbit and the other three orbits consist of repeated scan-mode G141 spectra.

Visit ORIENT constraints are included to prevent overlap with a faint but non-neglible star located 6.5" away from GJ1132 (PA=305 degrees). The constraints are designed to create a 32 pixel vertical buffer between the two spectra, allowing a 20 pixel gap beyond the 12 pixel vertical extent each spectrum will create in a single 7.3 second read (256x256, SPARS10).

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LHS-281 Alt Name1: GJ1132	RA: 10 14 51.7700 (153.7157083d) Dec: -47 09 24.10 (-47.15669d) Equinox: J2000	Proper Motion RA: -1046 mas/yr Proper Motion Dec: +416 mas/yr Parallax: 0.08307" Epoch of Position: 2000.0 Radial Velocity: +35 km/sec	V=13.49+/-0.03 U=16.51, B=15.17, V=13.49, Rc=12.26, Ic=10.69, J=9.245, H=8.666, Ks=8.322	Reference Frame: ICRS

Comments: RA, Dec, proper motions, parallax were drawn from RECONS astrometry originally published in Jao et al. (2005; 2005AJ....129.1954J) and restated in Berta-Thompson et al. (2015; 2015Natur.527..204B). We adopt uncertainties on the RA and Dec as those for 2MASS for this object, through which these positions are tied to the ICRS. The RECONS astrometry is more accurate than the positions and proper motions listed in SIMBAD. We confirmed that the quoted position and proper motions match both the epoch 1992.2 position of the star in the APT Target Confrimation Chart and the epoch 2015.8 position of the star in recent MEarth imaging. These coordinates were successfully used for target acquisition with STIS in GO-14462, which has much more stringent
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	GJ1132 direct image, phase-constrained	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID	PHASE 0.90322162 TO 0.91387965	Sequence 1-2 Non-Int in Visit 05 Pattern 2, Exps 1-1 in Sequence 1-2 Non-Int in Visit 05 (2)	1.706054 Secs (3.412 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: This is the direct image of the GJ1132 field, to be used as a reference for the scan mode observations. We use the larger 512 aperture to provide references for objects beyond the 256x256 field of view. We take advantage of otherwise unused time to two dithered exposures for this direct image.

According to the ETC, the time saturation for GJ1132 in this direct image (using a Pickles M4V, normalized to H=8.67) is 1.46 seconds with the F130N. This direct image will saturate GJ1132, but enable a centroid to be estimated from the first read.

This exposure is phase constrained to a window 25 minutes in width, meant to center the third orbit of the visit on the transit of GJ1132b.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	GJ1132 scan, grism image	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	POS TARG -1.5,-13.5; SPATIAL SCAN 0.2,90.0 Degrees,Round trip	Sequence 1-2 Non-Int in Visit 05	103.128633 Secs X 10 (2062.573 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]*	***[1]***

Comments: This is the first of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

3	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 3-3 Non-In t in Visit 05	103.128633 Secs X 11 (2268.83 Sec s)	
								[==>(Copy 1, Forward)] *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[2]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

4	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 4-4 Non-In t in Visit 05	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[3]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

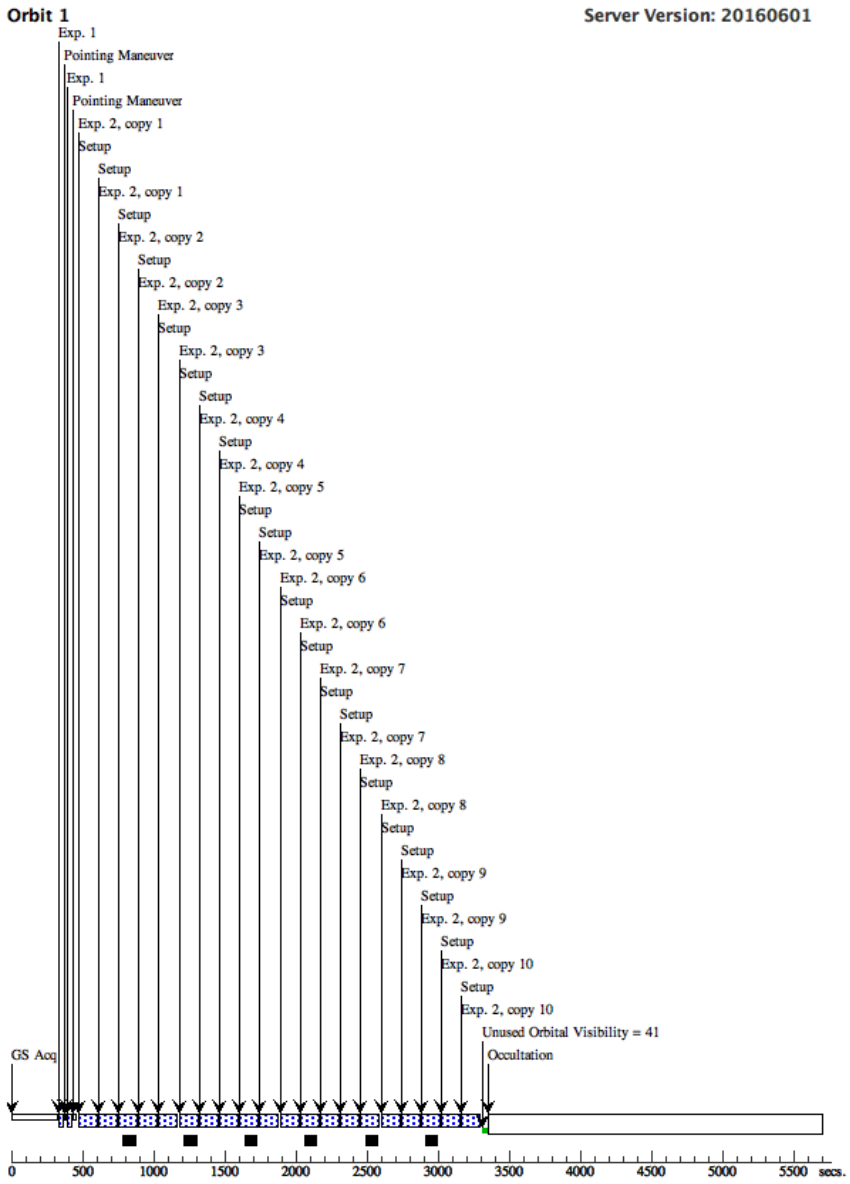
	5	GJ1132 scan , grism imag e	(1) LHS-281	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	POS TARG -1.5,-13. 5; SPATIAL SCAN 0.2 ,90.0 Degrees,Round trip	Sequence 5-5 Non-In t in Visit 05	103.128633 Secs X 11 (2268.83 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]*	***[4]***

Comments: These are some of many for a wide-field scan-mode slitless spectroscopy image of the GJ1132 field.

According to the ETC (using a Pickles M4V, normalized to H=8.67), with a scan rate of 0.2" the brightest pixel on GJ1132 with the G141 grism would collect 23,360 electrons, well below saturation.

We use similiar POS-TARG's as for GJ3470 in GO-13665 (PI Benneke), which is of similar brightness as GJ1132 and therefore had a similar scan length.

Orbit Structure

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Exp. 3, copy 9
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Exp. 3, copy 10
Exp. 3, copy 10
Setup
Setup
Exp. 3, copy 11
Setup
Exp. 3, copy 11
Unused Orbital Visibility = 6
Occultation
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1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
Server Version: 20160601
GS Reacq
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Exp. 4, copy 9
Exp. 4, copy 9
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Exp. 4, copy 10
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Exp. 4, copy 11
Setup
Exp. 4, copy 11
Setup
Unused Orbital Visibility = 6
Occultation
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1000
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3500
4000
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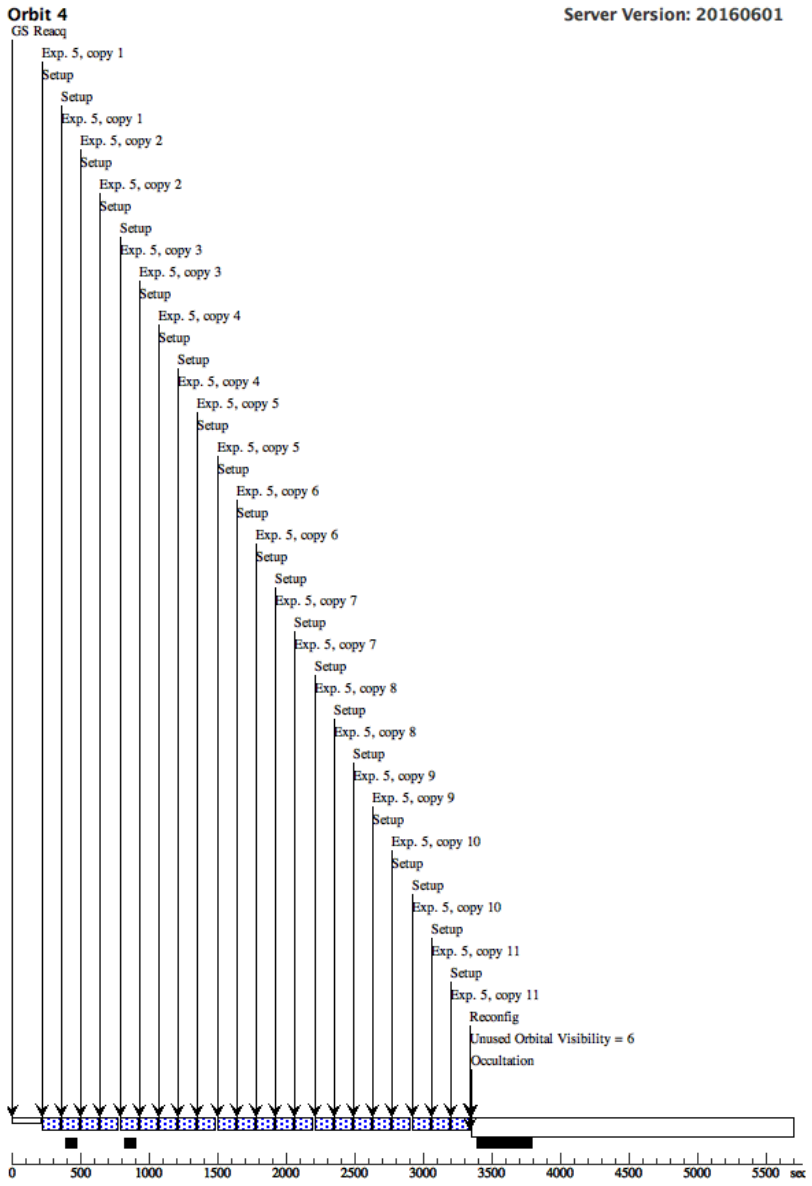
5000
5500
secs.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Server Version: 20160601
GS Reacq
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Exp. 5, copy 10
Setup
Setup
Exp. 5, copy 10
Setup
Exp. 5, copy 11
Setup
Exp. 5, copy 11
Reconfig
Unused Orbital Visibility = 6
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec