15674 - UV transmission spectrum of Earth as an exoplanet: the ozone signature

Cycle: 26, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Allison Youngblood (PI) (Contact)	**NASA Goddard Space Flight Center**	**allison.a.youngblood@gmail.com**
Dr. Kevin France (CoI)	University of Colorado at Boulder	kevin.france@colorado.edu
Prof. John Thomas Stocke (CoI)	University of Colorado at Boulder	stocke@casa.colorado.edu
Dr. Giada Arney (CoI)	NASA Goddard Space Flight Center	giada.arney@gmail.com

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(3) MOON-OFFSET-GUIDE-STAR	S/C	1	07-Jan-2019 21:00:12.0	yes
02	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD	2	07-Jan-2019 21:00:14.0	yes
03	(3) MOON-OFFSET-GUIDE-STAR	S/C	1	07-Jan-2019 21:00:16.0	yes
04	(2) MOON-HIGHLANDS-FULL	STIS/CCD	1	07-Jan-2019 21:00:18.0	yes

5 Total Orbits Used

ABSTRACT

We propose UV spectroscopy of a lunar eclipse to allow the first UV observation of Earth as a transiting exoplanet. The observatories and instruments that will be able to perform transmission spectroscopy of exo- Earths are beginning to be planned, and exhaustively characterizing the spatially-integrated transmission spectrum of Earth is key to ensuring that key spectral features (e.g., ozone) are appropriately captured in mission concept studies. Ozone is photochemically produced from O2, a product of the dominant metabolism on Earth today. It will therefore be sought in future observations as critical evidence for life on exoplanets. Ground-based lunar eclipse observations have provided the Earth's transmission

spectrum at optical and near-IR wavelengths, and this program will extend Earth's measured transmission spectrum into the UV. The strongest expected signals are from ozone, CO2, and N2 (via Rayleigh scattering), with weaker signals from ionospheric species like Ca II and Mg II. The resulting Earth transmission spectrum will also be compared to the Venus transmission spectrum that was observed in during the 2012 Venus transit with a similar HST STIS configuration. The ability to distinguish Earth-like and Venus-like terrestrial exoplanets via transmission spectroscopy is of great importance to future missions targeting direct detection of inhabited planets, and ozone is an important gas to consder in the search for life elsehwere in the universe.

OBSERVING DESCRIPTION

We will observe the penumbral and umbral phases of the total lunar eclipse on Jan 21, 2019 with the STIS spectrograph. More details to be filled in.

Visit

Proposal 15674, guide star visit 1 (01), withdrawn Tue Jan 08 02:00:19 GMT 2019

Diagnostic Status: Error

Scientific Instruments: S/C

Special Requirements: NOTRACK

Diagnostics

(Offset guide star (01.001)) Error (Form): Illegal selection: S/C.

(Offset guide star (01.001)) Error (Form): POINTING is not a valid selection.

(Offset guide star (01.001)) Error (Form): This attribute is not allowed to have this value: Aperture = V1
It is an Available option and cannot normally be used in a GO proposal.

(Offset guide star (01.001)) Error (Form): This attribute is not allowed to have this value: Config = S/C
It is an Available option and cannot normally be used in a GO proposal.

(Offset guide star (01.001)) Error (Form): This attribute is not allowed to have this value: Mode = POINTING
It is an Available option and cannot normally be used in a GO proposal.

(Offset guide star (01.001)) Error (Form): V1 is not a valid selection.

Solar System Targets

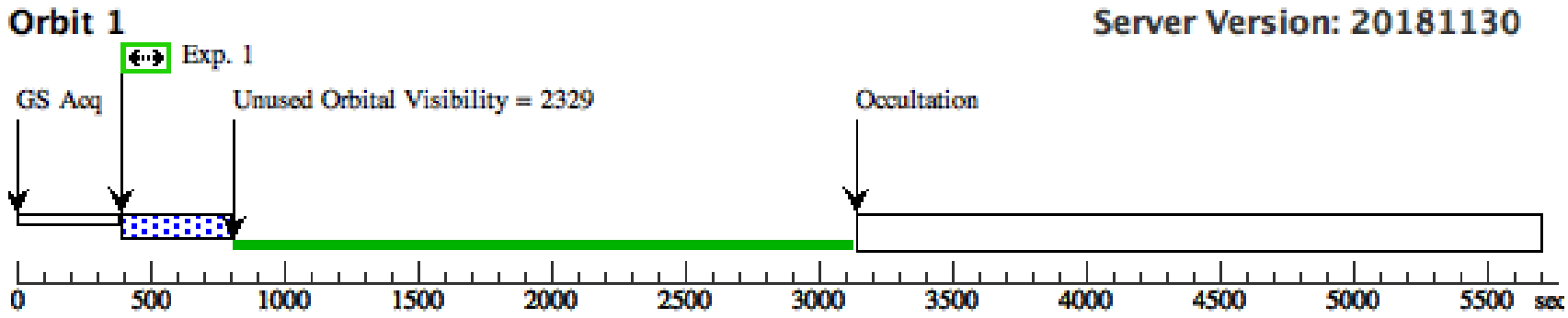
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	MOON-OFFSET-GUIDE-STAR	STD=EARTH	STD=MOON	TYPE=POS_ANGLE,RAD=36000,ANG=90,REF=NORTH		HUBBLE

Comments: Description=STAR 9 DEGREES AWAY
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Offset guide star	(3) MOON-OFFSET-GUIDE-STAR	S/C, POINTING, V1					420 Secs (420 Secs)	
								[==>]	*[1]*

Orbit Structure



Visit

Proposal 15674, penumbral and total eclipse visit (02), implementation Tue Jan 08 02:00:19 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE GYRO; AFTER_01 BY 0_Orbits TO 0.5_Orbits; BETWEEN 21-JAN-2019:02:00:00 AND 21-JAN-2019:08:00:00

Diagnostics

(penumbral and total eclipse visit (02)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

Solar System Targets

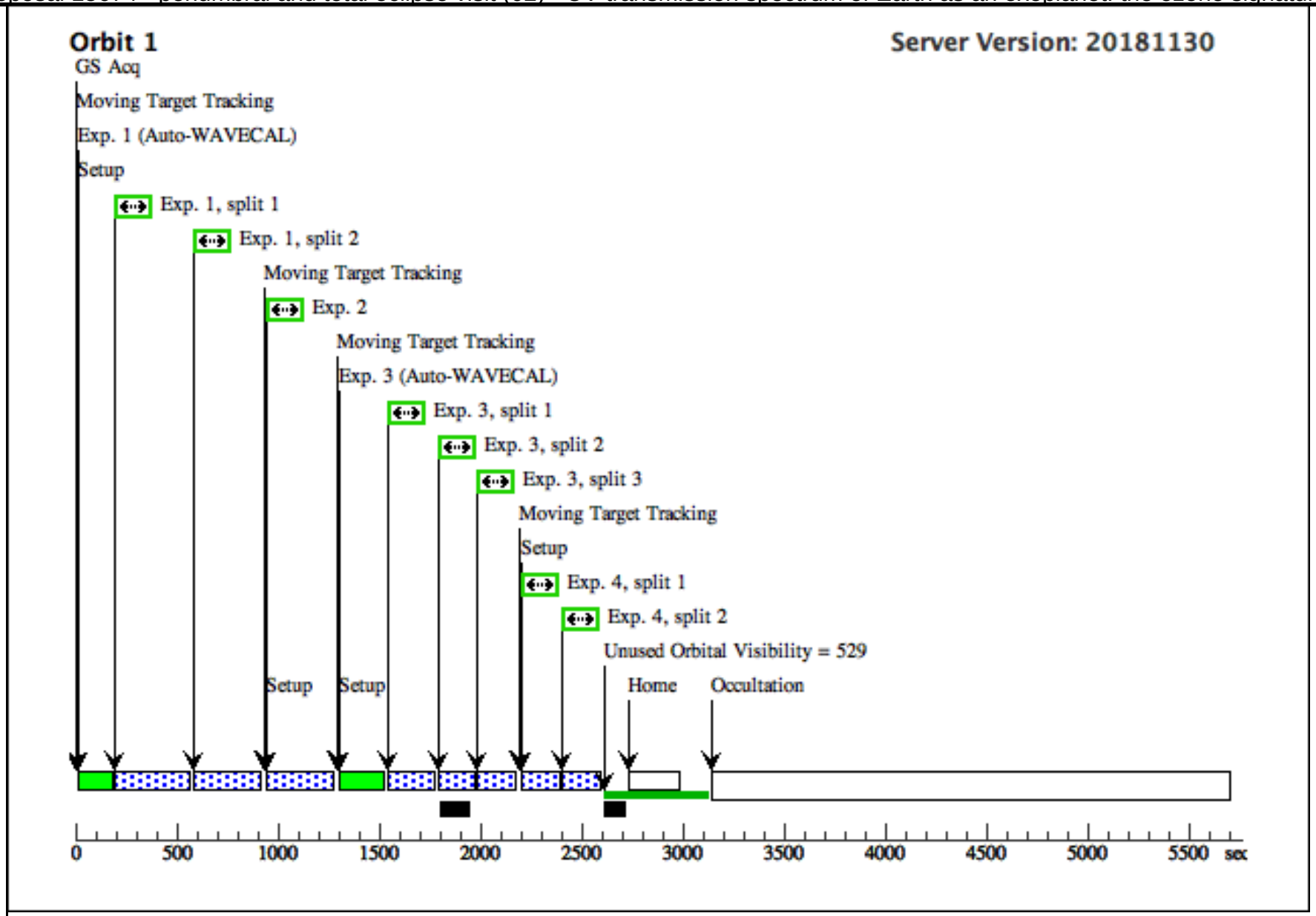
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	MOON-HIGHLANDS-ECLIPSE	STD=EARTH	STD=MOON	TYPE=PGRAPHIC,LONG=-8.2,LAT=-7.3	NOT OCC OF MOON-HIGHLANDS-ECLIPSE BY MOON FROM EARTH, ECL P PARTIAL OF MOON-HIGHLANDS-ECLIPSE BY EARTH FROM HUBBLE MOSS Planning Start: 21-JAN-2019:00:00:00 MOSS Planning End: 22-JAN-2019:00:00:00	HUBBLE

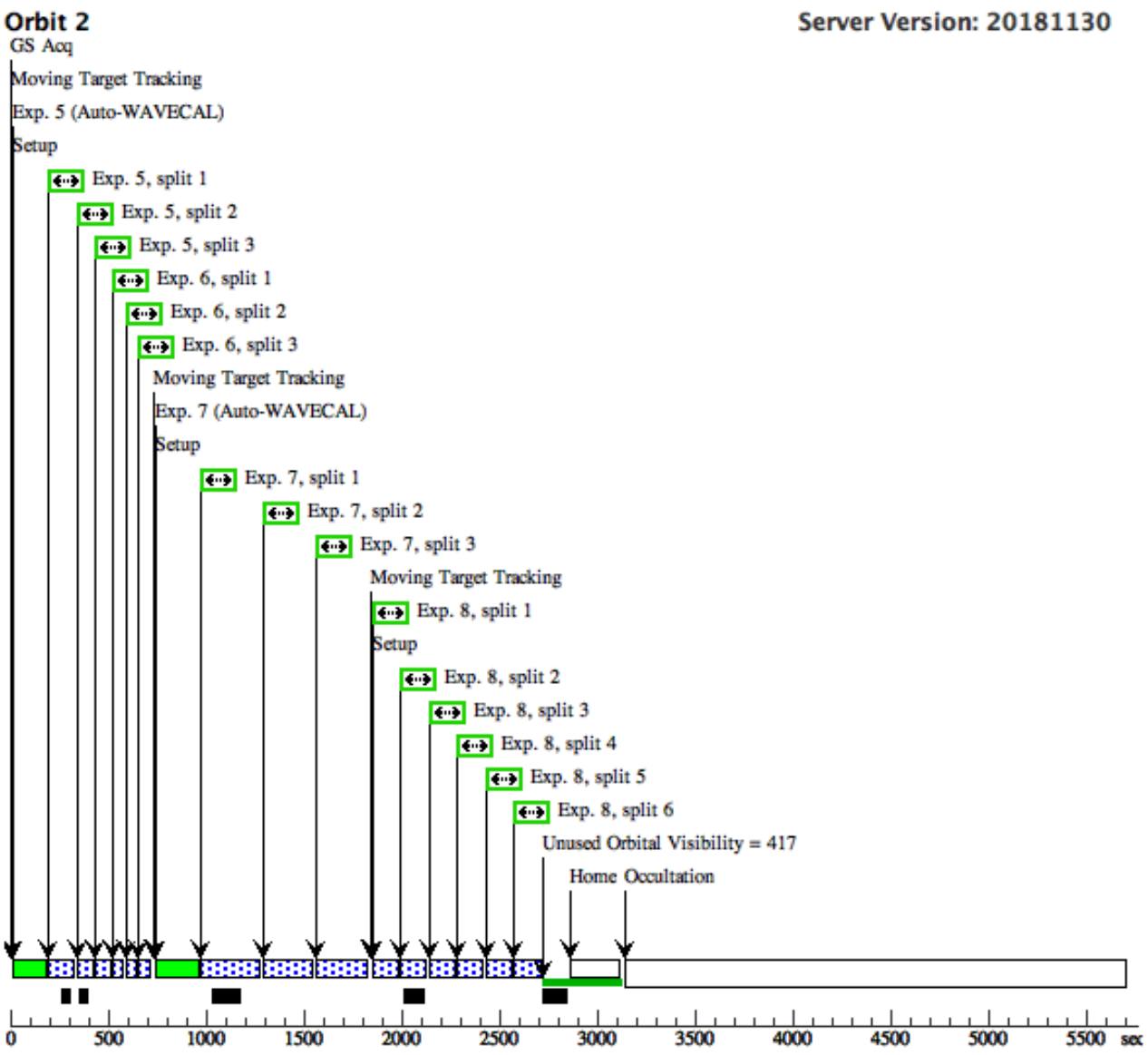
Comments: Description=SATELLITE MOON
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	G230LB_2_orbit1 (STIS.sp.13 05199)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			586.6 Secs (586.6 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
2	G230LB_2_orbit1 (STIS.sp.13 05199)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=NO	NEW ALIGNMENT		293.3 Secs (293.3 Secs) *[==>]*	***[1]***
3	G430L_2_orbit1 (STIS.sp.13 05204)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=3	NEW ALIGNMENT		464.1 Secs (464.1 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]*	***[1]***
4	G430L_2_orbit1 (STIS.sp.13 05204)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=2	NEW ALIGNMENT		309.6 Secs (309.6 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
5	G430LB_2_orbit1 (STIS.sp.13 05203)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=3	NEW OBSET FULL ACQ		144.9 Secs (144.9 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]*	***[2]***
6	G430LB_2_orbit2 (STIS.sp.13 05203)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=3			60 Secs (60 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]*	***[2]***
7	G230LB_2_orbit2 (STIS.sp.13 05199)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=3	NEW ALIGNMENT		675 Secs (675 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]*	***[2]***
8	G230LB_2_orbit2 (STIS.sp.13 05198)	(1) MOON-HIGHLANDS-ECLIPSE	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=6	NEW ALIGNMENT		600 Secs (600 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20181130
GS Acq
Moving Target Tracking
Exp. 5 (Auto-WAVECAL)
Setup
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 6, split 1
Exp. 6, split 2
Exp. 6, split 3
Moving Target Tracking
Exp. 7 (Auto-WAVECAL)
Setup
Exp. 7, split 1
Exp. 7, split 2
Exp. 7, split 3
Moving Target Tracking
Exp. 8, split 1
Setup
Exp. 8, split 2
Exp. 8, split 3
Exp. 8, split 4
Exp. 8, split 5
Exp. 8, split 6
Unused Orbital Visibility = 417
Home Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15674, guide star visit 2 (03), withdrawn Tue Jan 08 02:00:19 GMT 2019

Diagnostic Status: Error

Scientific Instruments: S/C

Special Requirements: NOTRACK; AFTER 02 BY 2.9 Orbits TO 3.1 Orbits

Diagnostics

(Offset guide star (03.001)) Error (Form): Illegal selection: S/C.

(Offset guide star (03.001)) Error (Form): POINTING is not a valid selection.

(Offset guide star (03.001)) Error (Form): This attribute is not allowed to have this value: Aperture = V1
It is an Available option and cannot normally be used in a GO proposal.

(Offset guide star (03.001)) Error (Form): This attribute is not allowed to have this value: Config = S/C
It is an Available option and cannot normally be used in a GO proposal.

(Offset guide star (03.001)) Error (Form): This attribute is not allowed to have this value: Mode = POINTING
It is an Available option and cannot normally be used in a GO proposal.

(Offset guide star (03.001)) Error (Form): V1 is not a valid selection.

Solar System Targets

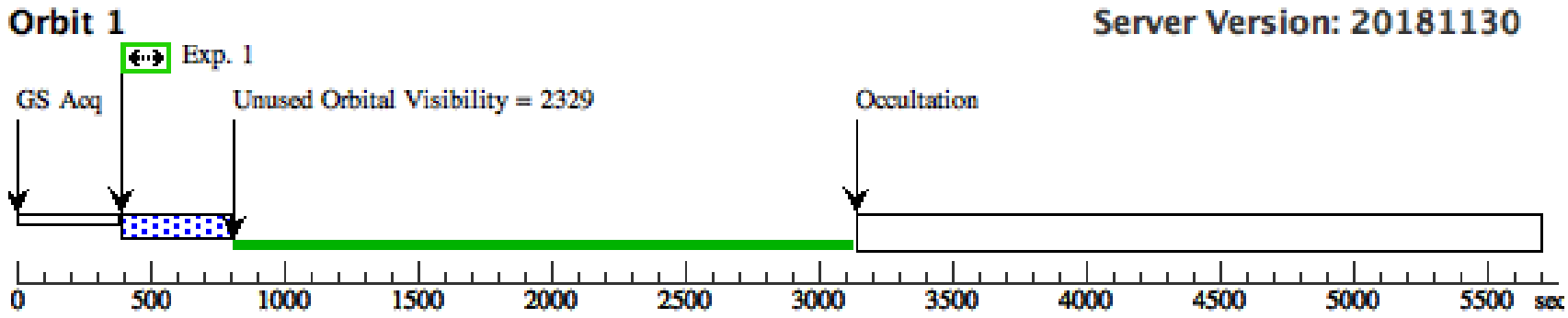
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	MOON-OFFSET-GUIDE-STAR	STD=EARTH	STD=MOON	TYPE=POS_ANGLE,RAD=36000,ANG=90,REF=NORTH		HUBBLE

Comments: Description=STAR 9 DEGREES AWAY
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Offset guide star	(3) MOON-OFFSET-GUIDE-STAR	S/C, POINTING, V1					420 Secs (420 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 15674, Full moon visit (04), implementation Tue Jan 08 02:00:19 GMT 2019

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE GYRO; AFTER .03 BY 0 Orbits TO 0.5 Orbits

Diagnostics

(Full moon visit (04)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	MOON-HIGHLANDS-FULL	STD=EARTH	STD=MOON	TYPE=PGRAPHIC,LONG=-8.2,LAT=-7.3	NOT OCC OF MOON-HIGHLANDS-FULL BY MOON FROM EARTH MOSS Planning Start: 21-JAN-2019:00:00:00 MOSS Planning End: 22-JAN-2019:00:00:00	HUBBLE

Comments: For use during the full moon phase (i.e., no eclipse constraint)
Description=SATELLITE MOON
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			90 Secs (90 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
2	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			90 Secs (90 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
3	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			90 Secs (90 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
4	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2	NEW ALIGNMENT		90 Secs (90 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
5	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			90 Secs (90 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
6	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			100 Secs (100 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
7	G230LB_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2	NEW ALIGNMENT		150 Secs (150 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
8	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.5 Secs (0.5 Secs) *[==>]*	***[1]***
9	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.5 Secs (0.5 Secs) *[==>]*	***[1]***
10	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.5 Secs (0.5 Secs) *[==>]*	***[1]***
11	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.5 Secs (0.5 Secs) *[==>]*	***[1]***
12	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.5 Secs (0.5 Secs) *[==>]*	***[1]***
13	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO	NEW ALIGNMENT		0.70 Secs (0.7 Secs) *[==>]*	***[1]***
14	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.70 Secs (0.7 Secs) *[==>]*	***[1]***
15	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.70 Secs (0.7 Secs) *[==>]*	***[1]***
16	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO			0.70 Secs (0.7 Secs) *[==>]*	***[1]***

	17	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO	0.70 Secs (0.7 Secs) *[==>]*	 ***[1]***
	18	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO	0.70 Secs (0.7 Secs) *[==>]*	 ***[1]***
	19	G430L_2 (STIS.sp.13 05883)	(2) MOON-HIGHL ANDS-FULL	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=NO	0.70 Secs (0.7 Secs) *[==>]*	 ***[1]***

Orbit Structure