15463 - Benchmark Multi-Wavelength Flare Spectra of M Dwarfs

Cycle: 25, Proposal Category: GO

(UV Initiative)

(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) HD-204961	STIS/CCD STIS/NUV-MAMA	3	30-Oct-2018 15:01:54.0	yes
02	(1) HD-204961	STIS/CCD STIS/NUV-MAMA	2	30-Oct-2018 15:01:56.0	yes
03	(2) GJ-1061	STIS/CCD STIS/NUV-MAMA	3	30-Oct-2018 15:01:57.0	yes
04	(2) GJ-1061	STIS/CCD STIS/NUV-MAMA	2	30-Oct-2018 15:01:58.0	yes
Z4	(2) GJ-1061	STIS/CCD STIS/NUV-MAMA	1	30-Oct-2018 15:01:59.0	yes

11 Total Orbits Used

ABSTRACT

We propose STIS G230L observations as part of multi-wavelength flare survey of two M dwarfs, including a host to a habitable-zone super-Earth, to determine the spectral response of the NUV during flares. An essential task on the journey to finding life beyond the solar system is to determine which places are suitable for life. While terrestrial planets orbiting M dwarfs are highly sought after, their habitability is in question owing to high activity levels and close-in habitable zones. We are undertaking a large multi-wavelength flare study of M dwarfs carried out primarily via broadband photometry using Swift, TESS and the JVLA. We are studying flares from dozens of M dwarfs spanning all combinations of mass and age. STIS can greatly enhance the scientific yield from this project by uncovering the underlying spectral energy distribution during simultaneous NUV and optical photometry and X-ray spectroscopy. We will uncover the typical spectral response during a flare in the broadband Swift UVM2 bandpass with a few strategic observations. Multi-wavelength observations of flares are few, yet are critically important for understanding the effect of space weather on exoplanets. These NUV flare observations will provide an essential puzzle piece in our comprehensive M dwarf survey.

OBSERVING DESCRIPTION

The two targets, nearby M dwarfs GJ 832 (HD 204961; M2 V) and GJ 1061 (M5.5 V), will be observed with STIS G230L 52"x0.2" slit in time-tag mode to observe NUV flares. These observations are scheduled within the 1-2 month window that the TESS spacecraft will be obtaining continuous red-optical photometry at 2-minute cadence of these stars. We have also been allocated Swift time for these targets, and the Swift observatory will trigger off of the HST observations. Swift will obtain NUV photometry in the UVM2 bandpass which closely follows the spectral range of STIS G230L. Our STIS G230L spectra are designed to measure the typical M dwarf spectral response in Swift's broadband UVM2 filter, for our upcoming Swift Key Project to observe 46 nearby M dwarfs simultaneously with TESS and Swift (and ~16 targets also with the VLA) to study M dwarf activity through time.

Each target will have two visits (four visits total, each with 2-3 orbits) to maximize scheduling flexibility as this was strongly encouraged in correspondence with STScI. While the successful MUSCLES and ongoing Mega-MUSCLES Treasury Surveys have utilized 5 consecutive orbits for FUV flare studies, these surveys find that individual FUV flares have durations less than 90 minutes. Thus, each individual HST orbit is randomly sampling flares from the star.

Exposure time calculations were carried out using known spectra for one target (GJ 832) and the spectrum of a spectral type match to the distance

and radius for the second target (GJ 1061). The 52"x0.2" was selected to maximize S/N and absolute flux calibration accuracy.

Visit

Proposal 15463, 3 orbits GJ 832 (01), completed Tue Oct 30 19:01:59 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: BETWEEN 27-JUL-2018:00:00:00 AND 08-AUG-2018:08:10:00; BETWEEN 09-AUG-2018:00:10:00 AND 22-AUG-2018:15:40:00

Comments: Note that the TESS observing windows for this target are not finalized yet. TESS is undergoing some issues in its commissioning period, and we do not yet have definitive observing windows for this target. The ones implemented below are with our best working knowledge, but it will almost certainly change.

Fixed Targets

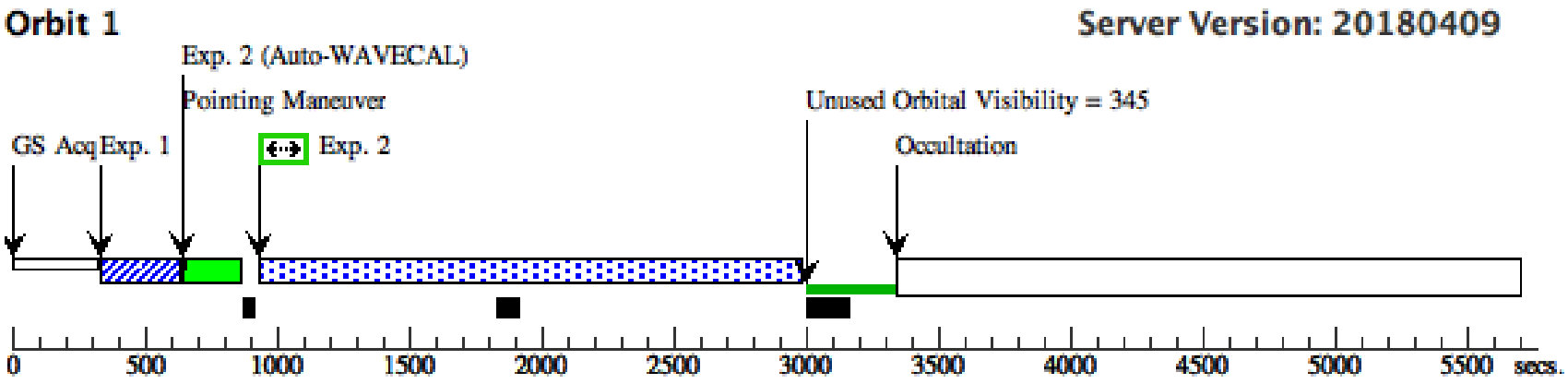
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-204961 Alt Name1: GJ-832	RA: 21 33 33.9753 (323.3915638d) Dec: -49 00 32.42 (-49.00901d) Equinox: J2000	Proper Motion RA: -45.83443354321247 mas/yr Proper Motion Dec: -816.603876009252 mas/yr Parallax: 0.2014" Epoch of Position: 2000 Radial Velocity: 4.30 km/sec	V=8.672	Reference Frame: ICRS

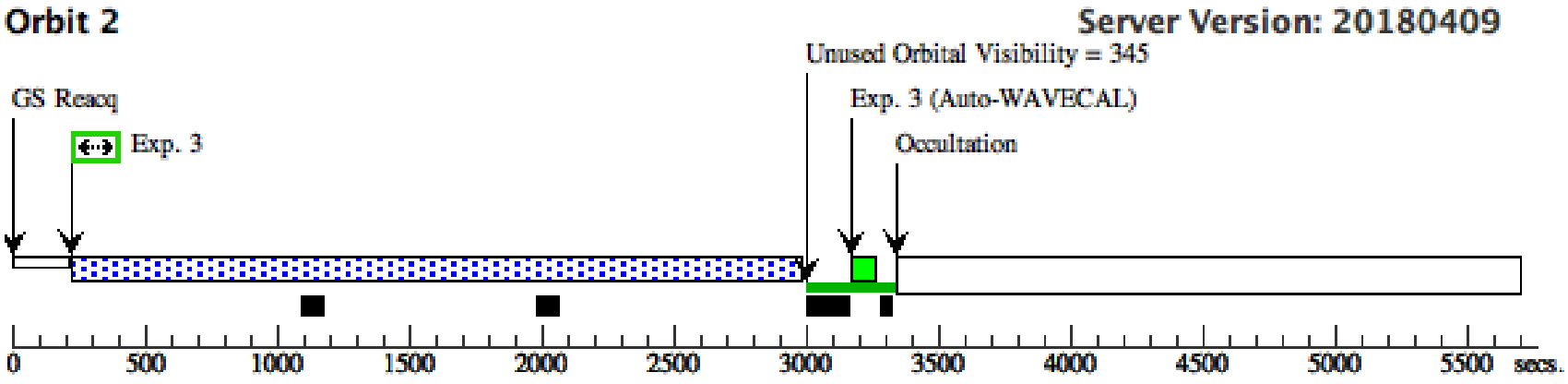
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[EXTRA-SOLAR PLANET, M V-IV]
Extended=NO

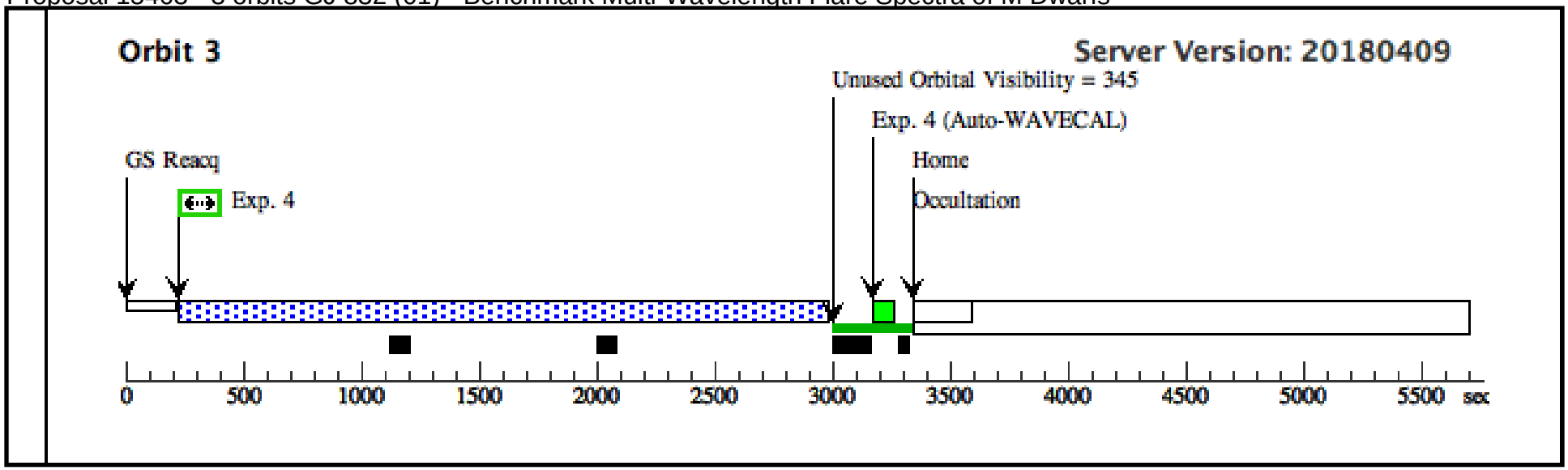
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1163467)	(1) HD-204961	STIS/CCD, ACQ, F25ND3	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
Comments: Used MUSCLES HLSP for GJ 832 as input spectrum.									
2	(STIS.sp.1168852)	(1) HD-204961	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=880.			2010 Secs (2010 Secs) *[==>]*	 ***[1]***
3	(STIS.sp.1168852)	(1) HD-204961	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=880.			2750 Secs (2750 Secs) *[==>]*	 ***[2]***
4	(STIS.sp.1168852)	(1) HD-204961	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=880.			2725 Secs (2725 Secs) *[==>]*	 ***[3]***

Orbit Structure






Orbit 3
Server Version: 20180409
Unused Orbital Visibility = 345
Exp. 4 (Auto-WAVECAL)
GS Reacq
Home
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15463, 2 orbits GJ 832 (02), completed Tue Oct 30 19:02:00 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: BETWEEN 27-JUL-2018:00:00:00 AND 08-AUG-2018:08:10:00; BETWEEN 09-AUG-2018:00:10:00 AND 22-AUG-2018:15:40:00

Comments: Note that the TESS observing windows for this target are not finalized yet. TESS is undergoing some issues in its commissioning period, and we do not yet have definitive observing windows for this target. The ones implemented below are with our best working knowledge, but it will almost certainly change.

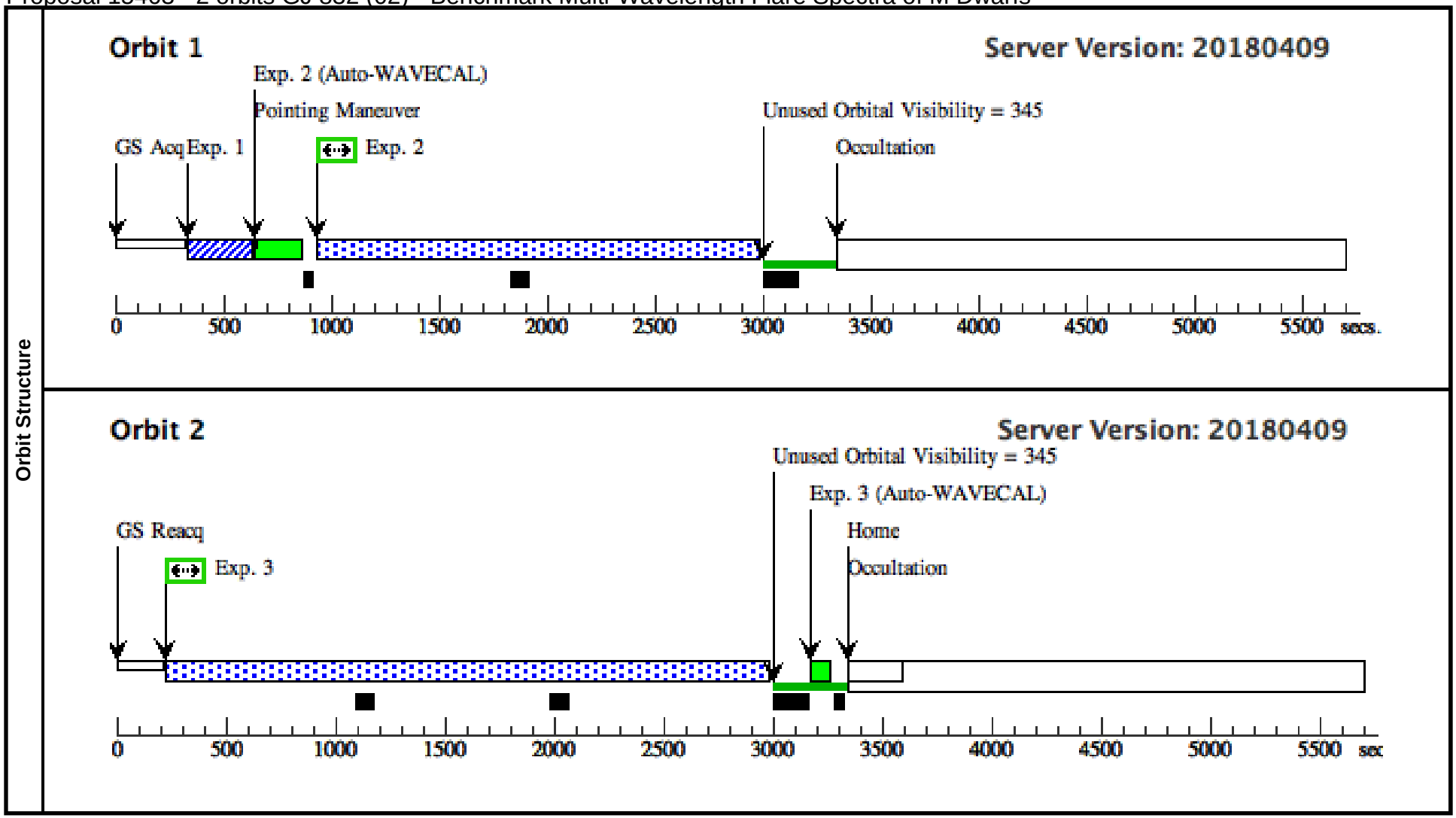
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-204961 Alt Name1: GJ-832	RA: 21 33 33.9753 (323.3915638d) Dec: -49 00 32.42 (-49.00901d) Equinox: J2000	Proper Motion RA: -45.83443354321247 mas/yr Proper Motion Dec: -816.603876009252 mas/yr Parallax: 0.2014" Epoch of Position: 2000 Radial Velocity: 4.30 km/sec	V=8.672	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[EXTRA-SOLAR PLANET, M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1163467)	(1) HD-204961	STIS/CCD, ACQ, F25ND3	MIRROR				1 Secs (1 Secs)	
								[==>]	***[1]***
2	(STIS.sp.1168852)	(1) HD-204961	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=880.			2010 Secs (2010 Secs)	
								[==>]	***[1]***
3	(STIS.sp.1168852)	(1) HD-204961	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=880.			2750 Secs (2750 Secs)	
								[==>]	***[2]***


Orbit Structure
Orbit 1
Server Version: 20180409
Exp. 2 (Auto-WAVECAL)
Pointing Maneuver
Unused Orbital Visibility = 345
GS Acq
Exp. 1
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20180409
Unused Orbital Visibility = 345
Exp. 3 (Auto-WAVECAL)
GS Reacq
Exp. 3
Home
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15463, 3 orbits GJ 1061 (03), scheduling Tue Oct 30 19:02:00 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: (none)

Comments: Final TESS windows

Fixed Targets

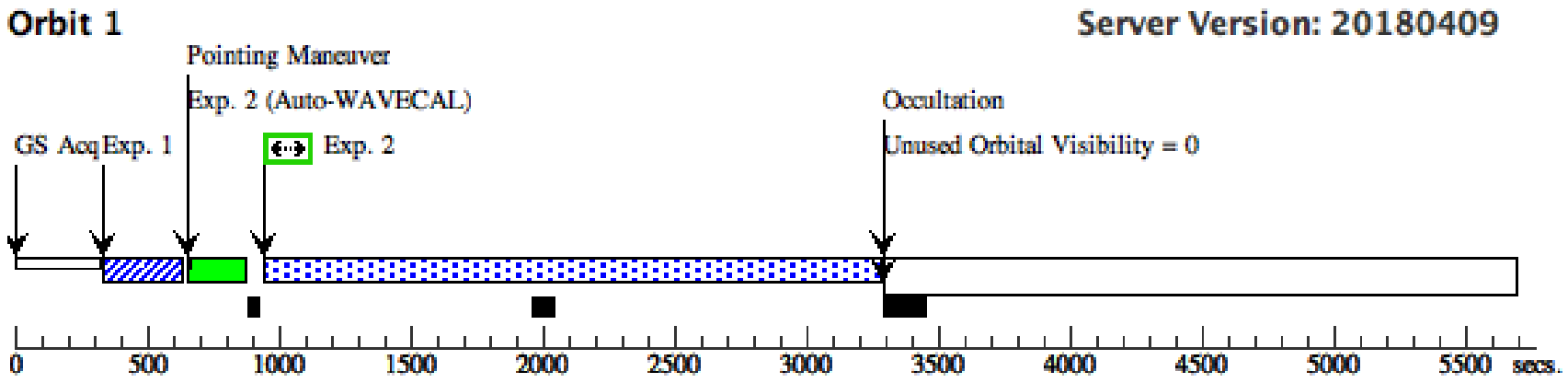
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	GJ-1061	RA: 03 35 59.6900 (53.9987083d) Dec: -44 30 45.30 (-44.51258d) Equinox: J2000	Proper Motion RA: 745.2860104124696 mas/yr Proper Motion Dec: -373.6733483591148 mas/yr Parallax: 0.2722" Epoch of Position: 2000 Radial Velocity: -20 km/sec	V=13.07	Reference Frame: ICRS

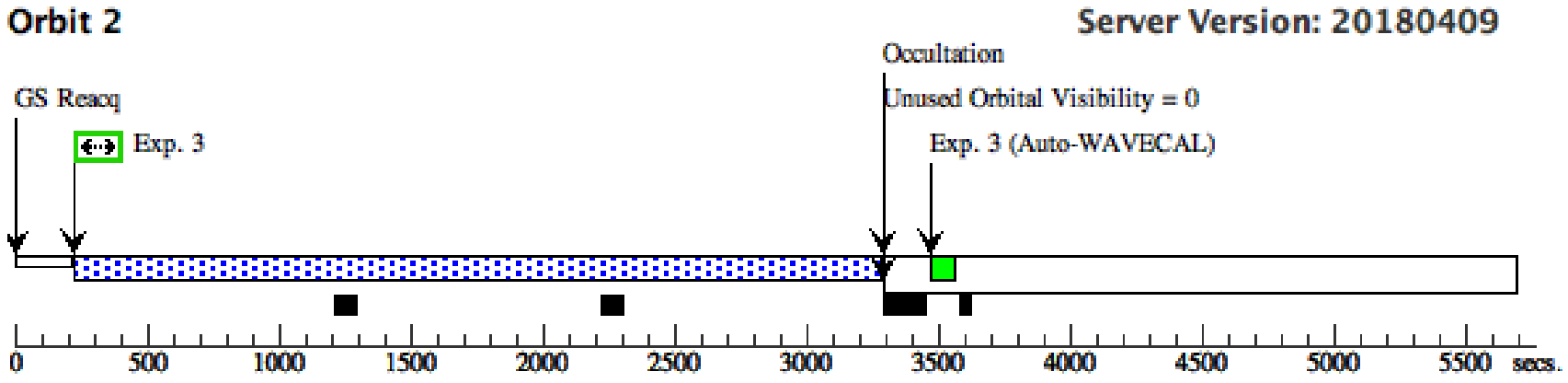
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[M V-IV]
Extended=NO

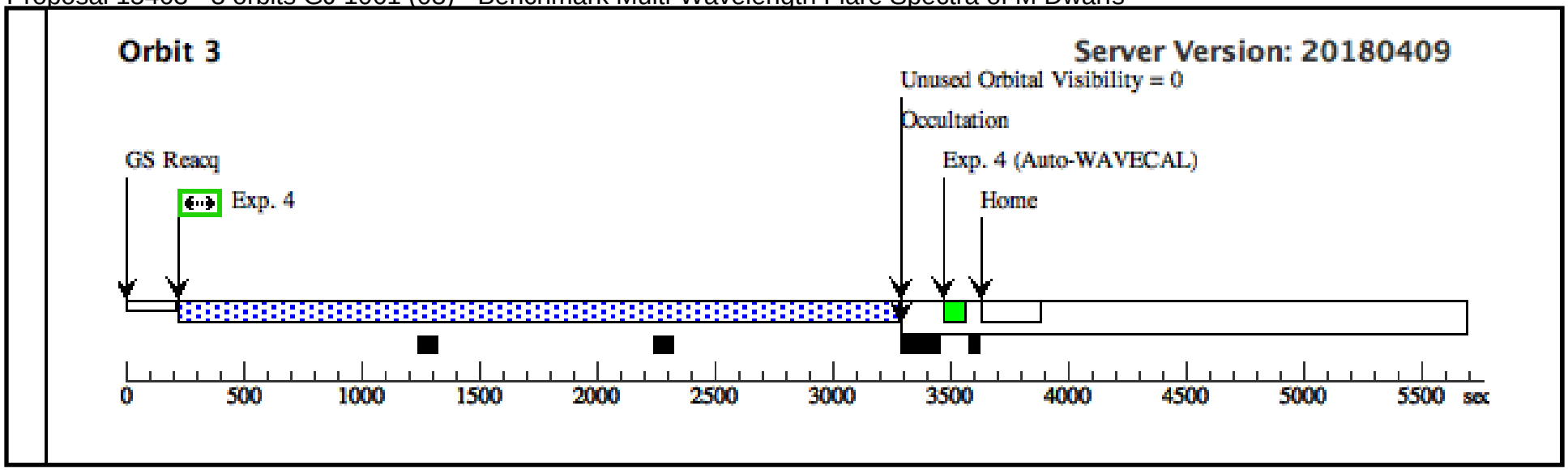
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1291170)	(2) GJ-1061	STIS/CCD, ACQ, F25ND3	MIRROR				3 Secs (3 Secs)	
								[==>]	***[1]***
Comments: Previously used GJ 876 (d=4.7, R=0.38) MUSCLES HLSP spectrum scaled to radius and distance of GJ 1061 (d=3.69, R=0.16). Replaced with M5 V (2951 K) Pickles model normalized to V=13.07 (Vega) and with Mg II flux estimates around 2800 Angstroms.									
2	(STIS.sp.1168855)	(2) GJ-1061	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=1000			1942 Secs (2300 Secs)	
								[==>2300.0 Secs]	***[1]***
3	(STIS.sp.1168855)	(2) GJ-1061	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=1000			2682 Secs (3048 Secs)	
								[==>3048.0 Secs]	***[2]***
4	(STIS.sp.1168855)	(2) GJ-1061	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=1000.			2657 Secs (3023 Secs)	
								[==>3023.0 Secs]	***[3]***

Orbit Structure






Orbit 3
Server Version: 20180409
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15463, 2 orbits GJ 1061 (04), failed Tue Oct 30 19:02:00 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: BETWEEN 24-SEP-2018:00:00:00 AND 04-OCT-2018:00:00:00; BETWEEN 06-OCT-2018:00:00:00 AND 18-OCT-2018:00:00:00

Comments: Final TESS windows

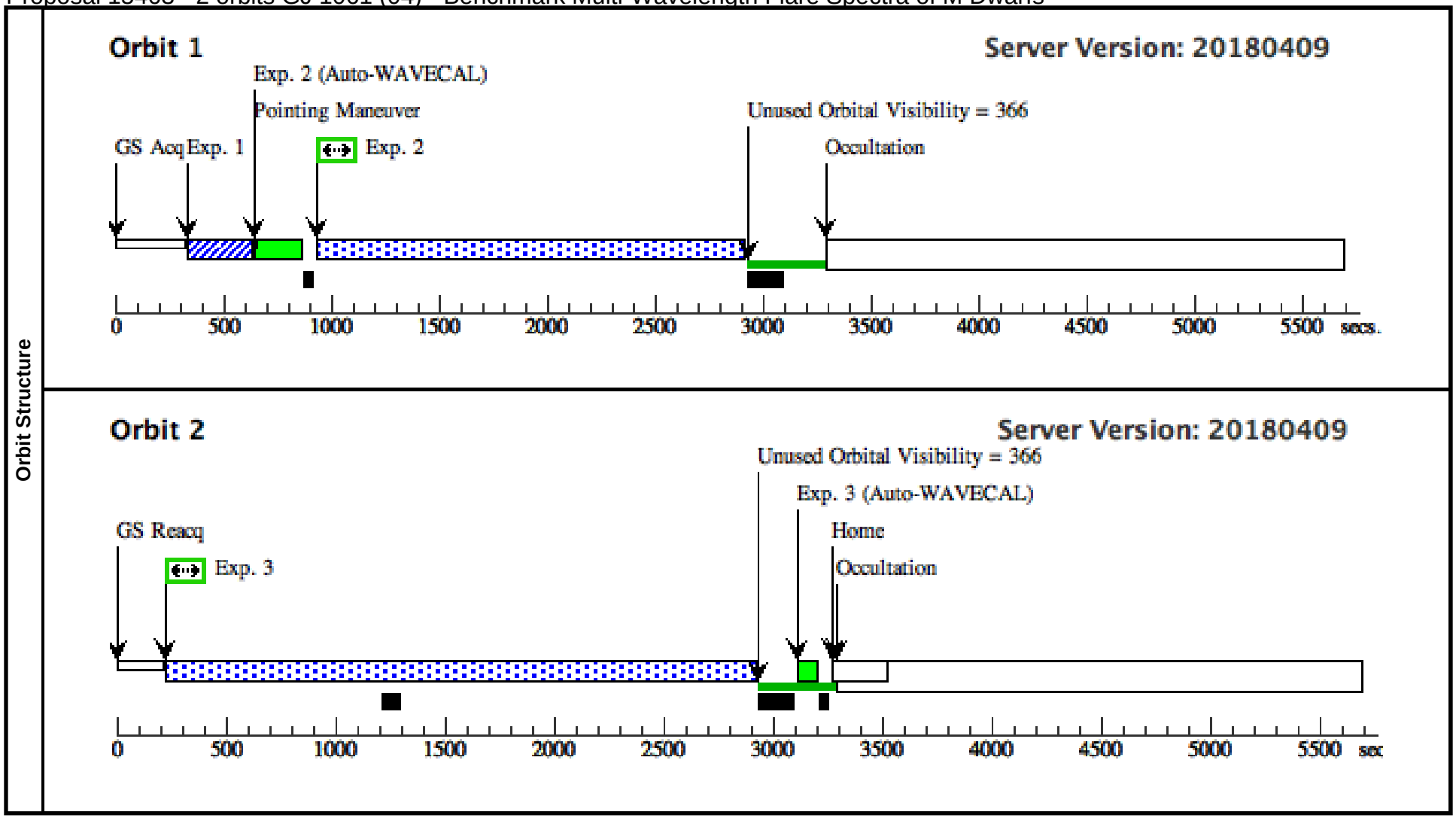
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	GJ-1061	RA: 03 35 59.6900 (53.9987083d) Dec: -44 30 45.30 (-44.51258d) Equinox: J2000	Proper Motion RA: 745.2860104124696 mas/yr Proper Motion Dec: -373.6733483591148 mas/yr Parallax: 0.2722" Epoch of Position: 2000 Radial Velocity: -20 km/sec	V=13.07	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1163473)	(2) GJ-1061	STIS/CCD, ACQ, F25ND3	MIRROR				1 Secs (1 Secs)	
								[==>]	***[1]***
2	(STIS.sp.1168855)	(2) GJ-1061	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=1000.			1942 Secs (1942 Secs)	
								[==>]	***[1]***
3	(STIS.sp.1168855)	(2) GJ-1061	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=1000.			2682 Secs (2682 Secs)	
								[==>]	***[2]***


Orbit Structure
Orbit 1
Server Version: 20180409
Exp. 2 (Auto-WAVECAL)
Pointing Maneuver
Unused Orbital Visibility = 366
GS Acq
Exp. 1
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20180409
Unused Orbital Visibility = 366
Exp. 3 (Auto-WAVECAL)
GS Reacq
Exp. 3
Home
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15463, 1 orbit GJ 1061-HOPR (Z4), scheduling Tue Oct 30 19:02:00 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: (none)

Comments: Final TESS windows

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	GJ-1061	RA: 03 35 59.6900 (53.9987083d) Dec: -44 30 45.30 (-44.51258d) Equinox: J2000	Proper Motion RA: 745.2860104124696 mas/yr Proper Motion Dec: -373.6733483591148 mas/yr Parallax: 0.2722" Epoch of Position: 2000 Radial Velocity: -20 km/sec	V=13.07	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[M V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1291170)	(2) GJ-1061	STIS/CCD, ACQ, F25ND3	MIRROR				3 Secs (3 Secs) *[==>]*	*[1]*

Comments: Previously used GJ 876 (d=4.7, R=0.38) MUSCLES HLSP spectrum scaled to radius and distance of GJ 1061 (d=3.69, R=0.16). Replaced with M5 V (2951 K) Pickles model normalized to V=13.07 (Vega) and with Mg II flux estimates around 2800 Angstroms.

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	(STIS.sp.1168855)	(2) GJ-1061	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=1000.			1942 Secs (2300 Secs) *[==>2300.0 Secs]*	*[1]*

Orbit Structure