15690 - Host Mass and Distance Dependence of Wide Orbit Planets with Near Simultaneous HST and Keck AO Observations

Cycle: 26, Proposal Category: GO

(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) MOA-2009-BLG-387	WFC3/UVIS	2	06-May-2019 18:00:22.0	yes
02	(2) OGLE-2008-BLG-355	WFC3/UVIS	2	06-May-2019 18:00:25.0	yes
03	(3) MOA-2012-BLG-505	WFC3/UVIS	1	06-May-2019 18:00:26.0	yes
04	(3) MOA-2012-BLG-505	WFC3/UVIS	2	06-May-2019 18:00:28.0	yes

7 Total Orbits Used

ABSTRACT

We propose Hubble observations to detect both the photometric and astrometric signatures of host stars for 3 planets found by gravitational microlensing. These signatures will allow us to determine the masses and distances of the exoplanet host stars, and they will help us sharpen tests of the core accretion theory predictions for the exoplanet mass function beyond the snow line. Because of their small angular Einstein radii, these events are crucial to avoid a degeneracy between the dependence of exoplanet properties on host mass and their dependence on distance. In order to avoid systematic errors due to stellar proper motions, we request observations within 7 days of our already secured NASA Keck observing time in May, 2019. These near simultaneous observations will provide a precise comparison between optical astrometry of the Hubble images and the infrared astrometry of Keck adaptive optics (AO) images, and they will allow us to detect the separation of the planetary host and source stars via the color-dependent centroid shift effect. This effect is maximized with the optical-infrared color difference that the combined HST and Keck AO data will provide. We propose to observe only the events which require the centroid shift method to determine the masses and distance of the planet and its host star. Our proposed observations will help us to develop and test this optical-infrared color-dependent centroid shift method and constrain the exoplanet mass function in a larger statistical sample of microlens planetary systems.

OBSERVING DESCRIPTION

We propose Hubble observations to detect both the photometric and astrometric signatures of host stars for 3 planets found by gravitational microlensing. These signatures will allow us to determine the masses and distances of the exoplanet host stars, and they will help us sharpen tests of the core accretion theory predictions for the exoplanet mass function beyond the snow line. We request nearly simultaneous observations with our NASA Keck Key Strategic Mission Support observing program to provide a precise comparison between optical astrometry of the Hubble images and the infrared astrometry of Keck adaptive optics (AO) images. This will allow us to detect the separation of the planetary host and source stars via the color-dependent centroid shift effect. In order to avoid systematic errors due to stellar proper motions, we request observations within 5 days of our Keck Key observing program, which is scheduled for 7 half-nights during May 24-30. This effect is maximized with the optical-infrared color difference that the combined HST and Keck AO data will provide. Our proposed observations will help us to develop and test this optical-infrared color-dependent centroid shift method for use with a larger sample of microlens planetary systems during the second year of our Keck observing program.

Visit

Proposal 15690, Visit 01, implementation Mon May 06 22:00:29 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 19-MAY-2019:00:00:00 AND 05-JUN-2019:00:00:00

Fixed Targets

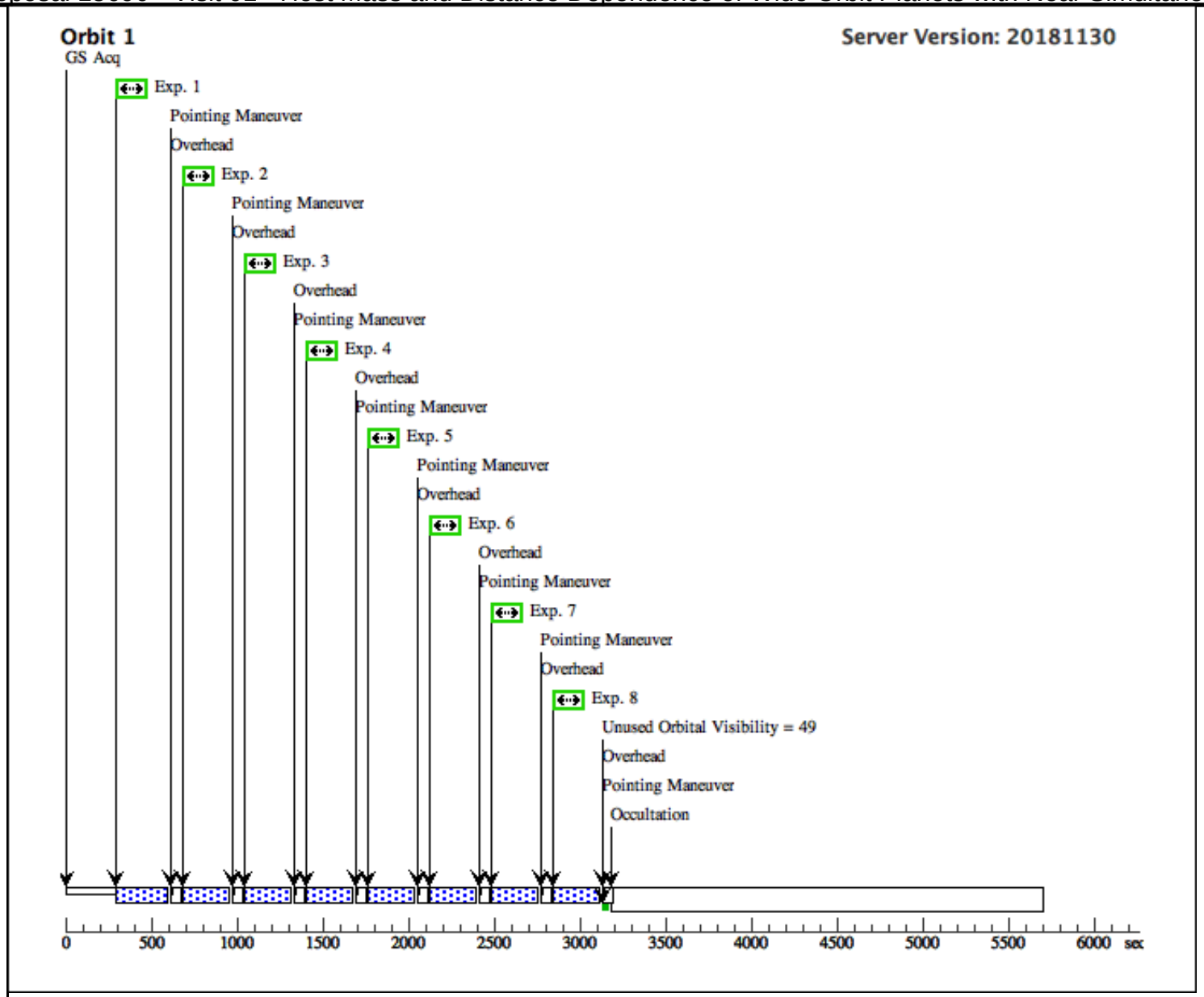
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MOA-2009-BLG-387	RA: 17 53 50.7900 (268.4616250d) Dec: -33 59 25.00 (-33.99028d) Equinox: J2000		V=21.819+/-0.1 19.985 +- 0.1	Reference Frame: ICRS

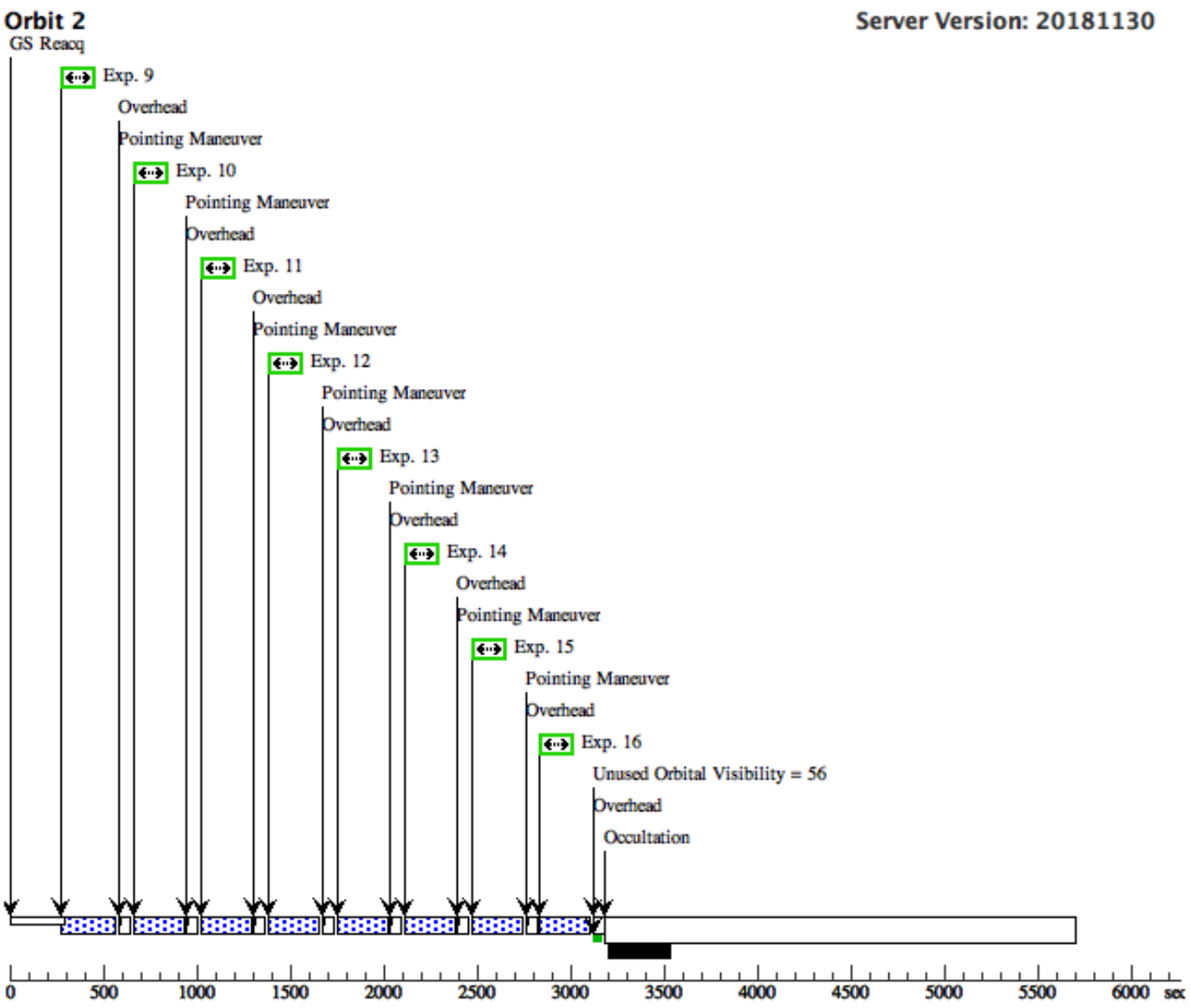
Comments:
Category=EXT-STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.0,0.0		270 Secs (270 Secs) *[==>]*	 ***[1]***
2		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.03993, 0.18187		270 Secs (270 Secs) *[==>]*	 ***[1]***
3		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.09982, 0.40488		270 Secs (270 Secs) *[==>]*	 ***[1]***
4		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.17948, 0.11141		270 Secs (270 Secs) *[==>]*	 ***[1]***
5		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.20944, 0.30258		270 Secs (270 Secs) *[==>]*	 ***[1]***
6		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.36889, 0.09403		270 Secs (270 Secs) *[==>]*	 ***[1]***
7		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.34899, 0.23212		270 Secs (270 Secs) *[==>]*	 ***[1]***
8		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.38893, 0.45382		270 Secs (270 Secs) *[==>]*	 ***[1]***
9		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 1		273 Secs (273 Secs) *[==>]*	 ***[2]***
10		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 2		273 Secs (273 Secs) *[==>]*	 ***[2]***
11		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 3		273 Secs (273 Secs) *[==>]*	 ***[2]***
12		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 4		273 Secs (273 Secs) *[==>]*	 ***[2]***
13		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 5		273 Secs (273 Secs) *[==>]*	 ***[2]***
14		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 6		273 Secs (273 Secs) *[==>]*	 ***[2]***
15		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 7		273 Secs (273 Secs) *[==>]*	 ***[2]***
16		(1) MOA-2009-BLG-387	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 8		273 Secs (273 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20181130
GS Reacq
Exp. 9
Overhead
Pointing Maneuver
Exp. 10
Pointing Maneuver
Overhead
Exp. 11
Overhead
Pointing Maneuver
Exp. 12
Pointing Maneuver
Overhead
Exp. 13
Pointing Maneuver
Overhead
Exp. 14
Overhead
Pointing Maneuver
Exp. 15
Pointing Maneuver
Overhead
Exp. 16
Unused Orbital Visibility = 56
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 15690, Visit 02, implementation Mon May 06 22:00:29 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 18-MAY-2019:00:00:00 AND 06-JUN-2019:00:00:00

Fixed Targets

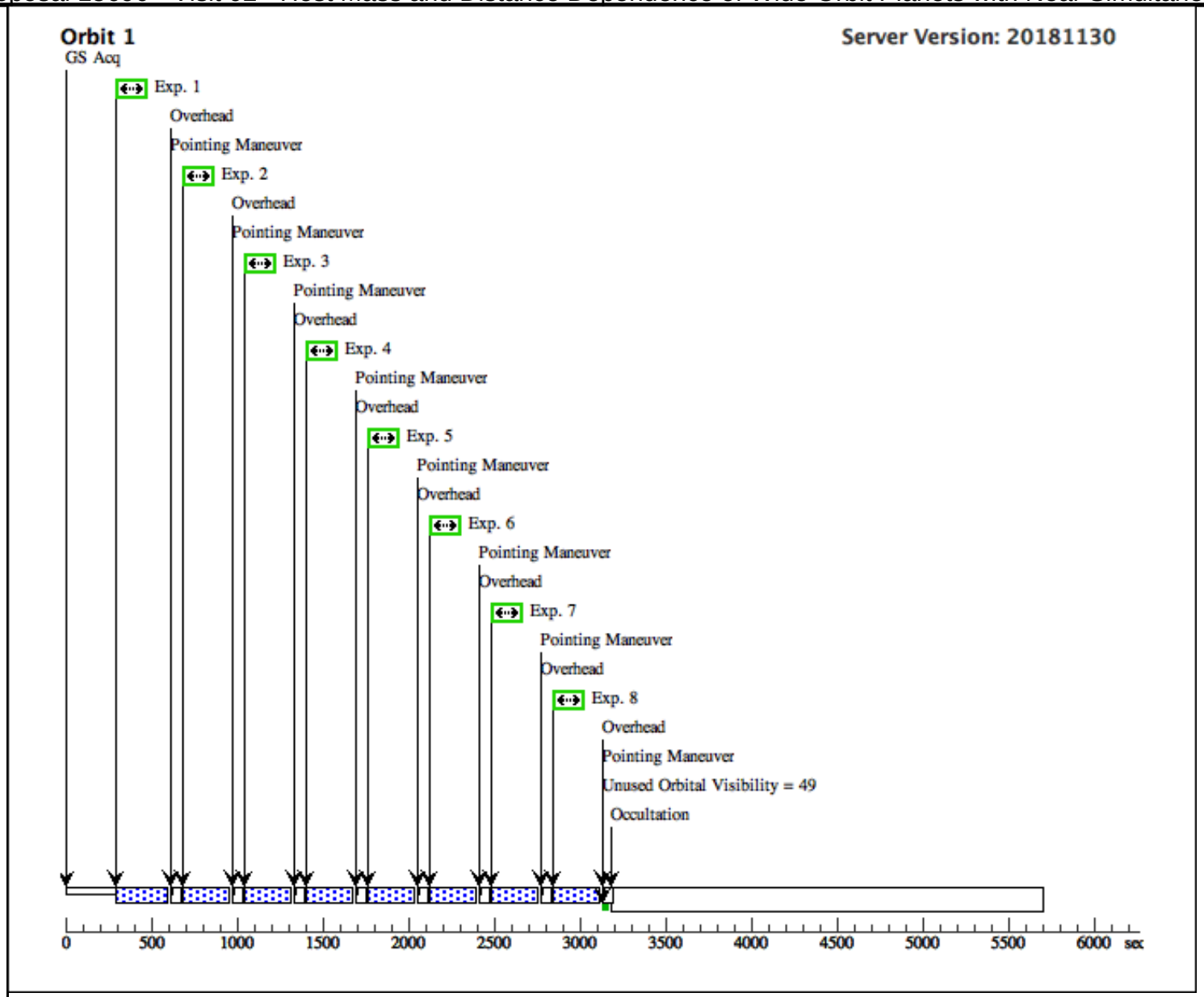
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	OGLE-2008-BLG-355	RA: 17 59 8.8100 (269.7867083d) Dec: -30 45 34.10 (-30.75947d) Equinox: J2000		V=21.94+/-0.1 20.02 +- 0.1	Reference Frame: ICRS

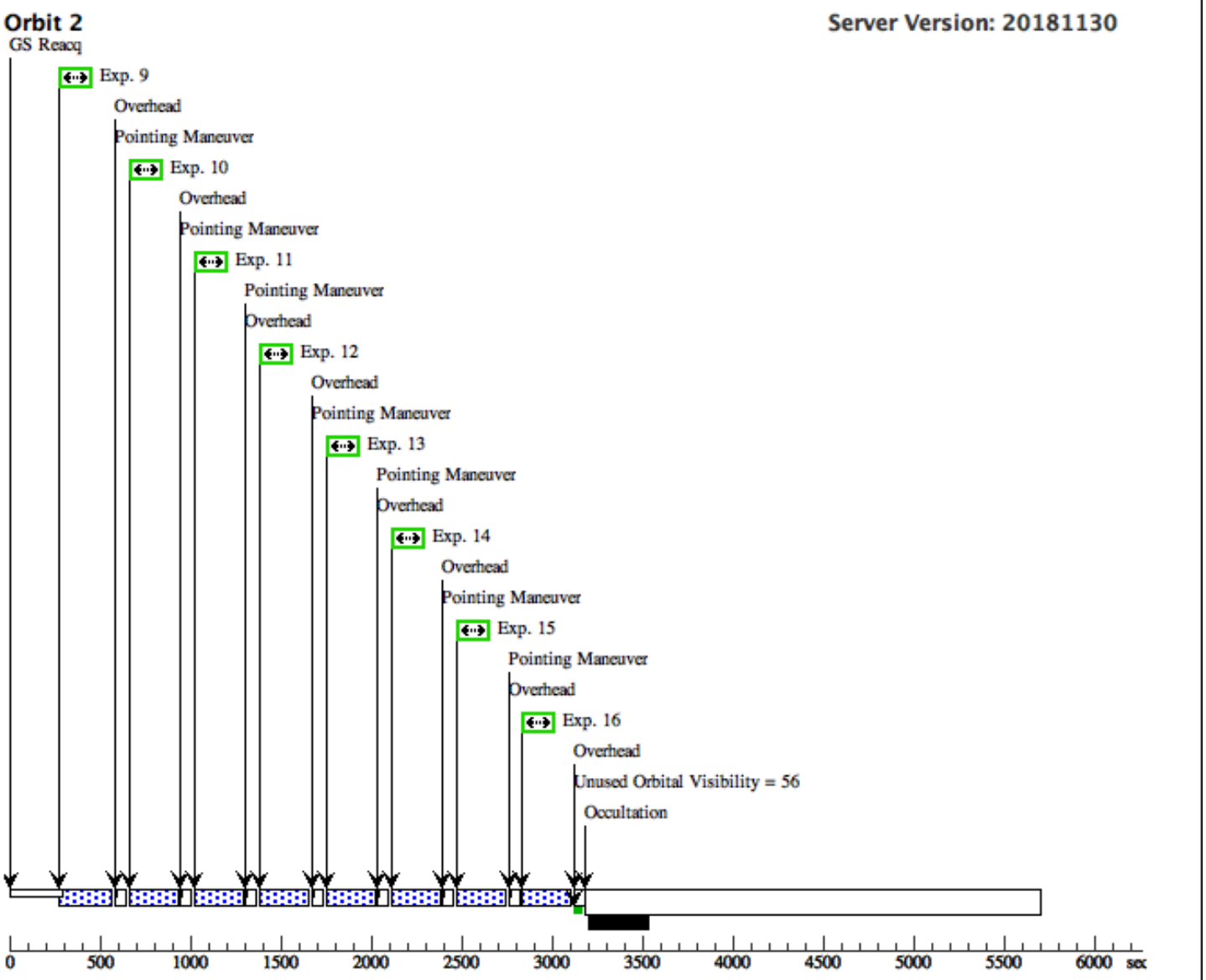
Comments:
Category=EXT-STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.0,0.0		270 Secs (270 Secs) *[==>]*	 ***[1]***
2		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.03993, 0.18187		270 Secs (270 Secs) *[==>]*	 ***[1]***
3		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.09982, 0.40488		270 Secs (270 Secs) *[==>]*	 ***[1]***
4		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.17948, 0.11141		270 Secs (270 Secs) *[==>]*	 ***[1]***
5		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.20944, 0.30258		270 Secs (270 Secs) *[==>]*	 ***[1]***
6		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.36889, 0.09403		270 Secs (270 Secs) *[==>]*	 ***[1]***
7		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.34899, 0.23212		270 Secs (270 Secs) *[==>]*	 ***[1]***
8		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.38893, 0.45382		270 Secs (270 Secs) *[==>]*	 ***[1]***
9		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 1		273 Secs (273 Secs) *[==>]*	 ***[2]***
10		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 2		273 Secs (273 Secs) *[==>]*	 ***[2]***
11		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 3		273 Secs (273 Secs) *[==>]*	 ***[2]***
12		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 4		273 Secs (273 Secs) *[==>]*	 ***[2]***
13		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 5		273 Secs (273 Secs) *[==>]*	 ***[2]***
14		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 6		273 Secs (273 Secs) *[==>]*	 ***[2]***
15		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 7		273 Secs (273 Secs) *[==>]*	 ***[2]***
16		(2) OGLE-2008-BLG-355	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	SAME POS AS 8		273 Secs (273 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20181130
GS Reacq
Exp. 9
Overhead
Pointing Maneuver
Exp. 10
Overhead
Pointing Maneuver
Exp. 11
Pointing Maneuver
Overhead
Exp. 12
Overhead
Pointing Maneuver
Exp. 13
Pointing Maneuver
Overhead
Exp. 14
Overhead
Pointing Maneuver
Exp. 15
Pointing Maneuver
Overhead
Exp. 16
Overhead
Unused Orbital Visibility = 56
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 15690, Visit 03, implementation Mon May 06 22:00:30 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 18-MAY-2019:00:00:00 AND 06-JUN-2019:00:00:00

Fixed Targets

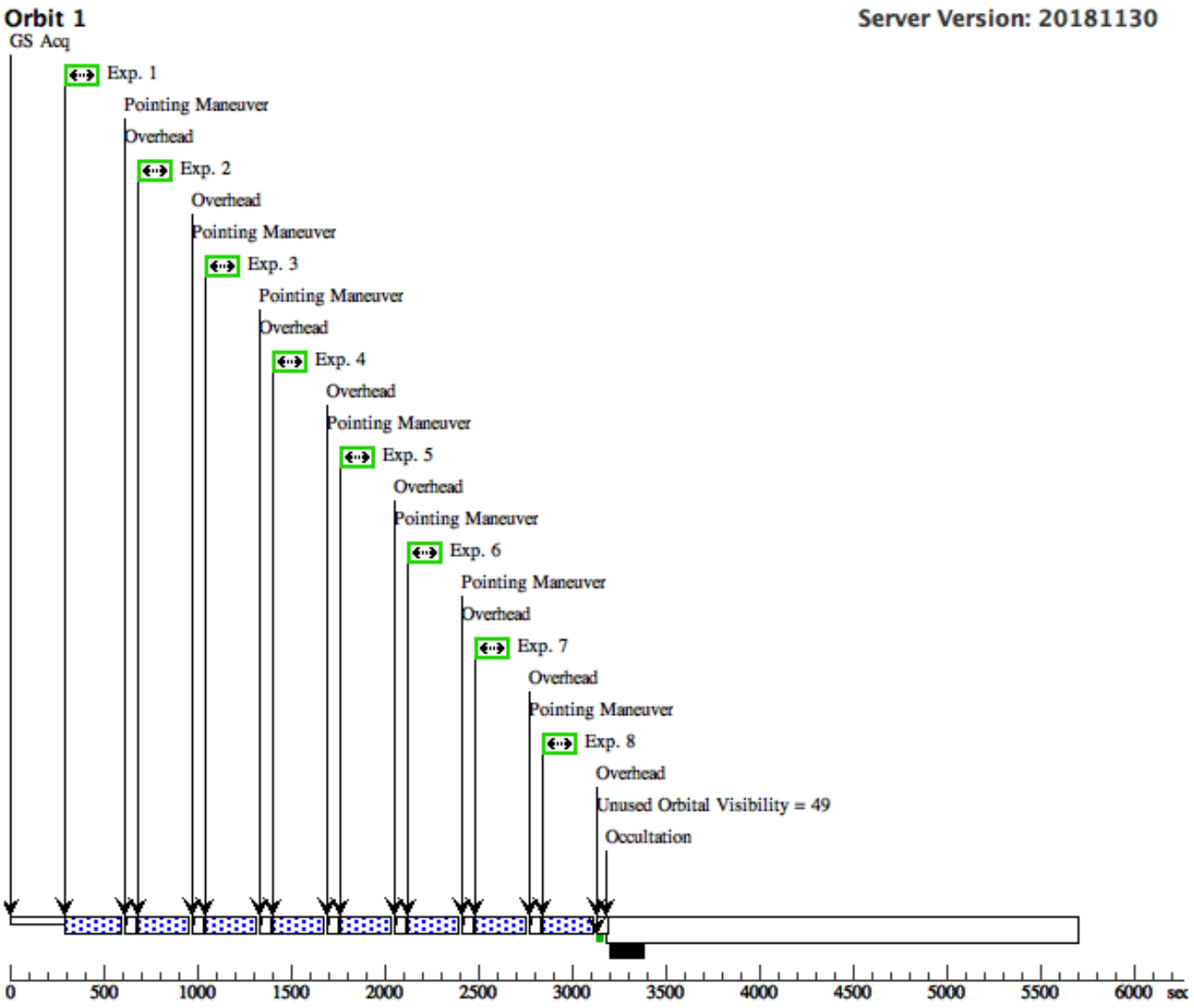
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	MOA-2012-BLG-505	RA: 17 52 34.3400 (268.1430833d) Dec: -32 02 24.33 (-32.04009d) Equinox: J2000		V=23.29+/-0.1 21.29 +- 0.1	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.0,0.0		270 Secs (270 Secs) *[==>]*	 ***[1]***
2		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.03993, 0.18187		270 Secs (270 Secs) *[==>]*	 ***[1]***
3		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.09982, 0.40488		270 Secs (270 Secs) *[==>]*	 ***[1]***
4		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.17948, 0.11141		270 Secs (270 Secs) *[==>]*	 ***[1]***
5		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.20944, 0.30258		270 Secs (270 Secs) *[==>]*	 ***[1]***
6		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.36889, 0.09403		270 Secs (270 Secs) *[==>]*	 ***[1]***
7		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.34899, 0.23212		270 Secs (270 Secs) *[==>]*	 ***[1]***
8		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=5.0	POS TARG 0.38893, 0.45382		270 Secs (270 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 15690, Visit 04, implementation Mon May 06 22:00:30 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 18-MAY-2019:00:00:00 AND 06-JUN-2019:00:00:00

Fixed Targets

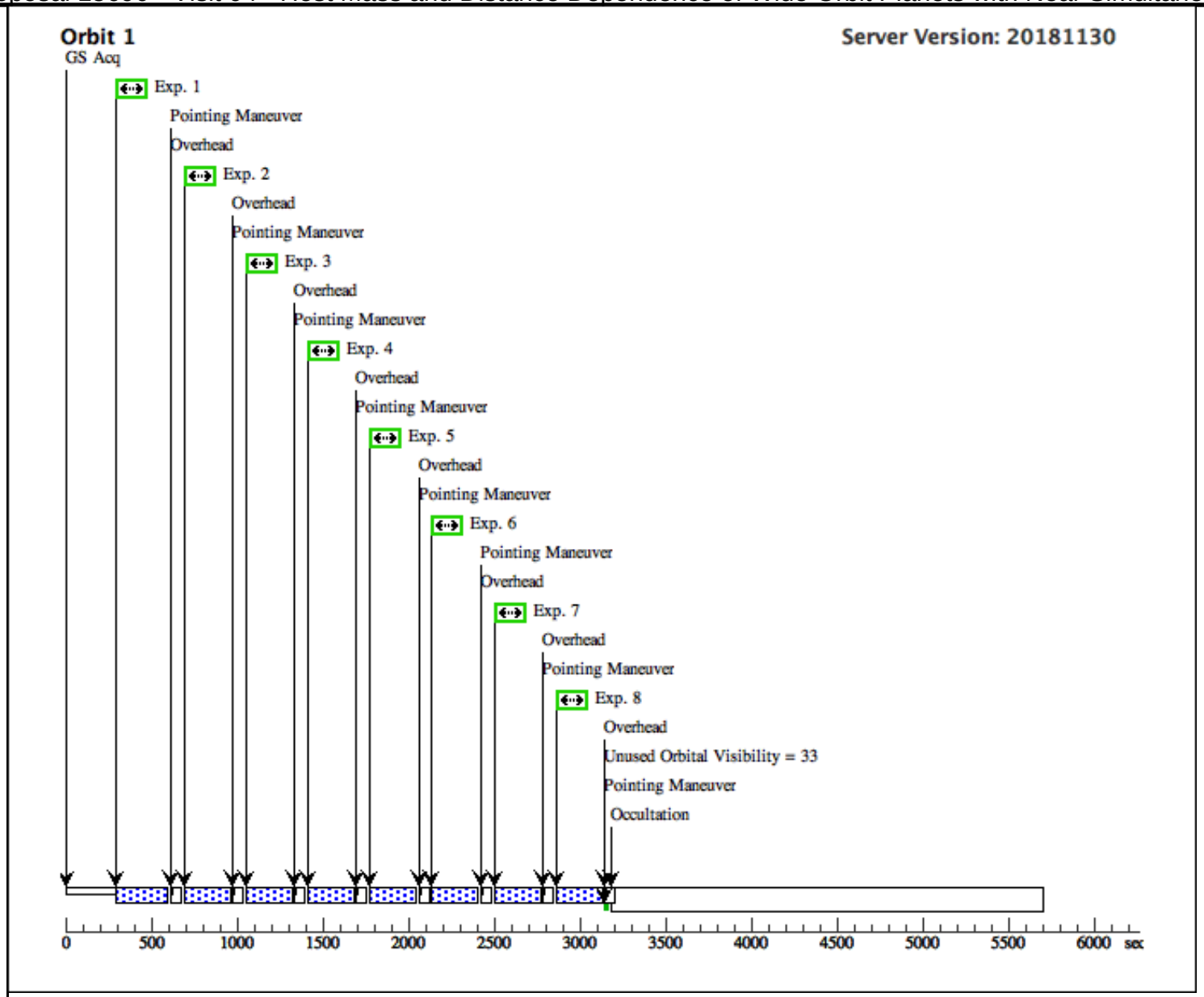
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	MOA-2012-BLG-505	RA: 17 52 34.3400 (268.1430833d) Dec: -32 02 24.33 (-32.04009d) Equinox: J2000		V=23.29+/-0.1 21.29 +- 0.1	Reference Frame: ICRS

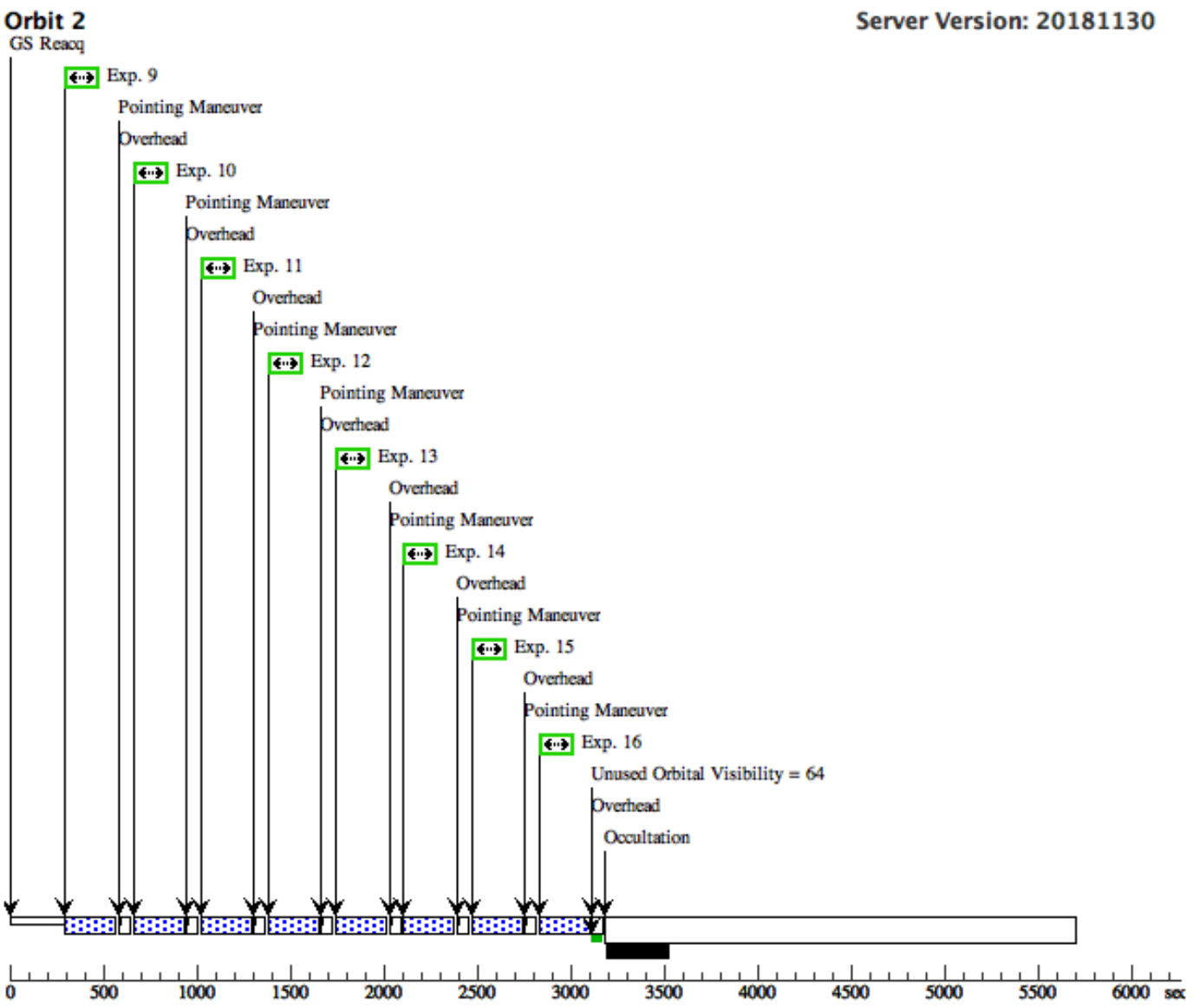
Comments:
Category=EXT-STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.0,0.0		272 Secs (272 Secs) *[==>]*	 ***[1]***
2		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.21846, 0.01351		272 Secs (272 Secs) *[==>]*	 ***[1]***
3		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.08043, 0.22512		272 Secs (272 Secs) *[==>]*	 ***[1]***
4		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.29889, 0.23864		272 Secs (272 Secs) *[==>]*	 ***[1]***
5		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.56639, 0.11508		272 Secs (272 Secs) *[==>]*	 ***[1]***
6		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.78486, 0.12860		272 Secs (272 Secs) *[==>]*	 ***[1]***
7		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.64681, 0.34021		272 Secs (272 Secs) *[==>]*	 ***[1]***
8		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.90498, 0.35619		272 Secs (272 Secs) *[==>]*	 ***[1]***
9		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.08678, 0.53571		272 Secs (272 Secs) *[==>]*	 ***[2]***
10		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.30523, 0.54923		272 Secs (272 Secs) *[==>]*	 ***[2]***
11		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.20692, 0.76328		272 Secs (272 Secs) *[==>]*	 ***[2]***
12		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.38565, 0.77434		272 Secs (272 Secs) *[==>]*	 ***[2]***
13		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.65315, 0.65081		272 Secs (272 Secs) *[==>]*	 ***[2]***
14		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.87159, 0.66433		272 Secs (272 Secs) *[==>]*	 ***[2]***
15		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.73356, 0.87593		272 Secs (272 Secs) *[==>]*	 ***[2]***
16		(3) MOA-2012-BLG-505	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=4.0	POS TARG 0.95199, 0.88945		272 Secs (272 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20181130
GS Reacq
Exp. 9
Pointing Maneuver
Overhead
Exp. 10
Pointing Maneuver
Overhead
Exp. 11
Overhead
Pointing Maneuver
Exp. 12
Pointing Maneuver
Overhead
Exp. 13
Overhead
Pointing Maneuver
Exp. 14
Overhead
Pointing Maneuver
Exp. 15
Overhead
Pointing Maneuver
Exp. 16
Unused Orbital Visibility = 64
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec