16067 - Mass Measurement of Isolated Black Hole Candidate MOA-2019-BLG-284L via Lensed Image Separation

Cycle: 27, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. David P. Bennett (PI) (Contact)	**University of Maryland**	**bennett.moa@gmail.com**
Dr. Aparna Bhattacharya (CoI)	University of Maryland	abhatta5@umd.edu
Dr. Jay Anderson (CoI)	Space Telescope Science Institute	jayander@stsci.edu
Dr. Jean-Philippe Beaulieu (CoI) (ESA Member)	CNRS, Institut d'Astrophysique de Paris	beaulieu@iap.fr
Dr. Ian Bond (CoI)	Massey University	i.a.bond@massey.ac.nz
Dr. Andrzej Udalski (CoI) (ESA Member)	Warsaw University	udalski@astrouw.edu.pl
Dr. Przemek Mroz (CoI)	California Institute of Technology	pmroz@astrouw.edu.pl
Dr. Jessica Ryan Lu (CoI)	University of California - Berkeley	jlu.astro@berkeley.edu
Casey Lam (CoI)	University of California - Berkeley	casey_lam@berkeley.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) MOA-2019-BLG-284	WFC3/UVIS	2	26-Aug-2020 18:00:24.0	yes
02	(1) MOA-2019-BLG-284	WFC3/UVIS	2	26-Aug-2020 18:00:29.0	yes
03	(1) MOA-2019-BLG-284	WFC3/UVIS	2	26-Aug-2020 18:00:33.0	yes

6 Total Orbits Used

ABSTRACT

We propose a novel method to measure the mass of the MOA-2019-BLG-284 microlens, which is a black hole candidate due to its extremely long Einstein radius crossing time of 890 days and its low microlensing parallax amplitude. The microlensing parallax is well measured due to the multiyear event duration, and the duration of the event is long enough to suggest a lens mass of more than 20 solar masses. This event will be passing through its peak magnification during 2020, which should allow the measement of a slight image elongation due to the separation of the two relatively bright lensed images. Furthermore, the direction of this elongation will rotate during the year, with a total rotation of about 53 degrees over the course of our proposed observations from March to September, 2020. This rotation will confirm that the image elongation is indeed a gravitational lensing effect. If successful, these observations will determine the lens mass and open a new window on the, as yet unmeasured, isolated black hole population of our Galaxy. This method can be futher exploited by JWST, which shoud be able to make such measurements with higher sensitivity than HST.

OBSERVING DESCRIPTION

The observations that we propose are challenging, but if successful, they will open a new window on the population of black holes in our Galaxy and likely contribute to the first ever Galactic census of black holes. We have based our sensitivity estimates on the best stellar separation measurement that has been done in the Galactic bulge with HST, and we have scaled them to account for our much detected photon count. This results in a factor of 3.2 improvement over the previous best measurement. In order to achieve such an improvement, we require significant redundancy so that we can test for and correct systematic errors. Therefore, we have proposed independent measurements in two passbands and three separate visits to measure the expected rotation of the elongated blended image.

We request three visits of two orbits each, with one orbit to observe in each of the F814W and F606W passbands. Three visits are needed in order to measure the rotation of the image orientation. We request 16 exposures per orbit in the WFC3/UVIS F814W and F606W passbands to get good spatial sampling of the effective PSFs (Anderson and King 2000), and this means that will be unable to do parallel, full-frame buffer dumps. However, our target is relatively bright, so we want a large enough area to ensure a sufficient number of stars with a similar color and brightness to our target that can be used to construct precise PSF models and calibrate the data. So, we select the UVIS2-C1K1C-SUB subarray to obtain ~25 stars within 0.6 in magnitude and V-I color from the target.

To minimize systematic errors that might interfere with our measurements, we require that each of the visits impose the same pixel grid orientation on the sky. It is not possible to observe our target with exactly the same pixel orientation in two visits separated by ~200 days, so we request

orientations that differ by a 180 degree orientation for the first and third visits in order to have the pixel grids lined up between the different visits. It is also not possible to observe our target between May 29 and June 28, so we request our second visit shortly before May 29 or shortly after June 28, with an orientation that is identical to that of the first or third visit.

Visit

Proposal 16067, Visit 01, completed Wed Aug 26 22:00:35 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 269D TO 269 D; BETWEEN 29-FEB-2020:00:00:00 AND 21-MAR-2020:00:00:00

Diagnostics

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MOA-2019-BLG-284	RA: 18 05 55.0600 (271.4794167d) Dec: -30 20 12.94 (-30.33693d) Equinox: J2000		V=18.2+/-0.10 I = 16.3 +- 0.10	Reference Frame: ICRS

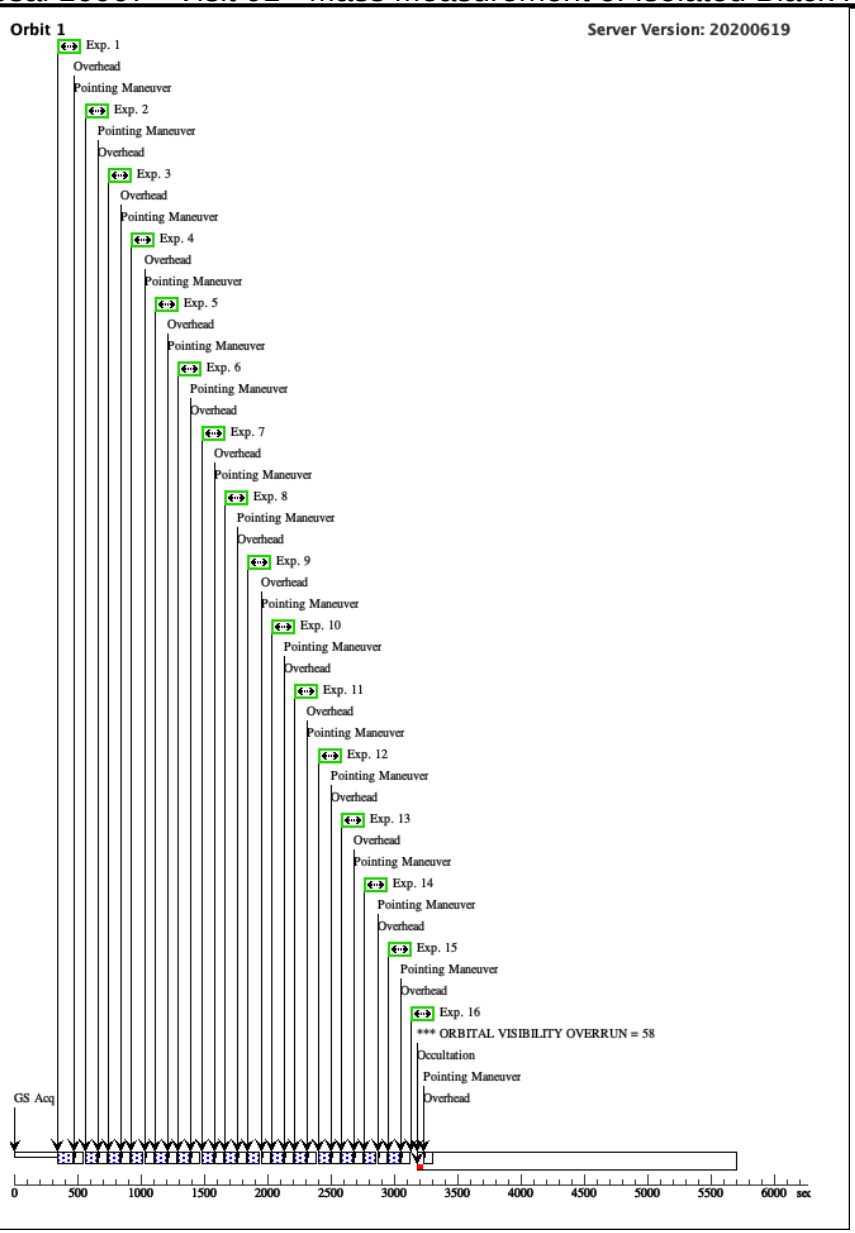
Comments:
Category=STAR
Description=[BULGE, GRAVITATIONAL LENS, K V-IV]

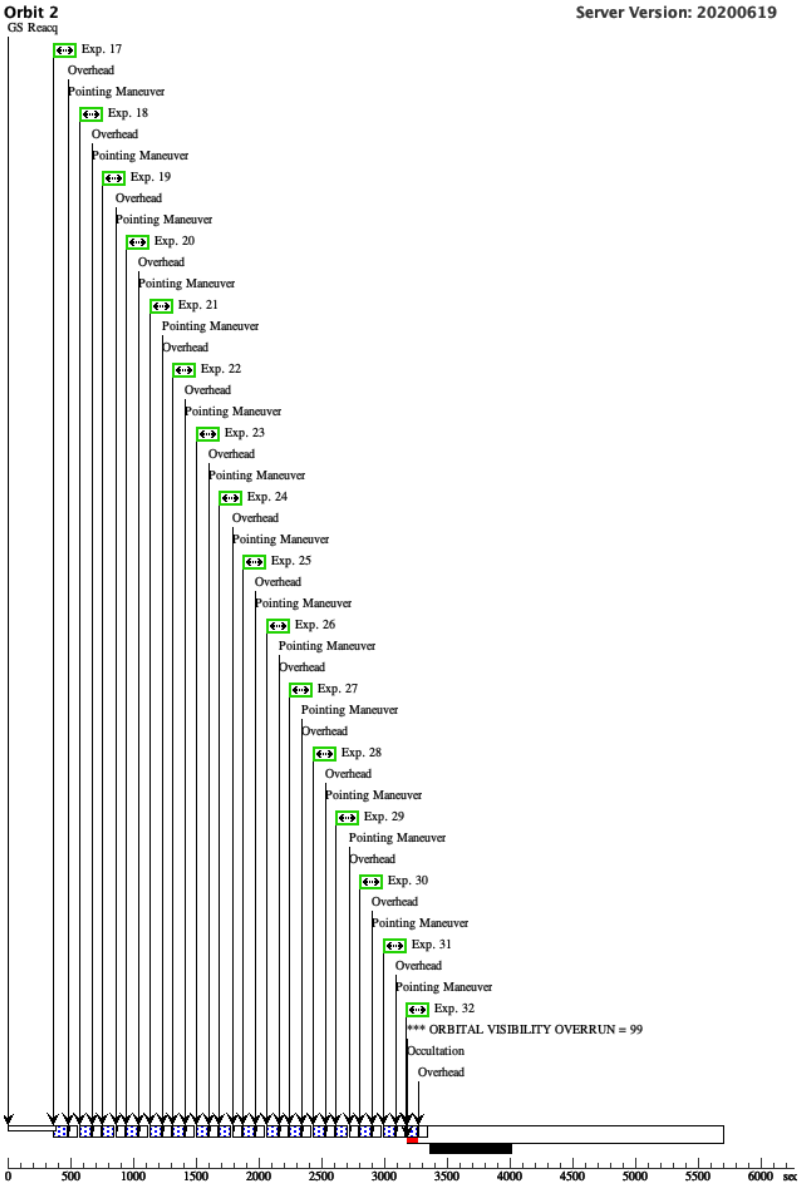
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3		87 Secs (87 Secs) *[==>]*	*[1]*
2		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.21846, 0.01351		87 Secs (87 Secs) *[==>]*	*[1]*
3		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.08043, 0.22512		87 Secs (87 Secs) *[==>]*	*[1]*
4		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.29889, 0.23864		87 Secs (87 Secs) *[==>]*	*[1]*
5		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.56639, 0.11508		87 Secs (87 Secs) *[==>]*	*[1]*
6		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.78486, 0.12860		87 Secs (87 Secs) *[==>]*	*[1]*
7		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.64681, 0.34021		87 Secs (87 Secs) *[==>]*	*[1]*
8		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.90498, 0.35619		87 Secs (87 Secs) *[==>]*	*[1]*
9		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.08678, 0.53571		87 Secs (87 Secs) *[==>]*	*[1]*
10		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.30523, 0.54923		87 Secs (87 Secs) *[==>]*	*[1]*
11		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.20692, 0.76328		87 Secs (87 Secs) *[==>]*	*[1]*
12		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.38565, 0.77434		87 Secs (87 Secs) *[==>]*	*[1]*
13		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.65315, 0.65081		87 Secs (87 Secs) *[==>]*	*[1]*
14		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.87159, 0.66433		87 Secs (87 Secs) *[==>]*	*[1]*
15		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.73356, 0.87593		87 Secs (87 Secs) *[==>]*	*[1]*
16		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.95199, 0.88945		87 Secs (87 Secs) *[==>]*	*[1]*
17		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.0,0.0		89 Secs (89 Secs) *[==>]*	*[2]*
18		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.21846, 0.01351		89 Secs (89 Secs) *[==>]*	*[2]*
19		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.08043, 0.22512		89 Secs (89 Secs) *[==>]*	*[2]*
20		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.29889, 0.23864		89 Secs (89 Secs) *[==>]*	*[2]*
21		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.56639, 0.11508		89 Secs (89 Secs) *[==>]*	*[2]*

	22	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.78486, 0.12860	89 Secs (89 Secs) *[==>]*	 ***[2]***
	23	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.64681, 0.34021	89 Secs (89 Secs) *[==>]*	 ***[2]***
	24	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.90498, 0.35619	89 Secs (89 Secs) *[==>]*	 ***[2]***
	25	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.08678, 0.53571	89 Secs (89 Secs) *[==>]*	 ***[2]***
	26	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.30523, 0.54923	89 Secs (89 Secs) *[==>]*	 ***[2]***
	27	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.20692, 0.76328	89 Secs (89 Secs) *[==>]*	 ***[2]***
	28	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.38565, 0.77434	89 Secs (89 Secs) *[==>]*	 ***[2]***
	29	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.65315, 0.65081	89 Secs (89 Secs) *[==>]*	 ***[2]***
	30	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.87159, 0.66433	89 Secs (89 Secs) *[==>]*	 ***[2]***
	31	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.73356, 0.87593	89 Secs (89 Secs) *[==>]*	 ***[2]***
	32	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.95199, 0.88945	89 Secs (89 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20200619
GS Reacq
Exp. 17
Overhead
Pointing Maneuver
Exp. 18
Overhead
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Exp. 19
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Exp. 20
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Exp. 31
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Exp. 32
*** ORBITAL VISIBILITY OVERRUN = 99
Occultation
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16067, Visit 02, completed Wed Aug 26 22:00:35 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 269D TO 269 D; BETWEEN 17-MAY-2020:00:00:00 AND 29-JUL-2020:00:00:00

Diagnostics

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MOA-2019-BLG-284	RA: 18 05 55.0600 (271.4794167d) Dec: -30 20 12.94 (-30.33693d) Equinox: J2000		V=18.2+/-0.10 I = 16.3 +- 0.10	Reference Frame: ICRS

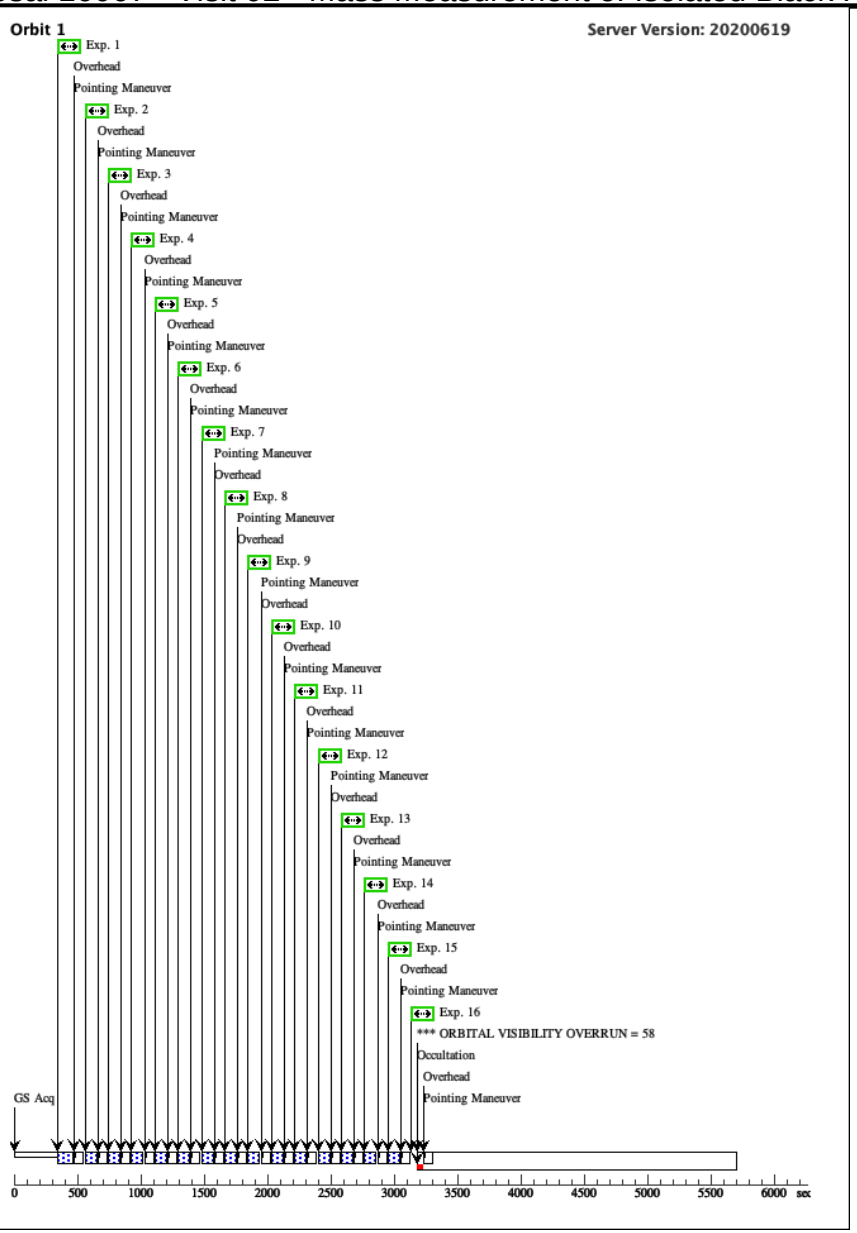
Comments:
Category=STAR
Description=[BULGE, GRAVITATIONAL LENS, K V-IV]

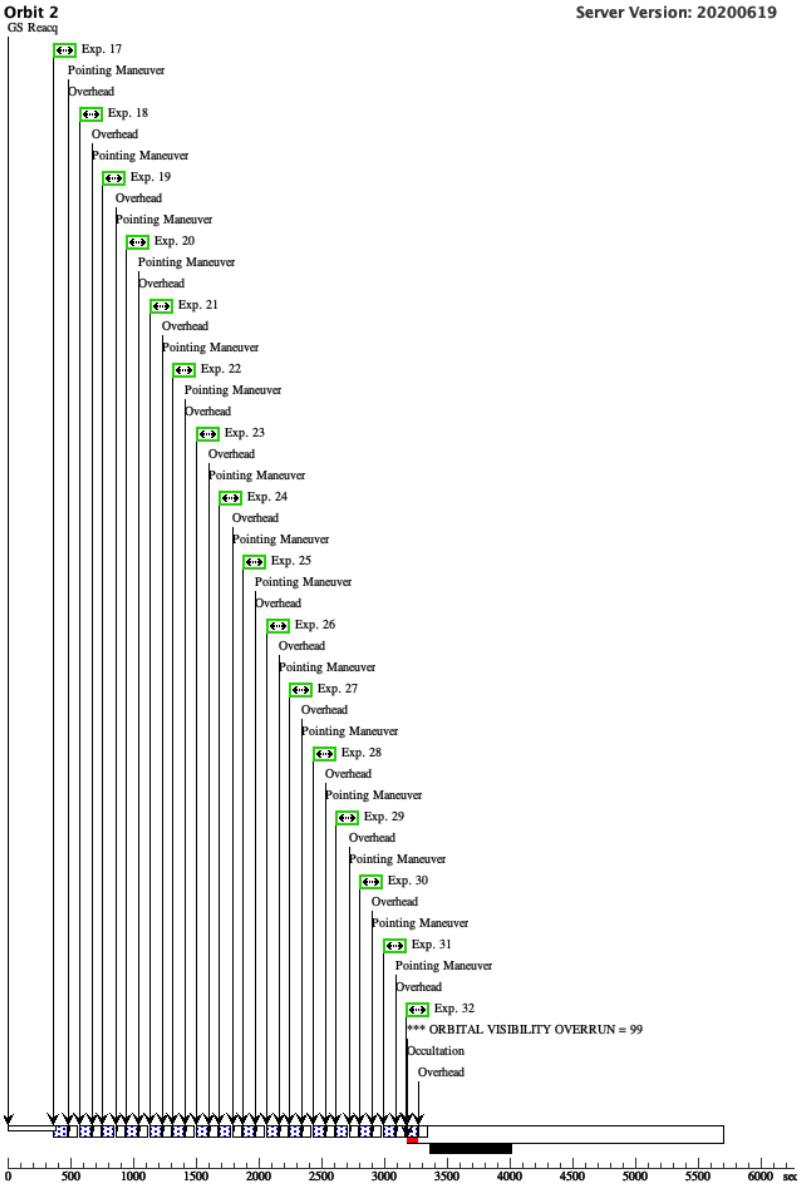
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3		87 Secs (87 Secs) *[==>]*	*[1]*
2		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.21846, 0.01351		87 Secs (87 Secs) *[==>]*	*[1]*
3		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.08043, 0.22512		87 Secs (87 Secs) *[==>]*	*[1]*
4		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.29889, 0.23864		87 Secs (87 Secs) *[==>]*	*[1]*
5		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.56639, 0.11508		87 Secs (87 Secs) *[==>]*	*[1]*
6		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.78486, 0.12860		87 Secs (87 Secs) *[==>]*	*[1]*
7		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.64681, 0.34021		87 Secs (87 Secs) *[==>]*	*[1]*
8		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.90498, 0.35619		87 Secs (87 Secs) *[==>]*	*[1]*
9		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.08678, 0.53571		87 Secs (87 Secs) *[==>]*	*[1]*
10		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.30523, 0.54923		87 Secs (87 Secs) *[==>]*	*[1]*
11		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.20692, 0.76328		87 Secs (87 Secs) *[==>]*	*[1]*
12		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.38565, 0.77434		87 Secs (87 Secs) *[==>]*	*[1]*
13		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.65315, 0.65081		87 Secs (87 Secs) *[==>]*	*[1]*
14		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.87159, 0.66433		87 Secs (87 Secs) *[==>]*	*[1]*
15		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.73356, 0.87593		87 Secs (87 Secs) *[==>]*	*[1]*
16		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.95199, 0.88945		87 Secs (87 Secs) *[==>]*	*[1]*
17		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.0,0.0		89 Secs (89 Secs) *[==>]*	*[2]*
18		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.21846, 0.01351		89 Secs (89 Secs) *[==>]*	*[2]*
19		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.08043, 0.22512		89 Secs (89 Secs) *[==>]*	*[2]*
20		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.29889, 0.23864		89 Secs (89 Secs) *[==>]*	*[2]*
21		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.56639, 0.11508		89 Secs (89 Secs) *[==>]*	*[2]*

	22	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.78486, 0.12860	89 Secs (89 Secs) *[==>]*	 ***[2]***
	23	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.64681, 0.34021	89 Secs (89 Secs) *[==>]*	 ***[2]***
	24	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.90498, 0.35619	89 Secs (89 Secs) *[==>]*	 ***[2]***
	25	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.08678, 0.53571	89 Secs (89 Secs) *[==>]*	 ***[2]***
	26	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.30523, 0.54923	89 Secs (89 Secs) *[==>]*	 ***[2]***
	27	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.20692, 0.76328	89 Secs (89 Secs) *[==>]*	 ***[2]***
	28	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.38565, 0.77434	89 Secs (89 Secs) *[==>]*	 ***[2]***
	29	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.65315, 0.65081	89 Secs (89 Secs) *[==>]*	 ***[2]***
	30	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.87159, 0.66433	89 Secs (89 Secs) *[==>]*	 ***[2]***
	31	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.73356, 0.87593	89 Secs (89 Secs) *[==>]*	 ***[2]***
	32	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.95199, 0.88945	89 Secs (89 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20200619
GS Reacq
Exp. 17
Pointing Maneuver
Overhead
Exp. 18
Overhead
Pointing Maneuver
Exp. 19
Overhead
Pointing Maneuver
Exp. 20
Pointing Maneuver
Overhead
Exp. 21
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Pointing Maneuver
Exp. 22
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Exp. 25
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Exp. 28
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Exp. 29
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Exp. 30
Overhead
Pointing Maneuver
Exp. 31
Pointing Maneuver
Overhead
Exp. 32
*** ORBITAL VISIBILITY OVERRUN = 99
Occultation
Overhead
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16067, Visit 03, implementation Wed Aug 26 22:00:35 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-SEP-2020:00:00:00 AND 15-OCT-2020:00:00:00

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MOA-2019-BLG-284	RA: 18 05 55.0600 (271.4794167d) Dec: -30 20 12.94 (-30.33693d) Equinox: J2000		V=18.2+/-0.10 I = 16.3 +- 0.10	Reference Frame: ICRS

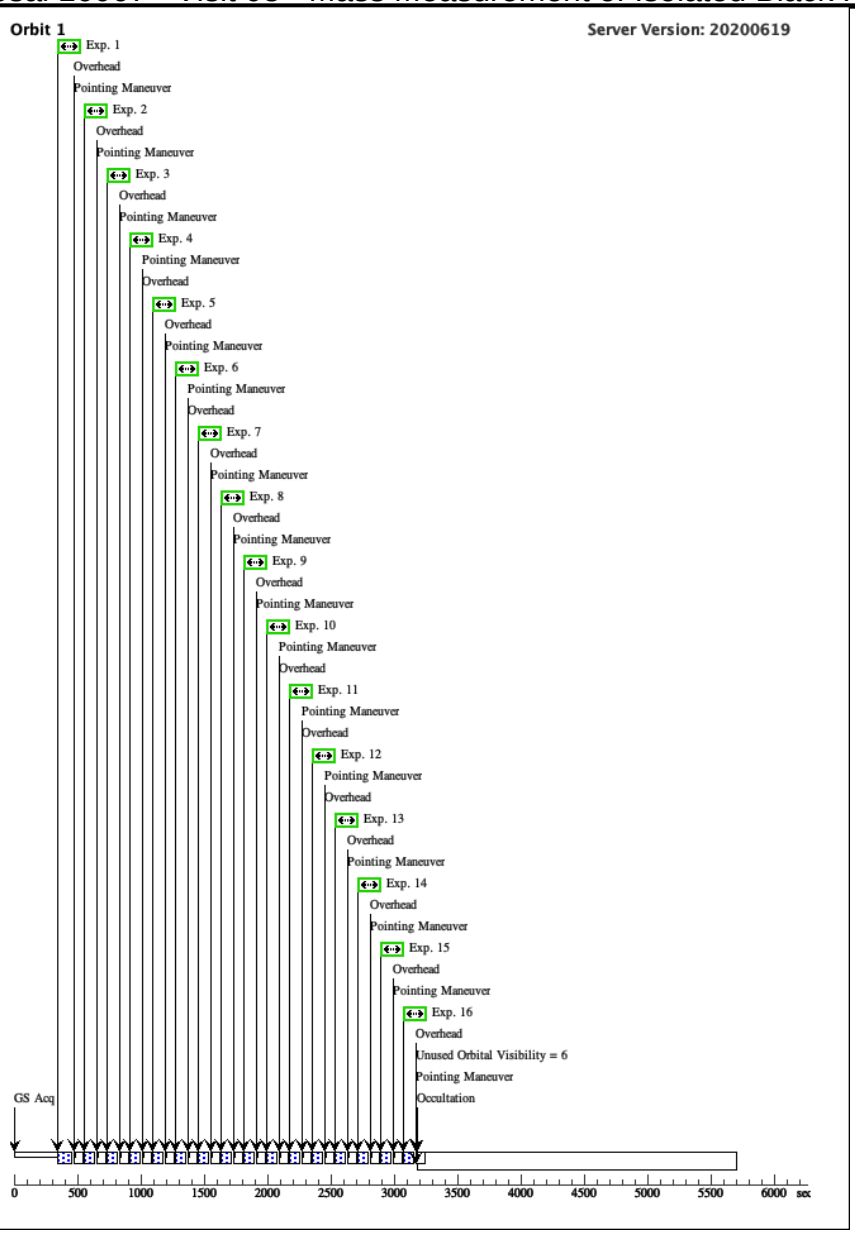
Comments:
Category=STAR
Description=[BULGE, GRAVITATIONAL LENS, K V-IV]

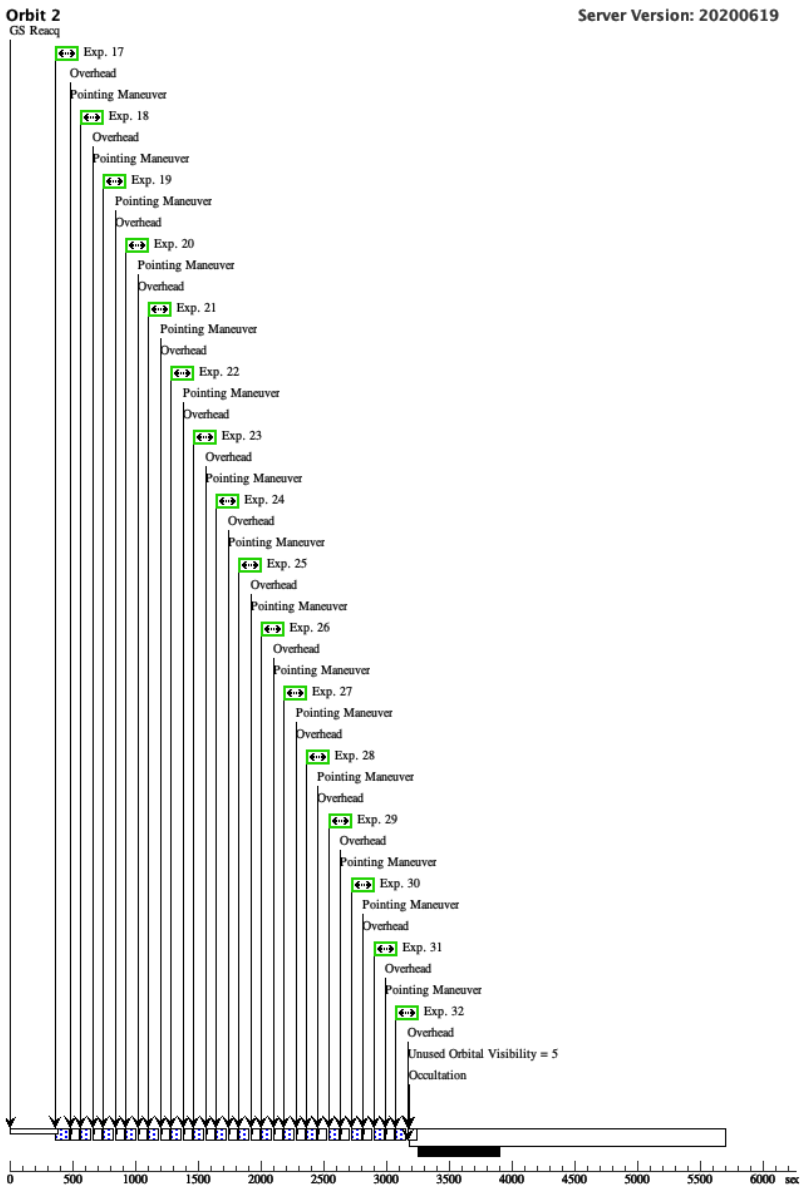
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3		83 Secs (83 Secs) *[==>]*	*[1]*
2		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.21846, 0.01351		83 Secs (83 Secs) *[==>]*	*[1]*
3		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.08043, 0.22512		83 Secs (83 Secs) *[==>]*	*[1]*
4		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.29889, 0.23864		83 Secs (83 Secs) *[==>]*	*[1]*
5		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.56639, 0.11508		83 Secs (83 Secs) *[==>]*	*[1]*
6		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.78486, 0.12860		83 Secs (83 Secs) *[==>]*	*[1]*
7		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.64681, 0.34021		83 Secs (83 Secs) *[==>]*	*[1]*
8		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.90498, 0.35619		83 Secs (83 Secs) *[==>]*	*[1]*
9		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.08678, 0.53571		83 Secs (83 Secs) *[==>]*	*[1]*
10		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.30523, 0.54923		83 Secs (83 Secs) *[==>]*	*[1]*
11		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.20692, 0.76328		83 Secs (83 Secs) *[==>]*	*[1]*
12		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.38565, 0.77434		83 Secs (83 Secs) *[==>]*	*[1]*
13		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.65315, 0.65081		83 Secs (83 Secs) *[==>]*	*[1]*
14		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.87159, 0.66433		83 Secs (83 Secs) *[==>]*	*[1]*
15		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.73356, 0.87593		83 Secs (83 Secs) *[==>]*	*[1]*
16		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	FLASH=10	POS TARG 0.95199, 0.88945		83 Secs (83 Secs) *[==>]*	*[1]*
17		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.0,0.0		83 Secs (83 Secs) *[==>]*	*[2]*
18		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.21846, 0.01351		83 Secs (83 Secs) *[==>]*	*[2]*
19		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.08043, 0.22512		83 Secs (83 Secs) *[==>]*	*[2]*
20		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.29889, 0.23864		83 Secs (83 Secs) *[==>]*	*[2]*
21		(1) MOA-2019-BLG-284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.56639, 0.11508		83 Secs (83 Secs) *[==>]*	*[2]*

	22	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.78486, 0.12860	83 Secs (83 Secs) *[==>]*	 ***[2]***
	23	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.64681, 0.34021	83 Secs (83 Secs) *[==>]*	 ***[2]***
	24	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.90498, 0.35619	83 Secs (83 Secs) *[==>]*	 ***[2]***
	25	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.08678, 0.53571	82 Secs (82 Secs) *[==>]*	 ***[2]***
	26	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.30523, 0.54923	82 Secs (82 Secs) *[==>]*	 ***[2]***
	27	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.20692, 0.76328	82 Secs (82 Secs) *[==>]*	 ***[2]***
	28	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.38565, 0.77434	82 Secs (82 Secs) *[==>]*	 ***[2]***
	29	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.65315, 0.65081	82 Secs (82 Secs) *[==>]*	 ***[2]***
	30	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.87159, 0.66433	82 Secs (82 Secs) *[==>]*	 ***[2]***
	31	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.73356, 0.87593	82 Secs (82 Secs) *[==>]*	 ***[2]***
	32	(1) MOA-2019-BLG -284	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	FLASH=10	POS TARG 0.95199, 0.88945	82 Secs (82 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20200619
GS Reacq
Exp. 17
Overhead
Pointing Maneuver
Exp. 18
Overhead
Pointing Maneuver
Exp. 19
Pointing Maneuver
Overhead
Exp. 20
Pointing Maneuver
Overhead
Exp. 21
Pointing Maneuver
Overhead
Exp. 22
Pointing Maneuver
Overhead
Exp. 23
Overhead
Pointing Maneuver
Exp. 24
Overhead
Pointing Maneuver
Exp. 25
Overhead
Pointing Maneuver
Exp. 26
Overhead
Pointing Maneuver
Exp. 27
Pointing Maneuver
Overhead
Exp. 28
Pointing Maneuver
Overhead
Exp. 29
Overhead
Pointing Maneuver
Exp. 30
Pointing Maneuver
Overhead
Exp. 31
Overhead
Pointing Maneuver
Exp. 32
Overhead
Unused Orbital Visibility = 5
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec