15164 - Ultraviolet spectroscopy of the dust extinction in the M31 inner bulge

Cycle: 25, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Hui Dong (PI) (Contact)	**SETI Institute**	**hdong@iaa.es**
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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) REFERENCE-GC (2) M31-BULGE-CLUMPA	STIS/CCD STIS/NUV-MAMA	5	12-Jun-2019 11:00:18.0	yes
02	(1) REFERENCE-GC (3) M31-BULGE-CLUMPB	STIS/CCD STIS/NUV-MAMA	5	12-Jun-2019 11:00:23.0	yes

10 Total Orbits Used

ABSTRACT

The extinction curve in the central 250 pc region of the M31 bulge is substantially steeper than that in the Milky Way. In addition, there is also clear evidence for a strong 2175 Angstrom extinction bump, the strength of which shows variation among different dusty clumps in the region. To better understand these important characteristics of the extinction properties and their spatial variation, we propose to use the HST/STIS, the only long-slit ultraviolet spectroscopic detector available, to observe two prominent dusty clumps. Combining with the existing photometric data, we will contrast

these dusty clumps with neighboring extinction-free regions to construct their extinction curves, which will allow us to precisely measure the slope in the UV wavelength range and to tightly quantify the width and strength of the 2175 Angstrom bump. The results compared with the existing multi-wavelength data will enable us to address such questions as: 1) What causes the steep slope of the extinction curve in the M31 bulge? 2) How does the variation of the extinction curve, especially the 2175 Angstrom bump, depend on the properties and environments of the clumps? The results of this investigation should have strong implications for the dust extinction corrections for stellar light from other similar galactic spheroids.

OBSERVING DESCRIPTION

We use the HST/STIS long-slit (52"x2") spectroscopy with the NUV-MAMA camera and G230L grating to observe two dusty clumps in the M31 bulge. From the photometric observations taken by the HST ACS/WFC3 and SWIFT/UVOT camera, Dong et al. 2014, ApJ, 785, 136 found that these two dusty clumps seem to have a steep extinction curve (Rv=2.4-2.5) and strong 2175 A extinction bumps, but with different strengths. Therefore, the main purpose of this program is to use the HST/STIS spectra to characterise the extinction curves of the two dusty clumps, such as Rv and the strength of the 2175 A bump.

We use a nearby (~ 1 arcminute away) bright globular cluster, M31GC J004248+411537 (B=16.13, V=15.32 mag) to be the reference target. After the telescope locks the cluster through the acquisition observation, we will shift the telescope to our targets.

Limited by the size of the NUV-MAMA camera, the length of the long-slit is accurately 25". Therefore, we use two pointing to cover the two dusty clumps, respectively.

In order to make sure that we observe the same lint-of-sight, we use a continuous observations with 5 orbits for each dusty clump.

'STIS-ALONG-SLIT' pattern is used to correct the hot pixels and remove the cosmic rays. Because we extract the spectrum from 100 pixels (0.024608"/pixel in AXIS2), we shift along the grid with 2.46" for three times.

Visit

Proposal 15164, Visit 01, scheduling Wed Jun 12 15:00:25 GMT 2019

Diagnostic Status: No Diagnostics

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

Special Requirements: ORIENT 263D TO 265 D; ORIENT 83D TO 85 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(2), (3), (4), (5), (6)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=3	Angle Between Sides=		
	Point Spacing=2.4608	Center Pattern=true		
	Line Spacing=			

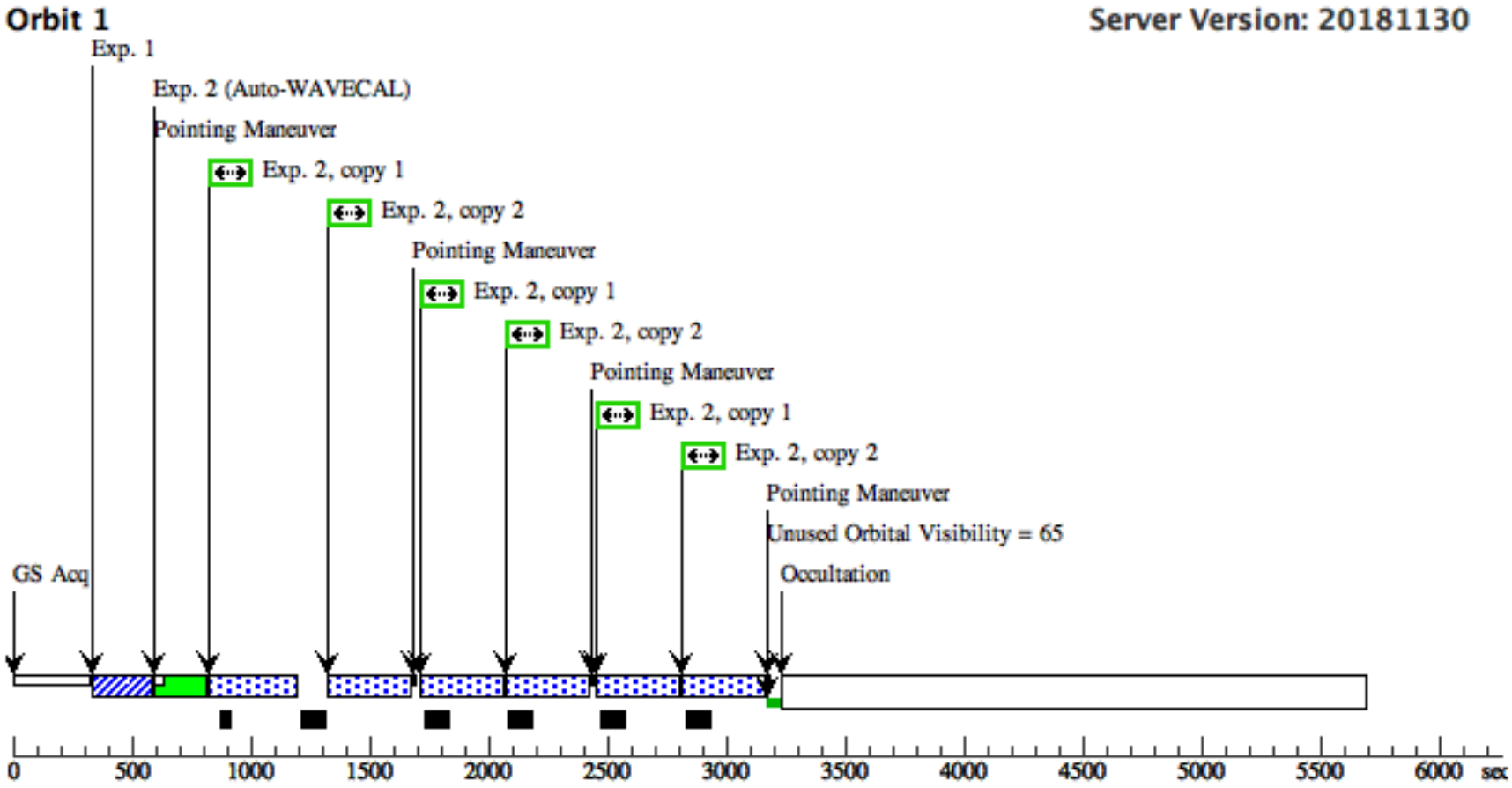
Fixed Targets

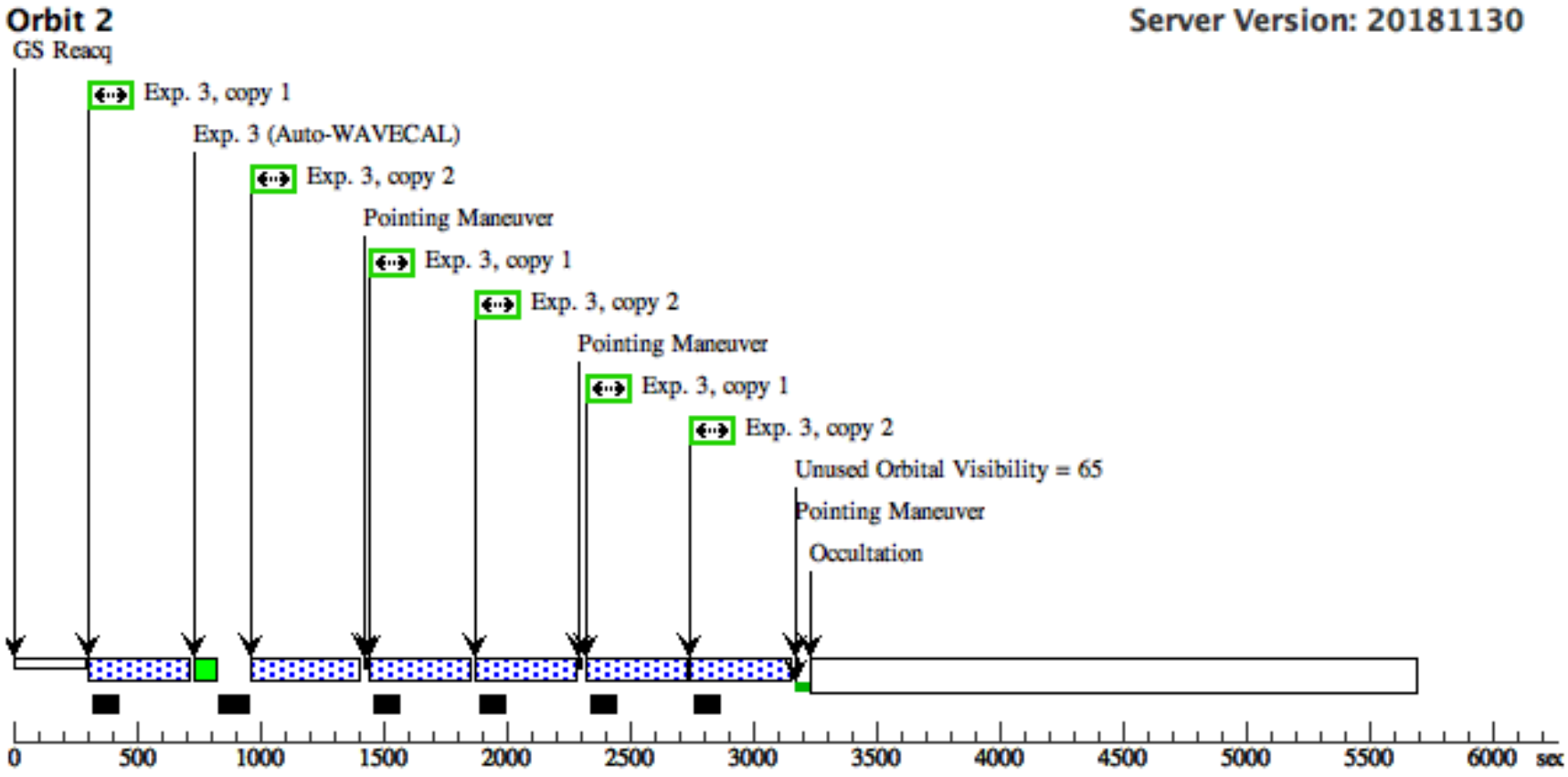
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	REFERENCE-GC	RA: 00 42 48.0490 (10.7002042d) Dec: +41 15 37.02 (41.26028d) Equinox: J2000		V=15.32+/-10	Reference Frame: ICRS
Comments: It is a bright globular cluster in the M31 bulge near our targets. (B=16.13, V=15.32 mag) *Category=ISM* *Description=[BULGE, MOLECULAR CLOUD]*					
(2)	M31-BULGE-CLUMPA	Offset from REFERENCE-GC RA Offset: -0.0170288 Degrees Dec Offset: 0.0128212 Degrees		V=18	Offset Position (M31-BULGE-CLUMPA)
Comments: *Category=ISM* *Description=[MOLECULAR CLOUD]*					

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1011684)	(1) REFERENCE-GC	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT	GS ACQ SCENARIO BASE1B3	Sequence 1-2 Non-Int in Visit 01	5 Secs (5 Secs) *[==>]*	***[1]***
2	(STIS.sp.1011699)	(2) M31-BULGE-CLUMPA	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 1-2 Non-Int in Visit 01 Pattern 1, Exps 2-2 in Sequence 1-2 Non-Int in Visit 01 (1)	335 Secs X 2 (2010 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[1]***
3	(STIS.sp.1011704)	(2) M31-BULGE-CLUMPA	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 3-3 Non-Int in Visit 01 Pattern 1, Exps 3-3 in Sequence 3-3 Non-Int in Visit 01 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[2]***
4	(STIS.sp.1011705)	(2) M31-BULGE-CLUMPA	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 4-4 Non-Int in Visit 01 Pattern 1, Exps 4-4 in Sequence 4-4 Non-Int in Visit 01 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[3]***
5	(STIS.sp.1011707)	(2) M31-BULGE-CLUMPA	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 5-5 Non-Int in Visit 01 Pattern 1, Exps 5-5 in Sequence 5-5 Non-Int in Visit 01 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[4]***
6	(STIS.sp.1011704)	(2) M31-BULGE-CLUMPA	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 6-6 Non-Int in Visit 01 Pattern 1, Exps 6-6 in Sequence 6-6 Non-Int in Visit 01 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[5]***

Orbit Structure

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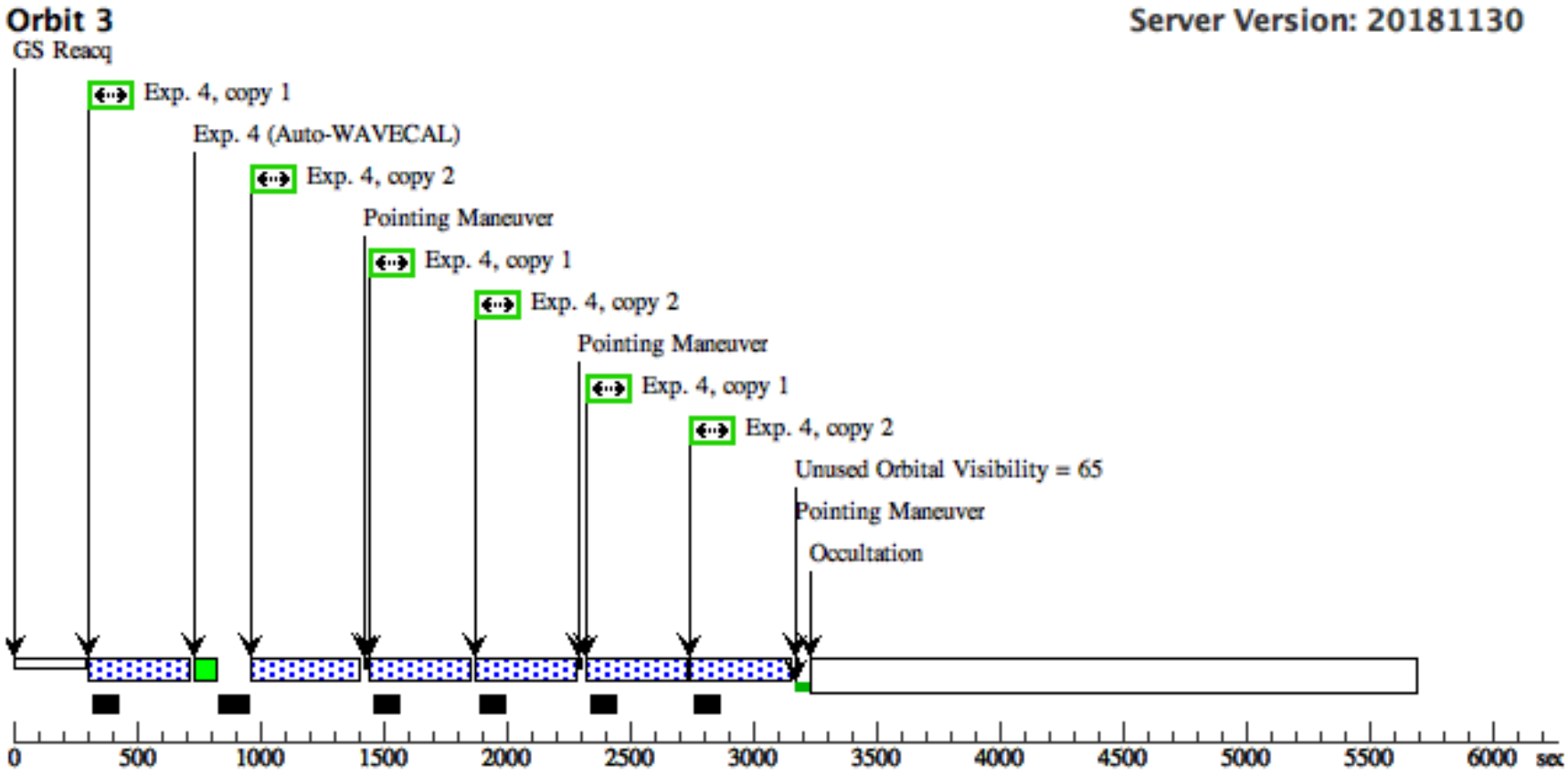
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Unused Orbital Visibility = 65
Pointing Maneuver
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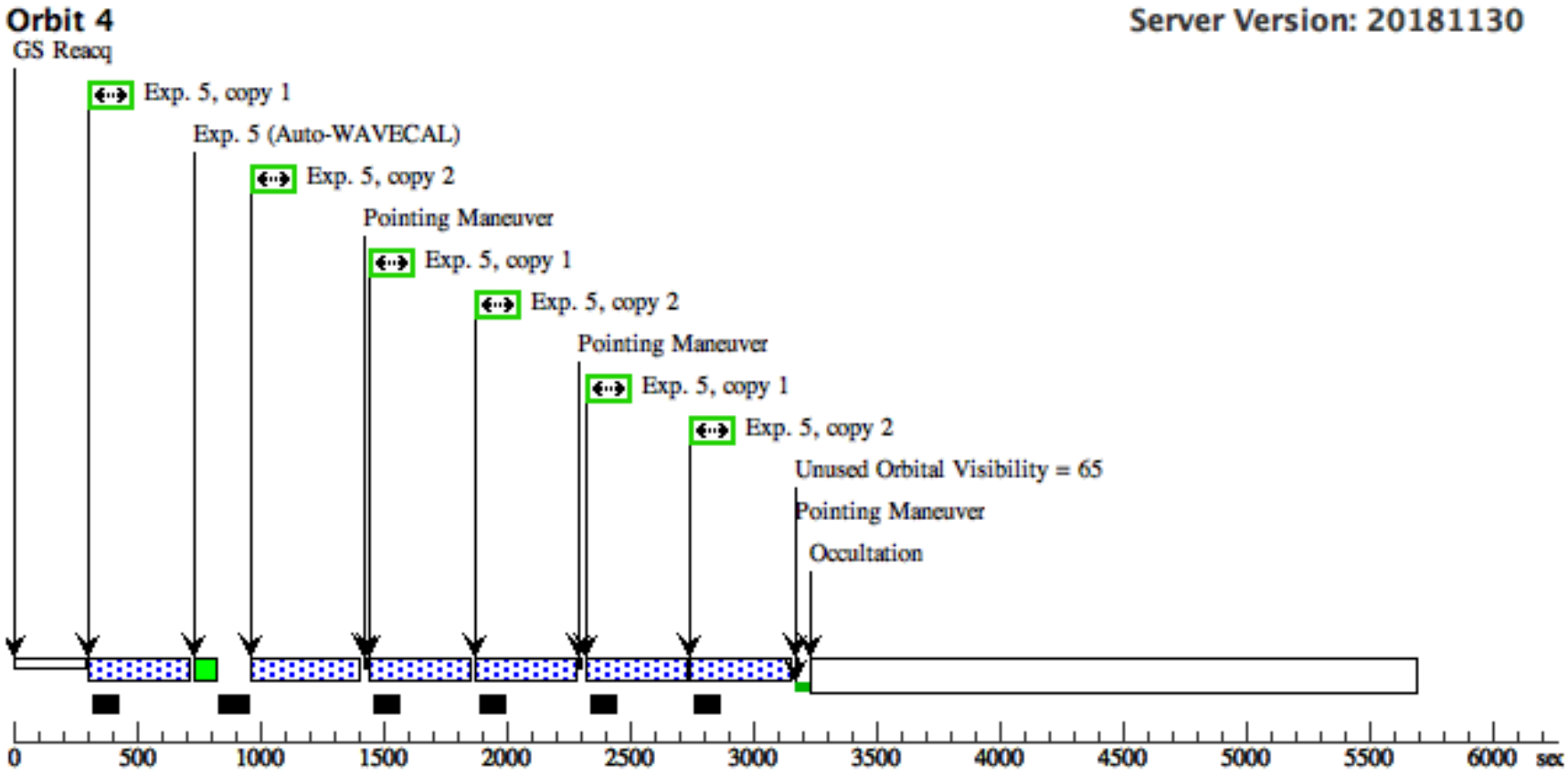
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Exp. 5, copy 1
Exp. 5, copy 2
Unused Orbital Visibility = 65
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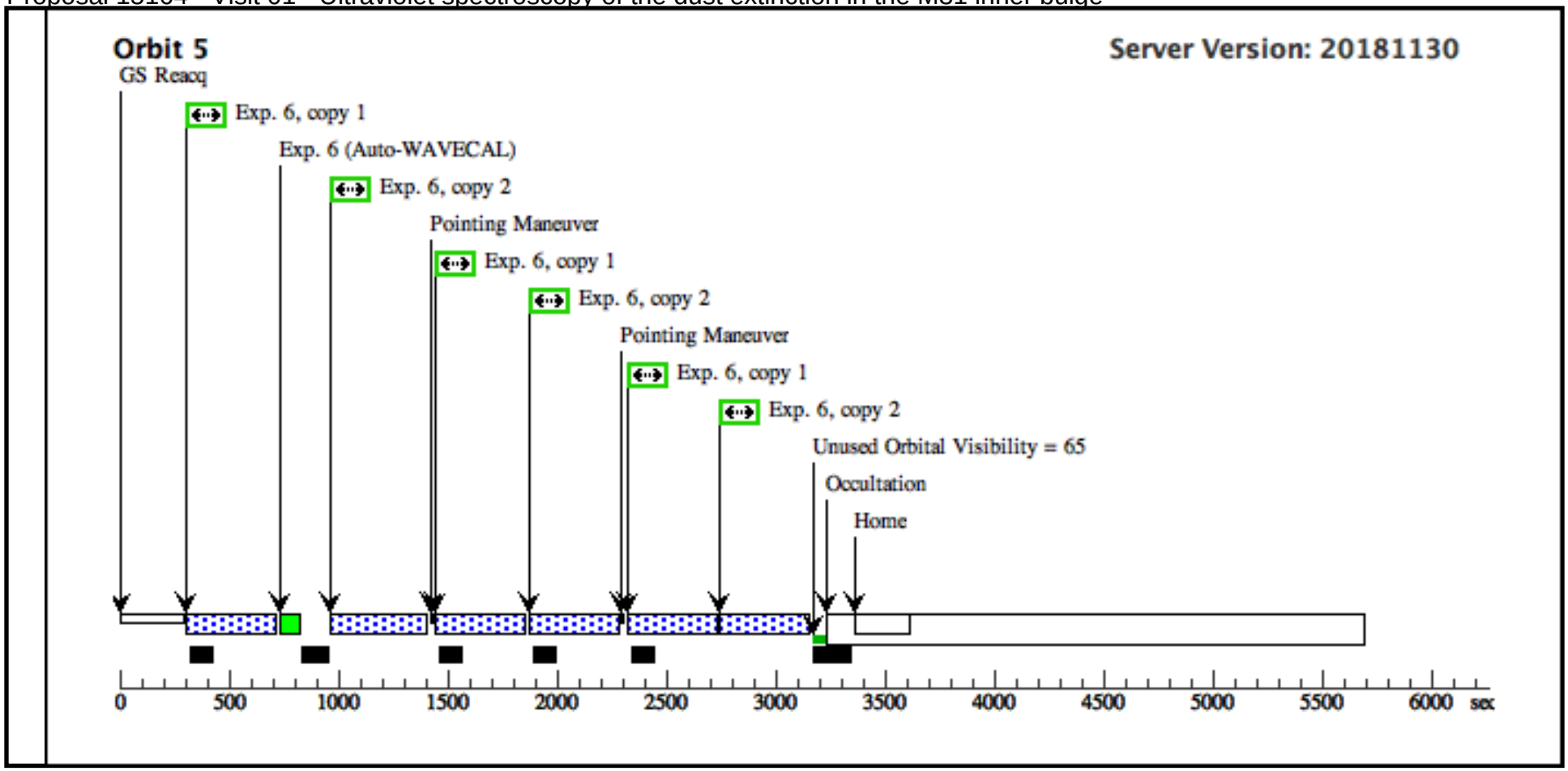
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Exp. 6, copy 2
Unused Orbital Visibility = 65
Occultation
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Visit

Proposal 15164, Visit 02, scheduling Wed Jun 12 15:00:25 GMT 2019

Diagnostic Status: No Diagnostics

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

Special Requirements: ORIENT 263D TO 265 D; ORIENT 83D TO 85 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(2), (3), (4), (5), (6)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=3	Angle Between Sides=		
	Point Spacing=2.4608	Center Pattern=true		
	Line Spacing=			

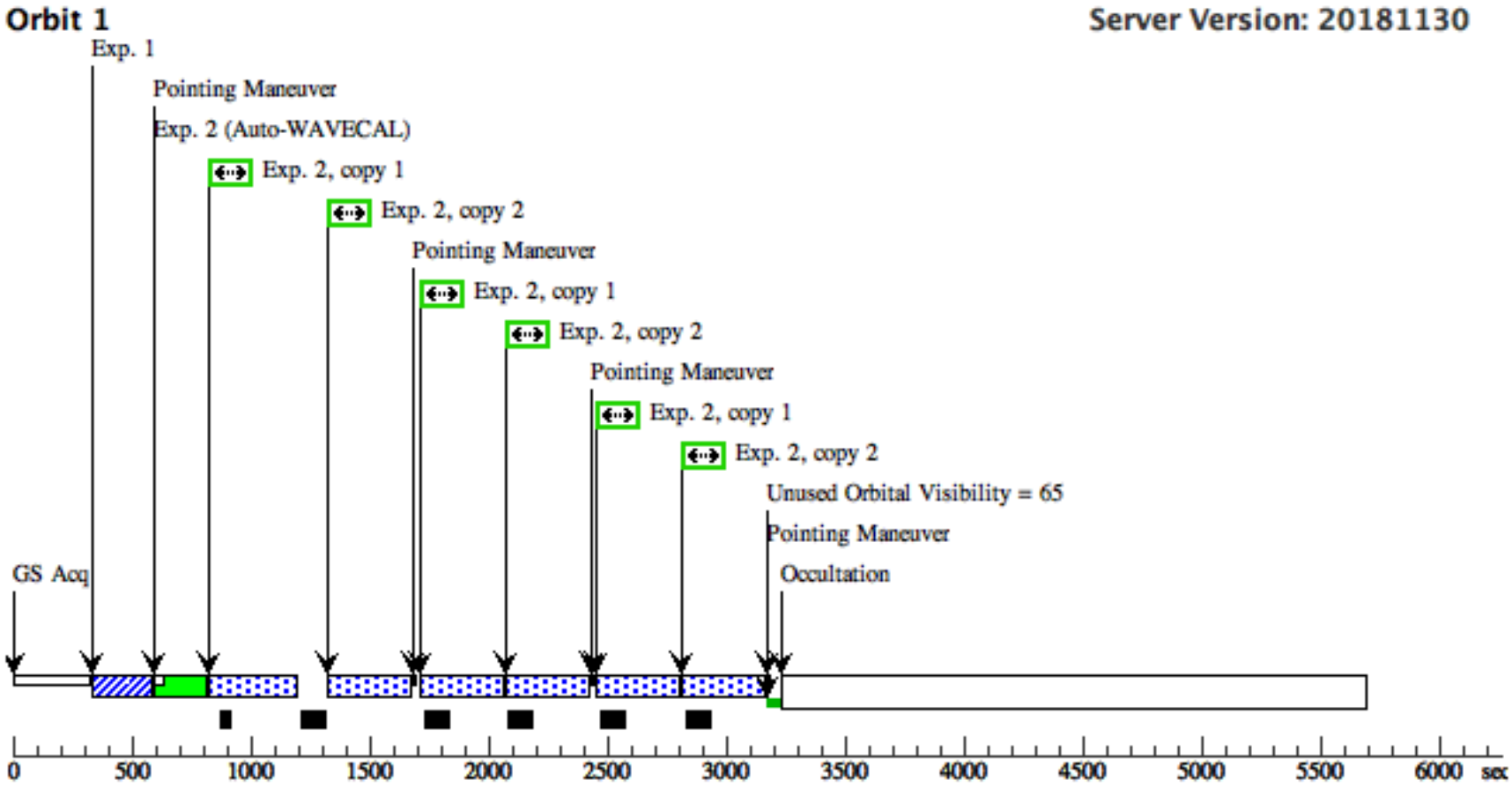
Fixed Targets

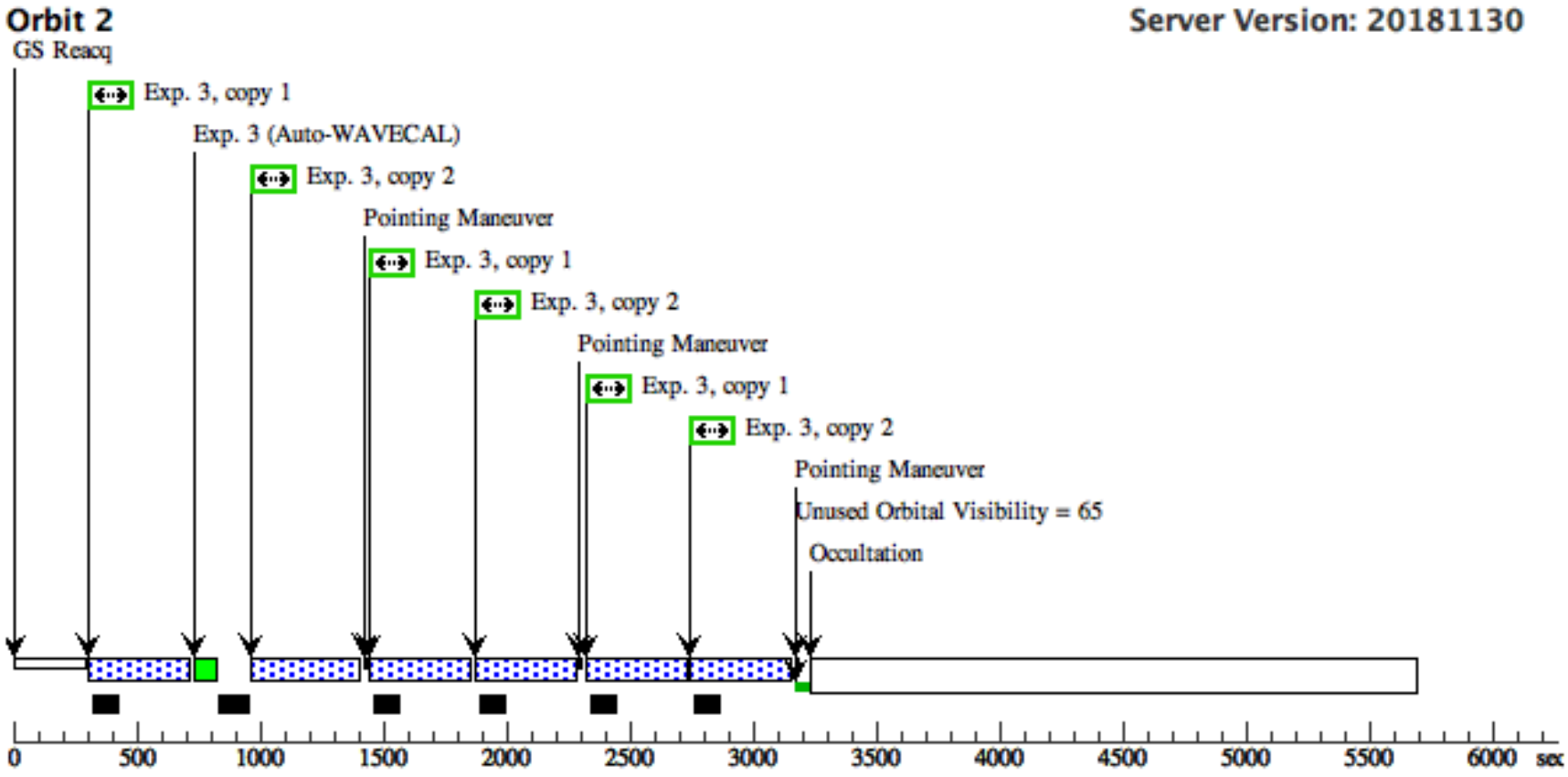
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	REFERENCE-GC	RA: 00 42 48.0490 (10.7002042d)		V=15.32+/-10	Reference Frame: ICRS
		Dec: +41 15 37.02 (41.26028d)			
		Equinox: J2000			
Comments: It is a bright globular cluster in the M31 bulge near our targets. (B=16.13, V=15.32 mag)					
Category=ISM					
Description=[BULGE, MOLECULAR CLOUD]					
(3)	M31-BULGE-CLUMPB	Offset from REFERENCE-GC		V=18	Offset Position (M31-BULGE-CLUMPB)
		RA Offset: -0.0231085 Degrees			
		Dec Offset: 0.00750351 Degrees			
Comments:					
Category=ISM					
Description=[MOLECULAR CLOUD]					

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.101 1684)	(1) REFERENCE-G C	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT	GS ACQ SCENARI O BASE1B3	Sequence 1-2 Non-In t in Visit 02	5 Secs (5 Secs) *[==>]*	***[1]***
2	(STIS.sp.10 11699)	(3) M31-BULGE-CL UMPB	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 1-2 Non-In t in Visit 02 Pattern 1, Exps 2-2 i n Sequence 1-2 Non-Int in Visit 02 (1)	335 Secs X 2 (2010 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[1]***
3	(STIS.sp.10 11704)	(3) M31-BULGE-CL UMPB	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 3-3 Non-In t in Visit 02 Pattern 1, Exps 3-3 i n Sequence 3-3 Non-Int in Visit 02 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[2]***
4	(STIS.sp.10 11705)	(3) M31-BULGE-CL UMPB	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 4-4 Non-In t in Visit 02 Pattern 1, Exps 4-4 i n Sequence 4-4 Non-Int in Visit 02 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[3]***
5	(STIS.sp.10 11707)	(3) M31-BULGE-CL UMPB	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 5-5 Non-In t in Visit 02 Pattern 1, Exps 5-5 i n Sequence 5-5 Non-Int in Visit 02 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[4]***
6	(STIS.sp.10 11704)	(3) M31-BULGE-CL UMPB	STIS/NUV-MAMA, ACCUM, 52X2	G230L 2376 A			Sequence 6-6 Non-In t in Visit 02 Pattern 1, Exps 6-6 i n Sequence 6-6 Non-Int in Visit 02 (1)	401 Secs X 2 (2406 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]*	***[5]***

Orbit Structure

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Pointing Maneuver
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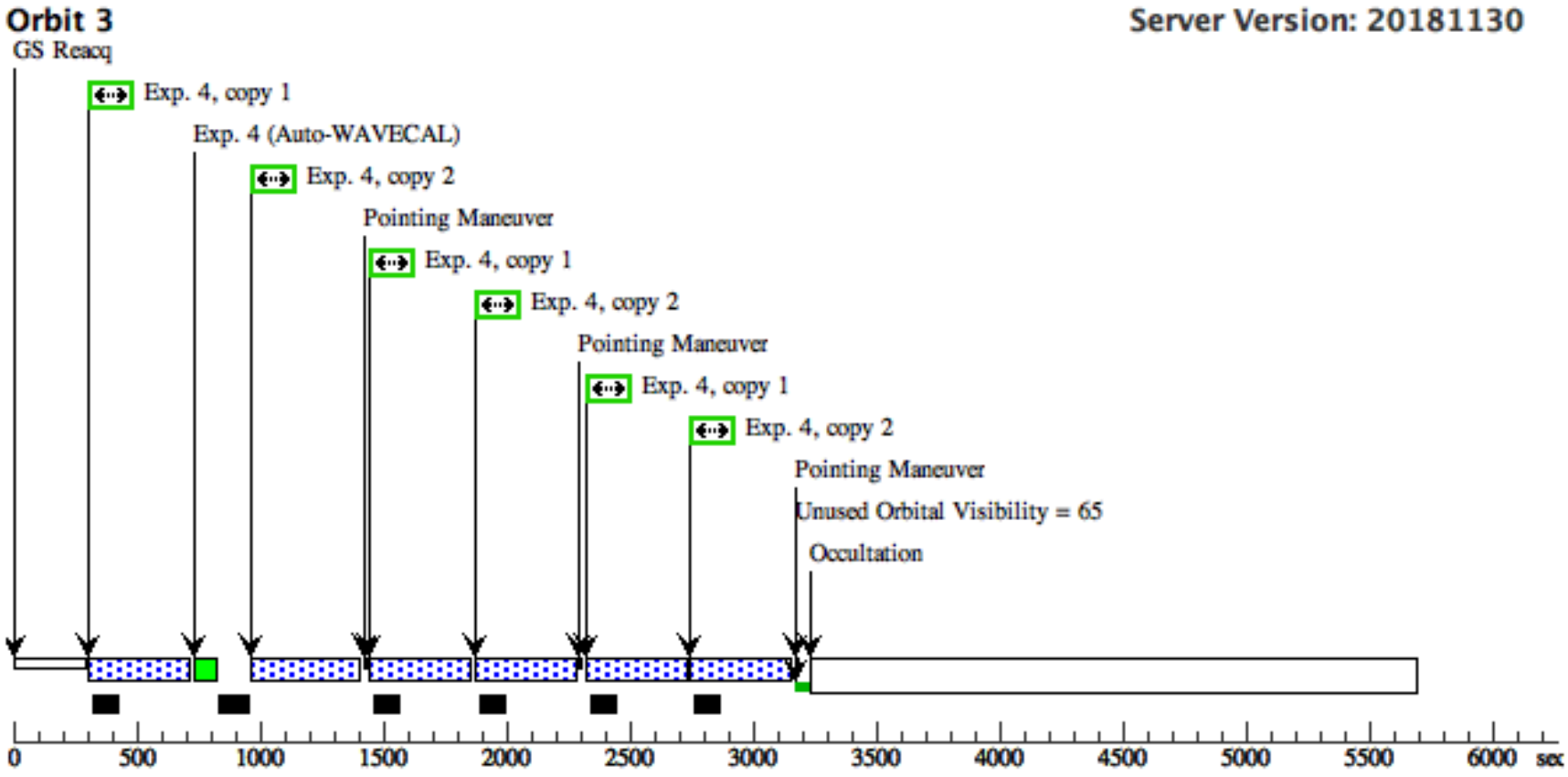
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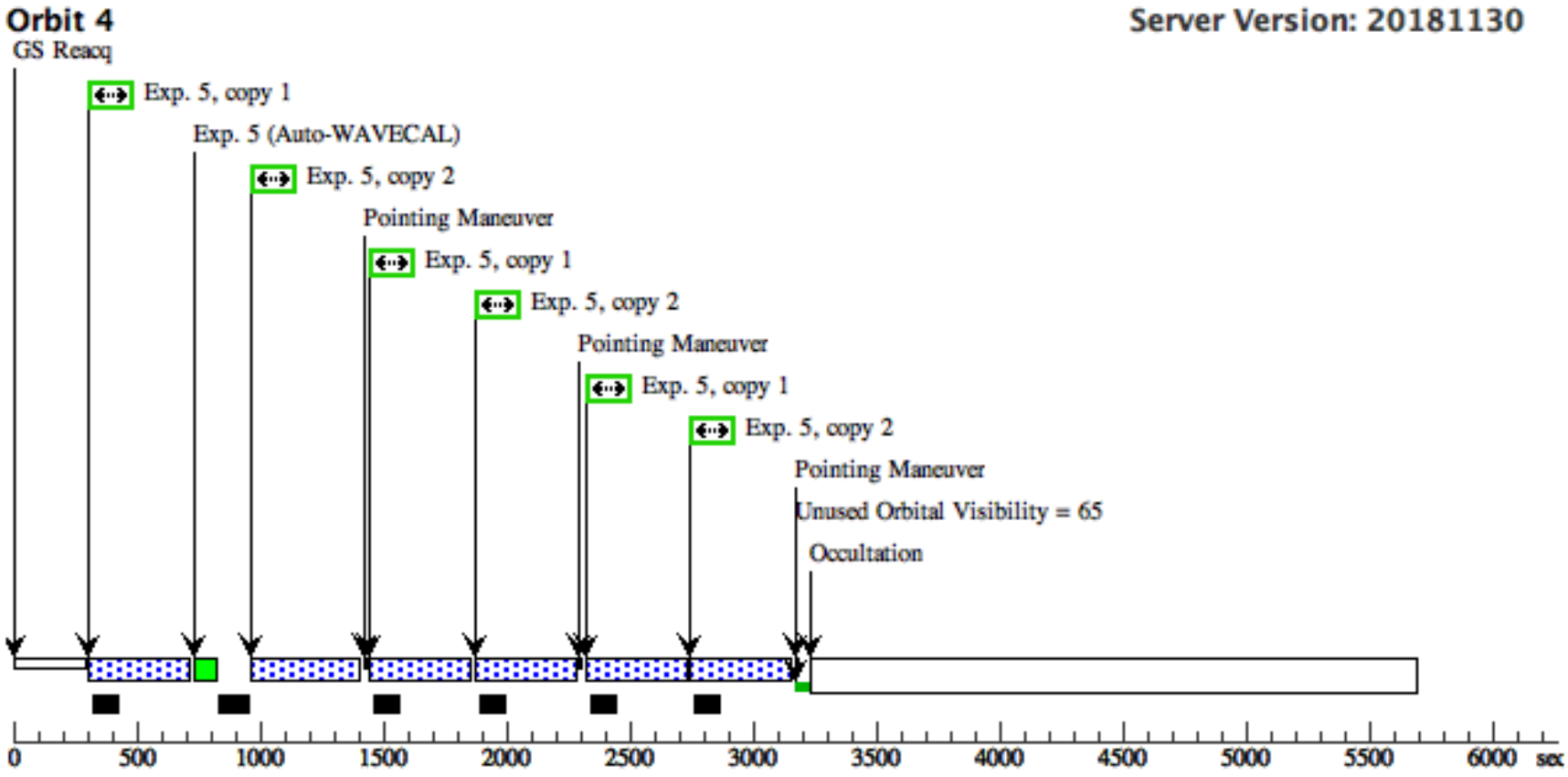
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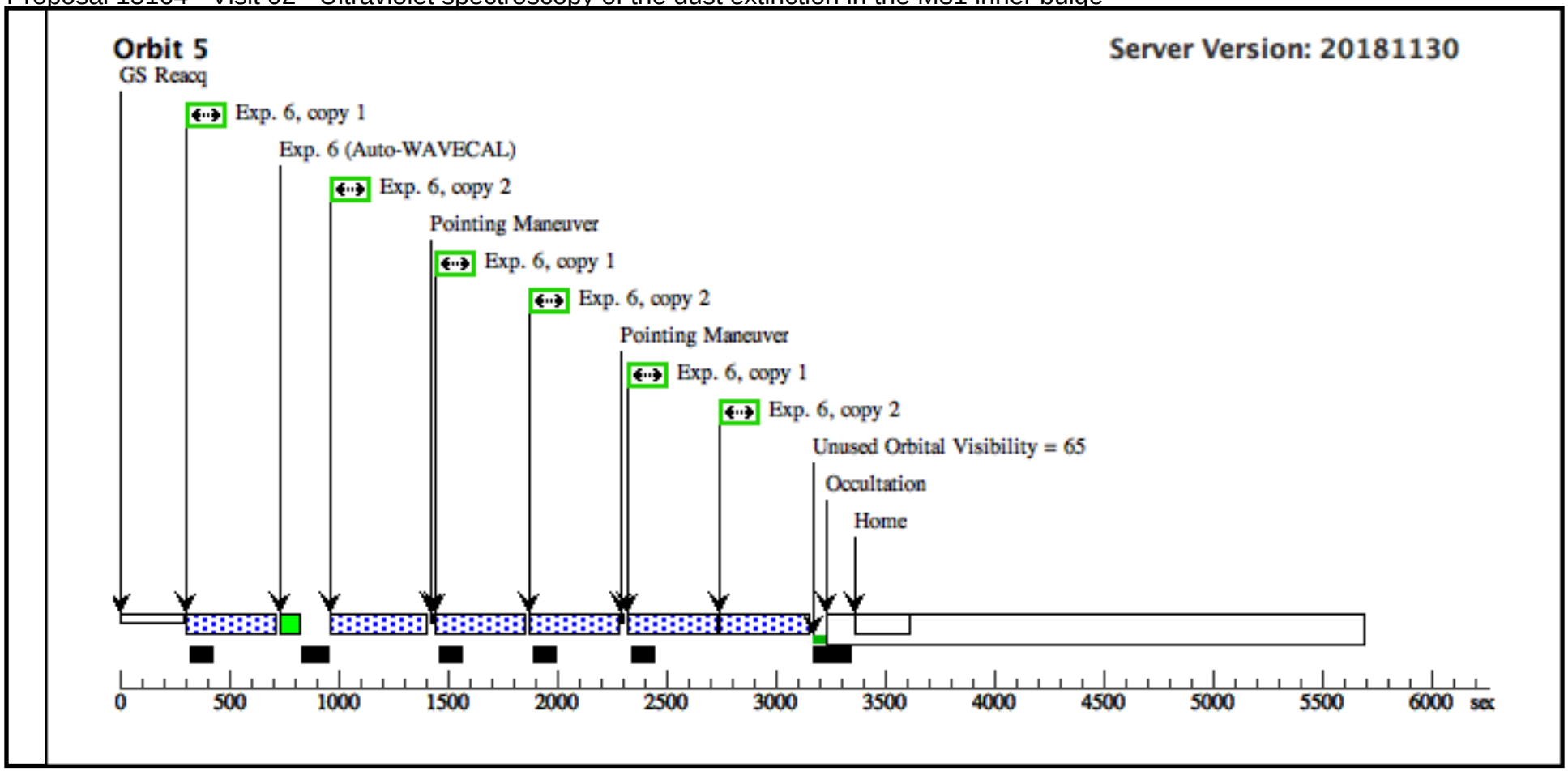
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Unused Orbital Visibility = 65
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