15176 - Resolving the late planet formation stages around young M-stars

Cycle: 25, 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) 2MASS-J16090075-1908526	STIS/CCD	1	22-Aug-2017 23:00:26.0	yes
02	(1) 2MASS-J16090075-1908526	STIS/CCD	1	22-Aug-2017 23:00:27.0	yes
03	(4) RAVE-J161322.1-192417	STIS/CCD	1	22-Aug-2017 23:00:28.0	yes
04	(2) 2MASS-J16142029-1906481	STIS/CCD	1	22-Aug-2017 23:00:29.0	yes
05	(2) 2MASS-J16142029-1906481	STIS/CCD	1	22-Aug-2017 23:00:30.0	yes
06	(5) UCAC2-24134747	STIS/CCD	1	22-Aug-2017 23:00:31.0	yes

6 Total Orbits Used

ABSTRACT

Recent discoveries of earth-like planets around M-stars have highlighted the importance of understanding planet formation around late-type stars. However, this effort has been hampered by the lack of resolved observations of protoplanetary disks. In particular, scattered light images of M-star disks near the age of dispersal are critical to making further progress. The Upper Sco region provides a promising venue to remedy this situation, as it is the closest region with an age of 5-11 Myrs, commensurate with dispersal timescales. We propose to observe three M-star protoplanetary disks in the Upper Sco association using HST/STIS coronography to resolve the disks in scattered-light for the first time and to search for morphological signatures of forming planets. These three disks have been selected based on ALMA mm-dust and CO measurements that display radii within the STIS field of view and outside its inner working angle (IWA). We will use these observations to carry out a comparative study of the evolutionary state between M-star disks in Upper Sco and the younger 1-2 Myr Taurus region, leveraging both previous scattered-light images of disks in Taurus, as well as previous observations of the mm-dust and CO in both regions. All three targets are too faint to be observed using ground-based AO. Therefore, HST/STIS is the only instrument able to make these important measurements. These observations will act as critical diagnostics of the evolutionary state of nearby M-star protoplanetary disks, that will inform theories of planet formation and will further our understanding of the evolution of the planets around M-stars, such as our nearest neighbor Proxima Centauri b.

OBSERVING DESCRIPTION

Our observations seek to take advantage of the recently commissioned STIS BAR5 (i.e. the bent finger; Gaspar & Schneider, GO-12923) coronagraphic mode to achieve the 0.25" inner working angle required to image these three disks in scattered light. The expected outer radius of the scattered-light disk is unknown, as the exact relationship between the small dust and the CO at these evolved stages is unknown, but it is expected to be at least that of the CO radius (and therefore observable with STIS), but possibly extending further. Empirically measuring the relationship between these two components is one of the main goals of this proposal.

The relatively small angular separations of the expected emission in these disks (~0.5") necessitates the use of PSF subtraction techniques in order to reasonably expect a detection. We therefore use three orbits per target: two orbits at different telescope ORIENT positions separated from each other by 30 degrees, and one orbit for a reference star.

The first two roll-orbits allow for basic angular differential imaging PSF subtraction while building signal to noise in a given disk, and the third orbit is required to mitigate self-subtraction of the disk in order to recover its true morphology. This multi-roll-plus-reference-star PSF subtraction strategy

is well established and has led to many successfully imaged disks (e.g. Schneider et al., 2014).

In each case the ORIENTs are assigned using the disk's known position angle such that the disk does not fall behind either a diffraction spike or the BAR5 finger itself. The three reference stars for this program are RAVE-J161322.1-192417, UCAC2- 24134747 and 2MASS-J16150856-1851009 - one for each target. Each reference star was chosen to match the B-V color, the Vmag and the position in the sky as close as possible.

Visit

Proposal 15176, Visit 01, implementation Wed Aug 23 03:00:32 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 110D TO 111 D; GROUP 01,02,03 WITHIN 2.9 Orbits

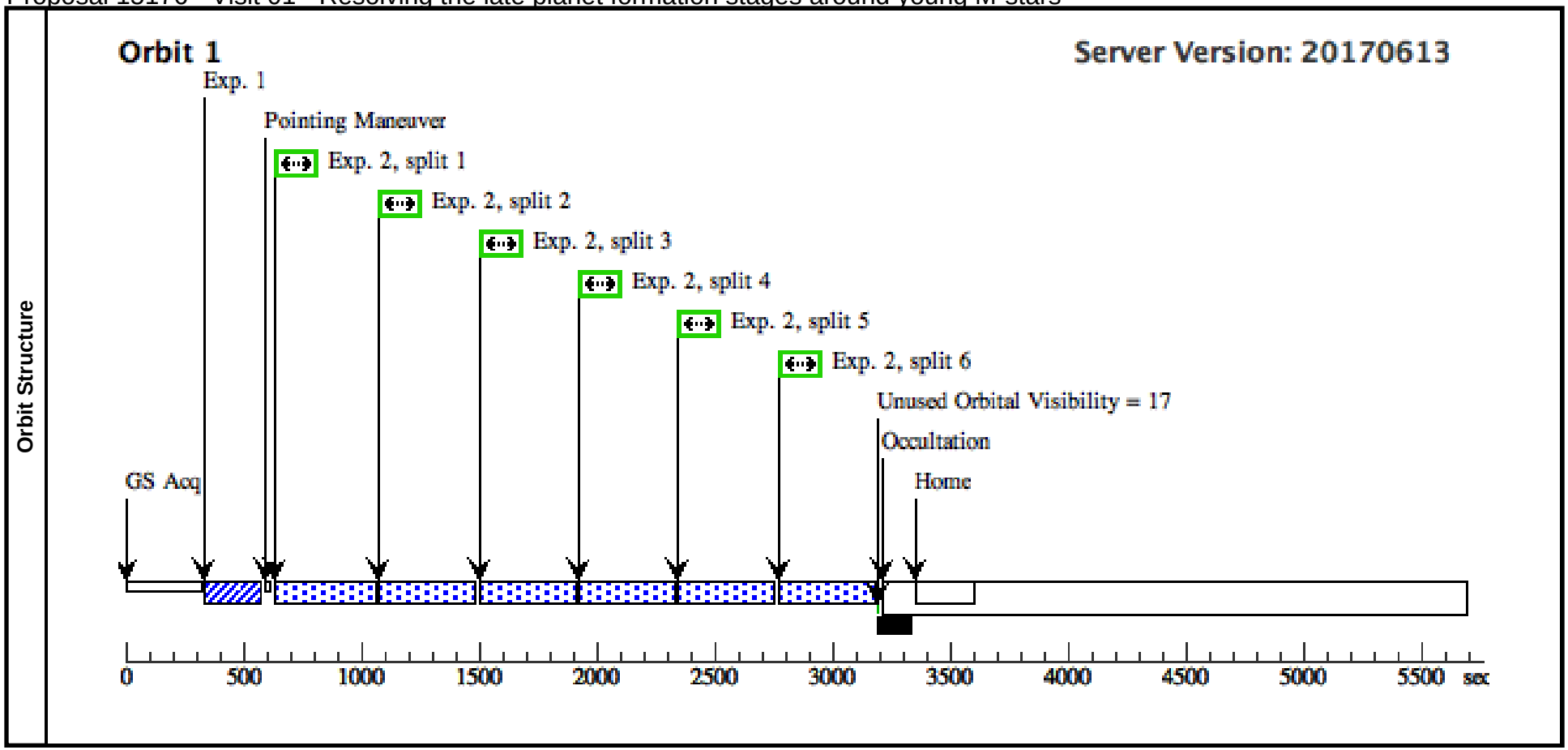
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2MASS-J16090075-1908526	RA: 16 09 0.7610 (242.2531708d) Dec: -19 08 52.68 (-19.14797d) Equinox: J2000		V=14+/-0.3	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J16090075-ACQ	(1) 2MASS-J16090075-1908526	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
2	J16090075 Roll 1	(1) 2MASS-J16090075-1908526	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.34596,-7.20172		2274 Secs (2274 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	 ***[1]***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Server Version: 20170613
Exp. 1
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Unused Orbital Visibility = 17
Occultation
GS Acq
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
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5500
sec

Visit

Proposal 15176, Visit 02, implementation Wed Aug 23 03:00:32 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 27D TO 28D FROM 01

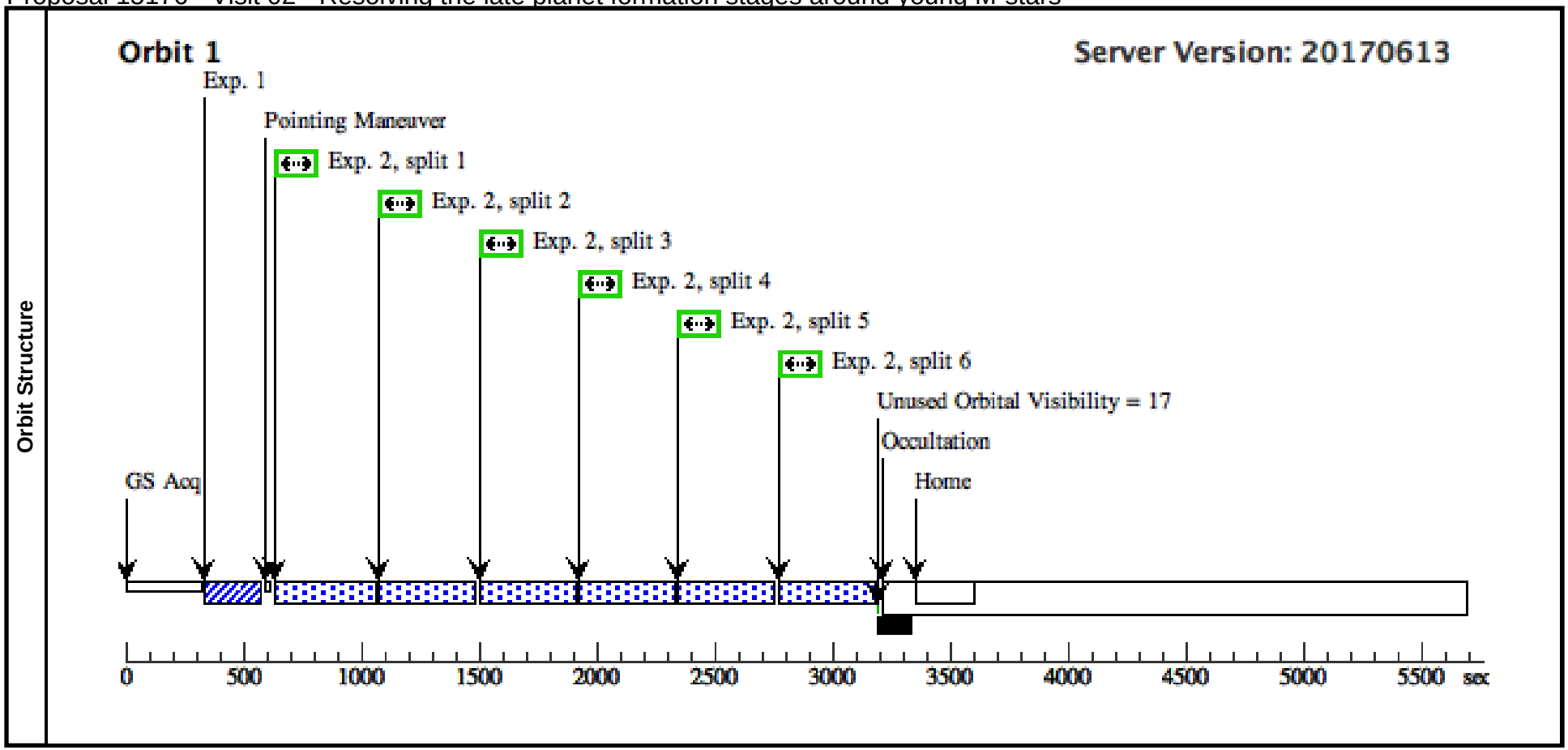
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2MASS-J16090075-1908526	RA: 16 09 0.7610 (242.2531708d) Dec: -19 08 52.68 (-19.14797d) Equinox: J2000		V=14+/-0.3	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J16090075-ACQ	(1) 2MASS-J16090075-1908526	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
								[==>]	***[1]***
2	J16090075 Roll 2	(1) 2MASS-J16090075-1908526	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.34596,-7.20172		2274 Secs (2274 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	***[1]***


Orbit Structure
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Server Version: 20170613
Exp. 1
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Unused Orbital Visibility = 17
Occultation
GS Acq
Home
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Visit

Proposal 15176, Visit 03, implementation Wed Aug 23 03:00:32 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: (none)

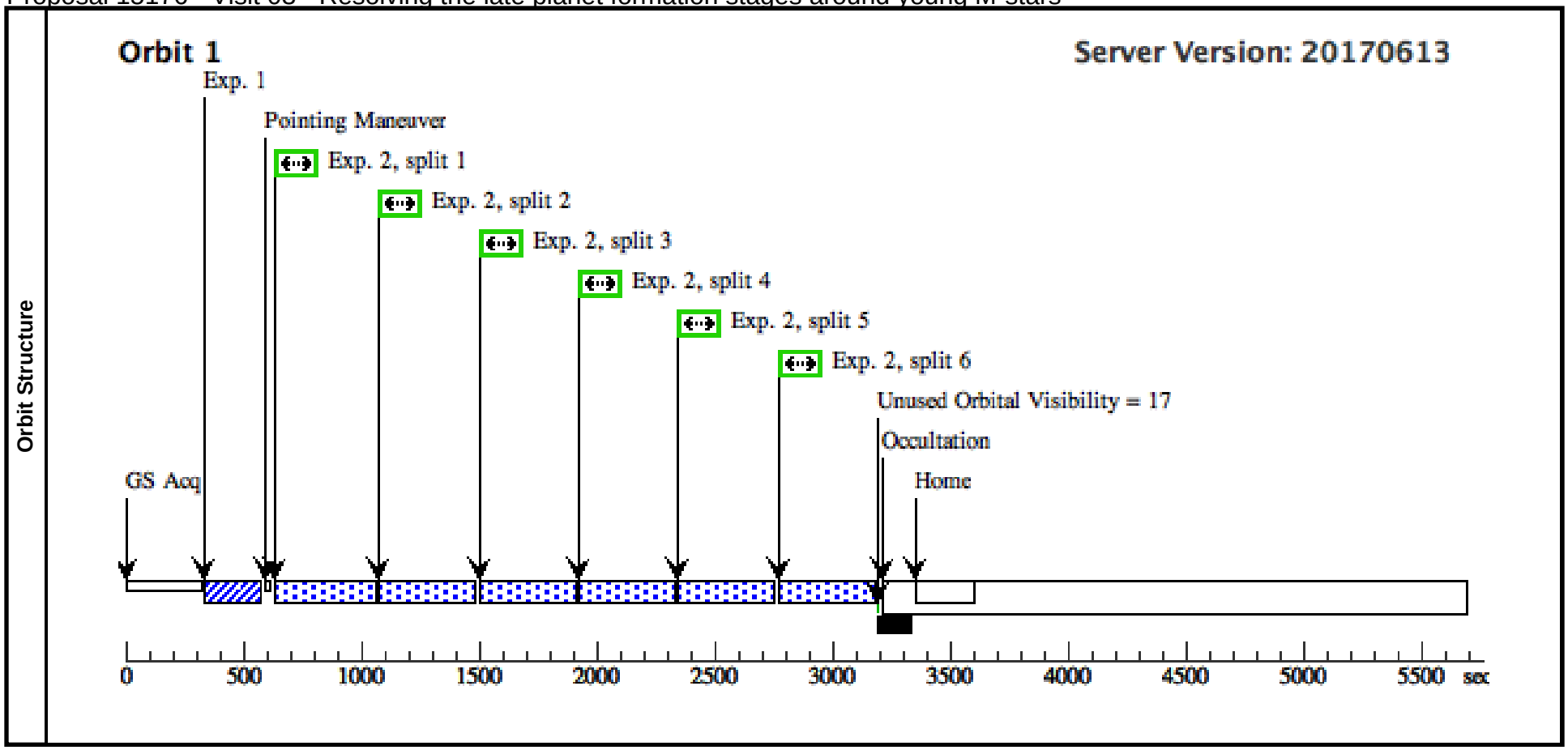
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	RAVE-J161322.1-192417	RA: 16 13 22.1430 (243.3422625d) Dec: -19 24 17.25 (-19.40479d) Equinox: J2000		V=13.17	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	RAVE-J161322.1-ACQ	(4) RAVE-J161322.1-192417	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
								[==>]	***[1]***
2	RAVE-J161322.1	(4) RAVE-J161322.1-192417	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.34596,-7.20172		2274 Secs (2274 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20170613
Exp. 1
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Unused Orbital Visibility = 17
Occultation
Home
GS Acq
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Visit

Proposal 15176, Visit 04, implementation Wed Aug 23 03:00:32 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 280D TO 281 D; GROUP 04,05,06 WITHIN 2.9 Orbits

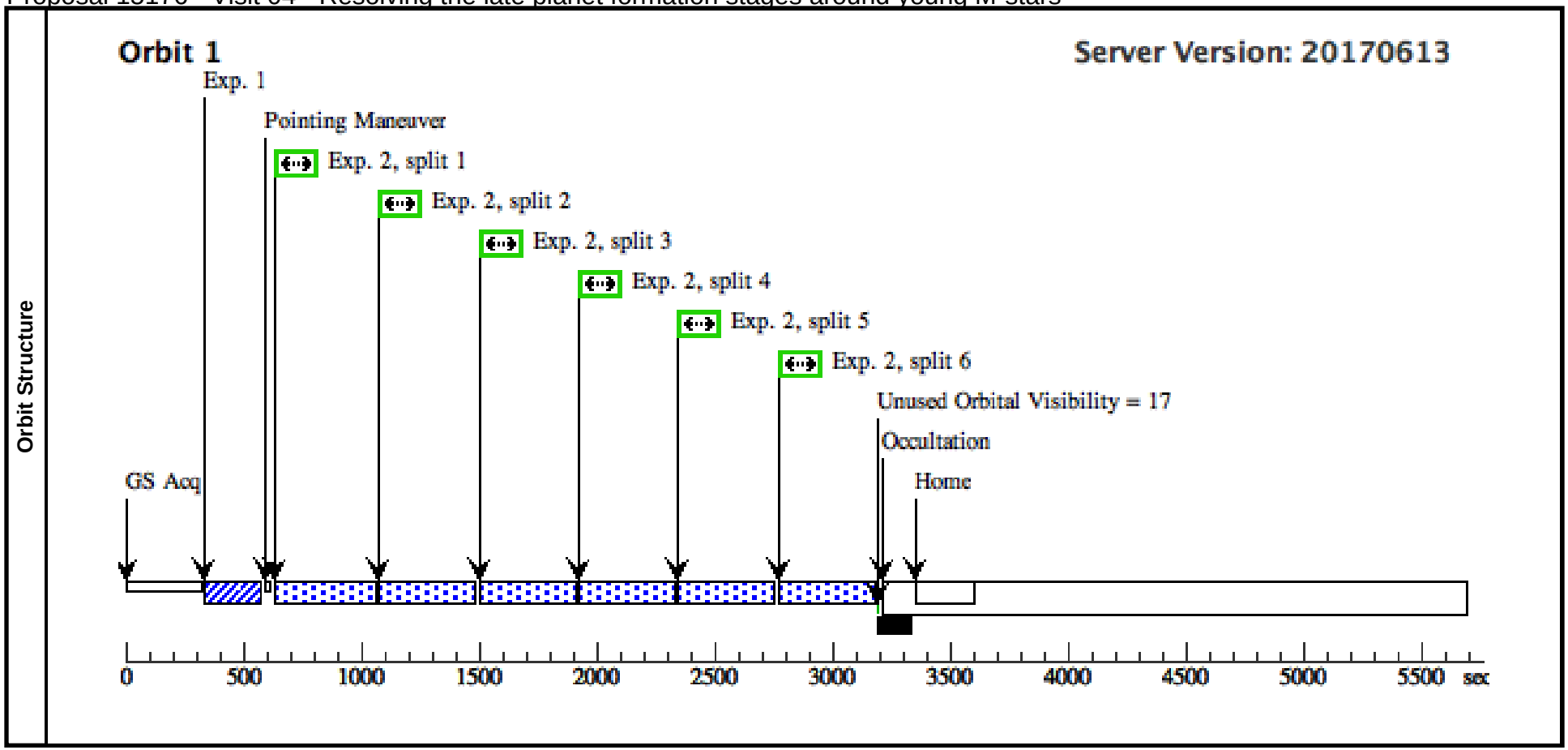
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2MASS-J16142029-1906481	RA: 16 14 20.2990 (243.5845792d) Dec: -19 06 48.14 (-19.11337d) Equinox: J2000		V=14.01+/-0.1	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J16142029-ACQ	(2) 2MASS-J16142029-1906481	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
								[==>]	***[1]***
2	J16142029 Roll 1	(2) 2MASS-J16142029-1906481	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.34596,-7.20172		2274 Secs (2274 Secs)	
								[==>(Split 1)]	***[1]***
								[==>(Split 2)]	
								[==>(Split 3)]	
								[==>(Split 4)]	
								[==>(Split 5)]	
								[==>(Split 6)]	


Orbit Structure
Orbit 1
Server Version: 20170613
Exp. 1
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Unused Orbital Visibility = 17
Occultation
GS Acq
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Visit

Proposal 15176, Visit 05, implementation Wed Aug 23 03:00:32 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 20D TO 22D FROM 04

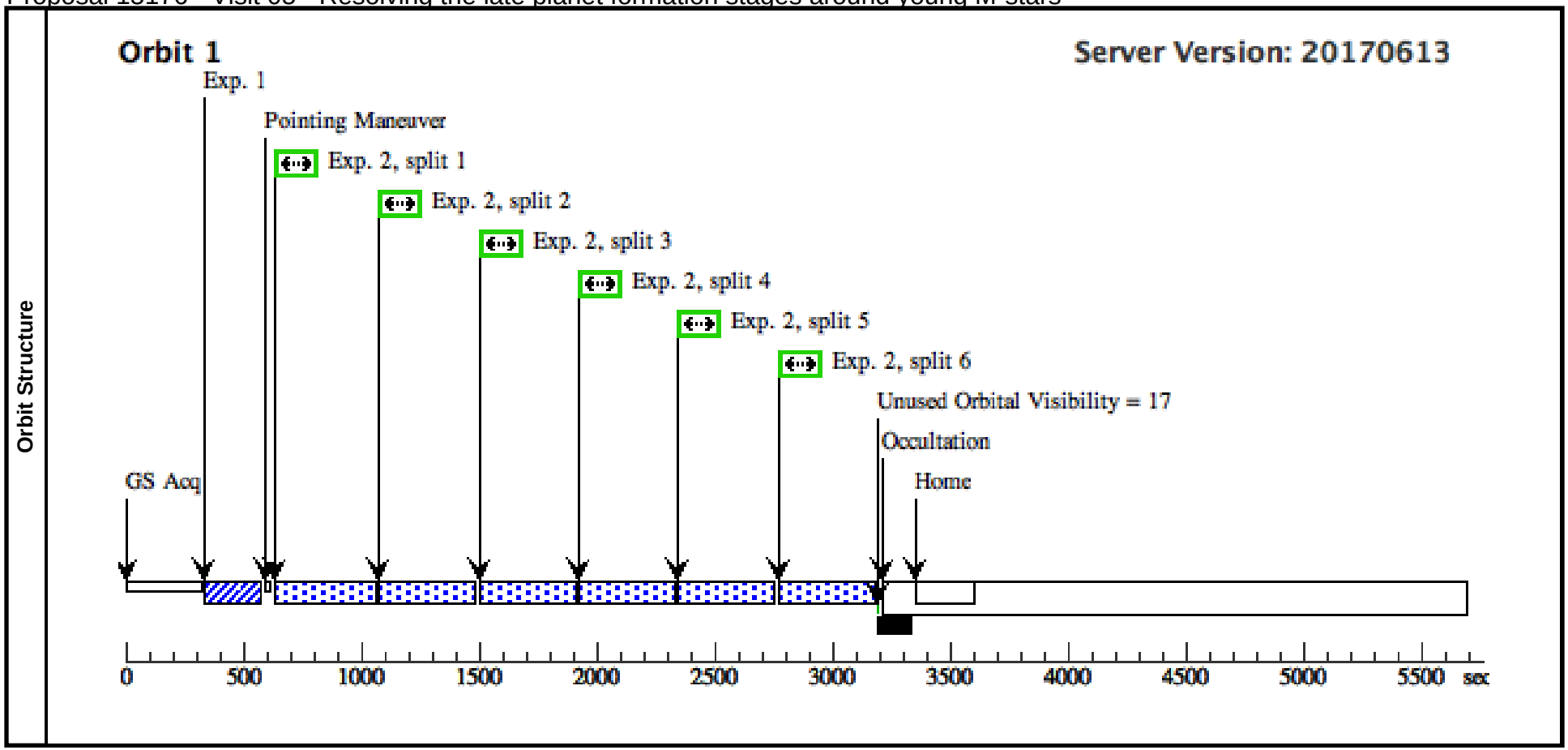
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2MASS-J16142029-1906481	RA: 16 14 20.2990 (243.5845792d) Dec: -19 06 48.14 (-19.11337d) Equinox: J2000		V=14.01+/-0.1	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J16142029-ACQ	(2) 2MASS-J16142029-1906481	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs)	
								[==>]	***[1]***
2	J16142029 Roll 2	(2) 2MASS-J16142029-1906481	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.34596,-7.20172		2274 Secs (2274 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	***[1]***


Orbit Structure
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Server Version: 20170613
Exp. 1
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Unused Orbital Visibility = 17
Occultation
GS Acq
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Visit

Proposal 15176, Visit 06, implementation Wed Aug 23 03:00:32 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: (none)

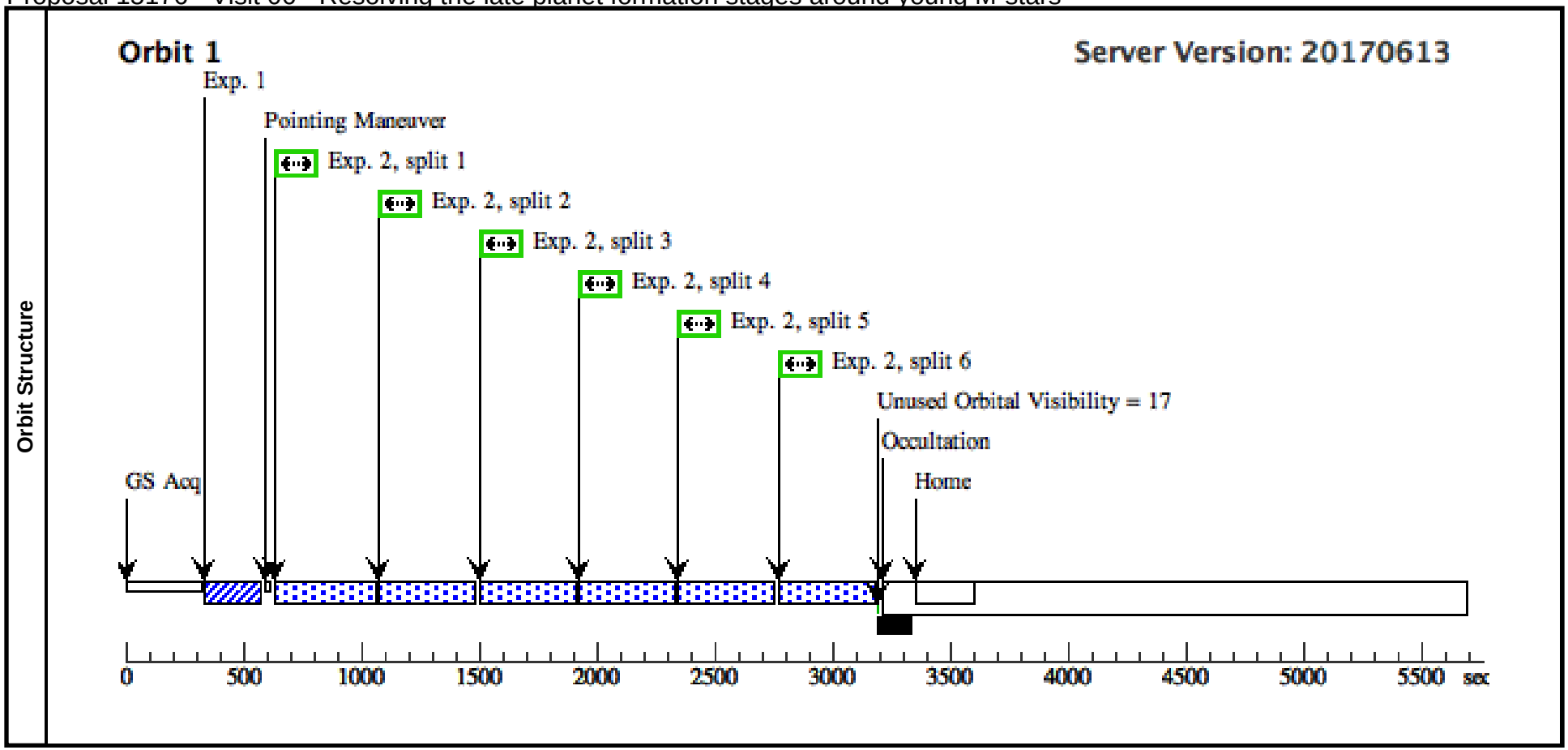
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	UCAC2-24134747	RA: 16 08 22.3430 (242.0930958d) Dec: -19 30 5.28 (-19.50147d) Equinox: J2000		V=13.5+/-5	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	UCAC2-24134747-ACQ	(5) UCAC2-24134747	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
2	UCAC2-24134747	(5) UCAC2-24134747	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.34596,-7.20172		2274 Secs (2274 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	 ***[1]***


Orbit Structure
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Exp. 1
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Unused Orbital Visibility = 17
Occultation
GS Acq
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