15165 - Connecting mass accretion and ejection in pre-main sequence stars

Cycle: 25, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) V-GM-AUR CCDFLAT	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	19-Jul-2017 20:00:41.0	yes
02	(1) V-GM-AUR CCDFLAT	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	19-Jul-2017 20:00:44.0	yes
03	(1) V-GM-AUR CCDFLAT	STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	2	19-Jul-2017 20:00:46.0	yes

6 Total Orbits Used

ABSTRACT

Many pre-main sequence stars are surrounded by circumstellar material and display the typical signatures of astrophysical accretion disks, namely mass accretion onto the central object and mass ejection via jets. There is an observed correlation between the accretion rate onto the star and the mass loss rate. This suggests a linked formation mechanism, presumably the stellar magnetic field which can both channel material onto the star as well as eject it in collimated jets along twisted field lines. This correlation is based on secondary tracers of the accretion rate and mass loss rate (e.g., emission lines). Here we propose a more direct test of the observed correlation between mass accretion and ejection by using UV emission to detect accreting gas and centimeter emission to trace the jet while disentangling the influence of high-energy X-ray radiation from the star. This would be the first simultaneous HST-Chandra-VLA observation of a young, accreting star.

OBSERVING DESCRIPTION

We request 3 observations for GM Aur separated by about 1 week. Each observation will be 2 orbits in length. We will follow the same observing procedure from our previous successful observations of GM Aur. We will need MAMA FUV and NUV spectra to measure the H_2 feature and mass accretion rates and so we choose the G140L and G230L gratings which cover 1150, 1730, and 1570, 3180 Angstroms respectively. Obtaining simultaneous optical spectra is crucial in order to measure the extinction precisely and accurately measure the FUV/NUV excess above the stellar photosphere. We will use the CCD G430L grating (2900-5700 Angstroms) and the CCD G750L grating (5240-11490 Angstroms) to do this. In addition, we will need contemporaneous fringe-flats to correct the spectra beyond 7000 Angstroms where severe fringing occurs. Low-resolution is sufficient for this study since we are not attempting to measure individual lines in detail. We will achieve a SNR of at least ~10-20 and note that each HST orbit is ~96 minutes in length. We have checked the brightness limits of MAMA and the saturation levels of the CCD and our targets fall within the acceptable limits for variable objects. We will also employ the TIME-TAG feature, so that the position and detection time of every photon is recorded. This is "free" information that to the best of our knowledge has not been utilized to study CTTS accretion variability before, but may prove useful to test for short time-scale changes during the observation.

--------- Additional Comments ----------

Additional care must be taken for scheduling purposes, as these observations will be simulatenous to Chandra and Very Large Array (VLA) observations. Scheduling availability overlap between Chandra, HST and VLA are currently unknown, so further communication with the appropriate agents is requested.

The date constraints to perform the three coordinated observations are set mainly by the HST visibility of GM Aur and the dates when B

configuration is available at the VLA. The available dates are divided in three periods of time comprising 70 days in total: 2017 Sep 13 - 2017 Sep 20, 2017 Oct 23 - 2017 Nov 12, and 2017 Dec 18 - 2018 Jan 29. If necessary, the coordinated observations could also be performed during the transition time from B to A configuration: 2018 Jan 30 - 2018 Mar 01, resulting in 30 more days available. The elevation of GM Aur in the VLA site will also set some time constraints for the coordinated observations. GM Aur's elevation will be between 30 and 80 degrees (the optimal range of elevations for VLA observations) in the LST (at the VLA) ranges 00:00-04:10 and 5:40-09:45. We note that both periods of time are longer than 3.2 hours, the amount of time requested for each of the three observations. Chandra places no additional visibility constraints on the object.

Because this is a variability study, we request that each visit is spaced by roughly one week (4-9d). Based on this, the visibility constraints imposed above, and maximized scheduling flexibility, it is ideal that the three visits occur between 2017 Dec 19 and 2018 Jan 29.

Note that the requested dates have not included the visibilty constraints placed by the elevation at the VLA site. Ideally, observations will be taken simultaenously, but if necessary can be at most several hours apart. Additional scheduling coordination between VLA, HST and Chandra is likely necessary to ensure maximal simultaneity.

GM Aur is flagged as a health/safety concern by the BOT for the NUV G230L exposure. GM Aur has been observed with the G230L grating on 7 separate occasions and has not exceeded the brightness limit. We know the spectral type of GM Aur is ~K4-K5, not O5 as assumed by the BOT.

Visit

Proposal 15165, Visit 01 Thu Jul 20 00:00:47 GMT 2017

Diagnostic Status: No Diagnostics

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

Special Requirements: BETWEEN 13-SEP-2017:00:00:00 AND 20-SEP-2017:00:00:00; BETWEEN 23-OCT-2017:00:00:00 AND 12-NOV-2017:00:00:00; BETWEEN 12-DEC-2017:00:00:00 AND 29-JAN-2018:00:00:00; BETWEEN 30-JAN-2018:00:00:00 AND 01-MAR-2018:00:00:00

Fixed Targets

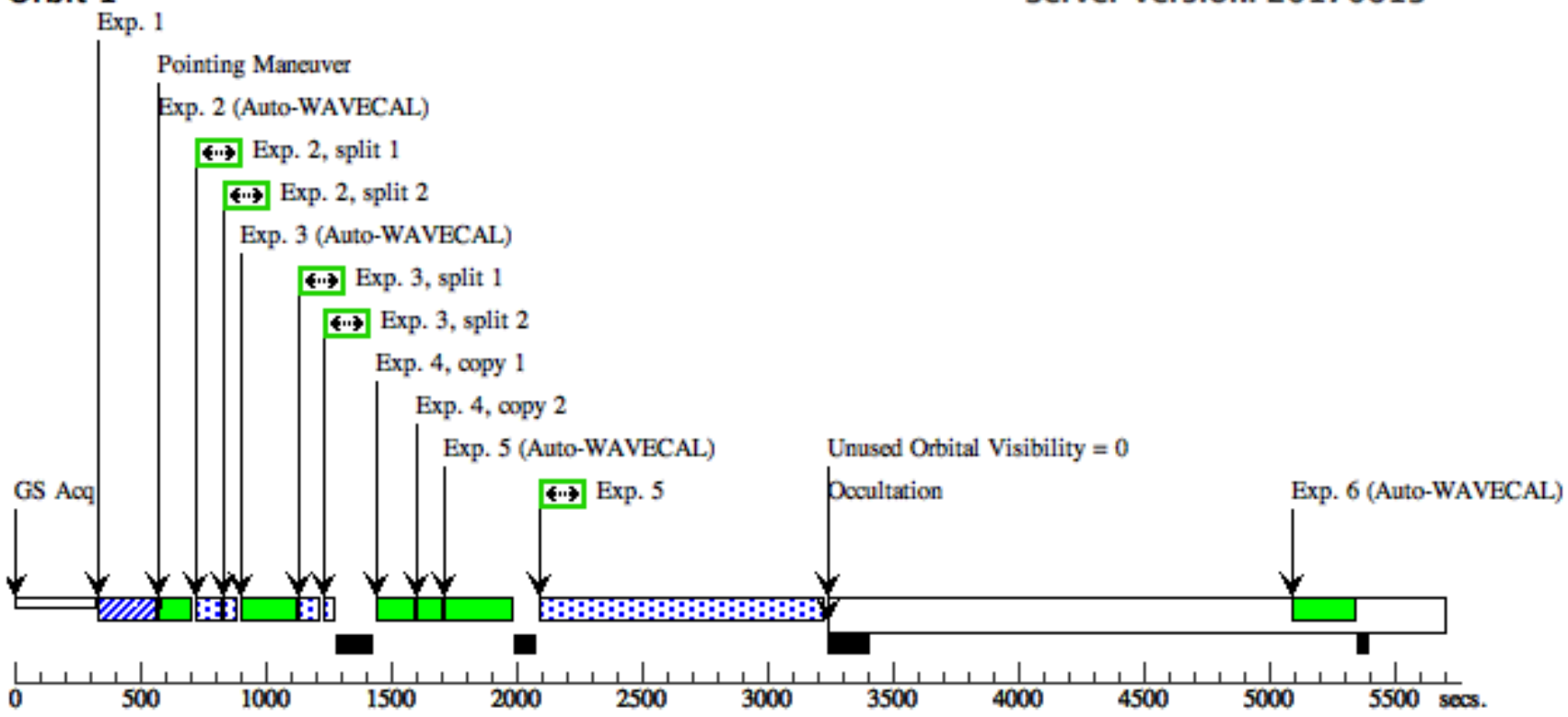
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-GM-AUR	RA: 04 55 10.9830 (73.7957625d) Dec: +30 21 59.54 (30.36654d) Equinox: J2000		V=13.1	Reference Frame: ICRS

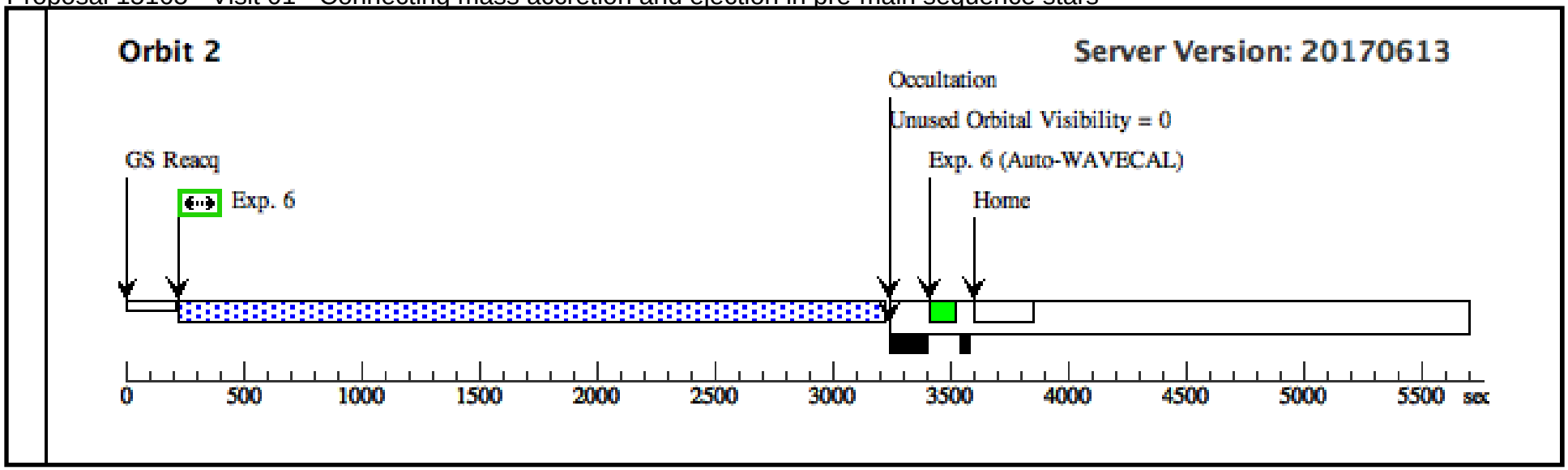
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.1005300)	(1) V-GM-AUR	STIS/CCD, ACQ, F28X50LP	MIRROR				0.5 Secs (0.5 Secs) *[==>]*	***[1]***
2	(STIS.sp.1005282)	(1) V-GM-AUR	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=2			35 Secs (35 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
3	(STIS.sp.1005285)	(1) V-GM-AUR	STIS/CCD, ACCUM, 52X2	G750L 7751 A	CR-SPLIT=2			8 Secs (8 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
4		CCDFLAT	STIS/CCD, ACCUM, 0.3X0.09	G750L 7751 A				*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
5	(STIS.sp.1005279)	(1) V-GM-AUR	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=547			1093 Secs (1093 Secs) *[==>]*	***[1]***
6	(STIS.sp.1005274)	(1) V-GM-AUR	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=1475			2950 Secs (2950 Secs) *[==>]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20170613
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 6
Exp. 6 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15165, Visit 02 Thu Jul 20 00:00:47 GMT 2017

Diagnostic Status: No Diagnostics

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

Special Requirements: AFTER 01 BY 4 D TO 9 D; BETWEEN 09-SEP-2017:00:00:00 AND 20-SEP-2017:00:00:00; BETWEEN 23-OCT-2017:00:00:00 AND 12-NOV-2017:00:00:00; BETWEEN 18-DEC-2017:00:00:00 AND 29-JAN-2018:00:00:00; BETWEEN 30-JAN-2018:00:00:00 AND 01-MAR-2018:00:00:00

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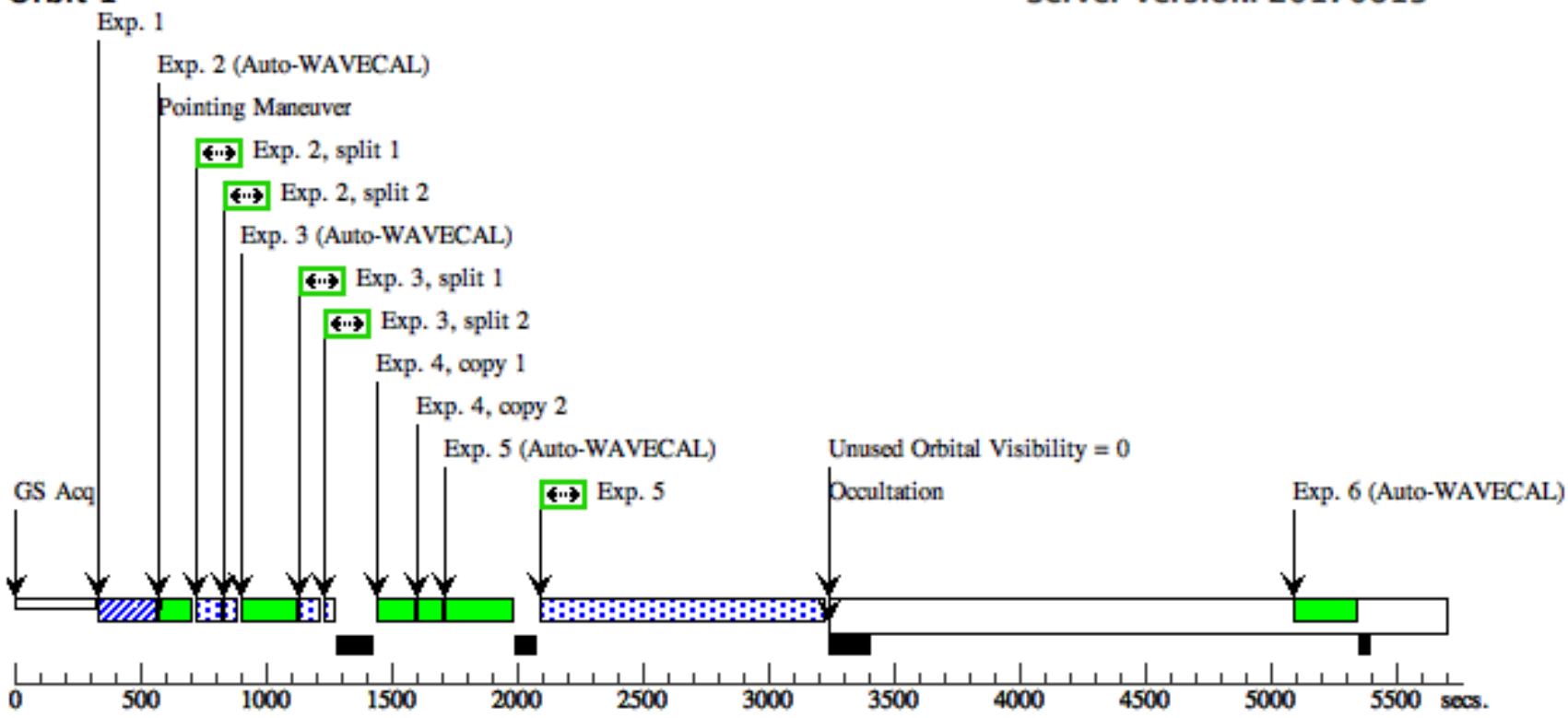
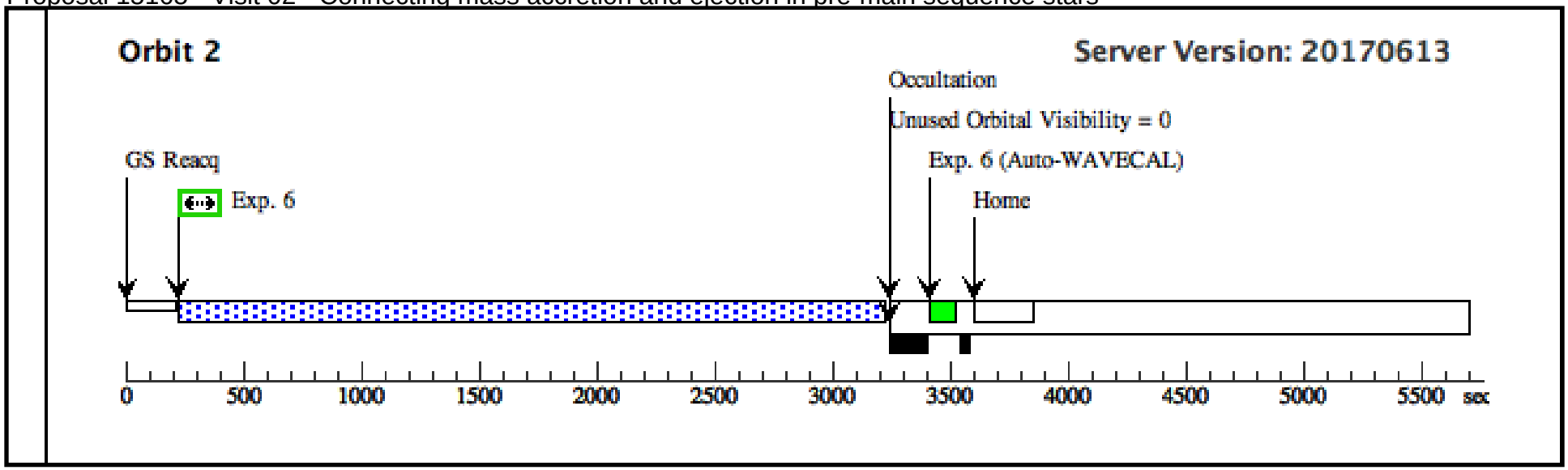
2	(STIS.sp.1005282)	(1) V-GM-AUR	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=2			35 Secs (35 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
3	(STIS.sp.1005285)	(1) V-GM-AUR	STIS/CCD, ACCUM, 52X2	G750L 7751 A	CR-SPLIT=2			8 Secs (8 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
4		CCDFLAT	STIS/CCD, ACCUM, 0.3X0.09	G750L 7751 A				*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
5	(STIS.sp.1005279)	(1) V-GM-AUR	STIS/NUV-MAMA, TIME-TAG, 52X2	G230L 2376 A	BUFFER-TIME=547			1093 Secs (1093 Secs) *[==>]*	***[1]***
6	(STIS.sp.1005138)	(1) V-GM-AUR	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=1475			2950 Secs (2950 Secs) *[==>]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20170613
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 6
Exp. 6 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15165, Visit 03 Thu Jul 20 00:00:47 GMT 2017

Diagnostic Status: No Diagnostics

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

Special Requirements: AFTER 02 BY 4 D TO 9 D; BETWEEN 13-SEP-2017:00:00:00 AND 20-SEP-2017:00:00:00; BETWEEN 23-OCT-2017:00:00:00 AND 12-NOV-2017:00:00:00; BETWEEN 18-DEC-2017:00:00:00 AND 29-JAN-2018:00:00:00; BETWEEN 30-JAN-2018:00:00:00 AND 01-MAR-2018:00:00:00

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3	(STIS.sp.1005285)	(1) V-GM-AUR	STIS/CCD, ACCUM, 52X2	G750L 7751 A	CR-SPLIT=2			8 Secs (8 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
4		CCDFLAT	STIS/CCD, ACCUM, 0.3X0.09	G750L 7751 A				*[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
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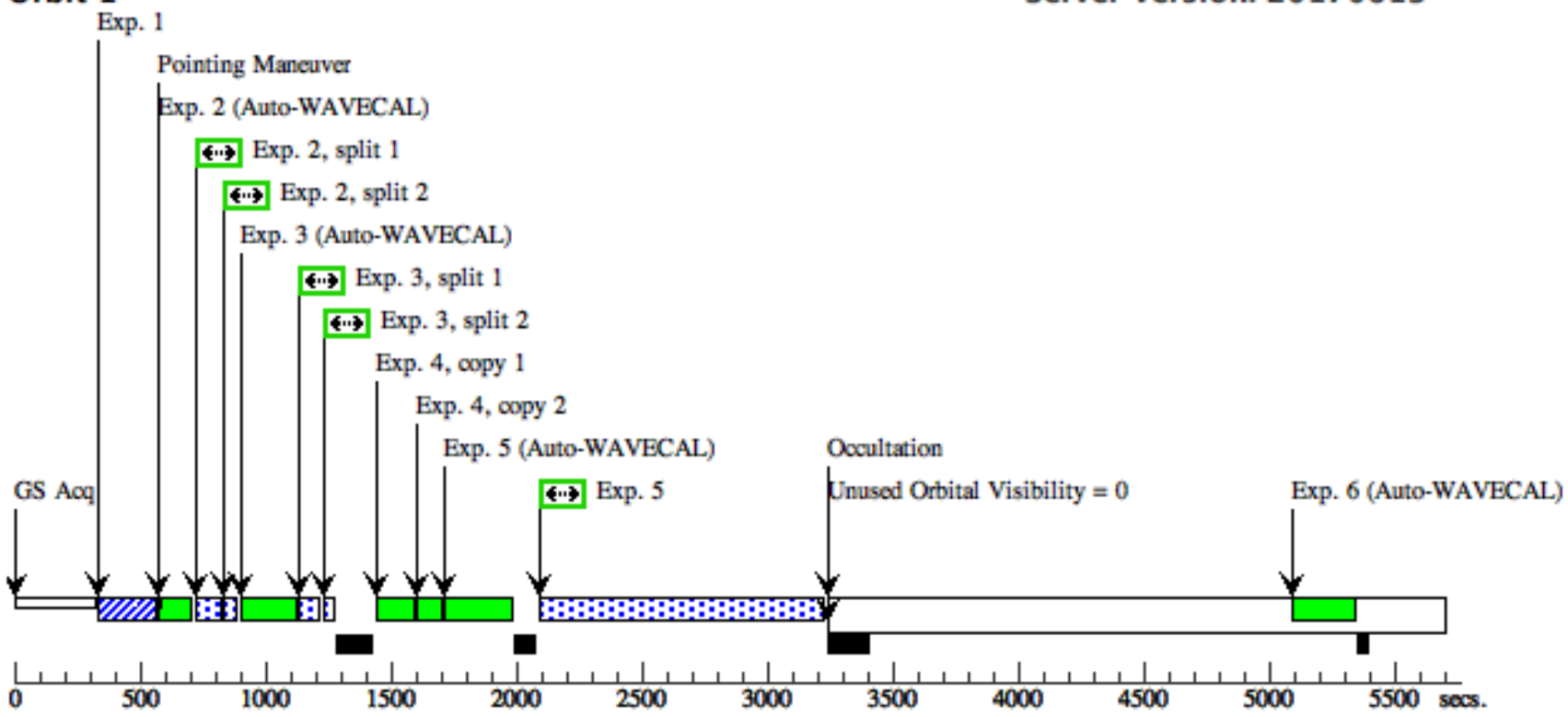
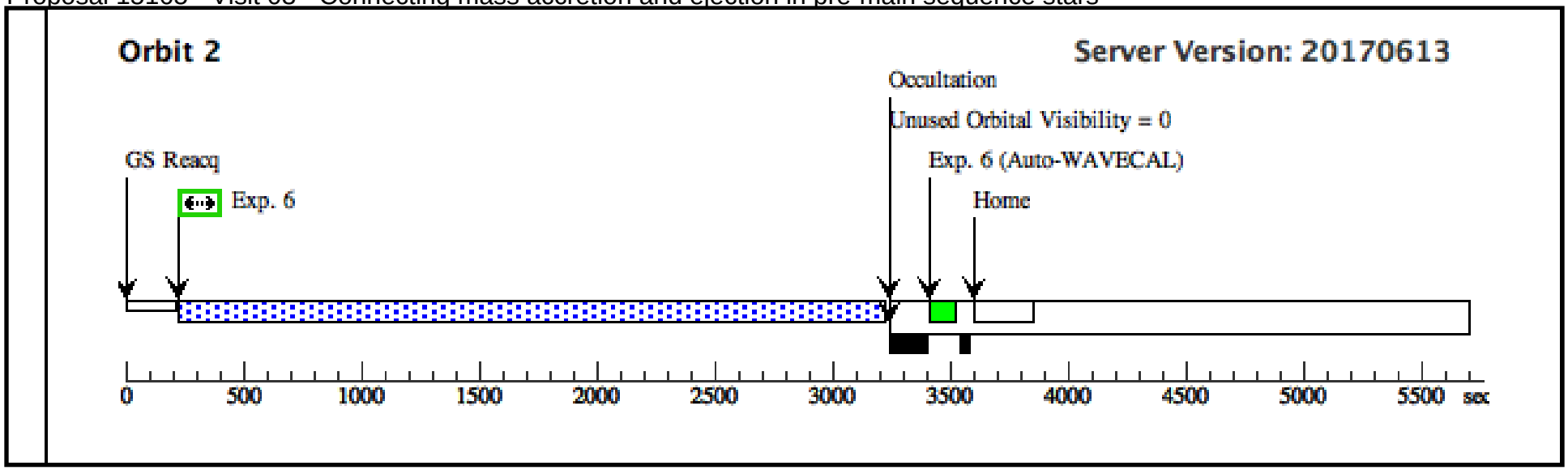
Orbit Structure




Orbit 2
Server Version: 20170613
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 6
Exp. 6 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec