11607 - Ly-alpha propagation in the planet-forming region of a circumstellar disk

Cycle: 17, 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) V-TW-HYA	STIS/CCD STIS/FUV-MAMA	3	23-Nov-2009 21:21:11.0	yes
02	(2) WD-1056-384	STIS/CCD STIS/FUV-MAMA	3	23-Nov-2009 21:21:18.0	yes

6 Total Orbits Used

ABSTRACT

We propose using STIS to spectrally image the radial profile of resonantly scattered Lyman-alpha from the protoplanetary disk of TW Hya.
Recent HST results have demonstrated that strong Lyman-alpha emission dominates the FUV radiation field of TW Hya. This has significant consequences for the

chemical equilibrium of key species such as water within the planet-forming zone. Exploratory radiative transfer modeling predicts that the dominant Lyman-alpha component should resonantly scatter from the atomic layers of such disks at levels easily detectable with STIS. Using careful PSF subtraction, S/N ratios greater than 5 should be obtainable between 6-25AU from the central star. A detection of extended, resonantly scattered Lyman-alpha will reveal new information about the disk properties that cannot be obtained directly from other methods of observation. This includes constraining the morphology of the upper layers of the gas disk and possibly revealing the existence of a puffed-up inner disk. We will also be able to place limits on the Lyman-alpha flux driving chemistry in the disk interior.

OBSERVING DESCRIPTION

We require high SNR, spatially resolved spectra of the Ly-alphga emission in the vicinity of the star TW Hya. To extract the Ly-alpha excess above the stellar PSF we use PSF subtraction by obtaining the instrument PSF from a WD. The basic observations employ long slit spectroscopy using STIS FUV-MAMA, the 52x0.2" slit, and the G140M grating which will select the Ly-alpha spectrum (that must be subsequently separated from the continuum emission in the case of TW Hya). This requires an identical sequence of exposures for TW Hya and the WD.

Long slit observation will be made at offset -0.4,-0.2,0,0.2,0.4" relative to each star. This is achieved by defining a single perpendicular-to-slit pattern. In general the exposures are limited by available orbits, although the SNR will be enhanced by integrating over wavelength space. Regardless, the Ly-alpha line of TW Hya is sufficiently broad (~400km/s) to be resolved by the G140M grating.

The most important exposure is the 0 offset, which has the longest exposure times. The other offsets are provided to reveal (albeit crudely) any 2D asymmetries in TW Hya's emission.

The Peak-up exposure for TW Hya employs the G430L and may provide usual scientific information regarding the accretion rate.

REAL TIME JUSTIFICATION

None.

CALIBRATION JUSTIFICATION

None.

Visit

Proposal 11607, Visit 01, scheduling Tue Nov 24 02:21:23 GMT 2009

Diagnostic Status: Warning

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

Special Requirements: (none)

Comments: TW Hya visit. Acquisition followed by Peak-up followed by series of five offset science exposures from -0.4 to +0.4"

Diagnostics

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

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

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(3)
	Purpose=DITHER	Pattern Orientation=0.0		
	Number Of Points=5	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-TW-HYA	RA: 11 01 51.9063 (165.4662763d)	Proper Motion RA: -0.0054s/yr	V=11.1	Reference Frame: ICRS
	Alt Name1: CD34D7151	Dec: -34 42 17.02 (-34.70473d)	Proper Motion Dec: -0.01236"/yr	B=11.8	
		Equinox: J2000	Epoch of Position: 1997		

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

Proper motions and fluxes from Simbad entry.

Proper motion RA has been transformed from arsec/yr to sec/yr

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TW Hya ACQ	(1) V-TW-HYA	STIS/CCD, ACQ, F28X50OIII	MIRROR				6 Secs	
								[==>]	***[1]***

Comments: ACQ ETC used to calculate ACQ exposure time.

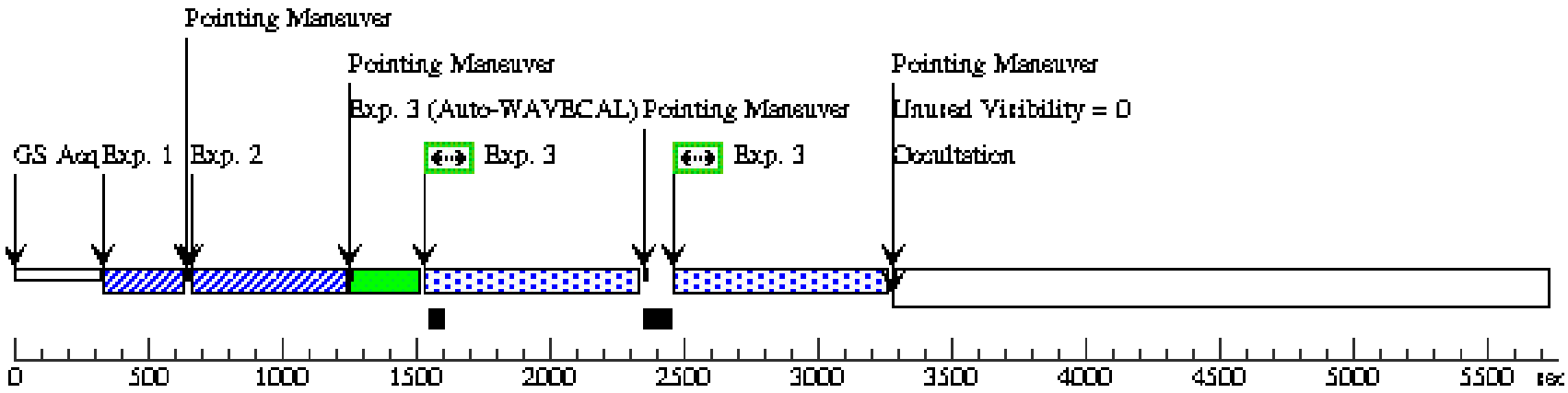
Trebled time required for SNR=40, as recommended.

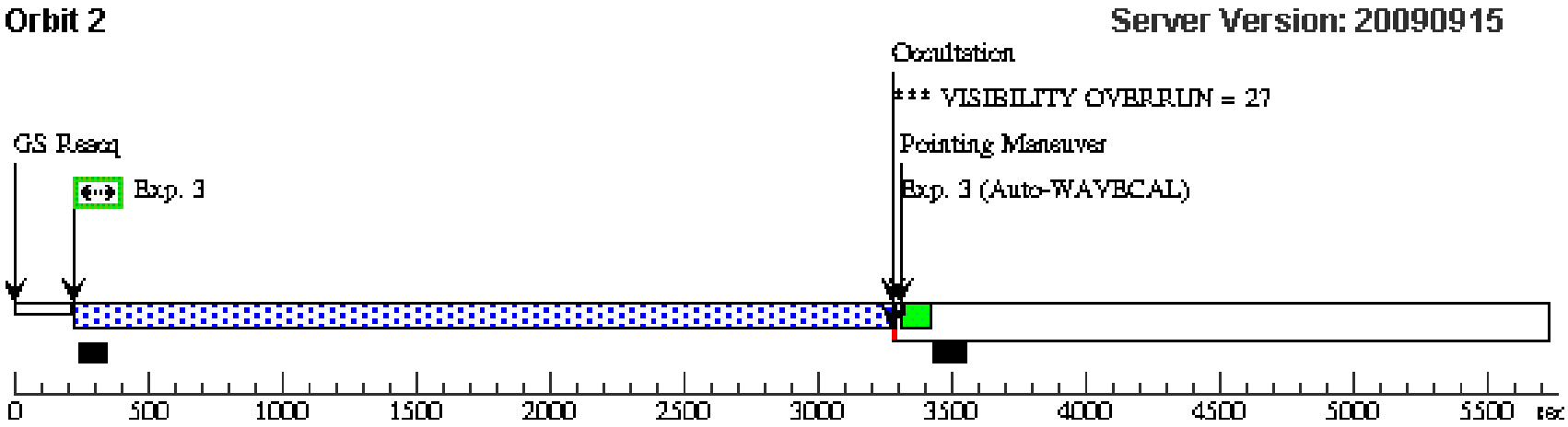
2	TW Hya ACQ Peak	(1) V-TW-HYA	STIS/CCD, ACQ/PEAK, 52X0.05	G430L 4300 A				15 Secs	
								[==>]	***[1]***

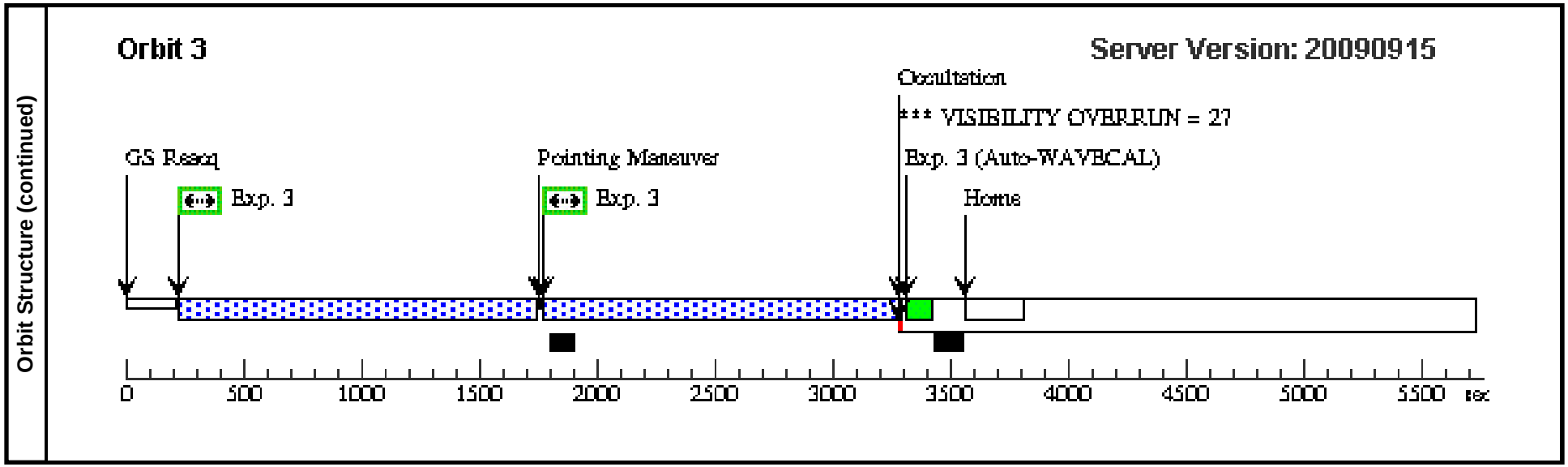
Comments: STIS Spectroscopic ETC used. Exposure time treble that required for SNR=40.

3	TW Hya ACCUM science	(1) V-TW-HYA	STIS/FUV-MAMA, ACCUM, 52X0.2	G140M 1222 A			Pattern 1, Exps 3-3 (1)	1000 Secs	
								[==>788.0 Secs (Pattern 1)] *[==>788.0 Secs (Pattern 2)]*	***[1]***
								[==>3058 Secs (Pattern 3)]	***[2]***
								[==>1504.0 Secs (Pattern 4)] *[==>1504.0 Secs (Pattern 5)]*	***[3]***

Orbit Structure






Orbit Structure (continued)
Orbit 3
Server Version: 20090915
Occultation
*** VISIBILITY OVERRUN = 27
GS Reacq
Exp. 3
Pointing Maneuver
Exp. 3
Exp. 3 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 11607, Visit 02, scheduling Tue Nov 24 02:21:24 GMT 2009

Diagnostic Status: Warning

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

Special Requirements: SAME ORIENT AS 01

Comments: Visit WD 1056-384. Same sequence of exposures as visit 1, although the acquisition filters/gratings differ.

This visit uses a special requirement on the orientation.

Diagnostics

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

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

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(3)
	Purpose=DITHER	Pattern Orientation=0.0		
	Number Of Points=5	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	WD-1056-384	RA: 10 58 20.1100 (164.5837917d)	Proper Motion RA: -0.013s/yr	V=14.0	Reference Frame: ICRS
	Alt Name1: GSC-07724-01874	Dec: -38 44 25.10 (-38.74031d)	Proper Motion Dec: 0.0324"/yr		
		Equinox: J2000	Epoch of Position: 2006		

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

Coordinates were updated to more accurate and recent (2006-2007 epoch observations) J2000/ICRS coordinates to meet STIS accuracy requirements.

Coordinates and proper motions taken from Landolt 2007 AJ. Proper motion RA has been converted from arcsec/yr to sec/yr.

Chosen for its proximity to Target 1 (TW Hya).

This object is used primarily to obtain the instrument PSF.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	WD 1056-384 ACQ	(2) WD-1056-384	STIS/CCD, ACQ, F28X50LP	MIRROR				0.4 Secs	
								[==>]	***[1]***

Comments: Exposure time calculated using ACQ ETC.

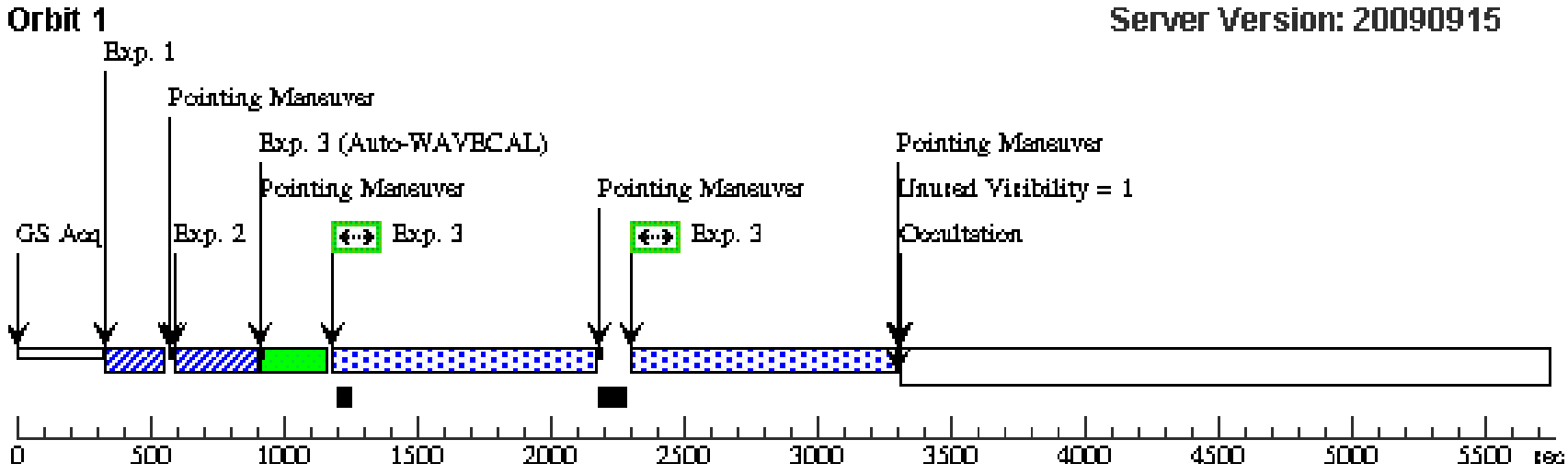
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	WD 1056-384 ACQ Peak	(2) WD-1056-384	STIS/CCD, ACQ/PEAK, 52X0.05	MIRROR				1.5 Secs	
								[==>]	***[1]***

Comments: ACQ PEAK ETC used. Exposure time (for SNR=40) multiplied by five.

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
3	WD 1056-3 84 ACCUM	(2) WD-1056-384	STIS/FUV-MAMA, ACCUM, 52X0.2	G140M 1222 A			Pattern 1, Exps 3-3 (1)	10 Secs	
								[==>977 Secs (Pattern 1)] *[==>977 Secs (Pattern 2)]*	*[1]*
								[==>3085 Secs (Pattern 3)]	*[2]*
								[==>1517 Secs (Pattern 4)] *[==>1517 Secs (Pattern 5)]*	*[3]*

Orbit Structure



Orbit Structure (continued)