



14603 - Ultraviolet fluxes and dynamical structure in the pulsating atmosphere of helium star V652 Her

Cycle: 24, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Prof. C Simon Jeffery (PI) (ESA Member) (Contact)	Armagh Observatory	csj@arm.ac.uk

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) V-V652-HER WAVE	STIS/CCD STIS/FUV-MAMA	4	30-Nov-2016 21:01:08.0	yes
02	(1) V-V652-HER WAVE	STIS/CCD STIS/FUV-MAMA	4	30-Nov-2016 21:01:13.0	yes

8 Total Orbits Used

ABSTRACT

V652 Her is a B-type extreme helium star which pulsates with a period of 154 minutes and a velocity amplitude of 70 km/s. It is believed to have formed from the merger of two helium white dwarfs, and to be the progenitor of a helium-rich hot subdwarf. Its remarkable velocity curve consists of a short shocked acceleration followed by near-ballistic deceleration. Optical spectroscopy has recently resolved dynamical structure within the pulsating photosphere.

In contrast, the radius and mass of V652 Her have been measured with a precision seriously limited by sparse low-resolution IUE photometry. To measure the mass to better than ± 0.1 Msun, constrain the progenitor binary and test the physics of the hydrodynamic pulsation model, a precise measurement of the total flux variation throughout the pulsation cycle is vital.

We propose a series of time-resolved HST/STIS ultraviolet observations. These will measure the effective temperature and angular radius with a phase resolution of 0.025 cycles and precision comparable to the velocities provided by recent optical spectroscopy. The shifted and co-added spectrum will explore the surface abundances of iron-group and heavier elements, and hence address questions of origin and evolution. Unleashing the full power of tomography, the dynamical behaviour of the CIV and SiIV absorption lines, formed at optical depths 100 times smaller than the optical helium lines, will be used to explore how pulsations propagate to the outermost layers of the atmosphere and, possibly, into the wind itself.

OBSERVING DESCRIPTION

The objective is to obtain time-resolved ultraviolet spectroscopy of a pulsating variable star, with particular emphasis on resolving photospheric structure around minimum radius. The pulsation period is circa 9200 seconds.

The fast acceleration passage through minimum radius lasts for less than 900 seconds.

The observations will be accomplished in two visits, each of four orbits ... the limit being imposed by the SAA.

The gap between visits is not crucial; however, there are constraints on the overall starting orbit in each block.

Repeat observations will be made throughout each visit with HST/STIS MAMA-FUV G140M + 0.2x0.06.

The aim is to observe 95% of all pulsation phases at least three times over, and 100 % at least two times over, which should deliver $S/N \sim 20$ with a phase resolution of approx 0.05 cycles at good spectral resolution between 1300 and 1600 Å.

Ideally, we should observe pulsation phases 0.0 - 0.25 four times over.

At present, we have selected exposure times of c. 250s, adjusted locally to optimally fill each orbit.

Timing Constraint: If the first orbit is chosen poorly, the critical phase through minimum radius will only be observed twice (rather than three or four times). In practical terms, it is necessary to avoid either block

commencing at a time corresponding to pulsation phases $0.35 < \phi < 0.70$.

Given a list of orbit start times, we can compute the pulsation phase at the start of each orbit, using the ephemeris given by Jeffery et al. 2015, MNRAS 447, 2836 and the appropriate heliocentric time correction..

There is also a probability that an auto-wavecal will interrupt a sequence during minimum radius.

We have to live with this.

Proposal 14603 - V652 Her - STIS (01) - Ultraviolet fluxes and dynamical structure in the pulsating atmosphere of helium star V652 Her

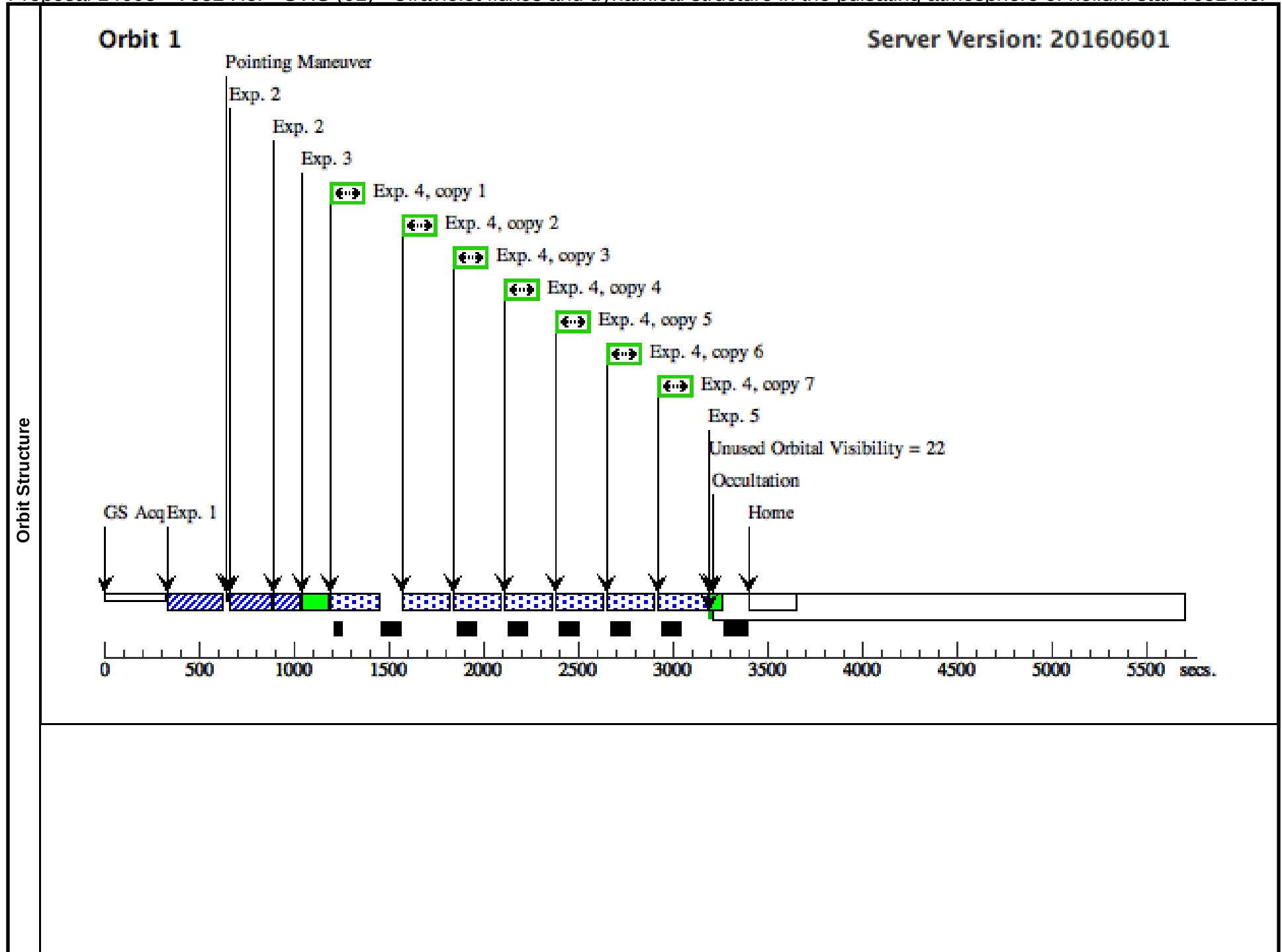
Visit	Proposal 14603, V652 Her - STIS (01), implementation					Thu Dec 01 02:01:15 GMT 2016
	Diagnostic Status: No Diagnostics					
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA					
	Special Requirements: Period 0.10683759 D AND ZERO-PHASE HJD2457993.00064394102					
	Comments: Both visits have a timing requirement -- specifically, to ensure that Rmin is observed twice, the start of the first orbit must not coincide with pulsation phases between 0.30 and 0.90. This has been specified in the Visit Timing Requirement so that T0 corresponds to phase -0.30 and the allowed phases are then transposed to lie between 0 and 0.40.					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	V-V652-HER	RA: 16 48 4.6933 (252.0195554d)	Proper Motion RA: -4.32 mas/yr	V=10.51+/-0.01	Reference Frame: ICRS
			Dec: +13 15 42.41 (13.26178d)	Proper Motion Dec: 3.17 mas/yr	Mean flux between 1300 and 1400 A varies between 3.7E-12 and 5.1E-12 ergs/s/cm^2/A (IUE low resolution data)	
			Equinox: J2000	Epoch of Position: 2000		
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.					
	Extended=NO					

Proposal 14603 - V652 Her - STIS (01) - Ultraviolet fluxes and dynamical structure in the pulsating atmosphere of helium star V652 Her

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Acquisition (STIS.ta.827 646)	(1) V-V652-HER	STIS/CCD, ACQ, F25ND3	MIRROR		PHASE 0 TO 0.4		1 Secs (1 Secs) [==>]	[1]
	2	Acquisition/ Peakup (STIS.ta.827 673)	(1) V-V652-HER	STIS/CCD, ACQ/PEAK, 0.2X0.06	MIRROR				0.1 Secs (0.1 Secs) [==>]	[1]
	3	WAVECAL	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A				20 Secs (20 Secs) [==>]	[1]
	<i>Comments: During occultation.</i>									
	4	STIS Scienc e Exposures 7 x 245 (STIS.sp.82 7666)	(1) V-V652-HER	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A	WAVECAL=NO			245 Secs X 7 (1715 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)]	[1]
	<i>Comments: 1. ETC Run based on an IUE low-resolution spectrum obtained close to UV flux maximum.</i>									
	5	WAVECAL	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A				20 Secs (20 Secs) [==>]	[1]
	<i>Comments: During occultation.</i>									
	6	STIS Scienc e Exposures 11x235 (STIS.sp.82 7666)	(1) V-V652-HER	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A	WAVECAL=NO	NEW OBSET		235 Secs X 11 (2585 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)]	[2]
	<i>Comments: 1. ETC Run based on an IUE low-resolution spectrum obtained close to UV flux maximum.</i>									
	7	WAVECAL	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A				20 Secs (20 Secs) [==>]	[2]
	<i>Comments: During occultation.</i>									

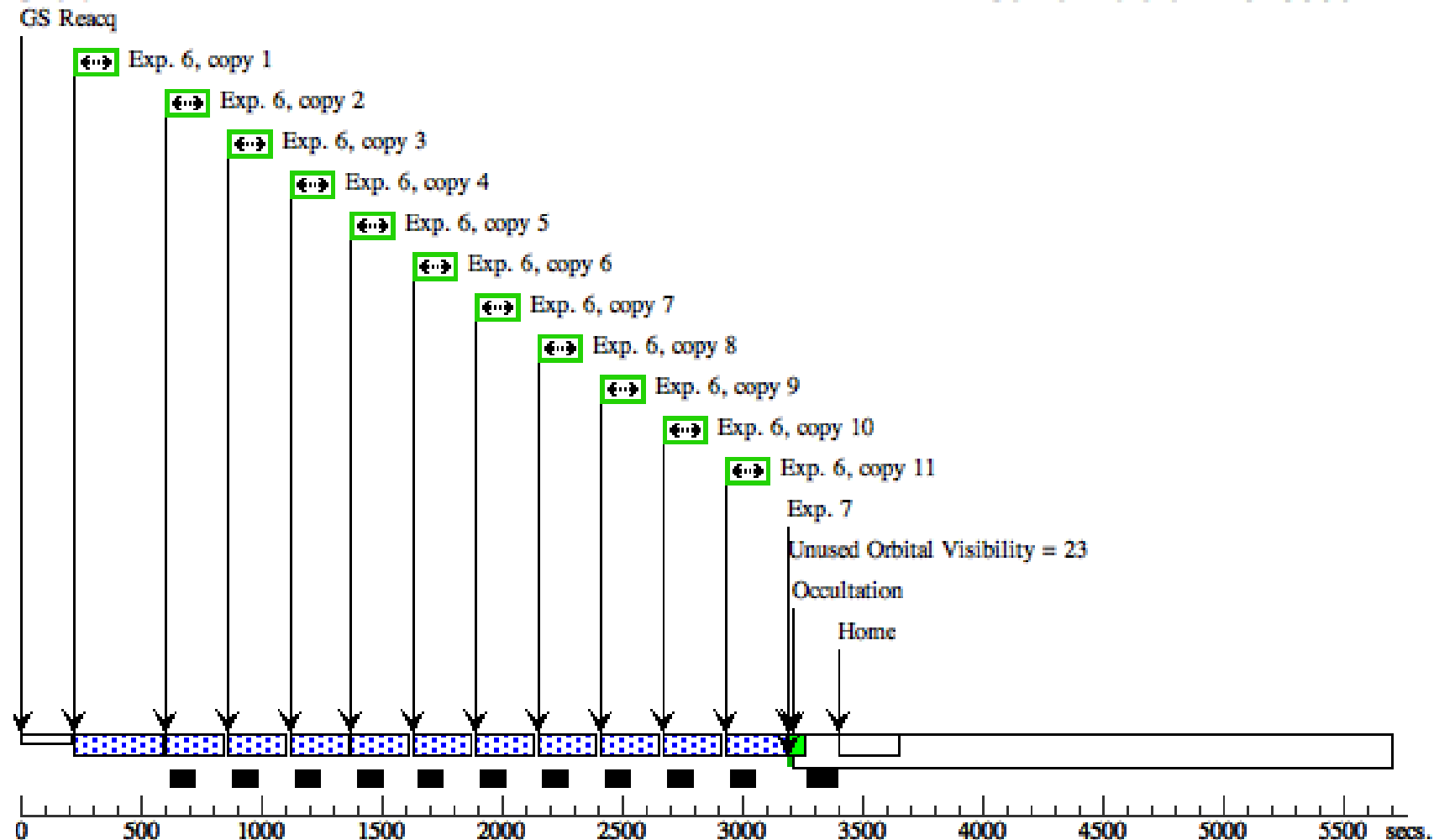
Proposal 14603 - V652 Her - STIS (01) - Ultraviolet fluxes and dynamical structure in the pulsating atmosphere of helium star V652 Her

8	STIS Science Exposures 11x235 (STIS.sp.82 7666)	(1) V-V652-HER	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A	WAVECAL=NO	NEW OBSET	235 Secs X 11 (2585 Secs)		[3]
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							[==>]		
Comments: During occultation.									



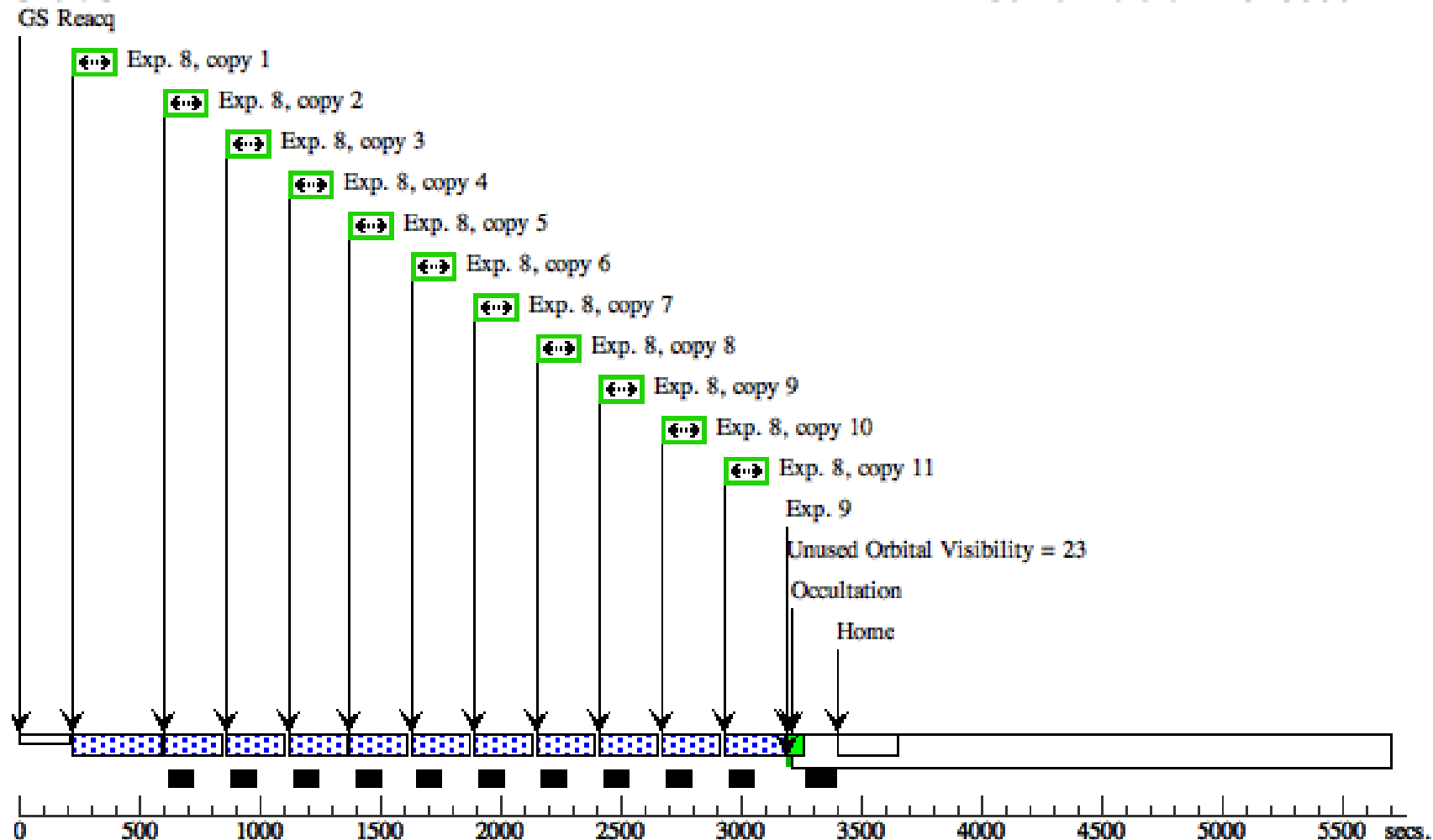
Orbit 2

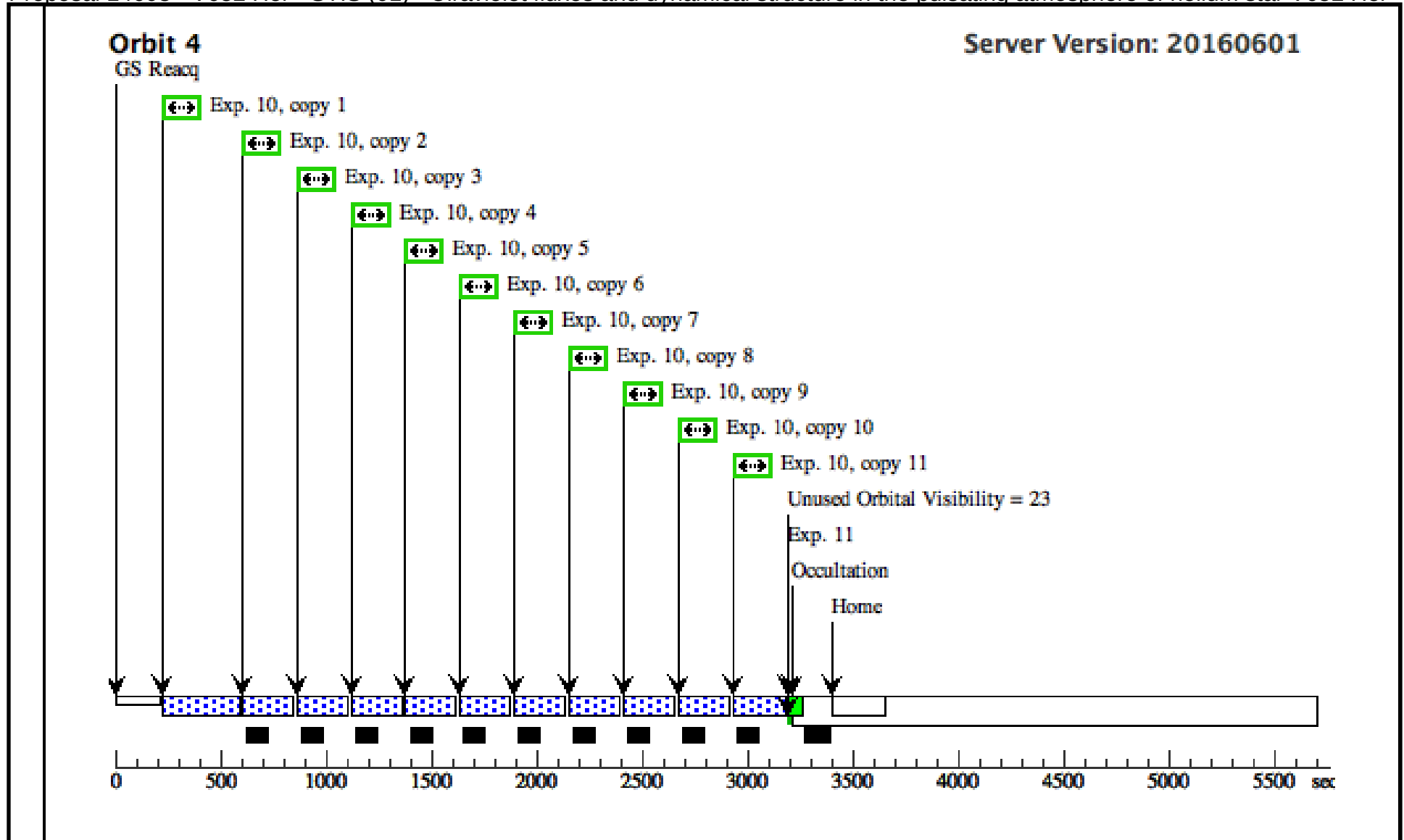
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Orbit 3

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Proposal 14603 - V652 Her - STIS (02) - Ultraviolet fluxes and dynamical structure in the pulsating atmosphere of helium star V652 Her

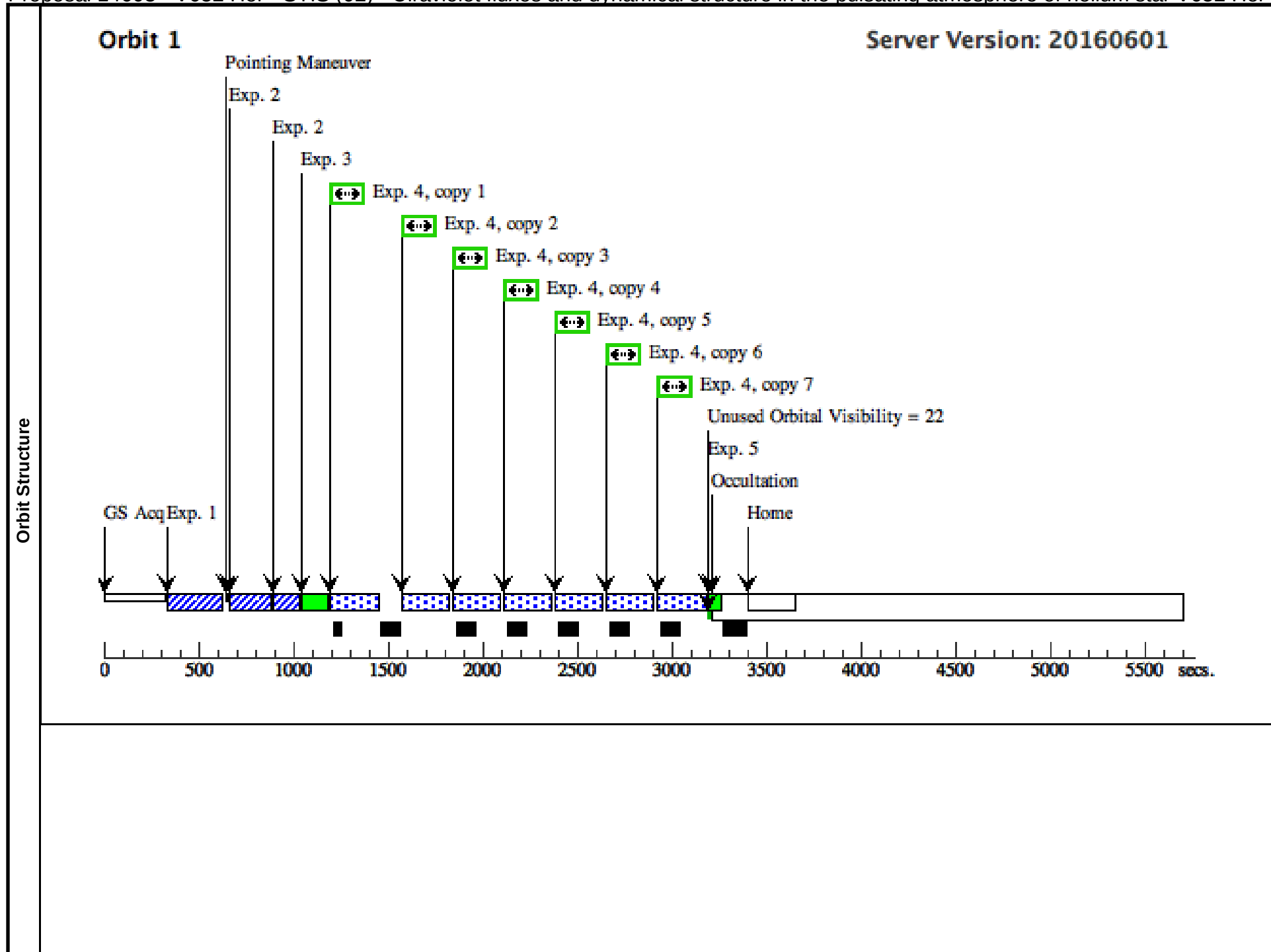
Visit	Proposal 14603, V652 Her - STIS (02)					Thu Dec 01 02:01:16 GMT 2016
	Diagnostic Status: No Diagnostics					
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA					
	Special Requirements: Period 0.10683759 D AND ZERO-PHASE HJD2457993.00064394102					
	Comments: Both visits have a timing requirement -- specifically, to ensure that Rmin is observed twice, the start of the first orbit must not coincide with pulsation phases between 0.30 and 0.90. This has been specified in the Visit Timing Requirement so that T0 corresponds to phase -0.30 and the allowed phases are then transposed to lie between 0 and 0.40.					
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			Equinox: J2000	Epoch of Position: 2000		
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Extended=NO					

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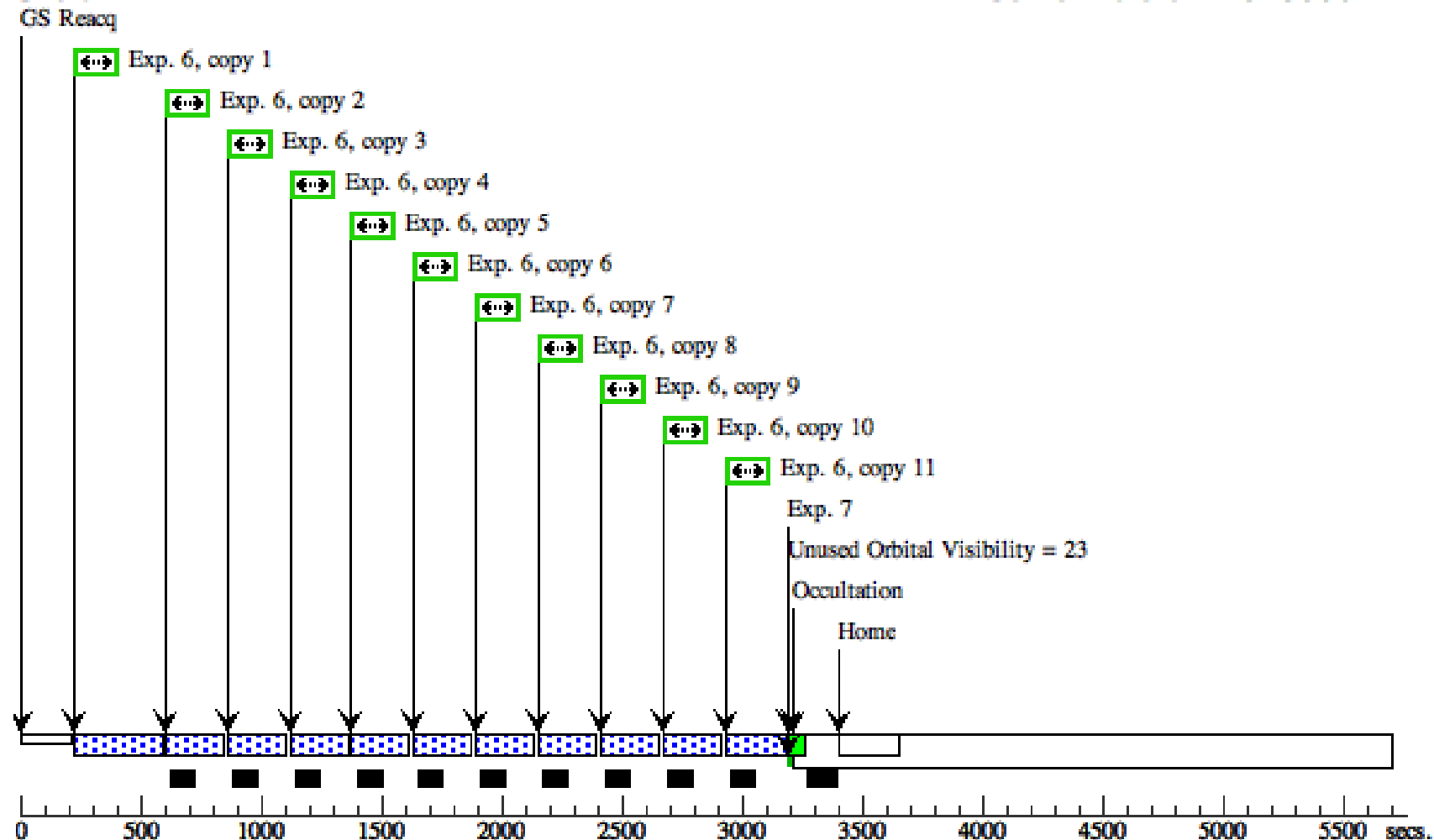
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Comments: 1. ETC Run based on an IUE low-resolution spectrum obtained close to UV flux maximum.									
11	WAVECAL WAVE		STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A			20 Secs (20 Secs)		[4]
							[==>]		
Comments: During occultation.									



Orbit 2

Server Version: 20160601



Orbit 3

Server Version: 20160601

GS Reacq

