17107 - A very low mass, highly irradiated survivor of the common envelope phase

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Prof. Boris T. Gaensicke (PI) (ESA Member) (Contact)	**The University of Warwick**
Prof. Tom R. Marsh (CoI) (ESA Member)	The University of Warwick
Dr. Nicole Reindl (CoI) (ESA Member)	Universitat Potsdam
Dr. Veronika Schaffenroth (CoI) (ESA Member)	Thuringer Landessternwarte Tautenburg (TLS)

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) WDJ200328.97+083847.22	STIS/CCD STIS/FUV-MAMA	3	14-Jun-2024 12:00:16.0	yes
02	(1) WDJ200328.97+083847.22	STIS/CCD STIS/FUV-MAMA	3	14-Jun-2024 12:00:17.0	yes
52	(1) WDJ200328.97+083847.22	STIS/CCD STIS/FUV-MAMA	3	14-Jun-2024 12:00:18.0	yes

9 Total Orbits Used

ABSTRACT

The common envelope (CE) phase is a key driver in the evolution of close binary stars, causing their periods to shrink dramatically, or the two stars to merge altogether. An important parameter for the survival of many systems, including planets enveloped by host giant branch stars, is the minimum companion mass that can survive a CE. No certain survivor of a CE has been found with a mass less than 50 Jupiter masses (M_J), well above the lowest theoretical prediction of 5 M_J. With the theory itself uncertain, it is important to establish firmer observational limits. A recently

discovered hot white dwarf / brown dwarf binary with a period of 2.4 hours promises to do just this. Optical data of this system indicate a mass for the brown dwarf lying between 11 and 44 M_J. Better constraints require a measurement of the temperature of the hot white dwarf, which translates to a better mass for the brown dwarf through a combination of distance, model atmosphere, gravitational red-shift and dynamical constraints. Preliminary indications from optical spectra suggest a white dwarf temperature of order 100,000 K and a brown dwarf mass of order 20 M_J, substantially reducing the current gap between theory and observation. However, optical spectra have relatively few and weak features compared to the FUV, and suffer significant contamination from light emitted by the heated face of the brown dwarf in this compact system. The aim of this proposal is to acquire FUV spectra to measure the white dwarf's effective temperature and to obtain improved values for the dynamical and red-shift constraints upon which the mass estimates hinge.

OBSERVING DESCRIPTION

The goal of this proposal is to obtain far-ultraviolet, orbital phase-resolved, high-resolution spectroscopy of WD 2003+0838 to measure the effective temperature and orbital velocity of the white dwarf, in order to determine its mass and hence the mass of its brown dwarf companion, and to look for evidence of mass loss and/or accretion in the system and circumstellar material.

The observations will be split into 2 x 3 orbits, following standard STIS procedures: target acquisition with the F28X50LP long-pass filter, followed by E140M time-tag spectroscopy (such that we can bin the data into arbitrary phase bins during the analysis) using the 0.2"x0.2" aperture. The two visits can be scheduled totally independently.

Visit

Proposal 17107, Visit 1 (01), implementation Fri Jun 14 16:00:19 GMT 2024

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

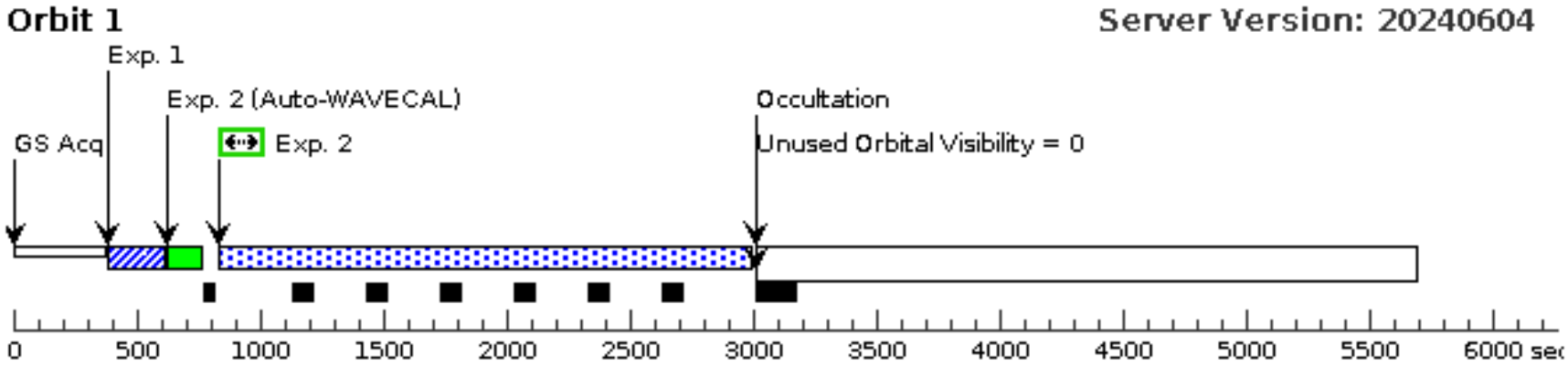
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ200328.97+083847.22	RA: 20 03 28.9775 (300.8707396d) Dec: +08 38 46.97 (8.64638d) Equinox: J2000	Proper Motion RA: 3.018 mas/yr Proper Motion Dec: -15.695 mas/yr Epoch of Position: 2016	V=14.1+/-0.05 GALEX NUV=13.5	Reference Frame: ICRS

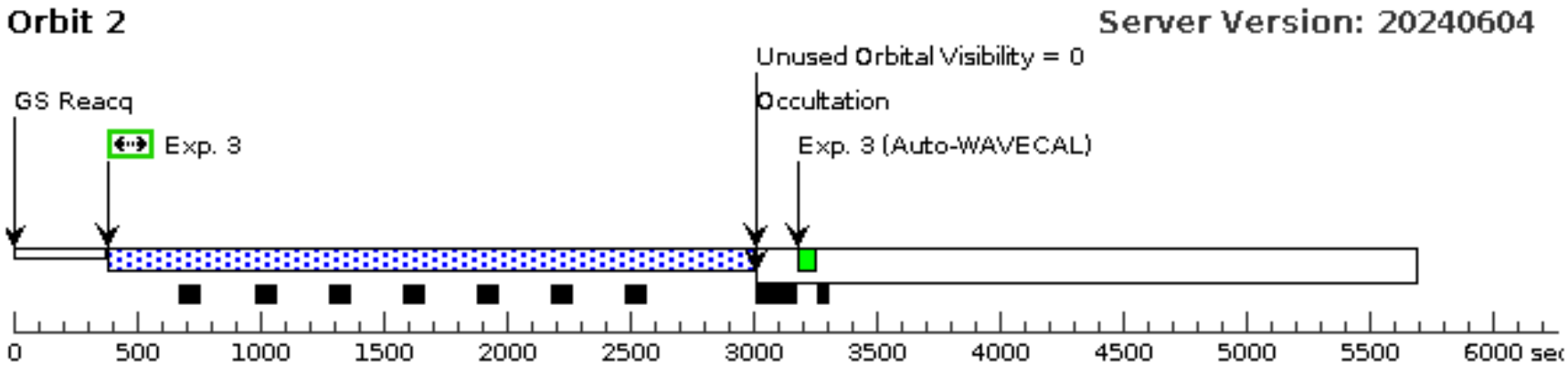
Comments: Coordinates and proper motions were taken from Gaia EDR3.
Category=STAR
Description=[DA]
Extended=NO

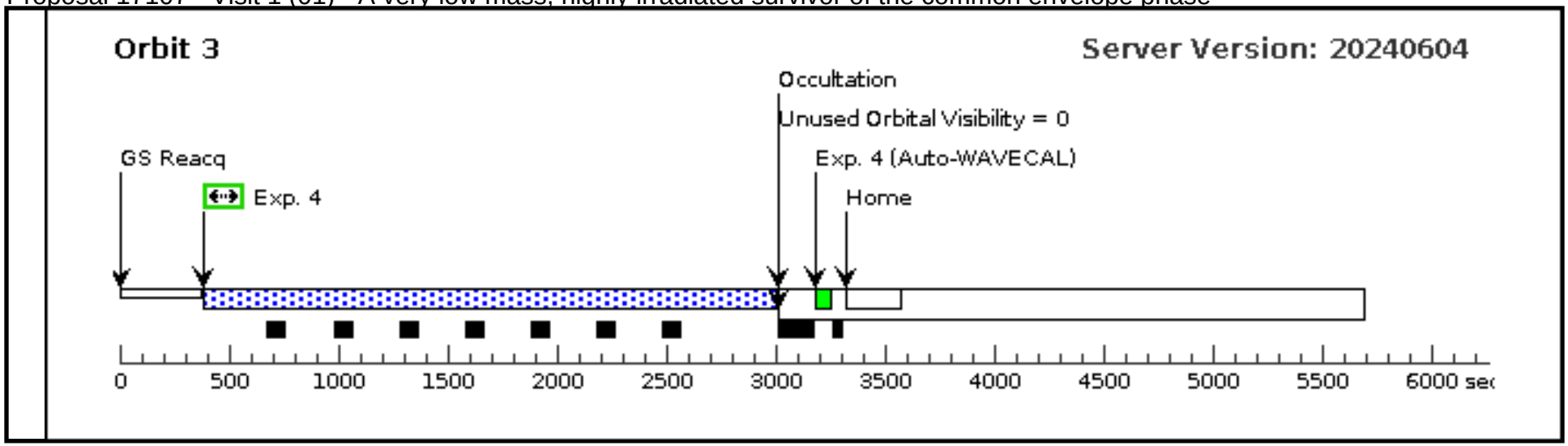
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	STIS/ACQ (STIS.ta.1809530)	(1) WDJ200328.97+083847.22	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			0.5 Secs (0.5 Secs) *[==>]*	*[1]*
	Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to V=14.1 for the STIS ETC calculation.								
2	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2269 Secs (2147 Secs) *[==>2147.0 Secs]*	*[1]*
	Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.								
3	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2723 Secs (2600 Secs) *[==>2600.0 Secs]*	*[2]*
	Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.								
4	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2723 Secs (2600 Secs) *[==>2600.0 Secs]*	*[3]*
	Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.								

Orbit Structure






Orbit 3
Server Version: 20240604
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 4 (Auto-WAVECAL)
Exp. 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17107, Visit 2 (02), failed Fri Jun 14 16:00:19 GMT 2024

Diagnostic Status: Warning

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

Special Requirements: (none)

Diagnostics

(Visit 2 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 2 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 2 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ200328.97+083847.22	RA: 20 03 28.9775 (300.8707396d) Dec: +08 38 46.97 (8.64638d) Equinox: J2000	Proper Motion RA: 3.018 mas/yr Proper Motion Dec: -15.695 mas/yr Epoch of Position: 2016	V=14.1+/-0.05 GALEX NUV=13.5	Reference Frame: ICRS

Comments: Coordinates and proper motions were taken from Gaia EDR3.
Category=STAR
Description=[DA]
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/ACQ (STIS.ta.1809530)	(1) WDJ200328.97+083847.22	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			0.5 Secs (0.5 Secs) *[==>]*	***[1]***

Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to V=14.1 for the STIS ETC calculation.

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
2	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2269 Secs (2269 Secs) *[==>]*	***[1]***

Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.

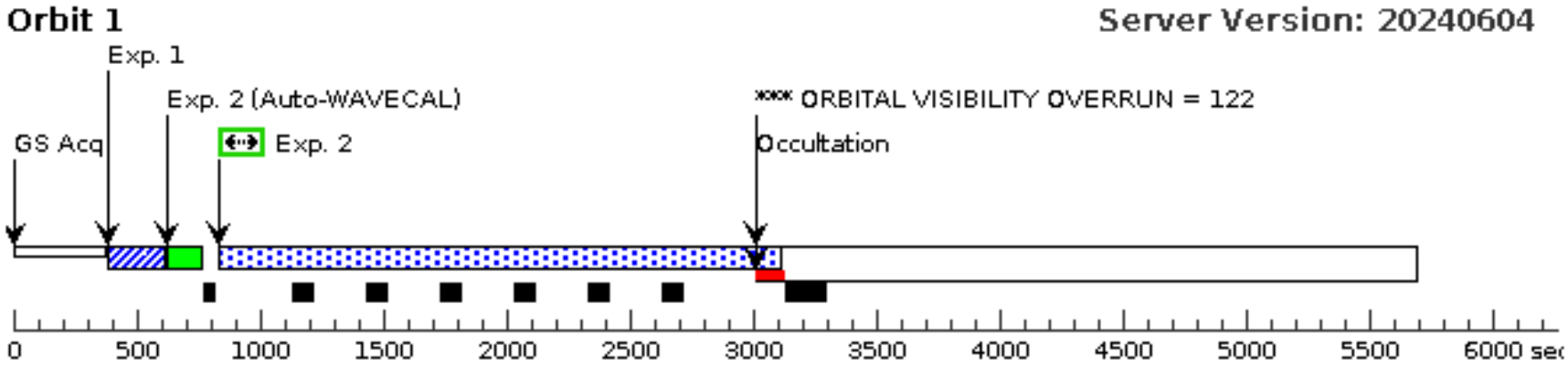
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
3	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2723 Secs (2723 Secs) *[==>]*	***[2]***

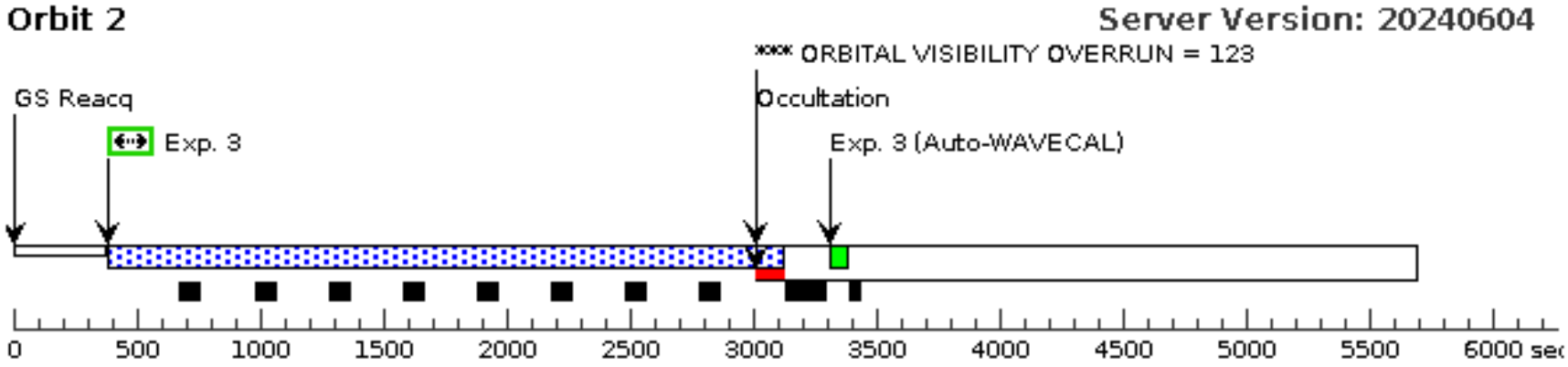
Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.

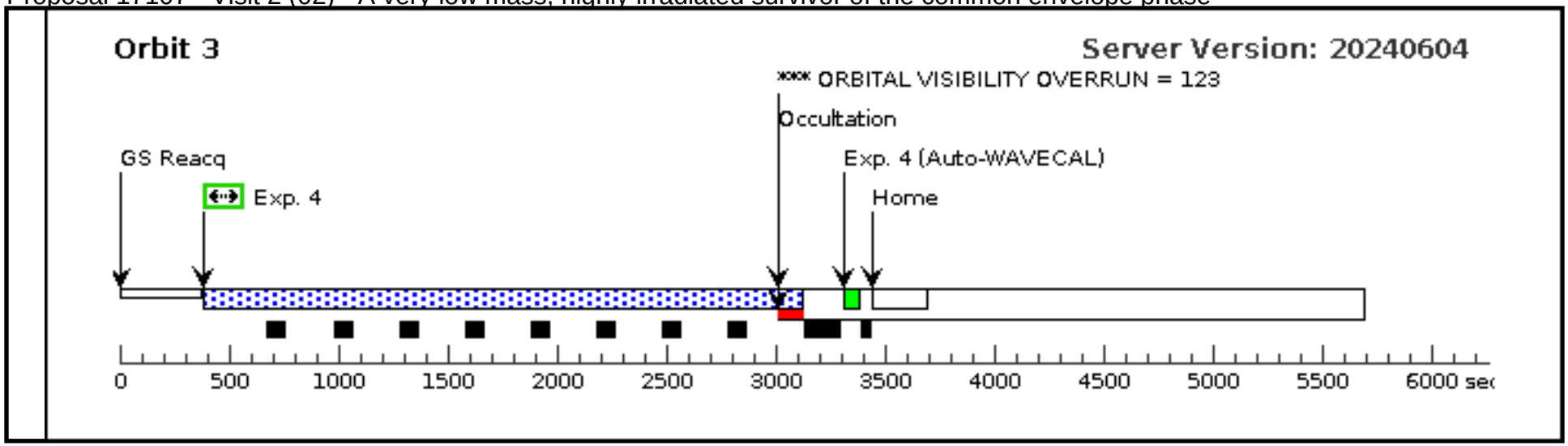
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
4	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2723 Secs (2723 Secs) *[==>]*	***[3]***

Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.

Orbit Structure






Orbit 3
Server Version: 20240604
**** ORBITAL VISIBILITY OVERRUN = 123
Occultation
GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17107, Visit 52 (52), implementation Fri Jun 14 16:00:19 GMT 2024

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Comments: HOPR repeat of visit 02.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ200328.97+083847.22	RA: 20 03 28.9775 (300.8707396d) Dec: +08 38 46.97 (8.64638d) Equinox: J2000	Proper Motion RA: 3.018 mas/yr Proper Motion Dec: -15.695 mas/yr Epoch of Position: 2016	V=14.1+/-0.05 GALEX NUV=13.5	Reference Frame: ICRS

Comments: Coordinates and proper motions were taken from Gaia EDR3.
Category=STAR
Description=[DA]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
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Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to V=14.1 for the STIS ETC calculation.									
2	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2269 Secs (2147 Secs) *[==>2147.0 Secs]*	***[1]***
Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.									
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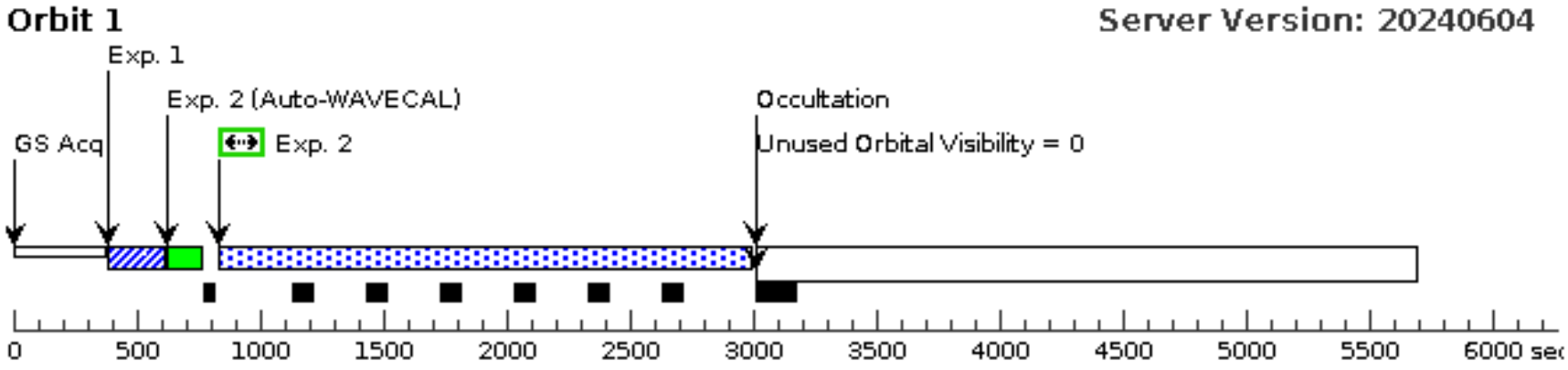
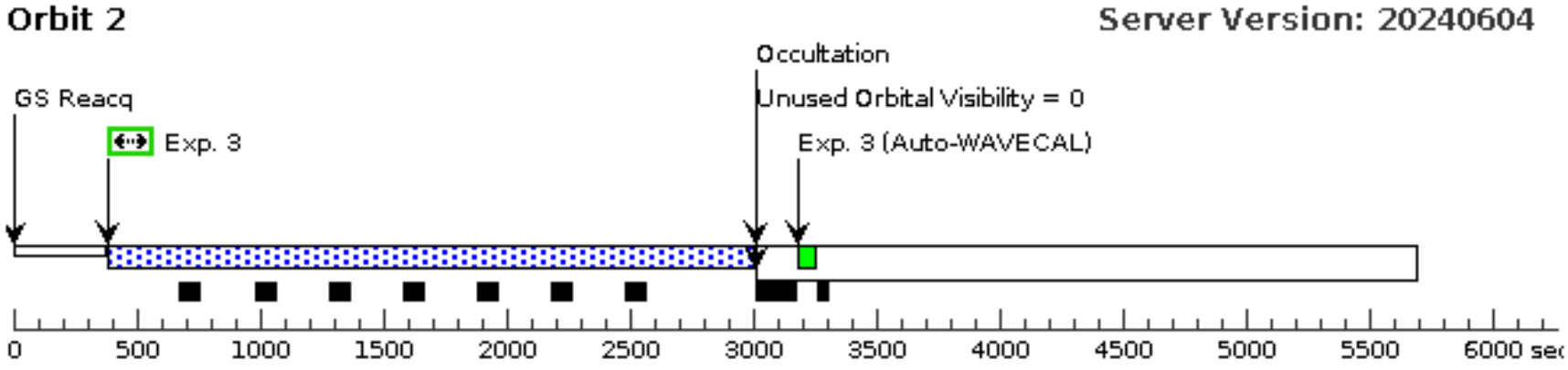
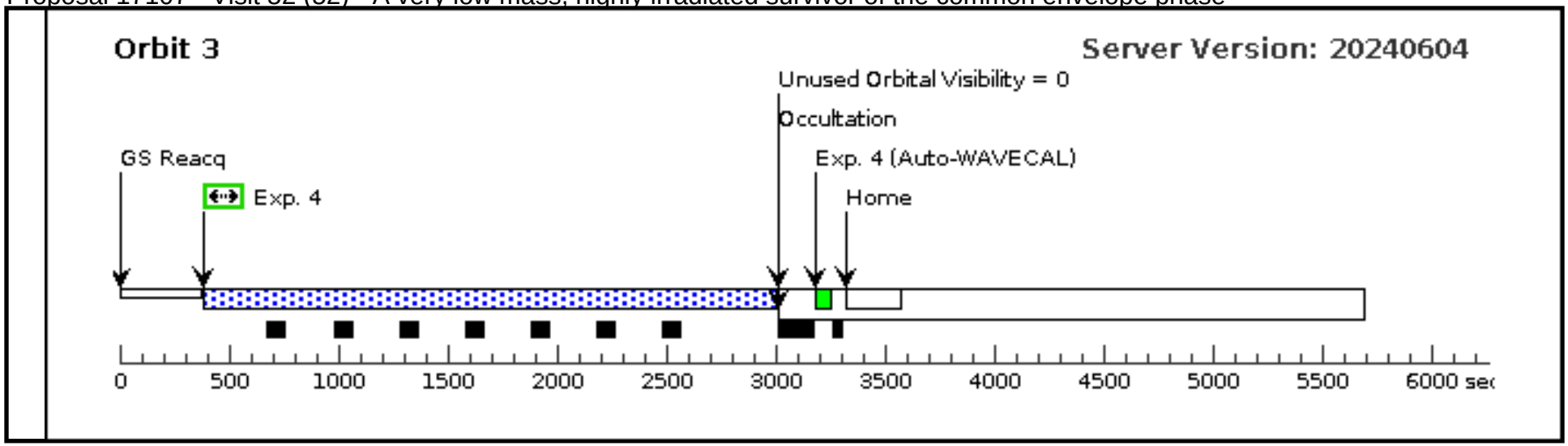
Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.									
4	STIS/E140M (STIS.sp.1809527)	(1) WDJ200328.97+083847.22	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140M 1425 A	BUFFER-TIME=300			2723 Secs (2600 Secs) *[==>2600.0 Secs]*	***[3]***
Comments: At the estimated Teff=100000K for the white dwarf in this binary, the spectrum will closely resemble a blackbody, hence we chose a blackbody with T=100000K and scaled it to GALEX NUV=13.5 for the STIS ETC calculation.									

Orbit Structure






Orbit 3
Server Version: 20240604
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec