16034 - Dissecting the evaporating atmosphere of a giant planet in a close orbit around a white dwarf with COS ultraviolet spectroscopy

Cycle: 27, Proposal Category: GO

(UV Initiative)

(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) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:13.0	yes
02	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:14.0	yes
03	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:14.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:15.0	yes
05	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:15.0	yes
06	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:16.0	yes
07	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:16.0	yes
08	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:16.0	yes
09	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:17.0	yes
10	(1) WDJ091405.30+191412.25	COS/FUV COS/NUV	1	04-Nov-2019 14:00:17.0	yes

10 Total Orbits Used

ABSTRACT

We have identified the first white dwarf that is photo-evaporating a close-in giant planet. The atmospheric material lost by the planet is detected via H, O, and S emission lines from a gaseous circumstellar disk, and we detect O and S in the white dwarf photosphere, indicating ongoing accretion from this disk. The accretion rate onto the white dwarf is ~3.3e9g/s, comparable to the mass loss rates of warm Neptunes. With a sub-solar upper limit of log(C/O)<-0.8, this planet may resemble warm low-metallicity Neptunes, such as HAT-P-26b.

The discovery of this system opens up the unprecedented opportunity to determine the atmospheric composition of a highly irradiated gas giant via spectroscopy of the material accreted by the white dwarf, and compare the resulting abundances with planetary atmosphere models. Optical spectroscopy is limited by the lack of strong metal transitions, and hence HST's access to the far-ultraviolet is critically important for this study. We therefore propose deep COS spectroscopy to measure the abundances, or derive upper limits, of C, N, Al, Si, P, Cl, Ti, V, Cr, Mn, Fe and Ni. These elements span the majority of atmospheric species and cloud condensates that may be present in the atmosphere of the planet.

This program should not be affected should HST move to a 2-gyro mode.

OBSERVING DESCRIPTION

The goal of these observations is to obtain a high signal-to-noise far-ultraviolet spectrum of the white dwarf WDJ0914+1914, which hosts, and evaporates a close-in giant planet. Some of the atmospheric material accretes onto the white dwarf, and the planned COS spectroscopy will be used to measure the abundances of that material from the sharp photospheric metal lines.

We use the G130M grating with two central wavelengths to maximise the wavelength covered by these observations, and to achieve gap-less coverage. We make use of all permitted FP-POS positions, i.e. 3 & 4 for @1291A, and 1,2,3,4 @ 1222A.

The expected period of the planet is ~15 days, and there is a chance that part of the evaporating atmosphere crosses our line-of-sight onto the white dwarf, which would result in the transient appearence of resonance absorption lines of O, S, C, or N. We therefore plan the observations as ten individual orbits with a separation of 1.3-1.7 days between them.

Visit

Proposal 16034, Visit 01 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

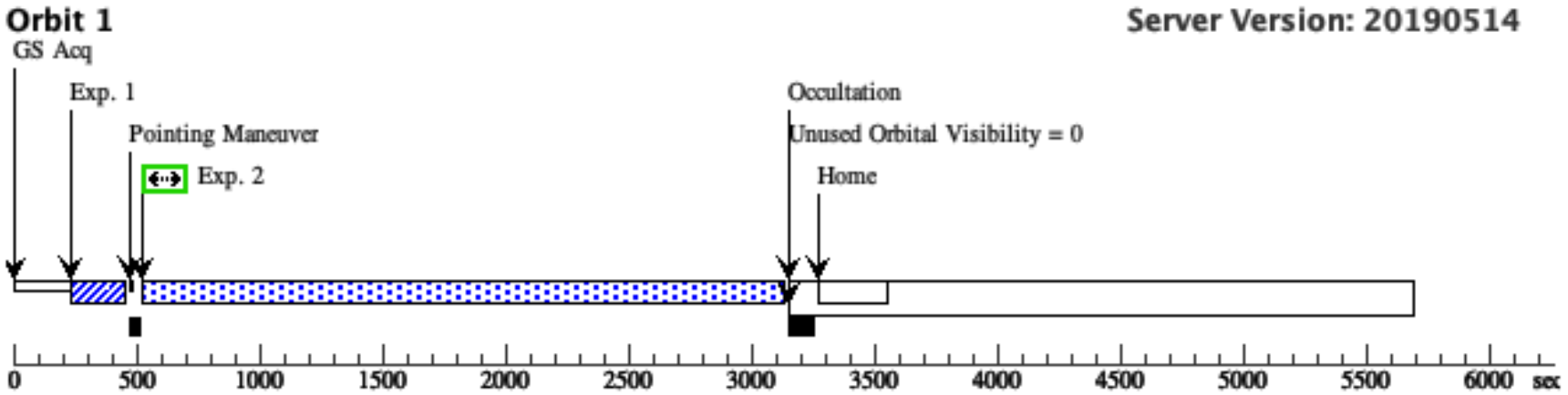
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390428)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2445; FP-POS=3			2445 Secs (2445 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 02 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_01 BY 1.3 D TO 1.7 D

Fixed Targets

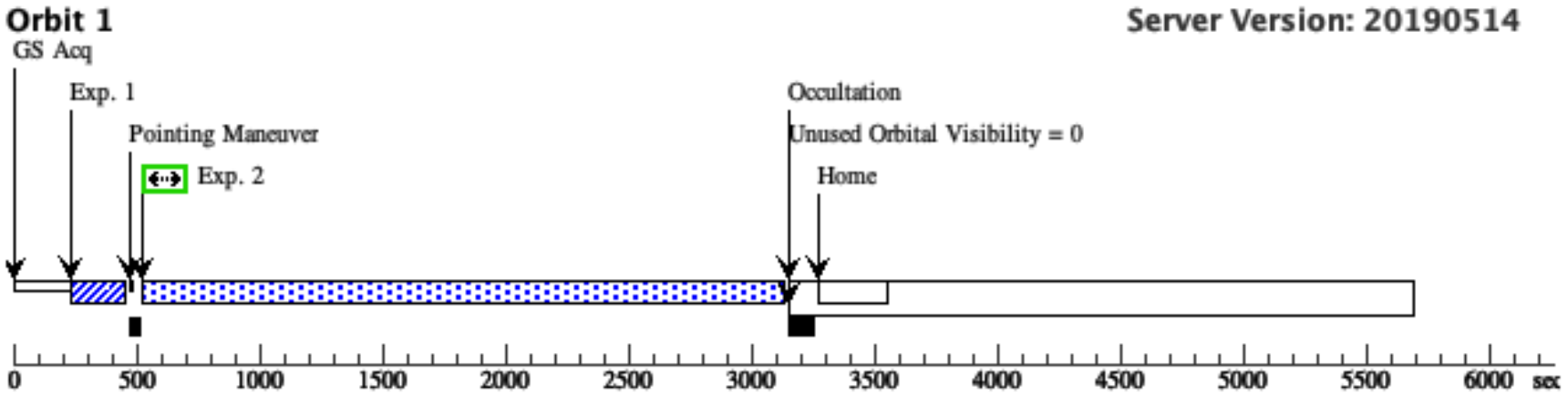
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390428)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2445; FP-POS=4			2445 Secs (2445 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 03 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_02 BY 1.3 D TO 1.7 D

Fixed Targets

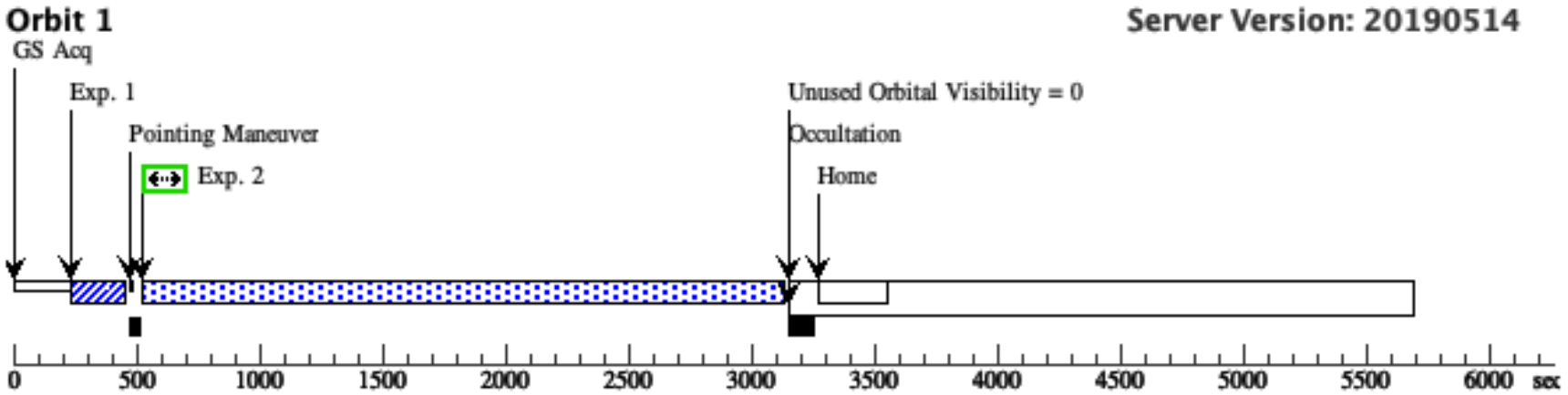
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390428)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2445; FP-POS=3			2445 Secs (2445 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 04 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER 03 BY 1.3 D TO 1.7 D

Fixed Targets

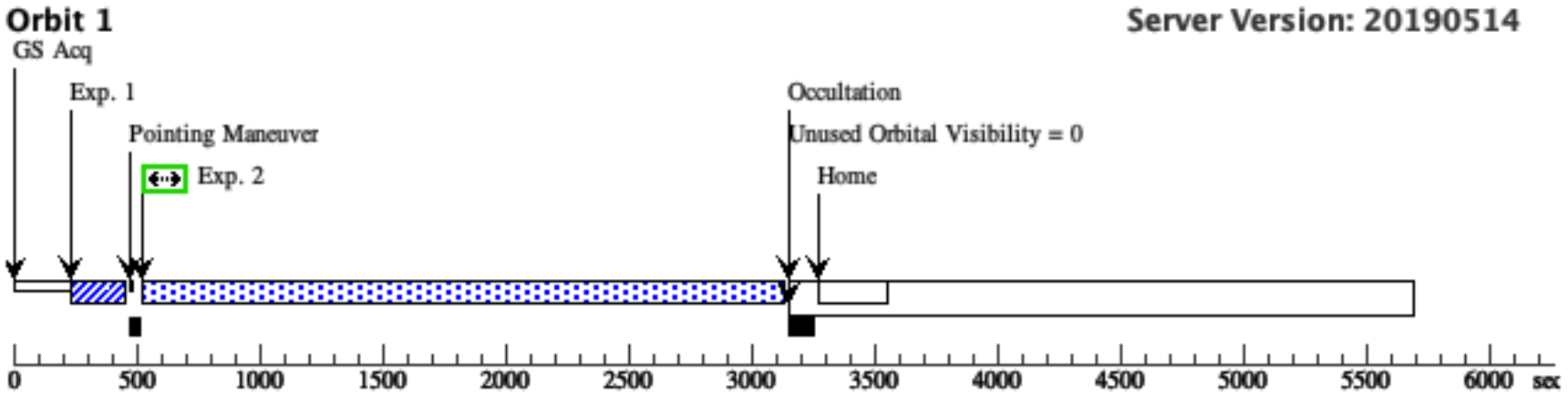
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390428)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2445; FP-POS=4			2445 Secs (2445 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 05 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_04 BY 1.3 D TO 1.7 D

Fixed Targets

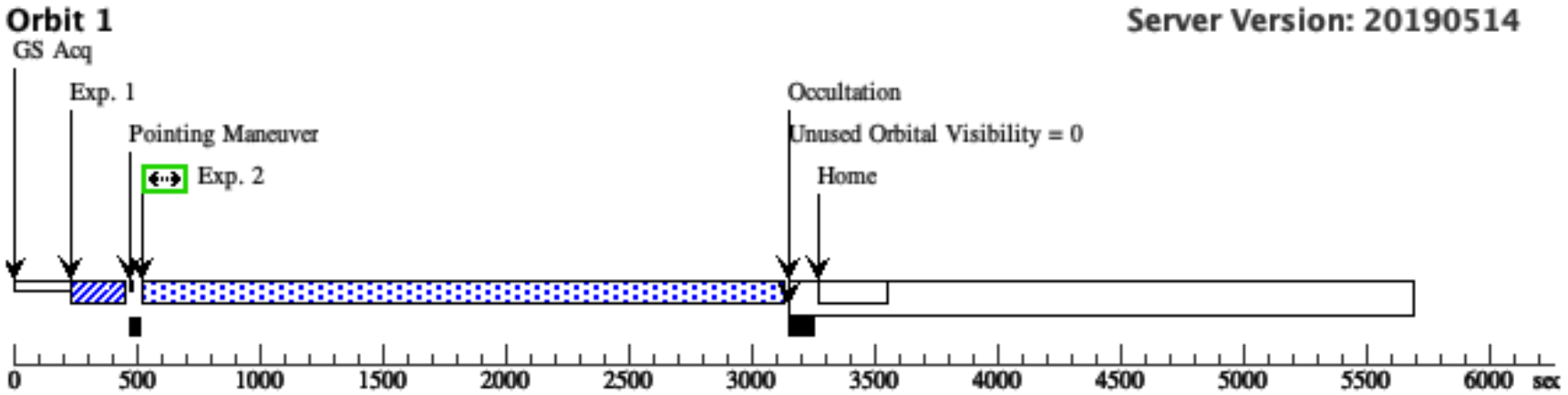
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390428)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2445; FP-POS=3			2445 Secs (2445 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 06 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_05 BY 1.3 D TO 1.7 D

Fixed Targets

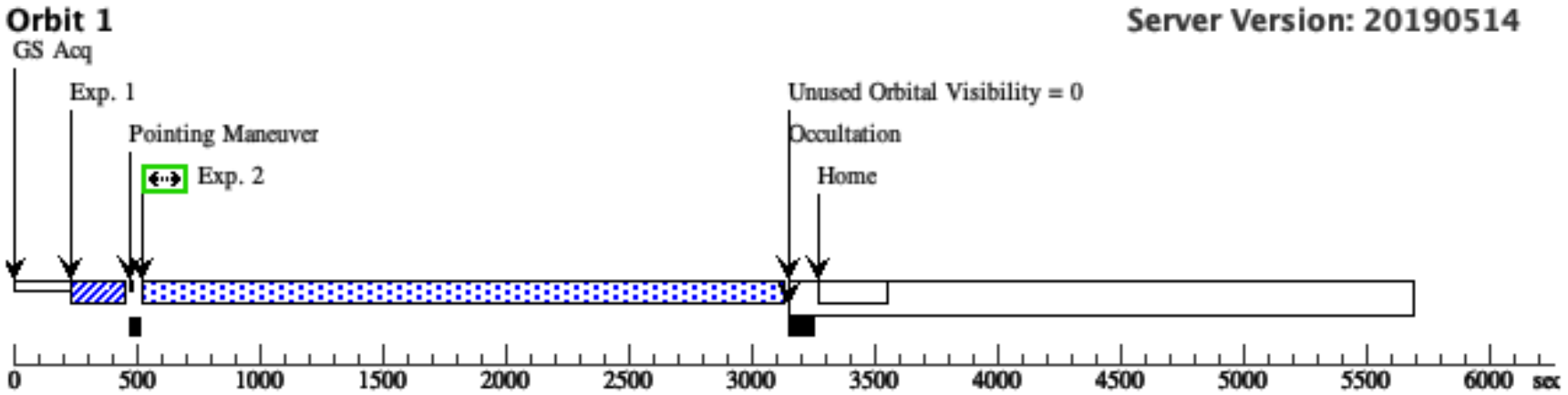
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390432)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2430; FP-POS=1			2430 Secs (2430 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 07 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER 06 BY 1.3 D TO 1.7 D

Fixed Targets

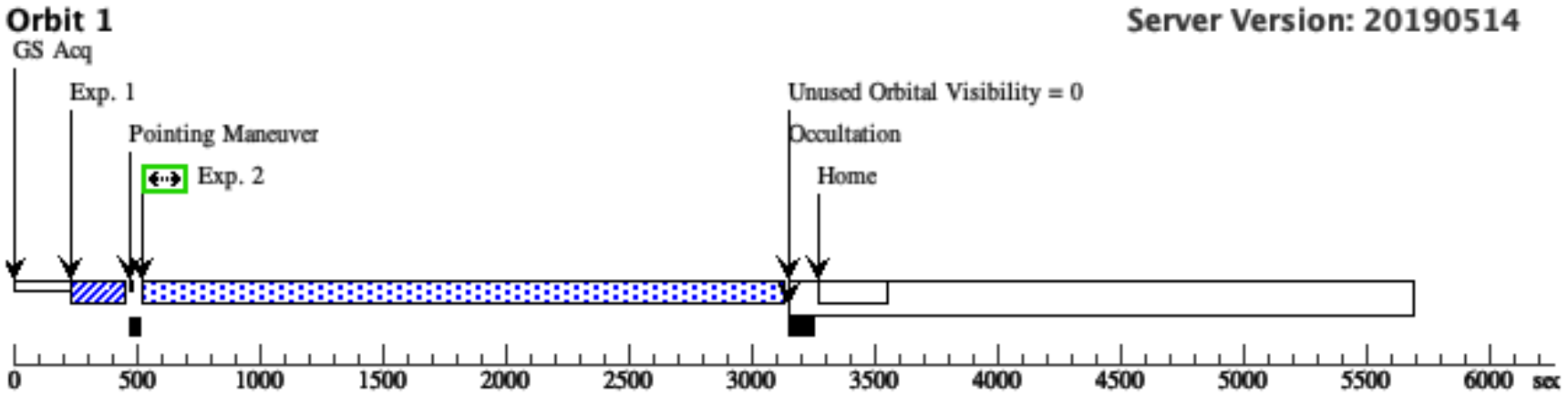
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390432)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2430; FP-POS=2			2430 Secs (2430 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 08 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_07 BY 1.3 D TO 1.7 D

Fixed Targets

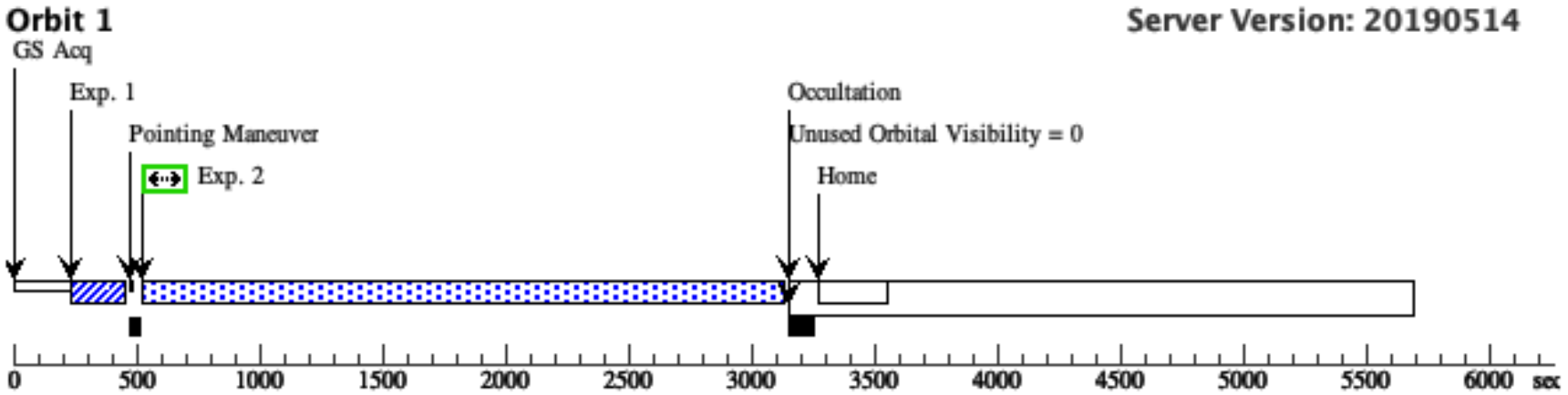
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390432)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2430; FP-POS=3			2430 Secs (2430 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 09 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER 08 BY 1.3 D TO 1.7 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

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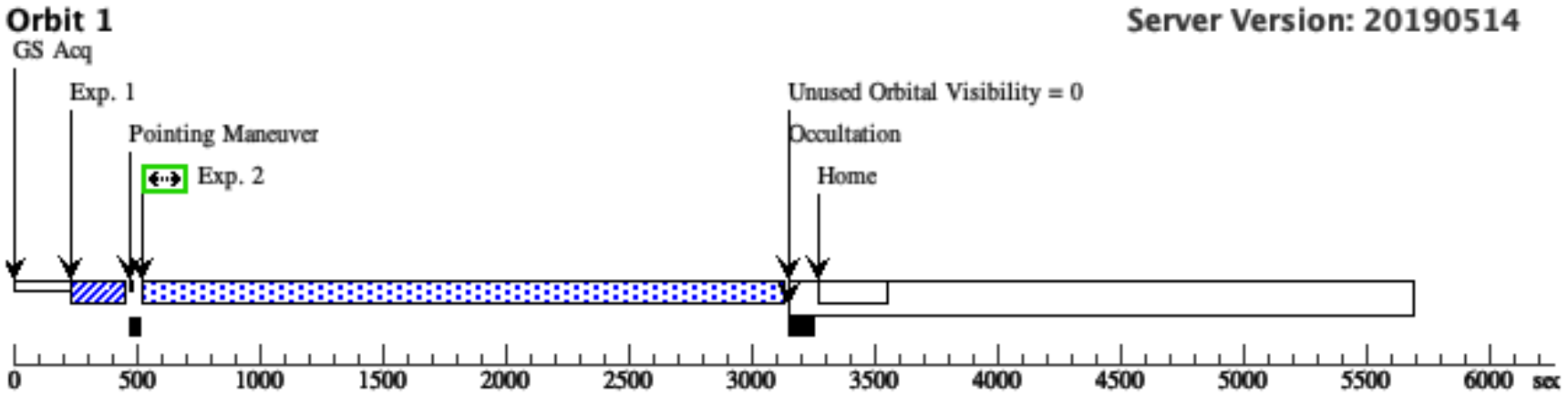
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390432)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2430; FP-POS=4			2430 Secs (2430 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 16034, Visit 10 Mon Nov 04 19:00:18 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: AFTER_09 BY 1.3 D TO 1.7 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WDJ091405.30+191412.25	RA: 09 14 5.3030 (138.5220958d) Dec: +19 14 12.07 (19.23669d) Equinox: J2000	Proper Motion RA: -1.221 mas/yr Proper Motion Dec: -11.594 mas/yr Epoch of Position: 2015.5	V=18.8+/-0.1 GALEX FUV=17.77 +- 0.06	Reference Frame: ICRS

Comments:
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	(COS.ta.1390429)	(1) WDJ091405.30+191412.25	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				3 Secs (3 Secs) *[==>]*	 ***[1]***
2	(COS.sp.1390432)	(1) WDJ091405.30+191412.25	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2430; FP-POS=1			2430 Secs (2430 Secs) *[==>]*	 ***[1]***

Orbit Structure