15068 - A Detailed Study of Rocky Planetary Material in the Hyades

Cycle: 25, 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?*
02	(1) WD0421+162	COS/FUV	4	14-Aug-2017 14:03:21.0	yes
05	(1) WD0421+162	STIS/CCD STIS/NUV-MAMA	2	14-Aug-2017 14:03:24.0	yes
04	(3) WD0437+138	COS/FUV	3	14-Aug-2017 14:03:25.0	yes
06	(3) WD0437+138	STIS/CCD STIS/NUV-MAMA	2	14-Aug-2017 14:03:27.0	yes

11 Total Orbits Used

ABSTRACT

The Hyades is the nearest open cluster, relatively young, and containing numerous A-type stars. Its youth, distance, and metallicity make it an ideal site to study planet formation around 2-3 Msun stars, and in a dynamically challenging environment.

During our HST COS Snapshot, we discovered the ongoing accretion of Si-rich and C-deficient material in two white dwarf Hyads. The lower limit Si/C ratios determined from these 400s exposures indicate the material is more C-depleted than in chondritic meteorites, the most primitive rocks in the Solar System. Our 2013 Keck discovery of metal pollution in a third Hyades white dwarf indicates that planet formation is common in the cluster. Together, these three stars indicate that substantial minor bodies persist at several AU or more, and provide an unprecedented opportunity for a detailed study of rocky exoplanet precursors in a cluster environment.

We propose to obtain detailed abundances of the planetary debris at these three polluted Hyads, which requires a modest investment of observatory time. The mass ratios between C, O, Mg, and Si are accurate indicators of the temperature and orbital regions where the parent bodies formed, their water and volatile contents. We will also detect Al and Fe, which are key indicators of differentiation and giant impacts among planetary embryos.

Our proposed observations will provide legacy value for planet formation models, and especially those in cluster enviroments. These observations cannot be done from the ground or at optical or longer wavelengths, and must be carried out by HST in the ultraviolet.

OBSERVING DESCRIPTION

In previous G130M COS observations, we detected photospheric metal contamination in these two Hyades white dwarfs, demonstrating that they accrete planetary debris.

Here, we will obtain much deeper ultraviolet spectra spanning a wider wavelength range, probing for additional elements (C, Fe, Al, O, Mg).

* WD0421+162: we obtained a short (400sec) COS G130M@1291A spectrum as part of our snapshot survey. Critical lines are at 1152A, 1260/65A, ~1290-1340A, ~1390-1403A. Because of the COS 2025 strategy, we will not be able to execute the observions @ 1291A with all FP-POS settings. To mitigate this, we will use one orbit @1291A, using FP-POS 3/4, and one orbit @1222A, using FP-POS 3/4, combining those two settings will provide particularly good coverage of the O I 1152A line.
In addition, we will obtain COS G160M spectroscopy (Al 1670A) and STIS G230M (Mg 2800A).

* WD0437+138: we obtained good G130M spectra as part of program 14597, here we will obtain COS G160M and STIS G230M spectroscopy.

Visit

Proposal 15068, WD0421+162 COS (02), implementation

Mon Aug 14 18:03:28 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV

Special Requirements: (none)

Diagnostics

(WD0421+162 COS (02)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WD0421+162	RA: 04 23 55.7040 (65.9821000d) Dec: +16 21 15.15 (16.35421d) Equinox: J2000	Proper Motion RA: 114.3 mas/yr Proper Motion Dec: -32.3 mas/yr Epoch of Position: 2000	V=14.283 +/-0.046 GALEX FUV=13.75836 GALEX NUV=13.89075	Reference Frame: ICRS

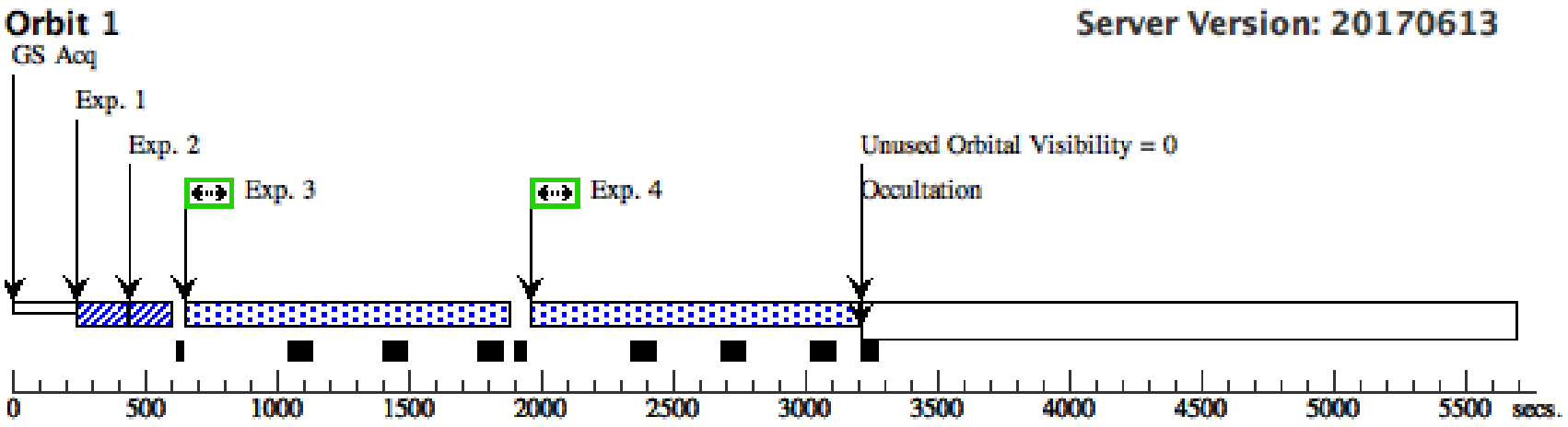
Comments: White dwarf in the Hyades, d=47pc, Teff=19322K, logg=8.10.

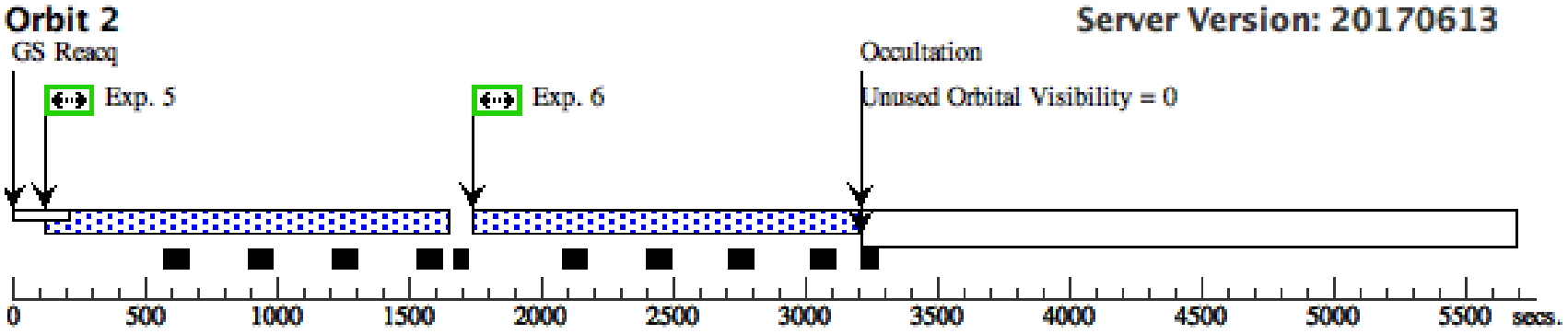
Observed with COS/G130M: LBIYA8010
Extended=NO

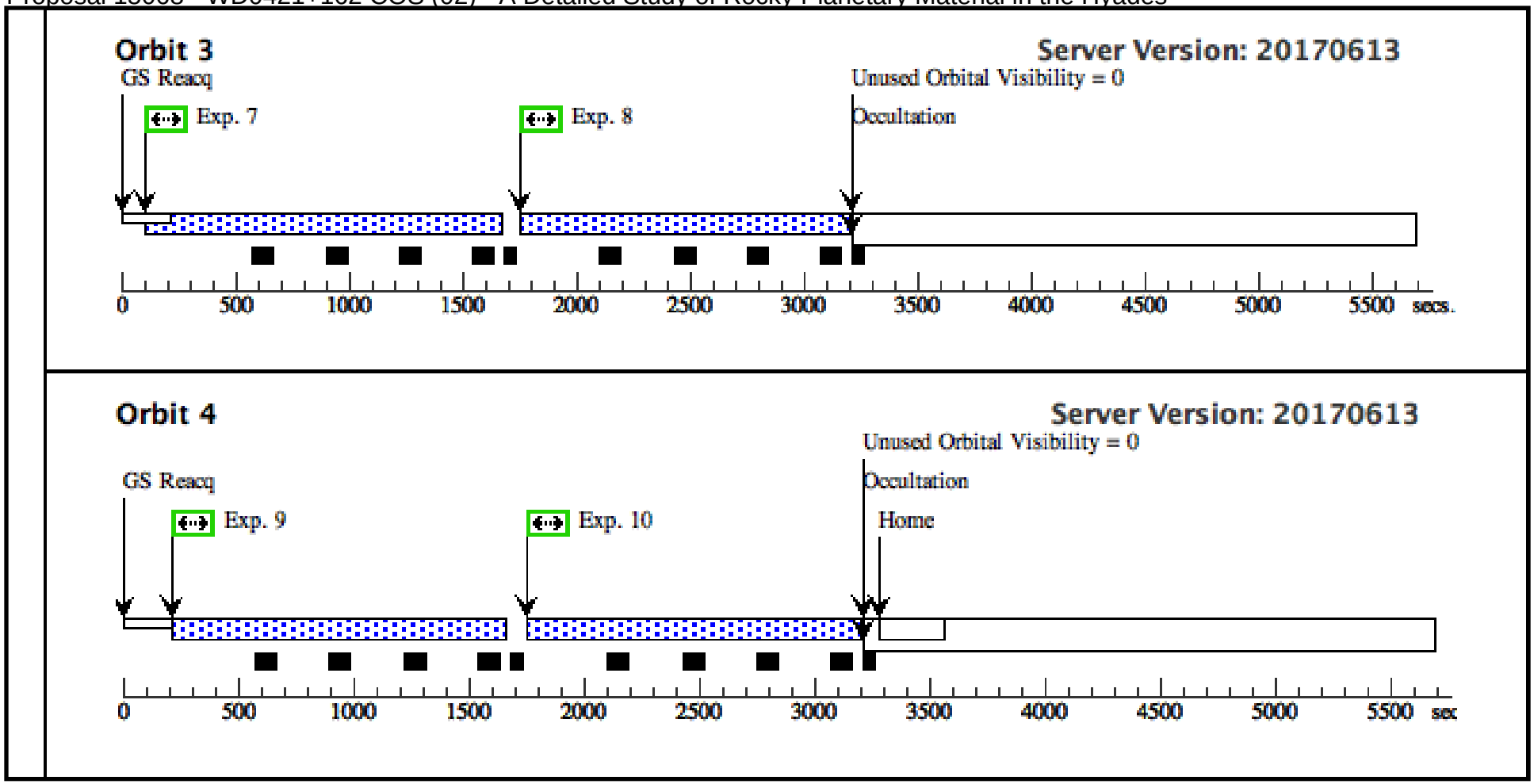
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/PEAKXD (COS.sa.1013893)	(1) WD0421+162	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A				2 Secs (2 Secs) *[==>]*	*[1]*
2	ACQ/PEAKD (COS.sa.1013893)	(1) WD0421+162	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	STEP-SIZE=0.9; NUM-POS=5; CENTER=DEF			2 Secs (2 Secs) *[==>]*	*[1]*
3	COS/G130M @ 1291 FP-POS=3 (COS.sp.1017433)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=358; FLASH=YES; FP-POS=3			1185 Secs (1185 Secs) *[==>]*	*[1]*
4	COS/G130M @ 1291 FP-POS=4 (COS.sp.1017433)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=341; FLASH=YES; FP-POS=4			1186 Secs (1186 Secs) *[==>]*	*[1]*
5	COS/G130M @ 1222 FP-POS=3 (COS.sp.1017435)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=320; FLASH=YES; FP-POS=3			1390 Secs (1390 Secs) *[==>]*	*[2]*
6	COS/G130M @1222 FP-POS=4 (COS.sp.1017435)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=310; FLASH=YES; FP-POS=4			1406 Secs (1406 Secs) *[==>]*	*[2]*
7	COS/G160M FP-POS=1 (COS.sp.1013908)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=321; FLASH=YES; FP-POS=1			1397 Secs (1397 Secs) *[==>]*	*[3]*
8	COS/G160M FP-POS=2 (COS.sp.1013908)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=321; FLASH=YES; FP-POS=2			1397 Secs (1397 Secs) *[==>]*	*[3]*
9	COS/G160M FP-POS=3 (COS.sp.1013908)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=321; FLASH=YES; FP-POS=3			1398 Secs (1398 Secs) *[==>]*	*[4]*
10	COS/G160M FP-POS=4 (COS.sp.1013908)	(1) WD0421+162	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=321; FLASH=YES; FP-POS=4			1398 Secs (1398 Secs) *[==>]*	*[4]*

Orbit Structure



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sec

Visit

Proposal 15068, WD0421+162 STIS (05)

Mon Aug 14 18:03:28 GMT 2017

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WD0421+162	RA: 04 23 55.7040 (65.9821000d) Dec: +16 21 15.15 (16.35421d) Equinox: J2000	Proper Motion RA: 114.3 mas/yr Proper Motion Dec: -32.3 mas/yr Epoch of Position: 2000	V=14.283 +/-0.046 GALEX FUV=13.75836 GALEX NUV=13.89075	Reference Frame: ICRS

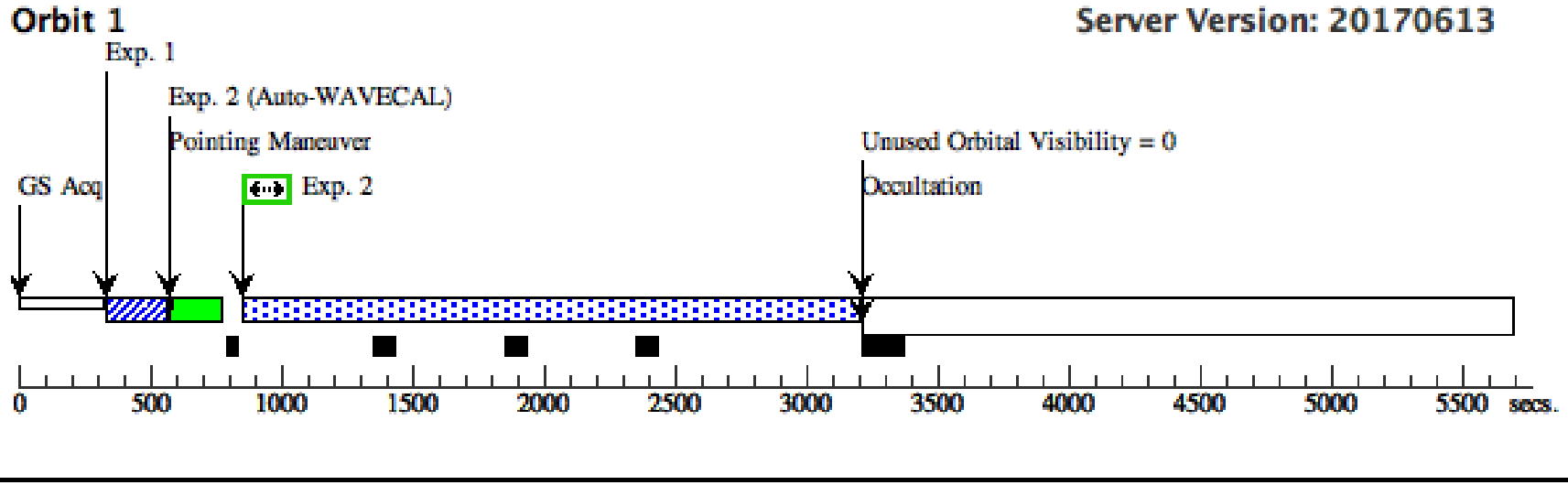
Comments: White dwarf in the Hyades, d=47pc, Teff=19322K, logg=8.10.

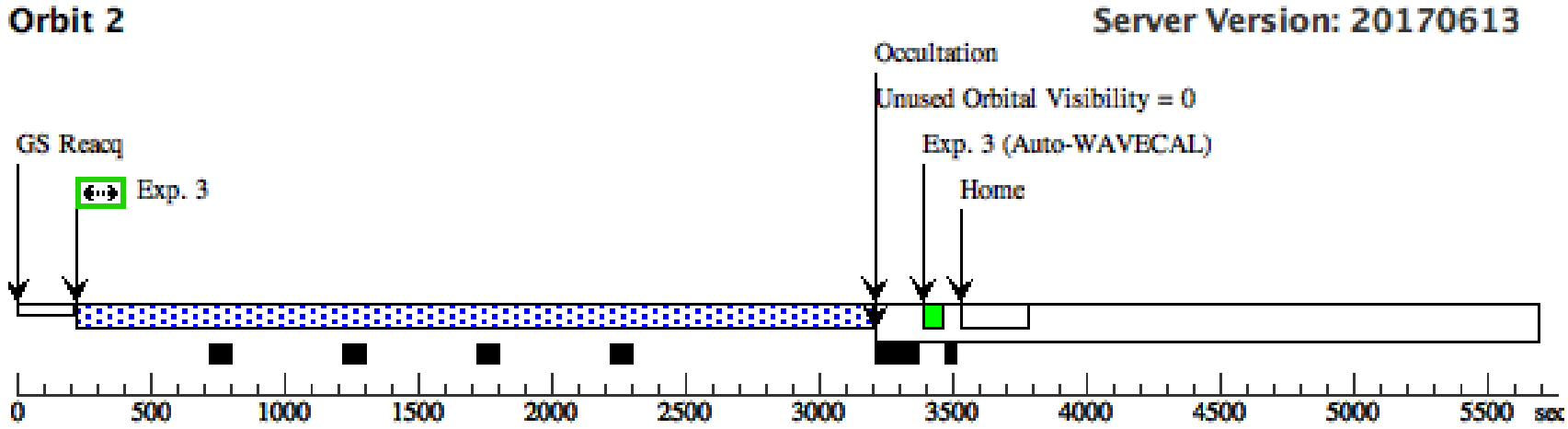
Observed with COS/G130M: LBIYA8010
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WD0421+162 Acq (STIS.ta.1017440)	(1) WD0421+162	STIS/CCD, ACQ, F28X50LP	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
2	WD0421+162 Science (STIS.sp.1017439)	(1) WD0421+162	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230M 2800 A	BUFFER-TIME=500			2332 Secs (2332 Secs) *[==>]*	 ***[1]***
3	WD0421+162 Science (STIS.sp.1017439)	(1) WD0421+162	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230M 2800 A	BUFFER-TIME=500			2964 Secs (2964 Secs) *[==>]*	 ***[2]***

Orbit Structure





Visit

Proposal 15068, WD0437+138 COS (04), implementation Mon Aug 14 18:03:28 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	WD0437+138	RA: 04 40 23.8770 (70.0994875d) Dec: +13 58 45.97 (13.97944d) Equinox: J2000	Proper Motion RA: 94.1 mas/yr Proper Motion Dec: 94.1 mas/yr Epoch of Position: 2000	V=14.924+/-0.030 GALEX FUV=15.43189 GALEX NUV=14.84796	Reference Frame: ICRS

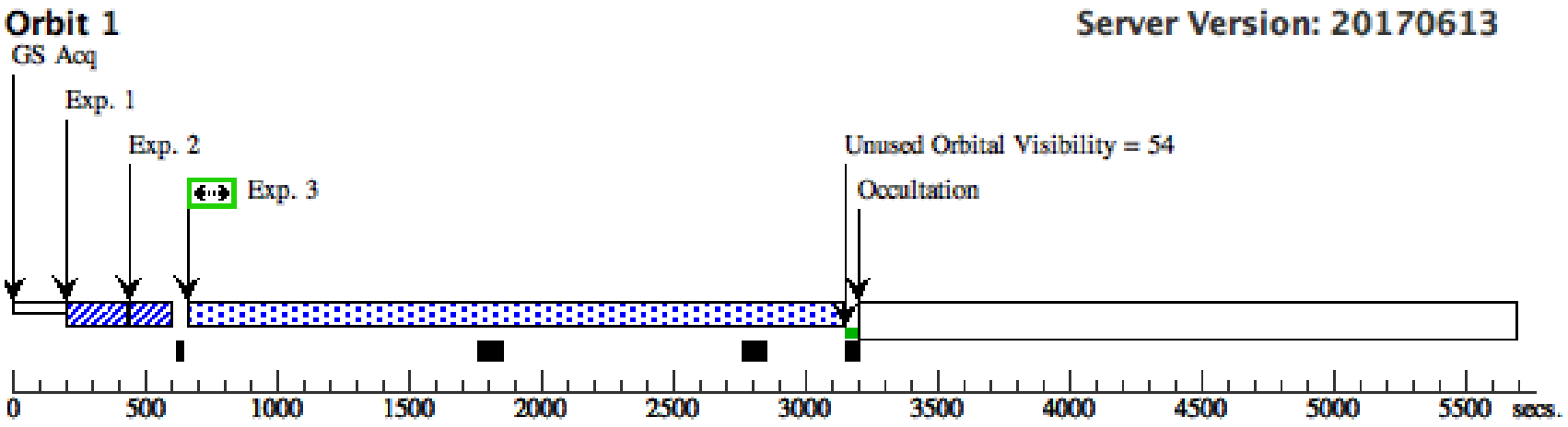
Comments: White dwarf in the Hyades, d=45pc, Teff=15120K, logg=8.25

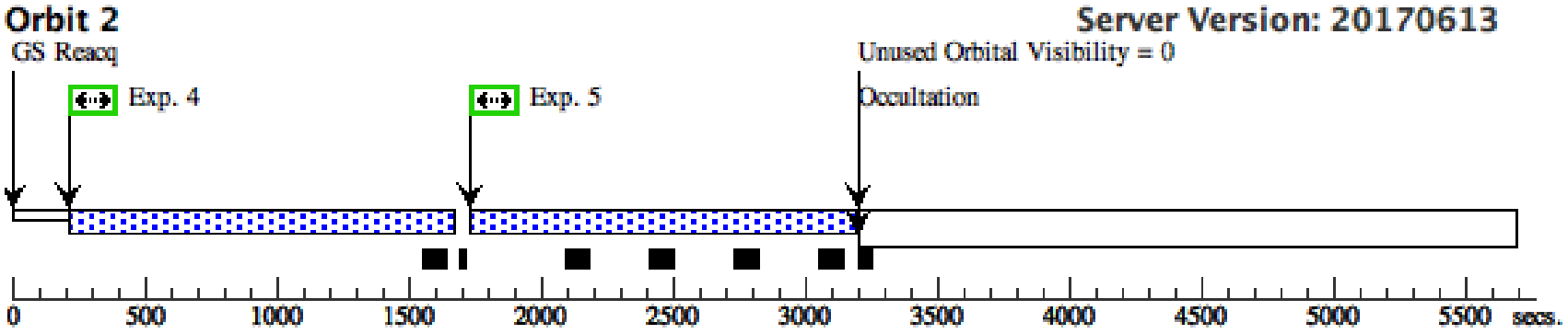
Observed with COS/G130M: LDAO08010
Extended=NO

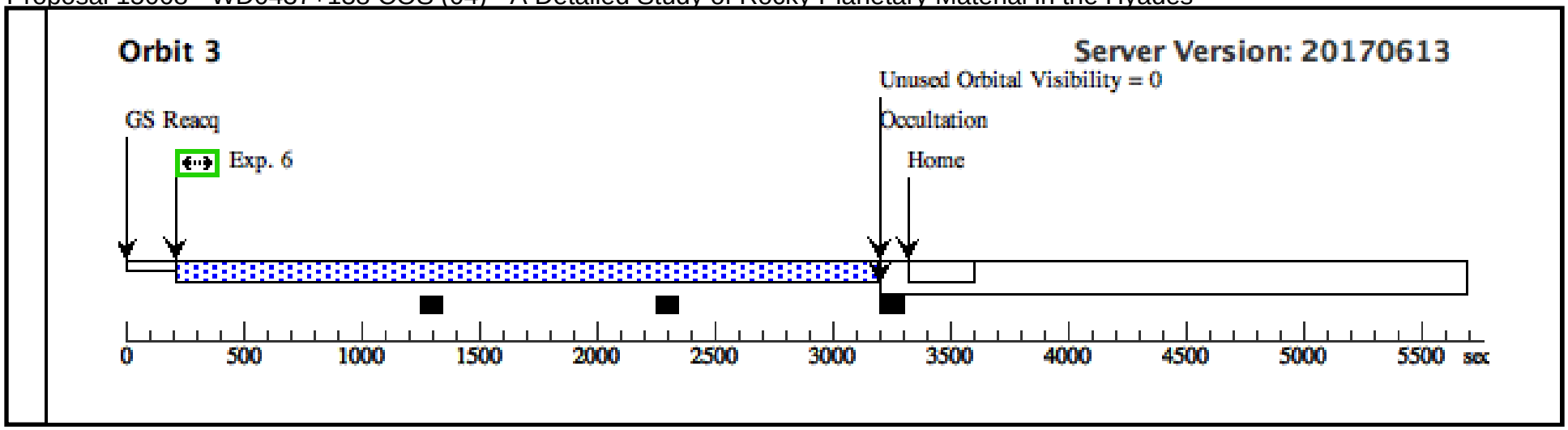
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ/PEAKXD (COS.sa.1013917)	(3) WD0437+138	COS/FUV, ACQ/PEAKXD, PSA	G160M 1577 A				3 Secs (3 Secs) *[==>]*	***[1]***
2	ACQ/PEAKD (COS.sa.1013917)	(3) WD0437+138	COS/FUV, ACQ/PEAKD, PSA	G160M 1577 A	STEP-SIZE=0.9; NUM-POS=5; CENTER=DEF			3 Secs (3 Secs) *[==>]*	***[1]***
3	COS/G160M FP-POS=1 (COS.sp.1013919)	(3) WD0437+138	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1000; FLASH=YES; FP-POS=1			2360 Secs (2360 Secs) *[==>]*	***[1]***
4	COS/G160M FP-POS=1 (COS.sp.1013919)	(3) WD0437+138	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1300; FLASH=YES; FP-POS=2			1410 Secs (1410 Secs) *[==>]*	***[2]***
5	COS/G160M FP-POS=1 (COS.sp.1013919)	(3) WD0437+138	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=320; FLASH=YES; FP-POS=3			1408 Secs (1408 Secs) *[==>]*	***[2]***
6	COS/G160M FP-POS=1 (COS.sp.1013919)	(3) WD0437+138	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1000; FLASH=YES; FP-POS=4			2923 Secs (2923 Secs) *[==>]*	***[3]***

Orbit Structure



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Visit

Proposal 15068, WD0437+138 STIS (06) Mon Aug 14 18:03:28 GMT 2017

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	WD0437+138	RA: 04 40 23.8770 (70.0994875d) Dec: +13 58 45.97 (13.97944d) Equinox: J2000	Proper Motion RA: 94.1 mas/yr Proper Motion Dec: 94.1 mas/yr Epoch of Position: 2000	V=14.924+/-0.030 GALEX FUV=15.43189 GALEX NUV=14.84796	Reference Frame: ICRS

Comments: White dwarf in the Hyades, d=45pc, Teff=15120K, logg=8.25

Observed with COS/G130M: LDAO08010
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	WD0437+162 Acq (STIS.ta.1017441)	(3) WD0437+138	STIS/CCD, ACQ, F28X50LP	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
2	WD0437+162 Science (STIS.sp.1017442)	(3) WD0437+138	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230M 2800 A	BUFFER-TIME=500			2325 Secs (2325 Secs) *[==>]*	 ***[1]***
3	WD0437+162 Science (STIS.sp.1017442)	(3) WD0437+138	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230M 2800 A	BUFFER-TIME=500			2957 Secs (2957 Secs) *[==>]*	 ***[2]***

Orbit Structure