16218 - Confirming the first double degenerates in globular clusters

Cycle: 28, 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) NGC1851-FUV1 (3) NGC1851-OFFSET1	STIS/CCD STIS/FUV-MAMA	2	13-May-2022 16:00:12.0	yes
02	(1) NGC1851-FUV1 (3) NGC1851-OFFSET1	STIS/CCD STIS/FUV-MAMA	2	13-May-2022 16:00:13.0	yes
03	(2) 47TUC-W62 (4) 47TUC-OFFSET1	STIS/CCD STIS/FUV-MAMA	3	13-May-2022 16:00:15.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
53	(2) 47TUC-W62 (4) 47TUC-OFFSET1	STIS/CCD STIS/FUV-MAMA	3	13-May-2022 16:00:17.0	yes
04	(2) 47TUC-W62 (4) 47TUC-OFFSET1	STIS/CCD STIS/FUV-MAMA	3	13-May-2022 16:00:18.0	yes

13 Total Orbits Used

ABSTRACT

The first 3 good candidates to AM CVn (double degenerate binaries) binaries in a globular cluster were recently identified with HST photometry. One of them is N1851-FUV1 which was identified as a short
period (18 minutes) far-ultraviolet variable near the center of the globular cluster NGC 1851
(Zurek et al 2016). The other 2 candidates have been identified in the globular cluster 47 Tuc
(Rivera Sandoval et al 2018) based on a combination of the their X-ray and optical/near-ultraviolet properties.
A far-ultraviolet spectrum of each of these candidates will confirm or refute these candidates as AM CVn. Their confirmation will establish globular clusters as factories of compact binaries that emit gravitational waves and which are expected to be detected with LISA. The characterization of these systems is crucial to be performed while HST is still working, as it is the only telescope capable to resolve the stars in the cores of globular clusters. If confirmed, the first comparison to AM CVns in the Galactic field will be possible, giving direct evidence of the impact of stellar interactions in their formation and evolution. This program may enable follow-up studies to set important constraints on double degenerate binary models.

OBSERVING DESCRIPTION

We will acquire a bright red giant and offset to our target.
For NGC 1851 we will make a second peak up on the target before obtaining the science exposures.
For NGC 104 the offset star is relatively isolated, a peak up on the target previous to science data is not feasible considering its faintness.
The main observations will be with the G140L grating and the FUV-MAMA.

Visit

Proposal 16218, NGC1851-FUV1 (01), completed Fri May 13 20:00:19 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Comments: It would be very convenient to have visits 1 and 2 for this target scheduled very close to each other.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC1851-FUV1	RA: 05 14 6.6790 (78.5278292d) Dec: -40 02 48.71 (-40.04686d) Equinox: J2000		V=16.0 +/-0.05 F140LP = 18.7 +/- 0.06	Reference Frame: ICRS

Comments: We used the WFPC2 image (PC chip), because saturation isn't an issue, to measure the positions of this offset star and the intended source FUV1. The F555W WFPC2 frame used is U2VO0301T. We have also made calculations using a FUV image of the cluster (STIS/FUV-MAMA and the F25QTZ filter) and none of the sources exceed the bright limits. The brightest sources have about 11 cnts/ second. This corresponds (using the photflam of 1.0388894E-16) to a flux of about 1.13446722E-15. If we put this value into the ETC with our setup (using a black body model of 50,000K to mimic a hot source) the bright limits are never in danger of being exceeded. The ETC calculation done is STIS.sp.1479536. We have also sent images to our HST program coordinator.
Category=STAR
Description=[INTERACTING BINARY]

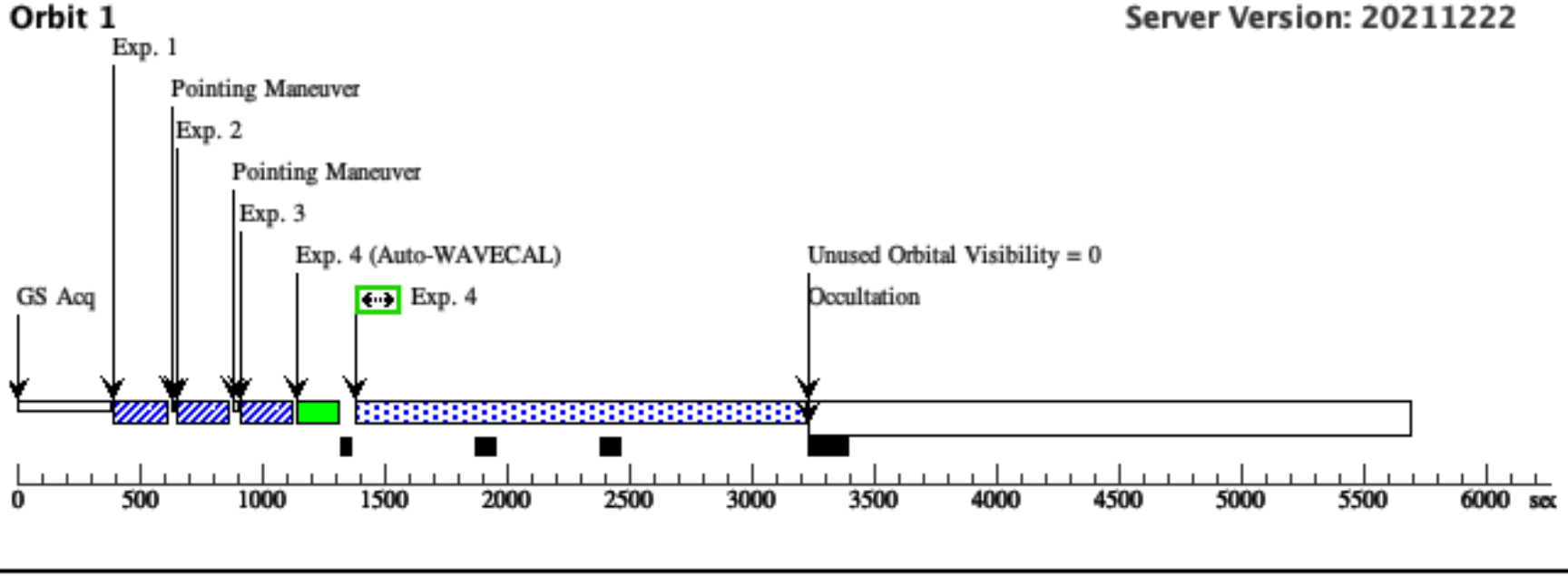
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NGC1851-OFFSET1	RA: 05 14 5.7900 (78.5241250d) Dec: -40 02 46.55 (-40.04626d) Equinox: J2000		V=13.3	Reference Frame: ICRS

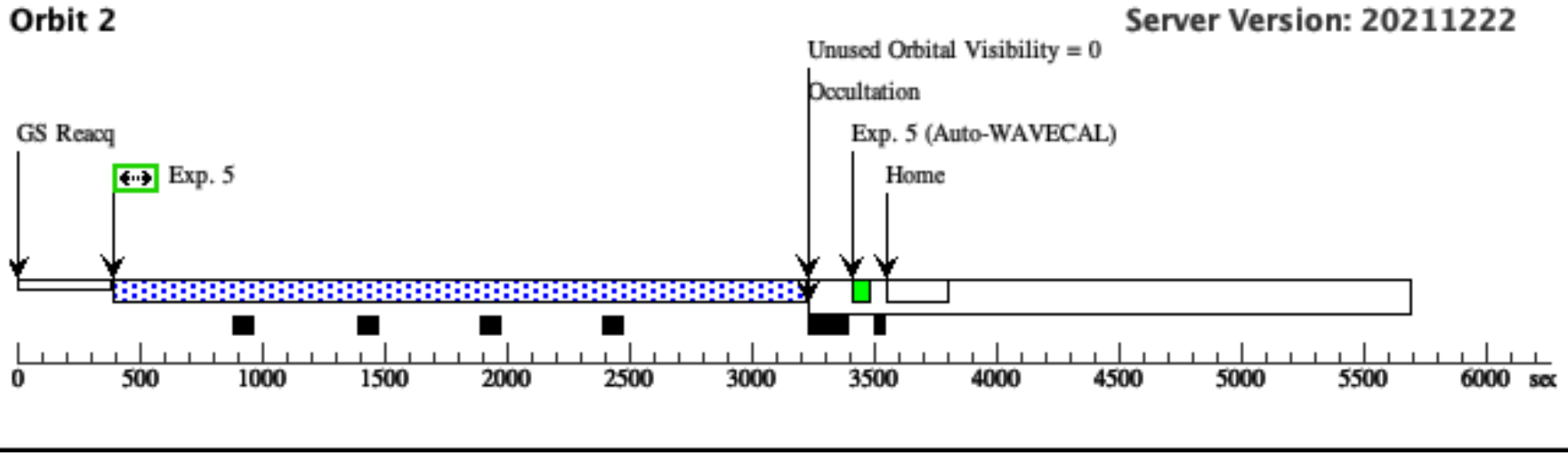
Comments: We used the WFPC2 image (PC chip), because saturation isn't an issue, to measure the positions of this offset star and the intended source FUV1. The F555W WFPC2 frame used is U2VO0301T.
Category=STAR
Description=[M III-I]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) NGC1851-OFFSET1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.2 Secs (0.2 Secs)	
								[==>]	***[1]***
2		(3) NGC1851-OFFSET1	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				0.2 Secs (0.2 Secs)	
								[==>]	***[1]***
3		(1) NGC1851-FUV1	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				1.0 Secs (1 Secs)	
								[==>]	***[1]***
4	(STIS.sp.1450494)	(1) NGC1851-FUV1	STIS/FUV-MAMA, TIME-TAG, 52X0.1	G140L 1425 A	BUFFER-TIME=500.0			1829 Secs (1829 Secs)	
								[==>]	***[1]***
5	(STIS.sp.1450494)	(1) NGC1851-FUV1	STIS/FUV-MAMA, TIME-TAG, 52X0.1	G140L 1425 A	BUFFER-TIME=500.0			2818 Secs (2818 Secs)	
								[==>]	***[2]***

Orbit Structure





Visit

Proposal 16218, NGC1851-FUV1 (02), completed Fri May 13 20:00:19 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Comments: It would be very convenient to have visits 1 and 2 for this target scheduled very close to each other.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC1851-FUV1	RA: 05 14 6.6790 (78.5278292d) Dec: -40 02 48.71 (-40.04686d) Equinox: J2000		V=16.0 +/-0.05 F140LP = 18.7 +/- 0.06	Reference Frame: ICRS

Comments: We used the WFPC2 image (PC chip), because saturation isn't an issue, to measure the positions of this offset star and the intended source FUV1. The F555W WFPC2 frame used is U2VO0301T. We have also made calculations using a FUV image of the cluster (STIS/FUV-MAMA and the F25QTZ filter) and none of the sources exceed the bright limits. The brightest sources have about 11 cnts/ second. This corresponds (using the photflam of 1.0388894E-16) to a flux of about 1.13446722E-15. If we put this value into the ETC with our setup (using a black body model of 50,000K to mimic a hot source) the bright limits are never in danger of being exceeded. The ETC calculation done is STIS.sp.1479536. We have also sent images to our HST program coordinator.
Category=STAR
Description=[INTERACTING BINARY]

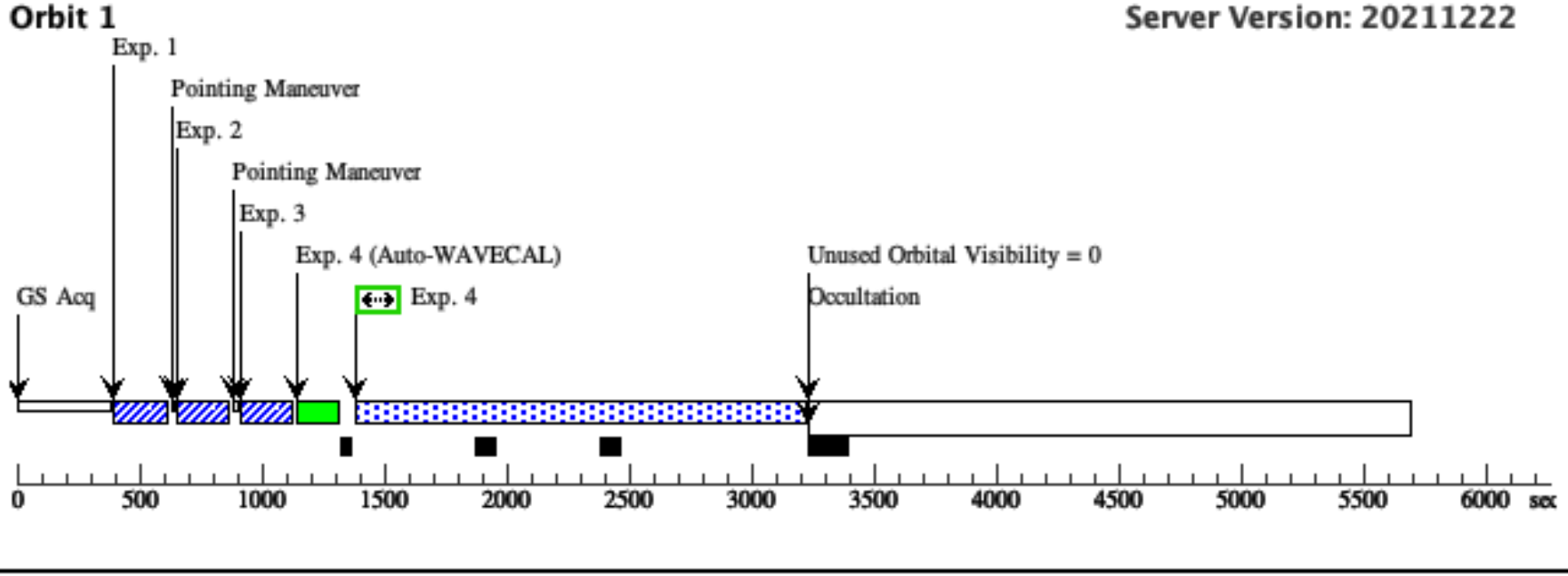
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NGC1851-OFFSET1	RA: 05 14 5.7900 (78.5241250d) Dec: -40 02 46.55 (-40.04626d) Equinox: J2000		V=13.3	Reference Frame: ICRS

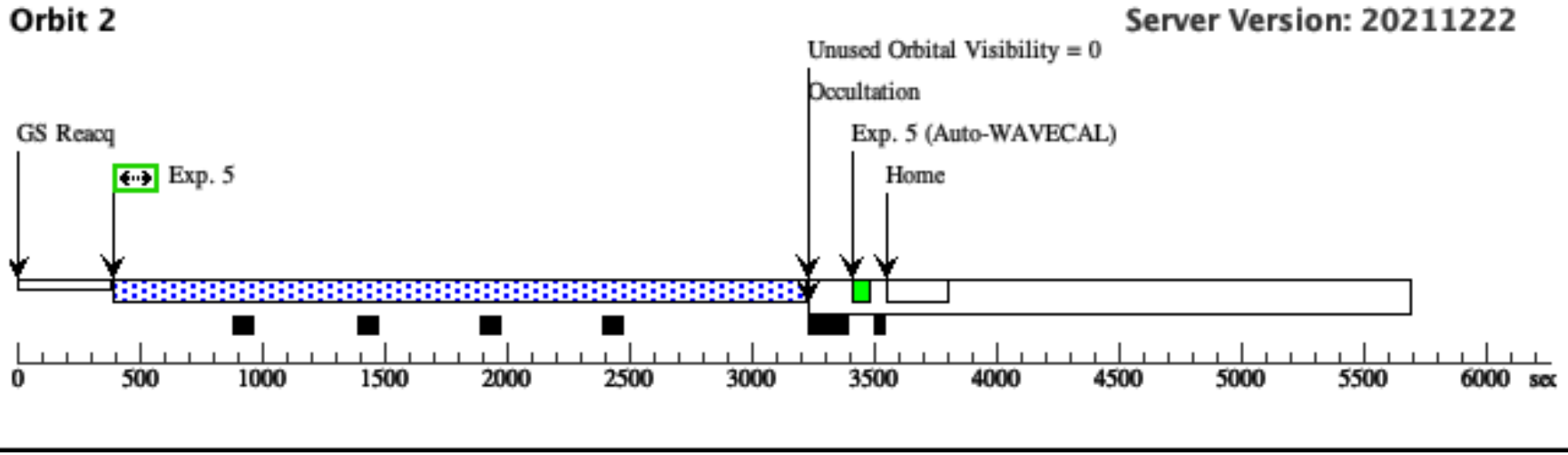
Comments: We used the WFPC2 image (PC chip), because saturation isn't an issue, to measure the positions of this offset star and the intended source FUV1. The F555W WFPC2 frame used is U2VO0301T.
Category=STAR
Description=[M III-I]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) NGC1851-OFFSET1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.2 Secs (0.2 Secs)	
								[==>]	***[1]***
2		(3) NGC1851-OFFSET1	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				0.2 Secs (0.2 Secs)	
								[==>]	***[1]***
3		(1) NGC1851-FUV1	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				1.0 Secs (1 Secs)	
								[==>]	***[1]***
4	(STIS.sp.1450494)	(1) NGC1851-FUV1	STIS/FUV-MAMA, TIME-TAG, 52X0.1	G140L 1425 A	BUFFER-TIME=500.0			1829.0 Secs (1829 Secs)	
								[==>]	***[1]***
5	(STIS.sp.1450494)	(1) NGC1851-FUV1	STIS/FUV-MAMA, TIME-TAG, 52X0.1	G140L 1425 A	BUFFER-TIME=500.0			2818.0 Secs (2818 Secs)	
								[==>]	***[2]***

Orbit Structure





Visit

Proposal 16218, 47TUC-W62 (03), failed Fri May 13 20:00:19 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ORIENT 135D TO 181 D; ORIENT 315D TO 1 D

Comments: It would be very convenient to have visits 1 and 2 for this target scheduled very close to each other.
We have given 6 orbits to the target in 47 Tuc, the faintest one, to recover some of the time lost in the visit's split.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	47TUC-W62	RA: 00 23 59.3391 (5.9972462d) Dec: -72 04 48.24 (-72.08007d) Equinox: J2000		V=19.54+/-0.02	Reference Frame: ICRS

Comments: We used the ACS/WFC image j9l960a7q_flc.fits (exptime=3s in F606W) which is under the J9L960010 data set to select the offset star. We have also used a 3.6 sec STIS/F28X50LP image (o48c0100r0_crj.fits under o48c010r0) and the stars in the cluster did not exceed the brightness limits, we sent finding chart to our HST program coordinator. The cluster has previously been observed in FUV slitless spectroscopy with no problems, so the current configuration will not be an issue. The current coordinates are based on precise absolute astrometry performed by our group (epoch J2000), not on the above mentioned archival reference HST image.
Category=STAR
Description=[INTERACTING BINARY]

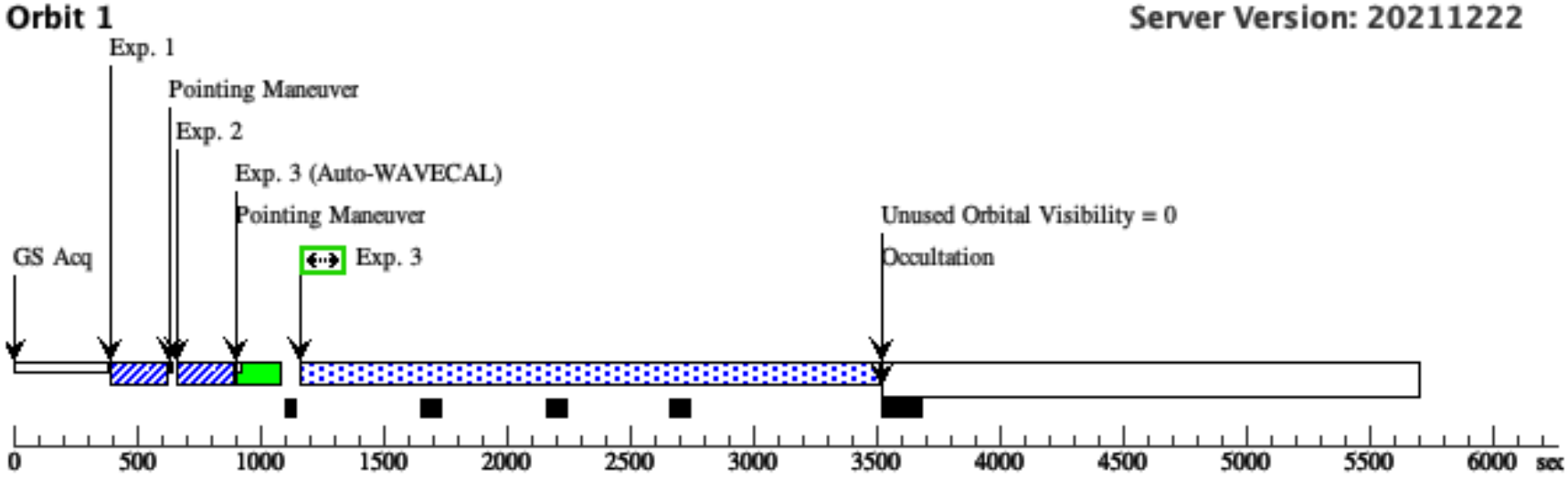
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	47TUC-OFFSET1	RA: 00 23 56.2960 (5.9845667d) Dec: -72 04 41.49 (-72.07819d) Equinox: J2000		V=14.3 F606W = 12.8, F814W=11.8	Reference Frame: ICRS

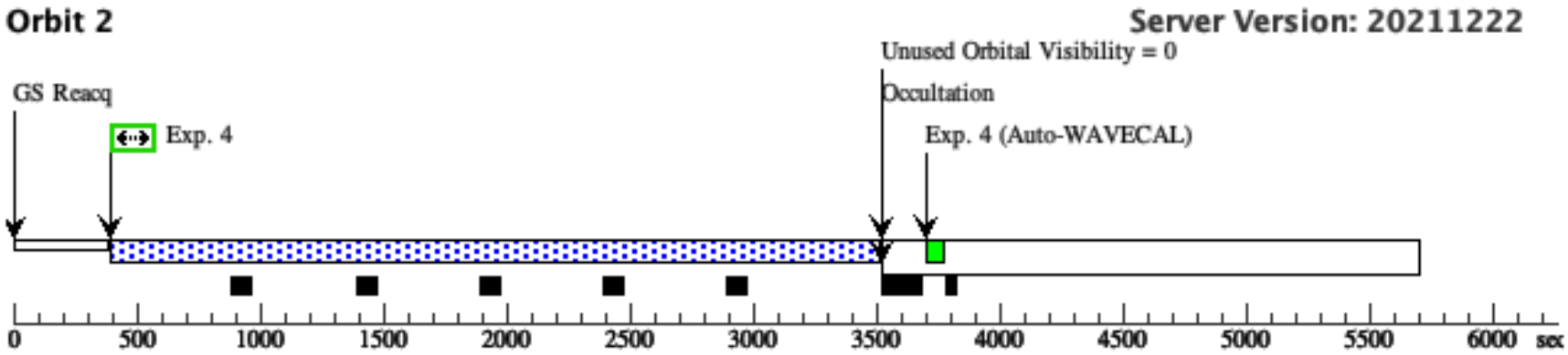
Comments: We used the ACS/WFC image j9l960a7q_flc.fits (exptime=3s in F606W) which is under the J9L960010 data set to identify a suitable, isolated, bright offset-star. The current coordinates are based on precise absolute astrometry performed by our group (epoch J2000), not on the above mentioned archival reference HST image.
Category=STAR
Description=[K III-I]

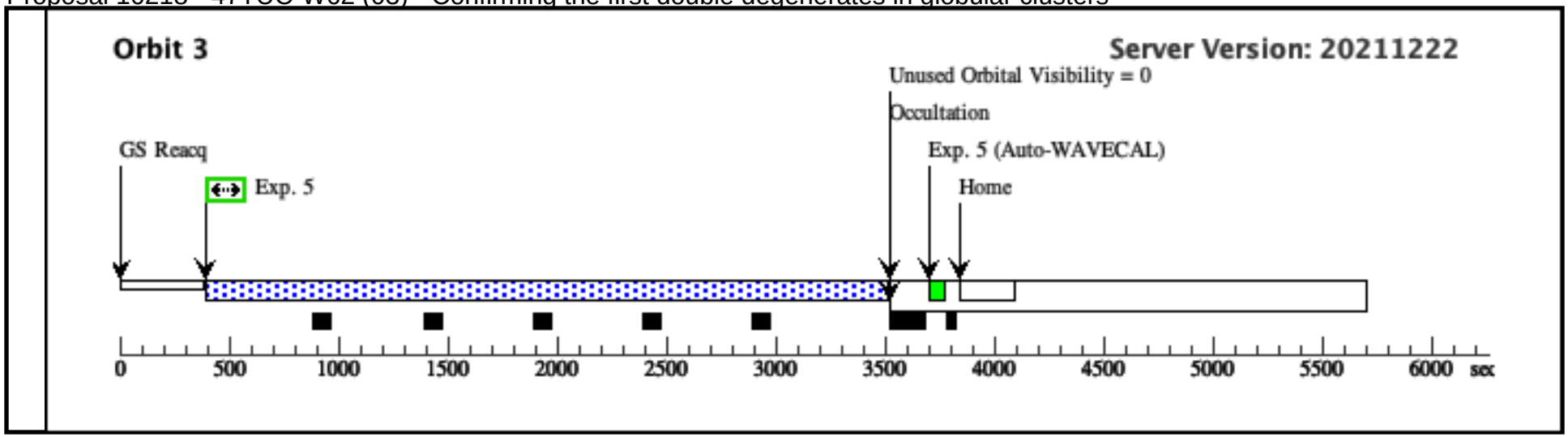
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) 47TUC-OFFSET 1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2		(4) 47TUC-OFFSET 1	STIS/CCD, ACQ/PEAK, 52X0.1D1	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
3	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140L 1425 A	BUFFER-TIME=50 0.0			2337 Secs (2337 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140L 1425 A	BUFFER-TIME=50 0.0			3105 Secs (3105 Secs) *[==>]*	 ***[2]***
5	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140L 1425 A	BUFFER-TIME=50 0.0			3105 Secs (3105 Secs) *[==>]*	 ***[3]***

Orbit Structure






Orbit 3
Server Version: 20211222
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 5
Exp. 5 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16218, 47TUC-W62 (53), implementation Fri May 13 20:00:19 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ORIENT 135D TO 181 D; ORIENT 315D TO 1 D

Comments: It would be very convenient to have visits 1 and 2 for this target scheduled very close to each other.
We have given 6 orbits to the target in 47 Tuc, the faintest one, to recover some of the time lost in the visit's split.

Repeat of failed visit 03.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	47TUC-W62	RA: 00 23 59.3391 (5.9972462d) Dec: -72 04 48.24 (-72.08007d) Equinox: J2000		V=19.54+/-0.02	Reference Frame: ICRS

Comments: We used the ACS/WFC image j9l960a7q_flc.fits (exptime=3s in F606W) which is under the J9L960010 data set to select the offset star. We have also used a 3.6 sec STIS/F28X50LP image (o48c0100r0_crj.fits under o48c010r0) and the stars in the cluster did not exceed the brightness limits, we sent finding chart to our HST program coordinator. The cluster has previously been observed in FUV slitless spectroscopy with no problems, so the current configuration will not be an issue. The current coordinates are based on precise absolute astrometry performed by our group (epoch J2000), not on the above mentioned archival reference HST image.
Category=STAR
Description=[INTERACTING BINARY]

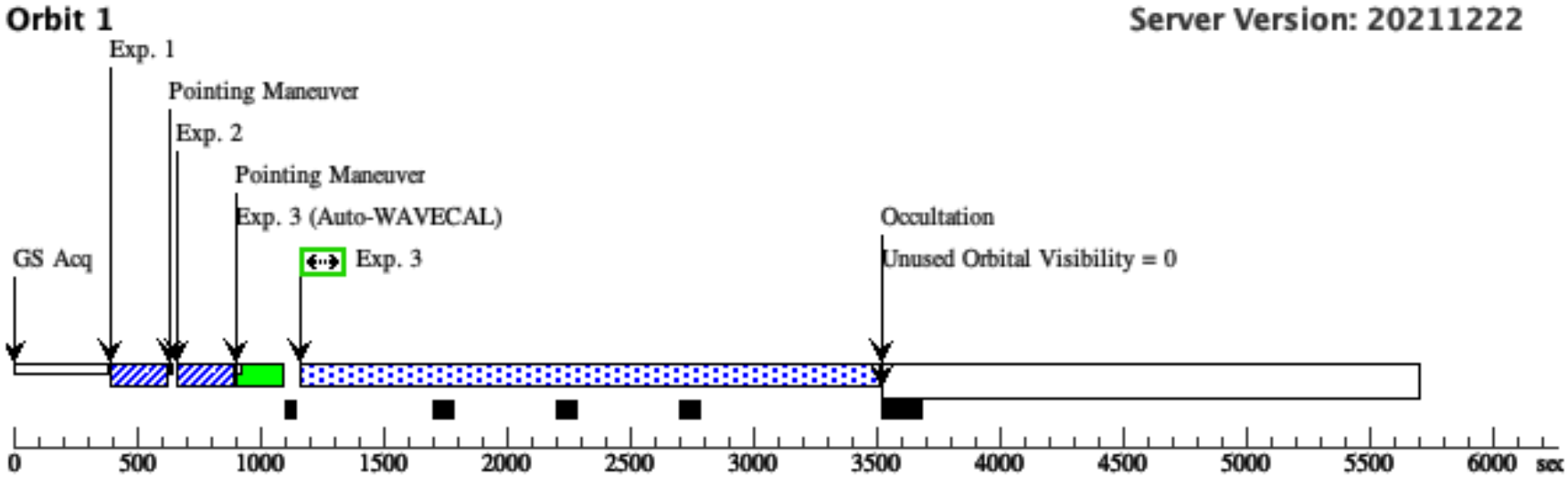
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	47TUC-OFFSET1	RA: 00 23 56.2960 (5.9845667d) Dec: -72 04 41.49 (-72.07819d) Equinox: J2000		V=14.3 F606W = 12.8, F814W=11.8	Reference Frame: ICRS

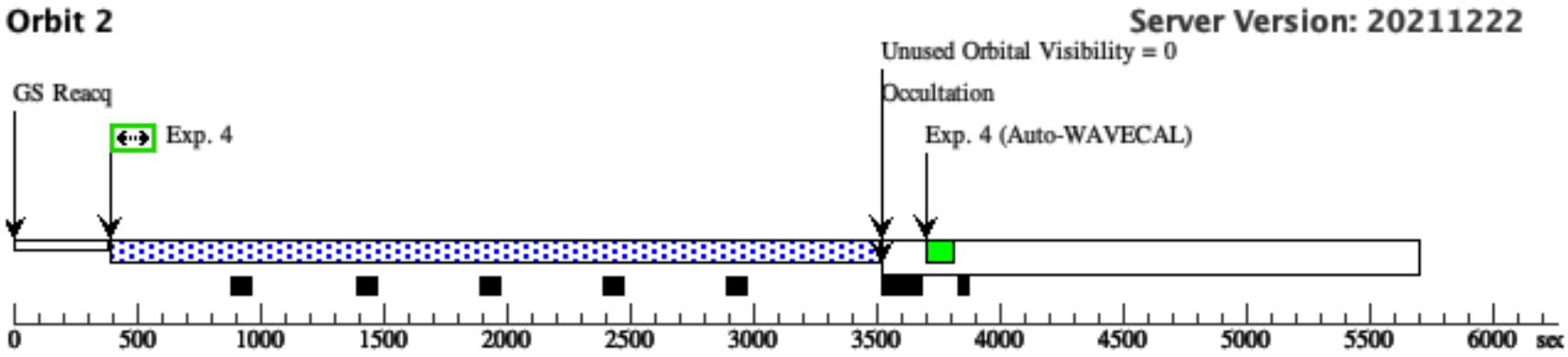
Comments: We used the ACS/WFC image j9l960a7q_flc.fits (exptime=3s in F606W) which is under the J9L960010 data set to identify a suitable, isolated, bright offset-star. The current coordinates are based on precise absolute astrometry performed by our group (epoch J2000), not on the above mentioned archival reference HST image.
Category=STAR
Description=[K III-I]

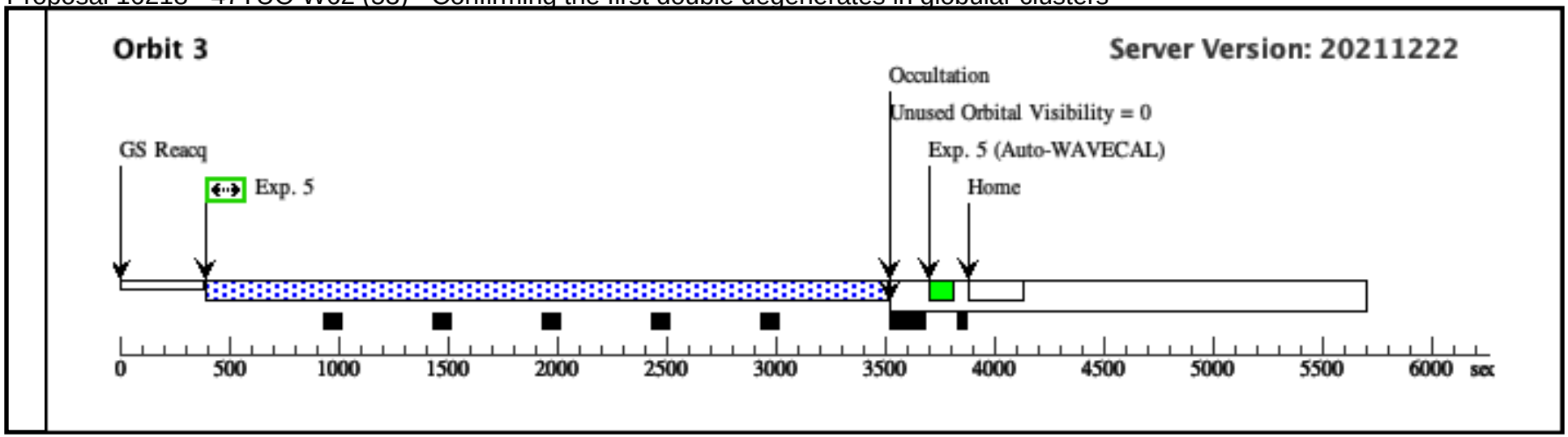
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) 47TUC-OFFSET 1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.5 Secs (0.5 Secs) *[==>]*	*[1]*
2		(4) 47TUC-OFFSET 1	STIS/CCD, ACQ/PEAK, 52X0.1D1	MIRROR				1 Secs (1 Secs) *[==>]*	*[1]*
3	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140L 1425 A	BUFFER-TIME=50 0.0			2294 Secs (2294 Secs) *[==>]*	*[1]*
4	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140L 1425 A	BUFFER-TIME=50 0.0			3105 Secs (3105 Secs) *[==>]*	*[2]*
5	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140L 1425 A	BUFFER-TIME=50 0.0			3063 Secs (3063 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20211222
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 5
Exp. 5 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16218, 47TUC-W62 (04), completed Fri May 13 20:00:19 GMT 2022

Diagnostic Status: No Diagnostics

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

Special Requirements: ORIENT 135D TO 181 D; ORIENT 315D TO 1 D

Comments: It would be very convenient to have visits 1 and 2 for this target scheduled very close to each other.
We have given 6 orbits to the target in 47 Tuc, the faintest one, to recover some of the time lost in the visit's split.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	47TUC-W62	RA: 00 23 59.3391 (5.9972462d) Dec: -72 04 48.24 (-72.08007d) Equinox: J2000		V=19.54+/-0.02	Reference Frame: ICRS

Comments: We used the ACS/WFC image j9l960a7q_flc.fits (exptime=3s in F606W) which is under the J9L960010 data set to select the offset star. We have also used a 3.6 sec STIS/F28X50LP image (o48c0100r0_crj.fits under o48c010r0) and the stars in the cluster did not exceed the brightness limits, we sent finding chart to our HST program coordinator. The cluster has previously been observed in FUV slitless spectroscopy with no problems, so the current configuration will not be an issue. The current coordinates are based on precise absolute astrometry performed by our group (epoch J2000), not on the above mentioned archival reference HST image.
Category=STAR
Description=[INTERACTING BINARY]

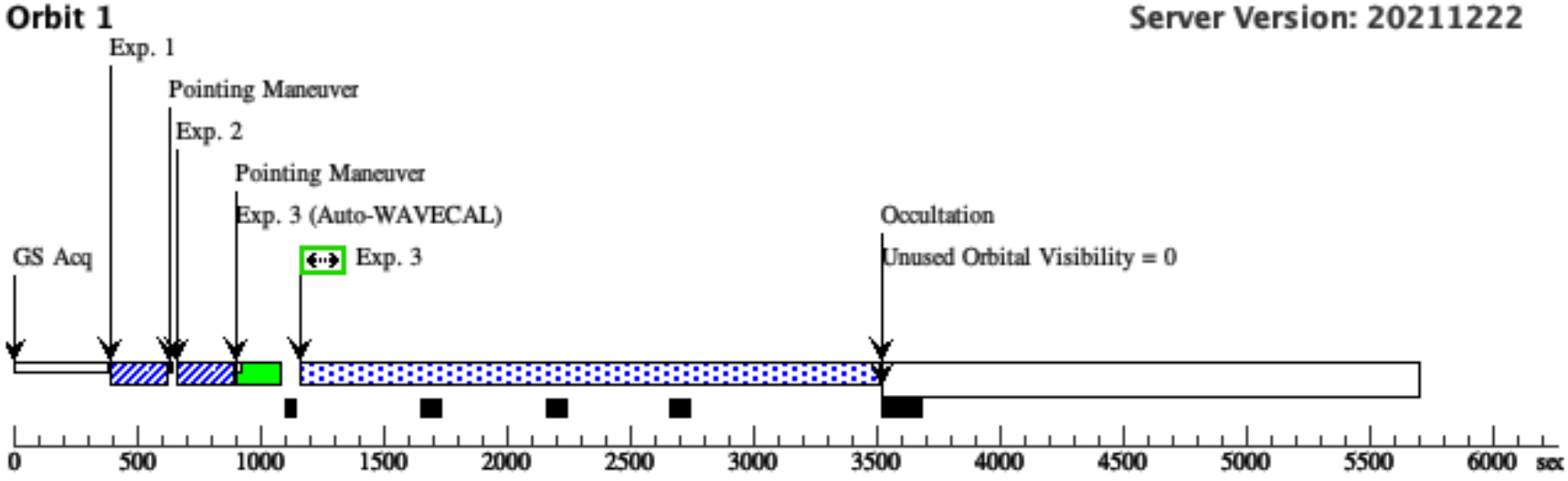
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	47TUC-OFFSET1	RA: 00 23 56.2960 (5.9845667d) Dec: -72 04 41.49 (-72.07819d) Equinox: J2000		V=14.3 F606W = 12.8, F814W=11.8	Reference Frame: ICRS

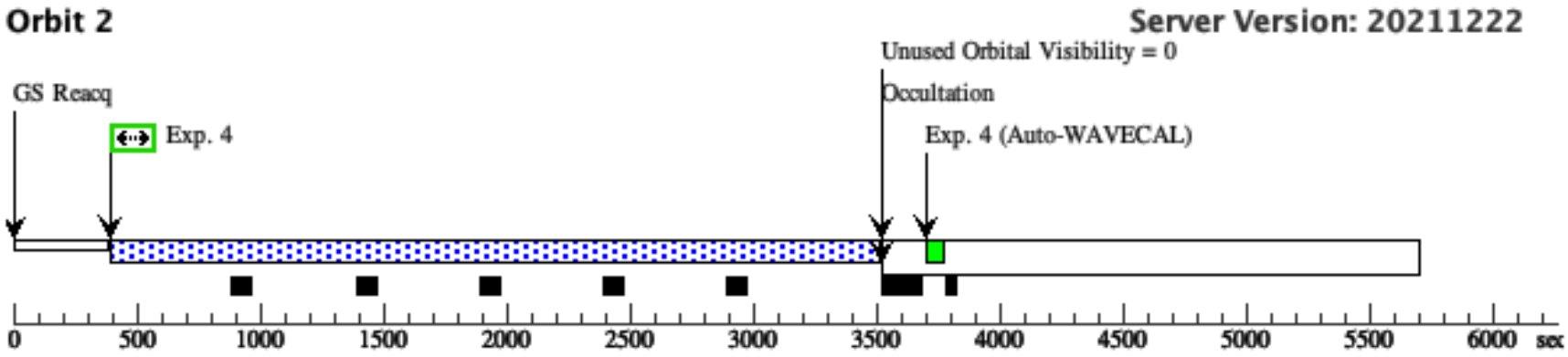
Comments: We used the ACS/WFC image j9l960a7q_flc.fits (exptime=3s in F606W) which is under the J9L960010 data set to identify a suitable, isolated, bright offset-star. The current coordinates are based on precise absolute astrometry performed by our group (epoch J2000), not on the above mentioned archival reference HST image.
Category=STAR
Description=[K III-I]

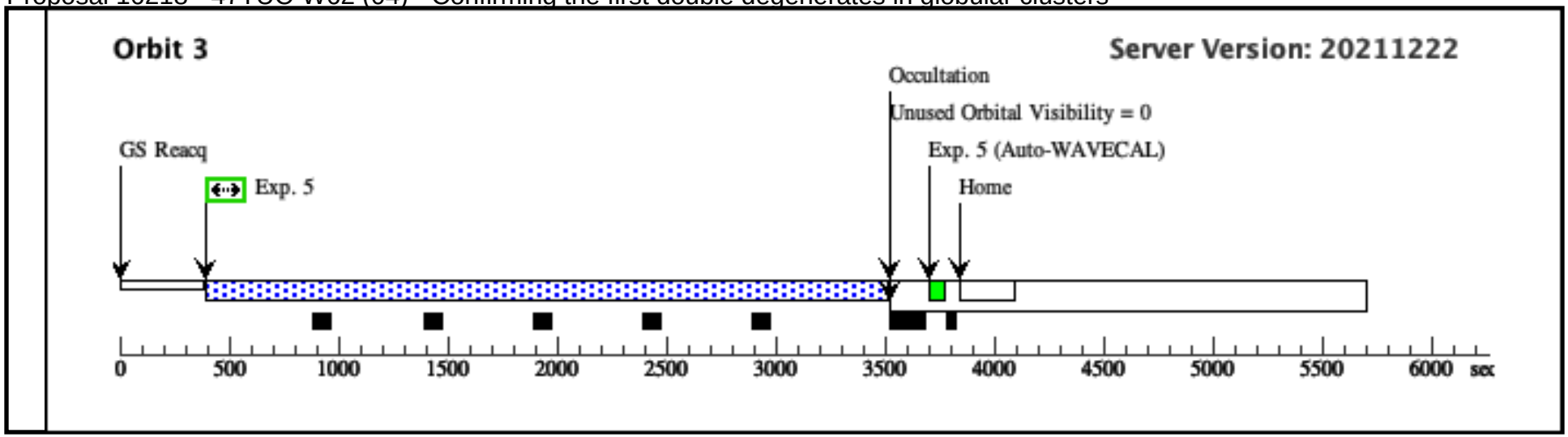
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) 47TUC-OFFSET 1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2		(4) 47TUC-OFFSET 1	STIS/CCD, ACQ/PEAK, 52X0.1D1	MIRROR				1 Secs (1 Secs) *[==>]*	 ***[1]***
3	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140L 1425 A	BUFFER-TIME=50 0.0			2337 Secs (2337 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140L 1425 A	BUFFER-TIME=50 0.0			3105 Secs (3105 Secs) *[==>]*	 ***[2]***
5	(STIS.sp.14 50499)	(2) 47TUC-W62	STIS/FUV-MAMA, TIME-TAG, 52X0.2D1	G140L 1425 A	BUFFER-TIME=50 0.0			3105 Secs (3105 Secs) *[==>]*	 ***[3]***

Orbit Structure



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Occultation
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GS Reacq
Exp. 5
Exp. 5 (Auto-WAVECAL)
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