15206 - Origin of the high velocity gas in NGC 6231

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?*
01	(1) HD326332	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:12.0	yes
02	(2) HD326328	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:13.0	yes
03	(3) CPD-41D7711	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:14.0	yes
04	(4) CPD-41D7712	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:14.0	yes
05	(5) CPD-41D7715	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:15.0	yes
06	(6) CD-41D11031	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:15.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
07	(7) CPD-41D7736	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:16.0	yes
08	(8) CPD-41D7743	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:17.0	yes
09	(9) NGC-6231-209	STIS/CCD STIS/FUV-MAMA	1	26-Oct-2018 02:00:17.0	yes
10	(10) NGC-6231-213	COS/FUV COS/NUV	1	26-Oct-2018 02:00:18.0	yes
11	(11) NGC-6231-217	COS/FUV COS/NUV	1	26-Oct-2018 02:00:19.0	yes
12	(12) NGC-6231-222	COS/FUV COS/NUV	1	26-Oct-2018 02:00:21.0	yes

12 Total Orbits Used

ABSTRACT

It is well known that clusters of massive stars are influenced by the presence of strong winds, that they are sources of diffuse X-rays from shocked gas, and that this gas can be vented into the surrounding region or the halo, forming a critical element in the process of galactic feedback. However, the details of how these different environments interact and evolve are far from complete. Recently, Massa (2017) showed that the peculiar C IV 1550 Ang absorption seen in several otherwise normal main sequence B stars in NGC 6231 is not intrinsic to the stars. Instead, this absorption, which extends to more than -2000 km/s, is due to intervening carbon rich, high speed gas in the cluster environment. In this proposal, we seek to identify the origin of the high speed gas. The proposed observations will enable us to determine whether it is due to the outer wind of the WC star WR79, or to a collective cluster wind, enriched by carbon from the wind of WR79. If it is due to the wind of WR79, then the new data will furnish a novel, less model dependent estimate of the mass loss rate of a WC star. If it is due to a collective wind from the cluster, then we could be witnessing an important stage of galactic feedback. In either case, the proposed observations will provide a unique and significant insight on how massive, open clusters evolve -- insight that can only be obtained through UV spectroscopy.

OBSERVING DESCRIPTION

We will use 12 orbits to observe 12 main sequence B stars (BVs) to map the flow of the high speed gas in NGC 6231. STIS must be used for 9 of the targets because they are too bright for COS. These will be observed with the STISE140M. The remaining 3 will be observed with COS. Two COS settings are needed to observe the absorption and to determine the stellar parameters. G160M CENWAVE 1589 will covers the high speed absorption we intend to model. G130M CENWAVE 1291 covers the N v and Si iv resonance lines and several Si II and III stellar lines needed to determine the physical parameters of the BVs. These stellar lines will be used to select spectra to represent the intrinsic BV spectra in the vicinity of C IV. Good S/N is needed to determine the find good stellar matches and to search for systematic deviations from the simple model of the absorption caused by the flow. Due to the turbulent nature of the flow, only modest spectral resolution (~50 km/s) is needed for the analysis. Therefore, the high resolution STIS or COS spectra can be binned for increased S/N.

Visit

Proposal 15206, Visit 01, implementation Fri Oct 26 06:00:21 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

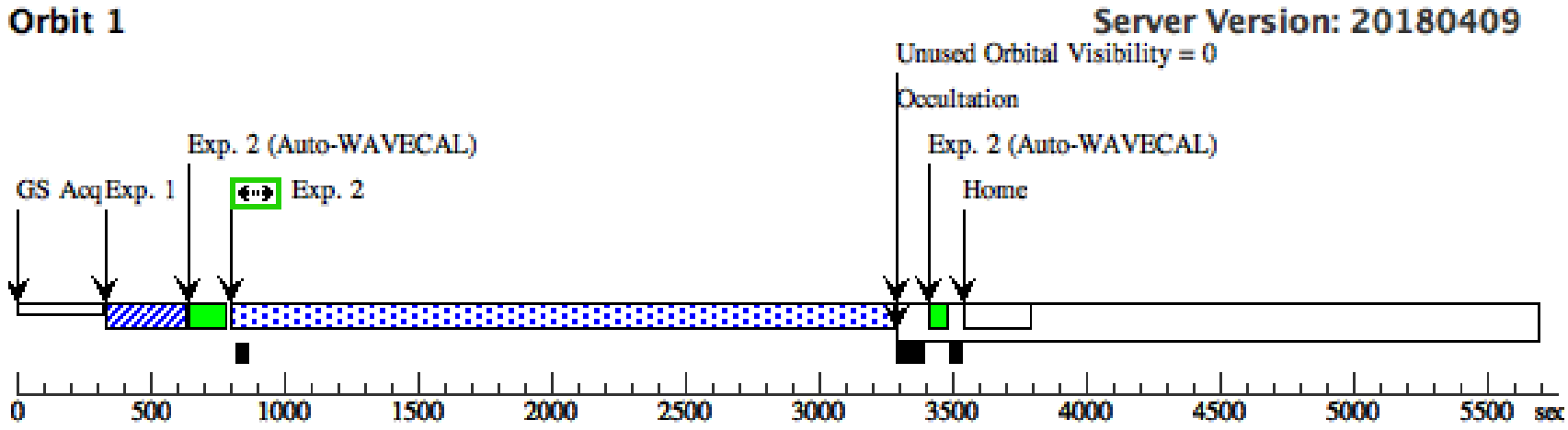
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD326332	RA: 16 54 35.8200 (253.6492500d) Dec: -41 50 12.20 (-41.83672d) Equinox: J2000		V=9.74+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(1) HD326332	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs) *[==>]*	*[1]*
2	(1006334)	(1) HD326332	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs) *[==>2468.0 Secs]*	*[1]*

Orbit Structure



Visit

Proposal 15206, Visit 02, implementation Fri Oct 26 06:00:21 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

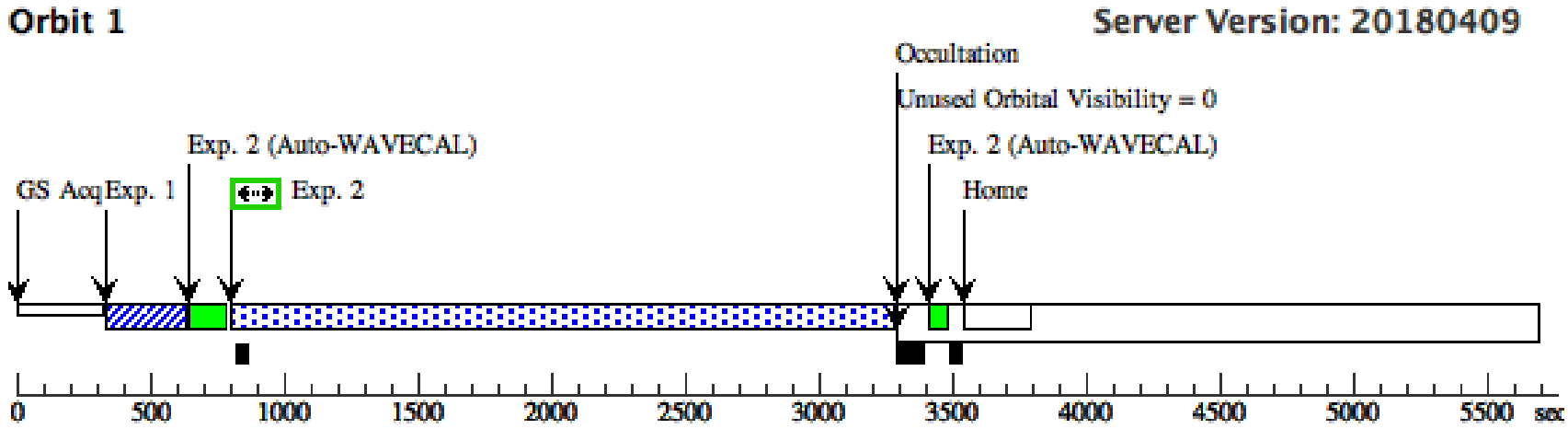
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	HD326328	RA: 16 53 45.5800 (253.4399167d) Dec: -41 49 9.60 (-41.81933d) Equinox: J2000		V=10.08+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(2) HD326328	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs) *[==>]*	*[1]*
2	(1006334)	(2) HD326328	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs) *[==>2468.0 Secs]*	*[1]*

Orbit Structure



Visit

Proposal 15206, Visit 03, implementation Fri Oct 26 06:00:21 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

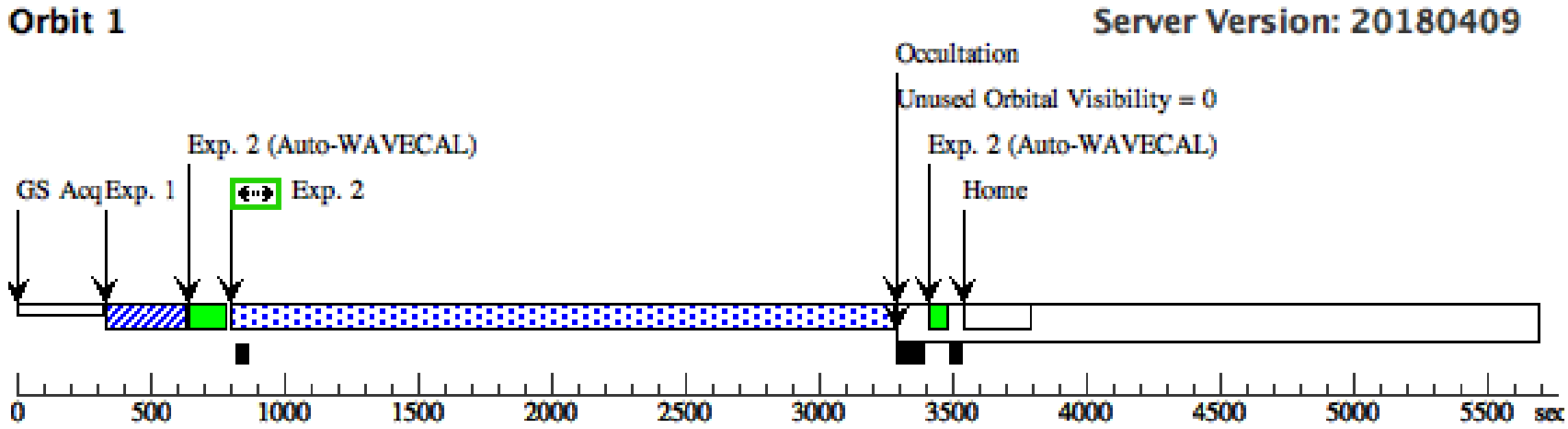
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CPD-41D7711	RA: 16 53 58.6000 (253.4941667d) Dec: -41 48 41.80 (-41.81161d) Equinox: J2000		V=9.78+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(3) CPD-41D7711	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs) *[==>]*	*[1]*
2	(1006334)	(3) CPD-41D7711	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs) *[==>2468.0 Secs]*	*[1]*

Orbit Structure



Visit

Proposal 15206, Visit 04, implementation Fri Oct 26 06:00:21 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

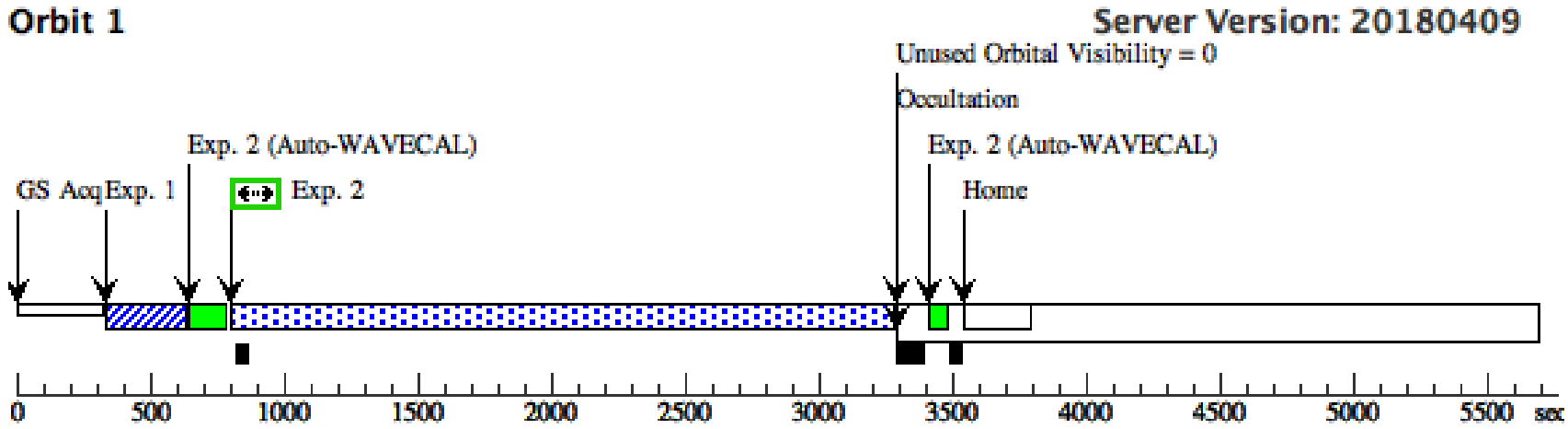
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	CPD-41D7712	RA: 16 54 0.3790 (253.5015792d) Dec: -41 52 43.63 (-41.87879d) Equinox: J2000		V=9.08+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(4) CPD-41D7712	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs) *[==>]*	*[1]*
2	(1006334)	(4) CPD-41D7712	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs) *[==>2468.0 Secs]*	*[1]*

Orbit Structure



Visit

Proposal 15206, Visit 05, implementation Fri Oct 26 06:00:21 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

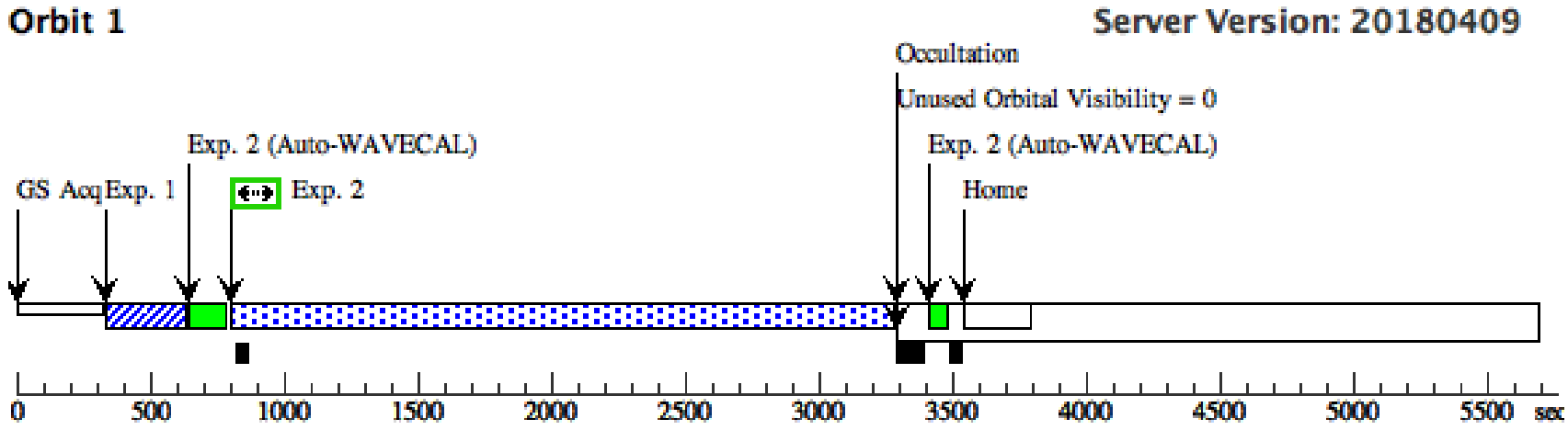
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	CPD-41D7715	RA: 16 54 1.7680 (253.5073667d) Dec: -41 51 12.12 (-41.85337d) Equinox: J2000		V=10.28+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(5) CPD-41D7715	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs)	
								[==>]	***[1]***
2	(1006334)	(5) CPD-41D7715	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs)	
								[==>2468.0 Secs]	***[1]***

Orbit Structure



Visit

Proposal 15206, Visit 06, implementation Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

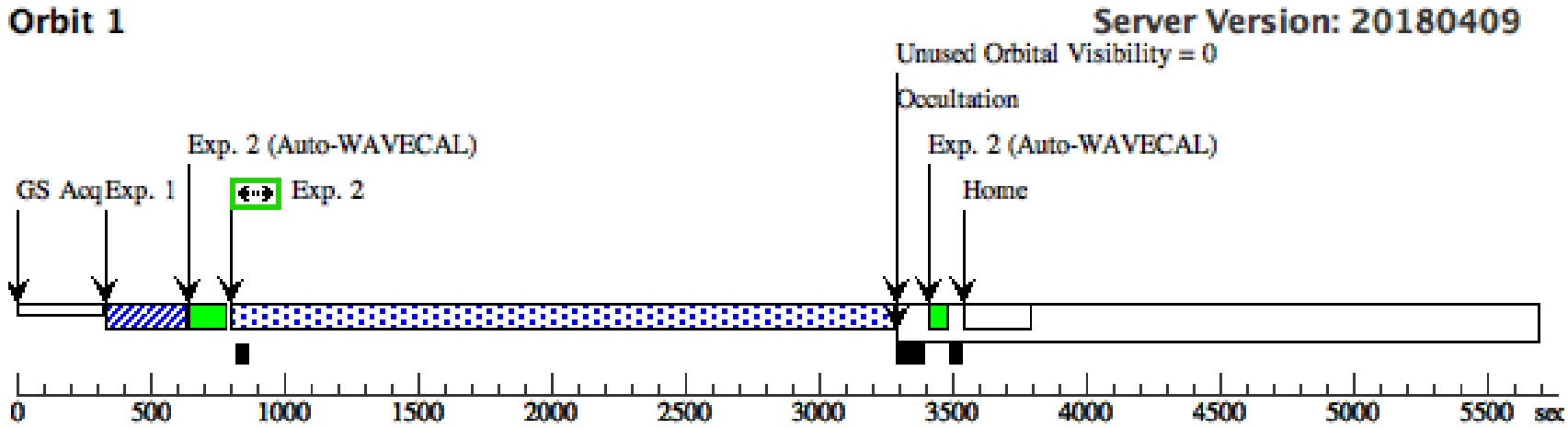
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	CD-41D11031 Alt Name1: CPD-41D7725	RA: 16 54 7.5300 (253.5313750d) Dec: -41 44 40.60 (-41.74461d) Equinox: J2000		V=9.90+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(6) CD-41D11031	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs)	
								[==>]	***[1]***
2	(1006334)	(6) CD-41D11031	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs)	
								[==>2468.0 Secs]	***[1]***

Orbit Structure



Visit

Proposal 15206, Visit 07, implementation Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

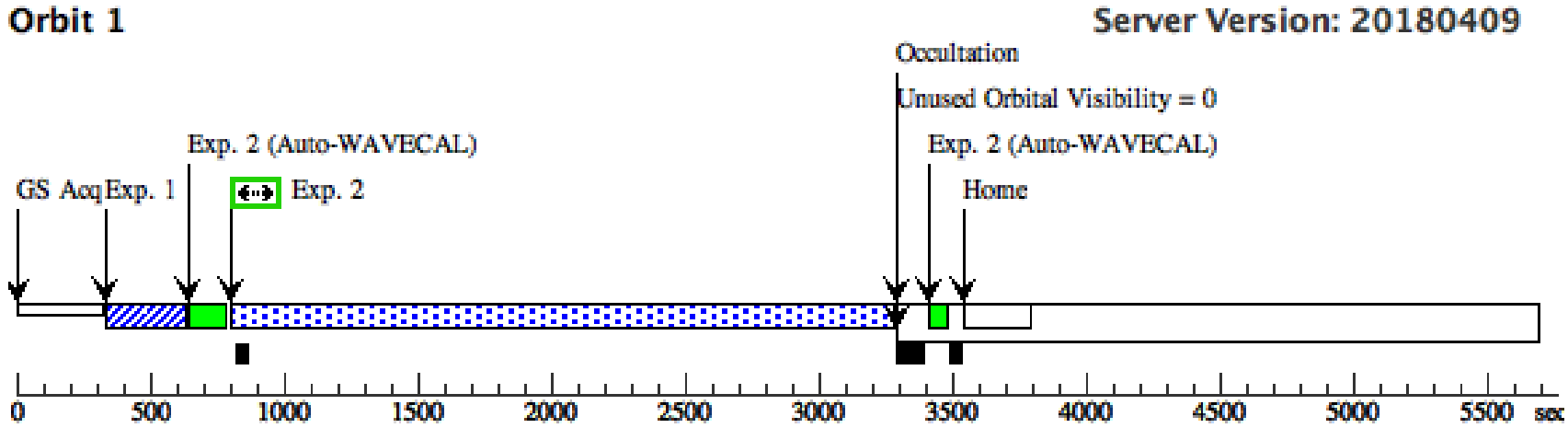
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	CPD-41D7736	RA: 16 54 15.7400 (253.5655833d) Dec: -41 49 32.40 (-41.82567d) Equinox: J2000	Epoch of Position: 2000	V=10.19+/-0.02	Reference Frame: ICRS

Comments: This star has a listed proper motion of (-102.2, 52.1) mas/yr, or more than 0.1 arc sec/yr. At the distance of the cluster (consistent with its spectral type and reddening), that would imply a tangential velocity of around 100,000 km/s. This has been ignored, and assumed to be the result of an erroneous measurement.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1005781)	(7) CPD-41D7736	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs)	
								[==>]	***[1]***
2	(1006334)	(7) CPD-41D7736	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs)	
								[==>2468.0 Secs]	***[1]***

Orbit Structure



Visit

Proposal 15206, Visit 08, implementation Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

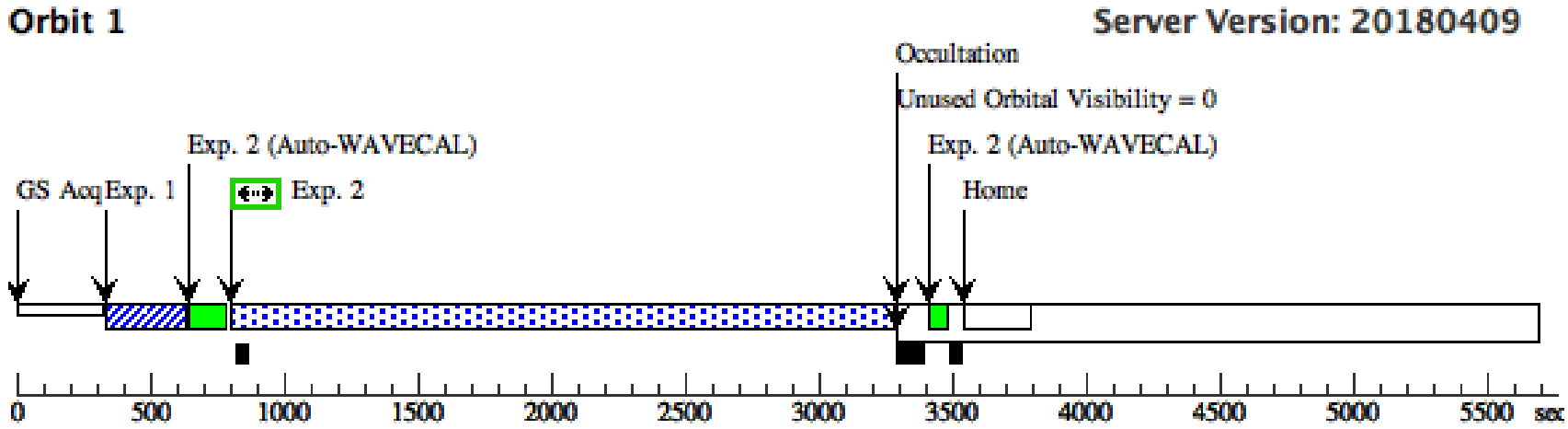
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(8)	CPD-41D7743	RA: 16 54 21.3000 (253.5887500d) Dec: -41 51 42.00 (-41.86167d) Equinox: J2000		V=9.75+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1007515)	(8) CPD-41D7743	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs) *[==>]*	*[1]*
2	(1007526)	(8) CPD-41D7743	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				800 Secs (2468 Secs) *[==>2468.0 Secs]*	*[1]*

Orbit Structure



Visit

Proposal 15206, Visit 09, completed Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: No Diagnostics

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

Special Requirements: (none)

Fixed Targets

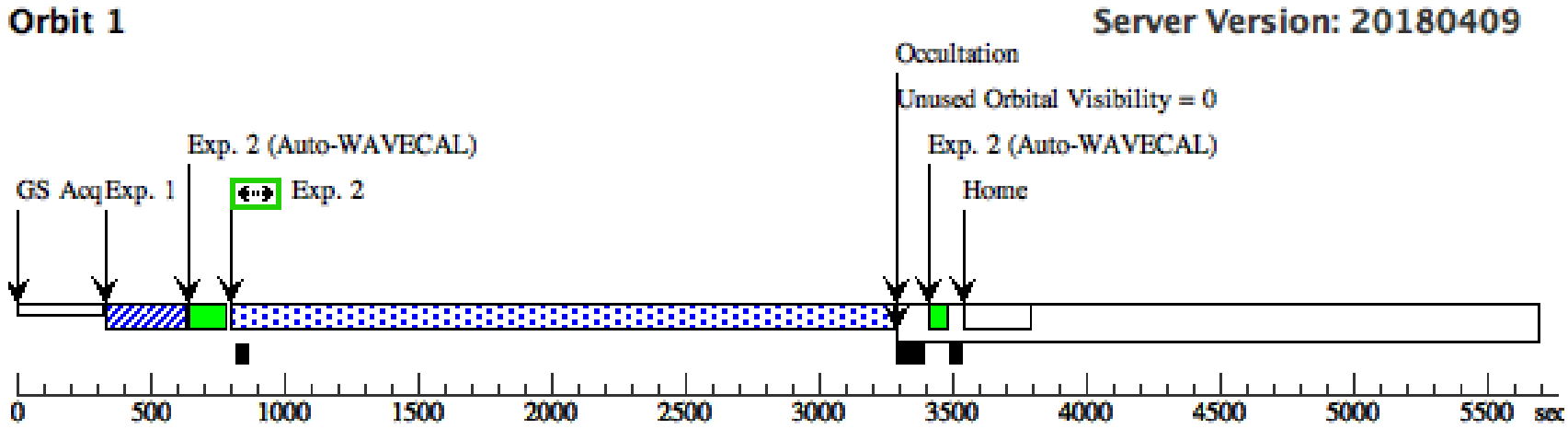
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(9)	NGC-6231-209	RA: 16 54 10.7200 (253.5446667d) Dec: -41 47 47.40 (-41.79650d) Equinox: J2000		V=10.58+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1007477)	(9) NGC-6231-209	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs) *[==>]*	*[1]*
2	(1006725)	(9) NGC-6231-209	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140M 1425 A				1800 Secs (2468 Secs) *[==>2468.0 Secs]*	*[1]*

Orbit Structure



Visit

Proposal 15206, Visit 10, completed Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: ORIENT 60D TO 300 D

Comments: ORIENT restriction imposed to avoid Cl NGC6231 SS108 from possibly falling into the PSA during the ACQ/IMAGE*

Diagnostics

(Visit 10) 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.

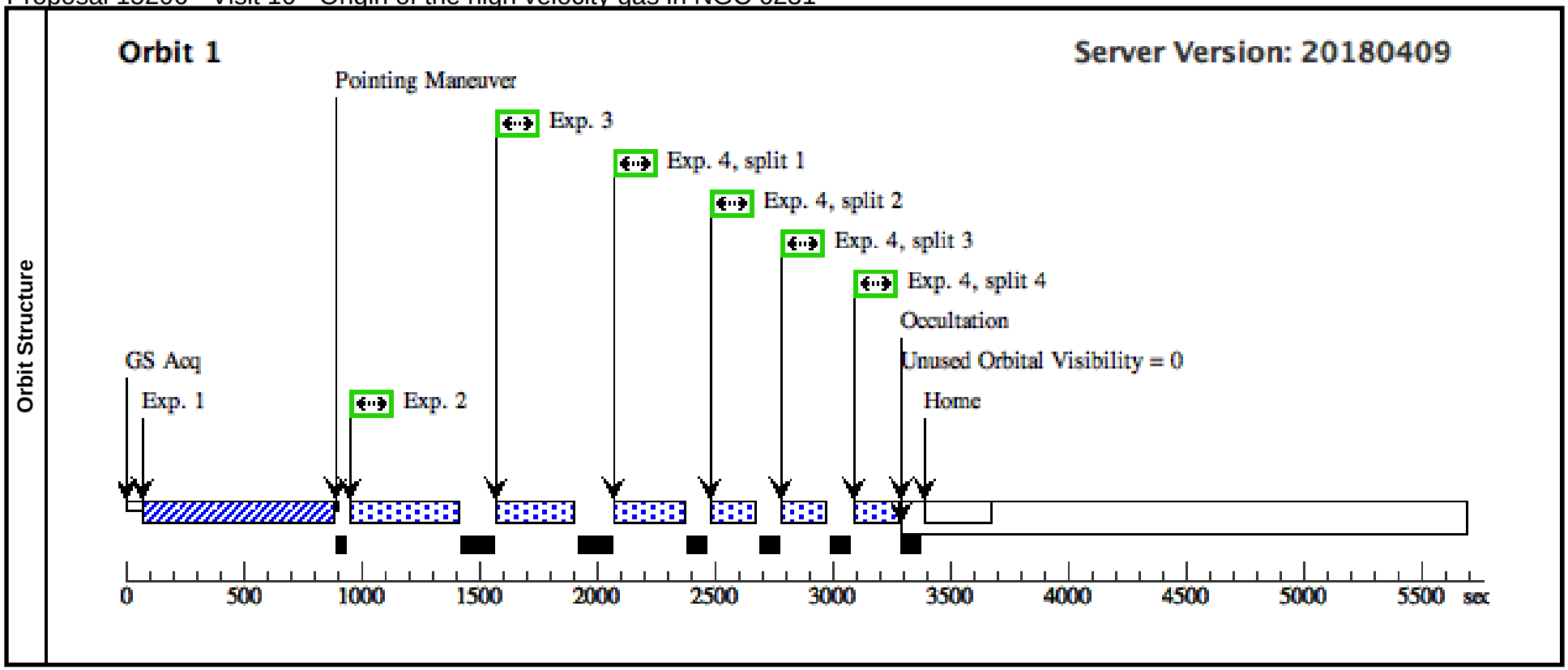
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(10)	NGC-6231-213	RA: 16 54 17.9200 (253.5746667d) Dec: -41 48 1.20 (-41.80033d) Equinox: J2000		V=11.01+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B0-B2 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1166662)	(10) NGC-6231-213	COS/NUV, ACQ/IMAGE, BOA	MIRRORB				245 Secs (245 Secs) *[==>]*	***[1]***
2	(1006460)	(10) NGC-6231-213	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2000; FP-POS=3; SEGMENT=BOTH			350 Secs (281 Secs) *[==>281.0 Secs]*	***[1]***
3	(1006460)	(10) NGC-6231-213	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=2000; FP-POS=4; SEGMENT=BOTH			350 Secs (281 Secs) *[==>281.0 Secs]*	***[1]***
4	(1006461)	(10) NGC-6231-213	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=2000; FP-POS=ALL; SEGMENT=BOTH			210 Secs (564 Secs) *[==>141.0 Secs (Split 1)]* *[==>141.0 Secs (Split 2)]* *[==>141.0 Secs (Split 3)]* *[==>141.0 Secs (Split 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20180409
Pointing Maneuver
Exp. 3
Exp. 4, split 1
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Occultation
Unused Orbital Visibility = 0
GS Acq
Exp. 1
Exp. 2
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15206, Visit 11, completed Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 11) 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.

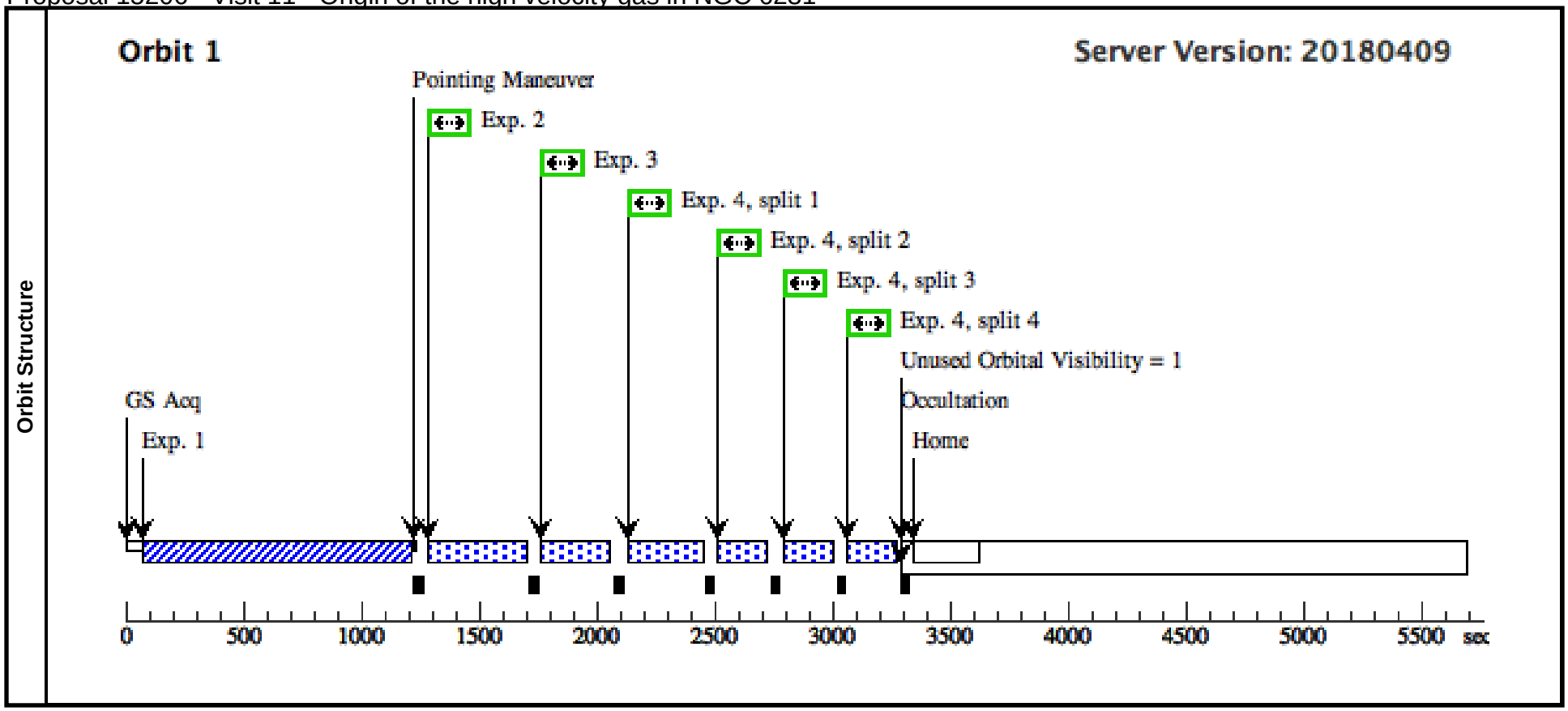
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(11)	NGC-6231-217	RA: 16 54 22.0000 (253.5916667d) Dec: -41 48 47.20 (-41.81311d) Equinox: J2000		V=12.21+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B6-B9.5 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1166719)	(11) NGC-6231-217	COS/NUV, ACQ/IMAGE, BOA	MIRRORB				410 Secs (410 Secs) *[==>]*	***[1]***
2	(1006470)	(11) NGC-6231-217	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=900; FP-POS=3; SEGMENT=BOTH			350 Secs (241 Secs) *[==>241.0 Secs]*	***[1]***
3	(1006470)	(11) NGC-6231-217	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=900; FP-POS=4; SEGMENT=BOTH			350 Secs (241 Secs) *[==>241.0 Secs]*	***[1]***
4	(1009294)	(11) NGC-6231-217	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=750; FP-POS=ALL; SEGMENT=BOTH			270 Secs (644 Secs) *[==>161.0 Secs (Split 1)]* *[==>161.0 Secs (Split 2)]* *[==>161.0 Secs (Split 3)]* *[==>161.0 Secs (Split 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20180409
Pointing Maneuver
Exp. 2
Exp. 3
Exp. 4, split 1
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Unused Orbital Visibility = 1
Occultation
Home
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15206, Visit 12, completed Fri Oct 26 06:00:22 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Visit 12) 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.

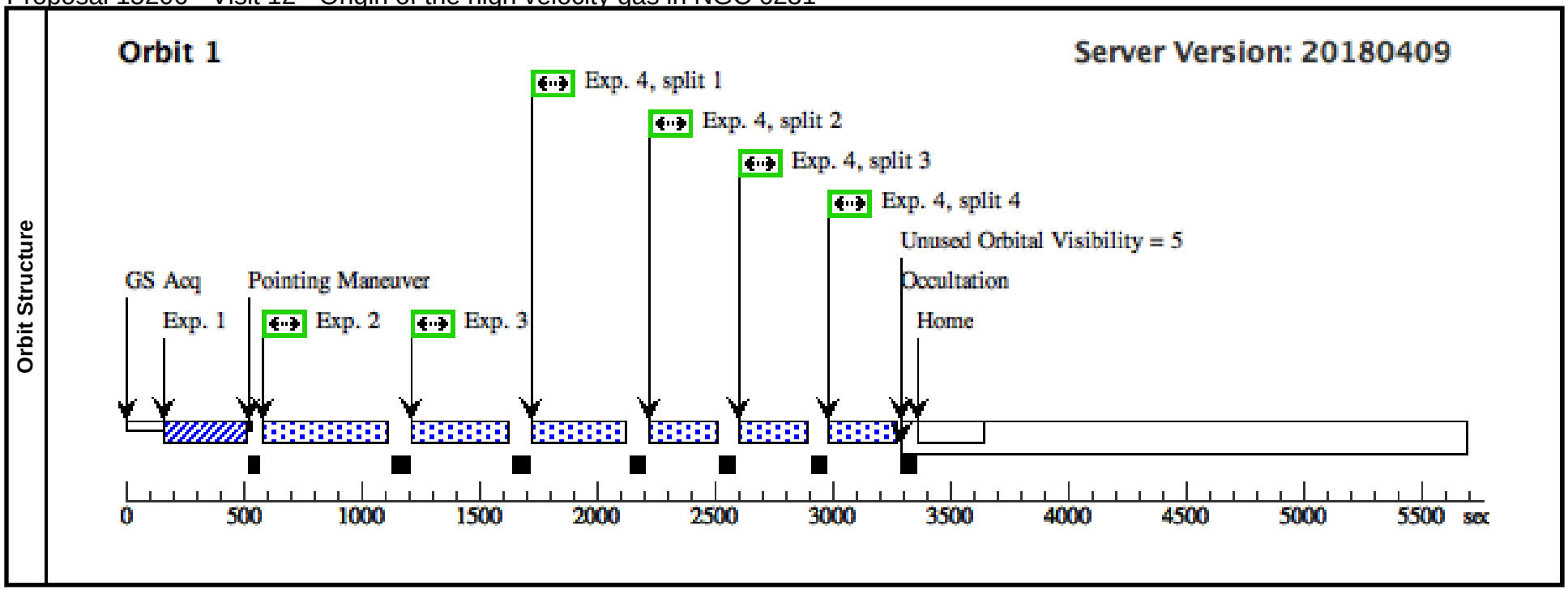
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(12)	NGC-6231-222	RA: 16 54 27.9800 (253.6165833d) Dec: -41 50 14.00 (-41.83722d) Equinox: J2000		V=11.81+/-0.02	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[B3-B5 V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1006473)	(12) NGC-6231-222	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				60 Secs (60 Secs) *[==>]*	***[1]***
2	(1006474)	(12) NGC-6231-222	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=600; FP-POS=3; SEGMENT=BOTH			350 Secs (360 Secs) *[==>360.0 Secs]*	***[1]***
3	(1006474)	(12) NGC-6231-222	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=600; FP-POS=4; SEGMENT=BOTH			350 Secs (360 Secs) *[==>360.0 Secs]*	***[1]***
4	(1009296)	(12) NGC-6231-222	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=500; FP-POS=ALL; SEGMENT=BOTH			230 Secs (960 Secs) *[==>240.0 Secs (Split 1)]* *[==>240.0 Secs (Split 2)]* *[==>240.0 Secs (Split 3)]* *[==>240.0 Secs (Split 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20180409
Exp. 4, split 1
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Unused Orbital Visibility = 5
GS Acq
Pointing Maneuver
Occultation
Exp. 1
Exp. 2
Exp. 3
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec