15066 - Mapping the structure and kinematics of NGC 1624-2's giant magnetosphere

Cycle: 25, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Alexandre David-Uraz (PI) (Contact)	**University of Delaware**	**adu@udel.edu**
Dr. Veronique Petit (CoI)	University of Delaware	vpetit@udel.edu
Dr. David Cohen (CoI)	Swarthmore College	cohen@astro.swarthmore.edu
Christiana Erba (CoI)	University of Delaware	cerba@udel.edu
Dr. Alexander W. Fullerton (CoI)	Space Telescope Science Institute	fullerton@stsci.edu
Mr. Zsolt Keszthelyi (CoI) (CSA Member)	Royal Military College of Canada	zsolt.keszthelyi@queensu.ca
Dr. Maurice Leutenegger (CoI)	University of Maryland Baltimore County	maurice.a.leutenegger@nasa.gov
Dr. Stanley P. Owocki (CoI)	University of Delaware	owocki@bartol.udel.edu
Dr. Jon O. Sundqvist (CoI) (ESA Member)	Universitats-Sternwarte Munchen	jon@usm.uni-muenchen.de
Rebecca MacInnis (CoI)	University of Delaware	macinnis@udel.edu
Dr. Gregg A. Wade (CoI) (CSA Member)	Royal Military College of Canada	gregg.wade@rmc.ca
Dr. Nolan R. Walborn (CoI)	Space Telescope Science Institute	walborn@stsci.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) NGC-1624-2	COS/FUV COS/NUV	2	17-Oct-2017 15:00:50.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
02	(1) NGC-1624-2	COS/FUV COS/NUV	2	17-Oct-2017 15:00:53.0	yes
03	(1) NGC-1624-2	COS/FUV COS/NUV	2	17-Oct-2017 15:00:56.0	yes
04	(1) NGC-1624-2	COS/FUV COS/NUV	2	17-Oct-2017 15:00:58.0	yes

8 Total Orbits Used

ABSTRACT

We propose to obtain phase-resolved COS observations of the extraordinary magnetic star NGC 1624-2, which has the strongest magnetic field ever detected in an O-type star, by nearly an order of magnitude. Two COS observations, obtained at rotational phases when the magnetic field is closest to pole-on and equator-on, respectively, revealed a remarkable variation of the wind line profiles, caused by the magnetically-imposed break of spherical symmetry in the kinematics, density, and ionization structure of the stellar wind. With 4 new observations, we will now monitor the variation of the UV line profiles over the whole stellar rotation to map the complex structure of NGC 1624-2's enormous magnetosphere, which represents a new regime of extreme wind confinement that will test the limits of the current theory of magnetized stellar winds.

OBSERVING DESCRIPTION

Our program requires time-critical observations of NGC 1624-2 at four rotational phases, as described below.

For each of these observations, we aim to investigate important photospheric, wind, and magnetospheric features such as N V 1239,1243 A, Si IV 1393,1403 A, C IV 1548,1550 AA, N IV 1718 A. NGC 1624-2, with V=11.77, E(B-V)=0.9, will therefore be optimally observed at the COS medium resolution with the G130M (settings 1223, 1291 A) and G160M (1577, 1623 A) gratings for the maximum available, quasi-uninterrupted wavelength coverage of 1135 - 1798 A (with a small gap at 1214 - 1218 A).

Two orbits in each of the four visits at phases 0.26, 0.38, 0.63 and 0.91 will be required, as follows.

The visibility period is 57 min. Guide star acquisition consumes 6 min and COS imaging target acquisition another 3 min of the first orbit. COS

overheads for the required 4-setting sequence are 5+3=8 min in the first orbit, but only 3 min in the second because a setting change can be done during the occultation. Guide star reacquisition requires only 4 min in the second orbit, and the target acquisition is not repeated. Thus, 40 min remain for G130M exposure in the first orbit, and 50 min for G160M in the second. For a spectral type of O7 and the above photometry, the COS ETC predicts S/N of 26 and 28 per resolution element, respectively, sufficient for our objectives. The ephemeris for NGC 1624-2 is JD = 2455967.0 (+/-10) + 157.99 (+/-0.94) x E (Wade et al. 2012).

A tolerance of +-0.05 cycles around the desired phases leads to periodic observational windows of 2 weeks that are consistent with these constraints.

Visit

Proposal 15066, Phase 0.26 (01), implementation Tue Oct 17 19:01:00 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: Period 157.99 D AND ZERO-PHASE HJD2455967.0

Diagnostics

(Phase 0.26 (01)) 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

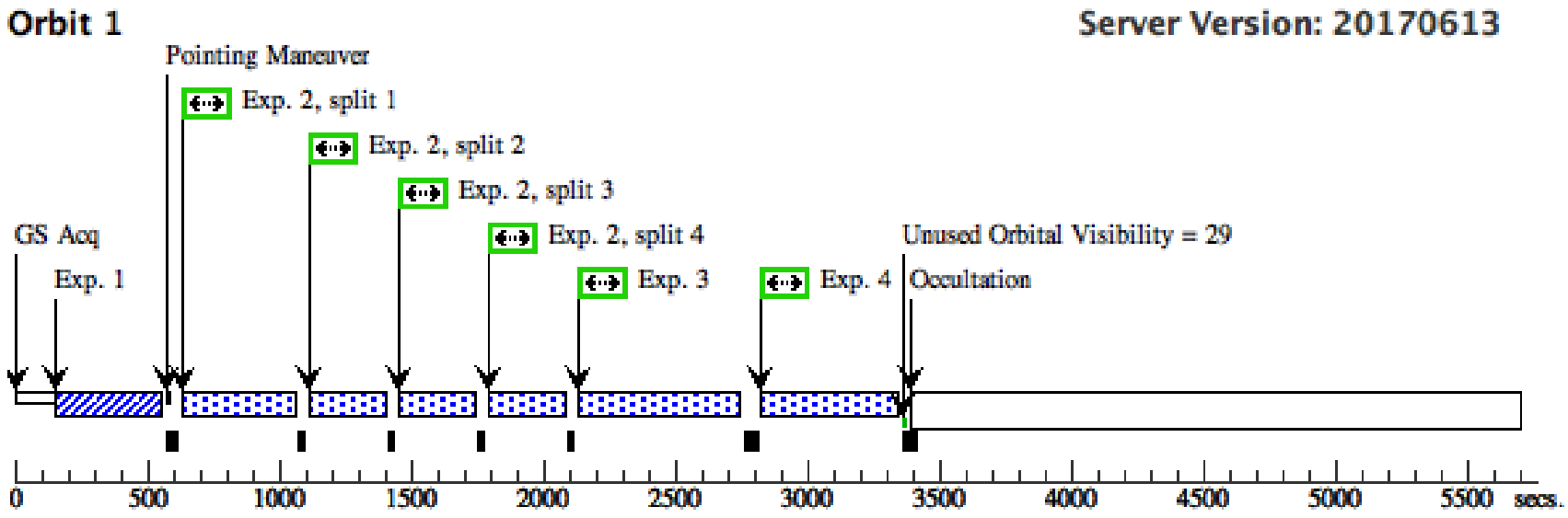
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-1624-2 Alt Name1: J04403728+5027410	RA: 04 40 37.2800 (70.1553333d) Dec: +50 27 41.08 (50.46141d) Equinox: J2000		V=11.77	Reference Frame: ICRS

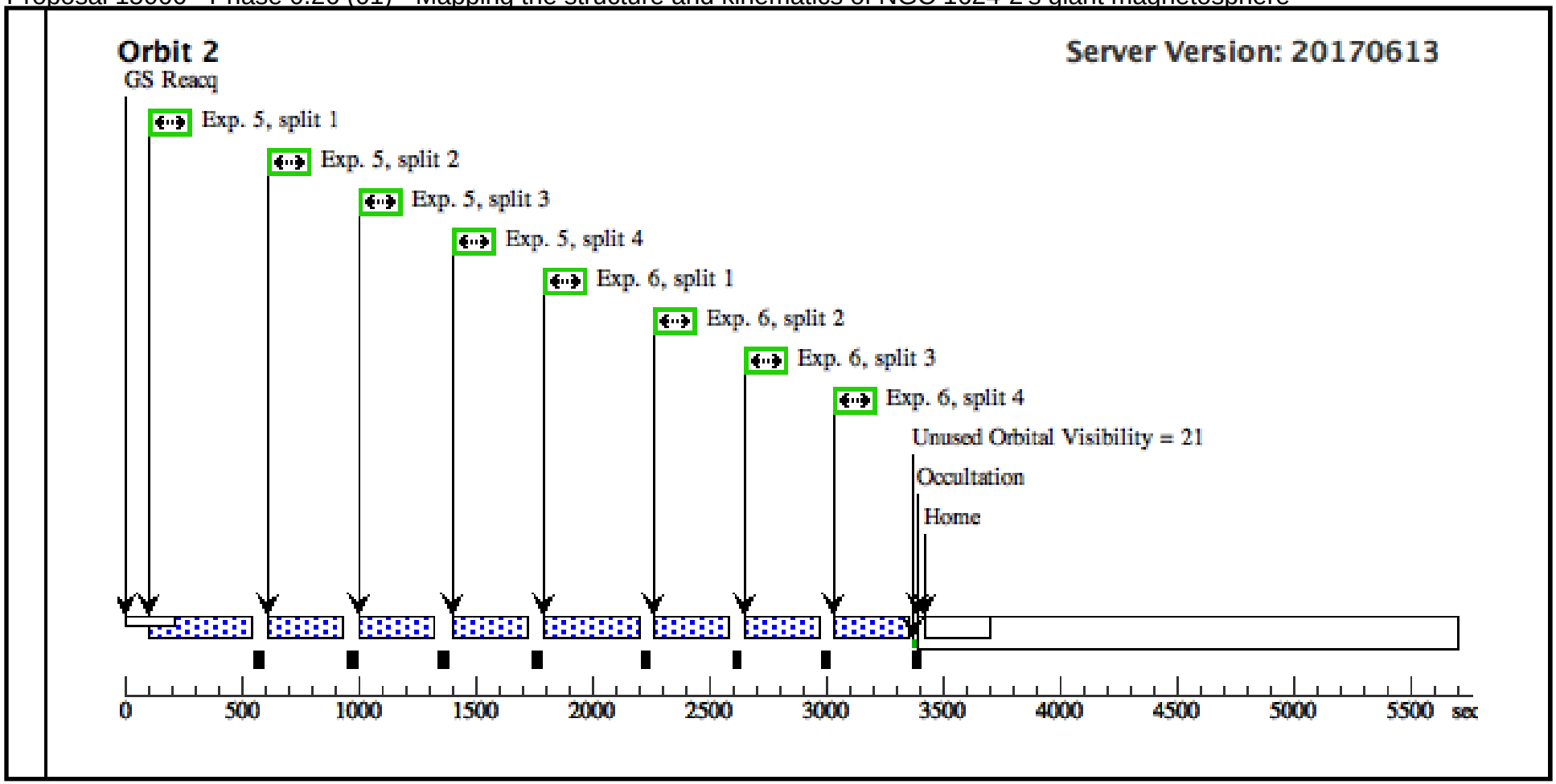
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Phase 0.26 ACQ (COS.ta.1012277)	(1) NGC-1624-2	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		PHASE 0.21 TO 0.31		86 Secs (86 Secs) *[==>]*	*[1]*
2	Phase 0.26 G130M-1222 (COS.sp.1012484)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2313; FP-POS=ALL			235 Secs (940 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*
3	Phase 0.26 G130M-1291 (FP-POS=3) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=3			470 Secs (470 Secs) *[==>]*	*[1]*
4	Phase 0.26 G130M-1291 (FP-POS=4) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=4			470 Secs (470 Secs) *[==>]*	*[1]*
5	Phase 0.26 G160M-1577 (COS.sp.1012441)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1139; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*
6	Phase 0.26 G160M-1623 (COS.sp.1012444)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=1265; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*

Orbit Structure




Orbit 2
Server Version: 20170613
GS Reacq
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 5, split 4
Exp. 6, split 1
Exp. 6, split 2
Exp. 6, split 3
Exp. 6, split 4
Unused Orbital Visibility = 21
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15066, Phase 0.38 (02), implementation Tue Oct 17 19:01:00 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: Period 157.99 D AND ZERO-PHASE HJD2455967.0

Diagnostics

(Phase 0.38 (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

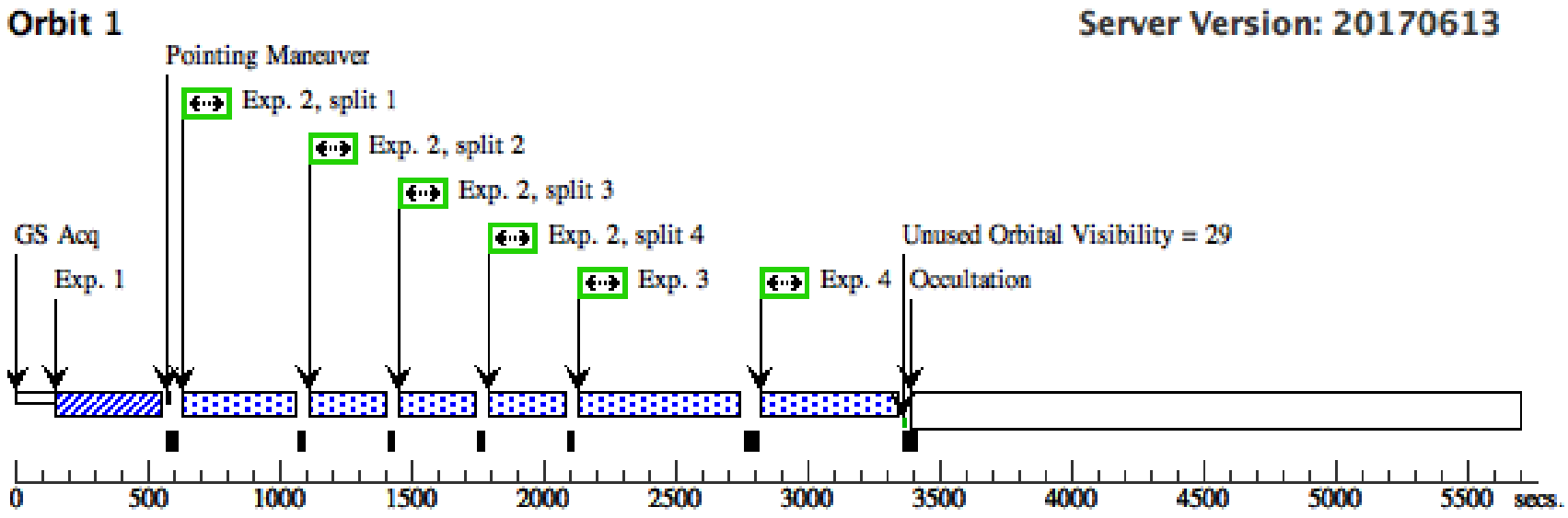
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-1624-2 Alt Name1: J04403728+5027410	RA: 04 40 37.2800 (70.1553333d) Dec: +50 27 41.08 (50.46141d) Equinox: J2000		V=11.77	Reference Frame: ICRS

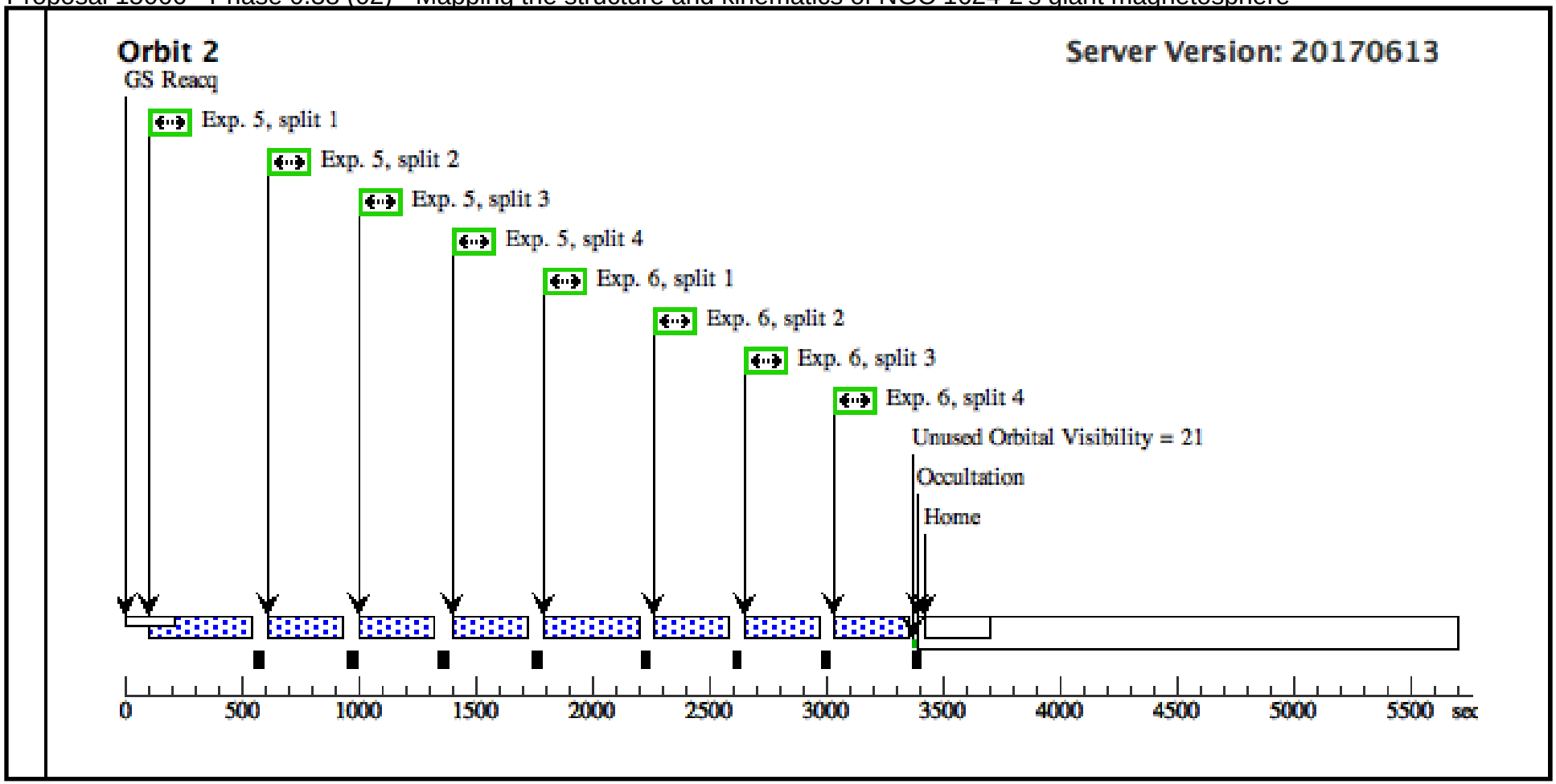
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Phase 0.38 ACQ (COS.ta.1012277)	(1) NGC-1624-2	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		PHASE 0.33 TO 0.43		86 Secs (86 Secs) *[==>]*	*[1]*
2	Phase 0.38 G130M-1222 (COS.sp.1012484)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2313; FP-POS=ALL			235 Secs (940 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*
3	Phase 0.38 G130M-1291 (FP-POS=3) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=3			470 Secs (470 Secs) *[==>]*	*[1]*
4	Phase 0.38 G130M-1291 (FP-POS=4) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=4			470 Secs (470 Secs) *[==>]*	*[1]*
5	Phase 0.38 G160M-1577 (COS.sp.1012441)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1139; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*
6	Phase 0.38 G160M-1623 (COS.sp.1012444)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=1265; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*

Orbit Structure




Orbit 2
Server Version: 20170613
GS Reacq
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 5, split 4
Exp. 6, split 1
Exp. 6, split 2
Exp. 6, split 3
Exp. 6, split 4
Unused Orbital Visibility = 21
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15066, Phase 0.63 (03), implementation Tue Oct 17 19:01:00 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: Period 157.99 D AND ZERO-PHASE HJD2455967.0

Diagnostics

(Phase 0.63 (03)) 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

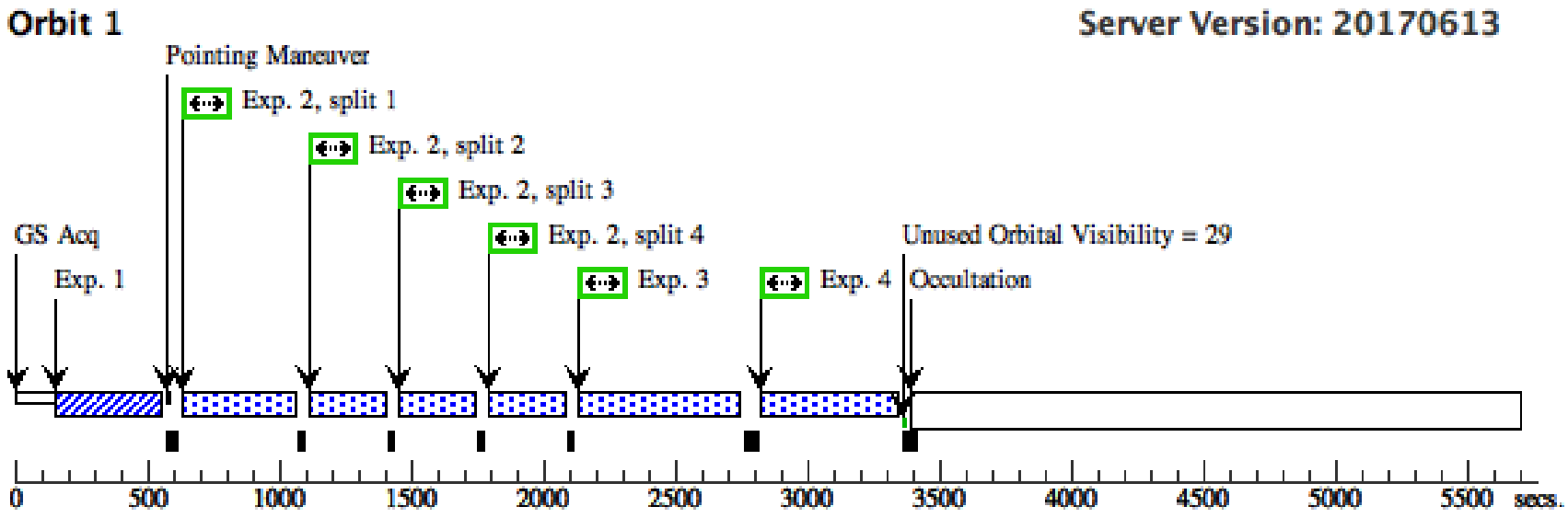
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-1624-2 Alt Name1: J04403728+5027410	RA: 04 40 37.2800 (70.1553333d) Dec: +50 27 41.08 (50.46141d) Equinox: J2000		V=11.77	Reference Frame: ICRS

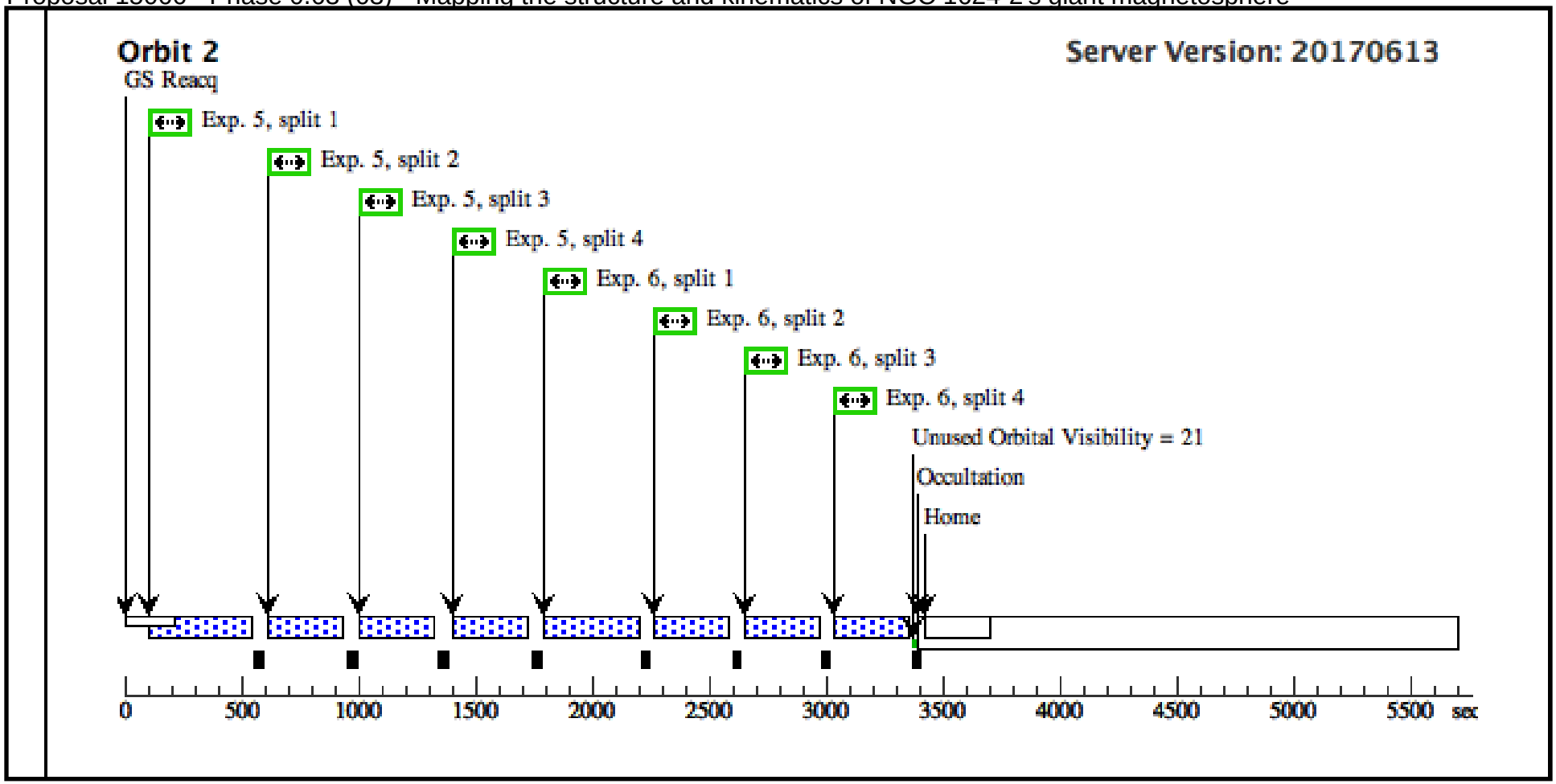
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Phase 0.63 ACQ (COS.ta.1012277)	(1) NGC-1624-2	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		PHASE 0.58 TO 0.68		86 Secs (86 Secs) *[==>]*	*[1]*
2	Phase 0.63 G130M-1222 (COS.sp.1012484)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2313; FP-POS=ALL			235 Secs (940 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*
3	Phase 0.63 G130M-1291 (FP-POS=3) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=3			470 Secs (470 Secs) *[==>]*	*[1]*
4	Phase 0.63 G130M-1291 (FP-POS=4) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=4			470 Secs (470 Secs) *[==>]*	*[1]*
5	Phase 0.63 G160M-1577 (COS.sp.1012441)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1139; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*
6	Phase 0.63 G160M-1623 (COS.sp.1012444)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=1265; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*

Orbit Structure




Orbit 2
Server Version: 20170613
GS Reacq
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 5, split 4
Exp. 6, split 1
Exp. 6, split 2
Exp. 6, split 3
Exp. 6, split 4
Unused Orbital Visibility = 21
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15066, Phase 0.91 (04), implementation Tue Oct 17 19:01:00 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: Period 157.99 D AND ZERO-PHASE HJD2455967.0

Comments: To be observed preferably once the transition to LP4 is done so that all 4 visits are accomplished with the same settings

Diagnostics

(Phase 0.91 (04)) 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

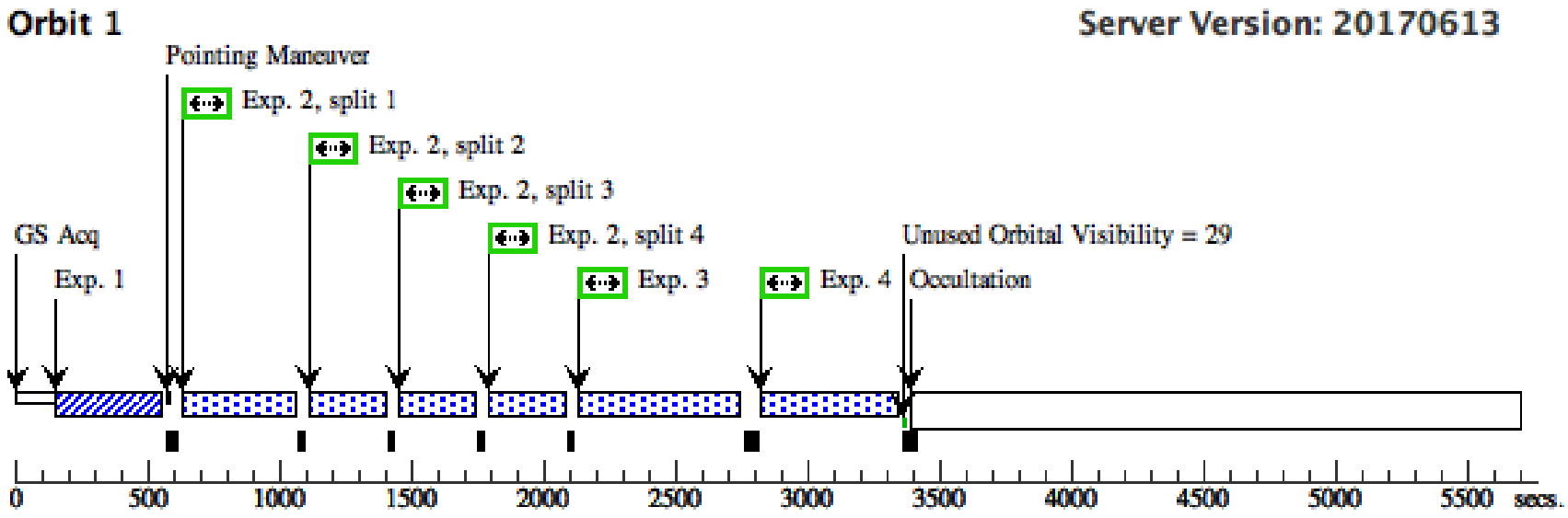
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-1624-2 Alt Name1: J04403728+5027410	RA: 04 40 37.2800 (70.1553333d) Dec: +50 27 41.08 (50.46141d) Equinox: J2000		V=11.77	Reference Frame: ICRS

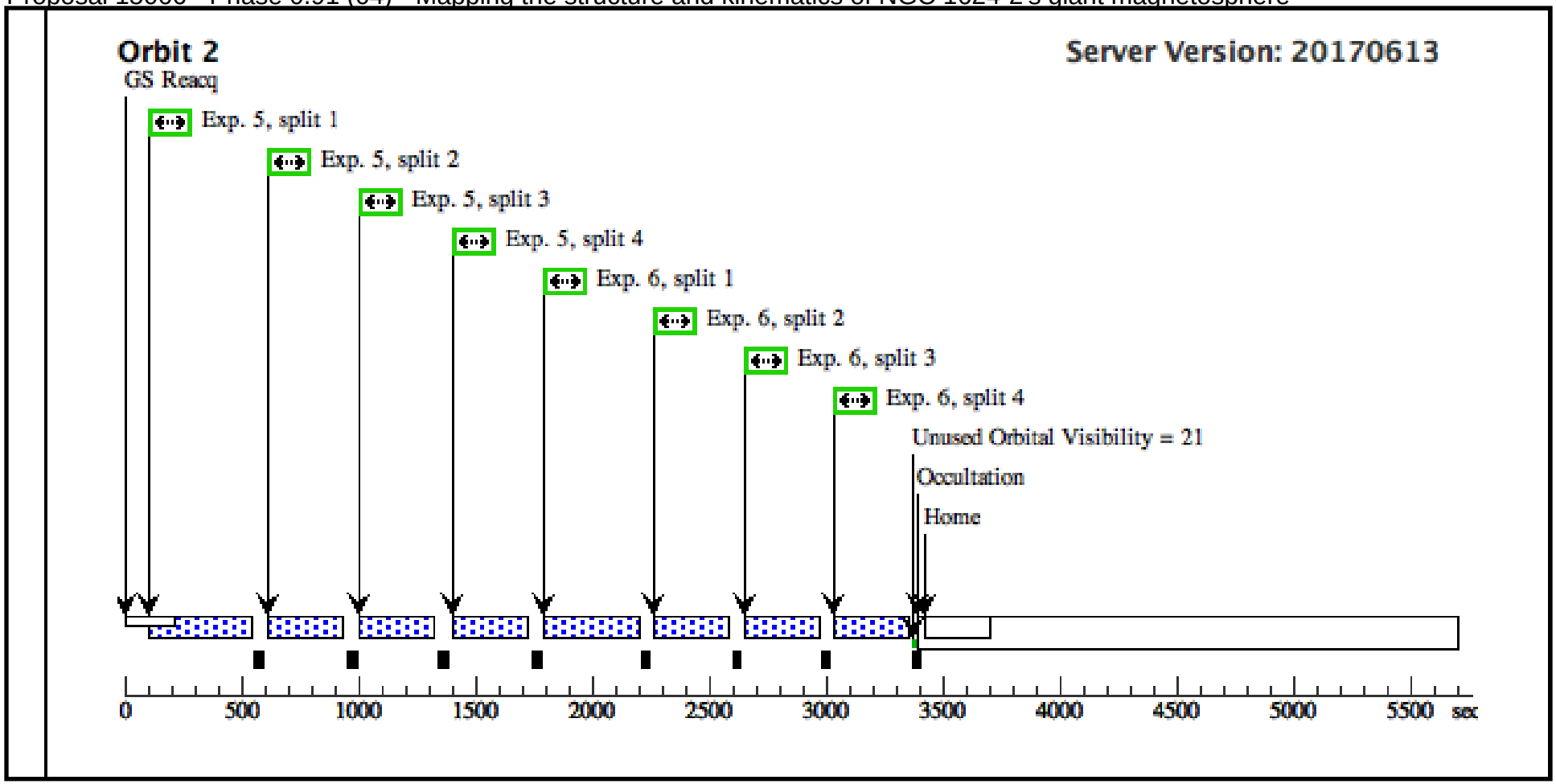
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Phase 0.91 ACQ (COS.ta.1012277)	(1) NGC-1624-2	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		PHASE 0.86 TO 0.96		86 Secs (86 Secs) *[==>]*	***[1]***
2	Phase 0.91 G130M-1222 (COS.sp.1012484)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2313; FP-POS=ALL			235 Secs (940 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	Phase 0.91 G130M-1291 (FP-POS=3) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=3			470 Secs (470 Secs) *[==>]*	***[1]***
4	Phase 0.91 G130M-1291 (FP-POS=4) (COS.sp.1012486)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1343; FP-POS=4			470 Secs (470 Secs) *[==>]*	***[1]***
5	Phase 0.91 G160M-1577 (COS.sp.1012441)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1139; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***
6	Phase 0.91 G160M-1623 (COS.sp.1012444)	(1) NGC-1624-2	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=1265; FP-POS=ALL			270 Secs (1080 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20170613
GS Reacq
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 5, split 4
Exp. 6, split 1
Exp. 6, split 2
Exp. 6, split 3
Exp. 6, split 4
Unused Orbital Visibility = 21
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec