17406 - The Beat Goes On

Cycle: 31, Proposal Category: GO

(Availability Mode: AVAILABLE)

INVESTIGATORS

Name	*Institution*
Dr. Thomas R. Ayres (PI) (Contact)	**University of Colorado at Boulder**

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
10	(1) HD-131156A (2) HD-131156B	COS/FUV COS/NUV	2	10-Jun-2024 15:00:56.0	yes
11	(3) HD-165341A (4) HD-165341B	COS/FUV COS/NUV	2	10-Jun-2024 15:00:58.0	yes

4 Total Orbits Used

ABSTRACT

(This is a joint Chandra/HST program: the Chandra proposal abstract follows.)

Chandra has been following magnetic heartbeats of late-type stars via high-contrast coronal X-rays. Goal is to provide fundamental observational constraints for contemporary and future studies of the underlying magnetic dynamo, whose internal workings remain elusive. The Sun's high-energy modulations play an important space weather role in our heliosphere, as do stellar counterparts for their exoplanets. A 3-year continuation (joint with HST) is proposed for current cycles targets Xi Boo (G8V+K4) and 70 Oph (K0V+K5V). Key questions: (1) origin of diverging branches in rotational period vs. cycle duration, where Sun sits isolated in the middle, possibly in a transitional state; (2) extent of high-energy variability bias, which can affect interpretations of large surveys.

OBSERVING DESCRIPTION

Impact of Reduced Gyro Mode

The two targets, Xi Boo and 70 Oph, would be minimally affected by RGM, because there is only a minor orientation constraint on the observations (having to do with protecting the PSA for the NUV/BOA target acquisition). Further, the Visits are only 2 orbits, minimizing the possibility of re-acquisition failures. However, if target acquisition times are increased by RGM, then one or more of the exposures would have to be shortened. This can be done with minimal loss of science.

Phase II Observing Description (for normal 3-gyro operations)

Observational goal is to obtain FUV moderate-resolution spectra of both components of Xi Boo and 70 Oph using Cosmic Origins Spectrograph (COS) . The primaries, Xi Boo A and 70 Oph A, are nearly identical in FUV flux levels, about a tenth of well-studied (by STIS) Alpha Cen A. Normally, high-sensitivity COS would be off-limits for these primaries, because their strong Lyman-alpha features would violate FUV detector bright limits. However, the COS G130M-1222 setting places Lyman-alpha in the gap between detector sides A and B, so can be used for cool stars, as long as their other strong emissions (e.g., C II 133 nm) are "safe" (as is the case for Xi Boo A and 70 Oph A). When combined with COS G160M-1533, the spectral range 107-171 nm can be covered, with only two small gaps: 120.7-122.3 nm (Lyman-alpha) and 151.5-153.3 nm (devoid of important lines). COS's 15 km/s resolution is fully adequate for the relatively broad FUV emission features of these cool stars, especially the "hot" lines like Si III 120.6 nm (T~30,000 K), Si IV 139.3 nm (80,000 K), and C IV 154.8 nm (100,000 K). The COS FUV channel is so sensitive that a mere 1000 s exposure obtains S/N~100 (line peak) at Si III, 80 at Si IV, and 65 at C IV, for both primary stars. Each grating setting requires 4 "FP-Splits" to mitigate fixed pattern noise.

The pair of FUV settings plus FP-SPLITs can be done in a single orbit for the primary of each system, including the initial Guide Star and NUV imaging target acquisitions.

At the beginning of the second orbit, the secondary star would be centered by a small offset manuever from the primary, given the accurate orbital ephemeris. The same dual-setting FUV sequence then would be carried out, extending over the remaining unocculted part of the second orbit.

The COS visits would be once a year for each system (4 HST orbits per year, total): experience with Alpha Cen AB has shown that the FUV variability, while significant, is not as pronounced as that of the X-rays (which are observed twice a year for each system). Helpfully, key coronal forbidden lines Fe XII 134.9 nm (T~2 MK) and Fe XXI 135.4 nm (10 MK) are available in the FUV to assess the stellar coronal states at the times of the COS pointings. For this reason, the HST and Chandra observations need not be simultaneous. In fact, it is better to have them separated, since the FUV coronal forbidden lines would then provide an additional point on the high-energy time line. Given the very deep COS exposures proposed here (especially at 134.9 nm and 135.4 nm, which receive double coverage in the 2 nm overlap between G130M and G160M), the Fe XII coronal forbidden line will be easily detected in the primary stars (based on the previous COS visits), and even in the UV-fainter secondaries.

Proposal 17406 - Visit 10 - The Beat Goes On

Visit

Proposal 17406, Visit 10, completed Mon Jun 10 19:00:59 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: ORIENT 130D TO 10 D

Diagnostics

(Visit 10) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(Visit 10) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 10) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Exposure 1 (Visit 10) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

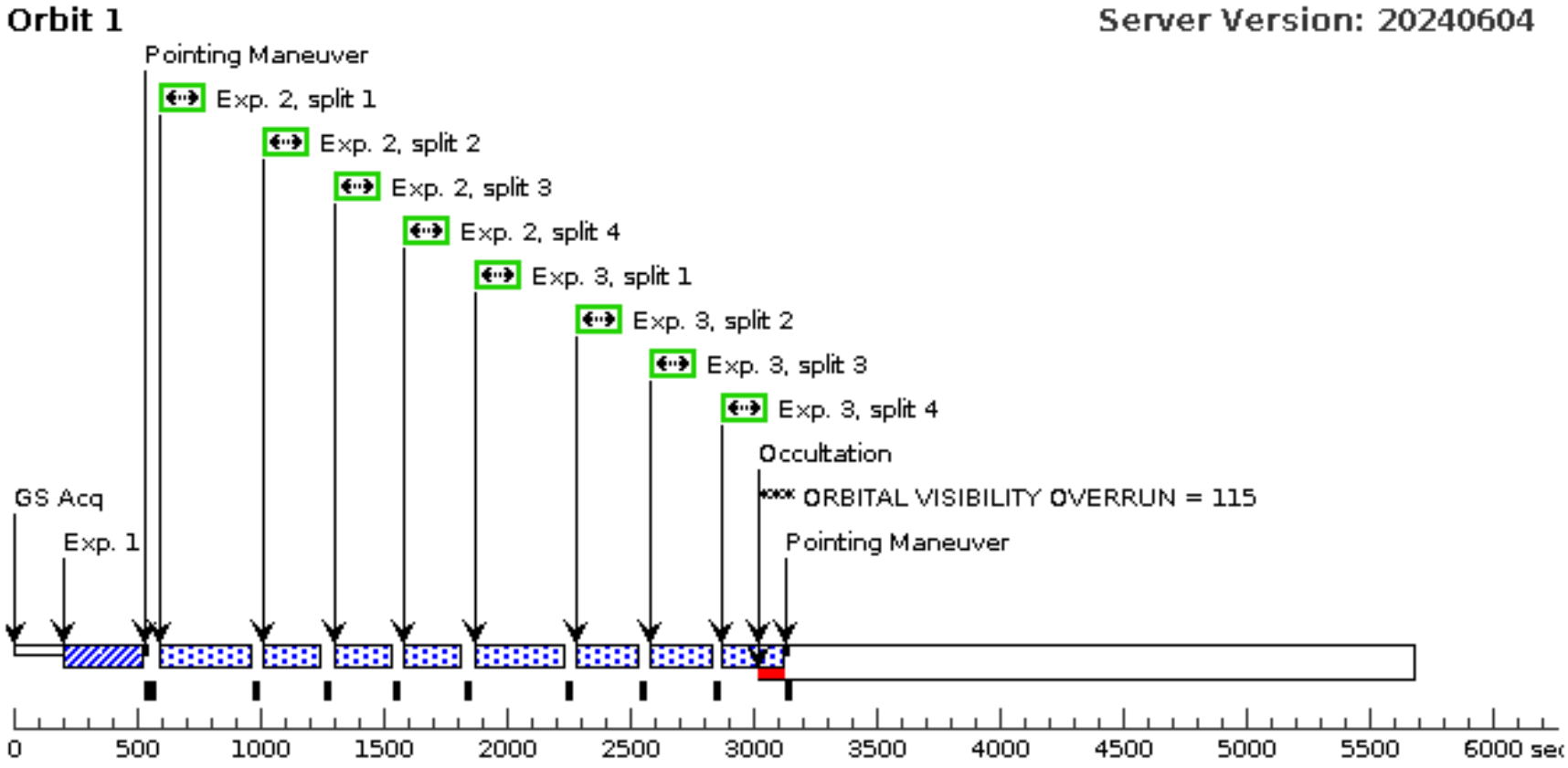
Fixed Targets

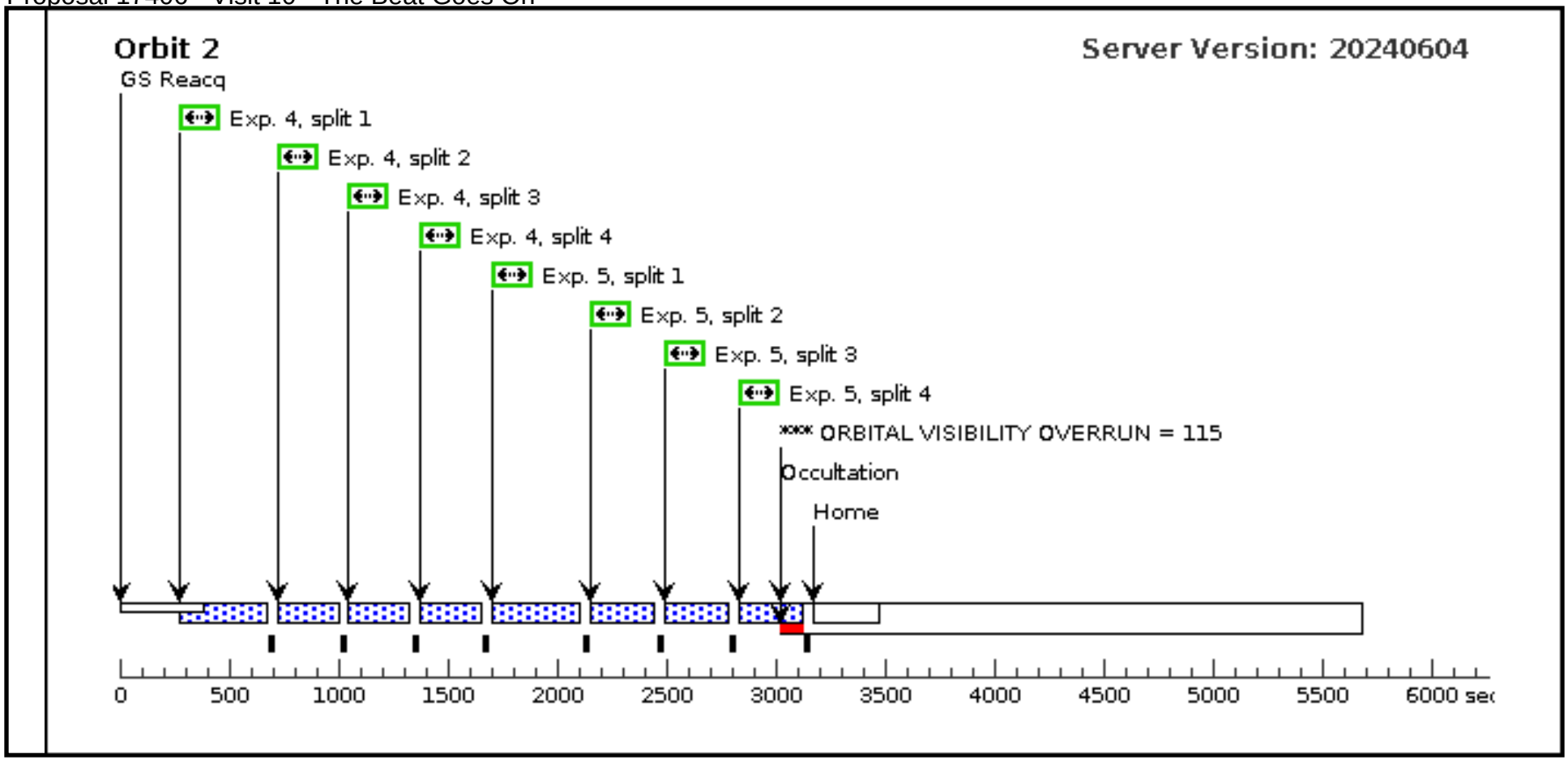
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-131156A	RA: 14 51 23.3885 (222.8474521d)	Proper Motion RA: +0.1275 arcsec/yr	V=+4.68+/-0.1	Reference Frame: ICRS
	Alt Name1: XI-BOO-A	Dec: +19 06 1.62 (19.10045d)	Proper Motion Dec: -0.0406 arcsec/yr		
		Equinox: J2000	Parallax: 0.148"		
			Epoch of Position: 2000		
			Radial Velocity: +1.5 km/sec		
Comments: Target coords for epoch 2000 from SIMBAD, based on Gaia measurements for a mean epoch of 2015.5 corrected for Gaia proper motions *Category=STAR* *Description=[CORONA, G V-IV]* *Extended=NO*					
(2)	HD-131156B	Offset from HD-131156A	Radial Velocity: +2.3 km/sec	V=+6.82+/-0.1	Offset Position (HD-131156B)
	Alt Name1: XI-BOO-B	RA Offset: -0.328 Secs			
		Dec Offset: 1.69 Arcsec			
Comments: Target offset based on ephemeris from 6th Orbital Catalog, for 2024.5 *Category=STAR* *Description=[CORONA, K 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	(COS.ta.1367079)	(1) HD-131156A	COS/NUV, ACQ/IMAGE, BOA	MIRRORB		GS ACQ SCENARIO BASE1BE		11 Secs (11 Secs) *[==>]*	 ***[1]***
	Comments: Castelli-Kurucz Models G8V, renormalized to vegamag = 4.68 in filter Johnson/V								
2	(COS.sp.1367281)	(1) HD-131156A	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2400; FP-POS=ALL; LIFETIME-POS=LP4			180 Secs (720 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	 ***[1]***
	Comments: h_hd131156_uvsum_1m_51163_etc.dat from StarCAT (STIS E140M-1425)								
3	(COS.sp.1367282)	(1) HD-131156A	COS/FUV, TIME-TAG, PSA	G160M 1533 A	BUFFER-TIME=4000; FP-POS=ALL; LIFETIME-POS=LP4			193 Secs (772 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	 ***[1]***
	Comments: h_hd131156_uvsum_1m_51163_etc.dat from StarCAT (STIS E140M-1425)								
4	(COS.sp.1367319)	(2) HD-131156B	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=9300; FP-POS=ALL; LIFETIME-POS=LP4			224 Secs (896 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	 ***[2]***
	Comments: B fluxes scaled by 0.14 from A [h_hd131156_uvsum_1m_51163_etc.dat from StarCAT (STIS E140M-1425)]								
5	(COS.sp.1367320)	(2) HD-131156B	COS/FUV, TIME-TAG, PSA	G160M 1533 A	BUFFER-TIME=13400; FP-POS=ALL; LIFETIME-POS=LP4			234 Secs (936 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	 ***[2]***
	Comments: B fluxes scaled by 0.14 from A [h_hd131156_uvsum_1m_51163_etc.dat from StarCAT (STIS E140M-1425)]								

Orbit Structure




Orbit 2
Server Version: 20240604
GS Reacq
Exp. 4, split 1
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 5, split 4
**** ORBITAL VISIBILITY OVERRUN = 115
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17406, Visit 11, implementation Mon Jun 10 19:00:59 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: ORIENT 315D TO 195 D

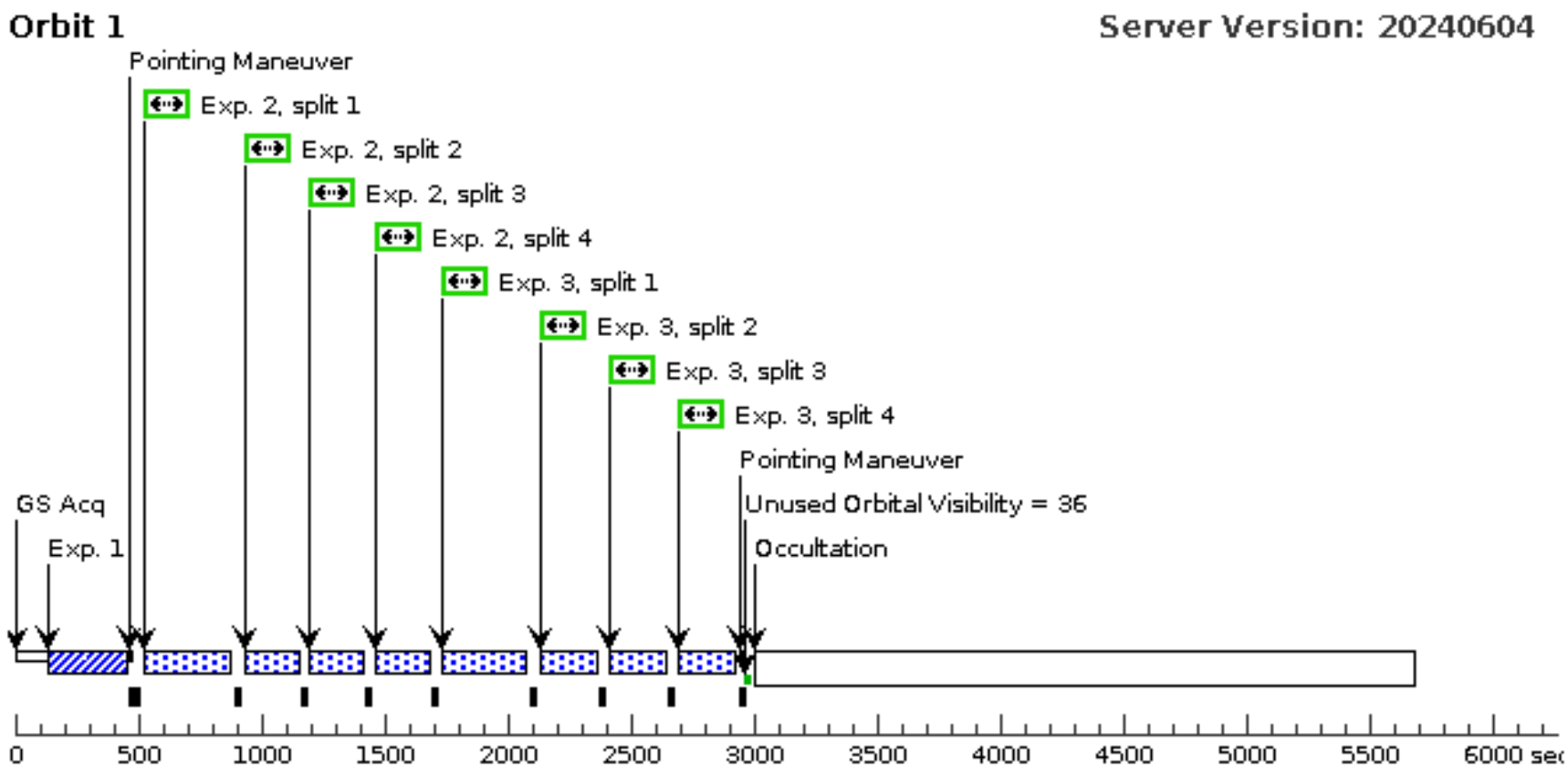
Fixed Targets

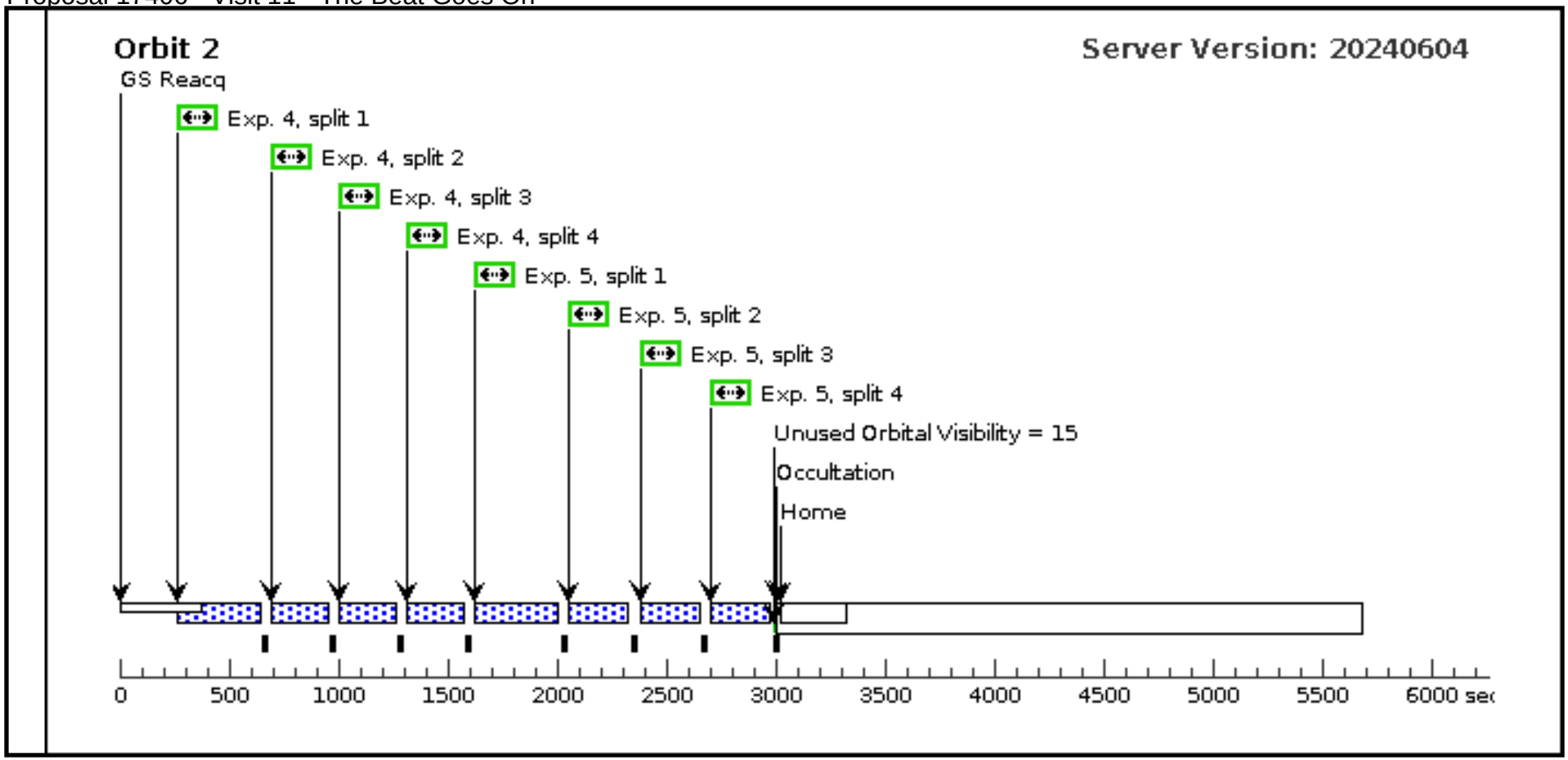
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	HD-165341A Alt Name1: 70-OPH-A	RA: 18 05 27.2484 (271.3635350d) Dec: +02 30 0.53 (2.50015d) Equinox: J2000	Proper Motion RA: +0.2065 arcsec/yr Proper Motion Dec: -1.1075 arcsec/yr Parallax: 0.1956" Epoch of Position: 2000 Radial Velocity: -9.7 km/sec	V=+4.03+/-0.1	Reference Frame: ICRS
Comments: Target coords for epoch 2000 from SIMBAD, based on Gaia measurements for a mean epoch of 2015.5 corrected for Gaia proper motions *Category=STAR* *Description=[CORONA, K V-IV]* *Extended=NO*					
(4)	HD-165341B Alt Name1: 70-OPH-B	Offset from HD-165341A RA Offset: 0.398 Secs Dec Offset: -3.15 Arcsec	Radial Velocity: -10.0 km/sec	V=+6.07+/-0.1	Offset Position (HD-165341B)
Comments: Target offset based on ephemeris from 6th Orbital Catalog, for 2024.5 *Category=STAR* *Description=[CORONA, K 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	(COS.ta.1367302)	(3) HD-165341A	COS/NUV, ACQ/IMAGE, BOA	MIRRORB		GS ACQ SCENARIO BASE1O3		8 Secs (8 Secs) *[==>]*	*[1]*
Comments: Castelli-Kurucz Models K0V, renormalized to vegamag = 4.22 in filter Johnson/V (from BSC and WDS)									
2	(COS.sp.1367312)	(3) HD-165341A	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=2800; FP-POS=ALL; LIFETIME-POS=LP4			163 Secs (652 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*
3	(COS.sp.1367313)	(3) HD-165341A	COS/FUV, TIME-TAG, PSA	G160M 1533 A	BUFFER-TIME=4300; FP-POS=ALL; LIFETIME-POS=LP4			178 Secs (712 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*
4	(COS.sp.1367325)	(4) HD-165341B	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=9200; FP-POS=ALL; LIFETIME-POS=LP4			206 Secs (824 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*
5	(COS.sp.1367326)	(4) HD-165341B	COS/FUV, TIME-TAG, PSA	G160M 1533 A	BUFFER-TIME=12700; FP-POS=ALL; LIFETIME-POS=LP4			218 Secs (872 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[2]*

Orbit Structure




Orbit 2
Server Version: 20240604
GS Reacq
Exp. 4, split 1
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Exp. 5, split 1
Exp. 5, split 2
Exp. 5, split 3
Exp. 5, split 4
Unused Orbital Visibility = 15
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec