13020 - A Comprehensive COS Study of the Magnetic Dynamos, Rotations, UV Irradiances and Habitability of dM Stars with a Broad Span of Ages

Cycle: 20, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Edward F. Guinan (PI) (Contact)	**Villanova University**	**edward.guinan@villanova.edu**
Mr. Scott G. Engle (CoI) (Contact)	Villanova University	scott.engle@villanova.edu
Dr. Graham Harper (CoI) (ESA Member)	University of Dublin, Trinity College	graham.harper@tcd.ie

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) GJ176	COS/FUV COS/NUV	2	26-Feb-2013 02:35:11.0	yes
02	(2) LHS353	COS/FUV COS/NUV	2	26-Feb-2013 02:35:26.0	yes
03	(3) NSV11919	COS/FUV COS/NUV	2	26-Feb-2013 02:35:40.0	yes
04	(4) G-111-72	COS/FUV COS/NUV	2	26-Feb-2013 02:35:53.0	yes
05	(5) LHS26	COS/FUV COS/NUV	2	26-Feb-2013 02:36:05.0	yes
07	(7) GJ4304A	COS/FUV COS/NUV	2	26-Feb-2013 02:36:16.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
10	(10) GJ213	COS/FUV COS/NUV	2	26-Feb-2013 02:36:28.0	yes
11	(11) GJ821	COS/FUV COS/NUV	2	26-Feb-2013 02:36:42.0	yes
12	(9) KAPTEYNSTAR	COS/FUV COS/NUV	3	26-Feb-2013 02:36:57.0	yes

19 Total Orbits Used

ABSTRACT

We propose HST/COS FUV spectrophotometry of a carefully selected sample of 9 dM1-5 stars with recently reliably determined ages ranging from ~1-12 Gyr. This program complements our Chandra Cycle 13 program of the same targets to determine their coronal X-ray properties. Ages (of all but one star) have recently been firmly determined from memberships in wide binaries with white dwarf (WD) companions having reliable cooling time+main-sequence evolution ages (Zhao et al. 2012, Garces et al 2011). Until these studies, reliable age determinations for dM stars >2 Gyr were nearly impossible. However, we can now carry out a comprehensive UV study of dM star atmospheres across nearly the full age-range of the current Universe. The primary goals are 1) to study the evolution of their dynamo-generated X-ray and UV (XUV) emissions with age/rotation and to better define the heating and energetics of their atmospheres (via Age-Rotation-Activity-XUV Irradiance relations) and 2) to study the effects of the XUV radiation on planets hosted by red dwarfs. The COS UV spectral region contains numerous important diagnostic emission lines for characterizing the energy transfer and atmospheric structure, while line ratios yield valuable information about the electron density. Further, these data (when combined with our coronal X-ray measures) are also important for gauging dM star XUV emissions - critical for assessing the photochemical & photoionization evolution of planetary atmospheres and ionospheres that in turn strongly affect the possible development of life on hosted extrasolar planets. We are requesting a total of 19 HST orbits to achieve the science goals of the program.

OBSERVING DESCRIPTION

We are proposing HST/COS FUV-UV low/medium resolution spectrophotometry of the target stars, all of which are currently being observed by Chandra. The majority of the targets (the stars with d < 20-pc) will be observed from 1150-2830A using G140L and G285M. The most distant target (G 111-72; 37-pc) will be observed from 1150-3150A with the G140L/230L elements. All observations will use the Primary Science Aperture. We are requesting two consecutive HST orbits per target to carry out this program. Taking into account acquisition and overheads this request will result

in an average of about 2400-2600 sec of on-target time per HST orbit. We plan to devote the first HST orbit of each visit to the G285M or G230L element (~2400s) and the second orbit (with re-acquire) to G130M (~2600-2800s). The longer exposure is has been chosen for the shorter wavelength region because almost all of the important emission lines are in that region. All exposures will be split to extend wavelength coverage, mitigate cosmics, and to discriminate any observed flare events. Kapteyn's Star is an exceptional target. It has an exceedingly slow rotation period of ~198+/-18 days. Also, it is the nearest of our proposed stars, serves as a proxy for Pop II metal poor stars, and has a large radial velocity of +245 km/sec. At this speed, the Ly-alpha line will be red-shifted by ~1A, moving it off of the ISM and geocoronal features and allowing a "clean" measure of the stellar Ly-alpha flux for a very old (presumably low activity) star. Thus we are proposing for a third orbit on Kapteyn's Star to observe in the G130M element. This will give us the resolution necessary to perform a detailed study of the Ly-alpha feature free of contamination, compare to the deconstructed Ly-alpha fluxes modeled by Wood et al. 2005, and test acoustic heating models for stars with very slow rotations. We are particularly excited by this aspect of the program.

Visit

Proposal 13020, GJ176 (01), implementation Tue Feb 26 02:37:07 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

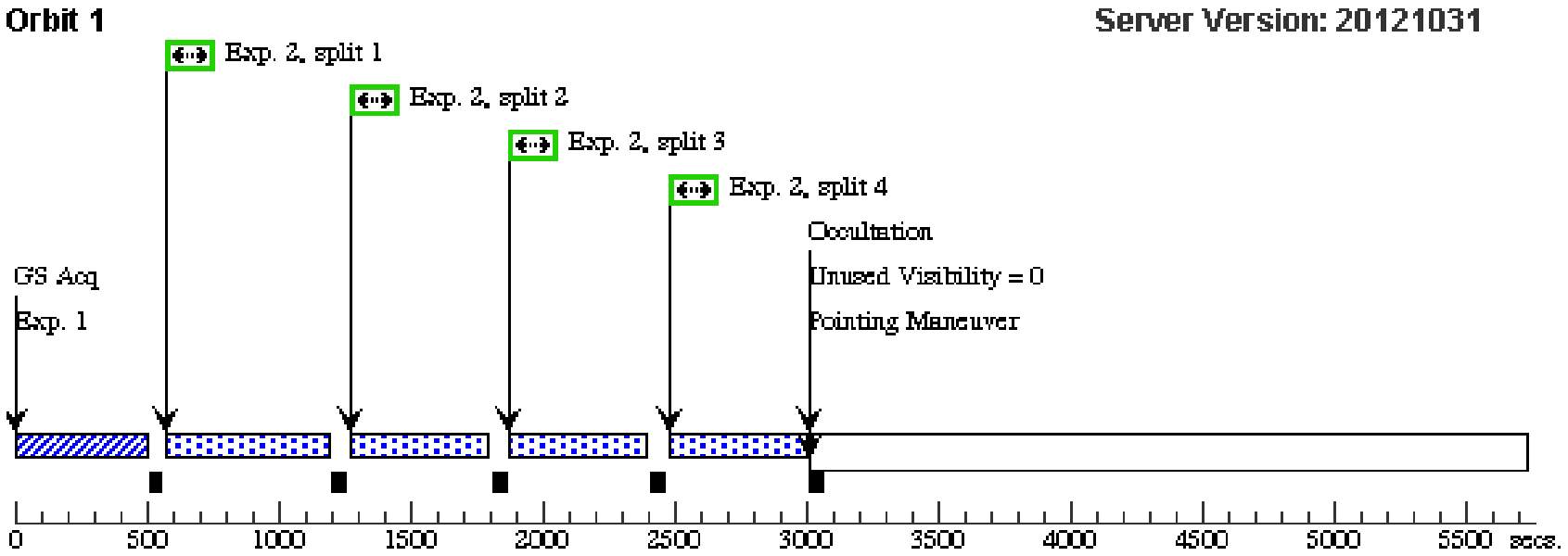
Fixed Targets

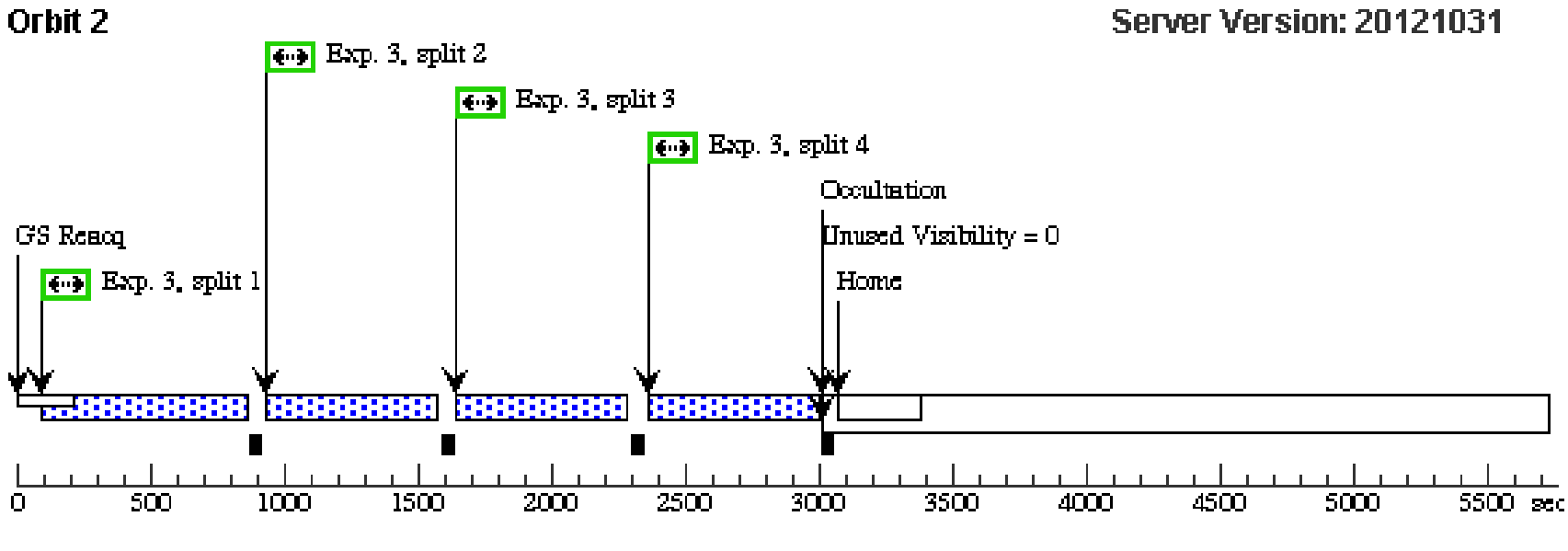
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GJ176	RA: 04 42 55.7750 (70.7323958d) Dec: +18 57 29.40 (18.95817d) Equinox: J2000	Proper Motion RA: 656.85 mas/yr Proper Motion Dec: -1116.2 mas/yr Parallax: 0.10783" Epoch of Position: 2000	V=9.951	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.470729)	(1) GJ176	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				35 Secs *[==>]*	*[1]*
2	(COS.sp.470723)	(1) GJ176	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1500			490 Secs *[==>514.0 Secs (Split 1)]* *[==>505.0 Secs (Split 2)]* *[==>505.0 Secs (Split 3)]* *[==>505.0 Secs (Split 4)]*	*[1]*
3	(COS.sp.464236)	(1) GJ176	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=2244; FLASH=YES; FP-POS=ALL			589 Secs *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>588.0 Secs (Split 4)]*	*[2]*

Orbit Structure





Visit

Proposal 13020, LHS 353 (02), implementation Tue Feb 26 02:37:11 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

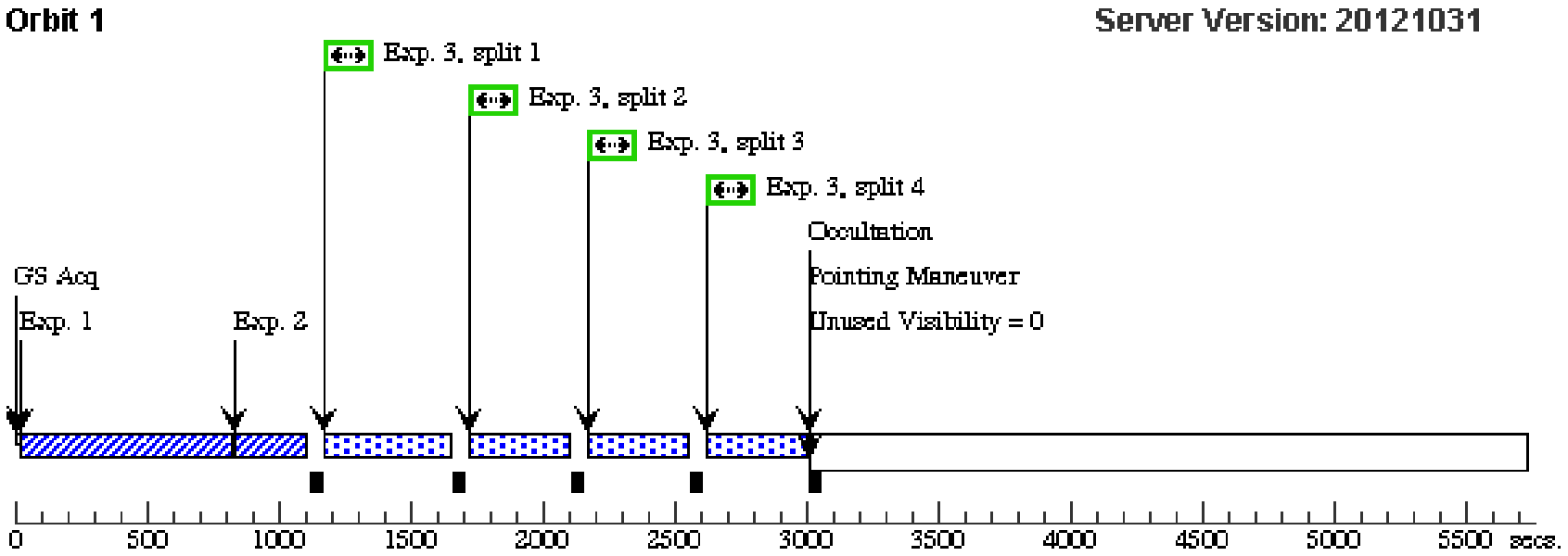
Fixed Targets

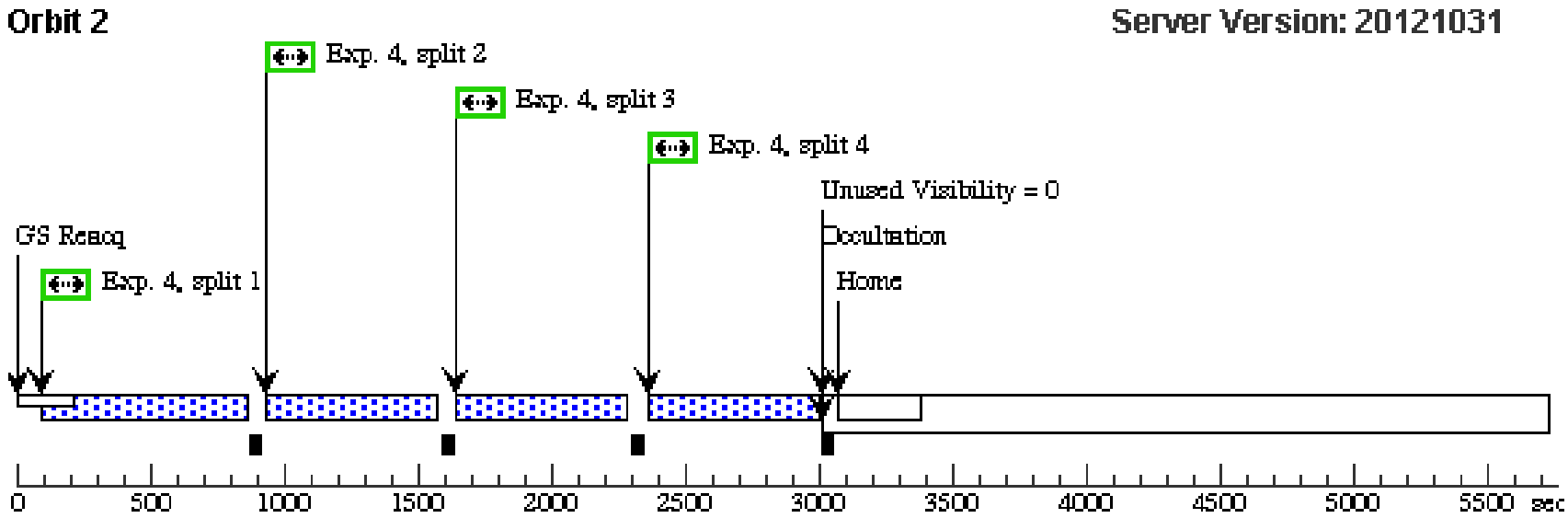
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	LHS353	RA: 13 30 2.8500 (202.5118750d) Dec: -08 42 25.20 (-8.70700d) Equinox: J2000	Proper Motion RA: -1273 mas/yr Proper Motion Dec: -484 mas/yr Parallax: 0.066" Epoch of Position: 2000	V=14.18	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.470735)	(2) LHS353	COS/NUV, ACQ/SEARCH, PSA	MIRRORA	SCAN-SIZE=2; STEP-SIZE=1.767			86 Secs *[==>]*	 ***[1]***
2	(COS.ta.470735)	(2) LHS353	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				86 Secs *[==>]*	 ***[1]***
3	(COS.sp.470752)	(2) LHS353	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1400			362 Secs *[==>363.0 Secs (Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	 ***[1]***
4	(COS.sp.464238)	(2) LHS353	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=2244; FLASH=YES; FP-POS=ALL			1283 Secs *[==>589.0 Secs (Split 1)]* *[==>589.0 Secs (Split 2)]* *[==>589.0 Secs (Split 3)]* *[==>588.0 Secs (Split 4)]*	 ***[2]***

Orbit Structure





Visit

Proposal 13020, NSV 11919 (03), implementation Tue Feb 26 02:37:14 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

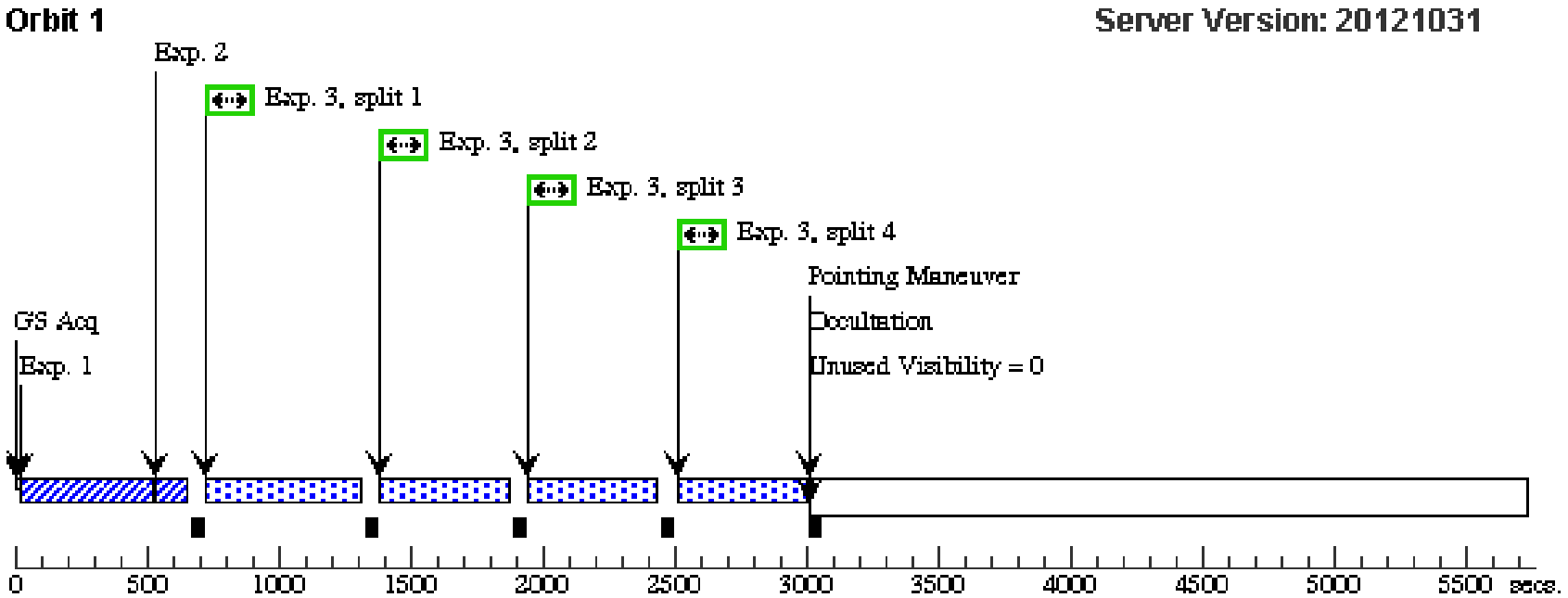
Fixed Targets

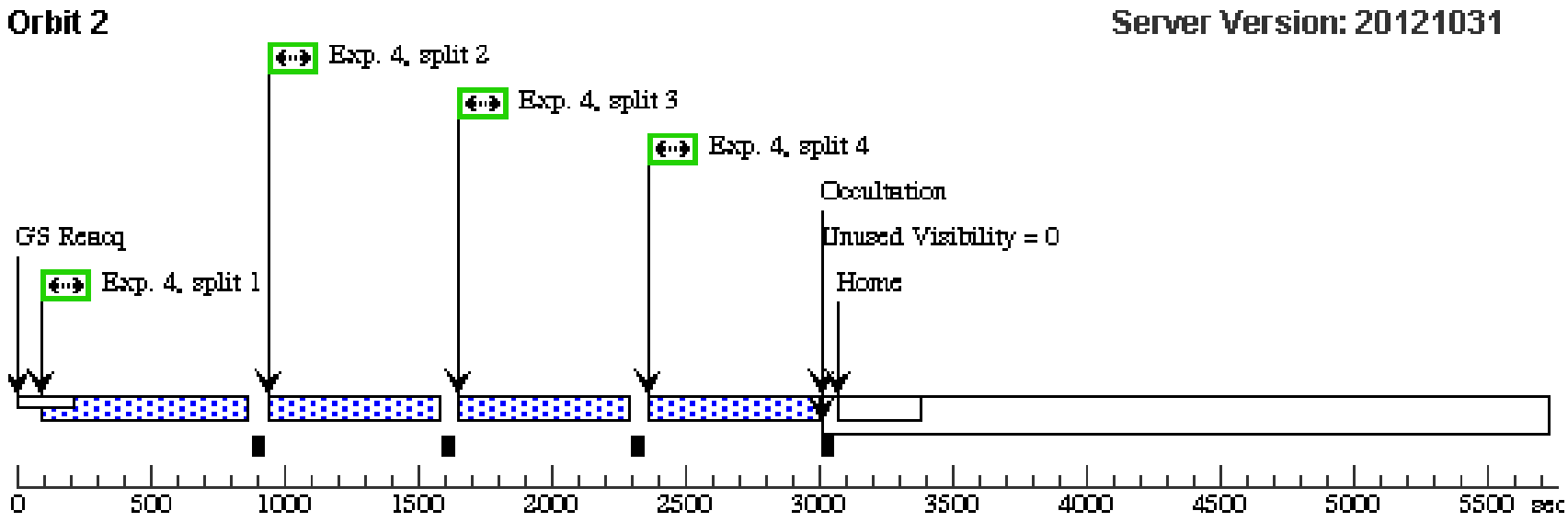
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NSV11919	RA: 19 20 33.4610 (290.1394208d) Dec: -07 39 43.56 (-7.66210d) Equinox: J2000	Proper Motion RA: -61 mas/yr Proper Motion Dec: -162 mas/yr Parallax: 0.09131" Epoch of Position: 2000	V=12.12	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.471007)	(3) NSV11919	COS/NUV, ACQ/SEARCH, PSA	MIRRORA	SCAN-SIZE=2; STEP-SIZE=1.767			11 Secs *[==>]*	 ***[1]***
2	(COS.ta.471007)	(3) NSV11919	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				11 Secs *[==>]*	 ***[1]***
3	(COS.sp.471011)	(3) NSV11919	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1500			350 Secs *[==>475.0 Secs (Split 1)]* *[==>475.0 Secs (Split 2)]* *[==>475.0 Secs (Split 3)]* *[==>474.0 Secs (Split 4)]*	 ***[1]***
4	(COS.sp.464200)	(3) NSV11919	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=2244; FLASH=YES; FP-POS=ALL			400 Secs *[==>596.0 Secs (Split 1)]* *[==>587.0 Secs (Split 2)]* *[==>586.0 Secs (Split 3)]* *[==>586.0 Secs (Split 4)]*	 ***[2]***

Orbit Structure





Visit

Proposal 13020, G 111-72 (04), implementation Tue Feb 26 02:37:16 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

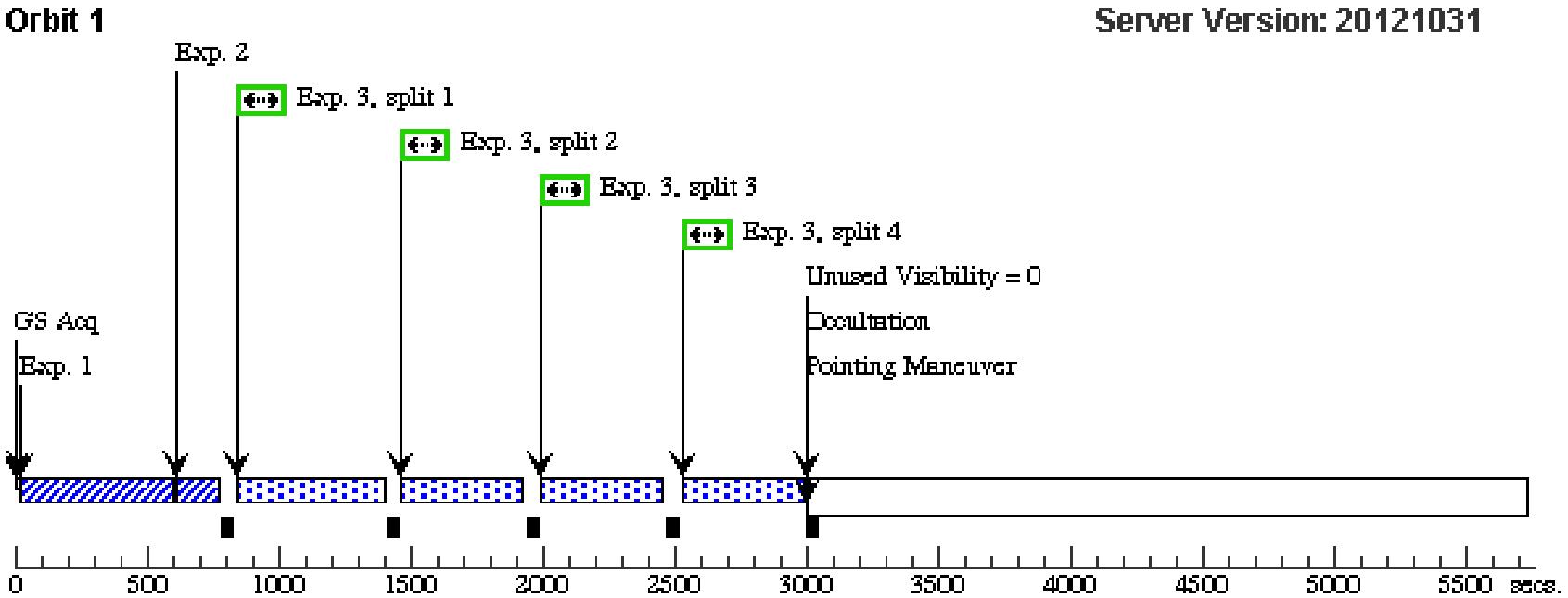
Fixed Targets

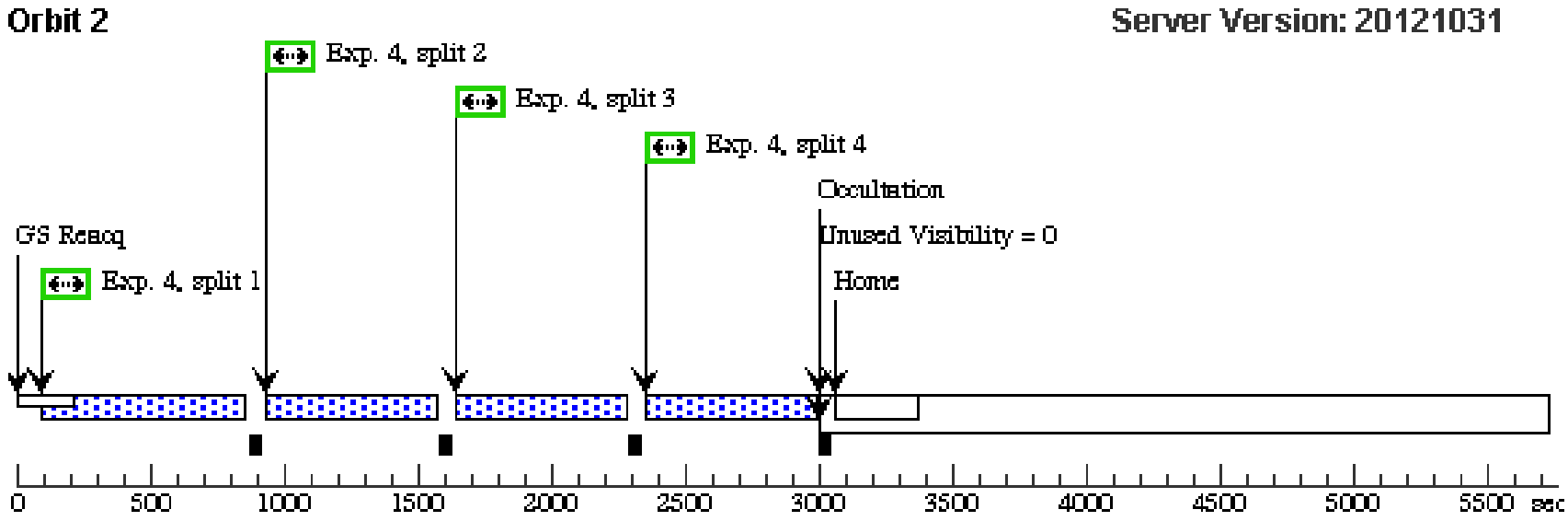
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	G-111-72	RA: 08 20 4.2500 (125.0177083d) Dec: +38 34 41.50 (38.57819d) Equinox: J2000	Proper Motion RA: -178 mas/yr Proper Motion Dec: -254 mas/yr Parallax: 0.027" Epoch of Position: 2000	V=13.18	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.472039)	(4) G-111-72	COS/NUV, ACQ/SEARCH, PSA	MIRRORA	SCAN-SIZE=2; STEP-SIZE=1.767			30 Secs *[==>]*	 ***[1]***
2	(COS.ta.472039)	(4) G-111-72	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				30 Secs *[==>]*	 ***[1]***
3	(COS.sp.472045)	(4) G-111-72	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1700			443 Secs *[==>(Split 1)]* *[==>(Split 2)]* *[==>444.0 Secs (Split 3)]* *[==>444.0 Secs (Split 4)]*	 ***[1]***
4	(COS.sp.463897)	(4) G-111-72	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2244			800 Secs *[==>586.0 Secs (Split 1)]* *[==>586.0 Secs (Split 2)]* *[==>586.0 Secs (Split 3)]* *[==>586.0 Secs (Split 4)]*	 ***[2]***

Orbit Structure





Visit

Proposal 13020, LHS 26 (05), implementation Tue Feb 26 02:37:17 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

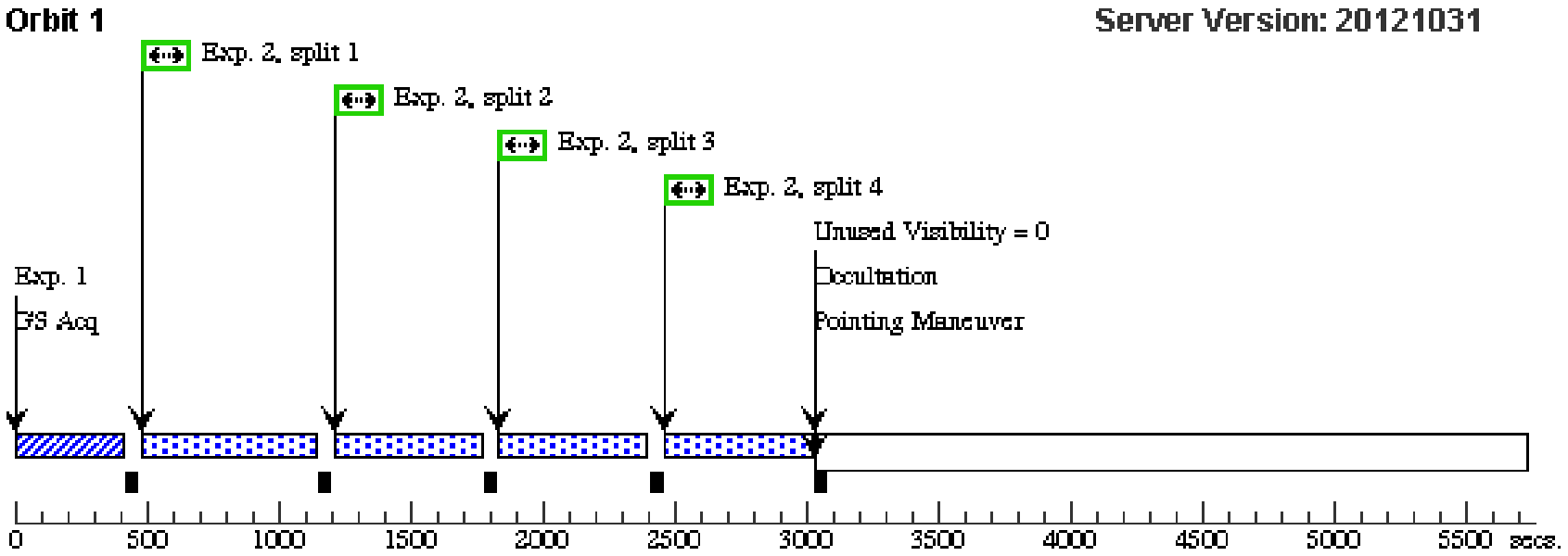
Fixed Targets

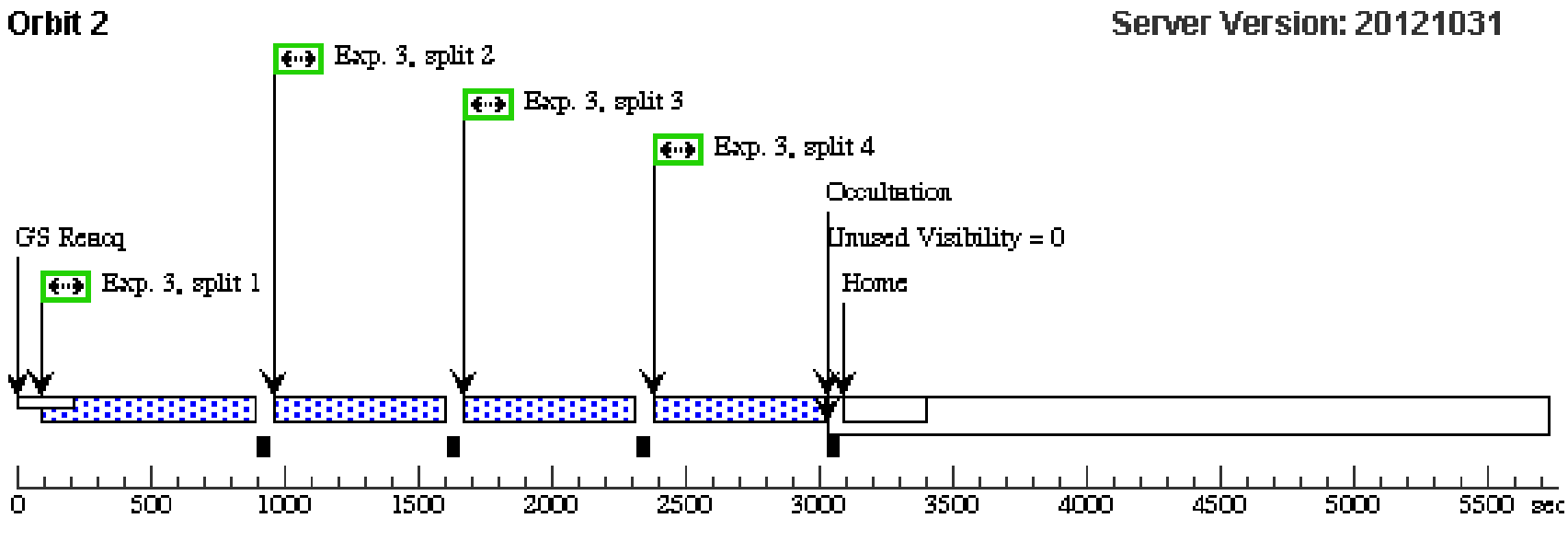
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	LHS26	RA: 04 31 11.4790 (67.7978292d) Dec: +58 58 37.57 (58.97710d) Equinox: J2000	Proper Motion RA: 1290 mas/yr Proper Motion Dec: -2010 mas/yr Parallax: 0.17927" Epoch of Position: 2000	V=11.08	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.472060)	(5) LHS26	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				5 Secs	
								[==>]	***[1]***
2	(COS.sp.472062)	(5) LHS26	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2000			500 Secs	
								[==>541.0 Secs (Split 1)] *[==>541.0 Secs (Split 2)]* *[==>542.0 Secs (Split 3)]* *[==>542.0 Secs (Split 4)]*	***[1]***
3	(COS.sp.465784)	(5) LHS26	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=2200; FLASH=YES; FP-POS=ALL			500 Secs	
								[==>621.0 Secs (Split 1)] *[==>586.0 Secs (Split 2)]* *[==>586.0 Secs (Split 3)]* *[==>586.0 Secs (Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 13020, GJ 4304 A (07), implementation Tue Feb 26 02:37:19 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

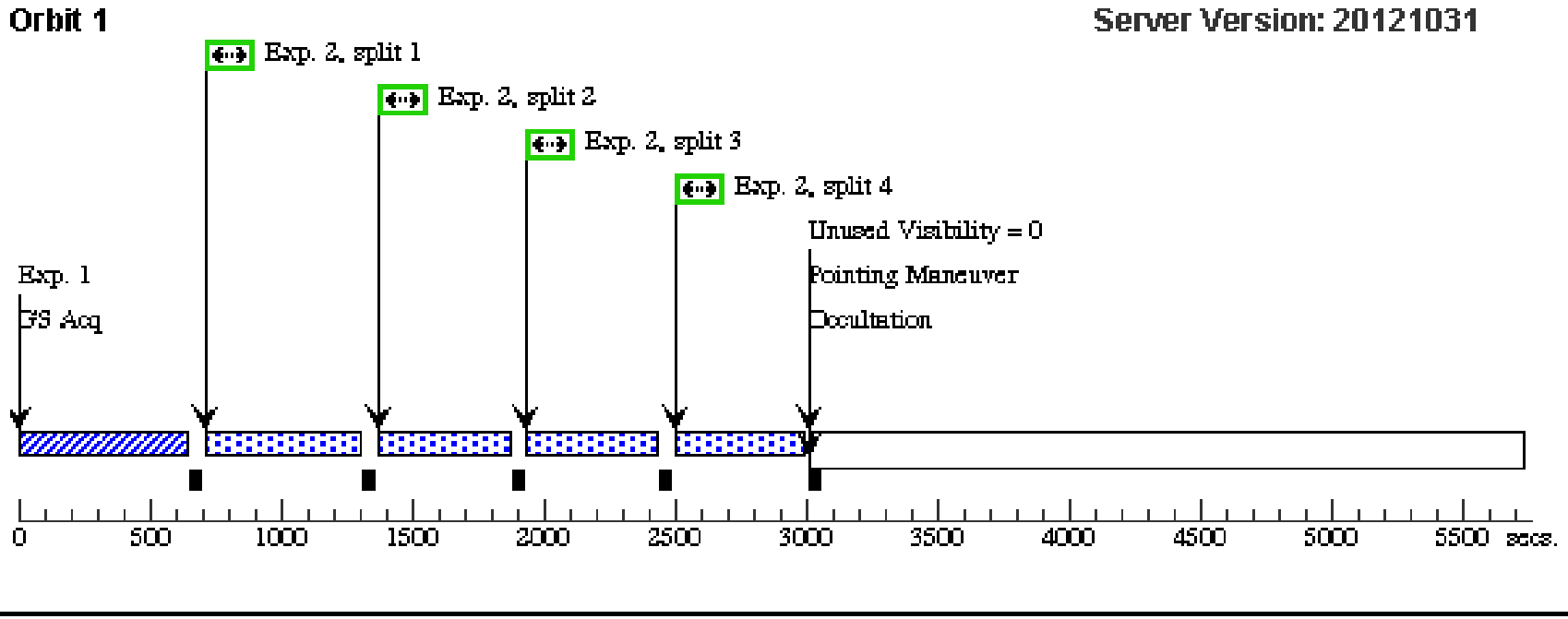
Fixed Targets

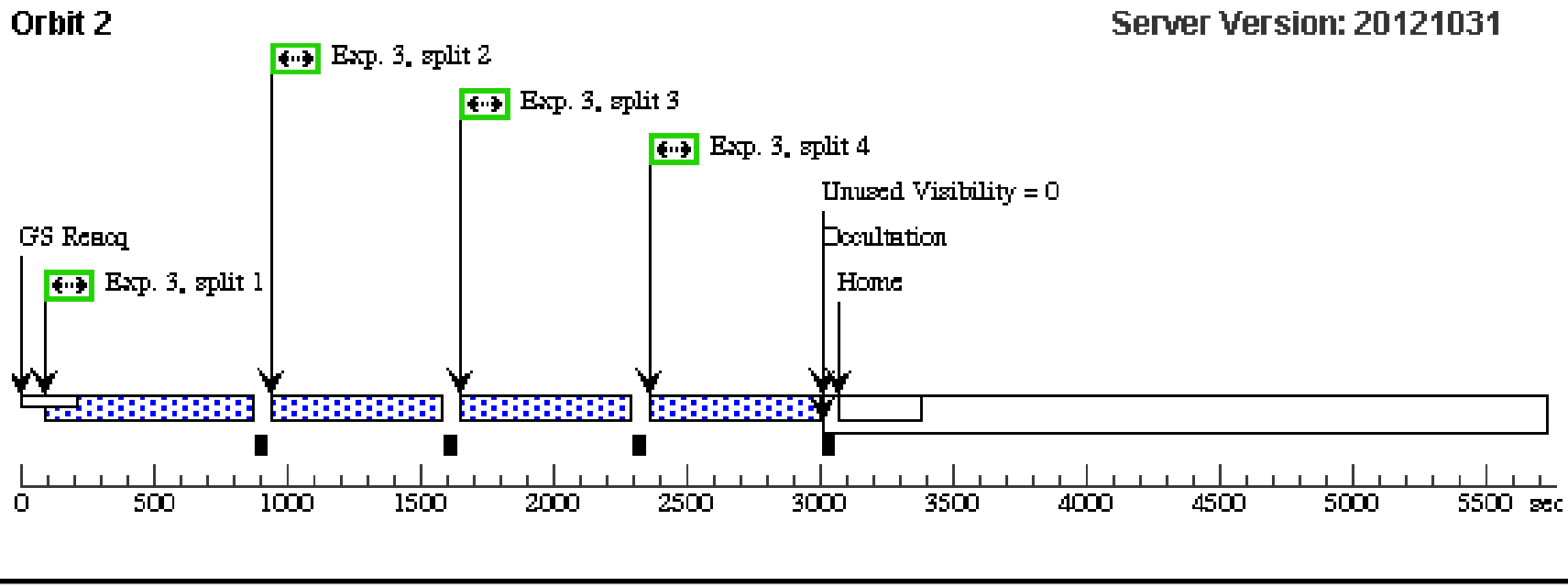
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	GJ4304A	RA: 22 55 56.8198 (343.9867492d) Dec: +05 45 18.34 (5.75509d) Equinox: J2000	Proper Motion RA: 356.76 mas/yr Proper Motion Dec: -269.79 mas/yr Parallax: 0.04089" Epoch of Position: 2000	V=11.212	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.472073)	(7) GJ4304A	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				105 Secs	
								[==>]	***[1]***
2	(COS.sp.472079)	(7) GJ4304A	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2000			370 Secs	
								[==>480.0 Secs (Split 1)] *[==>480.0 Secs (Split 2)]* *[==>480.0 Secs (Split 3)]* *[==>479.0 Secs (Split 4)]*	***[1]***
3	(COS.sp.465812)	(7) GJ4304A	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=2200; FLASH=YES; FP-POS=ALL			500 Secs	
								[==>597.0 Secs (Split 1)] *[==>586.0 Secs (Split 2)]* *[==>586.0 Secs (Split 3)]* *[==>586.0 Secs (Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 13020, GJ 213 (10) Tue Feb 26 02:37:21 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

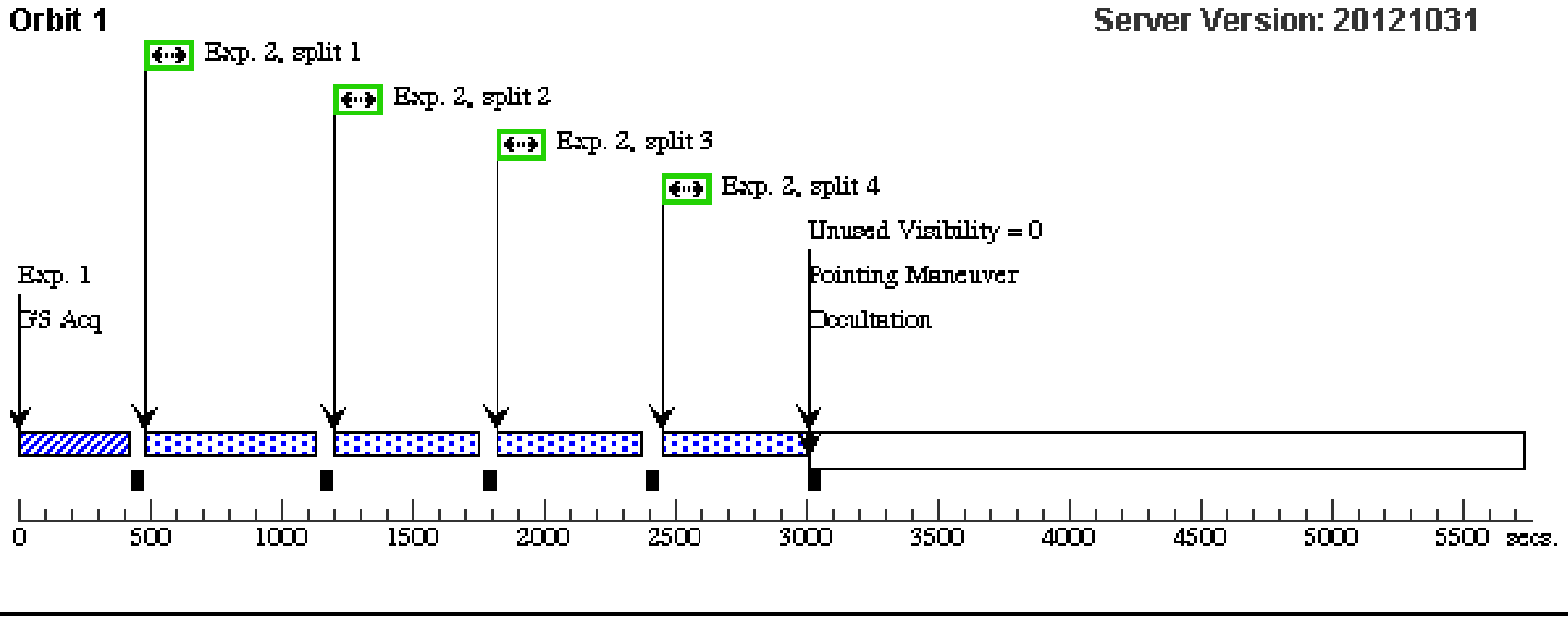
Fixed Targets

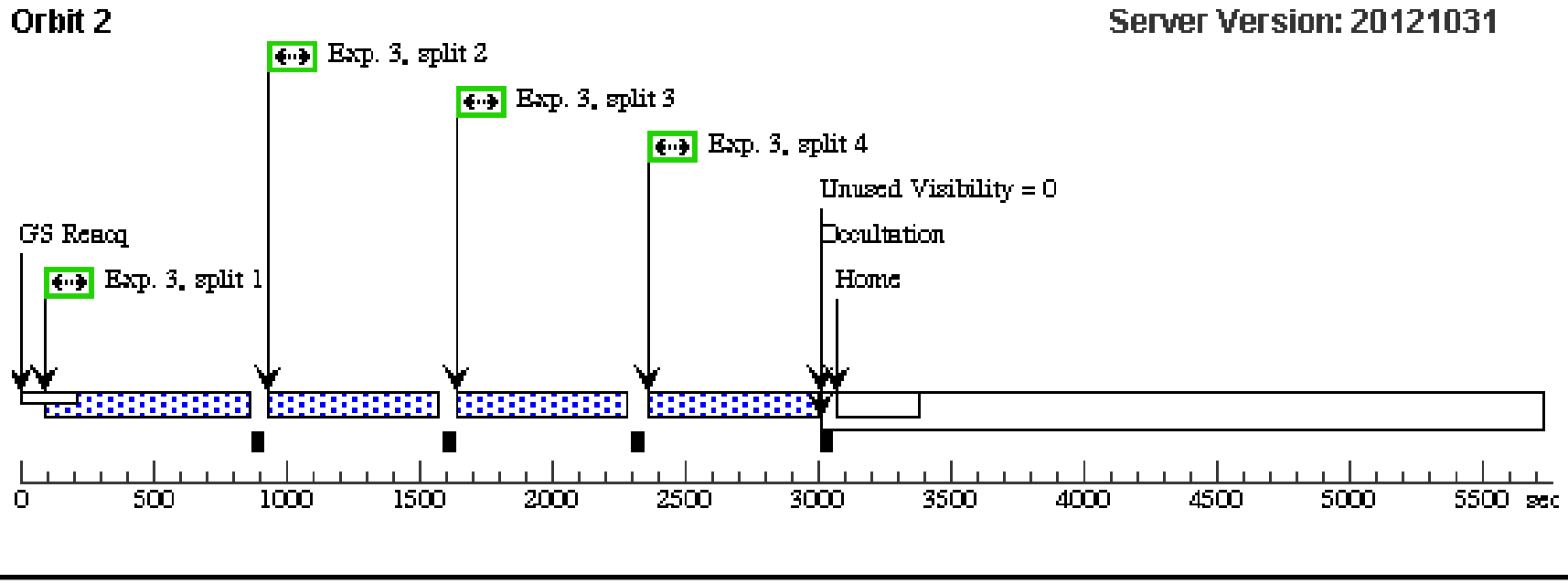
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(10)	GJ213	RA: 05 42 9.2677 (85.5386154d) Dec: +12 29 21.62 (12.48934d) Equinox: J2000	Proper Motion RA: 2000.53 mas/yr Proper Motion Dec: -1569.63 mas/yr Parallax: .17155" Epoch of Position: 2000	V=11.509	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.472088)	(10) GJ213	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				7 Secs	
								[==>]	***[1]***
2	(COS.ta.472088)	(10) GJ213	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=1700			400 Secs	
								[==>534.0 Secs (Split 1)] *[==>534.0 Secs (Split 2)]* *[==>535.0 Secs (Split 3)]* *[==>535.0 Secs (Split 4)]*	***[1]***
3	(COS.sp.465910)	(10) GJ213	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2200			500 Secs	
								[==>589.0 Secs (Split 1)] *[==>589.0 Secs (Split 2)]* *[==>589.0 Secs (Split 3)]* *[==>588.0 Secs (Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 13020, GJ 821 (11) Tue Feb 26 02:37:23 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: SCHED 100%

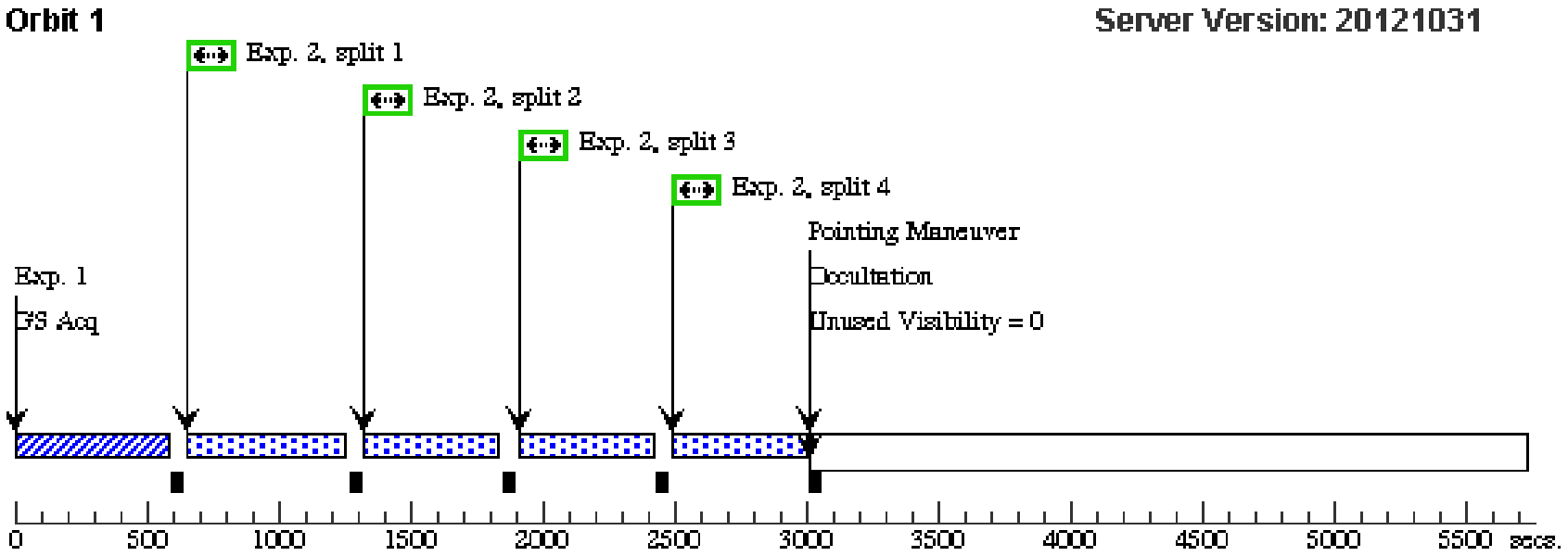
Fixed Targets

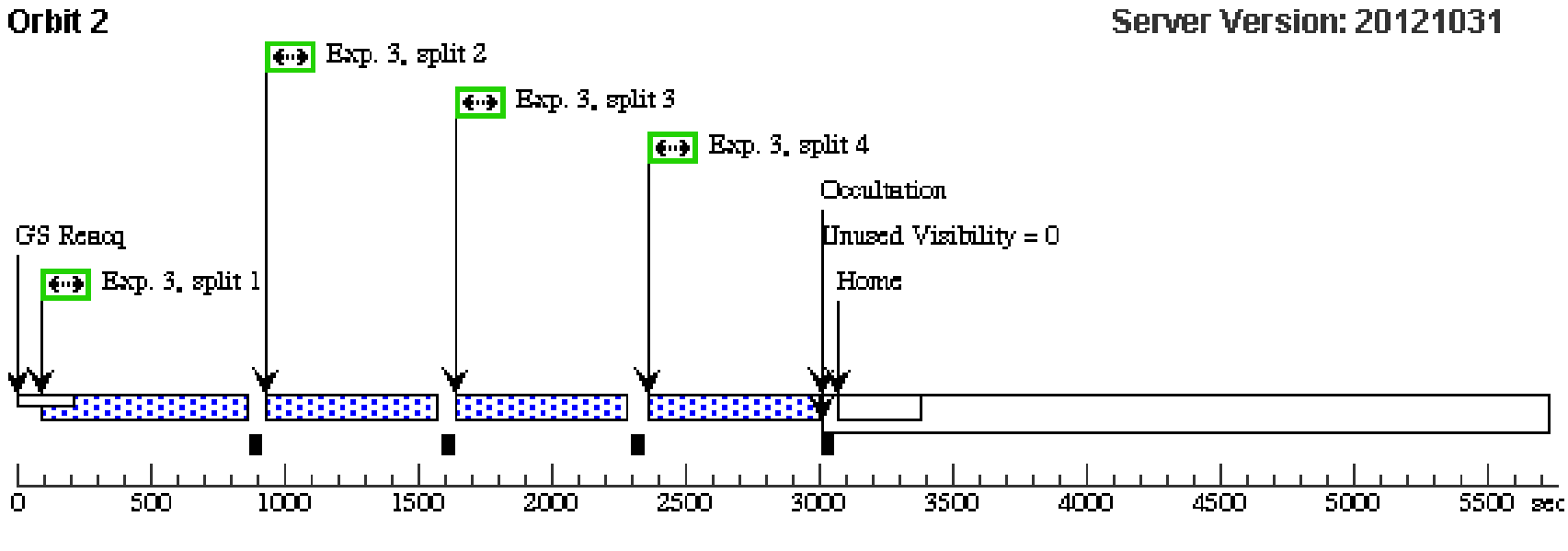
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(11)	GJ821	RA: 21 09 17.4265 (317.3226104d) Dec: -13 18 9.01 (-13.30250d) Equinox: J2000	Proper Motion RA: 713.47 mas/yr Proper Motion Dec: -1994.64 mas/yr Parallax: .08218" Epoch of Position: 2000	V=10.869	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.472098)	(11) GJ821	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				76 Secs	
								[==>]	***[1]***
2	(COS.sp.472099)	(11) GJ821	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2000			400 Secs	
								[==>495.0 Secs (Split 1)] *[==>494.0 Secs (Split 2)]* *[==>494.0 Secs (Split 3)]* *[==>494.0 Secs (Split 4)]*	***[1]***
3	(COS.sp.465910)	(11) GJ821	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2300			500 Secs	
								[==>589.0 Secs (Split 1)] *[==>589.0 Secs (Split 2)]* *[==>589.0 Secs (Split 3)]* *[==>588.0 Secs (Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 13020, Kapteyn (12) Tue Feb 26 02:37:25 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: (none)

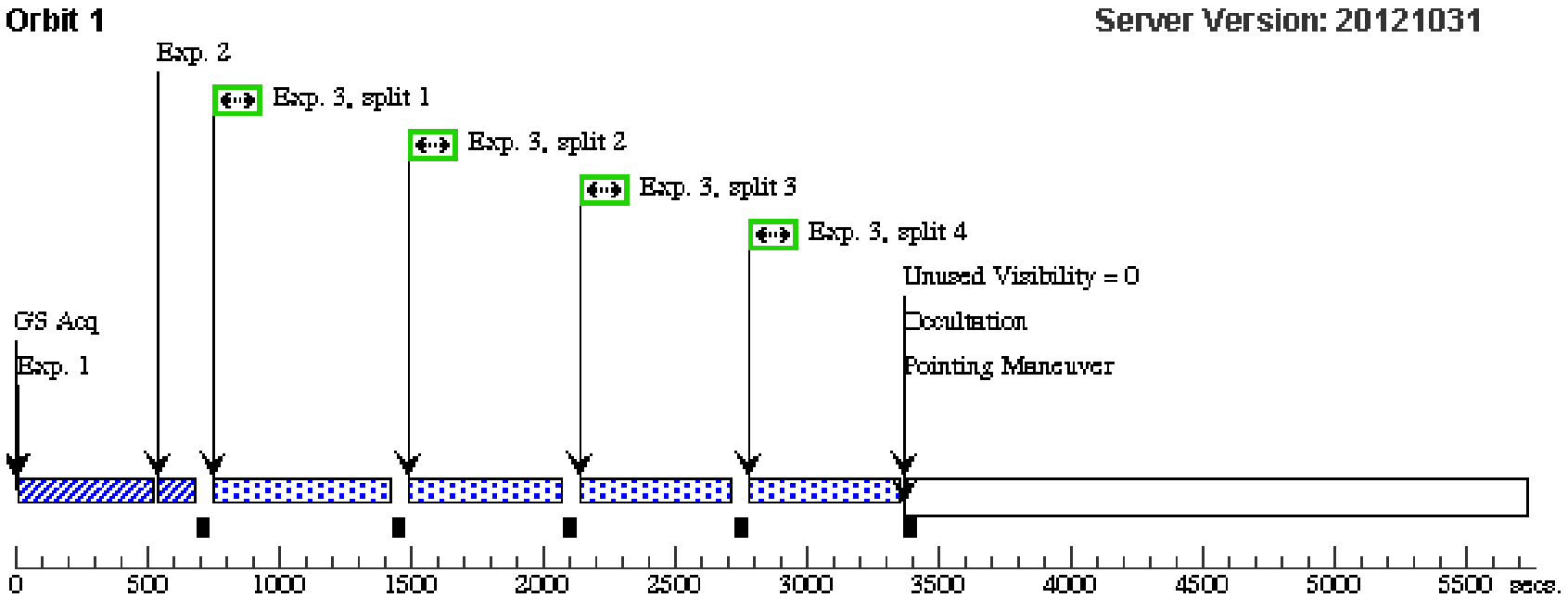
Fixed Targets

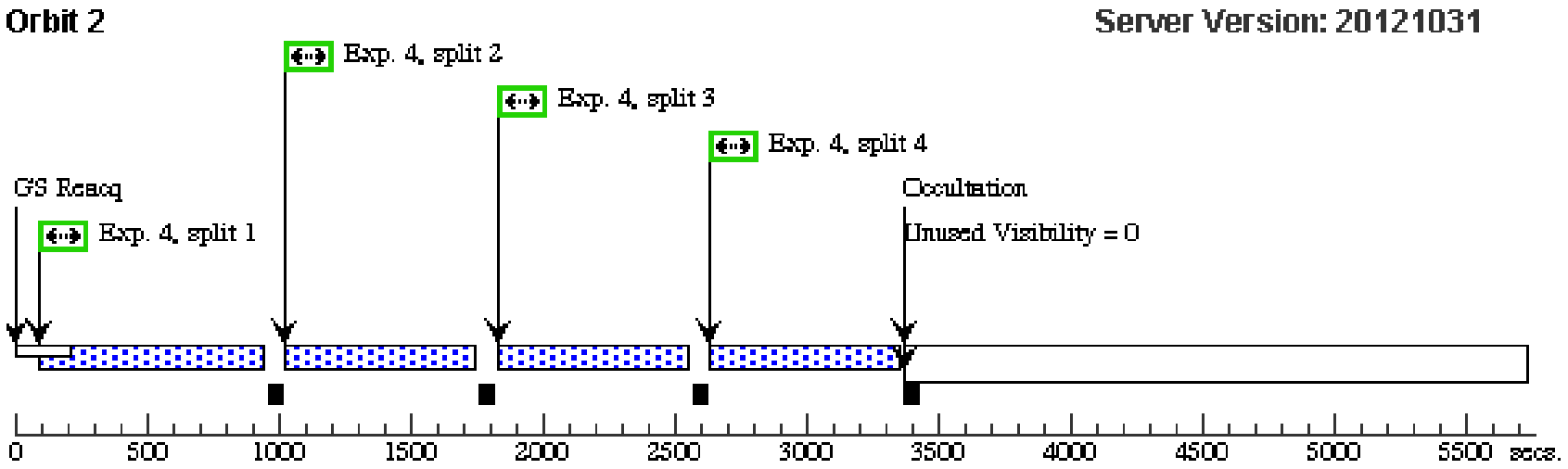
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(9)	KAPTEYNSTAR	RA: 05 11 40.5811 (77.9190879d) Dec: -45 01 6.29 (-45.01841d) Equinox: J2000	Proper Motion RA: 6505.08 mas/yr Proper Motion Dec: -5730.84 mas/yr Parallax: 0.25566" Epoch of Position: 2000	V=8.853	Reference Frame: ICRS

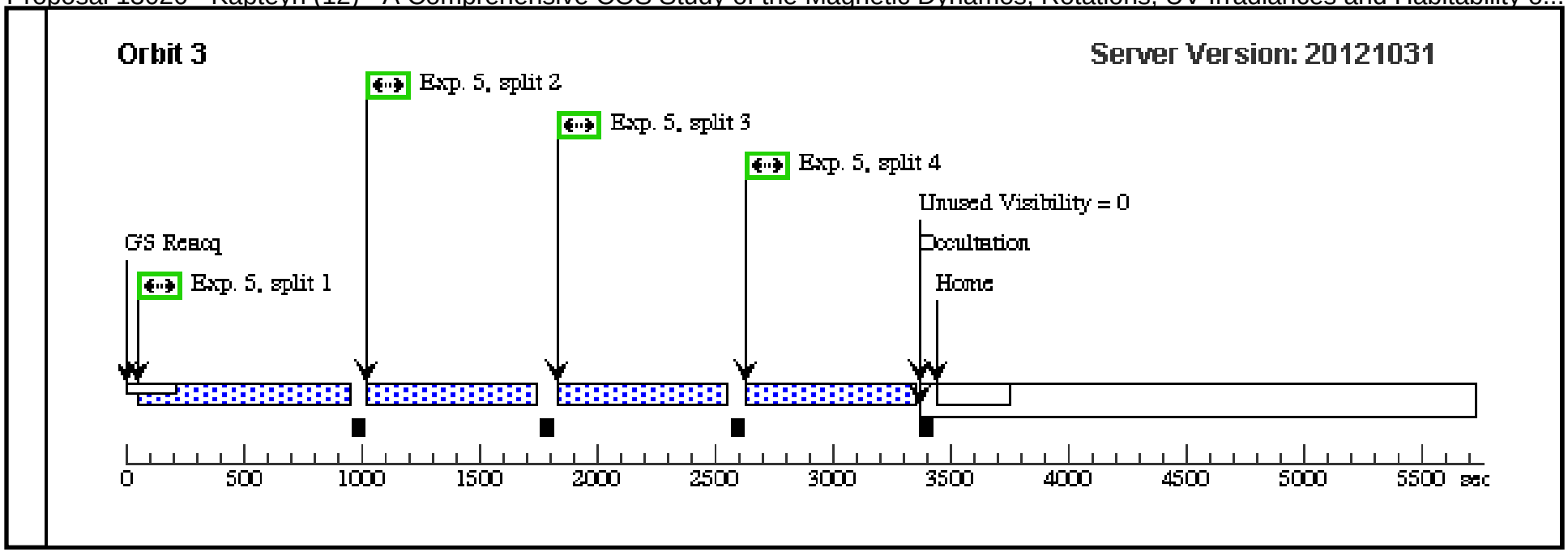
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	(COS.ta.472102)	(9) KAPTEYNSTAR	COS/NUV, ACQ/SEARCH, PSA	MIRRORB	SCAN-SIZE=2; STEP-SIZE=1.767			12 Secs *[==>]*	 ***[1]***
2	(COS.ta.472102)	(9) KAPTEYNSTAR	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				12 Secs *[==>]*	 ***[1]***
3	(COS.sp.472106)	(9) KAPTEYNSTAR	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2000			500 Secs *[==>560.0 Secs (Split 1)]* *[==>560.0 Secs (Split 2)]* *[==>559.0 Secs (Split 3)]* *[==>559.0 Secs (Split 4)]*	 ***[1]***
4	(COS.sp.472112)	(9) KAPTEYNSTAR	COS/FUV, TIME-TAG, PSA	G140L 1280 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2000			500 Secs *[==>672.0 Secs (Split 1)]* *[==>672.0 Secs (Split 2)]* *[==>672.0 Secs (Split 3)]* *[==>671.0 Secs (Split 4)]*	 ***[2]***
5	(COS.sp.472116)	(9) KAPTEYNSTAR	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=2000			500 Secs *[==>672.0 Secs (Split 1)]* *[==>672.0 Secs (Split 2)]* *[==>672.0 Secs (Split 3)]* *[==>671.0 Secs (Split 4)]*	 ***[3]***

Orbit Structure






Orbit 3
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Exp. 5, split 3
Exp. 5, split 4
Unused Visibility = 0
Occultation
GS Reacq
Exp. 5, split 1
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec