12929 - COS Observations of Pulsating DB White Dwarfs

Cycle: 20, Proposal Category: GO

(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) PG-1351+489	COS/FUV COS/NUV	3	18-Jan-2013 21:11:00.0	yes
02	(14) WD-J1929+4447	COS/FUV	4	18-Jan-2013 21:11:19.0	yes
03	(11) EC04207-4748	COS/FUV	2	18-Jan-2013 21:11:36.0	yes
04	(12) WD1654+160	COS/FUV	2	18-Jan-2013 21:11:52.0	yes
54	(15) WD1654+160-COPY	COS/FUV	2	18-Jan-2013 21:12:11.0	yes
05	(5) PG-1115+158	COS/FUV	3	18-Jan-2013 21:12:25.0	yes
06	(2) V-QU-TEL	COS/FUV	2	18-Jan-2013 21:12:42.0	yes

18 Total Orbits Used

ABSTRACT

Convection is an important energy transfer process for most stars. Yet convection is poorly understood, and remains one of the largest sources of theoretical uncertainty in stellar modeling. Pulsating white dwarfs are the ideal laboratories to provide to a self consistent description of convection in different environments. We can combine asteroseismology with nonlinear analysis of pulsating white dwarf light curves to provide empirical descriptions of convection across the hydrogen and helium instability strips. However, our ability to interprete the convection turnover timescale and its dependence on effective temperature across the helium white dwarf instability strip is severely limited by the large errors associated with optical spectroscopic temperature determinations for these objects. Our proposed COS observations of pulsating DB white dwarfs will determine the slope of their energy distributions and determine the presence of trace abundances of H, C, O, and Si, leading to greatly improved effective temperature determinations for these stars.

OBSERVING DESCRIPTION

We have 6 targets: PG1351+489, WD1654+160, EC04207-4748, PG1115-158, QU Tel, and KIC8626021. The observations will be done with COS in TIME-TAG mode using the G130M grating with central wavelength of 1291 Angstroms and the G160M grating with a central wavelength of 1611 Angstroms. We chose these combinations to ensure that our spectra contain Lyman alpha, the 1305 Angstrom oxygen lines, CII 1335 Angstroms, and HeII 1640 Angstroms. White dwarfs have high surface gravities with broad spectral lines. We expect features between 3 and 4 Angstroms wide. For G130M, the spectroscopic features should cover 30-40 pixels and for G160M, 25-30 pixels. We will take advantage of COS's TIME-TAG capabilities to bin the photons by pulsation phase to directly measure temperature variations through the pulsation cycle. WDs have short pulsation periods (100-1000 s), allowing us to cover a sufficient number of pulsation cycles in the orbits requested.

As an example of our exposure time estimates, we consider PG1115-158, with an effective temperature of 26010 K. We calculated a number of exposure times, using both blackbody simulations and previous GD358 observations. Taking into account guide star acquisition, NUV acq/image, TIME-TAG set up, exposure readout, and other overheads, we find that one orbit is required to achieve a S/N ratio of $\approx$ 25 with the G130M grating, and two orbits for the G160M grating. We performed similar estimates for our other targets with the aim of achieving spectra with S/N of 20-25. We do not require any non-standard calibrations. We will use FP-POS=ALL and use a flatfield to ensure maximum signal to noise.

Our targets do not exceed the brightness limits for COS. Four targets are well isolated with accurate coordinates, and we use NUV ACQ/IMAGE. WD1654+160 and QU Tel have nearby cool companions, so we use FUV ACQ/SEARCH, ACQ/PEAKXD, and ACQ/PEAKD. We chose COS over

STIS because its throughput is 10-30 times greater at our wavelengths of interest. Two targets are within the restricted RA ranges for cycle 20, but both stars are particularly important, as EC04207-4748 is one of our hotter targets and PG1115-158 is one of the cooler objects.

Visit

Proposal 12929, PG1351a (01), scheduling Sat Jan 19 02:12:51 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: PCS MODE FINE

Fixed Targets

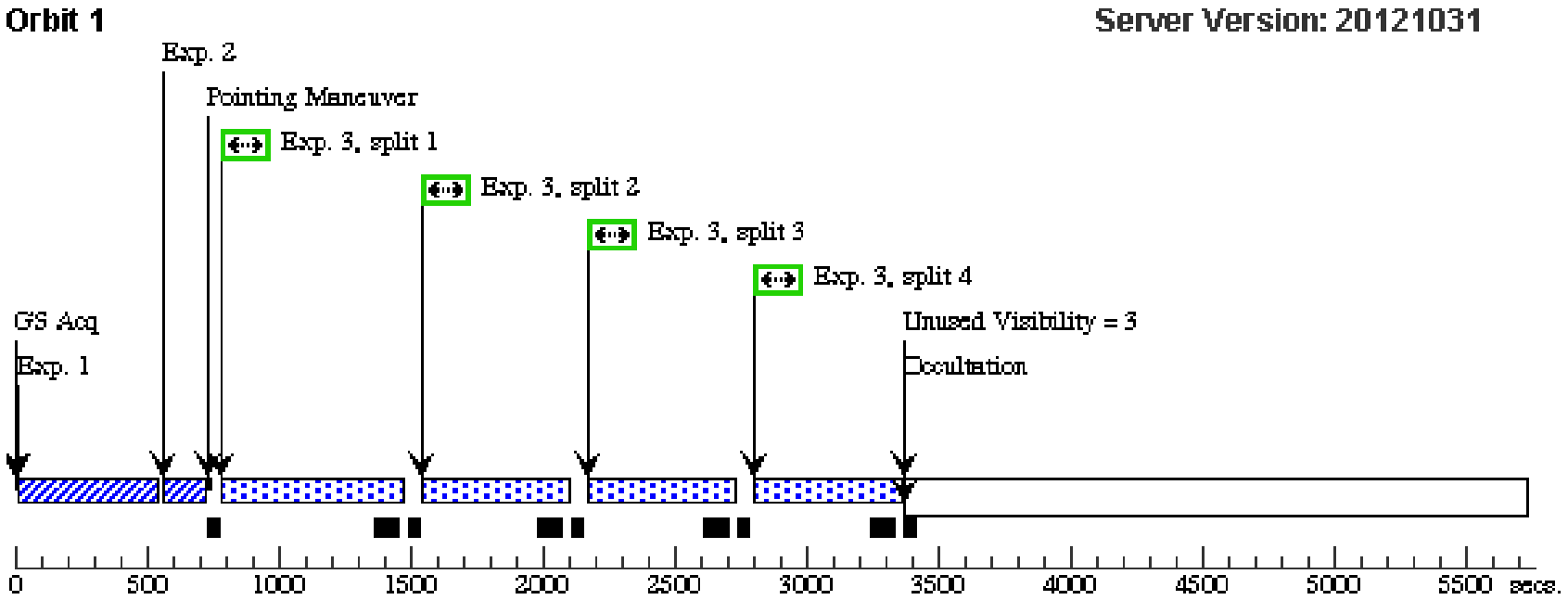
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PG-1351+489 Alt Name1: WD-1351+489 Alt Name2: N5N9001608	RA: 13 53 9.9000 (208.2912500d) Dec: +48 40 22.60 (48.67294d) Equinox: J2000		V=16.87 B=16.38	Reference Frame: ICRS

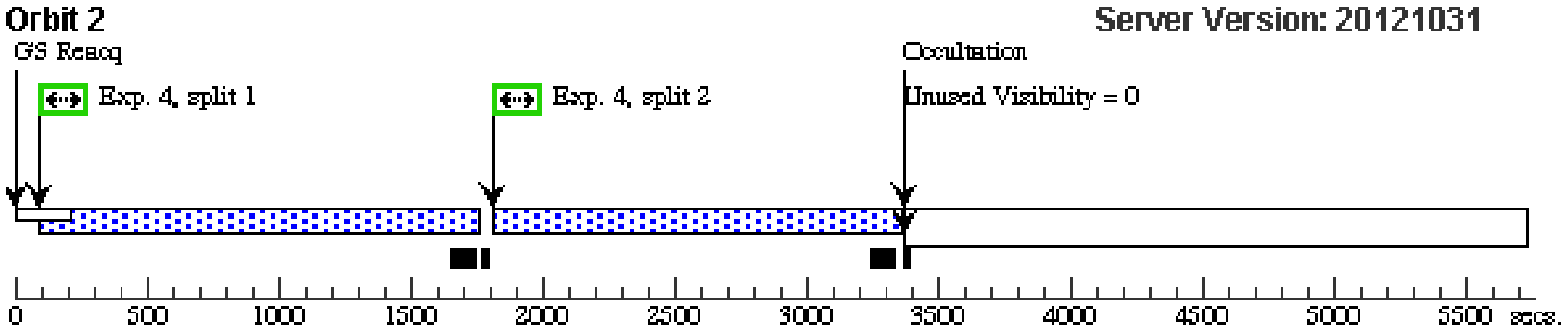
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

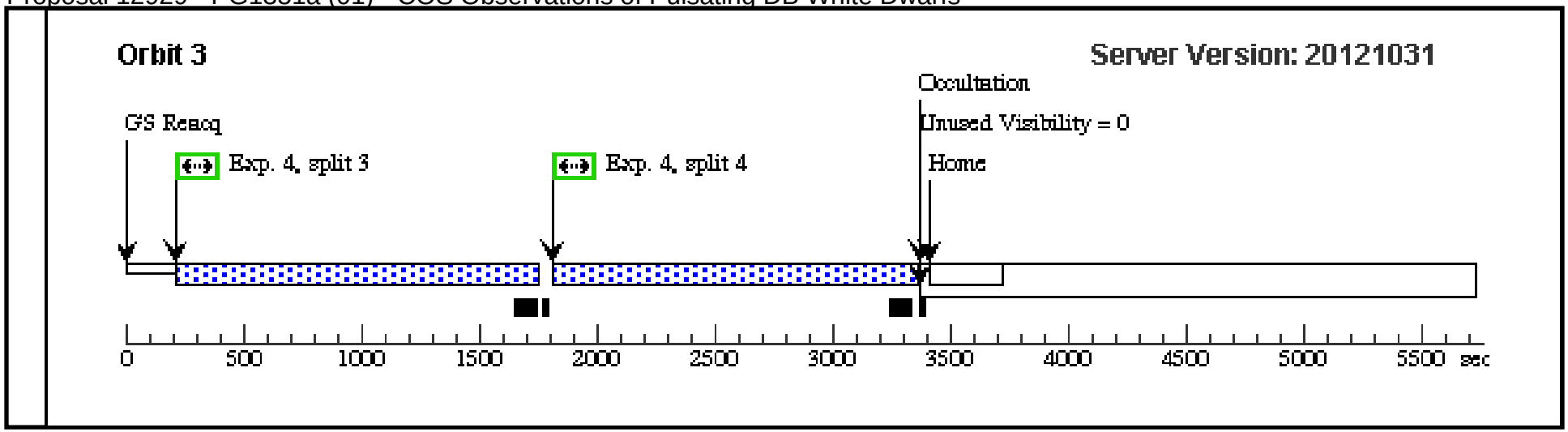
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TAsearch (415912)	(1) PG-1351+489	COS/NUV, ACQ/SEARCH, PSA	MIRRORB	CENTER=FLUX-WT; SCAN-SIZE=2			17.4 Secs *[==>]*	***[1]***
2	TAimage (415912)	(1) PG-1351+489	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				17.4 Secs *[==>]*	***[1]***
3	pg1351sci1 (415917)	(1) PG-1351+489	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=405; SEGMENT=BOTH; FP-POS=ALL			550 Secs *[==>504.0 Secs (Split 1)]* *[==>504.0 Secs (Split 2)]* *[==>504.0 Secs (Split 3)]* *[==>504.0 Secs (Split 4)]*	 ***[1]***
4	pg1351sci2 (415923)	(1) PG-1351+489	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=1396			1450 Secs *[==>1488.0 Secs (Split 1)]* *[==>1496.0 Secs (Split 2)]* *[==>1488.0 Secs (Split 3)]* *[==>1498.0 Secs (Split 4)]*	 ***[2]*** ***[3]***

Orbit Structure






Orbit 3
Server Version: 20121031
Occultation
GS Reacq
Unused Visibility = 0
Exp. 4, split 3
Exp. 4, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12929, kicstar (02), completed Sat Jan 19 02:12:55 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: PCS MODE FINE

Fixed Targets

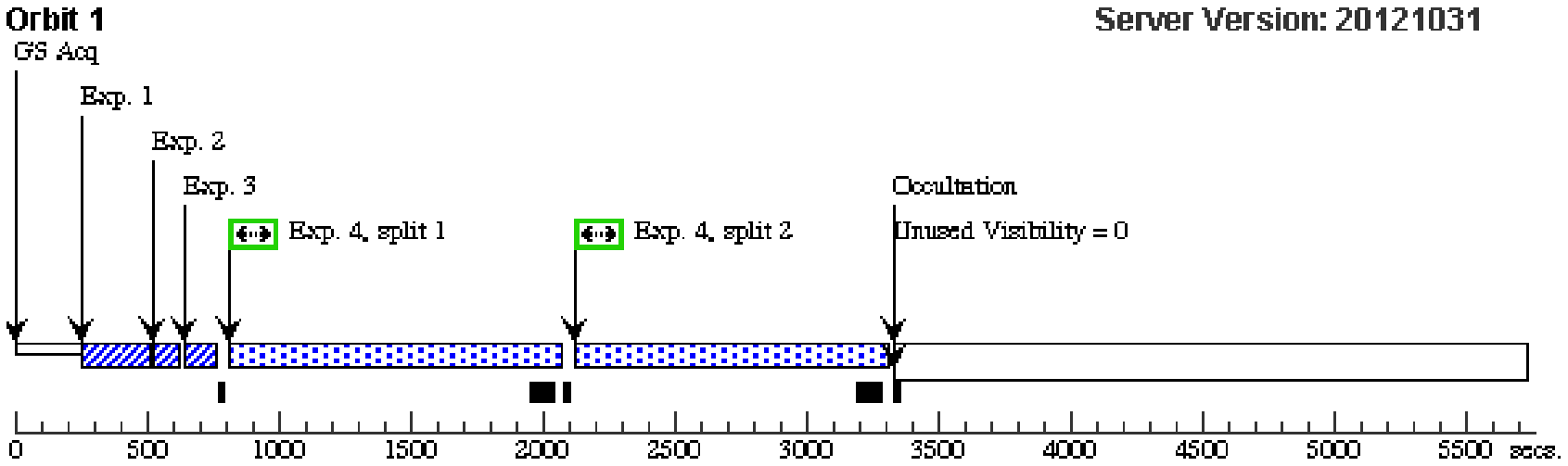
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(14)	WD-J1929+4447 Alt Name1: N2KD066558 Alt Name2: KIC8626021	RA: 19 29 4.6900 (292.2695417d) Dec: +44 47 9.04 (44.78584d) Equinox: J2000		V=18.2+/-0.1	Reference Frame: ICRS

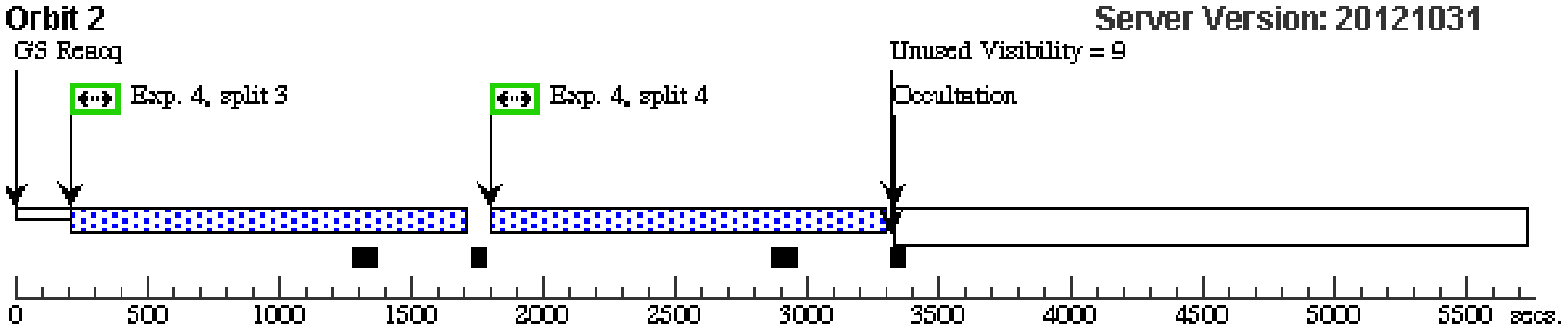
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

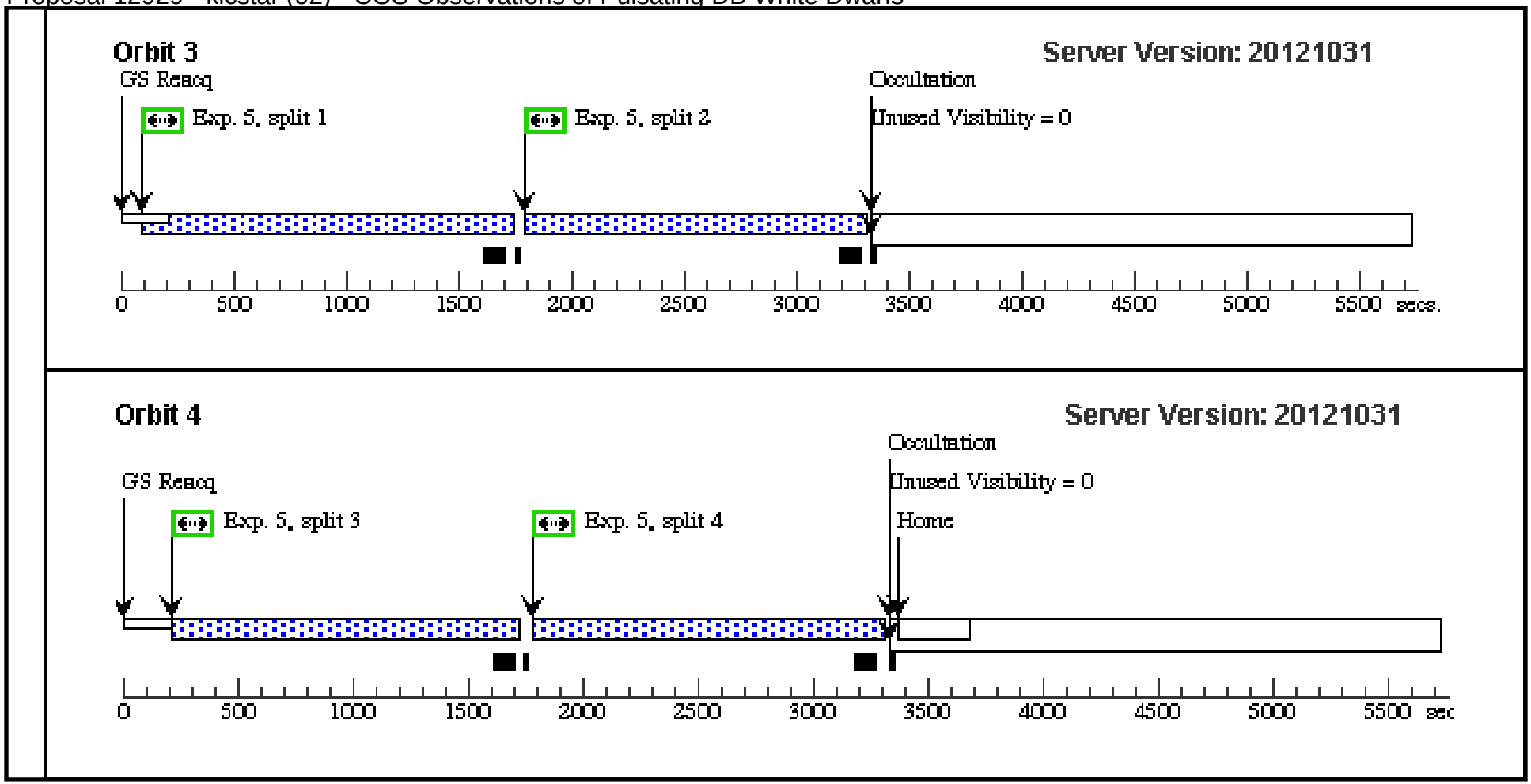
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA-kicsearch (416084)	(14) WD-J1929+4447	COS/FUV, ACQ/SEARCH, PSA	G130M 1291 A	CENTER=FLUX-WT; SCAN-SIZE=2; SEGMENT=BOTH			8.6 Secs *[==>]*	*[1]*
2	kic-peakxd (416085)	(14) WD-J1929+4447	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	SEGMENT=BOTH			8.1 Secs *[==>]*	*[1]*
3	kic-peakd (416084)	(14) WD-J1929+4447	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	CENTER=FLUX-WT; NUM-POS=3.0; SEGMENT=BOTH; STEP-SIZE=1.3			8.6 Secs *[==>]*	*[1]*
4	kicsci1 (416088)	(14) WD-J1929+4447	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=1032; SEGMENT=BOTH; FP-POS=ALL			1100 Secs *[==>1139.0 Secs (Split 1)]* *[==>1139.0 Secs (Split 2)]* *[==>1452.0 Secs (Split 3)]* *[==>1452.0 Secs (Split 4)]*	*[1]* *[2]*
5	kicsci2 (416090)	(14) WD-J1929+4447	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=1360			1350 Secs *[==>1470.0 Secs (Split 1)]* *[==>1470.0 Secs (Split 2)]* *[==>1461.0 Secs (Split 3)]* *[==>1481.0 Secs (Split 4)]*	*[3]* *[4]*

Orbit Structure






Orbit 3
Server Version: 20121031
GS Reacq
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Exp. 5, split 2
Occultation
Unused Visibility = 0
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2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 4
Server Version: 20121031
Occultation
GS Reacq
Unused Visibility = 0
Exp. 5, split 3
Exp. 5, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12929, ec04207 (03), completed Sat Jan 19 02:12:59 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: PCS MODE FINE; SCHED 100%

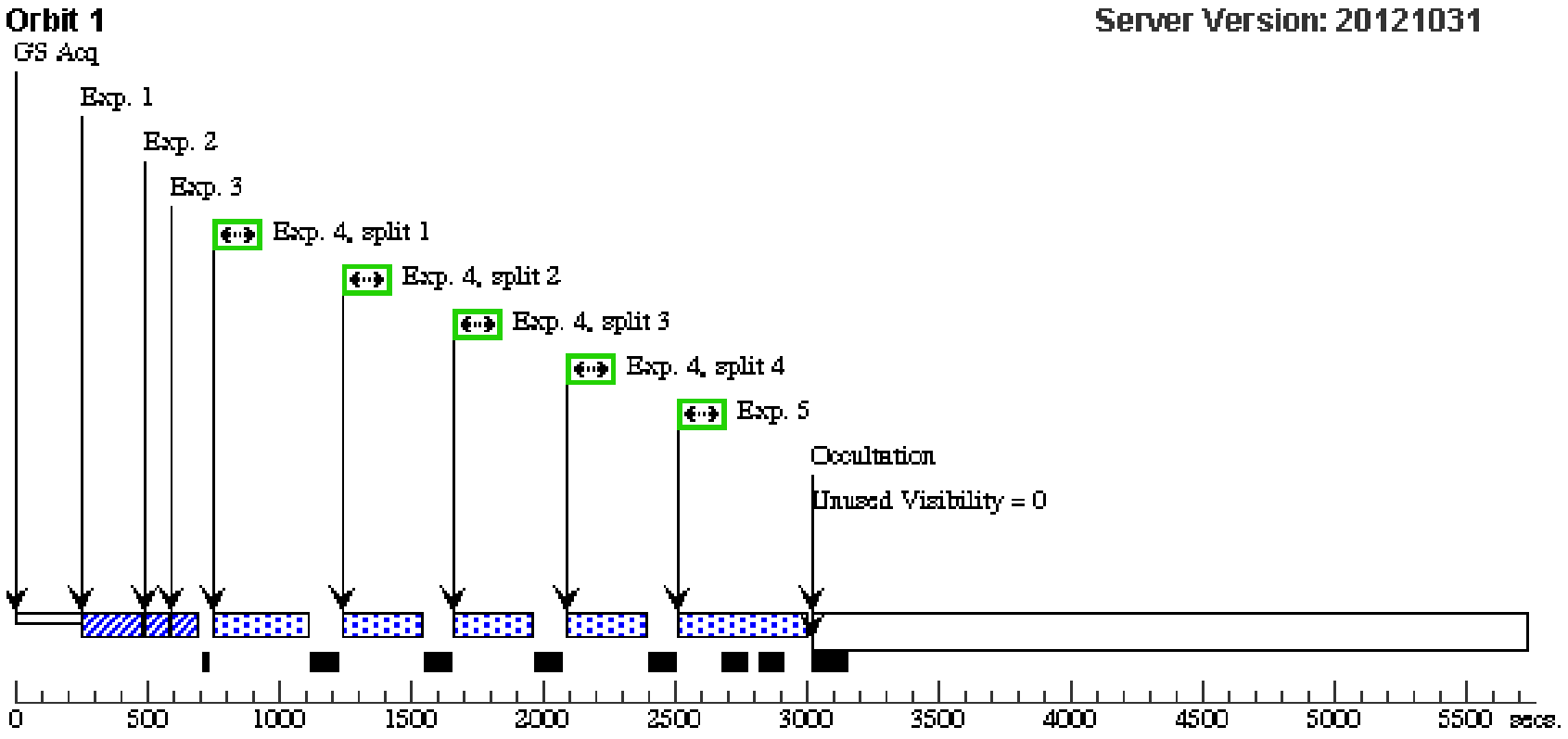
Fixed Targets

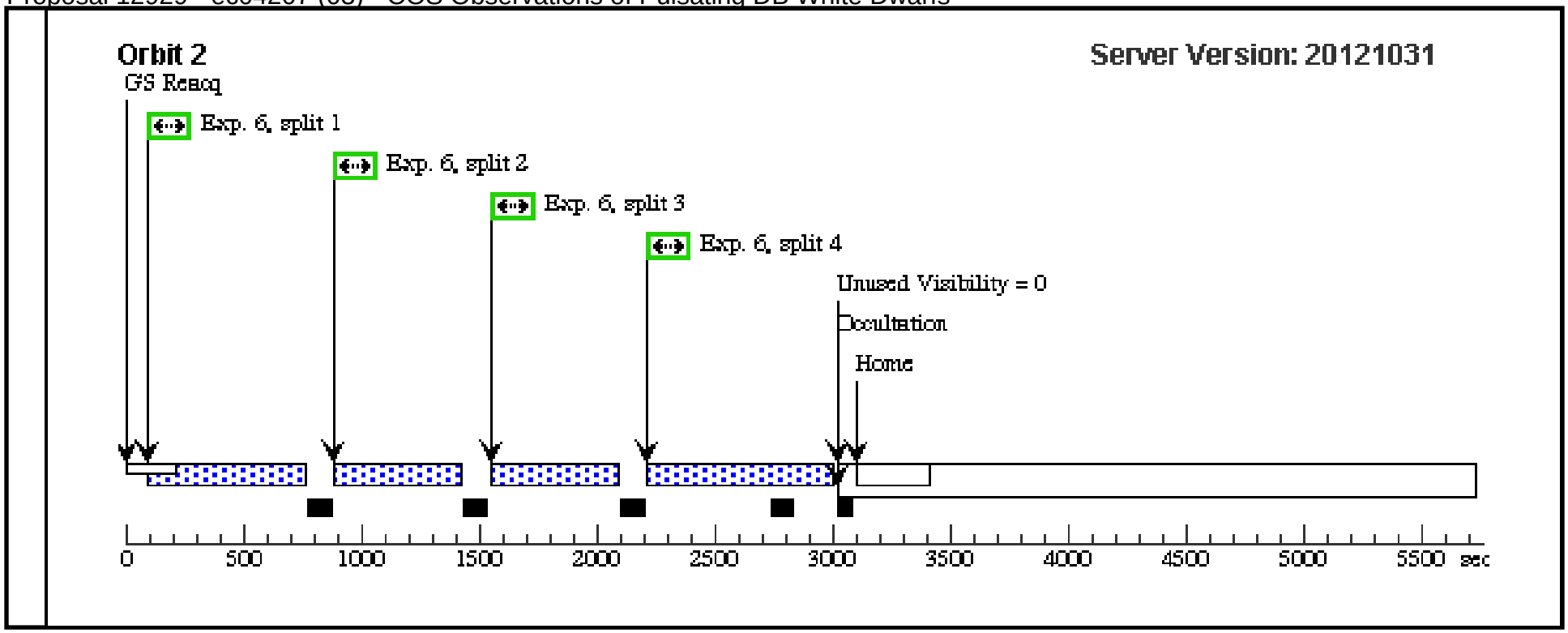
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(11)	EC04207-4748	RA: 04 22 11.3500 (65.5472917d)		V=14.7+/-0.1	Reference Frame: ICRS
	Alt Name1: S2JD000159	Dec: -47 41 41.90 (-47.69497d)		J 15.86 H 15.581	
		Equinox: J2000			

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA-ec04020 7search (416047)	(11) EC04207-4748	COS/FUV, ACQ/SEARCH, PSA	G130M 1291 A	CENTER=FLUX-WT; SCAN-SIZE=2; SEGMENT=BOTH			0.3 Secs *[==>]*	*[1]*
2	ec04207pea kxd (416050)	(11) EC04207-4748	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	SEGMENT=BOTH			0.3 Secs *[==>]*	*[1]*
3	ec04207pea kd (416047)	(11) EC04207-4748	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	CENTER=FLUX-WT; NUM-POS=3.0; SEGMENT=BOTH; STEP-SIZE=1.3			0.3 Secs *[==>]*	*[1]*
4	ec04207sci1 (416053)	(11) EC04207-4748	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=ALL; SEGMENT=BOTH; BUFFER-TIME=244			100 Secs *[==>244.0 Secs (Split 1)]* *[==>244.0 Secs (Split 2)]* *[==>244.0 Secs (Split 3)]* *[==>244.0 Secs (Split 4)]*	*[1]*
5	ec04207sci1 b (416058)	(11) EC04207-4748	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; SEGMENT=BOTH; BUFFER-TIME=135			235 Secs *[==>443.0 Secs]*	*[1]*
6	ec04207sci2 (416057)	(11) EC04207-4748	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=485; FP-POS=ALL; SEGMENT=BOTH			700 Secs *[==>485.0 Secs (Split 1)]* *[==>485.0 Secs (Split 2)]* *[==>485.0 Secs (Split 3)]* *[==>738.0 Secs (Split 4)]*	*[2]*

Orbit Structure




Orbit 2
Server Version: 20121031
GS Reacq
Exp. 6, split 1
Exp. 6, split 2
Exp. 6, split 3
Exp. 6, split 4
Unused Visibility = 0
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12929, wd1654 (04), failed Sat Jan 19 02:13:01 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: PCS MODE FINE

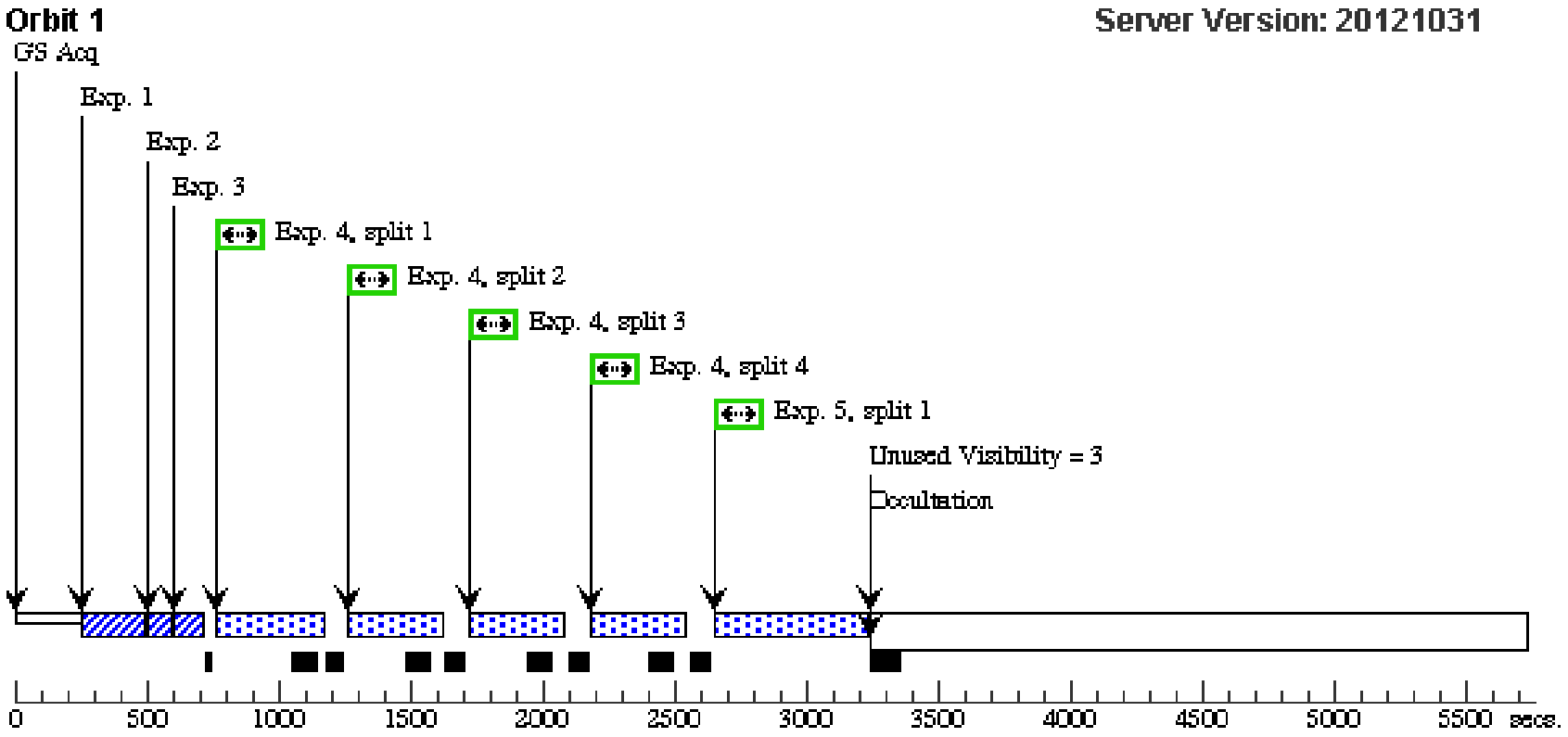
Fixed Targets

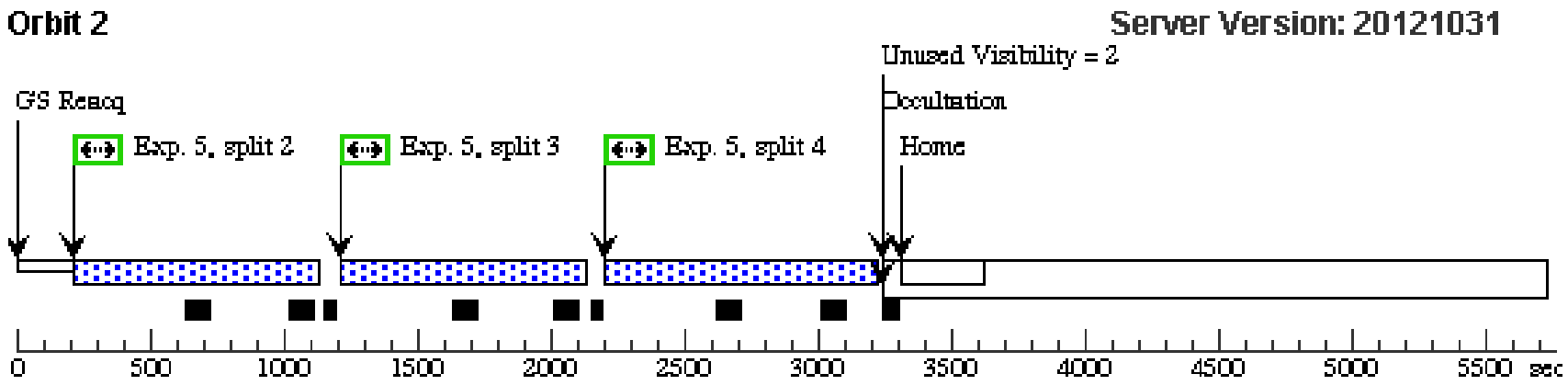
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(12)	WD1654+160	RA: 16 56 57.5900 (254.2399583d) Dec: +15 56 26.00 (15.94056d) Equinox: J2000	Proper Motion RA: -30 mas/yr Proper Motion Dec: 36 mas/yr Epoch of Position: 1989.26000976563	V=16.55+/-0.2	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA-wd1654 (416020)	(12) WD1654+160	COS/FUV, ACQ/SEARCH, PSA	G130M 1291 A	SEGMENT=BOTH; CENTER=FLUX-WT; SCAN-SIZE=2			2.2 Secs *[==>]*	*[1]*
2	TA-wd1654xd (416021)	(12) WD1654+160	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	SEGMENT=BOTH			2.1 Secs *[==>]*	*[1]*
3	TA-wd1654d (416020)	(12) WD1654+160	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	CENTER=FLUX-WT; NUM-POS=3.0; SEGMENT=BOTH; STEP-SIZE=1.3			2.2 Secs *[==>]*	*[1]*
4	wd1654sci1 (416022)	(12) WD1654+160	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=186			270 Secs *[==>286.0 Secs (Split 1)]* *[==>310.0 Secs (Split 2)]* *[==>310.0 Secs (Split 3)]* *[==>310.0 Secs (Split 4)]*	*[1]*
5	wd1654sci2 (416027)	(12) WD1654+160	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=382			300 Secs *[==>393.0 Secs (Split 1)]* *[==>871.0 Secs (Split 2)]* *[==>871.0 Secs (Split 3)]* *[==>966.0 Secs (Split 4)]*	*[1]* *[2]*

Orbit Structure





Visit

Proposal 12929, wd1654 (54), implementation Sat Jan 19 02:13:03 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: PCS MODE FINE

Comments: This is a repeat of visit 04.

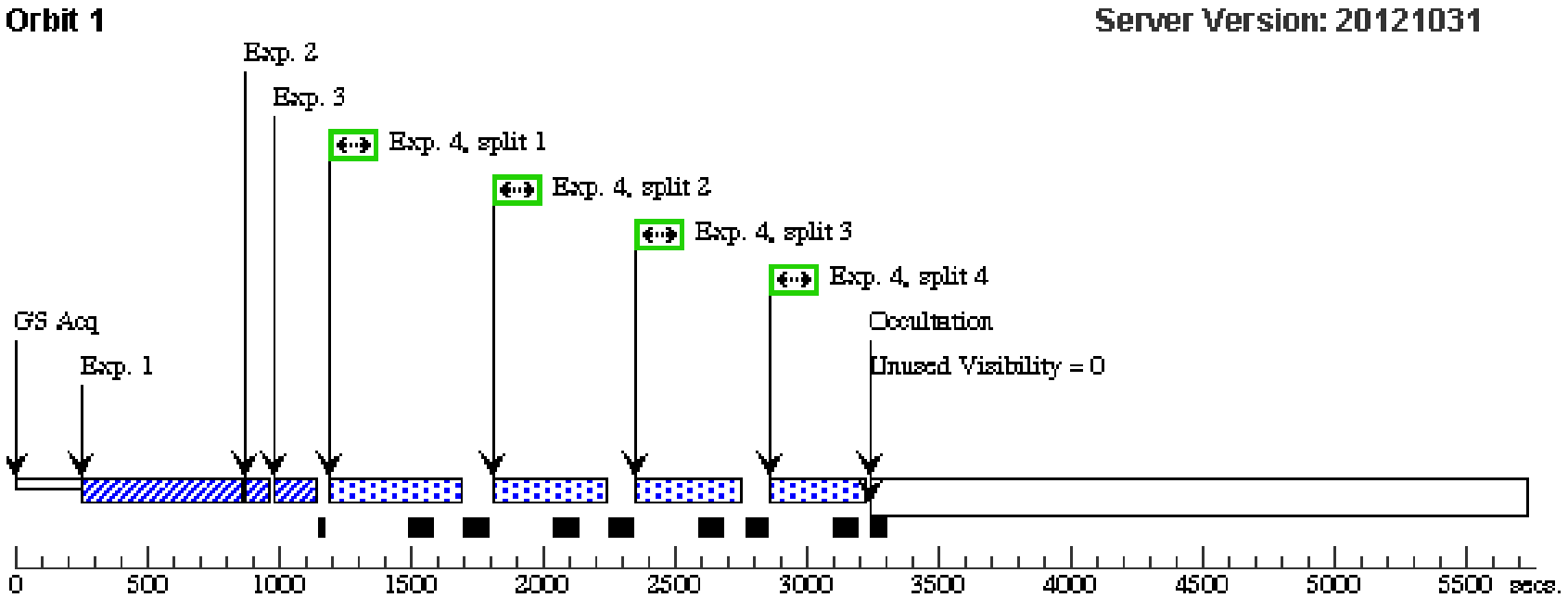
Fixed Targets

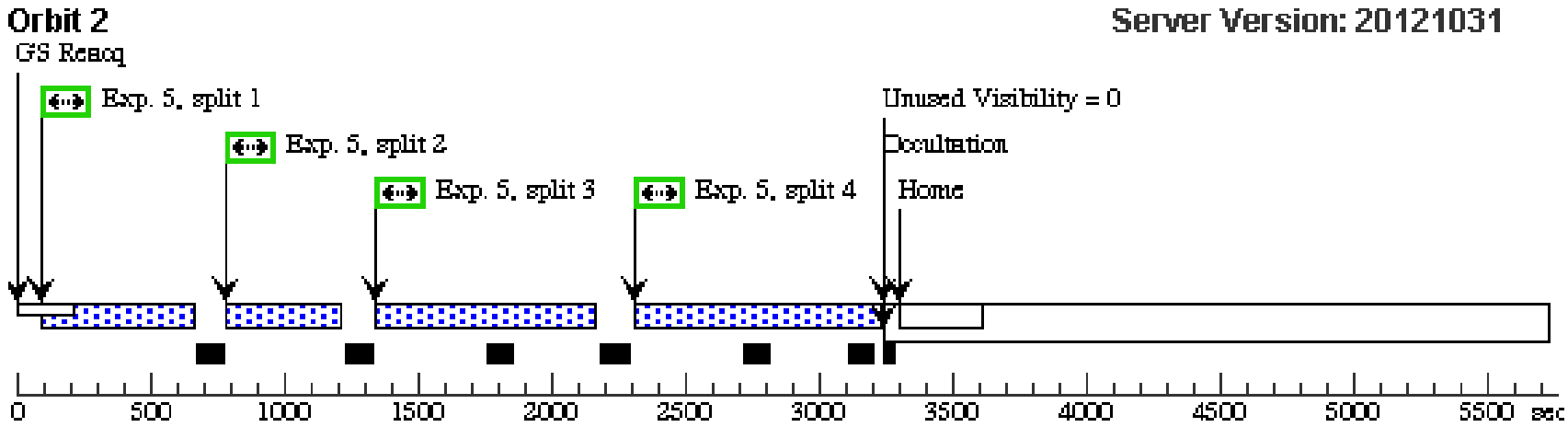
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(15)	WD1654+160-COPY	RA: 16 56 57.5100 (254.2396250d) Dec: +15 56 27.30 (15.94092d) Equinox: J2000	Proper Motion RA: -62 mas/yr Proper Motion Dec: 58 mas/yr Epoch of Position: 1989.26198151951	V=16.55+/-0.2	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA-wd1654 (416020)	(15) WD1654+160-COPY	COS/FUV, ACQ/SEARCH, PSA	G130M 1291 A	SEGMENT=BOTH; CENTER=FLUX-WT-FLR; SCAN-SIZE=4; STEP-SIZE=1.2			2.2 Secs *[==>]*	***[1]***
	Comments: changed scan size and updated coordinates								
2	TA-wd1654xd (416021)	(15) WD1654+160-COPY	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	SEGMENT=BOTH			2.1 Secs *[==>]*	***[1]***
3	TA-wd1654d (416020)	(15) WD1654+160-COPY	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	CENTER=FLUX-WT-FLR; NUM-POS=5.0; SEGMENT=BOTH; STEP-SIZE=0.9			2.2 Secs *[==>]*	***[1]***
4	wd1654sci1 (416022)	(15) WD1654+160-COPY	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=200			270 Secs *[==>377.0 Secs (Split 1)]* *[==>375.0 Secs (Split 2)]* *[==>347.0 Secs (Split 3)]* *[==>310.0 Secs (Split 4)]*	***[1]***
5	wd1654sci2 (416027)	(15) WD1654+160-COPY	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=382			300 Secs *[==>382.0 Secs (Split 1)]* *[==>382.0 Secs (Split 2)]* *[==>772.0 Secs (Split 3)]* *[==>867.0 Secs (Split 4)]*	***[2]***

Orbit Structure





Visit

Proposal 12929, pg1115 (05), scheduled Sat Jan 19 02:13:05 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: PCS MODE FINE; SCHED 100%

Fixed Targets

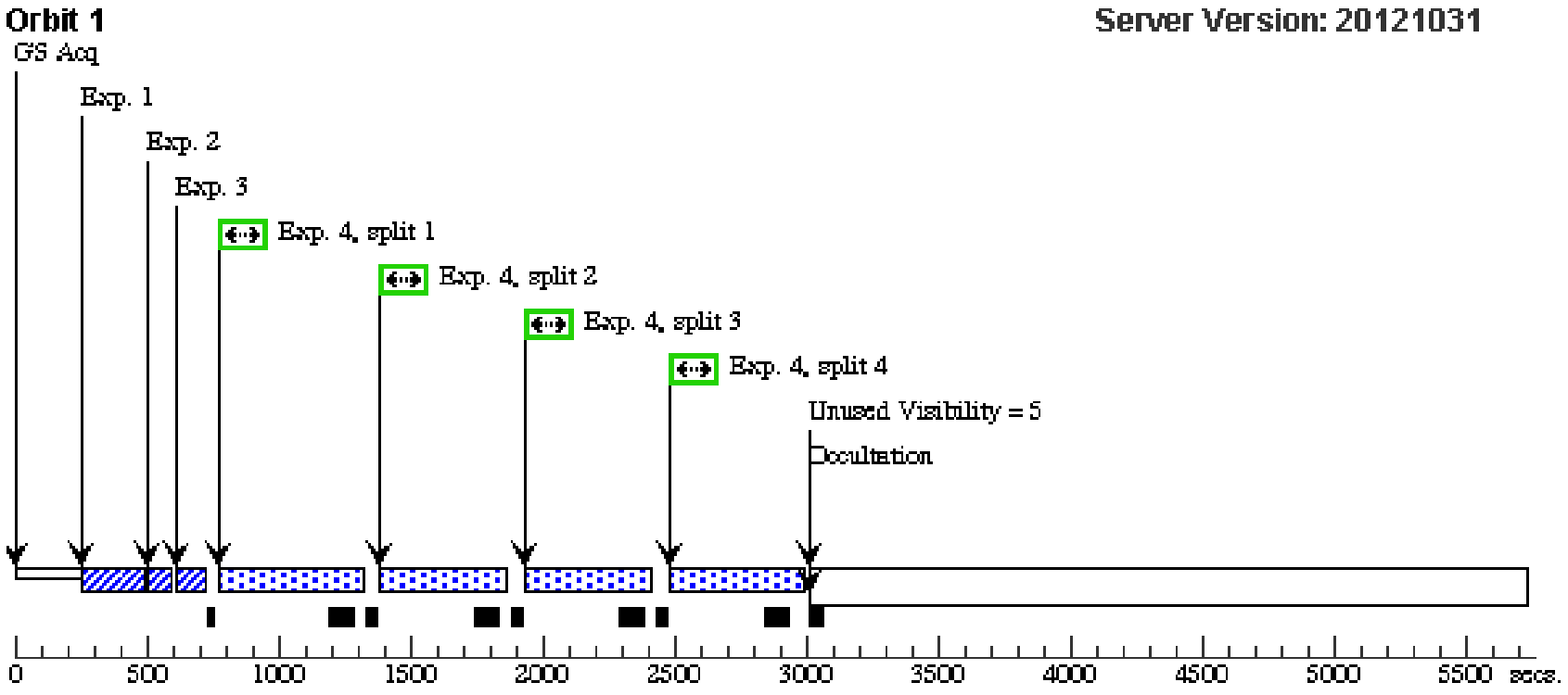
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	PG-1115+158 Alt Name1: WD-1115+158 Alt Name2: N71R003840	RA: 11 18 22.7000 (169.5945833d) Dec: +15 33 34.50 (15.55958d) Equinox: J2000		V=16.8 B=16.12	Reference Frame: ICRS

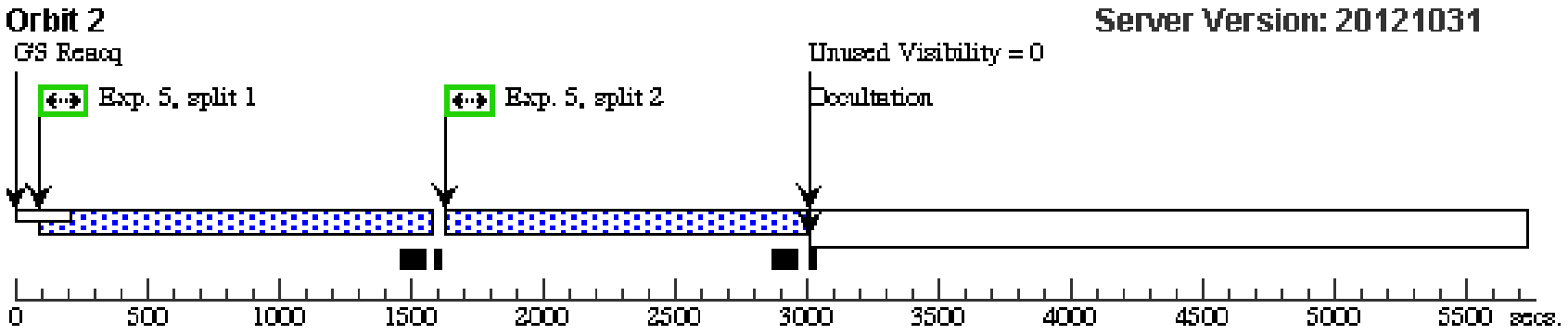
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

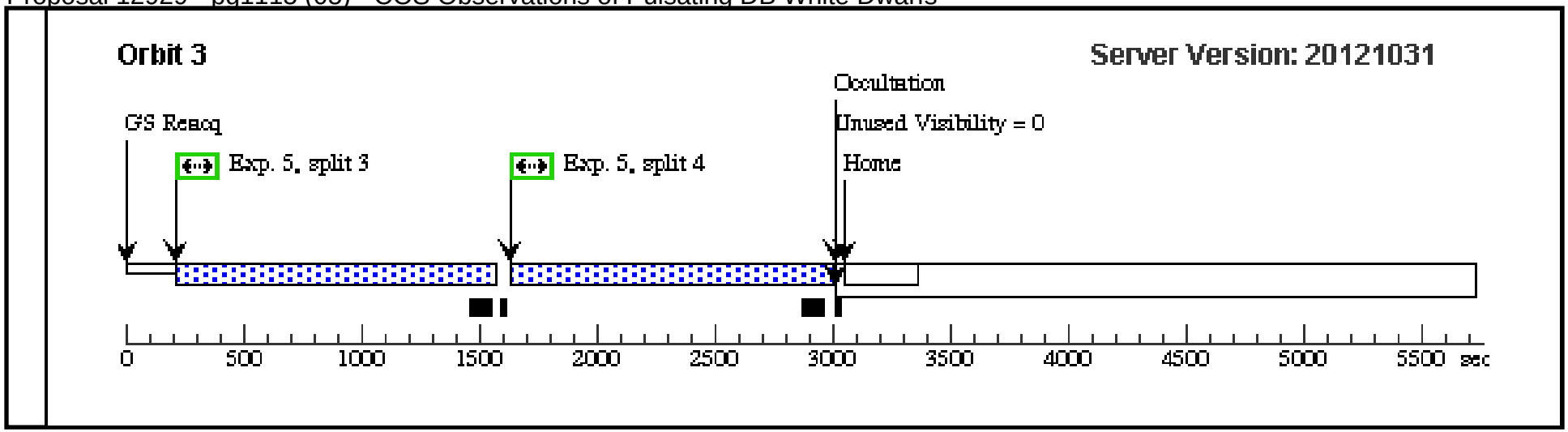
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA-pg1115search (415989)	(5) PG-1115+158	COS/FUV, ACQ/SEARCH, PSA	G130M 1291 A	CENTER=FLUX-WT; SCAN-SIZE=2; SEGMENT=BOTH			2.8 Secs *[==>]*	***[1]***
2	TA-pg1115xd (415990)	(5) PG-1115+158	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	SEGMENT=BOTH			2.6 Secs *[==>]*	***[1]***
3	TA-pg1115peakd (415989)	(5) PG-1115+158	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	CENTER=FLUX-WT; NUM-POS=3.0; SEGMENT=BOTH; STEP-SIZE=1.3			2.8 Secs *[==>]*	***[1]***
4	pg1115sci1 (415991)	(5) PG-1115+158	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=326			400 Secs *[==>426.0 Secs (Split 1)]* *[==>426.0 Secs (Split 2)]* *[==>426.0 Secs (Split 3)]* *[==>456.0 Secs (Split 4)]*	***[1]***
5	pg1115sci2 (416001)	(5) PG-1115+158	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=ALL; BUFFER-TIME=1206			1300 Secs *[==>1306.0 Secs (Split 1)]* *[==>1316.0 Secs (Split 2)]* *[==>1307.0 Secs (Split 3)]* *[==>1317.0 Secs (Split 4)]*	***[2]*** ***[3]***

Orbit Structure






Orbit 3
Server Version: 20121031
Occultation
GS Reacq
Unused Visibility = 0
Exp. 5, split 3
Exp. 5, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12929, ec20058 (06), completed Sat Jan 19 02:13:08 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV

Special Requirements: PCS MODE FINE

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	V-QU-TEL Alt Name1: WD-2005-525	RA: 20 09 40.1100 (302.4171250d) Dec: -52 25 15.50 (-52.42097d) Equinox: J2000		V=15.58	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA-ec20058 (415945)	(2) V-QU-TEL	COS/FUV, ACQ/SEARCH, PSA	G130M 1291 A	SEGMENT=BOTH; SCAN-SIZE=2; CENTER=FLUX-WT; STEP-SIZE=1.767			0.7 Secs *[==>]*	 ***[1]***
2	TA-ec20058xd (415946)	(2) V-QU-TEL	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	SEGMENT=BOTH			0.7 Secs *[==>]*	 ***[1]***
3	ec20058d (415945)	(2) V-QU-TEL	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	CENTER=FLUX-WT; NUM-POS=3.0; SEGMENT=BOTH; STEP-SIZE=1.3			0.7 Secs *[==>]*	 ***[1]***
4	ec20058sci1 (415949)	(2) V-QU-TEL	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=275; FP-POS=ALL; SEGMENT=BOTH			150 Secs *[==>275.0 Secs (Split 1)]* *[==>275.0 Secs (Split 2)]* *[==>275.0 Secs (Split 3)]* *[==>275.0 Secs (Split 4)]*	 ***[1]***
5	eec20058sci2 (415960)	(2) V-QU-TEL	COS/FUV, TIME-TAG, PSA	G160M 1611 A	BUFFER-TIME=585; FP-POS=ALL; SEGMENT=BOTH			460 Secs *[==>585.0 Secs (Split 1)]* *[==>946.0 Secs (Split 2)]* *[==>946.0 Secs (Split 3)]* *[==>946.0 Secs (Split 4)]*	 ***[1]*** ***[2]***

Orbit Structure