18096 - COS-RAD: Where Radio Jets Meet the Halo gas

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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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) J0926	COS/FUV COS/NUV	3	26-Aug-2025 18:00:16.0	yes
02	(2) J0945	COS/FUV COS/NUV	5	26-Aug-2025 18:00:17.0	yes
03	(3) J0954	COS/FUV COS/NUV	4	26-Aug-2025 18:00:19.0	yes
04	(4) J1428	COS/FUV COS/NUV	3	26-Aug-2025 18:00:20.0	yes
05	(5) J1459	COS/FUV COS/NUV	3	26-Aug-2025 18:00:21.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
06	(6) J1441	COS/FUV COS/NUV	3	26-Aug-2025 18:00:22.0	yes
07	(7) FRIISDSS	COS/FUV COS/NUV	5	26-Aug-2025 18:00:23.0	yes

26 Total Orbits Used

ABSTRACT

We propose COS-RAD, a 26-orbit HST/COS program to conduct the first UV absorption-line survey of the circumgalactic medium (CGM) in powerful FRII radio galaxies at z<0.6. While JWST is now exposing how radio jets disturb gas on ISM scales, COS-RAD will reveal their large (halo)-scale impact-- probing how mechanical jet-driven feedback alters the ionization, kinematics, and mass of multiphase gas in the CGM. We will observe 7 carefully selected radio galaxies using bright background quasars whose sightlines pass through the jet-inflated shocked cocoon region, aligned near the jet axis where feedback effects are strongest. Using primarily the G130M/1291 grating, we will detect the full suite of UV absorption lines, from neutral species to highly ionized tracers like OVI, capturing the CGM's thermal structure, ionization state, and gas flows.

COS-RAD addresses two fundamental science goals:
(1) Constrain the extent, ionization, and metal content of shocked gas in jet-inflated cocoons, and
(2) Test whether radio jets dynamically disturb or accelerate CGM gas, producing distinct kinematic signatures compared to non-jetted systems.

These observations will deliver the first direct, multiphase constraints on how radio-mode feedback reshapes galaxy halos, which is crucial for anchoring jet feedback models in cosmological simulations. Only HST/COS provides access to the UV diagnostics needed to probe the CGM gas across a range of ionization potentials and densities, and to uncover this hidden phase of AGN feedback.

OBSERVING DESCRIPTION

We select a sample of classical FRII radio galaxies from combined FIRST+VLASS surveys, and cross matched with SDSS quasars to build a sample of background quasars with foreground radio galaxies. Radio galaxies of interest lie between $0.2 < z < 0.4$ with one source at $z = 0.7$, and the background quasar targets are at redshifts z~0.49 to 1.33. The background quasars have GALEX FUV mags between 18.5 - 19.33.
For the target acquisition, we ask for SN = 40 for a point source of flat continuum SED, and flux normalized by the known GALEX magnitudes of each target. we ask for MIRRORA configuration. This yields Target acquisition times of ~6 to 9 seconds.

For spectroscopy of 6 out of 7 sources, we use G130M/1291 setting to cover all the key emission lines of the Radio galaxies. We require SN ~8-10 at 1250 A where most lines line, and a minimum SN > 5 at 1400 A where throughput is the lowest. Using COS ETC, we find that the required times range from 3 to 5 orbits. For the 7th source, we use G160M/1611. We request total 26 orbits to observe 7 quasar sightlines, which probes the CGM of 7 FRII radio galaxies in absorption.

Visit

Proposal 18096, Visit 01, implementation Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

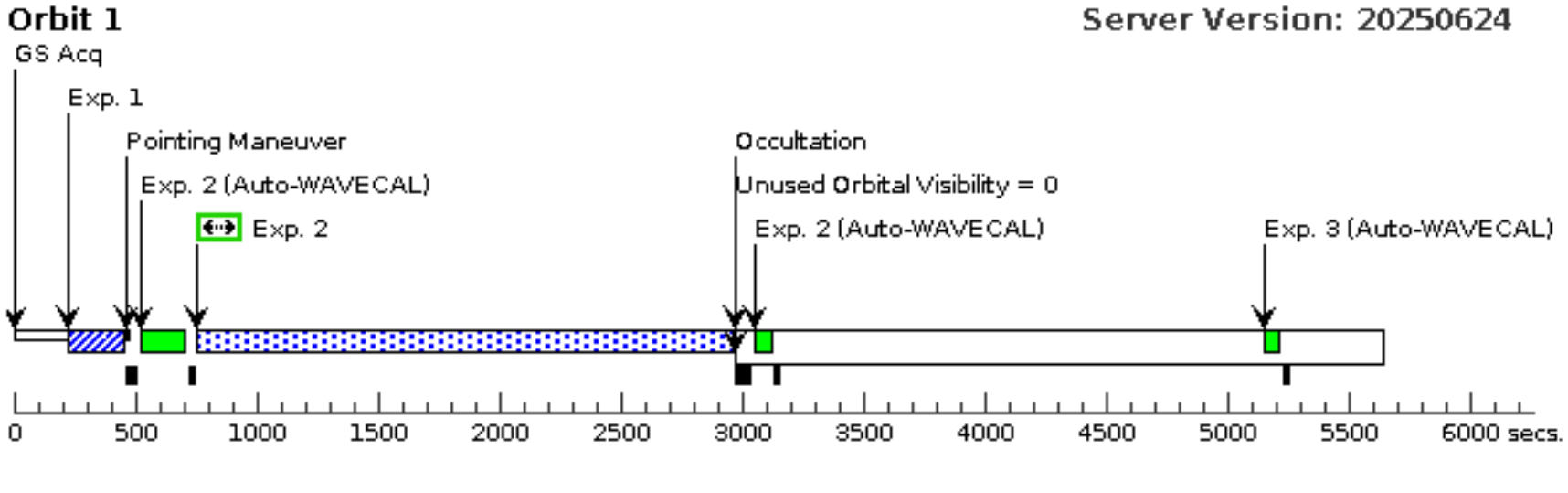
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J0926	RA: 09 26 56.7103 (141.7362929d) Dec: +04 16 13.19 (4.27033d) Equinox: J2000		V=17.27 GALEX FUV (AB magnitude) = 19.04	Reference Frame: ICRS

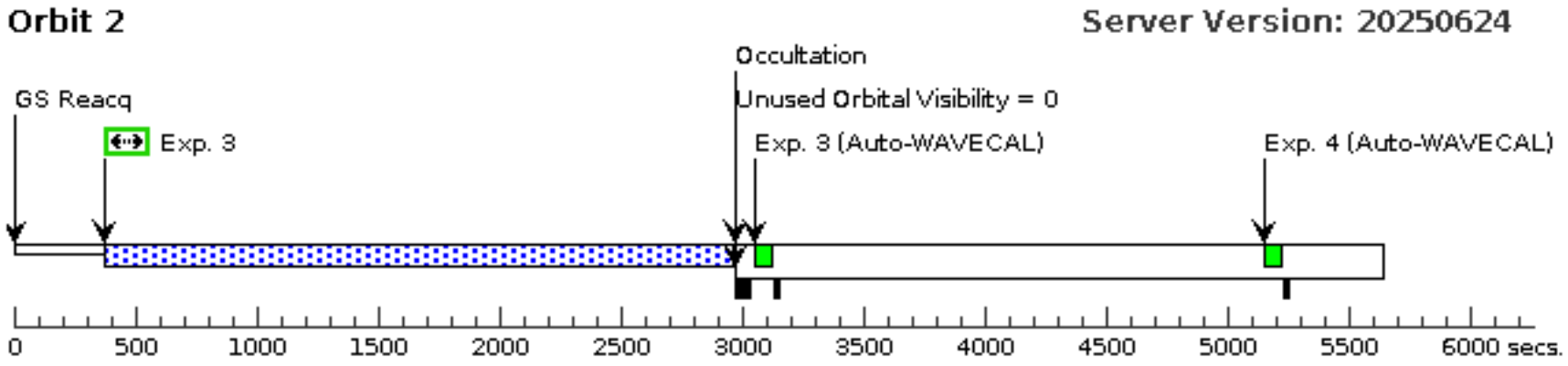
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

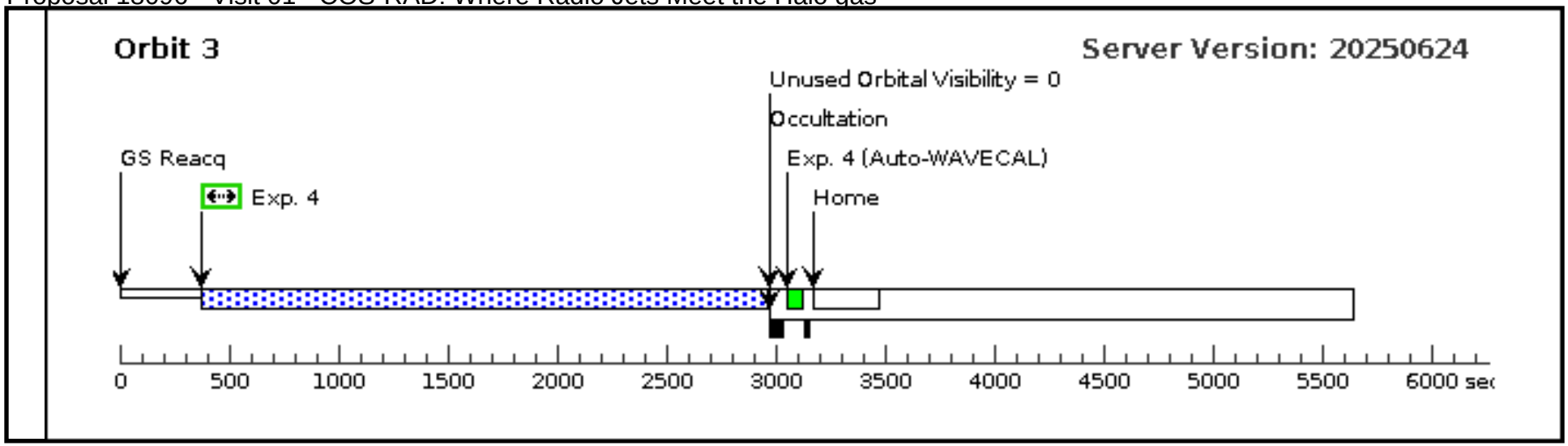
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (J0926) (COS.ta.2026120)	(1) J0926	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				7 Secs (7 Secs) *[==>]*	*[1]*
2	G130M Exp 2 (COS.sp.2025667)	(1) J0926	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=4822			2155 Secs (2155 Secs) *[==>]*	*[1]*
3	G130M Exp 3 (COS.sp.2025667)	(1) J0926	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=4822			2539 Secs (2539 Secs) *[==>]*	*[2]*
4	G130M Exp 4 (COS.sp.2025667)	(1) J0926	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=4822			2539 Secs (2539 Secs) *[==>]*	*[3]*

Orbit Structure



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GS Reacq
Exp. 4
Exp. 4 (Auto-WAVECAL)
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Visit

Proposal 18096, Visit 02, implementation Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

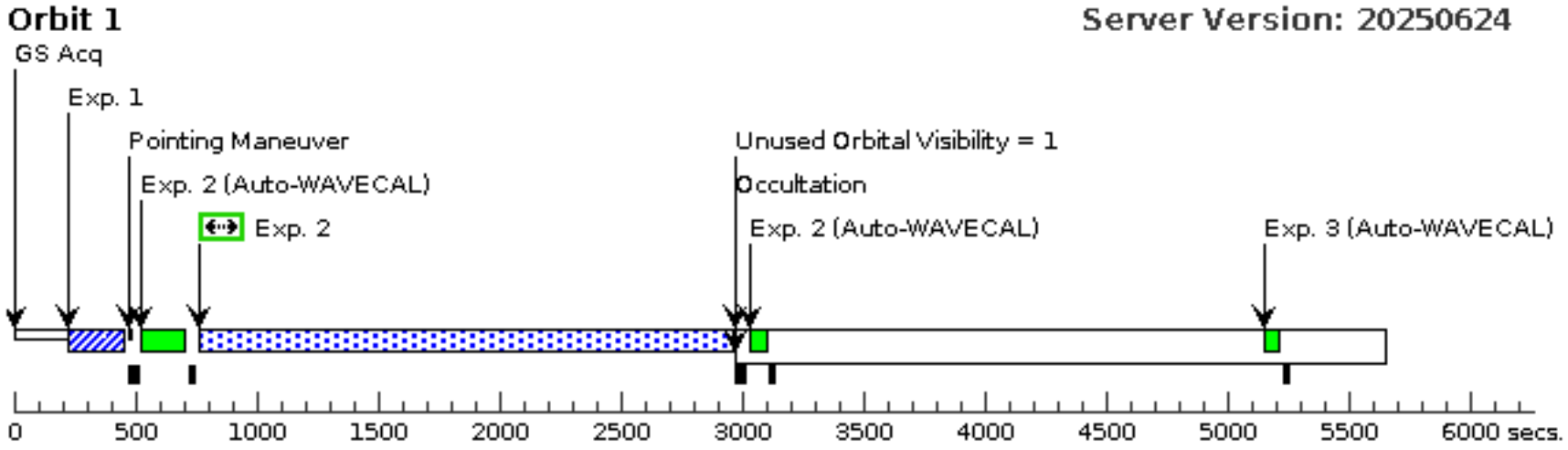
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	J0945	RA: 09 45 58.4267 (146.4934446d) Dec: +13 56 50.82 (13.94745d) Equinox: J2000		V=18.73 GALEX FUV (AB magnitude) = 19.24	Reference Frame: ICRS

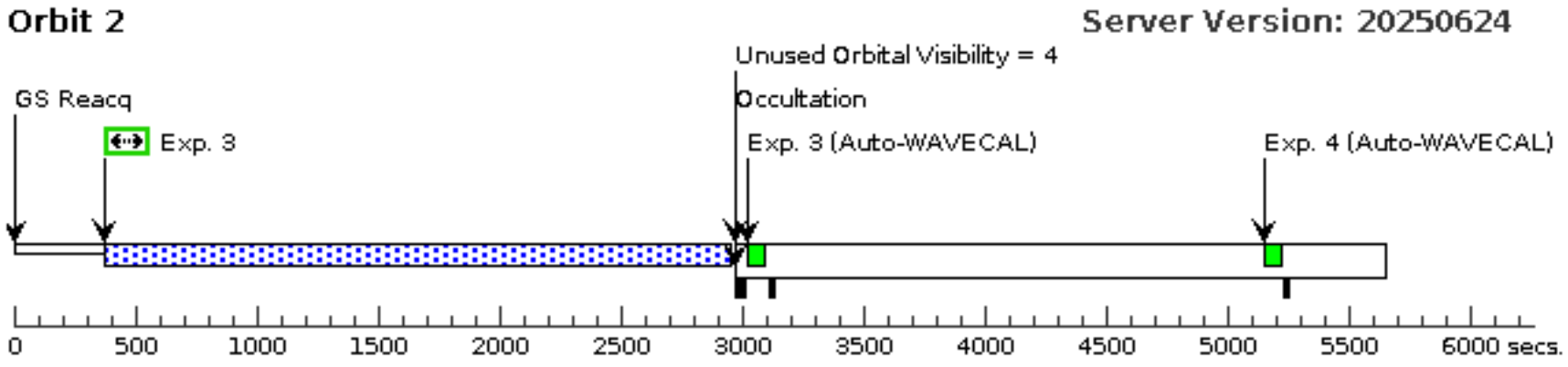
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

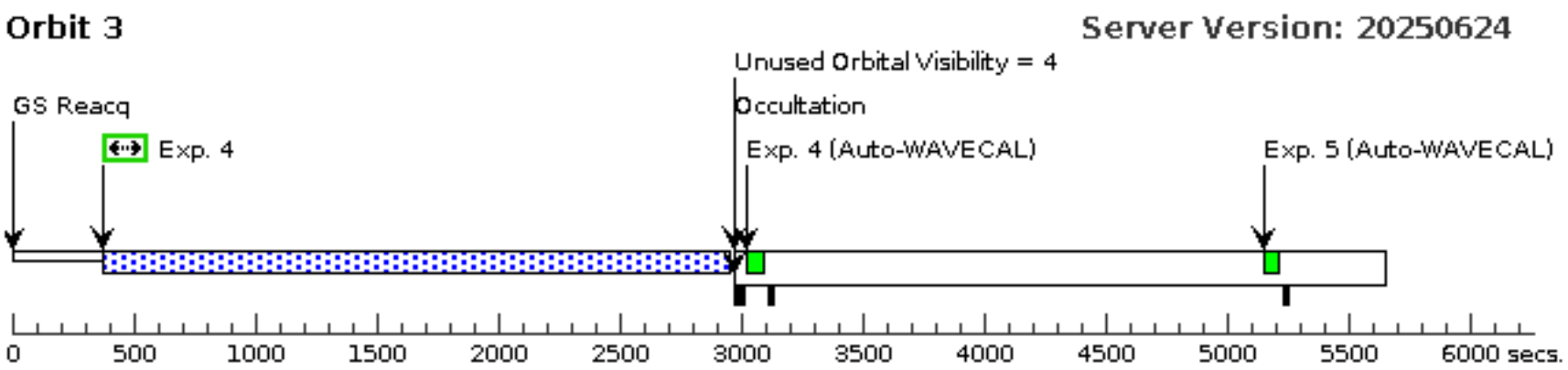
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (J0945) (COS.ta.2026128)	(2) J0945	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				9 Secs (9 Secs) *[==>]*	*[1]*
2	G130M Exp 2 (COS.sp.2025662)	(2) J0945	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=8176			2145 Secs (2145 Secs) *[==>]*	*[1]*
3	G130M Exp 3 (COS.sp.2025662)	(2) J0945	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=8176			2530 Secs (2530 Secs) *[==>]*	*[2]*
4	G130M Exp 4 (COS.sp.2025662)	(2) J0945	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=8176			2530 Secs (2530 Secs) *[==>]*	*[3]*
5	G130M Exp 5 (COS.sp.2025662)	(2) J0945	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=8176			2530 Secs (2530 Secs) *[==>]*	*[4]*
6	G130M Exp 6 (COS.sp.2025662)	(2) J0945	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=8176			2530 Secs (2530 Secs) *[==>]*	*[5]*

Orbit Structure



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GS Reacq
Occultation
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Exp. 4 (Auto-WAVECAL)
Exp. 5 (Auto-WAVECAL)
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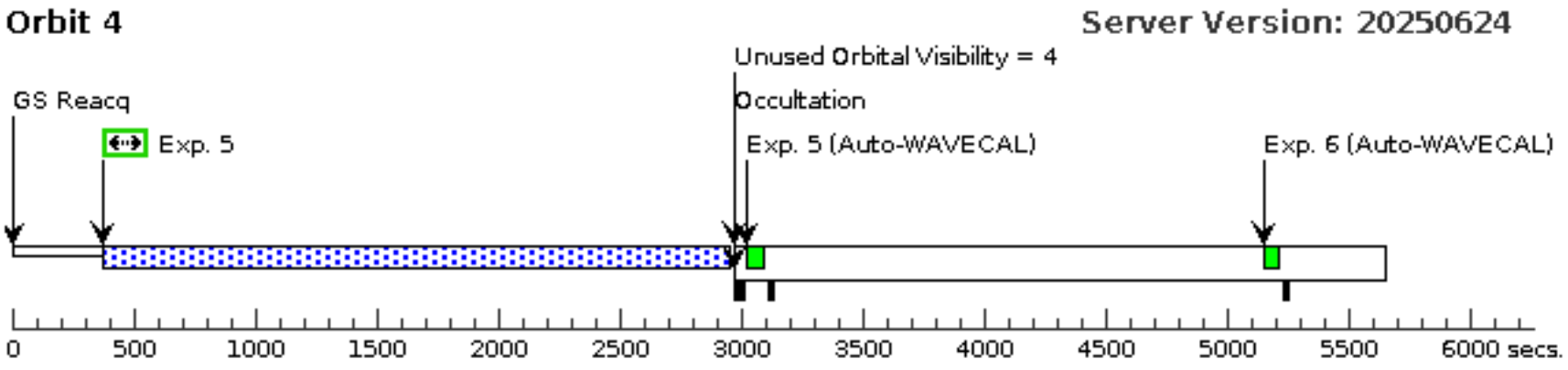
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Occultation
Exp. 5
Exp. 5 (Auto-WAVECAL)
Exp. 6 (Auto-WAVECAL)
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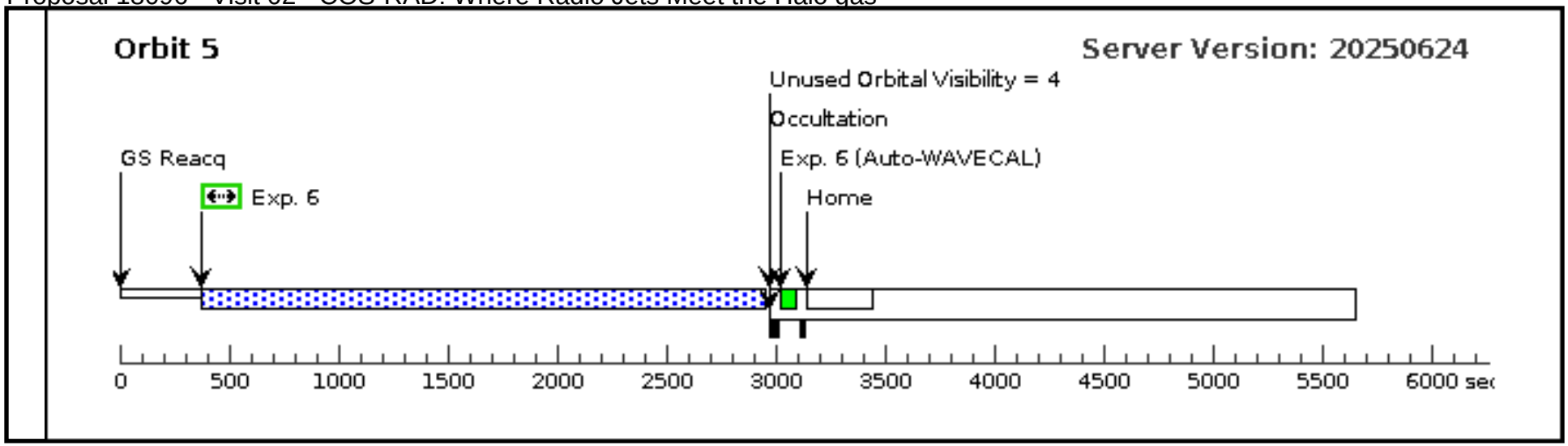
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Server Version: 20250624
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Occultation
GS Reacq
Exp. 6 (Auto-WAVECAL)
Exp. 6
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Visit

Proposal 18096, Visit 03, implementation

Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

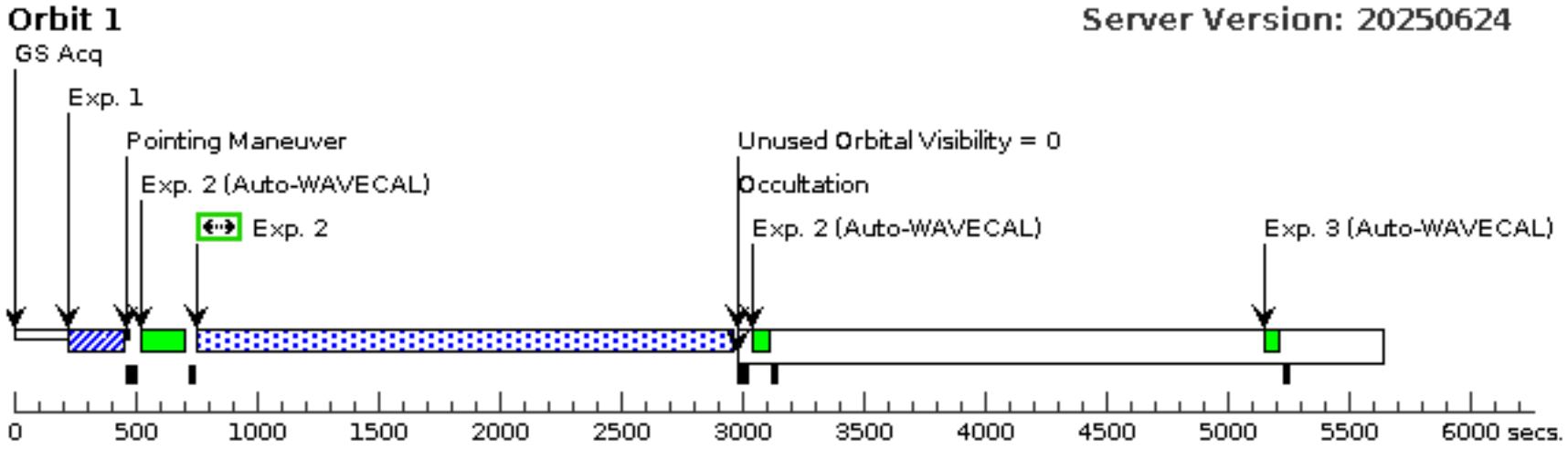
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	J0954	RA: 09 54 27.8196 (148.6159150d) Dec: +30 19 12.96 (30.32027d) Equinox: J2000		V=17.50 GALEX FUV (AB magnitude) = 18.95	Reference Frame: ICRS

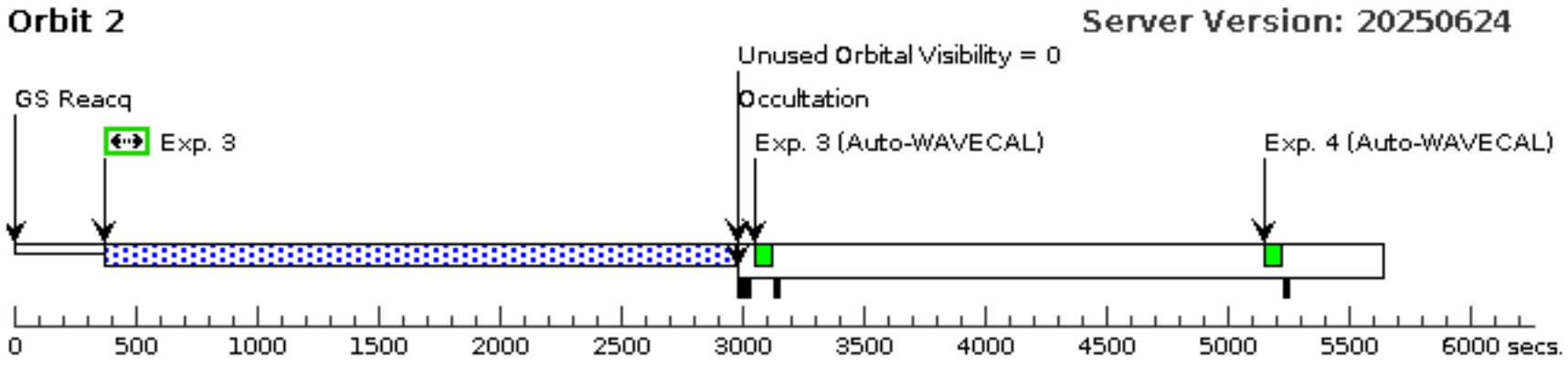
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

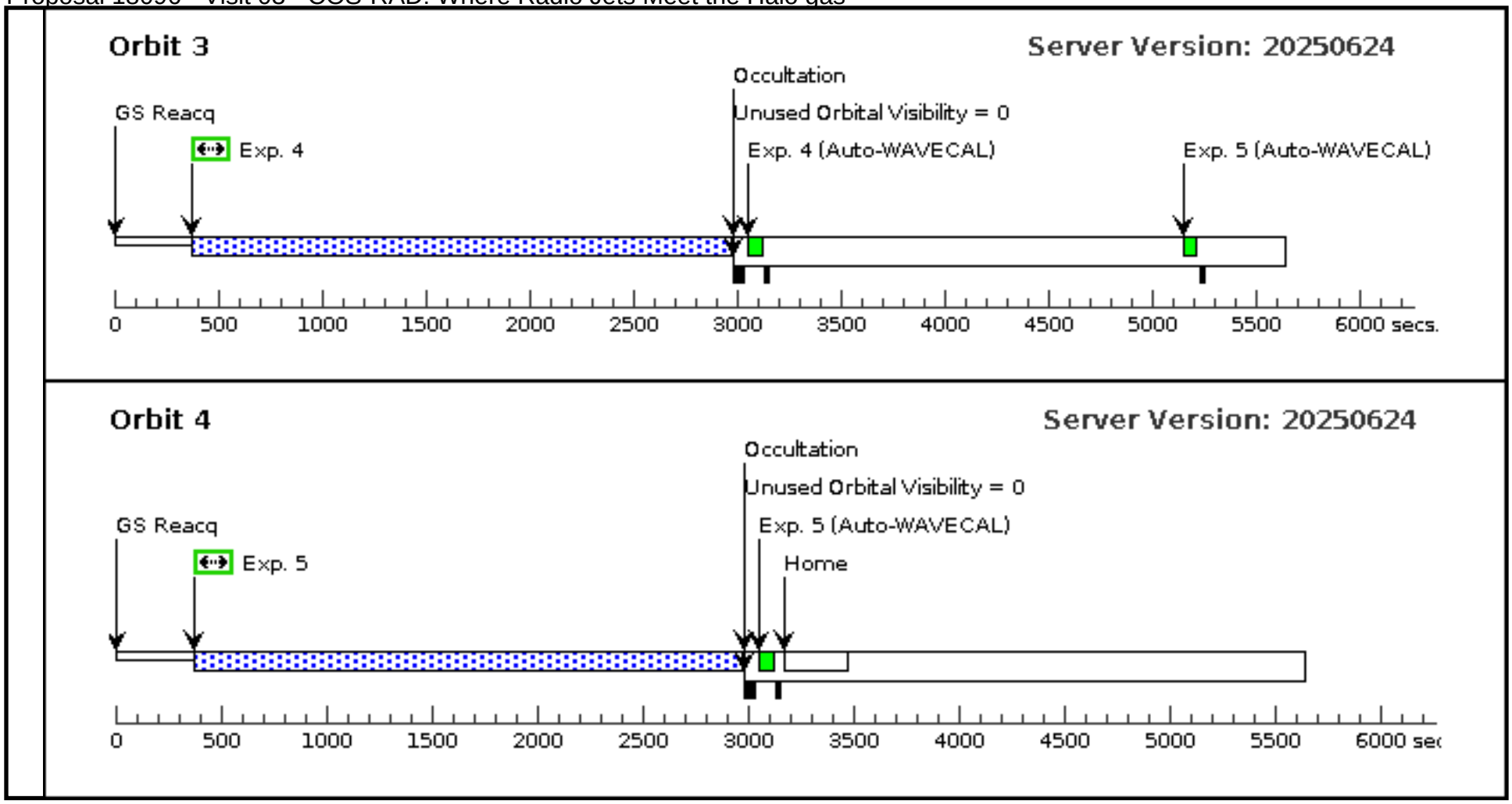
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (J0954) (COS.ta.2026129)	(3) J0954	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				7 Secs (7 Secs) *[==>]*	*[1]*
2	G130M Exp 2 (COS.sp.2026130)	(3) J0954	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=6536			2163 Secs (2163 Secs) *[==>]*	*[1]*
3	G130M Exp 3 (COS.sp.2026130)	(3) J0954	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=6536			2547 Secs (2547 Secs) *[==>]*	*[2]*
4	G130M Exp 4 (COS.sp.2026130)	(3) J0954	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=6536			2547 Secs (2547 Secs) *[==>]*	*[3]*
5	G130M Exp 5 (COS.sp.2026130)	(3) J0954	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=6536			2547 Secs (2547 Secs) *[==>]*	*[4]*

Orbit Structure



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Exp. 4
Exp. 4 (Auto-WAVECAL)
Exp. 5 (Auto-WAVECAL)
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Orbit 4
Server Version: 20250624
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 5
Exp. 5 (Auto-WAVECAL)
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Visit

Proposal 18096, Visit 04, implementation Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

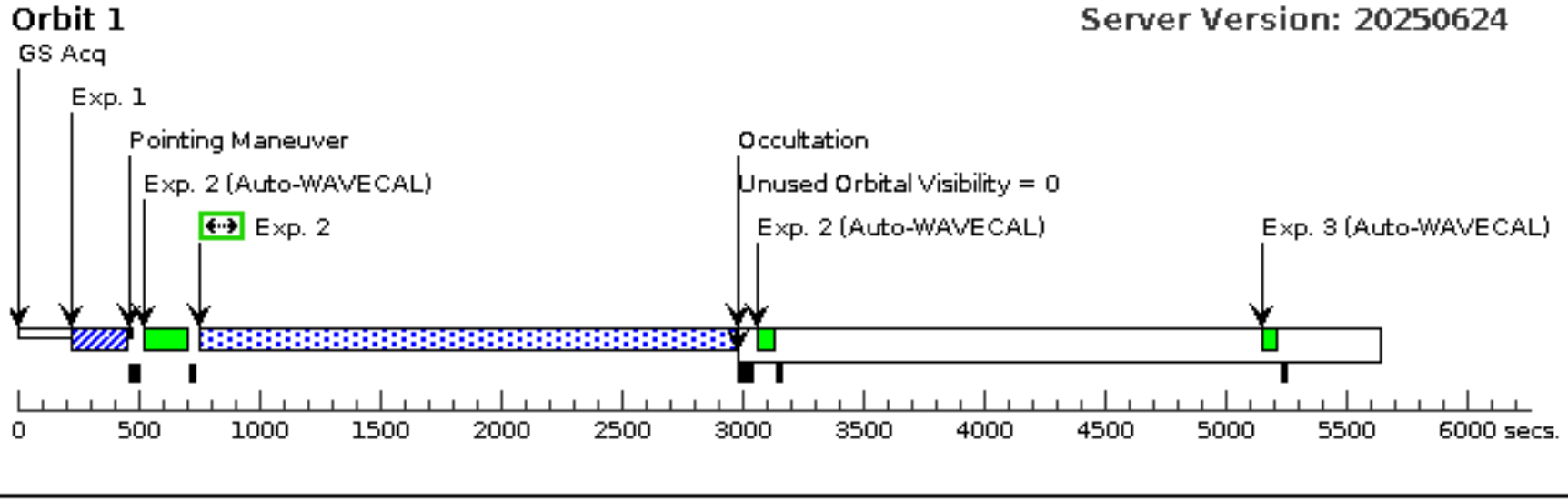
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	J1428	RA: 14 27 58.7316 (216.9947150d) Dec: +32 47 41.45 (32.79485d) Equinox: J2000		V=18.31 GALEX FUV (AB magnitude) = 18.91	Reference Frame: ICRS

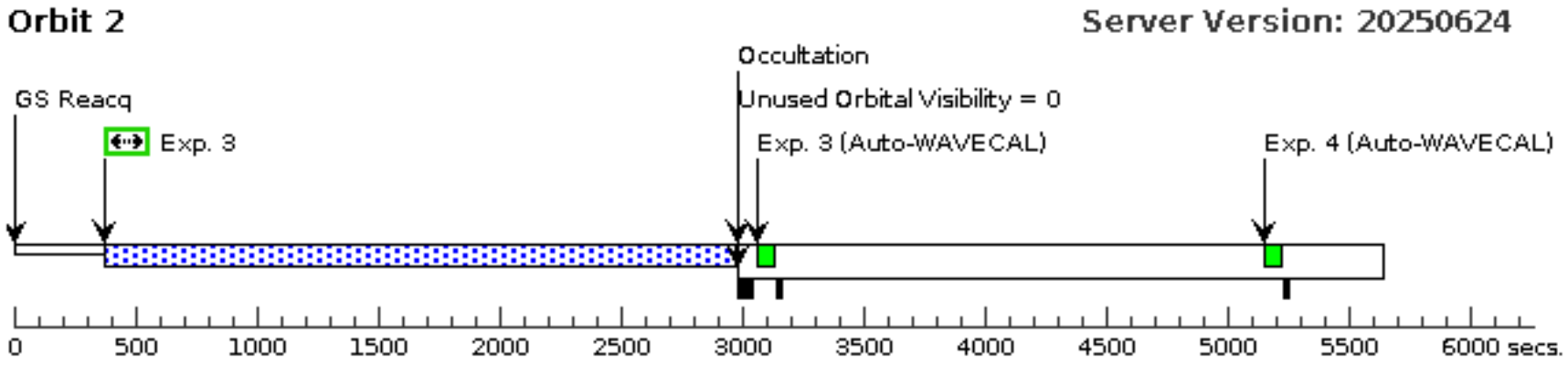
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

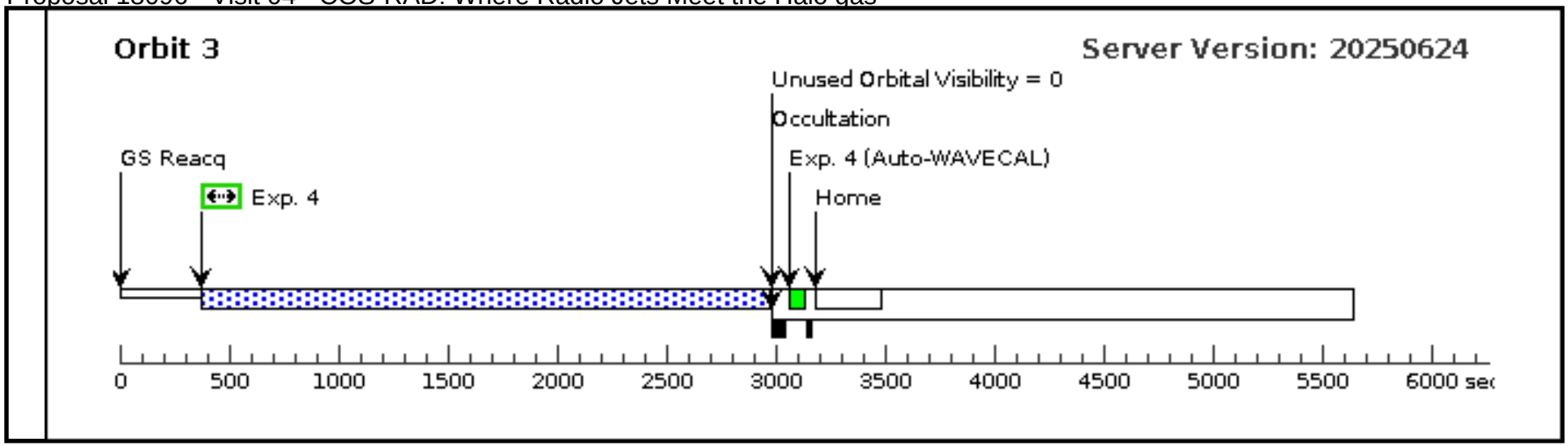
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (J1428) (COS.ta.2026132)	(4) J1428	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				6 Secs (6 Secs) *[==>]*	*[1]*
2	G130M Exp 2 (COS.sp.2025992)	(4) J1428	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=4839			2165 Secs (2165 Secs) *[==>]*	*[1]*
3	G130M Exp 3 (COS.sp.2025992)	(4) J1428	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=4839			2547 Secs (2547 Secs) *[==>]*	*[2]*
4	G130M Exp 4 (COS.sp.2025992)	(4) J1428	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=4839			2547 Secs (2547 Secs) *[==>]*	*[3]*

Orbit Structure



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Exp. 4
Exp. 4 (Auto-WAVECAL)
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Visit

Proposal 18096, Visit 05, implementation Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

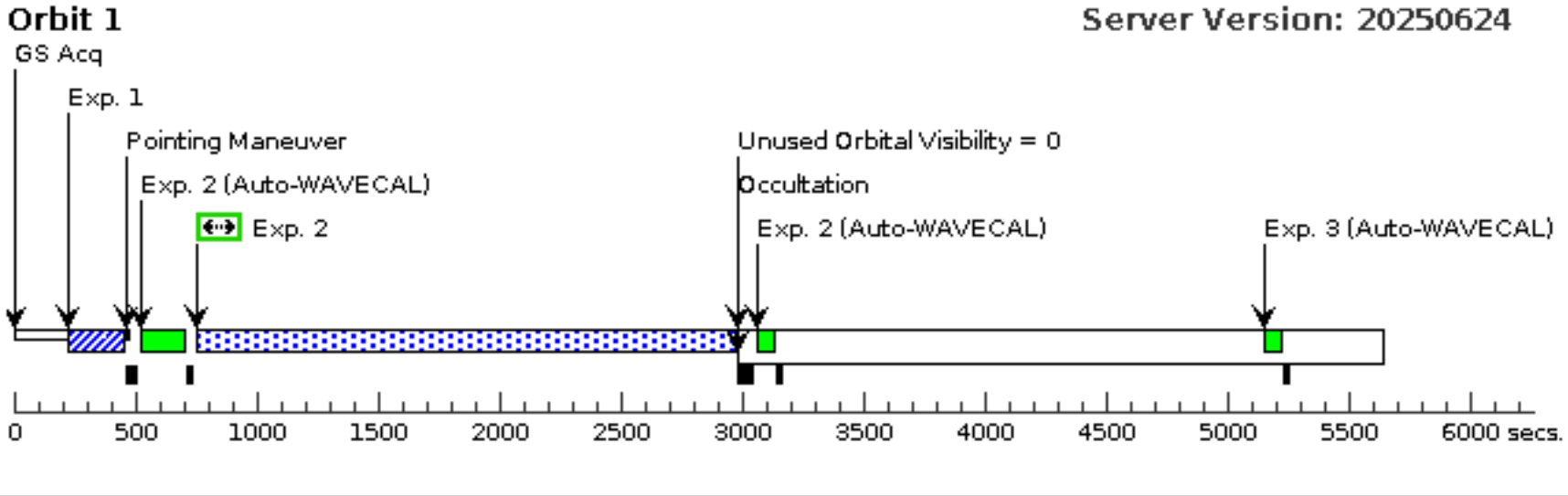
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	J1459	RA: 14 59 0.9869 (224.7541121d) Dec: +33 19 19.85 (33.32218d) Equinox: J2000		V=18.44 GALEX FUV (AB magnitude) = 18.76	Reference Frame: ICRS

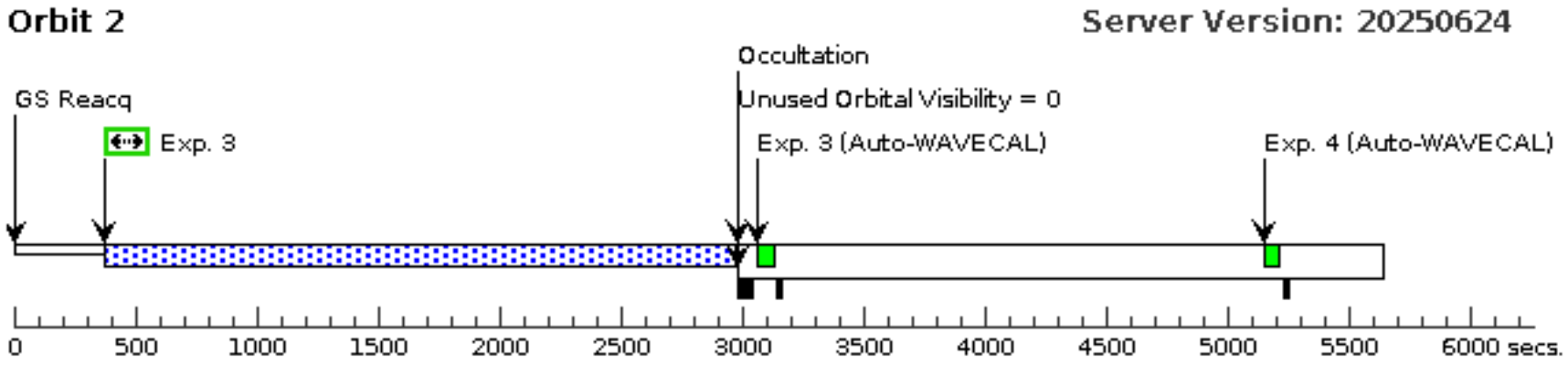
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

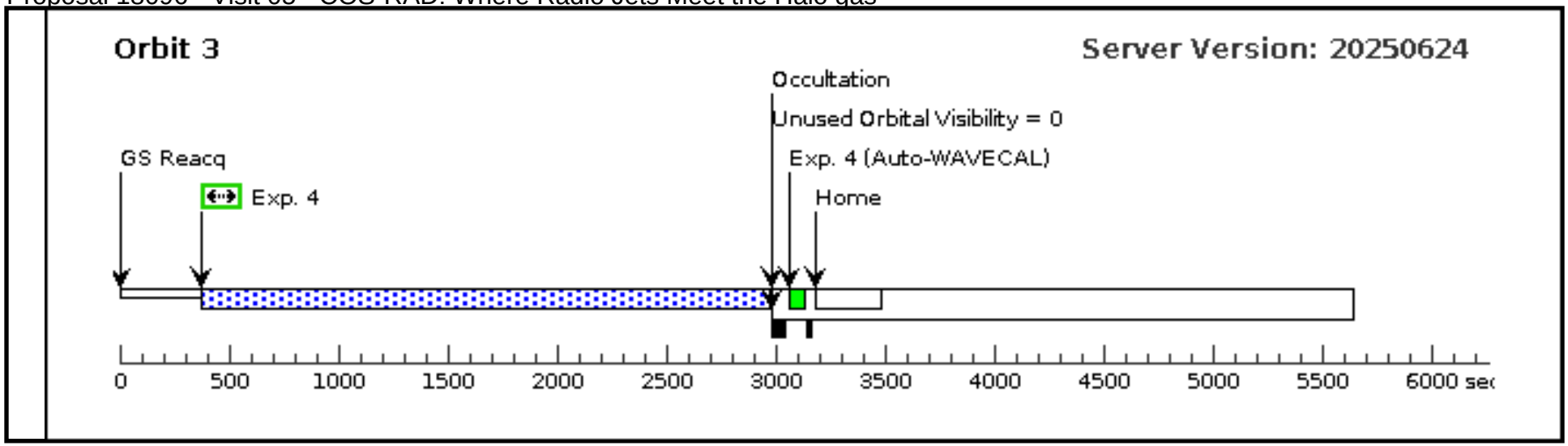
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (J1459) (COS.ta.2026134)	(5) J1459	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				6 Secs (6 Secs) *[==>]*	*[1]*
2	G130M Exp 2 (COS.sp.2026137)	(5) J1459	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=4839			2165 Secs (2165 Secs) *[==>]*	*[1]*
3	G130M Exp 3 (COS.sp.2026137)	(5) J1459	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=4839			2547 Secs (2547 Secs) *[==>]*	*[2]*
4	G130M Exp 4 (COS.sp.2026137)	(5) J1459	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=4839			2547 Secs (2547 Secs) *[==>]*	*[3]*

Orbit Structure



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Server Version: 20250624
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Exp. 4 (Auto-WAVECAL)
Exp. 4
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Visit

Proposal 18096, Visit 06, implementation Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

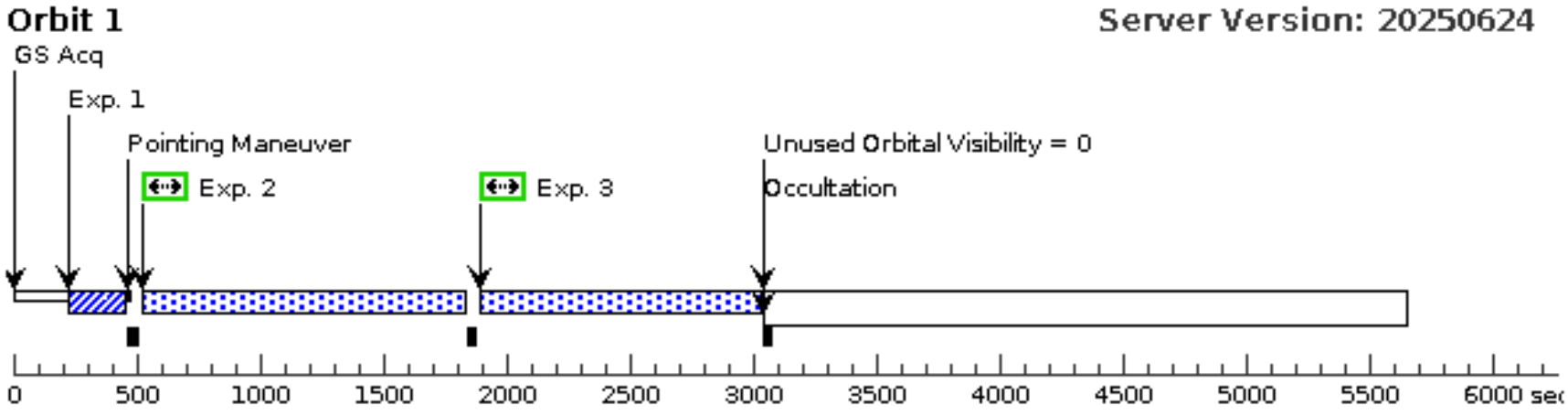
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	J1441	RA: 14 41 6.8155 (220.2783979d) Dec: +57 49 39.94 (57.82776d) Equinox: J2000		V=17.10 GALEX FUV (AB magnitude) = 18.97	Reference Frame: ICRS

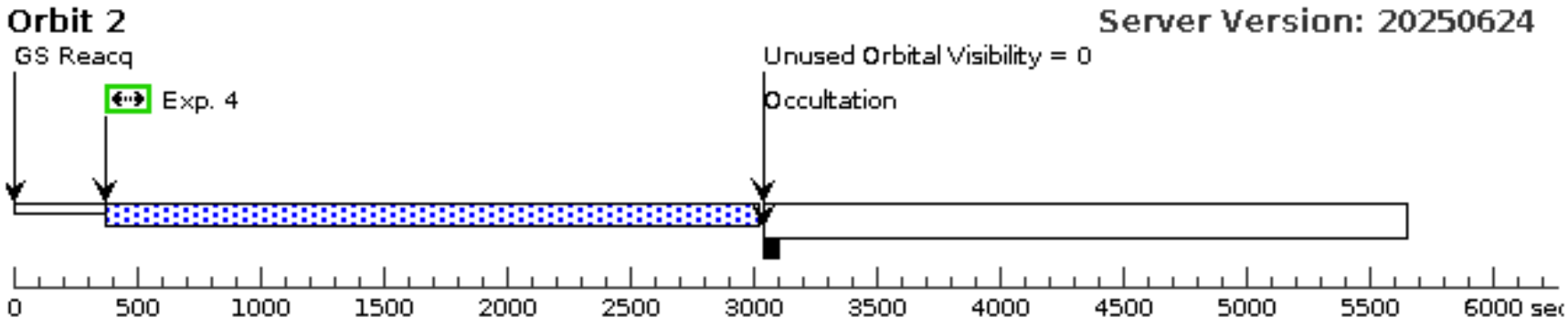
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

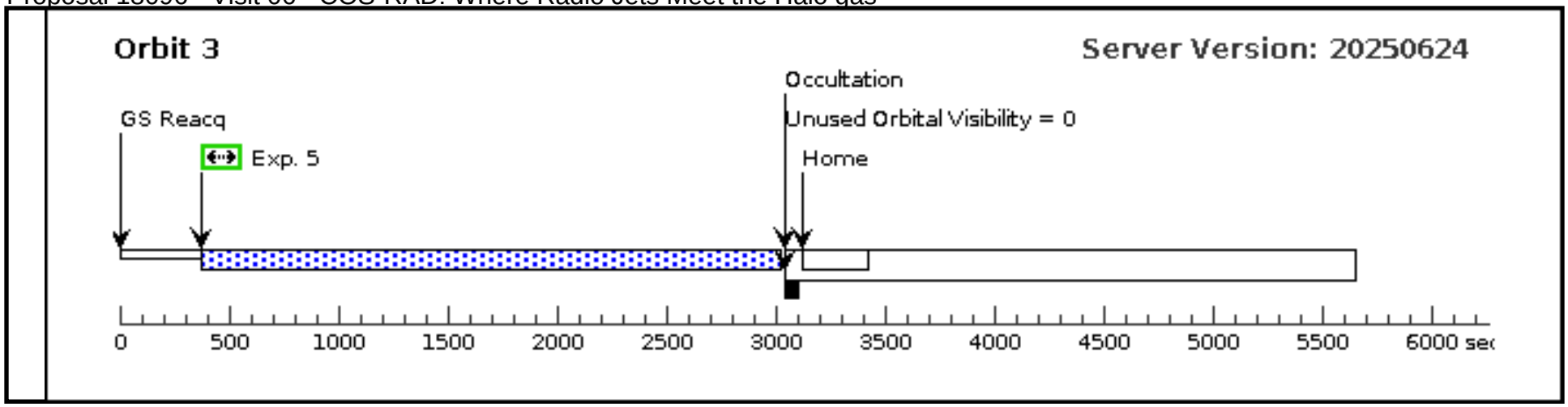
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (J1441) (COS.ta.2026817)	(6) J1441	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				8 Secs (8 Secs) *[==>]*	*[1]*
2	G160M Exp 2 (COS.sp.2026841)	(6) J1441	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=1; BUFFER-TIME=4946			1085 Secs (1085 Secs) *[==>]*	*[1]*
3	G160M Exp 3 (COS.sp.2026841)	(6) J1441	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=2; BUFFER-TIME=4946			1085 Secs (1085 Secs) *[==>]*	*[1]*
4	G160M Exp 4 (COS.sp.2026841)	(6) J1441	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=4946			2600 Secs (2600 Secs) *[==>]*	*[2]*
5	G160M Exp 5 (COS.sp.2026841)	(6) J1441	COS/FUV, TIME-TAG, PSA	G160M 1611 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=4946			2600 Secs (2600 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20250624
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 5
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 18096, Visit 07, implementation Tue Aug 26 22:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

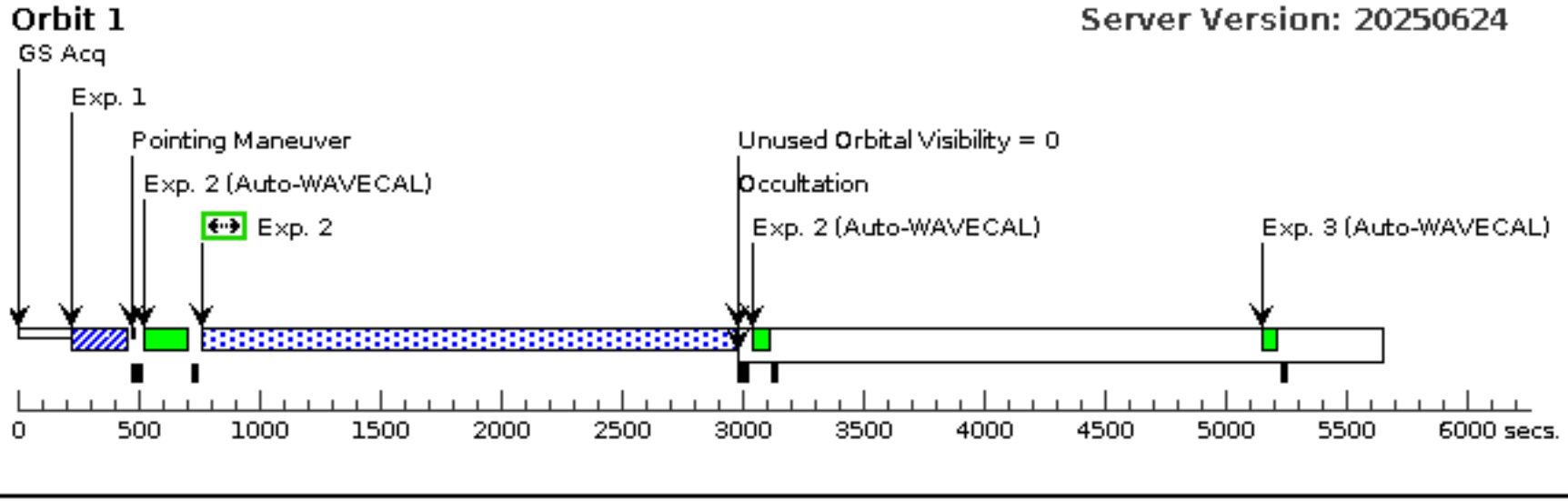
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	FRIISDSS	RA: 09 01 19.6761 (135.3319838d) Dec: +29 44 39.70 (29.74436d) Equinox: J2000		V=18.47 GALEX FUV (AB magnitude) = 19.33	Reference Frame: ICRS

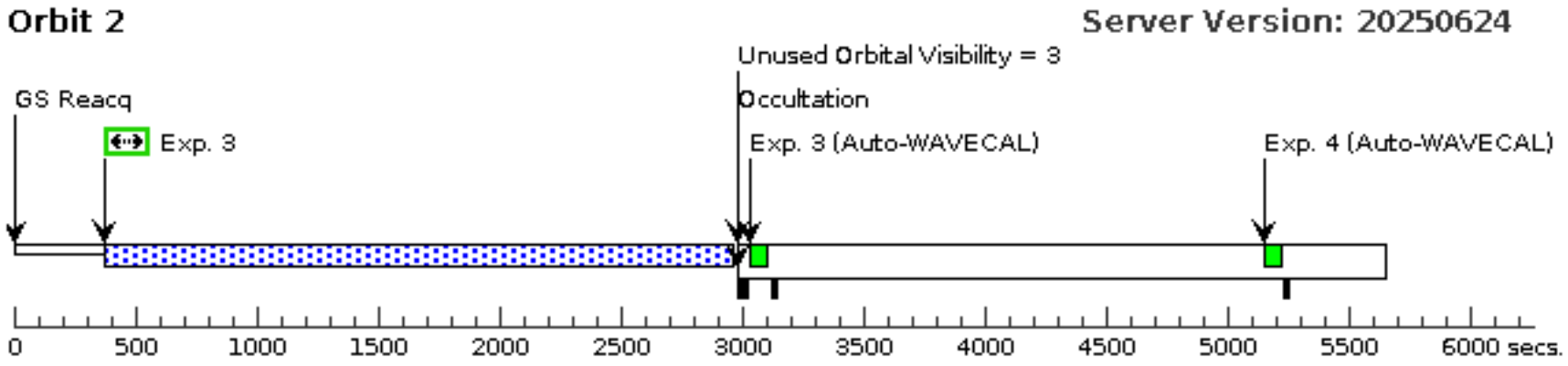
Comments:
Category=GALAXY
Description=[QSO]
Extended=NO

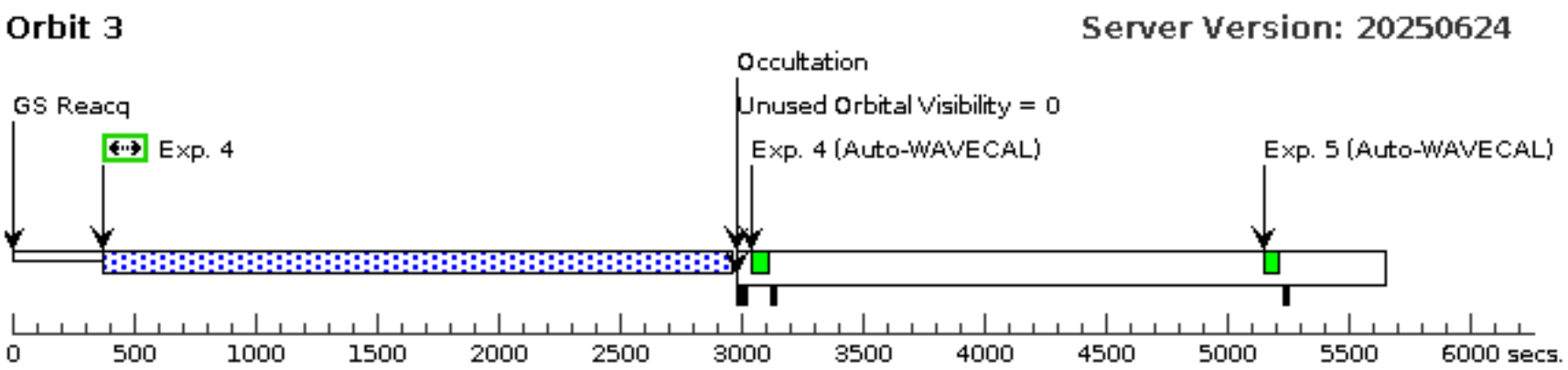
Exposures

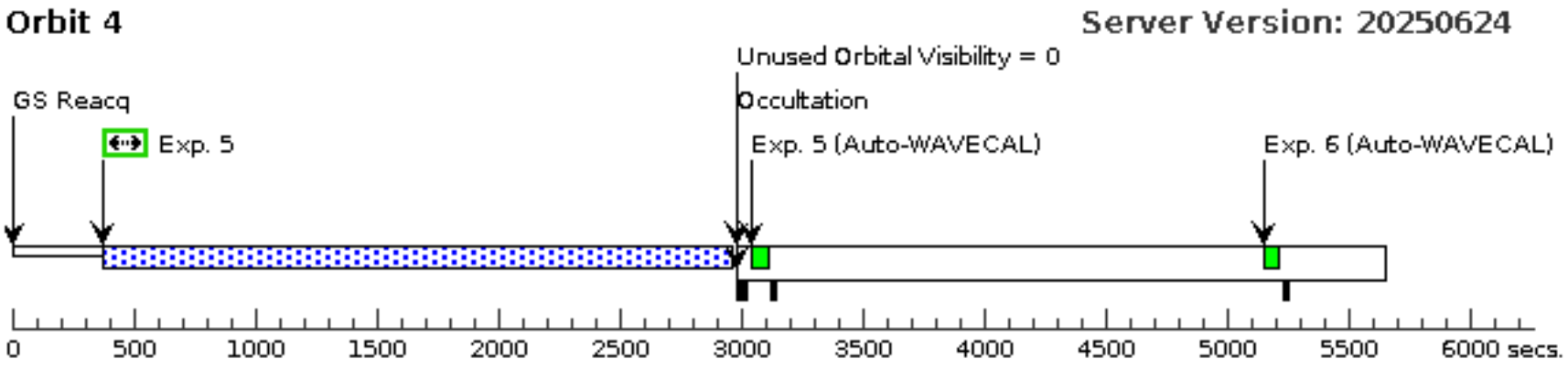
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target Acq (FRIISDSS) (COS.ta.2026140)	(7) FRIISDSS	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				9 Secs (9 Secs) *[==>]*	*[1]*
2	G130M Exp 2 (COS.sp.2026142)	(7) FRIISDSS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=8210			2155 Secs (2155 Secs) *[==>]*	*[1]*
3	G130M Exp 3 (COS.sp.2026142)	(7) FRIISDSS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=3; BUFFER-TIME=8210			2540 Secs (2540 Secs) *[==>]*	*[2]*
4	G130M Exp 3 (COS.sp.2026142)	(7) FRIISDSS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=8210			2543 Secs (2543 Secs) *[==>]*	*[3]*
5	G130M Exp 3 (COS.sp.2026142)	(7) FRIISDSS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=8210			2543 Secs (2543 Secs) *[==>]*	*[4]*
6	G130M Exp 3 (COS.sp.2026142)	(7) FRIISDSS	COS/FUV, TIME-TAG, PSA	G130M 1291 A	SEGMENT=BOTH; FP-POS=4; BUFFER-TIME=8210			2543 Secs (2543 Secs) *[==>]*	*[5]*

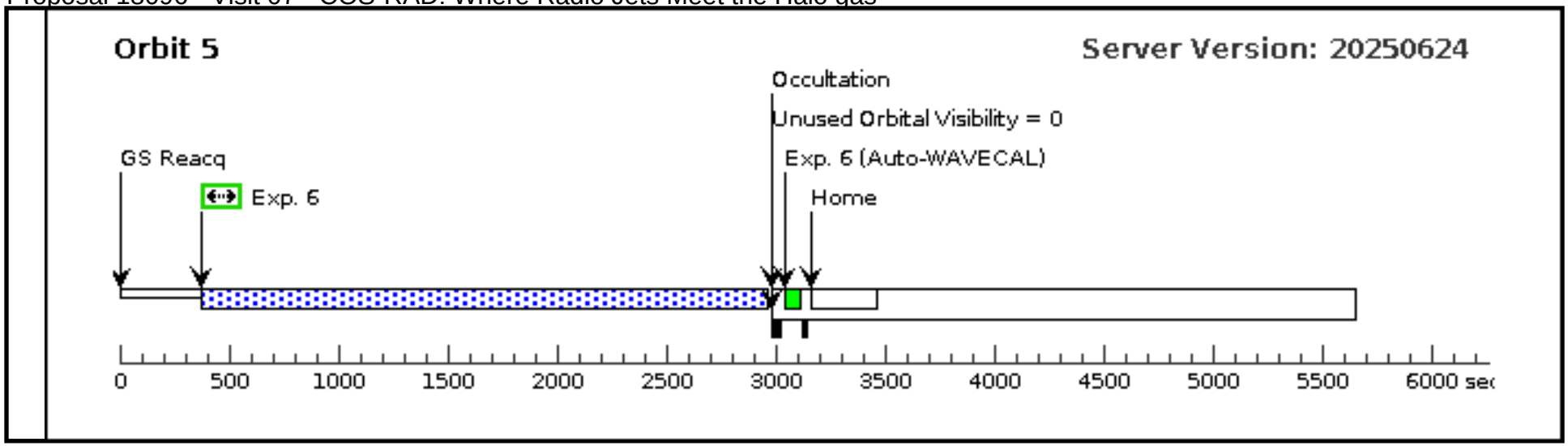
Orbit Structure






Orbit 3
Server Version: 20250624
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 4
Exp. 4 (Auto-WAVECAL)
Exp. 5 (Auto-WAVECAL)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 secs.


Orbit 4
Server Version: 20250624
Unused Orbital Visibility = 0
GS Reacq
Occultation
Exp. 5
Exp. 5 (Auto-WAVECAL)
Exp. 6 (Auto-WAVECAL)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 secs.


Orbit 5
Server Version: 20250624
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 6 (Auto-WAVECAL)
Exp. 6
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec