17878 - Community Discovery Program: CXO/VLA/HST observations of GW-detected compact mergers in O4b

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Sergio Campana (PI) (ESA Member) (Contact)	**INAF, Osservatorio Astronomico di Brera, Merate**
Prof. Daryl Haggard (CoI) (CSA Member) (CoPI) (Contact)	McGill University

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) GW-1	WFC3/UVIS	3	25-Oct-2024 12:01:36.0	yes
02	(1) GW-1	WFC3/UVIS	6	25-Oct-2024 12:01:37.0	yes
03	(1) GW-1	WFC3/UVIS	6	25-Oct-2024 12:01:37.0	yes
04	(2) GW-2	WFC3/UVIS	6	25-Oct-2024 12:01:38.0	yes
05	(2) GW-2	WFC3/UVIS	6	25-Oct-2024 12:01:39.0	yes
06	(2) GW-2	WFC3/UVIS	6	25-Oct-2024 12:01:39.0	yes

33 Total Orbits Used

ABSTRACT

Chandra was the first facility to detect X-ray light from a watershed neutron star (NS) merger. In this ToO program we propose to continue Chandra's legacy in the nascent and revolutionary field of gravitational wave astronomy to identify, monitor, and characterize X-ray emission from compact-object mergers. Our goals are three-fold: (i) to characterize the diversity of emission from NS-NS mergers; (ii) to enable breakthroughs, such as the

discovery of emission from a neutron star-black hole (NS-BH) merger and (iii) to model panchromatic jetemission to constrain system parameters, particularly inclination and jet structure. We will support these Chandra observations via coordinated multi-wavelength follow-up, including with VLA (radio) and HST (optical). We have gathered a large, international team to maximize our scientific output during the second half of LIGO/Virgo/KAGRA's 4th Observing Run (O4b), expected to run from Apr 2024 to early 2025. To enhance the scientific impact of these data, their value to the community, and to fully engage junior scientists in this frontier scientific pursuit we also waive any proprietary rights.

OBSERVING DESCRIPTION

Chandra Cyle 26: We request a companion HST observation for 3 Chandra/VLA epochs at 15-30 d, 100-150 d, and 200-300 d to constrain the spectral index and location of the cooling break. We select the F606W filter on the WFC3 due to its broadband sensitivity and continuity with ground-based r-band, which will enable a complete light curve out to late times. Based on Fig. 5, to probe jets with more optimistic densities (n~0.1 cm-3), we request our first HST observation to reach a 3sigma limiting mag of mF606W = 28 AB, coordinated with the 15-30 d epoch. We forgo the first Chandra observation as the kilonova emission will still be expected to dominate at < 1 week. Using the WFC3 ETC, this requires 3 orbits, assuming 40 min of usable time per orbit. To probe GW170817-like events which are fainter and peak on longer timescales, we request two deeper epochs to reach mF606W = 28.5 AB mag roughly coordinated with our 100-150 d and 200-300 d epochs. This requires 2x6 = 12 orbits.

Chandra Cycle 25 follow-up: We request HST/WFC3 F606W observations aligned with two of the final three Chandra epochs, for a total of 2x6= 12 orbits to achieve detections or reasonable limits on this target.

Galaxy Template: Finally, we note that the host galaxy of GW170817 had severe contamination which impacted the reliability of the counterpart photometry in the absence of a template. It is possible that the last epoch will serve as this template if a source is no longer detected. However, if the final epoch yields a detected source with S/N > 3, we request one additional 6-orbit epoch at t-t0 > 300 days to serve as a deep template and mitigate contamination, assuming only one of the events will need a template.

Thus our total HST request is 33 orbits.

Visit

Proposal 17878, GW-1 (01), implementation Fri Oct 25 16:01:40 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 15.0D

Generic Targets

#	Name	Criteria	Description
(1)	GW-1	GW trigger	GAMMA RAY BURSTER NEUTRON STAR

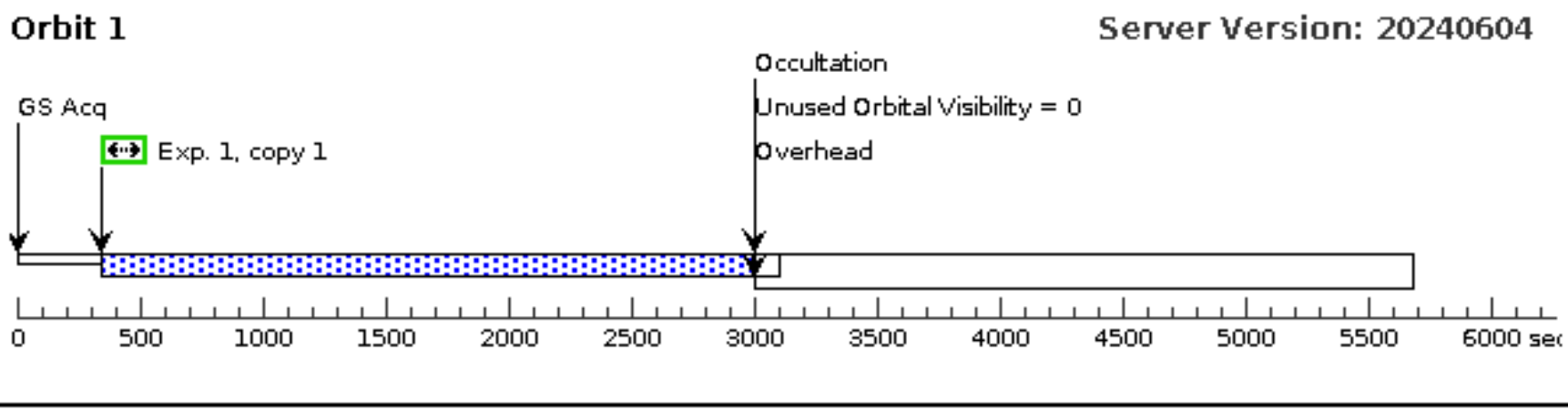
Comments: Electromagnetic counterpart of a GW trigger

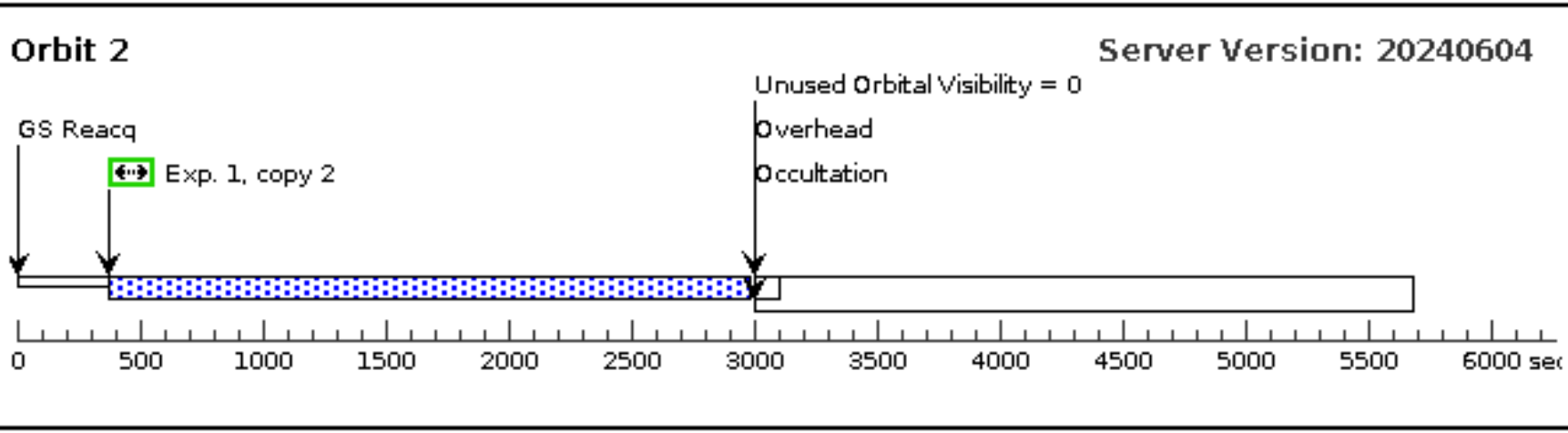
Exposures

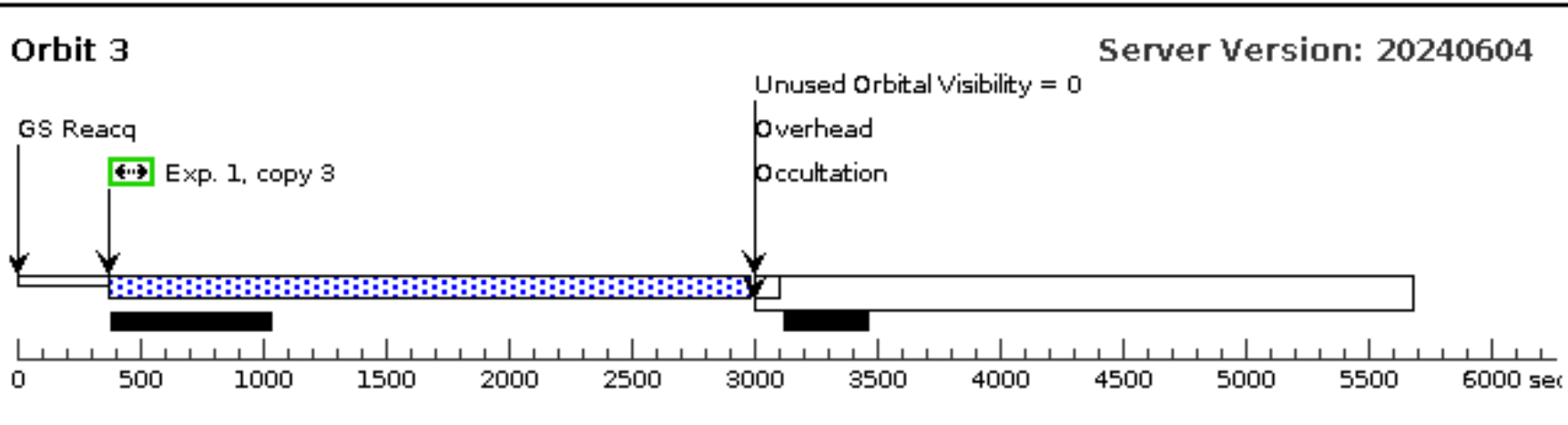
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) GW-1	WFC3/UVIS, ACCUM, UVIS	F606W		POS TARG 0,0		2400 Secs X 3 (7851 Secs)	
								[==>2617.0 Secs (Copy 1)]	***[1]***
								[==>2617.0 Secs (Copy 2)]	***[2]***
								[==>2617.0 Secs (Copy 3)]	***[3]***

Comments: TOO observation

Orbit Structure







Visit

Proposal 17878, GW-1 (02), implementation Fri Oct 25 16:01:40 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 100.0D

Generic Targets

#	Name	Criteria	Description
(1)	GW-1	GW trigger	GAMMA RAY BURSTER NEUTRON STAR

Comments: Electromagnetic counterpart of a GW trigger

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) GW-1	WFC3/UVIS, ACCUM, UVIS	F606W				2400 Secs X 6 (15702 Secs)	
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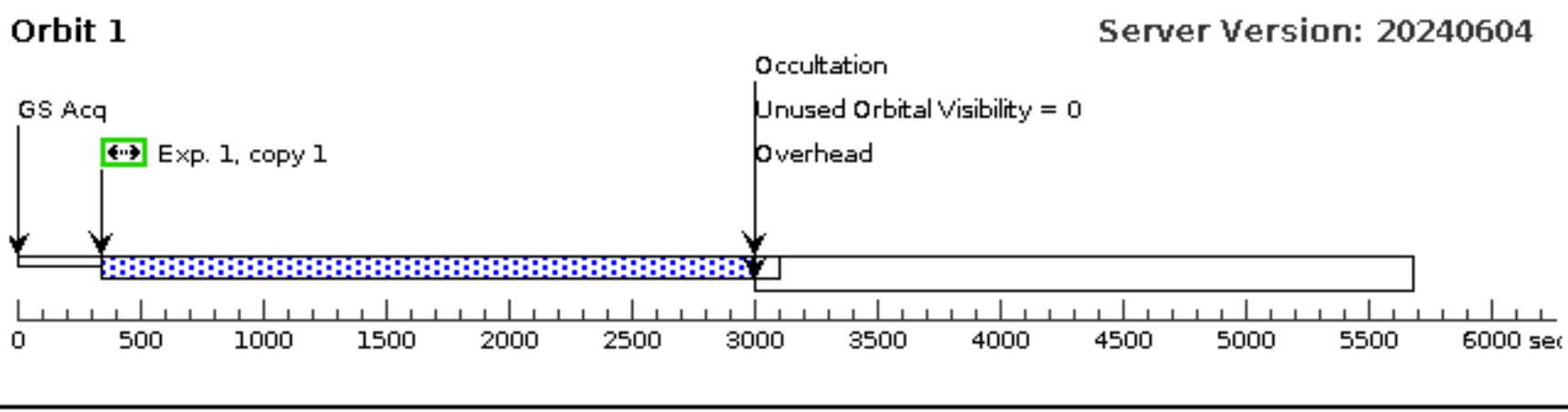
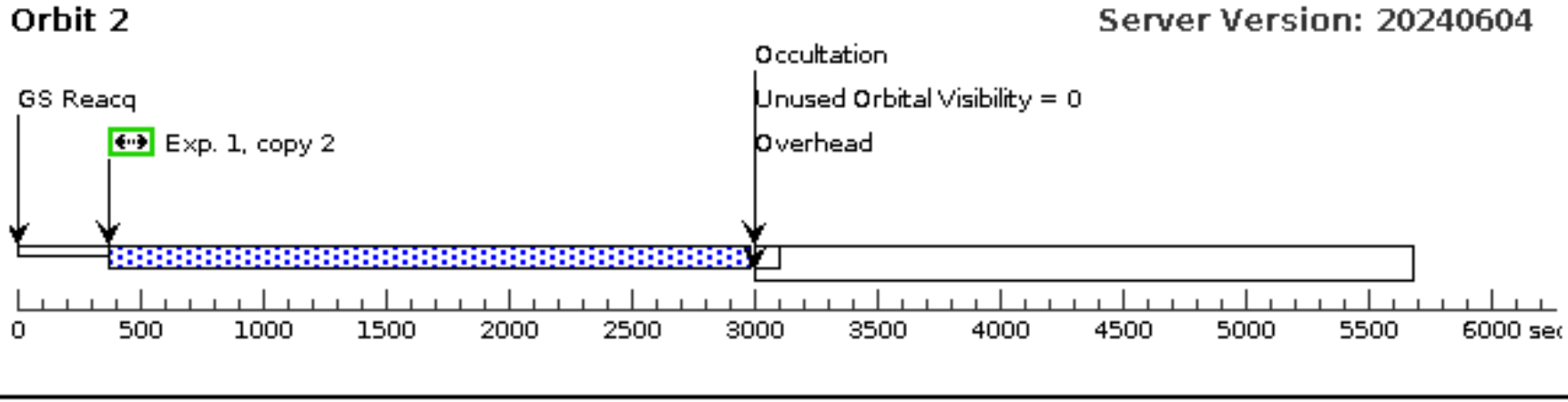
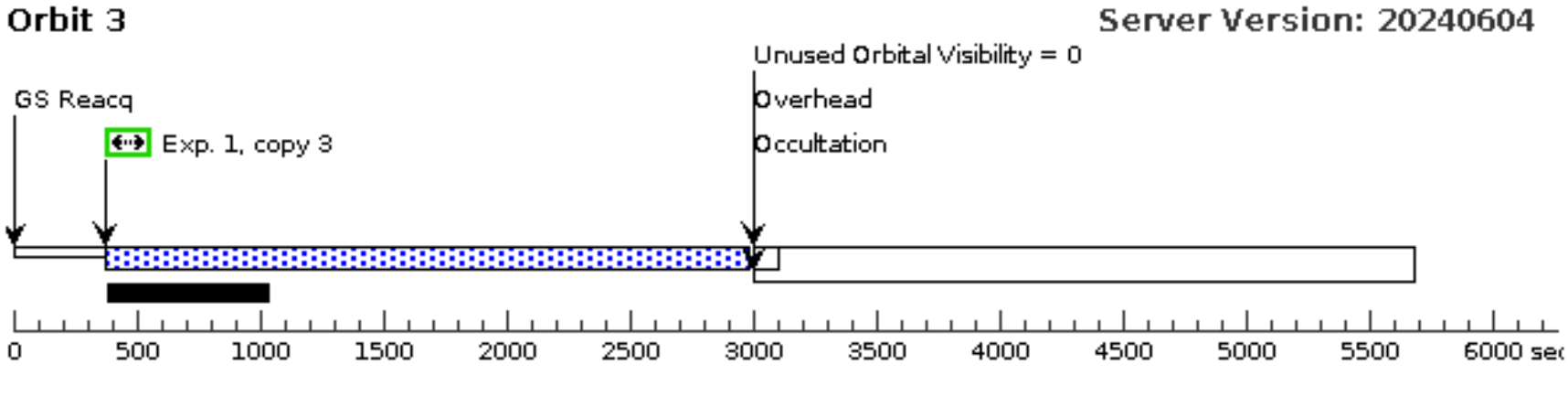
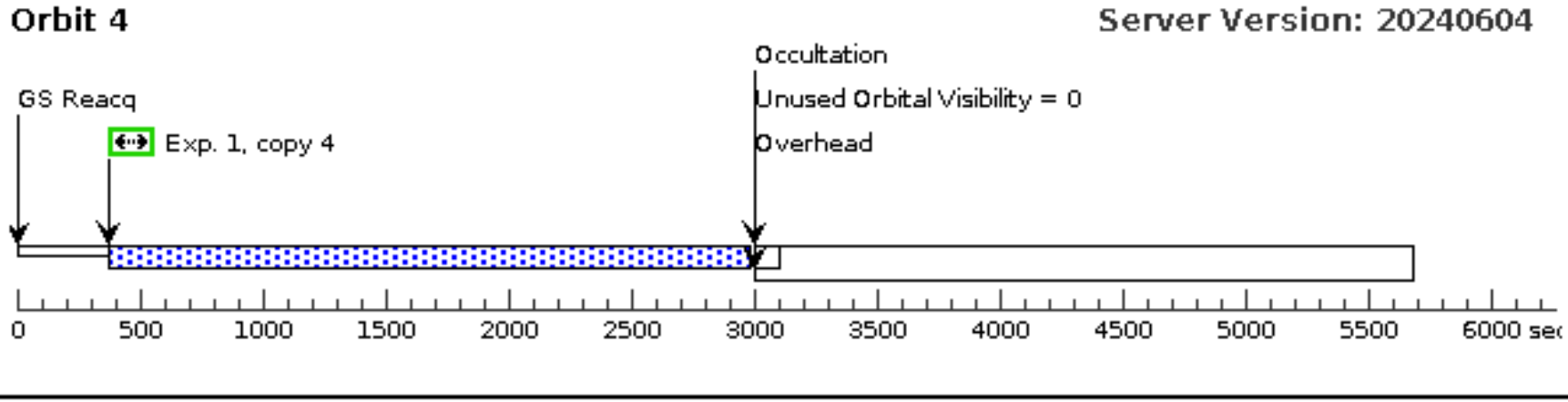
Orbit Structure





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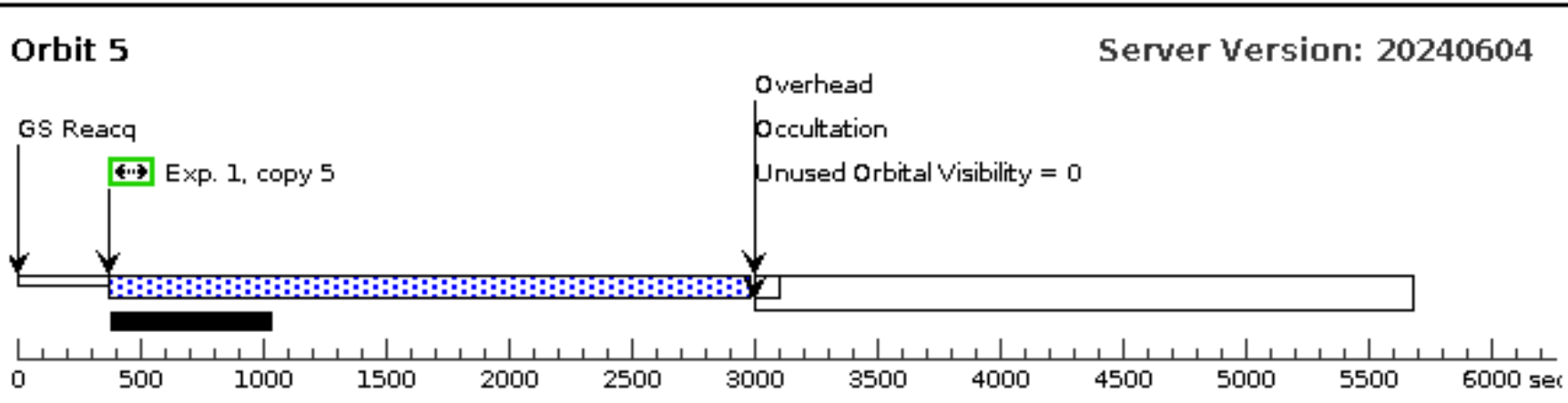
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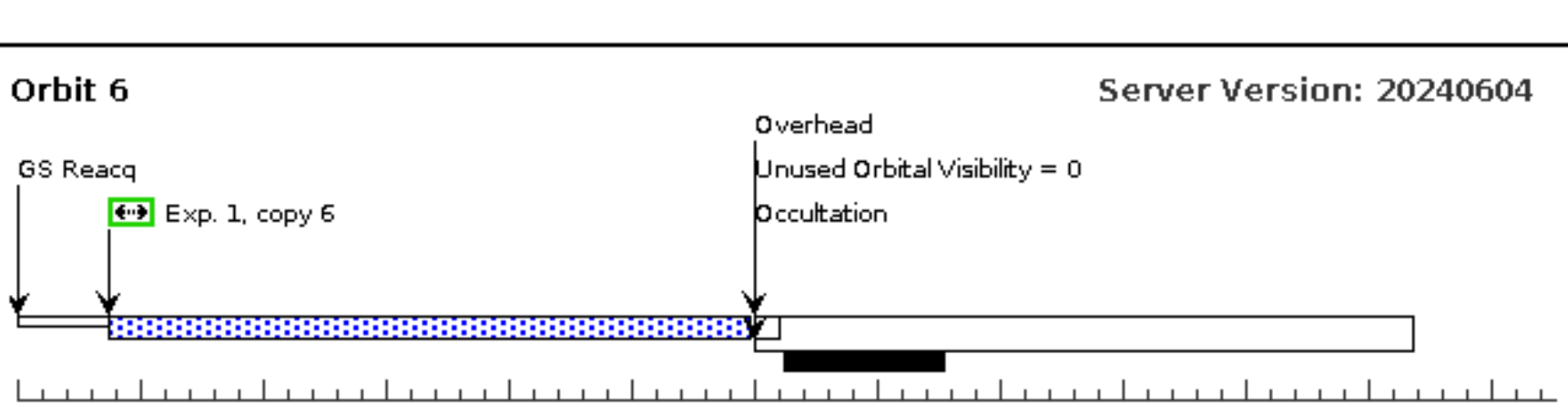
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Visit

Proposal 17878, GW-1 (03), implementation Fri Oct 25 16:01:40 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 200.0D

Generic Targets

#	Name	Criteria	Description
(1)	GW-1	GW trigger	GAMMA RAY BURSTER NEUTRON STAR

Comments: Electromagnetic counterpart of a GW trigger

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) GW-1	WFC3/UVIS, ACCUM, UVIS	F606W				2400 Secs X 6 (15702 Secs)	
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								[==>2617.0 Secs (Copy 2)]	***[2]***
								[==>2617.0 Secs (Copy 3)]	***[3]***
								[==>2617.0 Secs (Copy 4)]	***[4]***
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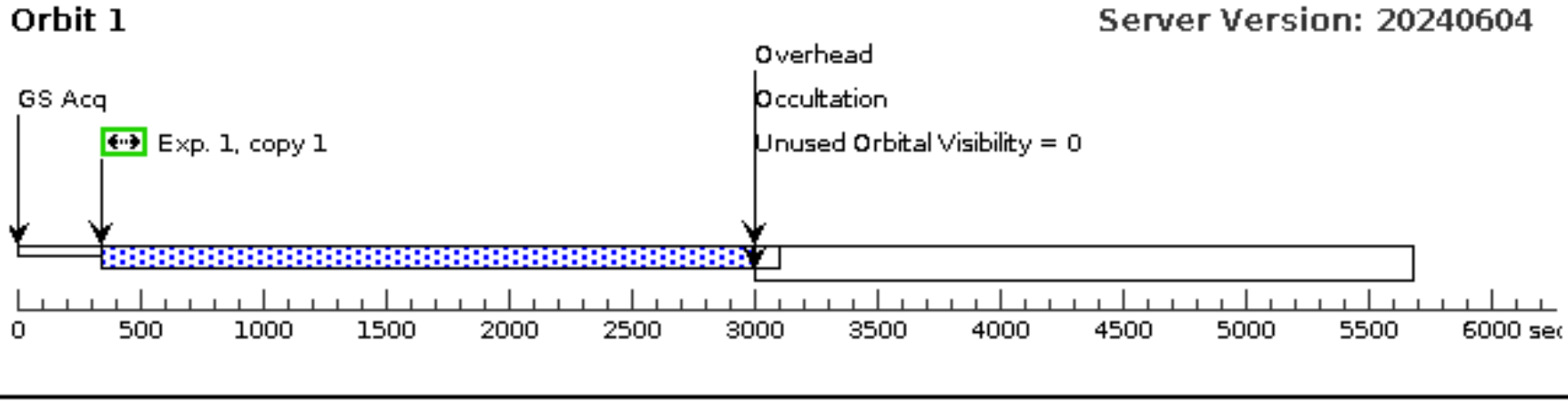
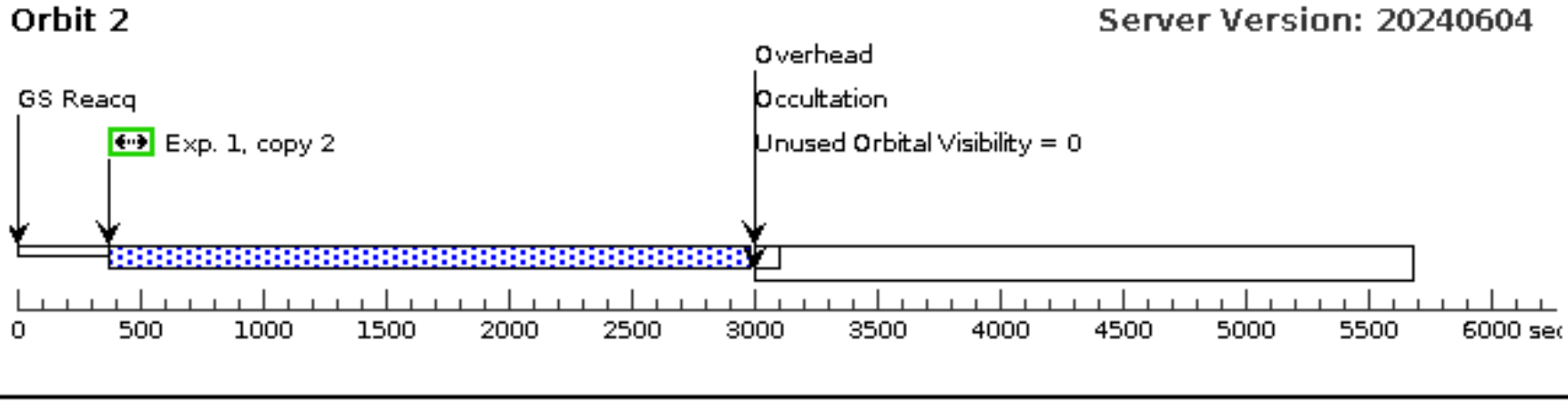
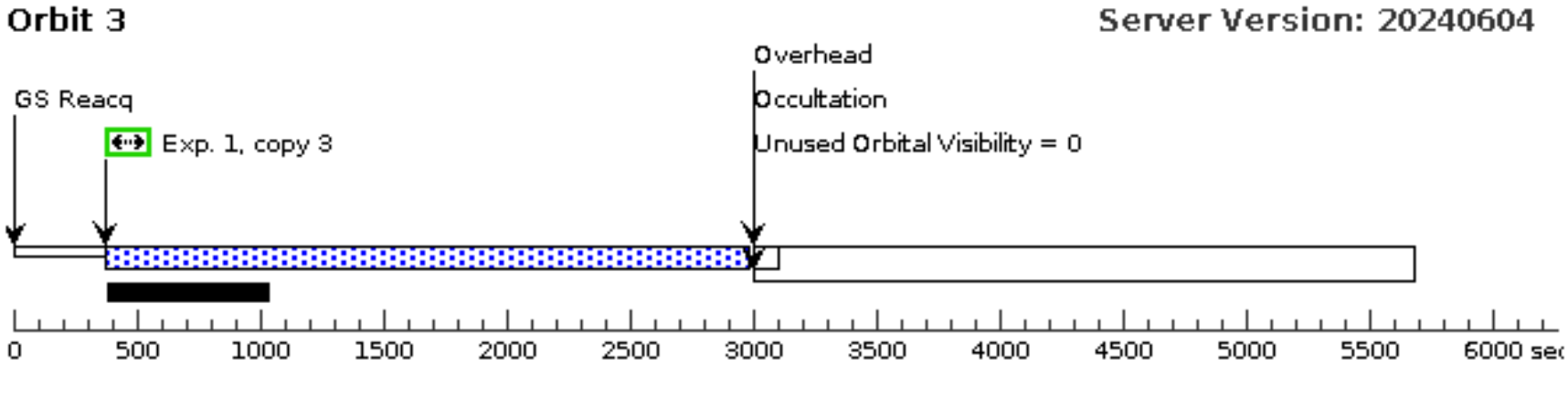
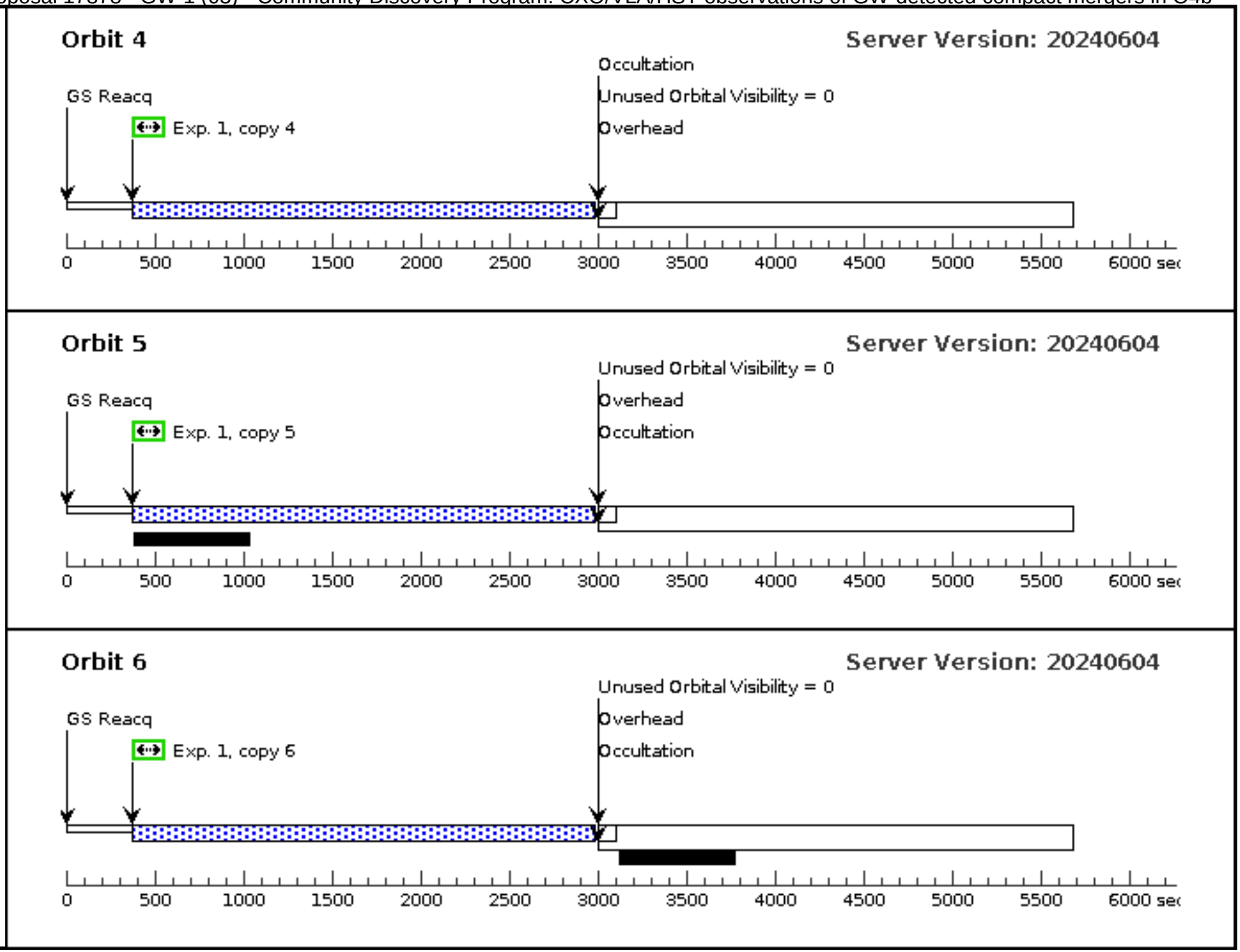
Orbit Structure





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Visit

Proposal 17878, GW-2 (04), implementation Fri Oct 25 16:01:40 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 100.0D

Generic Targets

#	Name	Criteria	Description
(2)	GW-2	GW trigger	GAMMA RAY BURSTER NEUTRON STAR

Comments: Electromagnetic counterpart of a GW trigger

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) GW-2	WFC3/UVIS, ACCUM, UVIS	F606W				2400 Secs X 6 (15702 Secs)	
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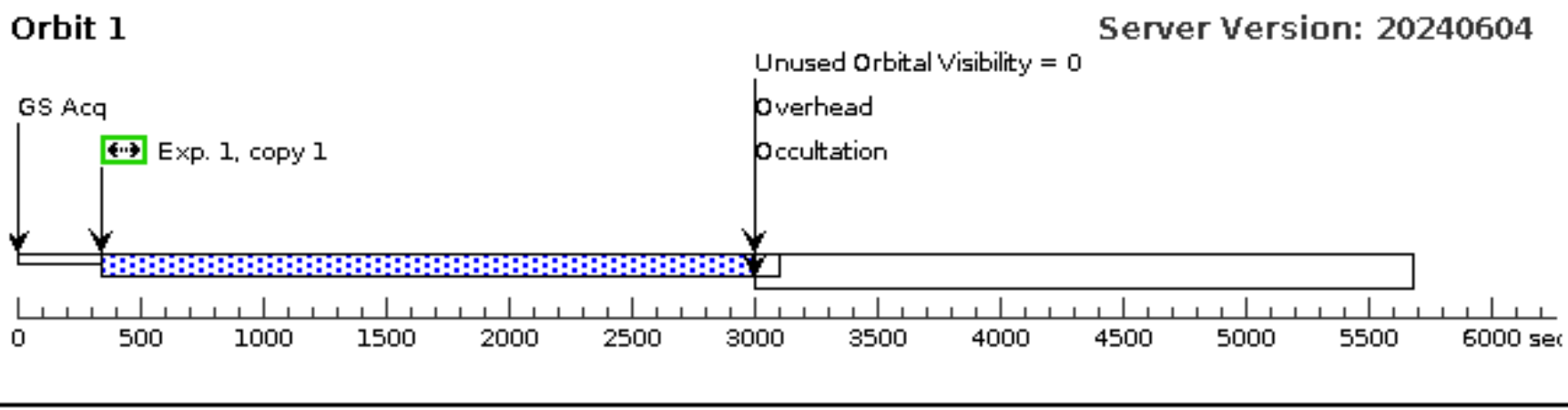
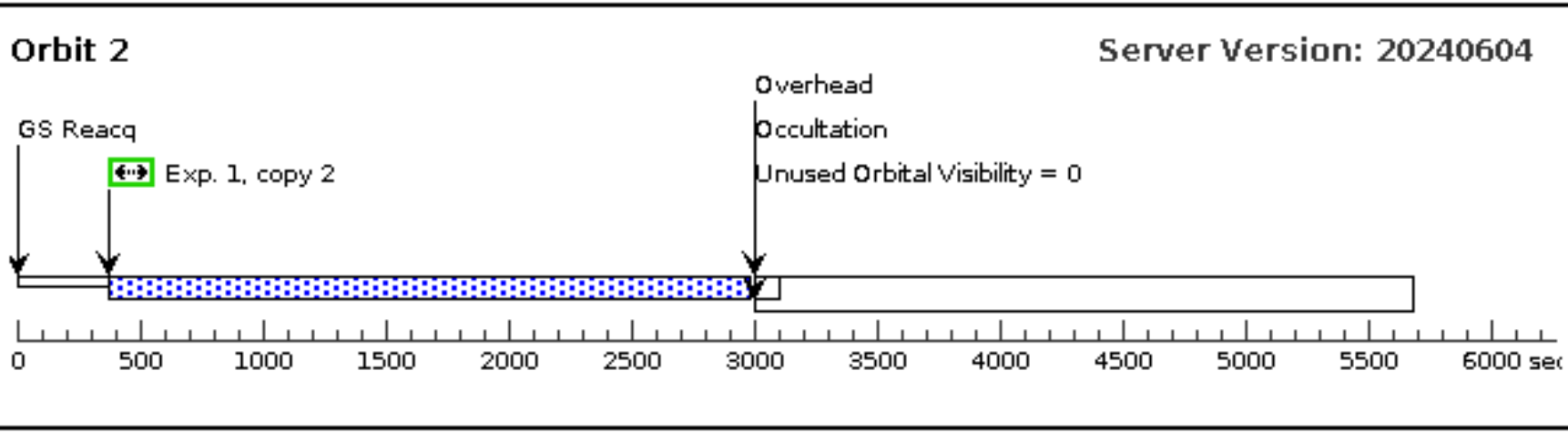
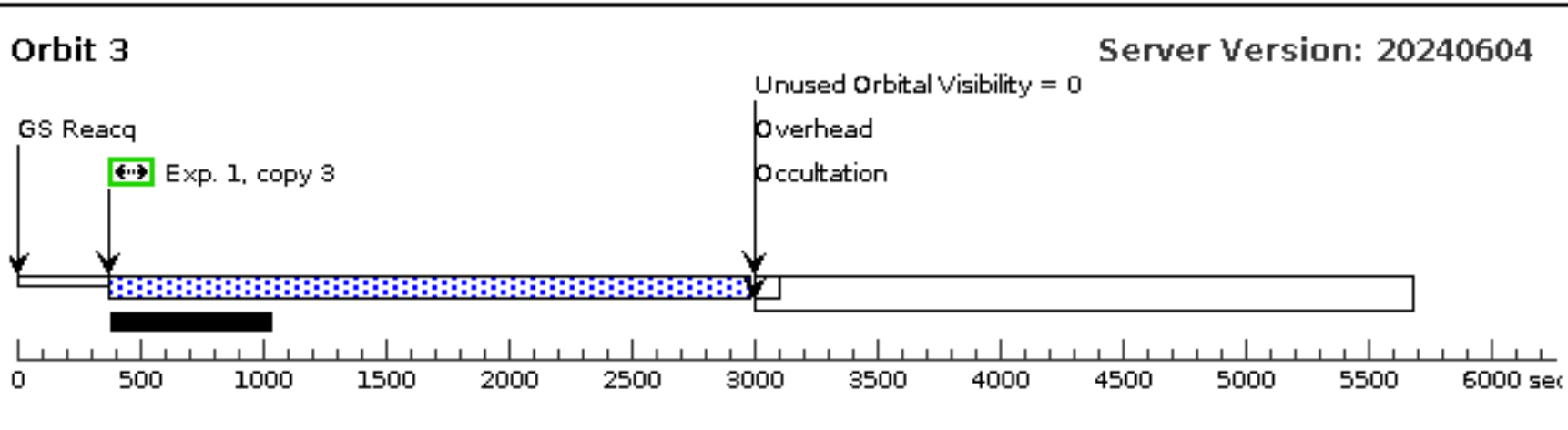
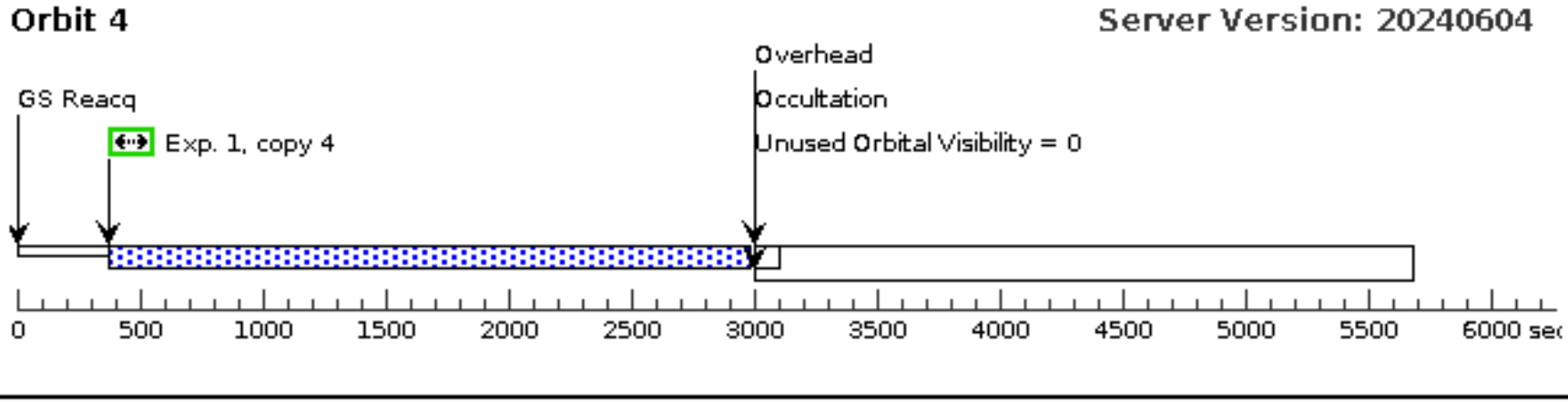
Orbit Structure





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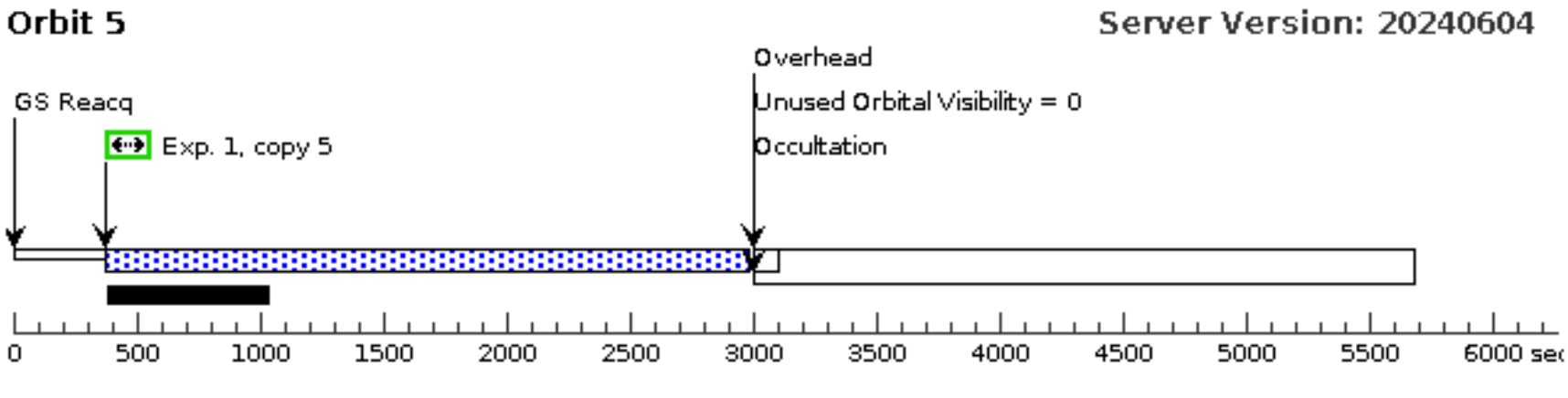
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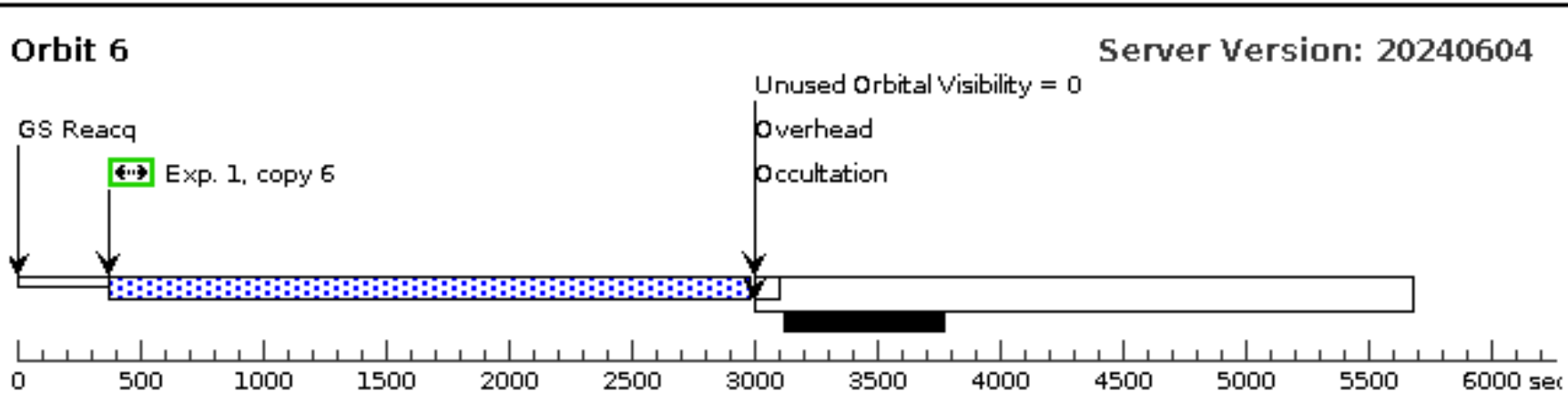
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Visit

Proposal 17878, GW-2 (05), implementation Fri Oct 25 16:01:40 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 200.0D

Generic Targets

#	Name	Criteria	Description
(2)	GW-2	GW trigger	GAMMA RAY BURSTER NEUTRON STAR

Comments: Electromagnetic counterpart of a GW trigger

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) GW-2	WFC3/UVIS, ACCUM, UVIS	F606W				2400 Secs X 6 (15702 Secs)	
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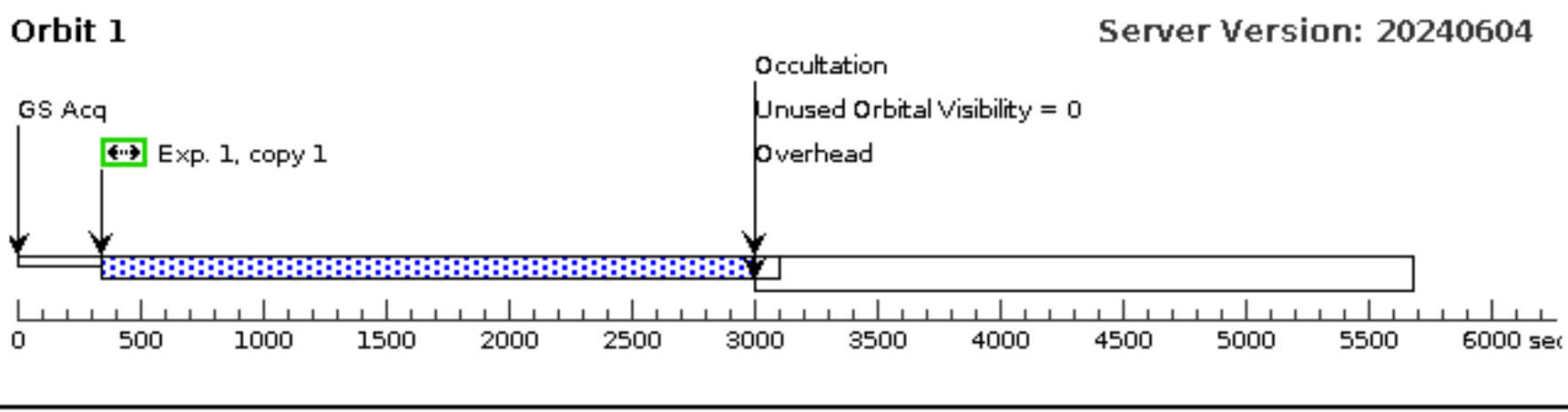
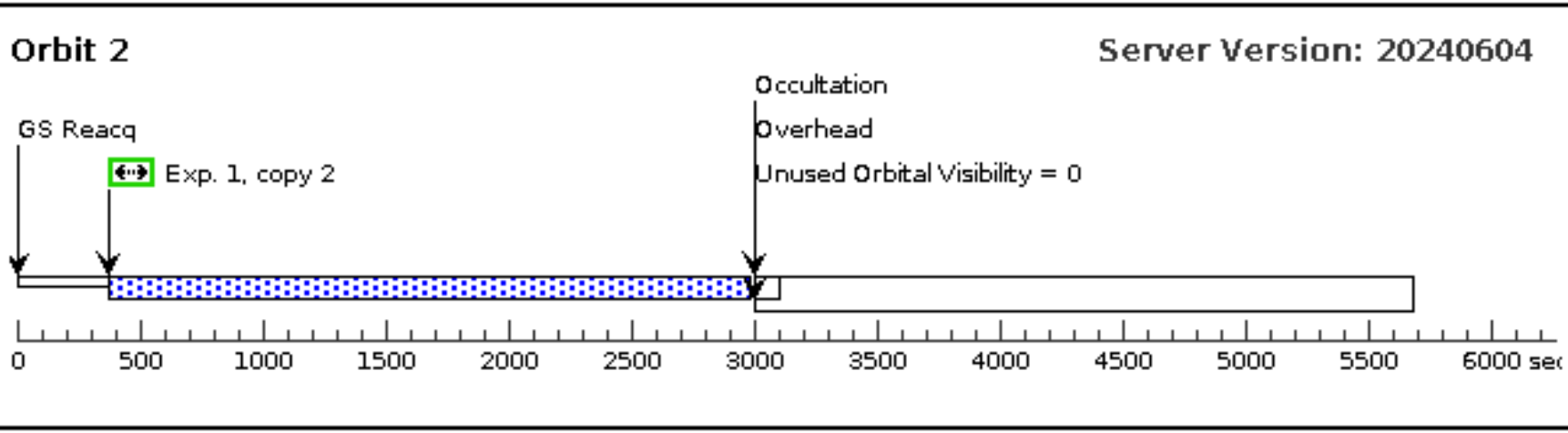
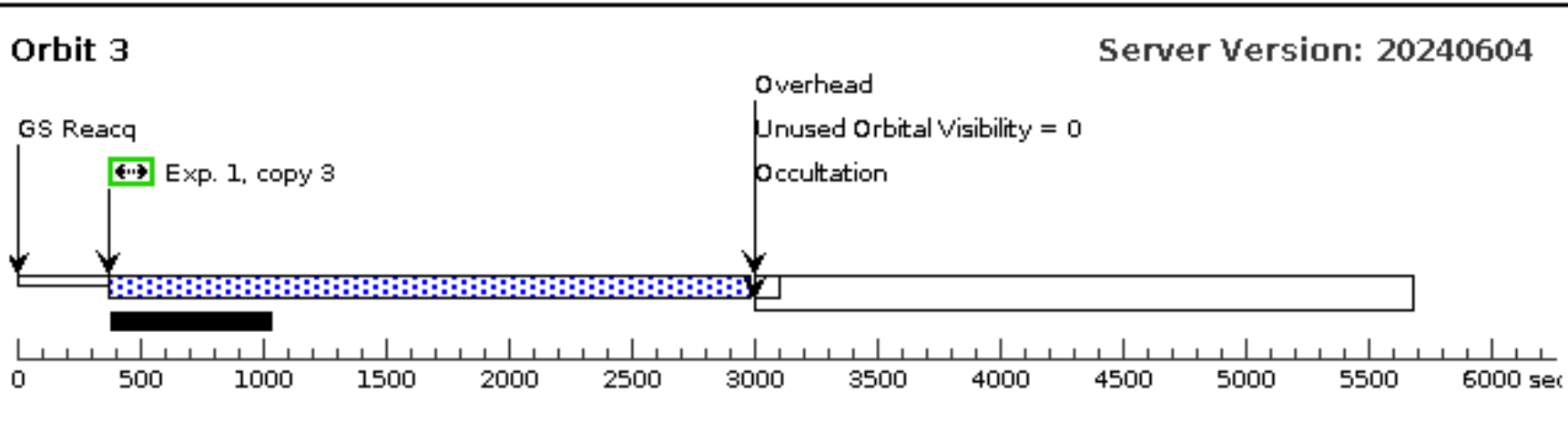
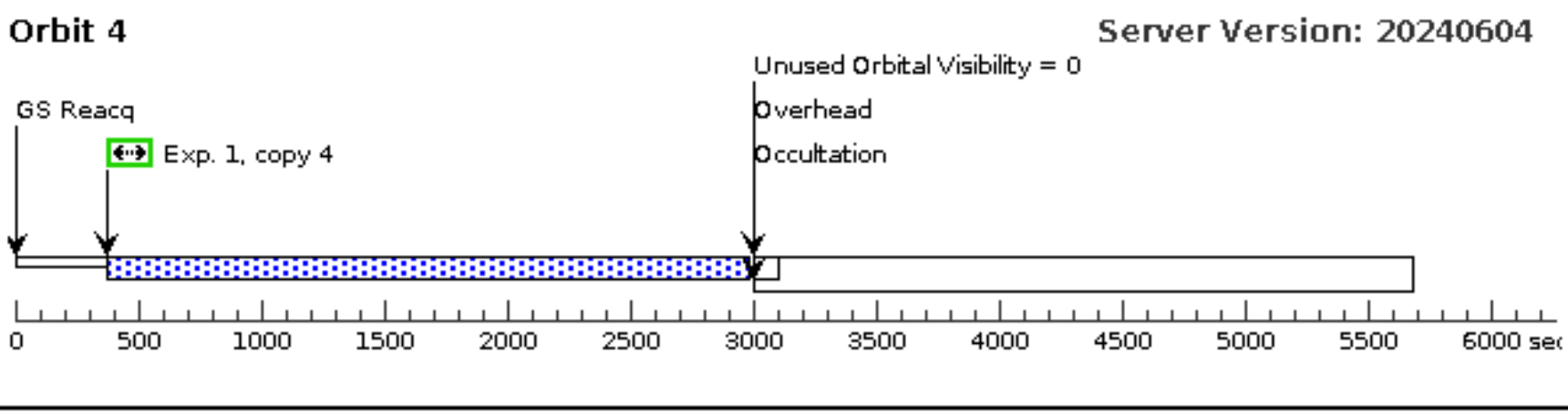
Orbit Structure





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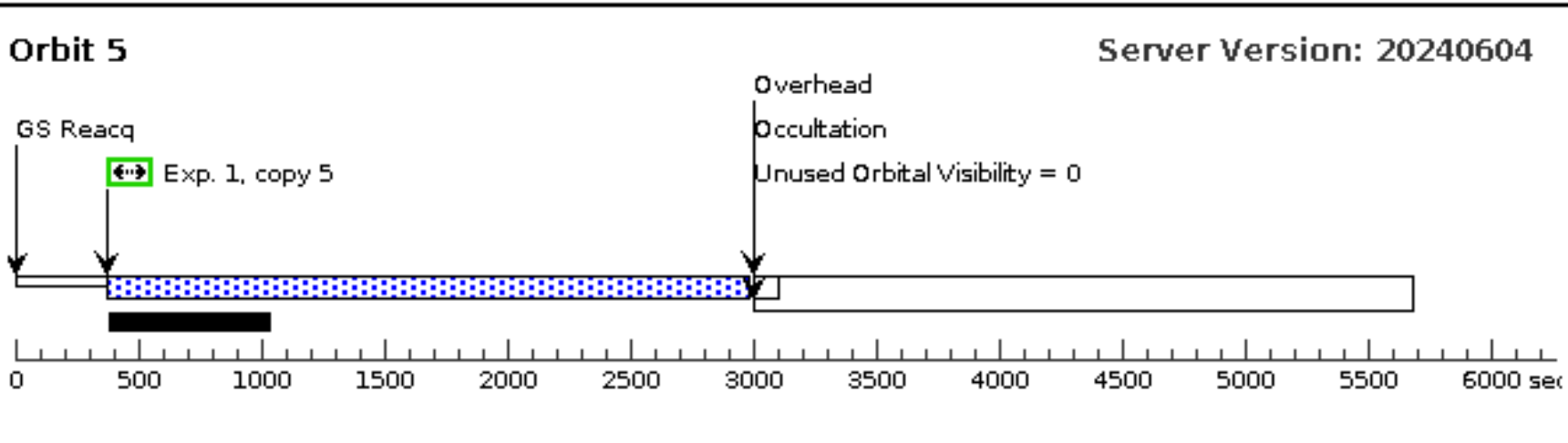
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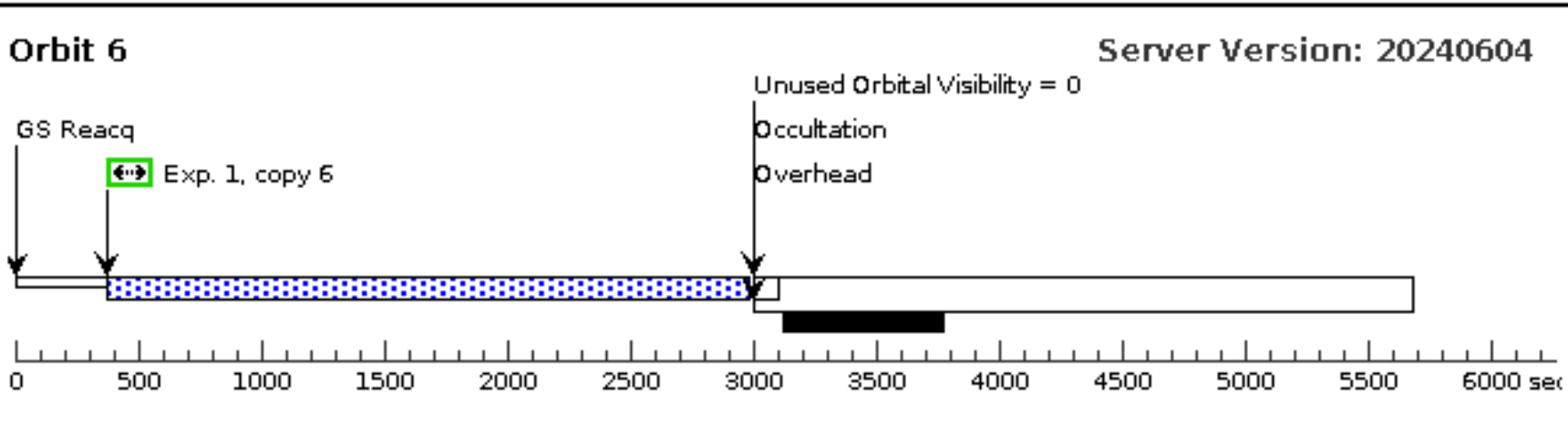
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Visit

Proposal 17878, GW-1 (06), implementation Fri Oct 25 16:01:40 GMT 2024

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 300.0D

Generic Targets

#	Name	Criteria	Description
(2)	GW-2	GW trigger	GAMMA RAY BURSTER NEUTRON STAR

Comments: Electromagnetic counterpart of a GW trigger

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) GW-2	WFC3/UVIS, ACCUM, UVIS	F606W				2400 Secs X 6 (15702 Secs)	
								[==>2617.0 Secs (Copy 1)]	***[1]***
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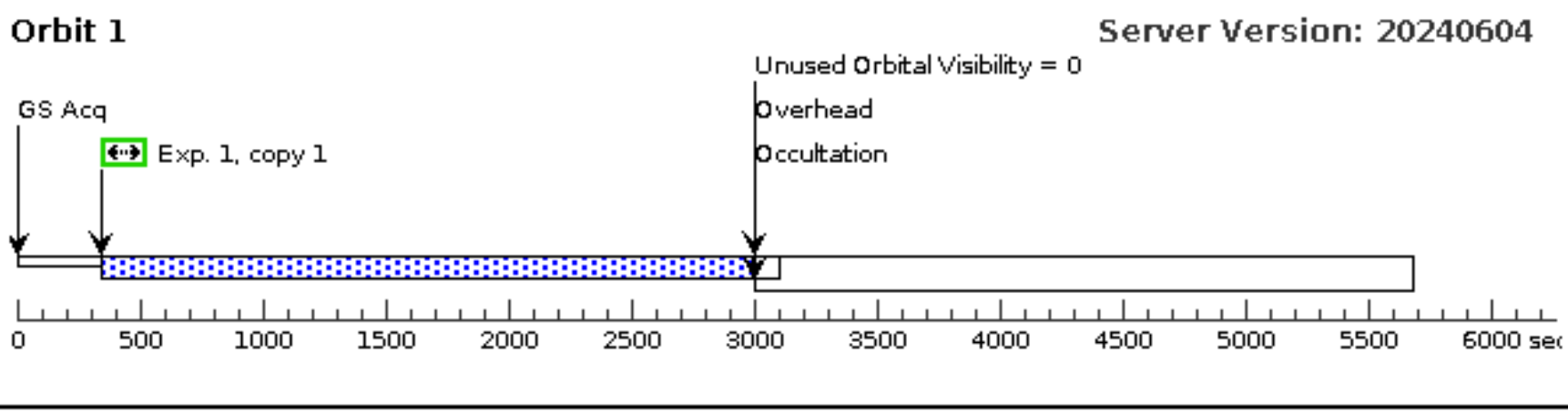
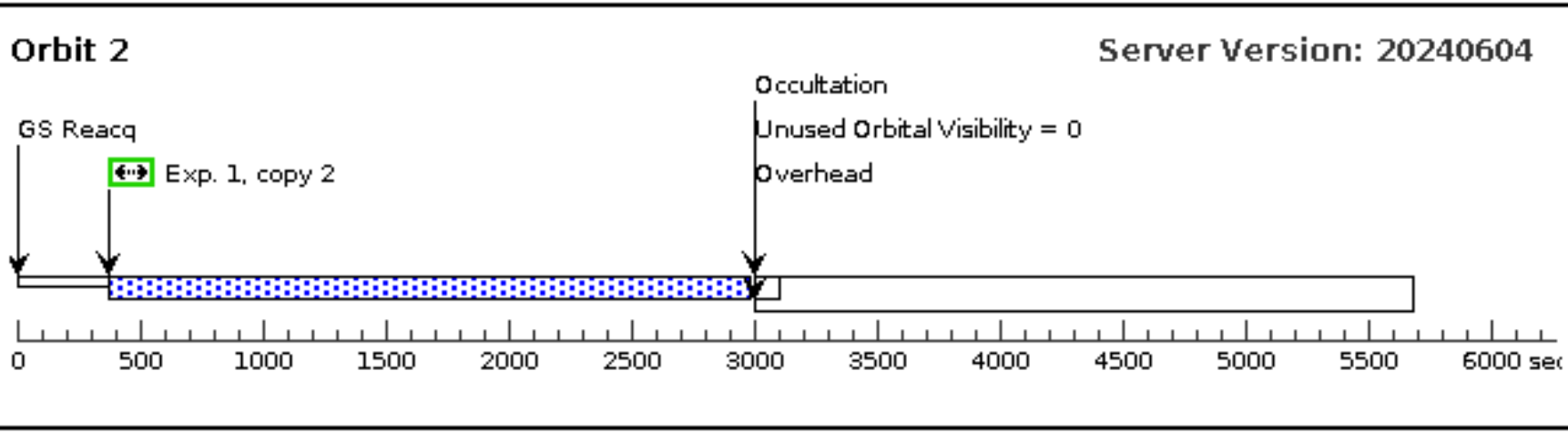
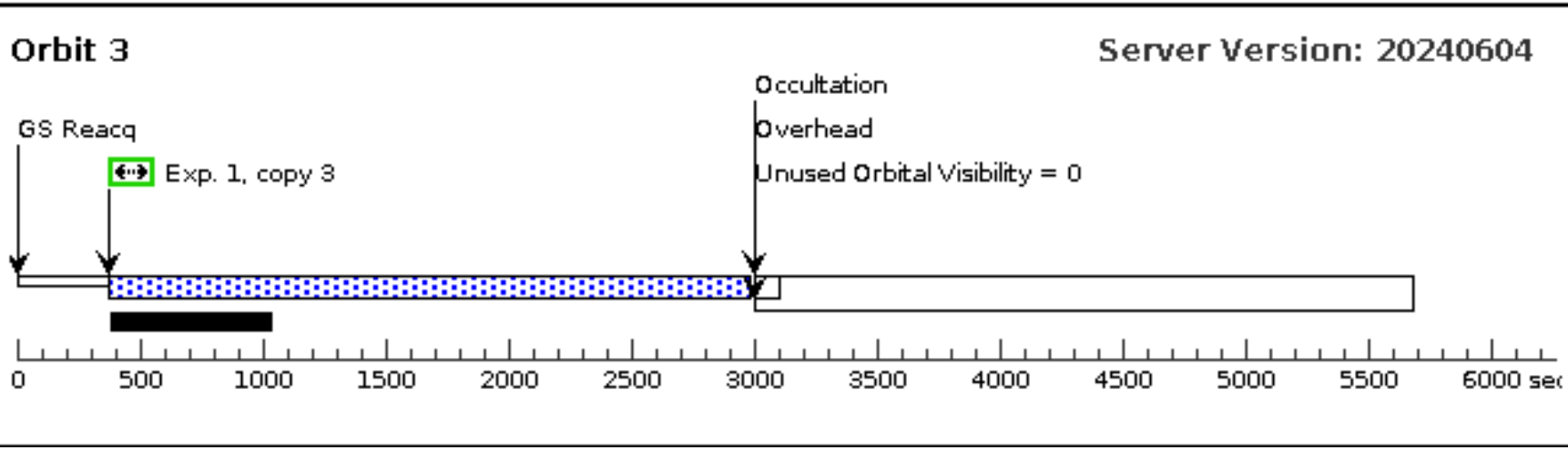
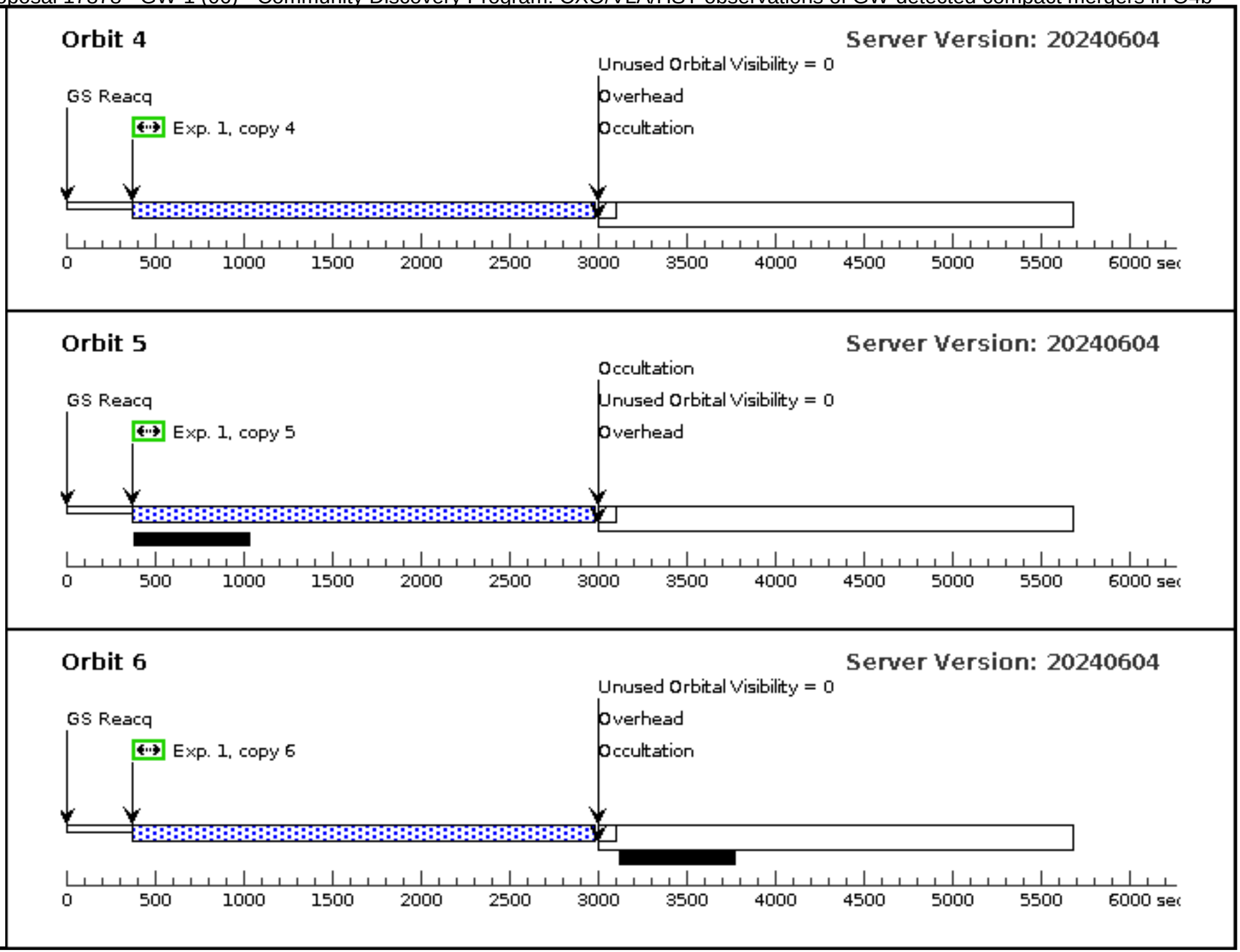
Orbit Structure





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