17447 - Joint HST+XMM time-resolved UV+X-ray observations of a quasi-periodically erupting X-ray source

Cycle: 31, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Thomas Wevers (PI) (Contact)	**Space Telescope Science Institute**
Dr. Dheeraj Pasham (CoI)	Massachusetts Institute of Technology
Riccardo Arcodia (CoI)	Massachusetts Institute of Technology

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) ERO-QPE2	STIS/FUV-MAMA	5	07-Sep-2023 15:00:15.0	yes
02	(1) ERO-QPE2	STIS/FUV-MAMA	5	07-Sep-2023 15:00:15.0	yes

10 Total Orbits Used

ABSTRACT

Quasi-periodic eruptions (QPEs) are recurrent, high-amplitude bursts of X-ray emission in the nuclei of galaxies hosting low mass (10^5-6 M_sun) black holes. Their nature is still hotly debated, with the main two model classes including various flavours of accretion disk instabilities, and two (or multi-)body interactions between the central SMBH and a stellar-mass perturber. The latter can involve a main sequence star, white dwarf, or stellar mass black hole, and the eruptions are variously related to tidal stripping of orbiting companions, Roche lobe overflow, or interactions of the perturber with an accretion disk. The main QPE properties are short recurrence times (2-20 hrs), short durations (27 min - few hrs) and high amplitudes (factor 10-100). Discovered and well studied in X-rays, the UV, IR and radio properties remain poorly constrained. We propose to obtain

the first deep observations in the UV (currently constrained only with the XMM-Newton Optical monitor), with high cadence (3 min) HST FUV imaging of a QPE with eruptions lasting only 27 min and recurring every 114 min. These timescales are perfectly suited to perform the first time-resolved UV variability search during the X-ray eruptions. The HST spatial resolution will resolve out the host galaxy emission; with HST sensitivity in the FUV this will lead to a >2 orders of magnitude improvement compared to current constraints. A detection of UV variability and how it correlates with the X-rays will have field-defining implications that will redraw the theoretical landscape. Non-detections will provide very strong additional constraints on the geometry, extent and properties of the putative accretion disks.

OBSERVING DESCRIPTION

HST/STIS/FUV-MAMA F25QTZ time-tag imaging observations of 1 target in 2 identical visits taken strictly simultaneous with XMM-Newton. This will be done through a 5-orbit contiguous visit, repeated twice. No time restrictions exist on the relative timing of the 2 visits in the cycle.

We wish to obtain the highest possible time resolution, so use time-tag mode for imaging to fill the entire orbital visibility period.
F25QTZ filter was chosen to obtain the lowest background with good sensitivity to FUV photons.
Buffer times estimated from the ETC are > the orbital visibility time, so this has been set to 20000.

Visit

Proposal 17447, Visit 01

Thu Sep 07 19:00:16 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: (none)

Fixed Targets

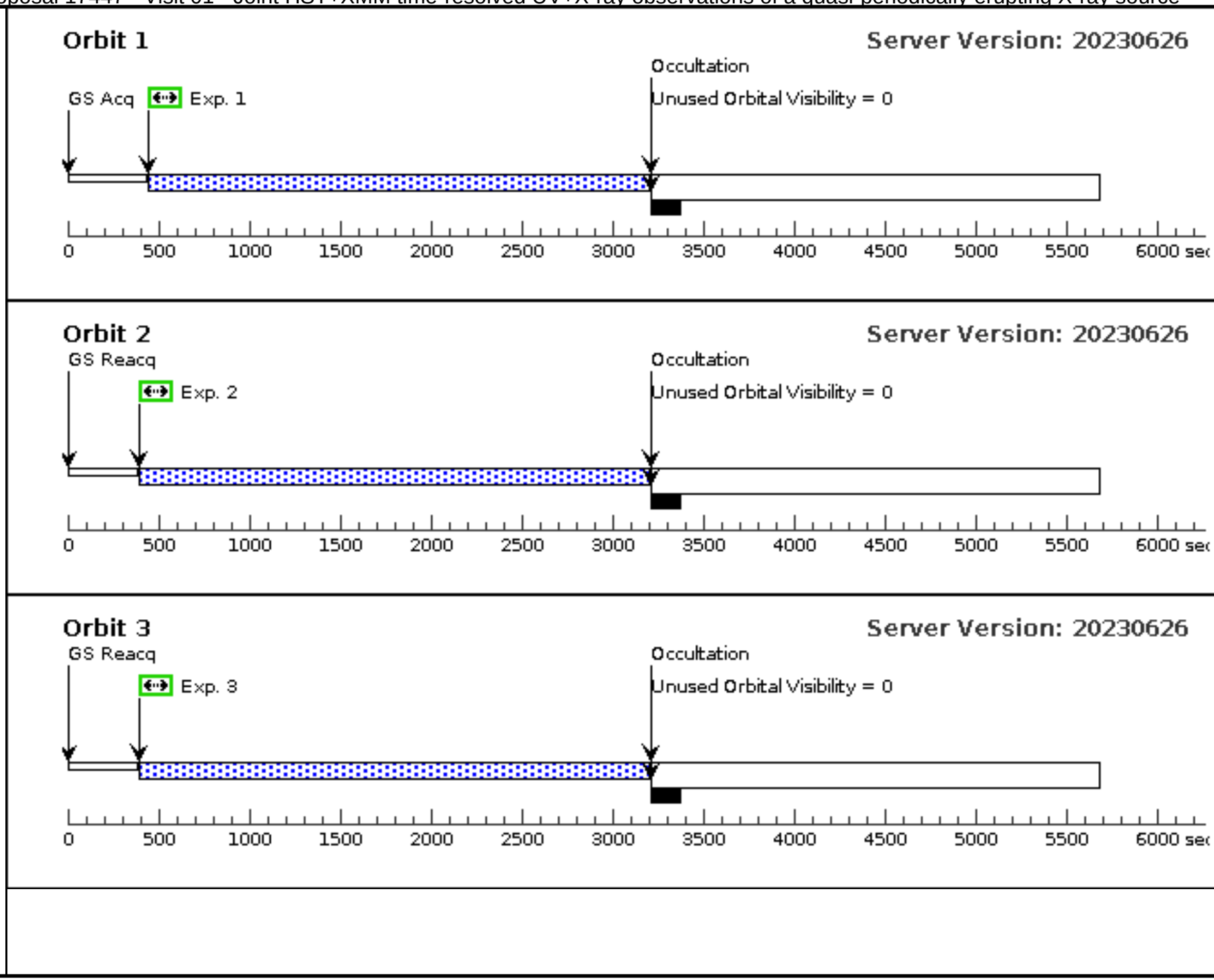
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ERO-QPE2	RA: 02 34 48.7051 (38.7029379d) Dec: -44 19 32.79 (-44.32578d) Equinox: J2000		V=18 galex FUV = 19.4 mag	Reference Frame: ICRS

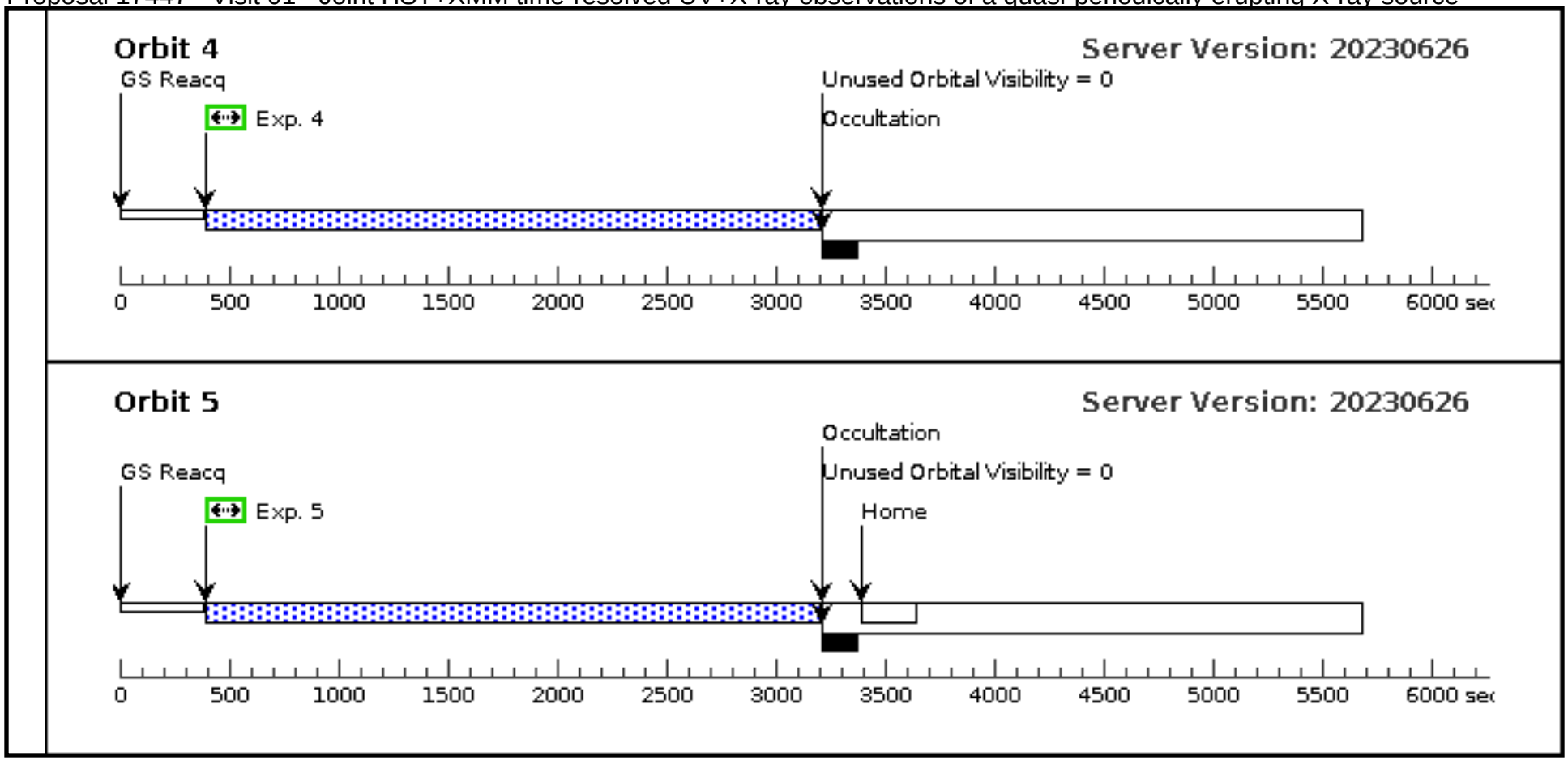
Comments:
Category=GALAXY
Description=[ACCRETION DISK, NUCLEUS]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1889760)	(1) ERO-QPE2	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=20000			2614 Secs (2614 Secs) *[==>]*	*[1]*
2	(1889760)	(1) ERO-QPE2	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=20000			2796 Secs (2796 Secs) *[==>]*	*[2]*
3	(1889760)	(1) ERO-QPE2	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=20000			2796 Secs (2796 Secs) *[==>]*	*[3]*
4	(1889760)	(1) ERO-QPE2	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=20000			2796 Secs (2796 Secs) *[==>]*	*[4]*
5	(1889760)	(1) ERO-QPE2	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=20000			2796 Secs (2796 Secs) *[==>]*	*[5]*

Orbit Structure

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Server Version: 20230626
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GS Reacq
Unused Orbital Visibility = 0
Exp. 5
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Visit

Proposal 17447, Visit 02

Thu Sep 07 19:00:16 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: (none)

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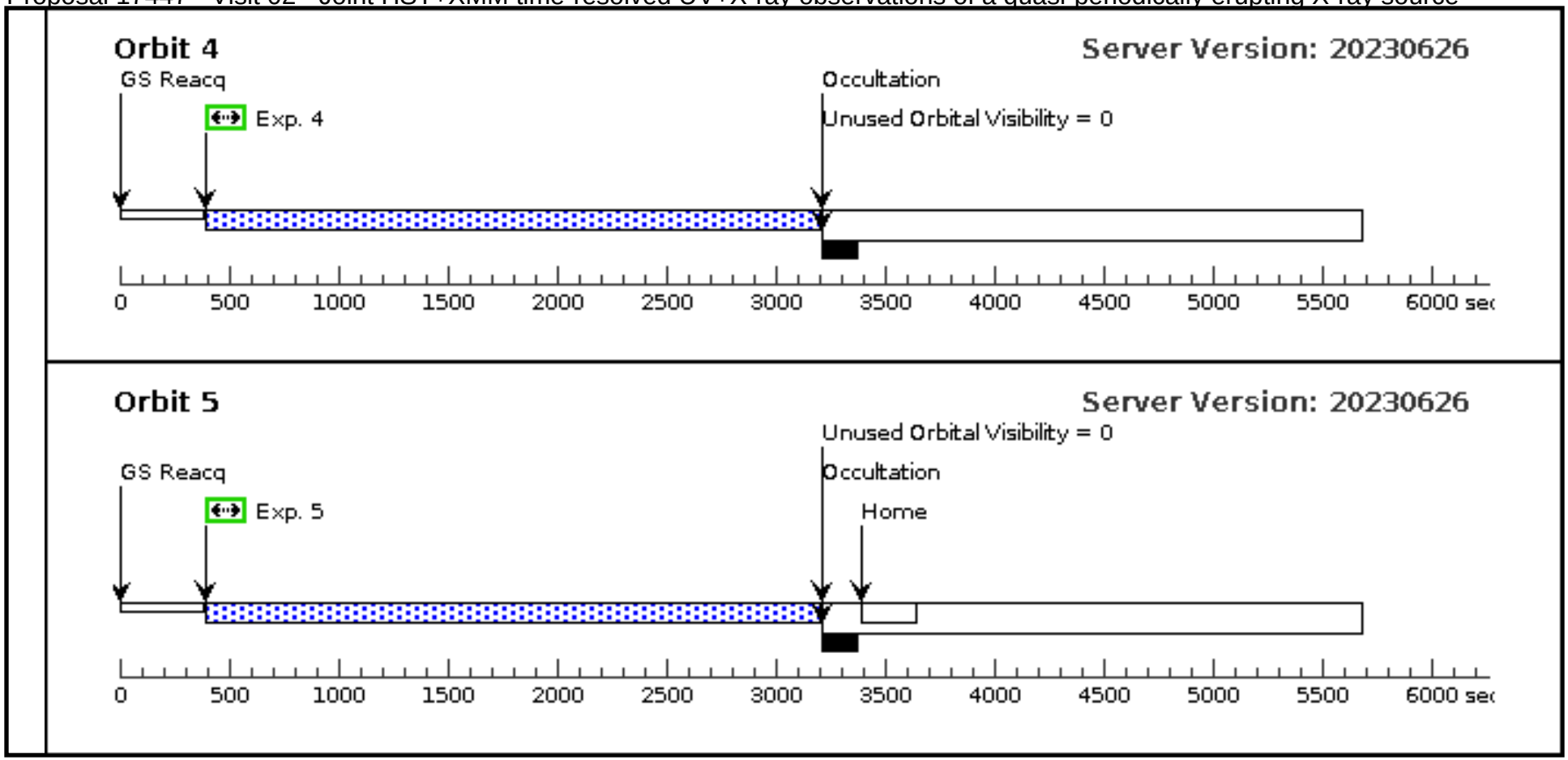
Orbit Structure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Server Version: 20230626
Unused Orbital Visibility = 0
GS Reacq
Exp. 5
Occultation
Home
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6000 sec