



17742 - A new laboratory for fundamental AGN physics

Cycle: 32, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Marianne Vestergaard (PI) (ESA Member) (Contact)	University of Copenhagen, Niels Bohr Institute
Dr. Sandra Raimundo (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute
Dr. Gisella De Rosa (CoI) (AdminUSPI)	Space Telescope Science Institute
Dr. Daniel P. Lawther (CoI)	University of Arizona
Dr. Jun Yi (Kevin) Koay (CoI)	Academia Sinica, Institute of Astronomy and Astrophysics

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) NGC863	COS/FUV COS/NUV	1	09-Aug-2024 16:00:16.0	yes
02	(1) NGC863	COS/FUV COS/NUV	1	09-Aug-2024 16:00:17.0	yes
03	(1) NGC863	COS/FUV COS/NUV	1	09-Aug-2024 16:00:17.0	yes
05	(1) NGC863	COS/FUV COS/NUV	1	09-Aug-2024 16:00:18.0	yes
04	(1) NGC863	COS/FUV COS/NUV	1	09-Aug-2024 16:00:19.0	yes

5 Total Orbits Used

ABSTRACT

A bona-fide AGN in the 1990s, Mrk 590 now flares repeatedly in a low flux state. This offers a very rare opportunity to follow in real time the onset of AGN activity that can lead to better insights on the AGN central engine physics. While directly impacting galaxy evolution through energetic feedback, the AGN structure and physics are still poorly understood. We wish to catch the early onset of AGN activity to test details of AGN accretion physics that cannot be constrained in any other way.

We propose a ToO program to obtain up to five COS spectra of Mrk 590 at different X-ray/UV flux levels as its AGN builds up. We will measure UV broad-line fluxes, constrain the UV and EUV ionizing continuum emission from the accretion flow, and test theoretical model predictions for the broad-line region physics. The efficient strategy we employ ensures that instructive constraints are obtained with a very modest HST program - yet, the full time request may not be needed. HST is the only telescope that can obtain spectra of the far-UV emission below 1900Å that are crucial to reach our science goals.

By combining this HST program with (new and archival) observations obtained with Swift, NuSTAR, LCO and VLT we will provide a comprehensive account of the black hole accretion state changes during the early onset of AGN activity. These HST/COS data will contribute with unique information to the legacy database on this intriguing object that will undoubtedly spawn new insight on AGN physics, including the extreme variability seen in some objects.

OBSERVING DESCRIPTION

We request COS low-resolution FUV observations of Seyfert 1 galaxy Mrk 590 to determine the strength of the AGN thermal disk continuum emission and the broad emission lines.

Using the G140L grating with the 1105 cenwave setting (=1120-2100Å) we will cover the Ly 1215, Nv 1240, Si iv+Oiv 1400, Civ 1549, and He ii 1640 broad emission lines in a single exposure. The resolution (R 1500-4000) is adequate to resolve the typical AGN narrow emission components; the [O III] 5007 narrow line width is FWHM~400 km s⁻¹.

The program consists of 5 ToOs (1 orbit each), that will be triggered based on SWIFT and LCO monitoring. Mrk590 is being monitored with Swift every 10 days and with LCO every 4 days. Once the source Xray flux drops below the '2013 low', we will obtain VLT reference spectra to confirm

Proposal 17742 (STScI Edit Number: 0, Created: Friday, August 9, 2024 at 3:00:19 PM Eastern Standard Time) - Overview

the lack of broad lines. If broad H α emission is still present below '2013 low', the HST program will not be triggered until Mrk 590 fades further to a point where the optical broad lines and continuum vanish both in VLT & LCO data.

This ensures that we capture the initial response of the broad-line region to a subsequent continuum increase.

We reserve (up to) 3 COS ToOs to identify the threshold for no broad UV lines to be present (Limit 1) to exclude hysteresis effects (i.e. a line 'afterglow'). Then, we activate VLT, LCO and HST observations when the XRT flux rises above one of two well-defined XRT flux levels, selected to be evenly spaced between Limit 1 and Limit 2, e.g. at (0.3, 0.9) $\times 10^{11}$ erg/s/cm 2 .

We have requested 4 non disruptive ToOs (requested response time \sim 21 days) and 1 disruptive ToO (requested response time \sim 7 days). The disruptive ToO will be triggered only in case of rapid rise of the X-Ray and UV fluxes.

We request long term status for these observations since we cannot guarantee trigger during cy32.

The current observing strategy (see below) is based on past successful COS observations of the same sources. We will update strategy, exposure time and ETC calculations as needed once visits are triggered and SWIFT UV fluxes are available.

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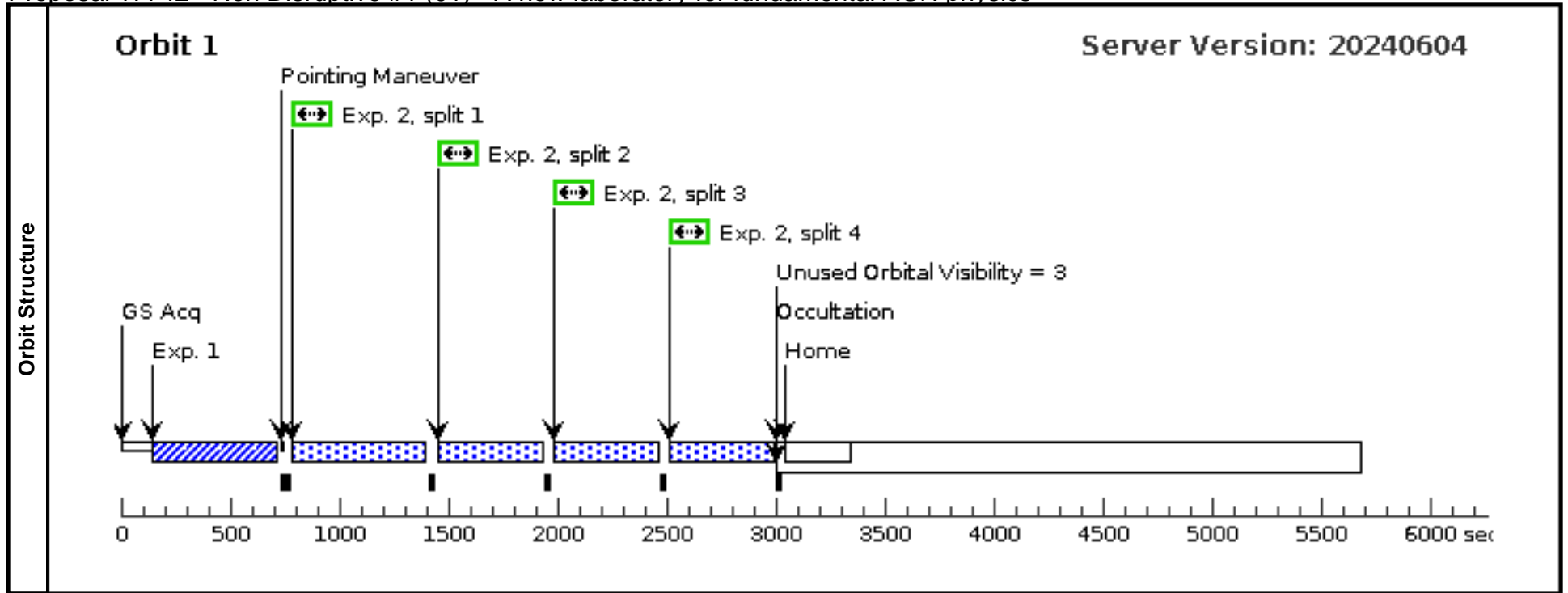
ACQUISITION: The target has precise 2MASS coordinates (ICRS reproduced with an error $< 0.1''$). We plan to use ACQ/IMG NUV MIRRORB and an exp time of 140s. For our ETC calculations we assume a flat continuum in fl normalized to half of the min observed UVW2 flux $f_{1} \sim 1.1 \times 10^{-15}$ erg s $^{-1}$ cm $^{-2}$ Ang $^{-1}$ @1928 Ang (<http://etc.stsci.edu/etc/results/COS.ta.1030198/>). This will ensure acquisition in case of "faint" state. The source will not pose a threat to the detector even if it ends up being 5 times more luminous than the max detected in the past 80 days (<http://etc.stsci.edu/etc/results/COS.ta.1030199/>).

SCIENCE: We use the G140L grating at 1105Ang with FP_POS=ALL. For ETC calculations we assume a flat continuum normalized to the mean observed UVW2 flux in the past 80 days (<http://etc.stsci.edu/etc/results/COS.sp.1030204/>). Buffer time is set to 2/3 of the ETC buffer time. The source will not pose a threat to the detector even if it ends up being 5 times more luminous than the past 80 days (<http://etc.stsci.edu/etc/results/COS.sp.1030205/>).

Proposal 17742 - Non Disruptive #1 (01) - A new laboratory for fundamental AGN physics

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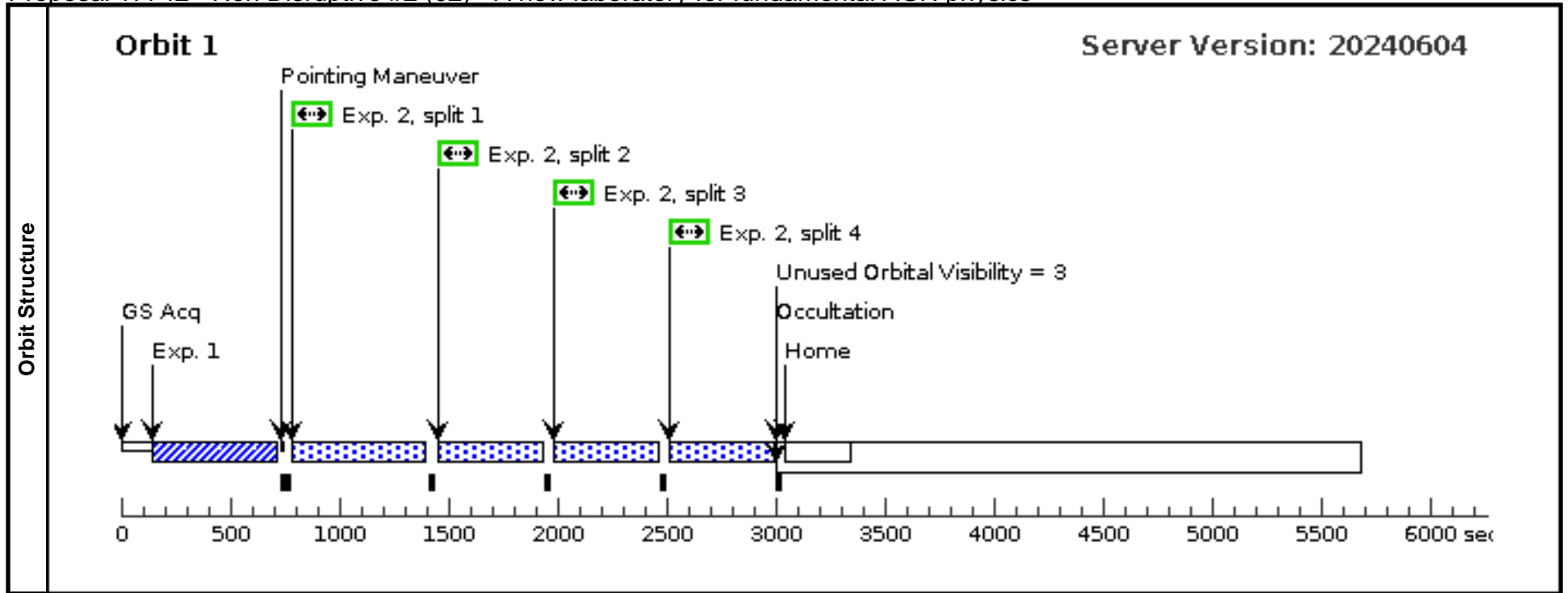
Visit	<p>Proposal 17742, Non Disruptive #1 (01)</p> <p>Diagnostic Status: Warning</p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D</p> <p><i>Comments: Observing strategy and exposure times are currently based on previous COS observations (PID 15448). We will update acq settings, exp times and ETC calculations as soon as the observations are triggered and SWIFT UV fluxes are available.</i></p> <p><i>On Hold Comments: Non disruptive ToO.</i></p>																																							
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Proposal 17742 - Non Disruptive #2 (02) - A new laboratory for fundamental AGN physics

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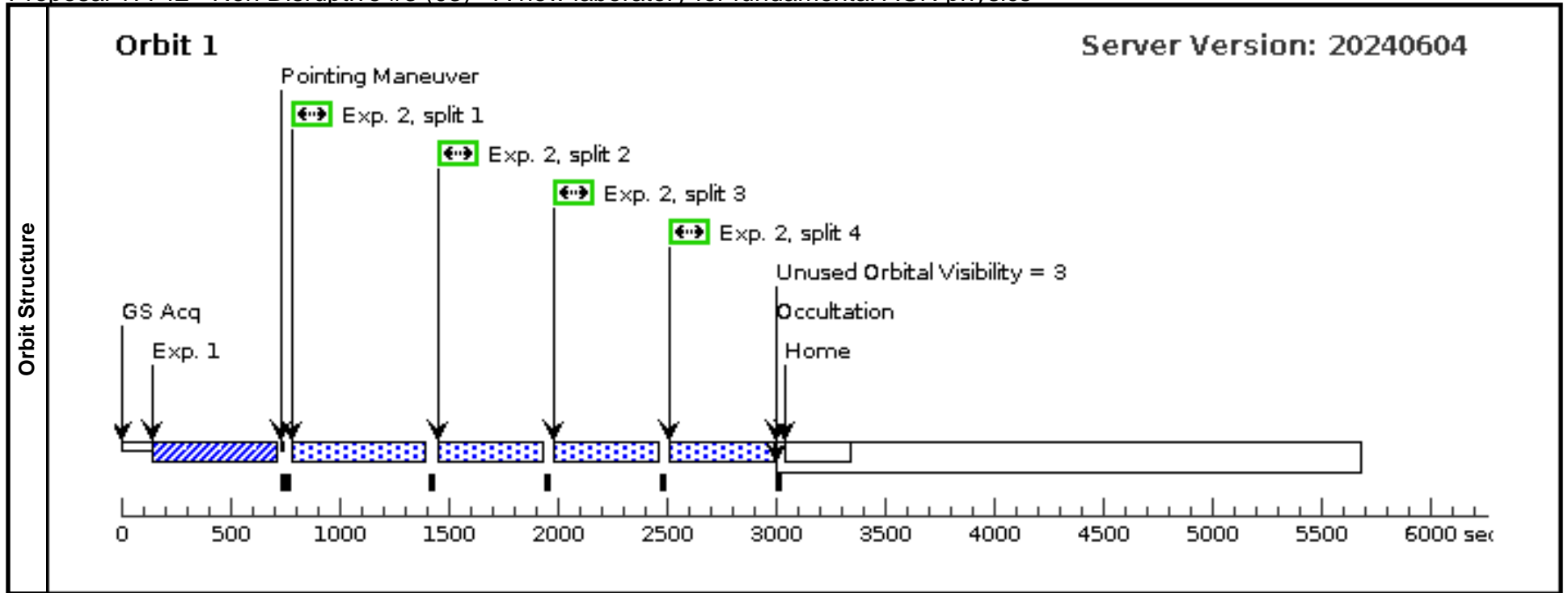
Visit	<p>Proposal 17742, Non Disruptive #2 (02)</p> <p>Diagnostic Status: Warning</p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D</p> <p><i>Comments: Observing strategy and exposure times are currently based on previous COS observations (PID 15448). We will update acq settings, exp times and ETC calculations as soon as the observations are triggered and SWIFT UV fluxes are available.</i></p> <p><i>On Hold Comments: Non disruptive ToO.</i></p>																																							
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Proposal 17742 - Non Disruptive #3 (03) - A new laboratory for fundamental AGN physics

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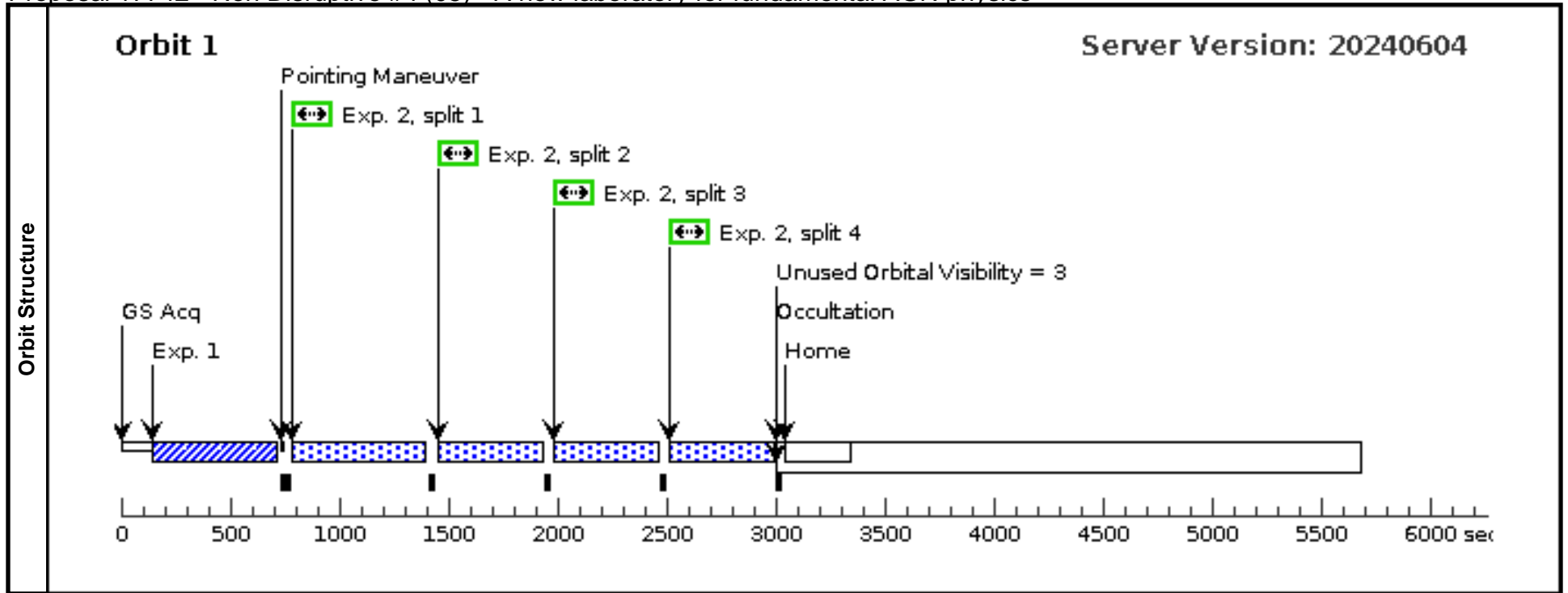
Visit	<p>Proposal 17742, Non Disruptive #3 (03)</p> <p>Diagnostic Status: Warning</p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D</p> <p><i>Comments: Observing strategy and exposure times are currently based on previous COS observations (PID 15448). We will update acq settings, exp times and ETC calculations as soon as the observations are triggered and SWIFT UV fluxes are available.</i></p> <p><i>On Hold Comments: Non disruptive ToO.</i></p>																																																																																									
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Proposal 17742 - Non Disruptive #4 (05) - A new laboratory for fundamental AGN physics

Fri Aug 09 20:00:19 GMT 2024

Visit	<p>Proposal 17742, Non Disruptive #4 (05)</p> <p>Diagnostic Status: Warning</p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D</p> <p><i>Comments: Observing strategy and exposure times are currently based on previous COS observations (PID 15448). We will update acq settings, exp times and ETC calculations as soon as the observations are triggered and SWIFT UV fluxes are available.</i></p> <p><i>On Hold Comments: Non disruptive ToO.</i></p>																																							
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Proposal 17742 - Disruptive #1 (04) - A new laboratory for fundamental AGN physics

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