17990 - A strong test for accretion disk buildup in a changing-look AGN

Cycle: 32, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Daniel P. Lawther (PI) (Contact)	**University of Arizona**
Dr. Gisella De Rosa (CoI)	Space Telescope Science Institute
Dr. Marianne Vestergaard (CoI) (ESA Member) (CoPI) (Contact)	University of Copenhagen, Niels Bohr Institute
Dr. Sandra Raimundo (CoI) (ESA Member)	University of Southampton

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) NGC-863	COS/FUV COS/NUV	1	15-Aug-2025 12:00:29.0	yes
51	(1) NGC-863	COS/FUV COS/NUV	1	15-Aug-2025 12:00:29.0	yes

2 Total Orbits Used

ABSTRACT

The changing-look AGN Mrk 590 has entered a high-flux state not seen since the 1990s, after a decade of quiescence and several years of low-level X-ray driven flaring. Here, we ask for a single-orbit HST COS observation to determine whether a standard disk component has emerged. Near-contemporaneous, approved XMM-Newton, NuSTAR and VLT Xshooter ToO observations will be triggered to support this study. While AGN are theoretically expected to develop a standard `thin disk' accretion flow as the mass accretion rate exceeds a few per cent of the Eddington limit, archival HST COS data for Mrk 590 show no thin-disk activity during the previous low-level flares, even at up to ~2% Eddington. Instead, the spectral energy distribution was fully described by a combination of hot and warm coronal emission. Recent Swift UVOT lightcurves show steadily

increasing flux levels; the far-UV flux is now a factor ~10 brighter than previously captured with HST. The UV variability is now more smooth and gradual, with a weaker response to X-ray 'flickering', suggesting that a stable inner disk is finally building up and becoming the dominant mechanism for the release of accretion energy. As the previous 'turn-off' and intermediate states are well-documented at all wavelengths, and as Mrk 590 has a well-constrained black hole mass, this unexpected brightening is a unique opportunity to pin-point the accretion rate at which a standard thin disk is formed. HST COS is the only current instrument capable of testing this directly. If we do not detect a disk at the current accretion rate (~6% Eddington), we demonstrate that changing-look AGN do not rebuild standard accretion disks on human timescales.

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 (=1120-2100A) 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 science goals can be achieved with a single orbit COS FUV spectral exposure of 1200 sec, divided into 4 subexposures of 300 sec.

The current observing strategy (see below) is based on past successful COS observations of the same source. We will update the exposure time and ETC calculations as needed if the 4-day cadence Swift UVOT monitoring observations show the source has brightened significantly (by a factor of 3 or more) by the time the phase II is due.

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ACQUISITION: The target has precise 2MASS coordinates (ICRS reproduced with an error < 0.1").
Similar to previous COS/G140L observations of this target we can use ACQ/IMG NUV MIRRORB for acquisition.
To reach a S/N ratio of 40 requires an exp time of 8s. For our ETC calculations we assume a power law continuum with slope alpha=-1.25 as measured from the Swift UVOT broad band photometry, and amplitude of the Swift UVW2 flux f_l ~2.3e-14 erg s-1 cm-2 Ang-1 @1928 Ang (http://etc.stsci.edu/etc/results/COS.ta.20211530). The source will not pose a threat to the detector even if it ends up being 4 times more luminous than the max detected in the past 8 years.

SCIENCE: We use the G140L grating at 1105Ang with FP_POS=ALL. For ETC calculations we assume a power law continuum with slope alpha=-

1.25 as measured from the Swift UVOT broad band photometry, and amplitude of the Swift UVW2 flux f_l ~2.3e-14 erg s-1 cm-2 Ang-1 @1928 Ang. We will reach S/N ratio per resolution element of 34 with an exposure time of 1200 sec, subdivided into four 300 sec sub-exposures (http://etc.stsci.edu/etc/results/COS.sp.2021167/). 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 4.5 times more luminous than the past 8 years (http://etc.stsci.edu/etc/results/COS.sp.2021168/).

Visit

Proposal 17990, Non-disruptive visit - high state (01), failed Fri Aug 15 16:00:30 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: PCS MODE FINE; BEFORE 17-AUG-2025:00:00:00

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-863	RA: 02 14 33.5605 (33.6398354d)	Proper Motion RA: 0.54 mas/yr	V=14.45	Reference Frame: ICRS
		Dec: -00 46 0.18 (-.76672d)	Proper Motion Dec: 0.108 mas/yr		
		Equinox: J2000	Epoch of Position: 2000		

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

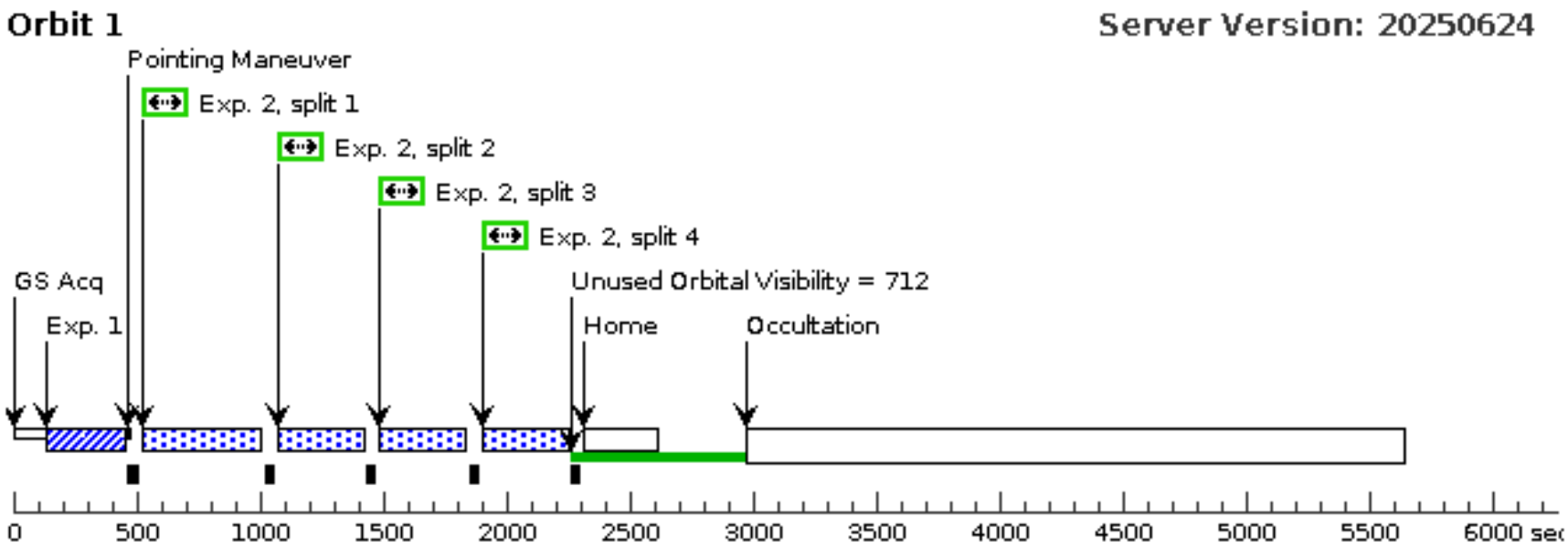
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.

V =13.81mag in catalogs includes galaxy light. Current nuclear V-band mag = 14.45mag (Swift, UVOT)
Category=GALAXY
Description=[ACCRETION DISK, BLR, NUCLEUS, SEYFERT]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	NUV MIRROR B ACQ (cos.ta.2021530)	(1) NGC-863	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				8 Secs (8 Secs)	
								[==>]	***[1]***
2	Science Exp os 2 (COS.sp.2021167)	(1) NGC-863	COS/FUV, TIME-TAG, PSA	G140L 1105 A	FP-POS=ALL; BUFFER-TIME=1556			300 Secs (1200 Secs)	
								[==>300 Secs (Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17990, Non-disruptive visit - high state (51), scheduling Fri Aug 15 16:00:30 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: PCS MODE FINE; BEFORE 15-SEP-2025:00:00:00

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
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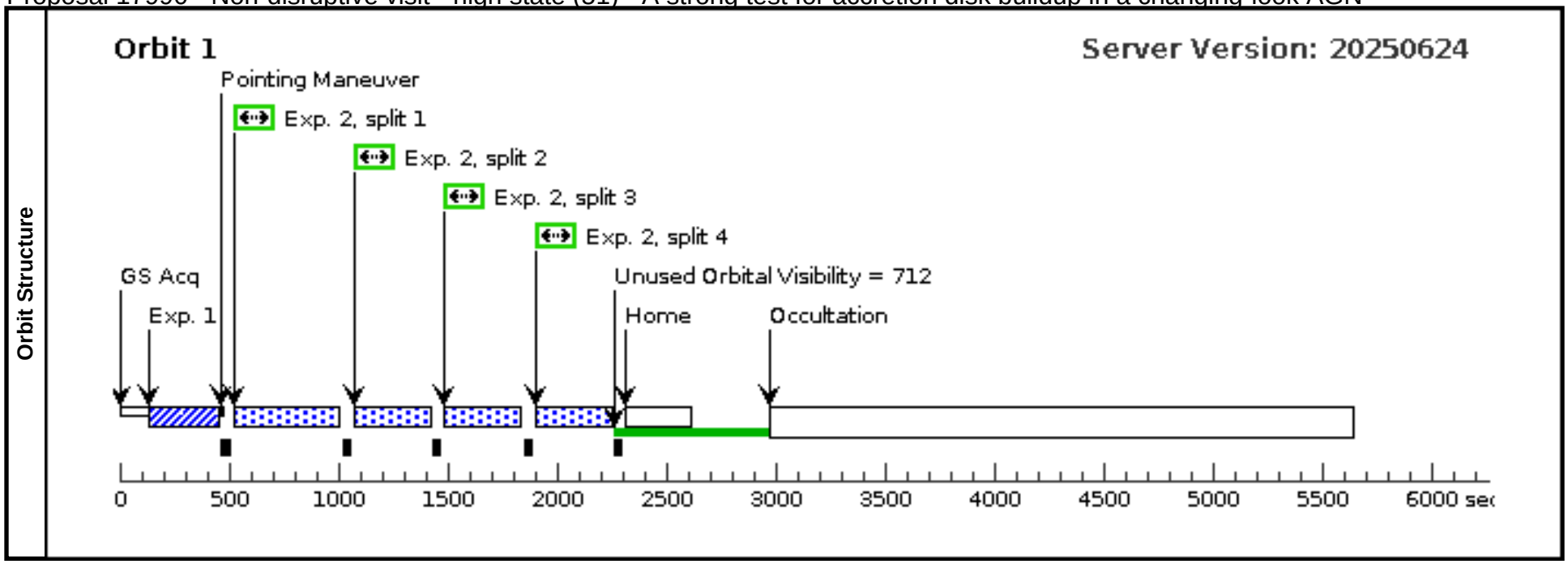
								[==>300 Secs (Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20250624
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
GS Acq
Exp. 1
Unused Orbital Visibility = 712
Home
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec