16905 - Capturing the transient obscuring wind in Mrk 841 with HST

Cycle: 29, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) MRK-841	COS/FUV COS/NUV	1	08-Dec-2025 15:00:14.0	yes

1 Total Orbits Used

ABSTRACT

From Swift monitoring of the X-ray hardness variability of a sample of Seyfert-1 active galactic nuclei (AGN), we have found a transient X-ray obscuration event in Mrk 841. This event was found on 2021-12-26 and confirmed again on 2022-01-02. We propose one non-disruptive HST/COS observation (1 orbit) to investigate the crucial association between the X-ray obscuration and the outflowing winds in AGN by high-resolution UV spectroscopy. Such obscuring outflows are remarkably different from the commonly-seen ionized outflows in AGN and can have important implications for the surrounding gas and the launching of AGN outflows. X-ray obscuration events have been captured with HST in only a few AGN so far, yet the scientific yield has been immense. However, there are still outstanding questions, which require further investigation of these events in additional AGN. This rare opportunity would help us in addressing the existing questions on obscuring outflows and broaden our understanding of

the transient obscuration events in AGN.

OBSERVING DESCRIPTION

From recent Swift monitoring of the hardness ratio in Mrk 841 we have found a 'transient obscuration event'. The 1-orbit observation with HST/COS G130M and G160M enables us to study all the key absorption lines associated to this event.

Using the UV flux information of Mrk 841 (described in the proposal) in the Exposure Time Calculator (ETC), we find that for a 1-orbit observation with the G130M/1222 and G160M/1600 gratings we obtain a S/N of about 9 at 1223 A and a S/N of about 10 at 1623 A. These S/N per resolution element is adequate to measure the broad UV absorption lines, as well as the weak, low-ionization lines associated with the new ionization state of the warm absorber. Also, for intrinsic absorption lines with widths of > 100 km/s , the spectrum can be binned to achieve S/N ratios of 15-20.

Following the Phase II Proposal instructions and the allowed COS settings for Cycle 29, the central wavelengths and FPPOS positions that we have selected provide the optimum full spectral coverage of the interested regions with the G130M and G160M gratings, and maximize the potential of the detection of the relevant broad and narrow absorption lines. This enables us to fully explore the UV spectral signatures of the obscuring outflow in Mrk 841.

This is a ToO proposal, so ask that the observation to be taken as soon as possible.

For the BUFFER-TIME, we obtained the recommended buffer (2/3 of the buffer fill time) from the ETC for each exposure.

There are no bright field objects that would prove an overlight risk to COS.

Reduced gyro operations would approximately halve the opportunities for coordination with Chandra. Also, any orientation limitation would not impact our program.

Because we are using two different CENWAVES with each grating and two FP-POS positions in each, we already accomplish the actual objectives of switching between different FP-POS settings:

(1) Better science return: the spectrum is placed at four different locations on the detector, enabling us to detect and reject detector anomalies like

dead spots, hot spots, grid-wire shadows, etc.

(2) Spread the flux across the detector in multiple locations, especially in bright emission lines, to decrease charge depletion and extend the lifetime of the detectors.

We do not want to sacrifice S/N with unnecessary extra exposures and increased overhead during each visit by using all 4 FP-POS settings with each CENWAVE. When only one CENWAVE is used, then 4 FP-POS settings makes sense, but that's not the case for our observations. Our chosen FP-POS settings reflect our S/N requirements while still meeting the objectives of using different FP-POS settings in our program.

Visit

Proposal 16905, Visit 01, completed Mon Dec 08 20:00:15 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SCHED 100%

Diagnostics

(Visit 01) Warning (Form): For the best data quality, it is generally required to use all four FP-POS positions at a given COS cenwave (or 2 positions for certain exception cases). See extended explanation in the diagnostic browser.

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

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Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	MRK-841	RA: 15 04 1.1935 (226.0049729d) Dec: +10 26 15.78 (10.43772d) Equinox: J2000	Proper Motion RA: -8.812492047315963E-7 sec of time/yr Proper Motion Dec: 1.86E-4 arcsec/yr Epoch of Position: 2015.5	V=14.27	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[ACCRETION DISK, BLR, SEYFERT, WIND]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1684904)	(1) MRK-841	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				55 Secs (55 Secs) *[==>]*	***[1]***
Comments: Using the UV flux information of Mrk 841, and its range, the exposure calculated with ETC provides a S/N of 30.									
2	(1682486)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1268; FP-POS=1			65 Secs (65 Secs) *[==>]*	***[1]***
Comments: S/N of about 9 at 1223 A									
3	(1682486)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G130M 1222 A	BUFFER-TIME=1268; FP-POS=2			65 Secs (65 Secs) *[==>]*	***[1]***
Comments: S/N of about 9 at 1223 A									
4	(1682486)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=967; FP-POS=3			65 Secs (65 Secs) *[==>]*	***[1]***
Comments: S/N of about 9 at 1223 A									
5	(1682486)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=967; FP-POS=4			65 Secs (65 Secs) *[==>]*	***[1]***
Comments: S/N of about 9 at 1223 A									
6	(1682487)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=2067; FP-POS=1			200 Secs (200 Secs) *[==>]*	***[1]***
Comments: S/N of about 10 at 1623 A									
7	(1682487)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=2067; FP-POS=2			200 Secs (200 Secs) *[==>]*	***[1]***
Comments: S/N of about 10 at 1623 A									
8	(1682487)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=2281; FP-POS=3			200 Secs (200 Secs) *[==>]*	***[1]***
Comments: S/N of about 10 at 1623 A									
9	(1682487)	(1) MRK-841	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=2281; FP-POS=4			205 Secs (205 Secs) *[==>]*	***[1]***
Comments: S/N of about 10 at 1623 A									

Orbit Structure