



# 13429 - Unveiling the X-ray/UV Connection in AGN Winds: the PG 1126-041 Case Study

Cycle: 21, Proposal Category: GO  
(Availability Mode: SUPPORTED)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
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## 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) PG1126-041	COS/FUV	2	11-Feb-2014 21:24:29.0	yes
02	(1) PG1126-041	COS/FUV	2	11-Feb-2014 21:24:46.0	yes
03	(1) PG1126-041	COS/FUV	2	11-Feb-2014 21:25:01.0	yes

6 Total Orbits Used

## **ABSTRACT**

Winds are key to understanding the nature of AGN at small and large scales. Winds are common in AGN, and likely play a role in regulating the black hole growth and star formation in the surrounding galaxies. Models of radiatively-driven winds predict that X-ray absorbing gas acts as a shield, preventing over-ionization of the UV outflowing gas by the strong illuminating continuum source. However, recent observations are putting the hypothesis of this X-ray absorbing gas to the test.

We propose a 2-cycle small GO program of 4 HST+XMM coordinated observations with the goal of exploring the connection (if any) between the UV and X-ray absorbing wind phase(s). PG 1126-041 is a low redshift ( $z=0.06$ ) luminous Seyfert 1 galaxy that displays complex and variable UV and X-ray absorption. A 1992 simultaneous IUE+ROSAT observation revealed X-ray absorption in the OVII/OVIII band, and broad blueshifted ( $v \sim 5,000$  km/s) UV absorption in, at least, CIV and NV transitions. Later, independent IUE and XMM-Newton observations showed that UV and X-ray absorption is highly variable, but no more UV+X-ray simultaneous observations have been carried out since 1992. The X-ray absorbing gas could be acting as a "patchy" porous shield, and its variations in our line-of-sight could be causing the observed UV variability; if so, a correlation between UV and X-ray absorption is expected. COS observations will cover a large range of transitions, allowing the detections of changes in the ionization of the UV absorber. Our results will be a direct test of the relation between the UV and the X-ray phases of the wind, and as such will be of crucial interest to test AGN wind models.

## **OBSERVING DESCRIPTION**

Our goal is to observe the AGN PG1126-410 with sufficiently high S/N ratios ( $S/N > \sim 10$  per resolution element per grating) in order to detect changes in the ionization of the UV absorber and test whether they are coordinated with changes in the X-ray absorption (which is obtained with near-simultaneous XMM-Newton/EPIC, not separated from the HST/COS observations in more than 1 day).

We used the ETC on the HST/COS website to calculate the necessary exposure times to obtain spectra with, at least,  $S/N=10$  per resolution element. UV fluxes are included as "Other Fluxes" and are determined based on a previous HST/COS observation in cycle 19, which proves the feasibility of our program. In the ETC we employed average background, a spectrum of power law with index 0. (based on the previous HST/COS observation and other IUE previous exposures), a  $z=0.06196$  and a typical flux of  $1.e-14$  flam with no extinction.

We will use gratings G130M (centered at 1055 and 1327) and G160M (centered at 1577 Å) for the science exposures to cover a large range of UV absorption transitions (CIV, NV, OVI, PV, SiIV, and many lower ionization transitions). Grating M is necessary to be able to resolve these

absorption profiles into multiple narrower components.

We will observe PG1126-410 during 4 visits: 3 of them spaced 15 days during cycle 21, and a fourth observation on cycle 22 11 months later.

This target has accurate coordinates, and the HST/COS observation in 2012 was acquired successfully without ACQ/SEARCH and with dispersed light acquisition. Thus, during each visit we choose to do dispersed light acquisition (PEAKXD, PEAKD), which exposure times are calculated with  $S/N=40$  (as recommended).

The science exposures are all done in TIME-TAG mode to exclude poor quality data and improved background removal. We use the FP-SPLIT mode to reduce fixed pattern noise and avoid having important lines fall on grid wires. Since we only have 2 orbits and 3 different settings, we use 2 FP POSITIONS in the case of G130M/1327 and G130M/1577 and all 4 in the case of G130M/1055, starting in the neutral position (FP-POS=3) and increasing in 1 from exposure to exposure to minimize overheads as suggested in the COS manual.

#### **ADDITIONAL COMMENTS**

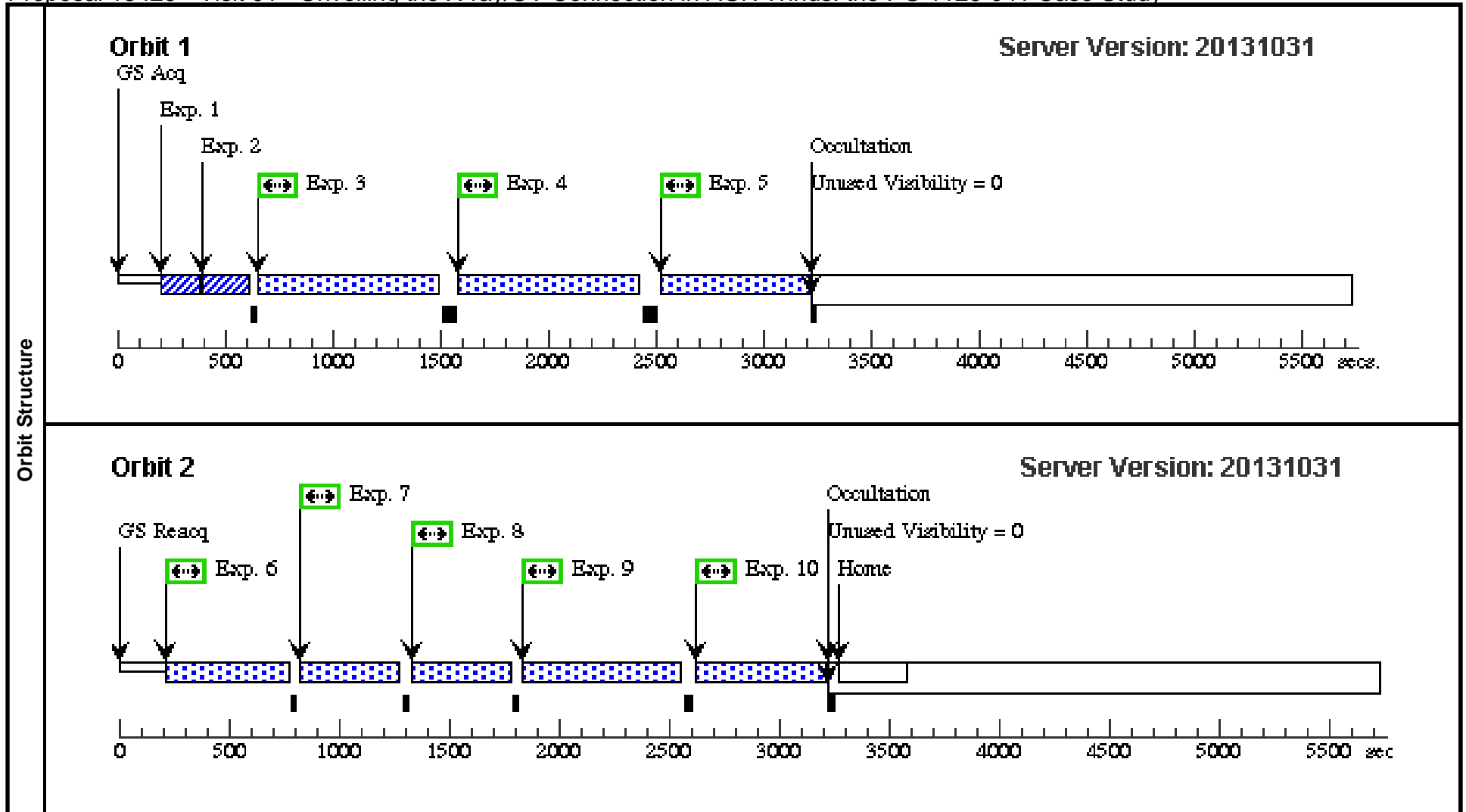
The buffer time has been selected based on  $2/3$ s of the real buffer time derived from ETC for double the flux to acquire the requested total  $S/N$  of 10. However, we are confused as whether once the exposure is divided in several FP-POS we should modify the buffer time as the exposure time for each observation has been reduced. We are waiting on information from STScI on this matter.

Proposal 13429 - Visit 01 - Unveiling the X-ray/UV Connection in AGN Winds: the PG 1126-041 Case Study

<b>Visit</b>	<p><b>Proposal 13429, Visit 01, implementation</b> <span style="float: right;">Wed Feb 12 02:25:11 GMT 2014</span></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV</p> <p>Special Requirements: (none)</p>					
<b>Diagnostics</b>	(Visit 01) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.					
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>
	(1)	PG1126-041	RA: 11 29 16.7300 (172.3197083d) Dec: -04 24 7.50 (-4.40208d) Equinox: J2000	Redshift: 0.061960	V=14.4 Previous HST/COS flux at 1320 Å rest-frame (1400 Å observed) = $1 \times 10^{(-14)}$ erg/s/cm <sup>2</sup> /Å	Reference Frame: ICRS
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>					

Proposal 13429 - Visit 01 - Unveiling the X-ray/UV Connection in AGN Winds: the PG 1126-041 Case Study

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	PG1126-041 -ACQ/PEA KXD (517633)	(1) PG1126-041	COS/FUV, ACQ/PEAKXD, PSA 1327 A	G130M	SEGMENT=BOTH		13 Secs (13 Secs) [==>]	[1]	
	<i>Comments: Calculated for 0.5*F(1150)=0.5E-14 erg/cm2/s/A COS ETC result for S/N=40 (default setting) is 12.1228 (id COS.sa.517633). Count rate entire detector: 523.445 c/sec.</i>									
	2	PG1126-041 -ACQ/PEA KD (517633)	(1) PG1126-041	COS/FUV, ACQ/PEAKD, PSA 1327 A	G130M	CENTER=DEF; NUM-POS=5.;	STEP-SIZE=0.9		13 Secs (13 Secs) [==>]	[1]
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	3	PG1126-041 -orbit1(1327 -3) (sp.515008)	(1) PG1126-041	COS/FUV, TIME-TAG, PSA 1327 A	G130M	BUFFER-TIME=14 89;	FP-POS=3		790 Secs (790 Secs) [==>]	[1]
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	4	PG1126-041 -orbit1(1327 -4) (sp.515008)	(1) PG1126-041	COS/FUV, TIME-TAG, PSA 1327 A	G130M	BUFFER-TIME=14 89;	FP-POS=4		790 Secs (790 Secs) [==>]	[1]
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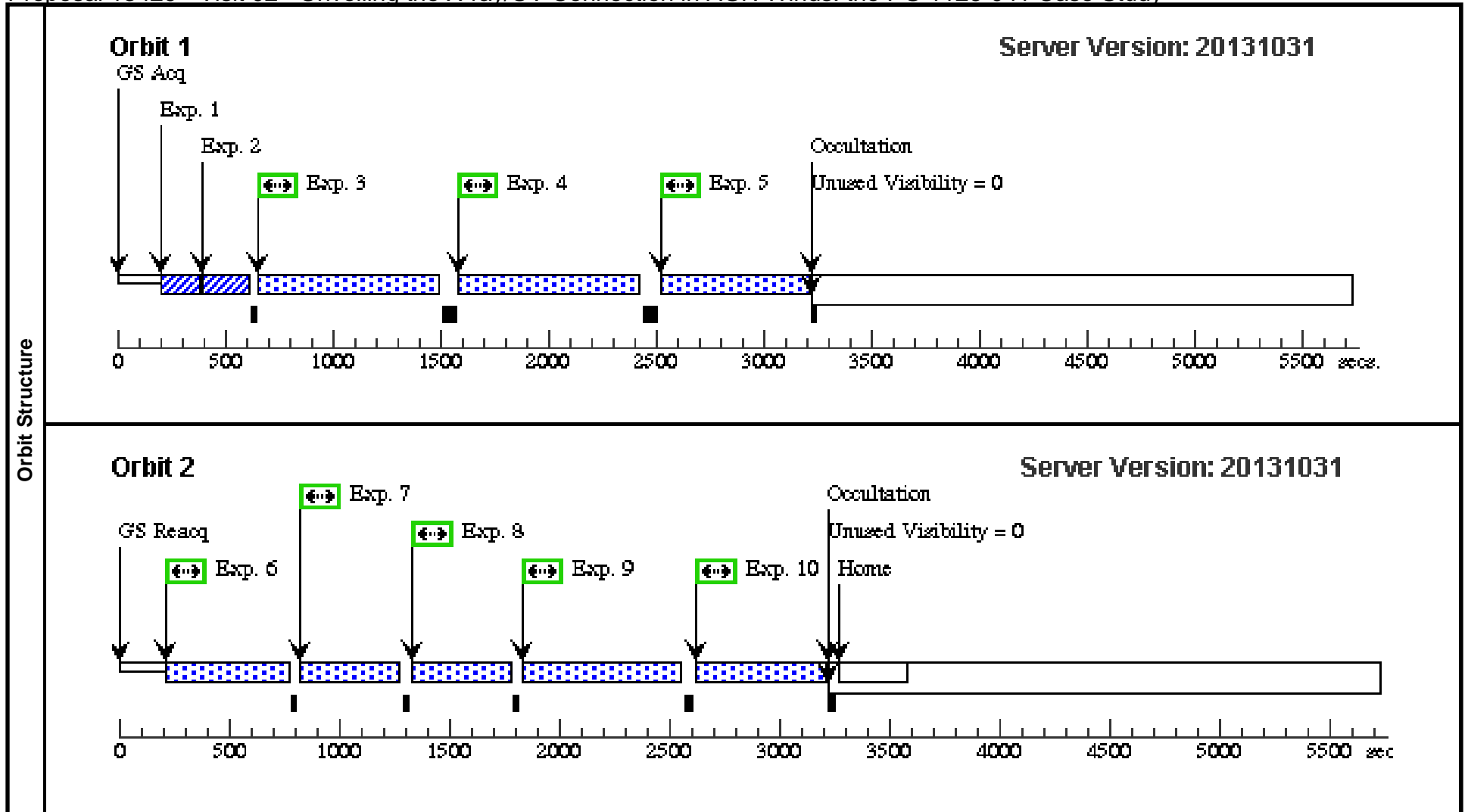
Proposal 13429 - Visit 02 - Unveiling the X-ray/UV Connection in AGN Winds: the PG 1126-041 Case Study

<b>Visit</b>	<b>Proposal 13429, Visit 02, implementation</b> <span style="float: right;">Wed Feb 12 02:25:14 GMT 2014</span> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV Special Requirements: AFTER 01 BY 7 D TO 30 D																
	<b>Diagnosics</b> (Visit 02) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.																
<b>Fixed Targets</b>	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>PG1126-041</td> <td>RA: 11 29 16.7300 (172.3197083d) Dec: -04 24 7.50 (-4.40208d) Equinox: J2000</td> <td>Redshift: 0.061960</td> <td>V=14.4 Previous HST/COS flux at 1320 Å rest-frame (1400 Å observed) = <math>1 \times 10^{(-14)}</math> erg/s/cm<sup>2</sup>/Å</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	PG1126-041	RA: 11 29 16.7300 (172.3197083d) Dec: -04 24 7.50 (-4.40208d) Equinox: J2000	Redshift: 0.061960	V=14.4 Previous HST/COS flux at 1320 Å rest-frame (1400 Å observed) = $1 \times 10^{(-14)}$ erg/s/cm <sup>2</sup> /Å	Reference Frame: ICRS
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Exposures



Proposal 13429 - Visit 03 - Unveiling the X-ray/UV Connection in AGN Winds: the PG 1126-041 Case Study

<b>Visit</b>	<b>Proposal 13429, Visit 03, implementation</b> <span style="float: right;">Wed Feb 12 02:25:16 GMT 2014</span> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV Special Requirements: AFTER 02 BY 7 D TO 30 D																
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