17818 - Structure of the Extreme-UV Continuum Source in the Heavily Microlensed Quasar SDSS J1339+1310

Cycle: 32, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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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) SDSS-J133907.13+131039.6	WFC3/IR	1	15-Dec-2025 14:00:17.0	yes
02	(1) SDSS-J133907.13+131039.6	WFC3/UVIS	1	15-Dec-2025 14:00:18.0	yes
03	(1) SDSS-J133907.13+131039.6	WFC3/UVIS	1	15-Dec-2025 14:00:19.0	yes
04	(1) SDSS-J133907.13+131039.6	WFC3/UVIS	1	15-Dec-2025 14:00:19.0	yes
05	(1) SDSS-J133907.13+131039.6	WFC3/UVIS	1	15-Dec-2025 14:00:20.0	yes
06	(1) SDSS-J133907.13+131039.6	WFC3/UVIS	1	15-Dec-2025 14:00:20.0	yes

6 Total Orbits Used

ABSTRACT

We propose to image the gravitationally lensed quasar SDSS J1339+1310 using a total of 12 orbits during HST Cycles 32 & 33. These regular monitoring observations of this heavily microlensed system with WFC3-UVIS in the F275W band will enable two primary science objectives: (1) We will analyze the microlensing variability in the resulting HST UV light curves in conjunction with existing optical light curves to make a measurement of the size of this quasar's continuum emission source at extreme-UV (EUV) wavelengths (83.7 nm in the rest frame). Only one other empirical measurement of a quasar's accretion disk size has ever been made at these extremely short UV wavelengths. (2) Coupling the new EUV size measurement with an existing measurement in the rest-frame near-UV will permit an empirical constraint on the temperature profile in this quasar's accretion disk. Empirical measurements of temperature profiles in other systems are quite discrepant from the predictions of basic thin disk models. We have also requested one deep observation with WFC3-IR in the F160W (H-band) to permit accurate modeling of the lens galaxy's mass profile. HST is the only existing telescope capable of making these UV observations with the angular resolution required to separate the flux from this lensed quasar's individual images and its lens galaxy.

OBSERVING DESCRIPTION

This obsering program was approved for 6 orbits in Cycle 32 and 6 orbits in Cycle 33. This Phase II proposal covers the 6 Cycle 32 observations; the Cycle 33 observations will be scheduled in a separate Phase II proposal prior to Cycle 33.

During Cycle 32, we will conduct 6 orbits of WFC3 observations to monitor SDSS1339 in the UV (F275W), and we will collect 1 deep image in the IR (F160W). Since the size scale of the quasar's BLR is much larger than the accretion disk, it is important to avoid contaminating emission line flux. The bandwidth of F275W corresponds to 775 A < lambda_{rest} < 898 A in the rest frame, just short of the Lyman limit at 912 A, but well clear of the Lyman beta emission line at 1026 A. Exposure times were calculated using the WFC3-UVIS Exposure Time Calculator (ETC) by direct upload of the 2016 UVIS G280 grism spectra with the goal of achieving S/N = 100 for the fainter image (image A). Each F275W observing epoch must be separated from a previous epoch by the system's time delay of 47+/-5 days. The need to differentiate between intrinsic and extrinsic (microlensing) variability drives the requirement for a (loose) scheduled monitoring interval in our observations.

In Cycle 32 we have scheduled 5 sequenced WFC3/UVIS observations separated by the 47+/-5 day time delay. Each WFC3/UVIS observation consists of a dithered F275W exposure, each of which is timed to accomplish S/N = 100 in the fainter of the two quasar images (image A) without saturating the brighter image (B). We made use of the WFC3-UVIS-DITHER-BOX pattern with default line and point spacing, comprising four 540 sec sub-exposures. The dithering scheme will allow for correction of cosmic rays and detector anomalies, while also sub-sampling the UVIS PSF.

To minimize losses from charge transfer effeciency (CTE) we employed the UVIS2-C1K1C-CTE aperture in all F275W images.

We will also conduct one deep observation of SDSS1339 using WFC3/IR in F160W to allow for an accurate photometric fit of the lens galaxy. We uploaded ground-based VLT-XSHOOTER spectra into the WFC3-IR ETC to develop the the observing scheme for this single deep observation, with a goal of accomplishing S/N =100 for the elliptical lens galaxy without saturating either of the quasar images. The lens galaxy has a half-light radius of 1 arcsec and the quasar images are separated by 1.7 arcsec, so we will use the WFC3-IR-DITHER-BLOB dither pattern with its larger point spacing. This ensures that the target will not overlap any of the same pixels during subexposures while also avoiding the IR dust blobs on the detector. To ensure adequate sub-PSF sampling, we used the WF3C-IR-DITHER-LINE-3POINT subpattern at each primary dither location.

Visit

Proposal 17818, Cycle 32 Visit 1 (01), completed Mon Dec 15 19:00:21 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=3 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=2.42 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)

Fixed Targets

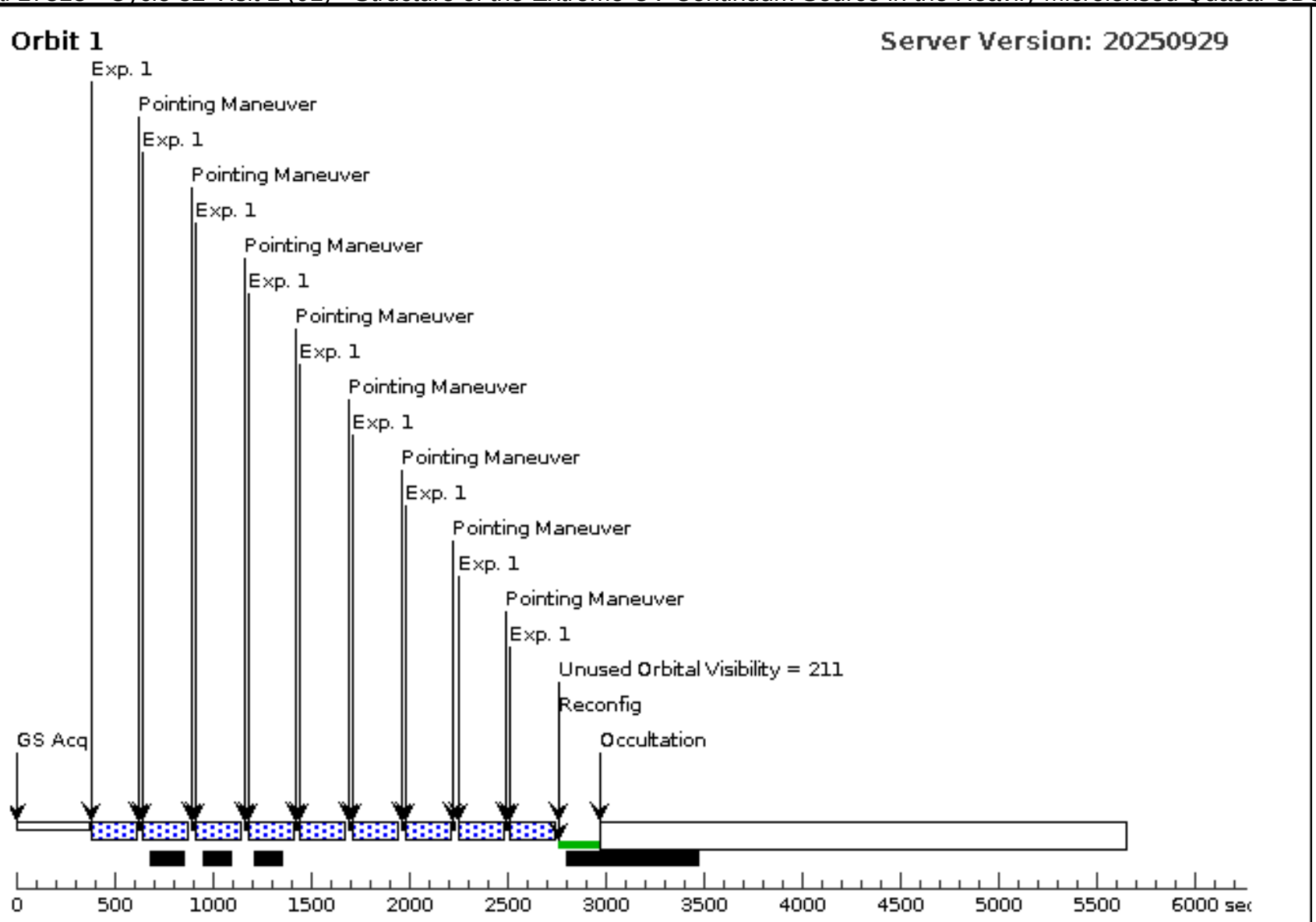
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J133907.13+131039.6	RA: 13 39 7.1409 (204.7797537d) Dec: +13 10 39.62 (13.17767d) Equinox: J2000	Epoch of Position: 2000	V=19.13 F_{\lambda} = 6.76 \times 10^{-17} erg cm^{-2} s^{-1} \AA^{-1} at 2750 \AA as measured by HST WFC3/UVIS G280 Grism Spectroscopy.	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, GRAVITATIONAL LENS, QUASAR]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Cycle 32 Visit 1 F160W (WFC3IR.im.1927157)	(1) SDSS-J133907.13+131039.6	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=5; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in Cycle 32 Visit 1 (01) (1)	202.934095 Secs (1826.407 Secs) *[==>(Pattern 1,1)]* *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]* *[==>(Pattern 2,1)]* *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]* *[==>(Pattern 3,1)]* *[==>(Pattern 3,2)]* *[==>(Pattern 3,3)]*	***[1]***

Orbit Structure



Visit

Proposal 17818, Cycle 32 Visit 2 (02), completed Mon Dec 15 19:00:21 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

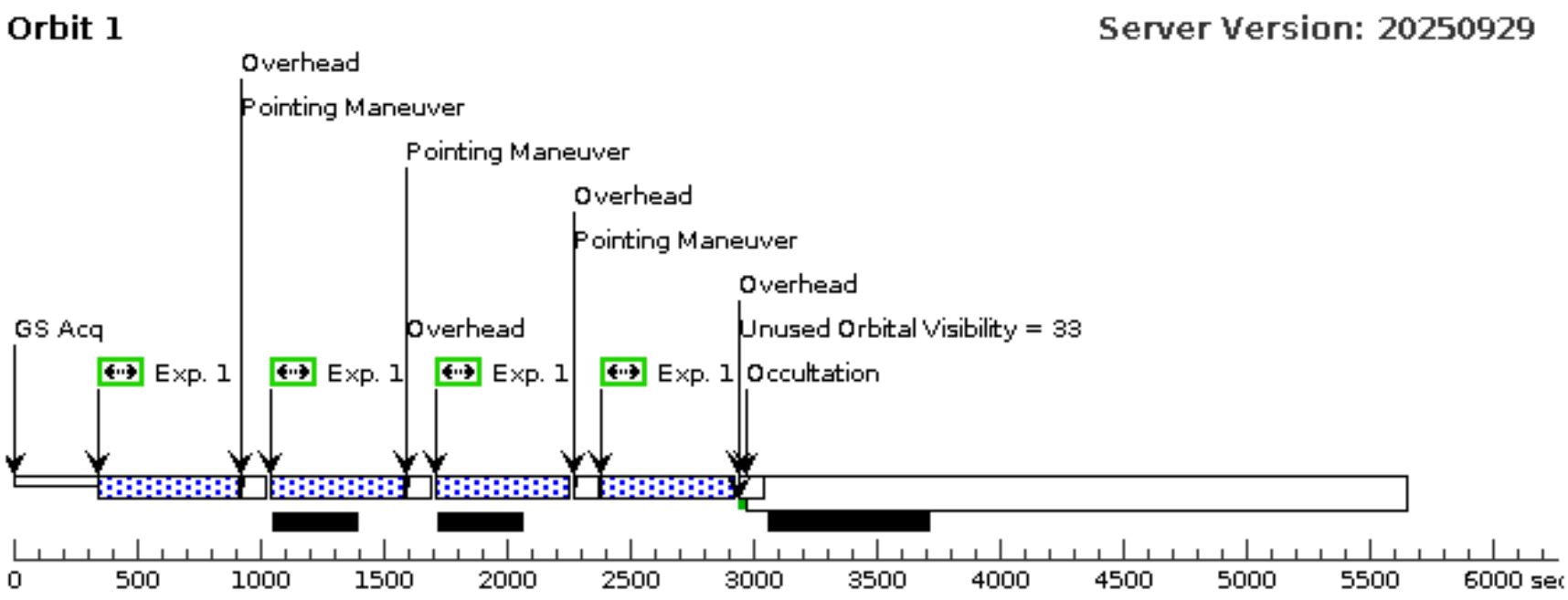
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J133907.13+131039.6	RA: 13 39 7.1409 (204.7797537d) Dec: +13 10 39.62 (13.17767d) Equinox: J2000	Epoch of Position: 2000	V=19.13 F_{\lambda} = 6.76 \times 10^{-17} erg cm^{-2} s^{-1} \AA^{-1} at 2750 \AA as measured by HST WFC3/UVIS G280 Grism Spectroscopy.	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, GRAVITATIONAL LENS, QUASAR]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Cycle 32 Visit 2 F275W (WFC3UVIS.im.1927144)	(1) SDSS-J133907.13+131039.6	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F275W	FLASH=21		Pattern 2, Exps 1-1 in Cycle 32 Visit 2 (02) (2)	540 Secs (2160 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17818, Cycle 32 Visit 3 (03), implementation Mon Dec 15 19:00:21 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 02 BY 42 D TO 52 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

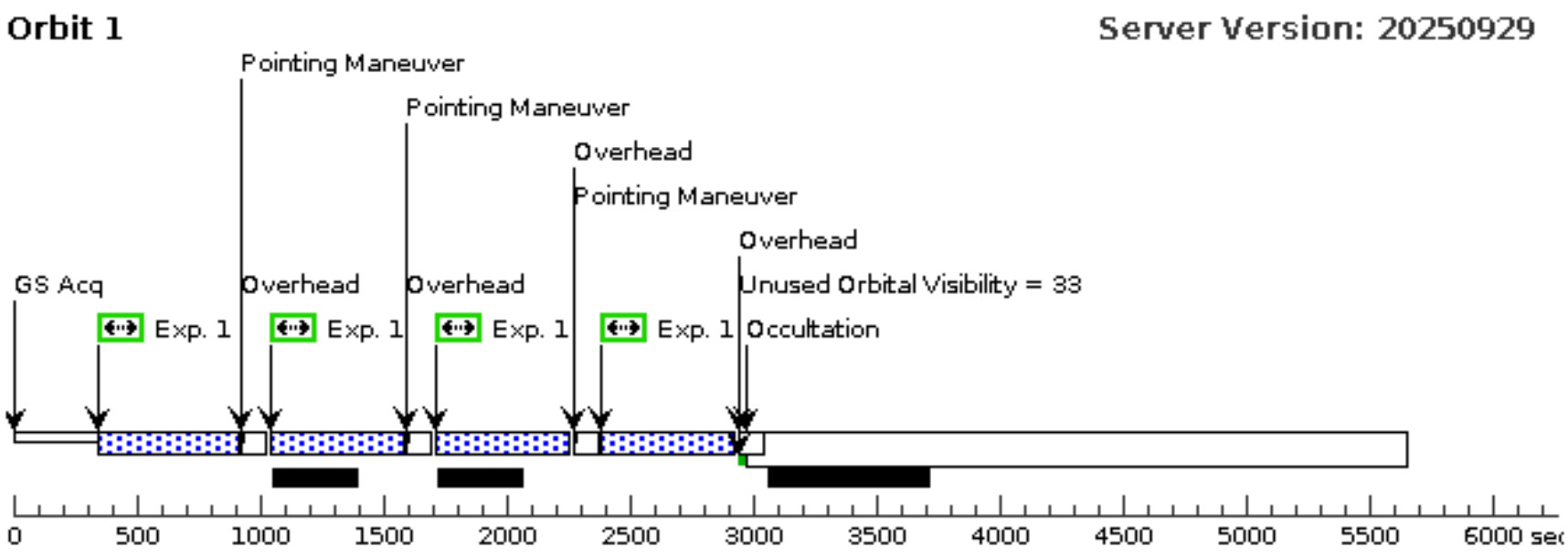
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J133907.13+131039.6	RA: 13 39 7.1409 (204.7797537d) Dec: +13 10 39.62 (13.17767d) Equinox: J2000	Epoch of Position: 2000	V=19.13 F_{\lambda} = 6.76 \times 10^{-17} erg cm^{-2} s^{-1} \AA^{-1} at 2750 \AA as measured by HST WFC3/UVIS G280 Grism Spectroscopy.	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, GRAVITATIONAL LENS, QUASAR]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Cycle 32 Visit 2 F275W (WFC3UVIS.im.1927144)	(1) SDSS-J133907.13+131039.6	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F275W	FLASH=21		Pattern 2, Exps 1-1 in Cycle 32 Visit 3 (03) (2)	540 Secs (2160 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17818, Cycle 32 Visit 4 (04), implementation Mon Dec 15 19:00:21 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 03 BY 42 D TO 52 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

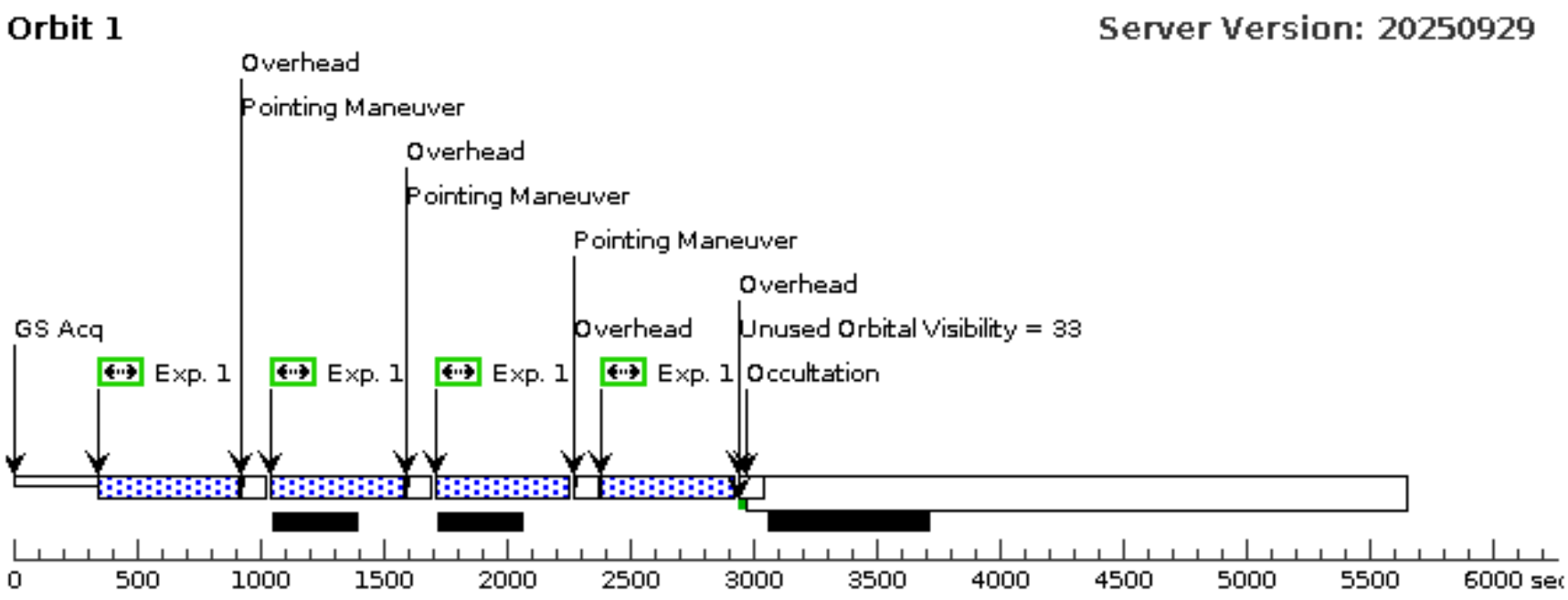
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J133907.13+131039.6	RA: 13 39 7.1409 (204.7797537d) Dec: +13 10 39.62 (13.17767d) Equinox: J2000	Epoch of Position: 2000	V=19.13 F_{\lambda} = 6.76 \times 10^{-17} erg cm^{-2} s^{-1} \AA^{-1} at 2750 \AA as measured by HST WFC3/UVIS G280 Grism Spectroscopy.	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, GRAVITATIONAL LENS, QUASAR]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(WFC3UVIS.im.1927144)	(1) SDSS-J133907.13+131039.6	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F275W	FLASH=21		Pattern 2, Exps 1-1 in Cycle 32 Visit 4 (04) (2)	540 Secs (2160 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17818, Cycle 32 Visit 5 (05), implementation Mon Dec 15 19:00:21 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 04 BY 42 D TO 52 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

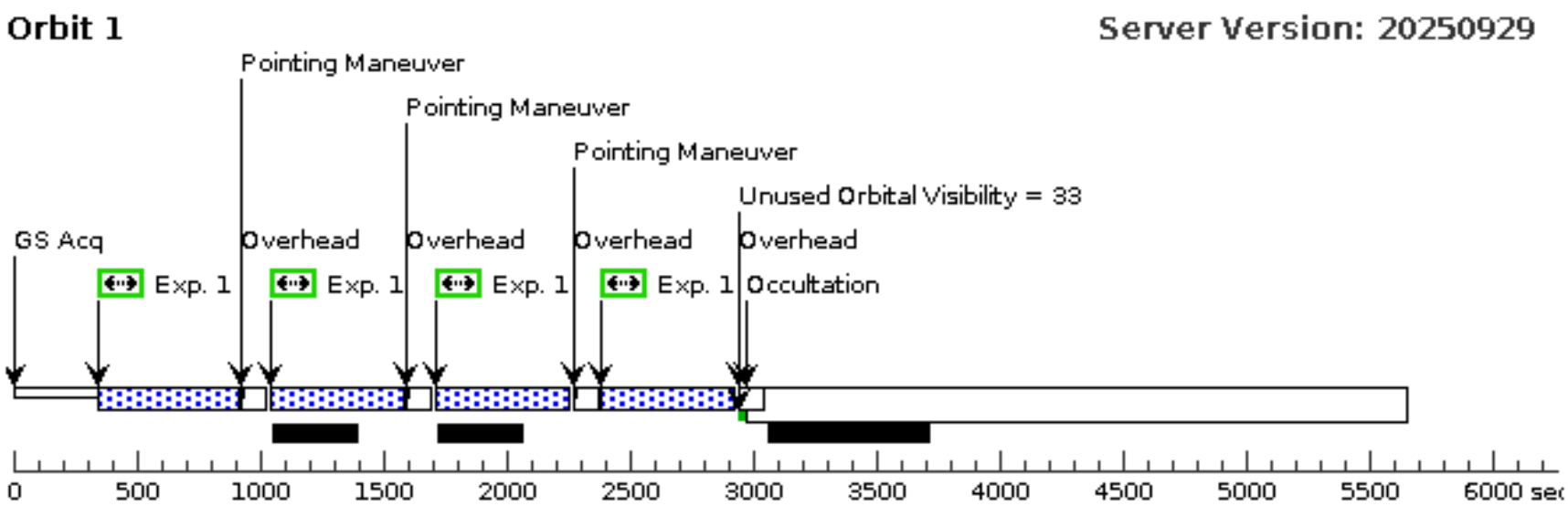
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J133907.13+131039.6	RA: 13 39 7.1409 (204.7797537d) Dec: +13 10 39.62 (13.17767d) Equinox: J2000	Epoch of Position: 2000	V=19.13 F_{\lambda} = 6.76 \times 10^{-17} erg cm^{-2} s^{-1} \AA^{-1} at 2750 \AA as measured by HST WFC3/UVIS G280 Grism Spectroscopy.	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, GRAVITATIONAL LENS, QUASAR]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Cycle 32 Visit 5 F275W (WFC3UVIS.im.1927144)	(1) SDSS-J133907.13+131039.6	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F275W	FLASH=21		Pattern 2, Exps 1-1 in Cycle 32 Visit 5 (05) (2)	540 Secs (2160 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17818, Cycle 32 Visit 6 (06), implementation Mon Dec 15 19:00:21 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 147D TO 148 D; AFTER 05 BY 42 D TO 52 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-J133907.13+131039.6	RA: 13 39 7.1409 (204.7797537d) Dec: +13 10 39.62 (13.17767d) Equinox: J2000	Epoch of Position: 2000	V=19.13 F_{\lambda} = 6.76 \times 10^{-17} erg cm^{-2} s^{-1} \AA^{-1} at 2750 \AA as measured by HST WFC3/UVIS G280 Grism Spectroscopy.	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, GRAVITATIONAL LENS, QUASAR]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Cycle 32 Visit 6 F275W (WFC3UVIS.im.1927144)	(1) SDSS-J133907.13+131039.6	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F275W	FLASH=21		Pattern 2, Exps 1-1 in Cycle 32 Visit 6 (06) (2)	540 Secs (2160 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure