17758 - Radio Jet-driven AGN Feedback in Dwarf Galaxies: A Pilot Study

Cycle: 32, Proposal Category: GO

(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) J0954+4717	ACS/WFC	1	22-Apr-2025 16:00:22.0	yes
02	(1) J0954+4717	STIS/CCD	3	22-Apr-2025 16:00:23.0	yes
03	(1) J0954+4717 CCDFLAT	STIS/CCD	3	22-Apr-2025 16:00:23.0	yes

7 Total Orbits Used

ABSTRACT

It is still under debate whether stellar feedback can effectively shape the evolution of dwarf galaxies as expected. There is growing evidence, both observational and theoretical, that feedback from active galactic nuclei (AGN) may also contribute to the evolution of dwarf galaxies. Indeed,

energetic outflows have been discovered in some dwarf galaxies with AGN, which can provide feedback to their dwarf hosts. In addition to such outflow-driven feedback, radio jet-driven feedback is the other one of the two fundamental forms of AGN feedback. Radio jet is also deemed an important mechanism for the launch of some powerful outflows. A close examination of the radio jet-related feedback is essential for a more comprehensive understanding of AGN feedback in dwarf galaxies. So here we propose to map the [O III]-emitting gas and examine radio jet-driven feedback and its relation to the rapid outflow in a dwarf galaxy with the most extended radio jet known in such systems, using high spatial resolution (~50 pc) ACS imaging and STIS long-slit spectroscopy. Our main objectives are: (1) characterize the role of the radio jet in driving the outflow; (2) examine the interaction between the radio jet and the interstellar medium; (3) obtain the dynamics of the outflow; (4) evaluate the overall impact from the radio jet and the outflow on the evolution of dwarf galaxies.

OBSERVING DESCRIPTION

Imaging: We will obtain a high-S/N ACS/WFC FR505N narrow band image for [O iii] 4959,5007 and an ACS/WFC F550M medium band image for the continuum on the red side of the [O iii] line. The FR505N filter is centered on 5150 A to put the redshifted [O iii] doublet in the high throughput window of the filter. The exposure time of the FR505N observation is calculated based on the best-fit [O iii] 4959,5007 doublet model to the Keck/KCWI spectrum extracted from a spaxel 0.5 away from the galaxy center (where the observed radio jet ends). The exposure time of the F550M observation is calculated based on the SDSS spectrum scaled to the flux level of the Keck/KCWI spectrum used above instead, since the Keck/KCWI spectrum does not cover the correct wavelength range. A target S/N of 30 for both observations will be adequate for a good quality [O iii] emission line-only map. The final exposure time requested are 2435 s and 635 s, respectively, and the two observations will be obtained in the same orbit.

Spectroscopy: We will also carry out STIS/G430M (4950-5236 A) and STIS/G750M (6482-7054 A) long-slit spectroscopy along the radio jet (see Fig. 3 of proposal for a sketch). The gratings are chosen to ensure a good spectral resolution (FWHM ~50 km/s) to fully resolve the emission line profiles (with overall FWHM of 100-200 km/s). The slit size is chosen to be 52" X 0.2", with the slit width comparable to the radio jet. The slit will be centered on the flux peak of the VLA continuum image.

The exposure time is calculated based on the same Keck/KCWI spectrum 0.5" away from the galaxy center and the SDSS spectrum scaled to the flux level of the Keck/KCWI spectrum for the G430M and G750M gratings, respectively. Based on our experience, the target S/N are ~4 per spatial pixel per spectral resolution element at the observed wavelength of Hbeta and [O i] 6300 emission line for the two gratings, respectively. The Hbeta and [O i] 6300 are the faintest lines we aim to observe in each grating, and the requested ex- posure time will thus allow for robust detections and

decomposition of all optical emission lines required to fulfill our science goals. A spatial binning of 1 is chosen to keep the finest spatial resolution. The final exposure time requested is ~9620s (or 3 orbits adopting anorbital visibility of 55 min) for each grating.

Target Acquisition: for the spectroscopy, we will use the standard STIS ACQ method
for an extended source with aperture F28X50LP, Gain=4, frame=1 and a spectrum template of Seyfert 2 NGC 1068 scaled to the r-band surface brightness of our target, 17.1 mag. arcsec^-2.

Visit

Proposal 17758, imaging (01), implementation Tue Apr 22 20:00:24 GMT 2025

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Diagnostics

(F505N_2 (01.003)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp filters as central wavelengths & transmission efficiencies vary within the apertures.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

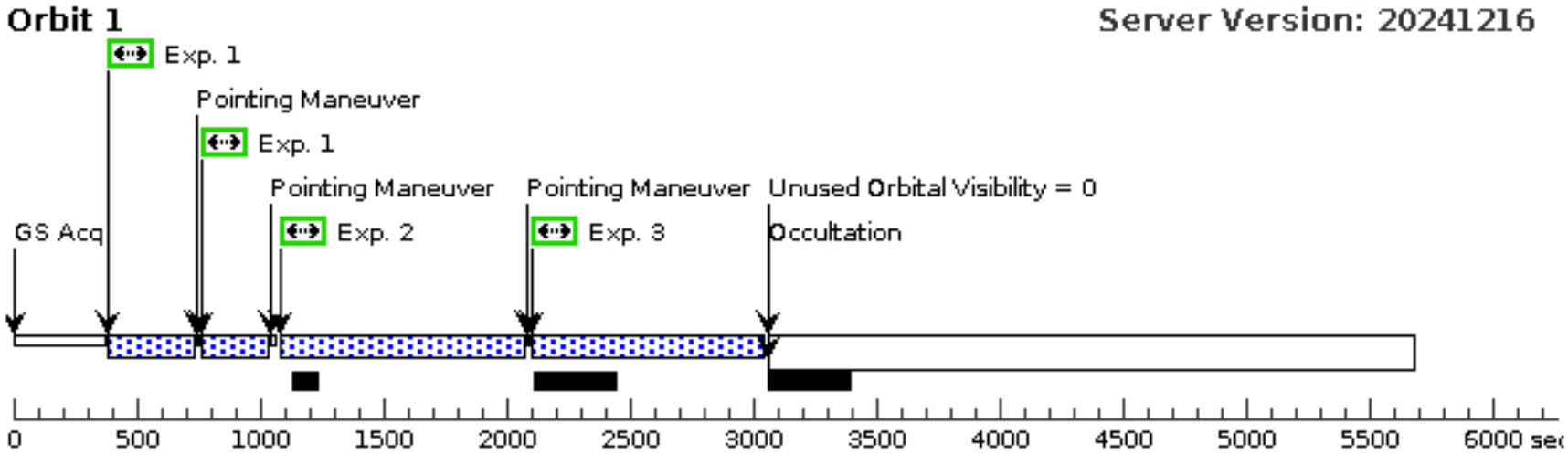
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J0954+4717	RA: 09 54 18.2150 (148.5758958d) Dec: +47 17 24.92 (47.29026d) Equinox: J2000	Proper Motion RA: 1.0118828057920067E-4 sec of time/yr Proper Motion Dec: 0.00148 arcsec/yr Epoch of Position: 2015.5	V=16.7	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SEYFERT]
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F550M (ACS.im.1862040)	(1) J0954+4717	ACS/WFC, ACCUM, WFC1B-1K	F550M			Pattern 5, Exps 1-1 in imaging (01) (5)	475 Secs (400 Secs) *[==>200 Secs (Pattern 1)]* *[==>200 Secs (Pattern 2)]*	***[1]***
2	F505N_1 (ACS.rf.1862037)	(1) J0954+4717	ACS/WFC, ACCUM, WFC1-MRAMP	FR505N 5150 A				1820 Secs (818 Secs) *[==>818.0 Secs]*	***[1]***
3	F505N_2 (ACS.rf.1862037)	(1) J0954+4717	ACS/WFC, ACCUM, WFC1-MRAMP	FR505N 5150 A		POS TARG 0.247,0.094		1820 Secs (817 Secs) *[==>817.0 Secs]*	***[1]***

Orbit Structure



Visit

Proposal 17758, Long-slit, G430M (02), implementation Tue Apr 22 20:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 311D TO 313 D

Fixed Targets

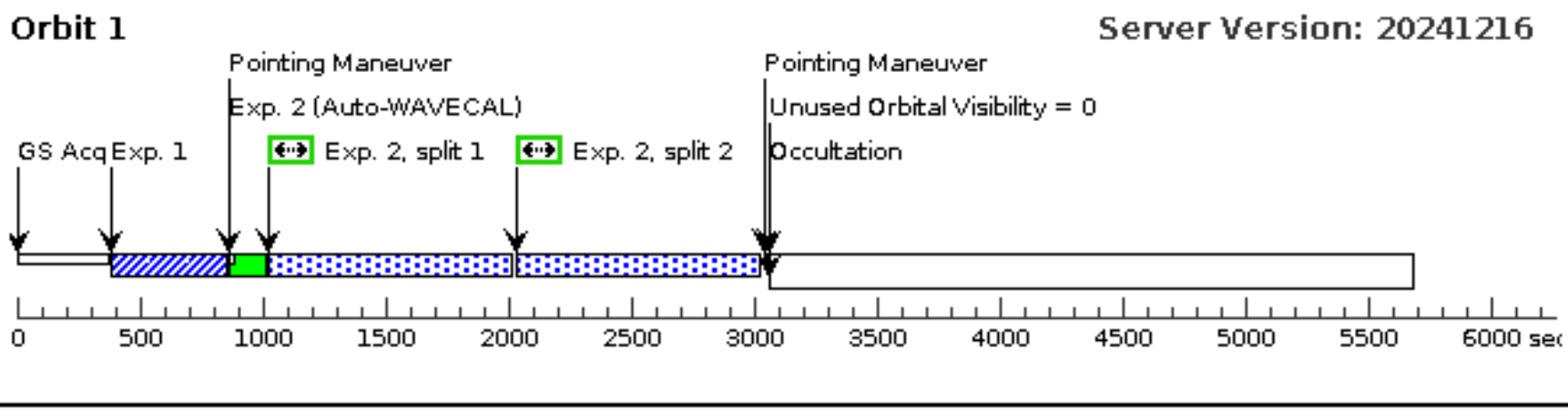
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J0954+4717	RA: 09 54 18.2150 (148.5758958d) Dec: +47 17 24.92 (47.29026d) Equinox: J2000	Proper Motion RA: 1.0118828057920067E-4 sec of time/yr Proper Motion Dec: 0.00148 arcsec/yr Epoch of Position: 2015.5	V=16.7	Reference Frame: ICRS

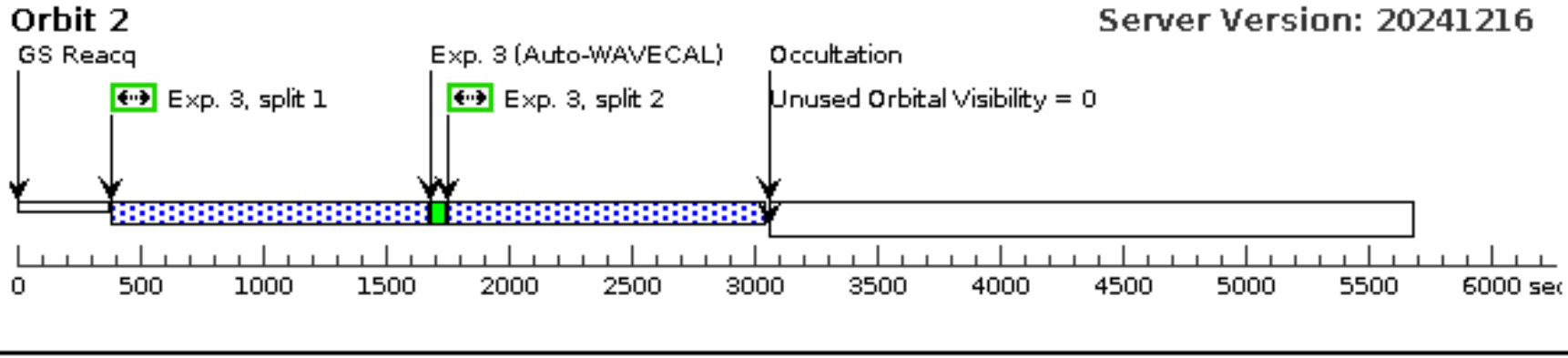
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SEYFERT]
Extended=YES

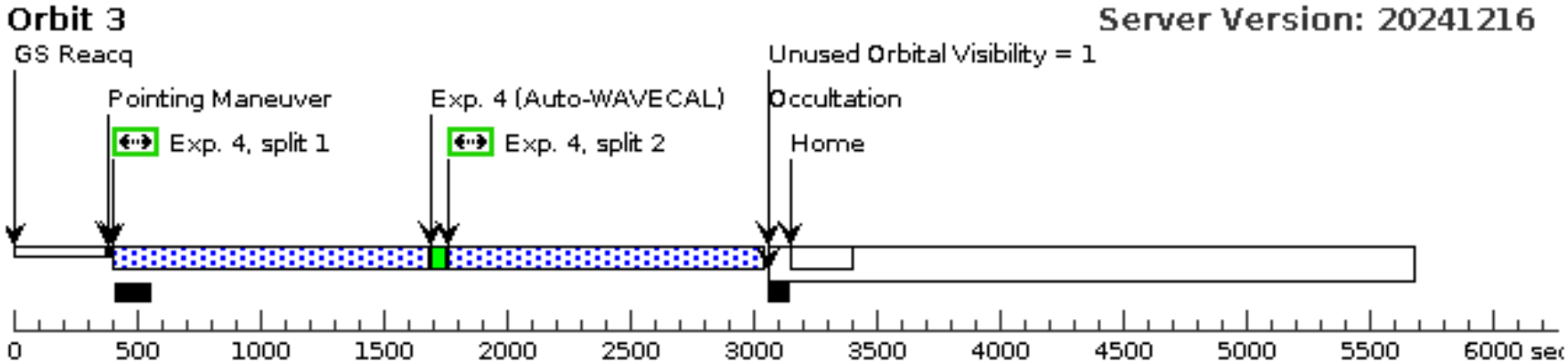
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq	(1) J0954+4717	STIS/CCD, ACQ, F28X50LP	MIRROR				60 Secs (60 Secs)	
								[==>]	***[1]***
2		(1) J0954+4717	STIS/CCD, ACCUM, 52X0.2E1	G430M 5093 A				1924 Secs (1924 Secs)	
								[==>(Split 1)] *[==>(Split 2)]*	***[1]***
3		(1) J0954+4717	STIS/CCD, ACCUM, 52X0.2E1	G430M 5093 A		POS TARG 0,-0.2285		2510 Secs (2510 Secs)	
								[==>(Split 1)] *[==>(Split 2)]*	***[2]***
4		(1) J0954+4717	STIS/CCD, ACCUM, 52X0.2E1	G430M 5093 A		POS TARG 0,-0.3808		2486 Secs (2486 Secs)	
								[==>(Split 1)] *[==>(Split 2)]*	***[3]***

Orbit Structure







Visit

Proposal 17758, Long-slit, G750M (03), implementation Tue Apr 22 20:00:24 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: SAME ORIENT AS 02

Fixed Targets

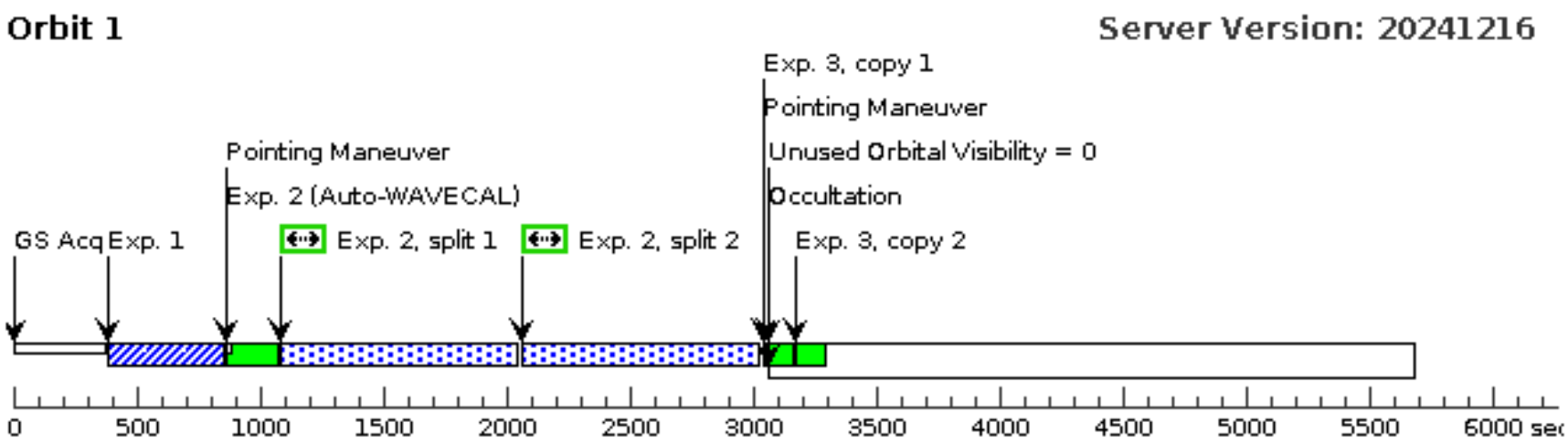
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	J0954+4717	RA: 09 54 18.2150 (148.5758958d) Dec: +47 17 24.92 (47.29026d) Equinox: J2000	Proper Motion RA: 1.0118828057920067E-4 sec of time/yr Proper Motion Dec: 0.00148 arcsec/yr Epoch of Position: 2015.5	V=16.7	Reference Frame: ICRS

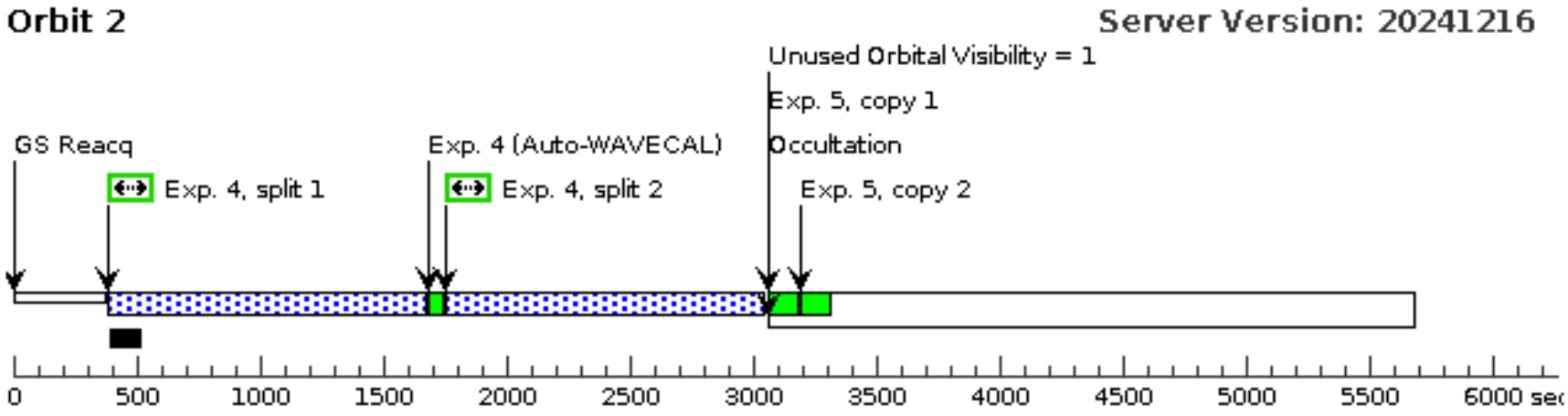
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[SEYFERT]
Extended=YES

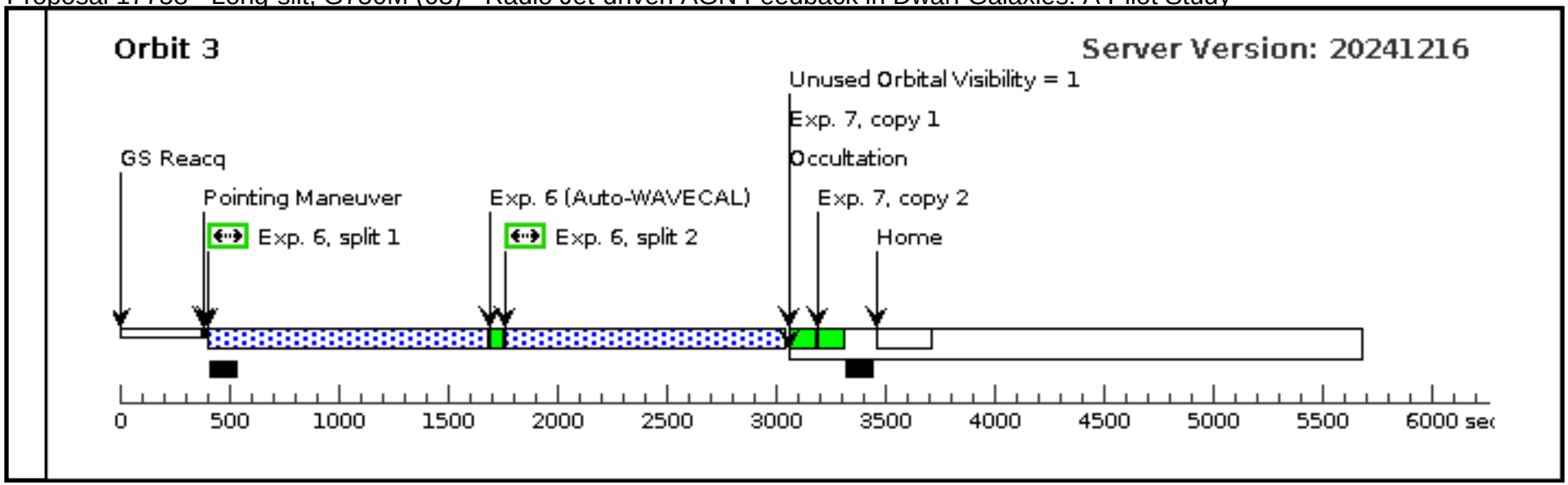
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	acq	(1) J0954+4717	STIS/CCD, ACQ, F28X50LP	MIRROR				60 Secs (60 Secs) *[==>]*	***[1]***
2	G750_1	(1) J0954+4717	STIS/CCD, ACCUM, 52X0.2E1	G750M 6768 A				1864 Secs (1864 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
3	ccdflat	CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750M 6768 A				45 Secs X 2 (90 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
4	G750_1	(1) J0954+4717	STIS/CCD, ACCUM, 52X0.2E1	G750M 6768 A		POS TARG 0,-0.2285		2506 Secs (2506 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
5	ccdflat	CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750M 6768 A				45 Secs X 2 (90 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
6	G750_1	(1) J0954+4717	STIS/CCD, ACCUM, 52X0.2E1	G750M 6768 A		POS TARG 0,-0.3808		2486 Secs (2486 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[3]***
7	ccdflat	CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750M 6768 A				45 Secs X 2 (90 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***

Orbit Structure



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Pointing Maneuver
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