



17485 - Dissecting Red geyser winds: low luminosity AGNs with large scale outflows in the ionized phase

Cycle: 31, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</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) SDSSJ090421.50+412854.2	WFC3/UVIS	3	17-Jun-2024 18:00:15.0	yes
02	(2) SDSSJ090421.50+412854.2-OFFSET	WFC3/UVIS	2	17-Jun-2024 18:00:16.0	yes
52	(2) SDSSJ090421.50+412854.2-OFFSET	WFC3/UVIS	1	17-Jun-2024 18:00:17.0	yes

6 Total Orbits Used

ABSTRACT

Spatially resolved optical spectroscopy from ground-based SDSS-MaNGA survey has recently discovered a new class of early-type galaxies - known as red geysers, that show signatures of large-scale active galactic nuclei (AGN) driven winds in the ionized gas phase. These are exciting candidates for black hole feedback driven by radiatively inefficient AGNs in quiescent galaxies. However, MaNGA's spatial resolution is relatively low (1-2

kpc), and is thus insufficient to probe the ionized winds close to the vicinity of the AGN. We propose a small program of 5 orbits to observe the ionized gas in a prototypical red geysers that is interacting with a companion galaxy using a combination of narrowband filters of the HST WFC3/UVIS instrument. This HST observation will be complemented by a large set of existing datasets from SDSS-MaNGA, Gemini GMOS, LOFAR (radio), and Keck ESI. Using HST, we will obtain an order-of-magnitude increase in the spatial resolution of ionized gas, traced by H-alpha, [OIII], [NII], and H-beta emission lines, using four narrowband filters. Our study will open a new window for studying low luminosity AGN-driven winds in early-type galaxies. We will be able to exploit the extremely high angular resolution of HST to probe length scales down to a few tens of pc zooming in close to the black hole, which is impossible to resolve using ground-based observations. The simultaneously large field of view will help us capture the complete picture of this fascinating interacting galaxy with winds. This study will serve as a pilot study on the red geysers sample, which will be supplemented in the future with additional objects with diverse characteristics.

OBSERVING DESCRIPTION

Our target

The main science goal of our proposal is to study outflowing ionized winds in a nearby ($z = 0.0245$) quiescent (Early type) galaxy called "red geysers". This galaxy hosts a Low luminosity AGN and shows large scale biconical outflows with ground-based IFU data from MaNGA survey. Using HST narrowband filters, we will be able to spatially resolve the outflow near the center with a resolution of 0.1" or equivalent.

choice of filters

We are proposing to observe a red geysers at $z=0.0245$ using WFC3-UVIS narrow-band and broadband imaging. We will use 4 NB filters FQ672N, F673N, FQ508N, and FQ492N which are uniquely suited to capture Ha, [NII], [OIII]5007, and Hb nebular emission lines at the redshift of our source. While FQ672N, FQ508N, and FQ492N quad filters suitably cover the wavelength range around the Ha, [OIII]5007 and Hbeta emission lines for our red geysers target, the F673N filter covers both Ha and [NII]6584. We will subtract the Ha (obtained from FQ672N) from the Ha+[NII] (obtained from F673N) to get the pure [NII] image.

The emission lines will trace the ionized gas properties. The filters are chosen such that the NB filters have bandpasses that span the range of

velocities we expect to observe in the lines. Among those 4 filters, the three quad Filters FQ672N, FQ508N, and FQ492N will be placed centered on the red geyser. But filter F673N has a larger field of view and will be placed enclosing both the red geyser and its companion galaxy. So, it will be placed at the optimal position between the red geyser and the companion galaxy. We will use broadband filters F775W and F475W to detect the stellar continuum that will enable continuum subtraction from emission line measurements.

exposure time

We want to observe the ionized gas in the nuclear region of our target with a sufficient angular resolution of 0.1" while simultaneously catching the low surface brightness emission in the outskirts at a radial distance > 5 kpc. Hence, to compute the exposure time, we aim for an emission line detection per resolution element with a minimum signal to noise of 3 at a ~ 5 kpc radial distance from the center. We estimate exposure times based on existing integral

field spectroscopy from MaNGA data. Based on MaNGA data, the average Ha (integrated line) flux from our target within an aperture of diameter 3" at a radial distance of 4 kpc from the center is 8×10^{-16} ergs/s/cm²/arcsec².

Using the ETC, we find that the exposure time needed

to detect a single Ha line within an extraction aperture of 0.1" at a radial distance of 5 kpc using WFC3 at an S/N

~ 3 is 43 minutes. This will give us S/N > 12 per pixel within the central 2 kpc * 2kpc region. To increase the S/N ratio for regions with inadequate flux,

particularly towards the outskirts, we will adopt optimal Voronoi binning.

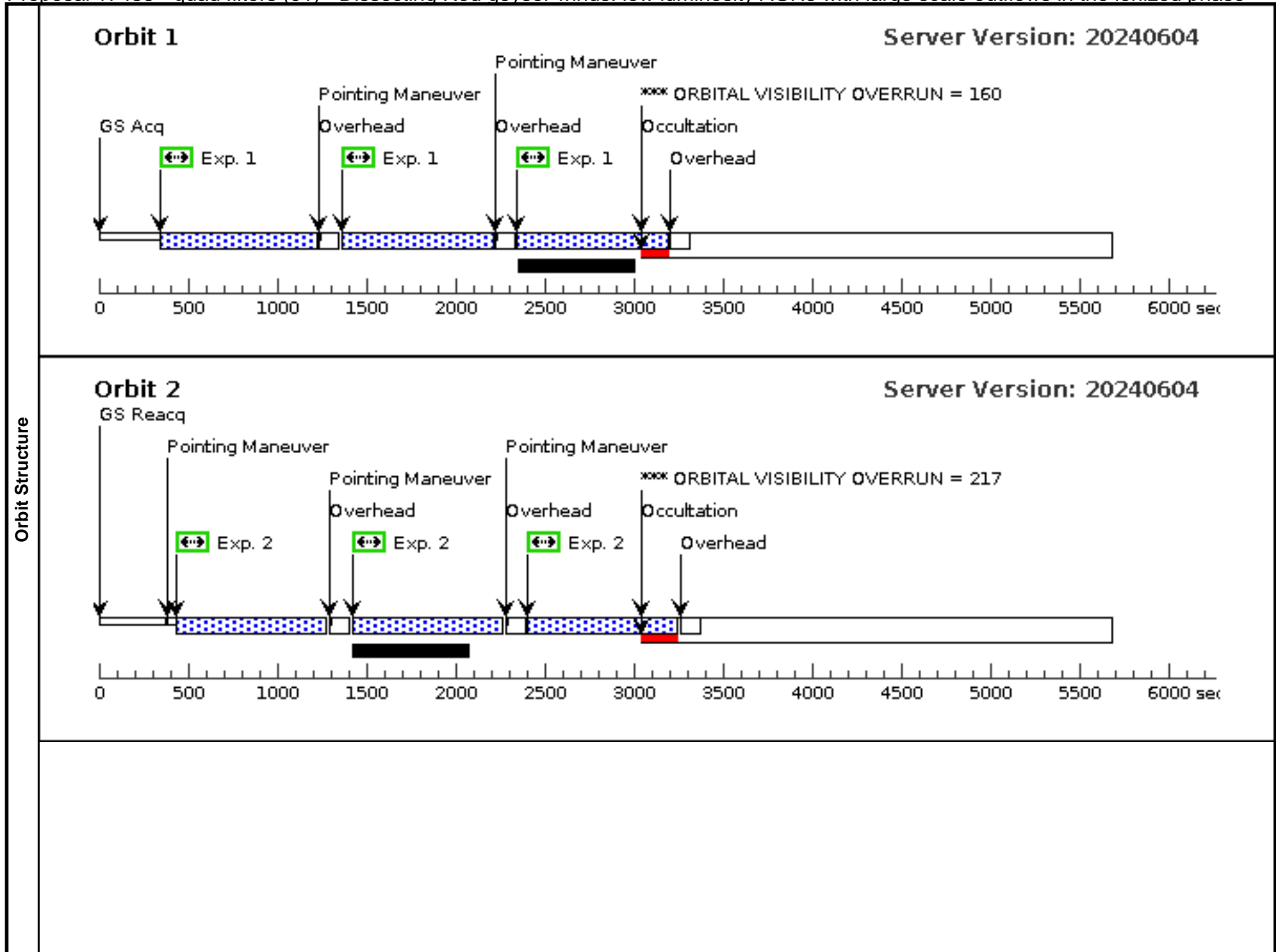
We request 3 exposures / dithers for each narrowband filter for robust cosmic-ray removal. Including overheads, this amount to 1 orbit being requested per narrowband filter. Additionally, We will split 1 orbit between the two broadband filters. For the 2 broadband filters, we will use a 2-point dither pattern. Thus, This gives a total of 5 orbits for the complete set of narrow- and wide-band images for our red geyser.

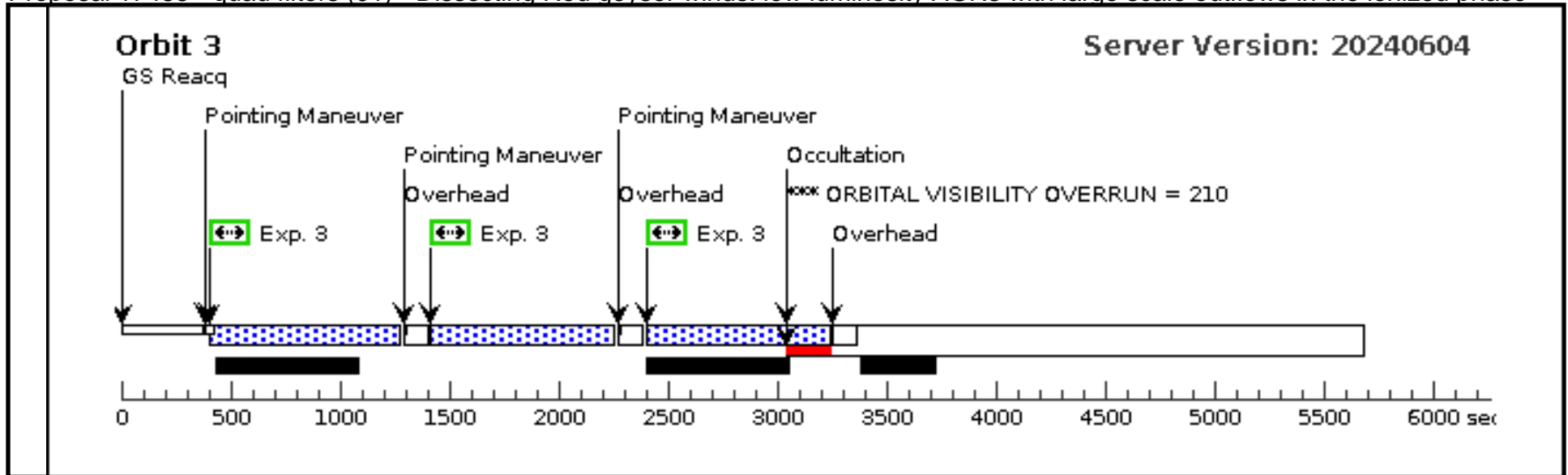
Reduction of gyros will have no effect on our program.

Proposal 17485 - quad filters (01) - Dissecting Red geyser winds: low luminosity AGNs with large scale outflows in the ionized phase

Mon Jun 17 22:00:17 GMT 2024

Visit	Proposal 17485, quad filters (01), completed Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Diagnosics (quad filters (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (quad filters (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (quad filters (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (FQ672N (01.001)) Warning (Form): POS TARG & PATTERN should be used carefully with WFC3 quad filters to avoid placing the target on the vignetted part of the field of view or moving it to another quadrant. (FQ508N (01.002)) Warning (Form): POS TARG & PATTERN should be used carefully with WFC3 quad filters to avoid placing the target on the vignetted part of the field of view or moving it to another quadrant. (FQ492N (01.003)) Warning (Form): POS TARG & PATTERN should be used carefully with WFC3 quad filters to avoid placing the target on the vignetted part of the field of view or moving it to another quadrant.									
Patterns	#	Primary Pattern		Secondary Pattern	Exposures					
	(1)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2), (3)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SDSSJ090421.50+412854.2	RA: 09 04 21.4844 (136.0895183d) Dec: +41 28 54.12 (41.48170d) Equinox: J2000		V=(?) u = 17.04, g = 15.12, r = 14.17, i = 13.67, z = 13.37	Reference Frame: ICRS				
Comments: Category=GALAXY Description=[ELLIPTICAL, INTERACTING GALAXY, LINER, WIND] Extended=YES										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	FQ672N	(1) SDSSJ090421.50+412854.2	WFC3/UVIS, ACCUM, UVIS-QUAD-FIX	FQ672N	FLASH=15		Pattern 1, Exps 1-1 in quad filters (01) (1)	849 Secs (2547 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	2	FQ508N	(1) SDSSJ090421.50+412854.2	WFC3/UVIS, ACCUM, UVIS-QUAD-FIX	FQ508N	FLASH=15		Pattern 1, Exps 2-2 in quad filters (01) (1)	847 Secs (2541 Secs)	
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[2]	
3	FQ492N	(1) SDSSJ090421.50+412854.2	WFC3/UVIS, ACCUM, UVIS-QUAD-FIX	FQ492N	FLASH=15		Pattern 1, Exps 3-3 in quad filters (01) (1)	847 Secs (2541 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[3]	





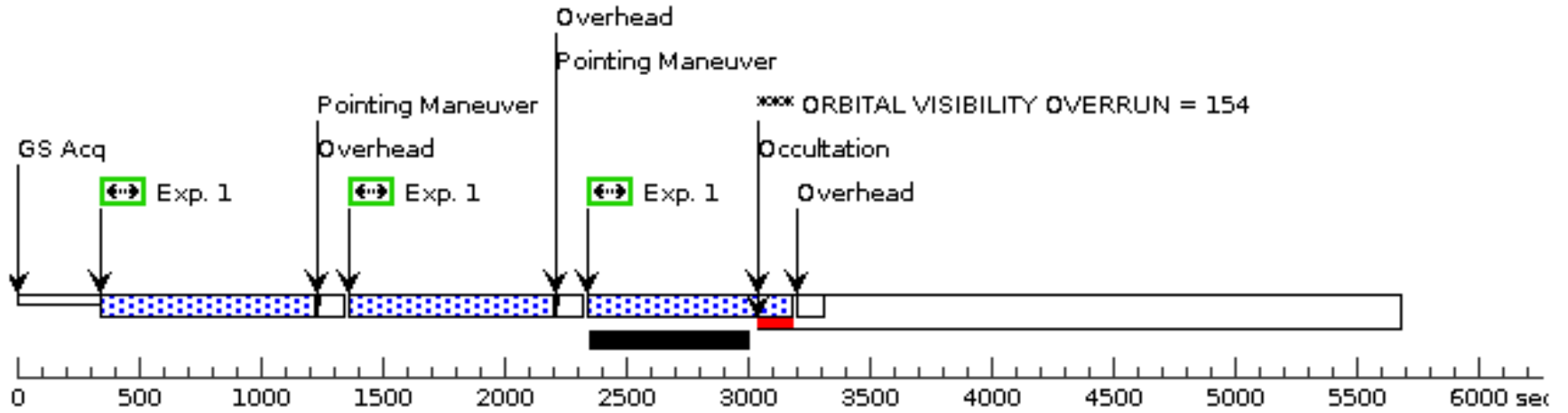
Proposal 17485 - broadband filters (02) - Dissecting Red geyser winds: low luminosity AGNs with large scale outflows in the ionized p...

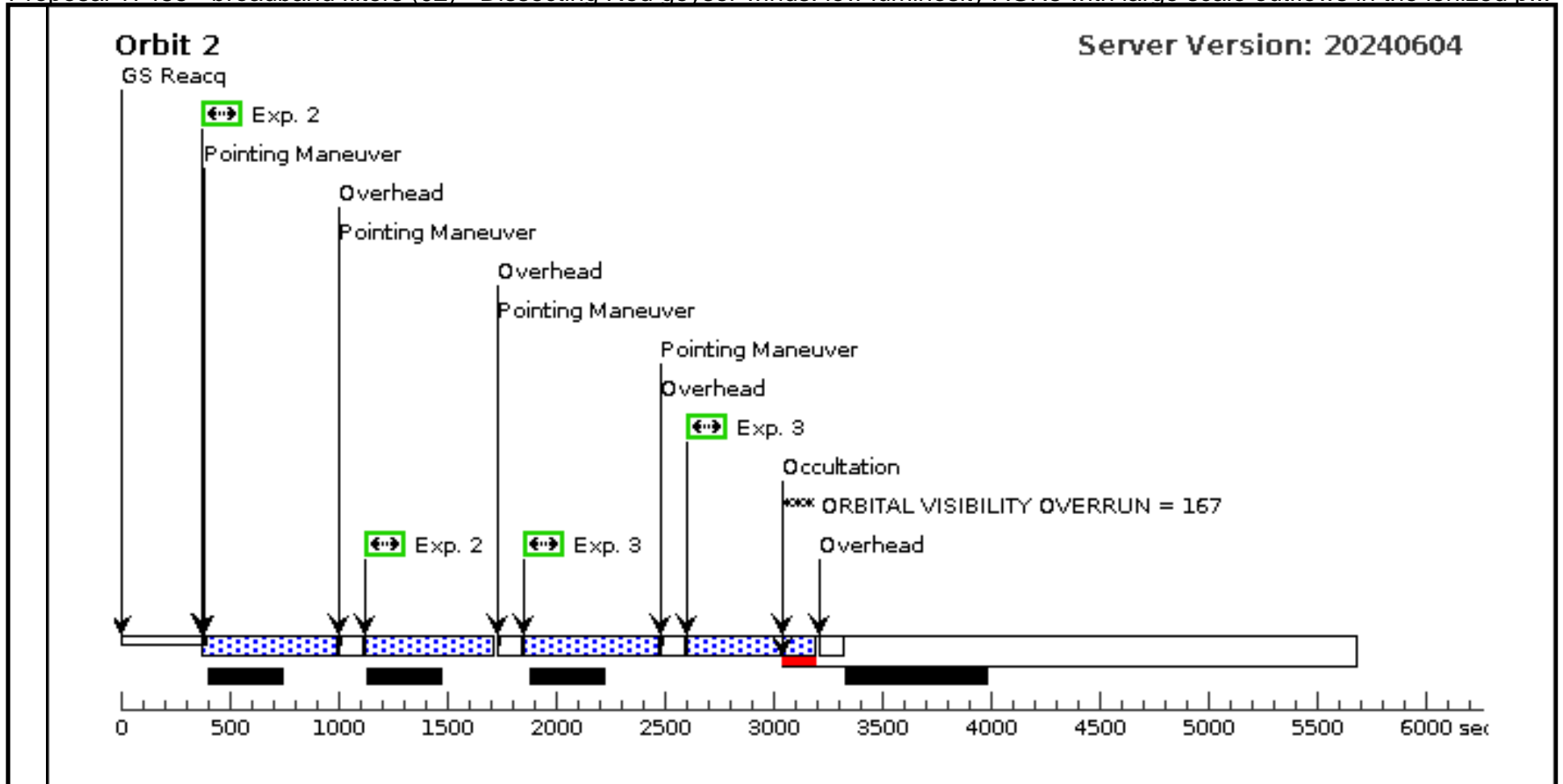
Mon Jun 17 22:00:17 GMT 2024

Visit	Proposal 17485, broadband filters (02), failed Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: (none)										
	(broadband filters (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (broadband filters (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN										
Diagnos											
Patterns	#	Primary Pattern				Secondary Pattern				Exposures	
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false								(1)	
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false								(2), (3)		
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	SDSSJ090421.50+412854.2-OFFSET	RA: 09 04 24.7000 (136.1029167d) Dec: +41 28 52.90 (41.48136d) Equinox: J2000				V=(?) u = 17.04, g = 15.12, r = 14.17, i = 13.67, z = 13.37		Reference Frame: ICRS		
Comments: Category=GALAXY Description=[ELLIPTICAL, INTERACTING GALAXY, LINER, TIDAL TAIL, WIND] Extended=YES											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F673N	(2) SDSSJ090421.50+412854.2-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 1, Exps 1-1 in broadband filters (02) (1)	847 Secs (2541 Secs)		
									[=>(Pattern 1)]		[1]
									[=>(Pattern 2)]		
2	F775W	(2) SDSSJ090421.50+412854.2-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F775W	FLASH=9		Pattern 2, Exps 2-2 in broadband filters (02) (2)	595 Secs (1190 Secs)			
								[=>(Pattern 1)]		[2]	
								[=>(Pattern 2)]			
3	F475W	(2) SDSSJ090421.50+412854.2-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F475W	FLASH=8		Pattern 2, Exps 3-3 in broadband filters (02) (2)	595 Secs (1190 Secs)			
								[=>(Pattern 1)]		[2]	
								[=>(Pattern 2)]			

Orbit 1

Server Version: 20240604





Proposal 17485 - broadband filter repeat (52) - Dissecting Red geyser winds: low luminosity AGNs with large scale outflows in the ion...

Mon Jun 17 22:00:17 GMT 2024

Visit	Proposal 17485, broadband filter repeat (52), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: (none) <i>Comments: Repeat of Exposure ID IF7Y02010 corresponding to visit 02. Three sub-exposures with Filter F673N.</i>									
Patterns	#	Primary Pattern		Secondary Pattern	Exposures					
	(1)	Pattern Type=WFC3-UVIS-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false			(1)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	SDSSJ090421.50+412854.2-OFFSET	RA: 09 04 24.7000 (136.1029167d) Dec: +41 28 52.90 (41.48136d) Equinox: J2000		V=(?) u = 17.04, g = 15.12, r = 14.17, i = 13.67, z = 13.37	Reference Frame: ICRS				
<i>Comments: Category=GALAXY Description=[ELLIPTICAL, INTERACTING GALAXY, LINER, TIDAL TAIL, WIND] Extended=YES</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F673N	(2) SDSSJ090421.50+412854.2-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N	FLASH=15		Pattern 1, Exps 1-1 in broadband filter repeat (52) (1)	795 Secs (2385 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[1]
Orbit Structure	Orbit 1 Server Version: 20240604									