



17197 - Proper Motions of Extragalactic Jets with HST: A New Epoch

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) 3C15	ACS/WFC	1	18-Jun-2024 17:00:30.0	yes
02	(2) 3C78	ACS/WFC	1	18-Jun-2024 17:00:31.0	yes
03	(3) 3C66B	ACS/WFC	1	18-Jun-2024 17:00:32.0	yes
04	(4) 3C371	ACS/WFC	1	18-Jun-2024 17:00:32.0	yes
06	(5) 0521-365	ACS/WFC	1	18-Jun-2024 17:00:33.0	yes
07	(6) 3C346	ACS/WFC	1	18-Jun-2024 17:00:34.0	yes
08	(7) 4C04.77	ACS/WFC	1	18-Jun-2024 17:00:35.0	yes

7 Total Orbits Used

ABSTRACT

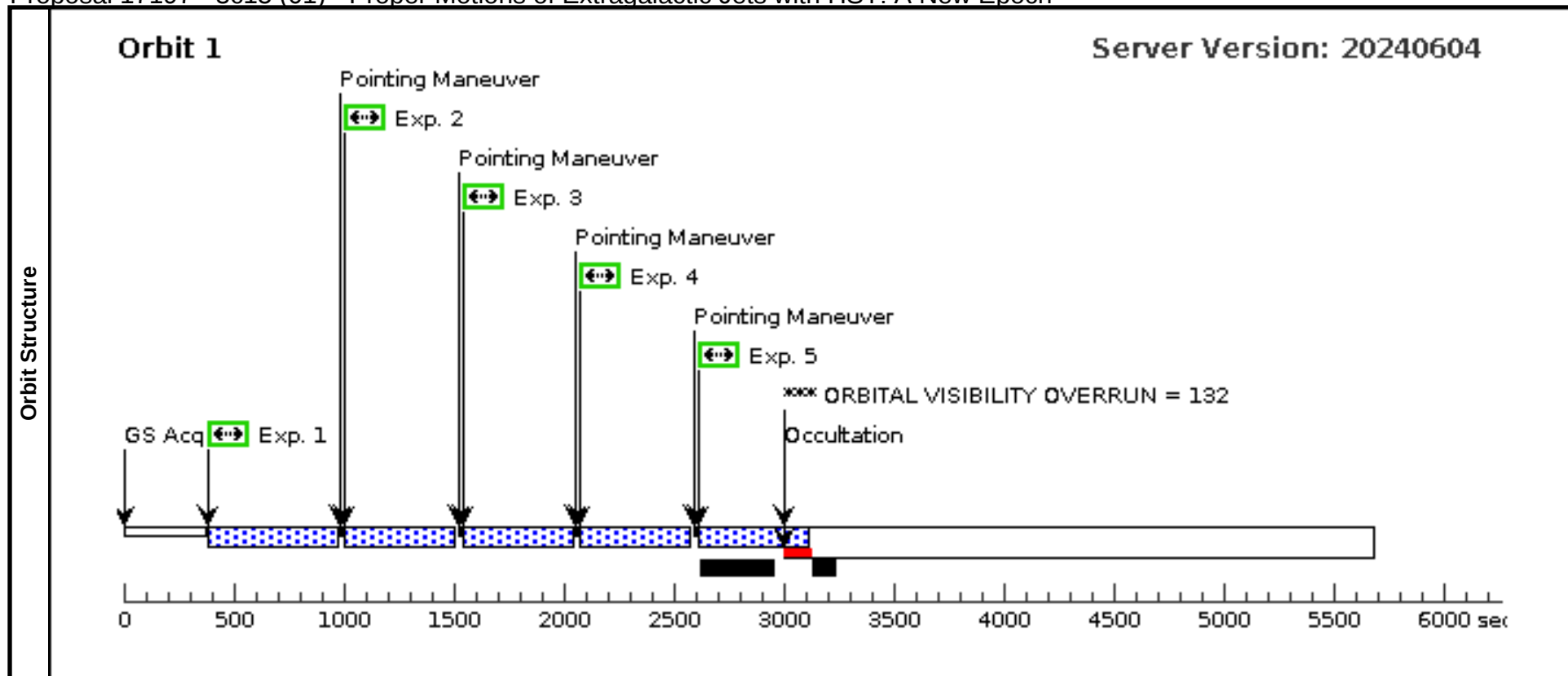
While we have long known that jets from super-massive black holes exhibit highly relativistic speeds on parsec scales from radio interferometry, it is not generally known how the jet evolves on kpc to Mpc scales, where the jet leaves the host galaxy and begins to interact with the intergalactic medium, with implications for our understanding of jet structure and quantifying the energy carried by the jet into the external environment. With the development of state-of-the-art astrometry techniques and new data from the Gaia mission, it is now possible register images of nearby jets first observed by HST in the 1990s to extremely high precision, reaching accuracies on proper motions of better than 0.3 mas/year. This enabled the dramatic finding of colliding superluminal knots in the jet of 3C264 and helical motions of plasma on kpc scales in M87. We propose a new epoch on the 7 remaining nearby optical jets which have been previously observed by HST for proper motions. This sample is an extremely unique one, and only HST can provide the precision astrometry and sensitivity needed to track the motion of plasma in jets on kpc scales.

OBSERVING DESCRIPTION

This is a proposal to observe 7 optical jets previously discovered by HST, for the purpose of detecting proper motions of the plasma in the jet. As these have been previously observed by HST in the same instrument/filter, it is a relatively straightforward program. In most cases, the jet is a relatively faint, extended structure on several-arcsecond scales, extending out from a bright central AGN (the 'core'). For all visits, we use ORIENT constraints so that any potential diffraction spikes from the central AGN (or other nearby bright sources) will not run over the faint jet. Subarrays are used to enable shorter exposures which will reduce the likelihood of core saturation.

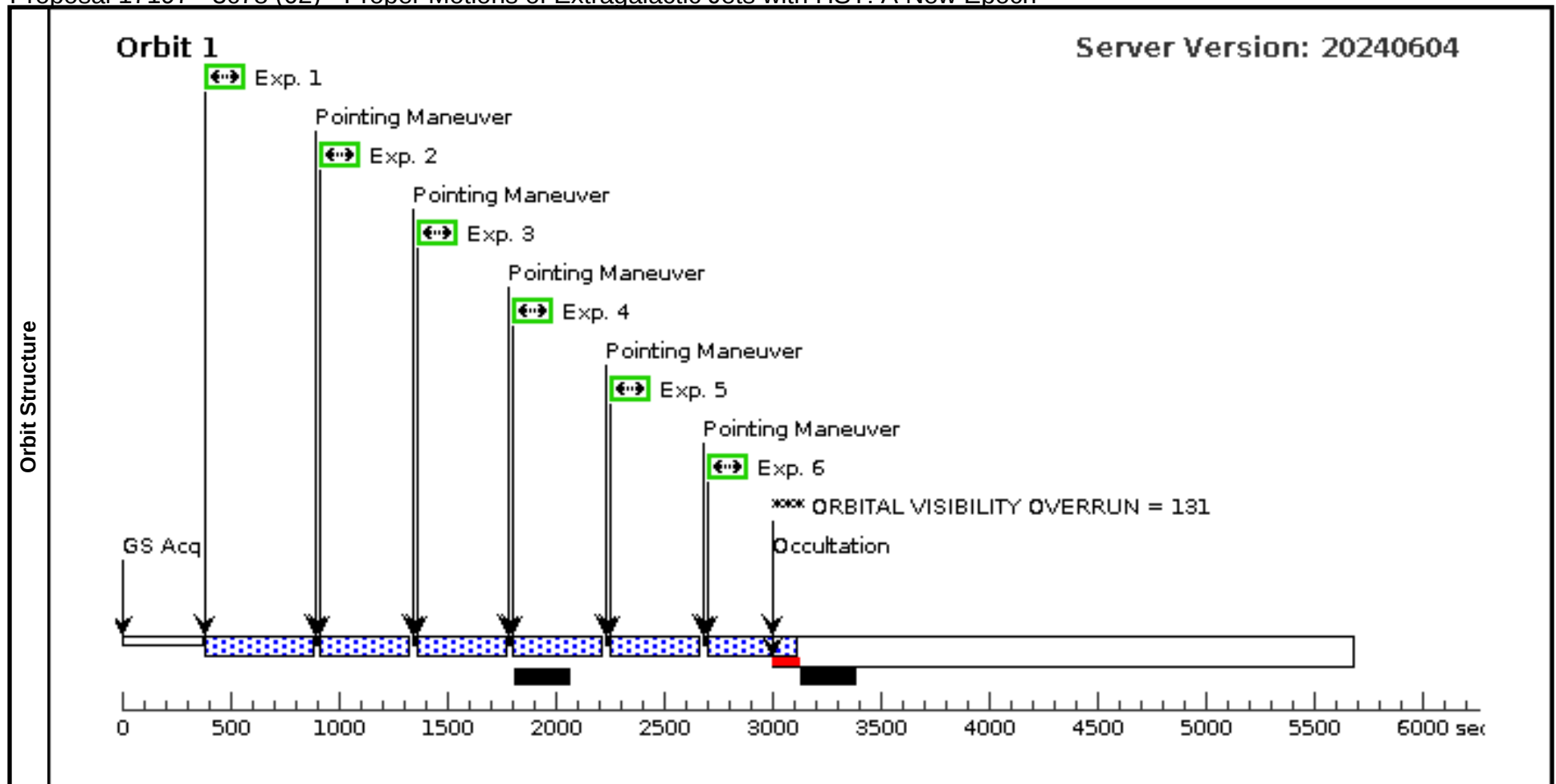
Proposal 17197 - 3c15 (01) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, 3c15 (01), completed										Tue Jun 18 21:00:35 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: ACS/WFC											
	Special Requirements: ORIENT 5D TO 40 D; ORIENT 195D TO 210 D; ORIENT 285D TO 305 D; ORIENT 87D TO 115 D											
	Comments: 3C 15 is an optical jet hosted by an elliptical galaxy. We have used orient constraints to ensure no diffraction spikes from the core and another nearby bright source overrun the jet.											
Diagnostics	(3c15 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	3C15	RA: 00 37 4.1110 (9.2671292d) Dec: -01 09 8.40 (-1.15233d) Equinox: J2000		Epoch of Position: 2015.5		V=16		Reference Frame: SIMBAD			
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.											
	Category=GALAXY											
	Description=[DISK, JET, QUASAR, RADIO GALAXY]											
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1		(1) 3C15	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 20,20		380 Secs (380 Secs)		
										[==>]		[1]
	2		(1) 3C15	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 20.1591 4,20.23969		380 Secs (380 Secs)		
										[==>]		[1]
	3		(1) 3C15	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 20.3164 1,20.08319		380 Secs (380 Secs)		
										[==>]		[1]
4		(1) 3C15	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 20.0799 0,20.19413		380 Secs (380 Secs)			
									[==>]		[1]	
5		(1) 3C15	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 20.2877 1,20.28896		380 Secs (380 Secs)			
									[==>]		[1]	



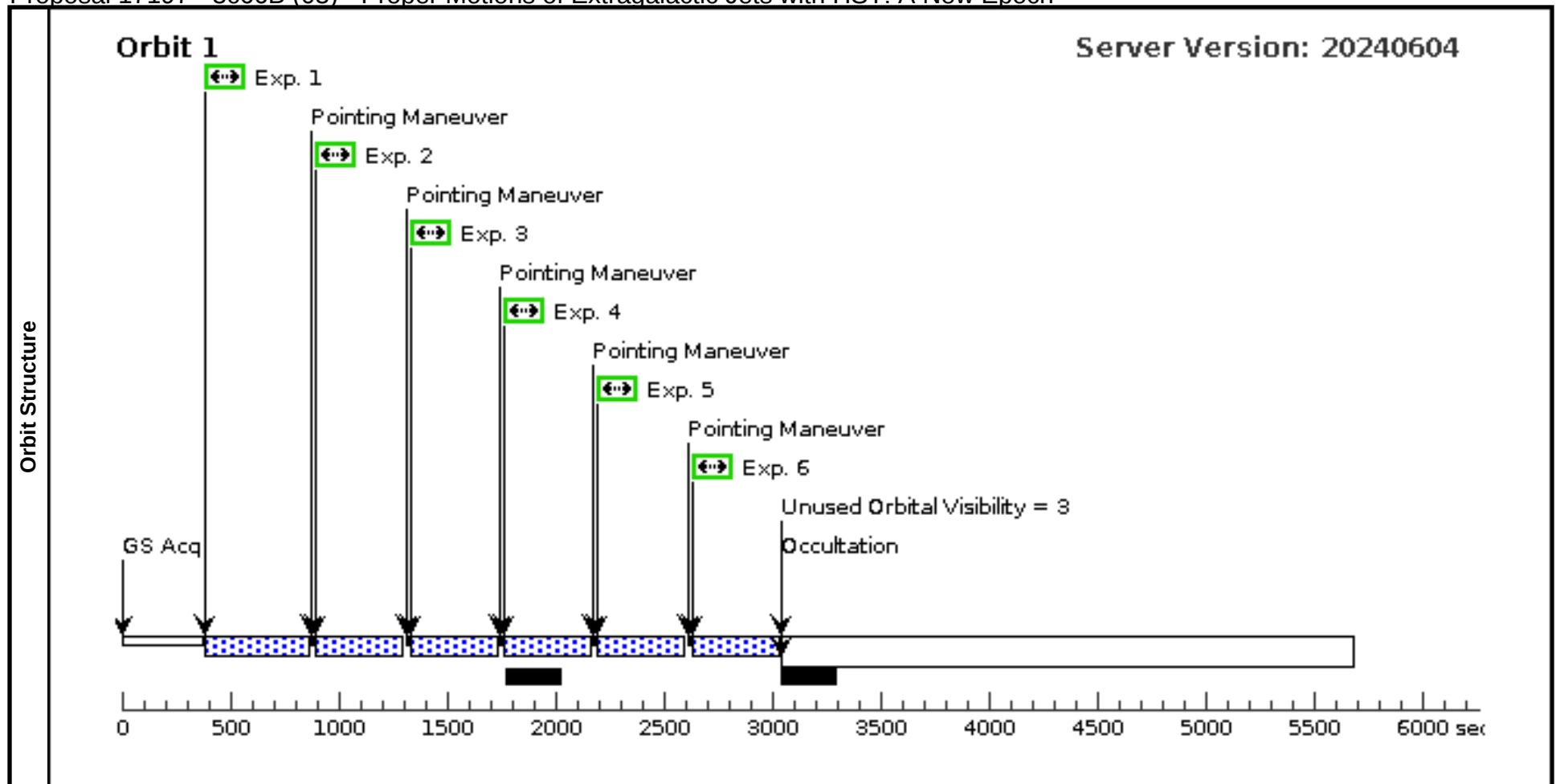
Proposal 17197 - 3c78 (02) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, 3c78 (02), completed										Tue Jun 18 21:00:35 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: ACS/WFC											
	Special Requirements: ORIENT 0D TO 15 D; ORIENT 85D TO 105 D; ORIENT 170D TO 195 D; ORIENT 272D TO 280 D											
Comments: The target is an optical jet hosted by a Vmag=13.8 elliptical galaxy. The field is relatively empty with no major nearby bright sources to require any special considerations. Orent constraints are specified to ensure that the bright core of the galaxy does not produce any saturation spikes which could over run the jet. We are using a subarray to enable shorter exposures to reduce saturation in the bright core.												
Diagnostics	(3c78 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	3C78	RA: 03 08 26.2231 (47.1092629d) Dec: +04 06 39.31 (4.11092d) Equinox: J2000			Epoch of Position: 2015.5		V=16		Reference Frame: SIMBAD		
	Comments: Reported V-mag is roughly extrapolated from the Gaia magnitude, which should mainly be from the central nuclear/core region. Total galaxy magnitude is much brighter, at 13.8.											
	Category=GALAXY Description=[JET, KNOT, QUASAR, RADIO GALAXY]											
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1		(2) 3C78	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0,0		290 Secs (290 Secs)		
										[==>]		[1]
	2		(2) 3C78	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.20646, 0.14754		290 Secs (290 Secs)		
										[==>]		[1]
	3		(2) 3C78	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.41257, 0.24554		290 Secs (290 Secs)		
										[==>]		[1]
	4		(2) 3C78	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.12505, 0.34768		290 Secs (290 Secs)		
										[==>]		[1]
	5		(2) 3C78	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.33111, 0.42753		290 Secs (290 Secs)		
										[==>]		[1]
	6		(2) 3C78	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.53746, 0.56020		290 Secs (290 Secs)		
									[==>]		[1]	



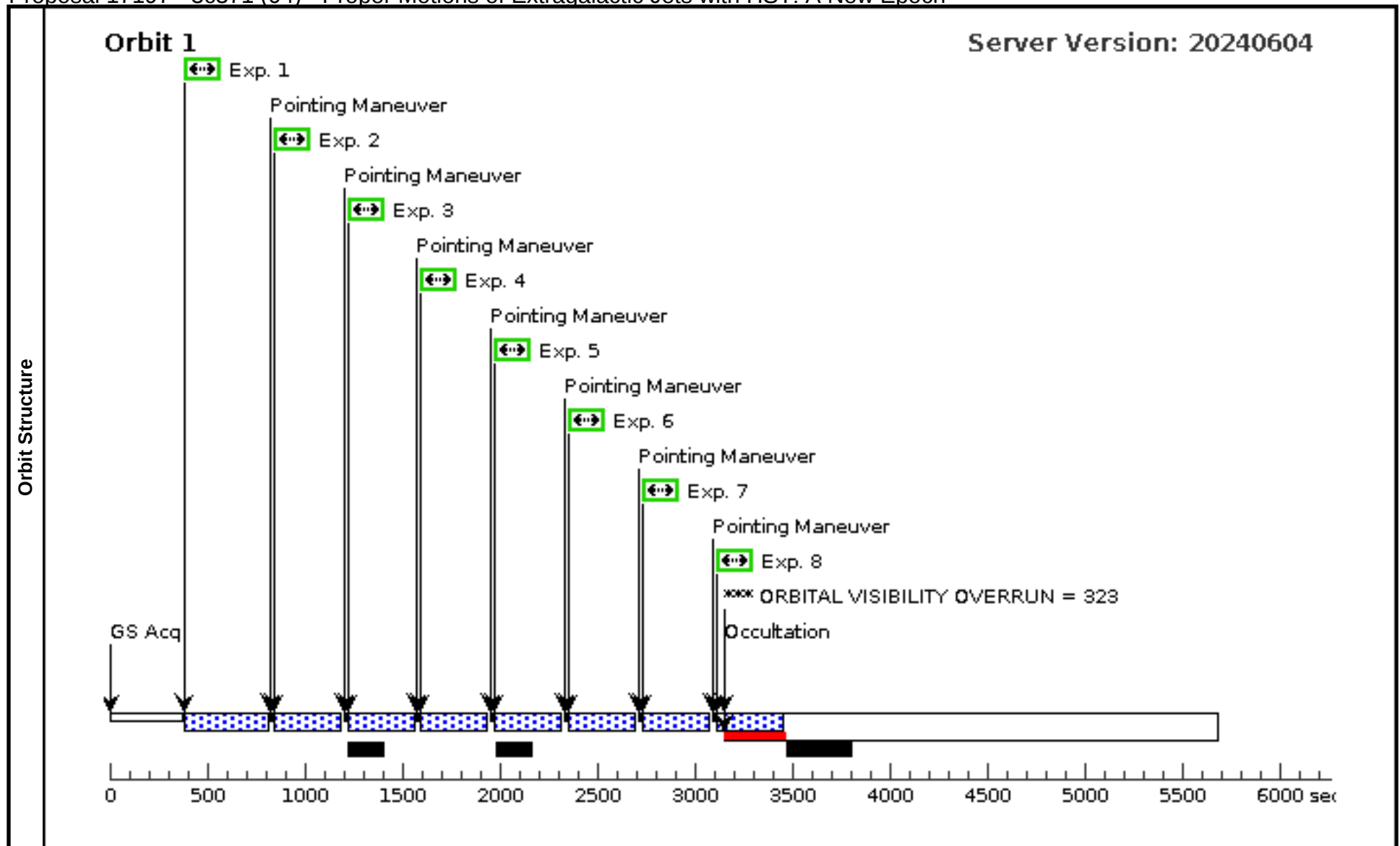
Proposal 17197 - 3c66B (03) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, 3c66B (03), implementation						Tue Jun 18 21:00:35 GMT 2024			
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: ACS/WFC									
	Special Requirements: ORIENT 0D TO 22 D; ORIENT 103D TO 115 D; ORIENT 180D TO 205 D; ORIENT 275D TO 285 D									
	Comments: The appearance of the target in the optical is mainly dominated by the host elliptical galaxy which is moderately bright (Vmag=15). The jet itself runs to the northwest (PA approx 45 deg N->W) and is about 10" arcseconds long. The main difficulties for the observation are two very bright, somewhat nearby sources -- one about 80" directly north (Vmag=9) and one about 80" south (Vmag=11.65). The orient ranges are specified to completely avoid having the brighter source on the WFC1 detector (where our target lies). In addition, we avoid roll angles where either the core of the host galaxy for our jet OR the Vmag=11.65 source to the south could possibly produce saturation spikes which would overrun the jet. We also avoid angles where bright sources would land at the edge of the detectors. Overall the field is crowded with bright sources, so we have opted for relatively short exposures (~ 300 seconds).									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	3C66B	RA: 02 23 11.4112 (35.7975467d) Dec: +42 59 31.38 (42.99205d) Equinox: J2000	Epoch of Position: 2015.5	V=16	Reference Frame: SIMBAD				
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=GALAXY Description=[DISK, JET, KNOT, QUASAR, RADIO GALAXY]										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) 3C66B	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 0,0		305 Secs (275 Secs)	
									[==>275.0 Secs]	[1]
	2		(3) 3C66B	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 0.20646, 0.14754		305 Secs (275 Secs)	
									[==>275.0 Secs]	[1]
	3		(3) 3C66B	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 0.41257, 0.24554		305 Secs (275 Secs)	
									[==>275.0 Secs]	[1]
	4		(3) 3C66B	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 0.12505, 0.34768		305 Secs (275 Secs)	
									[==>275.0 Secs]	[1]
	5		(3) 3C66B	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 0.33111, 0.42753		305 Secs (275 Secs)	
								[==>275.0 Secs]	[1]	
	6		(3) 3C66B	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 0.53746, 0.56020		305 Secs (275 Secs)	
									[==>275.0 Secs]	[1]



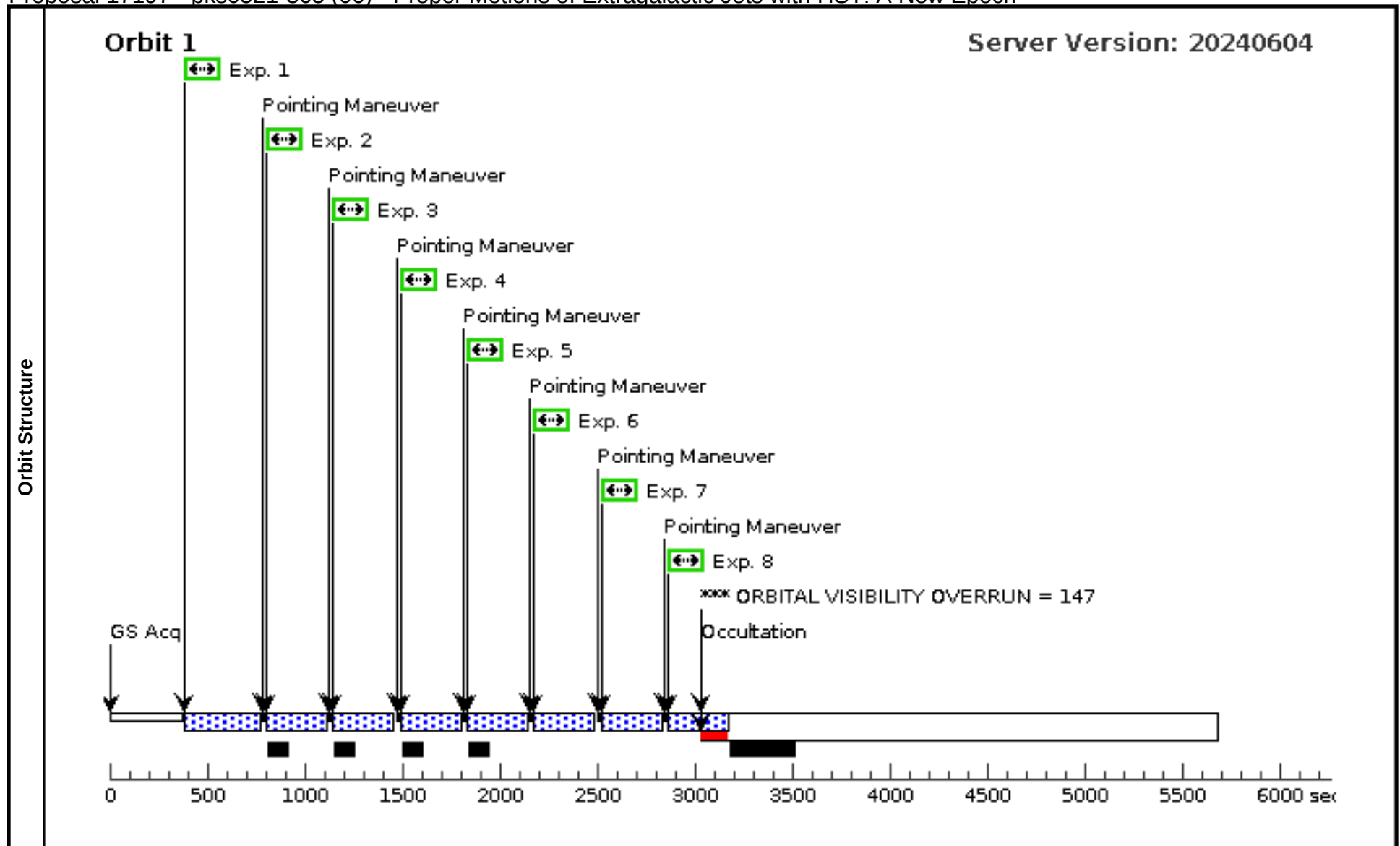
Proposal 17197 - 3c371 (04) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, 3c371 (04), completed										Tue Jun 18 21:00:35 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: ACS/WFC											
	Special Requirements: ORIENT 18D TO 37 D; ORIENT 115D TO 133 D; ORIENT 200D TO 220 D; ORIENT 292D TO 300 D											
Comments: The target is an optical jet pointed towards the southwest, approximately 6 arcseconds long. The host galaxy and central nucleus are very bright (V-mag 12) and saturated in the previous imaging, so we have opted for relatively short exposures ~220 seconds, to lessen the diffraction spikes/core saturation. Orient constraints are specified to avoid the bright core from producing diffraction spikes over the jet. POS TARGETS are used both for dithering and to place the target near to the WFC1 readouts to lessen CTE.												
Diagnostics	(3c371 (04)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(4)	3C371	RA: 18 06 50.6805 (271.7111688d)			Epoch of Position: 2015.5		V=14.22		Reference Frame: SIMBAD		
			Dec: +69 49 28.11 (69.82447d)									
			Equinox: J2000									
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.												
Category=GALAXY												
Description=[JET, KNOT, NUCLEUS, RADIO GALAXY]												
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0,0		220 Secs (220 Secs)		
										[==>]		[1]
	2		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.1740,0		220 Secs (220 Secs)		
								.1850		[==>]		[1]
	3		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.3232,0		220 Secs (220 Secs)		
								.1325		[==>]		[1]
	4		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.1005,0		220 Secs (220 Secs)		
								.3305		[==>]		[1]
	5		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.5075,0		220 Secs (220 Secs)		
								.0505		[==>]		[1]
	6		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.6815,0		220 Secs (220 Secs)		
								.2855		[==>]		[1]
	7		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.8300,0		220 Secs (220 Secs)		
								.1735		[==>]		[1]
	8		(4) 3C371	ACS/WFC, ACCUM, WFC1B-2K		F606W		POS TARG 0.6080,0		220 Secs (220 Secs)		
								.3810		[==>]		[1]



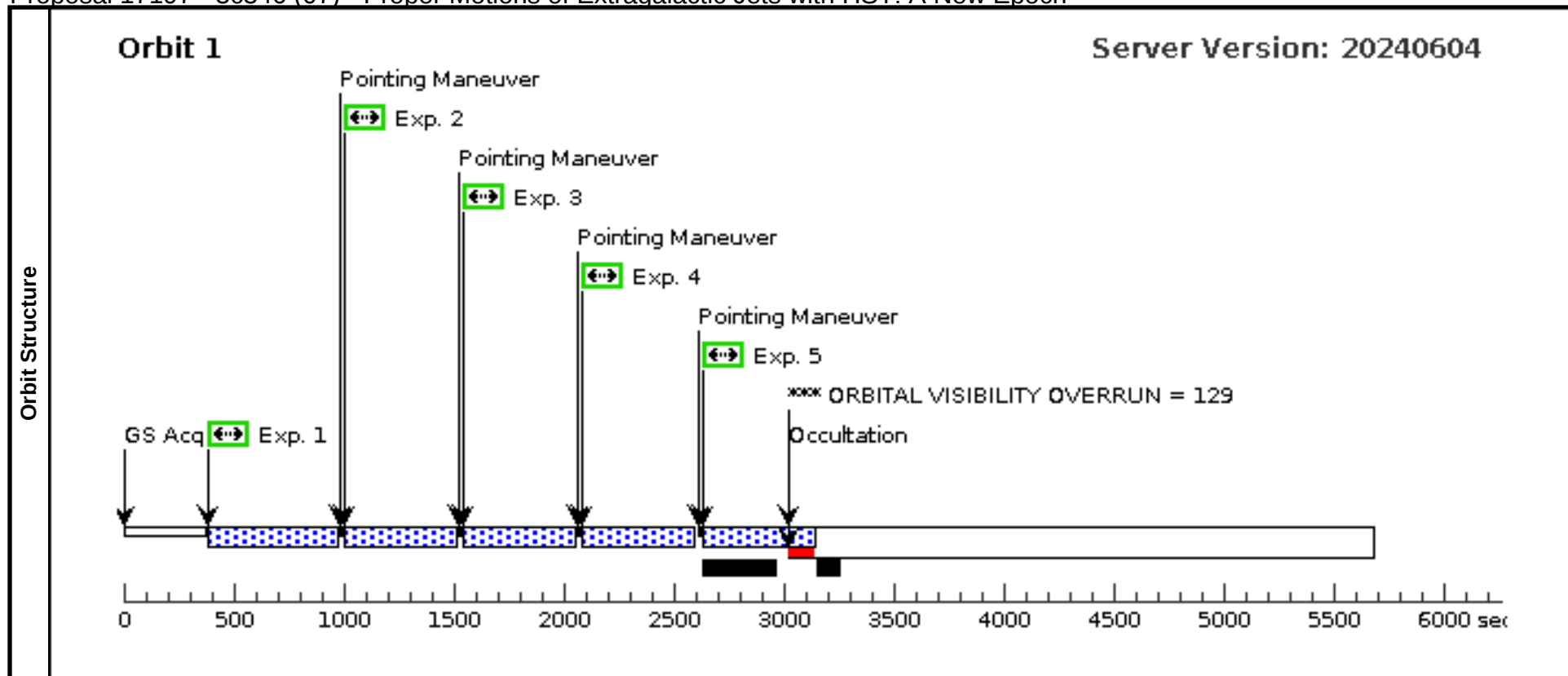
Proposal 17197 - pks0521-365 (06) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, pks0521-365 (06), completed										Tue Jun 18 21:00:35 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: ACS/WFC											
	Special Requirements: ORIENT 350D TO 360 D; ORIENT 80D TO 85 D; ORIENT 255D TO 272 D; ORIENT 172D TO 180 D											
Comments: Target is an optical jet approximately 45 degrees south of west. The host elliptical has a bright core - Vmag = 13. We have thus adopted relatively short exposures, and orient constraints to avoid diffraction spikes over the jet.												
Diagnostics	(pks0521-365 (06)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(5)	0521-365	RA: 05 22 57.9844 (80.7416017d)		Epoch of Position: 2015.5		V=14.62		Reference Frame: SIMBAD			
			Dec: -36 27 30.85 (-36.45857d)									
			Equinox: J2000									
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.												
Category=GALAXY												
Description=[JET, KNOT, NUCLEUS, RADIO GALAXY]												
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12,12		180 Secs (180 Secs)			
									[==>]		[1]	
	2		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.0747 8,12.15414		180 Secs (180 Secs)			
									[==>]		[1]	
	3		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.1125 7,12.31787		180 Secs (180 Secs)			
									[==>]		[1]	
	4		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.1855 7,12.07583		180 Secs (180 Secs)			
									[==>]		[1]	
	5		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.1986 3,12.23771		180 Secs (180 Secs)			
									[==>]		[1]	
	6		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.2733 7,12.39184		180 Secs (180 Secs)			
									[==>]		[1]	
	7		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.3093 5,12.15940		180 Secs (180 Secs)			
									[==>]		[1]	
	8		(5) 0521-365	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 12.3840 8,12.31353		180 Secs (180 Secs)			
									[==>]		[1]	



Proposal 17197 - 3c346 (07) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, 3c346 (07), completed										Tue Jun 18 21:00:35 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: ACS/WFC											
	Special Requirements: ORIENT 2D TO 15 D; ORIENT 93D TO 100 D; ORIENT 178D TO 200 D; ORIENT 267D TO 275 D											
Comments: Orient constraints are specified to avoid the bright core from producing diffraction spikes over the jet. POS TARGS and ORIENT constraints are used both for dithering and to place the target near to the WFC1 readouts to lessen CTE and to avoid having bright sources too near to the chip edge.												
Diagnostics	(3c346 (07)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(6)	3C346	RA: 16 43 48.6050 (250.9525208d)		Epoch of Position: 2015.5		V=14		Reference Frame: SIMBAD			
			Dec: +17 15 49.43 (17.26373d)									
			Equinox: J2000									
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.												
Category=GALAXY												
Description=[JET, KNOT, NUCLEUS, RADIO GALAXY]												
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1		(6) 3C346	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 9,9		383 Secs (383 Secs)			
									[==>]		[1]	
	2		(6) 3C346	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 9.15914, 9.23969		383 Secs (383 Secs)			
									[==>]		[1]	
	3		(6) 3C346	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 9.31641, 9.08319		383 Secs (383 Secs)			
									[==>]		[1]	
	4		(6) 3C346	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 9.28771, 9.28896		383 Secs (383 Secs)			
									[==>]		[1]	
	5		(6) 3C346	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 9.07990, 9.19413		383 Secs (383 Secs)			
								[==>]		[1]		



Proposal 17197 - 4c04.77 (08) - Proper Motions of Extragalactic Jets with HST: A New Epoch

Visit	Proposal 17197, 4c04.77 (08), completed						Tue Jun 18 21:00:35 GMT 2024			
	Diagnostic Status: Warning									
	Scientific Instruments: ACS/WFC									
	Special Requirements: ORIENT 80D TO 95 D; ORIENT 173D TO 185 D; ORIENT 250D TO 278 D; ORIENT 357D TO 5 D									
Comments: The target is an optical jet, of several arcseconds length pointed in the northwest direction. The host galaxy is an elliptical with a bright core. We have used orient constraints to avoid having the diffraction spikes run over the jet, also taking into account other nearby bright sources.										
Diagnostics	(4c04.77 (08)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(7)	4C04.77	RA: 22 04 17.6523 (331.0735513d) Dec: +04 40 2.02 (4.66723d) Equinox: J2000	Epoch of Position: 2015.5	V=15.2	Reference Frame: SIMBAD				
	Comments: NOTE: This target was accidentally specified as the southern source 4c-04.77 in the phase 1 proposal. We have corrected the target position to be 4C+04.77, located at RA 22 hr and +04 dec.									
	Category=GALAXY Description=[JET, KNOT, NUCLEUS, RADIO GALAXY]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(7) 4C04.77	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 3,3		290 Secs (290 Secs)	
									[==>]	[1]
	2		(7) 4C04.77	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 3.20646, 3.14754		290 Secs (290 Secs)	
									[==>]	[1]
	3		(7) 4C04.77	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 3.41257, 3.24554		290 Secs (290 Secs)	
									[==>]	[1]
	4		(7) 4C04.77	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 3.12505, 3.34768		290 Secs (290 Secs)	
									[==>]	[1]
	5		(7) 4C04.77	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 3.33111, 3.42753		290 Secs (290 Secs)	
									[==>]	[1]
	6		(7) 4C04.77	ACS/WFC, ACCUM, WFC1B-2K	F606W		POS TARG 3.53746, 3.56020		290 Secs (290 Secs)	
									[==>]	[1]

