



17783 - HST Polarimetry and Proper Motions of the Pictor A Hotspot

Cycle: 32, 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) PICTORA-WEST-POL	ACS/WFC	6	12-Aug-2024 13:01:25.0	yes
02	(2) PICTORA-WEST-V	ACS/WFC	1	12-Aug-2024 13:01:26.0	yes
03	(3) PICTORA-WEST-UV	WFC3/UVIS	2	12-Aug-2024 13:01:27.0	yes

9 Total Orbits Used

ABSTRACT

The X-ray emission mechanism and particle acceleration mechanism in kpc-scale AGN jets is still poorly understood. Nearby radio galaxy Pictor A hosts one of the nearest and brightest X-ray emitting jets, and is a highly valuable target for long-term monitoring and study. The jet has been deeply observed in the X-rays with Chandra, with a total exposure of nearly 0.5 Ms over 14 years. These observations revealed that the X-ray jet and hotspot unexpectedly vary on timescales as short as a few months to years in both the soft and hard X-rays, which places extreme constraints on the

particle acceleration mechanism. The western hotspot of Pictor A, as the brightest in the sky with sufficient spatial separation from the core, has been recently detected in the hard X-rays with NuSTAR and was also approved for a large 2 Ms observation with IXPE in the first GO cycle, to measure its X-ray polarization. We propose HST optical/UV and polarization imaging of the jet and western hotspot of Pictor A. The proposed observations are highly complimentary and will extend the longest time baselines of optical imaging to nearly 30 years, enabling a range of investigations into variability, proper motions, and spectral evolution of the source.

OBSERVING DESCRIPTION

This program is focused primarily on the Western hotspot of Pictor A, which is 4' from the central nucleus. The entire size of the source is 7.6 arcminutes between terminal hotspots.

The first observing mode is ACS/WFC Polarization, where the hotspot will be positioned near the center of the active detector region for the polarization filters. The observation will combine the linear polarization filters (POL0V, POL60V, POL120V), two orbits each, 3 exposures/orbit, with wide-V F606W. The F606W filter is by far the most efficient in terms of throughput in combination with the polarizers.

The second visit will be non-polarization imaging with ACS/WFC in the same filter as used for the polarization (F606W) to aid in the image alignment and also to provide a baseline for a long-term optical proper motions program. We use ORIENT constraints to ensure the hotspot is on the detector with the jet falling on the diagonal so that the jet and core (host galaxy) are both captured in all images. We used a WFCCENTER pointing which is midway between the core and the hotspot -- the finding charts do not show the hotspot because of the size of the source. All pointing/orient constraints have been checked using actual HST images to ensure good target placement.

The third visit/mode will be two orbits of WFC3/UVIS imaging in the F225W UV filter. The pointing will be somewhat similar to that used for the V-band imaging, in that we choose a point along the line of the jet to the hotspot and ORIENT constraints, in order to maximize the extent of the jet on the detector. Because of the smaller FOV of the UVIS detectors, it will not be possible to include the inner jet and nucleus of Pictor A in the observations, and the finding charts do not show the hotspot.

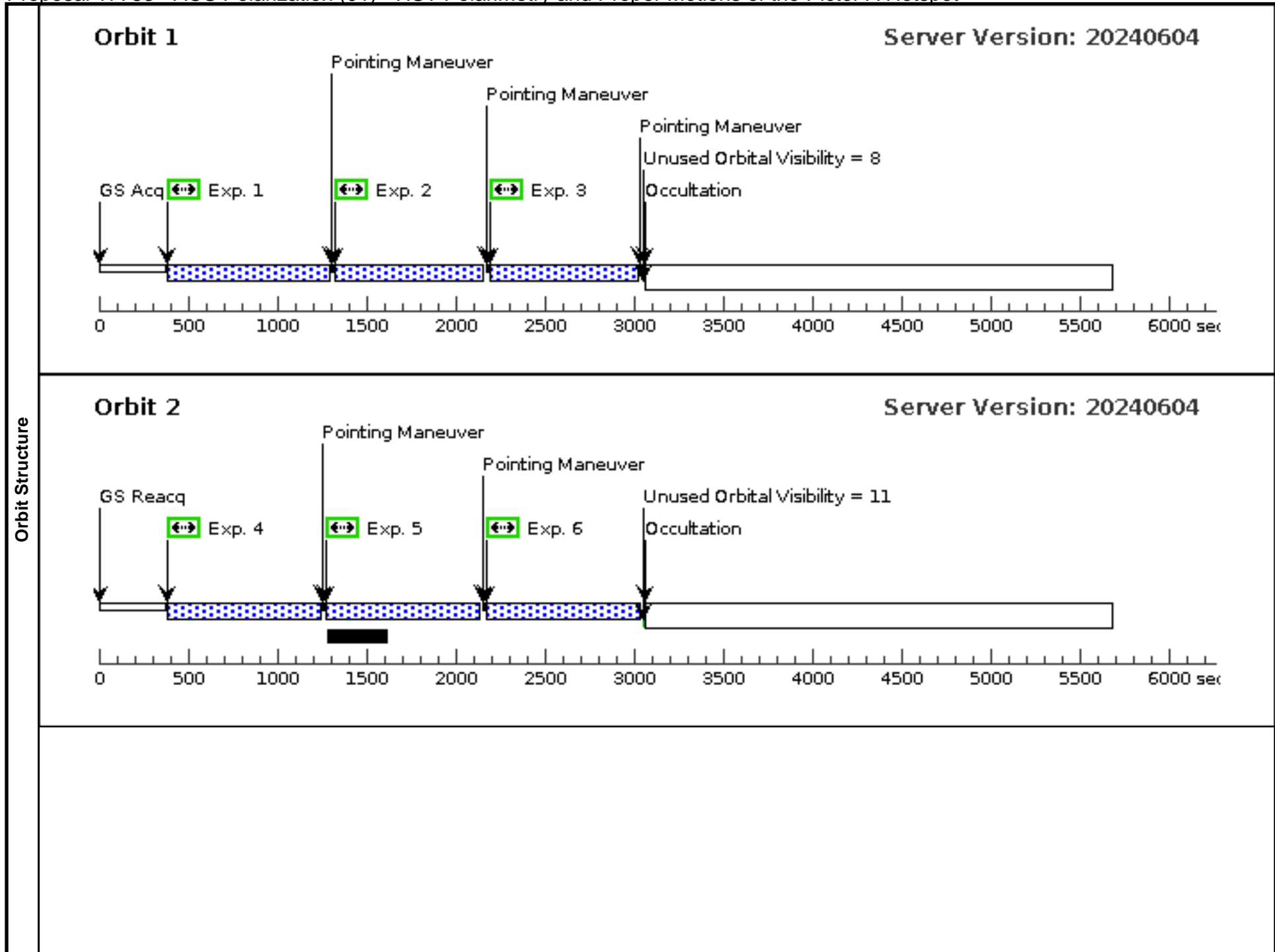
For all observations we use appropriate dithering to sample the PSF and cover the chip gap, if applicable.

Proposal 17783 - ACS Polarization (01) - HST Polarimetry and Proper Motions of the Pictor A Hotspot

Visit	Proposal 17783, ACS Polarization (01) Mon Aug 12 17:01:27 GMT 2024 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: (none)					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		PICTORA-WEST-POL	RA: 05 19 28.0000 (79.8666667d) Dec: -45 46 0.00 (-45.76667d) Equinox: J2000		V=16.45	Reference Frame: ICRS
	Comments: Category=GALAXY Description=[HOTSPOT, JET]					

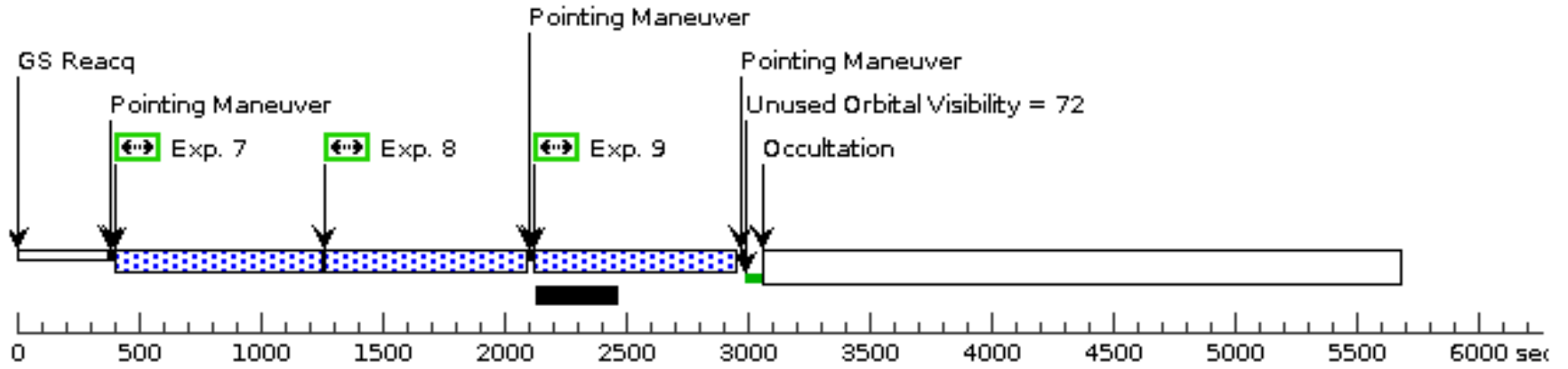
Proposal 17783 - ACS Polarization (01) - HST Polarimetry and Proper Motions of the Pictor A Hotspot

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
Exposures	1	POL0V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL0V		POS TARG 0,0	705 Secs (705 Secs)	[1]	
	2	POL0V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL0V		POS TARG 0.20646, 0.14754	705 Secs (705 Secs)	[1]	
	3	POL0V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL0V		POS TARG 0.41257 ,0.24554	705 Secs (705 Secs)	[1]	
	4	POL0V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL0V		POS TARG 0.12505 ,0.34768	738 Secs (738 Secs)	[2]	
	5	POL0V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL0V		POS TARG 0.33111, 0.42753	738 Secs (738 Secs)	[2]	
	6	POL0V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL0V		POS TARG 0.53746 ,0.56020	738 Secs (738 Secs)	[2]	
	7	POL60V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL60V		POS TARG 0,0	705 Secs (705 Secs)	[3]	
	8	POL60V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL60V		POS TARG 0,0	705 Secs (705 Secs)	[3]	
	9	POL60V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL60V		POS TARG 0.20646, 0.14754	705 Secs (705 Secs)	[3]	
	10	POL60V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL60V		POS TARG 0.41257 ,0.24554	705 Secs (705 Secs)	[4]	
	11	POL60V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL60V		POS TARG 0.12505 ,0.34768	738 Secs (738 Secs)	[4]	
	12	POL60V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL60V		POS TARG 0.33111, 0.42753	738 Secs (738 Secs)	[4]	
	13	POL120V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL120V		POS TARG 0.53746 ,0.56020	738 Secs (738 Secs)	[5]	
	14	POL120V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL120V		POS TARG 0.20646, 0.14754	705 Secs (705 Secs)	[5]	
	15	POL120V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL120V		POS TARG 0.41257 ,0.24554	705 Secs (705 Secs)	[5]	
	16	POL120V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL120V		POS TARG 0.12505 ,0.34768	738 Secs (738 Secs)	[6]	
	17	POL120V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL120V		POS TARG 0.33111, 0.42753	738 Secs (738 Secs)	[6]	
	18	POL120V	(1) PICTORA-WES T-POL	ACS/WFC, ACCUM, WFC2	F606W POL120V		POS TARG 0.53746 ,0.56020	738 Secs (738 Secs)	[6]	



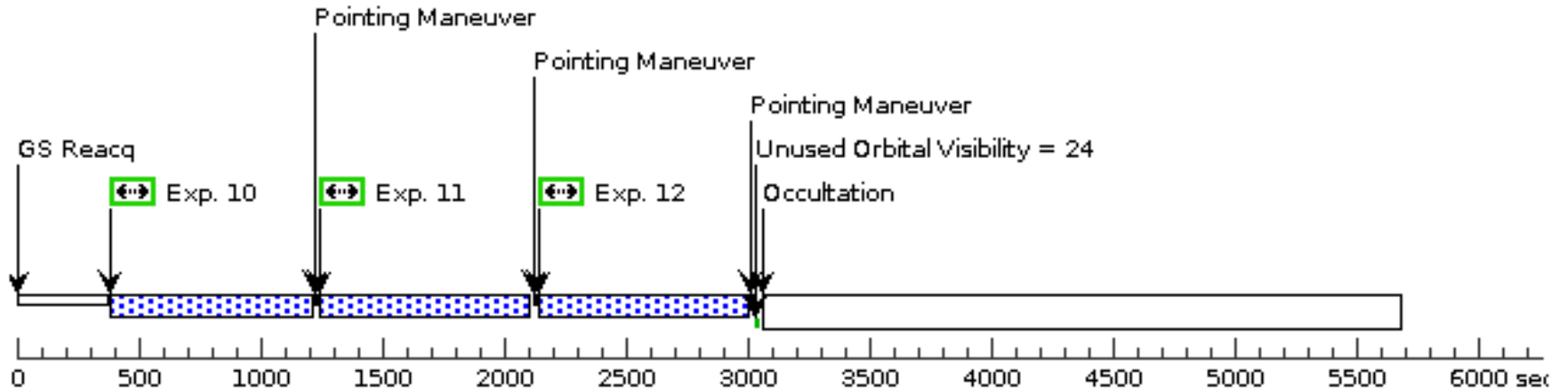
Orbit 3

Server Version: 20240604



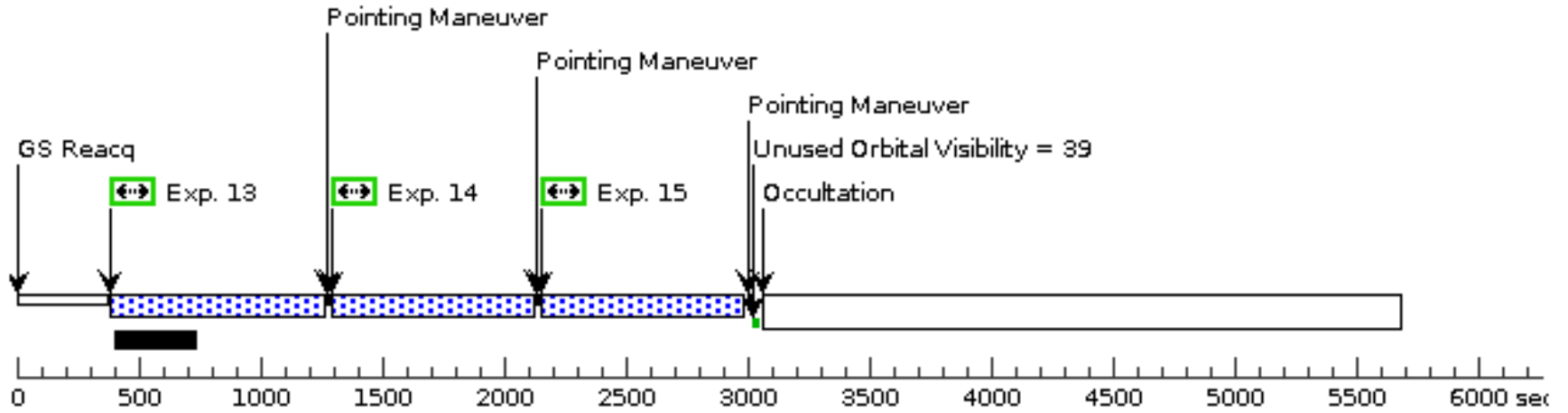
Orbit 4

Server Version: 20240604



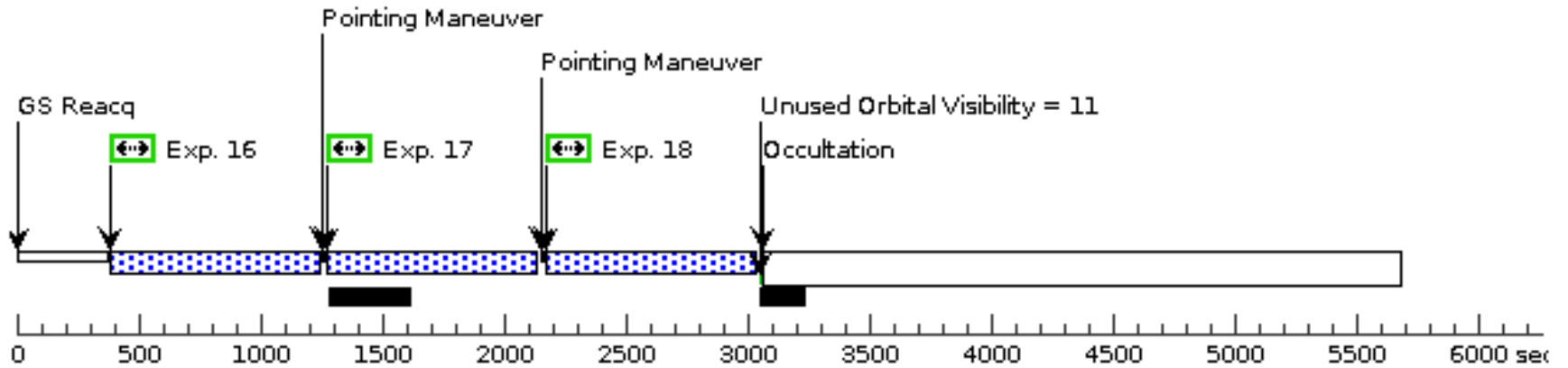
Orbit 5

Server Version: 20240604



Orbit 6

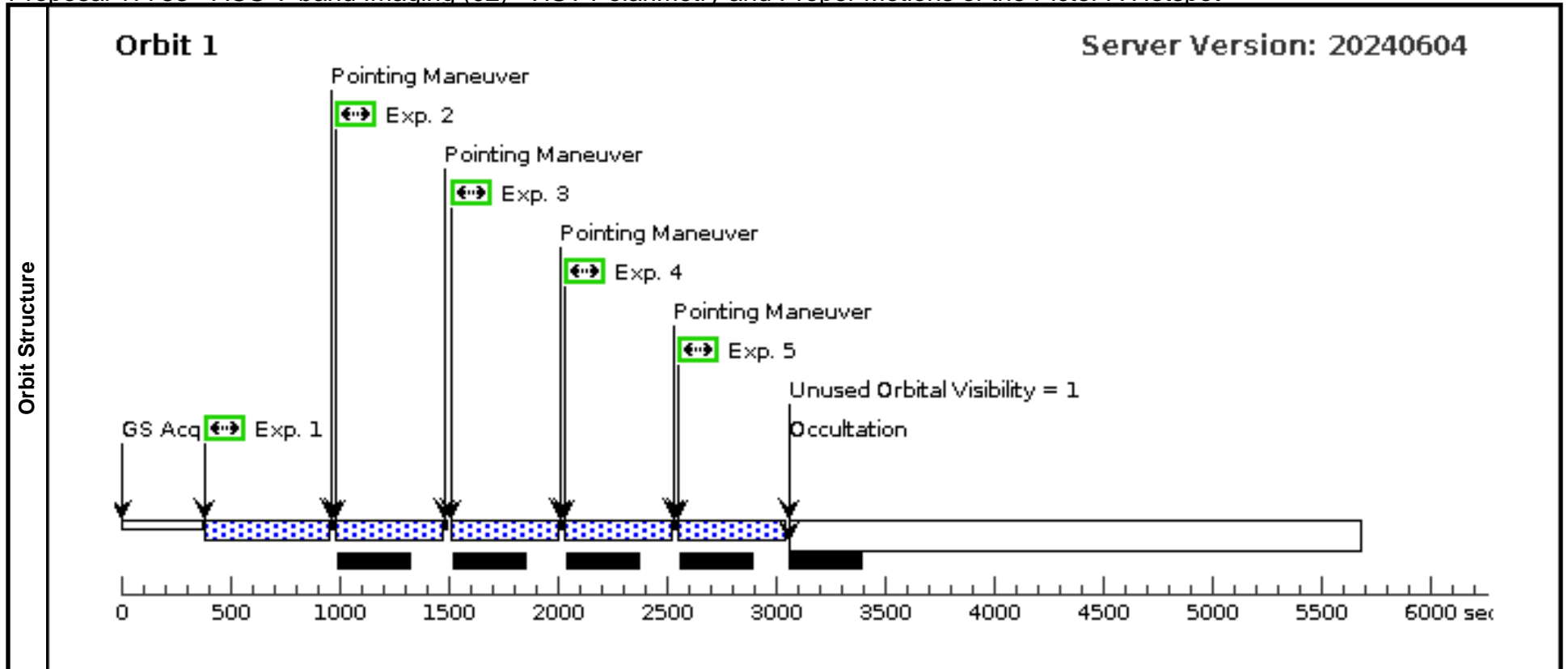
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Proposal 17783 - ACS V-band Imaging (02) - HST Polarimetry and Proper Motions of the Pictor A Hotspot

Mon Aug 12 17:01:27 GMT 2024

Visit	Proposal 17783, ACS V-band Imaging (02) Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: ORIENT 144D TO 151 D; ORIENT 323D TO 332 D									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(2)	PICTORA-WEST-V	RA: 05 19 36.2877 (79.9011987d) Dec: -45 46 12.21 (-45.77006d) Equinox: J2000		V=16.45	Reference Frame: ICRS				
	<i>Comments:</i> Category=GALAXY Description=[HOTSPOT, JET]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F606W	(2) PICTORA-WES T-V	ACS/WFC, ACCUM, WFCENTER	F606W				365 Secs (365 Secs)	
									[==>]	[1]
	2	F606W	(2) PICTORA-WES T-V	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.15914, 0.23969		365 Secs (365 Secs)	
									[==>]	[1]
	3	F606W	(2) PICTORA-WES T-V	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.31641, 3.08319		365 Secs (365 Secs)	
								[==>]	[1]	
4	F606W	(2) PICTORA-WES T-V	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.07990, 4.19413		365 Secs (365 Secs)		
								[==>]	[1]	
5	F606W	(2) PICTORA-WES T-V	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.28771, 5.28896		365 Secs (365 Secs)		
								[==>]	[1]	

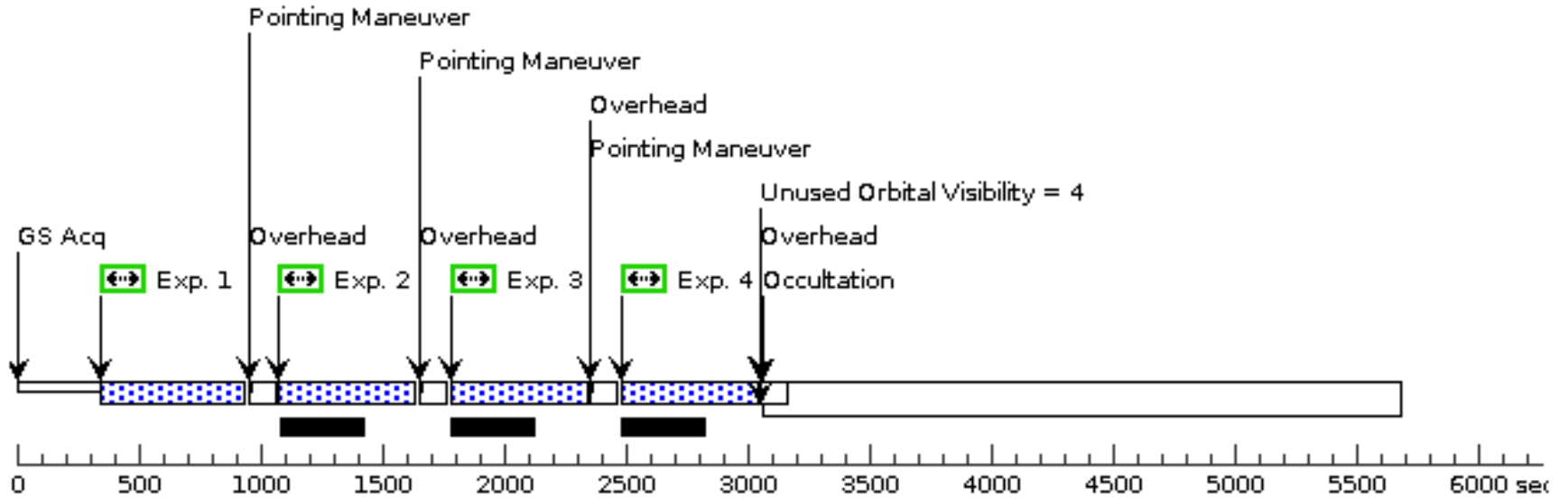


Proposal 17783 - UV Imaging (03) - HST Polarimetry and Proper Motions of the Pictor A Hotspot

Mon Aug 12 17:01:28 GMT 2024

Visit	Proposal 17783, UV Imaging (03) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 355D TO 12 D; ORIENT 265D TO 285 D; ORIENT 176D TO 192 D; ORIENT 80D TO 105 D									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	PICTORA-WEST-UV	RA: 05 19 33.7626 (79.8906775d) Dec: -45 46 3.16 (-45.76754d) Equinox: J2000		V=16.45	Reference Frame: ICRS				
	<i>Comments:</i> Category=GALAXY Description=[HOTSPOT, JET]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0,-2.8		564 Secs (564 Secs) [==>]	[1]
	2		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.1392,- 1.412		564 Secs (564 Secs) [==>]	[1]
	3		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.25856, 0.0988		564 Secs (564 Secs) [==>]	[1]
	4		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.0804,1 .4644		564 Secs (564 Secs) [==>]	[1]
	5		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.406,-2 .7596		558 Secs (558 Secs) [==>]	[2]
	6		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.5452,- 1.3716		558 Secs (558 Secs) [==>]	[2]
	7		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.664,0. 1388		558 Secs (558 Secs) [==>]	[2]
	8		(3) PICTORA-WES T-UV	WFC3/UVIS, ACCUM, UVIS-CENTER	F225W	FLASH=18	POS TARG 0.4864,1 .5048		558 Secs (558 Secs) [==>]	[2]

Orbit 1



Orbit Structure

Orbit 2

