13731 - The Real Impact of Extragalactic Jets on Their Environments: Measuring the Advance Speed of Hotspots with HST

Cycle: 22, 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) PICTORA-WEST	ACS/WFC	2	21-Jul-2014 21:06:00.0	yes
02	(2) PICTORA-EAST	ACS/WFC	2	21-Jul-2014 21:06:02.0	yes
03	(3) M87	ACS/WFC	4	21-Jul-2014 21:06:06.0	yes

8 Total Orbits Used

ABSTRACT

We propose moderately deep imaging of two nearby radio galaxies, M87 and Pictor A, in which the terminal shock of the jet as it impacts the IGM (aka 'hotspot') has previously been imaged in the optical with HST. The primary goal of this program is to leverage the 20 year imaging baselines afforded by Hubble archival data and state-of-the-art precision astrometry in order to measure, for the first time, the proper motions of a terminal shock/hotspot. This is the most direct method of constraining the velocity of the working surface, and when combined with existing multi-wavelength data, yields an estimate of the momentum carried by the jet, an important, but difficult-to-measure physical characteristic necessary for understanding the impact of extragalactic jets on their hosts and environments. In addition, the proposed imaging will allow us to study the inner kpc-scale jets of M87 and Pictor A, as well as the counter-jet and counter-hotspot of Pictor A.

OBSERVING DESCRIPTION

This proposal is for two known radio/optical jets. For Pictor A, the size of the source (7.6 arcminutes between terminal hotspots) will require two pointings to cover the entire extent, focused on covering either the eastern or western hotspot, with the jet falling on the diagonal of the ACS/WFC detector so that the jet and core (host galaxy) are also capture in all images. Each orbit is partitioned into 4 exposures of ~ 600 seconds each. We utilized an 8-point dithering strategy with a shift to cover the chip gap. Please note that in order to maximize the time when HST could observe this source given our ORIENT constraints, we used a WFCCENTER pointing which is midway between the core and the hotspot, the latter being the main science target. The finding charts do not thus show the hotspot because of the size of the source.

The primary scientific target of the M87 observations is the counter-jet hotspot, 25" from the core which is centered in a giant elliptical host galaxy, though the main optical jet will also be captured in the planned exposures. The four orbits for M87 have been partitioned into 20 exposures of 408-446 seconds, with the exposure time chosen to minimize saturation of the core/HST-1 regions of the jet (a secondary scientific target). A repeated 5-point dithering pattern has been utilized, with a shift to cover the chip gap.

Note: We are aware that another GO program, 13759 (PI J. Madrid) will also observe M87 during Cycle 22. The two programs have different science goals (13759 is specifically focused on jet variability), and most critically, the planned STIS observations of that proposal (GO-13759) will not cover the M87 southeast hotspot, which is the primary scientific target in this proposal. In addition, the goal of this project is to measure proper motions, so these observations are not duplicates of previous existing exposures, since the goal is to measure changes over time.

Visit

Proposal 13731, PictorA-west (01), implementation Tue Jul 22 01:06:08 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 140D TO 150 D; ORIENT 320D TO 330 D

Fixed Targets

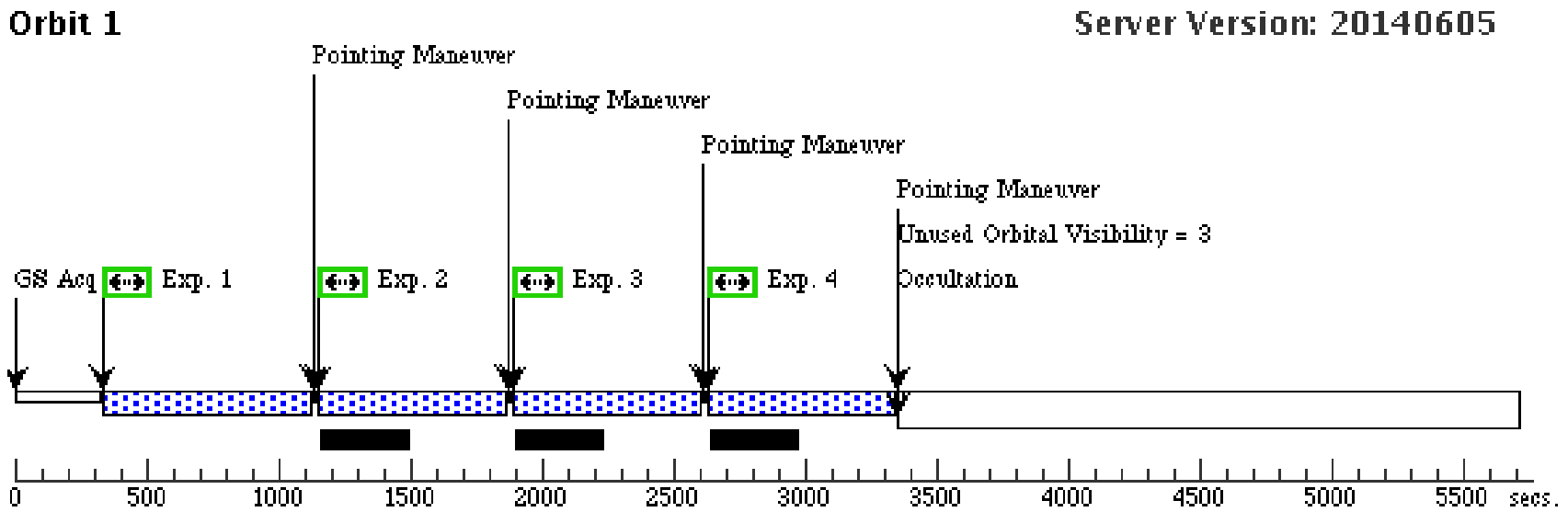
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PICTORA-WEST	RA: 05 19 36.2877 (79.9011987d) Dec: -45 46 12.21 (-45.77006d) Equinox: J2000		V=16.45	Reference Frame: SIMBAD

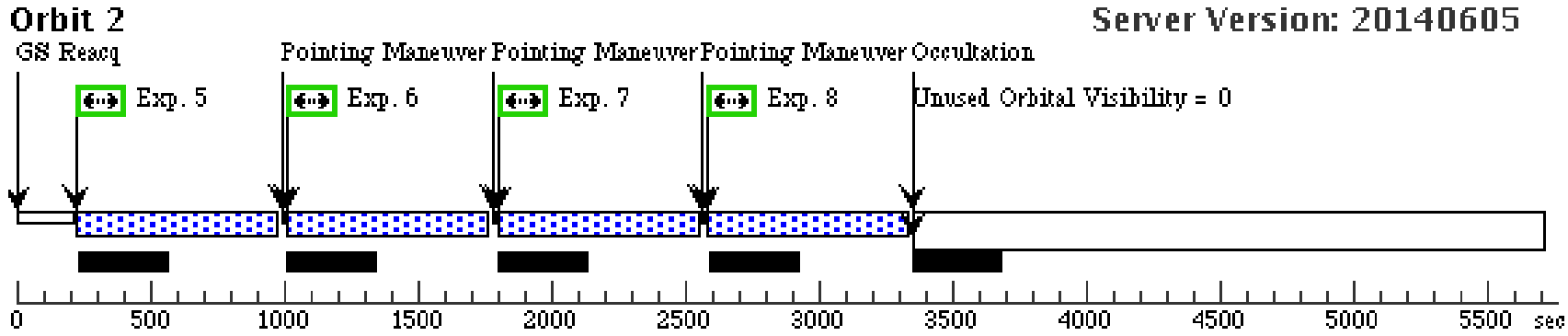
Comments: The host galaxy is at 05h19m49.7s -45d46m44s, with an optical magnitude of 16.45. The Western hotspot is 4.1 arcminutes to the west-northwest with a magnitude of 18.3.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0,0		582 Secs (582 Secs) *[==>]*	 ***[1]***
2		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.174,0.235		582 Secs (582 Secs) *[==>]*	 ***[1]***
3		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.3232,0.1235		582 Secs (582 Secs) *[==>]*	 ***[1]***
4		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1005,0.3305		582 Secs (582 Secs) *[==>]*	 ***[1]***
5		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 6.5075,6.0505		631 Secs (631 Secs) *[==>]*	 ***[2]***
6		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 6.6815,6.2855		631 Secs (631 Secs) *[==>]*	 ***[2]***
7		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 6.83,6.1735		631 Secs (631 Secs) *[==>]*	 ***[2]***
8		(1) PICTORA-WEST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 6.6080,6.3810		631 Secs (631 Secs) *[==>]*	 ***[2]***

Orbit Structure





Visit

Proposal 13731, PictorA-east (02), implementation Tue Jul 22 01:06:09 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 140D TO 165 D; ORIENT 320D TO 340 D

Fixed Targets

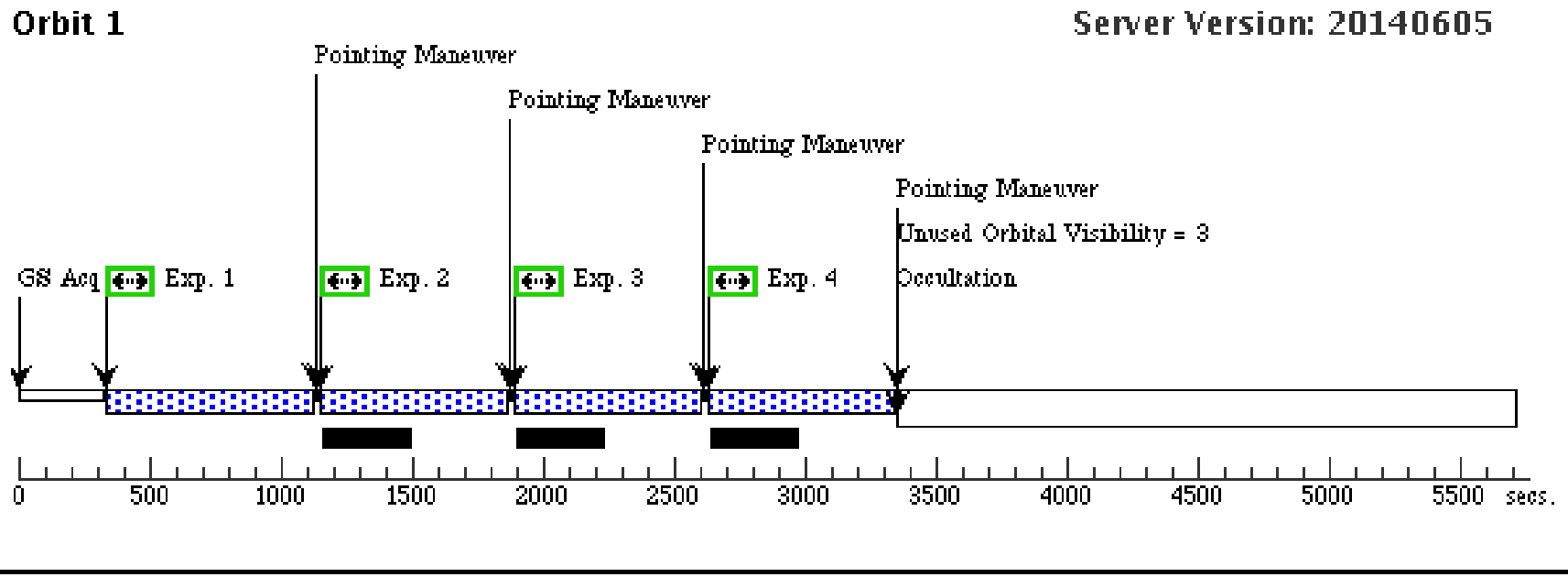
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	PICTORA-EAST	RA: 05 19 58.8665 (79.9952771d) Dec: -45 47 8.64 (-45.78573d) Equinox: J2000		V=16.45	Reference Frame: ICRS

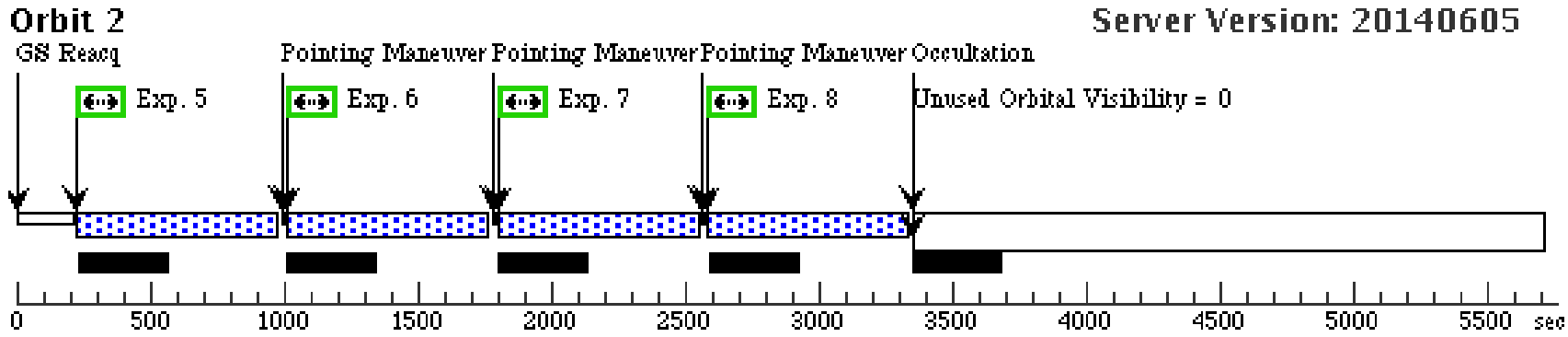
Comments: The host galaxy is at 05h19m49.7s -45d46m44s, with an optical magnitude of 16.45. The eastern (radio) hotspot is 3.5 arcminutes to the east-southeast, and not visible in the SDSS image.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0,0		582 Secs (582 Secs) *[==>]*	*[1]*
2		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1740,0.235		582 Secs (582 Secs) *[==>]*	*[1]*
3		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.3232,0.1235		582 Secs (582 Secs) *[==>]*	*[1]*
4		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG 0.1005,0.3305		582 Secs (582 Secs) *[==>]*	*[1]*
5		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG -5.4925, -5.9495		631 Secs (631 Secs) *[==>]*	*[2]*
6		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG -5.3185, -5.7145		631 Secs (631 Secs) *[==>]*	*[2]*
7		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG -5.17,-5.8265		631 Secs (631 Secs) *[==>]*	*[2]*
8		(2) PICTORA-EAST	ACS/WFC, ACCUM, WFCENTER	F606W		POS TARG -5.392,-5.619		631 Secs (631 Secs) *[==>]*	*[2]*

Orbit Structure





Visit

Proposal 13731, M87 (03), implementation Tue Jul 22 01:06:09 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 18.5D TO 88.5 D; ORIENT 118.5D TO 173.5 D; ORIENT 198.5D TO 268.5 D; ORIENT 298.5D TO 353.5 D

Fixed Targets

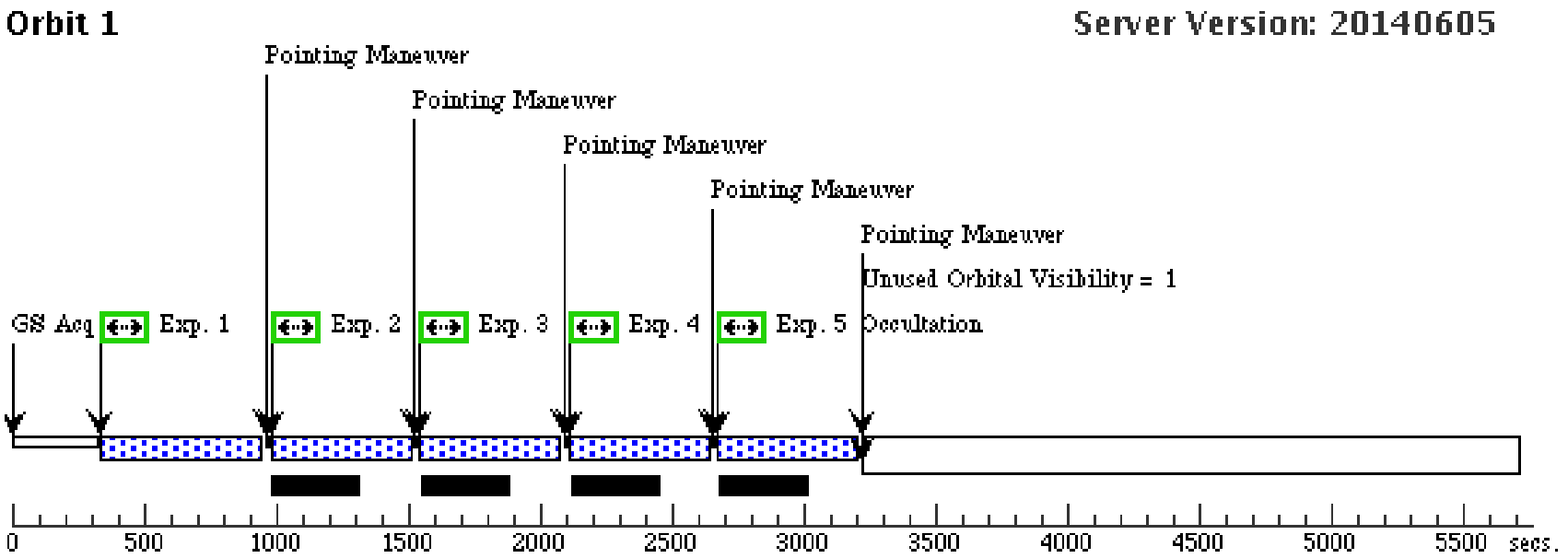
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	M87	RA: 12 30 50.2413 (187.7093388d) Dec: +12 23 28.00 (12.39111d) Equinox: J2000		V=8.63	Reference Frame: ICRS

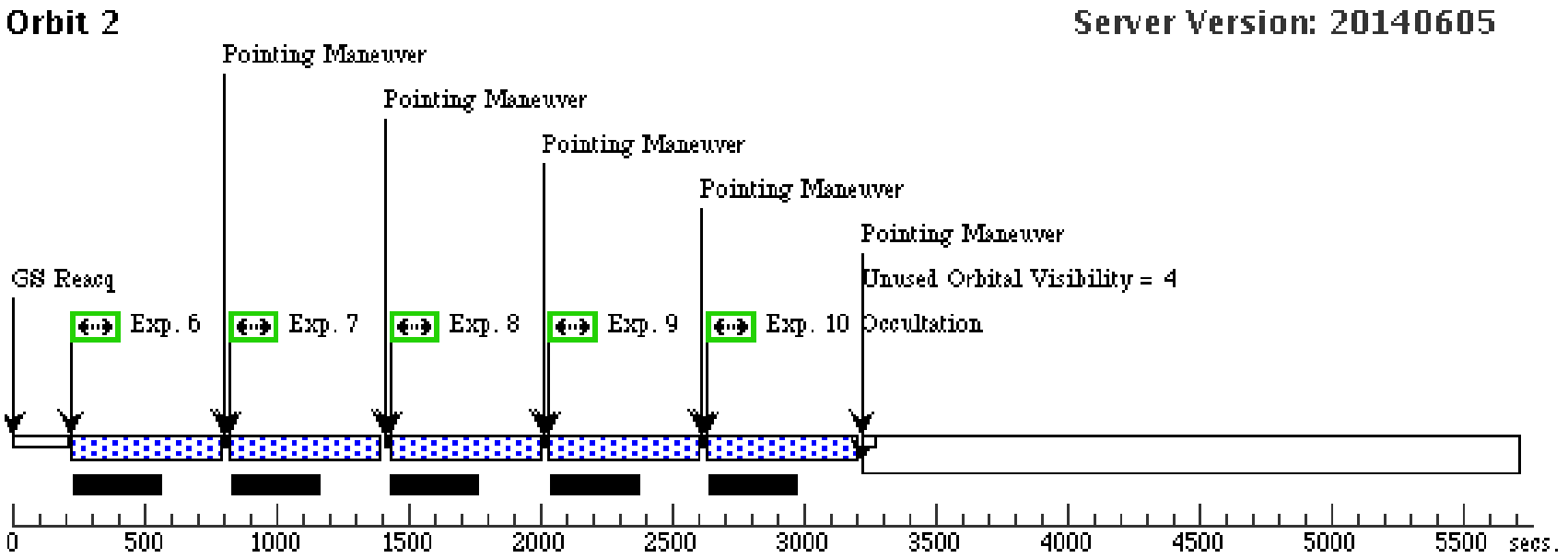
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

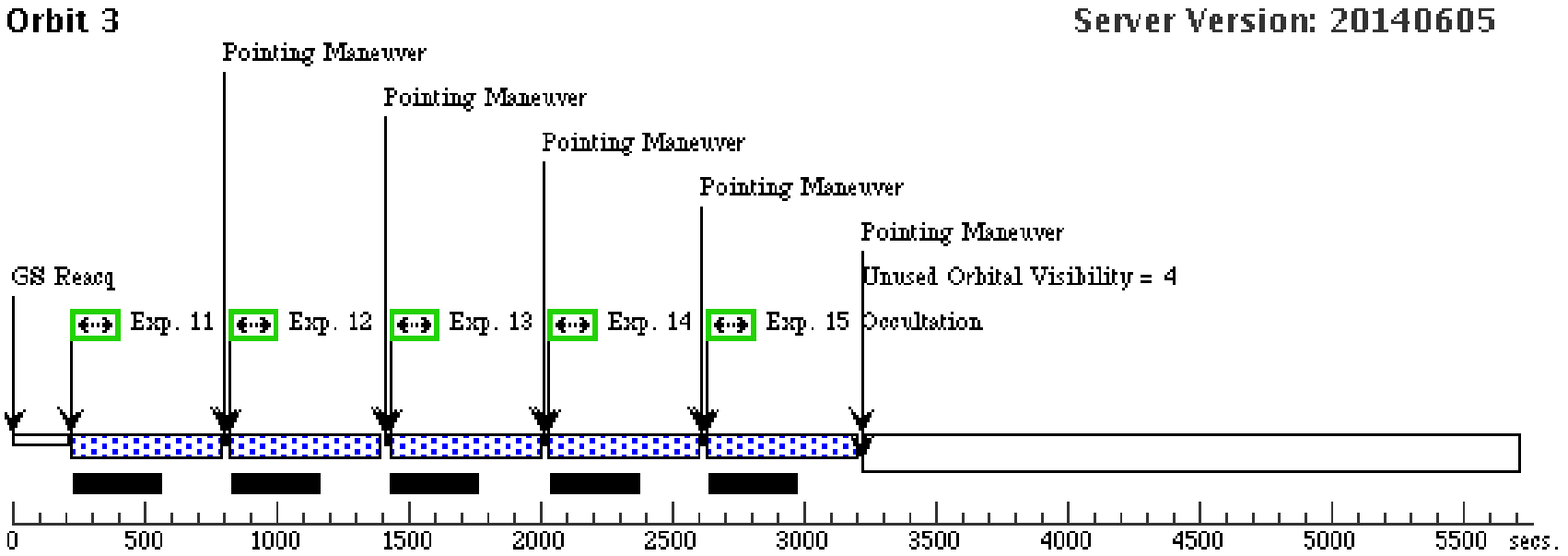
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0,0; GS ACQ SCENARIO BASE1B3		408 Secs (408 Secs) *[==>]*	 ***[1]***
2		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.15914, 0.23969		408 Secs (408 Secs) *[==>]*	 ***[1]***
3		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.31641, 0.08319		408 Secs (408 Secs) *[==>]*	 ***[1]***
4		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.07990, 0.19413		408 Secs (408 Secs) *[==>]*	 ***[1]***
5		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 0.28771, 0.28896		408 Secs (408 Secs) *[==>]*	 ***[1]***
6		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 5,5		446 Secs (446 Secs) *[==>]*	 ***[2]***
7		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 5.15914, 5.23969		446 Secs (446 Secs) *[==>]*	 ***[2]***
8		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 5.31641, 5.08319		446 Secs (446 Secs) *[==>]*	 ***[2]***
9		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 5.07990, 5.19413		446 Secs (446 Secs) *[==>]*	 ***[2]***
10		(3) M87	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 5.28771, 5.28896		446 Secs (446 Secs) *[==>]*	 ***[2]***
11		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0,0		446 Secs (446 Secs) *[==>]*	 ***[3]***
12		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.15914, 0.23969		446 Secs (446 Secs) *[==>]*	 ***[3]***
13		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.31641, 0.08319		446 Secs (446 Secs) *[==>]*	 ***[3]***
14		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.07990, 0.19413		446 Secs (446 Secs) *[==>]*	 ***[3]***
15		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.28771, 0.28896		446 Secs (446 Secs) *[==>]*	 ***[3]***
16		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 5,5		445 Secs (445 Secs) *[==>]*	 ***[4]***
17		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 5.15914, 5.23969		445 Secs (445 Secs) *[==>]*	 ***[4]***
18		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 5.31641, 5.08319		445 Secs (445 Secs) *[==>]*	 ***[4]***
19		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 5.07990, 5.19413		445 Secs (445 Secs) *[==>]*	 ***[4]***
20		(3) M87	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 5.28771, 5.28896		445 Secs (445 Secs) *[==>]*	 ***[4]***

Orbit Structure



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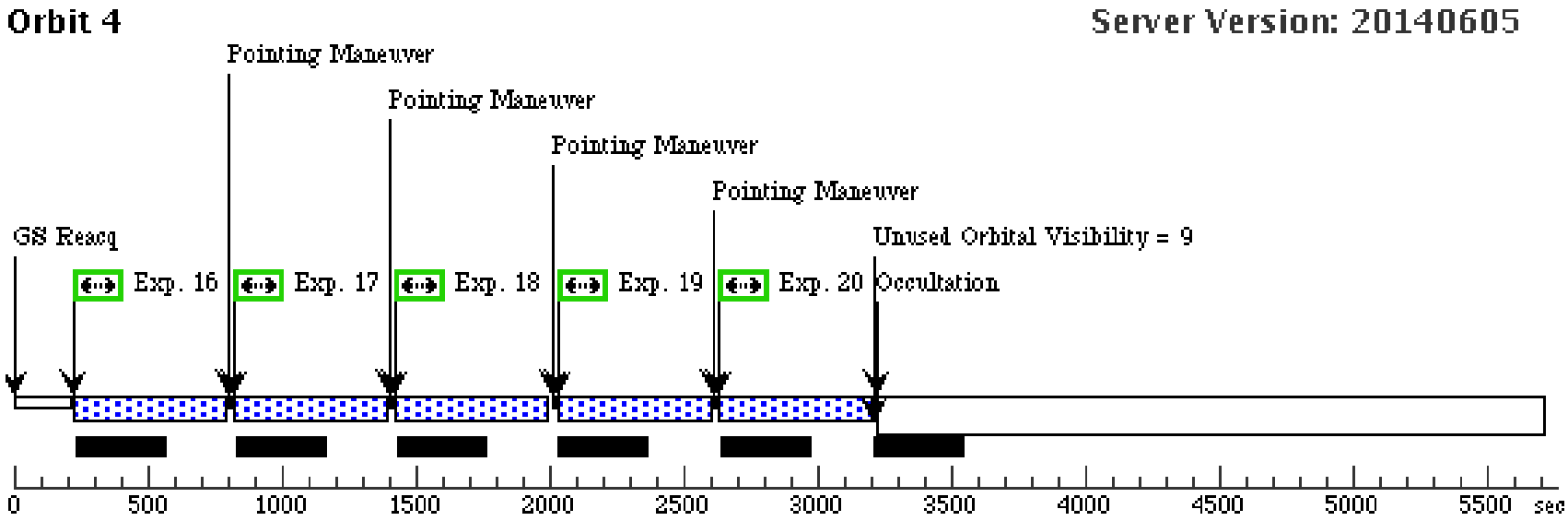
Orbit 4
Server Version: 20140605
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