



11574 - Physical Characteristics of the Massive Outflow in 3C 48

Cycle: 17, 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) 3C-048	STIS/CCD STIS/NUV-MAMA	2	30-Jun-2009 22:39:32.0	yes
02	(1) 3C-048 CCDFLAT	STIS/CCD	4	30-Jun-2009 22:39:42.0	yes
03	(1) 3C-048	STIS/CCD	4	30-Jun-2009 22:39:54.0	yes

10 Total Orbits Used

ABSTRACT

Superwinds associated with the triggering of quasars are of current interest because such feedback effects may be connected with the initial formation of the black-hole-mass/bulge mass correlation. In the $z = 0.369$ compact-steep-spectrum quasar 3C48, ground-based IFU observations show the presence of a high-velocity, wide-solid-angle outflow of gas, apparently connected with the recent formation of the radio jet. The total mass of gas in

this outflow is at least 10^9 solar masses, but it could be well over 10^{10} solar masses (i.e., similar to or greater than the total interstellar mass of the Milky Way) if most of the gas has densities like those seen in other quasar extended emission regions. To determine the physical state and energetics of the gas in the outflow, we request (1) high-spatial-resolution spectroscopy over a wide spectral range, including the near UV, and (2) medium-resolution spectroscopy of the strong [O III] 5007 line, which, when combined with unpublished archival data, will allow complete coverage of the velocity field of the high-velocity gas in the inner region.

OBSERVING DESCRIPTION

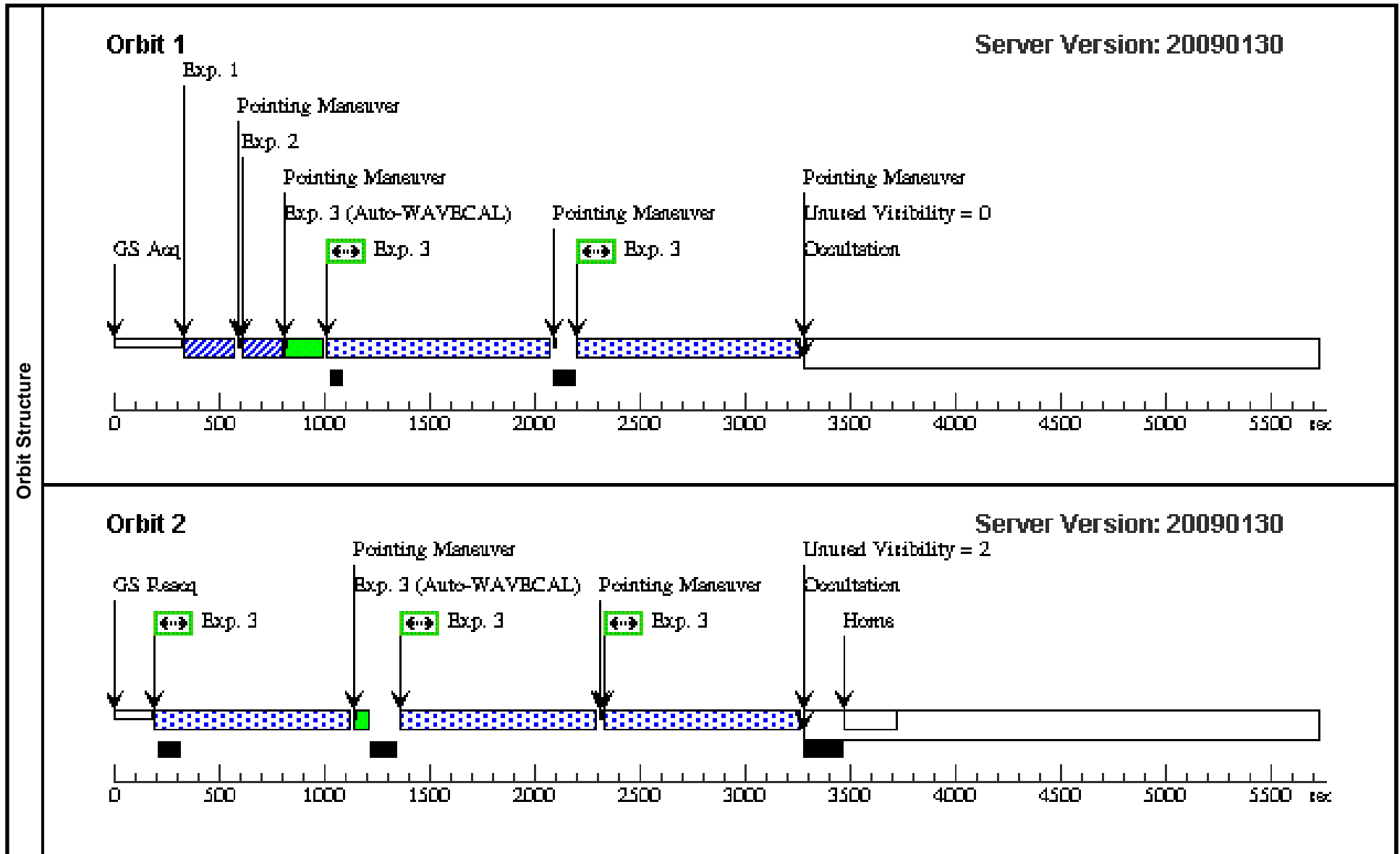
The proposed low-resolution observations use a 0.2" slit at a nominal position angle of 0 deg centered on the quasar and covering the brightest region of the high-velocity emission $\sim 0.2''$ to the north. While the narrow-band LRF WFPC-2 image shows the brightness peak slightly west of north, this position is influenced by the filter response function and the variation of velocity with position. From our GMOS IFU data shown in Fig. 3, we conclude that the best compromise position angle for the slit is due north. We use 3 of the low-resolution modes to cover rest-frame wavelengths from below Ly-alpha to beyond H-alpha and [S II] 6716,6731: the G230L grating with the NUV-MAMA detector, and the G430L and G750L gratings with the CCD. From archival WFPC2 linear-ramp-filter imaging, we have estimated the [O III] 5007 flux in the resolved emission peak $\sim 0.2''$ north of the quasar to be $\sim 10^{-14}$ ergs cm^{-2} s^{-1} . For the optical lines, we use measurements of an extended emission region in the quasar 4C37.43 (Stockton et al. 2002) to estimate relative line strengths. For the UV lines, we use models from the same paper that fit the optical spectrum well to predict the strengths. The estimates are likely to be somewhat conservative, as most of the weaker diagnostic lines are from species requiring similar or higher ionization potentials than [O III], and our best guess is that the gas in the region we are observing in 3C48 will likely have a higher ionization parameter than that in 4C37.43, since it is at a considerably smaller projected distance from the quasar. The lines that set the required exposure times are He II 1640 and C III] 1909 in the UV, and [Ne V] 3425, [O III] 4363, and He II 4686 in the optical region. Because we need to fit profiles to separate out the high-velocity emission from extended emission at the systemic velocity, we need a $S/N > 10$ per resolution element in these weaker lines. The weaker lines in the optical have typical predicted fluxes of $\sim 2 \times 10^{-16}$ ergs cm^{-2} s^{-1} ; those in the UV have $\sim 10^{-15}$ ergs cm^{-2} s^{-1} . However, the STIS ETC gives exposures to reach a $S/N \sim 10$ of ~ 4500 s in all cases. We therefore request 2 orbits for each of our grating/detector configurations, for a total of 6 orbits for the low-spectral-resolution observations. For the high-resolution observations of the [O III] 5007 region, we request the same exposures as the archival spectra we are matching, which we have found to give satisfactory S/N for profile fitting: 2 orbits for each of the 2 slit positions, for a total of 4 orbits. Thus, we are requesting 10 orbits in all.

There have been several previous HST spectroscopic investigations of 3C48 (6707, 8299, 9280, and our own 9365), but none of these duplicate the proposed observations. Those from GO-8299 cover some of the region we are interested in, but these have a spectral range that includes only small regions around the H-beta-[O III] 5007 region and the H-alpha region. As described above, 2 of our slit positions will obtain similar observations of the H-beta-[O III] 5007 region in spatial gaps not covered by this program. The remaining programs do not have the required spatial coverage, do not cover spectral regions of interest, or both.

Proposal 11574 - Visit 01 - Physical Characteristics of the Massive Outflow in 3C 48

Wed Jul 01 02:39:58 GMT 2009

Visit	Proposal 11574, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD, STIS/NUV-MAMA Special Requirements: PCS MODE FINE; ORIENT 40D TO 50 D; ORIENT 220D TO 230 D									
	Patterns	#	Primary Pattern	Secondary Pattern		Exposures				
	(1)	Pattern Type=STIS-ALONG-SLIT Coordinate Frame=POS-TARG Purpose=DITHER Pattern Orientation=90.0 Number Of Points=5 Angle Between Sides= Point Spacing=1.008 Center Pattern=true Line Spacing=			(3)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	3C-048	RA: 01 37 41.3100 (24.4221250d) Dec: +33 09 34.90 (33.15969d) Equinox: J2000	Redshift: 0.36926	V=16.06+/-0.1	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	3C48 ACQ UISITION	(1) 3C-048	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs	
									[==>]	[1]
	2	3C48 PEAK -UP	(1) 3C-048	STIS/CCD, ACQ/PEAK, 52X0.2F1-R	MIRROR				5 Secs	
									[==>]	[1]
	3		(1) 3C-048	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A			Pattern 1, Exps 3-3 (1)	900 Secs	
									[==>1050.0 Secs (Pattern 1)]	[1]
									[==>1050.0 Secs (Pattern 2)]	
									[==>921.0 Secs (Pattern 3)]	
									[==>921.0 Secs (Pattern 4)]	[2]
									[==>921.0 Secs (Pattern 5)]	



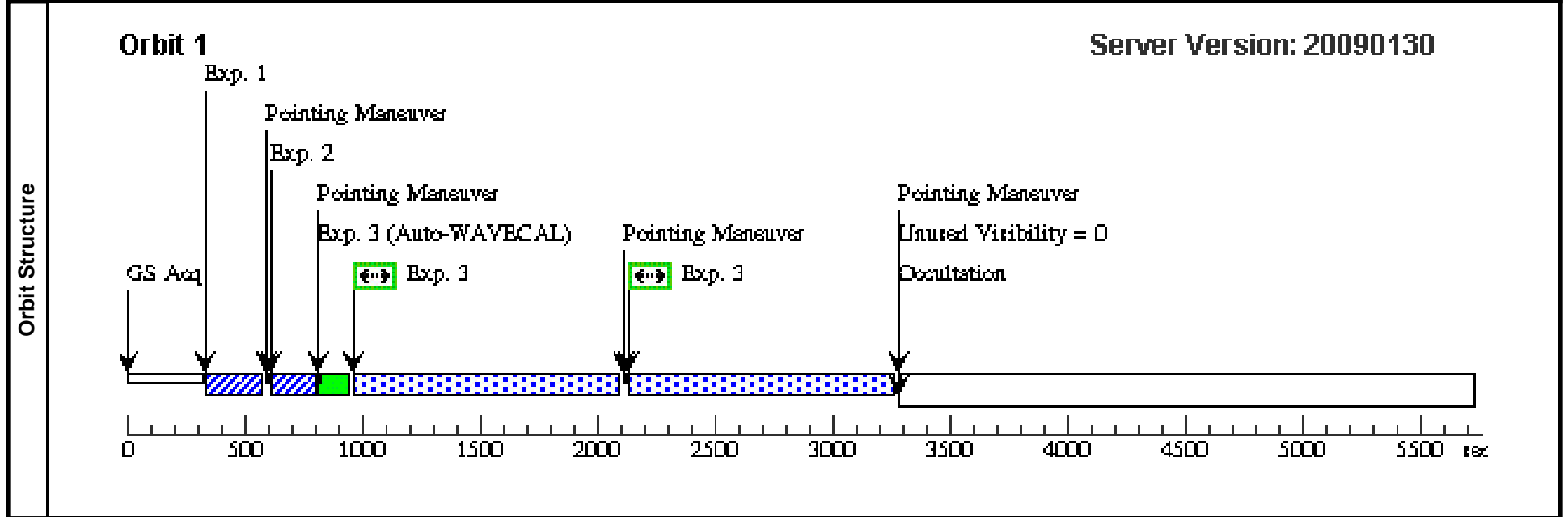
Proposal 11574 - Visit 02 - Physical Characteristics of the Massive Outflow in 3C 48

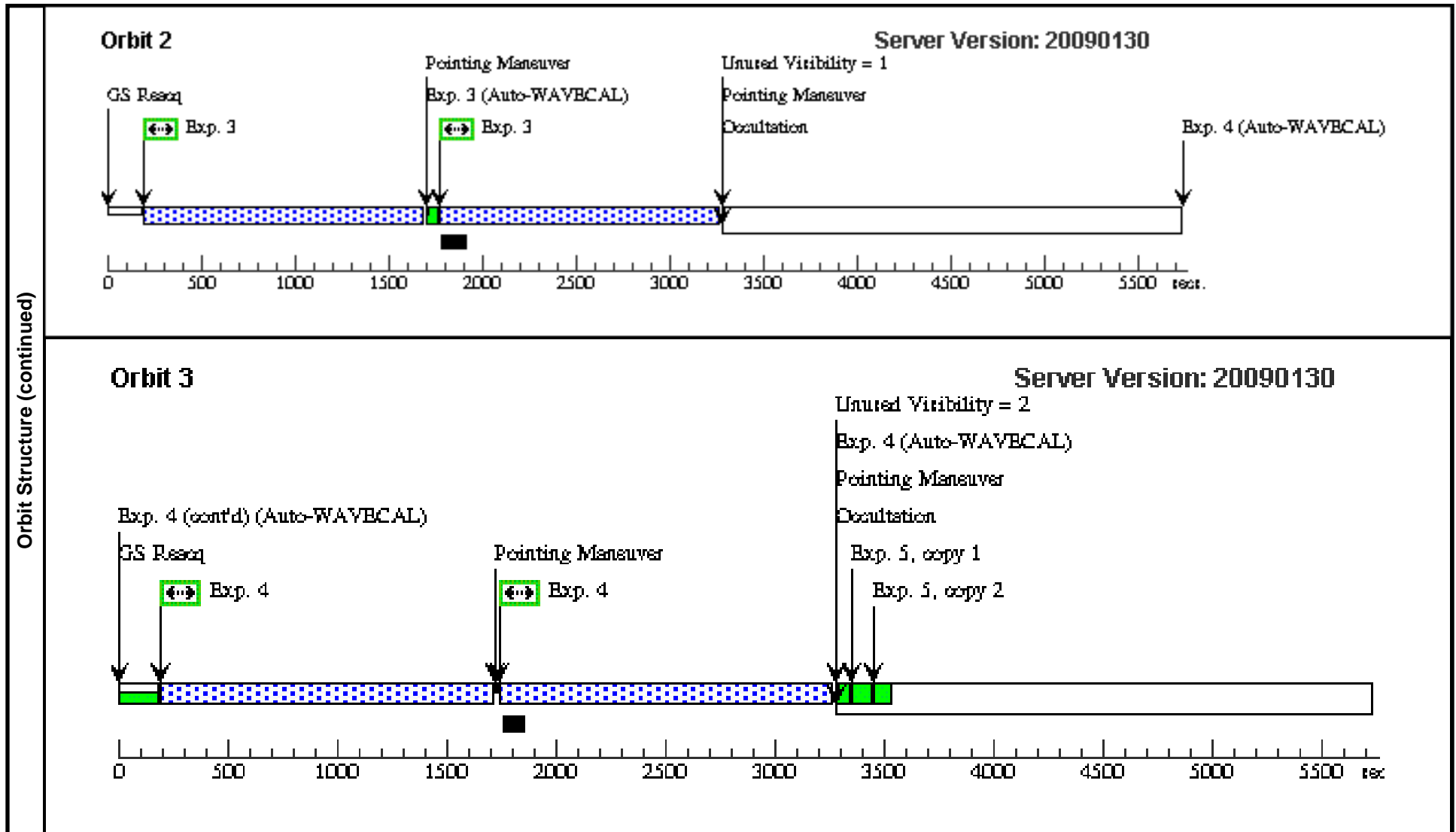
Wed Jul 01 02:40:00 GMT 2009

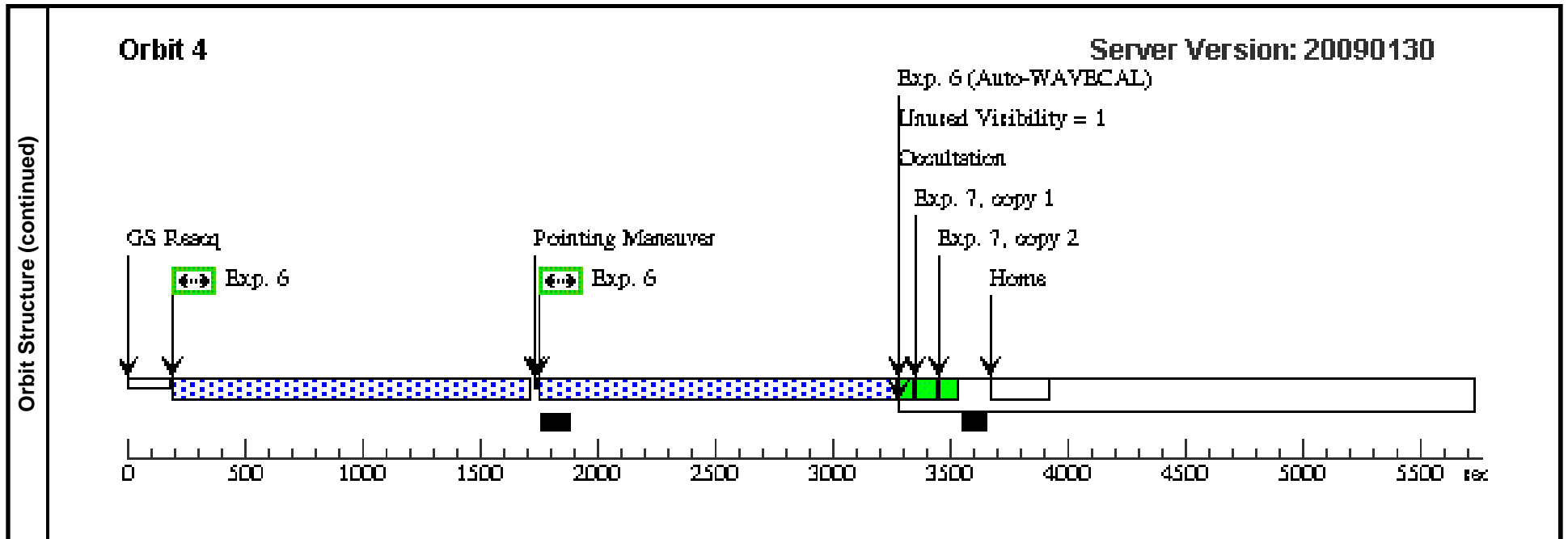
Visit	Proposal 11574, Visit 02, implementation Diagnostic Status: Warning Scientific Instruments: STIS/CCD Special Requirements: PCS MODE FINE; SAME ORIENT AS 01									
	Diagnosics (3C48 OPT LONG (02.004) special requirements) Warning (Form): Be very careful mixing POS TARG and Center_Pattern = Yes (3C48 OPT LONG (02.006) special requirements) Warning (Form): Be very careful mixing POS TARG and Center_Pattern = Yes									
Patterns	#	Primary Pattern		Secondary Pattern		Exposures				
	(2)	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=4 Point Spacing=1.00 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=true			(3)				
(4)	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=2 Point Spacing=1 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=true			(4), (6)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	3C-048	RA: 01 37 41.3100 (24.4221250d) Dec: +33 09 34.90 (33.15969d) Equinox: J2000	Redshift: 0.36926	V=16.06+/-0.1	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	3C48 ACQ UISITION	(1) 3C-048	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs	
									[==>]	[1]
	2	3C48 PEAK -UP	(1) 3C-048	STIS/CCD, ACQ/PEAK, 52X0.2F1-R	MIRROR				5 Secs	
									[==>]	[1]
	3	3C48 OPT S HORT	(1) 3C-048	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=NO			Pattern 2, Exps 3-3 (2)	1099 Secs
								[==>(Pattern 1)]		[1]
								[==>(Pattern 2)]		
								[==>1456.0 Secs (Pattern 3)]		[2]
								[==>1456.0 Secs (Pattern 4)]		
4	3C48 OPT L ONG	(1) 3C-048	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A	CR-SPLIT=NO	POS TARG 0.0,-1.0		Pattern 4, Exps 4-4 (4)	1000 Secs	
								[==>1483.0 Secs (Pattern 1)]		[3]
								[==>1483.0 Secs (Pattern 2)]		

Proposal 11574 - Visit 02 - Physical Characteristics of the Massive Outflow in 3C 48

Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	5		CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A				[==>(Copy 1)] [==>(Copy 2)]	[3]
	6	3C48 OPT L (1) 3C-048 ONG		STIS/CCD, ACCUM, 52X0.2	G750L 7751 A	CR-SPLIT=NO	POS TARG 0.0,1.0	Pattern 4, Exps 6-6 (4)	1000 Secs [==>1482.0 Secs (Pattern 1)] [==>1482.0 Secs (Pattern 2)]	[4]
	7		CCDFLAT	STIS/CCD, ACCUM, 52X0.2	G750L 7751 A				[==>(Copy 1)] [==>(Copy 2)]	[4]







Proposal 11574 - Visit 03 - Physical Characteristics of the Massive Outflow in 3C 48

Wed Jul 01 02:40:01 GMT 2009

Visit	Proposal 11574, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD Special Requirements: PCS MODE FINE; ORIENT 50D TO 50 D; ORIENT 230D TO 230 D									
	Patterns	#	Primary Pattern		Secondary Pattern		Exposures			
(3)		Pattern Type=STIS-PERP-TO-SLIT Purpose=MOSAIC Number Of Points=2 Point Spacing=0.3 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0.0 Angle Between Sides= Center Pattern=true	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=4 Point Spacing=1.0 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=false	(3)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	3C-048	RA: 01 37 41.3100 (24.4221250d) Dec: +33 09 34.90 (33.15969d) Equinox: J2000	Redshift: 0.36926	V=16.06+/-0.1	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the NED database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	3C48 ACQ UISITION	(1) 3C-048	STIS/CCD, ACQ, F28X50LP	MIRROR				5 Secs	
									[==>]	[1]
	2	3C48 PEAK -UP	(1) 3C-048	STIS/CCD, ACQ/PEAK, 52X0.2F1-R	MIRROR				5 Secs	
									[==>]	[1]
	3		(1) 3C-048	STIS/CCD, ACCUM, 52X0.2	G750M 6768 A	CR-SPLIT=NO		Pattern 3, Exps 3-3 (3)	1000 Secs	
									[==>1064.0 Secs (Pattern 1,1)]	[1]
									[==>1064.0 Secs (Pattern 1,2)]	[1]
								[==>1458.0 Secs (Pattern 1,3)]	[2]	
								[==>1458.0 Secs (Pattern 1,4)]	[2]	
								[==>1458.0 Secs (Pattern 2,1)]	[3]	
								[==>1458.0 Secs (Pattern 2,2)]	[3]	
								[==>1456.0 Secs (Pattern 2,3)]	[4]	
								[==>1456.0 Secs (Pattern 2,4)]	[4]	

