10797 - HE0450-2958: Lonesome black hole, scantly dressed quasar or massively dust obscured host galaxy?

Cycle: 15, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Knud Jahnke (PI) (ESA Member)	**Max-Planck-Institut fur Astronomie, Heidelberg**	**jahnke@mpia-hd.mpg.de**
Dr. Frederic Courbin (CoI) (ESA Member)	EPFL Lausanne	frederic.courbin@epfl.ch
Dr. Pascale Jablonka (CoI) (ESA Member)	Observatoire de Paris - Section de Meudon	pascale.jablonka@obspm.fr
Dr. Geraldine Letawe (CoI) (ESA Member)	Universite de Liege	gletawe@ulg.ac.be
Prof. Georges Meylan (CoI) (ESA Member)	EPFL Lausanne	georges.meylan@epfl.ch
Prof. Pierre Magain (CoI) (ESA Member)	Universite de Liege	pierre.magain@ulg.ac.be
Prof. Lutz Wisotzki (CoI) (ESA Member)	Astrophysikalisches Institut Potsdam	lwisotzki@aip.de
Dr. Asmus Boehm (CoI) (ESA Member)	Astrophysikalisches Institut Potsdam	aboehm@aip.de
Mr. Yannick Letawe (CoI) (ESA Member)	Universite de Liege	yletawe@ulg.ac.be

VISITS

Visit	*Targets*	*Configurations*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) HE0450-2958	NIC2	2	01-Aug-2006 21:27:37.0	yes
02	(3) EISJ033259.33-274638.5	NIC2	1	01-Aug-2006 21:27:44.0	yes
51	(1) HE0450-2958	NIC2	2	01-Aug-2006 21:27:49.0	yes
52	(3) EISJ033259.33-274638.5	NIC2	1	01-Aug-2006 21:27:59.0	yes

6 Total Orbits Used

ABSTRACT

We propose to obtain a deep NICMOS image of the bright z=0.285 quasar HE0450-2958 that has an exceptional, undetected host galaxy, at least 6 times fainter than expected for the quasar luminosity. Several mutually exclusive explanations that were put forward in the last weeks, attempting to explain the apparently undermassive host galaxy, have important implication for their respective areas: The host could be a dust obscured ultra-luminous infrared galaxy in transition to become a quasar, HE450-2958 could have a normal host galaxy but an undermassive central black hole, or the quasar could recently have been ejected from a nearby companion galaxy in a 3-body black hole interaction or by gravitational recoil. We want to use NIC2 with the minimum-background F160W filter to obtain a >=10 times fainter limit on the host galaxy mass than is currently available with ACS, in order to set strong constraints for these very important scenarios.

OBSERVING DESCRIPTION

Aim: We want to observe a QSO (target 1) to detect its surrounding host galaxies. It is so far undetected in the optical with ACS, but one explanation is dust obscuration so it is likely to be seen in the NIR. We wish to reach the highest broad-band sensitivity posible on the host galaxy, in combination with a very accurate sampling of the point-spread-function to remove the nuclear light, to increase the contrast of the host galaxy. This prompted the choice of F160W for its low background, NIC2 for its spatial sampling and field size compromise, the choice of PSF calibrator star (same colour as QSO nucleus), and the dither strategy.

Target: The main target (target 1: HE0450-2958) consists of a point source at the nominal location, a fainter star 1.5 arcsec distance to the N-W and a companion galaxy 1.5" to the S-E. The QSO system has a maximum linear extention of about 5 arcsec and fits completely into one quadrant of NIC2, while the other 3 quadrants are empty.

The second target (target 2: TVLM868-110639) is a PSF calibrator star with the same (J-H)-colours as the QSO nucleus, that is needed to remove the nuclear light contribution during data analysis. The PSF calibrator star was chosen to have the same J-H=0.75 colour as the QSO to remove chromatic effects of PSF shape, and was chosen to be bright. This made the star invariably nearby and so the PSF-star has a significant proper motion. Its position was computed to a precision of 0.1" for the epoch 2006.7, the stated anual proper motions are exact to 10mas.

Strategy: QSO and PSF-star are supposed to be observed at the same positions on the detector, so the QSO observation pattern of 6 dither positions is the same as the initial pattern (6 positions) for the PSF star. The remaining PSF-star exposures are either repetitions of 4 of the positions or sample different parts of the chip to quantify the PSF variations. The last PSF-star exposure is a deep exposure to also get the fainter wings of the PSF.

Dither pattern and POS-TARG offsets are chosen to put the targets into the centers of the 4 quadrants. Additional 0.5 pixel offsets are applied to allow sub-sampling of pixel positions for better sampling of the PSF. Our experience shows that this will greatly improve the quality of the derived PSF.

Since NIC2 is read-noise-limited at all shorter exposure times, we needed to split the available time into as few sub-exposures as possible, but for good PSF reconstruction we need at least 3 dither positions. This requires to make 4 long exposures split over 2 orbits. The first and last QSO exposure in visit 1 are short exposures at different sub-pixel positions to possibly further enhance the sampling by adding two further sampling positions.

Saturation: We take 4 long sub-exposures at each a different position/quadrant on the chip. The centres will be very much saturated, the saturation limit is at about 30-40s for the QSO nucleus. We expose for 1200s with MULTIACCUM which will allow to reconstruct the QSO center in a PSF-shape consistent way from read-out #8 in a STEP128 sequence and get the faint parts from read-out #25. The PSF-star is supposed to be treated in the same way.

The saturation will leave persistent charge at the position of the QSO nucleus and PSF-star, but since we do not go back to any one quadrant within the same orbit for the QSO, this should not influence the images. We will have to deal with Mr. Staypuff streaks, however. For the PSF-star we have to go back to the same position after 200-300s, but here the images are not quite saturated in any but the last exposure (approx 96,000 electrons in the brightest pixel for 10s at the given object brightness of H=10.9). The last exposure is saturated by a factor of 5 in the central pixel but only one sub-exposure per quadrant is taken.

Visit

Proposal 10797, Visit 01 Wed Aug 02 01:28:01 GMT 2006

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SPIRAL-DITH	Coordinate Frame=POS-TARG		(2)
	Purpose=BACKGROUND	Pattern Orientation=0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=9.562	Center Pattern=false		
	Line Spacing=			

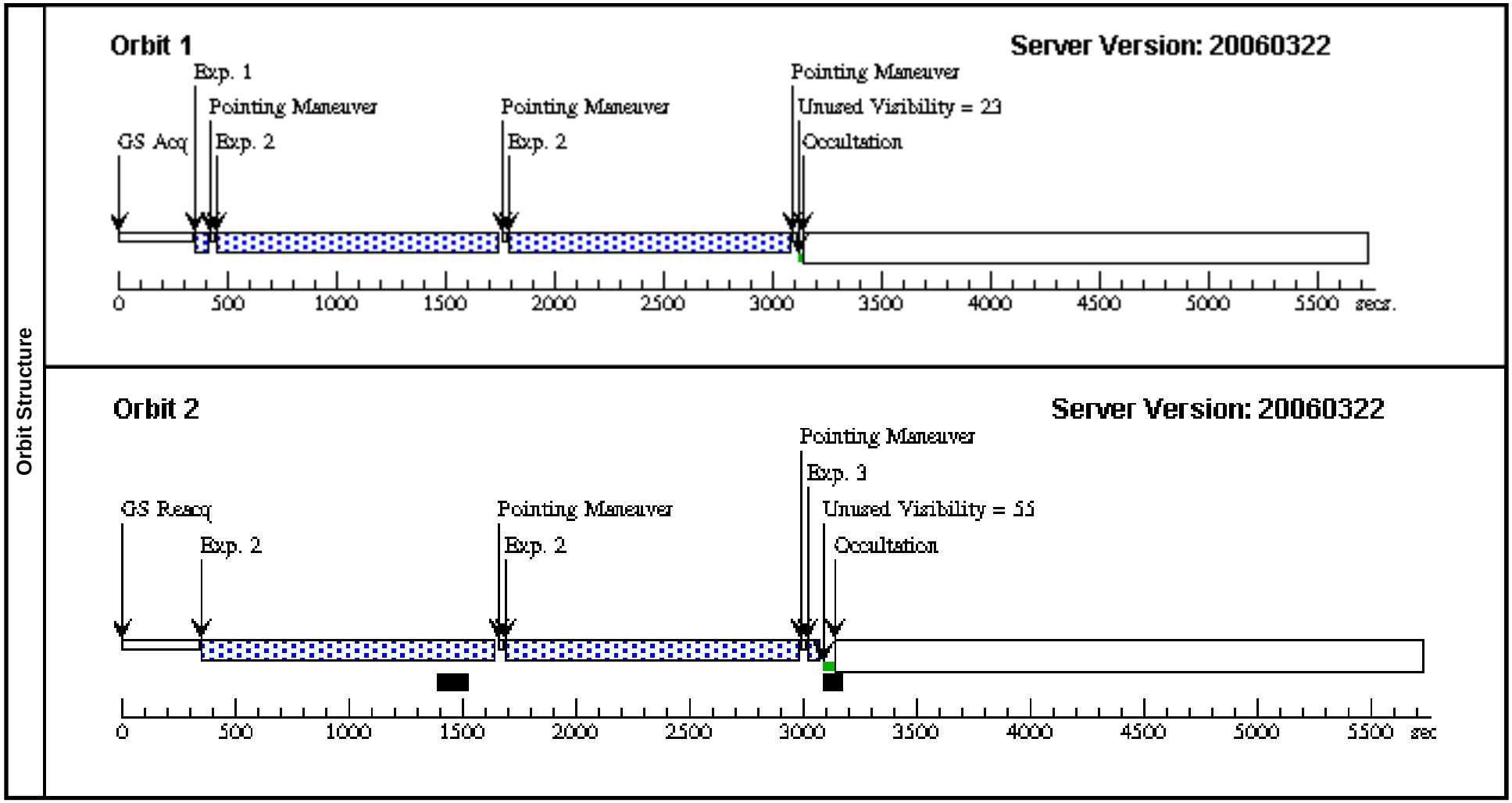
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HE0450-2958	RA: 04 52 30.1400 (73.1255833d) Dec: -29 53 35.30 (-29.89314d) Equinox: J2000		V=(?) H_mag=13 Vega (total, QSO nucleus), H_mag=24.3 mag/sqarcsec (surface brightness, target host galaxy)	Reference Frame: ICRS

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	QSO_1_short	(1) HE0450-2958	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP2; NSAMP=25	POS TARG -4.7812 5,4.78125		*[==>]*	***[1]***
2	QSO_2_5_long	(1) HE0450-2958	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP128; NSAMP=19	POS TARG -4.8,-4.8	Pattern 2-2 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
3	QSO_6_short	(1) HE0450-2958	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP2; NSAMP=25	POS TARG -4.8187 5,-4.78125		*[==>]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20060322
Exp. 1
Pointing Maneuver
GS Acq
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Unused Visibility = 23
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20060322
Pointing Maneuver
Exp. 3
GS Reacq
Exp. 2
Pointing Maneuver
Exp. 2
Unused Visibility = 55
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 10797, Visit 02 Wed Aug 02 01:28:02 GMT 2006

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2

Special Requirements: (none)

Patterns

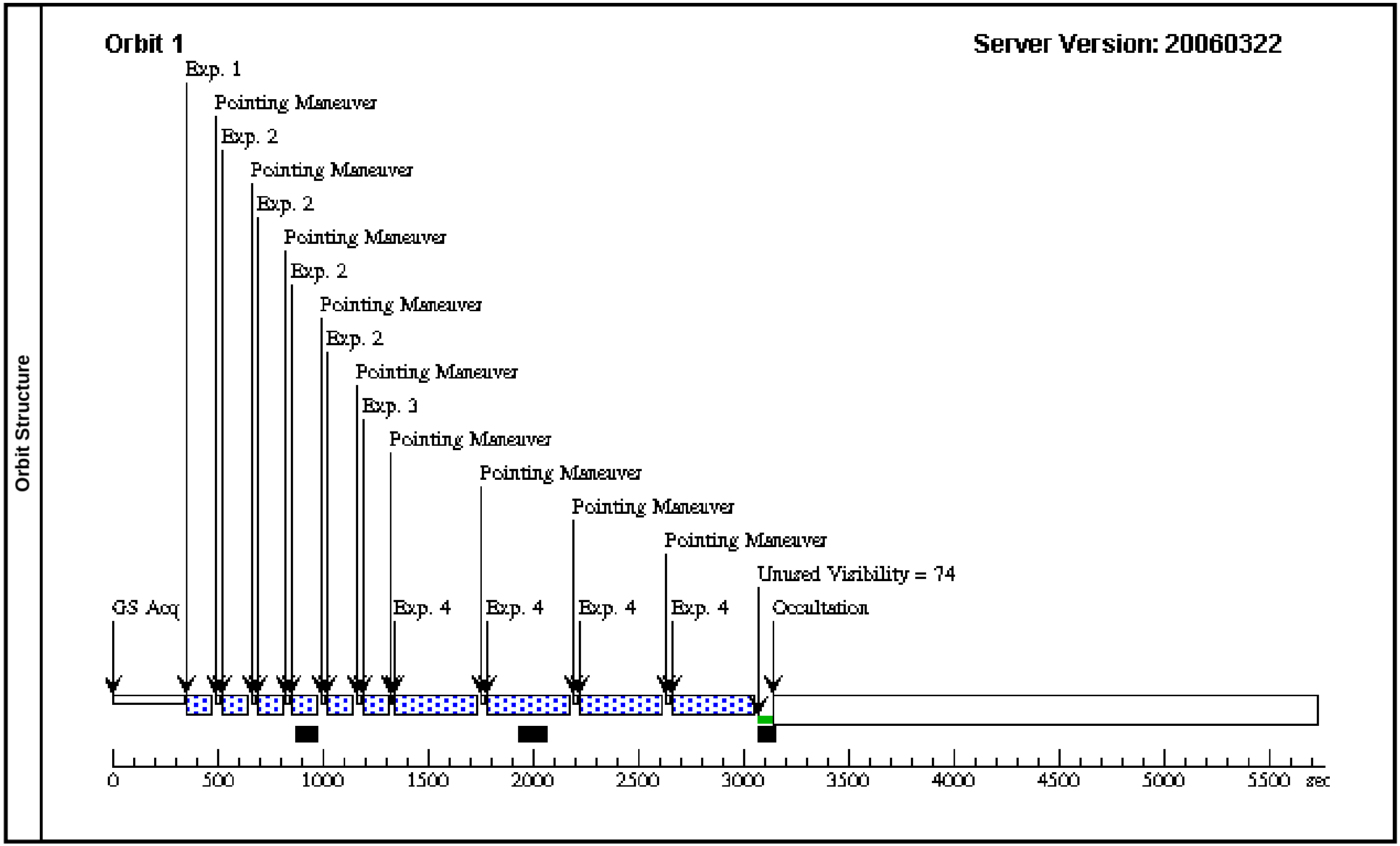
#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SPIRAL-DITH	Coordinate Frame=POS-TARG		(2), (4)
	Purpose=BACKGROUND	Pattern Orientation=0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=9.562	Center Pattern=false		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	EISJ033259.33-274638.5	RA: 03 32 59.3330 (53.2472208d) Dec: -27 46 38.30 (-27.77731d) Equinox: J2000		V=17.03+/-0.01	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	PSF_1	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP8; NSAMP=19	POS TARG -4.78125,4.78125		*[==>]*	***[1]***
2	PSF_2_5	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP8; NSAMP=19	POS TARG -4.8,-4.8	Pattern 2-2 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3	PSF_6	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP8; NSAMP=19	POS TARG -4.81875,-4.78125		*[==>]*	***[1]***
4	PSF_long_dither	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP32; NSAMP=19	POS TARG -4.8,-4.8	Pattern 4-4 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20060322
Exp. 1
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 3
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 74
GS Acq
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 10797, Visit 51 Wed Aug 02 01:28:02 GMT 2006

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SPIRAL-DITH	Coordinate Frame=POS-TARG		(2)
	Purpose=BACKGROUND	Pattern Orientation=0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=9.562	Center Pattern=false		
	Line Spacing=			

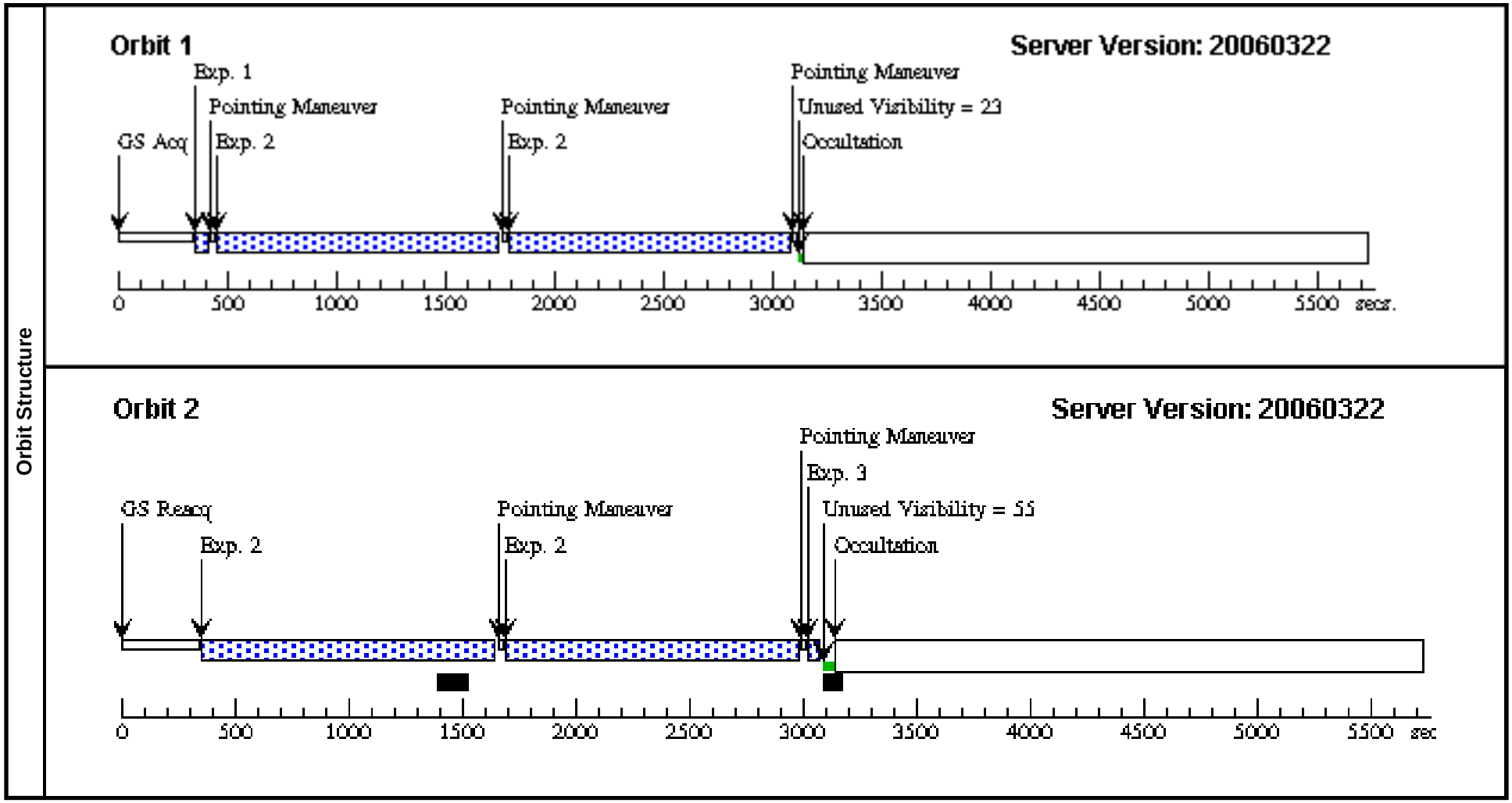
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HE0450-2958	RA: 04 52 30.1400 (73.1255833d) Dec: -29 53 35.30 (-29.89314d) Equinox: J2000		V=(?) H_mag=13 Vega (total, QSO nucleus), H_mag=24.3 mag/sqarcsec (surface brightness, target host galaxy)	Reference Frame: ICRS

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	QSO_1_short	(1) HE0450-2958	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP2; NSAMP=25	POS TARG -4.78125,4.78125; GS ACQ SCENARIO BASE1TNS		*[==>]*	***[1]***
2	QSO_2_5_long	(1) HE0450-2958	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP128; NSAMP=19	POS TARG -4.8,-4.8	Pattern 2-2 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
3	QSO_6_short	(1) HE0450-2958	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP2; NSAMP=25	POS TARG -4.81875,-4.78125		*[==>]*	***[2]***


Orbit Structure
Orbit 1
Server Version: 20060322
Exp. 1
Pointing Maneuver
GS Acq
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Unused Visibility = 23
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 2
Server Version: 20060322
Pointing Maneuver
Exp. 3
GS Reacq
Exp. 2
Pointing Maneuver
Exp. 2
Unused Visibility = 55
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 10797, Visit 52 Wed Aug 02 01:28:03 GMT 2006

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2

Special Requirements: (none)

Patterns

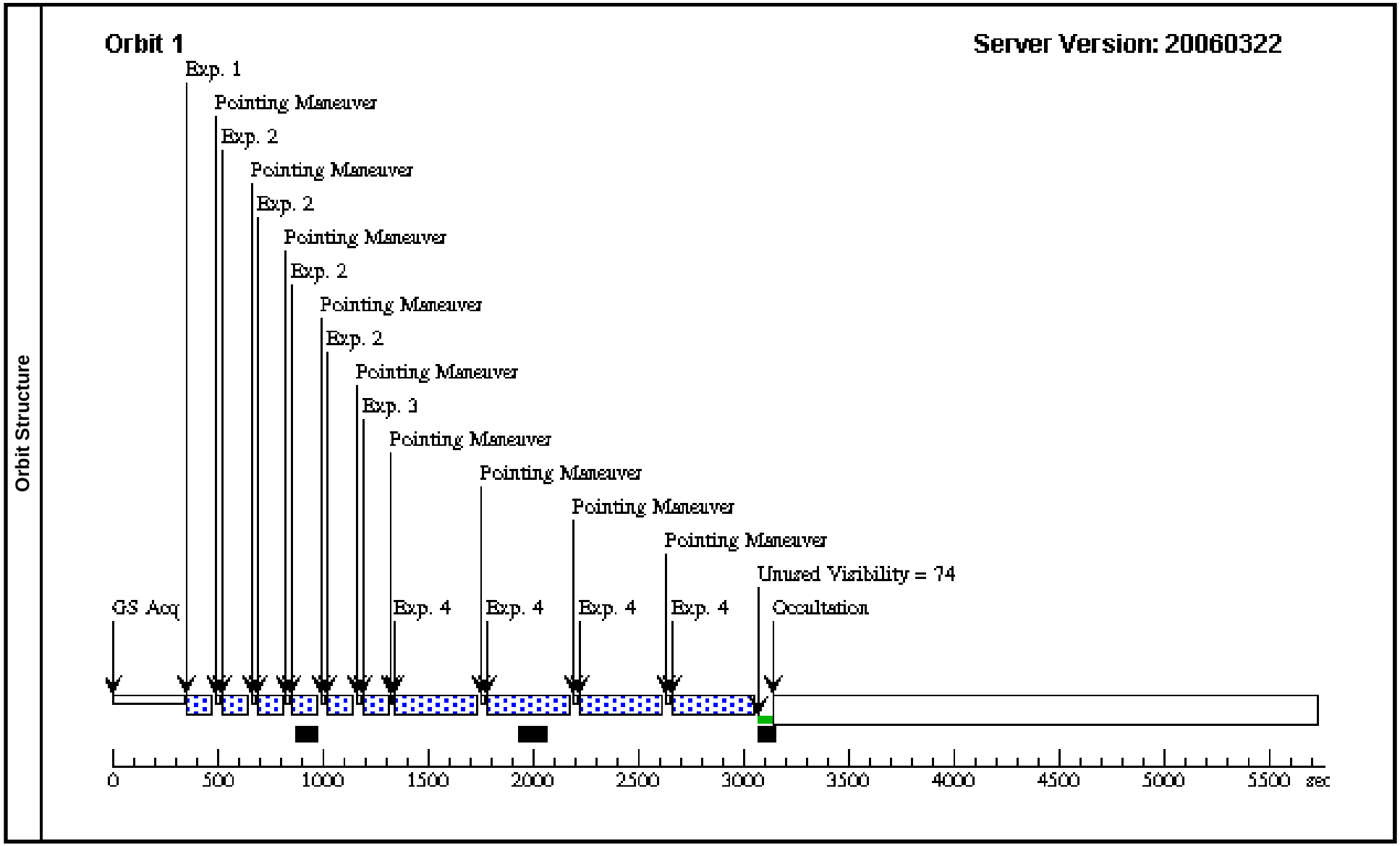
#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=NIC-SPIRAL-DITH	Coordinate Frame=POS-TARG		(2), (4)
	Purpose=BACKGROUND	Pattern Orientation=0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=9.562	Center Pattern=false		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	EISJ033259.33-274638.5	RA: 03 32 59.3330 (53.2472208d)		V=17.03+/-0.01	Reference Frame: ICRS
		Dec: -27 46 38.30 (-27.77731d)			
		Equinox: J2000			

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	PSF_1	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP8; NSAMP=19	POS TARG -4.78125,4.78125; GS ACQ SCENARIO BASE1TNS		*[==>]*	***[1]***
2	PSF_2_5	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP8; NSAMP=19	POS TARG -4.8,-4.8	Pattern 2-2 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3	PSF_6	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP8; NSAMP=19	POS TARG -4.81875,-4.78125		*[==>]*	***[1]***
4	PSF_long_dither	(3) EISJ033259.33-274638.5	NIC2, MULTIACCUM, NIC2-FIX	F160W	SAMP-SEQ=STEP32; NSAMP=19	POS TARG -4.8,-4.8	Pattern 4-4 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20060322
Exp. 1
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 2
Pointing Maneuver
Exp. 3
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 74
GS Acq
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec