13399 - Spatially Resolved WFC3/Grism Spectral Line Imaging of Gravitational Lensed Herschel-selected Luminous Dusty Starbursts

Cycle: 21, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Asantha Cooray (PI) (Contact)	**University of California - Irvine**	**acooray@uci.edu**
Dr. Hai Fu (CoI)	University of California - Irvine	haif@uci.edu
Dr. Julie Wardlow (CoI)	University of California - Irvine	jwardlow@uci.edu
Dr. Mattia Negrello (CoI) (ESA Member)	Open University	m.negrello@open.ac.uk
Dr. Dominik A. Riechers (CoI)	Cornell University	riechers@astro.cornell.edu
Dr. Shane Bussmann (CoI)	Harvard University	rbussmann@cfa.harvard.edu
Prof. Rob Ivison (CoI) (ESA Member)	Royal Observatory Edinburgh	rji@roe.ac.uk
Dr. Paul van der Werf (CoI) (ESA Member)	Universiteit Leiden	pvdwerf@strw.leidenuniv.nl
Dr. Stephen Serjeant (CoI) (ESA Member)	Open University	s.serjeant@open.ac.uk
Dr. Ismael Perez-Fournon (CoI) (ESA Member)	Instituto de Astrofisica de Canarias	ipf@iac.es
Dr. Kristen Coppin (CoI)	McGill University	coppink@physics.mcgill.ca
Dr. Helmut Dannerbauer (CoI) (ESA Member)	CEA/DSM/DAPNIA/Service d'Astrophysique	helmut.dannerbauer@cea.fr
Dr. Aprajita Verma (CoI) (ESA Member)	University of Oxford	verma@astro.ox.ac.uk
Dr. Pasquale Temi (CoI)	NASA Ames Research Center	pasquale.temi@nasa.gov
Dr. Edo Ibar (CoI)	Pontificia Universidad Catolica de Chile	ibar@roe.ac.uk
Prof. Lerothodi L Leeuw (CoI)	University of South Africa	lerothodi@gmail.com
Dr. Filiberto G. Braglia (CoI) (ESA Member)	Imperial College of Science Technology and Medicine	f.braglia@imperial.ac.uk
Dr. Joaquin Gonzalez-Nuevo (CoI) (ESA Member)	Instituto de Fisica de Cantabria	gnuevo@ifca.unican.es
Dr. Neil Nagar (CoI) (ESA Member)	Osservatorio Astrofisico di Arcetri	neil@arcetri.astro.it
Mr. Hugo Messias (CoI)	Universidad de Concepcion	hmessias@astro-udec.cl

Name	*Institution*	*E-Mail*
Jae Alyson Calanog (CoI)	University of California - Irvine	jacalanog@gmail.com
Dr. Alexandre Amblard (CoI)	NASA Ames Research Center	alexandre.amblard@nasa.gov
Dr. Dave Clements (CoI) (ESA Member)	Imperial College of Science Technology and Medicine	d.clements@imperial.ac.uk
Dr. Mattia Vaccari (CoI) (ESA Member)	Universita degli Studi di Padova	mattia.vaccari@gmail.com
Prof. Steve Eales (CoI) (ESA Member)	University of Wales, College of Cardiff (UWCC)	steve.eales@astro.cf.ac.uk
Dr. Andrea Lapi (CoI) (ESA Member)	Scuola Internazionale Superiore di Studi Avanzati	lapi@sissa.it
Dr. Lucia Marchetti (CoI) (ESA Member)	Open University	lucia.marchetti@open.ac.uk

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) G15.19	WFC3/IR	2	14-Oct-2013 21:17:44.0	yes
02	(2) NB.43	WFC3/IR	3	14-Oct-2013 21:17:56.0	yes

5 Total Orbits Used

ABSTRACT

We propose WFC3 G102 and G141 grism spectral imaging of two gravitationally lensed dusty, starburst galaxies found with the 600 square degree Herschel-ATLAS survey. One galaxy is the brightest (both in far-IR at 250 micron and in near-IR in J/K-band), while the second is the largest (11 arcsec on the sky) of the lensed sub-mm galaxies in a sample of 200 imaged with WFC3/F110W. The two galaxies are at redshifts that are optimal for grism observations with HST/WFC3. The lensing flux magnification and spatial enhancement makes them very unique for the study proposed here

and will increase the number of lensed galaxies imaged in spectral lines with WFC3 grisms to three from existing single serendipitous lens studied in HST-3D survey. With WFC3 grism spectra taken in a specific orientation to minimize foreground and lensing galaxy confusion we can map each of these galaxies in a variety of spatially-resolved spectral lines in the rest-frame optical, including impostant Balmer lines for studies on the interstellar medium. The grism spectra will allow us to determine the gas-phase metallicities of these two galaxies and to study the extinction of optically-thin regions compared to direct sub-mm emission seen in interferometric continuum images of optically thick dust in starbursting knots and clumps. With spatial resolution provided by gravitational lensing combined with HST/WFC3 resolution, we will be able to study the dependence of line ratios in high density/SFR regions to low dense diffuse environments.

OBSERVING DESCRIPTION

The program is related to rest-frame optical spectro-imaging of two lensed starbursting galaxies (G15.19 at z=1.06 and NB.43 at z=1.667) found with Herschel. The two lensed galaxies are near-IR bright and spans 3 arcsec Einstein ring in G15.19 to a giant arc of 11 arcsec long in NB.43.

The most basic goals of this program are (i) Obtain spatially resolved imaging in multiple spectral lines to study the line intensity variations across two starburst galaxies within the ISM in at least 20 spatial resolution elements (i.e., independent spectral pixels). (ii) Derive extinction corrections using either Halpha/Hbeta (G15.19 at z = 1.026) or Hbeta/Hgamma
(NB.43 at z = 1.677) at multiple locations within the galaxy. Compare and contrast
with the spatial distribution of optically-thick dust extinction directly seen with
high-resolution sub-mm dust emission maps from ALMA (G15.19) and SMA
(NB.43/G15.19). (iii) Derive gas-phase metallicities of these two galaxies with either R23 or O23 ratios, and study any differences in the rest UV and optical line intensities and line ratios relative
to the gas and SFR surface densities of these galaxies derived from mm-wave
interferometeric observations.

To achieve these science goals we make use of both G141 and G102 grisms of WFC3.
To align grism spectra on the sky we also take deep images following the guidelines of the WFC3 handbook. We use F160W and F105W.

We have used the on-line calculator to estimate the exposure time necessary to detect the Halpha or Hbeta from each of the G102 or G141 spectra of the two sources. The times are such that we need to spend 2 orbits on G15.19 and 3 orbits on NB.43.

REAL TIME JUSTIFICATION

To minimize the source overlap in grism spectra and to separate the lensed starbursting galaxy from the foreground lens, these grism observations require certain ranges in orientation. These were described in the original science proposal. We do not need to do orthogonal grism observations as the sources we are studying are bright and the contamination can be minimized over a range of PA.

The request ranges were calculated based on the orientation and the angle between the WFC3/grism dispersion direction and the U3 roll angle. To allow a range of possible scheduling options, we have left +/- 30 degrees from the preferred position angle for observations.

Visit

Proposal 13399, Visit 01, implementation Tue Oct 15 01:18:05 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 255D TO 285 D; ORIENT 75D TO 105 D; VISIBILITY INTERVAL 52 M

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2-4)

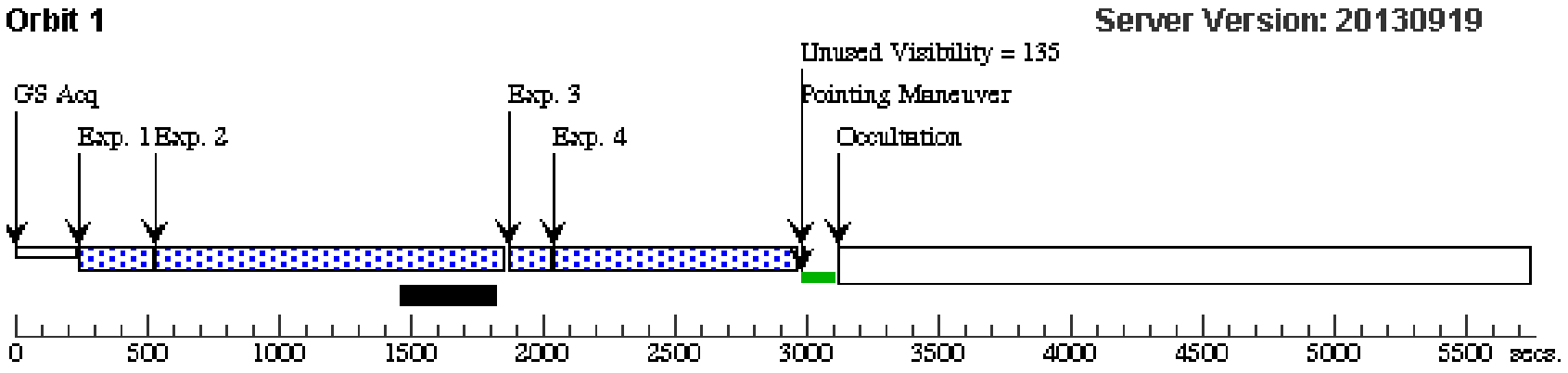
Fixed Targets

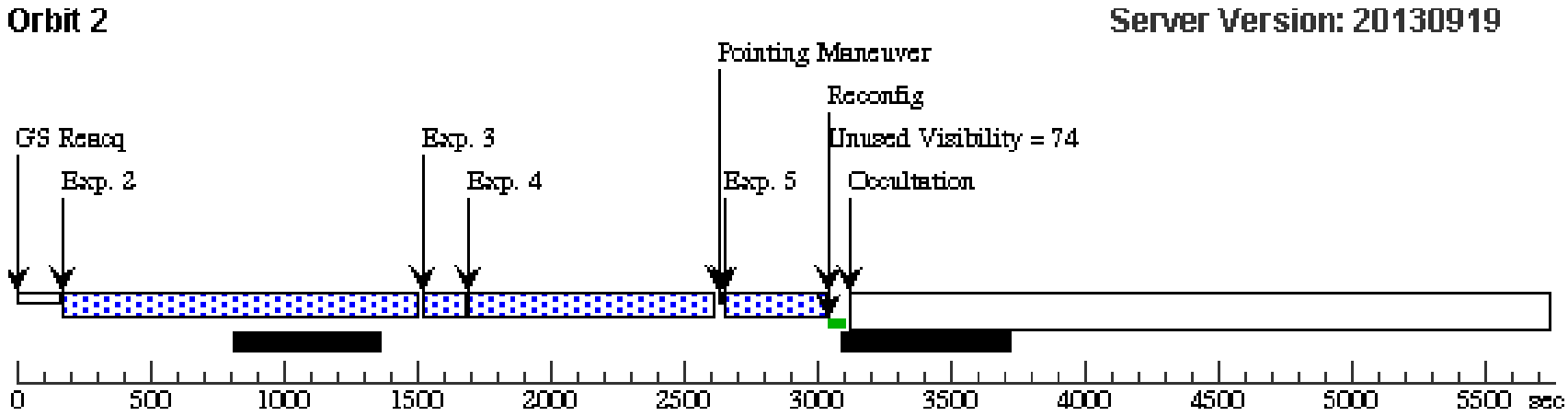
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	G15.19	RA: 14 29 35.3112 (217.3971300d) Dec: -00 28 36.74 (-.47687d) Equinox: J2000		V=(?) K-band AB = 18	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) G15.19	WFC3/IR, MULTIACCUM, GRISM1024	F160W	NSAMP=6; SAMP-SEQ=SPARS50	GS ACQ SCENARIO SINGLE		252.934546 Secs (252.935 Secs) *[==>]*	 ***[1]***
2		(1) G15.19	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=14; SAMP-SEQ=SPARS100		Pattern 1, Exps 2-4 in Visit 01 (1)	1302.93649 Secs (2605.873 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]*** ***[2]***
3		(1) G15.19	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=4; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-4 in Visit 01 (1)	152.933644 Secs (305.867 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]*** ***[2]***
4		(1) G15.19	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 1, Exps 2-4 in Visit 01 (1)	902.935198 Secs (1805.87 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]*** ***[2]***
5		(1) G15.19	WFC3/IR, MULTIACCUM, GRISM1024	F105W	SAMP-SEQ=SPARS50; NSAMP=8			352.935448 Secs (352.935 Secs) *[==>]*	 ***[2]***

Orbit Structure





Visit

Proposal 13399, Visit 02, implementation Tue Oct 15 01:18:07 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 330D TO 30 D; ORIENT 150D TO 210 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2-3), (5)

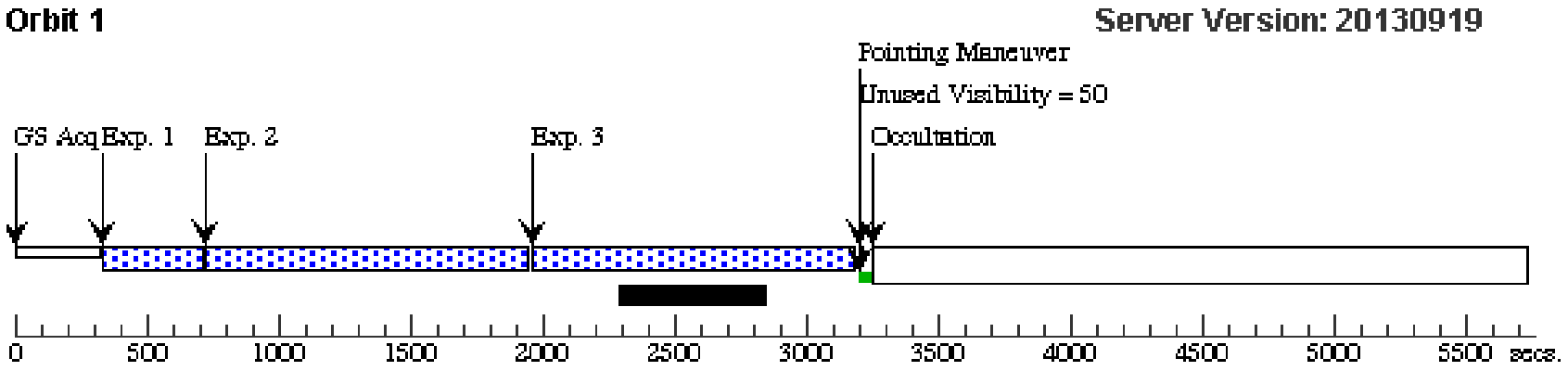
Fixed Targets

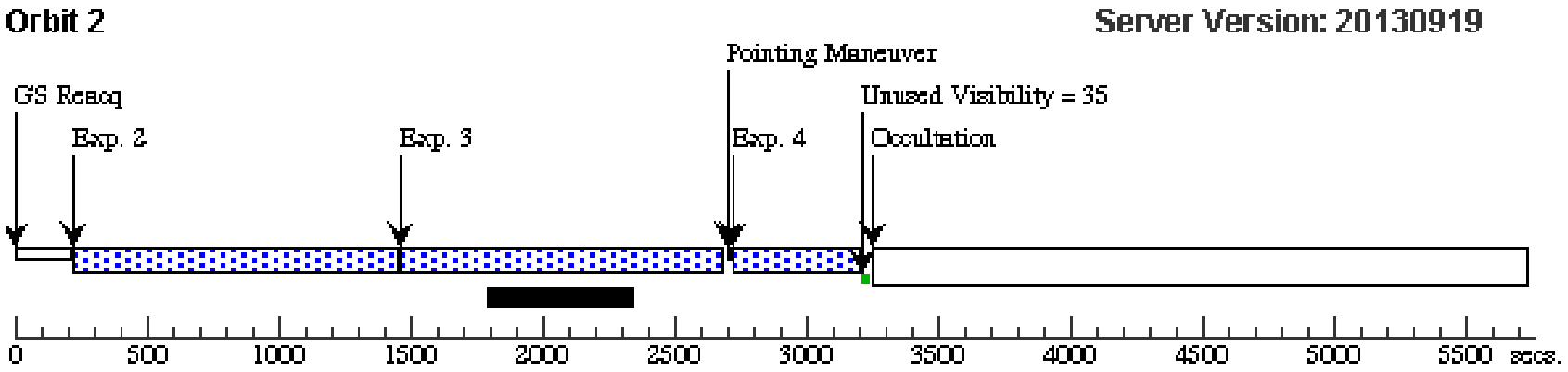
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NB.43	RA: 13 24 26.9462 (201.1122758d) Dec: +28 44 52.43 (28.74790d) Equinox: J2000		V=(?) K-band AB = 20.5	Reference Frame: ICRS

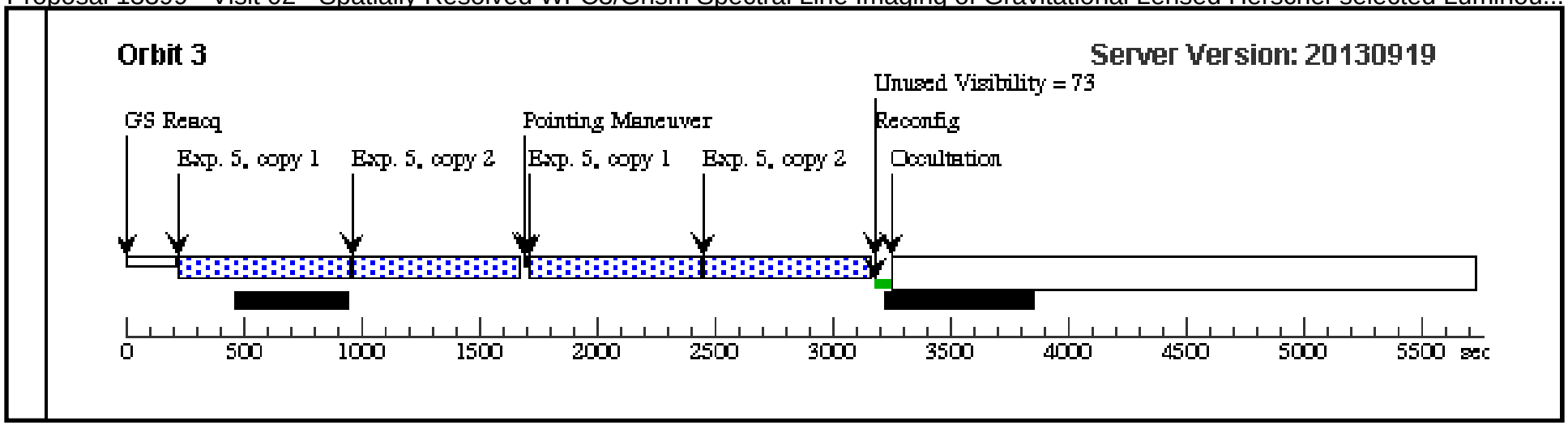
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) NB.43	WFC3/IR, MULTIACCUM, GRISM1024	F160W	NSAMP=8; SAMP-SEQ=SPARS50			352.935448 Secs (352.935 Secs) *[==>]*	 ***[1]***
2		(2) NB.43	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=13; SAMP-SEQ=SPARS100		Pattern 1, Exps 2-3 in Visit 02 (1)	1202.936167 Secs (2405.872 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]*** ***[2]***
3		(2) NB.43	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=13; SAMP-SEQ=SPARS100		Pattern 1, Exps 2-3 in Visit 02 (1)	1202.936167 Secs (2405.872 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]*** ***[2]***
4		(2) NB.43	WFC3/IR, MULTIACCUM, GRISM1024	F105W	SAMP-SEQ=SPARS50; NSAMP=10			452.93635 Secs (452.936 Secs) *[==>]*	 ***[2]***
5		(2) NB.43	WFC3/IR, MULTIACCUM, GRISM1024	G102	SAMP-SEQ=SPARS100; NSAMP=8		Pattern 1, Exps 5-5 in Visit 02 (1)	702.934552 Secs X 2 (2811.738 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]*	 ***[3]***

Orbit Structure






Orbit 3
Server Version: 20130919
Unused Visibility = 73
GS Reacq
Exp. 5, copy 1
Exp. 5, copy 2
Pointing Maneuver
Exp. 5, copy 1
Exp. 5, copy 2
Reconfig
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec