12194 - High resolution Near-Infrared imaging of the first sub-mm selected gravitational lens candidates in the Herschel ATLAS

Cycle: 18, 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) SDSS-090312+003907	WFC3/IR	2	23-Sep-2010 21:01:01.0	yes
02	(2) SDSS-091305-005343	WFC3/IR	2	23-Sep-2010 21:01:10.0	yes
03	(3) SDSS-090740-004160	WFC3/IR	2	23-Sep-2010 21:01:18.0	yes
04	(4) SDSS-091043-000323	WFC3/IR	2	23-Sep-2010 21:01:25.0	yes
05	(5) SDSS-090303-014127	WFC3/IR	2	23-Sep-2010 21:01:31.0	yes

10 Total Orbits Used

ABSTRACT

We propose HST/WFC3 near-IR high-resolution imaging of five gravitational lens candidates produced by the Herschel Astrophysical Terahertz Large Area Survey (H-ATLAS). These sources are among the brightest sub-mm objects detected in H-ATLAS. Their spectral energy distribution, sub-mm colors and optical IDs are consistent with a gravitational lensing system where a low redshift ($z<0.8$) elliptical galaxy is acting as a lens on a dust-obscured high-redshift ($z>1.5$) galaxy. However, the background galaxy is predicted to be too faint in the optical/near-IR to be detectable in the ancillary SDSS and UKIDSS images, therefore our proposal for deep near-IR imaging with HST/WFC3. The discovery of gravitational lenses is one of the scientific goals of H-ATLAS and, if achieved, it will demonstrate the efficiency of blank wide-area sub-mm survey in producing unbiased and complete samples of gravitational lensing systems. Thanks to its sensitivity and unique spatial resolution HST/WFC3 will allow us to constrain the morphology of the brightest sub-mm sources detected by Herschel and therefore to eventually confirm their nature as gravitational lenses. In that case we will use HST/WFC3 images to reconstruct the intrinsic morphology of the background source and constrain the mass and matter profile of the lens.

OBSERVING DESCRIPTION

The background source in each of these 5 lens systems is heavily obscured by dust. Therefore we propose near-IR WFC3/HST observations using the two broad filters F110W and the F160W. The combined observations at two different wavelengths will provide the color information needed to disentangle the lens from the background source, the former having a bluer spectrum than the latter. In particular we will use the F110W image to accurately fit the light profile of the lens and exploit the F160W image for the detection of the background source after performing the lens subtraction.

We have used the on-line calculator to estimate the exposure time necessary to detect the background source with a signal-to-noise ratio (SNR) >8 in the WFC3/F160W image, after the lens subtraction. We have made the assumption that the background source is lensed into an Einstein ring (the worst case scenario) so the total flux is distributed over the largest area. The Einstein radius (theta_E) is estimated from the line-of-sight stellar velocity dispersion of the lensing galay as inferred from the Faber-Jackson relation between the velocity dispersion and the rest-frame B-band luminosity for elliptical galaxies. The latter is derived from the fit to the available UV/optical/near-IR data (i.e. from GALEX, SDSS and UKIDSS). We assume for the Einstein ring a thickness of 0.2 arcseconds. There is an important issue related to the contamination from the lens that acts as an extra source of background noise. In order to account for this effect we have fitted the light profile of the lens with GALFIT (assuming either a Sersic profile or a Sersic+exponential disc profile) and estimated its brightness at a distance equal to theta_E from the center of the lens. In practice this contamination can be significantly reduced by subtracting the GALFIT model for the lens from the F160W image (after re-scaling the profile of the lens to the value of the peak measured in the F160W image). We expect the residual contribution of the lens, after the subtraction of the best-fit GALFIT model, to be of the order of 1 per cent. Therefore we have calculated the exposure time using the value of the brightness of the lens at a distance theta_E from its center and rescaled by a factor of 0.01. We have checked that for the derived integration times for observations with the F160W filter the flux contributed by the lens is not going to saturate the CCD. In order to estimate the exposure time for observations with F110W we required the lens to be detected with a signal-to-noise ratio of at least several hundreds. This will allow us to accurately fit the light profile of the lens and efficiently subtract it from the F160W image.
In all the exposure time calculations, the fluxes of the lensing galaxy and of the background source in the F110W and F160W filters have been estimated from the SED models of da Chuna et al. (2008, 2010) which best-fit the available UV/optical/near-IR photometric data.

2 HST orbits are used for each object. One orbit is entirely dedicated to the imaging in the F160W filter (with a 4-dither patter to sample the PSF) to obtain the highest detection for the background source, typically with a signal-to-noise ratio >5 after the lens is subtracted off.
The other orbit is split into 2 sets of exposures: one set in the F110W filter (with a 4-dither patter to sample the PSF) is meant to allow the detection of the lensing galaxy with a signal-to-noise ratio >400; a second set in the F160W filter (with a 2-dither pattern) is meant instead to improve the detection of the background source once the data are combined with those collected in the other orbit.

Visit

Proposal 12194, Visit 01, implementation Fri Sep 24 01:01:35 GMT 2010

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (3)
(2)	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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS-090312+003907 Alt Name1: HATLAS-J090311.6+003906	RA: 09 03 11.5700 (135.7982083d) Dec: +00 39 6.50 (.65181d) Equinox: J2000	Redshift: 0.2999	V=(?) F(10200) = 9.3+/-1.4 E-17, F(12200) = 8.5+/-1.3 E-17, F(16300) = 5.5+/-0.8 E-17, F(21900) = 3.9+/-0.6 E-17, SIZE=1.23+/-0.18	Reference Frame: ICRS

Comments: Gravitational lensing system.
Redshift of the lensing galaxy: z=0.2999±0.0002
Redshift of the background source: z=3.042±0.001
Estimated Einstein radius: theta_E=1.62 arcsec

The fluxes quoted above are for the lensing galaxy.
The lensing galaxy extends over an area of 3.05 square arcseconds, and its light profile has FWHM=1.23 arcsec

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA/F110W	(1) SDSS-090312+003907	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=8; SAMP-SEQ=SPARS25		Pattern 1, Exps 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Comments: 4-dither pattern.
total time = 177.936x4 sec (for 1024x1024 image size)
This gives SNR = 1,176.97 (4 frames)
and a Time to Saturation (for a single exposure) = 2,225.53 seconds
(Exposure ID: WFC3.A329203)

Input values for ETC:
Diameter of the source = 1.97 arcsec
(this is the diameter of a circle that has the same area of the source light profile)
Radius of the extraction region = 0.615 arcsec
(this is equal to half of the FWHM of the source light profile)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	TA/F160W	(1) SDSS-090312+003907	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 2, Exps 2-2 (2)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: 2-dither pattern.
total time = 902.935x2 sec (for 1024x1024 image size)
This gives SNR = 57.23 (2 frames), corresponding to an effective SNR = 8.0
and a Time to Saturation (for a single exposure) = 66,251.33 seconds
(Exposure ID: WFC3.A329218)
Time to Saturation for the lens (for a single exposure) = 3892 seconds

Input values for ETC:
Diameter of the source = 1.62 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.81 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 13.7 microJy per square arcseconds
B_S = 1.28 microJy per square arcseconds

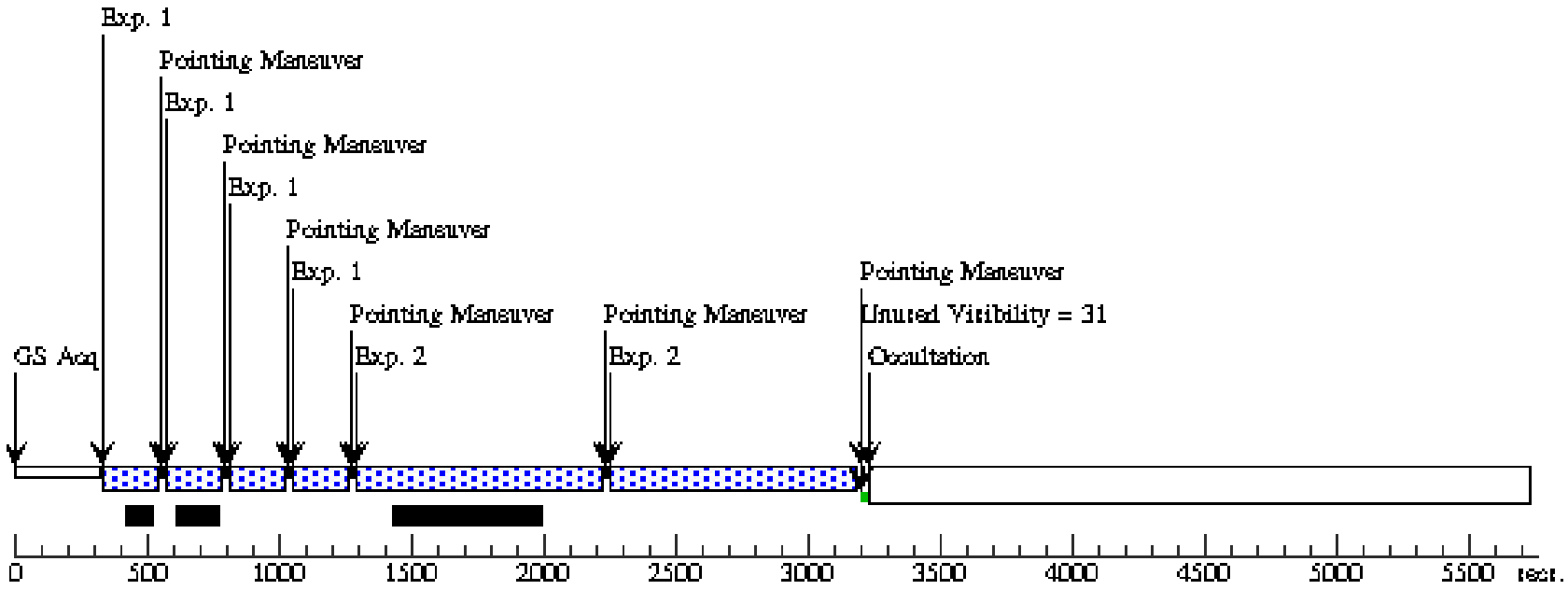
3	TA/F160W	(1) SDSS-090312+003907	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50	Pattern 1, Exps 3-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

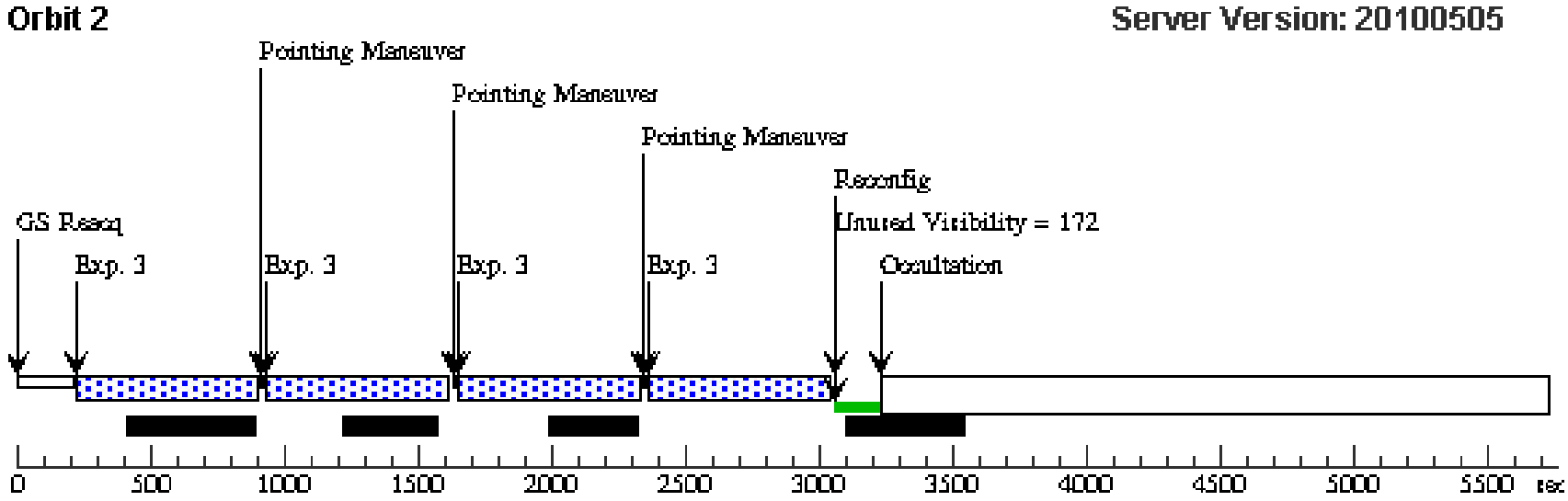
Comments: 4-dither pattern.
total time = 652.938x4 sec (for 1024x1024 image size)
This gives SNR = 66.53 (4 frames), corresponding to an effective SNR = 8.2
and a Time to Saturation (for a single exposure) = 66,251.33 seconds
(Exposure ID: WFC3.A329227)
Time to Saturation for the lens (for a single exposure) = 3892 seconds

Input values for ETC:
Diameter of the source = 1.62 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.81 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 13.7 microJy per square arcseconds
B_S = 1.28 microJy per square arcseconds

Orbit Structure





Visit

Proposal 12194, Visit 02, implementation Fri Sep 24 01:01:37 GMT 2010

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (3)
(2)	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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SDSS-091305-005343 Alt Name1: HATLAS-J091305.0-005343	RA: 09 13 5.0800 (138.2711667d) Dec: -00 53 42.70 (-.89519d) Equinox: J2000	Redshift: 0.2201	V=(?) F(10200) = 5.4+/-0.8 E-17, F(12200) = 5.4+/-0.8 E-17, F(16300) = 3.8+/-0.6 E-17, F(21900) = 2.5+/-0.4 E-17, SIZE=1.17+/-0.59	Reference Frame: ICRS

Comments: Gravitational lensing system.
Redshift of the lensing galaxy: z=0.2201±0.002
Redshift of the background source: z=2.6260±0.0003
Estimated Einstein radius: theta_E=0.59 arcsec

The fluxes quoted above are for the lensing galaxy.
The lensing galaxy extends over an area of 3.02 square arcseconds, and its light profile has FWHM=1.17 arcsec

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA/F110W	(2) SDSS-091305-00 5343	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=8; SAMP-SEQ=SPARS25		Pattern 1, Exps 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Comments: 4-dither pattern.
total time = 177.936x4 sec (for 1024x1024 image size)
This gives SNR = 875.49 (4 frames)
and a Time to Saturation (for a single exposure) = 3,357.51 seconds
(Exposure ID: WFC3.A329241)

Input values for ETC:
Diameter of the source = 1.96 arcsec
(this is the diameter of a circle that has the same area of the source light profile)
Radius of the extraction region = 0.585 arcsec
(this is equal to half of the FWHM of the source light profile)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	TA/F160W	(2) SDSS-091305-00 5343	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 2, Exps 2-2 (2)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: 2-dither pattern.
total time = 902.935x2 sec (for 1024x1024 image size)
This gives SNR = 522.96 (2 frames), corresponding to an effective SNR = 64.6
and a Time to Saturation (for a single exposure) = 13,412.60 seconds
(Exposure ID: WFC3.A329248)
Time to Saturation for the lens (for a single exposure) = 5430 seconds

Input values for ETC:
Diameter of the source = 0.97 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.49 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 53.2 microJy per square arcseconds
B_S = 39.2 microJy per square arcseconds

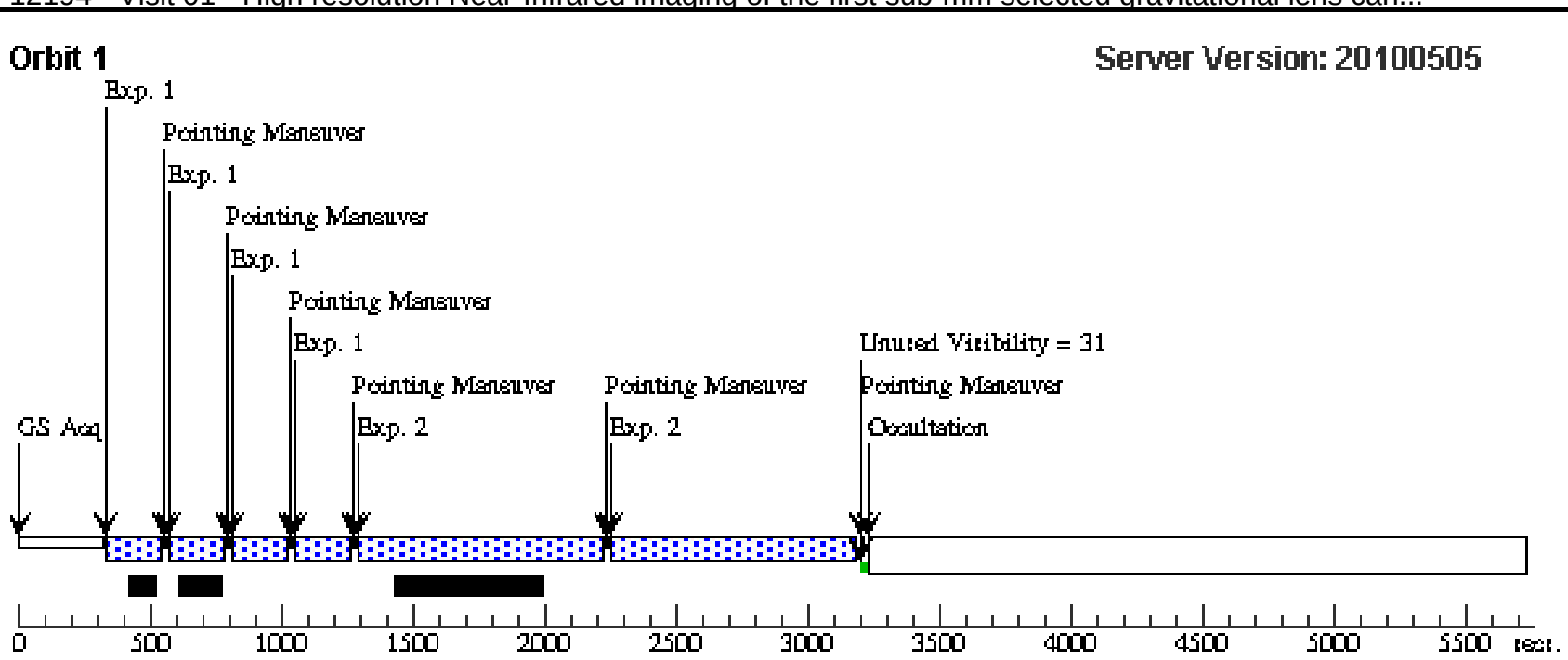
	3	TA/F160W	(2) SDSS-091305-00 5343	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50	Pattern 1, Exps 3-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

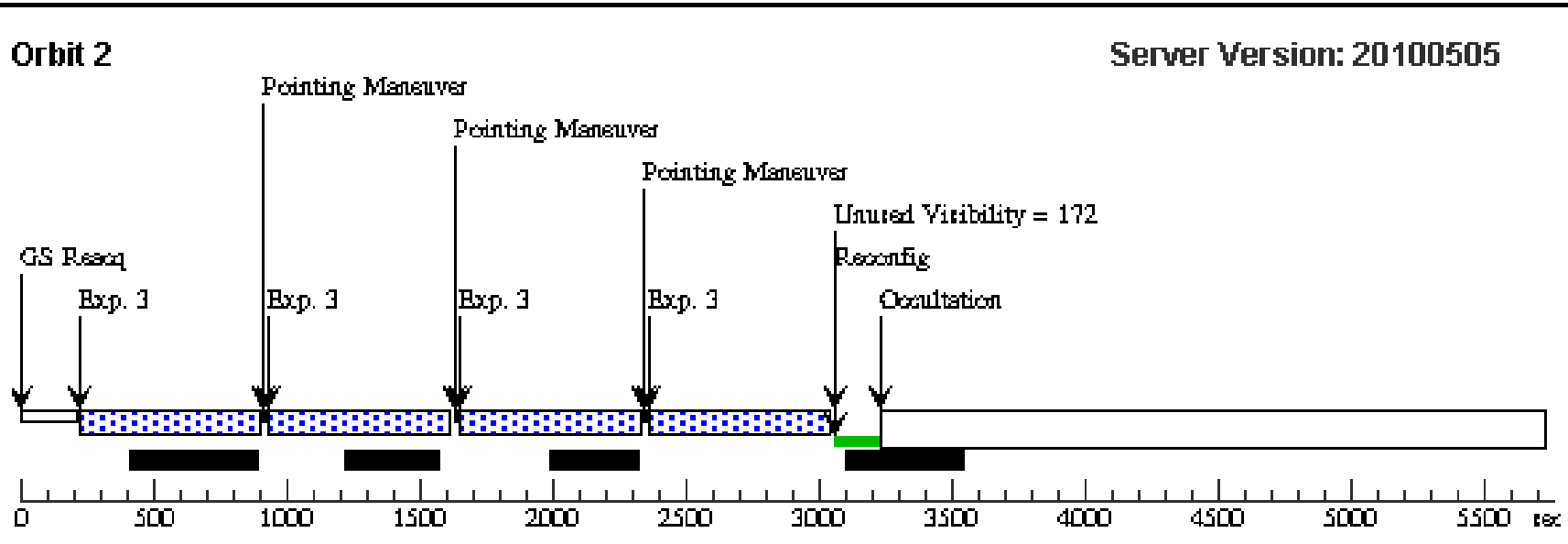
Comments: 4-dither pattern.
total time = 652.938x4 sec (for 1024x1024 image size)
This gives SNR = 623.67 (4 frames), corresponding to an effective SNR = 65.9
and a Time to Saturation (for a single exposure) = 13,412.60 seconds
(Exposure ID: WFC3.A329252)
Time to Saturation for the lens (for a single exposure) = 5430 seconds

Input values for ETC:
Diameter of the source = 0.97 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.49 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 53.2 microJy per square arcseconds
B_S = 39.2 microJy per square arcseconds

Orbit Structure





Visit

Proposal 12194, Visit 03, implementation Fri Sep 24 01:01:37 GMT 2010

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (3)
(2)	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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SDSS-090740-004160 Alt Name1: HATLAS-J090740.0-004200	RA: 09 07 40.0200 (136.9167500d) Dec: -00 41 59.90 (-.69997d) Equinox: J2000	Redshift: 0.679	V=(?) F(10200) = 9.5+/-1.4 E-18, F(12200) = 8.3+/-1.2 E-18, F(16300) = 8.5+/-1.3 E-18, F(21900) = 6.7+/-1.0 E-18, SIZE=1.16+/-0.17	Reference Frame: ICRS

Comments: Gravitational lensing system.
Redshift of the lensing galaxy: z=0.679±0.057
Redshift of the background source: z=1.577±0.008
Estimated Einstein radius: theta_E=0.67 arcsec

The fluxes quoted above are for the lensing galaxy.
The lensing galaxy extends over an area of 2.50 square arcseconds, and its light profile has FWHM=1.16 arcsec

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA/F110W	(3) SDSS-090740-00 4160	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=8; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Comments: 4-dither pattern.
total time = 352.935x4 sec (for 1024x1024 image size)
This gives SNR = 456.92 (4 frames)
and a Time to Saturation (for a single exposure) = 12,620.38 seconds
(Exposure ID: WFC3.A329260)

Input values for ETC:
Diameter of the source = 1.79 arcsec
(this is the diameter of a circle that has the same area of the source light profile)
Radius of the extraction region = 0.58 arcsec
(this is equal to half of the FWHM of the source light profile)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	TA/F160W	(3) SDSS-090740-00 4160	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS50		Pattern 2, Exps 2-2 (2)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: 2-dither pattern.
total time = 552.937x2 sec (for 1024x1024 image size)
This gives SNR = 40.38 (2 frames), corresponding to an effective SNR = 13.0
and a Time to Saturation (for a single exposure) = 61,848.38 seconds
(Exposure ID: WFC3.A329262)
Time to Saturation for the lens (for a single exposure) = 18,804 seconds

Input values for ETC:
Diameter of the source = 1.03 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.52 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 10.1 microJy per square arcseconds
B_S = 1.93 microJy per square arcseconds

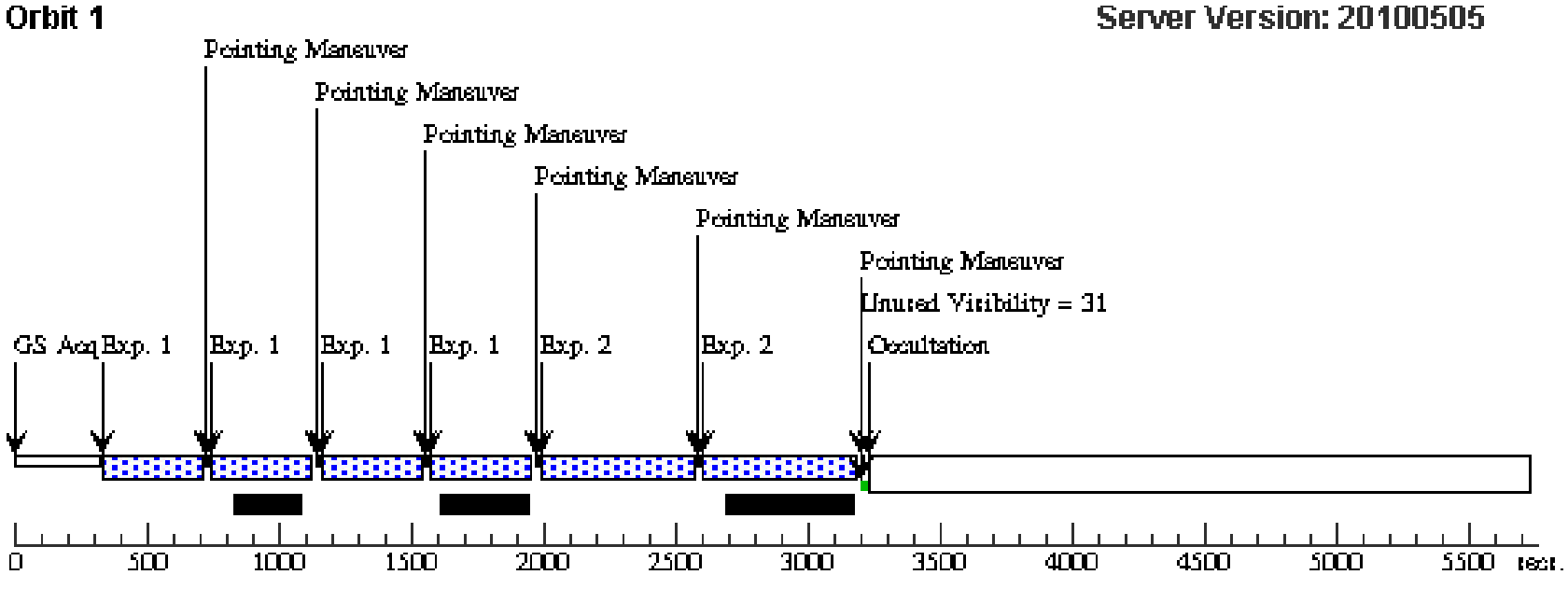
3	TA/F160W	(3) SDSS-090740-00 4160	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50	Pattern 1, Exps 3-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

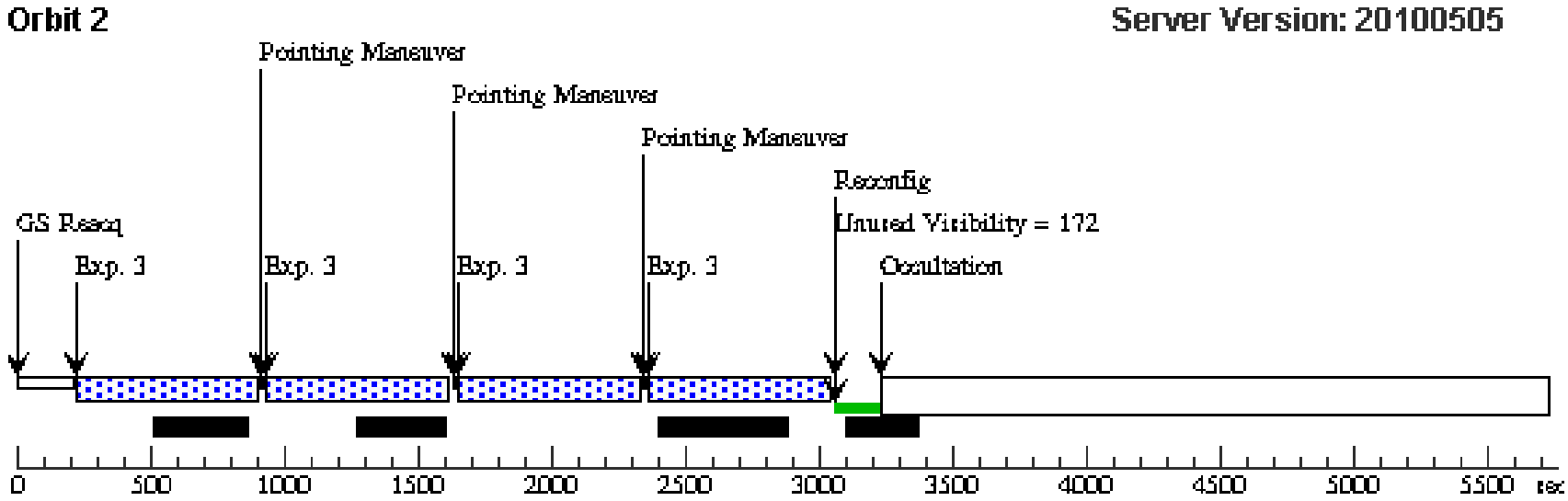
Comments: 4-dither pattern.
total time = 652.938x4 sec (for 1024x1024 image size)
This gives SNR = 63.31 (4 frames), corresponding to an effective SNR = 14.7
and a Time to Saturation (for a single exposure) = 61,848.38 seconds
(Exposure ID: WFC3.A329264)
Time to Saturation for the lens (for a single exposure) = 18,804 seconds

Input values for ETC:
Diameter of the source = 1.03 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.52 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 10.1 microJy per square arcseconds
B_S = 1.93 microJy per square arcseconds

Orbit Structure





Visit

Proposal 12194, Visit 04, implementation Fri Sep 24 01:01:39 GMT 2010

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (3)
(2)	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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	SDSS-091043-000323 Alt Name1: HATLAS-J091043.1-000321	RA: 09 10 43.0800 (137.6795000d) Dec: -00 03 23.00 (-.05639d) Equinox: J2000	Redshift: 0.7932	V=(?) F(10200) = 1.3+/-0.2 E-17, F(12200) = 1.3+/-0.2 E-17, F(16300) = 1.2+/-0.2 E-17, F(21900) = 1.1+/-0.2 E-17, SIZE=1.41+/-0.21	Reference Frame: ICRS

Comments: Gravitational lensing system.
Redshift of the lensing galaxy: z=0.7932±0.0012
Redshift of the background source: z=1.786±0.005
Estimated Einstein radius: theta_E=0.75 arcsec

The fluxes quoted above are for the lensing galaxy.
The lensing galaxy extends over an area of 3.55 square arcseconds, and its light profile has FWHM=1.41 arcsec

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA/F110W	(4) SDSS-091043-00 0323	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=8; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Comments: 4-dither pattern.
total time = 352.935x4 sec (for 1024x1024 image size)
This gives SNR = 585.10 (4 frames)
and a Time to Saturation (for a single exposure) = 11,982.17 seconds
(Exposure ID: WFC3.A329266)

Input values for ETC:
Diameter of the source = 2.12 arcsec
(this is the diameter of a circle that has the same area of the source light profile)
Radius of the extraction region = 0.705 arcsec
(this is equal to half of the FWHM of the source light profile)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	TA/F160W	(4) SDSS-091043-00 0323	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS50		Pattern 2, Exps 2-2 (2)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: 2-dither pattern.
total time = 552.937x2 sec (for 1024x1024 image size)
This gives SNR = 177.95 (2 frames), corresponding to an effective SNR = 54.7
and a Time to Saturation (for a single exposure) = 34,482.63 seconds
(Exposure ID: WFC3.A329268)
Time to Saturation for the lens (for a single exposure) = 17,214 seconds

Input values for ETC:
Diameter of the source = 1.09 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.55 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 12.9 microJy per square arcseconds
B_S = 10.2 microJy per square arcseconds

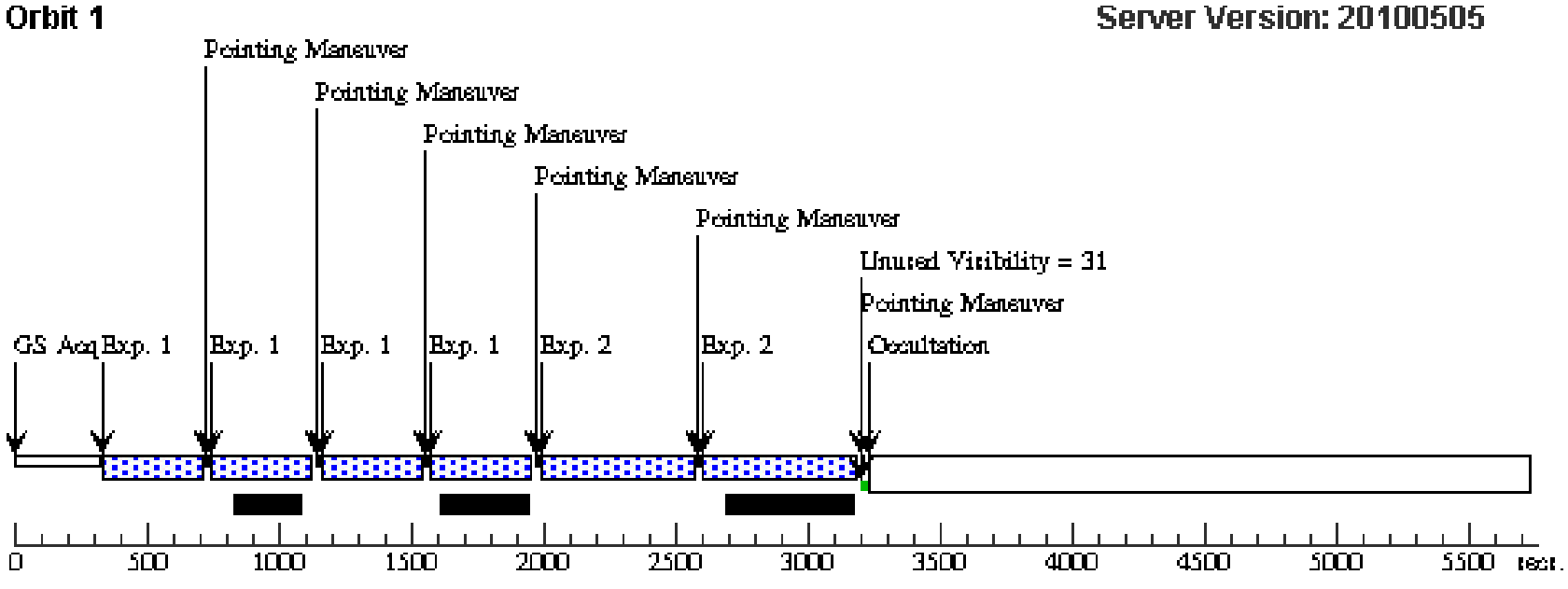
3	TA/F160W	(4) SDSS-091043-00 0323	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50	Pattern 1, Exps 3-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

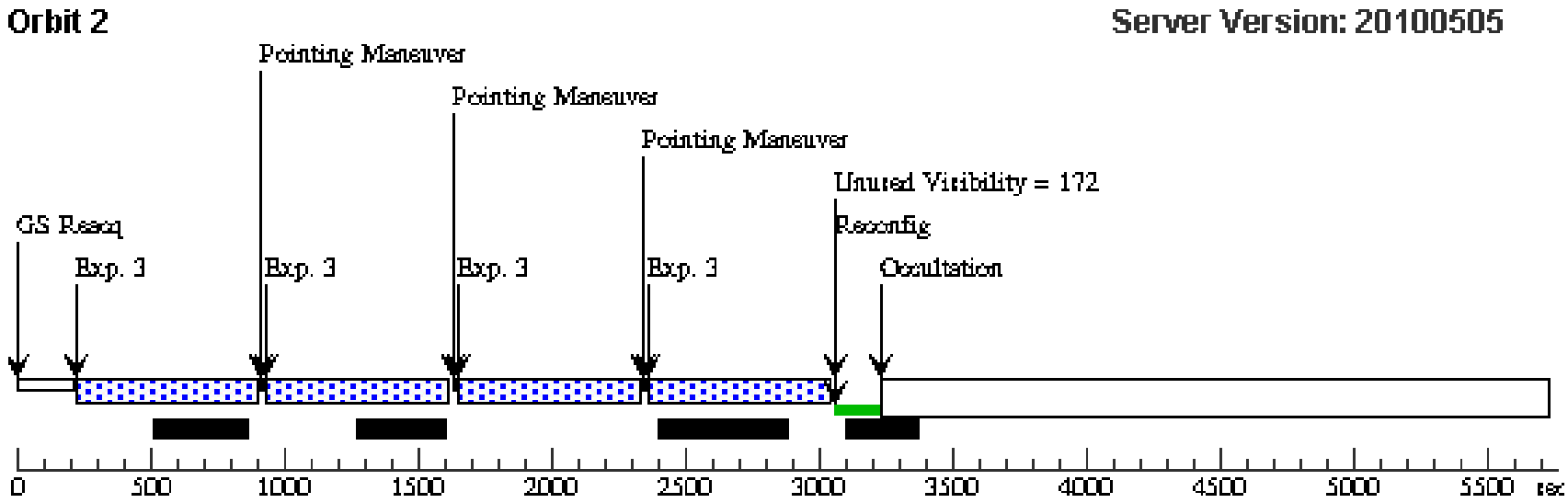
Comments: 4-dither pattern.
total time = 652.938x4 sec (for 1024x1024 image size)
This gives SNR = 276.91 (4 frames), corresponding to an effective SNR = 61.5
and a Time to Saturation (for a single exposure) = 34,482.63 seconds
(Exposure ID: WFC3.A329271)
Time to Saturation for the lens (for a single exposure) = 17,214 seconds

Input values for ETC:
Diameter of the source = 1.09 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.55 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 12.9 microJy per square arcseconds
B_S = 10.2 microJy per square arcseconds

Orbit Structure





Visit

Proposal 12194, Visit 05, implementation Fri Sep 24 01:01:39 GMT 2010

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (3)
(2)	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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	SDSS-090303-014127 Alt Name1: HATLAS-J090302.9-014127	RA: 09 03 3.0100 (135.7625417d) Dec: -01 41 26.90 (-1.69081d) Equinox: J2000	Redshift: 0.77	V=(?) F(10200) = 1.0+/-0.2 E-17, F(12200) = 8.9+/-1.3 E-18, F(16300) = 8.0+/-1.2 E-18, F(21900) = 6.9+/-1.0 E-18, SIZE=2.48+/-0.37	Reference Frame: ICRS

Comments: Gravitational lensing system.
Redshift of the lensing galaxy: z=0.77±0.13
Redshift of the background source: z=2.308±0.011
Assumedd Einstein radius: theta_E=0.70 arcsec

The fluxes quoted above are for the lensing galaxy.
The lensing galaxy extends over an area of 7.20 square arcseconds, and its light profile has FWHM=2.48 arcsec

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	TA/F110W	(5) SDSS-090303-01 4127	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=8; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Comments: 4-dither pattern.
total time = 352.935x4 sec (for 1024x1024 image size)
This gives SNR = 465.63 (4 frames)
and a Time to Saturation (for a single exposure) = 21,929.71 seconds
(Exposure ID: WFC3.A329278)

Input values for ETC:
Diameter of the source = 3.03 arcsec
(this is the diameter of a circle that has the same area of the source light profile)
Radius of the extraction region = 1.24 arcsec
(this is equal to half of the FWHM of the source light profile)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2	TA/F160W	(5) SDSS-090303-01 4127	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPARS50		Pattern 2, Exps 2-2 (2)	*[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Comments: 2-dither pattern.
total time = 552.937x2 sec (for 1024x1024 image size)
This gives SNR = 26.68 (2 frames), corresponding to an effective SNR = 9.8
and a Time to Saturation (for a single exposure) = 66,596.33 seconds
(Exposure ID: WFC3.A329279)
Time to Saturation for the lens (for a single exposure) = 35,741.23 seconds

Input values for ETC:
Diameter of the source = 1.06 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.53 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 7.80 microJy per square arcseconds
B_S = 1.20 microJy per square arcseconds

	3	TA/F160W	(5) SDSS-090303-01 4127	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPARS50	Pattern 1, Exps 3-3 (1)	*[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Comments: 4-dither pattern.
total time = 652.938x4 sec (for 1024x1024 image size)
This gives SNR = 41.88 (4 frames), corresponding to an effective SNR = 11.3
and a Time to Saturation (for a single exposure) = 66,596.33 seconds
(Exposure ID: WFC3.A329281)
Time to Saturation for the lens (for a single exposure) =35,741.23 seconds

Input values for ETC:
Diameter of the source = 1.06 arcsec
(this is the diameter of a circle that has the same area of the assumed Einstein ring)
Radius of the extraction region = 0.53 arcsec
(this is equal to half of the diameter of the source)

The effective signal-to-noise ratio, SNR_eff, is estimated as
*SNR_eff = 1/(1/SNR_etc + B_L*0.01/B_S)*
where
- SNR_etc is the signal-to-noise ratio returned by the exposure time calculator for the input exposure time;
- B_L is the surface brightness of the lensing galaxy at a distance theta_E (i.e. the Einstein radius) from its center;
- B_S is the surface density of the background source (assumed to be lensed into an Einstein ring).
The adopted values for B_L and B_S are:
B_L = 7.80 microJy per square arcseconds
B_S = 1.20 microJy per square arcseconds

Orbit Structure