12543 - Fine-scale Density, Temperature, and Ionization Fluctuations: Their Effect on Abundance Determinations

Cycle: 19, Proposal Category: GO

(Calibration)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) ORION-INNER (2) ORION-QUADS	ACS/WFC WFC3/UVIS	4	10-Oct-2011 21:12:00.0	yes
02	(2) ORION-QUADS	ACS/WFC WFC3/UVIS	3	10-Oct-2011 21:12:32.0	yes
03	(2) ORION-QUADS	ACS/WFC WFC3/UVIS	1	10-Oct-2011 21:12:44.0	yes

8 Total Orbits Used

ABSTRACT

Knowledge of chemical abundances is fundamental to understanding the processes of nucleosynthesis and galactic chemical evolution. There are two major problems in nebular astrophysics that seriously affect the ability to derive reliable elemental abundances from emission lines. Attempts to solve

these long-standing problems [the "abundance" & "temperature problems"-see text] have focused on electron temperature (Te) fluctuations within nebulae. The problems remain, and there is now a substantial faction who argue that Te variations alone are insufficient. We propose to build upon the previous observations of the benchmark Orion Nebula to measure not only Te variations but also the cospatial electron density (Ne) and ionization variations. With the new capability enabled by WFC3 and its unique set of narrow-band filters, we will obtain images with a scale as fine as 0.04". Through these filters, we will isolate emission lines including OIII 4363 & 5007, NII 5755 & 6584, SII 6716 & 6731, and SIII 9532 A. These observations will allow us to study in unprecedented detail variations (as well as their interdependence) in the fine-scale structure of Ne[SII], temperature (Te[OIII] for the high-ionization regions, Te[NII] for the low-ionization ones), and the degree of ionization via S+/S++.

As a coordinated parallel program with no added time, we will image with ACS/F658N to provide a second epoch dataset with at least a seven year time-base. The goal is to obtain greater accuracy for the motions of jets and shocks arising from Young Stellar Objects and thus to better determine the time-dependent-characteristics of the episodic collimated outflows from these objects.

OBSERVING DESCRIPTION

WFC3/UVIS imaging will be made of M42 (the Orion Nebula). A set of full field images will be made centered on a region SW of the Trapezium and a set of quadrant filter images will be made in a portion of the full field images that is centered to the NE from the center for the full field filters.
We choose these targets for several important reasons, including that they include the brightest part of the nebula, they include some shocked outflow sources, and for which Co-I O'Dell has Keck HIRES spectra. Coordinated parallel images will be made using the ACS.

ADDITIONAL COMMENTS

The position combinations of the ORION-INNER and ORION-QUADS WFC3 targets are:

ORION-INNER Target 5:35:09.57 -5:24:22.82

ORION-QUADS Target 5:35:12.89 -5:24:00.83

This is for an ORIENT = 70 Degrees exactly, our preferred ORIENT.

This specific value permits a scheduling window in 2012 from 16 or 17 Jan - 13 Mar, ~56 days.

If we cannot get this specific ORIENT value, then a range from 60 - 80 Degrees would also work. However we would need to know the expected value in order to make small changes to our target positions (order a few arcsec).

The reason for this is to avoid the bright stars in the Trapezium.

Note that the APT submission has the ORIENT range from 60 - 80 Degrees which opens the scheduling window a few more days, from 8 Jan - 13 Mar 2012.

Visit

Proposal 12543, Visit 01, implementation Tue Oct 11 01:12:51 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 59D TO 59 D

Comments: First Visit

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-MOSAIC-LINE Purpose=MOSAIC Number Of Points=2 Point Spacing=3.264 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=63.697 Angle Between Sides= Center Pattern=false		(1), (2), (3), (4), (5-6), (7), (8-9), (10)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(11-12)

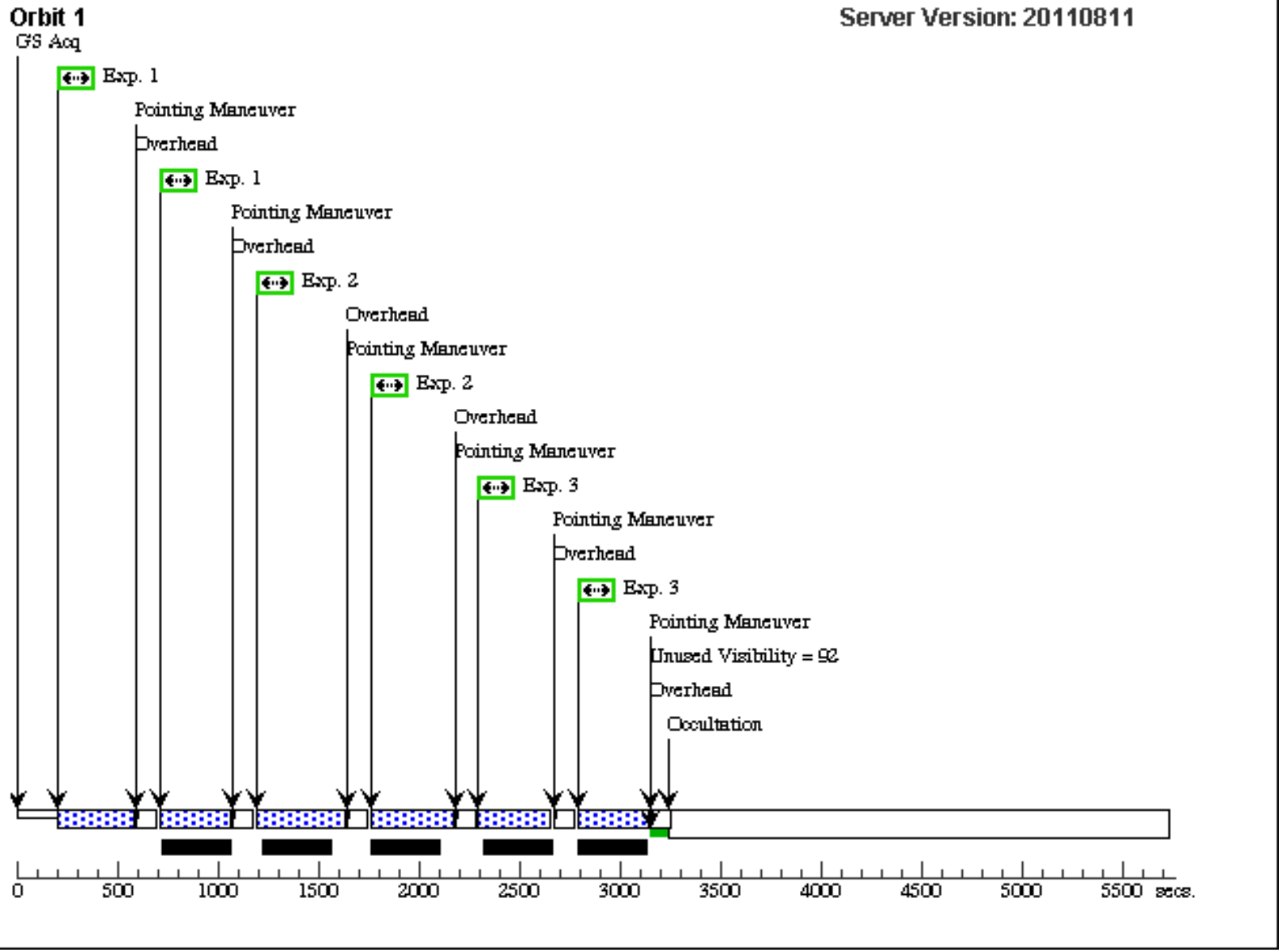
Fixed Targets

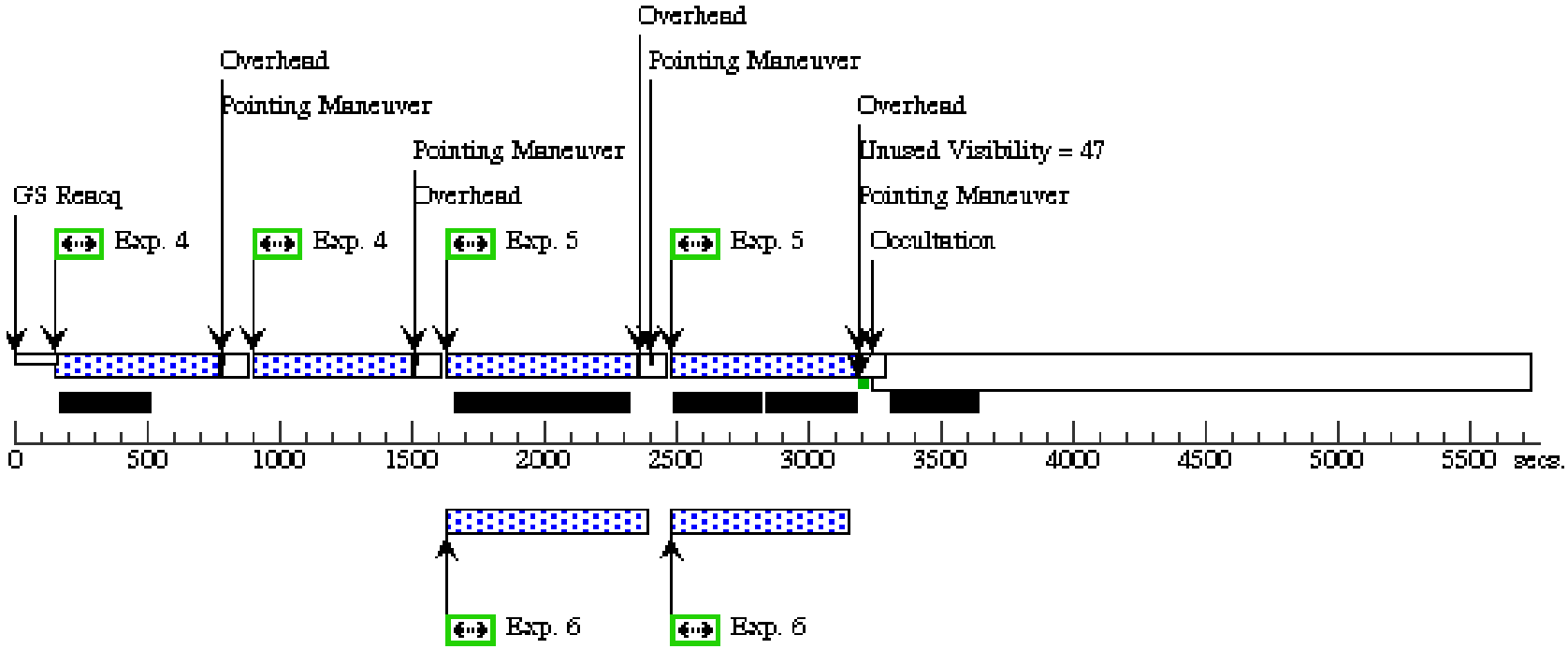
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	ORION-INNER Alt Name1: FULLFIELDFILTERS	RA: 05 35 9.4700 (83.7894583d) Dec: -05 24 25.00 (-5.40694d) Equinox: J2000		V=9.0+/-0.1 V-magnitude estimate is for a field star, which is not important for this emission-line object.	Reference Frame: FK5
(2)	ORION-QUADS Alt Name1: QUAD-FILTERS	RA: 05 35 13.6700 (83.8069583d) Dec: -05 24 8.71 (-5.40242d) Equinox: J2000		V=9.0+/-0.1 V-magnitude is for a field star, which is not important for this emission-line object.	Reference Frame: FK5

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	F656N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F656N		GS ACQ SCENARIO SINGLE	Pattern 1, Exps 1-1 in Visit 01 (1)	349 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2	F487N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F487N			Pattern 1, Exps 2-2 in Visit 01 (1)	409 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
3	F502N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F502N			Pattern 1, Exps 3-3 in Visit 01 (1)	348 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
4	F658N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F658N			Pattern 1, Exps 4-4 in Visit 01 (1)	602 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
5	F673N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F673N			Pattern 1, Exps 5-6 in Visit 01 (1) Prime + Parallel Group 5-6 in Pattern 1, Exps 5-6 in Visit 01	700 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
6	ACS658	(1) ORION-INNER	ACS/WFC, ACCUM, WFC-FIX	F658N			Pattern 1, Exps 5-6 in Visit 01 (1) Prime + Parallel Group 5-6 in Pattern 1, Exps 5-6 in Visit 01	550 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
7	F953N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N			Pattern 1, Exps 7-7 in Visit 01 (1)	413 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***
8	F469N	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F469N			Pattern 1, Exps 8-9 in Visit 01 (1) Prime + Parallel Group 8-9 in Pattern 1, Exps 8-9 in Visit 01	889 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***
9	ACS658	(1) ORION-INNER	ACS/WFC, ACCUM, WFC-FIX	F658N			Pattern 1, Exps 8-9 in Visit 01 (1) Prime + Parallel Group 8-9 in Pattern 1, Exps 8-9 in Visit 01	750 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***
10	F547M	(1) ORION-INNER	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M			Pattern 1, Exps 10-10 in Visit 01 (1)	348 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[4]***
11	FQ436N	(2) ORION-QUADS	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ436N			Pattern 2, Exps 11-12 in Visit 01 (2) Prime + Parallel Group 11-12 in Pattern 2, Exps 11-12 in Visit 01	550 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[4]***
12	ACS658	(1) ORION-INNER	ACS/WFC, ACCUM, WFC-FIX	F658N			Pattern 2, Exps 11-12 in Visit 01 (2) Prime + Parallel Group 11-12 in Pattern 2, Exps 11-12 in Visit 01	500 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[4]***

Orbit Structure

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Pointing Maneuver
Overhead
Pointing Maneuver
Pointing Maneuver
Overhead
Overhead
Unused Visibility = 47
Pointing Maneuver
GS Reacq
Exp. 4
Exp. 4
Exp. 5
Exp. 5
Occultation
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2000
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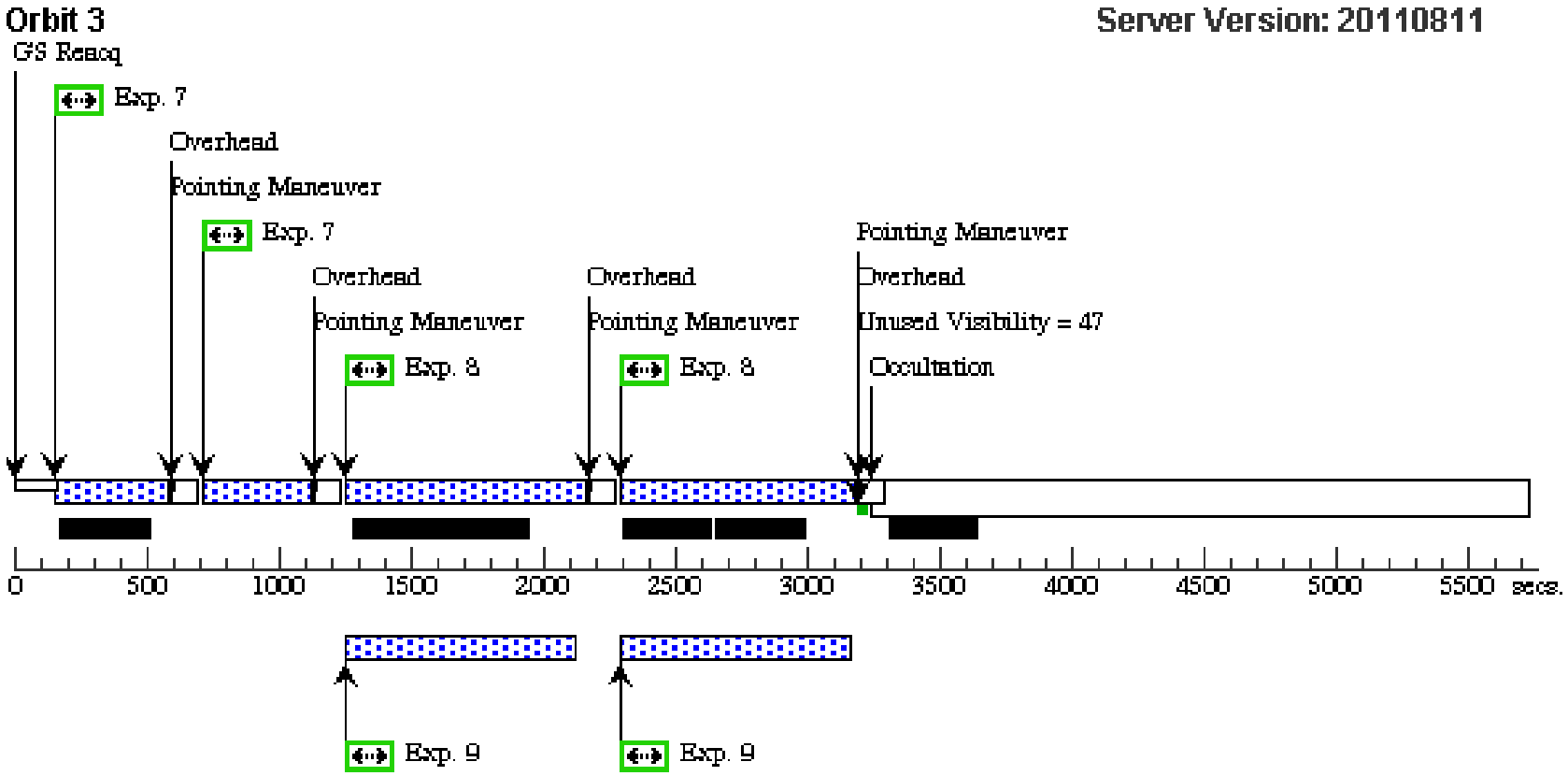
5000
5500
secs.
Exp. 6
Exp. 6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Server Version: 20110811
GS Reacq
Exp. 7
Overhead
Pointing Maneuver
Exp. 7
Overhead
Pointing Maneuver
Exp. 8
Overhead
Pointing Maneuver
Exp. 8
Pointing Maneuver
Overhead
Unused Visibility = 47
Occultation
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1500
2000
2500
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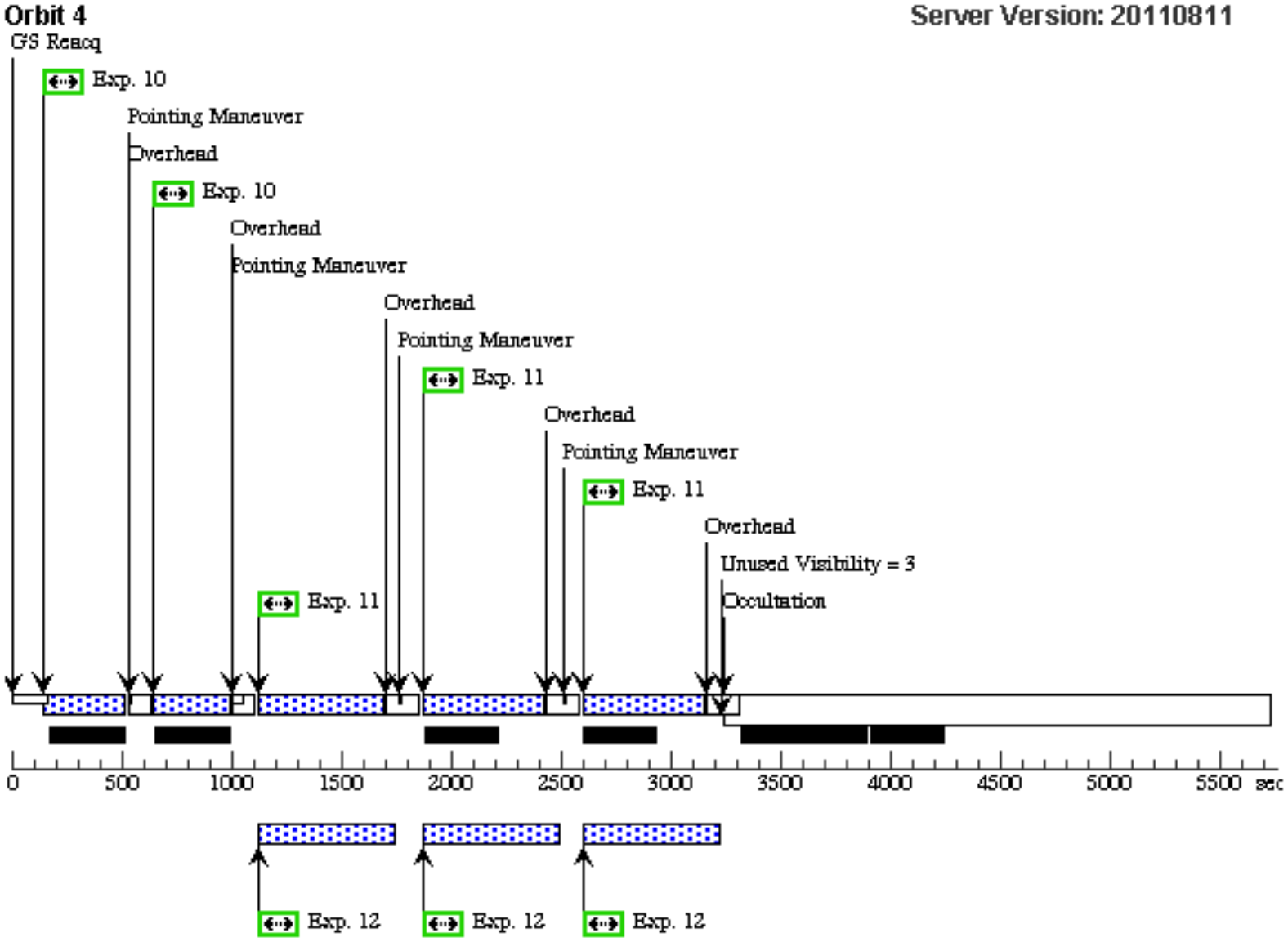
3500
4000
4500
5000
5500
secs.
Exp. 9
Exp. 9


Orbit 4
Server Version: 20110811
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Exp. 10
Pointing Maneuver
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Exp. 10
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Exp. 11
Overhead
Pointing Maneuver
Exp. 11
Overhead
Unused Visibility = 3
Occultation
Exp. 11
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 12
Exp. 12
Exp. 12

Visit

Proposal 12543, Visit 02, implementation Tue Oct 11 01:12:55 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 101.0D TO 101.0 D

Comments: Second Visit

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4), (6-7)

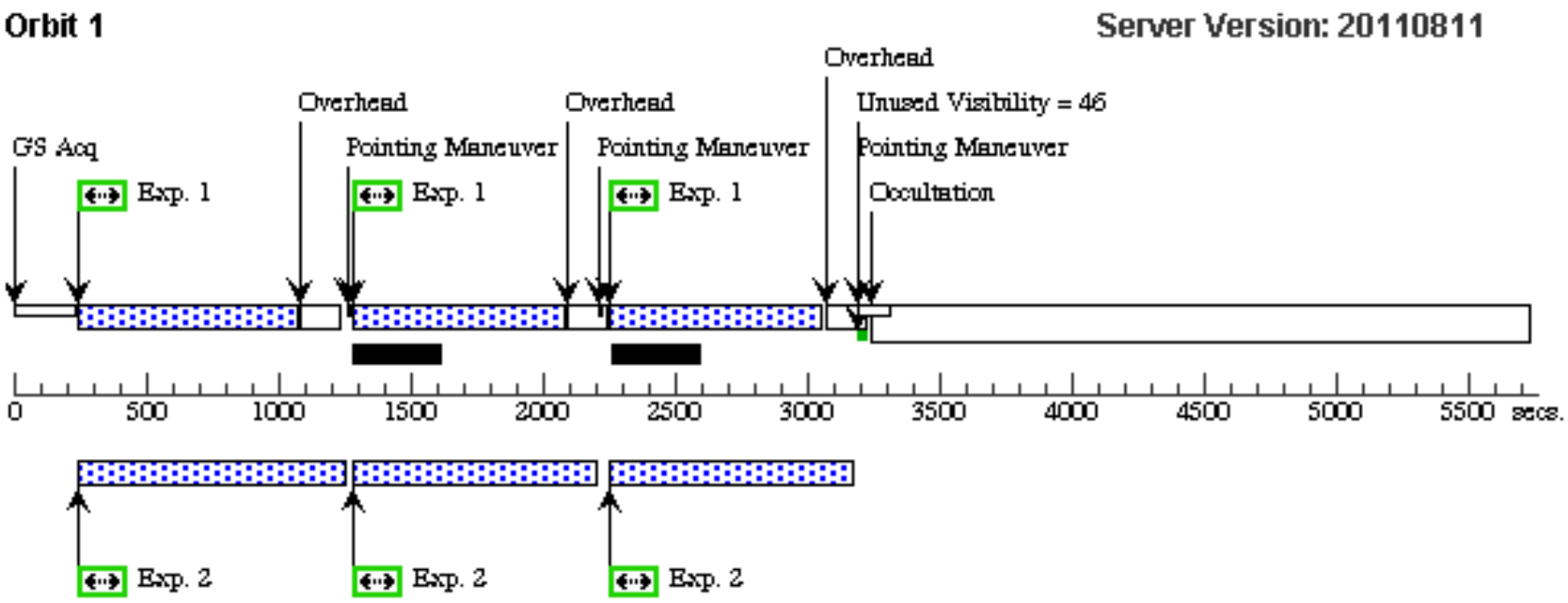
Fixed Targets

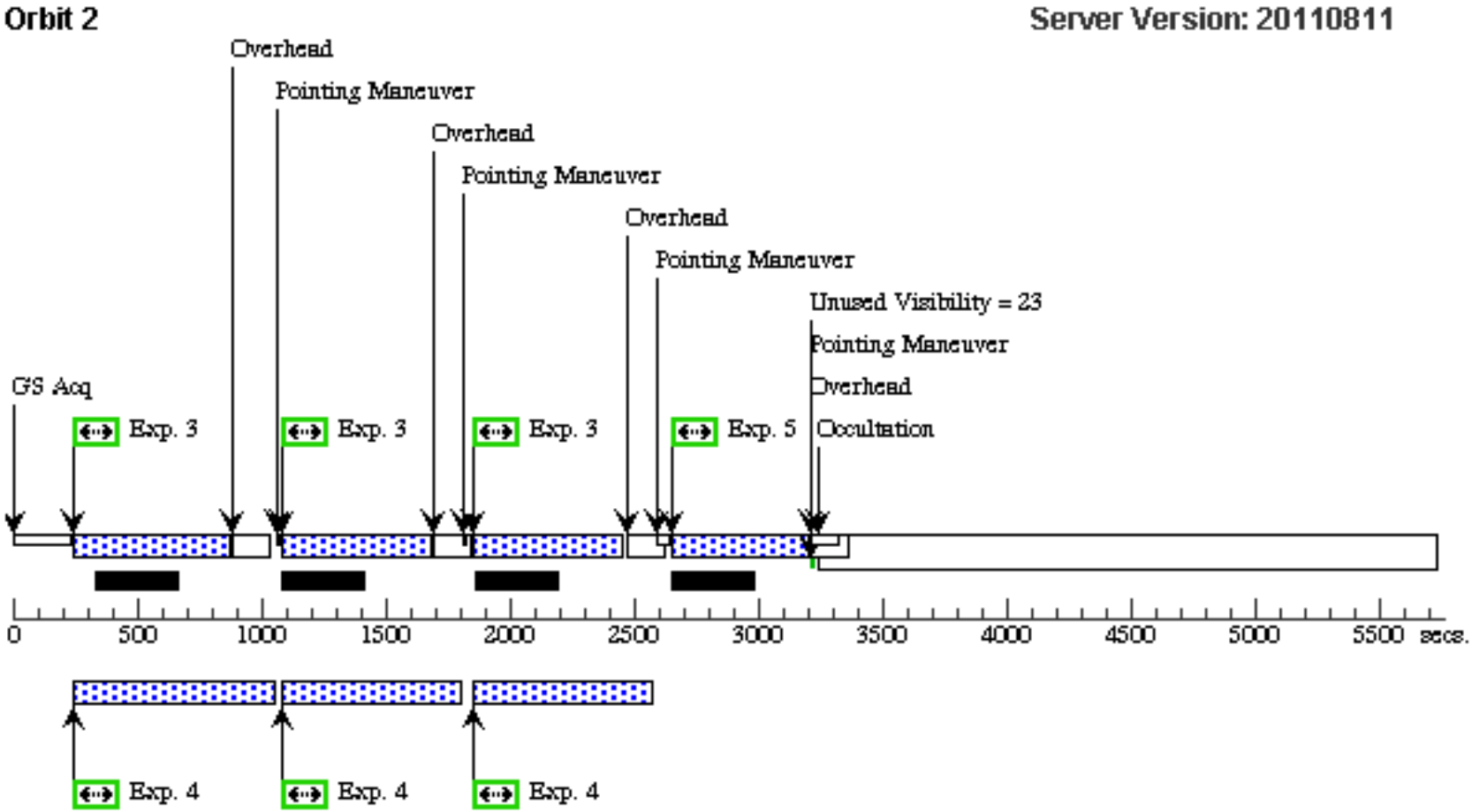
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	ORION-QUADS Alt Name1: QUAD-FILTERS	RA: 05 35 13.6700 (83.8069583d) Dec: -05 24 8.71 (-5.40242d) Equinox: J2000		V=9.0+/-0.1 V-magnitude is for a field star, which is not important for this e mission-line object.	Reference Frame: FK5

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	FQ575N	(2) ORION-QUADS	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ575N		GS ACQ SCENARIO SINGLE	Pattern 2, Exps 1-2 in Visit 02 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 02	800 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2	ACSQ	(2) ORION-QUADS	ACS/WFC, ACCUM, WFC	F658N			Pattern 2, Exps 1-2 in Visit 02 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 02	800 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
3	FQ674N	(2) ORION-QUADS	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ674N		NEW OBSET FULL ACQ	Pattern 2, Exps 3-4 in Visit 02 (2) Prime + Parallel Group 3-4 in Pattern 2, Exps 3-4 in Visit 02	600 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
4	ACSQ	(2) ORION-QUADS	ACS/WFC, ACCUM, WFC	F658N			Pattern 2, Exps 3-4 in Visit 02 (2) Prime + Parallel Group 3-4 in Pattern 2, Exps 3-4 in Visit 02	600 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
5	FQ575N	(2) ORION-QUADS	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ575N		GS ACQ SCENARIO SINGLE		550 Secs *[==>]*	***[2]***
6	FQ672N	(2) ORION-QUADS	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ672N		NEW OBSET FULL ACQ; GS ACQ SCENARIO SINGLE	Pattern 2, Exps 6-7 in Visit 02 (2) Prime + Parallel Group 6-7 in Pattern 2, Exps 6-7 in Visit 02	850 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[3]***
7	ACSQ	(2) ORION-QUADS	ACS/WFC, ACCUM, WFC	F658N			Pattern 2, Exps 6-7 in Visit 02 (2) Prime + Parallel Group 6-7 in Pattern 2, Exps 6-7 in Visit 02	700 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[3]***

Orbit Structure

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Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
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Overhead
Occultation
GS Acq
Exp. 3
Exp. 3
Exp. 3
Exp. 5
Exp. 4
Exp. 4
Exp. 4
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1000
1500
2000
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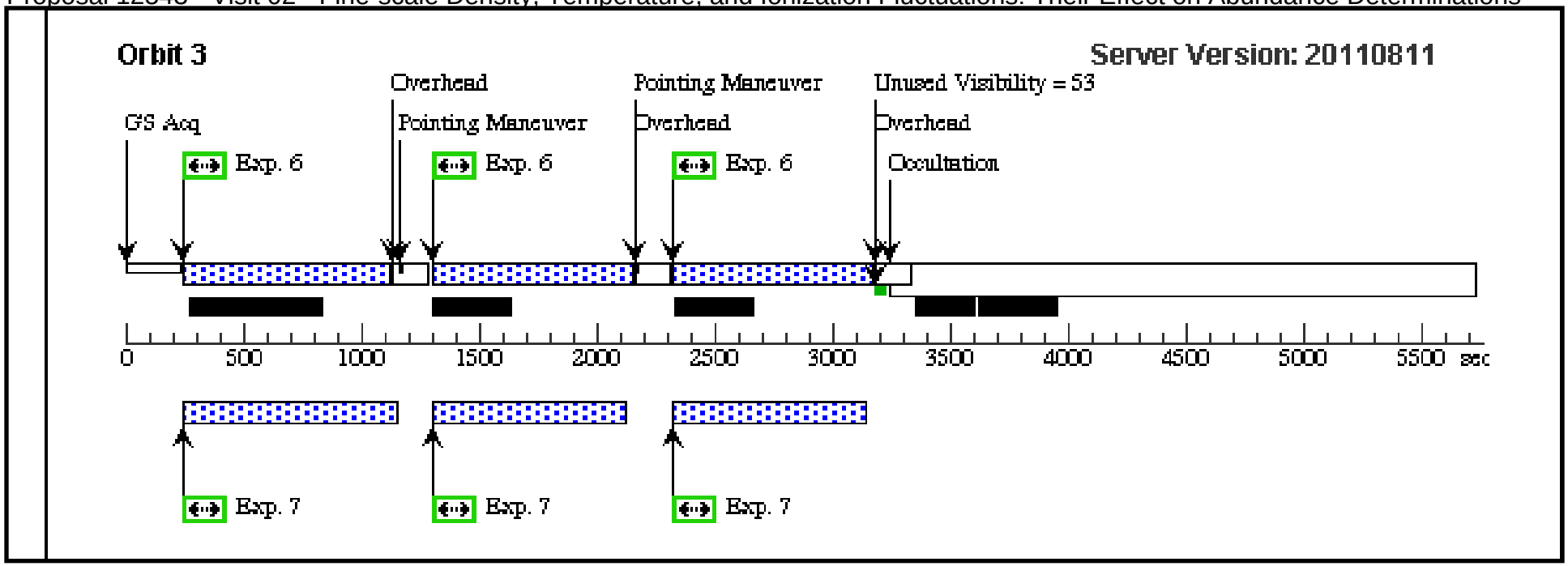
secs.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Server Version: 20110811
GS Acq
Overhead
Pointing Maneuver
Pointing Maneuver
Overhead
Overhead
Unused Visibility = 53
Occultation
Exp. 6
Exp. 6
Exp. 6
Exp. 7
Exp. 7
Exp. 7
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12543, Visit 03, implementation Tue Oct 11 01:12:57 GMT 2011

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 11.0D TO 11.0 D

Comments: Second Visit

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	ORION-QUADS Alt Name1: QUAD-FILTERS	RA: 05 35 13.6700 (83.8069583d) Dec: -05 24 8.71 (-5.40242d) Equinox: J2000		V=9.0+/-0.1 V-magnitude is for a field star, which is not important for this e mission-line object.	Reference Frame: FK5

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	FQ437N	(2) ORION-QUADS	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ437N		NEW OBSET FULL ACQ; GS ACQ SCENARIO SINGLE	Pattern 2, Exps 1-2 in Visit 03 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 03	850 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2	ACSQ	(2) ORION-QUADS	ACS/WFC, ACCUM, WFC	F658N			Pattern 2, Exps 1-2 in Visit 03 (2) Prime + Parallel Group 1-2 in Pattern 2, Exps 1-2 in Visit 03	750 Secs *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***

Orbit Structure