11306 - Direct radius measurement of the Neptune-size transiting exoplanet GJ436b

Cycle: 15, Proposal Category: GO

(Availability Mode: RESTRICTED)

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) GJ436	NIC3	4	01-Oct-2007 21:28:49.0	yes
02	(1) GJ436	NIC3	4	01-Oct-2007 21:45:59.0	yes

8 Total Orbits Used

ABSTRACT

We propose to measure the radius of the first transiting Neptune-class extrasolar planet, GJ 436b. The transits of this 22-Earth-mass planet around a nearby M dwarf were recently detected by our team. Ground-based photometric observations indicate a planet size compatible with a Neptune-like structure or an "Ocean Planet". A direct radius determination from an HST infrared lightcurve will provide a much more direct measurement of the

radius and density of the planet.
GJ 436b is the nearest known transiting exoplanet, as well as the smallest and lightest, by a large margin. The high planet-to-star contrast in the infrared make it very favorable for detailed studies. NICMOS 1-2 microns observations, in addition to measuring its size, may reveal water absorption from its outer atmosphere.

OBSERVING DESCRIPTION

We observe GJ 436 during 2 visits of 4 orbits each, attaining redundant coverage of the transit. Since the expected transit duration is 2/3 of an HST orbit and the target star can be seen for a little bit less than half of each orbit, two visits (with appropriate timing constraints) are required to obtain good phase coverage of the transit event.

We will center the transit such that ingress or egress at the extreme limits are 1600s into the start of orbit 2, or 1600s before the end of orbit 4 respectively. This leaves at least about 60% of an orbit beyond the transit for establishing trends.
We assume that stability will not have been achieved during orbit 1.

We will use the NICMOS3 camera and grism G141. For HD 209458 at H = 6.36 we used moderate defocus with the NICMOS focus mechanism to smear the signal across 3-4 pixels instead of undersampling the line spread function. This allowed MULTIACCUM STEP1 NSAMP=4 exposures of 1.993 seconds to reach about half of saturation at peak.
At H = 6.32 GJ 436 is nearly identical in brightness. We will adopt NSAMP = 4, again reaching nearly identical (to GO-9832) exposure levels.

We will obtain about 250 exposures per HST orbit with a goal of having
precisions in co-added 80s intervals of less than 0.0002..
Our observational approach for these observations is basically identical
to the one used for the transit of HD 209458 in GO-9832. However,
we now adopt the currently preferred means of achieving defocus of
NICMOS following CAL/11335 -- see text in Additional Comments below.

ADDITIONAL COMMENTS

IMPLEMENTATION NOTES: the new parameter CAMERA-FOCUS=DEFOCUS and aperture NIC3-FIXD is used to place the NIC3 focus mechanism at -0.5mm and adjust the target placement in the aperture for the defocus respectively.

Review of all potential scheduling windows has resulted in selection of two
at 314:23 and 349:08 that yield best phase coverage of the transit event.
The Phase II will contains BETWEENs restricting Visits 1 and 2 to these dates
respectively, in the event that one or both of these opportunities cannot be
used these would need modification.

Visit

Proposal 11306, Visit 01, implementation Tue Oct 02 01:47:21 GMT 2007

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC3

Special Requirements: SCHED 70%; BETWEEN 09-NOV-2007:00:00:00 AND 12-NOV-2007:00:00:00; Period 2.64387 D AND ZERO-PHASE JD2454243.7664

Comments: Phase window made as wide as possible. A small subset of possible schedulings within this wide window would not be good for the science. We request access to the detailed draft schedule one month before execution to review the actual phase obtained, with the possibility of asking that the observations be delayed to a more opportune window. After access to these details Visit 1 is intended for Nov 11, 2007. This is selected with a BETWEEN, and a narrow phase window of +/-20 min is applied to guard against potential 1 orbit scheduling slips.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GJ436	RA: 11 42 11.0940 (175.5462250d) Dec: +26 42 23.65 (26.70657d) Equinox: J2000	Proper Motion RA: 0.0669s/yr Proper Motion Dec: -0.8137"/yr Epoch of Position: 2000.0	V=10.68+/-0.1 H = 6.32	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	F166N	SAMP-SEQ=STEP1; NSAMP=3; CAMERA-FOCUS=DEFOCUS	POS TARG 2.6,-11.6; PHASE 0.944 TO 0.954		*[==>]*	***[1]***

Comments: POS TARG +2.6, -11.6 moves the filter image to the position reached (approx 141,70) in GO-9832 moving the grism spectrum to a rather clean area of NIC3. Note that the new CAMERA-FOCUS=DEFOCUS parameter is used to defocus NIC3 to -0.5mm and the aperture NIC3-FIXD adjusts the target position for the defocus.

Without defocus this would saturate slightly, should be fine here. This is the single direct image per visit allowing specification of wavelengths in the grism exposures.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=STEP1; NSAMP=4; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***

Comments: Starting with 10 exps at what will become standard exposure.

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
3		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCA MRR; NSAMP=7; CAMERA-FOCUS =DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Starting a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									
4		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCA MRR; NSAMP=6; CAMERA-FOCUS =DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
5		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=7; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
	Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.								
6		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=6; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
	Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.								

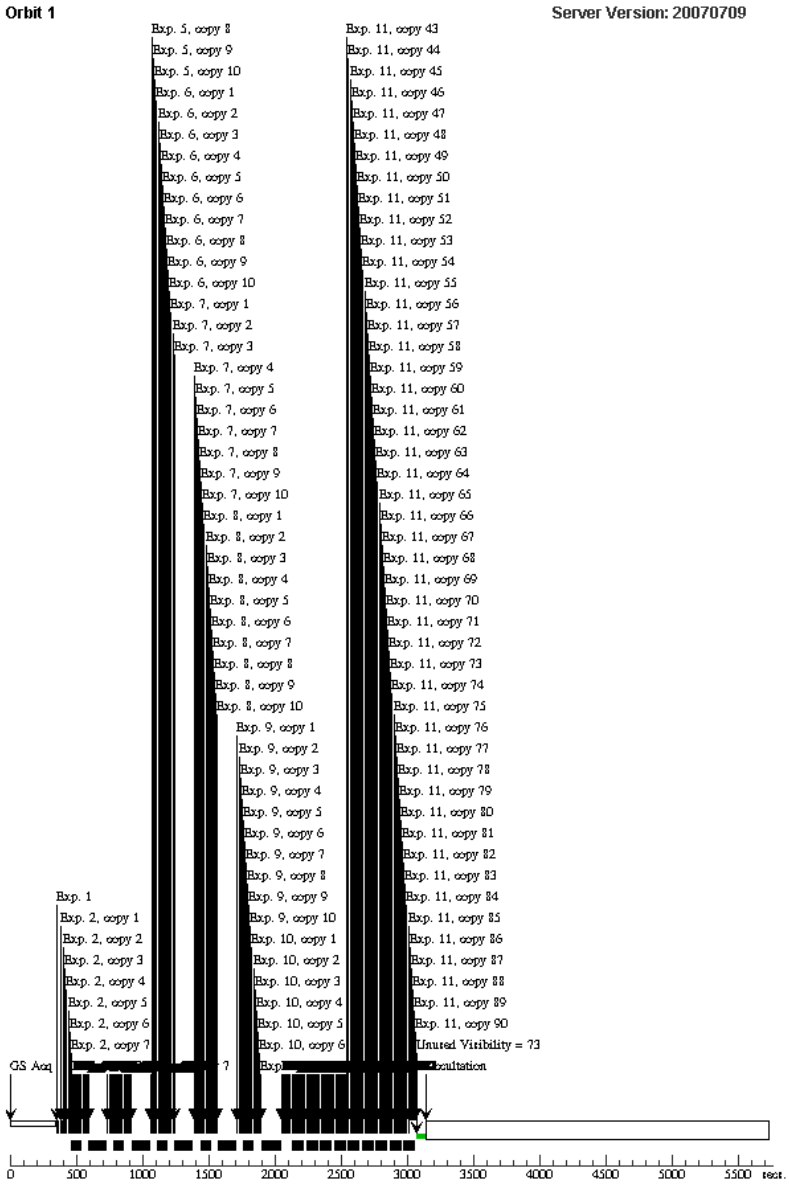
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
7		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=7; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									
8		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=6; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									

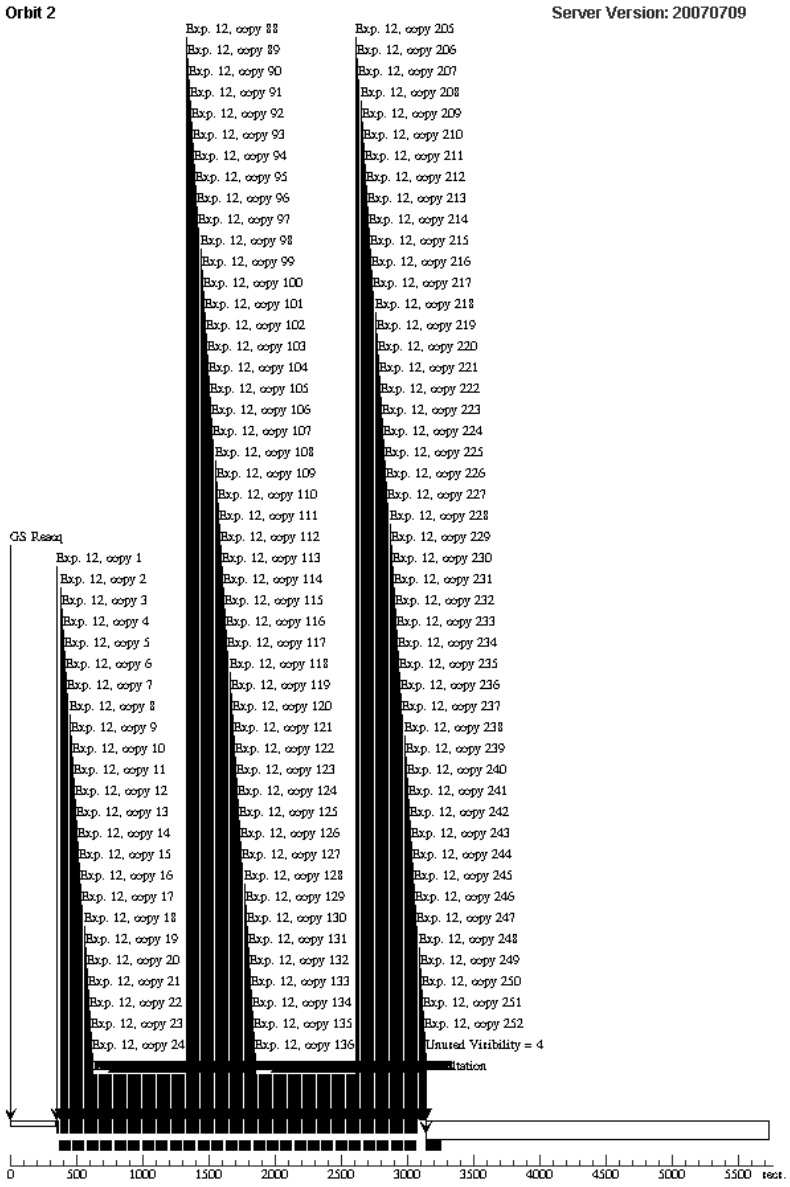
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
9		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=7; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									
10		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=6; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									

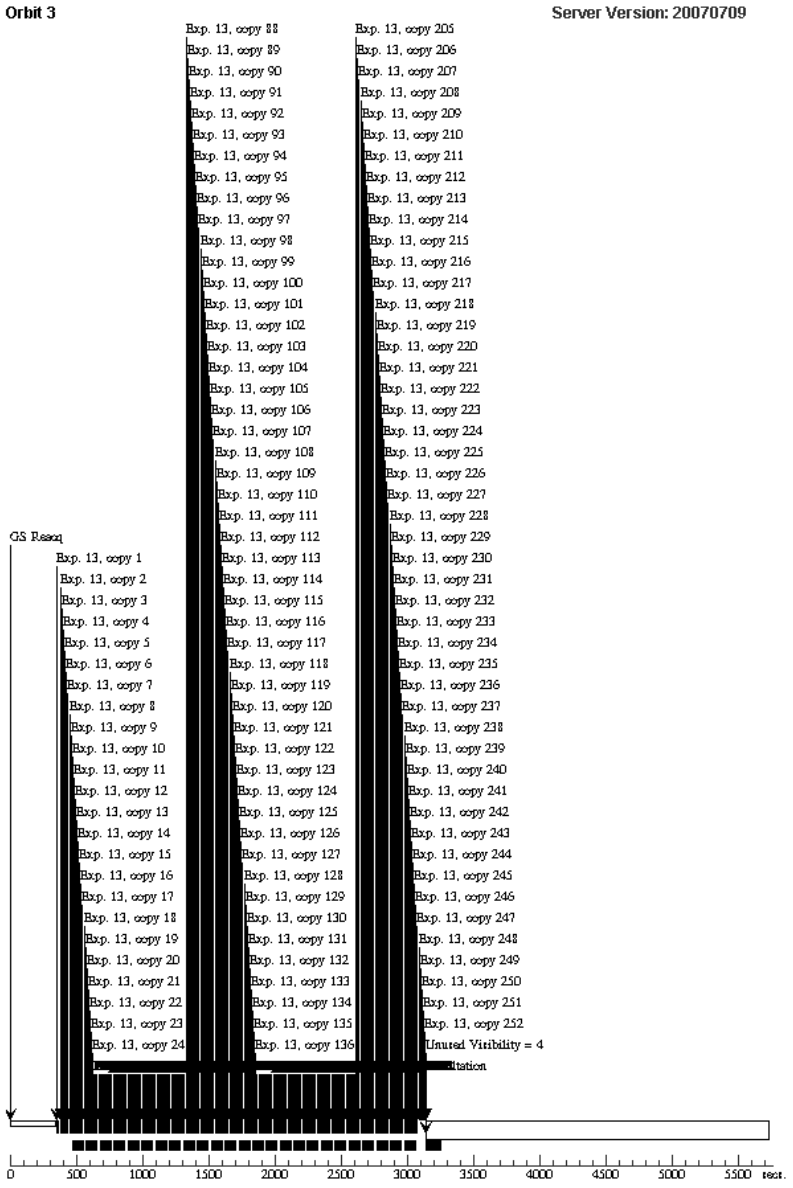
Orbit Structure



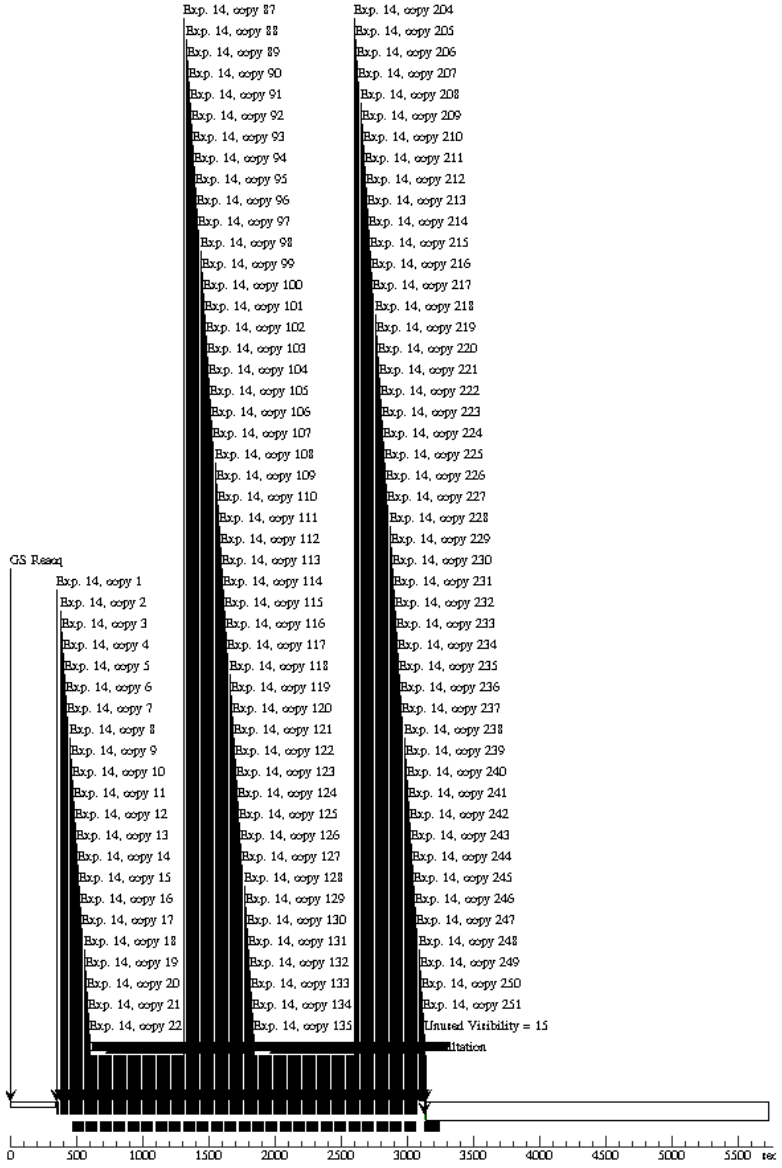
Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)



Visit

Proposal 11306, Visit 02, implementation Tue Oct 02 01:47:31 GMT 2007

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC3

Special Requirements: SCHED 70%; BETWEEN 14-DEC-2007:00:00:00 AND 17-DEC-2007:00:00:00; Period 2.64387 D AND ZERO-PHASE JD2454243.7664

Comments: Phase window made as wide as possible. A small subset of possible schedulings within this wide window would not be good for the science. We request access to the detailed draft schedule one month before execution to review the actual phase obtained, with the possibility of asking that the observations be delayed to a more opportune window.

After inspecting draft schedule Visit 2 has been restricted to execute on the Dec 15, 2007 opportunity. This is forced with use of BETWEENs, and to guard against potential slip of 1 orbit in final scheduling a narrow phase window of +/-20 minutes is used.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GJ436	RA: 11 42 11.0940 (175.5462250d) Dec: +26 42 23.65 (26.70657d) Equinox: J2000	Proposal Motion RA: 0.0669s/yr Proposal Motion Dec: -0.8137"/yr Epoch of Position: 2000.0	V=10.68+/-0.1 H = 6.32	Reference Frame: ICRS

Exposures

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1		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	F166N	SAMP-SEQ=STEP1; NSAMP=3; CAMERA-FOCUS=DEFOCUS	POS TARG 2.6,-11.6; PHASE 0.946 TO 0.956		*[==>]*	***[1]***

Comments: POS TARG +2.6, -11.6 moves the filter image to the position reached (approx 141,70) in GO-9832 moving the grism spectrum to a rather clean area of NIC3. Note that the new CAMERA-FOCUS=DEFOCUS parameter is used to defocus NIC3 to -0.5mm and the aperture NIC3-FIXD adjusts the target position for the defocus.

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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=STEP1; NSAMP=4; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***

Comments: Starting with 10 exps at what will become standard exposure.

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
3		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCA MRR; NSAMP=7; CAMERA-FOCUS =DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
	Comments: Starting a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.								
4		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCA MRR; NSAMP=6; CAMERA-FOCUS =DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
5		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=7; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
	Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.								
6		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=6; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
	Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.								

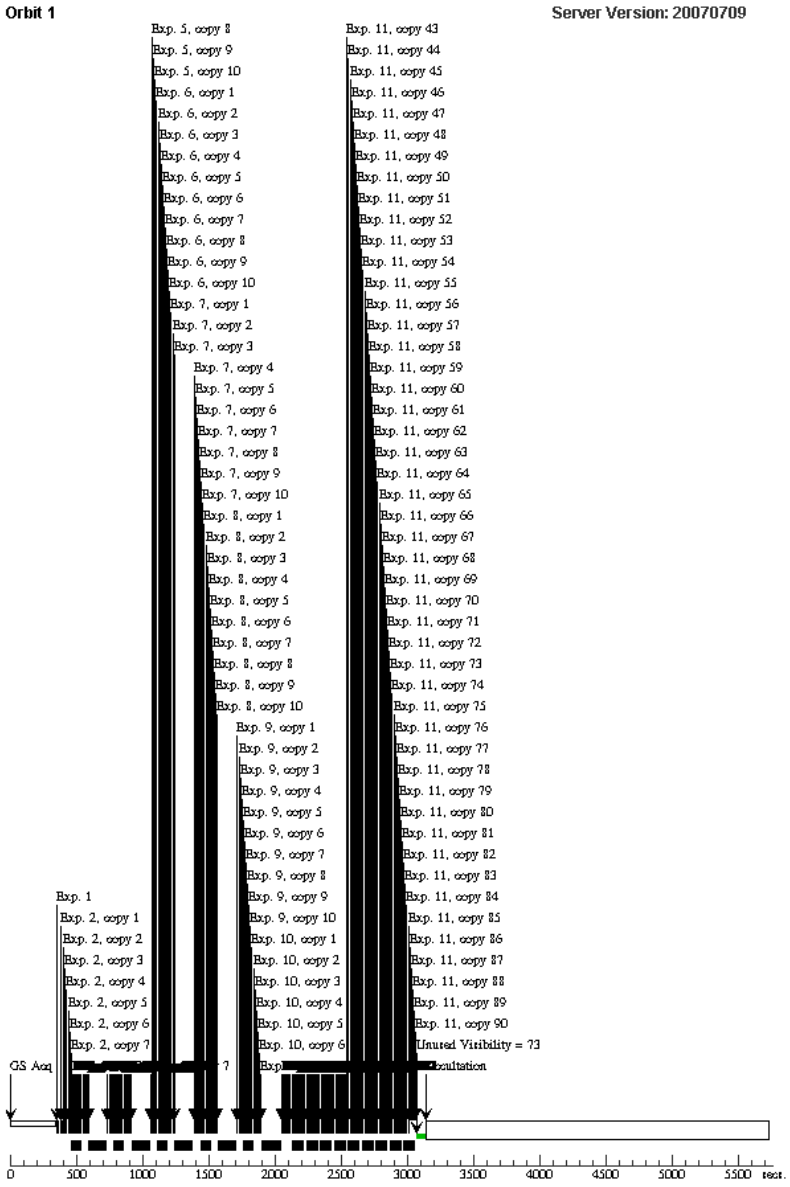
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
7		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=7; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									
8		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCAMRR; NSAMP=6; CAMERA-FOCUS=DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									

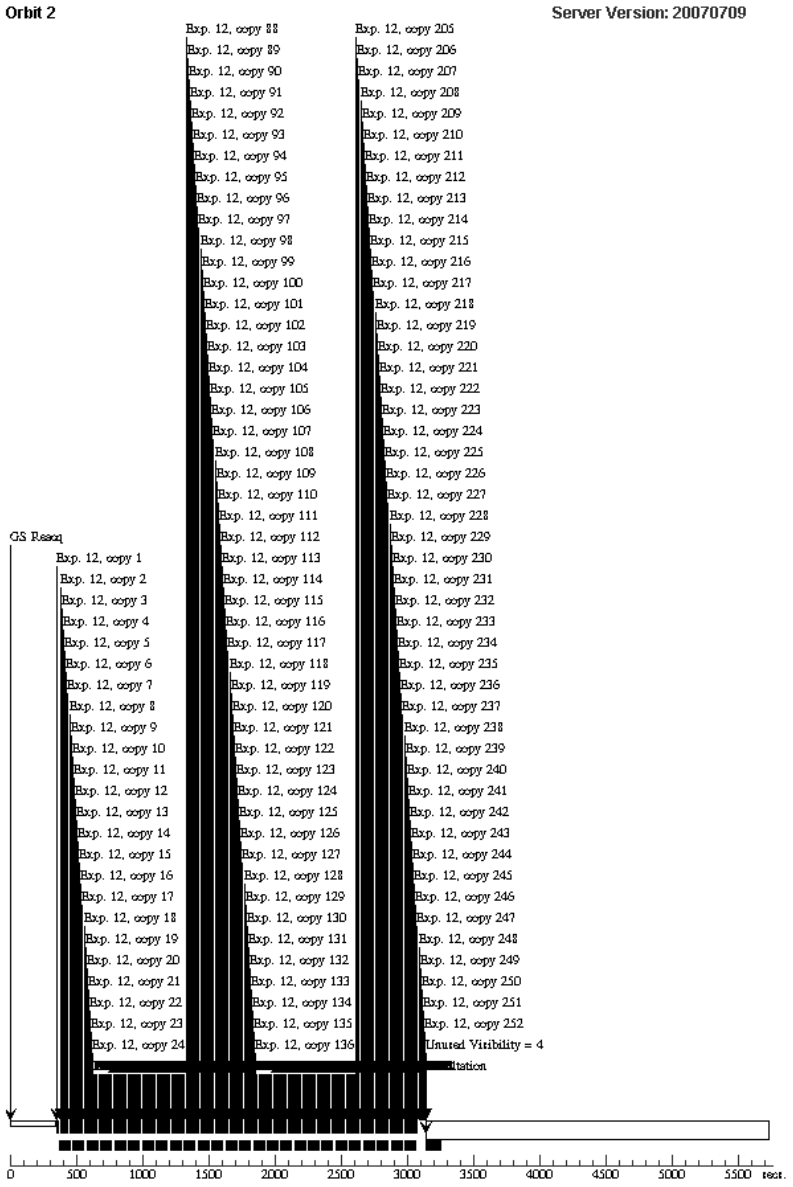
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
9		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCA MRR; NSAMP=7; CAMERA-FOCUS =DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									
10		(1) GJ436	NIC3, MULTIACCUM, NIC3-FIXD	G141	SAMP-SEQ=MCA MRR; NSAMP=6; CAMERA-FOCUS =DEFOCUS	SAME POS AS 1		*[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
Comments: Continuing a sequence of expsoures during first orbit only that use NSAMP = 7 and 6 to yield exposure times that bracket the 1.993 s of standard STEP1 at NSAMP=4. These will be used for linearity self-consistency checks.									

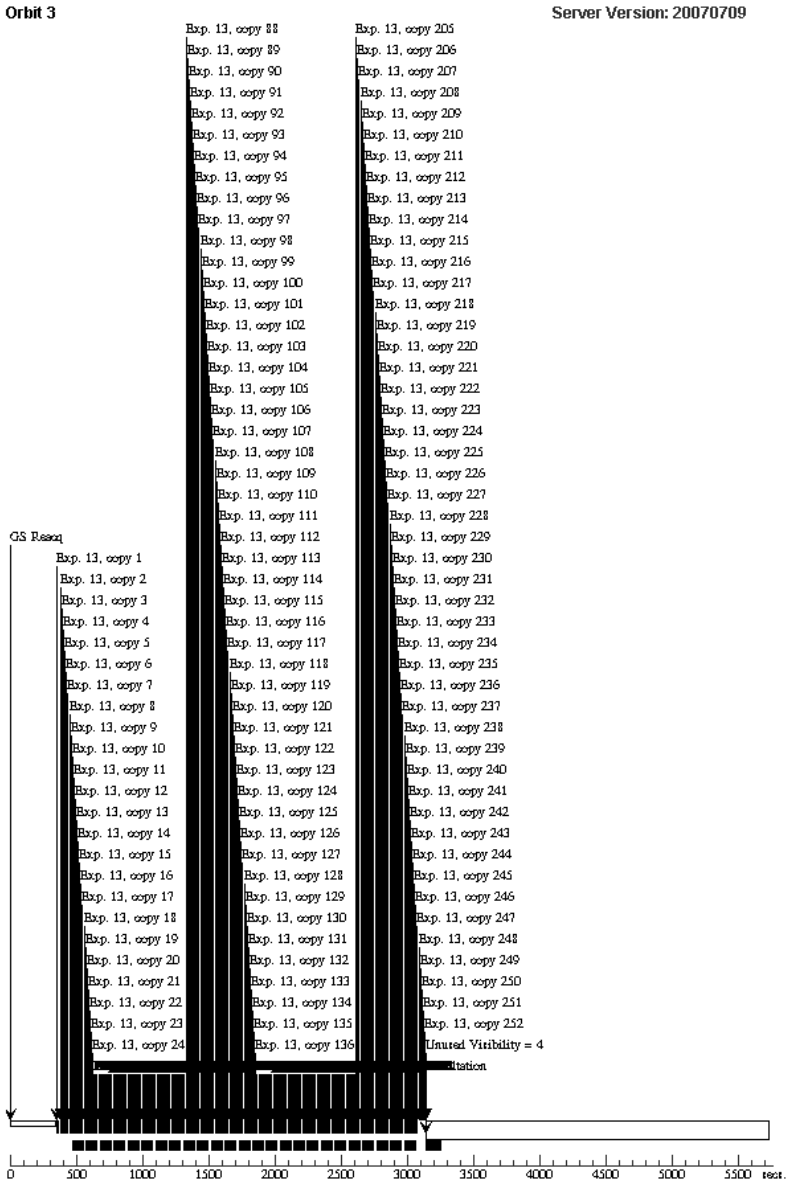
Orbit Structure



Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)