16037 - Securing a sample of exceptionally bright z>~9 galaxies to prepare for JWST and probe early galaxy assembly

Cycle: 27, Proposal Category: GO

(JWST Initative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Mauro Stefanon (PI) (ESA Member) (Contact)	**Universiteit Leiden**	**stefanon@strw.leidenuniv.nl**
Dr. Rychard Bouwens (CoI) (ESA Member)	Universiteit Leiden	bouwens@strw.leidenuniv.nl
Prof. Pascal Oesch (CoI) (ESA Member)	Observatoire de Geneve	pascal.oesch@unige.ch
Prof. Ivo Labbe (CoI)	Swinburne University of Technology	ivolabbe@gmail.com
Dr. Renske Smit (CoI) (ESA Member)	University of Cambridge	rs940@cam.ac.uk
Prof. Garth D. Illingworth (CoI) (AdminUSPI)	University of California - Santa Cruz	gdi@ucolick.org
Ryan Endsley (CoI)	University of Arizona	rendsley@email.arizona.edu
Dr. Gabriel Brammer (CoI) (ESA Member)	University of Copenhagen, Niels Bohr Institute	gabriel.brammer@nbi.ku.dk
Dr. Themiya Nanayakkara (CoI) (ESA Member)	Universiteit Leiden	themiyananayakkara@gmail.com
Sander Schouws (CoI) (ESA Member)	Sterrewacht Leiden	sanderschouws@gmail.com

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 246557	WFC3/IR	1	27-Nov-2019 12:00:41.0	yes
02	(2) 290767	WFC3/IR	1	27-Nov-2019 12:00:42.0	yes
03	(3) 104648	WFC3/IR	1	27-Nov-2019 12:00:43.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) 265881	WFC3/IR	1	27-Nov-2019 12:00:44.0	yes

4 Total Orbits Used

ABSTRACT

Especially massive galaxies are thought to be rare in the high-redshift universe, so the discovery of one very bright z=11.1 galaxy (GN-z11) within the original CANDELS program (0.25 sq. deg) was quite a surprise. Most theoretical models suggested a 10-50x larger area would be required to identify such a source. While such a discovery could suggest high-mass galaxies form particularly efficiently at early times, it could also be a "lucky" find. To determine which and to probe the properties of the most massive assembled galaxies in the early universe, we search a much larger volume for bright z>8.5 galaxies and discovered 4 very bright, high-probability z~9-10 candidate galaxies over that 6 square degree area with the deepest optical, near-IR, and Spitzer/IRAC data. The extreme luminosities of these sources demands that we urgently try to confirm their nature as secure z>8 galaxies with deeper follow-up observations given the implications for the formation efficiency of massive galaxies in the early universe and the proximity of the JWST cycle 1 deadline. With just 1 orbit of HST imaging data at 0.1 micron, these candidates would be detected at 10 sigma if at z<7, or be found to be secure >99.9999%-probability z>8 galaxies if undetected. Thanks to the very large volumes we search, we will likely confirm 1 of these extreme sources as robust, and potentially more if galaxy formation is especially efficient at early times. Our resultant sample of exceptionally bright z~9-10 galaxies should serve as high value targets for deep spectroscopy in the near future with JWST, ALMA, and also with the ELTs.

OBSERVING DESCRIPTION

We observe 4 candidate ultrabright (mH~24-24.5 A) star-forming galaxies at z>8.5. Each source is observed during one visit for one orbit split between imaging in the F105W (~0.8 orbit) and F140W (~0.2 orbit) bands. We adopt a 4-point dither strategy in F105W (3-point for F140W), similar to the WFC3-IR-DITHER-BOX-MIN pattern, to improve spatial sampling and limit systematics from potential cosmetic defects and residual cosmic ray hits, and alternating observations in the F140W to those in the F105W band, to optimize the time available for integration. Furthermore, each orbit starts and ends with observations in the F140W, to limit the contamination from HeII emission that could affect the F105W band at low limb angles from earth. We minimized the sampling time of each integration to pursue optimal cosmic ray rejection.

In the event of Reduced Gyro Mode, given the current short (17-20sec) unused time in each orbit, our observing strategy would need minor revision to accommodate the additional ~2minutes required for the initial target acquisition.

Visit

Proposal 16037, 246557 (01), implementation Wed Nov 27 17:00:45 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

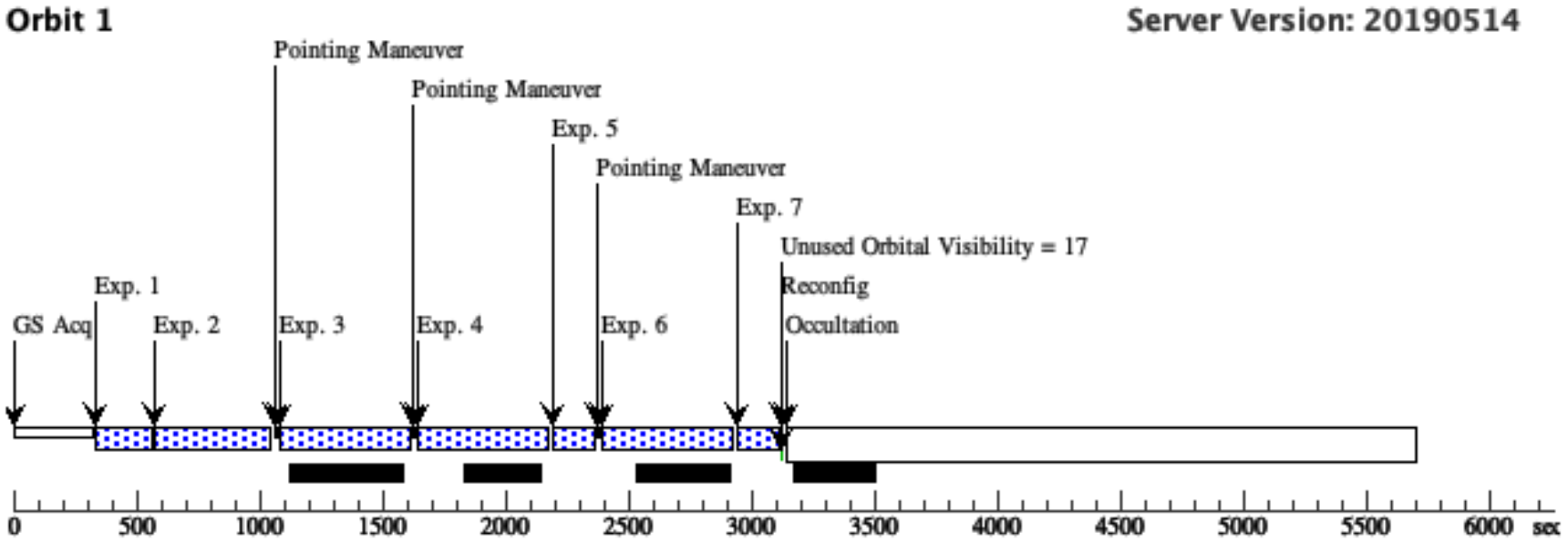
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	246557	RA: 02 21 56.6693 (35.4861221d) Dec: -04 42 44.17 (-4.71227d) Equinox: J2000		V=35 H=24 AB	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F140_1_200	(1) 246557	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=9			202.936411 Secs (202.936 Secs) *[==>]*	*[1]*
2	F105_1_450	(1) 246557	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=10	SAME POS AS 1		452.93635 Secs (452.936 Secs) *[==>]*	*[1]*
3	F105_2_500	(1) 246557	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.81300 0,0.423850		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
4	F105_3_500	(1) 246557	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.60975 0,0.726600		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
5	F140_2_150	(1) 246557	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 4		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*
6	F105_4_500	(1) 246557	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG -0.4742 50,0.544950		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
7	F140_3_150	(1) 246557	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 6		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16037, 290767 (02), implementation Wed Nov 27 17:00:45 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

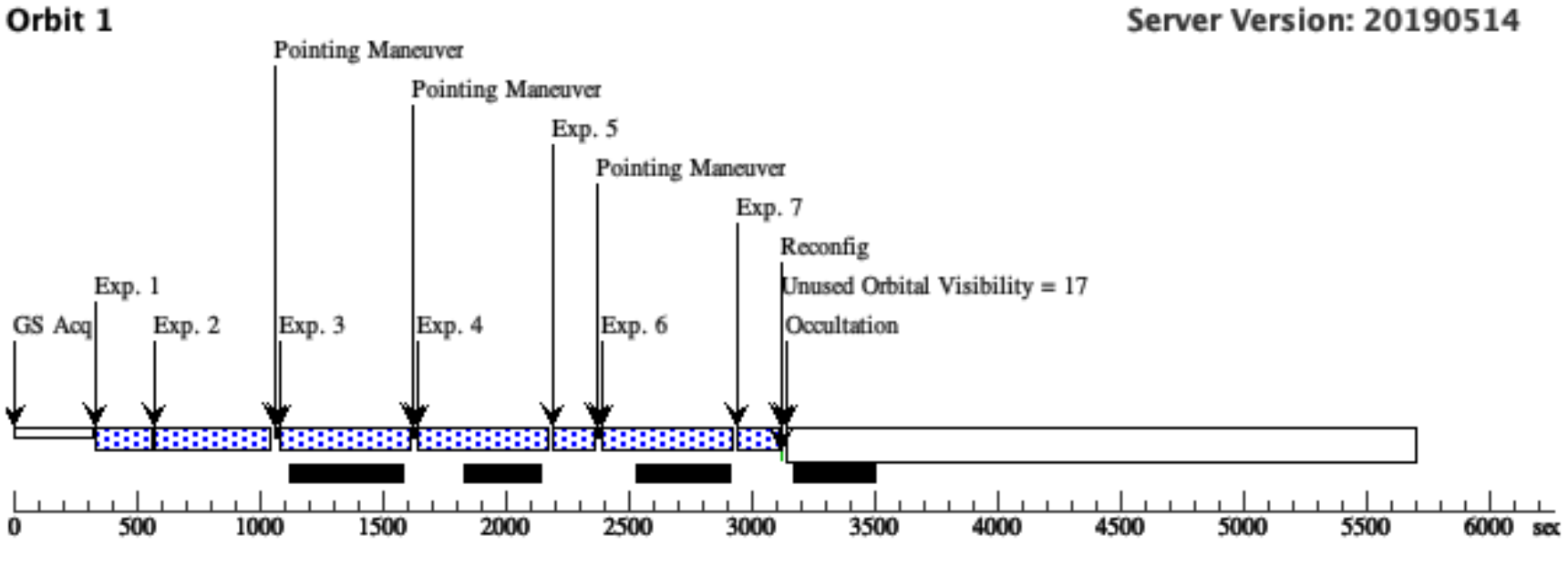
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	290767	RA: 02 28 36.6304 (37.1526267d) Dec: -04 35 34.55 (-4.59293d) Equinox: J2000		V=35 H=24 AB	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F140_1_200	(2) 290767	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=9			202.936411 Secs (202.936 Secs) *[==>]*	*[1]*
2	F105_1_450	(2) 290767	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=10	SAME POS AS 1		452.93635 Secs (452.936 Secs) *[==>]*	*[1]*
3	F105_2_500	(2) 290767	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.81300 0,0.423850		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
4	F105_3_500	(2) 290767	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.60975 0,0.726600		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
5	F140_2_150	(2) 290767	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 4		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*
6	F105_4_500	(2) 290767	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG -0.4742 50,0.544950		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
7	F140_3_150	(2) 290767	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 6		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16037, 104648 (03), implementation Wed Nov 27 17:00:45 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

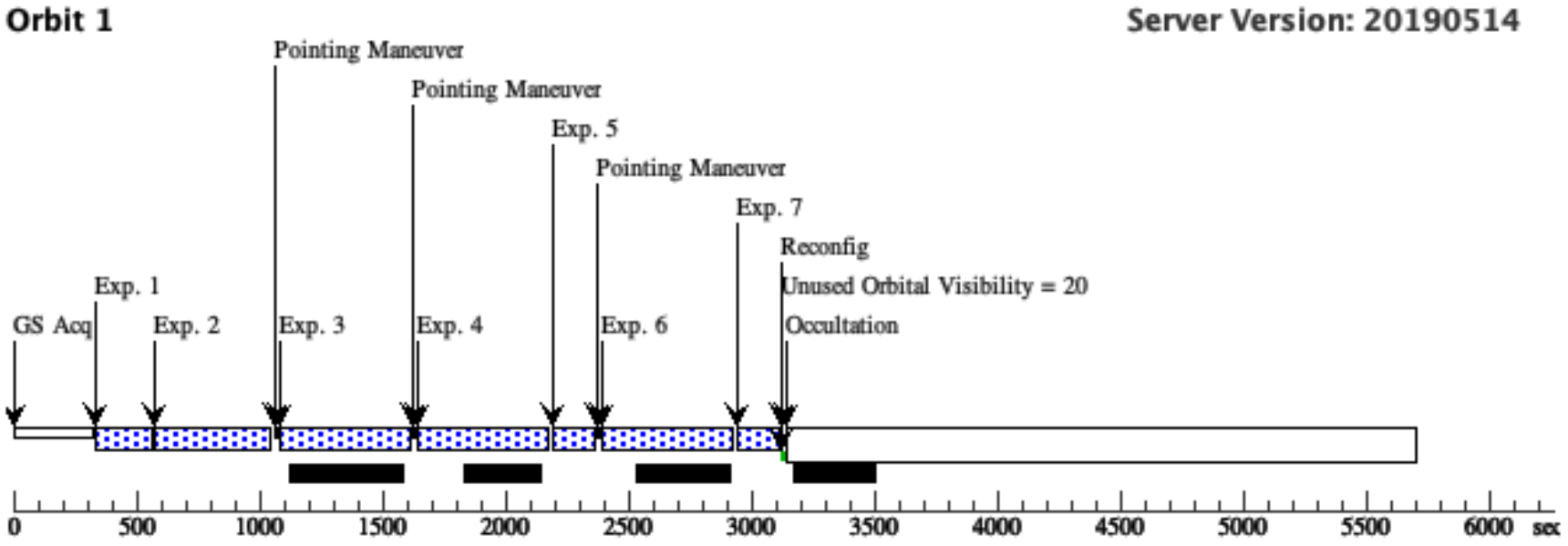
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	104648	RA: 02 25 37.7299 (36.4072079d) Dec: -05 06 53.44 (-5.11484d) Equinox: J2000		V=35 H=24 AB	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F140_1_200	(3) 104648	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=9	GS ACQ SCENARIO BASE1B3		202.936411 Secs (202.936 Secs) *[==>]*	*[1]*
2	F105_1_450	(3) 104648	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=10	SAME POS AS 1		452.93635 Secs (452.936 Secs) *[==>]*	*[1]*
3	F105_2_500	(3) 104648	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.81300 0,0.423850		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
4	F105_3_500	(3) 104648	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.60975 0,0.726600		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
5	F140_2_150	(3) 104648	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 4		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*
6	F105_4_500	(3) 104648	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG -0.4742 50,0.544950		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
7	F140_3_150	(3) 104648	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 6		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 16037, 265881 (04), implementation Wed Nov 27 17:00:45 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	265881	RA: 02 28 23.0883 (37.0962013d) Dec: -04 38 24.60 (-4.64017d) Equinox: J2000		V=35 H=24 AB	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[HIGH REDSHIFT GALAXY]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F140_1_200	(4) 265881	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=9			202.936411 Secs (202.936 Secs) *[==>]*	*[1]*
2	F105_1_450	(4) 265881	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=10	SAME POS AS 1		452.93635 Secs (452.936 Secs) *[==>]*	*[1]*
3	F105_2_500	(4) 265881	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.81300 0,0.423850		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
4	F105_3_500	(4) 265881	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG 0.60975 0,0.726600		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
5	F140_2_150	(4) 265881	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 4		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*
6	F105_4_500	(4) 265881	WFC3/IR, MULTIACCUM, IR	F105W	SAMP-SEQ=SPARS50; NSAMP=11	POS TARG -0.4742 50,0.544950		502.936801 Secs (502.937 Secs) *[==>]*	*[1]*
7	F140_3_150	(4) 265881	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS25; NSAMP=7	SAME POS AS 6		152.935381 Secs (152.935 Secs) *[==>]*	*[1]*

Orbit Structure