15461 - The detailed elemental composition of an exo-Pluto

Cycle: 25, Proposal Category: GO

(UV Initiative)

(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) SDSSJ023415.51-040609.0	COS/FUV COS/NUV	3	23-May-2018 13:00:42.0	yes
02	(1) SDSSJ023415.51-040609.0	COS/FUV COS/NUV	4	23-May-2018 13:00:43.0	yes

7 Total Orbits Used

ABSTRACT

We have identified a new single, polluted, circumstellar disk-bearing white dwarf star first identified as a photometric white dwarf candidate in SDSS. SDSSJ0234-0406 is accreting extremely oxygen- and hydrogen-rich material that is otherwise depleted in all other rocky elements, suggesting that it is being polluted by a massive icy body. Similarities with the extrasolar Kuiper belt object-ingesting WD1425+540 suggest SDSSJ0234-0406 is being polluted by what could be an exo-Pluto analog. We propose COS FUV spectroscopic observations of SDSSJ0234-0406 that will allow us to confirm our interpretation and then obtain an exhaustive elemental composition for a Pluto-like body from another planetary system. These

observations will address questions pertaining to the homogeneity of the formation and evolution of outer planetary systems and be a timely comparison to the New Horizons results for Pluto and eventually 2014 MU69.

OBSERVING DESCRIPTION

Our primary goal is to confirm the O-rich and rocky element-poor (Si, Fe) nature of SDSSJ0234-0406 and determine how much C, N, and S are present to place the origin of the accreted parent body. Our secondary goal is then to characterize additional elements. Modeling of absorption lines shows that the desired elements can be measured or sufficiently strongly constrained with observations in the 1130-1433 Angstrom range. We will perform medium spectral resolution ultraviolet spectroscopy with COS and the G130M grating to cover the 1130-1433 Angstrom range. In accordance with the COS2025 policies, we will only use two FP-POS positions (3 and 4).

For the GALEX-measured FUV flux of SDSSJ0234-0406 (FUV AB magnitude of 17.27+/-0.035), we estimate how much time on source is necessary to obtain our desired S/N. It should be possible to obtain average S/N~15 in the 1130-1433 Angstrom wavelength range with total on-source exposure time of approximately 17,000 seconds. These estimates are made using the COS ETC assuming standard background parameters and with a white dwarf spectral energy distribution matched to the parameters and flux level of our target. A signal-to-noise ratio of ~15 for the 1130-1433 Angstrom wavelength range will enable detection or tight limits on the abundances of O, Fe, Si, C, N, and S. Such a signal-to-noise ratio will also enable the detection or constraint of other elements (e.g., aluminum, phosphorus, chromium, manganese, or nickel). Our requested time estimates for COS are increased assuming 20 minutes of instrument overhead (including all acquisition and exposure overheads as suggested in the COS manual) per visit and 6 minutes of observatory overhead per orbit (spacecraft acquisition). In sum, we request 7 orbits total for COS observations of SDSSJ0234-0406.

Observations will be done in the TIME-TAG mode using TAG-FLASH wavelength calibration.

SDSSJ0234-0406 is an ICRS object (SDSS position with less than 0.4" positional uncertainty), has measured GALEX UV fluxes, and is safe for the COS detectors in our desired setups.

Visit

Proposal 15461, SDSSJ0234COSFUV_3ORB (01) Wed May 23 17:00:44 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: COS/FUV observations of SDSSJ0234-0406

Diagnostics

(SDSSJ0234COSFUV_3ORB (01)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details.

(SDSSJ0234COSFUV_3ORB (01)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

Fixed Targets

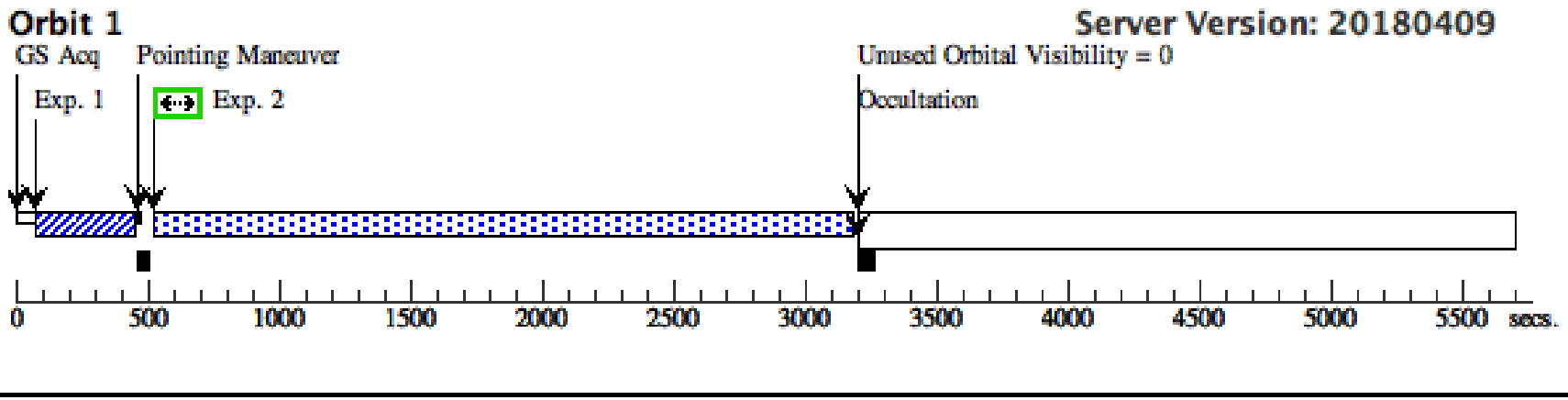
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ023415.51-040609.0 Alt Name1: PHL1360	RA: 02 34 15.5120 (38.5646333d) Dec: -04 06 9.06 (-4.10252d) Equinox: J2000	Proper Motion RA: 4.452 mas/yr Proper Motion Dec: 22.393 mas/yr Parallax: 0.0108609" Epoch of Position: 2008.9973	V=16.3+/-0.01 m_FUV = 17.3, m_NUV = 16.5	Reference Frame: ICRS

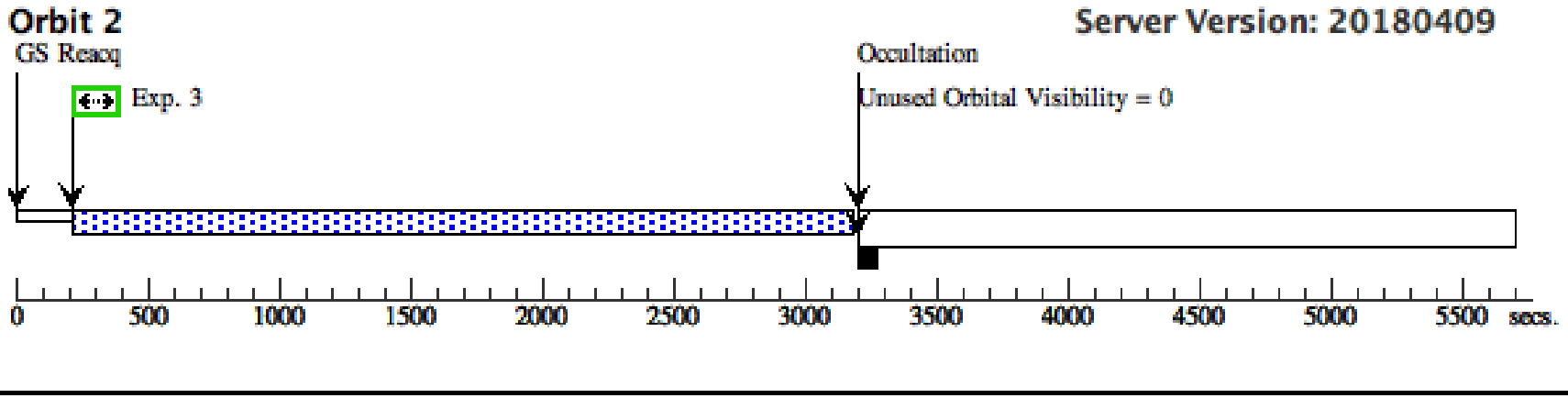
Comments:
Category=STAR
Description=[DA, DB, DZ]
Extended=NO

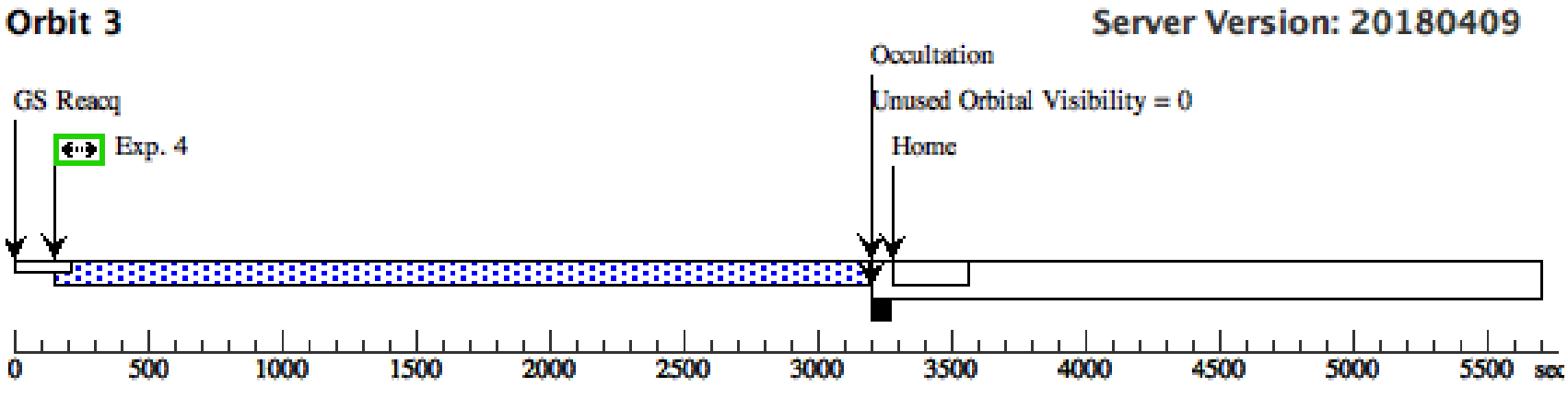
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (COS.ta.1164987)	(1) SDSSJ023415.51-040609.0	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				32 Secs (32 Secs) *[==>]*	*[1]*
2	SCI1 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=4690; FLASH=YES			2494 Secs (2494 Secs) *[==>]*	*[1]*
3	SCI2 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=4690; FLASH=YES			2916 Secs (2916 Secs) *[==>]*	*[2]*
4	SCI3 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=4690; FLASH=YES			2916 Secs (2916 Secs) *[==>]*	*[3]*

Orbit Structure







Visit

Proposal 15461, SDSSJ0234COSFUV_4ORB (02) Wed May 23 17:00:45 GMT 2018

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: COS/FUV observations of SDSSJ0234-0406

Diagnostics

(SDSSJ0234COSFUV_4ORB (02)) Warning (Form): For the best data quality, it is strongly recommended that the maximum number of allowed FP-POS positions is used when observing at a given COS CENWAVE setting. See full description for details.

(SDSSJ0234COSFUV_4ORB (02)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

Fixed Targets

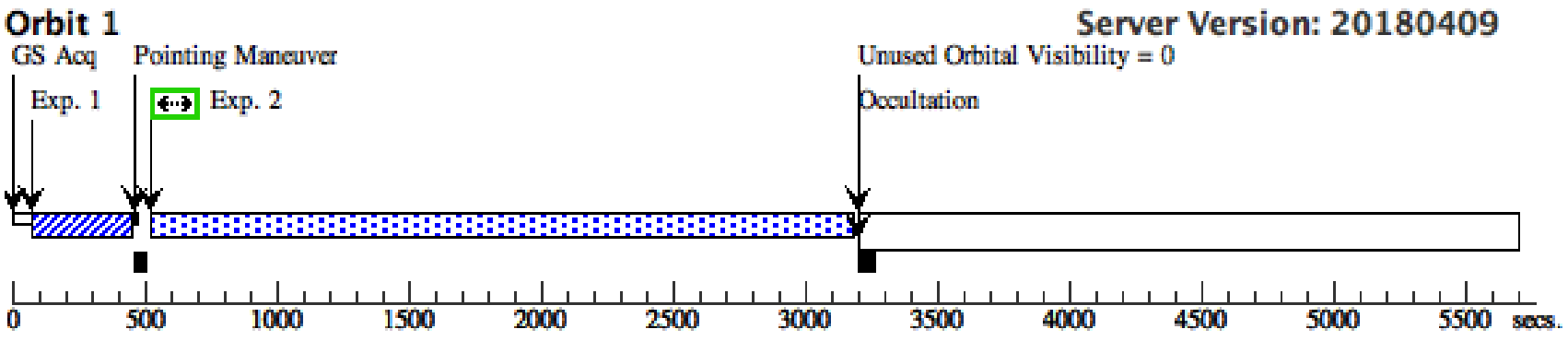
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ023415.51-040609.0 Alt Name1: PHL1360	RA: 02 34 15.5120 (38.5646333d) Dec: -04 06 9.06 (-4.10252d) Equinox: J2000	Proper Motion RA: 4.452 mas/yr Proper Motion Dec: 22.393 mas/yr Parallax: 0.0108609" Epoch of Position: 2008.9973	V=16.3+/-0.01 m_FUV = 17.3, m_NUV = 16.5	Reference Frame: ICRS

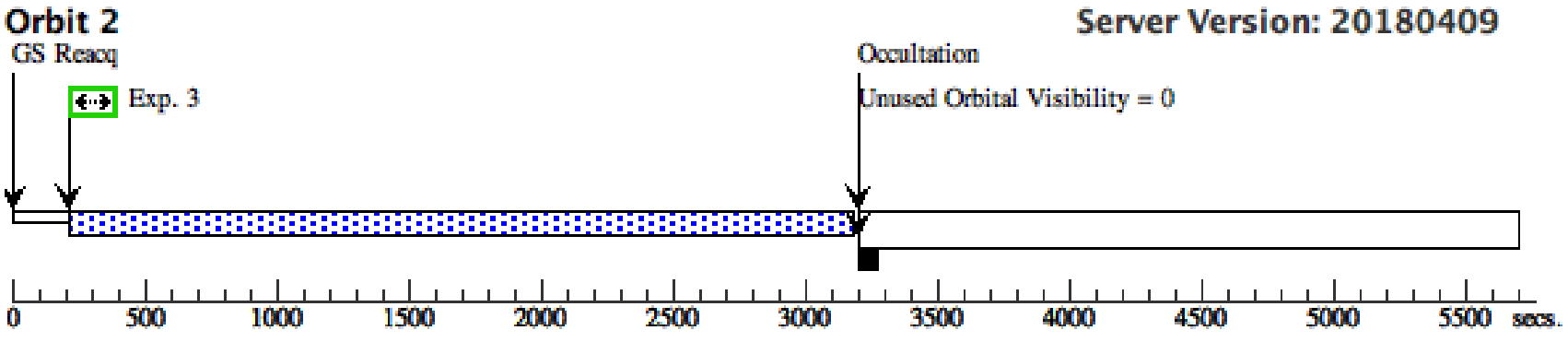
Comments:
Category=STAR
Description=[DA, DB, DZ]
Extended=NO

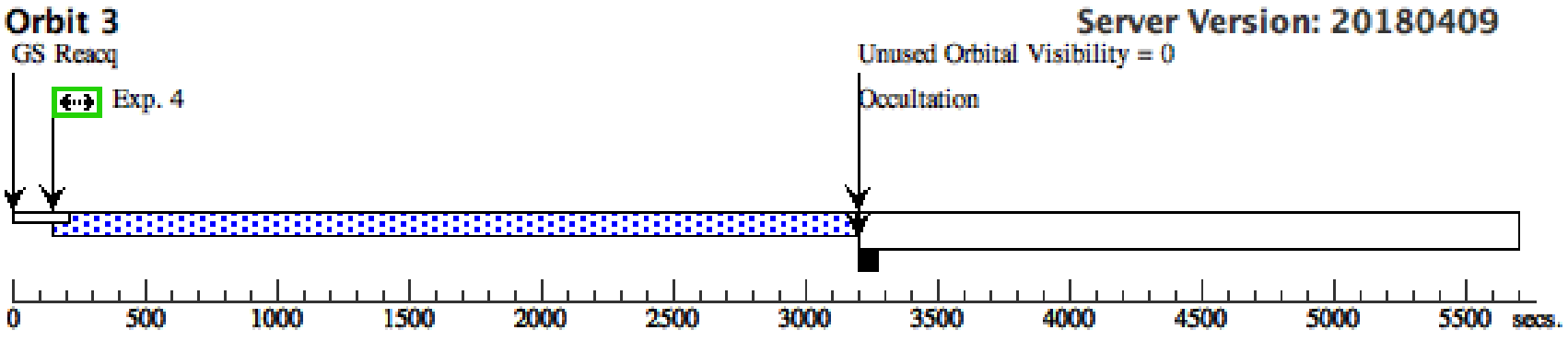
Exposures

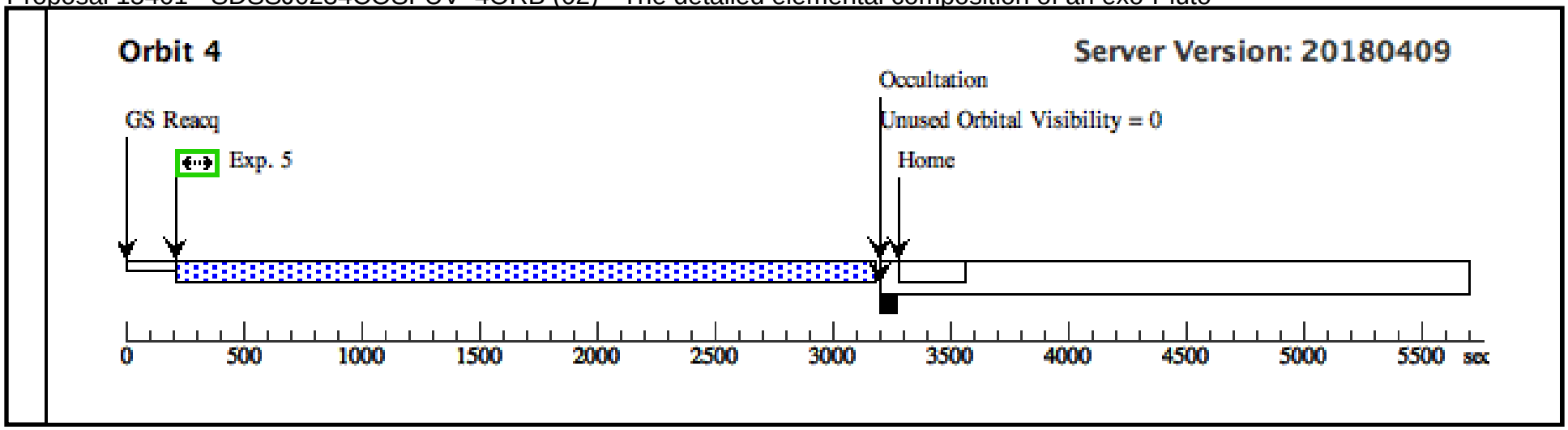
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (COS.ta.1164987)	(1) SDSSJ023415.51-040609.0	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				32 Secs (32 Secs) *[==>]*	*[1]*
2	SCI1 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=4690; FLASH=YES			2494 Secs (2494 Secs) *[==>]*	*[1]*
3	SCI2 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=4690; FLASH=YES			2916 Secs (2916 Secs) *[==>]*	*[2]*
4	SCI3 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=4690; FLASH=YES			2916 Secs (2916 Secs) *[==>]*	*[3]*
5	SCI4 (COS.sp.1164988)	(1) SDSSJ023415.51-040609.0	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=4690; FLASH=YES			2916 Secs (2916 Secs) *[==>]*	*[4]*

Orbit Structure





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