15501 - An Extinction Probe Through the HD 107146 Debris Ring: Taking Unique Advantage of a Background Galaxy Transit

Cycle: 26, 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) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:20.0	yes
02	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:21.0	yes
03	(2) HD-120066	STIS/CCD	1	27-Nov-2018 11:04:22.0	yes
04	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:23.0	yes
05	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:24.0	yes
11	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:24.0	yes
12	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:25.0	yes
13	(2) HD-120066	STIS/CCD	1	27-Nov-2018 11:04:26.0	yes
14	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:26.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
15	(1) HD-107146	STIS/CCD	1	27-Nov-2018 11:04:27.0	yes

10 Total Orbits Used

ABSTRACT

We propose a 3-cycle GO program utilizing a total of HST 30 orbits to directly measure and map the line-of-sight optical depth through the brightest sector of the HD 107146 solar-analog debris ring by ring-transit differential photometry of a bright (compared to the disk), spatially extended, background galaxy. We will advantageously exploit its serendipitously unique and experiment-enabling high proper motion reflex trajectory w.r.t. the galaxy back-lighting a sectional slice the exoplanetary debris system (EDS) with a 2D grid of multiple sight-lines through the nearly face-on disk over time. These measures (the only opportunity for such in remaining HST lifetime) will uniquely provide unambiguous extinction/optical depth constraints to better elucidate the physical properties of the debris particles in this otherwise well studied EDS. With these and prior data we will: (a) disambiguate inferred particle spatial, size, and mass density distributions otherwise conflated with debris material optical property dependencies, (b) better constrain the posited pathways for planetary debris dust production mechanisms in EDSs (e.g., catastrophic collisions of parent bodies, dust-production cascades, cratering events, etc.) and (c) search for and discriminated between "clumps ", "bumps ", and "clouds" of collisional debris of varying particle (and mass) densities. This investigation was enabled in forethought by mapping the galaxy surface brightness out-of-transit in a comprehensive 2011 precursor study (HST GO/12228) using exactly the same STIS instrumental configuration with multi-roll PSF template subtracted coronagraphy we propose for the upcoming ring transit opportunity.

OBSERVING DESCRIPTION

We are imaging the HD 107146 nearly face-on circumstellar debris ring over period of three years (HST Cycles 24 - 26) as it partially transits serendipitously in front of a bright background galaxy. Beginning in late 2016, part of the outer periphery of the debris ring will be back-lit by the galaxy. Debris dust orbiting HD 107146 will partially extinct the galaxy light with variable column depth with stellocentric distance. By appx. 2020, the galaxy will be behind the brightest part of the debris ring (and presumably of highest optical depth) closer to the host star. Baseline out-of-transit observations were obtained in 2011 with HST/STIS PSF-subtracted multi-roll coronagraphy of HD 107146 in GO 12228 and closely follow the same observing strategy here for the now, in-transit, observations.

Using a total of 30 HST orbits, we are re-visiting and identically image the system six times over a three year period, roughly every six months consuming 5 orbits per transit-phase epoch. The first 10 orbits (two epochs) were executed in GO program 14712 (Cy 24), the second set of ten orbits

(epochs 3 and 4) are executing in GO 15221 (Cy 25) and the last set of 10 orbits (epochs 5 and 6) will execute in this program GO 15501. Other than small differences in allowable min and max orientation angles, the observing plan in Cy 25 replicates the Cy 24 plan.

At each epoch we will image the HD 107146 debris system+background galaxy in four orbits, with also a contemporaneously observed nearby and color-matched PSF temple calibration star, interleaved in a 5th orbit. Each visit-set of five orbit executes contiguously interrupted only by Earth occultation. Each of the four orbits on the disk+galaxy execute with small spacecraft roll offsets, a "roll dither" about HD 107146 of nominally (-6, -2, +2, +6) deg appx. around nominal roll required to simultaneously better suppress and reject PSF-template subtraction (correlated) image residuals with roll discrimination and build image SNR.

The STIS coronagraphic image plane wedges obscure some circum-azimuthal regions around the occulted star, and some other regions along the field "diagonals" with respect to the location of the occulted star are degraded by the unapodized HST diffraction spikes. We therefor MUST place the galaxy on the detector only where it does not fall on any of these regions. These regions are rotationally invariant in the instrument free (SAIF) with a spacecraft rotation reorienting the celestial image. We thus must impose absolute orientation constraints for our roll dithers to image the galaxy only in unaffected annular sectors around the occulted star. There are four sufficiently large annular regions to accommodate the nears roll dithers of utility. These fall in annular sectors to the "right and left" of Wedge A, and between the lower diffraction pikes and the edges of Wedge-A. We do not care which one(s) is/are scheduled for our observations, and we provide multiple absolute orientation angle range to ease schedulability.

ABSOLUTE ORIENTATION CONSTRAINTS - NOTES TO OUR PC
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(1) AS PLANNED PRIOR IN GO 14714/CYCLE 24: We computed the APT ORIENTATION constraints for the middle of each of the four acceptable imaging regions (azimuthal sectors) spoken to above on the basis of: (a) the galaxy Position Angle (PA_gal) w.r.t. the occulted star (this will slowly change over the 3 years of the program), and (b) the angle between the STIS 50CCD U3 Reference that is +45 degrees CCW from the image +Y axis (this, in the SIAF frame, is in the direction of the upper left diffraction spike) and the middle of the annular sector to place the galaxy.

These orientations were computed and used as visit level (min and max) orientation constraints as:

ORIENTATION = PA_galaxy - SECTOR_n_Angle_from_U3_REF

(see email to PC sent June 29, 2016 01:50:44 PM MST)

For Cycle 24 (GO 14714) we measured and compute as follows with one minor differences for the first and second halves of Cycle 24:

1st half CY 24 -- 10/2016 PA_galaxy = 212.5 deg EofN (r=5.0328")

	SECTOR_n_Angle_from_U3_REF		ORIENTATION CONSTRAINT	
SECTOR	min(deg)	max(dec)	min(deg)	max(dec)
B	8	83	129.5	204.5
C	97	122	90.5	115.5
D	145	169	43.5	67.5
E	189	261	-48.5 (311.5)	23.5 (note zero angle crossing)

2nd half CY 24 -- 04/2017 PA_galaxy = 212.1 deg EofN (r=4.9233")

	SECTOR_n_Angle_from_U3_REF		ORIENTATION CONSTRAINT	
SECTOR	min(deg)	max(dec)	min(deg)	max(dec)
B	9	83	129.1	203.1
C	98	122	90.1	114.1
D	146	169	66.1	43.1
E	189	261	-48.9 (311.1)	23.1 (note zero angle crossing)

Our PC verified we have done this correctly so the galaxy is placed "in between" the diffraction spikes and A-wedge obscurations, not superimposed upon them. This was confirmed with the first epoch imaging in late March, 2017, thus we proceed on this basis also for Cycle 25 and now Cycle 26.

These absolute orientation constraints are placed on visits 04 and 14, and the relative orientation constraints within on visits 01,02,05 and 11,12,15.

(2) AS PLANNED FOR GO 15221/CYCLE 25: The APT Phase 2 observing plan for GO 15221 is identical to GO 14714 with the exception of small changes to the allowable Min and Max Orientation ranges in the visit level requirements in visits 04 and 14 (These are implicitly applied to the other HD 107146 visits with linked "Orient From"s). The min|max Orient changes w.r.t. GO 14714 (due to the stellar proper motion w.r.t. the background galaxy) are optimally specified for placement of the galaxy unaffected by the HST diffraction spikes and obscuring STSI occulting wedges.

However, the only appx 1 degree changes in orientation angles are within the roll angle tolerances for no change and the observations may be scheduled identically to HD 14714 that are nearly central in the ranges re-specified. For traceability (and requested verification by our PC) we explain the orientation ranges below. Following that, the rest of the observing description follows directly from GO 14714.

As in GO 14714, in order to position the galaxy in the "clear" circum-azimuthal space unobscured by the target star diffraction spikes and STIS A/B occulting wedges, we compute the celestial PA (eastward from north) of the galaxy w.r.t. HD 107146 over time at discrete epochs in October and April (designated twice yearly epochs "a" and "b") from 2016 - 2020 as tabulated below based on our 2011 epoch imaging and relative PM measures w.r.t. earlier ACS imaging with also SIMBAD stellar PMs. The GO 14714 and first epoch (completed) observations from GO 15221 were planned in this manner executed per expectations. In both Cycles, schedualbity was found in late March and July, and anticipate similar now for Cy 26. We this tabulate and use an intermediate epoch for planning designated CY26c now added to the table below.

	EPOCH	GAL:X	GAL:Y	SEP:PIX	GAL:PA	SEP:ASEC	
BASE	04/2011	922.605	653.442	123.080	215.84	6.2488	
CY24a	10/2016	903.738	669.573	99.129	212.46	5.0328	GO 14714 V01-05 (actual 3/26/2017)
CY24b	04/2017	902.023	671.039	96.974	212.07	4.9233	GO 14714 V11-15 (actual 7/27/2017)
CY25a	10/2017	900.308	672.505	94.823	211.66	4.8141	GO 15221 V01-05 (actual 3/16/2018)
CY25b	04/2018	898.592	673.972	92.677	211.23	4.7052	GO 15221 V11-15 (actual 3/29/2018)
CY26a	10/2018	896.877	675.438	90.536	210.78	4.5965	
CY26b	04/2019	895.162	676.905	88.402	210.32	4.4882	GO 15501 V01-05 (anticipated)
CY26c	07/2019	894.32	677.68	87.39	210.02	4.433	GO 15501 V11-15 (anticipated)
CY27a	10/2019	893.447	678.371	86.273	209.82	4.3801	
CY27b	04/2020	891.732	679.838	84.151	209.31	4.2724	
CY28a	10/2020	890.016	681.304	82.037	208.76	4.1650	

(Epochal dates are notionally twice per HST Cycle, not a cadence requirement as tabulated)

We define four azimuthal sectors (denoted B - E) around HD 107146 that are unaffected or unobscured by the HST diffraction spikes where, though constrained by absolute orientations (MinOrient and MaxOrient), where it is allowable to place the galaxy. The boundaries of these sectors are

measured from the STIS 50CCD U3 reference frame. The four sectors are defined as follows:

SECTOR_B_{min|max}_Angle_from_U3_Ref = 9 to 83 deg
SECTOR_C_{min|max}_Angle_from_U3_Ref = 97 to 122 deg
SECTOR_D_{min|max}_Angle_from_U3_Ref = 145 to 169 deg
SECTOR_E_{min|max}_Angle_from_U3_Ref = 189 to 261 deg

For each sector (allowable {min|max} Visit Orientation Requirement range), are:

{min|max}_ORIENTATION = PA_galaxy - SECTOR_#_{min|max}_Angle_from_U3_Ref ; (# = B-E)

This is tabulated for the Cycle26 "a" and "b" epochs below:

CYCLE 26b: PA_galaxy = 210.32
SECTOR sector_{min|max} {Min|Max}_ORIENT (in ascending order)
B 9 83 127.32 201.32
C 97 122 88.32 113.32
D 145 169 41.32 65.32
E 189 261 -50.68 21.32 --> 309.32 21.32 (note zero degree crossing)

CYCLE 26c: PA_galaxy = 210.02
SECTOR sector_{min|max} {Min|Max}_ORIENT (in ascending order)
B 9 83 127.02 201.02
C 97 122 88.02 113.02
D 145 169 41.02 65.02
E 189 261 -50.98 21.02 --> 309.02 21.02 (note zero degree crossing)

(3) To ease scheduling opportunities, we applied near-symmetrical tolerances to the mid-sector ORIENTATIONs, (expressed as {min|max} on each

orientation} that is non-intrusive on the "bad" areas. Each of these allowable absolute orientation ranges is larger than the full (+/-6 degrees at the extrema) extent of the 4-orbit "roll dithers". APT does not allow us to specify where within the (min/max) absolute orientation constraints the roll dithers in relative offset angles would fall other than being constrained somewhere within. However, we VERY strongly prefer the roll-dithered visits to scheduled scheduled so that at each epoch they are done are done as close to the center (mid point) of the selected allowable roll ranges as possible (i.e., placing the target in the middle of the min max range with roll dither offsets). We understand the can be set up this way with manual scheduling by our PC though is not expressible by APT and we request this. This was done this way in GO 14714 and GO 15221.

(4) We do not have a requirement for which of the four allowable roll ranges are used at any epoch, however, if annual revisits to every other visit set should occur at close to the same time of year with possible scheduling into the same sectors, that is preferable than in different sectors.

OTHER NOTES:

Each visit, whether disk+galaxy target or PSF template/calibration star begins with a Mode-2 target acquisition exposure, followed by a series of identical WedgeA-1.0 coronagraphic images to fill the visibility period. Exposure times were chosen to optimize the SNR in the region of the ring without image saturation due to incompletely suppressed stellar light as verified in GO 12228 and confirmed in GO 14714.

The two 5-orbit visit sets to be executed at different transit-track phases should be scheduled roughly six months apart, though this is a loose constraint +/- ~ 2 months. The additional four 5-orbit visit sets are separately provided in separate APT files for Cycles 24 and 26 under proposal numbers 14714 and 15221.

The APT Phase 2 observing plan is identical in construction as GO 15221, EXCEPT as follows:
a. small changes in {min|max} orientation angles per the above table for epochs designated CY26b and CY26c.
b. Restoration of full (desired) ORIENT from specifications in Visits 11, 12, 15 that was more limited
in Cycle 25 due to guide star constraints.
c. update of explanatory notes in this proposal description.

Visit

Proposal 15501, EPOCH26B_HD107146_01 (01), implementation Tue Nov 27 16:04:27 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT -4.452D TO -4.452D FROM 04

Comments: Visit 01. HD 107146 (V=7.07, B-V = +0.62). 5th epoch (26b), 1st orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: -6 deg ONR (-8 deg w.r.t. visit 04)
Relative Timing: This visit (01) should immediately precede visit (02) in back-to-back orbits.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

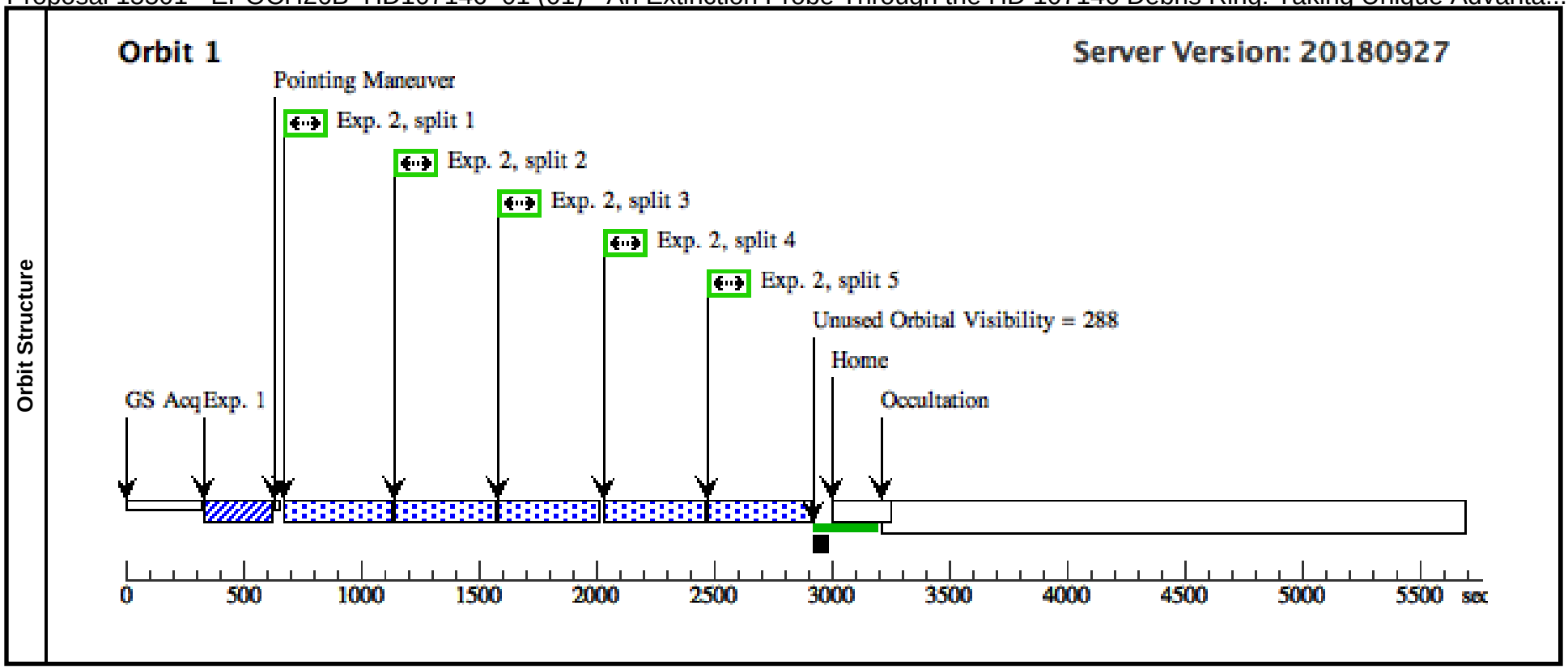
Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***

Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second

Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26B_HD107146_02 (02), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT -2.226D TO -2.226D FROM 04; AFTER 01 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 02. HD 107146 (V=7.07, B-V = +0.62). 5th epoch (26b), 2nd orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: -2 deg ONR
Relative Timing: This visit (02) should immediately follow visit (01) in back-to-back orbits.

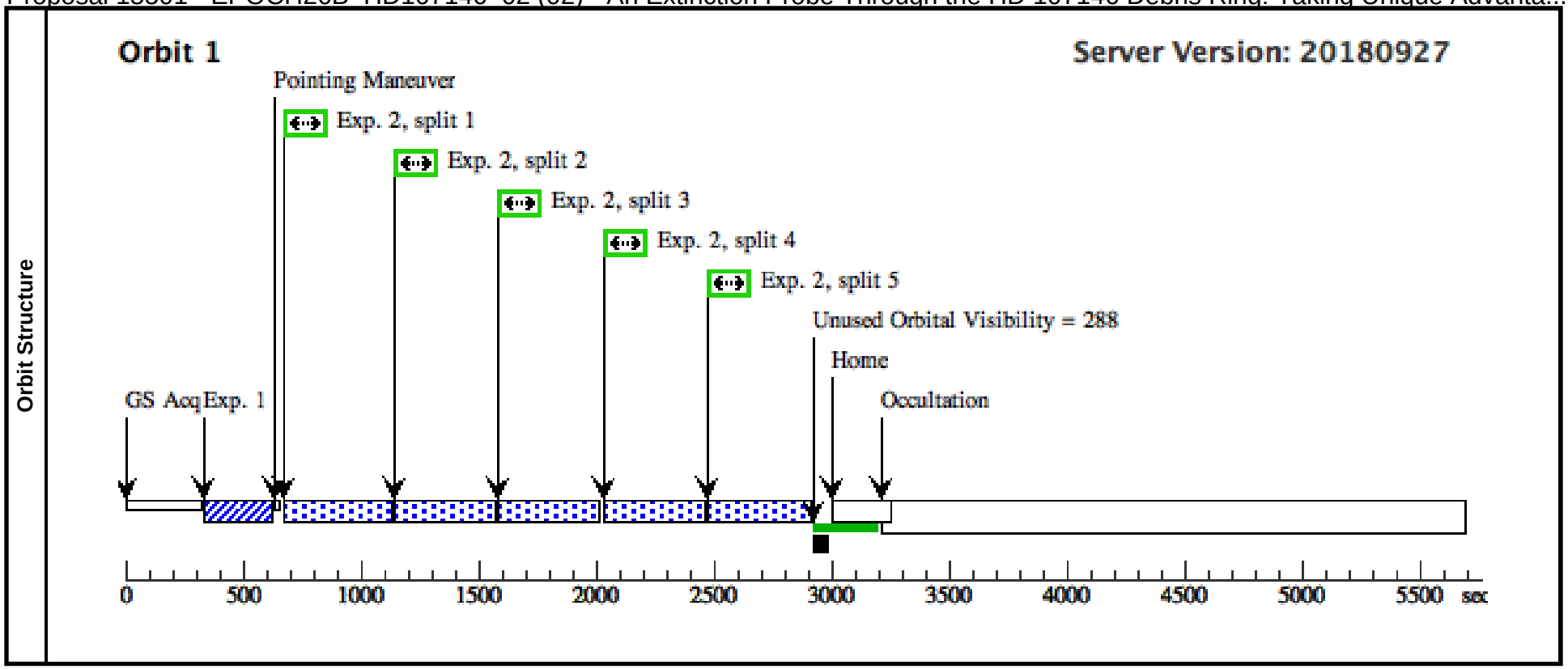
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second									
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26B_HD120066_03 (03), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; AFTER 02 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 03 (HD120066 PSF; V= +6.3). 5th epoch (26b), 3rd orbit
Absolute Orientation: Unconstraind
Relative Orientation: Unconstrained
Relative Timing: This visit (03) should immediately follow visit (02) in back-to-back orbits.

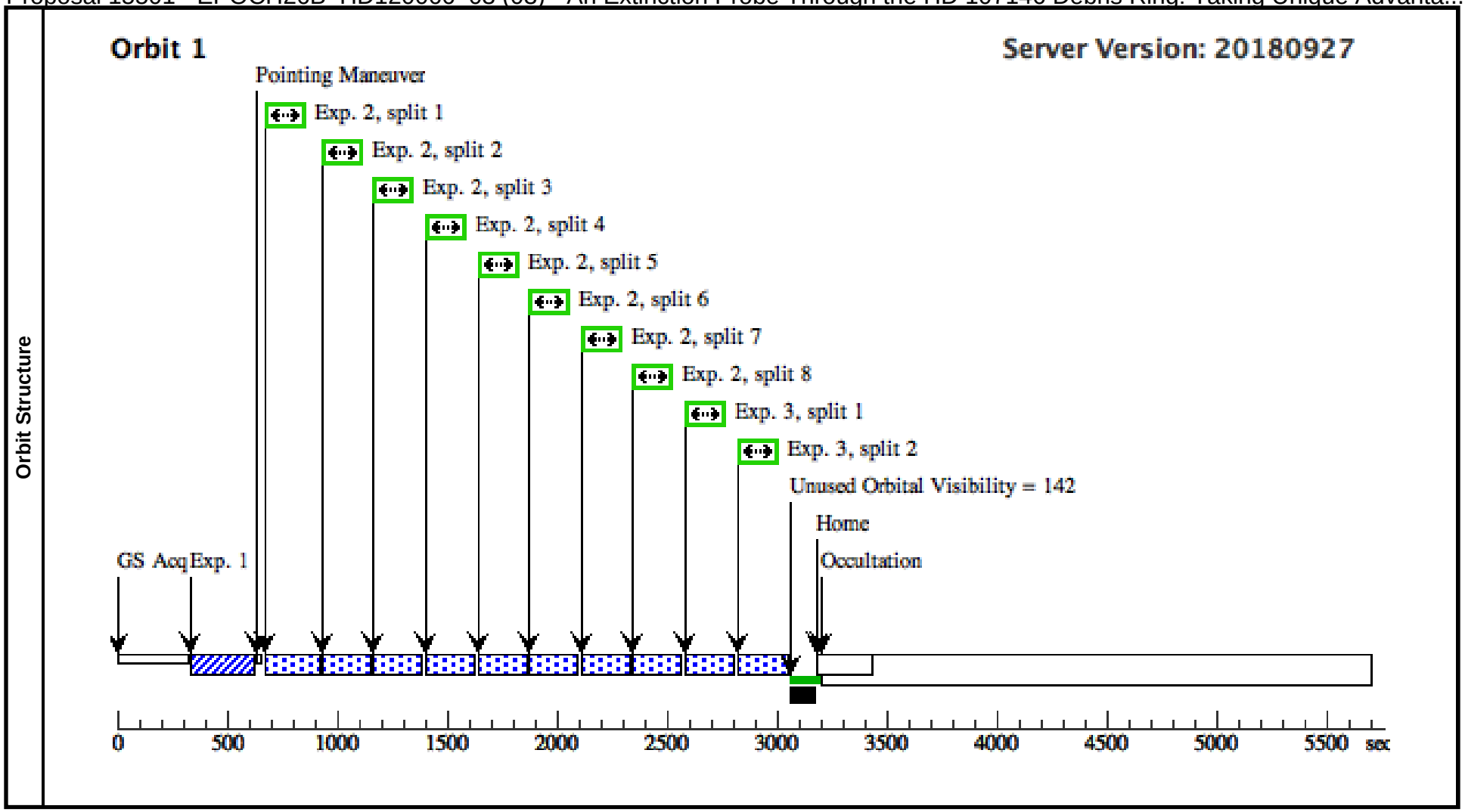
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	HD-120066	RA: 13 46 57.1231 (206.7380129d) Dec: +06 21 1.34 (6.35037d) Equinox: J2000	Proper Motion RA: -509.71 mas/yr Proper Motion Dec: -110.51 mas/yr Parallax: 0.03158" Epoch of Position: 2000	V=6.3	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	PSF03A_ACQ	(2) HD-120066	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARIO BASE1BN3		0.2 Secs (0.2 Secs)	
								[==>]	***[1]***
	Comments: SNR = 100, V = 6.30, sp = G0V, Exptime rounded to nearest 0.1 second								
2	PSF03A_LONG	(2) HD-120066	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=8; GAIN=4			1652 Secs (1652 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]* *[==>(Split 7)]* *[==>(Split 8)]*	***[1]***
	Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.								
3	PSF03A_LONG	(2) HD-120066	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=2; GAIN=4			413 Secs (413 Secs)	
								[==>(Split 1)] *[==>(Split 2)]*	***[1]***
	Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.								


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Exp. 2, split 7
Exp. 2, split 8
Exp. 3, split 1
Exp. 3, split 2
Unused Orbital Visibility = 142
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26B_HD107146_04 (04), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT 127.32D TO 201.32 D; ORIENT 88.32D TO 113.32 D; ORIENT 41.32D TO 65.32 D; ORIENT 309.32D TO 21.32 D; AFTER 03 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 04. HD 107146 (V=7.07, B-V = +0.62). 5th epoch (26b), 4th orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: +2 deg ONR
Relative Timing: This visit (04) should immediately follow visit (03) in back-to-back orbits.

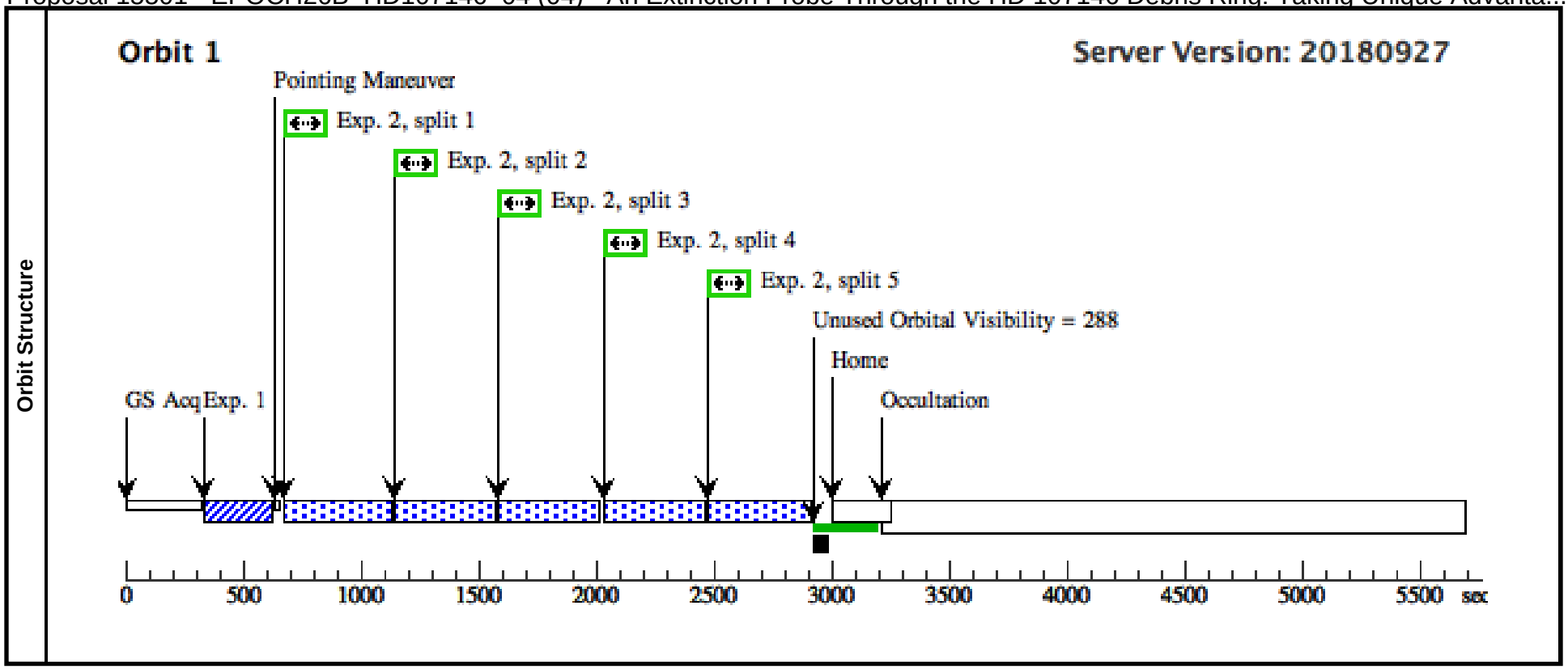
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second									
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26B_HD107146_05 (05), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT 2.226D TO 2.226D FROM 04; AFTER 04 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 05. HD 107146 (V=7.07, B-V = +0.62). 5th epoch (26b), 5th orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: +6 deg ONR
Relative Timing: This visit (05) should immediately follow visit (04) in back-to-back orbits.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

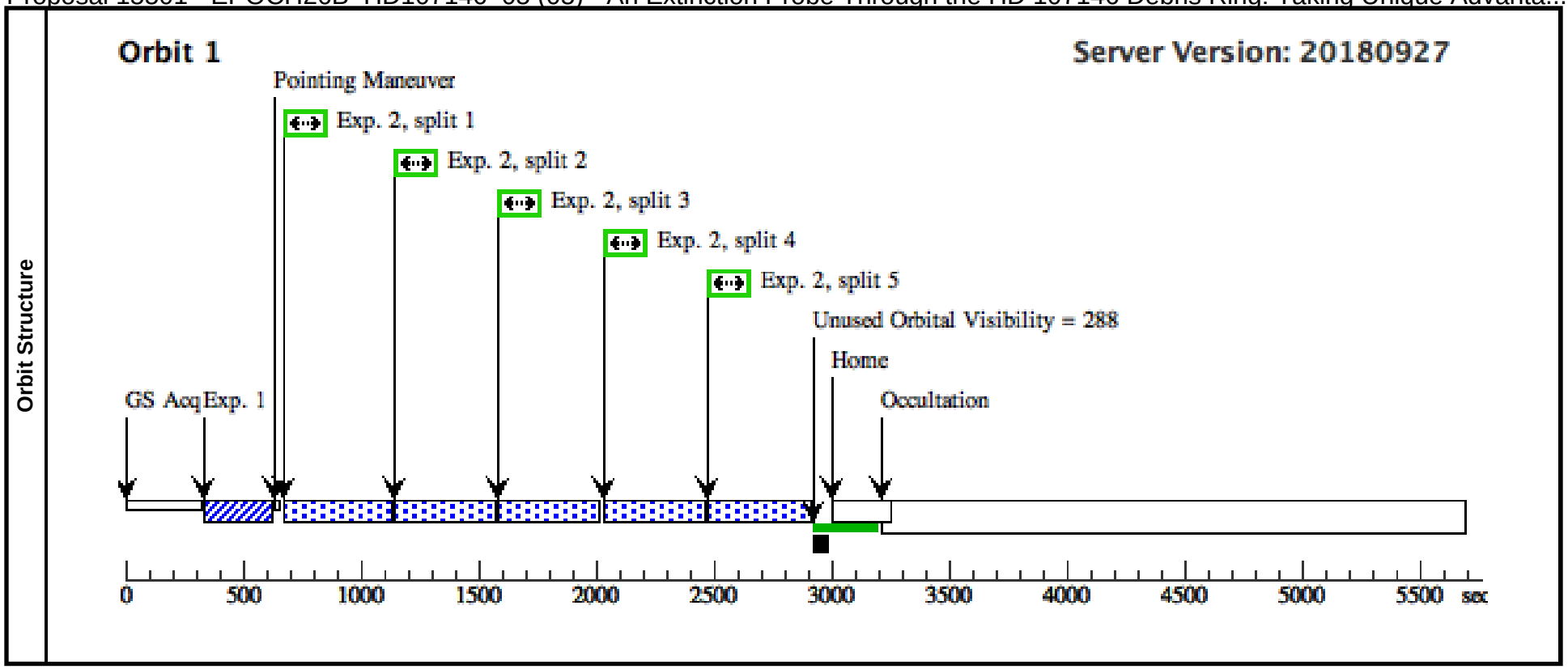
Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***

Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second

Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26C_HD107146_11 (11), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT -8D TO -8D FROM 14; AFTER 01 BY 120 D TO 240 D

Comments: Visit 11. HD 107146 (V=7.07, B-V = +0.62). 6th epoch (26c), 1st orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: -6 deg ONR (-8 deg w.r.t. visit 14)
Relative Timing: This visit (11) should immediately precede visit (12) in back-to-back orbits.

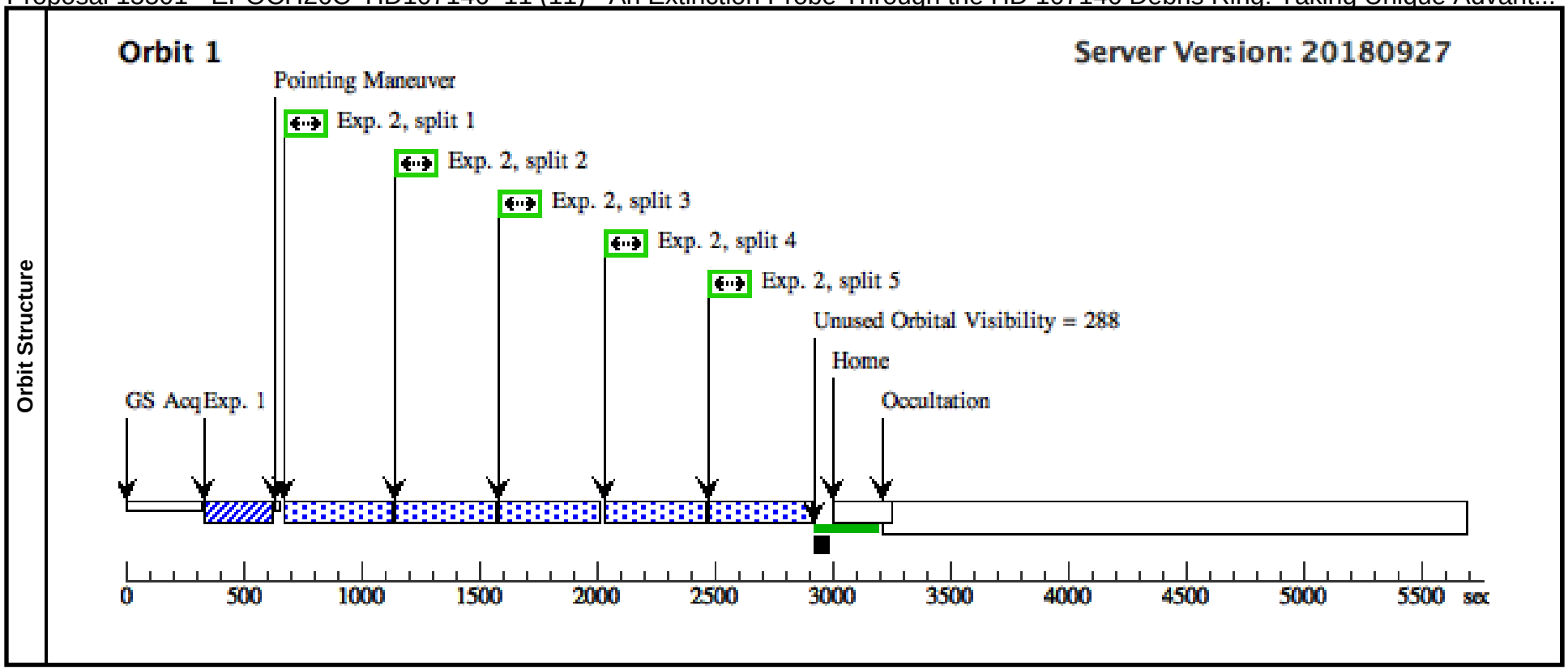
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second									
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26C_HD107146_12 (12), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT -4D TO -4D FROM 14; AFTER 11 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 12. HD 107146 (V=7.07, B-V = +0.62). 6th epoch (26c), 2nd orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: -2 deg ONR
Relative Timing: This visit (12) should immediately follow visit (11) in back-to-back orbits.

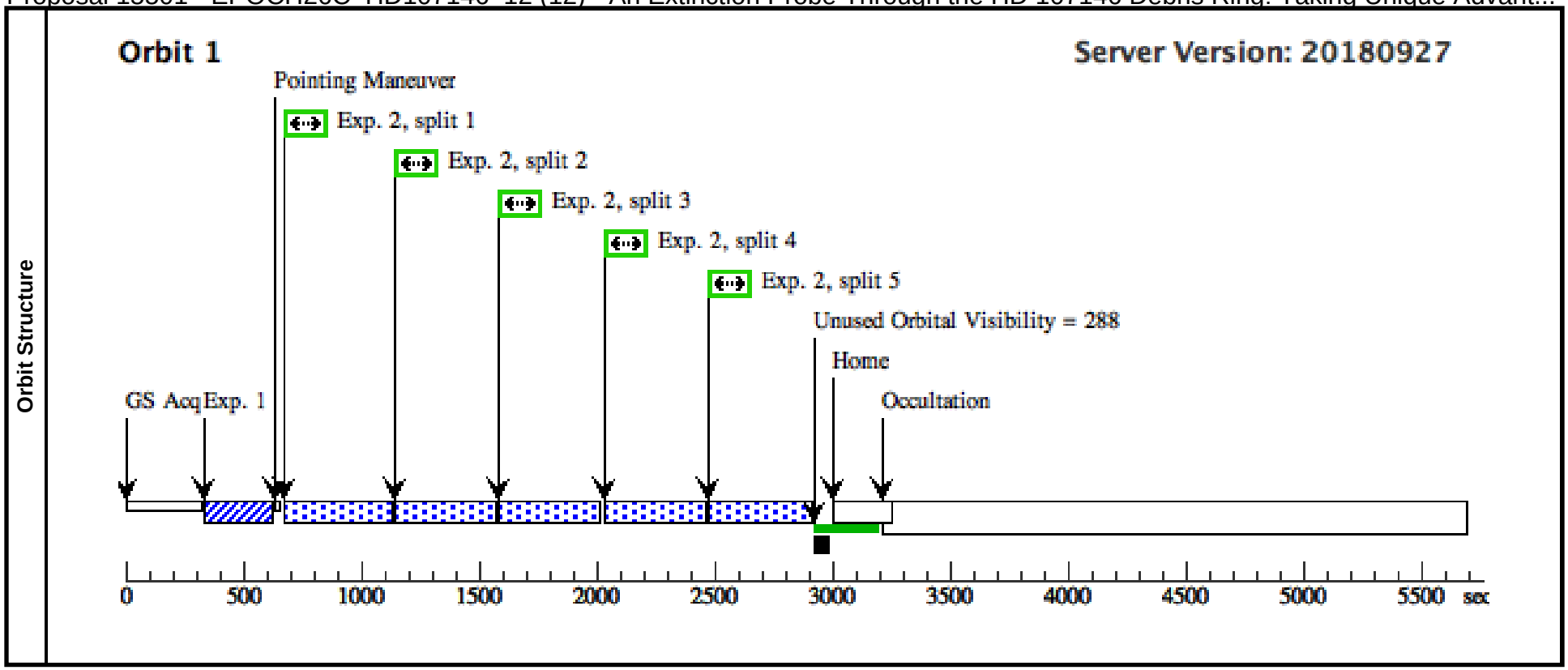
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second									
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26C_HD120066_13 (13), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; AFTER 12 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 03 (HD120066 PSF; V= +6.3). 6th epoch (26c), 3rd orbit
Absolute Orientation: Unconstraind
Relative Orientation: Unconstrained
Relative Timing: This visit (13) should immediately follow visit (12) in back-to-back orbits.

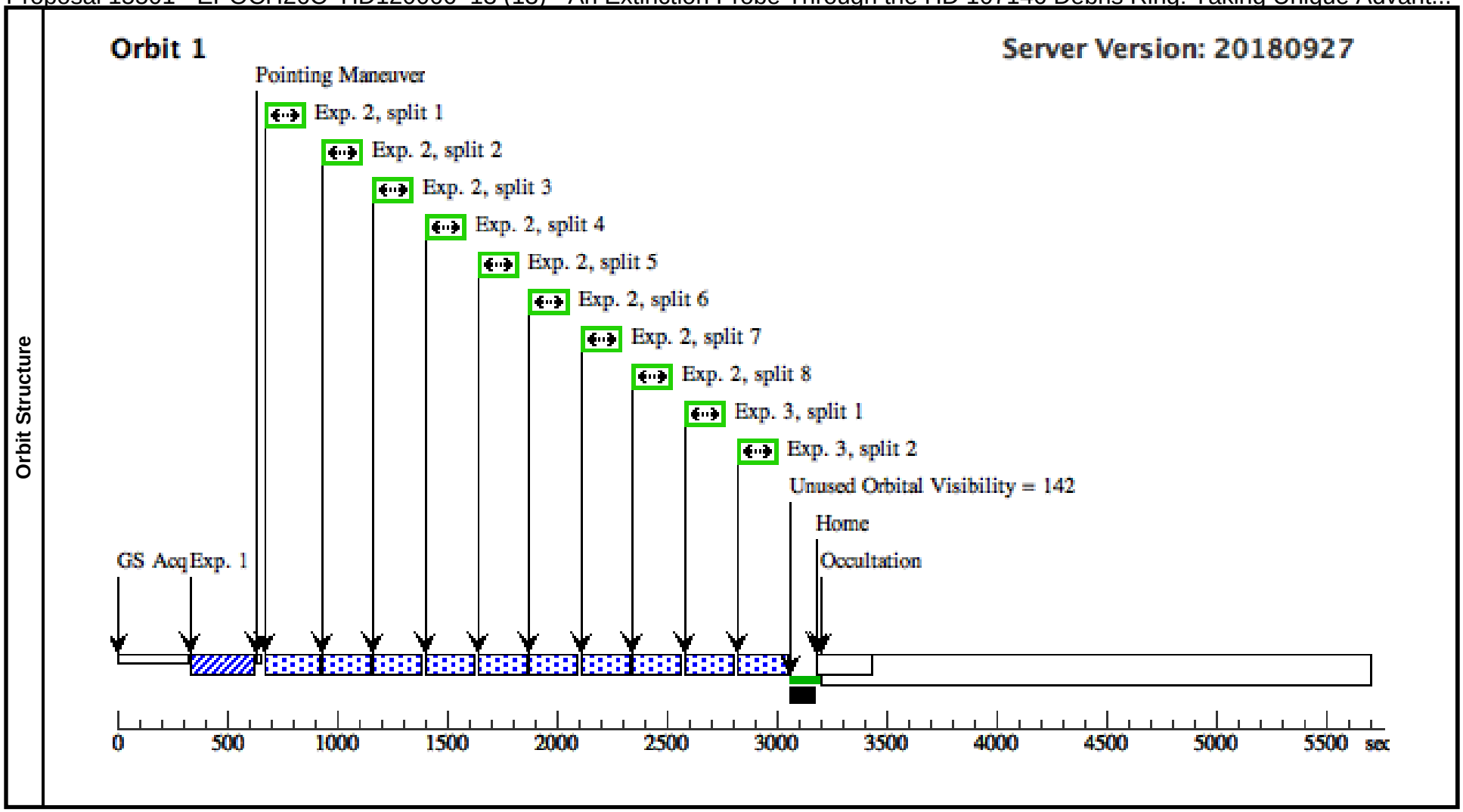
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	HD-120066	RA: 13 46 57.1231 (206.7380129d) Dec: +06 21 1.34 (6.35037d) Equinox: J2000	Proper Motion RA: -509.71 mas/yr Proper Motion Dec: -110.51 mas/yr Parallax: 0.03158" Epoch of Position: 2000	V=6.3	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	PSF03A_ACQ	(2) HD-120066	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARIO BASE1BN3		0.2 Secs (0.2 Secs) *[==>]*	 ***[1]***
Comments: SNR = 100, V = 6.30, sp = G0V, Exptime rounded to nearest 0.1 second									
2	PSF03A_LONG	(2) HD-120066	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=8; GAIN=4			1652 Secs (1652 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]* *[==>(Split 7)]* *[==>(Split 8)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									
3	PSF03A_LONG	(2) HD-120066	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=2; GAIN=4			413 Secs (413 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									


Orbit 1
Server Version: 20180927
Orbit Structure
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Exp. 2, split 6
Exp. 2, split 7
Exp. 2, split 8
Exp. 3, split 1
Exp. 3, split 2
Unused Orbital Visibility = 142
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26C_HD107146_14 (14), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT 127.02D TO 201.02 D; ORIENT 88.02D TO 113.02 D; ORIENT 41.02D TO 65.02 D; ORIENT 309.02D TO 21.02 D; AFTER 13 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 14. HD 107146 (V=7.07, B-V = +0.62). 6th epoch (26c), 4th orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: +2 deg ONR
Relative Timing: This visit (14) should immediately follow visit (13) in back-to-back orbits.

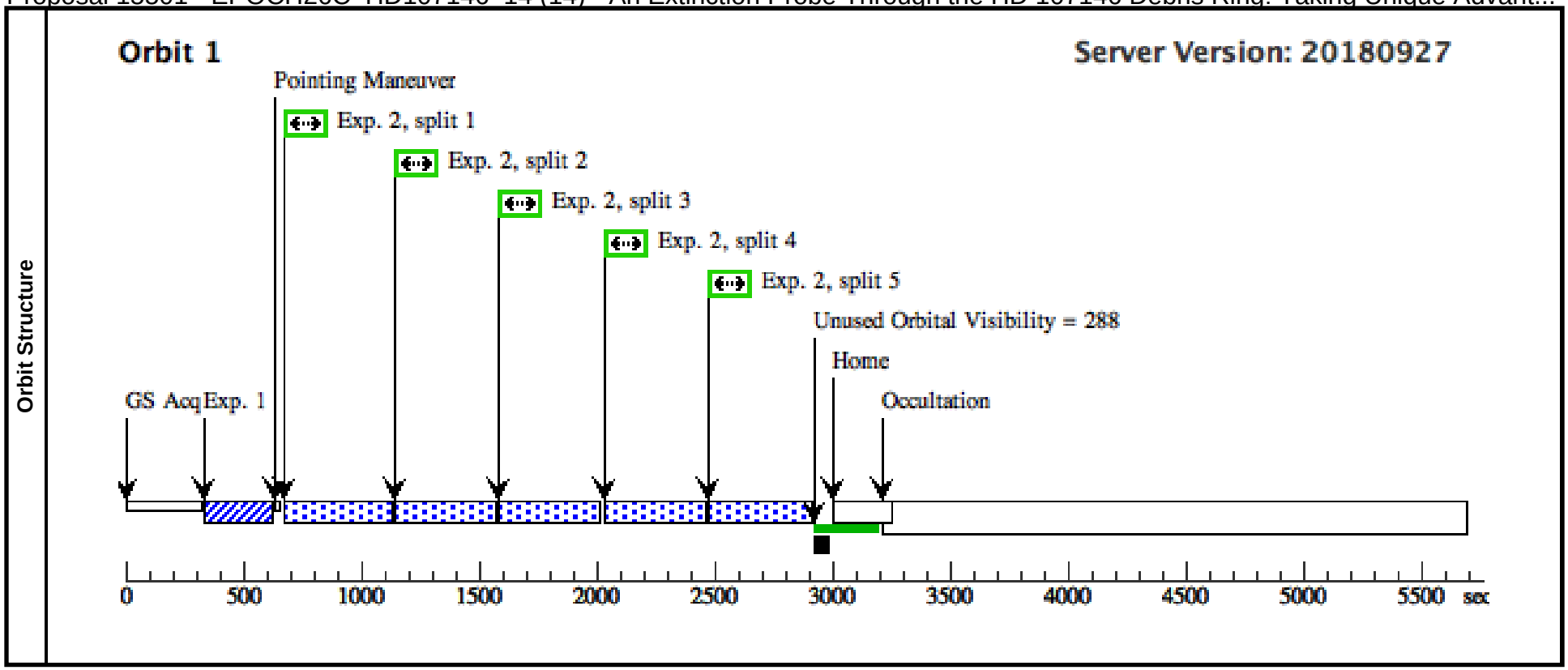
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second									
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***
Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.									


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15501, EPOCH26C_HD107146_15 (15), implementation Tue Nov 27 16:04:28 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE; GUID TOL 0.005"; GYRO MODE 3GOBAD; ORIENT 4D TO 4D FROM 14; AFTER 14 BY 0.8 Orbits TO 1.2 Orbits

Comments: Visit 15. HD 107146 (V=7.07, B-V = +0.62). 6th epoch (26c), 5th orbit
Absolute Orientation: Within any of the allowable orientation angle ranges specified
Relative Orientation: +6 deg ONR
Relative Timing: This visit (15) should immediately follow visit (14) in back-to-back orbits.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-107146	RA: 12 19 6.5023 (184.7770929d) Dec: +16 32 53.86 (16.54829d) Equinox: J2000	Proper Motion RA: -174.16 mas/yr Proper Motion Dec: -148.90 mas/yr Parallax: 0.03642" Epoch of Position: 2000	V=7.01	Reference Frame: ICRS

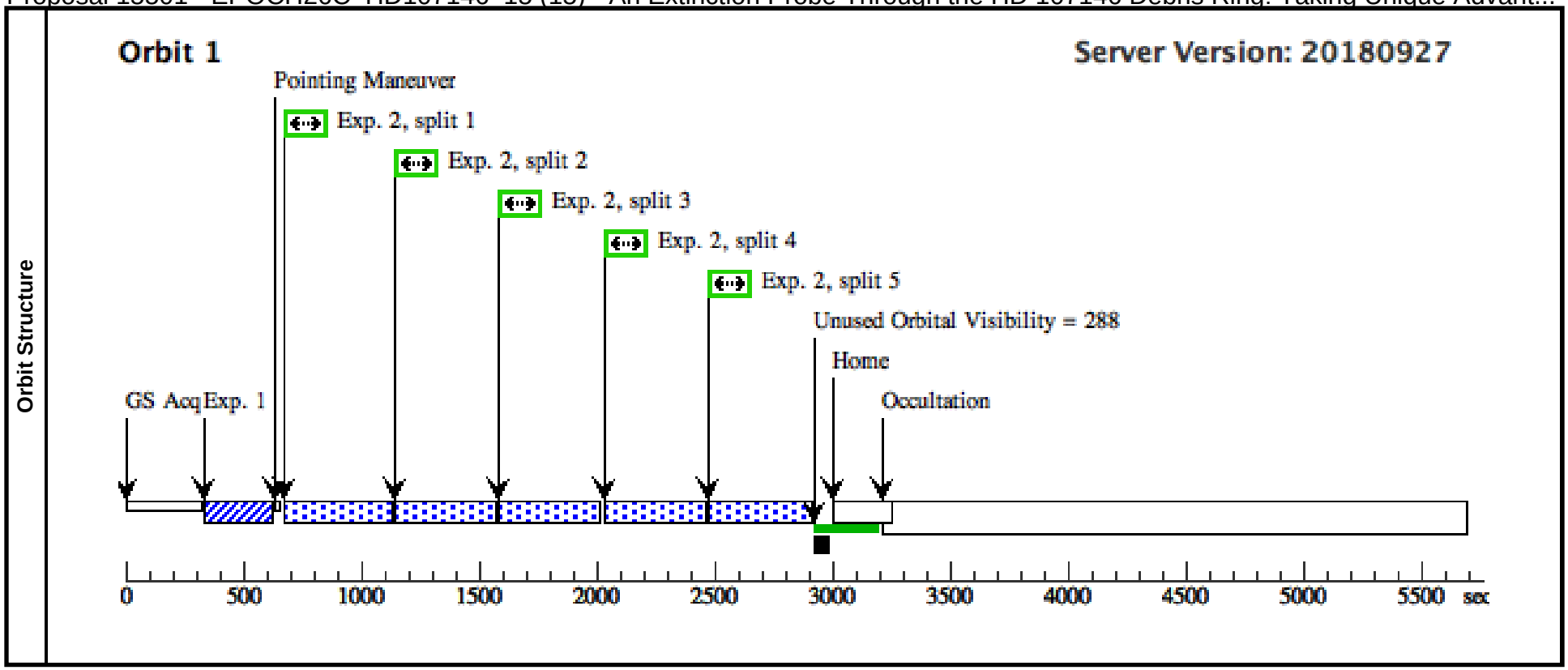
Comments:
Category=STAR
Description=[G III-I]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	HD107146_ ACQ	(1) HD-107146	STIS/CCD, ACQ, F25ND3	MIRROR		GS ACQ SCENARI O BASE1BN3		0.3 Secs (0.3 Secs) *[==>]*	 ***[1]***
2	HD107146_ LONG	(1) HD-107146	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	SIZEAXIS2=427; CR-SPLIT=5; GAIN=4			2078.5 Secs (2078.5 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]*	 ***[1]***

Comments: SNR = 100, V = 7.07, sp = G2V, Exptime rounded to nearest 0.1 second

Comments: Exposure time, detector gain, and subarray region identical to GO 12228 observations in 2011.


Orbit Structure
Orbit 1
Server Version: 20180927
Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Exp. 2, split 3
Exp. 2, split 4
Exp. 2, split 5
Unused Orbital Visibility = 288
Home
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec