



16915 - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Shouldn't Exist

Cycle: 29, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Michael Radica (PI) (CSA Member) (Contact)	Universite de Montreal	radica@astro.umontreal.ca
Jake Taylor (CoI) (CSA Member)	Universite de Montreal	jake.taylor@umontreal.ca
Dr. David Lafreniere (CoI) (CSA Member)	Universite de Montreal	david.lafreniere@umontreal.ca
Dr. Hannah Wakeford (CoI) (ESA Member)	University of Bristol	hannah.wakeford@bristol.ac.uk
Dr. Vivien Parmentier (CoI) (ESA Member)	University of Oxford	vivien.parmentier@physics.ox.ac.uk
Prof. Nicolas B Cowan (CoI) (CSA Member)	McGill University	nicolas.cowan@mcgill.ca
Dr. James Jenkins (CoI)	Universidad de Chile	jjenkins@das.uchile.cl
Sergio Hoyer (CoI) (ESA Member)	Laboratoire d'Astrophysique de Marseille	sergio.hoyer@lam.fr
Dr. Romain Allart (CoI) (CSA Member)	Universite de Montreal	romain.allart@umontreal.ca

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) CD-38-15670 BIAS	WFC3/UVIS	3	17-May-2022 11:00:17.0	yes
02	(1) CD-38-15670 BIAS	WFC3/UVIS	3	17-May-2022 11:00:22.0	yes
03	(1) CD-38-15670 BIAS	WFC3/UVIS	3	17-May-2022 11:00:28.0	yes

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
04	(1) CD-38-15670 BIAS	WFC3/UVIS	3	17-May-2022 11:00:33.0	yes

12 Total Orbits Used

ABSTRACT

Our current understanding of the evolution of exoplanet atmospheres predicts the existence of a so-called 'hot-Neptune desert' - a dearth of Neptune-mass planets with orbital periods less than four days, and this prediction has so far been borne-out by observations. The discovery of LTT 9779b, a roughly two Neptune-mass planet with an orbital period of less than a day, thus provides a challenge to the current atmosphere evolution paradigm. LTT 9779b is currently the only known ultra-hot-Neptune, and Spitzer/IRAC observations find tentative evidence for an atmosphere with observable molecular signatures. Although we expect the atmospheres of hot planets to be dark at UV/optical wavelengths, TESS and CHEOPS measurements show evidence of a significant amount of light scattering from the atmosphere of LTT 9779b - likely indicating the presence of clouds. We here propose to leverage the unique capabilities of the WFC3 instrument's UVIS channel to conduct a spectroscopic study of scattered light from the atmosphere of LTT 9779b during its eclipse. Such observations will allow us to constrain the planet's energy budget, as well as robustly discern the presence of, and quantify the composition of clouds in its atmosphere. This program will be highly complementary to the planned JWST/NIRISS observations, and facilitate a deeper understanding of one of the most unique worlds discovered to date.

OBSERVING DESCRIPTION

We propose to measure the energy budget and constrain the presence and composition of clouds in the atmosphere of LTT 9779b, the only known member of the hot-Neptune desert to have retained a substantial gaseous envelope, via observations of scattered light during its eclipse. Due to its extreme levels of irradiation, LTT 9779b is the best sub-Saturn planet for such a study, and we have shown in the previous section that multiple lines of evidence indicate the presence of clouds in its atmosphere. The UVIS channel of HST/WFC3 is the best instrument to carry out these observations. These science goals require observations in the blue-optical and near UV, where the planet's thermal contribution is negligible, and the scattered signature of cloud condensates can be observed. Such observations will be impossible with the JWST, which only can observe down to 0.6 microns. Wakeford et al. (2020) demonstrated that for targets fainter than $V = 7$ the G280 grism yields reduced systematics, as well as higher resolution, precision and wavelength coverage than either STIS gratings (the V magnitude of LTT 9779 is 9.79). Our program also requires a sensitivity and stability that is currently beyond the reach of ground-based instruments operating in a similar wavelength range, and the critical NUV wavelength regime which enables the distinguishing between various cloud models is highly attenuated by the Earth's atmosphere. Thus, ground based

observations, even if they could reach a comparable sensitivity to the HST, would not be of the same scientific value as our proposed program. We include three eclipses in our program, requiring a total of 12 orbits, to ensure that we reach the required sensitivity to provide, at minimum, the most robust upper limit of geometric albedo for an ultra-hot sub-Saturn planet. Using a publicly available tool (Wakeford et al., 2020), we simulated the precision that would be obtained with the G280 grism with three eclipses, as well as the corresponding achievable photometric precision if the spectrum were to be completely binned down. This tool has shown to accurately replicate the precision achieved by the observations of Wakeford et al. (2020). We find a photometric precision of 11 ppm when stacking all three eclipses. This is sufficient to detect the scattered light eclipse of LTT 9779 b at 3sigma if its geometric albedo is at least 0.2. Given that the existing TESS and CHEOPS observations indicate a significant scattered light signal, we predict a geometric albedo for LTT 9779 b of 0.4. We also note that unlike with the IR channel of WFC3, the first orbit of the UVIS channel can be fully used (Wakeford et al., 2020).

Proposal 16915 - Eclipse 1 (01) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

Tue May 17 15:00:35 GMT 2022

Visit	<p>Proposal 16915, Eclipse 1 (01), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/UVIS</p> <p>Special Requirements: ORIENT 17.9D TO 125.3 D; ORIENT 211.8D TO 292.9 D; Period 1.58414044 D AND ZERO-PHASE HJD2458783.51636</p> <p><i>Comments: We have specified phase constraints of 0.1983 - 0.2005 for the start of each eclipse to ensure that the second orbit is centered on the eclipse midpoint. This assumes a minimum start time of mid eclipse - T14/2 - 96min (single HST orbit) - 5min (using a 5 minute starting window). With such a start window, we should be able to capture the entire ~40min T14 in the 47min observing window, with one orbit for baseline both before and after. Since the period of this planet is <1d, we have doubled the period to 1.584d and halved the resulting phases to overcome the limitations of the APT when handling short periods. We note that the propagated error on our ephemeris (Crossfield+ 2020) is ~2mins.</i></p> <p><i>We have placed orient constraints to avoid contamination of the spectral trace by two nearby stars.</i></p> <p><i>A bias frame will be taken at the end of each visit as we have specified a custom subarray for which the appropriate calibrations will not be already available.</i></p>															
	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>CD-38-15670</td> <td>RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000</td> <td>Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5</td> <td>V=9.76</td> <td>Reference Frame: SIMBAD</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=STAR</i></p> <p><i>Description=[G V-IV]</i></p>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous											
(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76	Reference Frame: SIMBAD											

Proposal 16915 - Eclipse 1 (01) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Reference I mage (WFC3UVI S.im.174302 2)	(1) CD-38-15670	WFC3/UVIS, ACCUM, G280-REF	F300X	FLASH=18; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50; PHASE 0.19521717 983105924 TO 0.203 5777181647932	Sequence 1-2 Non-In t in Eclipse 1 (01)	3 Secs (3 Secs) [==>]	[1]
<p><i>Comments: FLASH=18 added to reach the 20e- nominal background count. 3s exposure in the F300X filter reaches S/N=427 which is sufficient.</i></p>									
2	Orbit 1 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50	Sequence 1-2 Non-In t in Eclipse 1 (01)	60 Secs X 19 (1140 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)]	[1]
<p><i>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</i></p>									

Exposures

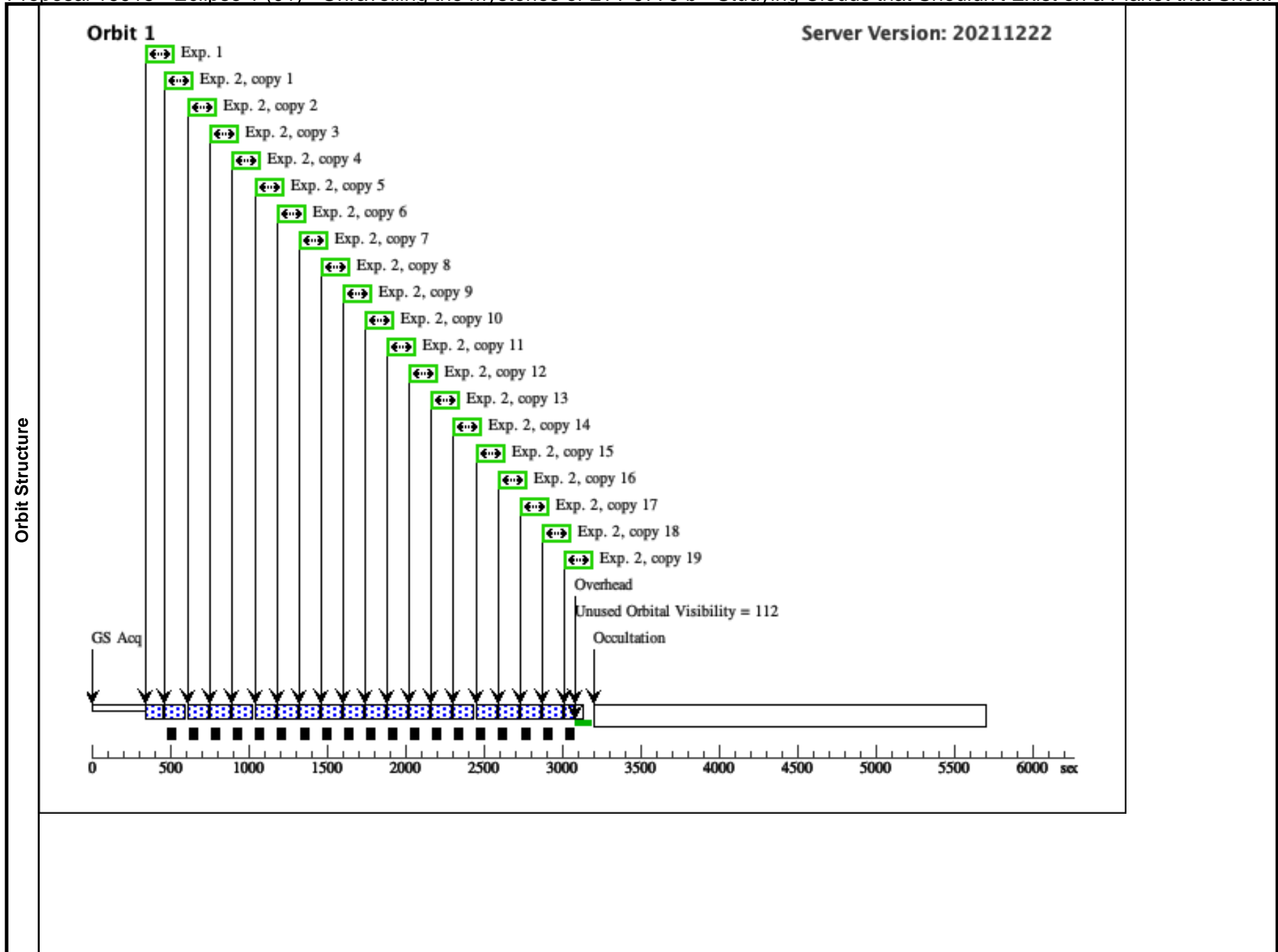
Proposal 16915 - Eclipse 1 (01) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

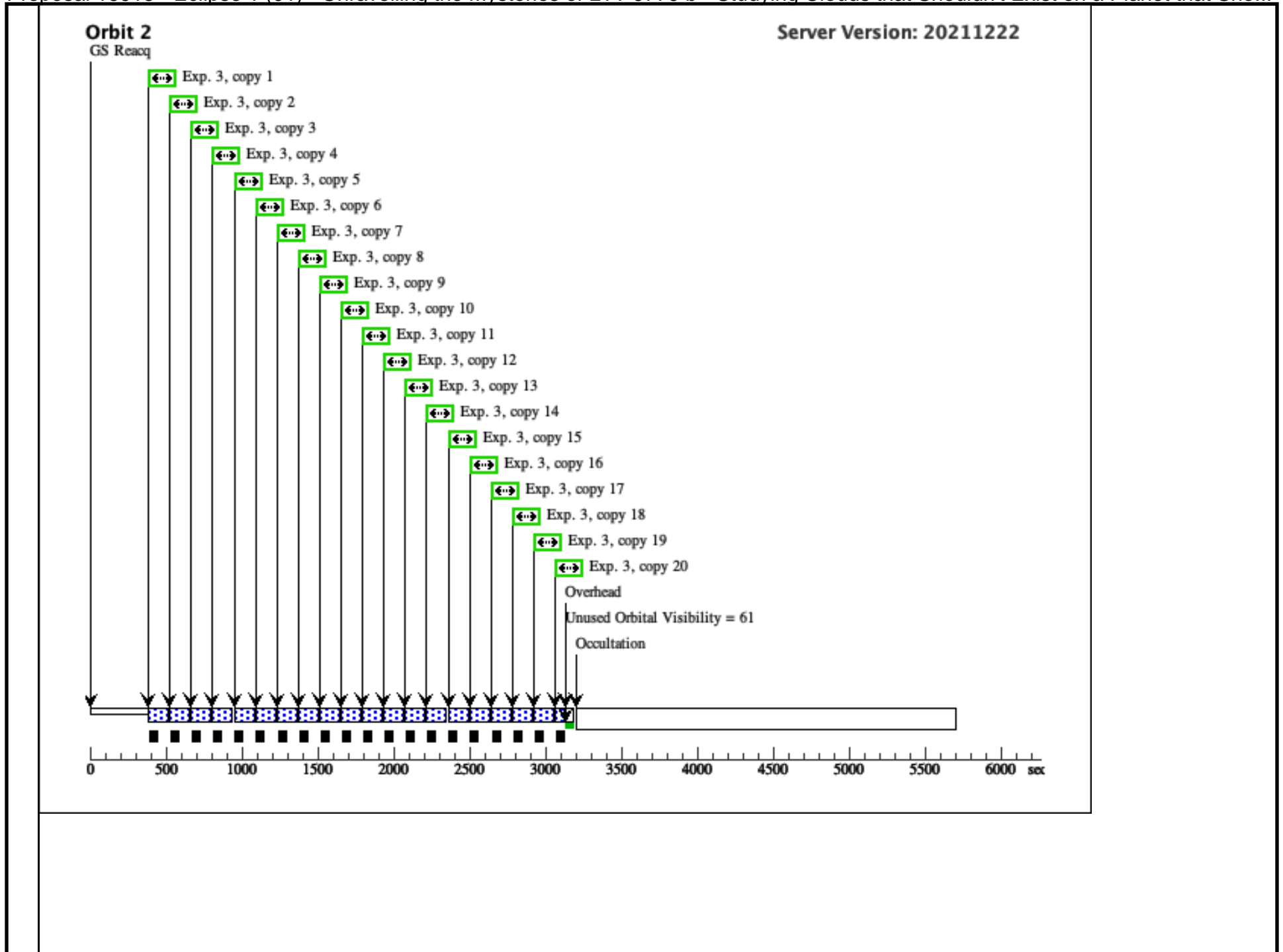
3	Orbit 2 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 3-3 Non-Int in Eclipse 1 (01)	60 Secs X 20 (1200 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[2]
---	--	-----------------	------------------------	------	---	--	--------------------------	---	-----

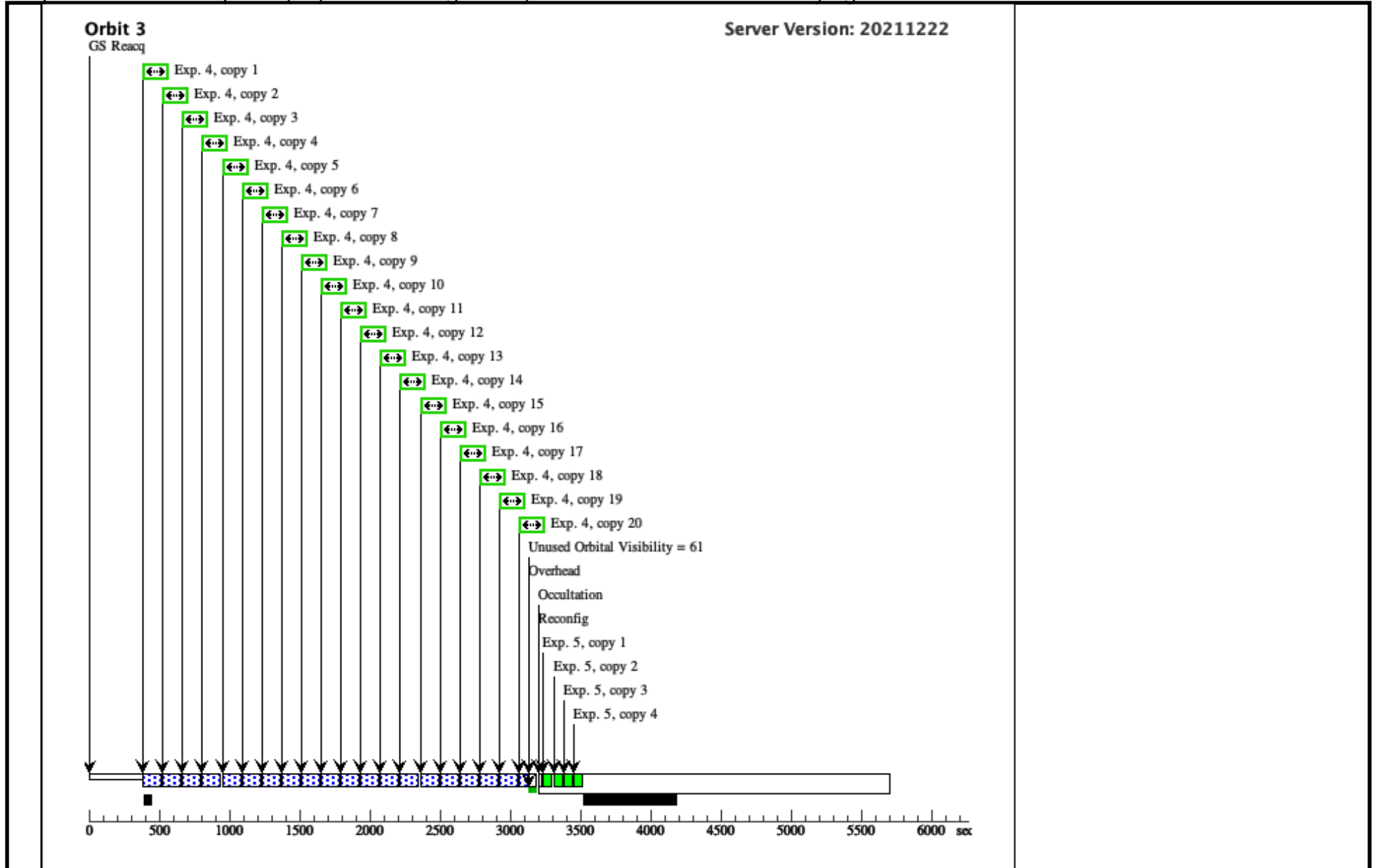
Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.

Proposal 16915 - Eclipse 1 (01) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

4	Orbit 3 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 4-5 Non-Int in Eclipse 1 (01)	60 Secs X 20 (1200 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[3]	
<p>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</p>									
5	Bias	BIAS	WFC3/UVIS, ACCUM, UVIS	DEF	CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	Sequence 4-5 Non-Int in Eclipse 1 (01)	0 Secs X 4 (0 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)]	[3]	
<p>Comments: Bias frames with same setup and subarray size as science observations are required since we have used a custom subarray.</p>									







Proposal 16915 - Eclipse 2 (02) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

Tue May 17 15:00:35 GMT 2022

Visit	<p>Proposal 16915, Eclipse 2 (02), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/UVIS</p> <p>Special Requirements: ORIENT 17.9D TO 125.3 D; ORIENT 211.8D TO 292.9 D; Period 1.58414044 D AND ZERO-PHASE HJD2458784.30843022</p> <p><i>Comments: We have specified phase constraints of 0.1983 - 0.2005 for the start of each eclipse to ensure that the second orbit is centered on the eclipse midpoint. This assumes a minimum start time of mid eclipse - T14/2 - 96min (single HST orbit) - 5min (using a 5 minute starting window). With such a start window, we should be able to capture the entire ~40min T14 in the 47min observing window, with one orbit for baseline both before and after. Since the period of this planet is <1d, we have doubled the period to 1.584d and halved the resulting phases to overcome the limitations of the APT when handling short periods. We note that the propagated error on our ephemeris (Crossfield+ 2020) is ~2mins.</i></p> <p><i>We have placed orient constraints to avoid contamination of the spectral trace by two nearby stars.</i></p> <p><i>A bias frame will be taken at the end of each visit as we have specified a custom subarray for which the appropriate calibrations will not be already available.</i></p>															
	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>CD-38-15670</td> <td>RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000</td> <td>Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5</td> <td>V=9.76</td> <td>Reference Frame: SIMBAD</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=STAR</i></p> <p><i>Description=[G V-IV]</i></p>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous											
(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76	Reference Frame: SIMBAD											

Proposal 16915 - Eclipse 2 (02) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Reference I mage (WFC3UVI S.im.174302 2)	(1) CD-38-15670	WFC3/UVIS, ACCUM, G280-REF	F300X	FLASH=18; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50; PHASE 0.19521717 983105924 TO 0.203 5777181647932	Sequence 1-2 Non-In t in Eclipse 2 (02)	3 Secs (3 Secs) [==>]	[1]
<p><i>Comments: FLASH=18 added to reach the 20e- nominal background count. 3s exposure in the F300X filter reaches S/N=427 which is sufficient.</i></p>									
2	Orbit 1 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50	Sequence 1-2 Non-In t in Eclipse 2 (02)	60 Secs X 19 (1140 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)]	[1]
<p><i>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</i></p>									

Exposures

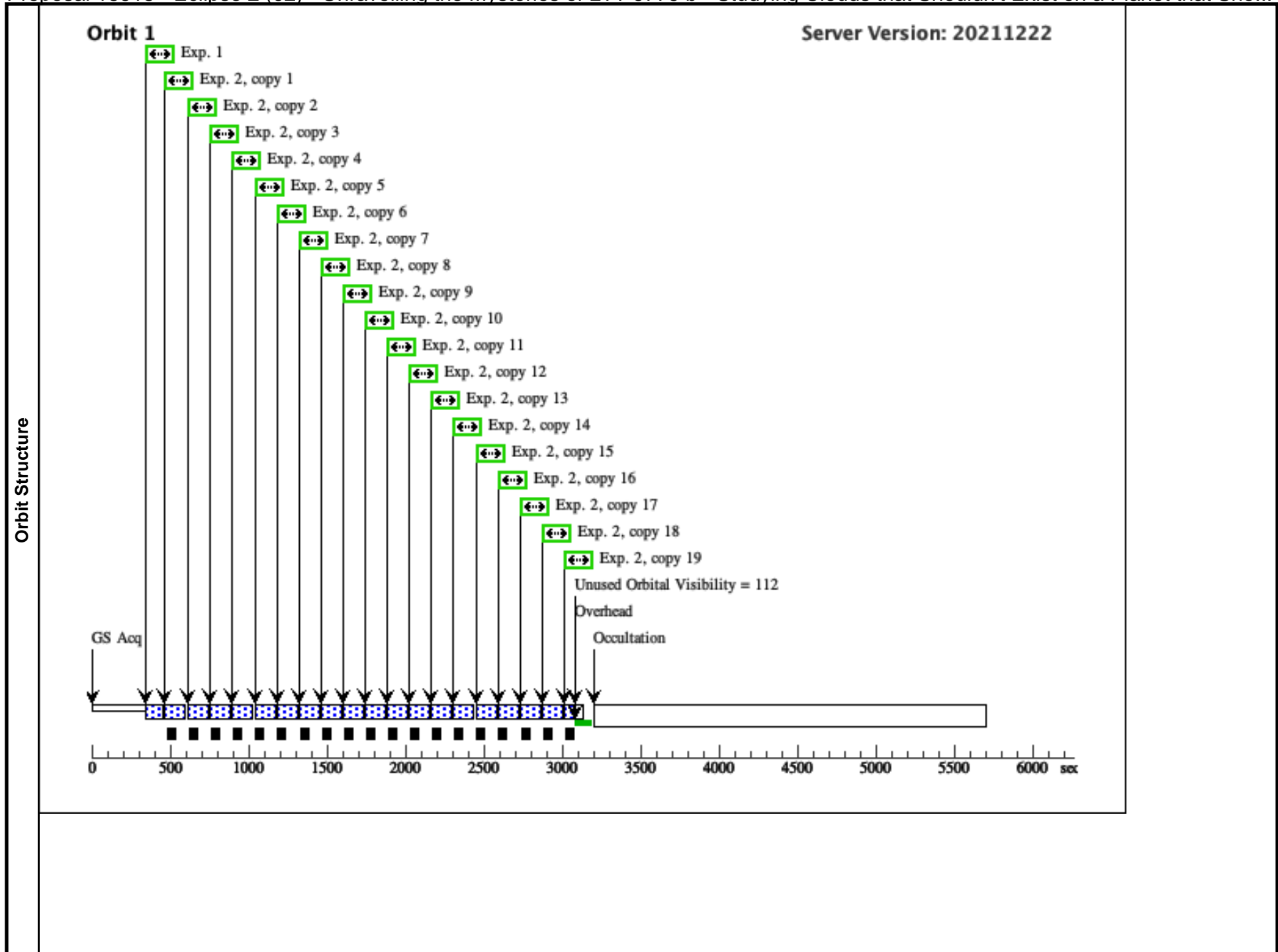
Proposal 16915 - Eclipse 2 (02) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

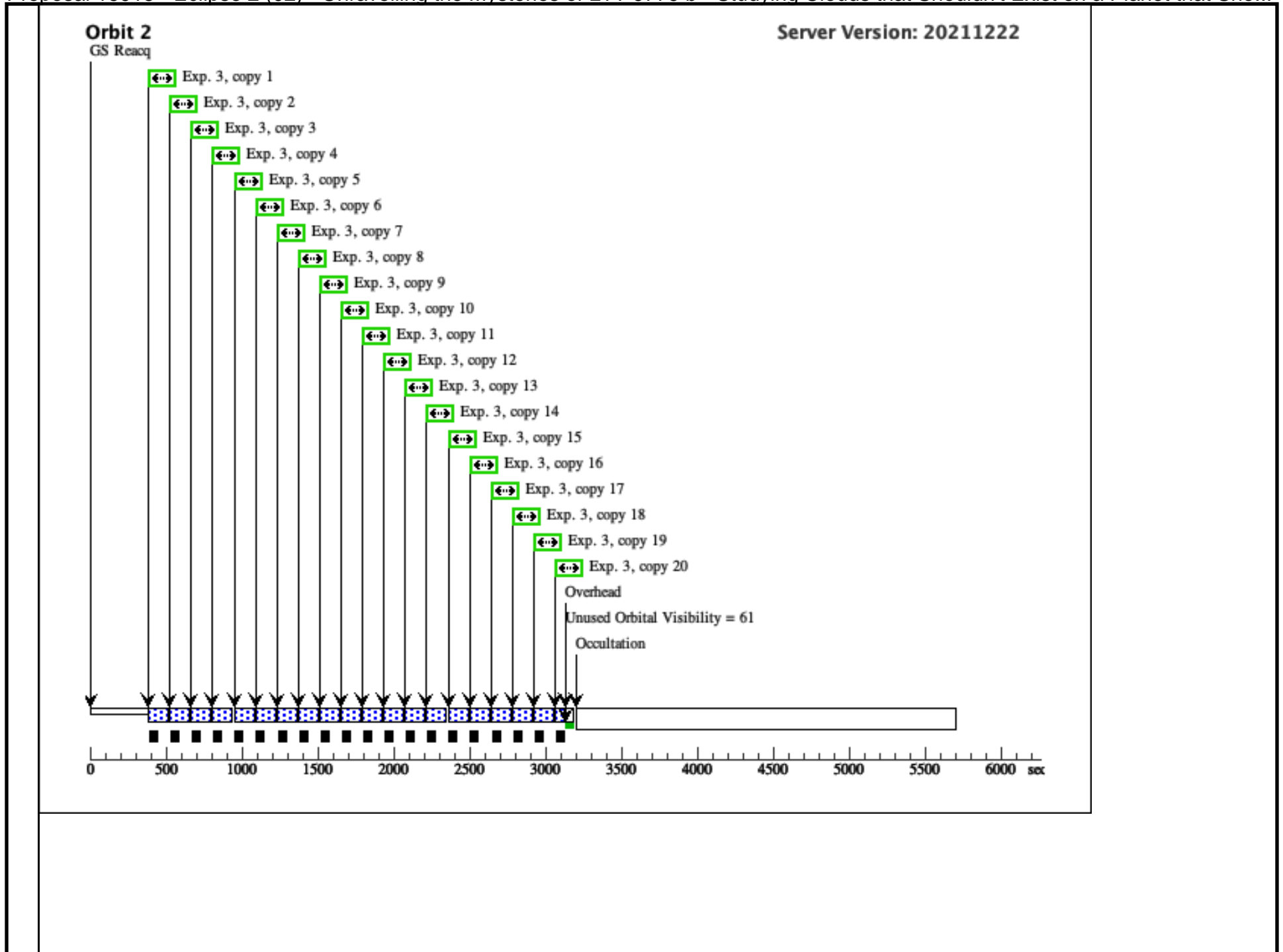
3	Orbit 2 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50	Sequence 3-3 Non-Int in Eclipse 2 (02)	60 Secs X 20 (1200 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[2]
---	--	-----------------	------------------------	------	---	-------------------	---	--------------------------	---	-----

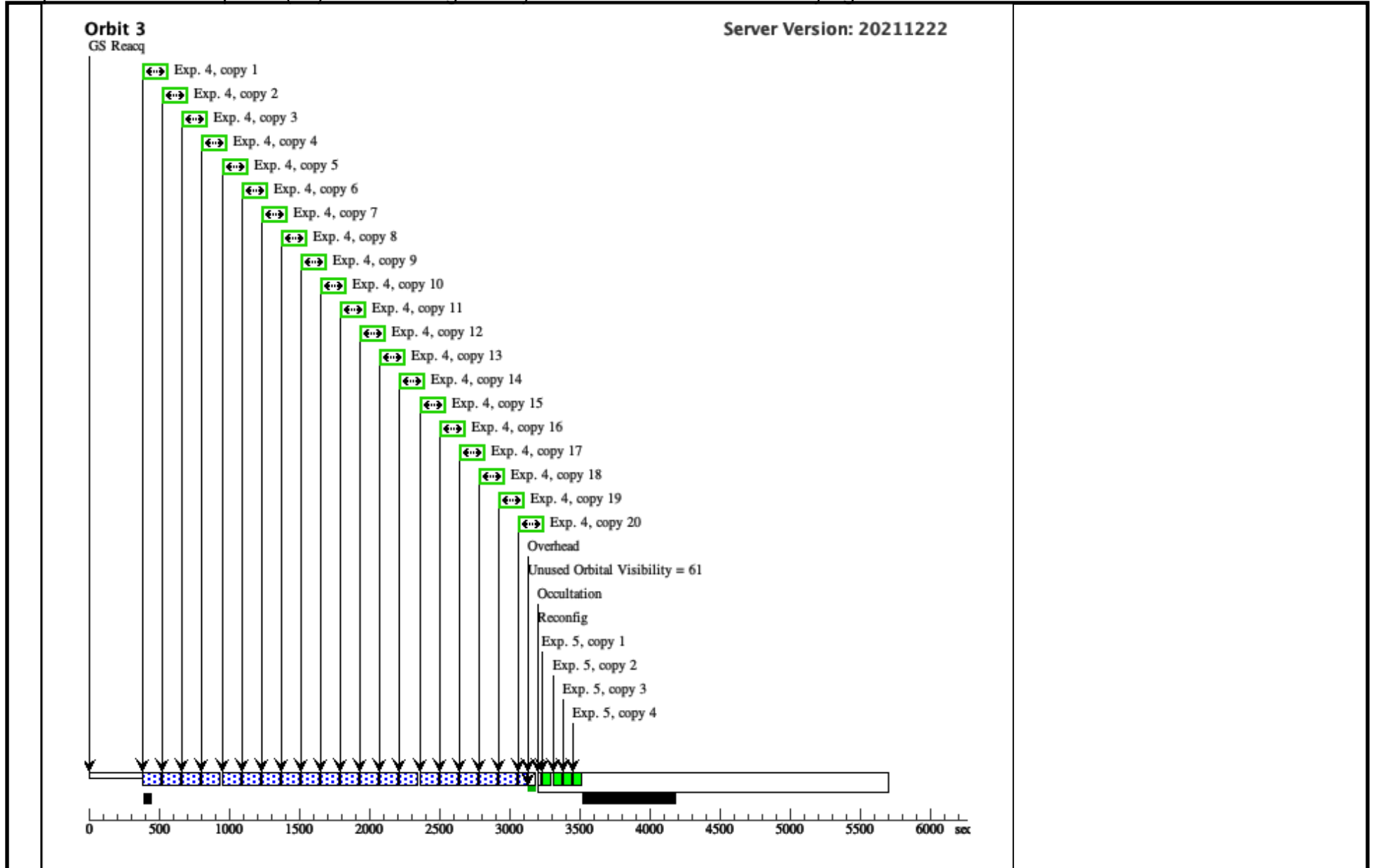
Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.

Proposal 16915 - Eclipse 2 (02) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

4	Orbit 3 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 4-5 Non-Int in Eclipse 2 (02)	60 Secs X 20 (1200 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[3]	
<p>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</p>									
5	Bias	BIAS	WFC3/UVIS, ACCUM, UVIS	DEF	CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	Sequence 4-5 Non-Int in Eclipse 2 (02)	0 Secs X 4 (0 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)]	[3]	
<p>Comments: Bias frames with same setup and subarray size as science observations are required since we have used a custom subarray.</p>									







Proposal 16915 - Eclipse 3 (03) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

Tue May 17 15:00:35 GMT 2022

Visit	<p>Proposal 16915, Eclipse 3 (03), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/UVIS</p> <p>Special Requirements: ORIENT 17.9D TO 125.3 D; ORIENT 211.8D TO 292.9 D; Period 1.58414044 D AND ZERO-PHASE HJD2458783.51636</p> <p><i>Comments: We have specified phase constraints of 0.1983 - 0.2005 for the start of each eclipse to ensure that the second orbit is centered on the eclipse midpoint. This assumes a minimum start time of mid eclipse - T14/2 - 96min (single HST orbit) - 5min (using a 5 minute starting window). With such a start window, we should be able to capture the entire ~40min T14 in the 47min observing window, with one orbit for baseline both before and after. Since the period of this planet is <1d, we have doubled the period to 1.584d and halved the resulting phases to overcome the limitations of the APT when handling short periods. We note that the propagated error on our ephemeris (Crossfield+ 2020) is ~2mins.</i></p> <p><i>We have placed orient constraints to avoid contamination of the spectral trace by two nearby stars.</i></p> <p><i>A bias frame will be taken at the end of each visit as we have specified a custom subarray for which the appropriate calibrations will not be already available.</i></p>															
	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>CD-38-15670</td> <td>RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000</td> <td>Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5</td> <td>V=9.76</td> <td>Reference Frame: SIMBAD</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=STAR</i></p> <p><i>Description=[G V-IV]</i></p>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous											
(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76	Reference Frame: SIMBAD											

Proposal 16915 - Eclipse 3 (03) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Reference I mage (WFC3UVI S.im.174302 2)	(1) CD-38-15670	WFC3/UVIS, ACCUM, G280-REF	F300X	FLASH=18; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50; PHASE 0.19521717 983105924 TO 0.203 5777181647932	Sequence 1-2 Non-In t in Eclipse 3 (03)	3 Secs (3 Secs) [==>]	[1]
<p><i>Comments: FLASH=18 added to reach the 20e- nominal background count. 3s exposure in the F300X filter reaches S/N=427 which is sufficient.</i></p>									
2	Orbit 1 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50	Sequence 1-2 Non-In t in Eclipse 3 (03)	60 Secs X 19 (1140 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)]	[1]
<p><i>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</i></p>									

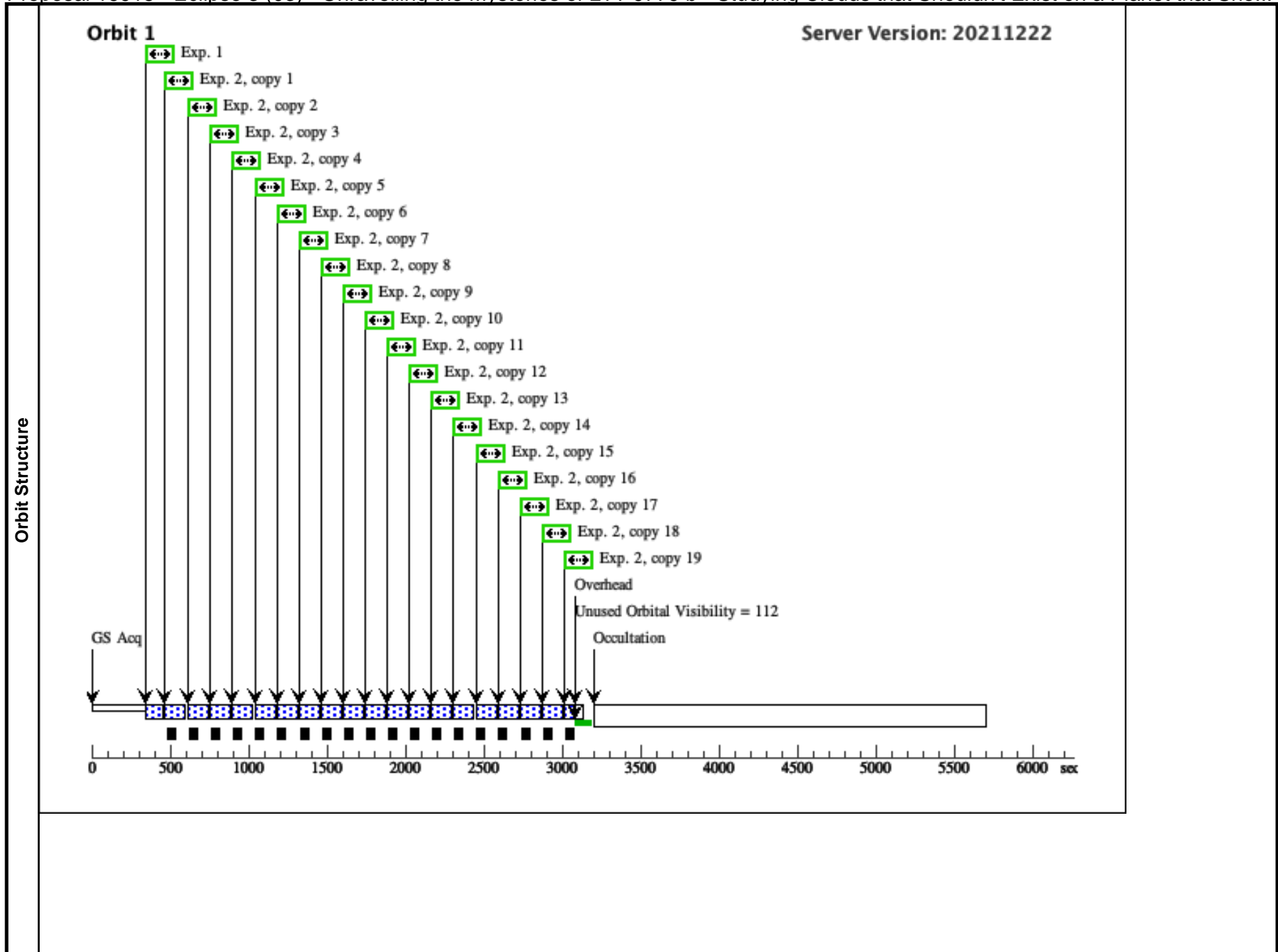
Exposures

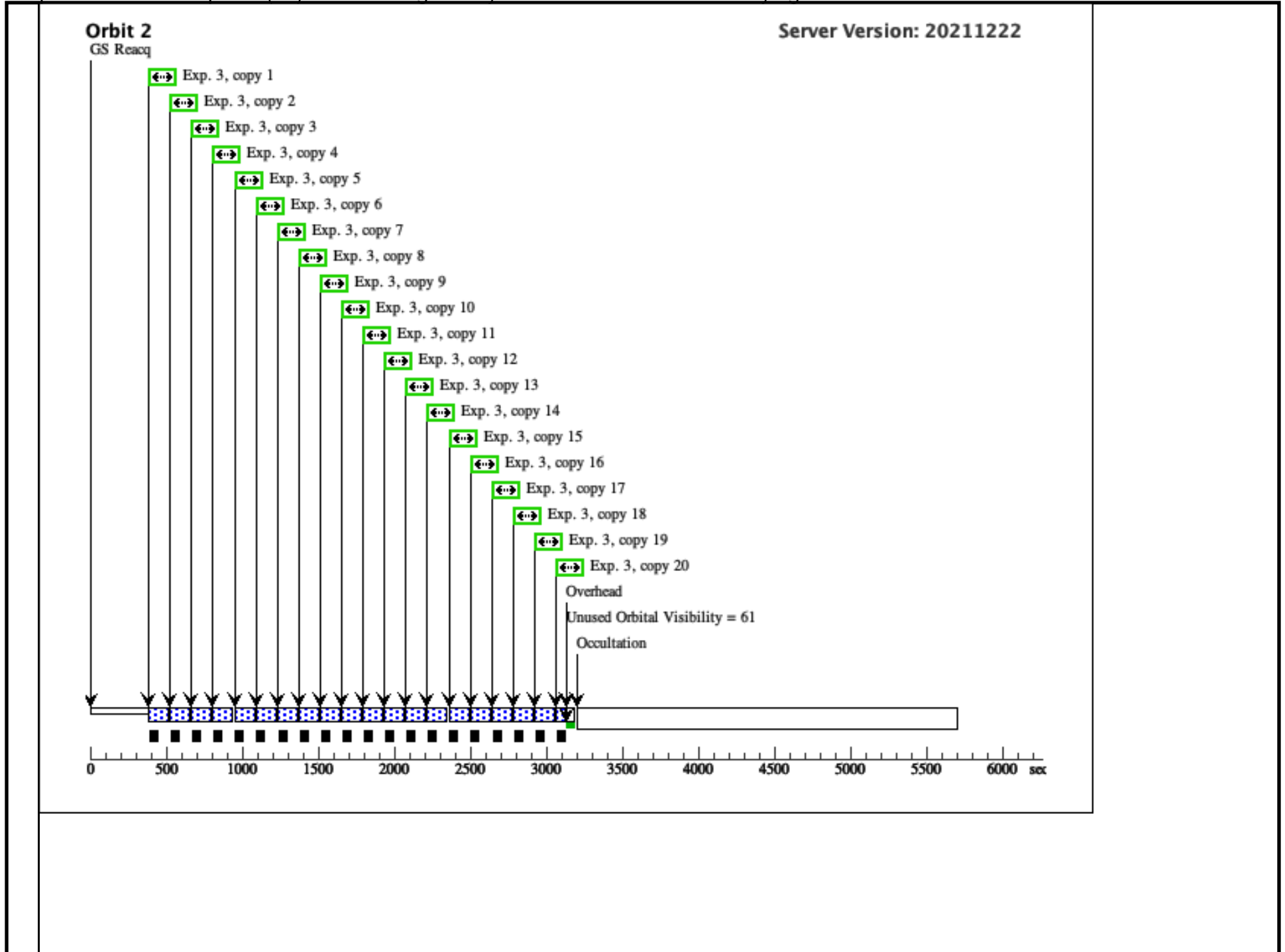
Proposal 16915 - Eclipse 3 (03) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

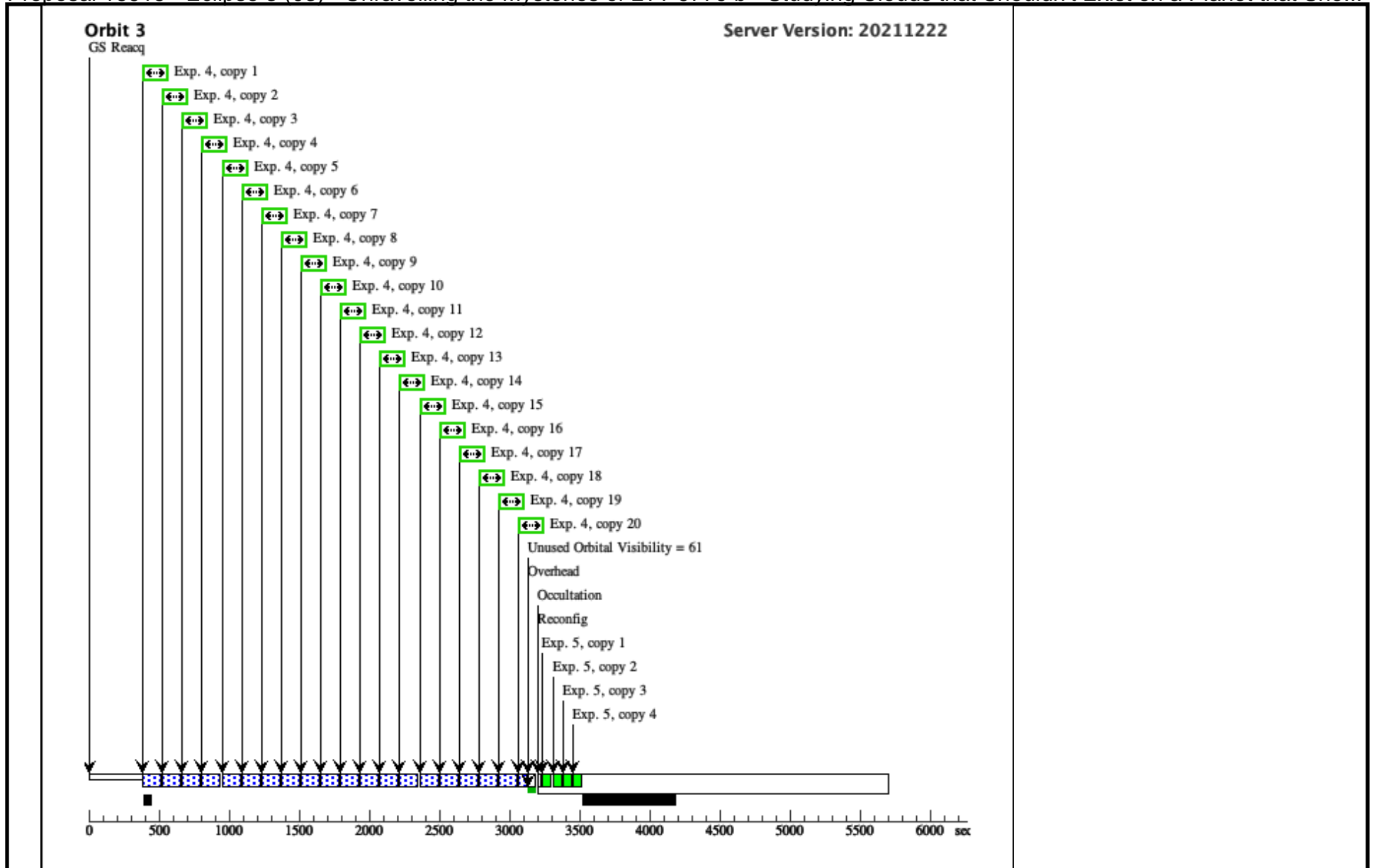
3	Orbit 2 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 3-3 Non-Int in Eclipse 3 (03)	60 Secs X 20 (1200 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[2]
<p><i>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</i></p>									

Proposal 16915 - Eclipse 3 (03) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

4	Orbit 3 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 4-5 Non-Int in Eclipse 3 (03)	60 Secs X 20 (1200 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[3]	
<p>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</p>									
5	Bias	BIAS	WFC3/UVIS, ACCUM, UVIS	DEF	CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	Sequence 4-5 Non-Int in Eclipse 3 (03)	0 Secs X 4 (0 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)]	[3]	
<p>Comments: Bias frames with same setup and subarray size as science observations are required since we have used a custom subarray.</p>									







Proposal 16915 - Eclipse 4 (04) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

Tue May 17 15:00:35 GMT 2022

Visit	<p>Proposal 16915, Eclipse 4 (04), implementation</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: WFC3/UVIS</p> <p>Special Requirements: ORIENT 17.9D TO 125.3 D; ORIENT 211.8D TO 292.9 D; Period 1.58414044 D AND ZERO-PHASE HJD2458784.30843022</p> <p><i>Comments: We have specified phase constraints of 0.1983 - 0.2005 for the start of each eclipse to ensure that the second orbit is centered on the eclipse midpoint. This assumes a minimum start time of mid eclipse - T14/2 - 96min (single HST orbit) - 5min (using a 5 minute starting window). With such a start window, we should be able to capture the entire ~40min T14 in the 47min observing window, with one orbit for baseline both before and after. Since the period of this planet is <1d, we have doubled the period to 1.584d and halved the resulting phases to overcome the limitations of the APT when handling short periods. We note that the propagated error on our ephemeris (Crossfield+ 2020) is ~2mins.</i></p> <p><i>We have placed orient constraints to avoid contamination of the spectral trace by two nearby stars.</i></p> <p><i>A bias frame will be taken at the end of each visit as we have specified a custom subarray for which the appropriate calibrations will not be already available.</i></p>															
	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>CD-38-15670</td> <td>RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000</td> <td>Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5</td> <td>V=9.76</td> <td>Reference Frame: SIMBAD</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p><i>Category=STAR</i></p> <p><i>Description=[G V-IV]</i></p>					#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous											
(1)	CD-38-15670	RA: 23 54 40.5304 (358.6688767d) Dec: -37 37 41.61 (-37.62822d) Equinox: J2000	Proper Motion RA: 0.020843303178745425 sec of time/yr Proper Motion Dec: -0.06980099994962075 arcsec/yr Epoch of Position: 2015.5	V=9.76	Reference Frame: SIMBAD											

Proposal 16915 - Eclipse 4 (04) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Reference I mage (WFC3UVI S.im.174302 2)	(1) CD-38-15670	WFC3/UVIS, ACCUM, G280-REF	F300X	FLASH=18; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50; PHASE 0.19521717 983105924 TO 0.203 5777181647932	Sequence 1-2 Non-In t in Eclipse 4 (04)	3 Secs (3 Secs) [==>]	[1]
<p><i>Comments: FLASH=18 added to reach the 20e- nominal background count. 3s exposure in the F300X filter reaches S/N=427 which is sufficient.</i></p>									
2	Orbit 1 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50	Sequence 1-2 Non-In t in Eclipse 4 (04)	60 Secs X 19 (1140 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)]	[1]
<p><i>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</i></p>									

Exposures

Proposal 16915 - Eclipse 4 (04) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

3	Orbit 2 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 3-3 Non-In t in Eclipse 4 (04)	60 Secs X 20 (1200 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[2]
---	--	-----------------	------------------------	------	---	---	--------------------------	---	-----

Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.

Proposal 16915 - Eclipse 4 (04) - Unravelling the Mysteries of LTT 9779 b - Studying Clouds that Shouldn't Exist on a Planet that Sho...

4	Orbit 3 (WFC3UVI S.sp.174177 3)	(1) CD-38-15670	WFC3/UVIS, ACCUM, UVIS	G280	FLASH=14; CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	POS TARG null,-50 Sequence 4-5 Non-Int in Eclipse 4 (04)	60 Secs X 20 (1200 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)] [==>(Copy 10)] [==>(Copy 11)] [==>(Copy 12)] [==>(Copy 13)] [==>(Copy 14)] [==>(Copy 15)] [==>(Copy 16)] [==>(Copy 17)] [==>(Copy 18)] [==>(Copy 19)] [==>(Copy 20)]	[3]	
<p>Comments: FLASH=14 added, which when combined with the natural background of about 6 e- per exposure will result in 20 e- and better CTE. To limit data volume, and hence buffer dumps, we have specified SIZEAXIS2=650 and SIZEAXIS1=2250. The target trace will occupy only a narrow range in y, so this is fine. CENTERAXIS1 & CENTERAXIS2 parameters have also been specified to center the target on chip 2. A POSTARG in the y-direction of -50 arcsec has been added to further center the target on chip 2.</p>									
5	Bias	BIAS	WFC3/UVIS, ACCUM, UVIS	DEF	CENTERAXIS1=21 36; CENTERAXIS2=12 00; SIZEAXIS1=2250; SIZEAXIS2=650	Sequence 4-5 Non-Int in Eclipse 4 (04)	0 Secs X 4 (0 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)]	[3]	
<p>Comments: Bias frames with same setup and subarray size as science observations are required since we have used a custom subarray.</p>									

