



13855 - STIS Coronagraphy of a Debris Disk Newly Discovered Around a Young M Dwarf

Cycle: 22, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Elodie Choquet (PI) (Contact)	Space Telescope Science Institute	choquet@stsci.edu
Dr. Marshall Perrin (CoI)	Space Telescope Science Institute	mperrin@stsci.edu
Dr. Laurent Pueyo (CoI)	Space Telescope Science Institute	lap@pha.jhu.edu
Dr. Remi Soummer (CoI)	Space Telescope Science Institute	soummer@stsci.edu
Mr. Jonathan Aguilar (CoI)	The Johns Hopkins University	jaguilar@pha.jhu.edu
Dr. John Henry Debes (CoI)	Space Telescope Science Institute	debes@stsci.edu
Dr. Christine Chen (CoI)	Space Telescope Science Institute	cchen@stsci.edu
Dr. Glenn Schneider (CoI)	University of Arizona	gschneider@as.arizona.edu
Ms. Schuyler Wolff (CoI)	The Johns Hopkins University	swolff@pha.jhu.edu
Dr. David A. Golimowski (CoI)	Space Telescope Science Institute	golim@stsci.edu
Dr. Amaya Moro-Martin (CoI)	Space Telescope Science Institute	amaya@stsci.edu
Dr. Dean C. Hines (CoI)	Space Telescope Science Institute	hines@stsci.edu
Dr. Mamadou N'Diaye (CoI)	Space Telescope Science Institute	mamadou@stsci.edu
Dr. Dimitri Mawet (CoI) (ESA Member)	European Southern Observatory - Chile	dmawet@eso.org
Mr. Julien Milli (CoI) (ESA Member)	European Southern Observatory - Chile	jmilli@eso.org

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) GJ3054	STIS/CCD	1	03-Sep-2014 21:16:02.0	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>
02	(2) L221-60	STIS/CCD	1	03-Sep-2014 21:16:03.0	yes
03	(1) GJ3054	STIS/CCD	1	03-Sep-2014 21:16:04.0	yes
04	(1) GJ3054	STIS/CCD	1	03-Sep-2014 21:16:04.0	yes

4 Total Orbits Used

ABSTRACT

We propose STIS coronagraphic observations of a new debris disk recently discovered around an M dwarf in our reanalysis of NICMOS coronagraphic archive as part of the ALICE program (Archival Legacy Investigations of Circumstellar Environments, AR-12652). Our target is a young (30 Myr) M dwarf. Only two disks have been imaged so far around M dwarfs, with only one in scattered light (AU Mic). STIS coronagraphy will dramatically surpass the NICMOS discovery, with 2x better angular resolution and much improved contrast and sensitivity. These observations will allow us to measure in detail the disk geometry, determining whether parent bodies are constrained in "birth rings" analogous to the Kuiper Belt, and to search for the signatures of unseen planets gravitationally stirring the disk. Only HST/STIS is capable of obtaining, at optical wavelengths, the necessary high angular resolution, sub-arcsecond high contrast, and image fidelity that are essential for tracing the faint extended components of this disk.

OBSERVING DESCRIPTION

We are obtaining 4 HST orbits for 3 roll + 1 PSF star STIS coronagraphy for one science target (GJ3054). Our observation plan follows established best practices for STIS coronagraphy, obtaining for the target a series of deep exposures at WEDGEA1.0. We summarize our plans here, and provide further comments attached to the individual visits and observations.

1) Visit structure and linkages: we observe three science visits plus one PSF reference star visit between them (so the orbits are ordered Target-PSF-Target-Target). These four visits are linked to execute back-to-back.

2) Orientation Constraints:

Our target is known to have an approximately edge-on disk. We therefore provide *absolute* orient constraints on one visit to ensure the disk major axis is near perpendicular to the STIS occulting wedge. We use relative orient constraints to roll the two other science visits 15 to 25 degrees and -15

to -25 degrees relative to the absolute orient visite. Approximately 20 degrees is the desired roll between visits since it rotates by about half the angle between the diffraction spikes and the wedge occulter, thereby minimizing the field area obscured in the three visits.

The visit with the disk oriented perpendicular to the wedge provides somewhat better inner working angle for our disks (by $1/\cos(20) \sim 7\%$). Since we expect thermal transients and instability may be greatest in the first orbit of each linked set (due to the unknown attitude of HST for prior observations), we choose to place the visit with the disk perpendicular to the wedge as the *third* visit. We set absolute Orient Range constraints accordingly. The first visit has Orient From constraints to set its orientation ~ 20 deg roll from the third visit. Similarly, the fourth visit has Orient From constraints to set its orientation ~ -20 deg roll from the third visit. For the second visit between them (the PSF star), ideally we prefer to have it at the same orientation as the third visit (this is a lower priority constraint and could easily be dropped if needed to ease scheduling, but in practice with the Visit Planner this does not appear to be a significant constraint). In summary, the visit are ordered Target(20deg)-PSF(0deg)-Target(absolute orient)-Target(-20deg).

We found one schedulable window of 11 days using these constraints. If needed, we can trade a fraction of integration time for schedulability (minimum of schedulability = 90 to keep enough integration time on the science target).

3) Guide Stars: We require pointing and roll control with 2-FGS guiding. Single-FGS guiding does not offer sufficient target position stability for coronagraphy.

4) Target Acquisitions: We expose TA images to achieve $S/N \sim 100$ using the STIS TA ETC. Because we will use the TA images to assess "behind the wedge" target positions to high precision, higher S/N than the default 40 is required. We use F25ND3 for all TA exposures.

5) Exposure times:

Science target: considering the faintness of the target, we set the exposure time to the maximum available in the orbit after the target acquisition exposure, with CR-SPLIT of 3, which is the best trade-off between cosmic ray processing and read out noise. We estimate 25% of full well capacity at the edge of the wedge for the individual exposure time, which is to scale with acquisition of TW Hydrae with the same observing parameters in program GO 8624 (PI Weinberger).

PSF star: the PSF star is 2.6 times brighter than the science star. To have the same noise statistics in science and PSF acquisition, we shortened the exposure time by 2.6 for the reference star, which gives about the same total exposure time but CR-SPLIT 8 instead of 3 for the science star. This

strategy also provides more PSF acquisitions, we will improve postprocessing with a better selection or linear combination matching telescope breathing state in the science images.

The exposures are obtained with GAIN=4 and subarray SIZEAXIS2=427. This gives a field of view 21.65" in size centered on the WEDGE1.0 position 10.82" inset along the wedge away from the field of view edge. This is the same subarray we have used previously for STIS observations at the wedge 1.0" position.

7) PSF star selection. We choose a PSF star (L221-60) that is close in the sky (< 8 deg), about one magnitude brighter than the science target, is closely matched in optical colors (UBVRI) and measured effective temperature and spectral type, and for which available literature information indicates a high probability this is a single star, not a close binary. Details of the specific selection criteria is provided in target notes.

----- Realtime Justification -----

n/a

----- Calibration Justification -----

n/a

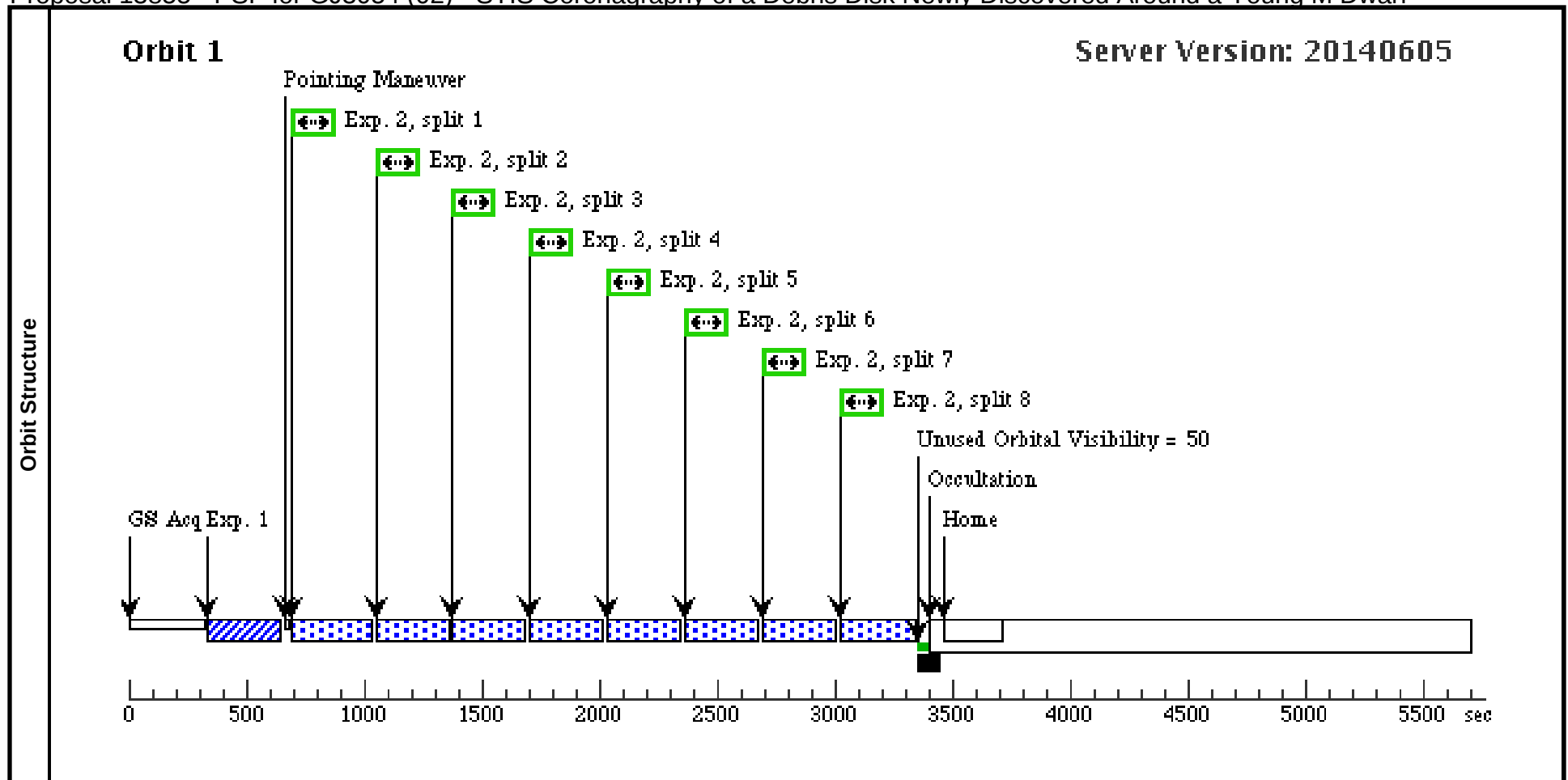
Proposal 13855 - GJ 3054 V1 (01) - STIS Coronagraphy of a Debris Disk Newly Discovered Around a Young M Dwarf

Thu Sep 04 01:16:05 GMT 2014

Visit	Proposal 13855, GJ 3054 V1 (01), implementation						Thu Sep 04 01:16:05 GMT 2014			
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD									
	Special Requirements: ORIENT 25.0D TO 35.0D FROM 03									
Comments: Edge-on disk major axis is at position angle ~ 27 degrees.										
As noted in the Proposal Description, we prefer to schedule the 2nd science visit (3rd visit of the program) with the disk perpendicular to the STIS wedge. For this 1st visit, we want it offset in roll angle by either + or - 20 degrees with respect to that third visit, with loose tolerance of ~ 5 deg around that nominal offset.										
EDIT: no guide stars can be found for visit 04 with these ranges, so we decided (with Alison Vick and John Debes) to push orient of visit 01 closer to the spiders (30degrees instead of 20), and squeeze orient of visit 04 between 01 and 03 (so 15degrees instead of -20).										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	GJ3054	RA: 00 45 28.1516 (11.3672983d)	Proper Motion RA: 95.74 mas/yr	V=12.013+/-0.012	Reference Frame: ICRS				
		Alt Name1: HIP3556	Dec: -51 37 33.94 (-51.62609d)	Proper Motion Dec: -58.95 mas/yr	Koen+2002 photometry: B-V=1.52 U-B=1.142 V-R=1.026 V-I=2.25					
			Equinox: J2000	Parallax: 0.023"						
Epoch of Position: 2000										
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Vmag from Koen+2002 IBV(RI)c photometric catalog.										
Circumstellar disk detected with NIMCOS, with PA = 27deg E of N.										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	GJ 3054 AC Q (STIS.ta.621 821)	(1) GJ3054	STIS/CCD, ACQ, F25ND3	MIRROR	ACQTYPE=POINT	GS ACQ SCENARI O BASE1B3	Sequence 1-2 Non-Int in GJ 3054 V1 (01)	14 Secs (14 Secs) [==>]	[1]
	2	GJ 3054 CO RO 1	(1) GJ3054	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	GAIN=4; SIZEAXIS2=427; CR-SPLIT=3		Sequence 1-2 Non-Int in GJ 3054 V1 (01)	2550 Secs (2550 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)]	[1]
Orbit Structure	Orbit 1 Server Version: 20140605 Unused Orbital Visibility = 13 GS Acq Exp. 1 Pointing Maneuver Exp. 2, split 1 Exp. 2, split 2 Exp. 2, split 3 Occultation Home 0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 sec									

Proposal 13855 - PSF for GJ3054 (02) - STIS Coronagraphy of a Debris Disk Newly Discovered Around a Young M Dwarf

Visit	Proposal 13855, PSF for GJ3054 (02), implementation									Thu Sep 04 01:16:06 GMT 2014
	Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD Special Requirements: SAME ORIENT AS 03; AFTER 01 BY 0.5 Orbits TO 1.5 Orbits Comments: PSF star for visits V1, V2, and V3. Ideally this should be observed at similar spacecraft orientation as Visit V2, but this constraint can be relaxed if needed for schedulability.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	L221-60	RA: 01 14 34.1974 (18.6424892d) Dec: -53 56 31.61 (-53.94211d) Equinox: J2000	Proper Motion RA: 104.14 mas/yr Proper Motion Dec: 311.53 mas/yr Epoch of Position: 2000	V=11.070+/-0.009 Koen+2002 photometry: B-V=1.511 U-B=1.185 V-R=0.981 V-I=2.086	Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.									
	PSF star selected for GJ 3054. Best match to B-V, U-B, V-R and V-I colors within 8 degrees in the catalog "IBV(RI)c photometry of HIP red stars (Koen+,2002)". Tycho B-V is not consistent but is also the best color match within 10deg. All color matches are better than 0.1mag, except for V-I which is off by 0.164mag. Hipparcos show no trace of multiplicity.									
	PSF star is 7.6 deg separation from the science target.									
No reliable I mag flux in literature; V-I color from Pickles 2010 spectral fits to Tycho+USNO+2MASS.										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	L221-60 AC Q (STIS.ta.621822)	(2) L221-60	STIS/CCD, ACQ, F25ND3	MIRROR	ACQTYPE=POINT	GS ACQ SCENARIO BASE1B3	Sequence 1-2 Non-Int in PSF for GJ3054 (02)	6 Secs (6 Secs) [==>]	[1]
	2	L221-60 CO RO	(2) L221-60	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	GAIN=4; SIZEAXIS2=427; CR-SPLIT=8		Sequence 1-2 Non-Int in PSF for GJ3054 (02)	2400 Secs (2400 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)] [==>(Split 4)] [==>(Split 5)] [==>(Split 6)] [==>(Split 7)] [==>(Split 8)]	[1]
	Comments: PSF is V=11.07 and SCI is V=12.13, so PSF is 2.6 times brighter. To have the same SNR, the exposures are 2.6 time shorter (so 300s instead of 800s). We also get 2400s total, but CR-split 8 instead of 3 for the science target									



Proposal 13855 - GJ 3054 V2 (03) - STIS Coronagraphy of a Debris Disk Newly Discovered Around a Young M Dwarf

Thu Sep 04 01:16:06 GMT 2014

Visit	Proposal 13855, GJ 3054 V2 (03), implementation									
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD									
Visit	Special Requirements: ORIENT 157D TO 167 D; ORIENT 337D TO 347 D; AFTER 02 BY 0.5 Orbits TO 1.5 Orbits									
	Comments: Edge-on disk major axis is at position angle ~ 27 degrees.									
	As noted in the Proposal Description, we prefer to schedule this 2nd science visit with the disk perpendicular to the STIS wedge, hence PA=27deg should be parallel with the AXIS1 direction. To achieve this we add either 135 or 315 degrees to that PA. Hence the desired orientation for this visit is either ORIENT ~ 342 or ORIENT ~ 162. (No preference between those two) We specify a +/- 5 deg range around the nominal orientation. If scheduling proves difficult this constraint could be relaxed slightly.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	GJ3054	RA: 00 45 28.1516 (11.3672983d)	Proper Motion RA: 95.74 mas/yr	V=12.013+/-0.012	Reference Frame: ICRS				
		Alt Name1: HIP3556	Dec: -51 37 33.94 (-51.62609d)	Proper Motion Dec: -58.95 mas/yr	Koen+2002 photometry: B-V=1.52 U-B=1.142 V-R=1.026 V-I=2.25					
Fixed Targets			Equinox: J2000	Parallax: 0.023"						
				Epoch of Position: 2000						
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.									
Fixed Targets	Vmag from Koen+2002 IBV(RI)c photometric catalog.									
	Circumstellar disk detected with NIMCOS, with PA = 27deg E of N.									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	GJ 3054 AC Q (STIS.ta.621 821)	(1) GJ3054	STIS/CCD, ACQ, F25ND3	MIRROR	ACQTYPE=POINT	GS ACQ SCENARI O BASE1B3	Sequence 1-2 Non-Int in GJ 3054 V2 (03)	14 Secs (14 Secs)	
									[==>]	[1]
Exposures	2	GJ 3054 CO RO 1	(1) GJ3054	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	GAIN=4; SIZEAXIS2=427; CR-SPLIT=3		Sequence 1-2 Non-Int in GJ 3054 V2 (03)	2550 Secs (2550 Secs)	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
Exposures									[==>(Split 3)]	
Orbit Structure	Orbit 1									
	Server Version: 20140605									
	Unused Orbital Visibility = 13									
Orbit Structure	Pointing Maneuver									
	Occultation									
	Home									
Orbit Structure	GS Acq Exp. 1									
	Exp. 2, split 1									
	Exp. 2, split 2									
Orbit Structure	Exp. 2, split 3									
Orbit Structure										

Proposal 13855 - GJ 3054 V3 (04) - STIS Coronagraphy of a Debris Disk Newly Discovered Around a Young M Dwarf

Visit	Proposal 13855, GJ 3054 V3 (04), implementation										Thu Sep 04 01:16:06 GMT 2014
	Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD Special Requirements: ORIENT 10.0D TO 20.0D FROM 03; AFTER 03 BY 0.5 Orbits TO 1.5 Orbits										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
	(1)	GJ3054 Alt Name1: HIP3556	RA: 00 45 28.1516 (11.3672983d) Dec: -51 37 33.94 (-51.62609d) Equinox: J2000	Proper Motion RA: 95.74 mas/yr Proper Motion Dec: -58.95 mas/yr Parallax: 0.023" Epoch of Position: 2000	V=12.013+/-0.012 Koen+2002 photometry: B-V=1.52 U-B=1.142 V-R=1.026 V-I=2.25	Reference Frame: ICRS					
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Vmag from Koen+2002 IBV(RI)c photometric catalog. Circumstellar disk detected with NIMCOS, with PA = 27deg E of N.											
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	GJ 3054 AC Q (STIS.ta.621 821)	(1) GJ3054	STIS/CCD, ACQ, F25ND3	MIRROR	ACQTYPE=POINT	GS ACQ SCENARI O BASE1B3	Sequence 1-2 Non-Int in GJ 3054 V3 (04)	14 Secs (14 Secs) [==>]	[1]	
	2	GJ 3054 CO RO 1	(1) GJ3054	STIS/CCD, ACCUM, WEDGEA1.0	MIRROR	GAIN=4; SIZEAXIS2=427; CR-SPLIT=3		Sequence 1-2 Non-Int in GJ 3054 V3 (04)	2550 Secs (2550 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)]	[1]	
Orbit Structure	Orbit 1										
	Server Version: 20140605 Unused Orbital Visibility = 13 										