



15497 - Resolving the late planet formation stages around young M-stars

Cycle: 26, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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>
07	(3) T64-6	STIS/CCD	1	14-Dec-2018 17:00:17.0	yes
09	(6) 2MASS-J16150856-1851009	STIS/CCD	1	14-Dec-2018 17:00:18.0	yes
10	(3) T64-6	STIS/CCD	1	14-Dec-2018 17:00:18.0	yes

3 Total Orbits Used

ABSTRACT

Recent discoveries of earth-like planets around M-stars have highlighted the importance of understanding planet formation around late-type stars. However, this effort has been hampered by the lack of resolved observations of protoplanetary disks. In particular, scattered light images of M-star

disks near the age of dispersal are critical to making further progress. The Upper Sco region provides a promising venue to remedy this situation, as it is the closest region with an age of 5-11 Myrs, commensurate with dispersal timescales. We propose to observe three M-star protoplanetary disks in the Upper Sco association using HST/STIS coronagraphy to resolve the disks in scattered-light for the first time and to search for morphological signatures of forming planets. These three disks have been selected based on ALMA mm-dust and CO measurements that display radii within the STIS field of view and outside its inner working angle (IWA). We will use these observations to carry out a comparative study of the evolutionary state between M-star disks in Upper Sco and the younger 1-2 Myr Taurus region, leveraging both previous scattered-light images of disks in Taurus, as well as previous observations of the mm-dust and CO in both regions. All three targets are too faint to be observed using ground-based AO. Therefore, HST/STIS is the only instrument able to make these important measurements. These observations will act as critical diagnostics of the evolutionary state of nearby M-star protoplanetary disks, that will inform theories of planet formation and will further our understanding of the evolution of the planets around M-stars, such as our nearest neighbor Proxima Centauri b.

OBSERVING DESCRIPTION

Our observations seek to take advantage of the recently commissioned STIS BAR5 (i.e. the bent finger; Gaspar & Schneider, GO-12923) coronagraphic mode to achieve the 0.25" inner working angle required to image these three disks in scattered light. The expected outer radius of the scattered-light disk is unknown, as the exact relationship between the small dust and the CO at these evolved stages is unknown, but it is expected to be at least that of the CO radius (and therefore observable with STIS), but possibly extending further. Empirically measuring the relationship between these two components is one of the main goals of this proposal.

The relatively small angular separations of the expected emission in these disks (~0.5") necessitates the use of PSF subtraction techniques in order to reasonably expect a detection. We therefore use three orbits per target: two orbits at different telescope ORIENT positions separated from each other by 30 degrees, and one orbit for a reference star.

The first two roll-orbits allow for basic angular differential imaging PSF subtraction while building signal to noise in a given disk, and the third orbit is required to mitigate self-subtraction of the disk in order to recover its true morphology. This multi-roll-plus-reference-star PSF subtraction strategy is well established and has led to many successfully imaged disks (e.g. Schneider et al., 2014).

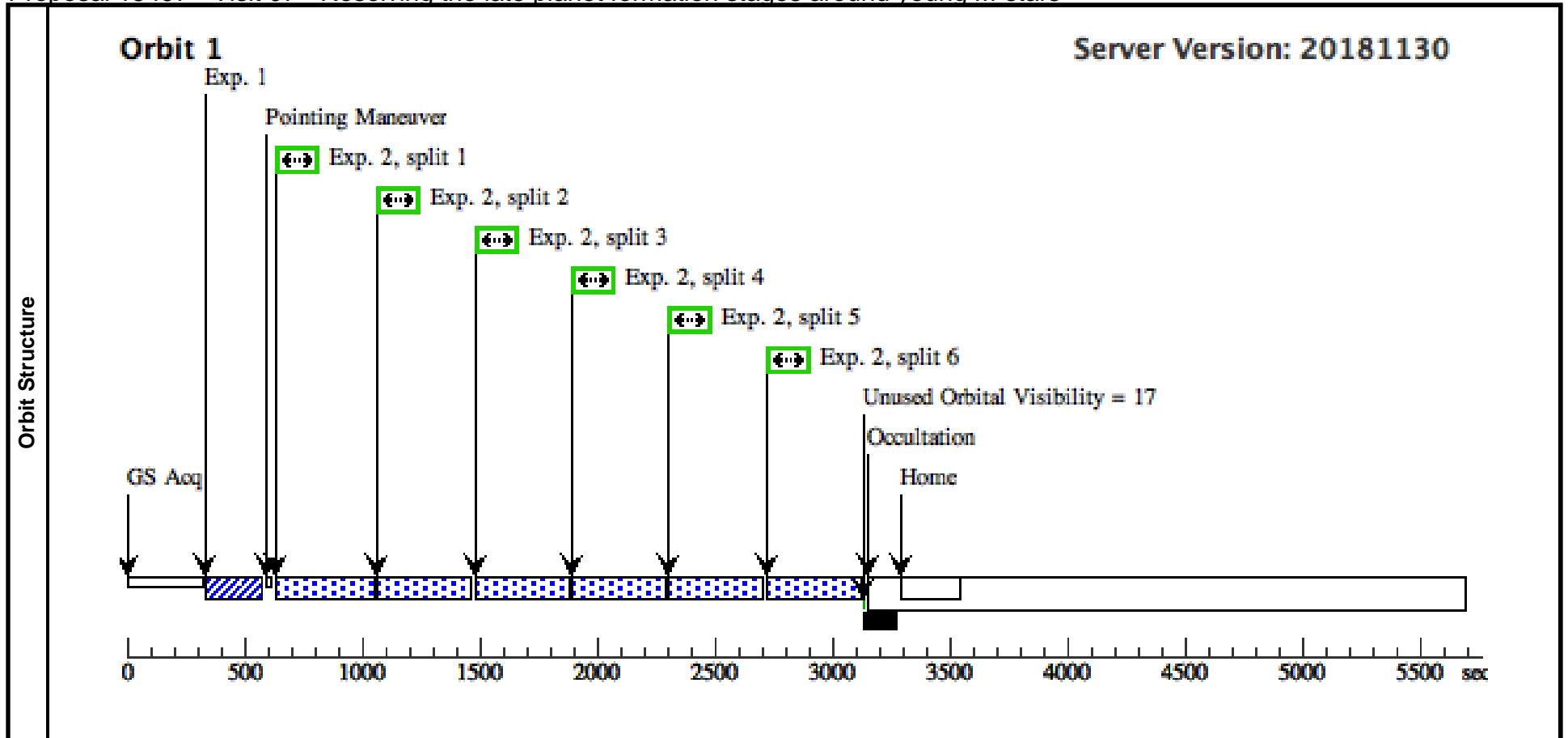
In each case the ORIENTs are assigned using the disk's known position angle such that the disk does not fall behind either a diffraction spike or the BAR5 finger itself. The three reference stars for this program are RAVE-J161322.1-192417, UCAC2- 24134747 and 2MASS-J16150856-1851009 -

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one for each target. Each reference star was chosen to match the B-V color, the Vmag and the position in the sky as close as possible.

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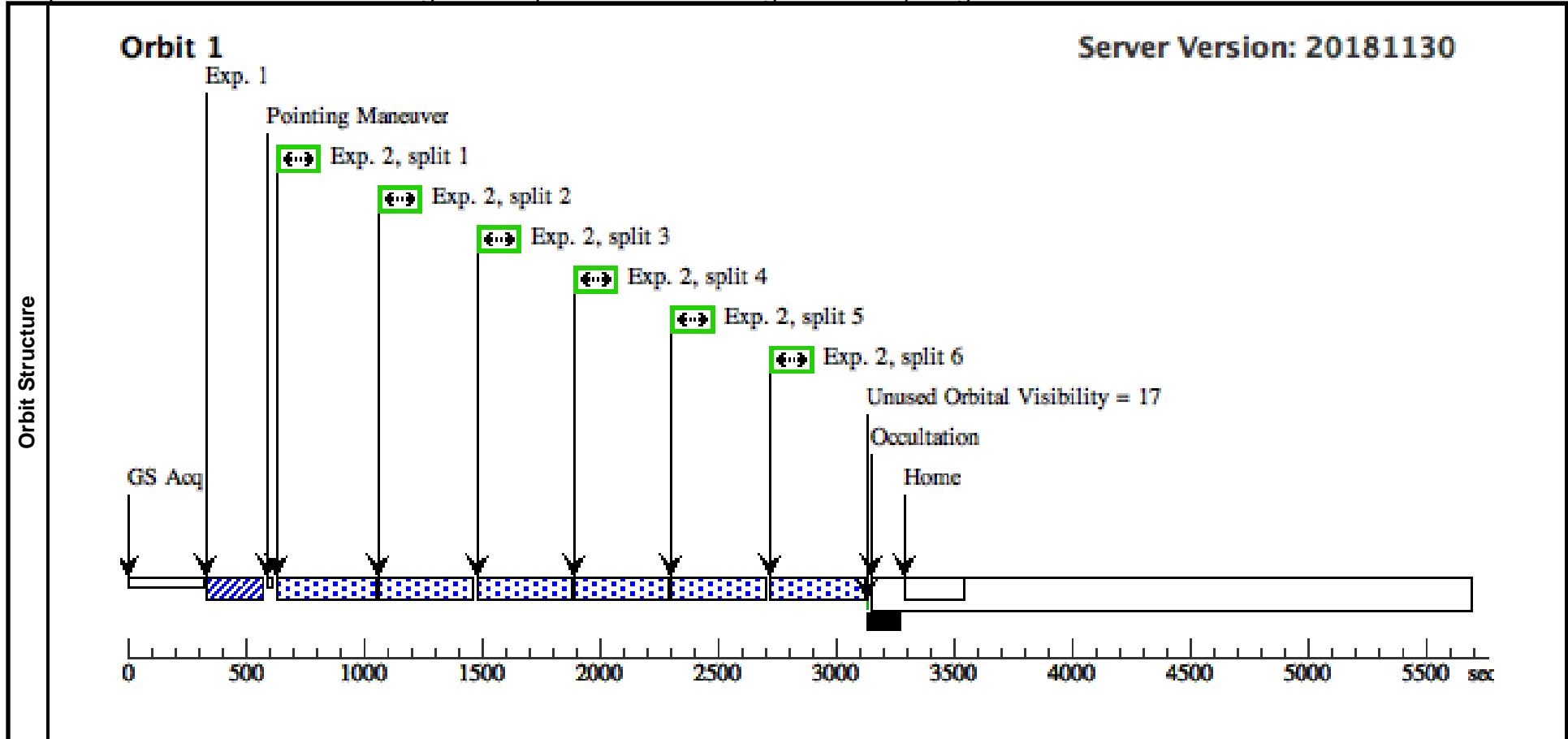
Visit	Proposal 15497, Visit 07, implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD Special Requirements: ORIENT 119D TO 119.5 D; SEQ 07.09.10 WITHIN 2.9 Orbits									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	T64-6 Alt Name1: 2MASS-J16123916-1859284	RA: 16 12 39.1690 (243.1632042d) Dec: -18 59 28.51 (-18.99125d) Equinox: J2000		V=14.3+/-0.3	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Position angle of disk around 2MASS J16123916-1859284 (T64-6) PA = 105 (+11 -11)</i> Category=STAR Description=[DISK]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	J16123916-1859284-A CQ	(3) T64-6	STIS/CCD, ACQ, 50CCD	MIRROR				1 Secs (1 Secs) [==>]	[1]
2	J16123916-1859284 Rol 11	(3) T64-6	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.3459 6,-7.17672		2214 Secs (2214 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)] [==>(Split 4)] [==>(Split 5)] [==>(Split 6)]	[1]	



Proposal 15497 - Visit 09 - Resolving the late planet formation stages around young M-stars

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Visit	Proposal 15497, Visit 09, implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(6)	2MASS-J16150856-1851009	RA: 16 15 8.5600 (243.7856667d) Dec: -18 51 1.00 (-18.85028d) Equinox: J2000		V=14.5+/-0.2	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[M V-IV]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	J16150856-1851009-A CQ	(6) 2MASS-J16150856-1851009	STIS/CCD, ACQ, 50CCD	MIRROR					1 Secs (1 Secs) [==>]
2	J16150856-1851009	(6) 2MASS-J16150856-1851009	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.3459 6,-7.17672			2214 Secs (2214 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)] [==>(Split 4)] [==>(Split 5)] [==>(Split 6)]	[1]



Proposal 15497 - Visit 10 - Resolving the late planet formation stages around young M-stars

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Visit	Proposal 15497, Visit 10, implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD Special Requirements: ORIENT 16D TO 21D FROM 07									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	T64-6 Alt Name1: 2MASS-J16123916-1859284	RA: 16 12 39.1690 (243.1632042d) Dec: -18 59 28.51 (-18.99125d) Equinox: J2000		V=14.3+/-0.3	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Position angle of disk around 2MASS J16123916-1859284 (T64-6) PA = 105 (+11 -11)</i> Category=STAR Description=[DISK]									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	J16123916-1859284-A CQ	(3) T64-6	STIS/CCD, ACQ, 50CCD	MIRROR					1 Secs (1 Secs) [==>]
	2	J16123916-1859284 Rol 12	(3) T64-6	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.3459 6,-7.17672		2214 Secs (2214 Secs) [==>(Split 1)] [==>(Split 2)] [==>(Split 3)] [==>(Split 4)] [==>(Split 5)] [==>(Split 6)]	[1]

