15172 - Validating early stellar encounters as the cause of dynamically hot planetary systems

Cycle: 25, 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) -ALF-PSA-C	STIS/CCD	1	28-Aug-2017 20:10:54.0	yes
02	(1) -ALF-PSA-C	STIS/CCD	1	28-Aug-2017 20:10:55.0	yes

2 Total Orbits Used

ABSTRACT

One of the key questions concerning exoplanetary systems is why some are dynamically cold, such as TRAPPIST-1, whereas others are dynamically hot, with highly eccentric planets and/or perturbed debris disks. Dynamical theory describes a variety of plausible mechanisms, but few can be empirically tested since the critical dynamical evolution that sets the final planetary architecture is short-lived. One rare system available for testing dynamical upheaval scenarios is the 400 Myr-old Fomalhaut system. In Cycle 22 we coronagraphically studied Fomalhaut C, which is a wide M-dwarf companion to Fomalhaut A, in order to test our prediction that the unresolved, Herschel-detected debris disk around Fomalhaut C may be highly perturbed because of a recent close interaction with Fomalhaut A. Using HST/STIS we discovered a highly asymmetric feature extending northward of Fomalhaut C by 3" that resembles our model of a dynamically hot disk. However, it may be a background galaxy and the definitive test of its physical relationship to Fomalhaut C is to demonstrate common proper motion. Using Keck adaptive optics follow-up observations in J band, we did not detect the feature, and hence follow-up HST observations are the only way to test for common proper motion. Here we request a very small program to revisit Fomalhaut C with STIS in order to validate the initial discovery as a debris disk (1" proper motion between HST epochs). The astrophysical significance is demonstrating that the Fomalhaut system is a valuable case for studying dynamical upheavals via stellar encounters that are inferred to occur in the evolution of many other planetary systems.

OBSERVING DESCRIPTION

Our observing plan builds on the successful Cycle 22 observing sequence (GO-13725). The absolute roll constraints are chosen so that the circumstellar feature (PA = 0 degrees) will not intersect the diffraction spikes or BAR5. Scheduling windows appear to be available through the end of November 2017.

Fomalhaut C will be occulted at the bent finger with width ~0.3". The bent finger (BAR 5) is a newly supported coronagraphic mode for STIS that is ideal for fainter targets such as Fomalhaut C (Gaspar & Schneider, GO-12923).

Two orbits of integration on Fomalhaut C will be executed at two different telescope ORIENTs separated from each other by 25-30 degrees, with ORIENTs selected to avoid having the disk feature behind a diffraction spike or the finger obscuration.

A GROUP WITHIN 1.9 orbits is specified in order to achieve two contiguous, non-interrupted orbits to achieve PSF stability (needed for PSF subtraction during data reduction).

To go to BAR5, the acquision is on BAR10 and each exposure has a POS TARG X = 16.34596, Y = -7.20172 arcsec. Though a BAR5 aperture is

available in the APT, from Cycle 22 we know that the BAR10 acquision combined with this POS TARG places the target at the tip of the bent finger instead of farther down the bent finger (closer to the right edge of the CCD).

Visit

Proposal 15172, Fom C - Roll 1 (01), implementation Tue Aug 29 00:10:56 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 28D TO 45 D; ORIENT 225D TO 227 D; GROUP 01,02 WITHIN 1.9 Orbits

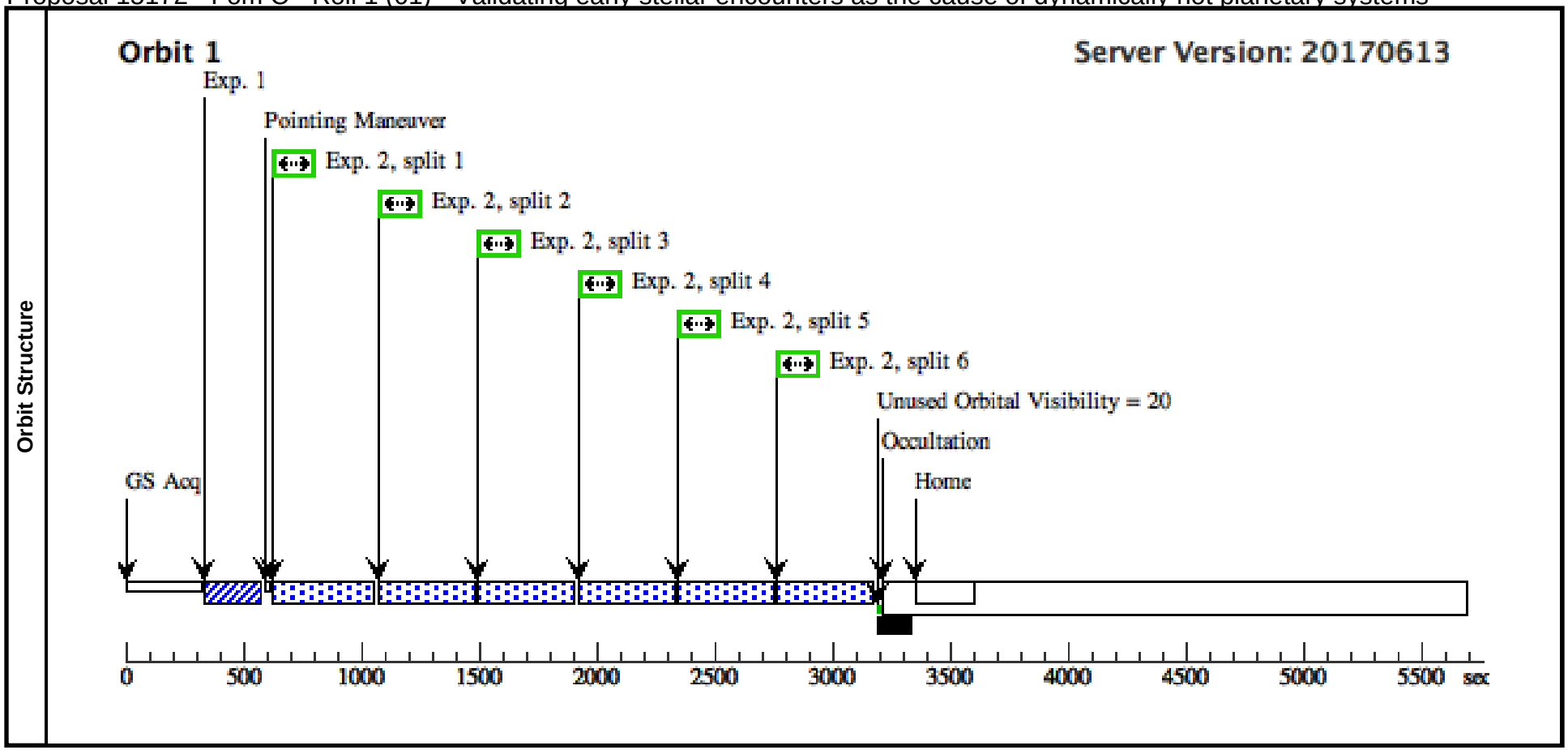
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	-ALF-PSA-C	RA: 22 48 4.4700 (342.0186250d) Dec: -24 22 7.50 (-24.36875d) Equinox: J2000	Proper Motion RA: 333.84 mas/yr Proper Motion Dec: -177.51 mas/yr Parallax: 0.130" Epoch of Position: 2000.0	V=12.624	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) -ALF-PSA-C	STIS/CCD, ACQ, 50CCD	MIRROR				0.8 Secs (0.8 Secs)	
								[==>]	***[1]***
2		(1) -ALF-PSA-C	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.3459 6,-7.20172		2274 Secs (2274 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20170613
Exp. 1
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
Unused Orbital Visibility = 20
Occultation
GS Acq
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15172, Fom C - Roll 2 (02), implementation Tue Aug 29 00:10:56 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 25D TO 30D FROM 01

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	-ALF-PSA-C	RA: 22 48 4.4700 (342.0186250d) Dec: -24 22 7.50 (-24.36875d) Equinox: J2000	Proper Motion RA: 333.84 mas/yr Proper Motion Dec: -177.51 mas/yr Parallax: 0.130" Epoch of Position: 2000.0	V=12.624	Reference Frame: ICRS

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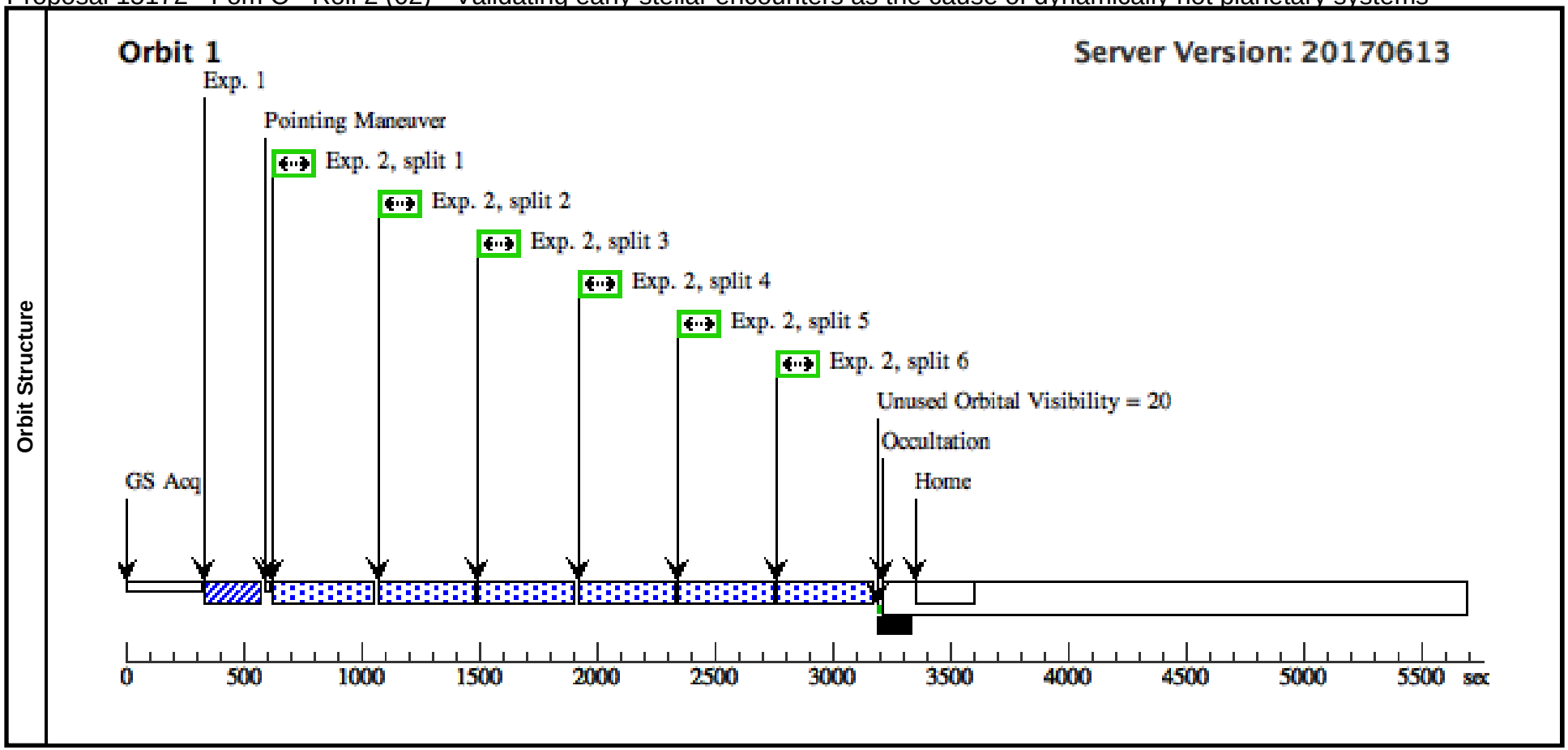
1		(1) -ALF-PSA-C	STIS/CCD, ACQ, 50CCD	MIRROR				0.8 Secs (0.8 Secs)	
								[==>]	***[1]***
2		(1) -ALF-PSA-C	STIS/CCD, ACCUM, BAR10	MIRROR	CR-SPLIT=6; GAIN=4	POS TARG 16.3459 6,-7.20172		2274 Secs (2274 Secs)	
								[==>(Split 1)] *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]* *[==>(Split 5)]* *[==>(Split 6)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20170613
Exp. 1
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
Unused Orbital Visibility = 20
Occultation
Home
GS Acq
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec