15157 - The Primordial Binary Fraction in Trumpler 14: Frequency and Multiplicity Parameters

Cycle: 25, Proposal Category: GO

(Availability Mode: AVAILABLE)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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	(3) CL-TRUMPLER-14-P3	WFC3/UVIS	1	14-Jul-2017 13:03:52.0	yes
02	(3) CL-TRUMPLER-14-P3	WFC3/UVIS	2	14-Jul-2017 13:03:55.0	yes

3 Total Orbits Used

ABSTRACT

This is an astrometric proposal designed to identify and characterize the properties of medium- and long-period (orbital periods ranging from 1.8 to 100 years) visual binaries in the mass range between ~4 and 20 Mo in the young compact cluster Trumpler 14 in the Carina Nebula. We aim to probe the virtually unexplored population of intermediate- and high-mass binaries that will experience a Roche-lobe overflow during their post-main-sequence evolution. These binaries are of particular interest because they are expected to be the progenitors of supernovae Type Ia, b, and c, X-ray binaries, double neutron stars and double black holes. Multiplicity properties of young stars can be further used to constrain the outcome of the star-formation process and hence distinguish between various formation scenarios. The medium- and long-period binaries (P> 0.5 yr) are hard to detect and expensive to characterize with traditional ground-based spectroscopy. Knowledge of their orbital properties is however crucial to properly estimate the overall fraction of OB stars whose evolution is affected by binary interaction and to predict the outcome of such interaction. Because of the well characterized PSF of WFC3/UVIS and its temporal stability, HST is the only facility able to characterize the properties of OB-type medium-period binaries in Tr14, and Tr14 is the only nearby high-density OB-type young cluster.

OBSERVING DESCRIPTION

We plan to characterize intermediate and long period binaries by measuring their orbital parameters such as orbital period, mass ratio, orbital separation and eccentricity.

The binaries we are looking for are barely resolved and require a very careful characterization of the PSF. For this reason we are acquiring as many exposures as possible within each orbit. This will allow us not only to derive the most accurate PSF library for each epoch, but also to obtain a very well characterized geometric distortion calibration in two narrow band filters.

In each visit binary stars will be identify as those sources with a poor fit of a single-star stellar model. We will then repeat the fitting using a multiple-component PSF.

We will observe Tr14 in two filters to characterize the color(=temperature) of the sources. We will observe the cluster in three different epochs to measure the motion of the companions around the primary sources.

Stars in Tr14 are very bright and will guarantee very high S/N even in very short exposure times and narrow band filters.

Observations have been organized in three visits:

1) Visit 01 will collect data in the filters F631N and F935N ,and should be executed at the beginning of the cycle (before the end of November 2015);

2) Visit 02 will observe Tr14 only in the filter F631N and should be executed between March and April

3) Visit 03 will use the Tr14 again in both filters F631N and F953N; this visit should be be execute at the end of the cycle between August and September.

Orientation angles have been chosen to be consistent with the requested observing window. Eleven e- of postflash have been added to each exposure to mitigate the effects of CTE. Because of the very high backgroun (Tr14 is in the Carina Nebula) we will use the first epoch dataset to carefuly verify that the ammount of postflash is not too high.

In the phaseI we asked to observe Tr14 using subarray 2Kx2K, in preparing the phaseII we realized that using full frame observations will not affect the quality of pour astrometry, but will allow us to increase the fraction of monitored stars, therefore we have slightly modified our observing strategy.

Visit

Proposal 15157, Visit 01, implementation Fri Jul 14 17:03:57 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 336D TO 92 D; BETWEEN 01-MAR-2018:00:00:00 AND 30-APR-2018:00:00:00

Fixed Targets

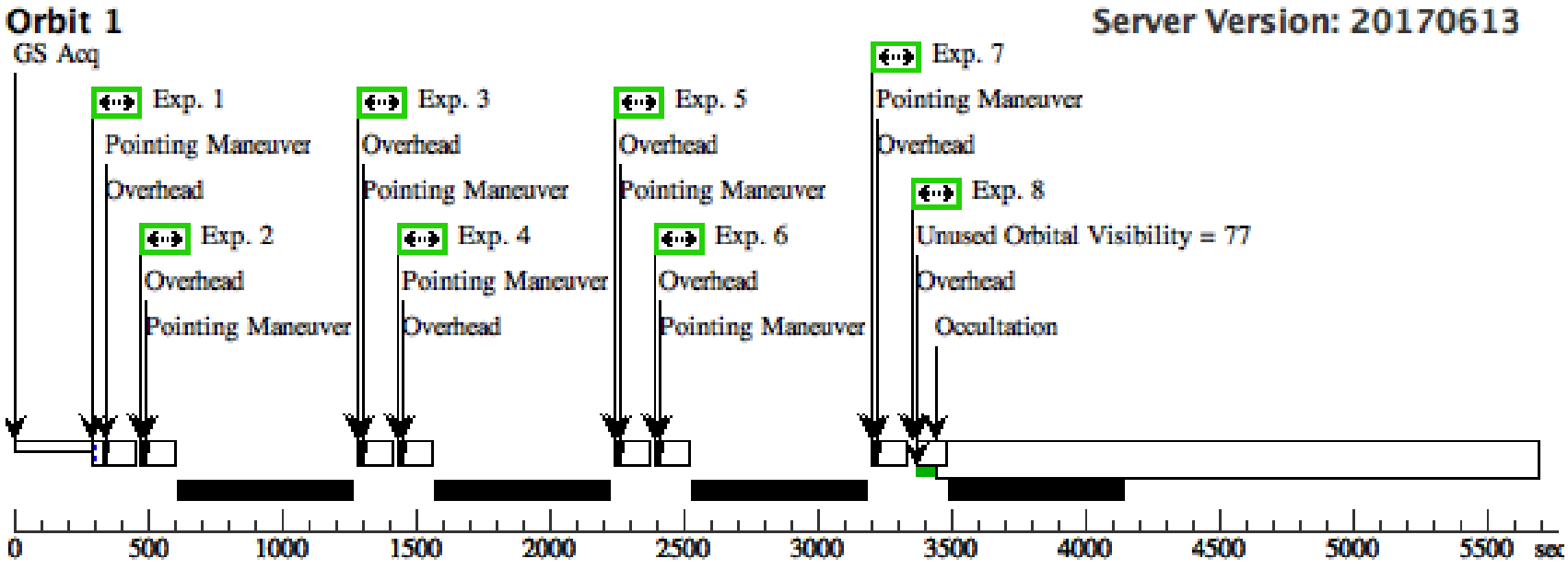
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CL-TRUMPLER-14-P3	RA: 10 43 56.0000 (160.9833333d) Dec: -59 33 14.00 (-59.55389d) Equinox: J2000		V=5.5	Reference Frame: SIMBAD

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		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG 0.180,1.555		5 Secs (5 Secs) *[==>]*	 ***[1]***
2		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG 0.292,1.429		5 Secs (5 Secs) *[==>]*	 ***[1]***
3		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG 0.186,1.25		5 Secs (5 Secs) *[==>]*	 ***[1]***
4		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A			5 Secs (5 Secs) *[==>]*	 ***[1]***
5		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.126,0.306		5 Secs (5 Secs) *[==>]*	 ***[1]***
6		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.186,-1.25		5 Secs (5 Secs) *[==>]*	 ***[1]***
7		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.292,-1.49		5 Secs (5 Secs) *[==>]*	 ***[1]***
8		(3) CL-TRUMPLER-14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.180,-1.55		5 Secs (5 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 15157, Visit 02, implementation Fri Jul 14 17:03:57 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 146D TO 215 D; BETWEEN 01-AUG-2018:00:00:00 AND 30-SEP-2018:00:00:00

Fixed Targets

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(3)	CL-TRUMPLER-14-P3	RA: 10 43 56.0000 (160.9833333d) Dec: -59 33 14.00 (-59.55389d) Equinox: J2000		V=5.5	Reference Frame: SIMBAD

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

Exposures

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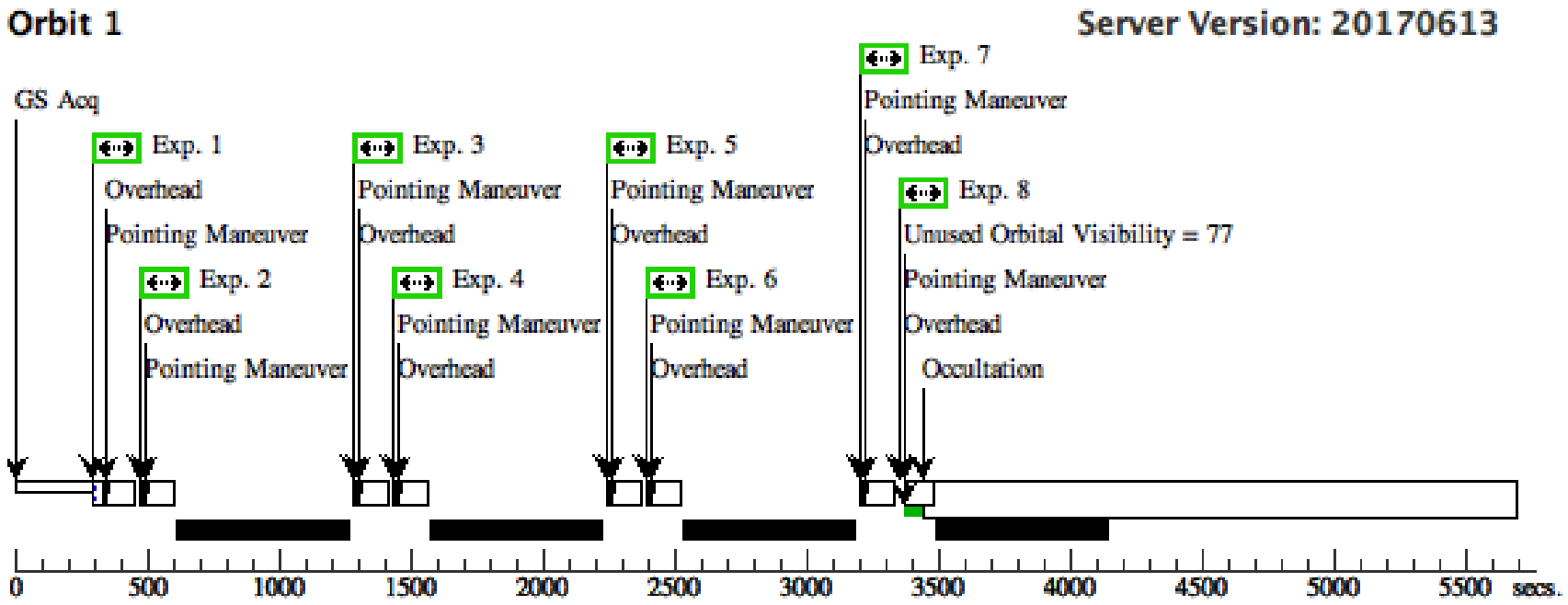
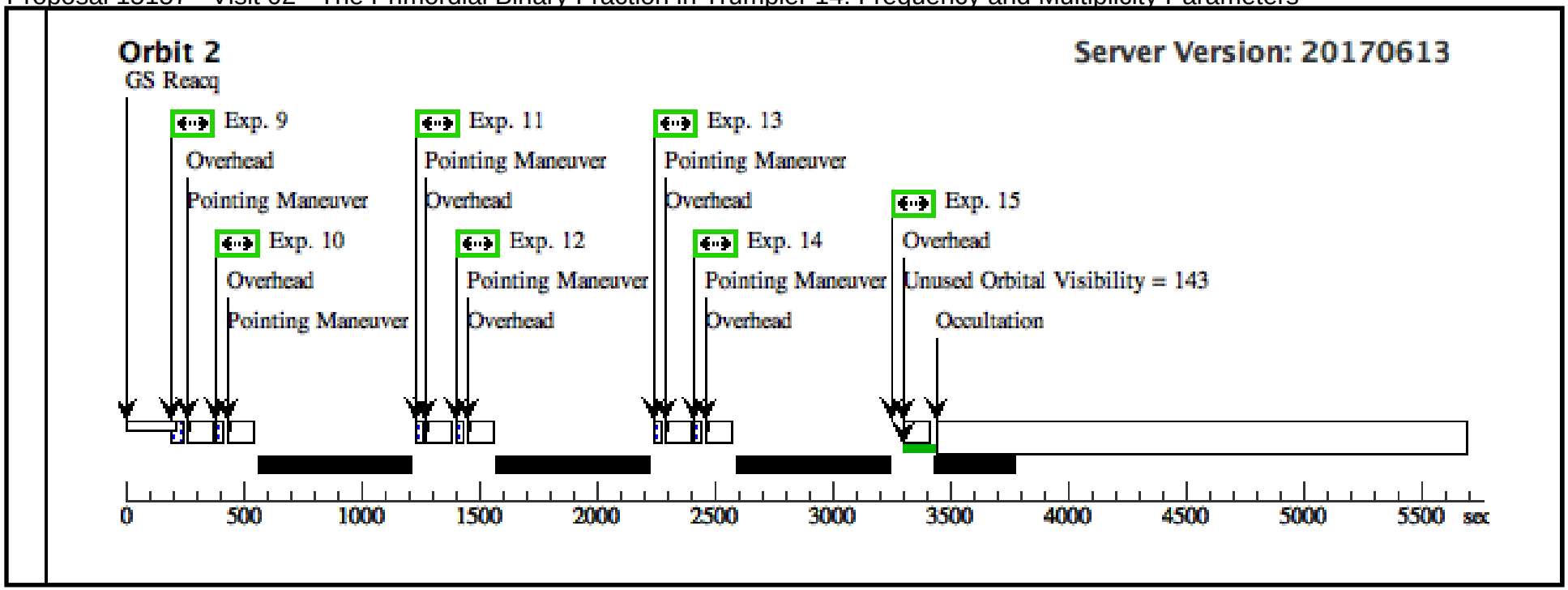
1		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG 0.180,1.555		5 Secs (5 Secs) *[==>]*	 ***[1]***
2		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG 0.292,1.429		5 Secs (5 Secs) *[==>]*	 ***[1]***
3		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG 0.186,1.25		5 Secs (5 Secs) *[==>]*	 ***[1]***
4		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A			5 Secs (5 Secs) *[==>]*	 ***[1]***
5		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.126,0.306		5 Secs (5 Secs) *[==>]*	 ***[1]***
6		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.186,-1.25		5 Secs (5 Secs) *[==>]*	 ***[1]***
7		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.292,-1.49		5 Secs (5 Secs) *[==>]*	 ***[1]***
8		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F631N	FLASH=11; BLADE=A	POS TARG -0.180,-1.55		5 Secs (5 Secs) *[==>]*	 ***[1]***
9		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11	POS TARG 0.180,1.555		34 Secs (34 Secs) *[==>]*	 ***[2]***
10		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11	POS TARG 0.292,1.429		34 Secs (34 Secs) *[==>]*	 ***[2]***
11		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11	POS TARG 0.186,1.25		34 Secs (34 Secs) *[==>]*	 ***[2]***
12		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11			34 Secs (34 Secs) *[==>]*	 ***[2]***
13		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11	POS TARG -0.186,-1.25		34 Secs (34 Secs) *[==>]*	 ***[2]***
14		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11	POS TARG -0.292,-1.49		34 Secs (34 Secs) *[==>]*	 ***[2]***
15		(3) CL-TRUMPLER -14-P3	WFC3/UVIS, ACCUM, UVIS-CENTER	F953N	FLASH=11	POS TARG -0.180,-1.55		34 Secs (34 Secs) *[==>]*	 ***[2]***

Orbit Structure

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Overhead
Pointing Maneuver
Exp. 10
Overhead
Pointing Maneuver
Exp. 11
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Overhead
Exp. 12
Pointing Maneuver
Overhead
Exp. 13
Pointing Maneuver
Overhead
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Overhead
Exp. 15
Overhead
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