14339 - The parallax and mass of the binary classical Cepheid V1334 Cyg

Cycle: 23, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

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) V1334-CYG (2) V1334-REF2 (3) V1334-REF3 (4) V1334-REF4 (5) V1334-REF5 (6) V1334-REF6 (7) V1334-REF7 (8) V1334-REF8 (9) V1334-REF9 (11) V1334-REF11	FGS	1	16-Jul-2015 21:14:33.0	yes
02	(1) V1334-CYG WAVE	STIS/CCD STIS/FUV-MAMA	1	16-Jul-2015 21:14:36.0	yes

2 Total Orbits Used

ABSTRACT

V1334 Cyg is a short-period classical Cepheid, and the primary star ("A") of a binary system. Using the CHARA interferometer, we spatially resolved its companion ("B") for the first time at an angular separation of 8 mas (Gallenne et al. 2013). Our two epochs clearly show the orbital displacement of B on its 5.3-year orbit, relative to the Cepheid, with an astrometric accuracy of 30 microas. This observation opens the exciting opportunity to determine the orbital parallax of this system.

Based on the existing long-term radial velocimetry of A, and our interferometric data, we already derived the main orbital parameters of the system. However, we face a degeneracy between the mass ratio of the two stars and the distance. We miss the radial velocity of B (V1334 Cyg is still an SB1) or the orbital trajectory of the Cepheid around the center-of-mass. To waive this degeneracy, we request FGS astrometry and STIS high resolution spectroscopy. The FGS observations will trace the apparent orbital trajectory of A on the sky (to 0.1 mas accuracy), and the high-resolution STIS spectroscopy will give us the radial velocity of B (to < 1 km/s). The spectral disentangling of A and B is impossible in the visible due to the high contrast between A and B in this wavelength domain. In the UV, the companion flux dominates the Cepheid, thanks to its early spectral type (~B5V), and the disentangling is a lot easier.

Combining STIS and FGS with CHARA interferometry, our goal is to obtain in 3 years the parallax and mass of the Cepheid with an unbiased accuracy of 1%. This will set a solid fiducial point for the calibration of fundamental Cepheid relations (period-luminosity, mass-period,...).

OBSERVING DESCRIPTION

The STIS observations aim at obtaining the spectrum and deriving the radial velocity of the hot companion V1334 Cyg B (hereafter "B") of the Cepheid. Contrary to the visible domain, the spectrum of B dominates the composite spectrum in the UV. The observations themselves do not present a particular technical difficulty. They will be repeated every year for 3 years, once per cycle, starting in September 2014. The minimum radial velocity will occur in 2014, and the maximum radial velocity will occur in 2016.

The FGS observations are scheduled yearly in late July/early August starting in 2013 for 4 epochs. This relatively tight constraing in observing date is intended to obtain observations with always the same parallax factor. As the first observing epoch will occur shortly before the start of Cycle 21 observations, we submitted a change request (reference number 74730) that was approved.

Visit	**Proposal 14339, FGS-2016 (01), implementation** Fri Jul 17 01:14:38 GMT 2015 **Diagnostic Status: Warning** Scientific Instruments: FGS Special Requirements: ORIENT 187D TO 189 D; BETWEEN 04-AUG-2016 AND 08-AUG-2016
Diagnostics	(FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA (FGS-2016 (01)) Warning (Orbit Planner): FGS EXPOSURE TOO SHORT TO GUARANTEE SCIENCE DATA

Fixed Targets

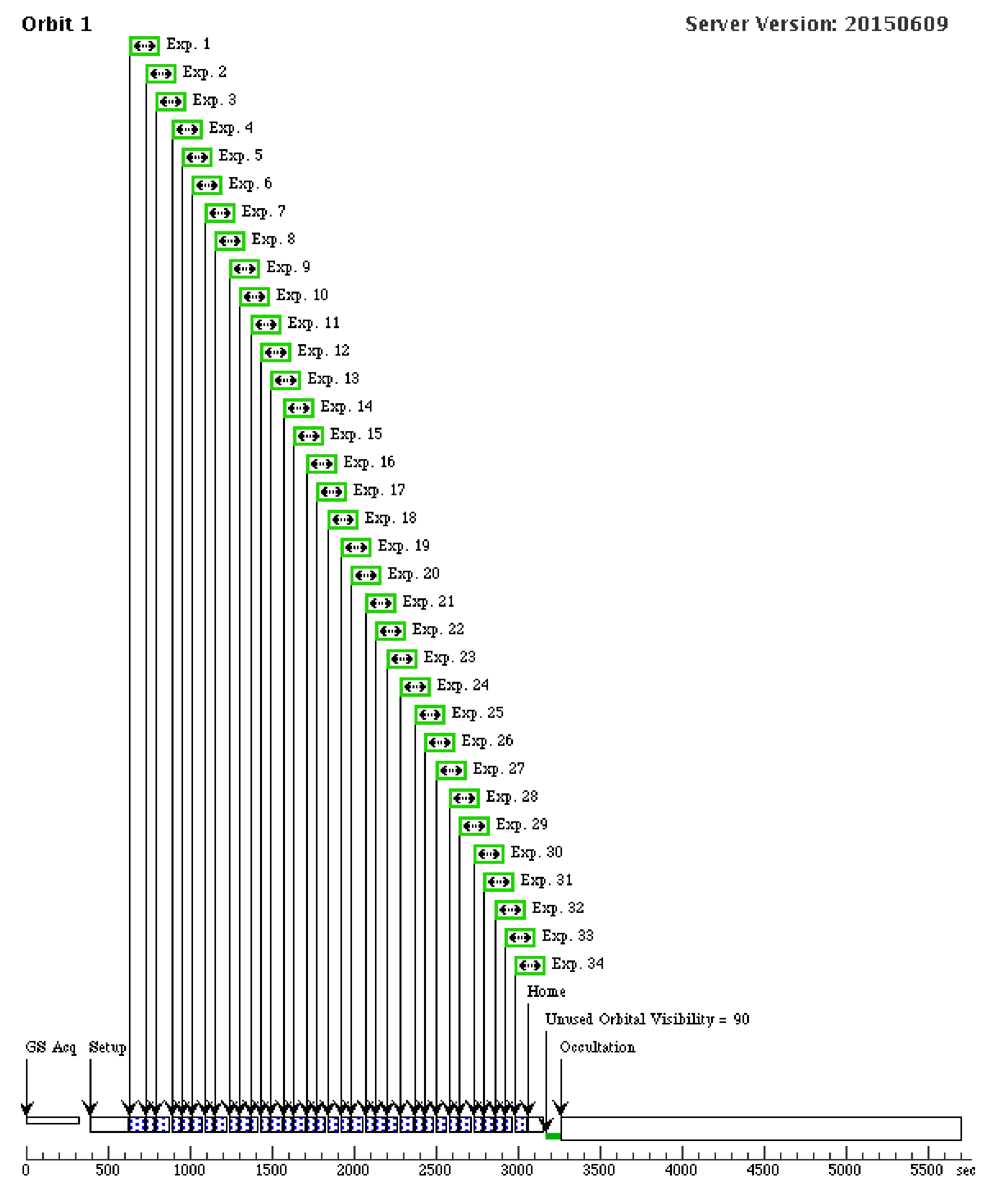
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V1334-CYG	RA: 21 19 22.1800 (319.8424167d) Dec: +38 14 14.91 (38.23748d) Equinox: J2000	Proper Motion RA: -0.49 mas/yr Proper Motion Dec: -2.29 mas/yr Parallax: 0.00151" Epoch of Position: 2000 Radial Velocity: -2 km/sec	V=5.893+/-0.10 FLAM(1400)=1e-11; FLAM(1565)=8.47e-11; FLAM(2365)=4.90e-12	Reference Frame: ICRS
(2)	V1334-REF2	RA: 21 19 27.7420 (319.8655917d) Dec: +38 14 27.38 (38.24094d) Equinox: J2000		V=12.29+/-0.1	Reference Frame: ICRS
(3)	V1334-REF3	RA: 21 19 28.9660 (319.8706917d) Dec: +38 13 24.13 (38.22337d) Equinox: J2000		V=13.74+/-0.1	Reference Frame: ICRS
(4)	V1334-REF4	RA: 21 19 24.5597 (319.8523321d) Dec: +38 11 27.45 (38.19096d) Equinox: J2000		V=12.14+/-0.1	Reference Frame: ICRS
(5)	V1334-REF5	RA: 21 19 15.7270 (319.8155292d) Dec: +38 14 38.54 (38.24404d) Equinox: J2000		V=13.59+/-0.1	Reference Frame: ICRS
(6)	V1334-REF6	RA: 21 19 23.8340 (319.8493083d) Dec: +38 18 1.91 (38.30053d) Equinox: J2000		V=12.33+/-0.1	Reference Frame: ICRS
(7)	V1334-REF7	RA: 21 19 21.1202 (319.8380008d) Dec: +38 19 28.52 (38.32459d) Equinox: J2000		V=12.60+/-0.2	Reference Frame: ICRS
(8)	V1334-REF8	RA: 21 19 12.8604 (319.8035850d) Dec: +38 09 47.90 (38.16331d) Equinox: J2000		V=8.83+/-0.2	Reference Frame: ICRS
(9)	V1334-REF9	RA: 21 19 6.0329 (319.7751371d) Dec: +38 08 34.45 (38.14290d) Equinox: J2000		V=11.52+/-0.2	Reference Frame: ICRS
(11)	V1334-REF11	RA: 21 19 17.1151 (319.8213129d) Dec: +38 13 14.08 (38.22058d) Equinox: J2000		V=12.60+/-0.2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) V1334-CYG	FGS, POS, 1	F5ND			Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
2		(2) V1334-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
3		(9) V1334-REF9	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
4		(8) V1334-REF8	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
5		(4) V1334-REF4	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
6		(3) V1334-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
7		(1) V1334-CYG	FGS, POS, 1	F5ND		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
8		(7) V1334-REF7	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
9		(6) V1334-REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
10		(2) V1334-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
11		(1) V1334-CYG	FGS, POS, 1	F5ND		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
12		(2) V1334-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
13		(5) V1334-REF5	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
14		(11) V1334-REF11	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
15		(9) V1334-REF9	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
16		(8) V1334-REF8	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
17		(4) V1334-REF4	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
18		(3) V1334-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
19		(1) V1334-CYG	FGS, POS, 1	F5ND		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
20		(7) V1334-REF7	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
21		(6) V1334-REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
22		(1) V1334-CYG	FGS, POS, 1	F5ND		SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***

	23	(5) V1334-REF5	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	24	(9) V1334-REF9	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	25	(8) V1334-REF8	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	26	(4) V1334-REF4	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	27	(3) V1334-REF3	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	28	(1) V1334-CYG	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	29	(7) V1334-REF7	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	30	(6) V1334-REF6	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	31	(2) V1334-REF2	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	32	(11) V1334-REF11	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	33	(1) V1334-CYG	FGS, POS, 1	F5ND	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***
	34	(8) V1334-REF8	FGS, POS, 1	F583W	SAME POS AS 1	Sequence 1-34 Non-Int in FGS-2016 (01)	2 Secs (2 Secs) *[==>]*	***[1]***

Orbit Structure



Proposal 14339 - STIS-2016 (02) - The parallax and mass of the binary classical Cepheid V1334 Cyg

Visit

Proposal 14339, STIS-2016 (02), implementation Fri Jul 17 01:14:39 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: BETWEEN 10-AUG-2016:00:00:00 AND 29-OCT-2016:00:00:00

Comments: Our adopted UV spectral energy distribution is based on the IUE low dispersion, large aperture observations SWP41795 and LWP20452.
In the FUV, the contribution of the Cepheid itself is negligible, and the spectrum is dominated by the late-B star companion, with a flux at 1400 angstroms of about 1e-11 ergs/cm2/s/A. There are also two other SWP low dispersion, large aperture spectra, SWP08319 and SWP19267, taken at different epochs, which show essentially the same flux, so any significant FUV flux variability can be ruled out.

Inserting our adopted spectral energy distribution into the ETC for the E140H 1271 with the 0.2X0.09 aperture gives a predicted global count rate of about 12500 c/s (ETC ID STIS.sp.466167).

Diagnostics

(STIS-2016 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	**Name**	**Target Coordinates**	**Targ. Coord. Corrections**	**Fluxes**	**Miscellaneous**
(1)	V1334-CYG	RA: 21 19 22.1800 (319.8424167d) Dec: +38 14 14.91 (38.23748d) Equinox: J2000	Proper Motion RA: -0.49 mas/yr Proper Motion Dec: -2.29 mas/yr Parallax: 0.00151" Epoch of Position: 2000 Radial Velocity: -2 km/sec	V=5.893+/-0.10 FLAM(1400)=1e-11; FLAM(1565)=8.47e-11; FLAM(2365)=4.90e-12	Reference Frame: ICRS

Exposures

#	**Label (ETC Run)**	**Target**	**Config,Mode,Aperture**	**Spectral Els.**	**Opt. Params.**	**Special Reqs.**	**Groups**	**Exp. Time (Total)/[Actual Dur.]**	**Orbit**
1	F25ND3 ACQ (STIS.ta.466076)	(1) V1334-CYG	STIS/CCD, ACQ, F25ND3	MIRROR			Sequence 1-5 Non-Int in STIS-2016 (02)	0.2 Secs (0.2 Secs) *[==>]*	***[1]***
2	G230LB ACQ/PEAK (STIS.sp.466041)	(1) V1334-CYG	STIS/CCD, ACQ/PEAK, 0.2X0.09	G230LB 2375 A			Sequence 1-5 Non-Int in STIS-2016 (02)	2.0 Secs (2 Secs) *[==>]*	***[1]***
3	wavecal	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1271 A			Sequence 1-5 Non-Int in STIS-2016 (02)	75 Secs (75 Secs) *[==>]*	***[1]***
4	time-tag exposure (STIS.sp.466167)	(1) V1334-CYG	STIS/FUV-MAMA, TIME-TAG, 0.2X0.09	E140H 1271 A	WAVECAL=NO; BUFFER-TIME=99		Sequence 1-5 Non-Int in STIS-2016 (02)	1800 Secs (1800 Secs) *[==>]*	***[1]***
Comments: 1271 (STIS.sp.466167) predicts global rate of about 12,500									
5	wavecal	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1271 A			Sequence 1-5 Non-Int in STIS-2016 (02)	250 Secs (250 Secs) *[==>]*	***[1]***

Proposal 14339 - STIS-2016 (02) - The parallax and mass of the binary classical Cepheid V1334 Cyg

Orbit Structure