



18414 - Resolving the Nature of the qWR Star in HD 45166 with High-Resolution FUV Spectroscopy

Cycle: 34, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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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>
01	(1) HD-45166 WAVE	STIS/CCD STIS/FUV-MAMA	3	18-Aug-2026 15:00:56.0	yes

3 Total Orbits Used

ABSTRACT

The nature of the quasi-Wolf-Rayet (qWR) primary in the binary HD 45166 remains fundamentally uncertain: it may be either a low-mass stripped helium star analogous to hot subdwarfs or a genuinely massive Wolf-Rayet star. Resolving this ambiguity requires a precise mass determination, which in this non-eclipsing system depends critically on composite spectral modeling. Current optical analyses are limited by degeneracies in wind structure, chemical abundances, and flux contributions.

We propose high-resolution far-ultraviolet spectroscopy with STIS to constrain the atmospheric properties of the qWR component. Resonance lines

such as C IV 1548Å/1550Å, N V 1238Å/1242Å, and Si IV 1393Å/1402Å directly probe the wind kinematics, ionization structure, and mass-loss rate, providing diagnostics inaccessible from optical data. By anchoring the wind and abundance structure, the FUV data will remove the dominant systematic uncertainties in the spectral modeling and enable a robust mass determination.

These observations also serve as a feasibility test for a planned ultraviolet survey of massive stars in the PLATO fields, complementing previous surveys focused on low-metallicity and low-mass populations. HD 45166 is the key benchmark system for establishing this methodology and distinguishing between massive-star and stripped-star evolutionary channels.

OBSERVING DESCRIPTION

We will obtain far-UV spectroscopy of HD 45166 with HST/STIS using the E140H grating and the 31X0.05NDA aperture. The observations are divided into three single-orbit visits, each using TIME-TAG mode, with no special scheduling constraints. The three E140H settings together provide the required FUV spectral coverage at a resolving power of approximately $R = 14,000$. The neutral-density aperture is required because of the high UV brightness of HD 45166. Each orbit will provide an exposure of approximately 2300 s, yielding an expected S/N of 23 near 1550 Å. The resulting spectra will resolve the narrow photospheric and wind features of the qWR component and provide key diagnostics of its ionization structure, chemical abundances, wind velocity field, and mass-loss properties.

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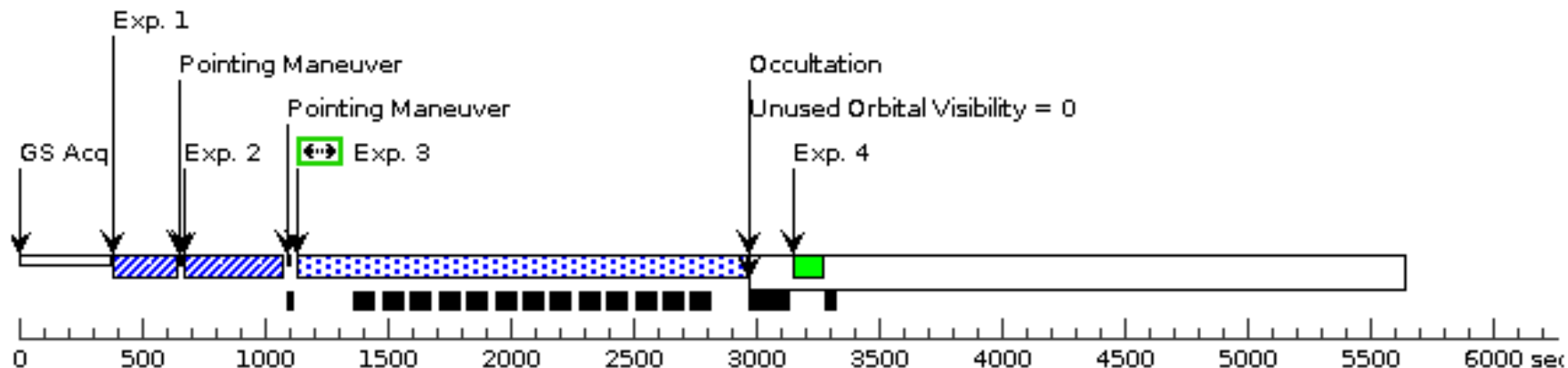
Visit	Proposal 18414, Visit 01 Tue Aug 18 19:00:57 GMT 2026				
	Diagnostic Status: Warning Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: (none)				
Diagnosics	(Visit 01) Warning (Orbit Planner): STIS TIME-TAG EXPOSURE GENERATES HEAVY DATA VOLUME				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	HD-45166	RA: 06 26 19.1552 (96.5798133d) Dec: +07 58 28.06 (7.97446d) Equinox: J2000	Proper Motion RA: -0.389 mas/yr Proper Motion Dec: -0.3390000983927166 mas/yr Parallax: 9.955E-4" Epoch of Position: 2000	V=9.88 Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=STAR Description=[B6-B9.5 V-IV, COMPOSITE SPECTRAL TYPE, EMISSION LINE STAR, WOLF RAYET]					

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Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ	(1) HD-45166	STIS/CCD, ACQ, 50CCD	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	2	ACQ-PEAK	(1) HD-45166	STIS/CCD, ACQ/PEAK, 31X0.05NDA	MIRROR				5 Secs (5 Secs)	
									[==>]	[1]
	3	Science 1 (STIS.sp.23 66731)	(1) HD-45166	STIS/FUV-MAMA, TIME-TAG, 31X0.05NDA	E140H 1416 A	WAVECAL=NO; BUFFER-TIME=11 4			1694 Secs (1694 Secs)	
									[==>]	[1]
	Comments: Exposure time (seconds) = 1,694.0000 at wavelength 1400.00 A gives: SNR = 25.2033 (per resolution element) https://etc.stsci.edu/etc/results/STIS.sp.2366731/									
	4	WAVE	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A				[==>]	[1]
	5	Science 2 (STIS.sp.23 66736)	(1) HD-45166	STIS/FUV-MAMA, TIME-TAG, 31X0.05NDA	E140H 1234 A	BUFFER-TIME=12 4; WAVECAL=NO			2395 Secs (2395 Secs)	
									[==>]	[2]
	Comments: Exposure time (seconds) = 2,395.0000 at wavelength 1200.00 A gives: SNR = 19.8204 (per resolution element) https://etc.stsci.edu/etc/results/STIS.sp.2366736/									
	6	WAVE	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1234 A				[==>]	[2]
	7	Science 3 (STIS.sp.23 66737)	(1) HD-45166	STIS/FUV-MAMA, TIME-TAG, 31X0.05NDA	E140H 1598 A	BUFFER-TIME=29 5; WAVECAL=NO			2395 Secs (2395 Secs)	
									[==>]	[3]
	Comments: Exposure time (seconds) = 2,395.0000 at wavelength 1600.00 A gives: SNR = 19.6822 (per resolution element) https://etc.stsci.edu/etc/results/STIS.sp.2366737/									
	8	WAVE	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				[==>]	[3]

Orbit 1

Server Version: 20260618



Orbit 2

Server Version: 20260618

