



## 16708 - Testing the Existence of a 3 Solar Mass Dark Companion to V723 Mon

Cycle: 29, 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>
01	(1) V-V723-MON	STIS/CCD	1	18-Jan-2022 12:00:11.0	yes
02	(1) V-V723-MON	STIS/CCD	1	18-Jan-2022 12:00:12.0	yes
52	(1) V-V723-MON	STIS/CCD	1	18-Jan-2022 12:00:13.0	yes

3 Total Orbits Used

### ABSTRACT

The bright, nearby star V723 Mon has a 3 Solar mass dark companion, most easily explained as a mass gap black hole. There is no optical spectral evidence for a stellar companion, nor are there continuum eclipses, but there is evidence of a non-stellar, blue "veiling" light and eclipses of the Balmer lines. Extraordinary claims require extraordinary evidence, and

so it is important to better characterize the excess UV emission. Because all but one (UVM2) of the Swift UV filters have red leaks, the shape of the UV spectral energy distribution (SED) cannot be measured with Swift in the presence of V723 Mon. A rising UV SED would strongly suggest the presence of a hot stellar companion. More generally, the UV emission is not dominated by the red giant and so is the best place to search for spectral features from any stellar companion. If it is not stellar emission, the UV is also an important probe of the origin of the claimed "veiling" light source. These questions are easily addressed with two one orbit STIS/CCD/G230LB spectra, one in eclipse and one out of eclipse.

## **OBSERVING DESCRIPTION**

The goal is a UV spectrum when the companion is in eclipse, and one when it is not. The in eclipse observation is pretty tightly constrained. The eclipse is estimated to last 5 days, and the observations are constrained to be in the three days centered on opposition. The out of eclipse observation is pretty lightly constrained to be any time from quadrature to quadrature. Since there is no need to do the observations in the same orbit, this means that the out of eclipse observations are not highly constrained even though the in eclipse observations are. The visit planner still reports that both observations can be scheduled, although the in eclipse observations have only two full windows and then one fractional window.

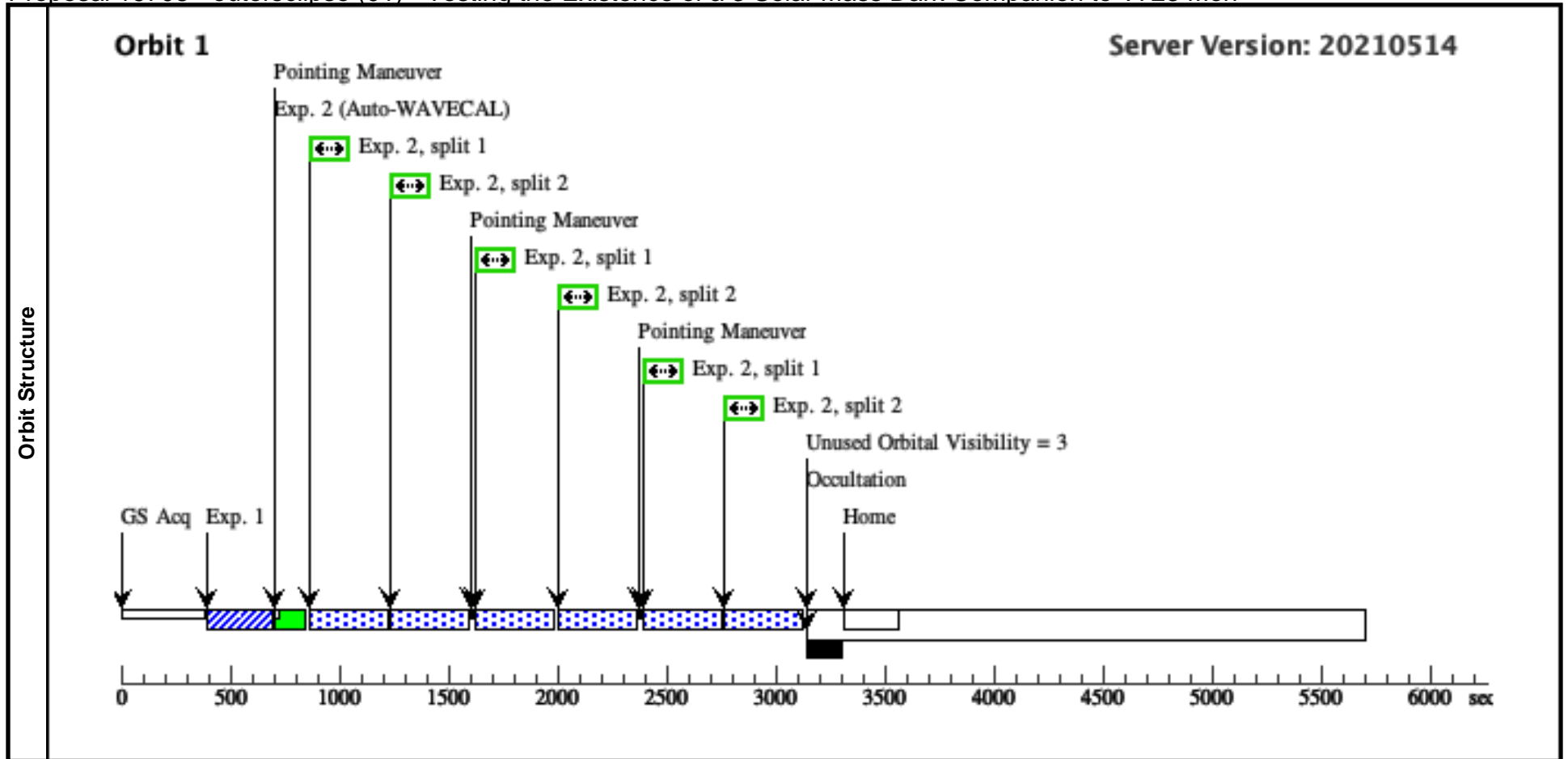
The target star is a very bright red giant ( $V \sim 8.3$ ), so the acquisition image is very short (2 sec). Even with the  $10^{-3}$  neutral density filter, the expected signal-to-noise ratio of the image is very high. We have supplied the ETC run code, and it would probably be good to have a sanity check. With the 0.2 arcsec slit, the plan is to use only a acquisition image and not the additional slit image mode. The target position and proper motion was imported from SIMBAD -- this is the first time I have dealt with a source with a proper motion -- it all looks OK to me.

The spectra are taken in 6 equal time observations at 3 along slit dithers each with 2 CR-split images. We have Swift UV observations (unfortunately only in one filter since the others have red leaks) and so we know the UV flux. Based on this flux, and the U band flux of the giant, we should not have any problems with saturation in the spectra. The 0.5 arcsec dither spacing exceeds the width of the spectral extraction width (although it is surprising that the manuals only give a "make it bigger than this" rather than "we recommend a dither of X for point sources").

Proposal 16708 - outofeclipse (01) - Testing the Existence of a 3 Solar Mass Dark Companion to V723 Mon

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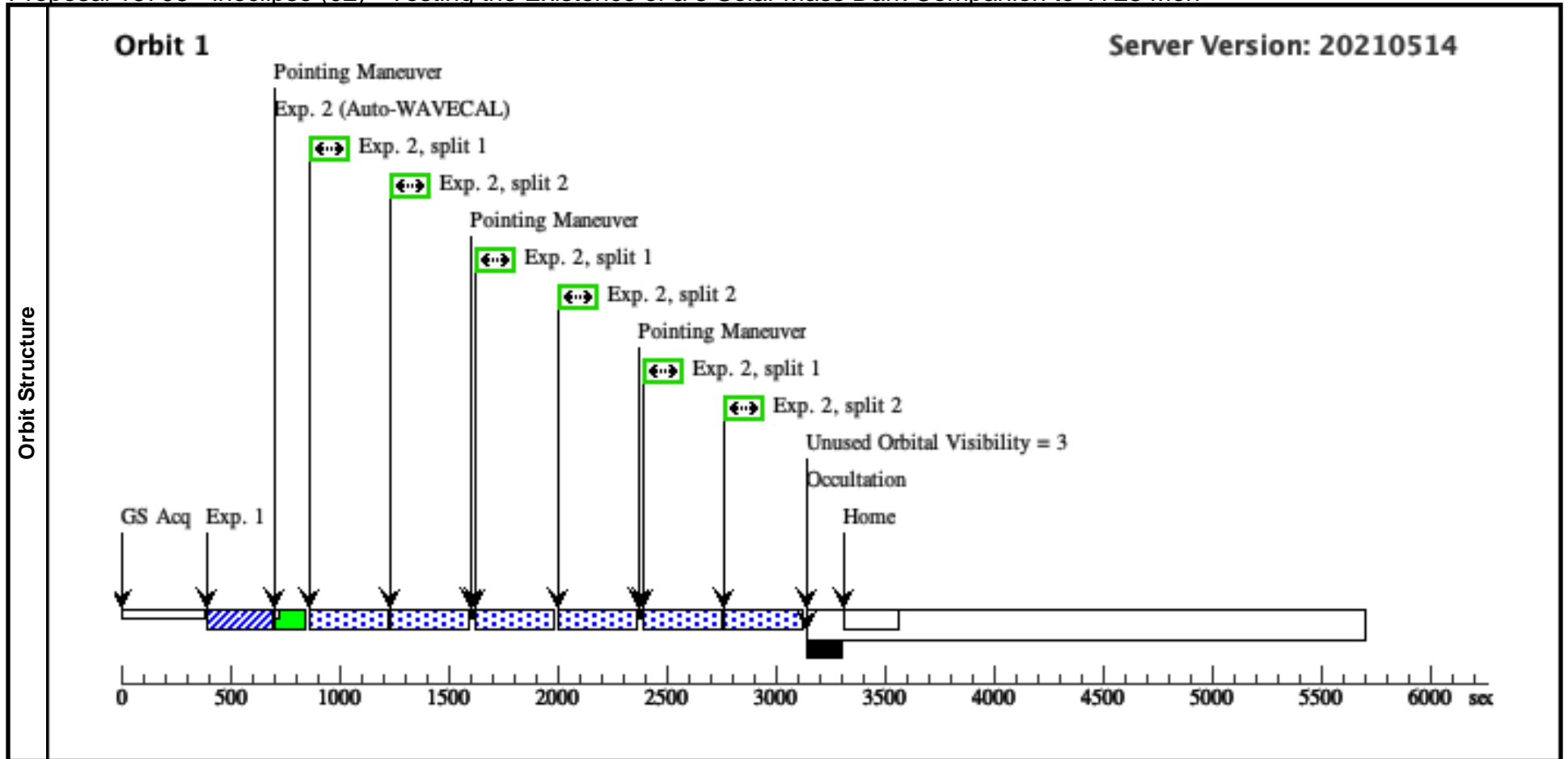
<b>Visit</b>	<b>Proposal 16708, outofeclipse (01), completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: STIS/CCD Special Requirements: BETWEEN 03-OCT-2021:00:00:00 AND 02-NOV-2021:00:00:00; BETWEEN 02-DEC-2021:00:00:00 AND 01-JAN-2022:00:00:00; BETWEEN 31-JAN-2022:00:00:00 AND 02-MAR-2022:00:00:00; BETWEEN 01-APR-2022:00:00:00 AND 01-MAY-2022:00:00:00; BETWEEN 31-MAY-2022:00:00:00 AND 30-JUN-2022:00:00:00; BETWEEN 31-JUL-2022:00:00:00 AND 29-AUG-2022:00:00:00; BETWEEN 04-AUG-2021:00:00:00 AND 03-SEP-2021:00:00:00 Comments: <i>Observation of V723 Mon with the companion out of eclipse - observe any time between quadratures</i>										
	<b>Patterns</b>	<b>#</b>	<b>Primary Pattern</b>				<b>Secondary Pattern</b>			<b>Exposures</b>	
(1)		Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG						(2)		
		Purpose=DITHER	Pattern Orientation=90.0								
		Number Of Points=3	Angle Between Sides=								
		Point Spacing=0.50	Center Pattern=false								
		Line Spacing=									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>		<b>Targ. Coord. Corrections</b>		<b>Fluxes</b>	<b>Miscellaneous</b>			
	(1)	V-V723-MON	RA: 06 29 4.6572 (97.2694050d)	Dec: -05 34 19.98 (-5.57222d)	Equinox: J2000	Proper Motion RA: -1.513 mas/yr	Proper Motion Dec: 15.840 mas/yr	V=8.28	Reference Frame: ICRS		
						Epoch of Position: 2015.5	B 9.2 Vega, Swift UVM2 14.1 AB				
	Comments: <i>This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[G III-I]										
<b>Exposures</b>	<b>#</b>	<b>Label (ETC Run)</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>		<b>Orbit</b>
	1	(STIS.ta.152 5259)	(1) V-V723-MON	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs)		
									[=>]		[1]
	2		(1) V-V723-MON	STIS/CCD, ACCUM, 52X0.2E1	G230LB 2375 A	CR-SPLIT=2		Pattern 1, Exps 2-2 in outofeclipse (01) (1)	655 Secs (1953 Secs)		
								[=>>325.5 Secs (Pattern 1, Split 1)]		[1]	
								[=>>325.5 Secs (Pattern 1, Split 2)]			
								[=>>325.5 Secs (Pattern 2, Split 1)]			
								[=>>325.5 Secs (Pattern 2, Split 2)]			
								[=>>325.5 Secs (Pattern 3, Split 1)]			
								[=>>325.5 Secs (Pattern 3, Split 2)]			



Proposal 16708 - ineclipse (02) - Testing the Existence of a 3 Solar Mass Dark Companion to V723 Mon

Tue Jan 18 17:00:13 GMT 2022

<b>Visit</b>	<b>Proposal 16708, ineclipse (02), failed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: STIS/CCD Special Requirements: BETWEEN 16-NOV-2021:02:09:00 AND 18-NOV-2021:11:42:00; BETWEEN 15-JAN-2022:00:42:00 AND 17-JAN-2022:10:15:00; BETWEEN 15-MAR-2022:23:16:00 AND 18-MAR-2022:08:48:00; BETWEEN 14-MAY-2022:21:49:00 AND 17-MAY-2022:07:22:00; BETWEEN 13-JUL-2022:20:22:00 AND 16-JUL-2022:05:55:00; BETWEEN 11-SEP-2022:18:56:00 AND 14-SEP-2022:04:28:00; BETWEEN 17-SEP-2021:03:36:00 AND 19-SEP-2021:13:08:00 Comments: observation of V723 Mon when the companion is in eclipse -- observations are 3 day windows centered on the estimated 5 day eclipse period									
	<b>Patterns</b>	<b>#</b>	<b>Primary Pattern</b>				<b>Secondary Pattern</b>			
(1)		Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG							(2)
		Purpose=DITHER	Pattern Orientation=90.0							
		Number Of Points=3	Angle Between Sides=							
		Point Spacing=0.50	Center Pattern=false							
		Line Spacing=								
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>		<b>Fluxes</b>	<b>Miscellaneous</b>			
	(1)	V-V723-MON	RA: 06 29 4.6572 (97.2694050d) Dec: -05 34 19.98 (-5.57222d) Equinox: J2000	Proper Motion RA: -1.513 mas/yr Proper Motion Dec: 15.840 mas/yr Epoch of Position: 2015.5	V=8.28 B 9.2 Vega, Swift UVM2 14.1 AB	Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=STAR Description=[G III-I]									
<b>Exposures</b>	<b>#</b>	<b>Label (ETC Run)</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>	<b>Orbit</b>
	1	(STIS.ta.152 5259)	(1) V-V723-MON	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs)	
									[==>]	[1]
	2		(1) V-V723-MON	STIS/CCD, ACCUM, 52X0.2E1	G230LB 2375 A	CR-SPLIT=2		Pattern 1, Exps 2-2 in ineclipse (02) (1)	675 Secs (1953 Secs)	
									[==>325.5 Secs (Pattern 1, Split 1)] [==>325.5 Secs (Pattern 1, Split 2)] [==>325.5 Secs (Pattern 2, Split 1)] [==>325.5 Secs (Pattern 2, Split 2)] [==>325.5 Secs (Pattern 3, Split 1)] [==>325.5 Secs (Pattern 3, Split 2)]	[1]



Proposal 16708 - ineclipse (52) - Testing the Existence of a 3 Solar Mass Dark Companion to V723 Mon

Tue Jan 18 17:00:13 GMT 2022

<b>Visit</b>	<b>Proposal 16708, ineclipse (52)</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: STIS/CCD Special Requirements: BETWEEN 16-NOV-2021:02:09:00 AND 18-NOV-2021:11:42:00; BETWEEN 15-JAN-2022:00:42:00 AND 17-JAN-2022:10:15:00; BETWEEN 15-MAR-2022:23:16:00 AND 18-MAR-2022:08:48:00; BETWEEN 14-MAY-2022:21:49:00 AND 17-MAY-2022:07:22:00; BETWEEN 13-JUL-2022:20:22:00 AND 16-JUL-2022:05:55:00; BETWEEN 11-SEP-2022:18:56:00 AND 14-SEP-2022:04:28:00; BETWEEN 17-SEP-2021:03:36:00 AND 19-SEP-2021:13:08:00 Comments: observation of V723 Mon when the companion is in eclipse -- observations are 3 day windows centered on the estimated 5 day eclipse period									
	<b>Patterns</b>	<b>#</b>	<b>Primary Pattern</b>				<b>Secondary Pattern</b>			<b>Exposures</b>
(1)		Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG						(2)	
		Purpose=DITHER	Pattern Orientation=90.0							
		Number Of Points=3	Angle Between Sides=							
		Point Spacing=0.50	Center Pattern=false							
		Line Spacing=								
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>		<b>Fluxes</b>	<b>Miscellaneous</b>			
	(1)	V-V723-MON	RA: 06 29 4.6572 (97.2694050d) Dec: -05 34 19.98 (-5.57222d) Equinox: J2000	Proper Motion RA: -1.513 mas/yr Proper Motion Dec: 15.840 mas/yr Epoch of Position: 2015.5		V=8.28 B 9.2 Vega, Swift UVM2 14.1 AB	Reference Frame: ICRS			
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=STAR Description=[G III-I]									
<b>Exposures</b>	<b>#</b>	<b>Label (ETC Run)</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>	<b>Orbit</b>
	1	(STIS.ta.152 (1) V-V723-MON 5259)	(1) V-V723-MON	STIS/CCD, ACQ, F25ND3	MIRROR				2 Secs (2 Secs)	
									[==>]	[1]
	2		(1) V-V723-MON	STIS/CCD, ACCUM, 52X0.2E1	G230LB 2375 A	CR-SPLIT=2		Pattern 1, Exps 2-2 in ineclipse (52) (1)	675 Secs (1953 Secs)	
									[==>325.5 Secs (Pattern 1, Split 1)] [==>325.5 Secs (Pattern 1, Split 2)] [==>325.5 Secs (Pattern 2, Split 1)] [==>325.5 Secs (Pattern 2, Split 2)] [==>325.5 Secs (Pattern 3, Split 1)] [==>325.5 Secs (Pattern 3, Split 2)]	[1]

