



13052 - A Massive Star Census of the Starburst Cluster R136

Cycle: 20, 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	(2) R136-SE9 (4) R136-SE8 (5) R136-SE7 (6) R136-SE6 (7) R136-SE5 (8) R136-SE4 (9) R136-SE3 (10) R136-SE2 (11) R136-SE1 (12) R136-NW1 (22) MELNICK34	STIS/CCD	4	06-Jul-2012 22:20:23.0	yes
02	(13) R136-NW2 (14) R136-NW3 (15) R136-NW4 (16) R136-NW5 (17) R136-NW6 (18) R136-NW7 (19) R136-NW8 (22) MELNICK34	STIS/CCD	3	06-Jul-2012 22:20:52.0	yes

7 Total Orbits Used

ABSTRACT

We propose to carry out a comprehensive census of the most massive stars in the central parsec (4") of the starburst cluster, R136, which powers the Tarantula Nebula in the LMC. R136 is both sufficiently massive that the upper mass function is richly populated and young enough that its most massive stars have yet to explode as supernovae. The identification of very massive stars in R136, up to 300 solar masses, raises general questions of star formation, binarity and feedback in young massive clusters. The proposed STIS spectral survey of ~36 stars more massive than ~50 solar masses within R136 is ground-breaking, of legacy value, and is specifically tailored to a) yield physical properties; b) detect the majority of binaries by splitting observations between Cycles 19 and 20; c) measure rotational velocities, relevant for predictions of rotational mixing; d) quantify mass-loss properties for very massive stars; e) determine surface compositions; f) measure radial velocities, relevant for runaway stars and cluster dynamics; g) quantify radiative and mechanical feedback. This census will enable the mass function of very massive stars to be measured for the first time, as a

result of incomplete and inadequate spectroscopy to date. It will also perfectly complement our Tarantula Survey, a ground-based VLT Large Programme, by including the most massive stars that are inaccessible to ground-based visual spectroscopy due to severe crowding. These surveys, together with existing integrated UV and optical studies will enable 30 Doradus to serve as a bona-fide template for unresolved extragalactic starburst regions.

OBSERVING DESCRIPTION

Completion of Cycle 19 (GO 12465) UV + optical slit scan across LMC star cluster R136 from SE to NW. Due to severe crowding in cluster core, initial acquisition (+ pickup) is of an isolated bright star Melnick 34. Offset positions and position angle 64 degrees (E of N) are selected to ensure that both R136a1 and a2 are included in NW1 slit (offset: -1.863 sec in RA and +2.97 arcsec in Dec with respect to Melnick 34). Execution split across Cycles 19 and 20 to search for long period binaries.

REAL TIME JUSTIFICATION

Visit 1 G430M setup requested in Oct 2012 window to ensure 6 month baseline with respect to Cycle 19 G430M visit (SE9-NW1, Apr 2012) necessary to search for radial velocity variations (resulting from potential long period binary companions). Similarly Visit 2 setup requested for Apr 2013 window, since other G430M visits for NW2-NW8 scheduled for Oct 2012.

ADDITIONAL COMMENTS

ICRS coordinates for Melnick 34 are obtained from 2MASS. F555W photometry of brightest source in each slit is obtained from WFC3 images (De Marchi et al. 2011). Visits 1 + 2 in GO 13052 identical to visits 1 + 7 for GO 12465 except for G430M wavelength setup (3936 -> 4194).

Proposal 13052 - Visit 01 - A Massive Star Census of the Starburst Cluster R136

Visit	Proposal 13052, Visit 01, implementation				Sat Jul 07 02:21:03 GMT 2012
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD				
	Special Requirements: ORIENT 109D TO 109 D; ORIENT 289D TO 289 D; BETWEEN 19-OCT-2012 AND 29-OCT-2012				
	Comments: STIS G430M/4194 scan (52x0.2 arcsec) across star cluster R136 at 10 (visit 1) + 7 (visit 2) adjoining slit positions (PA=64 degrees). ORIENT = PA+45 or PA+180+45 = 109 or 289				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(4)	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=2 Point Spacing=0.35546 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=false		(3), (4), (5), (6), (7), (8), (9), (10), (11), (12)

Proposal 13052 - Visit 01 - A Massive Star Census of the Starburst Cluster R136

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(2)	R136-SE9	Offset from MELNICK34 by RA Offset: -1.715 Secs Dec Offset: 1.35 Arcsec		V=14.74	Offset Position (R136-SE9) Reference Frame: ICRS
	<i>Comments: -9.176 arcsec RA, 1.350 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit Hunter 55 (VEGA V = 14.74)</i>					
	(4)	R136-SE8	Offset from MELNICK34 by RA Offset: -1.731 Secs Dec Offset: 1.53 Arcsec		V=13.24	Offset Position (R136-SE8) Reference Frame: ICRS
	<i>Comments: -9.264 arcsec RA, +1.530 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - R136B (VEGA V = 13.24)</i>					
	(5)	R136-SE7	Offset from MELNICK34 by RA Offset: -1.748 Secs Dec Offset: 1.71 Arcsec		V=14.65	Offset Position (R136-SE7) Reference Frame: ICRS
	<i>Comments: -9.352 arcsec RA, +1.710 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 45 (VEGA V = 14.65)</i>					
	(6)	R136-SE6	Offset from MELNICK34 by RA Offset: -1.764 Secs Dec Offset: 1.89 Arcsec		V=15.79	Offset Position (R136-SE6) Reference Frame: ICRS
	<i>Comments: -9.439 arcsec RA, +1.890 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 116 (VEGA V = 15.788)</i>					
	(7)	R136-SE5	Offset from MELNICK34 by RA Offset: -1.78 Secs Dec Offset: 2.07 Arcsec		V=15.1	Offset Position (R136-SE5) Reference Frame: ICRS
	<i>Comments: -9.527 arcsec RA, +2.070 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter69 (VEGA B = 15.1)</i>					
	(8)	R136-SE4	Offset from MELNICK34 by RA Offset: -1.797 Secs Dec Offset: 2.25 Arcsec		V=15.13	Offset Position (R136-SE4) Reference Frame: ICRS
	<i>Comments: -9.615 arcsec RA, +2.250 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 73 (VEGA V = 15.13)</i>					
	(9)	R136-SE3	Offset from MELNICK34 by RA Offset: -1.813 Secs Dec Offset: 2.43 Arcsec		V=14.41	Offset Position (R136-SE3) Reference Frame: ICRS
	<i>Comments: -9.703 arcsec RA, +2.430 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 3 (VEGA V = 14.41)</i>					
	(10)	R136-SE2	Offset from MELNICK34 by RA Offset: -1.83 Secs Dec Offset: 2.61 Arcsec		V=14.65	Offset Position (R136-SE2) Reference Frame: ICRS
	<i>Comments: -9.790 arcsec RA, +2.610 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 50 (VEGA V = 14.65)</i>					
	(11)	R136-SE1	Offset from MELNICK34 by RA Offset: -1.846 Secs Dec Offset: 2.79 Arcsec		V=12.97	Offset Position (R136-SE1) Reference Frame: ICRS
	<i>Comments: -9.878 arcsec RA, +2.790 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit R136a3 (VEGA V = 12.97)</i>					
	(12)	R136-NW1	Offset from MELNICK34 by RA Offset: -1.863 Secs Dec Offset: 2.97 Arcsec		V=12.28	Offset Position (R136-NW1) Reference Frame: ICRS
	<i>Comments: -9.966 arcsec RA, +2.970 arcsec Dec offset (R136a1/a2) from Mk34 in WFC3 V555W image. Brightest cluster star in slit R136a1 (VEGA V = 12.28)</i>					

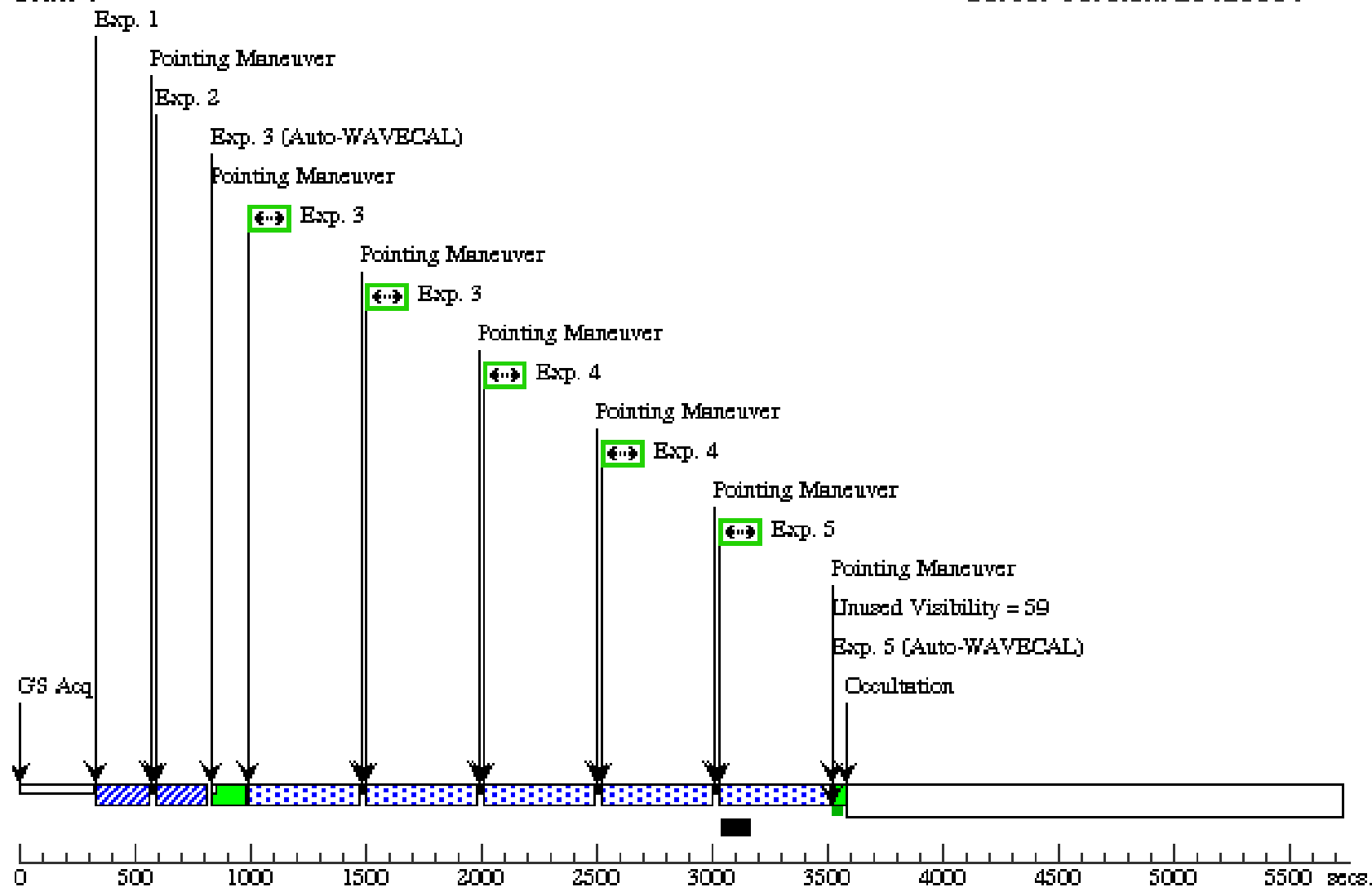
Proposal 13052 - Visit 01 - A Massive Star Census of the Starburst Cluster R136

Exposures	(22)	MELNICK34	RA: 05 38 44.2460 (84.6843583d) Dec: -69 06 5.85 (-69.10163d) Equinox: J2000	V=13.09+/-0.01 B-V = 0.25	Reference Frame: ICRS					
	Comments: VEGAMAG Photometry from WFC3 F555W Early Release Obervation IB6WD6050 (De Marchi et al. 2011). ICRS astrometry of Melnick 34 (2MASS 05384424-6906058). Used for acquisition due to severe crowding within R136 itself.									
	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(197926)	(22) MELNICK34	STIS/CCD, ACQ, F28X50LP	MIRROR				1 Secs [==>]	[1]
	Comments: ETC predicts S/N=174 for 1 sec exposure through F28X50LP aperture for Melnick 34 (V=13.09).									
	2	(198019)	(22) MELNICK34	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				0.5 Secs [==>]	[1]
	Comments: Peakup on Melnick 34 for accurate positioning prior to offset. ETC predicts 58,000 e- from source in 0.5 sec exposure through 52x0.1 aperture for Melnick 34 (V=13.09), order of magnitude below saturati on level.									
	3		(2) R136-SE9	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 3-3 i n Visit 01 (4)	440 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	4		(4) R136-SE8	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 4-4 i n Visit 01 (4)	440 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	5		(5) R136-SE7	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 5-5 i n Visit 01 (4)	440 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1] [2]
	6		(6) R136-SE6	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 6-6 i n Visit 01 (4)	570 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[2]
	7		(7) R136-SE5	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 7-7 i n Visit 01 (4)	570 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[2]
	8		(8) R136-SE4	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 8-8 i n Visit 01 (4)	540 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[3]
	9		(9) R136-SE3	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 9-9 i n Visit 01 (4)	540 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[3]
	10		(10) R136-SE2	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 10-1 0 in Visit 01 (4)	540 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[3] [4]
	11		(11) R136-SE1	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 11-1 1 in Visit 01 (4)	540 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[4]
	12		(12) R136-NW1	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 12-1 2 in Visit 01 (4)	540 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[4]

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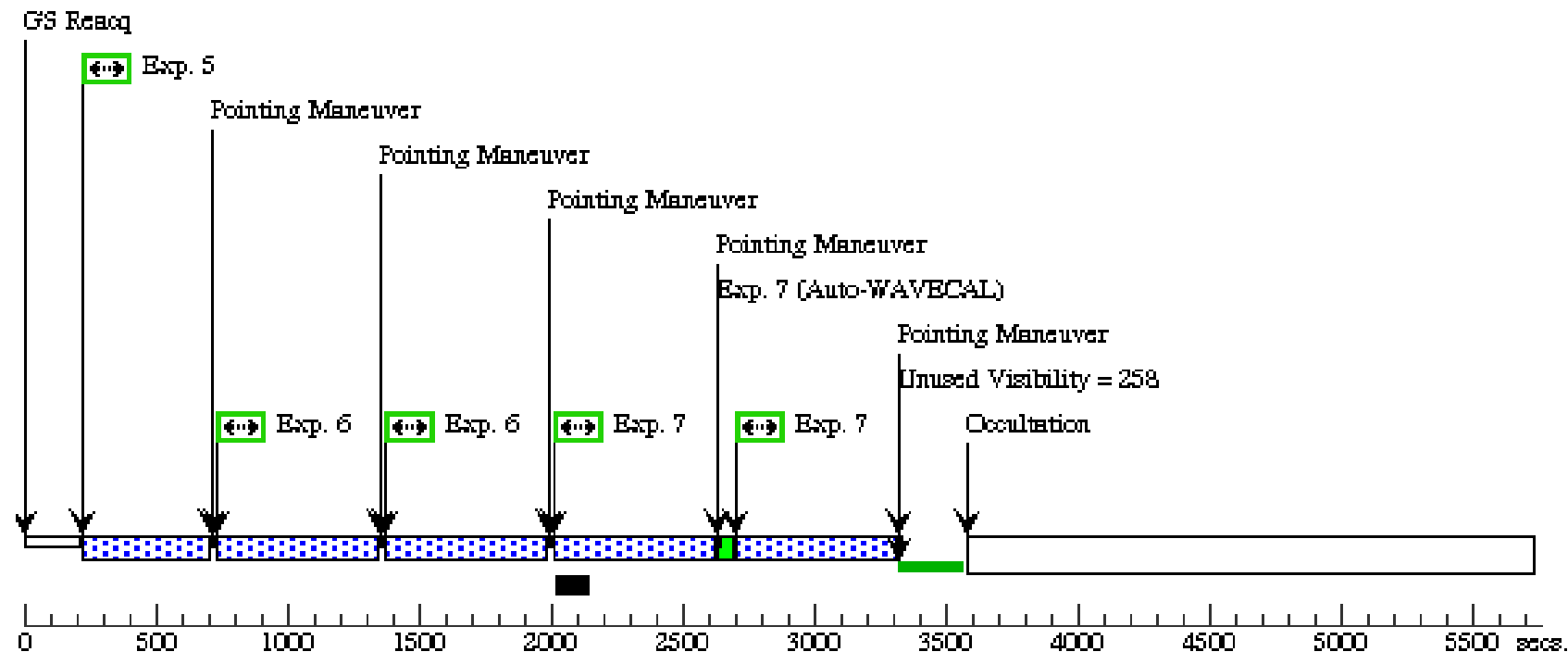
Orbit Structure

Orbit 1



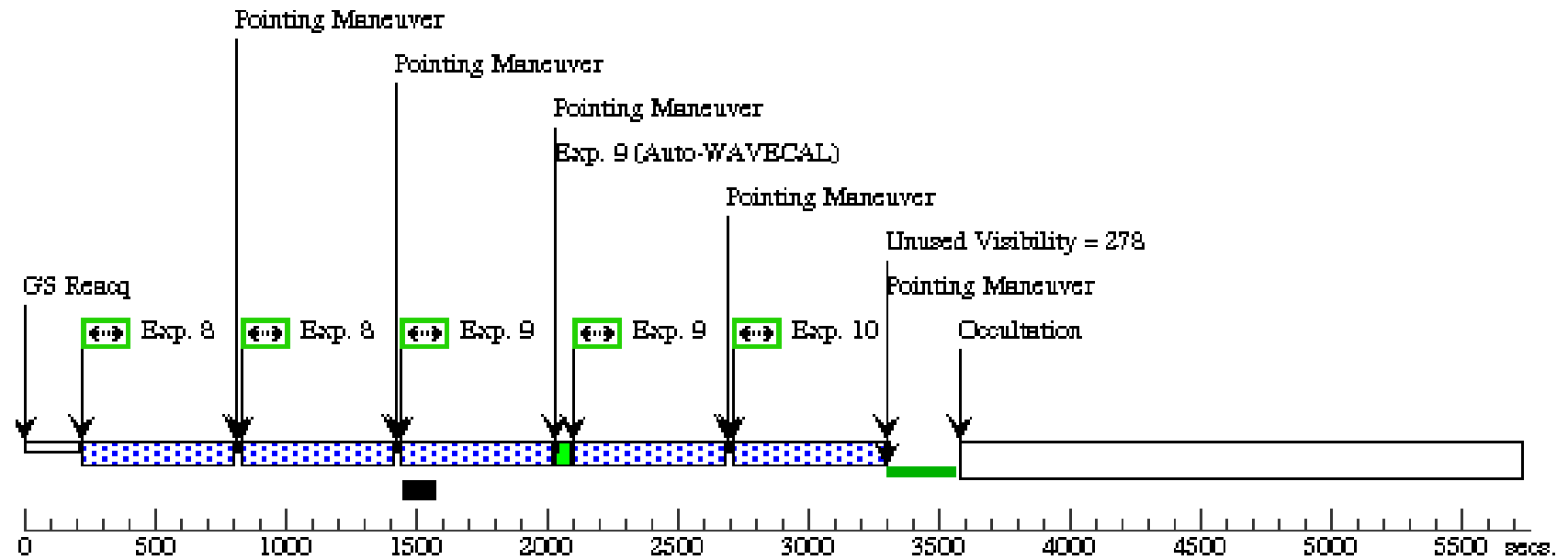
Orbit 2

Server Version: 20120604



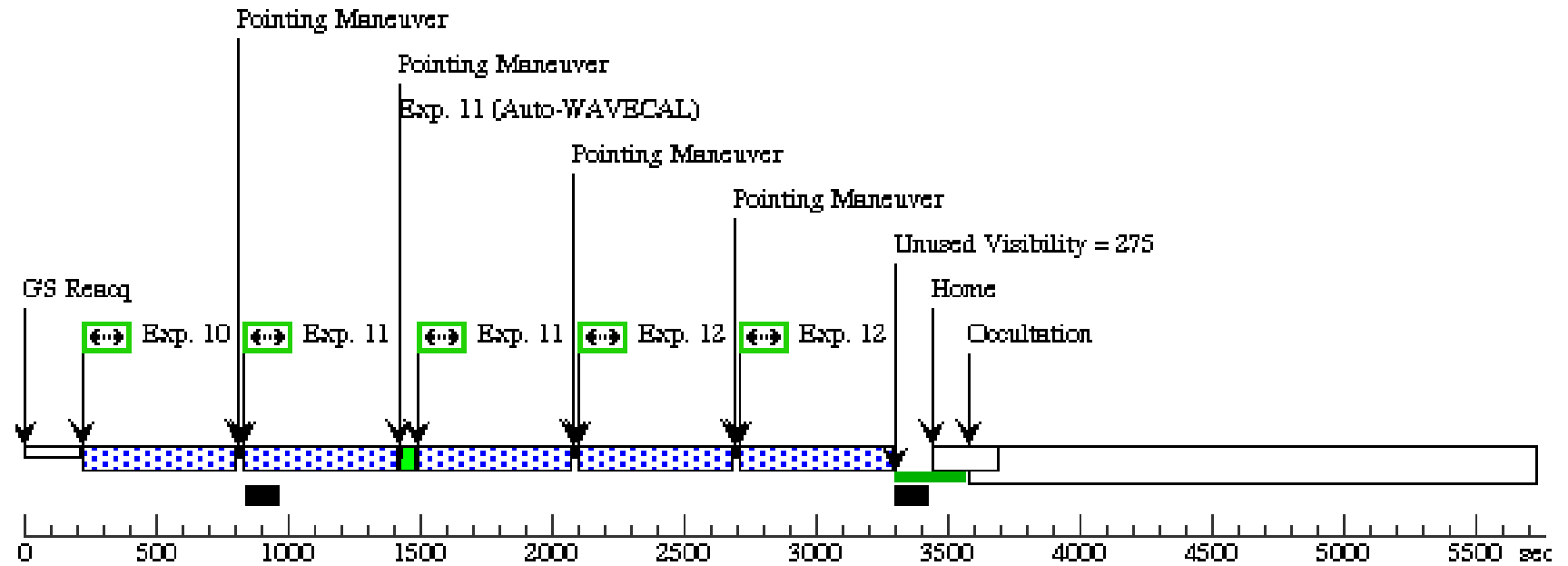
Orbit 3

Server Version: 20120604



Orbit 4

Server Version: 20120604



Proposal 13052 - Visit 02 - A Massive Star Census of the Starburst Cluster R136

Visit	Proposal 13052, Visit 02			Sat Jul 07 02:21:11 GMT 2012
	Diagnostic Status: No Diagnostics			
	Scientific Instruments: STIS/CCD			
	Special Requirements: ORIENT 109D TO 109 D; ORIENT 289D TO 289 D; BETWEEN 01-APR-2013 AND 09-APR-2013			
	Comments: STIS G430M/4194 slit scan (52x0.2 arcsec) across R136 at 10 (visit 1) + 7 (visit 2) adjoining positions (PA=64 degrees). ORIENT = PA+45 or PA+180+45 = 109 or 289			
Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(4)	Pattern Type=STIS-ALONG-SLIT Purpose=DITHER Number Of Points=2 Point Spacing=0.35546 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=90.0 Angle Between Sides= Center Pattern=false		(3), (4), (5), (6), (7), (8), (9)

Proposal 13052 - Visit 02 - A Massive Star Census of the Starburst Cluster R136

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(13)	R136-NW2	Offset from MELNICK34 by RA Offset: -1.879 Secs Dec Offset: 3.15 Arcsec		V=13.97	Offset Position (R136-NW2) Reference Frame: ICRS
	<i>Comments: -10.054 arcsec RA, +3.150 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - R136a7 (VEGA V = 13.97)</i>					
	(14)	R136-NW3	Offset from MELNICK34 by RA Offset: -1.895 Secs Dec Offset: 3.33 Arcsec		V=13.41	Offset Position (R136-NW3) Reference Frame: ICRS
	<i>Comments: -10.142 arcsec RA, +3.330 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - R136a4+a8 (VEGA V = 13.41)</i>					
	(15)	R136-NW4	Offset from MELNICK34 by RA Offset: -1.912 Secs Dec Offset: 3.51 Arcsec		V=14.21	Offset Position (R136-NW4) Reference Frame: ICRS
	<i>Comments: -10.229 arcsec RA, +3.510 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 30 (VEGA V = 14.21)</i>					
	(16)	R136-NW5	Offset from MELNICK34 by RA Offset: -1.928 Secs Dec Offset: 3.69 Arcsec		V=14.43	Offset Position (R136-NW5) Reference Frame: ICRS
	<i>Comments: -10.317 arcsec RA, 3.690 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 35 (VEGA V = 14.43)</i>					
	(17)	R136-NW6	Offset from MELNICK34 by RA Offset: -1.945 Secs Dec Offset: 3.87 Arcsec		V=15.46	Offset Position (R136-NW6) Reference Frame: ICRS
	<i>Comments: -10.405 arcsec RA, +3.870 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 92 (VEGA V = 15.46)</i>					
	(18)	R136-NW7	Offset from MELNICK34 by RA Offset: -1.961 Secs Dec Offset: 4.05 Arcsec		V=15.03	Offset Position (R136-NW7) Reference Frame: ICRS
	<i>Comments: -10.493 arcsec RA, +4.050 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 64 (VEGA V = 15.03)</i>					
	(19)	R136-NW8	Offset from MELNICK34 by RA Offset: -1.977 Secs Dec Offset: 4.23 Arcsec		V=14.56	Offset Position (R136-NW8) Reference Frame: ICRS
	<i>Comments: -10.580 arcsec RA, +4.230 arcsec Dec offset from Mk34 in WFC3 V555W image. Brightest cluster star in slit - Hunter 40 (VEGA V = 14.56)</i>					
	(22)	MELNICK34	RA: 05 38 44.2460 (84.6843583d) Dec: -69 06 5.85 (-69.10163d) Equinox: J2000		V=13.09+/-0.01 B-V = 0.25	Reference Frame: ICRS
	<i>Comments: VEGAMAG Photometry from WFC3 F555W Early Release Observation IB6WD6050 (De Marchi et al. 2011). ICRS astrometry of Melnick 34 (2MASS 05384424-6906058). Used for acquisition due to severe crowding within R136 itself.</i>					

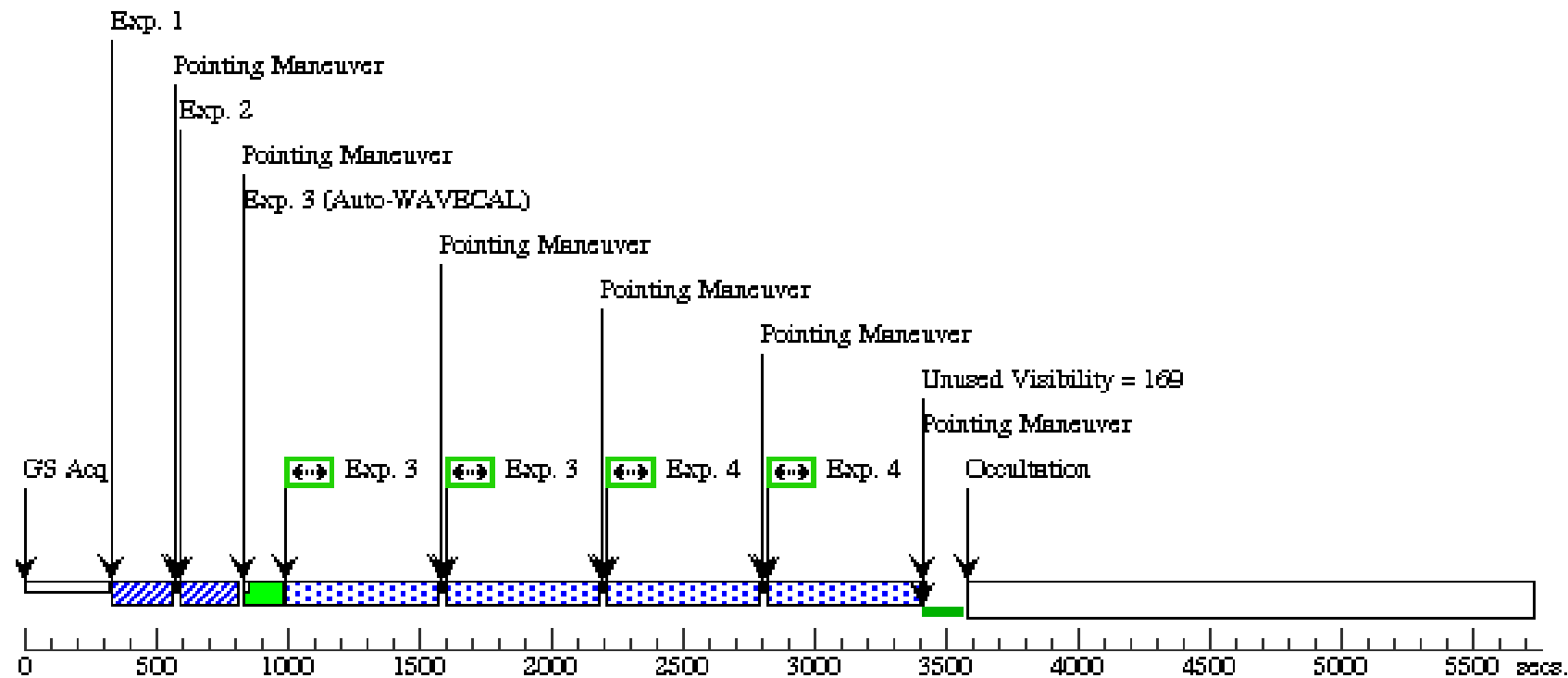
Proposal 13052 - Visit 02 - A Massive Star Census of the Starburst Cluster R136

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(197926)	(22) MELNICK34	STIS/CCD, ACQ, F28X50LP	MIRROR				1 Secs	
									[==>]	[1]
	Comments: ETC predicts S/N=174 for 1 sec exposure through F28X50LP aperture for Melnick 34 (V=13.09).									
	2	(198019)	(22) MELNICK34	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				0.5 Secs	
									[==>]	[1]
	Comments: Peakup on Melnick 34 for accurate positioning prior to offset. ETC predicts 58,000 e- from source in 0.5 sec exposure through 52x0.1 aperture for Melnick 34 (V=13.09), order of magnitude below saturation level.									
	3		(13) R136-NW2	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 3-3 in Visit 02 (4)	540 Secs	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	
Exposures	4		(14) R136-NW3	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 4-4 in Visit 02 (4)	540 Secs	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	
	5		(15) R136-NW4	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 5-5 in Visit 02 (4)	540 Secs	
									[==>(Pattern 1)]	[2]
									[==>(Pattern 2)]	
	6		(16) R136-NW5	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 6-6 in Visit 02 (4)	540 Secs	
									[==>(Pattern 1)]	[2]
									[==>(Pattern 2)]	
	7		(17) R136-NW6	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 7-7 in Visit 02 (4)	540 Secs	
Exposures									[==>(Pattern 1)]	[2]
									[==>(Pattern 2)]	
	8		(18) R136-NW7	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 8-8 in Visit 02 (4)	540 Secs	
									[==>(Pattern 1)]	[3]
									[==>(Pattern 2)]	
	9		(19) R136-NW8	STIS/CCD, ACCUM, 52X0.2	G430M 4194 A	CR-SPLIT=NO		Pattern 4, Exps 9-9 in Visit 02 (4)	540 Secs	
									[==>(Pattern 1)]	[3]
									[==>(Pattern 2)]	

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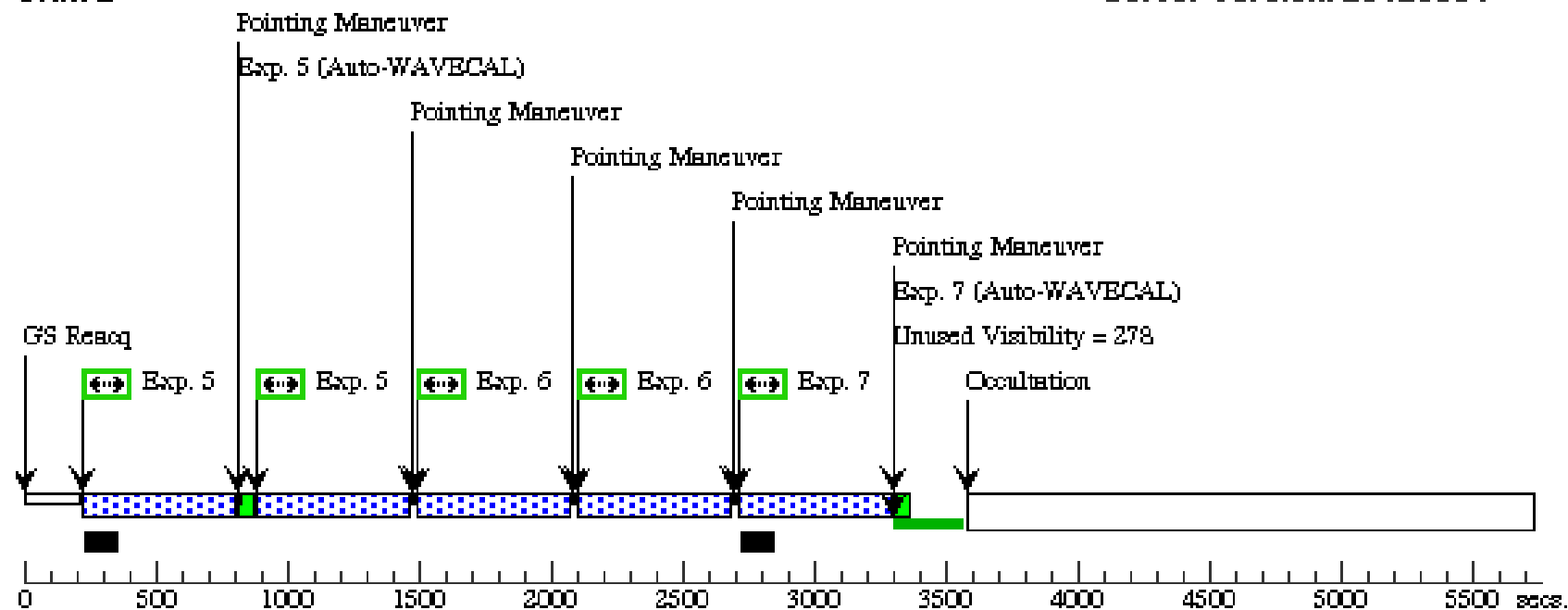
Orbit Structure

Orbit 1



Orbit 2

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Orbit 3

Server Version: 20120604

