



# 13437 - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Cycle: 21, 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) SGAS143845.1+145407	ACS/WFC WFC3/IR	2	30-Sep-2013 21:46:39.0	yes
02	(1) SGAS143845.1+145407	WFC3/IR	1	30-Sep-2013 21:46:48.0	yes
A1	BIAS	ACS/WFC	1	30-Sep-2013 21:46:53.0	yes
A2	BIAS	ACS/WFC	1	30-Sep-2013 21:46:57.0	yes
A3	BIAS	ACS/WFC	1	30-Sep-2013 21:47:01.0	yes
A4	BIAS	ACS/WFC	1	30-Sep-2013 21:47:05.0	yes

7 Total Orbits Used

## **ABSTRACT**

Evidence from both the SEDs and morphologies of vigorous starbursts at  $z \sim 1$  compared to local templates shows that the mode of star formation in these galaxies is distinctly different in the past compared to the present day. Locally these objects (luminous infrared galaxies - LIRGs) show compact nuclear star forming regions with hot dusty SEDs; distant objects of similar luminosity appear much cooler and show signs of star formation over much larger regions. At  $z \sim 1$  these galaxies dominate the star formation rate density; they are where most stars are being formed, and so studying these sources is critical to understanding the overall picture of galaxy evolution. In a recent paper we detail the discovery of SGAS1438+1454, a lensed LIRG at  $z=0.816$  that allows us to confirm this evolution of the mode of star formation in distant LIRGS in unprecedented detail. The lensed galaxy is a typical  $z \sim 1$  LIRG. With imaging data from g-band to 500 microns, and both optical and near-IR spectra in hand, we now seek to cap these extensive observations with a modest 3 orbit observation with HST. From the proposed data we will confirm the morphology and extent of the source with multi-band imaging, and directly measure the detailed distribution of star formation with an H-alpha grism observation. Extensive work shows that  $z \sim 1$  LIRGS are very different than today; with this lensed (but otherwise typical) LIRG and HST we will begin to illuminate how and why this difference exists.

## **OBSERVING DESCRIPTION**

ACS imaging in F606 and F814 in a single orbit. 3-point line dither using 1kx1k subraster to manage buffer dumps : total of 3 frames per filter.

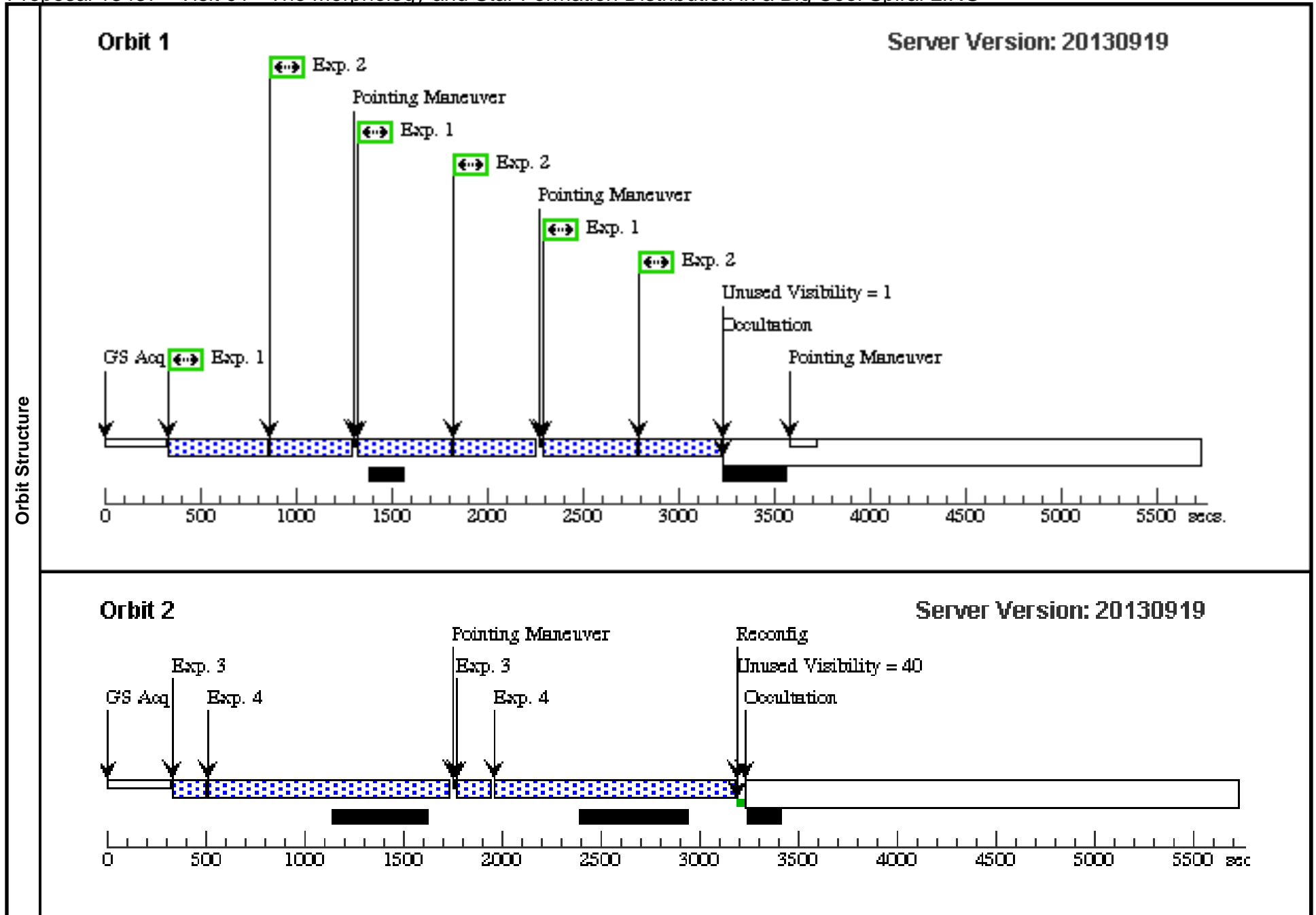
WFC3 grism observations at two roll angles, one orbit each angle. Two-point line dither for sub-pixel sampling; short F140W image taken at each position.

ACS imaging packaged with the first of the WFC3-IR grism orbits to make total program consist of one two-orbit visit and one one-orbit visit. ACS imaging packaged with the IR grism observation roll angle with greater visibility in an attempt to maximise schedulability.

Proposal 13437 - Visit 01 - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Tue Oct 01 01:47:12 GMT 2013

Visit	<b>Proposal 13437, Visit 01, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR, ACS/WFC Special Requirements: ORIENT 144D TO 159 D									
	#	Primary Pattern	Secondary Pattern	Exposures						
Patterns	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.1633 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides= Center Pattern=false		(1-2)						
	(2)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(3-4)						
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SGAS143845.1+145407	RA: 14 38 45.0300 (219.6876250d) Dec: +14 54 12.50 (14.90347d) Equinox: J2000		V=21.0+/-0.3	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) SGAS143845.1+145407	ACS/WFC, ACCUM, WFC1-2K	F606W			Pattern 1, Exps 1-2 in Visit 01 (1)	260 Secs (780 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[1]
	2		(1) SGAS143845.1+145407	ACS/WFC, ACCUM, WFC1-2K	F814W			Pattern 1, Exps 1-2 in Visit 01 (1)	200 Secs (600 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]	[1]
	3		(1) SGAS143845.1+145407	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=15; SAMP-SEQ=SPAR S10		Pattern 2, Exps 3-4 in Visit 01 (2)	142.945773 Secs (285.892 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[2]
4		(1) SGAS143845.1+145407	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=13; SAMP-SEQ=SPAR S100		Pattern 2, Exps 3-4 in Visit 01 (2)	1202.936167 Secs (2405.872 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[2]	



Proposal 13437 - Visit 02 - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Tue Oct 01 01:47:15 GMT 2013

<b>Visit</b>	Proposal 13437, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 261D TO 271 D									
	<b>Patterns</b>	# (2)	<b>Primary Pattern</b> Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	<b>Secondary Pattern</b>	<b>Exposures</b> (1-2)				
<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SGAS143845.1+145407	RA: 14 38 45.0300 (219.6876250d) Dec: +14 54 12.50 (14.90347d) Equinox: J2000		V=21.0+/-0.3	Reference Frame: ICRS				
<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) SGAS143845.1+145407	(1) SGAS143845.1+145407	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=15; SAMP-SEQ=SPAR S10		Pattern 2, Exps 1-2 in Visit 02 (2)	142.945773 Secs (285.892 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[1]
	2	(1) SGAS143845.1+145407	(1) SGAS143845.1+145407	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=13; SAMP-SEQ=SPAR S100		Pattern 2, Exps 1-2 in Visit 02 (2)	1202.936167 Secs (2405.872 Secs) [=>(Pattern 1)] [=>(Pattern 2)]	[1]
<b>Orbit Structure</b>	<p><b>Orbit 1</b> <span style="float: right;"><b>Server Version: 20130919</b></span></p> <p>The diagram illustrates the orbit structure over a 5500-second period. It shows the timing of various events: GS Acq (Ground Station Acquisition) at approximately 100 seconds, followed by two exposures (Exp. 1 and Exp. 2) between 400 and 500 seconds. A pointing maneuver occurs at 1800 seconds, followed by another set of exposures (Exp. 1 and Exp. 2) between 1900 and 2000 seconds. A reconfiguration and occultation event happen at 3200 seconds, leading to a period of unused visibility from 3300 to 3700 seconds. The observation period is indicated by a blue checkered bar from 400 to 3200 seconds.</p>									

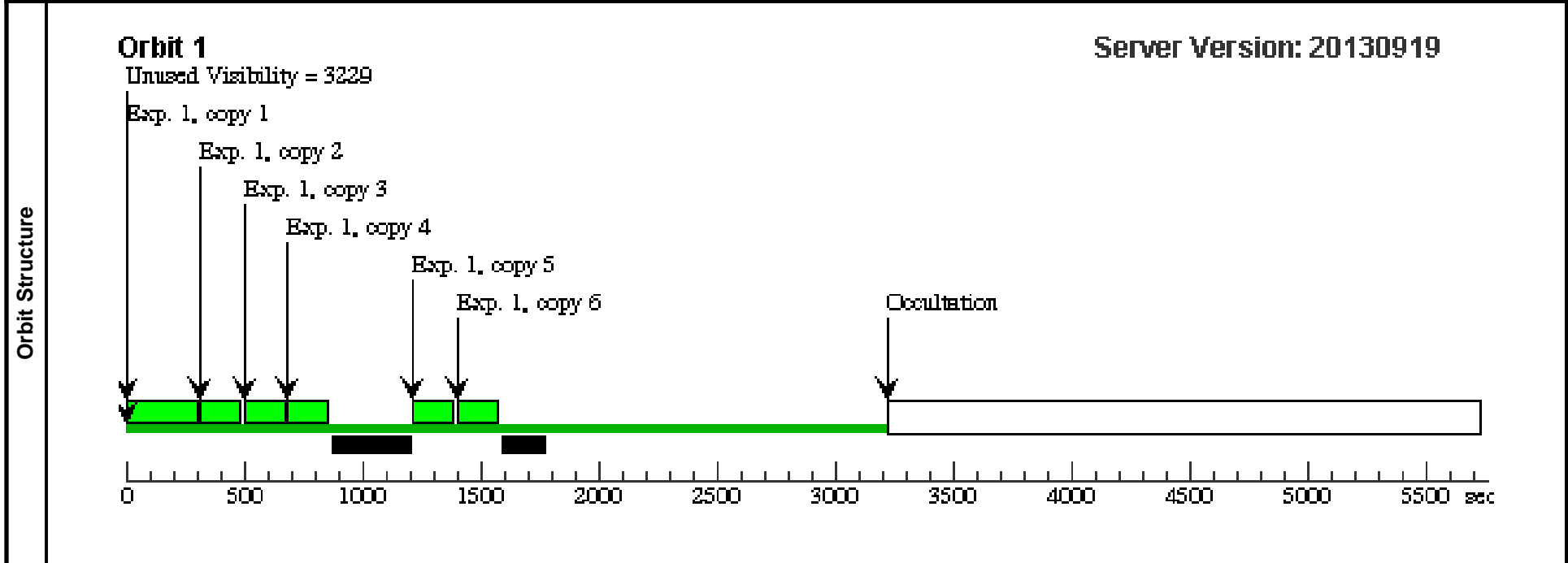
Proposal 13437 - ACS Subarray Calibration (A1) - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Tue Oct 01 01:47:16 GMT 2013

**Visit**  
**Proposal 13437, ACS Subarray Calibration (A1)**  
**Diagnostic Status: Error**  
 Scientific Instruments: ACS/WFC  
 Special Requirements: SEQ A1,A2,A3,A4 WITHIN 1 D  
*Comments: This orbit is charged to the Cycle 21 ACS Subarray Bias Calibration Program.*

**Diagnostics**  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): This attribute cannot have this value due to other choices: Spectral\_Element=DEF  
 This value is by default illegal.  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): Illegal selection: DEF.  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): Target BIAS is no longer a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): This attribute is not allowed to have this value: Calibration\_Target = BIAS  
 It is an Available option and cannot normally be used in a GO proposal.  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): COMPRESSION is not a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION  
 The combination of attributes chosen is illegal.  
 (Exposure 1 (ACS Subarray Calibration (A1))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION=NONE  
 The combination of attributes chosen is illegal.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		BIAS	ACS/WFC, ACCUM, WFC1-2K	DEF	GAIN=2.0; COMPRESSION=N ONE			0 Secs X 6 (0 Secs) [=>(Copy 1)] [=>(Copy 2)] [=>(Copy 3)] [=>(Copy 4)] [=>(Copy 5)] [=>(Copy 6)]	[1]



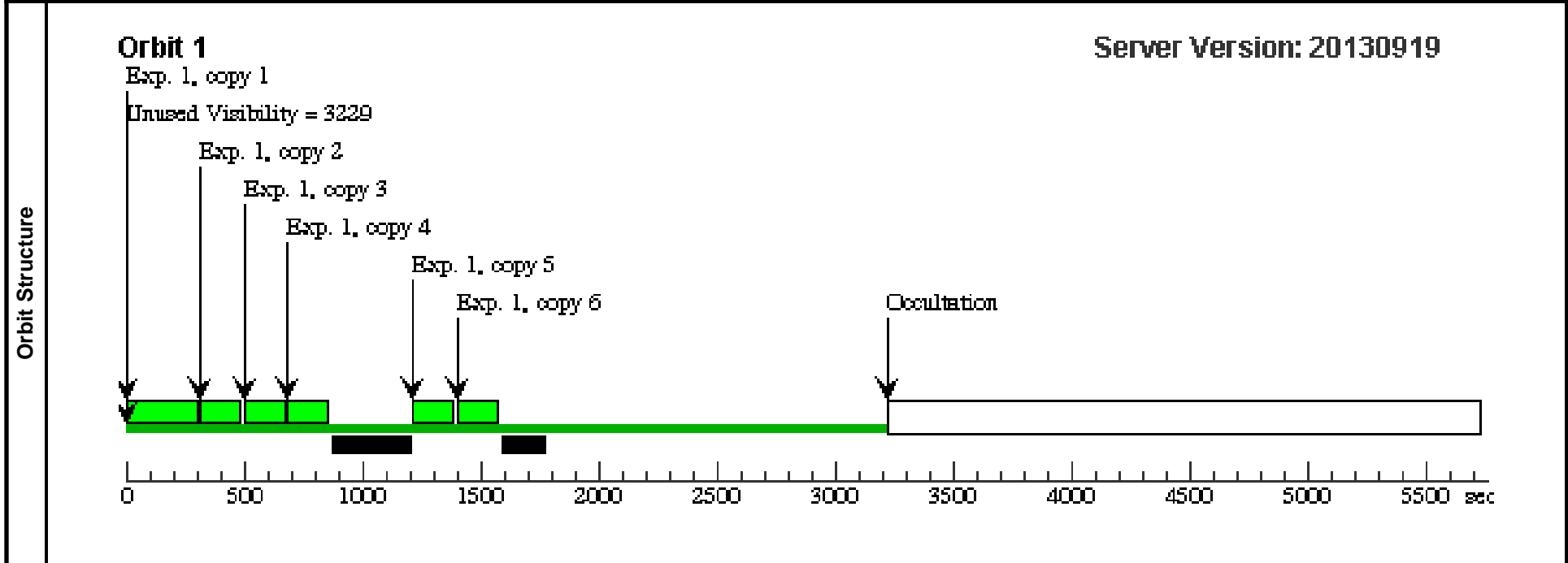
Proposal 13437 - ACS Subarray Calibration (A2) - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Tue Oct 01 01:47:16 GMT 2013

**Visit**  
**Proposal 13437, ACS Subarray Calibration (A2)**  
**Diagnostic Status: Error**  
 Scientific Instruments: ACS/WFC  
 Special Requirements: (none)  
*Comments: This orbit is charged to the Cycle 21 ACS Subarray Bias Calibration Program.*

**Diagnostics**  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): COMPRESSION is not a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION=NONE  
 The combination of attributes chosen is illegal.  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): This attribute is not allowed to have this value: Calibration\_Target = BIAS  
 It is an Available option and cannot normally be used in a GO proposal.  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): This attribute cannot have this value due to other choices: Spectral\_Element=DEF  
 This value is by default illegal.  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): Illegal selection: DEF.  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): Target BIAS is no longer a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A2))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION  
 The combination of attributes chosen is illegal.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		BIAS	ACS/WFC, ACCUM, WFC1-2K	DEF	GAIN=2.0; COMPRESSION=N ONE			0 Secs X 6 (0 Secs) [=>(Copy 1)] [=>(Copy 2)] [=>(Copy 3)] [=>(Copy 4)] [=>(Copy 5)] [=>(Copy 6)]	[1]



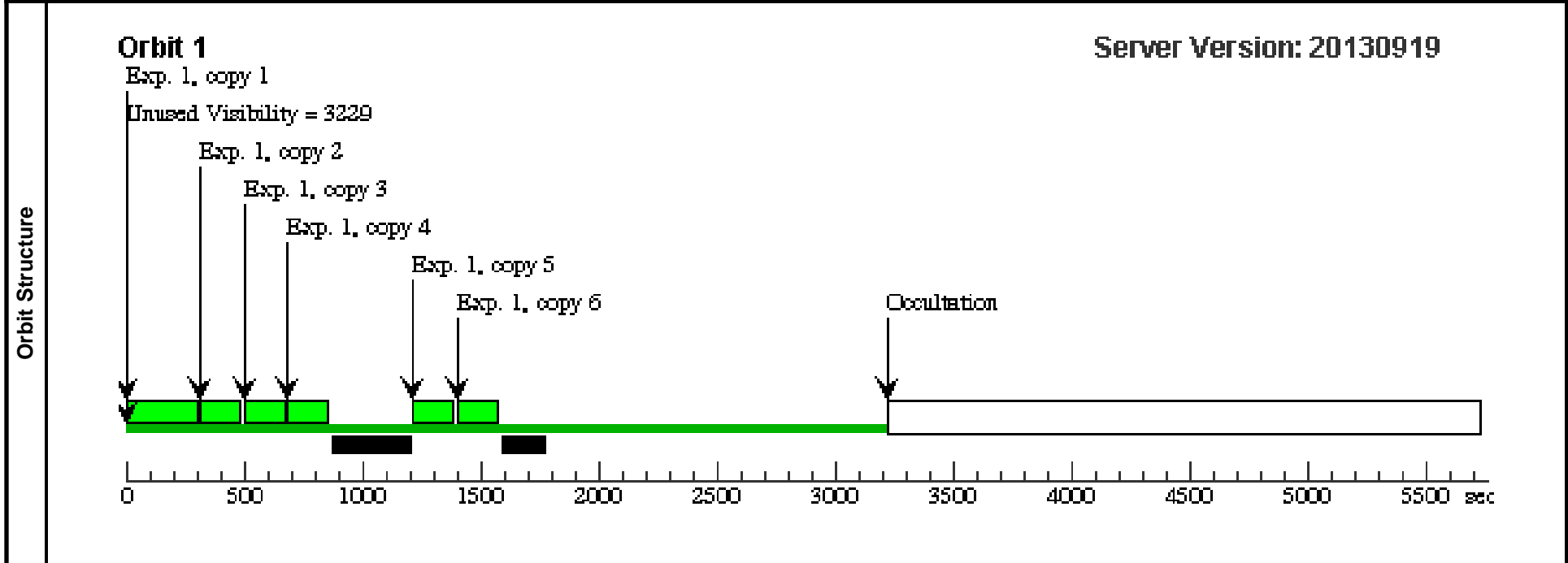
Proposal 13437 - ACS Subarray Calibration (A3) - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Tue Oct 01 01:47:17 GMT 2013

**Visit**  
**Proposal 13437, ACS Subarray Calibration (A3)**  
**Diagnostic Status: Error**  
 Scientific Instruments: ACS/WFC  
 Special Requirements: (none)  
*Comments: This orbit is charged to the Cycle 21 ACS Subarray Bias Calibration Program.*

**Diagnostics**  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION  
 The combination of attributes chosen is illegal.  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): This attribute cannot have this value due to other choices: Spectral\_Element=DEF  
 This value is by default illegal.  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): Target BIAS is no longer a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): COMPRESSION is not a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): This attribute is not allowed to have this value: Calibration\_Target = BIAS  
 It is an Available option and cannot normally be used in a GO proposal.  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): Illegal selection: DEF.  
 (Exposure 1 (ACS Subarray Calibration (A3))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION=NONE  
 The combination of attributes chosen is illegal.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		BIAS	ACS/WFC, ACCUM, WFC1-2K	DEF	GAIN=2.0; COMPRESSION=N ONE			0 Secs X 6 (0 Secs) [=>(Copy 1)] [=>(Copy 2)] [=>(Copy 3)] [=>(Copy 4)] [=>(Copy 5)] [=>(Copy 6)]	[1]



Proposal 13437 - ACS Subarray Calibration (A4) - The Morphology and Star Formation Distribution in a Big Cool Spiral LIRG

Tue Oct 01 01:47:18 GMT 2013

**Visit**  
**Proposal 13437, ACS Subarray Calibration (A4)**  
**Diagnostic Status: Error**  
 Scientific Instruments: ACS/WFC  
 Special Requirements: GROUP A4,01 WITHIN 14D  
*Comments: This orbit is charged to the Cycle 21 ACS Subarray Bias Calibration Program.*

**Diagnostics**  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): Target BIAS is no longer a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): This attribute cannot have this value due to other choices: Spectral\_Element=DEF  
 This value is by default illegal.  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): Illegal selection: DEF.  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): COMPRESSION is not a valid selection  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): This attribute is not allowed to have this value: Calibration\_Target = BIAS  
 It is an Available option and cannot normally be used in a GO proposal.  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION  
 The combination of attributes chosen is illegal.  
 (Exposure 1 (ACS Subarray Calibration (A4))) Error (Form): This attribute cannot have this value due to other choices: Optional\_Parameter=COMPRESSION=NONE  
 The combination of attributes chosen is illegal.

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		BIAS	ACS/WFC, ACCUM, WFC1-2K	DEF	GAIN=2.0; COMPRESSION=N ONE			0 Secs X 6 (0 Secs) [=>(Copy 1)] [=>(Copy 2)] [=>(Copy 3)] [=>(Copy 4)] [=>(Copy 5)] [=>(Copy 6)]	[1]

