



# 13379 - Multiple stellar populations in the young Large Magellanic Cloud cluster NGC1856

Cycle: 21, Proposal Category: GO

(UV Initiative)

(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) NGC-1856	ACS/WFC WFC3/UVIS	1	14-Nov-2013 21:33:43.0	yes
02	(1) NGC-1856	ACS/WFC WFC3/UVIS	1	14-Nov-2013 21:33:54.0	yes
03	(1) NGC-1856	ACS/WFC WFC3/UVIS	1	14-Nov-2013 21:34:05.0	yes

<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>
04	(1) NGC-1856	ACS/WFC WFC3/UVIS	1	14-Nov-2013 21:34:15.0	yes

4 Total Orbits Used

### **ABSTRACT**

The recent discovery of multiple sequences in the color-magnitude diagram of Galactic globular clusters have demonstrated that star clusters have experienced a complex star-formation history. Apparently, the only way to explain the main sequence splitting appears to be the product of hot CNO burning, including He, which can be enriched up to an astonishingly high  $Y \sim 0.40$ . Recent discoveries have demonstrated that the CMDs of a large fraction of intermediate-age clusters in the Magellanic Clouds ( $\sim 70\%$ ) are not consistent with the simple, single stellar population hypothesis. The conditions under which star clusters experience the formation of multiple generations remain controversial.

A breakthrough understanding of the problem can be provided by the young stellar clusters, where second generation of stars may be forming, or just formed. However, these objects have been poorly studied to date. To properly constraint the multipopulation phenomenon, we propose deep UVIS imaging of the  $\sim 300$  Myrs old LMC star cluster NGC 1856 which, according to a recent study, is the best candidate to host multiple stellar populations. The proposed observations will allow us to accurately measure possible age difference between the stellar populations providing fundamental clues on the formation mechanism. Our simulations of WFC3 performance suggest that our observing strategy allow us to detect a main sequence split caused by an He difference as small as  $\Delta Y \sim 0.03$ .

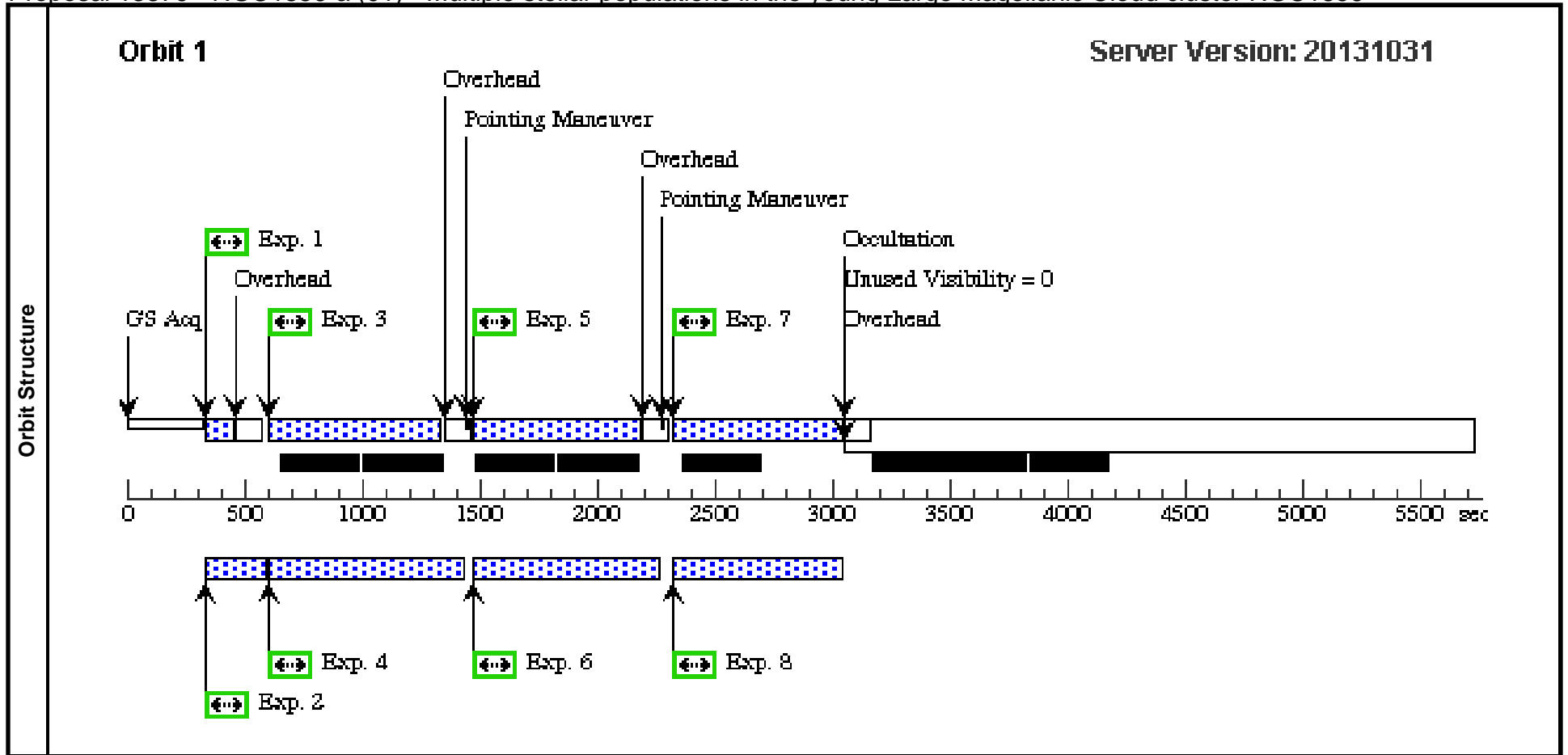
### **OBSERVING DESCRIPTION**

This is a proposal aimed at obtaining high accuracy photometry of the MC cluster NGC 1856 in the UV WFC3/UVIS/F336W and optical WFC3/UVIS/F814W bands.

Proposal 13379 - NGC1856-a (01) - Multiple stellar populations in the young Large Magellanic Cloud cluster NGC1856

Fri Nov 15 02:34:23 GMT 2013

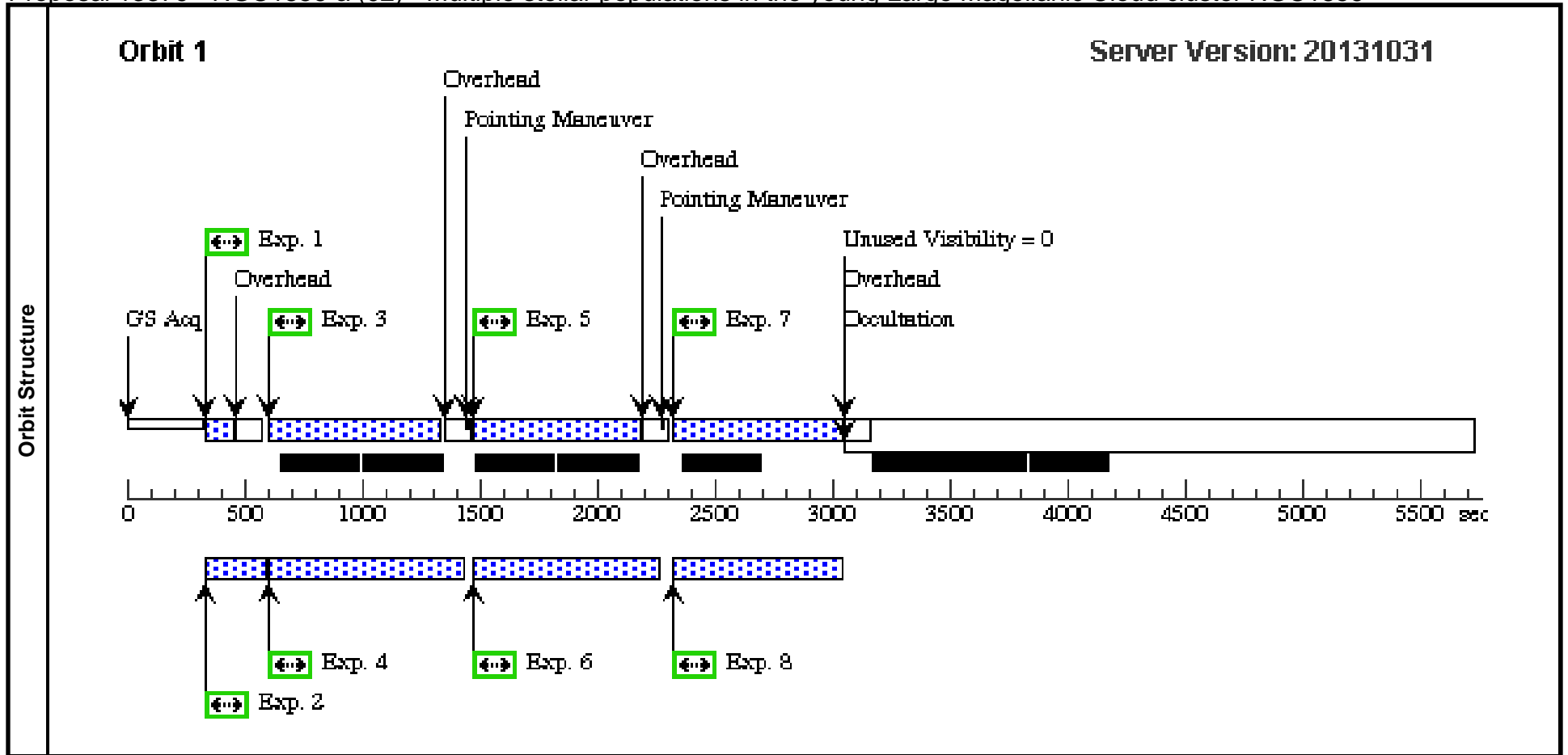
<b>Visit</b>	<b>Proposal 13379, NGC1856-a (01), implementation</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SCHED 100% <i>Comments: NGC-1856 - part 1</i>									
	(NGC1856-a (01)) Warning (Orbit Planner): NO ORIENT FOR COORDINATED PARALLEL (NGC1856-a (01)) Warning (Orbit Planner): NO ORIENT FOR COORDINATED PARALLEL (NGC1856-a (01)) Warning (Orbit Planner): NO ORIENT FOR COORDINATED PARALLEL (NGC1856-a (01)) Warning (Orbit Planner): NO ORIENT FOR COORDINATED PARALLEL									
<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)	NGC-1856	RA: 05 09 30.3900 (77.3766250d) Dec: -69 07 45.40 (-69.12928d) Equinox: J2000		V=10.06	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
<b>Exposures</b>	<b>#</b>	<b>Label</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		(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 1-2 in NGC1856-a (01)	90 Secs (90 Secs) [==>]	[1]
	2		(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W	FLASH=16		Prime + Parallel Group 1-2 in NGC1856-a (01)	42 Secs (42 Secs) [==>]	[1]
	3		(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 3-4 in NGC1856-a (01)	711 Secs (711 Secs) [==>]	[1]
	4		(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 3-4 in NGC1856-a (01)	665 Secs (665 Secs) [==>]	[1]
	5		(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG 0,0	Prime + Parallel Group 5-6 in NGC1856-a (01)	711 Secs (711 Secs) [==>]	[1]
	6		(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 5-6 in NGC1856-a (01)	665 Secs (665 Secs) [==>]	[1]
	7		(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG +3,+3	Prime + Parallel Group 7-8 in NGC1856-a (01)	704 Secs (704 Secs) [==>]	[1]
	8		(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W			Prime + Parallel Group 7-8 in NGC1856-a (01)	559 Secs (559 Secs) [==>]	[1]



Proposal 13379 - NGC1856-a (02) - Multiple stellar populations in the young Large Magellanic Cloud cluster NGC1856

Fri Nov 15 02:34:26 GMT 2013

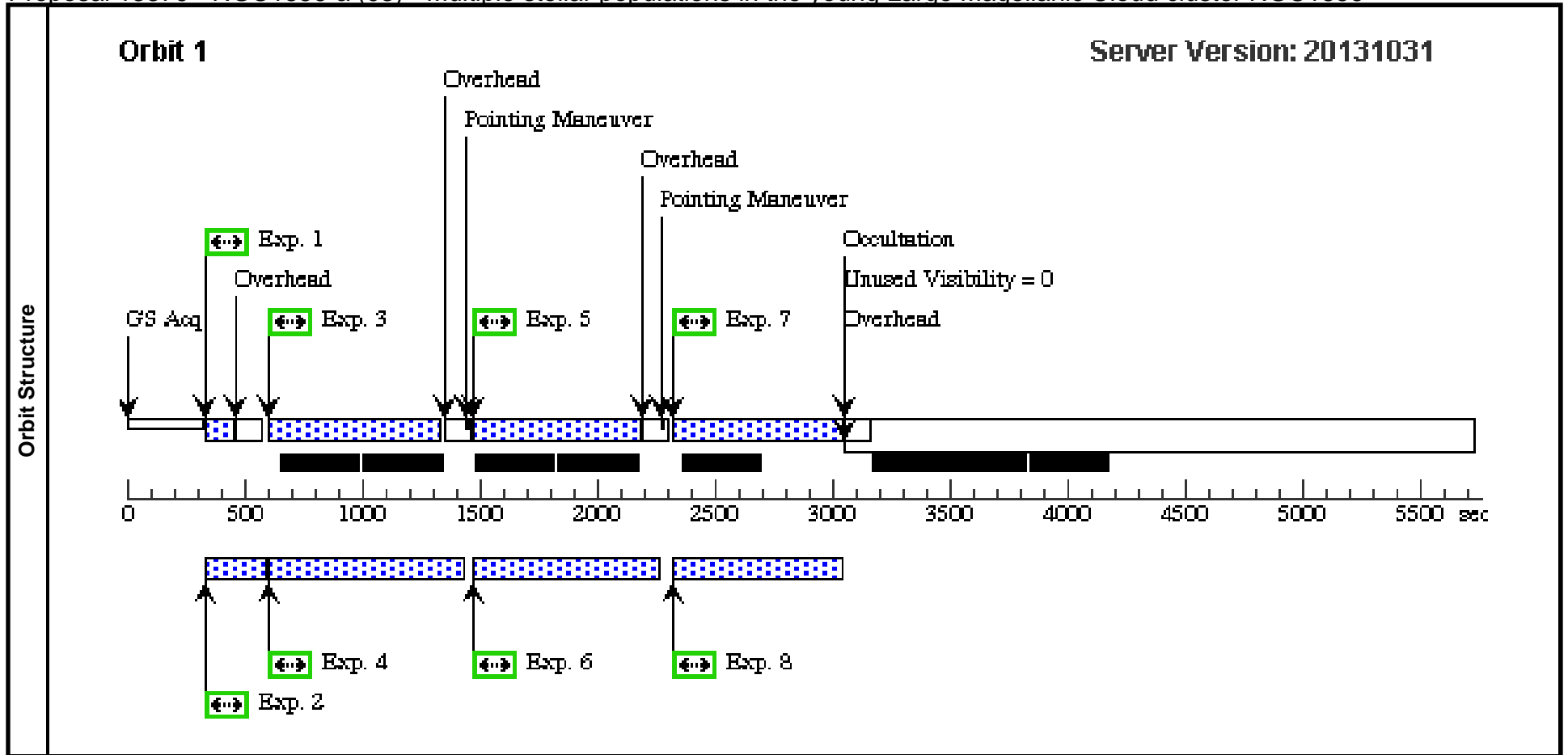
Visit	<b>Proposal 13379, NGC1856-a (02), implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SCHED 100%; ORIENT 44D TO 46D FROM 01 Comments: NGC-1856 - part 1																											
	Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>NGC-1856</td> <td>RA: 05 09 30.3900 (77.3766250d) Dec: -69 07 45.40 (-69.12928d) Equinox: J2000</td> <td></td> <td>V=10.06</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td colspan="6">Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</td> </tr> </tbody> </table>										#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	NGC-1856	RA: 05 09 30.3900 (77.3766250d) Dec: -69 07 45.40 (-69.12928d) Equinox: J2000		V=10.06	Reference Frame: ICRS	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.				
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous																							
(1)	NGC-1856	RA: 05 09 30.3900 (77.3766250d) Dec: -69 07 45.40 (-69.12928d) Equinox: J2000		V=10.06	Reference Frame: ICRS																							
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.																												
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit																		
	1	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 1-2 in NGC1856-a (02)	90 Secs (90 Secs) [==>]	[1]																			
	2	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W	FLASH=16		Prime + Parallel Group 1-2 in NGC1856-a (02)	42 Secs (42 Secs) [==>]	[1]																			
	3	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 3-4 in NGC1856-a (02)	711 Secs (711 Secs) [==>]	[1]																			
	4	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 3-4 in NGC1856-a (02)	665 Secs (665 Secs) [==>]	[1]																			
	5	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG 0,0	Prime + Parallel Group 5-6 in NGC1856-a (02)	711 Secs (711 Secs) [==>]	[1]																			
	6	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 5-6 in NGC1856-a (02)	665 Secs (665 Secs) [==>]	[1]																			
	7	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG +3,+3	Prime + Parallel Group 7-8 in NGC1856-a (02)	704 Secs (704 Secs) [==>]	[1]																			
	8	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W			Prime + Parallel Group 7-8 in NGC1856-a (02)	559 Secs (559 Secs) [==>]	[1]																			



Proposal 13379 - NGC1856-a (03) - Multiple stellar populations in the young Large Magellanic Cloud cluster NGC1856

Fri Nov 15 02:34:27 GMT 2013

Visit	<b>Proposal 13379, NGC1856-a (03), implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SCHED 100%; ORIENT 89D TO 91D FROM 01 Comments: NGC-1856 - part 1									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(1)	NGC-1856	RA: 05 09 30.3900 (77.3766250d) Dec: -69 07 45.40 (-69.12928d) Equinox: J2000		V=10.06	Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 1-2 in NGC1856-a (03)	90 Secs (90 Secs) [==>]	[1]
	2	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W	FLASH=16		Prime + Parallel Group 1-2 in NGC1856-a (03)	42 Secs (42 Secs) [==>]	[1]
	3	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 3-4 in NGC1856-a (03)	711 Secs (711 Secs) [==>]	[1]
	4	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 3-4 in NGC1856-a (03)	665 Secs (665 Secs) [==>]	[1]
	5	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG 0,0	Prime + Parallel Group 5-6 in NGC1856-a (03)	711 Secs (711 Secs) [==>]	[1]
	6	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 5-6 in NGC1856-a (03)	665 Secs (665 Secs) [==>]	[1]
	7	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG +3,+3	Prime + Parallel Group 7-8 in NGC1856-a (03)	704 Secs (704 Secs) [==>]	[1]
	8	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W			Prime + Parallel Group 7-8 in NGC1856-a (03)	559 Secs (559 Secs) [==>]	[1]



Proposal 13379 - NGC1856-a (04) - Multiple stellar populations in the young Large Magellanic Cloud cluster NGC1856

Fri Nov 15 02:34:28 GMT 2013

Visit	<b>Proposal 13379, NGC1856-a (04), implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SCHED 100%; ORIENT 134D TO 136D FROM 01 Comments: NGC-1856 - part 1									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(1)	NGC-1856	RA: 05 09 30.3900 (77.3766250d) Dec: -69 07 45.40 (-69.12928d) Equinox: J2000		V=10.06	Reference Frame: ICRS				
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 1-2 in NGC1856-a (04)	90 Secs (90 Secs) [==>]	[1]
	2	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W	FLASH=16		Prime + Parallel Group 1-2 in NGC1856-a (04)	42 Secs (42 Secs) [==>]	[1]
	3	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG -3,-3	Prime + Parallel Group 3-4 in NGC1856-a (04)	711 Secs (711 Secs) [==>]	[1]
	4	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 3-4 in NGC1856-a (04)	665 Secs (665 Secs) [==>]	[1]
	5	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=8	POS TARG 0,0	Prime + Parallel Group 5-6 in NGC1856-a (04)	711 Secs (711 Secs) [==>]	[1]
	6	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F475W			Prime + Parallel Group 5-6 in NGC1856-a (04)	665 Secs (665 Secs) [==>]	[1]
	7	(1) NGC-1856	(1) NGC-1856	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=8	POS TARG +3,+3	Prime + Parallel Group 7-8 in NGC1856-a (04)	704 Secs (704 Secs) [==>]	[1]
	8	(1) NGC-1856	(1) NGC-1856	ACS/WFC, ACCUM, WFCENTER	F814W			Prime + Parallel Group 7-8 in NGC1856-a (04)	559 Secs (559 Secs) [==>]	[1]

