



14191 - The Star Formation History and Proper Motion of NGC 6822

Cycle: 23, 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) NGC6822.BAR.EAST ANY	ACS/WFC WFC3/UVIS	2	07-Jul-2015 21:15:04.0	yes
02	(1) NGC6822.BAR.EAST ANY	ACS/WFC WFC3/UVIS	2	07-Jul-2015 21:15:07.0	yes
03	(1) NGC6822.BAR.EAST ANY	ACS/WFC WFC3/UVIS	2	07-Jul-2015 21:15:09.0	yes
04	(1) NGC6822.BAR.EAST ANY	ACS/WFC WFC3/UVIS	1	07-Jul-2015 21:15:11.0	yes

7 Total Orbits Used

ABSTRACT

Dwarf galaxies are sensitive probes of galaxy formation theory because of both their susceptibility to feedback from star formation and their vulnerability to interactions with neighbors. Theory and observation both suggest that galaxies with stellar masses in the range of 0.1-1 billion solar masses are critical for understanding galaxy assembly and reionization. NGC 6822 is one of only two galaxies in the Local Group in this critical mass range that is outside the virial radius of the Milky Way and M31. We have already measured the star formation history (SFH) of the other galaxy, IC 1613, and discovered it to have a nearly constant star formation rate over a Hubble time. The SFH of NGC 6822, on the other hand, remains unknown for ages greater than ~ 3 Gyr. We propose to obtain the deepest-ever color-magnitude diagrams of two fields in NGC 6822 using ACS/WFC and WFC3/UVIS. In only 7 orbits, we will measure its ancient SFH with resolution of ~ 1 Gyr at the oldest ages, making this an extremely efficient program. The SFH will have accuracy and precision equal to that of IC 1613 ($\sim 10\%$, 13 Gyr ago), directly testing the prediction that feedback linked to SFH controls the structural parameters of dwarfs at this mass. It has been suggested that NGC 6822 may have passed within 50 kpc of the Milky Way, altering its structure and gas content. We will target fields in NGC 6822 that have already been observed with ACS/WFC in 2010; measuring the reflex motion of background galaxies over the 6 year baseline we will make the first measurement of its proper motion, constraining its orbit and testing whether NGC 6822 has been influenced by an ancient interaction with the Milky Way.

OBSERVING DESCRIPTION

We propose to image NGC 6822 using the F606W and F814W filters of ACS/WFC. These filters yield the optimum combination of throughput and age/metallicity for the subgiant branch and main-sequence turnoffs of old (>10 Gyr) stellar populations with the distance and reddening of NGC 6822. Our observations are structured to maximize sensitivity to color differences between isochrones as a function of age and metallicity, while minimizing the impact of hot pixels and cosmic rays on photometry of stars near the detection limit.

We will also image a flanking field in the outskirts of NGC 6822 as a coordinated parallel observation with WFC3/UVIS in order to constrain radial population gradients and increase the sample of proper motion targets. The parallel observations will achieve nearly the same photometric depth as the ACS observations, using the WFC3/UVIS F606W and F814W filters.

Our limiting magnitude requirement is based on the expected magnitude and colors of the subgiant branch and main-sequence turnoff, which contain unique information about the oldest stars in the target galaxy. The ACS ETC suggests that exposure times of ~ 8600 seconds and ~ 8200 seconds in F606W and F814W respectively are sufficient to achieve $S/N \sim 10$ at the required depth for optimally extracted PSF photometry.

Proposal 14191 (STScI Edit Number: 0, Created: Tuesday, July 7, 2015 8:15:12 PM EST) - Overview

The observing plan closely follows our successful programs in previous cycles, targeting other isolated and M31 satellite dwarfs (e.g., GO-12925, Cole et al. 2014). We have divided the observations as closely as possible into visits of 2 orbits each. Each orbit contains one exposure each in F606W and F814W. The exposures are not CR-SPLIT, but we will eliminate hot pixels and CR hits in the combined images by using a 2-3 pixel dither pattern in between orbits according to the ACS instrument handbook; the dither pattern is to be implemented using POS-TARG commands. This minimizes overheads and maximizes sensitivity to faint stars. While 7 orbits does not allow extremely high sensitivity to variable stars, our observing plan separates exposures in each filter by the duration of an orbit in order to improve sampling of light star curves as an additional benefit. To ensure that the observations span enough of the light curve phase to identify and characterize any prospective RR Lyrae variables, we wish to group all of our visits in each galaxy together within a roughly 3-day window. This strikes a balance between the desire to detect variables and the necessity to allow for easy schedulability. NGC 6822 has very low ecliptic latitude and thus must be observed when the Sun-telescope-target angle is greater than 100 degrees. However, earthshine is NOT a strong contributor to the background, so we do not require the LOW-SKY constraint. Instead, we have specified the observing dates to ensure low zodiacal light background by using the visit-level BETWEEN constraint. This gains a few extra minutes per orbit compared to the LOW-SKY constraint and does not strongly impact schedulability.

Our field in NGC 6822 is chosen to overlap with existing shallower photometry from ACS/WFC (Cannon et al. 2012). This will allow us to use the astrometry of the stars in common, relative to background galaxies, to obtain the first proper motion measurement of NGC 6822. In order to minimize the effects of differential reddening and crowding, we choose to observe within the HI hole that overlaps with Cannon's "Field 5", just to the east of the NGC 6822 bar. This field has already been demonstrated to show a wide range of stellar populations without being subject to strong crowding issues.

We are using WFC3 to obtain coordinated parallel observations in a secondary field in the target galaxy. The coordinated parallel observations will constrain population gradients and increase the proper motion sample size. To use the WFC3 parallels in the proper motion measurement requires that we overlap the parallel field with one that has previous data. This can be accomplished for roll angles of 68-88 degrees, placing the parallel field on Cannon's "Field 6"; fortunately this does not significantly impact schedulability. Within this range the exact placement is not critical but because the science goals are similar for the prime and parallel exposures, visits 2-4 are constrained to have the SAME ORIENT as visit 1 to allow for deep integrations over the entire primary field as well as the parallel field.

Additional comments: NGC 6822 has previous WFPC2 and ACS/WFC imaging. None of the 1999-2010 data are deep enough to meet the star-formation history goals of this program. Our program builds upon the deepest and most recent imaging, the 2010 ACS/WFC fields observed in program GO-12180 (PI: Cannon), using astrometry in two of those fields as a first epoch for a proper motion measurement with ~6 year baseline.

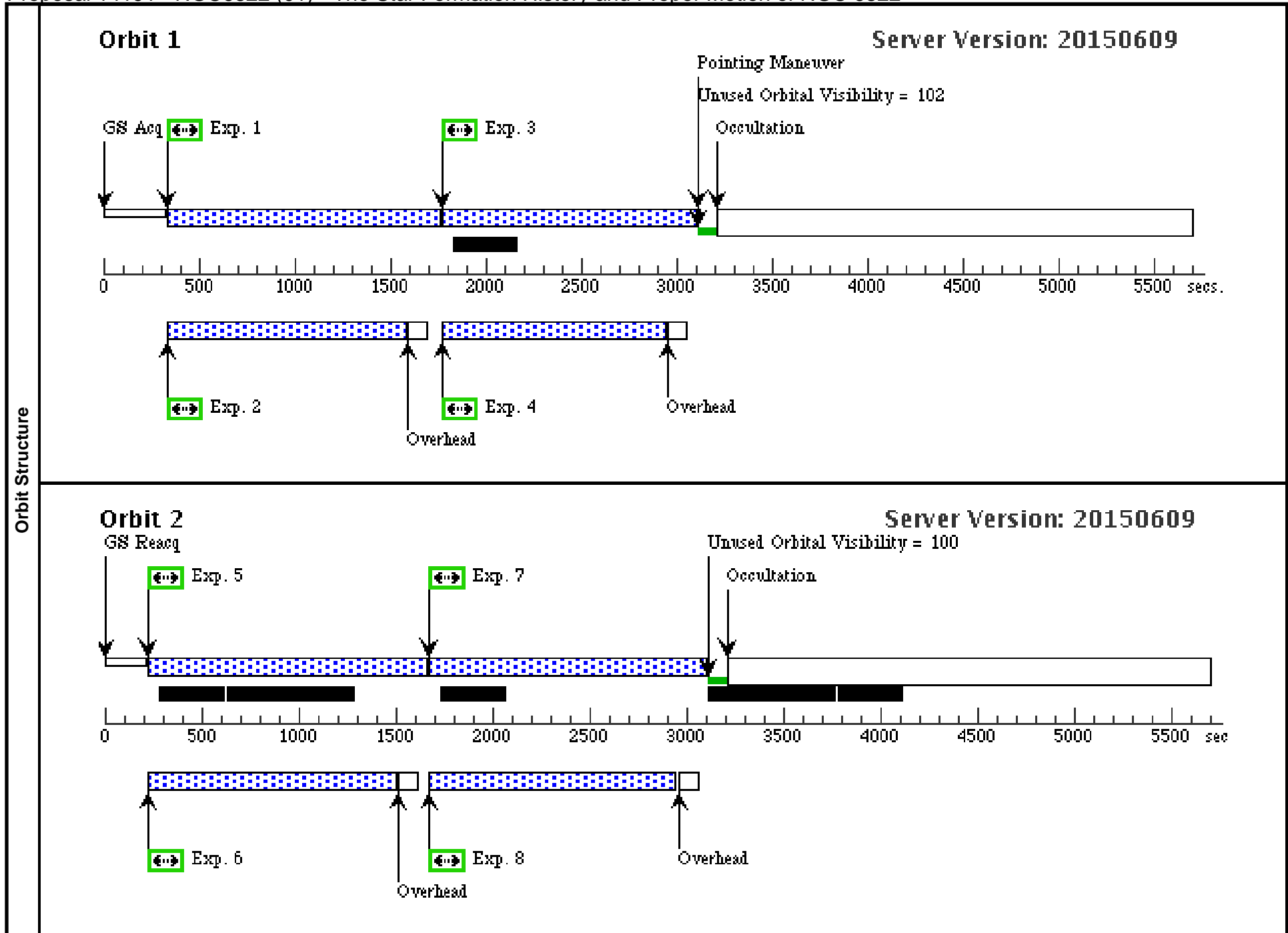
Proposal 14191 - NGC6822 (01) - The Star Formation History and Proper Motion of NGC 6822

Wed Jul 08 01:15:13 GMT 2015

Visit	Proposal 14191, NGC6822 (01) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: ORIENT 68D TO 88 D; BETWEEN 01-SEP-2015:00:00:00 AND 30-NOV-2015:00:00:00; BETWEEN 01-SEP-2016:00:00:00 AND 30-NOV-2016:00:00:00; GROUP 01,02,03,04 WITHIN 3D					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		NGC6822.BAR.EAST	RA: 19 45 30.3000 (296.3762500d) Dec: -14 53 14.30 (-14.88731d) Equinox: J2000		V=19.0+/-1 Faintest targets have V ~ 28. Distribution of brighter magnitudes to 19; a few V=13 foreground	Reference Frame: ICRS

Proposal 14191 - NGC6822 (01) - The Star Formation History and Proper Motion of NGC 6822

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	Sequence 1-4 Non-Int in NGC6822 (01) Prime + Parallel Gro up 1-2 in Sequence 1 -4 Non-Int in NGC6 822 (01)	1220 Secs (1220 Secs) [==>]	[1]	
	2	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W		Sequence 1-4 Non-Int in NGC6822 (01) Prime + Parallel Gro up 1-2 in Sequence 1 -4 Non-Int in NGC6 822 (01)	1220 Secs (1220 Secs) [==>]	[1]	
	<i>Comments: Parallel with Exposure 01.001</i>									
	3	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	Sequence 1-4 Non-Int in NGC6822 (01) Prime + Parallel Gro up 3-4 in Sequence 1 -4 Non-Int in NGC6 822 (01)	1150 Secs (1150 Secs) [==>]	[1]	
	4	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W		Sequence 1-4 Non-Int in NGC6822 (01) Prime + Parallel Gro up 3-4 in Sequence 1 -4 Non-Int in NGC6 822 (01)	1150 Secs (1150 Secs) [==>]	[1]	
	<i>Comments: Parallel with Exposure 01.003</i>									
	5	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.148,0. 086	Sequence 5-8 Non-Int in NGC6822 (01) Prime + Parallel Gro up 5-6 in Sequence 5 -8 Non-Int in NGC6 822 (01)	1260 Secs (1260 Secs) [==>]	[2]
	6	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W			Sequence 5-8 Non-Int in NGC6822 (01) Prime + Parallel Gro up 5-6 in Sequence 5 -8 Non-Int in NGC6 822 (01)	1260 Secs (1260 Secs) [==>]	[2]
<i>Comments: Parallel with Exposure 01.005</i>										
7	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.148,0. 086	Sequence 5-8 Non-Int in NGC6822 (01) Prime + Parallel Gro up 7-8 in Sequence 5 -8 Non-Int in NGC6 822 (01)	1250 Secs (1250 Secs) [==>]	[2]	
8	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W			Sequence 5-8 Non-Int in NGC6822 (01) Prime + Parallel Gro up 7-8 in Sequence 5 -8 Non-Int in NGC6 822 (01)	1250 Secs (1250 Secs) [==>]	[2]	
<i>Comments: Parallel with Exposure 01.007</i>										



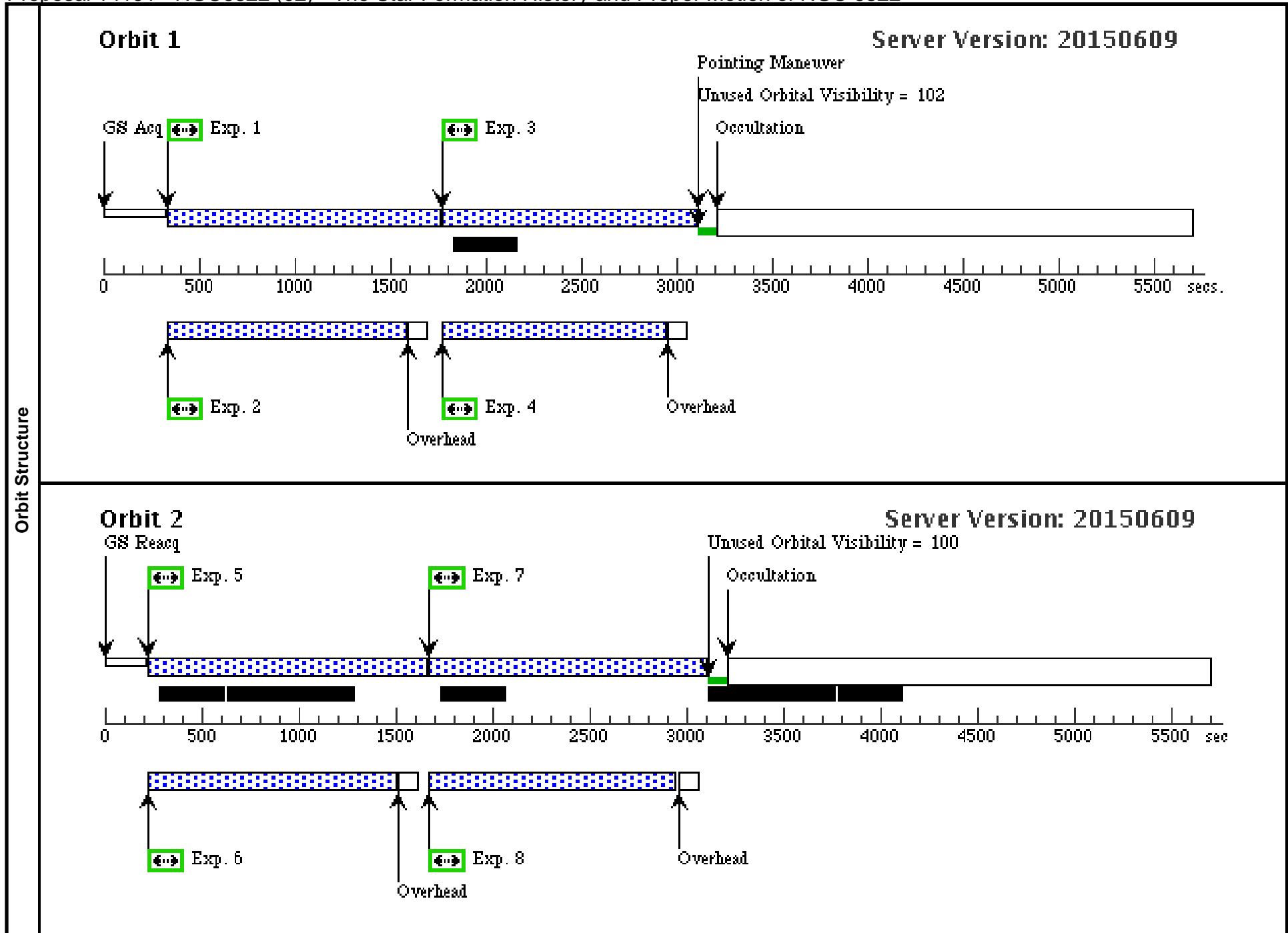
Proposal 14191 - NGC6822 (02) - The Star Formation History and Proper Motion of NGC 6822

Wed Jul 08 01:15:13 GMT 2015

Visit	Proposal 14191, NGC6822 (02) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SAME ORIENT AS 01; BETWEEN 01-SEP-2015:00:00:00 AND 30-NOV-2015:00:00:00; BETWEEN 01-SEP-2016:00:00:00 AND 30-NOV-2016:00:00:00; GROUP 02,01,03,04 WITHIN 3D					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		NGC6822.BAR.EAST	RA: 19 45 30.3000 (296.3762500d) Dec: -14 53 14.30 (-14.88731d) Equinox: J2000		V=19.0+/-1 Faintest targets have V ~ 28. Distribution of brighter magnitudes to 19; a few V=13 foreground	Reference Frame: ICRS

Proposal 14191 - NGC6822 (02) - The Star Formation History and Proper Motion of NGC 6822

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.222,0. 240	Sequence 1-4 Non-Int in NGC6822 (02) Prime + Parallel Gro up 1-2 in Sequence 1 -4 Non-Int in NGC6 822 (02)	1220 Secs (1220 Secs) [==>]	[1]
	2	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W			Sequence 1-4 Non-Int in NGC6822 (02) Prime + Parallel Gro up 1-2 in Sequence 1 -4 Non-Int in NGC6 822 (02)	1220 Secs (1220 Secs) [==>]	[1]
	<i>Comments: Parallel with Exposure 02.001</i>									
	3	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.222,0. 240	Sequence 1-4 Non-Int in NGC6822 (02) Prime + Parallel Gro up 3-4 in Sequence 1 -4 Non-Int in NGC6 822 (02)	1150 Secs (1150 Secs) [==>]	[1]
	4	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W			Sequence 1-4 Non-Int in NGC6822 (02) Prime + Parallel Gro up 3-4 in Sequence 1 -4 Non-Int in NGC6 822 (02)	1150 Secs (1150 Secs) [==>]	[1]
	<i>Comments: Parallel with Exposure 02.003</i>									
	5	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.074,0. 154	Sequence 5-8 Non-Int in NGC6822 (02) Prime + Parallel Gro up 5-6 in Sequence 5 -8 Non-Int in NGC6 822 (02)	1260 Secs (1260 Secs) [==>]	[2]
	6	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W			Sequence 5-8 Non-Int in NGC6822 (02) Prime + Parallel Gro up 5-6 in Sequence 5 -8 Non-Int in NGC6 822 (02)	1260 Secs (1260 Secs) [==>]	[2]
<i>Comments: Parallel with Exposure 02.005</i>										
7	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.074,0. 154	Sequence 5-8 Non-Int in NGC6822 (02) Prime + Parallel Gro up 7-8 in Sequence 5 -8 Non-Int in NGC6 822 (02)	1250 Secs (1250 Secs) [==>]	[2]	
8	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W			Sequence 5-8 Non-Int in NGC6822 (02) Prime + Parallel Gro up 7-8 in Sequence 5 -8 Non-Int in NGC6 822 (02)	1250 Secs (1250 Secs) [==>]	[2]	
<i>Comments: Parallel with Exposure 02.007</i>										



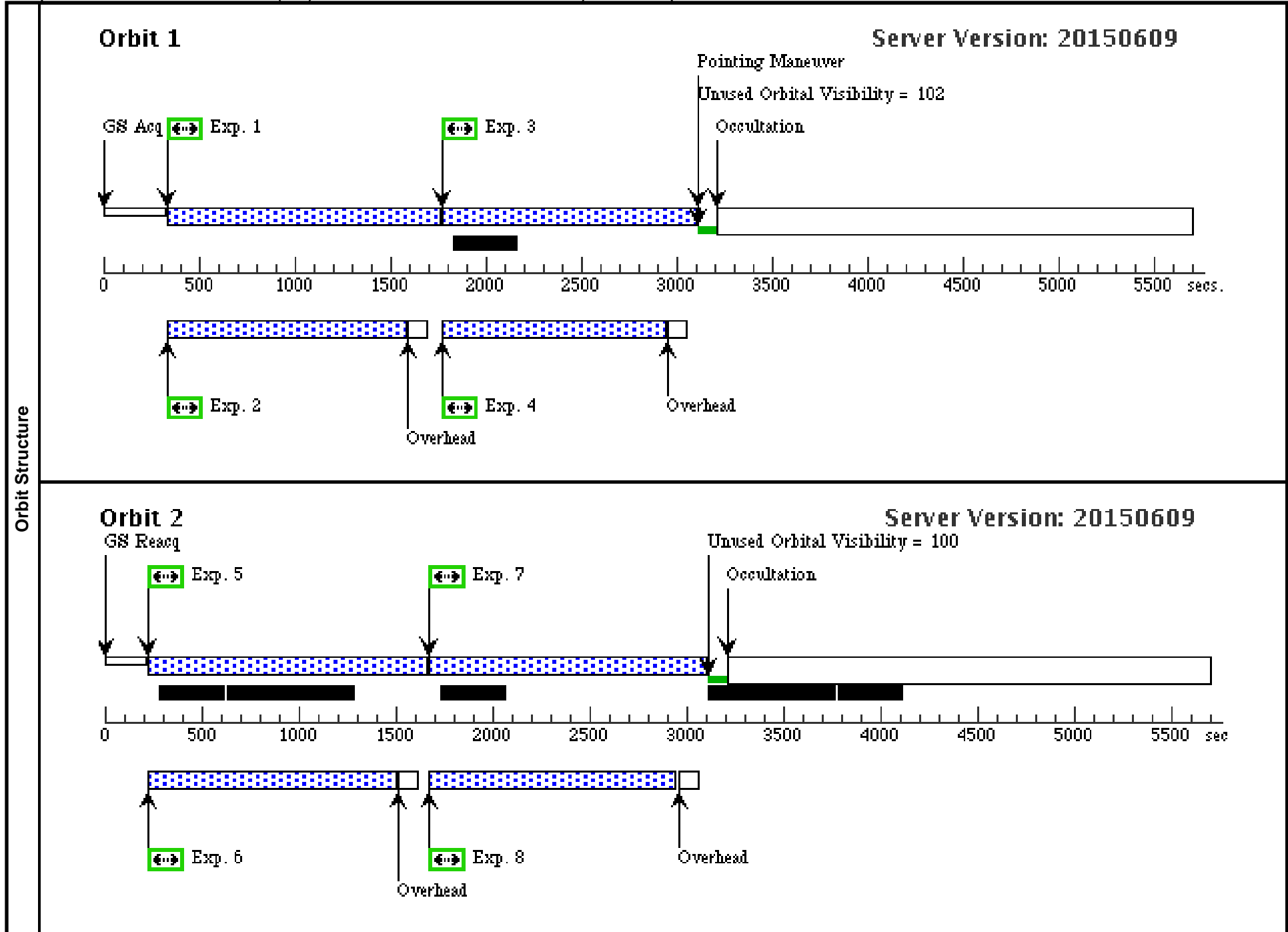
Proposal 14191 - NGC6822 (03) - The Star Formation History and Proper Motion of NGC 6822

Wed Jul 08 01:15:13 GMT 2015

Visit	Proposal 14191, NGC6822 (03) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SAME ORIENT AS 01; BETWEEN 01-SEP-2015:00:00:00 AND 30-NOV-2015:00:00:00; BETWEEN 01-SEP-2016:00:00:00 AND 30-NOV-2016:00:00:00; GROUP 03,01,02,04 WITHIN 3D					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		NGC6822.BAR.EAST	RA: 19 45 30.3000 (296.3762500d) Dec: -14 53 14.30 (-14.88731d) Equinox: J2000		V=19.0+/-1 Faintest targets have V ~ 28. Distribution of brighter magnitudes to 19; a few V=13 foreground	Reference Frame: ICRS

Proposal 14191 - NGC6822 (03) - The Star Formation History and Proper Motion of NGC 6822

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.085,0. 105	Sequence 1-4 Non-Int in NGC6822 (03) Prime + Parallel Gro up 1-2 in Sequence 1 -4 Non-Int in NGC6 822 (03)	1220 Secs (1220 Secs) [==>]	[1]
	2	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W			Sequence 1-4 Non-Int in NGC6822 (03) Prime + Parallel Gro up 1-2 in Sequence 1 -4 Non-Int in NGC6 822 (03)	1220 Secs (1220 Secs) [==>]	[1]
	<i>Comments: Parallel with Exposure 03.001</i>									
	3	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.085,0. 105	Sequence 1-4 Non-Int in NGC6822 (03) Prime + Parallel Gro up 3-4 in Sequence 1 -4 Non-Int in NGC6 822 (03)	1150 Secs (1150 Secs) [==>]	[1]
	4	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W			Sequence 1-4 Non-Int in NGC6822 (03) Prime + Parallel Gro up 3-4 in Sequence 1 -4 Non-Int in NGC6 822 (03)	1150 Secs (1150 Secs) [==>]	[1]
	<i>Comments: Parallel with Exposure 03.003</i>									
	5	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.233,0. 191	Sequence 5-8 Non-Int in NGC6822 (03) Prime + Parallel Gro up 5-6 in Sequence 5 -8 Non-Int in NGC6 822 (03)	1260 Secs (1260 Secs) [==>]	[2]
	6	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W			Sequence 5-8 Non-Int in NGC6822 (03) Prime + Parallel Gro up 5-6 in Sequence 5 -8 Non-Int in NGC6 822 (03)	1260 Secs (1260 Secs) [==>]	[2]
<i>Comments: Parallel with Exposure 03.005</i>										
7	NGC6822-F ield1	(1) NGC6822.BAR. EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.233,0. 191	Sequence 5-8 Non-Int in NGC6822 (03) Prime + Parallel Gro up 7-8 in Sequence 5 -8 Non-Int in NGC6 822 (03)	1250 Secs (1250 Secs) [==>]	[2]	
8	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W			Sequence 5-8 Non-Int in NGC6822 (03) Prime + Parallel Gro up 7-8 in Sequence 5 -8 Non-Int in NGC6 822 (03)	1250 Secs (1250 Secs) [==>]	[2]	
<i>Comments: Parallel with Exposure 03.007</i>										



Proposal 14191 - NGC6822 (04) - The Star Formation History and Proper Motion of NGC 6822

Wed Jul 08 01:15:14 GMT 2015

Visit	Proposal 14191, NGC6822 (04) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: SAME ORIENT AS 01; BETWEEN 01-SEP-2015:00:00:00 AND 30-NOV-2015:00:00:00; BETWEEN 01-SEP-2016:00:00:00 AND 30-NOV-2016:00:00:00; GROUP 04,01,02,03 WITHIN 3D										
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	NGC6822.BAR.EAST	RA: 19 45 30.3000 (296.3762500d) Dec: -14 53 14.30 (-14.88731d) Equinox: J2000		V=19.0+/-1 Faintest targets have V ~ 28. Distribution of brighter magnitudes to 19; a few V=13 foreground	Reference Frame: ICRS					
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	NGC6822-F ield1	(1) NGC6822.BAR.EAST	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.307,0.345	Sequence 1-4 Non-Int in NGC6822 (04) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in NGC6822 (04)	1220 Secs (1220 Secs) [==>]	[1]	
	2	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F606W			Sequence 1-4 Non-Int in NGC6822 (04) Prime + Parallel Group 1-2 in Sequence 1-4 Non-Int in NGC6822 (04)	1220 Secs (1220 Secs) [==>]	[1]	
	<i>Comments: Parallel with Exposure 04.001</i>										
	3	NGC6822-F ield1	(1) NGC6822.BAR.EAST	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=NO; GAIN=2.0	POS TARG 0.307,0.345	Sequence 1-4 Non-Int in NGC6822 (04) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in NGC6822 (04)	1150 Secs (1150 Secs) [==>]	[1]	
4	NGC6822-F ield2	ANY	WFC3/UVIS, ACCUM, UVIS-FIX	F814W			Sequence 1-4 Non-Int in NGC6822 (04) Prime + Parallel Group 3-4 in Sequence 1-4 Non-Int in NGC6822 (04)	1150 Secs (1150 Secs) [==>]	[1]		
<i>Comments: Parallel with Exposure 04.003</i>											

