



13696 - The Anemic Stellar Halo of M101

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Benne W. Holwerda (PI) (ESA Member) (Contact)	Sterrewacht Leiden	holwerda@strw.leidenuniv.nl
Dr. Eric F. Bell (CoI) (AdminUSPI)	University of Michigan	ericbell@umich.edu
Dr. Antonela Monachesi (CoI)	University of Michigan	antonela@umich.edu
Dr. David J. Radburn-Smith (CoI)	University of Washington	david@astro.washington.edu
Dr. Jeremy Bailin (CoI)	University of Alabama	jbailin@ua.edu
Dr. Roelof S. de Jong (CoI) (ESA Member)	Leibniz-Institut fur Astrophysik Potsdam	rdejong@aip.de
Mr. David Streich (CoI) (ESA Member)	Leibniz-Institut fur Astrophysik Potsdam	dstreich@aip.de

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) M101-40KPC	ACS/WFC WFC3/UVIS	2	24-Jul-2014 21:29:44.0	yes
02	(2) M101-55KPC	ACS/WFC WFC3/UVIS	2	24-Jul-2014 21:29:47.0	yes
03	(3) M101-75KPC	ACS/WFC WFC3/UVIS	2	24-Jul-2014 21:29:49.0	yes

6 Total Orbits Used

ABSTRACT

Models of galaxy formation in a cosmological context predict that massive disk galaxies should have richly-structured extended stellar halos, containing ~10% of a galaxy's stars, originating in large part from the tidal disruption of dwarf galaxies. Observations of a number of nearby disk galaxies have generally agreed with these expectations.

Recent new observations in integrated light with a novel array of low scattered-light telephoto lenses have failed to convincingly detect a stellar halo in the nearby massive face-on disk galaxy M101 (van Dokkum et al. 2014). They argue that any halo has to have <0.3% of the mass of the galaxy. This halo would be the least massive of any massive disk galaxy in the local Universe (by factors of several) -- such a halo is not predicted or naturally interpreted by the models, and would present a critical challenge to the picture of ubiquitous stellar halos formed from the debris of disrupting dwarf galaxies.

We propose to resolve the stellar populations of this uniquely anemic stellar halo for 6 orbits with HST (ACS and WFC3), allowing us to reach surface brightness limits sufficient to clearly detect and characterize M101's stellar halo if it carries more than 0.1% of M101's mass. With resolved stellar populations, we can use the gradient of stellar populations as a function of radius to separate stellar halo from disk, which is impossible using integrated light observations. The resolved stellar populations will reveal the halo mass to much greater accuracy, measure the halo radial profile, constrain any halo lopsidedness, estimate the halo's stellar metallicity, and permit an analysis of outer disk stellar populations.

OBSERVING DESCRIPTION

The observations are designed to probe the anemic halo of M101.

We have placed three pointings at 40, 55 and 75 kpc away from the center with

ACS parallel observations aligned with the major axis of M101.

We alternate between East-West along this axis.

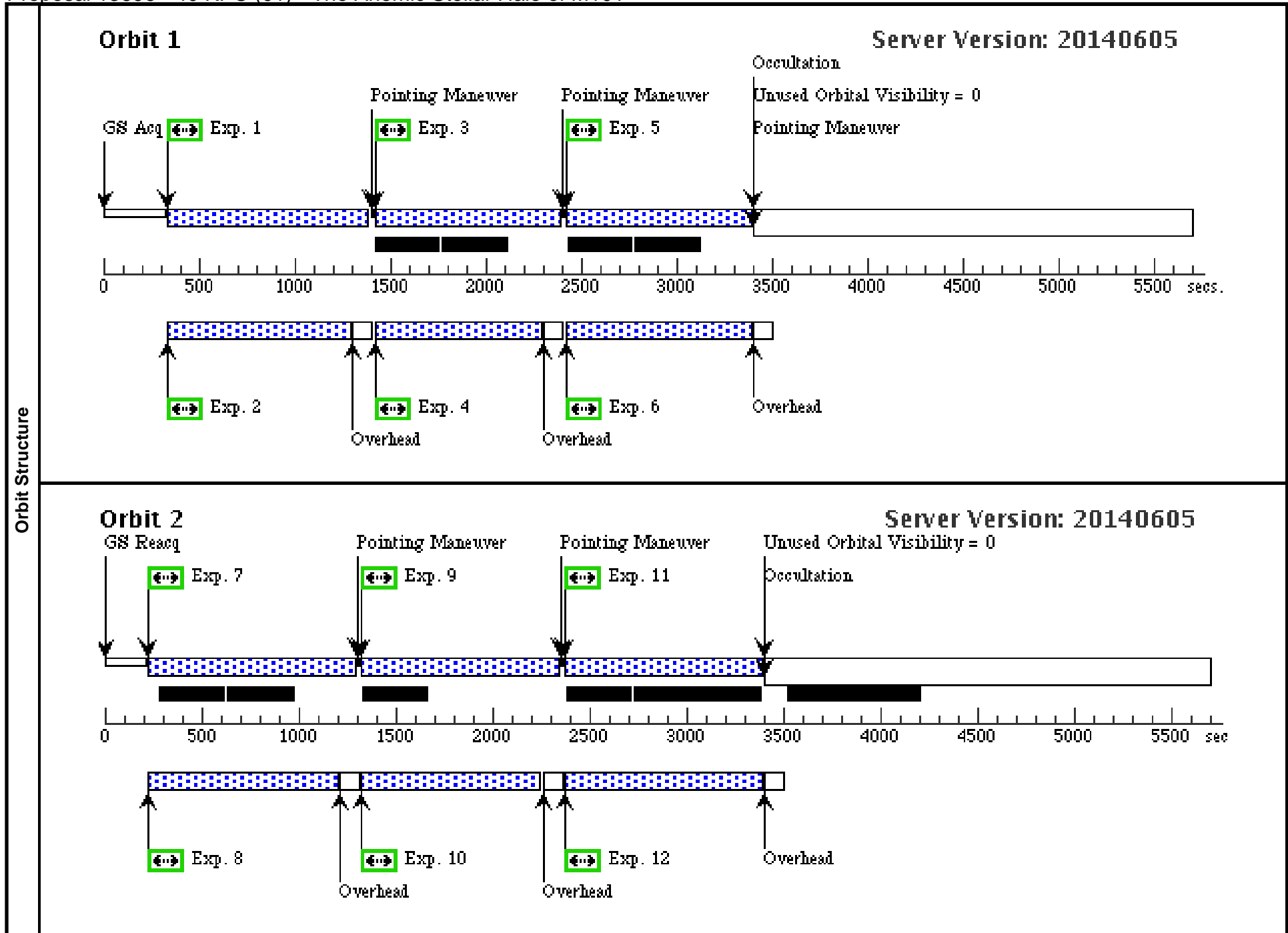
We have checked to the best of our abilities against accidental overlaps with the other Cycle 22 M101 programs: 13682, 13701 and 13691

Orientation is chosen such that the ACS field is away from M101. However, the reciprocal angle would be acceptable (ACS field on the inside) if it aids with scheduling.

Proposal 13696 - 40 KPC (01) - The Anemic Stellar Halo of M101

Fri Jul 25 01:29:50 GMT 2014

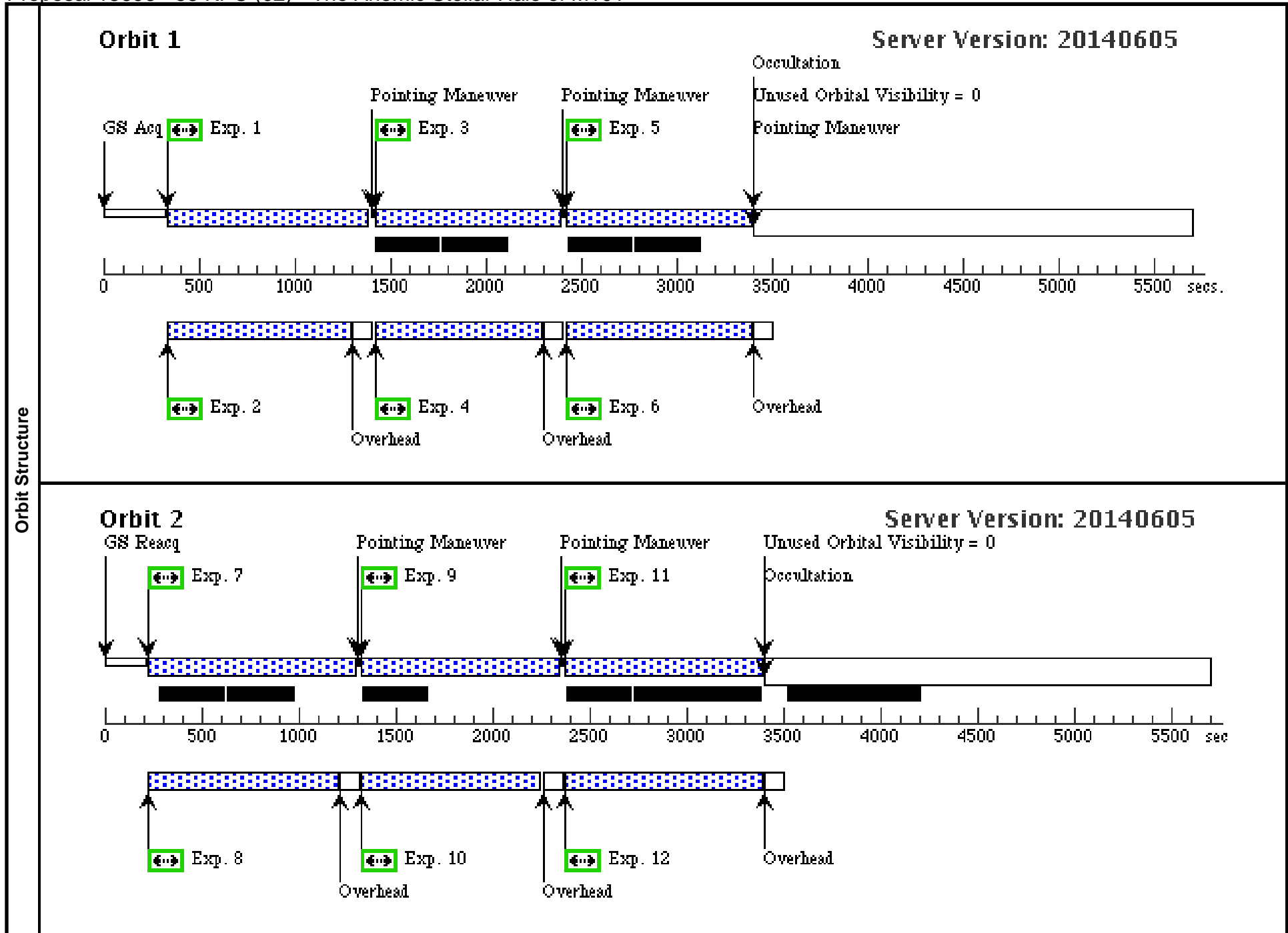
Visit	Proposal 13696, 40 KPC (01) Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: ORIENT 210D TO 240 D									
	Diagnostics	(40 KPC (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (40 KPC (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (40 KPC (01)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE								
Fixed Targets		#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	M101-40KPC	RA: 14 05 30.6800 (211.3778333d) Dec: +54 20 57.40 (54.34928d) Equinox: J2000		V=7.86	Reference Frame: SIMBAD			
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1)	M101-40KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -149.22 63,124.8626	Prime + Parallel Group 1-2 in 40 KPC (01)	848 Secs (848 Secs) [==>]	[1]
	2	(1)	M101-40KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 1-2 in 40 KPC (01)	928 Secs (928 Secs) [==>928.0 Secs]	[1]
	3	(1)	M101-40KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -149.01 20,124.9873	Prime + Parallel Group 3-4 in 40 KPC (01)	846 Secs (846 Secs) [==>]	[1]
	4	(1)	M101-40KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 3-4 in 40 KPC (01)	876 Secs (876 Secs) [==>876.0 Secs]	[1]
	5	(1)	M101-40KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -148.79 77,125.1120	Prime + Parallel Group 5-6 in 40 KPC (01)	846 Secs (846 Secs) [==>]	[1]
	6	(1)	M101-40KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 5-6 in 40 KPC (01)	972 Secs (972 Secs) [==>]	[1]
	7	(1)	M101-40KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 1	Prime + Parallel Group 7-8 in 40 KPC (01)	894 Secs (894 Secs) [==>]	[2]
	8	(1)	M101-40KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 7-8 in 40 KPC (01)	956 Secs (956 Secs) [==>956.0 Secs]	[2]
	9	(1)	M101-40KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 3	Prime + Parallel Group 9-10 in 40 KPC (01)	892 Secs (892 Secs) [==>]	[2]
	10	(1)	M101-40KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 9-10 in 40 KPC (01)	922 Secs (922 Secs) [==>922.0 Secs]	[2]
	11	(1)	M101-40KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 5	Prime + Parallel Group 11-12 in 40 KPC (01)	892 Secs (892 Secs) [==>]	[2]
	12	(1)	M101-40KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 11-12 in 40 KPC (01)	1018 Secs (1018 Secs) [==>]	[2]



Proposal 13696 - 55 KPC (02) - The Anemic Stellar Halo of M101

Fri Jul 25 01:29:51 GMT 2014

Visit	Proposal 13696, 55 KPC (02) Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: ORIENT 30D TO 60 D									
	Diagnostics	(55 KPC (02)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (55 KPC (02)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (55 KPC (02)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE								
Fixed Targets		#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(2)	M101-55KPC	RA: 14 00 23.1211 (210.0963379d) Dec: +54 20 29.70 (54.34158d) Equinox: J2000		V=7.86	Reference Frame: SIMBAD				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(2) M101-55KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -149.22 63,124.8626	Prime + Parallel Group 1-2 in 55 KPC (02)	848 Secs (848 Secs) [==>]	[1]	
	2	(2) M101-55KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 1-2 in 55 KPC (02)	928 Secs (928 Secs) [==>]	[1]	
	3	(2) M101-55KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -149.01 20,124.9873	Prime + Parallel Group 3-4 in 55 KPC (02)	846 Secs (846 Secs) [==>]	[1]	
	4	(2) M101-55KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 3-4 in 55 KPC (02)	876 Secs (876 Secs) [==>]	[1]	
	5	(2) M101-55KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -148.79 77,125.1120	Prime + Parallel Group 5-6 in 55 KPC (02)	846 Secs (846 Secs) [==>]	[1]	
	6	(2) M101-55KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 5-6 in 55 KPC (02)	972 Secs (972 Secs) [==>]	[1]	
	7	(2) M101-55KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 1	Prime + Parallel Group 7-8 in 55 KPC (02)	894 Secs (894 Secs) [==>]	[2]	
	8	(2) M101-55KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 7-8 in 55 KPC (02)	956 Secs (956 Secs) [==>]	[2]	
	9	(2) M101-55KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 3	Prime + Parallel Group 9-10 in 55 KPC (02)	892 Secs (892 Secs) [==>]	[2]	
	10	(2) M101-55KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 9-10 in 55 KPC (02)	922 Secs (922 Secs) [==>]	[2]	
	11	(2) M101-55KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 5	Prime + Parallel Group 11-12 in 55 KPC (02)	892 Secs (892 Secs) [==>]	[2]	
	12	(2) M101-55KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 11-12 in 55 KPC (02)	1018 Secs (1018 Secs) [==>]	[2]	



Proposal 13696 - 75 KPC (03) - The Anemic Stellar Halo of M101

Fri Jul 25 01:29:51 GMT 2014

Visit	Proposal 13696, 75 KPC (03) Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS, ACS/WFC Special Requirements: ORIENT 210D TO 240 D									
	Diagnostics	(75 KPC (03)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (75 KPC (03)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE (75 KPC (03)) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE								
Fixed Targets		#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	M101-75KPC	RA: 14 07 4.8683 (211.7702846d) Dec: +54 20 26.22 (54.34062d) Equinox: J2000		V=7.86	Reference Frame: SIMBAD				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(3) M101-75KPC	(3) M101-75KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -149.22 63,124.8626	Prime + Parallel Group 1-2 in 75 KPC (03)	848 Secs (848 Secs) [==>]	[1]
	2	(3) M101-75KPC	(3) M101-75KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 1-2 in 75 KPC (03)	928 Secs (928 Secs) [==>]	[1]
	3	(3) M101-75KPC	(3) M101-75KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -149.01 20,124.9873	Prime + Parallel Group 3-4 in 75 KPC (03)	846 Secs (846 Secs) [==>]	[1]
	4	(3) M101-75KPC	(3) M101-75KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 3-4 in 75 KPC (03)	876 Secs (876 Secs) [==>]	[1]
	5	(3) M101-75KPC	(3) M101-75KPC	ACS/WFC, ACCUM, WFCENTER	F606W	CR-SPLIT=NO	POS TARG -148.79 77,125.1120	Prime + Parallel Group 5-6 in 75 KPC (03)	846 Secs (846 Secs) [==>]	[1]
	6	(3) M101-75KPC	(3) M101-75KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	CR-SPLIT=NO		Prime + Parallel Group 5-6 in 75 KPC (03)	972 Secs (972 Secs) [==>]	[1]
	7	(3) M101-75KPC	(3) M101-75KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 1	Prime + Parallel Group 7-8 in 75 KPC (03)	894 Secs (894 Secs) [==>]	[2]
	8	(3) M101-75KPC	(3) M101-75KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 7-8 in 75 KPC (03)	956 Secs (956 Secs) [==>]	[2]
	9	(3) M101-75KPC	(3) M101-75KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 3	Prime + Parallel Group 9-10 in 75 KPC (03)	892 Secs (892 Secs) [==>]	[2]
	10	(3) M101-75KPC	(3) M101-75KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 9-10 in 75 KPC (03)	922 Secs (922 Secs) [==>]	[2]
	11	(3) M101-75KPC	(3) M101-75KPC	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	SAME POS AS 5	Prime + Parallel Group 11-12 in 75 KPC (03)	892 Secs (892 Secs) [==>]	[2]
	12	(3) M101-75KPC	(3) M101-75KPC	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	CR-SPLIT=NO		Prime + Parallel Group 11-12 in 75 KPC (03)	1018 Secs (1018 Secs) [==>]	[2]

