



10580 - A tip of the red giant branch distance to NGC 4038/39 ("The Antennae")

Cycle: 14, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets</i>	<i>Configurations</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC	4	20-Jun-2005 10:53:49.0	yes
02	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC	3	20-Jun-2005 10:53:53.0	yes

7 Total Orbits Used

ABSTRACT

We propose to use ACS to determine a tip of the red giant branch (TRGB) distance to the merger system archetype NGC4038/39 ("The Antennae"). This system is the closest major merger to us, but its distance remains a point of debate, with proposed values ranging from 14 to 33 Mpc. Our previous HST/WFPC2 V,I band observation targeted the star forming (SF) regions near the tip of the southern tail of NGC4038. These data revealed a background population of red stars far from SF regions which we identify as RGB stars. The TRGB was detected near our completeness limit at

about 26.5 mag, suggesting a distance of 13.8 ± 1.7 Mpc, 30% lower than the most accepted distance of 21 Mpc, and less than half the distance of 29 Mpc adopted to characterize the "ultraluminous X-ray binaries" (UXB) sources discovered in recent Chandra observations by Fabbiano et al. (2001). The lower distance has profound implications for the mass and luminosities of all sources associated with The Antennae, such as the Tidal Dwarf candidates, the globular cluster system, and the UXB population. With its greater sensitivity and higher resolution, ACS can resolve this issue in just a few orbits. We therefore request seven orbits to obtain V,I band images of the southern tail of NGC4038/39 to reach 1.6 mag lower than the TRGB, for our proposed distance modulus. Even if the larger distance is the correct one, our proposed imaging would still give a robust distance constraint from the TRGB.

OBSERVING DESCRIPTION

Our aim is to test the range of plausible distances in the literature. If we are seeing the RGB tip in our data, the field of ACS will enable us to study the structure of Schweizer's object in star counts. On the other hand, if we use the Fabbiano et al. (2001) distance, 29 Mpc, the RGB tip should be at $I = 28.1$. A photometric precision comparable to our current study of the Antennae can be reached for $S/N = 3$, and according to the ACS/ETC, less than 3 hours are needed to reach it for the F606W filter (splitting into 4 exposures), and less than 2 hours for the F814W filter (splitting into 3 exposures) of the WFC camera (for a K4V star, and $EB-V = 0.046$). These exposure times will allow us to obtain photometry with a precision of 0.4 mag (1-sigma), i.e. comparable to that of our current WFPC2 data set. The same exposure times will allow us to reach the tip at $S/N > 12$ if our distance modulus is correct (i.e. the precision of our photometry will be around 0.08 mag).

The visibility of the Antennae is 52 minutes, but, according to the ACS manual, overheads will reduce the effective observing time. If the observations are done in one visit, then 5 minutes per orbit will be taken by the guide star acquisition (6 min the first orbit). The ACS overhead is 4min for the first exposure, and 2.5 min for the rest. Using a small dithering pattern, the telescope overhead for the movements is 0.7 min per exposure, i.e. 3 min is the effective overhead per exposure (except the first one). During the first orbit we thus have $52 - 6 - 4 = 42$ min effective observing time. After the first orbit, the effective observing time is $52 - 5 - 3 = 44$ min, if we take 1 CR-SPLIT exposure per orbit. In 4 orbits we then get 2.9 hours which are sufficient for the F606W filter to reach $S/N \sim 3$. We will follow with another 3 orbits for the F814W filter, with 1 CR-SPLIT exposure per orbit. The effective observing time will be 2.2 hours, enough to reach $S/N \sim 3$ for the F814W filter. Our total request is then for 7 orbits, split into two visits.

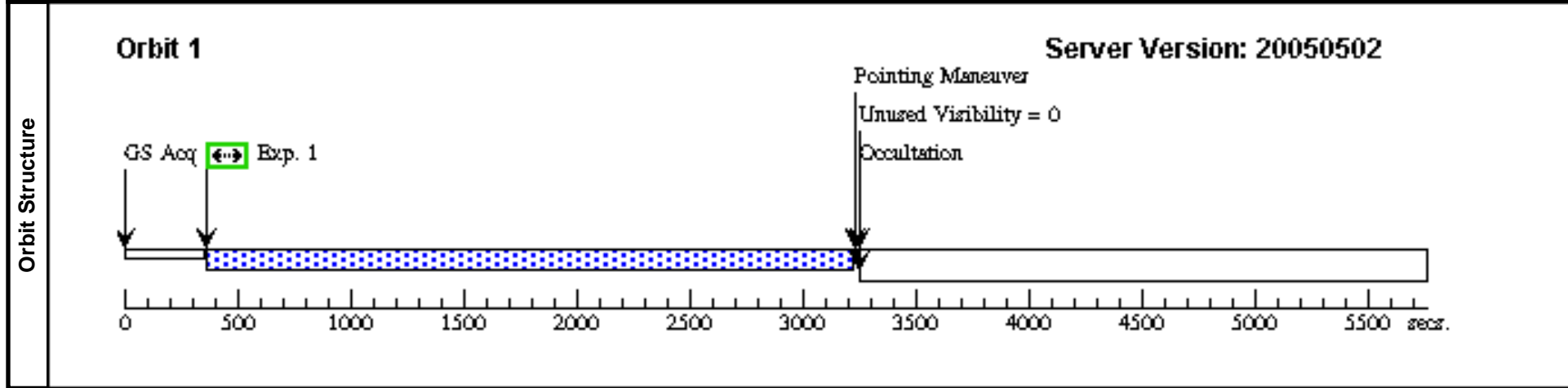
Proposal 10580 - Overview

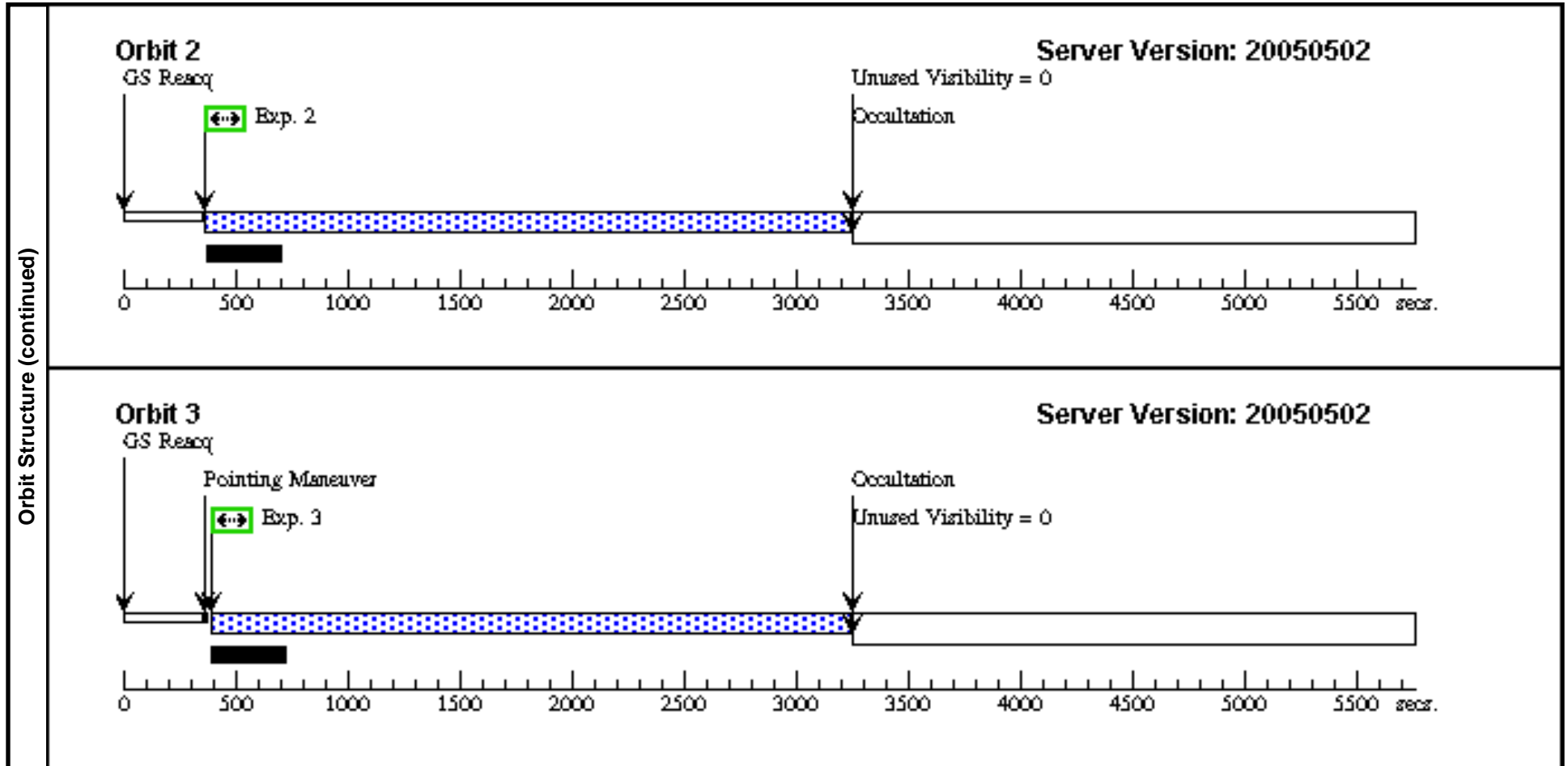
This will allow us to study the RGB in some detail if our short distance is correct, and to detect the RGB tip if the longer distance is valid, thus placing a reasonable limit on the Antennae distance modulus.

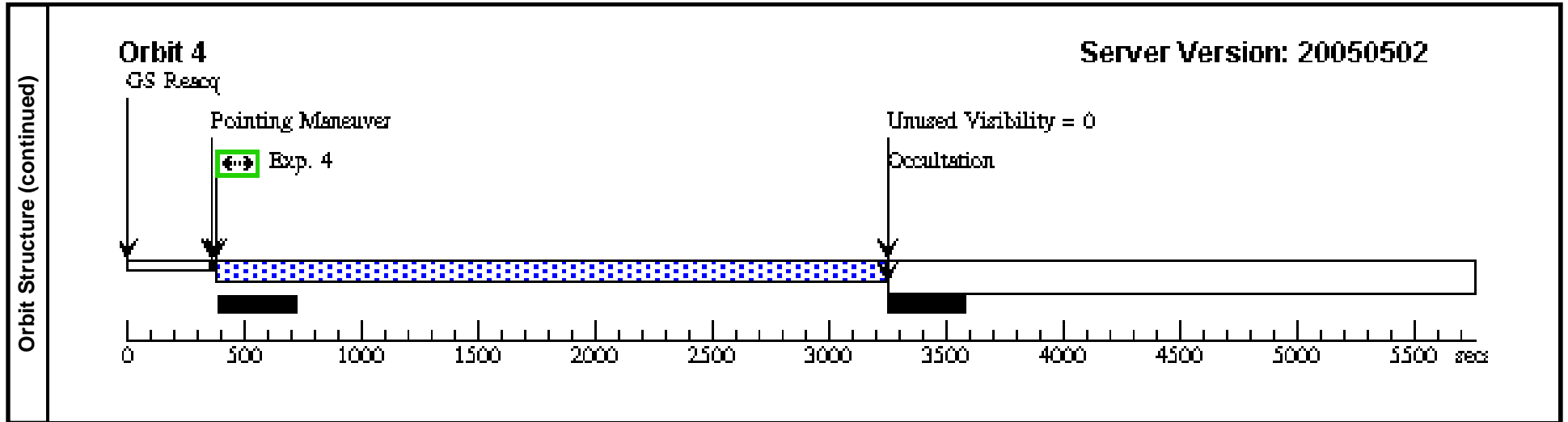
Visit	Proposal 10580, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: (none) <i>Comments: Collect 4 F606W exposures in 4 orbits, and apply a minimal dither pattern, to cover the inter-chip gap and provide some PSF subpixel sampling</i>				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	NGC4038+4039-TIDAL-TAIL-S	RA: 12 01 26.5112 (180.3604633d) Dec: -18 59 21.35 (-18.98926d) Equinox: J2000 Plate Id: (?)		V=19.0+/-0.2	Coordinate Source: HST_IMAGE

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	F606W 1	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO			1250.0 Secs [=>2652.0 Secs]	[1]
	2	F606W 2	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO	POS TARG 0.124,0.232		1250.0 Secs [=>2754.0 Secs]	[2]
	3	F606W 3	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO	POS TARG 0.494,3.078		1250.0 Secs [=>2730.0 Secs]	[3]
	4	F606W 4	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F606W	CR-SPLIT=NO	POS TARG 0.123,3.122		1250.0 Secs [=>2734.0 Secs]	[4]







Visit	Proposal 10580, Visit 02 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: SAME ORIENT AS 01 <i>Comments: Collect 3 F606W exposures in 3 orbits, and apply a minimal dither pattern, to cover the inter-chip gap and provide some PSF subpixel sampling</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
(1)		NGC4038+4039-TIDAL-TAIL-S	RA: 12 01 26.5112 (180.3604633d) Dec: -18 59 21.35 (-18.98926d) Equinox: J2000 Plate Id: (?)		V=19.0+/-0.2	Coordinate Source: HST_IMAGE				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	F814W 1	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO			1250.0 Secs [=>2652.0 Secs]	[1]
	2	F814W 2	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.124,0.232		1250.0 Secs [=>2754.0 Secs]	[2]
	3	F814W 3	(1) NGC4038+4039-TIDAL-TAIL-S	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.494,3.078		1250.0 Secs [=>2730.0 Secs]	[3]
Orbit Structure	Orbit 1 Server Version: 20050502 <p>The diagram shows a horizontal timeline from 0 to 5500 seconds. Key events are marked with vertical arrows: 'GS Acq' at approximately 100s, 'Exp. 1' (highlighted in green) at approximately 400s, 'Pointing Maneuver' at approximately 3250s, and 'Occultation' at approximately 3300s. A blue checkered bar represents the observation period from approximately 400s to 3250s. A solid grey bar represents the 'Unused Visibility' period from approximately 3250s to 5500s.</p>									
	Unused Visibility = 0									

