



# 14775 - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

Cycle: 24, 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) MCBRIDGE-QSO1	WFC3/UVIS	1	23-Oct-2017 18:20:31.0	yes
02	(2) MCBRIDGE-QSO2	WFC3/UVIS	1	23-Oct-2017 18:20:33.0	yes
03	(3) MCBRIDGE-QSO3	WFC3/UVIS	1	23-Oct-2017 18:20:34.0	yes
04	(4) MCBRIDGE-QSO4	WFC3/UVIS	1	23-Oct-2017 18:20:36.0	yes
05	(5) MCBRIDGE-QSO5	WFC3/UVIS	1	23-Oct-2017 18:20:37.0	yes
52	(2) MCBRIDGE-QSO2	WFC3/UVIS	1	23-Oct-2017 18:20:39.0	yes

6 Total Orbits Used

## **ABSTRACT**

Our HST PM measurements of the LMC and SMC have revolutionized our understanding of the Magellanic System, and have spurred new research on its use as a cosmological probe of galaxy formation. The PMs imply that the Magellanic Clouds are likely on their first infall towards the Milky Way (MW). The disturbed nature of the Magellanic System is therefore likely due to the LMC-SMC interaction, and not to the MW influence. This has emphasized the importance of dwarf galaxy interactions for galaxy evolution. The Clouds are connected by a complex of gas and stars called the Magellanic Bridge. We will map the stellar PM field of the Bridge, similar to our prior HST mapping of the LMC PM rotation field. Our state-of-the-art N-body simulations show that the PM field will tightly constrain the impact parameter of LMC-SMC orbit at its last pericenter 100-300 Myr ago, which is the main uncertainty in our understanding of the LMC/SMC interaction history. This will test whether the tidal debris between the galaxies is due to a recent direct-hit collision. It will also test models in which the tidal debris is responsible for the observed microlensing events. For each of the 8 target fields in the Magellanic Bridge, we expect to achieve PM accuracies of 10-25 km/s per field, well below the 130 km/s velocity difference between the Clouds. This will yield the best constraints to date on the LMC/SMC interaction, and will further test the importance of dwarf-dwarf interactions for galaxy evolution. We will also model the CMDs for all 16 (8 primary and 8 coordinated-parallel) fields, to better determine the stellar population properties of the Magellanic Bridge, and its spatial variation. The age and metallicity of the stars will further constrain the N-body models and the scenarios for the formation of the Magellanic Bridge.

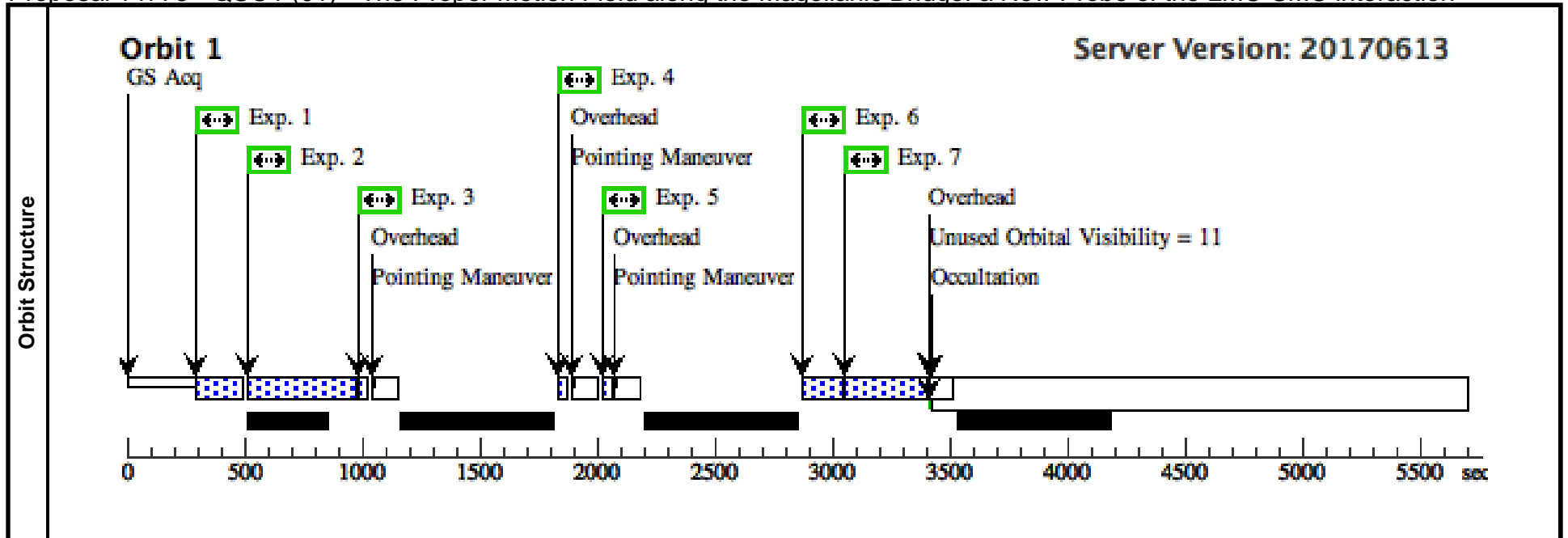
## **OBSERVING DESCRIPTION**

To measure the absolute proper motion of stars in the program fields, we will use quasars as stationary reference sources. This Cycle 24 GO-14775 program is for obtaining the second-epoch images of the quasar fields in the Magellanic Bridge. The first-epoch images for the same fields have already been obtained through the Cycle 22 GO-13834 program. We will largely use the same strategy used in our first-epoch observations, but use the F606W as the primary filter in this epoch. In addition, we added one long F606W and one long F814W exposures to construct deep CMDs in our field that will help with the identification of Magellanic Bridge stars. Each field in this epoch will consist of a single orbit observation, obtaining multiple dithered WFC3/UVIS exposures in a POSTARG pattern to optimize PSF sampling.

Proposal 14775 - QSO1 (01) - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

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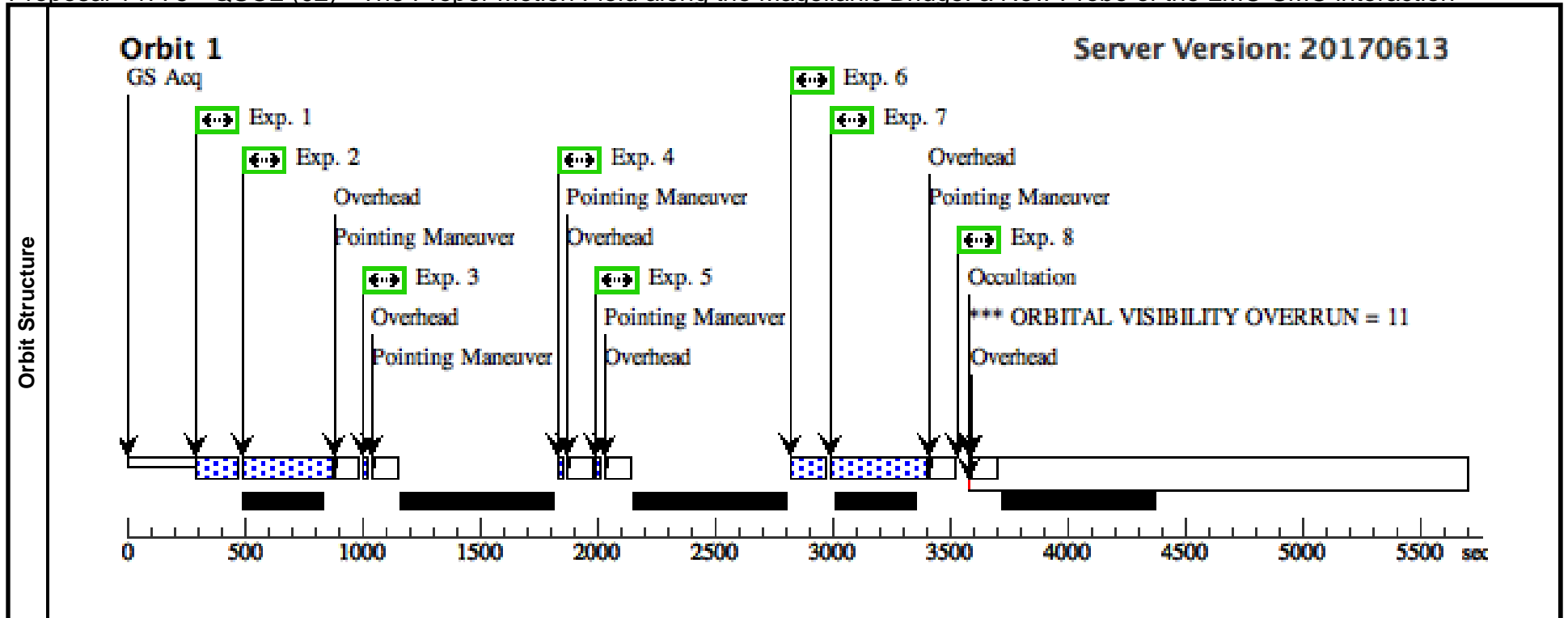
Visit	<b>Proposal 14775, QSO1 (01), scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: SCHED 50%; ORIENT 51.10D TO 51.10 D <i>Comments: This is the visit for second-epoch observation of MCBRIDGE-QSO1.</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	MCBRIDGE-QSO1 Alt Name1: B0202-765	RA: 02 02 13.6945 (30.5570604d) Dec: -76 20 3.06 (-76.33418d) Equinox: J2000	Redshift: 0.389	V=16.77+/-0.1	Reference Frame: ICRS			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.000,0.000	Sequence 1-7 Non-Int in QSO1 (01)	45 Secs (45 Secs) [==>]	[1]
	2		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.000,0.000	Sequence 1-7 Non-Int in QSO1 (01)	348 Secs (348 Secs) [==>]	[1]
	3		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.000,0.000	Sequence 1-7 Non-Int in QSO1 (01)	45 Secs (45 Secs) [==>]	[1]
	4		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.1647,0.0124	Sequence 1-7 Non-Int in QSO1 (01)	45 Secs (45 Secs) [==>]	[1]
	5		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.1795,0.1114	Sequence 1-7 Non-Int in QSO1 (01)	45 Secs (45 Secs) [==>]	[1]
	6		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.3689,0.0940	Sequence 1-7 Non-Int in QSO1 (01)	45 Secs (45 Secs) [==>]	[1]
	7		(1) MCBRIDGE-QSO1	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.3689,0.0940	Sequence 1-7 Non-Int in QSO1 (01)	348 Secs (348 Secs) [==>]	[1]



Proposal 14775 - QSO2 (02) - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

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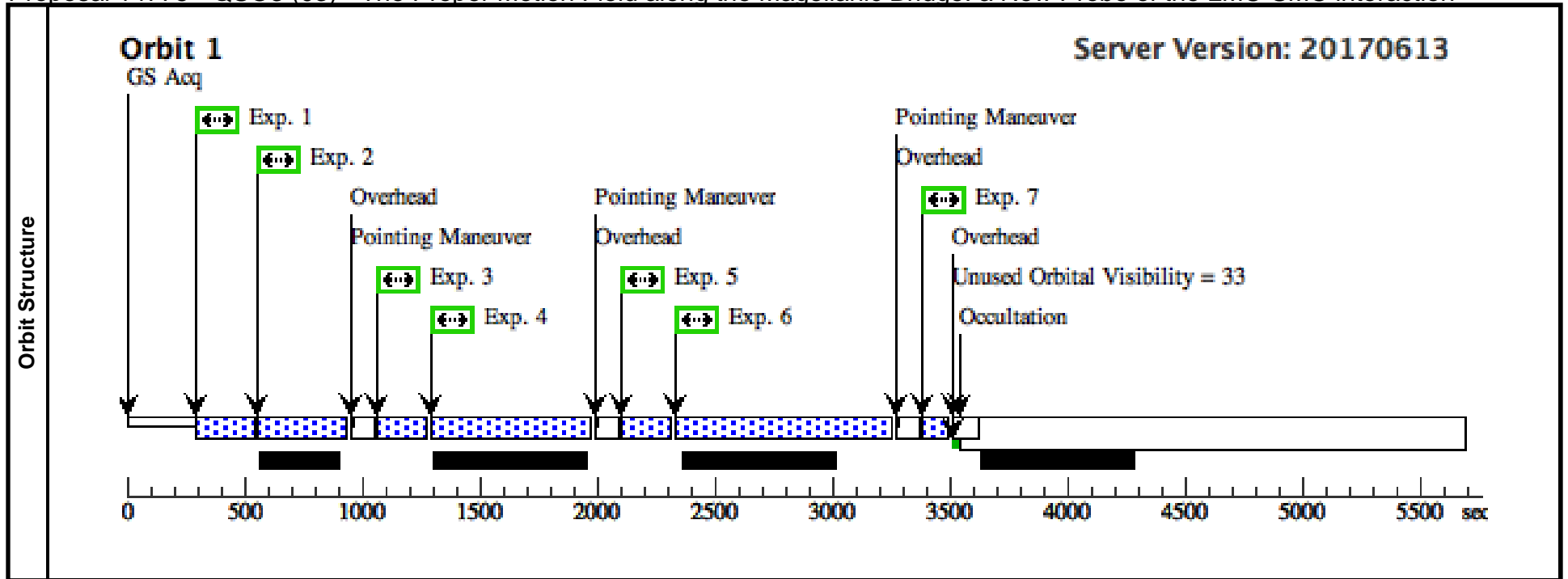
<b>Visit</b>	Proposal 14775, QSO2 (02), failed <b>Diagnostic Status: Warning</b> Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 2.35D TO 2.35 D <i>Comments: This is the visit for second-epoch observation of MCBRIDGE-QSO2.</i>									
	(QSO2 (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
	(2)	MCBRIDGE-QSO2 Alt Name1: B0242-7229	RA: 02 43 9.6100 (40.7900417d) Dec: -72 16 48.20 (-72.28006d) Equinox: J2000	Redshift: 0.102	V=15.9+/-0.1	Reference Frame: ICRS				
<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	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.0000,0 .0000	Sequence 1-8 Non-Int in QSO2 (02)	25 Secs (25 Secs) [==>]	[1]
	2	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.0000,0 .0000	Sequence 1-8 Non-Int in QSO2 (02)	384 Secs (384 Secs) [==>]	[1]
	3	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.1647,0 .0124	Sequence 1-8 Non-Int in QSO2 (02)	25 Secs (25 Secs) [==>]	[1]
	4	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.3293,0 .0248	Sequence 1-8 Non-Int in QSO2 (02)	25 Secs (25 Secs) [==>]	[1]
	5	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.0747,0 .1294	Sequence 1-8 Non-Int in QSO2 (02)	25 Secs (25 Secs) [==>]	[1]
	6	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.2393,0 .1418	Sequence 1-8 Non-Int in QSO2 (02)	25 Secs (25 Secs) [==>]	[1]
	7	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=3.0	POS TARG 0.2393,0 .1418	Sequence 1-8 Non-Int in QSO2 (02)	389 Secs (389 Secs) [==>]	[1]
	8	(2) MCBRIDGE-QSO2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.4039,0 .1541	Sequence 1-8 Non-Int in QSO2 (02)	25 Secs (25 Secs) [==>]	[1]



Proposal 14775 - QSO3 (03) - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

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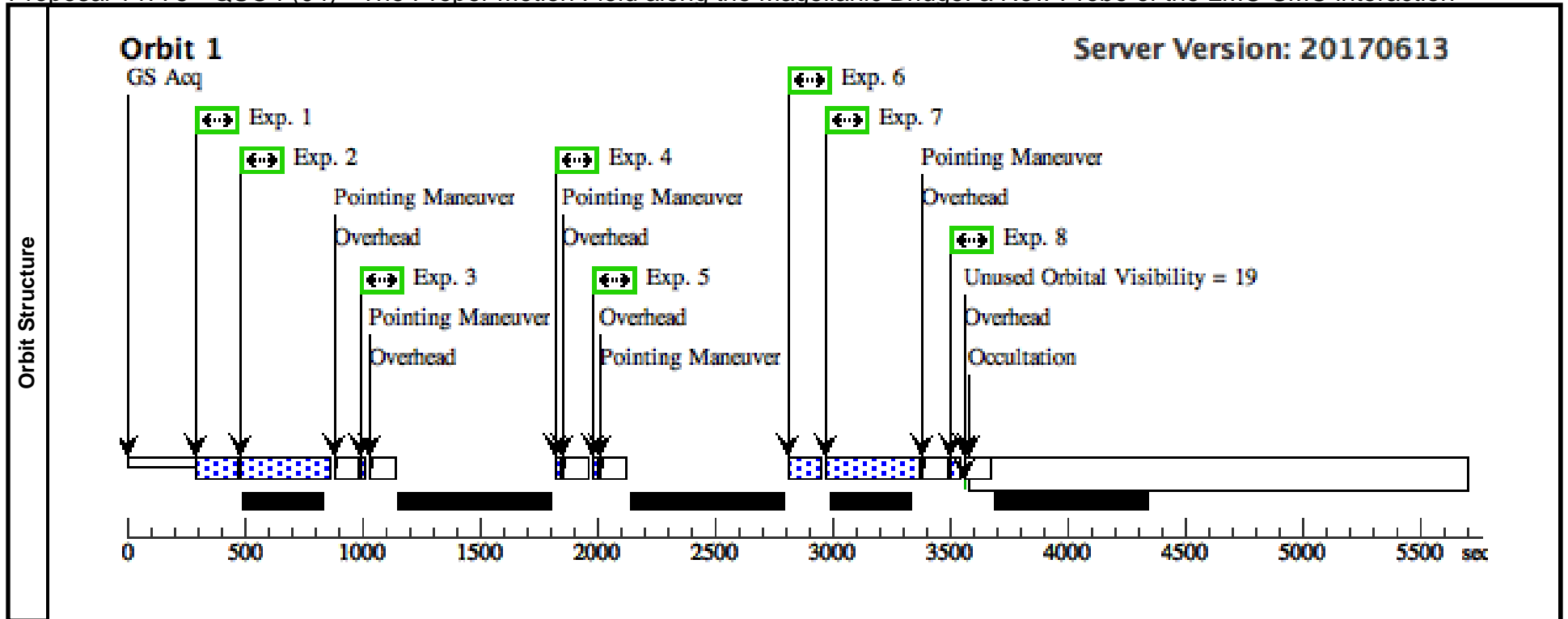
Visit	<b>Proposal 14775, QSO3 (03), completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 337.32D TO 337.32 D <i>Comments: This is the visit for second-epoch observation of MCBRIDGE-QSO3.</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	MCBRIDGE-QSO3 Alt Name1: B0251-675	RA: 02 51 55.7840 (42.9824333d) Dec: -67 18 0.14 (-67.30004d) Equinox: J2000	Redshift: 1.002	V=17.5+/-0.1	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=8.0	POS TARG 0.0000,0.0000	Sequence 1-7 Non-Int in QSO3 (03)	90 Secs (90 Secs) [==>]	[1]
	2	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.0000,0.0000	Sequence 1-7 Non-Int in QSO3 (03)	384 Secs (384 Secs) [==>]	[1]
	3	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=8.0	POS TARG 0.158,0.070	Sequence 1-7 Non-Int in QSO3 (03)	90 Secs (90 Secs) [==>]	[1]
	4	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F606W		POS TARG 0.158,0.070	Sequence 1-7 Non-Int in QSO3 (03)	684 Secs (684 Secs) [==>]	[1]
	5	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=8.0	POS TARG 0.099,0.165	Sequence 1-7 Non-Int in QSO3 (03)	90 Secs (90 Secs) [==>]	[1]
	6	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.099,0.165	Sequence 1-7 Non-Int in QSO3 (03)	900 Secs (900 Secs) [==>]	[1]
	7	(3) MCBRIDGE-QSO3	MCBRIDGE-QSO3	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=8.0	POS TARG -0.060,0.095	Sequence 1-7 Non-Int in QSO3 (03)	90 Secs (90 Secs) [==>]	[1]



Proposal 14775 - QSO4 (04) - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

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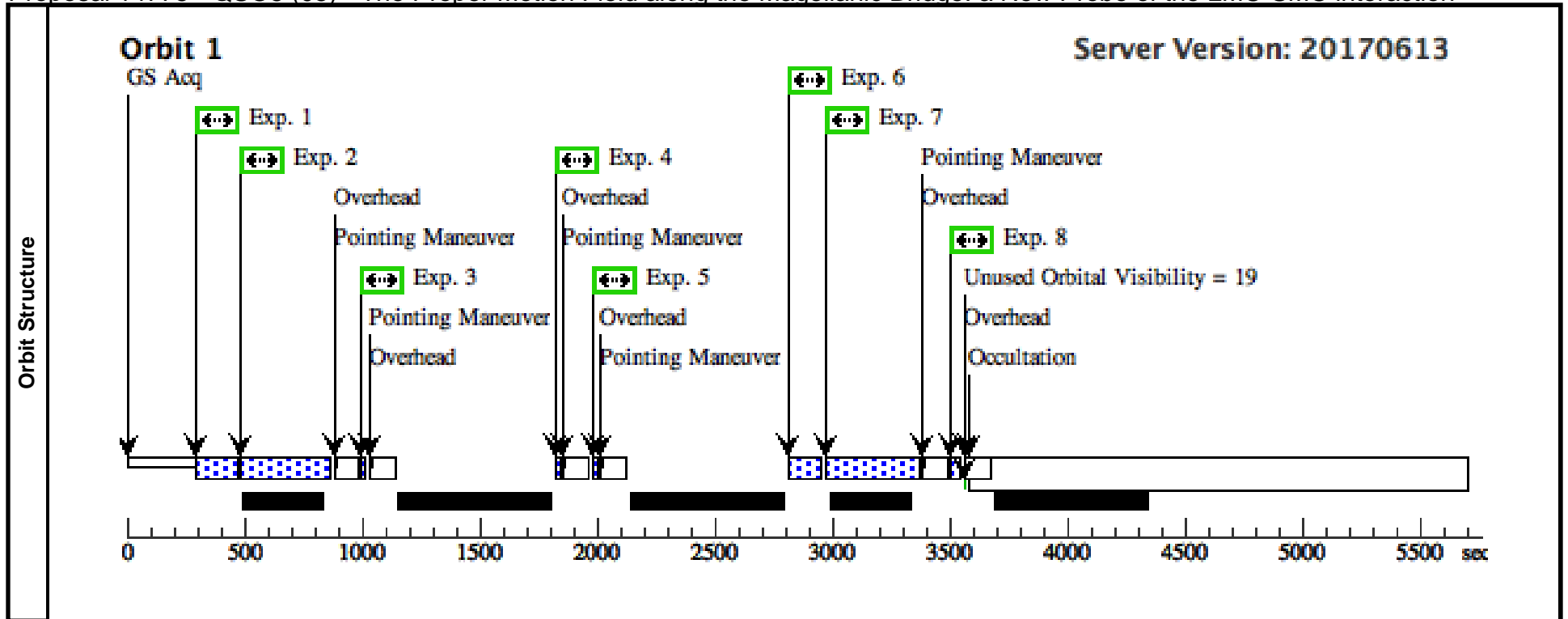
Visit	<b>Proposal 14775, QSO4 (04), scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 24.15D TO 24.15 D Comments: This is the visit for second-epoch observation of MCBRIDGE-QSO4									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(4)	MCBRIDGE-QSO4 Alt Name1: ESO31-8	RA: 03 07 35.3200 (46.8971667d) Dec: -72 50 2.50 (-72.83403d) Equinox: J2000	Redshift: 0.028	V=(?) B = 15.5	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.0000,0 .0000	Sequence 1-8 Non-Int in QSO4 (04)	20 Secs (20 Secs)	[1]	
	2	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.0000,0 .0000	Sequence 1-8 Non-Int in QSO4 (04)	384 Secs (384 Secs)	[1]	
	3	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.1647,0 .0124	Sequence 1-8 Non-Int in QSO4 (04)	20 Secs (20 Secs)	[1]	
	4	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.3293,0 .0248	Sequence 1-8 Non-Int in QSO4 (04)	20 Secs (20 Secs)	[1]	
	5	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.0747,0 .1294	Sequence 1-8 Non-Int in QSO4 (04)	20 Secs (20 Secs)	[1]	
	6	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.2393,0 .1418	Sequence 1-8 Non-Int in QSO4 (04)	20 Secs (20 Secs)	[1]	
	7	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=3.0	POS TARG 0.2393,0 .1418	Sequence 1-8 Non-Int in QSO4 (04)	384 Secs (384 Secs)	[1]	
	8	(4) MCBRIDGE-QSO4	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.4039,0 .1541	Sequence 1-8 Non-Int in QSO4 (04)	20 Secs (20 Secs)	[1]	



Proposal 14775 - QSO5 (05) - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

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Visit	<b>Proposal 14775, QSO5 (05), scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 12.33D TO 12.33 D <i>Comments: This is the visit for second-epoch observation of MCBRIDGE-QSO5.</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(5)	MCBRIDGE-QSO5 Alt Name1: ESO55-2	RA: 03 54 2.0300 (58.5084583d) Dec: -72 08 4.90 (-72.13469d) Equinox: J2000	Redshift: 0.049	V=(?) B = 15.7	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.0000,0 .0000	Sequence 1-8 Non-Int in QSO5 (05)	20 Secs (20 Secs) [==>]	[1]
	2	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.0000,0 .0000	Sequence 1-8 Non-Int in QSO5 (05)	384 Secs (384 Secs) [==>]	[1]
	3	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.1647,0 .0124	Sequence 1-8 Non-Int in QSO5 (05)	20 Secs (20 Secs) [==>]	[1]
	4	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.3293,0 .0248	Sequence 1-8 Non-Int in QSO5 (05)	20 Secs (20 Secs) [==>]	[1]
	5	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.0747,0 .1294	Sequence 1-8 Non-Int in QSO5 (05)	20 Secs (20 Secs) [==>]	[1]
	6	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.2393,0 .1418	Sequence 1-8 Non-Int in QSO5 (05)	20 Secs (20 Secs) [==>]	[1]
	7	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=3	POS TARG 0.2393,0 .1418	Sequence 1-8 Non-Int in QSO5 (05)	384 Secs (384 Secs) [==>]	[1]
	8	(5) MCBRIDGE-QSO5	MCBRIDGE-QSO5	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=12	POS TARG 0.4039,0 .1541	Sequence 1-8 Non-Int in QSO5 (05)	20 Secs (20 Secs) [==>]	[1]



Proposal 14775 - QSO2 (52) - The Proper Motion Field along the Magellanic Bridge: a New Probe of the LMC-SMC interaction

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Visit	<b>Proposal 14775, QSO2 (52)</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: SCHED 90%; ORIENT 2.00D TO 2.70 D <i>Comments: This is the visit for second-epoch observation of MCBRIDGE-QSO2. This was originally Visit 02, which failed due to the FGS not being able to lock on guide stars. We filed a HOPR (89178) and was approved.</i>									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(2)	MCBRIDGE-QSO2 Alt Name1: B0242-7229	RA: 02 43 9.6100 (40.7900417d) Dec: -72 16 48.20 (-72.28006d) Equinox: J2000	Redshift: 0.102	V=15.9+/-0.1	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.0000,0.0000	Sequence 1-7 Non-Int in QSO2 (52)	25 Secs (25 Secs)	[1]	
	2	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.0000,0.0000	Sequence 1-7 Non-Int in QSO2 (52)	348 Secs (348 Secs)	[1]	
	3	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.1647,0.0124	Sequence 1-7 Non-Int in QSO2 (52)	25 Secs (25 Secs)	[1]	
	4	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.3293,0.0248	Sequence 1-7 Non-Int in QSO2 (52)	25 Secs (25 Secs)	[1]	
	5	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.0747,0.1294	Sequence 1-7 Non-Int in QSO2 (52)	25 Secs (25 Secs)	[1]	
	6	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=10.0	POS TARG 0.2393,0.1418	Sequence 1-7 Non-Int in QSO2 (52)	25 Secs (25 Secs)	[1]	
	7	(2) MCBRIDGE-QSO2	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=9.0	POS TARG 0.2393,0.1418	Sequence 1-7 Non-Int in QSO2 (52)	125 Secs (125 Secs)	[1]	

