15476 - The Formation History of Milky Way Satellite Canes Venatici I

Cycle: 25, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CVN-I-DSPH-1 ANY	ACS/WFC WFC3/UVIS	2	07-Jun-2018 14:00:18.0	yes
02	(1) CVN-I-DSPH-1 ANY	ACS/WFC WFC3/UVIS	2	07-Jun-2018 14:00:21.0	yes
03	(2) CVN-I-DSPH-2 ANY	ACS/WFC WFC3/UVIS	2	07-Jun-2018 14:00:23.0	yes
04	(2) CVN-I-DSPH-2 ANY	ACS/WFC WFC3/UVIS	2	07-Jun-2018 14:00:24.0	yes

8 Total Orbits Used

ABSTRACT

We propose deep ACS/WFC and WFC3/UVIS F606W and F814W imaging of Milky Way (MW) satellite Canes Venatici I (CVn I) to measure its star formation history (SFH) and establish first epoch imaging for its proper motion (PM) determination. CVn I (Mv = -7.9) is a distant (~220 kpc) MW satellite that straddles the boundary between ultra-faint and classical dwarf galaxy. It is among the most diffuse, faint satellites in the local Universe (r_h > 500pc, mu=28.1 mag/arcsec^2), but whether its low density is intrinsic or environmentally driven remains unknown.

The SFH and PM motion measurements enable a wide range of immediate and long term science including (1) determining if the timing and intensity of star formation can explain CVn I's low density through dark matter core creation; (2) examining how reionization impacts galaxy formation in this transitional mass regime; (3) checking if the sub-Solar stellar IMF follows the trends established in other ultra-faint galaxies; (4) determining if CVn I's orbital history includes a close pericentric passage (< 20kpc) to the MW's disk, which would have tidally disturbed CVn I; (5) providing one of the most precise measurements of the total mass of the MW's halo. Furthermore, this program will put CVn I on same observational footing as all other MW satellites.

Only HST can achieve any of these science goals. However, all archival HST observations of CVn I are inadequate. Maximizing the time baseline for PM measurement is scientifically imperative, but it will be 2 cycles until normal channels for small programs are restored. Waiting will substantially compromise the precision of the PM determination.

OBSERVING DESCRIPTION

We will image CVn I using the F606W and F814W filters of ACS/WFC and WFC3/UVIS. Our imaging will reach high S/N at the oldest main sequence turnoff in multiple fields, allowing us to measure the detailed star formation history (SFH) of CVn I across all cosmic time. Our imaging is well-dithered, and thus establishes a first epoch proper motion baseline, and is deep enough to explore the sub-Solar stellar initial mass function.

Our observing plan generally follows that specificed in the GO-14734, a Treasury survey of Milky Way satellites, which did not include CVn I. Our program consists of two adjacent ACS pointings located within the half-light radius. Each pointing is allocated 4 orbits, two in F606W and two in F814W, spread out over two visits. Each orbit is executed as a single filter and divided into long exposures (~1100-1300 sec per filter) in order to minimze overheads. For a single orbit in each filter, we add a short intergration (60 sec) to mitigate any potential saturation issues with bright stars. We use POS-TARG commands to implement the 4 point dither pattern specified by the ACS users handbook. This dither pattern satisfies PSF sampling requirements for consistent astrometic fidelity with observations of other MW satellites.

WFC3/UVIS observations are taken in parallel mode, and follow a similar observing strategy to ACS. For the 60 sec UVIS exposures, we use FLASH=10. To maximize schedulability of this program, we only constrain the roll angle to avoid bright foreground stars that may negatively affect the parallels. However, we do require that differnet visits for the same pointings have the same ORIENTATION. Given the minimal roll angle constraints and the diffuse nature of CVn I, there is a >50% chance that one of the UVIS fields will sample stars within the galaxy's half-light radius.

Visit

Proposal 15476, Visit 01, implementation Thu Jun 07 18:00:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 15D TO 215 D; ORIENT 270D TO 320 D

Fixed Targets

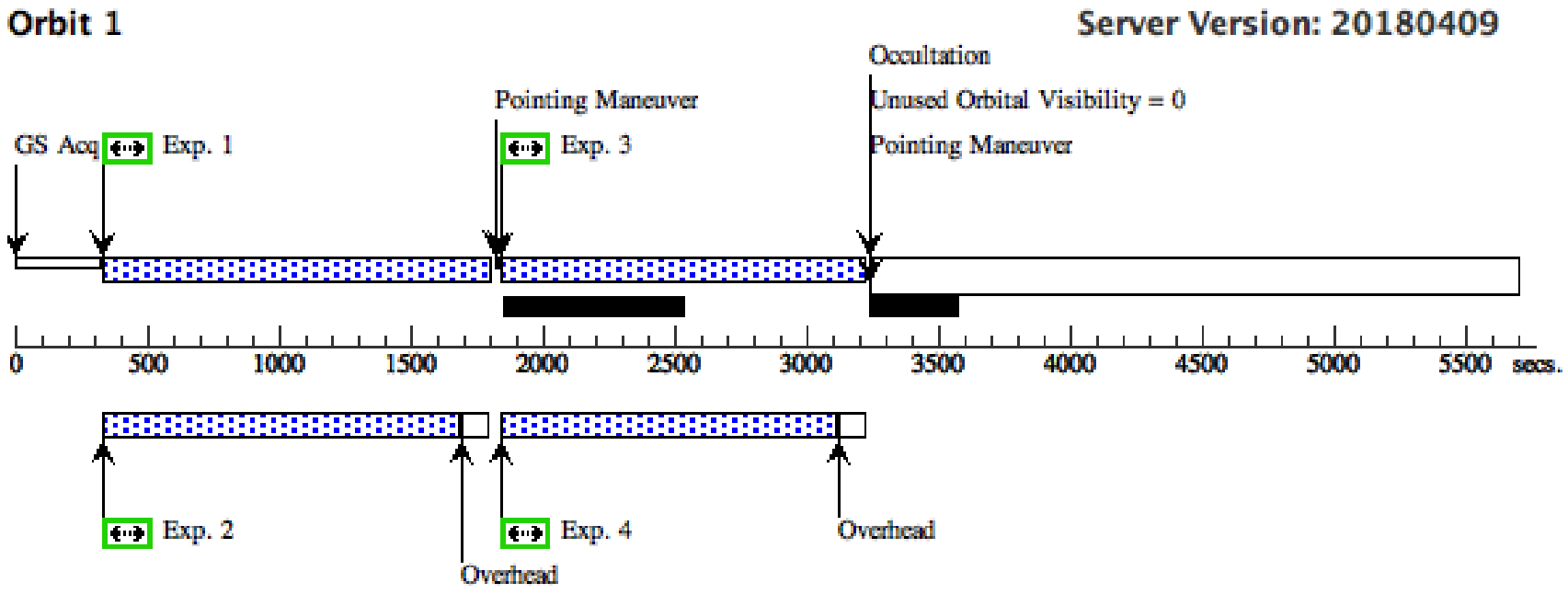
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CVN-I-DSPH-1	RA: 13 28 18.2939 (202.0762246d) Dec: +33 35 1.34 (33.58371d) Equinox: J2000		V=19+/-1	Reference Frame: NED

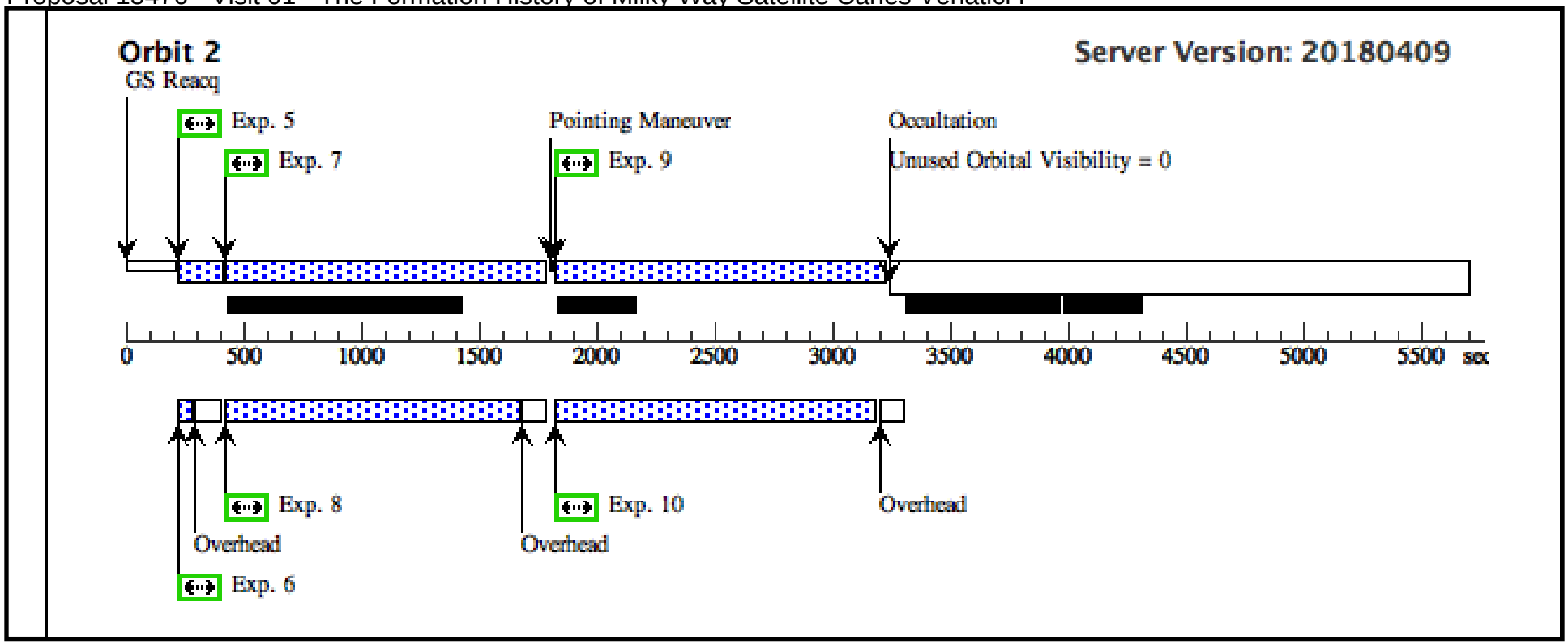
Comments: Faintest targets have V~28-29. A few foreground stars with V~13
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.0,0.0	Prime + Parallel Group 1-2 in Visit 01	1269 Secs (1269 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in Visit 01	1229 Secs (1320 Secs) *[==>1320.0 Secs]*	 ***[1]***
3		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.148,0.086	Prime + Parallel Group 3-4 in Visit 01	1260 Secs (1260 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 3-4 in Visit 01	1229 Secs (1270 Secs) *[==>1270.0 Secs]*	 ***[1]***
5		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.222,0.240	Prime + Parallel Group 5-6 in Visit 01	60 Secs (60 Secs) *[==>]*	 ***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=10		Prime + Parallel Group 5-6 in Visit 01	60 Secs (60 Secs) *[==>]*	 ***[2]***
7		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.222,0.240	Prime + Parallel Group 7-8 in Visit 01	1240 Secs (1240 Secs) *[==>]*	 ***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 7-8 in Visit 01	1230 Secs (1250 Secs) *[==>1250.0 Secs]*	 ***[2]***
9		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.074,0.154	Prime + Parallel Group 9-10 in Visit 01	1280 Secs (1280 Secs) *[==>]*	 ***[2]***
10		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 9-10 in Visit 01	1300 Secs (1366 Secs) *[==>1366.0 Secs]*	 ***[2]***

Orbit Structure

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Server Version: 20180409
GS Reacq
Exp. 5
Exp. 7
Pointing Maneuver
Exp. 9
Occultation
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 8
Exp. 10
Overhead
Overhead
Overhead
Exp. 6

Visit

Proposal 15476, Visit 02, implementation Thu Jun 07 18:00:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: SAME ORIENT AS 01

Fixed Targets

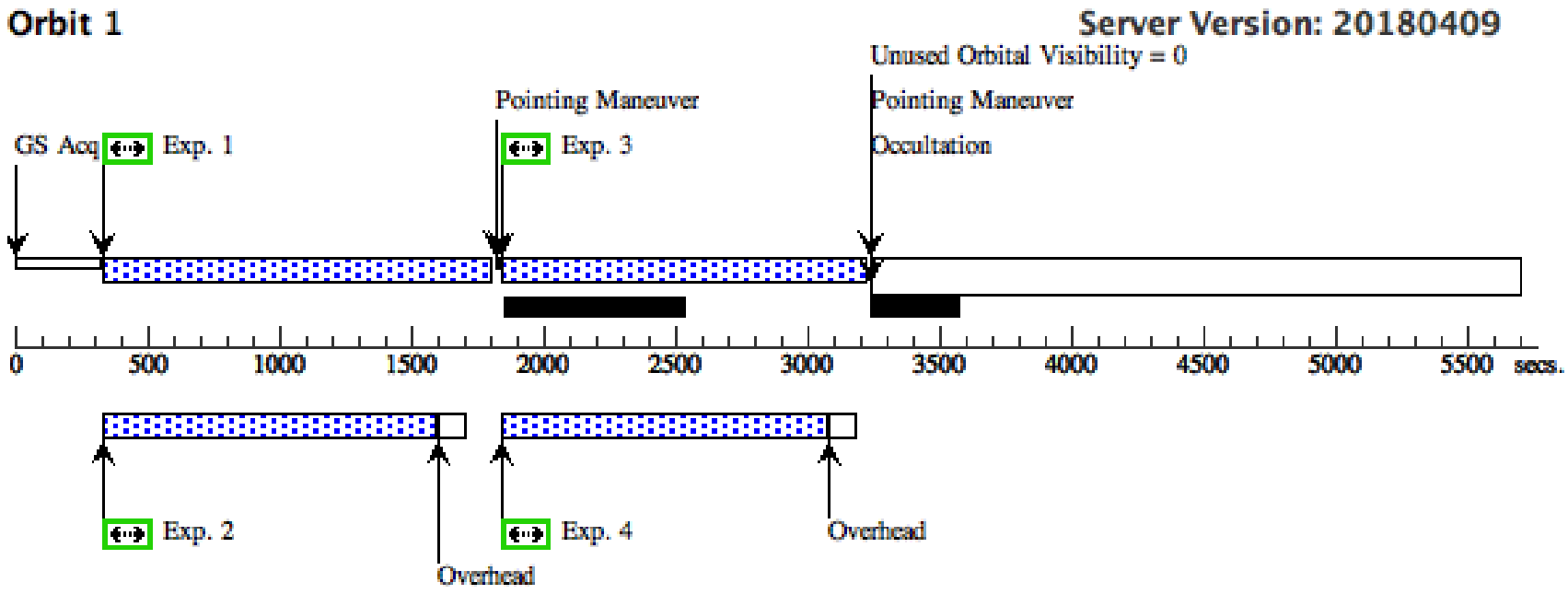
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	CVN-I-DSPH-1	RA: 13 28 18.2939 (202.0762246d) Dec: +33 35 1.34 (33.58371d) Equinox: J2000		V=19+/-1	Reference Frame: NED

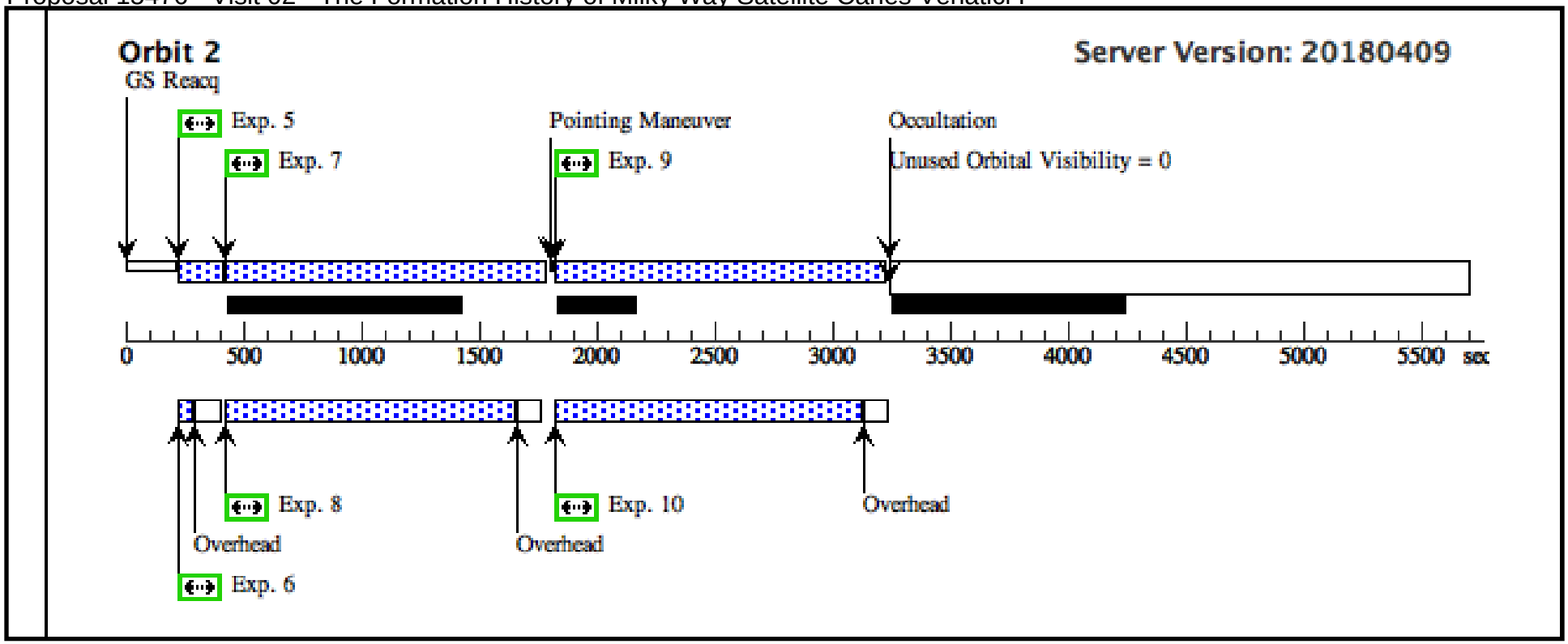
Comments: Faintest targets have V~28-29. A few foreground stars with V~13
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.0,0.0	Prime + Parallel Group up 1-2 in Visit 02	1269 Secs (1269 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 1-2 in Visit 02	1229 Secs (1229 Secs) *[==>]*	 ***[1]***
3		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.148,0.086	Prime + Parallel Group up 3-4 in Visit 02	1260 Secs (1260 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 3-4 in Visit 02	1229 Secs (1229 Secs) *[==>]*	 ***[1]***
5		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.222,0.240	Prime + Parallel Group up 5-6 in Visit 02	60 Secs (60 Secs) *[==>]*	 ***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=10		Prime + Parallel Group up 5-6 in Visit 02	60 Secs (60 Secs) *[==>]*	 ***[2]***
7		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.222,0.240	Prime + Parallel Group up 7-8 in Visit 02	1240 Secs (1240 Secs) *[==>]*	 ***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 7-8 in Visit 02	1230 Secs (1230 Secs) *[==>]*	 ***[2]***
9		(1) CVN-I-DSPH-1	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.074,0.154	Prime + Parallel Group up 9-10 in Visit 02	1280 Secs (1280 Secs) *[==>]*	 ***[2]***
10		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 9-10 in Visit 02	1300 Secs (1300 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20180409
GS Reacq
Exp. 5
Exp. 7
Pointing Maneuver
Exp. 9
Occultation
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Exp. 8
Exp. 10
Overhead
Overhead
Overhead
Exp. 6

Visit

Proposal 15476, Visit 03, implementation Thu Jun 07 18:00:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 1D TO 240 D; ORIENT 300D TO 359 D

Fixed Targets

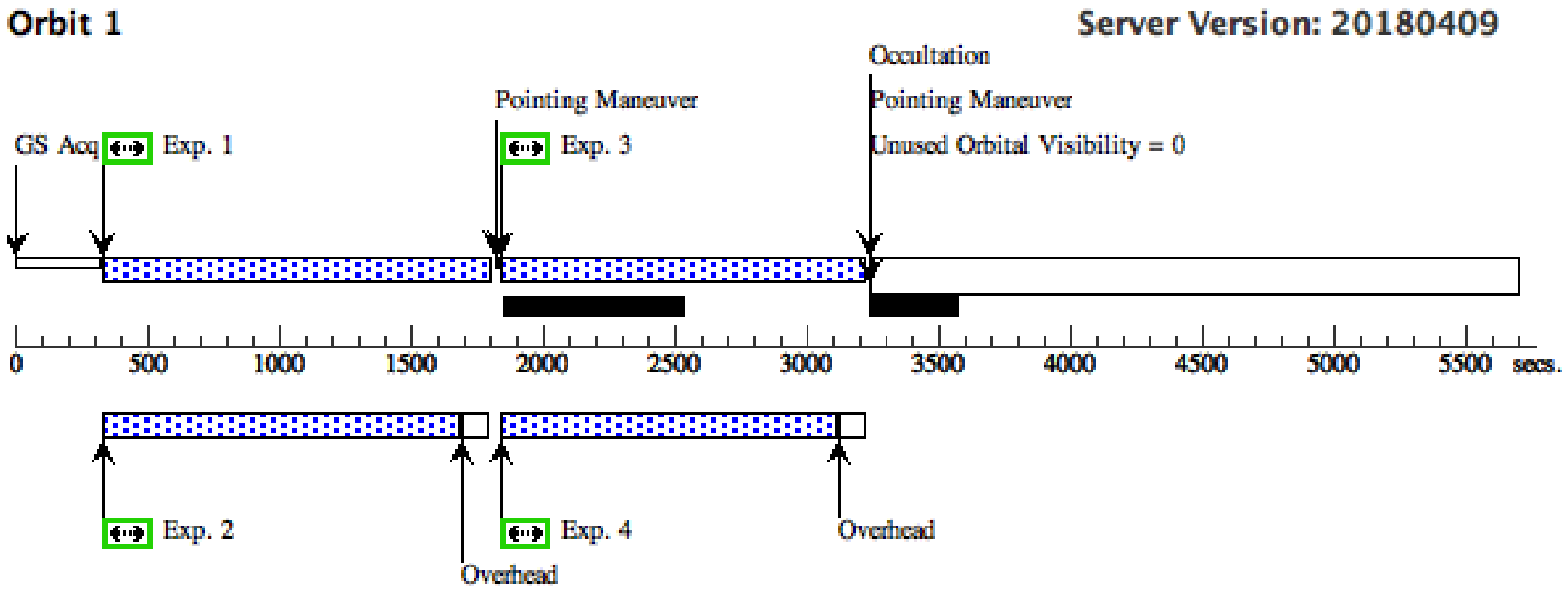
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	CVN-I-DSPH-2	RA: 13 28 2.0601 (202.0085837d) Dec: +33 33 30.88 (33.55858d) Equinox: J2000		V=19+/-1	Reference Frame: NED

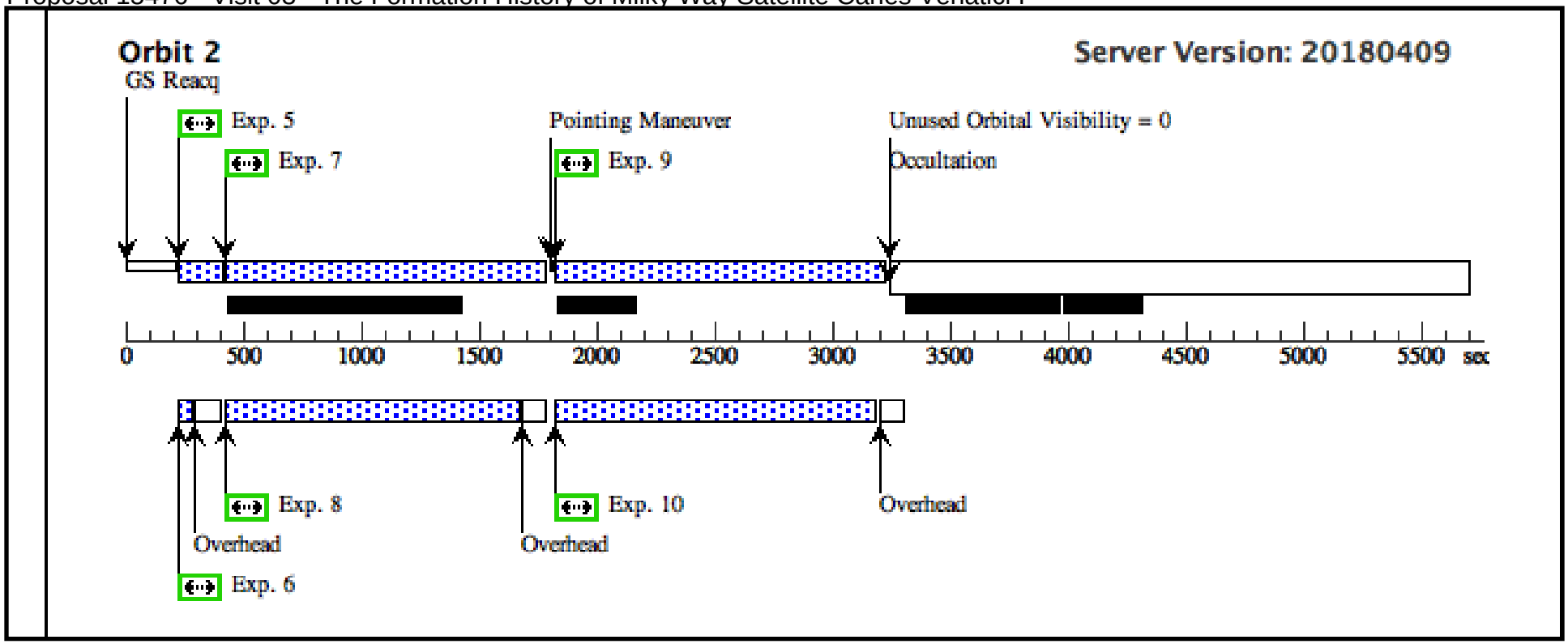
Comments: Faintest targets have V~28-29. A few foreground stars with V~13
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.0,0.0	Prime + Parallel Group 1-2 in Visit 03	1269 Secs (1269 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 1-2 in Visit 03	1229 Secs (1320 Secs) *[==>1320.0 Secs]*	 ***[1]***
3		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.148,0.086	Prime + Parallel Group 3-4 in Visit 03	1260 Secs (1260 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 3-4 in Visit 03	1229 Secs (1270 Secs) *[==>1270.0 Secs]*	 ***[1]***
5		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.222,0.240	Prime + Parallel Group 5-6 in Visit 03	60 Secs (60 Secs) *[==>]*	 ***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=10		Prime + Parallel Group 5-6 in Visit 03	60 Secs (60 Secs) *[==>]*	 ***[2]***
7		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.222,0.240	Prime + Parallel Group 7-8 in Visit 03	1240 Secs (1240 Secs) *[==>]*	 ***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 7-8 in Visit 03	1230 Secs (1250 Secs) *[==>1250.0 Secs]*	 ***[2]***
9		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0.074,0.154	Prime + Parallel Group 9-10 in Visit 03	1280 Secs (1280 Secs) *[==>]*	 ***[2]***
10		ANY	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 9-10 in Visit 03	1300 Secs (1366 Secs) *[==>1366.0 Secs]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20180409
GS Reacq
Exp. 5
Exp. 7
Pointing Maneuver
Exp. 9
Unused Orbital Visibility = 0
Occultation
0
500
1000
1500
2000
2500
3000
3500
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4500
5000
5500
sec
Exp. 8
Exp. 10
Overhead
Overhead
Overhead
Exp. 6

Visit

Proposal 15476, Visit 04, implementation Thu Jun 07 18:00:26 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: SAME ORIENT AS 03

Fixed Targets

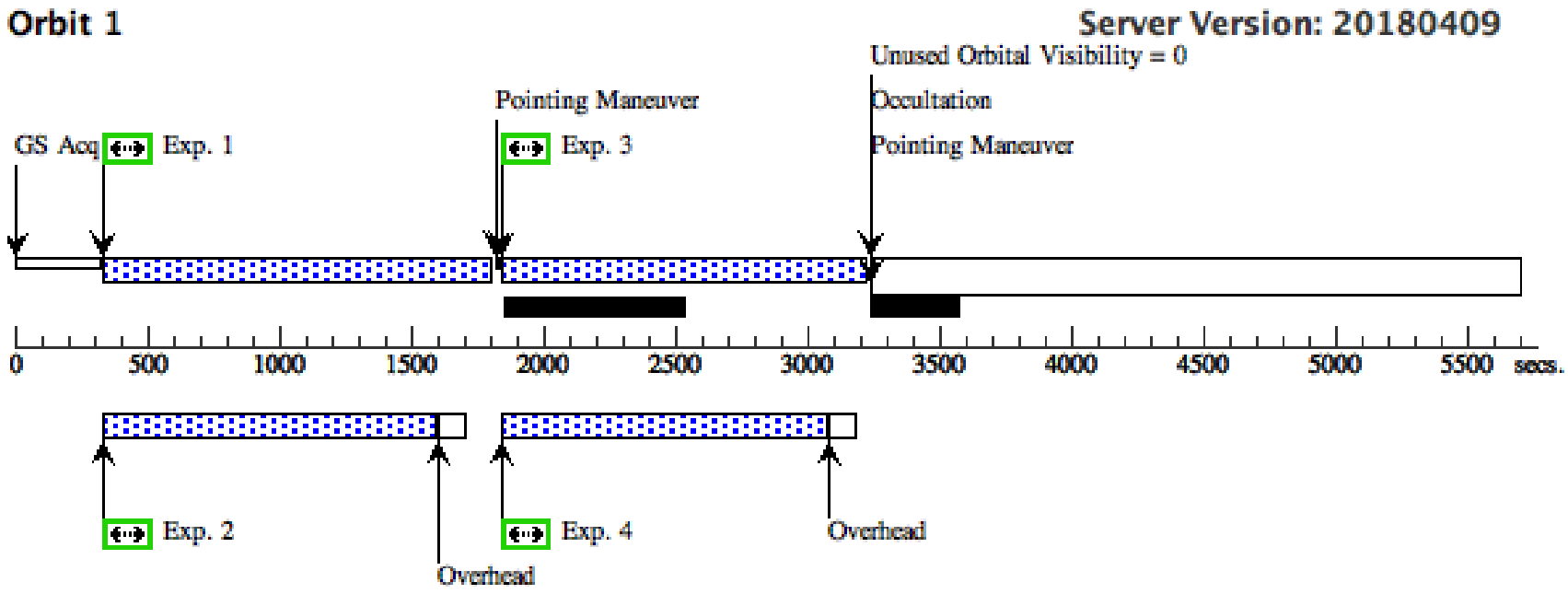
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	CVN-I-DSPH-2	RA: 13 28 2.0601 (202.0085837d) Dec: +33 33 30.88 (33.55858d) Equinox: J2000		V=19+/-1	Reference Frame: NED

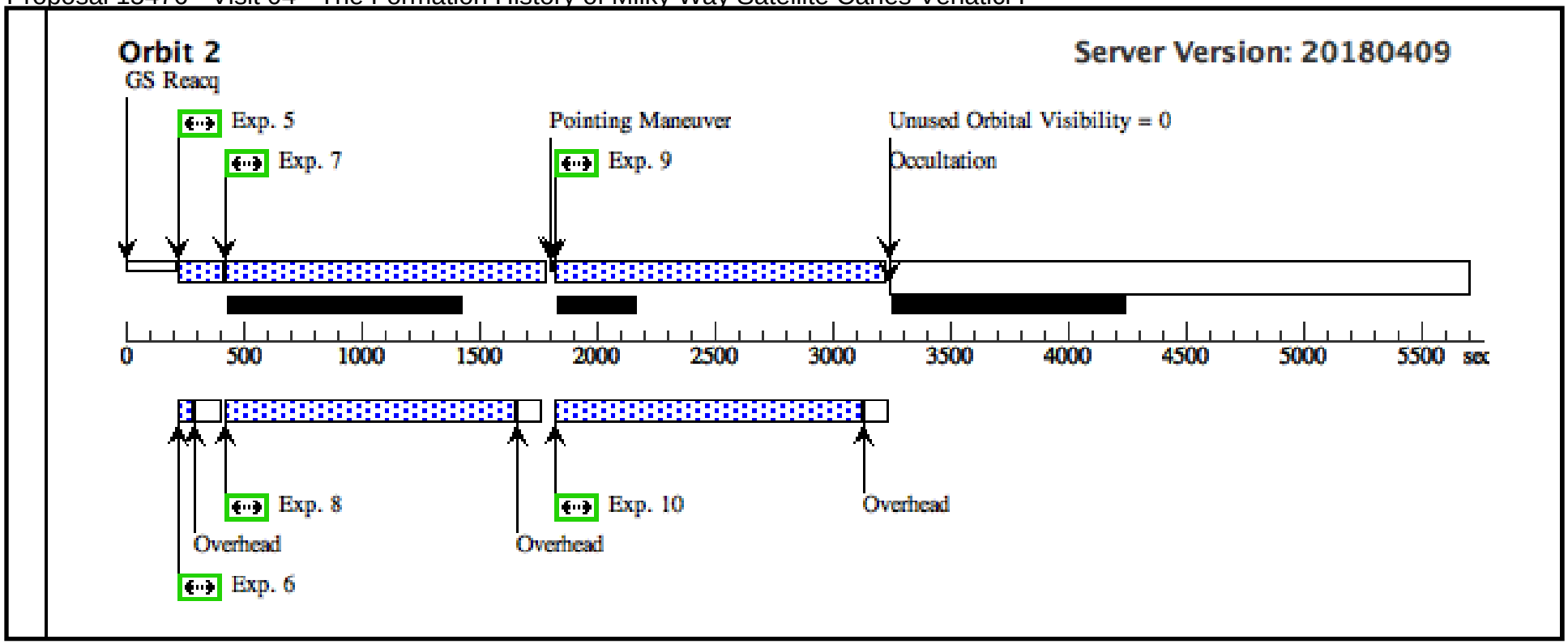
Comments: Faintest targets have V~28-29. A few foreground stars with V~13
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.0,0.0	Prime + Parallel Group up 1-2 in Visit 04	1269 Secs (1269 Secs) *[==>]*	 ***[1]***
2		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 1-2 in Visit 04	1229 Secs (1229 Secs) *[==>]*	 ***[1]***
3		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.148,0.086	Prime + Parallel Group up 3-4 in Visit 04	1260 Secs (1260 Secs) *[==>]*	 ***[1]***
4		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 3-4 in Visit 04	1229 Secs (1229 Secs) *[==>]*	 ***[1]***
5		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.222,0.240	Prime + Parallel Group up 5-6 in Visit 04	60 Secs (60 Secs) *[==>]*	 ***[2]***
6		ANY	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=10		Prime + Parallel Group up 5-6 in Visit 04	60 Secs (60 Secs) *[==>]*	 ***[2]***
7		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.222,0.240	Prime + Parallel Group up 7-8 in Visit 04	1240 Secs (1240 Secs) *[==>]*	 ***[2]***
8		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 7-8 in Visit 04	1230 Secs (1230 Secs) *[==>]*	 ***[2]***
9		(2) CVN-I-DSPH-2	ACS/WFC, ACCUM, WFC	F814W		POS TARG 0.074,0.154	Prime + Parallel Group up 9-10 in Visit 04	1280 Secs (1280 Secs) *[==>]*	 ***[2]***
10		ANY	WFC3/UVIS, ACCUM, UVIS	F814W			Prime + Parallel Group up 9-10 in Visit 04	1300 Secs (1300 Secs) *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20180409
GS Reacq
Exp. 5
Exp. 7
Pointing Maneuver
Exp. 9
Unused Orbital Visibility = 0
Occultation
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sec
Exp. 8
Overhead
Exp. 6
Overhead
Exp. 10
Overhead