17473 - Moving beyond the Milky Way: Enabling Cross-Observatory Proper Motion Determinations with HST and JWST

Cycle: 31, 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) NAME-DRACO-II	ACS/WFC	2	10-Jun-2024 11:01:01.0	yes
03	(1) NAME-DRACO-II	ACS/WFC	2	10-Jun-2024 11:01:02.0	yes
02	(2) WLM	ACS/WFC	2	10-Jun-2024 11:01:02.0	yes
04	(2) WLM	ACS/WFC	2	10-Jun-2024 11:01:03.0	yes

8 Total Orbits Used

ABSTRACT

HST has made unique contributions to our understanding of the dynamical evolution of the Milky Way and its constituent satellites, globular clusters, halo stars and tidal streams. Proper motions enabled by multi-epoch HST observations have been used to probe the nature of dark matter, the epoch of reionization, and correlated satellite infall. While Gaia now, too, provides unparalleled astrometric precision for the Milky Way, at outer halo distances this is only for intrinsically bright stars. Moving beyond the Milky Way halo will only be possible by utilizing long baselines with HST or by extending these baselines using another facility, such as JWST or Roman, in tandem with a first epoch from HST. Thus, it is imperative that we calibrate cross-observatory techniques to measure absolute proper motions. Here, we request 8 orbits with ACS/WFC and 3.27 hours with JWST's NIRCam for Draco II, an ultra-faint dwarf galaxy, and WLM, a star-forming galaxy. Both objects already have an epoch of ACS/WFC data, as well as publicly available NIRCam data from the Resolved Stellar Populations Early Release Science program. We will use the newly requested data to measure an HST-HST proper motion for each dwarf. This proper motion will be used as a "ground truth" to investigate and calibrate (i) detector-based systematics and (ii) reference frame-based systematics, in combining HST and JWST data. We stress the urgency of getting these observations now while HST is operating well. Such cross-observatory calibrations will be extremely difficult if the astrometric capabilities of HST degrade.

OBSERVING DESCRIPTION

We will observe Draco II - an ultra-faint dwarf galaxy - and WLM - a star-forming, isolated dwarf galaxy - with ACS/WFC, using 4 orbits for each target. Both objects already have an epoch of ACS/WFC data, as well as deep NIRCam data in two SW filters. This new data can be used to measure an HST-HST proper motion for each dwarf galaxy, which can serve as a "ground truth" to investigate and calibrate (i) detector-based systematics and (ii) refrence frame-based systematics in combining HST and JWST data. In this program, each target field will be observed using the same telescope pointings and orientations as the first-epoch images to maximize the overlaps of the observed fields between first- and second-epoch data. This will also minimize position-dependent uncertainties originating from imperfect CTE and geometric distortion corrections. These observations will be

made in the F814W filter, which has proven to give the best astrometric handle on background galaxies, and which is also one of the filters used for the first-epoch observations of both targets. Two exposures per orbit will be taken in order to complete and eight-point dither, allowing for deep single-exposure images that together allow for a well-sampled PSF.

Visit

Proposal 17473, Draco II (01), completed Mon Jun 10 15:01:03 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 30%; ORIENT 243.4269015D TO 243.4269015 D

Diagnostics

(Draco II (01)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(Exposure 1 (Draco II (01)) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

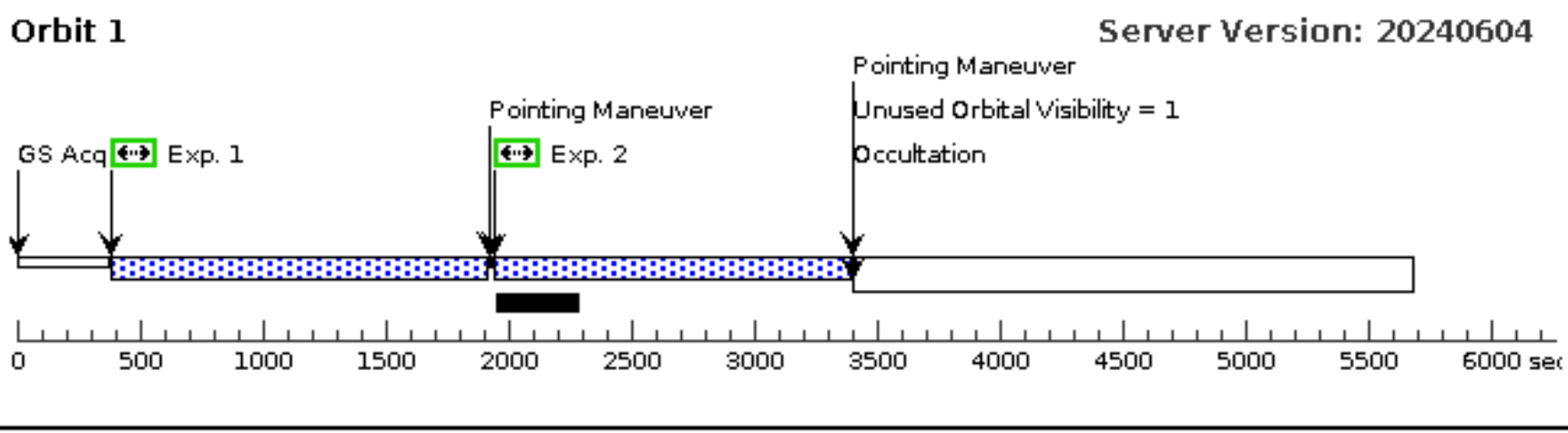
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NAME-DRACO-II	RA: 15 52 47.3483 (238.1972846d) Dec: +64 33 56.00 (64.56556d) Equinox: J2000	Proper Motion RA: 8.382181051432045E-5 sec of time/yr Proper Motion Dec: 9.400000000000001E-4 arcsec/yr Epoch of Position: 2015.5	V=(?) M_V=-2.9	Reference Frame: SIMBAD

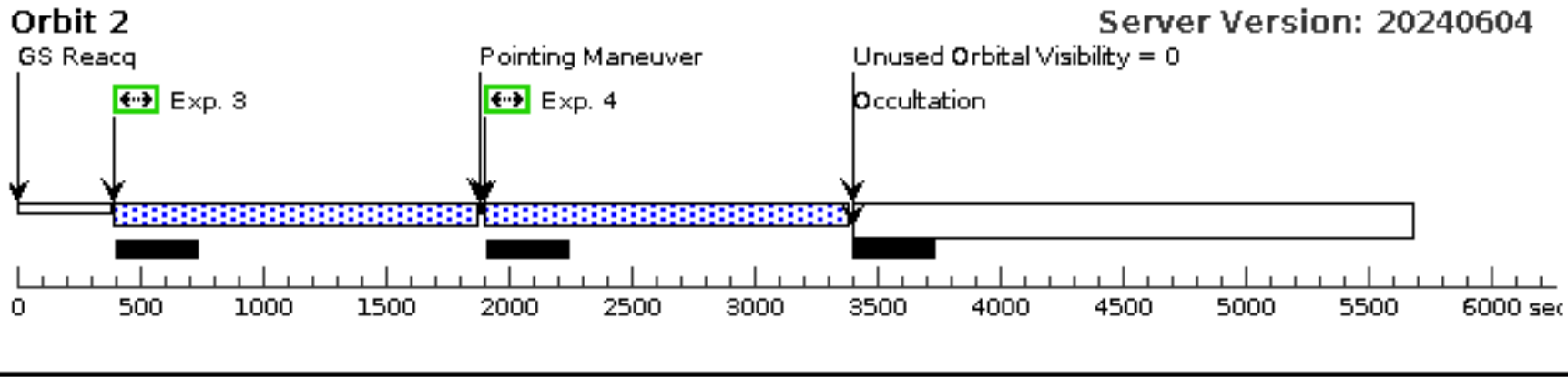
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3		1151 Secs (1322 Secs) *[==>1322.0 Secs]*	 ***[1]***
2		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.1740,0.2350		1151 Secs (1322 Secs) *[==>1322.0 Secs]*	 ***[1]***
3		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.3232,0.1235		1151 Secs (1359 Secs) *[==>1359.0 Secs]*	 ***[2]***
4		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.1005,0.3305		1151 Secs (1359 Secs) *[==>1359.0 Secs]*	 ***[2]***

Orbit Structure





Visit

Proposal 17473, Draco II (03), completed

Mon Jun 10 15:01:03 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 30%; ORIENT 243.4269015D TO 243.4269015 D

Diagnostics

(Draco II (03)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE

(Exposure 1 (Draco II (03)) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.

Fixed Targets

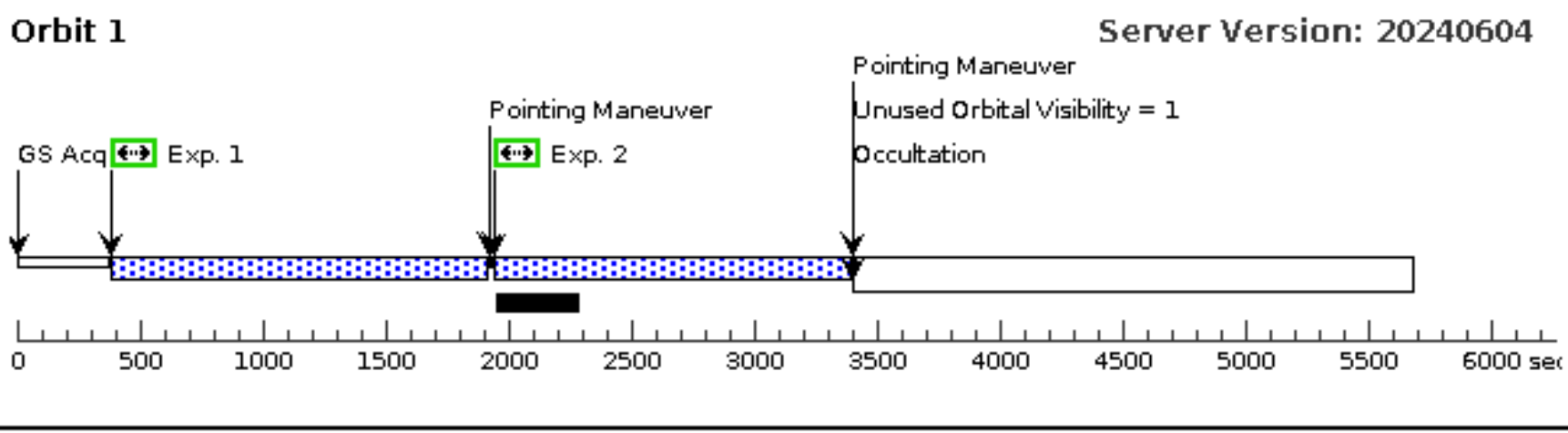
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NAME-DRACO-II	RA: 15 52 47.3483 (238.1972846d) Dec: +64 33 56.00 (64.56556d) Equinox: J2000	Proper Motion RA: 8.382181051432045E-5 sec of time/yr Proper Motion Dec: 9.400000000000001E-4 arcsec/yr Epoch of Position: 2015.5	V=(?) M_V=-2.9	Reference Frame: SIMBAD

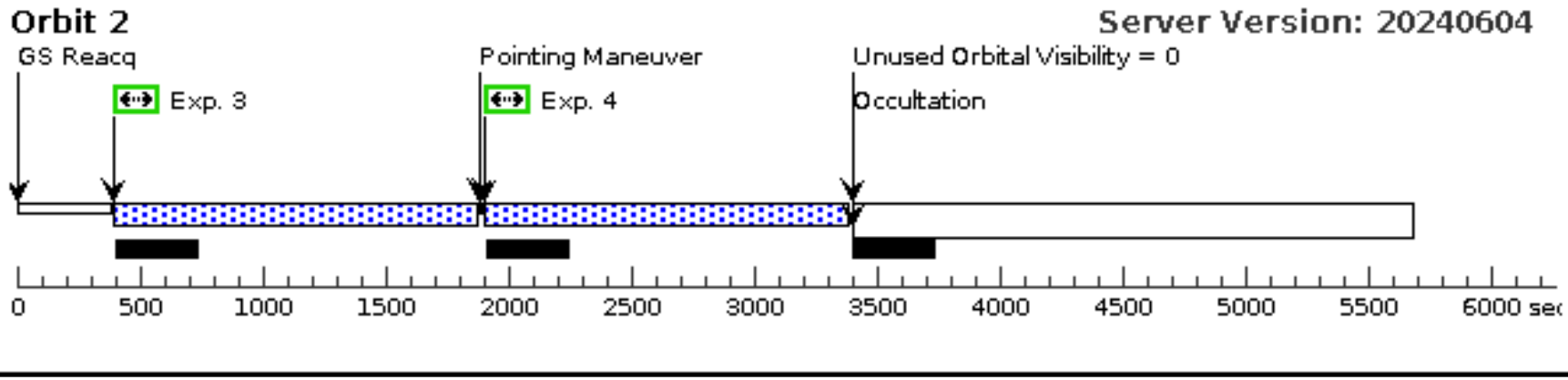
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[DWARF SPHEROIDAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.5075,0.0505; GS ACQ SCENARIO BASE1B3		1151 Secs (1322 Secs) *[==>1322.0 Secs]*	***[1]***
2		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.6815,0.2855		1151 Secs (1322 Secs) *[==>1322.0 Secs]*	***[1]***
3		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.8300,0.1735		1151 Secs (1359 Secs) *[==>1359.0 Secs]*	***[2]***
4		(1) NAME-DRACO-II	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.6080,0.3810		1151 Secs (1359 Secs) *[==>1359.0 Secs]*	***[2]***

Orbit Structure





Visit

Proposal 17473, WLM (02), implementation Mon Jun 10 15:01:03 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 30%; ORIENT 257.943153D TO 257.943153 D

Diagnostics

(WLM (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

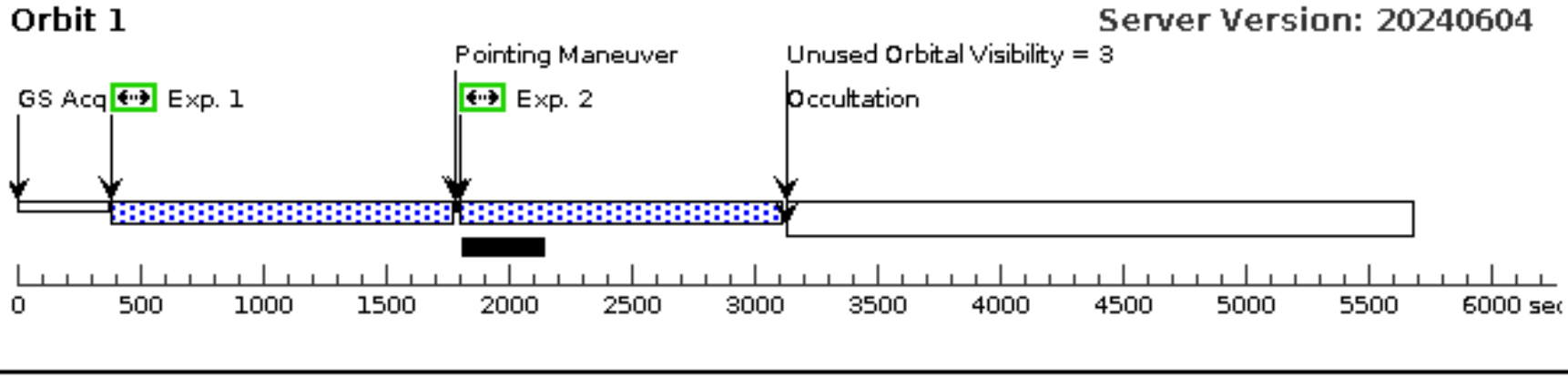
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	WLM	RA: 00 01 57.3000 (.4887500d) Dec: -15 31 22.70 (-15.52297d) Equinox: J2000		V=19+/-1	Reference Frame: ICRS

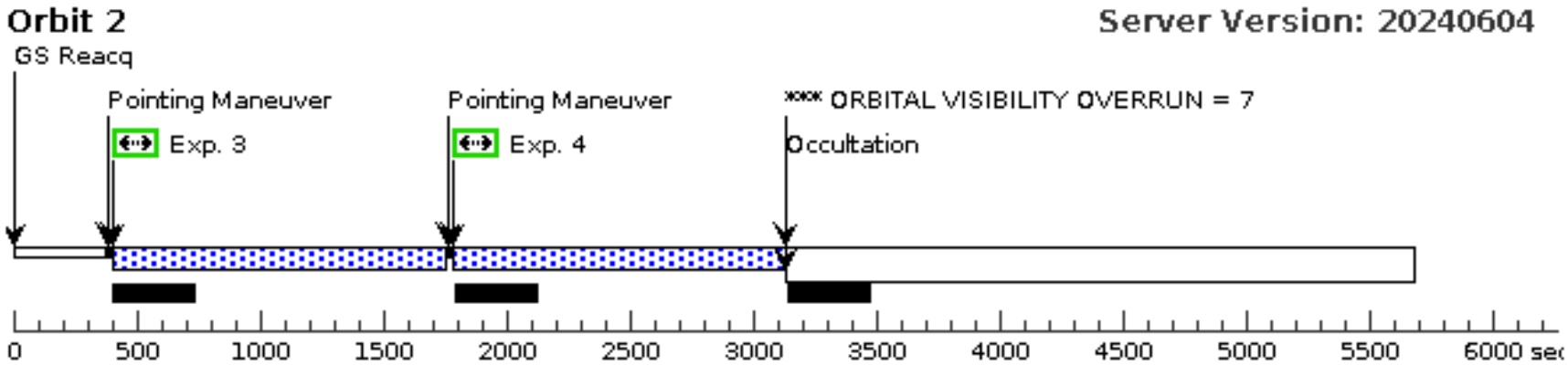
Comments:
Category=GALAXY
Description=[DWARF ELLIPTICAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1O3		1151 Secs (1189 Secs) *[==>1189.0 Secs]*	***[1]***
2		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.1740,0.2350		1151 Secs (1189 Secs) *[==>1189.0 Secs]*	***[1]***
3		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.3232,0.1235		1151 Secs (1225 Secs) *[==>1225.0 Secs]*	***[2]***
4		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.1005,0.3305		1151 Secs (1225 Secs) *[==>1225.0 Secs]*	***[2]***

Orbit Structure





Visit

Proposal 17473, WLM (04), implementation Mon Jun 10 15:01:04 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: SCHED 30%; ORIENT 257.943153D TO 257.943153 D

Diagnostics

(WLM (04)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	WLM	RA: 00 01 57.3000 (.4887500d) Dec: -15 31 22.70 (-15.52297d) Equinox: J2000		V=19+/-1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[DWARF ELLIPTICAL]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.5075,0.0505; GS ACQ SCENARIO BASE1O3		1151 Secs (1189 Secs) *[==>1189.0 Secs]*	***[1]***
2		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.6815,0.2855		1151 Secs (1189 Secs) *[==>1189.0 Secs]*	***[1]***
3		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.8300,0.1735		1151 Secs (1225 Secs) *[==>1225.0 Secs]*	***[2]***
4		(2) WLM	ACS/WFC, ACCUM, WFC	F814W	CR-SPLIT=NO	POS TARG 0.6080,0.3810		1151 Secs (1225 Secs) *[==>1225.0 Secs]*	***[2]***

Orbit Structure