16112 - HIgh-precision astrometry of (15094) Polymele in support of the Lucy Mission

Cycle: 27, Proposal Category: GO/DD

(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) POLYMELE	WFC3/UVIS	1	09-Sep-2020 11:00:12.0	yes
02	(1) POLYMELE	WFC3/UVIS	1	09-Sep-2020 11:00:13.0	yes
03	(1) POLYMELE	WFC3/UVIS	1	09-Sep-2020 11:00:14.0	yes

3 Total Orbits Used

ABSTRACT

We propose a targeted set of observations of (15094) Polymele which is the smallest prime target for the Lucy mission. The goal of these observations is to get high-precision astrometry at three epochs. This astrometry will be used to reduce the uncertainties of Polymele's orbit estimate needed to enable a high-chord-density occultation observation later in 2020.

OBSERVING DESCRIPTION

All visits are independent and identical except for when they need to execute. We will take 5 full-frame WFC3/UVIS images of the field containing Polymele. The exposure time is set to fully utilize the visibility window and small adjustments are acceptible to adapt to slight changes in the visibility window. The placement of Polymele is initially set for the default location (POSTARG=0). All observations will track Polymele meaning the stars will be trailed by target motion and HST motion-induced parallax.

As work begins to schedule each visit, we need an opportunity to check the candidate windows for suitability. We have a system in place that allows checking for sufficient Gaia DR2 reference stars in the field and to avoid overlap with the target at the star trails given a table of candidate window from STScI. This is the same process that we have been using for all of our Arrokoth, Oumuamua, and Borisov observations with HST. Field star interference is grounds for rejecting a window. The use of POSTARG and small changes to roll angle are used in cases where the field star density is low and an adjustment is needed to increase the number of field stars. We will not use these adjustments unless absolutely necessary. They are not for optimizing the visit but rather to improve one option to get even a single candidate that will work. So far, that has only been necessary for the Oumuamua observations. For reference, getting 6 or so field stars has generally been good enough but having fewer means we will look for better options.

The scheduling windows are meaningful but there is additional flexibility available if the initial windows prove to be too restrictive. Notionally, we want to attempt observations in June, July, and September. The overall requirement is to spread out the three visits between the end of the solar exclusion window and the occultation in September. The initial placement of the first two visits gives us a backup window in August in case one of these fails. The September window is set to be just before the occultation with sufficient width to be schedulable and provide sufficient time after observation to process the data, update the orbit fit, and provide an occultaiton prediction update. The end of the window is the more stringent constraint.

Visit

Proposal 16112, AST1 (01), completed Wed Sep 09 15:00:14 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-JUN-2020:00:00:00 AND 15-JUN-2020:00:00:00

Comments: All visits have the same structure with 5 long, dithered exposures that fill the orbit. The only variable is how the visits are scheduled.

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in AST1 (01)) special requirements) Warning (Form): Be very careful mixing POS TARG and Center_Pattern = Yes

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=LINE	Coordinate Frame=CELESTIAL		(1)
	Purpose=OTHER	Pattern Orientation=0		
	Number Of Points=5	Angle Between Sides=		
	Point Spacing=0.03	Center Pattern=true		
	Line Spacing=			

Solar System Targets

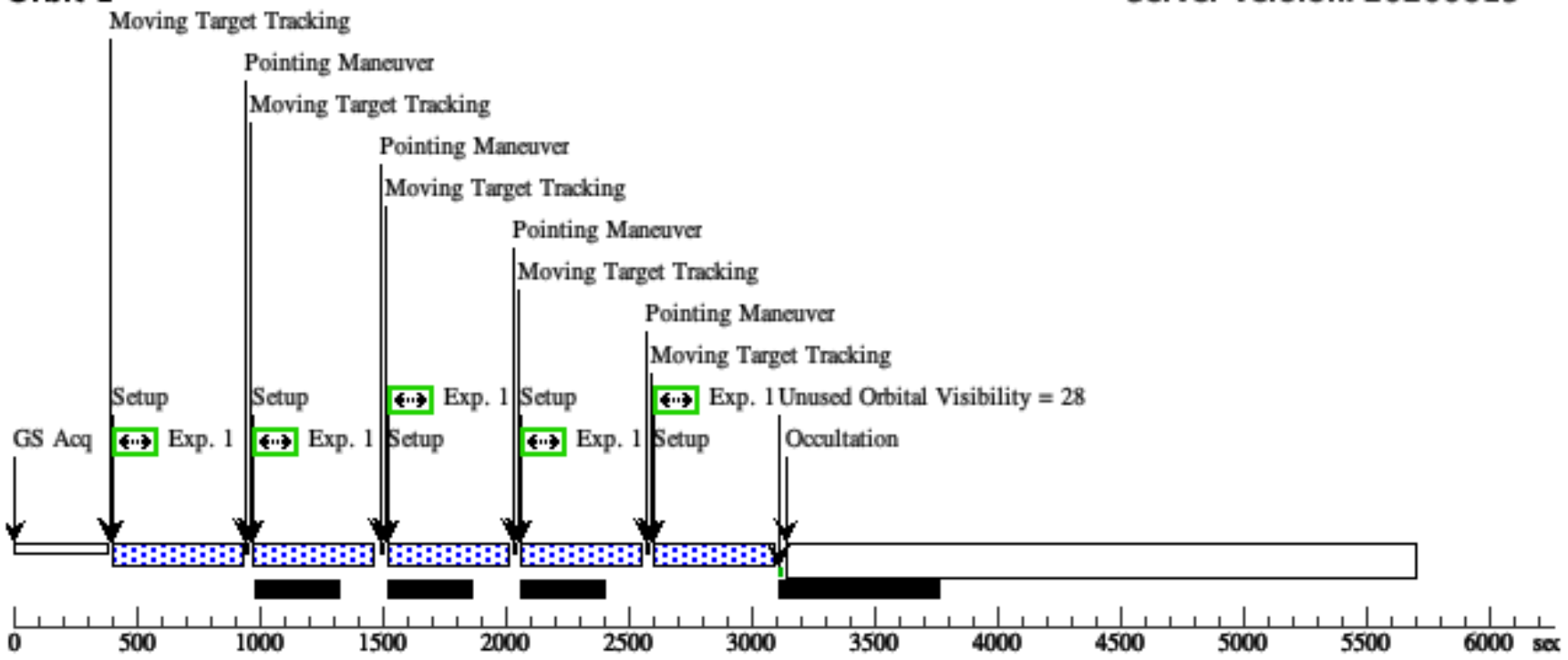
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	POLYMELE	TYPE=ASTEROID,A=5.16843082935 6419,E=0.09482321984419208,I=12.9 8961897481968 ,O=50.31762273700706,W=4.4015420 22614581,M=295.7073098559924,EQ UINOX=J2000,EPOCH=05-AUG- 2019:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Updates to the orbit during the execution of this program are unlikely. We have already worked with JPL to produce this orbit and any future updates will only be important for occultaiton planning and not at all important for HST.
Description=Lucy mission target

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) POLYMELE	WFC3/UVIS, ACCUM, UVIS	F350LP		POS TARG 0,0	Sequence 1-1 Non-Int in AST1 (01)	380 Secs (1900 Secs)	
							Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in AST1 (01) (1)	*[==>(Pattern 1)]*	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	
								[==>(Pattern 5)]	

Orbit Structure



Visit

Proposal 16112, AST2 (02), completed Wed Sep 09 15:00:14 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 06-JUL-2020:18:30:00 AND 06-JUL-2020:19:30:00

Comments: All visits have the same structure with 5 long, dithered exposures that fill the orbit. The only variable is how the visits are scheduled.

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in AST2 (02)) special requirements) Warning (Form): Be very careful mixing POS TARG and Center_Pattern = Yes

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=LINE	Coordinate Frame=CELESTIAL		(1)
	Purpose=OTHER	Pattern Orientation=0		
	Number Of Points=5	Angle Between Sides=		
	Point Spacing=0.03	Center Pattern=true		
	Line Spacing=			

Solar System Targets

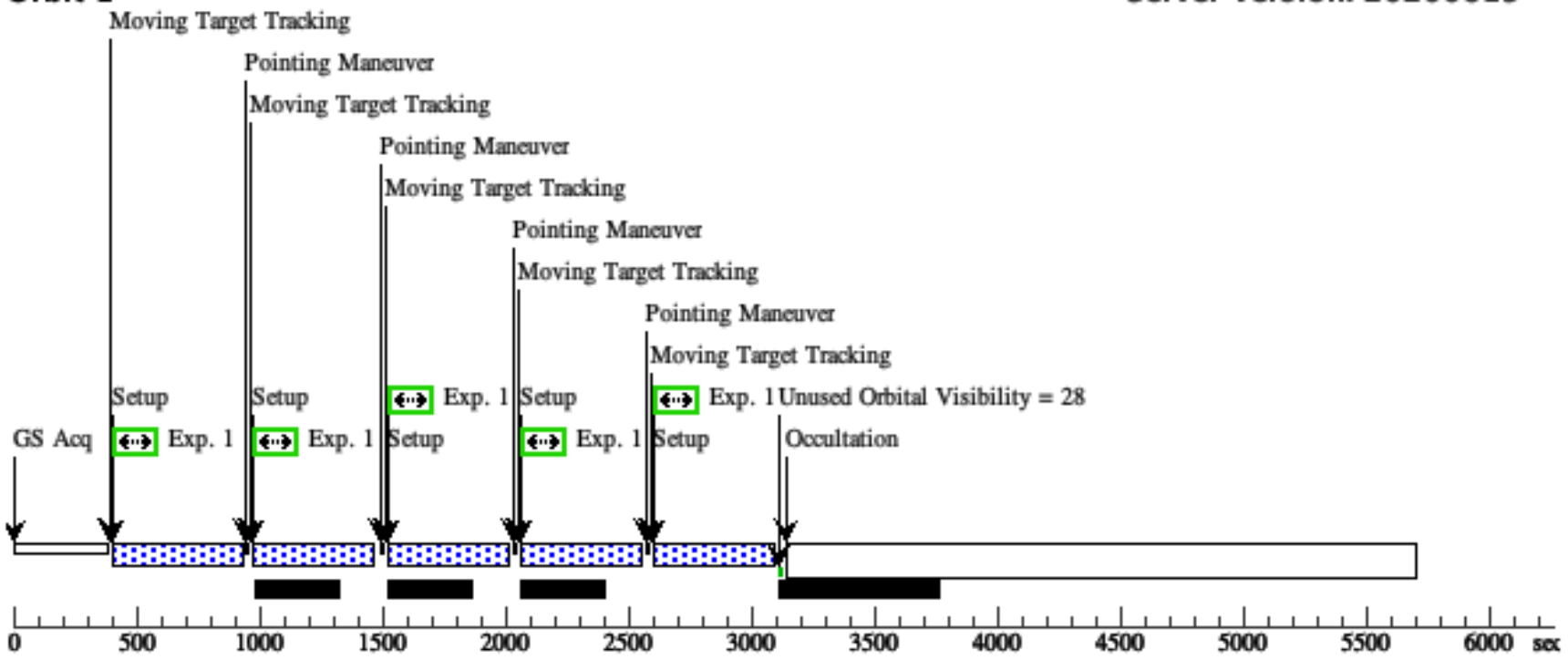
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	POLYMELE	TYPE=ASTEROID,A=5.16843082935 6419,E=0.09482321984419208,I=12.9 8961897481968 ,O=50.31762273700706,W=4.4015420 22614581,M=295.7073098559924,EQ UINOX=J2000,EPOCH=05-AUG-2019:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Updates to the orbit during the execution of this program are unlikely. We have already worked with JPL to produce this orbit and any future updates will only be important for occultaiton planning and not at all important for HST.
Description=Lucy mission target

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) POLYMELE	WFC3/UVIS, ACCUM, UVIS	F350LP		POS TARG 0,12	Sequence 1-1 Non-In t in AST2 (02)	380 Secs (1900 Secs)	
							Pattern 1, Exps 1-1 i n Sequence 1-1 Non-Int in AST2 (02) (1)	*[==>(Pattern 1)]*	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	
								[==>(Pattern 5)]	

Orbit Structure



Visit

Proposal 16112, AST3 (03), implementation Wed Sep 09 15:00:15 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Comments: All visits have the same structure with 5 long, dithered exposures that fill the orbit. The only variable is how the visits are scheduled.

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in AST3 (03)) special requirements) Warning (Form): Be very careful mixing POS TARG and Center_Pattern = Yes

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=LINE	Coordinate Frame=CELESTIAL		(1)
	Purpose=OTHER	Pattern Orientation=0		
	Number Of Points=5	Angle Between Sides=		
	Point Spacing=0.03	Center Pattern=true		
	Line Spacing=			

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	POLYMELE	TYPE=ASTEROID,A=5.16843082935 6419,E=0.09482321984419208,I=12.9 8961897481968 ,O=50.31762273700706,W=4.4015420 22614581,M=295.7073098559924,EQ UINOX=J2000,EPOCH=05-AUG-2019:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Updates to the orbit during the execution of this program are unlikely. We have already worked with JPL to produce this orbit and any future updates will only be important for occultaiton planning and not at all important for HST.
Description=Lucy mission target

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) POLYMELE	WFC3/UVIS, ACCUM, UVIS2	F350LP		POS TARG 24.0,26.0	Sequence 1-1 Non-Int in AST3 (03)	380 Secs (1900 Secs)	
							Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in AST3 (03) (1)	*[==>(Pattern 1)]*	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	
								[==>(Pattern 5)]	

Orbit Structure