17291 - Investigating a Vanishing Active Centaur

Cycle: 30, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) COMET-P-2020-MK4	WFC3/UVIS	1	27-Dec-2022 07:00:14.0	yes

1 Total Orbits Used

ABSTRACT

Centaurs are minor planets found between the orbits of Jupiter and Neptune. In this region temperatures are too cold for water ice to be sublimate, yet a rare (<20) subset of Centaurs display cometary activity such as a tail or coma. Observations by our team of one such active Centaur, P/2020 MK4, revealed the object had dimmed dramatically, by over 4 magnitudes. A distinct cloud of material has been consistently observable, even in the absence of a clearly discernible nucleus. We present two hypotheses to explain the vanishing of active Centaur P/2020 MK4: (1) the object is disintegrating or dissipating, or (2) the object is much smaller than previously estimated and is now entering a quiescent phase. Notably, the object has a nearly circular orbit (e=0.01), so a decrease in temperature alone cannot account for sublimation cessation, thus disintegration or material exhaustion may be more plausible. In order to test our hypotheses we propose to observe P/2020 MK4 with the WFC3 instrument with the F350LP filter in a sequence of four images acquired during a single orbit. With these observations we will (1) search for the presence of a nucleus (or nuclei,

in case of breakup), (2) characterize the activity morphology, (3) measure the size of the debris cloud, and (4) describe the changes in mass loss rates through an observationally informed model of our own construction. In addition to furthering our understanding of active Centaurs, our findings will significantly enhance our understanding of the Centaur population if a fraction of the objects vanish prior to discovery, a possibility enhanced by their recent arrival to the Centaur region and short dynamical lifetimes.

OBSERVING DESCRIPTION

We request 4 X 432 s WFC3 exposures with the F350LP filter, all within a single orbit (though our science can be carried out with observations spanning multiple orbits if necessary). The target is P/2020 MK4, and it should be tracked non-siderealy.

Visit

Proposal 17291, 377s X 4 (01), implementation Tue Dec 27 12:00:14 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 02-JAN-2023:00:00:00 AND 08-JAN-2023:16:00:00; BETWEEN 08-JAN-2023:22:00:00 AND 10-JAN-2023:09:00:00; BETWEEN 10-JAN-2023:15:00:00 AND 11-JAN-2023:00:00:00; TOO RESPONSE TIME 19.0D

Comments: expanded via "auto-adjust" to 432 s each to maximize usable time of orbit

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

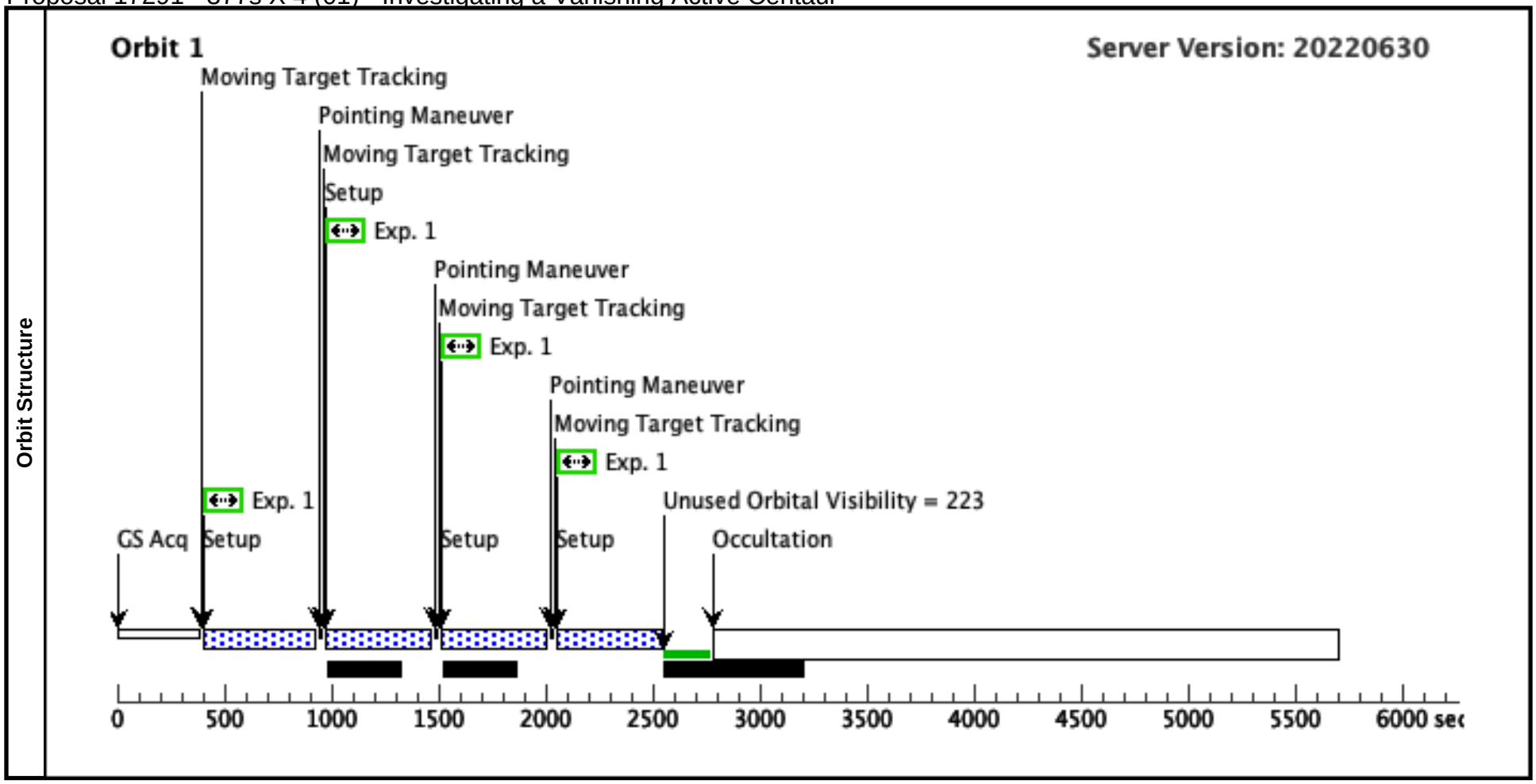
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	COMET-P-2020-MK4	TYPE=COMET,Q=6.023599722627209,E=0.020544759584441 75,I=6.691382147221793,O=1.888050999838472,W=169.9937011228537,T=06-MAY-2015:10:29:43,TTimeScale=TDB,EQUINOX=J2000,EPOCH=07-SEP-2020:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=P/2020 MK4
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(WFC3UVIS.im.1836162)	(1) COMET-P-2020-MK4	WFC3/UVIS, ACCUM, UVIS2	F350LP			Sequence 1-1 Non-Int in 377s X 4 (01) Pattern 2, Exps 1-1 in Sequence 1-1 Non-Int in 377s X 4 (01) (2)	377 Secs (1508 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20220630
Moving Target Tracking
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 1
Pointing Maneuver
Moving Target Tracking
Exp. 1
Pointing Maneuver
Moving Target Tracking
Exp. 1
Exp. 1
Unused Orbital Visibility = 223
GS Acq
Setup
Setup
Setup
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec