



14810 - High-Precision Proper Motions in the M87 Jet

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) M87-NUCLEUS	STIS/NUV-MAMA	1	29-Jul-2016 15:54:16.0	yes

1 Total Orbits Used

ABSTRACT

As the nearest galaxy with an optical jet, M87 affords an unparalleled opportunity to study extragalactic jet phenomena at the highest resolution. We have previously obtained HST images of the jet with unprecedented resolution which show detailed shock structures as well as numerous unresolved condensations over the first few arcseconds of the jet. Our previous HST monitoring observations have found superluminal motion at speeds up to 6c in many of these features, and showed the formation of new emission regions and rapid variability.

The STIS/NUV instrument presents a unique opportunity to measure proper motions in the M87 jet with a single highly stable, high resolution detector across a 19 yr timebase. We will use these new data, together with existing STIS/NUV data, to map the velocity field of the jet with much higher accuracy than previously possible. This will allow us to measure the bulk deceleration of the jet, transverse motions, accelerations / decelerations of individual features, and numerous fainter jet features. We will use this to test models for the structure and kinematics of relativistic

jet flows, synchrotron emission regions, and AGN in general.

OBSERVING DESCRIPTION

We will obtain STIS NUV F25QTZ images of the jet using a setup which closely duplicates our previous monitor observations. Sub-exposures will be dithered to improve PSF sampling by the 0.024" pixels and minimize detector artifacts. ACCUM mode is used for greatest consistency with past monitoring observations. We do not expect any bright object issues for either the M87 nucleus or jet.

Bright object discussion for STIS NUV-MAMA:

We have used an identical observation (same mode and filter) taken in May 2016 (program 14256) to perform a baseline check of the MAMA-NUV count rate. The brightest compact feature had $F(\lambda)=2.0\text{e-}16 \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$. With these inputs the ETC gives the brightest pixel as 8 counts/sec (STIS.im.828069). This is well below the limit of 100 counts/sec.

The M87 jet has been previously seen to produce a bright flare with an e-folding (factor 3) rise time ~ 1 year. Based on this timescale, and the above flux observation from May 2016, any new flare is predicted to be have <24 counts/sec, or a factor ~ 4 below the brightness limit, in mid-2017.

Proposal 14810 - STIS NUV-MAMA (01) - High-Precision Proper Motions in the M87 Jet

Visit	Proposal 14810, STIS NUV-MAMA (01) Fri Jul 29 19:54:17 GMT 2016									
	Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA Special Requirements: SCHED 100%; ORIENT 105.D TO 105. D; BETWEEN 01-APR-2017 AND 01-OCT-2017 Comments: STIS NUV-MAMA ORIENT chosen to match prior epochs of monitoring observations. POS TARG used to place middle of jet near center of detector. Dithering used to improve PSF sampling and remove any detector artifacts. ACCUM used for greatest consistency with prior observations. A BETWEEN timing constraint is used to place this observation roughly one year after our previous epoch.									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	M87-NUCLEUS	RA: 12 30 49.3590 (187.7056625d) Dec: +12 23 29.00 (12.39139d) Equinox: J2000		V=16.7	Reference Frame: ICRS				
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.im.82 8069)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -7,7		585 Secs (585 Secs)	
									[=>]	[1]
	Comments: See OBSERVING DESCRIPTION for discussion of Bright Object issues.									
	2	(STIS.im.82 8069)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -6.496,6 .748		585 Secs (585 Secs)	
									[=>]	[1]
Orbit Structure	3	(STIS.im.82 8069)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -6.244,6 .244		585 Secs (585 Secs)	
									[=>]	[1]
	4	(STIS.im.82 8069)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -6.748,6 .496		585 Secs (585 Secs)	
									[=>]	[1]
Orbit 1 Server Version: 20160601										