15358 - High-Precision Proper Motions in the M87 Jet

Cycle: 25, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. John A. Biretta (PI) (Contact)	**Eureka Scientific Inc.**	**john.biretta@gmail.com**
Dr. William B. Sparks (CoI)	SETI Institute	sparks@stsci.edu
Dr. Eileen T Meyer (CoI)	University of Maryland Baltimore County	meyer@umbc.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) M87-NUCLEUS	STIS/NUV-MAMA	1	02-Aug-2018 17:44:40.0	yes
02	(1) M87-NUCLEUS	STIS/NUV-MAMA	1	02-Aug-2018 17:44:41.0	yes

2 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 made an identical observation (same mode and filter, program 14810) in May 2017, and used these images to check the MAMA-NUV count rate. The brightest compact feature (highest counts/pixel) was the nucleus which had F(lambda)=5.0e-16 erg cm-2 s-1 A-1. With these inputs the ETC gives the brightest pixel as 19 counts/sec (STIS.im.1014493). This is well below the limit of 100 counts/sec. The actual observed maximum counts in the image was only 6 counts/sec, due to pixelation and de-focus effects.

The M87 jet has been previously seen to produce a bright flare with an e-folding (factor 3) rise time ~1 year. In May 2017 the same flaring component had only F(lambda)=7.4e-17 erg cm-2 s-1 A-1. Based on this flare timescale and observed flux, the maximum count rate in May 2018 would be <8 counts/sec. Finally we note the flaring component in fact faded between 2016 and 2017, at a rate of 20% loss per year, which suggests it will be far below the limit in 2018.

Visit

Proposal 15358, STIS NUV-MAMA (01), failed Thu Aug 02 21:44:42 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: SCHED 100%; ORIENT 105.D TO 105. D; BETWEEN 01-APR-2018 AND 01-OCT-2018

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

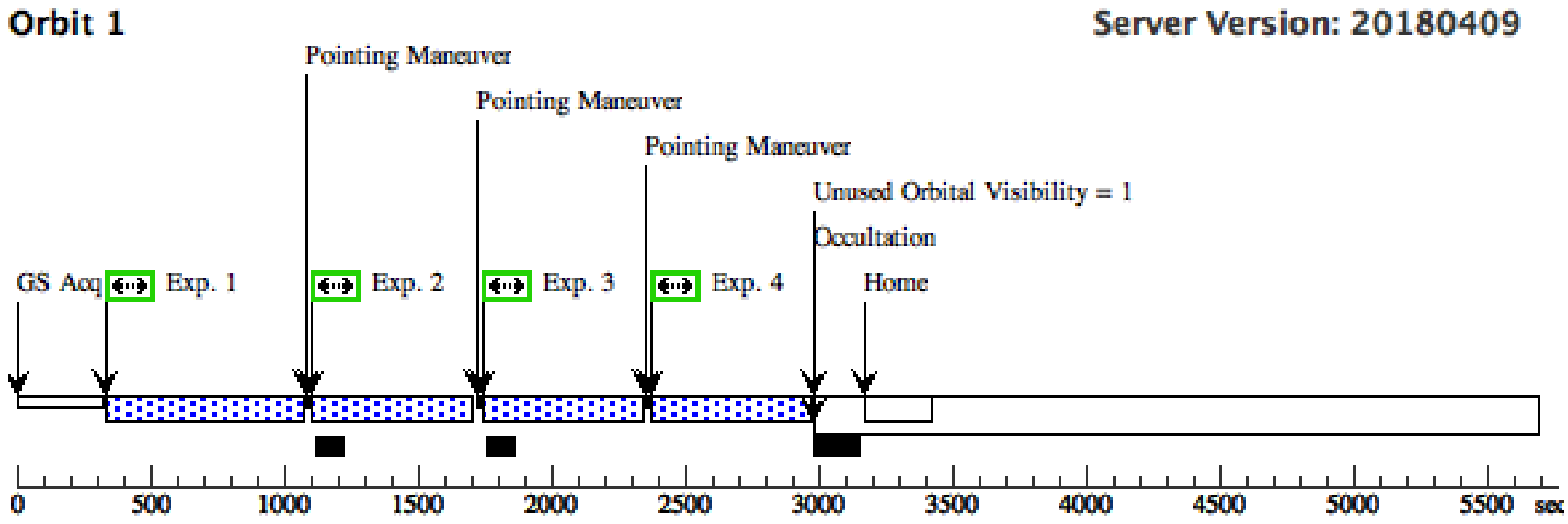
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M87-NUCLEUS	RA: 12 30 49.3590 (187.7056625d) Dec: +12 23 29.00 (12.39139d) Equinox: J2000		V=16.7	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[ELLIPTICAL, JET, RADIO GALAXY]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.im.10 14493)	(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.10 14493)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -6.496,6 .748		585 Secs (585 Secs) *[==>]*	*[1]*
3	(STIS.im.10 14493)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -6.244,6 .244		585 Secs (585 Secs) *[==>]*	*[1]*
4	(STIS.im.10 14493)	(1) M87-NUCLEUS	STIS/NUV-MAMA, ACCUM, F25QTZ	MIRROR		POS TARG -6.748,6 .496		585 Secs (585 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 15358, STIS NUV-MAMA (02) Thu Aug 02 21:44:42 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: SCHED 100%; ORIENT 105.D TO 105. D; BETWEEN 01-APR-2018 AND 01-OCT-2018

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.

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