



18187 - A Movie Campaign on M87: Chandra, NuSTAR, Hubble, and the EHT

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Joseph Neilsen (PI) (Contact)	Villanova University
Prof. Daryl Haggard (CoI) (CSA Member)	McGill University
Dr. Michael Nowak (CoI)	Washington University in St. Louis
Prof. Sera Markoff (CoI) (ESA Member)	Universiteit van Amsterdam
Giacomo Principe (CoI) (ESA Member)	INAF - Istituto di Radioastronomia
Dr. Michael Johnson (CoI)	Smithsonian Institution Astrophysical Observatory
Dr. Mislav Balokovic (CoI)	Yale University
Dr. Sunil Chandra (CoI)	North-West University Potchefstroom Campus
Dr. Shuo Zhang (CoI)	Michigan State University
Dr. Thomas Krichbaum (CoI) (ESA Member)	Max Planck Institut fur Radioastronomie
Dr. Geoffrey Bower (CoI)	Academia Sinica, Institute of Astronomy and Astrophysics
Dr. Razieh Emami (CoI)	Smithsonian Institution Astrophysical Observatory
Monika Moscibrodzka (CoI) (ESA Member)	Radboud University Nijmegen
Mr. Chris Sheridan (CoI)	Villanova University
Bart Ripperda (CoI) (CSA Member)	Canadian Institute for Theoretical Astrophysics
Dr. Venkatesh Ramakrishnan (CoI) (ESA Member)	University of Turku

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) M-87	WFC3/UVIS	2	02-Oct-2025 09:00:39.0	yes
02	(1) M-87	WFC3/UVIS	2	02-Oct-2025 09:00:40.0	yes

4 Total Orbits Used

ABSTRACT

With a large, well-studied jet and the second largest event horizon on the sky, the radio galaxy M87 is one of the primary targets for the Event Horizon Telescope, but the origin of its jet remains unclear. If the jet is powered by the supermassive black hole spin, there should be a direct connection between the bright shadow/ring and the subsequent evolution of the jet. An upcoming EHT movie campaign will test this connection in 2026 (priv comm) with an unprecedented study of the dynamics of the turbulent near-horizon plasma. Chandra observations (4x5 ks) coordinated with NuSTAR (priv comm) and HST (4 orbits) will be essential for tracking the high-energy variability of this plasma, diagnosing particle heating and acceleration, and interpreting models of the accretion flow.

OBSERVING DESCRIPTION

The goal of our HST program is to study the optical and UV variability of M87 in conjunction with Chandra/EHT observations in Spring 2026. We are particularly interested in tracking the relative flux and SED changes of the core and the knot HST-1 over time. Our observations will occur in two visits consisting of two orbits each. This is now standard for M87. Beyond taking place during the EHT campaign, no specific coordination is required. We adopt a modified version of the WFC3/UVIS observing strategy used for historical Hubble M87 monitoring (e.g. PI:Shara). In our analysis, comparable exposures produced to 3-10% uncertainties on the core and HST-1 fluxes after subtracting the host galaxy contribution.

Generally each visit consists of two orbits to acquire observations in F275W and F814W (orbit 1) and F390W and F606W (orbit 2) in ACCUM mode. The first orbit consists of three dithered 449 s exposures in F275W and two dithered 348 s exposures in F814W in ACCUM mode, for a total of 2043 s on source; the second orbit has 2x489 s in F390W and 3x348 s in F606W. ETC calculations are given for the nucleus and are approximate as they neglect the host galaxy. The remaining ~1 ks per orbit is covered by overhead (setup, readouts, filter changes, and dithering). We mitigate CTE with a flash to increase the background; sub-exposures reduce cosmic rays.

The second visit has a ~3-day window.

Proposal 18187 - Visit 1 (01) - A Movie Campaign on M87: Chandra, NuSTAR, Hubble, and the EHT

Thu Oct 02 13:00:41 GMT 2025

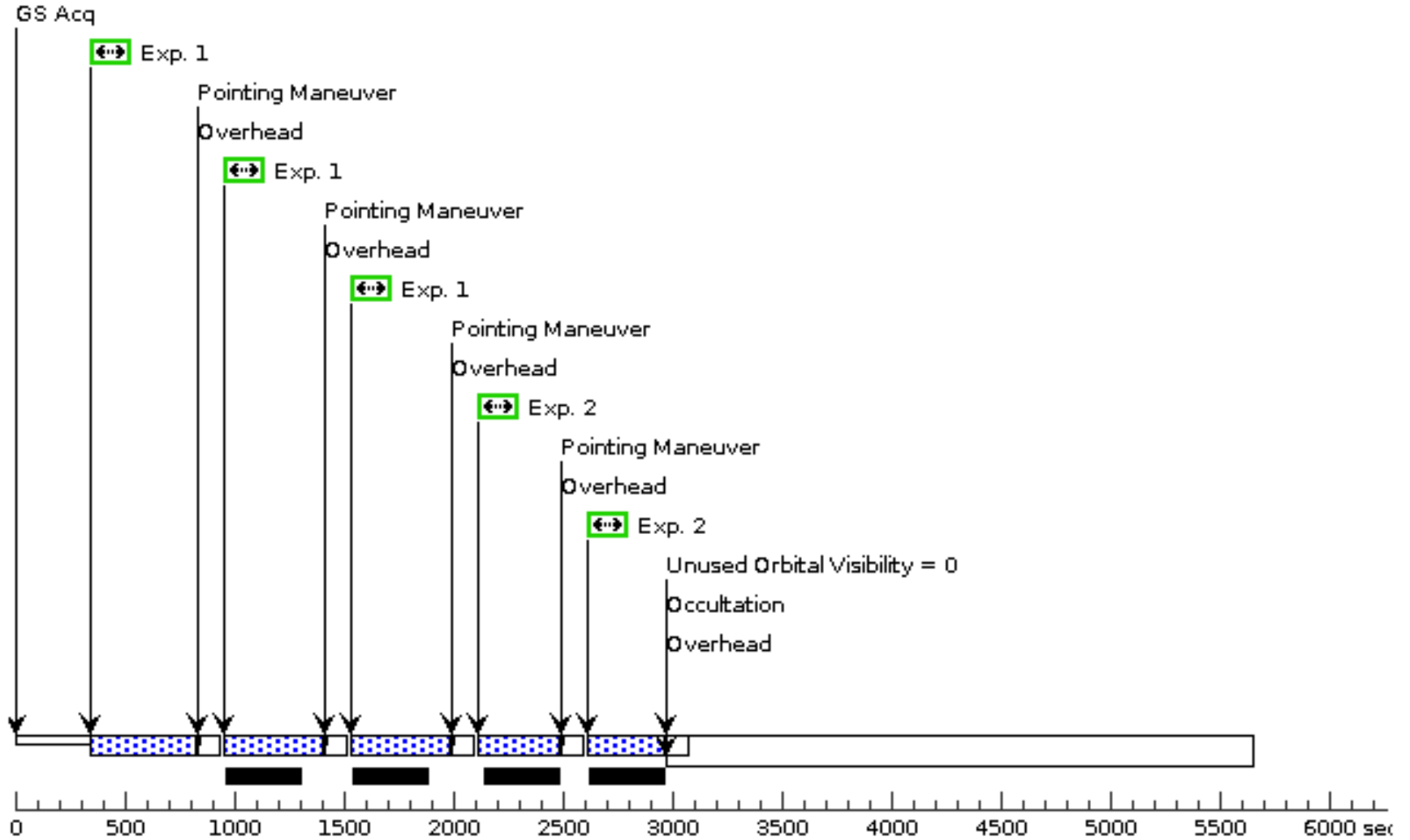
Visit	Proposal 18187, Visit 1 (01) Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: PCS MODE FINE; BETWEEN 28-FEB-2026:00:00:00 AND 01-APR-2026:00:00:00 <i>Comments: This visit is scheduled earlier in the EHT campaign. No specific coordination with the EHT, Chandra, or NuSTAR is required.</i>					
	Diagnosics (F390W (01.003)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser (F606W (01.004)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser					
Patterns	#	Primary Pattern	Secondary Pattern	Exposures		
	(1)	Pattern Type=WFC3-UVIS-GAP-LINE Coordinate Frame=POS-TARG Purpose=DITHER Pattern Orientation=85.759 Number Of Points=3 Angle Between Sides= Point Spacing=2.414 Center Pattern=true Line Spacing=		(1), (4)		
(2)	Pattern Type=WFC3-UVIS-DITHER- Coordinate Frame=POS-TARG LINE Pattern Orientation=46.84 Purpose=DITHER Angle Between Sides= Number Of Points=2 Center Pattern=false Point Spacing=0.145 Line Spacing=		(2), (3)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	M-87	RA: 12 30 49.4234 (187.7059308d) Dec: +12 23 28.04 (12.39112d) Equinox: J2000	Proper Motion RA: -8.029 mas/yr Proper Motion Dec: 10.734 mas/yr Epoch of Position: 2000	V=8.63	Reference Frame: ICRS
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=GALAXY Description=[JET, RADIO GALAXY]						

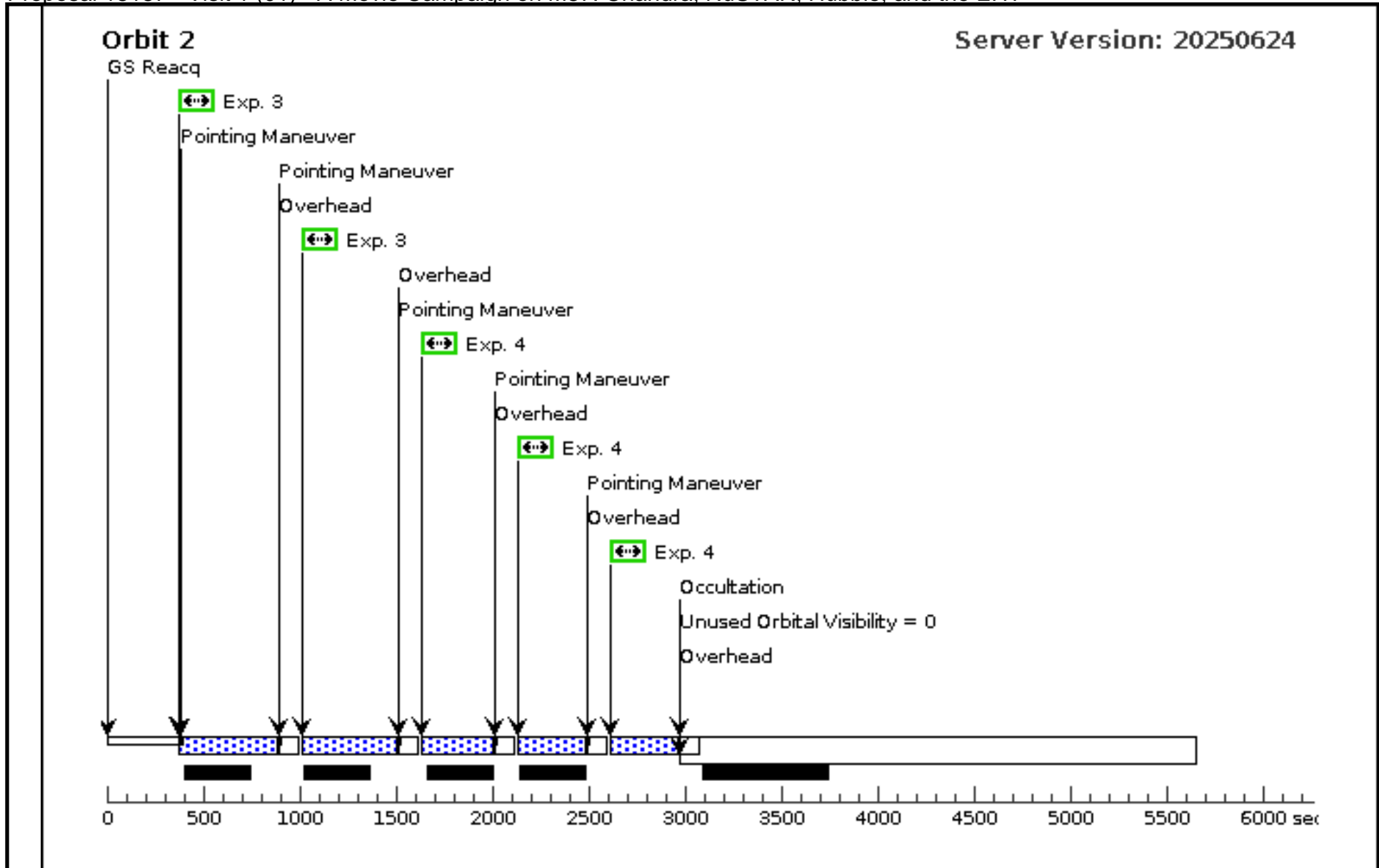
Proposal 18187 - Visit 1 (01) - A Movie Campaign on M87: Chandra, NuSTAR, Hubble, and the EHT

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	F275W (WFC3UVI S.im.211126 3)	(1) M-87	WFC3/UVIS, ACCUM, UVIS2	F275W	FLASH=21			Pattern 1, Exps 1-1 i n Visit 1 (01) (1)	449 Secs (1346 Secs) [==>448.0 Secs (Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[1]
	2	F814W (WFC3UVI S.im.211126 4)	(1) M-87	WFC3/UVIS, ACCUM, UVIS2	F814W	FLASH=14			Pattern 2, Exps 2-2 i n Visit 1 (01) (2)	348 Secs (696 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	3	F390W (WFC3UVI S.im.211126 7)	(1) M-87	WFC3/UVIS, ACCUM, UVIS2	F390W	FLASH=21			Pattern 2, Exps 3-3 i n Visit 1 (01) (2)	489 Secs (978 Secs) [==>(Pattern 1)] [==>(Pattern 2)]	[2]
	4	F606W (WFC3UVI S.im.211126 8)	(1) M-87	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=14			Pattern 1, Exps 4-4 i n Visit 1 (01) (1)	348 Secs (1044 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[2]

Orbit Structure

Orbit 1





Proposal 18187 - Visit 2 (02) - A Movie Campaign on M87: Chandra, NuSTAR, Hubble, and the EHT

Thu Oct 02 13:00:41 GMT 2025

Visit	Proposal 18187, Visit 2 (02) Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: PCS MODE FINE; BETWEEN 01-APR-2026:00:00:00 AND 30-APR-2026:00:00:00 <i>Comments: This visit is scheduled later in the EHT campaign. No specific coordination with the EHT, Chandra, or NuSTAR is required.</i>					
	Diagnosics (F390W (02.003)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser (F606W (02.004)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser					
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
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<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=GALAXY Description=[JET, RADIO GALAXY]						

Proposal 18187 - Visit 2 (02) - A Movie Campaign on M87: Chandra, NuSTAR, Hubble, and the EHT

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	4	F606W (WFC3UVI S.im.211126 8)	(1) M-87	WFC3/UVIS, ACCUM, UVIS2	F606W	FLASH=14		Pattern 1, Exps 4-4 i n Visit 2 (02) (1)	348 Secs (1044 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)]	[2]

Orbit Structure

Orbit 1

