



## 15928 - Imaging the transition of SN 1987A to SNR 1987A

Cycle: 27, 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>
21	(1) SN-1987A	WFC3/UVIS	1	19-Jul-2019 14:00:20.0	yes
22	(1) SN-1987A	WFC3/UVIS	3	19-Jul-2019 14:00:22.0	yes

4 Total Orbits Used

**ABSTRACT**

SN 1987A is the great supernova (SN) of the HST era. An unbroken string of observations is the essential tool for detecting change and establishing a uniform legacy archive. Previous imaging has shown that the SN ejecta has changed from being powered by radioactive  $^{44}\text{Ti}$  up to day 5000, to being powered by the X-rays from the ring collision. This is seen both in the light curve and the rapidly changing morphology of the ejecta. As the X-rays penetrate further in we expect the metal rich core to also become illuminated. As the ejecta expand the dust in the center may become transparent and our limits on a compact object will become stronger, or yield a detection. Also the circumstellar ring surrounding the SN is undergoing a dramatic change. After a rapid increase, the flux reached a maximum around day 8000 and is now decaying rapidly. This marks the final destruction of the ring and we estimate that by 2025 it will be dissolved. At the same time, diffuse emission and new hot spots outside the inner ring are becoming visible, providing a tool to study the unknown circumstellar environment outside the ring.

Imaging in both narrow and broad bands allow us to follow these developments. The HST observations have a unique blend of photometric fidelity and angular resolution that makes them the indispensable partner to ongoing ground-based, X-ray and sub-mm ALMA observations, providing the morphology of both the inner metal rich core and the H-rich envelope. They will also be a necessary complement to our approved STIS and COS observations and by 2019 also of the JWST GTO observations. This is a long term study: given the rapid change we see, sampling every year is necessary.

**OBSERVING DESCRIPTION**

The WFC3/UVIS observations using filters F438W, F625W, F502N and F657N connect with our earlier observations at similar, or better S/N ratio through drizzled observations. As described above, these new images will allow us to follow the light curve, the morphology of the ejecta, the ring emission as well as new spots and diffuse gas outside the ring. Broad band images: We request imaging with F438W and F625W in all three years. To obtain a similar quality as our previous observations we need half an orbit per filter. This is our request for F438W all three years and for F625W in year one and year three. In year two, we request a significantly deeper observation of 1.5 orbits for F625W. This observation will allow us to probe

Proposal 15928 (STScI Edit Number: 2, Created: Friday, July 19, 2019 at 1:00:23 PM Eastern Standard Time) - Overview

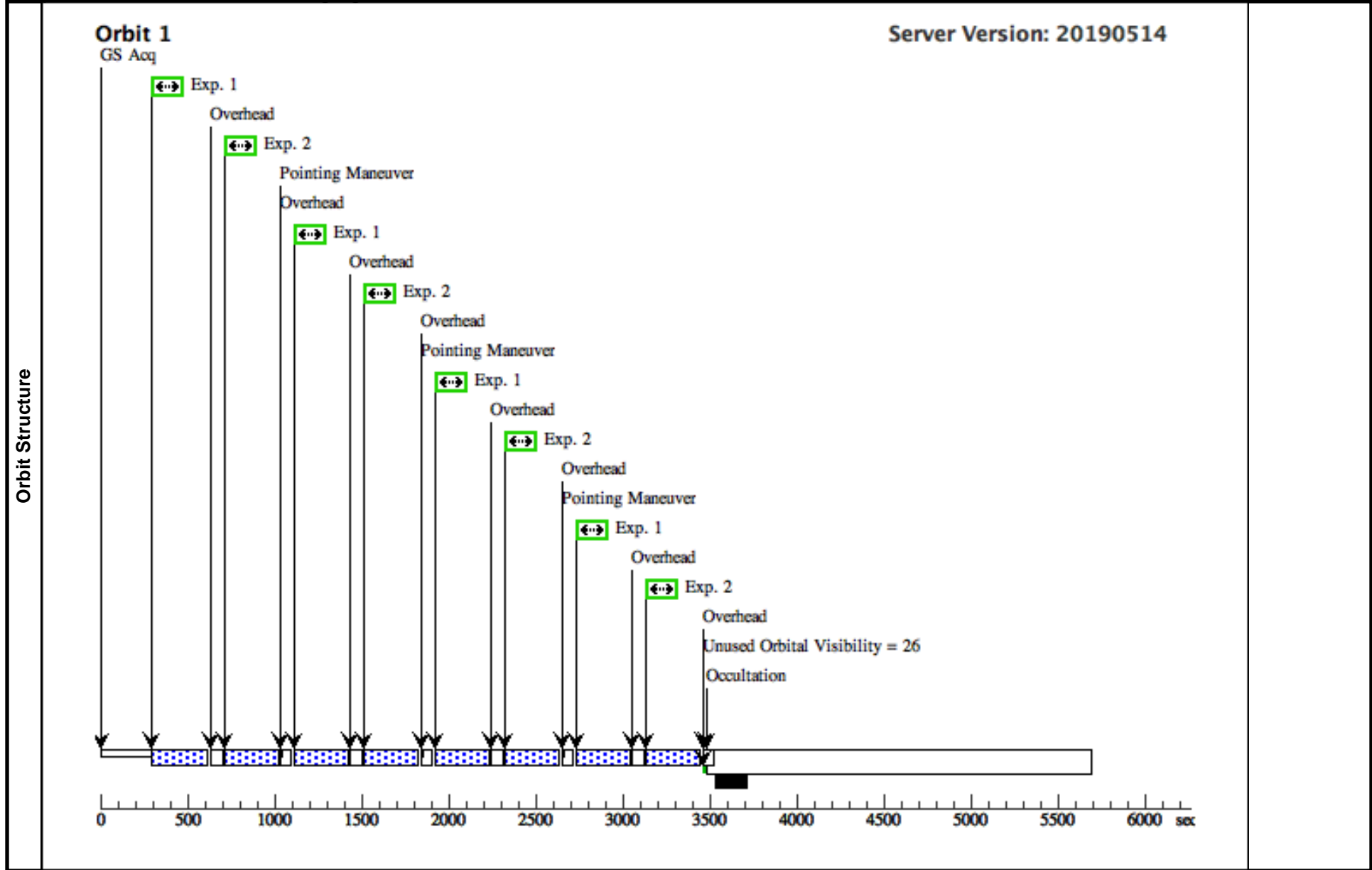
the faintest structures in the ejecta, ring and reverse shock. Such a deep observation also offers the possibility of detecting previously unseen emission components. The total request for the broad filters is thus  $1+2+1=4$  orbits.

Narrow band images: We request imaging in F502N and F657N in year one and year three only. To obtain similar quality as our previous observations we need two orbits for F502N and one orbit for F657N.

Proposal 15928 - Visit 21 - Imaging the transition of SN 1987A to SNR 1987A

Fri Jul 19 18:00:23 GMT 2019

Visit	<b>Proposal 15928, Visit 21, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 01-JUL-2020:00:00:00 AND 30-SEP-2020:00:00:00; SEQ 21.22 WITHIN 7 D									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(1)	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		(1-2)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SN-1987A	RA: 05 35 28.1000 (83.8670833d) Dec: -69 16 11.07 (-69.26974d) Equinox: J2000		V=23.0	Reference Frame: SIMBAD				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.                      frpk our astrometric STIS image                      5:35:28.107 -69:16:11.050 Jk5 514 503 142.747                      Category=EXT-STAR                      Description=[SUPERNOVA, SUPERNOVA TYPE II]</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) SN-1987A	(1) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	FLASH=10		Pattern 1, Exps 1-2 in Visit 21 (1)	290 Secs (1160 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
2	(1) SN-1987A	(1) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F625W	FLASH=5		Pattern 1, Exps 1-2 in Visit 21 (1)	290 Secs (1160 Secs) [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]	



Proposal 15928 - Visit 22 - Imaging the transition of SN 1987A to SNR 1987A

Fri Jul 19 18:00:23 GMT 2019

Visit	<b>Proposal 15928, Visit 22, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/UVIS Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(1)	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		(1-3)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	SN-1987A	RA: 05 35 28.1000 (83.8670833d) Dec: -69 16 11.07 (-69.26974d) Equinox: J2000		V=23.0	Reference Frame: SIMBAD				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.                      frpk our astrometric STIS image                      5:35:28.107 -69:16:11.050 fk5 514 503 142.747                      Category=EXT-STAR                      Description=[SUPERNOVA, SUPERNOVA TYPE II]</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F502N	FLASH=12		Pattern 1, Exps 1-3 in Visit 22 (1)	700 Secs (2800 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[3]
									[==>(Pattern 4)]	[3]
	2		(1) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F502N	FLASH=12		Pattern 1, Exps 1-3 in Visit 22 (1)	700 Secs (2800 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
									[==>(Pattern 3)]	[2]
									[==>(Pattern 4)]	[3]
	3		(1) SN-1987A	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F657N	FLASH=12		Pattern 1, Exps 1-3 in Visit 22 (1)	720 Secs (2880 Secs)	
									[==>(Pattern 1)]	[1]
								[==>(Pattern 2)]	[2]	
								[==>(Pattern 3)]	[2]	
								[==>(Pattern 4)]	[3]	

