16884 - Do subluminous Type Ia supernovae experience a near-infrared plateau?

Cycle: 29, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) SN2021QVV	WFC3/IR WFC3/UVIS	1	23-Nov-2021 10:00:45.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
02	(1) SN2021QVV	WFC3/IR WFC3/UVIS	1	23-Nov-2021 10:00:46.0	yes
03	(1) SN2021QVV	WFC3/IR WFC3/UVIS	1	23-Nov-2021 10:00:47.0	yes
04	(1) SN2021QVV	WFC3/IR WFC3/UVIS	1	23-Nov-2021 10:00:47.0	yes

4 Total Orbits Used

ABSTRACT

We ask for 4 WFC3 orbits to observe the subluminous 1991bg-like Type Ia supernova (SN Ia) SN 2021qvv when it is 150-250 days past maximum light. With observations in F125W (J), F160W (H), and F350LP (optical) in each of four visits, we will determine whether this SN Ia subtype undergoes a similar near-infrared (NIR) plateau as the one recently discovered in so-called "normal" SNe Ia. The latter have long been used as standard candles in cosmology, yet the nature of their progenitors and explosion mechanism remains elusive. The abundance of SN Ia subtypes, including 1991bg-like SNe Ia, only complicates matters. It is still unclear whether several (or all) SN Ia subtypes share the same progenitor and explosion method as normal SNe Ia, or whether each subtype originates in a different type of star and explosion physics. The first option ties into the nagging question of how standard SNe Ia really are as standard candles. Revealing the progenitors of normal SNe Ia and the other SN Ia subtypes would go some way to answering this question. The recently discovered NIR plateau at 150-500 days offers a new way to constrain the progenitors and explosion physics. In normal SNe Ia, this plateau could be a third NIR maximum, similar to the second NIR maximum seen shortly after the first peak. These additional peaks could be due to the recombination of iron in the expanding ejecta. These secondary NIR peaks are not seen in 1991bg-like SNe Ia, a fact used to constrain the mass, temperature, and chemical composition of the progenitor. The presence or absence of the late-time NIR plateau in 1991bg-like SNe would place further constraints on the progenitor and the recombination wave model.

OBSERVING DESCRIPTION

In this program, we will be observing a 1991bg-like supernova called SN 2021qvv. In each visit, one orbit will be split between F350LP, F125W, and F160W, with most of the time spent on the near-IR filters.

The first visit is set to occur sometime in the first half of December, as I assume that's the earliest date we could schedule it. The next visit should

occur 25-35 days after the first visit. This will also be the cadence for visits 3 and 4.

The timing of visit 4 will be flexible. Once visits 1 and 2 are taken, we will analyze the data, locate the supernova, and decide whether we underestimated the background light from the host galaxy. If that is the case, visit 4 will be moved to the end of Cycle 30, when the supernova has faded away, and be used as a template to subtract from visits 1-3. This will allow us to subtract the galaxy and isolate the supernova.

Throughout the program, we may ask to remove certain filters or change exposure times, based on our ongoing analysis of the incoming data. We will always allow plenty of time for such changes to be scheduled.

Visit

Proposal 16884, 170 days (01), implementation Tue Nov 23 15:00:48 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: BETWEEN 10-DEC-2021:00:00:00 AND 20-DEC-2021:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2-3)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

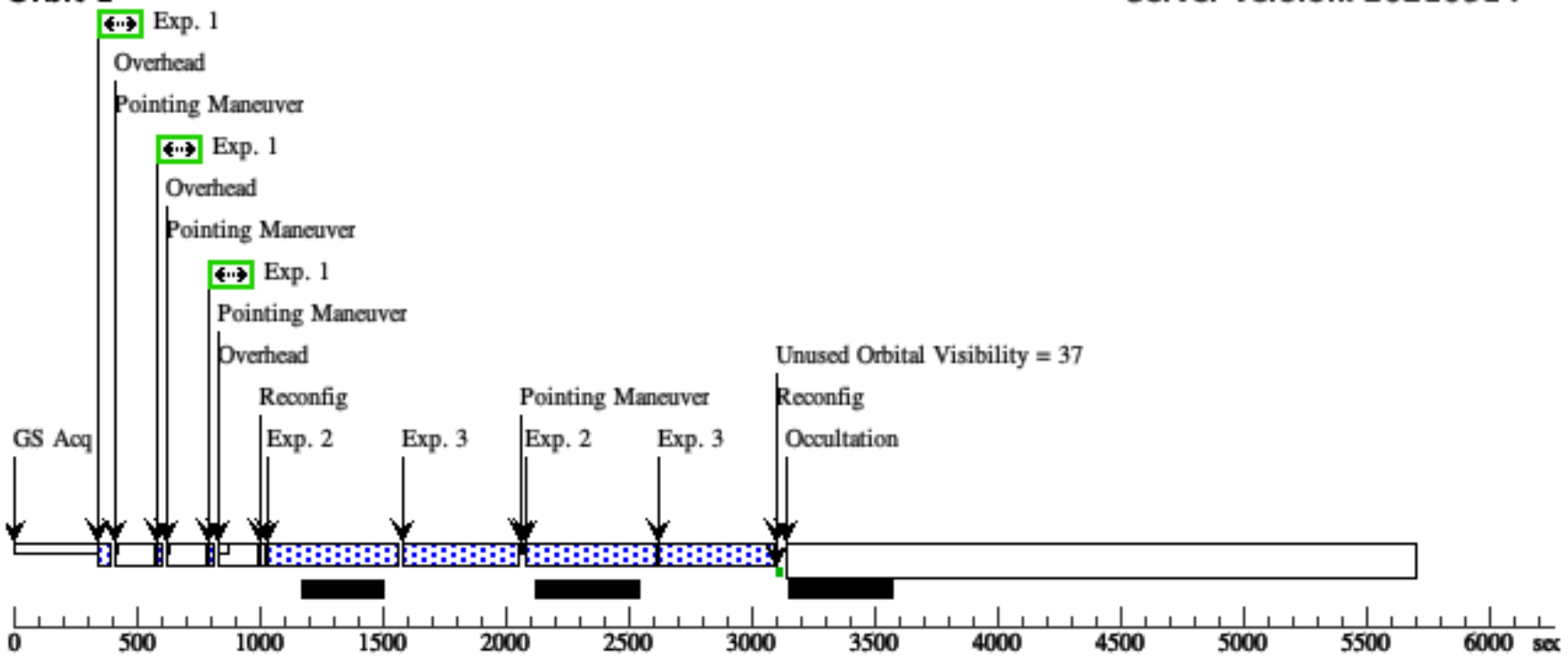
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2021QVV	RA: 12 28 2.9800 (187.0124167d) Dec: +09 48 9.90 (9.80275d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN2021QVV	WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB	F350LP	FLASH=15		Pattern 2, Exps 1-1 in 170 days (01) (2)	20 Secs (60 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***
2		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F125W	NSAMP=11; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 170 days (01) (1)	502.936801 Secs (1005.874 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
3		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F160W	NSAMP=10; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 170 days (01) (1)	452.93635 Secs (905.873 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16884, 195 days (02), implementation Tue Nov 23 15:00:48 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: AFTER 01 BY 26 D TO 35 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2-3)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

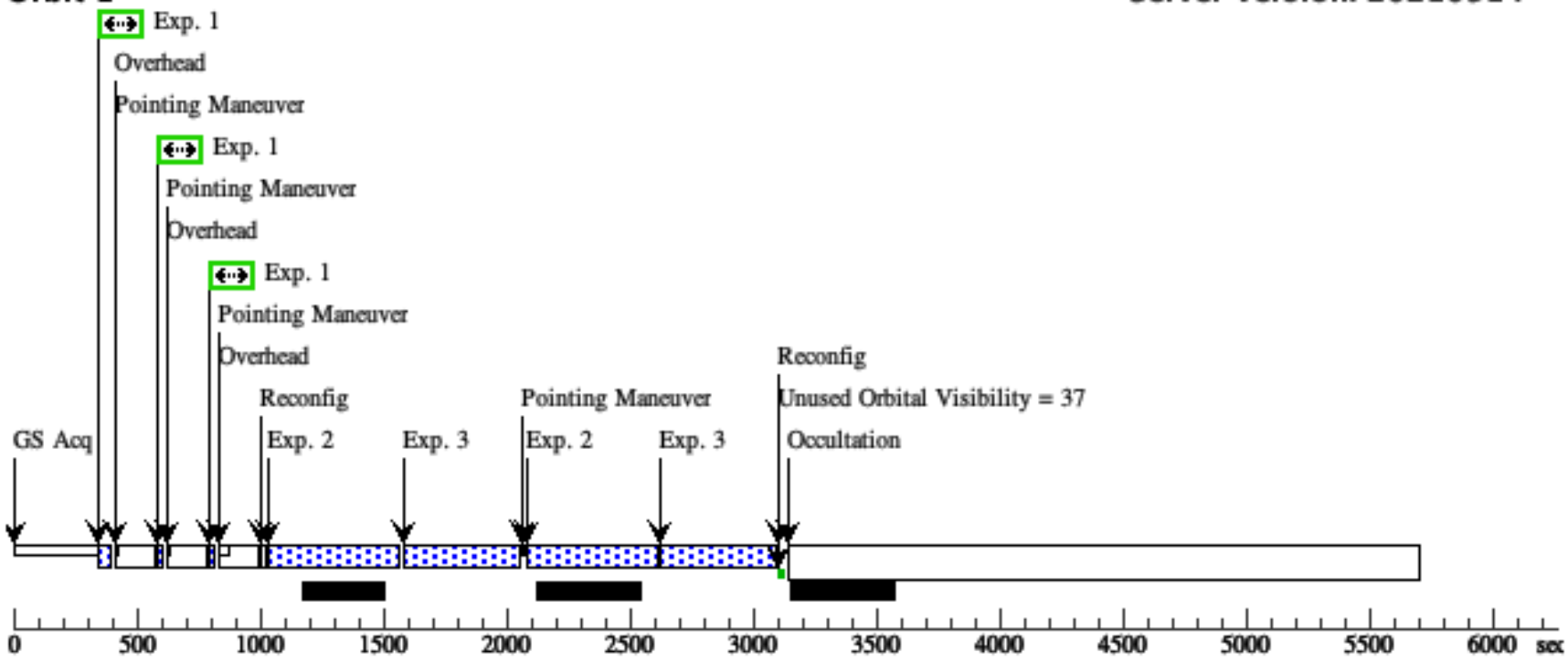
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2021QVV	RA: 12 28 2.9800 (187.0124167d) Dec: +09 48 9.90 (9.80275d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN2021QVV	WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB	F350LP	FLASH=15		Pattern 2, Exps 1-1 in 195 days (02) (2)	20 Secs (60 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***
2		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F125W	NSAMP=11; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 195 days (02) (1)	502.936801 Secs (1005.874 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
3		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F160W	NSAMP=10; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 195 days (02) (1)	452.93635 Secs (905.873 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16884, 220 days (03), implementation Tue Nov 23 15:00:48 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: AFTER 02 BY 26 D TO 35 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2-3)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

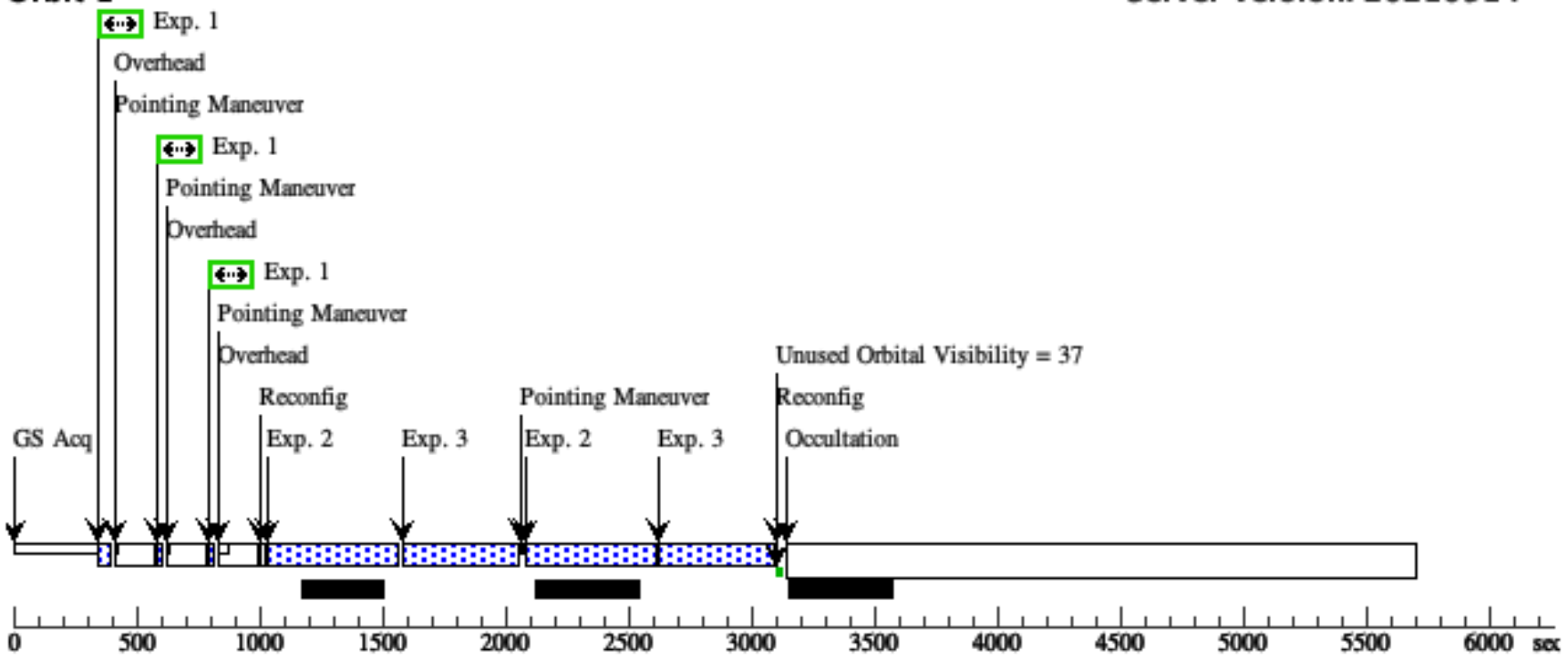
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2021QVV	RA: 12 28 2.9800 (187.0124167d) Dec: +09 48 9.90 (9.80275d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN2021QVV	WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB	F350LP	FLASH=15		Pattern 2, Exps 1-1 in 220 days (03) (2)	20 Secs (60 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	 ***[1]***
2		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F125W	NSAMP=11; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 220 days (03) (1)	502.936801 Secs (1005.874 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***
3		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F160W	NSAMP=10; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 220 days (03) (1)	452.93635 Secs (905.873 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16884, 245 days (04), implementation Tue Nov 23 15:00:48 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: AFTER 03 BY 26 D TO 35 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.636 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2-3)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SN2021QVV	RA: 12 28 2.9800 (187.0124167d) Dec: +09 48 9.90 (9.80275d) Equinox: J2000		V=19	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[SUPERNOVA TYPE IA]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SN2021QVV	WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB	F350LP	FLASH=15		Pattern 2, Exps 1-1 in 245 days (04) (2)	20 Secs (60 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F125W	NSAMP=11; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 245 days (04) (1)	502.936801 Secs (1005.874 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
3		(1) SN2021QVV	WFC3/IR, MULTIACCUM, IR-UVIS	F160W	NSAMP=10; SAMP-SEQ=SPARS50		Pattern 1, Exps 2-3 in 245 days (04) (1)	452.93635 Secs (905.873 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***

Orbit Structure