11723 - Imaging the Crab Nebula-Like Supernova Remnant 3C 58

Cycle: 17, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) 3C58-NORTH-EAST (2) 3C58-SOUTH-EAST (6) 3C58-NORTH-WEST (7) 3C58-SOUTH-WEST	WFC3/UVIS	4	22-Sep-2009 21:38:30.0	yes
02	(3) 3C58-NORTH-CENTRAL (4) 3C58-CENTRAL (5) 3C58-SOUTH-CENTRAL	WFC3/UVIS	4	22-Sep-2009 21:38:48.0	yes

8 Total Orbits Used

ABSTRACT

The Galactic supernova remnant 3C 58 shares several important properties with the Crab Nebula. It possesses a young, rapidly spinning pulsar and an associated compact optical/IR synchrotron wind nebula. This makes 3C 58, along with the Crab and PSR B0540-69 in the LMC, only the third such

PWN detected in the optical and IR. Also like the Crab, 3C58 has been associated with a historically reported `guest star', in this case, the apparent SN of 1181 CE. Its optical nebulosity contains an unusually large fraction of shocked circumstellar material, with the remnant's high-velocity, N-rich ejecta knots exhibiting a strong bi-polar expansion asymmetry.

Despite having a relatively extensive optical nebula, it is the only young and nearby Galactic SNR that has not yet been imaged by HST. However, some recent deep, high-resolution Gemini images show a surprising amount of fine-scale filament detail, revealing some peculiar optical emission morphologies. Here we propose a WFC3 imaging survey of 3C 58 in order to investigate: 1) the optical luminosity and emission efficiency of the remnant's young, 65.7 ms pulsar PSR J0205+6449 thereby providing a rare testing of pulsar emission models, 2) the effect of the remnant's expanding synchrotron nebula on the formation of Rayleigh-Taylor instabilities in its optical filaments like that observed so far only in the Crab through HST imaging, and 3) the fine-scale structure of 3C 58's slow moving circumstellar and high-velocity SN ejecta and the morphological and distribution differences between them.

OBSERVING DESCRIPTION

This project is to use WFP3 to image the galactic supernova remnant 3C58.
The object is broken up into 7 target fields. For all 7 pointings, the filters
F657N and F665N will be used to obatin on/off Halpha images.

For the remnant's central region, two other filter images will be taken in addition to
the F657N and F665N ones. These are SDSS r and i filters (F625W and F775W).

Visit

Proposal 11723, Visit 01, implementation Wed Sep 23 01:38:54 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: CVZ; BETWEEN 01-NOV-2009:00:00:00 AND 15-DEC-2009:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=1.5 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-4), (5-6), (7-8)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	3C58-NORTH-EAST	RA: 02 06 3.0310 (31.5126292d) Dec: +64 51 2.20 (64.85061d) Equinox: J2000		V=21.0+/-2.0	Reference Frame: ICRS
(2)	3C58-SOUTH-EAST	RA: 02 06 5.0000 (31.5208333d) Dec: +64 48 35.13 (64.80976d) Equinox: J2000		V=21.0 +/-2.0	Reference Frame: ICRS
(6)	3C58-NORTH-WEST	RA: 02 05 17.6400 (31.3235000d) Dec: +64 51 3.00 (64.85083d) Equinox: J2000		V=21.0+/-2.0	Reference Frame: ICRS
(7)	3C58-SOUTH-WEST	RA: 02 05 19.5000 (31.3312500d) Dec: +64 48 34.00 (64.80944d) Equinox: J2000		V=21.0+/-2.0	Reference Frame: ICRS

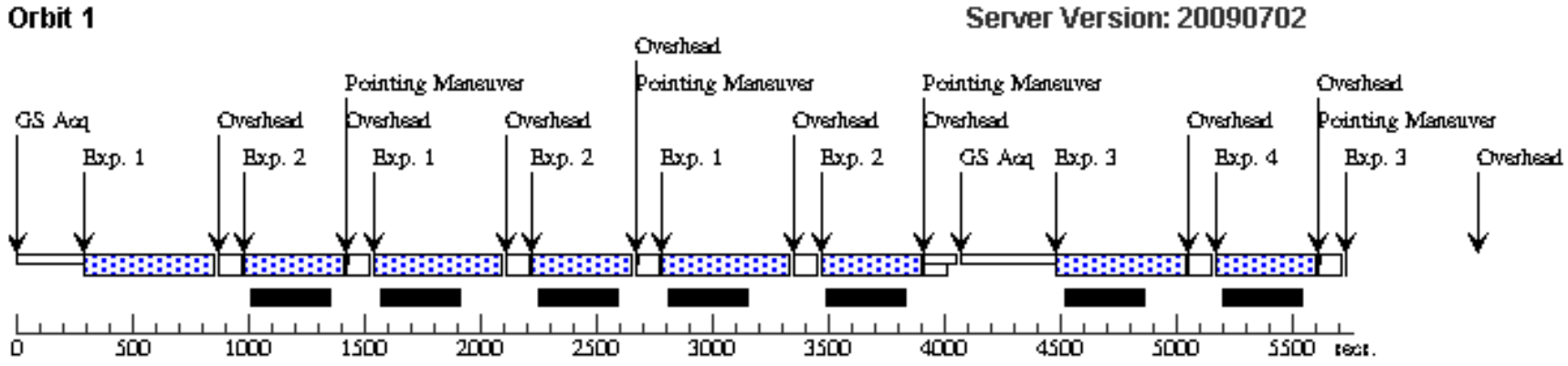
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	NE H-alpha	(1) 3C58-NORTH-EAST	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	530.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2	NE off band	(1) 3C58-NORTH-EAST	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	410.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
3	SE H-alpha	(2) 3C58-SOUTH-EAST	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 3-4 (1)	530.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)]	***[2]***

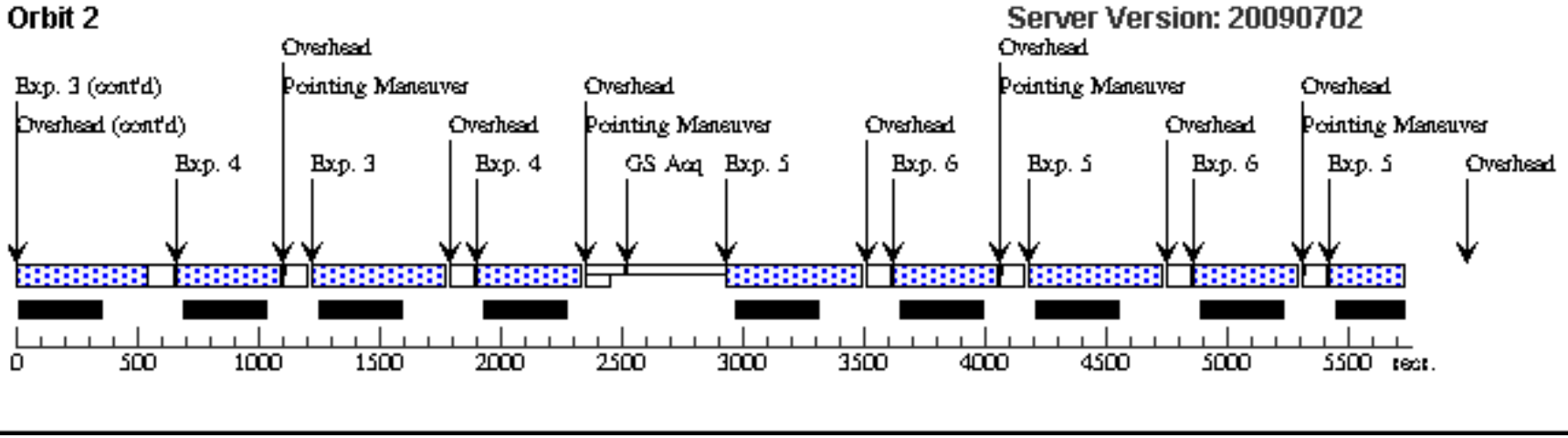
Exposures (continued)

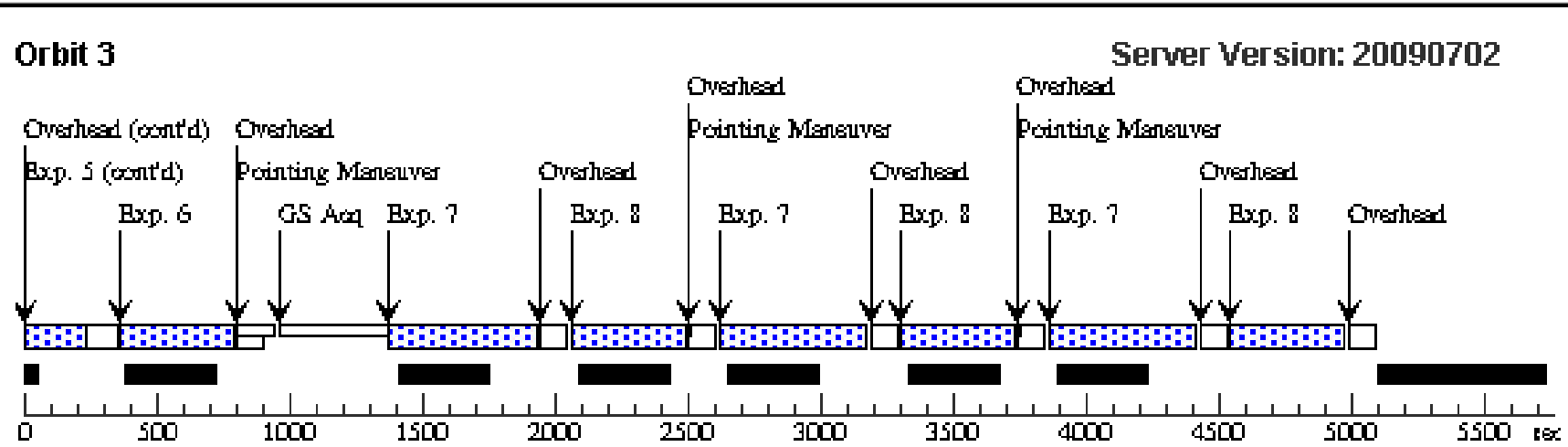
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4	SE off band	(2) 3C58-SOUTH-EAST	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 3-4 (1)	410.0 Secs	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)] *[==>(Pattern 3)]*	***[2]***
5	NW H-alpha	(6) 3C58-NORTH-WEST	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 5-6 (1)	530.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
6	NW off band	(6) 3C58-NORTH-WEST	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 5-6 (1)	410.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[2]***
								[==>(Pattern 3)]	***[3]***
7	SW H-alpha	(7) 3C58-SOUTH-WEST	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 7-8 (1)	530.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[3]***
8	SW off band	(7) 3C58-SOUTH-WEST	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 7-8 (1)	410.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[3]***

Orbit Structure



Orbit Structure (continued)





Orbit Structure (continued)

Orbit 4

Server Version: 20090702

Visit

Proposal 11723, Visit 02, implementation Wed Sep 23 01:38:56 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: CVZ; ORIENT 129.0D TO 130.0 D; BETWEEN 01-NOV-2009:00:00:00 AND 15-DEC-2009:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=1.5 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2), (3-6), (7-8)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	3C58-NORTH-CENTRAL	RA: 02 05 40.0520 (31.4168833d) Dec: +64 51 30.63 (64.85851d) Equinox: J2000		V=21.0+/-2.0	Reference Frame: ICRS
(4)	3C58-CENTRAL	RA: 02 05 41.5000 (31.4229167d) Dec: +64 49 12.22 (64.82006d) Equinox: J2000		V=21.0+/-2.0	Reference Frame: ICRS
(5)	3C58-SOUTH-CENTRAL	RA: 02 05 42.0000 (31.4250000d) Dec: +64 48 28.22 (64.80784d) Equinox: J2000		V=21.0+/-2.0	Reference Frame: ICRS

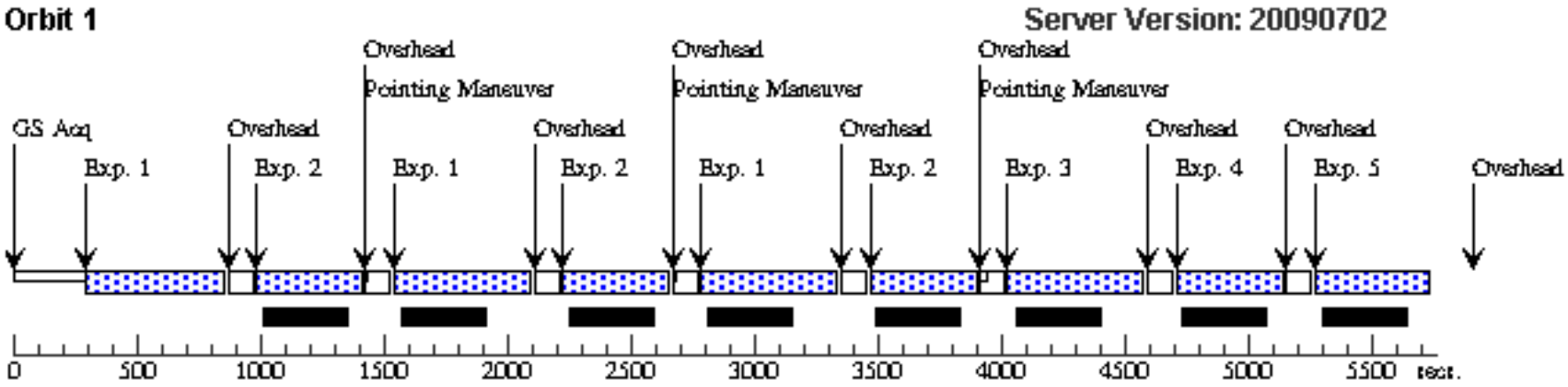
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	SC H-alpha	(5) 3C58-SOUTH-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	530.0 Secs	
								[==>(Pattern 1)]	
								[==>(Pattern 2)]	***[1]***
								[==>(Pattern 3)]	
2	SC off band	(5) 3C58-SOUTH-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	410.0 Secs	
								[==>(Pattern 1)]	
								[==>(Pattern 2)]	***[1]***
								[==>(Pattern 3)]	
3	Central H-alpha	(4) 3C58-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 3-6 (1)	530.0 Secs	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	
4	Central off band	(4) 3C58-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 3-6 (1)	410.0 Secs	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	***[2]***
								[==>(Pattern 3)]	

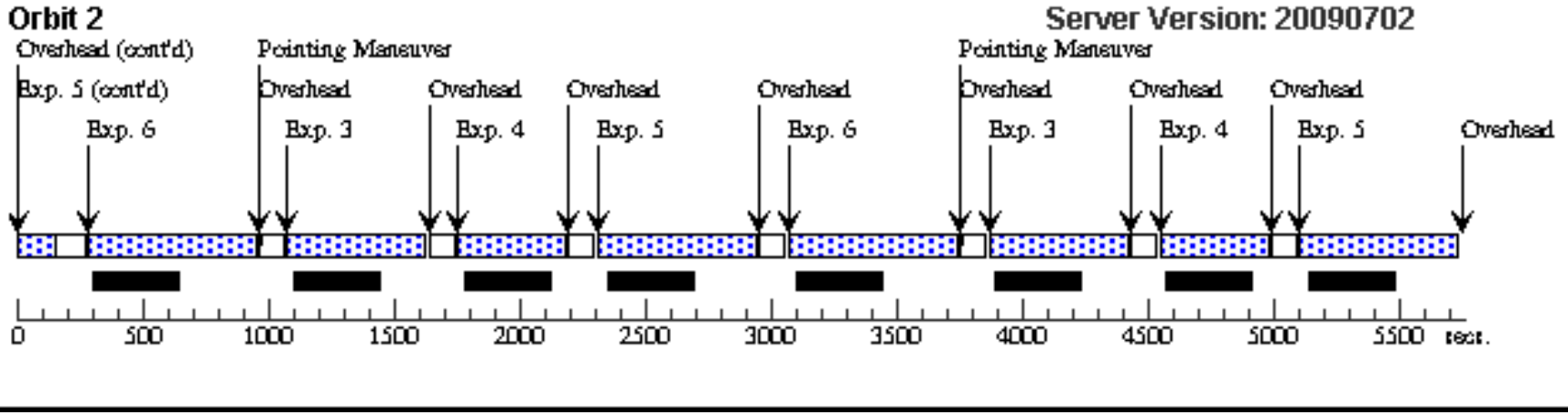
Exposures (continued)

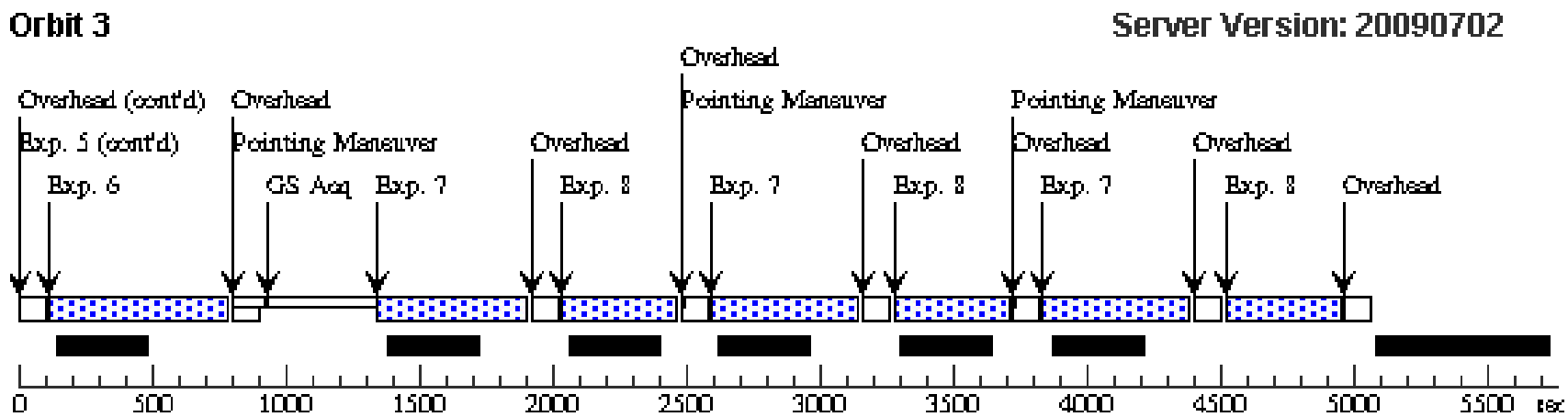
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
5	Central SDSS r	(4) 3C58-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F625W	CR-SPLIT=NO		Pattern 1, Exps 3-6 (1)	600.0 Secs	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)] *[==>(Pattern 3)]*	***[2]***
6	Central SDSS i	(4) 3C58-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F775W	CR-SPLIT=NO		Pattern 1, Exps 3-6 (1)	650.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[2]***
								[==>(Pattern 3)]	***[3]***
7	NC H-alpha	(3) 3C58-NORTH-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F657N	CR-SPLIT=NO		Pattern 1, Exps 7-8 (1)	530.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[3]***
8	NC off band	(3) 3C58-NORTH-CENTRAL	WFC3/UVIS, ACCUM, UVIS	F645N	CR-SPLIT=NO		Pattern 1, Exps 7-8 (1)	410.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[3]***

Orbit Structure



Orbit Structure (continued)





Orbit Structure (continued)

Orbit 4

Server Version: 20090702