11985 - Polarimetric WFPC2 Imaging of the Dust Torus around the Born-Again Star V605 Aquilae

Cycle: 16, 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) V605-AQL	WFPC2	1	27-Jan-2009 21:23:45.0	yes
02	(1) V605-AQL	WFPC2	2	27-Jan-2009 21:23:49.0	yes
03	(1) V605-AQL	WFPC2	2	27-Jan-2009 21:23:53.0	yes
04	(1) V605-AQL	WFPC2	2	27-Jan-2009 21:23:55.0	yes

7 Total Orbits Used

ABSTRACT

We propose the first WFPC2 polarimetric imaging of the ejecta surrounding the helium shell final flash (FF) star V605 Aql. Polarimetry is a novel, little-used capability of WFPC2, which can provide confirmation of our proposed morphology of the compact ejecta..

Evolutionary models suggest that V605 Aql is experiencing a very late and very fast thermal pulse. Its evolution from a PN central star on the white-dwarf cooling track, to a cool luminous giant, and then back again, took place in only a few decades or less. V605 Aql, central star of the large, faint, and old planetary nebula A 58, has evolved from a hot central star before the 20th century, to Teff = 5000 K in 1921, and back to 95,000 K at the present time.

A compact, but resolved, dusty nebula lies at the site of V605 Aql. In addition to an extremely hydrogen-deficient nebular emission spectrum, this knot shows stellar features, even though no star-like object is seen within the knot. Therefore, we are probably seeing light from the star scattered around the edge of a thick dust torus viewed nearly edge-on, ejected during the FF event in the early 20th century. Why a star that had already reached the top of the white-dwarf cooling track, and then expanded to become a red giant again, would be capable of such non-spherical ejection is one of the leading mysteries in late stellar evolution. We will use the high resolution of the WFPC2 PC chip to investigate the nature of the V605 Aql torus, employing filters that isolate nebular emission lines.

The novel feature of our program is polarimetric imaging in the WF2 chip, using a filter that isolates scattered starlight and rejects nebular emission. If our model is correct, this scattered starlight will be very highly polarized. We will also measure the angular expansion rate of the central knot to constrain the distance. V605 Aql is a unique link between the young FF star Sakurai's Object (10 years old), and the extended FF objects A30 and A78 (few 1000 years old).

OBSERVING DESCRIPTION

We will use WFPC2 to carry out direct and polarimetric imaging of the compact nebulosity surrounding the "born-again" star V605 Aquilae.

For the direct imaging, we will place the target in the corner of the PC chip (for less degradation by CTE) and taken 2 dithered exposures each in the nebular emission lines [O III] (F502N) and [N II] (F658N).

For the polarimetric imaging, we will use Strategy 2c as outlined by Biretta & Sparks in their 1995 WFPC2 ISR on WFPC2 polarimetry. The observations will be taken with the target fixed at 12.5, -12.5 in the WF2 chip (with small dithers about this position), the same telescope ORIENT throughout, and the polarizer quad at four different filter rotations. The polarizers are combined with the F547M filter, which isolates an emission line of the central star and rejects light from gas in the nebula, thus giving information on the light from the star that is scattered by dust in the nebula.

We are using CLOCKS=YES throughout, since this yields significantly less time lost to overheads.

Visit

Proposal 11985, Visit 01, implementation Wed Jan 28 02:23:59 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

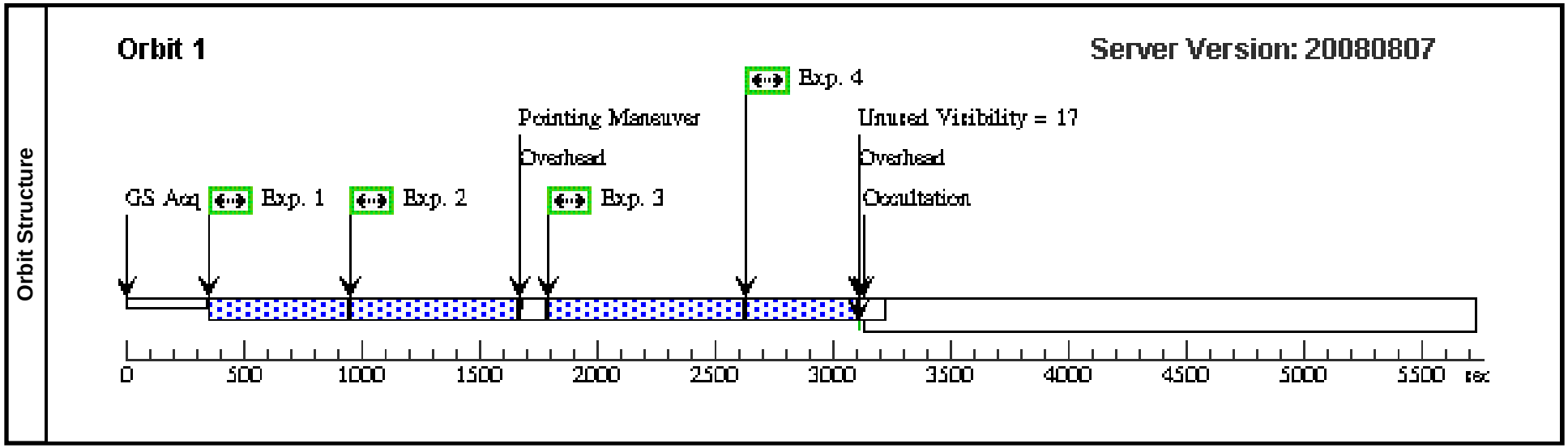
Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V605-AQL	RA: 19 18 20.5700 (289.5857083d) Dec: +01 46 58.35 (1.78288d) Equinox: J2000		V=23+/-1	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) V605-AQL	WFPC2, IMAGE, PC1-FIX	F502N	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG -7,-7		300 Secs *[==>400.0 Secs]*	 ***[1]***
2		(1) V605-AQL	WFPC2, IMAGE, PC1-FIX	F658N	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG -7,-7		400 Secs *[==>600.0 Secs]*	 ***[1]***
3		(1) V605-AQL	WFPC2, IMAGE, PC1-FIX	F658N	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG -6.8860 75,-6.886075		400 Secs *[==>600.0 Secs]*	 ***[1]***
4		(1) V605-AQL	WFPC2, IMAGE, PC1-FIX	F502N	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG -6.8860 75,-6.886075		300 Secs *[==>400.0 Secs]*	 ***[1]***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Orbit 1
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Exp. 4
Pointing Maneuver
Overhead
Unused Visibility = 17
Overhead
GS Acq
Exp. 1
Exp. 2
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 11985, Visit 02, implementation Wed Jan 28 02:24:00 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

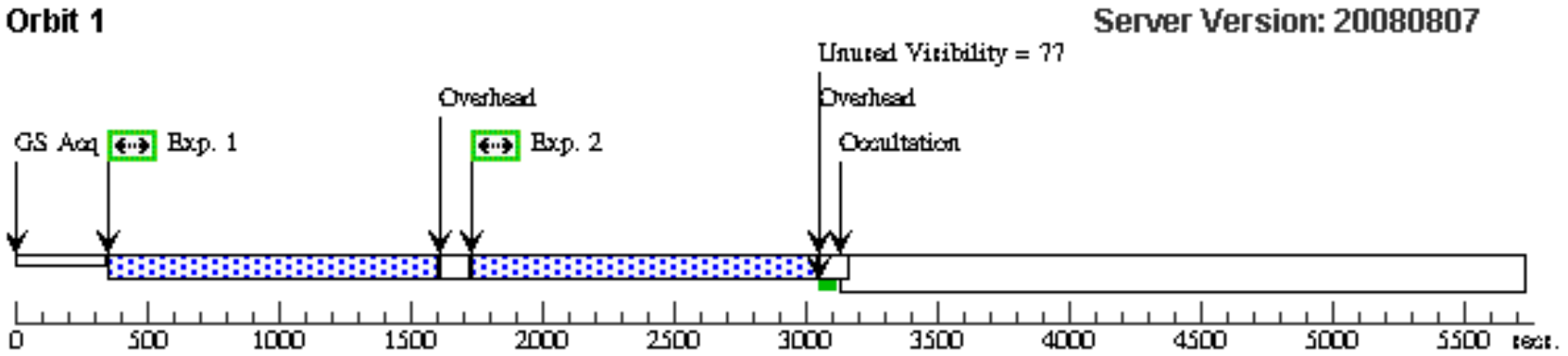
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V605-AQL	RA: 19 18 20.5700 (289.5857083d) Dec: +01 46 58.35 (1.78288d) Equinox: J2000		V=23+/-1	Reference Frame: ICRS

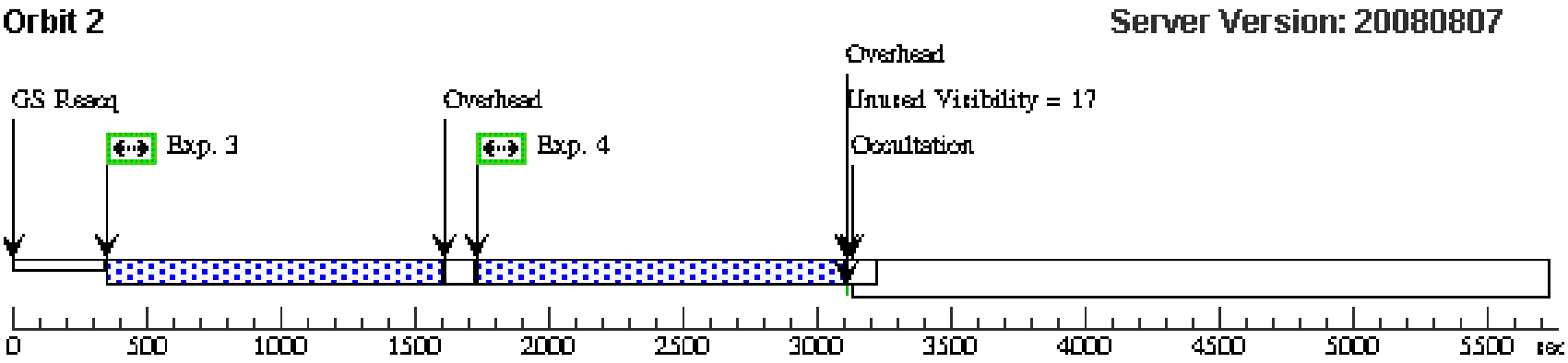
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQP15	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.5,-12.5		1000 Secs *[==>]*	*[1]*
2		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQ	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.5,-12.5		1100 Secs *[==>1100.0 Secs]*	*[1]*
3		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQN18	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.5,-12.5		1000 Secs *[==>]*	*[2]*
4		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQN33	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.5,-12.5		1100 Secs *[==>1100.0 Secs]*	*[2]*

Orbit Structure



Orbit Structure (continued)



Visit

Proposal 11985, Visit 03 Wed Jan 28 02:24:01 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: SAME ORIENT AS 02

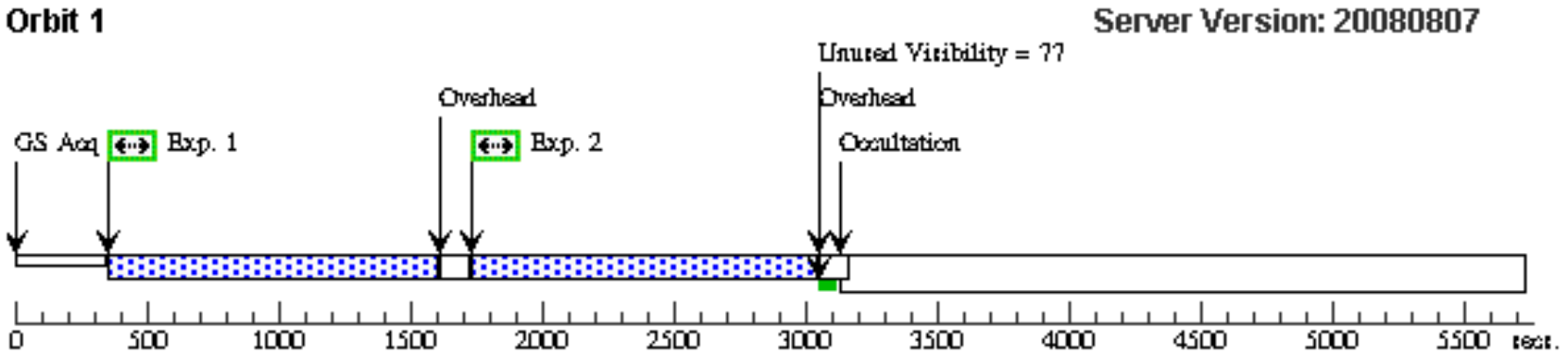
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V605-AQL	RA: 19 18 20.5700 (289.5857083d) Dec: +01 46 58.35 (1.78288d) Equinox: J2000		V=23+/-1	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQP15	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.7490 25,-12.3754875		1000 Secs *[==>]*	***[1]***
2		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQ	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.7490 25,-12.3754875		1100 Secs *[==>]*	***[1]***
3		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQN18	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.7490 25,-12.3754875		1100 Secs *[==>]*	***[2]***
4		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQN33	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.7490 25,-12.3754875		1000 Secs *[==>]*	***[2]***

Orbit Structure



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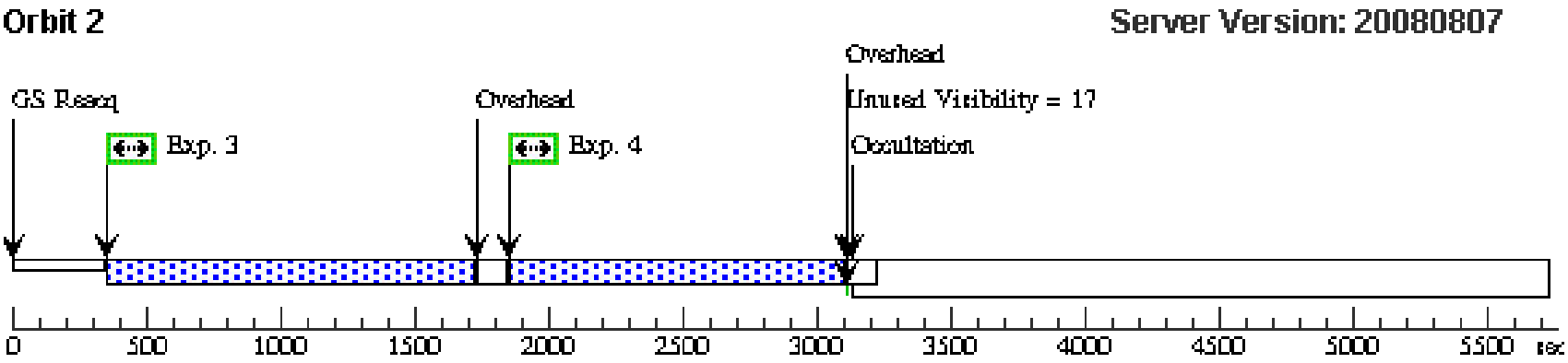


Visit

Proposal 11985, Visit 04 Wed Jan 28 02:24:02 GMT 2009

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: SAME ORIENT AS 02

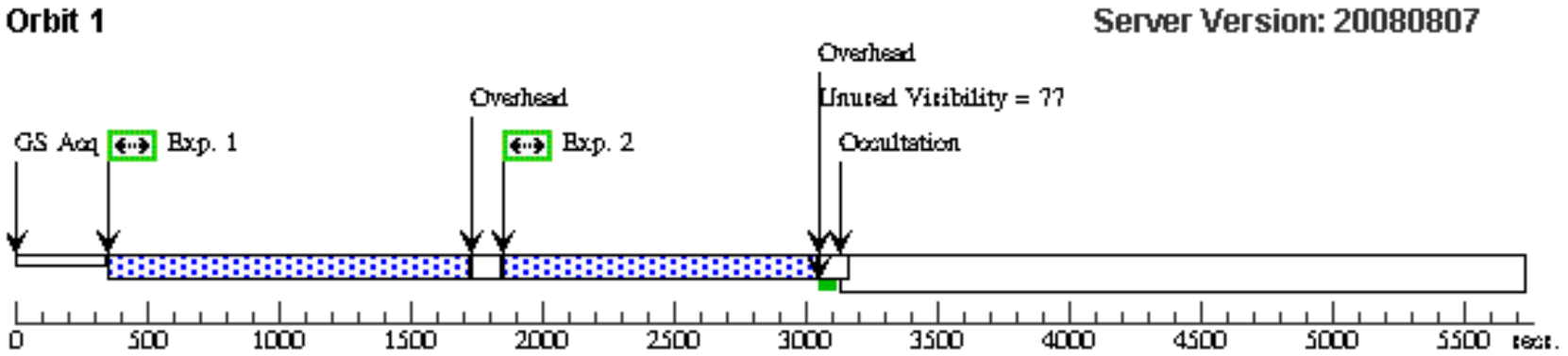
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V605-AQL	RA: 19 18 20.5700 (289.5857083d) Dec: +01 46 58.35 (1.78288d) Equinox: J2000		V=23+/-1	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQP15	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.1264 625,-12.8735375		1000 Secs *[==>1100.0 Secs]*	 ***[1]***
2		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQ	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.1264 625,-12.8735375		1000 Secs *[==>1000.0 Secs]*	 ***[1]***
3		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQN18	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.1264 625,-12.8735375		1000 Secs *[==>]*	 ***[2]***
4		(1) V605-AQL	WFPC2, IMAGE, WF2-FIX	F547M POLQN33	ATD-GAIN=7; CR-SPLIT=NO; CLOCKS=YES	POS TARG 12.1264 625,-12.8735375		1100 Secs *[==>]*	 ***[2]***

Orbit Structure



Orbit Structure (continued)