14696 - The Physics of the Jets of Powerful Radio Galaxies and Quasars

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

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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	(4) QSO-J0635-7516	ACS/WFC	4	07-Sep-2016 18:14:08.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
02	(4) QSO-J0635-7516	ACS/WFC	4	07-Sep-2016 18:14:10.0	yes
03	(4) QSO-J0635-7516	ACS/WFC	4	07-Sep-2016 18:14:11.0	yes
04	(4) QSO-J0635-7516	ACS/WFC	1	07-Sep-2016 18:14:12.0	yes

13 Total Orbits Used

ABSTRACT

We propose HST polarimetry of the jet of PKS 0637-752. This object represents the quasar jet with the most extreme SED, thought to be the most Compton dominated of all, and now that the IC/CMB model appears to be ruled out (thanks in large part to our discovery of high optical polarization in the knots of the PKS 1136-135 jet), it provides an excellent opportunity to test the applicability of synchrotron models for jet X-ray emission in even the most extreme circumstances. While the synchrotron model does not have the extreme requirements of exceptionally fast flows (Gamma>30) at hundreds of kpc, tiny viewing angle (only a few degrees) and super-Eddington kinetic power, it does require particles to be accelerated up to at least tens of TeV and hence radiative lifetimes as short as a few years.

Polarization is a critical parameter for understanding jet flows, and only HST has the resolution and capability to perform this measurement. The data will confirm which mechanisms are operating to create its optical and X-ray emission, and will show locations where the magnetic fields are being structured by shocks and shears. Comparison with in-hand radio polarimetry at matched resolution will untangle whether the optical and radio emitting particle populations occupy the same or different volumes, as in lower power jets where this was discovered using our earlier HST polarimetry. Additional Chandra observations will also look for spectral curvature and possible variability in the X-rays, which could give us additional information about the high-energy synchrotron component.

OBSERVING DESCRIPTION

The goal of this program is to obtain HST polarimetry of the PKS0637-752 jet using the ACS/WFC + POLVIS + F606W filters. The program also proposes to obtain deeper imaging (120 ks exposure time with ACIS) of the PKS 0637-752 jet with Chandra to complement the data that already exist and allow for modeling of the X-ray spectrum of all components.

We are using F606W because it gives the optimal mix between rejection of cross-polarized light and high throughput of parallel polarized light with the POLVIS filters. It also gives the best compromise between total count rate, jet-to-galaxy ratio, and polarizer fidelity. This is critically important

because we will need to do the highest quality galaxy subtraction possible prior to combining the three polarizer observations to obtain Stokes I, Q and U images.

We will do sub-pixel dithering as specified below, and combine the images with astrodrizzle. This technique is well tested, and will allow us to achieve the full ~ 0.05" resolution which HST is capable of at 6000 Angstroms. In order to achieve maximum observing efficiency, we will not CR-SPLIT at each dither position. Instead we will rely on the multiple dither positions to subtract out both cosmic rays and hot pixels.

The observations have been constructed in a very simple way. All long integrations with the same POL filter are in a single visit. Thus POL0 observations are in Visit 01, POL60 observations are in Visit 02, and POL120 observations are in Visit 03. Each of these visits use a standard, 4-point
ACS-WFC-DITHER-BOX pattern. In all of them, we are doing two exposures per orbit - a short, 60s exposure for PSF calibration, and a longer one of 2830s which is our main science exposure. In addition, the exposure order maximizes the efficiency by placing all readouts either during Earth-shadow times or long exposures.

The observations in Visit 04 are for calibration purposes. There, we obtain a 1-orbit image of the source, giving us a check on the flux and polarization calibration. We used this strategy successfully in our previous ACS polarization programs 9847, 11138 and 13764. The Visit 04 observations use a standard, 3-point ACS-WFC-DITHER-LINE pattern, and are CR-SPLIT to minimize cosmic ray double-hit pixels.

We have specified four fairly wide, 40 degree orientation windows so that the jet can be placed near to or along a chip diagonal. We have required SAME-ORIENT so that the chip is then oriented identically and the jet is in the same chip quadrant in all four visits, thus minimizing calibration issues. This was recommended by Andre' Martel, a member of the team and also a previous member of the ACS instrument team. Finally, we are requiring that all four visits occur within 14 days of one another to minimize any effect from variability of components.

Visit

Proposal 14696, POL0 (01), implementation Wed Sep 07 22:14:13 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 22.2D TO 62.2 D; ORIENT 112.2D TO 152.2 D; ORIENT 202.2D TO 242.2 D; ORIENT 292.2D TO 332.2 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(1-2)

Fixed Targets

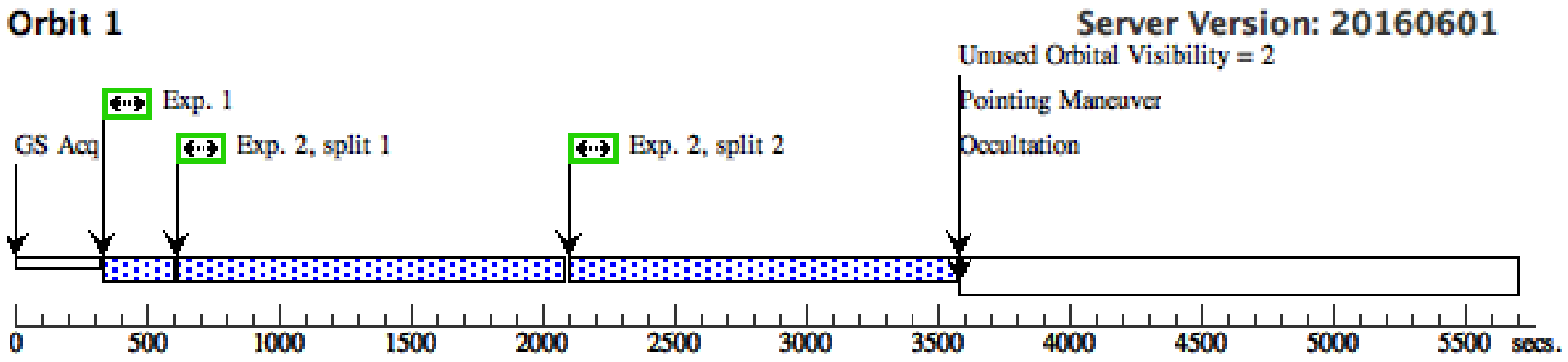
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	QSO-J0635-7516 Alt Name1: PKS0637-75	RA: 06 35 46.5144 (98.9438100d) Dec: -75 16 16.74 (-75.27132d) Equinox: J2000		V=15.75	Reference Frame: SIMBAD

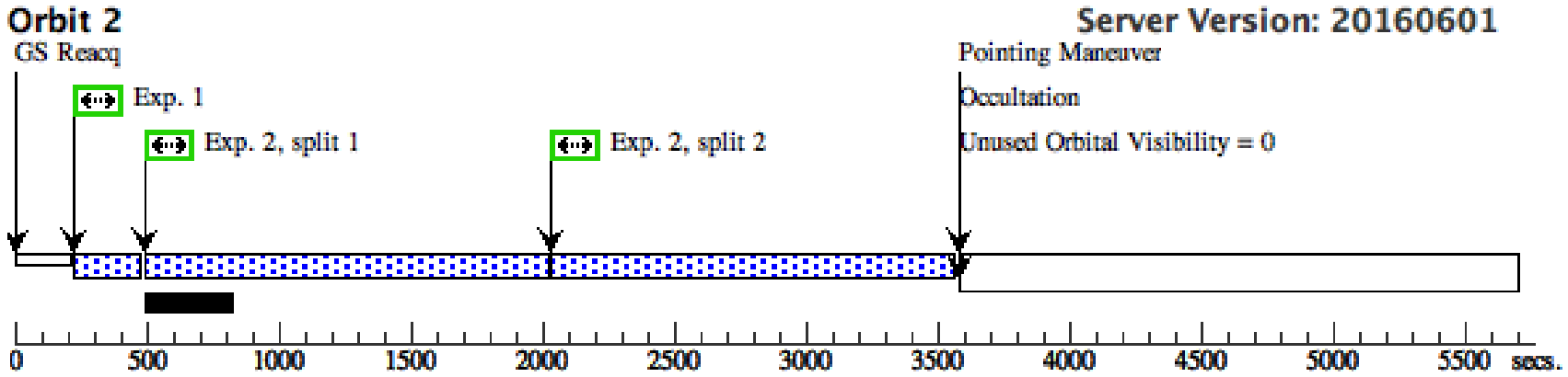
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

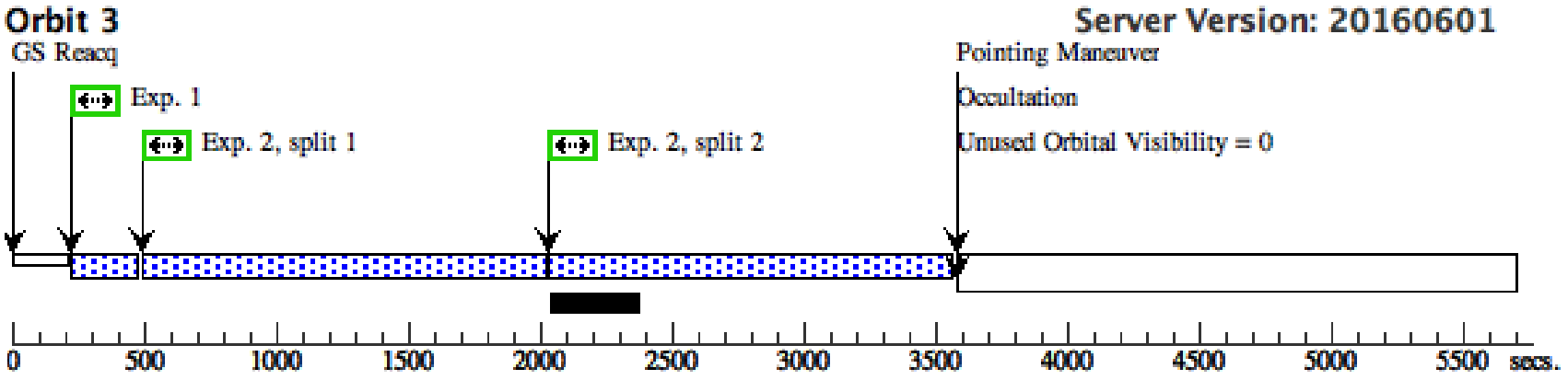
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W POL0V			Pattern 2, Exps 1-2 in POL0 (01) (2)	60 Secs (435 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>125.0 Secs (Pattern 2)]	***[2]***
								[==>125.0 Secs (Pattern 3)]	***[3]***
								[==>125.0 Secs (Pattern 4)]	***[4]***
2		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W POL0V	CR-SPLIT=2		Pattern 2, Exps 1-2 in POL0 (01) (2)	2690 Secs (11150 Secs)	
								[==>(Pattern 1, Split 1)] *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>1410.0 Secs (Pattern 2, Split 1)] *[==>1410.0 Secs (Pattern 2, Split 2)]*	***[2]***
								[==>1410.0 Secs (Pattern 3, Split 1)] *[==>1410.0 Secs (Pattern 3, Split 2)]*	***[3]***
								[==>1410.0 Secs (Pattern 4, Split 1)] *[==>1410.0 Secs (Pattern 4, Split 2)]*	***[4]***

Orbit Structure



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Server Version: 20160601
GS Reacq
Exp. 1
Exp. 2, split 1
Exp. 2, split 2
Pointing Maneuver
Occultation
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3500
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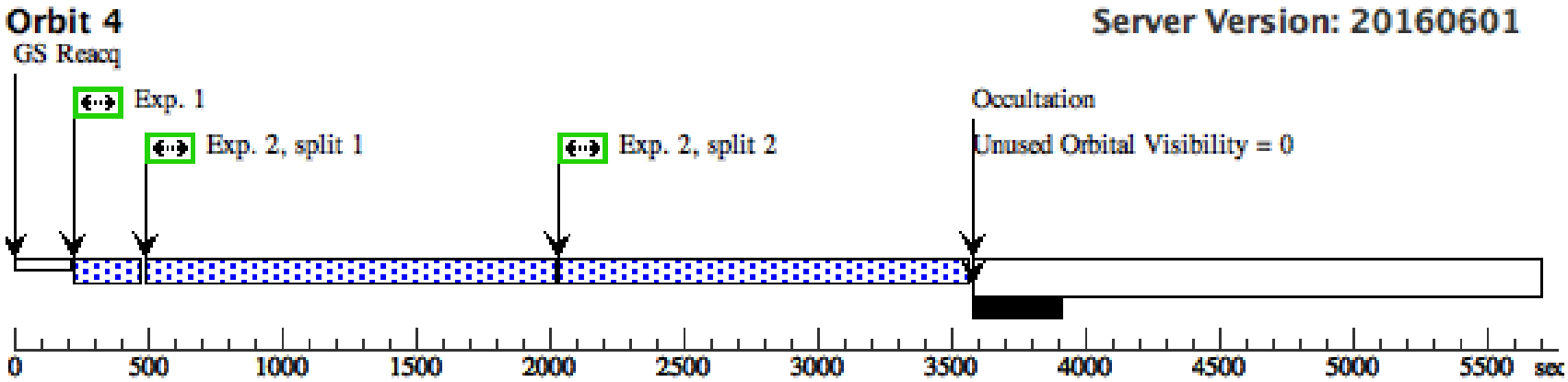
5000
5500
secs.


Orbit 4
Server Version: 20160601
GS Reacq
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Exp. 2, split 1
Exp. 2, split 2
Occultation
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5000
5500
sec

Visit

Proposal 14696, POL60 (02), implementation Wed Sep 07 22:14:13 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 0 D TO 14 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(1-2)

Fixed Targets

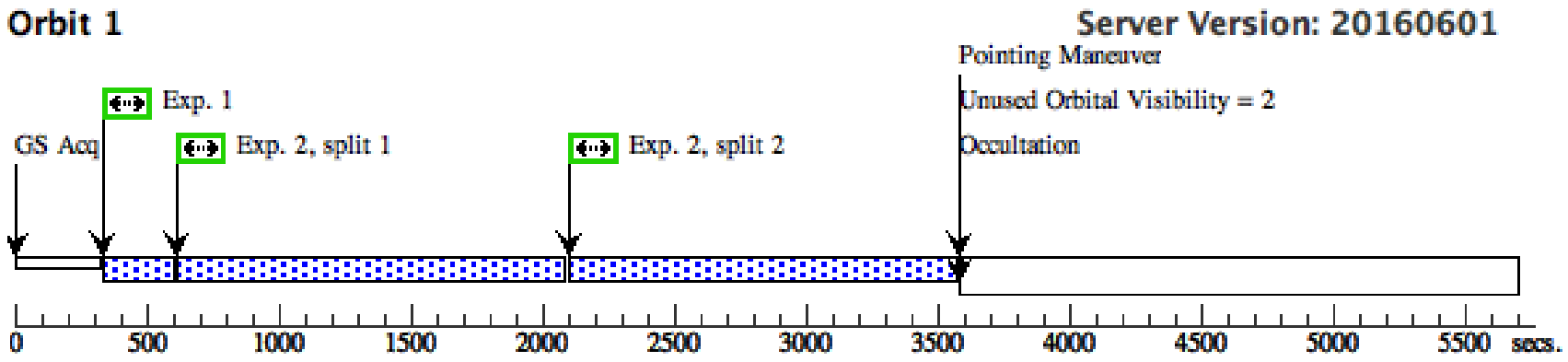
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	QSO-J0635-7516 Alt Name1: PKS0637-75	RA: 06 35 46.5144 (98.9438100d) Dec: -75 16 16.74 (-75.27132d) Equinox: J2000		V=15.75	Reference Frame: SIMBAD

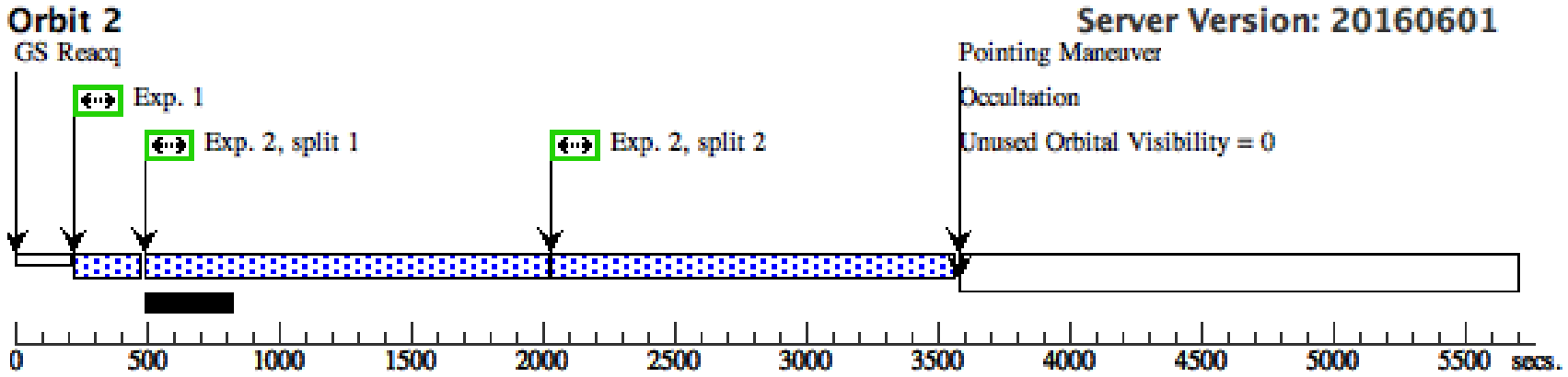
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

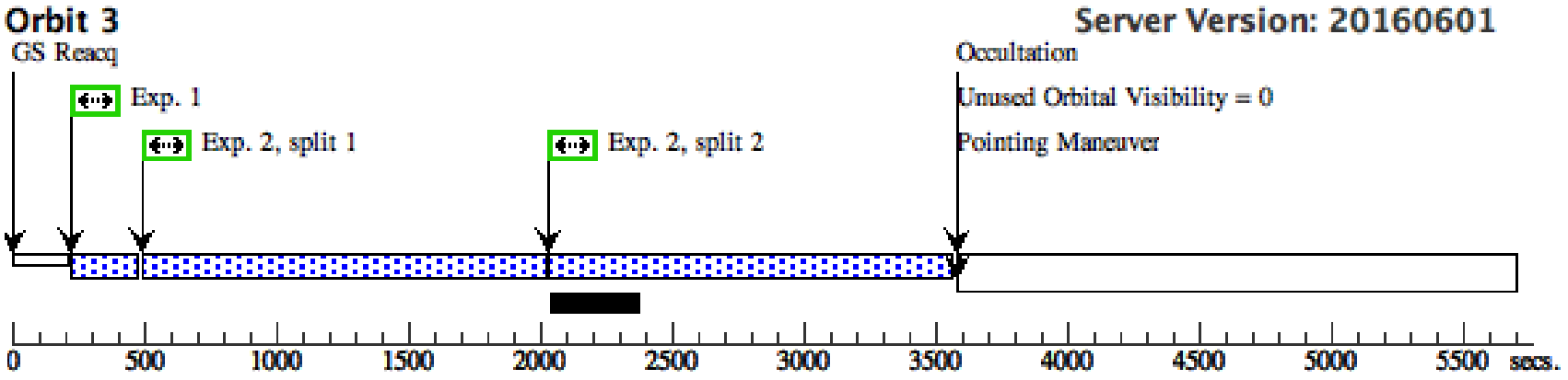
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W POL60V			Pattern 2, Exps 1-2 in POL60 (02) (2)	60 Secs (435 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>125.0 Secs (Pattern 2)]	***[2]***
								[==>125.0 Secs (Pattern 3)]	***[3]***
								[==>125.0 Secs (Pattern 4)]	***[4]***
2		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W POL60V	CR-SPLIT=2		Pattern 2, Exps 1-2 in POL60 (02) (2)	2690 Secs (11150 Secs)	
								[==>(Pattern 1, Split 1)] *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>1410.0 Secs (Pattern 2, Split 1)] *[==>1410.0 Secs (Pattern 2, Split 2)]*	***[2]***
								[==>1410.0 Secs (Pattern 3, Split 1)] *[==>1410.0 Secs (Pattern 3, Split 2)]*	***[3]***
								[==>1410.0 Secs (Pattern 4, Split 1)] *[==>1410.0 Secs (Pattern 4, Split 2)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20160601
GS Reacq
Occultation
Exp. 1
Unused Orbital Visibility = 0
Exp. 2, split 1
Exp. 2, split 2
Pointing Maneuver
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1000
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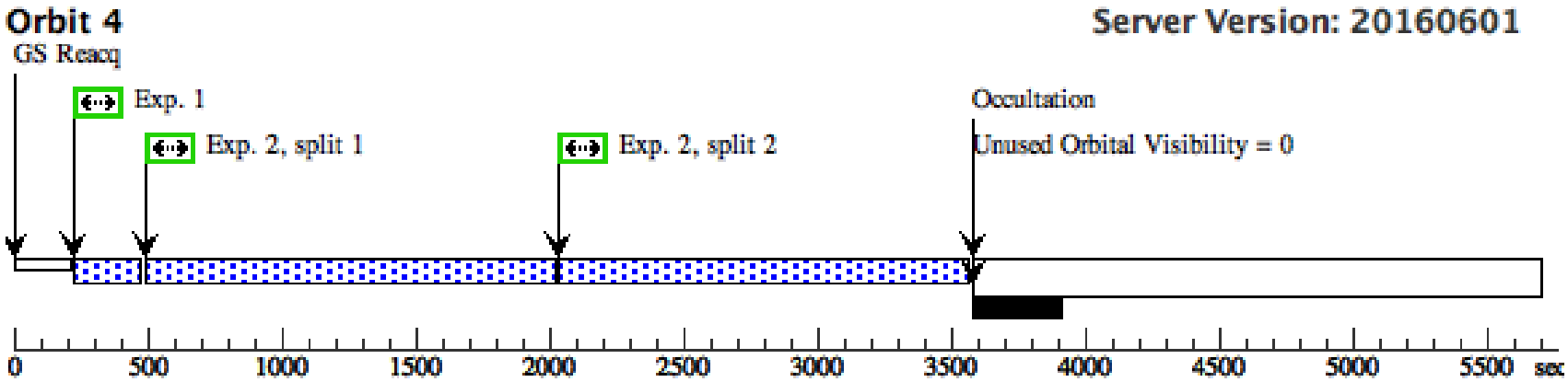
5000
5500
secs.


Orbit 4
Server Version: 20160601
GS Reacq
Exp. 1
Occultation
Exp. 2, split 1
Exp. 2, split 2
Unused Orbital Visibility = 0
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1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14696, POL120 (03), implementation Wed Sep 07 22:14:13 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 01; AFTER 01 BY 0 D TO 14 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.262 Line Spacing=0.192	Coordinate Frame=POS-TARG Pattern Orientation=18.39 Angle Between Sides=68.14 Center Pattern=true		(1-2)

Fixed Targets

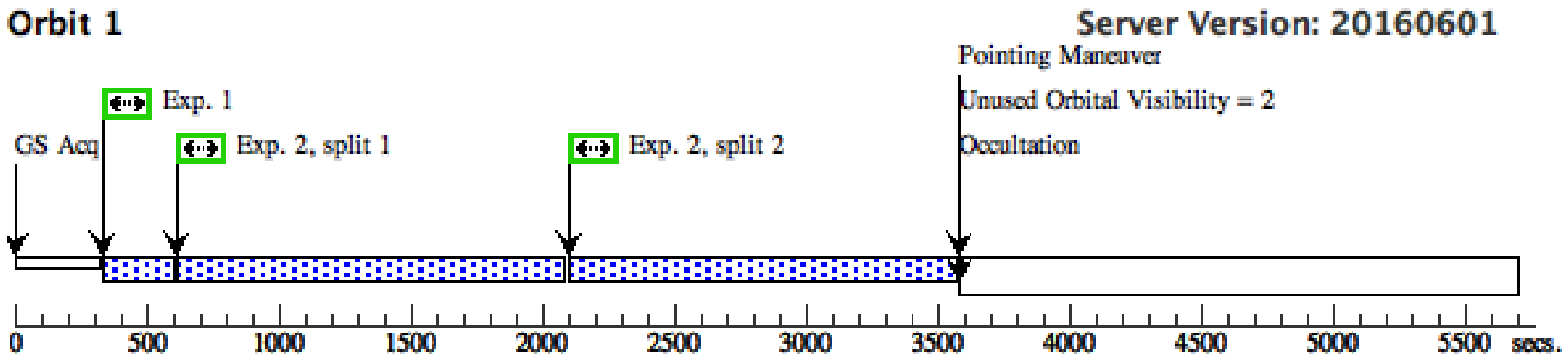
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	QSO-J0635-7516 Alt Name1: PKS0637-75	RA: 06 35 46.5144 (98.9438100d) Dec: -75 16 16.74 (-75.27132d) Equinox: J2000		V=15.75	Reference Frame: SIMBAD

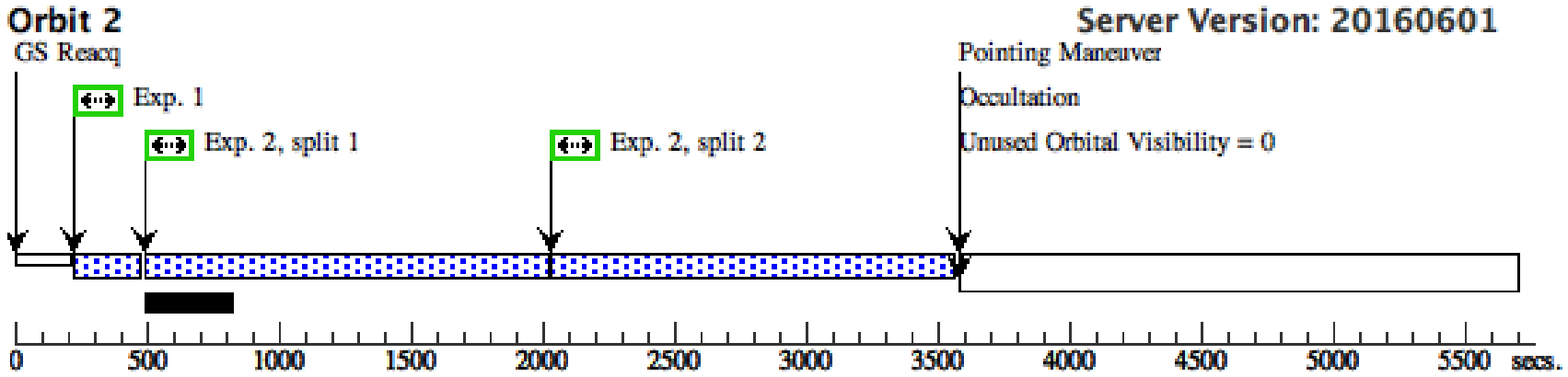
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

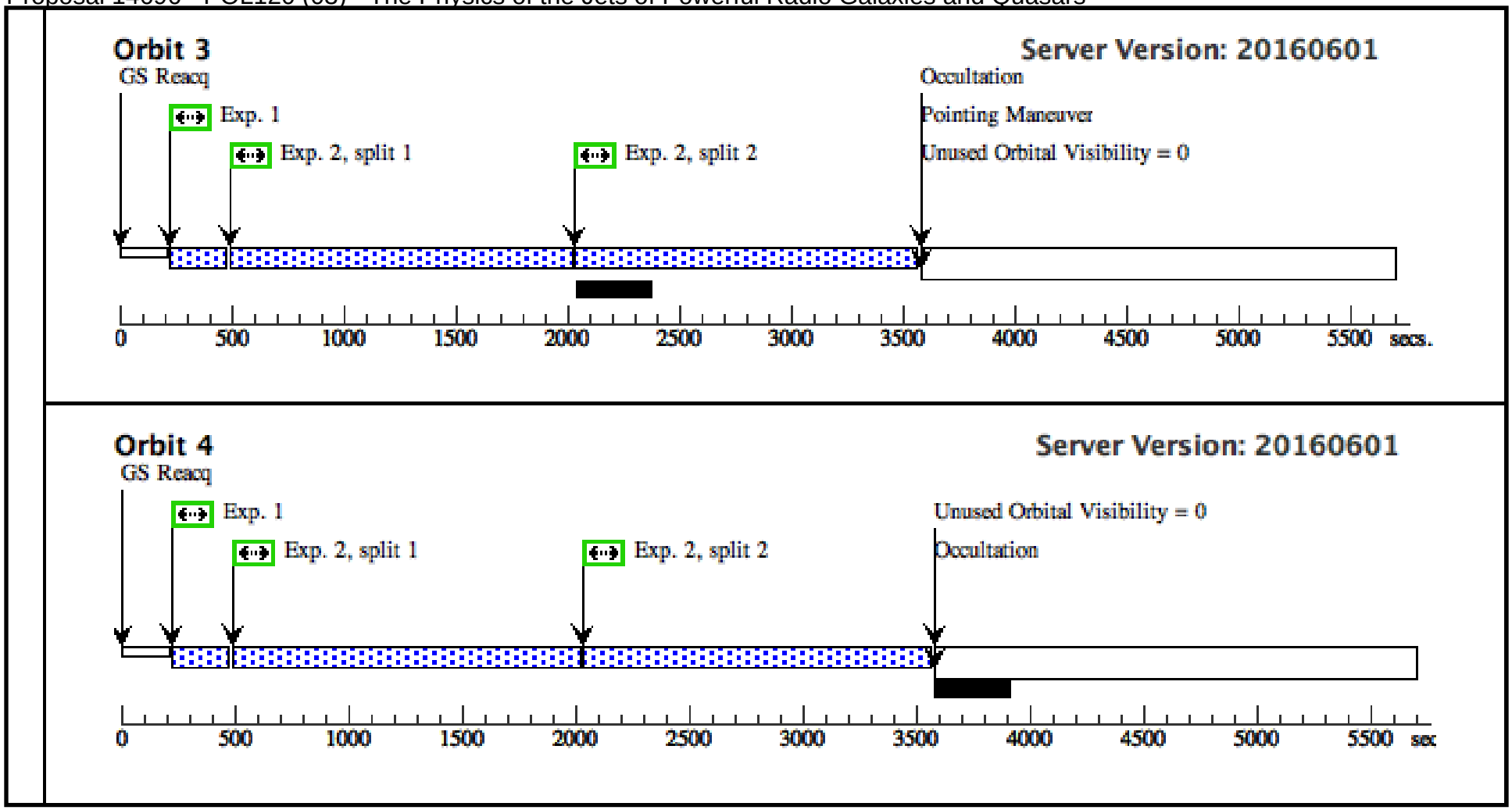
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W POL120V			Pattern 2, Exps 1-2 in POL120 (03) (2)	60 Secs (435 Secs)	
								[==>(Pattern 1)]	***[1]***
								[==>125.0 Secs (Pattern 2)]	***[2]***
								[==>125.0 Secs (Pattern 3)]	***[3]***
								[==>125.0 Secs (Pattern 4)]	***[4]***
2		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W POL120V	CR-SPLIT=2		Pattern 2, Exps 1-2 in POL120 (03) (2)	2690 Secs (11150 Secs)	
								[==>(Pattern 1, Split 1)] *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>1410.0 Secs (Pattern 2, Split 1)] *[==>1410.0 Secs (Pattern 2, Split 2)]*	***[2]***
								[==>1410.0 Secs (Pattern 3, Split 1)] *[==>1410.0 Secs (Pattern 3, Split 2)]*	***[3]***
								[==>1410.0 Secs (Pattern 4, Split 1)] *[==>1410.0 Secs (Pattern 4, Split 2)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20160601
GS Reacq
Occultation
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Pointing Maneuver
Exp. 2, split 1
Exp. 2, split 2
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 4
Server Version: 20160601
GS Reacq
Exp. 1
Unused Orbital Visibility = 0
Exp. 2, split 1
Exp. 2, split 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14696, Calibration (04), implementation Wed Sep 07 22:14:13 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: AFTER 01 BY 0 D TO 14 D

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=true		(1)

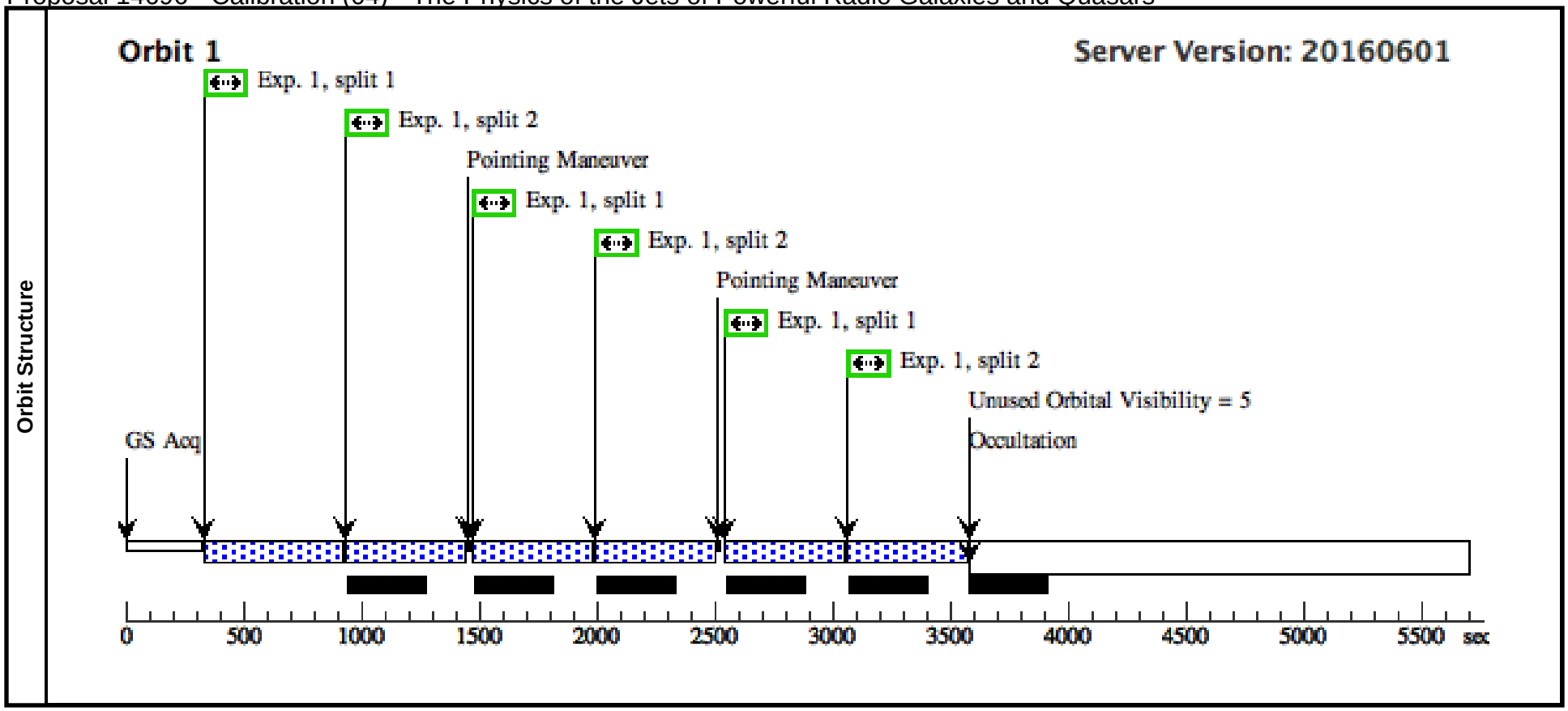
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	QSO-J0635-7516 Alt Name1: PKS0637-75	RA: 06 35 46.5144 (98.9438100d) Dec: -75 16 16.74 (-75.27132d) Equinox: J2000		V=15.75	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) QSO-J0635-7516	ACS/WFC, ACCUM, WFC1	F606W	CR-SPLIT=2		Pattern 3, Exps 1-1 in Calibration (04) (3)	764 Secs (2292 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]*	***[1]***


Orbit Structure
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Server Version: 20160601
Exp. 1, split 1
Exp. 1, split 2
Pointing Maneuver
Exp. 1, split 1
Exp. 1, split 2
Pointing Maneuver
Exp. 1, split 1
Exp. 1, split 2
Unused Orbital Visibility = 5
Occultation
GS Acq
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3500
4000
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5000
5500
sec