



12015 - Rapid Follow-Up Observations of Tidal Disruption Events Discovered by Pan-STARRS1

Cycle: 17, 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>
01	(1) TDE-PS1-1	WFC3/UVIS	1	16-Sep-2010 21:08:19.0	yes
02	(1) TDE-PS1-1	COS/FUV COS/NUV	3	16-Sep-2010 21:08:24.0	yes
03	(2) TDE-PS1-2	WFC3/UVIS	1	16-Sep-2010 21:08:27.0	yes
04	(2) TDE-PS1-2	COS/FUV COS/NUV	3	16-Sep-2010 21:08:31.0	yes
05	(3) TDE-PS1-3	WFC3/UVIS	1	16-Sep-2010 21:08:34.0	yes

9 Total Orbits Used

ABSTRACT

We propose for rapid follow-up Chandra TOO ACIS-S observations and HST/COS NUV imaging and FUV low-resolution spectroscopy of 5 flares from the tidal disruption of stars by supermassive black holes discovered in the Pan-STARRS1 Medium Deep Survey. With TOO observations obtained within a month of the peak of the flare, and 5 months later, we aim to 1) constrain the flare's broadband SED and bolometric luminosity, 2) follow the decay of the flare and look for spectral evolution, and 3) place strong limits on the presence of a persistent AGN nucleus. Tidal disruption events provide a cosmic laboratory to study the physics of accretion onto black holes, and are a unique probe of the mass of black holes in the nuclei of distant galaxies.

OBSERVING DESCRIPTION

We request 3 orbits with COS for NUV imaging and FUV low-resolution spectroscopy triggered at the same time as the initial \textsl{Chandra} TOO observation for each target, for a total of 15 orbits. Sensitive COS NUV imaging ($\lambda_{\text{eff}}=2032\text{\AA}$) in the ACQ/IMAGE mode will measure the NUV-g color of the flare, and confirm the spatial coincidence of the flare with the nucleus of the galaxy. COS low-resolution spectroscopy with the wide spectral range of the G140L grating (1230 - 2050\AA) will allow us to directly measure the nature of the flare UV continuum that we have previously inferred from \textsl{GALEX} broadband photometry, and look for the contribution of Ly α , C IV λ 1550, and C III] λ 1909 emission lines that may result from the reprocessing of the photoionizing continuum. A TDE with $g < 22$ and $kT_{\text{bb}} > 0.01$ keV, and a Galactic extinction of $E(B-V)=0.02$ with $z < 0.2$ will require an NUV ACQ/IMAGE with $t_{\text{exp}}=120$ sec for a $S/N > 40$ (the S/N requirement for an acquisition image). A FUV G140L spectrum with a $S/N > 10$ per resolution element will require $t_{\text{exp}}=7600$ sec (Calculated using the COS ETC). Each target should be observed by COS with a response time of 21-30 days, i.e. just above the rapid TOO activation limit for \textsl{HST}. The orbits should be structured as follows. Orbit 1: HST initial guide star, NUV ACQ/IMAGE with $t_{\text{exp}}=120$ sec and FUV G140L spectrum (TIME-TAG mode) with $t_{\text{exp}}=2000$ sec. Orbits 2 & 3: HST reacquisition, FUV G140L spectrum (TIME-TAG mode) with $t_{\text{exp}}=2800$ sec.

Proposal 12015 - Visit 01 - Rapid Follow-Up Observations of Tidal Disruption Events Discovered by Pan-STARRS1

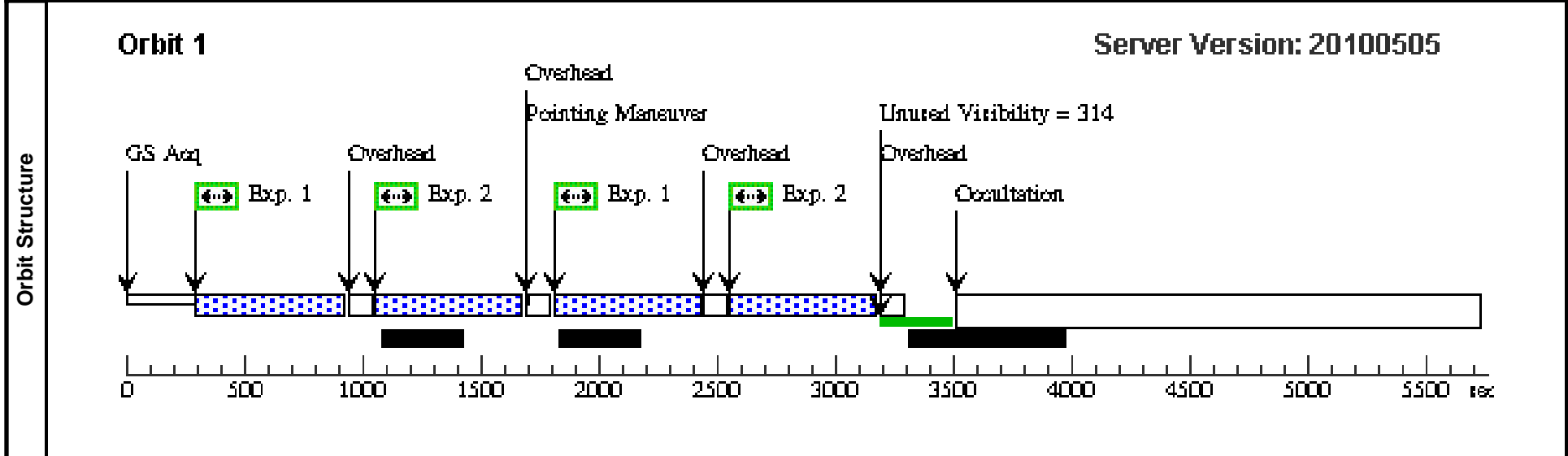
Fri Sep 17 01:08:38 GMT 2010

Visit	Proposal 12015, Visit 01, implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: WFC3/UVIS		
	Special Requirements: BEFORE 15-OCT-2010:00:00:00		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1-2)

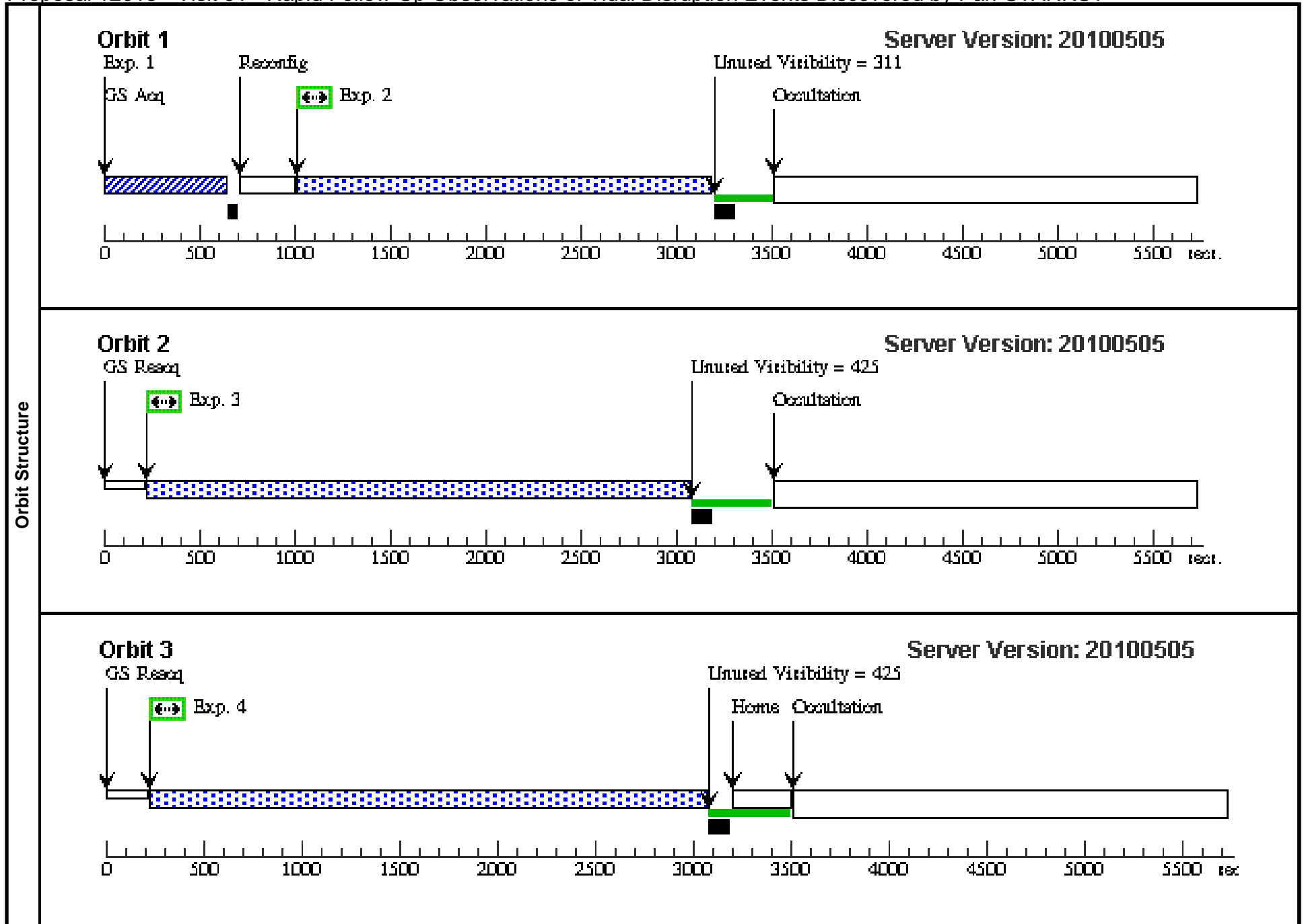
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	TDE-PS1-1	RA: 16 01 16.0510 (240.3168792d) Dec: +55 28 38.12 (55.47726d) Equinox: J2000	Redshift: 0.181	V=21.5+/-0.2	Reference Frame: ICRS

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) TDE-PS1-1	WFC3/UVIS, ACCUM, UVIS1	F225W	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	600 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]
	2		(1) TDE-PS1-1	WFC3/UVIS, ACCUM, UVIS1	F275W	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	600 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]



Proposal 12015 - Visit 01 - Rapid Follow-Up Observations of Tidal Disruption Events Discovered by Pan-STARRS1

Visit	Proposal 12015, Visit 02, implementation Fri Sep 17 01:08:38 GMT 2010 Diagnostic Status: No Diagnostics Scientific Instruments: COS/NUV, COS/FUV Special Requirements: AFTER 01 BY 17 D TO 21 D										
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	TDE-PS1-1	RA: 16 01 16.0510 (240.3168792d) Dec: +55 28 38.12 (55.47726d) Equinox: J2000	Redshift: 0.181	V=21.5+/-0.2	Reference Frame: ICRS					
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
	1		(1) TDE-PS1-1	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				120 Secs		
									[==>]	[1]	
	2		(1) TDE-PS1-1	COS/FUV, TIME-TAG, PSA	G140L	1105 A	BUFFER-TIME=20 00			2000 Secs	
									[==>]	[1]	
3		(1) TDE-PS1-1	COS/FUV, TIME-TAG, PSA	G140L	1105 A	BUFFER-TIME=28 00			2800 Secs		
								[==>]	[2]		
4		(1) TDE-PS1-1	COS/FUV, TIME-TAG, PSA	G140L	1105 A	BUFFER-TIME=28 00			2800 Secs		
								[==>]	[3]		



Proposal 12015 - Visit 02 - Rapid Follow-Up Observations of Tidal Disruption Events Discovered by Pan-STARRS1

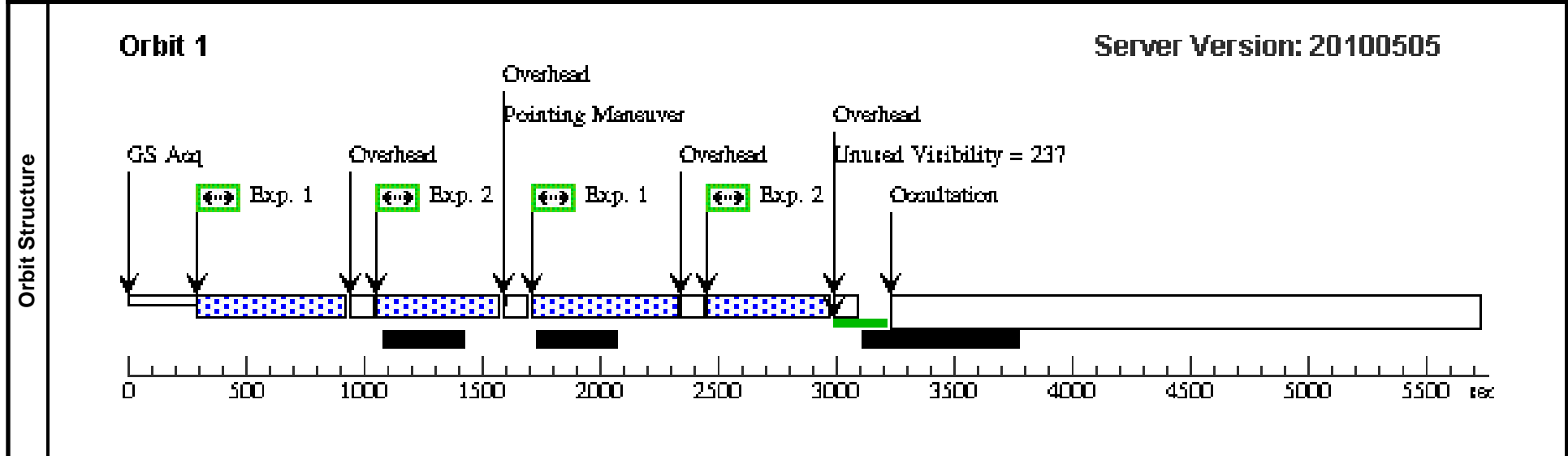
Fri Sep 17 01:08:39 GMT 2010

Visit	Proposal 12015, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ON HOLD <i>On Hold Comments: Target of Opportunity</i>		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2)

Generic Targets	#	Name	Criteria	Description
	(2)	TDE-PS1-2	Host galaxy has no evidence of an AGN, has a redshift < 0.2, and the flare has g < 22.	NUCLEUS

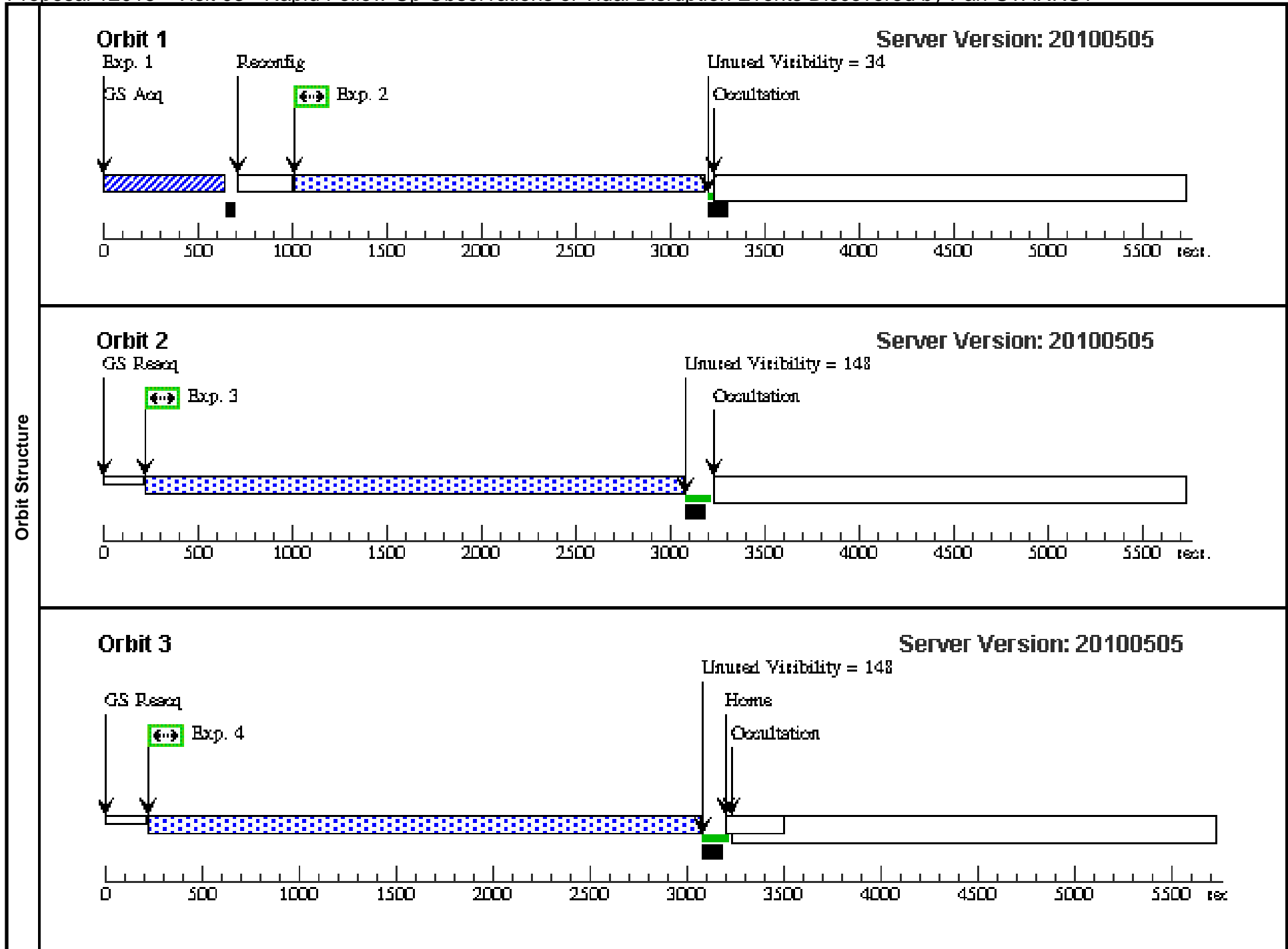
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) TDE-PS1-2	WFC3/UVIS, ACCUM, UVIS1	F225W	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	600 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]
	2		(2) TDE-PS1-2	WFC3/UVIS, ACCUM, UVIS1	F275W	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	500 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]



Proposal 12015 - Visit 03 - Rapid Follow-Up Observations of Tidal Disruption Events Discovered by Pan-STARRS1

Fri Sep 17 01:08:39 GMT 2010

Visit	Proposal 12015, Visit 04 Diagnostic Status: No Diagnostics Scientific Instruments: COS/NUV, COS/FUV Special Requirements: ON HOLD <i>On Hold Comments: Target of Opportunity</i>									
	Generic Targets	#	Name	Criteria	Description					
	(2)	TDE-PS1-2	Host galaxy has no evidence of an AGN, has a redshift < 0.2, and the flare has g < 22.	NUCLEUS						
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) TDE-PS1-2	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				120 Secs	
									[==>]	[1]
	2		(2) TDE-PS1-2	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=20 00			2000 Secs	
									[==>]	[1]
3		(2) TDE-PS1-2	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=28 00			2800 Secs		
								[==>]	[2]	
4		(2) TDE-PS1-2	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=28 00			2800 Secs		
								[==>]	[3]	



Orbit Structure

Proposal 12015 - Visit 05 - Rapid Follow-Up Observations of Tidal Disruption Events Discovered by Pan-STARRS1

Fri Sep 17 01:08:40 GMT 2010

Visit	Proposal 12015, Visit 05 Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ON HOLD <i>On Hold Comments: Target of Opportunity</i>		
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Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing= Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1-2)

Generic Targets	#	Name	Criteria	Description
	(3)	TDE-PS1-3	Host galaxy has no evidence of an AGN, has a redshift < 0.2, and the flare has g < 22.	

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(3) TDE-PS1-3	WFC3/UVIS, ACCUM, UVIS1	F225W	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	600 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]
	2		(3) TDE-PS1-3	WFC3/UVIS, ACCUM, UVIS1	F275W	CR-SPLIT=NO		Pattern 1, Exps 1-2 (1)	600 Secs [=>(Pattern 1)] [=>(Pattern 2)]	[1]

