



14165 - Revealing the largest gravitational lens PLCK G287.0+32.9

Cycle: 23, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Stella Seitz (PI) (ESA Member) (Contact)	Universitats-Sternwarte Munchen	stella@usm.uni-muenchen.de
Dr. Anna Monna (CoI) (ESA Member)	Universitats-Sternwarte Munchen	anna.monna@gmail.com
Dr. Daniel Gruen (CoI)	Stanford University	dgruen@stanford.edu
Dr. Adi Zitrin (CoI) (AdminUSPI)	California Institute of Technology	adiz@astro.caltech.edu
Dr. Johannes Koppenhoefer (CoI) (ESA Member)	Max-Planck-Institut fur extraterrestrische Physik	koppenh@mpe.mpg.de
Dr. Italo Balestra (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Trieste	italobale@gmail.com
Dr. Anton M. Koekemoer (CoI) (Contact)	Space Telescope Science Institute	koekemoer@stsci.edu
Mario Nonino (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Trieste	nonino@oats.inaf.it
Dr. Marisa Girardi (CoI) (ESA Member)	Universita degli Studi di Trieste	girardi@oats.inaf.it
Dr. Amata Mercurio (CoI) (ESA Member)	INAF, Osservatorio Astronomico di Capodimonte	mercurio@na.astro.it

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) PLCKESZ-G287.0+32.9-CENTER	ACS/WFC	4	27-Apr-2016 21:04:18.0	yes
02	(2) PLCKESZ-G287.0+32.9-WEST (3) PLCKESZ-G287.0+32.9-EAST	WFC3/IR	4	27-Apr-2016 21:04:22.0	yes

8 Total Orbits Used

ABSTRACT

We propose to investigate the peculiar and extremely large gravitational lens PLCK G287.0+32.9, discovered as one of the most massive objects in SZ measurements by Planck. Our follow-up of the cluster with optical WFI ground based imaging shows evident strong lensing features in the cluster core. The outer arcs, confirmed at $z=1.167$ from our recent VIMOS observations, is at a distance of $\sim 85''$ from the brightest and centrally located galaxy of the cluster, which makes PLCK G287.0+32.9 a candidate for the largest strong lens in the sky. If confirmed, this would significantly add to the tension of observed Einstein radii with predictions from Lambda-CDM. To this end, we require high resolution spatial imaging of the cluster to verify its large lensing features and further investigate its properties. Our goal is to use the HST photometry with our recent VLT/VIMOS spectroscopic datasets to perform a robust and detailed strong lensing analysis of this cluster. We aim to trace the total mass distribution of PLCK G287.0+32.9 by combining the strong lensing features with our WFI weak lensing analysis.

OBSERVING DESCRIPTION

According to our science project, we require observations of the core of the galaxy cluster PLCK G287.0+32.9 in 3 ACS/WFC filters (F475W, F606W and F814W) and 1 WFC3/IR filter (F110W). The rationale for using these filters is as follows. In order to detect arcs and their faint counter images we need filters with high throughput. Lensing is achromatic, which is why measuring at least one colour with good signal-to-noise ratio is essential for multiple images confirmation. Finally we want to be sensitive to lensed galaxies with various SED properties in a large redshift range. Having F110W band as the reddest filter, in addition allows us to detect F814W dropouts, which are candidate for magnified galaxies at redshift $z > 7$.

The ACS/WFC filters F475W and F606W will be essential to photometrically select cluster members which we need to include in the strong lensing model to accurately trace the total mass distribution of the galaxy cluster. These two filters will be used to select candidate cluster members from the cluster red sequence, in combination with information from the sample of spectroscopically confirmed members from the VLT/VIMOS program. In addition, for the lens modelling of the galaxies in the cluster we need to relate the luminosity to the depth of their potential (using the Faber-Jackson and Fundamental Plane relations, see e.g. Faber et al. 1976, 1987, Bender et al. 1992). According to our previous experience, the F814W and F110W filters provide the smaller scatter estimate for the halo potential depth (i.e. velocity dispersion). Taking together, our set of 4 filters covers the entire wavelength range from 3800 to 14000 Å. This will allow us to identify optical dropout candidates at $z = [4:8; 6:8]$ robustly. If a multiply imaged galaxy is found only in the F110W filter, it could have a redshift up to 10. This could then be confirmed through the strong lensing model, following the procedure in Zitrin et al. (2014).

In addition to allowing for the identification of multiply imaged objects and high redshift galaxies, the chosen filter set will help us to characterize the cluster galaxy population. For example, the F475W filter allows us to investigate whether galaxies which have elliptical morphology have undergone

recent star formation triggered by the ongoing merger of the galaxy cluster.

Exposure time estimations: Concerning the depths of the observations, the dithered pattern and cosmic rays split, we will follow our successful strategy from CLASH. Thus we require the following exposure time per filter:

F475W 4x500s = 2000s (1700-2200s) "1 orbit"

F606W 4x500s = 2000s (1700-2200s) "1 orbit"

F814W 8x500s = 4000s (3900-4200s) "2 orbits"

F110W 10x500s = 5000s (4900-5100s) "2 orbits".

These exposures will give us the following depths (5 magnitude limits for a point source):

F475W: 27.5 mag

F606W: 27.6 mag

F814W: 27.0 mag

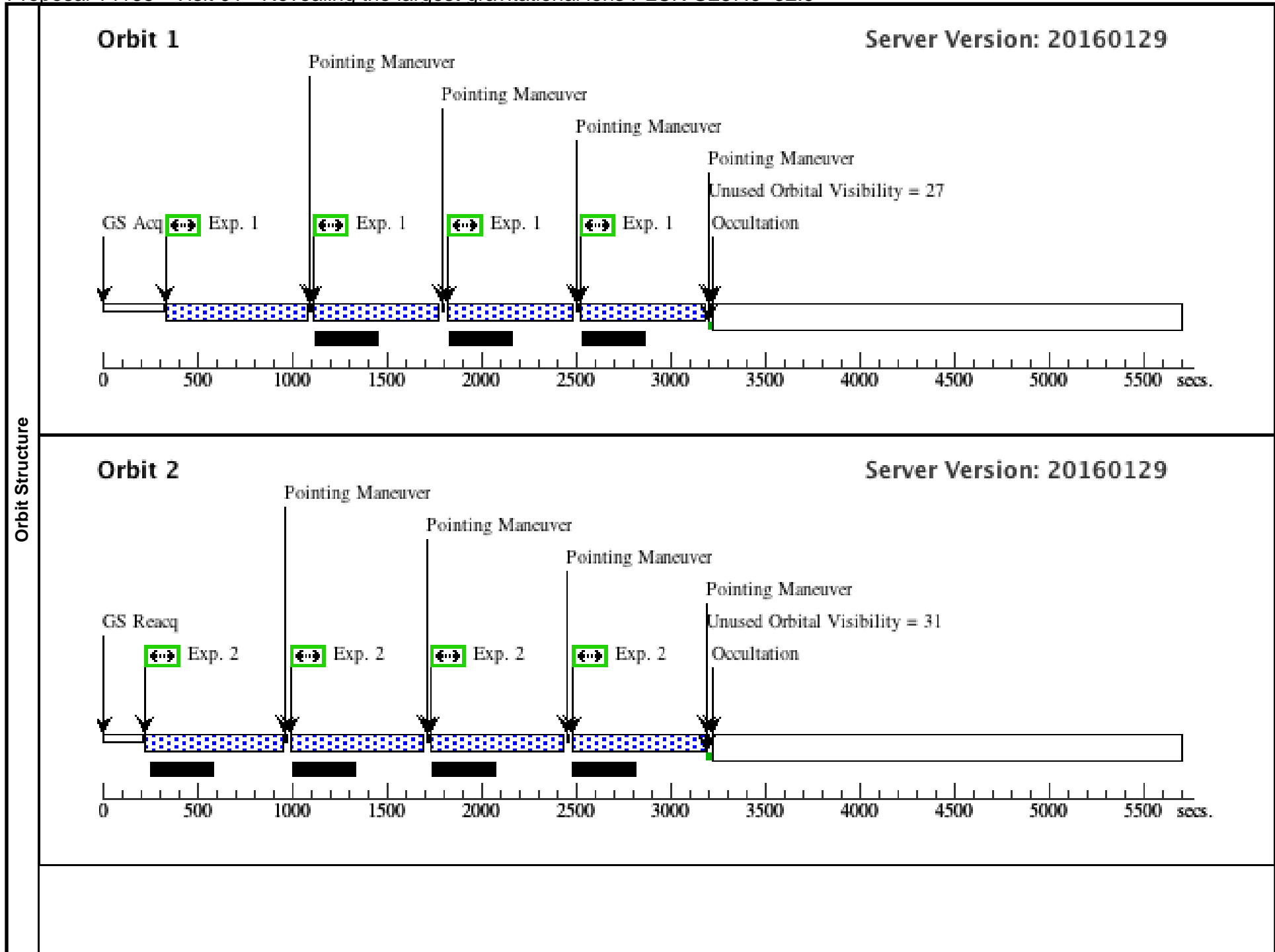
F110W: 28.2 mag

For the mean cluster redshift in CLASH ($z_{cl} \sim 0.4$) such a depth allowed for a robust identification of 10 to 20 multiply imaged systems over a broad redshift range per cluster, which is needed for a precise strong lensing model. We have already identified several strong lensing features spread over 160" in diameter. We can cover them with one pointing for the case of ACS/WFC, but need two pointings with the WFC3/IR. We have outlined roughly our pointing strategy in Fig. 3. By allowing the overlap of the WFC3/IR pointings in the central region of the cluster we will get even deeper there. This will help us to find central images for high- z lensed systems. Such a detection would make the case for high redshift galaxies even stronger, see Monna et al. (2014). The brightest star in the proposed pointings is comparable to the bright star in the core of the CLASH cluster MACS 0416, and still fainter than the brightest stars in the COSMOS field. Hence, it will not cause technical problems in the observations.

Proposal 14165 - Visit 01 - Revealing the largest gravitational lens PLCK G287.0+32.9

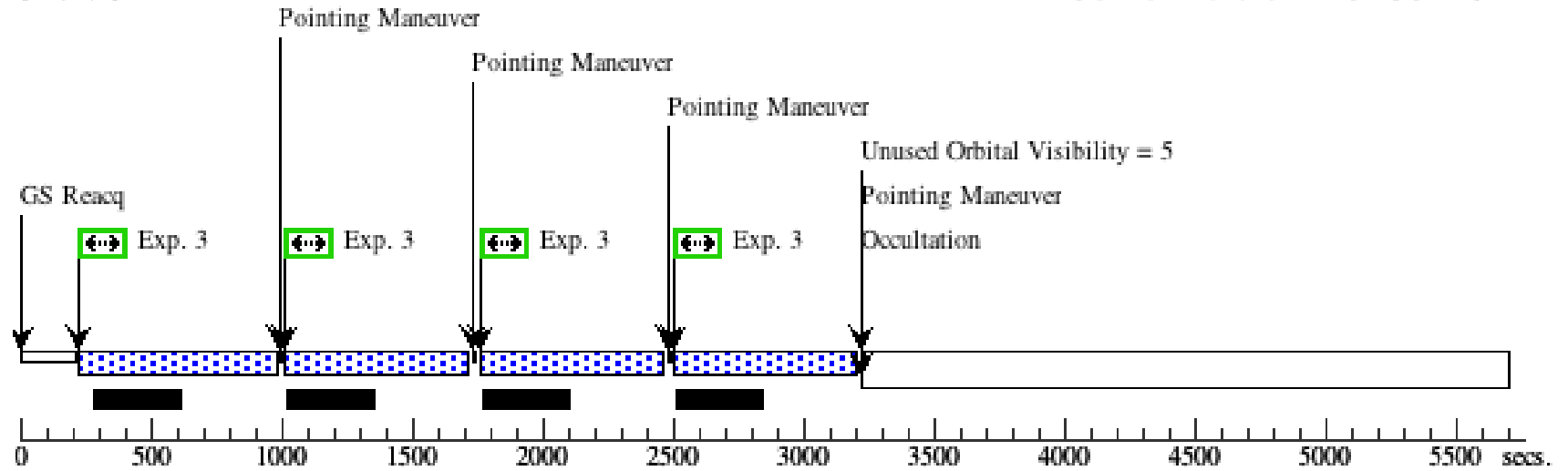
Thu Apr 28 01:04:24 GMT 2016

Visit	Proposal 14165, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: ORIENT 133D TO 133 D									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
		(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=3.06806 Line Spacing=6.06746	Coordinate Frame=POS-TARG Pattern Orientation=85.38230 Angle Between Sides=174.21599 Center Pattern=false		(1), (2), (3), (4)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	PLCKESZ-G287.0+32.9-CENTER	RA: 11 50 51.2000 (177.713333d) Dec: -28 05 0.80 (-28.08356d) Equinox: J2000		V=20	Reference Frame: SIMBAD				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) PLCKESZ-G287.0+32.9-CENTER	ACS/WFC, ACCUM, WFCENTER	F475W			Pattern 1, Exps 1-1 in Visit 01 (1)	540 Secs (2160 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2		(1) PLCKESZ-G287.0+32.9-CENTER	ACS/WFC, ACCUM, WFCENTER	F606W			Pattern 1, Exps 2-2 in Visit 01 (1)	580 Secs (2320 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
3		(1) PLCKESZ-G287.0+32.9-CENTER	ACS/WFC, ACCUM, WFCENTER	F814W			Pattern 1, Exps 3-3 in Visit 01 (1)	580 Secs (2320 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]	
4		(1) PLCKESZ-G287.0+32.9-CENTER	ACS/WFC, ACCUM, WFCENTER	F814W			Pattern 1, Exps 4-4 in Visit 01 (1)	590 Secs (2360 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]	



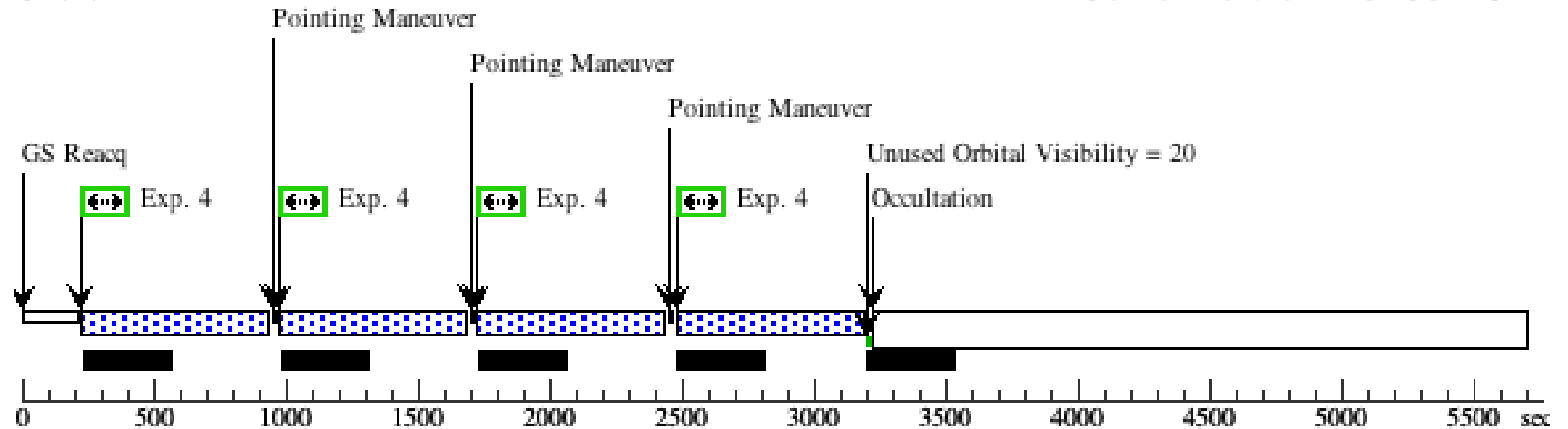
Orbit 3

Server Version: 20160129



Orbit 4

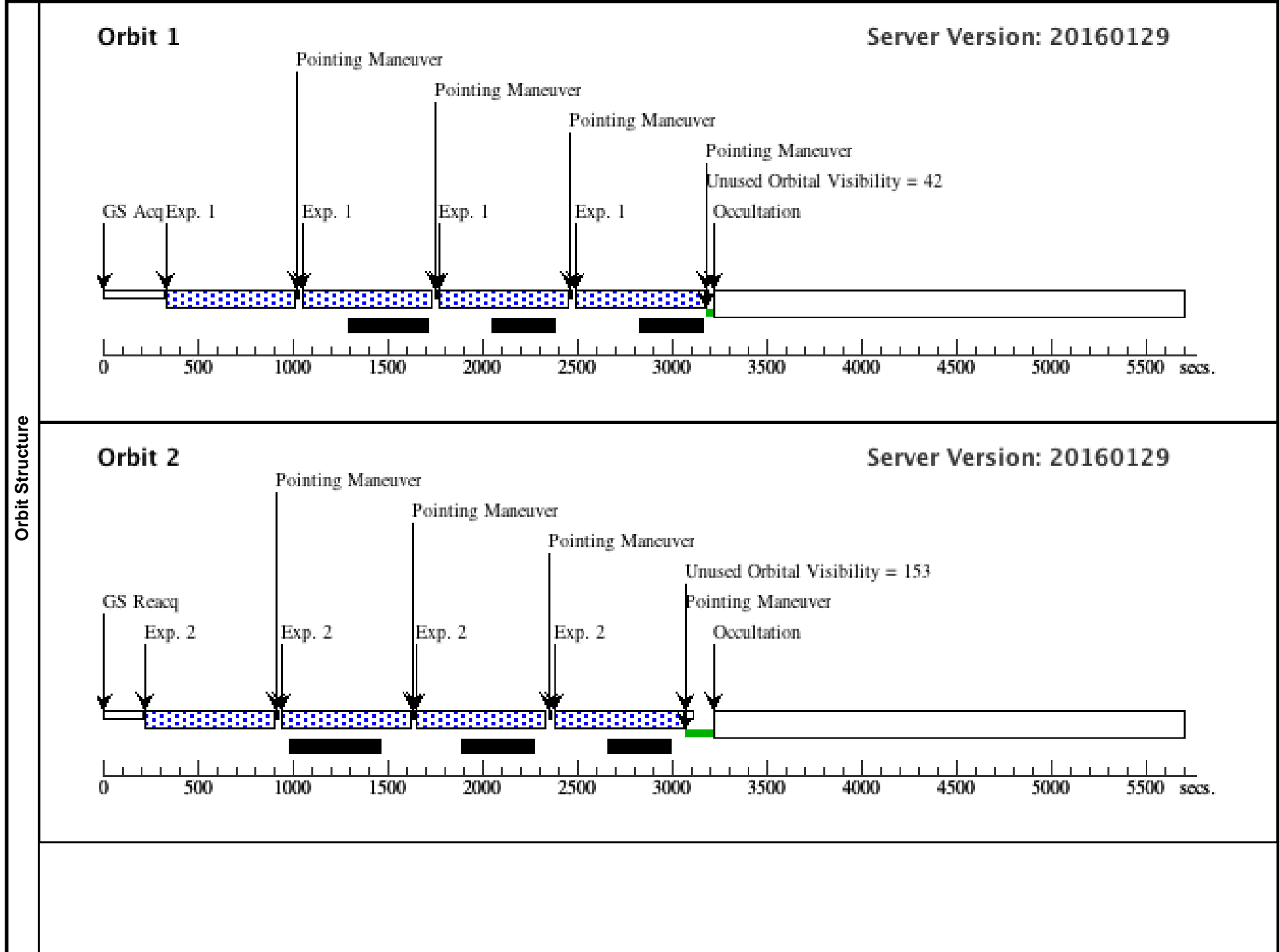
Server Version: 20160129



Proposal 14165 - Visit 02 - Revealing the largest gravitational lens PLCK G287.0+32.9

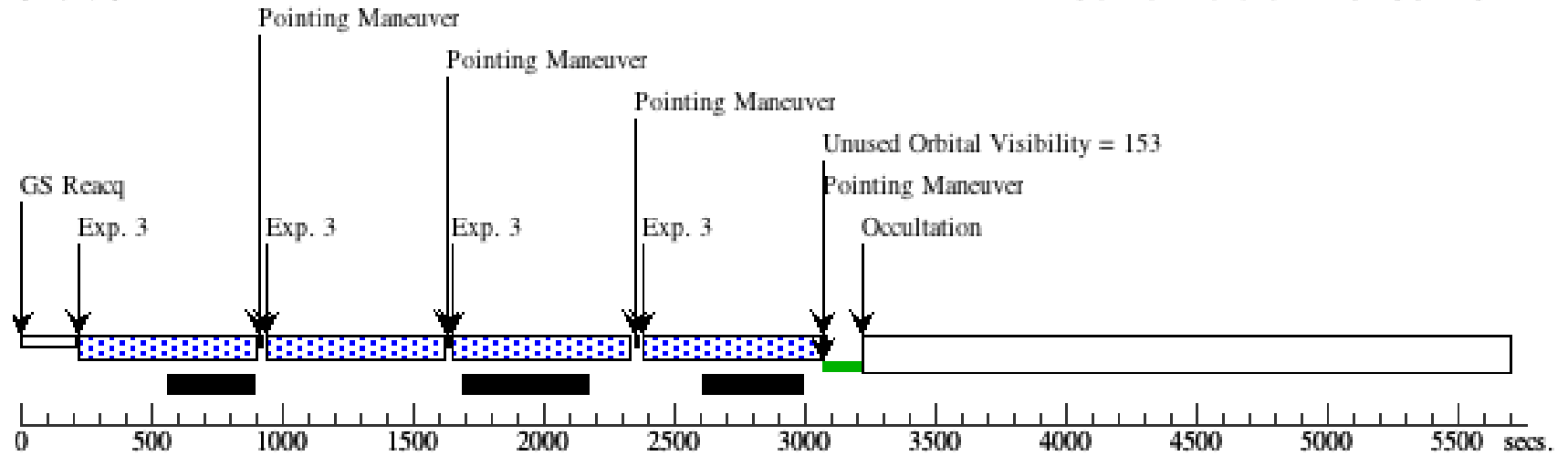
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Visit	Proposal 14165, Visit 02, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 110D TO 110 D									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(2)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=5.183 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false					(1), (2), (3), (4)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	PLCKESZ-G287.0+32.9-WEST	RA: 11 50 46.8000 (177.6950000d) Dec: -28 04 38.50 (-28.07736d) Equinox: J2000		V=20	Reference Frame: SIMBAD				
	(3)	PLCKESZ-G287.0+32.9-EAST	RA: 11 50 53.3000 (177.7220833d) Dec: -28 05 9.60 (-28.08600d) Equinox: J2000		V=20	Reference Frame: SIMBAD				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) PLCKESZ-G287.0+32.9-WEST	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=SPAR S50	GS ACQ SCENARI O BASE1B3	Pattern 2, Exps 1-1 in Visit 02 (2)	652.938154 Secs (2611.753 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2		(2) PLCKESZ-G287.0+32.9-WEST	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 2, Exps 2-2 in Visit 02 (2)	652.938154 Secs (2611.753 Secs)	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
3		(3) PLCKESZ-G287.0+32.9-EAST	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 2, Exps 3-3 in Visit 02 (2)	652.938154 Secs (2611.753 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]	
4		(3) PLCKESZ-G287.0+32.9-EAST	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 2, Exps 4-4 in Visit 02 (2)	652.938154 Secs (2611.753 Secs)		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]	



Orbit 3

Server Version: 20160129



Orbit 4

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