



# 10187 - Direct imaging of the progenitors of massive, core-collapse supernovae

Cycle: 13, Proposal Category: GO

(Availability Mode: SUPPORTED)

## INVESTIGATORS

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## VISITS

<i>Visit</i>	<i>Targets</i>	<i>Configurations</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(5) SN2003HN	ACS/WFC	1	28-Jun-2005 21:06:12.0	yes
02	(6) SN2004DG	ACS/WFC	2	28-Jun-2005 21:06:17.0	yes
03	(7) SN2004GT	ACS/HRC	2	28-Jun-2005 21:06:23.0	yes
04	(10) SN2005V	ACS/HRC	2	28-Jun-2005 21:06:28.0	yes
05	(9) SN2005AE	ACS/HRC	2	28-Jun-2005 21:06:33.0	yes

9 Total Orbits Used

## **ABSTRACT**

Modern supernovae searches in the nearby Universe are discovering large numbers of SNe which have massive star progenitors (Types II, Ib and Ic). The extensive HST image archives of galaxies within  $\sim 20$ Mpc enables their individual bright stellar content to be resolved. As massive, evolved stars are the most luminous single objects in a galaxy, the progenitors of core-collapse SNe should be directly detectable on pre-explosion images. In our ongoing HST programme we have detected the first red supergiant progenitor of a normal type II supernova, shown that SN 1993J came from a binary system, and set direct mass-limits on three other type II supernovae progenitors. These discoveries are providing strong constraints on theoretical models of pre-supernova stellar evolution that predict which stars produce which type of supernovae. We request time to continue this successful project, and require ACS observations of future SNe which are discovered in galaxies closer than 20Mpc which have pre-explosion HST archive images available. These observations will allow the SNe to be precisely positioned on the pre-explosion frames with the required astrometric accuracy of around 0.05", and provide 3-colour photometry of the surrounding stellar populations for reddening estimations. The goal of this project is to directly identify the progenitor stars of core-collapse supernovae. We will compare the results to our own stellar evolutionary tracks in order to determine masses or restrictive mass-limits for the progenitors.

## **OBSERVING DESCRIPTION**

We expect to trigger this non-urgent ToO programme between 1-4 times in Cycle 13.

The aim is to find progenitor stars of nearby supernovae. When a nearby SN is discovered in a galaxy at a distance of less than  $\sim 20$ Mpc, and if the SN position falls on the FOV of an HST archive image, then we will trigger this ToO. We require imaging of the supernova in 3 filters with ACS in order to carry out accurate differential astrometry of the SN using the fainter background stars. We will also use the deep 3-colour photometry to estimate the reddening towards the surrounding stellar populations. If the SN is bright enough that it may saturate in our CR split exposures of these background stars then we will do a shorter exposure in one filter to alleviate the problem. The exact choice of filters will be chosen after the SN is discovered and will depend on what the archive images have used. We will choose our filter combination to best match these.

**REAL TIME JUSTIFICATION**

As outlined above, this is a ToO programme as we do not yet know the exact targets. But we do not need rapid turn around, indeed it will be better for us to wait a few weeks until the SN fades somewhat to do the observations. We can inform STScI at least 1 month in advance of when we would like the observations, and the time of execution is very flexible.

Proposal 10187 - Visit 01 - Direct imaging of the progenitors of massive, core-collapse supernovae

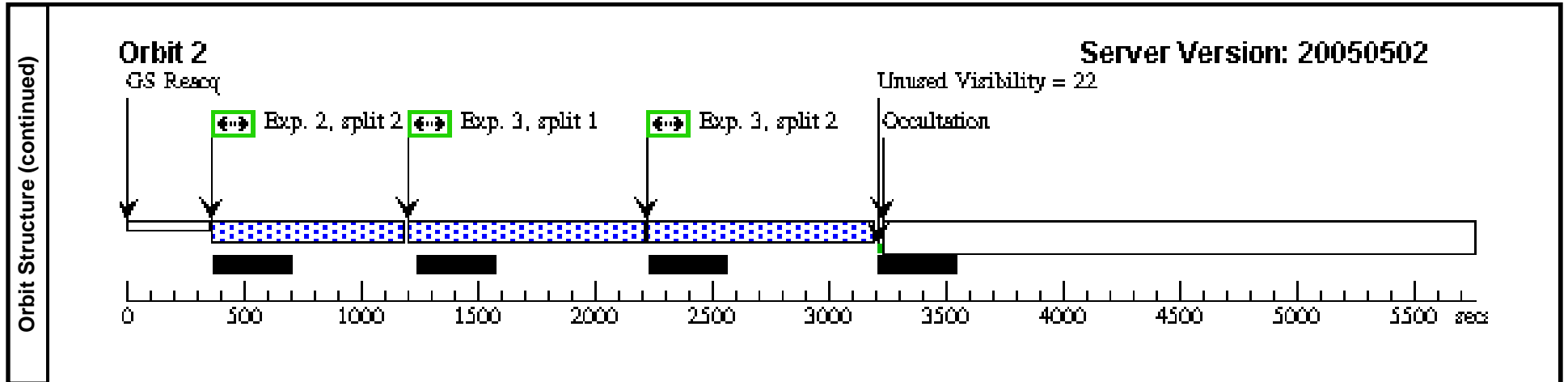
Wed Jun 29 01:06:35 GMT 2005

<b>Visit</b>	<b>Proposal 10187, Visit 01</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: PCS MODE FINE; SCHED 30%; ORIENT 128.0D TO 138.0 D; BETWEEN 01-APR-2005:00:00:00 AND 30-JUN-2005:00:00:00									
	<b>Fixed Targets</b>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
(5)		SN2003HN	RA: 03 44 36.1000 (56.1504167d) Dec: -44 37 49.00 (-44.63028d) Equinox: J2000 Plate Id: (?)		V=23.0+/-1.0	Coordinate Source: IAUC 8186				
<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	(5) SN2003HN		ACS/WFC, ACCUM, WFC1	F555W	CR-SPLIT=3			2552.0 Secs [=>805.0 Secs (Split 1)] [=>805.0 Secs (Split 2)] [=>805.0 Secs (Split 3)]	[1]
<b>Orbit Structure</b>	<p><b>Orbit 1</b> <span style="float: right;"><b>Server Version: 20050502</b></span></p>									
	<p>GS Acq    Exp. 1, split 1    Exp. 1, split 2    Exp. 1, split 3    Occultation</p> <p>0    500    1000    1500    2000    2500    3000    3500    4000    4500    5000    5500 secs</p>									

Proposal 10187 - Visit 02 - Direct imaging of the progenitors of massive, core-collapse supernovae

Wed Jun 29 01:06:35 GMT 2005

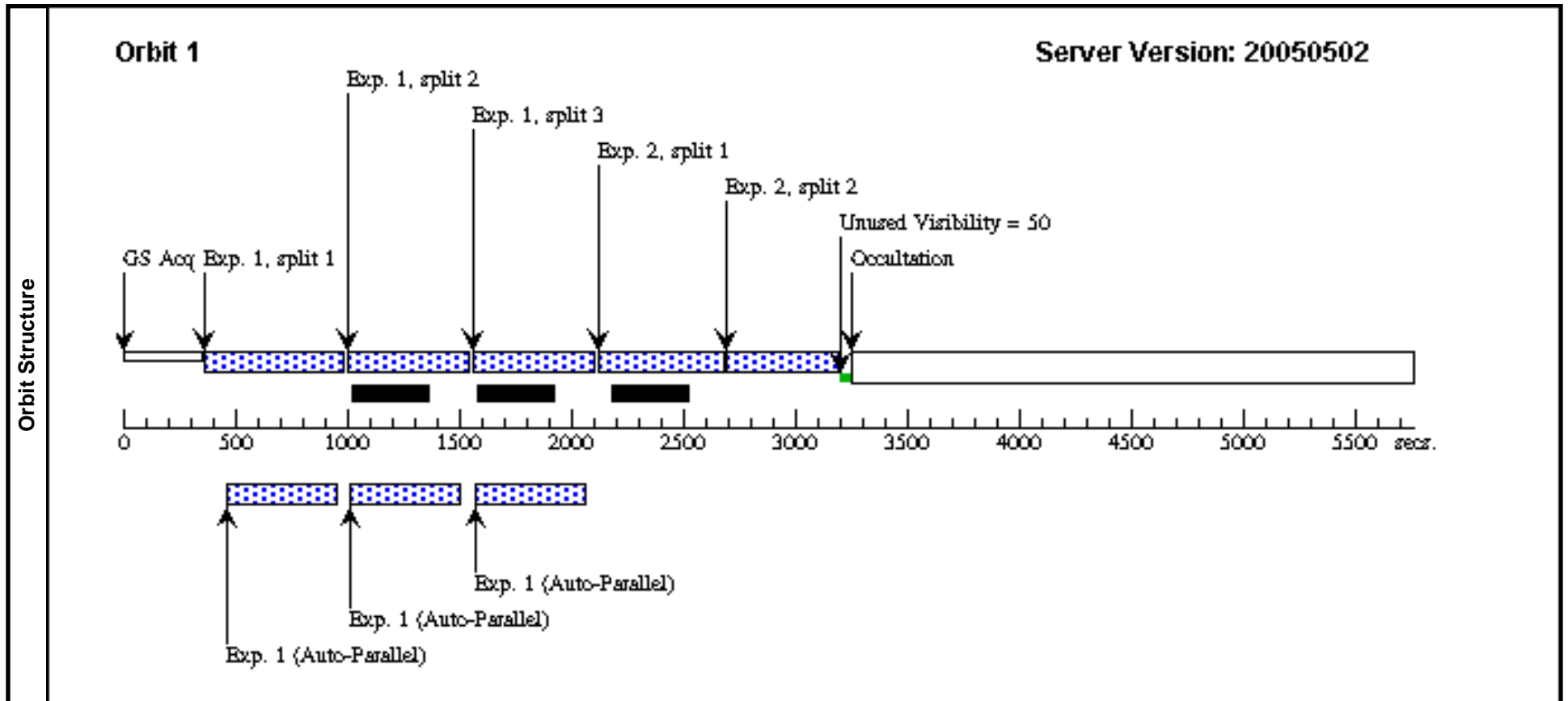
Visit	<b>Proposal 10187, Visit 02</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BEFORE 20-APR-2005:00:00:00									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(6)	SN2004DG	RA: 14 59 58.9600 (224.9956667d) Dec: +01 53 25.60 (1.89044d) Equinox: J2000 Plate Id: (?)		V=20.0+/-1.0	Coordinate Source: IMAGE_TIED_TO_GSC_FRAME				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	SN2004dg F 435W	(6) SN2004DG	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=2			1600.0 Secs [=>800.0 Secs (Split 1)] [=>800.0 Secs (Split 2)]	[1]
	2	SN2004dg F 555W	(6) SN2004DG	ACS/WFC, ACCUM, WFC1	F555W	CR-SPLIT=2			1400.0 Secs [=>700.0 Secs (Split 1)] [=>700.0 Secs (Split 2)]	[1] [2]
	3	SN2004dg F 814W	(6) SN2004DG	ACS/WFC, ACCUM, WFC1	F814W	CR-SPLIT=2			1700.0 Secs [=>850.0 Secs (Split 1)] [=>850.0 Secs (Split 2)]	[2]
Orbit Structure	<p><b>Orbit 1</b> <span style="float: right;"><b>Server Version: 20050502</b></span></p> <p>Unused Visibility = 31</p> <p>GS Acq    Exp. 1, split 1    Exp. 1, split 2    Exp. 2, split 1    Occultation</p> <p>0    500    1000    1500    2000    2500    3000    3500    4000    4500    5000    5500 secr.</p>									

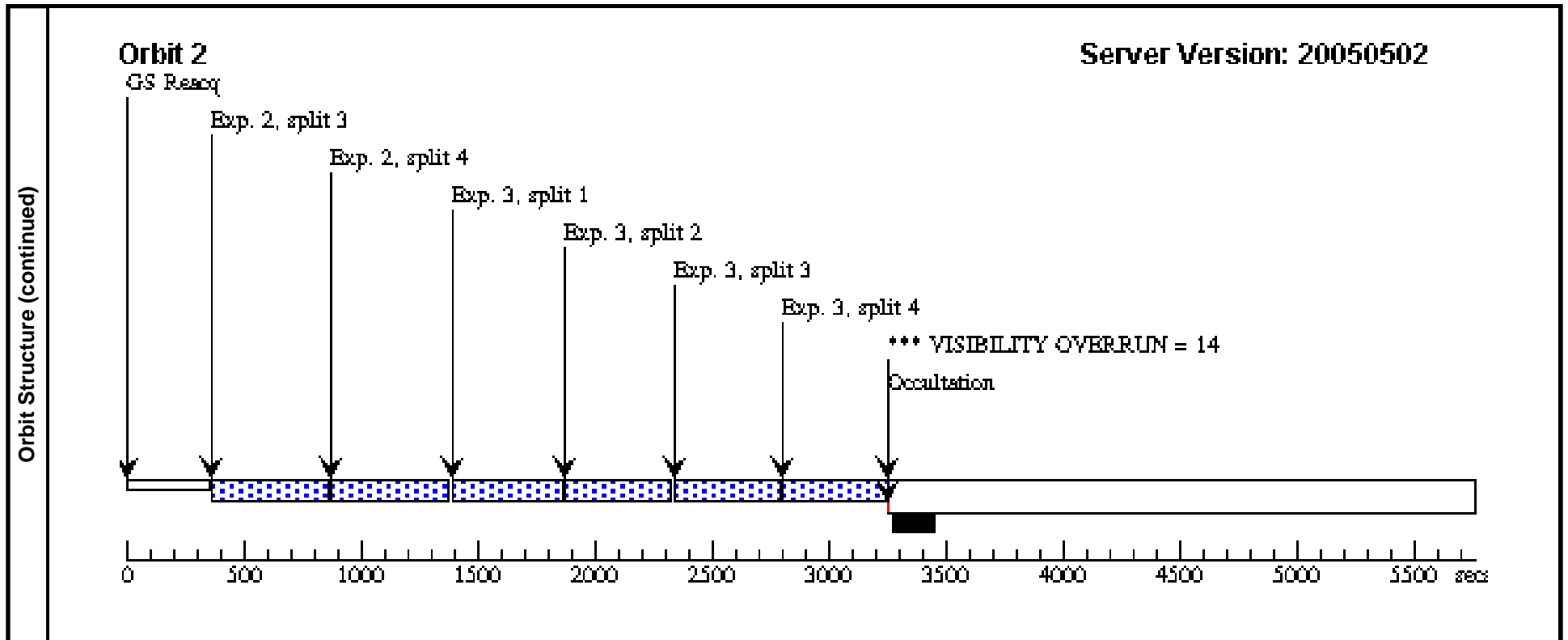


Proposal 10187 - Visit 03 - Direct imaging of the progenitors of massive, core-collapse supernovae

Wed Jun 29 01:06:36 GMT 2005

<b>Visit</b>	<b>Proposal 10187, Visit 03</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: ACS/HRC Special Requirements: BETWEEN 22-APR-2005:00:00:00 AND 28-MAY-2005:00:00:00									
	(Visit 03) Warning: VISIBILITY OVERRUN									
<b>Diagnostics</b>										
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
	(7)	SN2004GT	RA: 12 01 50.3700 (180.4598750d) Dec: -18 52 12.70 (-18.87019d) Equinox: J2000 Plate Id: (?)		V=18.4 B~18.9, I~17.92	Coordinate Source: SIMBAD				
<i>Comments: Magnitudes estimated from CSP obs of 2004gt</i> <a href="http://csp1.lco.cl/~cspuser1/images/OPTICAL_LIGHT_CURVES/SN04gt.html">http://csp1.lco.cl/~cspuser1/images/OPTICAL_LIGHT_CURVES/SN04gt.html</a>										
<b>Exposures</b>	<b>#</b>	<b>Label</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time/[Actual Dur.]</b>	<b>Orbit</b>
	1		(7) SN2004GT	ACS/HRC, ACCUM, HRC	F555W	CR-SPLIT=3			1530.0 Secs	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
									[==>(Split 3)]	
	2		(7) SN2004GT	ACS/HRC, ACCUM, HRC	F814W	CR-SPLIT=4			1860.0 Secs	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
									[==>(Split 3)]	
									[==>(Split 4)]	[2]
3		(7) SN2004GT	ACS/HRC, ACCUM, HRC	F435W	CR-SPLIT=4			1672.0 Secs		
								[==>(Split 1)]		
								[==>(Split 2)]		
								[==>(Split 3)]		
								[==>(Split 4)]	[2]	

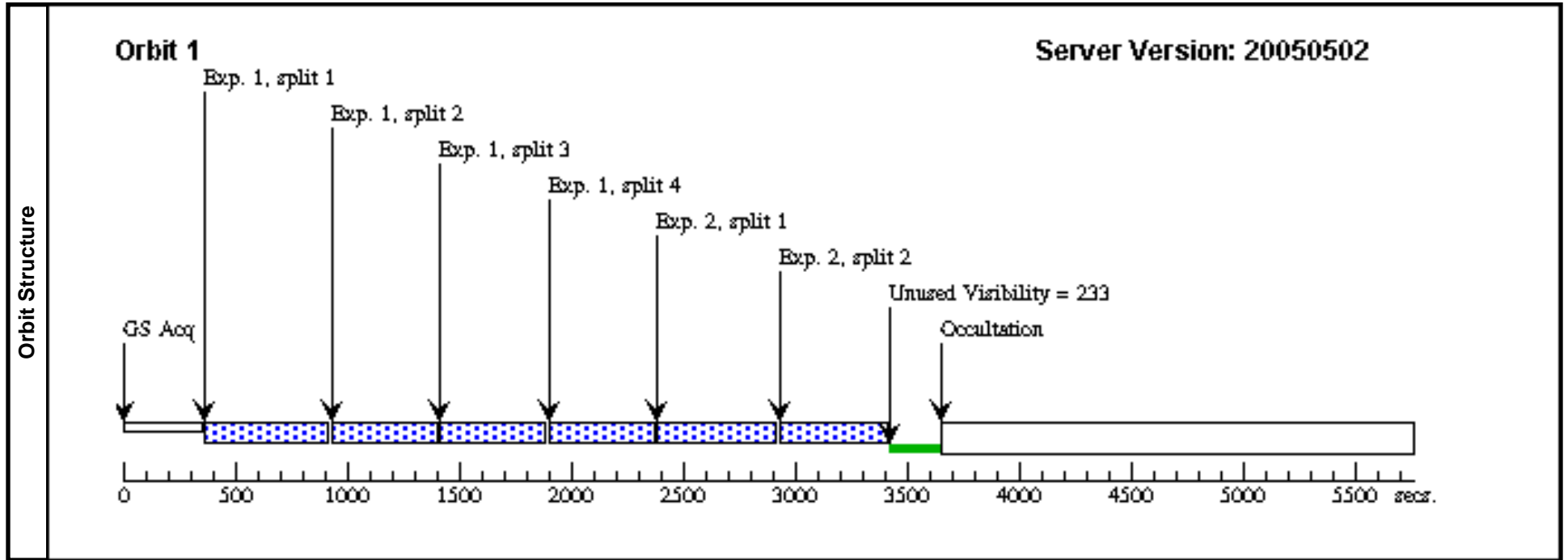


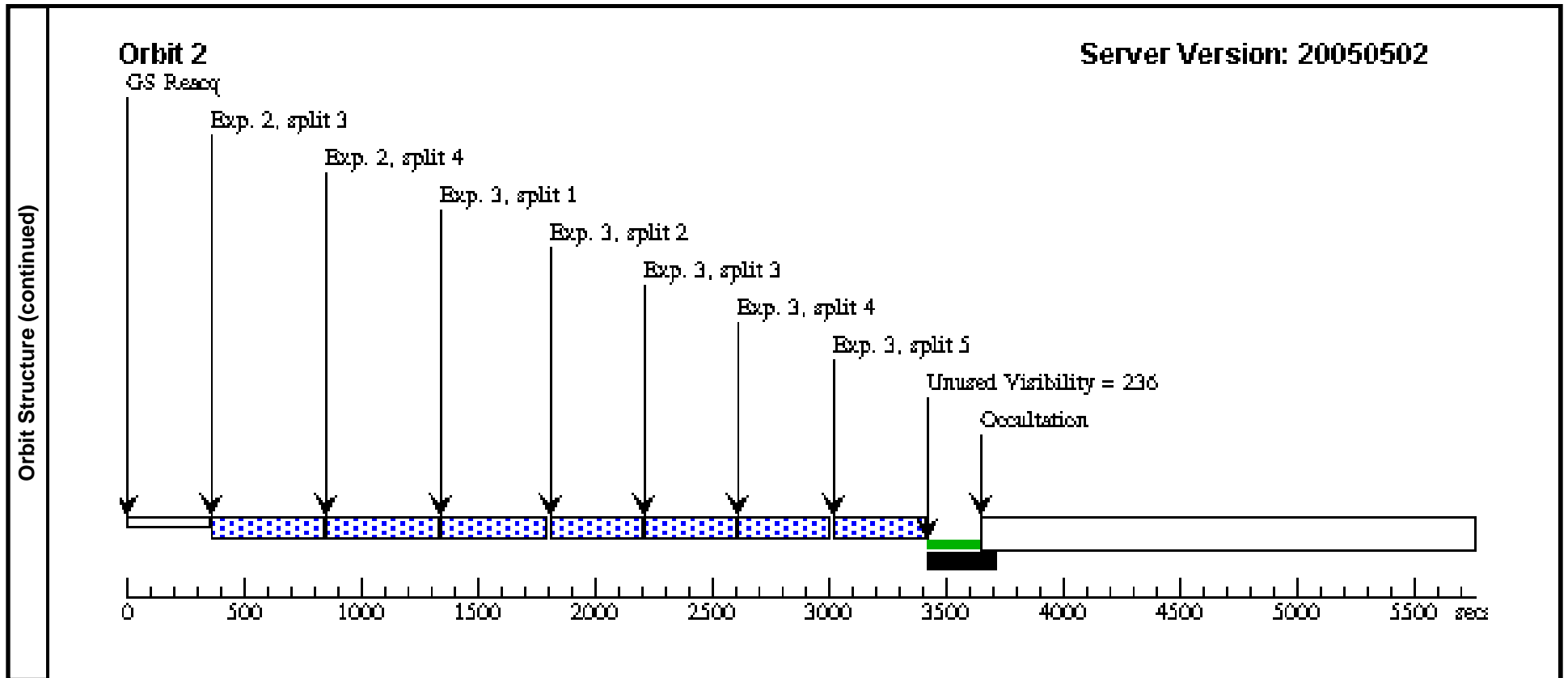


Proposal 10187 - Visit 04 - Direct imaging of the progenitors of massive, core-collapse supernovae

Wed Jun 29 01:06:37 GMT 2005

<b>Visit</b>	<b>Proposal 10187, Visit 04</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: ACS/HRC Special Requirements: BEFORE 01-SEP-2005:00:00:00									
	(Visit 04) Warning: ACS EXPOSURE TIME ADJUSTED (Visit 04) Warning: ACS EXPOSURE TIME ADJUSTED (Visit 04) Warning: ACS EXPOSURE TIME ADJUSTED (Visit 04) Warning: ACS EXPOSURE TIME ADJUSTED									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
	(10)	SN2005V	RA: 06 18 38.2800 (94.6595000d) Dec: +78 21 28.80 (78.35800d) Equinox: J2000 Plate Id: (?)		V=23.0	Coordinate Source: SIMBAD				
<b>Exposures</b>	<b>#</b>	<b>Label</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time/[Actual Dur.]</b>	<b>Orbit</b>
	1	(10) SN2005V	(10) SN2005V	ACS/HRC, ACCUM, HRC	F435W	CR-SPLIT=4			1750.0 Secs	
									[==>(Split 1)]	
									[==>(Split 2)]	
									[==>(Split 3)]	[1]
									[==>(Split 4)]	
	2	(10) SN2005V	(10) SN2005V	ACS/HRC, ACCUM, HRC	F555W	CR-SPLIT=4			1775.0 Secs	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
									[==>(Split 3)]	
								[==>(Split 4)]	[2]	
3	(10) SN2005V	(10) SN2005V	ACS/HRC, ACCUM, HRC	F814W	CR-SPLIT=5			1775.0 Secs		
								[==>(Split 1)]		
								[==>(Split 2)]		
								[==>(Split 3)]		
								[==>(Split 4)]		
								[==>(Split 5)]	[2]	





Proposal 10187 - Visit 05 - Direct imaging of the progenitors of massive, core-collapse supernovae

Wed Jun 29 01:06:38 GMT 2005

<b>Visit</b>	<b>Proposal 10187, Visit 05</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: ACS/HRC Special Requirements: (none)									
	(Visit 05) Warning: ACS EXPOSURE TIME ADJUSTED (Visit 05) Warning: ACS EXPOSURE TIME ADJUSTED (Visit 05) Warning: ACS EXPOSURE TIME ADJUSTED									
<b>Diagnosics</b>										
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
	(9)	SN2005AE	RA: 07 58 15.8400 (119.5660000d) Dec: -49 51 19.90 (-49.85553d) Equinox: J2000 Plate Id: (?)		V=23.0	Coordinate Source: SIMBAD				
<b>Exposures</b>	<b>#</b>	<b>Label</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time/[Actual Dur.]</b>	<b>Orbit</b>
	1	(9) SN2005AE	(9) SN2005AE	ACS/HRC, ACCUM, HRC	F435W	CR-SPLIT=3			1655.0 Secs	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
									[==>(Split 3)]	
	2	(9) SN2005AE	(9) SN2005AE	ACS/HRC, ACCUM, HRC	F555W	CR-SPLIT=6			1740.0 Secs	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
									[==>(Split 3)]	
									[==>(Split 4)]	
								[==>(Split 5)]	[2]	
								[==>(Split 6)]		
3	(9) SN2005AE	(9) SN2005AE	ACS/HRC, ACCUM, HRC	F814W	CR-SPLIT=5			1700.0 Secs		
								[==>(Split 1)]		
								[==>(Split 2)]		
								[==>(Split 3)]		
								[==>(Split 4)]	[2]	
								[==>(Split 5)]		

