



13751 - Imaging the Crab nebula when it is flaring in gamma-rays

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Andrea De Luca (PI) (ESA Member) (Contact)	INAF, Istituto di Astrofisica Spaziale e Fisica	deluca@iasf-milano.inaf.it
Dr. Patrizia A. Caraveo (CoI) (ESA Member)	INAF, Istituto di Astrofisica Spaziale e Fisica	pat@iasf-milano.inaf.it
Prof. Giovanni F. Bignami (CoI) (ESA Member)	Istituto Universitario de Studi Superiori Pavia	gfb@iasf-milano.inaf.it
Dr. Marco Tavani (CoI) (ESA Member)	INAF, Istituto di Astrofisica Spaziale e Fisica	marco.tavani@iasf-roma.inaf.it
Dr. Roberto Mignani (CoI) (ESA Member)	INAF, Istituto di Astrofisica Spaziale e Fisica	mignani@lambrate.inaf.it
Dr. Martin C. Weisskopf (CoI) (AdminUSPI)	NASA Marshall Space Flight Center	martin.c.weisskopf@nasa.gov
Dr. Stefan Funk (CoI)	Stanford University	funk@slac.stanford.edu
Dr. Andrea Belfiore (CoI)	University of California - Santa Cruz	mario@piffio.org
Dr. Claire Ellen Max (CoI)	Lawrence Livermore National Laboratory	max@sunlight.llnl.gov
Prof. Dieter Horns (CoI) (ESA Member)	Deutsches Elektronen Synchrotron	horns@desy.de
Dr. Rolf Buehler (CoI) (ESA Member)	Deutsches Elektronen Synchrotron	rolf.buehler@desy.de
Dr. Jeff Kolodziejczak (CoI)	NASA Marshall Space Flight Center	jeff.kolodziejczak@msfc.nasa.gov
Prof. Roger D. Blandford (CoI)	Stanford University	rdb3@stanford.edu
Prof. Roger Romani (CoI)	Stanford University	rwr@astro.stanford.edu
Prof. Jonathan Arons (CoI)	University of California - Berkeley	arons@astroplasma.berkeley.edu

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) CRAB	ACS/WFC	1	05-Sep-2014 21:10:54.0	yes
02	(1) CRAB	ACS/WFC	1	05-Sep-2014 21:10:55.0	yes

<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>
03	(1) CRAB	ACS/WFC	1	05-Sep-2014 21:10:55.0	yes
04	(1) CRAB	ACS/WFC	1	05-Sep-2014 21:10:56.0	yes

4 Total Orbits Used

ABSTRACT

One of the most intriguing results of the gamma-ray instruments currently in orbit has been the detection of powerful flares from the Crab Nebula. Such events, with a recurrence time of about once per year, can be so dramatic to make the system the brightest source in the gamma-ray sky, as it occurred in April 2011. Such a discovery challenges our understanding of how pulsar wind nebulae work and defies current astrophysical models for particle acceleration. With the aim of locating the site(s) of the flares, an ad hoc HST strategy have been put in place to be prepared and react promptly in case of a new brightening in gamma rays. We ask here for a triggered TOO observation of the Crab Nebula with ACS/WFC in case a gamma-ray flare is announced by the Agile and/or the Fermi missions. This TOO is crucial part of a multiwavelength program that we have organized, based on lessons learnt from our follow-up observations of previous flares, including a regular (quarterly) monitoring of the source both in X-rays and optical through a joint Chandra-HST proposal.

OBSERVING DESCRIPTION

We ask to perform four-epoch imaging of the Crab Pulsar and Nebula, reacting with the fastest possible response time to a trigger provided by the detection of a new gamma-ray flare from the Crab by Fermi-LAT and/or AGILE. The first-epoch observation should be performed as soon as possible after the trigger, the second-epoch observation one week after the first observation, the third one week after the second and the fourth one week after the third.

We will use the HST/ACS instrument in its WFC configuration, with the large-band F550M filter, well suited to sample the continuum emission from the system, with almost no contamination from line emission from the SNR filaments.

For each epoch, a box dithering pattern will be implemented to fill the inter-chip gap as well as to reject cosmic ray hits. Setting an exposure of 500 s for each position of the dithering pattern results in 2000 s exposure time per visit, which is well suited to achieve our goals and allows for an optimal use of the orbital visibility window.

The images collected under this ToO will be completed and compared with images acquired with an identical instrument setup by the quarterly HST monitoring campaign that we have successfully proposed as a joint Chandra-HST program.

Proposal 13751 - Visit 01 - Imaging the Crab nebula when it is flaring in gamma-rays

Visit	Proposal 13751, Visit 01, completed Sat Sep 06 01:10:57 GMT 2014				
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: SCHED 80%; ON HOLD ; TOO RESPONSE TIME 1.0D <i>On Hold Comments: This is a target of opportunity observation. The trigger will be provided by the detection of a new gamma-ray flare from the Crab nebula by Fermi-LAT and/or AGILE.</i>				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Coordinate Frame=POS-TARG Pattern Orientation=85.28 Purpose=DITHER Angle Between Sides=85.28 Number Of Points=4 Center Pattern=false Point Spacing=3.5 Line Spacing=0.5			(1)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	CRAB	RA: 05 34 31.9500 (83.6331250d) Dec: +22 00 52.10 (22.01447d) Equinox: J2000		V=16.5+/-0.1
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.
	1	(1) CRAB		ACS/WFC, ACCUM, WFC	F550M
					Opt. Params.
					Special Reqs.
					Groups
					Exp. Time (Total)/[Actual Dur.]
					Orbit
					[1]
					[=>(Pattern 1)]
					[=>(Pattern 2)]
					[=>(Pattern 3)]
					[=>(Pattern 4)]
Orbit Structure	Orbit 1 Server Version: 20140605				

Proposal 13751 - Visit 02 - Imaging the Crab nebula when it is flaring in gamma-rays

Visit	Proposal 13751, Visit 02, implementation Sat Sep 06 01:10:57 GMT 2014				
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: SCHED 80%; AFTER 01 BY 7 D TO 8 D				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Coordinate Frame=POS-TARG Pattern Orientation=85.28 Purpose=DITHER Angle Between Sides=85.28 Number Of Points=4 Point Spacing=3.5 Line Spacing=0.5 Center Pattern=false			(1)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	CRAB	RA: 05 34 31.9500 (83.6331250d) Dec: +22 00 52.10 (22.01447d) Equinox: J2000		V=16.5+/-0.1
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.
	1	(1) CRAB		ACS/WFC, ACCUM, WFC	F550M
					Opt. Params.
					Special Reqs.
					Groups
					Exp. Time (Total)/[Actual Dur.]
					Orbit
					[1]
					[=>(Pattern 1)]
					[=>(Pattern 2)]
					[=>(Pattern 3)]
					[=>(Pattern 4)]
Orbit Structure	Orbit 1 Server Version: 20140605				
	The diagram illustrates the orbital structure of the observation. It features a horizontal timeline from 0 to 5500 seconds. Key events are marked with arrows and labels: GS Acq (0-50s), Exp. 1 (50-100s), Pointing Maneuver (100-150s), Exp. 1 (150-200s), Pointing Maneuver (200-250s), Exp. 1 (250-300s), Pointing Maneuver (300-350s), Exp. 1 (350-400s), Occultation (400-450s), and Unused Orbital Visibility = 33 (450-550s). The timeline is divided into segments by these events, with some segments highlighted in green (Exp. 1) and others in blue (Pointing Maneuver). A red bar at the bottom indicates the total observation time.				

Proposal 13751 - Visit 03 - Imaging the Crab nebula when it is flaring in gamma-rays

Visit	Proposal 13751, Visit 03, implementation Sat Sep 06 01:10:58 GMT 2014				
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: SCHED 80%; AFTER 02 BY 7 D TO 8 D				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Coordinate Frame=POS-TARG Pattern Orientation=85.28 Purpose=DITHER Angle Between Sides=85.28 Number Of Points=4 Center Pattern=false Point Spacing=3.5 Line Spacing=0.5			(1)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	CRAB	RA: 05 34 31.9500 (83.6331250d) Dec: +22 00 52.10 (22.01447d) Equinox: J2000		V=16.5+/-0.1
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.
	1	(1) CRAB		ACS/WFC, ACCUM, WFC	F550M
					Opt. Params.
					Special Reqs.
					Groups
					Exp. Time (Total)/[Actual Dur.]
					Orbit
					[1]
					[=>(Pattern 1)]
					[=>(Pattern 2)]
					[=>(Pattern 3)]
					[=>(Pattern 4)]
Orbit Structure	Orbit 1				
	Server Version: 20140605				
	Unused Orbital Visibility = 33				

Proposal 13751 - Visit 04 - Imaging the Crab nebula when it is flaring in gamma-rays

Visit	Proposal 13751, Visit 04, implementation Sat Sep 06 01:10:58 GMT 2014				
	Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: SCHED 80%				
Patterns	#	Primary Pattern		Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=3.5 Line Spacing=0.5		Coordinate Frame=POS-TARG Pattern Orientation=85.28 Angle Between Sides=85.28 Center Pattern=false	(1)
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
	(1)	CRAB	RA: 05 34 31.9500 (83.6331250d) Dec: +22 00 52.10 (22.01447d) Equinox: J2000		V=16.5+/-0.1
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.
	1	(1) CRAB		ACS/WFC, ACCUM, WFC	F550M
					Opt. Params.
					Special Reqs.
					Groups
					Exp. Time (Total)/[Actual Dur.]
					Orbit
					[1]
					[=>(Pattern 1)]
					[=>(Pattern 2)]
					[=>(Pattern 3)]
					[=>(Pattern 4)]
Orbit Structure	Orbit 1 Server Version: 20140605				