14061 - Exploring the MSP prenatal stage: the optical identification of a NS burster in Terzan 5.

Cycle: 22, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Francesco R. Ferraro (PI) (ESA Member) (Contact)	**Universita di Bologna**	**francesco.ferraro3@unibo.it**
Dr. Cristina Pallanca (CoI) (ESA Member)	Universita di Bologna	cristina.pallanca3@unibo.it
Mr. Mario Cadelano (CoI) (ESA Member)	Universita di Bologna	mario.cadelano@unibo.it
Dr. Barbara Lanzoni (CoI) (ESA Member)	Universita di Bologna	barbara.lanzoni3@unibo.it
Dr. Emanuele Dalessandro (CoI) (ESA Member)	Universita di Bologna	emanuele.dalessandr2@unibo.it
Dr. Alessio Mucciarelli (CoI) (ESA Member)	Universita di Bologna	alessio.mucciarelli2@unibo.it

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) TERZAN5-ACS ANY	ACS/WFC WFC3/UVIS	2	06-Apr-2015 21:02:29.0	yes

2 Total Orbits Used

ABSTRACT

Low mass X-ray binaries (LMXBs) and radio Millisecond Pulsars (MSPs) are thought to be the initial and ending points of the evolution of a binary system where a neutron star accretes matter from a companion. Many crucial phases of this scenario still need to be understood. For instance, Papitto et al. (2013, Nature, 501, 517) provided the first evidence of a system currently swinging between the X-ray and the radio emission states, thus

showing that an intermediate phase marks the transition from a LMXB to a MSP. The X-ray properties of that object closely resemble those of EXO 1745-248, a transient LMXB located in Terzan 5, which therefore promises to be another system marking the LMXB-MSP transition. On March 13, 2015, SWIFT detected an X-ray burst in Terzan 5 at a location that may be consistent with the coordinates of EXO 1745-248. However, the error circle is still too large (2"-3") to exclude other possibilities. Since the thermonuclear burning runway at the origin of the X-ray burst is expected to produce also a significant enhancement of the optical luminosity, here we propose to invest 2 HST orbits to acquire deep optical images of the region. The comparison between these images (secured during the outburst) and those already available (acquired during quiescence) will immediately pinpoint the source, thus offering a unique opportunity to identify the object, determine precisely its coordinates and possibly confirm its association to EXO 1745-248. The optical emission is expected to fade by ~1mag after 1-2 months from the burst. Hence, the proposed DDT observations represent indeed a unique but temporary opportunity to catch a MSP in its pre-birth phase.

OBSERVING DESCRIPTION

The observations are organized in one visit of 2 orbits.

In each orbit we require one short exposure (10 sec in F814W and 50 sec in F606W) and 5 long exposures (~372 sec in F814W and ~398 sec in F606W). Dithering is performed by applying small offsets (via POS TARG keyword) to each exposure, adopting a path similar to that used in GO 12933. For each orbit we also planned two parallel WFC3-UVIS exposures (with F814W in the first orbit and F606W in the second orbit).
In order to duplicate the field of view of previous observations (Prop GO9799-PI Rich and GO12933-PI Ferraro), we adopted the WFC2 aperture and a proper ORENTATION (ORIENT 271.075287D). Note that, according to the Visit Planner, the required ORIENTATION has little impact on the observations schedulability.

We emphasize that, beacuse of the transient nature of the target, the observations need to be performed as soon as possible, nominally before May 31 2015 (see Timing Requirements). However, according to the Visit Planner, one visit of 2 full orbits on the target (Terzan 5) can be executed only between April 10 and April 27, 2015 (independently of the ORIENTATION).

Visit

Proposal 14061, Visit 01, implementation Tue Apr 07 01:02:31 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: ORIENT 271.075287D TO 271.075287 D; BEFORE 31-MAY-2015:00:00:00

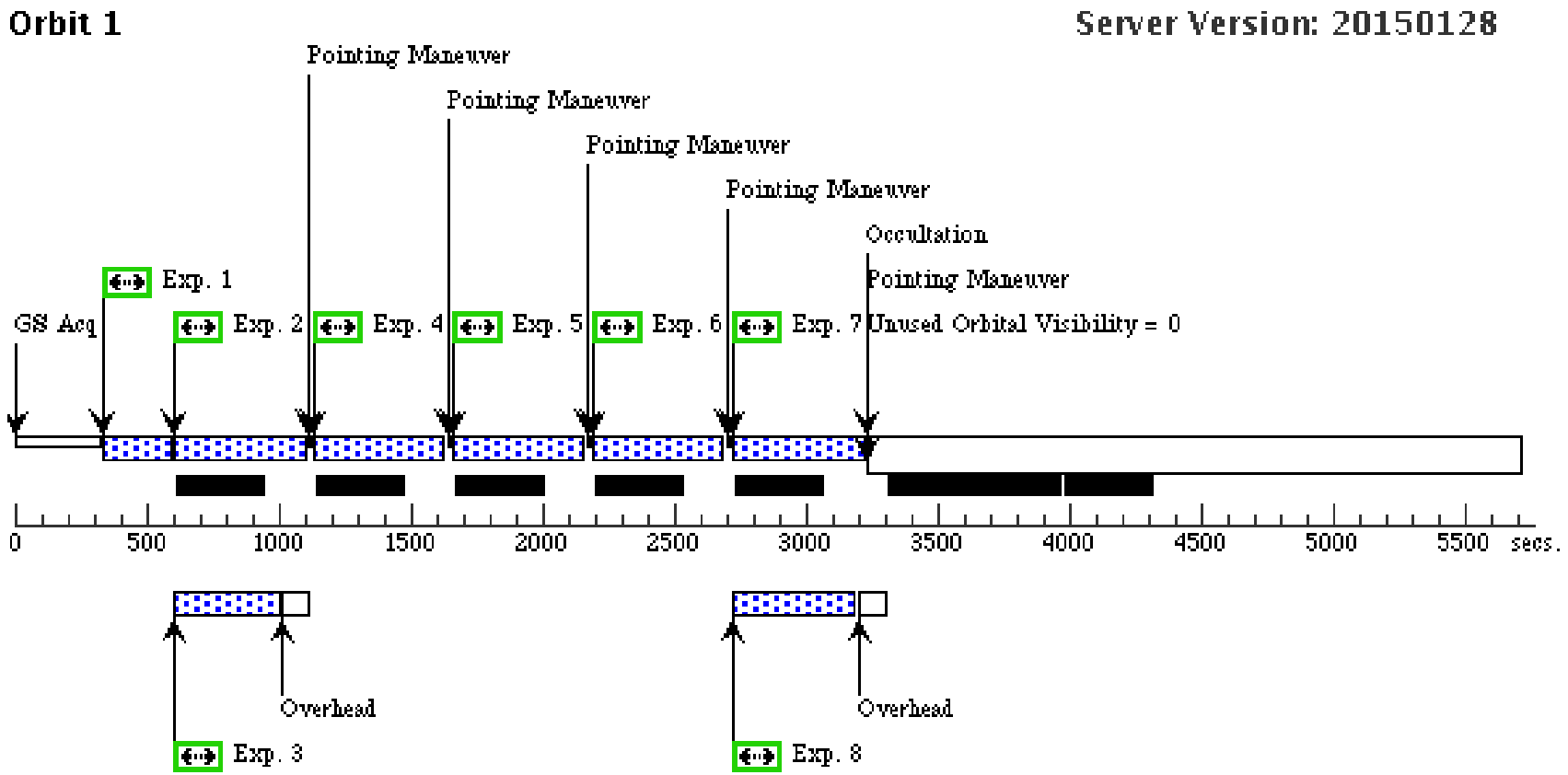
Fixed Targets

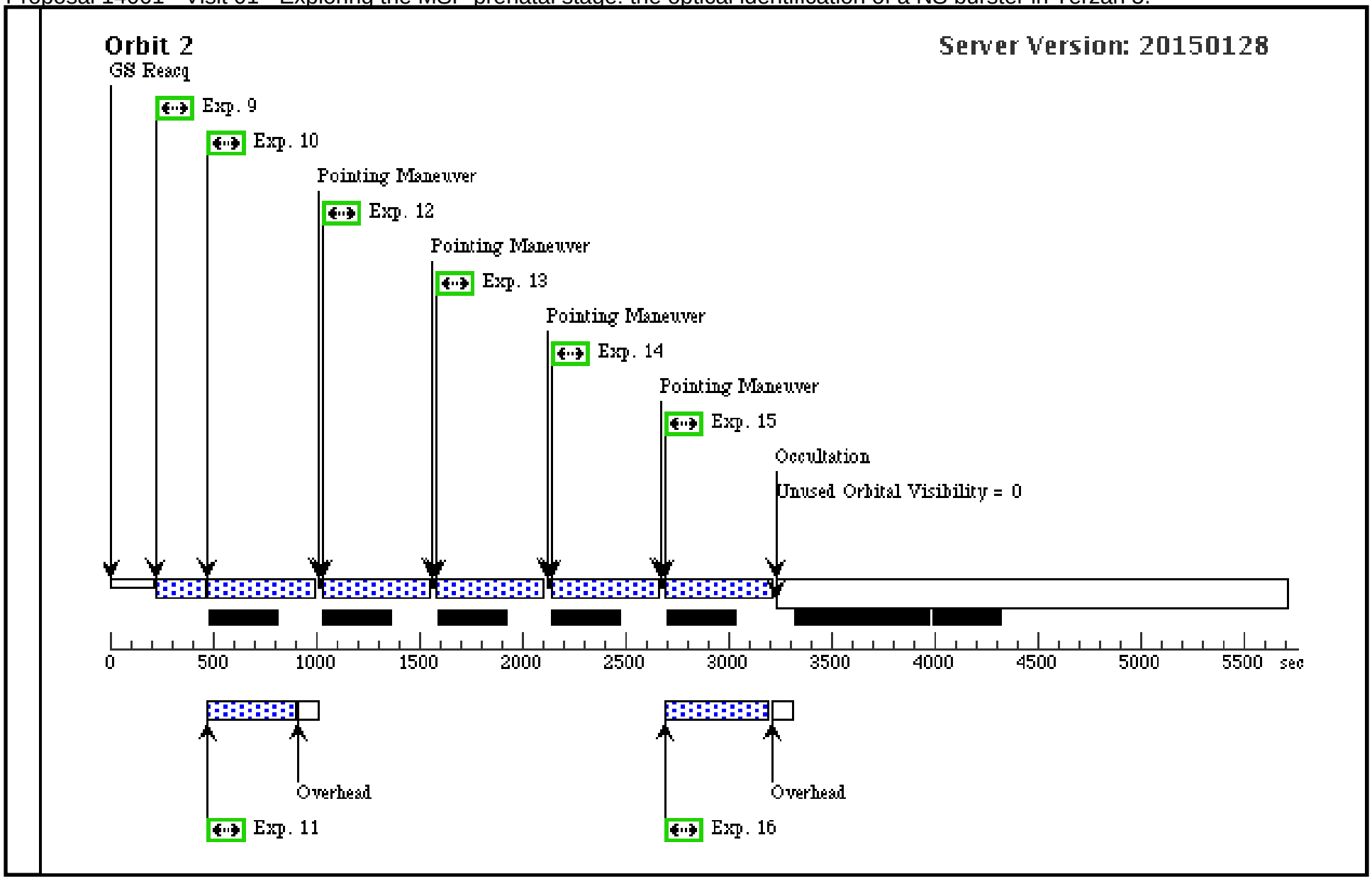
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TERZAN5-ACS	RA: 17 48 4.8500 (267.0202083d) Dec: -24 46 44.60 (-24.77906d) Equinox: J2000		V=13.8	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Is	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F814W	FLASH=20	POS TARG 0.000,0.000		10 Secs (10 Secs)	
								[==>]	***[1]***
2	I1	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.000,0.000	Prime + Parallel Group 2-3 in Visit 01	372 Secs (372 Secs)	
								[==>]	***[1]***
3	Ipar1	ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Prime + Parallel Group 2-3 in Visit 01	370 Secs (370 Secs)	
								[==>]	***[1]***
4	I2	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.247,0.094		371 Secs (371 Secs)	
								[==>]	***[1]***
5	I3	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.124,0.232		371 Secs (371 Secs)	
								[==>]	***[1]***
6	I4	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F814W		POS TARG -0.124,0.138		371 Secs (371 Secs)	
								[==>]	***[1]***
7	I5	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F814W		POS TARG 0.062,0.116	Prime + Parallel Group 7-8 in Visit 01	372 Secs (372 Secs)	
								[==>]	***[1]***
8	Ipar2	ANY	WFC3/UVIS, ACCUM, UVIS1	F814W			Prime + Parallel Group 7-8 in Visit 01	467 Secs (467 Secs)	
								[==>]	***[1]***
9	Vs	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F606W	FLASH=20	POS TARG 0.000,0.000		50 Secs (50 Secs)	
								[==>]	***[2]***
10	V1	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.000,0.000	Prime + Parallel Group 10-11 in Visit 01	398 Secs (398 Secs)	
								[==>]	***[2]***
11	Vpar1	ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Prime + Parallel Group 10-11 in Visit 01	405 Secs (405 Secs)	
								[==>]	***[2]***
12	V2	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.247,0.094		397 Secs (397 Secs)	
								[==>]	***[2]***
13	V3	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.124,0.232		397 Secs (397 Secs)	
								[==>]	***[2]***
14	V4	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F606W		POS TARG -0.124,0.138		397 Secs (397 Secs)	
								[==>]	***[2]***
15	V5	(1) TERZAN5-ACS	ACS/WFC, ACCUM, WFC2	F606W		POS TARG 0.062,0.116	Prime + Parallel Group 15-16 in Visit 01	398 Secs (398 Secs)	
								[==>]	***[2]***
16	Vpar2	ANY	WFC3/UVIS, ACCUM, UVIS1	F606W			Prime + Parallel Group 15-16 in Visit 01	502 Secs (502 Secs)	
								[==>]	***[2]***

Orbit Structure




Orbit 2
Server Version: 20150128
GS Reacq
Exp. 9
Exp. 10
Pointing Maneuver
Exp. 12
Pointing Maneuver
Exp. 13
Pointing Maneuver
Exp. 14
Pointing Maneuver
Exp. 15
Occultation
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Overhead
Exp. 11
Overhead
Exp. 16