Dichroic Installation plan
February 2014

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	Name	Date
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	Name	Date

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Change Record

Issue	Date	Section/ Paragraph Affected	Reasons / Remarks	Name
1.0	17.01.2014	all	created	M. Bonaglia
2.0	31.01.2014	After Sat 8th	Created	L. Busoni

1 Scope

This document details the telescope activities involving the ARGOS dichroic installation at LBT scheduled for February 2014.

2 Applicable documents

No.	Title	Number & Issue
AD 1	ARGOS_dichroic_installation.pdf	Technical note 119 - draft
AD 2		

3 Introduction

During the February '14 installation run we aim at:

- Install both DX and SX dichroic units, and verify functionality.
- Install both DX and SX WFS tables
- Position the dichroic mounts and WFS tables with the aid of the laser tracker

After the run the dichroic units will be left in a "parking" position that will not affect scientific observations. The dichroic electronic rack and cables will be removed from the telescope.

4 Personal Involved

GN: Giovanni Negrini, Tomelleri s.r.l.
INAF: Marco Bonaglia (MB), Enrico Pinna (EP), Lorenzo Busoni (LB), Jacopo Antichi (JA)
AE: ARGOS engineer (Gustavo Rahmer, Michael Lefebvre)
CO: Crane Operator (?, LBTO)
TO: Telescope Operator (?, LBTO)
LO: Laser tracker operator (Lee Dettmann)
LU: LUCI Cal Unit Operator (?, LBTO?)

5 Daily activity resume

1st week:

	Sun 2nd	Mon 3rd	Tue 4th	Wed 5th	Thu 6th	Fri 7th	Sat 8th
MORNING		Dichroic unpacking in high bay area	Platform installation on DX side (7:30-9:30 am)	Platform installation on DX side (7:30-9:30 am)	Platform installation on SX side (7:30-9:30 am)	Platform installation on SX side (7:30-9:30 am)	Laser tracker alignment of DX dichroic
			On telescope activity, DX side	On telescope activity, DX side	On telescope activity, SX side	On telescope activity, SX side	
AFTERNOON	GN, MB, EP arrival at LBT	DX mount test in clean room	Platform removal (12:30am-2:30pm)	Platform removal (11:0am-1:00pm)	Platform removal (12:30am-2:30pm)	Platform removal (11:00am-1:00pm)	
			On telescope activity, DX side	On telescope activity, DX side	On telescope activity, SX side	On telescope activity, SX side	
EVENING				SX mount test in clean room			

2nd week:

	Sun 9th	Mon 10th	Tue 11th	Wed 12th	Thu 13th	Fri 14th	Sat 15th
MORNING	Laser tracker alignment of SX dichroic	LUCI1 install - Refine alignment on DX	Define position of DX-LGSW on the LGSW table	No Access to the Telescope	Refine procedure of Tue 11th	No Access to the Telescope	TBD
AFTERNOON						TBD	
EVENING							

Monday February, 3rd - Unpacking

This day the dichroic box is unpacked in the high bay, the functionality of DX mount is tested in clean room and it is prepared for next day installation on telescope.

Start of activities: 8:00 a.m.

#	Description	By	Area	Req	End time
1.	Unpacking of dichroic box: • handling tool • 2x stands • 2x dichroic mounts • control electronics • 2x optic dummies	GN, INAF, AE, CO	High bay	Crane (or fork lift)	10:00 a.m. (2.0h)
1.1.	Hanging of handling tool to high bay crane	CO	High bay	Crane	
2.	Unpacking and storage of mounts and optics box: • 2x dichroic and 2x fold mirror cells • 3x dichroic optic, 2x fold mirror optic	GN, INAF, AE	High bay & clean room		10:30 a.m. (0.5h)
3.	Switch of DX mount from storage stand to reclining stand: • Mount DX cells on DX mount • Install dummies on DX cells • Connect cables and controller to DX mount • Slide out fold mirror • Disconnect cables • Hang mount on handling tool • Switch stand	GN, INAF, AE, CO	High bay	110V, crane with handling tool	12:00 a.m. (1.5h)
4.	Move and setup DX mount to clean room: • Connect controller and cables	GN, INAF, AE	High bay	110V	12:30 a.m. (0.5h)
4.1.	Move handling tool to dome level 5 with crane	CO	High bay-dome	Crane	
5.	Check controller connectivity and functionality in remote	GN, INAF, AE	Clean room		1:00 p.m. (0.5h)
6.	DX mount functionality test in manual control (dummies on): • Dichroic deployment • End stop functionality • Fold mirror deployment • End stop functionality	GN, INAF, AE	Clean room		1:30 p.m. (0.5h)
7.	DX mount functionality in remote control (dummies on): • Dichroic deployment • Dichroic limit switch signal activation	GN, INAF, AE	Clean room		2:00 p.m. (0.5h)

	• Fold mirror deployment • Fold mirror limit switch signal activation				
8.	Remove dummies from DX cells, clean DX cells	GN	Clean room		2:30 p.m. (0.5h)
8.1.	Check and clean optics	INAF	Clean room		
9.	Optics installation in DX cells	GN, INAF, AE	Clean room		3:00 p.m. (0.5h)
10.	Corner cube mounts installation on DX cell and optic covers adjustment	GN, INAF, AE	Clean room		3:30 p.m. (0.5h)
11.	Move DX mount to dome level 5 with elevator	GN, INAF, AE	Dome	Elevator	3:45 p.m. (0.25h)
11.1.	Move controller and cables to dome level 5	GN, INAF, AE	Dome		
12.	Prepare DX mount for lifting: • Connect cables and controller • Slide out fold mirror	GN, INAF, AE	Dome	110V	4:00 p.m. (0.5h)
12.1.	Prepare and move balcony to dome level 5	CO	Dome		

Tuesday February, 4th - Installation of DX unit

The day task is to install the DX mount on the instrument gallery and check that the LUCI rotator and LUCI Calibration Unit can be operated safely with the mount installed.

Start of activities: 7:30 a.m.

NOTE: 8h of activity on the telescope structure are scheduled. To be able to leave the dome area at 4:00 p.m. it is required to start operation maximum at 8:00 a.m. (7:30 a.m. is preferred to have contingency time).

#	Description	By	Area	Req	End Time
13.	Balcony installation on DX eye	CO, TO	Dome	Crane	9:30 a.m. (2.0h)
13.1.	Controller and cables setup on instrument gallery	GN, INAF	Inst. Gall		
14.	Install DX mount on instrument gallery: • Hang handling tool to crane • Lift DX mount to instrument gallery • Bolt DX mount to interface pads • Remove handling tool	GN, INAF, AE	Inst. Gall.	Crane, handling tool	11:00 a.m. (1.5h)
15.	DX mount test #1 at Zenith: • Connect cables and controller • Functionality test of dichroic and fold mirror	GN, INAF, AE	Inst. Gall.		11:30 a.m. (0.5h)
16.	Test possible collisions with AGW structure at Zenith with parked dichroic: • Rotate LUCI rotator by 360° • Deploy LUCI cal. Unit	GN, INAF, AE, TO, LU	Inst. Gall. & control room	Remote	12:30 a.m. (1h)
17.	Remove balcony from DX eye	CO, TO	Dome	Crane	2:30 p.m. (2h)
17.1.	Remove cables and controller from instrument gallery	GN, INAF	Inst. Gall.		
18.	Move telescope at horizon and check for collisions with AGW structure				3:00 p.m. (0.5h)
19.	Move telescope to Zenith and check of the status of DX mount before observing night				3:30 p.m. (0.5h)

Wednesday February, 5th – Functionality of DX unit

Functionality of DX mount is tested both at Zenith and horizon. To secure the operations at Zenith the balcony should be installed. To check the mount behavior at horizon we expect to be able to reach the front bent Gregorian station with the scissor lift.

Start of activities: 7:30 a.m.
NOTE: 8h of activity on the telescope structure are scheduled. To be able to leave the dome area at 4:00 p.m. it is required to start operation maximum at 8:00 a.m. (7:30 a.m. is preferred to have contingency time).

#	Description	By	Area	Req	End Time
20.	Balcony installation on DX eye	CO, TO	Dome	Crane	9:30 a.m. (2.0h)
20.1.	DX mount setup for operations: • Secure and connect controller and cables • Route Ethernet cable to dome level 5	GN, INAF	Inst. Gall	Very long eth cable, 110V	
21.	DX mount test #2 at Zenith: • Measure unobstructed volume • Measure deployment time • Stress test (move back and forth) • Measure deployment accuracy and repeatability	GN, INAF, AE	Inst. Gall.		10:30 a.m. (1h)
22.	Test possible collisions with AGW structure at Zenith with deployed dichroic: • Rotate LUCI rotator by 360°d	GN, INAF, AE, TO	Inst. Gall & control room	Remote	11:00 a.m. (0.5h)
23.	Remove balcony from DX eye	CO, TO	Dome	Crane	1:00 p.m. (2h)
24.	DX mount test #3 at horizon: • Measure deployment time • Stress test (move back and forth) • Measure deployment accuracy and repeatability (?)	GN, INAF, AE, CO	Inst. Gall.	Scissor lift	2:30 p.m. (1.5h)
25.	Test possible collisions with AGW structure at horizon with deployed dichroic: • Rotate LUCI rotator by 360°d	GN, INAF, AE, TO	Inst. Gall & control room	Remote, scissor lift	3:00 p.m. (0.5h)
26.	Move telescope to Zenith and check of the status of DX mount before observing night: • Remove cables and controller	GN, INAF, AE	Inst. Gall		3:30 p.m. (0.5h)

Second part of the day activity is performed in clean room to check the functionality of the SX mount and to prepare it for next day installation on telescope.

27.	Move and setup SX mount to clean room on storage stand: • Connect controller and cables	GN, INAF, AE	Clean room	110V	4:00 p.m. (0.5h)

	• Mount SX cells • Install dummies on SX cells • Install covers				
28.	SX mount functionality test: • Dichroic deployment • End stop functionality • Dichroic limit switch signal activation • Fold mirror deployment • End stop functionality • Fold mirror limit switch signal activation	GN, INAF, AE	Clean room		5:00 p.m. (1h)

Thursday February, 6th - Installation of SX unit

The day task is to install the SX mount on the instrument gallery and check that the LUCI rotator and LUCI Calibration Unit can be operated safely with the mount installed.

Start of activities: 7:30 a.m.
NOTE: 8h of activity on the telescope structure are scheduled. To be able to leave the dome area at 4:00 p.m. it is required to start operation maximum at 8:00 a.m. (7:30 a.m. is preferred to have contingency time).

#	Description	By	Area	Req	End Time
29.	Balcony installation on SX eye	CO, TO	Dome	Crane	9:30 a.m. (2.0h)
29.1.	Move SX mount, controller and cables to dome level 5	GN, INAF	Dome	110V	
29.2.	Prepare SX mount for lifting: • Connect cables and controller • Slide out fold mirror	GN, INAF, AE	Dome		
29.3.	Move controller and cables to instrument gallery	GN, INAF, AE	Inst. Gall.		
30.	Install SX mount on instrument gallery: • Hang handling tool to crane • Lift SX mount to instrument gallery • Bolt SX mount to interface pads • Remove handling tool	GN, INAF, AE	Inst. Gall.	Crane, handling tool	11:00 a.m. (1.5h)
31.	SX mount test #1 at Zenith: • Connect cables and controller • Functionality test of dichroic and fold mirror	GN, INAF, AE	Inst. Gall.		11:30 a.m. (0.5h)
32.	Test possible collisions with AGW structure at Zenith with parked dichroic: • Rotate LUCI rotator by 360° • Deploy LUCI cal. Unit	GN, INAF, AE, TO, LU	Inst. Gall. & control room	Remote	12:30 a.m. (1h)
33.	Remove balcony from DX eye	CO, TO	Dome	Crane	2:30 p.m. (2h)
33.1.	Remove cables and controller from instrument gallery	GN, INAF	Inst. Gall.		
34.	Move telescope at horizon and check for collisions with AGW structure				3:00 p.m. (0.5h)
35.	Move telescope to Zenith and check of the status of SX mount before observing night				3:30 p.m. (0.5h)

Friday February, 7th – Functionality of SX unit

Functionality of SX mount is tested both at Zenith and horizon. To secure the operations at Zenith the balcony should be installed. To check the mount behavior at horizon we expect to be able to reach the front bent Gregorian station with the scissor lift.

Start of activities: 7:30 a.m.
NOTE: 8h of activity on the telescope structure are scheduled. To be able to leave the dome area at 4:00 p.m. it is required to start operation maximum at 8:00 a.m. (7:30 a.m. is preferred to have contingency time).

#	Description	By	Area	Req	End Time
36.	Balcony installation on SX eye	CO, TO	Dome	Crane	9:30 a.m. (2.0h)
36.1.	SX mount setup for operations: • Secure and connect controller and cables • Route Ethernet cable to dome level 5	GN, INAF	Inst. Gall	Very long eth cable, 110V	
37.	SX mount test #2 at Zenith: • Measure unobstructed volume • Measure deployment time • Stress test (move back and forth) • Measure deployment accuracy and repeatability	GN, INAF, AE	Inst. Gall.		10:30 a.m. (1h)
38.	Test possible collisions with AGW structure at Zenith with deployed dichroic: • Rotate LUCI rotator by 360°d	GN, INAF, AE, TO	Inst. Gall & control room	Remote	11:00 a.m. (0.5h)
39.	Remove balcony from SX eye	CO, TO	Dome	Crane	1:00 p.m. (2h)
40.	SX mount test #3 at horizon: • Measure deployment time • Stress test (move back and forth) • Measure deployment accuracy and repeatability (?)	GN, INAF, AE, CO	Inst. Gall.	Scissor lift	2:30 p.m. (1.5h)
41.	Test possible collisions with AGW structure at horizon with deployed dichroic: • Rotate LUCI rotator by 360°d	GN, INAF, AE, TO	Inst. Gall & control room	Remote, scissor lift	3:00 p.m. (0.5h)
42.	Move telescope to Zenith and check of the status of SX mount before observing night: • Remove cables and controller	GN, INAF, AE	Inst. Gall		3:30 p.m. (0.5h)

Saturday February, 8th– Positioning the dichroic mounts with Laser Tracker on DX

This day will be used to position the DX dichroic mount, the DX fold mirror mount and the DX LGSW table. Positioning is done using the LUCI rotator axis as reference. Measurements are obtained with the laser tracker. To tune the position of the LGSW table the crane is needed.
Requires Laser Tracker operator, crane operator.

Start of activities: 8:00 a.m.

#	Description	By	Area	Req	End Time
43.	Bring cables and controller to instrument gallery, connect them to DX mount	GN, INAF, AE	Inst. Gall.	110V power cord	8:30 a.m. (0.5h)
44.	Install laser tracker on DX eye	LO, LB, INAF	Dome		
45.	Calibrate LT: • Origin on LUCI axis, in natural focus • Z axis along LUCI axis, toward focus • Y axis parallel to M1 plane, towards C-ring • X axis perpendicular to M1 plane, toward M2		Dome		
46.	Put DX dichroic in work position				
47.	Measure of the 3 points on the DX dichroic cell, work position				
48.	Put dichroic in parked position				
49.	Measure of the 3 points on the DX dichroic cell, parked position				
50.	Remove the 3 SMR mounts from DX dichroic cell				
51.	Install the 3 SMR mounts on DX LGSW table				
52.	Measure the 3 points on the DX LGSW table				

Sunday February, 9th – Positioning the dichroic mounts with Laser Tracker on SX

This day will be used to position the SX dichroic mount, the SX fold mirror mount and the SX LGSW table. Positioning is done using the LUCI rotator axis as reference. Measurements are obtained with the laser tracker. To tune the position of the LGSW table the crane is needed.
Requires Laser Tracker operator, crane operator.

Start of activities: 8:00 a.m.

#	Description	By	Area	Req	End Time
53.	Bring cables and controller to instrument gallery, connect them to SX mount	GN, INAF, AE	Inst. Gall.	110V power cord	8:30 a.m. (0.5h)
54.	Install laser tracker on SX eye	LO, LB, INAF	Dome		
55.	Calibrate LT: • Origin on LUCI axis, in natural focus • Z axis along LUCI axis, toward focus • Y axis parallel to M1 plane, towards C-ring • X axis perpendicular to M1 plane, toward M2		Dome		
56.	Put SX dichroic in work position				
57.	Measure of the 3 points on the SX dichroic cell, work position				
58.	Put dichroic in parked position				
59.	Measure of the 3 points on the SX dichroic cell, parked position				
60.	Remove the 3 SMR mounts from SX dichroic cell				
61.	Install the 3 SMR mounts on SX LGSW table				
62.	Measure the 3 points on the SX LGSW table				

Monday February, 10th – Refine dichroic positioning on DX

LUCI1 installation on SX side. Telescope at zenith most of time, crane not available.
This day will be used as contingency or refinement for the Laser Tracker operations of Sun 9th.
Requires Laser Tracker operator.

Tuesday February, 11th – Define position of DX-LGSW on the LGSW table

This day will be used to determine the projection of the rotator axis over the LGSW table and put mechanical fiducials on the LGSW table to guide alignment during the March installation.
The procedure consists of the following steps:

1. position on the AGW a temporary mirror perpendicular to the rotator axis that reflects a collimated laser beam shined from the M1 catwalk through the deployed dichroic.
2. Autocollimate the laser and identify the reflected beam on the LGSW table.
3. Adjust the Fold Mirror tip/tilt to position the reflected beam on the LGSW table in the nominal position
4. Place mechanical fiducials for LGSW installation

Requires telescope at zenith during the entire procedure, M3 undeployed. We need to rotate the LUCI2 rotator.
This operation will be done only on the DX side.
This operation is "best-effort" and may require to be repeated in the next run.
A tripod (like the one for photocameras) may be needed. Is it available at the LBT?
A rough estimate of the needed time is 6h.

#	Description	By	Area	Req	End Time
63.	Bring cables and controller to instrument gallery, connect them to DX mount	INAF, AE	Inst. Gall.	110V power cord	
64.	Install temporary mirror on AGW	INAF	Dome		
65.	Install the laser on the catwalk diametrally opposed to LUCI2 focal station.				
66.	Un-deploy M3 swing arm	TO	Dome		
67.	Adjust the mirror tip/tilt until the mirror is perpendicular to the rotator axis by nulling the wobble of the reflected spot when the rotator is rotated.	INAF TO	Dome		
68.	Deploy the dichroic in the working position	INAF	Dome		
69.	Move the laser and find the position in which it is autocollimated. In this condition the laser beam identifies the rotator axis	INAF	Dome		
70.	Install the target and the rail on the LGSW table	INAF	Dome		
71.	Adjust the Fold Mirror tip/tilt until the reflected beam on the LGSW table hits the target and is parallel to the rail.	INAF	Dome		
72.	Install fiducials on the LGSW table	INAF	Dome		
73.	Retract dichroic	INAF	Dome		
74.	Remove temporary mirror	INAF	Dome		
75.	Free the catwalk	INAF	Dome		

Wednesday February, 12th - No activity

No access to the telescope for LUCI1 calibration. No ARGOS activity

Thursday February, 13th – Refine DX-LGSW positioning

This day is for contingency / refinement of the procedure of Tuesday, 11th

End of document