The VLT-Astronomical Site Monitor

ASM Integration and Commissioning
Status January 1998

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Contents

List of Tables

List of Figures

1 Documentation

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of the specification shall be considered a superseding requirement.

1.1 Applicable Documents

-VLT-VPO-97/0184	Individual Integration/Commissioning Planning Activities 20 Aug.97, Updated Nov.97
-VLT-SPE-ESO-17410-1174	VLT-ASM Seeing and Coherence Monitor, Dimm Upgrade Plan -2.0, Dec.96
-VLT-SPE-ESO-17441-1175	Astronomical Site Monitor Control SW Specification - 1.0/prep.2, Nov.96
-VLT-SPE-ESO-17410-1253	VLT-ASM Dimm Retractable Enclosure, Functional Specification -2.0, Dec.96
-VLT-TRE-ESO-17430-1270	VLT-ASM Control Hardware, Functional Description - Draft 2, Jan.97
-VLT-SPE-ESO-17441-1213	Astronomical Site Monitor Control SW Design Description - 1.0/prep.1, Nov.96
-VLT-MAN-ESO-17441-1404	VLT-ASM Control Software, Installation and Operation Manual - 1.0/prep.1, 1 Aug.97
-VLT-MAN-ESO-17441-1405	Astronomical Site Monitor DIMM Upgrade Mission - Test Report, 21 Aug.97

1.2 Reference Documents

-VLT-DCR-DJO-11710-0000	Small CCD Head Interface -f, Jan.96
-VLT-MAN-DJO-11700-0001	Technical CCD Systems, User Manual -1, May96
-VLT-MAN-ESO-11240-0672	CCD Detectors Control Software, User Manual -1.5, 19 Nov.97
-VLT-TRE-ESO-17430-1271	VLT-ASM Control Hardware, Design Description - Draft 2, Jan.97
-VLT-TRE-ESO-17431-1272	VLT-ASM LCU, Signal Description - Draft 2, Jan.97
-VLT-TRE-ESO-17431-1273	VLT-ASM LCU, Hardware Signal Assignment - Draft 2, Jan.97
-VLT-TRE-ESO-17431-1274	VLT-ASM LCU, Software Signal Assignment - Draft 2, Jan.97
-VLT-PRO-ESO-17434-1274	VLT-ASM Seeing Monitor, Modifications to the Motor Assembly - Draft 2, Jan.97
-Vaisala Technical Notice	MILOS 500 Automatic Weather Station for the ESO VLT Project - Nov 97

2 Task Description

2.1 Task Terminology and Responsibilities

-Task Responsible: manages detailed planning, interfaces with other tasks responsible and requests for external support.
-Development: design, assembly, test and delivery of a new subsystem
-Shipment: reception, packing, identification of recipient, shipping request
-Upgrade: design, implementation and tests of modifications to an existing subsystem
-Installation: unpacking, assembly and stand-alone test of a delivered subsystem
-Integration: installation of a delivered sub-system into a higher level component. H/W: mechanical interface, alignment, cabling, electronic cabinet. S/W: communication, remote control.
-Test: reach goals defined in functional specifications.
-Commissioning: performance control, calibrations, completion of user manual and maintenance manual.

2.2 Name Achronyms

GFI=G. Fillippi
JNA=J. Navarrete
KWI=K. Wirenstrand
LNO=L. Noethe
MCU=M. Cullum
MDU=M. Duchateau
MMO=M. Mornhinweg
MRA=M. Ravensbergen
MSA=M. Sarazin
PGI=P. Giordano
PDU=Ph. Duhoux
RAM=R. Amestica
SMO=S. Moureau
SSA=S. Sandrock
VSB=VLT Site and Building Dept. (J. Eschewey)

3 Task List

Table 1 shows a tentative schedule established on the basis of the VLT Integration planned activities as of November 1997 (memo by J. van de Spreng) in which the ASM has to be integrated and tested during February 1998. Some schedule slippage is however possible for the Vaisala meteorological station as we still do not have firm delivery date from contractor.

The ASM integration is made of three steps (Garching-La Silla-Paranal) with the idea of moving to the next step only after having completed all achievable activities in the current one. The La Silla step was made necessary to cross-check the ASM-DIMM with the La Silla automated DIMM (DIMM2) before integration at Paranal.

PLACE	TASK	RESP.	START DATE	MAX DURATION	SUPPORT
GARCHING	DIMM Tel. Ctrl. Sys. H/W Devpt.	MRA	1/12/96	4 months	
GARCHING	DIMM Tel. Motor Upgrade	MRA	1/12/96	4 months	
GARCHING	DIMM Tel. Ctrl. Sys. S/W Devpt.	SSA	1/10/96	8 months	RAM
GARCHING	DIMM Tel. Motor Shipment	MRA	15/04/97	1 week	
GARCHING	DIMM Tel. H/W Shipment	MRA	1/05/97	1 week	
GARCHING	DIMM TCCD Head Procurement	MCU	19/03/97	1 week	
GARCHING	DIMM TCCD Ctrl. Sys. H/W Devpt.	SMO	7/03/97	1 month	
GARCHING	DIMM TCCD Ctrl. Sys. S/W Devpt.	SSA	1/03/97	3 months	PDU
GARCHING	DIMM TCCD H/W Shipment	?	1/05/97	1 week	
GARCHING	ASM Workstation Procurement	GFI	1/04/97	1 month	
GARCHING	ASM S/W Devpt.	SSA	1/10/96	8 months	RAM
GARCHING	Particle Counter Procurement	PGI	1/04/97	3 months	MSA
GARCHING	Meteo Station Procurement	MSA	1/04/97	3 months	
LA SILLA	DIMM Tel. Motor Integration	MMO	1/05/97	2 weeks	MRA
LA SILLA	DIMM TCCD Integration	JNA	21/05/97	1 week	
LA SILLA	DIMM Tel. Ctrl. Sys. Test	SSA	1/06/97	2 weeks	RAM
LA SILLA	DIMM TCCD Ctrl. Sys. Test	SSA	15/06/97	2 weeks	PDU
LA SILLA	DIMM S/W Test	SSA	1/06/97	4 weeks	RAM
LA SILLA	DIMM Commissioning	JNA	1/12/97	4 weeks	RAM, MSA
LA SILLA	DIMM Packing and Shipment	JNA	15/01/98	1 week	
PARANAL	DIMM Enclosure Installation	JNA	15/05/97	2 weeks	VSB
PARANAL	DIMM Local Control Room Installation	VSB	1/02/98	2 weeks	
PARANAL	Meteo Mast Extention Installation	VSB	1/03/98	2 weeks	
PARANAL	Meteo Station Installation	JNA	15/03/98	2 weeks	VSB+Vaisala
PARANAL	Airborne Particle Counter Installation	JNA	15/03/98	2 weeks	VSB+Vaisala
PARANAL	DIMM H/W Installation	JNA	16/02/98	2 weeks	VSB
PARANAL	North/South Detector Installation	MDU	1/03/98	2 days	JNA
PARANAL	Enclosure S/W Integr. (into DIMM)	RAM	15/12/97	2 weeks	SSA
PARANAL	Meteo Station S/W Integr. (into ASM)	RAM	01/01/98	2 weeks	SSA
PARANAL	ASM Workstation installation	RAM	1/03/98	3 days	SSA
PARANAL	Install ASM S/W	RAM	04/03/98	2 days	SSA
PARANAL	Test ASM S/W	RAM	06/03/98	2 weeks	JNA+SSA
PARANAL	ASM S/W Integration (into VLT-S/W)	RAM	15/03/98	2 days	SSA, KWI
PARANAL	ASM S/W Tests	RAM	03/02/98	2 weeks	JNA
PARANAL	ASM Commissioning-Calibrations	JNA	01/04/98	1 week	RAM, MSA
PARANAL	ASM Commissioning-Verification	JNA	07/04/98	7 weeks	RAM, MSA
PARANAL	Local Temp. Pred. S/W Test	MSA	15/04/98	1 week	RAM+(LNO?)

Table 1: Task List

3.1 ASM Major Component List

Documents generated by tasks responsibles should follow the product structure numbering given below:

17410 Seeing and Sky Monitor			
17411 Tower	OK	Capodimonte	1994
17412 Retractable enclosure	OK	Manufacturing (Fa. Halfmann)	1997
17413 Seeing and Coherence Monitor	Prototype	Upgrade (Internal)	1997
17414 All Sky (AS) Cloud monitor	None	Design (MSA)	1998?
17414 Extinction Monitor	Prototype	Design (MSA)	1998
17415 Infrared Emissivity Monitor	Pre-design	Manufacturing (?)	1998
17420 Ground Meteorological Station			
17421 Mast	10 m	Extend to 30 m (VSB)	1997
17422 Temperature sensors	old	Upgrade/Duplicate (Vaisala)	1998
17422 Wind Speed and Dir. Sensors	old	Upgrade/Duplicate (Vaisala)	1998
17422 Relative humidity Sensors	old	Upgrade/Duplicate (Vaisala)	1998
17422 Pressure Sensors	old	Upgrade (Vaisala)	1998
17423 Airborne Particle Counter	Proto	Purchase (Met One/Vaisala)	1998
17424 Seismometer	None	Purchase (MSA)	1998?
1742X Acoustic Sounder	Prototype	Cancelled for VLT	-
1742Y SCIDAR Profiler	Prototype	Considered for VLT (MSA/NHU)	1999
17430 ASM Control Hardware			
17431 DIMM Local Control Unit	OK	Integration (MRA)	1997
17432 DIMM Control Electronics Cabin	none	Build (VSB)	1998
17433 ASM Workstation	OK	Purchase (GFI)	1997
17434 DIMM Drive Hardware	OK	Upgrade (MRA)	1997
17435 DIMM TCCD Hardware	OK	Integration (SMO)	1997
17440 ASM Software			
17441 ASM Application Software	OK	Development (SSA-RAM)	1997
17442 ASM Modelling Software	ongoing	Feasibility (MSA)	1998
17443 ASM Global Prediction Software	ongoing	Pre-Operational (MSA)	1998
17444 ASM Local Prediction Software	started	Development (MSA)	1998

4 ASM-DIMM Upgrade

As detailed in Doc VLT-MAN-ESO-17441-1404 (Astronomical Site Monitor DIMM Upgrade Mission, Test Report, 21 Aug.97), the telescope and detector have been successfully upgraded in August 1997. However a number of software problems were detected and were solved only in the NOV97 pre-release of the VLT-TCCD software which was temporarily compiled on the MAY97 VLTROOT to allow commissioning in December. The full upgrade of the ASM S/W is foreseen during the integration at Paranal.

5 ASM-DIMM Commissioning

5.1 Recovering operational status

The following operations were executed by JNA with the remote support of RAM, MRA, SSA and MSA and the local help of MMO (plus kind support of other La Silla SMs when needed).
-The TETA motor showing a strong backlash has been replaced by one spare with a new harmonic drive.
-The ETA encoder, defective on one of the A/B outputs, has been replaced (could have been damaged during August snowstorm).
-The ETA/TETA crimped connectors have been replaced by soldered connectors.
-The cooling circuit has been extended to the outdoor cabinet housing the telescope control LCU.
-The optical alignment of the system telescope/transfer optics/detector has been adjusted.
- Software (RAM): Some bugs detected during the commissioning were fixed: i) asmtel encoder LOW-AMPLITUDE not trapped anymore, ii) zenith distance updated every time a sequence is started.
-Software (RAM): Dimm logging enhanced, now the dimm.log file also contains the elongation estimation on each direction (x/y) and of both spots.

5.2 Pointing Model Installation

From offset coordinates measured in the final mount position on several objects in the southern half-sky, the pointing model parameters were computed. Pre-setting was then accurate enough for all objects with negative hour angles to fall into the usefull field (as requested by specifications). Pre-setting of objects with positive hour angles was not as good, pointing model can probably be optimized, this will be performed when in final position at Paranal.

5.3 Automation Subroutines

The functions requested for an automated operation (Object Centering, Autoguiding, Star selection, Sun elevation calculation) have been cuccessfully tested. Only in one case was an improper star selected, the selection algorithm will be revised accordingly (RAM).

5.4 Adjustment of variable parameters

Image selection parameters have been adjusted according to the typical image quality provided by this telescope, the final parameter table is:

Saturation Limit	(kr)	4000	"A/D count"
Valid Pixels Limit	(kp)	3	"number"
S/N Ratio Limit	(SNmin)	5	""
Spot Elongation Limit	(ke)	60	"%"
Spot Decentering Limit	(kf)	1	"Spot fwhm"
Gaussian Clipping Limit	(kc)	3	"rms of distr."
Rejected Exposures Limit	(kN1)	10	"%"

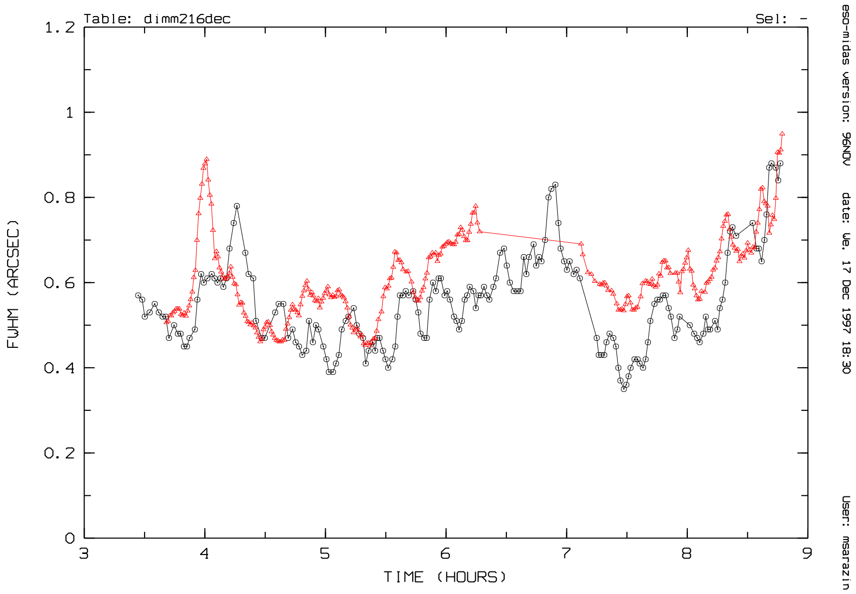

Figure 1: ASM-DIMM/DIMM2 Comparison: December 16. Circles = DIMM2-La Silla, Triangles = ASM-DIMM

Clipped Exposures Limit	(kN2)	3	"%"
Statistical Error Limit	(ks)	4	"1/sqrt(N-1)"

The following structural parameters have been used:
-ccd noise floor = 100
-display-enable = 0
-instrumental noise (X and Y) = 0.01 (default, real value to be measured at Paranal)
Also to be measured after integration at Paranal: the actual TCCD pixel angular size. For that purpose, a physical double star of known separation will be imaged.

Each seeing value is computed over 400 short exposures in about 50 seconds.

5.5 Comparison with DIMM2-La Silla

DIMM2 is on a tower at 5 m above ground while ASM-DIMM is a 2 m above ground close to the DIMM control room. Because of local turbulence, it was not expected to obtain a permanent perfect agreement. However, because of the stochastic nature of turbulence, a constant disagreement would have indicated the presence of some unwanted noise term: this was the aim of the comparison. As seen on Fig. 1, Fig. 2 and Fig. 3, no systematic trend is observed. Higher values of ASM-DIMM are thus attributed to turbulence close to ground. Unexpected lower values of ASM-DIMM are believed to be due to exposure time (10 ms) averaging when high altitude layers are moving very fast, the recommended exposure time at Paranal is thus 5 ms (DIMM2-LASILLA has 8 ms, minimum achievable with the mechanical shutter). Two more comparison nights have been performed with a 5 ms exposure time: Fig. 4 and Fig. 5 shows that ASM-DIMM seeing is not anymore lower than DIMM2 seeing, but higher or equal, as expected from local situation.

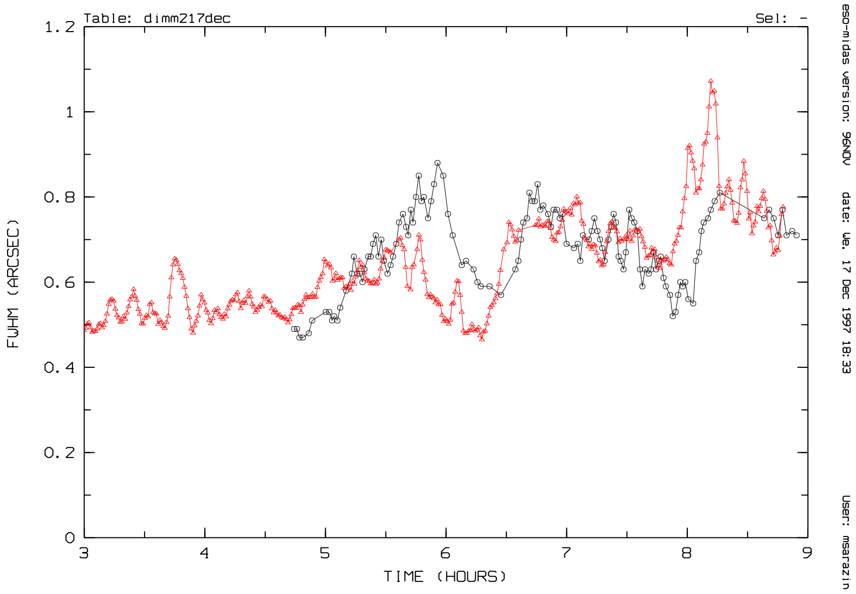

Figure 2: ASM-DIMM/DIMM2 Comparison: December 17. Circles = DIMM2-La Silla, Triangles = ASM-DIMM

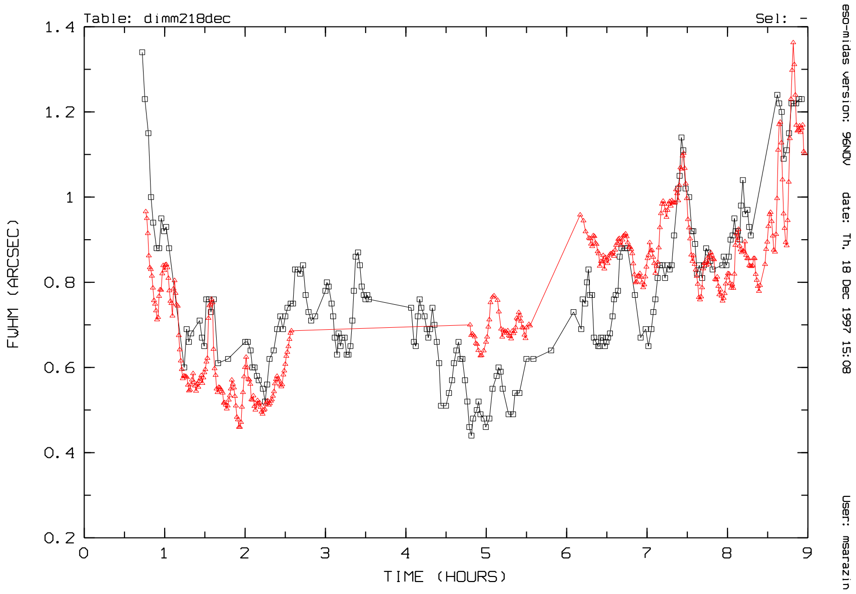

Figure 3: ASM-DIMM/DIMM2 Comparison: December 18. Squares = DIMM2-La Silla, Triangles = ASM-DIMM

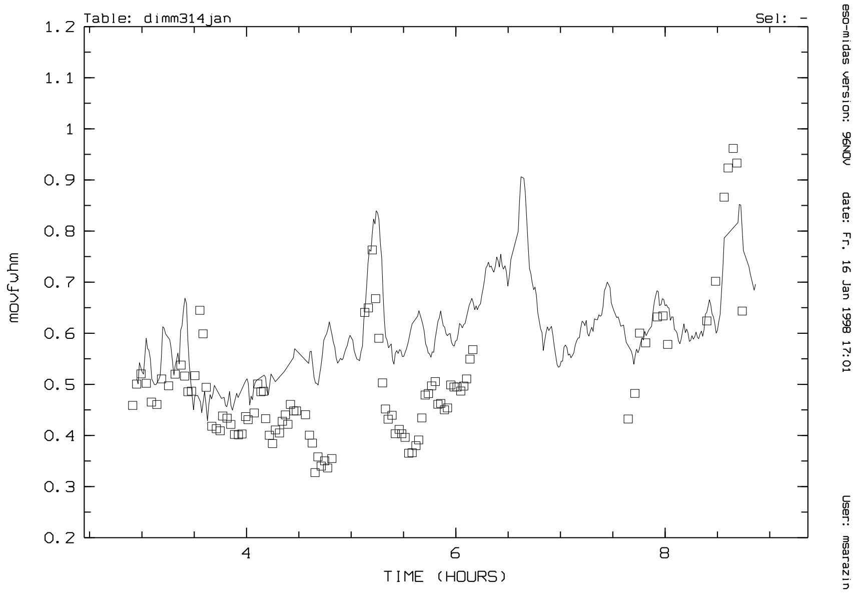

Figure 4: ASM-DIMM/DIMM2 Comparison: January 14. Squares = DIMM2-La Silla, full line = ASM-DIMM

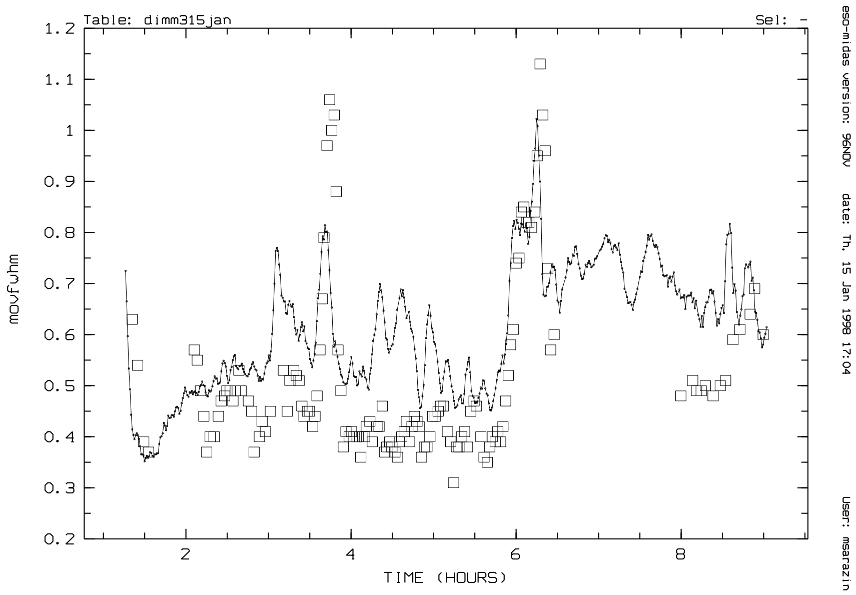

Figure 5: ASM-DIMM/DIMM2 Comparison: January 15. Squares = DIMM2-La Silla, full line = ASM-DIMM

6 Paranal Tasks

6.1 Integration and Testing

"Install ASM WS and DIMM" 3d D
1d - physical installation (WS, telescope, LCUs)
1d - HP-UX and Rtap installation
1d - VLTSW release installation + config

"Install ASM SW" 2d D
1d - Install code
1d - Global configuration

"Test ASM" 4d D - 5d N
2d - Meteo integration
2d - Enclosure integration
1d - DIMM alignment
1d - Pointing model
3d - Operation/Configuration

"Integration with VLT SW" 2d D
1d - TCS integration
1d - On-line archive I/F

6.2 Commissioning

tbd later on