E U R O P E A N   S O U T H E R N   O B S E R V A T O R Y

Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral

Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

VERY LARGE TELESCOPE

VLT-Software

Astronomical Site Monitor

DIMM Upgrade Mission

TEST REPORT

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		3	removed daily logs
		4	added time axis scaling
		8	extended conclusions

TABLE OF CONTENTS

1 INTRODUCTION **7**

1.1 Purpose 7

1.2 Reference Documents 7

1.3 Abbreviations and Acronyms 7

2 TEST PLAN **9**

3 DAILY LOGS **10**

4 TELESCOPE AXIS CONTROL LOOPS **11**

5 TELESCOPE POINTING MODEL **19**

6 DIMM CCD IMAGE SAMPLES **21**

7 ASM RELEASE 1 (JUL97) MODULE VERSIONS **24**

8 CONCLUSIONS **26**

1 INTRODUCTION

1.1 Purpose

The present document contains the report of the ASM control-software test period at La Silla from 01 to 31 July 1997, a.k.a. DIMM Upgrade Mission. This test is covering the DIMM part of the ASM for seeing measurements. Other components as meteorological station, telescope enclosure, etc. are not included.

A commissioning period will follow directly after, in order to verify correct operation, and to compare results with the existing La Silla DIMM.

Finally the system shall be moved to Paranal.

1.2 Reference Documents

Further information can be found in following documents:

[1] **DIMM Upgrade Plan**	VLT-SPE-ESO-17410-1174, 2.0
[2] **ASM Control Software Functional Specification**	VLT-SPE-ESO-17441-1175, 1.0
[3] **ASM Software Maintenance and Operations Manual**	VLT-MAN-ESO-17441-1404 (in preparation)

1.3 Abbreviations and Acronyms

ASM	Astronomical Site Monitor
CCD	Charge Coupled Device
CCS	Central Control Software
CPU	Central Processing Unit
DB	Database
DIMM	Differential Image Motion Monitor
HW	Hardware
I/F	Interface
I/O	Input/Output
LAN	Local Area Network
LCC	LCU Common Software
LCU	Local Control Unit
N/A	Not Applicable
RTAP	Real Time Application Platform
SW	Software
TBC	To Be Confirmed/Clarified
TBD	To Be Defined
TCCD	Technical CCD
TCS	Telescope Control Software
TIM	Time Interface Module
TRS	Time Reference System
VLT	Very Large Telescope
WS	Workstation

2 TEST PLAN

- **WEEK1:**
  - Workstation installation
  - Telescope set-up
  - Cabinet integration
  - CCD integration
  - Telescope initialization
  - ***FIRST LIGHT***

- **WEEK2:**
  - Telescope Control Panel (STOP TRACKING)
  - Control Loop Adjustment (THETA)
  - Pointing Model Implementation (ETA-THETA ---> ALPHA-DELTA)
  - ***ALL SKY CORRECT PRESETTING***

- **WEEK3:**
  - Auto-centering Implementation (CCD axes <-> Telescope axes)
  - Choice of Centroiding Algorithm
  - Image Quality Checks Implementation
  - Measurement Sequence (400 expos)
  - ***FIRST SEEING MEASUREMENTS***

- **WEEK4:**
  - Star Catalogue
  - Sun Position/Hour Angle/End of Night
  - Close the Loop (seeing/new star/seeing/...)
  - Start Comparisons with DIMM2
  - Train Operator
  - ***DIMM OPERATIONAL IN SOUTH HALF-SKY***

3 DAILY LOGS

The daily logs contain a brief summary of the activities of a day and the system status at the end of the day. Not included here are all detailed logs written by the individual persons, system log-files, night-session logs etc.

In this document version, the text of the daily logs (day 1 to 33) has been removed. It is still available in the issue 1, e.g. with anonymous FTP from *ftp://te1.hq.eso.org/vlt/pub/tmp/asm-tre-1405-1.ps.gz* .

The actual mile-stones of the test period were as follows:

- Day 8 - first light
- Day 14 - telescope correct presetting/tracking with pointing model
- Day 24 - first seeing measurements with autoguiding
- Day 31 - DIMM operational in south half-sky in automated mode

Due to bad weather in the last days it was unfortunately not possible to test the whole system in final version on the sky. As evident from the simulated test of day 31, a problem concerning software system stability remains pending, but we are confident to solve it before start of the commissioning period.

Many thanks to all people involved in this mission!

4 TELESCOPE AXIS CONTROL LOOPS

The following plots show the position error (in *radian*) and velocity reference output (in *volts*) during tracking and the response to different tracking offsets.

Fig. 1 Eta tracking

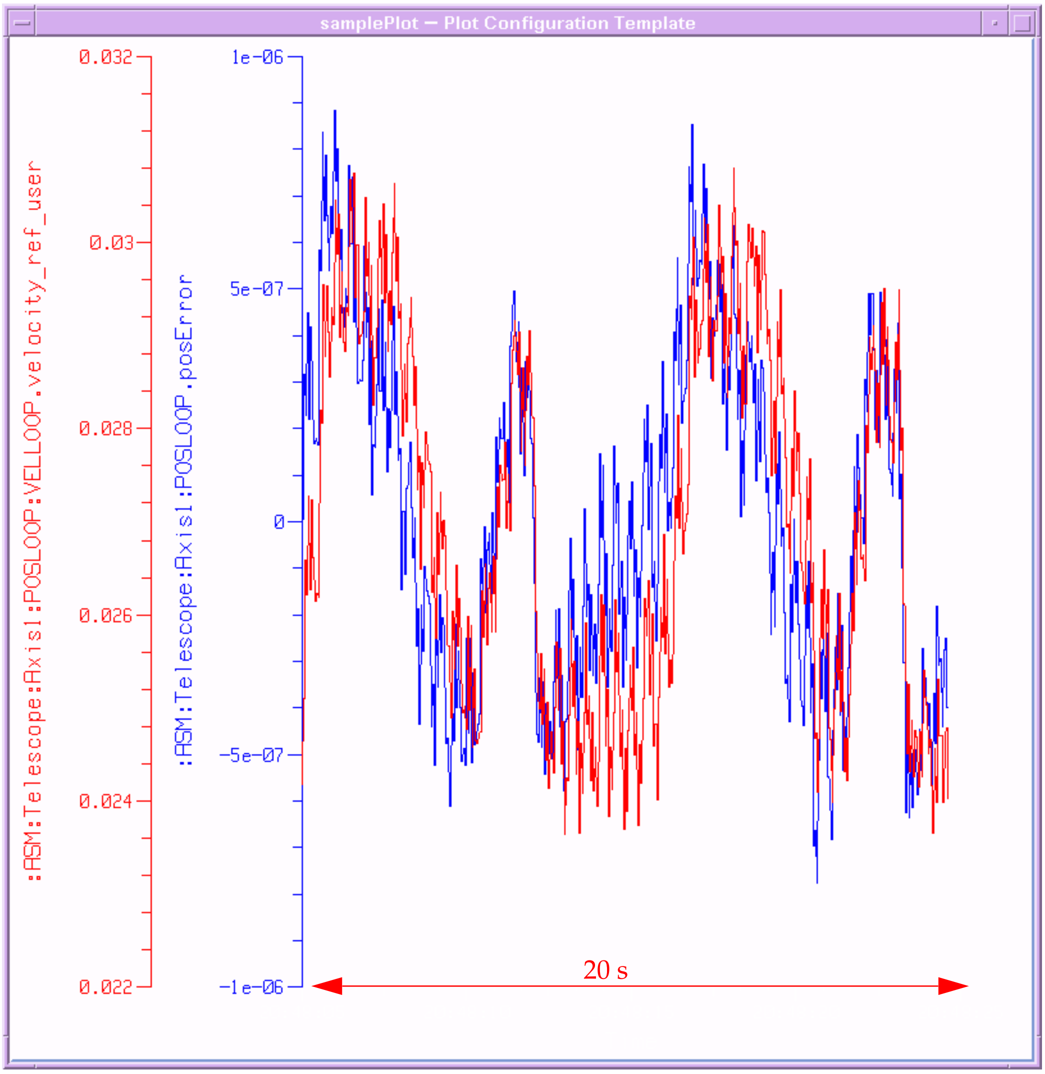


Fig. 2 Theta tracking

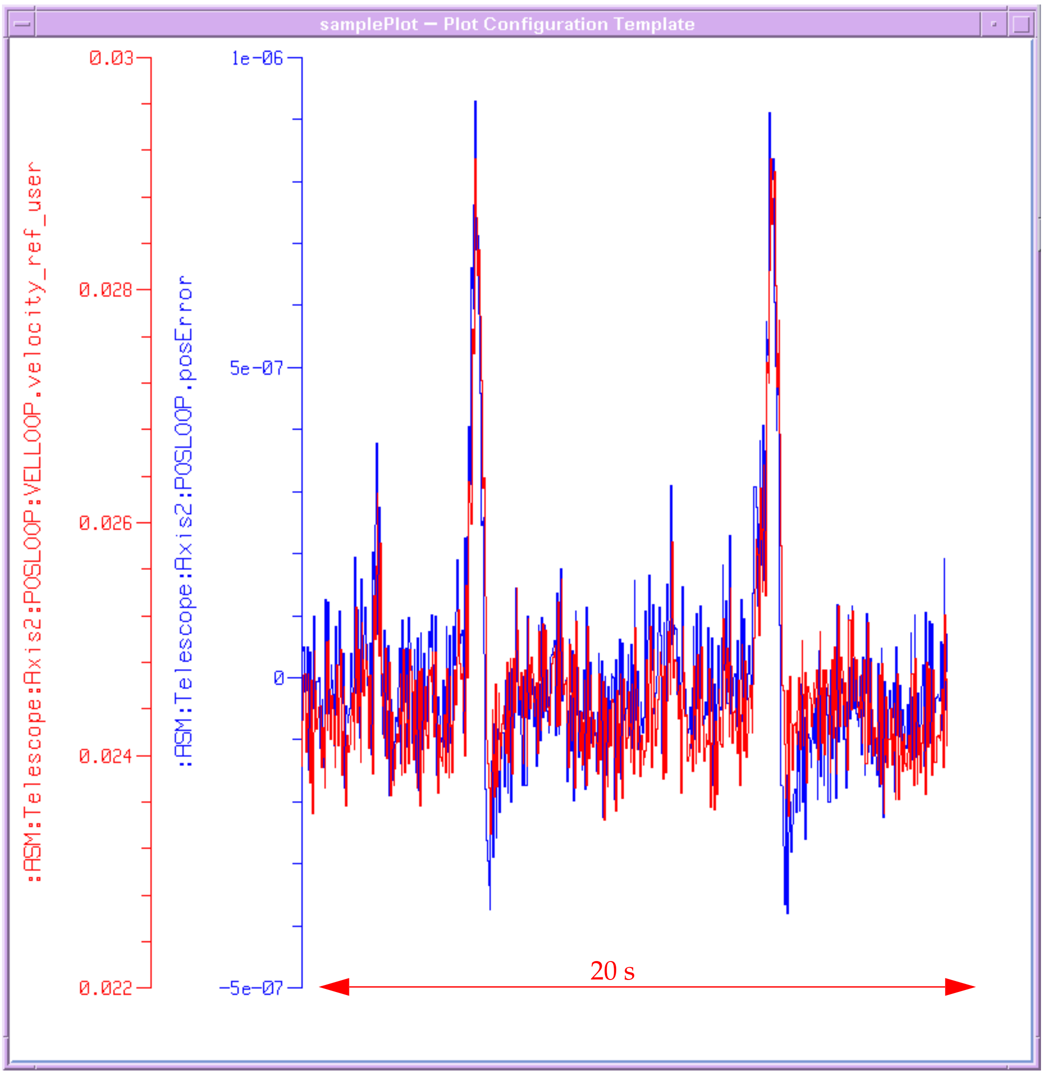


Fig. 3 Eta small offset (10 arcsec)

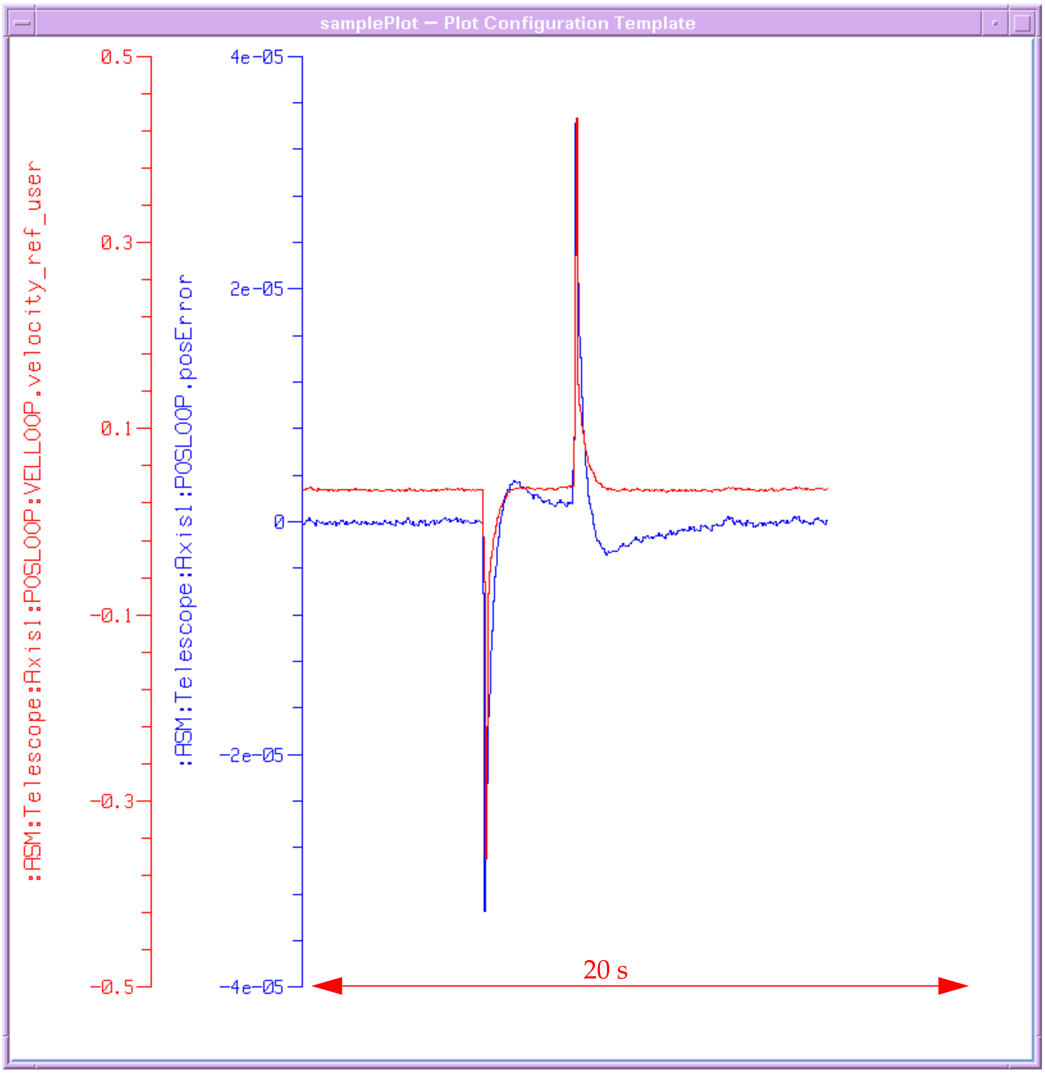


Fig. 4 Theta small offset (10 arcsec)

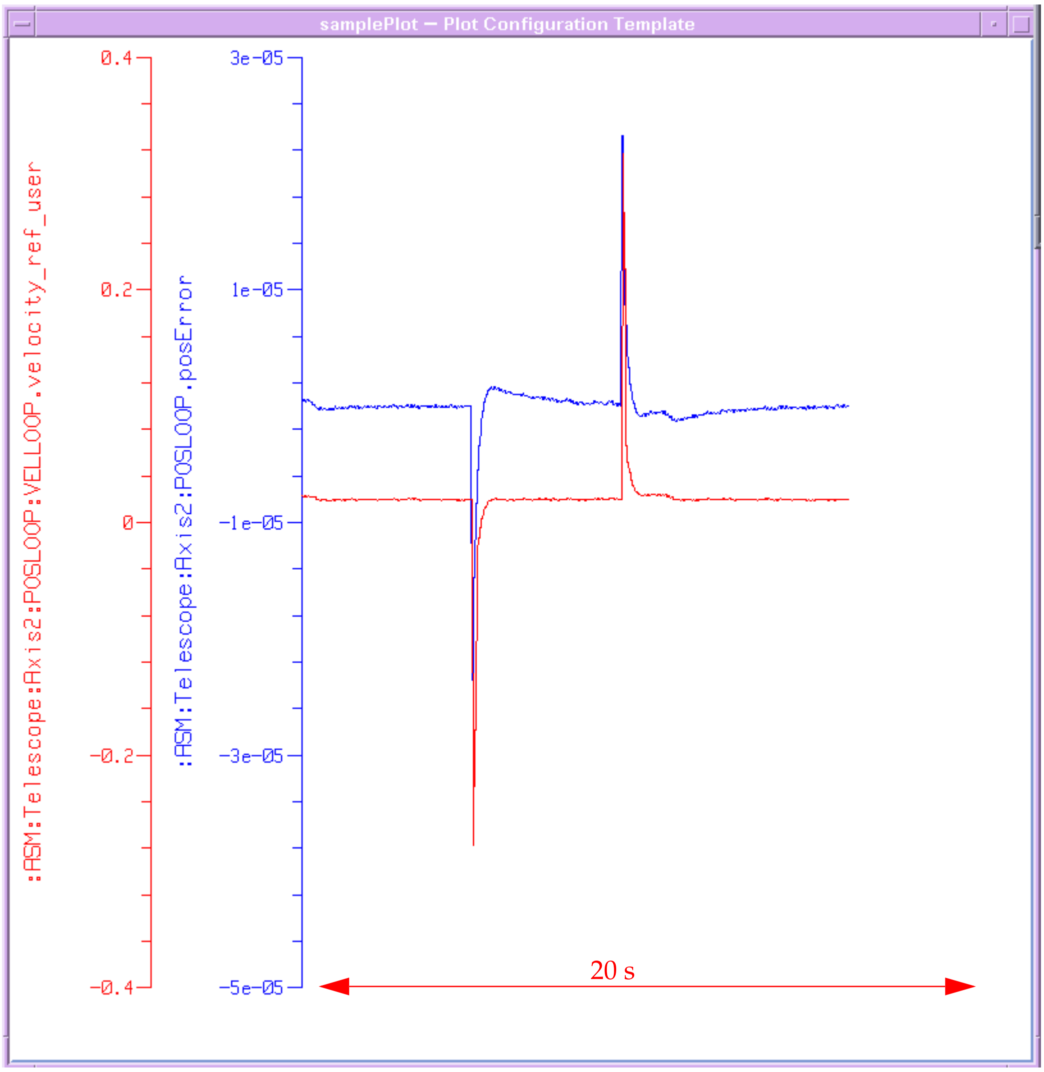


Fig. 5 Eta medium offset (1 arcmin)

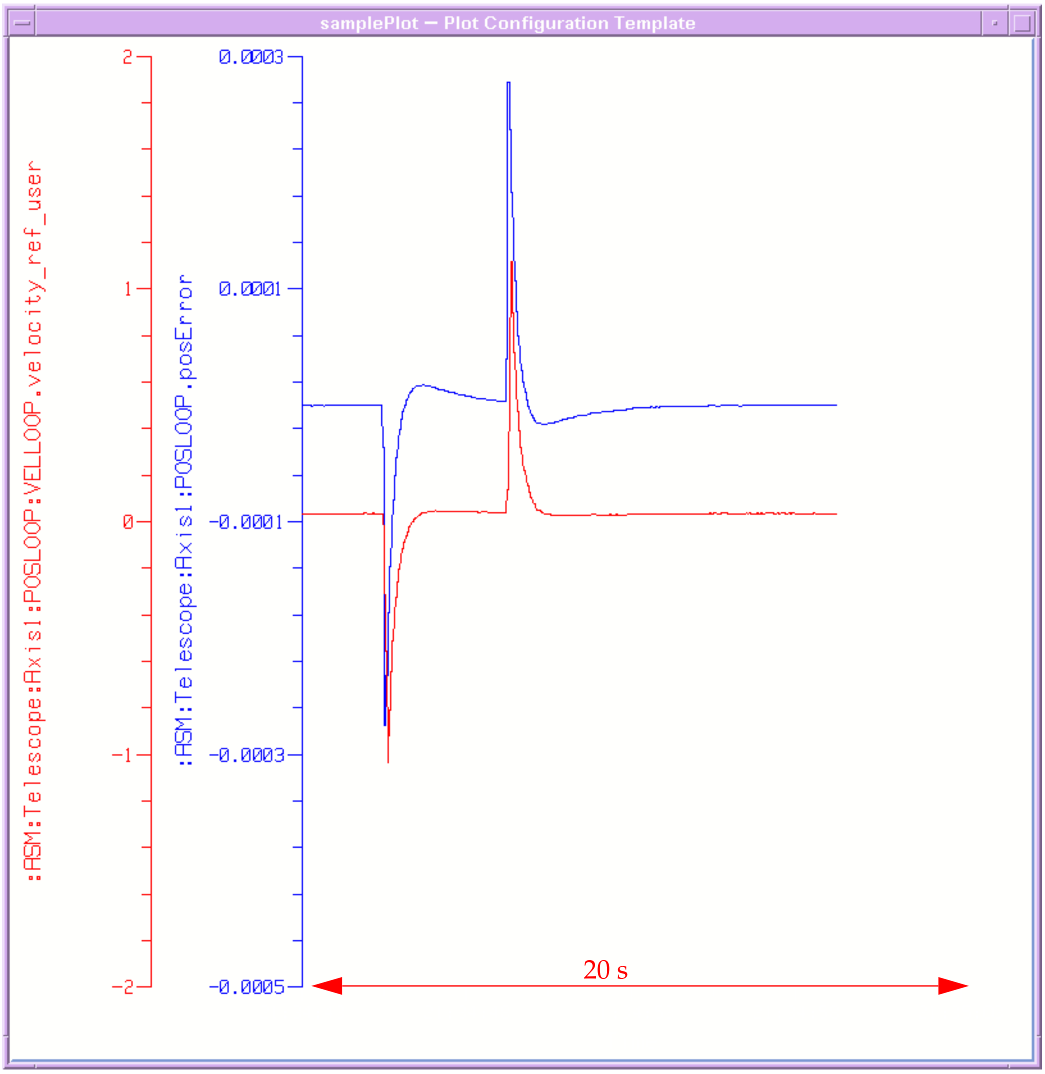


Fig. 6 Theta medium offset (1 arcmin)

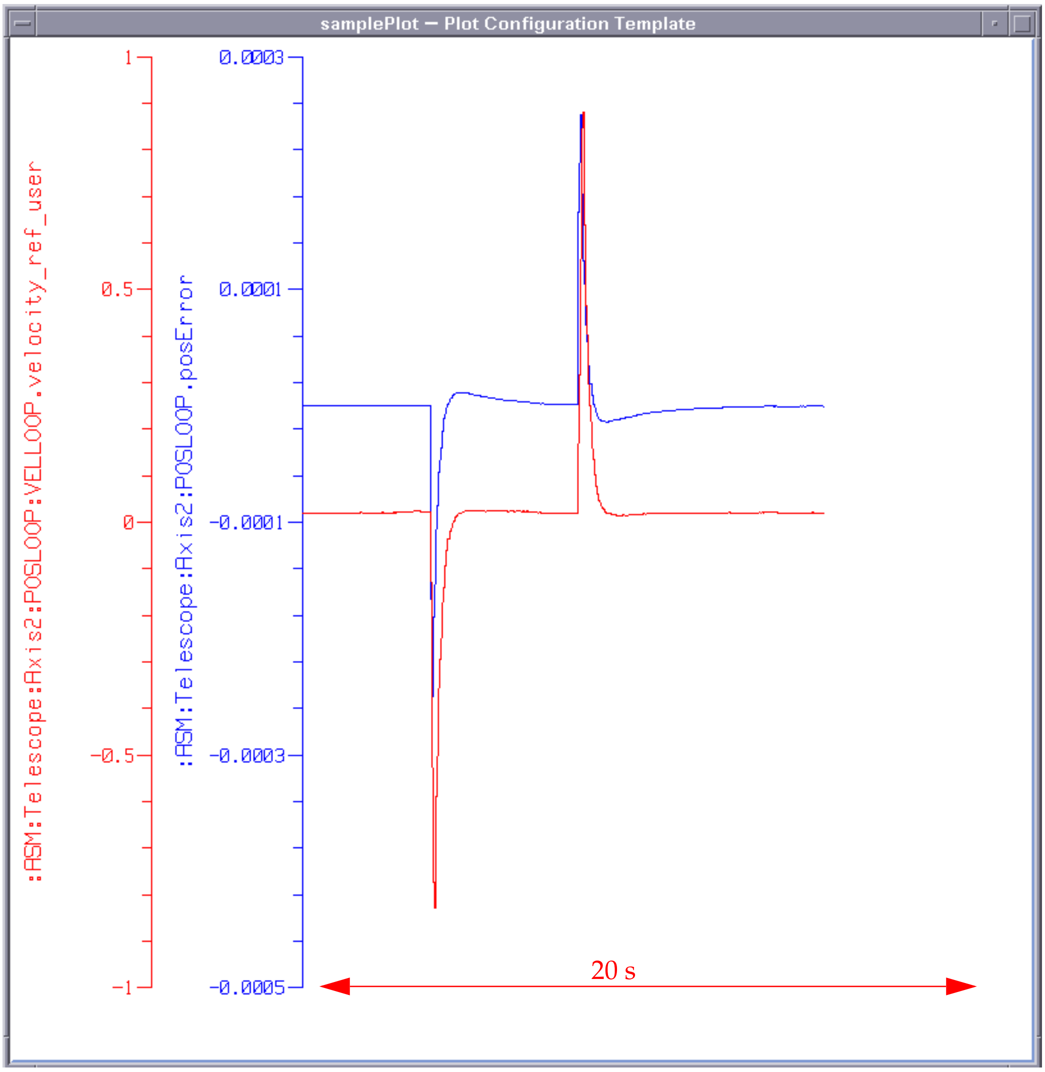


Fig. 7 Eta large offset (1 degree)

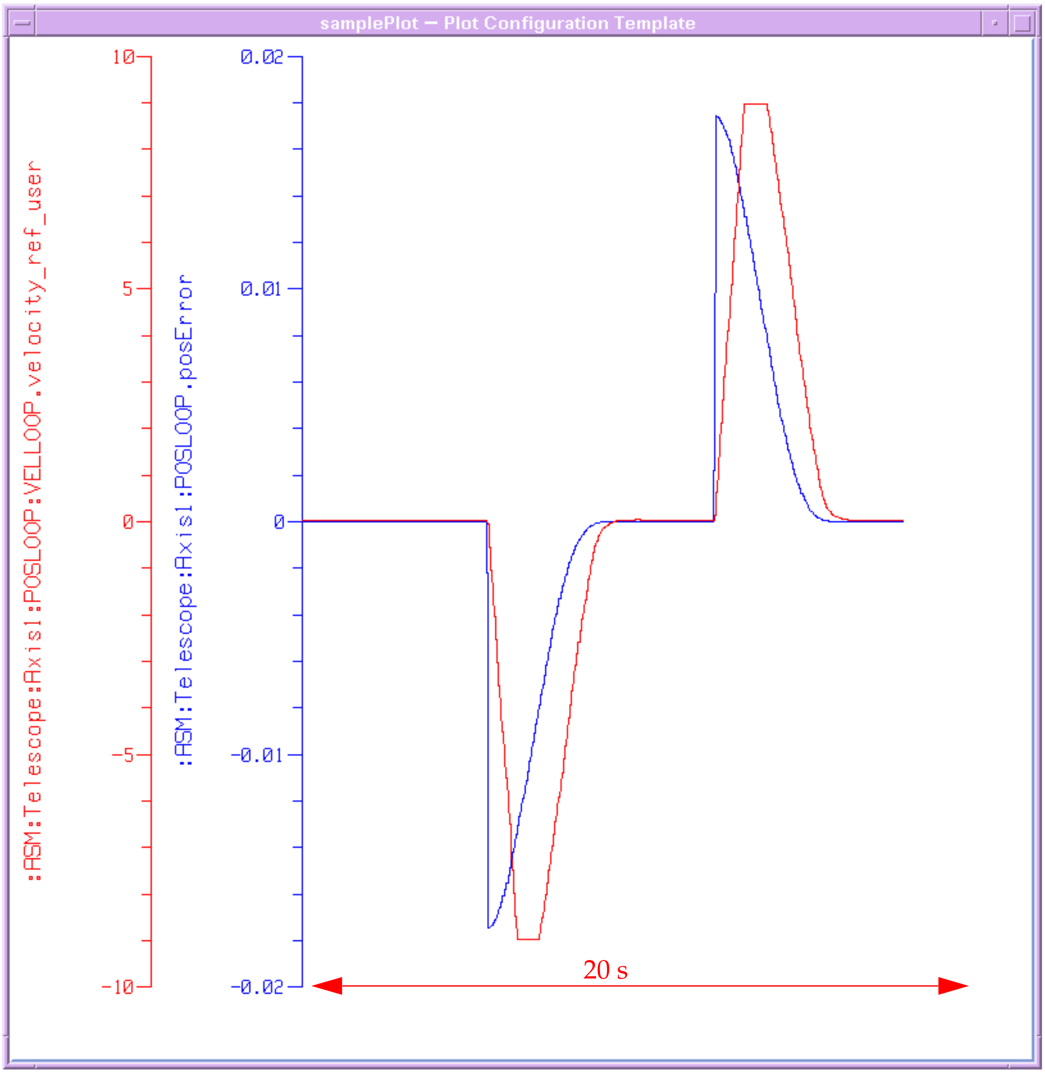
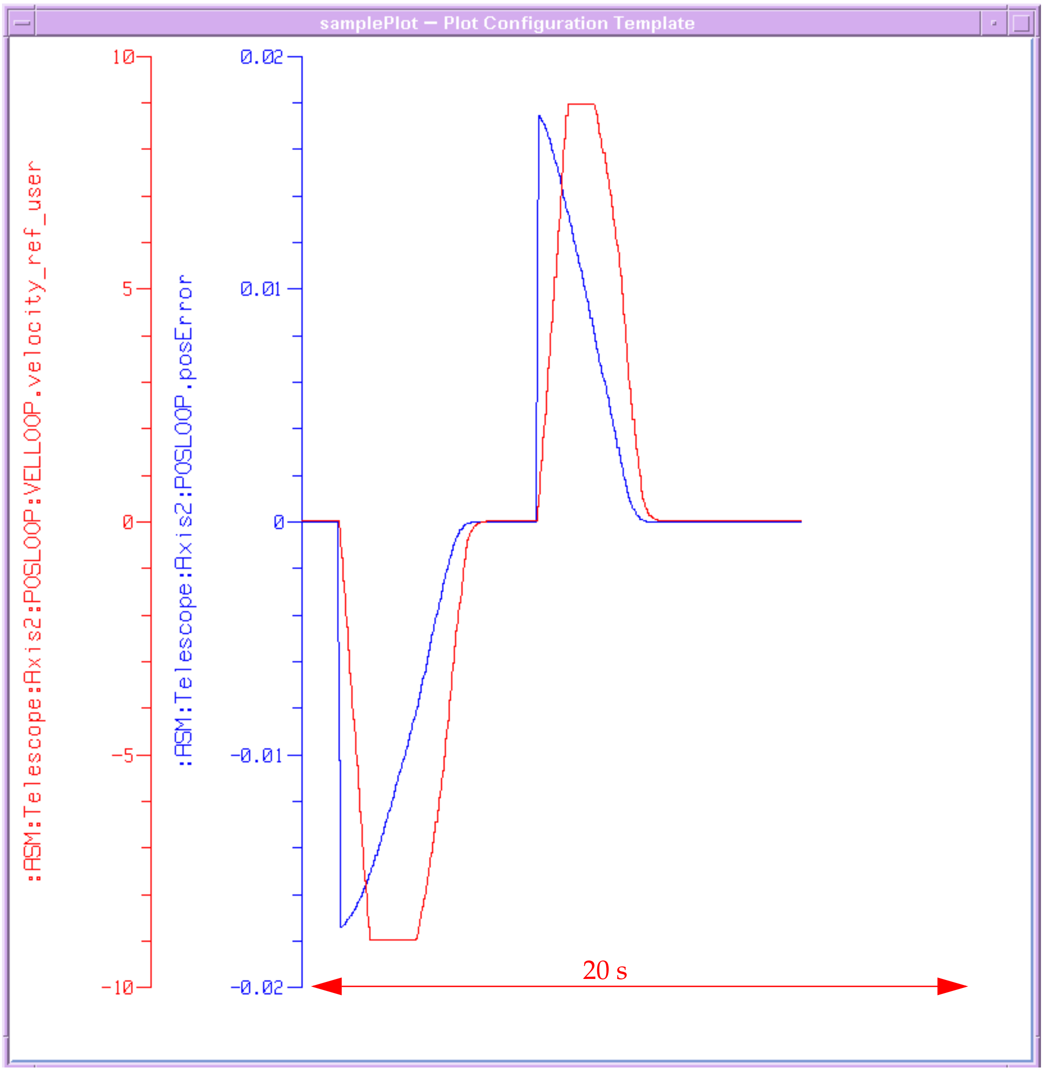


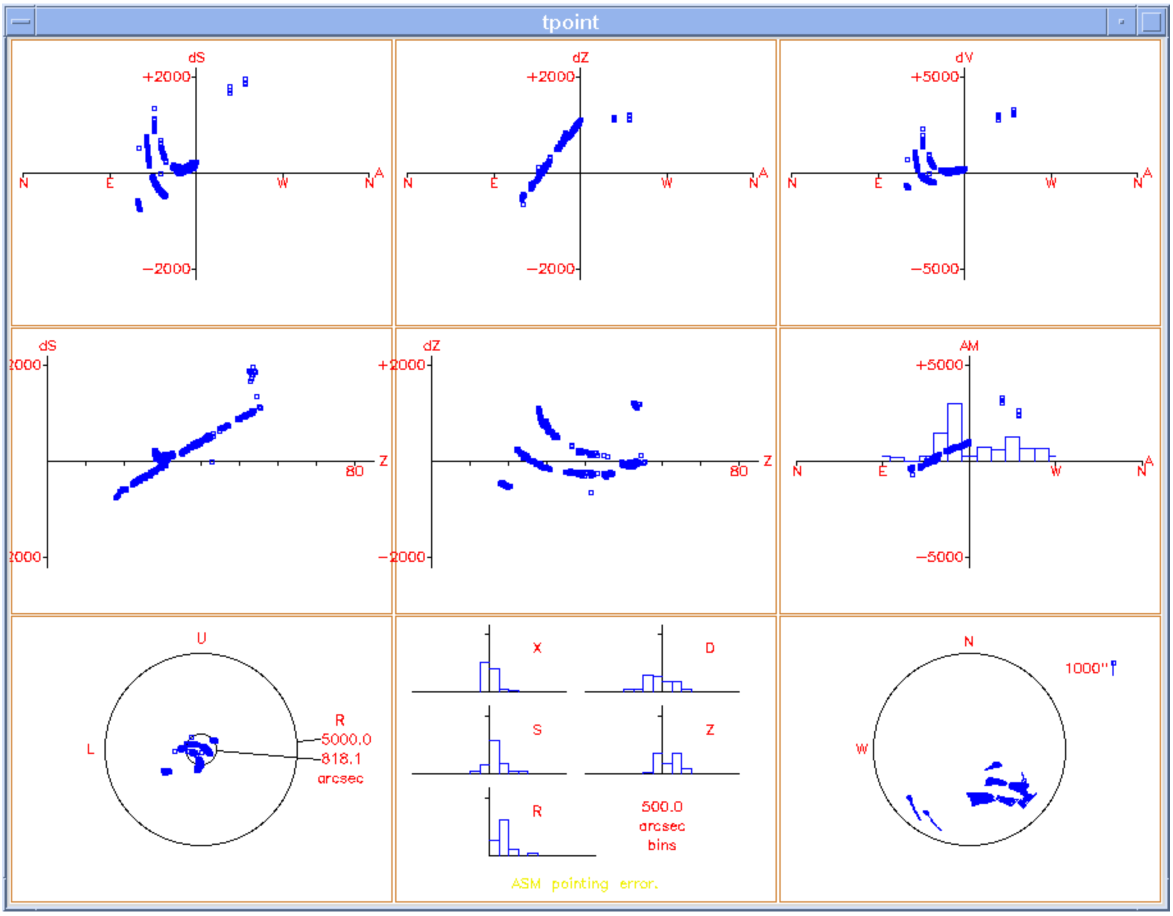
Fig. 8 Theta large offset (1 degree)



5 TELESCOPE POINTING MODEL

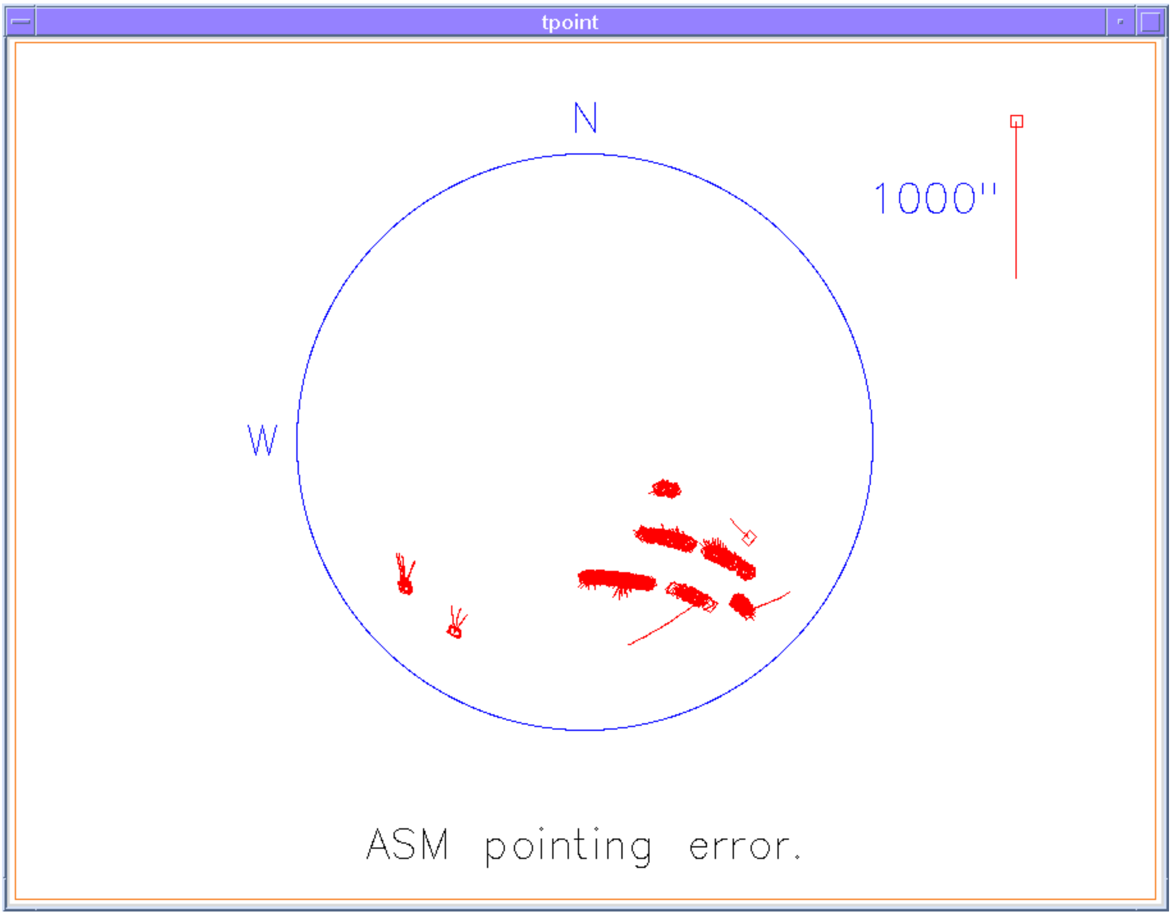
The following plots show the pointing data of the ASM telescope before and after the fitting process.

Fig. 9 Raw pointing data before fitting



Clearly visible are two separate groups of data, presumably caused by the backlash of the telescope axes, particularly theta.

Fig. 10 Final fitting of the model



The generated correction terms are as follows:

<CWP>: @lasm1:ASM:Telescope:Tracking:axes:asm:pointing
<ATTRIBUTE>: correctionTerms <TYPE>: Table <REC>: 0 - 19 <FIELDS>: 0 - 4
“ACEC” 0 1 0 ““
“ACES” 0 1 0 ““
“AN” 1 1 -1137.03 ““
“AW” 1 1 1232.84 ““
“CA” 1 1 230.95 ““
“ECEC” 0 1 0 ““
“ECES” 0 1 0 ““
“IA” 1 1 2258.48 ““
“IE” 1 1 81.53 ““
“NPAE” 0 1 0 ““
“NRX” 0 1 0 ““
“NRY” 0 1 0 ““
“TF” 1 1 -43.54 ““
“TX” 1 1 88.76000000000001 ““

6 DIMM CCD IMAGE SAMPLES

Fig. 11 First-light image (with unaligned optics)

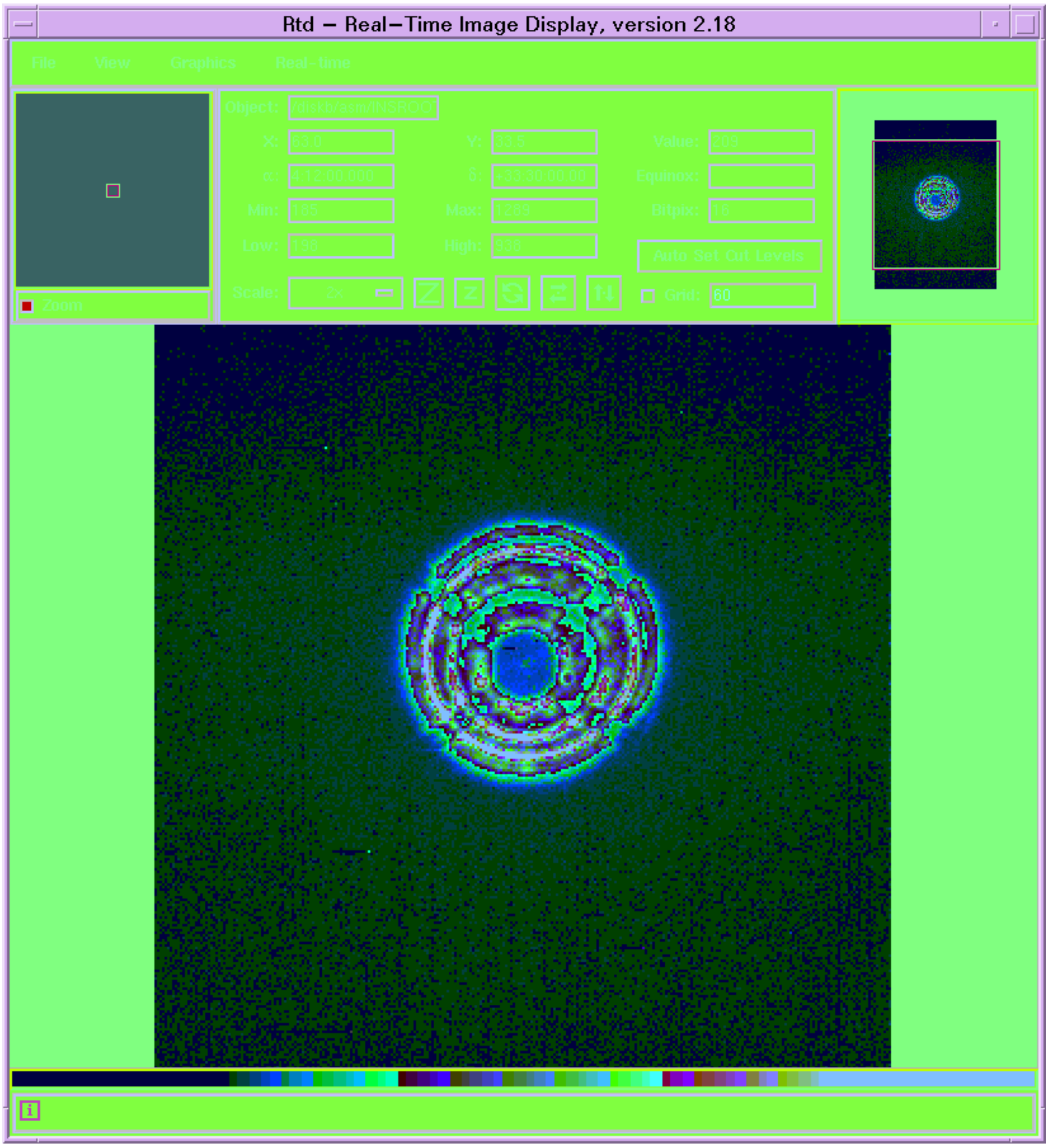


Fig. 12 Double star image during centering (full frame)

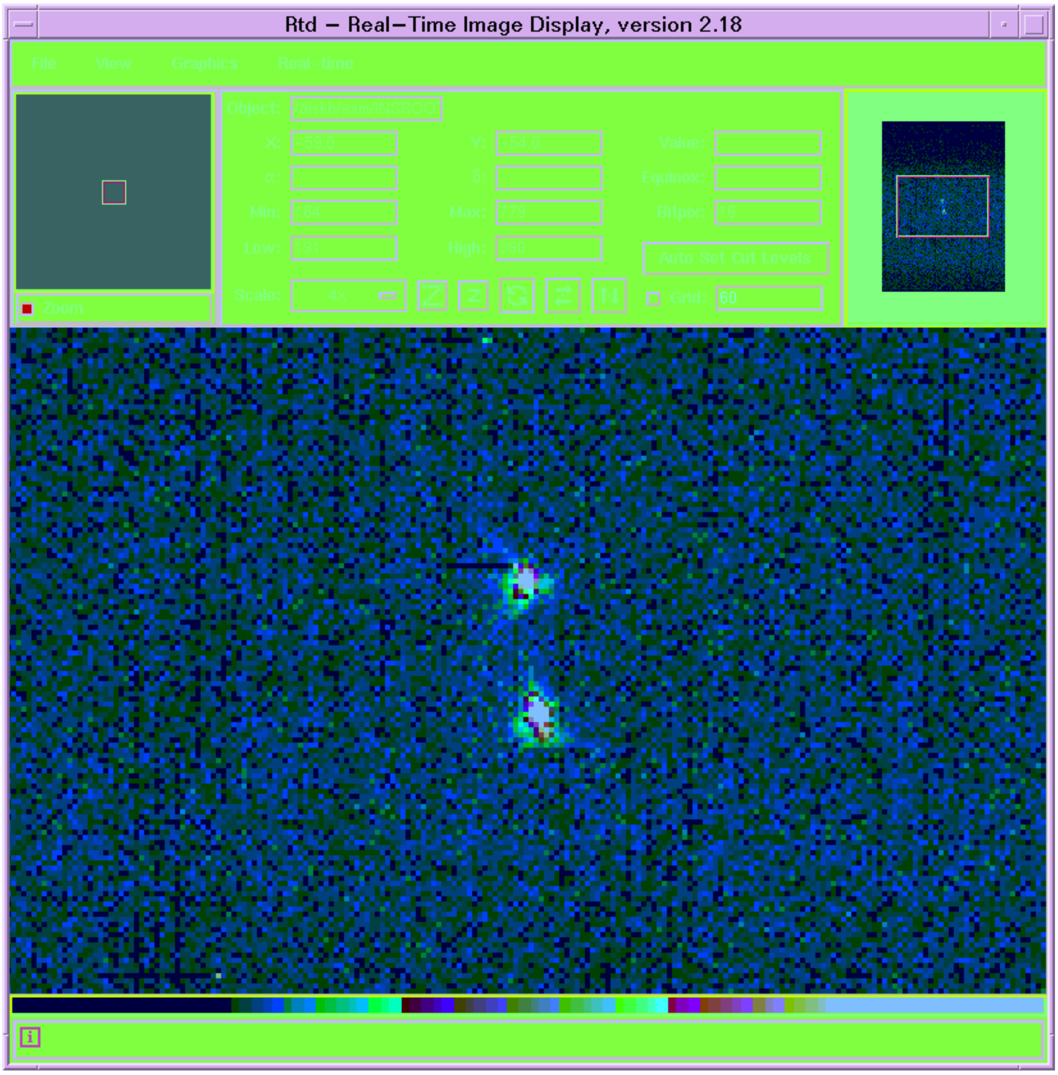
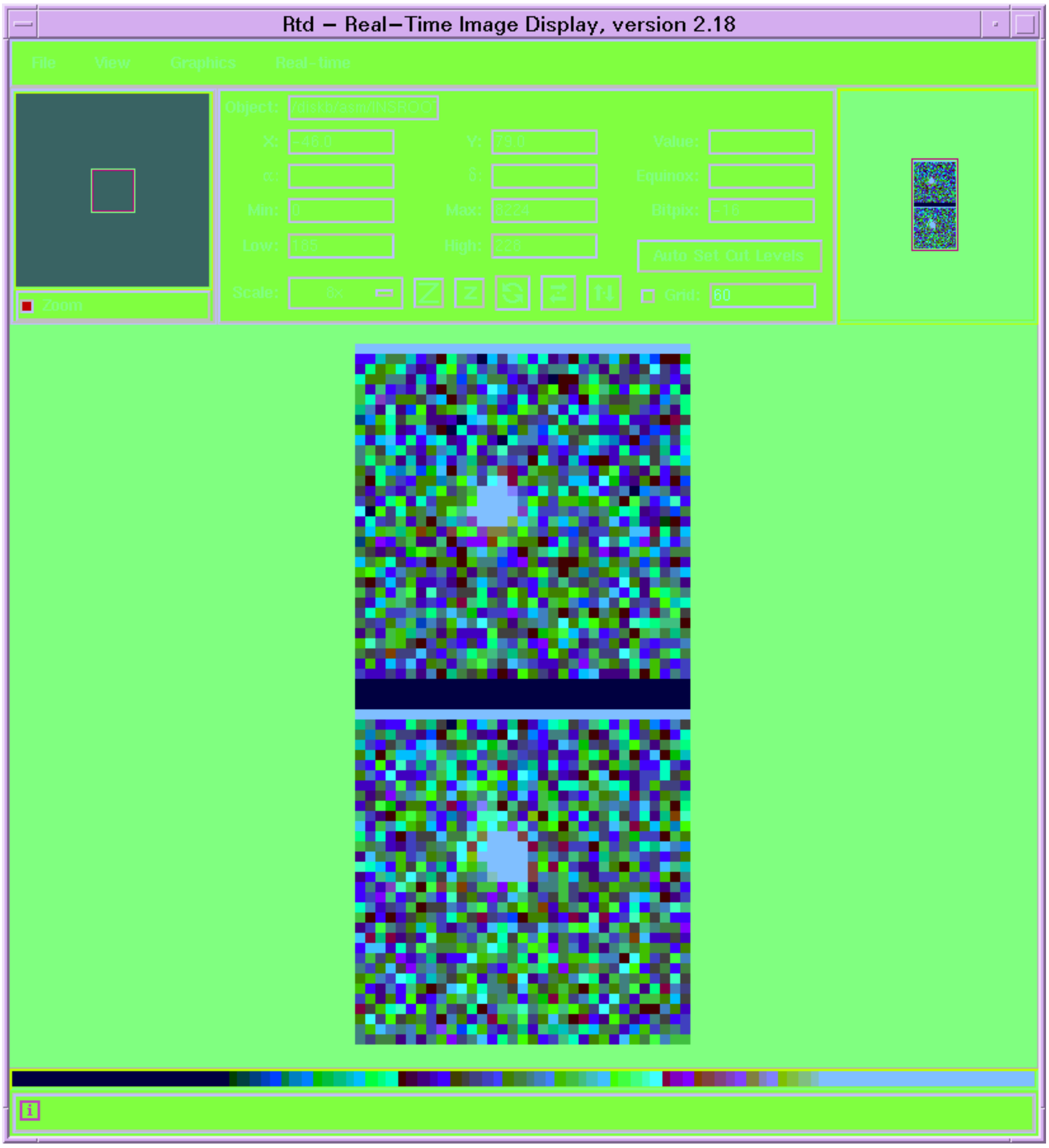


Fig. 13 Double star image during sequence (windowed)



7 ASM RELEASE 1 (JUL97) MODULE VERSIONS

The asmBUILD is the bootstrap module containing all versions to build up the complete software system. Included are upgrade versions of modules that are normally part of the VLT common SW release. Baseline is the VLTSW release MAY97.

```
#-*-Tcl-*-
#*******************************************************************************
# E.S.O. - VLT project
#
# "@(#) $Id: Modules.config,v 1.26 1997/08/02 01:02:50 vltsccm Exp $"
#
# who       when      what
# --------  --------  ----------------------------------------------
# ssandroc  09/06/97  created
#

#************************************************************************
#   NAME
#
#   SYNOPSIS
#
#   DESCRIPTION
#           This file contains the modules and versions to build the
#           ASM software. The order is significant.
#
#           Lines are interpreted as follows:
#
#           #...- comment
#           modname- use extract last version
#           modnameversion- extract this version from the archive
#
#   FILES
#
#   ENVIRONMENT
#
#   RETURN VALUES
#
#   CAUTIONS
#           This module (asmBUILD) itself shall not be in the list!
#
#   EXAMPLES
#
#   SEE ALSO
#
#   BUGS
#
#------------------------------------------------------------------------
#

#========
# CCS/LCC
#
eccs        1.65.1.1
evh         1.65.2.1
lcc3        3.53.2.1
too         1.19

#========
# CCD
#
# NOTE: do not change the order of modules!
# Otherwise it will take some headers from VLTROOT resulting in run-time error.
#
ccd         1.73
ccdit       1.62
ccdcon      1.80
```

```
ccdms       1.41.1.1
ccdos       1.57
ccdoss      1.15
ccdsht      1.30
ccdsha      1.21
ccdtel      1.22
ccdtla      1.22
ccdtmp      1.23
ccdtma      1.20
ccdrdt      1.46
ccdrda      1.44
ccdip       1.40


#========
# TCS
#
sla         1.10
acm         1.24
axis        1.40.1.1
trk         1.56

#========
# ASM
#

# Base level
asm         1.31
asmi        1.37

# Device level
asmcat      1.19
asmdim      1.57
asmmet      1.11
asmtel      1.45
asmten      1.12

# Top level
asmlcu      1.30
asmws       1.46

# Global level
asmINS      1.9
asmENV      1.34
asmei       1.5

# ___oOo___
```

8 CONCLUSIONS

This chapter summarizes the most important problems encountered during the test, together with possible future solutions.

- Software Problem Reports:

  A number of VLT common SW related problems have been detected. They have been submitted into the SPR system (# 970300 .. 970326).
- VLT software stability over long periods:

  The ASM is unique in the sense that it is supposed to run unattended without operator intervention, unlike the rest of the VLT systems. At the same time it uses the same core software. During this test period it could not directly be confirmed that such way of operation will not introduce stability problems. It has to be considered to add some kind of supervisor program on top, which checks the overall system status, and is able to react on stability problems.

  Tests after the test period showed that the problem is due to excessive LCU memory fragmentation, and not directly related to the application software. It is currently being fixed at LCC level.
- Telescope installations:

  The manual handset should not be mounted into the LCU cabinet. An emergency stop button should also be added. It would be useful if the power supply switch of the amplifiers is directly reachable at the front of the cabinet; when working with the software in simulation, the amplifiers should be switched off, leaving the LCU powered.
- Theta axis mechanical behaviour:

  The gear-box of the eta-drive has been replaced, and no problems have been encountered. The theta drive however showed considerable problems in pointing accuracy as well as tracking performance. For Paranal the mechanics of this drive should be checked.
- Pointing model:

  With a CCD field of about 5 arcmin, the DIMM telescope cannot reach the required pointing accuracy without a pointing model, regardless how precise the mechanical alignment can ever be done. However, even with a pointing model an all-sky accurate presetting can hardly be reached, the centering of some target stars will occasionally fail. Since the DIMM normally starts to track a new star before the meridian, the pointing accuracy in the east is much more important than that in the west. By corresponding selection of pointing measurements it could be confirmed that a sufficient accuracy (+/- 2 arcmin) is reachable. The used TPOINT program should be installed on the ASM workstation.
- Telescope axes backlash:

  This a *major* penalty for the pointing accuracy, as evident from the off-line analysis. Some effort should be invested into the mechanics to reduce it as much as possible.
- CCD LCU cabinet:

  The optical fibers are bended above their specs when closing the cabinet.
- FWHM calculation:

  The FWHM algorithm in ccdip should be revisited. After abandoning a precise but too slow version, the replacement function sometimes generates questionable results.
- EVH applications:

  Some callback installations of the evh-based asmwsControl application should be revisited. In general it has been found very difficult to test and debug within the evh framework. Some improvement concerning debugging tools is considered as urgent.

___oOo___