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VERY LARGE TELESCOPE

VLT

Astronomical Site Monitor

Control Software

Operation Manual

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1 INTRODUCTION

The ***Astronomical Site Monitor (ASM)*** provides information about the current meteorological data, outside air, seeing, cloud coverage etc. It also produces the data to be archived together with scientific and other data sets in the ESO on-line archive. The hardware of the ASM consists of the *Differential Image Motion Monitor* (*DIMM*, a 35-cm telescope with enclosure, technical CCD detector), and several external sensor facilities like a meteorological station.

1.1 Scope

This document contains the description how to operate and configure the ASM. It is assumed that the reader is familiar with general VLT control software concepts.

1.2 Reference Documents

This manual concentrates on practical issues of the ASM software, it does not cover intensively ASM software internals. Further information can be found in following documents:

[1] **ASM Data User Manual** VLT-MAN-ESO-17440-1773
describes data provided by the ASM and its access.

[2] **ASM Control Software Installation Manual** VLT-MAN-ESO-17441-1774
describes how to install the ASM system.

[3] **ASM Control Software Functional Specification** VLT-SPE-ESO-17441-1175
gives a detailed overview of ASM-internal aspects.

[4] **ASM Control Software Design Description** VLT-SPE-ESO-17441-1213
contains the design information about the ASM control software.

[5] **DIMM Upgrade Plan** VLT-SPE-ESO-17410-1174
presents details about the theory of seeing measurement etc.

[6] **ASM Commissioning Report (Aug. 1998)** VLT-TRE-ESO-17410-????
contains results of the ASM commissioning at Paranal.

The following general documents are also useful:

[7] VLT Common Software Installation Manual, VLT-MAN-ESO-17200-0642

[8] LCU Common Software User Manual, VLT-MAN-SBI-17210-0001

[9] CCS User Manual, VLT-MAN-ESO-17210-0619

[10]Technical CCD Systems User Manual, VLT-MAN-DJO-11700-0001

[11]CCD Cameras User Manual, Software part VLT-MAN-ESO-17240-0917

[12]Real Time Display User Manual, VLT-MAN-ESO-17240-0866

[13]Image Processing Algorithms for TCCD Systems VLT-TRE-ESO-17240-1689

[14]Heidenhain IK320 Driver User Manual VLT-MAN-ESO-17210-0806

[15]LCU Axis User/Maintenance Manual VLT-MAN-ESO-17130-1211

1.3 Abbreviations And Acronyms

The following abbreviations and acronyms are used in this document:

ACE	Array Control Electronics (for CCD Cameras)
ASM	Astronomical Site Monitor
CCD	Charge Coupled Device

CCS	Central Control Software
CDT	Command Definition Table
CI	Command Interpreter
CIT	Command Interpreter Table (for LCU CI)
CPU	Central Processing Unit
DB	Database
DIMM	Differential Image Motion Monitor
FTP	File Transfer Protocol
GUI	Graphical User Interface
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
RMS	Root Mean Square
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
VME	Versa Module Eurocard (Bus-System)
WS	Workstation
WWW	World Wide Web

1.4 Stylistic Conventions

The following styles are used:

bold
in the text, for commands, filenames, prefixes/suffixes as they have to be typed.

italic
in the text, for parts that have to be substituted with the real content before typing.

`teletype`
for examples.

`<name>`
in the examples, for parts that have to be substituted with the real content before typing.

bold and *italic* are also used to highlight words.

2 AUTOMATIC OPERATION

The ASM is supposed to run always in automatic operation, i.e. it sets itself in on-line or stand-by state depending on the time of day, and controls the connected devices correspondingly. The states are defined as follows:

On-line (default night-time state)	**Stand-by** (default day-time state)
Enclosure open	Enclosure closed
Telescope presetting or tracking	Telescope idle, optionally in park position
Target star selection enabled	Target star selection disabled
DIMM CCD taking exposures	DIMM CCD idle
Meteo and other external sensors enabled	Meteo and other external sensors enabled (i.e. no difference to online state)

Operator activities are normally unnecessary during automatic operation, except for system status monitoring. In any case, all operator actions *must* be performed as user ***asm*** on the ***wasm*** workstation.

2.1 Main operator control panel (*asmei*)

The *asmei* panel is intended for an operator of the ASM system. It displays the most important status of the system and accepts high level command (sent to the workstation control process) and - for maintenance and test - also low level commands (sent to specific devices).

To start-up the *asmei* panel, log in as user *asm* on *wasm* and use the following shell command:

```
wasm asm:~ > asmei &
```

Fig. 1 ASM main control panel (*asmei*).

As shown in the picture, the *asmei* panel contains several areas and each of them are described in the following subsections.

2.1.1 Workstation control process

The central area of the panel (below the 'dart board') concentrates commands and status displays related with the workstation control process (asmwsControl). Using these commands, it is possible to change the state of the whole system and to query its actual state. The provided commands are the following ones:

- START: force the system to enter the automatic operation (see 7.2). *asmwsControl* process decides autonomous the next state of the system (standby or online).
- WRAP: when the system is online this command will force to stop the current action and to restart the online operation from the beginning (Idle substate).
- ONLINE: switch the system to online *disabling at the same time the automatic operation*. If actually there is too much sun light then switching the enclosure to online will fail and the system will fall in an endless loop until the light sensor goes under its umbral limit. In any case, the ONLINE command will succeed and the ASM system will remain online until a new command is received.
- STANDBY: switches the system to standby *disabling at the same time the automatic operation*. The ASM system will remain standby until a new command (START or ONLINE) is received.
- PARK: allowed only when the global state is standby. This command will bring the axis and tracking servers to online and will park the telescope to a predifined position. After parking has finished successfully then the mentioned servers will be set to standby again. Actually the predifined parking position is at horizon looking south (eta = 0, theta = 180 degrees). This will also be visible in the telescope position displays.
- STATUS (Show Status): this command retrieves information about the actual status of the system and displays it in the area below the push button. *Note that this display is not updated automatically, so it may show not up-to-date information!*

2.1.2 Telescope

This displays information about the status of the telescope. Starting from the top the following information is presented:

- State and Substate of the tracking server (running in *lasm1*)
- Local Sidereal Time and Hour Angle of the target object
- Right ascension and declination of the object
- Eta and theta encoder positions
- Offsets applied on both axes plus state and substate of the corresponding axis server.

2.1.3 Target star selection

This section displays information about the actual selected target star. The following static data is taken from the local catalog:

- Object identification (Bayer designation plus proper name)
- Apparent magnitude
- Right ascension and declination

Following there is some dynamic data:

- TrkT: actual tracking time for this object (since it was preset)
- RemT: remaining time for this object (note that the total tracking time depends on the selection criteria configuration, see 5.2.2)
- SunT: remaining time until the scheduled end of night operation

The section also provides the following push buttons:

- Fixstar: a fixed star is use as target object. In this case the selected star will be followed forever if the tracking path does not go into limit. *The automatic star selection is disabled!*
- Automatic: if actually there is a fixed star selected then it is released (sending to asmwsControl process "FIXSTAR off" command). Then there is a new automatic selection for the present time, i.e. tracking of the currently selected star will end with the next sequence, or - if the same star is selected again - will continue until the maximum allowed hour angle is reached (*maxTrkHourAngle*, see 5.2.2).
- Config: starts an RtapPtDisplay panel over the catalogue point (:ASM:Devices:asmcat). Use this option to modify the star selection criteria. *Note that any change here shall only be temporary and will not be permanent!*

2.1.4 Enclosure

In this area of the panel the hardware and software status of the enclosure subsystem is displayed:

Hardware status:

- angle position of each half in degrees (0 = open, 90 = close),
  (note that for La Silla this is set artificially set to 0,45,90 since there is no encoder available)
- limit switches,
- daylight sensor,
- emergency push button and
- mode key selection (Local or Auto). In local mode the remote control is disabled allowing hardware commands from the local panel at the bottom of the tower. In Auto mode the system is control from the *lasm1* LCU.

Software status:

- state and substate of the Enclosure device

Additionally the OPEN and CLOSE push buttons (see Fig. 15) are provided to open or close the enclosure sending to the device task (*asmlcuServer*) running at *lasm1* the "ONLINE Enclosure" or "STANDBY Enclosure" commands, respectively.

In exceptional cases (e.g. when it is out of order) the enclosure can be put in simulation with the *Simulate* check-button.

2.1.5 Meteo

Meteo software device control and state/substate display. Buttons ON and OFF enable and disable Meteo data gathering. When enable the Meteo device keeps listening the serial data channel for new data. Every new received data block is processed (parsed into individual data value) and written into the database. At this point the workstation process *asmmetTransfer* transfers the new data from the LCU database to the workstation online database, and *asmarcArchive* prepares a paf file and sends it to the VLT on-line archive system using the OLAC interface.

When the Meteo device has been disabled (OFF) then listening to the serial channel is cancelled and no data is transferred any more. Note that workstation the processes *asmmetTransfer* and *asmarcArchive* keep running.

There is a background check that forces the whole system to stand-by through the meteo alarms when no valid data is received within 10 minutes. This check is only enabled when the Meteo device is on-line or stand-by, but not when loaded or off. Be aware of this behavior e.g. when disconnecting the serial line to the Meteo station. Switch the Meteo OFF in this case to prevent that the background check traps you.

In exceptional cases (e.g. when it is out of order) the Meteo device can be put in simulation with the *Simulate* check-button.

2.1.6 Dimm

The Dimm section of the panel is related with the CCD detector status/control and the status of the seeing calculation sequence.

CCD status/control:

- state display of the CCD control process (*ccdconCI_DIMM*)
- push buttons to send INIT/STANDBY/ONLINE commands to the CCD control process
- Config button starts the RTAP on-line database GUI (RtapPtDisplay) on the DIMM configuration point (<alias>asmdimConfig)
- images transference between lcu and workstation can be enabled or disabled using the "RTD on" selection button (see note below). Note that a change here is not immediate, but delayed until the next sequence starts.

Seeing calculation sequence:

- last calculated seeing
- actual star coordinates (Ra/Dec)
- actual airmass for the selected star
- time stamp associated with the displayed values
- progress bar for measurement sequence

Above the DIMM widget is located a real time display (RTD) GUI of the images being transfer from the lcu. This display is updated only if "RTD on" is enable.

NOTE: enabling online transference of images is discouraged from remote connections on benefit of system performance and reliability!

2.1.7 Menus

With the *asmei* panel menus it is possible to quickly access some useful panels and tools for:

- *Operations*: all tools in this menu will normally be necessary for operation
  - logMonitor - to view the logs
  - RTAP alarm display - to view the alarms
- *Engineering*: tools in this menu are needed only for maintenance or diagnostics
  - asmeiTelescope - for stand-alone operation of the telescope
  - ccdCtrl - for stand-alone operation of the DIMM CCD
  - ccseiMsg, ccseiDb and RtapPerfMon - for diagnostic purposes
- *Recovery*: this menu contains some 'hammer' tools that must be used only with special care!
  - Exit asmwsControl - to terminate the WS control process, thereby cancel central control of the ASM devices and leave them in stand-alone mode; the global state will be Off.
  - Start asmwsControl - to start the WS control process, thereby resume central control of the ASM devices. All devices will be put into the proper state after one minute, provided that their initial state is at least Loaded, otherwise behaviour is undefined.
  - Reboot lasm1 - to reboot the lasm1 LCU; asmwsControl must not be running, otherwise behaviour is undefined!
  - Init Meteo - to re-initialize the Meteo device
  - Init Enclosure - to re-initialize the Enclosure device

- Reboot lasm2 - to reboot the lasm2 LCU; asmwsControl should not be running, otherwise there may be undefined errors which should however be recovered automatically.
- Start DIMM CCD DCS - to (re-)start the DCS, i.e. bring the device state to Loaded
- Stop DIMM CCD DCS - to stop the DCS, i.e. bring the device state to Off

2.2 Details about automatic operation

2.2.1 System start-up and shut-down

Be sure that both LCU environments *lasm1* and *lasm2* and the workstation environment *wasm* has been started-up successfully (preferably in exactly this order, see 3.1 and 3.3 ahead). After this, the system is fully operational. All the needed processes should be running and waiting for commands.

As explained in 3.1, after the *asmwsControl* process has been started (or re-started) it will automatically execute the START command by itself. This command is the main entry point for the fully automatic operation of the ASM system.

To shut-down the environment, first all sub-systems should be brought to a secure state. Telescope and CCD LCUs must be set stand-by. If the control process *asmwsControl* is successfully set stand-by then one can be sure that the rest of the sub-systems are stand-by as well. After the system has been set stand-by successfully it is then possible to stop the workstation environment using the *vccEnvStop* command.

2.2.2 Enter automatic operation

The automatic operation of the system means the automatic switching between the Online and Standby states depending only in the sun position and operation limits setup (weather alarms, twilight limit).

The Standby state is defined as the normal state during day-time and Online as the normal state during night-time. The Standby state does not involve any software or hardware operation at all but meteorological (and possibly other sensor) data gathering. Under this state the system is ready to process the START or ONLINE command.

The Online state involves the interaction of almost all the subsystems. Automatically the system selects the best suitable star from the catalog, presets the telescope to it, centers the star in the CCD field and performs as many sequence of exposures as possible before the time runs out for this star or the daylight has come. If the time for the actual star expires then another star is selected and the sequence of exposures restarted.

There is only one needed command to get the system working in the automatic way: START. This command does not need parameters. As explained in 3.1, this command is sent by the control process to itself if after starting it does not receive the DISTART command within a time of 60 seconds. So, strictly speaking there is no need of a command at all to start the automatic operation of the system after the environments has been successfully started.

The START command then first sends the INIT command to the *asmwsControl* process which will trigger the initialization of all subsystems. Given that this includes the initialization of the encoders, this first phase could take a long time (~4 min). A default time-out of 10 minutes is internally set.

NOTE: if the encoders are already initialized then their initialization is skipped.

When the START initialization phase is successfully completed the command proceeds to determine if it is currently night or day. Depending on that it sends the ONLINE or STANDBY command to the *asmwsControl* process. At the same time, using internal methods, it gets the time remaining to the next sun event and accordingly starts a timer that will trigger the corresponding command in the future (ONLINE or STANDBY).

2.2.3 Leave automatic operation

Leaving the automatic operation means to stop the automatic switching between the on-line and stand-by states.

To stop this automatic internal mechanism it is enough to invoke the ONLINE or STANDBY commands. These commands - when explicitly given by the user - will cancel the internal switching timer and the system will remain on-line or stand-by until the next switching-state command is given (STANDBY or ONLINE), or automatic operation is resumed with the START command.

Indeed, the automatic operation basically involves the existence of the switching timer brief described in 3.2. The ONLINE and STANDBY commands kill that timer and brings the system to the corresponding state.

If the system is already on-line and the ONLINE command is invoked then the switching timer is killed but the on-line sequence remains running. Instead, if the system is stand-by and the ONLINE command is invoked then the switching timer is killed and the on-line actions triggered.

The same applies for the STANDBY command invocation.

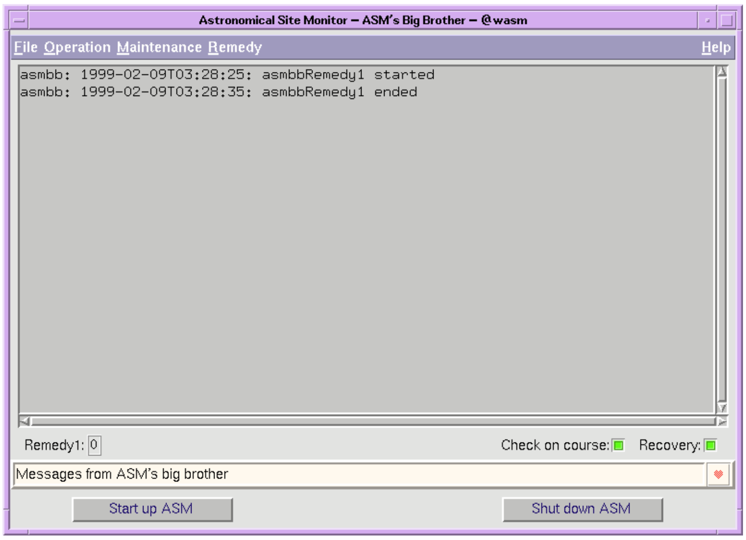
2.3 Recovery actions during automatic operation

The *asmbb* module (ASM big brother) has been developed with the aim of helping the user when confronted to unexpected failures of the ASM system. The idea is to provide one-click remedies for already known system intrinsic problems (automatic periodical scheduling of this remedies if foreseen for a future software release).

asmbb is a collection of scripts that checks for potential problems and if it is the case then the corresponding remedy is applied. From the point of view of the user the main entry point to this collection of scripts is the *asmbb* panel (see Fig. 2). To start-up this panel use the following shell command:

```
$asmbb &
```

Fig. 2 ASM recovery panel (Big Brother)



The "Remedy" pop-up item into the asmbb menu contains a list of the actual available so called Remedy scripts. These scripts perform a series of checks and if a problem is detected then a certain recovery action is applied. At the moment of this writing the only available remedy script is "Remedy1". This script performs the following checks:

- access to both lcu databases. If one of them is not accessible then the applied remedy correspond to the following sequence of actions:

i. *asmwsControl* is stopped (EXIT)
ii. the corresponding lcu is boot (LCCBOOT)
iii. after booting is finish *asmwsControl* is restarted
iv. at this point the script exits successfully

- check that expected processes are running on both lcu environments (vccEnvCheck)
- finally and only if the control process is online then Remedy1 checks whether the system is measuring or not (Running substate detected, does not matter the status of performed sequence). If the system is not starting any exposure sequence at all then the script proceeds as follow:

v. try a quick fixing sending INIT to CCD control process, if it is helpless then proceed with following point
vi. stop workstation control process
vii.boot both lcus and wait for completion
viii.re-start workstation control process

If during night operation the user detects that the system is not delivering seeing measurements then, in order to fix the problem, it should be enough that the user proceed as follow:

- start *asmbb* panel
- select “Remedy1” from the panel menu and wait for completion (the output list box in the panel shows actions status)
- if Remedy1 succeed then seeing measurements should come soon. If Remedy1 fails then step to next point.
- Shutdown the whole ASM system using ad-hoc button in the *asmbb* panel and wait for completion
- Start-up the whole ASM system using ad-hoc button in the *asmbb* panel and wait for completion
- if something goes bad with the Shutdown/Start-up procedure then ASM specialized software support is required. As a last chance to trouble-shut any serious problem during Shutdown/ Start-up is convenient to maintain opened a *logMonitor* panel while the actions are being executed.

2.4 Operation procedure for maintenance activities

The following steps must be executed for any maintenance activities like optical alignment. We assume that initially the system is in automatic operation with the asmei panel open.

1. Put the system in standby state to disable automatic operation: press STANDBY button in the center of the asmei panel and wait until the command is completed. After that all devices will be standby (incl. enclosure closed).
2. If necessary, open the enclosure again by pressing ‘Open’ button on asmei in the Enclosure section.
3. Open from the engineering menu the telescope and DIMM-CCD control panels.
4. From the telescope control panel: put Eta, Theta and Tracking ‘ONLINE’.
5. On the CCD control panel: put TCCD online using ‘re-init’ button, disable ‘context sensitive’ from options menu, select exposure time with options ‘repeat forever’ and start exposure loop by pressing START button.
6. Also on the CCD control panel: open display (Start Display button) and then attach the camera from RTD Real-Time menu. Then rotate the RTD image 90 degrees (‘flip’ button).
7. From the telescope control panel: select star from catalogue and START tracking. The telescope will preset to the star and then track it (START button turns from blue to yellow).
8. From telescope control panel explore the field using Eta/Theta Tracking Offsets.

The maintenance operation can then be executed while the telescope is tracking the star and the CCD is taking exposures. At the end of the maintenance activity the system must return to automatic operation:

9. 'Stop loop' from TCCD control panel.
10. Return to automatic operation pushing START from asmei panel. This is valid for night or day and the system will set everything in online or standby respectively.
11. Verify with the 'Show Status' button that 'Automatic operation: ON' is confirmed.
12. Close all panels but asmei.

2.5 Recommended screen setup

With the HP VUE environment there are 6 workspaces. We recommend the following distribution of panels for the operator terminal or console, so that all normally necessary information is visible:

1. ***Operation*** - asmei panel
2. ***Logs/Alarms*** - logMonitor and RtapASDisplay [9]
3. ***Data*** - data plots started with the 'asm' command [1]
4. ***wasm*** - RtapPerfMon to monitor the WS environment
5. ***lasm1/2*** - two rlogin sessions to monitor the LCU environments
6. ***Engineering*** - for additional panels and tools (initially empty)

3 MANUAL OPERATION

Manual operation of the ASM is intended for test and maintenance only!

3.1 System start-up and shut-down

The ASM software is a VLT standard software. Then the full start-up and shut-down of the workstation software is managed as the start-up or shut-down of one single VLT environment (RTAP database plus any needed process). That is to say, all the processes that should be running to have the environment fully operational are contained and defined in the RtapEnvList file under the environment's directory: $VLTDATA/ENVIRONMENTS/wasm.

To start the wasm environment use the standard vccEnvStart command:

```
wasm asm:~ 49 > vccEnvStart –e wasm
vccEnvStart: store log in "/diskb/vlt/data/ENVIRONMENTS/wasm/.RtapScheduler.log"...
vccEnvStart: run RtapScheduler in background...
```

This command will start all what is needed by the ASM software. Special importance has the *asmwsControl* process. This is the main workstation task of the ASM application and through it goes most of the available commands.

NOTE: once the control process has been started together with the start-up of the workstation environment (wasm) no further command is needed to set the system in a fully automatic operation. The control process will send to itself the command START if within 60 seconds after starting it does not receive the DISTART command. DISTART disables this automatic starting feature.

****** CAUTION: starting the environment will move the devices incl. telescope and enclosure! ******

To stop the wasm environment use the vccEnvStop command:

```
wasm asm:~ 48 > vccEnvStop –e wasm
vccEnvStop: update snapshots with RtapForceSnap...
vccEnvStop: stop wasm with RtapShutdown...
```

After stopping the wasm environment no more related process will exist in the workstation host and, therefore, no more commands could be sent.

3.2 Terminating and Re-Starting WS Control Process

The only way to terminate the *asmwsControl* process is to send to it the EXIT command. When this command is received by the process it terminates cleanfully without any special handling of sub-systems. This means that special care should be applied when the command is used. For example, if the command is sent during night operation then the enclosure will remain open, the telescope will keep tracking and the CCD will end the actual sequence of exposures and remains on-line.

On the other hand, the control process could be re-started only when it is *not* actually running and must be started as a child process of the *wasm* RTAP environment. This last requirement assures that the process will be automatically re-started by RTAP if it terminates with an invalid exit code. This occurs when the process rises a signal driven exception. When using the EXIT command the exit code of the process is valid and then it is not re-started by RTAP.

To re-start the *asmwsControl* process as a child of the environment is mandatory to use the following shell command:

```
wasm asm:~ 1 >RtapRunCmd –e wasm –u asmwsControl
```

Therefore, the normal procedure for terminating and re-starting the control process is the following:

1. bring the system to stand-by sending to the control process the STANDBY command (this assures that the system will be safe while there is not control process supervision)
2. terminate the process sending to it the EXIT command
3. do whatever needed maintenance tasks
4. re-start the process using the shell command shown above

3.3 LCU start-up and shut-down

The procedure to start-up and shut-down an LCU environment is the same as that for the workstation environment. vccEnvStart starts-up the environment and vccEnvStop stops it. However, rebooting the LCU from the shell with *Ctrl-X* or from the command line with *lccBoot* <*lcu*> has the same effect. Only what the user should check is that the power supply of the LCU it's on and that the machines it's also network reachable from the workstation host.

The ASM system involves two LCU:

1. *lasm1*: telescope control LCU.
2. *lasm2*: CCD control LCU.

See 2.2 and 2.3 for a hardware detailed description.

Use the vccEnvCheck command to check the status of a running environment. For example, to check the *lasm1* STATUS give the following command from a UNIX prompt:

```
wasm asm:~ 45 > vccEnvCheck –e lasm1
vccEnvCheck: locate environment directory "sv6:/vlt/data/ENVIRONMENTS/lasm1"...
vccEnvCheck: locate lasm1 in /etc/services...
vccEnvCheck: locate wasm in /etc/services...
vccEnvCheck: locate sv6 in /etc/hosts...
vccEnvCheck: locate sv2 in /etc/hosts...
vccEnvCheck: locate sv2 in /etc/exports...
vccEnvCheck: locate lasm1 in /vlt/data/config/logLCU.config...
vccEnvCheck: locate wasm in /vlt/data/config/logLCU.config...
vccEnvCheck: send PING command to asmlcuServer...
vccEnvCheck: send PING command to asmtrkServer...
vccEnvCheck: send PING command to etaServer...
vccEnvCheck: send PING command to inducerServer...
vccEnvCheck: send PING command to lccServer...
vccEnvCheck: send PING command to msgServer...
vccEnvCheck: send PING command to rdbServer...
vccEnvCheck: send PING command to thetaServer...
```

3.4 Sending commands

Use the ccseiMsg application to send commands to the system. To start it give the following command from the UNIX prompt:

```
wasm asm:~ 41 > ccseiMsg &
```

This command will start the VLT standard ccseiMsg panel. This panel it's intended to send command to a local or remote process.

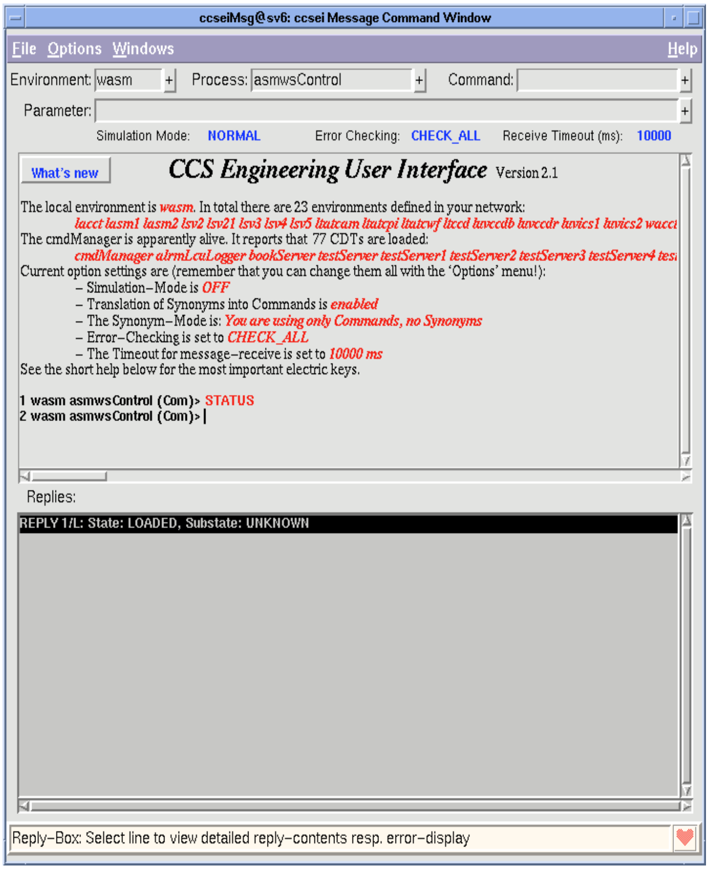
On the ccseiMsg panel select a target environment and a target process. Normally the user should need to send commands only to the local asmwsControl process. One healthy command that shows if the main process it's running and responding to the given commands it's the STATUS command. Immediately after starting the wasm environment the STATUS command output to the asmwsControl process should be the following:

wasm asmwsControl (Com)> STATUS

State: LOADED, Substate: UNKNOWN

Below Fig. 3 shows the normal layout of the *ccseiMsg* panel and the STATUS command output to the *asmwsControl* process.

Fig. 3 ccseiMsg panel.



3.5 Force online/standby state

When the workstation environment *wasm* and the two LCU environments *lasm1* and *lasm2* have been initialized successfully the ASM system is then fully ready to receive and process commands. Normally the operation of the ASM system should involve all the subsystems (ws, telescope, CCD) but it is also possible to send commands to each subsystem in a manual fashion. In this way it is possible to test the system with a bottom-top approach.

The manual operation of the system assumes that the user wishes to make tests that involve either the whole system or only a certain subsystem of it. For example, the next activities could be performed under manual operation:

- move the eta or theta axis to a given reference position
- move both axes to different position references
- preset and track a given astronomical reference coordinate
- take a single image from the CCD
- start a sequence of exposures

When manually operating any of the subsystems (enclosure, telescope or CCD) the actual state of the *asmwsControl* process should be Loaded. In this way unexpected commands to the LCU processes are avoided.

The manual operation of subsystems it is better achieved using the provided user panel interfaces, from which the delivery of commands is transparent for the user who normally should only need to press the left button of the mouse over the desired action.

The subsystems that could be tested isolated from the rest of the system are following:

1. axes drives movements (see 3.6)
2. presetting and tracking (see 3.7)
3. enclosure (see 3.8)
4. CCD chip read-out (see 3.9)

Manually it is also possible to force the Standby and Online states of the software:

- Standby: the software waits until the next user command
- Online: the night automatic sequence it is started, that is to say, automatic selection of a star from the catalogue, delivery of the appropriate tracking command and repeatedly a sequence of exposures are executed followed by the corresponding calculation of statistical data and seeing value.

To bring the system to the Standby or Online states the user should use the STANDBY and ONLINE commands. After that, the system will remain in that state until the next command it's given. These commands are allowed from any state of the *asmwsControl* process: Loaded, Standby or Online.

3.6 Telescope direct axis control

The *asmeiTelescope* panel is intended to manually control the operation of the telescope. This could involve the following actions:

- initialization of encoders
- movements to standard positions (zenith, horizon)
- presetting each individual axis to a given position
- presetting and tracking given celestial coordinates
- presetting and tracking a previously selected star from the catalogue
- mechanical alignment of the telescope (as described in [2])

To use the *asmeiTelescope* the *wasm* and *lasm1* environments must be running.

To start the panel use the following command from the UNIX shell:

```
wasm asm:~ 42 > asmeiTelescope &
```

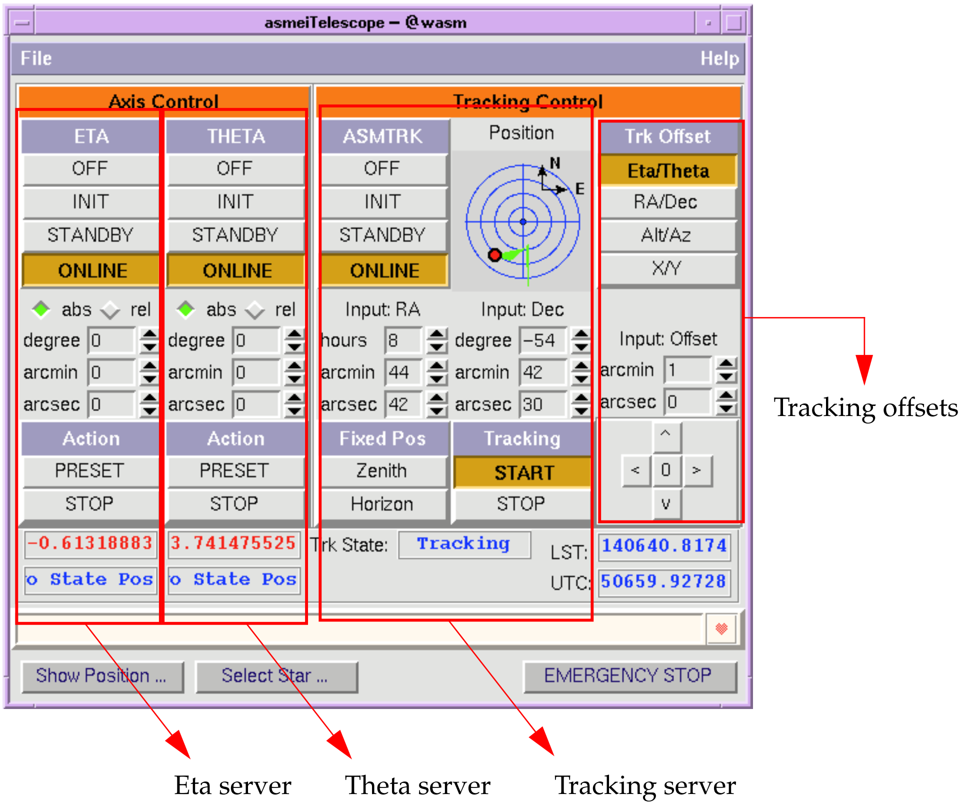
As shown in Fig. 4 each drive has its own control section to issue a certain action.

From the software point of view the control of each axis relies on independent devices running in the *lasm1* LCU. This means that the axes drives can be moved independently from each other. The control processes of each device are the following:

- eta axis: *etaServer*
- that axis: *thetaServer*

The above processes accept commands such INIT, STANDBY, ONLINE, PRESET and STOP that can be sent to each device just pressing the corresponding button-widget of the *asmeiTelescope* panel (see Fig. 4).

Fig. 4 asmeiTelescope panel layout.



The Off, Init, Standby, Online, Preset and Stop buttons of the *asmeiTelescope* panel are state switching related. This means that after pressing one of this buttons the state (or sub-state) of the corresponding axis server will change accordingly. The main purposes of these buttons are the following:

- Off: this button can be pressed to un-initialize the axis. Note that due to the LCC state definition [6], the Off state is never reported by the device, unless after an unrecoverable failure condition. Consequently it is impossible to know from here whether the device has already been initialized or not. However, the position display will show zero when not initialized.
- Init: due to the relative nature of the encoders (used on both drives of the telescope) the first action should be the initialization of them. This means to move them towards the init switches. To do so the Init buttons of the panel is provided. After a successful initialization the server is on state Loaded and ready to move. The initialization of one axis is independent from the other one and can be issued only to one of them if needed (leaving the other one uninitialized).
- Standby: the position control loop is open.
- Online: the position control loop it's closed and new reference position could be given to the server. The inputs widgets accept an angle reference in the format [degree, arcmin, arcsec]. Change it to the desired one and then press the Preset button to forward to the axis server the corresponding command. The motor will start moving until the reference position it's reached. After that the server will remain Online and the control loop closed. The software limits should be kept to avoid a rejection of the command from the respective axis server.
- Preset: moves the axis drive to the absolute or relative position given in the input widgets (degree, arcmin, arcsec). When a position outside the operational limits is commanded, the axis will move anyway and stop at the limit.
- Stop: this command is meant to be use when the target server is on-line. If the target server is an axis one then any movement is stopped and the server bring to stand-by, if actually the telescope is tracking then the tracking server gets an error (substate Error) and this causes that the other axis server goes to stand-

by as well. If the target for the STOP command is the tracking server then the behaviour depends on the actual substate of the server:

- PRESETTING: only after reaching the target position the tracking server substate is changed to Idle and the reference positions delivered to the axes servers are keep fixed at the target ones. Axes and tracking servers state remain on-line. Both position control loops remain closed.
- TRACKING: the tracking server substate is change to Idle immediately and the reference positions delivered to the axes servers are keep fixed at the actual values. Axes and tracking servers state remain on-line. Both position control loops remain closed.

The actual position and servo-state of each axis is updated periodically in the displays below each axes' STOP command button.

3.7 Telescope presetting and tracking

The coordinated motion control of both axes of the telescope is a duty of the tracking device in the *lasm1* LCU. Commands to this device are managed through the *asmtrkServer* task. ASM sends to this server two types of commands to move the telescope:

a. Fixed Pos. (OBJFIX): the telescope is commanded to move to a local Alt/Az position and when the target position is reached then the telescope keeps pointing there. Internally, the Alt/Az pair is converted to Eta/Theta.

b. Tracking (OBJSTAR): the telescope is commanded to move to a Ra/Dec position in the sky and when the target position is reached the telescope starts tracking that position.

NOTE: Any telescope movement command (preset and tracking) requires that the axes and tracking servers are on-line. To command this servers to initialize and switch to on-line the user must press the INIT and ONLINE buttons for each server.

3.7.1 Fixed Positions

The only possible preset commands managed by the panel allows the user to select any possible pre-defined position:

1. Zenith: eta = -90 deg, theta = 0 deg or
2. Horizon (south): eta = 0 deg, theta = 180 deg.

Both positions can be preseted using the buttons located under the "Fixed Pos" widget. No parameters are requested after pressing one of the buttons. Normally, the user will use this default preset position to park the telescope after work.

3.7.2 Object Tracking

The manual operation of the tracking server allows the user to select any possible Ra/Dec coordinates (inside the software limits) or a star coordinates from the catalogue to which the telescope should preset and then start tracking.

Equivalent to the axis servers the tracking server can be switched manually through the Init, Standby and Online panel buttons between its three possible states.

On the other hand, the tracking of a certain object is issued with the Start button under the "Tracking" widget. This action will read from the *Input RA* and *Input Dec* numerical-input widgets the right ascension and declination of the desired object and then forward it to the tracking server as a command that presets to the given coordinates and when the position is reached both axes references will be permanently updated tracking the astronomical object.

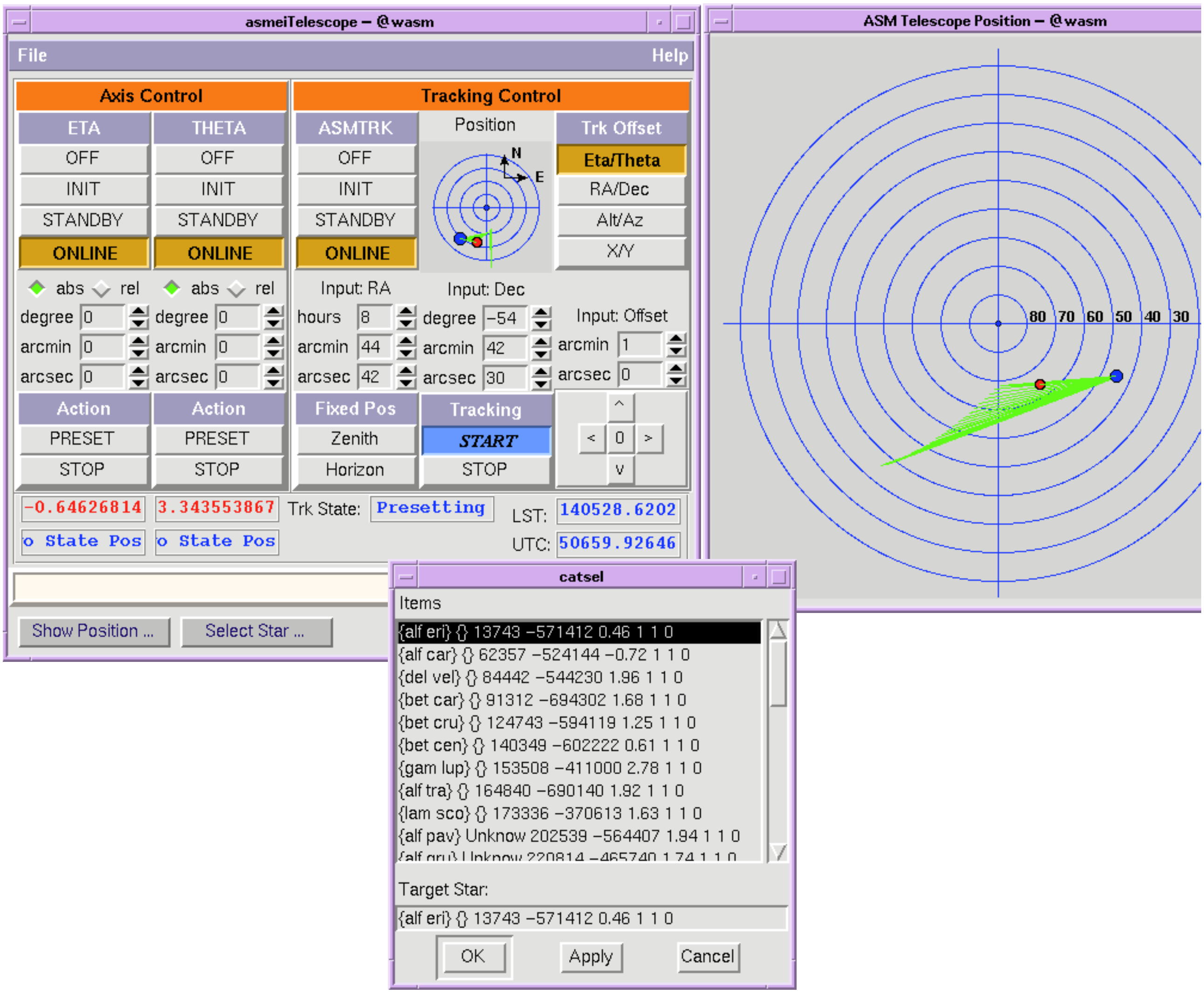
To make easier the selection of the coordinates of a star from the local catalogue the *Select Star* button is provided. Use this button to show the list of stars and select from them the desired one. Push Ok to copy its coordinates to the widgets of the main panel (see Fig. 5 below).

CAUTION: the selection star panel must be withdrawn (Cancel) before the buttons and widgets of the main panel are enabled again.

After selecting a star from the catalog and pressing the START button the tracking server will calculate the reference positions that will be forwarded to the axis servers. If these references lays outside the operational range of the telescope (software limits) then an error will occur. Under this situation the affected axis server will switch to stand-by and the tracking server will switch its substate to ERROR (state remains on-line). Afterwards the other axis server will switch to stand-by as well. In this state the tracking server will reject any further movement related command. To recover an operational state it is necessary to switch back both axis servers to on-line using the axes ONLINE buttons.

On the other hand, if the given coordinates are Ok for the actual time and the system is in the right state then the presetting will start. After reaching the target position the tracking server will switch to tracking and automatically will update the axes references position of the axis servers. Graphically the main panel asmeiTelescope should show the following sequence of changes in the *Trk State* widget: Idle --> Presetting --> Tracking.

Fig. 5 Position supervision and star selection widgets.



The STOP button stops the tracking movement and returns to Idle substate.

CAUTION: when STOP is pressed while still presetting, the movement will stop only when the target position is reached! At that time, also an error will be reported.

Once the tracking server is tracking then another object could be selected and preseted for tracking (START) without modifying the state of any other server. To do so it is necessary to manually give new astronomical coordinates or select another star with the catsel panel and then press the START button.

In the same way, during tracking manual offsets could be forwarded to each axis using the offset widgets of the main telescope panel (see Fig. 4). To do so, be sure that the wished offset mode is selected. Normally Eta/ Theta should be enough for all the testing needs of the telescope. The rest of the modes (RA/Dec, Atl/Az and X/Y) are provided for any additional need like optical alignment.

To supervise the actual position of the telescope and check the calculated reference use the *Show Position* button. As shown in Fig. 5 this button starts a widget that dynamically shows and updates the current pointing position of the telescope over an orthographic projection map of the sky. When using a normal color display, the two position points over the telescope-position graph are defined in the following way:

- green point: marks the commanded set-point and
- red point: displays the actual pointing position on the sky.

3.8 Enclosure movement

3.8.1 Enclosure Local Panel Operation

The local panel of the telescope enclosure is located at the foot of the tower. From this panel both halves of the dome can be operated independently and intermediated positions are feasible.

To operate the dome from this local panel make sure that the system is energized and that the mode key is set to *Local* respectively *Manual*.

3.8.2 Enclosure Software Operation

The Enclosure software device is foreseen to control every movement of the dome. Before any movement is possible the Enclosure device must be initialized. To do so use the ccseiMsg panel as explained in 3.4 and send the INIT command to the Enclosure device at the lasm1 environment.

After the initialization has been performed successfully there are only two movement actions that can be achieved through the Enclosure device: open and close (both halves simultaneously) the enclosure.

The open position of the dome is associated with the on-line state of the device and the close position with the stand-by state. Therefore, to open the enclosure send the ONLINE command to the Enclosure device and to close the enclosure send the STANDBY command to the device.

All ASM devices at LCU level are controlled through a single command interface (CI) application. The name of this task is *asmlcuServer*. So, using ccseiMsg to send any command to an ASM device, like Enclosure, select lasm1 environment and asmlcuServer task and then write the desired command in the following way:

```
lasm1 asmlcuServer> <cmd> <dev_name>
```

In this way open the enclosure with the following command:

```
lasm1 asmlcuServer> ONLINE Enclosure
```

and to close the enclosure use the following command:

```
lasm1 asmlcuServer> STANDBY Enclosure
```

3.8.3 Emergency Recovery Procedure

Whenever the emergency stop button of the enclosure has been activated then it becomes necessary to reset the local hardware before it can be commanded remotely again. To reset it is necessary to send a special command to the enclosure on board CPU. Procedure:

- after the emergency has been clear up then release the emergency button (there are two emergency buttons: at the base and top of the DIMM tower)
- verify at local panel that the operational mode is set to Auto
- login into lasm1 lcu:

  ```
  rlogin lasm1
  ```

- once the VxWorks is available type in the following command:

  ```
  lasm1> asmtenUsrCmd "SKULL"
  ```

- now then enclosure hardware should be back to a fully remote control mode.

For more information about *asmtenUsrCmd* check section 6.1.

3.9 DIMM CCD stand-alone

The stand-alone panel provided by the CCD software allows to the user a manual configuration of an exposure or to read from a *.det file a previously build setup. A pool of setup files for the ASM operation could be found under the following directory:

$INS_ROOT/SYSTEM/COMMON/SETUPFILES/DET

To start-up the CCD stand alone panel the CCD software provides the *ccdStart.sh* script that should be issued as a normal UNIX command. After that, the panel will start and the user could use it to command the CCD software into the LCU.

On how to use the CCD stand-alone panel refer to [11].

This stand-alone panel does not show any read-out from the ACE box. To see the actual shape of the read images from the CCD chip it's needed one additional tool. To start this tool the CCD stand-alone panel provides the 'Start Display" button widget into the 'Control' section of the panel.

The Start Display button will start a real time display panel. This panel shows any image actually read-out from the camera in an automatic fashion. To get it working in this way the user needs to attach the camera to the RTD panel and enable the automatic display of the images:

1. select the 'Attach Camera' item into the 'Real-time' pop-up menu of the RTD panel, this will attach the read-outs of the DIMM camera with the rtd application and
2. set to one the asmdim database attribute display_enable. To reduce the network traffic when not visual supervision it's required reset the display_enable attribute to zero.

On the RTD panel the "Flip-around" button should be pressed to put the CCD image vertically on the screen. In this case the offset arrow keys of the asmeiTelescope panel correspond directly to the movement of an object in the image. Also the apparent movement in the telescope finder is exactly identical then.

The image shown into the RTD panel corresponds to the raw data from the chip. It's not possible to display image processing results.

Detailed information on the use of the RTD panel could be found on [12].

4 CONFIGURATION OVERVIEW

Before starting operation, the ASM must once be configured. After that a re-configuration should only be an exception. Permanent changes have to be requested from the system responsible.

4.1 Configuration Principles

The following priority scheme is used for configuration values in the ASM SW:

1. Instant on-line database contents:

   These values are actually used by the SW. They can be changed on the fly with *ccseiDb* (WS and LCU) or *RtapPtSelector*/*RtapPtDisplay* (WS only). The values will be temporarily preserved due to a snapshot mechanism. Depending on the software, an explicit command (*INIT*/*UPDATE* etc.) is required in order that any changes are recognized. However, ***changes are not safe***! They may be *lost* when the WS environment is re-started, an LCU rebooted, or an environment is regenerated.
2. Configuration files located in *$VLTDATA/config*:

   Their contents is loaded into the on-line database when an WS or LCU environment is started, or on explicit request (*dbRestore* command, or via panel interaction). The files are generated only on explicit request (*dbBackup* command, or via panel interaction). These files are the *official* default ASM configuration, as determined during commissioning.
3. Default setting of database in the module sources:

   These values will be used when no overloading takes place. Modules are under configuration control in the CMM code archive.

4.2 Configuration Tools

Configuration files are maintained using two VLT tools: *dbBackup* and *dbRestore*. The former one is used to load into the on-line database (LCU or WS) the attributes values contained in a given dbcfg file. The second VLT tool (*dbRestore*) is used to update or create a dbcfg file. The use of dbRestore is based on provided dbbkp files. In this way is possible to better control any change on the configuration and the risk of manual edition of dbcfg files is suppressed.

Note: the provided dbbkp files define which attributes could be changed for a given device. It is not possible to add new database parameters into dbcfg files without editing a dbbkp file and this is a design change not recommended at user level.

4.2.1 Changing values in the configuration files

The following configuration files are defined under *$VLTDATA/config*:

- Alarms.dbcfg - for operational limits
- Dimm.dbcfg - for the DIMM device
- Enclosure.dbcfg - for enclosure software device (Enclosure)
- Meteo.dbcfg - for meteorological software device (Meteo)
- Pointing.dbcfg - pointing model terms (trk device)
- Stars.dbcfg - for the target stars catalogue and selection criteria
- Telescope.dbcfg - for telescope related devices (trk, etaAxis and thetaAxis)

Due to the fixed and private format of every dbcfg file the ASM configuration goes through the use of *dbBackup* based on provided and fixed input files (dbbkp). These files define which attributes are going to be recorded into the output file (dbcfg). That is to say, for each possible subsystem configuration ASM provides a pair of files:

- <subsystem>.dbcfg: default database configuration files. Only this type of files are subject to modifications under the willing of the user.
- <subsystem>.dbbkp: input files for *dbBackup* command. It's not recommended to edit these files.

The general procedure to update the file <subsystem>.dbcfg is as follow:

1. depending on the type of the environment (WS or LCU) where the database attributes reside use the appropriate tool to change their actual values. See 4.2.2 and 4.2.3 to know how to change on-line database attribute values.
2. using dbBackup update the content of the desired dbcfg file:
```
dbBackup -k -f $INTROOT/config/<subsystem.dbbkp> -o $VLTDATA/config/<subsystem.dbcfg>
```
3. at this point both: (i) on-line database and (ii) configuration file contain a new setup. But this setup will not necessarily take place automatically. Depending on the device the following cases are faced:
   - Dimm and Catalog devices: the effect will take place automatically because the software is updating its local variables from the database every time it starts a new sequence.
   - Meteo and Enclosure devices: the effect while take place only with the next re-start of the LCU environment (re-boot).
   - trk, etaAxis and thetaAxis devices: for telescope related devices is possible to force the effect to take place by re-initialization of the dives. This is achieve sending the INIT command followed by the ONLINE command. An special situation applies for the pointing correction terms (pointing model), refer to 5.1.6 for details.

Table 1: present a complete overview respect devices database re-configuration.

Table 1: Database re-configuration

Device	Environment	Auto. Update	Via Command	Env. Restart
Dimm	wasm	✔	✘	**optional**
Catalog	wasm	✔	✘	**optional**
etaAxis	lasm1	✘	✔	**optional**
thetaAxis	lasm1	✘	✔	**optional**
trk	lasm1	✘	✔	**optional**
Enclosure	lasm1	✘	✘	**mandatory**
Meteo	lasm1	✘	✘	**mandatory**

Using the above procedure, ad-hoc configuration could be prepared on-the-fly and taken into account with every re-start of the environments. To make a new configuration permanent the new dbcfg file must be archive into the asmENV module (using CMM tools).

4.2.2 Changing values in the WS on-line database

Start the following programs:

- RtapXColorMngr & (to be done once for an X-terminal, not needed on the console)
- RtapPtSelector &
- RtapPtDisplay &

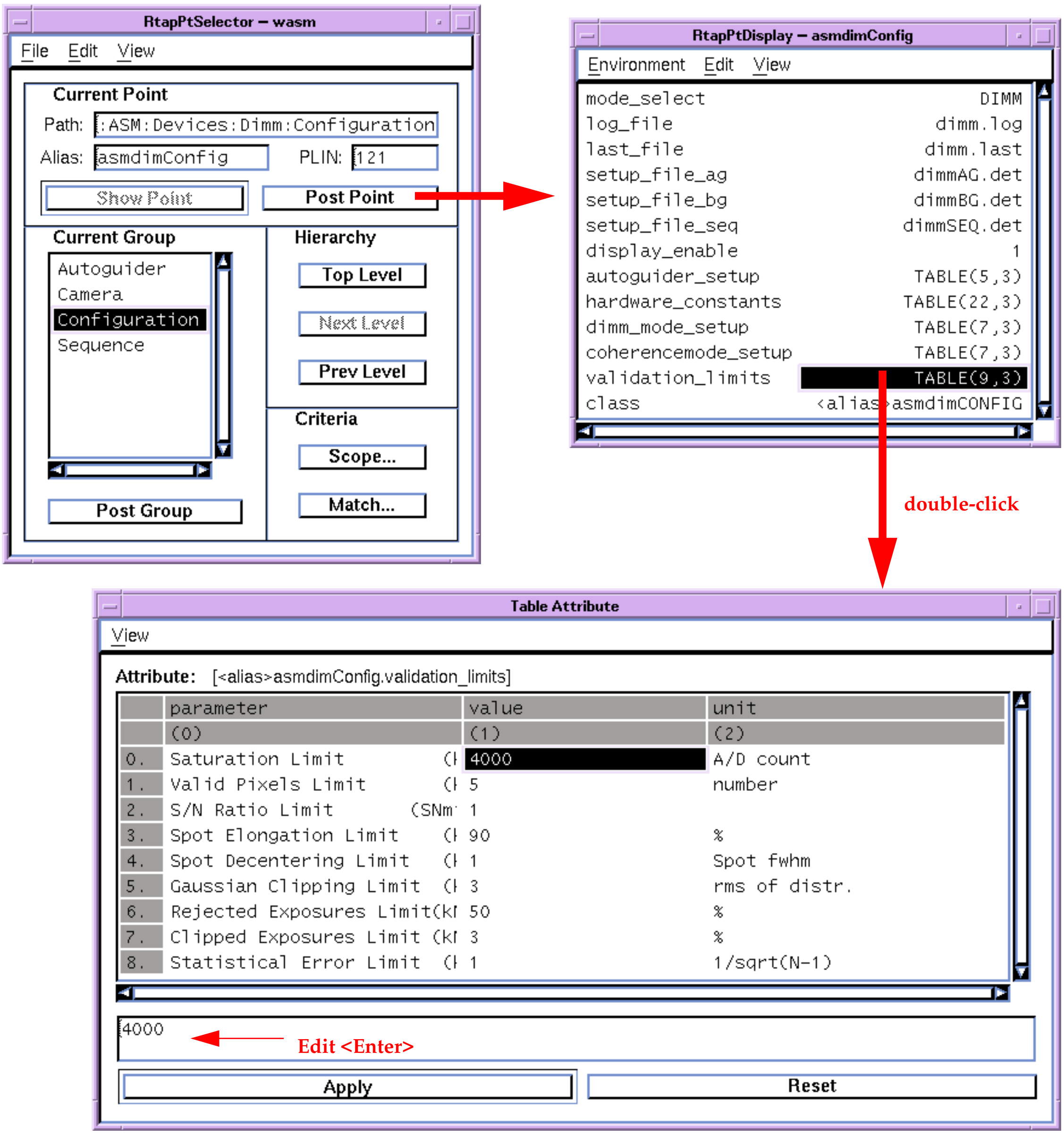
In the *RtapPtSelector*, select the *ASM* group, press *Next Level*, and proceed so until the point to be configured is reached, then press *Post Point*, e.g.:

- :ASM:Devices:asmdim:Configuration - for all DIMM related configuration
- :ASM:Devices:asmcat - for all target-star related configuration

The selected point will be displayed in the *RtapPtDisplay*. Then double-click the attribute to be changed, e.g. *validation_limits* in the Dimm configuration. This pops up another panel with all values. Select the value to be changed, enter the new value and *Apply*. Refer to Fig. 6 for an actual view of mentioned RTAP panels.

Multiple views of *RtapPtDisplay* can be opened at the same time, by selecting *Lock Panel* from the *View* menu.

Fig. 6 Rtap tools for database configuration



4.2.3 Changing values in the LCU on-line database

This should normally never be necessary! Anyway, one can use *ccseiDb* to change values in LCU databases, as well as WS databases. Refer to [9] for more information. Remark however that one can possibly crash the system by doing so - *know your exits*.

4.3 Security issues

There is currently no protection against unauthorized access to the nodes or via CCS message system. Anyone knowing the LCU hostnames can login there, and anyone knowing the environment TCP port numbers can in principle even from remote send commands to it, and change database values.

For the final installation, CCS booking mechanisms shall prevent any unauthorized access to the system.

5 DEVICES CONFIGURATION

5.1 Telescope Configuration

The file *$VLTDATA/config/Telescope.dbcfg* is foreseen to contain user-configurable items.

5.1.1 Hardware constants

These are not foreseen for user configuration. They are therefore only contained in the database sources of the *asmtel* module. See *asmtel/lcu/dbl/asmtel.class* for more information.

5.1.2 Absolute position offsets

After any change of installation at the axes or movement of the telescope structure, the axis offsets measured as explained in [2] have to be adjusted in order to get the reference to the absolute position on the sky.

1. Locate in *$VLTDATA/config/Telescope.dbcfg* the entry: <*ATTRIBUTE*>*: offset*
2. Edit the corresponding value; the first for the north half-sky initialization, the second for south.
3. Save the file.
4. The new value is not is not yet active. To make it active restore the database from the file with the command *dbRestore -f $VLTDATA/config/Telescope.dbcfg* and re-init the axis.

5.1.3 Coordinate rotation matrix

In principle it is possible to adjust the coordinate conversion alt/az to eta/theta by changing the rotation angles in the database. But it is recommended to leave them at round values, and put effort instead on the mechanical alignment. It has been possible to reach an accuracy of one arcmin using an standard level-meter tool.

5.1.4 Initialization speeds

The speed with which the telescope moves to the encoder initialization switch is defined in the database. Normally no user configuration is needed here.

5.1.5 Control loop tuning

Refer to [15] for details.

5.1.6 Pointing mode selection

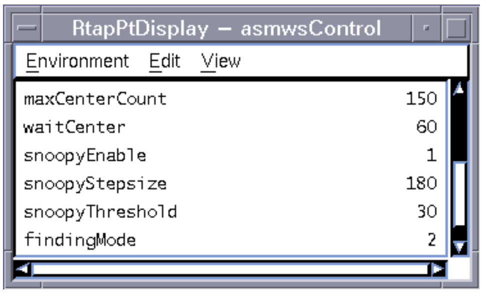
An analytical pointing model (instructions can be found in [2]) can be used to correct the actual position of the telescope in the sky. The parameters of this model are called pointing correction terms and they are calculated based on pointing errors measured over a certain part of the sky sphere (as explained below in this section). Additionally, the ASM software implements a last stage of pointing that fixes the errors that could not be fitted with a pointing solution - it searches for the star outside the field. This last pointing stage is called Snoopy (you can guess the reason for the name) and is explained in 5.1.7.

The actual procedure used to point a star is user-configurable but not maintained in a dbcfg file. The involved database attributes are listed in Fig. 7 and their meaning is the following:

- *maxCenterCount* - is the maximum number of iterations (exposure and centroid determination) that is executed to center the star before giving up on this star, and go to the next.
- *waitCenter* - is the time in seconds after presetting is completed before starting the iteration counter.
- *snoopyEnable* - is the flag enabling or disabling the snoopy pointing mode.
- *snoopyStepSize* - is the size in arcsec of each snoopy correction (see 5.1.7)

- *snoopyThreshold* - is the number of iterations without object in the field before Snoopy is started. Note that all parameters above together define the size of the Snoopy search field, i.e. the outer radius of the spiral.
- *findingMode* - defines in which way pointing solutions shall be applied. It can be:
  - 0 - do not apply any pointing solution at all
  - 1 - apply the pointing model always
  - 2 - apply the pointing model only during presetting but not during tracking
  - 3 - apply the pointing look-up table, but no pointing model

Fig. 7 Pointing Mode Configuration (@wasm:ASM:Control)



In general a pointing model is needed for sufficient pointing accuracy, but tracking performances with the DIMM telescope (eta/theta mounted) has shown to be poor around the culmination of a given object when the pointing model is used also during tracking.

The pointing look-up table is effectively not used any longer; it was implemented during the development phase when investigating various pointing solutions for the DIMM telescope. The pointing table is, however, still supported, and can be installed using *asmcatPomInstall*.

5.1.7 Snoopy Pointing Mode

Applying the standard pointing model (explained in 5.1.6) to the DIMM telescope data, it has been detected that is not possible to fit it with a precision better than the critical +/- 2 arcmin for all the used sky section. Due to this, a star searching method around the expected position in the sky (after applying the pointing correction terms) has been implemented. This method is called *Snoopy* and is based in an increasing spiral motion around the target position.

Two parameters define the behavior of the snoopy mode:

- *snoopyThreshold*: if after presetting the star is not in the field it may happen that it is actually drifting into the field due to mechanical flaws of the drives. Then it is reasonable not to start the snoopy mode immediately after presetting has ended (tracking started), but to wait some exposures. *snoopyThreshold* defines a fixed number of failed iterations (no object in the field) before starting snoopy mode.
- *snoopyStepsize*: once snoopy has been started it will command the telescope to move in an increasing spiral like motion searching for the star. The size in arcsec of every step of this motion is defined by this snoopy's configuration parameter.

The use of snoopy mode has shown to be quite useful when the pointing is not good. Long term drifting of the pointing should not be a problem when maintaining snoopy enabled.

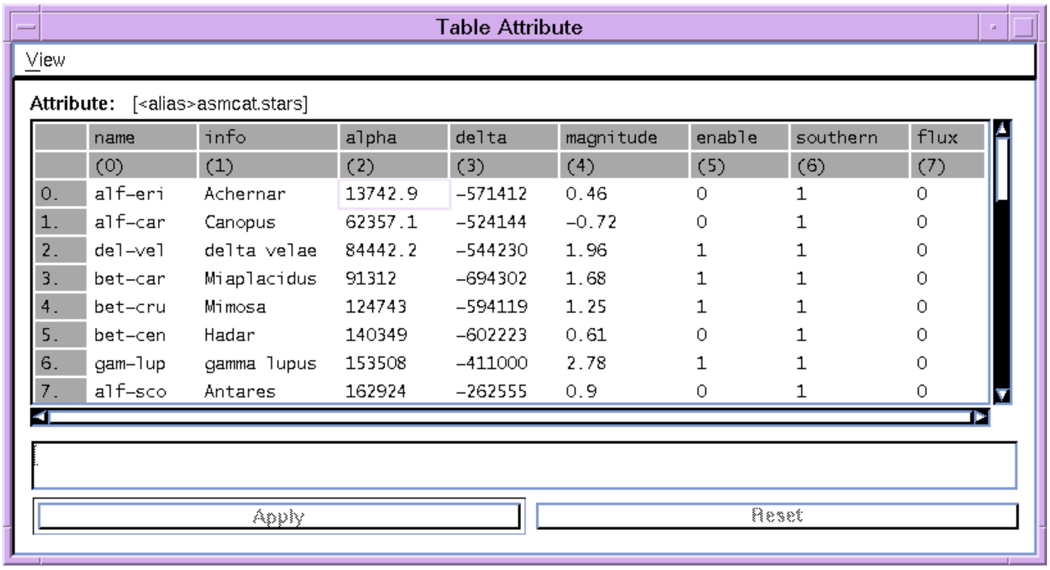
5.2 Target Stars Configuration

The ASM control process selects target stars from a database table based on certain criteria, which are also stored in the on-line database. The logical device *Catalog* is dedicated to this. The related configuration is located in the database point *@wasm:ASM:Devices:asmcat*.

5.2.1 Stars in the list

The DIMM should perform its measurements only on bright stars, preferably close to the zenith. Only a small number of stars is necessary, which are preset during the night. Double-stars are not suitable for measurements and must be omitted from the table.

Fig. 8 Target Stars Table (with sample values)



	name	info	alpha	delta	magnitude	enable	southern	flux
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.	alf-eri	Achernar	13742.9	-571412	0.46	0	1	0
1.	alf-car	Canopus	62357.1	-524144	-0.72	0	1	0
2.	del-vel	delta velae	84442.2	-544230	1.96	1	1	0
3.	bet-car	Miaplacidus	91312	-694302	1.68	1	1	0
4.	bet-cru	Mimosa	124743	-594119	1.25	1	1	0
5.	bet-cen	Hadar	140349	-602223	0.61	0	1	0
6.	gam-lup	gamma lupus	153508	-411000	2.78	1	1	0
7.	alf-sco	Antares	162924	-262555	0.9	0	1	0

As shown in Fig. 8 the stars table contains the following fields:

- *name* - official name of the star; empty fields are skipped
- *info* - any arbitrary user information; the column is not accessed programmatically
- *alpha* - the star's RA in HHMMSS format (a leading zero is not displayed)
- *delta* - the star's Dec in [+/-]DDDMMSS format
- *magnitude* - the star's magnitude
- *enable* - only enabled stars are considered for automatic selection; the software writes to this field depending on a failed centering procedure; the user can also modify this field to 0/1 in order to inhibit/allow automatic selection of a specific star.
- *southern* - assigns the star to the southern half-sky, so that it can only be selected when the telescope operates in that half-sky.
- *flux* - is dynamically updated by the software based on measurements on this target star. [1]

5.2.2 Selection criteria

The selection algorithm proceeds over the start list (from the first one till the last one) discarding the unsuitable ones: brightness too small (minBrightness), airmass too high (> maxAirmass) and those which actually have an hour angle greater than the maximum tracking hour angle (maxTrkHourAngle). After this the algorithm evaluates the criterion function and decides in a minimization way. See the man-page of

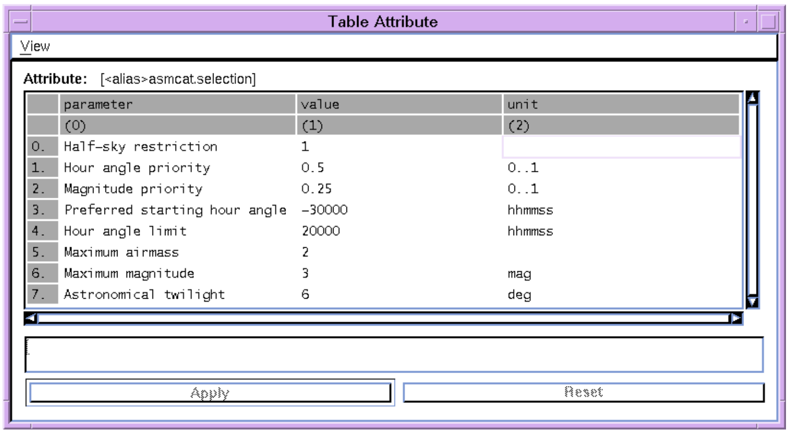
1. *Not implemented yet*.

asmcatDEVICE for detailed information.

The selection criteria parameters are shown in Fig. 9 and their meaning is the following:

- *onlyNorth/onlySouth* - either of both is set when the telescope operates in the corresponding half-sky; only stars assigned to the same half-sky are considered for selection then.
- *prioHourAngle/prioMagnitude* - specifies the relative priority with which to perform a weighted selection based on hour-angle or magnitude. Higher values will put more weight on a priority.
- *haReference* - this parameter is interpreted as the preferred starting hour angle of the selected star. So, stars with minimum hour angle difference from the reference are preferred.
- *maxTrkHourAngle* - stars whose current hour-angle is greater than this value are not considered for selection.
- *maxAirmass* - stars whose current airmass is greater than this value are not considered for selection.
- *minBrightness* - stars with magnitude lower (i.e. numerically greater) than this value are not considered for selection.
- *twilight* - specifies the sun position in degrees below horizon, at which on-line operation shall be started respectively stopped.

Fig. 9 Target Star Selection Criteria (with sample values)



	parameter	value	unit
	(0)	(1)	(2)
0.	Half-sky restriction	1	
1.	Hour angle priority	0.5	0..1
2.	Magnitude priority	0.25	0..1
3.	Preferred starting hour angle	-30000	hhmmss
4.	Hour angle limit	20000	hhmmss
5.	Maximum airmass	2	
6.	Maximum magnitude	3	mag
7.	Astronomical twilight	6	deg

As stated at the beginning of this subsection the star automatic selection is based in a minimization algorithm of a criterion function. Mathematically, this criterion function is presented in the following equation:

$$z = prioHourAngle \times f(HA) + prioMagnitude \times f(Mv)$$

$$f(HA) = |hourAngle - haReference| / \pi$$

$$f(Mv) = \frac{Mv}{2 \times minBrightness} + 0.5$$

where:

z = criterion function

$f(HA)$ = hour angle criterion part

$g(Mv)$ = magnitude criterion part

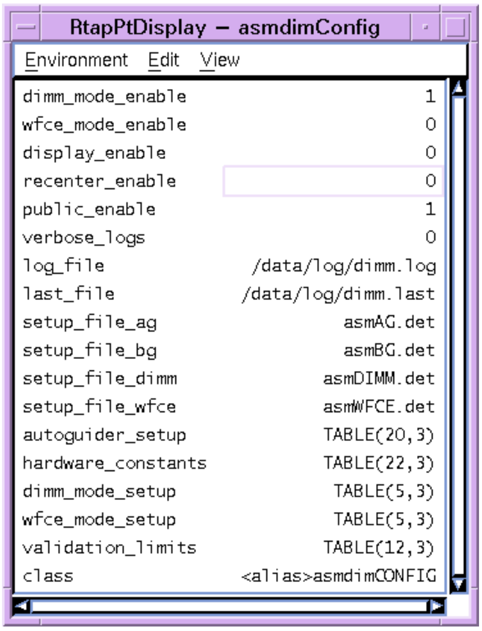
5.3 DIMM Configuration

The DIMM related configuration is located in the database point *@wasm:ASM:Devices:asmdim:Configuration*.

5.3.1 General items

As shown in Fig. 10 general items are the following ones (all flags can be 0=disabled or 1=enabled):

Fig. 10 DIMM general configuration (with sample values)



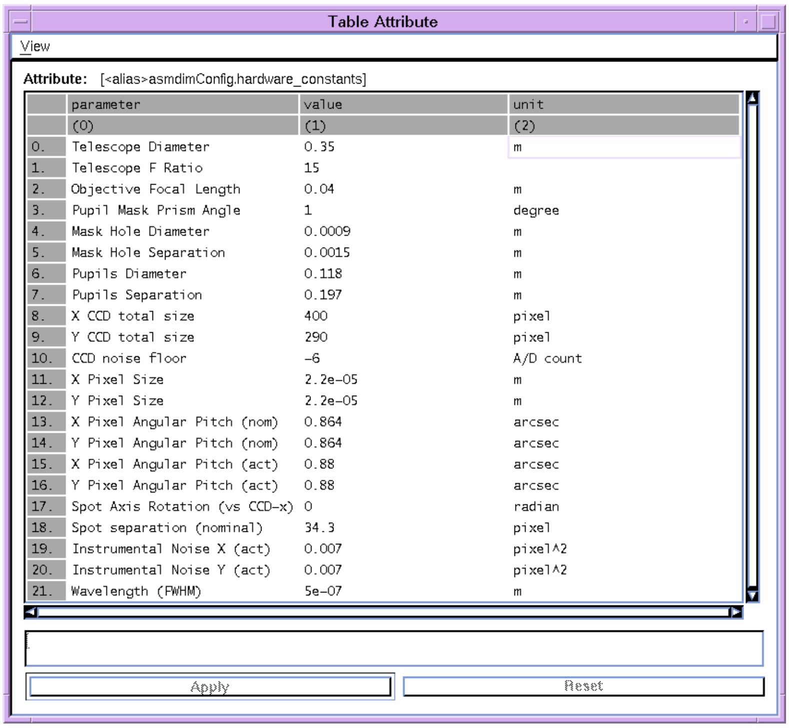
- *dimm_mode_enable* - flag to enable the DIMM seeing measurement mode.
- *wfce_mode_enable* - flag to enable the Wavefront Coherence Estimation mode. If both mode-enable flags are set, then the two modes are executed in alternating order.
- *display_enable* - flag to enable the transfer and display of exposures with RTD. This shall *only* be enabled when it is necessary to view the actual image for maintenance and test! It increases network traffic immensely!
- *recenter_enable* - flag to enable the re-centering after *every* sequence. Otherwise the star is only re-centered after a *rejected* sequence, but not after an accepted one, which is faster and normally better.
- *public_enable* - flag to enable the public output of seeing data. During maintenance activities this should be disabled, otherwise the (possibly false) data would be publicly output and archived.
- *verbose_logs* - flag to enable all logs during frame validation. This shall *only* be enabled for diagnostic purpose when it is necessary to find out the detailed reason of rejections in the frame validation! It increases network traffic immensely!
- *log_file* - name of the file receiving the private seeing logs. May include a directory.
- *last_file* - dto. for the 'last' file receiving only the last valid seeing value.
- *setup_file_ag* - CCD setup file to be used for centering. No path is allowed, all setup files are located under *$INS_ROOT/SYSTEM/COMMON/SETUPFILES/DET*. This is normally never changed.
- *setup_file_bg* - CCD setup file to be used for sky-background determination. Dito.
- *setup_file_seq* - CCD setup file to be used for the measurement sequence. Dito.

5.3.2 Hardware constants

This table contains the complete set of hardware constants. Once set, they will hardly need to be changed. See the DIMM upgrade plan [5] for a detailed description. In Fig. 11 is shown the actual content of the hardware constants table. The most important are:

- *CCD noise floor* - if positive, it defines the absolute a/d value to be used for thresholding; if negative then it must be in the range -1 to -9 (not more!) and defines the (positive) factor for the background standard-deviation to be used for thresholding ("n-sigma").
- *Spot separation* - defines the nominal distance in pixels of the two spots, as dependent on the optical setup.
- *Instrumental noise* - corresponds to the variance that is output by the system when measuring on a star simulator in the optics test bench, simulating perfect seeing. This has to be determined once on the actual system.

Fig. 11 DIMM hardware constants table (with sample values)



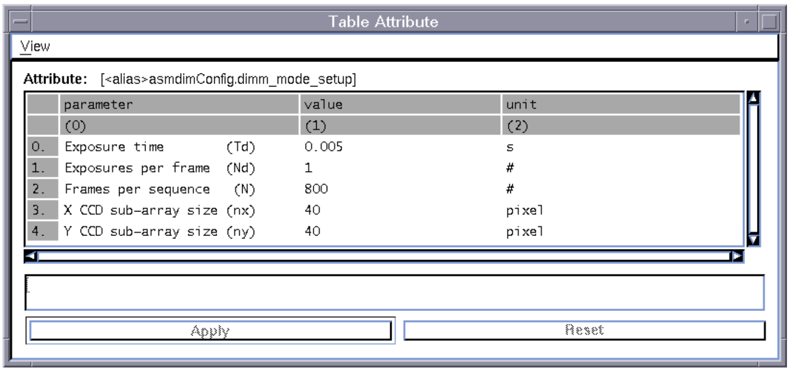
	parameter (0)	value (1)	unit (2)
0.	Telescope Diameter	0.35	m
1.	Telescope F Ratio	15	
2.	Objective Focal Length	0.04	m
3.	Pupil Mask Prism Angle	1	degree
4.	Mask Hole Diameter	0.0009	m
5.	Mask Hole Separation	0.0015	m
6.	Pupils Diameter	0.118	m
7.	Pupils Separation	0.197	m
8.	X CCD total size	400	pixel
9.	Y CCD total size	290	pixel
10.	CCD noise floor	-6	A/D count
11.	X Pixel Size	2.2e-05	m
12.	Y Pixel Size	2.2e-05	m
13.	X Pixel Angular Pitch (nom)	0.864	arcsec
14.	Y Pixel Angular Pitch (nom)	0.864	arcsec
15.	X Pixel Angular Pitch (act)	0.88	arcsec
16.	Y Pixel Angular Pitch (act)	0.88	arcsec
17.	Spot Axis Rotation (vs CCD-x)	0	radian
18.	Spot separation (nominal)	34.3	pixel
19.	Instrumental Noise X (act)	0.007	pixel^2
20.	Instrumental Noise Y (act)	0.007	pixel^2
21.	Wavelength (FWHM)	5e-07	m

5.3.3 Mode setup

Depending on the *mode_enable* fields in the general configuration, either the *dimm_mode_setup* table or *wfce_mode_setup* is used. All changed items will take effect not before the next sequence. As shown in Fig. 12 the table contains the following items:

- *Td* - the exposure time
- *Nd* - the number of exposures per frame, which will be line-shifted.
- *N* - the number of frames in a sequence. The accuracy of the final seeing value is proportional to the square-root of this number.
- *nx/ny* - the window size during the sequence. The larger the window, the slower will be the image processing routines, so that the final output data will be produced less frequently. The minimum size however is depending on the autoguiding performance.
- *X0/Y0* - the centering and autoguiding reference position on the CCD field. It should be chosen so that no dead pixels are inside the sequence windows.

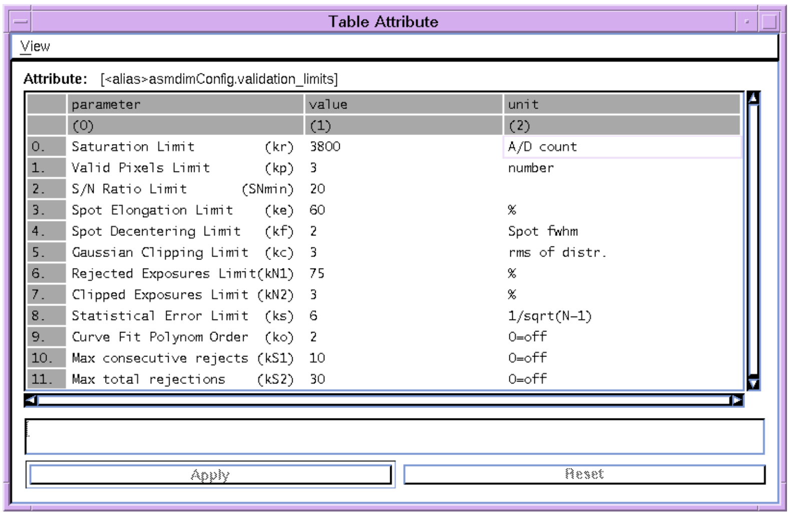
Fig. 12 DIMM mode setup table (with sample values)



5.3.4 Validation limits

The validation limits are applied in the frame validation (on LCU) respectively the calculation part (on WS). These limits are applied in order to accept or reject an exposure or calculated value. Rejected values will be discarded and not be forwarded to public or private output. The tuning of these parameters is of major importance to make the calculated seeing values reliable.

Fig. 13 DIMM validation limits table (with sample values)



Note that the whole configuration set stored in the WS-database will be copied to the LCU periodically (at the beginning of each sequence), overwriting any value there. All changed items will take effect before the next sequence. All these parameters are only applied to validate exposures during a sequence, but not for centering or autoguiding. The actual content of the *validation_limits* table is shown in Fig. 13 and their description follows below:

- k_r, *saturation limit* - windows with maximum pixel value higher than this are rejected.
- k_p, *valid pixels limit* - windows/exposures with less valid pixels are rejected.
- SN_{min}, *signal to noise ratio limit* - windows/exposures with signal-noise ratio less than SN_{min} are rejected.
- k_e, *spot elongation limit* - windows with FWHM x/y ratio higher than this are rejected.
- k_f, *spot decentering limit* - windows where the FWHM-padded centroid is nearer than this to the edge are rejected.
- k_c, *gaussian clipping limit* - exposures with relative spot motion outside the statistical margin given by kc are discarded.
- kN_1, *rejected exposures limit* - sequences with more than kN_1% exposures rejected in the frame validation are discarded.

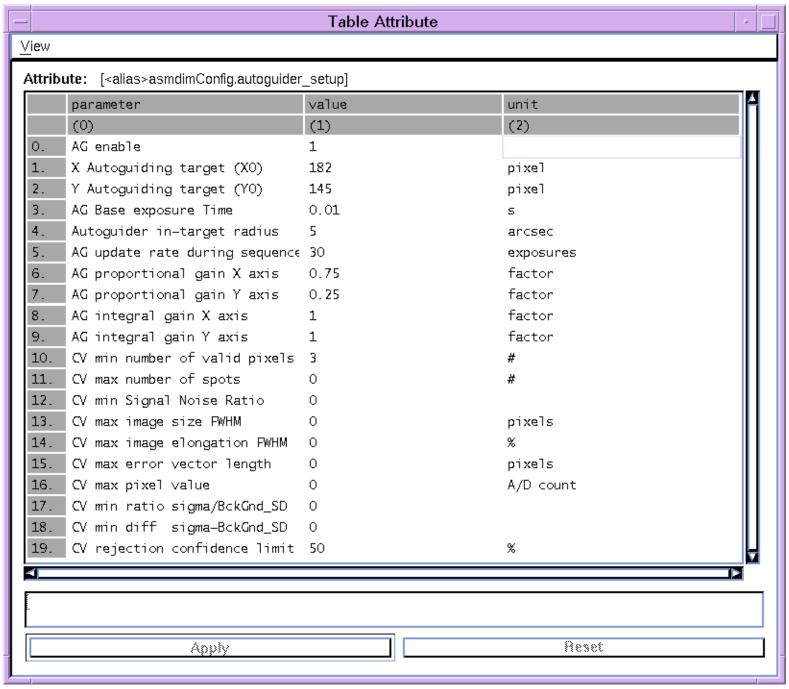
- *kN_2, clipped exposures limit* - sequences with more than kN_2% exposures rejected in the statistical validation are discarded.
- *k_s, statistical error limit* - sequences where the variances in parallel or perpendicular direction differ by more than the given limit are discarded.
- *k_o, curve fit polynom order* - defines the order of a polynom used in a least-square-fit to remove a systematic dependency of relative spot distance from spot decentering. The default value is two (second order polynom) and should normally not be modified by the user. Zero will disable the least-square-fit entirely. In its nature, this value is not a real validation *limit*, but is closely related.
- *kS1, maximum number of* ***consecutively*** *rejected sequences* - if this value is exceeded a new target star is selected. It might happen that the previously set criteria are unsuitable for a target star under certain conditions and all sequences are continuously rejected. In such case this star should be dropped.
- *kS2, maximum* ***total*** *number of rejected sequences* - dito.

See the DIMM upgrade plan [5] for a more detailed description and ASM Commissioning Report [6] for actual values.

5.3.5 Autoguider Setup

This includes centering (before the sequence) and autoguiding functionality (during the sequence). All changed items will not take effect before the next start of centering respectively start of sequence. Each parameter is marked with *seq* or *cen* to indicate whether they apply to the sequence autoguiding, centering procedure, or both. The actual content of the *autoguider_setup* table is shown in Fig. 14 and their description follows below:

Fig. 14 DIMM autoguider setup table (with sample values)



	parameter (0)	value (1)	unit (2)
0.	AG enable	1	
1.	X Autoguiding target (X0)	182	pixel
2.	Y Autoguiding target (Y0)	145	pixel
3.	AG Base exposure Time	0.01	s
4.	Autoguider in-target radius	5	arcsec
5.	AG update rate during sequence	30	exposures
6.	AG proportional gain X axis	0.75	factor
7.	AG proportional gain Y axis	0.25	factor
8.	AG integral gain X axis	1	factor
9.	AG integral gain Y axis	1	factor
10.	CV min number of valid pixels	3	#
11.	CV max number of spots	0	#
12.	CV min Signal Noise Ratio	0	
13.	CV max image size FWHM	0	pixels
14.	CV max image elongation FWHM	0	%
15.	CV max error vector length	0	pixels
16.	CV max pixel value	0	A/D count
17.	CV min ratio sigma/BckGnd_SD	0	
18.	CV min diff sigma-BckGnd_SD	0	
19.	CV rejection confidence limit	50	%

- *AG enable* (seq) - autoguiding corrections during sequence can be enabled/disabled using this flag
- *Autoguiding target* (X0/Y0) (seq/cen) - absolute CCD X/Y coordinate of the target (X/Y position reference of the PI controller). It should be chosen near the center of the field (which depends on optical alignment, and is not necessarily the same as the physical CCD center), with the side condition that no dead pixels are located inside the two windows.
- *AG Base exposure time* (cen) - is only used during centering to select an exposure time depending on the magnitude of the target star. The centering will increase the exposure time step-wise if necessary.

- *Autoguider in-target radius* (cen) - is only used during centering, and determines below which error the centering is regarded as finished, in order to proceed. It should be chosen so that even with wind-shake centering is still possible.
- *AG update rate during sequence* (seq) - is only used for autoguiding during the sequence. This number of exposures is taken to provide an averaged error-vector. The value should be chosen as compromise between tracking stability (to compensate with lower value) and wind-shake influences (requires higher value). A value of zero will disable autoguiding.
- *AG proportional gain X/Y axis* (seq) - proportional gain of the X/Y PI controller
- *AG integral gain X/Y axis* (seq/cen) - integral gain of the X/Y PI controller

The following centroid validation (CV) criteria are applied for centering, but not for autoguiding during the sequence. Basically, only if all conditions (that are set to non-zero) are met then the centroid is valid (we have an object in the field). [13] contains the detailed descriptions:

- CV minimum number of valid pixels
- CV maximum number of spots (not implemented)
- CV minimum signal-noise-ratio
- CV maximum image size FWHM in pixels
- CV maximum elongation FWHM in percent
- CV maximum error vector length in pixels
- CV maximum pixel value in a/d counts
- CV minimum ratio of flux standard deviation with background standard deviation
- CV minimum difference of flux standard deviation and background standard deviation
- CV rejection confidence limit in percent - the centroid is rejected if the rejection-confidence, calculated as the number of failed criteria divided by the number of applied criteria in percent, is higher than this limit. (Again: refer to [13] if this sounds too complicated.)

5.4 Telescope Enclosure Configuration

The file *$VLTDATA/config/Enclosure.dbcfg* contains a user configuration of the enclosure software device (Enclosure).

Any modification to the default values contained into the file must be done following the procedure indicated in section 5.2.1 of this document. For this device forcing an immediate update with the *dbRestore* command will not take effect over the running configuration of the device. It's necessary to re-boot the lcu to get the new configuration running.

All the database attributes included into the provided configuration files belong to the following lcu database point: `@lasm1:ASM:Enclosure:Config.` The meaning of the database attributes contained in this database point is as follow:

a. device: name of the operating system device associated with the physical connection of the serial line. This configuration could be useful in case the actual iser connection fails. Actual default value /iser1.
b. MoveTimeout: timeout in seconds when waiting for an open or close movement of the dome. This value should no be too big. If one (or both) of the limit switches that disable the enclosure motion when completely open or closed, is broken then the motors will force in any case the motion beyond mechanical restrictions increasing the electrical current through the motors. A fine tuning of this timeout makes possible then to minimize the time during which the motors will be forced at high current. A too big timeout could provoke the failure of one or both motors. Actual default value 60 sec.
c. period: interval in seconds at with the enclosure status is updated into the local lcu database. Actual default value 5 sec.

5.4.1 Serial line communication parameters

The serial line parameters are provided into the following lcu's database branch: *@lasm1:ASM:Enclosure:Config:Com*.

Actually none of this attributes are provided as configurable parameters through the enclosure's configuration file (*Enclosure.dbcfg*). For the time being, there are not foreseen changes on the communication setup. If needed in the future, the Enclosure.dbcfg should be archived and maintained including database attribute values of this branch.

The most important serial line communication parameter and their default values are the following ones:

a. *readbuff* (0): size of the receive-side buffer (zero --> do not resize, use iser default of 512)
b. *writebuff* (0): size of the send-side buffer (zero --> do not resize, use iser default of 512)
c. *baudrate* (9600): communication baud rate
d. *charbits* (8): bits per character
e. *stopbits* (1): number of stop bits
f. *parity* (0): parity type [1:even, 0:none, -1:odd]
g. *handshake* (3): handshake type [0:DTR,1:Xon,2:RTS,3:none]
h. *reclen* (1): iser record length [0:max, 1 to 1023]

5.5 Meteo Station Configuration

For the meteorological software device (Meteo) the file *$VLTDATA/config/Meteo.dbcfg* is foreseen as user configuration setup. Any modification to this file must be done following the procedure described into 4.2.1 in this same document.

The actual content of this configuration file is rather short, it just include the following lcu database attribute: `@lasm1:ASM:Enclosure:Config.LogFile`. This attribute defines where should be written the log file produced by this device. The log file is updated every time a valid telegram is received from the VAISALA system. Each telegram is appended to the file. The actual default value for the LogFile attribute is: "/data/log/meteo.log"

5.5.1 Serial line communication parameters

The serial line parameters are provided into the following lcu's database branch: *@lasm1:ASM:Meteo:Config:Com*.

Actually none of this attributes are provided as configurable parameters through the meteo's configuration file (*Meteo.dbcfg*). For the time being, there are not foreseen changes on the communication setup. If needed in the future, the *Meteo.dbcfg* should be archived and maintained including database attribute values of this branch.

The most important serial line communication parameter and their default values are the following ones (given for Paranal, La Silla may vary):

a. *readbuff* (3072): size of the reading buffer
b. *writebuff* (0): size of the send-side buffer (zero --> do not resize, use iser default of 512). Not applicable in this case because the Meteo device only reads the serial channel.
c. *baudrate* (9600): communication baud rate
d. *charbits* (8): bits per character
e. *stopbits* (1): number of stop bits
f. *parity* (0): parity type [1:even, 0:none, -1:odd]
g. *handshake* (3): handshake type [0:DTR,1:Xon,2:RTS,3:none]
h. *reclen* (1): iser record length [0:max, 1 to 1023]

5.6 Operational Limits Configuration

The operational limits (mainly for the telescope) are defined by attributes in the following WS database points:

- <alias>MeteoAlarmRH - relative humidity
- <alias>MeteoAlarmWS - wind speed
- <alias>MeteoAlarmWG - wind gusts

In each of these points is an attribute *lim* for the limit value and *hys* for hysteresis. If the actual values from the Meteo station exceed one of the limits - considering the hysteresis - then the asmwsControl process will force the whole system to stand-by. When the conditions recover, operation resumes in on-line state.

Note that also when the system is already stand-by (during day) it will be forced again to stand-by when a limit is exceeded. Upon recovery the system remains stand-by then.

Unlike the end of night procedure, the telescope is not moved to park position.

The configuration file for these values is *$VLTDATA/config/Alarms.dbcfg*.

6 DIAGNOSTICS

This section describe some facilities used to test individual devices or to generate data that normally is not available during automatic operation, due to performance reasons. Also software trouble shooting is discussed.

6.1 Enclosure serial commands (Paranal only)

In order to check the serial line communication between *lasm1* lcu and the enclosure on-board CPU the *asmtenUsrCmd* shell command (VxWorks) is provided. To use it log in lasm1 and type a command:

```
wasm asm:~ 1 > rlogin lasm1
lasm1 ->asmtenUsrCmd "command"
```

6.2 Exposure sequence parameters dump

To dump all image analysis parameters of an exposure sequence, use *asmdimExposDump*. It will at the end of each sequence write the parameters to a file in the current directory. The file-name contains a time-stamp to identify the sequence uniquely. The program supports a '-nice' option to produce a better readable tabular output, but this is normally too slow for long sequences > 100 exposures, and particularly does not work for coherence mode dumps. The file contains only the parameters of exposures that passed the frame validation, but includes also those that are (afterwards) rejected in the statistical validation.

6.3 System trouble shooting

Symptom: System does not do what it should - and no idea why.
Diagnostic: none.
Remedy: For any kind of ASM software problem, the complete restart should always help, but might be overdone:

vccEnvStop -e wasm (or - more drastic - RtapShutdown -f)
Reboot lasm1 and lasm2 (rlogin <lcu> and Ctrl-X), wait until rlogin is again possible
vccEnvStart -e wasm

The *asmwsControl* process will after one minute start automatic operation and set everything back to stand-by or on-line.

Symptom: Only red flags in seeing plot and progress-bar in asmDimm panel does not move.
Diagnostic: probably DIMM CCD in error.
Remedy: Try to send (while *asmwsControl* is happily running in an endless loop):

```
msgSend wasm ccdconCI_DIMM init ""
msgSend wasm ccdconCI_DIMM on-line ""
```

If that does not help:

```
ccdDcsStop.sh
Reboot lasm2
ccdDcsStart.sh
```

Symptom: Logs that Meteo data "outdated - not archived" and lasm1 log time-stamps are wrong.
Diagnostic: time-server distributes wrong time
Remedy: fix it there - e.g. power-cycle that time-warping machine.

Symptom: wasm logs about "NTP cannot connect to timeserver"
Diagnostic: NTP on wasm exited after time-server fault.
Remedy: Restart NTP it with "sam", you need to be *root*.

Symptom: Strange logs flooding from lasm1
Diagnostic: probably tracking screwed up, possible by time-server jumps. Fix also needed when timer-server distributes the wrong time, visible in the log's timestamps.
Remedy: Try:

```
msgSend wasm asmwsControl exit ""
Reboot lasm1
RtapRunCmd asmwsControl
```

and it will restart automatically after 1 minute. Note that *asmwsControl* must be started with *RtapRunCmd*, otherwise the restart-on-fault feature will not be enabled.

Symptom: Logs flooding from asmei or other panel about "bad quality of attribute".
Diagnostic: Scan system to LCU is in error, to be verified on the alarm display (RtapASDisplay).
Remedy: scanDevOff <lcu>; scanDevOn <lcu>

Symptom: After a reboot of the WS, the wasm environment cannot be started with vccEnvStart -e wasm. Logging errors about "shared memory id not found" or "database access failure".
Diagnostic: unknown yet, possibly a timing problem introduced with FEB99 release.
Remedy: Try again, usually it works after three retries.

Symptom: Serial line to enclosure gives always wrong reply and cannot be operated (this is for Paranal only).
Diagnostic: possibly the emergency stop has been pressed.
Remedy: Try the recovery procedure as described in section 3.8.3.

7 ASM QUICK REFERENCE

This is a summary of common procedures for ASM operation, i.e. cases where the operator must intervene. For each case the necessary action is given, and a cross-reference to the section where detailed description can be found.

What to do if ...

- ... it suddenly starts to rain and the DIMM won't close by itself because the current meteo data is way below the operational limits?

  ☞ Press the central *Standby* button on the asmei panel. The DIMM enclosure will close immediately, and the whole system is forced to standby until automatic operation is resumed by the *Start* button.

  ➥ section 2.1.1

- ... we want to open the DIMM for seeing measurements, although the current meteo data is above the operational limits, therefore an alarm pending and the system forced to standby?

  ☞ Press the central *Online* button on the asmei panel, and don't forget to press *Start* when done in order to resume automatic operation.

  ➥ section 2.1.1

- ... we have to disable any telescope movement by hardware but keep the meteo alive?

  ☞ Press the central *Standby* button on the asmei panel, and switch the amplifier rack in the rear of the lasm1 LCU cabinet off.

  ➥ section 2.1.1

- ... Meteo or Enclosure is defective and must be by-passed for automatic operation?

  ☞ Switch on the 'Simulate' checkbutton in the asmei panel. Now the device will no longer be controlled by the automatic procedure.

  ➥ section 2.1.4/2.1.5

- ... the Telescope is defective or out of order and must be by-passed for automatic operation?

  ☞ In this case exit the asmwsControl process so that all devices are in stand-alone mode. The individual devices (like Meteo) can then be operated from the asmei panel

  ➥ section 2.1.7/2.1.4/2.1.5

- ... the system does not behave as it should and we have no time to check for the reason?

  ☞ First one should try asmbb's remedy. If this fails, the complete environment restart/reboot should help and will take about 15 minutes; if the problem persists then there is something really wrong (file system full, network problem, hardware fault, ...).

  ➥ section 2.3/6.3

8 REFERENCE

8.1 WORKSTATION APPLICATIONS

8.1.1 asmwsControl

NAME

```
asmwsControl - astronomical site monitor control process
```

SYNOPSIS

```
asmwsControl [-r dbRoot] [-n processName]
```

DESCRIPTION

```
The asmwsControl process is part of the asmws module. It receives and
handles all user and standard commands to the module.
The process is responsible for coordinating the actions of all
astronomical site monitor facilities by sending commands to the
appropriate sub-modules.

The optional argument <dbRoot> is the root point of the ASM database
branch. If omitted it is defaulted to the local database root point.

The optional argument processName is the name under which the process
instance registers with the CCS and hence the destination process name
for commands to it. If omitted, the instance registers with CCS with
its UNIX process name, as passed by the shell in argv[0].

At start up the control process enebles the auto start feature, this
means that if before 60s it does not receives the DISTART command then
the system will be commanded itself to enter the automatic operation.
This is done self sending the START command.

Additionally, the process changes itself its RTAP re-start flag to PROGRAM,
this means that the process will be re-scheduled by RTAP if it terminates
anormally. Notice that this is not case if the process is not a child
(i.e. started from a shell) of the RtapScheduler process associated to the
running environment. To be sure that the RTAP re-start mechanism is
working always, when starting the contol process manually, use the
RtapRunCmd command like follows:

            RtapRunCmd -e wasm -u /vlt/asm/JUN98/bin/asmwsControl

(full path needed).
```

FILES

```
asmws_ERRORS - r - error message definitions
```

COMPILATION FLAGS

```
TARGET_TCS Is used to build the application for VLT (VLT_TCS) or
           NTT (NTT_TCS). It is usually set to the correct value
           in the makefile
```

COMMANDS

```
START   starts the automatic operation of the ASM
and all standard commands
```

RETURN VALUES

```
0 if everything OK
1 on error
```

EXAMPLES

```
shell> asmwsControl -r :testDB:TCS &

Starts a process instance with process name asmwsControl and specifies
":testDB:TCS" as the TCS branch root point.
```

SEE ALSO

```
"asm Control Software Design", VLT-SPE-ESO-17441-1213
```

```
- - - - - -
Last change:  19/02/99-18:22
```

8.2 WORKSTATION UTILITIES

8.2.1 asmcatPomInstall

NAME

```
asmcatPomInstall - install pointing offset table
```

SYNOPSIS

```
asmcatPomInstall [-v] [-a] <infile> | -clear
asmcatPomInstall -c
```

DESCRIPTION

```
The input-file is processed and the pointing offset table in the
database is filled with a grid of offset values.

<infile> must contain the pointing measurement data in the format
as produced by asmtelPomMeasure. This is the same as the input
format for the TPOINT modelling program. Any line which is not
in the required format is ignored. The two header line of a TPOINT
input file are also handled in this way.

The input file contains per line the nominal star position ra/dec,
the actual position, the local siderial time, and additionally
(not specified in the tpoint format) the eta/theta offset.
From that it is calculated the hour angle and offset to be put
into the pointing lookup table. Normally eta/theta offsets are
directly used. but optionally one can work with alpha/delta offsets,
see OPTIONS. The asmwsControl process expects eta/theta, however.

The database table with the pointing data represents a lookup
table with declination and hour angle as input coordinates, and
the offset as output value. The declination is put into
the rows, one for each declination value found in the input file.
The declination entries are therefore not equidistant.
The columns give the hour angle with a stepsize of 0.1 h (6 min).
All input data are averaged for the nearest hour angle grid point.
```

OPTIONS

```
-a      work with alpha/delta offsets; default is to use eta/theta offsets
-c      clears the table to zero
-v      verbose output
```

CAUTIONS

```
The offsets stored in the table are directly suitable for the
trkServer OFFSAD command. This implies a factor cos(declination)
for the RA offset.
```

SEE ALSO

```
asmtelPomMeasure(1), asmwsAutopommer(1)
```

```
- - - - - -
Last change:  19/02/99-18:13
```

8.2.2 asmcatPomLookup

NAME

asmcatPomLookup - install pointing offset table

SYNOPSIS

asmcatPomLookup <ra> <dec>

DESCRIPTION

Lookup of the pointing offset for a given star position.

CAUTIONS

Site coordinates of Paranal are hardcoded! Works nowhere else!

SEE ALSO

asmtelPomMeasure(1), asmwsAutopommer(1)

\- - - - - -
Last change: 19/02/99-18:13

8.2.3 asmdimExposDump

NAME

asmdimExposDump - dump all sequence image parameters to files

SYNOPSIS

asmdimExposDump [-nice]

DESCRIPTION

Waits until a sequence is completed, then reads all image
parameters of all exposures of the sequence from the LCU
database and dumps them to a file.
The file includes the timestamp in the name and is created
in the local directory
The program stays resident until killed.

The output format is normally the raw unformatted data vectors,
one per row with all exposures. With the "-nice" option the
parameters are formatted and output in nice columns;
however, the -nice option is MUCH slower and may not work
for large number of exposures.

EXAMPLES

asmdimExposDump /data/log

\- - - - - -
Last change: 19/02/99-18:25

8.2.4 asmwsAutopommer(1)

NAME

```
asmwsAutopommer - ASM automatic pointing modeller process
```

SYNOPSIS

```
asmwsAutopommer [-verbose]
```

DESCRIPTION

```
This program gathers pointing model data during the DIMM sequence.

While the DIMM measurement enters running state, and so the
target star should be centered, this process executes periodically
the asmtelPomMeasure tool to determine pointing model data.

This data is saved into a file, for later off-line analysis
to build a new (better?) pointing model. The format is suitable
for direct input into the TPOINT program.

Any errors will be logged, but the program continues.

In verbose mode all data output will also be logged.
```

FILES

```
$VLTDATA/tmp/Autopom.dat - receives the output data
```

ENVIRONMENT

```
VLTDATA - VLT data area
```

SEE ALSO

```
asmtelPomMeasure(1),
TPOINT Telescope Pointing Analysis System Manual
```

```
- - - - - -
Last change:  31/07/97-01:05
```

8.3 WORKSTATION COMMANDS

8.3.1 asmwsControl

PUBLIC_COMMANDS

START:
----------=
Starts the automatic operation of the Astronomical Site Monitor.
Depending on time of day and weather conditions it brings the system to
either Online or Standby state, which is further on automatically updated.
The automatic operation can be interrupted by an explicit ONLINE or STANDBY
command, and resumed after that by another START command.

CENTER:

This command centers in the CCD field the actual object on it.
The telescope must be tracking.
Only a maximum of `max' iterations are performed before giving up.
The corrections are issued using the telescope TELOFFS command.
If before the maximum number of iterations the calculated error vector is
`small' enough then the loop it's stopped and then an OK reply is send back.
In any other case and error reply is sent back.

PARK:

Send OBJNAME to tracking server. Accepted only if control process is stand-by.

PING:

Get lifesign from ASM.

STATE:

Get state of ASM.

STATUS:

Get complete status of ASM.

MAINTENANCE_COMMANDS

DISTART:

Disable the automatic STARTing of the control process. After the control
process has been spawned the user has 60 secs to send this command disabling
the automatic self-sending of the START command.

GETSUNA:

Get the altitude position of the sun in radians.

GETSUNE

Get the time (hh:mm) remaining for the next sun event.

POMDATA

Enable the automatic gathering of data for a pointing model fit.
The data it's recorded in the file $VLTDATA/config/pom.data.

GSTARD

Using the asmcatDEVICE::TestStarData method the data of the `name' star it's calculated and return as a string reply.

GSTARN

The actual selected star name is returned.

AUTON

Set to TRUE the internal AutOn logical flag.
When AutOn it's TRUE then the state transition machine will automatically execute the callback function of the next state (triggered by an event) and based on a 3 seconds polling timer. This command it's allowed in any state.
This command it's used only for debugging purposes.

AUTOFF

Set to false the internal AutOn logical flag.
When AutOn it's false then the state transition machine will be blocked to jump to the next state when an event is notified. The control process will wait until a ONESTEP command it's received before executing the callback associated with the next state. Use AUTON to cancel this feature.
This command it's allowed in any state.
This command it's used only for debugging purposes.

ONESTEP

If the automatic substate switching feature it's disable (AUTOFF) then this command enable it until the next event has been notified and attended.
When this event has been attended then the autoswitching (AUTON) remains blocked again.

FIXSTAR

This command writes into the database the catalog index of the given star.
Doing this one can override the selection criterion. If the witten index is not minus one then the SelectStar method (asmcatDEVICE class) will not go through the catalog list looking for the best star. Instead the star indexed by the database attribute will be forced.
If the argument it's `off' minus one will be written into the database attribute.

SELSTAR

Using the asmcatDEVICE::SelectStar method the name of best star for the given time is sent as reply.

INIT

Initializes the ASM system.
It aborts all operation and sets the system to Loaded state, and reads configuration parameters from the database.
This command it's allowed only when the asmwsControl process is in LOADED

state. The final state it's in any case LOADED.
The substate of the asm ws control process reflects if the INIT command was already processed at least once. If the substate it's equal UNKNOWN then the command it's processed and if all goes OK the substate switched to READY at the end. If the substate it's already READY then the command return immediately a last normal reply (no further actions performed).
When the command it's processed then the following actions are performed:

```
- set the devices timeout parameter on both LCUs (DEVSTIM)
- self-send the OFF command: --> OFF (eta-theta-trks)
                                 INIT    (CCD)
- send the LCCINIT command to both LCUs
- send the INIT command to the CCD workstation process
- get the site coordinates from the telescope LCU by means of
  trk GETSITE command
- set the site coordinates into the asmcatDEVICE object.
```

EXIT

Perform a shutdown by terminating the process. Brings the system to non-operational state.
First an OFF command it's self-sent to the ws control process. In despite of the type of the reply to the OFF command the EXIT command forces to terminate the asmwsControl process.

WRAP

Stop the actual actions going on within the on-line state. That is to say, when the state transition machine is working.
This command tries under any condition to restart the on-line sequence.
If any error/timeout reply is received while stopping the sequence this is withdraw and the next action take.
At the end the state machine switches to Idle and the on-line operation resume from this point.
This command is accepted only when the system is on-line.

ONLINE

Set the system explicitly into Online state.
If the automatic operation it's active then it will be broken and the control process will remains ONLINE as long as no other state-switching command is explcitly requested. The automatic operation can be resumed by the START command.

STANDBY

Set the system explitly into Standby state.
If the automatic operation it's active then it will be broken and the control process will remains STANDBY as long as no other state-switching command is explcitly requested. The automatic operation can be resumed by the START command.

OFF

Set the system explcitly into Loaded state. Any previous received command it's canceled.
An OFF command it's send to both axis servers and to the tracking server in the telescope LCU.

An INIT command it's send to the CCD workstation process (the OFF command actualy causes the CCD process to exit).

VERBOSE

Switch on or off verbose mode.

VERSION

Get version of asmws module.

___oOo___