LA SILLA OBSERVATORY

FEROS-II:
Instrument Software
User Requirements

Doc. No. 2p2-SRS-ESO-22400-0001

Issue 0.7
August 20, 2003

Prepared for Review - INTERNAL USE ONLY

Prepared: J.D. Pritchard  August 20, 2003
Name        Date        Signature

Approved: J.C. Guzman T.  August 21, 2003
Name        Date        Signature

Released: O. Hainaut  August 25, 2001
Name        Date        Signature
## Change Record

<table>
<thead>
<tr>
<th>Issue/Rev.</th>
<th>Date</th>
<th>Sect./Parag. affected</th>
<th>Reason/Initiation/Documents/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>19/05/2003</td>
<td>All</td>
<td>Creation</td>
</tr>
<tr>
<td>0.2</td>
<td>21/05/2003</td>
<td>All</td>
<td>Archived for safe keeping</td>
</tr>
<tr>
<td>0.3</td>
<td>29/05/2003</td>
<td>All</td>
<td>Archived for safe keeping</td>
</tr>
<tr>
<td>0.4</td>
<td>03/06/2003</td>
<td>All</td>
<td>Pre-Release draft</td>
</tr>
<tr>
<td>0.5</td>
<td>21/07/2003</td>
<td>All</td>
<td>Updated after release of URs</td>
</tr>
<tr>
<td>0.6</td>
<td>25/07/2003</td>
<td>All</td>
<td>Internal, not released</td>
</tr>
<tr>
<td>0.7</td>
<td>20/08/2003</td>
<td>All</td>
<td>Updated for release after review by JCGT</td>
</tr>
</tbody>
</table>
## Contents

1 Introduction
   1.1 Purpose .................................................. 1
   1.2 Scope .................................................. 1
   1.3 Applicable Documents ..................................... 1
   1.4 Reference Documents ...................................... 1
   1.5 Abbreviations and Acronyms ............................... 2
   1.6 Release Notes ........................................... 2

2 Overview of current system
   2.1 CCD .................................................. 3
   2.2 DCS .................................................. 3
   2.3 Instrument, Adapter and ICS .............................. 3
   2.4 Environment Monitoring .................................. 3
   2.5 DRS .................................................. 4

3 Hardware Upgrades
   3.1 Essential ............................................... 4
       3.1.1 Detector-Controller upgrade ......................... 4
       3.1.2 Science Fibres and Fibrehead upgrade .............. 4
       3.1.3 Atmospheric Dispersion Corrector ................. 4
       3.1.4 Calibration Unit upgrade ........................... 4
       3.1.5 Environment Monitoring upgrade .................... 4
       3.1.6 Stabilized LED upgrade ............................ 4
   3.2 Desirable ............................................... 5
       3.2.1 New FEROS/WFI or FEROS/GROND Adapter .......... 5

4 New functionalities
   4.1 Guiding on the FibreHead Viewing TCCD ................ 5
   4.2 Blind offset acquisition ................................ 5
   4.3 Acquisition of Fibrehead Viewer images ................. 5
   4.4 Pre-warm calibration lamps during science exposures .. 5

5 Overview of New System
   5.1 Hardware Architecture ................................... 6
       5.1.1 Devices ........................................... 6
       5.1.2 Computers ........................................ 6
       5.1.3 LANs ............................................ 6
       5.1.4 Special connections ................................ 7
   5.2 Software Architecture ................................... 7
       5.2.1 Software modules ................................ 7
       5.2.2 Environments ..................................... 7

6 Software User Requirements
   6.1 Description of all functions ............................. 8
       6.1.1 Motorised functions ................................ 8
       6.1.2 Lamps & LEDs ...................................... 8
       6.1.3 Sensors ........................................... 8
   6.2 Required Panels ......................................... 9
   6.3 DCS .................................................. 9
   6.4 ICS .................................................. 9
6.4.1 Moving the ADC and/or SCSM ........................................ 9
6.5 OS ............................................................................. 9
  6.5.1 Observing Modes .................................................. 10
  6.5.2 Readout Modes .................................................... 11
  6.5.3 Data Handling ..................................................... 11
  6.5.4 RTD ................................................................. 11
  6.5.5 FITS Headers ..................................................... 11
6.6 DRS ..................................................................... 11

7 Requirements of the TCS .................................................. 11

8 Observing Blocks and Templates ....................................... 12

A FEROS Image Headers ................................................... 13
  A.1 Current .................................................................. 13
  A.2 Proposed ............................................................ 16
1 Introduction

FEROS-II is a substantial project to be executed during 2003. It will consist of several components:

- Detector Controller upgrade and associated upgrade of Operating System to VLT standards
- Science Fibres and Fibrehead upgrade
- Atmospheric Dispersion Corrector
- Calibration Unit Upgrade
- Environment Monitoring Upgrade
- Improved functionalities: Guiding on TCCD, Blind offset target acquisition, Acquisition and archival of TCCD images, Pre-warming of calibration lamps.

A more complete description of the project is provided by the overall project User requirements [2].

1.1 Purpose

This document (2p2-SRS-ESO-22400-0001) provides the Software User Requirements of the client for the FEROS-II project, Science Operations. It deals primarily with the Upgrade to VLT Compliance since that is the major element of software the must be implemented. The addition of an Atmospheric Dispersion Corrector, a redesigned Calibration Unit, implementation of TCCD guiding and new functions associated with an upgraded FEROS/WFI Adapter will also require software solutions for these new functionalities.

1.2 Scope

This document is intended as input to the design phase of the Instrument Software to be implemented by La Silla Software and Communications (SWC). It deals only with software issues. Hardware issues will be dealt with in the overall FEROS-II User Requirements [2].

Some of the content of this document (e.g. the overview of the current system) is provided by direct request of the SWC group.

1.3 Applicable Documents

The following documents, of the exact issue shown, form a part of this document to the extent specified herein.

1 VLT-PRO-ESO-10000-0228, 1.0 10/03/1995 — VLT Software Programming Standards
2 LSO-URS-ESO-22400-0002, Pritchard: FEROS-II User Requirements
3 2p2-TRE-ESO-22400-0001, Pritchard: FEROS-II Template Manual

1.4 Reference Documents

The following documents are referenced in this document.

4 VLT-SPE-ESO-17120-1355, 1.2 12/01/1999 — Final Lay-out of VLT Control LANs
1.5 Abbreviations and Acronyms

2p2  The MPG/ESO-2.20-m telescope at the LSO
ADU  Analog to Digital conversion Unit
ADC  Atmospheric Dispersion Corrector
AG   Autoguider
BIAS Brorfelde Image Acquisition System
CCD  Charge-Coupled Device
DCS  Detector Control System
DFS  Data Flow System
DICB Data Interface Control Board
DRS  Data Reduction Software
ESO  European Southern Observatory
eu  encoder units
FEROS Fibre, Extended Range Optical Spectrograph
FFHV FEROS FibreHead Viewer
FITS Flexible Image Transport System
GUI  Graphical User Interface
ICS  Instrument Control System
LSO  La Silla Observatory
PSF  Point Spread Function
SCSM Sliding Calibration Selector Mirror
SWC  Software and Communications team at LSO
TBD  To Be Done/Discussed/Decided
TCCD Technical CCD
TCS  Telescope Control Software
TIO  Telescope & Instrument Operator
VLT  Very Large Telescope

1.6 Release Notes

This version (version 0.7) is intended as the final draft release version.

Version 0.6 was an ‘internal’ release, not released to the community. Version 0.5 was a Pre-Release draft intended for information purposes only. It is a work in progress. Many of the details which must eventually be contained here will depend on the outcome of the (hopefully) soon\(^1\) to be held FEROS-II Preliminary Design Review meeting. Wherever there are conflicts within this document it can be assumed only that the information provided caters for different possibilities. Wherever there are conflicts between this document and any other, the other should be taken as the reference.

Please mail comments to jpritcha@eso.org.

\(^1\)Hopefully.
2 Overview of current system

A detailed description of the current system is presented at the web page with URL:
http://www.ls.eso.org/lasilla/sciops/feros/Internal/SystemDescription/index.html

The following provides a simple overview.

2.1 CCD

The current FEROS CCD was built by Copenhagen University Astronomical Observatory and is based on the BIAS system, which uses IBM-PC compatible computers running under Linux. The PC controls the CCD via a custom built ISA interface board linked to the CCD electronics via fibre-optic cables.

The CCD chip and cryostat are understood to be ‘standard ESO’ components. It is not known exactly where the non-standard ESO electronics begin, but it can probably be assumed that all electronics are non VLT-compatible.

The BIAS system also controls the CCD shutter.

2.2 DCS

As noted above the Detector Control System (DCS) is implemented within the BIAS system. The user interface is a command line software also called BIAS. It provides controller configuration (i.e. specification of chip geometry, gain level, amplifier mode etc for readout), image acquisition, real-time display and basic image analysis (via ds9) and a means to run user configurable shell scripts (which allows basic interfacing to MIDAS where the DRS runs). BIAS is maintained in CMM module f bias.

FEROS/WFI Adapter and FEROS Calibration Unit header information for science images is provided by a text file written by the fcu panel (CMM modulefwacu).

Observer and program ID header information for science images is provided by a text file written by the FEROS Obs DataBase panel (CMM module fprocim).

Detector hardware configuration header information for science images is provided by a text file which must be manually edited whenever and configuration change is made.

The header information from the various sources is collected and formatted into an appropriate input file for use by BIAS by a suite of shell scripts (CMM module fprocim).

2.3 Instrument, Adapter and ICS

Although the FEROS instrument itself (currently) has no moving parts, the necessary FEROS/WFI Adapter and FEROS Calibration Unit do. These two components are currently controlled by one LCU (fwacu) and one C110 workstation (fwacu). All hardware are VLT-compliant. The current control software (CMM module fcu) is not VLT-compliant.

2.4 Environment Monitoring

The current environmental monitoring is implemented via a NON-VLT compliant LCU (fenv). The fenv LCU boots from an old version on VxWorks installed on wfwacu and then runs a script from the CMM module fenv.
2.5 DRS

The Data Reduction Software (or Pipeline) is a ‘standard reduction package’ implemented within MIDAS. The DRS currently runs on $\texttt{w2p2off}$.

3 Hardware Upgrades

The User-Requirements for the FEROS-II hardware upgrades are presented in detail in the FEROS-II User-Requirements [2]. The following provides an overview for information only.

3.1 Essential

3.1.1 Detector-Controller upgrade

The Detector will be upgraded to a FIERA system. Of the existing system probably only the CCD and cryostat will be reusable.

3.1.2 Science Fibres and Fibrehead upgrade

No impact on Instrument Software.

3.1.3 Atmospheric Dispersion Corrector

The implementation of the ADC will require the implementation of three new devices (ADC IN/OUT, ADC position sensing and rotational positioning and position sensing of two pairs of prisms). According to the design, one function should be able to control both pairs of prisms. The ADC IN/OUT function will be of the same type already implemented for the M3 in the adapter.

3.1.4 Calibration Unit upgrade

The existing calibration unit will be upgraded by replacing ‘blue’ FF lamp with a deuterium lamp – no new functions required by this option.

3.1.5 Environment Monitoring upgrade

The current, non-VLT compatible system will be replaced by new, VLT-compatible hardware which will provide eight sensors, six temperatures, one humidity and one Liquid Nitrogen Dewar pressure.

3.1.6 Stabilized LED upgrade

The existing Betalight system used for CCD tests will be replaced by a remote, computer controlled Stabilized LED system. New function(s) will be required to control the ON/OFF function(s) of the LEDs.$^2$

$^2$More than one function maybe required if LEDs of more than one colour are implemented.
3.2 Desirable

3.2.1 New FEROS/WFI or FEROS/GROND Adapter

Consideration should be given to the requirements of a possible new FEROS/WFI Adapter or eventual FEROS/GROND Adapter.

New features of either:

- Remote, computer control of Fibrehead position.
- Remote, computer control of TCCD focus.

Ideally the TCCD would be focused relative to the Fibrehead and the fibre head and TCCD assembly as a whole should be controlled to provide complete focusing ability. This functionality is HIGHLY desirable since the alternative is a long, tedious and some what hit-and-miss process to focus the adapter involving removal of WFI and adapter in order to make any adjustments and requiring testing during two consecutive nights of good photometric quality, whereas if these were remotely computer controlled the procedure could be done much more reliably and using just part of a single night. Moreover it will permit compensation of the thermal expansion of the adapter tower which will defocus the TCCD relative to the fibrehead.

4 New functionalities

4.1 Guiding on the FibreHead Viewing TCCD

Guiding on the FEROS FibreHead Viewing TCCD will be implemented. Guiding on fibre mode is CRITICAL. Guiding on field star mode is DESIRABLE.

4.2 Blind offset acquisition

To allow observations of FAINTE objects.

4.3 Acquisition of Fibrehead Viewer images

At the start of each SCIENCE exposure the current image on the FFHV TCCD should be ‘grabbed’ (as is done for HARPS). The TCCD image is the equivalent of a ‘thru-slit’ image, i.e. provides ultimate confirmation that the correct object has been observed. This will be particularly useful for Service Mode observations. It is not currently forseen that these images will be archived via the VLT-DFS.

4.4 Pre-warm calibration lamps during science exposures

Switch on calibration lamps a userdefinable time in advance of the end of an exposure so that time is not lost waiting for lamps to stabilise.
5 Overview of New System

5.1 Hardware Architecture

5.1.1 Devices

The instrument will consist of:

- 14 devices, controlled by ICS, on 1 LCU:
  - 8 motorized (M3(1), SCSM(1), FCU RSM(1), NDFW(1), FCU-Shutter(1), ADC(3))
  - 2 calibration lamp on/off functions
  - 3 CCD-Test LED on/off functions (allowing for three independant sets of LEDs of different colours.
  - 8 Environment Monitoring sensors six environmental Temperatures, one environmental Humidity, and one Liquid Nitrogen Dewar Pressure. The six temperatures will be installed at 2 different heights (table level and top of enclosure) inside instrument, 3 different levels (floor, mid height & ceiling) in FEROS Climate Controlled Room (but outside instrument) and one set in FEROS room. The Humidity sensor will be installed at mid-level (i.e. half way between table level and top of enclosure) inside the instrument
  - 4 Detector Monitoring sensors (3 temperature, $T_{CCD,Actual}$, $T_{CCD,Reference}$, $T_{N2}$ and 1 pressure $P_{Dewar}$)
  - 1 ISER board (serial RS232/485)

- 1 scientific FIERA detector
- 1 TCCD detector

Not to be forgotten is the TCCD, but it is part of the TCS system:

- 1 device, controlled by TCS, on 1 LCU (lffhv):
  - One standard ESO small format Technical CCD (the FEROS Fibrehead Viewing TCCD).

5.1.2 Computers

The computers on which the Instrument Software will run are:

- Instrument Workstation (wferos)
- ICS LCU (lfeics1) involved with all FEROS, Adapter, FCU devices except FFHV TCCD
- TCS LCU (lffhv) involved with FFHV TCCD
- FIERA UltraSparc (wfeacd)

5.1.3 LANs

The Instrument LAN will follow the layout of VLT Control LANs (see [4]) and is shown in figure ref:fig:ICSComputers. No ATM connection is forseen at this time (expense).
5.1.4 Special connections

The M3 and ADC IN/OUT functions are special devices.

5.2 Software Architecture

The software architecture of the Control Software will follow the VLT standard operational scheme. Observation Blocks, created with the P2PP toolkit, are sent to the Broker for Observation Blocks (BOB), which executes sequentially the templates defined in them.

In turn each template normally consists of a sequence of commands sent to the OS Server. This process is responsible for interpretation of the received commands, converting them into appropriate commands for the controlled sub-systems (ICS, DCS, and TCS), and of taking care of the resulting replies. At the end of an exposure, the OS Server process is also responsible for merging all data/information into one FITS file and then archiving that file, through the dedicated processes VOLAC/VCSOLAC/OLAS.

5.2.1 Software modules

The FEROS Instrument Software will consist of ‘the standard modules for new instruments at ESO’\(^3\).

5.2.2 Environments

The Instrument will use the following CCS environmets:

- *wferos*. ICS CCS environment (see RTAPENV)
- *lfeics1*. ICS LCU LCC environment, in charge of all FEROS, Adapter and Calibration Unit devices.
- *lffhv*. TCS LCU LCC environment, in charge of the FEROS Fibrehead Viewing Technical CCD.
- *wffedc*. FIERA DCS CCS environment.
- *wftecs*. TCS simulation CCD environment (see TCS_ENVNAME)

6 Software User Requirements

FEROS is to be upgraded to a *fully* VLT compliant system. Since all functions of instrument, adapter and calibration unit are, or can be made to be, VLT-hardware compliant, this should be a relatively straightforward procedure for SWC.

As a basic requisite, all present functionality should be maintained.

For convenience of development, maintenance and the observer all software, especially UIF panels, should be implemented so as to look, feel and behave as much as possible like HARPS.

\(^3\)Quote from Juan Carlos Guzmán.
6.1 Description of all functions

6.1.1 Motorised functions

1. **M3 In/Out**: The M3 is a simple IN/OUT function. *Technical description including Initialisation, limits etc: J.Alonso.*

2. **Sliding Calibration Selection Mirror**: *Technical description including Initialisation, limits etc: W.Eckert.*


4. **Fibre Lamp Selectors**: *Technical description including Initialisation, limits etc: W.Eckert.*

5. **Neutral Density Wheel**: *Technical description including Initialisation, limits etc: W.Eckert.*

6. **FCU Shutter**: *Technical description including Initialisation, limits etc: W.Eckert.*

7. **ADC In/Out**: The ADC In/Out will be of the same type as the M3 IN/OUT function. *Technical description including Initialisation, limits etc: J.Alonso.*

8. **ADC Prisms**: *Technical description including Initialisation, limits etc: W.Eckert.*

All motor movements will be able to be moved simultaneously and to move at the maximum reliable speed so as to minimally contribute to overheads.

6.1.2 Lamps & LEDs

All Lamps and LED sets require simple ON/OFF functionality.

6.1.3 Sensors

The 8 environmental monitoring (EnvMon) sensors \((6 \times T + H + P)\) will have the following properties:

- The temperature sensors will be accurate to \(\pm 0.1\) degree Celsius over a range of \(-10\text{–}+40\) degree Celsius.
- The humidity sensor will be accurate to 0.1\% humidity over a range of 0–100\%.
- The pressure sensor will be accurate to 1 hPa over a range of 760–780 hPa.

The 4 Detector Monitoring (DetMon) sensors \(T_{\text{CCD,Actual}}, T_{\text{CCD,Referencer}}, T_{N_2}\) and 1 pressure \(P_{\text{Dewar}}\) will have the following properties:

- The temperature sensors will be accurate to \(\pm 0.1\) degree Celsius over a range of \(-200\text{–}+40\) degrees Celsius (i.e. operating temperature to room temperature).
- The pressure sensor will be accurate to 0.1 hPa over a range of \(10^{-7}\text{–}10^{+3}\) hPa (i.e. operating pressure – atmospheric).

For each EnvMon and DetMon sensor the value will be displayed in the OS panel, recorded in the Headers of Science Images and logged in an ascii data file so as to be available for generating WWW pages and monitoring long term trends.
6.2 Required Panels

The following panels must be implemented:

- OS Control
- ICS standalone
- DCS standalone

6.3 DCS

A standard DCS should be implemented...

6.4 ICS

The ICS will need to control all functions and report readings of all sensors described in section 6.1...

The ICS software devices are defined in the table 1.

6.4.1 Moving the ADC and/or SCSM

Due to technical constraints, the ADC and SCSM can NOT both be IN simultaneously. Therefore when moving one or other function the following rules MUST be adhered to:

- **Moving the ADC**: Before starting an ADC preset, it must first be verified that the SCSM is in the PARK position. If not it must be preset to that position and it must arrive there BEFORE the ADC preset can begin.

- **Moving the SCSM**: Before starting an SCSM preset, it must first be verified that the ADC is in the OUT position. If not it must be preset to that position and it must arrive there BEFORE the SCSM preset can begin.

At this time it is not clear if hardware interlocks will be implemented, but certainly they would be useful.

6.5 OS

The OS will receive commands from BOB and redirect the appropriate commands to the relevant sub system(s). The OS panel will, look, feel and behave as much like the HARPS OS panel as is possible.
### Table 1: ICS Software Devices.

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Description</th>
<th>Range</th>
<th>Positions</th>
<th>FITS Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>m3</td>
<td>FEROS/WFI Selector Mirror</td>
<td>2</td>
<td>IN/OUT</td>
<td>INS.M3</td>
</tr>
<tr>
<td>2</td>
<td>scsm</td>
<td>Sliding Calibration Selector Mirror</td>
<td></td>
<td>PARK</td>
<td>BOTHFIBS</td>
</tr>
<tr>
<td>3</td>
<td>adc-in-out</td>
<td>ADC in/out</td>
<td>2</td>
<td>IN/OUT</td>
<td>INS.ADCA</td>
</tr>
<tr>
<td>4</td>
<td>adc-prism-a</td>
<td>A Prisms of ADC</td>
<td></td>
<td>0.0..3.0</td>
<td>INS.ADC1</td>
</tr>
<tr>
<td>5</td>
<td>adc-prism-b</td>
<td>B Prisms of ADC</td>
<td></td>
<td>0.0..3.0</td>
<td>INS.ADC2</td>
</tr>
<tr>
<td>6</td>
<td>ndfw</td>
<td>Neutral Density Filter Wheel</td>
<td></td>
<td></td>
<td>INS.NDFW</td>
</tr>
<tr>
<td>7</td>
<td>fcu-shutter</td>
<td>Calibration Fibre Shutter</td>
<td></td>
<td>DARK</td>
<td>BOTHFIBS</td>
</tr>
<tr>
<td>8</td>
<td>fcu-rsm</td>
<td>Rotating Selection Mirror</td>
<td></td>
<td>PARK</td>
<td>LAMP1</td>
</tr>
<tr>
<td>9</td>
<td>lamp1</td>
<td>Wavelength Calibration Lamp ThAr+Ne</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP1</td>
</tr>
<tr>
<td>10</td>
<td>lamp2</td>
<td>Wavelength Calibration Lamp ThArNe</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP2</td>
</tr>
<tr>
<td>11</td>
<td>lamp3</td>
<td>Flatfield Lamp Hal+Hal</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP3</td>
</tr>
<tr>
<td>12</td>
<td>lamp4</td>
<td>Flatfield Lamp D+Hal</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP4</td>
</tr>
<tr>
<td>13</td>
<td>lamp5</td>
<td>CCD-Test LEDs 1</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP5</td>
</tr>
<tr>
<td>14</td>
<td>lamp6</td>
<td>CCD-Test LEDs 2</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP6</td>
</tr>
<tr>
<td>15</td>
<td>lamp7</td>
<td>CCD-Test LEDs 3</td>
<td>2</td>
<td>ON/OFF</td>
<td>INS.LAMP7</td>
</tr>
<tr>
<td>16</td>
<td>sens1</td>
<td>Temperature FEROS Table Top</td>
<td></td>
<td>-10..+40</td>
<td>INS.TEMP1</td>
</tr>
<tr>
<td>17</td>
<td>sens2</td>
<td>Temperature FEROS Top Enclosure</td>
<td></td>
<td>-10..+40</td>
<td>INS.TEMP2</td>
</tr>
<tr>
<td>18</td>
<td>sens3</td>
<td>Temperature FCCR floor</td>
<td></td>
<td>-10..+40</td>
<td>INS.TEMP3</td>
</tr>
<tr>
<td>19</td>
<td>sens4</td>
<td>Temperature FCCR midlevel</td>
<td></td>
<td>-10..+40</td>
<td>INS.TEMP4</td>
</tr>
<tr>
<td>20</td>
<td>sens5</td>
<td>Temperature FCCR ceiling</td>
<td></td>
<td>-10..+40</td>
<td>INS.TEMP5</td>
</tr>
<tr>
<td>21</td>
<td>sens6</td>
<td>Temperature FR</td>
<td></td>
<td>-10..+40</td>
<td>INS.TEMP6</td>
</tr>
<tr>
<td>22</td>
<td>sens7</td>
<td>Humidity FEROS</td>
<td></td>
<td>0-100%</td>
<td>INS.HUM1</td>
</tr>
<tr>
<td>23</td>
<td>sens8</td>
<td>LN2 Dewar Capacity</td>
<td></td>
<td>0-100%</td>
<td>INS.PRES1</td>
</tr>
<tr>
<td>24</td>
<td>sens9</td>
<td>Temperature CCD</td>
<td></td>
<td>-200..+40</td>
<td>DET.TLM1</td>
</tr>
<tr>
<td>25</td>
<td>sens10</td>
<td>Temperature CCD LN2</td>
<td></td>
<td>-200..+40</td>
<td>DET.TLM2</td>
</tr>
<tr>
<td>26</td>
<td>sens11</td>
<td>Pressure CCD</td>
<td></td>
<td>10^-10^3</td>
<td>DET.TLM3</td>
</tr>
</tbody>
</table>

#### 6.5.1 Observing Modes

1. BIAS image
2. DARK image
3. LED image
4. Wavelength Calibration image
5. Smooth Field (aka flatfield) image
6. Focus sequence
7. Object-Sky mode Science image
8. Object-Calibration mode Science image
Each of the above observing modes will produce one or several Science image.

### 6.5.2 Readout Modes

1. ‘Best’ detector-performance readout mode
2. ‘Fast’ detector-performance readout mode
3. Single window of any size from $1 \times 1$ to the full chip $2148 \times 4096$ with binning of $1 \times 1$ and $2 \times 2$ possible.

### 6.5.3 Data Handling

Each target acquisition will produce a FibreHead View (FFHV) image (probably will be handled by templates). The FFFH images will NOT be handled by the VLT-DFS.

Each Science image will be handled by the VLT dataflow system.

### 6.5.4 RTD

The standard RTD tool will provide image display of the Science data as they are readout. Of course the already existing TCCD RTD will continue.

### 6.5.5 FITS Headers

A basic minimum DICB compliant set of headers for all Science-CCD images will be acceptable.

### 6.6 DRS

The DRS will be unchanged and must continue to function in the same way as always. Images in raw FITS file format will be ‘delivered’ to the *w2p2off* workstation via the VLT dataflow system. The DRS will then take care of them from there (this will be taken care of by SciOps including adding HEADER info in the appropriate format as necessary).

### 7 Requirements of the TCS

A ‘Pointing GUI’ will be required to allow rapid target acquisition$^4$.

Guiding on the FEROS FibreHead Viewing TCCD will be implemented, featuring guiding on fibre mode and possibly guiding on field star mode. Guiding on the fibre should be the optimum mode for ensuring maximum throughput. However the second mode guiding on field star is desirable for the few cases when the target object is not bright enough to allow adequate guiding on fibre.

The possibility to manually guide must also be retained since it is possible that in some cases the target will be too faint for guiding on and there will be now field stars bright enough.

Guiding with the FEROS FibreHead Viewing TCCD will eliminate the dependance on WFI which is necessary anyway since WFI will be decommissioned in the not too distant future. It should also improve the quality of the guiding, and therefore overall throughput, for two reasons:

---

$^4$Already implemented for current system.
1. Zero (for guiding on fibre) or at least much less (for guiding on field star) differential refraction between guide star and target.

2. No problem with needing to have FEROS and WFI simultaneously focussed (though of course it will then be more critical to have the TCCD correctly focussed).

The target acquisition procedure will be as follows:

1. Preset to target.

2. Use ‘Pointing GUI’ to position target on selected fibre (either predefined Object or Sky fibre – this info will be needed also by the guiding software in order to know which fibre to guide on (guiding on fibre) or to know which fibre must also be displayed in addition to the guide star window (guiding on field star)).

3. Select guiding mode: either guiding on fibre or guiding on field star. If the former, begin guiding immediately, the algorithm will automatically accurately center the star on the fibre (since the fibre position on the TCCD is known. If the latter then:
   
   (a) Select field star for guiding by clicking on the object in the TCCD RTD.
   (b) Start guiding.
   (c) Manually make final pointing correction to accurately position target on fibre.

4. Acquisition complete.

Given that guiding is usually performed on a small window of the guiding chip, in this case the FFHV TCCD, in the case of guiding on field star it will in general be necessary to readout and display TWO sub windows of the full chip, one containing the guide star, and the other containing the fibre with the target on it, in order to have visual confirmation that guiding is well behaved. A special case will be necessary when the field guide star is none the less close enough to the fibre that the default size for the two windows would overlap.

The Dynamic Centering algorithm, as implemented for HARPS, is not known to be necessary and is therefore not critical, but if it can be implemented without causing delay to the overall project then there is no reason not to do so.

8 Observing Blocks and Templates

See the FEROS-II Template Manual [3].
A  FEROS Image Headers

A.1  Current

The current set of image headers as delivered by BIAS5.

SIMPLE = T / FITS STANDARD
BITPIX = 16 / FITS BITS/PIXEL
NAXIS = 2 / NUMBER OF AXES
NAXIS1 = 2148 / X AXIS
NAXIS2 = 4102 / Y AXIS
COMMENT =
BSSCALE = 1.0E+00 / REAL = TAPE*BSSCALE + BZERO
BZERO = 32768.0E+00 /
ORIGIN = 'ESO-LASILLA ' /
OBSERVAT= 'ESO-LASILLA ' /
TELESCOP= 'MPG/ESO-220 ' /
INSTRUME= 'FEROS ' /
DETNAME = 'EEV 2k x 4k ' /
DATE = '2003-05-19' /
DATE-OBS= '2003-05-19' /
FILENAME= 'FEROS.2003-05-19T01:50:00.000.fits'
OBJECT = ' ' /
EXPTIME = 600.000 /
TM_START= 6600 / 01/50/00  UT start time
TM_END = 7356 / 02/02/36  UT end time
CRVAL1 = 1 /
CRPIX1 = 1 /
CDelt1 = 1 /
CRVAL2 = 1 /
CRPIX2 = 1 /
CDelt2 = 1 /
COMMENT =
COMMENT =
GAINM = 'LOW' / High or Low
AMPLM = 'B' / A / B or AB
CCDTEMP = -134.1 /
LH2TEMP = -135.8 /
COMMENT =
MPP = 0 /
CHIPID = 'EEV 2Kx4K, FEROS'/
DATAMIN = 375 /
DATAMAX = 385 /
XOVERSC = 0 /
YOVERSC = 0 /
P_DEWAR = 3.3E-06 /
TM-START= 6600 / 01/50/00  UT start time
SHSTAT = 'OPEN' /
COMMENT **************************************************************************
COMMENT Info obtained from the file /s1data/config/FEROS-CCD.tdb

5From image FEROS.2003-05-19T01:50:00.000.fits
COMMENTS at the start of the exposure
COMMENT CCDCCFG, the ten digits refer to the Controller Chassis, the eight cards
CCDCFG = '2222222222' / CCD Controller configuration
CCDPCCIQ = '0x500' / CCD PC card IO port
COMMENT **********************************************************************
COMMENT Info obtained from the file /home/feros/.FEROS-OBS.tdb
COMMENT at the start of the exposure
PRGID = '71.D-0554(A)' / ESO programme identification.
OBSEVER = 'JKT' / Name of Observer.
PI-COI = 'Maxted' / Name of PI-COI.
COMMENT **********************************************************************
COMMENT Info obtained from the TCS at the start of the exposure
COMMENT First info in same format as was used at ESO-1.52m
CIDENT = 'GVCar' / Object name from catalogue
RA-OBJ = '110533.00' / 11:05:33.000000 RA from catalogue
DEC-OBJ = '-584350.00' / -58:43:50.000000 Dec from catalogue
CEPOCH = 2000.000000 / Epoch of catalogue coordinates
ST = 12.87391 / [hrs] LST at start of exp 12:52:26.089255
RA = 166.41581 / [deg] Tel RA == Mean RA 11:05:39.794124
DEC = -58.73110 / [deg] Tel Dec == Mean Dec -58:43:51.975189
HA = +26.65899 / [deg] Tel Hour Angle +01:46:38.158786
ZDIST = 34.67291 / [deg] Tel Zenith Distance
COMMENT *********************************************************************
COMMENT Now in a more standard format
TCSUTC = 6600.000000 / [sec] UTC at start of exposure 01:50:00.000000
TCSLST = 46346.089255 / [sec] LST at start of exposure 12:52:26.089255
IDENT = 'GVCar' / Object name from catalogue
RA-OBJD = 166.387500 / [deg] RA from catalogue 11:05:33.000000
EPCH = 2000.000000 / Epoch of catalogue coordinates
PMA = 0.00 / Proper Motion in RA
PMD = 0.00 / Proper Motion in Dec
RA-MEAN = 166.415809 / [deg] Mean RA 11:05:39.794124
RA-APP = 166.449710 / [deg] Apparent RA 11:05:47.930468
HOURANG = +26.658995 / [deg] Hour Angle +01:46:38.158786
ALT = 55.327 / [deg] Altitude of telescope
AZ = 335.834 / [deg] Azimuth of telescope
ZD = 34.673 / [deg] Zenith Distance of telescope
AIRMASS = 1.215 / Airmass
PARANG = 0.000 / [deg] Parallactic Angle
MOONDIST = 79.177 / [deg] Distance to Moon
DGSTAT = 0 / Status of Differential Guiding
DGRATERA = 0.000 / [arcsec/sec] Differential Guiding rate in RA
DGRATEDE = 0.000 / [arcsec/sec] Differential Guiding rate in Dec
TELSTAT = 7 / Status of Telescope
TSURR = 8.500 / [C] Temperature of Long Surrier
TELFOCUS = 23318.000 / [eu] Focus value of telescope [encoder units]
DQMESTAT = 0 / Status of Dome
AGSTAT = 0 / Status of Auto Guider
RTPPOS = -0.900 / [deg] Rotator position

COMMENT****************************************************************************************************
COMMENT Info obtained from the FWCACU at the start of the exposure
COMMENT First info in same format as was used at ESO-1.52M AND as required by
COMMENT the FEROS MIDAS Data Reduction System (DRS) Pipeline.
INSTR = 'FEROS' / M3 Configuration
F_MODE = 'OS' / Fiber Configuration
EXPTYPE = 'SCIENCE' / Exposure Type
COMMENT There is NO Calibration Flip Mirror [CFM] for FEROS at the 2.2m.
COMMENT Therefore the header CFM_POS is obsolete. A default value of OUT is
COMMENT therefore written for backward compatibility.
CFM_POS = 'OUT' / Calibration Mirror
RSM_POS = 'S1' / Calib. Source Mirror
FFU = 'OFF' / Flatfield lamp
WCU1 = 'OFF' / Thorium-Argon lamp
WCU2 = 'OFF' / Helium-Argon lamp
NDFW = 0.000 / Neutral Density Filter
TSPEC = 16.35 / Temperature of Spectrograph
TRQOM = 14.43 / Temperature of Room
RHRQOM = 18.10 / rel.Humidity of Room
MTIME = 'May 19 2003, 01:49:38' / UTC DATE-TIME of T/RH Measurement

COMMENT****************************************************************************************************
COMMENT Now in a more standard format
SYSTIME= 'IDLE ' / System State: INIT|IDLE|EXEC|MOVE|INTE
COMMENT The Rotating Selection Mirror (RSM)
RSMSTR = 'FREE ' / RSM position: FREE|LAMP1|LAMP2|MOVING
RSMENC = 9000 / [eu] RSM position
RSMREF0 = 9000 / [eu] RSM Reference position: FREE
RSMREF1 = 7268 / [eu] RSM Reference position: LAMP1
RSMREF2 = 3636 / [eu] RSM Reference position: LAMP2

COMMENT The Neutral Density Filter Wheel
NDFWSTR = 0.000 / [Density] NDFW position
NDFWENC = 0 / [eu] NDFW position
NDFWGAIN = 8.160467300000e-04 / [Density/eu] NDFW eqn Slope
NDFWOFFS = 0.000000000000e+00 / [Density] NDFW eqn Offset
NDFWMIN = 0.00000 / [Density] Min allowable NDFW Density
NDFWMAX = 3.00000 / [Density] Max allowable NDFW Density
NDFWREF = 0.00000 / [Density] Reference NDFW Density

COMMENT The FCU Shutter
FCUSSTR = 'FIBER12' / FCU Shutter position: N|FIBRE|FIBRE1|FIBRE2|FIB
FCUSENC = 0 / [eu] FCU Shutter position
FCUSREF0 = 0 / [eu] FCU Shutter reference position: N|FIBRE
FCUSREF1 = 0 / [eu] FCU Shutter reference position: FIBRE1
FCUSREF2 = 0 / [eu] FCU Shutter reference position: FIBRE2
FCUSREF3 = 0 / [eu] FCU Shutter reference position: FIBRE12

COMMENT The Sliding Calibration Selection Mirror (SCSM)
SCSMSTR = 'FIBER12' / SCSM position: N|FIBRE|FIBRE1|FIBRE2|FIBRE12
SCSMENC = 2000 / [eu] SCSM position
SCSMREF0 = 2000 / [eu] SCSM reference position: NQFIBRE
SCSMREF1 = 60000 / [eu] SCSM reference position: FIBRE1
SCSMREF2 = 127000 / [eu] SCSM reference position: FIBRE2
SCSMREF3 = 95000 / [eu] SCSM reference position: FIBRE12

COMMENT The Calibration Lamps
CL1NAME = 'FFU' / Cal Lamp 1 Name
CL1STATE = 'OFF' / Cal Lamp 1: ON|OFF
CL1USED = 232277 / [sec] Cal Lamp 1 total usage
CL1WARN = 360000 / [sec] Cal Lamp 1 warning usage
CL2NAME = 'Th-Ar' / Cal Lamp 2 Name
CL2STATE = 'OFF' / Cal Lamp 2 (FF): ON|OFF
CL2USED = 308203 / [sec] Cal Lamp 2 total usage
CL2WARN = 360000 / [sec] Cal Lamp 2 warning usage
CL1OUT = 3600 / [sec] Cal Lamp Timeout

COMMENT The FEROS/WFI Selector Mirror aka M3
FWSM = 'FEROS' / Position: FEROS|WFI

COMMENT The EXPOSURE Type
FIBCONF = 'OBJJAYK' / Fibre Configuration: OBJJAYK|OBJCAL
OBJCALF1 = 'OFF' / OBJCAL Cal fibre: ON|OFF
OBJCALF2 = 'OFF' / OBJCAL Cal fibre: ON|OFF
FCUETYPE = 'OBJ' / FCU Exposure Type: OBJ|FF|WLC

COMMENT ***********************************************************************
ORIGFILE = 'fzero2084.mt'
ARCFILE = 'FEROS.2003-05-19T01:50:00.000.fits'
HISTORY SETHEAD 3.1.2 2003-05-18T22:02 ORIGFILE and ARCFILE updated
QDFN = 'fzero2084'
HISTORY SETHEAD 3.0 2003-05-18T22:03 FILENAME and QDFN updated

A.2 Proposed

The Image header information for FEROS-II at the 2.20m will be at least a minimum required for
DICB compliance. The following is an example of what should probably be possible based on WFI
and HARPS examples.

SIMPLE = T / Standard FITS format (QOST-100.0)
BITPIX = 16 / # of bits storing pix values
NAXIS = 2 / # of axes in frame
NAXIS1 = 4296 / # pixels/axis
NAXIS2 = 4696 / # pixels/axis
BZERO = 32768.0 / pixel=FITBSCALE+BZERO
BCALE = 1.0 / pixel=FITBSCALE+BZERO
ORIGIN = 'TEST' / European Southern Observatory
DATE = '2003-05-26T19:11:52.523' / UT date when this file was written
TELESCOP = 'ESO-3P6' / ESO Telescope Name
INSTRUME = 'FEROS' / Instrument used.
OBJECT = 'DARK,DARK' / Original target.
EXPTIME = 9.9996 / Total integration time
MJD-0BS = 52785.7997986 / MJD start (2003-05-26T19:11:42.552)
DATE-0BS = '2003-05-26T19:11:42.552' / Date of observation
PI-COI = 'VLTSW' / PI-COI name.
CTYPE1 = 'PIXEL' / Pixel coordinate system
CTYPE2 = 'PIXEL ' / Pixel coordinate system
CVAL1 = 1.0 / value of ref pixel
CVAL2 = 1.0 / value of ref pixel
CRPIX1 = 1.0 / Ref. pixel of center of rotation
CRPIX2 = 1.0 / Ref. pixel of center of rotation
CDELT1 = 1.0 / Binning factor
CDELT2 = 1.0 / Binning factor
EXTEND = F / Extension may be present
HIERARCH ESQ DET BITS = 16 / Bits per pixel readout
HIERARCH ESQ DET CHIP1 DATE = '14-11-01' / Date of installation [YYYY-MM-DD]
HIERARCH ESQ DET CHIP1 ID = 'CCD-60 ' / Detector chip identification
HIERARCH ESQ DET CHIP1 NAME = 'EEV, EEV' / Detector chip name
HIERARCH ESQ DET CHIP1 NX = 2048 / # of pixels along X
HIERARCH ESQ DET CHIP1 NY = 4096 / # of pixels along Y
HIERARCH ESQ DET CHIP1 PSZX = 15.0 / Size of pixel in X
HIERARCH ESQ DET CHIP1 PSZY = 15.0 / Size of pixel in Y
HIERARCH ESQ DET CHIP1 X = 1 / X location in array
HIERARCH ESQ DET CHIP1 Y = 1 / Y location in array
HIERARCH ESQ DET CHIPS = 1 / # of chips in detector array
HIERARCH ESQ DET DATE = '01-11-01' / Installation date
HIERARCH ESQ DET DEC = 0.00000000 / Apparent 00:00:00.0 DEC at start
HIERARCH ESQ DET DID = 'ESO-VLT-DIC.CCDDCS,ESO-VLT-DIC.FCDDCS' / Dictio
HIERARCH ESQ DET EXP DUMDIT = 0 / # of dummy readouts
HIERARCH ESQ DET EXP EXP NO = 21 / Unique exposure ID number
HIERARCH ESQ DET EXP RTDITIME = 25.533 / Image readout time
HIERARCH ESQ DET EXP TYPE = 'Dark ' / Exposure type
HIERARCH ESQ DET EXP XFERTIM = 25.577 / Image transfer time
HIERARCH ESQ DET FRAM ID = 1 / Image sequential number
HIERARCH ESQ DET FRAM TYPE = 'Dark ' / Type of frame
HIERARCH ESQ DET ID = 'CCD FIERA - Rev 3.8 ' / Detector system Id
HIERARCH ESQ DET NAME = 'feros - FEROS ' / Name of detector system
HIERARCH ESQ DET QT2 CHIP = 1 / Chip to which the output belongs
HIERARCH ESQ DET QT2 CONAD = 1.40 / Conversion from ADUs to electrons
HIERARCH ESQ DET QT2 GAIN = 0.71 / Conversion from electrons to ADU
HIERARCH ESQ DET QT2 ID = 'R ' / Output ID as from manufacturer
HIERARCH ESQ DET QT2 NAME = 'R ' / Description of output
HIERARCH ESQ DET QT2 NX = 2048 / Valid pixels along X
HIERARCH ESQ DET QT2 NY = 4096 / Valid pixels along Y
HIERARCH ESQ DET QT2 OVSCX = 50 / Ovscan region in X
HIERARCH ESQ DET QT2 PRSCX = 50 / Prescan region in X
HIERARCH ESQ DET QT2 RQN = 6.08 / Readout noise per output (e−)
HIERARCH ESQ DET QT2 X = 2048 / X location of output
HIERARCH ESQ DET QT2 Y = 1 / Y location of output
HIERARCH ESQ DET OUTPUTS = 1 / # of outputs
HIERARCH ESQ DET QTREF = 0 / Reference output
HIERARCH ESQ DET RA = 0.00000000 / Apparent 00:00:00.0 RA at start
HIERARCH ESQ DET READ CLOCK = '416kpx/rr' / Readout clock pattern used
HIERARCH ESQ DET READ MODE = 'normal ' / Readout method
HIERARCH ESQ DET READ SPEED = '416kHz,1,high' / Readout speed
HIERARCH ESQ DET SHUT ID = 'SESU ' / Shutter unique identifier
HIERARCH ESQ DET SHUT TMCLQS = 0.000 / Time taken to close shutter
HIERARCH ESQ DET SHUT TMOPEN = 0.000 / Time taken to open shutter
HIERARCH ESQ DET SHUT TYPE = 'IRIS ' / type of shutter
HIERARCH ESQ DET SQFW MODE = 'Normal ' / CCD sw operational mode
HIERARCH ESQ DET TELE INT = 1.0 / Interval between two successive t
HIERARCH ESQ DET TELE NO = 1 / # of sources active
HIERARCH ESQ DET TLM1 END = 181.00 / Telemetry value at read completio
HIERARCH ESQ DET TLM1 ID = 'CCD Sensor1' / ID of telemetry sensor
HIERARCH ESQ DET TLM1 NAME = 'CCD T1 ' / Description of telemetry param.
HIERARCH ESQ DET TLM1 START = 181.00 / Telemetry value at read start
HIERARCH ESQ DET TLM2 END = 181.00 / Telemetry value at read completio
HIERARCH ESQ DET TLM2 ID = 'CCD Sensor2' / ID of telemetry sensor
HIERARCH ESQ DET TLM2 NAME = 'CCD T2 ' / Description of telemetry param.
HIERARCH ESQ DET TLM3 END = 181.00 / Telemetry value at read start
HIERARCH ESQ DET TLM3 ID = 'CCD Sensor3' / ID of telemetry sensor
HIERARCH ESQ DET TLM3 NAME = 'CCD P1 ' / Description of telemetry param.
HIERARCH ESQ DET TLM3 START = 181.00 / Telemetry value at read start
HIERARCH ESQ DET WIN1 BINX = 1 / Binning factor along X
HIERARCH ESQ DET WIN1 BINY = 1 / Binning factor along Y
HIERARCH ESQ DET WIN1 DIT1 = 9.999616 / actual subintegration time
HIERARCH ESQ DET WIN1 DITM = 9.9996 / Dark current time
HIERARCH ESQ DET WIN1 NDIT = 1 / # of subintegrations
HIERARCH ESQ DET WIN1 NX = 4296 / # of pixels along X
HIERARCH ESQ DET WIN1 NY = 4096 / # of pixels along Y
HIERARCH ESQ DET WIN1 STRX = 1 / Lower left pixel in X
HIERARCH ESQ DET WIN1 STRY = 1 / Lower left pixel in Y
HIERARCH ESQ DET WIN1 UIT1 = 10.00000 / user defined subintegration time
HIERARCH ESQ DET WINDOWS = 1 / # of windows readout
HIERARCH ESQ DPR CATG = 'CALIB ' / Observation category
HIERARCH ESQ DPR TECH = 'IMAGE ' / Observation technique
HIERARCH ESQ DPR TYPE = 'DARK,DARK' / Observation type
HIERARCH ESQ INS ADC1 DEC = -225915.50861 / Telescope desclination [deg].
HIERARCH ESQ INS ADC1 END = 0.0000 / Position angle at end [deg].
HIERARCH ESQ INS ADC1 MODE = 'OFF ' / ADC mode.
HIERARCH ESQ INS ADC1 RA = 62810.971205 / Telescope right ascension [deg].
HIERARCH ESQ INS ADC2 DEC = -225915.50861 / Telescope desclination [deg].
HIERARCH ESQ INS ADC2 END = 0.0000 / Position angle at end [deg].
HIERARCH ESQ INS ADC2 MODE = 'OFF ' / ADC mode.
HIERARCH ESQ INS ADC2 RA = 62810.971205 / Telescope right ascension [deg].
HIERARCH ESQ INS ADCS NAME = 'OUT ' / ADC slide position.
HIERARCH ESQ INS ADCS NO = 1 / ADC slide position.
HIERARCH ESQ INS DATE = '2000-06-16' / Instrument release date (yyy-mm-
HIERARCH ESQ INS DET1 CTMAX = -1. / Maximum count during exposure.
HIERARCH ESQ INS DET1 CTMEAN = -1.0 / Average counts during exposure.
HIERARCH ESQ INS DET1 CTMIN = -1. / Minimum count during exposure.
HIERARCH ESQ INS DET1 CTMS = 0.00 / RMS of counts during exposure.
HIERARCH ESQ INS DET1 CTTOT = -15. / Total counts during exposure.
HIERARCH ESQ INS DET1 OFFDKR = 0. / Average dark background counts.
HIERARCH ESQ INS DET1 OFFSKY = 1. / Average sky background counts.
HIERARCH ESQ INS DET1 TMMEAN = 0.50 / Normalised mean exposure time.
HIERARCH ESQ INS DET1 UIT = 1.000 / User defined Integration time [se
HIERARCH ESQ INS DID = 'ESQ-VLT-DIC.FEROSICS-1.10' / Data dictionary file.
HIERARCH ESQ INS ID = 'FEROS/1.56' / Instrument ID.
HIERARCH ESQ INS LAMP3 SWSIM = T / If T, function is software simulated.
HIERARCH ESQ INS LAMP7 SWSIM = T / If T, function is software simulated.
HIERARCH ESQ INS MIRI1 ID = 'NONE' / Mirror unique ID.
HIERARCH ESQ INS MIRI1 NAME = 'FWM3' / Mirror name.
HIERARCH ESQ INS MIRI1 NO = 1 / Mirror slide position.
HIERARCH ESQ INS MIRI1 ID = 'NONE' / Mirror unique ID.
HIERARCH ESQ INS MIRI1 NAME = 'FWM3' / Mirror name.
HIERARCH ESQ INS MIRI1 NO = 1 / Mirror slide position.
HIERARCH ESQ INS MIRI1 ID = 'NONE' / Mirror unique ID.
HIERARCH ESQ INS MIRI1 NAME = 'FWASC' / Mirror name.
HIERARCH ESQ INS MIRI1 NO = 1 / Mirror slide position.
HIERARCH ESQ INS MIRI1 ID = 'NONE' / Mirror unique ID.
HIERARCH ESQ INS MIRI1 NAME = 'FWASC' / Mirror name.
HIERARCH ESQ INS OPTI2 ID = 'FEROS' / OPTI2 unique ID.
HIERARCH ESQ INS OPTI2 NAME = 'FEROS' / OPTI2 name.
HIERARCH ESQ INS OPTI2 NO = 1 / OPTI2 slot number.
HIERARCH ESQ INS OPTI2 TYPE = 'FIBER' / OPTI2 element.
HIERARCH ESQ INS OPTI3 ID = 'OUT' / OPTI3 unique ID.
HIERARCH ESQ INS OPTI3 NAME = 'OUT' / OPTI3 name.
HIERARCH ESQ INS OPTI3 NO = 2 / OPTI3 slot number.
HIERARCH ESQ INS OPTI3 TYPE = 'FREE' / OPTI3 element.
HIERARCH ESQ INS OPTI4 ID = 'OUT' / OPTI4 unique ID.
HIERARCH ESQ INS OPTI4 NAME = 'OUT' / OPTI4 name.
HIERARCH ESQ INS OPTI4 NO = 1 / OPTI4 slot number.
HIERARCH ESQ INS OPTI4 TYPE = 'OUT' / OPTI4 element.
HIERARCH ESQ INS PATH = 'DEFAULT' / Optical path used.
HIERARCH ESQ INS RQT1 ENC = 0 / Absolute position [Enc].
HIERARCH ESQ INS RQT1 POS = 0.0 / Position [deg].
HIERARCH ESQ INS SENS1 DETCDEF = 0.000000 / RMS of linear regression slope.
HIERARCH ESQ INS SENS1 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESQ INS SENS1 ID = 'PRSS' / sensor ID.
HIERARCH ESQ INS SENS1 LRCONST = 0.000000 / Linear regression constant.
HIERARCH ESQ INS SENS1 LRRMS = 763.835784 / Linear regression RMS.
HIERARCH ESQ INS SENS1 MAX = 763.835784 / Maximum value.
HIERARCH ESQ INS SENS1 MEAN = 763.835784 / Average value.
HIERARCH ESQ INS SENS1 MIN = 763.835784 / Minimum value.
HIERARCH ESQ INS SENS1 NAME = 'Vacuum vessel pressure' / sensor common name.
HIERARCH ESQ INS SENS1 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESQ INS SENS1 VAL = 763.840000 / Sensor numeric value.
HIERARCH ESQ INS SENS2 DETCDEF = 0.000000 / RMS of linear regression slope.
HIERARCH ESQ INS SENS2 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESQ INS SENS2 ID = 'LNLV' / sensor ID.
HIERARCH ESQ INS SENS2 LRCONST = 0.000000 / Linear regression constant.
HIERARCH ESQ INS SENS2 LRRMS = 100.000000 / Linear regression RMS.
HIERARCH ESQ INS SENS2 MAX = 100.000000 / Maximum value.
HIERARCH ESQ INS SENS2 MEAN = 100.000000 / Average value.
HIERARCH ESQ INS SENS2 MIN = 100.000000 / Minimum value.
HIERARCH ESQ INS SENS2 NAME = 'LN2 level' / sensor common name.
HIERARCH ESQ INS SENS2 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESQ INS SENS2 VAL = 100.000000 / Sensor numeric value.
HIERARCH ESQ INS SENSOR4 SWSIM= F / If T, function is software simula
HIERARCH ESQ INS SENSOR5 SWSIM= F / If T, function is software simula
HIERARCH ESQ INS SENSOR6 SWSIM= F / If T, function is software simula
HIERARCH ESQ INS SENSOR7 SWSIM= T / If T, function is software simula
HIERARCH ESQ INS SHUT1 ID = 'RMSH ' / Shutter ID.
HIERARCH ESQ INS SHUT1 NAME = 'FCUSHUT ' / Shutter name.
HIERARCH ESQ INS SHUT1 ST = F / Shutter open.
HIERARCH ESQ INS SWSIM = 'NORMAL ' / Software simulation.
HIERARCH ESQ INS TEMP1 DETCOEF= 0.000000 / RMS of linear regression slope.
HIERARCH ESQ INS TEMP1 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESQ INS TEMP1 ID = 'FAT1 ' / Temperature sensor ID.
HIERARCH ESQ INS TEMP1 LRCNST= 0.000000 / Linear regression constant.
HIERARCH ESQ INS TEMP1 LRMS = 12.060000 / Linear regression RMS.
HIERARCH ESQ INS TEMP1 MAX = 12.060000 / Maximum value.
HIERARCH ESQ INS TEMP1 MEAN = 12.060000 / Average value.
HIERARCH ESQ INS TEMP1 MIN = 12.060000 / Minimum value.
HIERARCH ESQ INS TEMP1 NAME = 'FEROS air temperature1' / Temperature sensor name
HIERARCH ESQ INS TEMP1 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESQ INS TEMP1 VAL = 12.060000 / Temperature sensor numeric value.
HIERARCH ESQ INS TEMP2 DETCOEF= 0.000000 / RMS of linear regression slope.
HIERARCH ESQ INS TEMP2 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESQ INS TEMP2 ID = 'FAT2 ' / Temperature sensor ID.
HIERARCH ESQ INS TEMP2 LRCNST= 0.000000 / Linear regression constant.
HIERARCH ESQ INS TEMP2 LRMS = 12.060000 / Linear regression RMS.
HIERARCH ESQ INS TEMP2 MAX = 12.060000 / Maximum value.
HIERARCH ESQ INS TEMP2 MEAN = 12.060000 / Average value.
HIERARCH ESQ INS TEMP2 MIN = 12.060000 / Minimum value.
HIERARCH ESQ INS TEMP2 NAME = 'FEROS air temperature2' / Temperature sensor name
HIERARCH ESQ INS TEMP2 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESQ INS TEMP2 VAL = 12.060000 / Temperature sensor numeric value.
HIERARCH ESQ INS TEMP3 DETCOEF= 0.000000 / RMS of linear regression slope.
HIERARCH ESQ INS TEMP3 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESQ INS TEMP3 ID = 'FCCRT1 ' / Temperature sensor ID.
HIERARCH ESQ INS TEMP3 LRCNST= 0.000000 / Linear regression constant.
HIERARCH ESQ INS TEMP3 LRMS = 12.060000 / Linear regression RMS.
HIERARCH ESQ INS TEMP3 MAX = 12.060000 / Maximum value.
HIERARCH ESQ INS TEMP3 MEAN = 12.060000 / Average value.
HIERARCH ESQ INS TEMP3 MIN = 12.060000 / Minimum value.
HIERARCH ESQ INS TEMP3 NAME = 'FEROS CCR air temperature1' / Temperature sensor name
HIERARCH ESQ INS TEMP3 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESQ INS TEMP3 VAL = 12.060000 / Temperature sensor numeric value.
HIERARCH ESQ INS TEMP4 DETCOEF= 0.000000 / RMS of linear regression slope.
HIERARCH ESQ INS TEMP4 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESQ INS TEMP4 ID = 'FCCRT2 ' / Temperature sensor ID.
HIERARCH ESQ INS TEMP4 LRCNST= 0.000000 / Linear regression constant.
HIERARCH ESQ INS TEMP4 LRMS = 12.060000 / Linear regression RMS.
HIERARCH ESQ INS TEMP4 MAX = 12.060000 / Maximum value.
HIERARCH ESQ INS TEMP4 MEAN = 12.060000 / Average value.
HIERARCH ESQ INS TEMP4 MIN = 12.060000 / Minimum value.
HIERARCH ESQ INS TEMP4 NAME = 'FEROS CCR air temperature2' / Temperature sensor name
HIERARCH ESQ INS TEMP4 RMS = 0.000000 / RMS of samples over exposure.
FROST-2: 2p2-SRS-ESO-22400-0001

HIERARCH ESO INS TEMP4 VAL = 12.060 / Temperature sensor numeric value.
HIERARCH ESO INS TEMP5 DETCOEF = 0.000000 / RMS of linear regression slope.
HIERARCH ESO INS TEMP5 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESO INS TEMP5 ID = 'FCRT3' / Temperature sensor ID.
HIERARCH ESO INS TEMP5 LRCOEF = 0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP5 LRRMS = 17.299000 / Linear regression RMS.
HIERARCH ESO INS TEMP5 MAX = 17.299000 / Maximum value.
HIERARCH ESO INS TEMP5 MEAN = 17.299000 / Average value.
HIERARCH ESO INS TEMP5 MIN = 17.299000 / Minimum value.
HIERARCH ESO INS TEMP5 NAME = 'FROST CCR air temperature3' / Temperature sensor name.
HIERARCH ESO INS TEMP5 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESO INS TEMP5 VAL = 17.202 / Temperature sensor numeric value.
HIERARCH ESO INS TEMP6 DETCOEF = 0.000000 / RMS of linear regression slope.
HIERARCH ESO INS TEMP6 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESO INS TEMP6 ID = 'FR1' / Temperature sensor ID.
HIERARCH ESO INS TEMP6 LRCOEF = 0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP6 LRRMS = 12.060000 / Linear regression RMS.
HIERARCH ESO INS TEMP6 MAX = 12.060000 / Maximum value.
HIERARCH ESO INS TEMP6 MEAN = 12.060000 / Average value.
HIERARCH ESO INS TEMP6 MIN = 12.060000 / Minimum value.
HIERARCH ESO INS TEMP6 NAME = 'FROST R air temperature1' / Temperature sensor name.
HIERARCH ESO INS TEMP6 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESO INS TEMP6 VAL = 17.302 / Temperature sensor numeric value.
HIERARCH ESO INS HUM1 DETCOEF = 0.000000 / RMS of linear regression slope.
HIERARCH ESO INS HUM1 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESO INS HUM1 ID = 'FAH1' / Humidity sensor ID.
HIERARCH ESO INS HUM1 LRCOEF = 0.000000 / Linear regression constant.
HIERARCH ESO INS HUM1 LRRMS = 12.060000 / Linear regression RMS.
HIERARCH ESO INS HUM1 MAX = 12.060000 / Maximum value.
HIERARCH ESO INS HUM1 MEAN = 12.060000 / Average value.
HIERARCH ESO INS HUM1 MIN = 12.060000 / Minimum value.
HIERARCH ESO INS HUM1 NAME = 'FROST air humidity1' / Humidity sensor name.
HIERARCH ESO INS HUM1 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESO INS HUM1 VAL = 12.060 / Humidity sensor numeric value.
HIERARCH ESO INS PRES1 DETCOEF = 0.000000 / RMS of linear regression slope.
HIERARCH ESO INS PRES1 GRAD = 0.000000 / Linear regression slope.
HIERARCH ESO INS PRES1 ID = 'FLWDP' / Pressure sensor ID.
HIERARCH ESO INS PRES1 LRCOEF = 0.000000 / Linear regression constant.
HIERARCH ESO INS PRES1 LRRMS = 12.060000 / Linear regression RMS.
HIERARCH ESO INS PRES1 MAX = 12.060000 / Maximum value.
HIERARCH ESO INS PRES1 MEAN = 12.060000 / Average value.
HIERARCH ESO INS PRES1 MIN = 12.060000 / Minimum value.
HIERARCH ESO INS PRES1 NAME = 'FROST LN2 Dewar pressure1' / Pressure sensor name.
HIERARCH ESO INS PRES1 RMS = 0.000000 / RMS of samples over exposure.
HIERARCH ESO INS PRES1 VAL = 12.060 / Pressure sensor numeric value.
HIERARCH ESO OBS DID = 'ESO-VLT-DIC.OBS-1.7' / OBS Dictionary
HIERARCH ESO OBS GRP = 'FROST' / linked blocks
HIERARCH ESO OBS ID = 0 / Observation block ID
HIERARCH ESO OBS NAME = 'FROST_ech_cal_dark' / OB name
HIERARCH ESO OBS PI-CQI ID = 0 / ESO internal PI-CQI ID
HIERARCH ESO OBS PI-CQI NAME = 'VLTSW' / PI-CQI name
HIERARCH ESOS OBS PROC = '60.A-9036(A)' / ESO program identification
HIERARCH ESOS OBS START = '2003-05-26T19:11:36' / OB start time
HIERARCH ESOS OBS TPLNO = 1 / Template number within OB
HIERARCH ESOS OCS DET1 IMGNAME = 'FEROS_ECH_CAL' / Data File Name.
HIERARCH ESOS OCS TPL DID = 'ESO-VLT-DIC.TPL-1.4' / Data dictionary for TPL
HIERARCH ESOS OCS TPL EXPNO = 1 / Exposure number within template
HIERARCH ESOS OCS TPL ID = 'FEROS_ech_cal_dark' / Template signature ID
HIERARCH ESOS OCS TPL NAME = 'FEROS_ech_cal_dark' / Template name
HIERARCH ESOS OCS TPL NEXP = 1 / Number of exposures within template
HIERARCH ESOS OCS TPL PRESEQ = 'FEROS_ech_cal_dark.seq' / Sequencer script
HIERARCH ESOS OCS TPL START = '2003-05-26T19:11:36' / TPL start time
HIERARCH ESOS OCS TPL VERSION = '1.0' / Version of the template
HIERARCH ESOS OCS TEL DID = 'ESO-2P2-DIC.TCS-1.4' / Data dictionary for TEL
HIERARCH ESOS OCS TEL ID = 'v 3.15' / TCS version number
HIERARCH ESOS OCS TEL DATE = '2000-10-15T15:21:35.745' / TCS installation date
HIERARCH ESOS OCS TEL GEQELV = 2335. / Elevation above sea level (m)
HIERARCH ESOS OCS TEL GEOLAT = -29.2543 / Tel geo latitude (+=North) (deg)
HIERARCH ESOS OCS TEL GEOLON = -70.7346 / Tel geo longitude (+=East) (deg)
HIERARCH ESOS OCS TEL OPER = 'ElCondor' / Telescope Operator
HIERARCH ESOS OCS TEL FOCU ID = 'CA' / Telescope focus station ID
HIERARCH ESOS OCS TEL FOCU LEN = 8.009 / Focal length (m)
HIERARCH ESOS OCS TEL FOCU SCALE = 11.650 / Focal scale (arcsec/mm)
HIERARCH ESOS OCS TEL FOCU VALUE = 22618.000 / M2 setting (mm)
HIERARCH ESOS OCS TEL AIRM START = 1.069 / Airmass at start
HIERARCH ESOS OCS TEL AMBI FWHM START= 1.29 / Observatory Seeing queried from A
HIERARCH ESOS OCS TEL AMBI PRES START= 773.20 / Observatory ambient air pressure
HIERARCH ESOS OCS TEL AMBI WINDSP = 7.50 / Observatory ambient wind speed qu
HIERARCH ESOS OCS TEL AMBI WINDDIR= 28. / Observatory ambient wind direction
HIERARCH ESOS OCS TEL AMBI RHUM = 32. / Observatory ambient relative humidity
HIERARCH ESOS OCS TEL AMBI TEMP = 12.50 / Observatory ambient temperature
HIERARCH ESOS OCS TEL MOON RA = 8.51041 / 00:34:02.4 RA (J2000) (deg)
HIERARCH ESOS OCS TEL MOON DEC = -0.28250 / -00:16:56.9 DEC (J2000) (deg)
HIERARCH ESOS OCS TEL TRAK STATUS = 'OFF' / Tracking status
HIERARCH ESOS OCS TEL DOME STATUS = 'FULLY-OPEN' / Dome status
HIERARCH ESOS OCS TEL CHOP ST = 'F' / True when chopping is active
HIERARCH ESOS OCS TEL AIRM END = 1.066 / Airmass at end
HIERARCH ESOS OCS TEL AMBI FWHM END= 0.87 / Observatory Seeing queried from A
HIERARCH ESOS OCS TEL AMBI PRES END= 773.30 / Observatory ambient air pressure
HIERARCH ESOS OCS ADA POSANG = -0.90000 / Position angle at start
HIERARCH ESOS OCS ADA GUID STATUS = 'ON' / Status of autoguider
END