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Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral

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LA SILLA OBSERVATORY

FEROS-II:
Instrument Software
User Requirements

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1 Introduction

FEROS-II is a subtantial 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, Aquisition 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 implmented 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

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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	Fibrefed, 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. Whereever there are conflicts within this document it can be assumed only that the information provided caters for different possibilities. Whereever there are conflicts between this document and any other, the other should be taken as the reference.

Please mail comments to `jpritcha@eso.org`.

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[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 controlls 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 implemeted 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 *fbias*.

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

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 (`lfwacu`) and one C110 workstation (`wfwacu`). 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*.

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2.5 DRS

The Data Reduction Software (or Pipeline) is a 'standard reduction package' implemented within MIDAS. The DRS currently runs on `w2p2off`.

3 Hardware Upgrades

The User-Requirements for the FEROS-II hardware upgrades are presented in detail in 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 exisiting 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.

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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 Adpater 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 adpater in order to make any adjustments and requiring testing during two consequetive 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 FAINT 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.

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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 Controled 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, $T_{\mathrm{CCD,Actual}}$, $T_{\mathrm{CCD,Reference}}$, $T_{\mathrm{N_2}}$ 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 (wfefcd)

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).

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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 environemts:

- 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.
- wfefcd. FIERA DCS CCS environment.
- wfetcs. 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 developement, 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 Guzman.

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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.*
3. **Rotating 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 accuarte to ± 0.1 degree Celcius over a range of -10–$+40$ degree Celcius.
- The humidity sensor will be accuarte to 0.1,% humidity over a range of 0–100%.
- The pressure sensor will be accuarte to 1 hPa over a range of 760–780 hPa.

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

- The temperature sensors will be accuarte to ± 0.1 degree Celcius over a range of -200–$+40$ degrees Celcius (i.e. operating temperature to room temperature).
- The pressure sensor will be accuarte to 0.1 hPa over a range of 10^{-7}–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.

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- **OS panel:** instantaneous values will be refreshed with a frequency of approximately once per minute. Values out of normal operating ranges (which must be configurable by SciOps and/or LED) will be flagged in the OS panel by coloured and/or flashing values.
- **Image headers:** Statistics (mean, standard deviation, min and max) calculated during the exposure for each sensor will be included in the header of each science exposure. During the exposure, the sensors will be sampled twice per minute. For exposures shorter than 30secs, sensors will be sampled at the beginning and end of the exposure.
- **Log file:** instantaneous values will be recorded once per minute. The log file will be maintained continuously, whether the instrument is IDLE or otherwise.

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 adherred 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 recieve 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.

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Table 1: ICS Software Devices.

#	Name	Description	Range	Positions	FITS Prefix
1	m3	FEROS/WFI Selector Mirror	2	IN/OUT	INS.M3
2	scsm	Sliding Calibration Selector Mirror	continuous	PARK|BOTHFIBS|OBJFIB|SKYFIB	INS.SCSM
3	adc-in-out	ADC in/out	2	IN/OUT	INS.ADCA
4	adc-prism-a	A Prisms of ADC	continuous	0.0...3.0	INS.ADC1
5	adc-prism-b	B Prisms of ADC	continuous	0.0...3.0	INS.ADC2
6	ndfw	Neutral Density Filter Wheel	continuous	0.0...3.0	INS.NDFW
7	fcu-shutter	Calibration Fibre Shutter	continuous	DARK|BOTHFIBS|OBJFIB|SKYFIB	INS.FCSH
8	fcu-rsm	Rotating Selection Mirror	continuous	PARK|LAMP1|LAMP2|LAMP3|LAMP4	INS.RSM
9	lamp1	Wavelength Calibration Lamp ThAr+Ne	2	ON/OFF	INS.LAMP1
10	lamp2	Wavelength Calibration Lamp ThArNe	2	ON/OFF	INS.LAMP2
11	lamp3	Flatfield Lamp Hal+Hal	2	ON/OFF	INS.LAMP3
12	lamp4	Flatfield Lamp D+Hal	2	ON/OFF	INS.LAMP4
13	lamp5	CCD-Test LEDs 1	2	ON/OFF	INS.LAMP5
14	lamp6	CCD-Test LEDs 2	2	ON/OFF	INS.LAMP6
15	lamp7	CCD-Test LEDs 3	2	ON/OFF	INS.LAMP7
16	sens1	Temperature FEROS Table Top	continuous	−10–+40	INS.TEMP1
17	sens2	Temperature FEROS Top Enclosure	continuous	−10–+40	INS.TEMP2
18	sens3	Temperature FCCR floor	continuous	−10–+40	INS.TEMP3
19	sens4	Temperature FCCR midlevel	continuous	−10–+40	INS.TEMP4
20	sens5	Temperature FCCR ceiling	continuous	−10–+40	INS.TEMP5
21	sens6	Temperature FR	continuous	−10–+40	INS.TEMP6
22	sens7	Humidity FEROS	continuous	0–100%	INS.HUMI1
23	sens8	LN2 Dewar Capacity	continuous	0–100%	INS.PRES1
24	sens9	Temperature CCD	continuous	−200–+40	DET.TLM1
25	sens10	Temperature CCD LN2	continuous	−200–+40	DET.TLM2
26	sens11	Pressure CCD	continuous	10^{-7}–10^{+3}	DET.TLM3

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

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Each of the above observing modes will produce one or several *Science* image.

6.5.2 Readout Modes

1. 'Best' detector-performace readout mode
2. 'Fast' detector-performace readout mode
3. Single window of any size from 1×1 to the full chip 2148×4096 with binning of 1×1 and 2×2 possible.

6.5.3 Data Handling

Each target acquisition will produce a FibreHead View (FFHV) image (probably will be handled by templates). The FFHV 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 iamge 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 necesary).

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 adeqaute *guiding on fibre*.

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

Guiding with the FEROS FibreHead Viewing TCCD will illiminate 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.

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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. Acqusition 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].

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A FEROS Image Headers

A.1 Current

The current set of image headers as delivered by BIAS[5].

```
SIMPLE  =                    T / FITS STANDARD
BITPIX  =                   16 / FITS BITS/PIXEL
NAXIS   =                    2 / NUMBER OF AXES
NAXIS1  =                 2148 / X AXIS
NAXIS2  =                 4102 / Y AXIS
COMMENT =
BSCALE  =              1.0E+00 / REAL = TAPE*BSCALE + 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 /
LN2TEMP =               -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 /vltdata/config/FEROS-CCD.tdb
```

[5]From image FEROS.2003-05-19T01:50:00.000.fits

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```
COMMENT at the start of the exposure
COMMENT CCDCCFG, the ten digits refer to the Controller Chassis, the eight cards
CCDCCFG = '2222222222        ' / CCD Controller configuration
CCDPCCIO= '0x500             ' / CCD PC card IO port
COMMENT ************************************************************************
COMMENT ************************************************************************
COMMENT Info obtained from the file /home/feros/.FEROS-OBS.tdb
COMMENT at the start of the exposure
PROGID  = '71.D-0554(A)      ' / ESO programme identification.
OBSERVER= 'JKT               ' / Name of Observer.
PI-COI  = 'Maxted            ' / Name of PI-COI.
COMMENT ************************************************************************
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  =            2000.00000 / 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
DEC-OBJD=           -58.730556 / [deg] Dec from catalogue       -58:43:50.000000
EPOCH   =          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
DEC-MEAN=           -58.731104 / [deg] Mean Dec                 -58:43:51.975189
RA-APP  =           166.449710 / [deg] Apparent RA               11:05:47.930468
DEC-APP =           -58.752540 / [deg] Apparent Dec             -58:45:09.144285
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] Paralactic 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 Surririer
TELFOCUS=           23318.000 / [eu] Focus value of telescope [encoder units]
```

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```
DOMESTAT=                    0 / Status of Dome
AGSTAT  =                    0 / Status of Auto Guider
ROTPOS  =               -0.900 / [deg] Rotator position
COMMENT ************************************************************************
COMMENT ************************************************************************
COMMENT Info obtained from the FWACU 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 2.20m.
COMMENT Therefore the header CFM_POS is obsolete. A default value of OUT is
COMMENT therefore writtten 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
TROOM   =                14.43 / Temperature of Room
RHROOM  =                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
SYSSTATE= '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: NOFIBRE|FIBRE1|FIBRE2|FIB
FCUSENC =                    0 / [eu] FCU Shutter position
FCUSREF0=                    0 / [eu] FCU Shutter reference position: NOFIBRE
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: NOFIBRE|FIBRE1|FIBRE2|FIBRE12
SCSMENC =                 2000 / [eu] SCSM position
```

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```
SCSMREF0=                 2000 / [eu] SCSM reference position: NOFIBRE
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
CLTOUT  =                 3600 / [sec] Cal Lamp Timeout
COMMENT The FEROS/WFI Selector Mirror aka M3
FWSM    = '             FEROS' / Position: FEROS|WFI
COMMENT The EXPOSURE Type
FIBCONF = '            OBJSKY' / Fibre Configuration: OBJSKY|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= 'fero0284.mt'
ARCFILE = 'FEROS.2003-05-19T01:50:00.000.fits'
HISTORY  SETHEAD 3.1.2 2003-05-18T22:02 ORIGFILE and ARCFILE updated
OLDFN   = 'fero0284'
HISTORY  SETHEAD 3.0 2003-05-18T22:03 FILENAME and OLDFN 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 (NOST-100.0)
BITPIX  =                   16         / # of bits storing pix values
NAXIS   =                    2         / # of axes in frame
NAXIS1  =                 4296         / # pixels/axis
NAXIS2  =                 4096         / # pixels/axis
BZERO   =              32768.0         / pixel=FITS*BSCALE+BZERO
BSCALE  =                  1.0         / pixel=FITS*BSCALE+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-OBS =       52785.79979806        / MJD start (2003-05-26T19:11:42.552)
DATE-OBS= '2003-05-26T19:11:42.552'   / Date of observation
PI-COI  = 'VLTSW   '             / PI-COI name.
CTYPE1  = 'PIXEL   '                  / Pixel coordinate system
```

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```
CTYPE2  = 'PIXEL   '                   / Pixel coordinate system
CRVAL1  =                  1.0         / value of ref pixel
CRVAL2  =                  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 ESO DET BITS        =           16 / Bits per pixel readout
HIERARCH ESO DET CHIP1 DATE  = '14-11-01'   / Date of installation [YYYY-MM-DD]
HIERARCH ESO DET CHIP1 ID    = 'CCD-60  '   / Detector chip identification
HIERARCH ESO DET CHIP1 NAME  = 'EEV, EEV'   / Detector chip name
HIERARCH ESO DET CHIP1 NX    =         2048 / # of pixels along X
HIERARCH ESO DET CHIP1 NY    =         4096 / # of pixels along Y
HIERARCH ESO DET CHIP1 PSZX  =         15.0 / Size of pixel in X
HIERARCH ESO DET CHIP1 PSZY  =         15.0 / Size of pixel in Y
HIERARCH ESO DET CHIP1 X     =            1 / X location in array
HIERARCH ESO DET CHIP1 Y     =            1 / Y location in array
HIERARCH ESO DET CHIPS       =            1 / # of chips in detector array
HIERARCH ESO DET DATE        = '01-11-01'   / Installation date
HIERARCH ESO DET DEC         =   0.00000000 / Apparent 00:00:00.0 DEC at start
HIERARCH ESO DET DID         = 'ESO-VLT-DIC.CCDDCS,ESO-VLT-DIC.FCDDCS' / Dictio
HIERARCH ESO DET EXP DUMDIT  =            0 / # of dummy readouts
HIERARCH ESO DET EXP NO      =           21 / Unique exposure ID number
HIERARCH ESO DET EXP RDTTIME =       25.533 / image readout time
HIERARCH ESO DET EXP TYPE    = 'Dark    '   / Exposure type
HIERARCH ESO DET EXP XFERTIM =       25.577 / image transfer time
HIERARCH ESO DET FRAM ID     =            1 / Image sequencial number
HIERARCH ESO DET FRAM TYPE   = 'Dark    '   / Type of frame
HIERARCH ESO DET ID          = 'CCD FIERA - Rev 3.8' / Detector system Id
HIERARCH ESO DET NAME        = 'feros - FEROS' / Name of detector system
HIERARCH ESO DET OUT2 CHIP   =            1 / Chip to which the output belongs
HIERARCH ESO DET OUT2 CONAD  =         1.40 / Conversion from ADUs to electrons
HIERARCH ESO DET OUT2 GAIN   =         0.71 / Conversion from electrons to ADU
HIERARCH ESO DET OUT2 ID     = 'R       '   / Output ID as from manufacturer
HIERARCH ESO DET OUT2 NAME   = 'R       '   / Description of output
HIERARCH ESO DET OUT2 NX     =         2048 / valid pixels along X
HIERARCH ESO DET OUT2 NY     =         4096 / valid pixels along Y
HIERARCH ESO DET OUT2 OVSCX  =           50 / Overscan region in X
HIERARCH ESO DET OUT2 PRSCX  =           50 / Prescan region in X
HIERARCH ESO DET OUT2 RON    =         6.08 / Readout noise per output (e-)
HIERARCH ESO DET OUT2 X      =         2048 / X location of output
HIERARCH ESO DET OUT2 Y      =            1 / Y location of output
HIERARCH ESO DET OUTPUTS     =            1 / # of outputs
HIERARCH ESO DET OUTREF      =            0 / reference output
HIERARCH ESO DET RA          =   0.00000000 / Apparent 00:00:00.0 RA at start
HIERARCH ESO DET READ CLOCK  = '416kpx/rr'  / Readout clock pattern used
HIERARCH ESO DET READ MODE   = 'normal  '   / Readout method
HIERARCH ESO DET READ SPEED  = '416kHz,1,high' / Readout speed
HIERARCH ESO DET SHUT ID     = 'SESO    '   / Shutter unique identifier
HIERARCH ESO DET SHUT TMCLOS =        0.000 / Time taken to close shutter
```

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```
HIERARCH ESO DET SHUT TMOPEN =        0.000 / Time taken to open shutter
HIERARCH ESO DET SHUT TYPE   = 'IRIS    '   / type of shutter
HIERARCH ESO DET SOFW MODE   = 'Normal  '   / CCD sw operational mode
HIERARCH ESO DET TELE INT    =          1.0 / Interval between two successive t
HIERARCH ESO DET TELE NO     =            1 / # of sources active
HIERARCH ESO DET TLM1 END    =       181.00 / Telemetry value at read completio
HIERARCH ESO DET TLM1 ID     = 'CCD Sensor1' / ID of telemetry sensor
HIERARCH ESO DET TLM1 NAME   = 'CCD T1  '   / Description of telemetry param.
HIERARCH ESO DET TLM1 START  =       181.00 / Telemetry value at read start
HIERARCH ESO DET TLM2 END    =       181.00 / Telemetry value at read completio
HIERARCH ESO DET TLM2 ID     = 'CCD Sensor2' / ID of telemetry sensor
HIERARCH ESO DET TLM2 NAME   = 'CCD T2  '   / Description of telemetry param.
HIERARCH ESO DET TLM2 START  =       181.00 / Telemetry value at read start
HIERARCH ESO DET TLM3 END    =       181.00 / Telemetry value at read completio
HIERARCH ESO DET TLM3 ID     = 'CCD Sensor3' / ID of telemetry sensor
HIERARCH ESO DET TLM3 NAME   = 'CCD P1  '   / Description of telemetry param.
HIERARCH ESO DET TLM3 START  =       181.00 / Telemetry value at read start
HIERARCH ESO DET WIN1 BINX   =            1 / Binning factor along X
HIERARCH ESO DET WIN1 BINY   =            1 / Binning factor along Y
HIERARCH ESO DET WIN1 DIT1   =     9.999616 / actual subintegration time
HIERARCH ESO DET WIN1 DKTM   =       9.9996 / Dark current time
HIERARCH ESO DET WIN1 NDIT   =            1 / # of subintegrations
HIERARCH ESO DET WIN1 NX     =         4296 / # of pixels along X
HIERARCH ESO DET WIN1 NY     =         4096 / # of pixels along Y
HIERARCH ESO DET WIN1 STRX   =            1 / Lower left pixel in X
HIERARCH ESO DET WIN1 STRY   =            1 / Lower left pixel in Y
HIERARCH ESO DET WIN1 UIT1   =    10.000000 / user defined subintegration time
HIERARCH ESO DET WINDOWS     =            1 / # of windows readout
HIERARCH ESO DPR CATG        = 'CALIB   '   / Observation category
HIERARCH ESO DPR TECH        = 'IMAGE   '   / Observation technique
HIERARCH ESO DPR TYPE        = 'DARK,DARK'  / Observation type
HIERARCH ESO INS ADC1 DEC    = -225915.50861 / Telescope desclination [deg].
HIERARCH ESO INS ADC1 END    =       0.0000 / Position angle at end [deg].
HIERARCH ESO INS ADC1 MODE   = 'OFF     '   / ADC mode.
HIERARCH ESO INS ADC1 RA     = 62810.971205 / Telescope right ascension [deg].
HIERARCH ESO INS ADC2 DEC    = -225915.50861 / Telescope desclination [deg].
HIERARCH ESO INS ADC2 END    =       0.0000 / Position angle at end [deg].
HIERARCH ESO INS ADC2 MODE   = 'OFF     '   / ADC mode.
HIERARCH ESO INS ADC2 RA     = 62810.971205 / Telescope right ascension [deg].
HIERARCH ESO INS ADCS NAME   = 'OUT     '   / ADC slide position.
HIERARCH ESO INS ADCS NO     =            1 / ADC slide position.
HIERARCH ESO INS DATE        = '2000-06-16' / Instrument release date (yyyy-mm-
HIERARCH ESO INS DET1 CTMAX  =           -1. / Maximum count during exposure.
HIERARCH ESO INS DET1 CTMEAN =         -1.0 / Average counts during exposure.
HIERARCH ESO INS DET1 CTMIN  =           -1. / Minimum count during exposure.
HIERARCH ESO INS DET1 CTRMS  =         0.00 / RMS of counts during exposure.
HIERARCH ESO INS DET1 CTTOT  =          -15. / Total counts during exposure.
HIERARCH ESO INS DET1 OFFDRK =            0. / Average dark background counts.
HIERARCH ESO INS DET1 OFFSKY =            1. / Average sky background counts.
HIERARCH ESO INS DET1 TMMEAN =         0.50 / Normalised mean exposure time.
HIERARCH ESO INS DET1 UIT    =        1.000 / User defined Integration time [se
```

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```
HIERARCH ESO INS DID         = 'ESO-VLT-DIC.FEROS_ICS-1.10' / Data dictionary f
HIERARCH ESO INS ID          = 'FEROS/1.56' / Instrument ID.
HIERARCH ESO INS LAMP3 SWSIM =            T / If T, function is software simula
HIERARCH ESO INS LAMP7 SWSIM =            T / If T, function is software simula
HIERARCH ESO INS MIRR1 ID    = 'NONE    '   / Mirror unique ID.
HIERARCH ESO INS MIRR1 NAME  = 'FWM3    '   / Mirror name.
HIERARCH ESO INS MIRR1 NO    =            1 / Mirror slide position.
HIERARCH ESO INS MIRR1 ID    = 'NONE    '   / Mirror unique ID.
HIERARCH ESO INS MIRR1 NAME  = 'FCURSM  '   / Mirror name.
HIERARCH ESO INS MIRR1 NO    =            1 / Mirror slide position.
HIERARCH ESO INS MIRR1 ID    = 'NONE    '   / Mirror unique ID.
HIERARCH ESO INS MIRR1 NAME  = 'FWASCSM '   / Mirror name.
HIERARCH ESO INS MIRR1 NO    =            1 / Mirror slide position.
HIERARCH ESO INS MODE        = 'FEROS   '   / Instrument mode used.
HIERARCH ESO INS OPTI2 ID    = 'FEROS   '   / OPTIi unique ID.
HIERARCH ESO INS OPTI2 NAME  = 'FEROS   '   / OPTIi name.
HIERARCH ESO INS OPTI2 NO    =            1 / OPTIi slot number.
HIERARCH ESO INS OPTI2 TYPE  = 'FIBER   '   / OPTIi element.
HIERARCH ESO INS OPTI3 ID    = 'OUT     '   / OPTIi unique ID.
HIERARCH ESO INS OPTI3 NAME  = 'OUT     '   / OPTIi name.
HIERARCH ESO INS OPTI3 NO    =            2 / OPTIi slot number.
HIERARCH ESO INS OPTI3 TYPE  = 'FREE    '   / OPTIi element.
HIERARCH ESO INS OPTI4 ID    = 'OUT     '   / OPTIi unique ID.
HIERARCH ESO INS OPTI4 NAME  = 'OUT     '   / OPTIi name.
HIERARCH ESO INS OPTI4 NO    =            1 / OPTIi slot number.
HIERARCH ESO INS OPTI4 TYPE  = 'OUT     '   / OPTIi element.
HIERARCH ESO INS PATH        = 'DEFAULT '   / Optical path used.
HIERARCH ESO INS ROT1 ENC    =            0 / Absolute position [Enc].
HIERARCH ESO INS ROT1 POS    =          0.0 / Position [deg].
HIERARCH ESO INS SENS1 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS SENS1 GRAD  =    0.000000 / Linear regression slope.
HIERARCH ESO INS SENS1 ID    = 'PRSS    '   / sensor ID.
HIERARCH ESO INS SENS1 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS SENS1 LRRMS =  763.835784 / Linear regression RMS.
HIERARCH ESO INS SENS1 MAX   =  763.835784 / Maximum value.
HIERARCH ESO INS SENS1 MEAN  =  763.835784 / Average value.
HIERARCH ESO INS SENS1 MIN   =  763.835784 / Minimum value.
HIERARCH ESO INS SENS1 NAME  = 'Vacuum vessel pressure' / sensor common name.
HIERARCH ESO INS SENS1 RMS   =    0.000000 / RMS of samples over exposure.
HIERARCH ESO INS SENS1 VAL   =  763.840000 / Sensor numeric value.
HIERARCH ESO INS SENS2 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS SENS2 GRAD  =    0.000000 / Linear regression slope.
HIERARCH ESO INS SENS2 ID    = 'LNLV    '   / sensor ID.
HIERARCH ESO INS SENS2 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS SENS2 LRRMS =  100.000000 / Linear regression RMS.
HIERARCH ESO INS SENS2 MAX   =  100.000000 / Maximum value.
HIERARCH ESO INS SENS2 MEAN  =  100.000000 / Average value.
HIERARCH ESO INS SENS2 MIN   =  100.000000 / Minimum value.
HIERARCH ESO INS SENS2 NAME  = 'LN2 level'  / sensor common name.
HIERARCH ESO INS SENS2 RMS   =    0.000000 / RMS of samples over exposure.
HIERARCH ESO INS SENS2 VAL   =  100.000000 / Sensor numeric value.
```

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```
HIERARCH ESO INS SENSOR4 SWSIM=           F / If T, function is software simula
HIERARCH ESO INS SENSOR5 SWSIM=           F / If T, function is software simula
HIERARCH ESO INS SENSOR6 SWSIM=           F / If T, function is software simula
HIERARCH ESO INS SENSOR7 SWSIM=           T / If T, function is software simula
HIERARCH ESO INS SHUT1 ID    = 'PMSH    '   / Shutter ID.
HIERARCH ESO INS SHUT1 NAME  = 'FCUSHUT   ' / Shutter name.
HIERARCH ESO INS SHUT1 ST    =           F / Shutter open.
HIERARCH ESO INS SWSIM       = 'NORMAL  '   / Software simulation.
HIERARCH ESO INS TEMP1 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS TEMP1 GRAD  =     0.000000 / Linear regression slope.
HIERARCH ESO INS TEMP1 ID    = 'FAT1    '   / Temperature sensor ID.
HIERARCH ESO INS TEMP1 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP1 LRRMS =    12.060000 / Linear regression RMS.
HIERARCH ESO INS TEMP1 MAX   =    12.060000 / Maximum value.
HIERARCH ESO INS TEMP1 MEAN  =    12.060000 / Average value.
HIERARCH ESO INS TEMP1 MIN   =    12.060000 / Minimum value.
HIERARCH ESO INS TEMP1 NAME  = 'FEROS air temperature1' / Temperature sensor name
HIERARCH ESO INS TEMP1 RMS   =     0.000000 / RMS of samples over exposure.
HIERARCH ESO INS TEMP1 VAL   =       12.060 / Temperature sensor numeric value.
HIERARCH ESO INS TEMP2 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS TEMP2 GRAD  =     0.000000 / Linear regression slope.
HIERARCH ESO INS TEMP2 ID    = 'FAT2    '   / Temperature sensor ID.
HIERARCH ESO INS TEMP2 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP2 LRRMS =    12.060000 / Linear regression RMS.
HIERARCH ESO INS TEMP2 MAX   =    12.060000 / Maximum value.
HIERARCH ESO INS TEMP2 MEAN  =    12.060000 / Average value.
HIERARCH ESO INS TEMP2 MIN   =    12.060000 / Minimum value.
HIERARCH ESO INS TEMP2 NAME  = 'FEROS air temperature2' / Temperature sensor name
HIERARCH ESO INS TEMP2 RMS   =     0.000000 / RMS of samples over exposure.
HIERARCH ESO INS TEMP2 VAL   =       12.060 / Temperature sensor numeric value.
HIERARCH ESO INS TEMP3 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS TEMP3 GRAD  =     0.000000 / Linear regression slope.
HIERARCH ESO INS TEMP3 ID    = 'FCCRT1  '   / Temperature sensor ID.
HIERARCH ESO INS TEMP3 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP3 LRRMS =    12.060000 / Linear regression RMS.
HIERARCH ESO INS TEMP3 MAX   =    12.060000 / Maximum value.
HIERARCH ESO INS TEMP3 MEAN  =    12.060000 / Average value.
HIERARCH ESO INS TEMP3 MIN   =    12.060000 / Minimum value.
HIERARCH ESO INS TEMP3 NAME  = 'FEROS CCR air temperature1' / Temperature sensor name
HIERARCH ESO INS TEMP3 RMS   =     0.000000 / RMS of samples over exposure.
HIERARCH ESO INS TEMP3 VAL   =       12.060 / Temperature sensor numeric value.
HIERARCH ESO INS TEMP4 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS TEMP4 GRAD  =     0.000000 / Linear regression slope.
HIERARCH ESO INS TEMP4 ID    = 'FCCRT2  '   / Temperature sensor ID.
HIERARCH ESO INS TEMP4 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP4 LRRMS =    12.060000 / Linear regression RMS.
HIERARCH ESO INS TEMP4 MAX   =    12.060000 / Maximum value.
HIERARCH ESO INS TEMP4 MEAN  =    12.060000 / Average value.
HIERARCH ESO INS TEMP4 MIN   =    12.060000 / Minimum value.
HIERARCH ESO INS TEMP4 NAME  = 'FEROS CCR air temperature2' / Temperature sensor name
HIERARCH ESO INS TEMP4 RMS   =     0.000000 / RMS of samples over exposure.
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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    = 'FCCRT3  '   / Temperature sensor ID.
HIERARCH ESO INS TEMP5 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP5 LRRMS =    17.191000 / Linear regression RMS.
HIERARCH ESO INS TEMP5 MAX   =    17.191000 / Maximum value.
HIERARCH ESO INS TEMP5 MEAN  =    17.191000 / Average value.
HIERARCH ESO INS TEMP5 MIN   =    17.191000 / Minimum value.
HIERARCH ESO INS TEMP5 NAME  = 'FEROS 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    = 'FRT1'       / Temperature sensor ID.
HIERARCH ESO INS TEMP6 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS TEMP6 LRRMS =    17.299000 / Linear regression RMS.
HIERARCH ESO INS TEMP6 MAX   =    17.299000 / Maximum value.
HIERARCH ESO INS TEMP6 MEAN  =    17.299000 / Average value.
HIERARCH ESO INS TEMP6 MIN   =    17.299000 / Minimum value.
HIERARCH ESO INS TEMP6 NAME  = 'FEROS 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 HUMI1 DETCOEF=    0.000000 / RMS of linear regression slope.
HIERARCH ESO INS HUMI1 GRAD  =     0.000000 / Linear regression slope.
HIERARCH ESO INS HUMI1 ID    = 'FAH1    '   / Humidity sensor ID.
HIERARCH ESO INS HUMI1 LRCONST=    0.000000 / Linear regression constant.
HIERARCH ESO INS HUMI1 LRRMS =    12.060000 / Linear regression RMS.
HIERARCH ESO INS HUMI1 MAX   =    12.060000 / Maximum value.
HIERARCH ESO INS HUMI1 MEAN  =    12.060000 / Average value.
HIERARCH ESO INS HUMI1 MIN   =    12.060000 / Minimum value.
HIERARCH ESO INS HUMI1 NAME  = 'FEROS air humidity1' / Humidity sensor name
HIERARCH ESO INS HUMI1 RMS   =     0.000000 / RMS of samples over exposure.
HIERARCH ESO INS HUMI1 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    = 'FLN2DP  '   / Pressure sensor ID.
HIERARCH ESO INS PRES1 LRCONST=    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  = 'FEROS 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         = 'FEROS   '   / linked blocks
HIERARCH ESO OBS ID          =           0 / Observation block ID
HIERARCH ESO OBS NAME        = 'FEROS_ech_cal_dark' / OB name
HIERARCH ESO OBS PI-COI ID   =           0 / ESO internal PI-COI ID
HIERARCH ESO OBS PI-COI NAME = 'VLTSW   '   / PI-COI name
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HIERARCH ESO OBS PROG ID     = '60.A-9036(A)' / ESO program identification
HIERARCH ESO OBS START       = '2003-05-26T19:11:36' / OB start time
HIERARCH ESO OBS TPLNO       =            1 / Template number within OB
HIERARCH ESO OCS DET1 IMGNAME= 'FEROS_ECH_CAL' / Data File Name.
HIERARCH ESO TPL DID         = 'ESO-VLT-DIC.TPL-1.4' / Data dictionary for TPL
HIERARCH ESO TPL EXPNO       =            1 / Exposure number within template
HIERARCH ESO TPL ID          = 'FEROS_ech_cal_dark' / Template signature ID
HIERARCH ESO TPL NAME        = 'FEROS_ech_cal_dark' / Template name
HIERARCH ESO TPL NEXP        =            1 / Number of exposures within templa
HIERARCH ESO TPL PRESEQ      = 'FEROS_ech_cal_dark.seq' / Sequencer script
HIERARCH ESO TPL START       = '2003-05-26T19:11:36' / TPL start time
HIERARCH ESO TPL VERSION     = '1.0     '   / Version of the template
HIERARCH ESO TEL DID         = 'ESO-2P2-DIC.TCS-1.4' / Data dictionary for TEL
HIERARCH ESO TEL ID          = 'v 3.15  '   / TCS version number
HIERARCH ESO TEL DATE        = '2000-10-15T15:21:35.745' / TCS installation dat
HIERARCH ESO TEL GEOELEV     =         2335. / Elevation above sea level (m)
HIERARCH ESO TEL GEOLAT      =     -29.2543 / Tel geo latitute (+=North) (deg)
HIERARCH ESO TEL GEOLON      =     -70.7346 / Tel geo longitute (+=East) (deg)
HIERARCH ESO TEL OPER        = 'ElCondor'   / Telescope Operator
HIERARCH ESO TEL FOCU ID     = 'CA      '   / Telescope focus station ID
HIERARCH ESO TEL FOCU LEN    =        8.009 / Focal length (m)
HIERARCH ESO TEL FOCU SCALE  =       11.650 / Focal scale (arcsec/mm)
HIERARCH ESO TEL FOCU VALUE  =    22618.000 / M2 setting (mm)
HIERARCH ESO TEL AIRM START  =        1.069 / Airmass at start
HIERARCH ESO TEL AMBI FWHM START=      1.29 / Observatory Seeing queried from A
HIERARCH ESO TEL AMBI PRES START=    773.20 / Observatory ambient air pressure
HIERARCH ESO TEL AMBI WINDSP =         7.50 / Observatory ambient wind speed qu
HIERARCH ESO TEL AMBI WINDDIR=           28. / Observatory ambient wind directi
HIERARCH ESO TEL AMBI RHUM   =           32. / Observatory ambient relative hum
HIERARCH ESO TEL AMBI TEMP   =        12.50 / Observatory ambient temperature
HIERARCH ESO TEL MOON RA     =     8.510141 / 00:34:02.4 RA (J2000) (deg)
HIERARCH ESO TEL MOON DEC    =     -0.28250 / -00:16:56.9 DEC (J2000) (deg)
HIERARCH ESO TEL TRAK STATUS = 'OFF     '   / Tracking status
HIERARCH ESO TEL DOME STATUS = 'FULLY-OPEN' / Dome status
HIERARCH ESO TEL CHOP ST     =            F / True when chopping is active
HIERARCH ESO TEL AIRM END    =        1.066 / Airmass at end
HIERARCH ESO TEL AMBI FWHM END=       0.87 / Observatory Seeing queried from A
HIERARCH ESO TEL AMBI PRES END=     773.30 / Observatory ambient air pressure
HIERARCH ESO ADA POSANG      =    -0.90000 / Position angle at start
HIERARCH ESO ADA GUID STATUS = 'ON      '   / Status of autoguider
END
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