EUROPEAN SOUTHERN OBSERVATORY

Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral

Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

LA SILLA OBSERVATORY

FEROS-II:
Template Manual

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

Issue 0.6

December 1, 2003

	Name	Date	Signature
Prepared	J.D.Pritchard	Xxxx xx, xxxx	
Approved	T.Dall	Xxxx xx, xxxx	
Released	O.Hainaut	Xxxx xx, xxxx	

This page was intentionally left blank

Change Record

Issue/Rev.	Date	Sect./Parag. affected	Reason/Initiation/Documents/Remarks
0.1	20/07/2003	All	Creation, First Internal release for comment
0.2	18/08/2003	All	CMM Archive with doc number
0.3	18/08/2003	All	Further work
0.4	15/10/2003	All	Bringing into line with reality after Comm-VI
0.5	16/11/2003	All	Bringing into line with reality after Comm-VII
0.6	01/12/2003	All	First Draft release suitable for public

This page was intentionally left blank

Contents

1 Introduction

This document (2p2-TRE-ESO-22400-0001) describes the **Templates** defined for the Fibre-fed, Extended Range, Échelle Spectrograph (FEROS). FEROS is a bench-mounted, thermally controlled, prism-crossdispersed échelle spectrograph. It is designed to be a high resolution, high efficiency, versatile spectrograph providing in a single spectrogram almost complete[1] spectral coverage from $\sim$ 350–920 nm. Precise radial velocity work (accuracies of $\sim$ 25 m/s or better) is also possible, especially via the Object-Calibration mode.

The spectrograph is fed by two fibres providing simultaneous spectra of object plus either sky or one of the two calibration lamps (wavelength calibration and flat-field). The fibres are illuminated via 2.0 arcsec apertures on the sky separated by 2.9 arcmins. A small amount of rotation of the telescope adapter is possible in the rare case that a field star by chance falls on the sky fibre. The resolving power is 48,000 achieved with a two-slice image slicer over the spectral range of $\sim$ 350–920 nm spread over 39 ećhelle orders. The detector is an EEV 2k×4k CCD.

In October of 2002 FEROS was transferred from the ESO-1.52m telescope to the MPG/ESO-2.20m telescope. In October-November of 2003 it was upgraded to full VLT-compliance (i.e. OB controlled observing).

The reader is referred to the FEROS user's manual [3] for a full description and detailed of FEROS.

This manual is intended to guide observers through the creation of observation blocks (OBs) with which to make scientific and calibration observations.

The FEROS **Templates** are characterised by the Template Signature Files (TSFs),...

1.1 Applicable Documents

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

- [1] 2p2-SRS-ESO-22400-0001, Pritchard: FEROS-II Software User Requirements
- [2] LSO-URS-ESO-90400-0002, Saviane: Implementation of ADC for FEROS: User requirements

1.2 Reference Documents

The following documents are referenced in this document.

- [3] LSO-MAN-ESO-22200-0001, Pritchard: FEROS-II Users Manual

[1] The two spectral ranges 853.4–854.1 nm and 886.2–887.5 nm are lost due to non overlap of the spectral orders.

1.3 Abbreviations and Acronyms

1.52m	The ESO-1.52 m telescope at the LSO
2.20m	The MPG/ESO-2.20 m telescope at the LSO
ADU	Analog to Digital conversion Unit
AG	Autoguider
BIAS	Brorfelde Image Acquisition System
CCD	Charge-Coupled Device
DCS	Detector Control 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
FRD	Focal Ratio Degradation
GUI	Graphical User Interface
ICS	Instrument Control System
LED	Light Emitting Diode
LSO	La Silla Observatory
MPG	Max-Planck-Gesellschaft
PSF	Point Spread Function
SWC	Software and Communications team at LSO
S/N	Signal to Noise
TBD	To Be Done/Discussed/Decided
TCS	Telescope Control Software
TIO	Telescope & Instrument Operator
VLT	Very Large Telescope
ZD	Zenith Distance

1.4 Release Notes

This is version 0.5, the fifth draft release primarily aimed at the Period-72 Service Mode observers.

Versions 0.3 – 0.4 were draft releases circulated for comments. There was no version 0.2 release. Version 0.1 was the first release circulated for comments.

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

2 Instrument Modes

FEROS has two observing modes, Object-Sky and Object-Calibration. These are implemented in-separate templates.

3 Template Modes

FEROS templates are split into three groups according to *function*:

1. Aquisition Templates (AT)
   (a) Acquisition on fibre (*FEROS_ech_acq*)
2. Observation Templates (OT)
   (a) Science Exposure in Object-Sky mode (*FEROS_ech_obs_objsky*)
   (b) Science Exposure in Object-Calibration mode (*FEROS_ech_obs_objcal*)
3. Calibration Templates (CT)
   (a) Calibration of detector BIAS (*FEROS_ech_cal_bias*)
   (b) Calibration of detector DARK current (*FEROS_ech_cal_dark*)
   (c) Calibration exposures for wavelength (*FEROS_ech_cal_wave*)
   (d) Calibration exposures of continuum lamp (*FEROS_ech_cal_flat*)
   (e) Calibration exposures of stabilized LEDs (*FEROS_ech_cal_led*)
   (f) Focus telescope exposures (*FEROS_ech_cal_focus*)
   (g) Manage DRS initialisation (*FEROS_ech_cal_DRS*)

4 Templates: General Remarks

4.1 Notation

In this document all template keywords are given in the following notation:

Keyword Name	`Parameter Range`	*Label in P2PP*

Within one template the keywords are ordered according to the sequence **DET-SEQ-TEL-INS**. A detailed listing of all free and fixed keywords is given in Appendix B.

4.2 Detector Setups

In all OTs and CTs the detector readout mode, integration time, binning and number of exposures must be specified:

DET1.READ.SPEED	`60kHz,1,high 225kHz,1,low 625kHz,1,med`	*Readout Mode*
DET1.WIN1.UIT1	`0...36000`	*Exposure Time*
DET1.WIN1.BIN	`1..2`	*CCD Binning (Sets both x AND Y)*

SEQ.NEXPO `1...999` *Number of exposures*

To optimize the S/N in different type of observations while keeping the number of modes to be calibrated reasonable, three standard readout modes have been defined. A readout mode defines the readout speed, the gain, and the binning factors, see table 1. Comparison properties of the previous BIAS system are given in table 2. The format of the readout mode label is *speedNo. of portsgain* where `number of ports` is the number of readout ports. The CCD system infact has 2 readout ports, but two port readout is NOT a support readout mode.

Note: that in the current version of the FEROS Instrument Package (Version 1.12), the 625kHz,1,med readout mode is incorrectly labelled 625kHz,1,low.

Note: the 625kHz,1,med readout mode should be considered *EXPERIMENTAL* and should not be used for science data until it has been properly commissioned. This might happen during Period-73.

Readout Mode	*CF*	*RON*	*ROT*		
"60kHz,1,high"	1.0	3.0	148	Service/Visitor	For faint, RON-limited sources
"225kHz,1,low"	3.2	5.1	41	Service/Visitor	For high S/N observations
"625kHz,1,med"	2.7	7.2	21	Service/Visitor	For fast monitoring observations

Table 1: FIERA controller Detector Readout Modes: CF is Conversion Factor (i.e. inverse of Gain) [e^-/ADU], RON is Read Out Noise [e^- RMS] and ROT is Read Out Time [sec]. For the 625kHz mode the Read Out Time is limited by the 10Mbit ethernet connection between the FIERA Sparc and the FEROS instrument workstation (wferos).

Readout Mode	*CF*	*RON*	*ROT*,1×1	*ROT*,2×2
"60kHz,high,1 Output"	0.55	3.5	152	52
"60kHz,low,2 Outputs"	2.8	5.0	77	29

Table 2: BIAS Controller Detector Readout Modes: CF is Conversion Factor (i.e. inverse of Gain) [e^-/ADU], RON is Read Out Noise [e^- RMS] and ROT is Read Out Time [sec] and is shown for both 1×1 and 2×2 binning. The readout times for high gain are for 1 output while those for low are for two outputs, though of course both 1 and 2 outputs were possible for both gain settings.

4.3 FEROS Calibration Unit Setup

The FEROS Calibration Unit consists of two lamps (wavelength calibration and flatfield), the RSM, the FCU-Shutter and the NDFW. Their positions are specified as follows:

INS.LAMP1	`ON|OFF`	*ThArNe Wavelength Calibration Lamp*
INS.LAMP2	`ON|OFF`	*Hal+Hal Flatfield Lamp*
INS.LAMP3	`ON|OFF`	*ThAr+Ne Wavelength Calibration Lamp*
INS.LAMP4	`ON|OFF`	*D2+Hal Flatfield Lamp*
INS.LED1	`ON|OFF`	*Red CCD Test LEDs*
INS.LED2	`ON|OFF`	*Green CCD Test LEDs*
INS.LED3	`ON|OFF`	*Blue CCD Test LEDs*
INS.RSM	`DARK|LAMP1|LAMP2|LAMP3|LAMP4`	*Rotating Selection Mirror*
INS.FCSH	`DARK|BOTHFIBS|SKYFIB|OBJFIB`	*FCU Shutter*
INS.NDFW	`0.0...2.5`	*FCU Neutral Density Filter Wheel*

Only two calibration lamps can be active at any time, the other two being in SIMULATION mode. Currently the ThArNe lamp and the Hal+Hal lamps are active.[2]

4.4 FEROS/WFI Adapter Setup

The FEROS/WFI Adapter consists of the M3, the SCSM and the ADC. The ADC itself consists of two prisms. Their positions are specified as follows:

INS.M3	`FEROS|WFI`	*Mirror 3*
INS.SCSM	`PARK|BOTHFIBS|SKYFIB|OBJFIB`	*Sliding Calibration Selection Mirror*
INS.ADCA	`IN|OUT`	*Atmospheric Dispersion Corrector*
INS.ADC1	`0.0...360.0`	*ADC Prism-A*
INS.ADC2	`0.0...360.0`	*ADC Prism-B*

4.5 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:

4.5.1 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.

4.5.2 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.

[2]The ThArNe lamp is a single lamp containing a thorium cathode and a gas mix of of **????** (??%), Argon (??%) and Neon (??%). The Hal+Hal lamp in fact consists of two halogen bulbs operated and different currents to provide flux in the blue and red parts of the spectrum (a filter cuts the red flux of the blue bulb). The ThAr+Ne consists of one bulb with a thorium cathode and a gas mix of **????** (??%) and Argon (??%). The D2+Hal lamp is a commercial unit consisting of a Deuterium source and a halogen source.

5 Acquistion Template

5.1 *FEROS_ech_acq*

The FEROS fibre acquisition template. The template will perform the following actions sequentially:

1. If *Preset flag* is TRUE the SCSM is moved to PARK, the FCU-Shutter is moved to DARK and the telescope presets to the specified RA and Dec. Template waits for the completion of the preset. [**5min**]
2. The telescope will offset to the specifed *Alpha offset* and *Delta offset* (if non-zero). Template waits for the completion of the offset. [**1min**]
3. Template then pauses to allow TIO to acquire target (or Pointing reference star as appropriate) onto the fibre specified by *Target Fibre* and of `Autoguider flag` is TRUE start guiding. Either Guiding on Fibre on the *Feros FibreHead Viewing TCCD* or the *WFI Tracker Chip*. Which guiding system to use is generally decided upon by the TIO. [**2min**]
4. Apply the reverse *Alpha offset* and *Delta offset* (if non-zero). Template waits for the completion of the offset. Restart guiding if necessary. [**1min**]
5. An image from the FFHV TCCD is acquired and copied to the Visiting Astronomer's DRL. This image is NOT archived in the ESO Data Archive. It is intended to provide correct acquisition of the requested target. [**10sec**]

Typical times to complete each step of this template are given above, giving a total maximum typical execution time of about **9min**.

The target RA (*Right Ascension* and Dec (*Declination*) are specified via the keywords:

TEL.TARG.ALPHA	`00:00:00.000...23:59:59.999`	*Target Right Ascencion*
TEL.TARG.DELTA	`+90:00:00.000...-90:00:00.000`	*Target Declination*

Target *Name*, *Equinox*, *Epoch*, *Class* should also be specified.

TEL.OBS.TARG.NAME	*String*	*Target Name*

Target proper motions (*proper motion RA* and *proper motion Dec*), and differential tracking rates (*Diff RA* and *Diff Dec*) can also be specified if relevant – this infromation is for the header.

For faint ($B \geq\sim 20.0$, $V \geq\sim 20.0$), extended objects or emmission line objects a nearby (within 10 arcmin) a pointing reference star should be used. In this case non-zero Telescope Offsets (*Alpha offset* and *Delta offset*) should be specified:

TEL.TARG.OFFSETALPHA	`-600.000...+600.000`	*RA offset [arcsec]*
TEL.TARG.OFFSETDELTA	`-600.000...+600.000`	*Dec offset [arcsec]*

The offsets are defined as follows:

$$\textbf{TEL.TARG.ALPHA} + \textbf{TEL.TARG.OFFSETALPHA} = RA(PointingReference)$$

$$\textbf{TEL.TARG.DELTA} + \textbf{TEL.TARG.OFFSETDELTA} = Dec(PointingReference)$$

The Adapter can be rotated a small amount if necessary if by chance a field star falls on the sky fibre:

ADA.POSANG	`-10.0...+10.0`	*Adapter Rotator Position Angle*

This is a manual adjustment at the telescope and should be avoided if at all possible!

Differential tracking rates (*Differential tracking in RA* and *Differential tracking in Dec*) can be specified if relevant:

TEL.TARG.PMA	`-500.0...+500.0`	*Proper motion RA*
TEL.TARG.PMD	`-500.0...+500.0`	*Proper motion RA*
TEL.TARG.ADDVELALPHA	`-25.0...+25.0`	*RA diff tracking*
TEL.TARG.ADDVELDELTA	`-25.0...+25.0`	*Dec diff tracking*

The required fibre to position the target on must be specified (*Target fibre*):

TEL.AG.FIBSELEC	`OBJFIB|SKYFIB`	*Fibre to Place Object on*

Whether or not to guide must be specified (*Autoguider flag*):

ADA.AG.STATUS	`T|F`	*Autoguiding*

Whether or not to actually make the preset must be specified by (*Preset flag*):

TEL.PRESET.NEW	`T|F`	*Preset telescope*

This option is usually used when an an OB is executed for the same target as the previous OB and hence a new preset is generally not required.

6 Science Templates

The science templates allow the observer to specify the detector parameters, Readout Mode, Exposure Time, Binning and Number of expsoures, see section 4.2.

6.1 *FEROS_ech_obs_objsky*

The FEROS science Object-Sky mode exposure template. The template will perform the following actions sequentially:

1. Set LEDs `OFF` [**1sec**]
2. Setup FEROS/WFI Adapter: M3 to `FEROS` position, SCSM to `PARK` position, wait for SCSM preset to complete. ADC to `IN/OUT` position according to the specified mode of operation. If ADC is `IN` ADC prisms will begin tracking. [**1min**]
3. Setup FEROS Calibration Unit: FCU-Shutter to `DARK` position. Status of lamps and position of RSM will NOT be changed (to minimise overheads for attached calibrations by minimising function movements and lamp warmup times).[**1min**]
4. Setup Detector according to selected readout mode and windowing
5. Template waits for completion of all above setups
6. Execute **SEQ.NEXPO DET1.WIN1.UIT1** second exposures in mode NORMAL [**NEXPO**×(**UIT**+**ROT**)**sec**]
7. At the end of EACH exposure submit image for processing by FEROS-DRS [**5sec**]
8. At the end of the template the status of the FCU lamps and the position of the RSM are unchanged, FCU-Shutter and NDFW and the M3, SCSM and ADC are left in their positions as at the end of the exposure.[**5sec**]

The total execution time for this template is thus approximately:
130+**NEXPO**×(**UIT**+ROT)sec
With binning 2×2 ROT is approximately half those given in table 1.

Whether to use the Atmospheric Dispersion Corrector or not must be specified:

INS.ADC.STATUS `IN|OUT` *ADC*

If the ADC is `IN` it will automatically track the atmospheric dispersion with an update frequency of approximately once every ~ 10 sec.

Note: The ADC is not yet implemented and will likely not be implemented till Period-73.

No further parameters can be specified for this template.

6.2 *FEROS_ech_obs_objcal*

The FEROS science Object-Calibration mode exposure template. The template will perform the following actions sequentially:

1. Set LEDs `OFF` **[1sec]**
2. Setup FEROS/WFI Adapter: M3 to `FEROS` position, ADC to `OUT` position[3], wait for ADC preset to complete. SCSM to `SKYFIB` or `OBJFIB` position accoridng to whether `OBJFIB` or `SKYFIB` fibre was specified for the fibre to position the target on (in Acquisition). **[1min]**
3. Setup FEROS Calibration Unit: Selected calibration lamp `ON` if not already on, other lamp(s) `OFF`, the RSM is moved to the appropriate position according to the selected calibration lamp, FCU-Shutter to `SKYFIB` or `OBJFIB` position accoridng to whether `OBJFIB` or `SKYFIB` fibre was specified for the fibre to position the target on, Neutral Density Filter Wheel to appropriate position according to specified calibration lamp equivalent time. **[1min]**
4. Setup Detector according to selected readout mode and windowing
5. Template waits for completion of all above setups
6. Templates waits for specified Lamp Warmup time. **[LAMPWAIT sec]**
7. Execute **SEQ.NEXPO DET1.WIN1.UIT1** second exposures in mode NORMAL **[NEXPO×(UIT+ROT)sec]**
8. At the end of EACH exposure submit image for processing by FEROS-DRS **[5sec]**
9. At the end of the template the calibration lamps are are left on and off respectively and the RSM, FCU-Shutter and NDFW and the M3, SCSM and ADC are left in their positions as at the end of the exposure. **[5sec]**

The total execution time for this template is thus approximately:
130+**LAMPWAIT**+**NEXPO**×(**UIT**+ROT)sec
With binning 2×2 ROT is approximately half those given in table 1.

The calibration lamp to use must be selected here, either Wavelength calibration (default) or continuum source lamp.

INS.OCLAMP	`WLC|FF`	*Calibration source*

The *equivalent exposure time* must be specified:

SEQ.CALTIME	`0..43200`	*Equivalent exposure time*

The *equivalent exposure time* is used to calculate the density to set the Neutral Density Filter wheel to in order that in the specified object exposure time, the same flux level is obtained in the calibration spectrum as would be obtained in the *equivalent exposure time* at the NDFW reference density (currently 0.0), i.e. the density will be given by:

$$density = \log_{10}[\texttt{DET1.WIN1.UIT1}/\texttt{SEQ.CALTIME}]$$

A lamp warmup period can be specifed.

SEQ.LAMPWAIT	`0..43200`	*Lamp warmup delay*

Normally the lamp will be turned off at the end of the exposure. The lamp can be left on by setting to true the *Leave Lamp on*:

[3]At this time it is NOT clear if the ADC can be used in Object-Calibration mode since under the current design of the ADC unit it is not possible to have both the ADC `IN` and the SCSM in any position other than `PARK???`.

SEQ.LEAVELAMPON	T|F	*Leave Lamp on at end of exposure*

The idea here is to avoid having to wait for the lamp to warmup for the following objcal exposure. For Service Mode the lamp should never be left on at the end of an OB, since in general OBs from a given program are NOT executed in sequence.

The ADC can NOT be used in Object-Calibration mode.

Note: The ADC is not yet implemented and will likely not be implemented till Period-73.

7 Calibration Templates

The calibration templates allow the observer to specify the detector parameters, Readout Mode, Exposure Time, Binning and Number of expsoures, see section 4.2.

7.1 *FEROS_ech_cal_bias*

The FEROS calibration BIAS exposure template. The template will perform the following actions sequentially:

1. Set LEDs `OFF`
2. No change to FEROS Calibration Unit setup
3. No change to FEROS/WFI Adapter setup
4. Setup Detector according to selected readout mode and windowing
5. Template waits for completion of all above setups
6. Execute **SEQ.NEXPO** 0.0 second exposures in mode DARK.
7. At the end of EACH exposure submit image for processing by FEROS-DRS
8. At the end of the template no change to FEROS Calibration Unit or FEROS/WFI Adapter setups

7.2 *FEROS_ech_cal_dark*

The FEROS calibration DARK exposure template. The template will perform the following actions sequentially:

1. Set LEDs `OFF`
2. No change to FEROS Calibration Unit setup.
3. No change to FEROS/WFI Adapter setup.
4. Setup Detector according to selected readout mode and windowing
5. Template waits for completion of all above setups

6. Execute **SEQ.NEXPO DET1.WIN1.UIT1** second exposures in mode NORMAL
7. At the end of EACH exposure submit image for processing by FEROS-DRS
8. At the end of the template no change to FEROS Calibration Unit or FEROS/WFI Adapter setups

7.3 *FEROS_ech_cal_wave*

The FEROS calibration WAVELENGTH CALIBRATION exposure template. The template will perform the following actions sequentially:

1. If non-zero Lamp Wait is specified the flatfield lamp is turned on and then the template sleeps for the specified duration (to allow the lamp to warmup)
2. Set LEDs `OFF` and setup Adapter, Calibration Unit and Detector
   - Set LEDs `OFF`
   - Setup FEROS/WFI Adapter: M3 to `FEROS` position, ADC to `OUT` position, wait for ADC preset to complete. SCSM to appropriate position according to which fibre(s) are selected (`BOTHFIBS|OBJFIB|SKYFIB`). Template will not at this time wait for completion of preset.
   - Setup FEROS Calibration Unit: Wavelength calibration lamp `ON` if not already on, other lamp(s) `OFF`, the RSM is moved to the appropriate position, FCU-Shutter to appropriate position according to which fibre(s) are selected (`BOTHFIBS|OBJFIB|SKYFIB`), Neutral Density Filter Wheel to reference density (*configurable by SciOps*). Template will not at this time wait for completion of presets.
   - Setup Detector according to selected readout mode and windowing
3. Template waits for completion of all above setups
4. Execute **SEQ.NEXPO DET1.WIN1.UIT1** second exposures in mode NORMAL
5. At the end of EACH exposure submit image for processing by FEROS-DRS
6. At the end of the template the FCU-Shutter to `DARK` position, lamps and RSM left in current status. No change to FEROS/WFI Adapter setups

Which fibre(s) to illuminate must be specified.

SEQ.CALFIBER	`BOTHFIBS|OBJFIB|SKYFIB`	*Fibre(s) to illuminate*

A lamp warmup period can be specifed.

SEQ.LAMPWAIT	`0..43200`	*Lamp warmup delay*

7.4 *FEROS_ech_cal_flat*

The FEROS calibration FLATFIELD exposure template. The template will perform the following actions sequentially:

1. If non-zero Lamp Wait is specified the flatfield lamp is turned on and then the template sleeps for the specified duration (to allow the lamp to warmup)

2. Set LEDs `OFF` and setup Adapter, Calibration Unit and Detector
   - Set LEDs `OFF`
   - Setup FEROS/WFI Adapter: M3 to `FEROS` position, ADC to `OUT` position, wait for ADC preset to complete. SCSM to appropriate position according to which fibre(s) are selected (`BOTHFIBS|OBJFIB|SKYFIB`). Template does not wait for completion of setup.
   - Setup FEROS Calibration Unit: Flatfield calibration lamp `ON` if not already on, other lamp(s) `OFF`, the RSM is moved to the appropriate position, FCU-Shutter to `BOTHFIBS` position, Neutral Density Filter Wheel to reference density (*configurable by SciOps*). Template will not at this time wait for completion of presets.
   - Setup Detector according to selected readout mode and windowing
3. Template waits for completion of all above setups
4. Execute **SEQ.NEXPO DET1.WIN1.UIT1** second exposures in mode NORMAL
5. At the end of EACH exposure submit image for processing by FEROS-DRS
6. At the end of the template the FCU-Shutter to `DARK` position, lamps and RSM left in current status. No change to FEROS/WFI Adapter setups

Which fibre(s) to illuminate must be specified.

SEQ.CALFIBER	`BOTHFIBS|OBJFIB|SKYFIB`	*Fibre(s) to illuminate*

A lamp warmup period can be specifed.

SEQ.LAMPWAIT	`0..43200`	*Lamp warmup delay*

7.5 *FEROS_ech_cal_DRS*

The FEROS calibration DRS initialisation template. The template will perform the following actions sequentially:

1. The template will run the shell command `ferosDRSinit` with the two arguments specified by `DPR.DRS.GUESS` and `DPR.DRS.STEP`. The command `ferosDRSinit` is a shell script which submits via `rsh` the appropriate command (`@@ init ThAr<Guess> <Step>`) to the DRS-MIDAS session running on the `w2p2off` machine.

A Execution times

TBD

B FEROS Template Signature Files

TBD

___oOo___