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Very Large Telescope Paranal Science Operations FORS Template Manual

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| 106 | January 27 2020 | 2.3, 2.4 | Note added that users should choose imaging filters in acquisition and through-slit templates consistent in wavelength with the grism for the science. |
| 110 | September 11 2022 | 2.3 and 2.3.1 | y-position acquisition coordinate changed to 238, RRM can only be used with SR collimator |

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1 Introduction

1.1 Scope

All observations with the VLT are carried out with “observing blocks” (OBs). OBs are prepared with the phase 2 proposal preparation web-based tool p2. With p2 the mode specific observation templates will be selected by the users and the parameter fields (“keywords”) are set to the user specified values. The p2 web pages introduce the functionality of the p2 tool while this FORS2 Template Manual describes the FORS templates and the keywords.

A general overview of the instrument and the FIMS mask preparation for FORS is given in the manuals found at the FORS2 documentation page:

<http://www.eso.org/sci/facilities/paranal/instruments/fors/doc.html>

The p2 help web pages and more information about OB preparation is available on page:

<https://www.eso.org/sci/observing/phase2/p2intro.html>

1.2 Contact Information

In case of questions related to your Service Mode observations and proposal preparation please contact the User Support Department through email:

`usd-help@eso.org`

For visitor mode observation runs please contact the Paranal Science Operations Team:

`fors2@eso.org`

1.3 Acknowledgments

The earlier versions of this manual have been edited by H. Bönhardt, G. Rupprecht, T. Szeifert, E. Jehin, K. O’Brien, I. Saviane and H. Boffin.

1.4 Abbreviations and Acronyms

The following abbreviations and acronyms are used in this manual:

| | |
|--------|--|
| ACQ | Acquisition |
| BOB | Broker of Observation Blocks |
| CCD | Charge Coupled Device |
| CS | Constrain set |
| ESO | European Southern Observatory |
| FIMS | FORS Instrumental Mask Simulator |
| FORS | Focal Reducer/Low Dispersion Spectrograph |
| HIT | High-Time resolution |
| HIT-I | High-Time resolution Imaging |
| HIT-S | High-Time resolution Spectroscopy |
| HIT-MS | High-Time resolution Spectroscopy with MXU masks |
| HR | High Resolution |
| IMG | Imaging |
| IPOL | Imaging Polarimetry |
| LADC | Longitudinal Atmospheric Dispersion Compensator |
| LSS | Long Slit Spectroscopy |
| MIT | More Infrared Transmission |
| MOS | Multi Object Spectroscopy |
| MXU | Mask eXchange Unit |
| OB | Observation Block |
| OD | Observation Description |
| OS | Observation Software |
| OSF | Order Separation Filter |
| OT | Observing Tool |
| PMOS | Polarimetric Multi Object Spectroscopy |
| p2 | Phase 2 Proposal Preparation tool |
| RA | Right Ascension |
| RRM | Rapid Response Mode |
| SR | Standard Resolution |
| TCS | Telescope Control System |
| TP | Target Package |
| VLT | Very Large Telescope |

2 FORS Templates

2.1 Introduction: Observation Blocks, Templates, Keywords

Observation Block (OB): Observations are described in so-called Observations Blocks (OB) containing all the necessary information to perform a single (science or calibration) observation. An OB contains a Target Package (TP), which tells the telescope where to go, an Acquisition Template (AT), which tells the system how to go, and an Observation Description (OD), which tells the system what to do once in position. The OD in turn may contain several templates, the true unit of observation. In service mode, OBs contain also a Constraint Set (CS). OBs are executed by BOB, the Broker for Observation Blocks. It sends commands to the Observation Software (OS), which then redistributes them to the instrument (ICS), detector (DCS), and telescope (TCS) control software. This forms the VLT Control Software (VCS).

Advance preparation of your OBs can optimize the use of the telescope by minimizing overheads. Investigators asking for service observing will have to submit a set of fully defined OBs to be executed under certain conditions, whereas visitors can prepare a few typical OBs, and will have more flexibility at the telescope to modify and adapt them to their immediate needs.

OBs are created and edited with p2 (phase 2 web-based tool): following the general p2 architecture, two types of Observation Blocks can be specified:

| | |
|-------------|--|
| “ObsBlocks” | night time observations, science and standard star exposures |
| “CalBlocks” | day time calibrations, bias, darks, screen flats, arcs |

Night time “ObsBlocks” consist of the target information, a single acquisition template and the observation description (OD) with a small selection of science observation templates. The day time “CalBlocks” consist of a small selection of calibration templates (but no acquisition templates). Besides this, constraint sets (CS) and scheduling information are requested in particular for the preparation of service more observations. The target information and the constraint sets are not described below, since they are general for all instruments and their description can be found on the p2 help web pages.

Observation Description (OD): this defines the sequence of setups and exposures for scientific or calibration purposes. It consists of one or more templates and the respective keywords. If several templates are included, their execution follows the sequence in the list. This sequence can be modified at the telescope through BOB, the Broker for OBs, in the sense that the execution of any individual templates can be skipped, paused or restarted.

2.2 FORS Templates: Acquisition, Science and Calibration

2.2.1 FORS Observing Modes

The FORS templates are specific for a given observation mode (see Table 1). Each mode has a specific set of templates for the acquisition, science exposures and calibrations. In most cases the templates of different modes cannot be mixed in one observation blocks.

Fast, RRM and FIMS based observing modes: Three groups of target acquisition templates are offered: FIMS based modes which require mask preparations and the more simple fast modes. All multi-object observations in modes MOS, MXU, and PMOS will require the preparation of masks with fims. Occulting bar imaging and slitless spectroscopy is only supported with fims-based modes. Typically, the mask design has to be ready before starting the preparation of the OBs.

Any observation in modes IMG, IPOL, LSS, and single target observations in “PMOS” mode can be done without mask preparation with fims. These are the so-called ‘fast’ observations. A sub-category of these are RRM templates, which are similar to fast templates, but with less user interaction due to the nature of RRM observations.

| Observing Mode | Acronym | Options | | |
|---|---------|---------|------|------|
| | | RRM | FAST | FIMS |
| Direct imaging | IMG | X | X | |
| Imaging with occulting bars | OCC | | | X |
| Longslit spectroscopy | LSS | X | X | |
| Multi-object spectroscopy (movable slits) | MOS | | | X |
| Imaging polarimetry | IPOL | X | X | |
| Spectropolarimetry | PMOS | X | X | X |
| Multi-object spectroscopy (slit masks) | MXU | | | X |

Table 1: Observing modes of FORS2.

For faint targets we support blind offset acquisition modes for all the fast modes (this is done with the through slit templates). The astrometric requirements are similar for blind fast acquisitions and fims acquisitions. In general the OB execution won't be much faster, but the OB preparation will be!

For the acquisition and science templates fast (incl RRM) and FIMS based option are usually considered as separate observing modes of FORS. They thus have separate templates for target acquisition, science observation and day time calibrations. In general the FIMS based and fast mode templates cannot be mixed in a single OB and the few exceptions are to be discussed with the observatory staff.

2.2.2 Template Types

Three template types are used with FORS: target acquisition templates, science observation templates and day time calibration templates. The following naming convention is normally used (<mode> gives the observing mode used - see Table 1; xxx indicates the option of the respective mode - fast for fast mode, all others are FIMS based):

```

Acquisition Templates  FORS2_<mode>_acq_<xxx>
Calibration Templates  FORS2_<mode>_cal_<xxx>
Observation Templates  FORS2_<mode>_obs_<xxx>

```

In a few cases we still break this naming scheme like for the occulting bar imaging or deviate slightly from the scheme, but you will find a cross identification list between acquisition and science observation templates below in Tables 2 & 3

2.2.3 Template Keywords

The parameters of the templates and the respective observations are to be specified in the template specific list of keywords. The keywords correspond to functionalities (for instance setups of the instrument, telescope preset) supported by the templates. Within p2 the keywords are designated by the names of p2 entry fields. For any keyword an allowed range and a default value is defined. The keywords themselves are not visible from p2. The tables in section 3 list - separately for each OB - the keywords names, their value range and defaults together with the p2 name as shown in the view panel of p2. In general only the keywords which will be in status "NODEFAULT" have to be set by the users, while the keywords already set to default values should remain at the original default value in almost all cases. Hidden parameters cannot be modified and will not appear at any place in p2.

| template name | short description |
|--|---|
| <code>FORS2_img_cal_coll</code> <code>FORS2_img_cal_bias</code> <code>FORS2_img_cal_dark</code> | select collimator for calibration exposures bias exposure dark exposure |
| <code>FORS2_img_acq</code> <code>FORS2_img_acq_rrm</code> <code>FORS2_img_obs_crsplit</code> <code>FORS2_img_cal_scrflat</code> <code>FORS2_img_cal_skyflat</code> | fast/normal imaging target acquisition RRM imaging target acquisition multiple imaging exposure with offsets (in arc sec and sky coordinates) imaging screen flatfield sky flat with automatic exposure time calculation and automatic offsets on the sky |
| <code>FORS2_img_acq_align</code> <code>FORS2_img_occ_crsplit</code> | FIMS based accurate imaging target acquisition multiple imaging exposures with occultation mask of MOS slit arms and offsets (in arc sec and sky coordinates) |
| <code>FORS2_ipol_acq_fast</code> <code>FORS2_ipol_acq_rrm</code> <code>FORS2_ipol_obs_off_fast</code> <code>FORS2_ipol_obs_scrflat_fast</code> | fast IPOL target acquisition RRM (fast) IPOL target acquisition IPOL sequence with offsets in y-direction (in arc seconds and detector coordinates) rotating the retarder plate IPOL screen flat sequence rotating the retarder plate |

Table 2: A list of all acquisition, science and calibration templates for imaging modes

2.3 Acquisition Templates

The prime goal of the acquisition templates is the positioning of user defined objects to user defined positions (eg. slits) in the focal plane of the instrument. The acquisition templates contain keywords related to the targets, the telescope and instrument setup and some mode specific options for the target acquisition sequence. The execution sequence of FORS acquisition templates has two phases: the preset to and the fine positioning of the target field. It has the following execution steps:

| | |
|---|---|
| <p>FORS2_lass_acq_fast FORS2_lass_acq_rrm FORS2_lass_obs_slit_fast FORS2_lass_obs_off_fast FORS2_lass_cal_daycalib</p> | <p>fast longslit spectroscopy target acquisition RRM (fast) longslit spectroscopy target acquisition through-slit longslit exposure longslit spectroscopy with offsets along the slit (in y-direction arc seconds in detector coordinates) longslit spectroscopic screen flatfield and wavelength calibration</p> |
| <p>FORS2_mos_acq FORS2_mos_obs_slit FORS2_mos_obs_off FORS2_mos_cal_daycalib</p> | <p>FIMS based MOS target acquisition MOS exposure through the slits MOS exposure with offset along the slit (in y-direction arc seconds in detector coordinates) MOS spectroscopic screen flatfield and wavelength calibration</p> |
| <p>FORS2_mxu_acq FORS2_mxu_obs_slit FORS2_mxu_obs_off FORS2_mxu_cal_daycalib</p> | <p>FIMS based MXU target acquisition MXU mask exposure through the slits MXU mask exposure with offsets along the slit (in y-direction arc seconds in detector coordinates) MXU spectroscopic screen flatfield and wavelength calibration</p> |
| <p>FORS2_pmos_acq FORS2_pmos_obs_slit FORS2_pmos_obs_off FORS2_pmos_cal_daycalib</p> | <p>FIMS based PMOS target acquisition FIMS based PMOS through-slit exposure FIMS based PMOS exposure sequence with offsets along the slit (in y-direction arc seconds in detector coordinates) PMOS screen flatfield and wavelength calibration rotating the retarder plate</p> |
| <p>FORS2_pmos_acq_fast FORS2_pmos_acq_rrm FORS2_pmos_obs_slit_fast FORS2_pmos_obs_off_fast FORS2_pmos_cal_daycalib_fast</p> | <p>fast PMOS target acquisition RRM (fast) PMOS target acquisition PMOS through-slit exposure PMOS exposure sequence with offset along the slit (no FIMS, in y-direction arc seconds in detector coordinates) PMOS screen flatfield and wavelength calibration rotating the retarder plate</p> |
| <p>FORS2_specphot_acq_fast FORS2_specphot_obs_slit_fast FORS2_specphot_obs_exp_fast FORS2_specphot_cal_daycalib</p> | <p>fast wide slit spectrophotometry acquisition through-slit exposure for spectrophotometry wide slit spectrophotometry exposure spectro-photometric screen flatfield and wavelength calibration</p> |

Table 3: A list of all acquisition, science and calibration templates for spectroscopy modes.

FORS acquisition sequence:

1. preset of the telescope to the center field coordinates of the target field (including instrument rotator)
2. set collimator of the instrument and LADC of the telescope (RRM will only be triggered if the SR collimator is currently in use)
3. optionally start differential tracking (for instance to follow moving objects. Not in RRM)
4. select and acquire reference star for active optics and auto guiding. Start and wait for the active optics and auto guiding (this part of the execution requires manual intervention by the telescope and instrument operator)
5. setup the instrument for the acquisition image
6. execute acquisition image of target field
7. cursor selection of the target(s) for fine positioning and rotation (fast option), the reference star (blind, fast option) or automatic measurement of reference stars for the field alignment and calculation of the required telescope offset (FIMS based option)
8. perform telescope offset (if needed)
9. repeat steps 6 to 8 (if needed) until the field alignment satisfies the requirements for the science observations
10. stop alignment process and end acquisition sequence

Each step is described in detail in the next section.

2.3.1 Functionality of the Acquisition Templates

The target information is always used by the OT scheduling tool for service mode observations. Therefore, the target coordinates shall always be entered into the p2 entry fields to ensure the proper scheduling of service mode observations.

Preset to target field: the “fast” acquisition templates will read the coordinate and equinox of the target (or the reference star in case of a “fast blind” acquisition) from the target entry fields on the bottom of the p2 window. The offset from a reference star to the target (fast mode templates, excluding RRM) requires that the user enters the coordinates of the reference stars into the target informations on the bottom of p2.

All FIMS based FORS observations will read the preset information as well as the coordinates of the reference stars and slits through the FIMS p_targ file attached to the acquisition templates. Templates FORS2_img_acq and FORS2_img_acq_rrm will only preset the telescope to the field and stops after the execution of steps 1 to 4, while all other templates will continue with the fine positioning of targets on slits.

Proper motion: Independent from the fact that earlier versions of p2 have had entry fields for proper motion and epoch — the coordinates have to be given at the actual epoch since there is no proper motion and epoch keyword in any of the FORS acquisition templates. The target coordinates are only precessed from the user define equinox to the actual epoch.

Set-up of FORS Collimator, LADC: besides the target acquisition, the acquisition templates will

also setup the FORS collimator and the LADC (transparent to the user). This is mainly done because of the long setup time of the collimator which will be done in the most economic way during telescope preset. This will have some impact for the preparation of calibration OBS (FORS_img_cal_coll template required) which will be discussed below.

Position angles and rotator offset angle: In the actual configuration of the telescope and instrument the rotator offset angle has to be specified: this is flipped in sign in respect of the position angle of the target on the sky (rot. angle = -PA). FIMS will do it automatically right, but be aware of this while using “fast” templates (see Fig. 1).

In addition to this, a value of “9999” can be used to set the position angle to the parallactic angle for long-slit observations (it is ignored for imaging acquisition).

IMPORTANT: a rotator angle of $\pm 180^\circ$ must be avoided in all FIMS based mode as it will lead to an undesired flip of the mask with respect of the field.

Start of the guiding and other telescope functions will be done by the telescope operator.

Fine positioning of the target field: the pointing is interactively refined through use of one or several acquisition images. The aim is the centering of the target(s) at the desired location(s) in the focal plane (e.g. to position objects in slits for spectroscopy).

For the fast option the offset and rotation are calculated from the actual target(s) position in the acquisition image and the predefined reference position of the slit.

- If only one object is selected, then only the offset to the default position is calculated and applied.
- If two objects are selected, then both an offset and the rotation angle are calculated and applied. The operator has the option to send any of the two objects to the reference pixel inside the slit. After presetting, the other object will be North of the selected one. It is also possible to select the middle point, in which case the minimum rotation angle to align the two objects vertically will be computed.

In case of a blind offset acquisition in fast mode the offset of the reference star to the slit is calculated (in arc sec in sky coordinates). We recommend to choose the reference star as close as possible to the target.

For the FIMS based acquisition modes the respective offsets are derived from the position of all user defined reference stars on the image in respect to the expected positions. The instrument rotation offset will also be calculated and corrected if at least three reference stars are selected within the fims software. The reference positions of the slits are read from the database (MOS, SPECPHOT) or from a reference image taken during day time (MXU, LSS) and kept up to date by the staff. The recommendation on reference stars in FIMS based modes is discussed in the FIMS manual. Here we only remind the users that the reference stars for any fims mode should be well distributed in the field to get the “base line” to determine the rotation offset. The distribution of reference stars should be in some way similar to the distribution of targets in the field to minimize problems with residual field distortion or residual scale offset, which will be not corrected by the software¹.

Y-position of the target in “fast” LSS and SPECPHOT mode: The target will be in the center of the field of view which will fall approximately on y-pixel 238 (unbinned) of the upper master CCD. The Y-pixel of the target (before dithering) will be given in fits keyword CRPIX2.

¹Suppose the scale offset or field distortion of the input between input image and FORS acquisition image is 0.002 and all reference stars are selected in average 1000 pixels off the position of the slits: all targets will be off by 2 pixels and most light will be lost

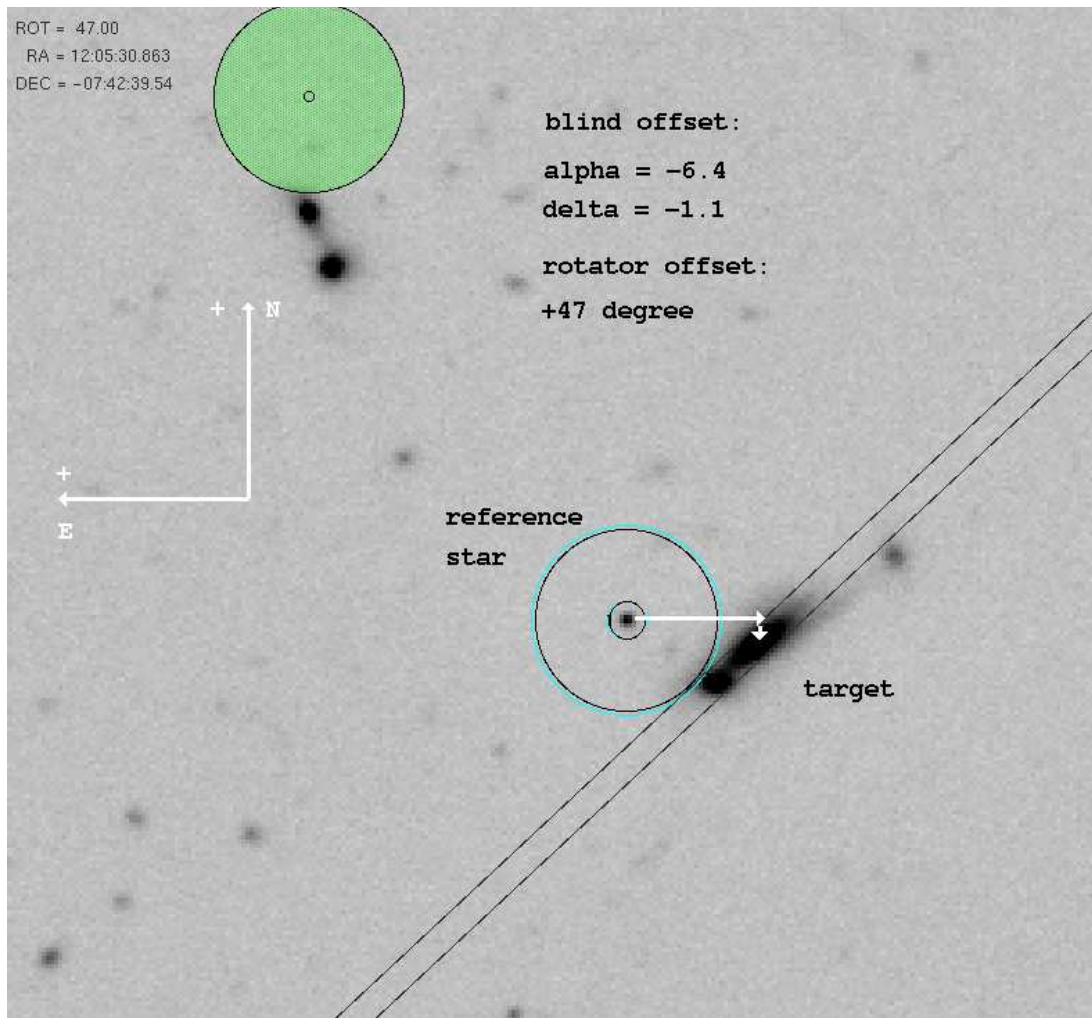


Figure 1: Fast modes and blind offsets: Offsets are defined from the reference star to the target. Rotator offset angle == minus position angle! Blind offsets are in arc seconds in sky coordinates. The blind offset is executed after the fine positioning of the reference star on the slit by the through slit templates.

IMPORTANT: for spectroscopic observations, make sure to choose an imaging filter for the acquisition template that is consistent in wavelength as the grism to be used in the subsequent science templates. This is to avoid the observations being flagged as laser sensitive when they are not.

2.4 Science and Through Slit Templates

The FORS science templates define the procedure and the parameters for the execution of science exposures on the night sky. Science templates of a given observing mode can only be combined with the corresponding acquisition template of the same observing mode. The association of acquisition and science templates is summarized below (section 2.4.3). Several science templates with the same observing mode can be combined in the one science OB. In the case of FORS the observation templates can be grouped into science and through slit templates. The science template will deliver the science data - the through slit templates are used to verify the proper target acquisition and to execute blind offsets in the case fast mode templates.

2.4.1 Through-slit templates:

The through-slit templates allow the verification and fine adjustment of the slit positioning of the targets for spectroscopy and spectropolarimetry. They perform a setup of the instrument and take through-slit images which can be used to adjust the slit positioning of the targets through small telescope offsets. The use of the through slit templates is mandatory for all spectroscopic observations and for the high time resolution imaging mode.

FORS through-slit observation sequence:

1. check for telescope guiding and active optics
2. perform setup of instrument: slits plus filters, retarder plate etc. (as requested by user)
3. take through-slit exposure
4. determine object slit position and offset for fine adjustment (to be done by the observatory personal)
5. execute telescope offset and change exposure time for next acquisition cycle (if needed)
6. repeat steps 3 to 5 until slit positioning is ok
7. for fast option of LSS, PMOS: after slit positioning is accomplished, perform user defined (blind) offset from the reference star to the target (blind offset mode only)

Blind offsets: The through-slit templates for the fast mode (except SPECPHOT and RRM modes) can execute blind offsets from a brighter reference star to a faint science target at the end of the slit alignment process. Such offsets are in arc seconds and in sky coordinates. The blind offsets are executed after the reference star is properly acquired in the slit, i.e. at the end of the through-slit templates. Therefore the coordinates of the reference star must be given as target information, while the blind offset from the reference star to the target must be specified as the blind offset in the through slit template. The signs of coordinate and rotation offset are indicated in figure 1. The size of offsets given on the sky - in the sense that 10" in RA is always 80 pixels (unbinned) for SR mode and 0".125/pixel, no matter which DEC. Reference stars for blind offset acquisitions should be selected as close as possible to the target since rotation and image scale of the input coordinates and the FORS CCD coordinates are not infinitely accurate.

Blind offsets - a double save method: The final position of the target on the slit can be verified if two through slit images are add to the OB: The target acquisition is done on the reference star, the 1st through slit is done on the reference star and the blind offset executed at the end of the 1st through slit image (short integration times). The 2nd through slit is then executed with the target on the slit (long integration and offset equal zero). Here an example of the templates to be attached to an OB for the double save blind offset acquisition in long slit mode:

| | | |
|-------------------------|--------------------------------------|-------------------------------------|
| FORS2_lss_acq_fast | target acquisition | |
| FORS2_lss_obs_slit_fast | through slit image on reference star | $\Delta\alpha, \Delta\delta \neq 0$ |
| FORS2_lss_obs_slit_fast | through slit image on the target | $\Delta\alpha, \Delta\delta = 0$ |
| FORS2_lss_obs_off_fast | science exposures | |

Blind acquisition on point sources - another safe method: If the coordinates of the target and a reference star close to the target are both very well known it is fast and safe to calculate the

rotator offset angle to have both the target and the reference star on the slit. The target acquisition can be then done on the reference star - without offsetting.

IMPORTANT: for spectroscopic observations, make sure to choose an imaging filter for the through-slit template that is consistent in wavelength as the grism to be used in the subsequent science templates. This is to avoid the observations being flagged as laser sensitive when they are not.

2.4.2 Science exposure templates:

The science exposure templates allow the execution of science exposures like filter images and spectra of the target field. The templates perform instrument setups, telescope offsets and sequences of science exposures.

FORS science observation sequence:

1. check for telescope guiding and active optics
2. perform first telescope offset relative to start position
3. perform setup of instrument (slits, filters, grism, retarder plate etc.)
4. take NEXP exposures at the actual offset position
5. for polarimetry only: move retarder plate to next angle
6. for polarimetry only: take NEXP exposures for the actual retarder plate setup and offset position
7. for polarimetry only: repeat steps 5 and 6 until user defined list of retarder plate settings is finished
8. perform the next telescope offsets from the user defined list (relative to last position)
9. repeat steps 3 to 8 until user defined number of exposures at all NOFF offset positions and all retarder plate angles (polarimetry only) are taken
10. offset the telescope back to start position

Number and order of exposures taken in the sequence: In the science exposure sequence NEXP exposures will be taken at NOFF offset positions. Finally NEXP*NOFF images will be taken. In the polarimetric modes the NEXP exposures will be taken at each retarder plate setting before offsetting to the next offset position. For linear polarimetry (0, 22.5, 45, 67.5 degree retarder plate angles and NEXP=3 and NOFF=2 this would end up with 24 exposures.

Size and Sign of jitter offsets: For imaging, lists of offsets (in arc seconds) are given in sky coordinates and they are applied to the telescope. For IPOL (imaging polarimetry) and *all spectroscopic modes*, offsets given in arc seconds in CCD coordinates and are applied to the target in the y-direction (it does not make sense to make offsets in the x-direction as this would move targets out of the slits, therefore x-direction offsets are not permitted by any templates). This means that for imaging, in the default position (zero rotator angle), an offset of +20" in RA will move the target to the right by 80 binned pixels (when using the SR collimator). Likewise an offset of +20" in DEC will move the target downwards by 80 binned pixels (SR collimator). In the case of IPOL and spectroscopic modes, an offset of +10" in the y-direction, the target will move +40 pixels upwards on the detector.

2.4.3 Association of Acquisition with Observation Templates

For each observation it is required to select the acquisition template which is associated to the type of observation description templates in the OB. As already mentioned - the through slit template is mandatory for all observations which will have to put targets on slits. In most case the fast acquisition mode should be preferred if both options are available. In PMOS mode the fast mode is available for single target observations only.

| Mode | Acquisition Template | Through Slit Template | Science Template |
|-------------|-------------------------|------------------------------|-----------------------------|
| IMA | FORS2_img_acq | | FORS2_img_obs_crsplit |
| IMA (RRM) | FORS2_img_acq_rrm | | FORS2_img_obs_crsplit |
| OCC (FIMS) | FORS2_img_acq_algn | | FORS2_img_occ_crsplit |
| LSS | FORS2_lss_acq_fast | FORS2_lss_obs_slit_fast | FORS2_lss_obs_off_fast |
| LSS (RRM) | FORS2_lss_acq_rrm | FORS2_lss_obs_slit_fast | FORS2_lss_obs_off_fast |
| SPECPHOT | FORS2_specphot_acq_fast | FORS2_specphot_obs_slit_fast | FORS2_specphot_obs_exp_fast |
| MOS (FIMS) | FORS2_mos_acq | FORS2_mos_obs_slit | FORS2_mos_obs_off |
| IPOL | FORS2_ipol_acq_fast | | FORS2_ipol_obs_off_fast |
| IPOL (RRM) | FORS2_ipol_acq_rrm | | FORS2_ipol_obs_off_fast |
| PMOS | FORS2_pmos_acq_fast | FORS2_pmos_obs_slit_fast | FORS2_pmos_obs_off_fast |
| PMOS (RRM) | FORS2_pmos_acq_rrm | FORS2_pmos_obs_slit_fast | FORS2_pmos_obs_off_fast |
| PMOS (FIMS) | FORS2_pmos_acq | FORS2_pmos_obs_slit | FORS2_pmos_obs_off |
| MXU (FIMS) | FORS2_mxu_acq | FORS2_mxu_obs_slit | FORS2_mxu_obs_off |

Slitless spectroscopy with FORS is treated as MOS observation with all slits open and mask preparation through FIMS.

2.5 Calibration Templates

The FORS calibration templates define the procedure and the parameters for the execution of calibration exposures. Calibration templates will be executed during daytime only, with telescope at zenith, hence there must not be an acquisition template in a calibration OB. The only exception from this rule are the sky flat calibration templates FORS2_img_cal_skyflat which are executed at twilight on the sky with the acquisition templates FORS2_img_acq.

The following types of calibration templates exist: generic templates for the CCD characterization bias and dark calibrations, templates for screen flatfield and arc exposures and the special automatic twilight flat field template. Furthermore a special template “FORS2_img_cal_coll” is provided to select the collimator at the start of a calibration OB. This template must be inserted as the first template of any daytime calibration OB. It should **never** be used in science OBs.

It is useful to point out that normally spectroscopic screen flats and arc frames for the same set-up are executed within a single template, with the suffix *daycalib*.

Bias and Dark execution sequence:

1. perform setup of CCD detector
2. take one or several exposures with the same CCD setting

Screen flat and arc execution sequence:

1. switch on calibration lamps of the instrument
2. insert MOS mask, filters, retarder plate (polarimetry only), grism in light path
3. perform setup of CCD detector
4. take a series of exposures with the same CCD setting
5. polarimetry only: move retarder plate to next position angle
6. repeat steps 4 to 5 until user defined number of exposures at all retarder plate angles (polarimetry only) are taken

Exposure times for flat field templates: The users should not change the default values for the daytime calibration frames. The observatory staff will take care to get the appropriate exposure levels.

Twilight flat execution sequence:

1. perform instrument and CCD setup
2. make a fast exposure to estimate the exposure time to reach the user specified exposure level in subsequent sky flat images
3. if exposure time within allowed range, start sky flat field exposure
4. after each sky flat measure exposure level and scale exposure time for next twilight flat to reach predefined level
5. perform telescope offset
6. repeat steps 3 - 5 until number of flatfields are taken or exposure time is too long (evening, 300s max.) or too short (morning, 0.25s min.) or template is aborted.

3 Templates Description

The following sections list in tabular form for each template:

1. the template keywords
2. the value range for the keywords
3. the default values
4. the p2 name of the keyword entry fields
5. the selection and entry option for the keyword

The tables are sorted by observing mode. For each observing mode the acquisition, the science and the calibration templates are given (in this order).

From p2 only items 2 - 4 from the list above are visible. The exported OB file (extension .obx) of an OB contains item 1 plus the actual value of the keyword parameters as set by the user.

Section 4 explains the p2 entry fields in some more detail.

Keyword order: in the tables below the keywords are ordered as follows:

1. DET keywords: parameters for CCD setup and exposure time
2. SEQ keywords: Sequence keywords for series of exposures, retarder plate angles, telescope offsets etc.
3. TEL keywords: parameters for telescope preset, guiding etc
4. INS keywords: parameters for instrument setup

Selection and entry options for the keywords: different selection and entry options exist for the actual value of the keyword entered by the user in the template form:

- single value in "Range" column: keyword parameter is fixed. No user modification is possible. "F" (fixed) in column "Entry".
- list of values in "Range" column: several predefined (named) values for the keyword are possible. Selection of the actual ones for template execution is done via a pull-down menu. "P" (pull-down menu) in column "Entry".
- range of values in "Range" column: the actual value should fall within a wider range of possible values (indicated by for instance 0.25..100000.0). The actual one to be used for the template execution has to be entered by typing. "T" (type) in column "Entry".
- file name in column "Range": a file name should be attached to this entry field. This option deals with the attachment of the FIMS output files to the templates. "A" (Attach file) in column "Entry".

An empty p2 entry field indicates that user input is required. Depending on the keyword, this input can be through file selection and attachment (for instance the FIMS output files) or through typing (for instance exposure time).

Hidden parameters: several templates contain so called hidden keywords. These keywords are needed for the proper execution of the templates, but they are not meant to be changed by the user. Therefore, they are hidden from the p2 display, i.e. no p2 entry field is assigned to them, but they appear in the exported version of the OB. The values of hidden keywords cannot be modified by the user.

3.1 Collimator Selection, Bias and Darks

| FORS2_img_cal_coll | | Select collimator for calibration exposures | | |
|------------------------------------|------------------------|---|------------|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS.COLL.NAID | COLL_SR+6 COLL_HR+7 | COLL_SR+6 | Collimator | P |
| <i>Hidden parameters: none</i> | | | | |

| FORS2_img_cal_bias | | Bias exposure | | |
|------------------------------------|---------|---------------|--|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup | T |

| FORS2_img_cal_dark | | Dark exposure | | |
|------------------------------------|--------------|---------------|--------------------------|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup | T |

3.2 Imaging Modes

3.2.1 Direct Imaging — IMG

| FORS2_img_acq | | Fast/normal imaging target acquisition | | |
|------------------------------------|--------------------------------|---|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| TEL.ROT.OFFANGLE | -180.0..+180.0 9999.0 | 0. | Rotator on Sky (= -PA on Sky) | T |
| TEL.AG.GUIDESTAR | CATALOGUE SETUPFILE NONE | CATALOGUE | Parallactic angle Get Guide Star from | P |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.COLLS.NAID | COLL_SR+6 COLL_HR+7 | COLL_SR+6 | Collimator | P |

| FORS2_img_acq_rrm | | RRM imaging target acquisition | | |
|------------------------------------|---------|---------------------------------------|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_img_obs_crsplit | | Multiple imaging exposure with offsets | | |
|------------------------------------|----------------------------------|---|---------------------------------|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD PRE-IMAGE | SCIENCE | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets | T |
| TEL.TARG.OFFSETALPHA | -999..999 | 0 | List of Tel. Offsets in RA | T |
| TEL.TARG.OFFSETDELTA | -999..999 | 0 | List of Tel. Offsets in DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |

| FORS2_img_cal_skyflat | | Skyflat with automatic Exposure Time calculation | | |
|------------------------------------|-----------|---|---------------------------------|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.EXPLEVEL | 0..65535 | 30000 | Skyflat Mean Count Level | T |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| TEL.TARG.OFFSETALPHA | -999..999 | 10 | List of Tel. Offsets in RA | T |
| TEL.TARG.OFFSETDELTA | -999..999 | 10 | List of Tel. Offsets in DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |

| FORS2_img_cal_scrflat | | Imaging screen flatfield | | |
|------------------------------------|---------------------------|---------------------------------|--------------------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.LAMP1.TIME | -1.0..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS.LAMP2.TIME | -1.0..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS.LAMP5.NAID | FlatBlue+3, FlatBlue+4 | FlatBlue+3 | External lamp | P |
| INS.LAMP5.TIME | -1.0..100000 | 0 | Switch-on Time External Lamp | T |
| DPR.CATG | CALIB SCI- ENCE TEST | CALIB | Data Prod. Categ. | P |

3.2.2 Imaging with Occulting Bars — OCC

| FORS2_img_acq_algn | | FIMS based imaging target acquisition | | |
|------------------------------------|--------------------------------|--|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| DET.FIELD.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time for Field Image | T |
| TEL.AG.GUIDESTAR | CATALOGUE SETUPFILE NONE | CATALOGUE | Get Guide Star from | P |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.TARG.SETUP | p_targ file name | NODEFAULT | FIMS Target Setup File .p_targ | A |

| FORS2_img_occ_crsplit | | Imaging with occultation mask of MOS slitarms | | |
|------------------------------------|----------------------------------|--|-------------------------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD PRE-IMAGE | SCIENCE | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets | T |
| TEL.TARG.OFFSETALPHA | -999..999 | 0 | List of Tel. Offsets in RA | T |
| TEL.TARG.OFFSETDELTA | -999..999 | 0 | List of Tel. Offsets in DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.FOCF.SETUP | p_focf file name | NODEFAULT | FIMS Focal Plane Setup File .p_focf | A |

3.3 Longslit Spectroscopy — LSS

| FORS2_lss_acq_fast | | Fast LSS spectroscopy target acquisition | | |
|------------------------------------|--|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| TEL.ROT.OFFANGLE | -180.0..+180.0 | 0. | Rotator on Sky (= -PA on Sky) | T |
| TEL.AG.GUIDESTAR | 9999.0 CATALOGUE SETUPFILE NONE | CATALOGUE | Parallactic angle Get Guide Star from | P |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.COLLS.NAID | COLL_SR+6 COLL_HR+7 | COLL_SR+6 | Collimator | P |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.SLIT.NAID | Table 11 | NODEFAULT | LSS Slit | P |

| FORS2_lss_acq_rrm | | RRM LSS spectroscopy target acquisition | | |
|------------------------------------|--------------|--|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.SLIT.NAID | Table 11 | NODEFAULT | LSS Slit | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_lss_obs_slit_fast | | LSS Through-slit exposure (fast mode) | | |
|------------------------------------|--------------|--|------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| TEL.TARG.OFFSETALPHA | -60..60 | 0 | Blind Offset RA | T |
| TEL.TARG.OFFSETDELTA | -60..60 | 0 | Blind Offset DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.SLIT.NAID | Table 11 | NODEFAULT | LSS Slit | P |

| FORS2_lss_obs_off_fast | | LSS spectroscopy with offsets along the slit (fast mode) | | |
|------------------------------------|---------------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD | SCIENCE | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets in CCD Y Direction | T |
| TEL.TARG.OFFSETY | -999..999 | 0 | List of Tel. Offsets in CCD Y Direction | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.GRIS.NAME | Table 10 | NODEFAULT | Grism | P |
| INS.SLIT.NAID | Table 11 | NODEFAULT | LSS Slit | P |

| FORS2_iss_cal_daycalib | | LSS spectroscopy screen flatfield and wavelength calibration (fast mode) | | |
|------------------------------------|--------------|--|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS1.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS1.GRIS.NAME | Table 10 | NODEFAULT | GRISM | P |
| INS1.LAMP1.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS1.LAMP2.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS1.LAMP3.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+1 | T |
| INS1.LAMP4.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+2 | T |
| INS1.LAMP5.NAID | FlatBlue+3 | FlatBlue+3 | External Lamp | T |
| | FlatBlue+4 | | | |
| INS1.LAMP5.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.LAMP6.NAID | FlatRed+3 | FlatRed+3 | External Lamp | T |
| | FlatRed+4 | | | |
| INS1.LAMP6.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.SLIT.NAID | Table 11 | NODEFAULT | LSS slit | P |
| INS2.LAMP1.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp He+1 | T |
| INS2.LAMP2.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp HgCd+2 | T |
| INS2.LAMP3.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+1 | T |
| INS2.LAMP4.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+2 | T |
| INS2.LAMP5.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+1 | T |
| INS2.LAMP6.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+2 | T |
| DET.READ.CLKIND | Table 7 | 100kHz,2x2,high | CCD Read-out Setup | P |
| SEQ.NEXPO1 | 0..666 | 1 | Number of Exp. per Setup for scrflat template | T |
| SEQ.NEXPO2 | 0..666 | 1 | Number of Exp. per Setup for wave template | T |
| SEQ.TIME1 | 0.25..100000 | NODEFAULT | Exposure Time for scrflat template | T |
| SEQ.TIME2 | 0.25..100000 | NODEFAULT | Exposure Time for wave template | T |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

3.4 Multi-Object Spectroscopy with Movable Slits - MOS

| FORS2_mos_acq | | FIMS based MOS target acquisition | | |
|------------------------------------|------------------|-----------------------------------|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.FIELD.UIT1 | 0.25..100000 | NODEFAULT | Exp. Time for Field Image | T |
| TEL.AG.GUIDESTAR | CATALOGUE | CATALOGUE | Get Guide Star from | P |
| | SETUPFILE | | | |
| | NONE | | | |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.TARG.SETUP | p.focf file name | NODEFAULT | FIMS Target Setup File .p_targ | A |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_mos_obs_slit | | MOS through-slit exposure (FIMS based) | | |
|------------------------------------|------------------|--|-------------------------------------|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| INS.FOCF.SETUP | p.focf file name | NODEFAULT | FIMS Focal Plane setup File .p_focf | A |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |

| FORS2_mos_obs_off | | MOS exposure with offset along the slit (FIMS based) | | |
|------------------------------------|------------------|--|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD | SCIENCE | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets in CCD Y Direction | T |
| TEL.TARG.OFFSEY | -999..999 | 0 | List of Tel. Offsets in CCD Y Direction | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.GRIS.NAME | Table 10 | NODEFAULT | Grism | P |
| INS.FOCF.SETUP | p.focf file name | NODEFAULT | FIMS Focal Plane Setup File .p_focf | A |

| FORS2_mos_cal_daycalib | | MOS spectroscopic screen flatfield and wavelength calibration (FIMS based) | | |
|------------------------------------|--------------------------|--|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS1.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS1.FOCF.SETUP | | | FIMS Focal Plane Setup File .p_focf | A |
| INS1.GRIS.NAME | Table 10 | NODEFAULT | GRISM | P |
| INS1.LAMP1.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS1.LAMP2.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS1.LAMP3.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+1 | T |
| INS1.LAMP4.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+2 | T |
| INS1.LAMP5.NAID | FlatBlue+3 FlatBlue+4 | FlatBlue+3 | External Lamp | T |
| INS1.LAMP5.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.LAMP6.NAID | FlatRed+3 FlatRed+4 | FlatRed+3 | External Lamp | T |
| INS1.LAMP6.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS2.LAMP1.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp He+1 | T |
| INS2.LAMP2.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp HgCd+2 | T |
| INS2.LAMP3.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+1 | T |
| INS2.LAMP4.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+2 | T |
| INS2.LAMP5.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+1 | T |
| INS2.LAMP6.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+2 | T |
| DET.READ.CLKIND | Table 7 | 100kHz,2x2,high | CCD Read-out Setup | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO1 | 0..666 | 1 | Number of Exp. per Setup for scrflat template | T |
| SEQ.NEXPO2 | 0..666 | 1 | Number of Exp. per Setup for wave template | T |
| SEQ.TIME1 | 0.25..100000 | | Exposure Time for scrflat template | T |
| SEQ.TIME2 | 0.25..100000 | | Exposure Time for wave template | T |
| <i>Hidden parameters:</i> | | | | |
| Parameter | Range | Default | Function | Entry |

3.5 Spectrophotometric Mode — SPECPHOT

| FORS2_specphot_acq_fast | | Fast wide slit spectrophotometry acquisition | | |
|------------------------------------|--------------------------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.SPEC.OFFSET | 0..1000 (1600) | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | Table 12 | MOS_center | MOS Slit Position Set To | P |
| TEL.ROT.OFFANGLE | - | 0. | Rotator on Sky (= -PA on Sky) | T |
| TEL.AG.GUIDESTAR | 180.0..+180.0, 9999.0 | CATALOGUE | Parallactic angle Get Guide Star from | P |
| TEL.GS1.ALPHA | CATALOGUE SETUPFILE NONE | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Right Ascension Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.COLL.NAID | COLL_SR+6 COLL_HR+7 | COLL_SR+6 | Collimator | P |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |

| FORS2_specphot_obs_slit_fast | | Through-slit exposure for spectrophotometry | | |
|-------------------------------------|----------------|--|---------------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| SEQ.SPEC.OFFSET | 0..1000 (1600) | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | Table 12 | MOS_center | MOS Slit Position Set To | P |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.SLIT.WID | 5.0 | 5.0 | MOS Slit Width (arcsec) | T |

| FORS2_specphot_obs_exp_fast | | Wide slit spectrophotometry exposure | | |
|------------------------------------|---------------------|---|---------------------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD | STANDARD | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.SPEC.OFFSET | 0..1000 (1600) | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | Table 12 | MOS_center | MOS Slit Position Set To | P |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.GRIS.NAME | Table 10 | NODEFAULT | Grism | P |
| INS.SLIT.WID | 5.0 | 5.0 | MOS Slit Width (arcsec) | T |

| FORS2_specphot_cal_daycalib | | Spectro-photometric screen flatfield and wavelength calibration | | |
|------------------------------------|--------------|---|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS1.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS1.GRIS.NAME | Table 10 | NODEFAULT | GRISM | P |
| INS1.LAMP1.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS1.LAMP2.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS1.LAMP3.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+1 | T |
| INS1.LAMP4.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+2 | T |
| INS1.LAMP5.NAID | FlatBlue+3 | FlatBlue+3 | External Lamp | P |
| | FlatBlue+4 | | | |
| INS1.LAMP5.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.LAMP6.NAID | FlatRed+3 | FlatRed+3 | External Lamp | P |
| | FlatRed+4 | | | |
| INS1.LAMP6.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.SLIT.WID | 1.0 | 1.0 | MOS Specphot Slit Width (arcsec) | T |
| INS2.LAMP1.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp He+1 | T |
| INS2.LAMP2.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp HgCd+2 | T |
| INS2.LAMP3.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+1 | T |
| INS2.LAMP4.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+2 | T |
| INS2.LAMP5.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+1 | T |
| INS2.LAMP6.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+2 | T |
| INS2.SLIT.WID | 1 | 1 | MOS Specphot Slit Width (arcsec) | F |
| DET.READ.CLKIND | Table 7 | 100kHz,2x2,high | CCD Read-out Setup | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO1 | 0..666 | 1 | Number of Exp. per Setup for scrflat template | T |
| SEQ.NEXPO2 | 0..666 | 1 | Number of Exp. per Setup for wave template | T |
| SEQ.SPEC.OFFSET | 0..1600 | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | Table 12 | MOS_center | MOS Slit Position Set To | P |
| SEQ.TIME1 | 0.25..100000 | | Exposure Time for scrflat template | T |
| SEQ.TIME2 | 0.25..100000 | | Exposure Time for wave template | T |

3.6 Imaging Polarimetry — IPOL

| FORS2_ipol_acq_fast | | Fast IPOL target acquisition | | |
|------------------------------------|--|-------------------------------------|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| TEL.ROT.OFFANGLE | -180.0..+180.0 | 0. | Rotator on Sky (= -PA on Sky) | T |
| TEL.AG.GUIDESTAR | 9999.0 CATALOGUE SETUPFILE NONE | CATALOGUE | Parallactic angle Get Guide Star from | P |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.COLLA.NAID | COLL_SR+6 COLL_HR+7 | COLL_SR+6 | Collimator | P |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_ipol_acq_rrm | | RRM IPOL target acquisition | | |
|------------------------------------|--------------|------------------------------------|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_ipol_obs_off_fast | | IPOL sequence with offset in Y rotating the retarder plate | | |
|------------------------------------|---------------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD | SCIENCE | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets in CCD Y Direction | T |
| SEQ.POL | circular linear | NODEFAULT | Polarization Type | P |
| SEQ.POL.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings | P |
| TEL.TARG.OFFSETY | -999..999 | 0 | List of Tel. Offsets in CCD Y Direction | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.WOLL.NAID | WOLL_34+13 | WOLL_34+13 | Wollaston Prism | F |

3.7 Spectropolarimetry — PMOS

3.7.1 Multi-Object FIMS Based Mode

| FORS2_pmos_acq | | FIMS based PMOS target acquisition | | |
|------------------------------------|------------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.FIELD.UIT1 | 0.25..100000 | NODEFAULT | Exp. Time for Field Image | T |
| TEL.AG.GUIDESTAR | CATALOGUE | CATALOGUE | Get Guide Star from | P |
| | SETUPFILE | | | |
| | NONE | | | |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.TARG.SETUP | p_targ file name | NODEFAULT | FIMS Target Setup File .p_targ | A |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_pmos_obs_slit | | PMOS through-slit exposure (FIMS based) | | |
|------------------------------------|------------------|--|-------------------------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.FOCF.SETUP | p_focf file name | NODEFAULT | FIMS Focal Plane Setup File .p_focf | A |

| FORS2_pmos_obs_off | | PMOS exposure sequence with offset along the slit | | |
|------------------------------------|------------------|--|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE | SCIENCE | Observation Category | P |
| | STANDARD | | | |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets in CCD Y Direction | T |
| SEQ.POL | circular linear | NODEFAULT | Polarization Type | P |
| SEQ.POL.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings | P |
| TEL.TARG.OFFSETY | -999..999 | 0 | List of Tel. Offsets in CCD Y Direction | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.FOCF.SETUP | p_focf file name | NODEFAULT | FIMS Focal Plane Setup File .p_focf | A |
| INS.GRIS.NAME | Table 10 | NODEFAULT | Grism | P |
| INS.WOLL.NAID | WOLL_34+13 | WOLL_34+13 | Wollaston Prism | F |

| FORS2_pmos_cal_daycalib | | PMOS screen flatfield and wavelength calibration rotating the retarder plate | | |
|------------------------------------|-----------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS1.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS1.FOCF.SETUP | | NODEFAULT | FIMS Focal Plane Setup File .p_focf | A |
| INS1.GRIS.NAME | Table 10 | NODEFAULT | GRISM | P |
| INS1.LAMP1.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS1.LAMP2.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS1.LAMP3.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+1 | T |
| INS1.LAMP4.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+2 | T |
| INS1.LAMP5.NAID | FlatBlue+3 | FlatBlue+3 | External Lamp | P |
| | FlatBlue+4 | | | |
| INS1.LAMP5.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.LAMP6.NAID | FlatRed+3 | FlatRed+3 | External Lamp | P |
| | FlatRed+4 | | | |
| INS1.LAMP6.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.WOLL.NAID | WOLL.34+13 | WOLL.34+13 | Wollaston Prism | F |
| INS2.LAMP1.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp He+1 | T |
| INS2.LAMP2.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp HgCd+2 | T |
| INS2.LAMP3.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+1 | T |
| INS2.LAMP4.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+2 | T |
| INS2.LAMP5.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+1 | T |
| INS2.LAMP6.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+2 | T |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO1 | 0..666 | 1 | Number of Exp. per Setup for scrflat template | T |
| SEQ.NEXPO2 | 0..666 | 1 | Number of Exp. per Setup for wave template | T |
| SEQ.POL | circular linear | NODEFAULT | Polarization Type | P |
| SEQ.POL1.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings for Arcs | P |
| SEQ.POL2.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings for Arcs | P |
| SEQ.TIME1 | 0.25..100000 | NODEFAULT | Exposure Time for scrflat template | T |
| SEQ.TIME2 | 0.25..100000 | NODEFAULT | Exposure Time for wave template | T |
| DET.READ.CLKIND | Table 7 | 100kHz,2x2,high | CCD Read-out Setup | P |

3.7.2 Fast Mode for Single Target Observations

| FORS2_pmos_acq_fast | | Fast PMOS target acquisition | | |
|------------------------------------|------------------|-------------------------------------|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| TEL.ROT.OFFANGLE | -180.0..+180.0 | 0. | Rotator on Sky (= -PA on Sky) | T |
| | 9999.0 | | Parallactic angle | |
| TEL.AG.GUIDESTAR | CATALOGUE | CATALOGUE | Get Guide Star from | P |
| | SETUPFILE | | | |
| | NONE | | | |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.SPEC.OFFSET | 0..1600 | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | LSS_0.3_arcsec.. | MOS_center | MOS Slit Position Set To | P |

| FORS2_pmos_acq_rrm | | RRM PMOS target acquisition | | |
|------------------------------------|--------------|------------------------------------|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |

| FORS2_pmos_obs_slit_fast | | PMOS through-slit exposure (fast mode) | | |
|------------------------------------|------------------|---|---------------------------|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| TEL.TARG.OFFSETALPHA | -60..60 | 0 | Blind Offset RA | T |
| TEL.TARG.OFFSETDELTA | -60..60 | 0 | Blind Offset DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.SLIT.WID | 0.2..30.0 | NODEFAULT | MOS Slit Width (arcsec) | T |
| SEQ.SPEC.OFFSET | 0..1600 | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | LSS_0.3_arcsec.. | MOS_center | MOS Slit Position Set To | P |

| FORS2_pmos_obs_off_fast | | PMOS exposure sequence with offset along the slit | | |
|------------------------------------|------------------|--|---|-------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.CATG | SCIENCE STANDARD | SCIENCE | Observation Category | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets in CCD Y Direction | T |
| SEQ.POL | circular linear | NODEFAULT | Polarization Type | P |
| SEQ.POL.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings | P |
| SEQ.SPEC.OFFSET | 0..1600 | 500 | MOS Slit Offset Amplitude | T |
| SEQ.SPEC.TARG | LSS_0.3_arcsec.. | MOS_center | MOS Slit Position Set To | P |
| TEL.TARG.OFFSETY | -999..999 | 0 | List of Tel. Offsets in CCD Y Direction | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.GRIS.NAME | Table 10 | NODEFAULT | Grism | P |
| INS.SLIT.WID | 0.2..30.0 | NODEFAULT | MOS Slit Width (arcsec) | T |
| INS.WOLL.NAID | WOLL_34+13 | WOLL_34+13 | Wollaston Prism | T |

| FORS2_pmos_cal_daycalib_fast | | PMOS screen flatfield and wavelength calibration rotating the retarder plate | | |
|-------------------------------------|-----------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS1.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS1.GRIS.NAME | Table 10 | NODEFAULT | GRISM | P |
| INS1.LAMP1.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS1.LAMP2.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS1.LAMP3.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+1 | T |
| INS1.LAMP4.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+2 | T |
| INS1.LAMP5.NAID | FlatBlue+3 | FlatBlue+3 | External Lamp | P |
| | FlatBlue+4 | | | |
| INS1.LAMP5.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.LAMP6.NAID | FlatRed+3 | FlatRed+3 | External Lamp | P |
| | FlatRed+4 | | | |
| INS1.LAMP6.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.MOS10.WID | 0.2..30 | NODEFAULT | Slit Width in arcseconds | T |
| INS1.WOLL.NAID | WOLL_34+13 | WOLL_34+13 | Wollaston Prism | F |
| INS2.LAMP1.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp He+1 | T |
| INS2.LAMP2.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp HgCd+2 | T |
| INS2.LAMP3.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+1 | T |
| INS2.LAMP4.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+2 | T |
| INS2.LAMP5.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+1 | T |
| INS2.LAMP6.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+2 | T |
| DET.READ.CLKIND | Table 7 | 100kHz,2x2,high | CCD Read-out Setup | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO1 | 0..666 | 1 | Number of Exp. per Setup for scrflat template | T |
| SEQ.NEXPO2 | 0..666 | 1 | Number of Exp. per Setup for wave template | T |
| SEQ.POL | circular linear | NODEFAULT | Polarization Type | P |
| SEQ.POL1.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings for Arcs | P |
| SEQ.POL2.ANGLES | Table 14 | NODEFAULT | List of Retarder Plate Settings for Arcs | P |
| SEQ.TIME1 | 0.25..100000 | NODEFAULT | Exposure Time for scrflat template | T |
| SEQ.TIME2 | 0.25..100000 | NODEFAULT | Exposure Time for wave template | T |

3.8 Multi-Object Spectroscopy with masks — MXU

| FORS2_mxu_acq | | FIMS based MXU target acquisition | | |
|------------------------------------|------------------|--|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.FIELD.UIT1 | 0.25..100000 | NODEFAULT | Exp. Time for Field Image | T |
| TEL.AG.GUIDESTAR | CATALOGUE | CATALOGUE | Get Guide Star from | P |
| | SETUPFILE | | | |
| | NONE | | | |
| TEL.GS1.ALPHA | Right Ascension | 0 (i.e. 00:00:00.0) | Guide Star RA | T |
| TEL.GS1.DELTA | Declination | 0 (i.e. 00:00:00.0) | Guide Star DEC | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.FOCF.SETUP | p.focf file name | NODEFAULT | FIMS Focal Plane Setup File .p.focf | A |
| INS.GBR.SETUP | p.gbr file name | NODEFAULT | FIMS MXU Mask Gerber Setup File .p.gbr | A |
| INS.TARG.SETUP | p.targ file name | NODEFAULT | FIMS Target Setup File .p.targ | A |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |

| FORS2_mxu_obs_slit | | MXU through-slit exposure (FIMS based) | | |
|------------------------------------|------------------|---|-------------------------------------|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.FOCF.SETUP | p.focf file name | NODEFAULT | FIMS Focal Plane Setup File .p.focf | A |

| FORS2_mxu_obs_off | | MXU mask exposure with offsets (FIMS Based) | | |
|------------------------------------|------------------|--|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| DET.WIN1.UIT1 | 0.25..100000 | NODEFAULT | Exposure Time | T |
| DET.READ.CLKIND | Table 7 | | CCD Read-out Setup | P |
| SEQ.NEXPO | 1..666 | 1 | Number of Exp. per Setup&Offset | T |
| SEQ.NOFF | 1..100 | 1 | Number of Tel. Offsets in CCD Y Direction | T |
| TEL.TARG.OFFSETY | -999..999 | 0 | List of Tel. Offsets in CCD Y Direction | T |
| INS.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS.FOCF.SETUP | p.focf file name | NODEFAULT | FIMS Focal Plane Setup File .p.focf | A |
| INS.GRIS.NAME | Table 10 | NODEFAULT | Grism | P |

| FORS2_mxu_cal_daycalib | | MXU spectroscopic screen flatfield and wavelength calibration (FIMS based) | | |
|------------------------------------|--------------------------|---|---|--------------|
| <i>Parameters to be specified:</i> | | | | |
| Parameter | Range | Default | p2 Label | Entry |
| INS1.FILT1.NAME | Table 9 | NODEFAULT | Filter1 Name | P |
| INS1.FOCF.SETUP | | | FIMS Focal Plane Setup File .p_focf | A |
| INS1.GRIS.NAME | Table 10 | NODEFAULT | GRISM | P |
| INS1.LAMP1.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+1 | T |
| INS1.LAMP2.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatBlue+2 | T |
| INS1.LAMP3.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+1 | T |
| INS1.LAMP4.TIME | -1..100000 | -1 | Switch-on Time Lamp FlatRed+2 | T |
| INS1.LAMP5.NAID | FlatBlue+3 FlatBlue+4 | FlatBlue+3 | External Lamp | P |
| INS1.LAMP5.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS1.LAMP6.NAID | FlatRed+3 FlatRed+4 | FlatRed+3 | External Lamp | P |
| INS1.LAMP6.TIME | -1..100000 | 0 | Switch-on Time External Lamp | T |
| INS2.LAMP1.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp He+1 | T |
| INS2.LAMP2.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp HgCd+2 | T |
| INS2.LAMP3.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+1 | T |
| INS2.LAMP4.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ar+2 | T |
| INS2.LAMP5.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+1 | T |
| INS2.LAMP6.TIME | -1..100000 | NODEFAULT | Switch-on Time Lamp Ne+2 | T |
| DET.READ.CLKIND | Table 7 | 100kHz,2x2,high | CCD Read-out Setup | P |
| SEQ.CCD | B R ANY | R | Required CCD: B (Blue), R (Red), ANY (Either one) | P |
| SEQ.NEXPO1 | 0..666 | 1 | Number of Exp. per Setup for scrflat template | T |
| SEQ.NEXPO2 | 0..666 | 1 | Number of Exp. per Setup for wave template | T |
| SEQ.TIME1 | 0.25..100000 | NODEFAULT | Exposure Time for scrflat template | T |
| SEQ.TIME2 | 0.25..100000 | NODEFAULT | Exposure Time for wave template | T |

4 Explanations of the p2 Entry Fields

The following list contains a description of the p2 entry fields of all FORS templates.

4.1 User defined p2 entry fields - DET keywords:

Exposure Time: the exposure time of an individual exposure in seconds. Default is NODEFAULT (i.e. user entry is expected here). The shortest exposure time supported by the FORS shutter is 0.25s.

Exp. Time for Field Image: the exposure time of the acquisition image on the sky in seconds. Default is NODEFAULT (i.e. user entry is expected here). The shortest exposure time supported by the FORS shutter is 0.25s.

Exp. Time for Slit Image: the exposure time of the reference slit exposure on the sky in seconds. Default is NODEFAULT (i.e. user entry is expected here). The shortest exposure time supported by the FORS shutter is 0.25s.

CCD Read-out Setup: The CCD readout mode are in general set to the standard modes 200kHz,2x2,low for imaging and 100kHz,2x2,high for spectroscopy. CCD windowing is no longer offered since the upgrade to mosaics in both instruments.

4.2 User defined p2 entry fields - SEQ keywords:

Observation Category: the category of the exposure for night observations. Three options exist: SCIENCE (for scientific exposure), STANDARD (for standard star exposure) and PRE-IMAGE (for pre-imaging exposure). This parameter is used to write fits header keywords in the image file which are appropriate for correct classification and automatic processing of the data. **It is therefore important to identify a standard star by setting SEQ.CATG=STANDARD, so that the pipeline may derive the proper calibrations (e.g. response curve).** The third option “PRE-IMAGE” was introduced for projects which have requested pre-images in the proposal. To simplify the fast data release all such pre-images should be prepared with the observation category set to “PRE-IMAGE”. Default is SCIENCE except for the template FORS2_specphot_obs_exp_fast in which it is set to STANDARD. For calibration exposures the corresponding keywords are automatically written by the templates and no entry field needs to be set.

Number of Exp. per Setup: the number of exposures to be taken for a given instrument setup. This number of exposures will be taken at each telescope offset position and for each instrument setup (for instance for each retarder plate angle) defined in the respective template. Default is 1.

Number of Exp. per Setup&Offset: the number of exposures to be taken at a given instrument and telescope setting. This number of exposures will be taken at each telescope offset position and for each instrument setup (for instance for each retarder plate angle) defined in the respective template. Default is 1.

Number of Tel. Offsets: number of offsets in right ascension and declination on the sky. This parameter corresponds to the entry fields **List of Tel. Offsets in RA/DEC**. If no telescope offset is foreseen, this parameter should be set to 1 and the list of offset values should contain 0. Default is 1.

Number of Tel. Offsets in CCD Y Direction: number of offsets along Y pixel direction of the CCD. This parameter corresponds to the entry field **List of Tel. Offsets in CCD Y Direction**. Default is 1.

Skyflat Mean Count Level: the mean ADU level for the sky flat exposures. This parameter is used by template FORS2_img_cal_skyflat to calculate automatically the optimum exposure time for the sky flat exposures. Default is 30000 ADU.

MOS Slit Position Set To: the focal field position of the MOS slits used in the respective “SPECPHOT” templates for spectro-photometric standard star observations. Different named positions exist (see table 12) defining the slit/target position in the focal area. Default is “MOS_center” which gives the position of the center of the MOS field ($X \sim 1040$ pixels in binning 2). “MOS_center+/-offset” allows to position the target to an arbitrary offset position in X direction. The offset from the MOS center in pixels is given in entry field “MOS slit offset amplitude”. Using predefined named positions for the LSS slits, the MOS slits can also be positioned to the X position of a user selected longslit. In this same way, using user defined offsets the default wavelength ranges covered by specific grisms (see Table 2.4 of the User Manual) can be adjusted to that required by a specific science case. Users interested in using this technique are encouraged to contact the FORS2 instrument scientist (fors2@eso.org).

MOS Slit Offset Amplitude: CCD offset position (in pixels) of the slit/target from the MOS field center as used for spectro-photometric standard stars. This entry field has effect only if “MOS_center+/-offset” is chosen for the entry field “MOS Slit Position Set To” in the respective SPECPHOT templates. Default is 500 pixels.

Polarization Type: the retarder plate mosaic to be used for the polarimetry exposures. Two mosaics are available: $\lambda/2$ plate mosaic for linear polarimetry (entry option = linear) and $\lambda/4$ plate mosaic for circular polarimetry (entry option = circular). The desired mosaic is selected from a pull-down menu. Default is NODEFAULT (i.e. user entry is expected here).

List of Retarder Plate Settings: the list of positions for the setting of the retarder plate angles. The positions are chosen from a pull-down list (see table 14). Prefix “lin” indicates linear, prefix “cir” circular polarimetry. The options of the list are named positions, i.e. they are specific for the polarimetry mode (circular polarimetry needs to have position angle with prefix “cir”, linear polarimetry those with prefix “lin”). Default is NODEFAULT (i.e. user entry is expected here).

4.3 User defined p2 entry fields - TEL keywords:

Rotator on Sky (= -PA on Sky): the angle of the telescope rotator on the sky. The angle is measured in deg North over West, i.e. it has the opposite sign of the position angle as measured on the sky. The values can range from -180 to 180 deg. Default is 0 deg.

Additional Velocity RA: the velocity of the non-sidereal tracking/auto guiding in right ascension (for instance for moving objects). The value is given in arcsec/s on the sky. Default is 0 arcsec/s.

Additional Velocity DEC: the velocity of the non-sidereal/auto guiding tracking in declination (for instance for moving objects). The value is given in arcsec/s on the sky. Default is 0 arcsec/s.

Get Guide Star from: source from which the coordinates for the guide star are taken. It is actually not recommended to use any other option than the default value. Three options exist:

- **CATALOGUE:** the guide star coordinates are selected from a guide star catalog installed at the telescope (HST Guide Star and USNO catalogs). This is the default and most frequently used option.
- **SETUPFILE:** the coordinates are read from the subsequent entry fields of the acquisition template. This option may be used if the user wants to specify a certain guide star to be used and it allows also to give guide stars not found in the catalogs of the telescope. Note: the guide star should be of brightness 11-13mag. The outer radius for the guide star selection area is 7.4 arcmin from the field center, the inner one is defined by the field size of the collimator used.
- **NONE:** this options is used if no guide star shall be used, for instance during twilight periods when it will be difficult to find one since the sky is too bright. In that case the telescope tracks with sidereal track rate.

Guide Star RA: the right ascension of the user selected guide star in hh mm ss. Equinox is J2000, default is 0 = 00 00 00.000.

Guide Star DEC: the declination of the user selected guide star in dd mm ss. Equinox is J2000, default is 0 = 00 00 00.000.

List of Tel. Offsets in RA: a list of telescope right ascension (RA) offsets in arcsec which will be executed step by step during the jitter sequence. The first offset step is performed before the start of the first exposure. The offsets are executed sequentially and relative to the last telescope position. The offset values are separated by spaces. The number of offsets done during the jitter sequence is defined by the entry field **Number of offsets**. If the number of offset values in the list is smaller than **Number of offsets**, the list of offset values will be repeated until the number of offsets is equal to the requested **Number of offset**. This parameter corresponds to entry field **number of offsets**. Default is 0 arcsec.

List of Tel. Offsets in DEC: a list of telescope declination (DEC) offsets in arcsec which will be executed step by step during the jitter sequence. The first offset step is performed before the start of the first exposure. The offsets are executed sequentially and relative to the last telescope position. The offset values are separated by spaces. The number of offsets done during the jitter sequence is defined by the entry field **Number of offsets**. If the number of offset values in the list is smaller than **Number of offsets**, the list of offset values will be repeated until the number of offsets is equal to the requested **Number of offsets**. This parameter corresponds to entry field **number of offsets**. Default is 0 arcsec.

List of Tel. Offsets in CCD Y Direction: list of telescope offsets along the slit. Offsets are given in arc seconds. Default is 0 arc seconds. The list can contain more or less values than the number of offsets indicates. If more, only the requested number of offsets are executed (starting with the first one). If less, the y offset list is repeated until the requested number of offsets are executed. The telescope offsets are executed relative to the last position and before the start of the exposure (series). Positive/negative offset values move the object in positive/negative Y direction on the CCD. At the end of the exposure sequence the telescope returns to the start position. This parameter corresponds to entry field **number of offsets in the y direction**.

Blind Offset RA: telescope offset (in arcsec) in right ascension for a blind offset. The offset will be executed only of $\neq 0$. The offset from the reference star to the target must be entered here. The default value is 0 arcsec.

Blind Offset DEC: telescope offset (in arcsec) in declination for a blind offset. The offset will be executed only of $\neq 0$. The offset from the reference star to the target must be entered here. The default is 0 arcsec.

4.4 User defined p2 entry fields - INS keywords:

LSS Slit: the longslit to be used for the spectrum exposure. The slit selection is done from a pull-down menu. For the available longslit see list in section 4.6.7. Default is NODEFAULT (i.e. user entry is expected here).

MOS Slit Width (arcsec): the width of the MOS slits (in arcsec) in the SPECPHOT, and PMOS fast templates (for spectro-photometric standard stars the default value is set to 5 arcsecs).

FIMS Target Setup File .p_targ: the content of the **FIMS** target setup file p_targ for the field acquisition. This file gives the center field coordinates and rotator angle for the telescope preset, the reference target coordinates and the collimator to be used. For MXU it also contains the MXU mask ID. This file is generated by FIMS and is attached to the acquisition template within p2. Since MXU p_targ files are very long, only the name of the p_targ file appears in the p2 entry field, while its content is hidden (but still present). The default content of this entry field is NODEFAULT (i.e. user entry is expected here).

FIMS MXU Mask Gerber Setup File .p_gbr: the content of the p_gbr file from FIMS which

contains the information for punching the MXU mask. This file is generated by FIMS and is attached to the acquisition template within p2. Since MXU p_gbr files are very long, only the name of the p_gbr file appears in the p2 entry field, while its content is hidden (but still present). The default content of this entry field is NODEFAULT (i.e. user entry is expected here).

FIMS Focal Plane Setup File .p_focf: the FIMS file (extension p_focf) with the user defined configuration of the FORS focal field during the exposure. This file is generated by FIMS and is attached to the template within p2. Since MXU p_focf files are very long, only the name of the p_focf file appears in the p2 entry field, while its content is hidden (but still present). The default content of this entry field is NODEFAULT (i.e. user entry is expected here).

Collimator: selection of the instrument collimator to be moved into the light path for the calibration. Two options exist: COLL_SR for the standard resolution collimator (default) and COLL_HR for the high resolution collimator.

Wollaston Prism: the use of the Wollaston prism is mandatory for polarimetry observations. Default and only setting: WOLL_34+13.

Grism: the grism to be inserted for the exposure. For the available grism see list in section 4.6.6. Default is NODEFAULT (i.e. user entry is expected here).

Filter1 Name: filter to be selected from the filter pull-down menu (see section 4.6.5). In visitor mode, a filter request has to be filled in at the site in order to make sure that the proper filters are mounted for the observations. For service mode, the observatory staff take care of this request by considering which filters are required throughout the semester. The broad band filters will be at any time in place at the position given by the standard instrument configuration.

4.4.1 Internal arc lamps:

The values are still to be defined by the users according to the recommended values in chapter 4 of the user manual. Most users won't have to send calibration OBs since the observatory staff perform this task for all standard observation modes (- the calibration plan). As a general hint: Ne lamps are bad for spectral resolution of much less than 1000! HgCd and He are to be used for all observations at wavelengths shorter than 600nm.

Switch-on Time Lamp He+1: the switch-on time of lamp He+1 in seconds. Default is NODEFAULT (i.e. user entry is expected here). (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp HgCd+2: the switch-on time of lamp HgCd+2 in seconds. Default is NODEFAULT (i.e. user entry is expected here). (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp Ar+1 is on: the switch-on time of lamp Ar+1 in seconds. Default is NODEFAULT (i.e. user entry is expected here). (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp Ar+2 is on: the switch-on time of lamp Ar+2 in seconds. Default is NODEFAULT (i.e. user entry is expected here). (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp Ne+1 is on: the switch-on time of lamp Ne+1 in seconds. Default is NODEFAULT (i.e. user entry is expected here). (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp Ne+2 is on: the switch-on time of lamp Ne+2 in seconds. Default is NODEFAULT (i.e. user entry is expected here). (-1 to be used to switch on the lamp continuously during the shutter open time)

4.4.2 Internal flat field lamps:

The default values should not be changed by the users as they have been optimized by the observatory staff.

Switch-on Time Lamp FlatBlue+1: the switch-on time of lamp FlatBlue+1 in seconds. Default is -1; permanently switched on. (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp FlatBlue+2: the switch-on time of lamp FlatBlue+2 in seconds. Default is -1; permanently switched on. (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp FlatRed+1: the switch-on time of lamp FlatRed+1 in seconds. Default is -1; permanently switched on. (-1 to be used to switch on the lamp continuously during the shutter open time)

Switch-on Time Lamp FlatRed+2: the switch-on time of lamp FlatRed+2 in seconds. Default is -1; permanently switched on. (-1 to be used to switch on the lamp continuously during the shutter open time)

4.4.3 External flat field lamps of the new calibration units:

The default values should not be changed by the users since the values are kept updated by the observatory staff.

External Lamp: Selection of the external lamps - only one of the two external lamps can be used at a given time. Two of the external lamps FlatBlue+4 and FlatRed+4 will be projected in focus onto the fiber bundle (high flux) and the two other lamps (FlatBlue+3 and FlatRed+3) off-focus with lower flux level. By default the off-focus lamps FlatBlue+3 and FlatRed+3 (i.e. low flux level) are selected.

Switch-on Time External Lamp: the switch-on time of lamp FlatBlue+3 or FlatBlue+4 in seconds. Default is 0 (i.e. the lamp is off).

Switch-on Time External Lamp: the switch-on time of lamp FlatRed+3 or FlatRed+4 in seconds. Default is 0 (i.e. the lamp is off).

4.5 Hidden p2 parameters:

CCD Windowing Flag: CCD windowing option. This option is hidden and should not be used except for technical purposes.

CCD Window X Start: start pixel in X direction for the CCD window read-out. Default is pixel 1.

CCD Window Y Start: start pixel in Y direction for the CCD window read-out. Default is pixel 1 except for SPECPHOT templates (default = 450).

CCD Window X Size: number of pixels of the CCD read-out window in X direction. Default is 1 pixel except for SPECPHOT templates (default = 2048.)

CCD Window Y Size: number of pixels of the CCD read-out window in Y direction. Default is 1 pixel except for SPECPHOT templates (default = 1000.)

Automatic Target Preset: this parameter decides on the (non-)execution of the telescope preset only in right ascension and declination. It has two values: T for true, F for False. If set to T, the telescope preset will be executed, if set to F, it will not be executed. For a full telescope preset including right ascension, declination and rotator this flag should be T. Default is T.

Acquisition Method: the acquisition method used during the fine positioning of the target field in the focal plane of the instrument. Two options exist:

- **Interactive:** this option allows the operator to interact with the control system during the alignment process in order to guide the acquisition sequence. The operator interaction typically comprises: confirmation of the alignment offset, repetition of the alignment sequence if needed, selection of reference stars if the automatic selection, executed after each alignment image is taken, fails. Default and recommended mode for the field alignment is interactive.
- **Automatic:** this options executes the alignment process completely automatically without any operator interaction. A single alignment iteration will be executed. This option is faster than the interactive mode, but requires that the alignment process is safe and successful (for instance it was verified interactively before). It is not recommended to be used for normal acquisitions.

Preset LADC: the LADC setup for the exposure to be chosen from the list in section in table 4. The LADC is set for air mass of the mid exposure time of the template. Default is COORD.

| p2 entry | LADC setting |
|----------|--|
| COORD | setting according to coordinates and elevation of mid-exposure time (default) |
| ACTUAL | setting according to coordinates and elevation of actual time of template start |
| ZENITH | setting for zenith position, LADC closed |
| ABSPOS | user defined explicit setting of LADC, to be entered through the telescope control console (it cannot be specified through p2) |
| NONE | no LADC setting done, LADC stays in current position |

Table 4: The LADC settings in p2.

Filter2 Name: combinations of two filters are not supported. To purchase a edge cutoff interference filter is the more economical choice.

4.6 Pull-Down Menus

Within p2 the various templates (acquisition, science, calibration) make use of a set of pull-down menus to define the parameter setups of the CCD, LADC, filter, grism, MOS (for spectrophotometry) and longslit, for the individual instrument/telescope configurations. The following sections describe the content of the pull-down menus.

4.6.1 Telescope Parameters

The telescope software supports different options for the selection of guide stars – see table 5. This parameter is selected in the p2 entry field "Get Guide Star from".

| p2 entry | Guide star selection option |
|-----------|--|
| CATALOGUE | Select guide star from a telescope catalog |
| SETUPFILE | Guide star RA and DEC are given in special p2 entry fields |
| NONE | No guide star is to be selected |

Table 5: Guide star selection parameter for FORS2 in p2. Further information is given in section 4.

4.6.2 Exposure Types

The FORS instruments produce 4 type of exposures: science exposures, standard star exposures, pre-imaging exposures and calibration exposures. The 4 image types differ in some fits keyword

parameters to support data organizers of reduction pipelines. Table 6 lists the p2 parameters to select science, standard star and pre-imaging exposures. The exposure type for calibrations is implicitly defined by the template ("cal" in template name).

| p2 entry | Exposure type |
|-----------|---|
| SCIENCE | science exposure |
| STANDARD | standard star exposure |
| PRE-IMAGE | pre-images – to trigger a fast data release in service mode |

Table 6: Exposure types of FORS2 in p2. Note (1): calibration exposures are defined through the template type – "cal" in template name.

4.6.3 CCD Readout Modes

The normal CCD setup modes for FORS2 are listed in table 7.

| Blue (E2V) | |
|------------------------|---|
| p2 entry | CCD mode |
| 100kHz,2x2,high | fast, 2x2 binned, 2-port mode (spectroscopy) |
| 200kHz,2x2,low | very fast, 2x2 binned, 2-port mode (imaging) |
| 100kHz,1x1,high | unbinned mode for spectroscopic observations |
| 200kHz,1x1,low | unbinned imaging mode (for special applications only, for example IPOL on bright sources) |
| Red (MIT) | |
| p2 entry | CCD mode |
| 100kHz,2x2,high | fast, 2x2 binned, 2-port mode (spectroscopy) |
| 200kHz,2x2,low | very fast, 2x2 binned, 2-port mode (imaging) |
| 200kHz,1x1,low | very fast, unbinned, 2-port mode (for special applications only) |

Table 7: CCD modes supported by FORS2 in p2. The default modes are highlighted.

4.6.4 Collimator selection

The collimator selection menu has two choices for each instrument – see table 8.

| p2 name | Collimator |
|-----------|--------------------------------|
| COLL_SR+6 | Standard resolution collimator |
| COLL_HR+7 | High resolution collimator |

Table 8: FORS2 collimators in p2.

4.6.5 Filter selection

The filter pull-down menu offers the filters listed in table 9. If not part of the instrument standard configuration (see FORS2 User’s Manual) the respective filters have to be requested for installation into the instrument via a special filter setup request form (visitor mode observations only).

| p2 name | Filter type |
|-----------------|--|
| GG375+80 | Order sorting filter GG375 |
| GG435+81 | Order sorting filter GG435 |
| OG590+32 | Order sorting filter OG590 |
| FILT_465.250+82 | Special order sorting filter |
| R_SPECIAL+76 | Bessel/Special R filter |
| L_BESS+77 | Bessel I filter |
| u_HIGH+112 | High through-put special u filter |
| g_HIGH+113 | High through-put special g filter |
| v_HIGH+114 | High through-put special v filter |
| b_HIGH+115 | High through-put special b filter |
| u_GUNN+38 | Gunn u filter |
| v_GUNN+39 | Gunn v filter |
| g_GUNN+40 | Gunn g filter |
| r_GUNN+41 | Gunn r filter |
| z_GUNN+78 | Gunn z filter |
| OII+44 | O II filter |
| OII/4000+45 | O II filter red-shifted by 4000 km/s |
| OII/8000+46 | O II filter red-shifted by 8000 km/s |
| HeII+47 | He II filter |
| HeII/3000+48 | He II filter red-shifted by 3000 km/s |
| HeII/6500+49 | He II filter red-shifted by 6500 km/s |
| OIII+50 | O III filter |
| OIII/3000+51 | O III filter red-shifted by 3000 km/s |
| OIII/6000+52 | O III filter red-shifted by 6000 km/s |
| HeI+53 | He I filter |
| HeI/2500+54 | He I filter red-shifted by 2500 km/s |
| HeI/5000+55 | He I filter red-shifted by 5000 km/s |
| OI+56 | O I filter |
| OI/2500+57 | O I filter red-shifted by 2500 km/s |
| OI/4500+58 | O I filter red-shifted by 4500 km/s |
| H_Alpha+83 | H Alpha filter |
| H_Alpha/2500+60 | H Alpha filter red-shifted by 2500 km/s |
| H_Alpha/4500+61 | H Alpha filter red-shifted by 4500 km/s |
| SII+62 | S II filter |
| SII/2000+63 | S II filter red-shifted by 2000 km/s |
| SII/4500+64 | S II filter red-shifted by 4500 km/s |
| SIII+65 | S III filter |
| SIII/1500+66 | S III filter red-shifted by 1500 km/s |
| SIII/3000+67 | S III filter red-shifted by 3000 km/s |
| FILT_485.37+68 | night sky suppression filter |
| FILT_691.55+69 | night sky suppression filter |
| FILT_815.13+70 | night sky suppression filter |
| FILT_834.48+71 | night sky suppression filter |
| FILT_530.25+84 | Munich intermediate-band filter |
| FILT_500.5+85 | Munich O III filter |
| FILT_503.5+86 | Munich O III filter red-shifted by 1800 km/s |
| z_SPECIAL+43 | Special z-band filter (width 20nm) |
| FILT_917.6+88 | Special z-band filter (width 6nm) |

Table 9: FORS2 filters in p2. Not all filters are installed in the instrument at any time.

4.6.6 Grism selection

The gratings listed in table 10 can be selected for longslit (LSS), multi-object (MOS), mask mode (MXU) as well as for spectrophotometry (specphot) and for spectropolarimetry (PMOS). The user is reminded that for PMOS, MXU and MOS modes with FORS2 only the standard resolution collimator (SR) is supported.

4.6.7 Longslit selection

The longslits listed in table 11 can be selected for longslit (LSS) spectroscopy with both the SR and HR collimators.

4.6.8 MOS slit position selection for spectrophotometry

Table 12 contains the list of options for predefined x-positions of the MOS slits during the execution of the spectrophotometric templates (SPECPHOT type). The positions correspond to the pre-defined positions of the MOS slits in the field of view. This can be optionally the x-position of the subsequent longslits or any other user defined x-offset in units of pixels on the CCD. The slit width is pre-defined to 5 arcsec.

4.6.9 Retarder plate angle for circular and linear polarimetry

The polarimetry modes IPOL and PMOS use named positions for the setup of the rotation angle for the linear and circular retarder plate. The selection options for the polarimetry modes are given in table 13. Table 14 lists the available options. The number in the named positions gives the retarder plate angle, "lin" and "cir" denote the polarization type (linear and circular). The named positions appear in a pull-down field which is used to select the retarder plate angle for polarimetry exposures. They can be added to a list of angle settings to be executed with the instrument.

| p2 name |
|---------------|
| normal grisms |
| GRIS_1400V+18 |
| GRIS_1200R+93 |
| GRIS_1028z+29 |
| GRIS_600B+22 |
| GRIS_600V+94 |
| GRIS_600RI+19 |
| GRIS_600I+25 |
| GRIS_600z+23 |
| GRIS_300V+10 |
| GRIS_300I+11 |
| GRIS_150I+27 |
| GRIS_1200B+97 |

Table 10: FORS2 grisms in p2.

| p2 entry | Longslit |
|----------------|--------------------------|
| lSlit0_3arcsec | 0.3 arcsec wide longslit |
| lSlit0_4arcsec | 0.4 arcsec wide longslit |
| lSlit0_5arcsec | 0.5 arcsec wide longslit |
| lSlit0_7arcsec | 0.7 arcsec wide longslit |
| lSlit1_0arcsec | 1.0 arcsec wide longslit |
| lSlit1_3arcsec | 1.3 arcsec wide longslit |
| lSlit1_6arcsec | 1.6 arcsec wide longslit |
| lSlit2_0arcsec | 2.0 arcsec wide longslit |
| lSlit2_5arcsec | 2.5 arcsec wide longslit |

Table 11: The FORS2 longslits in p2

| p2 entry | predefined MOS slit position |
|-------------------|--|
| LSS_0.3_arcsec | MOS slits at position of 0.3 arcsec longslit |
| LSS_0.4_arcsec | MOS slits at position of 0.4 arcsec longslit |
| LSS_0.5_arcsec | MOS slits at position of 0.5 arcsec longslit |
| LSS_0.7_arcsec | MOS slits at position of 0.7 arcsec longslit |
| LSS_1.0_arcsec | MOS slits at position of 1.0 arcsec longslit |
| LSS_1.3_arcsec | MOS slits at position of 1.3 arcsec longslit |
| LSS_1.6_arcsec | MOS slits at position of 1.7 arcsec longslit |
| LSS_2.0_arcsec | MOS slits at position of 2.0 arcsec longslit |
| LSS_2.5_arcsec | MOS slits at position of 2.5 arcsec longslit |
| p2 entry | user defined MOS slit position |
| MOS_center | MOS slits in center of MOS area |
| MOS_center+offset | MOS slits at positive X pixel offset from MOS center |
| MOS_center-offset | MOS slits at negative X pixel offset from MOS center |

Table 12: The FORS MOS slits in p2 used by SPECPHOT templates

| p2 entry | Polarimetry mode |
|----------|----------------------|
| linear | Linear polarimetry |
| circular | Circular polarimetry |

Table 13: Polarimetry options in p2.

| p2 entry | Longslit |
|----------------|---|
| clear list | empty list |
| cir-45 | circular polarimetry, retarder at -45 deg |
| cir45 | circular polarimetry, retarder at +45 deg |
| cir135 | circular polarimetry, retarder at 135 deg |
| cir225 | circular polarimetry, retarder at 225 deg |
| lin0 | linear polarimetry, retarder at 0 deg |
| lin22.5 | linear polarimetry, retarder at 22.5 deg |
| lin45 | linear polarimetry, retarder at 45 deg |
| lin67.5 | linear polarimetry, retarder at 67.5 deg |
| lin90 | linear polarimetry, retarder at 90 deg |
| lin112.5 | linear polarimetry, retarder at 112.5 deg |
| lin135 | linear polarimetry, retarder at 135 deg |
| lin157.5 | linear polarimetry, retarder at 157.5 deg |
| lin180 | linear polarimetry, retarder at 180 deg |
| lin202.5 | linear polarimetry, retarder at 202.5 deg |
| lin225 | linear polarimetry, retarder at 225 deg |
| lin247.5 | linear polarimetry, retarder at 247.5 deg |
| lin270 | linear polarimetry, retarder at 270 deg |
| lin292.5 | linear polarimetry, retarder at 292.5 deg |
| lin315. | linear polarimetry, retarder at 315 deg |
| lin337.5 | linear polarimetry, retarder at 337.5 deg |

Table 14: The retarder plate angles in p2 - the recommended default angles for the circular and linear polarimetry are highlighted