Gran Telescopio Canarias

Phase-2 Preparation Tool

Valid from period 2012A

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Contents

1. The GTC Phase-2 System

1.1. Introduction

This document describes how to use the Phase-2 tool for preparing observations at the Gran Telescopio CANARIAS (GTC).

Each Principal Investigator (PI) who has successfully obtained observing time at GTC through the Phase-1 call for proposals is required to complete a detailed definition of her/his observations, referred to as the "Phase-2". The purpose is to describe the observations sufficiently well to allow GTC staff astronomers to carry them out in service mode, as part of the observing queue. Each program has associated a support astronomer at GTC to assist in dealing with any question or problem that might occur, and to advise on the best possible use of the telescope.

To complete the Phase-2 there is no need to download or install code on your computer because the tool itself runs on a GTC server and is accessed through a web browser. You don't have to worry about having the latest version, because the version on-line is always the latest one. The products of the Phase-2 are also stored on the GTC server so you don't have to worry about losing your work.

The web page (Fig. 1.1) hosting the Phase-2 tool is:

URL: http://gtc-phase2.gtc.iac.es/science/F2

also reachable from the GTC home page. At any given time a user should open only one window to avoid conflicts when saving data and hence to avoid data loss.

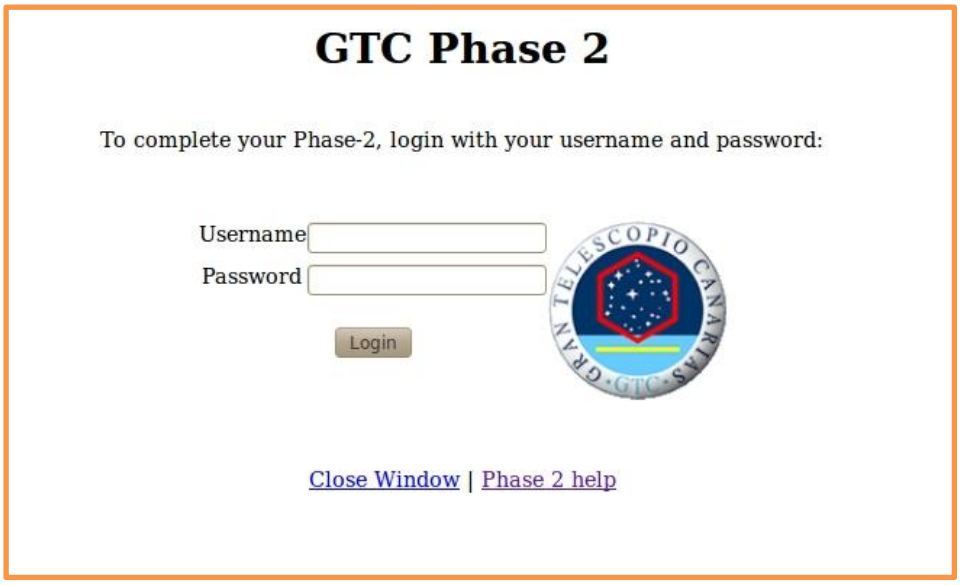

Fig 1.1: Phase-2 login page under Linux-firefox appearance.

1.2. Logging in

Each PI that has been allocated observing time on GTC will be provided with a *username* and *password* combination to enter the Phase-2 tool, and then create, inspect, modify or delete its

own observing blocks. The PI will also be given a contact Support Astronomer at GTC to deal with specific queries related to the observing proposal and the preparation of the Phase-2. In case of delay in answering your queries you may always contact the GTC user helpdesk at: astro-helpdesk@gtc.iac.es .

Once you have logged in, the system will show you all your proposals, including those of previous periods. To proceed with the preparation of the Phase-2 select a proposal and press "submit". You will enter the Phase-2 summary page (Fig. 1.2).

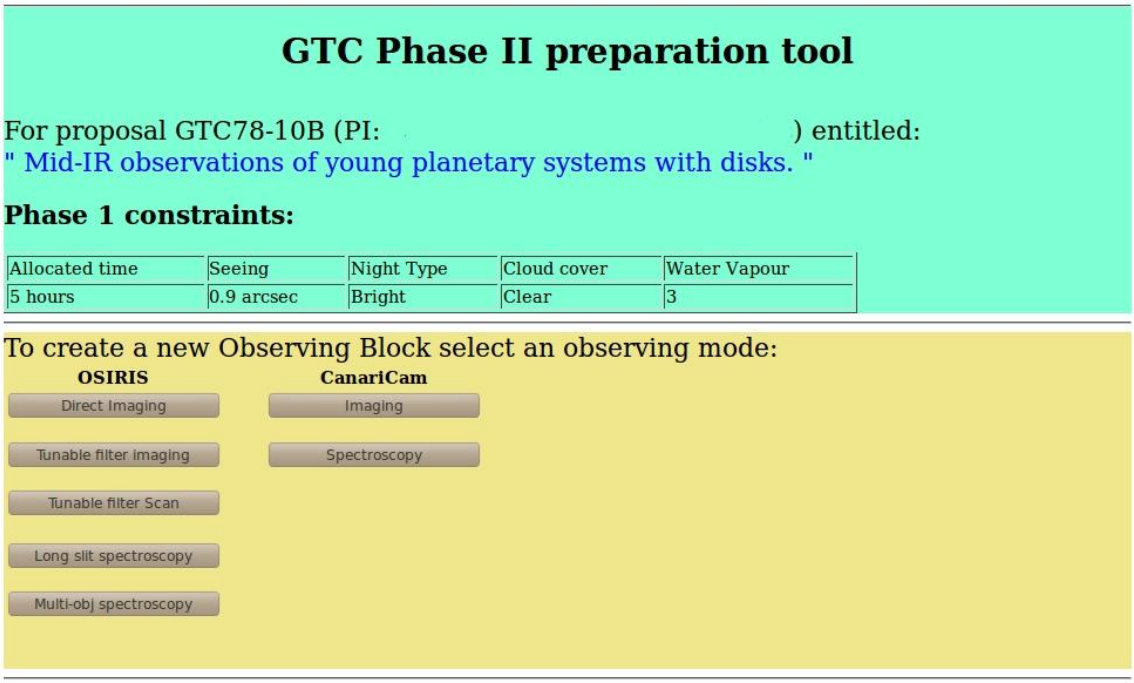

Fig 1.2: The Phase-2 summary page as it appears when no OBs have been created. The constraints from Phase-1 are shown, as well as the list of all possible observing modes shown below the corresponding instrument.

WARNING: only one session at the time should be started for a given proposal. Using multiple sessions might produce inconsistent result and/or loss of data.

2. Defining an observing block

After selecting a proposal for which the Phase-2 is to be completed you will be presented with the Phase-2 summary page (Fig. 1.2). Here you will see the title of the proposal, the proposal code, the time allocated, and the observing constraints coming from Phase-1 as approved by the time allocation committee. Basically, this is the home page for preparing Observing Blocks, or OBs, and for managing the Phase-2. In particular, you will be able to:

- Create an observing block for the requested instrument and observing mode.
- Modify and/or inspect existing observing block.

- Duplicate an existing observing block.
- Delete observing blocks.
- Fill in the README file.

An observing block (OB) is the smallest part in which your program can be subdivided. Normally an OB includes the information to acquire a target, and one or more templates. As a rule, at the telescope OBs are executed as indivisible units; they are treated like atoms of an observing program and are normally not split in time. Long observing blocks are more difficult to schedule and more sensitive to unstable observing conditions (both atmospheric and technical). The observatory only guarantees the required observing conditions for observing blocks up to one hour and therefore recommends using this duration as the maximum total length of any observing blocks. That is to say, if you need to integrate for 5 hours on a very faint target, you should not prepare a single OB containing 5 exposures of 1 hour each. Rather, you should prepare 5 OBs, each one with 1 exposure. Then, during the semester each OB will be most probably executed on different nights according to time availability and weather conditions. Keep in mind that short OBs have much more chances to be scheduled than long ones.

Each OB is in turn subdivided in templates, each one fully describing a specific action to be performed by the telescope. This can be the acquisition image, or for instance a number of exposures on the science target with a given filter.

Please ensure that your observing blocks adheres to the Phase-1 request. GTC staff will check the correctness of each set of observing blocks at the end of the process in order to ensure that the Phase-2 result matches the original instrument setup and time allocation. In particular, you should ensure that the total allocated time is not exceeded. Also note that in queue mode two observing blocks of the same target or otherwise linked, can be executed in separate nights. If for whatever reason they must be executed one after the other, this must be notified to the support astronomer through the README file.

Below follows a detailed description of how to fill an OBs for each observing mode.

2.1. Creating an observing block for OSIRIS

To start filling an OB just click on the corresponding observing mode. For OSIRIS, the list of choices is:

- OSIRIS Broad Band imaging,
- OSIRIS Imaging with Tunable Filter,
- OSIRIS Imaging with tunable filter scanning a range of wavelengths,
- OSIRIS Long Slit Spectroscopy,
- OSIRIS Multi-object Spectroscopy,

Once you have decided which observing mode is the most appropriate for your OB, you must provide some information that is common to all observing modes, with some other specific items depending on the mode.

2.1.1. Target definition

Target Name: This is the name that will appear in image header. It does not have to be unique, but for later handling it is better if it is. Special characters and spaces are not allowed.

Observing Priority: a number between 1 to 9, being 1 the maximum priority. The night astronomer will attempt to execute first the OBs with higher priority.

Coordinates (J2000): Target coordinates in the format HH:MM:SS.SS (-)DD:MM:SS.S. Note that positive declinations must be written without the + sign. It is required that you enter the coordinates with the exact number of decimals (i.e. 2 for the right ascension and 1 for the declination). The exact location of your target on the field of view depends on the observing mode. The night astronomer is taking care of placing the science target on a defect-free region of the CCD. For later scheduling coordinates are required even for non-sidereal targets. In this case enter a value close to the mean position the target will have during the period of visibility.

Proper Motion: If appropriate enter proper motion values in milli-arcseconds per year. This field can be left empty.

Non-Sidereal Target: Activate this flag for solar system targets. If selected, later you will be asked to enter a file of coordinates. IMPORTANT: Non-sidereal targets are not supported in the current semester.

Example screen shots are presented in Figures 2.1 and 2.2.

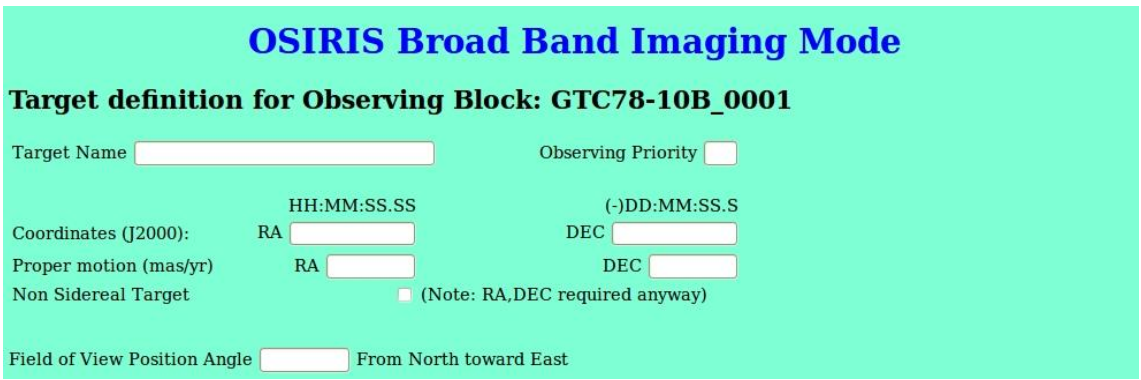

Fig 2.1: Target definition for the case of Osiris broad-band imaging. The same parameters are used for Osiris tunable-filter imaging.

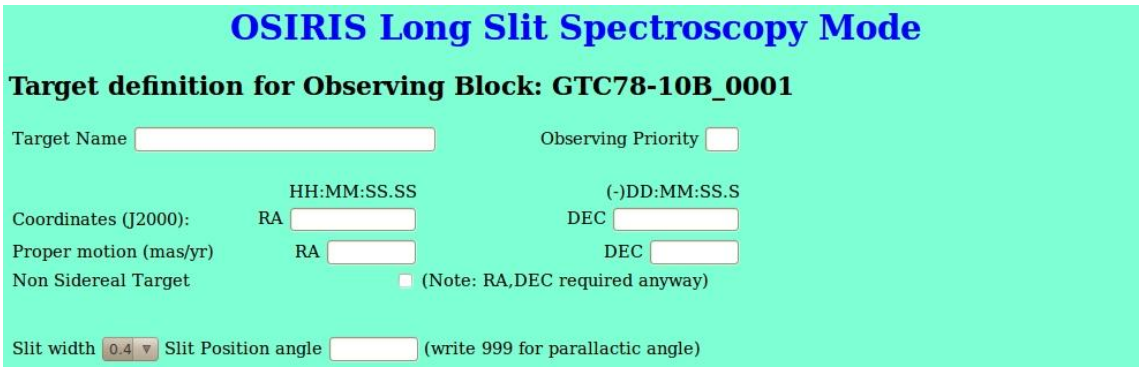

Fig 2.2: Target definition for the case of Osiris Long Slit Spectroscopy.

2.1.2. OSIRIS Broad-Band Imaging

In addition to the fields described in section 2.1.1, the following parameters are needed:

Field of view position angle: By default the instrument field of view is oriented so to have the North up and East to the left. However, the instrument can be oriented differently. If so, write in this field the desired position angle in degrees, starting from North toward East. Angles are assumed to be positive from North to East. For instance, a value of 90 means that you will have West up and North left.

Then, at least one template must be filled in, to define the details of the science exposures associated to the OB (fig. 2.3).

Science templates: Each template allows the user to define a series of one or more exposures to be taken with a given filter, exposure time, and readout mode, in different positions on the sky. The parameter to be configured are:

- The filter to be used. The pull-down menu lists all filters available for the active semester.
- The exposure time in seconds.
- The number of exposures ”N exp” in the series.
- The CCD readout mode, either 200 kHz or 100 kHz. Please note that the standard readout mode (200 kHz) is preselected. If you wish to use the other readout speed, the time for taking the corresponding non-standard calibrations will be charged to the project.
- The CCD binning. The standard mode for imaging, 2 x 2 binning, is preselected. If you wish to use a different binning, the time for taking the non-standard calibrations will be charged to the project.
- The offsets between images, in arcseconds. Note that within a template each offset will be added to the previous one, and if the requested number of exposures is greater than the number of offsets (or if no offsets at all are given) the telescope will reuse the last position as many times as needed. At the end of each template the telescope is sent back to the starting position. Values are given as a space separated array.

At the bottom of the form there is one final (optional) parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, but rather to allow the repetition of sequences of templates, for instance taking series of images alternating two filters.

Pressing the "Reset form" button at any time will clear all values from the form, including the fields for the target definition and the acquisition image for blind offset.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading a finding chart (Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a README file with further information (Section 3.3).

Here follow some examples:

Example 1: To take four exposures of 600 seconds each in the u band, readout mode 100kHz, in a squared dithering pattern 10" on a side, starting from the target position, the template should be filled as follow:

u, 600 , 4, 100kHz, 2x2, 0 10 0 -10, 0 0 10 0

Example 2: To take a similar sequence in g and r bands over the same positions on the sky:

g, 500 , 4, 100kHz, 2x2, 0 10 0 -10, 0 0 10 0

r, 400 , 4, 100kHz, 2x2, 0 10 0 -10, 0 0 10 0

Note that the very same offsets are given in both templates because at the end of the first one the telescope goes back to the pre-set position.

Example 3: Take 3, 10sec exposures in z band, in a fixed position on the sky, and slow readout mode:

z, 10, 3, 100kHz, 2x2 (note that no offsets are given).

Example 4: To take 3 exposures in the z band each one with a different exposure time, three templates must be configured:

z, 60, 1, 100kHz, 2x2

z, 120, 1, 100kHz, 2x2

z, 240, 1, 100kHz, 2x2

To loop through any of the above sequences 10 times, set the number of repetition to 10. Note that this last parameter is not meant to repeat the whole OB, but only the templates are repeated. That is to say, one cannot set the number of repetitions to 3 instead of preparing 3 separated OBs.

In the case of needing more templates than the maximum number off please contact your support astronomer.

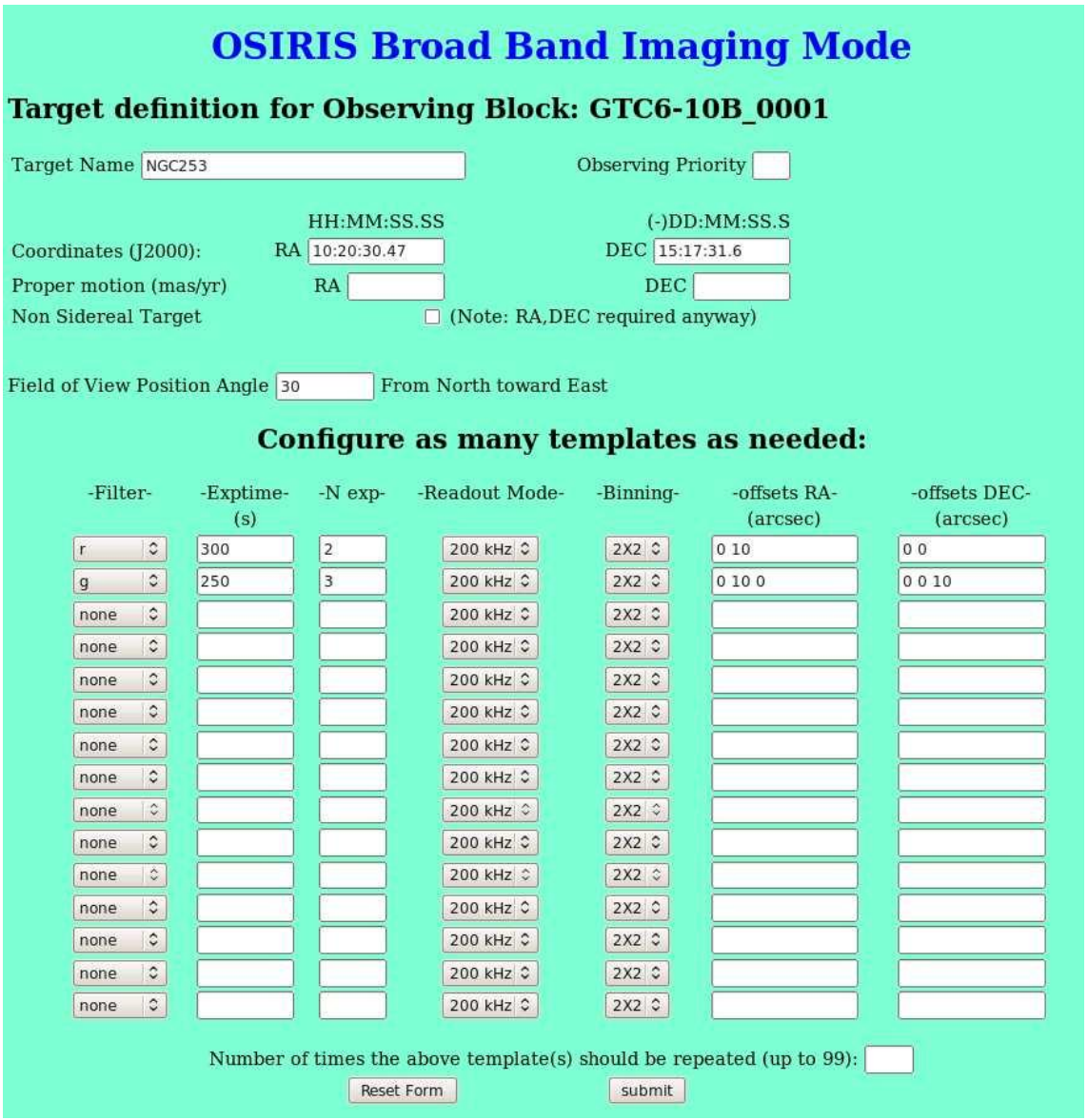

Fig 2.3: The form to prepare an OB for OSIRIS imaging mode

2.1.3. OSIRIS Tunable Filter Imaging.

The form specific to Tunable filter observations is shown in Fig. 2.4.

Science Templates: Each template allows the user to define a series of one or more exposures to be taken with a given Tunable filter, exposure time, and readout mode, in different position on the sky. This observing mode is quite similar to that of regular broad band imaging. Be aware that if you want to observe in more than one wavelength separated by a fix, small steps, it is more efficient to use the "TF scan mode".

After filling the upper part of the form, the remaining parameters to be configured are:

- The filter to be used. − IMPORTANT: For the time being ONLY THE RED TUNABLE FILTER IS OFFERED.
- The order separator filter (OS) needed to isolate the wavelength of interest (Table). The user is asked to explicitly select the OS filter, but be aware that moving from one wavelength to another a new OS filter might be required, which implies a full setup of OSIRIS, with as a consequence the overheads.
- The central wavelength in nanometers to be tuned. The FWHM of the passband in nanometers.
- The exposure time in seconds.
- The number of times ”N exp” the exposures must be repeated.
- The CCD readout mode, either 200 kHz or 100 kHz. Please note that the standard readout speed (200 kHz) is preselected. If you wish to use the other readout speed, the time for taking the non-standard calibrations will be charged to the project.
- The CCD binning. The standard mode for imaging, 2 x 2 binning, is preselected. If you wish to use a different binning, the time for taking the non-standard calibrations will be charged to the project.
- The offsets between images in arcsec, given as a space-separated array. The meaning of the offsets is the same as in section 2.1.2
- The number of times the defined templates should be repeated.

At the bottom of the form there is one final (optional) parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, but rather to allow the repetition of sequences of templates, for instance taking series of images alternating two setups.

Pressing the “Reset form” button at any time will clear all values from the form, including the fields for the target definition and the acquisition image for blind offset.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading a finding chart (Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a README file with further information (Section 3.3).

Here follow some examples:

Example 1: Take three exposures of 250s at 682.5 nm, with FWHM=1.9 nm, in dithered 20” positions on the sky, and 100 kHz readout mode:

TF RED, f680/43, 682.5, 1.9, 250, 3, 100 kHz, 2x2, 0 20 0, 0 0 20

Example 2: Take four 60s exposures at 700 nm, FWHM=0.9 nm, readout mode 200 kHz, in a squared 10” dithering pattern starting from the target position:

TF RED, 694/44, 700, 0.9, 60 , 4, 200 kHz, 2x2, 0 10 0 -10, 0 0 10 0

Example 3: Take two sequences like above as part of a single observing block:

TF RED, f680/43, 682.5, 1.9, 250, 3, 100 kHz, 2x2, 0 20 0, 0 0 20

TF RED, 694/44, 700, 0.9, 60, 4, 200 kHz, 2x2, 0 10 0 -10, 0 0 10 0

Note that at the end of the first template the telescope goes back to the pre-set position, thus the first exposure of the second template is centered on the target.

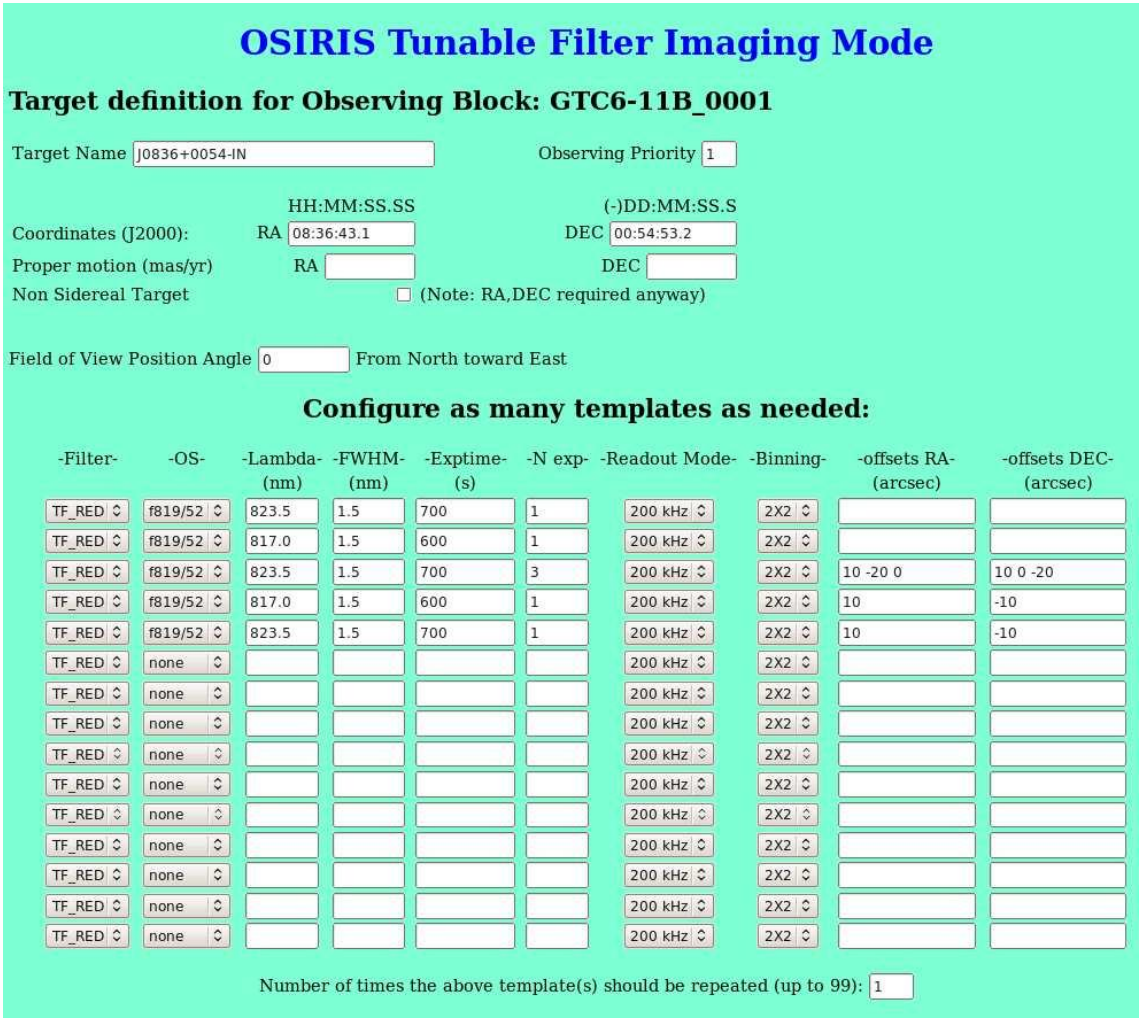

Fig 2.4: The form to prepare an observing block for OSIRIS tunable filters imaging mode.

2.1.4. OSIRIS Tunable Filter Scan

This mode of observation is meant for taking images with the TF while scanning over a range of wavelengths. The form specific to this mode of observations is shown in Fig. 2.5. The upper section of the form is identical to the one for imaging mode.

Each template allows the user to define a series of one or more exposures to be taken with a given exposure time and readout mode, in different position on the sky, scanning over a series of wavelength. The parameters to be configured are:

- The filter to be used. − IMPORTANT: For the time being ONLY THE RED TUNABLE FILTER IS OFFERED.
- The order separator filter (OS) needed to isolate the wavelength of interest (Table). The user is asked to explicitly select the OS filter, but be aware that moving from one wavelength to another a new OS filter might be required, which implies a full setup of OSIRIS, with as a consequence the overheads.
- The initial central wavelength in nanometers to be sintonized. The FWHM of the passband in nanometers
- The step in wavelength to be applied between exposures in the scan.
- The number of steps to the carried out. For instance to scan with a step of 25 nm from 600 to 800 nm, the number of steps is 9 (including the first exposure at 600 nm).
- The exposure time in seconds.
- The number of exposures "N exp" in the series. Please note that this parameter has the following meaning: it is the number of exposures taken at a given wavelength. That is to say, at every "step" in wavelength "N exp" exposures will be taken (each one at the position specified by the given offsets).
- The CCD readout mode, either 200 kHz or 100 kHz. Please note that the standard readout speed (200 kHz) is preselected. If you wish to use the other readout speed, the time for taking the non-standard calibrations will be charged to the project.
- The CCD binning. The standard mode for imaging, 2 x 2 binning, is preselected. If you wish to use a different binning, the time for taking the non-standard calibrations will be charged to the project.
- The offsets between images in arcsec, given as a space-separated array. The meaning of the offsets is the same as in section 2.1.2

At the bottom of the form there is one final (optional) parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, but rather to allow the repetition of sequences of templates, for instance taking series of images alternating two scans.

Pressing the "Reset form" button at any time will clear all values from the form, including the fields for the target definition and the acquisition image for blind offset.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading a finding chart (Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a README file with further information (Section 3.3).

Here follow some examples:

Example 1: Take a series of 5 exposures of 250s, at 200kHz read out speed and binning 2 x 2, starting at 680 nm, with FWHM 1.2 nm, and step of 2 nm:

TF RED, f680/43, 680, 1.2, 2, 5, 250, 1, 200 kHz, 2x2

In this example one image at each wavelength will be taken, scanning the values 680-682-684-686-688.

Example 2: As in example 1, but we now want to scan up to 700 nm. In this case one single template is not enough, because at 692 we have to change OS. Thus we have to write:

TF RED, f680/43, 680, 1.2, 2, 7, 250, 1, 200 kHz, 2x2

TF RED, f694/44, 694, 1.2, 2, 4, 250, 1, 200 kHz, 2x2

The first template ask for 7 steps scanning the wavengths 680-682-684-686-688-690-692 nm, and the second will take 4 more exposures at 694-696-698-700 nm.

Example 3: As in example 1 but now we want to take 4 exposures in four positions on the sky, at each wavelength:

TF RED, f680/43, 680, 1.2, 2, 5, 250, 4, 200 kHz, 2x2, 0 10 0 -10, 0 0 10 0

Example 3: To repeat 6 times the sequence of example 2, just set the number of repetitions to 6.

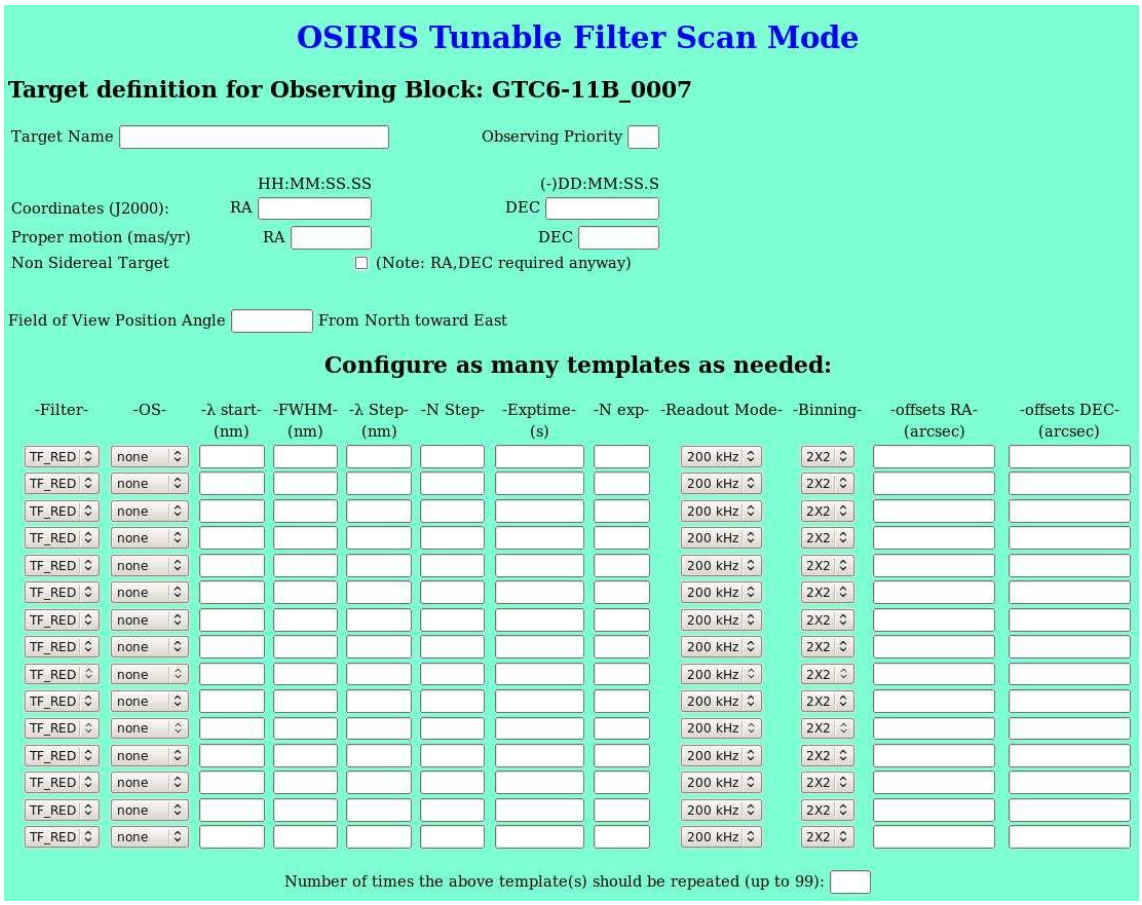

Fig 2.5: Form to prepare an OB for OSIRIS Tunable Filter Scan mode

Table 1: Order separator filters for tunable filter and narrow band imaging

Filter	Central Lambda (nm)	FWHM (nm)	Useful range for TF (nm)
643/27	643.1	27.7	646.2 - 651.6
648/28	648.4	27.9	651.6 - 657.0
657/35	657.2	35.0	657.0 - 667.6
666/36	666.8	35.5	667.6 - 677.4
680/43	680.2	43.2	677.4 - 692.7
694/44	694.4	44.0	692.7 - 707.1
709/45	708.8	44.9	707.1 - 721.8
723/45	723.3	45.2	721.8 - 736.4
738/46	738.0	46.1	736.4 - 751.3
754/50	754.2	49.6	751.3 - 768.5
770/50	770.6	49.7	768.5 - 784.9
785/48	785.6	47.6	784.9 - 799.4
802/51	802.0	51.3	799.4 - 816.8
819/52	819.0	52.4	816.8 - 834.1
838/58	838.6	57.8	834.1 - 854.9
858/58	858.2	57.9	854.9 - 874.7
878/59	878.2	59.3	874.7 - 895.1
893/50	893.2	49.6	895.1 - 907.9
902/40	902.4	40.1	907.9 - 914.7
910/40	910.6	40.5	914.7 - 923.0
919/41	918.9	40.8	923.0 - 931.5
923/34	923.8	34.2	931.5 - 934.6
927/34	927.9	34.4	934.6 - 938.7
932/34	932.0	34.5	938.7 - 942.9
936/35	936.2	34.7	942.9 - 947.1
940/35	940.3	34.8	947.1 - 951.2

2.1.5. OSIRIS Long-Slit Spectroscopy

In addition to the fields commented in section 2.1, to define a long-slit spectroscopy observation the following information is needed (Fig. 2.6):

Slit Width: Select the slit width. Only one slit width per observing block can be selected. See fig.5.

Slit Position Angle: Select the slit position angle on the sky, starting from North toward East, ranging from -90 to 90 degrees. For instance, PA=90 sets the slit along the east-west direction. To position the slit along the parallactic angle at the moment of observations, enter ”999”.

Acquisition Image: To center the target on the slit a direct image of the field is taken and the target identified. The parameters to define the acquisition image are:

- Filter: A pull down menu allow the selection of the filter to be used.
- Exptime: Integration exposure time in seconds.
- Readout mode: Readout speed.

Through slit image: After placing the target on the slit, an image of the target is taken with the slit in position (but without inserting the grism) to further improve centering. Here the user selects the filter, exposure time, and readout mode of the exposure (See fig.8). Values can be different from the ones used for acquisition. The meaning of the parameters is the same as for the acquisition image.

Blind offset: For faint targets the user can provide a blind offset from a known well defined celestial position, to be applied after the through-slit image. That is, it is possible to acquire on a bright target and then blindly offset the telescope to place the science target on the slit. The offset must be given in arcsec. To give the offsets with the correct sign keep in mind that the telescope will move from the bright to the faint target.

Filling the templates: In order for an OB to be valid at least one science template must be filled in. Each template allow the user to define a series of one or more exposures to be taken with the selected slit, exposure time, and readout mode, in different positions on the sky. The parameters to be configured are:

- The grism to be used.
- The exposure time in seconds.
- The number of exposures ”N exp” in the series.
- The CCD readout mode, either 100 kHz or 200 kHz. Please note that the standard readout speed for spectroscopy (100 kHz) is preselected. If you wish to use the other speed, the time for taking the non-standard calibrations will be charged to the project.
- The CCD binning. The standard mode for spectroscopy, 2 x 2 binning, is preselected. If you wish to use a different binning, the time for taking the non-standard calibrations will be charged to the project.
- The offsets along the slit, between images, in arcseconds. Note that within a series each offset will be added to the previous one, and if the requested number of exposures is greater than the number of offsets (or if no offsets at all are given) the last position is re-used as many times as needed. At the end of each template the telescope is always sent back to the starting position.

At the bottom of the form there is one final (optional) parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, but rather to allow the repetition of sequences of templates, for instance taking series of images alternating two spectral setups.

Pressing the “Reset form” button at any time will clear all values from the form, including the fields for the target definition and the acquisition image for blind offset.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading a finding chart

(Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a README file with further information (Section 3.3).

Here follow some examples:

Example 1: Take 3 exposures of 600s with grism R500B, without order separator, in 3 dithered positions of 5" below the slit center (obviously along the slit), on the center, and 5" above the slit center, and everything in the slow readout mode binning 2 x 2:

R500B, 600, 3, 100 kHz, 2x2, -5 5 5

Example 2: Take the same sequence as above but in a fixed position on the sky

R500B, 10, 3, 100 kHz, 2x2 (note that no offsets are given)

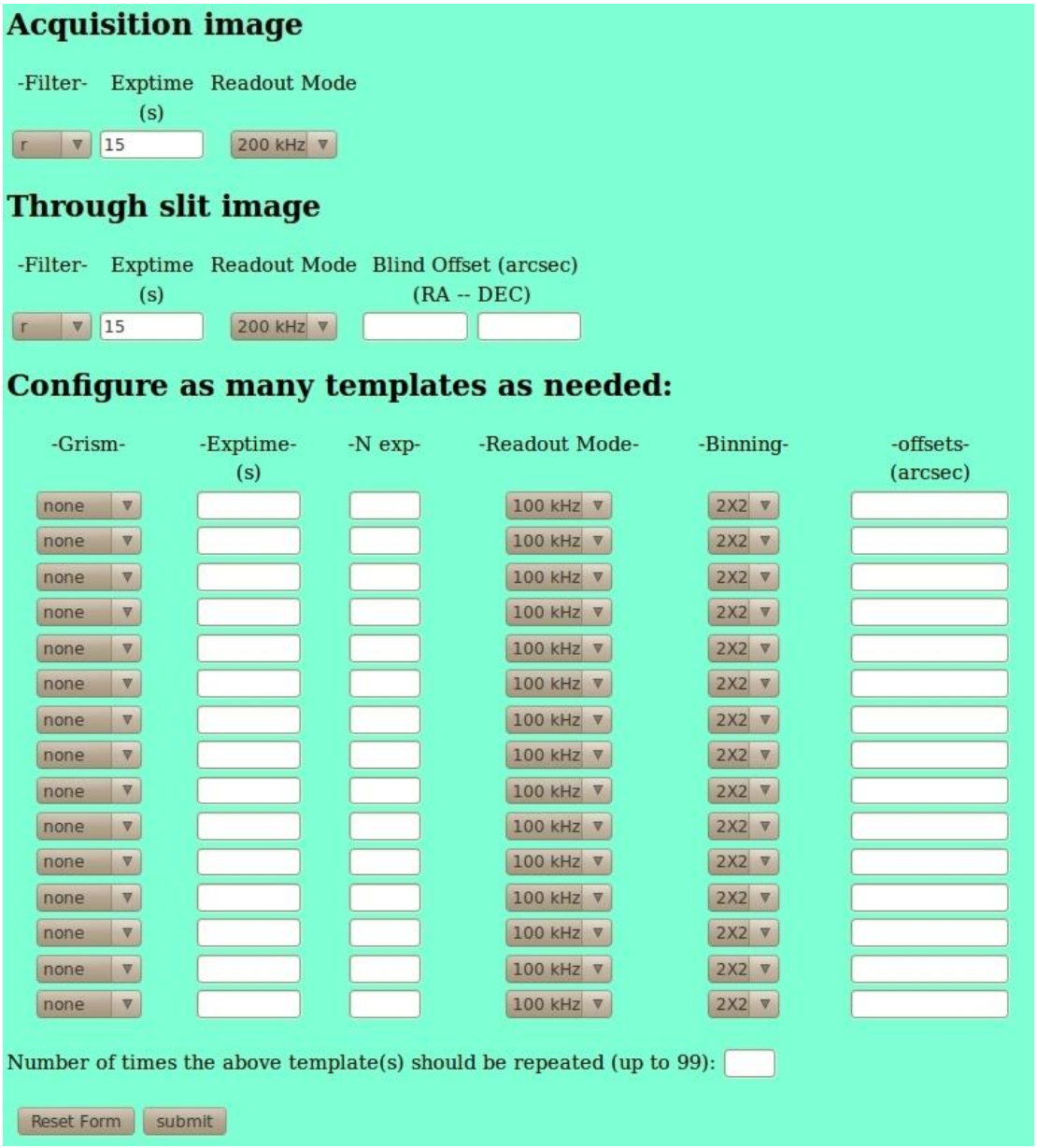

Fig 2.6: Form to define an OB for OSIRIS long-slit spectroscopy. The section relative to the target definition is not shown.

2.1.6. OSIRIS Multi-object Spectroscopy

NOTE: Multi-object spectroscopy mode is not offered yet

This observing mode requires the initial preparation of an instrument focal plane setup (a mask), which is done with a separate mask designer tool. Once you have designed the mask and saved it on a file called, let say, mask.xml, you are ready to prepare your observing block.

The first thing you are asked to do is to upload the mask file. After uploading, the center of the mask and the selected grism will be shown in order to double check whether it is the mask you wanted to upload. If not, then just go back with the navigator back button and upload the correct file.

When you are satisfied press "continue" and you will be presented with the form where to define the following parameters:

Acquisition Image: To center the targets on the slits, a direct image of the field is taken and the reference targets identified. Please select the exposure time, broad band filter, and readout mode to be used for this exposure (the binning for technical reasons is fixed to the default for imaging). In the case the science target is extremely diffuse and/or no precise centering of the targets is required, this exposure can be skipped to save time. In this case the user relies on the GTC pointing accuracy of few arcseconds.

For the acquisition image you are asked to specify the filter to be used, the integration time in seconds, and the readout mode.

Through slit image: After placing the target on the slit, an image of the target is taken with the slit mask in position (but without inserting the grism) to further improve centering. Please select the filter, exposure time, and readout mode of the exposure. Values can be set differently from the ones used for acquisition. The meaning of the columns is the same as in acquisition.

Filling in the templates: Because the focal plane setup is already defined, you are left to configure only few other parameters:

- The exposure time in seconds.
- The number of exposures "N exp" in the series.
- The CCD readout mode, either 100 kHz or 200 kHz. Please note that the standard readout speed for spectroscopy (100 kHz) is preselected. If you wish to use the other speed, the time for taking the non-standard calibrations will be charged to the project.
- The CCD binning. The standard mode for spectroscopy, 2 x 2 binning, is preselected. If you wish to use a different binning, the time for taking the non-standard calibrations will be charged to the project.
- The offsets along the slits between images, in arcseconds. Note that within a series each offset will be added to the previous one, and if the requested number of exposures is greater than the number of offsets (or if no offsets at all are given) the last position is re-used as many times as needed. At the end of each template the telescope is always sent back to the starting position.

At the bottom of the form there is one final (optional) parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, but rather to allow the repetition of sequences of templates, for instance taking series of images alternating two spectral setups.

Pressing the "Reset form" button at any time will clear all values from the form, including the fields for the target definition and the acquisition image for blind offset.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading a finding chart (Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a README file with further information (Section 3.3).

Here follow some examples:

Example 1: Take 3 exposures of 600s with a given mask, in 3 dithered positions of 5" below the slit center (obviously along the slit), on the center, and 5" above the slit center, and everything in the slow readout mode binning 2 x 1:

600, 3, 100 kHz, 2x1, -5 5 5

Example 2: Take the same sequence as above but in a fixed position on the sky

10, 3, 100 kHz, 2x1 (note that no offsets are given)

2.2. Creating an observing block for CanariCam

Observations in the mid-infrared are particularly challenging. Because of that, to properly fill the GTC phase-2 for CanariCam it is important to have a good understanding of how CanariCam works and to be familiar with the chopping and nodding techniques. Fig. 2.8 shows a general representation of the definition of the chopping and nodding and field of view position angles. This figure shows a case of an extended source surrounded by more extended emission, so that the chop and nod throws must be defined larger than the detector field-of-view (FOV). In the case of point sources (e.g. a standard star) chop and nod throws can have values smaller than the detector FOV. As a rule, for best performance in thermal infrared observations, chop and nod throw should have the same value, and the chop and nod angles should differ by 180 degrees. Users are allowed to ignore this rule, as long as they are aware of the risks involved. Section 2.2.2 contains a step-by-step guide to define the chopping and nodding configuration.

For CanariCam, only two observing modes are available in the current semester:

- CanariCam Imaging.
- CanariCam Spectroscopy.

Below follow detailed descriptions of how to prepare OBs for both modes.

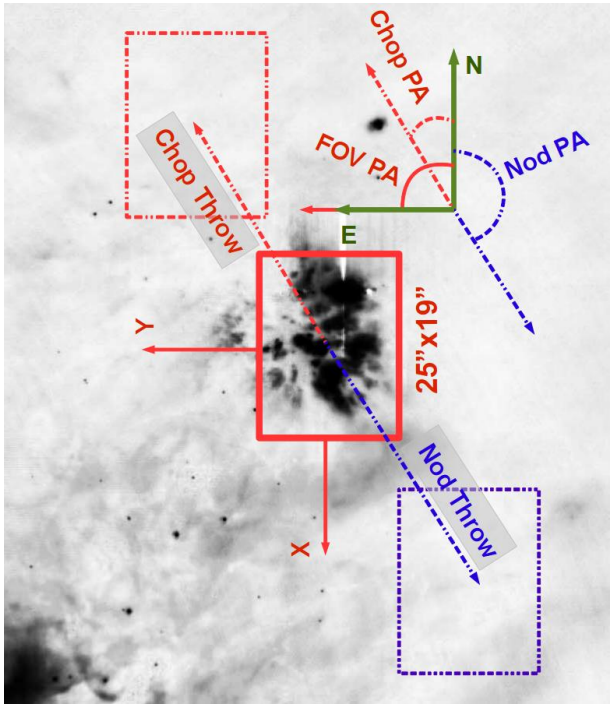

Figure 2.8: Graphical representation of the three angles that must be defined as part of the target definition. The field of view (FOV) position angle defines the orientation of the Y axis of the detector with respect to the celestial North, being the angles positive from North to East. The Chop and Nod angle differ by 180 degrees between each other and are also defined with respect to the North.

2.2.1. Target Definition

Once the observing mode has been selected in the Phase-2 summary page (see Fig. 1.2), the following acquisition information, common to both imaging and spectroscopy modes must be provided.

Target Name: This is a string defining the target name. It does not have to be unique but for archiving purposes it is better if it is. Special characters and spaces are not allowed.

Observing Priority: This is a number between 1 and 9 defining the Observing Block priority, being 1 the maximum priority. The night astronomer will attempt to execute first the OBs with higher priority.

Coordinates (J2000): Target coordinates in the format HH:MM:SS.SS (-)DD:MM:SS.S. Note that positive declination must be written without the + sign. It is required that you enter the coordinates with the exact number of decimals (i.e. 2 for the right ascension and 1 for the declination).

Proper Motion: Target proper motion values in milli-arcseconds per year. This field can be left empty.

Non Sidereal Target: This flag shall be used for Solar System targets. If selected, later you will be asked to enter an Ephemeris file. IMPORTANT: Non-sidereal targets are not supported in the current semester.

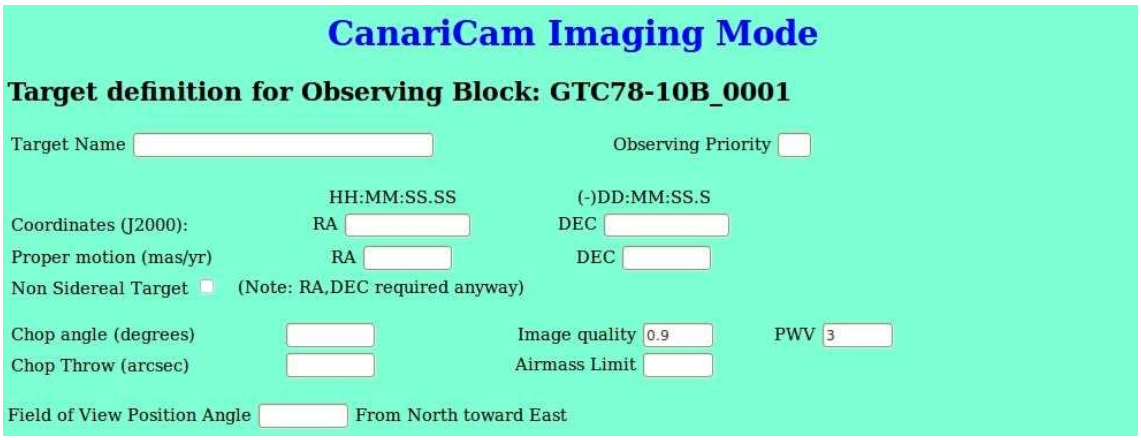

Figure 2.9: Parameters for target definition in the case of CanariCam imaging mode.

Chop Angle (degrees): Chop position angle in degrees with respect to the North. The telescope secondary mirror (M2) will chop along this direction on the sky. Angles are assumed positive from North to East. This value is defined between -180 and 180 degrees.

Chop Throw (arcsec): Distance between the two chop beams in arcseconds. The chop throw cannot be larger than 60 arcsec. This field cannot be left empty.

Nod Angle (degrees): Angle of nodding from North to nod position. The telescope axes will nod along this direction on the sky. To optimize the radiative offset correction, the nod and chop angles must have opposite orientations. Only nodding parallel to chopping is supported in the current semester, although in the future it may be possible to define the nodding perpendicular to chopping motion. Angles are assumed positive from North to East. This value is defined between -180 and 180 degrees. This field cannot be left empty.

Nod Throw (arcsec): Distance between the two nod beams in arcseconds. The nod and chop throws must have the same value. The nod throw cannot be larger than 60 arcsec. This field cannot be left empty.

Field of View Position Angle: This option is only available in imaging mode. The position angle is specified in degrees and indicates the angle of the detector vertical axis with respect to the North. Angles are assumed to be positive from North to East. By default the instrument field of view is assumed to have North up and East to the left. For instance, a value of 90 degrees means that the images will have West up and North to the left.

Image Quality (arcsec): Only in the case of CanariCam observations one can relax the image quality restrictions from the Phase-1, for each OB. It is not possible to select image quality requirements more stringent than those from the Phase-1. If no value is input in this field, the Phase-1 requirement will be adopted.

PWV (mm): Only in the case of CanariCam observations one can relax the Precipitable Water Vapor (PWV) restrictions from the Phase-1, for each OB. It is not possible to select PWV requirements more stringent than those from the Phase-1. If no value is input in this field, the Phase-1 requirement will be adopted.

Airmass Limit: This field is required only for CanariCam observing modes. If there is any airmass above which the observations would not be useful for science it must be stated here. If no value is input in this field, no airmass limitation will be assumed.

Slit Width: This option is only available in spectroscopy mode. A drop-down menu allows the selection of the slit width (in arcseconds) to be used for the observation. Only one slit per OB can be selected.

Slit Position: This option is only available in spectroscopy mode. Slit position angle in degrees with respect to the North. Angles are considered positive from North to East. If the observation must be performed with the slit along the parallactic angle, 999 should be introduced in this field.

2.2.2. Step-by-step definition of chop-nod configuration

The steps to the chop-nod and instrumental configuration are:

In imaging mode (see Figure 2.10):

1. Define Field of View position angle based on your object morphology.
2. Choose Chop Angle based on the object morphology and observing requirements.
3. Calculate Nod Angle = Chop Angle +/– 180, where the (+) sign must be used if Chop Angle is negative and the (-) sign must be used if Chop Angle is positive.
4. Choose Chop Throw based on the object morphology and observing requirements.
5. Nod Throw = Chop Throw.

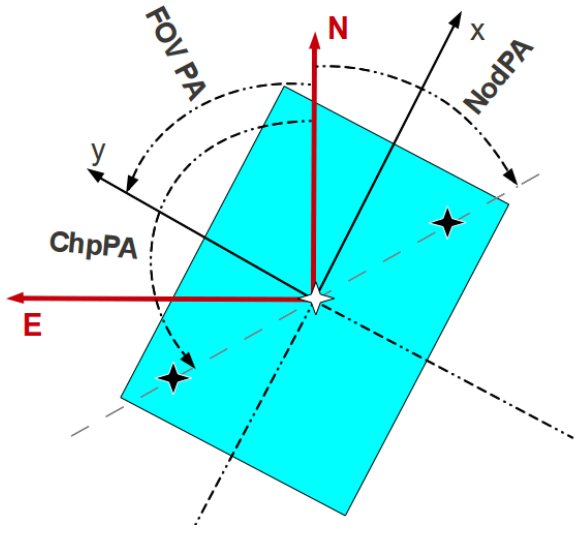

Figure 2.10: Relative orientation between FOV, chop and nod PA's in imaging mode. The sketch corresponds to chopping and nodding on chip. The white star represents the positive image of the source and black stars the negative images.

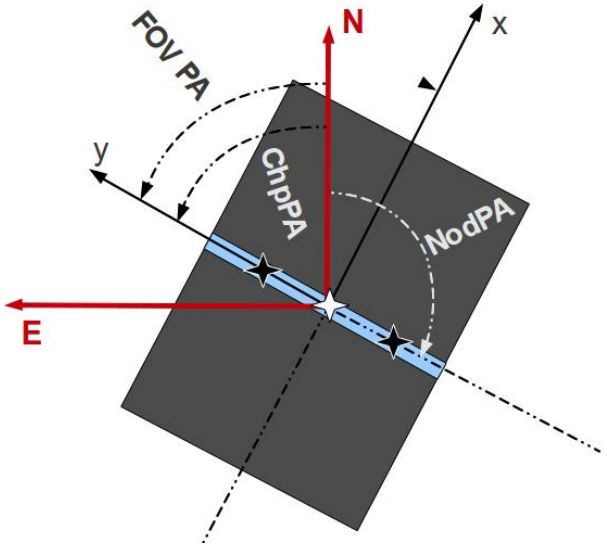

Figure 2.11: Relative orientation between FOV, chop and nod PA's in spectroscopy mode. The sketch corresponds to chopping and nodding on chip. The white star represents the positive image of the source and black stars the negative images.

In spectroscopy mode (See Figure 2.11):

1. Define Slit Position angle based on your object morphology.
2. Define Chop Angle = Slit Position Angle.
3. Calculate Nod Angle = Chop Angle +/– 180, where the (+) sign must be used if Chop Angle is negative and the (-) sign must be used if Chop Angle is positive.
4. Choose Chop Throw based on the object morphology and observing requirements.
5. Nod Throw = Chop Throw.

In the case of extended sources, it is recommendable that the chop and nod throw are at least 1.5 times the diameter of the source in the mid-IR, to avoid overlapping of the negative and positive images.

As example of imaging mode, let's assume that we want to observe an extended source that has a size of 10” by 5” with its larger dimension along a position angle of -30 degrees (see Figure 2.12). We define the FOV PA=-30 deg. We select this FOV orientation to do the chopping and nodding along the shortest dimension of the extended source, so that the optical aberrations due to M2 tilt while chopping are minimized. Since we are interested in doing on-chip imaging to use the negative images of the source, the chop and nod throws must be defined along the largest dimension of the detector. Therefore, the Chop PA=60 deg and the Nod PA= 60 – 180 = -120 degree, as illustrated in Figure 2.12). Finally, we select a Chop and Nod throw of 9” so that the negative images of the source are sufficiently far away from the positive image, but they are still within the detector FOV.

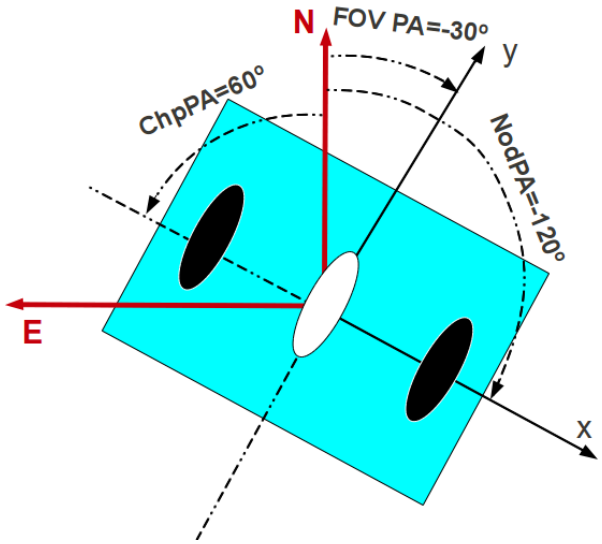

Figure 2.12: Example of angles definition in imaging mode of an extended (elliptical) source of 5"x10".

2.2.3. CanariCam Imaging

Besides the information described in Section 2.2.1, in the case of CanariCam imaging, an optional acquisition image for blind offset can be defined (Fig. 2.13). This can be useful when the science target is very weak so that the telescope is initially pointed and centered on a nearby bright reference source.

The fields to fill in for the acquisition image are the following:

Filter: Filter to be used for the acquisition image. This filter does not necessarily have to be the same as the filter(s) for the science observations.

On-Source time: Time on-source in seconds for the acquisition image. Note that there is an overhead factor of 2.7 between the on-source time and the total time, due to chopping and nodding duty cycles.

Blind offset: The offset in RA and DEC, in arcseconds, to be applied in order to center the faint science target. To enter the offset with the correct sign, please remember that the telescope will move from the bright reference target to the faint scientific target. It is important to bear in mind, that when the acquisition image for blind offset is selected, the coordinates in the target definition section shall be the ones of the bright reference source, not the ones of the science target.

Skip: Activate this box if no acquisition image for blind offset is required. If so, any value defined for the previous parameters will be neglected.

Figure 2.13: Form to define an acquisition image for blind offset in imaging mode. In this case the offset in RA and DEC are 10.1 and 7.23 arcsec, respectively. To enter the offset with the correct sign, please remember the telescope will move from the bright reference target to the faint scientific target. The flag "Skip" allows to activate, or de-activate this option.

Once telescope and instrument have been configured for acquisition, it is necessary to define the details of the actual observation. This is done by filling in one or more observing templates (Fig. 2.14). At least one observing template must be filled in for the OB to be valid. CanariCam imaging observing templates have the following fields:

Filter: The filter required for the observation is selectable using a drop-down menu. The menu shows all filters available in the current semester.

On-source time: Single image on-source time in seconds for the image. This time does not include the chop and nod duty cycle overhead, which is a factor of 2.7 (for a detailed description of the overheads see the appendix).

N repeats: Number of images to be taken in the template.

Offsets RA and DEC: The offsets between images in Right Ascension and Declination, expressed in arcseconds. Offset are given as a space-separated array. Within a template, each offset will be added to the previous one. Thus for instance the following sequence of three offsets 0 10 -10 will result in the first and third image to be taken at same position on the sky. If the requested number of images (N repeats) is greater than the number of offsets (or if no offsets at all are given) the telescope will reuse the last position as many times as needed. At the end of each template the telescope is sent back to the starting position.

Some examples of template definition are given in Fig. 2.15, 2.16, and 2.17.

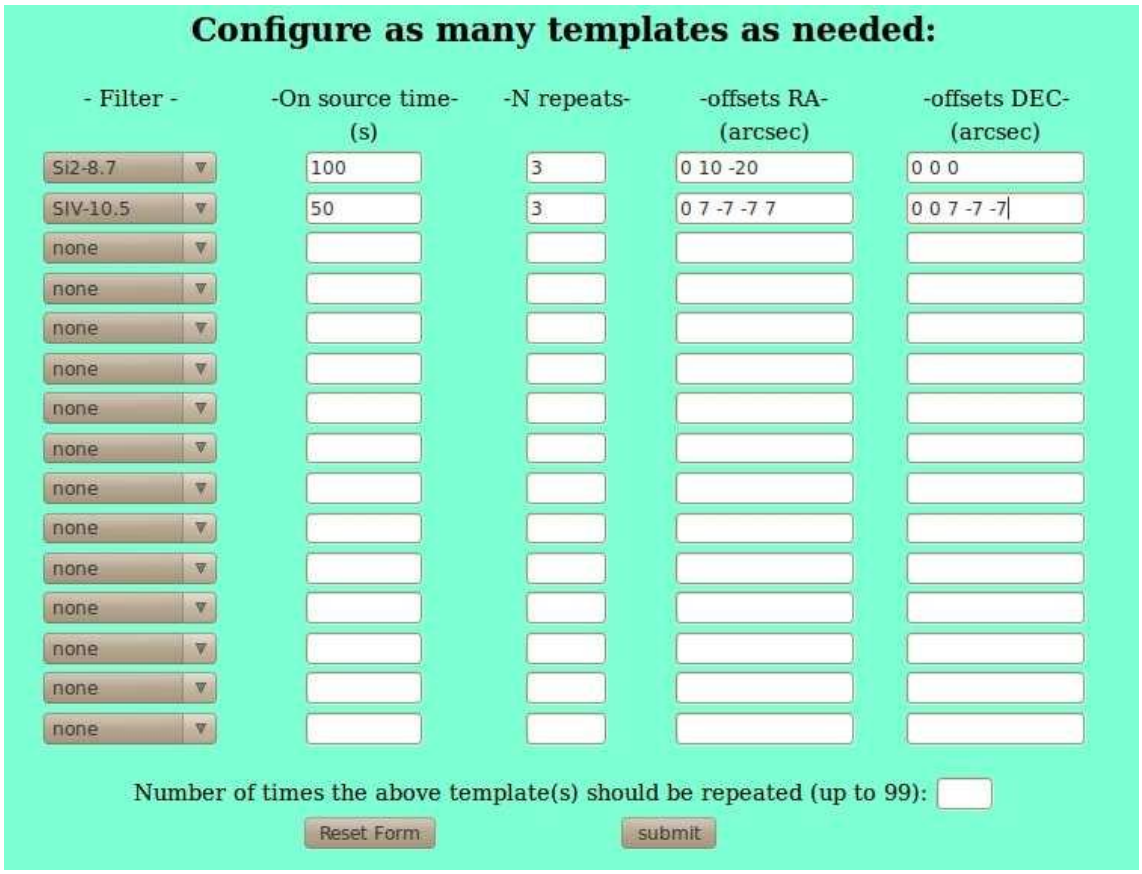

Figure 2.14: Observation templates definition page for CanariCam imaging.

At the bottom of the form there is one final parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, rather it is meant to allow the repetition of sequences of templates, for instance taking series of images alternating two filters.

Pressing the "Reset form" button at any time will clear all values from the form, including the fields for the target definition and the acquisition image for blind offset.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading an optional finding chart (Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a readme file with further information (Section 3.4).

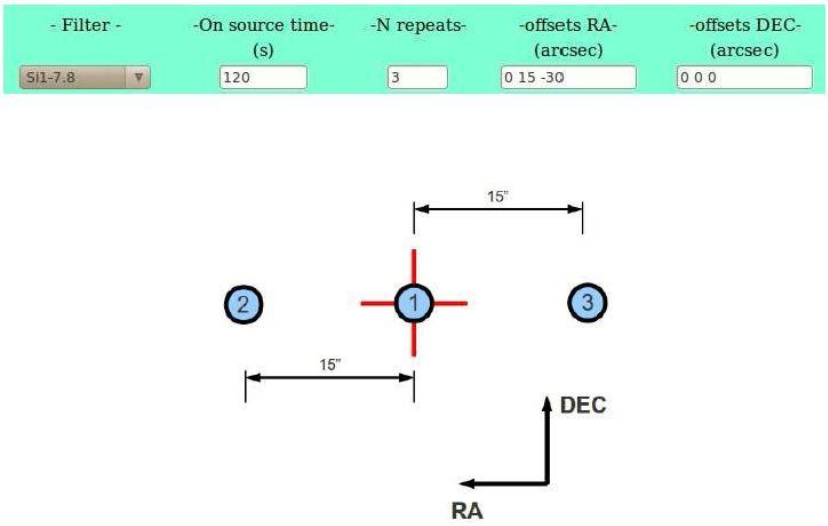

Figure 2.15: Correct configuration of a science template to take a series of three images in the Si-7.8 filter, with 2 minutes on-source time each, using a 3-step dither pattern along the RA axis, with an amplitude of 15 arcsec between positions. The sketch below shows the corresponding positions (blue points) where the images will be taken. The red cross represents the telescope pointing that in this case being 0,0 the first offset coincide with the position of the first exposure.

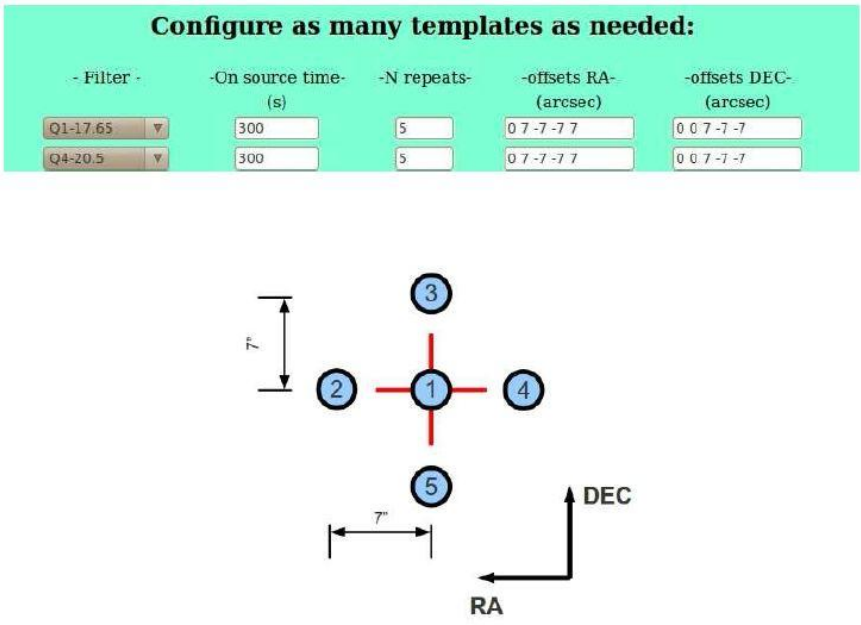

Figure 2.16: Example of configuration of two templates. The first is meant to take five images in the Q1-17.65 filter, each one with 5 minutes on-source time, using 5-step dither pattern in RA and DEC, with an amplitude of 7 arcsec between positions. The second template is meant to take another five images, with the same on-source time and dither pattern as in the previous template, using the filter Q4-20.5. Note that after the first template is completed the telescope is sent back to the preset position, thus the very same offset sequence is given in the two templates. Symbols are as in Fig. 2.15.

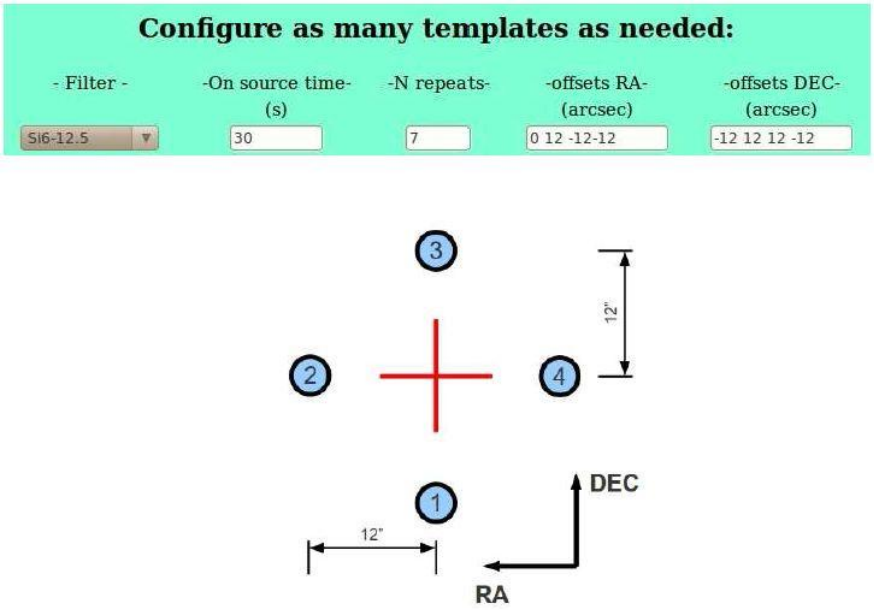

Figure 2.17: Example of correct configuration of a science template to take seven images in the Si6-12.5 filter, with 30 seconds on source time each, using a 4-step dither pattern, with an amplitude of 12 arcsec between positions. As only four offsets are given, images 4, 5, 6, and 7 are taken at the same position.

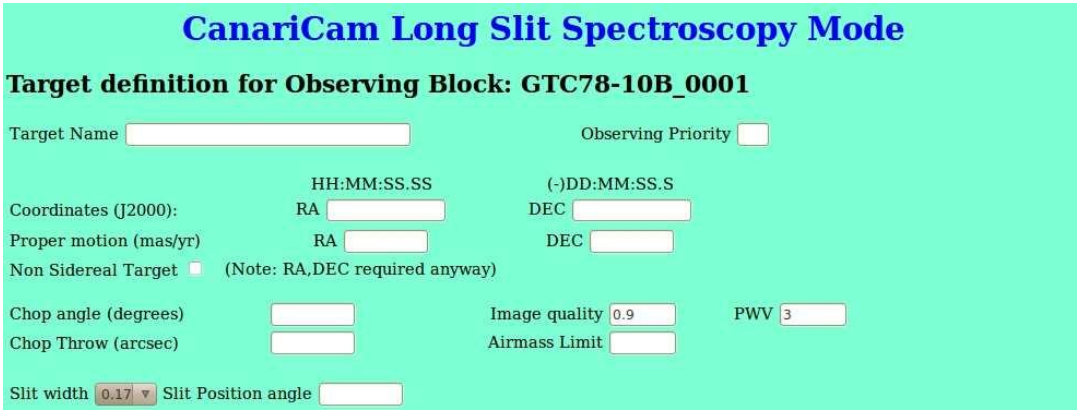

Figure 2.18: Parameters for target definition in the case of CanariCam spectroscopy mode. Note the presence of the fields to select the slit width and angle.

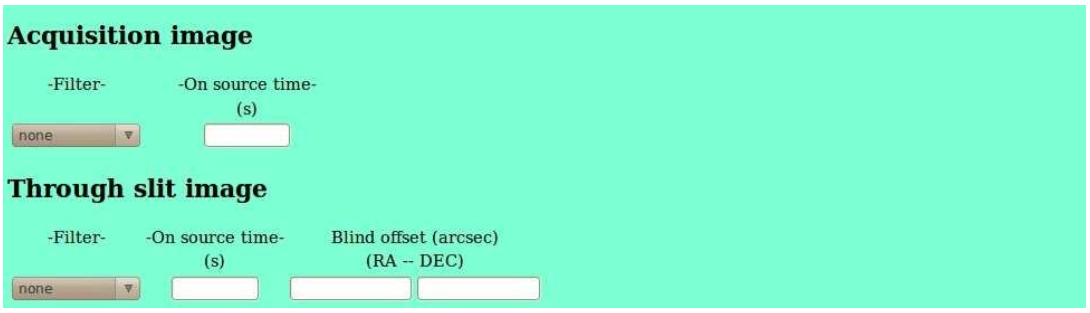

Figure 2.19: Acquisition and through-slit image for CanariCam spectroscopy.

2.2.4. CanariCam Spectroscopy

The form for preparing CanariCam spectroscopic mode OBs are very similar to the one for imaging mode. In the upper part you enter the general information described in Section 2.2.1, additionally you select the slit width and the position angle, in degrees from North toward East, (Fig. 2.18). These values will apply to the whole OB.

In the mid-section you define the acquisition image and the through slit image (Fig. 2.19). Both are mandatory and cannot be skipped. The following fields shall be filled in.

The fields to fill in for the acquisition image are the following:

Filter: Filter used for the acquisition image.

On-source time: On-source time in seconds for the acquisition image.

And similarly for the through-slit image:

Filter: Filter used for the through-slit image, which can be different from the one used for acquisition.

On-source time: On-source time in seconds for the through-slit image.

Blind offset: Optionally after the through slit image you can specify a blind offset in arcsec. To enter the blind offset with the correct sign keep in mind that the telescope will move from the bright reference target, to the faint scientific target. Also, note that the coordinate given in section 2.2.1 should be the one of the bright reference target used for acquisition.

Once telescope and instrument have been configured for acquisition, it is necessary to fill in the details of the actual observation. This is done by defining observing templates (Fig. 2.20). It is necessary to define at least one observing template for the OB to be valid. CanariCam spectroscopy observing templates have the following fields:

Grating: Grating to be used for the observation. At present there is only one choice.

On-source time: Single spectrum on-source time in seconds. This time does not include the chop and nod duty cycle overhead, which for spectroscopy is a factor of 3.1 (for a detailed description of the overheads see the Appendix.) We stress that the exposure time to be given here is the on-source time. All the additional overheads will be automatically computed by the phase-2 tool (and shown in the summary page). See the appendix for a complete list of the overheads associated to CanariCam observations.

N repeats: number of times the exposure should be repeated.

Offsets: The offsets between spectra along the slit, expressed in arcseconds. Note that these offsets refer to the creation of a dithering pattern, not to the nodding. Offset values are given as a space-separated array. Within a template, each offset will be added to the previous one. If the requested number of spectra (N repeats) is greater than the number of offsets (or if no offsets at all are given) the telescope will remain in the last position as many times as needed. At the end of each template, the telescope is sent back to the starting position.

At the bottom of the form there is one final parameter to be defined:

Number of times the templates should be repeated: This refers to the number of repetitions of all the templates within the OB. It is important to understand that this parameter is not meant to repeat the full OB, rather it is meant to allow the repetition of sequences of templates, for instance taking series of images alternating two filters.

Submit: Once you are happy with the values that you have filled, the submit button takes you to the next page in the Phase-2 completion process. The next steps consist of uploading an optional finding chart (Section 2.3), uploading an ephemeris file in the case of non-sidereal targets (Section 2.4) and filling in a readme file with further information (Section 3.3).

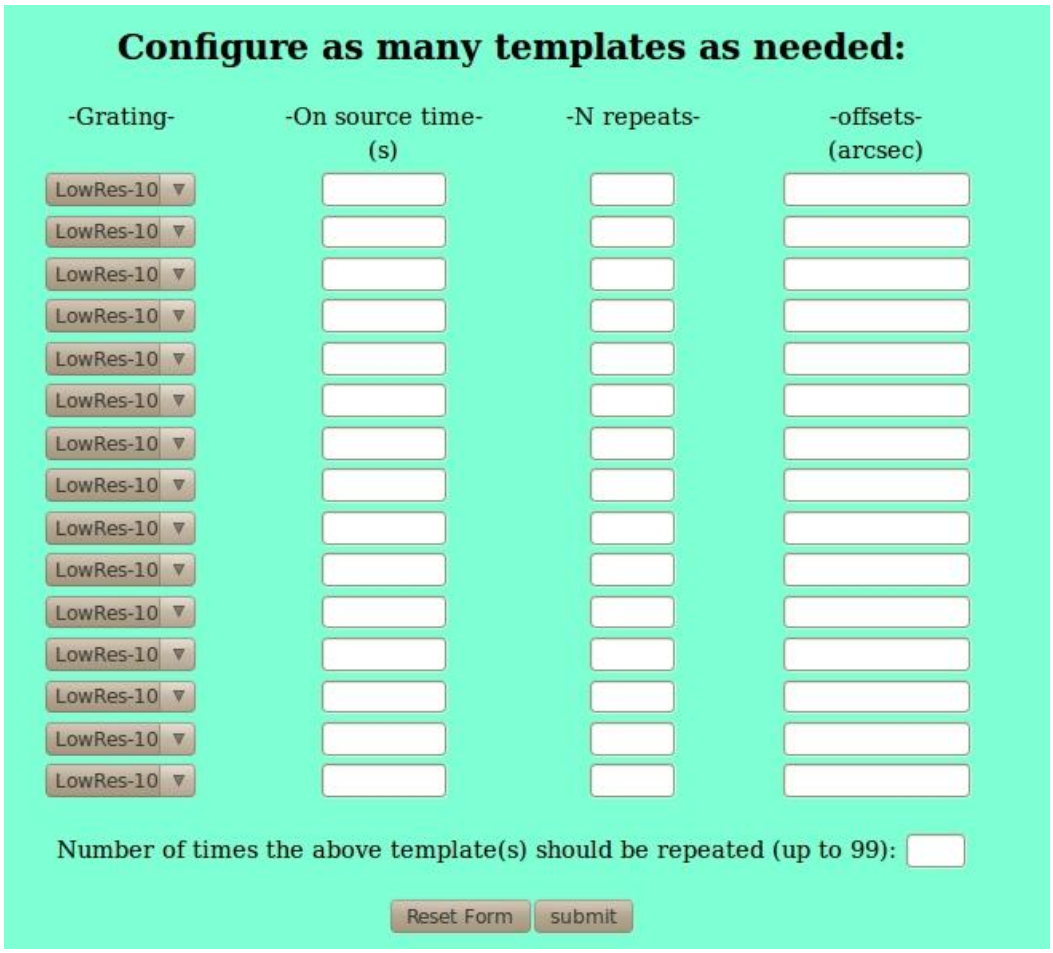

Figure 2.20: Observation templates definition page for CanariCam spectroscopy.

2.3. Uploading a finding chart

The finding chart is always required for Osiris observations, even for non-sidereal targets, and must be in JPEG or GIF format with a maximum size of 1 Mb. The finding chart is optional for CanariCam observations, due to its small FOV.

Please, bear in mind that the astronomer that is going to perform the observations is likely not to be familiar with the target regions. Hence, the following information must be clearly indicated in the finding chart, to facilitate the work at the telescope:

- The target(s) must be clearly marked (but not covered by the marking sign).
- In case of spectroscopic observations it is helpful to indicate the slit orientation.
- The orientation of the field must be clearly marked, e.g. using a compass indicating North and East or using a coordinate grid.
- The size of the field of view (or the scale of the figure) must be indicated. It is important that the FOV is large enough (e.g. a minimum of 4x4 arcmin) to contain enough stars to be easily recognizable in the acquisition images with OSIRIS. If a detailed view of the target is needed (e.g. because it may have a complex morphology), for instance, to center the target on a slit, a zoom into the target with much smaller FOV can also be very helpful. This zoomed image of the field can be added as an inset in the main chart, or a single composite chart may be created using different zooms. In the case of spectroscopic observations, a graphical representation of the slit overlaid on the FOV image can also be of great help. In general, any graphical information that facilitates the identification of the field is much appreciated.
- The filter in which the image was taken should be indicated. Keep in mind that objects might have very different luminosities in different bands, thus the ideal option is to try match the finding chart to the filter of the acquisition image.

While the finding chart can be attached to the OB at any time, the OB is not considered complete until a finding chart has been uploaded. Incomplete OBs are shown in red in the list of existing OBs. We do understand that in some cases it makes no sense to prepare a finding chart, for instance for moving objects or very bright stars. The Phase-2 tool will allow you to submit to GTC incomplete OBs and the support astronomer will decide whether this is OK.

Once the finding chart has been successfully uploaded, the OB is complete and you have the opportunity to go back to the summary page where you can start a new OB or modify an existing one.

2.4. Uploading the ephemerides file

According to whether the non-sidereal flag is ON, to complete an OB you need to upload a file of ephemerides. At the time of writing GTC does not support non-sidereal tracking, so the possibility of observing moving ob jects is not offered yet. However, just for reference, lists can be in any format as long as the coordinates of the target during the observing season are clearly provided. The file must be a plain text file.

3. Managing the observing blocks

Every time an OB is created it is permanently stored on the GTC server, thus no files will be created on your machine. The Phase-2 summary page will be modified to reflect the existence of the OB(s), displaying a table listing certain observational parameters specific of each OB (Fig. 3.1). From the proposal summary page it is also possible to perform certain actions: to modify and inspect an OB, to

duplicate an OB and to delete an OB. These actions are described in more detail in the following sections. Finally, a README file with further information about the whole proposal can also be accessed from the proposal summary page.

Existing Observing Blocks (Total Used Time: 3.44 hours)
(Incomplete Observing blocks shown in red)

	Num.	Target	RA	DEC	Mode	Filters	FC	non-Sid	Ephem	Length (s)	Priority	IQ	PWV	Executed
○	0001	NGC1068	02:42:40.77	-00:00:47.8	canaricam_IMA	Q1-17.65,Q4-20.5	N/A	no	no	1537	1	0.9	3	-
○	0002	HD16212_Phot_NGC1068	02:36:00.05	-07:49:53.6	canaricam_IMA	Q1-17.65,Q4-20.5	N/A	no	no	862	1	0.9	3	-
○	0003	HD10550_PSF_NGC1068	01:42:43.51	-03:41:24.6	canaricam_IMA	Q1-17.65,Q4-20.5	N/A	no	no	862	1	0.9	3	-
○	0004	HD36167_Phot_BN_KL_Object	05:29:43.98	-01:05:32.0	canaricam_IMA	PAH1-8.6,Si6-12.5	N/A	no	no	754	1	0.9	3	-
○	0005	BN_KL_Object	05:35:14.11	-05:22:22.9	canaricam_IMA	PAH1-8.6,Si6-12.5	N/A	no	no	3940	1	0.9	5	-
○	0006	NGC7027	21:07:01.59	42:14:10.1	canaricam_SPE	LowRes-10	N/A	no	no	3214	1	1	5	-
○	0007	HD197989_Tel_NGC7027	20:46:12.68	33:58:12.9	canaricam_SPE	LowRes-10	N/A	no	no	1230	1	1	5	-

Figure 3.1: The bottom part of the phase-2 summary page as it appears after a number of OBs have been created.

3.1. The OB summary table

The first line of information that appears in the summary is the total time used in all OBs, including overheads (see Fig. 3.1). If this time exceeds the granted time, a warning message will appear. The summary table shows the following parameters for each block:

- **Column 1**: OB identification number. The tool attempts to create a sequential list, filling the gaps that may result from deleting OBs. However, it is irrelevant whether the list is sequential or not.
- **Column 2**: Target name.
- **Column 3**: Right ascension (HH:MM:SS.SS)
- **Column 4**: Declination (DD:MM:SS.S)
- **Column 5**: A short string specifying the observing mode, with the following (obvious) meaning:
  Osiris Broad Band Imaging = osiris BB
  Osiris Multi-object Spectroscopy = osiris MOS
  Osiris Long-Slit Spectroscopy = osiris LSS
  Osiris Tunable-Filter Imaging = osiris TF
  Osiris Tunable-Filter Scan = osiris TFscan
  CanariCam Imaging = canaricam IMA

CanariCam Spectroscopy = canaricam SPE

- **Column 6**: Basic observing instrument configuration information (filters/grisms)
- **Column 7**: Flag showing if a finding chart (FC) has been provided. N/A stands for "not applicable", which can only occur with CanariCam, where the finding chart is optional.
- **Column 8**: Flag showing whether the target is non-siderial, or not.
- **Column 9**: Flag showing whether a text file with ephemeris has been provided in the case of non-sidereal targets.
- **Column 10**: Length of the OB in seconds, including all overheads (see the Appendix for a detailed description of the overheads).
- **Column 11**: The user defined priority of the observation.
- **Column 12**: Image Quality (IQ) requirement in arcseconds for the OB. This is only applicable to CanariCam observations where the requirements from the Phase-1 can be relaxed due to the wide variation in conditions that can occur between the 10 and 20-micron windows. In the case of Osiris observations this cell will be filled with a - minus sign.
- **Column 13**: Precipitable water vapor (PWV) requirement in millimeters for the OB. This is only applicable to CanariCam observations where the requirements from the Phase-1 can be relaxed due to the wide variation in conditions that can occur between the 10 and 20-micron windows. In the case of Osiris observations this cell will be filled with a - minus sign.
- **Column 14**: Flag indicating if an OB has been executed or not. This cell will be filled with four possible values:
  "-" indicating the OB has not yet been observed.
  "P.Q.C." meaning data have been taken and are Pending Quality Control.
  "YES" meaning the OB has been successfully completed and delivered to the PI.
  "A.D." meaning the OB was executed out of specifications and data have not passed quality control. The obtained frames, however, have been delivered to the PI as Additionl Data. OB marked like this are still in the observing queue and if possible the OB will be repeated.

3.2. Inspect or Modify OBs

At any time you can inspect or modify your OBs. This is done through the same interface used to create a new OB. Please keep in mind that changes are stored only after hitting the Apply Changes button. You can use the back button of your web browser to simply inspect an OB without making any changes. If changes are applied, it is not necessary to upload again the finding chart, if you had already uploaded one. You can decide whether to retain the existing one or change it. The same is true for the file of ephemeris. If either the finding chart or the ephemeris text file has changed, you should make sure that the browser is not displaying an old version of them from the local cache. In this case you may think the files have not been uploaded when they have actually been uploaded.

3.2.1. Duplicate an existing OB

This button allows you to duplicate an OB by filling the box with the full OB number, i.e. including all leading zeros (e.g. 0007). The number assigned to the newly created OB will be the smaller available, that is to say that if there is a gap in the number list, it will be filled.

3.2.2. Delete an OB

This button allows you to delete an OB (removing also the finding chart and ephemerides file from the server, if they were included). To minimize the risk of accidentally deleting an OB, it is necessary to write down explicitly the full OB number to be deleted, i.e. including all leading zeros (e.g. 0003), and then you will be asked to confirm the deletion.

3.3. The README file

The final step in order to complete the Phase-2 is to prepare a README file with additional information. This file is accessed by clicking on the Fill/Modify README file button from the summary page. Note that the README file is very important for the night astronomer to understand the purpose, method and objective of the observations. Also bear in mind that most probably the astronomer executing the observations will not be your contact support astronomer for the Phase-2 preparation, with who you may have discussed all the details of your observations. It is in the README file where you have the opportunity to directly instruct the astronomer who is going to actually execute the observations. Hence, the README file is the place where you can give all the information that you think may be helpful and relevant to the successful completion of the observations. Please prepare the README file with great care, fully describing any non-standard actions that the astronomer has to take during observations. Also bear in mind that this is not the place to repeat what you had already written in the original Phase-1 application. The README file is thought to include information relevant to the observations like, for instance, if there is a very bright star nearby the science target that you want to place outside the field of view, or that a certain instrument position angle should be avoided to prevent charge bleeding from a bright target to affect your science target, etc.

The README file is divided in four main parts:

1. **Are observations time critical?** If your observations can be executed successfully at any time during the semester, then answer NO to this question and leave this section empty. Otherwise, answer YES and highlight all the time critical aspects of your observations. For instance, that you want to monitor a variable source and only one of your OBs should be executed every week. Or that you are interested in observing an eclipsing binary star during the eclipse, so that only certain dates are useful, also including in this section the list of useful dates. Or that your observations must be executed at the same time as other telescope or satellite is observing the same target, also in this case you must provide a list of useful dates. etc.
2. **Are targets non-sidereal?** If at least one of your targets is a Solar System moving object you must answer YES to this question. That is to say, at least one OB has an ephemeris file attached to it. Please include here whatever information you think will be useful for the night astronomer to know. If there are not non-sidereal targets at all in your proposal, the answer to this question shall be NO.
3. **Are special calibrations required?** As part of the normal observing procedure in queue-observing mode, whenever possible, the observatory will take a number of standard

calibrations for the general use of programs that are executed during the night. These standard calibrations are summarized in the following list:

- Photometric standard star with Osiris in broad-band imaging mode, in the Sloan filters (u, g, r, i and z), in the standard readout mode for imaging, i.e. readout speed 200KHz and binning 2x2. Note that this standard may not necessarily be close (similar coordinates) to any of the science targets observed during the night. The standard star will be placed at the standard pointing position for imaging mode.
- Spectrophotometric standard star observations with Osiris in long-slit spectroscopy mode for any grisms used during the night, using the 2.5 arcsec slit, and using the standard detector readout mode for spectroscopy, i.e. readout speed 100KHz and binning 2x2. Note that this standard may not necessarily be close (similar coordinates) to any of the science targets observed during the night. The standard star will be placed at the standard pointing position for long-slit spectroscopic mode.
- Osiris bias using the standard detector readout mode for imaging and/or spectroscopy.
- Sky flats with Osiris in broad-band imaging mode, in the Sloan filters (u, g, r, i and z), in the standard readout mode for imaging. If for some reasons (i.e. bad weather conditions at twilight) the sky flats series cannot be obtained, a series of sky flats from the previous/next days will be provided.
- Dome flats for narrow-band imaging mode when using Order Sorter filters for OSIRIS tunable filter. When possible, a sky flat series will be also attempted, but this is not ensured.
- Arc lamps spectra with Osiris in long-slit spectroscopy mode for any grisms/slit combination used during the night, and using the standard detector readout mode for spectroscopy.
- Dome flats for tunable-filter imaging or tunable-filter scan observations with Osiris, using the standard readout mode for imaging.
- Mid-IR standard star observations with CanariCam in imaging mode, with the Si5-11.6 and Q1-17.65 filters. Note that this standard may not necessarily be close to any of the science targets observed during the night.

You can answer NO to the above question if the standard calibrations serve your purpose.

Other night-time calibrations will have to be explicitly defined as observing blocks and the time will be charged to the observing program. Since in these cases the observations are already defined as OBs you may still answer NO to the above question in the README file, for instance in cases like:

- Osiris photometric and spectro-photometric standard stars calibrations with non-standard readout speed and/or binning.
- Spectro-photometric standard star observations for tunable-filter imaging or tunable-filter scan observations with Osiris, using the standard readout mode for imaging.
- Mid-IR standard star observations with CanariCam in imaging mode with any filter other than the Si5-11.6 and Q1-17.65.
- Mid-IR standard star observations with CanariCam in spectroscopy mode.

If your program requires any calibrations that are not standard and cannot be defined as OBs, the answer to the question must be YES and you can provide a description of what you need. Some examples are:

- Any Osiris calibration frames (bias, arcs, flat fields) taken with non-standard binning and/or reaout speed.
- Osiris dark exposures.
- Osiris observations in imaging mode with a window using only a small area of the detector.
- Especially large series of bias or flat field exposures.
- Specific calibration targets or calibrations that are required at a specific moment during the night. In this case, it is also necessary to define the calibrations as OBs.

We finally note that in classical visitor mode the PI is responsible for defining all necessary calibrations.

4. **Description.** In this final section you describe all those aspects of the observations that did not find place in the previous sections. Again, bear in mind that this is what the night astronomer will have available at the time of observing so clearly highlight everything you feel is important for her/him to know. For instance if you want the OBs to be executed in a specific order following a sequence, or something similar, it should be declared/clarified here. Also comments like "please before moving to target YYY complete all blocks relative to target XXX" are very useful to achieve the desired science.

The Phase-2 tool allows to save preliminary version of the README file, coming back to modify it as many time as needed hitting the Fill/Modify README file button at the bottom part of the Phase-2 summary page.

3.4. Submitting the Phase 2 to GTC science operation

Once you are satisfied with your OBs and the README file, you are ready to submit the Phase-2 to GTC science operation and close the Phase-2 process. This is done in two steps, first click on the Fill/Modify README file button that is at the bottom of the Phase-2 summary page. Then, at the bottom of the README file form select the option "Save readme" and SUBMIT Phase-2 to GTC Science Operations, and then press "Continue". Once you close the Phase-2 process the proposal will be locked and no further changes will be possible.

For your convenience, the Phase-2 tool allows inspection of the OBs of locked proposal at any time, but no changes will be made on the GTC database. If you realize that you really need to modify an already completed Phase-2, or you have closed it by mistake, you have to contact your support astronomer that will provide to unlock it.

This last phase of locking the proposal triggers an assessment of the OBs by GRANTECAN personnel, and only when the OBs are verified then observations will be scheduled for their execution.

APPENDIX

A.1 OSIRIS Overheads.

Each observation has associated some fixed overheads that cannot be avoided. Because of that, the user must be aware that certain actions might "cost" a lot in terms of time compared to others. Users are encouraged to minimize the overheads charged to their project. In particular, the use of non-standard readout mode and binning implies that the observatory will have to take, for instance, photometric standards in that particular setup. This time will be charged to the project, while standard calibrations are taken free of charge.

In the case of Osiris the Phase-2 preparation tool will include the following overheads:

- Ten minutes are charged to all OSIRIS observing blocks for telescope presetting, focusing, and target acquisition.
- Two minutes for each setup of OSIRIS (for instance to change a filter or a mask).
- Ten seconds for each telescope offset.
- For imaging with the Tunable Filters, 10 additional minutes are charged for filter wavelength calibration.
- The overhead charged for each exposure according to CCD readout speed and binning is given in the following table:

Speed	***Binning***	***Time***
200 kHz	2X2	24 seconds (default for imaging)
200 kHz	2X1	39 seconds
200 kHz	1X1	58 seconds
100 kHz	2X2	42 seconds (default for spectroscopy)
100 kHz	2X1	73 seconds
100 kHz	1X1	106 seconds

As an example, Fig. A.1 shows a possible OB for OSIRIS LSS mode, asking for an acquisition image, through slit image, blind offset, and 7 exposures. The total duration of this OB is:

pointing	600 sec
setup acquisition image	120 sec
exptime acq. image	15 sec
readout acquisition	24 sec
Setup through slit image	120 sec
exptime through slit	15 sec
readout through slit	24 sec
blind offset	10 sec
setup first template	120 sec
(exptime+readout)*nexp	(100+42)*3
offsets	10*3
setup second template	120 sec

(exptime+readout)*nexp	(700+42)*4
offsets	10*4
---	---
Total duration	4632 seconds.

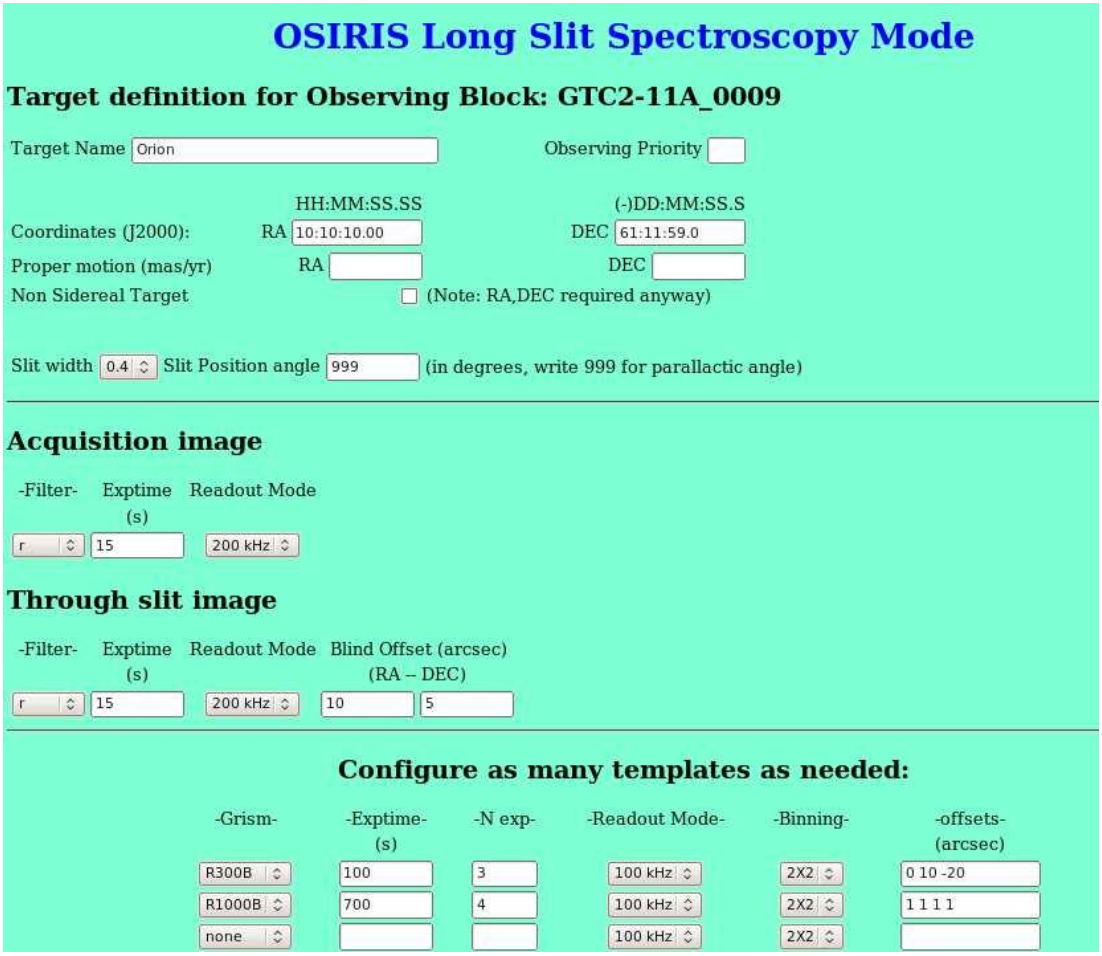

Figure A.1: Example of OSIRIS spectroscopy OB

A.2 CanariCam overheads

Each observation has associated some fixed overheads that cannot be avoided. CanariCam has particularly high overheads due to the intrinsic nature of mid-infrared observations. Users are encouraged to minimize the overheads charged to their project. In the case of CanariCam the Phase-2 preparation tool will include the following overheads:

All CanariCam imaging mode observing blocks are charged 10 minutes for telescope presetting, focusing, and target acquisition.

All CanariCam long-slit spectroscopy mode observing blocks are charged 15 minutes for telescope presetting, focusing, and target acquisition.

For each instrument setup 30 seconds are charged (for instance to change a filter). Ten seconds are charged for each telescope offset.

The time-loss factor in imaging mode is 2.7 times. That is, to integrate 1 minute on source, the total observing time needed is 2.7 minutes.

The time-loss factor in spectroscopy mode is 3.1. That is, to integrate 1 minute on source, the total observing time needed is 3.1 minutes.

As an example, Fig. A.2 shows a possible OB for CanariCam imaging mode, asking for an acquisition image and blind offset, and 7 exposures. The duration of this OB is:

pointing	600 sec
setup acquisition image	30 sec
exptime acq. image	30*2.7 sec
blind offset	10 sec
setup first template	30 sec
exptime*nexp	200*2.7*3 sec
offsets	10*3 sec
setup second template	30 sec
exptime*nexp	100*2.7*4 sec
offsets	10*4 sec
---	---
Total duration	3551 seconds

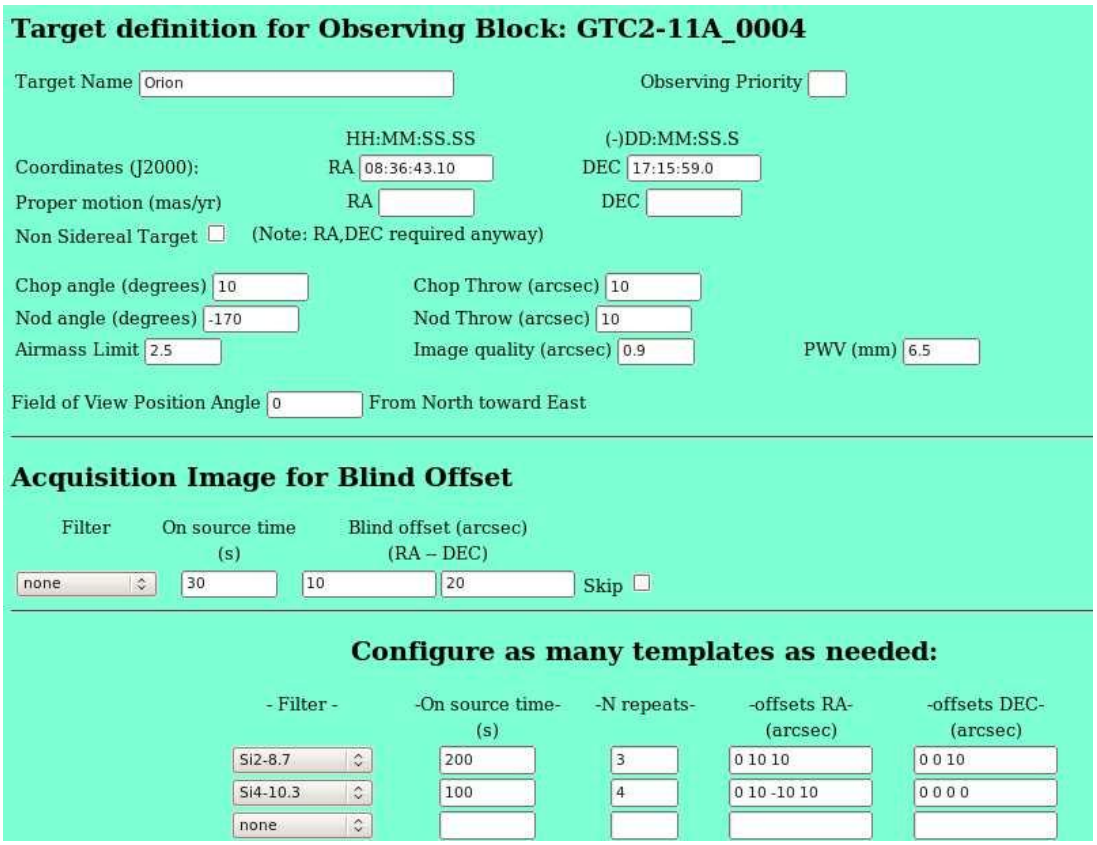

Figure A.2: Example of CanariCam imaging mode observations used for computing the OBs total duration.