


# Observation Tool User Manual

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## Document Change Log

Version	Date	Chapters affected	Comments
Issue 1.0 draft0	01.06.2015	All	Initial draft
Issue 2.0 draft1	22.06.2015	6	OB Panel & Dither pattern changes
Issue 3.0 draft2	07.12.2022	All	PANIC Update Commissioning
Issue 4.0 draft3	06.02.2024	All	OT new functionality and upgrade
Version 1.0	28.10.2024	All	Release of Version 1.0


## List of acronyms and abbreviations

CAHA	Centro Astronómico Hispano en Andalucía
IAA	Instituto de Astrofísica de Andalucía
JDK	Java Development Kit
JRE	Java Runtime Environment
GEIRS	Generic InfraRed camera Software
MPIA	Max-Planck-Institut für Astronomie
O2K	Omega 2000
OB	Observing Block
OP	Observing Program
OS	Observing Sequence
OT	Observation Tool
PANIC	<b>P</b> Anoramic <b>N</b> ear Infrared camera for <b>C</b> alar Alto
PAPI	PAnic Pipeline
TCP	Transmission Control Protocol
QL	QuickLook

## List of supporting documents


The following documents provide additional information about topics addressed in this document. They are referenced as RDx in the text:

RD Nr.	Doc. Title and Issue
RD 1	PANIC-GEN-SP-03 Sky Flatfield procedure Issue: 1.0, Date: 18.03.2015

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## 1 INTRODUCTION AND SCOPE

The PANIC Observation Tool (OT) is the software that will be used for detailed definition and pre-planning of the observations using PANIC. This software allows users to specify the observations in a user-friendly way, avoiding remembering large commands or building complicated scripts. The OT is also the high-level interface for on-site (visitor and staff) observations.

The OT controls PANIC and the telescope using GEIRS commands. GEIRS is the low-level software that implements the instrument control and detectors readout.

The philosophy of the OT is to hide the complexity of the instrument and telescope control systems to the astronomer, as well as to allow the support astronomer to optimize the night time arranging distinct observing blocks and programs. It also permits to check the OT observing plan integrity.

The OT provides a set of predefined templates that implements the most common types of IR observations. They permit to create quickly observing programs, just indicating the target, the filters and the exposure time. The astronomer can also build his/her own observation template. When an observation is going to be executed, the OT translates the observing blocks to the corresponding GEIRS commands, providing a higher abstraction level to users, who use a friendly graphic interface instead of scripts or complex commands with a large list of arguments.

To manage easily the observing programs, the OT shows the main entities as a tree in the left side of the screen (Figure 4). The information is displayed in the right part of the screen when an element is selected in the tree. The main entities of the OT are going to be described deeply in chapter 6.

## 2 REQUIREMENTS AND SUPPORTED PLATFORMS

The OT is implemented in Java, due to this development, it can be used in any platform that has installed Java Runtime Environment Version 7.0 or higher (for design/edit purposes). You can download the latest java version from <http://www.java.com/en/download/manual.jsp>


At Observatory, to execute an observing program, the OT only can be launched from the corresponding panic machines: panic22.caha.es and panic35.caha.es, both of them openSuSE 15.5 x86\_64 Linux OS.

The GEIRS package is indispensable in order to execute an observing program.

## 3 DOWNLOAD

The latest stable version of OT can be downloaded from PANIC website [here](#).

You have to download only one file: PANIC\_OT.jar This is a crossplatform java package that contains itself all the files that the tool needs. Ready to be run.

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## 4 OT INTERFACES

### 4.1 GEIRS

The OT controls the instrument and telescope through GEIRS commands. GEIRS has to be running and configured properly in the same PANIC computer as the OT in order to execute observing programs.

GEIRS provides a Command Server listening at TCP port 8501 that establish this interface.

It is very useful to have opened the `Display` and `Instrument Shell` windows of GEIRS in order to view the exposures that are being taken and the commands that are arriving from the OT.

### 4.2 QuickLook-PAPI

The PANIC QuickLook (QL) and PipeLine (PAPI) can reduce the data taken using the OT. The interface between the OT and QL/PAPI is defined through the FITS headers of the images taken. The OT inserts special headers into the images generated that are interpreted by QL/PAPI.

## 5 RUNNING OT

### 5.1 Running OT for design/edit

You can launch the OT for design/edit purposes from any computer with Java™ SE Runtime Environment 1.7.0 or higher installed. As a java crossplatform application, you can use any operating system Java compatible. You can determine in your computer which version of Java is the default by typing in a Terminal: `java -version`

#### *Running OT from command line (all Operating Systems)*


To run the OT from the command line, you can type the following at the directory where the PANIC\_OT.jar file is: `java -jar PANIC_OT.jar`

Note for Mac OS X users: When launching a Java application through the command line, the system uses the default JDK. It is possible for the version of the JRE to be different than the version of the JDK.

#### *Running OT by double click (only Windows and Mac OS X)*

Another option to run the OT is double clicking in the PANIC\_OT.jar file. Only available from Windows and Mac OS X operating systems.

#### *Running OT at PANIC computers*

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At Observatory, using the PANIC computers (panic22 and panic35) you can run the OT by typing `start_ot.sh` on any Terminal, this is a script included in the path.

## 5.2 Running OT for execution

To run an observing program for execution, you have to launch the OT from one of the PANIC computers (panic22 or panic35) depending the telescope you are using.

Typing `start_ot.sh` on any Terminal you can launch the OT.

The OT detects automatically the PANIC computers, and enables the option to run observing programs.

GEIRS must be running in the same computer we are going to execute an observing program from the OT.

Note: It is possible to run various instances of the OT at the same time, for example, one to edit and another one to execute a program. But you have to be aware do not open the same .xml file, and do not run two observing programs at the same time!!

## 5.3 OT initial window

The initial window that OT shows when it is started is presented at Figure 1.

The OT manages Observing Programs (OP), only one can be loaded at the same time.

In this initial window you have the option to create a new observing program by selecting “New Program” or to open an existing one already created by selecting “Open Existing Program”. You also have the option to exit the OT, by clicking in “Exit”.

### *New Program*

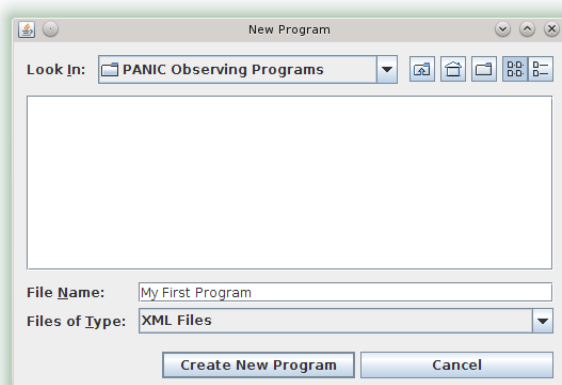
Selecting “New Program” in the initial window, a dialog box (Figure 2) is opened in which we can navigate to look for the directory or create a new one, and specify a name for our new observing program. The extension ‘.xml’ is automatically added to the file name introduced.

Clicking in “Create New Program” an empty observing program is created with the name specified into the directory indicated.

**Figure 1: OT initial window**



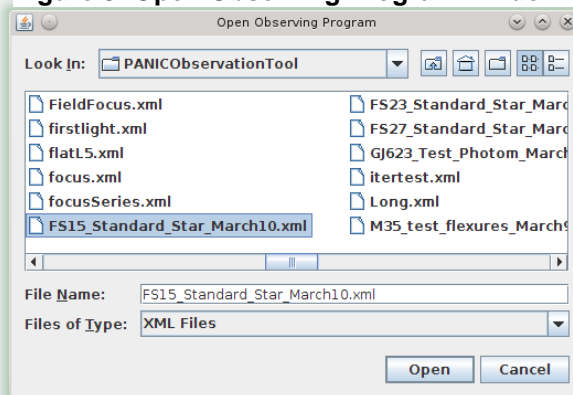
**Figure 2: New program window**



### Open Existing Program

Selecting “Open Observing Program” in the initial window, a dialog box (Figure 3) is opened in which we can navigate to look for the .xml file with the observing program we want to open. By clicking “Open” the OT loads the observing program indicated.

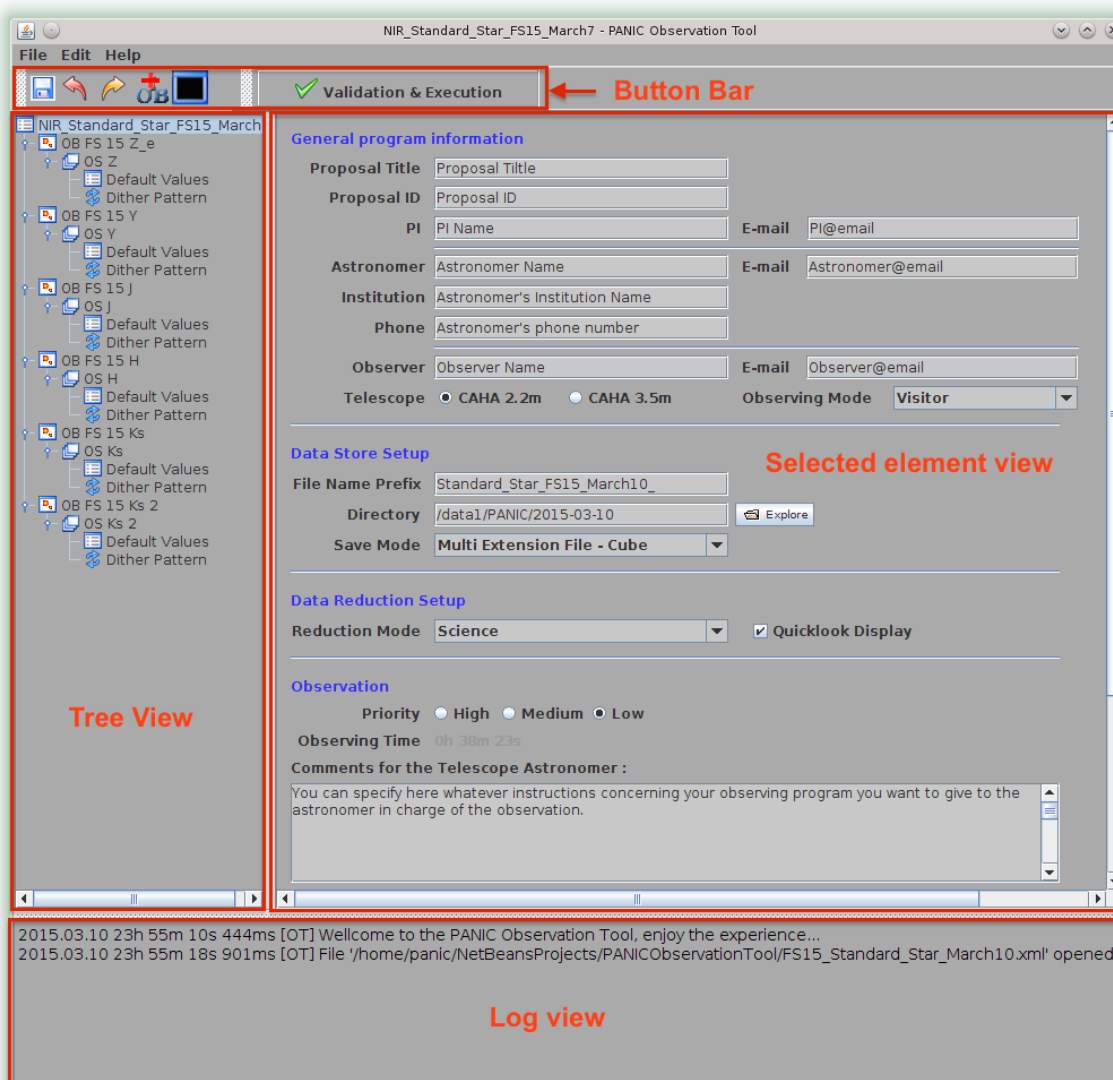
**Figure 3: Open Observing Program window**




## 5.4 OT application window

In the OT window we can distinguish four different parts (Figure 4): Button Bar, Tree View, Selected element view and Log view.

**Figure 4: OT Window**





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## 5.4.1 Button bar

**Figure 5: Button bar**



The button bar (Figure 5) allow quick access to the most common task during OT execution:

### *Save*

Save the current observing program we are working with. The program name is already specified, because the OT always needs it for normal operation. If we are creating a new observing program, is mandatory to specify the program name in the first step, just before design it.

### *Undo*

Reverse the last one or more edits we have introduce.

### *Redo*

To do over again the last edit we have introduced.

### *Add Observing Block*

This button allows us to add a new Observing Block to the Observing Program we are creating. Another way to add an OB, is right clicking on the OP level at Tree View, and selecting Add Observing Block.

### *Generate Darks*

Clicking this button we can automatically create the darks for a set of already taken images. It is highly recommended wait until we have executed our observing program before to click it, because this action creates a set of OBs, one for each different integration time we have in the exposures. When clicked, we have to specify the directory where the images are stored. Note that this functionality would take until 10 minutes to complete, depending of the number of images contained in the specified directory. Please wait until completion.

### *Validation & Execution*

Once we have finished the design of our OP, we can validate it and see the execution sequence. Clicking this button, we change from “Edit” mode to “Validation and Execution” mode, in which we can validate our designed OP and generate the execution sequence with the list of exposures that will be taken.


If we are using the PANIC computers at CAHA, we also have enabled the “Run” button, which allow us to execute our OP.

## 5.4.2 Tree view

The tree view is located at the left side of the OT window, and shows the OP we are editing in a very useful tree form.

The top element of the tree is the OP name, and all the OBs we defined are sons of this element, so, in the second level of the tree appears the OBs.

Each OB has one child called Observing Sequence (OS), which represent a resume in table form of all the exposures that will be taken as result of the actions defined in this OB.

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The OSs appears in the third level of the tree, and allows us, by right clicking on it, to add the different elements of the OB.

The sons of the OS will be the elements we have selected for this OB, which appears at the fourth level. We can choose one of the followings:

- Calibration Series
- Focus Series
- Dome Flats
- Sky Flats
- Default Values

Combined with one or two of the following options (depending of the element selected):

- Iterator
- Dither Pattern

We can operate with the three top-level elements of the tree (OP, OB and OS) by right clicking over them. They show a contextual menu with the different options we have depending the type of element.

We can select each element of the tree view by left clicking over it. The corresponding element info will be displayed at the 'Selected element view' area.

### 5.4.3 Selected element view

This is the area in which all the info related with the selected element is shown.

While we are editing our OP, it shows the different panels associated with each type of element, which consist in a set of controls and fields that we can operate or fill out.

During validation and execution, this area shows the execution buttons (run, abort and pause) and two tables: one with the Execution Sequence, in which we can select the OBs that are going to be executed; and other with the Exposures Sequence.

### 5.4.4 Log view

In the Log view are printed all the events that occurs while we are running the OT.

The warning and error messages are also displayed in this view, warning messages are printed in blue color, and error messages are printed in red color.

The log view is especially useful while we are executing an OP, because all the communication between GEIRS and the OT is displayed here.

## 5.5 OT output

After the design of an observing program, the OT saves it in an .xml file, which only can be executed from one of the PANIC computers at CAHA Observatory (panic22 or panic35).

The .xml file contains all the info of the observing program you have design, and can be loaded by the OT anytime for edit or execution.

## 6 OT MAIN ENTITIES

### 6.1 Observing Program (OP)

An Observing Program (OP) is defined as a full set of observations that the astronomer sets up to achieve his scientific goal. It contains most of the information associated with one proposal. Each OP consists of one or multiple Observing Blocks (OBs). The whole OP is managed in a XML file. This is the best format to work with the information concerning the OP. The astronomer can save his program as an XML file, and send it to the Observatory. The Observing Program (OP) is the top-level entity that manages the OT. It contains (Figure 6):

**Figure 6: Observing Program panel**

General program information

Proposal Title

Proposal ID

PI

E-mail

Astronomer

E-mail

Institution

Phone

Observer

E-mail

Telescope

☒ CAHA 2.2m
☐ CAHA 3.5m

Observing Mode

Service

Data Store Setup

File Name Prefix

Directory

Explore

Save Mode

Multi Extension File - Integrated

Data Reduction Setup

Reduction Mode

No reduction

Quicklook Display


Observation

Priority

☐ High
☐ Medium
☒ Low

Observing Time

Comments for the Telescope Astronomer :

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- General information of the program that the observer sent to the Observatory
- Storing options and save mode
- Reduction options
- Information for the astronomer in charge of the observation

In the tree view is the top-level entry, it will hang the different Observing Blocks of the observation, which has the information of the observing targets and calibrations.

## 6.2 Observing Block (OB)

The Observing Block (OB) entity is the most important in the OT. Astronomers specify their OPs in terms of OBs, which contain all the information necessary to obtain a “single” observation. Each OB is related to one target, its instrument and exposure setup parameters, and the required observing constraints (Figure 7). Such a single observation can contain, in principle, one or multiple exposures, or even multiple instrument configurations with multiple exposures. Each OB will be executed as a block and its results will be considered the smallest dataset of a given OP. It is recommended that one OB last at most one hour, in order whether some error occurs, do not lose much time.

Figure 7: OB panel

**Observing Block**  
 Name

Estimated Timeline: 0h 00m 00s  
 No Executions:

**Target**  
 Name    
 Epoch  RA   
 Type  Dec   
 Proper Motions:  
 RA  milli-arcsecs/year  
 Dec  milli-arcsecs/year

Centering   
 RA   
 Dec   
  
 at

---

**Instrument Setup**  
 ReadOutMode

---

**Observing Constraints**  
 Sky background   
 Transparency   
 Seeing   
 Moon Phase   
 Moon Distance   
 Max. Airmass   
☐ Mandatory Date from    to     
☐ Mandatory Time from   to

---

**Comments**

There are two types of OBs: Calibration OBs and Science OBs. Calibration OBs are used to acquire reference data such as lamp flat fields, darks, comparison lamps, etc. That does not require the observation of an astronomical target (we have to leave the RA and Dec coordinates in blank or all 0). Science OBs can be used to obtain scientific observations of an astronomical target, as well as reference data that require the observation of a specific target (such as photometric standards).

When the OBs are going to be executed at Observatory, the astronomer could arrange the OBs, sorting them in order to optimize the night time and to fit every OB in the best time slot during the observation.

## 6.3 Observing Sequence (OS).

The Observing Sequence (OS) entity contains a list of movements, exposures times, filters, etc. as a result of the configuration made in the OB using the different observing elements such dark, flat, focus or object, combined with repetition elements such iterator and dither

pattern. Each one of those elements has defined a number of repetitions (exposures per observation) and a number of cycles (iterations of the dither pattern). As a summary of all the programmed actions in this target, we can see a table with one row for each exposure is going to be taken (Figure 8). Every row shows the relative movement (if exist) to the target position, the exposure time, repetitions, filter and window used in the exposure.

**Figure 8: OS panel**

<b>Observing Sequence</b> Name <input type="text" value="OS Z"/>						
<b>Sequence</b>						
#	dx	dy	Int. time	Repetitions	Filter	Window
1	0	0	5	2	Z	Full frame Readout
2	90	90	5	2	Z	Full frame Readout
3	-180	90	5	2	Z	Full frame Readout
4	-90	-270	5	2	Z	Full frame Readout
5	360	-90	5	2	Z	Full frame Readout
6	0	0	6	2	Y	Full frame Readout
7	90	90	6	2	Y	Full frame Readout
8	-180	90	6	2	Y	Full frame Readout
9	-90	-270	6	2	Y	Full frame Readout
10	360	-90	6	2	Y	Full frame Readout
11	0	0	10	2	Ks	Full frame Readout
12	90	90	10	2	Ks	Full frame Readout
13	-180	90	10	2	Ks	Full frame Readout
14	-90	-270	10	2	Ks	Full frame Readout
15	360	-90	10	2	Ks	Full frame Readout
16	0	0	8	2	J	Full frame Readout
17	90	90	8	2	J	Full frame Readout
18	-180	90	8	2	J	Full frame Readout
19	-90	-270	8	2	J	Full frame Readout
20	360	-90	8	2	J	Full frame Readout

This table shows a resume of the entire Observing Block.

It is not editable.

Each row of the table is an exposure.

It is automatically filled when you add elements to the OB.

Please, right click over OS in the tree view and select from the pop-up menu the element you want to add.

Note: Skyflats do not show any row because are dynamically executed.

## 6.4 Iterators

The OT provides two useful elements to program repeated observations: the Iterator and the Dither Pattern. They offer an easy way to define recurrent actions. They allow quickly defining a set of exposures with a telescope offset or instrumenting changes between them.


### 6.4.1 Dither Pattern

Using the Dither Pattern element it is possible to construct any dither pattern you want of telescope motion. We have two ways to define dither patterns: custom and simple.

#### Custom

Using the custom way, there are four possibilities to specify movements that can be combined as desired. Those are the followings:

- Offset: where you can give a relative movement in arc seconds.
- Dither Pattern: it is possible to select a predefined dither pattern from a large list, given the relative movement. You can see the custom dither patterns in the Table 1.

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- Grid Pattern: you can create a rectangular net of points, specifying the initial relative movement, the spacing between points and the number of steps in each direction. You can see some grid pattern examples in Table 2.

- Predefined Pattern: a set of predefined models that are optimized to the particular characteristics of the instrument (see Table 3).

Offset positions are defined in an iteration table. Each row in the table is on step in the sequence (Figure 9).

### *Simple*

This way to specify dither pattern follows a predefined schema of 20 movements. You only have to indicate the following fields:

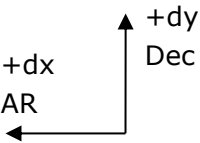
- Integration time: time of an individual frame.
- Exposure time: the sum of all coadds.
- Total exposure time: the sum of the entire dither positions, that is, one cycle.

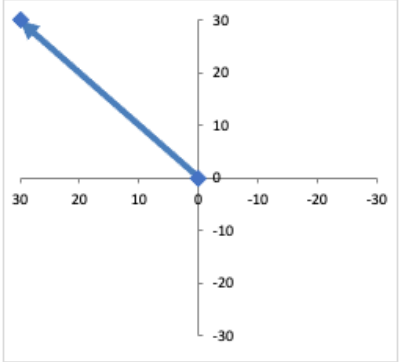
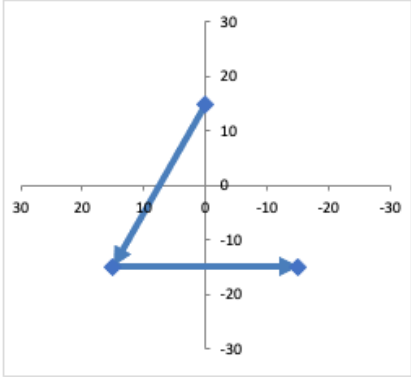
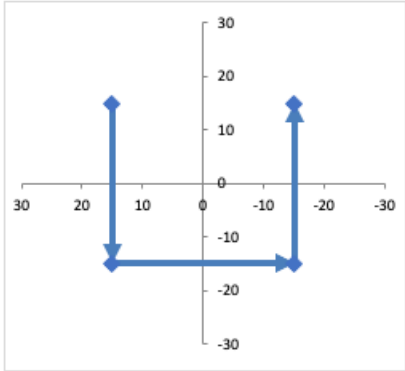
If as result, the dither needs more than 20 movements, it applies an offset to the initial position and repeats the 20 movements again.

### *Extended object*

There is also the option of Extended Object dither pattern, which allow combining the dither pattern defined with different Target (T) and Sky (S) options.

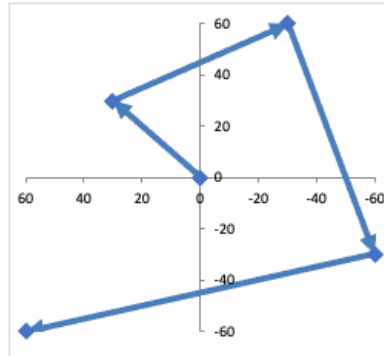
Table 1: Custom Dither patterns



Pattern	Movement/Schema (E.g. $dx=30$ $dy=30$ )
2-point (line)	
3-point (triangle)	
4-point (2x2)	 <p>Odd patterns from 4 on, involve a movement before first exposure is taken</p>

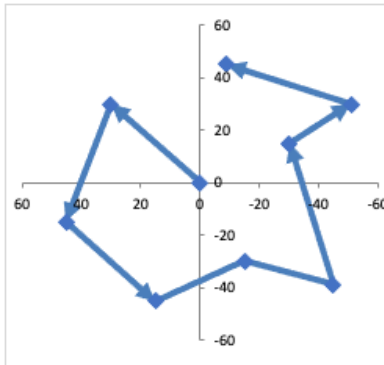


5-point (dice 5)

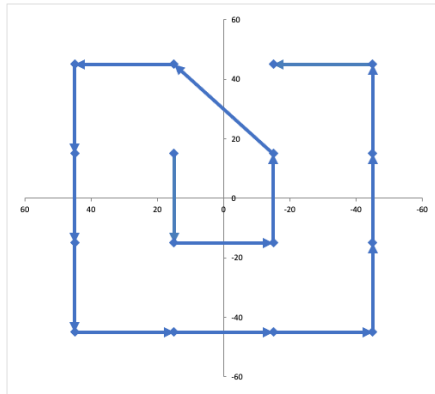


Even patterns from 5 on, takes first exposure before any movement

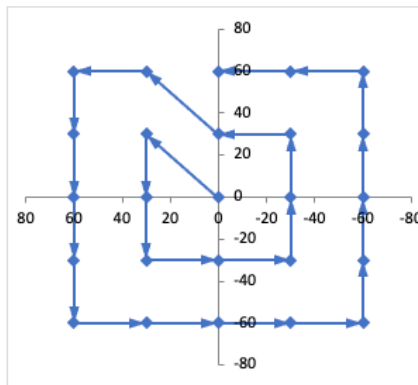
9-point (spiral)



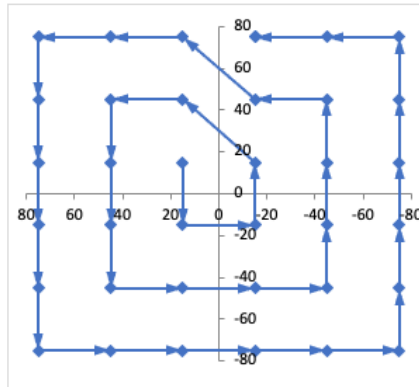
16-point (spiral)



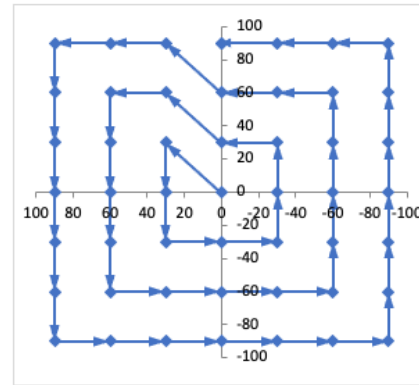
25-point (spiral)



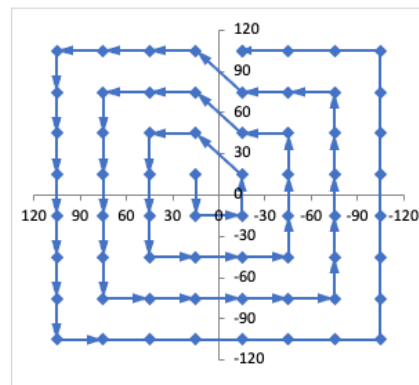
36-point (spiral)



49-point (spiral)



64-point (spiral)



81-point (spiral)

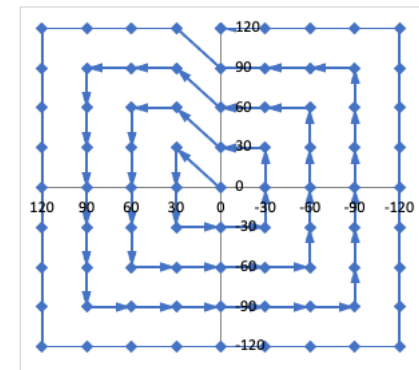
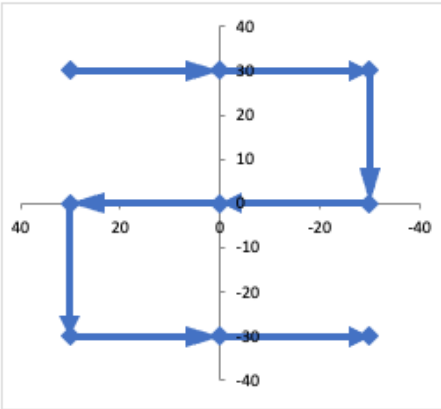
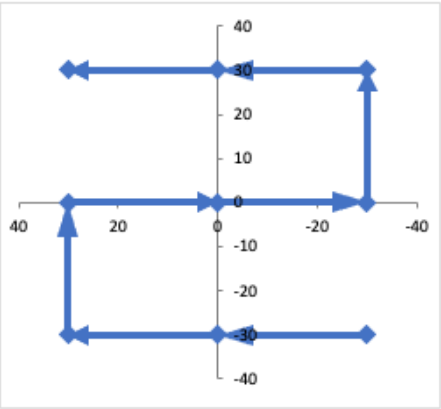
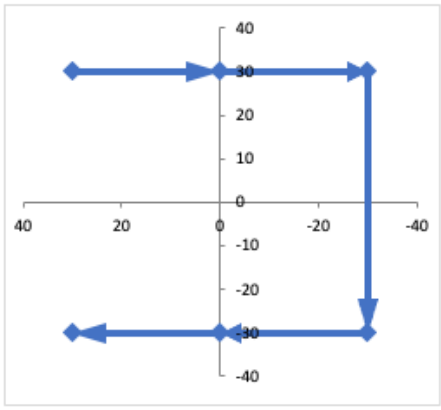


Table 2: Custom Grid patterns

Offset Pattern	Movement/Schema												
<p>Grid Pattern example:</p> <table><tr><td></td><td>Init.</td><td>Spac.</td><td>Steps</td></tr><tr><td>dx</td><td>30</td><td>-30</td><td>3</td></tr><tr><td>dy</td><td>30</td><td>-30</td><td>3</td></tr></table>		Init.	Spac.	Steps	dx	30	-30	3	dy	30	-30	3	
	Init.	Spac.	Steps										
dx	30	-30	3										
dy	30	-30	3										
<p>Grid Pattern example:</p> <table><tr><td></td><td>Init.</td><td>Spac.</td><td>Steps</td></tr><tr><td>dx</td><td>-30</td><td>30</td><td>3</td></tr><tr><td>dy</td><td>-30</td><td>30</td><td>3</td></tr></table>		Init.	Spac.	Steps	dx	-30	30	3	dy	-30	30	3	
	Init.	Spac.	Steps										
dx	-30	30	3										
dy	-30	30	3										
<p>Grid Pattern example:</p> <table><tr><td></td><td>Init.</td><td>Spac.</td><td>Steps</td></tr><tr><td>dx</td><td>30</td><td>-30</td><td>3</td></tr><tr><td>dy</td><td>30</td><td>-60</td><td>2</td></tr></table>		Init.	Spac.	Steps	dx	30	-30	3	dy	30	-60	2	
	Init.	Spac.	Steps										
dx	30	-30	3										
dy	30	-60	2										



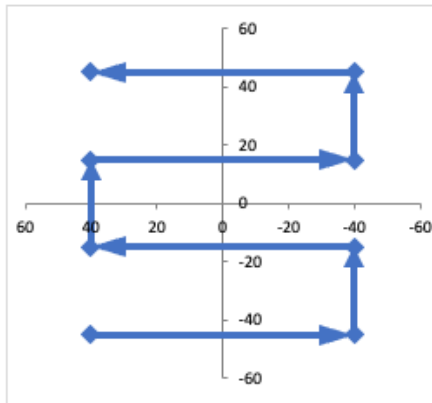
## Observation Tool User Manual

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PANIC-SW-MN-01  
Ver. 1.0  
28.10.2024

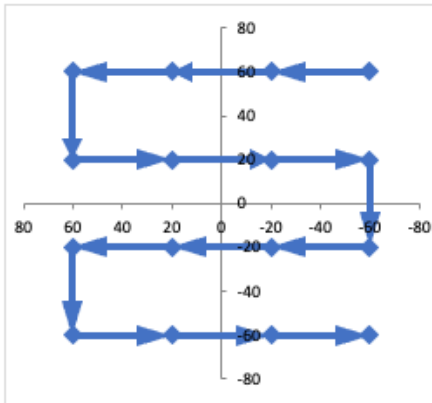
Grid Pattern example:

	Init.	Spac.	Steps
dx	40	-80	2
dy	-45	30	4

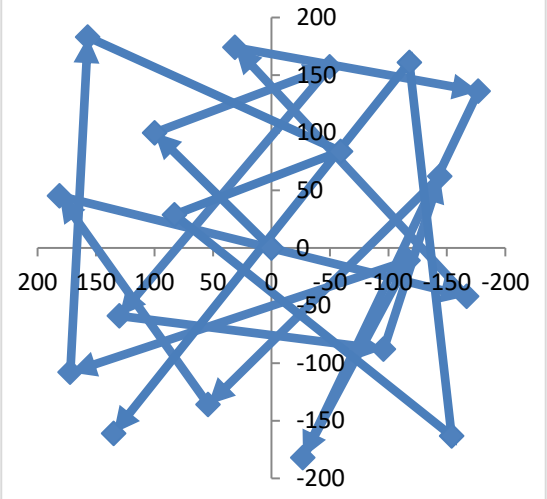
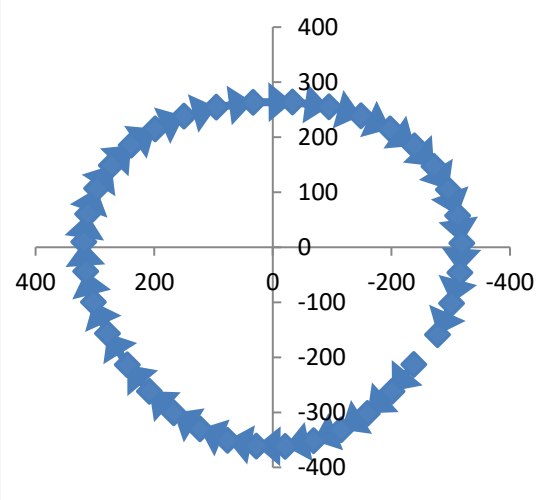
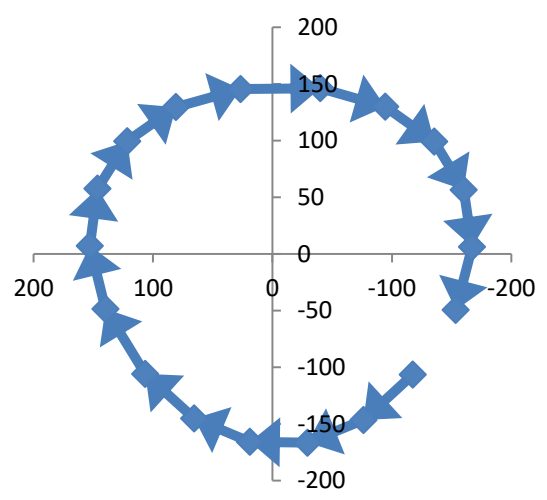


Grid Pattern example:

	Init.	Spac.	Steps
dx	-60	40	4
dy	60	-40	4




**Table 3: Predefined dither patterns**

Dither Pattern	Movement/Schema
Standard dither pattern with 20 positions	 <p>A 2D plot showing a standard dither pattern with 20 positions. The pattern consists of 20 blue diamond-shaped markers connected by lines, forming a complex, non-repeating path. The axes range from -200 to 200 on both the x and y dimensions.</p>
36-point Reuleaux	 <p>A 2D plot showing a 36-point Reuleaux pattern. The pattern consists of 36 blue diamond-shaped markers connected by lines, forming a circular shape. The axes range from -400 to 400 on both the x and y dimensions.</p>
18-point Reuleaux	 <p>A 2D plot showing an 18-point Reuleaux pattern. The pattern consists of 18 blue diamond-shaped markers connected by lines, forming a circular shape. The axes range from -200 to 200 on both the x and y dimensions.</p>

**Figure 9: Dither Pattern panel**

Dither Pattern



Name

Custom

Simple

Select one or more dither patterns:

1) Offset (arcsec)

dx"

dy"

Add Offset

2) Dither Pattern

Type 2-point (line)

dx"

dy"

Add Dither Pattern

3) Grid Pattern

Initial Offset (arcsec)

Spacing (arcsec)

Steps

Add Grid Pattern

dx	<input style="width: 50px;" type="text" value="-30.0"/>	<input style="width: 50px;" type="text" value="30.0"/>	<input style="width: 50px;" type="text" value="3"/>
dy	<input style="width: 50px;" type="text" value="-30.0"/>	<input style="width: 50px;" type="text" value="30.0"/>	<input style="width: 50px;" type="text" value="3"/>

4) Predefined Pattern

18-point Reuleaux

Add Prefef. Pattern

Optional: Extended Object dither pattern:

☒ Extended object

T-S

Offset  (arcmin)

Direction West

Add

Iteration Configuration:

#	dx	dy	Pattern	Shift	PAT_EXP	PAT_NEXP
1	-117.5	-106.5	18-point Reuleaux	\	1	18
2	41.33	-40	18-point Reuleaux	/	2	18
3	46.67	-20	18-point Reuleaux	/	3	18
4	48.33	0.67	18-point Reuleaux	\	4	18
5	46.67	20.67	18-point Reuleaux	\	5	18
6	41	39.33	18-point Reuleaux	\	6	18
7	33.33	57.33	18-point Reuleaux	\	7	18
8	13	55.67	18-point Reuleaux	\	8	18
9	-6.33	50.33	18-point Reuleaux	/	9	18
10	-25	42	18-point Reuleaux	/	10	18
11	-40.67	30	18-point Reuleaux	/	11	18
12	-54.33	16	18-point Reuleaux	/	12	18
13	-66.67	0.67	18-point Reuleaux	/	13	18
14	-54.33	-16.33	18-point Reuleaux	\	14	18
15	-41	-30.67	18-point Reuleaux	\	15	18
16	-24.67	-42.67	18-point Reuleaux	\	16	18
17	-7	-50.33	18-point Reuleaux	\	17	18
18	13.67	-55.67	18-point Reuleaux	/	18	18

Cycles   
(No. exec. entry table)

Show Preview

Delete Selected

Delete All

## 6.4.2 Iterator

The Iterator element is used to construct a sequence of instrument configurations (e.g. to cycle through filters as part of an observation). It allows iterating with parameters related with the instrument, such as the exposure time, the repetitions, the filter or the sub-window we want to use.

**Figure 10: Iterator panel**

Instrument Iterator

Name

Available Items

Filter: ☒ Ks ▼

Integration Time: ☒ 12 (sec)

Repetitions: ☒ 2 (exp/pos)

Possible Values

Window: 2 SubWindows ▼

SubWindows:

x Start	y Start	x Size	y Size
600	800	200	200
1100	1200	400	300

(4096,4096)

(1,1)

y

x

Add Step

Integration Time	Repetitions	Filter	Window
6	2	Z	2 SubWindows
8	2	Y	2 SubWindows
9	2	J	2 SubWindows
10	2	H	2 SubWindows
12	2	Ks	2 SubWindows

Delete All
Delete Step

The iterators can be combined in the same observation (e.g. to execute a dither pattern with filter changes). You can create complex sequences with as many instruments and offset iterators as you want.

## 7 OB TYPES

### 7.1 Calibration series

The element Calibration series, allow us to define two types of calibrations: dark (Figure 11) or flat (Figure 12).

We can set the exposure time as a fix value, or as a series between two values. If we define a series, we must indicate the spacing between: linearly, logarithmically or zero. This last option (zero) sets all the exposure times at the maximum value of the series. With the field Cycles we indicate the number of elements of the series.

**Figure 11: Calibration series panel - dark**

**Calibration Series**

Identifier:

Type: ☒ Dark ☐ Flat Filter:

Exposure Time: ☒ Fix  ( sec )  
☐ Serie  -

Spacing: ☐ linearly  
☐ logarithmically  
☐ zero

Repetitions (coadds):  ( nº images to be added up in memory )

Cycles:  ( nº pattern positions )

4 Images to be taken

When we select a Calibration Series type Flat, we must select also the filter.

**Figure 12: Calibration series panel - flat**

**Calibration Series**

Identifier:

Type: ☐ Dark ☒ Flat Filter:

Exposure Time: ☐ Fix  ( sec )  
☒ Serie  -

Spacing: ☒ linearly  
☐ logarithmically  
☐ zero

Repetitions (coadds):  ( nº images to be added up in memory )

Cycles:  ( nº pattern positions )

2 Images to be taken

The Calibration Series element cannot be combined with the iterators.



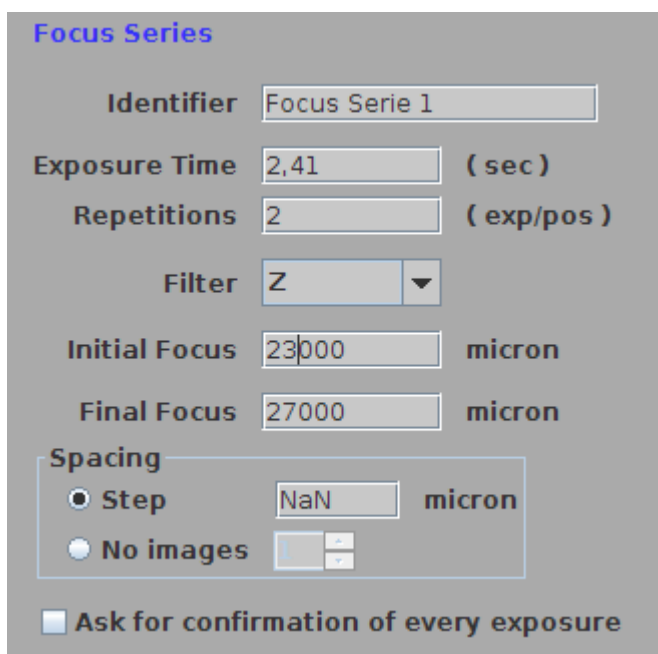
## 7.2 Focus series

This is a very useful type of OB, which allows us to determine the best focus with the help of the QuickLook analysis.

We have to indicate the exposure time, repetitions, filter and the initial and final focus in microns. For the spacing between different focus values, we have two options: To indicate the step in microns, or to indicate the number of images (Figure 13).

We also have the option to indicate the OT that asks us for confirmation after every exposure.

**Figure 13: Focus Series panel**



Once the execution of a focus series has finished, we can compute the best focus using the QuickLook tool. The OT asks us to introduce the best focus value, and sets it.

The Focus Series element cannot be combined with the iterators.

## 7.3 Dome flats

This element allows us to program the dome flats, using the different lamps and screen already located at dome. There are five lamps, four with a fixed power (150W, 300W, 1000W and 2000W), and one variable lamp between 1W and 10W.

We have two different ways to configure dome flats, specifying the lamp and exposure time, or specifying the counts level, in this case the lamp and exposure time is calculated.

**Dome Flats**

Identifier

**Exposure Time & Lamp**

☒ Fixed

Exposure Time  ( sec )

Lamp
 

☐ L1 2000W
 ☐ L2 1000W
 ☐ L3 300W
 ☐ L4 150W
 

☒ L5 [1..10W]
 

10W

▼

☐ Calculated
 

Counts Level

Filter 

J

 ▼

Repetitions  ( exp/obs )

Cycles 

2

 ( No. exec. dither pattern )

The Dome Flats element can be combined with the Iterator element.

## 7.4 Sky flats

The Sky flats element (Figure 14) permits taking skyflat at dusk or dawn almost automatically. See document RD 1, in which this sky flatfield procedure is carefully described.

The parameters we have to specify to take sky flatfields are the following:

- Bright limit: Maximum median count value to which exposures are usable (not saturated, linear correction possible). Typical lir: 40–45,000 ADU
- Target level: Desired median count value of good flatfields. Typical: 25–30,000 ADU
- Target tolerance: Tolerance around target level where exposures are still considered good. Typical: 15%
- Maximum exposure time: Longest duration for a good flatfield, typically 60 s.
- Maximum integration time: Longest duration of a single read, longer exposures are split into multiple reads, typically 15 s.
- Number of flatfields: Required number of flatfields in allowed range
- Offsets: RA and DEC dither offsets

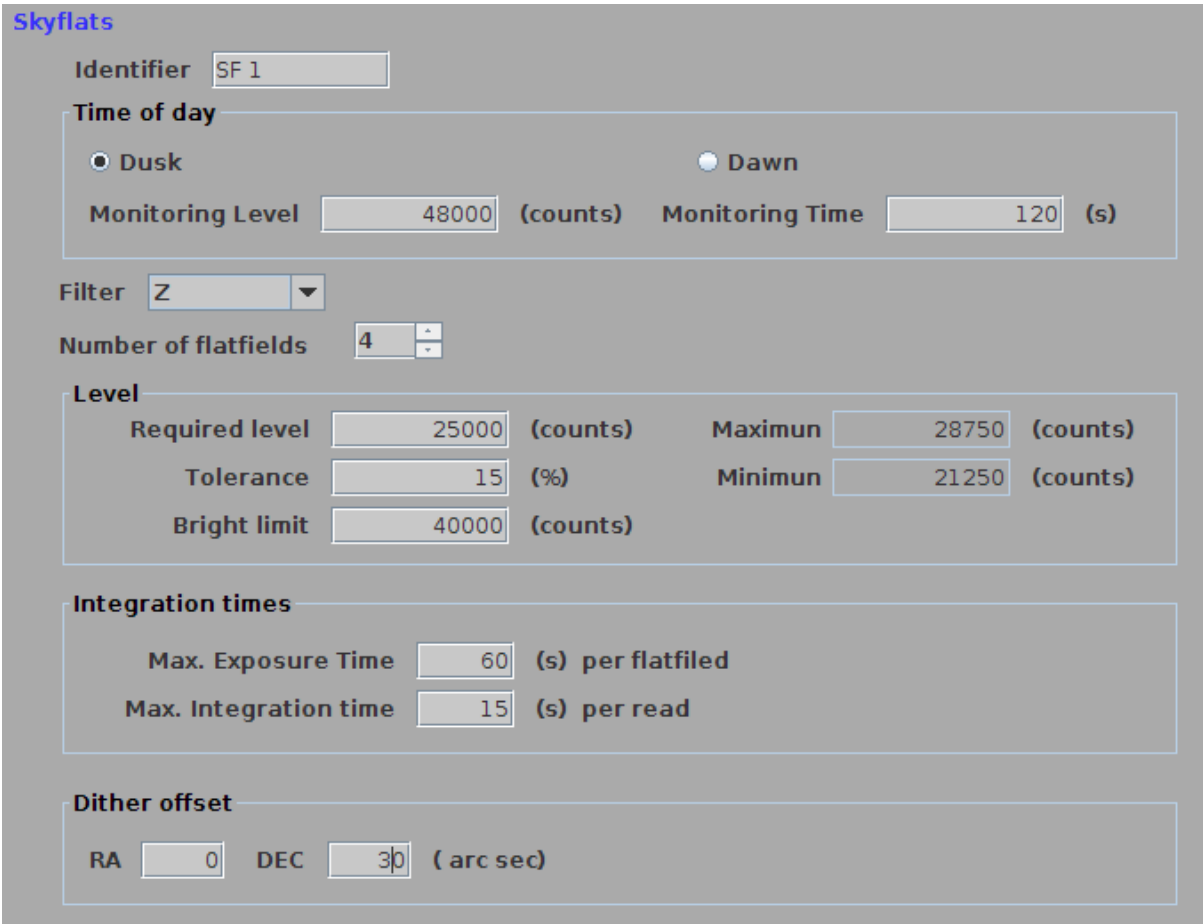
### 7.4.1 Individual parameters for Dusk

- Monitor level: Maximum median count level where to start monitoring the sky until it becomes faint enough. Typical lir: 52,000 ADU

## 7.4.2 Individual parameter for Dawn

- Monitor time: Maximum required integration time where to start monitoring until the sky is bright enough. Typical: 120 s.

**Figure 14: SkyFlat panel**



The screenshot shows the 'Skyflats' configuration panel. It includes the following sections and controls:

- Identifier:** A text box containing 'SF 1'.
- Time of day:** Two radio buttons, 'Dusk' (selected) and 'Dawn'.
- Monitoring Level:** A text box with '48000' followed by '(counts)'.
- Monitoring Time:** A text box with '120' followed by '(s)'.
- Filter:** A dropdown menu showing 'Z'.
- Number of flatfields:** A text box with '4' and increment/decrement buttons.
- Level:** A section containing four text boxes:
  - Required level:** '25000' (counts)
  - Maximum:** '28750' (counts)
  - Tolerance:** '15' (%)
  - Minimum:** '21250' (counts)
  - Bright limit:** '40000' (counts)
- Integration times:** Two text boxes:
  - Max. Exposure Time:** '60' (s) per flatfiled
  - Max. Integration time:** '15' (s) per read
- Dither offset:** Two text boxes:
  - RA:** '0'
  - DEC:** '30' (arc sec)

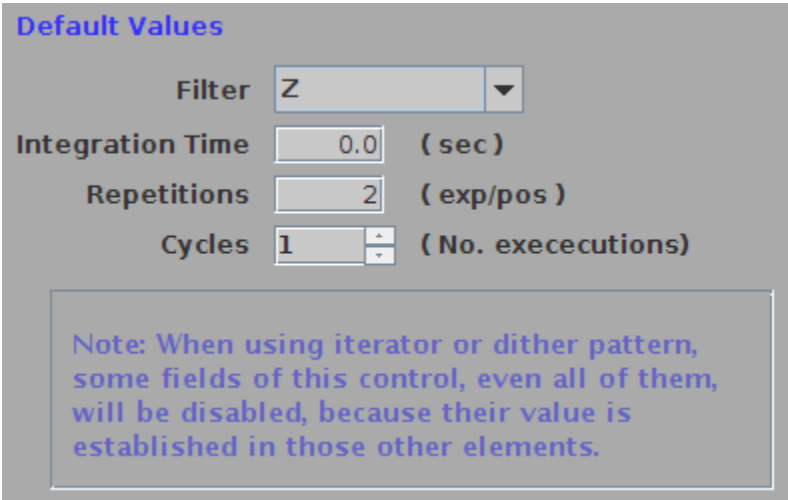
The Skyflat element is the unique one which execution is dynamical. So, in principle, we have no idea of how long it takes the execution of a skyflats, it depends of the brightness of the sky zone we are pointing at.

## 7.5 Default values

To define science OBs, we have to use the 'Default values' panel (Figure 15), that allows us to program scientific observations of an astronomical target, as well as reference data that require the observation of a specific target (such as photometric standards).

We can combine the 'Default values' panel with 'Dither pattern' and 'Iterator', in these cases some fields of this panel, even all of them, can be disabled, because their value is already established in those other panels.

**Figure 15: Default values panel**



## 8 VALIDATION AND EXECUTION

### 8.1 Validation

Once we have prepared our observing program, we can click on ‘Validation & Execution’, in order to validate the OP, and if we are at Observatory, to execute it.

The validation consists in a complete check of the whole OP, in order to find inconsistencies. If the OP is OK, as result of the validation you can see two tables (Figure 16).

The top one, called Execution Sequence, shows a list of the OBs, with the target, coordinates, proper motions and read-out mode.

The first column of the Execution Sequence table is a checkbox that allows us to select which OB we want to execute. Only the checked OBs will be executed.

The bottom table, called Exposures Sequence, shows a complete list of all the exposures that are going to be taken. We can see the following information for each exposure:

- #: Exposure number
- OB\_ID: Observing Block unique identifier
- OB\_NAME: Observing Block name
- Target: Name of the target (if defined)
- RA: Right Ascension coordinates of the target
- DEC: Declination coordinates of the target
- Proper M. RA: Proper motion in Right Ascension (if the object has)
- Proper M. DEC: Proper motion in Declination (if the object has)
- dx: Dither movement in Right Ascension (if defined)
- dy: Dither movement in Declination (if defined)
- Int. time: Integration time
- Rep.: Repetitions (number of coadds)
- Filter: Selected filter for this exposure
- Window: Describes if the exposure is full frame or has been defined subwindows

**Figure 16: Execution tables**

Execution Sequence

Validate

Run

Pause

Abort

Timeline: 1h 42m 03s

✓ #	OB...	OB_NAME	Target	RA	DEC	Proper M. RA	Proper M. DEC	Read Mode
✓ 1	1	OB Ks	UGCA290 Ks	12 37 41.98	+38 48 28.2	0.0	0.0	lir
✓ 2	2	OB J	UGCA290 J	12 37 41.98	+38 48 28.2	0.0	0.0	lir
✓ 3	3	OB H	UGCA290 H	12 37 41.98	+38 48 28.2	0.0	0.0	lir
✓ 4	4	OB Y	UGCA290 Y	12 37 41.98	+38 48 28.2	0.0	0.0	lir
✓ 5	5	OB Z	UGCA290 Z	12 37 41.98	+38 48 28.2	0.0	0.0	lir

Exposures Sequence

#	OB...	OB_NAME	OB_PAT	IMAGETYP	PAT_NAME	PAT_EXP	PAT_NEXP	dx	dy	Int.Time	Rep.	Filt...	Window
1	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		1	18	0	0	10	6	Ks	Full frame Readout
2	OB Ks	SKY 9-poin...	SKY	OS Ks		2	18	0	-489	10	6	Ks	Full frame Readout
3	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		3	18	60	549	10	6	Ks	Full frame Readout
4	OB Ks	SKY 9-poin...	SKY	OS Ks		4	18	0	-489	10	6	Ks	Full frame Readout
5	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		5	18	0	429	10	6	Ks	Full frame Readout
6	OB Ks	SKY 9-poin...	SKY	OS Ks		6	18	0	-489	10	6	Ks	Full frame Readout
7	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		7	18	0	429	10	6	Ks	Full frame Readout
8	OB Ks	SKY 9-poin...	SKY	OS Ks		8	18	0	-489	10	6	Ks	Full frame Readout
9	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		9	18	-60	489	10	6	Ks	Full frame Readout
10	OB Ks	SKY 9-poin...	SKY	OS Ks		10	18	0	-489	10	6	Ks	Full frame Readout
11	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		11	18	-60	489	10	6	Ks	Full frame Readout
12	OB Ks	SKY 9-poin...	SKY	OS Ks		12	18	0	-489	10	6	Ks	Full frame Readout
13	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		13	18	0	549	10	6	Ks	Full frame Readout
14	OB Ks	SKY 9-poin...	SKY	OS Ks		14	18	0	-489	10	6	Ks	Full frame Readout
15	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		15	18	0	549	10	6	Ks	Full frame Readout
16	OB Ks	SKY 9-poin...	SKY	OS Ks		16	18	0	-489	10	6	Ks	Full frame Readout
17	OB Ks	SCIENCE 9...	SCIENCE	OS Ks		17	18	60	489	10	6	Ks	Full frame Readout
18	OB Ks	SKY SCIEN...	SKY	OS Ks		18	18	0	-489	10	6	Ks	Full frame Readout
19	OB J	SCIENCE 9...	SCIENCE	OS J		1	18	0	0	10	5	J	Full frame Readout
20	OB J	SKY 9-poin...	SKY	OS J		2	18	0	-489	10	5	J	Full frame Readout
21	OB J	SCIENCE 9...	SCIENCE	OS J		3	18	60	549	10	5	J	Full frame Readout
22	OB J	SKY 9-poin...	SKY	OS J		4	18	0	-489	10	5	J	Full frame Readout
23	OB J	SCIENCE 9...	SCIENCE	OS J		5	18	0	429	10	5	J	Full frame Readout
24	OB J	SKY 9-poin...	SKY	OS J		6	18	0	-489	10	5	J	Full frame Readout
25	OB J	SCIENCE 9...	SCIENCE	OS J		7	18	0	429	10	5	J	Full frame Readout
26	OB J	SKY 9-poin...	SKY	OS J		8	18	0	-489	10	5	J	Full frame Readout
27	OB J	SCIENCE 9...	SCIENCE	OS J		9	18	-60	489	10	5	J	Full frame Readout
28	OB J	SKY 9-poin...	SKY	OS J		10	18	0	-489	10	5	J	Full frame Readout
29	OB J	SCIENCE 9...	SCIENCE	OS J		11	18	-60	489	10	5	J	Full frame Readout
30	OB J	SKY 9-poin...	SKY	OS J		12	18	0	-489	10	5	J	Full frame Readout
31	OB J	SCIENCE 9...	SCIENCE	OS J		13	18	0	549	10	5	J	Full frame Readout
32	OB J	SKY 9-poin...	SKY	OS J		14	18	0	-489	10	5	J	Full frame Readout
33	OB J	SCIENCE 9...	SCIENCE	OS J		15	18	0	549	10	5	J	Full frame Readout
34	OB J	SKY 9-poin...	SKY	OS J		16	18	0	-489	10	5	J	Full frame Readout
35	OB J	SCIENCE 9...	SCIENCE	OS J		17	18	60	489	10	5	J	Full frame Readout
36	OB J	SKY SCIEN...	SKY	OS J		18	18	0	-489	10	5	J	Full frame Readout
37	OB J	SCIENCE 9...	SCIENCE	OS J		1	18	0	0	10	5	J	Full frame Readout

## 8.2 Execution

If we are at Observatory, and we are using the PANIC computers, the Run button will be enabled to run our validated observing program.

Before clicking on Run, we have to be sure that GEIRS is already running in the same computer ('geirs\_start\_panic' command), and the instrument, telescope and dome are ready to work with them.

Once we click on Run, the OT automatically executes all the OBs we have checked in the Execution Sequence table. The current OB in execution and the exposure that is being taken are highlighted in blue on each table (Figure 17).

While the OT is executing our OP, we can see the remaining estimated time on the upper right side of the window. We also have the chance of pause, resume and abort the execution.

Important note: When we click on "Pause" the execution will pause when the last command sent to GEIRS will be finished, so it would take several seconds, even minutes. Be patient!

While we have the execution paused, if we click on Abort, we have to click Resume to finish the execution.

**Figure 17: Execution tables while running**

Execution Sequence										<input type="button" value="Validate"/> <input type="button" value="Run"/> <input type="button" value="Pause"/> <input type="button" value="Abort"/>			Remaining: 1h 40m 40s
#	OB...	OB_NAME	Target	RA	DEC	Proper M. RA	Proper M. DEC	Read Mode					
✓ 1	1	OB Ks	UGCA290 Ks	12 37 41.98	+38 48 28.2	0.0	0.0	lir					
✓ 2	2	OB J	UGCA290 J	12 37 41.98	+38 48 28.2	0.0	0.0	lir					
✓ 3	3	OB H	UGCA290 H	12 37 41.98	+38 48 28.2	0.0	0.0	lir					
✓ 4	4	OB Y	UGCA290 Y	12 37 41.98	+38 48 28.2	0.0	0.0	lir					
✓ 5	5	OB Z	UGCA290 Z	12 37 41.98	+38 48 28.2	0.0	0.0	lir					

Exposures Sequence													
#	OB...	OB_NAME	OB_PAT	IMAGETYP	PAT_NAME	PAT_EXP	PAT_NEXP	dx	dy	Int.Time	Rep.	Filt...	Window
1	1	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	1	18	0	0	10	6	Ks	Full frame Readout
2	2	OB Ks	SKY 9-poin...	SKY	OS Ks	2	18	0	-489	10	6	Ks	Full frame Readout
3	3	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	3	18	60	549	10	6	Ks	Full frame Readout
4	4	OB Ks	SKY 9-poin...	SKY	OS Ks	4	18	0	-489	10	6	Ks	Full frame Readout
5	5	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	5	18	0	429	10	6	Ks	Full frame Readout
6	6	OB Ks	SKY 9-poin...	SKY	OS Ks	6	18	0	-489	10	6	Ks	Full frame Readout
7	7	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	7	18	0	429	10	6	Ks	Full frame Readout
8	8	OB Ks	SKY 9-poin...	SKY	OS Ks	8	18	0	-489	10	6	Ks	Full frame Readout
9	9	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	9	18	-60	489	10	6	Ks	Full frame Readout
10	10	OB Ks	SKY 9-poin...	SKY	OS Ks	10	18	0	-489	10	6	Ks	Full frame Readout
11	11	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	11	18	-60	489	10	6	Ks	Full frame Readout
12	12	OB Ks	SKY 9-poin...	SKY	OS Ks	12	18	0	-489	10	6	Ks	Full frame Readout
13	13	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	13	18	0	549	10	6	Ks	Full frame Readout
14	14	OB Ks	SKY 9-poin...	SKY	OS Ks	14	18	0	-489	10	6	Ks	Full frame Readout
15	15	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	15	18	0	549	10	6	Ks	Full frame Readout
16	16	OB Ks	SKY 9-poin...	SKY	OS Ks	16	18	0	-489	10	6	Ks	Full frame Readout
17	17	OB Ks	SCIENCE 9...	SCIENCE	OS Ks	17	18	60	489	10	6	Ks	Full frame Readout
18	18	OB Ks	SKY SCIEN...	SKY	OS Ks	18	18	0	-489	10	6	Ks	Full frame Readout
19	19	OB J	SCIENCE 9...	SCIENCE	OS J	1	18	0	0	10	5	J	Full frame Readout
20	20	OB J	SKY 9-poin...	SKY	OS J	2	18	0	-489	10	5	J	Full frame Readout
21	21	OB J	SCIENCE 9...	SCIENCE	OS J	3	18	60	549	10	5	J	Full frame Readout
22	22	OB J	SKY 9-poin...	SKY	OS J	4	18	0	-489	10	5	J	Full frame Readout
23	23	OB J	SCIENCE 9...	SCIENCE	OS J	5	18	0	429	10	5	J	Full frame Readout
24	24	OB J	SKY 9-poin...	SKY	OS J	6	18	0	-489	10	5	J	Full frame Readout
25	25	OB J	SCIENCE 9...	SCIENCE	OS J	7	18	0	429	10	5	J	Full frame Readout
26	26	OB J	SKY 9-poin...	SKY	OS J	8	18	0	-489	10	5	J	Full frame Readout
27	27	OB J	SCIENCE 9...	SCIENCE	OS J	9	18	-60	489	10	5	J	Full frame Readout
28	28	OB J	SKY 9-poin...	SKY	OS J	10	18	0	-489	10	5	J	Full frame Readout
29	29	OB J	SCIENCE 9...	SCIENCE	OS J	11	18	-60	489	10	5	J	Full frame Readout
30	30	OB J	SKY 9-poin...	SKY	OS J	12	18	0	-489	10	5	J	Full frame Readout
31	31	OB J	SCIENCE 9...	SCIENCE	OS J	13	18	0	549	10	5	J	Full frame Readout
32	32	OB J	SKY 9-poin...	SKY	OS J	14	18	0	-489	10	5	J	Full frame Readout
33	33	OB J	SCIENCE 9...	SCIENCE	OS J	15	18	0	549	10	5	J	Full frame Readout
34	34	OB J	SKY 9-poin...	SKY	OS J	16	18	0	-489	10	5	J	Full frame Readout
35	35	OB J	SCIENCE 9...	SCIENCE	OS J	17	18	60	489	10	5	J	Full frame Readout
36	36	OB J	SKY SCIEN...	SKY	OS J	18	18	0	-489	10	5	J	Full frame Readout
37	37	OB H	UGCA290 H	SCIENCE	OS H	1	18	0	0	10	6	H	Full frame Readout

## 9 WARNING AND ERROR MESSAGES

All the warning and error messages are displayed at the Log view (Figure 19).

If an error occurs, a pop-up window arises displaying the error message and offering you some options (Figure 18).

The errors related with GEIRS communication, always allows the user to re-sent the command, before aborting the ongoing execution. So, it is important to revise that GEIRS is still running properly, or launch it again if not, before re-sent the command.

Figure 18: Warning messages at pop-up window

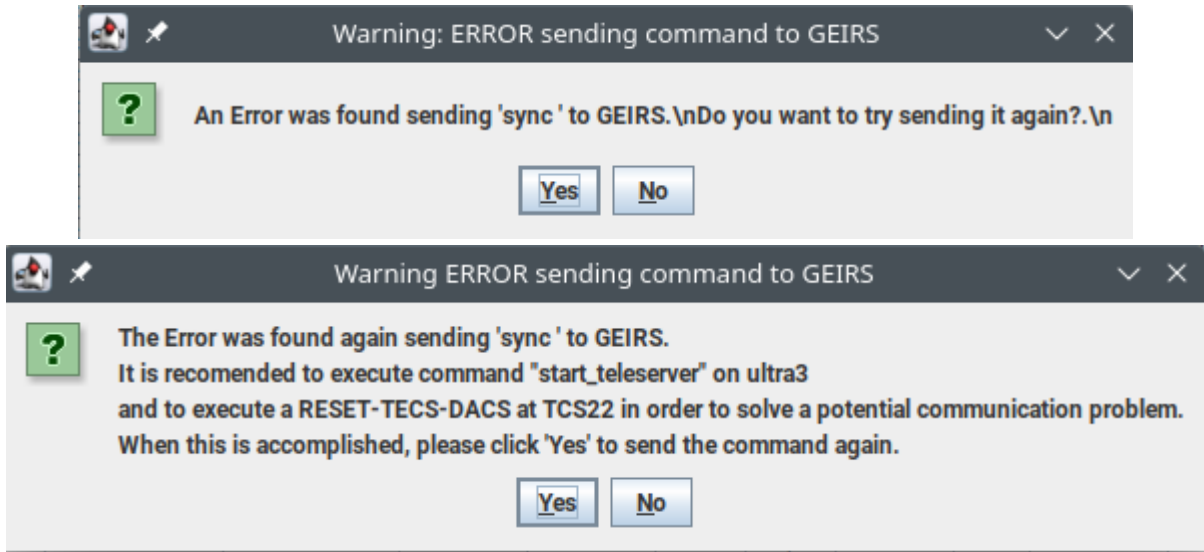


Figure 19: Warning and error messages at Log View

