A - Introduction

- The QSO Project
- The Phase 2 Proposal Submission
- Document Outline

B - Overview of the Phase 2 Tool (PH2)

- PH2: Purpose
- Some PH2 Notes
- The PH2 Interface
- The Concept of Observation Blocks
- The Observation Groups
- A Word on Data Format and Observing Modes with WIRCam
- A Word on the Calibrations
- PH2: Recent Changes

C - PH2: A detailed Tutorial

- Accessing PH2
- Navigating within PH2
- Program Selection
- Program Details
- Program Constraints
- Fixed Targets
- Ephemeris
- User Dithering Patterns
- Nodding Patterns
- Exclusion Zones
- Instrument Configurations
- Constraints
- Observation Blocks
- Observation Groups
- Summary
- HelpDesk
- Logout

D - A Few QSO Rules

E - Other Issues

- Night Reports
- Data Evaluation
- Data Distribution
A - Introduction

1) The QSO Project

The main concept behind the queue observation scheme is to perform programs only during sky conditions required to meet their science goals, as defined by the investigators. This can be achieved if the programs are all grouped together in a database and are selected appropriately according to a set of constraints, rules and sky conditions. Each night several queues, that is sequences of "observation blocks" of different programs, are prepared to cover diverse sky conditions and constraints. Observations are then carried out by a well trained, local team of observers in a service mode.

During 1999, CFHT started a project to implement the necessary software and to review all the issues for achieving a queue/service observing mode with its CFH12K mosaic camera. This Queued Service Observing (QSO) Project has been developed in parallel to other projects necessary for the data acquisition (NEO), processing and analysis (Elixir), and archiving and distribution (DADS). The software tools required for proposal submission, selection of programs, database management, and execution of the observations have all been developed within the QSO Project. Most of these software components are for internal use only except for two obvious exceptions: Poopsy, the proposal submission tool developed and maintained at CADC, and PH2, a Web based tool implemented and maintained by CFHT for the second tier of proposal submission (see below).

Starting in January 2001, queue observations were performed with the CFH12K camera for about 220 nights. By reaching good statistics on completeness, image quality requirements, Agency time balancing, and by meeting time constraints requirements for several programs, the QSO mode has been quite successful. Since 2003, all of the observations with MegaPrime have been also being conducted under the QSO mode. Starting with the semester 2005B, all observations for WIRCam, the new wide-field near-IR imager, will all be done through the QSO system as well.

The actual tutorial describes a version of PH2 developed specifically for observations with WIRCam. Following the evaluation of the different Time Allocation Committees (TAC), the successful proposals have received a certain amount of telescope time, a grade and a rank, and are now ready to prepare detailed observations, the Phase 2 submission period.

2) The Phase 2 Proposal Submission

The Phase 2 submission for proposals accepted for the semester 2008B extends over a period of several weeks. The two important dates to remember are given in the table below:

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 Starts for Semester 2008B</td>
<td>June 20, 2008 14:00 (HST) (24:00 UTC)</td>
</tr>
<tr>
<td>End of Phase 2 for Semester 2008B</td>
<td>July 24, 2008 14:00 (HST) (24:00 UTC)</td>
</tr>
</tbody>
</table>

Please take these points into consideration:

- **It is very important that the Phase 2 deadline is respected.** Diverse issues must be examined by the QSO Team prior to the semester regarding the information provided by the investigators during the Phase 2 (e.g. target positions, guide star availability, time constraints). Observations will start shortly after the Phase 2 deadline.

- Even if PH2 is straightforward, preparation of QSO observations for WIRCam can be time consuming. **This is VERY IMPORTANT:** We strongly recommend that you prepare your observations during the Phase 2 well ahead of the deadline. Unfortunately, our experience shows that 75% of most of the investigators wait until the last three days to prepare their phase 2... Preparing your observations well in advance of the deadline will allow you (and us!) to make sure that mistakes have been avoided. It is also only the third time that we offer WIRCam so it might take longer for the users to get familiar with the different modes and options offered for this instrument. Also, the QSO team will have enough time to react and find a solution if a problem occurs, since this version of PH2 for WIRCam might still have some bugs. Thanks for your cooperation....

- PH2 is only available from both the CFHT HQ Web site and a backup site located at the summit. The CDS PH2 site has now been retired. However, to ensure data integrity, only one session with the same user ID is allowed at the same time.

3) Document Outline

This document presents the complete information for the second submission Phase of the QSO proposals accepted for WIRCam. A
B - Overview of the Phase 2 Tool (PH2)

1) PH2: Purpose

The Web based Phase 2 tool (PH2) has been developed for one main purpose: Allowing the investigators of accepted QSO proposals to prepare a full description of their observations and to store this information in a database, accessible to the CFHT QSO Team. Observations to be carried out are extracted from this database during the QSO observing nights. PH2 represents then the key element in the entire QSO mode scheme. This is where the investigators tell the observers what observations should be done, and how (and sometime when) they should be done.

PH2 is flexible enough to accommodate many kinds of queue programs (but not all of them...) while remaining relatively simple to use. It is also constantly a work in progress. We hope to introduce more options in the future versions to add more versatility. And, of course, suggestions are always welcome!

2) Some PH2 notes

Some important characteristics of the actual version of PH2 for the general user are:

- PH2 is compatible with Netscape, Internet Explorer, and Firefox browsers. We highly recommend the Firefox browsers. Due to the recent prolific development of browsers on several platforms, we cannot support all of them. Browsers on Unix, Linux and Windows platforms are usually the most reliable for working with PH2. PH2 now works with the Safari version 3 browsers.

- Except for one optional tool, PH2 does not include any Java code. It is entirely developed around JavaScript and the ColdFusion language. There are some differences in the way the PH2 code is handled between the different browsers but all functionality should be preserved.

- For all of the accepted QSO proposals, the most relevant information entered in Poopsy during the Phase 1 is transferred to the PH2 database and is available for the user. So, if you have entered your targets in Poopsy, you won't have to do it again in PH2! The possibility to upload a specifically formatted ASCII file instead of typing everything by hand for the targets is also provided in PH2.

- **VERY IMPORTANT:** There is a time-out of 2 hour for inactivity periods (that is, between "save" activations) recorded on the server. A window reminds the user of this 2 minutes before the expiration of the session. This is to ensure that in case of a problem (e.g. local crash), you can always come back later and log in again with your user ID. So, **save your work frequently!** If you cannot access PH2 due to this but immediately must do so, send us an email and we will correct the situation.

- Of course, during the Phase 2 period allocated by CFHT, you can access PH2 at all time and as many times as you want. All your work is saved in the database so you do not have to finish everything at once... Also, **there is no "submit" button:** when you're satisfied with the preparation of your observations (for instance, what you see in your program summary), that's all there is to it!

- The actual version of PH2 does allow the observations of moving targets (e.g. Solar System objects) by entering targets ephemeris. However, "non-sidereal guiding" is not possible at the moment. Programs with moving targets can be complex so do not hesitate to contact us during the preparation of your observations.

- Due to some difficulties in tracking the sizing activity applied to a browser window from PH2, we recommend that you size PH2 to the maximum allowed by your screen at the beginning of the session (before logging in) and keep it that way. All the necessary scroll bars have been implemented for navigating within the browser frames.

3) The PH2 Interface

The typical schematic presentation of the PH2 interface is shown below:
**HINT:** You can change the size of all the frames inside PH2 by dragging their side with the mouse.

- **Navigation Menu:** The left frame is a navigation menu, presented with buttons of the names of the different sections of PH2. The button corresponding to the current form goes from blue to white.

- **Top Frame:** When present, it displays diverse passive information (e.g. list of target names). For two sections of PH2, however, the user must select diverse entries from several lists in order to create the observation blocks or groups (see below).

- **Middle Frame:** This frame presents the different tables for the targets, instrument configurations, etc. The maximum number of rows displayed at once is 5 (restrictions due to the speed of JavaScript) but buttons allow to navigate through different pages inside this frame. At the bottom of each table, a series of buttons allow the manipulation of the data entry in the table. The purpose of each button can be seen if the mouse is placed directly on it. The main function of some of the most important buttons is illustrated in the table below.

- **Bottom Frame:** This frame includes the buttons for saving the data to the database and a help button. The purpose of each button can be seen if the mouse is placed directly on it. The main function all the buttons is illustrated in the detailed tutorial.

4) The Concept of Observation Blocks

The entire architecture of PH2 and its database is based on the concept of "Observation Block" (OB). As illustrated below, an OB is formed of **one (and only one) target**, **one (or many) instrumental configurations**, and **one (and only one) constraint.**
The idea behind PH2 consists in several tables where the user can define these targets, instrumental configurations and constraints. Each row of these tables receives an unique label so each target, configuration or constraint is an "individual" entity. In other words, for example, one instrumental configuration defined only once might be subsequently used numerous times for observing different targets during the creation of the OBs.

**Important:** Since it is easier to schedule short observations at the telescope in a QSO mode, there is a limit of 2 hours (7200 seconds) for the total integration time of one individual observation block. PH2 will remind you if this time is exceeded...

The following four main steps lead to the creation of these observation blocks with WIRCam:

i) **Targets:** When this section is selected, a table with several entry fields is presented (see below). The user can then define all the targets in the program by adding the appropriate rows to the table. Pointing coordinates can be entered in the table or grabbed from the Aladin tool. When the "Save" or "Proceed" buttons are pressed, this information is automatically saved in the database.

### Table: Targets

<table>
<thead>
<tr>
<th>Label</th>
<th>Name</th>
<th>RA</th>
<th>Dec</th>
<th>Epoch</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT1</td>
<td>NGC 4258</td>
<td>12:47</td>
<td>1:43</td>
<td>2000.0</td>
</tr>
<tr>
<td>FT2</td>
<td>NGC 7479</td>
<td>23:12</td>
<td>2:17</td>
<td>2000.0</td>
</tr>
<tr>
<td>FT3</td>
<td>NGC 1073</td>
<td>00:01</td>
<td>0:34</td>
<td>2000.0</td>
</tr>
</tbody>
</table>

### Buttons:
- Add
- Duplicate
- Select All
- Delete
- Help

ii) **Instrument Configurations:** A table is presented for this section and the user can define all the instrument configurations (e.g. filter, dithering pattern, micro-dithering option, exposure time) planned to be used for observing the targets of the program (see below). Patterns for nodding or defined by the user can be defined in previous forms and selected in this table as well. **Remember:** The same configuration may be used for different targets over and over again so you might have to define it just once!

### Table: Instrument Configurations

<table>
<thead>
<tr>
<th>Label</th>
<th>Name</th>
<th>Filter</th>
<th>Dithering Pattern</th>
<th>Scale of DP</th>
<th>Micro-Dithering</th>
<th>Number of sub. or micro-exposures per DP position</th>
<th>Time per sub. or micro-exposure (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>HMC DF5</td>
<td>J</td>
<td>DP5(CD)</td>
<td>10</td>
<td>Yes</td>
<td>4</td>
<td>30.0</td>
</tr>
<tr>
<td>T2</td>
<td>HMC DF10</td>
<td>H</td>
<td>DF10(CD)</td>
<td>10</td>
<td>Yes</td>
<td>8</td>
<td>10.0</td>
</tr>
<tr>
<td>T3</td>
<td>No-MC DF6</td>
<td>H(1-0)</td>
<td>DF6(CD)</td>
<td>15</td>
<td>No</td>
<td>3</td>
<td>120.0</td>
</tr>
<tr>
<td>T4</td>
<td>CH4-nodding</td>
<td>CH4-On</td>
<td>hehe(NP)</td>
<td>N/A</td>
<td>No</td>
<td>1</td>
<td>30.0</td>
</tr>
</tbody>
</table>

### Buttons:
- Add
- Duplicate
- Select All
- Delete
- Help

iii) **Constraints:** Finally, the last ingredient required for the creation of an OB is the constraint. These requirements for the observation (e.g. image quality, sky background) can be entered in a table similar to the one below. Again, **one constraint may be used several times for different observations.**
iv) Observation Blocks: Here you are! It is now time to associate all the above individual "entities" to create the observation blocks. This is very easy to do. You must first select one (or several) targets in your list (mouse click), then create a list of instrumental configuration(s) by selecting one or several of them (can be ordered with the arrows in the list), and finally, select one constraint. By clicking on the "Create OB" button, you add automatically one (or several) row(s) to the table of Observation Blocks. The creation of the OBs can be done very quickly if many targets used the same configurations and constraints because these remain selected after creating an OB. Very Important: The number of configurations that can be linked within an OB is unlimited; however, we recommend to keep the OBs as simple as possible to avoid additional overheads. You are almost done.....

5) The Observation Groups

In principle, all the information entered in the tables above and used for the OBs would be enough for the operation of the QSO mode. However, to add more flexibility to PH2, we have introduced the concept of "Observation Groups" (OG). The OG will be the unit actually scheduled at the telescope and executed by the QSO Team. So, it is necessary to fill the observation group form! The interface to prepare the groups is illustrated below. Three different types of groups are available, as illustrated below:
**Single OB (1OB):** In this case, a group is only constituted of one single OB. If this is what is needed, all the groups can be created from all the OBs defined earlier by clicking on the "Quick Create OG" button. This is the recommended approach for the QSO mode.

**Sequence (SOB):** It is possible to create sequence of OBs, that is, to link different OBs that should be executed successively, under the same constraint. Contrary to the individual OBs, a sequence can include different targets. However, since this procedure can introduce additional overheads in telescope slewing time, so we do not recommend sequences unless necessary for the program. This option can be used for nodding (target-sky-target) with WIRCam although it is preferable to use the "nodding pattern" form especially developed for this purpose in PH2. The limit of 2 hours of total integration time remains also valid for a SOB.

**Monitoring (MOB):** If an OB must be observed several times at a regular period, a monitoring observation group including this OB can be defined. There is a window on the right (no showed) that allows the user to define the period (P), the number of iterations (N) and the minimum number of iterations acceptable. Note that is not possible to define monitoring parameters for sequences of OBs.
**I-Time Accounting.** An important aspect of the Observation Groups form is the accounting of the integration time (I-Time). This calculation is presented in the third frame and is automatically updated when an OG is created. The total readout time for the OBs, other overheads (e.g. offsets in the nodding mode) and the total I-time for the monitoring OG (N(iter) x I-Time (OB)) are automatically taken into account. If the "I-time left" becomes negative, a warning is displayed and the OG(s) created cannot be saved in the database.

The preparation of your observations is now completed! For WIRCam, additional patterns for nodding can be defined and exclusion of guide stars can also be performed (guiding for WIRCam is done on the arrays). There are also other options available for the observation groups (e.g. time constraints, relational execution link); information can be found in the detailed section below. A summary of the information saved into the QSO database is also available and can be sent by e-mail to the user. There is also a sophisticated HelpDesk available for e-mail exchanges between the QSO team and the investigators, if needed.

6) A word on data format and observing modes with WIRCam

**Data Cubes**

Operation of WIRCam under QSO is similar to MegaCam in several ways. However, there are also some significant differences regarding observing modes and data format. The main difference between MegaCam and WIRCam for the observation strategy is this: **Each exposure N within a given dithering pattern (DP) will be a cube made of shorter sub-exposures or micro-dithered exposures.** This is because the sky emission in the infrared becomes a strong limitation. For instance, it is typical that to get one exposure of 300 seconds in total on one pointing, the strategy will be to take 10 shorter exposures of 30 seconds each.

In the case of WIRCam, two options are offered for exposures within a DP: **Sub-exposures:** In this mode, each exposure of the DP is split into a cube of shorter sub-exposures. Each sub-exposure has an individual exposure time. **Micro-dithering:** In this mode, each exposure of the DP is split again into a set of shorter micro-exposures forming a micro-dithering pattern (a square box of size of 0.5 pixel across). Each micro-exposure has an individual exposure time and $m < 28$. A full cycle for a micro-dithering pattern includes 4 different micro-exposures offset by 0.5 pixel. Thus $m = 4, 8, 12, 16 \ldots 28$. **NOTE:** Since micro-dithering will only work well with good (bright) guide stars, it is **NOT** offered for narrow-band filters.

Thus the actual observation scenario for an OB, which essentially resides in defining the appropriate parameters in the instrument configuration form, in that case is roughly illustrated by those two examples:

Example 1: Dithering pattern on the sky of 5 exposures, with each exposure being a cube of 4 micro-dithered exposures; Example 2: Dithering pattern on the sky of 4 exposures, with each exposure being a cube of 6 sub-exposures (no micro-dithering).
Example 1:

Dithering Pattern (DP5)

Micro-dithered exposures:

→ Output: 5 files (cubes) with 4 micro-exposures/cube

Example 2:

Dithering Pattern (DP4)

Sub-exposures (6 per position):

→ Output: 4 files (cubes) with 6 sub-exposures/cube

Nodding
An important option for WIRCam is the possibility to define nodding (target-sky-target-...) patterns. PH2 offers a sophisticated form in order to be able to define those patterns for objects covering a large portion of the mosaic (see detailed tutorial). The same exposure strategy illustrated above applies to the nodding patterns.

7) A Word on the Calibrations

One of the main advantages of the queue mode is the possibility to share calibrations between programs. More so, since the queue runs are spread over about several consecutive nights, the quality of the calibrations is also greatly improved compared to the ones obtained during a short run in a classical mode. To achieve this, a calibration plan has been defined and carried out regularly by the service observers. This plan includes the necessary "detrend" frames for removal of the instrument signatures (bias, darks, flat-fields, fringing) and the astronomical calibrations (standard stars, astrometric fields).

For WIRCam, you can consider the following situations:

1- No programs under any circumstances are allowed to request "detrend" calibrations during Phase 1 or Phase 2. These calibrations are exclusively handled by the QSO and Elixir Teams. It is, in fact, not possible to define detrend calibrations through PH2 for the general users...

2- If your program includes the standard WIRCam filter set, YJHKs, the astronomical calibrations will be automatically done during the QSO runs and distributed to you. You do not have to include these calibrations during the Phase 2, that is, the integration time allocated should not be used for these calibrations. The accuracy of the photometry through the calibration plan for WIRCam should reach a level of 3-5% or better (see point 4 if this is not enough for your program).

3- If your program includes the WIRCam narrowband filters (H2,CH4(on,off), LowOH (1&2), Kcont; Br-gamma), the astronomical calibrations will not be done automatically by the QSO Team. You must include these specific calibrations during the Phase 2. Photometric calibration for these filters consist generally in observing a spectrophotometric standard star across the mosaic. To simplify, the entire mosaic will be relatively calibrated by the Elixir team so we rather recommend that you observe a spectrophotometric star on only one of the WIRCam array. The predefined offsets included in PH2 (below) allow you to define these positions very rapidly. The frequency of these observations depends, of course, of the relative photometry accuracy aimed for in your program. For this kind of procedure, we recommend to link the photometric observations with the science observations using the "sequence of OBs" (SOB) option.

4- If your program includes any WIRCam filters with a broad bandpass and that you prefer to obtain your own astronomical calibrations, these calibrations can be added as normal observation groups during the Phase 2. Of course, the integration time will be automatically charged to the program for this kind of observations.

Non-photometric Conditions

Of course, clouds are part of astronomy (!) so we will have to observe under non-photometric from time to time. For MegaCam, we take short exposures of fields requesting photometry, but done with cloudy conditions, during photometric time. However, for WIRCam, this is not necessary. Bootstrapping of photometric calibration of fields done during non-photometric conditions can be done directly using the 2MASS catalog which cover the entire sky.

8) PH2: WIRCam and Recent Changes

The actual version, specifically developed for WIRCam observations, include some very significant differences with the previous versions available for CFH12K/MegaCam. The basic functionality remains the same (that is, assembling the blocks and transforming them into observation groups) but PH2 now offers different options for pointing, nodding and dithering patterns, exclusion of guide stars, micro-dithering option, data distribution, etc. Refer to the detailed tutorial below for more information.

If you are already familiar with PH2 for WIRCam, the most significant differences implemented for WIRCam are the following:

- There is now a new question related to the image quality limit in the program constraints section. Additional explanation are also included on the validation process and how the upper limit of the IQ range specified is used to judge the quality of the data.

C - PH2: A detailed Tutorial

1) Accessing PH2

Accessing PH2 is limited to users having received confirmation of telescope time in the QSO mode with WIRCam for a given semester. Before accessing PH2 through an User ID/Password system, some characteristics of PH2 should be known:
• PH2 can be accessed either from the CFHT HQ Web server or a backup site located at the summit. The database is replicated in real-time. The CDS site has now been retired.

• To preserve data integrity, only one user with the same UserID is allowed at the same time. This is valid for both PH2 sites, since the verification is done through the replicated database.

• PH2 is compatible with Netscape, Internet Explorer, and Firefox browsers. It is usable with the version 4 of these browsers but we highly recommend the Firefox browsers. Netscape 4 on Unix will work well except for a bug of the browser (nothing we can do about it!) affecting the OB selection in the OG form. PH2 works also with the version 3 of the Safaru browsers. Depending on the speed of your connection, it can take up to 30 seconds to upload a page in PH2. If you are filling up a long list of entries in a table, save your work regularly!

• IMPORTANT: There is a time-out of 2 hour for inactivity periods recorded on the server. A window reminds the user of this 2 minutes before the expiration of the session. This is to ensure that in case of a problem (e.g. local crash), you can always come back later and log in again with your user ID. Beware: No "save" is performed if you session has automatically timed out. Save your work regularly!

• Of course, during the Phase 2 period allocated by CFHT, you can access PH2 at all time and as many times as you want. All your work can be saved in the database so you do not have to finish everything at once. Also, there is no "submit" button: when you're satisfied with the preparation of your observations (as seen in your program summary), that's all there is to it!

• Due to some difficulties in tracking the sizing activity applied to a browser window from PH2 (upon resize, the modifications to the current form might be lost), we recommend that you size PH2 to the maximum allowed by your screen at the beginning of the session (before logging in) and keep it that way. All the necessary scroll bars have been implemented for navigating within the browser frames.

Access to PH2 is done through this small window:

![User Login Form](UserLogin.png)

- **UserID:** The User ID is the same one that was used for Poopsy during the Phase 1, or was provided to you by e-mail by the QSO Team. If you used PH2 before, it's the same UserID as before. If you do not remember it, please contact the QSO Team (not CADC!).

- **Password:** The Password is the same one that was used for Poopsy during the Phase 1, or was provided to you by e-mail by the QSO Team. If you used PH2 before, it's the same password as before. If you do not remember it, please contact the QSO Team (not CADC!).

2) Navigating within PH2

The left frame of PH2 is the Navigation Menu. The user can easily go from one page to the other by just clicking on the appropriate button. The button corresponding to the form currently opened becomes white with blue fonts.

**Hint:** It is highly recommended to navigate through PH2 with the menu buttons instead of the normal browser buttons. Activity in the different forms is monitored so using the PH2 buttons ensure that all the data are saved before moving to another section of the tool.

The navigation buttons and their corresponding pages are described below:

<table>
<thead>
<tr>
<th>Button</th>
<th>Corresponding Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH2 Tutorial WIRCam</td>
<td><a href="http://www.cfht.hawaii.edu/Instruments/Queue/ph2_tutorial_v3_WC.html#changes">http://www.cfht.hawaii.edu/Instruments/Queue/ph2_tutorial_v3_WC.html#changes</a></td>
</tr>
</tbody>
</table>
3) Program Selection

This page allows the selection of your program for your session:

<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Login</td>
<td>First page of PH2 (Login). UserID and Password required.</td>
</tr>
<tr>
<td>Prg Selection</td>
<td>Program Selection Page, for multiple programs under the same UserID</td>
</tr>
<tr>
<td>Prg Details</td>
<td>Page describing the QSO program, the investigators (PI) and the TAC evaluation.</td>
</tr>
<tr>
<td>Prg Constraints</td>
<td>General Constraints and Information for the program. Depending on the answers, some options will be made available in the subsequent pages. Includes also a complete section for the distribution of the data.</td>
</tr>
<tr>
<td>Fixed Targets</td>
<td>Page containing the table used to define all of the targets used in the creation of the observation blocks</td>
</tr>
<tr>
<td>Ephemeris</td>
<td>Page containing the table used to define all of the targets for which coordinates are changing with time (ephemeris). Only accessible if requested in Program Constraints page</td>
</tr>
<tr>
<td>User DPs</td>
<td>Page used to define user dithering patterns. Not mandatory and only accessible from the navigation menu</td>
</tr>
<tr>
<td>Nodding Patterns</td>
<td>Special form used to define nodding (target-sky-target...) patterns for WIRCam. Not mandatory and only accessible from the navigation menu, if user specifies so in the Prg Constraints page.</td>
</tr>
<tr>
<td>Exclusion Zones</td>
<td>Special tool used to indicate regions to avoid using for guiding purposes for WIRCam. Not mandatory and only accessible from the navigation menu, if user specifies so in the Prg Constraints page.</td>
</tr>
<tr>
<td>Instr Configs</td>
<td>Page containing the table used to define all of the instrument configuration (e.g. filters, exposure time, dithering pattern) used in the creation of the observation blocks</td>
</tr>
<tr>
<td>Constraints</td>
<td>Page containing the table used to define all of the sky constraints entering in the creation of the observation blocks.</td>
</tr>
<tr>
<td>Obs Blocks</td>
<td>Page allowing the creation of the observation blocks from the lists of targets, instrumental configurations and constraints defined in the previous pages.</td>
</tr>
<tr>
<td>Obs Groups</td>
<td>Page allowing the creation of the observation groups (e.g. sequences) from a list of observation blocks. The I-time used for the program is also calculated and compared to the time allocated by TAC. Time constraints and REEL can be accessed here, if requested.</td>
</tr>
<tr>
<td>Summary</td>
<td>Page describing all the observations prepared with PH2 and stored in the database for a specific program.</td>
</tr>
<tr>
<td>HelpDesk</td>
<td>Page containing diverse forums related to the support of PH2 and the QSO mode. E-mail communication system available for contacting the QSO Team.</td>
</tr>
<tr>
<td>Logout</td>
<td>Logging out of PH2 (needs confirmation).</td>
</tr>
<tr>
<td>Help</td>
<td>Opens the quick help files for PH2, containing information on the diverse parameters of the PH2 forms.</td>
</tr>
<tr>
<td>Tutorial</td>
<td>This document! Detailed overview and general description of PH2 and how to use it.</td>
</tr>
</tbody>
</table>
This page can be opened at all time; it is possible to work on several programs at the same time without having to log out from PH2. The programs are first sorted out according to the semester (pull-down menu) and then are identified by the runID, instrument and title. **Be careful: always make sure that you are editing the right program for the right instrument!** For your convenience, the runID and instrument is shown on all the PH2 forms. **Note:** Following recommendations by the Time Allocation Committee, it is possible that a program was split into different programs with some specific I-time and grade/rank. If it's the case, the program with the higher ranking will keep the same runID as assigned during Poopsy Phase 1 but the other programs will be assigned a different runID by the QSO Team. When you click on "proceed", the version of PH2 you will need (MegaCam vs WIRCam) is loaded.

**HINT:** It is necessary to first select a program and click on the "Proceed" button before being able to navigate through the other pages of PH2.

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="118x493.png" alt="Help" /></td>
<td>Open the help files to the current page.</td>
</tr>
<tr>
<td><img src="144x285.png" alt="Proceed" /></td>
<td>Save the content of the current page in the QSO database and open the next form.</td>
</tr>
</tbody>
</table>

**4) Program Details**

This page presents information regarding the program, the investigators, and the TAC evaluation:
**Program Title:** This is the program title as entered with Poopsy during the Phase 1 proposal submission period (or through the TOO form). This field cannot be edited. The program title is available to the QSO Team at all time during the observations.

**Program Abstract:** This is the abstract of the program, as entered during the Phase 1 proposal submission period (or through the TOO form). This field cannot be edited. The program abstract is available to the QSO Team at all time during the observations.

**Investigators:**
- **PI:** Name of the Principal Investigator for this program. It cannot be changed.
- **Institute:** Current working institution of the PI. It must be up-to-date.
- **Phone:** The current phone number of the PI. It must be up-to-date and include the area code.
- **Fax:** The current fax number of the PI. It must be up-to-date and include the area code.
- **E-mail:** The current e-mail address of the PI. **It must be up-to-date and accurate.** This is the main contact resource used by the QSO Team for communication with the PI!

**Program Information:**
- **RunID:** Identification number for your QSO program and instrument for which it is assigned. This number is defined during the Phase 1 submission process and is attached to all of the QSO programs. It is important to remember your runID to communicate with the QSO Team (see HelpDesk) and also to monitor the progress made on your program using the night reports. The first three digits indicate the semester, the letter indicates the Agency and the last two digits is the number assigned by Poopsy or the QSO Team.
- **Agency:** Agency for which this telescope time has been assigned, as specified during the Phase 1. The values are CNRS (F), NRC (C), UH (UH), KAO (K), NTU (T), Opticon (O), CFHT (D-time).
- **Program Type:** The type of the program, as requested in Phase 1 or as assigned by the TAC. Three types are possible: Regular, Target-of-Opportunity (TOO), and Snapshots. The specific definitions of these programs is given in the Phase 1 tutorial.
- **TAC Grade:** Grade assigned to your proposal by the Time Allocation Committee (TAC) for your Agency. Four grades are possible "A: must do", "B: prioritized", "C: best effort", "S: snapshot". The corresponding priorities of these program grades are highest, good, medium and lowest, respectively. Grades C and S are considered for "overfilling" the queues (that is, these programs would not have received any time in a classical mode). See Phase 1 submission tutorial for more information.
- **TAC Rank:** Rank of your proposal within your program grade, assigned by the TAC. See Phase 1 submission tutorial for more information.
- **I-time:** The total integration time allocated for your QSO program by the TAC. This time is automatically calculated during the preparation of your observation groups and cannot be exceeded. The "readout time" and additional overheads of the WIRCam mosaic are calculated automatically for each individual exposures within an observation block.
### 5) Program Constraints

This page requests some important information regarding your QSO program. Depending of some of the answers you provide here, options will become available in the subsequent pages of PH2. This page is divided into several sections:

#### IQ Limit:
The image quality (IQ) constraint is one of the important parameters for QSO. In the constraints form later on, you will be asked to define a range (in K band) of IQ for your observations. During the validation process, the QSO Team uses the upper limit defined by this range to judge if the images meets the requirements or not. **A margin of about 15% higher than this upper limit is still considered acceptable for allocating a "grade 1" for the quality of the data.**

Example 1: A range of 0.55-0.65" in K band is selected; images in K band with IQ ~ 0.72" will be considered as valid. Example 2: A range of 0.65 - 0.80" is specified in K band, but the Y filter is used instead (which has usually an offset of about + 0.1" with respect to r band). So, images with IQ ~ 0.8 x (0.8 x 0.15) + 0.1 = 1.0" will be acceptable. If this is not acceptable, the user should specify this here and describe in the comments box what the upper limit for the observations should be.

#### Monitoring:
If your program requires several executions of the same observation spread over a specific period, **monitoring** is required and you should indicate so here. Monitoring is defined as executing an observation for a certain number of iterations, \( N_{\text{iter}} \), within a specific period, \( P \). A date for the first observation can be specified but is not obligatory. These parameters can be entered in the observation groups form. Repeating an observation block for a certain number of times but without a specific period is not considered monitoring. At present, it is not possible to have monitoring for sequences of observation blocks (SOB), only individual blocks.

#### Time Constraints:
It might happen that some of your observations will have to be performed within certain dates. If this is the case, you can indicate so here. The options will then be available in the OG form. Note that **time constraints are the most demanding constraints on a queue system.** Use only if science depends on it!

#### REEL:
This is an option in PH2 that allows the user to create specific links between observation groups. In short, we can resume the REEL concept as: "if OGx is observed and validated, then observe OGy within a certain opportunity window". The REEL are a powerful way to prepare specific sequence of observations, if science requires to do so. REEL must be used only if necessary, not for instance in the context "the object should be observed with this filter because if was observed with this other filter first".

#### Moving Targets:
If your targets (or some of them) have changing coordinates with time (e.g. comet), you can define their ephemeris in a special table located further in PH2. To access it, you must indicate so here.

#### Zones of Exclusion:
This is a new option for WIRCam. Guiding for WIRCam is done on the arrays themselves; the guide stars are selected by an automated process at the telescope. **Stars brighter than about 14-15th magnitude can be selected. Stars used for the**
guiding cannot be analyzed for scientific purpose. If your program is aimed at specific stellar objects, you might want to indicate to avoid selecting them for guiding. To do so, a special form has been implemented in PH2 and will become available if you select "yes" to the question.

- **Nodding Observations:** Due to the rapid variations of the sky background in near-IR astronomy, it is often necessary to insert "sky" observations between the target exposures, if the target cover an extensive fraction of the field-of-view of the camera. This is called "nodding". A special form has been implemented in PH2 to be able to define "nodding patterns". This is the most complicated mode of observations in PH2 by far but the form is relatively straightforward to use. If you need nodding, indicate so here and the form will become accessible from the navigation menu.

---

**Please enter a few (optional) comments (3-5 lines) describing your program. These comments would help the QSO Team during the observations:**

Data can be obtained with slight cirrus, if the Moon is not up. Priorities as defined for the QGs should be taken into account.

---

- **Program Comments:** It is important that the investigators transmit any comments that they judge useful for the QSO Team in their endeavor to carry out the observing program. This space is reserved for general comments on the program. These comments will be available at all time during the preparation of the queues and while performing the observations. If you have any special constraints, requirements, etc., they can be included here.

**HINT:** Do not be shy in this section! Examples of valuable comments include: "Observations to be done in photometric conditions only"; "Thin cirrus acceptable"; "Dark time requested but 20% Moon at more than 45 degrees is acceptable"; "Observe high priority groups first", etc. **We use these comments all the time. The more we know, the better!**

---

**Data distribution**

Please indicate your preference for the distribution of your data:

Refer to the help page for more information.

**Distribution Media**

- Network

**Distribution Schedule**

- Quick access
- After each QSO Run
- When program is 100% complete
- At the end of the semester

If you selected "Quick access" or "After each QSO Run" please justify:

---

- **Data Distribution:** CFHT is now offering only one option for the data distribution: network distribution. Your data will be placed in a special FTP site at CFHT for downloading over the network.

  **1 - Quick Access:** For certain programs, it is important to evaluate the data soon after being gathered at the telescope. However, if you ABSOLUTELY need access to the data during the QSO run, indicate so. We cannot promise that the observations will be immediately available due to the large volume of data produced by WIRCam. However, we will try our best. **Please note that this will be achieved ONLY for programs requesting a quick access to the data and for which this procedure is entirely JUSTIFIED.** Please indicate also if raw data are acceptable.

  **2 - After Each QSO Run:** If your program is long and that you prefer to receive data regularly through the semester, you can
choose to receive the data after each QSO run. Due to the data volume produced with WIRCam and the complexity if data reduction for near-IR observations, this will be done on a *best effort* only by the QSO/Elixir/DADS Teams. Please justify this request also in the entry field. The QSO Team will also review this request and decide if it makes sense or not to prepare a distribution after the run (for instance, in the case where only a few files were acquired). You can expect a delay of 7-10 days before we start preparing the files after a run; this delay is necessary for the pipeline to produce the best data possible.

**3 - 100% Completion:** If you would like to receive your data only when your program is completed, indicate so. If your program does not reach a completion level of 100% at any time during the semester, you will only receive the data at the end of the **semester**, unless the QSO Team judges that no additional observations will be performed for the rest of the semester due to other constraints (i.e. target distribution on the sky).

**4 - End of semester:** If this option is selected, all data accumulated during the semester for your program will only be sent all together after the end of the semester. **This is the default option.**

**Send data to:**

**PI Contact:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Pierre Martin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institute:</td>
<td>CFHT</td>
</tr>
<tr>
<td>Address line 1:</td>
<td>PO BOX 1997</td>
</tr>
<tr>
<td>Address line 2:</td>
<td>85-1888 Kamehameha Highway</td>
</tr>
<tr>
<td>Address line 3:</td>
<td>-</td>
</tr>
<tr>
<td>City *</td>
<td>Kaimuki</td>
</tr>
<tr>
<td>State/Province:</td>
<td>HI</td>
</tr>
<tr>
<td>Zip code: *</td>
<td>96743</td>
</tr>
<tr>
<td>Country: *</td>
<td>USA</td>
</tr>
</tbody>
</table>

**Alternate Contact:**

| Name (First Last): * |  |
| Institute: * |  |
| Address line 1: * |  |
| Address line 2: |  |
| Address line 3: |  |
| City * |  |
| State/Province: |  |
| Zip code: * |  |
| Country: * |  |
| Email: * |  |
| Phone: * |  |
| Fax: * |  |

* Data Distribution Recipient: Only one copy of the data will be distributed. By default, the PI will receive the data, unless an "alternate" person is selected. In that case, you must fill the **delivery address** of this person in the entry fields below. Please verify that the address is complete and accurate.

6) Fixed Targets

This page represents the first step toward the creation of the observation blocks. This is where the user defines all the targets of the program and their precise pointing coordinates. The main section of this page is composed of a table and a few buttons for the manipulation of the entry fields:
**HINT:** The maximum number of rows displayed at once is five. The "Next Page", "Previous Page" buttons can be used to navigate between the different pages. The blue hyperlinks FT# represent the first row of each individual pages and can also be used for moving quickly from a page to another.

- **Top Row:**
  - **RunID:** Identification of the program you are currently working on.
  - **Table Status:** List of the current rows and the total number of configurations already defined in the current table.
  - **Instrument:** Link to the WIRCam Web page.

- **Table (1):**
  - **Label:** The label identifies a row in the table. The fixed targets are simply identified as FT#. The label is automatically updated if the rows are changed.
  - **Name:** The name of the target, as given by the user. A mnemonic name (e.g. Virgo Field1) will make the subsequent steps easier. The name must be shorter than 20 characters.

**A word on Target Coordinates.** Coordinates for the targets can be entered from different ways in PH2. However, at the telescope, **pointing coordinates**, that is the combination of the target coordinates and the pointing offsets will be used. Basically, **Pointing Coordinates = Target Coordinates + Pointing Offsets.** So, placing the object on the right location on the WIRCam mosaic can be done from two ways: By using the real coordinates of the target and set up the pointing offsets to the appropriate values or, by modifying the target coordinates, so that they become the pointing coordinates, and set the pointing offsets to zero. Both ways can be easily achieved in PH2, as described below. **Note:** If you plan to use the "WIRCam Dithering Pattern" (WDP; that is put the object successively on each array of the mosaic), the pointing coordinates should be set in order to have the object at the "1" position (see below).

- **Table (2):**
  - **Aladin:** Aladin is an efficient software to display sky images. It has been developed by CDS and can be very useful for different tasks in PH2. However, it is **optional:** pointing coordinates can be entered directly in the target table with the combination of target coordinates and pointing offsets. First, if you know the real astronomical name of your target, Aladin can find the coordinates for you. Just enter the name (e.g. NGC 4258) and click one of the "Aladin" buttons (**Note:** To search by name, the coordinates entry fields have to be empty). The CDS database will be contacted and a window showing an area surrounding the pointing coordinates will be displayed. If you know already the coordinates of your target and want to verify the positioning or transform the target coordinates into pointing coordinates, you can enter the coordinates and click again on one of the Aladin buttons.

What are the "LR" and "HR" buttons? These buttons allow you to display your field with two different spatial resolutions: 1) The "Low Resolution" offers a field of view of 1.5 x 1.5 degrees (1 pixel = 6.8") 2) The "High Resolution" option displays an 15 x 15 arcmin image of the field (1 pixel = 1.7"). This HR image can be used for accurate positioning. However, due to the display limitations and the astrometry of the plates, **the pointing accuracy of Aladin will never be better than 3-4".**

**ATTENTION:** Aladin works only with coordinates for J2000.0. The coordinates sent back are automatically in J2000.0. **Important:** Please also note that the slight rotation of the superimposed WIRCam grid does not mean that we can rotate the mosaic! It is fixed at a given position at prime focus. The rotation in Aladin is just for respecting the orientation of the sky image. For instance, for the low resolution field surrounding M27 in the Aladin window will look like that:
Basically, an image of the target is displayed, stars in the fields are identified from the GSC (red circles) and 2MASS (blue circles; HR images only) catalogs, and a grid showing the WIRCam mosaic (including the gaps) is superimposed (see below for correct identification and orientation of the arrays). The coordinates indicated at the top left refer to the position of the center of the mosaic, indicated by the red cross, at the bottom corner of array 60. By clicking and holding the left button of the mouse, the mosaic can be moved across the field to position exactly the object where it should be. To be very precise, the zooming option can be used. When the object is correctly positioned, the pointing coordinates (that is, the center of the mosaic showed as the red cross) can be transferred to PH2 by simply clicking on the "Grab" button in the PH2 table, before closing the Aladin window. The coordinates will be included in the table and the pointing offsets set to zero; the target coordinates have now been transformed into pointing coordinates. That's it!

As shown in Aladin, the WIRCam mosaic has two different series of gaps between the detectors:

- **Vertical gaps:** The vertical gaps between each array is about 45 arcseconds. A dithering pattern with several exposures separated by offsets ~90° will get rid of these gaps (see instrument configurations).
- **Horizontal gaps:** The horizontal gap between both rows of detectors in the middle of the mosaic is about 45 arcseconds. A dithering pattern with several exposures separated by offsets ~90° will get rid of these gaps (see instrument configurations).

Very bright stars will saturate the chips so if it is an issue for your fields, you can use the GSC stars displayed in Aladin (magnitude is given by clicking on the red circles) and the moving grid to carefully define the target pointing.

- **Table (3):**
  - **Coordinates:** Coordinates of the targets can be entered manually through these entry fields, or with Aladin. The "check" and "save" options always verify that no typos resulting in illegal coordinates values (e.g. RA=26h) have been entered. No values
lower than -60 degrees in DEC are allowed.

- **Epoch**: The Epoch of the coordinates of the target. It can be fractional (e.g. 2001.3). All epochs between 1900.0 and 2050.0 are allowed.

- **Pointing Offsets**: Offsets applied from the target coordinates. The 5 positions are predefined offsets, illustrated below. These offsets are useful if you want to put the target at a specific location on the mosaic. By selecting the "New" button, you can edit the offset fields and define new positions. When the page is saved, these offsets are refereed under the name U_nnn (U for "user") and this option becomes available for all the targets in the table. After the save, it is not possible to redefine the values for a given customized offset. Just create a new one... When the target coordinates are rather entered with Aladin, the pointing offsets are set to zero. **NOTE**: As shown, the default offset "1" does NOT correspond to the physical center of the mosaic (center of the cross) but is rather shifted by about 1 arcminute from it to ensure that the object falls on a chip.

Schematics showing the positions of the 5 predefined offsets in PH2 for WIRCam. Position 1 is the default pointing. By selecting these pointing offsets, the target will be positioned on a specific location on the mosaic, as shown here by the green numbers.

- **Select**: Row selection for manipulation of the table with the "Duplicate", "Delete", etc. buttons.

**Downloading/Uploading Target Files.** At the bottom of the page, an option is available to download/upload a PH2 target list:

- **Astrores**: Astrores is a special XML format that is becoming standard in astronomy for this kind of application.

The "Download" option allows you to transform a list of target in the table of PH2 into an Astrores formatted file. For instance, if you have already a list of targets in a program that you would like to transfer to another program with a different runID, you can first go to the program with the target list, download it to an file on your local machine, edit it if necessary, and upload it in the appropriate program with the "upload" button. You can use also this button to create a template for further use: for instance, first enter a target, click "download", and you'll see the correct format for the Astrores template.

The following is a template of the Astrores file that you can copy to your local machine to use the download/upload features:

```xml
<?xml version = "1.0"?>
<!DOCTYPE ASTRO SYSTEM "http://vizier.u-strasbg.fr/xml/astrores.dtd">
<ASTRO ID="v0.8" xmlns:ASTRO="http://vizier.u-strasbg.fr/doc/astrores.htx">
    <TABLE ID="Table">
```
To upload a file, you can first save the example on your local machine by clicking on the "Astrores" button. All you have to do is to copy this template to your local machine within your favorite editor and then edit the ASCII table with your targets (do not change the XML code!). It is essential that you keep the appropriate format. Use the vertical lines as references for the number of spaces allowed. Most editors will keep this format automatically so it should not be a problem.

Important Note: Versions 6 and 7 of Netscape have an unfortunate bug affecting the translation of the XML template downloaded and ruins the format of the file. There is a workaround: 1 - After opening the Astrores template, go to "view page source" in the top menu. This will shows the HTML code. 2 - With the mouse, copy all the code between the "XMP and /XMP lines and paste to an editor. 3 - Edit the two occurrences of lowercase "table" appearing in the code to uppercase "TABLE", and save. The file is now ready to be edited and is uploadable. You can upload the file to PH2 by giving the right path and by clicking on the "Upload" button. We strongly encourage you to verify carefully your target list after that!

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Add N rows to the table.</td>
</tr>
<tr>
<td>x2 Duplicate</td>
<td>Duplicate the selected rows N times.</td>
</tr>
<tr>
<td>Select All</td>
<td>Select all the rows in the table. Clicking again on it deselect all the rows.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the selected rows. A confirmation window is displayed.</td>
</tr>
<tr>
<td>Check</td>
<td>Check the entries for errors. The errors found are displayed in a separate window and are indicated by a red frame in the table. An automatic check is done also when the form is saved or when the &quot;proceed&quot; button is activated.</td>
</tr>
<tr>
<td>Next Page</td>
<td>Display the next rows of the table.</td>
</tr>
<tr>
<td>Previous Page</td>
<td>Display the previous rows of the table.</td>
</tr>
<tr>
<td>Cancel</td>
<td>Cancel all the modifications done to the current page and reload data stored in the database.</td>
</tr>
<tr>
<td>Save</td>
<td>Save all the modifications done to the current page in the database and reload current page. Regular saving of the current form is recommended!</td>
</tr>
</tbody>
</table>
7) Ephemeris

This form allows the user to define targets for which coordinates might rapidly change with time. The form is only accessible if requested in the Program Constraints section. Before explaining how to use the form, here are two important caveats: 1 - For the moment, no extrapolation of any sort is conducted on the ephemeris entered; that is, coordinates used during the observations will be the ones matching the closest ephemeris entered for that date. 2 - Differential tracking (e.g. rates) is NOT possible right now; telescope tracking will be sidereal, with or without guiding (as can be indicated later in the OB form).

The general idea behind the ephemeris form is very simple: define a series of coordinates for a specific time for a given target. The top of the form, illustrated below, allows the user to first give a name to a target:

For instance, in the pull-down menu on the left, you can select "New". In the central window, you can then give a name to your target. "Pointing" refer to options for pointing offsets explained in the above "fixed targets" section. When you click on "Update", the table in the middle frame window is then created and your target receives a label "ET#" (for "ephemeris target").

The table below shows the entry fields for the ephemeris of the target specified:

Each row in the table is an ephemeris labeled "E#" and includes the UTC Date (beginning of a night in Hawaii is ~ 05:00:00 UT) and the coordinates of the target for this date (in J2000.0). As many ephemeris as wanted can be entered for a target and as many targets as wanted can be entered for a program. After defining all of the ephemeris for the target, we recommend that you save it immediately before starting defining the ephemeris for the next target (if needed). When saved, the ET will appeared in the list of targets used for defining the observation blocks (below).

Since entering a large number of ephemeris can be cumbersome the Astrores format template can be used at the bottom of the page to upload ephemeris for a given target (that is, one upload per target is necessary). To do so, apply first the procedure described above (create a new target name and click on update), since the name of the target cannot be defined from the Astrores template. Below there is a Astrores template (XML) that can copied on your local machine and then used to upload ephemeris to the table in the middle frame. (You can also create your own template on your local machine by first defining a target and click on "download". However, see important note in the fixed target section if you are using Netscape 6 and 7). It is important that the format is respected. You can then prepare the ephemeris for the target as seen in the lower part of the template and save the template under a specific name. When saved on your local
machine, you can then upload it by specifying the path. Check that everything is fine and then save the ephemeris table for that target. Repeat if necessary!

```xml
<?xml version = "1.0"?>
<!DOCTYPE ASTRO SYSTEM "http://vizier.u-strasbg.fr/xml/astrores.dtd">
<ASTRO ID="v0.8" xmlns:ASTRO="http://vizier.u-strasbg.fr/doc/astrores.htx">
  <TABLE ID="Table">
    <NAME>Ephemeris</NAME>
    <title>Ephemeris for CFHT QSO</title>
    <!-- Definition of each field -->
    <FIELD name="DATE_UTC"  datatype="A" width="19" format="YYYY-MM-DD hh:mm:ss">
      <DESCRIPTION>UTC Date</DESCRIPTION>
    </FIELD>
    <FIELD name="RA_J2000"  datatype="A" width="11" unit="h" format="RAh:RAm:RAs">
      <DESCRIPTION>Right ascension of target</DESCRIPTION>
    </FIELD>
    <FIELD name="DEC_J2000" datatype="A" width="11" unit="deg" format="DEd:DEm:DES">
      <DESCRIPTION>Declination of target</DESCRIPTION>
    </FIELD>
    <!-- Data table -->
    <DATA><CSV headlines="4" colsep="|">
      <![CDATA[
      DATE_UTC           |RA_J2000   |DEC_J2000  |
      YYYY-MM-DD hh:mm:ss|hh:mm:ss.ss|+dd:mm:ss.s|
      1234567890123456789|12345678901|12345678901|
      2003-06-04 06:30:00|09:34:00.00|+16:38:00.0|
      2003-06-05 06:30:00|09:35:15.00|+16:31:50.0|
      2003-06-06 06:30:00|09:36:33.00|+16:25:40.0|
      ]]></CSV></DATA>
  </TABLE>
</ASTRO>

8) User Dithering Patterns

This form allows the user to define his/her own dithering patterns. It is NOT a mandatory form and is only accessible from the navigation menu (i.e. "Proceed" from the "Fixed Targets" form will go to the "Instrument Configurations" form, not this one. Defining his own dithering patterns can be useful for some programs. Our experience, however, shows that data reduction can become much more difficult or can even be severely compromised with nonstandard patterns. Use only this form if only necessary for your program and if you have previous, extensive experience with data reduction of wide-field camera observations. For any doubt, do not hesitate to contact the QSO/Elixir Teams.

The idea behind this form is simple: the user can define a list of absolute offsets and saved this list as a dithering pattern under a customized name. This name can then be found under the pull-down menu for the available dithering patterns in the next PH2 form ("Instrument Configurations").

The top frame allows the user to visualize the offsets of a dithering pattern, create a new pattern, or delete a user pattern.

- **Left Window**
  - **Name:** Pull-down menu with the name of the existing dithering patterns, including the predefined "standard" patterns (see next form). The selection automatically displays the offsets in the table in the middle frame.
  - **Description:** Short description of the pattern
- **Middle Window**
  - **Name/Description** Name and description of the dithering pattern to be defined by the user. Clicking on "Create" open the
table in the middle frame.

- **Left Window**
  - **Delete DP**: Delete the current dithering pattern displayed in the table. A confirmation window will appear.

The middle frame displays the table used to define the dithering pattern:

<table>
<thead>
<tr>
<th>Label</th>
<th>Absolute Offset RA (arcmin arcsec)</th>
<th>Absolute Offset DEC (arcmin arcsec)</th>
<th>Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1</td>
<td>+00</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>O2</td>
<td>02</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>O3</td>
<td>01</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>O4</td>
<td>-02</td>
<td>01</td>
<td>00</td>
</tr>
</tbody>
</table>

- **Table:**
  - **Label**: The label identifies a row in the table which corresponds to an ABSOLUTE offset.
  - **Offsets**: Values of the RA/DEC offsets for each pointing within the dithering pattern. These offsets are ABSOLUTE, that is, DEFINED WITH RESPECT TO THE POSITION (0,0), NOT THE PREVIOUS POSITION. Positive offsets correspond to East and North. In the example above, the dithering pattern has four pointings: a reference (O1) corresponding to the pointing coordinates of the target since offsets are at 00:00; and three additional pointings all with respect to the position O1. Note that the largest offset possible for WIRCam is 10 arcminutes; this is to avoid problem with guide star selection.

### Button Function

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Add N rows to the table.</td>
</tr>
<tr>
<td>x2 Duplicate</td>
<td>Duplicate the selected rows N times.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the selected rows. A confirmation window is displayed.</td>
</tr>
<tr>
<td>Select All</td>
<td>Select all the rows in the table. Clicking again on it deselect all the rows.</td>
</tr>
<tr>
<td>Select All</td>
<td>Check the entries for errors. The errors found are displayed in a separate window and are indicated by a red frame in the table. An automatic check is done also when the form is saved or when the &quot;proceed&quot; button is activated.</td>
</tr>
<tr>
<td>Next Page</td>
<td>Display the next rows of the table.</td>
</tr>
<tr>
<td>Previous</td>
<td>Display the previous rows of the table.</td>
</tr>
<tr>
<td>Cancel</td>
<td>Cancel all the modifications done to the current page and reload data stored in the database.</td>
</tr>
<tr>
<td>Save</td>
<td>Save all the modifications done to the current page in the database and reload current page. <strong>Regular saving of the current form is recommended!</strong></td>
</tr>
<tr>
<td>Proceed</td>
<td>Save the content of the current page in the QSO database and open the next form.</td>
</tr>
</tbody>
</table>

### 9) Nodding Patterns

Infra-red astronomy differs from visible observations mostly because the sky background is a strong contributor and is much more...
variable. The near-IR sky on Mauna Kea can change by up to 10-20% in a few minutes. This is why exposure times and observing strategy must be able to frequently sample the sky. If the object is not very extended, the sky can be derived in regions of the mosaic without scientific signal for each dithering pattern position. However, when the object is extended (e.g. > 40% of the field of view of the mosaic), another technique must be used to sample the sky: **nodding.** The idea is simple: during the observations on the target, the telescope is slewed to a position away from the object in order to frequently established the sky background. For WIRCam, this is possible by applying regular offsets to the telescope.

PH2 offers a special **(optional)** form to define **nodding patterns.** The idea behind the form is this: define a precise sequence of observations (i.e. target-sky-target...) in order to be able to adequately sample the sky on a position close to the object and defined by offsets with respect to this target. The form in PH2 will appear quite complex at first but is in fact simple to use and allows the user to quickly define complex sequences. At the touch of a few buttons, the form allow the user to:

- Define a sequence of observations between the target and the sky region, with very flexible sampling frequency of the sky (T-S-T-S ; T-T-S-T-T; S-T-T-T-S, etc).
- Apply different dithering patterns (DP) or different scale to the target and the sky observations.
- Precisely define the sky region for a given target with a visual tool, Aladin.

There are two important things to take into account before defining the patterns:

1. The exposure strategy between the target and the sky will be the same. In other words, for each exposure within the DP, the time spent on the target and the sky will be spent the same way. For example, if for each DP position on the target, you apply a micro-dithering of 4 exposures of 10 seconds each, the same thing will be done on the sky region. Of course, the number of DP exposures on the sky is determined by the number of nodding offsets requested.
2. There is an **overhead of 60 seconds** charged for **every offset to or from** the sky position. We hope to reduce this overhead with some future improvements. The overhead is automatically accounted form in the Instrument Configuration form.

The top frame is where the user can fully define the nodding pattern for a given target:

- **Basic Target DP:** The first step is to define what basic Dithering Pattern must be applied to the target. For more information, the Instrument Configuration section below includes the complete list of patterns available. A pattern will be applied to the target, whatever the frequency of sky sampling is, so that the target will not be be found exactly at the same place all the time on the mosaic.
- **Scale:** The scale applies to the dithering pattern selected. See Instrument Configuration for more details.
- **Sequence Start:** The nodding sequence can either start on the target or on the sky region.
- **Sky Frequency:** This determines at what frequency the sky should be sampled relative to the target observations. For example, for each target DP exposure, the sky region can also be observed by slewing the telescope. There is no magical recipe for this sampling, however, since it all depends of your filter, exposure strategy and desired photometric precision.
- **DP on Sky Exposure:** The dithering pattern selected for the target can also be applied to the sky region, if desired. The default is set to "yes" since it's by far the best option to get a good sampling of the sky and remove the bad pixel regions.
- **Reference Sky Offsets:** The nodding patterns are defined by **offsets relative to the original target position.** The entry fields allow the user to precisely define the position of the sky region with respect to the target. The maximum offsets allowed is **5 degrees** from the target. The sign represent the motion of the telescope of the sky: + is East, + is North.
The second set of entry field "view sky") can be used to either visualize or fine tune the sky region position. It opens the Aladin tool as below:

The yellow frame display the WIRCam mosaic at the location of the sky region as defined by the offsets with respect to the target. By selecting the frame with the mouse, it's possible to move it and fine-tuned the location. When this is done, the "grab" button in the top frame form of the nodding form can be used to update this new position for the sky. That's all there is to it!

- **Existing Nodding Pattern:** This is used to display the parameters used for any existing nodding patterns saved by the user.
- **Creating Nodding Pattern:** This is used to give a name to the pattern created and some mnemonic description.

When the "create" button is selected, the table of offsets is displayed in the middle frame. All of the entry fields remained editable and additional offsets can even be added. The type of observation (target or sky) is described as well as the type of offset (e.g. target -> sky). When the user is satisfied, clicking on "save" will save the pattern and make it available in the Instrument Configuration form for further creation of the observation blocks.

**NOTE:** There is no simple way to directly edit an existing nodding pattern yet. The way to do it is like this: 1) View the existing pattern; 2) Change the name of the pattern in the create window; 3) Edit the pattern as needed; 4) Save.
Example

Nodding observation of an extended target is required from a user following this strategy: Five exposures on the target with a sky region located -1.5 degrees away in RA sampled every target exposure. For each exposure, micro-dithering is requested (1 loop of 4 micro-exposures; see instrument configurations). The nodding starts on the target and the DP is also applied on the sky. After selecting the appropriate entry fields in the form and saving the offsets, the observing sequence resulting in this strategy is illustrated in the figure below:

In this example, the sequence of offsets will be T1-S1-T2-S2-T3-S3-T4-S4-T5-S5, which each DP position producing a data cube of 4 exposures generated by the optional micro-dithering mode (instrument configuration).

10) Guide Star Exclusion Zones

Guiding for WIRCam is done on the arrays themselves. Acquisition software selects the stars according to their magnitude and location, and small guiding windows (size ~5" x 5") are then automatically positioned on those stars for guiding. Since those windows are read at a high rate, stars selected for guiding cannot be used for scientific purpose. For most scientific programs, this will not be an issue. However, for programs looking at bright stars, guiding might result in the lost of science if one of the interesting targets is choose for guiding.
To avoid this problem, we have developed a simple tool in PH2 with which the user can define small 30” x 30” exclusion zones for guide star selection. This information is passed to the acquisition software during the observations and algorithm for guiding selection automatically rejects stars located in those exclusion boxes. The form needed for that in Ph2 is optional and is only available when requested in the program constraints page.

**Important Note 1:** Use the exclusion zone tool only if you need it, that is, if there is a danger to lose one of your scientific targets to guiding. Guiding priorities are established according to the magnitude of the object. If your objects of scientific interest are bright stars (e.g. mag < 11), it might be preferable to use the exclusion zone tool to make sure that you will not lose interesting targets. Programs looking for extragalactic sources are not required to do although we have seen problematic cases when the center of a galaxy was very bright and peaked, enough to be confused with a star...

**Important Note 2:** Exclusion zones are directly linked to the target positions defined in the fixed target form. Before you define zones, make sure that the coordinates of the target are definitive. If not, a change in the target will result in invalidating the zones and you will have to start again!

**Important Note 3:** Exclusion zones are only possible for fixed targets. Targets defined by ephemeris positions cannot be used for defining zones of exclusion.

The top frame allows the user to first select the target for which the zones of exclusion of guide stars should be defined. The principle of the tool is very simple: when a target is selected, Aladin can be open either with the "low resolution" (LR) or "high resolution" (HR) mode. When this is done, the target is displayed along with the 2MASS and GSC catalog:
Aladin displays the field of the fixed target selected by the user. Here, for instance the object NGC 6946 is displayed in the low-resolution mode (1.5d x 1.5d) with the WIRCam mosaic field of view.
Here, the same target is displayed in the high-resolution mode. Unfortunately, this only shows a field of 15' x 15', smaller than the total field of view of WIRCam. The "gsez" button can be used to define 30'' x 30'' guide star exclusion zones across the field.

Guide Star Exclusion Zones: Selection and Editing

To enter exclusion zones, the user can select the "gsez" button and click on stars that he/she would like to remove from potential candidates for guide stars. A box of 30'' x 30'' will be displayed in Aladin; it is not possible to change the size of this box but everything inside will not be considered for guiding. Clicking again on the star will remove the box. If previous stars were already defined and saved in the table (see below), when you open Aladin, clicking on the "gsez" button will display all the stars in the list. **DO NOT CLOSE ALADIN BEFORE SAVING THE ZONES (see below)!!**

When the user is satisfied with the selection of zones, the grab button in the PH2 form should be selected.

Exclusion Zones Table

When the user is satisfied with the selection of zones, the grab button in the PH2 form should be selected. This action will result in a similar table as below:
This table displays all the zones defined by the user, including the coordinates and status. Three different status are possible: *Pending*, means that the zone has been defined but not saved; *Ready* means that the zone has been saved and will be taken into account during the observations; *Invalid* means that the zone was previously saved but that the coordinates of the target have changed and that the zone is no longer valid for the observations.

Editing a list of zones already saved is easy. Reselect the target in the top frame, open Aladin and click on the "gsez" button. If you want to remove one of the box, click on it (the box will disappear) and grab the boxes again in the PH2 form and save.

11) Instrument Configurations

This is the second mandatory step in the creation of the observing blocks. This page allows the user to define all the instrumental configurations necessary for the program. The same configuration can be used several times with different targets. The main section of the page is a table with different options under pull-down menus or editable entry fields. Some entry fields and dynamically linked, that is, a selection in one of the pull-down menu will change the options in another one.

But, first the top frame can be used to help in the preparation of these configurations by offering the following elements:

- **List of Targets:** This little window displays the name of the targets defined in the previous form. It is just available as a mnemonic resource so that the user does not have to navigate back and forth between page to look at the list of targets. Nothing to click on, it's just a scrolling display!

- **Predefined Dithering Patterns:** This window presents some of the different dithering patterns ("DP") offered in one of the pull-down menu in the configuration table. The "single" pattern represents the option for one exposure. The blue circle represents the radius of the pattern and the red dots show the relative positions of the individual exposures within the pattern. Two parameters describe the geometry of the other patterns: the number of exposures (indicated by the digits following the "DP"), and the scale factor within which the offsets are applied. The patterns have been designed so that the coordinates of the objects will never be the same twice during the sequence. Of course, as described in section B.7, each exposure within a DP for WIRCam is a cube of N sub- or micro-exposures. Experience has showed that at least a minimum of 5 exposures is necessary to get rid of the gaps between the chips. Additional pre-defined ditherings, WDP, successively putting the object in the center of each array are also available. More information on the different options for the dithering patterns is found below.

- **Exposure Time Calculator:** There is an exposure time calculator available for WIRCam. The Digital Imaging Exposure Time (DIET) interface is automatically open when this link is activated. We strongly recommend that you use the calculator during the preparation of your observations. By doing so, you will be able to specify the right parameters for your observations (exposure time, seeing, sky brightness) in order to achieve your science goals.
The middle frame of the configuration page consists in a table and buttons to manipulate the entry fields:

<table>
<thead>
<tr>
<th>Label</th>
<th>Name</th>
<th>Filter</th>
<th>Dithering Pattern</th>
<th>Scale of DP</th>
<th>Micro Dithering</th>
<th>Number of sub. or micro exposures per DP position</th>
<th>Time per sub. or micro-exposure (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>JMD_DP5</td>
<td>J</td>
<td>DP5(CP)</td>
<td>10</td>
<td>Yes</td>
<td>4</td>
<td>30.0</td>
</tr>
<tr>
<td>I2</td>
<td>HMD_DP10</td>
<td>H</td>
<td>DP10(CP)</td>
<td>10</td>
<td>Yes</td>
<td>8</td>
<td>10.0</td>
</tr>
<tr>
<td>I3</td>
<td>H2 No-MD DP6</td>
<td>H2(1-0)</td>
<td>DP6(CP)</td>
<td>15</td>
<td>No</td>
<td>3</td>
<td>120.0</td>
</tr>
<tr>
<td>I4</td>
<td>CH4 nodding</td>
<td>CH4-On</td>
<td>helix(CP)</td>
<td>N/A</td>
<td>No</td>
<td>1</td>
<td>30.0</td>
</tr>
</tbody>
</table>

- **Top Row:**
  - **RunID:** Identification of the program you are currently working on.
  - **Table Status:** List of the current rows and the total number of configurations already defined in the current table.
  - **Instrument:** Link to the WIRCam Web page.

- **Table:**
  - **Label:** The label identifies a row in the table. The instrument configurations are simply identified as I#. The label is automatically updated if the rows are changed.
  - **Name:** The name of the instrument configuration, as given by the user. A mnemonic name (e.g. Filter J, short) will make the subsequent steps easier. The name must be shorter than 20 characters.
  - **Filter:** The list of filters currently available for WIRCam. The number of filters offered for one semester is limited for a given semester (8). The current options for 2007A are: Y, J, H, Ks, H2(1-0), K-continuum, LowOH-1, Br-gamma. Information on these filters can be found on the WIRCam Web page.
  - **Pattern:** 1) **Name** of the dithering pattern. Single means one exposure. DP# means "dither pattern with # number of exposures", WDP# means "WIRCam dithering pattern" with # number of loops and, (NP) means a nodding pattern previously defined in the special form designed for this purpose. 2) **Scale** for the dithering pattern. Multiple exposures with no dithering are possible by selecting the appropriate pattern and requesting a scale of 0. These values are possible: N/A, 0, 1 and 1.5. Default is 1. The N/A is only judged valid for the single exposure, WDPs and nodding patterns.

### Basic Dithering Patterns

The WIRCam mosaic has only one series of gaps between the detectors which have all the same size (45°). The pre-defined basic dithering patterns offered for WIRCam (DP#) at this time cover those gaps and the bad pixel regions on the mosaic. The DP offsets are detailed in the following tables. The "DP" patterns can be used with two scale factor. Scale 1 covers the bad pixels regions and mosaic gaps. Scale 1.5 will cover all of those plus give a better sampling of the sky.
**WIRCam Dithering Patterns**

The pre-defined WIRCam dithering patterns (WDPs) are special patterns which put an object on the center of the four arrays. The number following WDP indicate the number of loops; a limit of 5 loops, that is 20 cubes, is possible. Offsets are automatically applied each time the object comes back to a specific array to help removing bad pixels and sky background. The figure below illustrates the 20 cube that a WDP5 would do, for example. Note of course, that each cube can have several sub- or micro-exposures. **IMPORTANT NOTE:** If you plan to use WDPs, make sure that the pre-defined pointing offsets in the fixed targets table is set to position 1 (in order word, the object should be found at the bottom right corner of chip 60).

### WIRCam Dithering Patterns Table

<table>
<thead>
<tr>
<th>DP2</th>
<th>Position</th>
<th>Scale Factor: 1</th>
<th>Scale Factor: 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RA Offset (&quot;)</td>
<td>Dec Offset (&quot;)</td>
<td>RA Offset (&quot;)</td>
</tr>
<tr>
<td>1</td>
<td>00:00</td>
<td>00:00</td>
<td>00:00</td>
</tr>
<tr>
<td>2</td>
<td>01:30</td>
<td>01:30</td>
<td>02:13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DP3</th>
<th>Position</th>
<th>Scale Factor: 1</th>
<th>Scale Factor: 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RA Offset (&quot;)</td>
<td>Dec Offset (&quot;)</td>
<td>RA Offset (&quot;)</td>
</tr>
<tr>
<td>1</td>
<td>00:00</td>
<td>00:00</td>
<td>00:00</td>
</tr>
<tr>
<td>2</td>
<td>01:30</td>
<td>01:30</td>
<td>02:12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DP4</th>
<th>Position</th>
<th>Scale Factor: 1</th>
<th>Scale Factor: 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RA Offset (&quot;)</td>
<td>Dec Offset (&quot;)</td>
<td>RA Offset (&quot;)</td>
</tr>
<tr>
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<td>00:00</td>
<td>00:00</td>
<td>00:00</td>
</tr>
<tr>
<td>2</td>
<td>01:18</td>
<td>00:42</td>
<td>01:00</td>
</tr>
<tr>
<td>3</td>
<td>00:00</td>
<td>00:42</td>
<td>04:30</td>
</tr>
<tr>
<td>4</td>
<td>00:42</td>
<td>01:18</td>
<td>01:30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DP5 - DP21</th>
<th>Position</th>
<th>Scale Factor: 1</th>
<th>Scale Factor: 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RA Offset (&quot;)</td>
<td>Dec Offset (&quot;)</td>
<td>RA Offset (&quot;)</td>
</tr>
<tr>
<td>1</td>
<td>00:00</td>
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<td>2</td>
<td>01:00</td>
<td>01:18</td>
<td>01:27</td>
</tr>
<tr>
<td>3</td>
<td>00:12</td>
<td>01:00</td>
<td>00:27</td>
</tr>
<tr>
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<td>01:00</td>
<td>01:30</td>
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<td>5</td>
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</tr>
<tr>
<td>6</td>
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<td>00:42</td>
<td>-01:00</td>
</tr>
<tr>
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<tr>
<td>9</td>
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</tr>
<tr>
<td>21</td>
<td>00:36</td>
<td>00:36</td>
<td>00:54</td>
</tr>
</tbody>
</table>
Micro-dithering: The pixel scale in WIRCams is 0.3"/pixel so the best image quality which is adequately sampled is ~0.7". To make good use of better seeing, WIRCams uses micro-dithering: 4 individual exposures, shifted by 0.15" on a square grid, provide Nyquist sampling of the recombined image for all conditions (several groups (up to 7) of 4 micro-dithered exposures can be done sequentially on one dithering pattern position (a cube)). In some cases this may require additional detectors readouts, and therefore introduce overheads. Note that micro-dithering is not expected to yield much improvement when the natural seeing is ~ > 0.8". For the YJHKs filter set, the user has the choice of using micro-dithering or not in this column. Since micro-dithering requires good (bright) guide stars, it is not offered for narrow-band filters anymore. The next column options is defined by this selection. The micro-dithering mode requires guiding as it uses the guiding stars to control the offset produced by the ISU. This requirement is checked in the observing block PH2 form.

- **Number of sub- or micro-exposures**: Number of sub-exposures or micro-exposures \( N \) per exposure of the DP (that is, the number of exposures within the cube). To keep the size of the files manageable, \( N < 28 \). Of course, for micro-dithering exposures, \( N = 4,8,16,20,24,28 \).

- **Exposure Time**: Exposure times for the individual sub- or micro-exposures taken within the dithering pattern. For 2007A, the lower limit is 5 seconds. For WIRCam, the upper limit depends on the filter selected to avoid saturation by the sky background. The current maximum exposure times for each filter are given in the following table:

<table>
<thead>
<tr>
<th>Filter</th>
<th>Maximum Exptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>150 seconds</td>
</tr>
<tr>
<td>J</td>
<td>60 seconds</td>
</tr>
<tr>
<td>H</td>
<td>15 seconds</td>
</tr>
<tr>
<td>Ks</td>
<td>25 seconds</td>
</tr>
<tr>
<td>LowOH-1, Low OH-2</td>
<td>5000 seconds</td>
</tr>
<tr>
<td>Ch4-On, CH4-Off</td>
<td>50 seconds</td>
</tr>
<tr>
<td>H2(1-0)</td>
<td>200 seconds</td>
</tr>
<tr>
<td>Kcont</td>
<td>200 seconds</td>
</tr>
<tr>
<td>Br-gamma</td>
<td>200 seconds</td>
</tr>
</tbody>
</table>

- **Select**: Row selection for manipulation of the table with the "Duplicate", "Delete", etc. buttons.

**Integration Time Calculation**

The integration time (I-time) calculation is done for each instrument configuration (IC) according to the general formula:

\[
I\text{-time} \ (IC) = I\text{-time} \ (target) + I\text{-time} \ (Sky) + \text{Overheads} \ (target + sky)
\]
where

I-time (target) = [Number of DP exposures x number of sub- (micro) exposures x Exptime] on target

I-time Sky) = [Number of DP exposures x number of sub- (micro) exposures x Exptime] on sky region

Overheads (target + sky) = readout 10sec overhead (target + sky) per sub- or micro-exposure + 60 sec x Number of Offsets for nodding

Of course, if no nodding is used, no I-time or overheads are charged for the sky exposures and offsets. At the moment, readout overhead = 10 seconds. The actual readout of the camera is shorter but there is all kind of other overheads related to the operations of WIRCam to achieve an exposure that must be taken into account. In short, each sub- or micro-exposure has an total overhead of 10 seconds. We hope to significantly reduce this overhead at some point...

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Add N rows to the table.</td>
</tr>
<tr>
<td>x2 Duplicate</td>
<td>Duplicate the selected rows N times.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the selected rows. A confirmation window is displayed.</td>
</tr>
<tr>
<td>Select All</td>
<td>Select all the rows in the table. Clicking again on it deselect all the rows.</td>
</tr>
<tr>
<td>Check</td>
<td>Check the entries for errors. The errors found are displayed in a separate window and are indicated by a red frame in the table. An automatic check is done also when the form is saved or when the &quot;proceed&quot; button is activated.</td>
</tr>
<tr>
<td>Next Page</td>
<td>Display the next rows of the table.</td>
</tr>
<tr>
<td>Previous Page</td>
<td>Display the previous rows of the table.</td>
</tr>
<tr>
<td>Cancel</td>
<td>Cancel all the modifications done to the current page and reload data stored in the database.</td>
</tr>
<tr>
<td>Save</td>
<td>Save all the modifications done to the current page in the database and reload current page. Regular saving of the current form is recommended!</td>
</tr>
<tr>
<td>Proceed</td>
<td>Save the content of the current page in the QSO database and open the next form.</td>
</tr>
</tbody>
</table>

12) Constraints

This page presents the table designed for defining the sky constraints under which the observations should be undertaken. The top frame displays information about the targets and instrument configurations defined previously:

- **List of Targets:** This little window displays the name of the targets defined in the Fixed Targets form. It is just available as a mnemonic resource so that the user does not have to navigate back and forth between pages to look at the list of target. Nothing to click on, it's just a scrolling display!

- **List of Instrument Configurations:** This window displays the names of the instrument configurations and some of their content defined in the previous form. It is just available as a mnemonic resource so that the user does not have to navigate back and forth between pages to look at the list of configurations. Nothing to click on, it's just a scrolling display! The different times between parenthesis indicate how the calculation for the total I-time of the instrument configuration was made (T: I-time on target ; S: I-time spent on sky for nodding; O: Overheads charged for nodding).
**Exposure Time Calculator:** There is an exposure time calculator available for WIRCam. The Digital Imaging Exposure Time (DIET) interface is automatically open when this link is activated. We strongly recommend that you use the calculator during the preparation of your observations. By doing so, you will be able to specify the right parameters for your observations (exposure time, seeing, sky brightness) in order to achieve your science goals.

The middle frame presents the table for the constraints:

<table>
<thead>
<tr>
<th>RUNID</th>
<th>06AP94</th>
<th>PI: Pierre Martin</th>
<th>Rows C1 to C2 of 2 Observing Block Constraints</th>
<th>PHYS: WIRCAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Label</td>
<td>Name</td>
<td>Image Quality</td>
<td>Sky Bright.</td>
<td>Airmass</td>
</tr>
<tr>
<td>C1</td>
<td>Good seeing</td>
<td>0.05 to 0.08</td>
<td>Medium</td>
<td>&lt; 2.0</td>
</tr>
<tr>
<td>C2</td>
<td>Mediolce seeing</td>
<td>1.00 to 1.20</td>
<td>High</td>
<td>any</td>
</tr>
</tbody>
</table>

**Top Row:**
- **RunID:** Identification of the program you are currently working on.
- **Table Status:** List of the current rows and the total number of constraints already defined in the current table.
- **Instrument:** Link to the WIRCam Web page.

**Table:**
- **Label:** The label identifies a row in the table. The constraints are simply identified as C#. The label is automatically updated if the rows are changed.
- **Name:** The name of the constraint, as given by the user. A mnemonic name (e.g. Best IQ, dark) will make the subsequent steps easier. The name must be shorter than 20 characters.
- **Image Quality:** Pull-down menu for indicating the image quality constraint in the K band (see below). The image quality constraint has normally the highest priority in the selection of the program to be executed by the QSO Team. The option available are bands of acceptable image quality: IQ < 0.55", 0.55" < IQ < 0.65", 0.65" < IQ < 0.80", 0.80" < IQ < 1.0", 1.0" < IQ < 1.2", IQ > 1.2". The table below indicates the equivalent image quality (+/- 25%) for the other broad-band filters. The next table illustrates some statistics on the image quality on Mauna Kea.
- **Max IQ (monitoring):** This option only appears for programs requesting monitoring constraints. You can indicate here the maximum image quality acceptable for your program. This upper limit will be used to meet the time constraints associated with the program (for instance, if the seeing is worse than the regular constraint requested when an observation has to be repeated). The N/A option means that the IQ band as specified will have to be respected - in short, the IQ band has priority over the time constraint. If the IQ is not met during the time constraint, the observation will not be done. If the time constraint has the absolute priority and that the field should be observed whatever the seeing conditions, indicate an upper limit of > 1.2".
- **Sky Background:** Qualitative sky brightness. Two options are offered for WIRCam: Median and High. In near-IR, the Moon does not have much of an influence but the sky emission can vary greatly during a night. On Mauna Kea, the first hour or so of the night can be considered "high" and after the airglow settles down a bit, the sky is usually darker (median"). Variations of 10-20% within a few minutes are common, however, so the actual range define by those two background values are quite large. Unless it's very critical that the sky emission is at the lowest possible for your observations, we recommend that you use "high" for the constraint.
- **Airmass:** Constraint on the airmass for the observations. The weight of this constraint is not very strong in the selection process of the program to be undertaken. Four options are available: < 1.2, < 1.5, < 2.0, any. Unless absolutely necessary, < 2.0 or "any" are the preferable options. We will aim for < 1.5 but beware that scheduling constraints might forbid the QSO Team to reach this goal for all of the observations.
- **Select:** Row selection for manipulation of the table with the "Duplicate", "Delete", etc. buttons.

**A word on the Image Quality.** The constraint on the band image quality is the strongest criterion for the selection of a program to be undertaken. The QSO Team will try to respect the constraint on the image quality at all time for your observations. Our goal is to never exceed the upper limit defined by your constraint by more than 15%. Evidently, the image quality varies through a band to another. The reference band for the QSO with WIRCam will be the K-band, that is that during the observations, the image quality will always be translated to this band. So, for instance, if you specify a limit of IQ of 0.80" for an observation with the Y filter, you could expect that an resulting image with about 1.0" would still be validated by the QSO Team.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value observed with respect to IQ specified in PH2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Quality in Y band</td>
<td>FWHM ~ + 0.1 - 0.2&quot; larger than K band</td>
</tr>
<tr>
<td>Image Quality in J band</td>
<td>FWHM ~ + 0.1&quot; larger than r band</td>
</tr>
<tr>
<td>Image Quality in H band</td>
<td>FWHM similar to K band</td>
</tr>
<tr>
<td>Image Quality in K band</td>
<td>Reference</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Image Quality (IQ) K Band</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ &lt; 0.55&quot;</td>
<td>20</td>
</tr>
<tr>
<td>0.55&quot; &lt; IQ 0.65&quot;</td>
<td>25</td>
</tr>
<tr>
<td>0.65&quot; &lt; IQ 0.80&quot;</td>
<td>20</td>
</tr>
<tr>
<td>0.80&quot; &lt; IQ 1.0&quot;</td>
<td>15</td>
</tr>
<tr>
<td>1.0&quot; &lt; IQ 1.2&quot;</td>
<td>15</td>
</tr>
<tr>
<td>IQ &gt; 1.2&quot;</td>
<td>5</td>
</tr>
</tbody>
</table>

From these tables, a few facts can be stated:

- Variations of the seeing are fast. This again argues for short observation blocks or groups. These quick variations might introduce images in a sequence for which the image quality is outside the IQ band specified. If the difference is about 10-20%, these images will be considered valid. However, if the IQ variation is too important, these images might be taken again.
- The probability that your program is executed depends strongly on the image quality required. Be realistic! In particular, for Programs with the C grade, it would be much preferable not to specify an IQ better than 0.8".
- It is important that you request a realistic IQ also when your targets do not reach a low airmass. For instance, asking for 0.6" when the airmass is never smaller than 1.5 is not very likely to happen....
- By definition, snapshots programs MUST request IQ > 1.2".

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
<td>Add N rows to the table.</td>
</tr>
<tr>
<td>x2 Duplicate</td>
<td>Duplicate the selected rows N times.</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete the selected rows. A confirmation window is displayed.</td>
</tr>
<tr>
<td>Select All</td>
<td>Select all the rows in the table. Clicking again on it deselect all the rows.</td>
</tr>
<tr>
<td>Check</td>
<td>Check the entries for errors. The errors found are displayed in a separate window and are indicated by a red frame in the table. An automatic check is done also when the form is saved or when the &quot;proceed&quot; button is activated.</td>
</tr>
<tr>
<td>Next Page</td>
<td>Display the next rows of the table.</td>
</tr>
<tr>
<td>Previous Page</td>
<td>Display the previous rows of the table.</td>
</tr>
<tr>
<td>Cancel</td>
<td>Cancel all the modifications done to the current page and reload data stored in the database.</td>
</tr>
</tbody>
</table>
13) Observation Blocks

This is it! This page allows the user to link all the previously defined entities within observation blocks (OB). The main page is divided into two main frames:

**Select target(s):**

- FT1, NGC 4258
- FT2, NGC 7479
- FT3, NGC 1072
- ET1, Testing

**Create the instrument config list:**

- [OB1]: J/M: DF5 [UCRPS(T):75.000s*+S:0.000s*+O:0.000s*+760s]
- [OB2]: H: D10 [H: D10(T):1440s*+S:0.000s*+O:0.000s*+1440s]
- [OB3]: H: No-MD DP6 [H: (1-0).DF6(T):2384s*+S:0.000s*+O:0.000s*+2384s]
- [OB4]: 3/Chon nodding [3/Chon(T):1520s*+S:1520s*+O:420s*+724s]

**Configuration List:**

- [OB1]: FT1 (T1) C1 (12:40): Sidereal Guiding
- [OB2]: FT1 (T1+H2) C1 (36:40): Sidereal Guiding

**Select one constraint:**

- C1: Good seeing
- C2: Mediocre seeing

**HINT:** The number of rows displayed at once is only a few. The "Next Page", "Previous Page" buttons can be used to navigate between the different pages. The blue links OB# represent the first row of each individual pages and can also be used for moving quickly from a page to another.

- **Top Frame:**
  - **Target Selection:** The first element to enter in the creation of the OB is **one target**. This window lists all the targets previously defined. To select one, simply click on it with the mouse. The selection is then enlighten by a darker background. It is also possible to select **several** targets in the list by holding the "control" button. An OB will be created for **each** target selected when the "Create OB" button is pressed. The selection remains visible after the creation of the OB with the "Create OB" button.
  - **Configuration List:** The second element to enter in the creation of the OB is the **configuration list**. An OB can have one or **several** configurations. To achieve that, you must create a list with first selecting the configurations and second, by adding them to the list on the right. You can change the order of the configurations with the up and down arrows. **The configurations will be executed in the order given in this list.** The total integration time for the instrument configuration is indicated; the calculation is the sum of the I-time spent on the target (T), the sky (S) and the overheads (O) charged in case of nodding.
  - **Constraint Selection:** The final entity to create an OB is the constraint. As with the target, the selection is done with the mouse and remains enlighten after the creation of the OB.
  - **Defaults:** This is new in PH2. It’s possible to define the defaults of certain parameters defining the observing blocks. **Accurate Pointing Option:** Pointing accuracy of the telescope is about 10-15". If this option is selected, an automated correction will be done to the pointing using an astrometric solution automatically computed during the observations. Final pointing will be accurate to about 1". The default is enabled. **Photometric:** See below. **Tracking:** You can specify if the observation will need guiding or non-guiding. Note that if you select non-guiding for an OB requesting micro-dithering, the tracking will be set to guiding.
- **Middle Frame:**
  - **Label:** The label identifies a row in the table. The observation blocks are simply identified as OB#. The label is automatically updated if the rows are changed. By clicking on the label in the table, the selections are displayed again in the windows of the top frame.
  - **Target:** Target label used for this observation block.
  - **Configuration(s):** List of configurations used for this observation block. Individual configurations are separated by the "+" sign and the order of execution goes from left to right.
  - **Constraint:** Constraint label used for this observation block.
  - **OB I-Time:** Total integration time (I-time) requested for the execution of this observation block. Since it is much easier to schedule short observation blocks, the total I-time for one OB cannot exceed 2 hours.
  - **Tracking:** Two options are offered here: 1) Sidereal, guiding. This is the typical exposure and the default selection. 2) Sidereal, non-guiding. In case of short exposures (e.g. < 10 seconds), it is entirely preferable to select this option because finding a guide star is time consuming and that the image quality is not degraded for images with very short exposure times. However, for WIRCam, sidereal non-guiding is not made available if the OB has an instrument configuration requesting micro-dithering.
  - **Type:** Type of observation. Only "object" is available.
  - **Photometric:** Does this OB require to be done during photometric time only? The definition for this flag for WIRCam differs from MegaCam. Observations for MegaCam done under non-photometric conditions are calibrated later on with short exposures if this flag is enabled. For WIRCam, photometric calibration is provided on each exposure by Elixir using the 2MASS catalog. So, in principle, photometry will be accurate to a few percents and extinction to clouds can be estimated for each image. However, for certain programs, in particular programs requesting very high photometric accuracy or programs with nodding might require to be done under photometric sky only. This flag is disabled by default.
  - **Accurate P?** Indicates if accurate pointing was selected or not. See above.
  - **Comment:** You can enter a comment for each individual OB. These comments are visible at all time during the observations. The comment associated to the OB is included in the FITS headers of the images (keyword:CMMTOBS).
  - **Select:** Row selection for manipulation of the table with the "Delete" button.

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="create.png" alt="Create OB(s)" /></td>
<td>Create an Observation Block, after selecting one target, one or several instrument configurations, and one constraint.</td>
</tr>
<tr>
<td><img src="modify.png" alt="Modify OB(s)" /></td>
<td>Modify an observation block. After selecting one or several OBs in the table (&quot;select&quot; column in the table), the OBs will be modified according to the parameters defined by the top lists after clicking this button. Thus, it is possible to change the content of an OB without having to delete it and create it again. <strong>Important:</strong> You must make sure that the total I-time allocated for your program has not been exceeded after modifying the OG.</td>
</tr>
<tr>
<td><img src="delete.png" alt="Delete" /></td>
<td>Delete the selected rows. A confirmation window is displayed.</td>
</tr>
<tr>
<td><img src="select_all.png" alt="Select All" /></td>
<td>Select all the rows in the table. Clicking again on it deselect all the rows.</td>
</tr>
<tr>
<td><img src="check.png" alt="Check" /></td>
<td>Check the entries for errors. The errors found are displayed in a separate window and are indicated by a red frame in the table. An automatic check is done also when the form is saved or when the &quot;proceed&quot; button is activated.</td>
</tr>
<tr>
<td><img src="next_page.png" alt="Next Page" /></td>
<td>Display the next rows of the table.</td>
</tr>
<tr>
<td><img src="previous_page.png" alt="Previous Page" /></td>
<td>Display the previous rows of the table.</td>
</tr>
<tr>
<td><img src="cancel.png" alt="Cancel" /></td>
<td>Cancel all the modifications done to the current page and reload data stored in the database.</td>
</tr>
<tr>
<td><img src="save.png" alt="Save" /></td>
<td>Save all the modifications done to the current page in the database and reload current page. <strong>Regular saving of the current form is recommended!</strong></td>
</tr>
<tr>
<td><img src="proceed.png" alt="Proceed" /></td>
<td>Save the content of the current page in the QSO database and open the next form.</td>
</tr>
</tbody>
</table>

### 14) Observation Groups

This page presents the last step in the preparation of your observations: the creation of the observation groups (OG). The OGs will be the entities scheduled at the telescope so **this step is necessary**, even if you have previously defined all the observation blocks. The OG page is presented below:
Observation Group Type:

Three types of Observing Groups (OG) are possible:

1) **1OB (Single OB)** means that the observation blocks previously prepared are transformed into individual OGs. If all the OBs should be transformed into OG, this can be done automatically by selecting the "Quick Create OGs" button; it is the **recommended approach** for the QSO mode.

2) **Monitoring OG (MOB)** means that one specific OB will be observed a certain number of times within a given period. The selection of the OB is done through the list on the right and the OG monitoring parameters are entered in the window on the right.

3) **OBs can be linked together to form a sequence (SOB)**. The list of OBs to link can be done with the entry field on the right. **Beware:** only OBs requesting the **same constraint** can be linked together. We also want to **discourage the use of SOBs as much as possible:** shorter 1OB OGs are easier to schedule and execute!

**OB List:** Except when one desire to transform all the OBs into OGs with the "Quick Create OGs" button, the creation of an OG of any type requires a list of OBs. This can be done using this window. The order of the OB within the list can be altered with the arrows. When clicking on an OB from this list, the window on the right displays a summary of its content. There is a new feature in PH2: it is now possible to do multiple selection of the OB in the left window before clicking on the "add" button. This can diminish greatly the number of clicks necessary to create a sequence of OBs for instance. If multiple OBs are found in the list (on the right) and the "single OB" option was selected, one OG per OB in the list will be created if you click on "Create OG(s)" in the table. If "monitoring OG" is selected and multiple OB are in the list, each OG created will have the same monitoring parameters.

**Observation Groups Options:** See Below

Middle Frame:

- **Label:** The label identifies a row in the table. The observation groups are simply identified as OG#. The label is automatically updated if the rows are changed.
- **Type:** Identifies the type of groups: 1OB (single OB); MOB (monitoring OB); SOB (sequence of OBs).
- **OB:** Identifies the observation block(s) used to create this specific observation group. Clicking on an OB from this entry field displays again the content of the block in the top frame.
- **Group I-time:** Total integration time in seconds for this Observation Group. If monitoring, I-time (OG) = N(iterations) x I-time (OB).
- **Priority:** Priority (high, medium, low) of this observation group for your program. This will be used by the QSO Team during the selection process leading to the execution of the observations for your program. Selecting "lowest" does not mean that this OG will never be done; we aim for the completion of programs. It is only a way to ensure that if the completion level of your program is not 100%, that at least the most important targets have been observed.
- **Comment:** Any comments you might think would be useful for the QSO Team.
- **Select:** Row selection for manipulation of the table with the "Delete" buttons.
- **I-Time Allocated**: Integration time allocated by the Time Allocation Committee for your program. **This time cannot be exceeded!**
- **I-Time Calculated**: Total integration time requested for all the observing groups defined in this page. It automatically includes the readout time for the CCD for all of the individual exposure in the OG and an overhead of 2 minutes for each accurate pointing required, if necessary. The I-time is automatically calculated after the creation of an OG.
- **I-Time Left**: I-time allocated - (I-time calculated); it cannot be negative. If I-time left < 0, a warning window is displayed. **The new OG is included in the table but cannot be saved.** You must modify the OG table in order to get I-Time equal or larger than zero. If you click on "cancel" instead, the new OG is removed from the table.

**Observation Groups: Options**

There are three important options available for the Observation Groups, useful to precise specific observations. These options are first presented in the "Program Constraints" section and **appear only in the OG form if requested.**

![Params for Monitoring OGs](image)

**Monitoring Parameters**: Parameters for the monitoring OGs. This window appears only if you have indicated that your program requires monitoring. You can enter a *period* in hours, days or weeks. To enter the parameters, first select the unit and then fill up its value. The *number of iterations* corresponds to the numbers of times that this OG should be done at the interval of the period. The *minimum number of iterations* corresponds to the acceptable minimum number of observations to reach the science goals. We will reach for the total number of iterations but only OGs that have met the minimum number of iterations will be considered valid.

![Params for Relational Execution](image)

**Relational Execution Link (REEL)**: For certain programs, it is important that the observations take place within a specific sequence of events. For instance, if OG1 is done and validated, only then OG2 should be done within a certain timescale. It is possible to manage this kind of sequence at a higher level on a small scale (that is, during the preparation of the queues) but on a larger scale, it is much more preferable to have these options "hard coded" in the database. To cover such possibilities, we have developed the concept of the **REEL**: basically, it is possible to create a *causal* link between observation groups. This can be done in the last window on the right, if you have selected the REEL option in the "Program Constraints" section. Essentially, a REEL means this: "After the validation of the reference OG, the linked OG should be done within a certain delay." You can then link several OGs, if needed. For instance, OG3 to OG2 to OG1, etc. The links created appear in the OG table. An example of a REEL sequence is showed below.
IMPORTANT: The REEL option should be used ONLY when appropriate. If the observations cannot be done within the window defined by the (delay +/- delay) (due to bad weather or technical problems), the completion of the chain will not be done. Also, the logic involved in defining the REELs in PH2 is complicated. It is preferable to define first all the OGs, save them, and then create the links. This can be done using the "modif OGs" button: after defining all the OGs, you can create the REEL link by selecting the OG from its label, entering the REEL parameters, click in the "select" box on the row, click on the "modif OGs" button and save. Deleting OGs which have REELs will not be permitted.

Time Constraints: For certain programs, some observations must be done during a specific time range. These entry fields, available in the OG table, allow the user to define such a constraint by specifying a period for which the observations should be undertaken. These fields are optional and will appear only if required in the "Program Constraints" page. It must also be understood that these constraints are very severe: if for a reason or another (e.g. bad weather or conditions not meeting the sky constraints) the observations cannot be done during the period required, these observations will not be tempt again and will be taken out of the queue. Time constraints are not compatible with REELs, for example if an OG is to be done after another one is validated, that OG cannot have time constraints as well.
15) Summary

This page opens a complete summary of what is currently the Phase 2 status of the program. As showed below, the summary can be sent by e-mail to several destinations as a HTML attachment (to be compatible with people not using a browser for their mail system), by clicking on the "Send this page to" button. The summary can also be printed using the "Print" button of the browser used for PH2.

HINT: We strongly suggest that you keep the summary (printed or electronic) of the final version of the program submitted during the Phase 2. It will be useful to you for monitoring the progress of your program with the night reports and for any necessary communication between you and the QSO Team regarding the observations.

16) HelpDesk

The HelpDesk offers a powerful communication system between the PH2 users and the QSO Team. It is directly interfaced with the QSO database so it stores all the messages exchanged between the different parties regarding PH2, and more generally, the QSO program. The main interface is simple to use and offers numerous options:
Forums: The left frame presents the users with a series of forums. Two are accessible for all the users of PH2: PH2 Support and QSO Support. All messages written in these forums can be seen by all the PH2 users, after moderation by the QSO Team. There is also a private forum, identified by your runID. Only you and the QSO Team can have access to the messages posted in this forum.

Threads: These represent the different subjects discussed under the forums. If you want to start a new thread, you can click on the "New Thread" button. The right window will then request that you entered the appropriate forum. A mail editor will then be opened and the thread name will be the subject of your mail. This is the best way to communicate with the QSO Team. To send an e-mail in a thread already existing, just click on it. All the message contained in thread will be opened in the right window. You can then add your message to this thread by clicking on the "Post new message in the thread" button.

Options: You can search for a specific word through the threads by clicking on the "Search" button at the top. Attachments are possible by clicking on the "Advanced" button in the mail editor.

17) Logout

To exit PH2, you must confirm it by clicking on the 'Logout' button in the window below. If you do not want to do so, select another page with the navigation buttons on the left frame.

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logout</td>
<td>Logout from PH2 and open the first page of PH2.</td>
</tr>
</tbody>
</table>

4 - A Few QSO Rules
Maybe the most difficult task facing the queue observing model is found in the selection process leading to the execution of a science program. This selection can be based on simple criteria (e.g. mounted filters) but it becomes immensely complicated when other parameters like actual sky conditions, completeness level, science merit, monitoring constraints, filters availability, or targets visibility are taken into account.

The process, resulting in the choice of a specific program to be undertaken for the queue observations with WIRCam, will be done in three steps:

1- Selection: This is the first selection of the viable observations stored in the database according to instrumental constraints, sky constraints, completeness level, and the position of the targets.

2- Ordering: This second step creates a prioritized list of observations to be sequentially executed regarding their TAC grade, rank, target positions, and user's priorities.

3- Human filtering: The final step consists in the possibility for the QSO observer to modify the queue list according to special constraint like the focus sequences, calibration plan, etc.

Without going into too many details, each of these steps include an algorithm based on a set of observing rules. The rules given here are not presented in any order of priority. Among them:

- As much as possible, images should not be obtained in worse IQ (or sky brightness) conditions than required. For WIRCam, the sky brightness measured should not exceed the upper limit of the IQ band required my more than about 20%.
- Images can be obtained in conditions better than required, if no other observations actually requesting these conditions are available.
- For very bad IQ periods (>1.2"), the snapshot programs requesting bad conditions should be executed, unless other possibilities exist among the regular programs.
- The priority of the programs started is automatically increased compared to programs not started.
- Unless an upper limit is specified during the Phase 2, observations will be tentatively done with airmass smaller than 1.5.
- During ordering, the priority goes from grade A to B to C, followed by the snapshots. Inside these grades, priority is given according to the TAC rank.
- As much as possible, the observer will execute the observations belonging to a given program according to the priority index given by the investigators.
- A QSO run should never be completed without getting all the necessary calibrations for all the programs fully or partially executed during the run.
- No programs will be recycled for completion during the next semester.
- When started, a monitoring program receives a higher priority so that the observations to be repeated can be carried out within the specified timeframe period.
- The QSO Team will always try to obtain the required number of observations for a given monitoring program. In case of other constraints, the minimum number of observations specified during Phase 2 is the minimum acceptable.
- For target-of-opportunity programs submitted during the semester, these program will be subject to the same selection process and prioritization based on a grade and a rank as the regular programs.

5 - Other Issues

1) Night reports

After each observing night, a report detailing what observations were performed will be available on the CFHT Web site. These reports include the observations blocks executed and the sky conditions at the time of the observations. This does not mean that your data will be immediately available (see below). The goal of these reports is to inform the community of the progress of the queue and, in particular, the current status of your program.

2) Data Evaluation

As part of the data quality control assessment, all data taken will be automatically processed and calibrated by the Elixir Team. Data evaluation will be done in two steps: during the observation by the Service Observer ("on-line" evaluation) and, during and after the data processing. This last step is very involving and represents one of the reasons why data cannot be distributed immediately. If the observations are judged satisfactory, the queue database is then updated by the Queue coordinator.

3) Data Distribution
Data distribution will be ensured by the DAD Team. Our goal is to be able to distribute the data to the PI of each project (or another member if specified during the Phase 2) and the relevant calibrations according to the data distribution preference specified in PH2. Due to the heavy workload during a run, it will not be possible to send the data to the investigators. However, for certain types of programs (e.g. TOO) where looking at the data as soon as possible is important, this will be possible under the supervision of the Queue coordinator.

4) The QSO Team

The current QSO Team is formed of Pierre Martin (QSO Project Scientist/Manager), Billy Mahoney (Database Specialist), Tom Vermeulen (System Programmer), Todd Burdullis (Senior Service Observer), and Mary Beth Laychak, Adam Draginda, Rachael Zelman, Peter Forshay (Service Observers). During a QSO run, supervision is ensured by the QSO Coordinator (one of the CFHT Resident Astronomers) who, among other things, is responsible for managing the queue database and maintaining the contact with the investigators, if necessary. Observations will be conducted by the Service Observers and with a strong involvement by the Observing Assistants. Software support will also be provided during the observing nights. For TOO programs and decisions related to the viability of some programs, the CFHT Executive Director acts as the final authority.