

# Getting Started on the LCO Global Telescope Network

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The Las Cumbres Observatory (LCO) global telescope network currently consists of two 2-meter telescopes, nine 1-meter telescopes, and three 0.4m telescopes. This document explains how to get started using the network for scientific observations. If you are not a professional scientist (e.g. you are a teacher, school student, general public) this document is not applicable. Please see our [website for details of educational use of the 1-meter network](#).

This document describes the use of all three telescope aperture classes. The general system for requesting observations, tracking the status of requests, and viewing and downloading data is the same. The instrumentation differs among the three aperture classes, and so the description of technical capabilities and the instrument-specific fields are separate.

The 2-meter network includes one telescope at Haleakala Observatory on Maui and one telescope at Siding Spring Observatory in Australia.

The 1-meter network is one telescope in the northern hemisphere at McDonald Observatory in Texas, and eight 1-meter telescopes in the southern hemisphere. There are three at Cerro Tololo Inter-American Observatory (CTIO), three at South African Astronomical Observatory (SAAO) and two at Siding Spring Observatory in Australia.

The 0.4-meter network includes one telescope at Haleakala Observatory on Maui, one at Siding Spring Observatory in Australia, and one at Teide Observatory on Tenerife in the Canary Islands. LCO operates four additional 0.4-meter telescopes for tracking positions of satellites in earth orbit, one each at the three sites listed above plus one at CTIO.

The LCO network is dedicated to time-domain observations at optical and near-IR (silicon cutoff) wavelengths. The types of objects and events typically targeted include supernovae, exoplanets, gamma ray bursts, variable stars and near-Earth objects. A goal of the technical capabilities and of the operations model is to enable observations for which a global network is uniquely capable, for example, continuous monitoring over 24 hours, rapid response to alerts, and reliable long-term monitoring at any cadence. For details on the network, instrumentation, or science goals see [Las Cumbres Observatory Global Telescope Network](#) in Publications of the Astronomical Society of the Pacific, 125, 1031, July 2013, also available at <http://arxiv.org/abs/1305.2437>.

In addition to the LCO science team, users on the network include the LCO Science Collaboration, those institutions which, through physical resources or intellectual contributions, have made the development and operation of the network possible. Time on the network may also be purchased from LCO. Each collaborating institution that receives a guaranteed allocation each semester, defines and operates its own proposal submission and review process. All collaborating institutions may not have access to all aperture classes. All

researchers who have access to the network through their institution may submit proposals for Director’s Discretionary time on any aperture class through the link on [this page](#).

This document is intended to describe and explain the methods needed to obtain access to the system, request observations, monitor the status of requests, review and use the data, and provide feedback.

For a one-page jump start to using the system, go to: [LCO Network Quick-Ref](#).

## Observatory Capabilities and Limitations

Target observations on the network can be characterized as pointings of either known RA and Dec, or expressible as a set of orbital elements. The characteristics of the supported instruments are given in the table below:

Aperture class	Instrument	Field of view	Pixel size/wavelength range	Approximate magnitude range
2-meter	Spectral (optical imager)	10 X 10 arcmin	0.31 arcsec (binned 2X2)	10-22
2-meter	FLOYDS (low dispersion optical spectrograph)	30 arcsec slit; width selectable	320-1100 nm	10-19
1-meter	Sinistro (optical imager)	26 X 26 arcmin	0.39	8-19
1-meter (not yet in operation)	NRES (high dispersion optical spectrograph)	3 arcscond diameter fiber	390-870 nm	5-15
0.4m	SBIG STX-6303 (optical imager)	20 X 30 arcmin	1.14 arcsec (binned 2X2)	6-18

Exposure times and S/N for the imagers can be estimated using the [exposure time calculator](#).

The portal/scheduler does not currently support grouping observations of more than one target in a single observing request.

## Overview

Using the LCO observation portal requires a few simple steps.

1. Create user accounts and link Co-investigators to observing programs.
2. Create and submit observation requests.
3. Track status of submitted requests.
4. Identify and download completed observations.
5. Report questions, problems or suggestions.

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## Create User Accounts

Anyone may create a user account on the LCO observing portal. However, only users with a proposal to which time has been allocated can submit requests for observations.

If you are a qualified user and want to propose an observing program, start by creating an account.

If co-investigators are required for your proposal, they will need to register for accounts before they can be included in your proposals or submit observation requests.

### Create an LCO Account

All proposals and observations are managed on the LCO website.

1. Both PIs and Co-Is go to <https://lco.global/observe/auth/accounts/register/>.
2. Complete and Submit the registration.
3. You will receive confirmation via e-mail.

### Link Co-Is to a proposal

Once a proposal has been allocated network time, it will appear on the [PI's proposals page](#).

This page can also be reached through the "Proposals" link at the top of the web page. Under the title and abstract for each proposal, there is a "Co-investigators" link. This will allow PIs to associate registered Co-Is with that proposal.

## Create Observation Requests

An observation on the LCO network is defined as a single target with extensions and constraints. Extensions (allowed in multiples) are exposures, each of which has a quantity, duration and filter selection, and one or more time windows. Allowed constraint are (1) a maximum air mass value (default is 2), and (2) a minimum angular separation from the moon (default is 30 degrees). Both of these constraints apply to all exposures for a given observation.

After specifying a target, you can add a time window within which it should be done. A larger window gives the scheduler more flexibility. A narrow time window may restrict your observation(s) to be done from one site, or may even be unschedulable due to twilight restrictions. Instead of a single time window you can add an observation cadence by specifying a frequency of observations with a permissible jitter. For example a cadence of 1 observation every 24 hours over some calendar period, with a jitter of 3 hours, should result in observations that have a nominal spacing of 24 hours, but each one may begin as much as 1.5 hours earlier or later than the nominal time. Thus, the spacing between two successive observations may be as little as 21 hours, or as much as 27 hours.

To do multiple observations of the same target, you can add exposures with different filters and different exposure times to the request. These will all be scheduled and executed together. To do multiple related targets, you can add another request to the observation group. This ensures the observations are managed together, and the data is easily seen together after capture. Note that the scheduling of individual requests (different targets) within an observation group is completely independent. See the [network visibility tool](#) to check source visibility and airmass limits.

**Important:** Requests on the LCO network do not identify specific sites or telescopes. The telescopes are distributed, identical, and redundant. The LCO Scheduler books each observation on the best telescope available, and rebooks it on the next available telescope in the event of failure due to weather or technical problems.

## Compose an observation

1. Select Compose from the menu to begin an observation request.
2. At the top of the Compose window, click on the question mark (?) to select the proposal for this request. This is the proposal which the system will use for time accounting on this request. Time is decremented only when an exposure is successfully started on a telescope.
3. Enter a title for the request. Because this request will appear in lists of other requests, it is useful to choose a unique and meaningful name. For example, a useful title might be “ABC NGC1206 001”, where ABC are a PI’s initials, NGC1206 is the target, and 001 is a sequence number.
4. The “IPP Value” does not have to be entered or altered at this time. Its use will be described below, and there will be a later opportunity to set this.
5. Click “Add an imaging Target” or “Add a spectrograph Target” in the middle of the requests box. The Add a Target dialog opens.

## Add the request target

Each request has a single target. Once you define the target, you may enter additional filters, exposures, time windows and constraints in any order.

1. Enter the target name and press Enter. If the target is in the common astronomical databases, the RA and Dec values are populated automatically.
2. If the RA and Dec are not resolved, enter them in hour:minute:second.hundredths format (e.g. 03:06:09.70, -08:49:58.00). All subsequent values in a request apply to this target.
3. Proper motion, parallax, and epoch may be entered if they differ from the default values.
4. Telescope class should be set to the appropriate aperture class/instrument.

At this time, you have the option to select (at the bottom) whether this is a “Target of Opportunity” observation. Unlike most observatories, we reserve this designation for observations that have to be executed immediately upon submission. Typically, the scheduler can produce a new schedule within about 15 minutes, so “Target of Opportunity” or “Rapid Response” is for times when this is not quickly enough. Target of Opportunity requests bypass the scheduler and abort the currently executing observation on the telescope most appropriate for the newly submitted observation. Because such observations are disruptive to the network operation, only a limited (and well justified) amount of time is given out to be used in this mode.

We now digress to how to add a non-sidereal target. Following that, the discussion will branch to setting instrument parameters, either for imaging or for spectroscopy.

## **Moving objects**

### **Asteroids**

Submitting requests for moving (solar system) objects follows a very similar path to that above for fixed targets. After selecting a proposal the request should belong to, and clicking on Add a target, you should change the ‘Sidereal: Yes’ dropdown to say ‘Sidereal: No’. The form will reconfigure to show a larger number of fields which will allow the orbital elements to be entered.

Currently the set of elements we support is that given by the Minor Planet Center (MPC); these elements can be obtained from e.g. [http://www.minorplanetcenter.net/db\\_search](http://www.minorplanetcenter.net/db_search). When entering, care should be taken to convert the ‘epoch JD’ given by the MPC to a Modified Julian Date (MJD) by subtracting 2400000.5 e.g. if the MPC results have ‘epoch JD = 2456600.5’ then ‘56600.0’ should be entered in the ‘Epoch (MJD)’ box of the form.

When filled in, the completed should something like the following screenshot (with parameters for Amor asteroid (1917) Cuyo):

## Add a target

**Target name:** (e.g. "M82" or "Eagle Nebula")  
  
 Minor planet according to Minor Planet Ephemeris Service

**Sidereal:**  **Scheme:**

**Epoch (MJD):** (e.g. 56660.0)  **Orbital inclination (deg):**

**Longitude of ascending node (deg):**  **Argument of perihelion (deg):**

**Mean distance (AU):**  **Eccentricity:**

**Mean anomaly (deg):**

**Telescope class:**

**Wavelength filter:**

**Duration (seconds):** (e.g. 30)  **Exposures:** (1 or more)

**Binning:** (1-2)

Once the orbital elements have entered, you can continue to select the duration and number of exposures, binning and add time windows, observing constraints etc as normal.

### Comets

Objects with an eccentricity greater than approximately 0.9 should be presented to the system as comets with a slightly different set of orbital elements. The two main changes are that the mean distance and the mean anomaly are replaced by the perihelion distance and the epoch

(time) of perihelion. The scheme for the orbital elements should also be changed to 'MPC Comet' after selecting 'Sidereal: No' in the request form in order to get the new fields to appear. Please take care not to mix up the epoch of the elements set, which is normally given as a Julian Date rounded to the nearest multiple of 200 days e.g. 2457400.5, and the epoch of perihelion which is not rounded-up e.g. T = 2457462.77852 JDT. For both epochs, the numbers need to be converted to a Modified Julian Date by subtracting 2400000.5 giving an epoch of elements of 57400.0 and a time of perihelion passage of 57462.27852 for the above example. Below is an example of a fully filled out form for the short-period Jupiter-family comet 252P/LINEAR:

### Add a target

**Target name:** (e.g. "M82" or "Eagle Nebula")

Minor planet according to Minor Planet Ephemeris Service

<b>Sidereal:</b> <input type="text" value="No"/>	<b>Scheme:</b> <input type="text" value="MPC Comet"/>
<b>Epoch (MJD):</b> (e.g. 57400.0) <input type="text" value="57400.0"/>	<b>Orbital inclination (deg):</b> <input type="text" value="10.4047"/>
<b>Longitude of ascending node (deg):</b> <input type="text" value="190.9811"/>	<b>Argument of perihelion (deg):</b> <input type="text" value="343.2912"/>
	<b>Perihelion Distance (AU):</b> <input type="text" value="0.9960734"/>
	<b>Eccentricity:</b> <input type="text" value="0.673675"/>
<b>Epoch of perihelion (MJD):</b> <input type="text" value="57462.27852"/>	
<b>Telescope class:</b> <input type="text" value="1.0 meter SBIG"/>	<b>Wavelength filter:</b> <input type="text" value="SDSS-r'"/>
<b>Duration (seconds):</b> (e.g. 30) <input type="text" value="60"/>	<b>Exposures:</b> (1 or more) <input type="text" value="1"/>
	<b>Fill Window?:</b> <input type="checkbox"/>
<b>Binning:</b> Available: (1, 2, 3). Recommended is 2. <input type="text" value="2"/>	
<b>Target Of Opportunity (interrupts currently running observations)?</b> <input type="checkbox"/>	
<input type="button" value="Add"/> <input type="button" value="Clear form"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/>	

## Set instrument parameters (imaging)

1. Select a filter for this set of exposures. The pulldown menu of available filters is

populated according to the instrument chosen. For a given instrument, almost all filters listed are available at all telescopes of that aperture class. (See [filters reference](#) for specifications.)

2. Set the exposure duration in seconds. (See Observation overheads below for details on total time requirements.)
3. Enter the number of exposures.
4. Select a binning for the exposures. Although we give you the option of setting on-chip binning, our data reduction pipeline does not support multiple binning options for each imager. The (supported) defaults are Sinistro: 1X1, Spectral: 2X2, SBIG STX-6303: 2X2.
5. Select Add to save the request. You return to your Home page with the new request in the Request Group box.

## Set instrument parameters (spectroscopy)

### Add a spectroscopy target

Target name: (e.g. "M82" or "Eagle Nebula")

M51

Seyfert 2 Galaxy according to Simbad

Right Ascension: (e.g. "05:34:31.940")

13:29:52.698

Declination: (e.g. "+22:00:52.200")

+47:11:42.930

Proper motion ra: (+/-0.33  
mas/year)

0.0

Proper motion dec: (+/-0.33  
mas/year)

0.0

Epoch: (e.g. "2000.0")

2000.0

Parallax: (e.g. "+0.45 mas")

0.0

Telescope class:

2.0 meter FLOYDS

Slit width: (in arcseconds)

1.6 A slit

Acquire mode:

On brightest

Acquire radius (arc  
seconds):

5

Rotator mode:

Sky

Rotator angle: (0 to 360)

0

Duration (seconds): (e.g. 300)

30

Exposures: (1 or more)

1

Fill Window?:

Binning: Available: (1). Recommended is 1.

1

Target Of Opportunity (interrupts currently running  
observations)?

Add

Cancel

Help

After specifying your target name and coordinates, use the pull-down menus to select the slit width, acquire mode, and rotator mode.

Two acquire modes are available.

**On coordinates** places the coordinate position of the target in the middle of the slit.

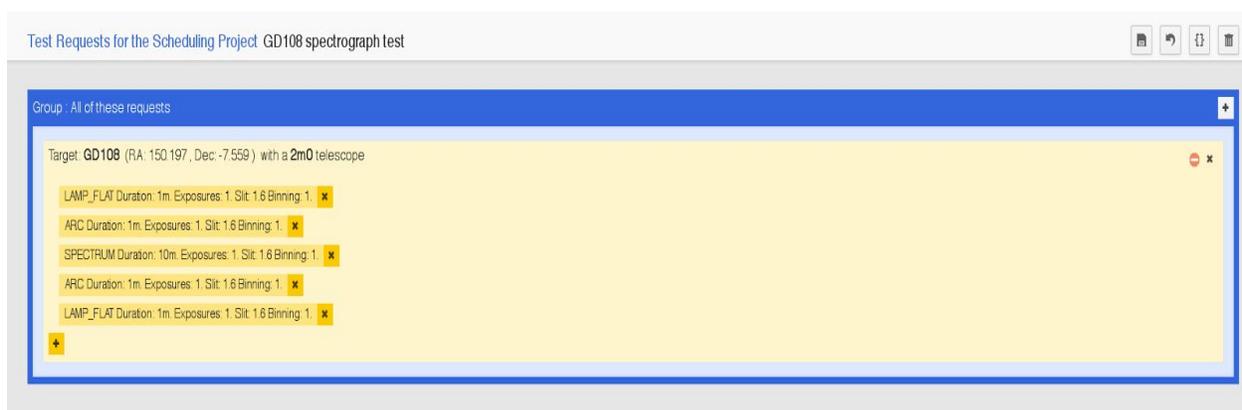
**On brightest** first moves the telescope to the entered coordinate position, then it takes a short imaging exposure of the field, locates the brightest object within the “Acquire radius”, and repositions the telescope such that this brightest object is in the middle of the slit.

Two rotator modes are available.

In **Sky** mode, the rotator will remain fixed at a specified Position Angle as the telescope moves. The Position Angle (increasing in an anticlockwise direction from 0 degrees north) should be specified the “Rotator angle” field.

In **Vertical Floating** mode, the rotator determines what the parallactic angle will be at the start of the exposure and keeps the slit oriented at that angle on the sky during the entire exposure. This mode minimizes effects from atmospheric dispersion. This is the most commonly used mode.

After filling in the target form and clicking ‘Add’, the screen display should look like:



The default option is to bracket the science spectrum exposure with a lamp flat and arc exposure to allow proper calibration. The different exposure types can be re-ordered by clicking and dragging to a new order. The calibrations or spectrum can be modified by double-clicking

on the observation. Extra calibrations can be added to the request or the existing ones deleted (by clicking on the 'X').

### Adding extra calibrations

To add extra calibrations to the request, click on the '+' button and choose 'Calibration'. This will bring up the following form:

## Add a spectrograph calibration observation

Adding calibrations can let you observe the same object with different calibration settings.

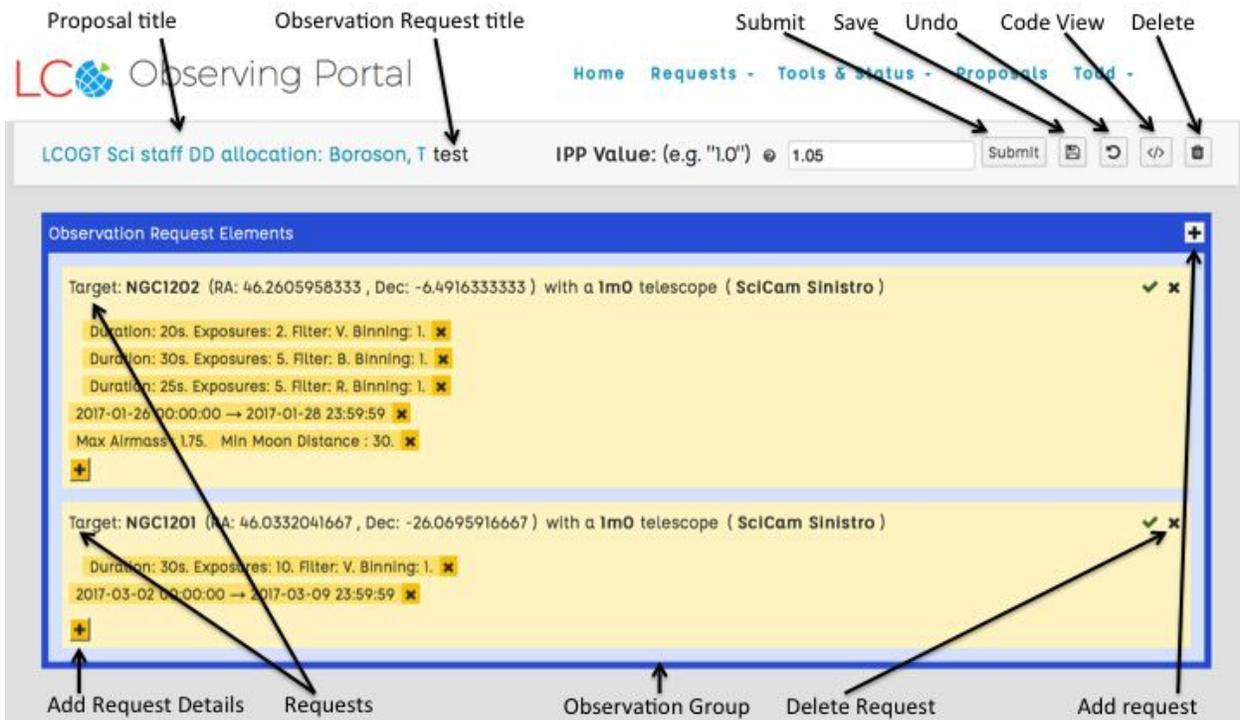
**Type:**

**Slit width:** (width in arcseconds, all slits are 30 arcseconds long)

**Duration (seconds):** (e.g. 300)

**Exposures:** (1 or more)

**Binning:** (1-2)



## Add a time window

A *time window* or a *cadence* is required before you can submit a request. (In some cases, the Submit button is not displayed if you do not define a window.) Add this by clicking the + sign after the target summary. You can define one or more windows for each request. The scheduler will determine the rise and set times of your target for each telescope that becomes available within the time windows you provide. In general, observations are booked at the earliest possible time. If they fail due to weather, air mass, technical, or priority constraints, they are automatically rebooked to another telescope at another time within the available time window(s). Either set your time window start and end to allow for rescheduling, or add additional windows to provide the scheduler additional scope. Make sure your time windows accommodate overhead.

## Multiple time windows

Your entire request including overhead must fit within ONE defined time window. By default, the system will complete your observation in the first available window. If the specific time does not matter, you may want to create one large window. If, however, the best observational times are limited (e.g., you want to define narrow windows at optimal air mass at the three southern observatory nodes), you would create multiple time windows.

**Important:** No matter the length of your window, you still must include enough time for your request plus adequate overhead. The overhead calculations are covered at the end of this document in Appendix A.

1. In the Request Group box, select the plus sign icon and choose Time Window. The time window dialog displays.
2. Enter the calendar start date for the window.
3. Enter the calendar start time in hour.minute.second format (00:00:00). This time is in UTC (i.e. no time zone) and is required.
4. Enter the calendar end date.
5. Enter the calendar end time in hour.minute.second format (00:00:00), again required and entered in UTC time.
6. Select Add to save the window. You return to the Compose view with the new time window shown in the Request Group box.
7. Repeat these steps to add additional time windows.

### Add a cadence

Often you may wish to observe a given target repeatedly and with a (roughly) specified repetition time. This is called a *cadence* observation. A cadence is defined by its *period* and its *jitter* (both in decimal hours). Think of the cadence as consisting of N windows, each with a width of (jitter) hours, with the first window centered on the specified start time, and the centers of subsequent windows separated by (period) hours. As with time windows, the jitter duration must be long enough to contain one observing request, with overheads. The overhead calculations are covered at the end of this document in Appendix A. Because of the phasing between solar rise/set times and the cadence period, some of the periodic windows may become too short for the observation and overheads to fit. These particular observations will not occur, but the rest of the cadence will continue. To make a cadence request:

1. In the Request Group box, select the plus sign icon and choose Cadence. The cadence dialog displays.
2. Enter the calendar start date for the window.
3. Enter the calendar start time in hour.minute.second format (00:00:00). This time is in UTC (i.e. no time zone) and is required.
4. Enter the calendar end date.
5. Enter the calendar end time in hour.minute.second format (00:00:00), again required and entered in UTC time.
6. Enter the desired period for the cadence, i.e., the nominal time interval between individual observations, in fractional hours (e.g., 43.21)
7. Enter the desired jitter time, i.e., the length of the time interval within which you would like the observation to start, in fractional hours (e.g., 3.456). Observations will be scheduled at the nominal time +/- (jitter/2).
8. Select Add to save the cadence. You return to the Compose view with the new cadence description shown in the Request Group box.

### Save a request

At this point Save your request to ensure you can access it later on. It is also worth reviewing the request in code format to learn the structure of requests.

1. At the top right of the Observation Portal, choose the disk icon to save the request.
2. Also at the top right of the Observation Portal window, choose the code icon `</>` to view the request in code format. The code window displays.
3. You can, if you choose, edit the request in this window. You can also select and copy the request without the target designations, start a new request for a different target, and paste and then edit the existing request details.

**Important:** Because the copy process is manual, you must verify the details carefully prior to submitting the new observations.

### Add exposures to a request

Once a target is defined for a request, you can add exposures to the target.

1. In the Request Group box, select the plus sign icon and choose Exposure. The Add an exposure dialog displays. Set the following:
  - A filter
  - Exposure duration in seconds
  - Number of exposures
  - Binning
2. Select Add to save the exposure. You return to your Home page with the new exposure in the Request Group box.
3. Save your request.
4. Repeat these steps to add additional exposures.

### Add observing constraints to a request

Allowed constraints are maximum allowable airmass and minimum lunar angular distance. The values selected for these apply to all exposures in the request.

By default, the allowable airmass is set to 2, which translates to roughly 30 degrees above the horizon and provides usable science data. The telescopes can physically achieve 15 degrees above the horizon, with an Hour Angle limit of 5 hours east and west for the 1-meter and 0.4-meter telescopes. The 2-meters are on alt-az mounts so they have no hour angle limits. You can request that an observation be available for consideration closer to the horizon by increasing the air mass value, for example to 3. To raise the horizon and decrease the airmass for your observations, use a number less than 2.

By default, the minimum lunar angular distance, independent of lunar phase, is set to 30.0 degrees. The scheduler will consider any time at which the target is closer to the selected value for this parameter to be unschedulable.

**Important:** The lower the max airmass value and the higher the minimum lunar distance

entered, the smaller the window for your observation, decreasing the possibility of scheduling your observation.

1. In the Request Group box, select the plus sign icon and choose Observing Constraint. The Add an observing constraint dialog displays.
2. Enter a positive value between 1.0 and 3.0 for the maximum airmass.
3. Enter a positive value between 0.0 and 180.0 for the minimum lunar distance.
4. Select Add to save the constraint. You return to your Home page with the new exposure in the Request Group box.
5. Save your request.

### Setting an IPP value

Users have the ability to adjust the priority of their requests so that they have some control over the outcome. This is known as Intra-/Inter- Proposal Priority, and is controlled by a single multiplicative number that is applied to each request. A comprehensive explanation of how IPP works is given in [Jair Arcavi's documentation](#). Over a semester, the increases and decreases have to average out, and the quantitative degree of change in priority is such that this value is mostly beneficial to users who have large target lists with a range of internal priority levels.

Allowed values for IPP are between 0.5 (decreasing a request's priority by a factor of 2) and 2.0 (increasing a request's priority by a factor of 2). For bookkeeping reasons, the default value is 1.05. The maximum and minimum allowed will change as different IPP values are applied to requests during the semester to ensure that a proposal's priority averages to the value it received from its TAC review.

If you don't want to use this, just leave it at its default value.

### Submit an observation

Submitting an observation sends your requests to the scheduler. Submitting also removes the observation from the drafts area, and thus is no longer be available for you to edit or delete. Requests that cannot be granted because they are not possible within the constraints specified by the user will not be able to be submitted.

1. At the top right of the Observation Portal window, choose Submit.
2. You are asked "Really schedule this? You won't be able to make changes once it is submitted." Choose Yes.
3. The Submitted Requests window displays a green box with the words "Request submitted successfully" It then switches to the page that shows all your submitted requests with the newly submitted on at the top.

### Overview of request statuses

A description of the information presented to allow the user to monitor the status of submitted requests is given in the document [Information on Submitted Observing Requests](#) and is summarized below.

The four major request state categories are Completed, Canceled, In Progress or Not Observed. The In Progress state doesn't necessarily mean that an observation is currently underway; it means that not all observations created as a part of that request have reached a final state.

Clicking on a particular request in the submitted request list takes the user to a new page. Basic information about the request (information provided by the submitter) is shown in the top left and top right corners. Included are the time that the request was submitted and the request tracking number. Individual observations are represented by bars across the page that show the Request ID numbers, the latest status of the requests, and (if a request has been completed) the option to download the data from the science archive. The color of a bar reflects its request status. **Clicking on a bar expands it to reveal a set of detailed information about the request.**

Three plots present the history and status of the observing request. The Scheduled Block History plot shows the history of the times that the the observing request was inserted into the network schedule. If the request has not yet been scheduled, the plot will be blank. **The presence of a bar of any color indicates that the request was scheduled.** The Visibility plot shows the visibility of the target at the eligible network sites over the duration of the observing window. The Telescope Status plot shows the status of each eligible telescope over the duration of the observing window. The condition of each telescope is indicated by a color.

If a request has completed successfully, thumbnail images of the exposures (with links) are shown at the bottom of the page.

## Managing observations

Once observations have been completed, they appear in your Home page under Your recent observations. Clicking on any of the displayed observation thumbnails brings up a 200 x 200 pixel JPEG image. From here you can also access the observing summary, the image archive and the page to add Co-Is to your proposals.

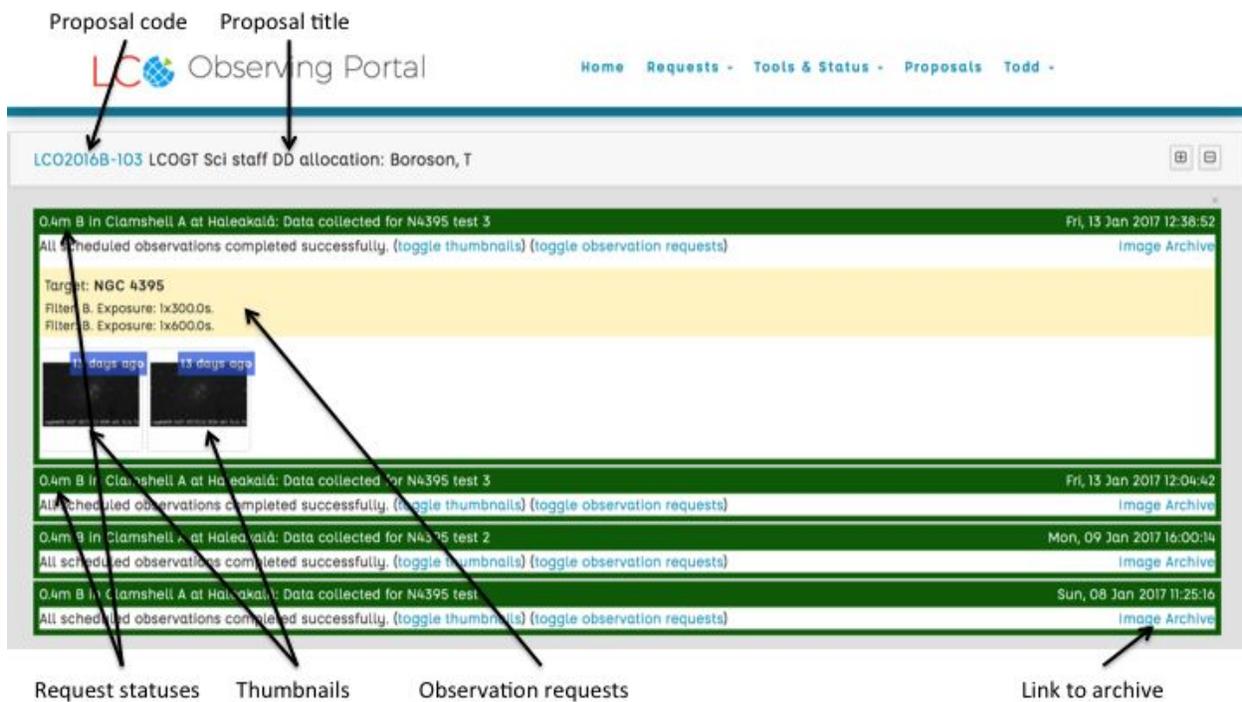
## Review the observing summary

1. Under the proposal name on your Home page, click on Observing Summary. The summary window opens. The history is listed from the oldest event to the most recent.

Successful events display in green, unsuccessful are in grey.

2. Alternately, if you click on Submitted in the menu bar on your Home page, you can see all submitted observations for a given proposal. From there, you can click on a request to open the observing summary.
3. Within a successful event, click on toggle thumbnails to view the JPEG image.
4. Click on toggle observation requests to view the exposure parameters including target, filters and exposures.

The observing summary displays the sequential history of your request and is helpful in understanding what went right (or wrong) with your request. Each event relates to a group of exposures and is tagged with either a telescope and status, or a scheduler message. The tag content is <telescope class> in <specific enclosure> at <observatory site>: status message.



Observatory sites (with LCO site codes) are:

- McDonald = McDonald Observatory, Texas (ELP)
- Cerro Tololo = Cerro Tololo Inter-American Observatory, Chile (LSC)
- Sutherland = South African Astronomical Observatory (CPT)
- Siding Spring = Siding Spring Observatory, Australia (COJ)
- Haleakala = Haleakala Observatory, Maui (OGG)
- TFN = Teide Observatory, Tenerife, Canary Islands, Spain (TFN)

Telescope classes are:

- 1.0m A (1-meter telescope)
- 2.0m A (2-meter telescope)
- 0.4m A (0.4-meter telescope - first in enclosure)
- 0.4m B (0.4-meter telescope - second in enclosure)
- 0.4m C (0.4-meter telescope - third in enclosure)

Enclosures are:

- Dome A (ELP, LSC, CPT, COJ)
- Dome B (LSC, CPT, COJ)
- Dome C (LSC, CPT)
- Clamshell A (COJ, OGG)
- Aqawan A (LSC, TFN)

The observation portal messages are:

- <Request name> has been scheduled. - The request is in the queue.
- <Request name> is being observed now. - The request has been sent to a specific telescope at a specific site.
- Data collected for <Request name>. - The request has been completed and data has been returned.
- <Request name> was unsuccessful. - The request was scheduled but not completed for technical or weather reasons or due to other higher priority observations. The request will be rescheduled if appropriate time windows remain.

### **Copy a submitted request**

To make a request for a single target to be executed on a succession of dates, or to make a set of requests that are similar or identical in design (exposures, filters, etc.) but for different targets, you copy a submitted request and modify it as needed to create the desired observation sequence.

1. In the Submitted requests view, a duplication icon appears to the left of each request. Click this to copy the request. The request displays in the Compose window with (edit) appended to the request title.
2. Click on the title to edit as needed. (You can also click on the Proposal to reassign the request to a different proposal.) Press Enter to save the change.
3. To request the same observation at a different time, click on the Time Window element in the request to open the Time Window dialog. Enter the new time window and choose Update.
4. To retain the same observation specifics, but change the target, click on the target name and edit the name. You must then click on the RA, edit the RA, and then click on the Dec value and edit that.
5. You can change any of the other settings for the observation by clicking on the exposure

or constraints elements.

6. Save the request.
7. Submit the request.

## Pipeline processing and access to data products

The raw data from the telescopes are brought back to LCO headquarters and processed through a pipeline that performs the standard steps to produce a reduced data set. The pipeline that processes data from the imagers is called [BANZAI](#). BANZAI runs twice for each raw science frame - once, in a quick-look mode, immediately upon receipt of the raw frame at LCO headquarters, using the best-at-time calibration information, and then again, following the completion of the local night, when all the final calibration information has been suggested. In addition to an instrumental-signature-removed image, BANZAI produces an object catalog of detected sources and a bitmap image. These data, along with the master calibration frames that are produced by the pipeline are transferred to and ingested into the [LCO Science Archive](#), hosted in the Amazon Cloud. FLOYDS data are processed through a different pipeline that extracts the two orders and produces a wavelength-calibrated, response-corrected 1D spectrum.

You can access the data in the archive by clicking on the Images link in each completed observation request.

Data taken on the LCO Network is normally proprietary for 1 year from time of observation. This means that all users of a proposal will need to be registered with the Science Archive (which will be handled by LCO, based on the proposal information received) and be logged into the archive in order to see, manipulate, plot and download data.

In order to access their data, users should open a link to the [Science Archive frontpage](#) in a separate tab in their browser and login with their email address and password. Once logged in, users can search for datasets using the archive front page - more detailed instructions are given in the archive [Users Guide](#). Alternatively, once logged into the archive, users can return to the Observing Portal and use the 'Image Archive' links to jump to the specific set of images for their observations on the LCO network.

## Feedback and Additional Support

On most screens in the interface, Feedback is on the menu. Selecting this opens a form which, when you submit it, is directed to the development team. This can be used for bugs, suggestions, or questions. You should receive a response within 24 hours (on business days).

In addition, you can contact [sciencefeedback@lco.global](mailto:sciencefeedback@lco.global) for support.

## Appendix A: Observation overheads

Most observations will not need to address overhead. The general rule is to create time windows that provide adequate coverage for your observations. The system does not and will not charge time by window, but by actual observations made.

However, if your target requires a finite window, such as a NEO passing into sunlight from behind the Earth, you will need to make sure to provide a time window that accommodates your observation request plus overhead.

Overhead is a calculation of the time required to set up for and complete your request. Overhead plus the exposure time is the minimum time you must allow for in the time window. Overhead can be complicated depending on how complex a request is, and how far it is broken down by the scheduler. A request comprised of multiple exposures is booked on a specific telescope. These are single target events of one or more exposures.

**Important:** Exact overhead provisions are managed programmatically and are subject to change as equipment, processing, and other factors change.

For each new pointing, the overhead is as follows:

### 1-meter / Sinistro imager

Per-pointing setup time for slewing, etc.	90 sec
Per-frame filter change (minimum of 1)	18 sec
Plus per-frame readout	
1x1 binning	37 sec
Plus per-frame overhead time	5 sec

For example, for a request of 9 x 30sec, exposures with a single filter, the total observation time is calculated as:

Setup	90 sec
Filter change	18 sec
Exposure (9 exp x 30 sec =)	270 sec
Readout (9 exp x 37 sec)	333 sec
Overhead (9 exp x 5 sec=)	45 sec
<b>Total time =</b>	<b>756 sec</b>

A request for one 120 sec exposure in each of B, V and I will take:

Setup	90 sec
Filter change (x 3 =)	54 sec
Exposure (3 exp x 120 sec =)	360 sec

Readout (3x37 sec =)	111 sec
Overhead (3x5 sec=)	15 sec
<b>Total time =</b>	<b>630 sec</b>

**0.4-meter / SBIG imager**

Per-pointing setup time for slewing, etc.	90 sec
Per-frame filter change (minimum of 1)	18 sec
Plus per-frame readout	
2x2 binning	10 sec
Plus per-frame overhead time	1 sec

**2.0-meter / Spectral imager**

Per-pointing setup time for slewing, etc.	240 sec
Per-frame filter change (minimum of 1)	15 sec
Plus per-frame readout	
2x2 binning	11 sec
Plus per-frame overhead time	12 sec

**2.0-meter / FLOYDS spectrograph**

Per-pointing setup time for slewing, etc.	240 sec
Acquisition time	90 sec
Per--config change (ARC->FLAT etc.; minimum of 1)	30 sec
Exposure times (70 sec for ARC, 20 sec for FLAT, X sec for SPECTRUM)	
Plus per-frame readout	
1X1 binning	25 sec
Plus per-frame overhead time	1 sec

**Revisions**

Added Data Archive access instructions.	2013 08 28
Added line of instructions to data access description.	2013 08 28
Major overhaul to capture beta comments, V1 orientation.	2013 10 31
TAL: Moving objects are now supported (but not yet documented here).	2014 01 23
Changed links to website versions of documents and updated email addresses.	
TAL: Update to reflect SBIG and Sinistro mixed network. Reworked overhead calculations with examples for both cases. Documented moving object target support.	2014 03 26
TAL: Small tweaks for V1.0.	2014 04 15
TAL: Updates for change of archive host from IPAC to Amazon. Add Comet examples, update overhead numbers.	2016 03 23



Las Cumbres **Observatory**

NV: Updated "Observatory Capabilities" section.

2016 05 11

TYB: Combine 2m and 1m documents; add 0.4m; update to 2017 2017 01 30