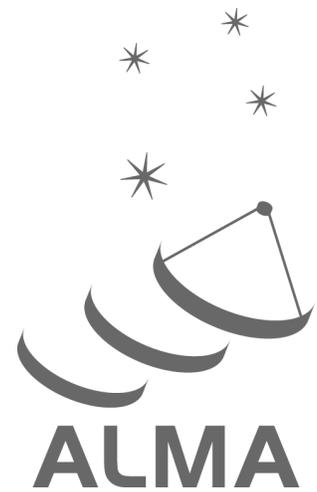


# ALMA Observing Tool

## Phase 1 Quickstart Guide: Creating a proposal in 10 Easy Steps

Suzanna Randall & Daniel Espada



## User Support:

For further information or to comment on this document, please contact your regional Helpdesk through the ALMA Science Portal at [www.almascience.org](http://www.almascience.org). Helpdesk tickets will be redirected automatically to the nearest ALMA Regional Center at ESO, NAOJ or NRAO.

## Revision History:

---

Version	Date	Editors
0 (IT 3)	15.03.2011	S. Randall, D. Espada
1 (OT release Cycle 0)	30.03.2011	S. Randall, D. Espada, E. Humphreys

---

## Contributors

---

East Asian ALMA Regional Center, European ALMA Regional Center



**EAST ASIAN ARC**  
ALMA Regional Center



**EUROPEAN ARC**  
ALMA Regional Centre

# Scope

This document is intended as a Quickstart guide to Phase I proposal preparation in Cycle 0 for the novice ALMA Observing Tool (OT) user. It takes the reader through all the basic steps to create an ALMA Observing Proposal.

A more comprehensive description of the OT and the different aspects of proposal preparation can be found in the **ALMA OT User Manual**<sup>1</sup>. The **ALMA OT Reference Manual**<sup>2</sup> provides a more concise explanation for all the fields and menu items in the OT. Both the User Manual and the Reference Manual can also be accessed from within the OT via the *Help* menu. For a visual demonstration of different aspects of the OT you are invited to consult the suite of **ALMA OT video tutorials**<sup>3</sup>.

## Getting started

In order to access the ALMA Archive and submit an observing proposal, you must have previously **registered** with the ALMA Science Portal at [www.almascience.org](http://www.almascience.org).

You can **download** the OT from the ALMA Science Portal > ALMA Software and Tools > Tools > Observing Tool page, which also contains detailed installation instructions. The OT is designed to run on all common operating systems, but requires Java 6 to be installed and set as the preferred Java Runtime Environment (JRE). For more information on Java versions, updates and troubleshooting please see the troubleshooting page accessible from the Science Portal.

The OT can be downloaded in two flavours: as a WebStart application or in tarball format. The WebStart application has the advantage that the OT is automatically downloaded and installed on your computer. Note that it does not work with the “Open JDK” versions of Java, such as the “Iced Tea” flavour common on many modern Linux installations. The tarball version of the OT requires a manual download and installation. However, it is more robust than the WebStart application and will work with most versions of Java 6. The tarball is also available with the appropriate JRE already included (Linux only).

You **start the OT** either by double-clicking on the ALMA OT icon (Web Start) or from the command line by typing `./ALMA-OT.sh` in the installation directory (tarball). You will then be given the options of creating a new proposal, opening an existing proposal from a file on disk, or retrieving a proposal from the ALMA Archive. To follow the step-by-step guide, please select the first option. Alternatively, you can select the *New Proposal (Phase I)* button from the toolbar in the OT. You will then be presented with the window shown in Fig. 1, which illustrates the main Graphical User Interface (GUI) components:

- **Menu:** Allows access to all functions available in the OT via pop-up submenus.
- **Toolbar:** Contains icons for some of the most frequently used functions in the Menu.
- **Project Structure Pane:** Visualisation and navigation of the **Project tree**, which describes the structure of the project. You can expand and collapse parts of the tree by clicking the node icon to the left of the components, e.g. by clicking on the *Project* node, the *Proposal* node will appear, and underneath that the *Planned Observing* node (which is later completed by adding *Science Goals*).

---

<sup>1</sup> The user manual is accessible at [http://www.eso.org/sci/facilities/alma/ot/ot\\_usermanual.pdf](http://www.eso.org/sci/facilities/alma/ot/ot_usermanual.pdf)

<sup>2</sup> The reference manual is accessible at [http://www.eso.org/sci/facilities/alma/ot/ot\\_referencemanual.pdf](http://www.eso.org/sci/facilities/alma/ot/ot_referencemanual.pdf)

<sup>3</sup> The suite of OT video tutorials can be found in the ALMA Science Portal under Documents & Tools > Documents

- **Editor Pane:** The technical specifications of the project are filled and edited in this pane. The content of the editor pane changes depending on the branch of the Project tree selected. Note that for the spatial and spectral setup the editor panes are composed of several tabs.
- **Feedback Pane:** Provides feedback on the validation process and allows you to identify problems with your proposal.
- **Overview Pane:** Informative summary of the proposal creation process and contextual help.

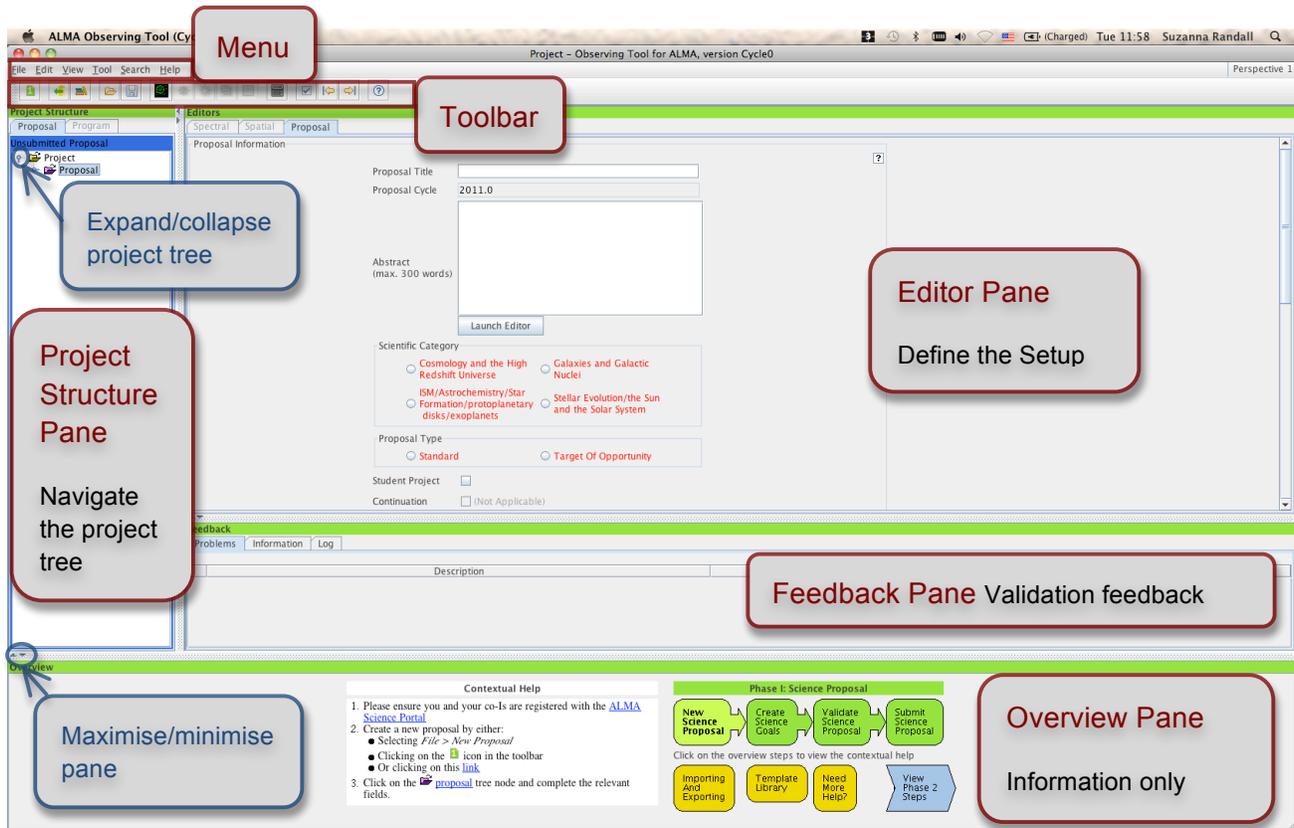


Figure 1: OT Graphical User Interface

Before starting work on your proposal, you can customize the GUI according to your needs. The size of the different panes can be modified by clicking and dragging their borders, or maximised/minimised by clicking on the triangular arrow symbols. You can toggle the *Overview* and *Feedback* panes by clicking on *View > Feedback / Overview* in the Menu, e.g. in order to maximise the *Editor* pane. The *Feedback* pane will normally not be visible upon starting the OT, but it will pop up when the project is validated (see Step 9). You can customise the OT further by selecting *File > Preferences*. For more information please see *OT video tutorial 1: A brief overview of the OT*.

## Proposal creation and submission in 10 easy steps

The workflow to be followed for the creation and submission of an ALMA observing proposal is described in detail in the following sections, and is audio-visually illustrated in *OT video tutorial 2: Creating a proposal in 10 easy steps*. You are invited to make use of both the video and this written document, which follow the same format and complement each other.

The steps to be followed in proposal creation and submission are:

1. Enter the basic information for your proposal
2. Attach supporting material
3. Create a Science Goal
4. Add the source information
5. Configure the spectral setup
6. Finalise the spatial setup
7. Select the calibration strategy
8. Enter the control and performance parameters
9. Validate your project
10. Submit your proposal

## 1. Enter the basic information for your proposal

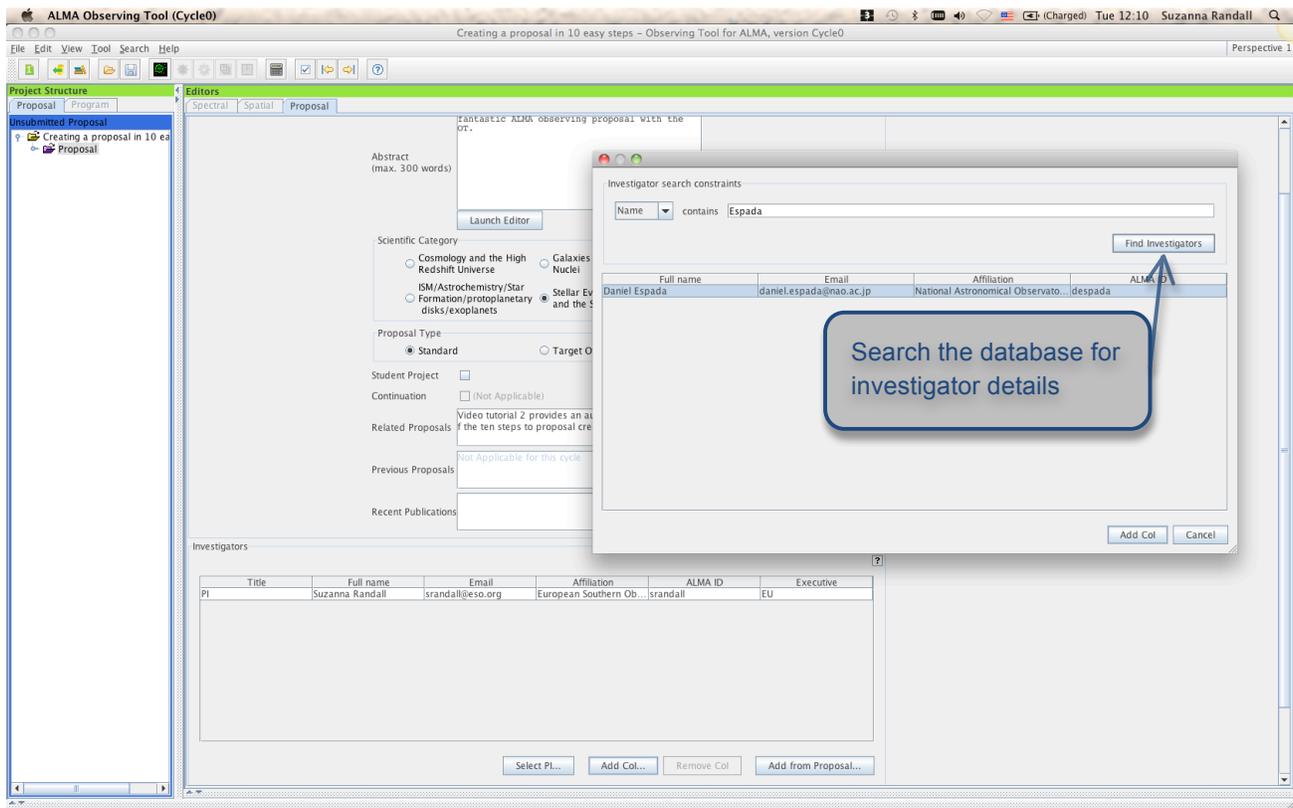


Figure 2: Select the PI and Co-Is in the Proposal editor pane

Start by **filling the fields in the Proposal editor pane** labelled *Proposal Title* and *Abstract*, and then select the *Scientific Category* and *Proposal Type* using the radio buttons (see Fig. 1). To facilitate filling in the abstract you can launch the *jEdit* editor, which allows you to load and edit a previously prepared text file. You can optionally provide additional information on previous proposals or recent publications related to the project.

In order for you to be able to submit the proposal, you will have to **select yourself as PI** by scrolling down, pressing the *Select PI* button and searching by name, e-mail or ALMA ID in the pop-up window (see Fig. 2). The ALMA ID is identical to your Science Portal login.

You can select an unlimited number of Co-Is in a similar way, **provided that they have previously registered with the ALMA Science Portal**. If you have a long list of Co-Is you may prefer to add them from a proposal previously saved on disk using the *Add from proposal* button.

## 2. Attach supporting material

In the second step you **attach supporting material** used for the scientific and technical assessment of your proposal in .pdf format. You are required to present a science and a technical case, and can optionally include figures and tables. The science case should put the proposed observations in a broad scientific context, highlight their impact on the field of research and present the immediate goal you expect to achieve. The technical case should justify the setup requested, including the sensitivity requirement, spectral resolution and field setup. **Any technical information not captured by the OT should be included here**. Examples of this may be justifying an observing time allocation that is not driven by sensitivity requirements, and thus differs from that estimated by the OT. Please see the *Technical Justification* section (section 6.4.2 of the *Proposers Guide* available on the Science Portal) for more detailed information.

## 3. Create a Science Goal

All the technical specifications for your project are contained in one or more Science Goals. In theory, each Science Goal should describe the observations necessary to achieve a scientific objective, however in practice these may have to be split across several Science Goals for technical reasons. A Science Goal can encompass a number of targets (single field pointings only; each mosaic spatial setup requires a separate Science Goal), but only one correlator setup and one set of Control and Performance parameters (see Step 8). You **create a new science goal** by clicking on the *New Phase 1 Science Goal* icon in the toolbar or selecting *Edit > New Phase 1 Science goal* from the Menu. The Science Goal can be **renamed** by right-clicking on the *Science Goal* node and selecting *Rename*, and a description can be optionally entered in the corresponding field. A **template library** containing a range of pre-defined science goals can be brought up with *View -> Show ALMA Template Library*. Note that you can also **copy and paste** Science Goals (or specific parts, such as the spectral setup) with *Edit > Copy* and *Edit > Paste* or dragging and dropping the components within the Project tree.

## 4. Add the source information

**Enter the information on your science target** (or targets) in the *Field Setup* editor pane (see Fig. 3). If your source has an entry in SIMBAD or NED, you can simply type in its name in the *Source Name* field and resolve the coordinate and velocity information from there, instead of filling it in manually. Please be aware that it is your responsibility to **ensure that this information is correct**. Since the source coordinates and the velocity are used by the OT to calculate the pointing(s) and the sky frequencies respectively, it is vital that they are correct in the submitted proposal. Solar System targets can be selected from a pull-down list if the *Choose a Solar System Object* box is checked.

Next, specify the *Target Type* by selecting one of the radio buttons. A Science Goal may contain several targets if *multiple single point fields* is selected, but just one *rectangular field* (for details on defining the spatial setup for these two cases see Step 6). For the single point field case you can add additional sources by scrolling down and

pressing the *Add source* button. You can also read in a target list from an ASCII file (see Figure 6.7 in the User Manual for the required input format).

For each source, you are required to provide an estimate of the *Peak Flux Density*, *Polarisation Percentage* and *Line Width*. The peak flux density entered should be an estimate of the expected flux appropriate for your source and setup (e.g. referring to the line you want to observe, or the continuum in the bandpass proposed). The polarisation and line width should only be entered if applicable to your scientific objective. The three quantities are used for the technical assessment of your proposal, but do not influence the technical setup as determined by the OT. Please make sure that the Control and Performance parameters entered in Step 8 are appropriate considering the estimated target properties.

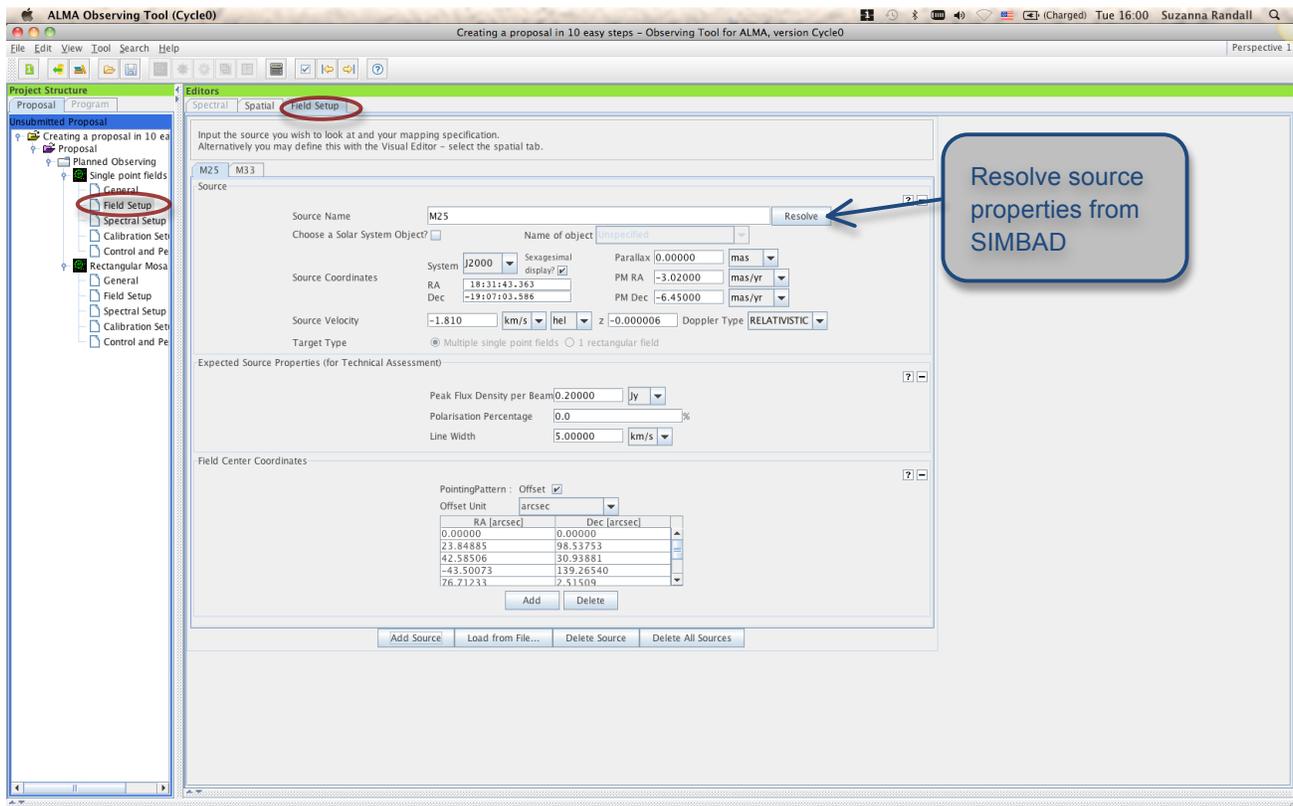


Figure 3: Adding the source information in the Field Setup pane

## 5. Configure the spectral setup

In Cycle 0, you will have two main options for the spectral setup, which are described in some detail below. In both cases, you will be asked to **specify your frequency** or frequencies in the rest frame, or alternatively on sky in the case of continuum observations. The sky frequency is calculated by the OT from the rest frequency using the source velocity specified in Step 4. Of course, the frequencies on sky of the proposed observations must fall within one of the ALMA bands offered (band 3,6,7 and 9 for Cycle 0). You can visualise your chosen spectral setup using the spectral viewer in the *Visualisation* section of the *Spectral* tab. By default, the spectral viewer will show the ALMA bands available, as well as the atmospheric transmission curve. Once you provide information on your spectral setup, it will also show the Local Oscillator (LO1) frequency and the sidebands as well as your spectral window(s). You can move around the spectral windows (e.g. to avoid strong atmospheric lines) by changing the input frequency. Moving the sidebands by dragging the LO in the spectral editor does **not** change the spectral

setup, but is for visualisation purposes only. For this reason, the sidebands will automatically “spring back” to any valid spectral setup actually specified after you move them in the visualiser.

You can zoom in/out by left/right-clicking when the cursor becomes a magnifying glass symbol or using the *Zoom to Band* and *Reset* buttons. Panning (i.e. horizontally shifting the frequency range viewed) is achieved by dragging the green sliding bars that appear when moving the cursor near the frequency axes, or using *Pan to Line*. For a practical demonstration of the spectral editor please refer to *OT video tutorial 3: The spectral setup*. You can select the *Polarization Products desired* using the appropriate radio buttons in the *Spectral Type* section. In Cycle 0, measurements of the source polarisation will not be possible, and you will normally use the default *Dual* option. You will generally only select *Single\_x* when attempting to achieve the highest possible resolution.

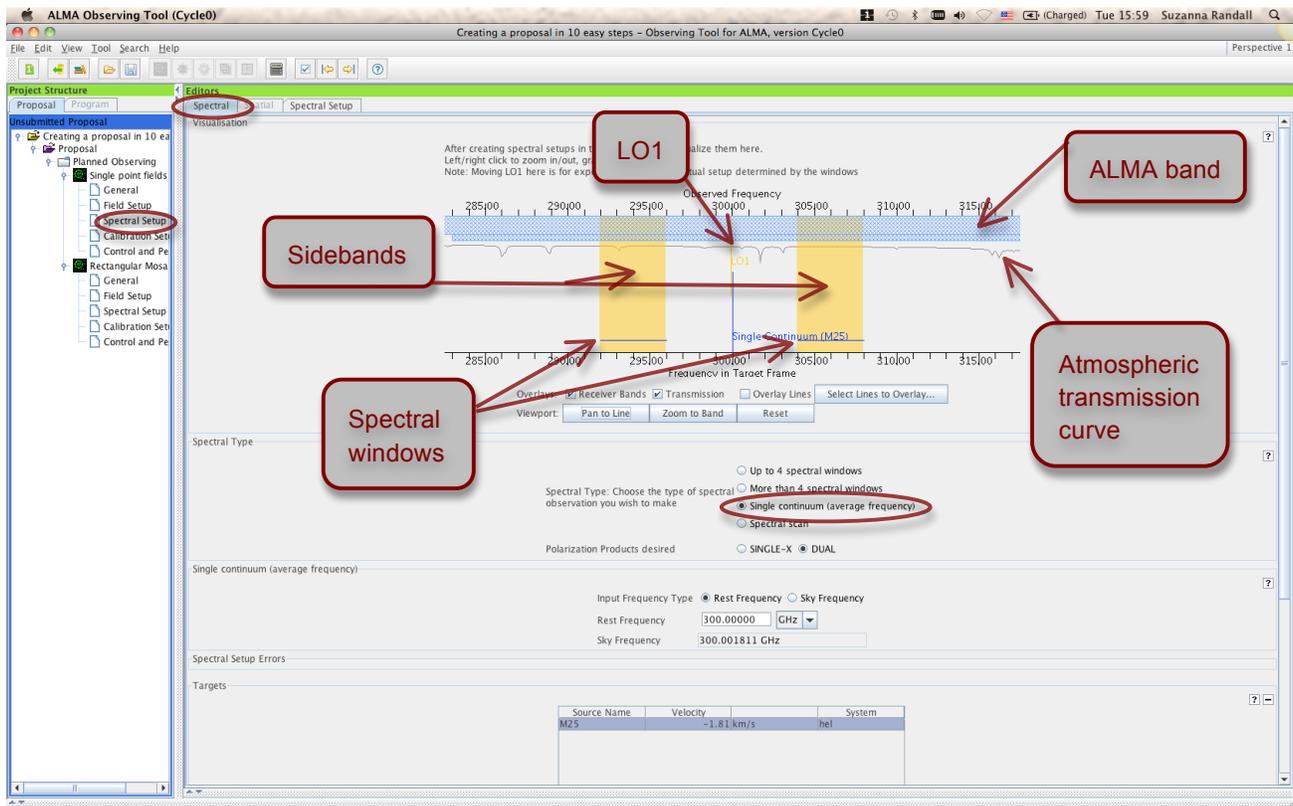


Figure 4: Visualisation of continuum observations in the spectral editor pane

## a) Continuum observations

Select the *Single continuum (average frequency)* option in the *Spectral Type* section of the *Spectral Setup* editor pane. You will then be asked to specify a single frequency to be used in the spectral setup.

In the *Spectral* tab you can visualise the spectral configuration that the OT has calculated based on your frequency input (see Fig. 4). The proposed sidebands are shaded in yellow, while the spectral windows covered by the observations are indicated by the horizontal blue lines labelled *Single Continuum (target name)*. Since the continuum setting is designed to maximise the spectral bandwidth covered, the spectral windows completely cover the width of the sidebands. Note that the continuum frequency specified actually corresponds to the LO frequency and is not itself observed in bands 3,6 and 7. In Band 9, the continuum frequency specified corresponds to the frequency at the centre of an 8 GHz wide sideband.

## b) Observing line transitions

In Cycle 0, you can observe up to four spectral windows with a limited choice of bandwidths and resolutions. Note that all spectral windows must have the same bandwidth and resolution for technical reasons; this restriction will be lifted in future cycles. Selecting the *Up to 4 spectral windows* option will present you with an empty table of spectral line information as well as buttons to *Select lines to Observe*, *Add* or *Delete* transitions.

**Adding spectral windows** manually is straightforward: you simply type the rest frequency in the appropriate field in the table and select the bandwidth and resolution required from the pull-down menu that appears when double-clicking on the relevant field. You also have the convenient option to *Select Lines to Observe* from a catalogue. Pressing this button will bring up the spectral line selector tool (see Fig. 5). Here, you can **search an extensive database** (the Splatalogue<sup>4</sup>) for popular transitions based on species (the wildcard \* is accepted), ALMA band, Sky frequency, maximum upper-state energy or molecules detected in a variety of astronomical sources. If you cannot find the transition you want in this offline database, try selecting just one ALMA band: you will then be able to also search online from a more extensive database. Once you have identified the transition(s) you are interested in, you select them and press the *Add to Selected Transitions* button. The *Enable Sideband Filter*, ticked by default, allows you to see which transitions are simultaneously observable with the transition(s) you have already selected. The OT will allow you to add up to four transitions to be observed. When you *Close Dialog and Apply Selection*, this will add spectral windows to the table with centre frequencies equal to the transition frequencies. You will be able to verify the transitions both in the table and visually in the spectral editor (see Fig. 6).

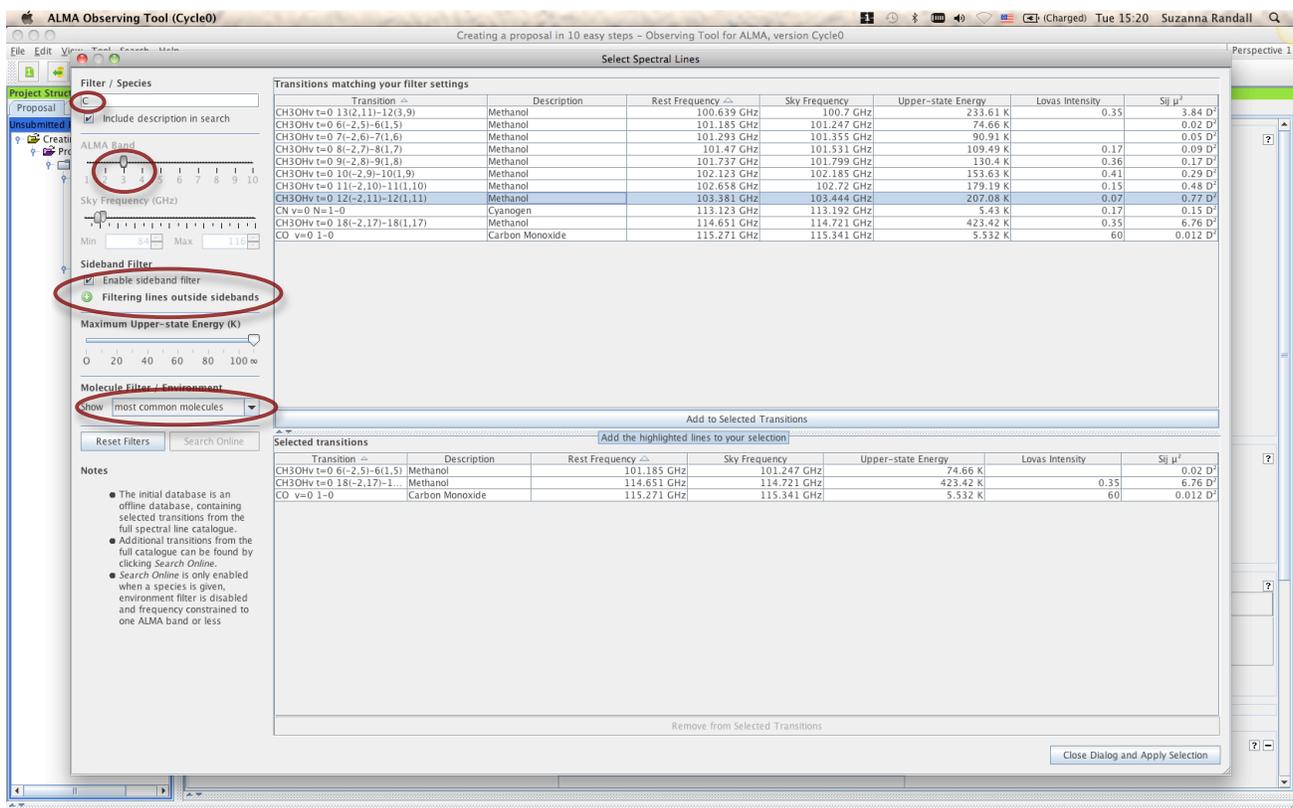


Figure 5: The spectral line selector tool

<sup>4</sup> Detailed information on the Splatalogue can be found at <http://www.splatalogue.net>

The OT will try to configure a spectral setup based on your input. In the spectral viewer, the sidebands are shaded in yellow and the spectral windows selected are indicated by the blue vertical (line frequency) and horizontal (bandwidth) lines. The latter are labelled according to the transition they refer to. If the OT cannot configure a valid spectral setup based on your input transitions, you will see a red error message in the Spectral Setup Errors box and in the spectral visualiser the sidebands will be faded to grey rather than appearing in yellow. In order for your proposal to pass validation, you must select a valid spectral setup, where all spectral windows can be fit within a possible sideband configuration. Note that for bands 3, 6 and 7 it is currently not possible to place 1 spectral window in one sideband and 3 in the other, however 2 and 2 is acceptable, as is 4 spectral windows in one sideband. Band 9 has no such restrictions.

You can **change the bandwidth and resolution** of a spectral window by double-clicking on the *Bandwidth*, *Channel Spacing* field of the spectral line table and choosing one of the options from the pull-down menu. Since all spectral windows are required to have the same bandwidth and resolution for Cycle 0, changing this for one line will automatically adjust the spectral setup for any other lines already selected. If you increase the bandwidth you should ensure that the OT can configure a valid spectral setup. It may be possible to change the centre frequency of spectral windows from the transition frequency in order to fit the spectral windows within the sideband, but please ensure that your lines are still covered by the spectral windows. Of course, if you cannot define a valid spectral setup for all the spectral windows you wish to observe, you can also put them into separate Science Goals.

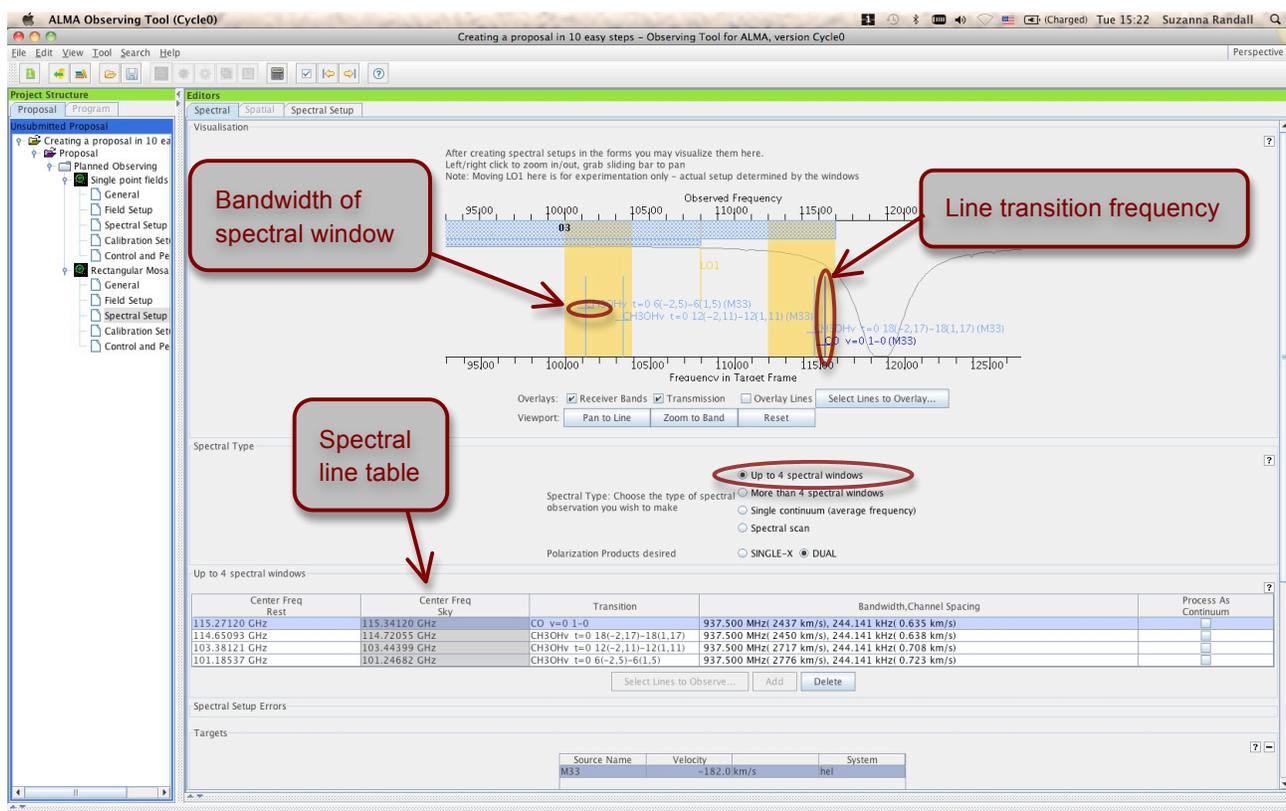


Figure 6: Visualisation of spectral line observations in the spectral editor pane

## 6. Finalise the spatial setup

Having specified the spectral setup, you are ready to finalise the spatial setup based on the target information you provided in Step 4. Selecting the *Spatial* tab of the *Field Setup* editor pane will bring up the visual editor (see Fig. 7). You can *Query* one of the image servers selected from the drop-down menu for a **catalogue image of the area**

**surrounding your source.** Alternatively, you can **load and display your own FITS image** by clicking the folder icon in the spatial editor toolbar (only if it contains WCS information in equatorial coordinates; galactic coordinates are currently not supported). The antenna primary beam (FOV) is indicated by a green circle centred on the source coordinates specified. Note that the **beam size is automatically calculated by the OT** based on a reference frequency from your spectral setup (this is why the spatial setup should only be finalised after the observing frequency has been selected). You can use the buttons in the toolbar above and below the spatial viewer to perform simple visualisation operations such as adjusting the cut levels, zooming, and saving the image. Please see *OT video tutorial 4: The spatial field setup* for a practical demonstration of all functionalities.

When entering the target information in Step 4 you selected one of two options: *Multiple single point fields* (several targets allowed per Science Goal) or *1 rectangular field* (only one mosaic per Science Goal). We now describe the procedure to be followed for both of these cases.

## a) Multiple single point fields

In this case, you can specify several sources, each to be observed with a number of offset pointings if required. You can visualise and configure the spatial setup for each target individually by selecting the relevant source tab. Of course, you must query the image server or load your own image for each target. To define multiple pointings you can manually *Add* the offsets from the position specified in the *Source Coordinates* field, specify the coordinates directly (untick the *Pointing Pattern: Offset* box), or graphically add fields of view in the spatial visual editor using the *Add a FOV* button (see Fig. 7).

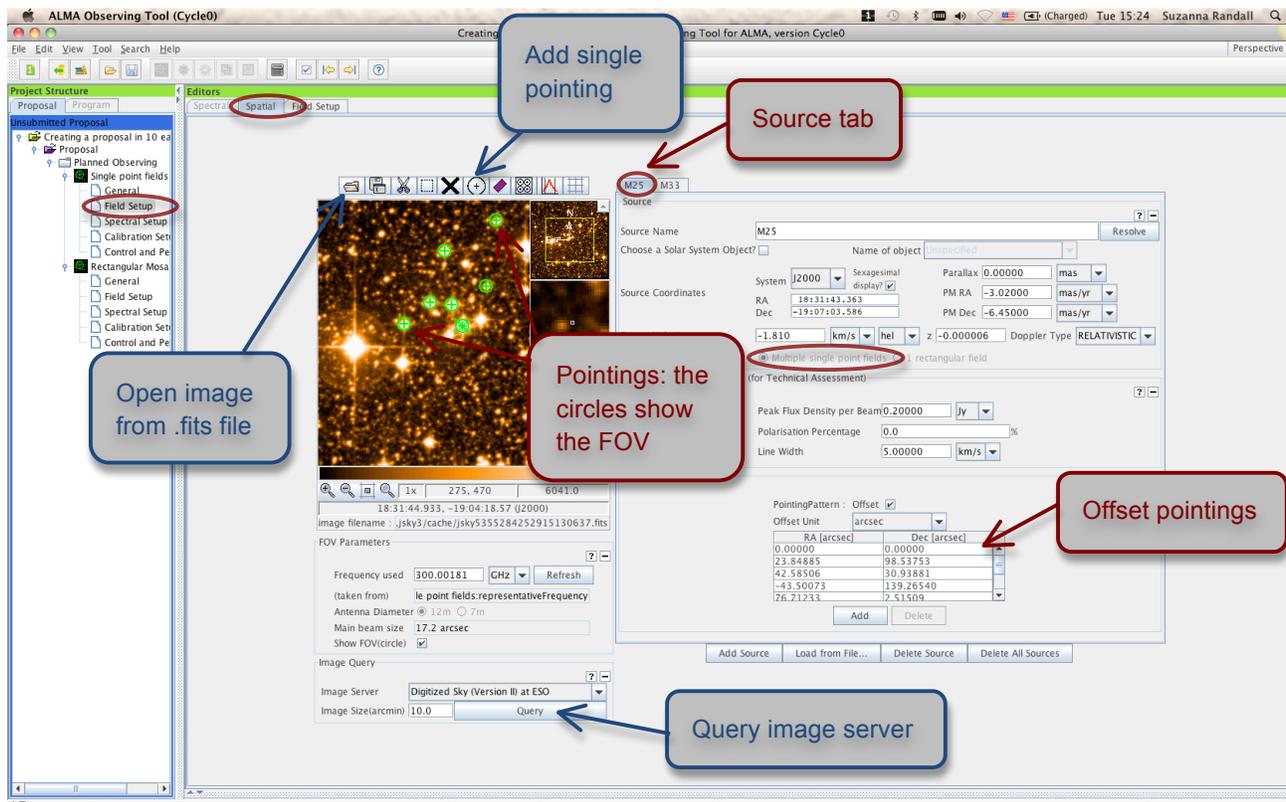


Figure 7: Visualisation of multiple single point fields in the spatial tab of the Field Setup pane

## b) 1 rectangular field (mosaic)

In this case, you can define just one evenly sampled rectangular field mosaic. In addition to the *Field Center Coordinates* (set by default to the *Source Coordinates*), you specify the size of the field as  $p$  length times  $q$  length, the *Position Angle* and the *Spacing* of individual pointings. By default, the spacing is set to Nyquist sampling (i.e.  $Spacing = 0.5$  times *fraction of main beam*). You can then visualise the rectangle and pointings in the spatial viewer (see Fig. 8).

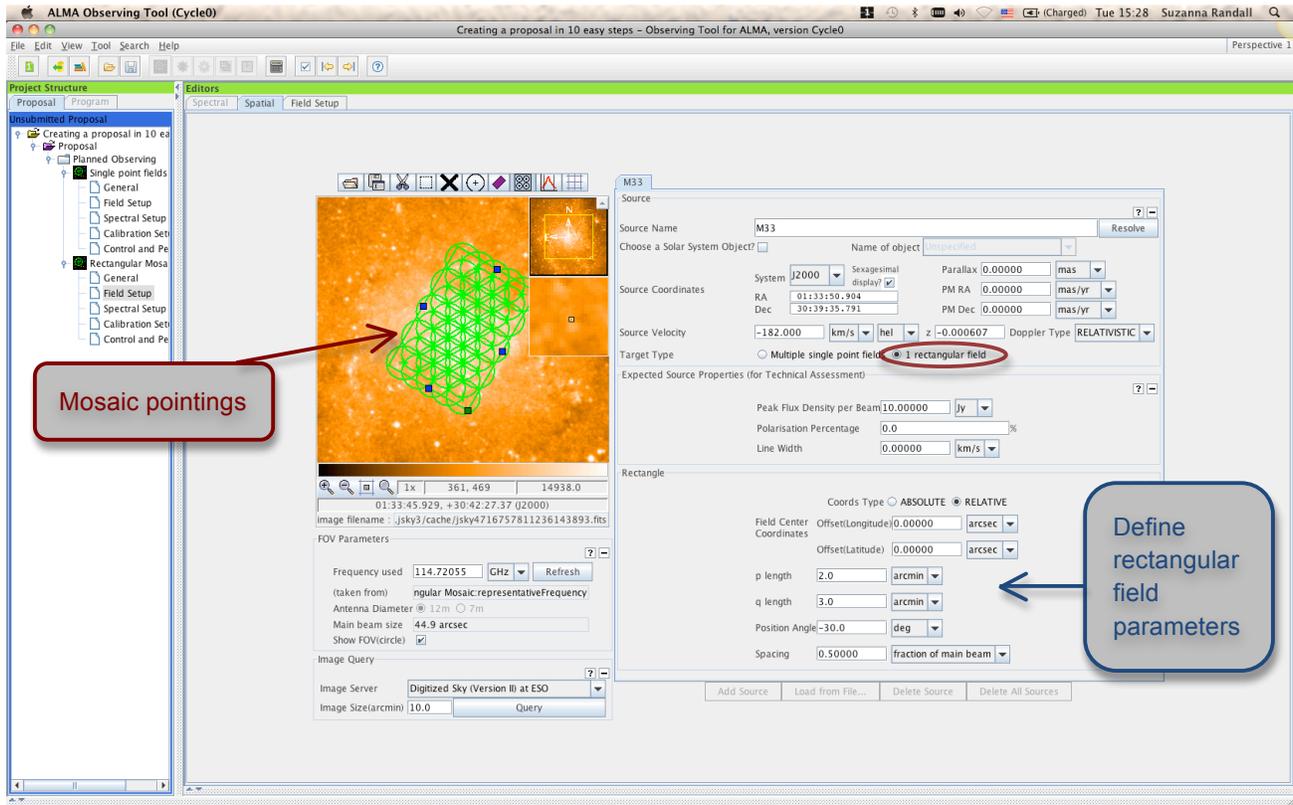


Figure 8: Visualisation of a rectangular mosaic

## 7. Select the calibration strategy

We strongly encourage all users to use the default *System-defined calibration* in the *Calibration Setup* pane. The system-defined calibration is designed to fully calibrate your science observations using the most appropriate sources available at execution time, and will at least include pointing, bandpass, gain and flux calibration. Only experts whose projects have special calibration requirements should specify *User-defined calibration*.

## 8. Enter the control and performance parameters

The final technical specifications of your Science Goal are entered in the *Control and Performance* panel (see Fig. 9). The *Representative Frequency* and resulting *Antenna Beamsize* are automatically computed from your spectral setup, and the synthesized beam sizes are listed for the two array configurations available in Cycle 0.

You will need to define four parameters in the *Control and Performance* panel:

- **Desired Angular Resolution:** the angular resolution you want to achieve. The synthesized beam sizes displayed for the two array configurations available in Cycle 0 are meant to guide your choice. In particular, angular resolutions smaller than the synthesized beam size of the more extended configuration cannot be observed. You can input the angular resolution in arc-seconds or a fraction of the main beam size.
- **Largest Angular Scale of source:** select whether you are observing a point source or an extended source. For the latter choice you will be prompted to specify the largest expected angular scale. Together with the angular resolution, this will be used to define the array configuration(s) necessary to achieve your scientific goals. The input units are the same as for the angular resolution.
- **Desired Sensitivity per Pointing:** the sensitivity you want to achieve per pointing (if you have a mosaic with overlapping fields, the sensitivity reached in the overlapping regions will be better than that specified). You should enter the sensitivity required for the most restrictive line/continuum observation to achieve the scientific aims of the Science Goal. You can mention the S/N ratio for the remaining lines/continuum in the technical justification. Note that in Cycle 0 the 7-m and Total Power Array (Atacama Compact Array) are not available.
- **Bandwidth used for Sensitivity:** for continuum observations, this field can only be set to *AggregateBandwidth*. For spectral line observations, you can pick one of four choices given in the dropdown menu:
  - *AggregateBandwidth:* the sensitivity calculation will be performed for the summed bandwidth of all your selected spectral windows
  - *LargestWindowBandwidth:* the bandwidth of your widest spectral window is used to perform the sensitivity calculation
  - *FinestResolution:* the sensitivity calculation is performed for the channel spacing of your observation
  - *User:* the sensitivity calculation is performed for a bandwidth of your choice, which is useful if you are intending to smooth your data after observation to achieve a certain S/N.

You can use the **Sensitivity Calculator** button to bring up a pop-up window (see Fig. 10) that allows you to experiment with the integration time estimated to achieve a given sensitivity for a given setup. By default, the setup is appropriate for the user-defined parameters and Cycle 0 capabilities, and thus the polarisation, frequency, angular resolution, sensitivity and the bandwidth used for the sensitivity will be set to those specified in the Control and Performance editor. If the spatial resolution entered is not within the acceptable range, a red error message will appear at the bottom of the calculator. After playing around with the various parameters, it is important to realise that apart from the desired sensitivity, any changes that are made here are not reflected in the Control and Parameter page. Therefore, after determining the optimal set of parameters for your project, it is important that you enter these manually into the Control and Parameter page. Note that the integration time computed from the Sensitivity Calculator refers to just one pointing for the science target and does not take into account calibrations. The **total time** required for your Science Goal can be displayed via the Time Estimate button. This is also the value that will be displayed on the front page of your proposal and that will be used by the observatory as an estimate of how long your project will take to complete; it includes multiple pointings and calibration overheads. Note that for Cycle 0, proposals requiring more than 100 hours cannot be submitted.

If the time required to reach your scientific objective is not driven purely by sensitivity, but also by other factors such as the u-v coverage or monitoring requirements specific to the target, you should **indicate that you need more time than that estimated by the OT** by selecting the 'Yes' radio button for *Does your setup need more time than is indicated by the time estimate?*, and carefully justify this in the technical justification. The OT currently has the facility to capture simple **time constraints** using a calendar tool (see Fig. 9). These can be entered after selecting

the 'Yes' radio button for *Is this observing time constrained?* . Other relevant timing information can be entered in the free-format text box.

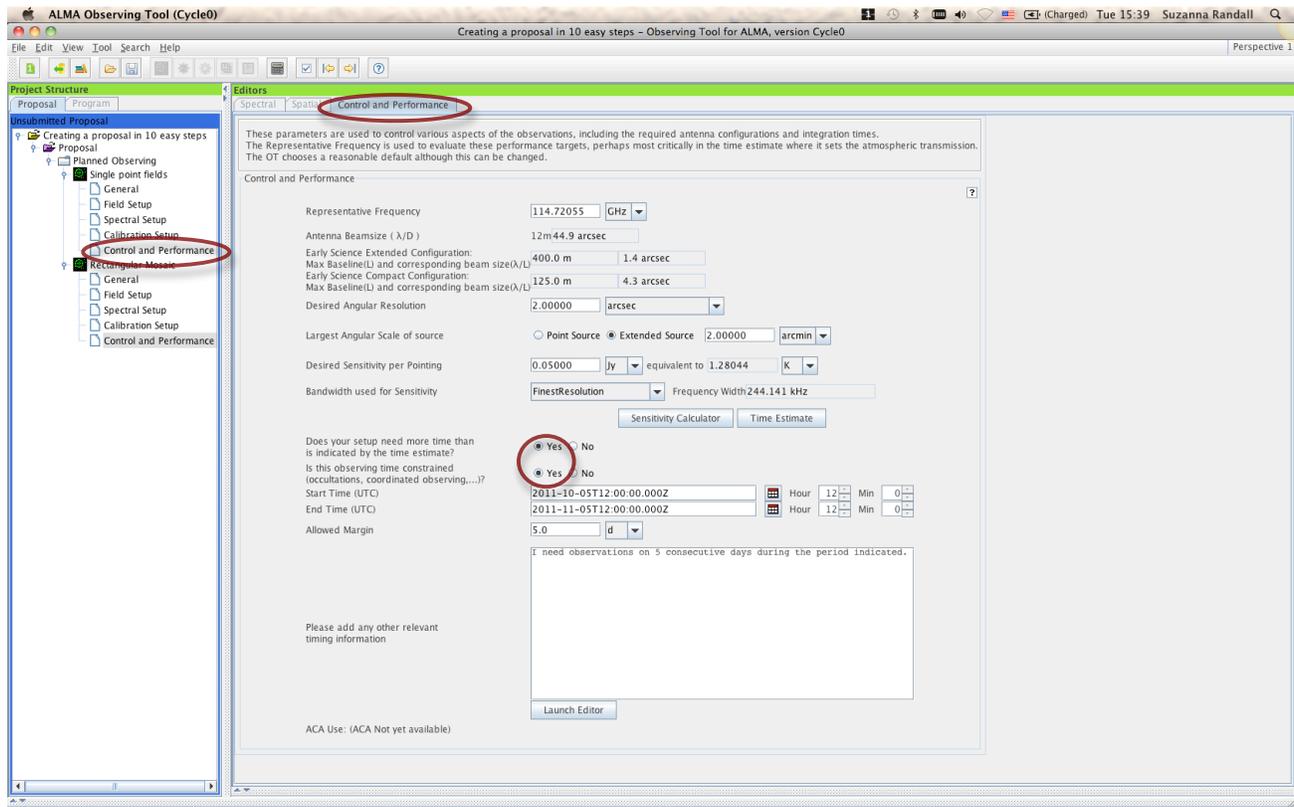


Figure 9: Control and Performance editor pane

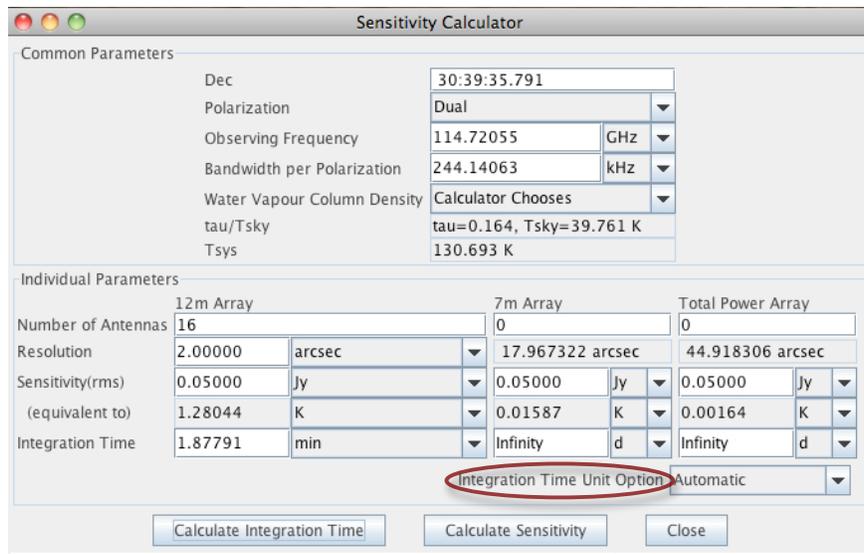


Figure 10: Sensitivity Calculator

## 9. Validate your project

By clicking on *Menu > Validate* or the corresponding tick icon in the toolbar you can check whether the project contains any setup errors. Successful validation is required before attempting to submit a project. As an example, Fig. 11 illustrates a case where no supporting material was included. At validation the OT gives the error message "No documents found" in the feedback pane. There is also a warning that two targets within the same Science Goal are more than 15 degrees apart. Warnings are simply for your attention, and do not prevent you from submitting a technically sound proposal. After correcting the error (and removing the cause for the warning) and re-validating, the Feedback pane gives a "No problems found" message (Fig. 12). Your project is now ready to be submitted!

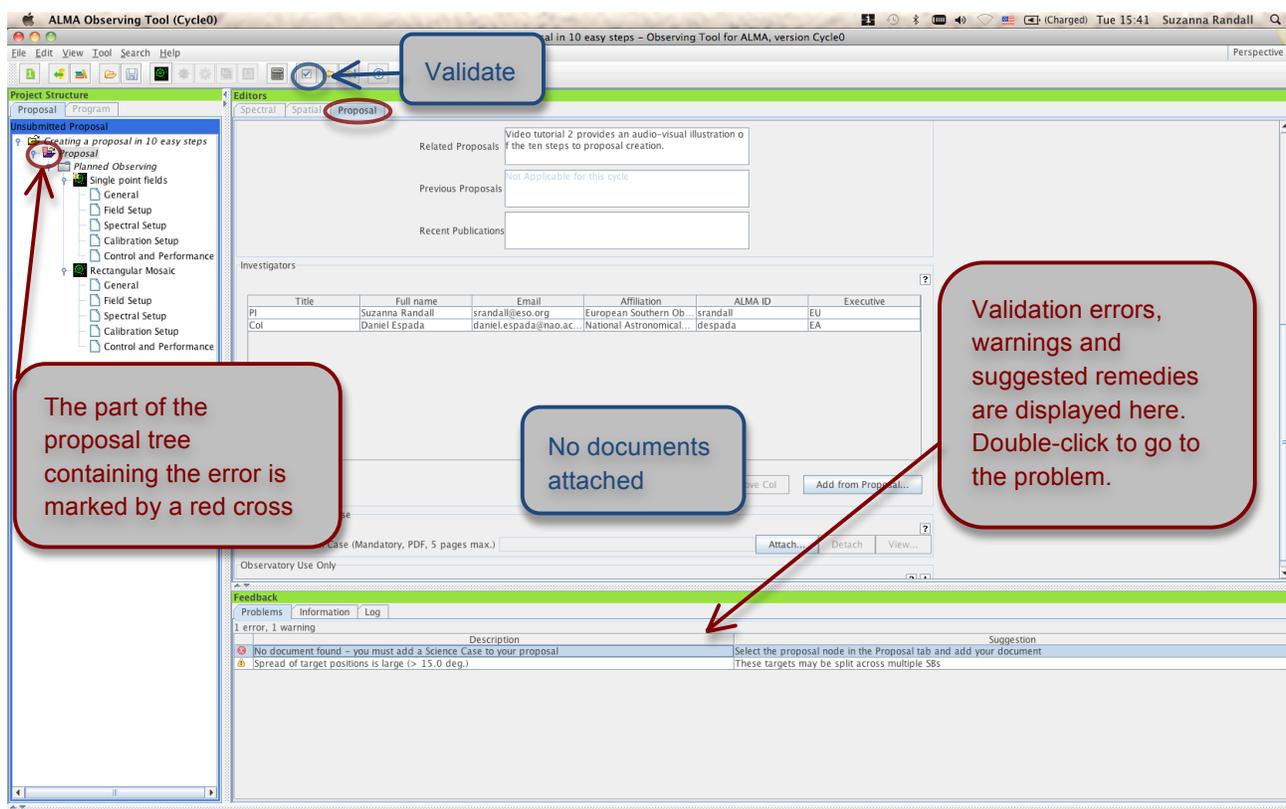


Figure 11: An example of failed validation

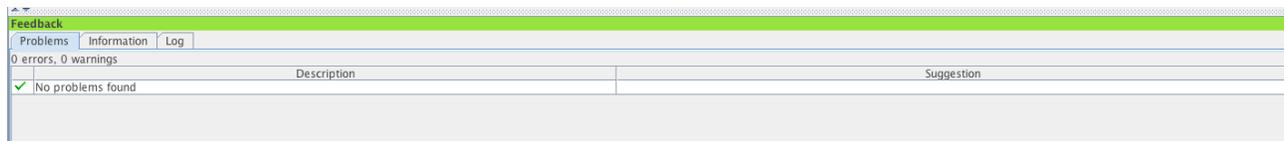


Figure 12: Successful validation!

## 10. Submit and save your proposal

You have reached the final step. Select *File > Submit Project* in the menu bar to submit your project to the ALMA archive. You should receive a confirmation e-mail after each proposal submission. Once you have submitted, the *Unsubmitted Proposal* label in the blue proposal status bar will be replaced by a red *Submitted* label (see Fig. 14). This indicates that the proposal has been stored in the ALMA archive and assigned the *Project Code* listed in the top-level overview panel of your proposal. You are encouraged to save your project to disk after submission in order to ensure that any future updates are made on the submitted version.

You can make changes and re-submit your *Submitted* proposal until the deadline; however any re-submission will overwrite the previous version of the proposal stored in the archive. It is not possible to submit an edited version of a *Submitted* proposal as a new project. In order to achieve this, you would have needed to save the first project to disk prior to submission (with the *Unsubmitted Proposal* label, and no *Project Code* assigned) and ensured that this file was not overwritten when saving the *Submitted* version by using *File > Save As* and choosing a different file name (see Fig. 13).

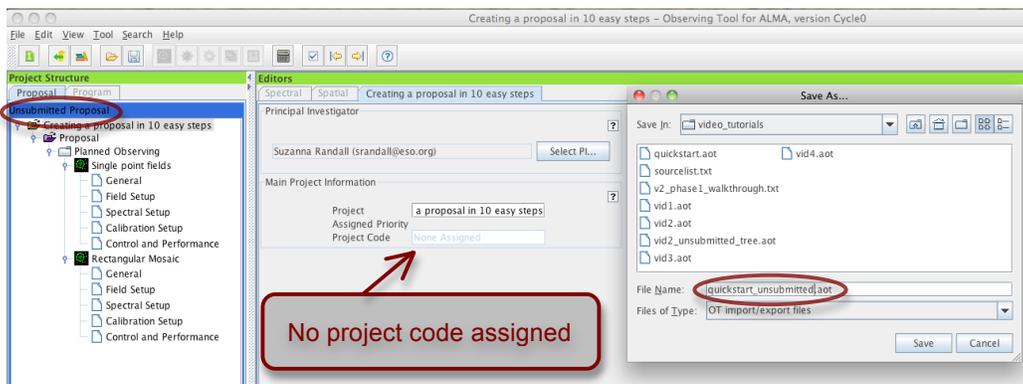


Figure 13: Saving an unsubmitted proposal under a unique filename

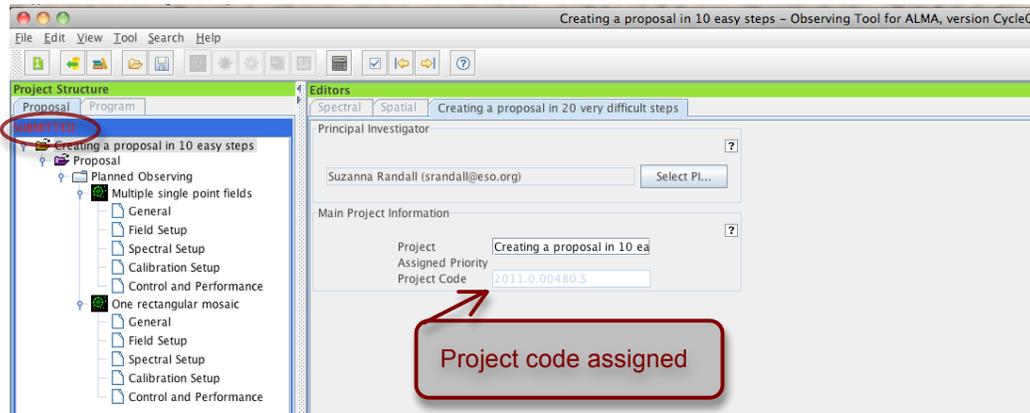


Figure 14: A submitted proposal with project code assigned

Saving your project to disk will produce a file in the OT's native .aot format, which can be re-opened and edited using any version of the OT. It contains all the information on your project, including .pdf attachments, and can be conveniently sent e.g. to co-I's for editing. You may also want to save your project in .pdf format. A .pdf summary including an overview page, all supporting material and technical details of the Science Goals can be created using *Tool -> Generate a PDF of Whole Proposal*. You will be asked to save the .pdf file to disk before opening or viewing it. In order to get an on-screen printable quick view of parts of your proposal (e.g. a Science Goal, or the proposal summary) click on the relevant node in the project tree and select *Tool -> Show printable Summary of ...*



The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI) and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.

