Observing with ALMA

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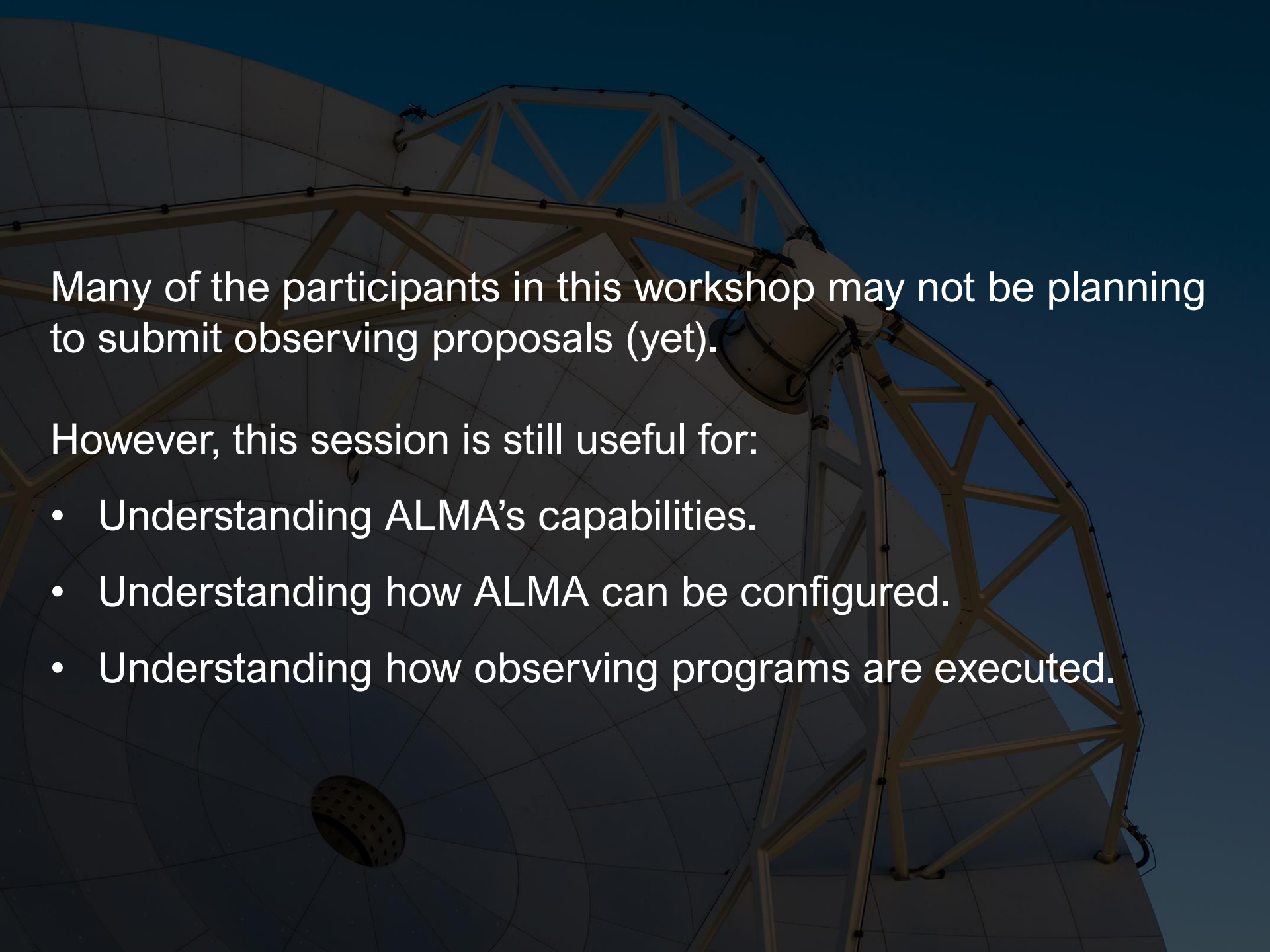


Many of the participants in this workshop may not be planning to submit observing proposals (yet).

However, this session is still useful for:

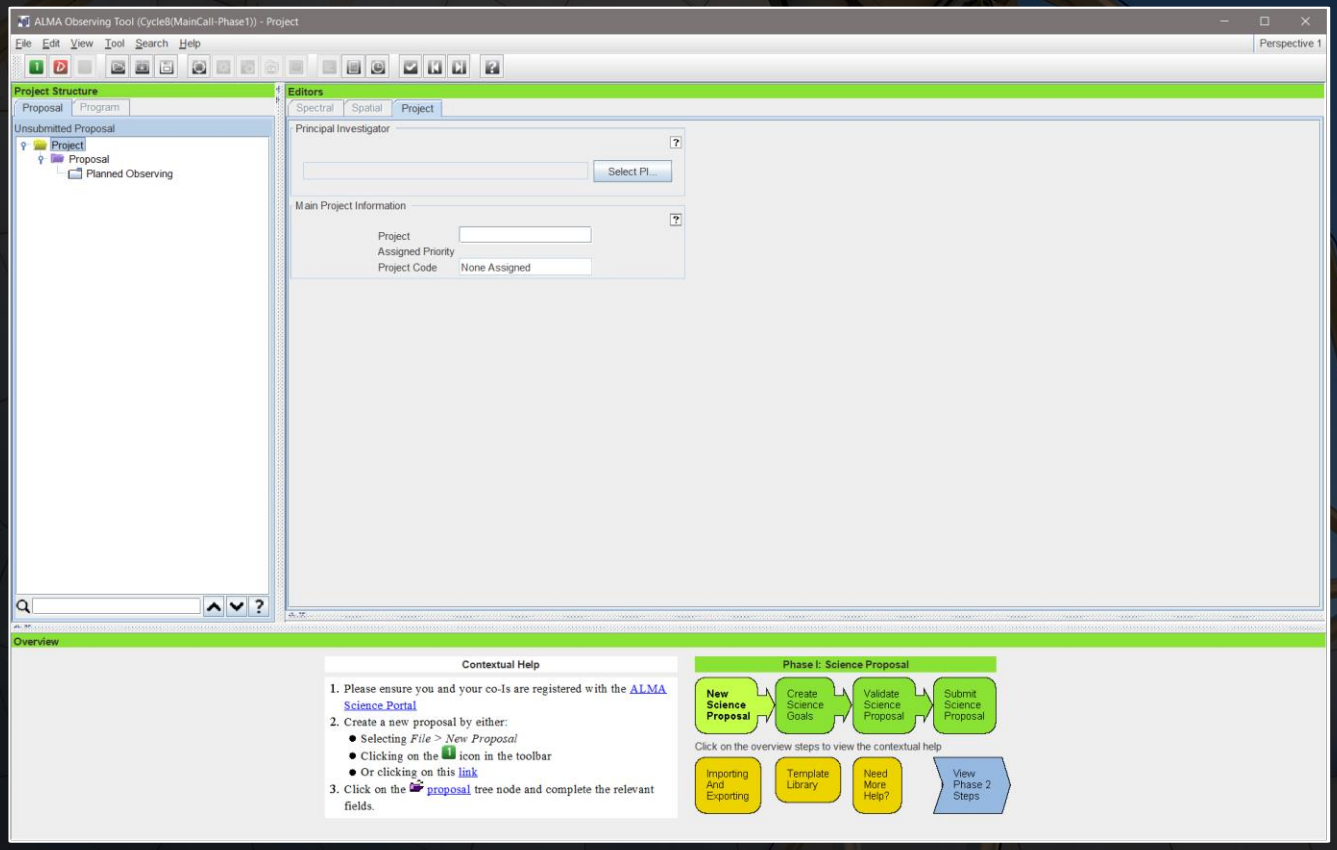
- Understanding ALMA's capabilities.
- Understanding how ALMA can be configured.
- Understanding how observing programs are executed.

ALMA uses the same timeline in every cycle for handling proposals.

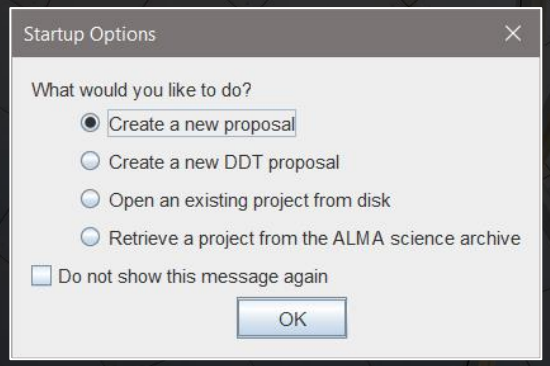
March	Call for proposals
April	Proposals due
August	Grades for proposals are announced
September	Phase 2 of proposal submission (review of the Scheduling Blocks); end of observations from the previous cycle
October	Observations start for new cycle

The Observing Tool (OT) is used to prepare and submit ALMA proposals.

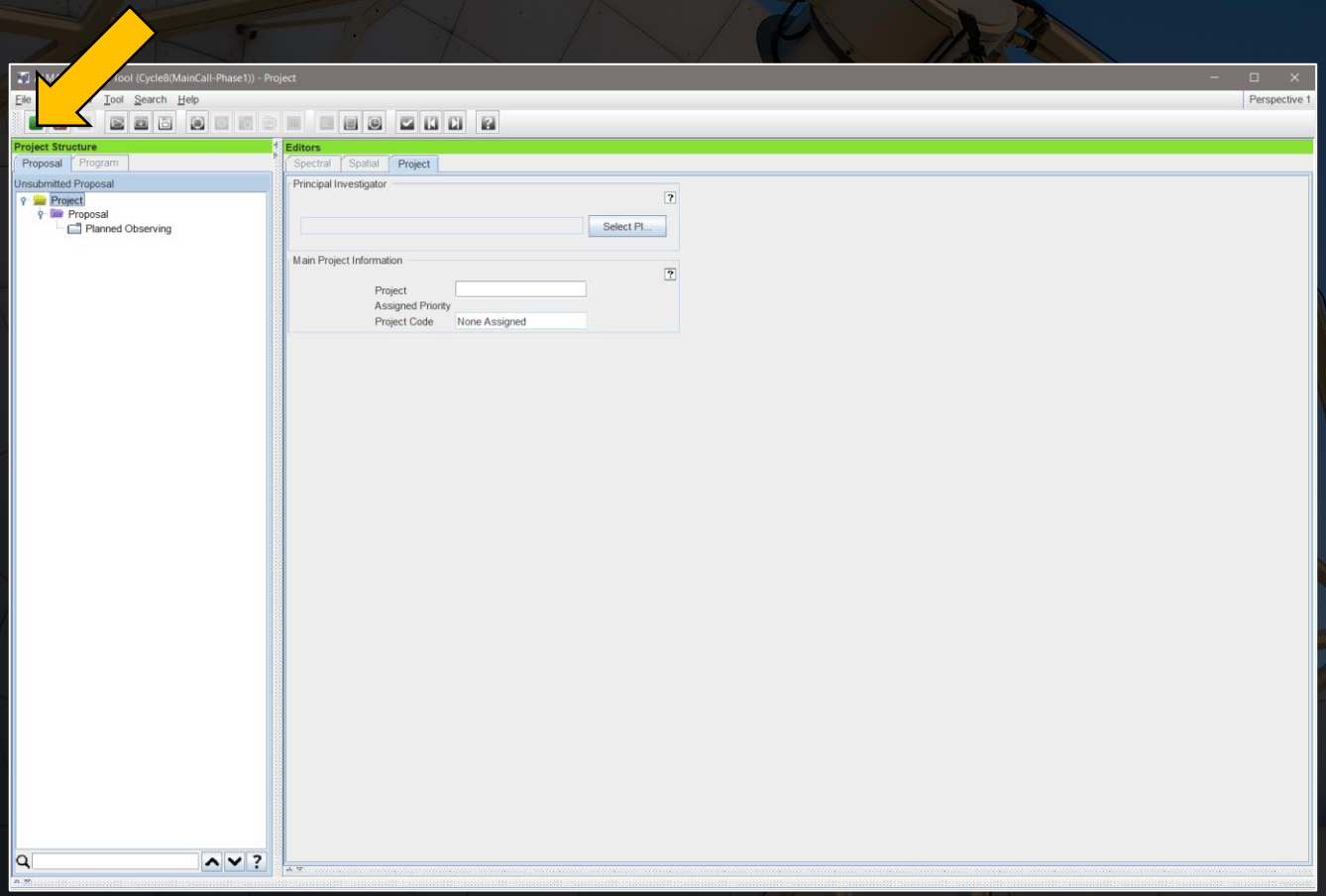
The OT can be downloaded from https://almascience.eso.org/tools/proposing/observing-tool .



When starting the OT, a pop-up window will ask whether to create a new proposal or open an existing one.

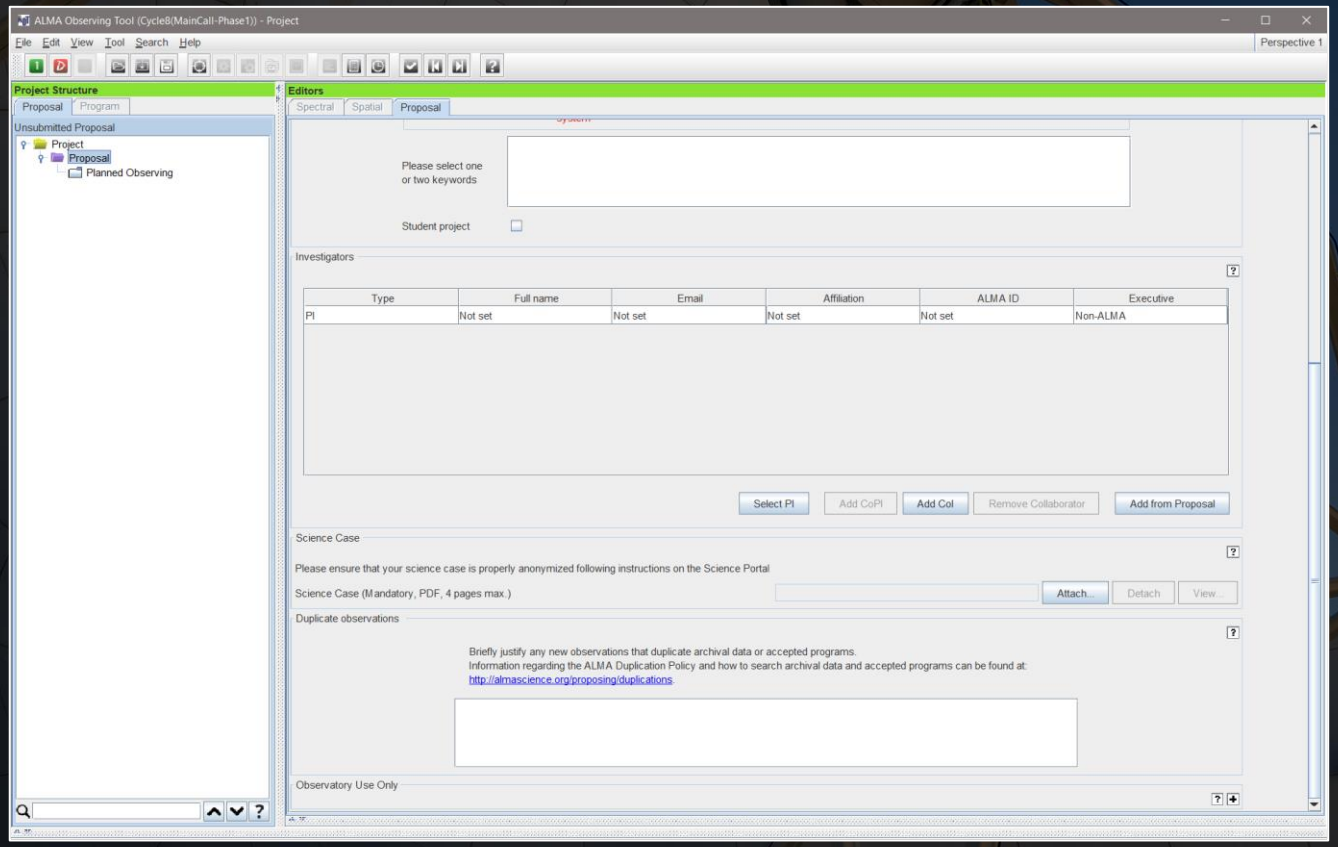


In the OT, proposals can be created or opened by either selecting the options from the File menu or button bar.



The proposal tab shows summary information about the proposal, including the abstract and authors of the project.

The science case is also attached using a button in this tab.



The science case is a separate LaTeX document that can be downloaded from https://almascience.eso.org/documents-and-tools/proposing/proposal-template .

1 Scientific justification

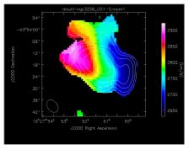


Figure 1: *The CO(1-0) velocity field of NGC 3256, with contours of the total line emission map overlaid (ALMA Science Verification Data).*

Table 1: *Here we show the continuum sensitivity required per band.*

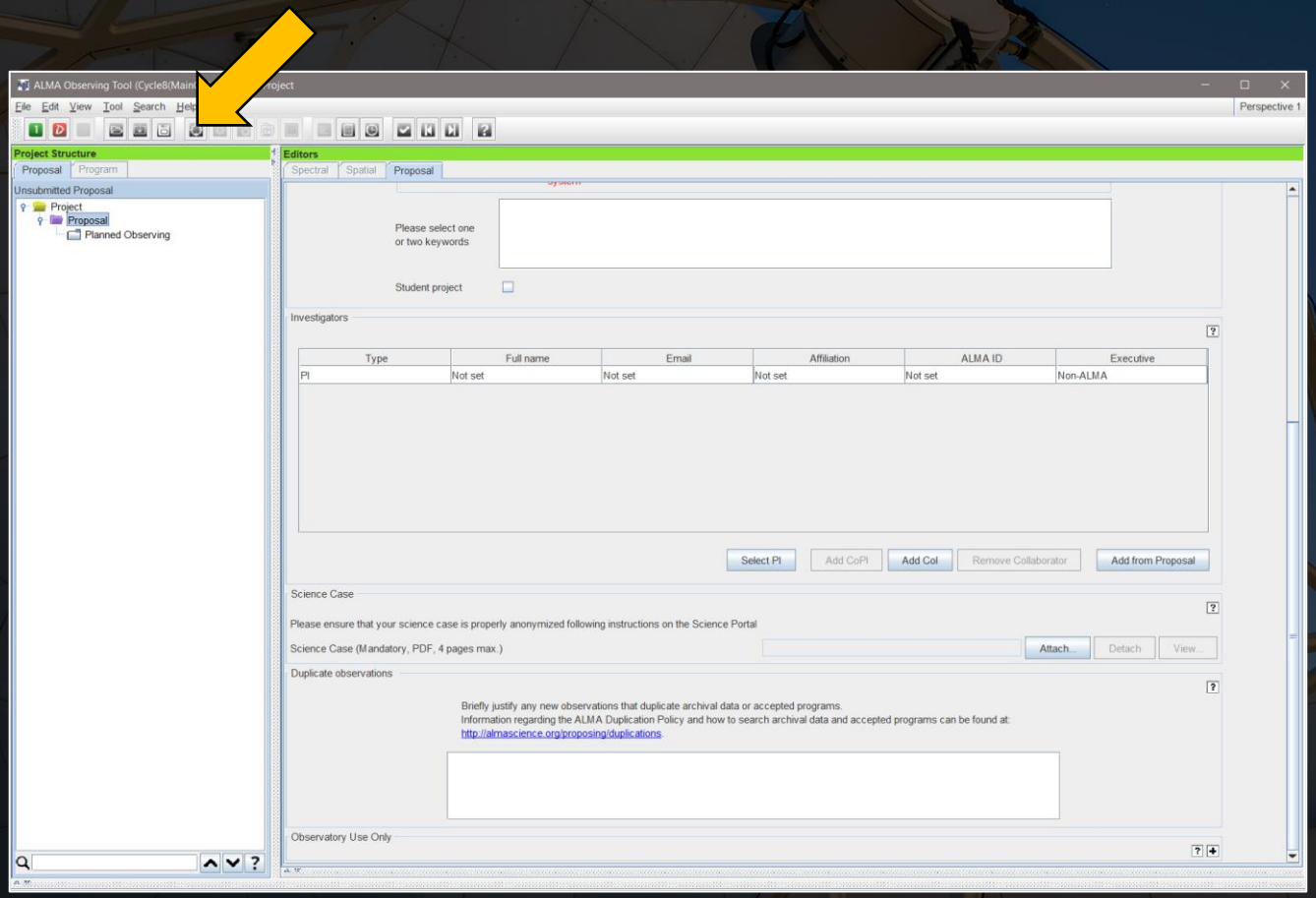
Frequency (GHz)	Sensitivity (mJy)
100	0.01
300	0.10

2 Description of observations

3 References

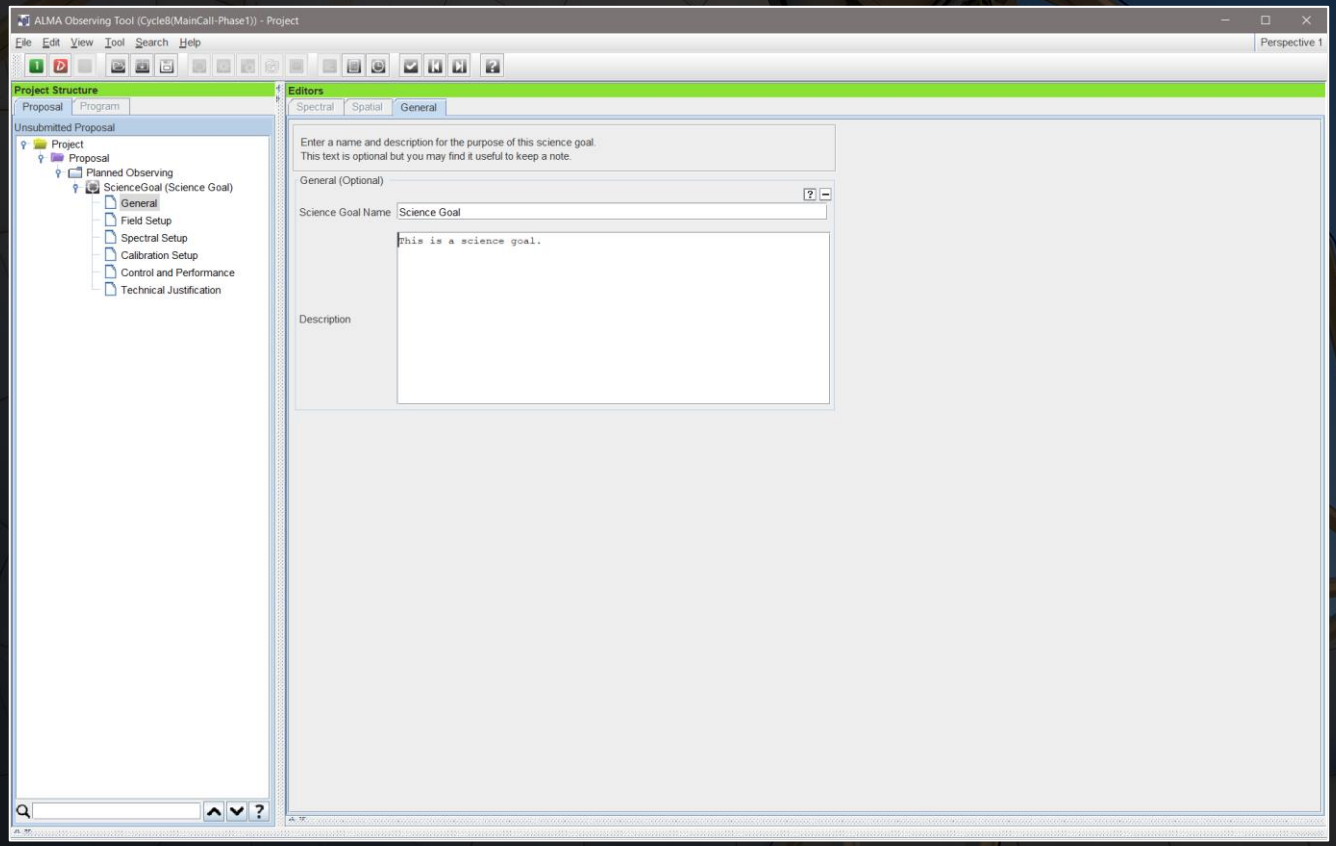
[1] Author1 et al. year, journal, vol, page
[2] Author2 et al. year, journal, vol, page

The observations are set up by adding Science Goals, which can be done by either right-clicking on the Planned Observations tab or clicking the corresponding button in the button bar.



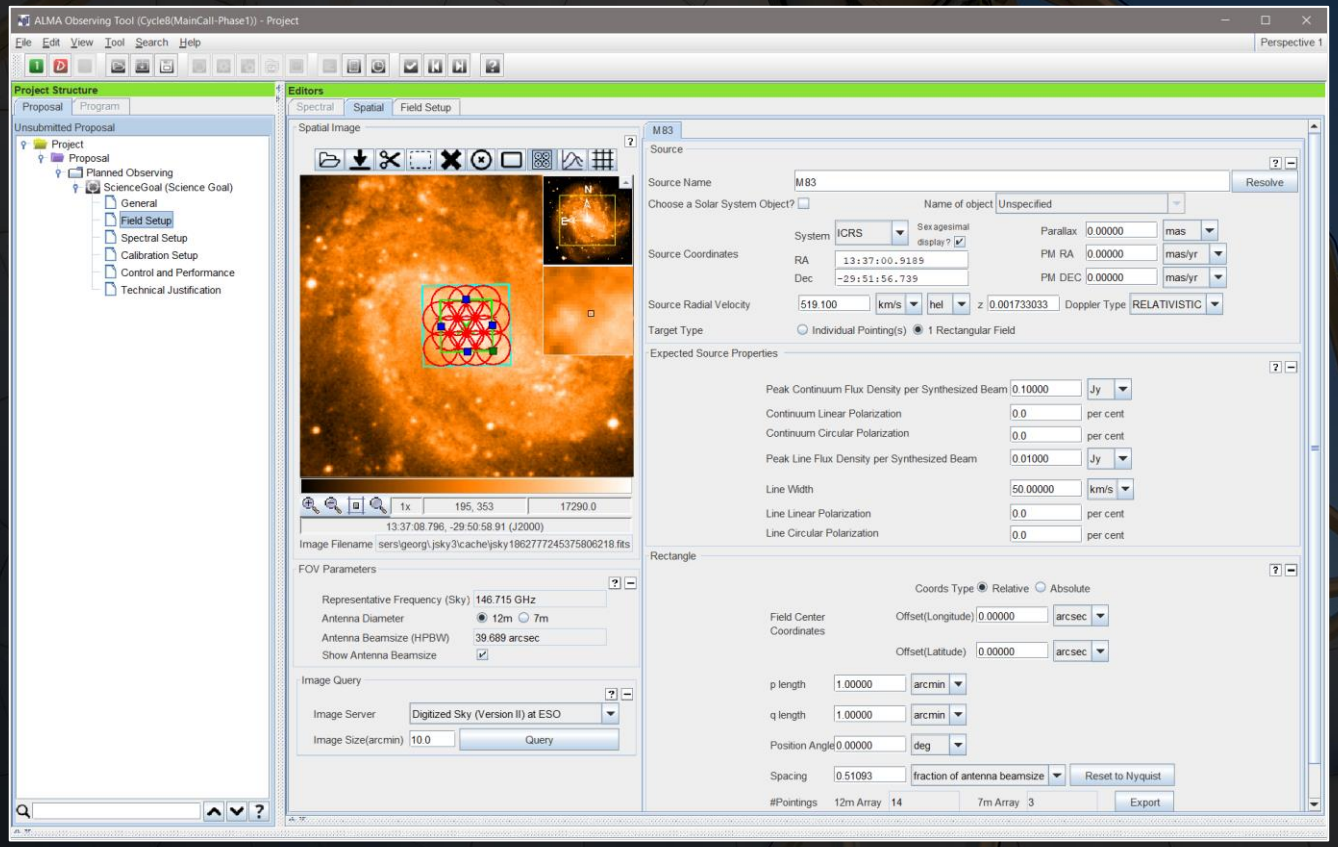
Each Science Goal consists of a set of six tabs.

The General tab describes the Science Goal.

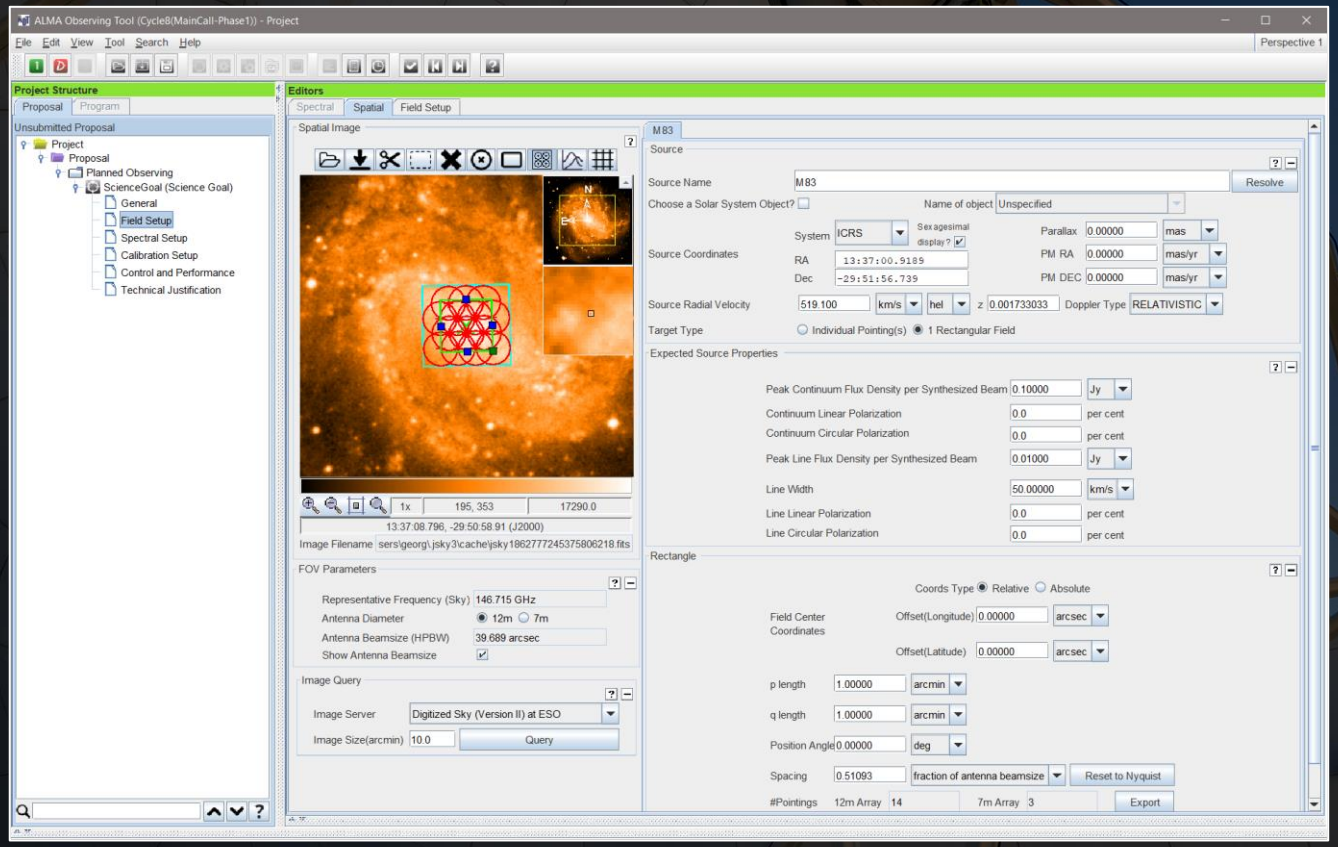


The Field Setup tab describes the locations in the sky to be observed.

Multiple sources can be specified in this tab. Mosaic observations can also be specified here.

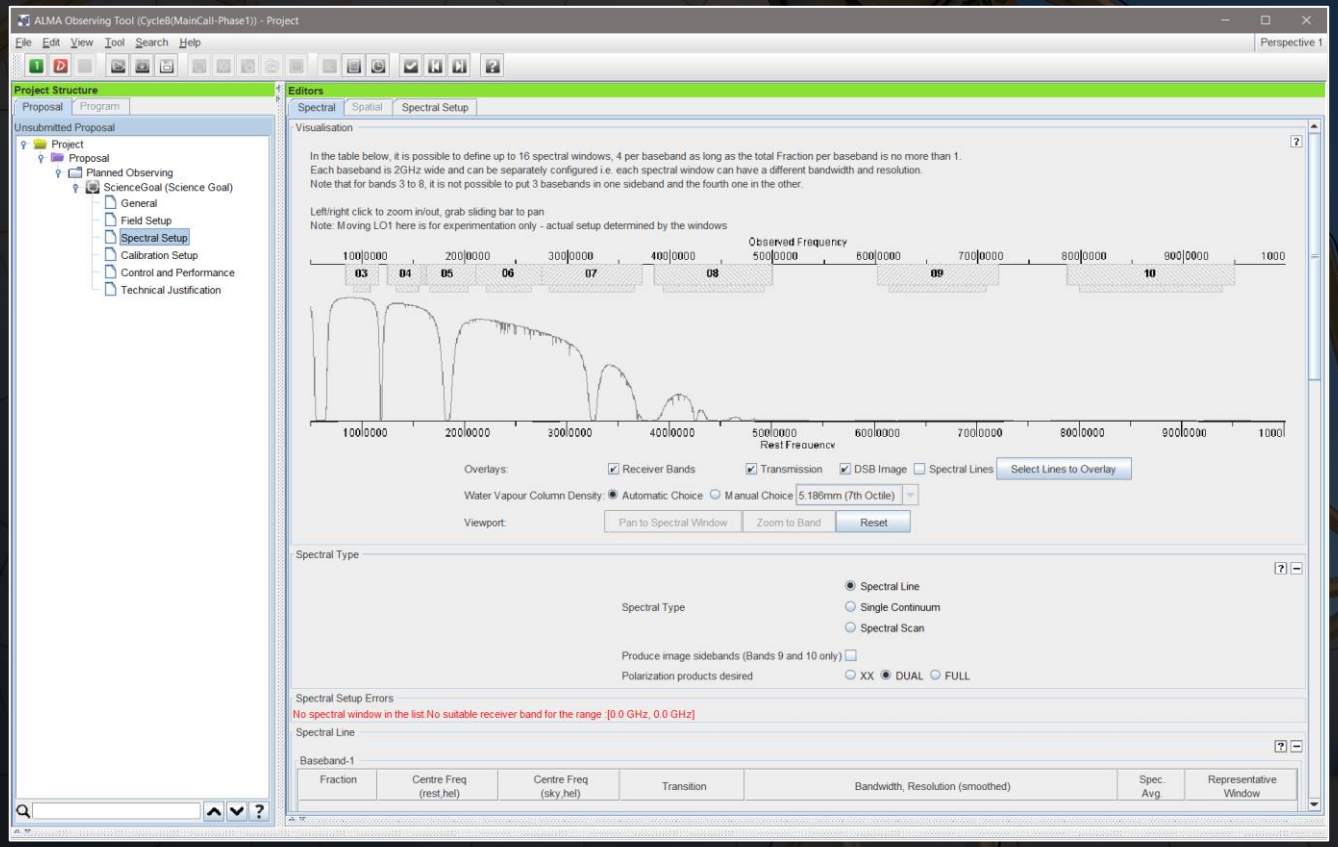


Although source positions and redshifts can be automatically filled in, users need to check that these quantities were filled in correctly or insert new values if appropriate.



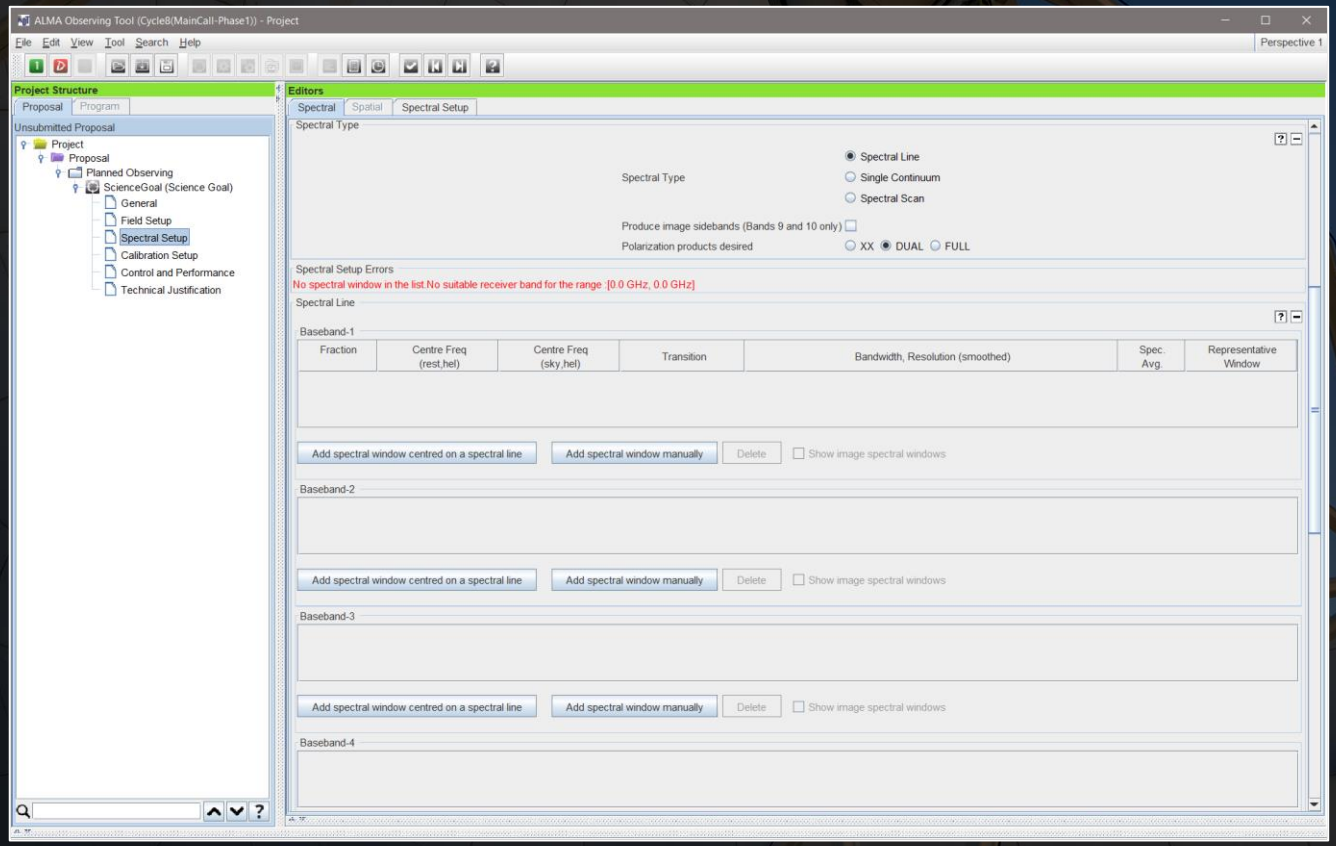
The Spectral Setup tab describes how the receivers are set up for the observations.

Multiple spectral and polarization settings are available.



When the spectral type is set to spectral line, the individual spectral windows need to be created by the user.

When the other spectral types are used, the spectral windows are set based on the user's input.



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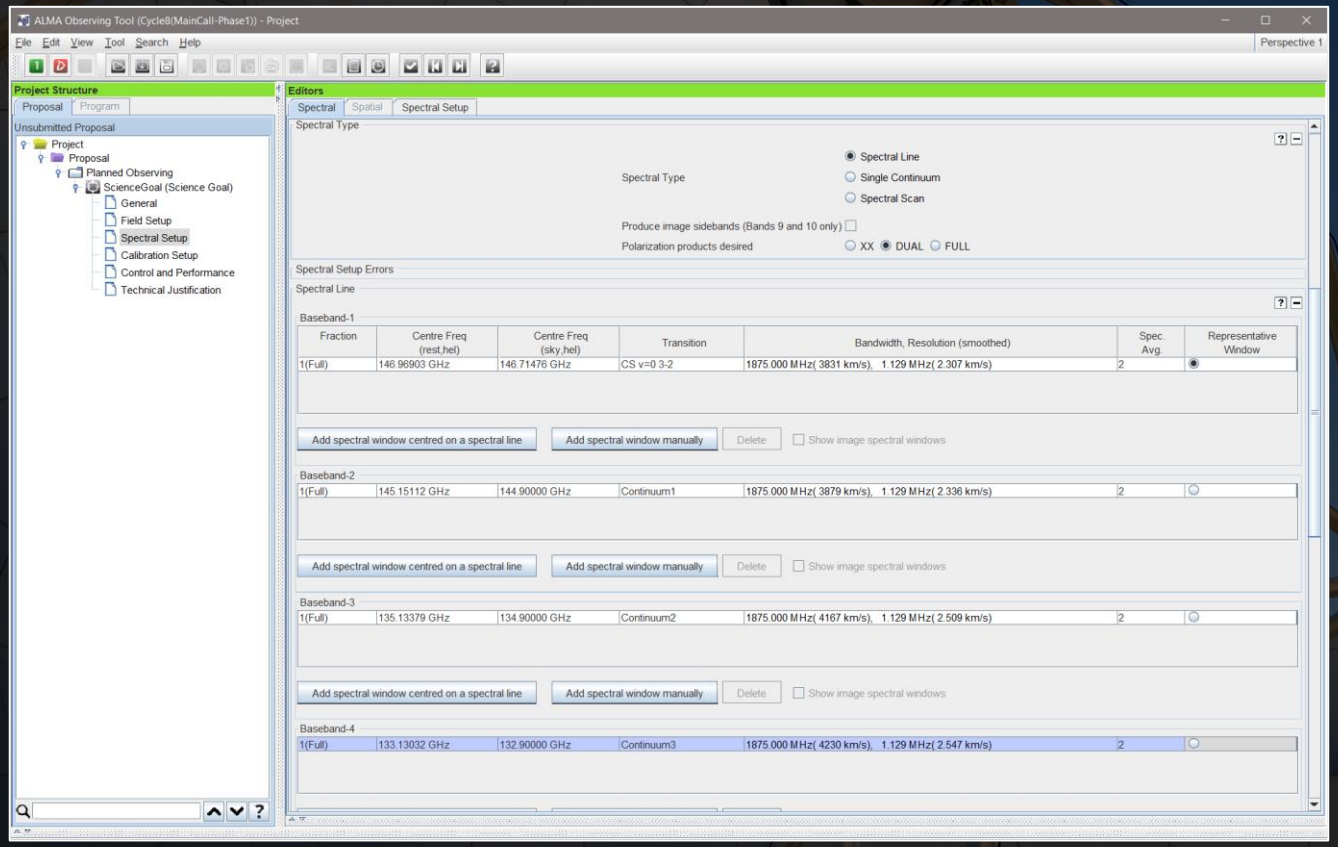

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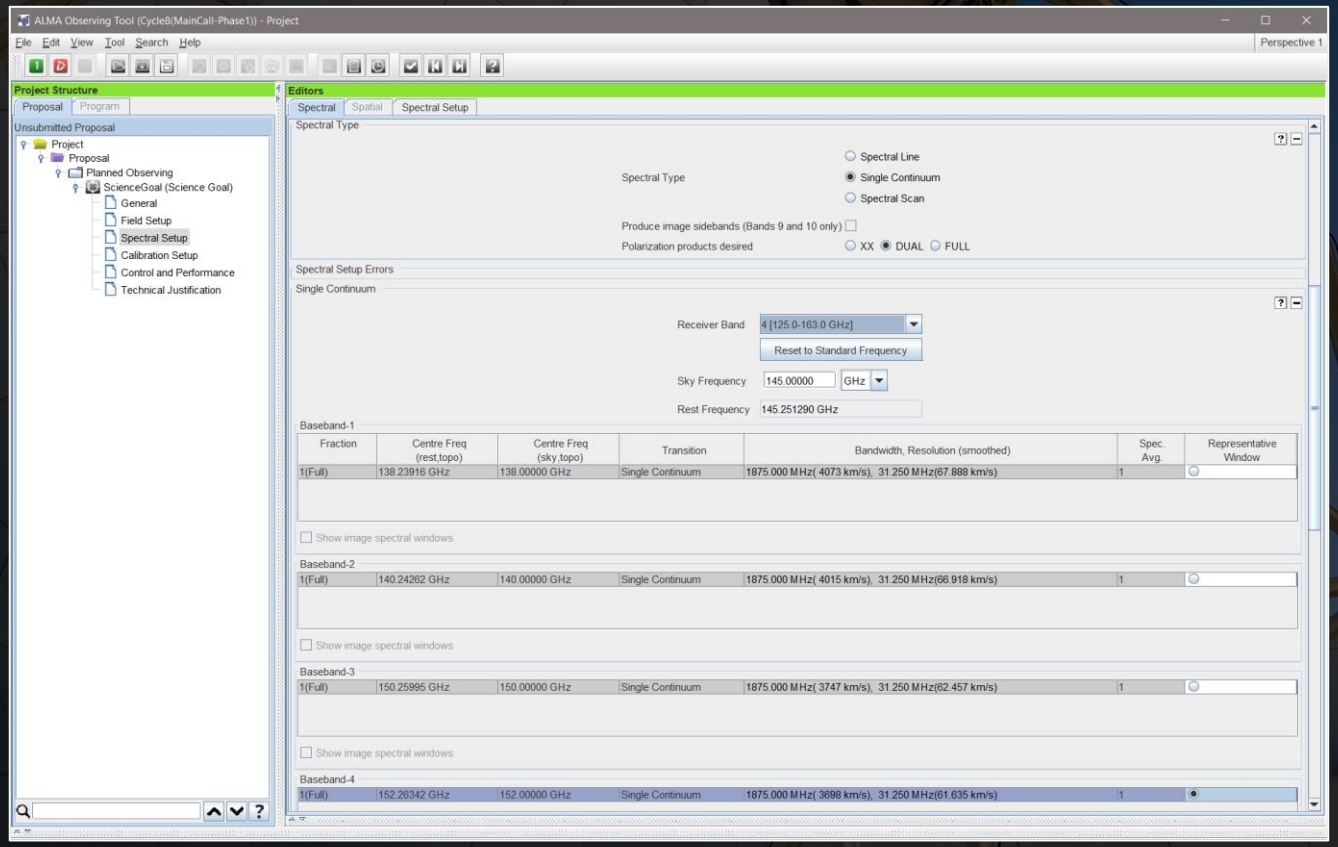
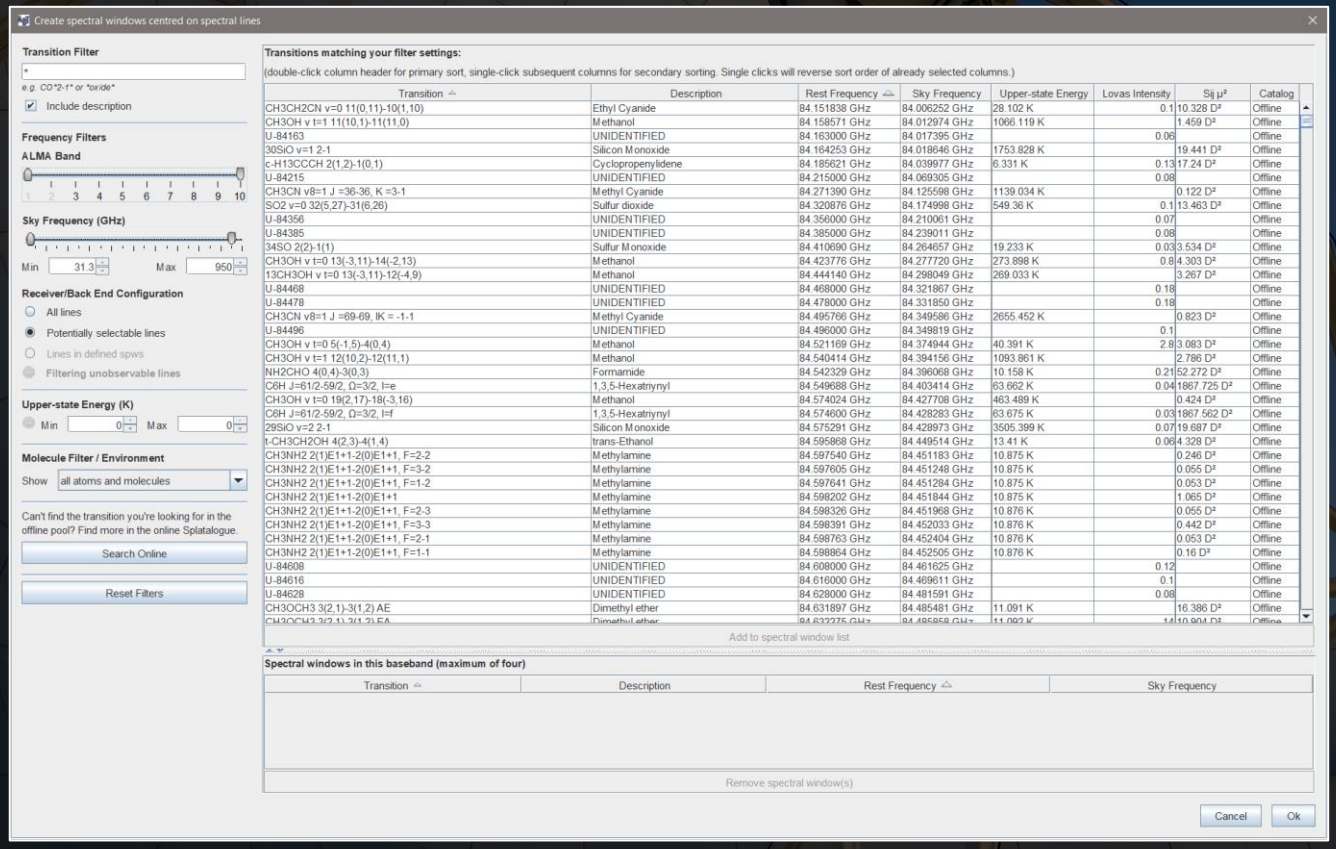
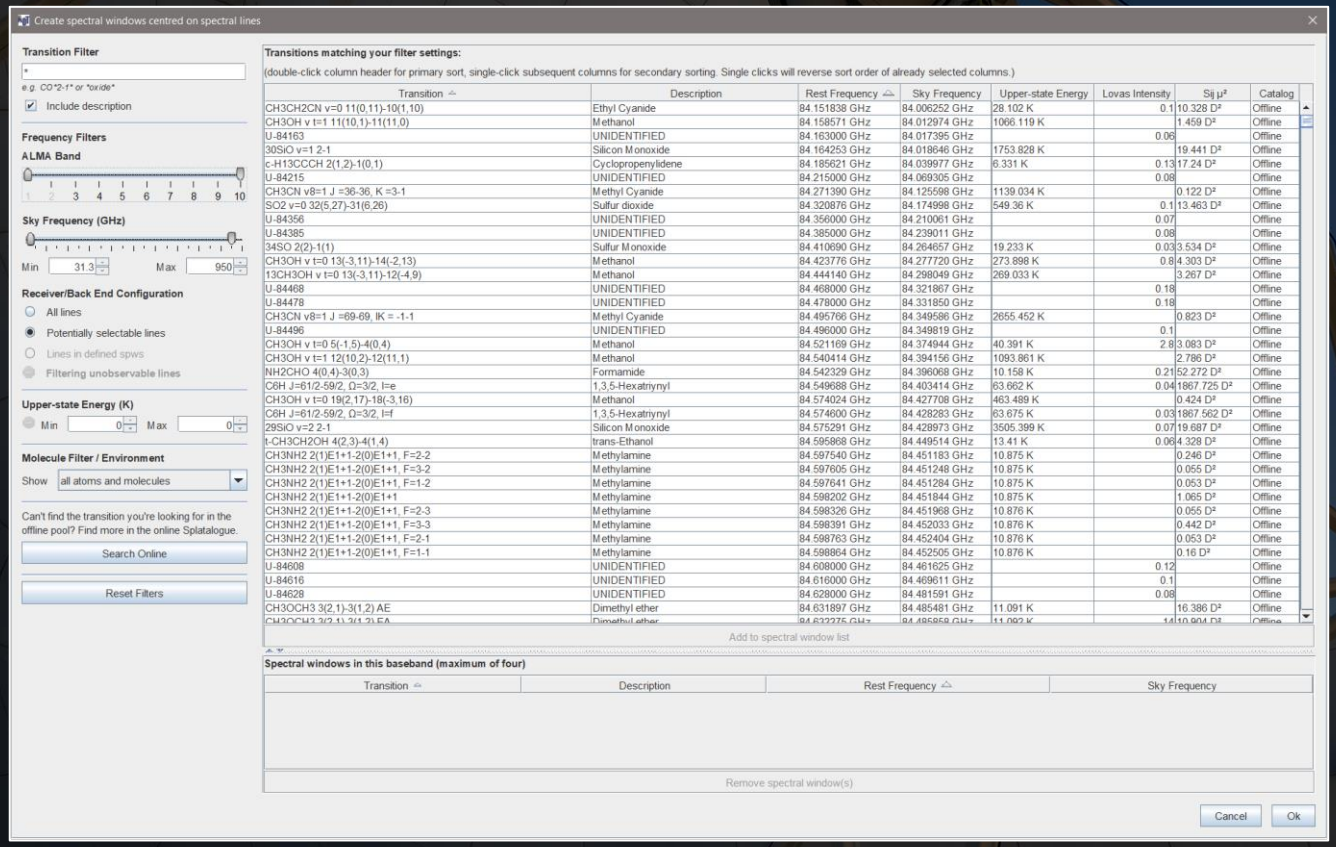


The spectral line catalogue will appear when either overlaying spectral lines in the spectrum plot or defining spectral windows to observe.



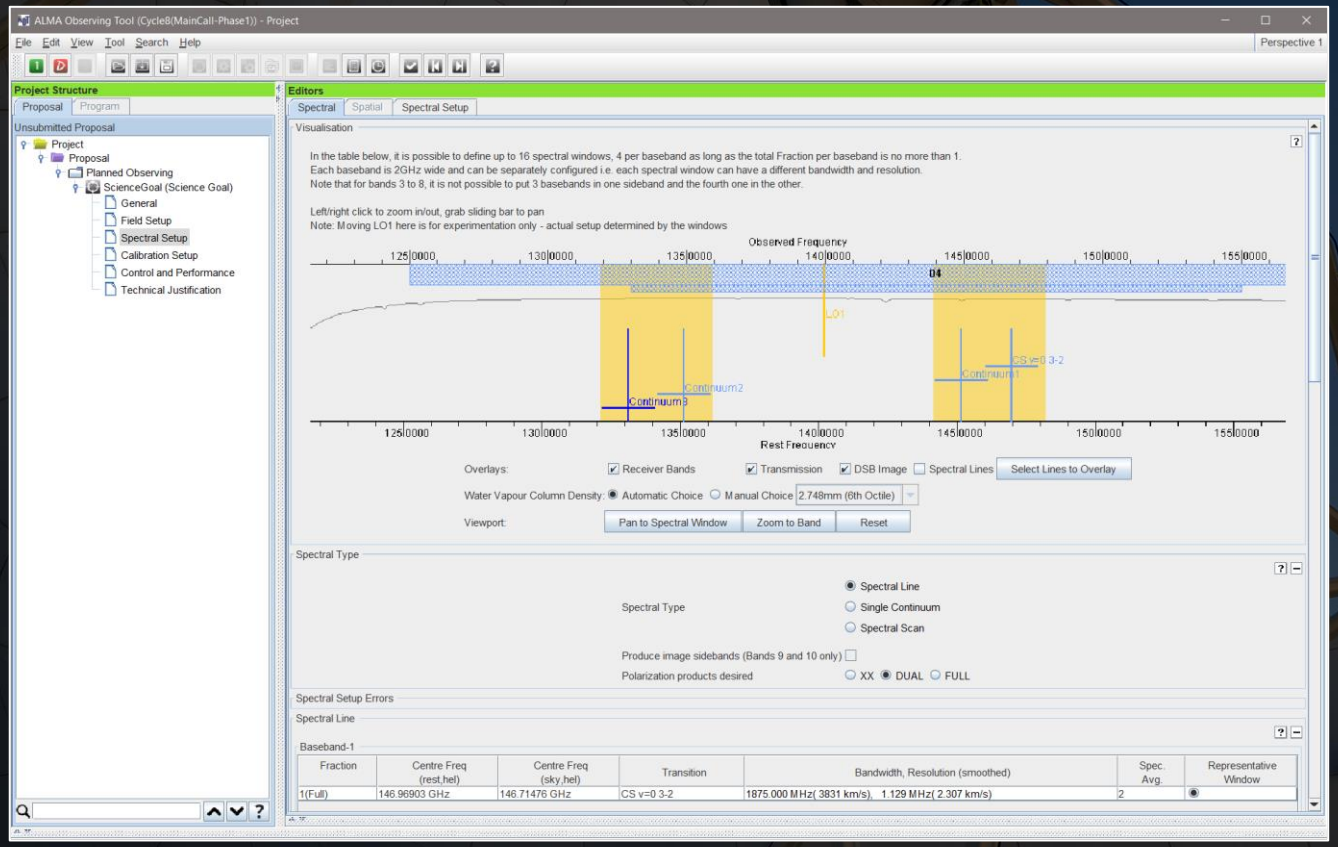
This catalogue can be searched using many criteria and is a generally useful reference.

The catalogue is also available on the web at https://splatalogue.online/ .



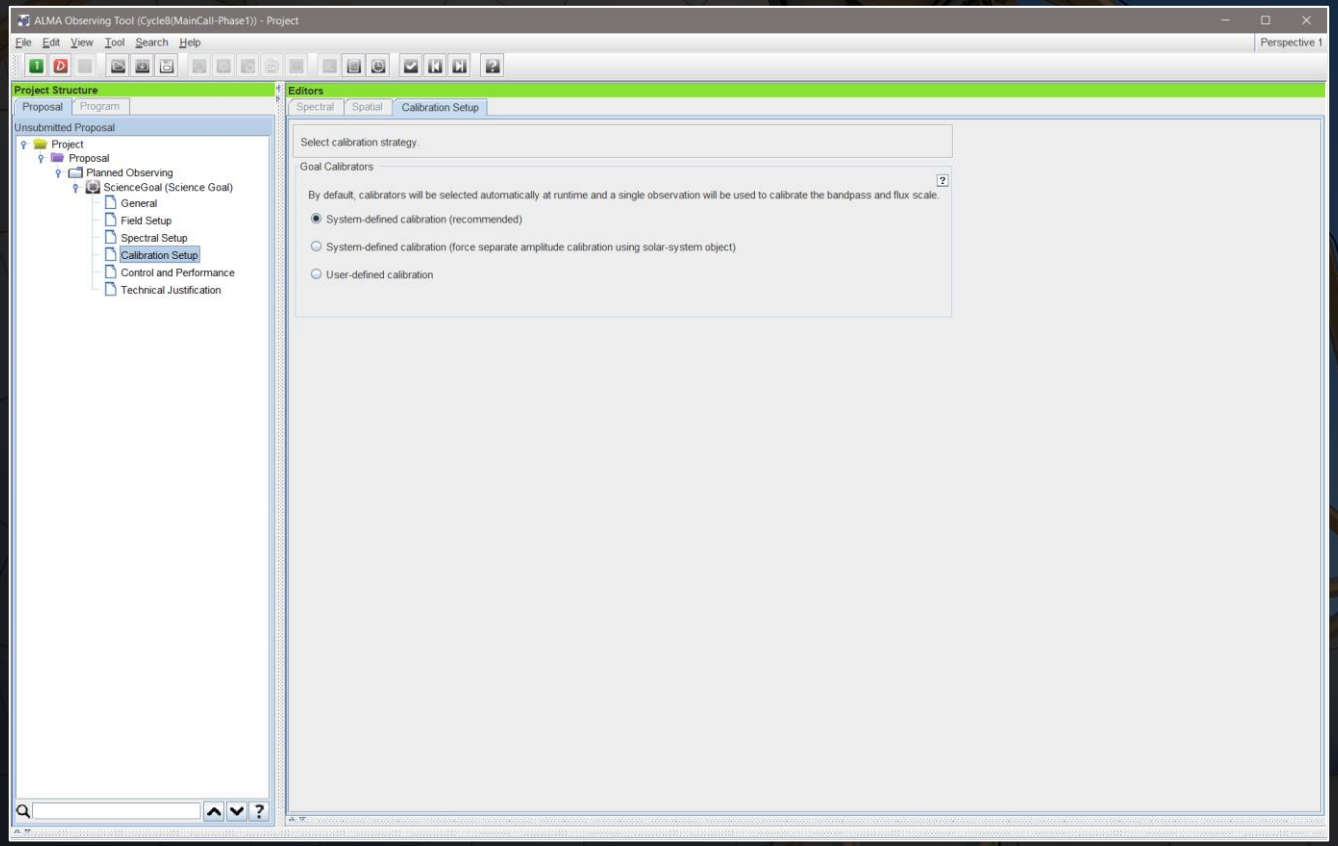
The plot at the top of the window will be updated as the spectral windows are set.

If the yellow bands do not appear, the spectral windows are not configured correctly.

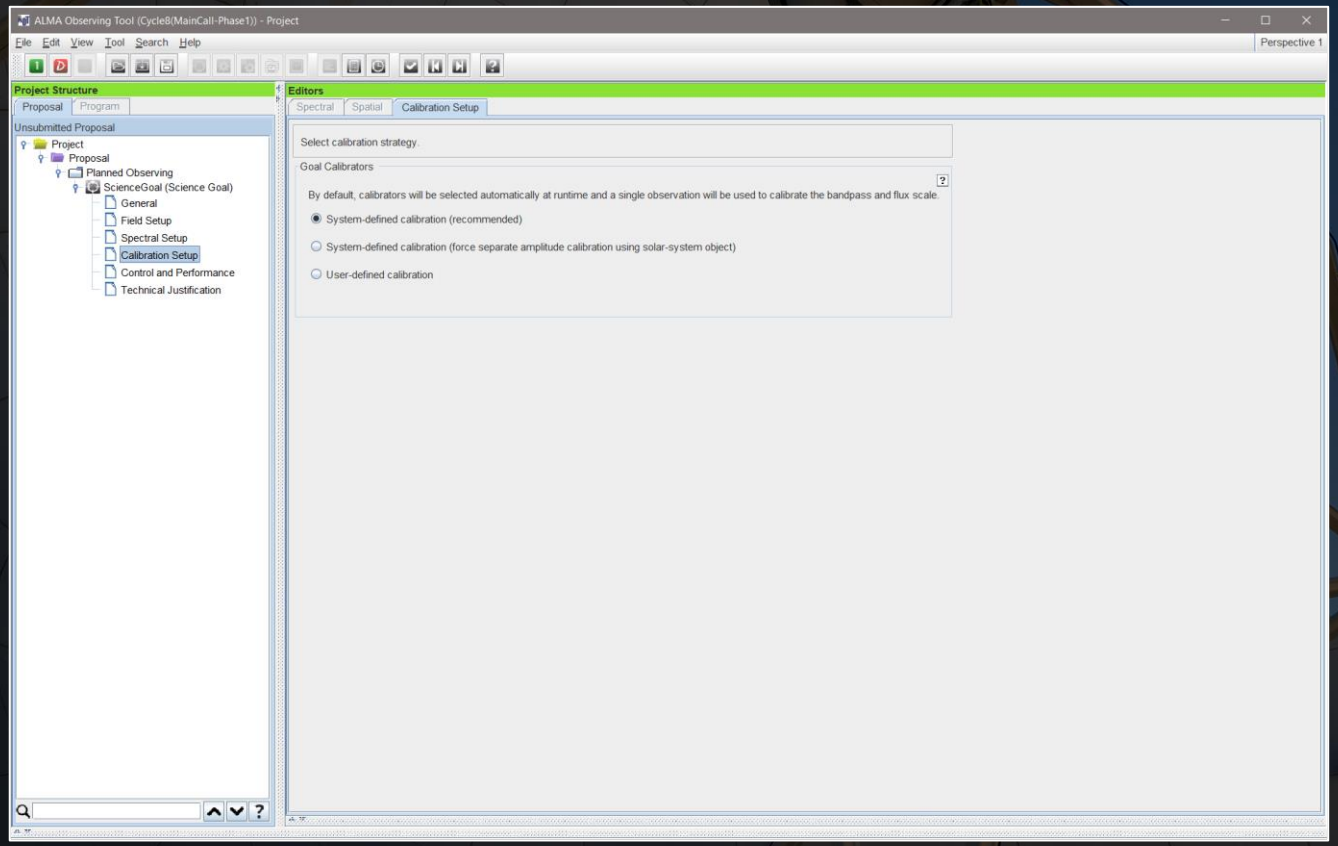


The Calibration Setup tab is used to create specific calibration settings for the observations.

For most programs, the default setting are generally all that is needed.

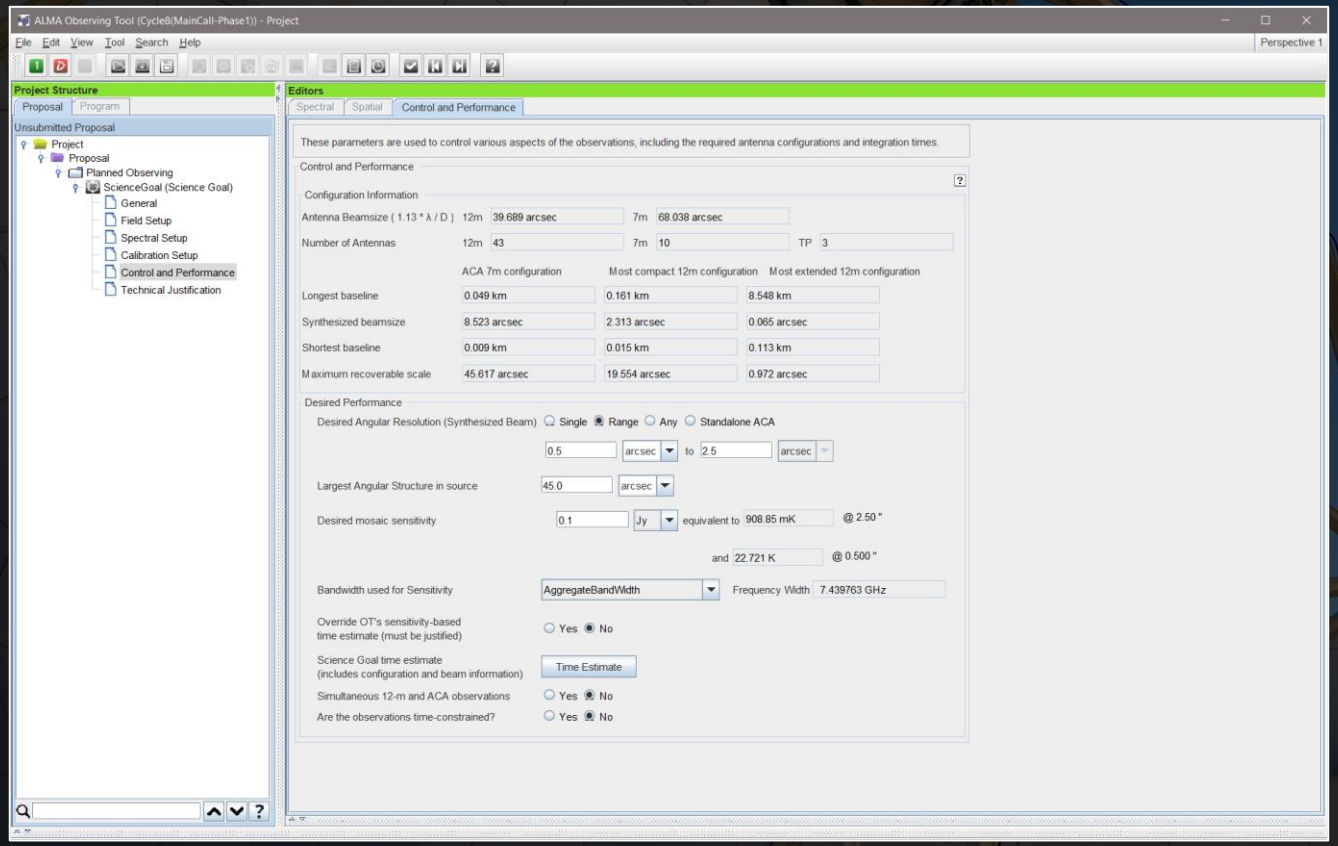


Do not select an option other than system-defined calibration without seeking expert help.

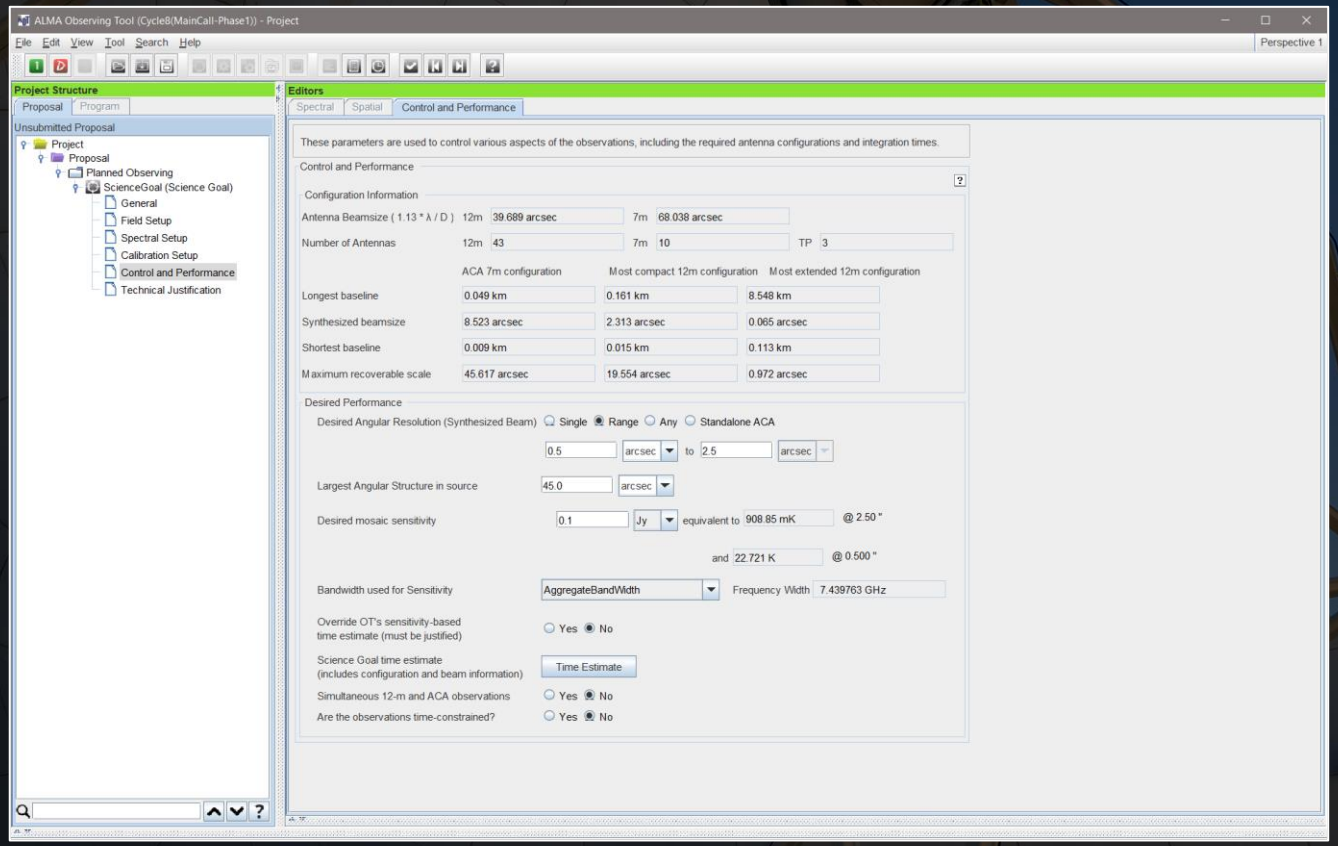


The Control and Performance tab is used to specify what sensitivity and angular resolution is required for the project.

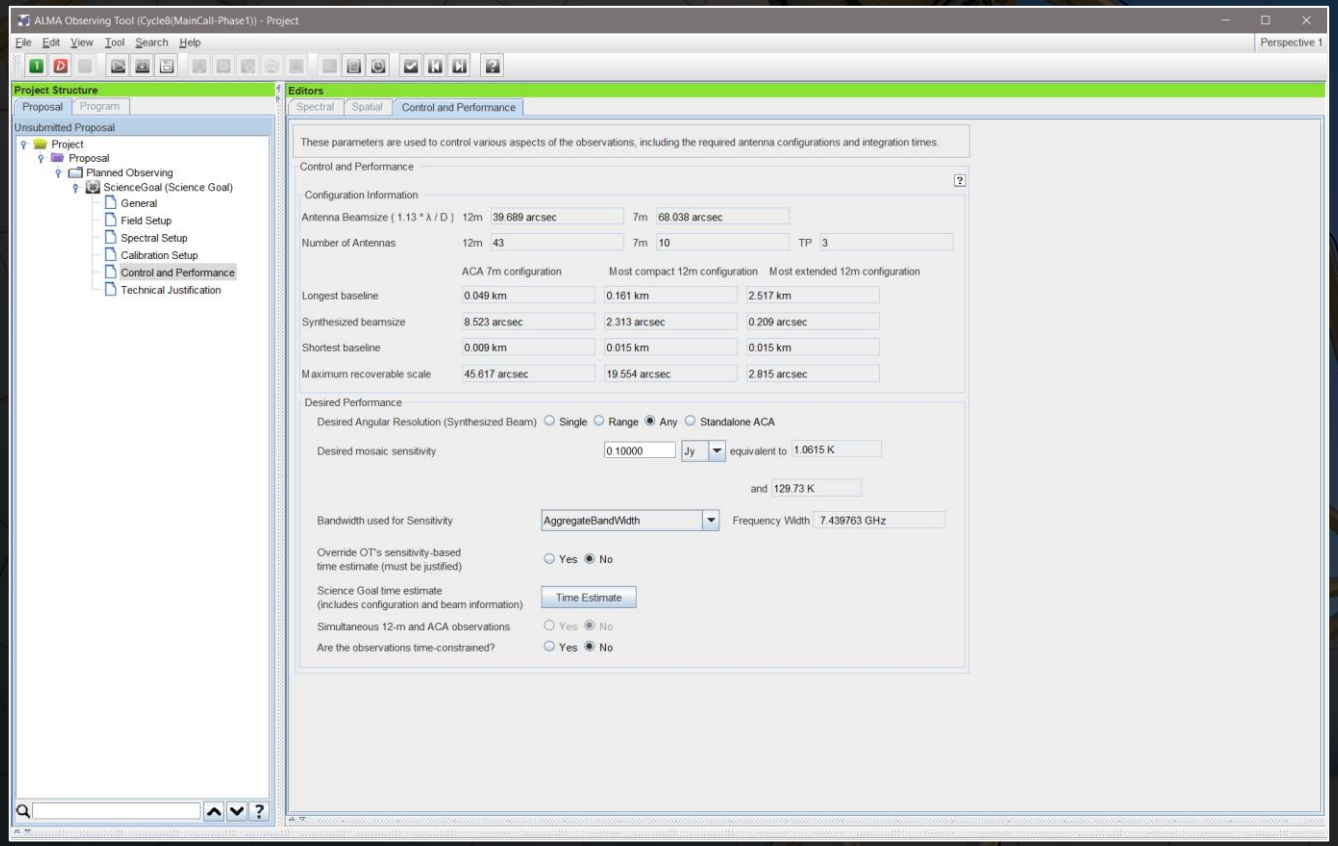
The options here cannot be set until the Field Setup and Spectral Setup are set.



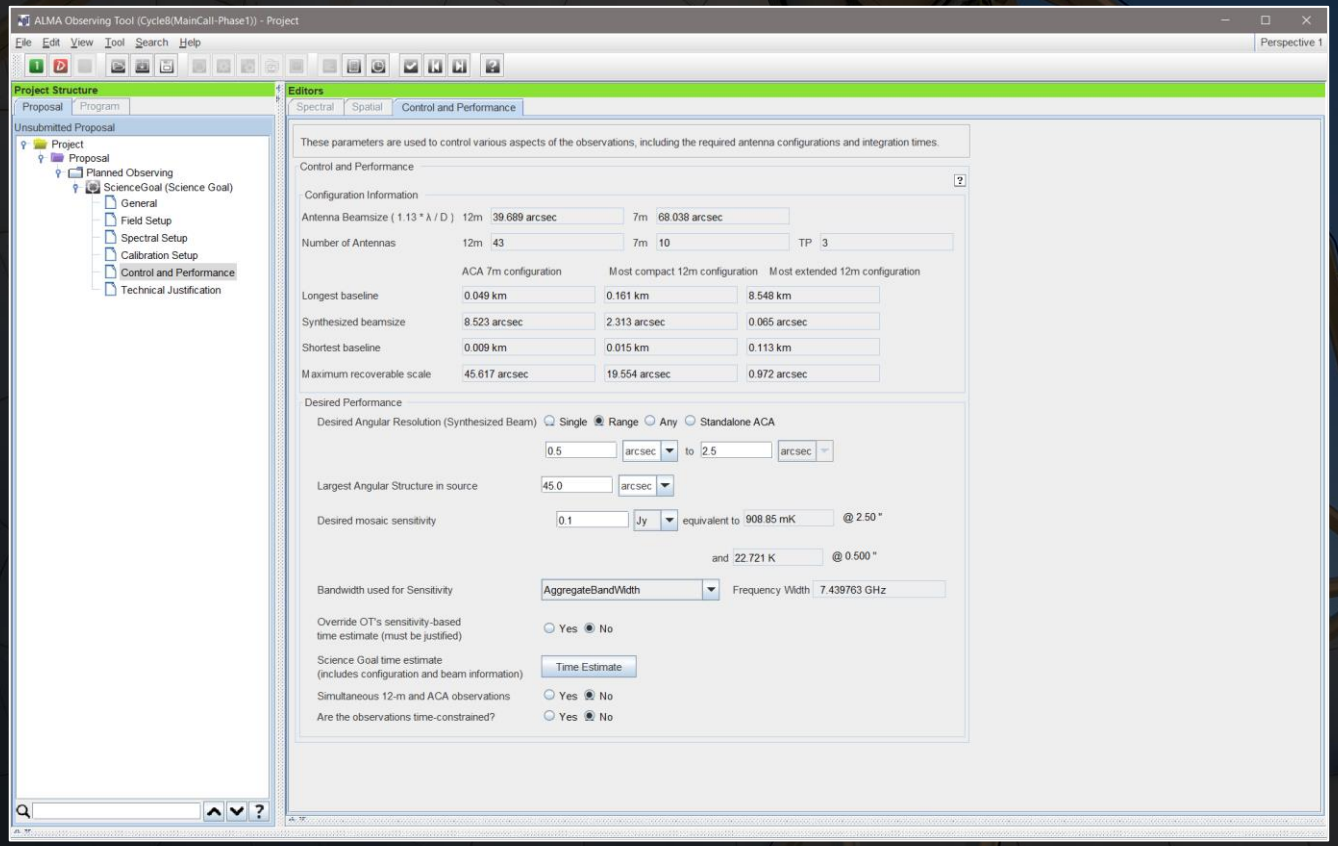
If a desired angular resolution is needed, that should be specified here. **Using the Range option is strongly recommended.**



For observations that only need detections, **using the Any option is strongly recommended.** Alternately, the standalone ACA can be used, particularly for bright sources.

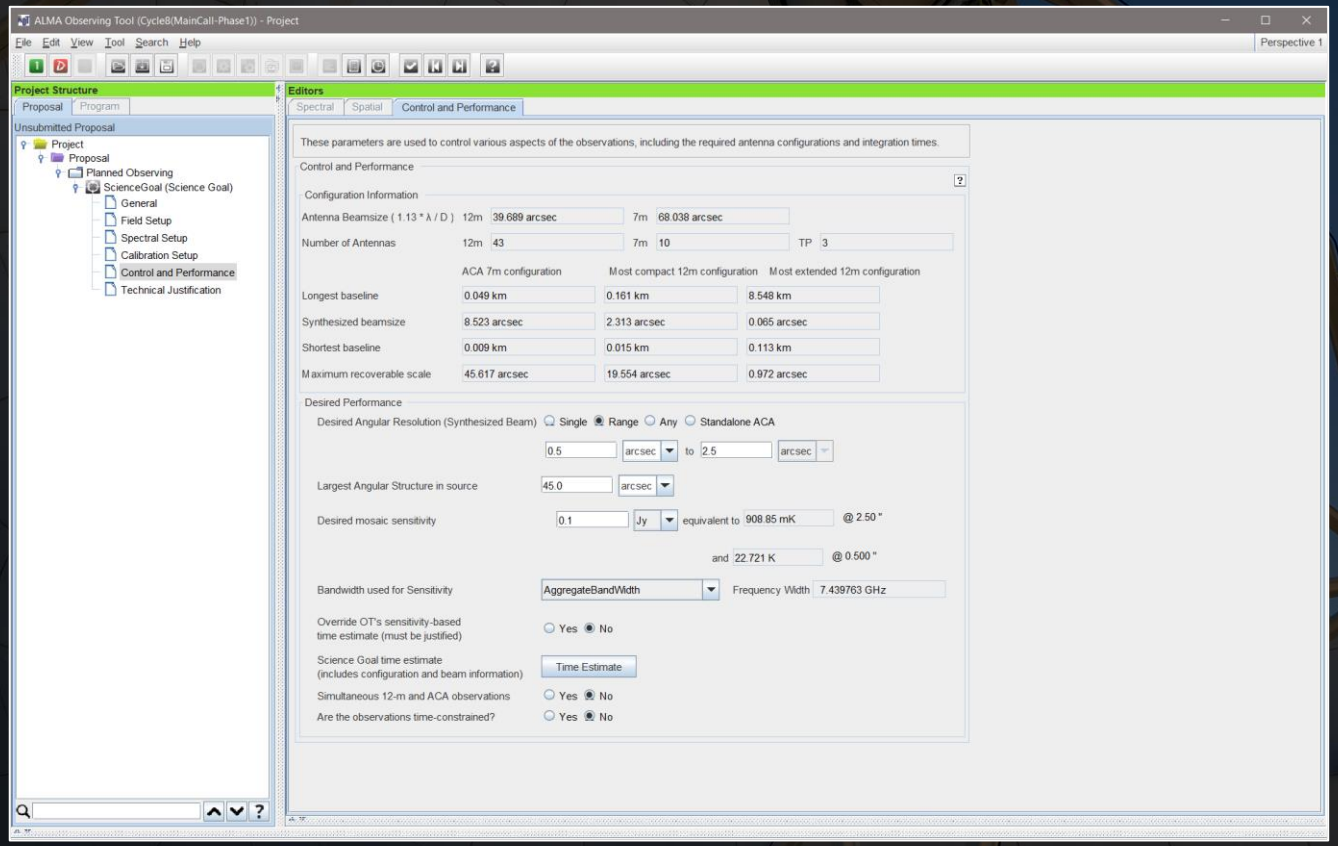


If the source is extended and if that extended emission is important for the science, then specifying the larges angular structure is important. This will determine whether the ACA or the total power arrays are needed. (Note that total power continuum observations are currently not possible.)

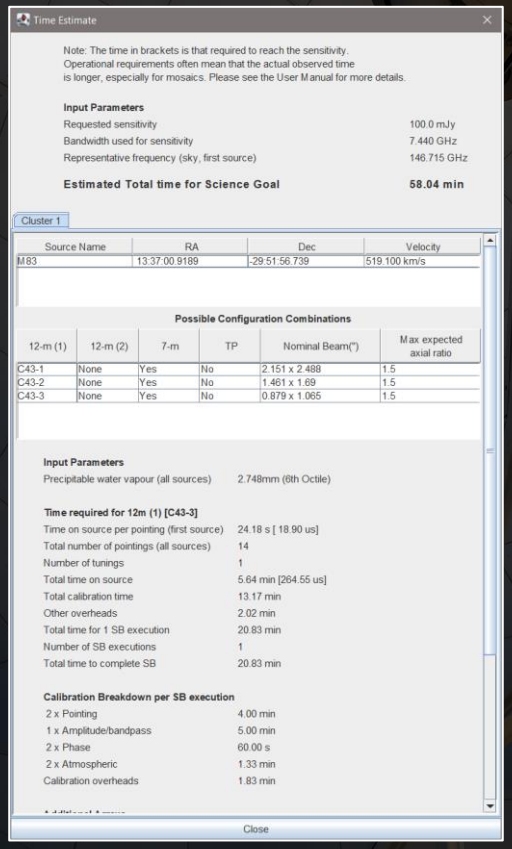


ALMA is not like other telescopes in that it does not allocate “time” to observing proposals.

ALMA will instead observe the targets until it achieves the desired sensitivity.



The tab has a button that can be used to check the time needed for an observation. While minimizing the observing time while achieving a desired sensitivity is important, keep in mind that **ALMA does not allocate "time" to observing proposals.**



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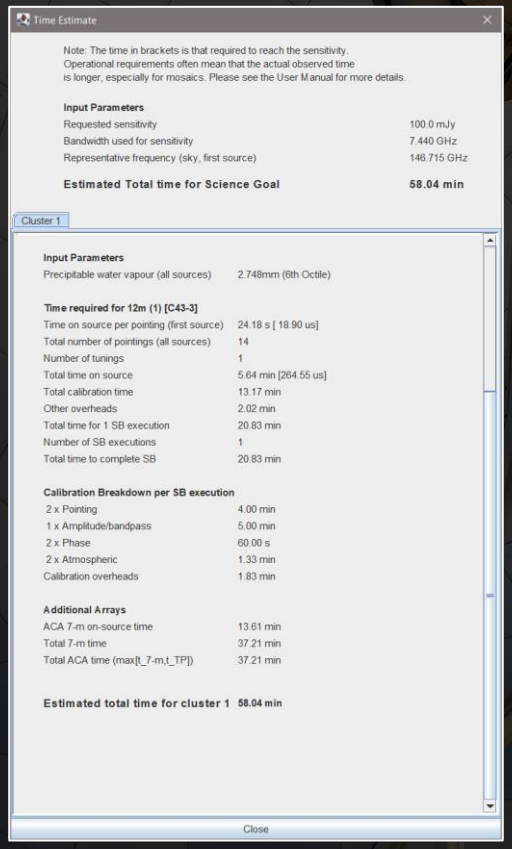
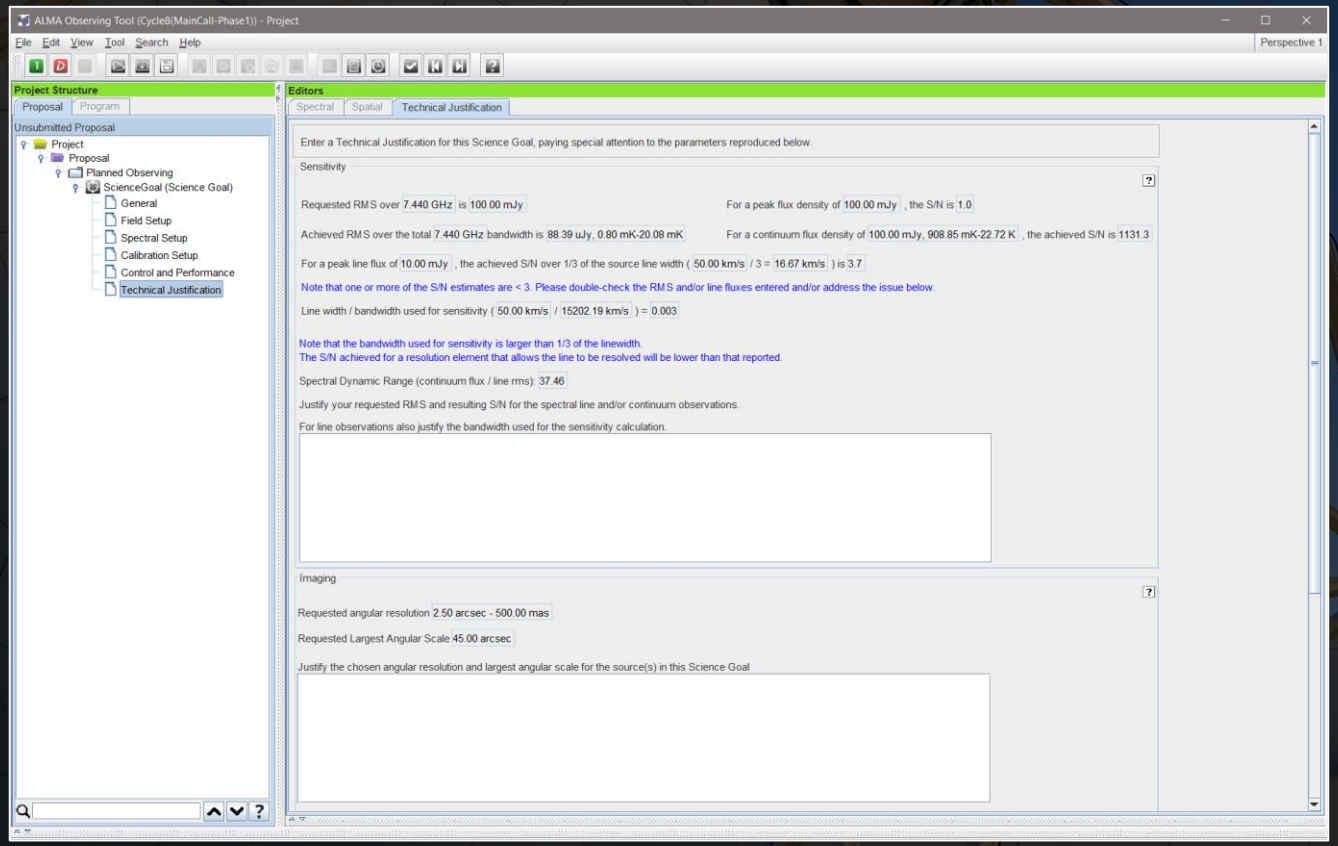


The Technical Justification tab is a place where a justification for the sensitivity goal, requested angular resolutions, and spectral window setup should be added.

This information does not need to be in the science case.



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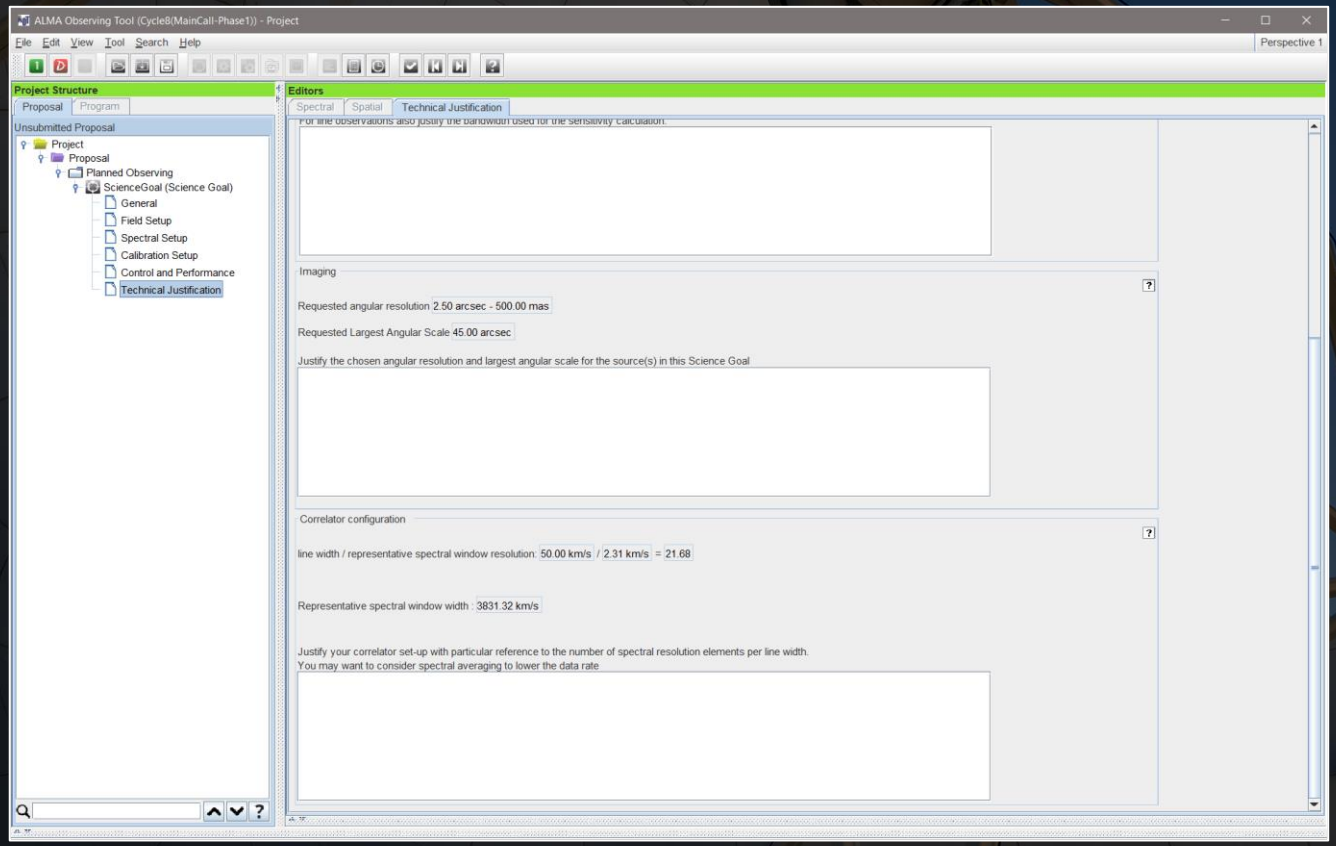
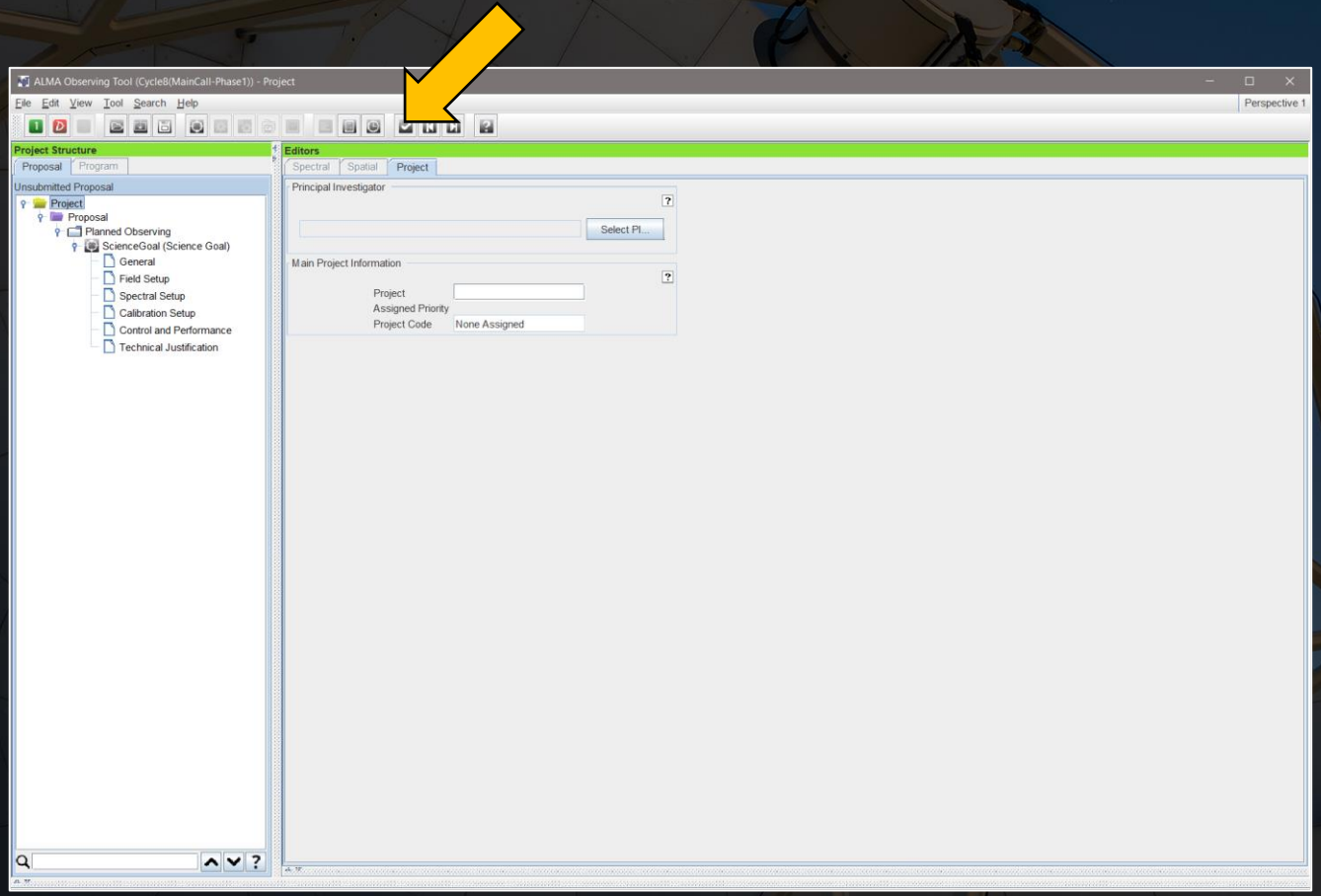


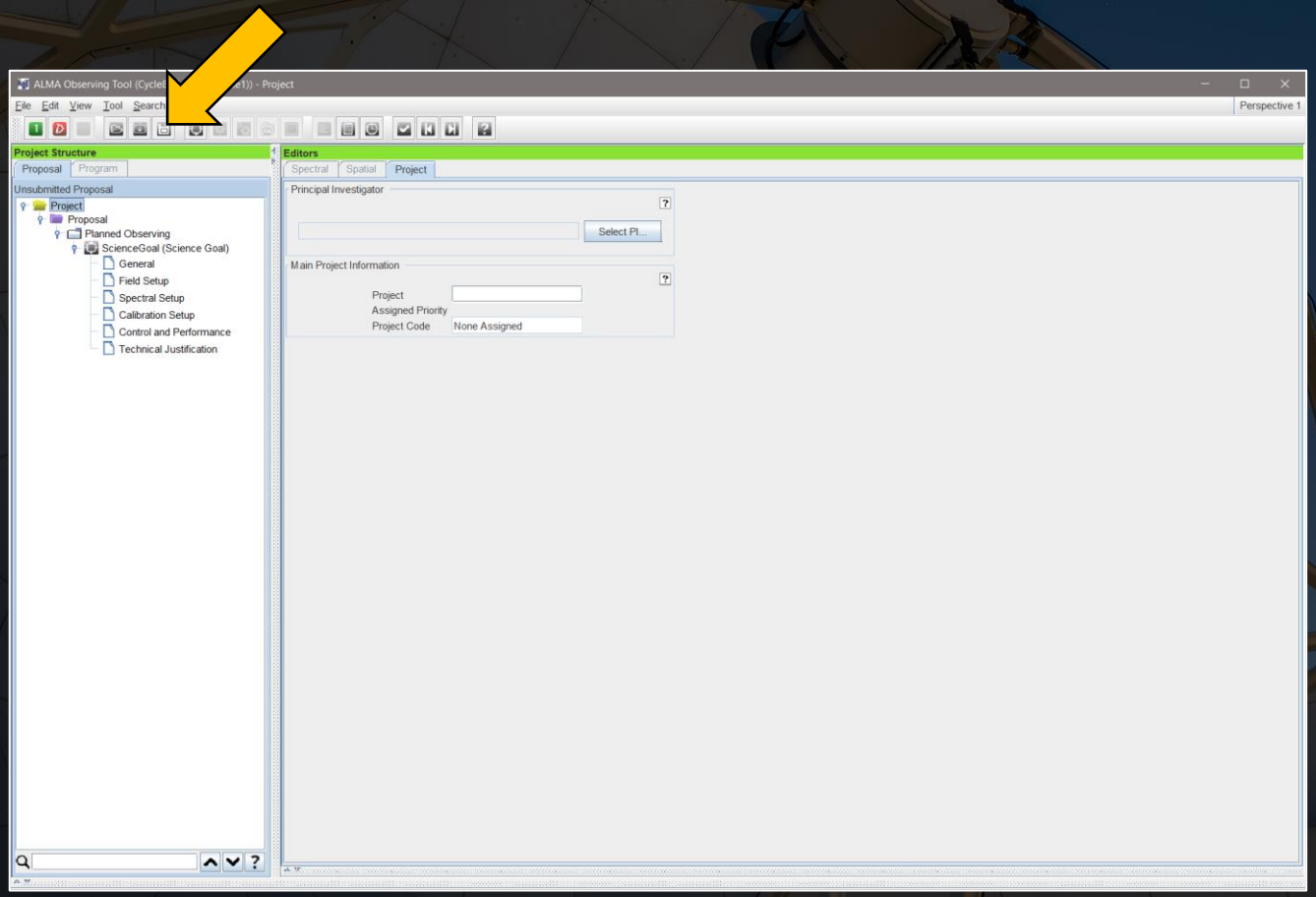
Once a proposal is created, it should be validated using the option in the File menu or the button in the button bar.

After the proposal is validated, it can be submitted using another option in the File menu.



The proposal can be saved as an aot file at any time using the save options in the File menu or button bar.

Additionally, the proposal can be exported as a PDF.

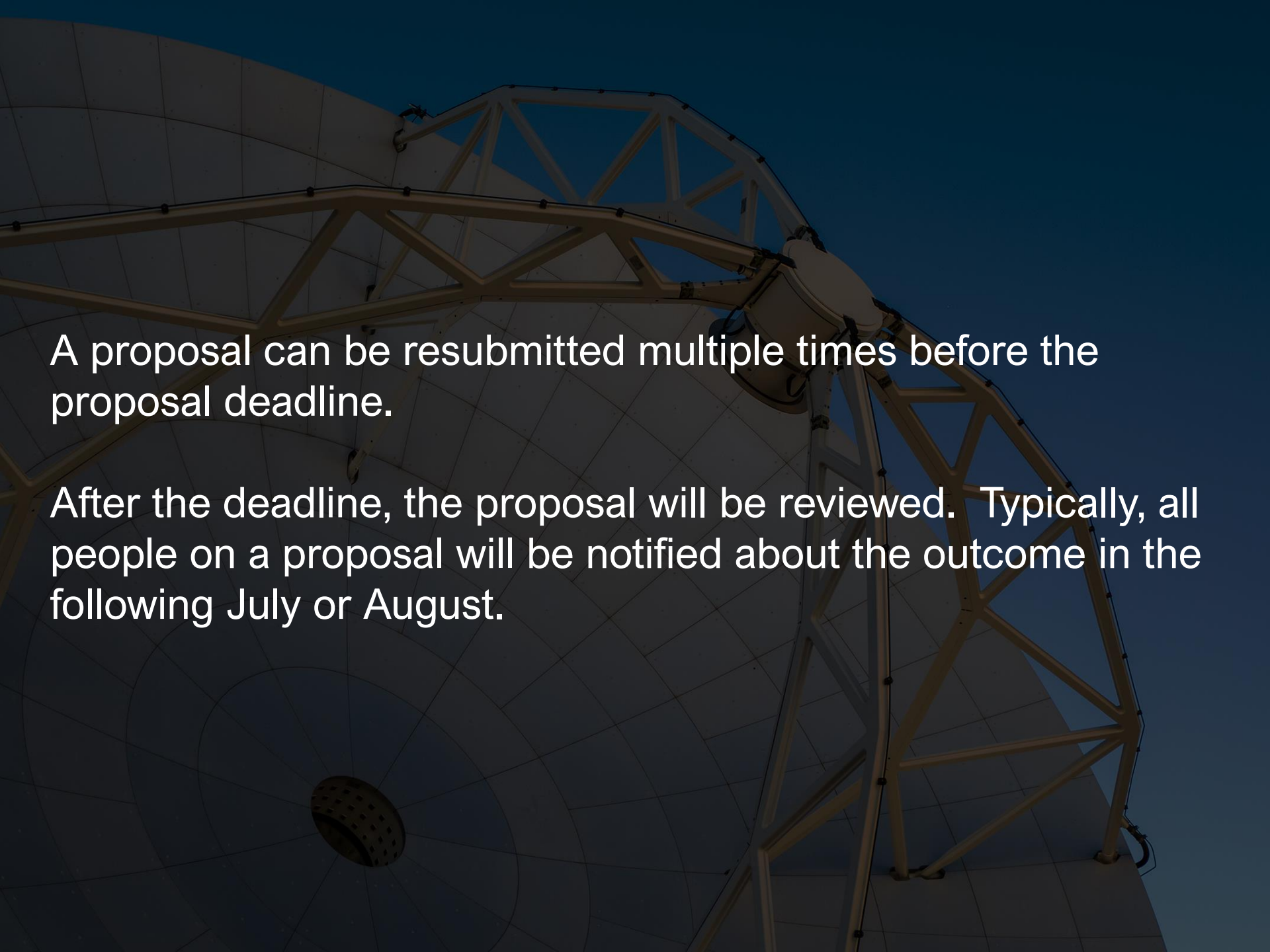


Some recommendations on setting up observations:

- Make sure all Co-Is have registered for an account with ALMA (or ESO) so that they can be listed on the proposal.
- Check the source coordinates, velocities and/or redshifts, and spectral settings before proposal submission. These can be updated later, but if more changes need to be made, more errors can be introduced.
- Use at least four spectral windows. Any spectral window not covering a line of scientific interest can be used for serendipitous continuum and spectral line detection.
- Use 1920 channels per baseband. The extra channels provide extra spectral resolution if needed, and if the higher resolution is not needed, the channels can be averaged together after observing to improve sensitivity.
- Do not use 3840 channels per spectral window. The effective spectral resolution will still be equivalent to 1920 channels.
- Do not place important spectral lines near the edges of spectral windows where the sensitivity of the detectors decreases.

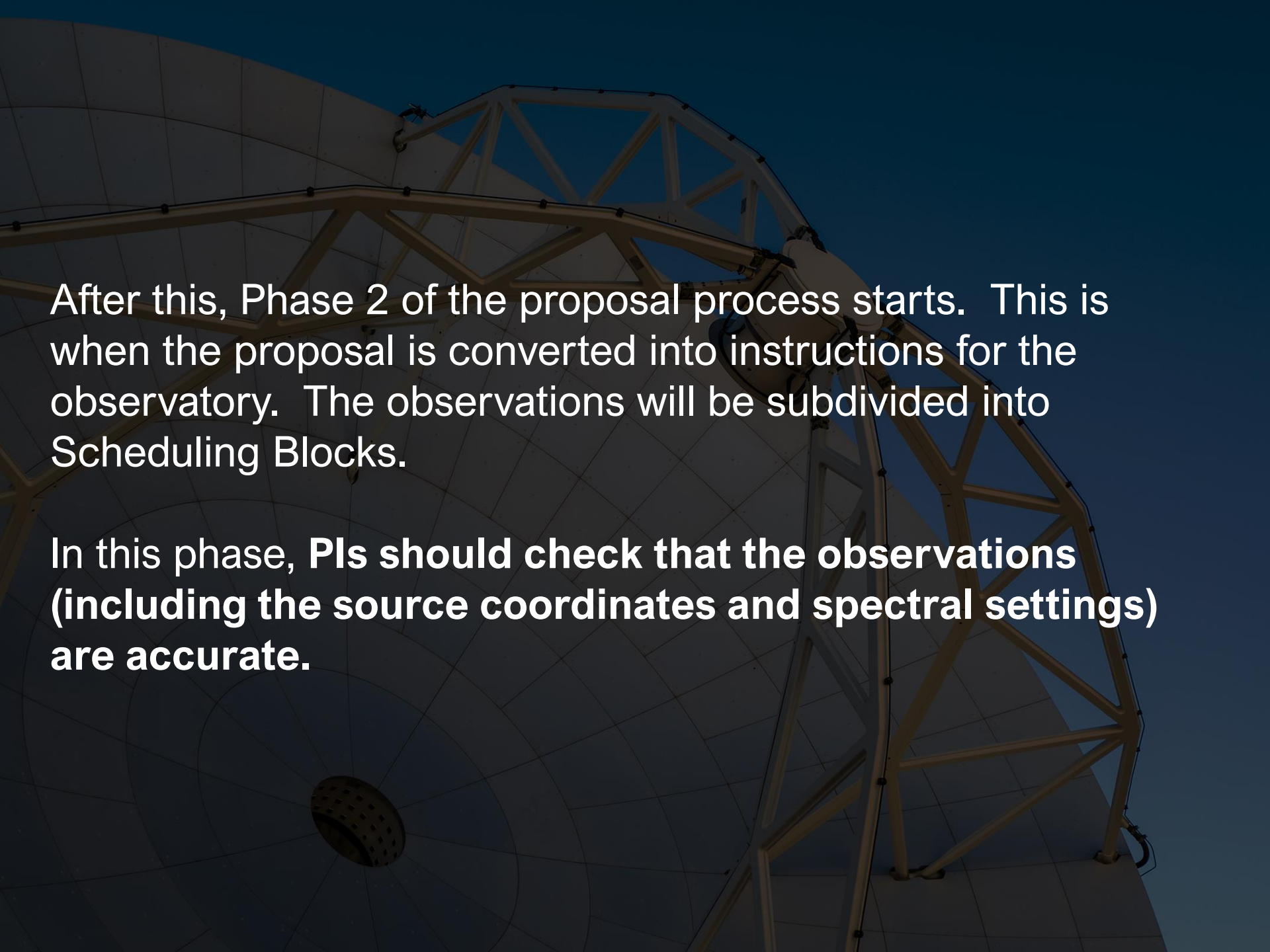
Some recommendations on setting up observations:

- Do not try to gain sensitivity by overlapping the spectral windows. The instrument doesn't work that way.
- Do not change anything under Calibration Setup unless you know what you are doing.
- Do not specify a single angular resolution unless you absolutely need to. A program that specifies a range is more likely to be observed.
- Use "Any" for the desired angular resolution if you only need to detect the source.
- Do not forget to account for extended source emission in terms of uv coverage.
- Do not forget to account for extent of the source emission when estimating the peak surface brightness.



A proposal can be resubmitted multiple times before the proposal deadline.

After the deadline, the proposal will be reviewed. Typically, all people on a proposal will be notified about the outcome in the following July or August.



After this, Phase 2 of the proposal process starts. This is when the proposal is converted into instructions for the observatory. The observations will be subdivided into Scheduling Blocks.

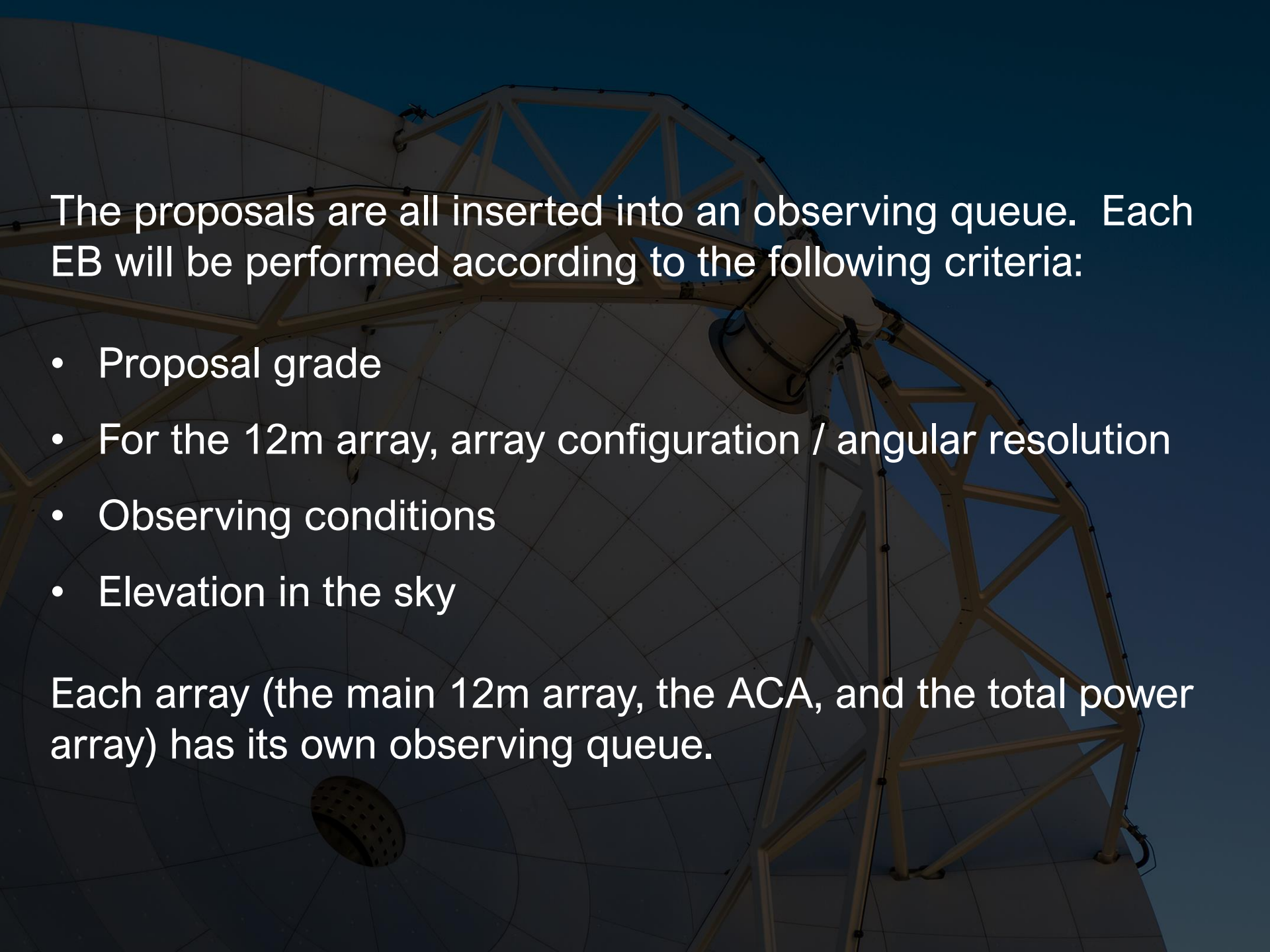
In this phase, **PIs should check that the observations (including the source coordinates and spectral settings) are accurate.**

For reference, a Scheduling Block (SB) is a set of observations grouped together according to the following criteria:

- Specific array / array configuration
- Specific spectral tuning
- Specific set of fields / targets
- Specific sensitivity and angular resolution goals

One Science Goal from a proposal may be subdivided into multiple SBs.

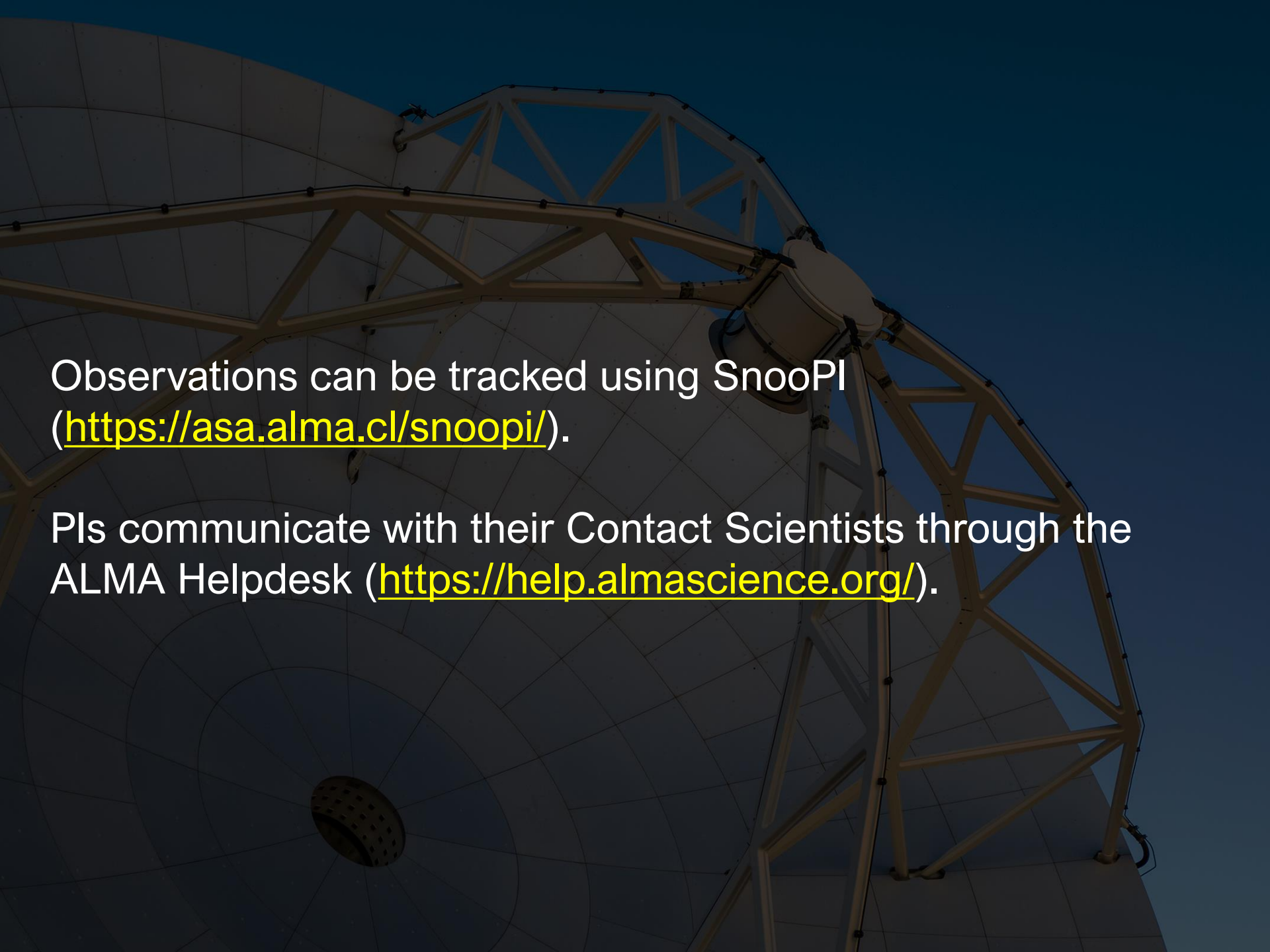
Each SB may need to be executed multiple times. Each of these executions are called Execution Blocks (EBs).



The proposals are all inserted into an observing queue. Each EB will be performed according to the following criteria:

- Proposal grade
- For the 12m array, array configuration / angular resolution
- Observing conditions
- Elevation in the sky

Each array (the main 12m array, the ACA, and the total power array) has its own observing queue.



Observations can be tracked using SnooPI (https://asa.alma.cl/snoopi/).

PIs communicate with their Contact Scientists through the ALMA Helpdesk (https://help.almascience.org/).