

The ALMA Observing Tool

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Introduction/Concepts

Phases of Proposal Submission

- Requesting ALMA time has two phases
 - Phase I: Proposal submission
 - Phase II: Submission of observing program
- Observing Tool (OT) is used for both
 - Fill in usual PI/co-I, etc. information
 - Attach scientific/technical justification (single PDF)
 - Define Science Goals
 - Submit!
 - If awarded time, generate Scheduling Blocks from Science Goals and submit

What is a Science Goal?



- Scientific requirements of the observations
- A user must enter:
 - Science targets (including mapping area, velocities)
 - Spectral line and/or continuum frequencies
 - Angular resolution, largest angular scale
 - Required sensitivity (**NOT TIME!**)
- Output (Scheduling Block) contains
 - Everything needed to run the observation!

What is a Science Goal?

- Scientific requirements of the observations
- A user must enter:

**No detailed knowledge of radio
astronomy or interferometry
should be necessary!**

- Output
 - Array configurations
 - Time on source
 - Calibration sources and strategy

What is a Scheduling Block?

- A self-contained definition of an observation
 - Generated from the Science Goal automatically
 - Each will last 30-40 minutes i.e. repeated if necessary
- It contains:
 - Source information (science targets + calibrators)
 - Spectral setup
 - Observing parameters
 - Time on source, cycle times, calibration tolerances
 - The name of an observing script
 - E.g. StandardInterferometry.py – this does the work!
- A user will not normally interact with an SB!

What is a Scheduling Block?

- A self-contained definition of an observation
 - Generated from the Science Goal automatically
 - Each will last 30-40 minutes i.e. repeated if necessary
- **Expert users can edit SBs and create arbitrarily complicated setups**
 - Source information (science targets + calibrators)
 - Spectral setup
 - Observing parameters
 - Time on source, cycle times, calibration tolerances
 - The name of an observing script
 - This actually runs the observation!
- A user will not normally interact with an SB!

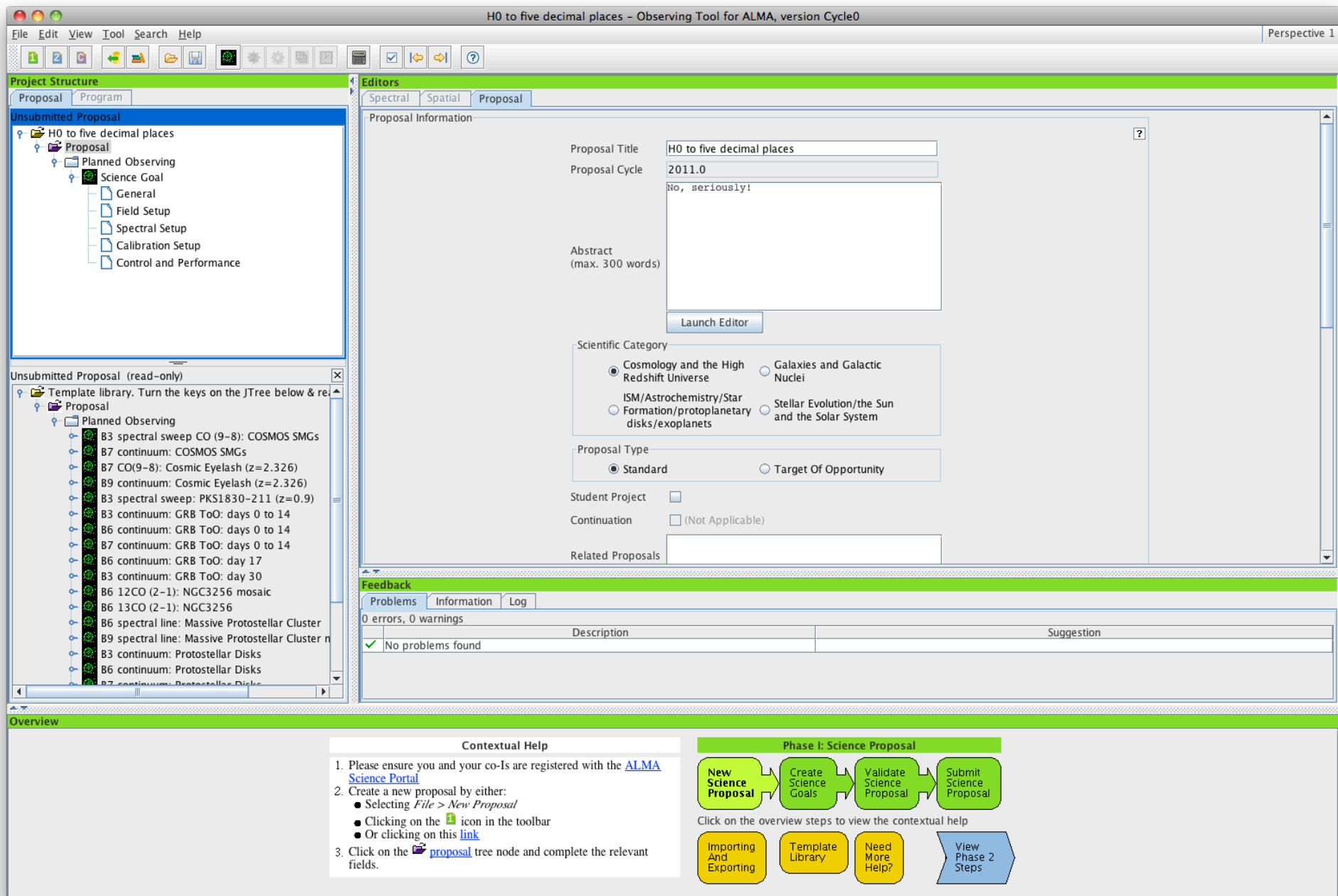
What you don't ask for...

- Time on source
 - OT will report an estimated time based on likely weather
 - Observations will proceed until sensitivity is reached
 - Additional time can be requested
 - (u,v) coverage at Cycle 0 is relatively poor
 - Must justify in proposal
- Calibration sources
 - The observatory will provide all necessary calibration
 - Choose “system-defined” calibration (the default)
 - Own calibrators can be requested
 - Must justify in proposal!

Implementation

- The OT is a Java application
 - Java 6 must be installed on your computer!
 - Now ship with built-in Java (for Linux only at the moment)
- Download and run locally
 - Web Start (recommended) and tarball versions
- Internet connection required intermittently
 - PI/co-I information from user database
 - Source catalogues and image servers
 - Spectral line catalogues
 - Submission!

A guide to the OT's layout



Overview panel:
Guides a user through the various steps required at both Phase I and II

The screenshot displays the 'H0 to five decimal places - Observing Tool for ALMA, version Cycle0' interface. The top menu bar includes File, Edit, View, Tool, Search, and Help. The Project Structure panel on the left shows a tree view of the proposal structure, including Unsubmitted Proposal, H0 to five decimal places, and Planned Observing. The Proposal Information panel on the right shows fields for Proposal Title, Proposal Cycle, Abstract, Scientific Category, Proposal Type, Student Project, Continuation, and Related Proposals. The Overview panel at the bottom provides Contextual Help and a Phase I: Science Proposal flowchart.

Contextual Help

- Please ensure you and your co-Is are registered with the [ALMA Science Portal](#)
- Create a new proposal by either:
 - Selecting *File > New Proposal*
 - Clicking on the icon in the toolbar
 - Or clicking on this [link](#)
- Click on the *proposal* tree node and complete the relevant fields.

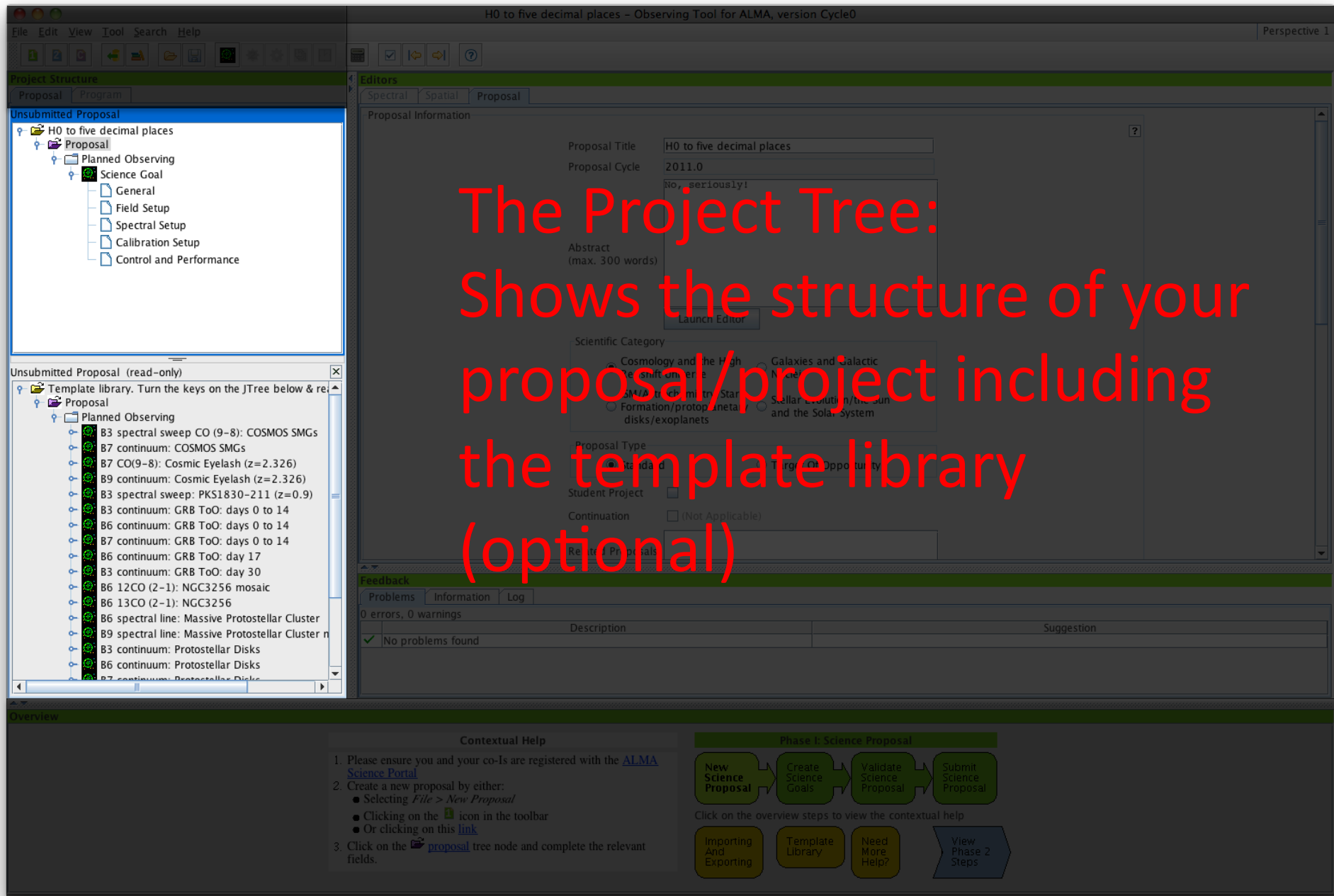
Phase I: Science Proposal

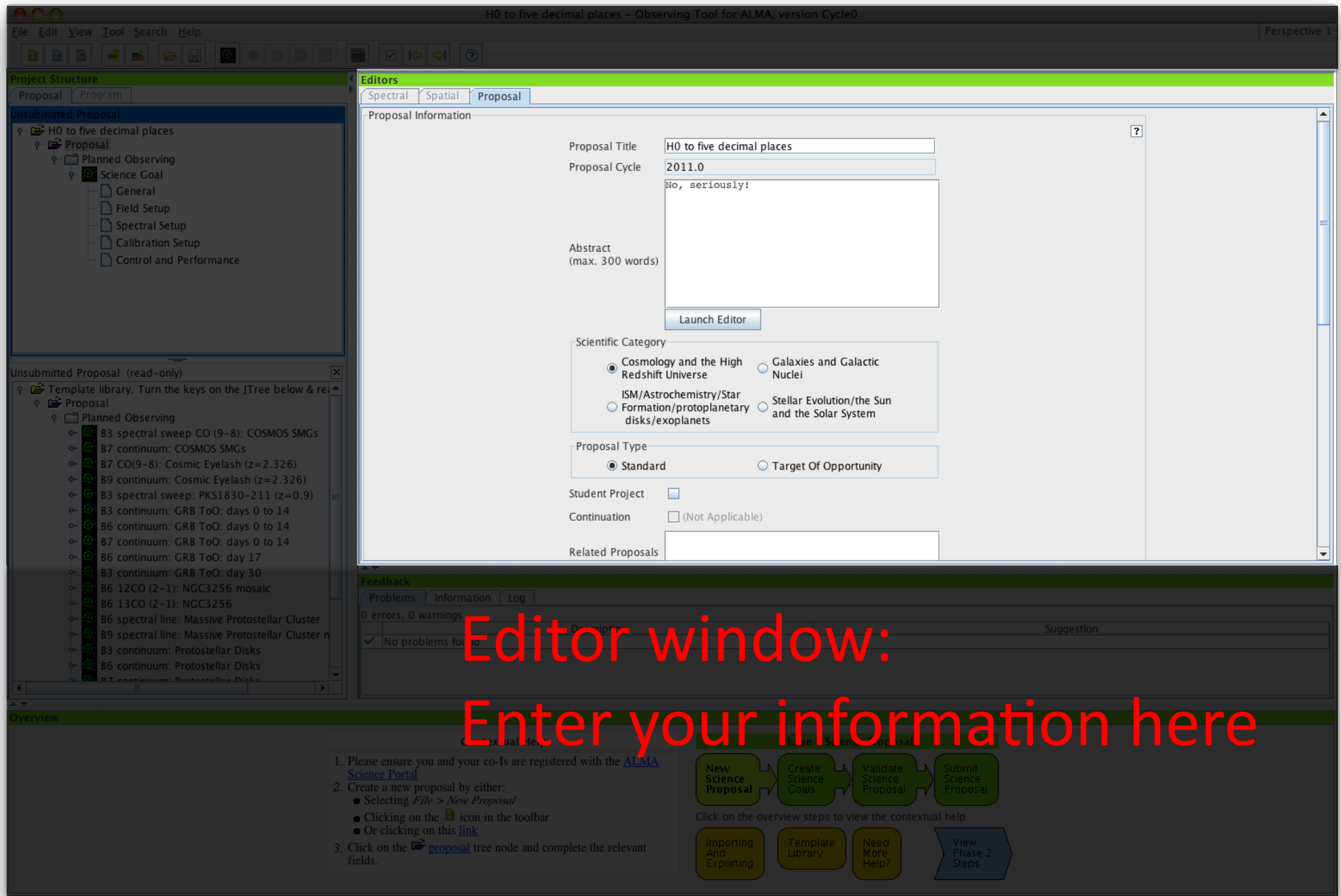
```

graph LR
    A[New Science Proposal] --> B[Create Science Goals]
    B --> C[Validate Science Proposal]
    C --> D[Submit Science Proposal]
  
```

Click on the overview steps to view the contextual help

Importing And Exporting | Template Library | Need More Help? | View Phase 2 Steps





H0 to five decimal places – Observing Tool for ALMA, version Cycle0

File Edit View Tool Search Help

Perspective 1

Project Structure

Proposal Program

Unsubmitted Proposal

- H0 to five decimal places
 - Proposal
 - Planned Observing
 - Science Goal
 - General
 - Field Setup
 - Spectral Setup
 - Calibration Setup
 - Control and Performance

Unsubmitted Proposal (read-only)

Template library. Turn the keys on the JTree below & re

- Proposal
 - Planned Observing
 - B3 spectral sweep CO (9–8): COSMOS SMGs
 - B7 continuum: COSMOS SMGs
 - B7 CO(9–8): Cosmic Eyelash (z=2.326)
 - B9 continuum: Cosmic Eyelash (z=2.326)
 - B3 spectral sweep: PKS1830–211 (z=0.9)
 - B3 continuum: GRB ToO: days 0 to 14
 - B6 continuum: GRB ToO: days 0 to 14
 - B7 continuum: GRB ToO: days 0 to 14
 - B6 continuum: GRB ToO: day 17
 - B3 continuum: GRB ToO: day 30
 - B6 12CO (2–1): NGC3256 mosaic
 - B6 13CO (2–1): NGC3256
 - B6 spectral line: Massive Protostellar Cluster
 - B9 spectral line: Massive Protostellar Cluster
 - B3 continuum: Protostellar Disks
 - B6 continuum: Protostellar Disks
 - B7 continuum: Protostellar Disks

Editors

Spectral Spatial Proposal

Proposal Information

Proposal Title: H0 to five decimal places

Proposal Cycle: 2011.0

Abstract (max. 300 words): No, seriously!

Launch Editor

Scientific Category

- ☒ Cosmology and the High Redshift Universe
- ☐ Galaxies and Galactic Nuclei
- ☐ ISM/Astrophysical Star Formation/protoplanetary disks/exoplanets
- ☐ Stellar Evolution/the Sun and the Solar System

Proposal Type

☒ Standard ☐ Target Of Opportunity

Student Project ☐

Continuation ☐ (Not Applicable)

Related Proposals

Feedback



Problems Information Log

0 errors, 0 warnings

	Description	Suggestion
✓	No problems found	

Overview

Contextual Help

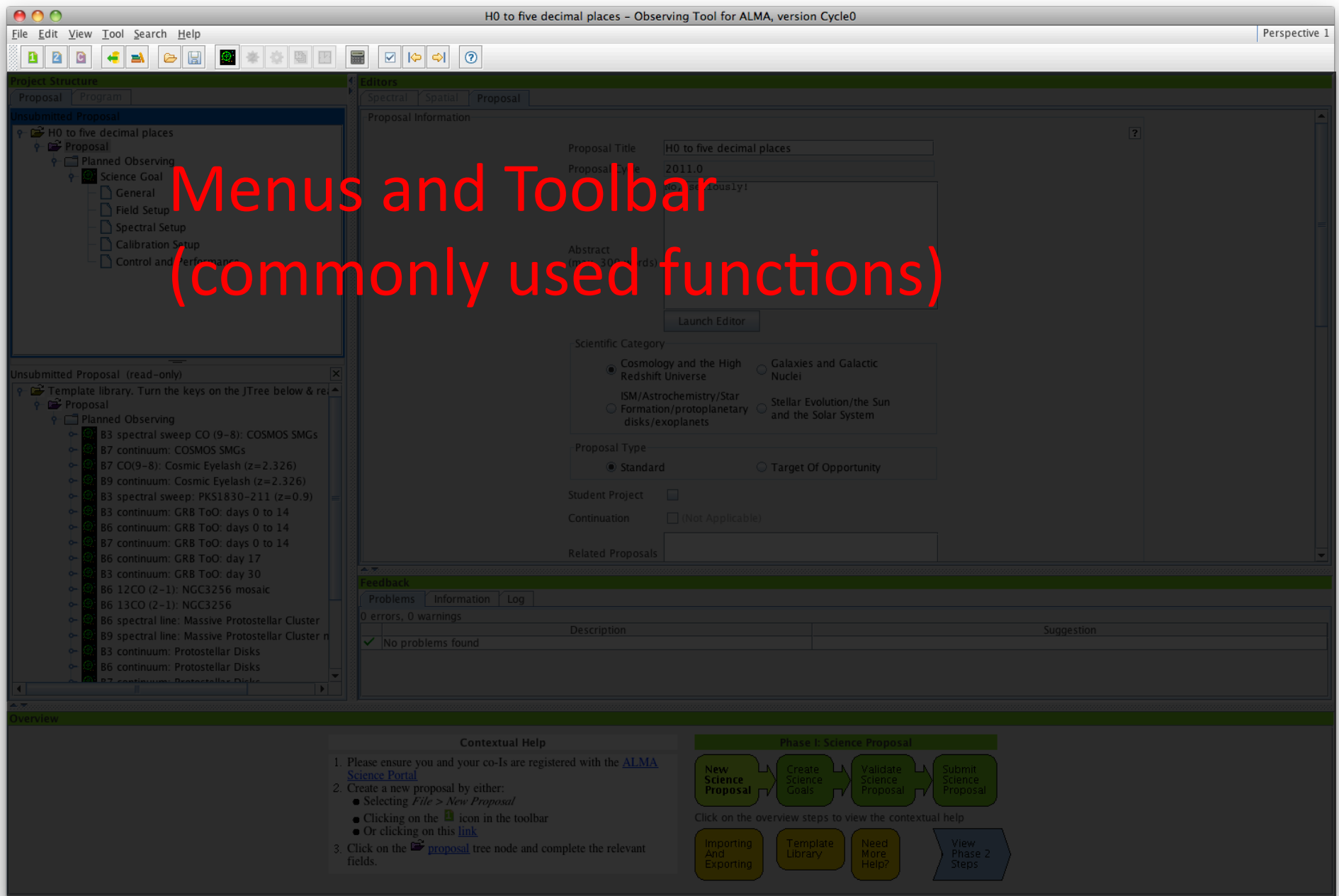
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 - Selecting *File > New Proposal*
 - Clicking on the  icon in the toolbar
 - Or clicking on this [link](#)
- Click on the  proposal tree node and complete the relevant fields.

Phase I: Science Proposal

New Science Proposal → Create Science Goals → Validate Science Proposal → Submit Science Proposal

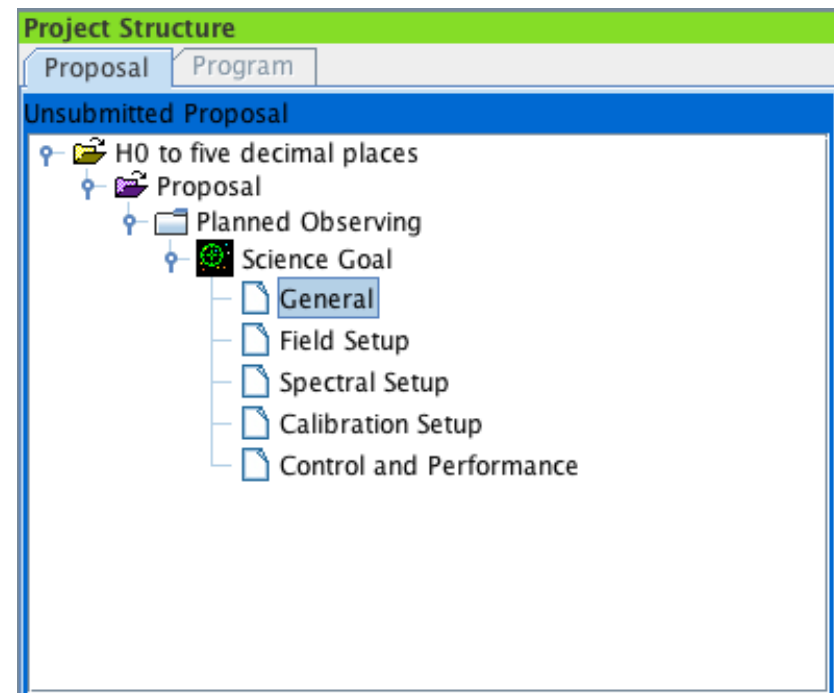
Click on the overview steps to view the contextual help

Importing And Exporting Template Library Need More Help? View Phase 2 Steps

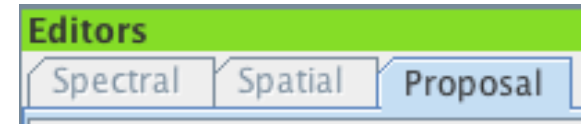


Project navigation

- Navigate through project using the Project Tree
- Content of Editor panel will change depending on which “node” you are in
- Two tabs
 - Proposal (Phase I)
 - Program (Phase II)
 - Not visible during Phase I



Editor tabs

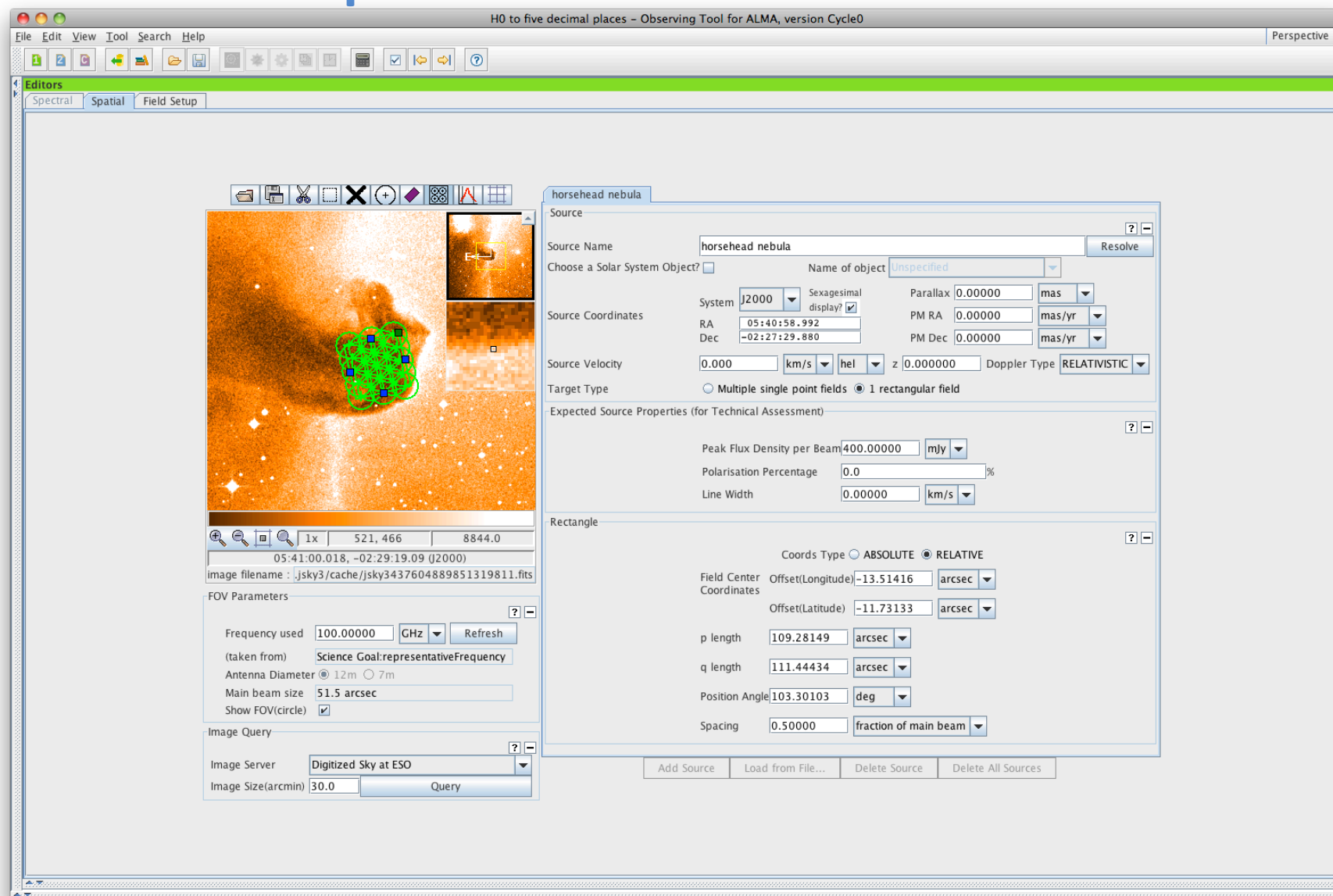


- Three kinds of editor are available
 - Forms
 - Basic textual input – always available
 - Name reflects which node in the Project Tree is currently selected
 - Spectral
 - Visualiser tool – only available with Spectral Setup
 - Spatial
 - Visualiser tool – only available with Spatial Setup
- Spatial/spectral editors also include the Forms editor
 - Can make these views the default in Preferences

Spatial Visual Editor

- Downloads and displays an image of the sky
 - Image servers include DSS, 2MASS, NVSS, FIRST...
 - Local image files (FITS) can also be displayed
 - Galactic coordinates not yet supported
- Rectangular mapping regions can be defined
 - Mosaic patterns are calculated and displayed
 - Maximum 50 pointings for Cycle 0
- Other required information (also via Forms editor)
 - Coordinate and velocity information
 - Source properties (peak flux density, polarization, line width)

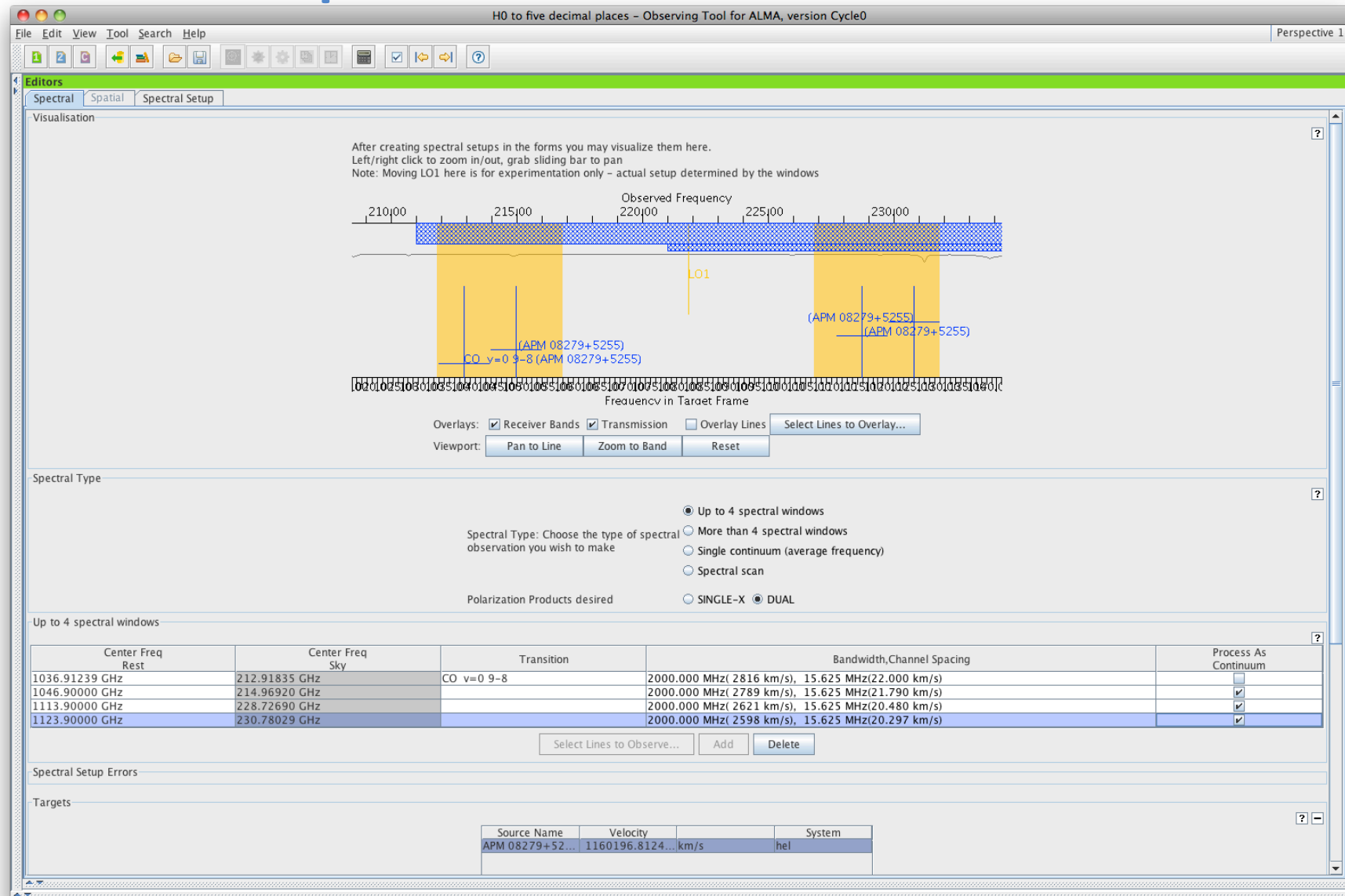
Spatial Visual Editor



Spectral Visual Editor

- User defines spectral windows (also in Forms editor)
 - OT calculates a tuning solution automatically
 - Spectral windows and solution are shown in SVE
 - Sidebands and LO1
- Spectral Visual Editor also displays
 - Atmospheric transmission
 - Other spectral lines...
- Feedback includes
 - Textual warnings if solution cannot be found
 - Sidebands change colour (yellow to grey)

Spectral Visual Editor



Where can you put your lines?

- For Cycle 0, 4 spectral windows are allowed
 - Must have the same bandwidth and resolution
 - 21 combinations of bw and resolution are available
- The spws must fit inside the sidebands
 - Width and separation of sidebands differs between bands
- Bands 3, 6 and 7 have a specific restriction
 - 2 spws in each sideband or all in the same sideband
 - 3 in 1 sideband and 1 in the other is not allowed
- The OT knows about all these restrictions!

Spectral Line Picker

- The OT's interface to NRAO's Splatalogue
 - Online search of 5.8 million lines
 - The OT has a smaller internal version
- Lines can be filtered and sorted e.g. by
 - Name (text search with wildcards)
 - Strength
 - Maximum upper state energy
 - Location (hot cores, comets, dark clouds, etc.)
 - Sideband (do the lines all fit? – EXPERIMENTAL!)

Spectral Line Picker

Filter / Species

HCN

☒ Include description in search

ALMA Band

1 2 3 4 5 6 7 8 9 10

Sky Frequency (GHz)

Min 312 Max 373

Sideband Filter

☒ Enable sideband filter (recommended)

☒ Filtering lines outside sidebands

Maximum Upper-state Energy (K)

0 20 40 60 80 100 ∞

Molecule Filter / Environment

Show all atoms and molecules

Reset Filters Search Online

Notes

- The initial database is an offline database, containing selected transitions from the full spectral line catalogue.
- Additional transitions from the full catalogue can be found by clicking *Search Online*.
- *Search Online* is only enabled when a species is given and one ALMA band is selected.
- *Search Online* does not (yet) return all information for a transition.

Transitions matching your filter settings

Transition	Description	Rest Freq...	Sky Freq...	Upper-state En...	Lovas Inten...	Sij μ^2
HCNv2=1 J=4-3, l=1e	Hydrogen Cyanide	354.46 GHz	354.46 GHz	1066.9 K	62.5	32.46 D ²
HCN v=0 J=4-3	Hydrogen Cyanide	354.505 GHz	354.505...	42.53 K	17.4	35.65 D ²
HCNv2=2 J=4-3, l=2f	Hydrogen Cyanide	356.135 GHz	356.135...	2095.18 K	5.2	25.21 D ²
HCNv2=2 J=4-3, l=2e	Hydrogen Cyanide	356.163 GHz	356.163...	2095.18 K	6.3	25.21 D ²
HCNv2=1 J=4-3, l=1f	Hydrogen Cyanide	356.256 GHz	356.256...	1067.12 K	72	32.46 D ²
HCNv2=2 J=4-3, l=0	Hydrogen Cyanide	356.301 GHz	356.301...	2073.45 K	9.4	33.61 D ²

Add to Selected Transitions

Selected transitions

Transition	Description	Rest Frequency	Sky Frequency	Upper-state Energy	Lovas Intensity	Sij μ^2
CO v=0 3-2	Carbon Monoxide	345.796 GHz	345.796 GHz	33.192 K	70	0.036 D ²

Remove from Selected Transitions

Close Dialog and Apply Selection

Calibrator Selection Tool

- Shouldn't normally be required!
 - ALMA will select appropriate calibrators
- Two kinds of calibrator definition
 - Dynamic
 - Define a cone search based on position, radius, flux, etc.
 - ALMA catalogue is searched during observations
 - Query can be tested in OT using current ALMA catalogue
 - Fixed
 - Define an actual source e.g. 3C 273

Calibrator Selection Tool

Phase Calibrator Query Editor

Source Catalog Search Parameters

- Set a non-zero value to enable a filter
- A maximum of 100 results can be returned

➕ Cone Search RA Dec Radius (")

➕ Flux Min Max

➕ Frequency Min Max

⊖ Last Observed Min Max

Max Results

Search Results

- This is designed to provide you with an idea of what calibrators are available in the ALMA database, but will not allow you to select a specific calibrator. Click *Test Query* to find source catalog measurements matching your constraints

⚠ These results could be different at project execution time

Source Name	RA	Dec	Separation	Frequency	Flux Density	Last Observed
nrao530; J1733-130	17:33:02.710	-13:04:49.550	16.524"	99.931 GHz	2.6 Jy	May 10, 2007
J1911-201	19:11:09.650	-20:06:55.110	8.825"	99.931 GHz	2.1 Jy	May 10, 2007
J1923-210	19:23:32.190	-21:04:33.330	11.631"	99.931 GHz	1.83 Jy	May 10, 2007
J1924-292	19:24:51.060	-29:14:30.120	14.164"	99.931 GHz	6.96 Jy	Oct 4, 2007

using

Control and Performance

- Constrain time and configurations here
 - Two Cycle-0 configurations (125 and 400-m baselines)
- OT reports
 - Representative frequency (sets opacity and thus time)
 - Max. angular resolution of each configuration (suggestions)
 - Field of view (will your source “fit”?)
- User must enter
 - Desired angular resolution (choose from above)
 - Desired sensitivity and associated bandwidth
 - Common choices for bandwidth are provided
 - Can also choose a user-defined value

Control and Performance

Control and Performance ?

Representative Frequency GHz

Antenna Beamsize (λ/D)

Early Science Extended Configuration:
Max Baseline(L) and corresponding beam size(λ/L)

Early Science Compact Configuration:
Max Baseline(L) and corresponding beam size(λ/L)

Desired Angular Resolution

Largest Angular Scale of source ☒ Point Source ☐ Extended Source

Desired Sensitivity per Pointing mJy equivalent to mK

Bandwidth used for Sensitivity Frequency Width

Does your setup need more time than is indicated by the time estimate? ☐ Yes ☒ No


Is this observing time constrained (occultations, coordinated observing,...)? ☐ Yes ☒ No

ACA Use: (ACA Not yet available)

Sensitivity calculator is available for experimentation

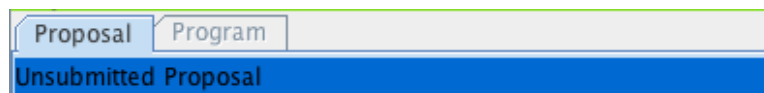
Time Estimate will report how long observation will take (including calibration!)

Proposal Submission

- When ready, validate your proposal 
 - OT will check that all necessary information is present
 - Errors will appear in Feedback panel
- A project cannot submit without validating
 - Submission server will validate if you don't!
- For your records...
 - Email will acknowledge submission
 - Printable summary of proposal can be produced
- OT will ask you to save to disk at this point
 - Project code assigned at this point

Proposal resubmission

- Resubmission is possible up to the deadline
 - Proposal can be retrieved from archive or from disk
- Things to be aware of
 - Your previous submission is overwritten
 - You can change almost every detail – still overwrites
 - A version saved before submission is a new submission
- OT will warn you about these dangers
 - e.g. new status panel



Usage tips

- The OT shows a lot of information
 - Running it in full-screen mode is recommended
- Panels can be hidden
 - Use the arrows in the corner of each panel
- Various default settings can be changed
 - Preferences dialogue is available through the File menu
- Extensive built-in help is available
 - Help menu (User Manual and Reference Manual)
 - Contextual help (Question Mark buttons)
 - Plus external videos and Quickstart guide (Science Portal)

Known Issues

- A few bugs and features have been identified
 - None stop you doing anything legitimate!
 - Access through OT Troubleshooting page in Science Portal
 - This list will be added to as they are found
- A patched OT version will probably be issued
 - The OT will warn you when a new version is available
 - Web Start will automatically fetch this
- The ALMA Archive doesn't open until 1 June
 - Submission not possible until then!