The ALMA Observing Tool

Andy Biggs

ALMA Regional Centre, ESO

EUROPEAN ARC

ALMA Regional Centre

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 source angular scale
  - Required sensitivity (NOT TIME!)
- SBs are generated from the above information
  - Contain the technical details required to operate the array
  - This is done automatically – no user input required

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

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

What is a Scheduling Block?

- A self-contained definition of an observation
  - SBs are what are executed at the telescope
- It contains:
  - Information from the Science Goal
    - positions, frequencies, σ, angular resolution
  - Enormous amounts of technical information
    - e.g. correlator and backend parameters
  - Approximate time on source
    - Each SB will last ~1 hour
    - Dynamic scheduler will execute SB till σ is achieved

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
    - This actually runs the observation!
- A user will not normally interact with an SB!

"Phase2Group" currently responsible for ensuring that all SBs meet the PI's needs

Time Estimates

- Time on source is only an estimate
  - Scheduler will run an SB in appropriate weather conditions
    - These may differ from those assumed by the OT
  - ALMA is still being characterised
  - Observations will proceed until sensitivity is reached
- Additional time can be requested
  - (u,v) coverage may be insufficient
  - Must justify in proposal
  - Almost never necessary – 32 12-m antennas at Cycle 1!

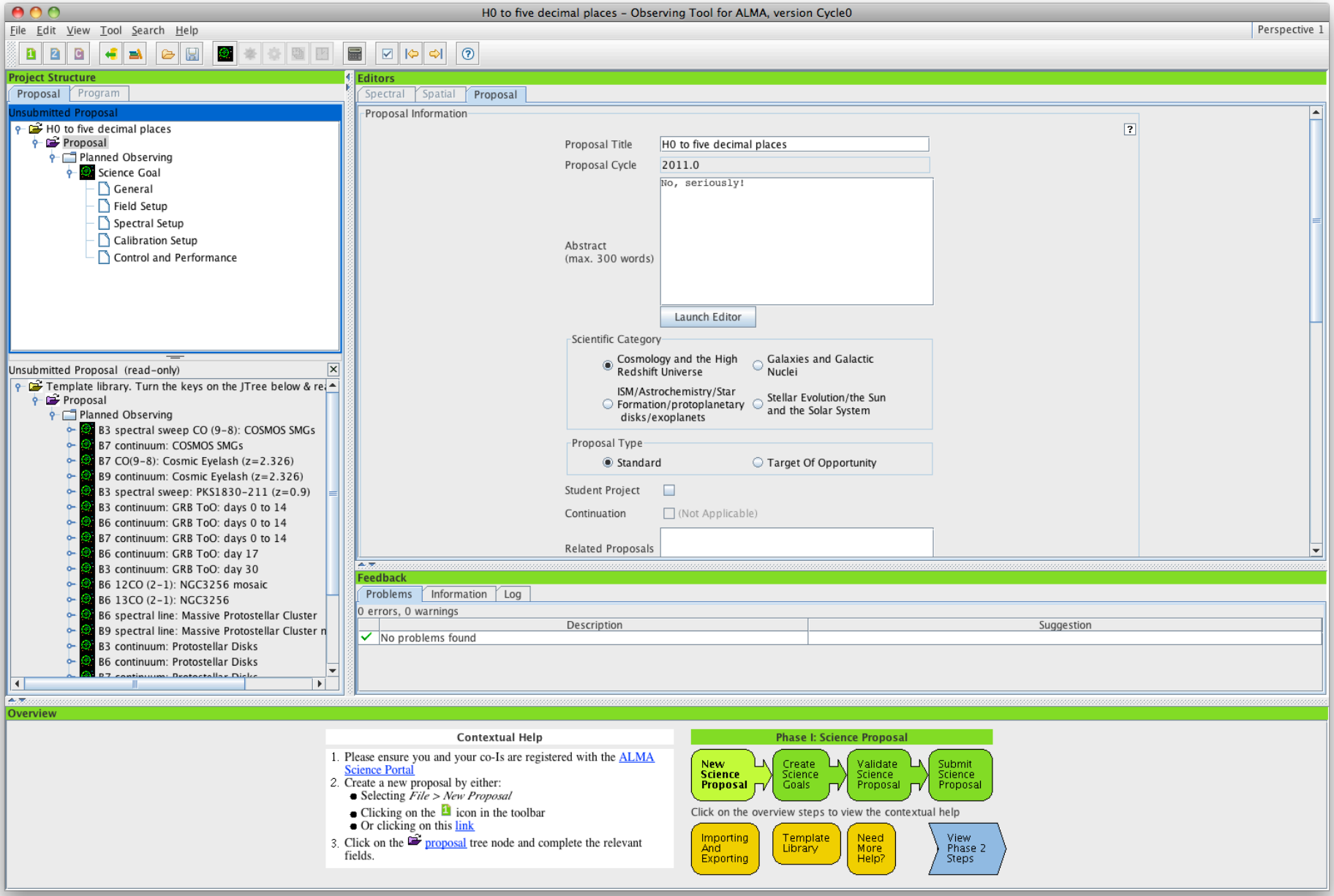
Calibration

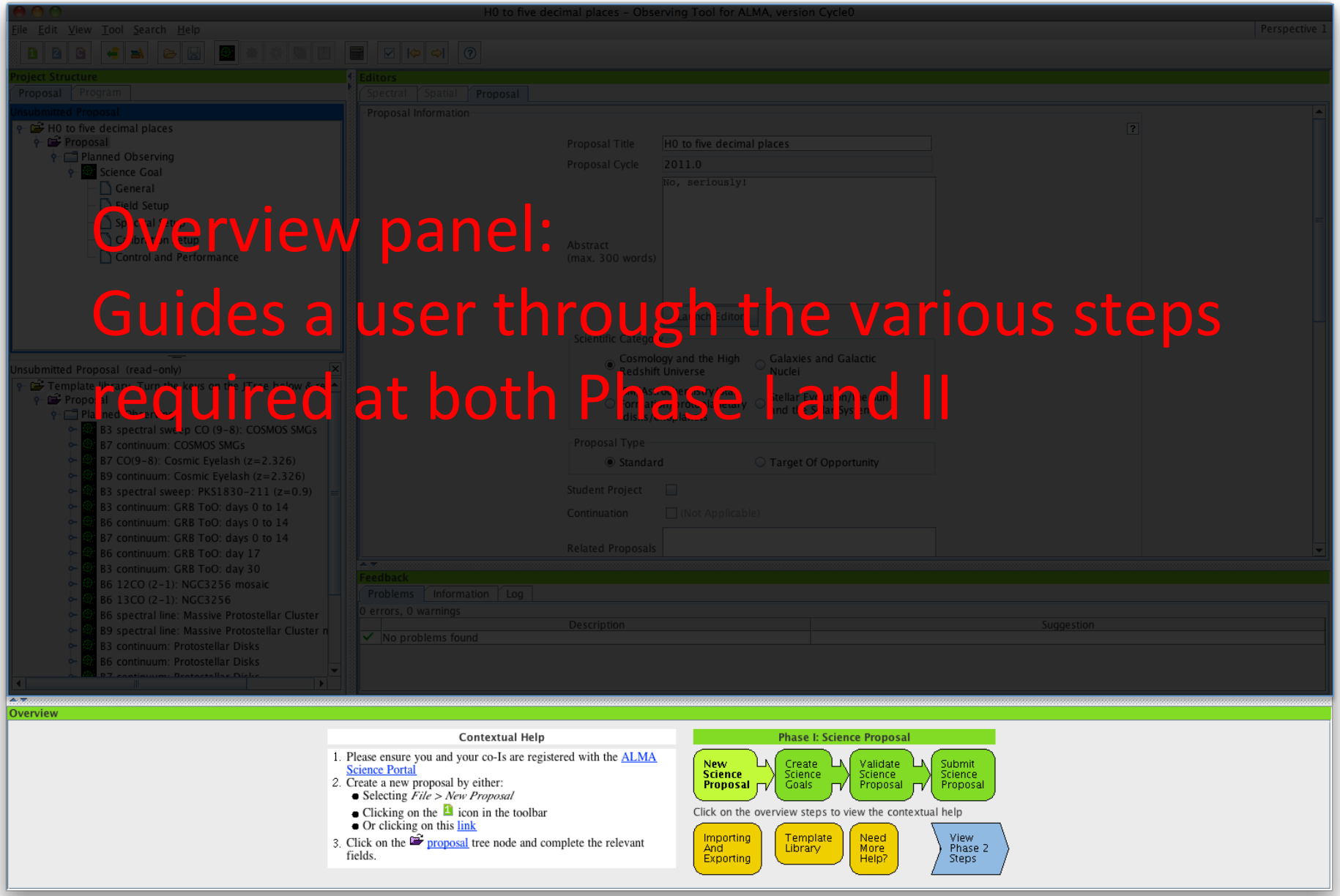
- The observatory will provide all necessary calibration
  - Choose “system-defined” calibration (the default)
  - Sources will eventually be selected at run time
    - Cycle 0: selected by Phase2Group
- Specific calibrators can be requested
  - Must justify in proposal
  - Almost never necessary
- Observation/calibration sequence not chosen by PI
  - An observing script (Python) actually controls ALMA
  - Observing sequence is largely determined by this

Implementation

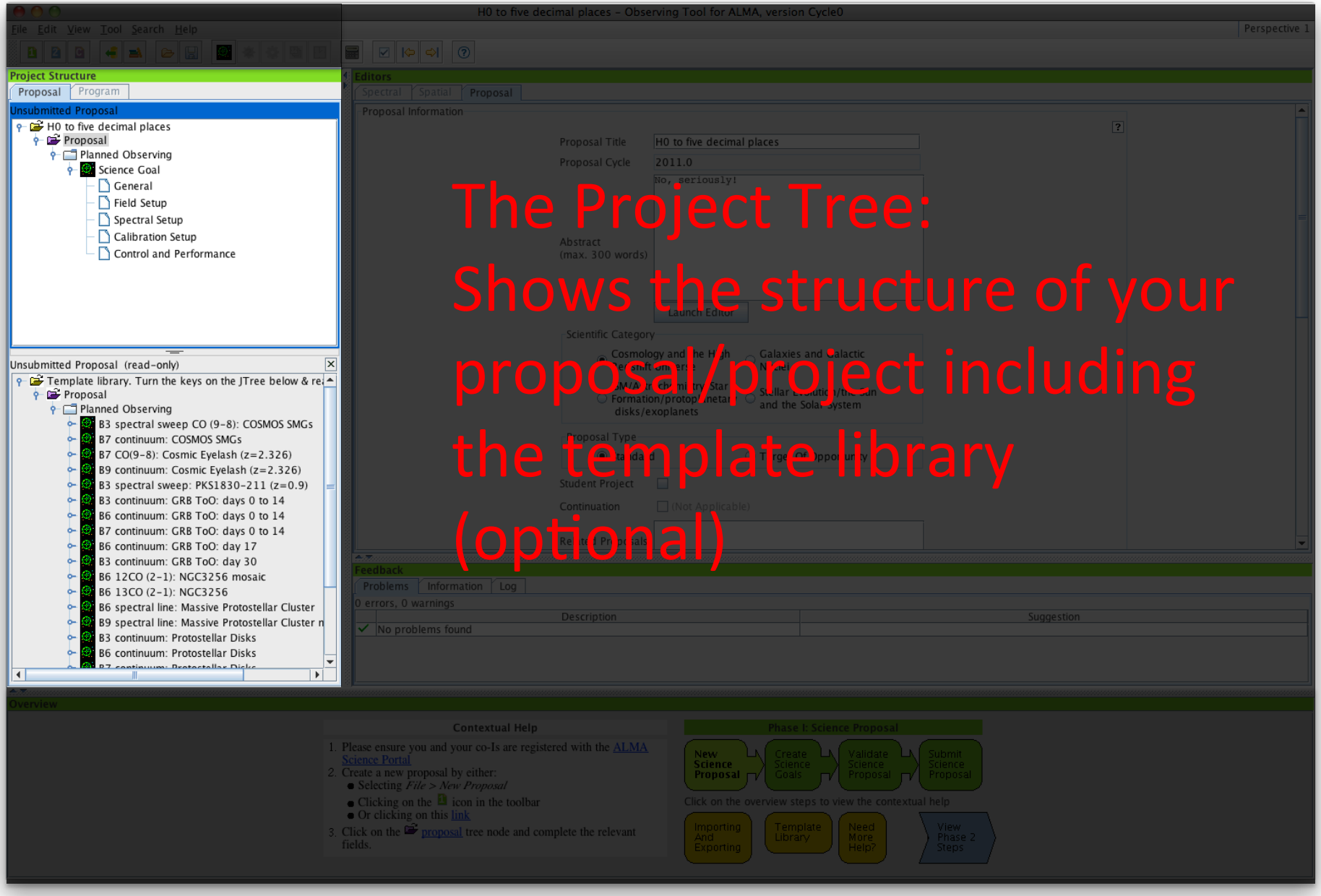
- The OT is a Java application
  - Java 6 must be installed on your computer
  - Version with built-in Java now available (Linux only)
- Download and run locally
  - Web Start (recommended) and tarball versions
- Internet connection required intermittently
  - PI/co-I information from user database
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

Layout of the OT

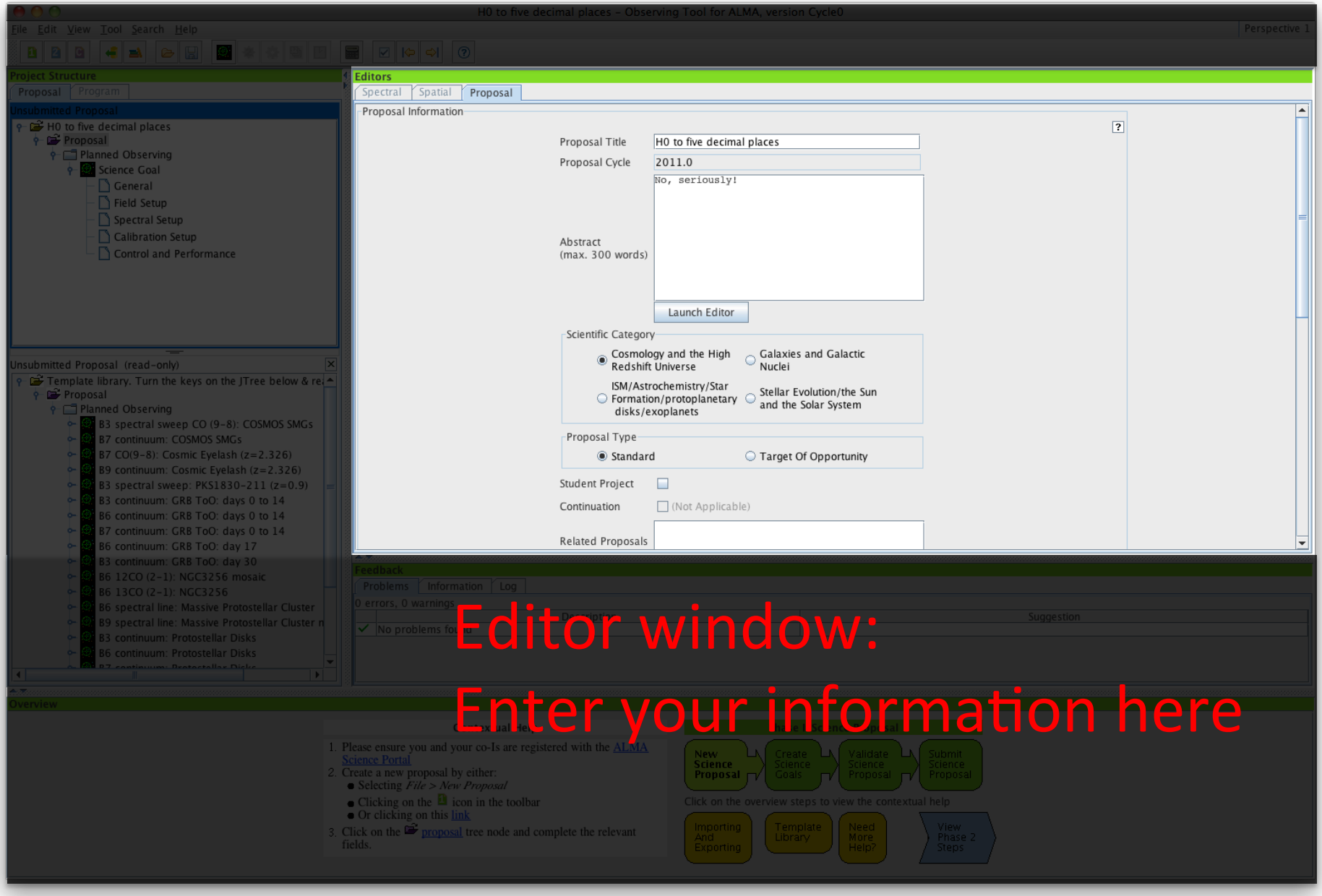

H0 to five decimal places - Observing Tool for ALMA, version Cycle0
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal Program
Unsubmitted Proposal
H0 to five decimal places
Proposal
Planned Observing
Science Goal
General
Field Setup
Spectral Setup
Calibration Setup
Control and 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 n
B3 continuum: Protostellar Disks
B6 continuum: Protostellar Disks
Editors
Spectral Spatial Proposal
Proposal Information
Proposal Title
H0 to five decimal places
Proposal Cycle
2011.0
No, seriously!
Abstract
(max. 300 words)
Launch Editor
Scientific Category
Cosmology and the High Redshift Universe
Galaxies and Galactic Nuclei
ISM/Astrochemistry/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
1. Please ensure you and your co-Is are registered with the ALMA Science Portal
2. Create a new proposal by either:
Selecting File > New Proposal
Clicking on the icon in the toolbar
Or clicking on this link
3. 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



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

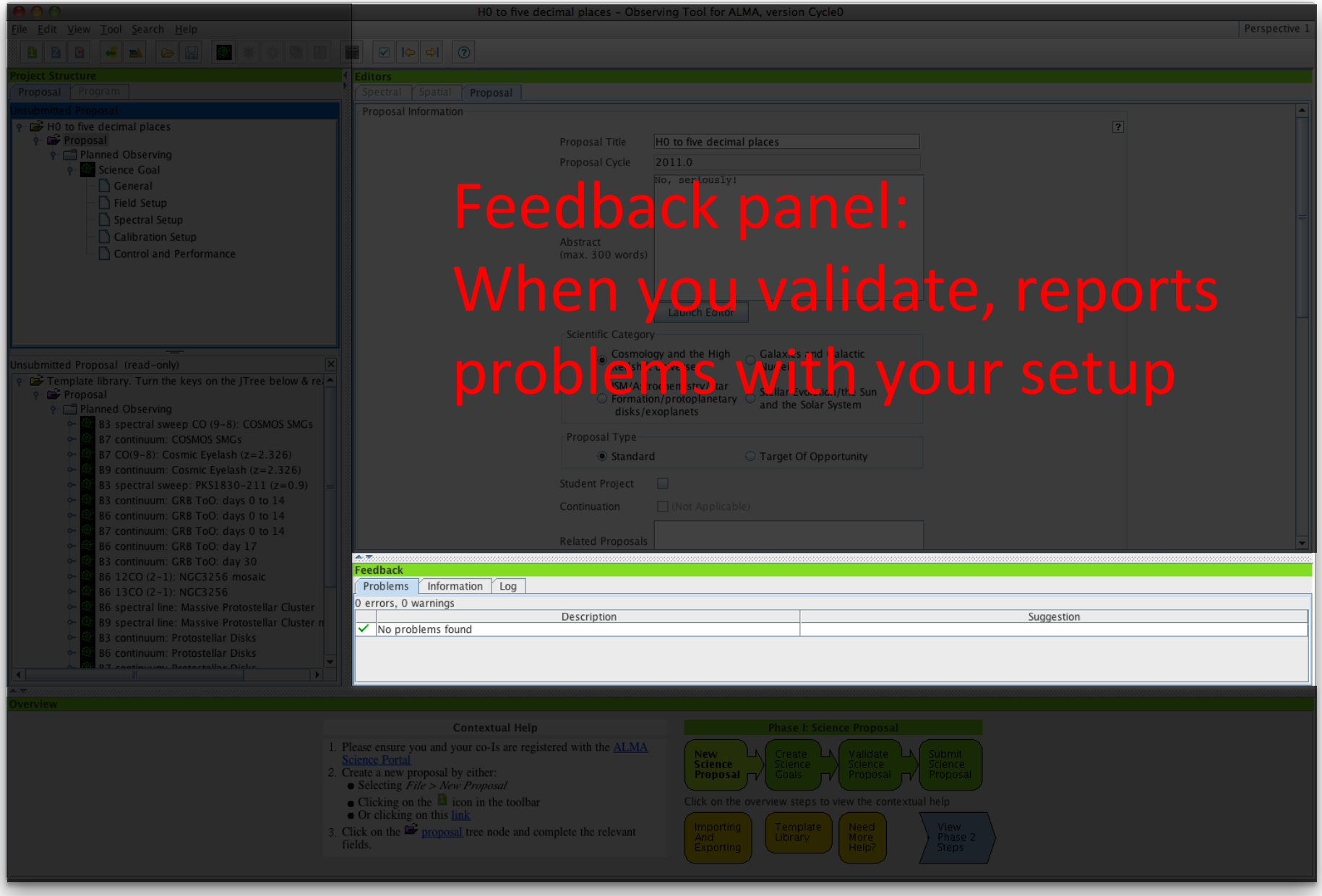


The Project Tree:
Shows the structure of your proposal/project including the template library (optional)

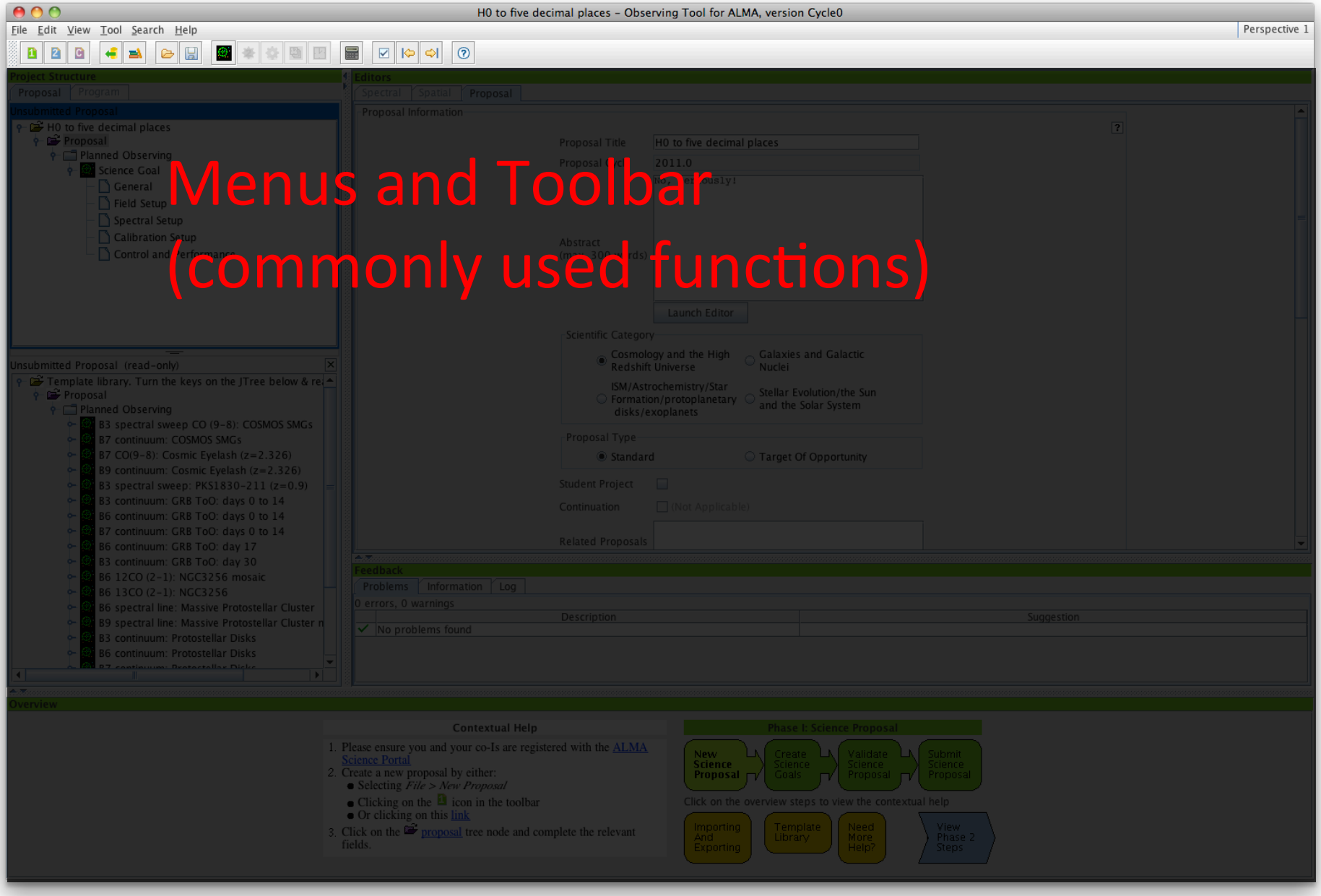


Editor window:

Enter your information here



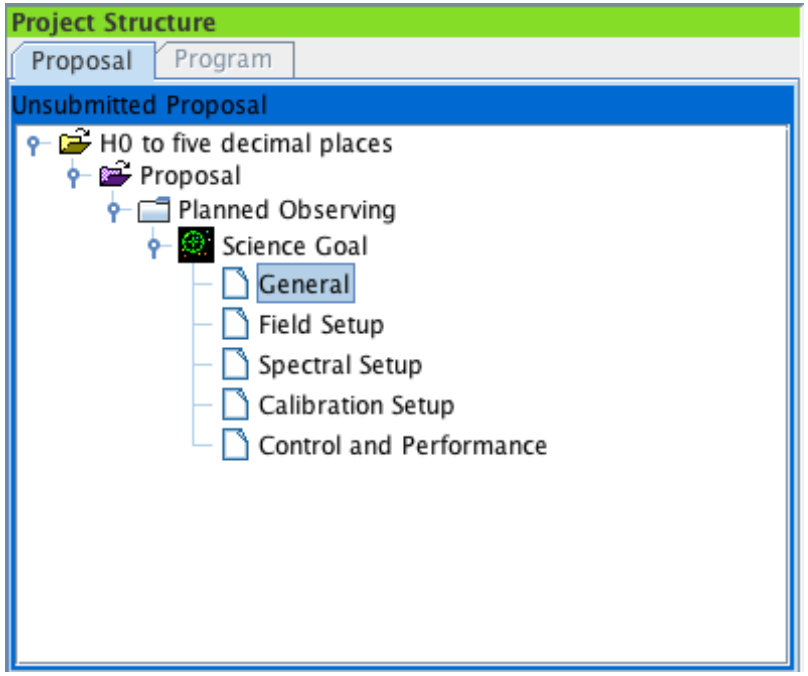
Feedback panel:
When you validate, reports problems with your setup



Menus and Toolbar (commonly used functions)

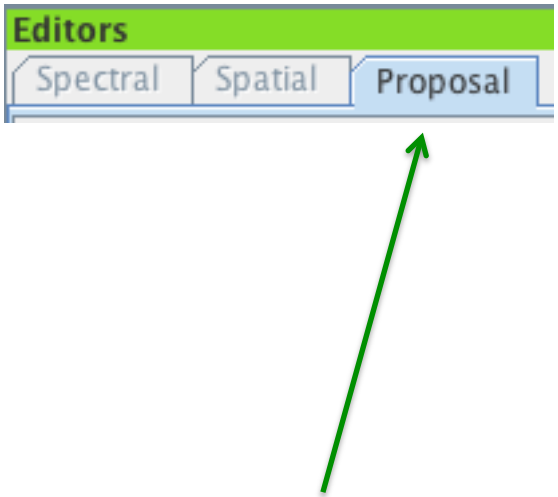
Project navigation

- 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)
    - No SBs here, only Science Goals
  - Program (Phase II)
    - Not available at Phase I
    - SBs are generated here



Tools

Editors

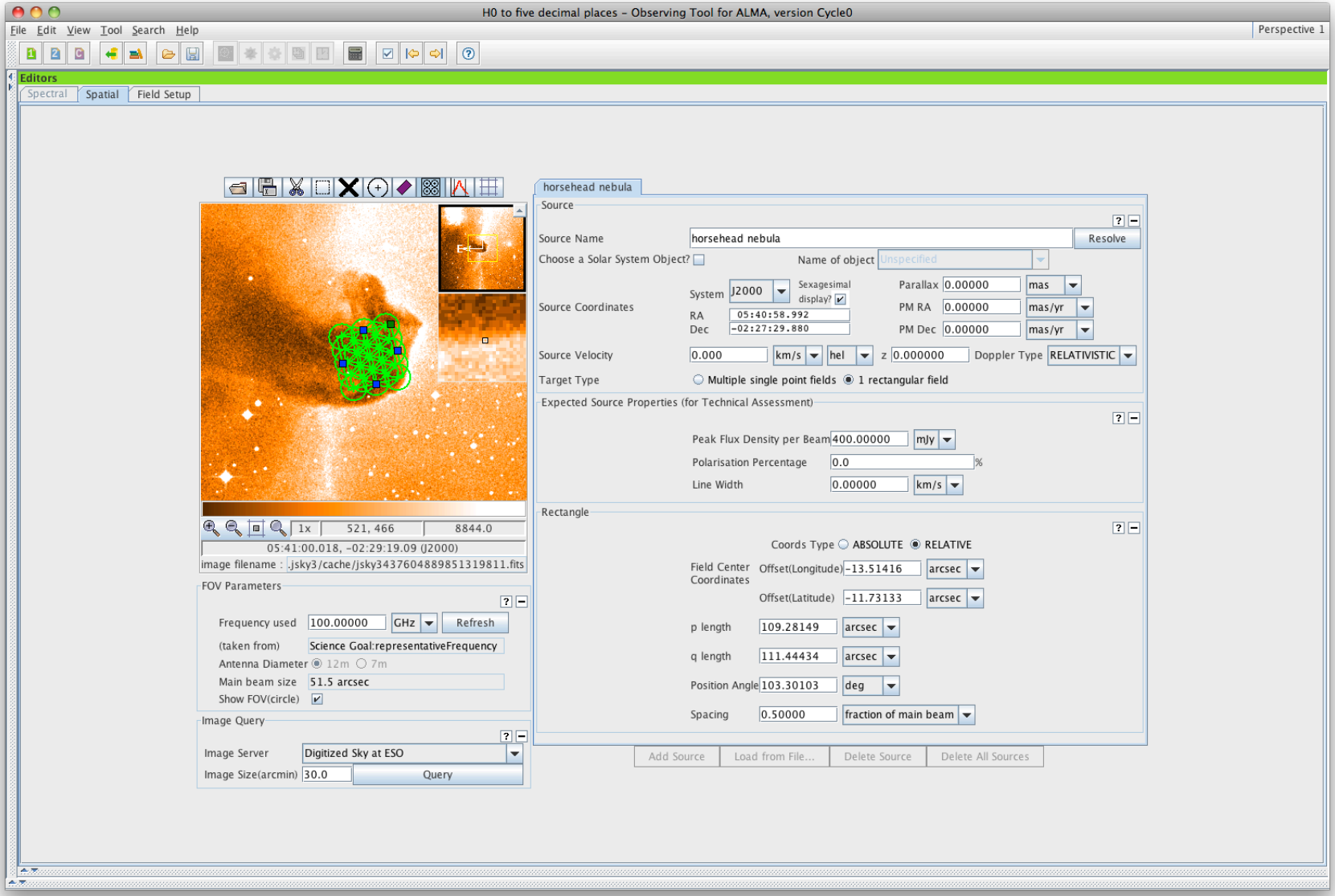


- Three kinds of editor are available
  - Forms
    - Basic textual input – always available
    - Name reflects which node in the Project Tree is currently selected
  - Spectral
    - Visualiser tool – only available with Spectral Setup
    - Also includes Forms editor
  - Spatial
    - Visualiser tool – only available with Spatial Setup
    - Also includes Forms editor

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
- Rectangular mapping regions can be defined
  - Mosaic patterns are calculated and displayed
  - Maximum 150 mosaic pointings for Cycle 1
  - ALMA and ACA pointings are shown

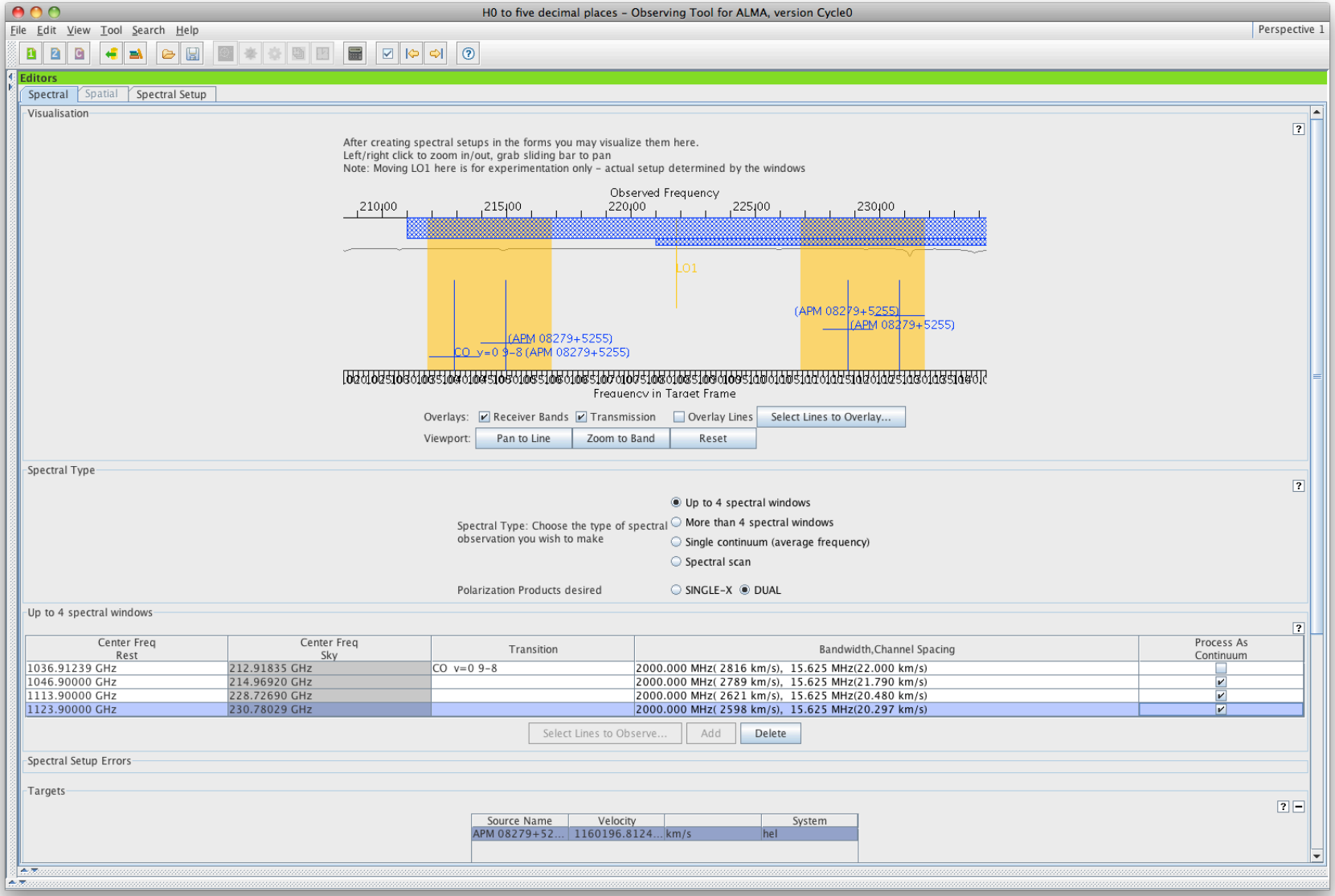
Spatial Visual Editor



Spectral Visual Editor

- Gives overview of spectral setup
  - User defines spectral windows
  - OT calculates a tuning solution automatically
- Spectral Visual Editor displays:
  - Spectral windows
  - Sidebands
  - LO1
  - Atmospheric transmission
  - Other spectral lines…

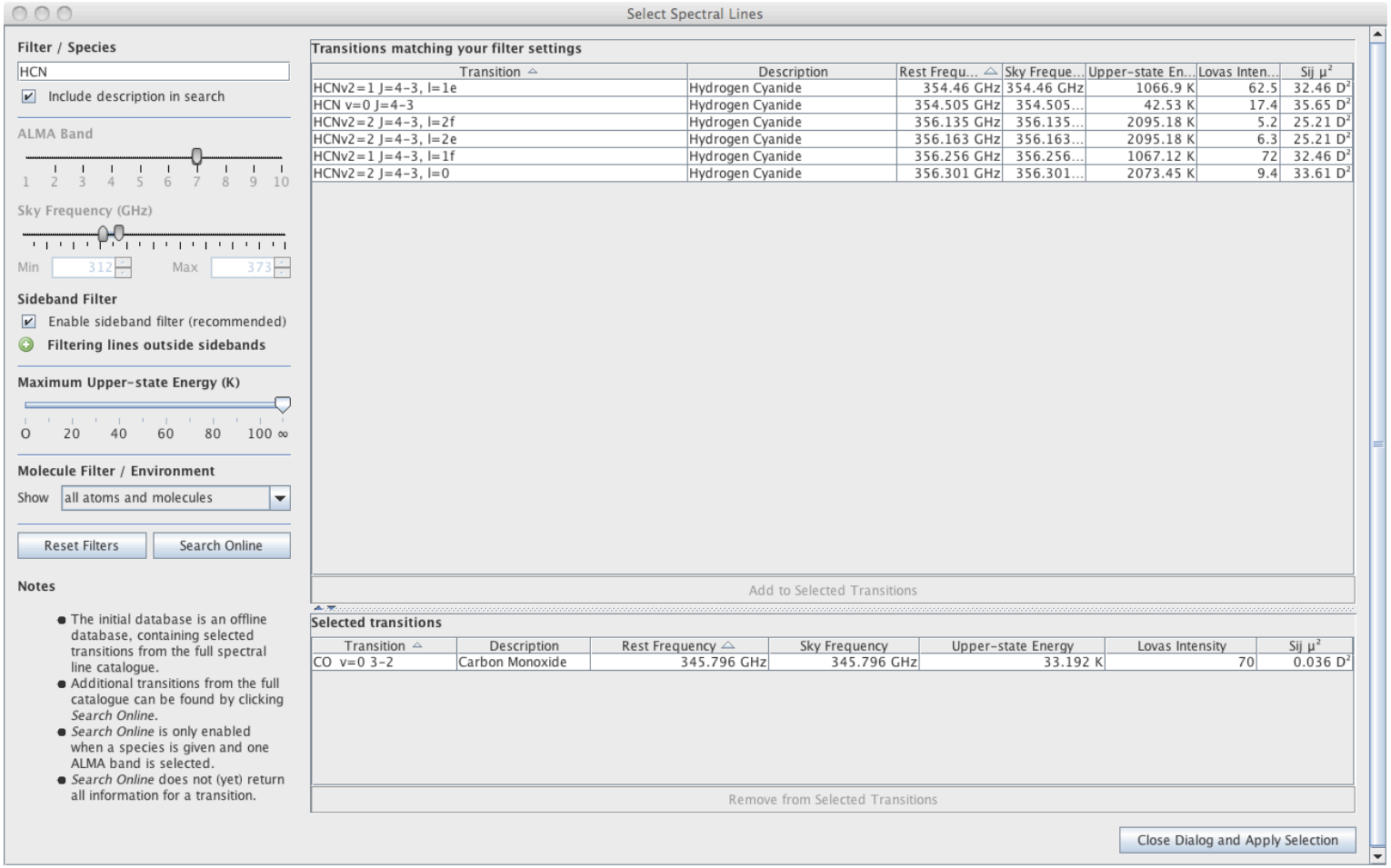
Spectral Visual Editor



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?)

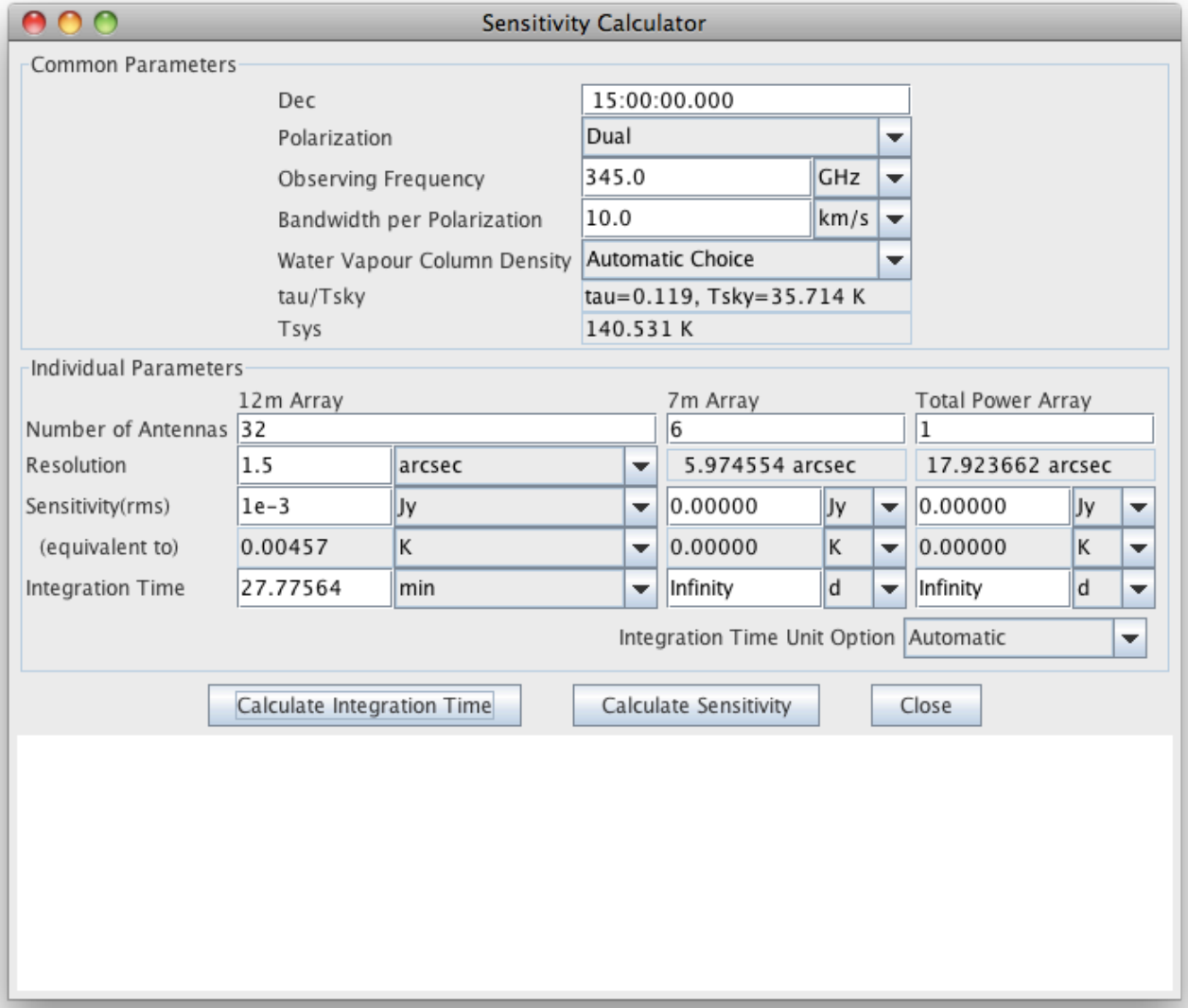
Spectral Line Picker



ALMA Sensitivity Calculator

- Available for experimentation
  - Both in OT and in Science Portal
- Calculates σ(t) or t(σ)
  - Standard inputs:
    - Frequency
    - Bandwidth
    - Angular resolution (only for brightness temperatures)
    - Number of antennas
    - Source declination (transit assumed)
    - Precipitable Water Vapour (PWV)
- Details can be found in document in Science Portal

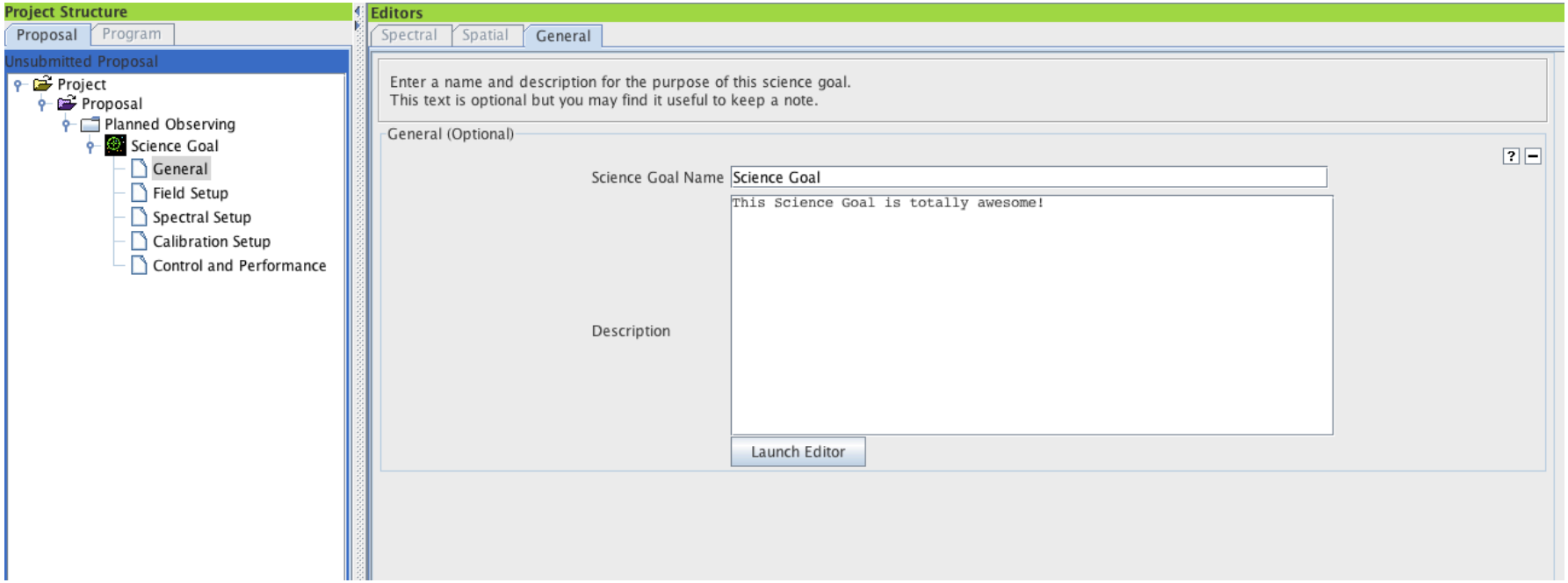
ALMA Sensitivity Calculator



Science Goal Sections

General

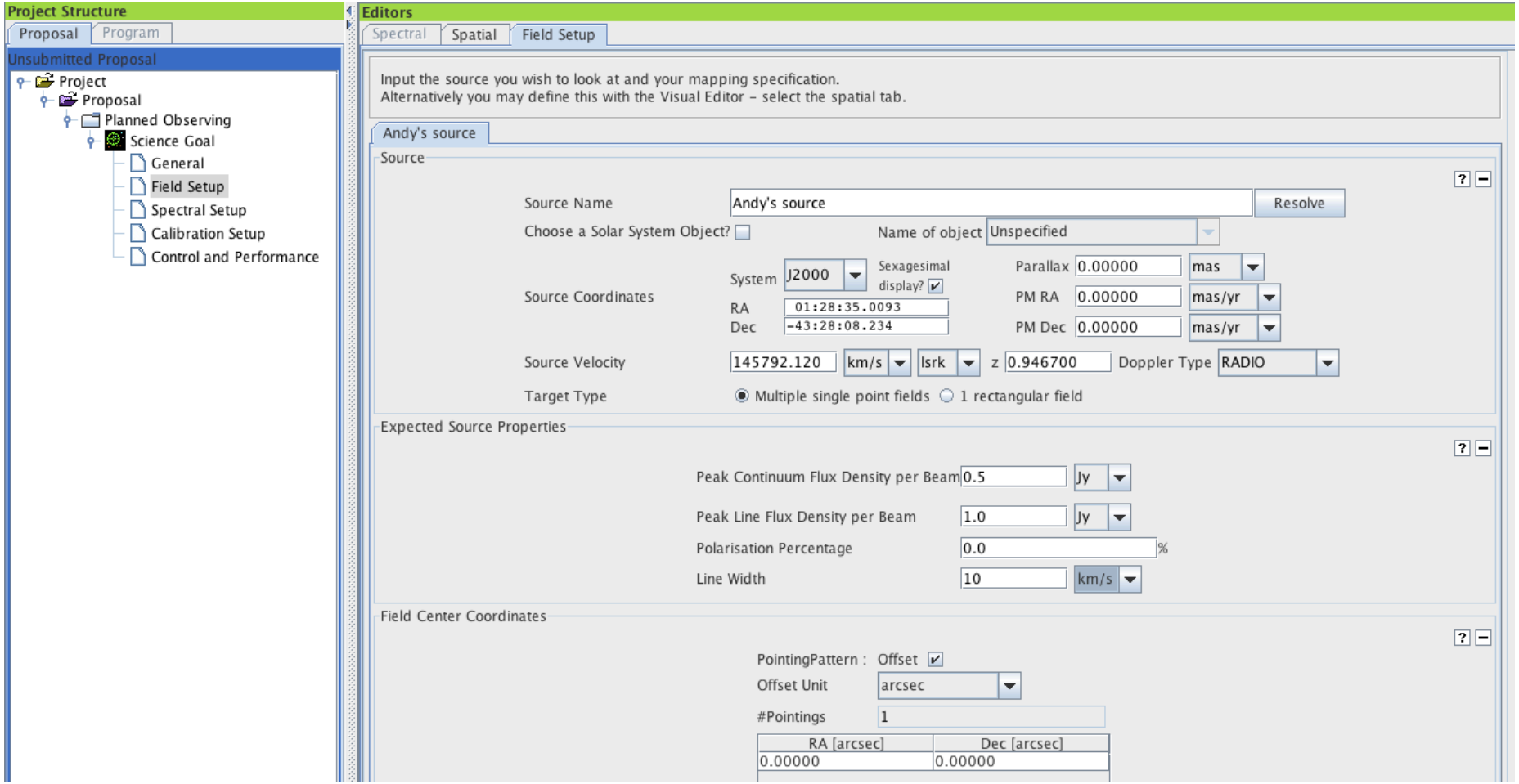
- Space for textual input
  - Optional description of Science Goal



Field Setup

- Telescope pointing parameters
  - Positions
  - Proper motions
  - Mapping areas
- Radial velocities
  - OT will Doppler shift spectral lines
- Fluxes and line widths
  - Currently only used for Technical Assessment
  - Might be used at Cycle 1 for imaging requirements

Field Setup


Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
Science Goal
General
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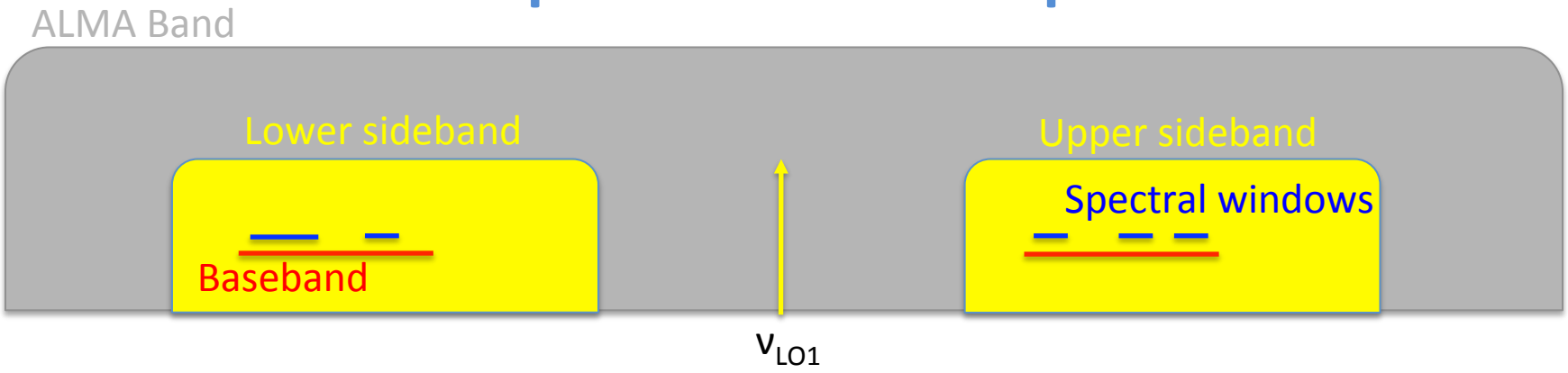
Spectral Setup
Calibration Setup
Control and Performance
Editors
Spectral
Spatial
Field Setup
Input the source you wish to look at and your mapping specification.
Alternatively you may define this with the Visual Editor - select the spatial tab.
Andy's source
Source
Source Name
Andy's source
Resolve
Choose a Solar System Object?
Name of object
Unspecified
Source Coordinates
System
J2000
Sexagesimal display?
RA
01:28:35.0093
Dec
-43:28:08.234
Parallax
0.00000
mas
PM RA
0.00000
mas/yr
PM Dec
0.00000
mas/yr
Source Velocity
145792.120
km/s
lsrk
z
0.946700
Doppler Type
RADIO
Target Type
Multiple single point fields
1 rectangular field
Expected Source Properties
Peak Continuum Flux Density per Beam
0.5
Jy
Peak Line Flux Density per Beam
1.0
Jy
Polarisation Percentage
0.0
%
Line Width
10
km/s
Field Center Coordinates
PointingPattern :
Offset
Offset Unit
arcsec
#Pointings
1
RA [arcsec]
Dec [arcsec]
0.00000
0.00000

Spectral Setup

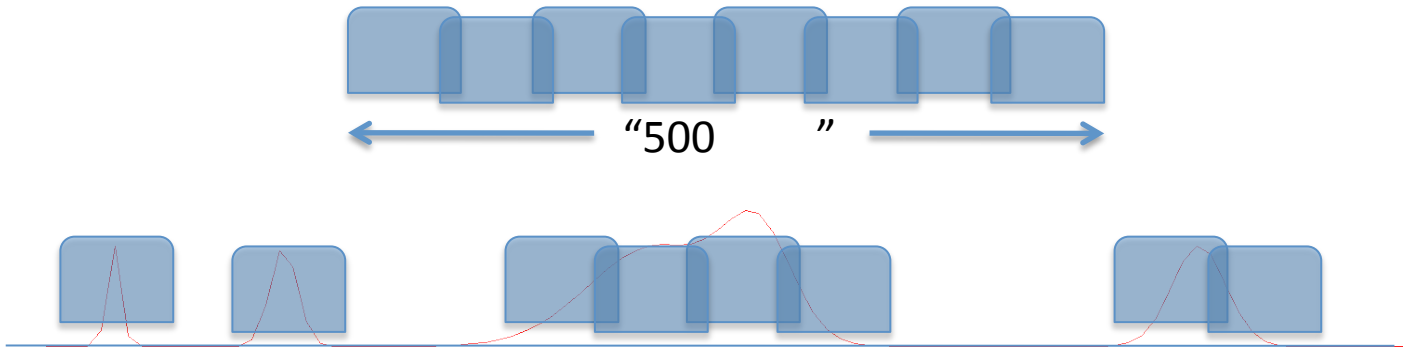


- ALMA bands have two sidebands (telescope output)
  - Widths and separations are band-dependent
  - Bands 3 and 7: each is 4 GHz wide
- Basebands sample the sideband signals
  - Each is 2-GHz wide and has two polarizations (X and Y)
- Spectral windows sample the baseband signals

Spectral Setup

- Each baseband can support one correlator mode
  - Centre frequency, bandwidth, channel spacing & pol.
  - 14 modes are available at Cycle 1
    - [6 high-resolution (FDM) and 1 low-resolution (TDM)] x 2 pol.
    - OT will only let you choose a valid mode
- Basebands are independent
  - Different correlator modes in each (FDM or TDM)
- OT will try and calculate tuning solution
  - Errors will be reported
  - Spectral Visual Editor very useful for identifying problems

Multiple Region Modes



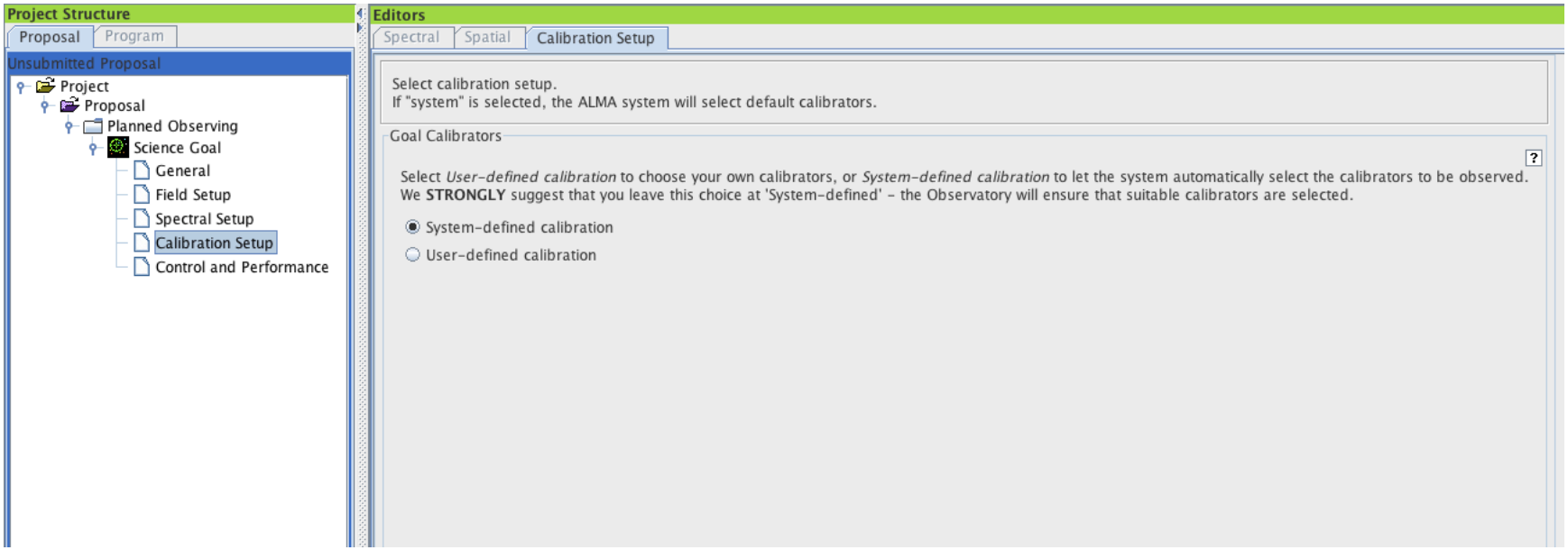
- FDM correlator modes can be split into >1 spws
  - Each is made up of multiple 62.5-MHz wide filters
  - Use the "fraction" parameter (½, ¼, ⅛, etc.)
  - Spectral resolution in each must be the same

Representative Frequency

- User must select one of the spws
  - Centre frequency becomes Representative Frequency
  - This default can be changed (within spw)
- RF has two purposes
  - Frequency used in sensitivity calculation
    - Determines PWV – user does not choose this
  - Sets field of view displayed in Spatial Visual Editor

Calibration Setup

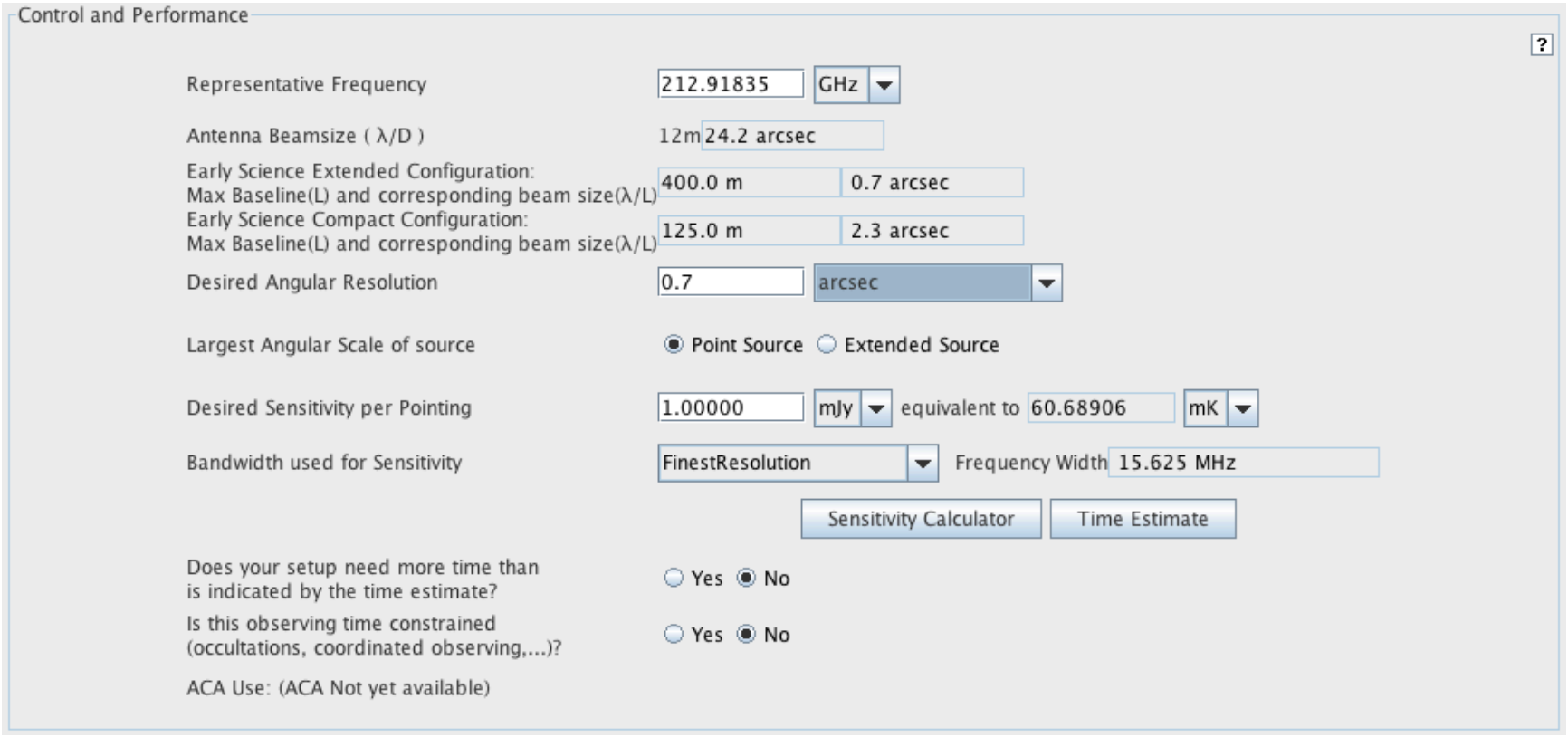
- As already explained, almost always not necessary



Control and Performance

- Most important user inputs
  - Angular resolution (Θ)
  - Largest Source Angular Scale (LAS)
  - Required sensitivity (σ)
  - Bandwidth used for sensitivity
- ACA requirement will be based on Θ and LAS
  - User can override (must be justified)
- Time Estimate button gives detailed breakdown
  - Includes calibration overheads

Control and Performance



Proposal Submission

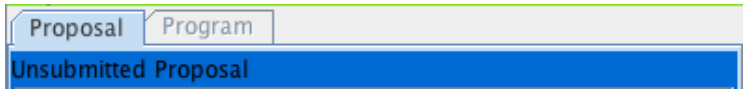
- When ready, validate your proposal
  - OT will check that all necessary information is present
  - Errors will appear in Feedback panel
  - A project cannot submit with validation errors
- Submit
  - Project code assigned at this point
- For your records...
  - Email will acknowledge submission
  - Printable summary of proposal can be produced
  - OT will ask you to save to disk at this point – DO IT!

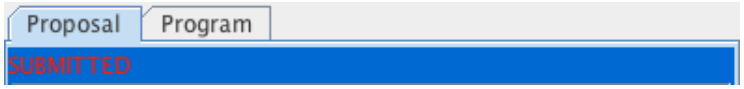
Proposal Resubmission

- Resubmission is possible up to the deadline
  - Previous submission is overwritten
  - You can change almost every detail – still overwrites
  - Please save a local copy each time you submit
- Older (local) versions can now be resubmitted
  - This wasn't possible at Cycle 0

Submission Dangers

- Using an old proposal as a template
  - This is very bad with an already submitted proposal
  - Other project will be overwritten
  - Read old proposal with “Use Project as Template”
- Resubmitting a locally-saved project that wasn’t saved after submission
  - This will be a new submission i.e. new project code
- OT shows a project’s submission status





Usage tips

- The OT shows a lot of information
  - Running it in full-screen mode is recommended
  - Panels can be hidden (e.g. Overview 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)

Happy proposal writing for Cycle 1!