# An Introduction to the ALMA Observing Tool

**How to turn that great idea into ALMA data ...**

**Harvey Liszt**, Drew Brisbin & Alison Peck

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

# On a Personal note

Explore JAMES WEBB SPACE TELESCOPE

more JWST

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JWST SOCIAL MEDIA

## People

People -> Meet the Team -> Gillian Wright

**MEET GILLIAN WRIGHT: EUROPEAN PRINCIPAL INVESTIGATOR FOR THE MID-INFRARED INSTRUMENT (MIRI) INSTRUMENT FOR THE WEBB TELESCOPE**


Gillian Wright is the European principal investigator for the Mid-Infrared instrument (MIRI) on the James Webb Space Telescope. Wright leads the nationally funded European consortium of institutes that have developed the MIRI instrument in a partnership with NASA's Jet Propulsion Laboratory in Pasadena, Calif.

**Gillian's husband Alan Bridger is the OT developer**

Professor Wright is also a research astronomer, who specializes in infrared observatories and astronomical instrumentation as well as studies of star formation and dust in interacting galaxies. Wright serves as the Director of the U.K. Astronomy Technology Centre in Edinburgh, Scotland and a member of the Webb telescope Science Working Group. She's the present co-Investigator for Herschel, a recent European Space Agency mission, for the Spectral and Photometric Imaging Receiver instrument.

Very Long Baseline Array

# Cycle 3 Capabilities

- At least **36 x 12-m** antennas, plus **10 x 7-m** antennas (for short baselines) and **2 x 12-m** antennas (for zero-spacing aka Total Power™)
- Receiver bands 3, 4, 6, 7, 8, 9, & 10 (wavelengths of about 3.5 to 0.32 mm)
- Baselines up to **2 km** for **Bands 8, 9 and 10 (high frequency)**
    - up to **5 km** for **Band 7,** and
    - up to **10 km** for **Bands 3, 4, & 6 (lower frequency)**
- Both single field interferometry and **mosaics** of up to **150 pointings**
- Spectral-line observations with all arrays and continuum observations with the 12-m Array and the 7-m Array. Single dish use will be limited to spectral line observations in Bands 3 to 8 (no singledish continuum, no standalone singledish spectral line)
- Linear polarization (on-axis, continuum in Band 3, 6 and 7, no ACA, no mosaics, no spectral line, no circular polarization)
- Mixed correlator modes and multiple spectral windows (both high and low frequency resolution in the same observation if not on the same baseband)
- The **maximum** observing **time** per proposal, as estimated by the OT, is **100 hrs**.

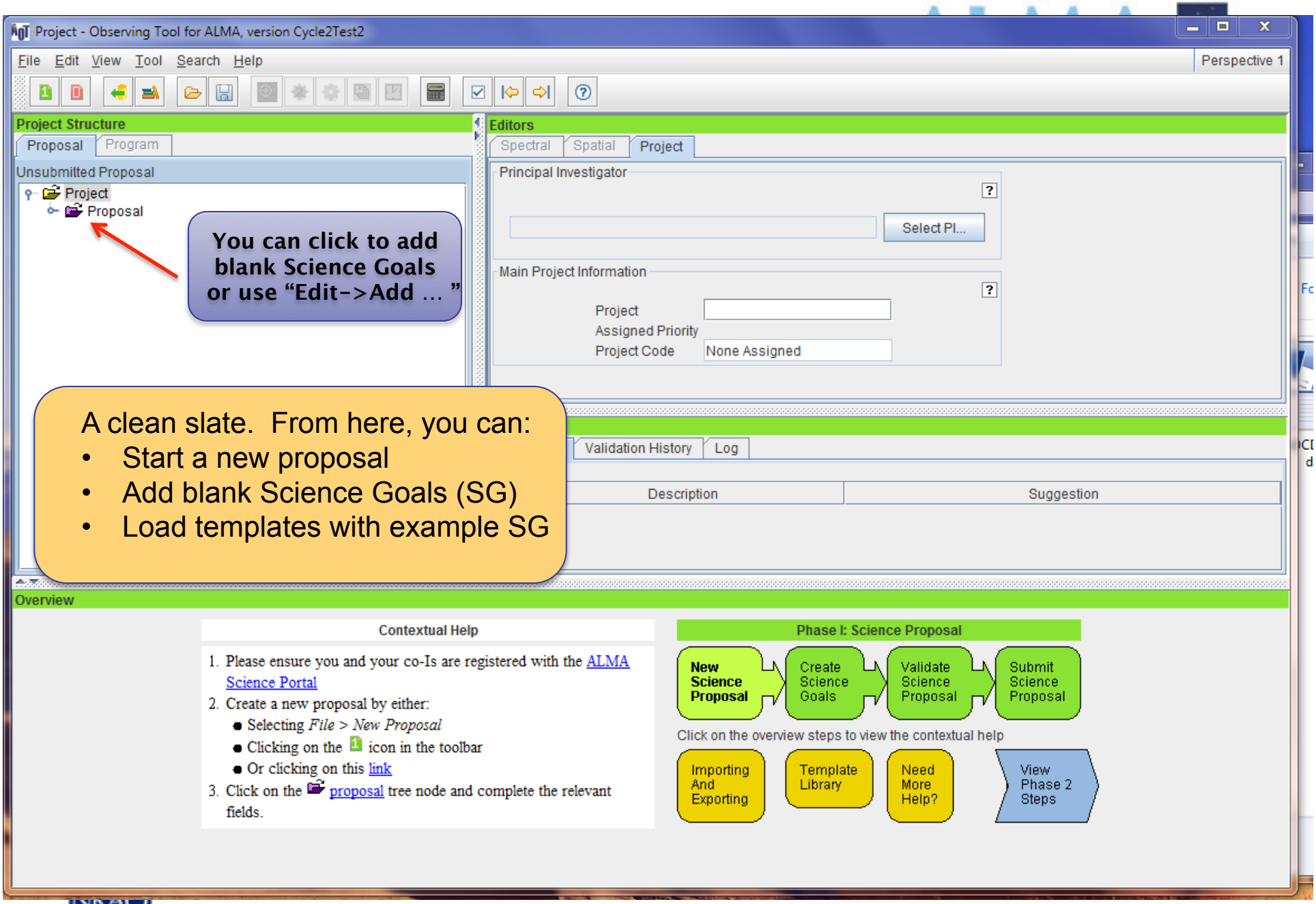
# Be aware of the configuration schedule

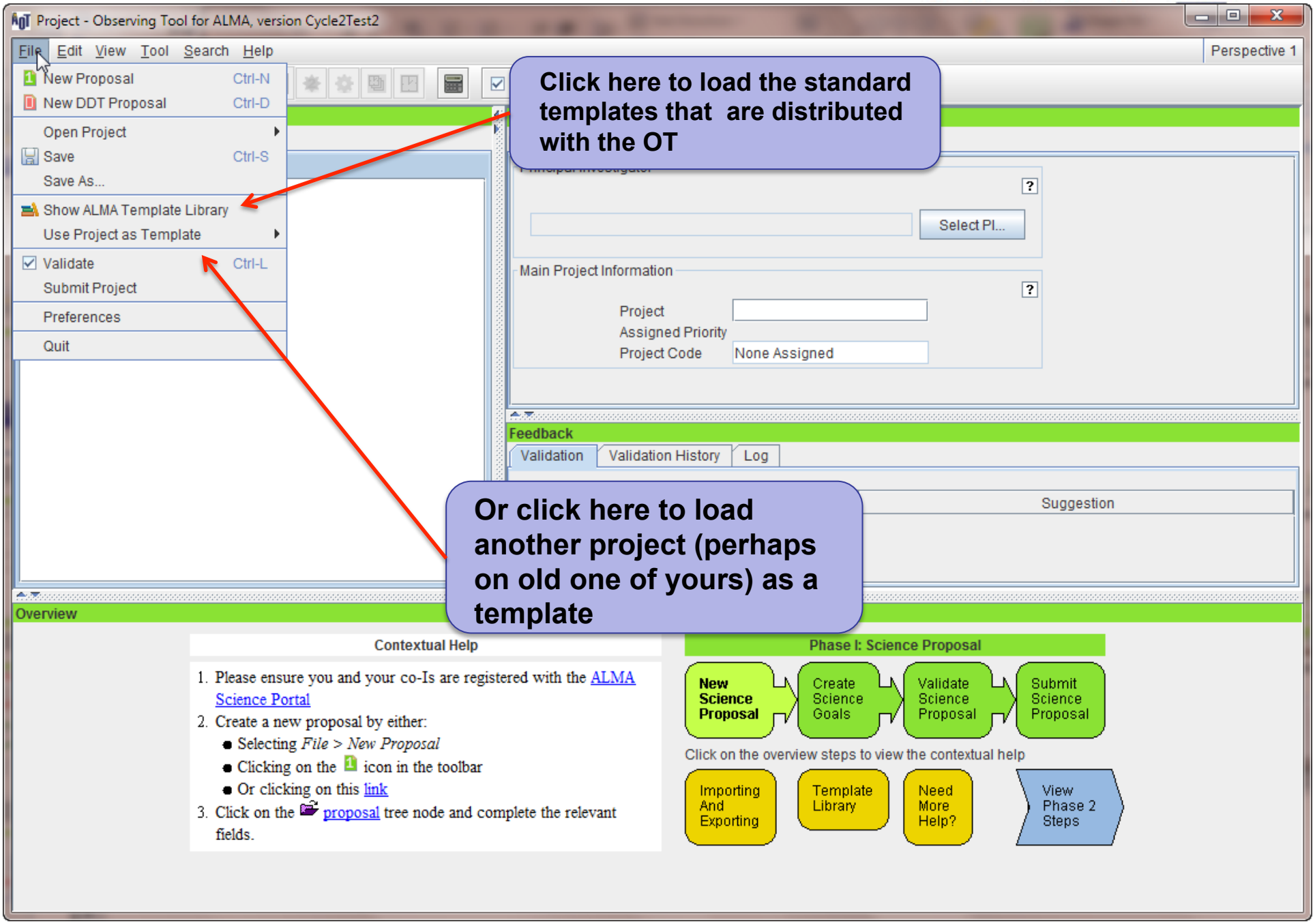
extended

compact

| Start Dates | Configuration | Night LST | Not recommended |
|---|---|---|---|
| **2015 October 1** | C36-8 | ~17h - 9h | High frequency projects especially during day time (LST ~10h-16h) |
| **2015 November 10** | C36-7 | ~19h - 11h | High frequency projects especially during day time (LST ~12h-18h) |
| **2015 December 29 (Maintenance in February)** | C36-1 | ~00h - 16h | High frequency projects any time , specially during day time (LST ~17h-23h) |
| **2016 March 22** | C36-2 | ~04h - 20h | High frequency projects day time (LST ~21h-03h) |
| **2016 April 19** | C36-3 | ~07h - 23h | High frequency projects day time (LST ~00h-06h) |
| **2016 May 10** | C36-4 | ~08h - 00h | High frequency projects day time (LST ~01h-07h) |
| **2016 May 31** | C36-5 | ~10h - 02h | High frequency projects day time (LST ~03h-09h) |
| **2016 July 5** | C36-6 | ~13h - 05h | High frequency projects especially during day time (LST ~06h-12h) |
| **2016 August 30** | C36-7 | ~16h - 08h | High frequency projects especially during day time (LST ~09h-15h) |

Notes for Table 3: Dates include relocation time at the end of every configuration


Project - Observing Tool for ALMA, version Cycle2Test2
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal Program
Unsubmitted Proposal
Project
Proposal
You can click to add blank Science Goals or use "Edit->Add ... "
Editors
Spectral Spatial Project
Principal Investigator
Select PI...
Main Project Information
Project
Assigned Priority
Project Code
None Assigned
Validation History Log
Description
Suggestion
A clean slate. From here, you can:
• Start a new proposal
• Add blank Science Goals (SG)
• Load templates with example SG
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


Project - Observing Tool for ALMA, version Cycle2Test2
File Edit View Tool Search Help
Perspective 1
New Proposal Ctrl-N
New DDT Proposal Ctrl-D
Open Project
Save Ctrl-S
Save As...
Show ALMA Template Library
Use Project as Template
Validate Ctrl-L
Submit Project
Preferences
Quit
Click here to load the standard templates that are distributed with the OT
Select PI...
Main Project Information
Project
Assigned Priority
Project Code
None Assigned
Feedback
Validation
Validation History
Log
Suggestion
Or click here to load another project (perhaps on old one of yours) as a template
Overview
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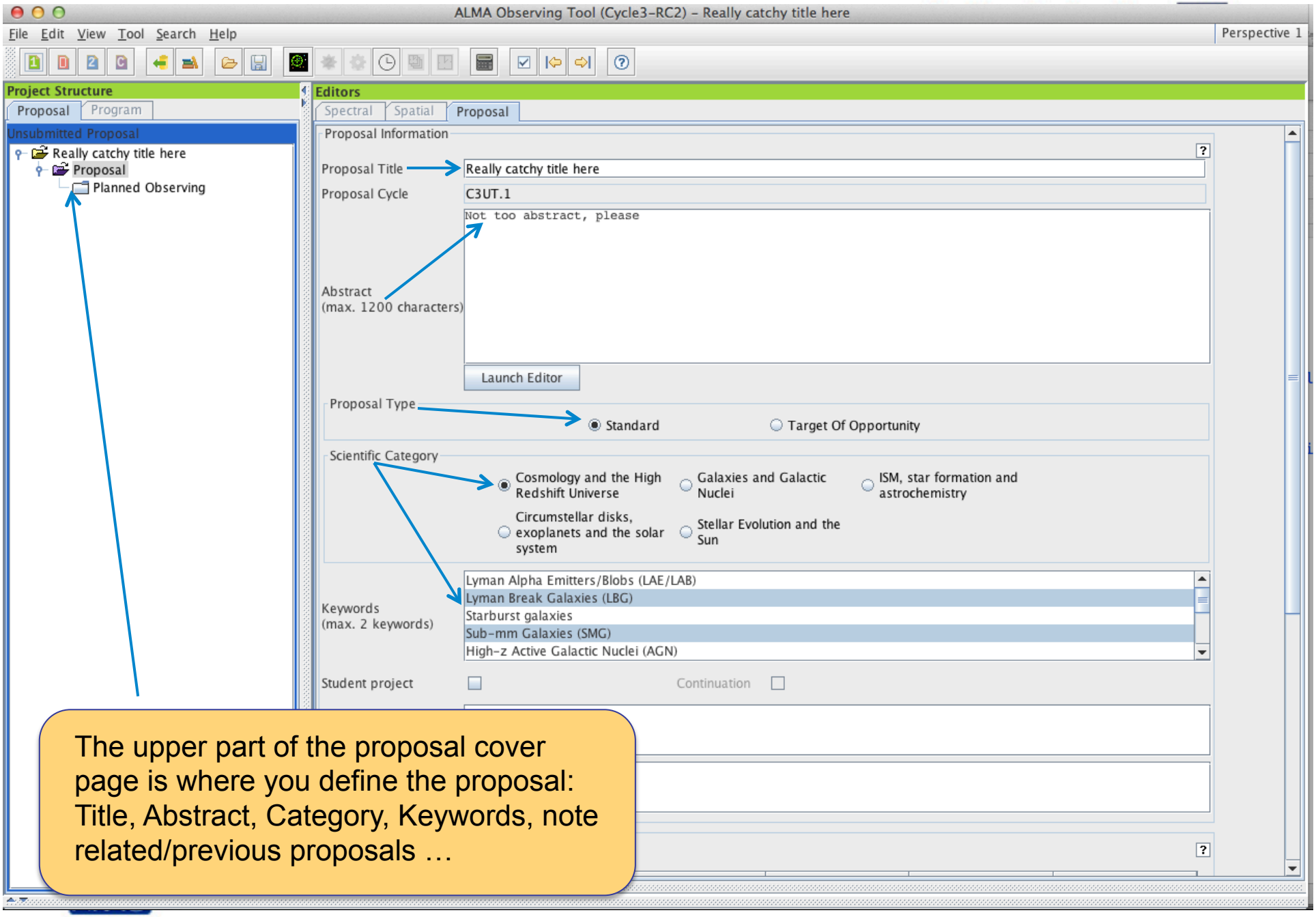
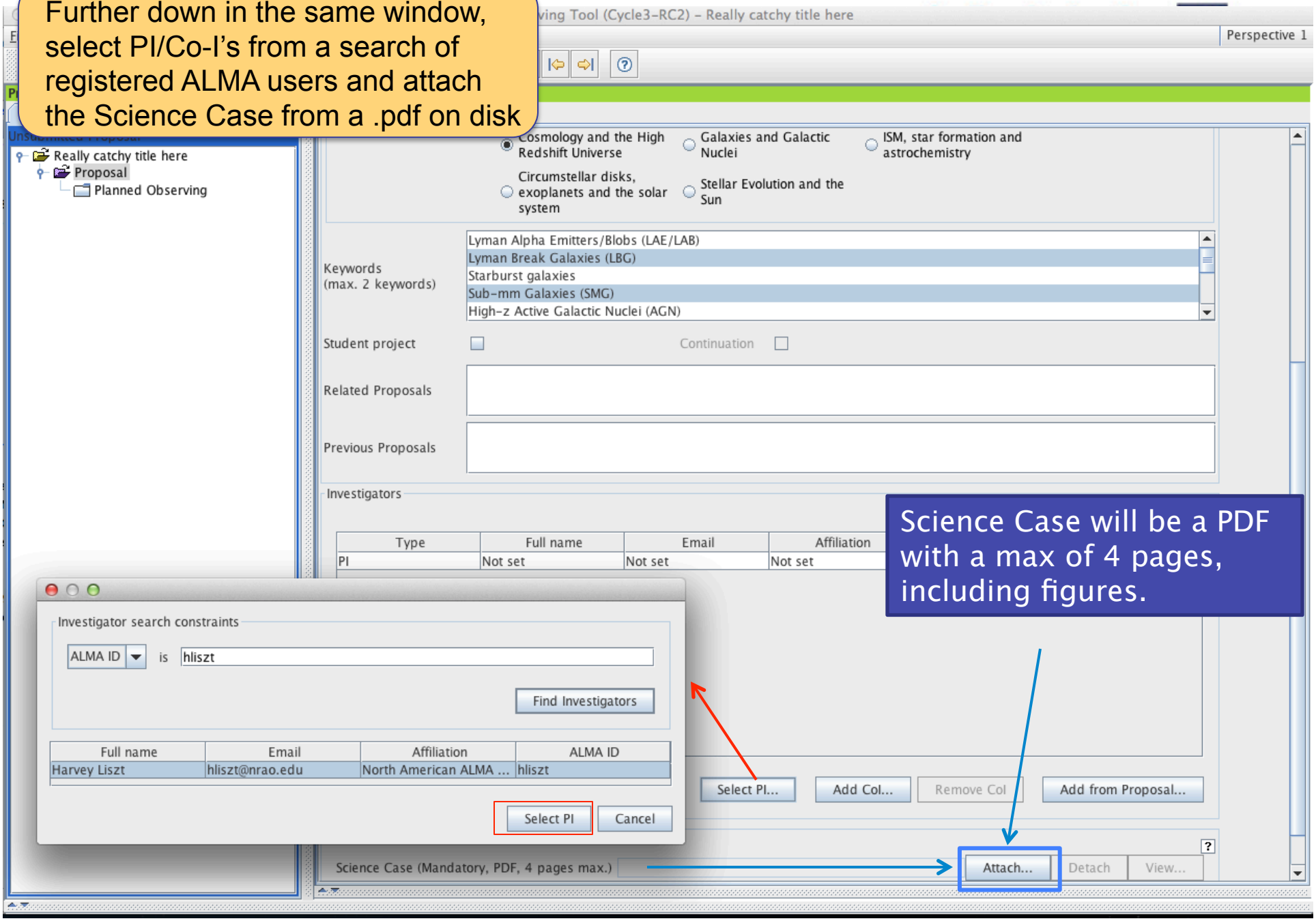
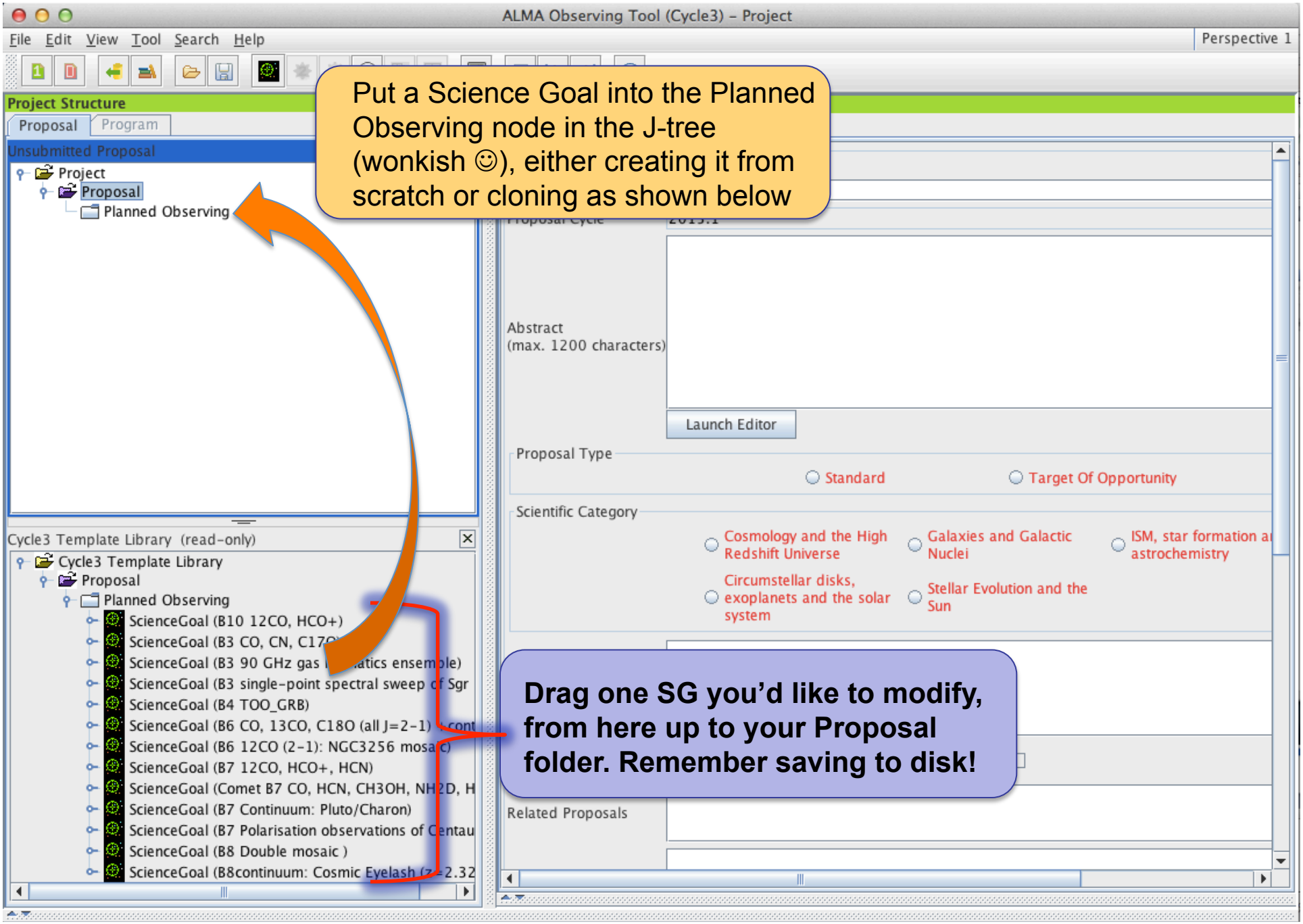


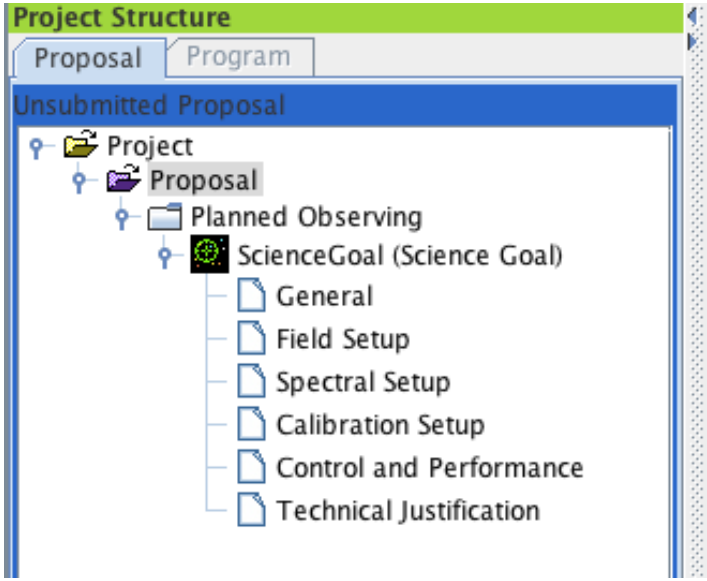

The upper part of the proposal cover page is where you define the proposal: Title, Abstract, Category, Keywords, note related/previous proposals …

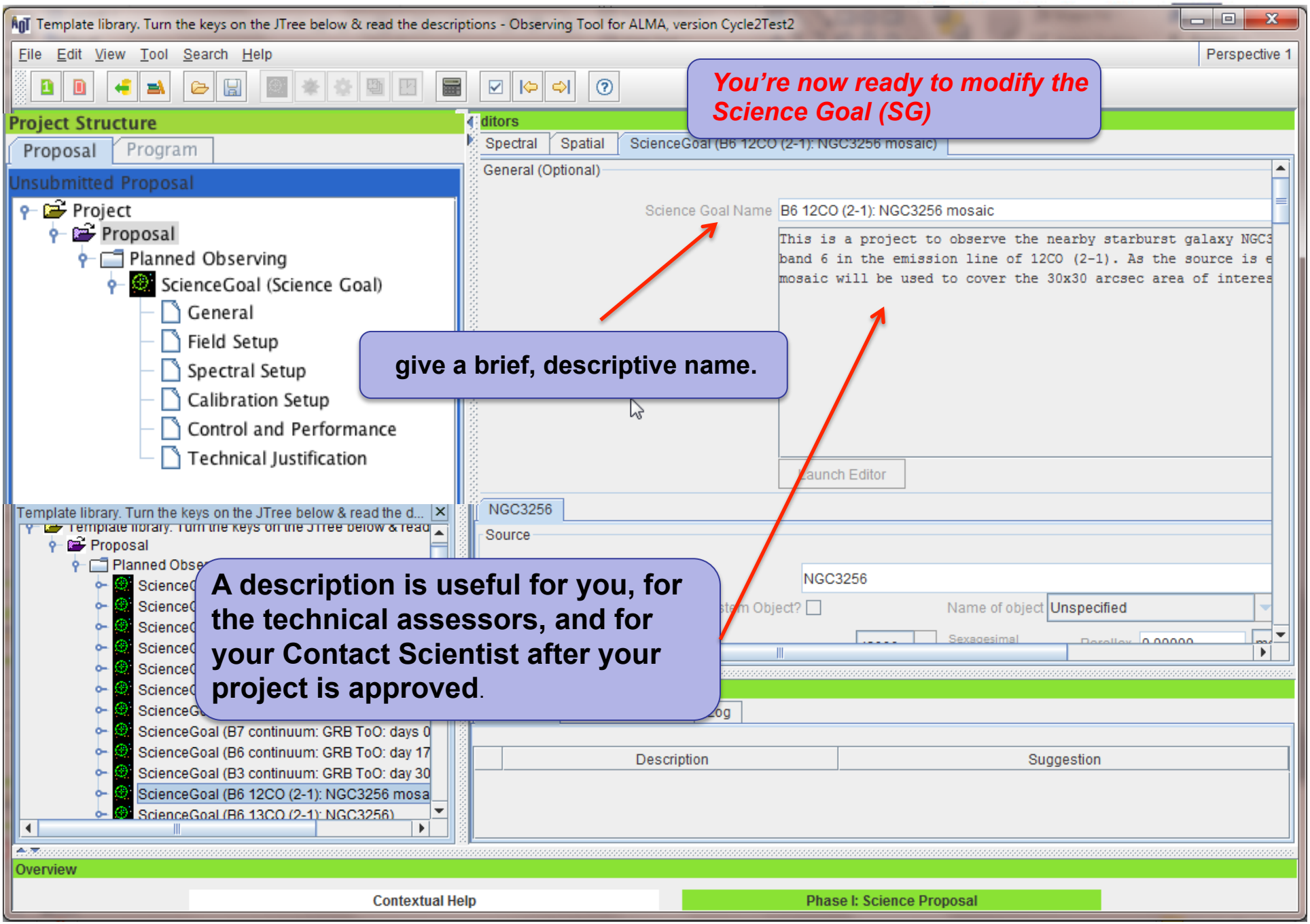
Further down in the same window, select PI/Co-I's from a search of registered ALMA users and attach the Science Case from a .pdf on disk

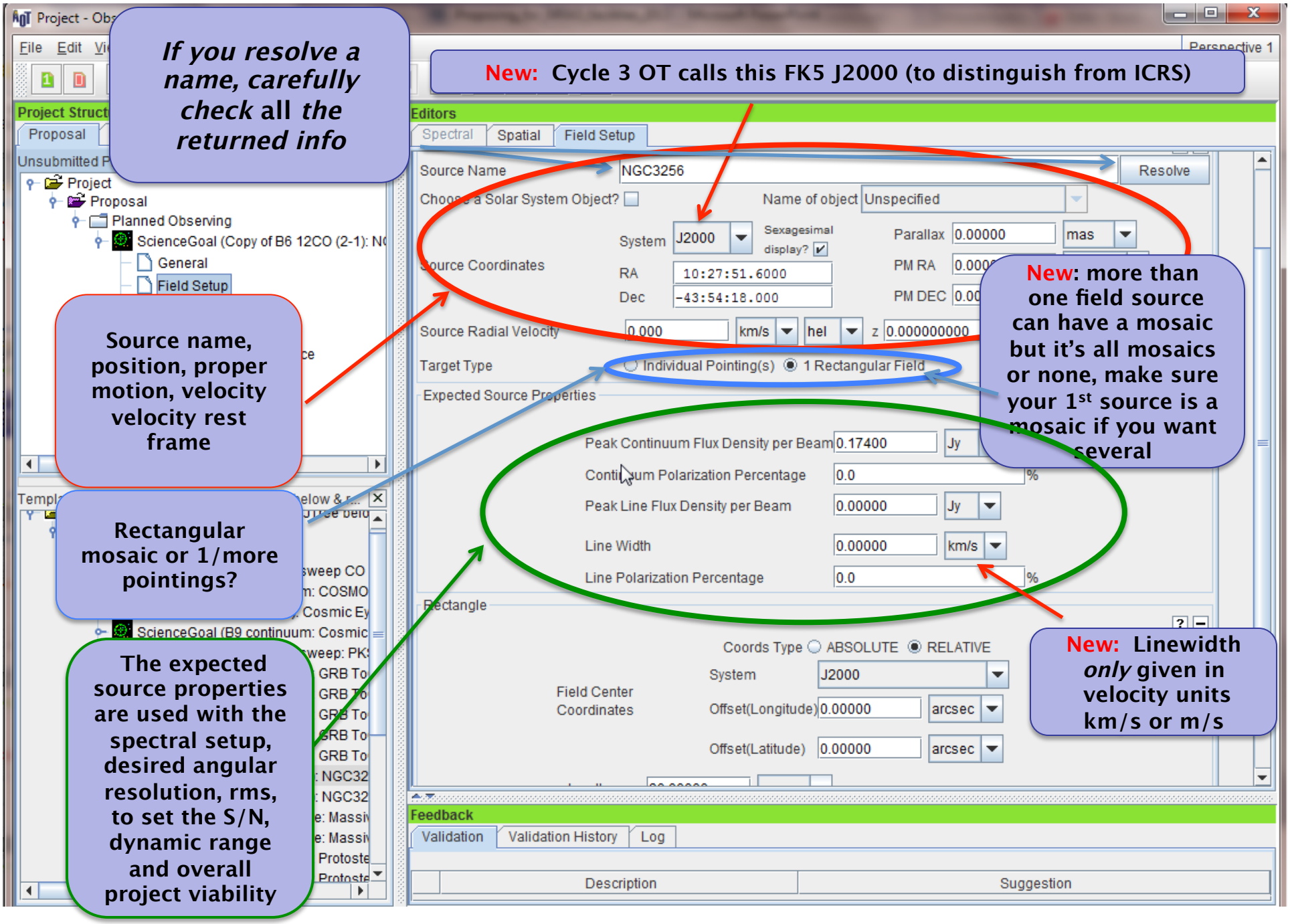



Science Case will be a PDF with a max of 4 pages, including figures.

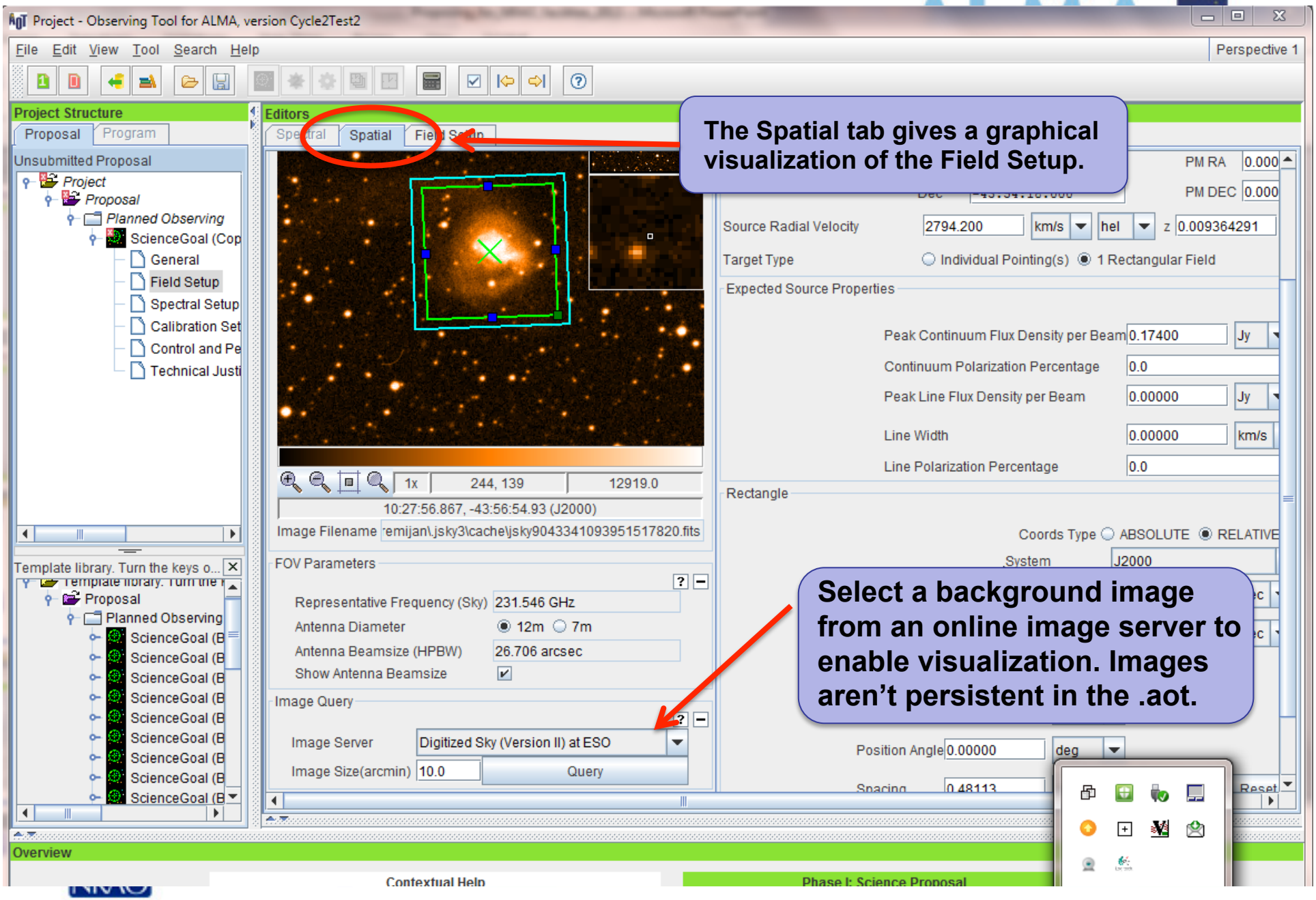

ALMA Observing Tool (Cycle3) – Project
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
Put a Science Goal into the Planned Observing node in the J-tree (wonkish ☺), either creating it from scratch or cloning as shown below
Cycle3 Template Library (read-only)
Cycle3 Template Library
Proposal
Planned Observing
ScienceGoal (B10 12CO, HCO+)
ScienceGoal (B3 CO, CN, C17O)
ScienceGoal (B3 90 GHz gas kinematics ensemble)
ScienceGoal (B3 single-point spectral sweep of Sgr
ScienceGoal (B4 TOO_GRB)
ScienceGoal (B6 CO, 13CO, C18O (all J=2-1) +cont
ScienceGoal (B6 12CO (2-1): NGC3256 mosaic)
ScienceGoal (B7 12CO, HCO+, HCN)
ScienceGoal (Comet B7 CO, HCN, CH3OH, NH2D, H
ScienceGoal (B7 Continuum: Pluto/Charon)
ScienceGoal (B7 Polarisation observations of Centau
ScienceGoal (B8 Double mosaic )
ScienceGoal (B8continuum: Cosmic Eyelash (z=2.32
Abstract
(max. 1200 characters)
Launch Editor
Proposal Type
Standard
Target Of Opportunity
Scientific Category
Cosmology and the High Redshift Universe
Galaxies and Galactic Nuclei
ISM, star formation and astrochemistry
Circumstellar disks, exoplanets and the solar system
Stellar Evolution and the Sun
Drag one SG you'd like to modify, from here up to your Proposal folder. Remember saving to disk!
Related Proposals


Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Science Goal)
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification


Template library. Turn the keys on the JTree below & read the descriptions - Observing Tool for ALMA, version Cycle2Test2
File Edit View Tool Search Help
Perspective 1
You're now ready to modify the Science Goal (SG)
Project Structure
Proposal Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Science Goal)
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Spectral Spatial ScienceGoal (B6 12CO (2-1): NGC3256 mosaic)
General (Optional)
Science Goal Name B6 12CO (2-1): NGC3256 mosaic
This is a project to observe the nearby starburst galaxy NGC3
band 6 in the emission line of 12CO (2-1). As the source is e
mosaic will be used to cover the 30x30 arcsec area of interes
give a brief, descriptive name.
NGC3256
Source
NGC3256
Name of object Unspecified
A description is useful for you, for the technical assessors, and for your Contact Scientist after your project is approved.
ScienceGoal (B7 continuum: GRB ToO: days 0
ScienceGoal (B6 continuum: GRB ToO: day 17
ScienceGoal (B3 continuum: GRB ToO: day 30
ScienceGoal (B6 12CO (2-1): NGC3256 mosa
Description
Suggestion
Overview
Contextual Help
Phase I: Science Proposal


If you resolve a name, carefully check all the returned info
New: Cycle 3 OT calls this FK5 J2000 (to distinguish from ICRS)
Source name, position, proper motion, velocity velocity rest frame
Rectangular mosaic or 1/more pointings?
The expected source properties are used with the spectral setup, desired angular resolution, rms, to set the S/N, dynamic range and overall project viability
New: more than one field source can have a mosaic but it's all mosaics or none, make sure your 1st source is a mosaic if you want several
New: Linewidth only given in velocity units km/s or m/s
Source Name
NGC3256
Resolve
Choose a Solar System Object?
Name of object
Unspecified
System
J2000
Sexagesimal display?
Parallax
0.00000
mas
Source Coordinates
RA
10:27:51.6000
Dec
-43:54:18.000
PM RA
PM DEC
Source Radial Velocity
0.000
km/s
hel
z
0.000000000
Target Type
Individual Pointing(s)
1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Beam
0.17400
Jy
Continuum Polarization Percentage
0.0
%
Peak Line Flux Density per Beam
0.00000
Jy
Line Width
0.00000
km/s
Line Polarization Percentage
0.0
%
Rectangle
Coords Type
ABSOLUTE
RELATIVE
Field Center Coordinates
System
J2000
Offset(Longitude)
0.00000
arcsec
Offset(Latitude)
0.00000
arcsec
Feedback
Validation
Validation History
Log
Description
Suggestion
Project Structure
Proposal
Project
Proposal
Planned Observing
ScienceGoal (Copy of B6 12CO (2-1): N
General
Field Setup
Editors
Spectral
Spatial
Field Setup
File
Edit
Perspective 1

# New: Put a mosaic around more than one field source



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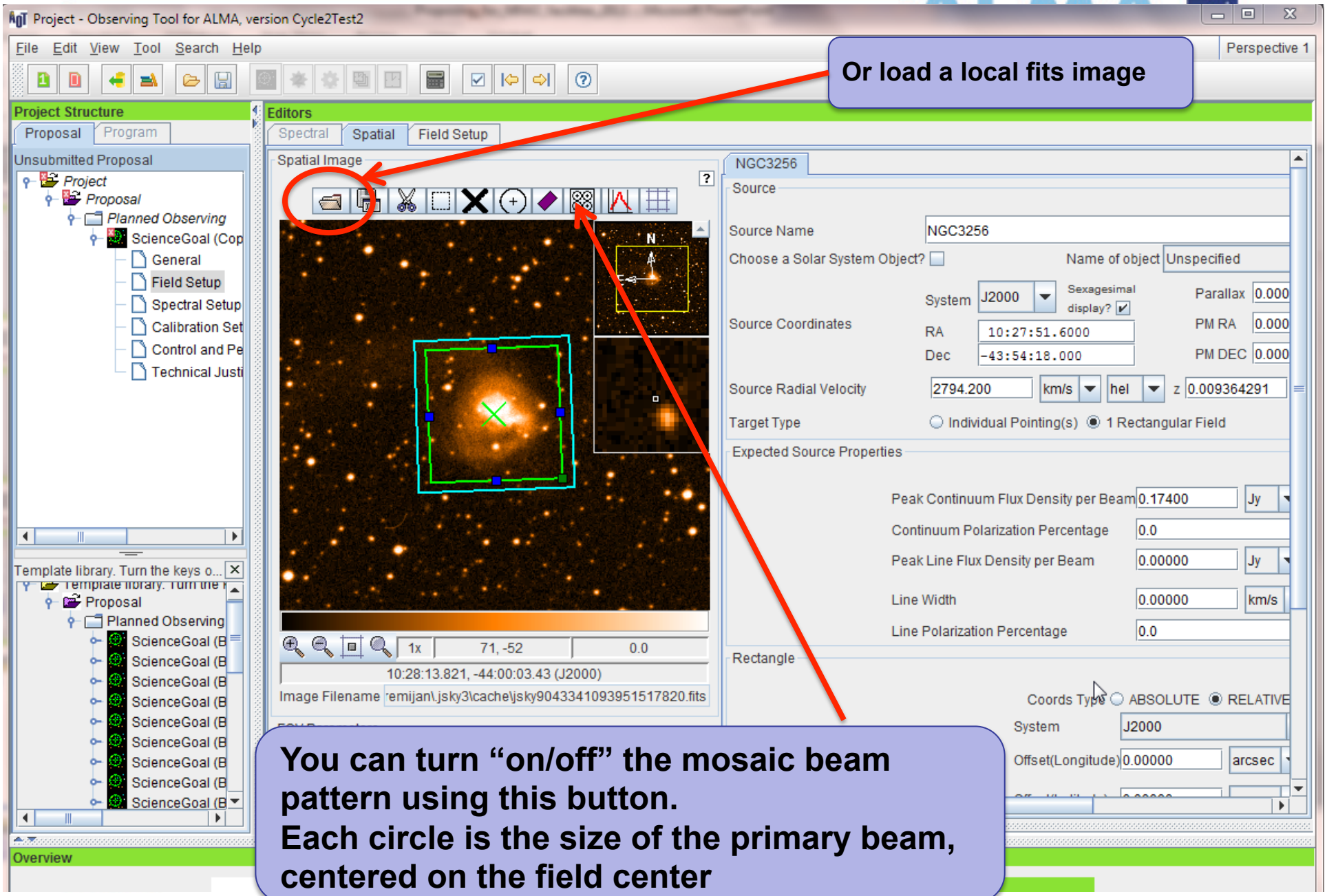
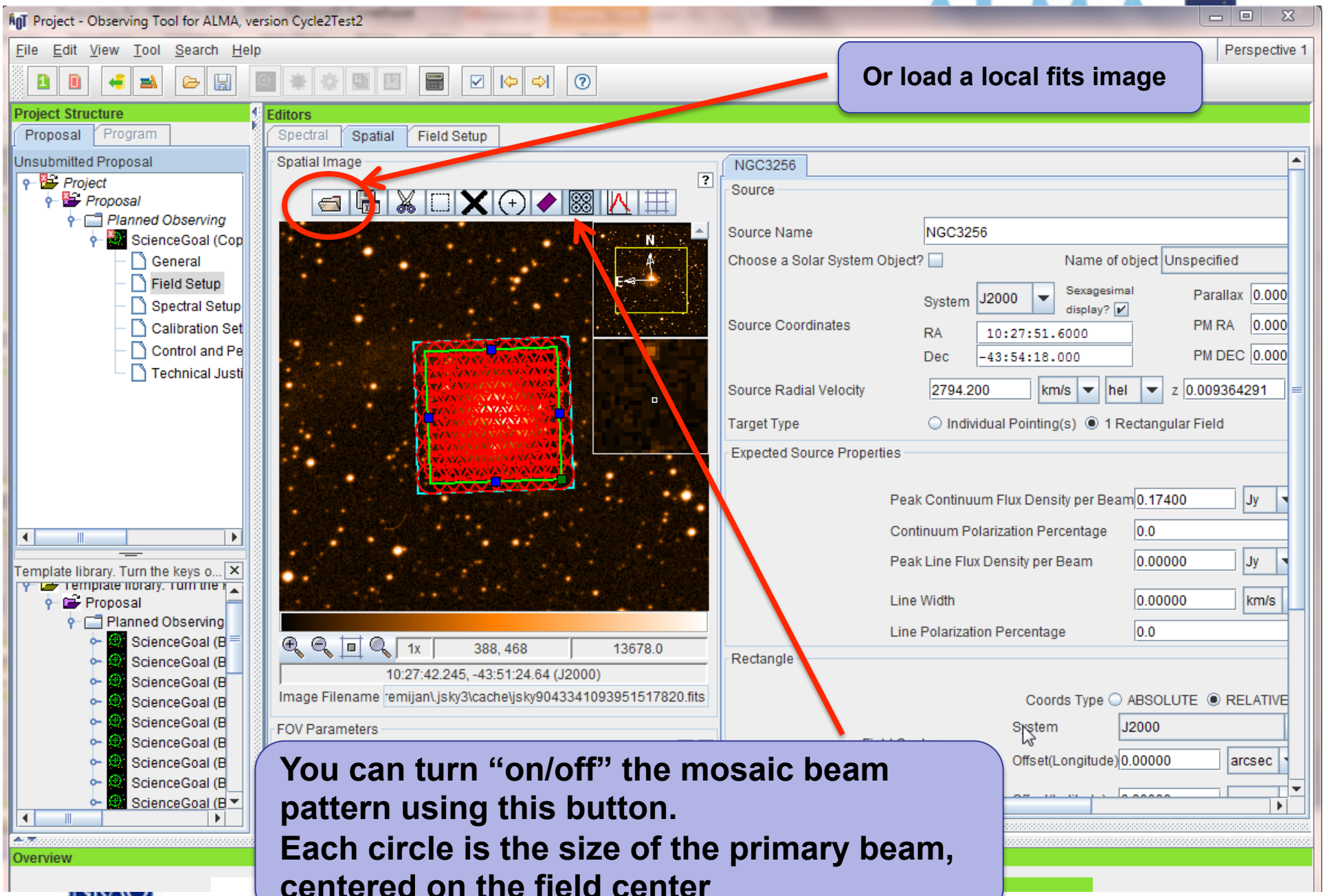



**You can turn "on/off" the mosaic beam pattern using this button.**
**Each circle is the size of the primary beam, centered on the field center**

# New: Put a mosaic around more than one field source

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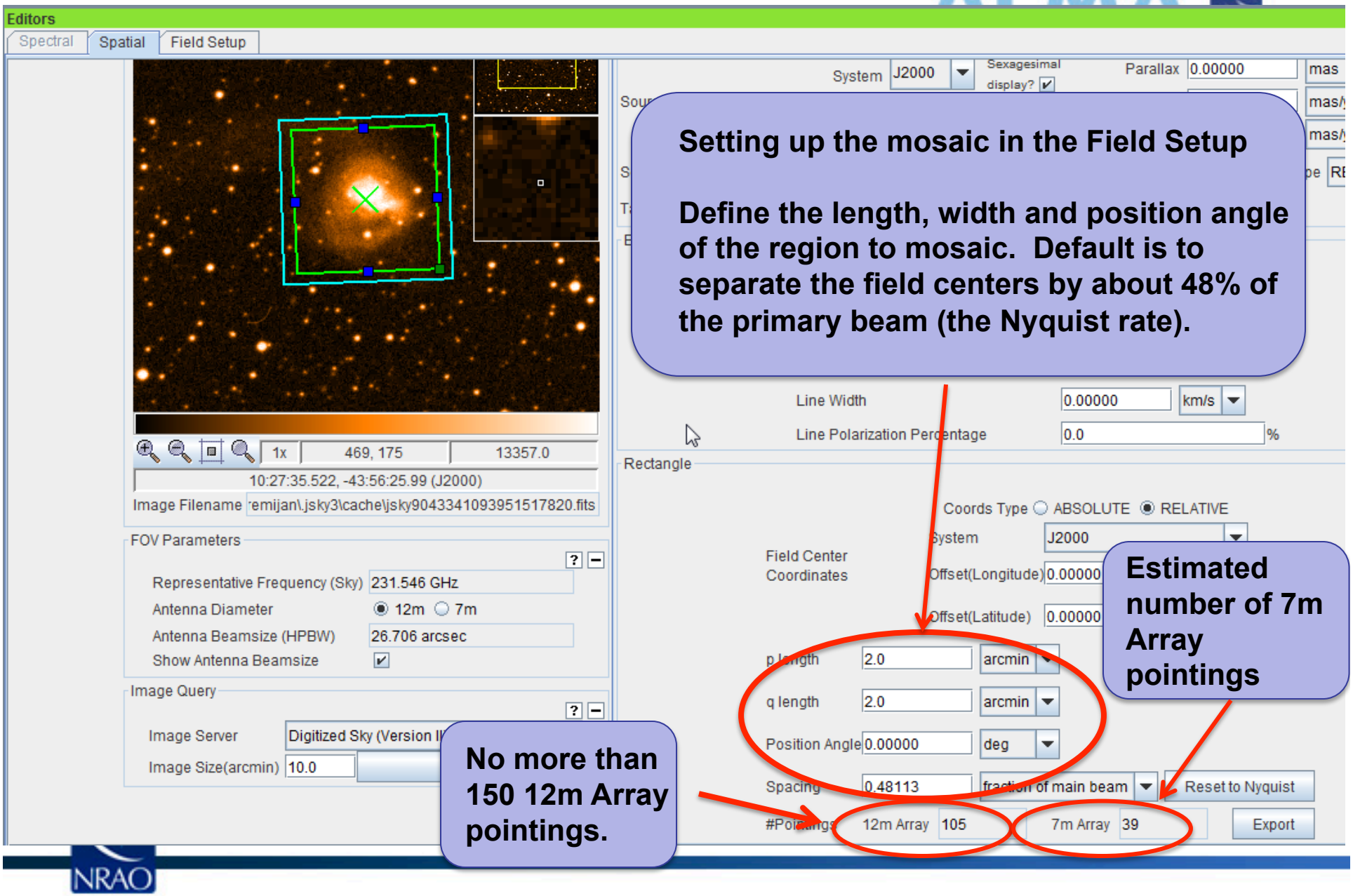
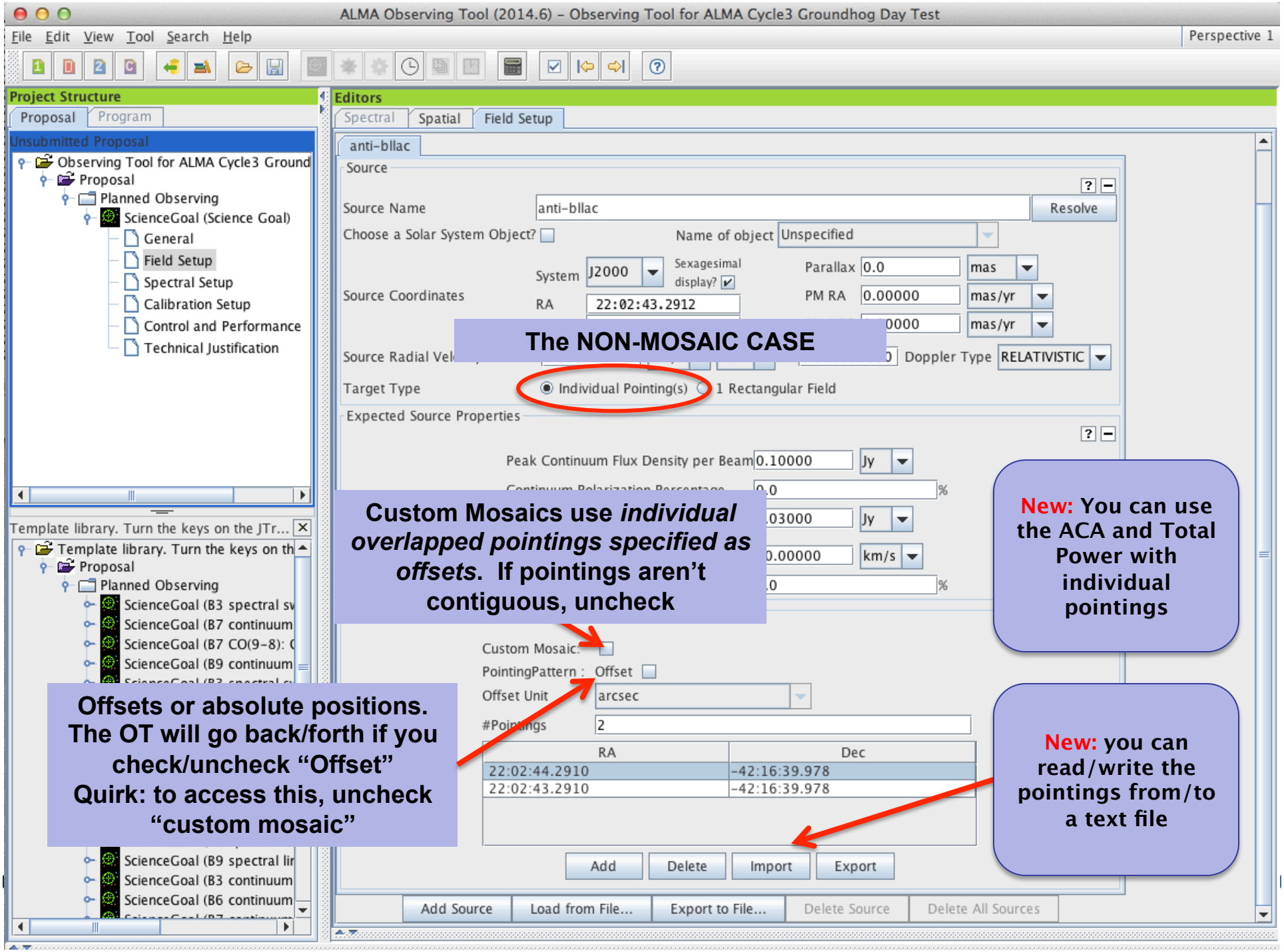



**Setting up the mosaic in the Field Setup**

**Define the length, width and position angle of the region to mosaic. Default is to separate the field centers by about 48% of the primary beam (the Nyquist rate).**

**Estimated number of 7m Array pointings**

**No more than 150 12m Array pointings.**


ALMA Observing Tool (2014.6) – Observing Tool for ALMA Cycle3 Groundhog Day Test
File Edit View Tool Search Help
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Observing Tool for ALMA Cycle3 Ground
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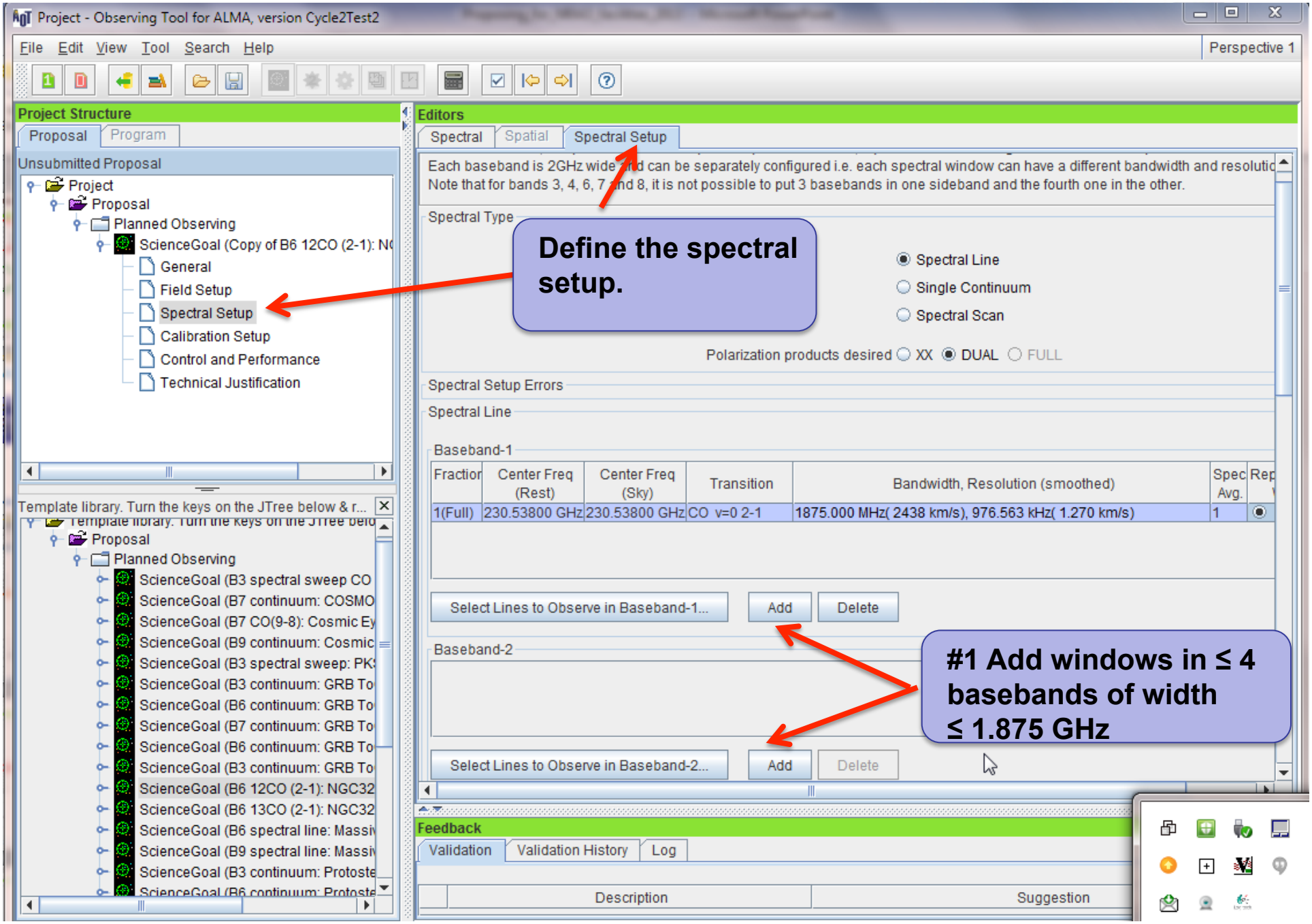
Editors
Spectral Spatial Field Setup
anti-bllac
Source
Source Name anti-bllac Resolve
Choose a Solar System Object?
Name of object Unspecified
Source Coordinates
System J2000
Sexagesimal display?
RA 22:02:43.2912
Parallax 0.0 mas
PM RA 0.00000 mas/yr
mas/yr
Source Radial Vel
Doppler Type RELATIVISTIC
Target Type
Individual Pointing(s)
1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Beam 0.10000 Jy
Jy
km/s
Custom Mosaic
PointingPattern : Offset
Offset Unit arcsec
#Pointings 2
RA Dec
22:02:44.2910 -42:16:39.978
22:02:43.2910 -42:16:39.978
Add Delete Import Export
Add Source Load from File... Export to File... Delete Source Delete All Sources
Template library. Turn the keys on the JTr...
Template library. Turn the keys on th
Proposal
Planned Observing
ScienceGoal (B3 spectral sv
ScienceGoal (B7 continuum
ScienceGoal (B7 CO(9-8): C
ScienceGoal (B9 continuum
ScienceGoal (B9 spectral lir
ScienceGoal (B3 continuum
ScienceGoal (B6 continuum
The NON-MOSAIC CASE
Custom Mosaics use individual overlapped pointings specified as offsets. If pointings aren't contiguous, uncheck
New: You can use the ACA and Total Power with individual pointings
Offsets or absolute positions. The OT will go back/forth if you check/uncheck "Offset" Quirk: to access this, uncheck "custom mosaic"
New: you can read/write the pointings from/to a text file


Project - Observing Tool for ALMA, version Cycle2Test2
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ScienceGoal (Copy of B6 12CO (2-1): N
General
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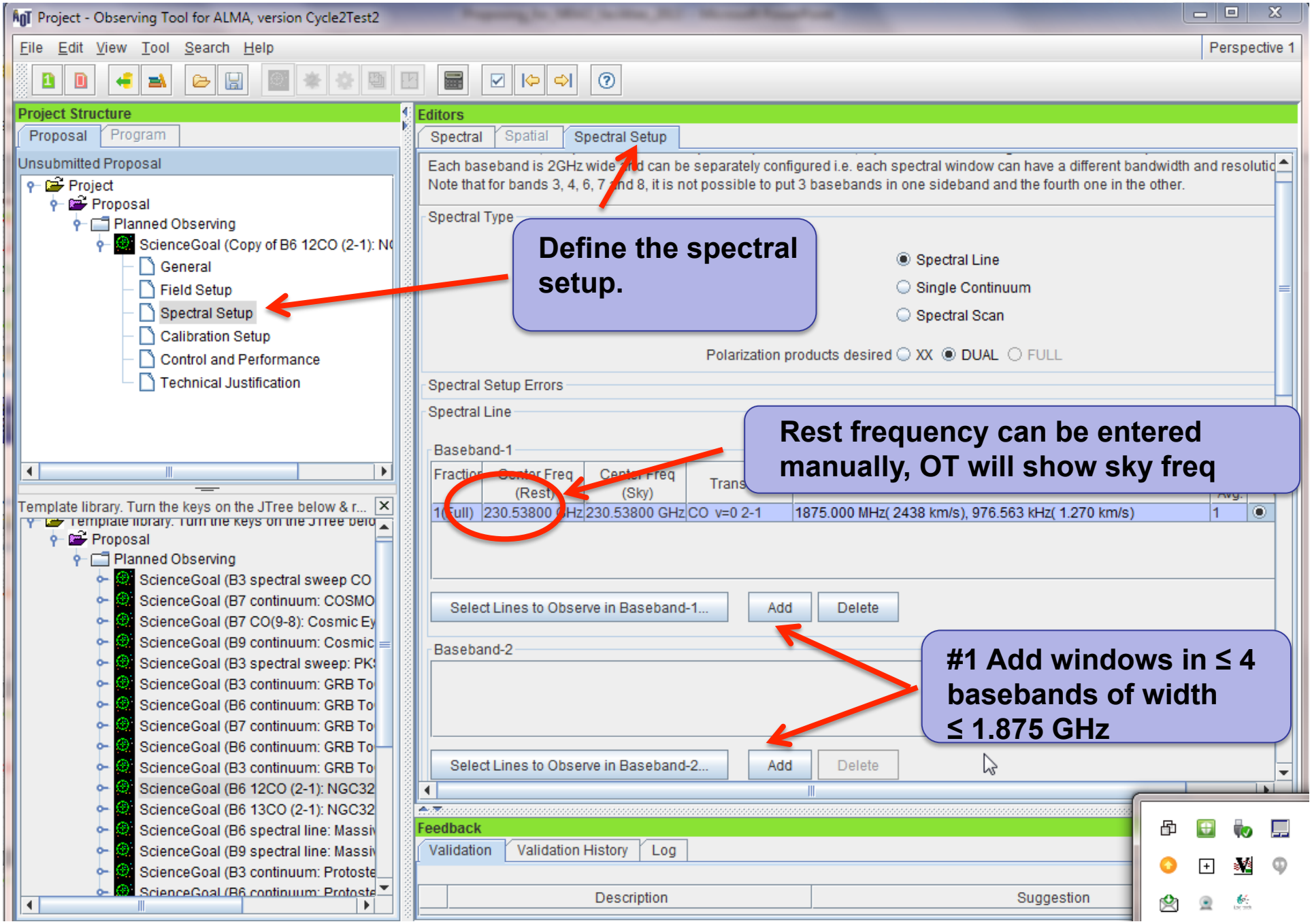
Template library. Turn the keys on the JTree below & r...
Proposal
Planned Observing
ScienceGoal (B3 spectral sweep CO
ScienceGoal (B7 continuum: COSMO
ScienceGoal (B7 CO(9-8): Cosmic Ey
ScienceGoal (B9 continuum: Cosmic
ScienceGoal (B3 spectral sweep: PK
ScienceGoal (B3 continuum: GRB To
ScienceGoal (B6 continuum: GRB To
ScienceGoal (B7 continuum: GRB To
ScienceGoal (B6 continuum: GRB To
ScienceGoal (B3 continuum: GRB To
ScienceGoal (B6 12CO (2-1): NGC32
ScienceGoal (B6 13CO (2-1): NGC32
ScienceGoal (B6 spectral line: Massi
ScienceGoal (B9 spectral line: Massi
ScienceGoal (B3 continuum: Protoste
Editors
Spectral Spatial Spectral Setup
Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolutio
Note that for bands 3, 4, 6, 7 and 8, it is not possible to put 3 basebands in one sideband and the fourth one in the other.
Spectral Type
Spectral Line
Single Continuum
Spectral Scan
Polarization products desired XX DUAL FULL
Spectral Setup Errors
Spectral Line
Baseband-1
Fraction | Center Freq (Rest) | Center Freq (Sky) | Transition | Bandwidth, Resolution (smoothed) | Spec Avg. | Rep
1(Full) | 230.53800 GHz | 230.53800 GHz | CO v=0 2-1 | 1875.000 MHz( 2438 km/s), 976.563 kHz( 1.270 km/s) | 1
Select Lines to Observe in Baseband-1... Add Delete
Baseband-2
Select Lines to Observe in Baseband-2... Add Delete
Feedback
Validation Validation History Log
Description Suggestion
Define the spectral setup.
#1 Add windows in ≤ 4 basebands of width ≤ 1.875 GHz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ScienceGoal (B6 continuum: GRB To
ScienceGoal (B7 continuum: GRB To
ScienceGoal (B6 continuum: GRB To
ScienceGoal (B3 continuum: GRB To
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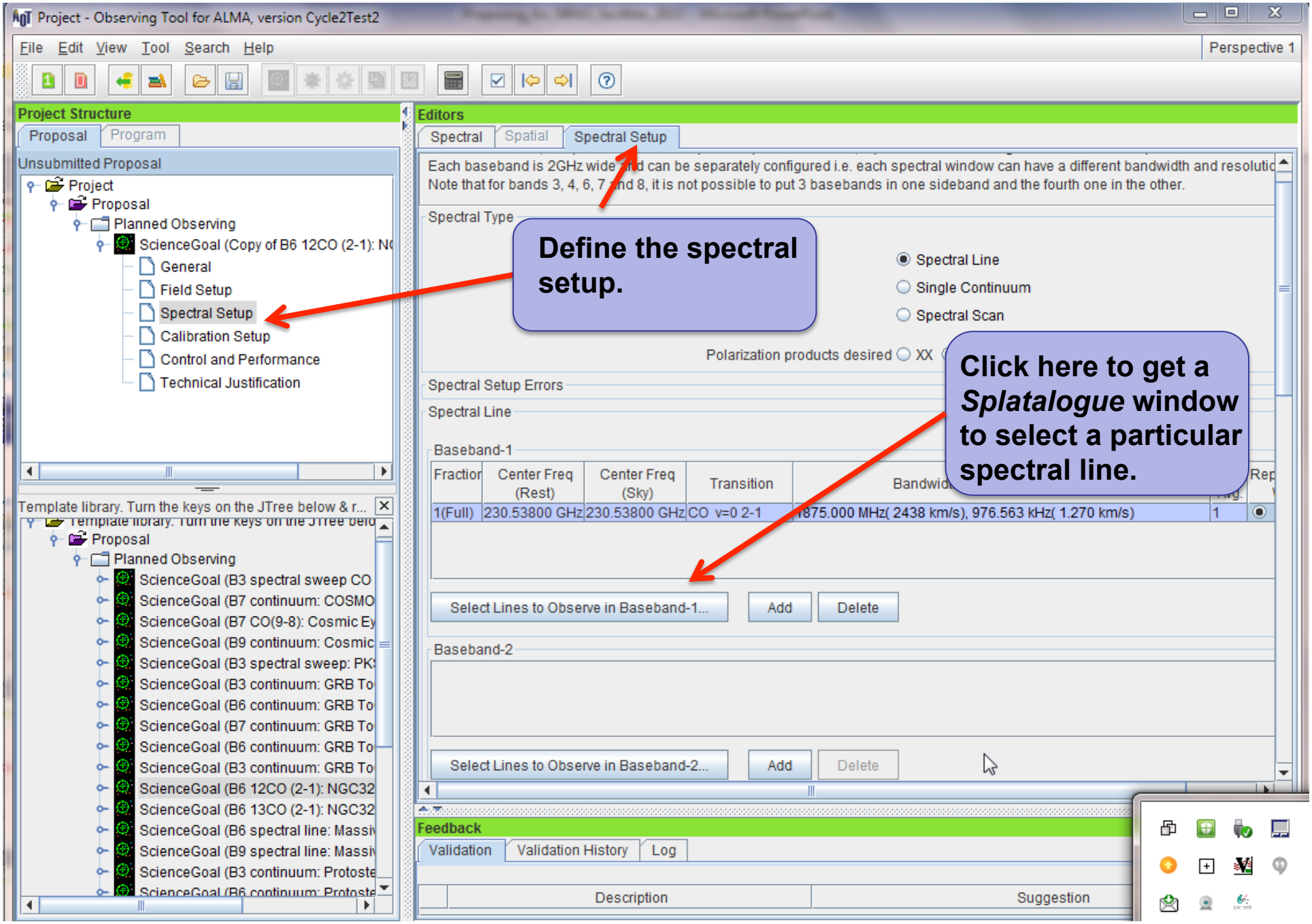
Spectral Line
Baseband-1
Fraction
Center Freq (Rest)
Center Freq (Sky)
Trans
1(Full) 230.53800 GHz 230.53800 GHz CO v=0 2-1 1875.000 MHz( 2438 km/s), 976.563 kHz( 1.270 km/s) 1
Select Lines to Observe in Baseband-1...
Add
Delete
Baseband-2
Select Lines to Observe in Baseband-2...
Add
Delete
Feedback
Validation Validation History Log
Description
Suggestion
Define the spectral setup.
Rest frequency can be entered manually, OT will show sky freq
#1 Add windows in ≤ 4 basebands of width ≤ 1.875 GHz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Spectral Line
Single Continuum
Spectral Scan
Polarization products desired XX
Spectral Setup Errors
Spectral Line
Baseband-1
Fraction
Center Freq (Rest)
Center Freq (Sky)
Transition
Bandwid
Rep
1(Full) 230.53800 GHz 230.53800 GHz CO v=0 2-1 1875.000 MHz( 2438 km/s), 976.563 kHz( 1.270 km/s) 1
Select Lines to Observe in Baseband-1...
Add
Delete
Baseband-2
Select Lines to Observe in Baseband-2...
Add
Delete
Feedback
Validation Validation History Log
Description
Suggestion
Define the spectral setup.
Click here to get a *Splatalogue* window to select a particular spectral line.

Select Spectral Lines

**Transition Filter**

CO*

☑ Include description

**Frequency Filters**

**ALMA Band**

1 2 3 4 5 6 7 8 9 10

**Sky Frequency (GHz)**

Min 31.3 Max 950

**Receiver/Back End Configuration**

☐ Hide unobservable lines

Filtering unobservable lines

**Maximum Upper-state Energy (K)**

0 20 40 60 80 100 ∞

**Molecule Filter / Environment**

Show all atoms and molecules

Can't find the transition you're looking for in the offline pool? Find more in the online Splatalogue.

Find More...

Reset Filters

**Transitions matching your filter settings:**

(double-click column header for primary sort, single-click subsequent columns for secondary sorting. Single clicks will reverse sort order of alread

| Transition | Description | Rest Frequency | Sky Frequency | Upper-state Energy | Lovas Intensity | |
|---|---|---|---|---|---|---|
| CO v=2 1-0 | Carbon Monoxide | 113.172 GHz | 113.172 GHz | 6134.675 K | | 0.01 |
| CO v=1 1-0 | Carbon Monoxide | 114.222 GHz | 114.222 GHz | 3089.154 K | | 0.01 |
| CO v=0 1-0 | Carbon Monoxide | 115.271 GHz | 115.271 GHz | 5.532 K | 60 | 0.01 |
| CO v=2 2-1 | Carbon Monoxide | 226.34 GHz | 226.34 GHz | 6145.538 K | | 0.02 |
| CO v=1 2-1 | Carbon Monoxide | 228.439 GHz | 228.439 GHz | 3100.118 K | 0.62 | 0.02 |
| CO v=0 2-1 | Carbon Monoxide | 230.538 GHz | 230.538 GHz | 16.596 K | 70 | 0.02 |
| CO+ J=2-1, F=3/2-1/2 | Carbon Monoxide Ion | 235.79 GHz | 235.79 GHz | | 0.1 | 0.66 |
| CO+ J=2-1, F=5/2-3/2 | Carbon Monoxide Ion | 236.063 GHz | 236.063 GHz | | 0.1 | 1.2 |
| CO v=2 3-2 | Carbon Monoxide | 339.5 GHz | 339.5 GHz | 6161.831 K | | 0.03 |
| CO v=1 3 | | 342.648 GHz | 342.648 GHz | 3116.561 K | 0.71 | 0.03 |
| CO v=0 3 | | 345.796 GHz | 345.796 GHz | 33.192 K | 70 | 0.03 |
| CO+ J=3 | | 353.741 GHz | 353.741 GHz | | 0.1 | 1.2 |
| CO+ J=3-2, F=7/2-5/2 | Carbon Monoxide Ion | 354.014 GHz | 354.014 GHz | | 0.18 | 1.71 |
| CO v=2 4-3 | Carbon Monoxide | 452.645 GHz | 452.645 GHz | 6183.555 K | | 0.04 |
| CO v=1 4-3 | Carbon Monoxide | 456.843 GHz | 456.843 GHz | 3138.486 K | | 0.04 |
| CO v=0 4-3 | Carbon Monoxide | 461.041 GHz | 461.041 GHz | 55.317 K | 60 | 0.04 |
| CO v=2 5-4 | Carbon Monoxide | 565.774 GHz | 565.774 GHz | 6210.707 K | | 0.06 |
| CO v=1 5-4 | Carbon Monoxide | 571.021 GHz | 571.021 GHz | 3165.891 K | | 0.06 |
| CO v=0 5-4 | Carbon Monoxide | 576.268 GHz | 576.268 GHz | 82.974 K | | 0.06 |
| CO | | | 678.88 GHz | 6243.288 K | | 0.07 |
| CO | | | 685.176 GHz | 3198.774 K | | 0.07 |
| CO | | | 691.473 GHz | 116.159 K | 100 | 0.07 |
| CO | | | 791.96 GHz | 6281.296 K | | 0.08 |
| CO v=1 7-6 | Carbon Monoxide | 799.306 GHz | 799.306 GHz | 3237.134 K | | 0.08 |
| CO v=0 7-6 | Carbon Monoxide | 806.652 GHz | 806.652 GHz | 154.872 K | 110 | 0.08 |
| CO v=2 8-7 | Carbon Monoxide | 905.009 GHz | 905.009 GHz | 6324.729 K | | 0.09 |

Add to Selected Transitions

**Selected transitions**

| Transition | Description | Rest Frequency | Sky Fre |
|---|---|---|---|
| CO v=0 2-1 | | 230.538 GHz | 230.538 GHz |

Remove from Selected Transitions

**Select a line from the list**

**Filters can be used to narrow the search**

NRAO

Project - Observing Tool for ALMA, version Cycle2Test2

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Copy of B6 12CO (2-1): N
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

**Editors**

Spectral | Spatial | Spectral Setup

Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolution.
Note that for bands 3, 4, 6, 7 and 8, it is not possible to put 3 basebands in one sideband and the fourth one in the other.

Spectral Type

Spectral Type: Spectral Line / Single Continuum / Spectral Scan

Polarization products desired: XX / DUAL / FULL

Spectral Setup Errors

Spectral Line

Baseband-1

| Fraction | Center Freq (Rest) | Center Freq (Sky) | Transition | Bandwidth, Resolution (smoothed) | Spec Avg. | Representativ Window |
|---|---|---|---|---|---|---|
| 1(Full) | 230.53800 GHz | 230.53800 GHz | CO, v=0, J=2-1 | 1875.000 MHz( 2438 km/s), 976.563 kHz( 1.270 km/ | 1 | |

58.594 MHz( 76 km/s), 30.518 kHz( 0.040 km/s)
117.188 MHz( 152 km/s), 61.035 kHz( 0.079 km/s)
234.375 MHz( 305 km/s), 122.070 kHz( 0.159 km/s)
468.750 MHz( 610 km/s), 244.141 kHz( 0.317 km/s)
937.500 MHz( 1219 km/s), 488.281 kHz( 0.635 km/s)
1875.000 MHz( 2438 km/s), 976.563 kHz( 1.270 km/s)
2000.000 MHz( 2438 km/s), 31.250 MHz(40.638 km/s)

Select Lines to Observe in Baseband-1... | Add

Baseband-2

**Double click this field to select the desired bandwidth/resolution**

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

- Proposal
  - Planned Observing
    - ScienceGoal (B3 spectral sweep CO
    - ScienceGoal (B7 continuum: COSMO
    - ScienceGoal (B7 CO(9-8): Cosmic Ey
    - ScienceGoal (B9 continuum: Cosmic
    - ScienceGoal (B3 spectral sweep: PK
    - ScienceGoal (B3 continuum: GRB To

**Feedback**

Validation | Validation History | Log

| Description | Suggestion |
|---|---|

**Overview**

Contextual Help | Phase I: Science Proposal

NRAO

Project - Observing Tool for ALMA, version Cycle2Test2

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Copy
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setu
        - Control and Perf
        - Technical Justifi

Template library. Turn the keys on...

- Proposal
  - Planned Observing
    - ScienceGoal (B3
    - ScienceGoal (B7
    - ScienceGoal (B7
    - ScienceGoal (B9
    - ScienceGoal (B3
    - ScienceGoal (B3
    - ScienceGoal (B6
    - ScienceGoal (B7
    - ScienceGoal (B6

**Editors**

Spectral | Spatial | Spectral Setup

In the table below, it is possible to define up to 16 spectral windows, 4 per baseband as long as the total Fraction per baseband is no more than 1.
Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolution.
Note that for bands 3, 4, 6, 7 and 8, it is not possible to put 3 basebands in one sideband and the fourth one in the other.

Spectral Type

Spectral Line

Spectral Type

Single

Spect

sired XX

Spectral Line

Baseband-1

| Fraction | Center Freq (Rest) | Center Freq (Sky) | Transition | Bandwidth, Resolution (smoothed) | Spec Avg. | Representativ Window |
|---|---|---|---|---|---|---|
| 1/4 | 230.30000 GHz | 228.16341 GHz | ...Enter Name ... | 117.188 MHz( 154 km/s), 244.141 kHz( 0.321 km/s) | 1 | |
| 1/4 | 231.10000 GHz | 228.95599 GHz | ...Enter Name ... | 117.188 MHz( 153 km/s), 244.141 kHz( 0.320 km/s) | 1 | |
| 1/2 | 230.53800 GHz | 228.39920 GHz | CO v=0 2-1 | 234.375 MHz( 308 km/s), 484.619 kHz( 0.636 km/s) | | |

1
2
4
8
16

Select Lines to Observe in Baseband-1... | Add | Delete

**Spectral specs share a baseband, sum of shares can't exceed 1**

**Multiple spectral specs, spectral averaging**

**Feedback**

Validation | Validation History | Log

15 errors, 0 warnings

| Description |
|---|
| No science case. a Science and Technical Case is a manda |
| Must select a minimum of 1 science keywords |
| Largest scale is not achievable with the 12m array configura |
| Spectral Window name is invalid |
| Spectral Window name is invalid |

**Failing to rename a spectral window is a validation error. Please give useful names.**

**Overview**

Contextual Help | Phase I: Science Proposal

NRAO

Project - Observing Tool for ALMA, version Cycle2Test2

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Copy
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setu
        - Control and Perf
        - Technical Justifi

Template library. Turn the keys on...

- Proposal
  - Planned Observing
    - ScienceGoal (B3
    - ScienceGoal (B7
    - ScienceGoal (B7
    - ScienceGoal (B9
    - ScienceGoal (B3
    - ScienceGoal (B3
    - ScienceGoal (B6
    - ScienceGoal (B7
    - ScienceGoal (B6

**Editors**

Spectral | Spatial | Spectral Setup

In the table below, it is possible to define up to 16 spectral windows, 4 per baseband as long as the total Fraction per baseband is no more than 1.
Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolution.
Note that for bands 3, 4, 6, 7 and 8, it is not possible to put 3 basebands in one sideband and the fourth one in the other.

Spectral Type

Spectral Type: Spectral Line / Single / Spect

Polarization products desired: XX

Spectral Setup Errors

Spectral Line

Baseband-1

| Fractior | Center Freq (Rest) | Center Freq (Sky) | Transition | Bandwidth, Resolution (smoothed) | Spec Avg. | Representativ Window |
|---|---|---|---|---|---|---|
| 1/4 | 230.30000 GHz | 228.16341 GHz | ...Enter Name ... | 117.188 MHz( 154 km/s), 244.141 kHz( 0.32 km/s) | 1 | |
| 1/4 | 231.10000 GHz | 228.95599 GHz | ...Enter Name ... | 117.188 MHz( 153 km/s), 244.141 kHz( 0.320 km/s) | 1 | |
| 1/2 | 230.53800 GHz | 228.39920 GHz | CO v=0 2-1 | 234.375 MHz( 308 km/s), 484.619 kHz( 0.636 km/s) | | |

1
2
4
8
16

Select Lines to Observe in Baseband-1... | Add | Delete

**New: spectral windows can have different total width but still must have the same resolution**

**Spectral averaging reduces resolution and data rate**

**Feedback**

Validation | Validation History | Log

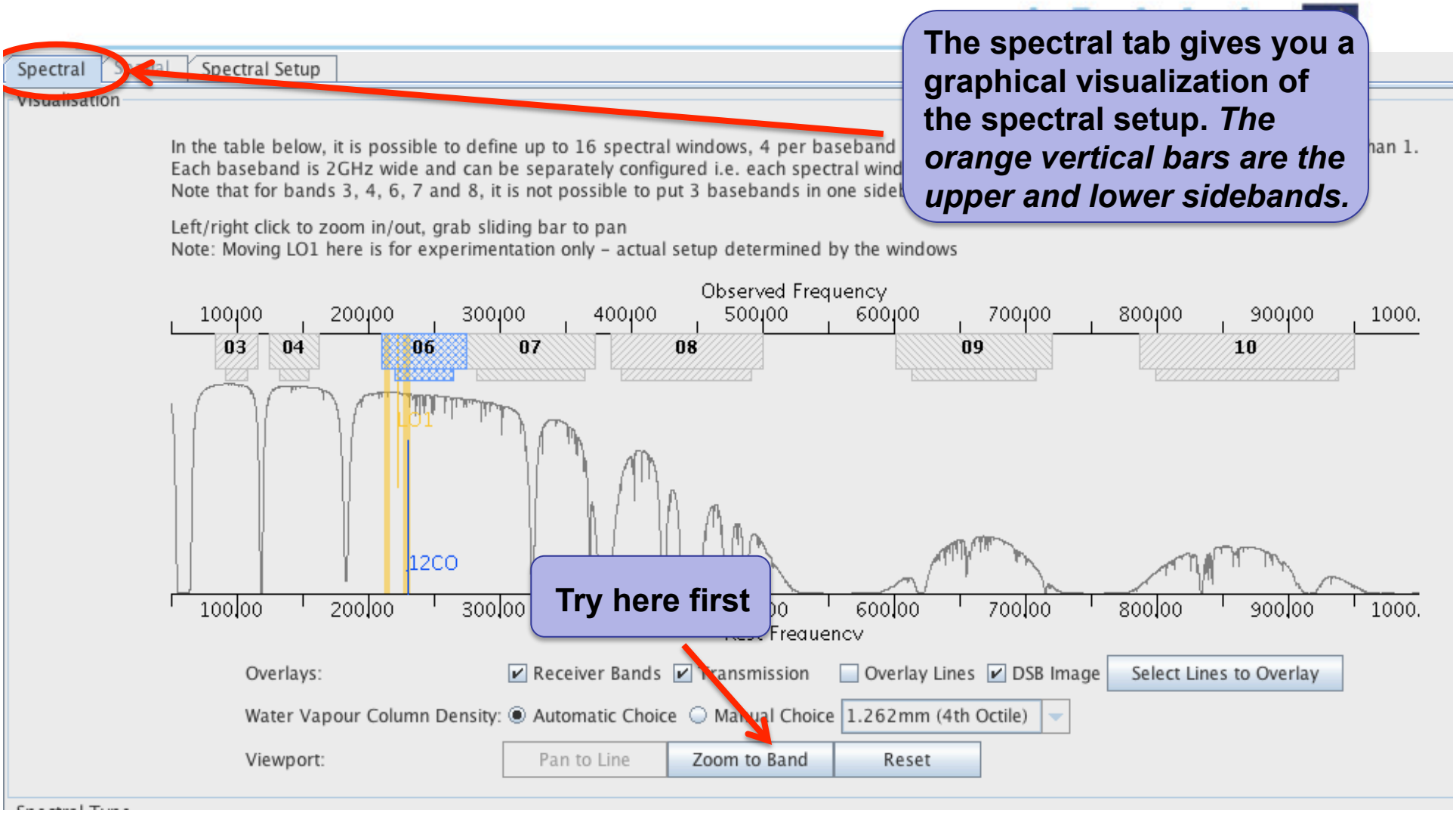
15 errors, 0 war

| Description | Suggestion |
|---|---|
| No science case. a Science and Technical Case is a mandatory | Select the proposal node in the Proposal tab and add a science case |
| Must select a minimum of 1 science keywords | Select the Proposal node and then add some science keywords (minimum 1 keywords) |
| Largest scale is not achievable with the 12m array configurations | Select the Control Parameters in the Science Goal and reduce the value or check the |
| Spectral Window name is invalid | Change the name to something more meaningful |
| Spectral Window name is invalid | Change the name to something more meaningful |

**Overview**

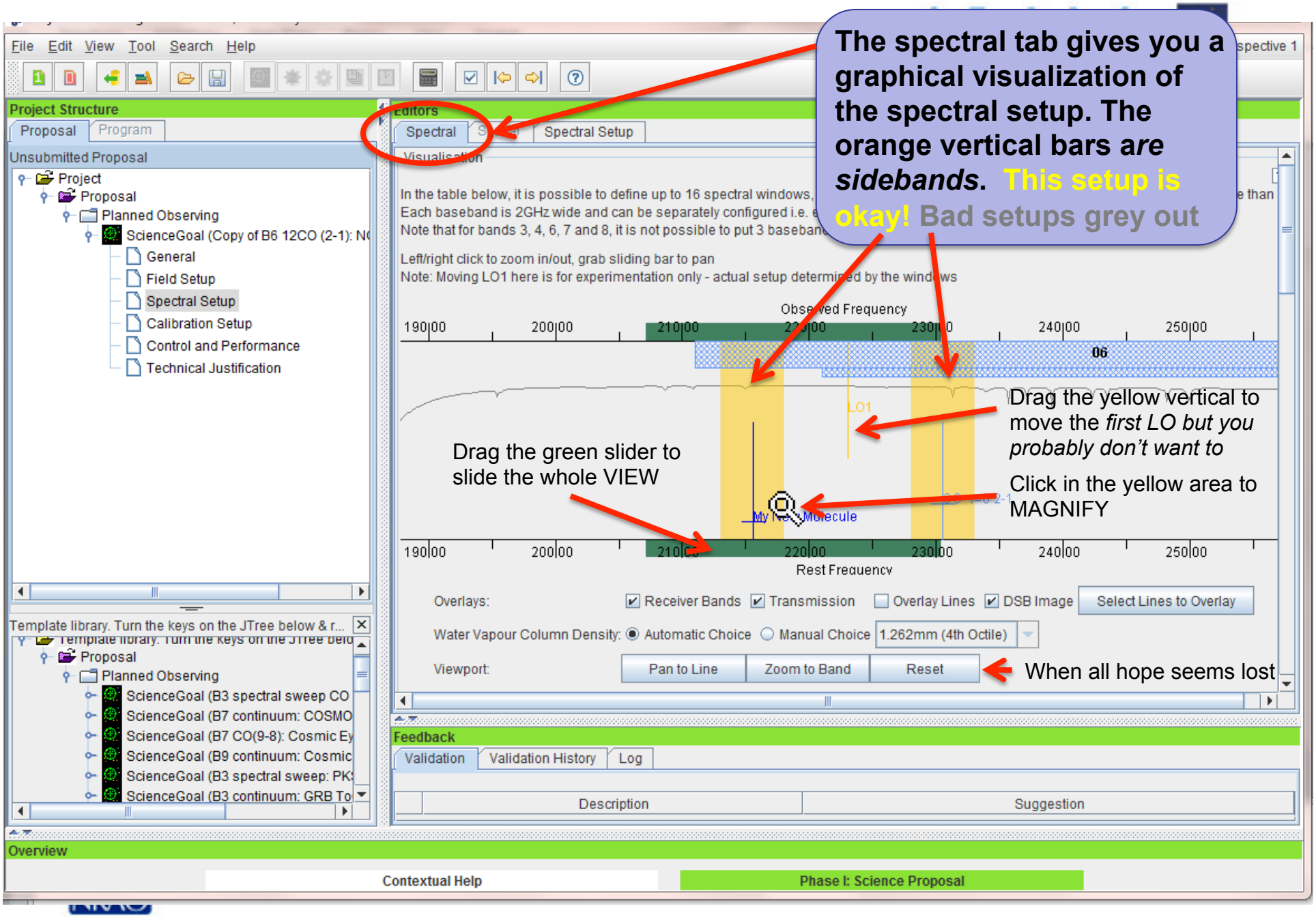
Contextual Help | Phase I: Science Proposal

NRAO

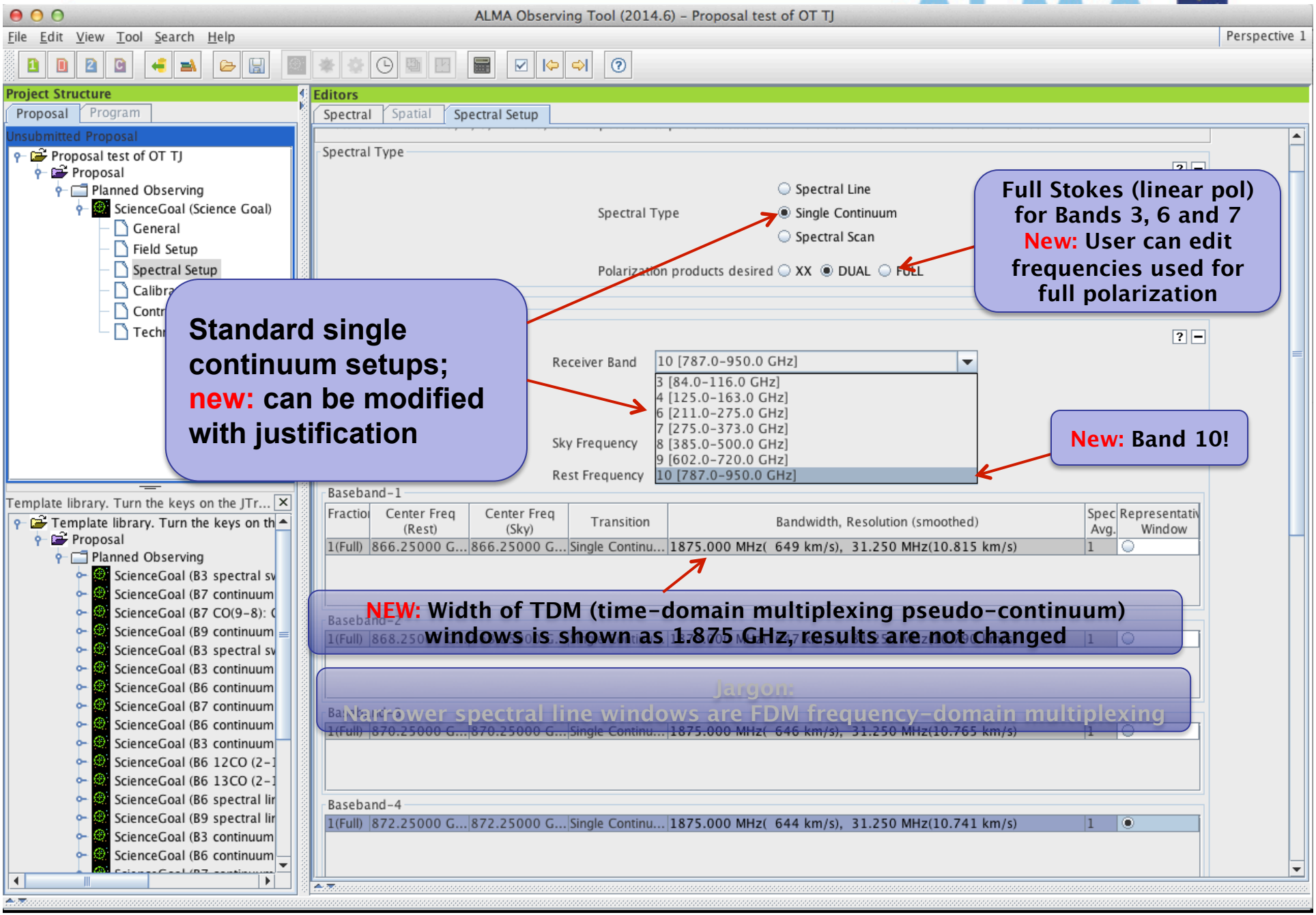



**The spectral tab gives you a graphical visualization of the spectral setup. *The orange vertical bars are the upper and lower sidebands.***

**Try here first**


The spectral tab gives you a graphical visualization of the spectral setup. The orange vertical bars *are sidebands*. This setup is okay! Bad setups grey out
Drag the yellow vertical to move the *first LO but you probably don't want to*
Click in the yellow area to MAGNIFY
Drag the green slider to slide the whole VIEW
When all hope seems lost
File Edit View Tool Search Help
Project Structure
Proposal Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Copy of B6 12CO (2-1): N
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral
Spectral Setup
Visualisation
In the table below, it is possible to define up to 16 spectral windows,
Each baseband is 2GHz wide and can be separately configured i.e.
Note that for bands 3, 4, 6, 7 and 8, it is not possible to put 3 baseban
Left/right click to zoom in/out, grab sliding bar to pan
Note: Moving LO1 here is for experimentation only - actual setup determined by the windows
Observed Frequency
190|00 200|00 210|00 220|00 230|00 240|00 250|00
06
LO1
My Fav. Molecule
Rest Frequency
Overlays: Receiver Bands Transmission Overlay Lines DSB Image Select Lines to Overlay
Water Vapour Column Density: Automatic Choice Manual Choice 1.262mm (4th Octile)
Viewport: Pan to Line Zoom to Band Reset
Template library. Turn the keys on the JTree below & r...
Proposal
Planned Observing
ScienceGoal (B3 spectral sweep CO
ScienceGoal (B7 continuum: COSMO
ScienceGoal (B7 CO(9-8): Cosmic Ey
ScienceGoal (B9 continuum: Cosmic
ScienceGoal (B3 spectral sweep: PK
ScienceGoal (B3 continuum: GRB To
Feedback
Validation Validation History Log
Description Suggestion
Overview
Contextual Help
Phase I: Science Proposal

# Full Continuum & Polarization



# Automated spectral scan - I

Project - Observing Tool for ALMA, version Cycle2Test2

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- Project
  - Proposal
    - Planned Observing
      - ScienceGoal (Copy
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setu
        - Control and Perf
        - Technical Justifi

Template library. Turn the keys on...

- Proposal
  - Planned Observing
    - ScienceGoal (B3
    - ScienceGoal (B7
    - ScienceGoal (B7
    - ScienceGoal (B9
    - ScienceGoal (B3
    - ScienceGoal (B3
    - ScienceGoal (B6
    - ScienceGoal (B7
    - ScienceGoal (B6
    - ScienceGoal (B3
    - ScienceGoal (B6

**Editors**

Spectral | Spatial | Spectral Setup

Spectral Type: Spectral Line / Single Continuum / Spectral Scan

Polarization products desired: XX / DUAL / FULL

Spectral Setup Errors

Spectral Scan

| | | |
|---|---|---|
| Requested start frequency (sky) | 95.0 | GHz |
| Requested end frequency (sky) | 107.0 | GHz |
| Requested range (rest) | 95.8896 GHz - 108.0020 GHz | |
| Achieved scan range (sky) | 95.0 GHz - 110.0 GHz | |
| Bandwidth, Resolution (Hanning smoothed) | 1875.000 MHz, 976.563 kHz | |
| Spectral averaging | 1 | |
| Representative frequency (sky) | 102.50000 | GHz |

The representative frequency defined in the observed frame is used in conjunction with the sensitivity entered on the 'Control and Performance' page to estimate the required observing time and to set the size of the antenna beam shown in the 'Spatial Visual' editor. The representative frequency defaults to the average mid-frequency of the achieved scan range but may be subsequently set by the user to any frequency within the achieved scan range.

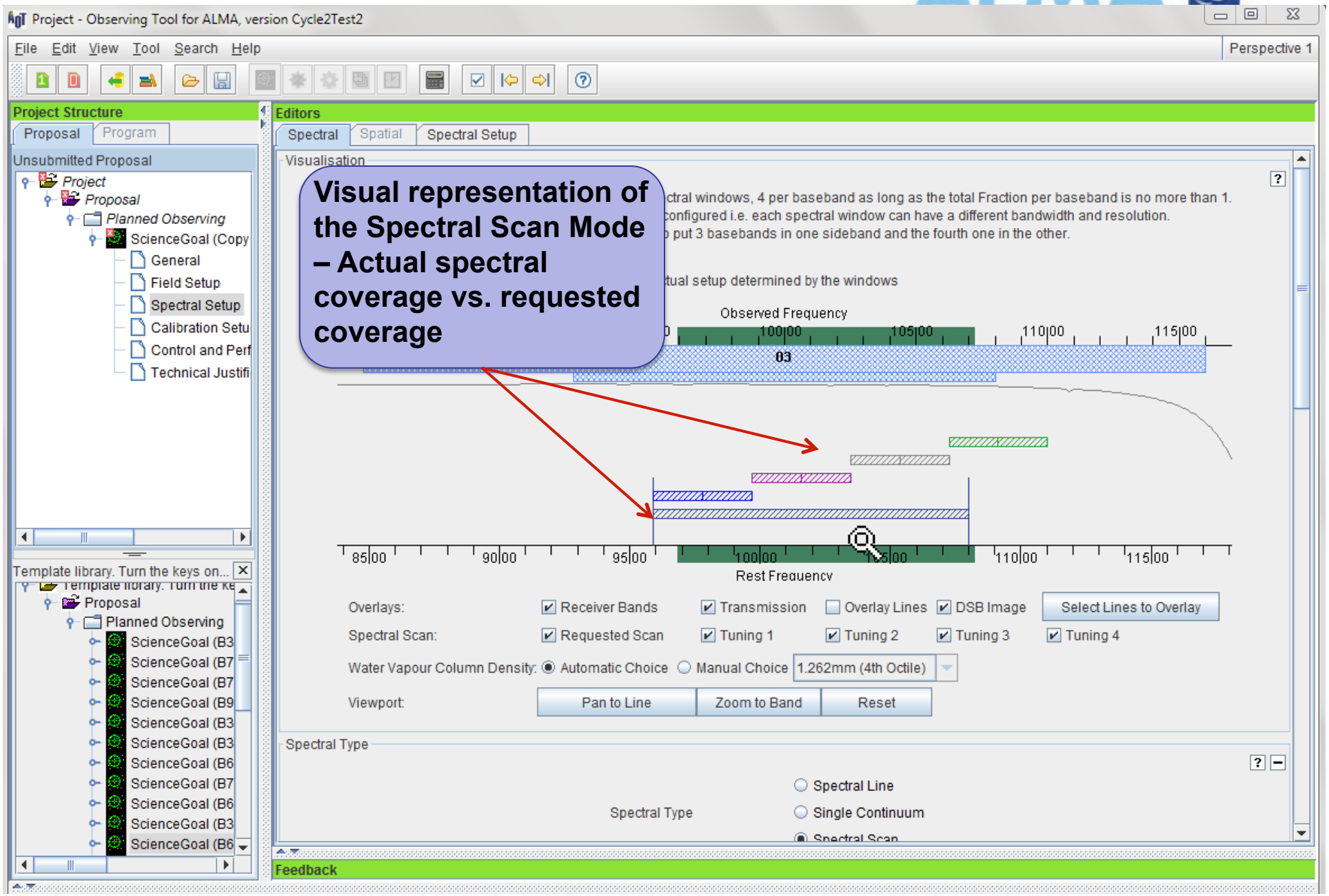
| Tuning (Max. 5) | SPW 1 (GHz) | SPW 2 (GHz) |
|---|---|---|
| 1 | 95.9375 GHz | 97.8125 GHz |
| 2 | 99.6875 GHz | 101.5625 GHz |
| 3 | 103.4375 GHz | 105.3125 GHz |
| 4 | 107.1875 GHz | 109.0625 GHz |

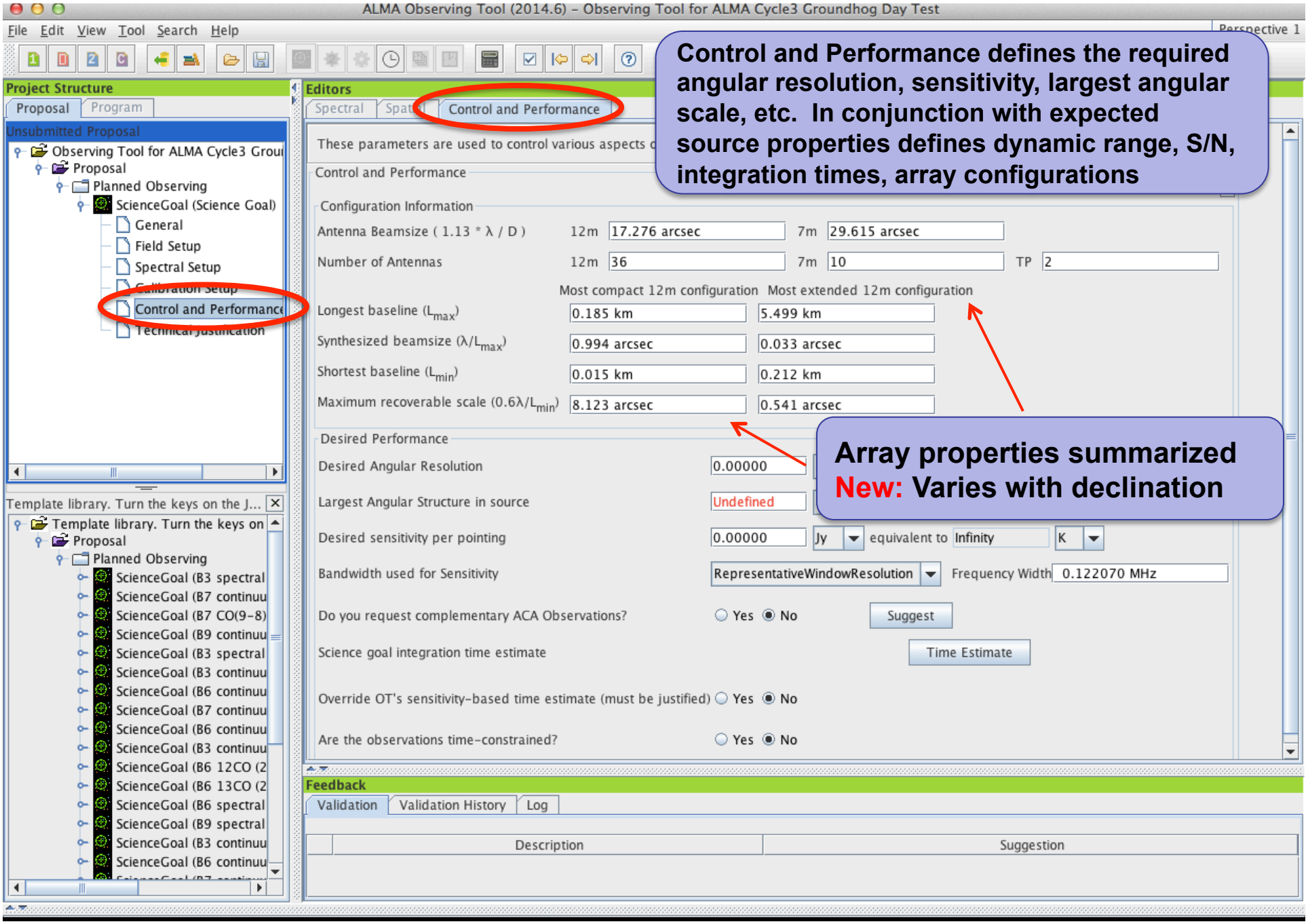
Feedback

**Automated Spectral Scan mode and tunings**

There are "issues" with OT time estimates for spectral scans

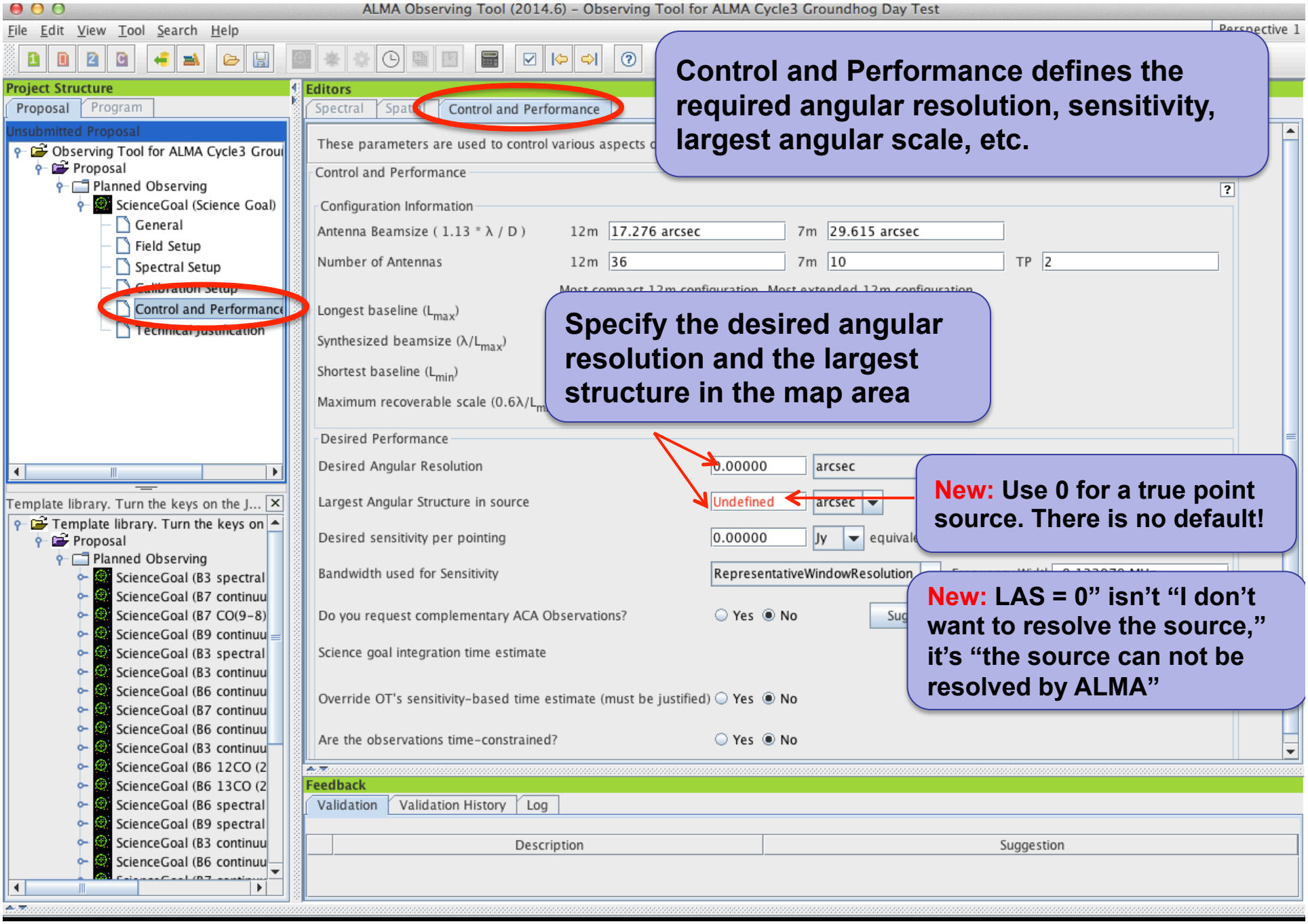
# Automated spectral scan - II






**Control and Performance defines the required angular resolution, sensitivity, largest angular scale, etc. In conjunction with expected source properties defines dynamic range, S/N, integration times, array configurations**

**Array properties summarized**
**New: Varies with declination**

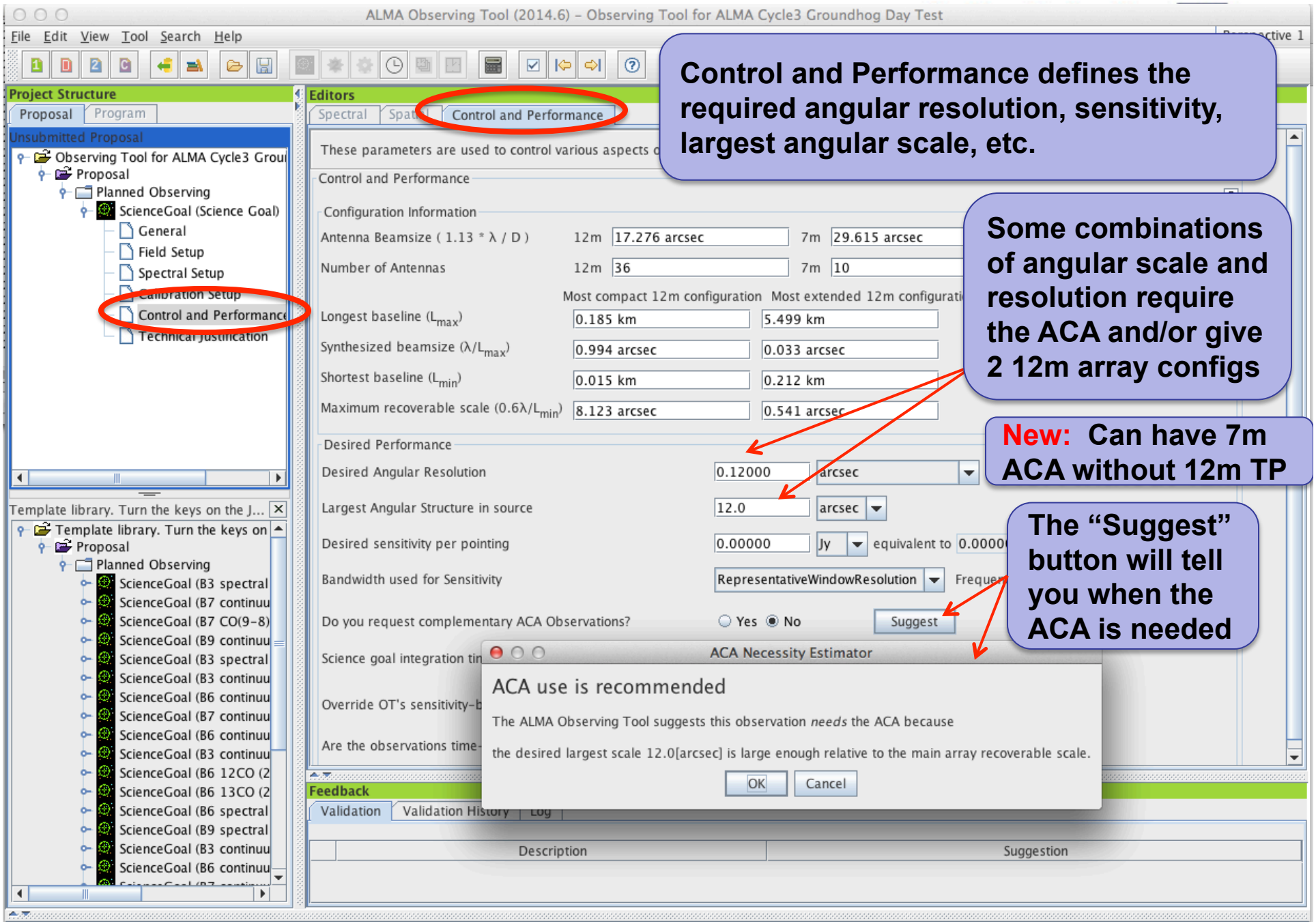



**Control and Performance defines the required angular resolution, sensitivity, largest angular scale, etc.**

**Specify the desired angular resolution and the largest structure in the map area**

**New: Use 0 for a true point source. There is no default!**

**New: LAS = 0" isn't "I don't want to resolve the source," it's "the source can not be resolved by ALMA"**



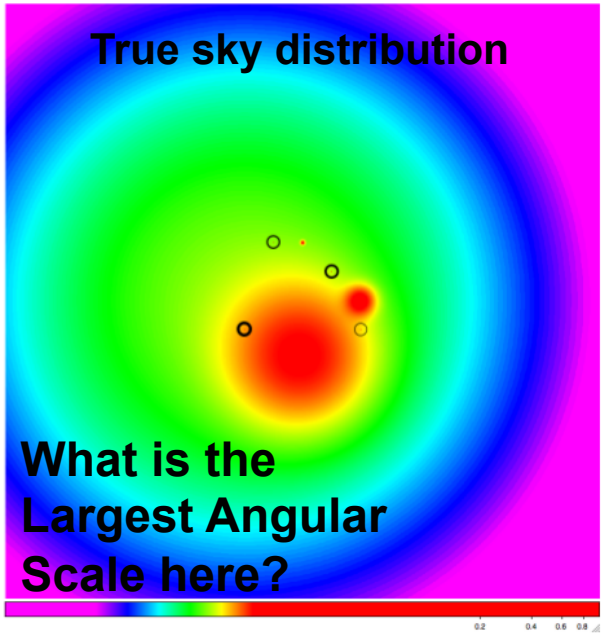

**Control and Performance defines the required angular resolution, sensitivity, largest angular scale, etc.**

**Some combinations of angular scale and resolution require the ACA and/or give 2 12m array configs**

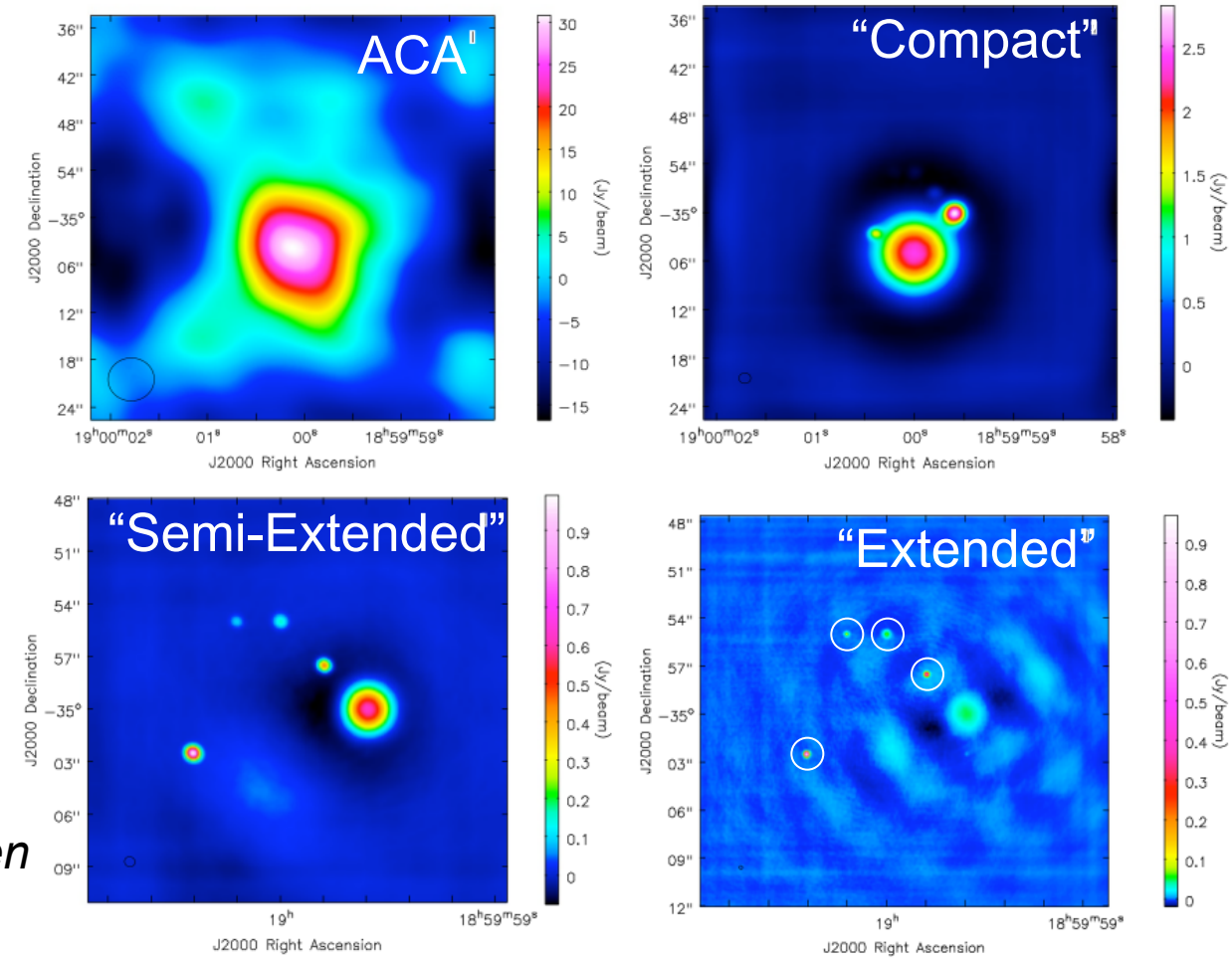
**New: Can have 7m ACA without 12m TP**

**The "Suggest" button will tell you when the ACA is needed**

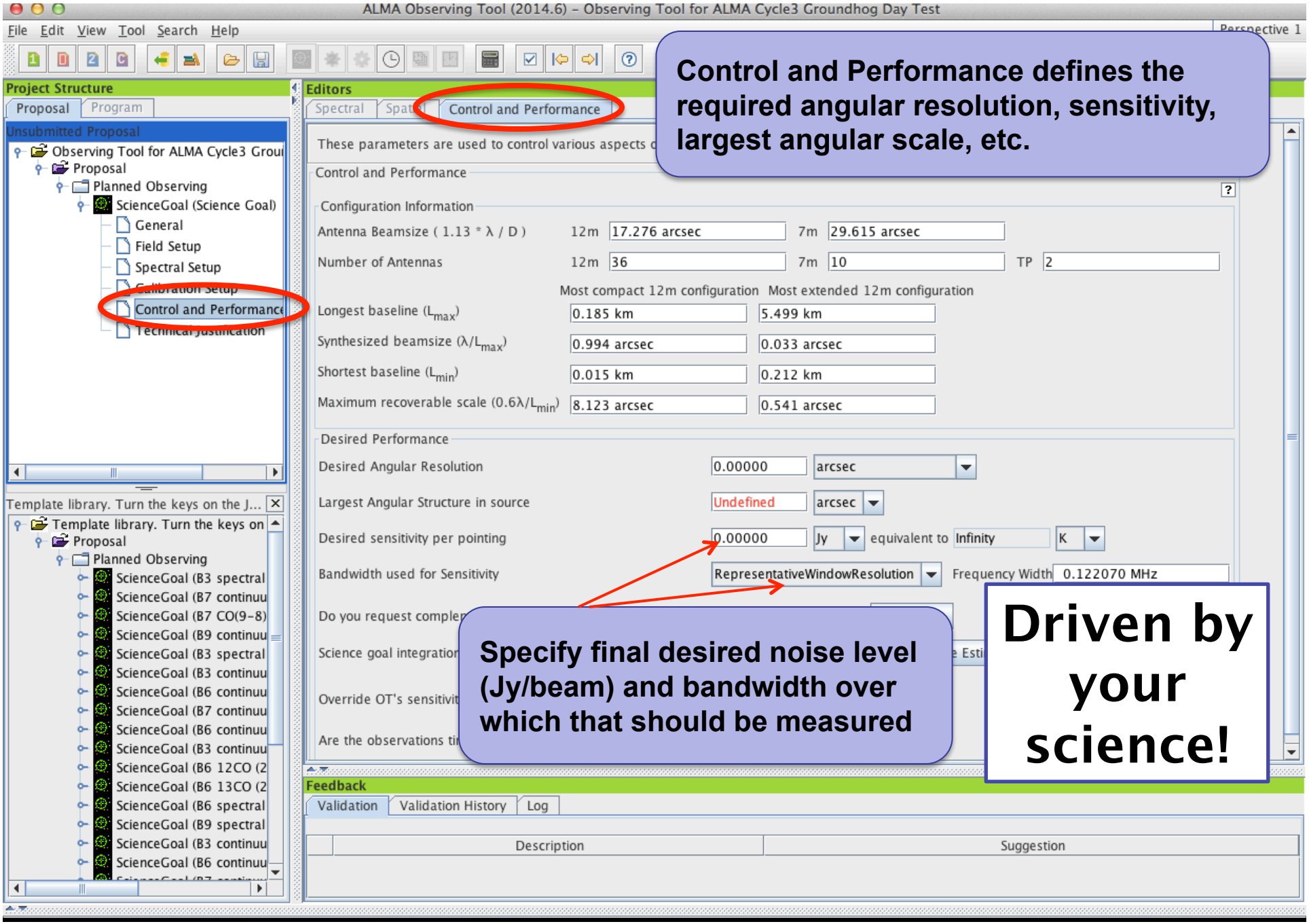
# Think about your target…




→ **Observed with different ALMA configurations**



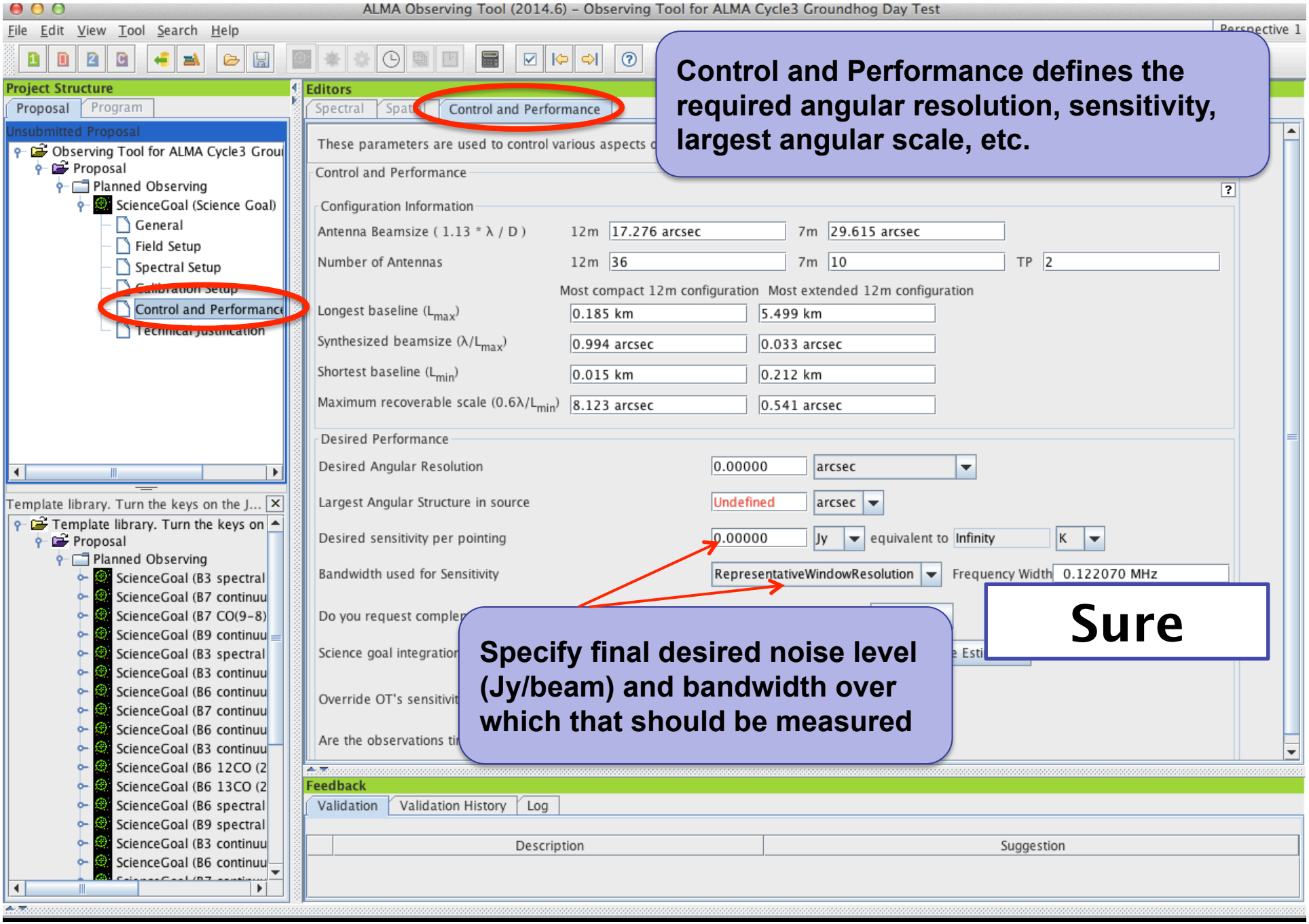

**Credit**: *Allegro group in Leiden*




**Control and Performance defines the required angular resolution, sensitivity, largest angular scale, etc.**

**Specify final desired noise level (Jy/beam) and bandwidth over which that should be measured**

**Driven by your science!**

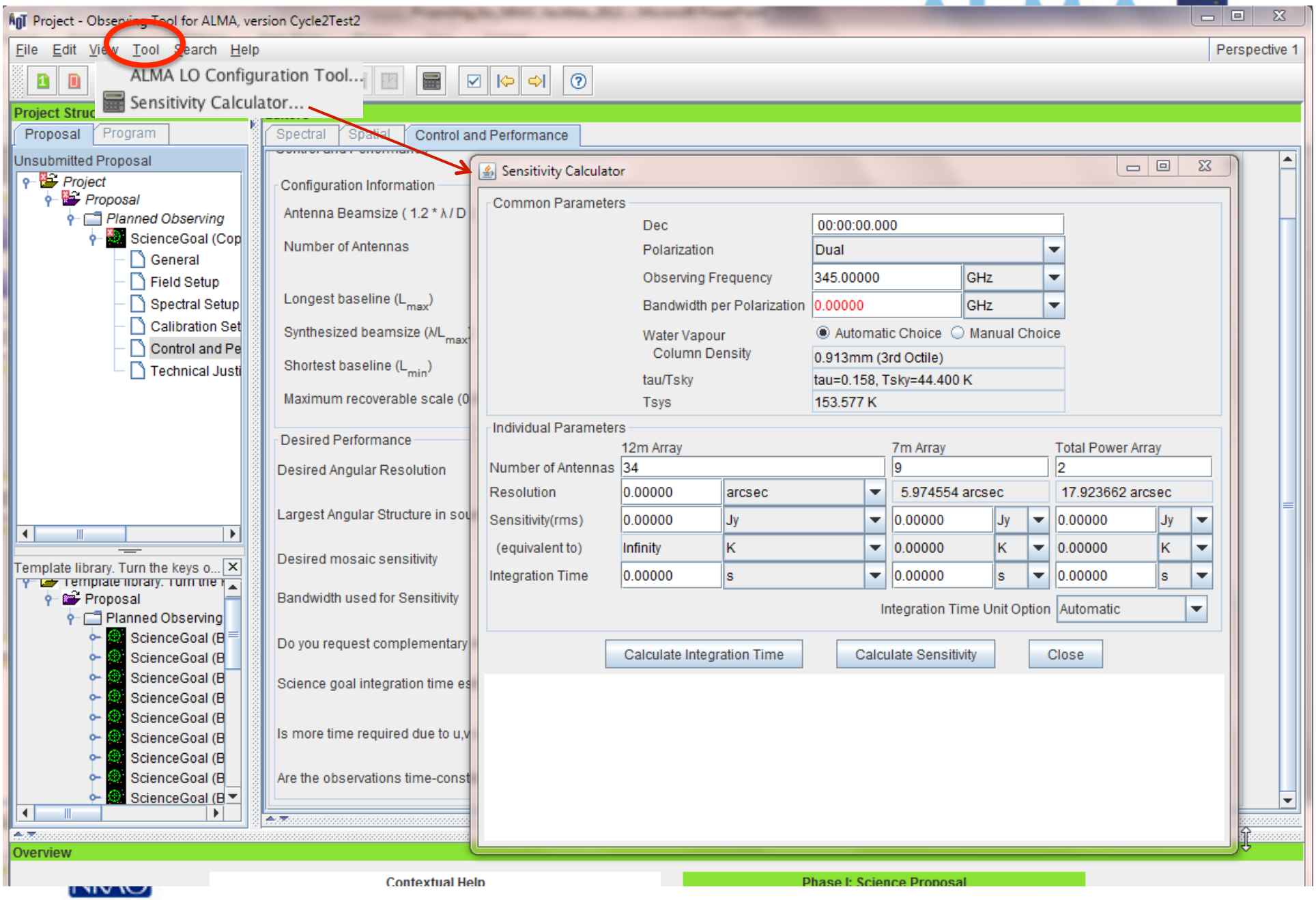



**Control and Performance defines the required angular resolution, sensitivity, largest angular scale, etc.**

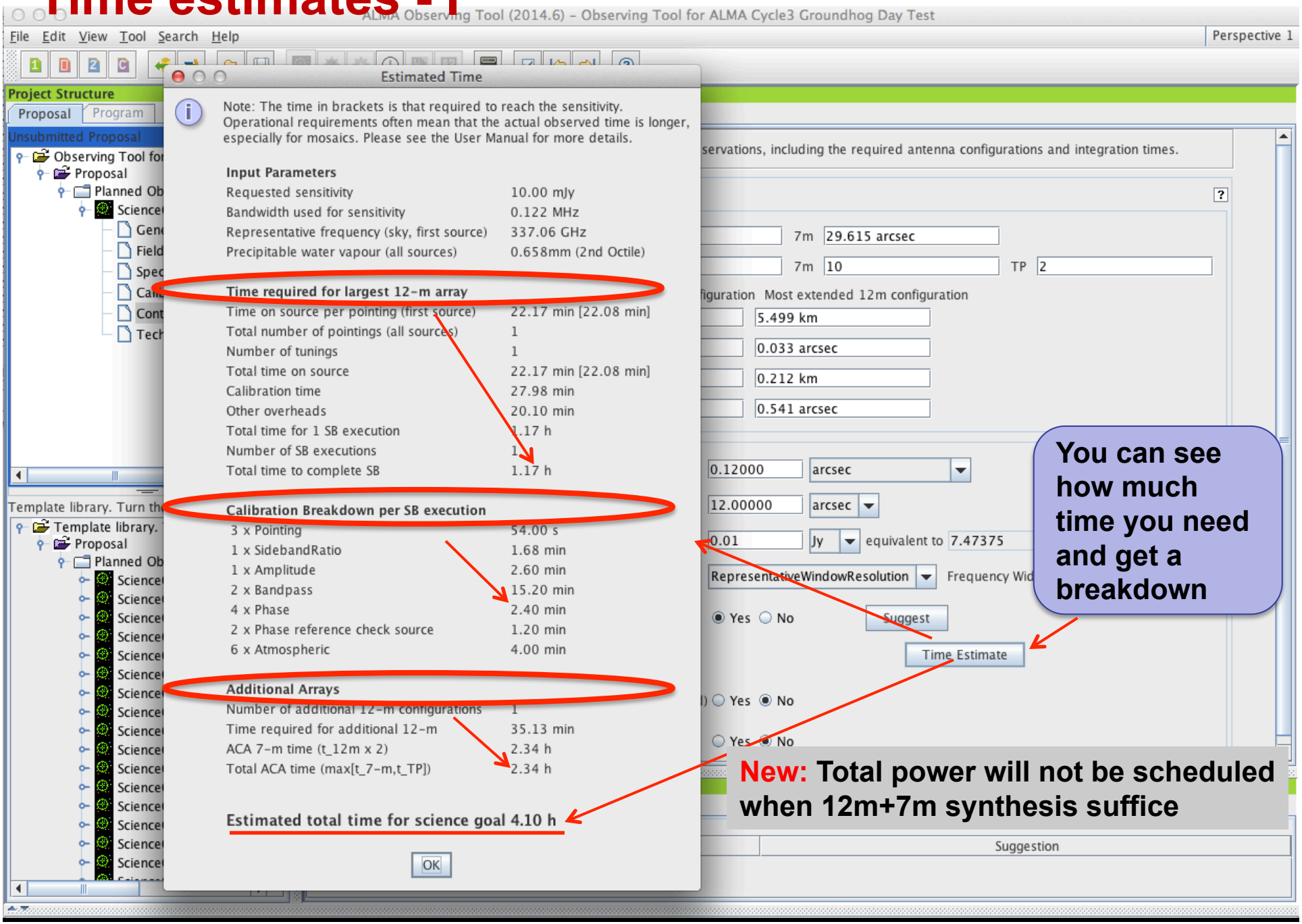
**Specify final desired noise level (Jy/beam) and bandwidth over which that should be measured**

**Sure**

The sensitivity calculator is available separately in the OT (or on the web)



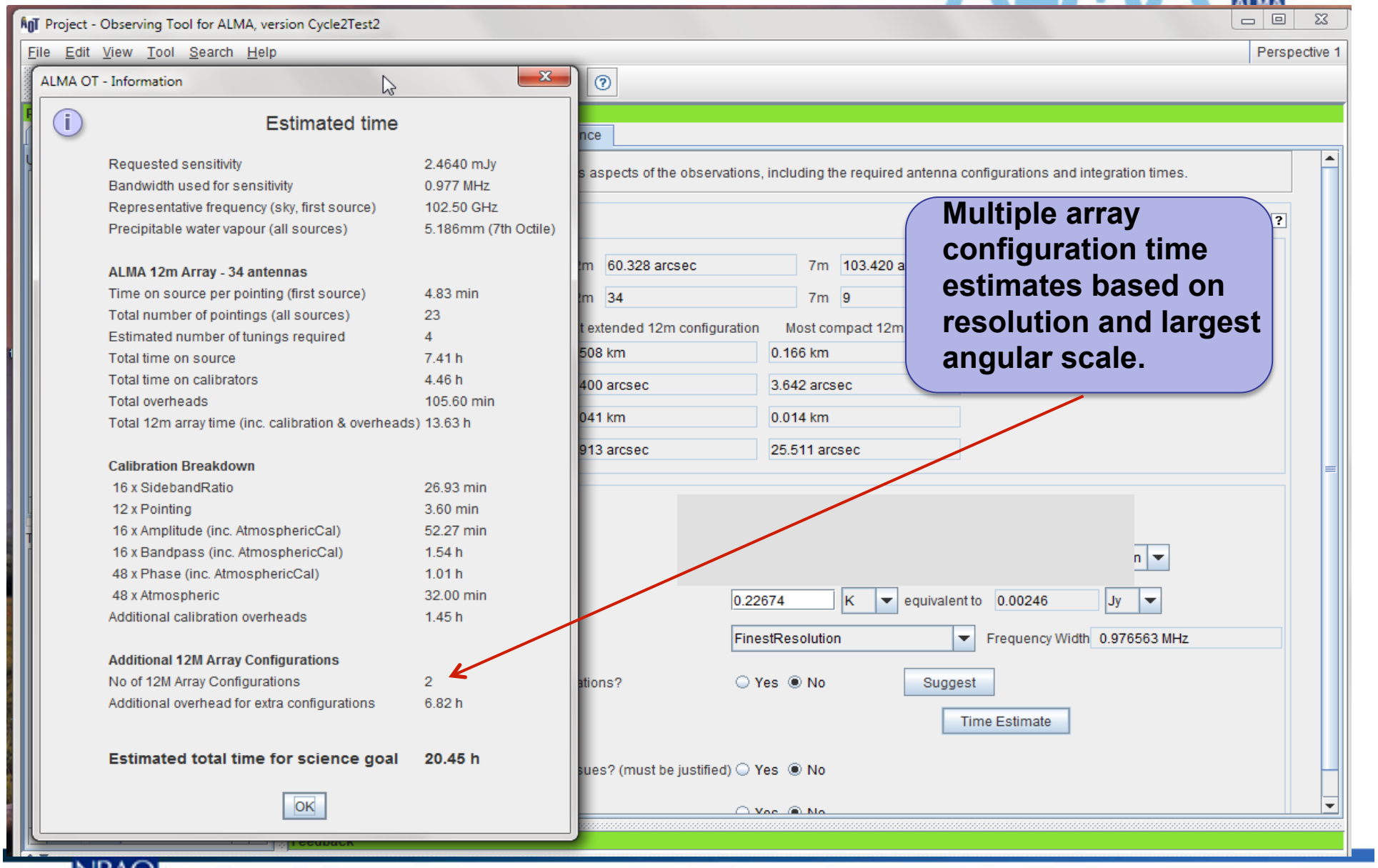
# Time estimates - I




You can see how much time you need and get a breakdown

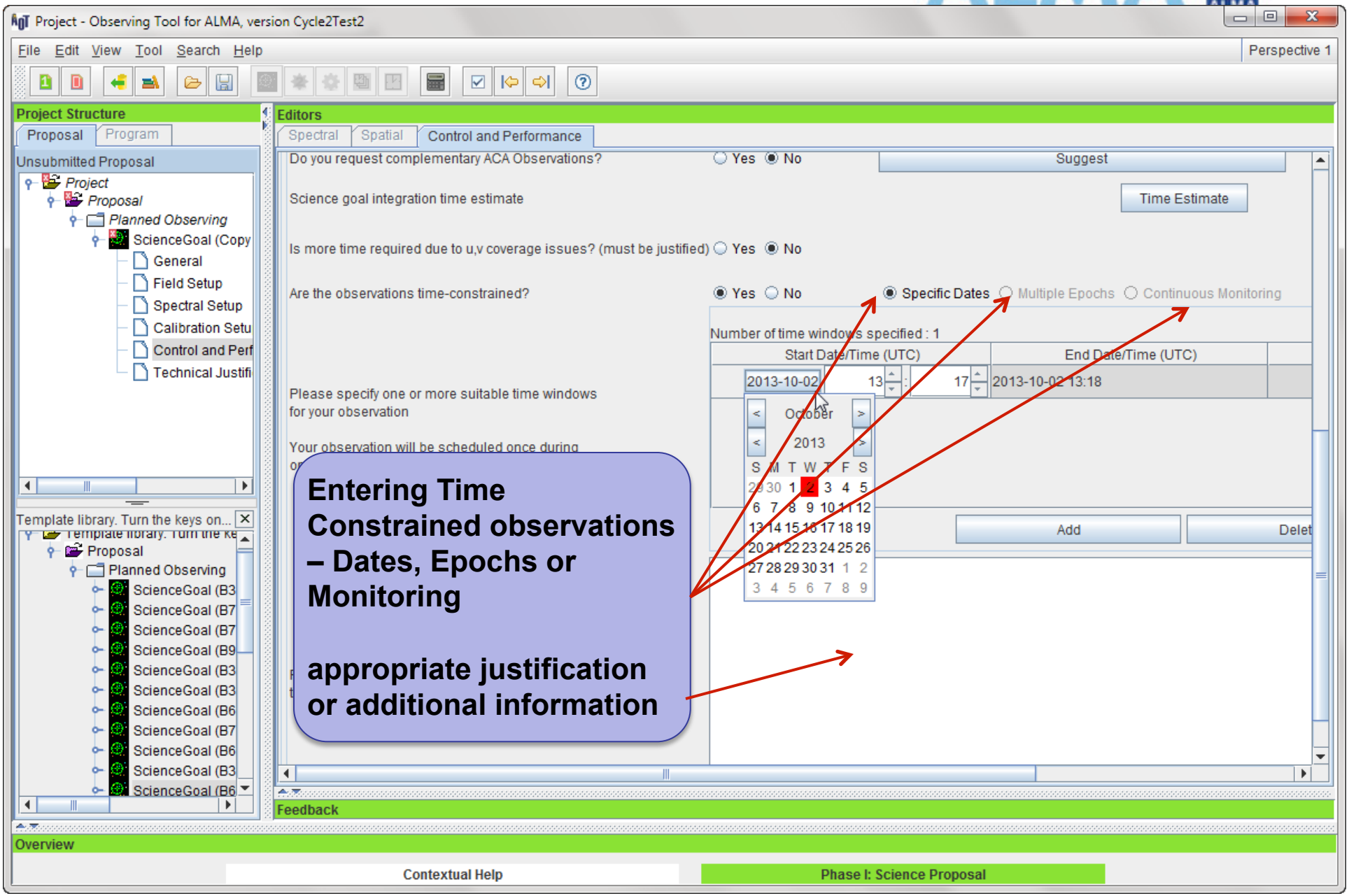
**New:** Total power will not be scheduled when 12m+7m synthesis suffice

# Time estimates - II




**Multiple array configuration time estimates based on resolution and largest angular scale.**

# Time constrained observing




**Entering Time Constrained observations – Dates, Epochs or Monitoring**

**appropriate justification or additional information**

# What else new in Cycle 3 OT?

**New:** Clicking on an error usually takes you to the problem directly

Project Structure

Proposal | Program

Unsubmitted Proposal

- Observing Tool for ALMA Cycle3 Grou
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

Template library. Turn the keys on the J...

- Template library. Turn the keys on
  - Proposal
    - Planned Observing
      - ScienceGoal (B3 spectral
      - ScienceGoal (B7 continuu
      - ScienceGoal (B7 CO(9-8)
      - ScienceGoal (B9 continuu
      - ScienceGoal (B3 spectral
      - ScienceGoal (B3 continuu
      - ScienceGoal (B6 continuu
      - ScienceGoal (B7 continuu
      - ScienceGoal (B6 continuu
      - ScienceGoal (B3 continuu
      - ScienceGoal (B6 12CO (2
      - ScienceGoal (B6 13CO (2
      - ScienceGoal (B6 spectral
      - ScienceGoal (B9 spectral
      - ScienceGoal (B3 continuu
      - ScienceGoal (B6 continuu

Editors

Spectral | Spatial | ScienceGoal (Science Goal)

Source Coordinates: System J2000; Sexagesimal display? ☑; RA 22:02:43.2912; Dec -42:16:39.978; Parallax 0.00000 mas; PM RA 0.00000 mas/yr; PM DEC 0.00000 mas/yr

Source Radial Velocity: 0.000 km/s hel; z 0.000000000; Doppler Type RELATIVISTIC

Target Type: ◉ Individual Pointing(s) ○ 1 Rectangular Field

Expected Source Properties

| | | |
|---|---|---|
| Peak Continuum Flux Density per Beam | 0.00000 | Jy |
| Continuum Polarization Percentage | 0.0 | % |
| Peak Line Flux Density per Beam | 0.00000 | Jy |
| Line Width | 0.00000 | km/s |
| Line Polarization Percentage | 0.0 | % |

Field Center Coordinates

Custom Mosaic: ☐

PointingPattern: Offset ☑

arcsec

1

| RA [arcsec] | Dec [arcsec] |
|---|---|
| 0.00000 | 0.00000 |

Feedback

Validation | Validation History | Log

9 errors, 0 warnings

| Description | Suggestion |
|---|---|
| No Principal Investigator specified | Select the top level Project node in the tree and fill in the Principal Investigator field |
| No scientific category defined | Select Proposal node and set a scientific category |
| No document found - you must add a Science Case to your proposal | Select the proposal node in the Proposal tab and add your document |
| Must select a minimum of 1 science keywords | Select the Proposal node and then add some science keywords (minimum 1 |
| Expected peak continuum flux is required for a single continuum | Select the Target Parameters (anti-bllac) in the Science Goal and enter a valid value |
| Either a continuum or a line polarization percentage is required for | Select the Target Parameters (anti-bllac) in the Science Goal and enter a valid value |

# Tech Justification New for Cycle 3!!

ALMA Observing Tool (2014.6) - Observing Tool for ALMA Cycle3 Groundhog Day Test

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- Observing Tool for ALMA Cycle3 Ground
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

Template library. Turn the keys on the JTr...

- Template library. Turn the keys on th
  - Proposal
    - Planned Observing
      - ScienceGoal (B3 spectral sv
      - ScienceGoal (B7 continuum
      - ScienceGoal (B7 CO(9-8): (
      - ScienceGoal (B9 continuum
      - ScienceGoal (B3 spectral sv
      - ScienceGoal (B3 continuum
      - ScienceGoal (B6 continuum
      - ScienceGoal (B7 continuum
      - ScienceGoal (B6 continuum
      - ScienceGoal (B3 continuum
      - ScienceGoal (B6 12CO (2-1
      - ScienceGoal (B6 13CO (2-1
      - ScienceGoal (B6 spectral lir
      - ScienceGoal (B9 spectral lir
      - ScienceGoal (B3 continuum
      - ScienceGoal (B6 continuum

**Editors**

Spectral | Spatial | Technical Justification

Enter a Technical Justification for this Science Goal, paying special attention to the parameters reproduced below.

Sensitivity

Requested RMS over 2.4414062500000005E-4 GHz is 3.00 mJy  For a peak flux density of 30.00 mJy , the achieved S/N is 10.0

Achieved RMS over the total 351.56 MHz bandwidth is 111.80 uJy  For a continuum flux density of 100.00 mJy , the achieved S/N is 894.4

For a peak line flux of 30.00 mJy , the achieved S/N over 1/3 of the source line width ( 30.00 km/s / 3 = 10.00 km/s ) is 26.1

Line width / bandwidth used for sensitivity 30.00 km/s / 731.92 m/s = 40.99

Dynamic Range: 33.33

Justify your requested RMS and resulting S/N for the spectral line and/or continuum observations.

For line observations also justify the bandwidth used for the sensitivity calculation.

*Here would be the standard required justification of the sensitivity parameters*

Imaging

Requested angular resolution : 1.10 arcsec

Requested largest angular scale : 1.00 arcsec

Justify the chosen angular resolution and largest angular scale for the sour

There are separate sections for **Sensitivity**, **Imaging** and **Correlator setup**

Each requires its own 50+ word justification

NRAO

# Tech Justification New for Cycle 3

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- Observing Tool for ALMA Cycle3 Ground
  - Proposal
    - Planned Observing
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

Template library. Turn the keys on the JTr...

- Template library. Turn the keys on th
  - Proposal
    - Planned Observing
      - ScienceGoal (B3 spectral sv
      - ScienceGoal (B7 continuum
      - ScienceGoal (B7 CO(9-8): (
      - ScienceGoal (B9 continuum
      - ScienceGoal (B3 spectral sv
      - ScienceGoal (B3 continuum
      - ScienceGoal (B6 continuum
      - ScienceGoal (B7 continuum
      - ScienceGoal (B6 continuum
      - ScienceGoal (B3 continuum
      - ScienceGoal (B6 12CO (2-1
      - ScienceGoal (B6 13CO (2-1
      - ScienceGoal (B6 spectral lir
      - ScienceGoal (B9 spectral lir
      - ScienceGoal (B3 continuum
      - ScienceGoal (B6 continuum

**Editors**

Spectral | Spatial | Technical Justification

Imaging

Requested angular resolution : 1.10 arcsec

Requested largest angular scale : 1.00 arcsec

Justify the chosen angular resolution and largest angular scale for the source(s) in this Science Goal

*Here would be the standard required justification of the imaging parameters*

ACA is not recommended but is selected.
Justify over-riding of the OT recommendation for the ACA

Exceptions to standard practice require separate justification. Here, the OT notes that the ACA is selected even though the OT thinks it is unneeded.

Correlator configuration

line width / representative spectral window resolution: 30.00 km/s / 731.92 m/s = 40.99

Representative spectral window width : 702.64 km/s

Justify your correlator set-up with particular reference to the number of spectral resolution elements per line width.
You may want to consider spectral averaging to lower the data rate

*Here would be the regular required correlator justification*

NRAO

# Keep tabs on your progess by validating

ALMA Observing Tool (Cycle3-Patchtests4) – Project

File Edit View Tool Search Help

Perspective 1

**Project Structure**

Proposal | Program

Unsubmitted Proposal

- *Project*
  - *Proposal*
    - *Planned Observing*
      - ScienceGoal (Science Goal)
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

**Editors**

Spectral | Spatial | General

Enter a name and description for the purpose of this science goal.
This text is optional but you may find it useful to keep a note.

General (Optional)

Science Goal Name: Science Goal

Description

Launch Editor

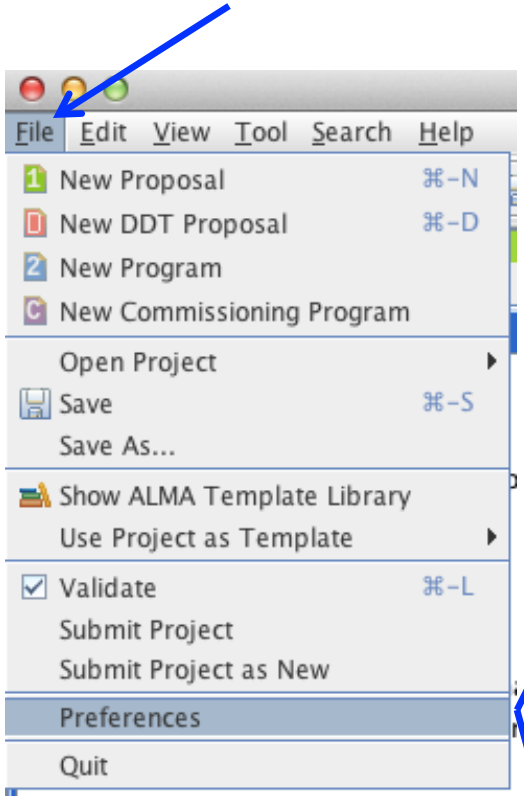
**Feedback**

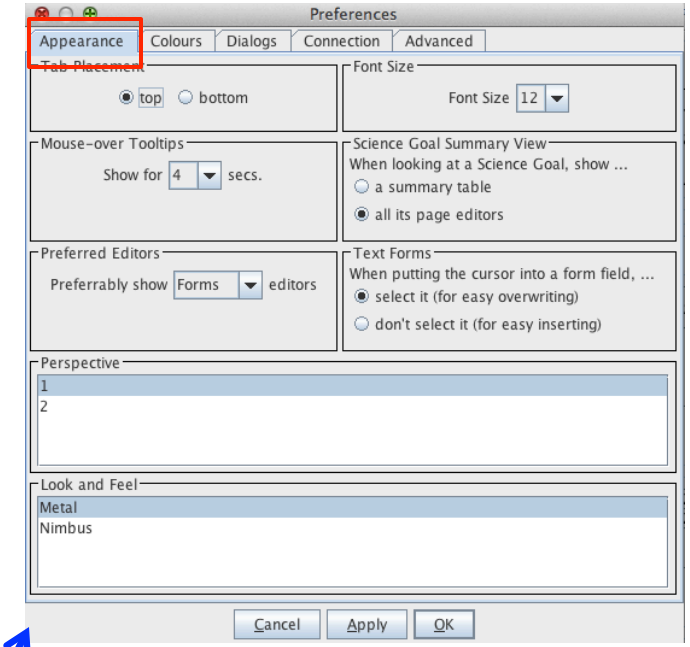
Validation | Validation History | Log

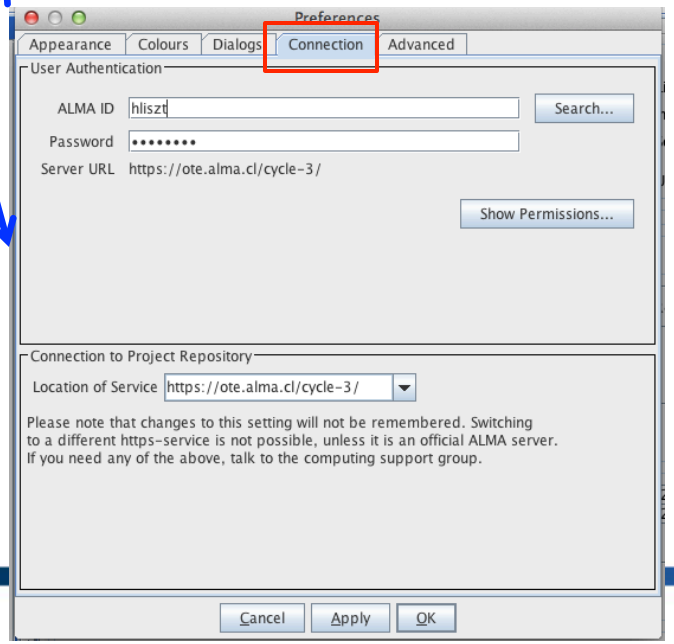
18 errors, 2 warnings

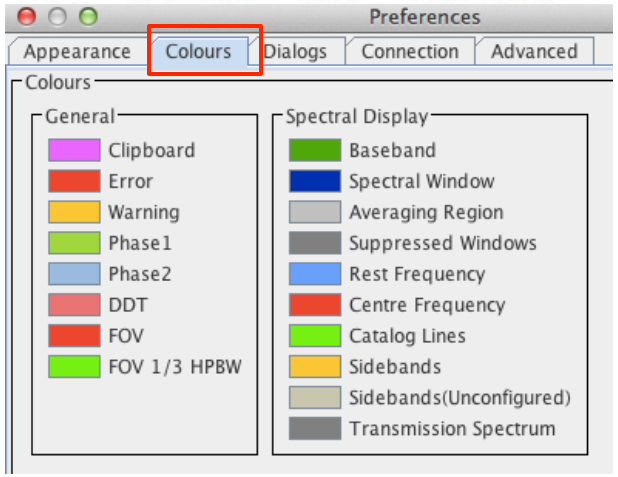
| Description | Suggestion |
|---|---|
| No Principal Investigator specified | Select the top level Project node in the tree and fill in the Principal Investigator field |
| No Project Name specified | Select the top level Project node in the tree and fill in the Project Name field |
| Abstract appears to be empty | Select the proposal node in the Proposal tab and edit your abstract |
| No proposal type defined | Select Proposal node and set a proposal type |
| No document found – you must add a Science Case to your proposal | Select the proposal node in the Proposal tab and add your document |
| Unable to calculate estimated array times | Please revise your setup: An invalid desired LAS has been specified |
| Must select a minimum of 1 science keywords | Select the Proposal node and then add some science keywords (minimum 1 keywords) |
| Non-standard observing mode identified | The aggregate bandwidth for the spectral setup is less than 1 GHz. |
| Desired largest scale must be a positive number | Select the Control Parameters in the Science Goal and enter a valid value |
| Desired sensitivity is too small | Select the Control Parameters in the Science Goal and enter a valid value |
| Desired Angular resolution is outside the range of possible resolutions for the | Select the Control Parameters in the Science Goal and enter a valid value |
| Spectral window name is invalid | Change the name to something more meaningful |
| Spectral window name is invalid | Change the name to something more meaningful |
| No source name provided | Check the Target Parameters in the Science Goal and ensure all have a non-blank source name |
| Your field source coordinates are 0.0, 0.0 | Please be sure you mean this – OK for ToO goals |
| Expected peak line flux is required for a spectral line or spectral scan setup | Select the Target Parameters (no source name) in the Science Goal and enter a valid value |
| Expected line width is required for a spectral line or spectral scan setup | Select the Target Parameters (no source name) in the Science Goal and enter a valid value |
| The justification of correlator setup must be at least 50 characters long | Select the Science Goal's Technical Justification node in the Proposal tab and edit the text |

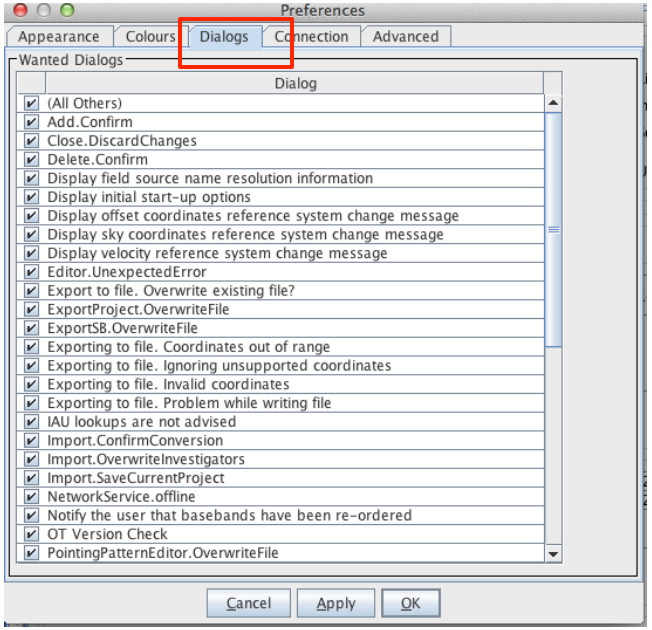
# Use preferences to customize

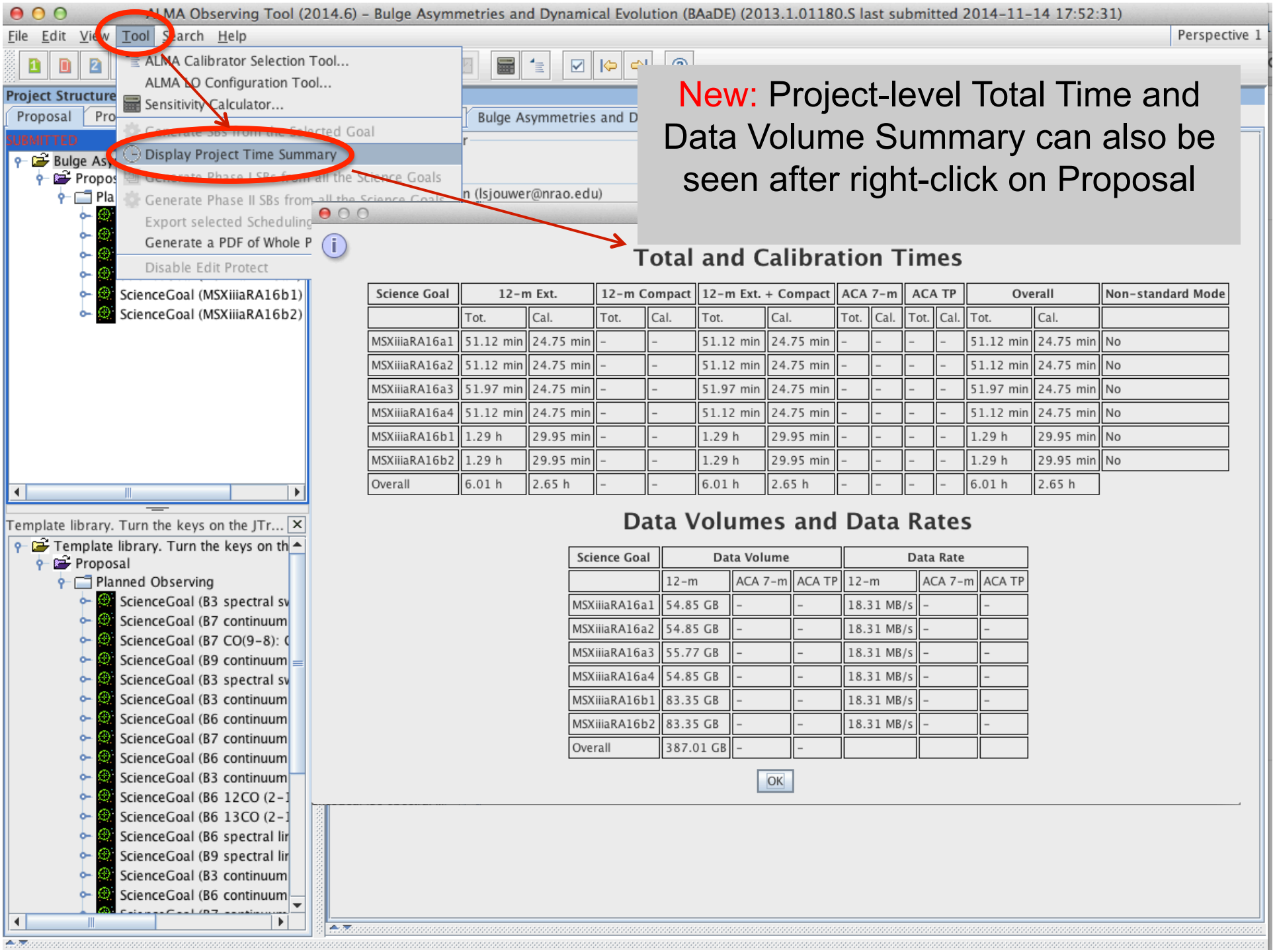


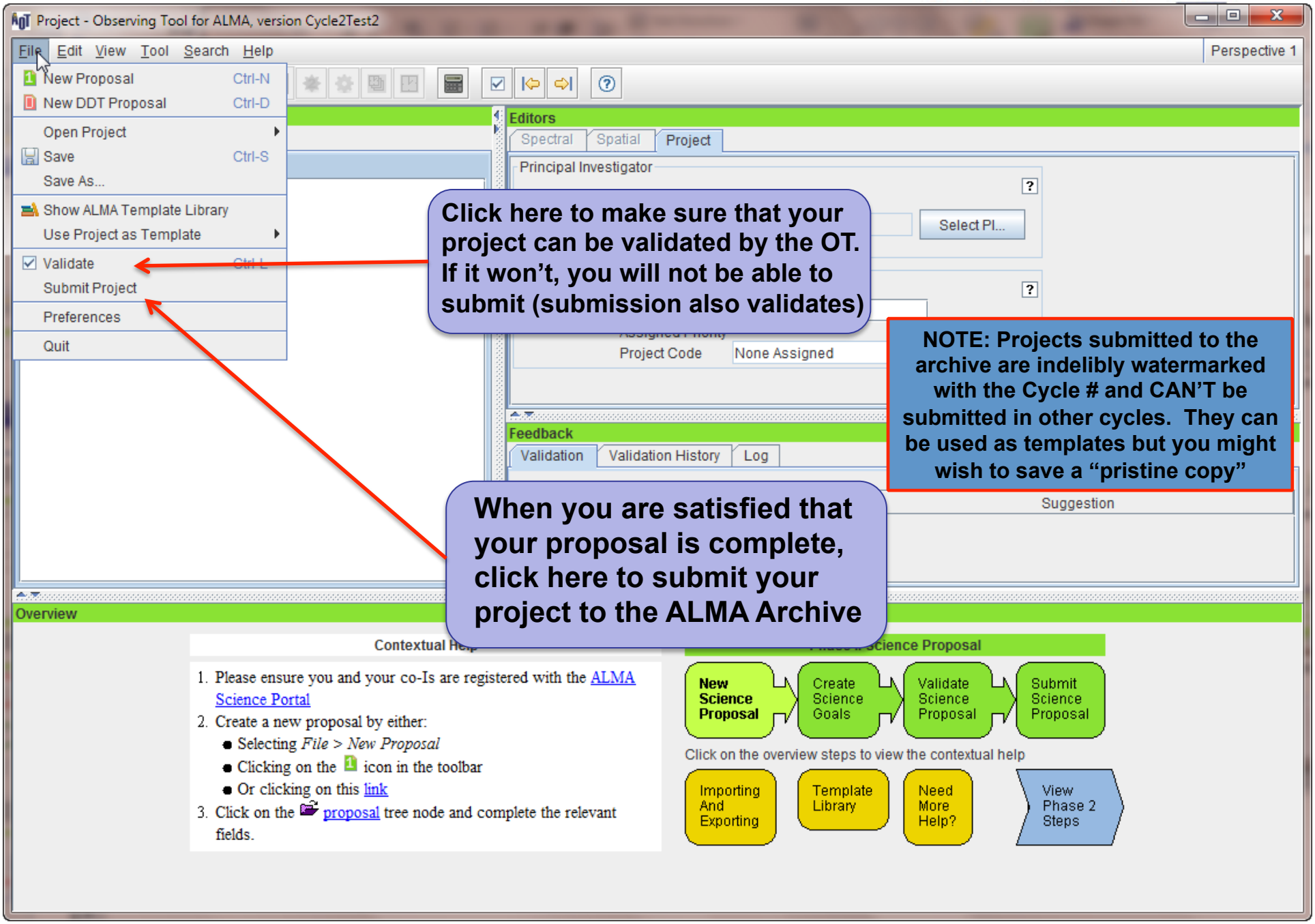



## Total and Calibration Times

| Science Goal | 12-m Ext. | | 12-m Compact | | 12-m Ext. + Compact | | ACA 7-m | | ACA TP | | Overall | | Non-standard Mode |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tot. | Cal. | Tot. | Cal. | Tot. | Cal. | Tot. | Cal. | Tot. | Cal. | Tot. | Cal. | |
| MSXiiiaRA16a1 | 51.12 min | 24.75 min | - | - | 51.12 min | 24.75 min | - | - | - | - | 51.12 min | 24.75 min | No |
| MSXiiiaRA16a2 | 51.12 min | 24.75 min | - | - | 51.12 min | 24.75 min | - | - | - | - | 51.12 min | 24.75 min | No |
| MSXiiiaRA16a3 | 51.97 min | 24.75 min | - | - | 51.97 min | 24.75 min | - | - | - | - | 51.97 min | 24.75 min | No |
| MSXiiiaRA16a4 | 51.12 min | 24.75 min | - | - | 51.12 min | 24.75 min | - | - | - | - | 51.12 min | 24.75 min | No |
| MSXiiiaRA16b1 | 1.29 h | 29.95 min | - | - | 1.29 h | 29.95 min | - | - | - | - | 1.29 h | 29.95 min | No |
| MSXiiiaRA16b2 | 1.29 h | 29.95 min | - | - | 1.29 h | 29.95 min | - | - | - | - | 1.29 h | 29.95 min | No |
| Overall | 6.01 h | 2.65 h | - | - | 6.01 h | 2.65 h | - | - | - | - | 6.01 h | 2.65 h | |

## Data Volumes and Data Rates

| Science Goal | Data Volume | | | Data Rate | | |
|---|---|---|---|---|---|---|
| | 12-m | ACA 7-m | ACA TP | 12-m | ACA 7-m | ACA TP |
| MSXiiiaRA16a1 | 54.85 GB | - | - | 18.31 MB/s | - | - |
| MSXiiiaRA16a2 | 54.85 GB | - | - | 18.31 MB/s | - | - |
| MSXiiiaRA16a3 | 55.77 GB | - | - | 18.31 MB/s | - | - |
| MSXiiiaRA16a4 | 54.85 GB | - | - | 18.31 MB/s | - | - |
| MSXiiiaRA16b1 | 83.35 GB | - | - | 18.31 MB/s | - | - |
| MSXiiiaRA16b2 | 83.35 GB | - | - | 18.31 MB/s | - | - |
| Overall | 387.01 GB | - | - | | | |


Project - Observing Tool for ALMA, version Cycle2Test2
File Edit View Tool Search Help
Perspective 1
New Proposal Ctrl-N
New DDT Proposal Ctrl-D
Open Project
Save Ctrl-S
Save As...
Show ALMA Template Library
Use Project as Template
Validate Ctrl-L
Submit Project
Preferences
Quit
Editors
Spectral
Spatial
Project
Principal Investigator
Select PI...
Project Code
None Assigned
Feedback
Validation
Validation History
Log
Suggestion
Click here to make sure that your project can be validated by the OT. If it won't, you will not be able to submit (submission also validates)
NOTE: Projects submitted to the archive are indelibly watermarked with the Cycle # and CAN'T be submitted in other cycles. They can be used as templates but you might wish to save a "pristine copy"
When you are satisfied that your proposal is complete, click here to submit your project to the ALMA Archive
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.
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

# Summary: New for Cycle 3 OT

**For Cycle 3, there are a relatively small number of *major* new "ALMA" features:**

+ Band 10 (780 – 950 GHz)
+ Free choice of TDM frequency for continuum/polarization (with justification)
+ 36 12-m array, 10 7-m array, 2 TP (use of ACA w/o TP)

**There are more new "OT" features:**

+ *Sesame* is now used to query source information (*but still check all returned info!!*)
+ A Science Goal can contain multiple sources with rectangular field definitions
+ The TP mapping area is automatically calculated for custom mosaics or single pointings
+ Import/export of pointing positions has been updated slightly
+ Absolute positions can be used for pointing centers
+ “Point source” button has been removed, use 0 for LAS, *there is no default*

+ Various improvements to time-constrained interface
+ Technical Justification node completely overhauled
+ Total time for a proposal can be displayed in the main OT GUI – Under “Tool” in menu bar

ALMA

## For more info:

https://almascience.nrao.edu/

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 and operation of ALMA.

NRAO