ALMA Observing Tool hands on session

How to turn that great idea into an ALMA proposal...

Veronica Allen

Author: Harvey Liszt

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Very Long Baseline Array

ALMA Cycle 8 Planning

https://almascience.nrao.edu/news/cycle-8-pre-announcement

19 December 2019	Cycle 8 pre-announcement
17 March 2020	Release of the ALMA Cycle 8 Call for Proposals and Observing Tool, and opening of archive for proposal submission
15 April 2020	Proposal submission deadline **Now no earlier than 19 May 2020**
End of July 2020	Results of the proposal review sent to proposers
9 September 2020	Deadline for phase 2 submission by PIs or designees
15 September 2020	Release of ACA Supplemental Call for Proposals
30 September 2020	End of Cycle 7 observations
1 October 2020	Start of Cycle 8 observations
8 October 2020	Supplemental Call deadline

Configurations

- The configuration schedule strongly influences when an object will be observed
- Some combinations of object LST + desired angular resolution may not allow night observing

Start date	Configuration	Longest baseline	LST for best observing conditions
2020 October 1	C-8	8.5 km	~ 22—10 h
2020 October 20	C-7	3.6 km	~ 23—11 h
2020 November 10	C-6	2.5 km	~ 1—13 h
2020 December 1	C-5	1.4 km	~ 2—14 h
2020 December 20	C-4	0.78 km	~ 4—15 h
2021 January 10	C-3	0.50 km	~ 5—17 h
2021 February 1	No observations due to maintenance		
2021 March 1	C-1	0.16 km	~ 8—21 h
2021 March 26	C-2	0.31 km	~ 9—23 h
2021 April 20	C-3	0.50 km	~ 11—0 h
2021 May 10	C-4	0.78 km	~ 12—2 h
2021 May 31	C-5	1.4 km	~ 13—4 h
2021 June 23	C-6	2.5 km	~15—6 h
2021 July 28	C-5	1.4 km	~17—7 h
2021 August 18	C-4	0.78 km	~19—8 h
2021 September 10	C-3	0.50 km	~20—9 h

Cycle 8 Capabilities - I

- **Antennas:** At least 43 antennas in the 12-m Array, ten 7-m antennas (for short baselines) and three 12-m antennas (for single dish spectral line mapping) in the ACA
- **Receiver bands:** 3, 4, 5, 6, 7, 8, 9, 10
  - (wavelengths 3.1, 2.1, 1.5, 1.3, 0.87, 0.74, 0.44, 0.35 mm)
- **Baselines:**
  - **Long baseline configurations 9,10 will not be visited!**
  - Max baselines 3.7 km (Bands 8-10), 8.5 km for (Bands 3–7)
- **Spectral line, continuum, and mosaic observations:**
  - Spectral line and continuum observations with the 12-m and 7-m Arrays in all bands
  - Single field interferometry (all bands) and mosaics (Bands 3 – 9) with both the 12-m and 7-m arrays
    - Single dish (total power) spectral line in Bands 3 - 8

Cycle 8 Capabilities - II

- **Polarization**
  - Single pointing, on-axis, full linear or circular polarization for continuum and full spectral resolution observations in Bands 3-7 on the 12-m Array
  - Linear polarization on-axis imaging in continuum and full spectral resolution modes at the level of 0.1% (3 sigma) fractional polarization with the very brightest calibrators, and 0.2% (3 sigma) level for a typical observation
  - Minimum detectable degree of circular polarization 1.8% of the peak flux for continuum and full spectral resolution spectral line observing
  - Mosaicking of continuum linear polarization observations in Bands 3 to 7 **NEW!**

New for Cycle 8 - I:

In Cycle 8, the following opportunities will be available to Proposers for the first time:

- Solar observations in Band 5
- VLBI observations of faint science targets (correlated flux density <500 mJy within an unresolved core on ALMA) on ALMA baselines up to 1 km.
  - In "passive phasing" mode, with a known bright phase calibrator within 5^{o}
- HF Band 9 and 10 observing with the standalone 7-m Array
- Mosaicking of linear polarization continuum in Bands 3 to 7
- Spectral scans with the 7-m array including standalone ACA
- No observing mode is described as "non-standard"

New for Cycle 8 - II:

- The whole-proposal .pdf and printable summary generated by the OT will not show PI or co-I names

Casting Light on Chameleon's Dark CO

ABSTRACT

In Cycle 4 proposal 2016.1.00714.S we searched for HCO+ absorption against 13 QSO-phase calibrators seen toward the Chameleon cloud complex, where the H I - H2 transition has been extensively studied in H I, CO, dust optical depth, extinction, and gamma-ray emission. The results were delivered in 2017 March. Although CO emission is seen in one or two directions, HCO+ absorption was present in all directions but one where the QSO flux was very low. Here we propose to observe 2.6mm 12CO absorption along six of the Chameleon sightlines (two clusters of three sources), to determine whether the CO is dark due to low CO column density or low number density and weak rotational excitation. The 5sigma upper limits on N(CO) derived from this work will be 10 times below those that would be inferred from the upper limits on CO emission alone.

SCIENCE CATEGORY:	ISM, star formation and astrochemistry				
ESTIMATED 12-M TIME:	**2.0 h**	**ESTIMATED 7-M TIME:**	**0.0 h**	**ESTIMATED TP TIME:**	**0.0 h**
DUPLICATE OBSERVATION JUSTIFICATION:					

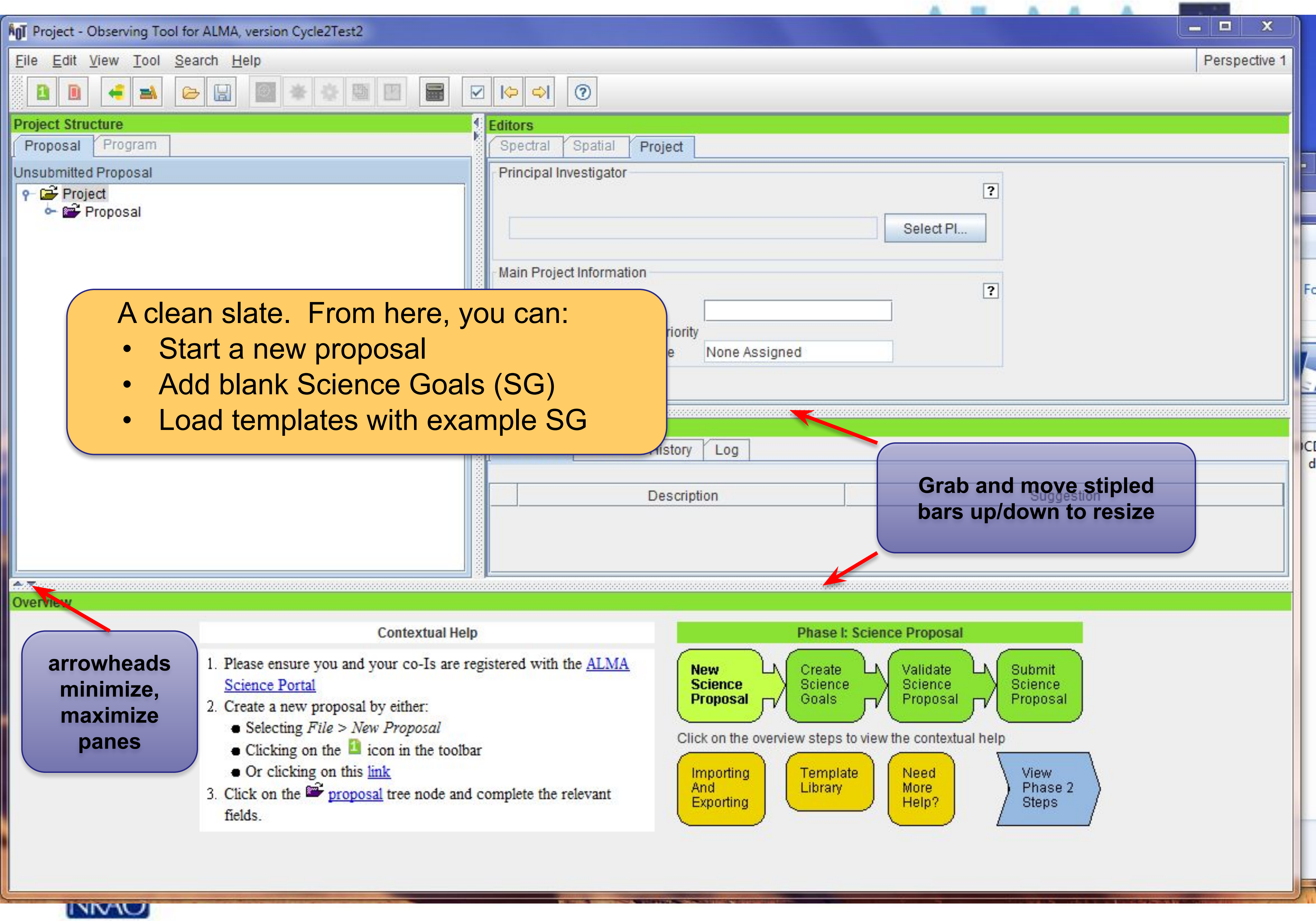
REPRESENTATIVE SCIENCE GOALS (UP TO FIRST 30)

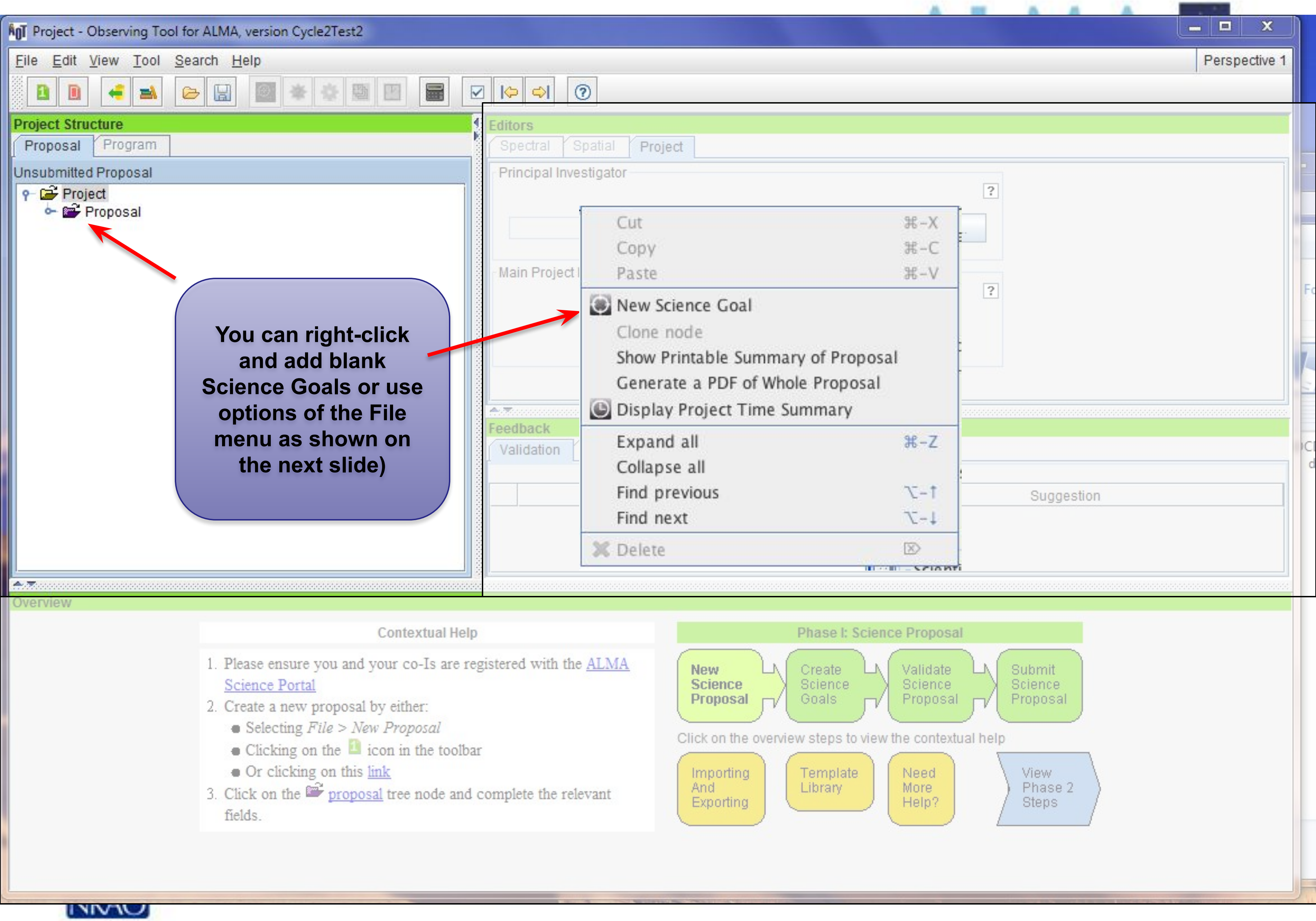
SCIENCE GOAL	POSITION	BAND	ANG.RES.(")	LAS.(")	ACA?
Chameleon's dark CO viewed in 2.6 mm J=1-0 absorption cluster 1	ICRS 11:36:02.0970, -68:27:05.810	3	1.600 - 0.100	0.000	N
Chameleon's dark CO viewed in 2.6 mm J=1-0 absorption cluster 2	ICRS 09:42:42.7520, -77:31:11.840	3	1.600 - 0.100	0.000	N
Total # Science Goals : 2					

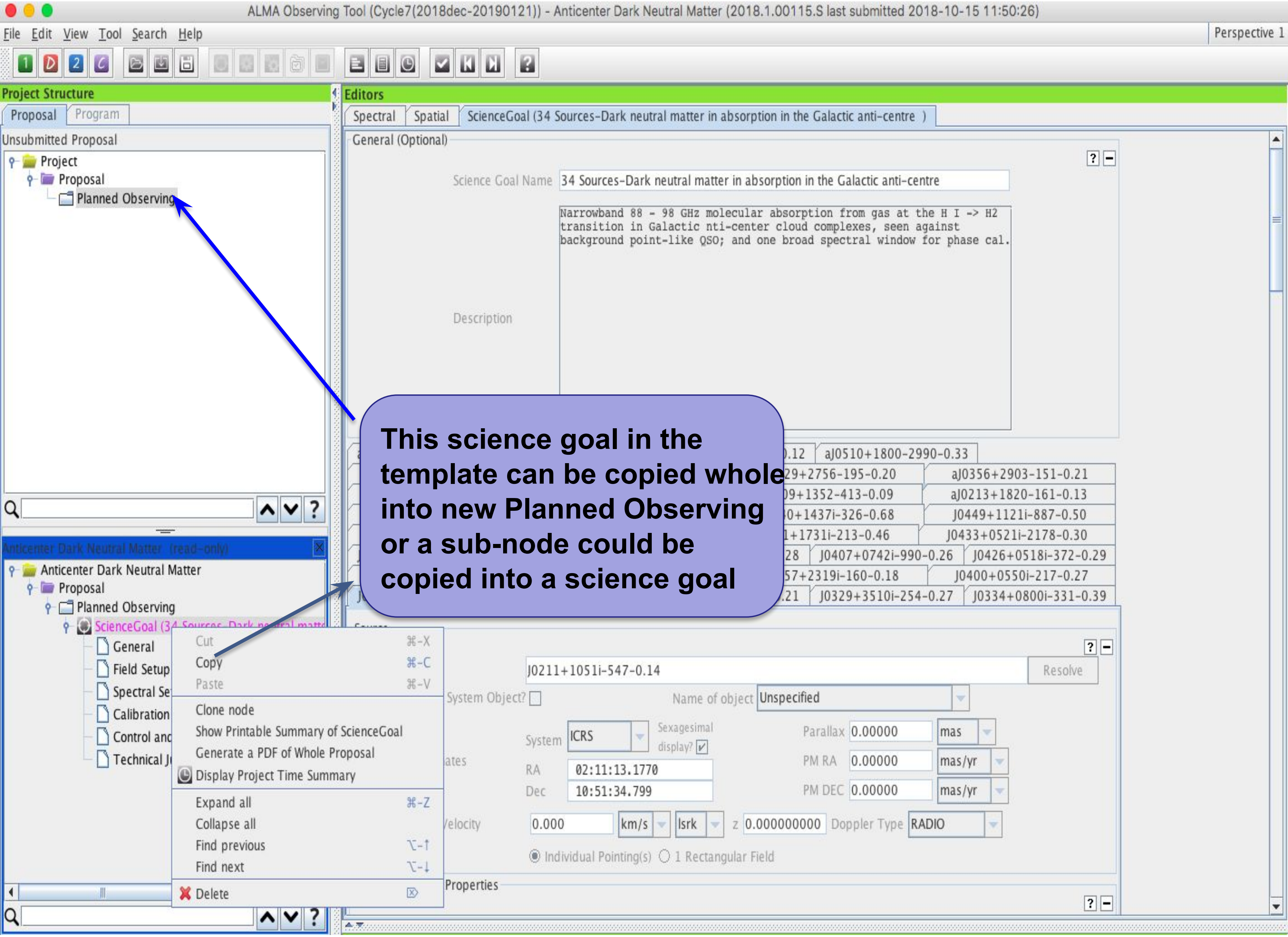
SCHEDULING TIME CONSTRAINTS	NONE	**TIME ESTIMATES OVERRIDDEN ?**	No

New for Cycle 8 - NOTE:

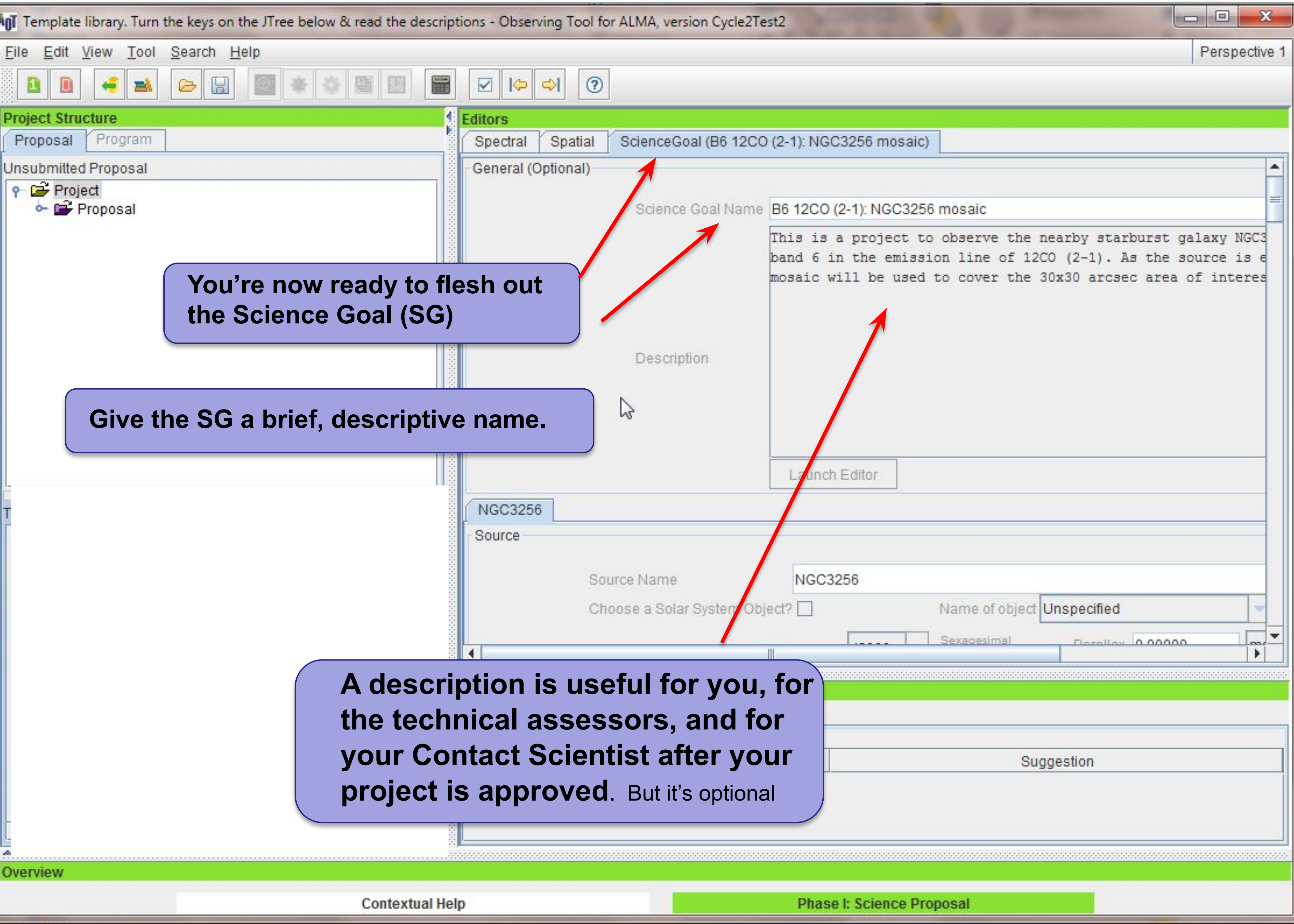
The 150-hour limit for Standalone ACA Large Programs has been changed such that it now only applies to the 7-m time i.e. the TP time is not counted.


Project - Observing Tool for ALMA, version Cycle2Test2
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
Editors
Spectral
Spatial
Project
Principal Investigator
Select PI...
Main Project Information
None Assigned
Log
Description
Overview
A clean slate. From here, you can:
• Start a new proposal
• Add blank Science Goals (SG)
• Load templates with example SG
Grab and move stipled bars up/down to resize
arrowheads minimize, maximize panes
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
Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
You can right-click and add blank Science Goals or use options of the File menu as shown on the next slide)
Editors
Spectral
Spatial
Project
Principal Investigator
Main Project I
Cut ⌘-X
Copy ⌘-C
Paste ⌘-V
New Science Goal
Clone node
Show Printable Summary of Proposal
Generate a PDF of Whole Proposal
Display Project Time Summary
Expand all ⌘-Z
Collapse all
Find previous
Find next
Delete
Feedback
Validation
Suggestion
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



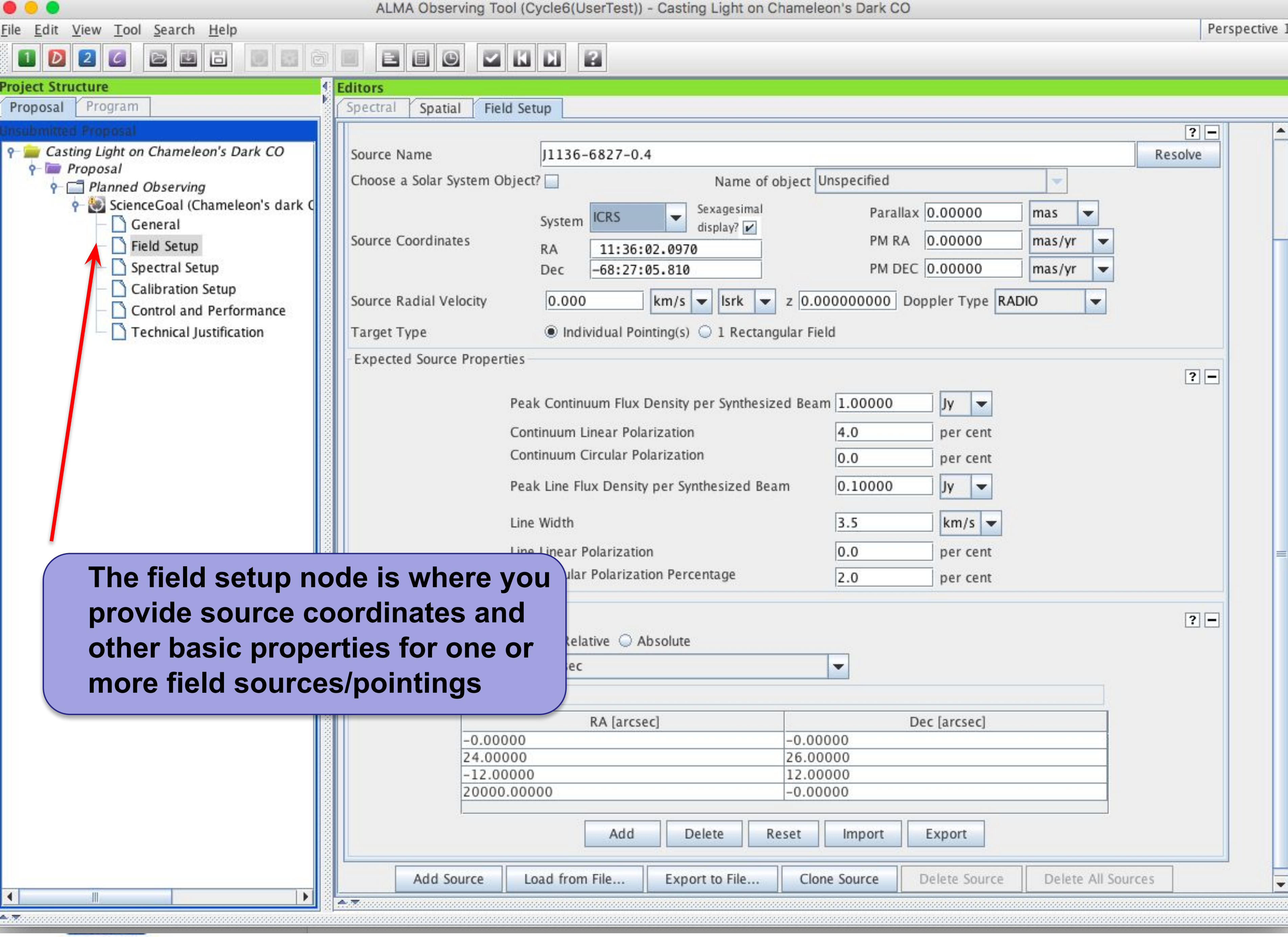
This science goal in the template can be copied whole into new Planned Observing or a sub-node could be copied into a science goal

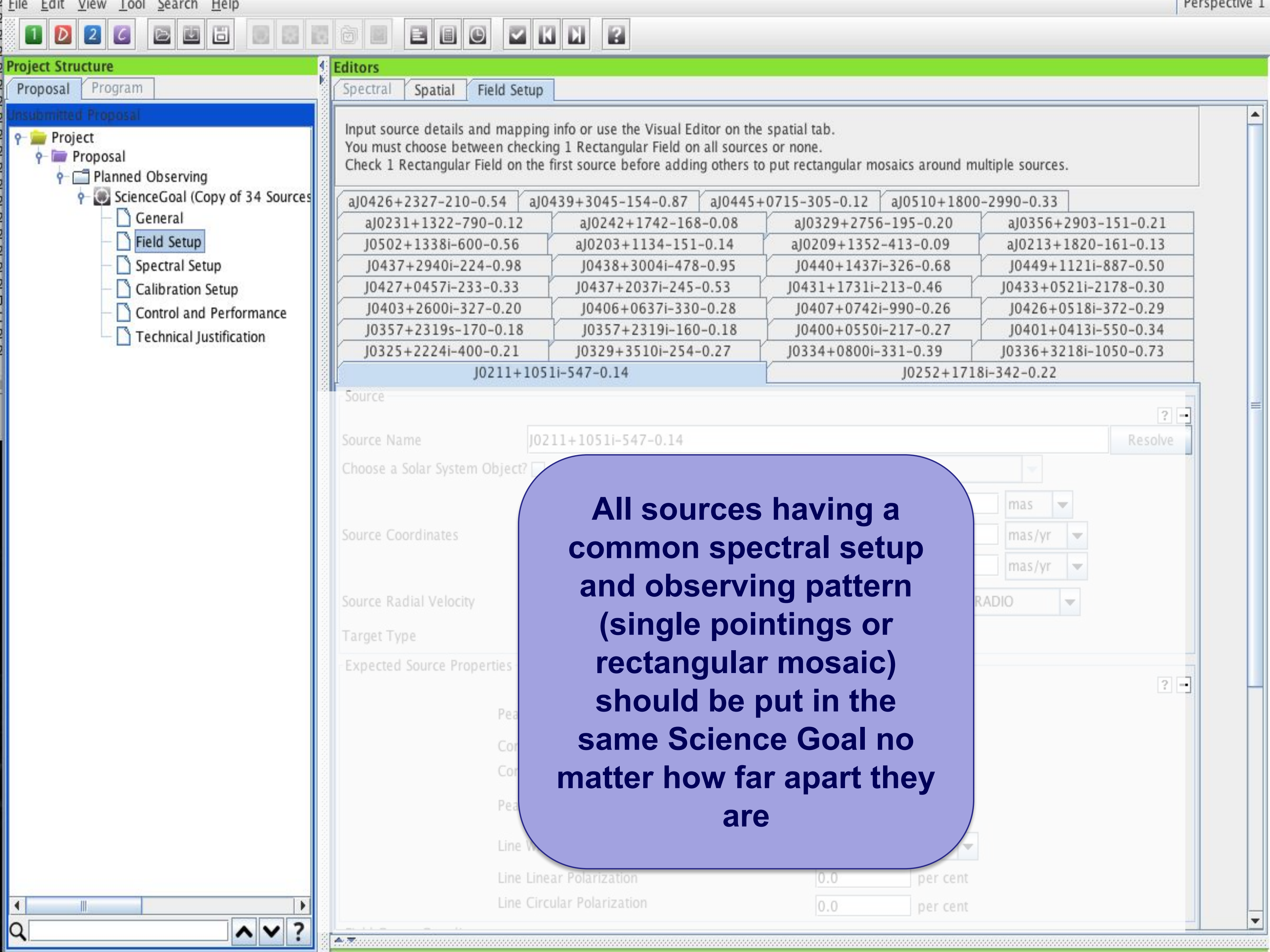


You're now ready to flesh out the Science Goal (SG)

Give the SG a brief, descriptive name.

A description is useful for you, for the technical assessors, and for your Contact Scientist after your project is approved. But it's optional


ALMA Observing Tool (Cycle6(UserTest)) - Casting Light on Chameleon's Dark CO
Project Structure
Proposal
Program
Unsubmitted Proposal
Casting Light on Chameleon's Dark CO
Proposal
Planned Observing
ScienceGoal (Chameleon's dark C
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral
Spatial
Field Setup
Source Name
J1136-6827-0.4
Resolve
Choose a Solar System Object?
Name of object
Unspecified
Source Coordinates
System
ICRS
Sexagesimal display?
RA
11:36:02.0970
Dec
-68:27:05.810
Parallax
0.00000
mas
PM RA
0.00000
mas/yr
PM DEC
0.00000
mas/yr
Source Radial Velocity
0.000
km/s
lsrk
z
0.000000000
Doppler Type
RADIO
Target Type
Individual Pointing(s)
1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Synthesized Beam
1.00000
Jy
Continuum Linear Polarization
4.0
per cent
Continuum Circular Polarization
0.0
per cent
Peak Line Flux Density per Synthesized Beam
0.10000
Jy
Line Width
3.5
km/s
Line Linear Polarization
0.0
per cent
2.0
per cent
Absolute
RA [arcsec]
Dec [arcsec]
-0.00000
-0.00000
24.00000
26.00000
-12.00000
12.00000
20000.00000
-0.00000
Add
Delete
Reset
Import
Export
Add Source
Load from File...
Export to File...
Clone Source
Delete Source
Delete All Sources
The field setup node is where you provide source coordinates and other basic properties for one or more field sources/pointings


File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Copy of 34 Sources
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral
Spatial
Field Setup
Input source details and mapping info or use the Visual Editor on the spatial tab.
You must choose between checking 1 Rectangular Field on all sources or none.
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.
aJ0426+2327-210-0.54
aJ0439+3045-154-0.87
aJ0445+0715-305-0.12
aJ0510+1800-2990-0.33
aJ0231+1322-790-0.12
aJ0242+1742-168-0.08
aJ0329+2756-195-0.20
aJ0356+2903-151-0.21
J0502+1338i-600-0.56
aJ0203+1134-151-0.14
aJ0209+1352-413-0.09
aJ0213+1820-161-0.13
J0437+2940i-224-0.98
J0438+3004i-478-0.95
J0440+1437i-326-0.68
J0449+1121i-887-0.50
J0427+0457i-233-0.33
J0437+2037i-245-0.53
J0431+1731i-213-0.46
J0433+0521i-2178-0.30
J0403+2600i-327-0.20
J0406+0637i-330-0.28
J0407+0742i-990-0.26
J0426+0518i-372-0.29
J0357+2319s-170-0.18
J0357+2319i-160-0.18
J0400+0550i-217-0.27
J0401+0413i-550-0.34
J0325+2224i-400-0.21
J0329+3510i-254-0.27
J0334+0800i-331-0.39
J0336+3218i-1050-0.73
J0211+1051i-547-0.14
J0252+1718i-342-0.22
Source
Source Name
J0211+1051i-547-0.14
Resolve
Choose a Solar System Object?
Source Coordinates
mas
mas/yr
mas/yr
Source Radial Velocity
RADIO
Target Type
Expected Source Properties
Line Linear Polarization
0.0
per cent
Line Circular Polarization
0.0
per cent
All sources having a common spectral setup and observing pattern (single pointings or rectangular mosaic) should be put in the same Science Goal no matter how far apart they are

Hands-on Tutorial

Two practice scenarios

Milky Way: Line detection for chemical characterization in Orion KL

Background: The chemical composition of gas surrounding young stars gives some indication of physical conditions. Additionally, the deuterium fraction of a system can be used to determine the age of that system. We will use ALMA to detect multiple lines of CH_3CN and CH_3OH to determine the properties of this region and better understand star formation.

Extragalactic: Continuum and CO mapping of NGC 4797

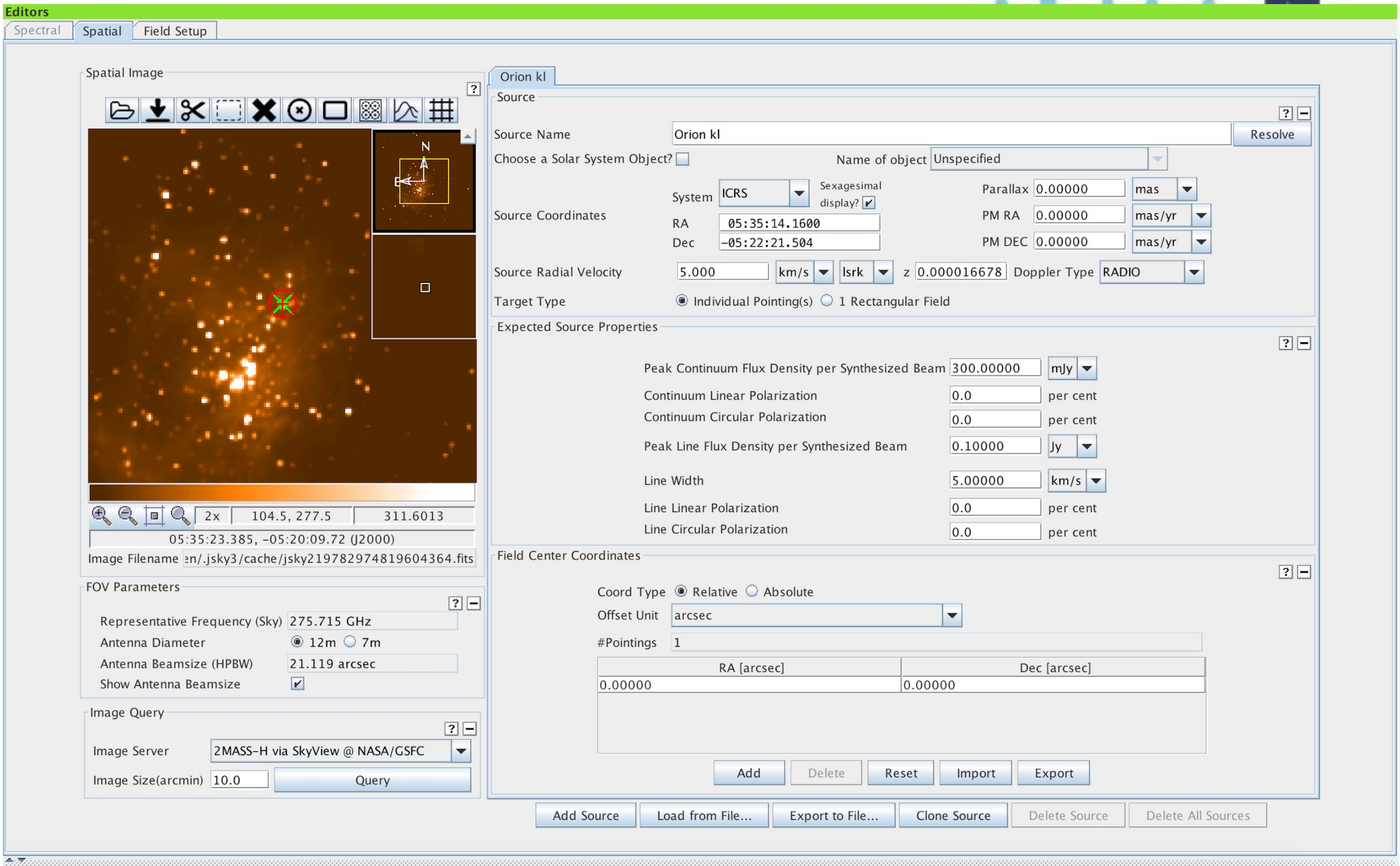
Background: Minor mergers are an important process in galaxy evolution. Whilst major mergers often enhance star formation, minor mergers have been shown to suppress star-formation (Davis et al. 2015). We will use ALMA to determine the underlying physical cause of this intriguing effect.

Scenario 1: ISM & Astrochemistry

- Science goal: determine the chemical composition and deuterium fraction of star-forming region Orion KL.
- Method: high-resolution mapping of the area to trace variations in composition and D/H for CH_3CN and CH_3OH

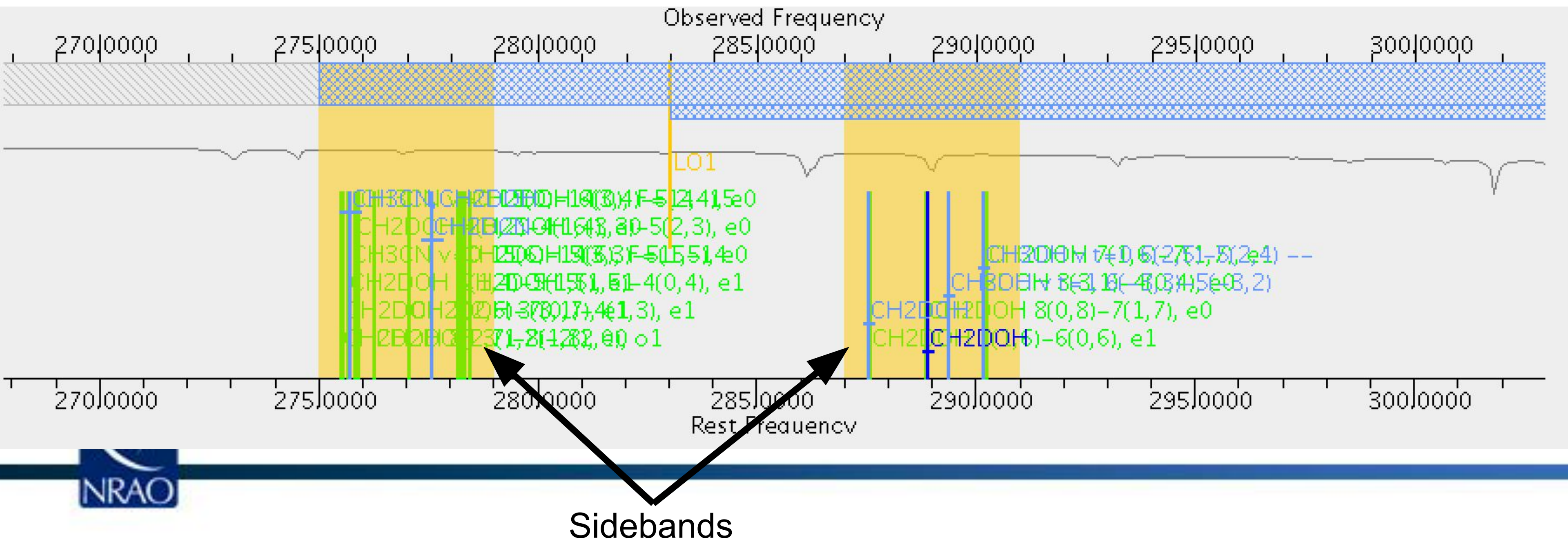
Field Setup

- Orion KL is a common object, so press Resolve to input the coordinates. Always check that these are accurate for your object.
- Display your source and the field of view using Image Query
  - For Orion KL, 2MASS works well
- Continuum flux density estimated from SED or existing continuum observations
- Line flux for the weakest line you aim to detect – spectral modeling helps in estimating this


Editors
Spectral
Spatial
Field Setup
Spatial Image
N
E
2x
104.5, 277.5
311.6013
05:35:23.385, -05:20:09.72 (J2000)
Image Filename
en/.jsky3/cache/jsky219782974819604364.fits
FOV Parameters
Representative Frequency (Sky) 275.715 GHz
Antenna Diameter 12m 7m
Antenna Beamsize (HPBW) 21.119 arcsec
Show Antenna Beamsize
Image Query
Image Server 2MASS-H via SkyView @ NASA/GSFC
Image Size(arcmin) 10.0
Query
Orion kl
Source
Source Name Orion kl
Resolve
Choose a Solar System Object?
Name of object Unspecified
System ICRS
Sexagesimal display?
Parallax 0.00000 mas
Source Coordinates
RA 05:35:14.1600
PM RA 0.00000 mas/yr
Dec -05:22:21.504
PM DEC 0.00000 mas/yr
Source Radial Velocity 5.000 km/s lsrk z 0.000016678 Doppler Type RADIO
Target Type Individual Pointing(s) 1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Synthesized Beam 300.00000 mJy
Continuum Linear Polarization 0.0 per cent
Continuum Circular Polarization 0.0 per cent
Peak Line Flux Density per Synthesized Beam 0.10000 Jy
Line Width 5.00000 km/s
Line Linear Polarization 0.0 per cent
Line Circular Polarization 0.0 per cent
Field Center Coordinates
Coord Type Relative Absolute
Offset Unit arcsec
#Pointings 1
RA [arcsec] Dec [arcsec]
0.00000 0.00000
Add Delete Reset Import Export
Add Source Load from File... Export to File... Clone Source Delete Source Delete All Sources

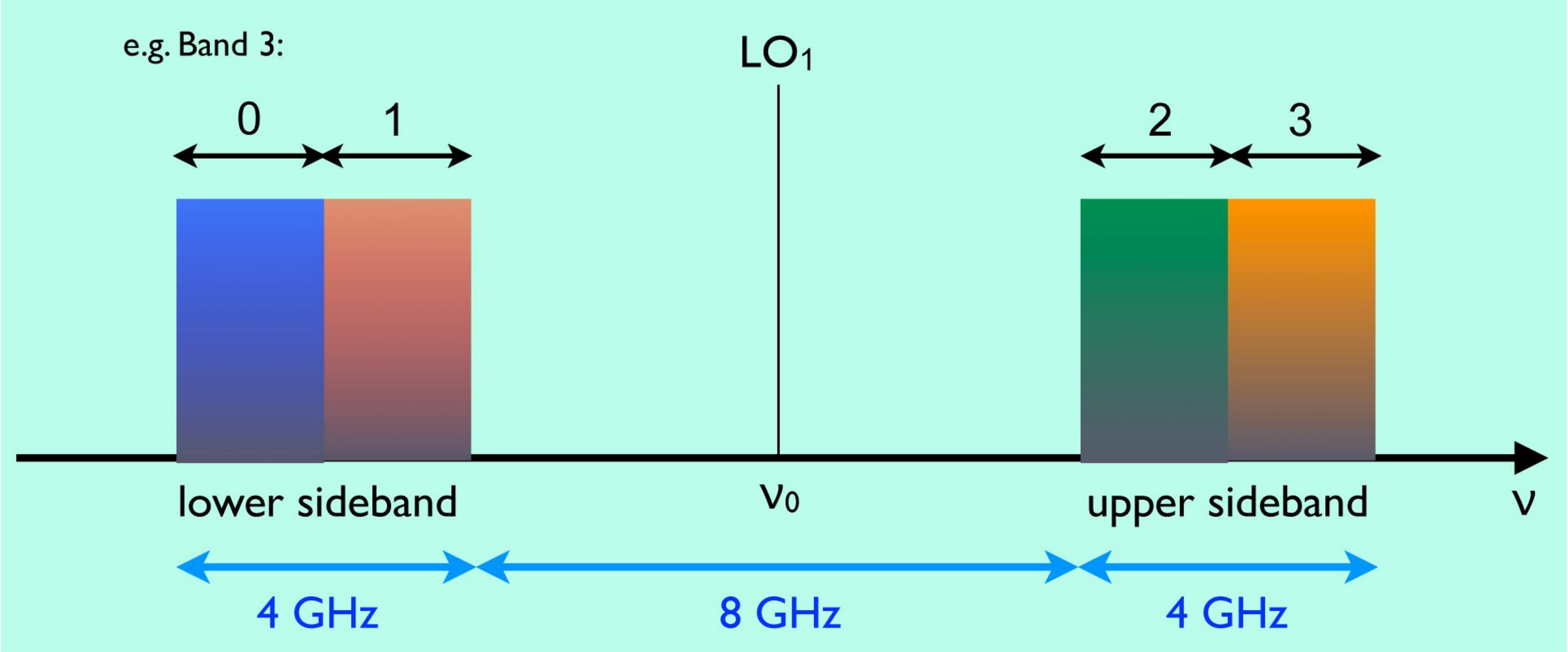
Spectral setup

- Our main science goal involves detecting multiple transitions of CH_3CN, CH_2DCN, CH_3OH, and CH_2DOH so the spectral windows are set accordingly.
- Use "Select Lines to Overlay" to set spectral windows covering multiple lines.
- There are 2 basebands per side band but you can subdivide them into as many as 4 spectral windows each



Correlator

- Your spectral windows are organized into basebands which are set to be 4 GHz wide at ± 4GHz from the Local Oscillator frequency. This is mostly automatic in the OT but you can move the LO.



Dividing basebands

- The single spectral window used for CH_3OH does not cover the higher energy lines so we need another smaller spectral window

- Add a spectral window centered on the CH_3OH v=1 transition at 289.399655 GHz

- Select a correlator mode to match the others and ensure that the other spectral window in this baseband is ½

- How wide are the spectral windows now?

Spectral Line

Baseband-1

Fraction	Centre Freq (rest,lsrk)	Centre Freq (sky,bar)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1(Full)	275.72000 GHz	275.69880 GHz	CH3CN,CH2DOH	468.750 MHz(510 km/s), 282.227 kHz(0.307 km/s)	2	◉

Add spectral window centred on a spectral line | Add spectral window manually | Delete | ☐ Show image spectral windows

Baseband-2

Fraction	Centre Freq (rest,lsrk)	Centre Freq (sky,bar)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1(Full)	277.60000 GHz	277.57866 GHz	CH2DCN	468.750 MHz(506 km/s), 282.227 kHz(0.305 km/s)	2	○

Add spectral window centred on a spectral line | Add spectral window manually | Delete | ☐ Show image spectral windows

Baseband-3

Fraction	Centre Freq (rest,lsrk)	Centre Freq (sky,bar)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1/2	289.39966 GHz	289.37741 GHz	CH3OH v t=1 ...	234.375 MHz(243 km/s), 282.227 kHz(0.292 km/s)	2	○
1/2	290.18469 GHz	290.16238 GHz	CH3OH v t=0 ...	234.375 MHz(242 km/s), 282.227 kHz(0.292 km/s)	2	○

Add spectral window centred on a spectral line | Add spectral window manually | Delete | ☐ Show image spectral windows

Baseband-4

Fraction	Centre Freq (rest,lsrk)	Centre Freq (sky,bar)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1/2	288.92000 GHz	288.89779 GHz	CH2DOH	234.375 MHz(243 km/s), 282.227 kHz(0.293 km/s)	2	○
1/2	287.56000 GHz	287.53789 GHz	CH2DOH	234.375 MHz(244 km/s), 282.227 kHz(0.294 km/s)	2	○

Add spectral window centred on a spectral line | Add spectral window manually | Delete | ☐ Show image spectral windows

Control and Performance

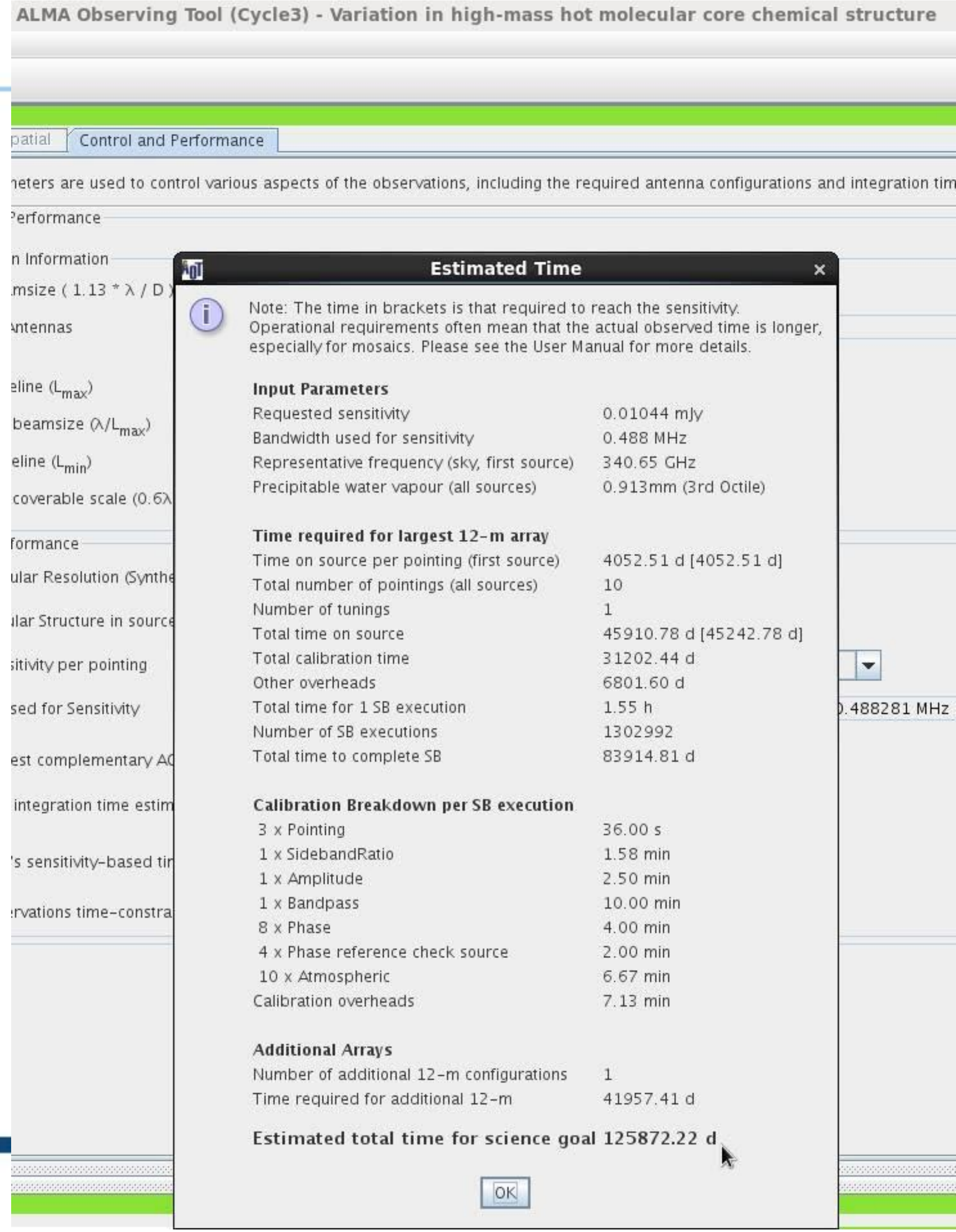
- Setting the desired angular resolution and largest angular structure automatically decides the needed configurations
- Desired sensitivity should give you at least a 3-sigma detection of the line flux density in Field setup
- Our setup includes a full array and an ACA configuration
- An ACA configuration adds ~4x the 12m-array time

Total and Calibration Times

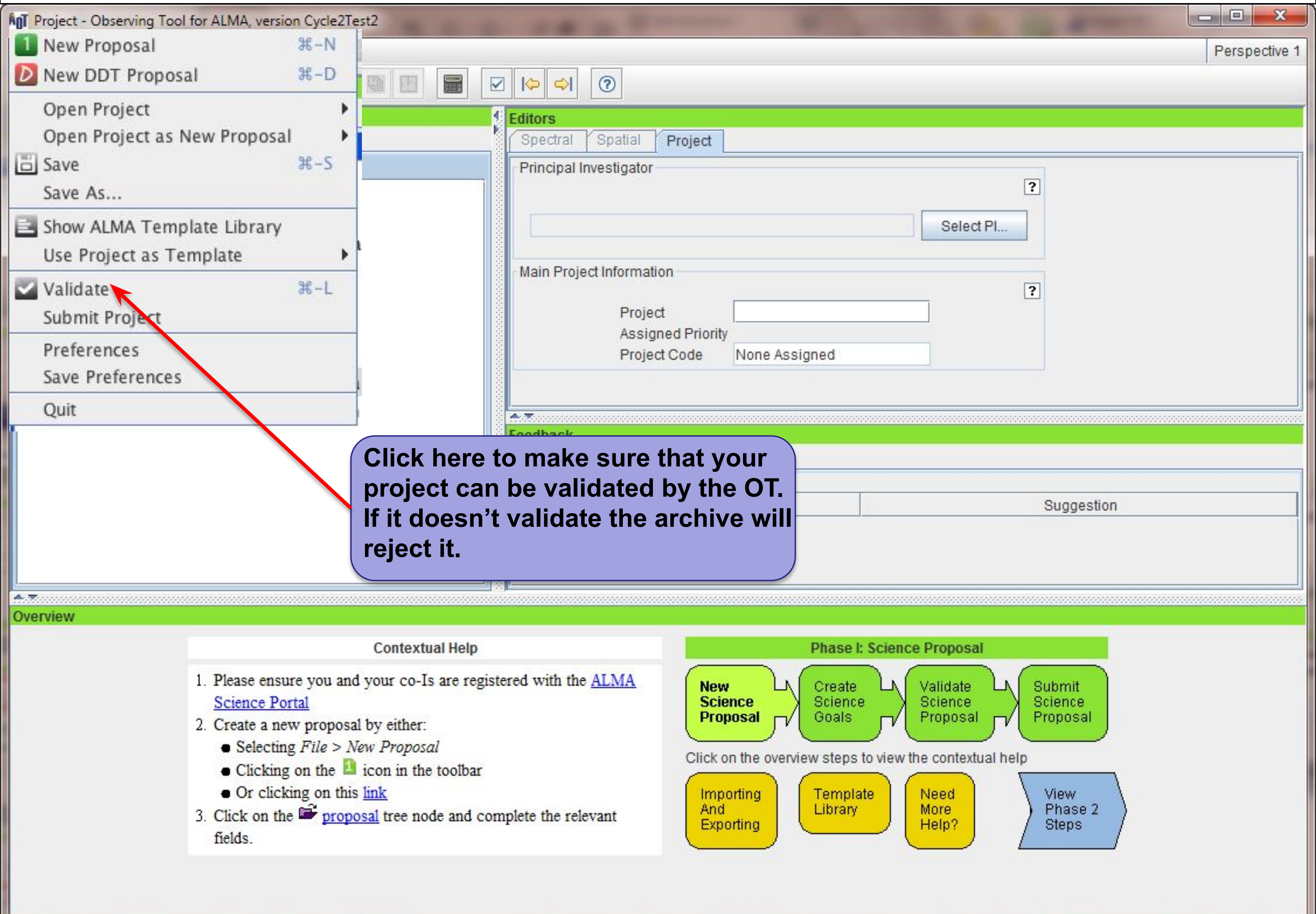
Science Goal	12-m (1)		12-m (2)		12-m (1+2)		ACA 7-m		ACA TP		Overall		Non-standard Mode
	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	
Science Goal	1.04 h	23.63 min	-	-	1.04 h	23.63 min	4.85 h	1.84 h	-	-	5.89 h	2.23 h	No
Overall	1.04 h	23.63 min	-	-	1.04 h	23.63 min	4.85 h	1.84 h	-	-	5.89 h	2.23 h	

Don't be greedy

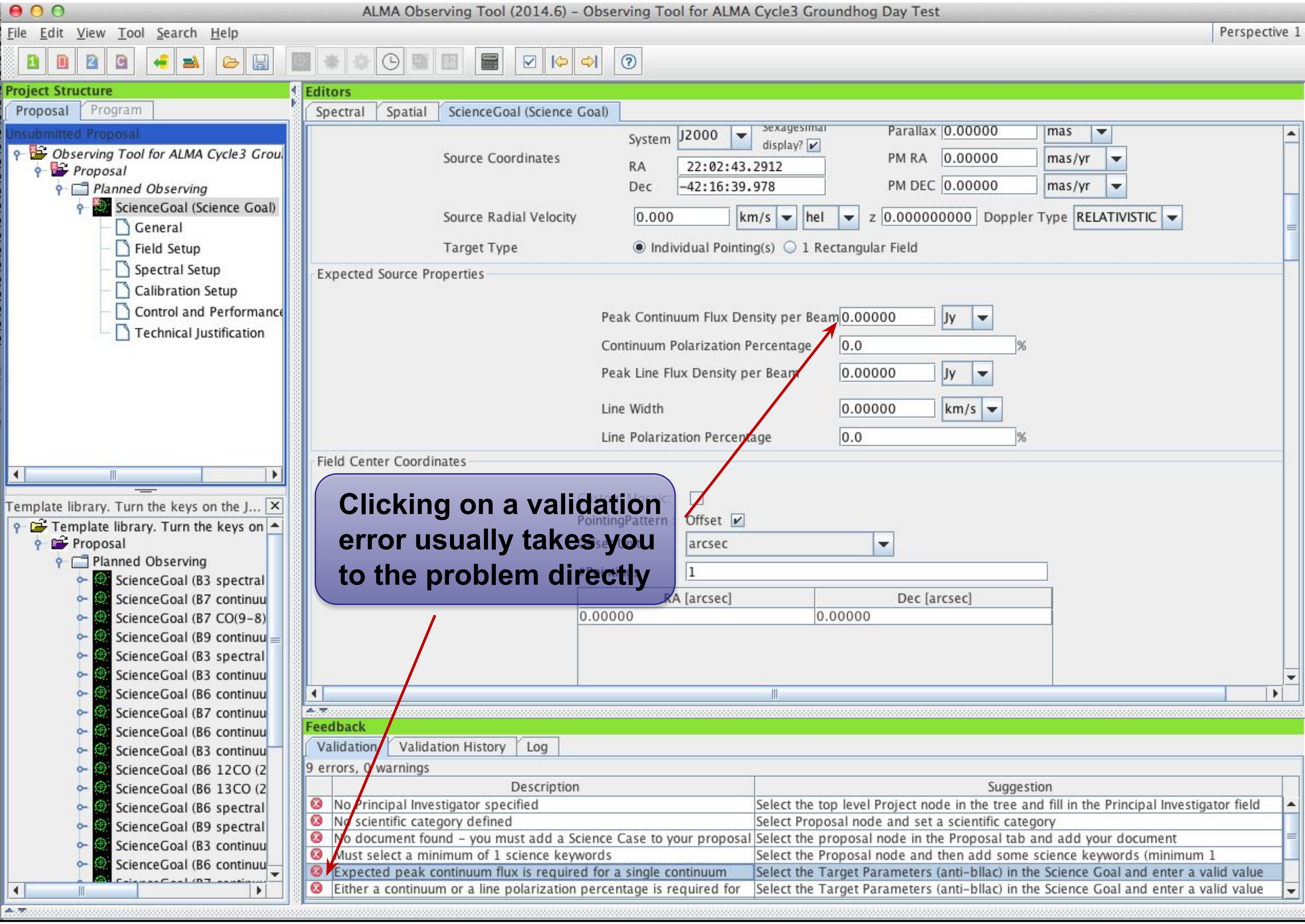
- If you ask for high spatial resolution, crazy sensitivity, and multiple configurations, your observation will last hundreds of years…



Validate & submit



Click here to make sure that your project can be validated by the OT. If it doesn't validate the archive will reject it.


ALMA Observing Tool (2014.6) - Observing Tool for ALMA Cycle3 Groundhog Day Test
File Edit View Tool Search Help
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Project Structure
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Observing Tool for ALMA Cycle3 Grou
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Planned Observing
ScienceGoal (Science Goal)
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Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
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Proposal
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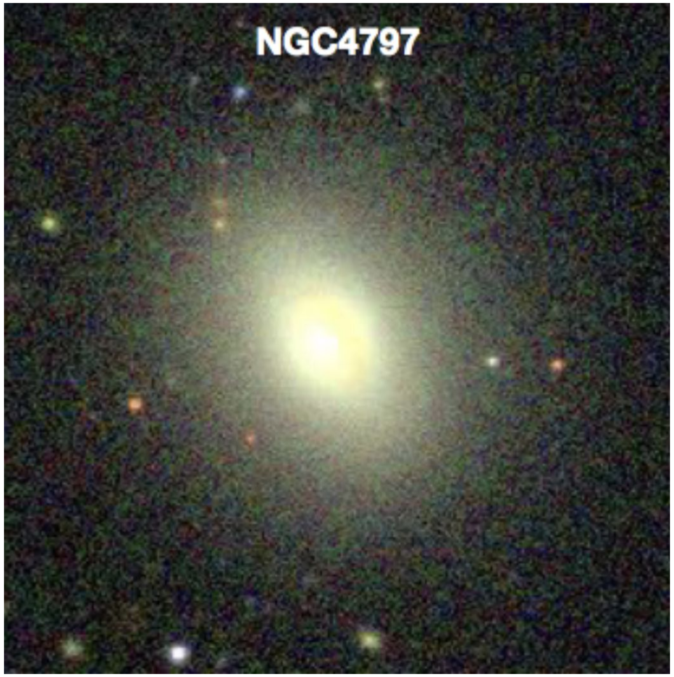
ScienceGoal (B7 continuu
ScienceGoal (B7 CO(9-8)
ScienceGoal (B9 continuu
ScienceGoal (B3 spectral
ScienceGoal (B3 continuu
ScienceGoal (B6 continuu
ScienceGoal (B7 continuu
ScienceGoal (B6 continuu
ScienceGoal (B3 continuu
ScienceGoal (B6 12CO (2
ScienceGoal (B6 13CO (2
ScienceGoal (B6 spectral
ScienceGoal (B9 spectral
ScienceGoal (B3 continuu
ScienceGoal (B6 continuu
Editors
Spectral
Spatial
ScienceGoal (Science Goal)
Source Coordinates
System J2000
Sexagesimal display?
Parallax 0.00000 mas
RA 22:02:43.2912
PM RA 0.00000 mas/yr
Dec -42:16:39.978
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
Offset
arcsec
1
RA [arcsec]
Dec [arcsec]
0.00000
0.00000
Clicking on a validation error usually takes you to the problem directly
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

Scenario 2: Extragalactic

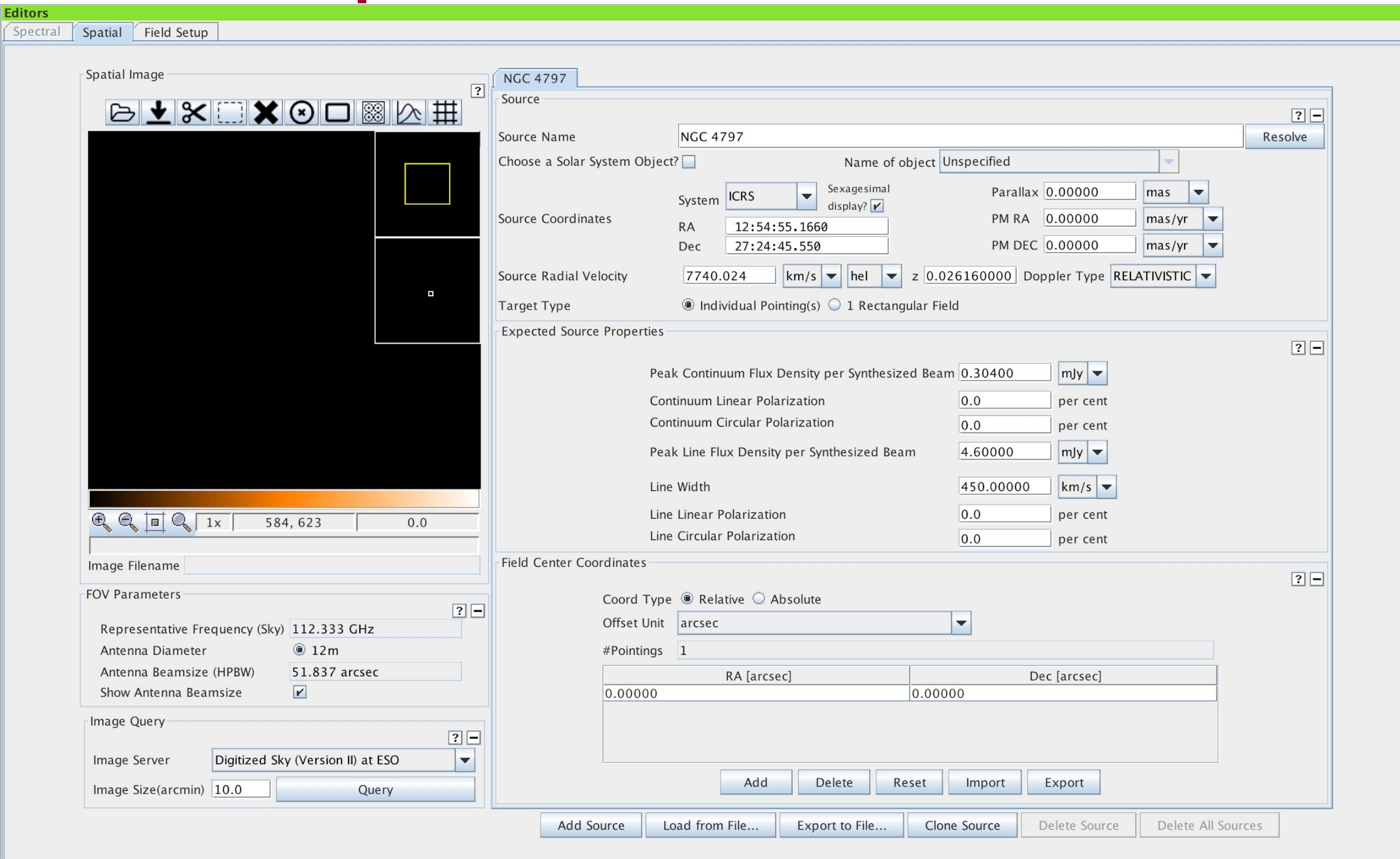
Two separate Science cases

Science case 1: Gas

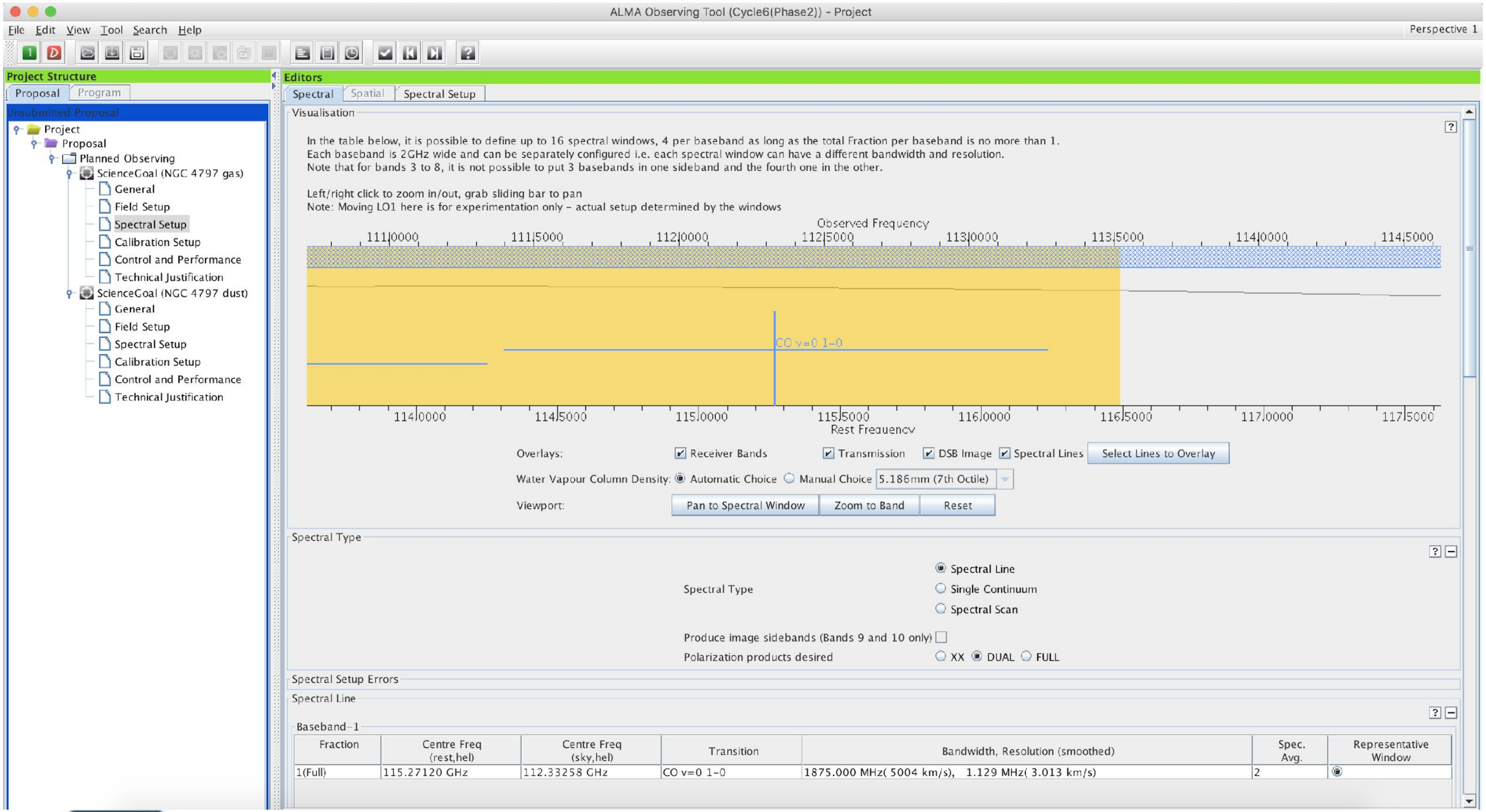
- Science goal: Study the gas velocity and distribution in a minor merger remnant (NGC 4797), to distinguish between dynamical suppression, gravitational heating and AGN/starburst feedback (van de Voort et al. 2018).
- Method: Spectral line observation of CO (1-0) at 10 km/s resolution. The CO gas traces molecular hydrogen gas and will be used to map the gas velocity and distribution.



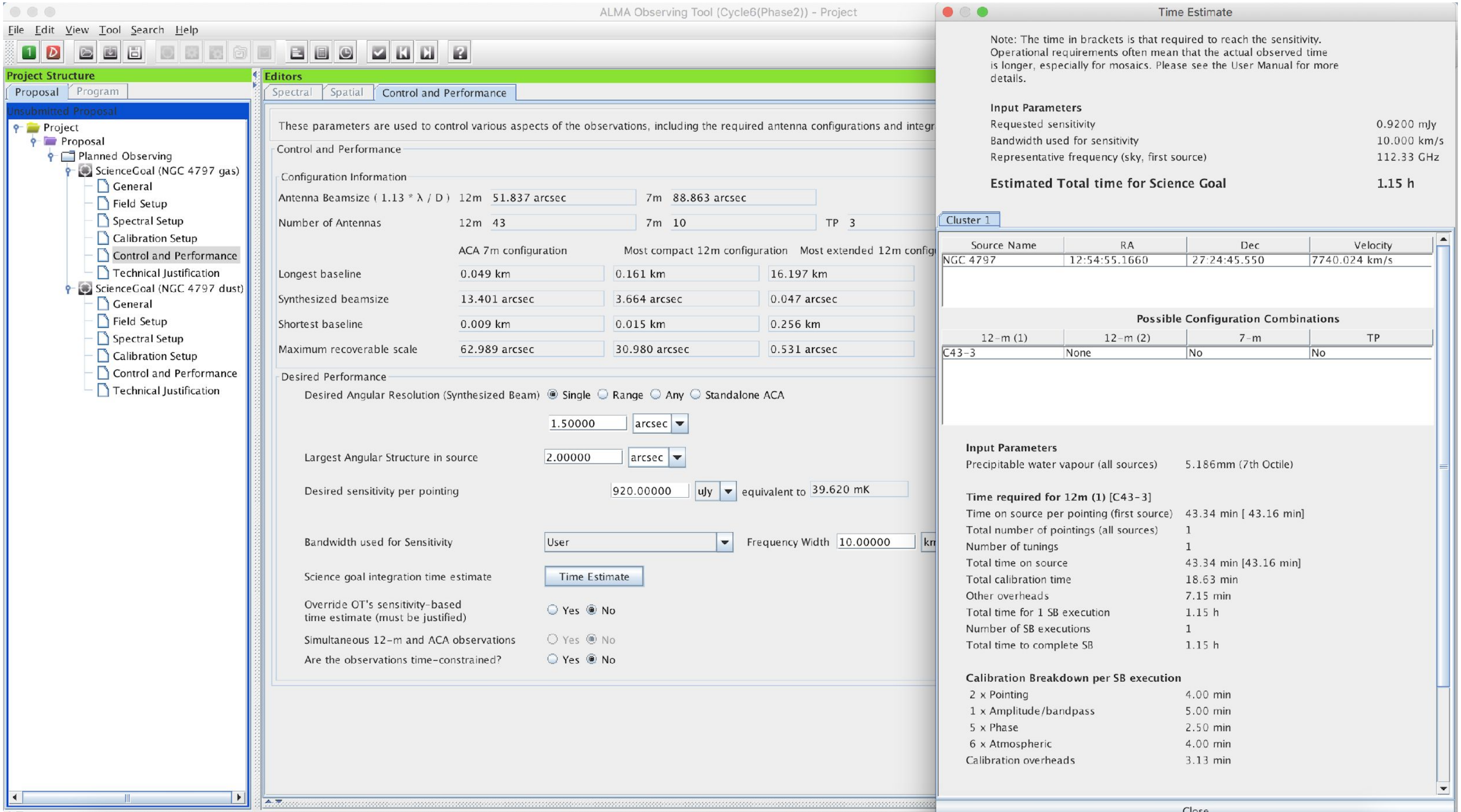
Field Setup


Editors
Spectral
Spatial
Field Setup
Spatial Image
Image Filename
FOV Parameters
Representative Frequency (Sky) 112.333 GHz
Antenna Diameter 12m
Antenna Beamsize (HPBW) 51.837 arcsec
Show Antenna Beamsize
Image Query
Image Server Digitized Sky (Version II) at ESO
Image Size(arcmin) 10.0
Query
NGC 4797
Source
Source Name NGC 4797
Resolve
Choose a Solar System Object?
Name of object Unspecified
Source Coordinates
System ICRS
Sexagesimal display?
RA 12:54:55.1660
Dec 27:24:45.550
Parallax 0.00000 mas
PM RA 0.00000 mas/yr
PM DEC 0.00000 mas/yr
Source Radial Velocity 7740.024 km/s hel z 0.026160000 Doppler Type RELATIVISTIC
Target Type Individual Pointing(s) 1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Synthesized Beam 0.30400 mJy
Continuum Linear Polarization 0.0 per cent
Continuum Circular Polarization 0.0 per cent
Peak Line Flux Density per Synthesized Beam 4.60000 mJy
Line Width 450.00000 km/s
Line Linear Polarization 0.0 per cent
Line Circular Polarization 0.0 per cent
Field Center Coordinates
Coord Type Relative Absolute
Offset Unit arcsec
#Pointings 1
RA [arcsec] Dec [arcsec]
0.00000 0.00000
Add Delete Reset Import Export
Add Source Load from File... Export to File... Clone Source Delete Source Delete All Sources

Spectral Setup



Angular resolution and time estimate



Science Case I Continuum

- Set the peak continuum flux sensitivity per synthesized beam to 0.304mJy/beam in the field setup (this was estimated from fitting a modified blackbody to fluxes at shorter wavelengths).

- Now add 3 spectral windows to record continuum in band 3. Use the lowest spectral resolution correlator mode, and use the full 7.5 GHz bandwidth.

- What is the continuum flux density S/N? (Hint – use the Technical Justification tab).

- Change the largest angular structure to 20". What is the integration time now, and why is it longer?

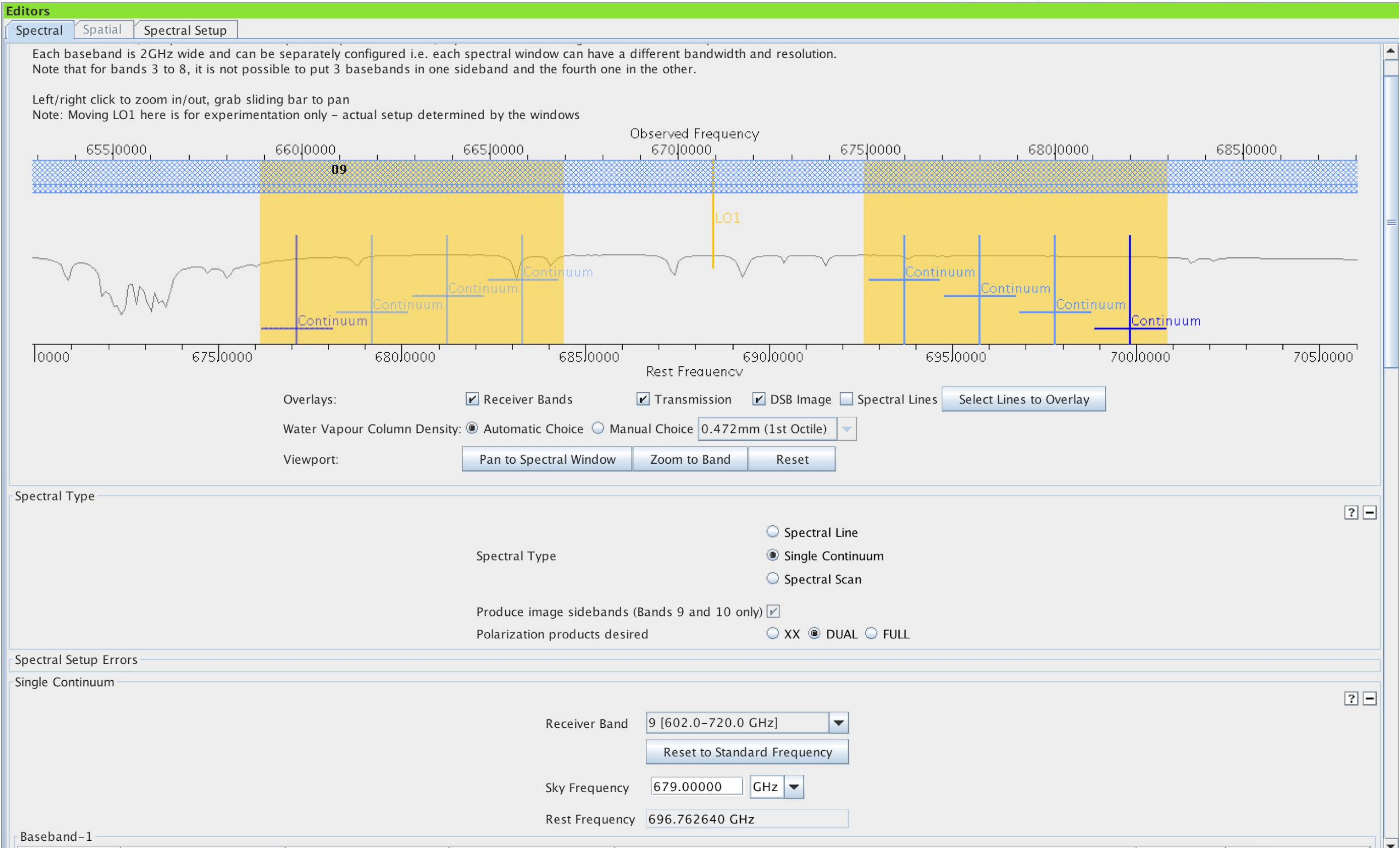
NGC 4797 Science case 2

Science case 2: dust continuum

- Science goal: Map the dust continuum to look for extended dust emission, and to do radiative transfer modelling to reveal the sources of dust heating.
- Method: Image the dust continuum at high resolution to match the spatial resolution of existing optical data. The dust continuum will be brightest at high frequency (Band 9).

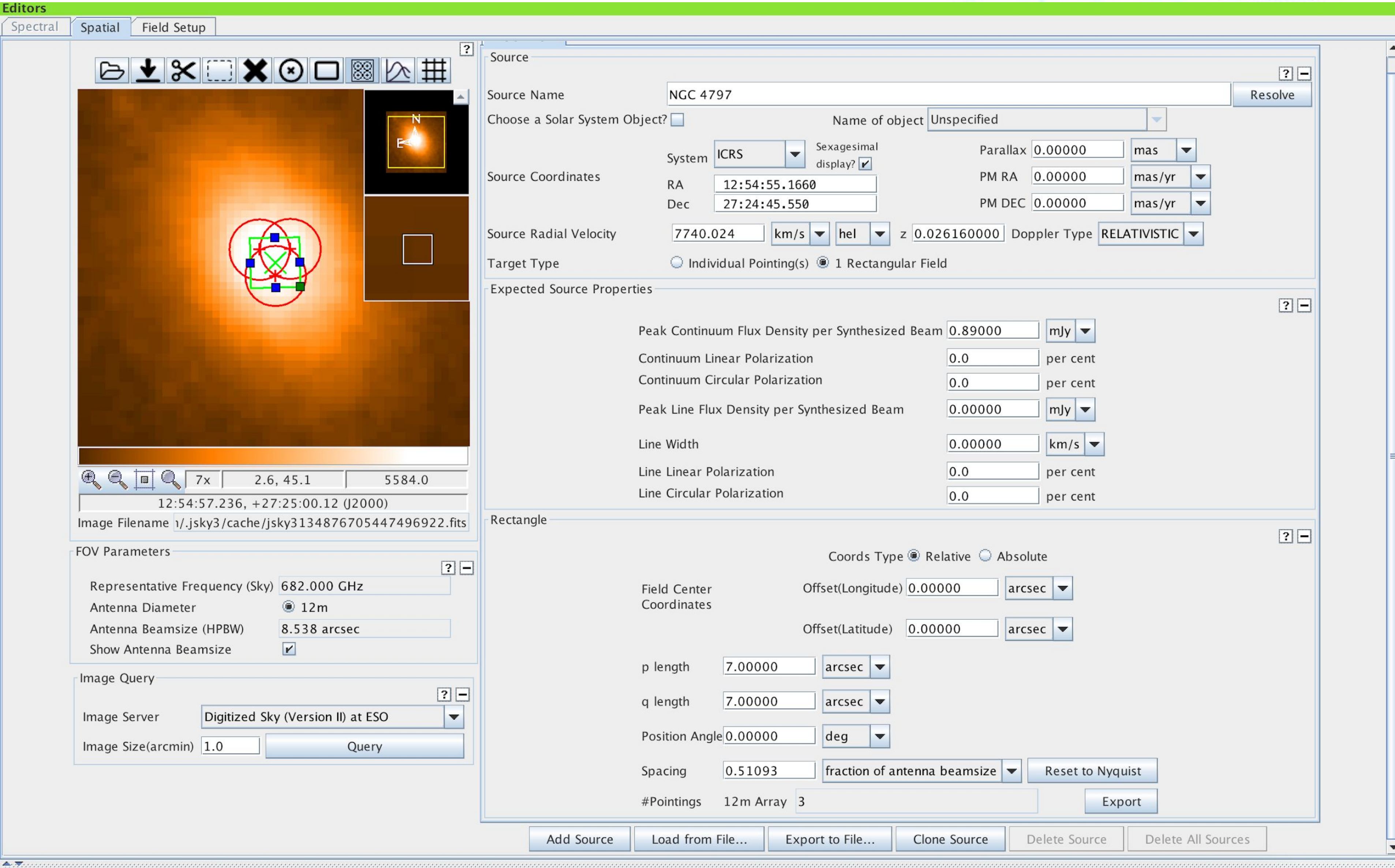
Setup second Science case

- Copy the science goal and give it a new name.
- Change the spectral setup to observe continuum in band 9. Note the mirror images of the spectral windows.
- Set the peak continuum flux to 0.89 mJy/beam and the peak line flux to zero.
- Set the desired angular resolution to 0.6" and the largest angular scale to 2.0".
- What is the desired sensitivity needed to reach a S/N of 5 for the continuum? (Hint, the integration time is 8.8 hours).

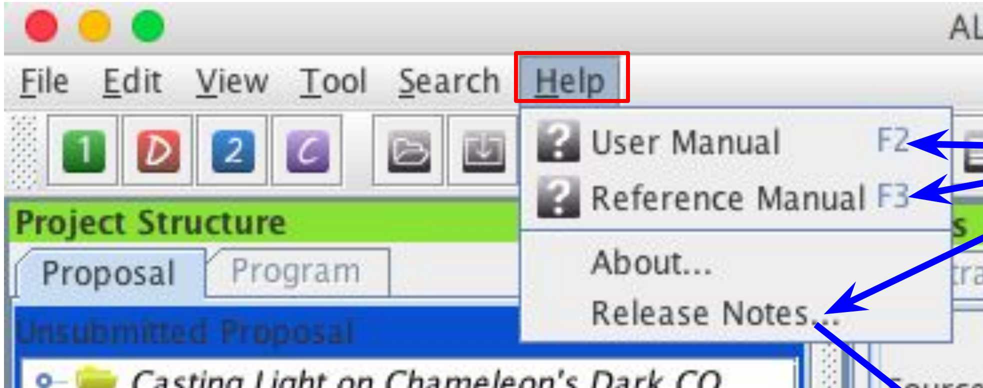

Editors
Spectral
Spatial
Spectral Setup
Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolution.
Note that for bands 3 to 8, it is not possible to put 3 basebands in one sideband and the fourth one in the other.
Left/right click 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
655.0000
660.0000
665.0000
670.0000
675.0000
680.0000
685.0000
09
LO1
Continuum
Continuum
Continuum
Continuum
Continuum
Continuum
Continuum
Continuum
0000
675.0000
680.0000
685.0000
690.0000
695.0000
700.0000
705.0000
Rest Frequency
Overlays:
Receiver Bands
Transmission
DSB Image
Spectral Lines
Select Lines to Overlay
Water Vapour Column Density:
Automatic Choice
Manual Choice
0.472mm (1st Octile)
Viewport:
Pan to Spectral Window
Zoom to Band
Reset
Spectral Type
Spectral Type
Spectral Line
Single Continuum
Spectral Scan
Produce image sidebands (Bands 9 and 10 only)
Polarization products desired
XX
DUAL
FULL
Spectral Setup Errors
Single Continuum
Receiver Band
9 [602.0-720.0 GHz]
Reset to Standard Frequency
Sky Frequency
679.00000
GHz
Rest Frequency
696.762640 GHz
Baseband-1

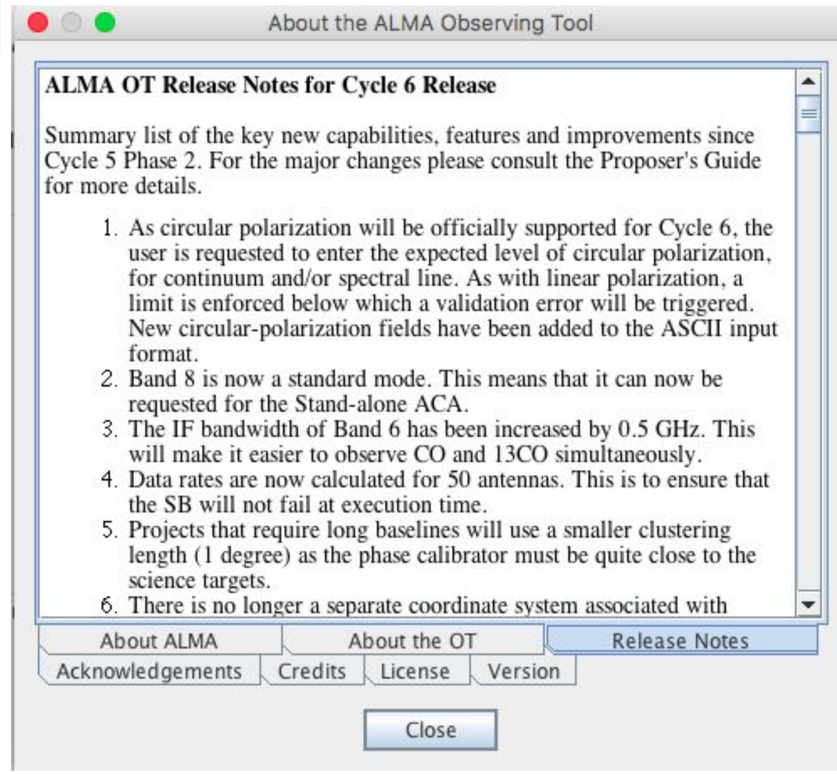
Mosaic

- We want to make a map of the dust a larger region than one pointing.
- In field setup, change to a rectangular field and make a 7"x7" mosaic. Use Nyquist spacing (the default) between the pointings.
  This is the spacing of samples on the sky needed to get good imaging of large-scale low surface brightness emission. Use the spatial image tool to help you visualize the pointing positions.
- How long is the integration time now?


Editors
Spectral
Spatial
Field Setup
Source
Source Name
NGC 4797
Resolve
Choose a Solar System Object?
Name of object
Unspecified
Source Coordinates
System
ICRS
Sexagesimal display?
RA
12:54:55.1660
Dec
27:24:45.550
Parallax
0.00000
mas
PM RA
0.00000
mas/yr
PM DEC
0.00000
mas/yr
Source Radial Velocity
7740.024
km/s
hel
z
0.026160000
Doppler Type
RELATIVISTIC
Target Type
Individual Pointing(s)
1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Synthesized Beam
0.89000
mJy
Continuum Linear Polarization
0.0
per cent
Continuum Circular Polarization
0.0
per cent
Peak Line Flux Density per Synthesized Beam
0.00000
mJy
Line Width
0.00000
km/s
Line Linear Polarization
0.0
per cent
Line Circular Polarization
0.0
per cent
Rectangle
Coords Type
Relative
Absolute
Field Center Coordinates
Offset(Longitude)
0.00000
arcsec
Offset(Latitude)
0.00000
arcsec
p length
7.00000
arcsec
q length
7.00000
arcsec
Position Angle
0.00000
deg
Spacing
0.51093
fraction of antenna beamsize
Reset to Nyquist
#Pointings
12m Array
3
Export
Add Source
Load from File...
Export to File...
Clone Source
Delete Source
Delete All Sources
N
E
7x
2.6, 45.1
5584.0
12:54:57.236, +27:25:00.12 (J2000)
Image Filename
ı/.jsky3/cache/jsky3134876705447496922.fits
FOV Parameters
Representative Frequency (Sky)
682.000 GHz
Antenna Diameter
12m
Antenna Beamsize (HPBW)
8.538 arcsec
Show Antenna Beamsize
Image Query
Image Server
Digitized Sky (Version II) at ESO
Image Size(arcmin)
1.0
Query

Don’t be afraid to ask for directions





Suggestion: input file formats are shown in the help sections that you invoke with the local ?

A Few OT Tips…

- The same cut and paste commands you use outside the OT for text also work inside it since Cycle 5
- Ctrl-Z global shortcut will expand out all succeeding items in the J-tree (try it, you'll see what we mean)
- Holding down ALT when making choices in dropdown lists will convert to the unit or type of the new choice
  - Otherwise, only the description changes, not value
- OT does galactic-celestial conversion automatically
  - Cannot convert in other ways, eg not FK5 J2000 to ICRS. FK5 J2000 now deprecated

A Few More OT Tips…

- NEW In the J-tree: Holding down the alt key in combination with the up/down arrows will move from a node in one SG to the same node in the adjacent SG (try it when you have more than one SG)

Atacama Large Millimeter/submillimeter Array

In search of our Cosmic Origins

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Forgot Account

Observatory News

Additional Information for Cycle 5 Proposals
Feb 01, 2017

Release of a New Installment of Science Verification Data
Jan 18, 2017

RadioNet: Calls for financial support - OPEN
Jan 16, 2017

More news...

NRAO News

American Astronomical Society Meeting
Jun 04, 2017

2017 Astrobiology Graduate Conference
Jun 05, 2017

Women in Astronomy IV: The Many Faces of Women Astronomers
Jun 09, 2017

More...

Status

ALMA Cycle 5 Pre-Announcement

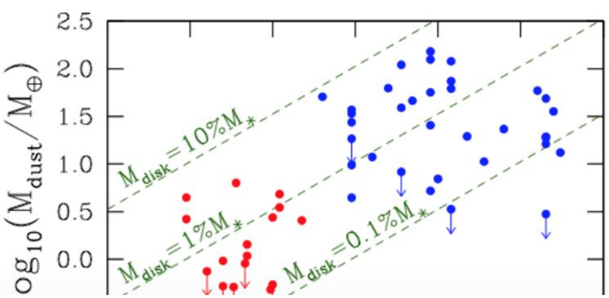
Refereed publications:

Last observed source:

Current configuration: C40-2

More...

Science Highlights - Possible Disk Truncation in Ophiuchus Brown Dwarfs



The sensitivity, resolution and the wavelength coverage of ALMA makes it an ideal tool for studying the properties of the cold outer disks of young stars and low mass objects. Such observations can aid us in understanding the formation of their central objects and their likelihood of ultimately hosting planets. In a recent Astronomy & Astrophysics paper, Dr. Testi and his collaborators made use of ALMA Band 7 to observe an unbiased sample of spectroscopically confirmed Ophiuchus brown dwarfs with infrared excesses.

www.almascience.org

ALMA Science Portal @ NRAO

I could use a hand…

Have no fear, the ALMA Helpdesk is here…

<< Science Portal | Home | Knowledgebase | News | English (U.S.)

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» Knowledgebase
- General ALMA Queries (13)
- Early Science - Cycle 1 (31)
- Resources & Observer Support (12)
- Project Planning (14)
- ALMA Observing Tool (OT) (29)
- Proposal Handling (5)
- Archive & Data Retrieval (4)
- Offline Data Reduction and/or CASA (14)
- Development Program (1)

Live Chat Software by Kayako

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Knowledgebase

General ALMA Queries (13)
- Can I submit a ticket in Japanese?
- How close can ALMA observe to the Sun?

Early Science - Cycle 1 (31)
- Can I use "breakpoints" in ALMA cycle 1?
- The Cycle 1 Technical Handbook has some gaps in its discussion of ALMA receivers (SSB, 2SB, DSB). What else can you tell me about them?

Resources & Observer Support (12)
- How do I arrange a visit to one of the ARCs?
- Where can I find ALMA documentation and manuals?

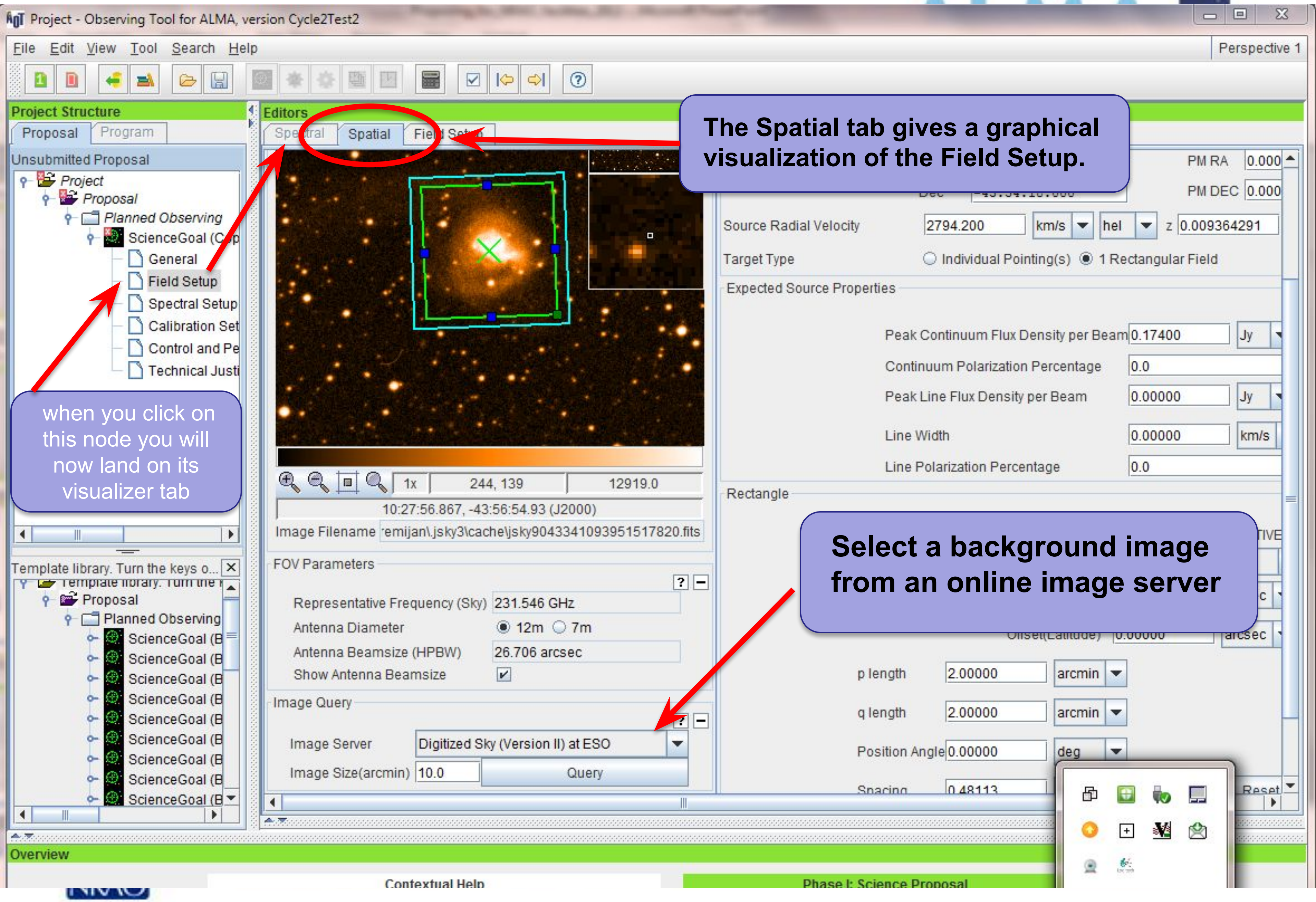
Project Planning (14)
- What should I include for the content of the Technical Justification and in what format should I submit it?
- Where can I find the online ALMA observing simulator developed by the University of Manchester?

ALMA Observing Tool (OT) (29)
- What do I do if I can't get the OT to work?
- How do I deal with targets with unspecified coordinates in the OT?

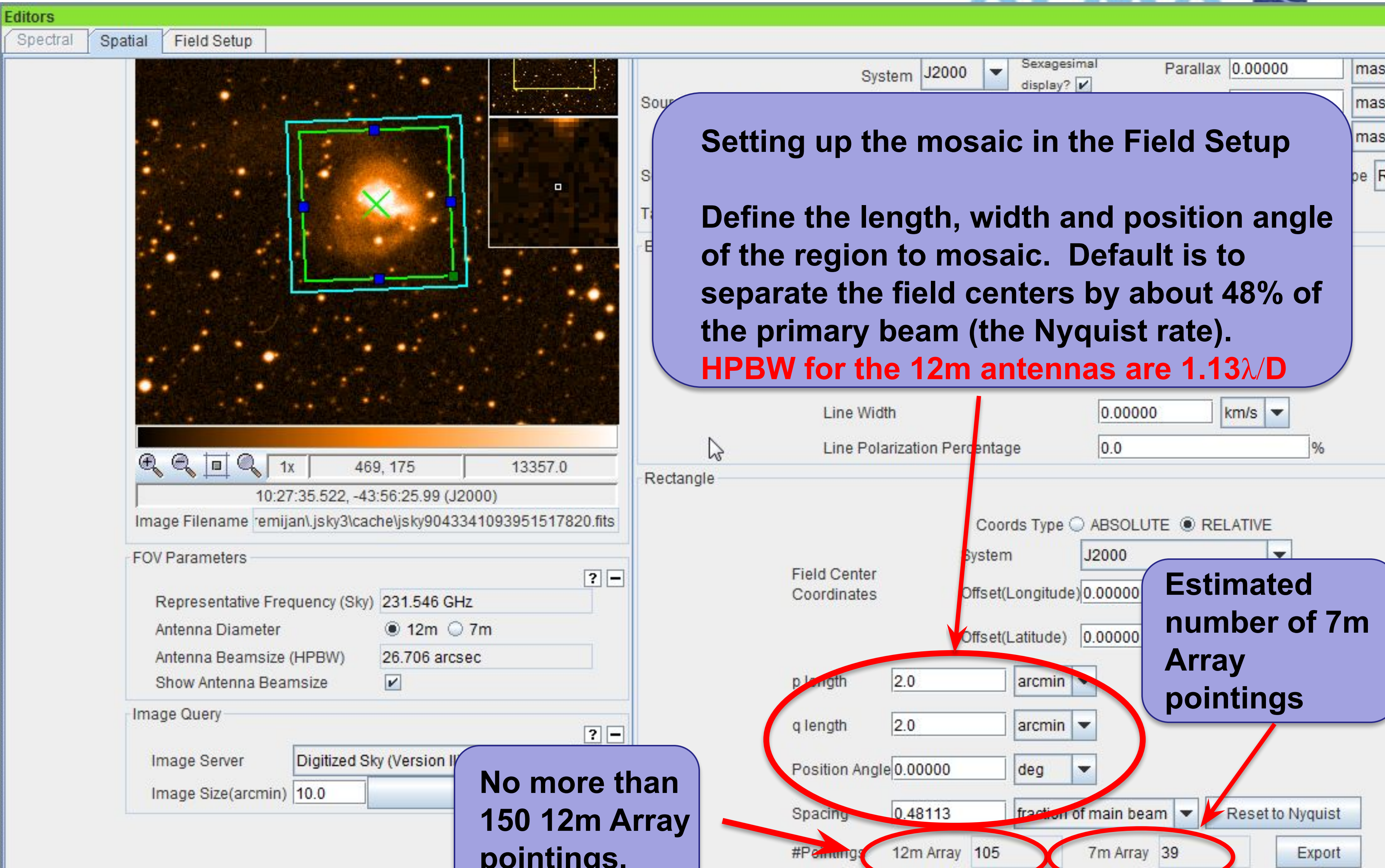
Proposal Handling (5)
- May I submit an identical proposal to more than one category, e.g. submitting a proposal on distant galaxies both to cosmology and to galaxy categories?
- Which category should I submit a proposal on distant galaxies: "cosmology/high-z" or "Galaxies/Nuclei"?

Extra OT slides

Crafting mosaics



Crafting mosaics



Setting up the mosaic in the Field Setup

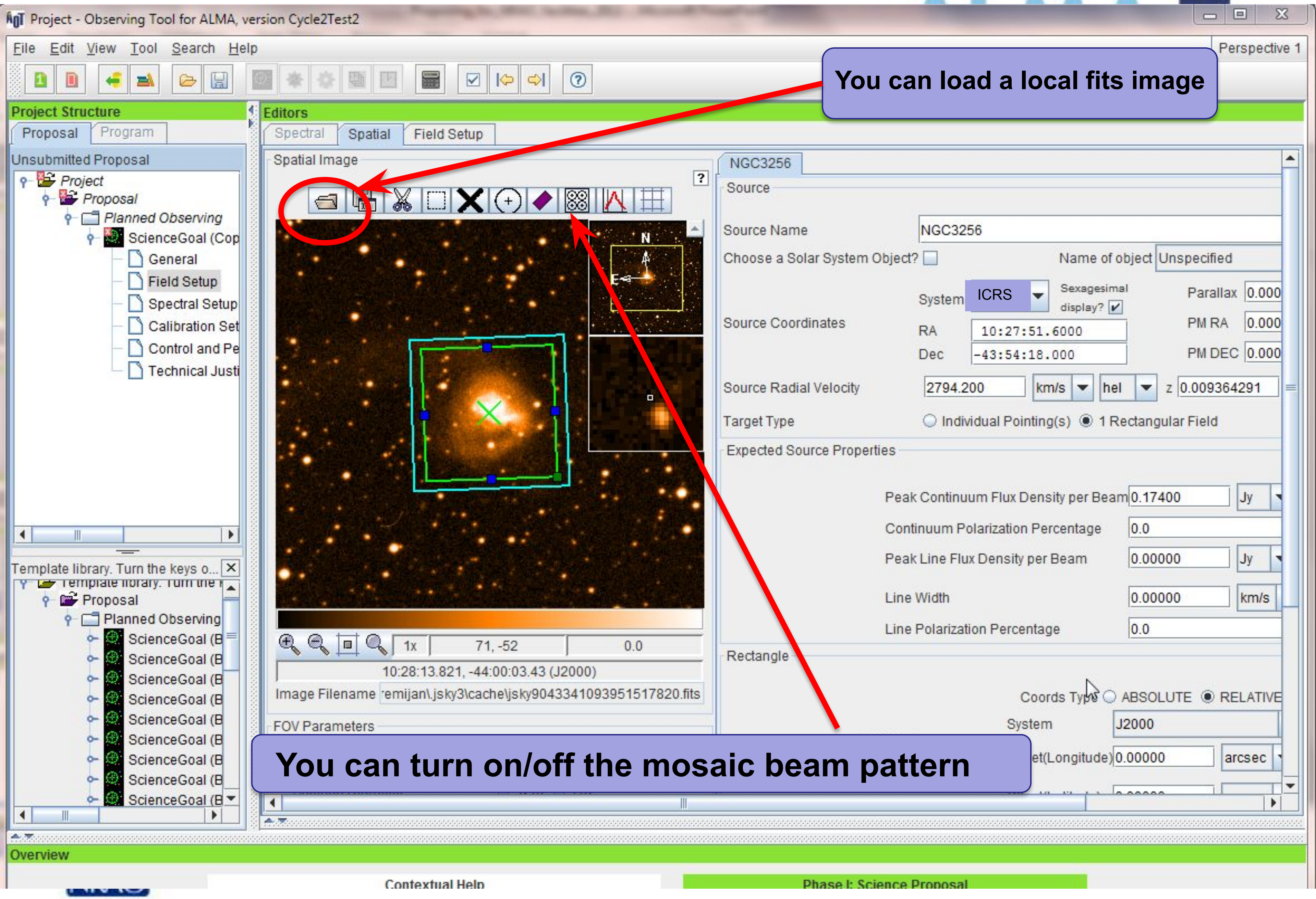
Define the length, width and position angle of the region to mosaic. Default is to separate the field centers by about 48% of the primary beam (the Nyquist rate).

HPBW for the 12m antennas are 1.13λ/D

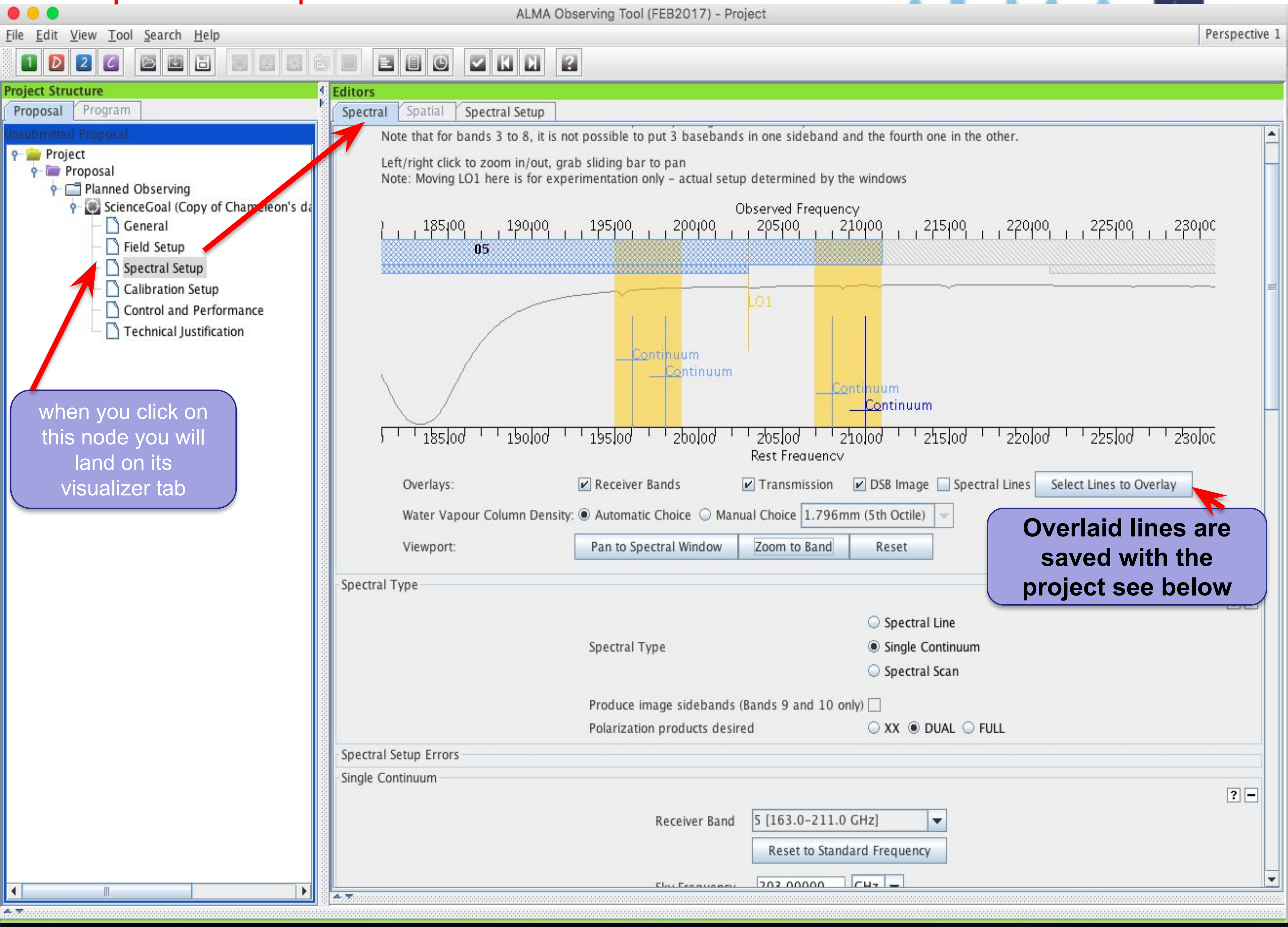
Estimated number of 7m Array pointings

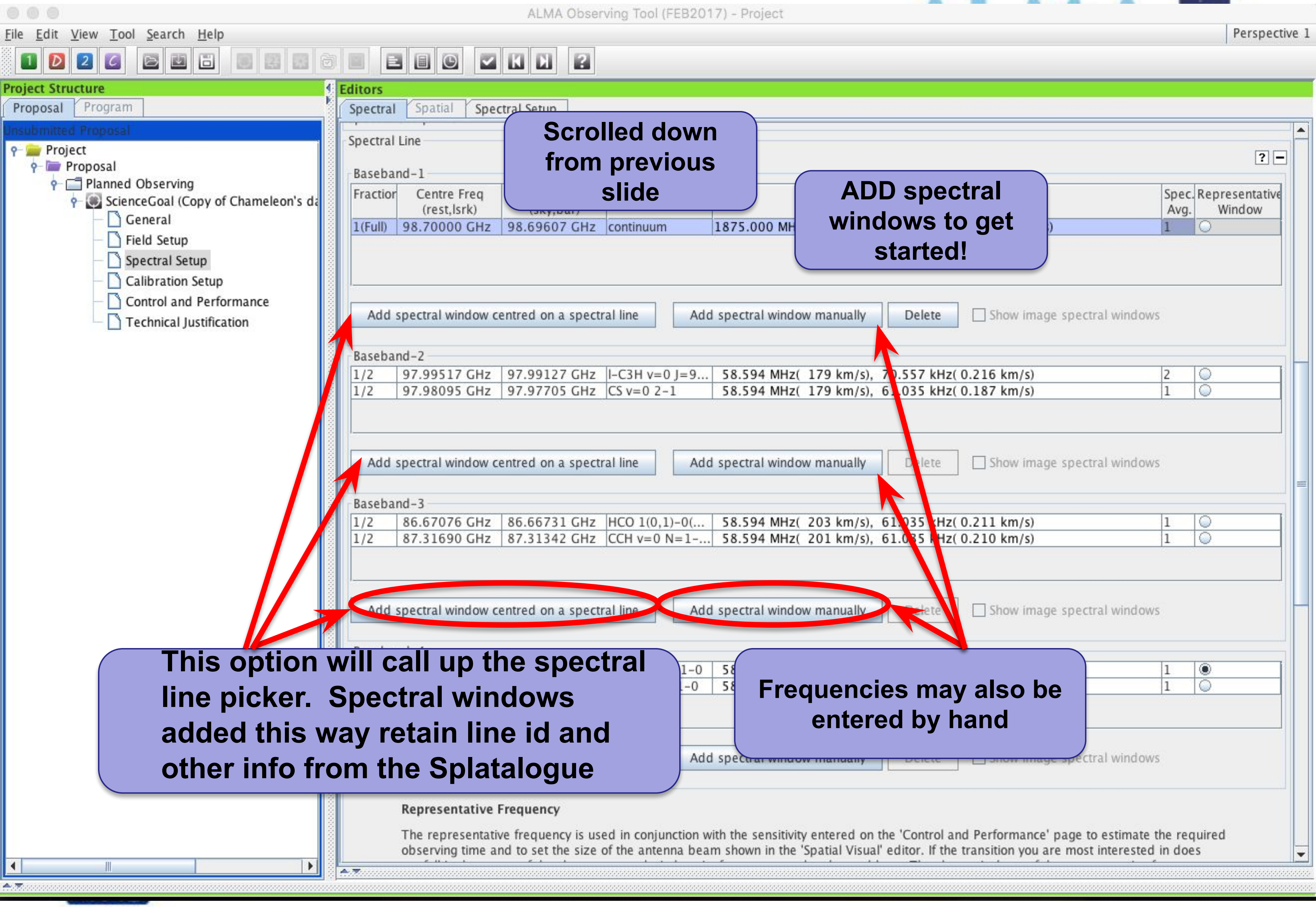
No more than 150 12m Array pointings.

Crafting mosaics



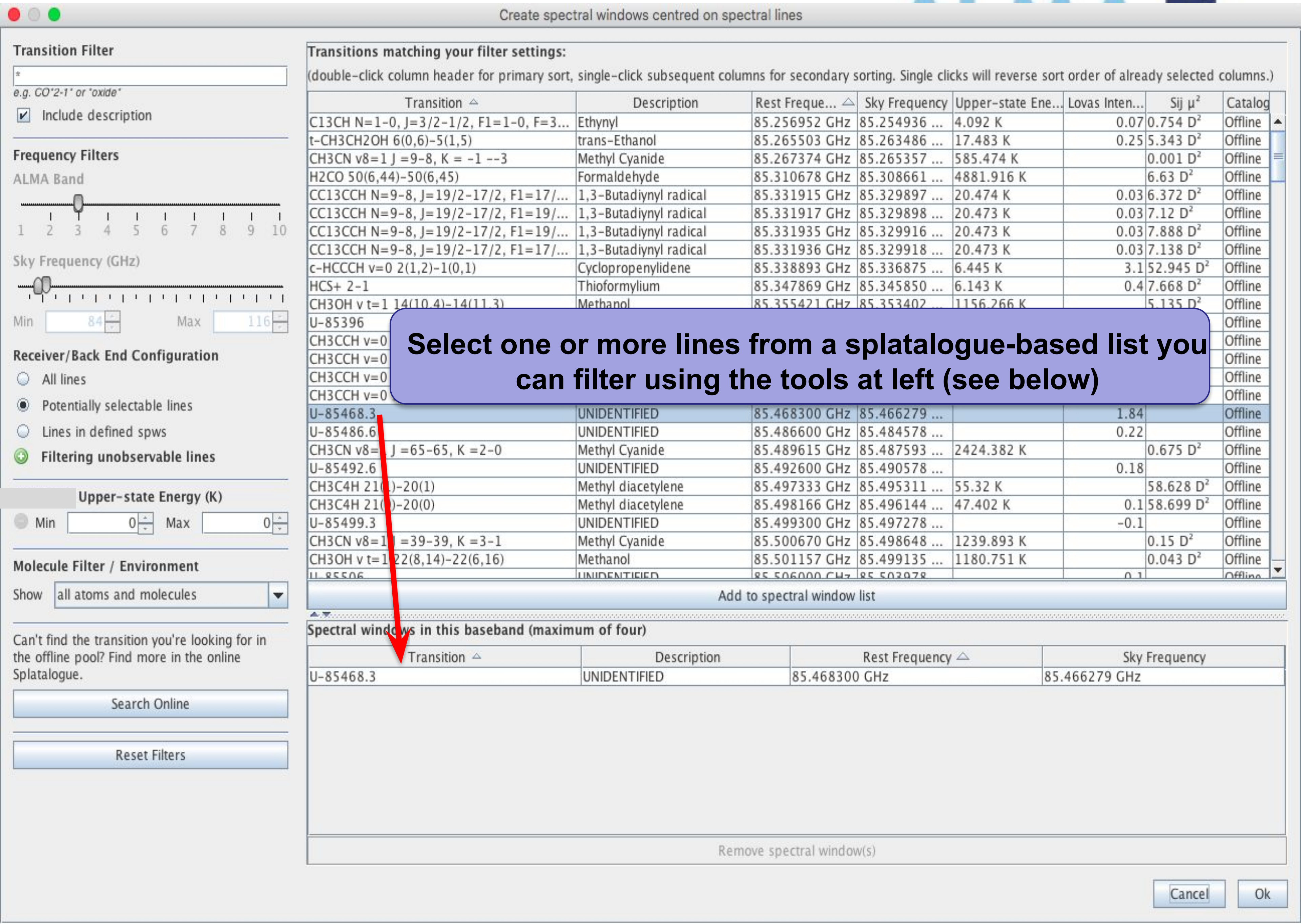
The spectral setup tab

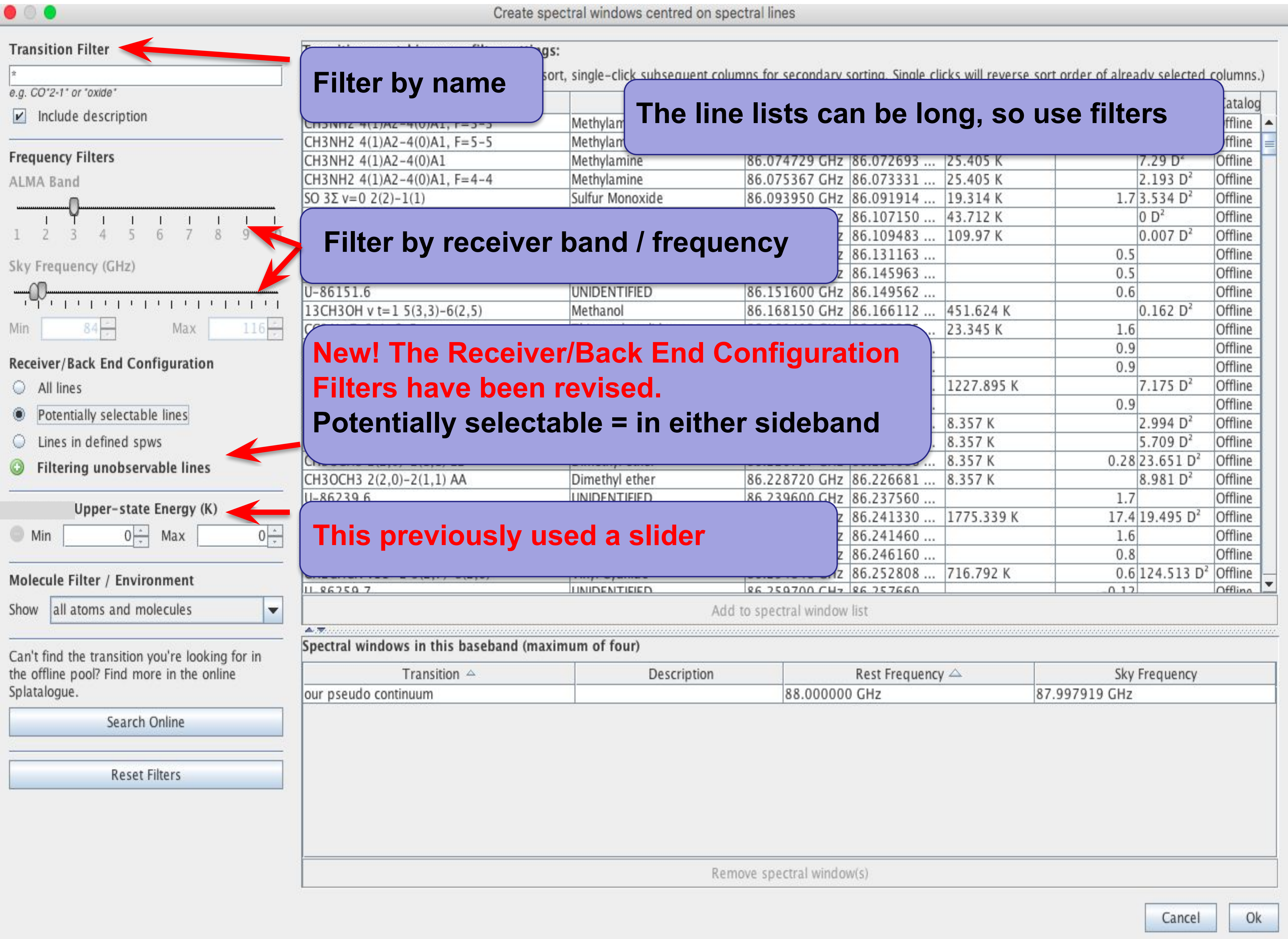


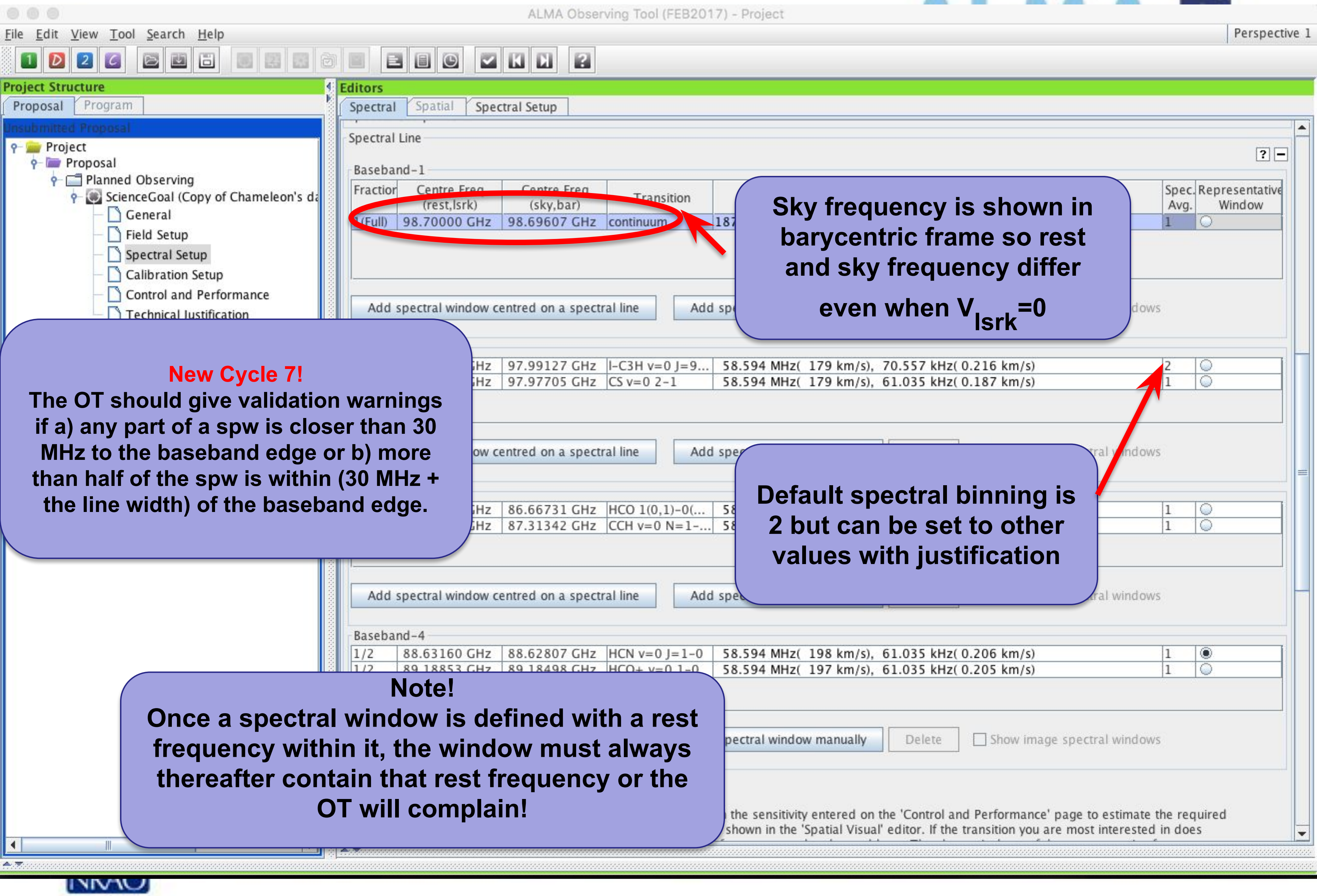


ALMA Observing Tool (FEB2017) - Project
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal
Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Copy of Chameleon's da
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral
Spatial
Spectral Setup
Spectral Line
Baseband-1
Fraction
Centre Freq (rest,lsrk)
Spec. Avg.
Representative Window
1(Full) 98.70000 GHz 98.69607 GHz continuum 1875.000 MH
Add spectral window centred on a spectral line
Add spectral window manually
Delete
Show image spectral windows
Baseband-2
1/2 97.99517 GHz 97.99127 GHz l-C3H v=0 J=9... 58.594 MHz(179 km/s),
1/2 97.98095 GHz 97.97705 GHz CS v=0 2-1 58.594 MHz(179 km/s),
Baseband-3
1/2 86.67076 GHz 86.66731 GHz HCO 1(0,1)-0(... 58.594 MHz(203 km/s),
1/2 87.31690 GHz 87.31342 GHz CCH v=0 N=1-... 58.594 MHz(201 km/s), 61.035
Representative Frequency
The representative frequency 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. If the transition you are most interested in does
Scrolled down from previous slide
ADD spectral windows to get started!
This option will call up the spectral line picker. Spectral windows added this way retain line id and other info from the Splatalogue
Frequencies may also be entered by hand

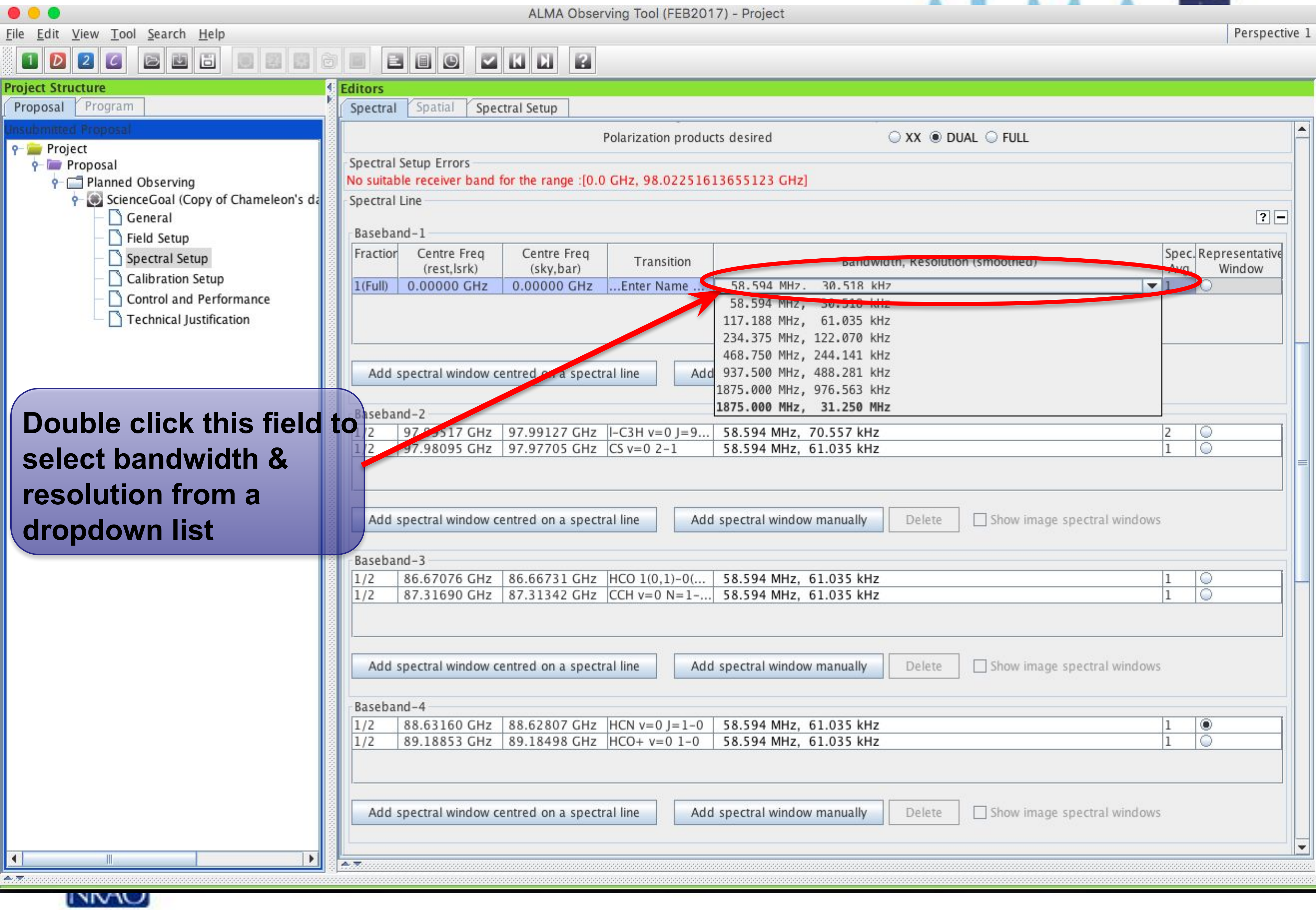
The spectral line picker has new filters

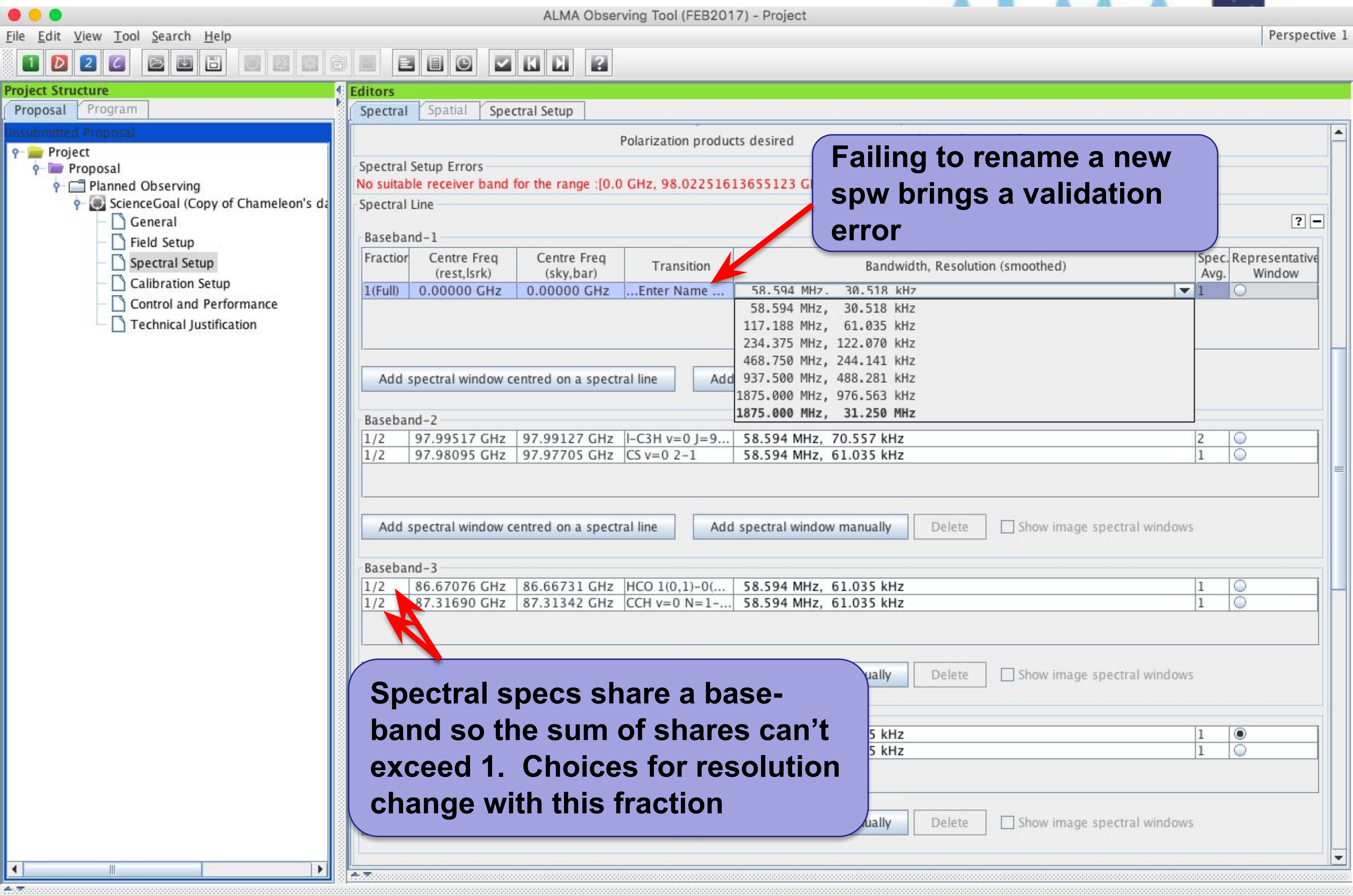



Create spectral windows centred on spectral lines
Transition Filter
e.g. CO*2-1* or *oxide*
Include description
Filter by name
The line lists can be long, so use filters
Frequency Filters
ALMA Band
Sky Frequency (GHz)
Min 84
Max 116
Filter by receiver band / frequency
Receiver/Back End Configuration
All lines
Potentially selectable lines
Lines in defined spws
Filtering unobservable lines
New! The Receiver/Back End Configuration Filters have been revised.
Potentially selectable = in either sideband
Upper-state Energy (K)
Min 0
Max 0
This previously used a slider
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.
Search Online
Reset Filters
CH3NH2 4(1)A2-4(0)A1, F=5-5
CH3NH2 4(1)A2-4(0)A1
CH3NH2 4(1)A2-4(0)A1, F=4-4
SO 3Σ v=0 2(2)-1(1)
Sulfur Monoxide
U-86151.6
UNIDENTIFIED
13CH3OH v t=1 5(3,3)-6(2,5)
Methanol
CH3OCH3 2(2,0)-2(1,1) AA
Dimethyl ether
Add to spectral window list
Spectral windows in this baseband (maximum of four)
Transition
Description
Rest Frequency
Sky Frequency
our pseudo continuum
88.000000 GHz
87.997919 GHz
Remove spectral window(s)
Cancel
Ok



ALMA Observing Tool (FEB2017) - Project
Sky frequency is shown in barycentric frame so rest and sky frequency differ even when V_{lsrk}=0
New Cycle 7!
The OT should give validation warnings if a) any part of a spw is closer than 30 MHz to the baseband edge or b) more than half of the spw is within (30 MHz + the line width) of the baseband edge.
Default spectral binning is 2 but can be set to other values with justification
Note!
Once a spectral window is defined with a rest frequency within it, the window must always thereafter contain that rest frequency or the OT will complain!

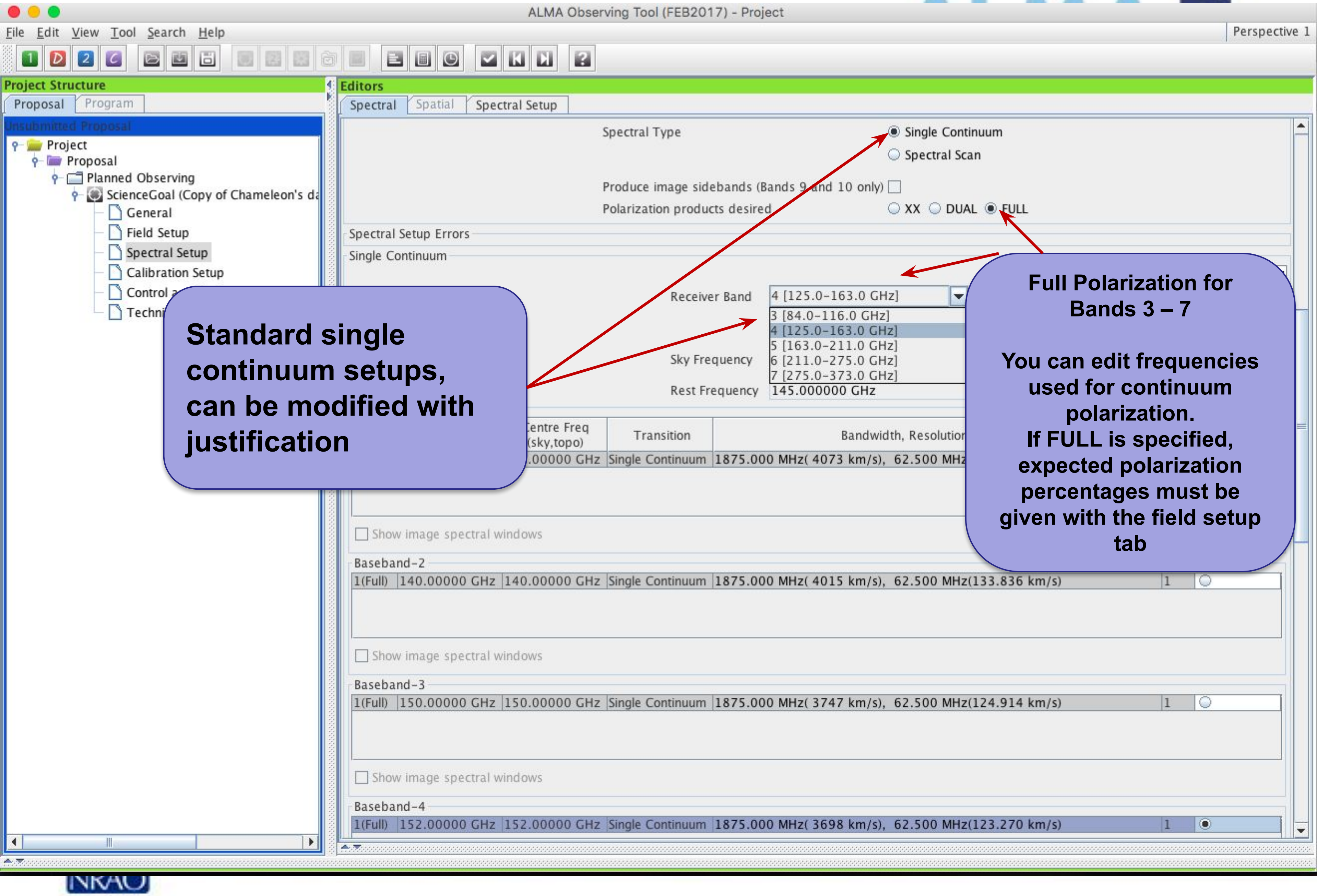

ALMA Observing Tool (FEB2017) - Project
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Copy of Chameleon's da
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral Spatial Spectral Setup
Polarization products desired
XX DUAL FULL
Spectral Setup Errors
No suitable receiver band for the range :[0.0 GHz, 98.02251613655123 GHz]
Spectral Line
Baseband-1
Fraction Centre Freq (rest,lsrk) Centre Freq (sky,bar) Transition Bandwidth, Resolution (smoothed) Spec. Avg. Representative Window
1(Full) 0.00000 GHz 0.00000 GHz ...Enter Name ... 58.594 MHz, 30.518 kHz
58.594 MHz, 30.518 kHz
117.188 MHz, 61.035 kHz
234.375 MHz, 122.070 kHz
468.750 MHz, 244.141 kHz
937.500 MHz, 488.281 kHz
1875.000 MHz, 976.563 kHz
1875.000 MHz, 31.250 MHz
Add spectral window centred on a spectral line
Baseband-2
1/2 97.99517 GHz 97.99127 GHz l-C3H v=0 J=9... 58.594 MHz, 70.557 kHz 2
1/2 97.98095 GHz 97.97705 GHz CS v=0 2-1 58.594 MHz, 61.035 kHz 1
Add spectral window centred on a spectral line
Add spectral window manually
Delete
Show image spectral windows
Baseband-3
1/2 86.67076 GHz 86.66731 GHz HCO 1(0,1)-0(... 58.594 MHz, 61.035 kHz 1
1/2 87.31690 GHz 87.31342 GHz CCH v=0 N=1-... 58.594 MHz, 61.035 kHz 1
Add spectral window centred on a spectral line
Add spectral window manually
Delete
Show image spectral windows
Baseband-4
1/2 88.63160 GHz 88.62807 GHz HCN v=0 J=1-0 58.594 MHz, 61.035 kHz 1
1/2 89.18853 GHz 89.18498 GHz HCO+ v=0 1-0 58.594 MHz, 61.035 kHz 1
Add spectral window centred on a spectral line
Add spectral window manually
Delete
Show image spectral windows
Double click this field to select bandwidth & resolution from a dropdown list



Failing to rename a new spw brings a validation error

Spectral specs share a base-band so the sum of shares can't exceed 1. Choices for resolution change with this fraction

Full Continuum & Polarization

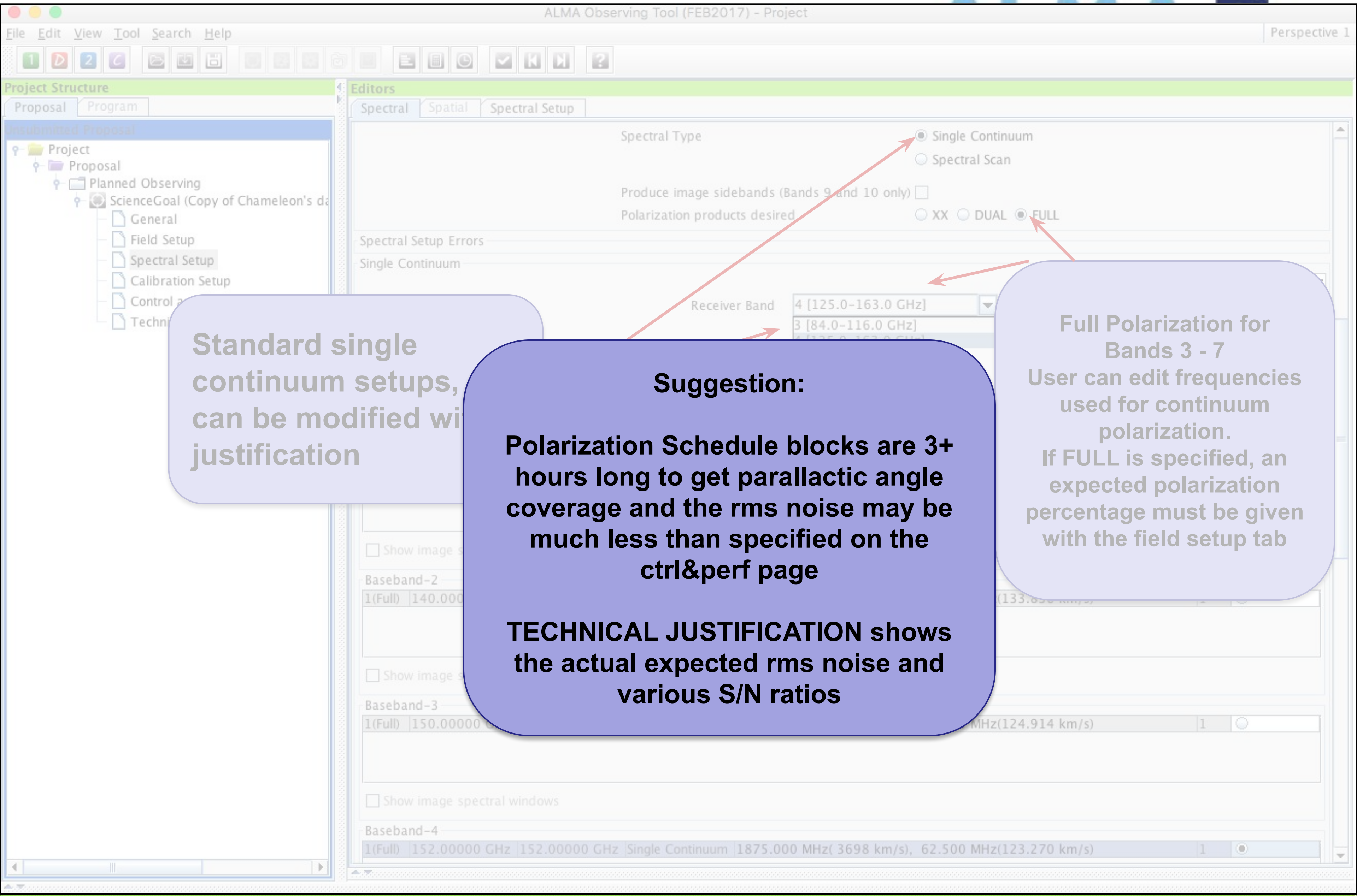


Standard single continuum setups, can be modified with justification

Full Polarization for Bands 3 – 7

You can edit frequencies used for continuum polarization.
If FULL is specified, expected polarization percentages must be given with the field setup tab

Full Continuum & Polarization



Standard single continuum setups, can be modified wi justification

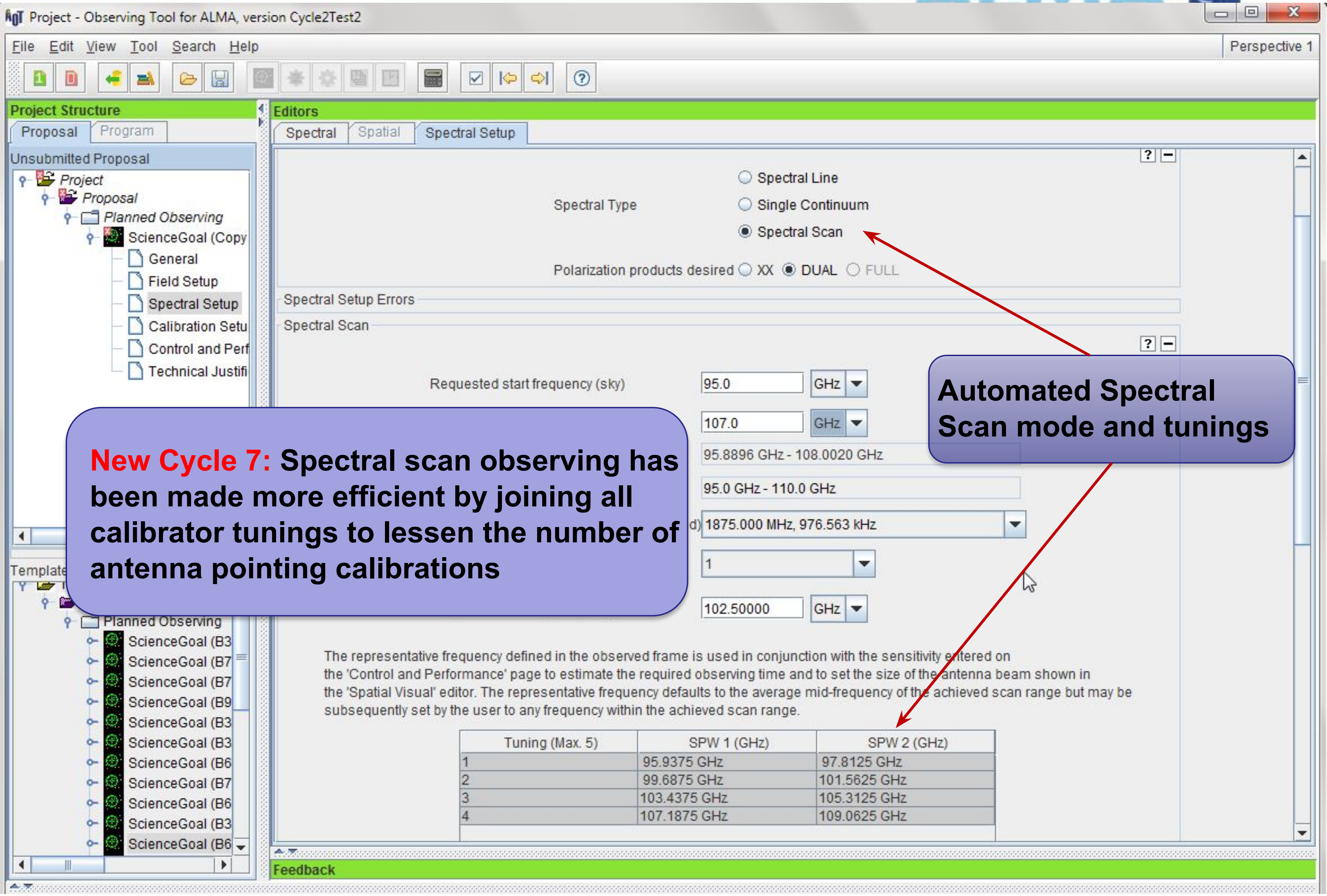
Suggestion:

Polarization Schedule blocks are 3+ hours long to get parallactic angle coverage and the rms noise may be much less than specified on the ctrl&perf page

TECHNICAL JUSTIFICATION shows the actual expected rms noise and various S/N ratios

Full Polarization for Bands 3 - 7
User can edit frequencies used for continuum polarization.
If FULL is specified, an expected polarization percentage must be given with the field setup tab

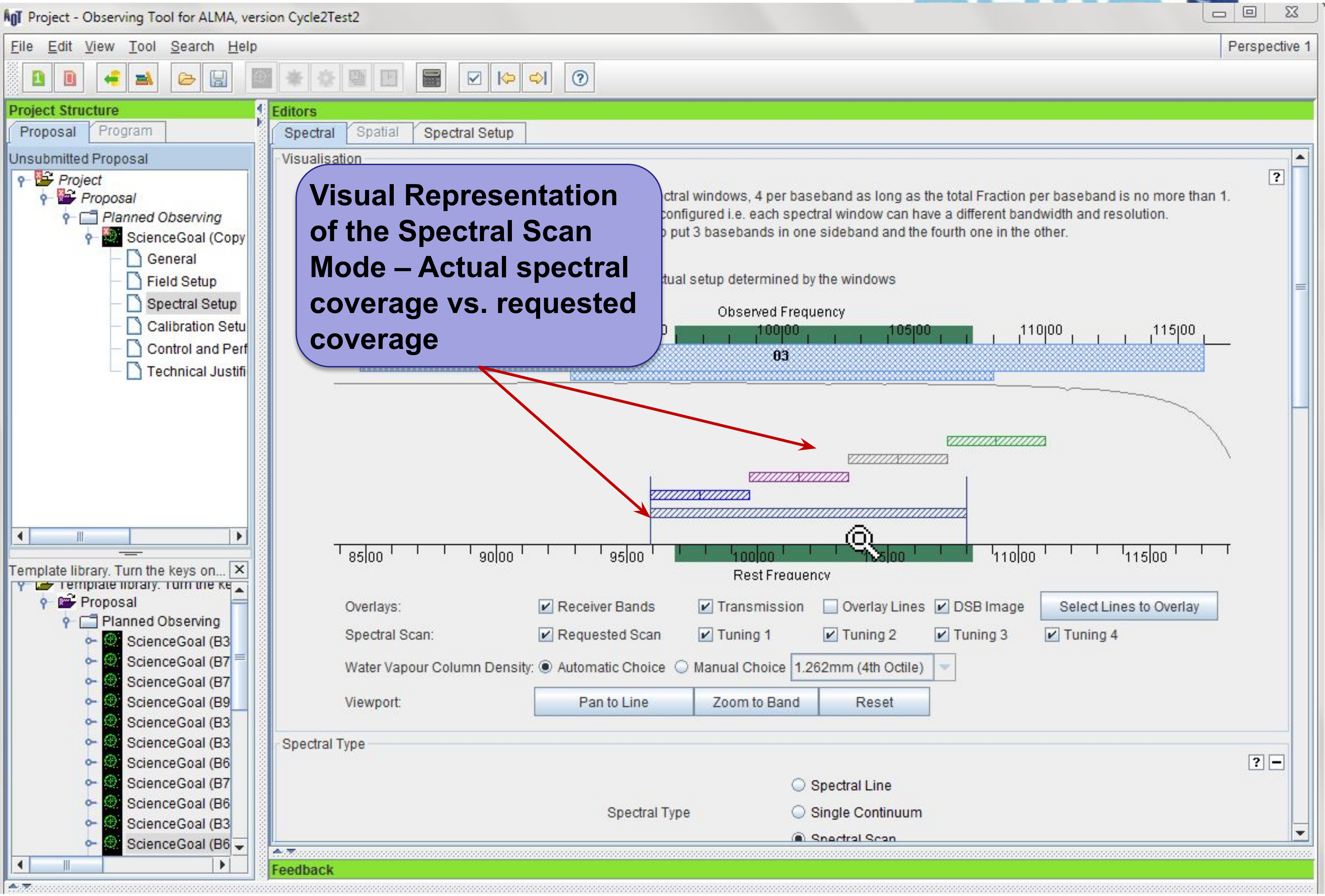
Automated spectral scan - I



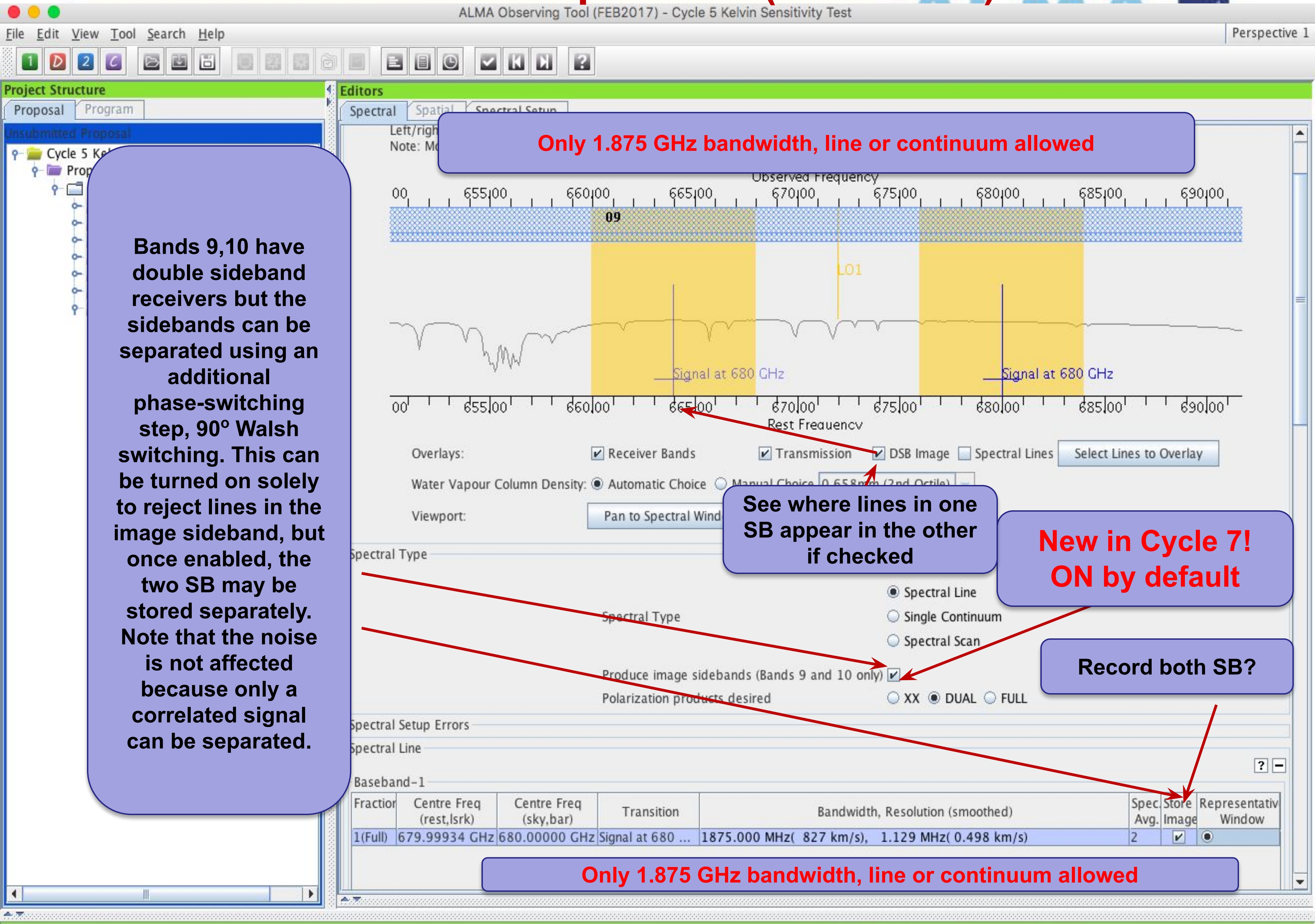
Automated Spectral Scan mode and tunings

New Cycle 7: Spectral scan observing has been made more efficient by joining all calibrator tunings to lessen the number of antenna pointing calibrations

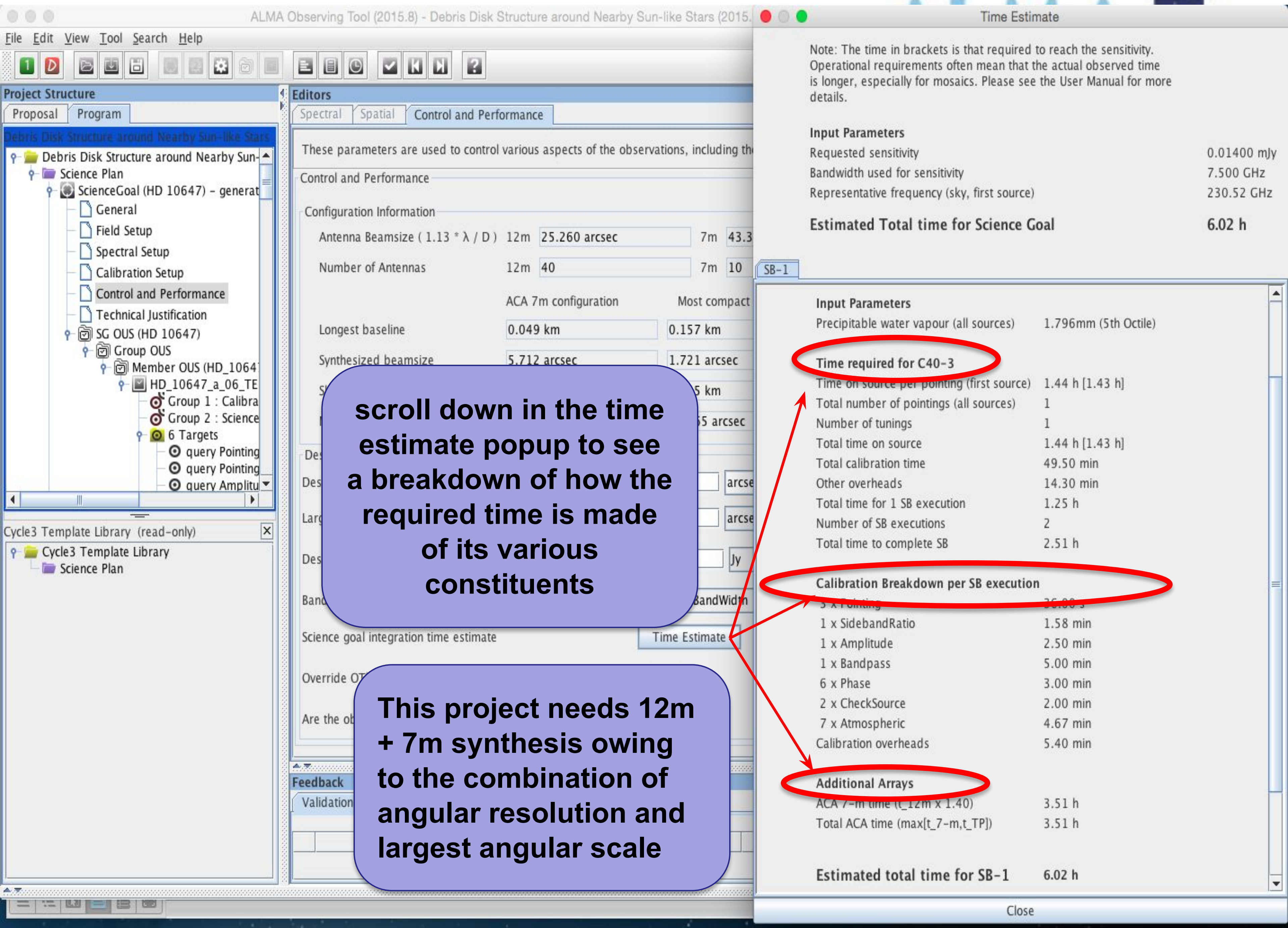
Automated spectral scan - II



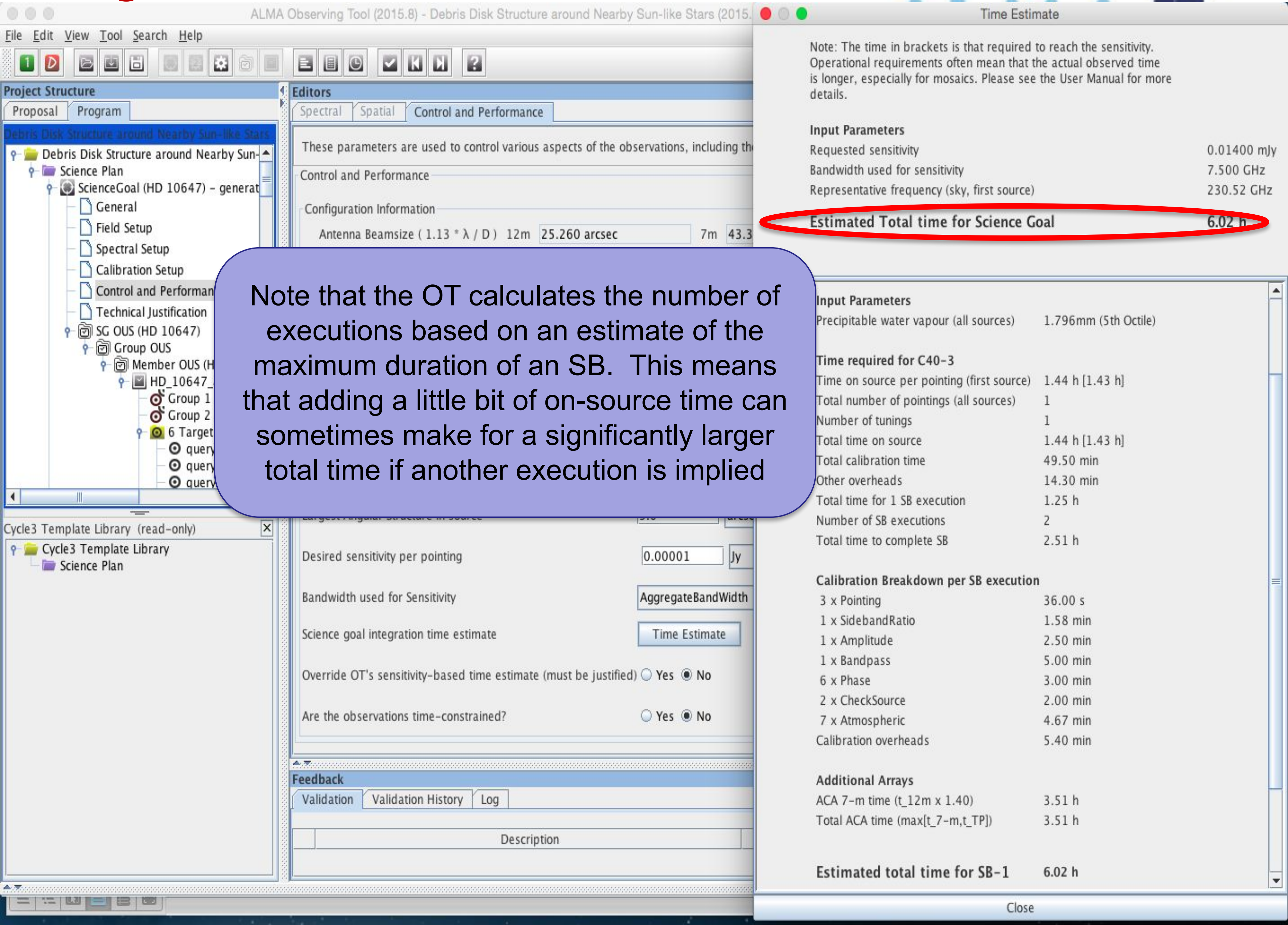
Bands 9&10 - sideband separation (90° Walsh)



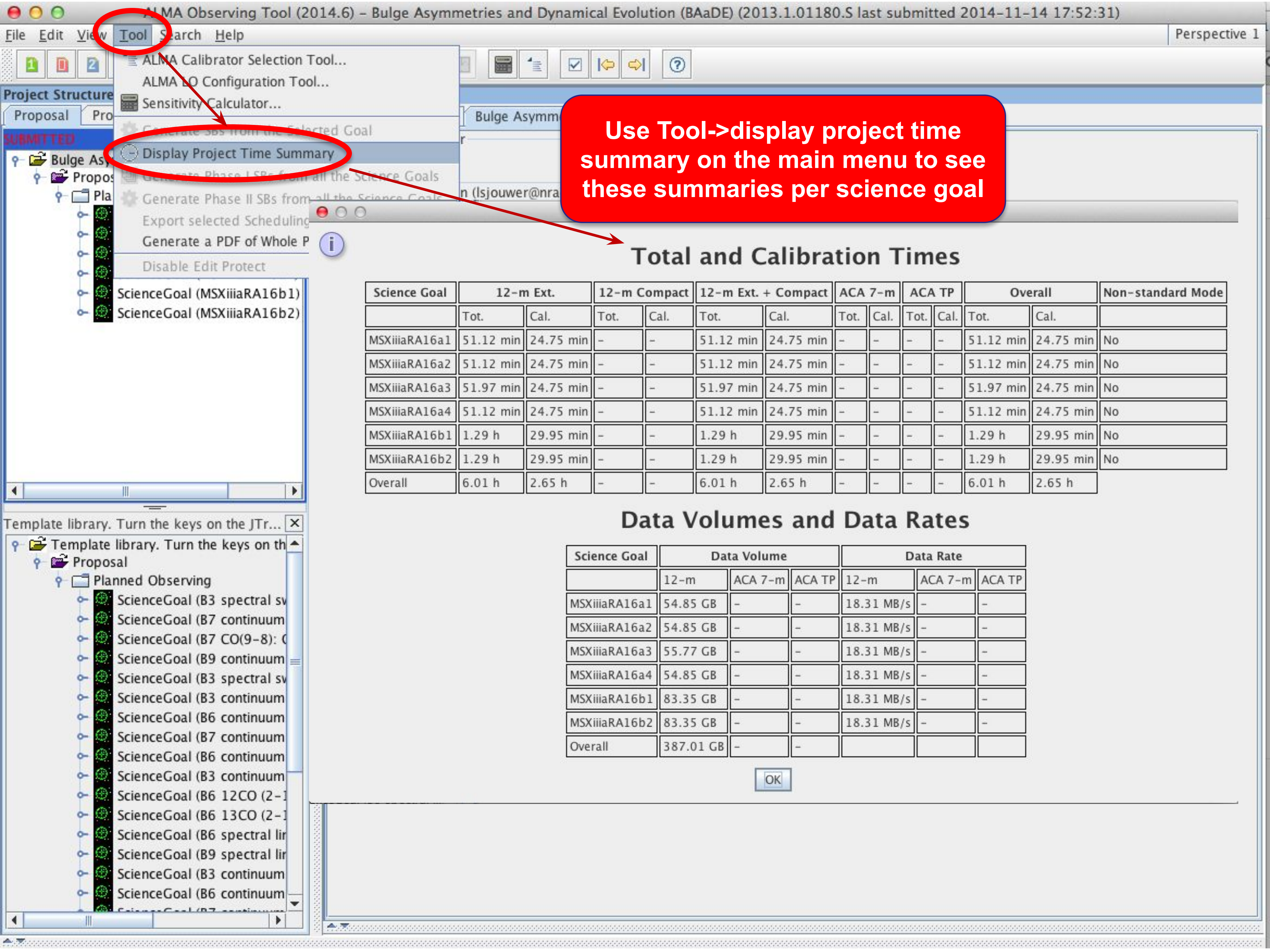
SG Time Estimates



Single source time estimates



Note that the OT calculates the number of executions based on an estimate of the maximum duration of an SB. This means that adding a little bit of on-source time can sometimes make for a significantly larger total time if another execution is implied



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 Summary

Total and Calibration Times

Science Goal	12-m (1)		12-m (2)		12-m (1+2)		ACA 7-m		ACA TP		Overall		Non-standard Mode
	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	
At ar 1"	1.03 d	6.21 h	9.92 h	2.48 h	1.45 d	8.70 h	-	-	-	-	1.45 d	8.70 h	No
Overall	1.03 d	6.21 h	9.92 h	2.48 h	1.45 d	8.70 h	-	-	-	-	1.45 d	8.70 h	

Project Summary

Total and Calibration Times

Science Goal	12-m (1)		12-m (2)		12-m (1+2)		ACA 7-m		ACA TP		Overall		Non-standard Mode
	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	
At ar 3"	31.53 min	13.83 min	-	-	31.53 min	13.83 min	2.63 h	1.15 h	-	-	3.15 h	1.38 h	No
Overall	31.53 min	13.83 min	-	-	31.53 min	13.83 min	2.63 h	1.15 h	-	-	3.15 h	1.38 h	

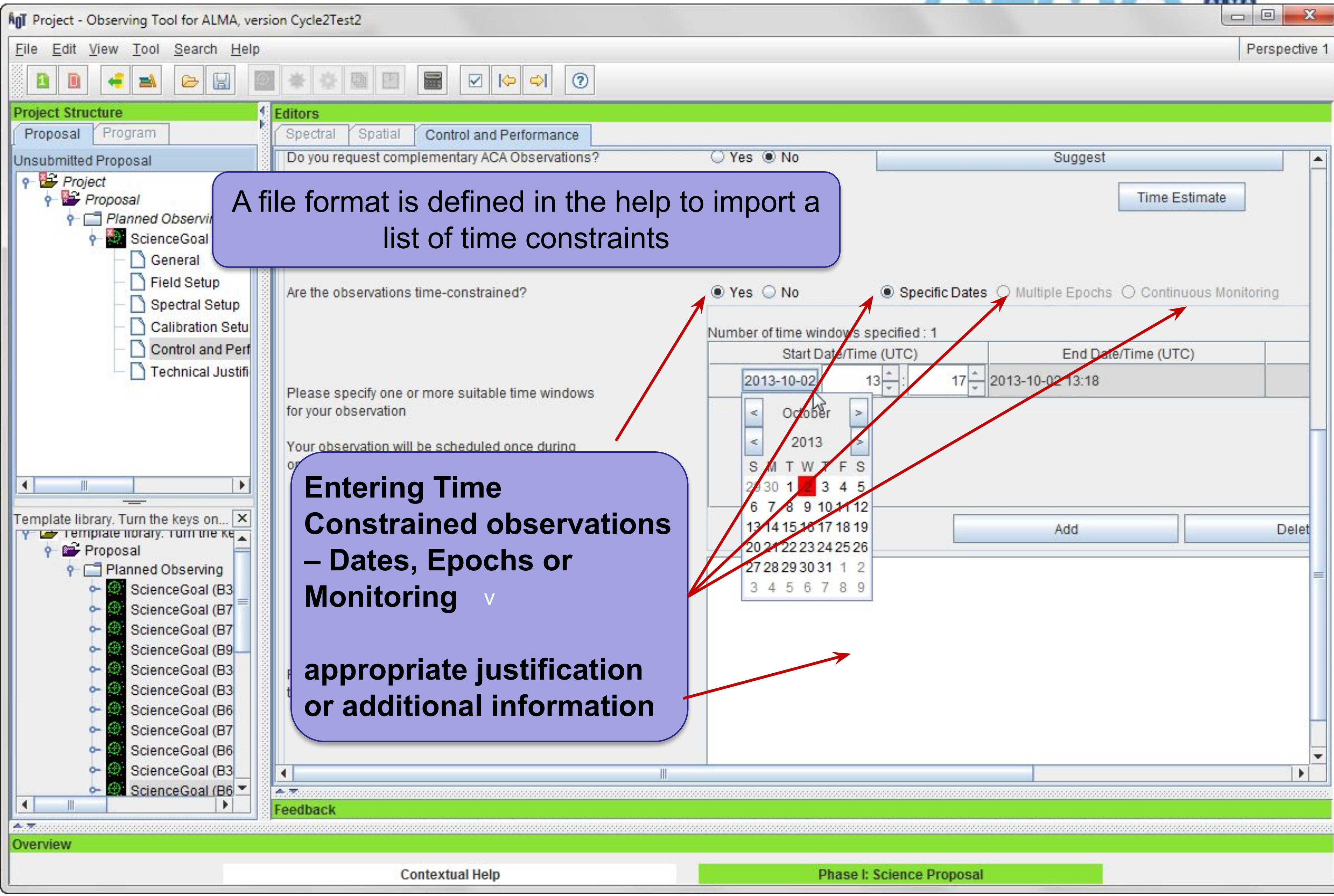
Especially when using RANGE:
Rules are operating under the hood to choose among the possible configuration choices and they may be biased toward the low resolution end of a range because less 12m time is needed. *Variations in the range can cause disproportionately large differences in the required time*.

In the two cases only the upper end of a range changes, from 1" to 3"

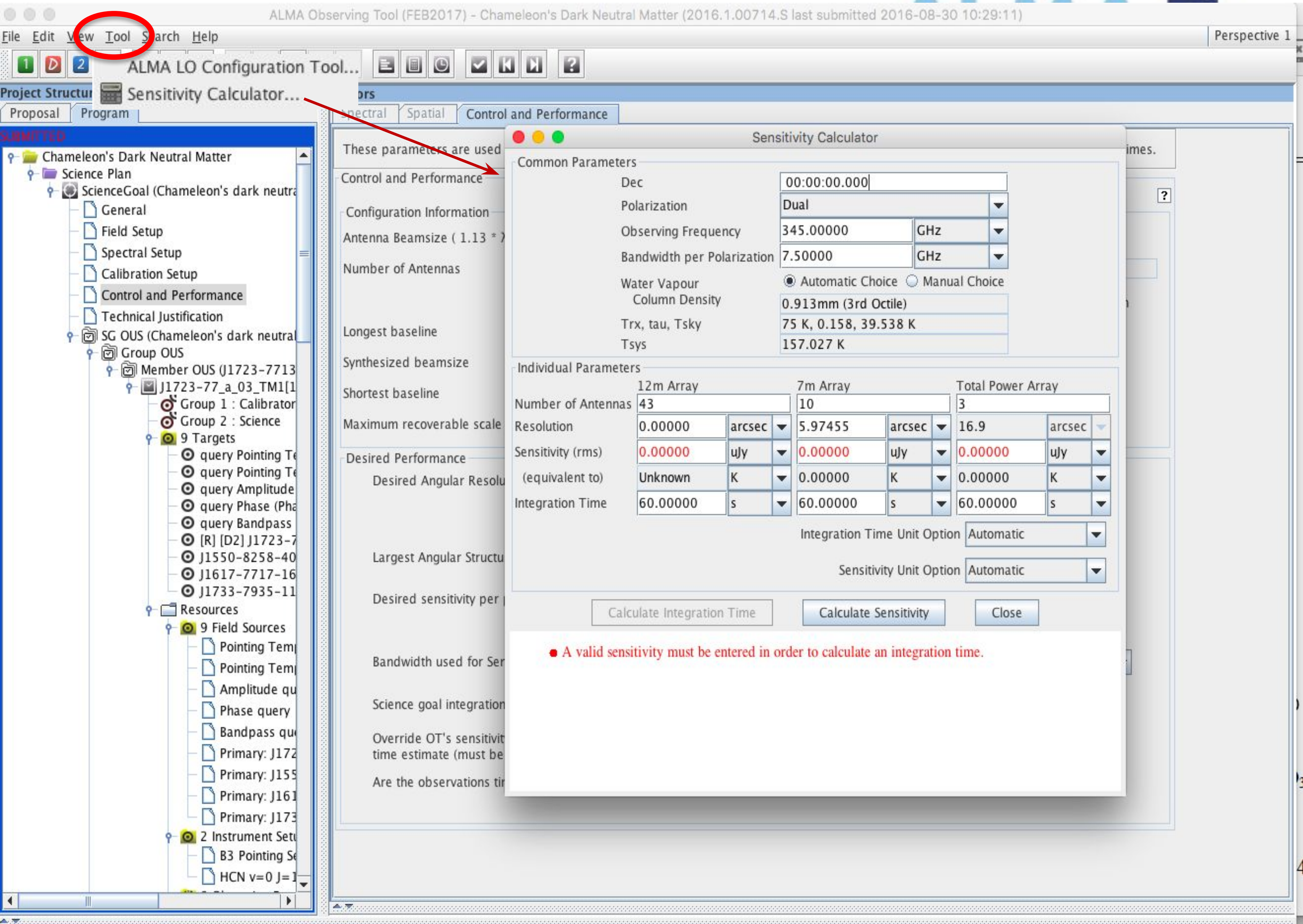
Be careful that the OT is not making choices for you that you would not make for yourself. Before submitting with a range, narrow it and use the project time summary to examine the choices the OT is making

NRAO

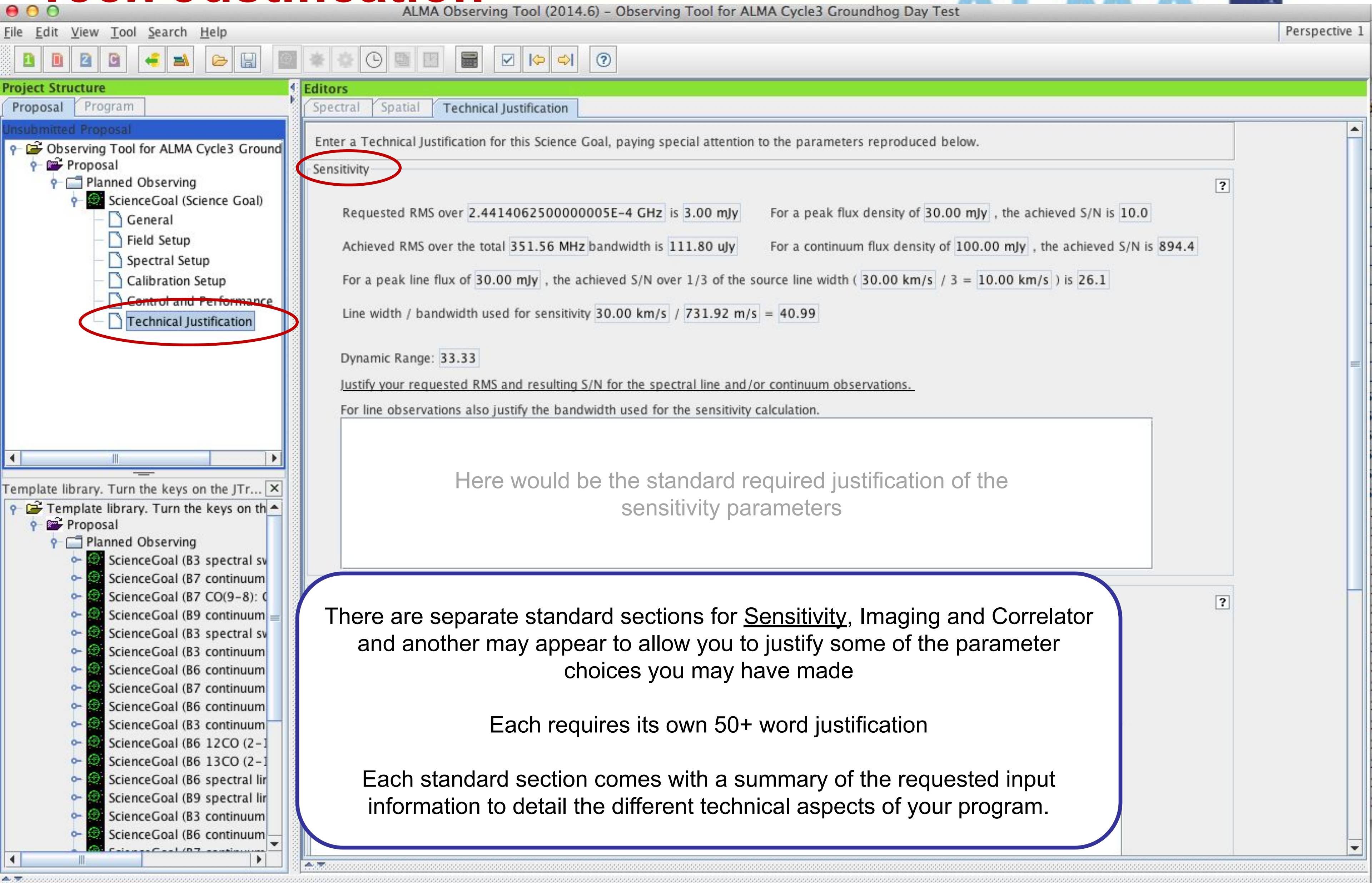
Time constrained observing



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



Tech Justification

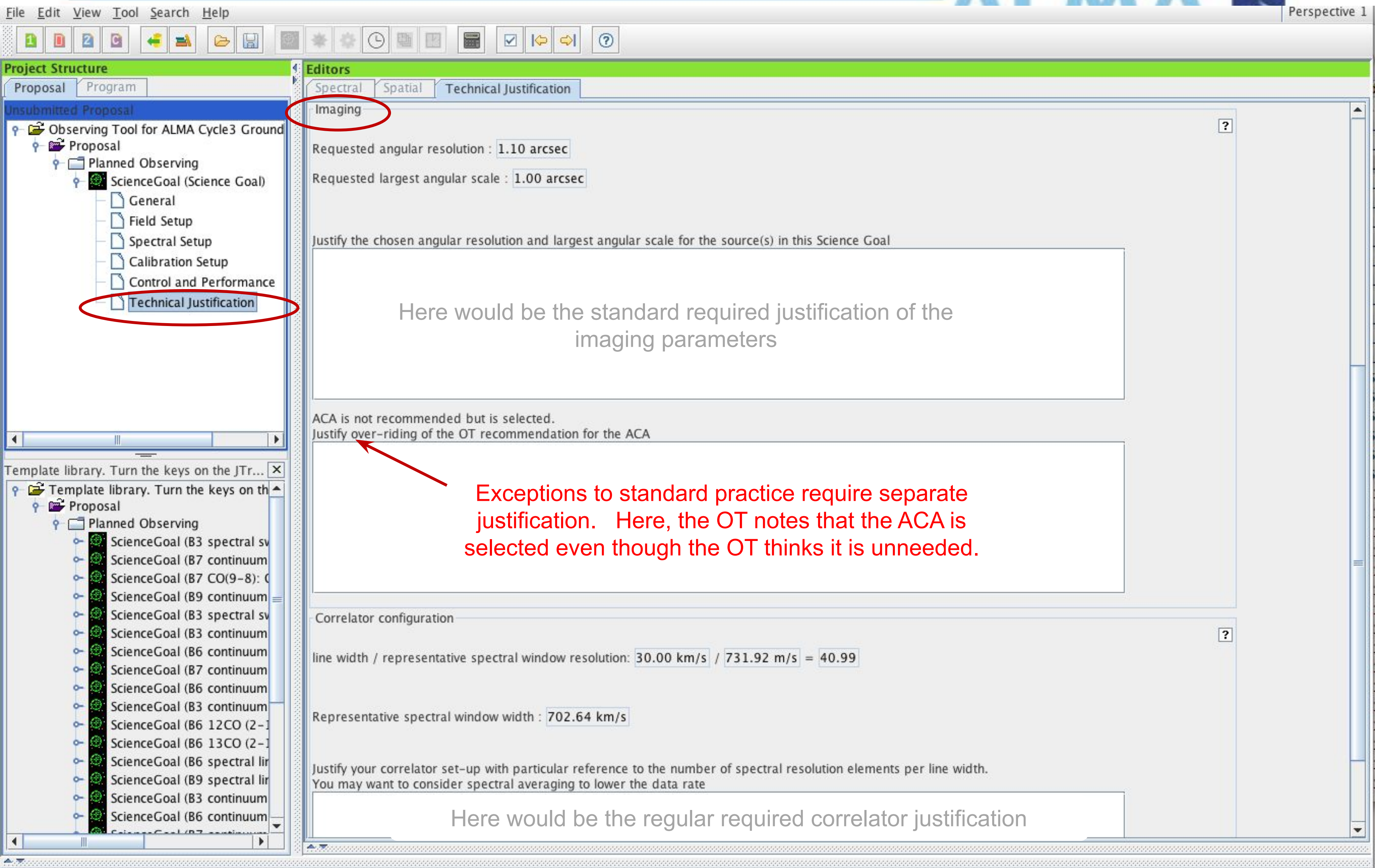


There are separate standard sections for Sensitivity, Imaging and Correlator and another may appear to allow you to justify some of the parameter choices you may have made

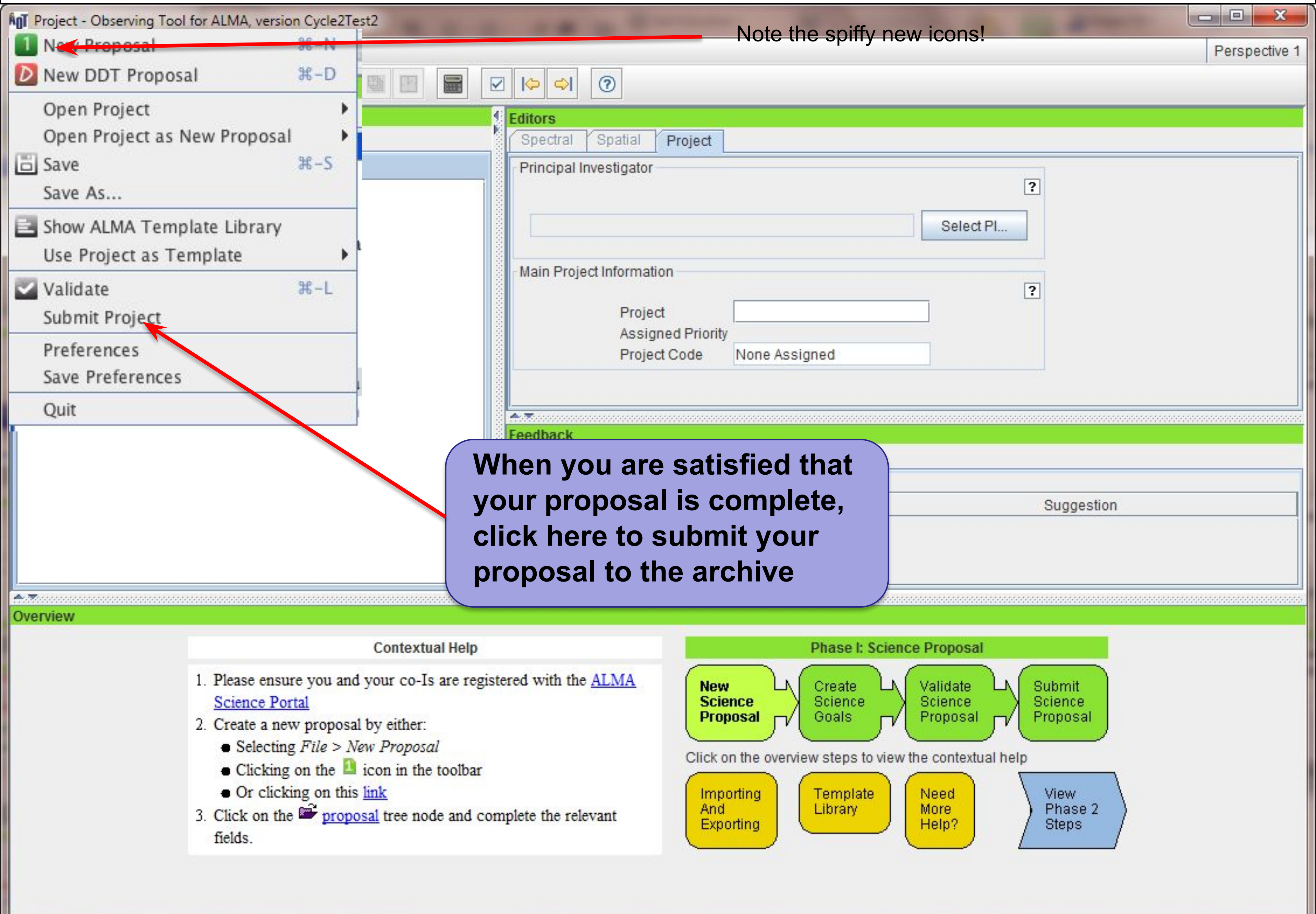
Each requires its own 50+ word justification

Each standard section comes with a summary of the requested input information to detail the different technical aspects of your program.

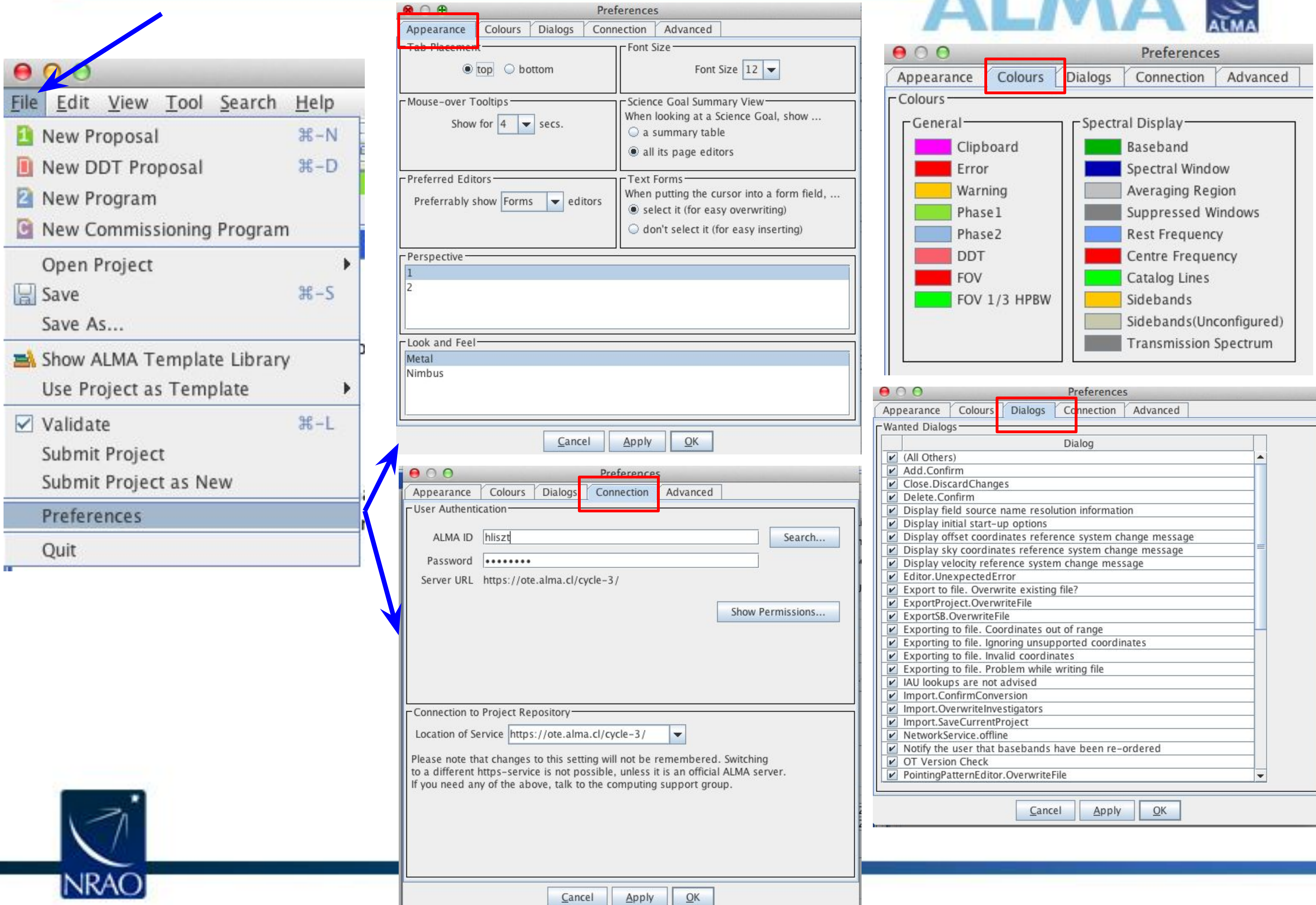
Tech Justification



When the time is ripe … validate & submit



Use preferences to customize



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.