

An Introduction to the ALMA Observing Tool



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



Sixteenth Synthesis Imaging Workshop
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How to turn that great idea into an ALMA proposal...



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With thanks to Arielle Moullet & Harvey Liszt



What is ALMA?

- A global partnership to deliver a revolutionary millimeter/submillimeter telescope array by **North America, Europe, East Asia**, in collaboration with Chile
- 66 reconfigurable, high precision antennas
- $\lambda \sim 0.32 - 8.5\text{mm}$
- Array configurations between 150 meters and >16 kilometers:
 - ◆ Main Array: 50 x 12m antennas
 - ◆ Total Power Array: 4 x 12m antennas
 - ◆ Atacama Compact Array (ACA): 12 x 7m antennas
 - ◆ TP + ACA (Morita Array)
- Array Operations Site is located at 5000m elevation in the Chilean Andes
- Provides unprecedented imaging* & spectroscopic capabilities at mm/submm λ



ALMA in a Nutshell...



- ◆ Angular resolution down to 0.015" (at 300 GHz)
- ◆ Sensitive, precision imaging 84 to 950 GHz (3 mm to 320 μm)
- ◆ State-of-the-art low-noise, wide-band receivers* (8 GHz bandwidth)
- ◆ Flexible correlator with high spectral resolution at wide bandwidth
- ◆ Full polarization capabilities including circular.
- ◆ Estimated 1 TB/day data rate
- ◆ All science data archived
- ◆ Pipeline processing



- Construction Project ended in September 2014
- Science observing has been out to **> 16 km baselines (C43-10)** thanks to the highly successful Long Baseline Campaigns in 2014 and 2015
- **All 66 antennas accepted**
 - Currently all 66 antennas are at the high site (AOS), of which ~47 on average (up to max ~54) are being used for Cycle 5 observations
 - Some construction and verification items remain to be finished (e.g., wide-field polarization; various observing modes)
- The ACA (Atacama Compact Array) or Morita Array – up to 12x7m antennas and 4x12m antennas for TP observations
 - currently being used for Cycle 5 observations

The Cycle 6 capabilities are fully described in Appendix A of the ALMA Proposers Guide available at:

<https://almascience.nrao.edu/documents-and-tools>

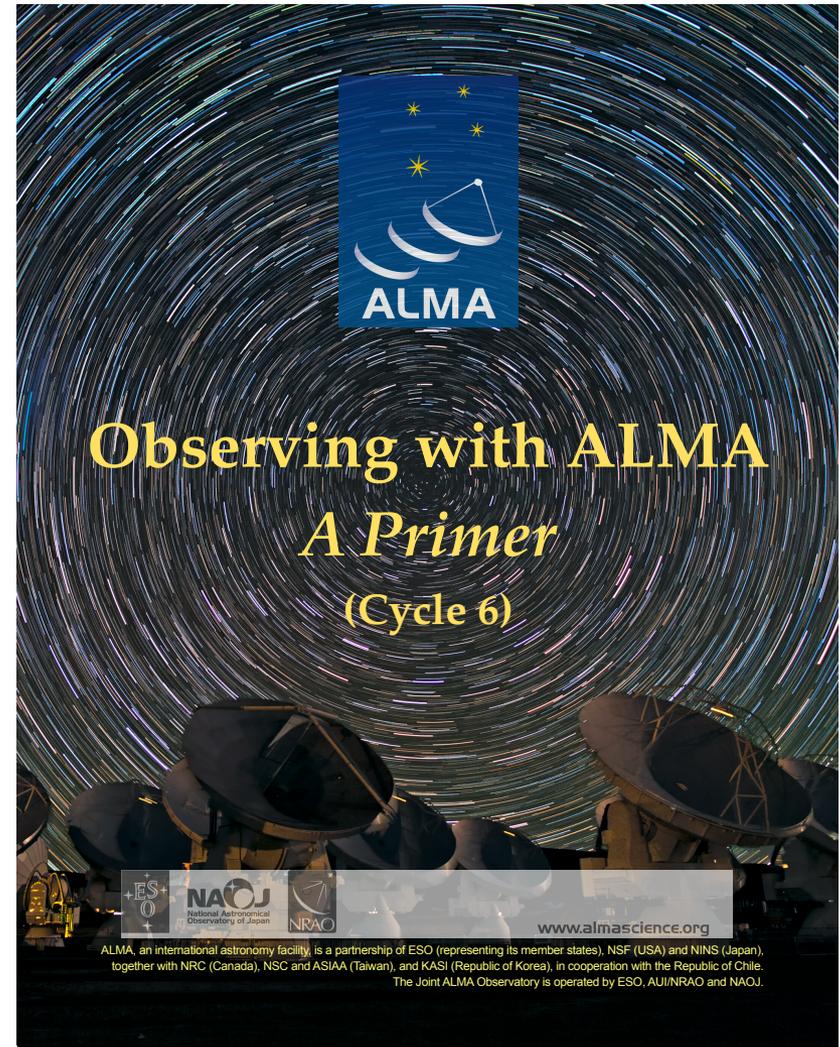
In summary:

- **Number of antennas**
 - At least forty-three (43) antennas in the 12-m Array
 - At least ten (10) 7-m antennas (for short baselines) and three (3) 12-m antennas (for making single-dish maps) in the ACA
- **Receiver bands**
 - Receiver Bands 3, 4, 5, 6, 7, 8, 9, and 10 (wavelengths of about 3.1, 2.1, 1.6, 1.3, 0.87, 0.74, 0.44, and 0.35 mm, respectively)
- **12-m Array Configurations**
 - Maximum baselines for the antenna configurations between 0.15 km and 16 km
 - Maximum baselines of 3.6 km for Bands 8, 9 and 10
 - Maximum baselines of 8.5 km for Band 7
 - Maximum baselines of 16 km for Bands 3, 4, 5 and 6

- **Spectral line, continuum, and mosaic observations**
 - Spectral line and continuum observations with the 12-m Array and the 7-m Array in all bands
 - Single field interferometry (all bands) and mosaics (Bands 3 to 9) with the 12-m Array and the 7-m Array
 - Single-dish spectral line observations in Bands 3 to 8
- **Polarization**
 - Single pointing, on axis, full (including circular) polarization for both continuum and full-spectral-resolution observations in Band 3, 4, 5, 6, and 7 are offered on the 12-m Array. (min polarization percentage of 1.8% of the peak flux for circular polarization; only for sources that are on-axis with an angular size less than 10% of the FWHM primary beam).
- **Observing Time:**
 - 4000 hours for successful proposals of PI programs expected on the 12m Array (includes DDT, Cycle 4 Carryover and resubmissions)
 - 3000 hours available on the ACA
 - 3000 hours available on the Total Power Array

- Read relevant documentation (CfP Guide, Primer, etc.)
- Create an ALMA account by registering at the Science Portal (almascience.org)
- Download the Observing Tool (OT) & related guides
- Prepare the Science Case
 - Note the new capabilities for the current cycle!
- Prepare Science Goals (sources, frequency & correlator setup, integration times) within the OT
- Make use of the Helpdesk & the Knowledgebase

- Call for Proposals
- Proposer's Guide
- ALMA Primer
- OT Guide
- ALMA Tech Handbook
- Timeline for Cycle 6
 - ~~Mar. 20~~ — Call for Proposals
 - ~~Apr. 19~~ — Proposal Deadline
 - End July – Results to PIs
 - Aug. 2018 – PIs submit SBs
 - Oct. 2018 – Start of Cycle 6
 - Sept. 2019 – End of Cycle 6



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- **Prepare the Science Case**
 - Note the new capabilities for the current cycle!
- Prepare Science Goals (sources, frequency & correlator setup, integration times) within the OT
- Make use of the Helpdesk & the Knowledgebase

From your science case:

- Source(s):
 - single pointings or mosaics?
 - what angular resolution do you need?
 - what is the largest angular size of your source(s)?
- Spectral configuration:
 - continuum or spectral lines?
 - frequency: which band?
- Are you doing polarization?
 - what is the expected polarization fraction?
- Sensitivity:
 - what rms do you need to achieve your science goals?
 - over what bandwidth? i.e., 3 km/s, or 1.875 GHz, etc.

ALMA configuration schedule



- The configuration schedule may determine when an object will be observed
- In Cycle 6, for example:
 - C43-1,2 January, March
 - C43-3,4 December, April
 - C43-5 October only
 - C43-8..10 June, July
- Some combinations of object + configuration may not be available for night-time observing

Table 1: Cycle 6 configuration schedule

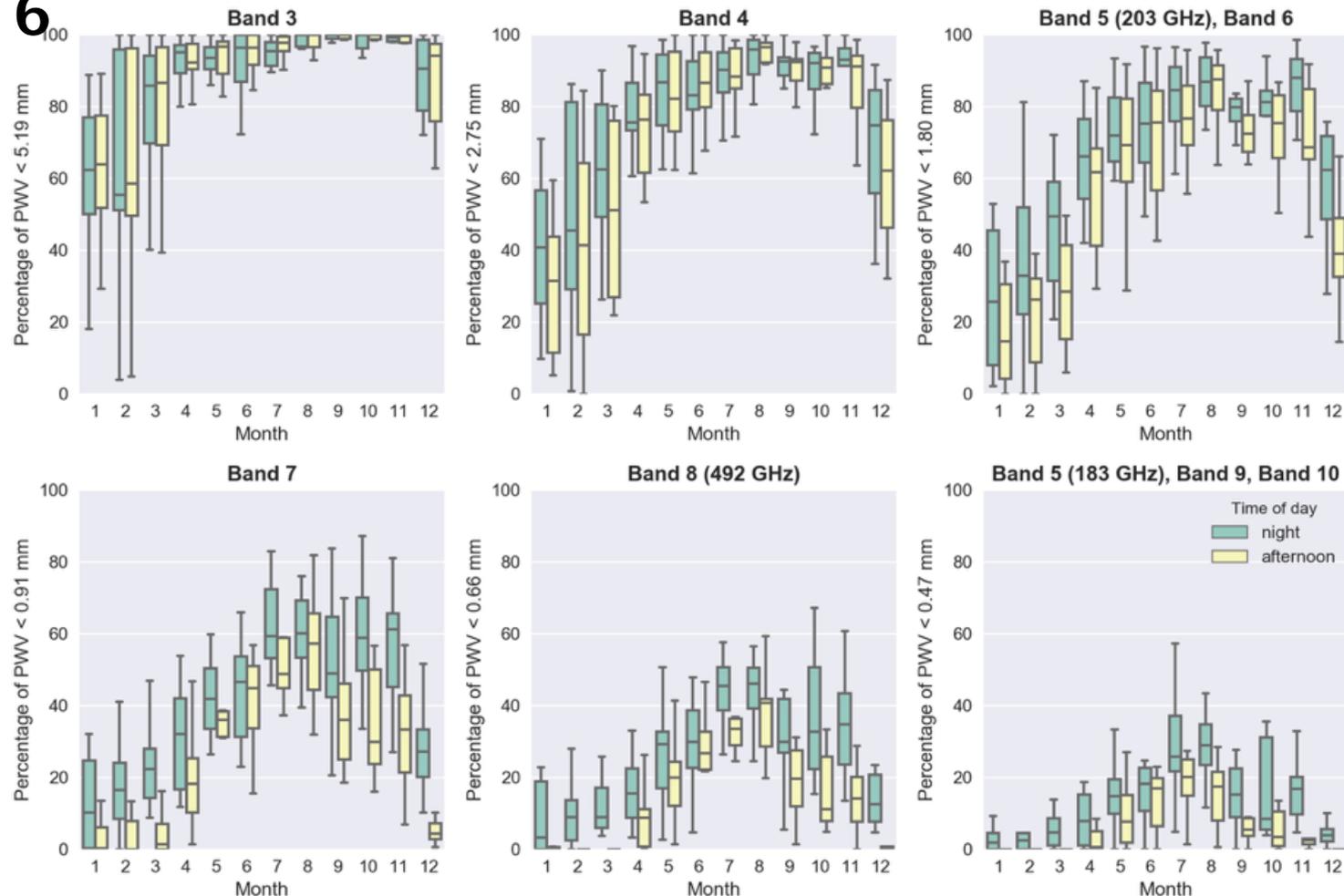
Start date	Configuration	Longest baseline	LST for best observing conditions
2018 October 1	C43-6	2.5 km	~ 22h – 10h
2018 October 15	C43-5	1.4 km	~ 0h – 12h
2018 November 25	C43-4	0.78 km	~ 2h – 14h
2018 December 15	C43-3	0.50 km	~ 4h – 15h
2019 January 5	C43-2	0.31 km	~ 5h – 16h
2019 January 20	C43-1	0.16 km	~ 6h – 17h
2019 February 1-28	<i>No observations due to February shutdown</i>		
2019 March 1	C43-1	0.16 km	~ 8h – 21h
2019 March 15	C43-2	0.31 km	~ 8h – 22h
2019 April 1	C43-3	0.50 km	~ 9h – 23h
2019 April 15	C43-4	0.78 km	~ 10h – 0h
2019 May 1	<i>No observations due to major antenna relocation</i>		
2019 June 1	C43-10	16.2 km	~ 13h – 3h
2019 June 20	C43-9	13.9 km	~ 14h – 5h
2019 July 10	C43-8	8.5 km	~ 16h – 6h
2019 August 1	C43-7	3.6 km	~ 18h – 8h
2019 September 5	C43-6	2.5 km	~ 20h – 9h

ALMA Observing Strategies

ALMA



Cycle 6



- Box and whisker plots of the percentage of time that the precipitable water vapor (PWV) is less than the thresholds adopted for the various ALMA bands versus the month of the year. Results are shown for both night time (green) and mid-afternoon (yellow), and assume a source elevation of 60 degrees. The horizontal line within a box indicates the median, the boundaries of a box indicate the 25th- and 75th-percentile of the distribution, and the whiskers indicate the highest and lowest values of the distribution. The PWV measurements were obtained by the APEX weather stations between 2007 and 2017.

From your science case:

- Source(s):
 - single pointings or mosaics?
 - what angular resolution do you need?

On to the Observing Tool!

- Spectral configuration:
 - continuum or spectral lines?
 - frequency: which band?
- Are you doing polarization?
 - what is the expected polarization fraction?
- Sensitivity:
 - what rms do you need to achieve your science goals?
 - over what bandwidth? i.e., 3 km/s, or 1.875 GHz, etc.

Downloading the ALMA OT



<https://almascience.nrao.edu>



Atacama Large Millimeter/submillimeter Array
In search of our Cosmic Origins



Log in

About Science **Proposing** Observing Data Processing **Tools** Documentation Help

Search Site

Observing Tool

The ALMA Observing Tool (OT) is a Java application used for the preparation and submission of ALMA Phase 1 (observing proposal) and Phase 2 (telescope runfiles for accepted proposals) materials. It is also used for preparing and submitting Director's Discretionary Time (DDT) proposals. The current *Cycle 6* release of the OT is configured for the present capabilities of ALMA as described in the [Cycle 6 Call For Proposals](#). Note that in order to submit proposals you will have to register with the ALMA Science Portal beforehand.

Note that preparation of Cycle 5 DDT proposals needs to be done using the Cycle 5 version of the Observing Tool. This version of the OT can be found in the [DDT page](#), or the Phase 2 menu.

Download & Installation

The OT will run on most common operating systems, as long as a **64-bit version of Java 8** is installed (see the [troubleshooting page](#) if you are experiencing Java problems). The ALMA OT is available in two flavours: Web Start and tarball.

The **Web Start** application is the recommended way of using the OT. It has the advantage that the OT is automatically downloaded and installed on your computer and it will also automatically detect and install updates. There are some issues with Web Start, particularly that it does not work with the Open JDK versions of Java such as the "Iced Tea" flavour common on many modern Linux installations. The Oracle variant of Java should therefore be installed instead. If this is not possible, then the tarball installation of the OT is available.

The **tarball** version must be installed manually and will not automatically update itself, however there should be no installation issues. For Linux users, we also provide a download complete with a recommended version of the Java Runtime Environment. Please use this if you have any problems running the OT tarball with your default Java.

Webstart

Tarball

Documentation

Extensive documentation is available to help you

- If you are a novice OT user you should start with the [Getting Started](#) guide.
- Audio-visual illustrations of different aspects of the OT can be found in the [OT video tutorials](#). These are recommended for novices and advanced users alike.
- More in-depth information on the OT can be found in the [User Manual](#), while concise explanations of all fields and menu items in the OT are given in the [Reference Manual](#). These two documents are also available within the OT under the Help menu.

Troubleshooting

If you have problems with the installation and/or startup of the OT, please see the [troubleshooting page](#). A list of currently known bugs, their status and possible workarounds can be found on the regularly updated [known OT Issues](#) page. A further source of information is the [OT section of the ALMA Helpdesk Knowledgebase](#) - this contains a number of articles that deal with frequently-asked questions. After exploring these resources, if confusion over some aspect of the OT remains, or if a previously unidentified bug has been uncovered, please file a [Helpdesk ticket](#).

Using webstart is easier and has the advantage that it checks for and will download a newer version at startup



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Associated Universities, Inc.



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About Science **Proposing** Observing Data Processing Tools Documentation Help

Search Site



OT Video Tutorials

The OT video tutorials provide an audio-visual demonstration of different aspects of proposal preparation in the OT. Novice users should start with the first video and work their way down, while more experienced users may want to jump straight to one of the specialised videos.

OT Video Tutorial 1: Useful to Know

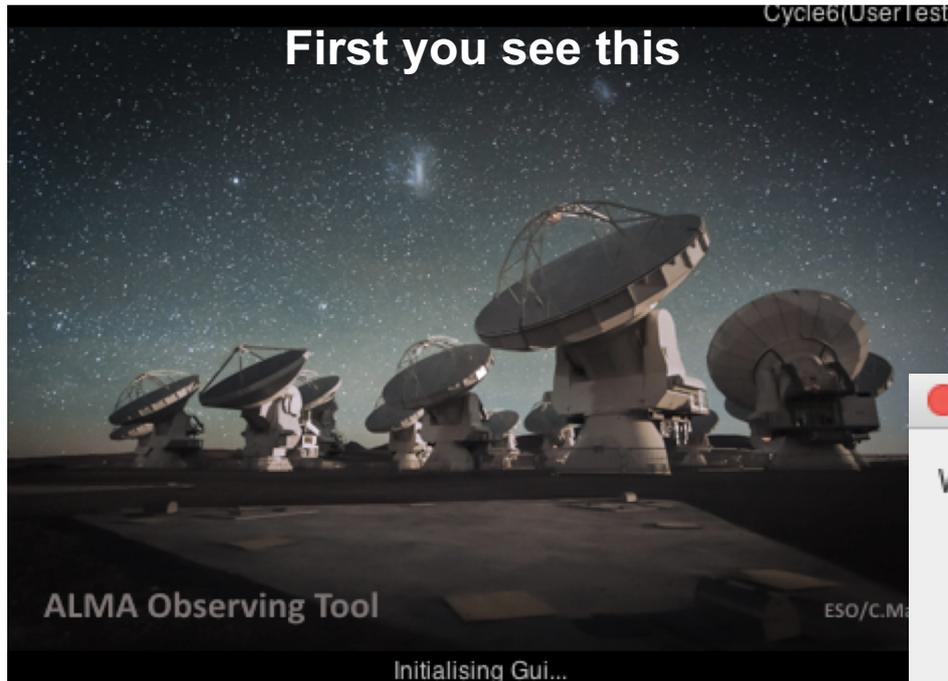
This video will help you get started with the OT and introduce you to some handy tips and tricks. Topics covered include navigating the OT, using the help function, the template library, time estimation, validation, opening & submitting projects including re-submissions, and the concept of non-standard modes. **Note:** this video is from Cycle 4, some things have changed slightly in Cycle 5. In particular, time constraints can now also include simultaneous 12-m and 7-m observations, and re-submissions are no longer defined by the user. Also, the time estimate interface has changed a bit.



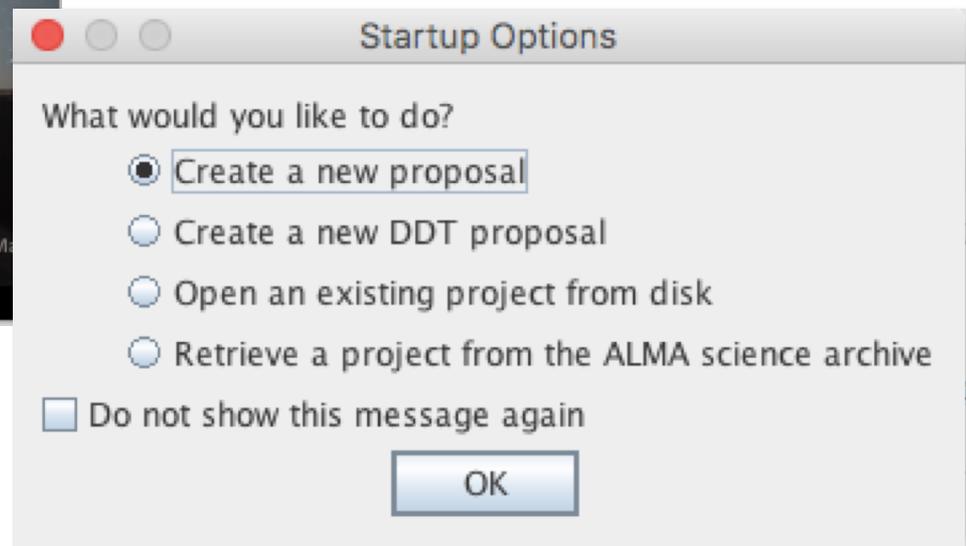
Video 1:
Useful to Know

When the ALMA OT starts

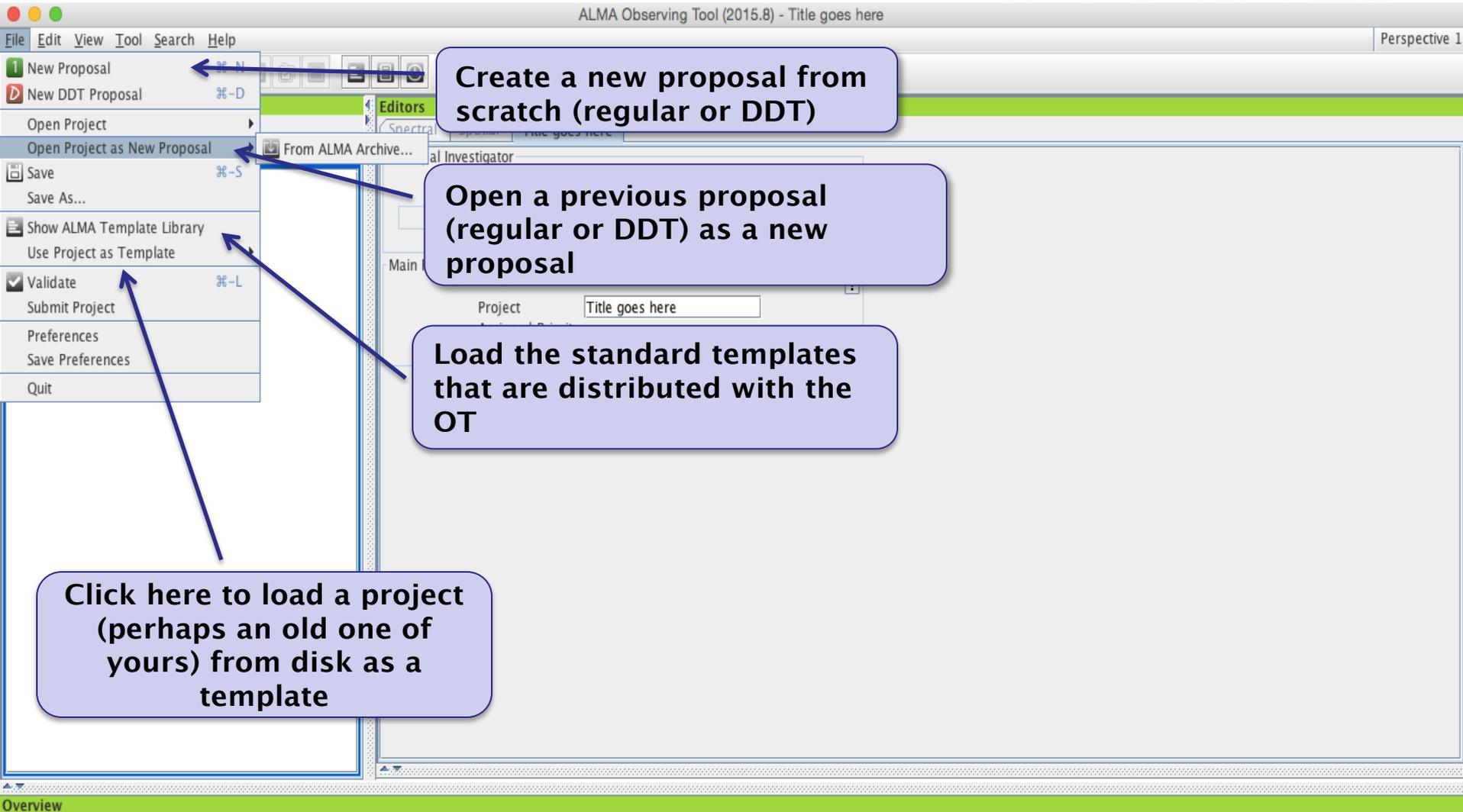
First you see this



Then you see this



Creating a new proposal



The screenshot shows the ALMA Observing Tool (2015.8) interface. The title bar reads "ALMA Observing Tool (2015.8) - Title goes here". The menu bar includes "File", "Edit", "View", "Tool", "Search", and "Help". The "File" menu is open, showing options: "New Proposal", "New DDT Proposal", "Open Project", "Open Project as New Proposal", "Save", "Save As...", "Show ALMA Template Library", "Use Project as Template", "Validate", "Submit Project", "Preferences", "Save Preferences", and "Quit".

Callouts provide instructions:

- Create a new proposal from scratch (regular or DDT)**: Points to the "New Proposal" menu item.
- Open a previous proposal (regular or DDT) as a new proposal**: Points to the "Open Project as New Proposal" menu item.
- Load the standard templates that are distributed with the OT**: Points to the "Show ALMA Template Library" menu item.
- Click here to load a project (perhaps an old one of yours) from disk as a template**: Points to the "Use Project as Template" menu item.

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](#)

Phase I: Science Proposal



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

Click on the overview steps to view the contextual help

Proposal front page



ALMA Observing Tool (Cycle5(Phase2)u2) - Your snazzy title

File Edit View Tool Search Help

Perspective 1

Project Structure

- Proposal
- Program

Unsubmitted Proposal

- Your snazzy title
 - Proposal

Editors

Spectral Spatial Proposal

Proposal Information

Proposal Title: Your snazzy title

Proposal Cycle: 2017.1

Abstract (max. 1200 characters):
Not too abstract, please!

Proposal Type

- Regular
- Target Of Opportunity
- VLBI
- Large Program

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

Keywords (max. 2 keywords)

- Lyman Alpha Emitters/Blobs (LAE/LAB)
- Lyman Break Galaxies (LBG)
- Starburst galaxies
- Sub-mm Galaxies (SMG)
- High-z Active Galactic Nuclei (AGN)

Student project:

Related Proposals:

Previous Proposals:

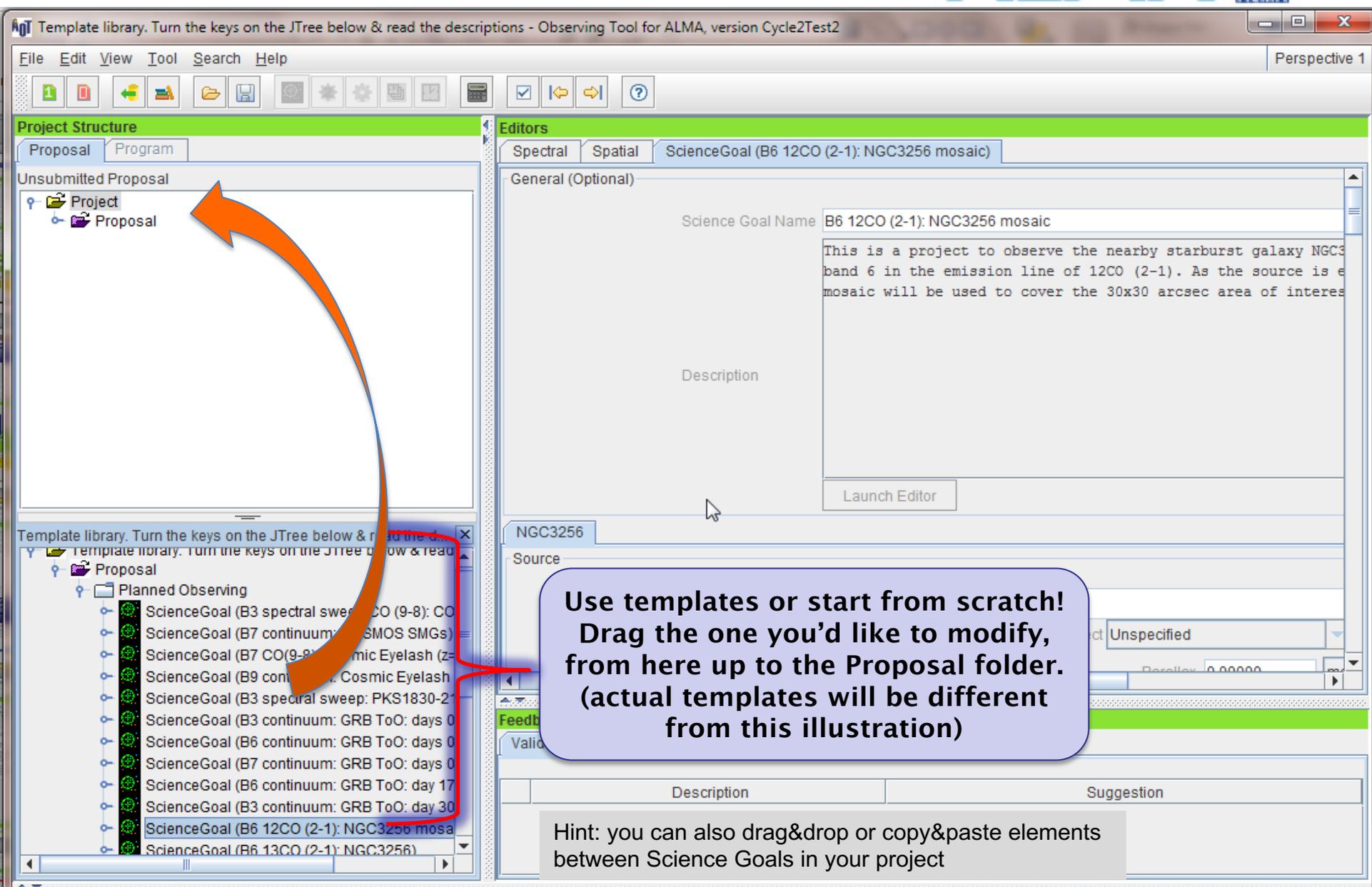
Investigators

Feedback

Validation Validation History Log

Description	Suggestion

Next: Add science goals



The screenshot shows the ALMA Observing Tool interface. The top window title is "Template library. Turn the keys on the JTree below & read the descriptions - Observing Tool for ALMA, version Cycle2Test2". The interface is divided into several panes:

- Project Structure:** Shows a tree view with "Unsubmitted Proposal" and "Project" folders. An orange arrow points from the "Project" folder in the tree to the "ScienceGoal" entry in the template library.
- Editors:** Shows the "ScienceGoal (B6 12CO (2-1): NGC3256 mosaic)" editor. The "Science Goal Name" field contains "B6 12CO (2-1): NGC3256 mosaic". The "Description" field contains the text: "This is a project to observe the nearby starburst galaxy NGC3256 in the emission line of 12CO (2-1). As the source is extended, a mosaic will be used to cover the 30x30 arcsec area of interest." A "Launch Editor" button is visible at the bottom of the editor.
- Template Library:** A list of science goal templates is shown. The "ScienceGoal (B6 12CO (2-1): NGC3256 mosaic)" template is highlighted. A red box highlights this template, and an orange arrow points from it to the "Project" folder in the Project Structure pane.

**Use templates or start from scratch!
Drag the one you'd like to modify,
from here up to the Proposal folder.
(actual templates will be different
from this illustration)**

Hint: you can also drag&drop or copy&paste elements between Science Goals in your project

Before you start the OT...

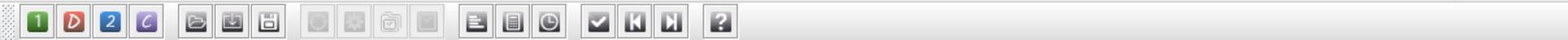


From your science case:

- Source(s):
 - single pointings or mosaics?
 - What angular resolution do you need?
 - What is the largest angular size of your source(s)?
- Spectral configuration:
 - continuum or spectral lines?
 - Frequency: which band?
- Are you doing polarization?
 - What is the expected polarization fraction?
- Sensitivity:
 - what rms do you need to achieve your science goals?
 - over what bandwidth? i.e., 3 km/s, or 1.875 GHz, etc.



Set your targets: Field Setup



Project Structure

Proposal Program

Unsubmitted Proposal

- Casting Light on Chameleon's Dark CO
 - Proposal
 - Planned Observing
 - ScienceGoal (Chameleon's dark CO)
 - General

Editors

Spectral Spatial Field Setup

Source Name

Choose a Solar System Object? Name of object

System Sexagesimal display?

Parallax

Source Coordinates RA PM RA

Dec PM DEC

Source Radial Velocity z Doppler Type

Target Type Individual Pointing(s) 1 Rectangular Field

Expected Source Properties

Peak Continuum Flux Density per Synthesized Beam

Continuum Linear Polarization per cent

Continuum Circular Polarization per cent

Peak Line Flux Density per Synthesized Beam

Line Width

Line Linear Polarization per cent

Line Circular Polarization Percentage per cent

Field Center Coordinates

Coord Type Relative Absolute

Offset Unit

#Pointings

RA [arcsec]	Dec [arcsec]
0.00000	0.00000

Source name, position, proper motion, velocity, velocity rest frame.

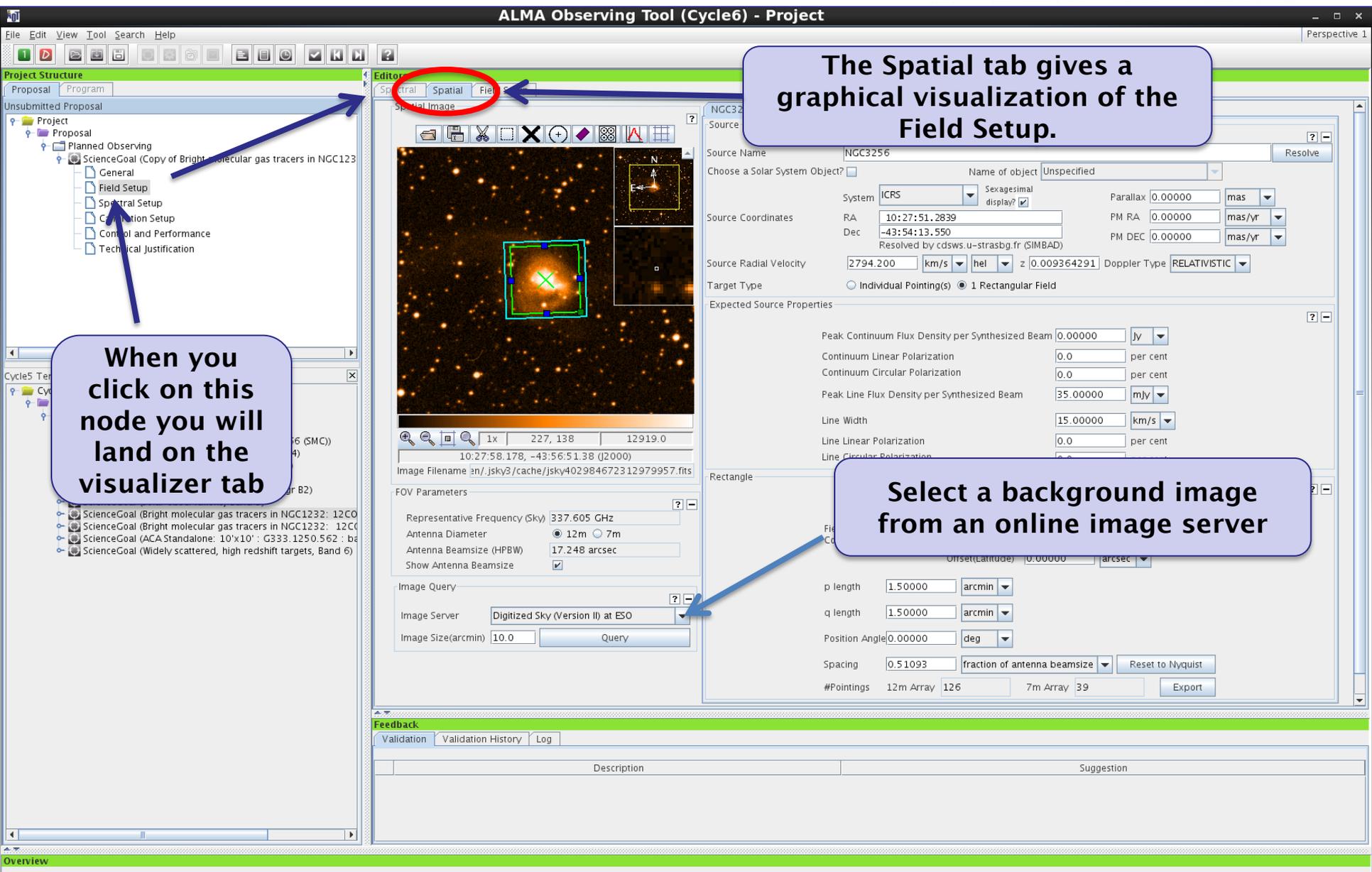
Rectangular mosaic or 1/more offset pointings?

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

When you resolve a name check all returned info

Feedback

Set your targets: Mosaics



Project Structure

- Proposed
- Program
- Unsubmitted Proposal
- Project
 - Proposed
 - Planned Observing
 - ScienceGoal (Copy of Bright molecular gas tracers in NGC1232)
 - General
 - Field Setup
 - Spatial Setup
 - Configuration Setup
 - Control and Performance
 - Technical Justification

Editor

Spectral Spatial Field

Field Setup

Source Name: NGC3256

Source Coordinates: RA: 10:27:51.2839, Dec: -43:54:13.550

Source Radial Velocity: 2794.200 km/s

Target Type: Individual Pointing(s) 1 Rectangular Field

Expected Source Properties:

- Peak Continuum Flux Density per Synthesized Beam: 0.00000 Jy
- Continuum Linear Polarization: 0.0 per cent
- Continuum Circular Polarization: 0.0 per cent
- Peak Line Flux Density per Synthesized Beam: 35.00000 mJy
- Line Width: 15.00000 km/s
- Line Linear Polarization: 0.0 per cent
- Line Circular Polarization: 0.0 per cent

Image Query:

Image Server: Digitized Sky (Version II) at ESO

Image Size(arcmin): 10.0

Feedback

Description	Suggestion

The Spatial tab gives a graphical visualization of the Field Setup.

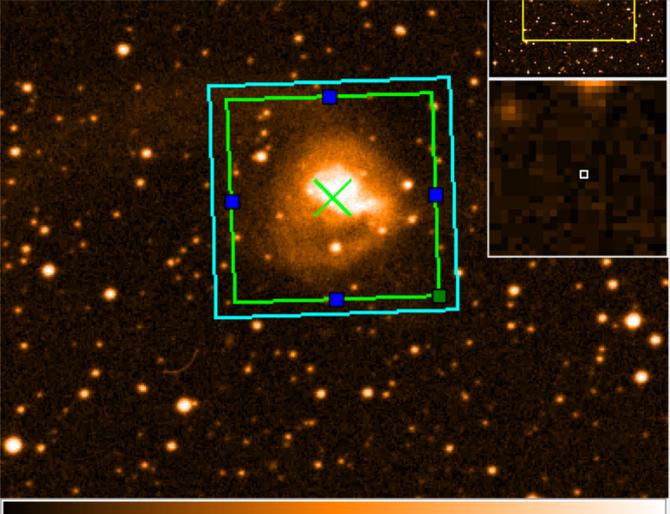
When you click on this node you will land on the visualizer tab

Select a background image from an online image server

Set your targets: Mosaics

Editors

Spectral Spatial **Field Setup**



System J2000 Sexagesimal display? Parallax 0.00000

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 $1.13\lambda/D$

Line Width 0.00000 km/s

Line Polarization Percentage 0.0 %

Rectangle

Coords Type ABSOLUTE RELATIVE

System J2000

Field Center Coordinates

Offset(Longitude) 0.00000

Offset(Latitude) 0.00000

p length 2.0 arcmin

q length 2.0 arcmin

Position Angle 0.00000 deg

Spacing 0.48113 fraction of main beam

#Pointings

12m Array	105
7m Array	39

Estimated number of 7m Array pointings

No more than 150 12m Array pointings.

Reset to Nyquist

Export

Before you start the OT...



From your science case:

- Source(s):
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 - Frequency: which band?
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- Sensitivity:
 - what rms do you need to achieve your science goals?
 - over what bandwidth? i.e., 3 km/s, or 1.875 GHz, etc.



Spectral setup

ALMA Observing Tool (FEB2017) - Project

File Edit View Tool Search Help

Perspective 1

Project Structure

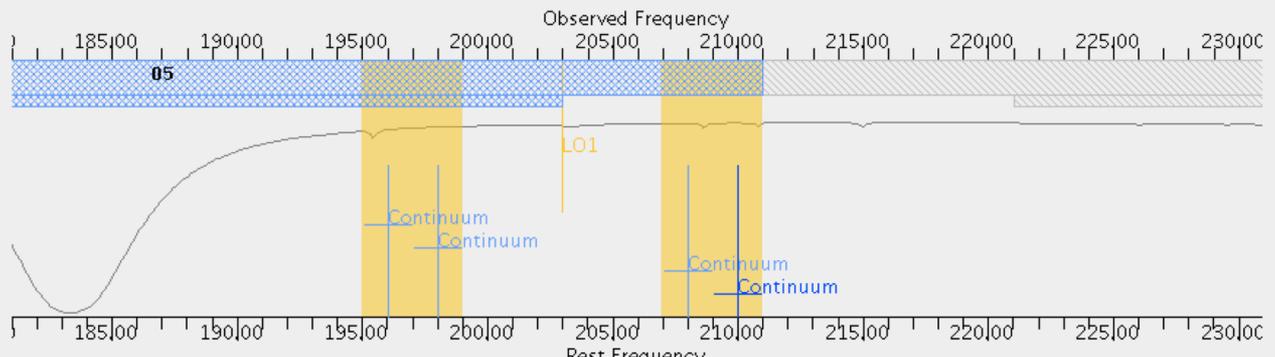
- Unsubmitted Proposal
 - Project
 - Proposal
 - Planned Observing
 - ScienceGoal (Copy of Champion's data) (selected)
 - General
 - Field Setup
 - Spectral Setup** (highlighted)
 - Calibration Setup
 - Control and Performance
 - Technical Justification

Editors

Spectral Spatial Spectral Setup

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

Rest Frequency

Overlays: Receiver Bands Transmission DSB Image Spectral Lines Select Lines to Overlay

Water Vapour Column Density: Automatic Choice Manual Choice 1.796mm (5th 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 5 [163.0-211.0 GHz] Reset to Standard Frequency

Obs. Frequency 203.00000 GHz

When you click on this node you will land on the visualizer tab

Adding spectral windows

ALMA Observing Tool (FEB2017) - Project

File Edit View Tool Search Help Perspective 1

Project Structure

- Unsubmitted Proposal
 - Project
 - Proposal
 - Planned Observing
 - ScienceGoal (Copy of Chameleon's data) (Selected)
 - 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)	Centre Freq (sky,bar)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1(Full)	98.70000 GHz	98.69607 GHz	continuum	1875.000 MHz(5695 km/s), 31.250 MHz(94.923 km/s)	1	<input type="radio"/>

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), 70.557 kHz(0.216 km/s)	2	<input type="radio"/>
1/2	97.98095 GHz	97.97705 GHz	CS v=0 2-1	58.594 MHz(179 km/s), 61.035 kHz(0.187 km/s)	1	<input type="radio"/>

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(203 km/s), 61.035 kHz(0.211 km/s)	1	<input type="radio"/>
1/2	87.31690 GHz	87.31342 GHz	CCH v=0 N=1-...	58.594 MHz(201 km/s), 61.035 kHz(0.210 km/s)	1	<input type="radio"/>

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

Baseband-4

v=0 J=1-0	58.594 MHz(198 km/s), 61.035 kHz(0.206 km/s)	1	<input checked="" type="radio"/>
v=0 1-0	58.594 MHz(198 km/s), 61.035 kHz(0.206 km/s)	1	<input type="radio"/>

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

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

This option will call up a version of the spectral line picker. Windows added this way retain line id and other info from the splatalog

Frequencies may also be entered by hand

Using the spectral line catalog



Select Spectral Lines

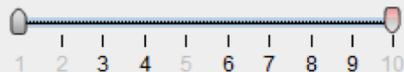
Transition Filter

CO*

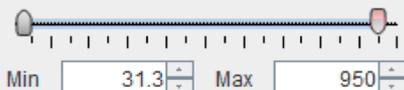
Include description

Frequency Filters

ALMA Band



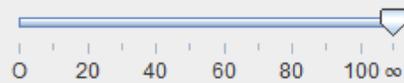
Sky Frequency (GHz)



Receiver/Back End Configuration

- Hide unobservable lines
 Filtering unobservable lines

Maximum Upper-state Energy (K)



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 already sorted columns.)

Transition \triangle	Description	Rest Frequency \triangle	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 1.21
CO v=2 3-2	Carbon Monoxide	339.5 GHz	339.5 GHz	6161.831 K	0.03
CO v=1 3-2	Carbon Monoxide	342.648 GHz	342.648 GHz	3116.561 K	0.71 0.03
CO v=0 3-2	Carbon Monoxide	345.796 GHz	345.796 GHz	33.192 K	70 0.03
CO+ J=3-2, F=5/2-3/2	Carbon Monoxide Ion	353.741 GHz	353.741 GHz		0.1 1.21
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 v=2 6-5	Carbon Monoxide	678.88 GHz	678.88 GHz	6243.288 K	0.07
CO v=1 6-5	Carbon Monoxide	685.176 GHz	685.176 GHz	3198.774 K	0.07
CO v=0 6-5	Carbon Monoxide	691.473 GHz	691.473 GHz	116.159 K	100 0.07
CO v=2 7-6	Carbon Monoxide	791.96 GHz	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

Select a line from the list

Filters can be used to narrow the search

Add to Selected Transitions

Selected transitions

Transition \triangle	Description	Rest Frequency \triangle	Sky Frequency
CO v=0 2-1		230.538 GHz	230.538 GHz

Remove from Selected Transitions

Before you start the OT...



From your science case:

- Source(s):
 - single pointings or mosaics?
 - What angular resolution do you need?
 - What is the largest angular size of your source(s)?
- Spectral configuration:
 - continuum or spectral lines?
 - Frequency: which band?
- Are you doing polarization?
 - What is the expected polarization fraction?
- Sensitivity:
 - what rms do you need to achieve your science goals?
 - over what bandwidth? i.e., 3 km/s, or 1.875 GHz, etc.



Control & Performance

ALMA Observing Tool (FEB2017) - Project

File Edit View Tool Search Help

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Project Structure

- Unsubmitted Proposal
 - Project
 - Proposal
 - Planned Observing
 - ScienceGoal (Copy of Chameleon's data) (selected)
 - General
 - Field Setup
 - Spectral Setup
 - Calibration Setup
 - Control and Performance** (circled)
 - Technical Justification

Editors

Spectral Spatial **Control and Performance** (circled)

These parameters are used to control various aspects of the observations, including the required antenna configurations and integration times.

Control and Performance

Configuration Information

Antenna Beamsize ($1.13 * \lambda / D$)	12m	38.309 arcsec	7m	65.672 arcsec		
Number of Antennas	12m	43	7m	10	TP	3
		ACA 7m configuration	Most compact 12m configuration	Most extended 12m configuration		
Longest baseline		0.049 km	0.161 km	16.197 km		
Synthesized beamsize		10.103 arcsec	2.906 arcsec	0.033 arcsec		
Shortest baseline		0.009 km	0.015 km	0.256 km		
Maximum recoverable scale		47.725 arcsec	24.192 arcsec	0.409 arcsec		

Desired Performance

Desired Angular Resolution (Synthesized Beam) Single Range Any Standalone ACA

arcsec

Largest Angular Structure in source arcsec

Desired sensitivity per pointing Jy equivalent to mK

Bandwidth used for Sensitivity Frequency Width GHz

Science goal integration time estimate

Override OT's sensitivity-based time estimate (must be justified) Yes No

Are the observations time-constrained? Yes No

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

Array properties summarized: what resolution and angular scales are observable?

Time-constrained observing



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 Justi

Editors

Spectral Spatial **Control and Performance**

Do you request complementary ACA Observations? Yes No Suggest

Science goal integration time estimate Time Estimate

Is more time required due to u,v coverage issues? (must be justified) Yes No

Are the observations time-constrained? Yes No Specific Dates Multiple Epochs Continuous Monitoring

Number of time windows specified : 1

Start Date/Time (UTC)	End Date/Time (UTC)
2013-10-02 13:18	2013-10-02 13:18

Please specify one or more suitable time windows for your observation

Your observation will be scheduled once during

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)

Overview

Phase I: Science Proposal

Entering Time Constrained observations - Dates, Epochs or Monitoring

Justification or additional information

A file format is defined in the help to import a list of time constraints

Science Goal time estimates



ALMA Observing Tool (2015.8) - Debris Disk Structure around Nearby Sun-like Stars (2015.

Time Estimate

File Edit View Tool Search Help



Project Structure

- Proposal
- Program
 - Debris Disk Structure around Nearby Sun-like Stars
 - Science Plan
 - ScienceGoal (HD 10647) - generat
 - General
 - Field Setup
 - Spectral Setup
 - Calibration Setup
 - Control and Performance
 - Technical Justification
 - SG OUS (HD 10647)
 - Group OUS
 - Member OUS (HD_10647)
 - HD_10647_a_06_TE
 - Group 1 : Calibra

Editors

Spectral Spatial Control and Performance

These parameters are used to control various aspects of the observations, including the

Control and Performance

Configuration Information

Antenna Beamsize ($1.13 * \lambda / D$)	12m 25.260 arcsec	7m 43.3
Number of Antennas	12m 40	7m 10
	ACA 7m configuration	Most compact
Longest baseline	0.049 km	0.157 km
Synthesized beamsize	5.712 arcsec	1.721 arcsec
Shortest baseline	0.009 km	0.015 km
	19.709 arcsec	12.765 arcsec

beam) 0.60000 arcse

9.0 arcse

0.00001 Jy

AggregateBandWidth

Science goal integration time estimate

Override OT's sensitivity-based time estimate (must be justified) Yes No

Are the observations time-constrained? Yes No

Note: The time in brackets is that required to reach the sensitivity. Operational requirements often mean that the actual observed time is longer, especially for mosaics. Please see the User Manual for more details.

Input Parameters

Requested sensitivity	0.01400 mJy
Bandwidth used for sensitivity	7.500 GHz
Representative frequency (sky, first source)	230.52 GHz

Estimated Total time for Science Goal 6.02 h

SB-1

Input Parameters

Precipitable water vapour (all sources)	1.796mm (5th Octile)
Time required for C40-3	
Time on source per pointing (first source)	1.44 h [1.43 h]
Total number of pointings (all sources)	1
Number of tunings	1
Total time on source	1.44 h [1.43 h]
Total calibration time	49.50 min
Other overheads	14.30 min
Total time for 1 SB execution	1.25 h
Number of SB executions	2
Total time to complete SB	2.51 h

Calibration Breakdown per SB execution

3 x Pointing	36.00 s
1 x SidebandRatio	1.58 min
1 x Amplitude	2.50 min
1 x Bandpass	5.00 min
6 x Phase	3.00 min
2 x CheckSource	2.00 min
7 x Atmospheric	4.67 min
Calibration overheads	5.40 min

Additional Arrays

ACA 7-m time (t_12m x 1.40)	3.51 h
Total ACA time (max{t_7-m,t_TP})	3.51 h

Estimated total time for SB-1 6.02 h

Click the time estimate to see how much time you need and get a breakdown by array and on-source vs. overhead for the 12m synthesis



Science Goal time estimates



ALMA Observing Tool (2015.8) - Debris Disk Structure around Nearby Sun-like Stars (2015)

File Edit View Tool Search Help

Project Structure

- Debris Disk Structure around Nearby Sun-like Stars
 - Science Plan
 - ScienceGoal (HD 10647) - generat
 - General
 - Field Setup
 - Spectral Setup
 - Calibration Setup
 - Control and Performance
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 - SG OUS (HD 10647)
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 - HD_10647_a_06_TE
 - Group 1 : Calibra

Editors

Spectral Spatial Control and Performance

These parameters are used to control various aspects of the observations, including the

Control and Performance

Configuration Information

Antenna Beamsize ($1.13 * \lambda / D$)	12m	25.260 arcsec	7m	43.3
Number of Antennas	12m	40	7m	10
	ACA 7m configuration		Most compact	
Longest baseline		0.049 km		0.157 km
Synthesized beamsize		5.712 arcsec		1.721 arcsec
Shortest baseline		0.009 km		0.015 km
		19.709 arcsec		12.765 arcsec

beam) 0.60000 arcsec

9.0 arcsec

0.00001 Jy

AggregateBandWidth

Time Estimate

Science goal integration time estimate

estimate (must be justified) Yes No

Yes No

Time Estimate

Note: The time in brackets is that required to reach the sensitivity. Operational requirements often mean that the actual observed time is longer, especially for mosaics. Please see the User Manual for more details.

Input Parameters

Requested sensitivity	0.01400 mJy
Bandwidth used for sensitivity	7.500 GHz
Representative frequency (sky, first source)	230.52 GHz

Estimated Total time for Science Goal 6.02 h

SB-1

Input Parameters

Precipitable water vapour (all sources)	1.796mm (5th Octile)
Time required for C40-3	
Time on source per pointing (first source)	1.44 h [1.43 h]
Total number of pointings (all sources)	1
Number of tunings	1
Total time on source	1.44 h [1.43 h]
Total calibration time	49.50 min
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1 x Bandpass	5.00 min
6 x Phase	3.00 min
2 x CheckSource	2.00 min
7 x Atmospheric	4.67 min
Calibration overheads	5.40 min

Additional Arrays

ACA 7-m time (t_12m x 1.40)	3.51 h
Total ACA time (max[t_7-m,t_TP])	3.51 h

Estimated total time for SB-1 6.02 h

Click the time estimate to see how much time you need and get a breakdown by array and on-source vs. overhead for the 12m synthesis

This project needs 12m + 7m synthesis owing to the combination of angular resolution and largest angular scale

View the project time summary

ALMA Observing Tool (2014.6) - Bulge Asymmetries and Dynamical Evolution (BAaDE) (2013.1.01180.S last submitted 2014-11-14 17:52:31)

File Edit View **Tool** Search Help

- ALMA Calibrator Selection Tool...
- ALMA LO Configuration Tool...
- Sensitivity Calculator...
- Generate SBs from One Selected Goal
- Display Project Time Summary**
- Generate Phase I SBs from all the Science Goals
- Generate Phase II SBs from all the Science Goals
- Export selected Scheduling
- Generate a PDF of Whole P
- Disable Edit Protect

Bulge Asymmetries and Dynamical Evolution (BAaDE)

Project Time Estimates

Total and Calibration Times

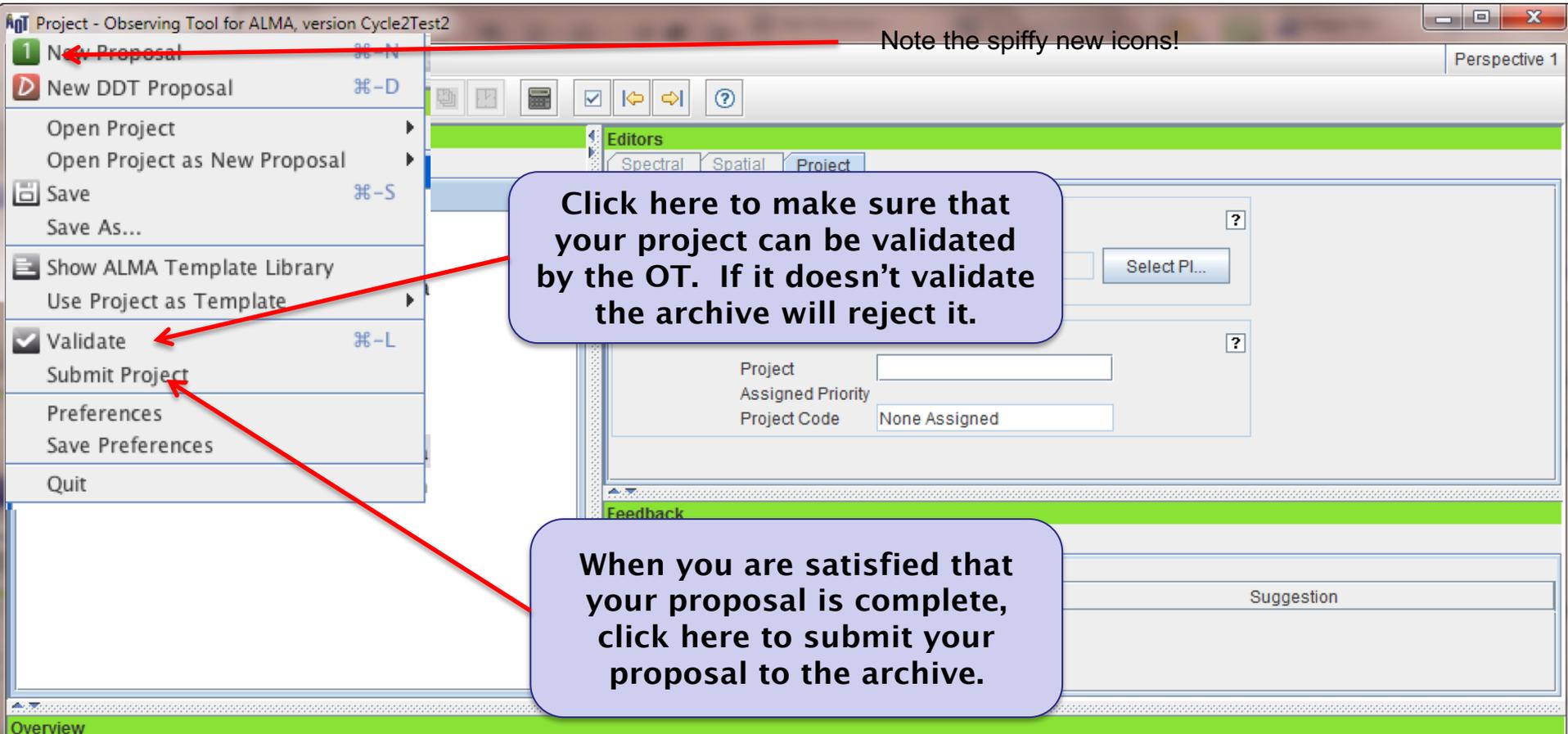
Science Goal	12-m Ext.		12-m Compact		12-m Ext. + Compact		ACA 7-m		ACA TP		Overall		Non-standard Mode
	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	Tot.	Cal.	
MSXiiiRA16a1	51.12 min	24.75 min	-	-	51.12 min	24.75 min	-	-	-	-	51.12 min	24.75 min	No
MSXiiiRA16a2	51.12 min	24.75 min	-	-	51.12 min	24.75 min	-	-	-	-	51.12 min	24.75 min	No
MSXiiiRA16a3	51.97 min	24.75 min	-	-	51.97 min	24.75 min	-	-	-	-	51.97 min	24.75 min	No
MSXiiiRA16a4	51.12 min	24.75 min	-	-	51.12 min	24.75 min	-	-	-	-	51.12 min	24.75 min	No
MSXiiiRA16b1	1.29 h	29.95 min	-	-	1.29 h	29.95 min	-	-	-	-	1.29 h	29.95 min	No
MSXiiiRA16b2	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
MSXiiiRA16a1	54.85 GB	-	-	18.31 MB/s	-	-
MSXiiiRA16a2	54.85 GB	-	-	18.31 MB/s	-	-
MSXiiiRA16a3	55.77 GB	-	-	18.31 MB/s	-	-
MSXiiiRA16a4	54.85 GB	-	-	18.31 MB/s	-	-
MSXiiiRA16b1	83.35 GB	-	-	18.31 MB/s	-	-
MSXiiiRA16b2	83.35 GB	-	-	18.31 MB/s	-	-
Overall	387.01 GB	-	-			

OK

Ready? Validate & submit!

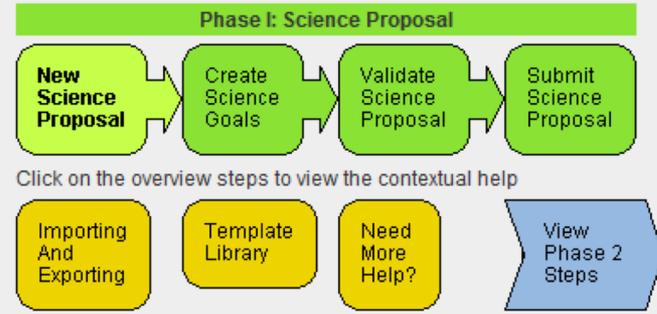


Note the spiffy new icons!

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

When you are satisfied that your proposal is complete, click here to submit your proposal to the archive.

- 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.



User support

ALMA



Atacama Large Millimeter/submillimeter Array
In search of our Cosmic Origins



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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](#)

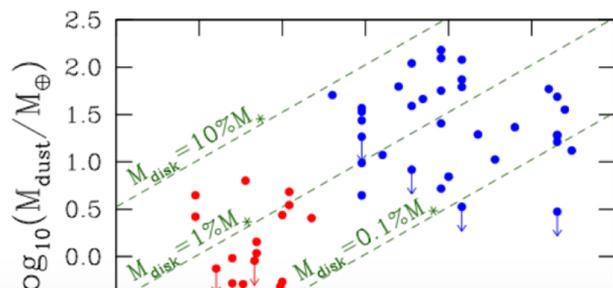
Refereed publications:

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...

ALMA



Have no fear, the ALMA Helpdesk is here...

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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

Please type your search query here

SEARCH

Knowledgebase

General ALMA Queries (13)

- Can I submit a ticket in Japanese?
- How close can ALMA observe to the Sun?

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?

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?

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?

Resources & Observer Support (12)

- How do I arrange a visit to one of the ARCs?
- Where can I find ALMA documentation and manuals?

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/Nudei"?





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.