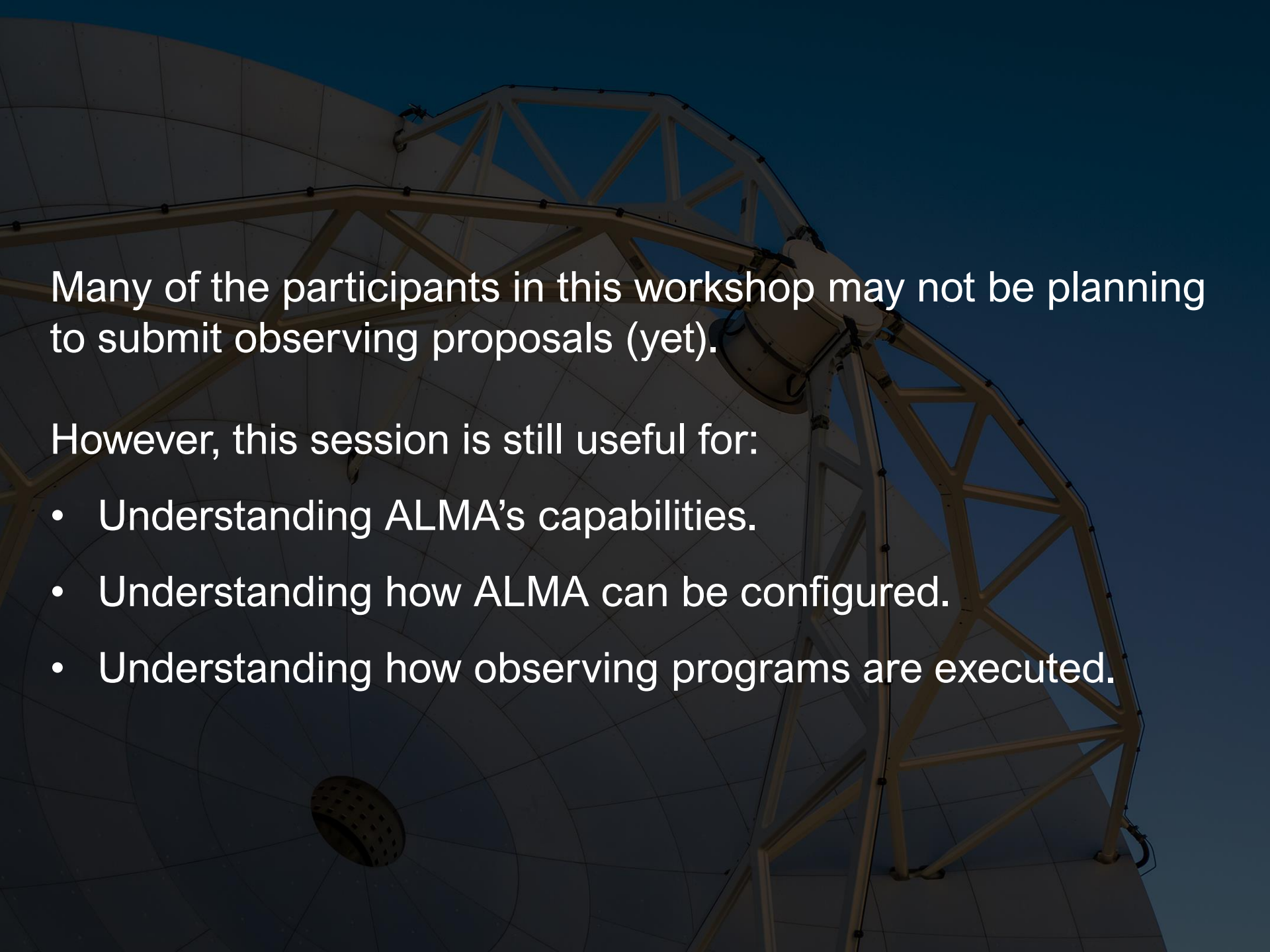


Observing with ALMA

George Bendo

UK ALMA Regional Centre Node
Jodrell Bank Centre for Astrophysics
The University of Manchester





Many of the participants in this workshop may not be planning to submit observing proposals (yet).

However, this session is still useful for:

- Understanding ALMA's capabilities.
- Understanding how ALMA can be configured.
- Understanding how observing programs are executed.

A large, white, segmented radio telescope dish is shown against a dark blue sky. The dish is supported by a complex metal truss structure. The text is overlaid on the left side of the dish.

ALMA uses the same timeline in every cycle for handling proposals.

March Call for proposals

April Proposals due

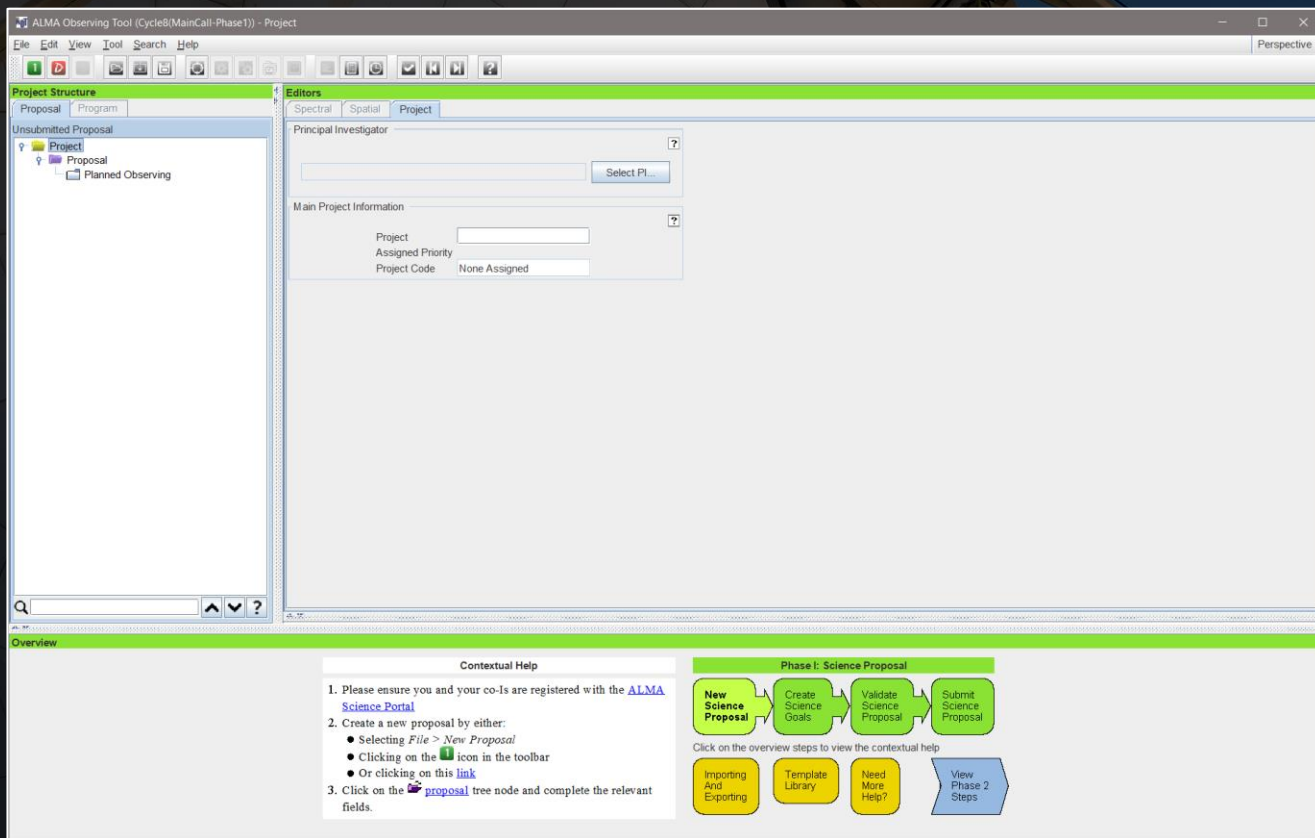
August Grades for proposals are announced

September Phase 2 of proposal submission (review of the Scheduling Blocks); end of observations from the previous cycle

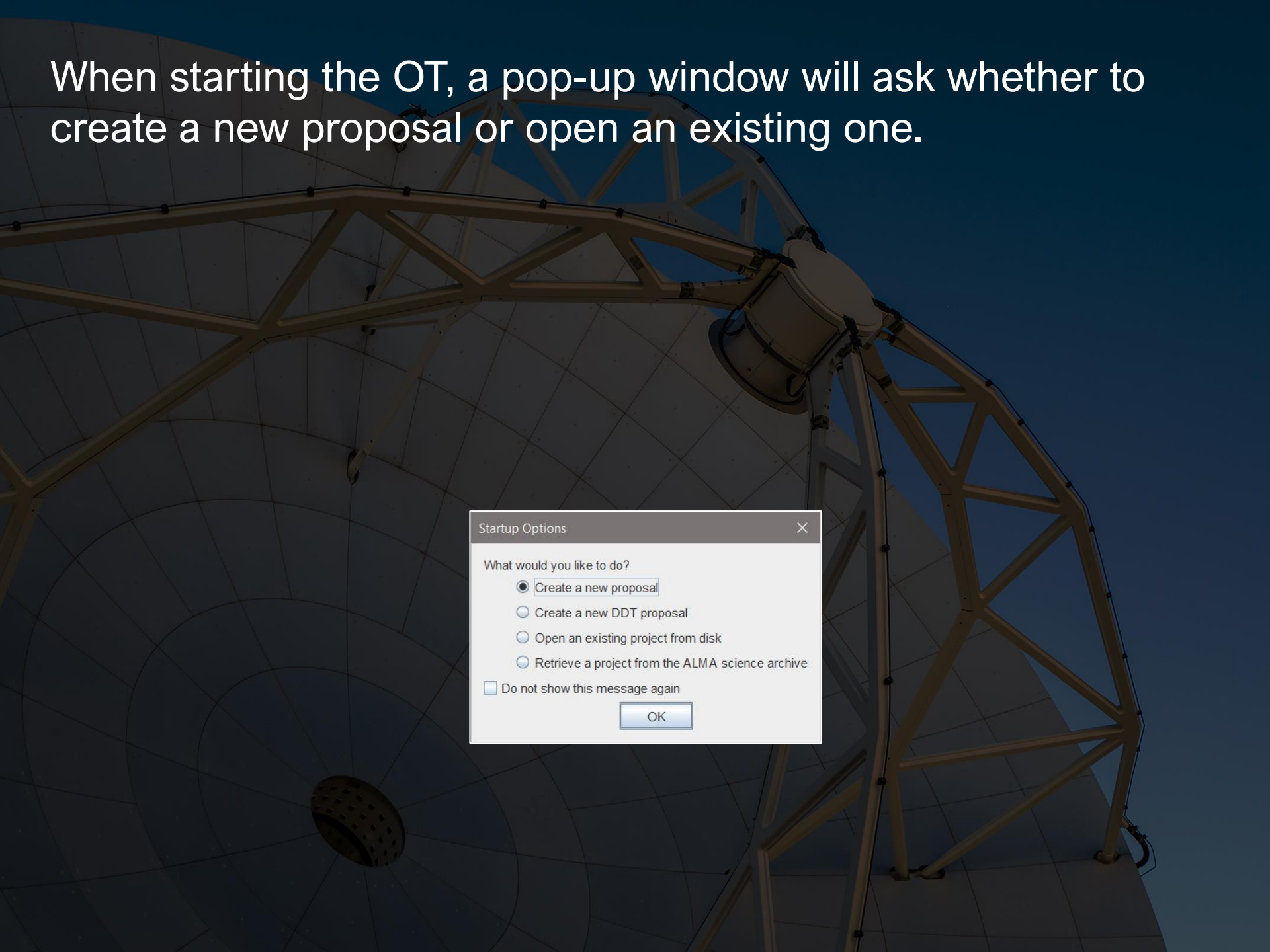
October Observations start for new cycle

The Observing Tool (OT) is used to prepare and submit ALMA proposals.

The OT can be downloaded from <https://almascience.eso.org/tools/proposing/observing-tool>.



When starting the OT, a pop-up window will ask whether to create a new proposal or open an existing one.



Startup Options

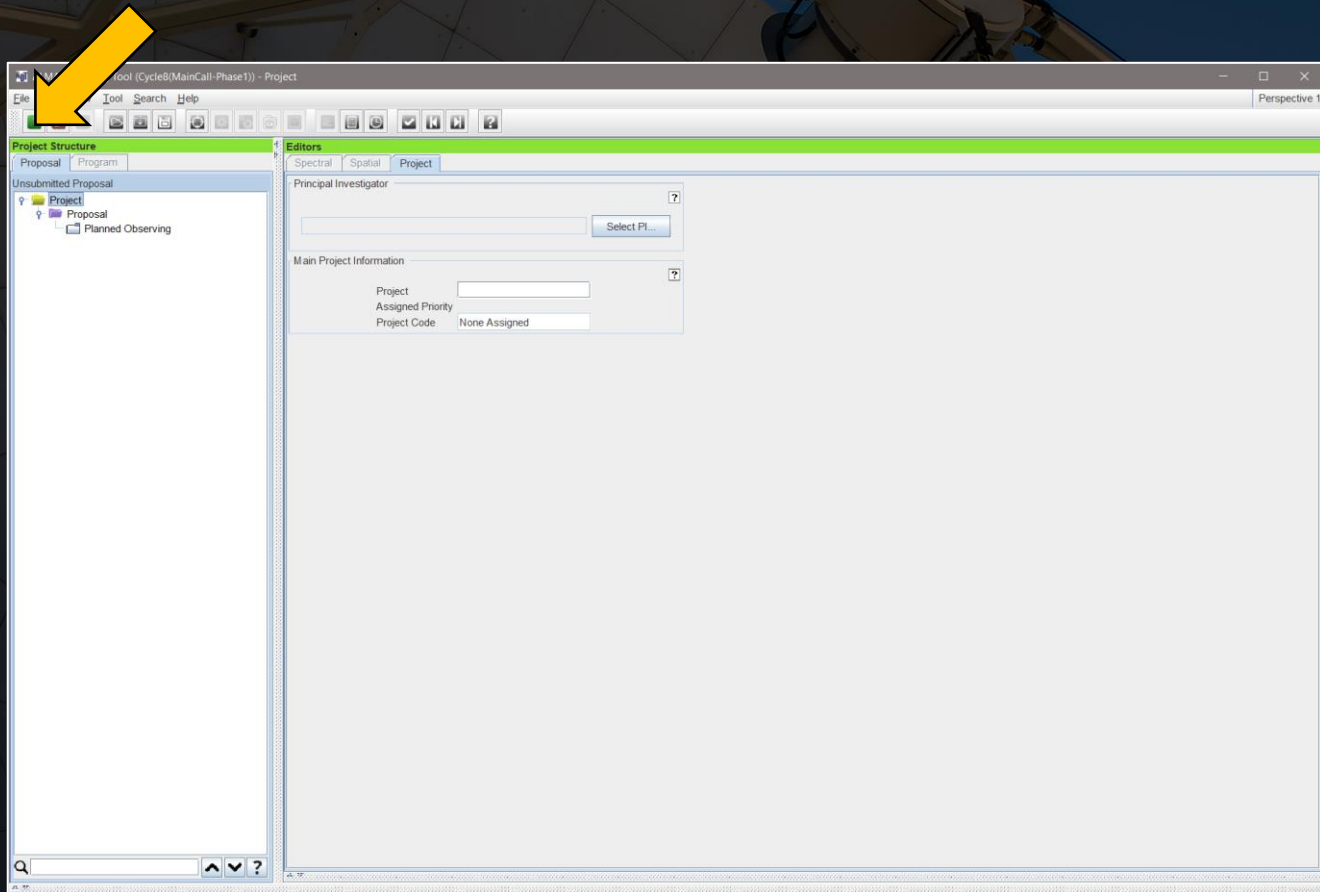
What would you like to do?

- Create a new proposal
- Create a new DDT proposal
- Open an existing project from disk
- Retrieve a project from the ALMA science archive

Do not show this message again

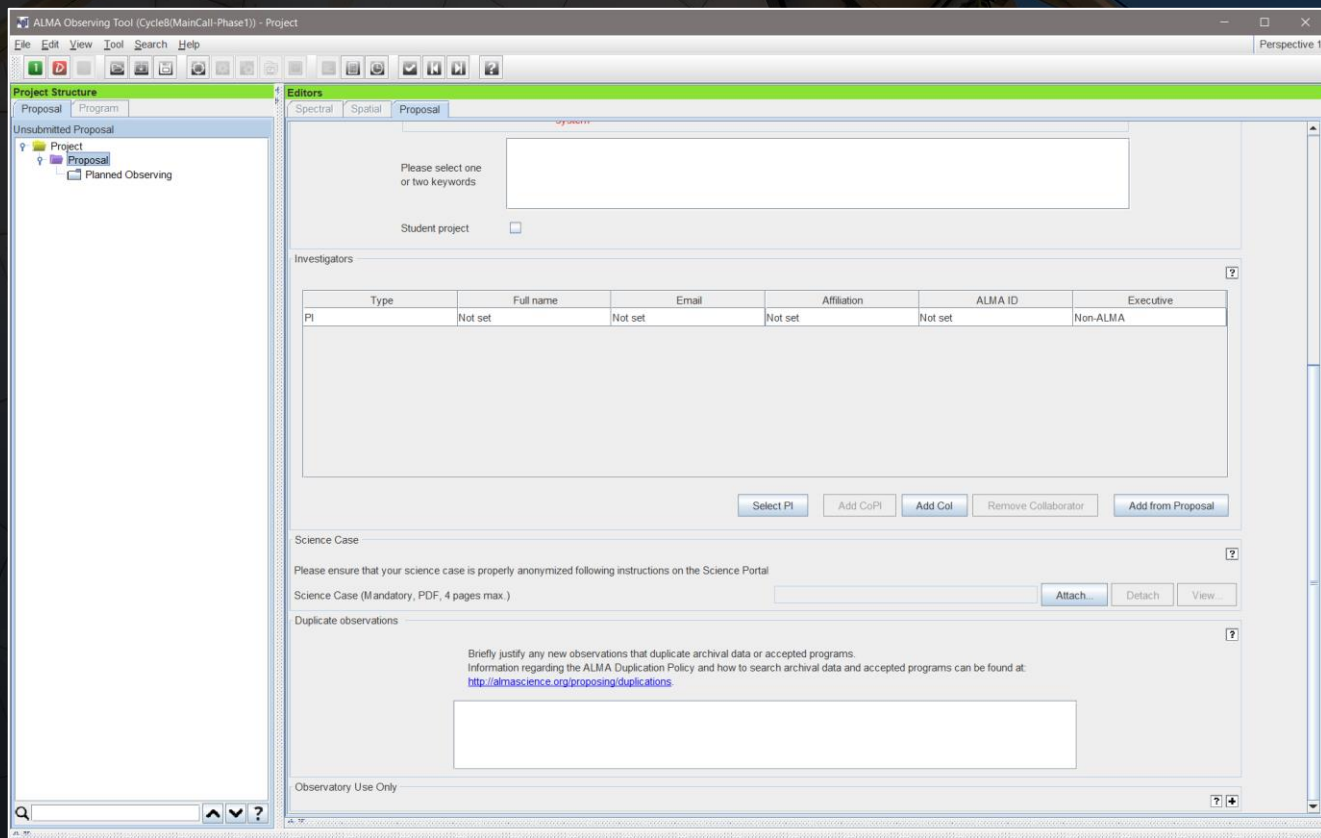
OK

In the OT, proposals can be created or opened by either selecting the options from the File menu or button bar.



The proposal tab shows summary information about the proposal, including the abstract and authors of the project.

The science case is also attached using a button in this tab.



The science case is a separate LaTeX document that can be downloaded from <https://almascience.eso.org/documents-and-tools/proposing/proposal-template>.

1 Scientific justification

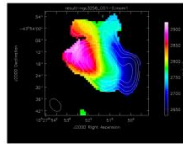


Figure 1: The $CO(1-0)$ velocity field of NGC 3256, with contours of the total line emission map overlaid (ALMA Science Verification Data).

Table 1: Here we show the continuum sensitivity required per band.

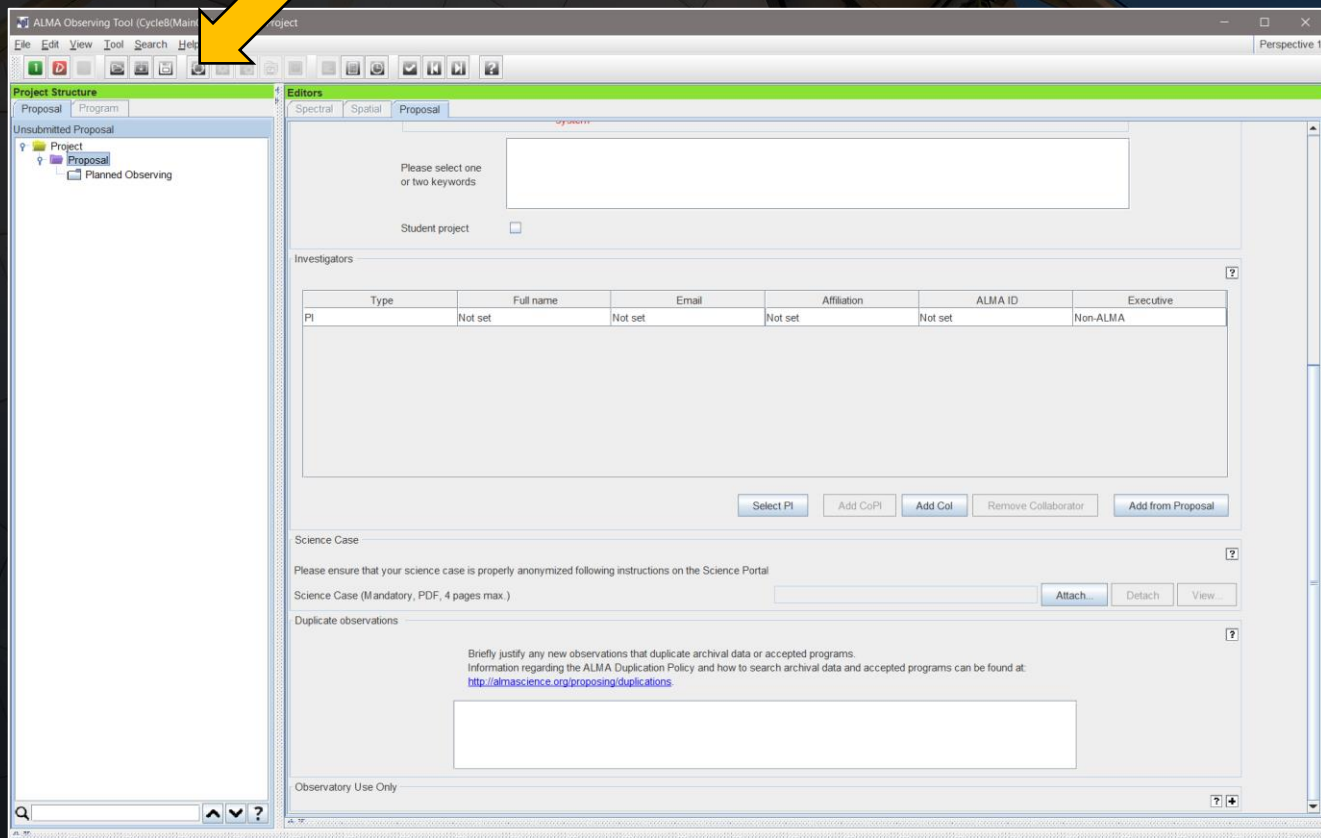
Frequency (GHz)	Sensitivity (mJy)
100	0.01
300	0.10

2 Description of observations

3 References

- [1] Author1 et al. year, journal, vol, page
- [2] Author2 et al. year, journal, vol, page

The observations are set up by adding Science Goals, which can be done by either right-clicking on the Planned Observations tab or clicking the corresponding button in the button bar.



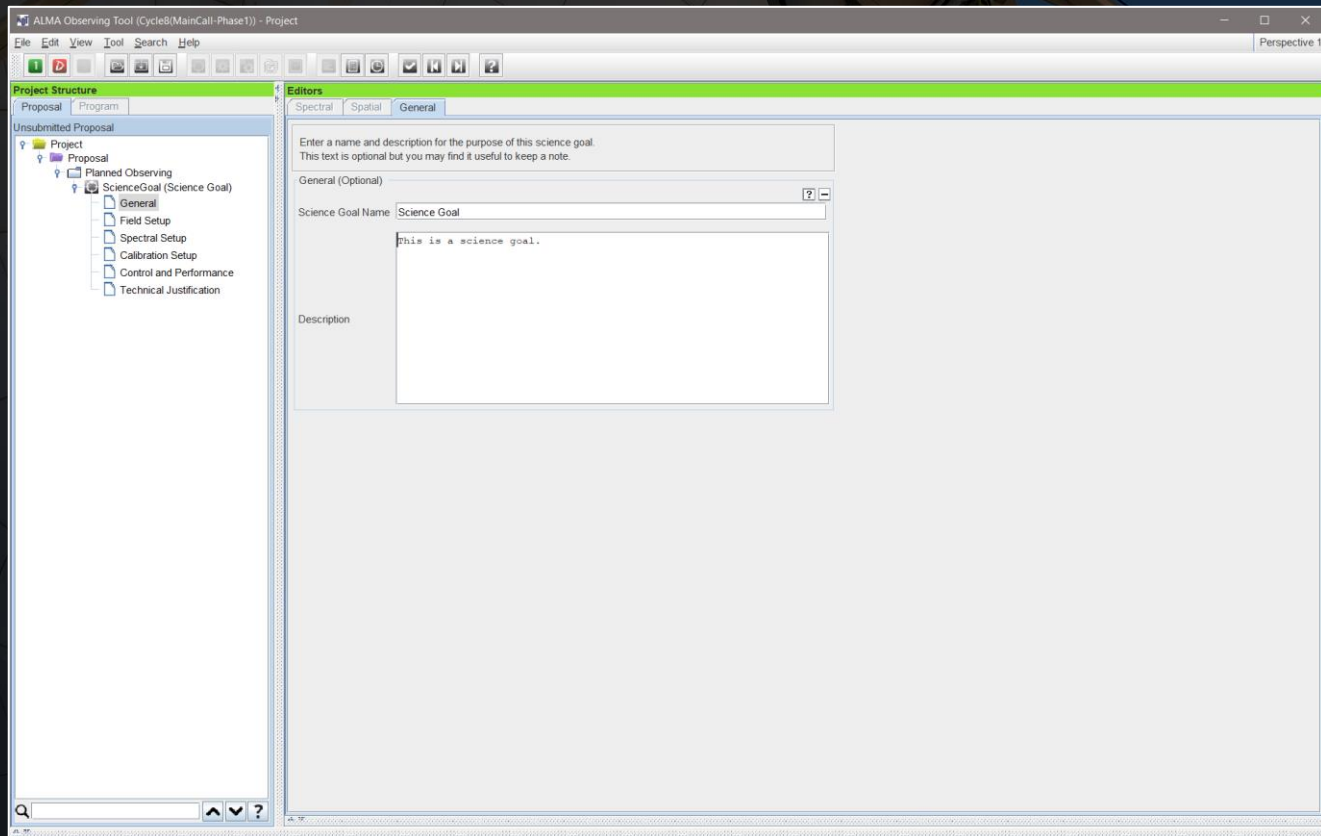
The screenshot shows the ALMA Observing Tool interface. On the left, the 'Project Structure' pane shows a tree view with 'Project' expanded to show 'Planned Observing'. A yellow arrow points to this 'Planned Observing' tab. The main 'Editors' pane is active, showing a 'Proposal' editor with various sections: 'Please select one or two keywords', 'Student project' checkbox, 'Investigators' table, 'Science Case' section with an 'Attach...' button, and 'Duplicate observations' section with a text area and a URL. The 'Investigators' table is as follows:

Type	Full name	Email	Affiliation	ALMA ID	Executive
PI	Not set	Not set	Not set	Not set	Non-ALMA

Buttons at the bottom of the 'Investigators' section include 'Select PI', 'Add CoPI', 'Add Col', 'Remove Collaborator', and 'Add from Proposal'.

Each Science Goal consists of a set of six tabs.

The General tab describes the Science Goal.



The Field Setup tab describes the locations in the sky to be observed.

Multiple sources can be specified in this tab. Mosaic observations can also be specified here.

The screenshot displays the ALMA Observing Tool interface. The main window is titled "ALMA Observing Tool (Cycle8/MainCall-Phase1) - Project". The "Field Setup" tab is active, showing a spatial image of a star-forming region with a red and blue field layout overlaid. The "Source" configuration panel on the right is set for source "M83".

Source Configuration:

- Source Name: M83
- System: ICRS
- RA: 13:37:00.9185
- Dec: -29:51:56.739
- Source Radial Velocity: 519.100 km/s
- Target Type: 1 Rectangular Field

Expected Source Properties:

- Peak Continuum Flux Density per Synthesized Beam: 0.10000 Jy
- Continuum Linear Polarization: 0.0 per cent
- Continuum Circular Polarization: 0.0 per cent
- Peak Line Flux Density per Synthesized Beam: 0.01000 Jy
- Line Width: 50.00000 km/s
- Line Linear Polarization: 0.0 per cent
- Line Circular Polarization: 0.0 per cent

FOV Parameters:

- Representative Frequency (Sky): 146.715 GHz
- Antenna Diameter: 12m
- Antenna Beamsize (HPBW): 39.689 arcsec

Rectangle Configuration:

- Field Center Coordinates: Offset(Longitude) 0.00000 arcsec, Offset(Latitude) 0.00000 arcsec
- p length: 1.00000 arcmin
- q length: 1.00000 arcmin
- Position Angle: 0.00000 deg
- Spacing: 0.51093 fraction of antenna beamsize
- #Pointings: 12m Array 14, 7m Array 3

Although source positions and redshifts can be automatically filled in, users need to check that these quantities were filled in correctly or insert new values if appropriate.

The screenshot displays the ALMA Observing Tool interface, which is used for configuring observations. The window title is "ALMA Observing Tool (Cycle8(MainCall-Phase1)) - Project".

Project Structure: A tree view on the left shows the project hierarchy, including "Unsubmitted Proposal", "Project", "Planned Observing", "ScienceGoal (Science Goal)", "General", "Field Setup", "Spectral Setup", "Calibration Setup", "Control and Performance", and "Technical Justification".

Editors: The main workspace is divided into several panels:

- Spatial Image:** Displays a central image of the galaxy M83 with a red and blue beam pattern overlaid. Below the image, the coordinates are given as "13:37:08.796, -29:50:58.91 (J2000)". The image filename is "sers/georgljsky3/cache/jsky1862777245375806218.fits".
- FOV Parameters:** Shows "Representative Frequency (Sky)" as 146.715 GHz, "Antenna Diameter" as 12m (selected), "Antenna Beamsize (HPBW)" as 39.689 arcsec, and "Show Antenna Beamsize" checked.
- Image Query:** Shows "Image Server" as "Digitized Sky (Version II) at ESO" and "Image Size(arcmin)" as 10.0.
- Source (M83):** Contains the following parameters:
 - Source Name: M83
 - System: ICRS
 - Source Coordinates: RA 13:37:00.9185, Dec -29:51:56.739
 - Source Radial Velocity: 519.100 km/s
 - Target Type: 1 Rectangular Field
 - Expected Source Properties: Peak Continuum Flux Density per Synthesized Beam 0.10000 Jy, Continuum Linear Polarization 0.0 per cent, Continuum Circular Polarization 0.0 per cent, Peak Line Flux Density per Synthesized Beam 0.01000 Jy, Line Width 50.00000 km/s, Line Linear Polarization 0.0 per cent, Line Circular Polarization 0.0 per cent.
 - Rectangle: Coords Type Relative, Field Center Coordinates Offset(Longitude) 0.00000 arcsec, Offset(Latitude) 0.00000 arcsec, p length 1.00000 arcmin, q length 1.00000 arcmin, Position Angle 0.00000 deg, Spacing 0.51093 fraction of antenna beamsize, #Pointings 12m Array 14, 7m Array 3.

The Spectral Setup tab describes how the receivers are set up for the observations.

Multiple spectral and polarization settings are available.

The screenshot shows the 'Spectral Setup' tab in the ALMA Observing Tool. The interface includes a 'Project Structure' tree on the left, a 'Visualisation' plot area, and various configuration options.

Project Structure:

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

Visualisation:

In the table below, it is possible to define up to 16 spectral windows, 4 per baseband as long as the total Fraction per baseband is no more than 1. Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolution. Note that for bands 3 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 LD1 here is for experimentation only - actual setup determined by the windows

Observed Frequency: 100|0000, 200|0000, 300|0000, 400|0000, 500|0000, 600|0000, 700|0000, 800|0000, 900|0000, 1000|0000

Rest Frequency: 100|0000, 200|0000, 300|0000, 400|0000, 500|0000, 600|0000, 700|0000, 800|0000, 900|0000, 1000|0000

Overlays: Receiver Bands Transmission DSB Image Spectral Lines

Water Vapour Column Density: Automatic Choice Manual Choice 5.196mm (7th Octile)

Viewport:

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:

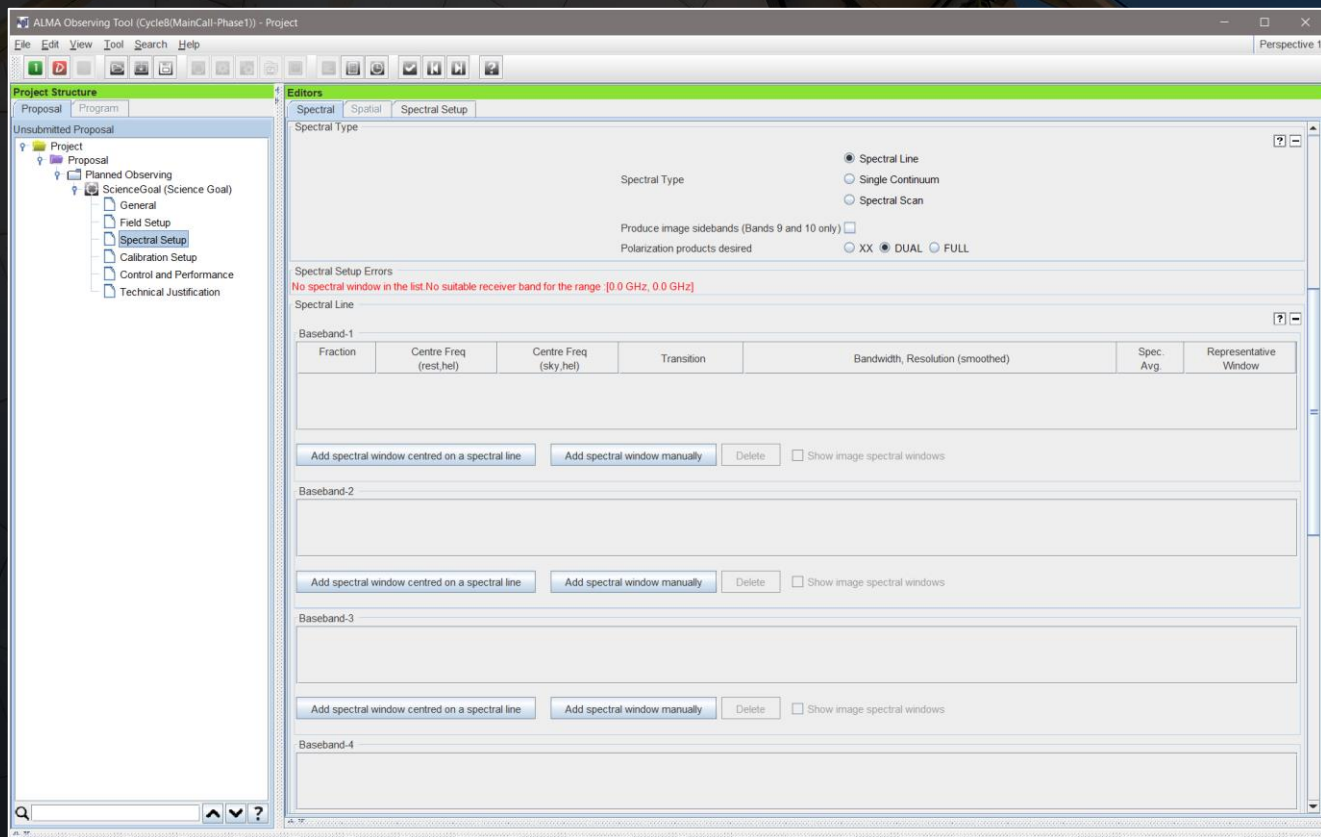
No spectral window in the list.No suitable receiver band for the range :[0.0 GHz, 0.0 GHz]

Spectral Line:

Fraction	Centre Freq (rest_hel)	Centre Freq (sky_hel)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg	Representative Window
----------	------------------------	-----------------------	------------	----------------------------------	-----------	-----------------------

When the spectral type is set to spectral line, the individual spectral windows need to be created by the user.

When the other spectral types are used, the spectral windows are set based on the user's input.



When the spectral type is set to spectral line, the individual spectral windows need to be created by the user.

When the other spectral types are used, the spectral windows are set based on the user's input.

The screenshot shows the ALMA Observing Tool interface. The 'Spectral Setup' window is open, and the 'Spectral Type' is set to 'Spectral Line'. The 'Spectral Line' section contains a table of spectral windows for four basebands. The 'Representative Window' column has a radio button next to the first row of Baseband-1, indicating it is selected.

Baseband	Fraction	Centre Freq (rest_hel)	Centre Freq (sky_hel)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg	Representative Window
Baseband-1	1(Full)	146 96903 GHz	146 71476 GHz	CS v=0 3-2	1875.000 MHz(3831 km/s), 1.129 MHz(2.307 km/s)	2	<input checked="" type="radio"/>
Baseband-2	1(Full)	145 15112 GHz	144 90000 GHz	Continuum1	1875.000 MHz(3879 km/s), 1.129 MHz(2.336 km/s)	2	<input type="radio"/>
Baseband-3	1(Full)	135 13379 GHz	134 90000 GHz	Continuum2	1875.000 MHz(4167 km/s), 1.129 MHz(2.509 km/s)	2	<input type="radio"/>
Baseband-4	1(Full)	133 13032 GHz	132 90000 GHz	Continuum3	1875.000 MHz(4230 km/s), 1.129 MHz(2.547 km/s)	2	<input type="radio"/>

When the spectral type is set to spectral line, the individual spectral windows need to be created by the user.

When the other spectral types are used, the spectral windows are set based on the user's input.

ALMA Observing Tool (Cycle8/MainCall-Phase1) - Project

File Edit View Tool Search Help

Project Structure

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

Editors

Spectral Spatial Spectral Setup

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: 125.0-163.0 GHz

Reset to Standard Frequency

Sky Frequency: 145.00000 GHz

Rest Frequency: 145.251290 GHz

Fraction	Centre Freq (rest,topo)	Centre Freq (sky,topo)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1(Full)	138.23916 GHz	138.00000 GHz	Single Continuum	1875.000 MHz(4073 km/s), 31.250 MHz(67.888 km/s)	1	<input type="radio"/>
Show image spectral windows						
1(Full)	140.24262 GHz	140.00000 GHz	Single Continuum	1875.000 MHz(4015 km/s), 31.250 MHz(66.918 km/s)	1	<input type="radio"/>
Show image spectral windows						
1(Full)	150.25995 GHz	150.00000 GHz	Single Continuum	1875.000 MHz(3747 km/s), 31.250 MHz(62.457 km/s)	1	<input type="radio"/>
Show image spectral windows						
1(Full)	152.26342 GHz	152.00000 GHz	Single Continuum	1875.000 MHz(3698 km/s), 31.250 MHz(61.635 km/s)	1	<input checked="" type="radio"/>

The spectral line catalogue will appear when either overlaying spectral lines in the spectrum plot or defining spectral windows to observe.

Create spectral windows centred on spectral lines

Transition Filter
 *
 e.g. CO(2-1) or "oxide"
 Include description

Frequency Filters
 ALMA Band
 1 2 3 4 5 6 7 8 9 10
 Sky Frequency (GHz)
 Min 31.3 Max 950

Receiver/Back End Configuration
 All lines
 Potentially selectable lines
 Lines in defined spws
 Filtering unobservable lines

Upper-state Energy (K)
 Min 0 Max 0

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.

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 selected columns.)

Transition	Description	Rest Frequency	Sky Frequency	Upper-state Energy	Lovas Intensity	Sij μ^2	Catalog
CH3CH2CN v=0 11(0,11)-10(1,10)	Ethyl Cyanide	84 151838 GHz	84 006252 GHz	28 102 K	0.1	10.328 D ²	Offline
CH3OH v=1 11(10,11)-11(11,0)	Methanol	84 158571 GHz	84 012974 GHz	1066 119 K		1.459 D ²	Offline
U-84163	UNIDENTIFIED	84 163000 GHz	84 017395 GHz		0.06		Offline
90SiO v=1 2-1	Silicon Monoxide	84 164253 GHz	84 019646 GHz	1753 828 K		19.441 D ²	Offline
c-113CCH 2(1,2)-1(0,1)	Cyclopropenylidene	84 185821 GHz	84 039917 GHz	8 331 K		17.24 D ²	Offline
U-84215	UNIDENTIFIED	84 215000 GHz	84 069305 GHz		0.08		Offline
CH3CN v8=1 J=36-36, K=3-1	Methyl Cyanide	84 271390 GHz	84 125598 GHz	1139 034 K		0.122 D ²	Offline
SO2 v=0 32(5,27)-31(6,26)	Sulfur dioxide	84 320876 GHz	84 174998 GHz	549 36 K	0.1	13.463 D ²	Offline
U-84356	UNIDENTIFIED	84 356000 GHz	84 210061 GHz		0.07		Offline
U-84385	UNIDENTIFIED	84 385000 GHz	84 239011 GHz		0.08		Offline
34SO 2(2)-1(1)	Sulfur Monoxide	84 410690 GHz	84 264657 GHz	19 233 K	0.03	3.534 D ²	Offline
CH3OH v=1 12(10,2)-12(11,1)	Methanol	84 423776 GHz	84 277720 GHz	273 898 K	0.8	4.303 D ²	Offline
13COHCOH v=0 13(-3,11)-12(-4,9)	Methanol	84 444140 GHz	84 298049 GHz	269 033 K		3.267 D ²	Offline
U-84468	UNIDENTIFIED	84 468000 GHz	84 321867 GHz		0.18		Offline
U-84478	UNIDENTIFIED	84 478000 GHz	84 331850 GHz		0.18		Offline
CH3CN v8=1 J=69-69, K=1-1	Methyl Cyanide	84 495768 GHz	84 349586 GHz	2655 452 K		0.823 D ²	Offline
U-84496	UNIDENTIFIED	84 496000 GHz	84 349819 GHz		0.1		Offline
CH3OH v=0 5(-1,5)-4(0,4)	Methanol	84 521169 GHz	84 374944 GHz	40 391 K	2.8	3.083 D ²	Offline
CH3OH v=1 12(10,2)-12(11,1)	Methanol	84 540414 GHz	84 394156 GHz	1093 861 K		2.786 D ²	Offline
NH2CHO 4(0,4)-3(0,3)	Formamide	84 542328 GHz	84 396098 GHz	10 158 K	0.2	15.272 D ²	Offline
C6H J=612-59/2, D=3/2, I=6	1,3,5-Hexatriynyl	84 549688 GHz	84 403014 GHz	83 662 K	0.04	1867.725 D ²	Offline
CH3OH v=0 19(2,17)-18(-3,16)	Methanol	84 574024 GHz	84 427708 GHz	463 489 K		0.424 D ²	Offline
C6H J=612-59/2, D=3/2, I=6	1,3,5-Hexatriynyl	84 574600 GHz	84 428283 GHz	83 675 K	0.03	1867.562 D ²	Offline
29SiO v=2 2-1	Silicon Monoxide	84 575291 GHz	84 428973 GHz	3505 399 K	0.07	19.687 D ²	Offline
t-CH3CH2OH 4(2,3)-4(1,4)	trans-Ethanol	84 595868 GHz	84 449514 GHz	13 41 K	0.08	4.328 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-2	Methylamine	84 597540 GHz	84 451183 GHz	10 875 K		0.246 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=3-2	Methylamine	84 597805 GHz	84 451248 GHz	10 875 K		0.055 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=1-2	Methylamine	84 597841 GHz	84 451384 GHz	10 875 K		0.053 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1	Methylamine	84 598202 GHz	84 451944 GHz	10 876 K		1.065 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-3	Methylamine	84 598326 GHz	84 451968 GHz	10 876 K		0.055 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=3-3	Methylamine	84 598391 GHz	84 452033 GHz	10 876 K		0.442 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-1	Methylamine	84 598763 GHz	84 452404 GHz	10 876 K		0.053 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=1-1	Methylamine	84 598864 GHz	84 452505 GHz	10 876 K		0.16 D ²	Offline
U-84808	UNIDENTIFIED	84 608000 GHz	84 481625 GHz		0.12		Offline
U-84616	UNIDENTIFIED	84 616000 GHz	84 489611 GHz		0.1		Offline
U-84628	UNIDENTIFIED	84 628000 GHz	84 481591 GHz		0.08		Offline
CH3OCH3 3(2,1)-3(1,2) AE	Dimethyl ether	84 631897 GHz	84 485481 GHz	11 091 K		16.386 D ²	Offline
CH3OCH3 3(2,1)-3(1,2) EA	Dimethyl ether	84 632276 GHz	84 485858 GHz	11 092 K		14.10 604 D ²	Offline

Add to spectral window list

Spectral windows in this baseband (maximum of four)

Transition	Description	Rest Frequency	Sky Frequency

Remove spectral window(s)

Cancel Ok

This catalogue can be searched using many criteria and is a generally useful reference.

The catalogue is also available on the web at <https://splatalogue.online/>.

Create spectral windows centred on spectral lines

Transition Filter
*
e.g. CO^{2-1*} or "oxide"
 Include description

Frequency Filters
ALMA Band
1 2 3 4 5 6 7 8 9 10
Sky Frequency (GHz)
Min 31.3 Max 950

Receiver/Back End Configuration
 All lines
 Potentially selectable lines
 Lines in defined spws
 Filtering unobservable lines

Upper-state Energy (K)
 Min 0 Max 0

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.

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 selected columns.)

Transition	Description	Rest Frequency	Sky Frequency	Upper-state Energy	Lovas Intensity	Sij μ ²	Catalog
CH3CH2CN v=0 11(0,11)-10(1,10)	Ethyl Cyanide	84 151838 GHz	84 006252 GHz	28 102 K	0.1	10 328 D ²	Offline
CH3OH v=1 11(10,1)-11(11,0)	Methanol	84 158571 GHz	84 012974 GHz	1066 119 K		1 459 D ²	Offline
U-84163	UNIDENTIFIED	84 163000 GHz	84 017395 GHz		0.06		Offline
90SiO v=1 2-1	Silicon Monoxide	84 164253 GHz	84 019646 GHz	1753 828 K		19 441 D ²	Offline
c-H13CCH 2(2)-1(0,1)	Cyclopropenylidene	84 185821 GHz	84 039977 GHz	8 331 K		17 24 D ²	Offline
U-84215	UNIDENTIFIED	84 215000 GHz	84 069305 GHz		0.08		Offline
CH3CN v8=1 J=36-36, K=3-1	Methyl Cyanide	84 271390 GHz	84 125598 GHz	1139 034 K		0 122 D ²	Offline
SO2 v=0 32(5,27)-31(6,26)	Sulfur dioxide	84 320876 GHz	84 174998 GHz	549 36 K	0.1	13 463 D ²	Offline
U-84356	UNIDENTIFIED	84 356000 GHz	84 210061 GHz		0.07		Offline
U-84385	UNIDENTIFIED	84 385000 GHz	84 239011 GHz		0.08		Offline
34SO 2(2)-1(1)	Sulfur Monoxide	84 410690 GHz	84 264657 GHz	19 233 K	0.03	3 534 D ²	Offline
CH3OH v=1 12(10,2)-12(11,1)	Methanol	84 423776 GHz	84 277720 GHz	273 898 K	0.8	4 303 D ²	Offline
13COHCOH v=0 13(-3,11)-12(-4,9)	Methanol	84 444140 GHz	84 298049 GHz	269 033 K		3 267 D ²	Offline
U-84468	UNIDENTIFIED	84 468000 GHz	84 321867 GHz		0.18		Offline
U-84478	UNIDENTIFIED	84 478000 GHz	84 331850 GHz		0.18		Offline
CH3CN v8=1 J=69-69, K=1-1	Methyl Cyanide	84 495768 GHz	84 349586 GHz	2655 452 K		0 823 D ²	Offline
U-84496	UNIDENTIFIED	84 496000 GHz	84 349819 GHz		0.1		Offline
CH3OH v=0 5(-1,5)-4(0,4)	Methanol	84 521169 GHz	84 374944 GHz	40 391 K	2.8	3 083 D ²	Offline
CH3OH v=1 12(10,2)-12(11,1)	Methanol	84 540414 GHz	84 394156 GHz	1093 861 K		2 786 D ²	Offline
NH2CHO 4(0,3)-3(0,3)	Formaldehyde	84 542328 GHz	84 396008 GHz	10 158 K	0.2	15 272 D ²	Offline
CH J=612-592, D=32, I=6	1,3,5-Hexatriynyl	84 549688 GHz	84 403414 GHz	83 662 K	0.04	1867 725 D ²	Offline
CH3OH v=0 19(2,17)-18(-3,16)	Methanol	84 574024 GHz	84 427708 GHz	463 489 K		0 424 D ²	Offline
CH J=612-592, D=32, I=6	1,3,5-Hexatriynyl	84 574000 GHz	84 428283 GHz	83 675 K	0.03	1867 562 D ²	Offline
29SiO v=2 2-1	Silicon Monoxide	84 575291 GHz	84 428973 GHz	3505 399 K	0.07	19 687 D ²	Offline
t-CH3CO2H 4(2,3)-4(1,4)	trans-Ethanol	84 595868 GHz	84 449514 GHz	13 41 K	0.08	4 328 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-2	Methylamine	84 597540 GHz	84 451183 GHz	10 875 K		0 246 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=3-2	Methylamine	84 597505 GHz	84 451248 GHz	10 875 K		0 055 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=1-2	Methylamine	84 597841 GHz	84 451841 GHz	10 875 K		0 055 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1	Methylamine	84 598202 GHz	84 451944 GHz	10 876 K		1 065 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-3	Methylamine	84 598326 GHz	84 451968 GHz	10 876 K		0 055 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=3-3	Methylamine	84 598391 GHz	84 452033 GHz	10 876 K		0 442 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-1	Methylamine	84 598763 GHz	84 452404 GHz	10 876 K		0 053 D ²	Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=1-1	Methylamine	84 598864 GHz	84 452505 GHz	10 876 K		0 16 D ²	Offline
U-84808	UNIDENTIFIED	84 608000 GHz	84 481625 GHz		0.12		Offline
U-84816	UNIDENTIFIED	84 616000 GHz	84 489611 GHz		0.1		Offline
U-84628	UNIDENTIFIED	84 628000 GHz	84 481591 GHz		0.08		Offline
CH3OCH3 3(2,1)-3(1,2) AE	Dimethyl ether	84 631897 GHz	84 485481 GHz	11 091 K		16 386 D ²	Offline
CH3OCH3 3(2,1)-3(1,2) EA	Dimethyl ether	84 632276 GHz	84 485858 GHz	11 092 K		14 10 604 D ²	Offline

Add to spectral window list

Spectral windows in this baseband (maximum of four)

Transition	Description	Rest Frequency	Sky Frequency
------------	-------------	----------------	---------------

Remove spectral window(s)

Cancel Ok

The plot at the top of the window will be updated as the spectral windows are set.

If the yellow bands do not appear, the spectral windows are not configured correctly.

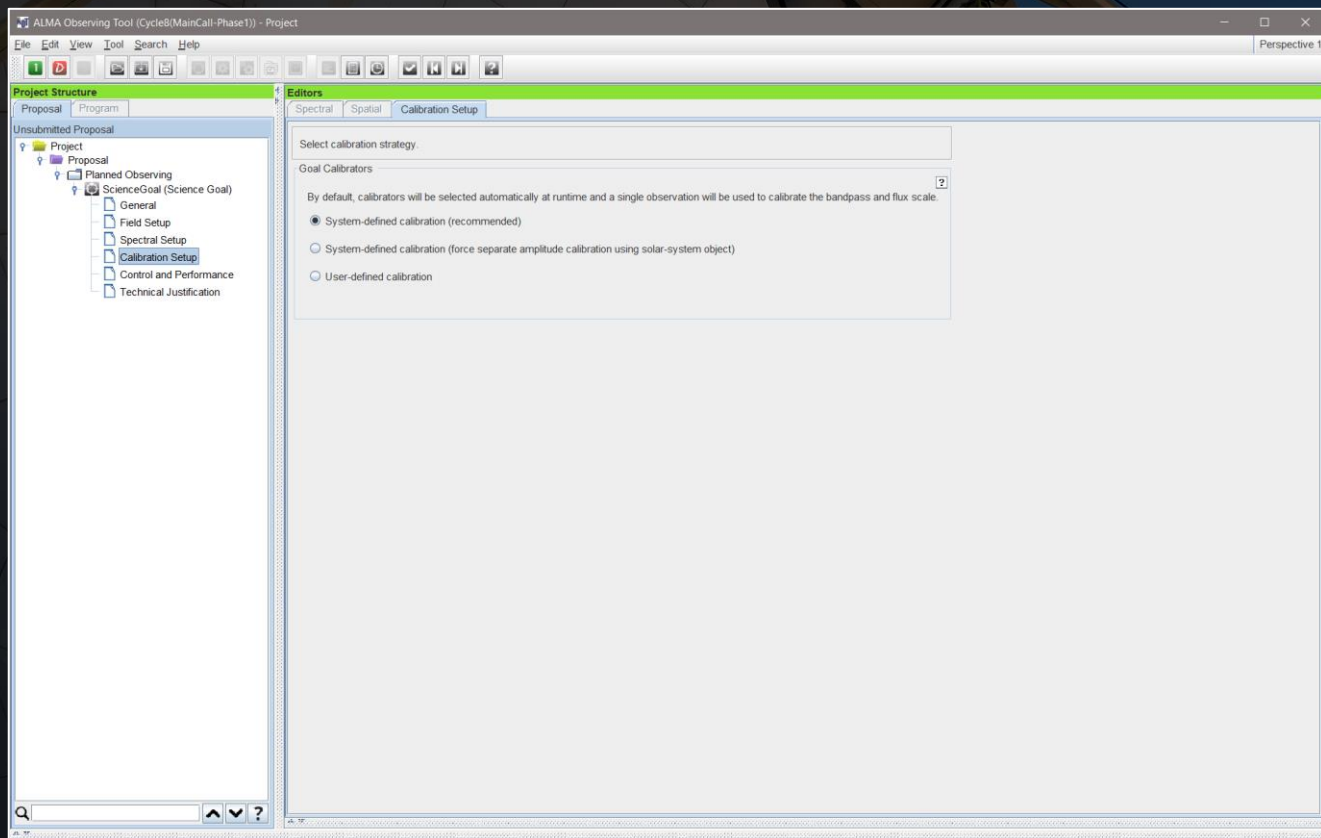
The screenshot displays the ALMA Observing Tool interface. The main window is titled "ALMA Observing Tool (Cycle8(MainCall-Phase1)) - Project". The interface is divided into several sections:

- Project Structure:** A tree view on the left showing the project hierarchy, including "Unsubmitted Proposal", "Project", "Proposal", "Planned Observing", "ScienceGoal (Science Goal)", "General", "Field Setup", "Spectral Setup", "Calibration Setup", "Control and Performance", and "Technical Justification".
- Editors:** A tabbed interface with "Spectral", "Spatial", and "Spectral Setup" tabs. The "Spectral Setup" tab is active.
- Visualisation:** A plot showing the observed frequency spectrum. The x-axis is labeled "Rest Frequency" and ranges from 125,000,000 to 155,000,000. The y-axis is labeled "Observed Frequency" and ranges from 125,000,000 to 155,000,000. The plot shows a continuum signal with several spectral lines. Two yellow shaded regions are visible, labeled "Continuum2" and "Continuum1". A blue shaded region is labeled "Continuum3". A vertical line is labeled "L01".
- Overlays:** A section with checkboxes for "Receiver Bands", "Transmission", "DSB Image", and "Spectral Lines". A "Select Lines to Overlay" button is also present.
- Water Vapour Column Density:** A section with radio buttons for "Automatic Choice" and "Manual Choice". The "Manual Choice" is selected, with a value of "2.748mm (6th Octile)".
- Viewport:** A section with buttons for "Pan to Spectral Window", "Zoom to Band", and "Reset".
- Spectral Type:** A section with radio buttons for "Spectral Line", "Single Continuum", and "Spectral Scan". The "Spectral Line" option is selected.
- Spectral Setup Errors:** A section with a "Spectral Line" label and a "Spectral Line" button.
- Spectral Line Table:** A table with columns: "Fraction", "Centre Freq (rest_hel)", "Centre Freq (sky_hel)", "Transition", "Bandwidth, Resolution (smoothed)", "Spec. Avg.", and "Representative Window".

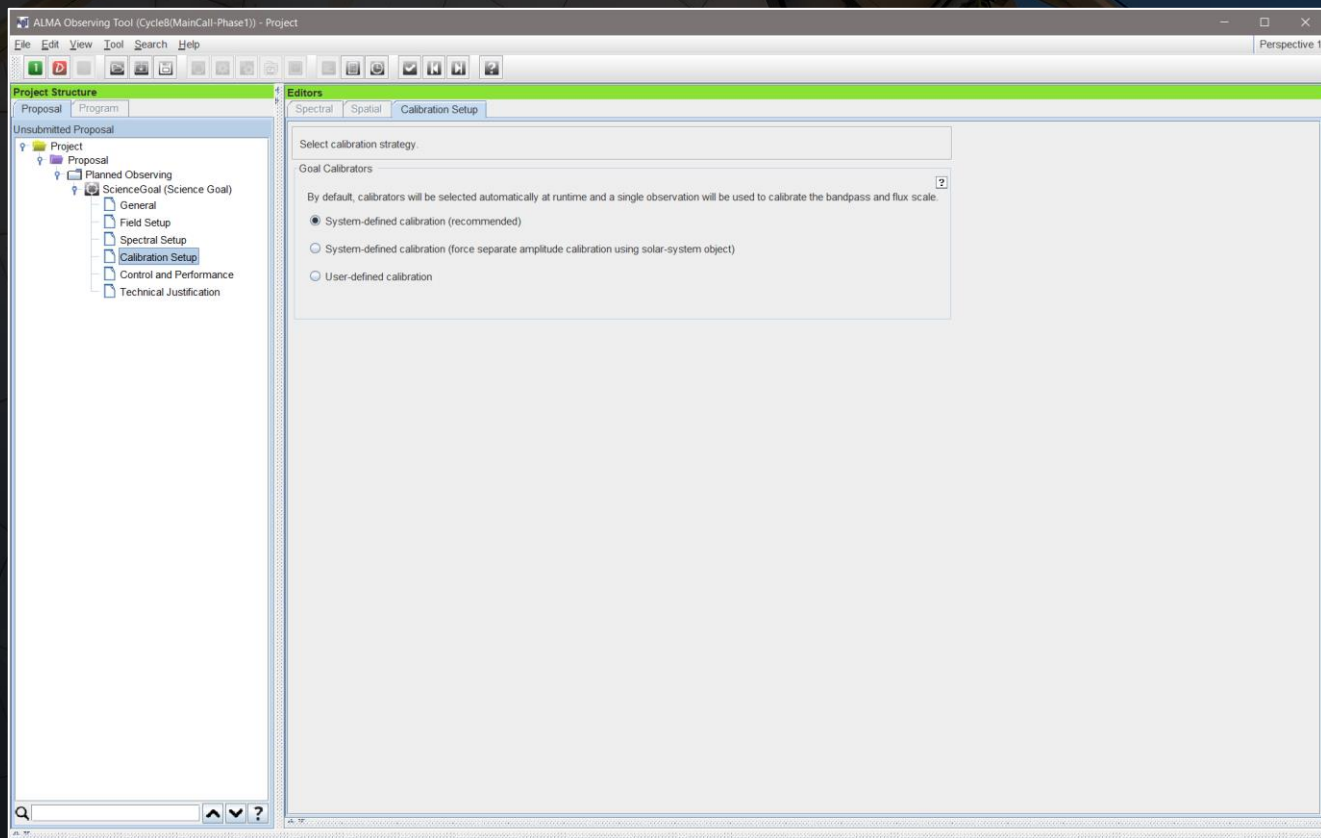
Fraction	Centre Freq (rest_hel)	Centre Freq (sky_hel)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1(Full)	146.96903 GHz	146.71476 GHz	CS v=0 3-2	1875.000 MHz(3831 km/s), 1.129 MHz(2.307 km/s)	2	<input checked="" type="radio"/>

The Calibration Setup tab is used to create specific calibration settings for the observations.

For most programs, the default settings are generally all that is needed.

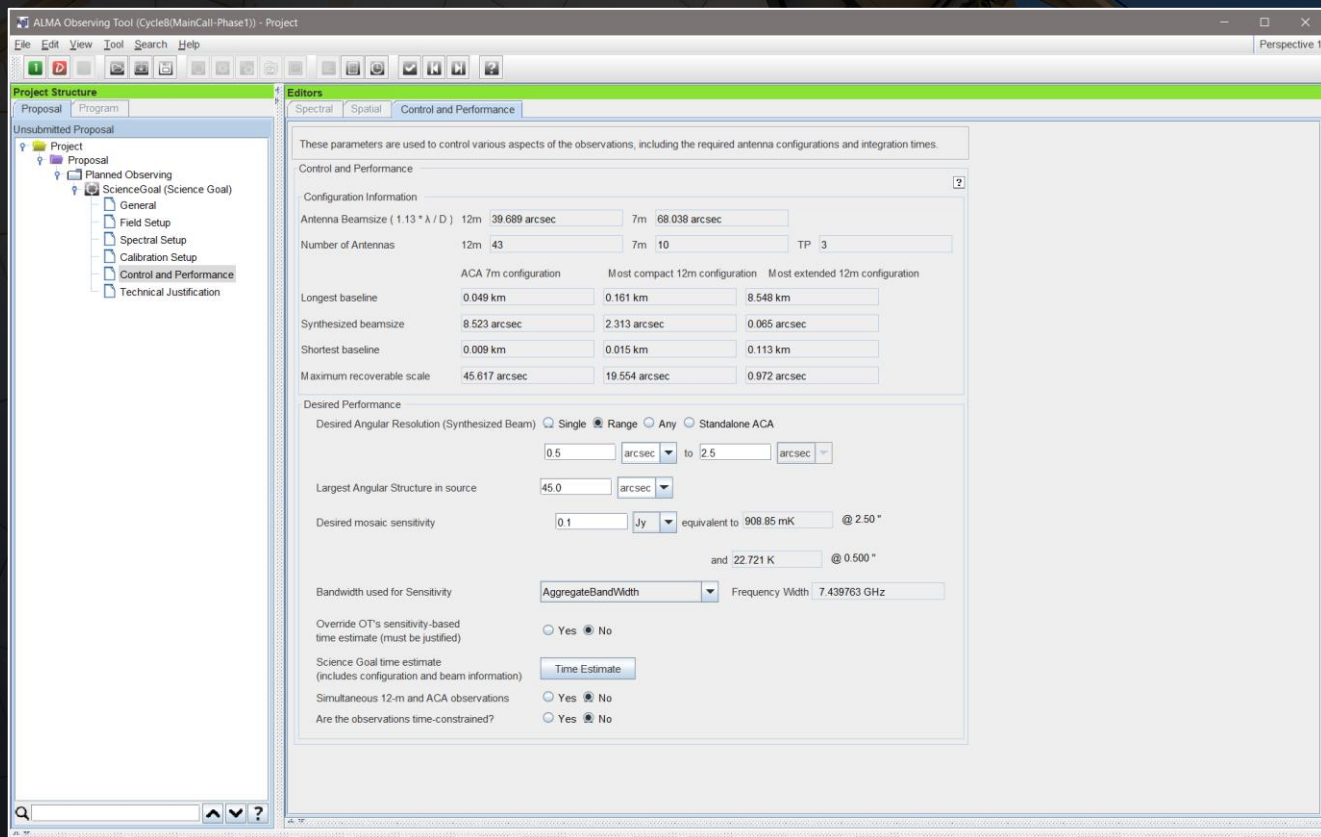


Do not select an option other than system-defined calibration without seeking expert help.



The Control and Performance tab is used to specify what sensitivity and angular resolution is required for the project.

The options here cannot be set until the Field Setup and Spectral Setup are set.



The screenshot shows the ALMA Observing Tool interface. The 'Control and Performance' tab is active, displaying the following configuration parameters:

Configuration Information

Antenna Beamsize ($1.13 \cdot \lambda / D$) 12m 39.689 arcsec 7m 68.038 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	8.548 km
Synthesized beamsize	8.523 arcsec	2.313 arcsec	0.065 arcsec
Shortest baseline	0.009 km	0.015 km	0.113 km
Maximum recoverable scale	45.617 arcsec	19.554 arcsec	0.972 arcsec

Desired Performance

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

0.5 arcsec to 2.5 arcsec

Largest Angular Structure in source 45.0 arcsec

Desired mosaic sensitivity 0.1 Jy equivalent to 908.85 mK @ 2.50" and 22.721 K @ 0.500"

Bandwidth used for Sensitivity AggregateBandWidth Frequency Width 7.439763 GHz

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

Science Goal time estimate (includes configuration and beam information) Time Estimate

Simultaneous 12-m and ACA observations Yes No

Are the observations time-constrained? Yes No

If a desired angular resolution is needed, that should be specified here. **Using the Range option is strongly recommended.**

ALMA Observing Tool (Cycle8/MainCall-Phase1) - Project

File Edit View Tool Search Help

Perspective 1

Project Structure

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

Editors

Spectral Spatial **Control and Performance**

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 ($1.13 \cdot \lambda / D$) 12m 39.689 arcsec 7m 68.038 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	8.548 km
Synthesized beamsize	8.523 arcsec	2.313 arcsec	0.065 arcsec
Shortest baseline	0.009 km	0.015 km	0.113 km
Maximum recoverable scale	45.617 arcsec	19.554 arcsec	0.972 arcsec

Desired Performance

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

0.5 arcsec to 2.5 arcsec

Largest Angular Structure in source 45.0 arcsec

Desired mosaic sensitivity 0.1 Jy equivalent to 908.85 mK @ 2.50° and 22.721 K @ 0.500°

Bandwidth used for Sensitivity AggregateBandWidth Frequency Width 7.439763 GHz

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

Science Goal time estimate (includes configuration and beam information) Time Estimate

Simultaneous 12-m and ACA observations Yes No

Are the observations time-constrained? Yes No

For observations that only need detections, **using the Any option is strongly recommended.** Alternately, the standalone ACA can be used, particularly for bright sources.

ALMA Observing Tool (Cycle8/MainCall-Phase1) - Project

File Edit View Tool Search Help

Project Structure

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

Editors

Spectral Spatial Control and Performance

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 ($1.13 \cdot \lambda / D$) 12m 39.689 arcsec 7m 68.038 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	2.517 km
Synthesized beamsize	8.523 arcsec	2.313 arcsec	0.209 arcsec
Shortest baseline	0.009 km	0.015 km	0.015 km
Maximum recoverable scale	45.617 arcsec	19.554 arcsec	2.815 arcsec

Desired Performance

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

Desired mosaic sensitivity 0.10000 Jy equivalent to 1.0615 K and 129.73 K

Bandwidth used for Sensitivity AggregateBandWidth Frequency Width 7.439763 GHz

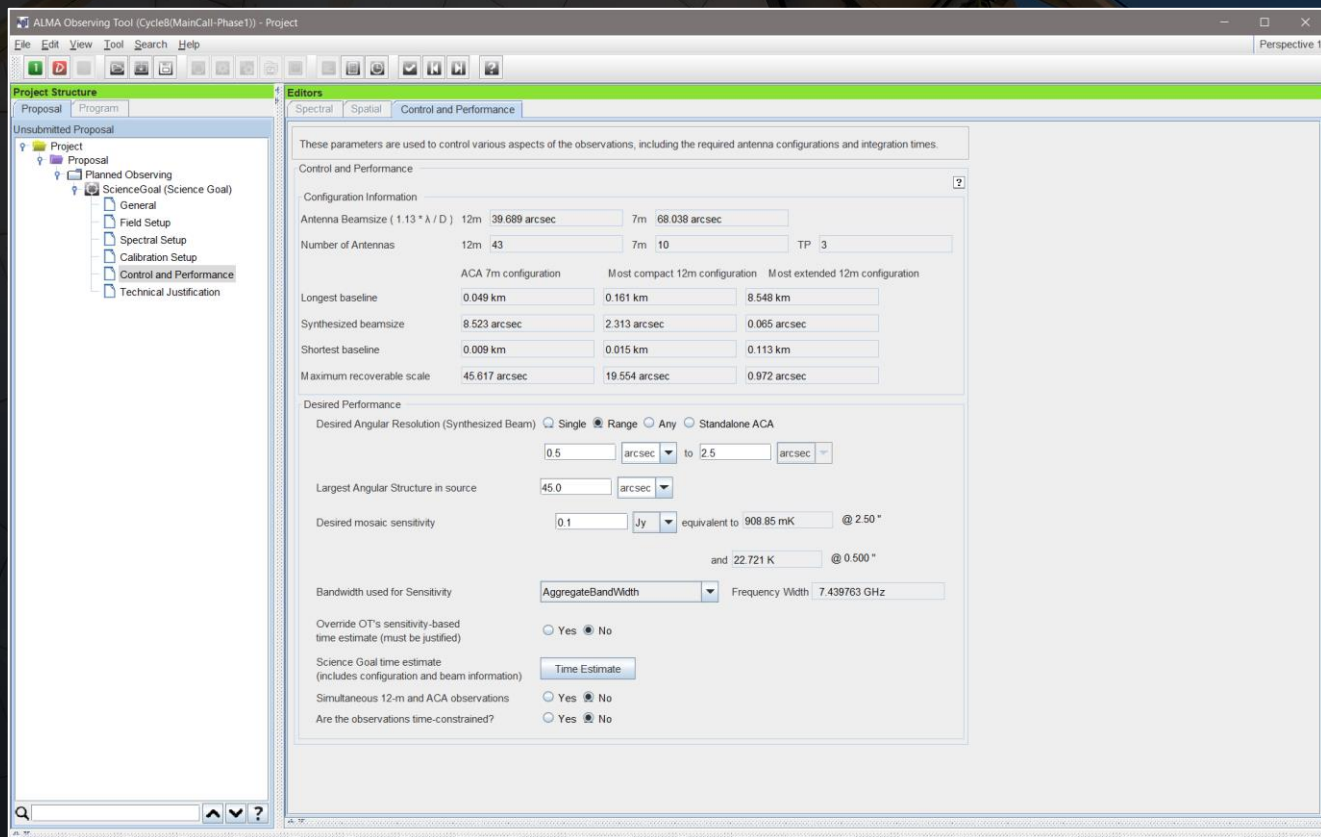
Override OT's sensitivity-based time estimate (must be justified) Yes No

Science Goal time estimate (includes configuration and beam information) Time Estimate

Simultaneous 12-m and ACA observations Yes No

Are the observations time-constrained? Yes No

If the source is extended and if that extended emission is important for the science, then specifying the largest angular structure is important. This will determine whether the ACA or the total power arrays are needed. (Note that total power continuum observations are currently not possible.)



ALMA Observing Tool (Cycle8/MainCall-Phase1) - Project

File Edit View Tool Search Help

Perspective 1

Project Structure

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

Editors

Spectral Spatial **Control and Performance**

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 ($1.13 \cdot \lambda / D$) 12m 39.689 arcsec 7m 68.038 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	8.548 km
Synthesized beamsize	8.523 arcsec	2.313 arcsec	0.065 arcsec
Shortest baseline	0.009 km	0.015 km	0.113 km
Maximum recoverable scale	45.617 arcsec	19.554 arcsec	0.972 arcsec

Desired Performance

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

0.5 arcsec to 2.5 arcsec

Largest Angular Structure in source 45.0 arcsec

Desired mosaic sensitivity 0.1 Jy equivalent to 908.85 mK @ 2.50" and 22.721 K @ 0.500"

Bandwidth used for Sensitivity AggregateBandWidth Frequency Width 7.439763 GHz

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

Science Goal time estimate (includes configuration and beam information) Time Estimate

Simultaneous 12-m and ACA observations Yes No

Are the observations time-constrained? Yes No

ALMA is not like other telescopes in that it does not allocate “time” to observing proposals.

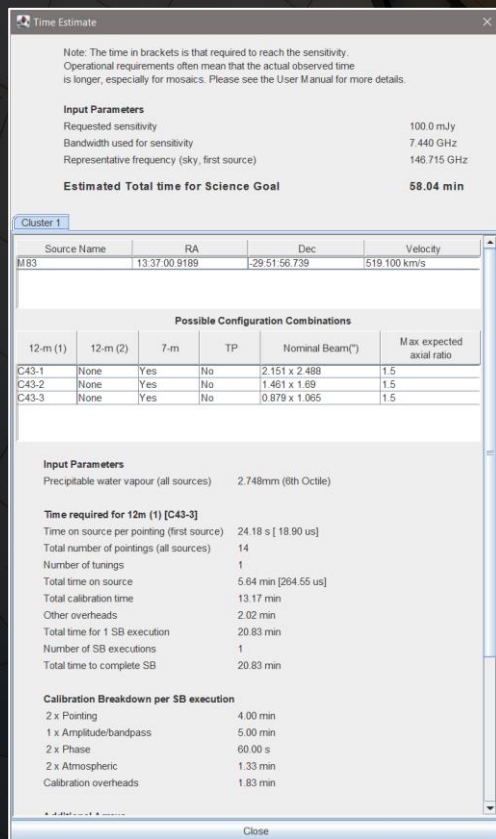
ALMA will instead observe the targets until it achieves the desired sensitivity.

The screenshot displays the ALMA Observing Tool interface, specifically the 'Control and Performance' configuration panel. The interface is divided into a 'Project Structure' tree on the left and a main configuration area on the right. The 'Project Structure' tree shows a hierarchy starting with 'Project', followed by 'Planned Observing', 'ScienceGoal (Science Goal)', and 'Control and Performance'. The main configuration area is titled 'Editors' and contains several sections:

- Configuration Information:** A table of parameters for different antenna configurations.
- Desired Performance:** Radio button options for resolution and sensitivity settings.
- Bandwidth used for Sensitivity:** A dropdown menu for 'AggregateBandWidth' and a text field for 'Frequency Width'.
- Override OT's sensitivity-based time estimate (must be justified):** Radio button options for 'Yes' and 'No'.
- Science Goal time estimate (includes configuration and beam information):** A 'Time Estimate' button.
- Simultaneous 12-m and ACA observations:** Radio button options for 'Yes' and 'No'.
- Are the observations time-constrained?:** Radio button options for 'Yes' and 'No'.

Parameter	ACA 7m configuration	Most compact 12m configuration	Most extended 12m configuration
Antenna Beamsize (1.13 * λ / D)	12m 39.689 arcsec	7m 68.038 arcsec	
Number of Antennas	12m 43	7m 10	TP 3
Longest baseline	0.049 km	0.161 km	8.548 km
Synthesized beamsize	8.523 arcsec	2.313 arcsec	0.065 arcsec
Shortest baseline	0.009 km	0.015 km	0.113 km
Maximum recoverable scale	45.617 arcsec	19.554 arcsec	0.972 arcsec

The tab has a button that can be used to check the time needed for an observation. While minimizing the observing time while achieving a desired sensitivity is important, keep in mind that **ALMA does not allocate “time” to observing proposals.**



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	100.0 mJy
Bandwidth used for sensitivity	7.440 GHz
Representative frequency (sky, first source)	146.715 GHz

Estimated Total time for Science Goal **58.04 min**

Cluster 1

Source Name	RA	Dec	Velocity
M83	13:37:00.9189	-29:51:56.739	519.100 km/s

Possible Configuration Combinations

12-m (1)	12-m (2)	7-m	TP	Nominal Beam(°)	Max. expected axial ratio
C43-1	None	Yes	No	2.151 x 2.488	1.5
C43-2	None	Yes	No	1.461 x 1.69	1.5
C43-3	None	Yes	No	0.879 x 1.065	1.5

Input Parameters

Precipitable water vapour (all sources)	2.748mm (0th Octile)
---	----------------------

Time required for 12m (1) [C43-3]

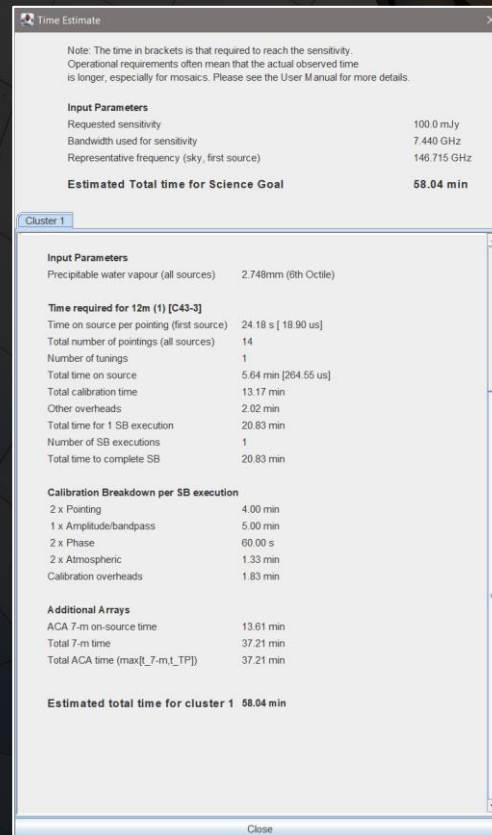
Time on source per pointing (first source)	24.18 s [18.90 us]
Total number of pointings (all sources)	14
Number of tunings	1
Total time on source	5.64 min [264.55 us]
Total calibration time	13.17 min
Other overheads	2.02 min
Total time for 1 SB execution	20.83 min
Number of SB executions	1
Total time to complete SB	20.83 min

Calibration Breakdown per SB execution

2 x Pointing	4.00 min
1 x Amplitude/bandpass	5.00 min
2 x Phase	60.00 s
2 x Atmospheric	1.33 min
Calibration overheads	1.83 min

Close

The tab has a button that can be used to check the time needed for an observation. While minimizing the observing time while achieving a desired sensitivity is important, keep in mind that **ALMA does not allocate “time” to observing proposals.**



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	100.0 mJy
Bandwidth used for sensitivity	7.440 GHz
Representative frequency (sky, first source)	146.715 GHz

Estimated Total time for Science Goal 58.04 min

Cluster 1

Input Parameters

Precipitable water vapour (all sources)	2.748mm (6th Octile)
---	----------------------

Time required for 12m (1) [C43-3]

Time on source per pointing (first source)	24.18 s [18.90 us]
Total number of pointings (all sources)	14
Number of tunings	1
Total time on source	5.64 min [264.55 us]
Total calibration time	13.17 min
Other overheads	2.02 min
Total time for 1 SB execution	20.83 min
Number of SB executions	1
Total time to complete SB	20.83 min

Calibration Breakdown per SB execution

2 x Pointing	4.00 min
1 x Amplitude/bandpass	5.00 min
2 x Phase	60.00 s
2 x Atmospheric	1.33 min
Calibration overheads	1.83 min

Additional Arrays

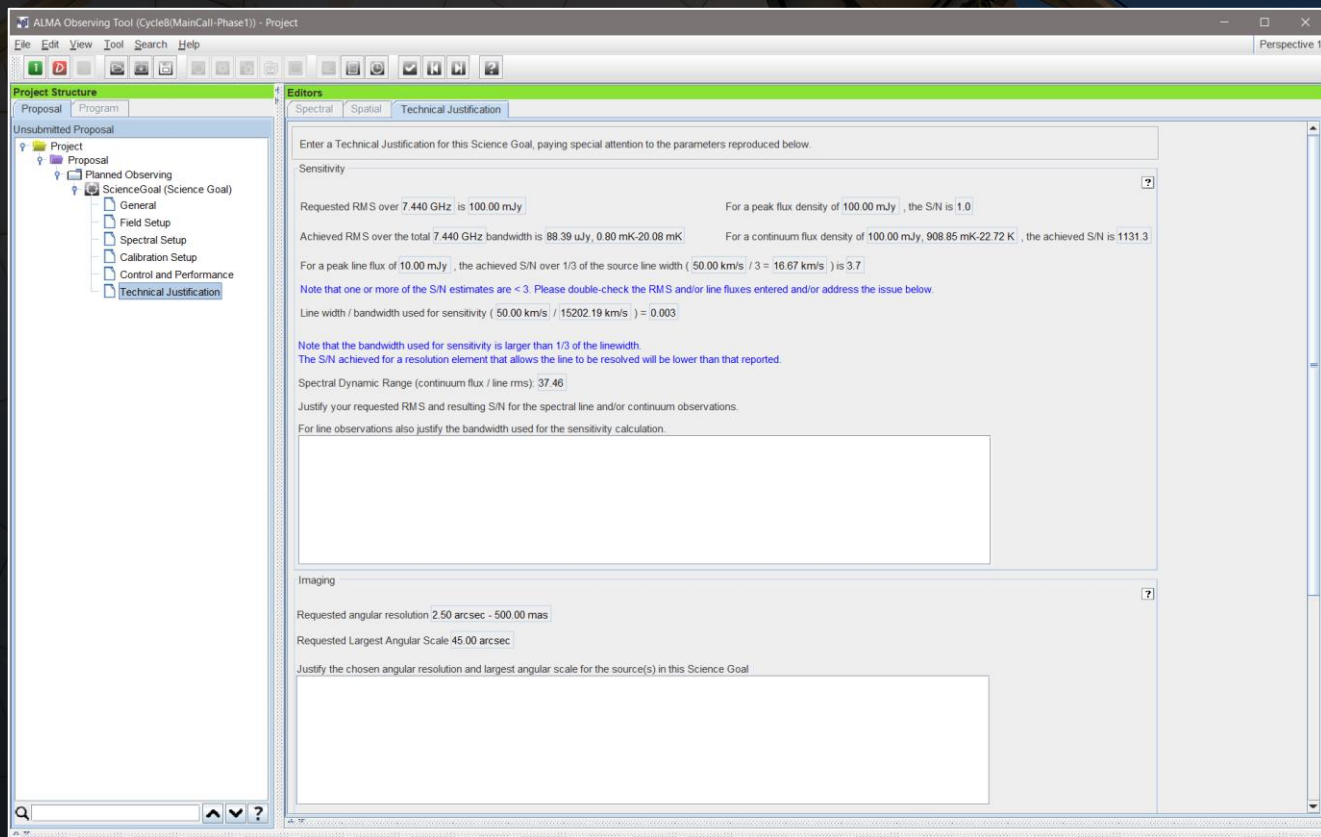
ACA 7-m on-source time	13.61 min
Total 7-m time	37.21 min
Total ACA time (max[t_{7-m} , TPI])	37.21 min

Estimated total time for cluster 1 58.04 min

Close

The Technical Justification tab is a place where a justification for the sensitivity goal, requested angular resolutions, and spectral window setup should be added.

This information does not need to be in the science case.



The Technical Justification tab is a place where a justification for the sensitivity goal, requested angular resolutions, and spectral window setup should be added.

This information does not need to be in the science case.

ALMA Observing Tool (Cycle8/MainCall-Phase1) - Project

File Edit View Tool Search Help

Project Structure

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

Editors

Spectral Spatial Technical Justification

or the observations also justify the bandwidth used for the sensitivity calculation.

Imaging

Requested angular resolution 2.50 arcsec - 500.00 mas

Requested Largest Angular Scale 45.00 arcsec

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

Correlator configuration

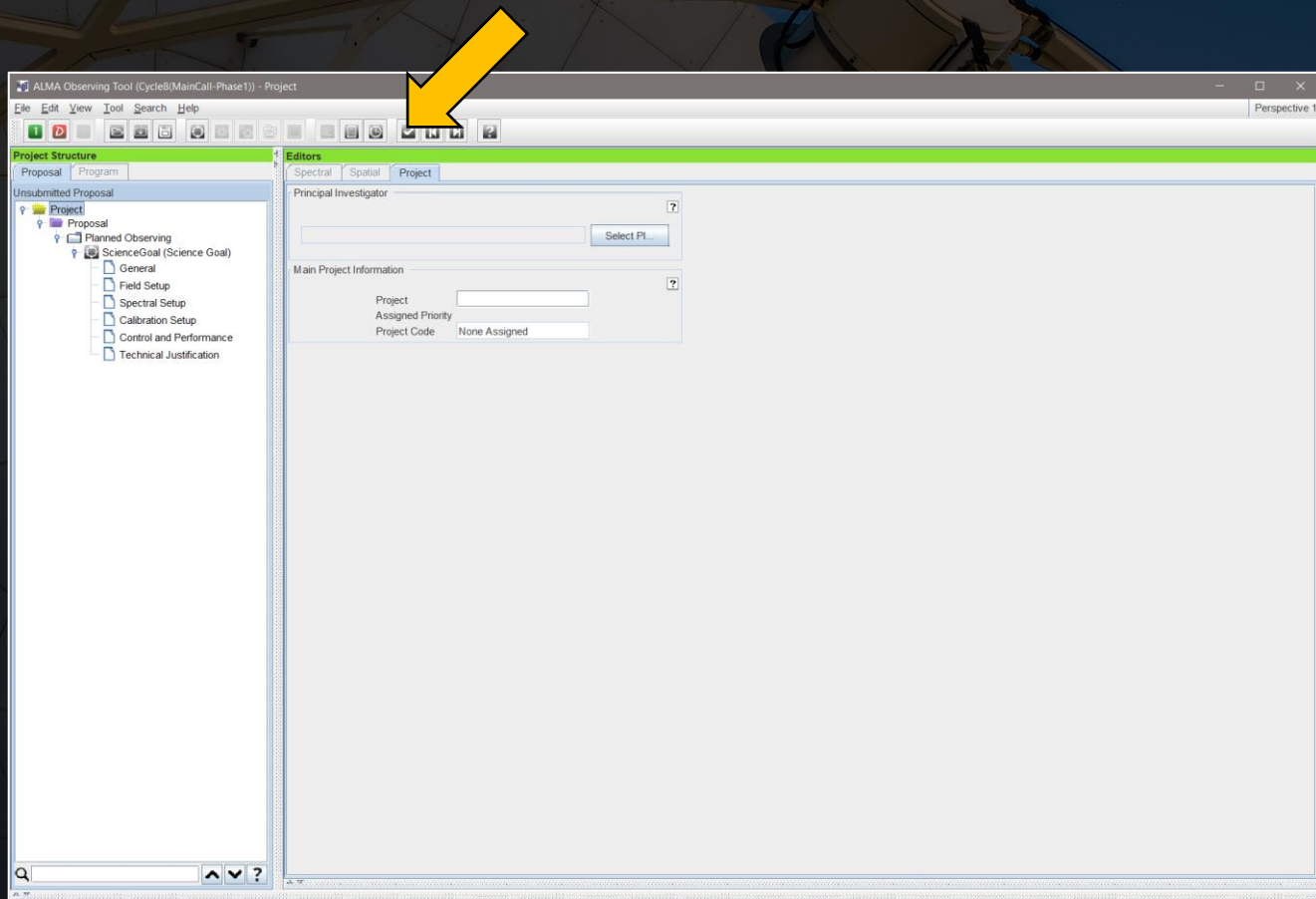
line width / representative spectral window resolution: 50.00 km/s / 2.31 km/s = 21.68

Representative spectral window width: 3831.32 km/s

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

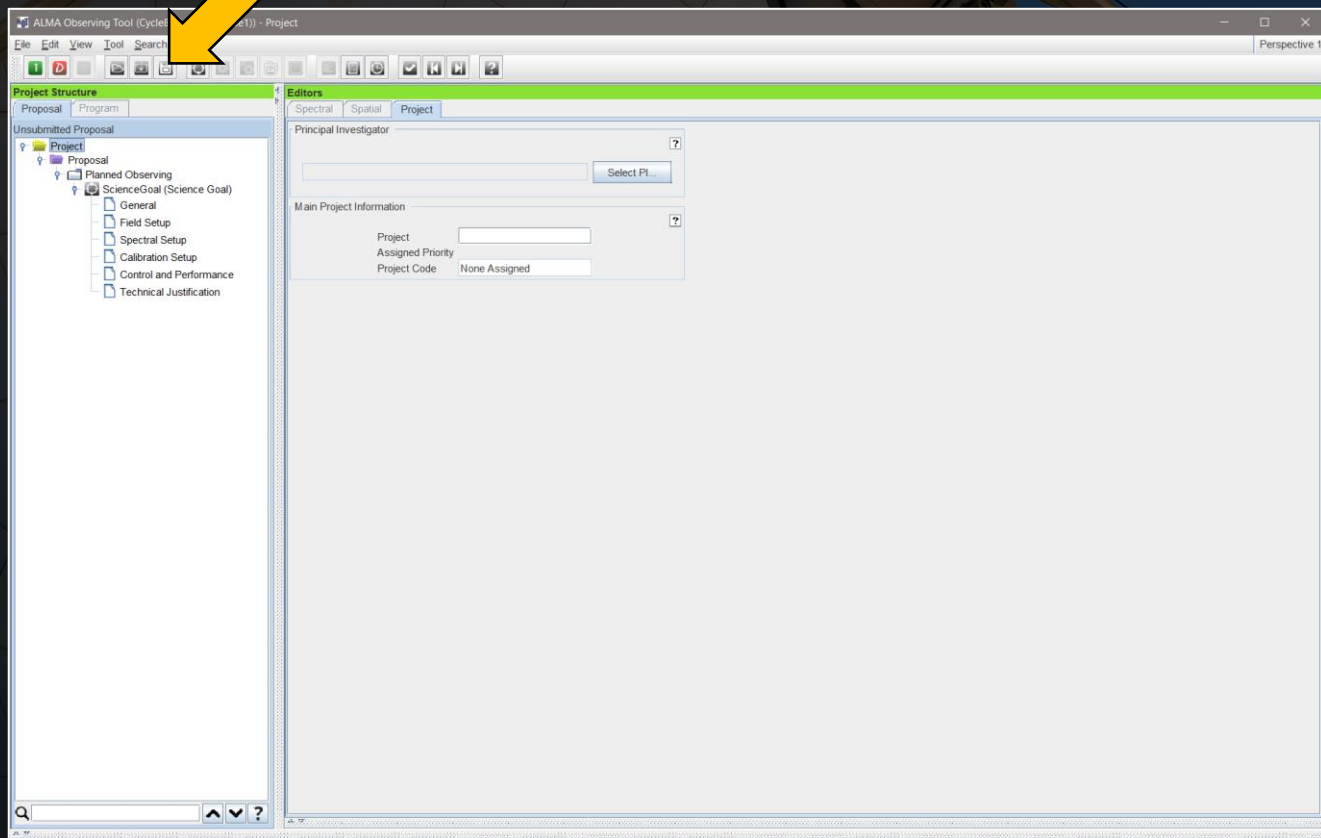
Once a proposal is created, it should be validated using the option in the File menu or the button in the button bar.

After the proposal is validated, it can be submitted using another option in the File menu.



The proposal can be saved as an aot file at any time using the save options in the File menu or button bar.

Additionally, the proposal can be exported as a PDF.



Some recommendations on setting up observations:

- Make sure all Co-Is have registered for an account with ALMA (or ESO) so that they can be listed on the proposal.
- Check the source coordinates, velocities and/or redshifts, and spectral settings before proposal submission. These can be updated later, but if more changes need to be made, more errors can be introduced.
- Use at least four spectral windows. Any spectral window not covering a line of scientific interest can be used for serendipitous continuum and spectral line detection.
- Use 1920 channels per baseband. The extra channels provide extra spectral resolution if needed, and if the higher resolution is not needed, the channels can be averaged together after observing to improve sensitivity.
- Do not use 3840 channels per spectral window. The effective spectral resolution will still be equivalent to 1920 channels.
- Do not place important spectral lines near the edges of spectral windows where the sensitivity of the detectors decreases.

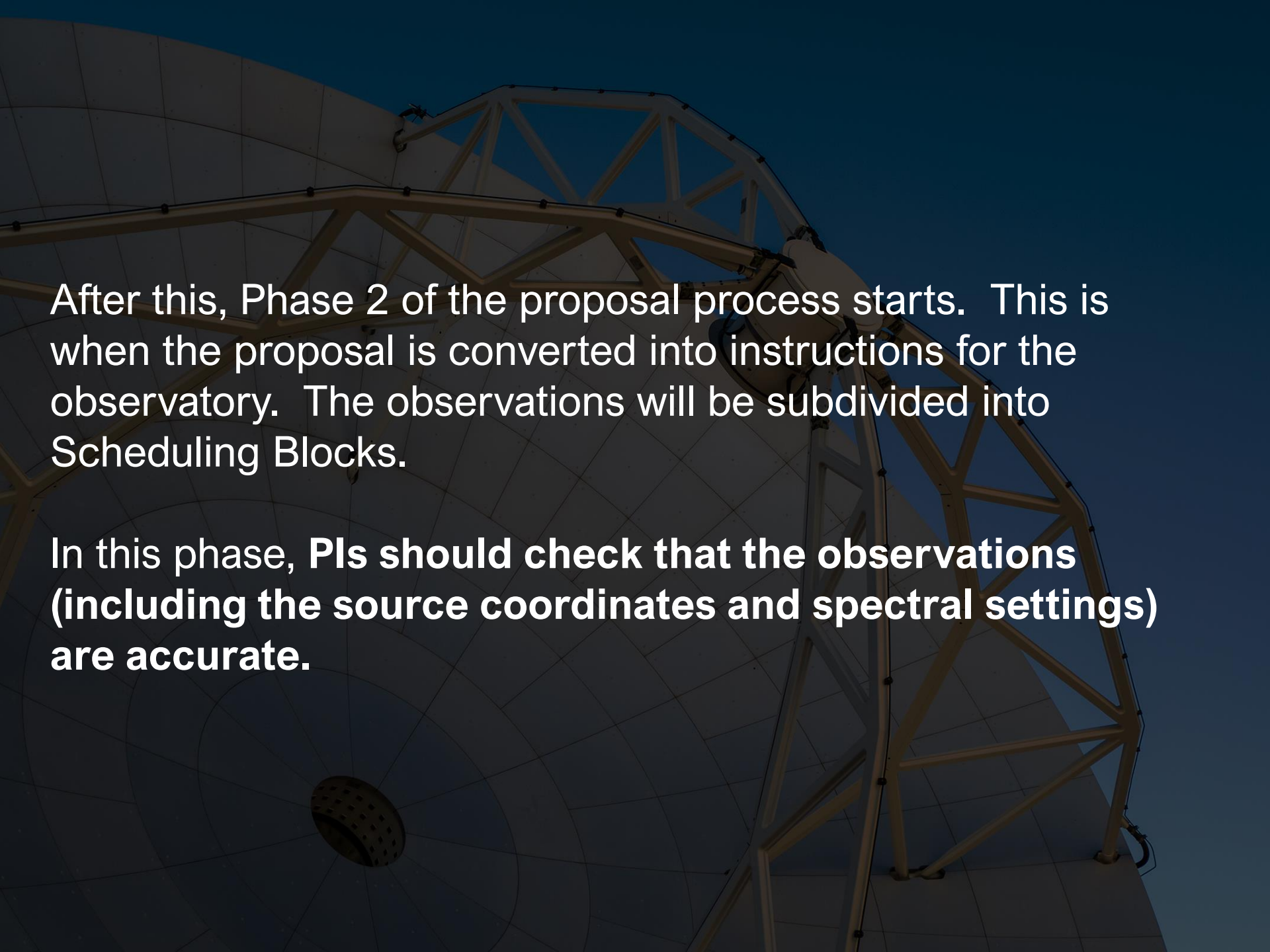
Some recommendations on setting up observations:

- Do not try to gain sensitivity by overlapping the spectral windows. The instrument doesn't work that way.
- Do not change anything under Calibration Setup unless you know what you are doing.
- Do not specify a single angular resolution unless you absolutely need to. A program that specifies a range is more likely to be observed.
- Use “Any” for the desired angular resolution if you only need to detect the source.
- Do not forget to account for extended source emission in terms of uv coverage.
- Do not forget to account for extent of the source emission when estimating the peak surface brightness.

A large satellite dish antenna structure is shown against a dark blue sky. The dish is composed of a grid of white panels and a complex metal support structure. The text is overlaid on the left side of the image.

A proposal can be resubmitted multiple times before the proposal deadline.

After the deadline, the proposal will be reviewed. Typically, all people on a proposal will be notified about the outcome in the following July or August.



After this, Phase 2 of the proposal process starts. This is when the proposal is converted into instructions for the observatory. The observations will be subdivided into Scheduling Blocks.

In this phase, PIs should check that the observations (including the source coordinates and spectral settings) are accurate.



For reference, a Scheduling Block (SB) is a set of observations grouped together according to the following criteria:

- Specific array / array configuration
- Specific spectral tuning
- Specific set of fields / targets
- Specific sensitivity and angular resolution goals

One Science Goal from a proposal may be subdivided into multiple SBs.

Each SB may need to be executed multiple times. Each of these executions are called Execution Blocks (EBs).



The proposals are all inserted into an observing queue. Each EB will be performed according to the following criteria:

- Proposal grade
- For the 12m array, array configuration / angular resolution
- Observing conditions
- Elevation in the sky

Each array (the main 12m array, the ACA, and the total power array) has its own observing queue.



Observations can be tracked using SnooPI
(<https://asa.alma.cl/snoopi/>).

PIs communicate with their Contact Scientists through the
ALMA Helpdesk (<https://help.almascience.org/>).