

The ALMA Observing Tool

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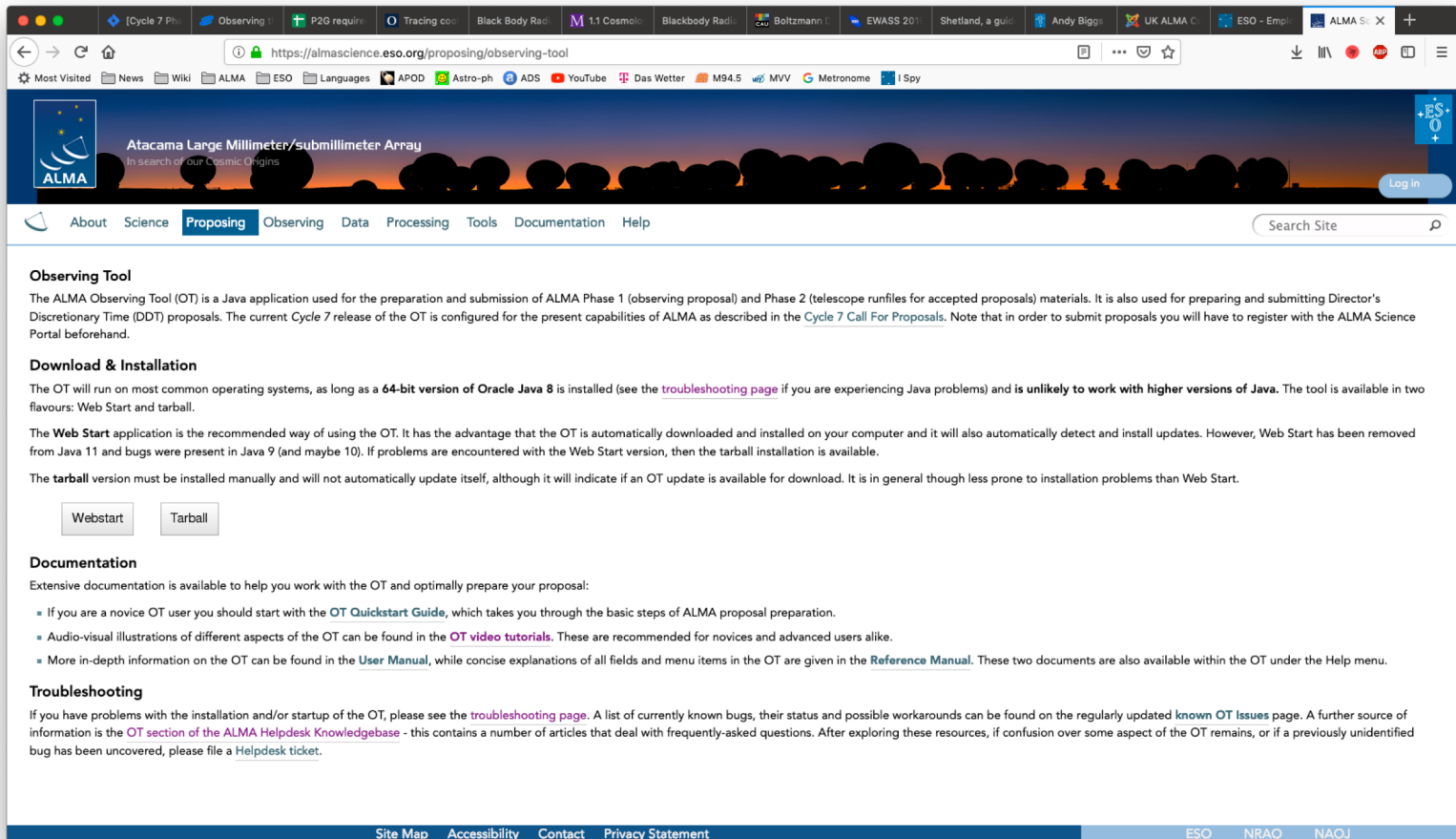


The ALMA Observing Tool (OT)

- The ALMA OT performs two roles:
 - Preparation and submission of ALMA proposals
 - Including Director's Discretionary Time and Supplemental Call
 - Production of Phase-2 products (Scheduling Blocks)
 - SBs are generated automatically – PIs do not do this!
 - Observatory staff can edit if required
- The OT has been in use since Cycle 0 (2011)
 - More than 10^4 proposals have been submitted with it so far
- The tool remains under continuous development
 - New features are added in every cycle
 - Already discussed the ALMA capabilities in the previous talk

Installation

- Downloaded from ALMA Science Portal
 - <https://almascience.eso.org/proposing/observing-tool>



The screenshot shows a web browser window displaying the ALMA Science Portal. The address bar shows the URL <https://almascience.eso.org/proposing/observing-tool>. The page header includes the ALMA logo and the text "Atacama Large Millimeter/submillimeter Array" with the tagline "In search of our Cosmic Origins". A navigation menu is visible with options: About, Science, Proposing, Observing, Data, Processing, Tools, Documentation, Help. A search bar is located on the right side of the menu.

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 7 release of the OT is configured for the present capabilities of ALMA as described in the [Cycle 7 Call For Proposals](#). Note that in order to submit proposals you will have to register with the ALMA Science Portal beforehand.

Download & Installation

The OT will run on most common operating systems, as long as a **64-bit version of Oracle Java 8** is installed (see the [troubleshooting page](#) if you are experiencing Java problems) and is **unlikely to work with higher versions of Java**. The tool 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. However, Web Start has been removed from Java 11 and bugs were present in Java 9 (and maybe 10). If problems are encountered with the Web Start version, then the tarball installation is available.

The **tarball** version must be installed manually and will not automatically update itself, although it will indicate if an OT update is available for download. It is in general though less prone to installation problems than Web Start.

Documentation

Extensive documentation is available to help you work with the OT and optimally prepare your proposal:

- If you are a novice OT user you should start with the [OT Quickstart Guide](#), which takes you through the basic steps of ALMA proposal preparation.
- 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](#).

Site Map Accessibility Contact Privacy Statement ESO NRAO NAOJ

Installation

- The OT is a Java Desktop Application (not a web app)
- There are two installation choices
 - Java Web Start
 - Traditional tar archive (“tarball”)
- Web Start is **generally** recommended
 - “Single-click” install
 - Automatically gets updates
- Tarball most useful if user can’t install Java
 - Manual installation and updates necessary
 - The OT will warn the user if an update is available

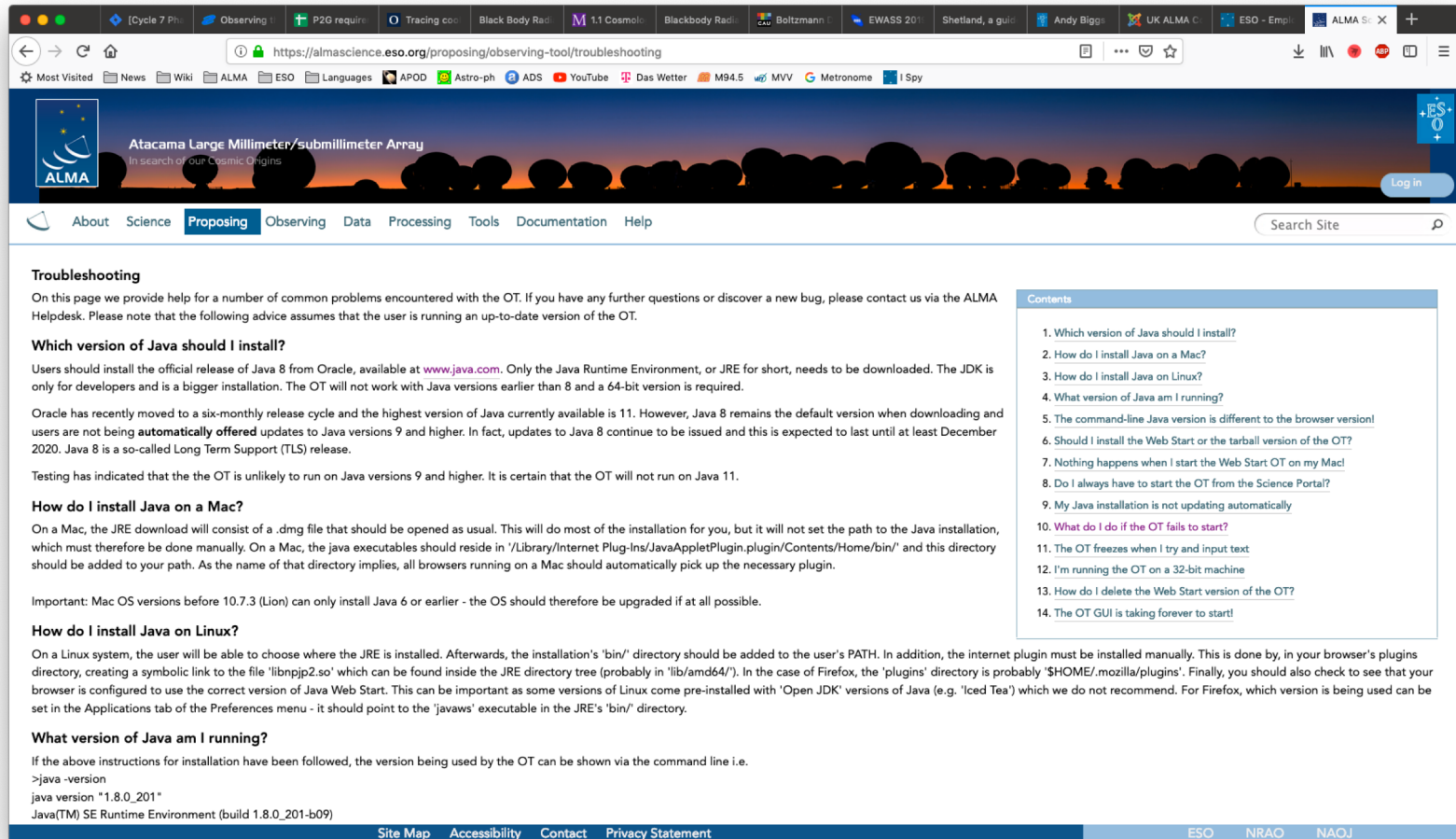
Java

- The OT is written in Java and requires this to run
- **Java 8 is required!!!**
 - Downloadable from *<https://www.java.com>*
- The official Oracle version should be used
 - OpenJDK variants cannot be guaranteed to work
- Beware: Oracle has moved to six-monthly releases
 - Java 11 is the current release, but ...
 - Java 8 remains the default download
 - Java 8 continues to be updated
 - Automatic updates **will not** install a higher version (9, 10 or 11)

ALMA is moving to Java 11 this year and this doesn't include Web Start
A different installer option will be used instead ("InstallAnywhere")

Java Help

- Troubleshooting page in Science Portal
 - <https://almascience.eso.org/proposing/observing-tool/troubleshooting>



Troubleshooting

On this page we provide help for a number of common problems encountered with the OT. If you have any further questions or discover a new bug, please contact us via the ALMA Helpdesk. Please note that the following advice assumes that the user is running an up-to-date version of the OT.

Which version of Java should I install?

Users should install the official release of Java 8 from Oracle, available at www.java.com. Only the Java Runtime Environment, or JRE for short, needs to be downloaded. The JDK is only for developers and is a bigger installation. The OT will not work with Java versions earlier than 8 and a 64-bit version is required.

Oracle has recently moved to a six-monthly release cycle and the highest version of Java currently available is 11. However, Java 8 remains the default version when downloading and users are not being **automatically offered** updates to Java versions 9 and higher. In fact, updates to Java 8 continue to be issued and this is expected to last until at least December 2020. Java 8 is a so-called Long Term Support (TLS) release.

Testing has indicated that the the OT is unlikely to run on Java versions 9 and higher. It is certain that the OT will not run on Java 11.

How do I install Java on a Mac?

On a Mac, the JRE download will consist of a .dmg file that should be opened as usual. This will do most of the installation for you, but it will not set the path to the Java installation, which must therefore be done manually. On a Mac, the java executables should reside in `/Library/Internet Plug-Ins/JavaAppletPlugin.plugin/Contents/Home/bin/` and this directory should be added to your path. As the name of that directory implies, all browsers running on a Mac should automatically pick up the necessary plugin.

Important: Mac OS versions before 10.7.3 (Lion) can only install Java 6 or earlier - the OS should therefore be upgraded if at all possible.

How do I install Java on Linux?

On a Linux system, the user will be able to choose where the JRE is installed. Afterwards, the installation's 'bin/' directory should be added to the user's PATH. In addition, the internet plugin must be installed manually. This is done by, in your browser's plugins directory, creating a symbolic link to the file 'libnpp2.so' which can be found inside the JRE directory tree (probably in 'lib/amd64/'). In the case of Firefox, the 'plugins' directory is probably '\$HOME/.mozilla/plugins'. Finally, you should also check to see that your browser is configured to use the correct version of Java Web Start. This can be important as some versions of Linux come pre-installed with 'Open JDK' versions of Java (e.g. 'Iced Tea') which we do not recommend. For Firefox, which version is being used can be set in the Applications tab of the Preferences menu - it should point to the 'javaws' executable in the JRE's 'bin/' directory.

What version of Java am I running?

If the above instructions for installation have been followed, the version being used by the OT can be shown via the command line i.e.

```
>java -version
java version "1.8.0_201"
Java(TM) SE Runtime Environment (build 1.8.0_201-b09)
```

Contents

1. Which version of Java should I install?
2. How do I install Java on a Mac?
3. How do I install Java on Linux?
4. What version of Java am I running?
5. The command-line Java version is different to the browser version!
6. Should I install the Web Start or the tarball version of the OT?
7. Nothing happens when I start the Web Start OT on my Mac!
8. Do I always have to start the OT from the Science Portal?
9. My Java installation is not updating automatically
10. What do I do if the OT fails to start?
11. The OT freezes when I try and input text
12. I'm running the OT on a 32-bit machine
13. How do I delete the Web Start version of the OT?
14. The OT GUI is taking forever to start!

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Layout

Project-structure Panel (navigation)

Editor Panel for entering information

Feedback Panel

The interface displays the following information:

- Project Structure:** NGC253 in EXTREME close-up, Proposal, Planned Observing, ScienceGoal (Science Goal), General, Field Setup, Spectral Setup, Calibration Setup, Control and Performance, Technical Justification.
- Spatial Image:** Shows a field of view with antenna positions. Coordinates: 00:47:45.848, -25:16:38.89 (J2000). Image Filename: i/j/sky3/cache/jsky2830059632536121281.fits.
- FOV Parameters:** Representative Frequency (Sky): 104.500 GHz, Antenna Diameter: 12m, Antenna Beamsize (HPBW): 55.722 arcsec, Show Antenna Beamsize: checked.
- Image Query:** Image Server: Digitized Sky (Version II) at ESO, Image Size(arcmin): 30.0.
- ngc253 Source Properties:** Source Name: ngc253, System: ICRS, RA: 00:47:33.1340, Dec: -25:17:19.680, Parallax: 0.00000 mas, PM RA: 0.00000 mas/yr, PM DEC: 0.00000 mas/yr, Source Radial Velocity: 258.800 km/s, Doppler Type: RELATIVISTIC, Target Type: 1 Rectangular Field.
- Expected Source Properties:** Peak Continuum Flux Density per Synthesized Beam: 0.10000 Jy, Continuum Polarization Percentage: 0.0 per cent, Peak Line Flux Density per Synthesized Beam: 10.00000 mJy, Line Width: 1.30000 km/s, Line Polarization Percentage: 0.0 per cent.
- Rectangle:** Coords Type: Relative, System: ICRS, Field Center Coordinates: Offset(Longitude): 11.40667 arcsec, Offset(Latitude): 2.20402 arcsec, p length: 171.33192 arcsec, q length: 339.53987 arcsec, Position Angle: 48.50039 deg, Spacing: 0.51093 fraction of antenna beamsize, #Pointings: 12m Array 81.
- Feedback:** Validation, Validation History, Log, 0 errors, 0 warnings, No problems found.

Proposal details

- Add PI, co-I's, title, abstract and scientific justification (PDF)

ALMA Observing Tool (Cycle 7) - UK ALMA Community Day: Cycle 7 Preparation

Perspective 1

Project Structure

- UK ALMA Community Day: Cycle 7 Preparation
 - Proposal

Editors

Spectral Spatial Proposal

Proposal Title: UK ALMA Community Day: Cycle 7 Preparation

Proposal Cycle: 2019.1

Abstract (max. 1200 characters): The UK ARC Node is please to announce an ALMA Community Day for Cycle 7 for the UK astronomical community. This one day meeting will cover ALMA's new (VLBI, Solar) and existing capabilities and proposal preparation in readiness for the ALMA Cycle 7 proposal deadline (April 17th 2019).

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

Please select one or two 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:

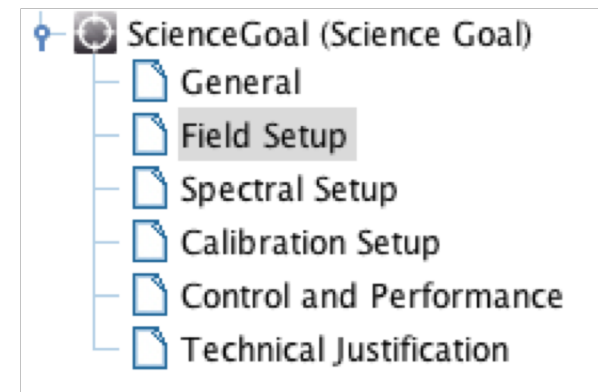
Investigators

| Type | Full name | Email | Affiliation | ALMA ID | Executive |
|------|----------------|-----------------------|--------------------------|---------|-----------|
| PI | Andy Biggs | abiggs@eso.org | Headquarters Garchi... | abiggs | Europe |
| Col | Anita Richards | amsr@j.b.man.ac.uk | Jodrell Bank Centre f... | amsr | Europe |
| Col | Adam Avison | adam.avison@manch... | Jodrell Bank Centre f... | aavison | Europe |
| Col | George Bendo | george.bendo@manch... | Jodrell Bank Centre f... | gbendo | Europe |
| Col | Tom Muxlow | tom.muxlow@manch... | Jodrell Bank Centre f... | tmuxlow | Europe |

Select PI Add CoPI Add Col Remove Collaborator Add from Proposal

Science Goals (SGs)

- A Science Goal captures basic **scientific** requirements
 - Direction in which to observe
 - Frequency at which to observe
 - Bandwidth
 - Angular resolution
 - Largest structure to image
 - Required sensitivity



No experience of radio astronomy or interferometry necessary!

- Multiple SGs often required
 - e.g. observations in different bands, different sensitivities
- OT calculates tunings, configurations and time estimate

Source finder

- Use *Resolve* button once source name is entered
 - Queries Simbad first, will try NED if no match found
 - Can enter position, velocity and proper motion (beware proper motions of quasars!)

The screenshot displays the ALMA Observing Tool interface. The main window is titled "Editors" and has tabs for "Spectral" and "Field Setup". The "Field Setup" tab is active, showing a "Spatial Image" window with a black image and a yellow box indicating a region of interest. To the right of the image is a "Source" configuration panel for "Proxima Centauri". The "Source" panel includes fields for "Source Name", "Choose a Solar System Object?", "Name of object", "System" (set to ICRS), "Sexagesimal display?" (checked), "Parallax" (0.00000 mas), "PM RA" (0.00000 mas/yr), "PM DEC" (0.00000 mas/yr), "Source Radial Velocity" (0.000 km/s), and "Doppler Type" (RADIO). A "Resolve" button is located at the top right of the "Source" panel.

Overlaid on the main window is a "Name Resolver Results" dialog box. It contains the text: "simbad.u-strasbg.fr (SIMBAD) found 1 match for the object 'Proxima Centauri'." Below this text is a table with the following data:

| Name / Alias | Position | | Proper Motion | | Velocity |
|--------------|---------------|---------------|------------------|----------------|------------|
| | RA | Dec | RA | Dec | |
| V* V645 Cen | 14:29:42.9451 | -62:40:46.170 | -3781.306 mas/yr | 769.766 mas/yr | -22400 m/s |

At the bottom of the dialog box are "Cancel" and "Select" buttons. The "Delete All Sources" button is visible at the bottom right of the main window.

Source clustering

- Up to 150 pointings can be added per SG
- These can be distributed over up to 150 sources
- Sources can be anywhere on the sky
 - OT splits sources into multiple clusters
 - Uses a “hierarchical clustering” algorithm
- Radius of each cluster is...
 - 10 degrees for “normal” Science Goals
 - 1 degree for long-baseline SGs (need closer phase calibrator)

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 | 12.00 mJy |
| Bandwidth used for sensitivity | 0.141 MHz |
| Representative frequency (sky, first source) | 218.939 GHz |

Estimated Total time for Science Goal 1.11 d

| Source Name | RA | Dec | Velocity |
|-------------|---------------|---------------|-------------|
| B1946+0076 | 18:49:22.3000 | -00:50:32.000 | 96.000 km/s |
| Z4013+0488 | 18:33:18.5000 | -07:42:23.000 | 94.000 km/s |
| Z8178-0091 | 18:43:02.6000 | -04:14:52.000 | 98.000 km/s |

Possible Configuration Combinations

| 12-m (1) | 12-m (2) | 7-m | TP | Nominal Beam(°) | Max expected axial ratio |
|----------|----------|-----|-----|-----------------|--------------------------|
| C43-2 | None | Yes | Yes | 1.03 x 1.137 | 1.5 |

Input Parameters

Precipitable water vapour (all sources) 1.796mm (5th Octile)

Time required for 12m (1) [C43-2]

| | |
|--|-----------------------|
| Time on source per pointing (first source) | 5.04 min [4.76 min] |
| Total number of pointings (all sources) | 3 |
| Number of tunings | 1 |
| Total time on source | 15.11 min [14.08 min] |
| Total calibration time | 13.17 min |
| Other overheads | 2.42 min |
| Total time for 1 SB execution | 30.70 min |
| Number of SB executions | 1 |
| Total time to complete SB | 30.70 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

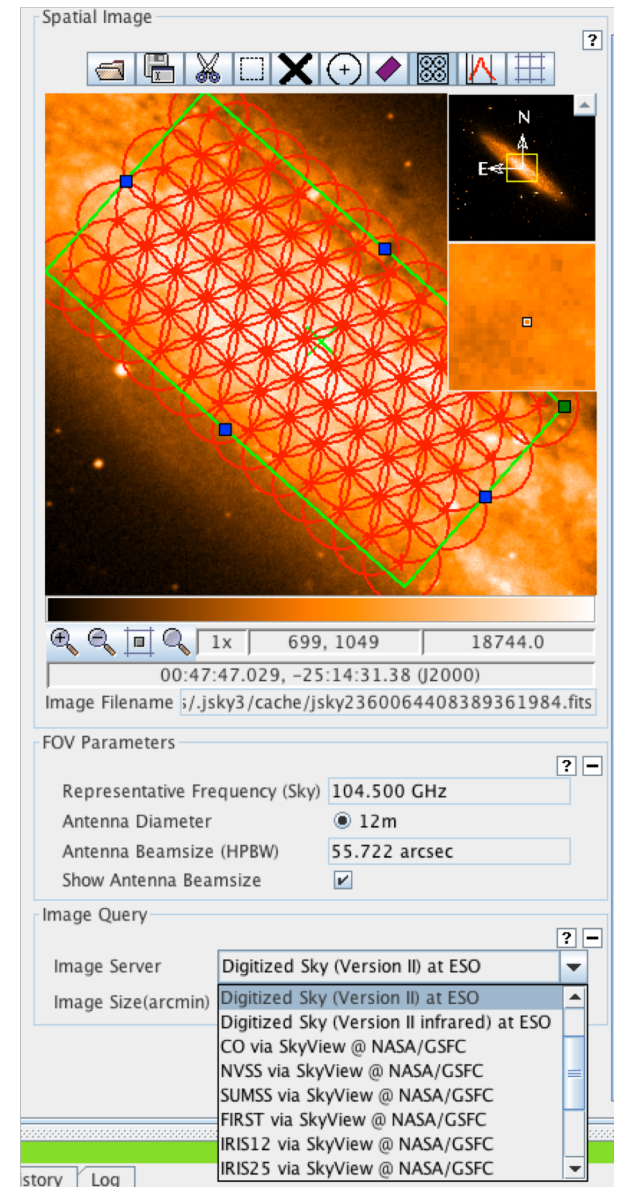
| | |
|----------------------------------|--------|
| ACA 7-m on-source time | 1.21 h |
| Total 7-m time | 2.15 h |
| TP on-source time | 2.25 h |
| Total TP time | 5.78 h |
| Total ACA time (max{T,7-m,T,TP}) | 5.78 h |

Estimated total time for cluster 1 6.29 h

Close

Spatial Visualiser

- Displays astronomical images
 - Download from various servers
 - Open own FITS file
- Shows telescope pointings
 - Rectangles
 - Individually defined pointings
- Can be used interactively
 - Draw and edit (resize/rotate) rectangle
 - Add or delete individual pointings



Galactic coordinates

- OT converts coordinates to ICRS during SB generation
- Can use different systems in text and visual editors
 - Rectangle will be rotated appropriately

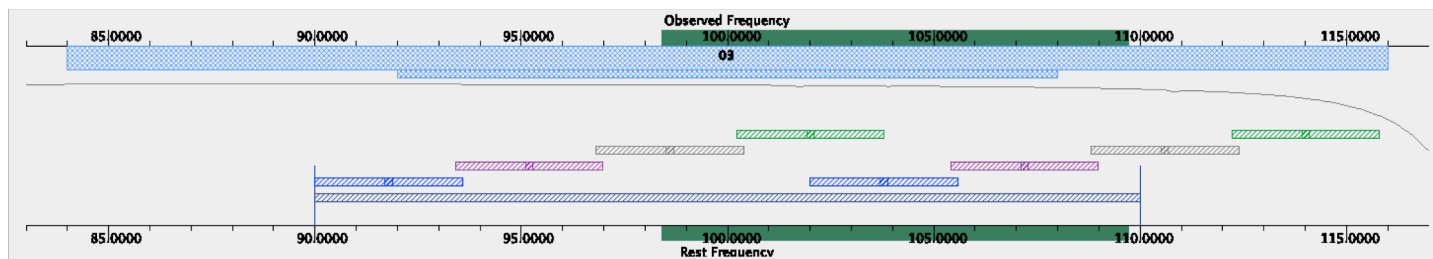
The screenshot displays the 'Editors' window of the ALMA Observing Tool, specifically the 'Spatial Image' and 'Source' configuration panels for the source 'Sgr A*'. The 'Spatial Image' panel on the left shows a field of stars with a green rectangular field of view (FOV) overlaid, which is rotated relative to the image axes. The 'Source' panel on the right contains the following configuration details:

- Source Name:** Sgr A*
- System:** galactic (highlighted with a red box)
- Source Coordinates:** Lon (deg) 359.94423521, Lat (deg) -0.04616008
- Parallax:** 0.00000 mas
- PM RA:** 0.00000 mas/yr
- PM DEC:** 0.00000 mas/yr
- Source Radial Velocity:** 0.000 km/s
- Target Type:** 1 Rectangular Field
- Expected Source Properties:** Peak Continuum Flux Density per Synthesized Beam: 1000.00000 mJy; Continuum Linear Polarization: 1.0 per cent; Continuum Circular Polarization: 0.0 per cent; Peak Line Flux Density per Synthesized Beam: 1000.00000 mJy; Line Width: 1.00000 km/s; Line Linear Polarization: 1.0 per cent; Line Circular Polarization: 0.0 per cent
- Rectangle:** p length: 100.00000 arcsec; q length: 140.00000 arcsec; Position Angle: 0.00000 deg (highlighted with a red box)

A red annotation 'Note different angle of rectangle in visualiser' is placed next to the Position Angle field, indicating that the rectangle in the visualizer is rotated according to the specified Position Angle.

Spectral Setup

- Users define spectral windows
 - A Spectral Line Picker tool is available (uses the Splatalogue)
 - Spws can also be added manually www.splatalogue.net
- OT will try to finding a tuning solution
 - Spws will need to be moved if errors are reported
- Three options
 - Spectral Line (gives the most flexibility)
 - Single Continuum (shortcut to maximum-bandwidth setup)
 - Spectral Scan (sets up multiple tunings automatically)



Spectral Line Picker

- Enter text (e.g. 'CO') and tool will show all lines that match
- Various filters are provided e.g. only those that would still give a tuning

Transition Filter

HC

e.g. CO2+1 or 'oxide'

Include description

Frequency Filters

ALMA Band

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.

Search Online

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 selected columns.)

| Transition | Description | Rest Frequency | Sky Frequency | Upper-state Energy | Lovas Intensity | Sij μ^2 | Catalog |
|------------------|----------------|----------------|----------------|--------------------|-----------------|---------------------------|---------|
| HC3N v=0 J=49-48 | Cyanoacetylene | 445.551722 GHz | 445.533876 GHz | 534.725 K | | 682.369 D ² | Offline |
| HC3N v=0 J=5-4 | Formylum | 445.902907 GHz | 445.885047 GHz | 64.202 K | | 76.05 D ² | Offline |
| HC3N v=0 J=51-50 | Cyanoacetylene | 463.715301 GHz | 463.696728 GHz | 578.799 K | | 8.2710.194 D ² | Offline |
| HC3N v=0 J=52-51 | Cyanoacetylene | 472.796107 GHz | 472.777169 GHz | 601.489 K | | 724.203 D ² | Offline |

Add to spectral window list

Spectral windows in this baseband (maximum of four)

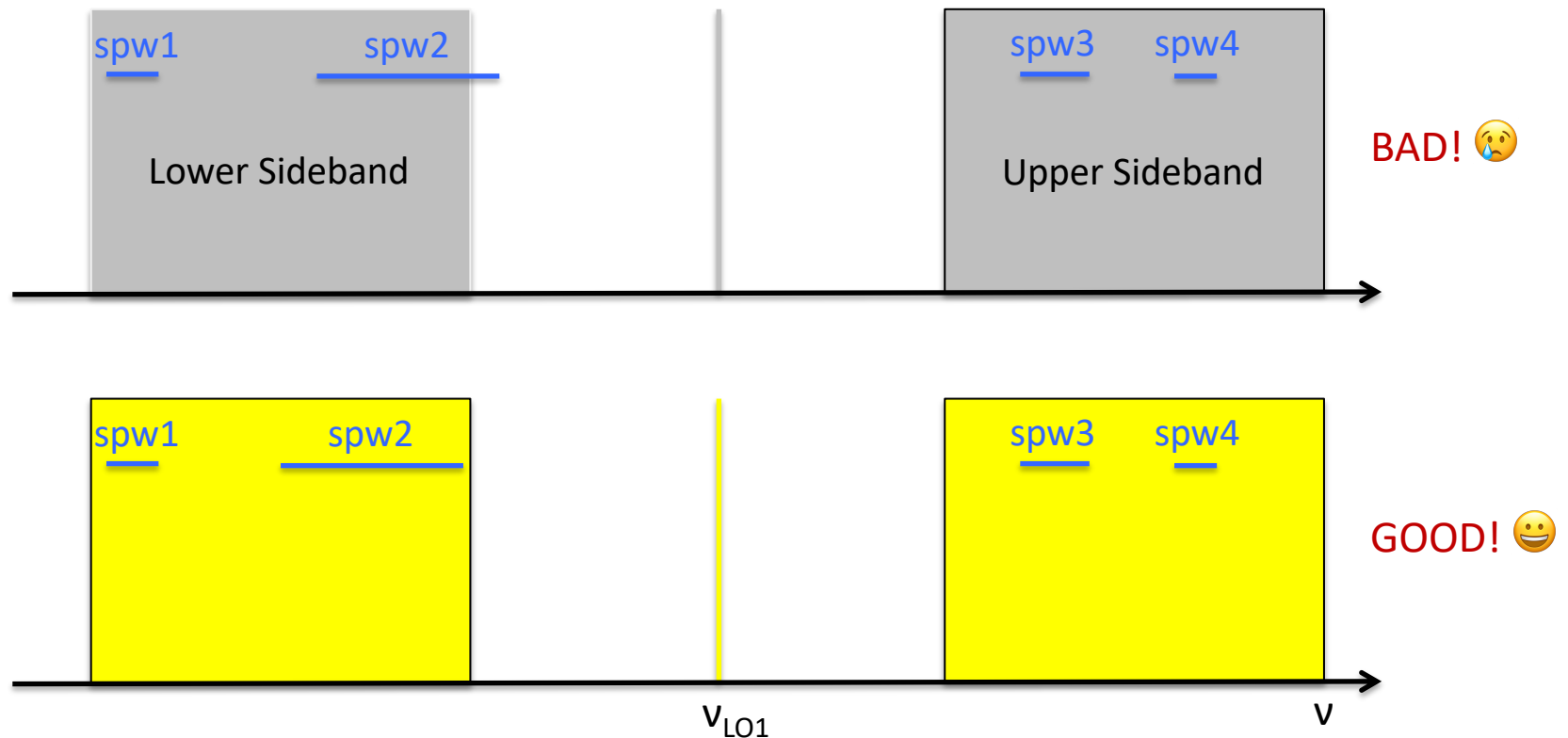
| Transition | Description | Rest Frequency | Sky Frequency |
|------------|-------------|----------------|---------------|
|------------|-------------|----------------|---------------|

Remove spectral window(s)

Cancel Ok

Sidebands

- All spws must lie within the sidebands
 - These are **generally** 4-GHz wide and separated by 8 GHz (e.g. Bands 3, 4, 5, 7 and 8)



Basebands/Correlator modes

- Spws lie in basebands of which there are four
 - Each is 2-GHz wide
 - Up to four can be defined per baseband
 - Each baseband can use a different correlator mode
- A correlator mode must be chosen for each spw
 - Six FDM (high spectral resolution – 60 to 1875-MHz bandwidth)
 - One TDM (low spectral resolution – 1875-MHz bandwidth)
- Spectral averaging is possible for FDM (N=1,2,4,8,16)

The screenshot displays the configuration for two basebands in the ALMA Observing Tool. The top panel, 'Baseband-3', shows a single spectral window (1(Full)) with a bandwidth of 468.750 MHz (637 km/s) and a resolution of 282.227 kHz (0.384 km/s). The bottom panel, 'Baseband-4', shows four spectral windows (1/4) with a bandwidth of 58.594 MHz (80 km/s) and a resolution of 141.113 kHz (0.193 km/s). A dropdown menu is open for the selected window, showing options for spectral averaging: 80 km/s, 161 km/s, 321 km/s, and 642 km/s.

| Baseband | Window | Start Frequency (GHz) | End Frequency (GHz) | Correlator Mode | Bandwidth (MHz) | Bandwidth (km/s) | Resolution (kHz) | Resolution (km/s) |
|------------|---------|-----------------------|---------------------|-----------------------------|-----------------|------------------|------------------|-------------------|
| Baseband-3 | 1(Full) | 220.53000 | 220.56608 | CH3CN v=0 12(0)-11(0), F... | 468.750 | 637 | 282.227 | 0.384 |
| Baseband-4 | 1/4 | 218.47563 | 218.51138 | H2CO 3(2,2)-2(2,1) | 58.594 | 80 | 141.113 | 0.193 |
| | 1/4 | 218.90336 | 218.93917 | OCS v=0 18-17 | 58.594 | 80 | 141.113 | 0.193 |
| | 1/4 | 218.22219 | 218.25789 | H2CO 3(0,3)-2(0,2) | 58.594 | 80 | 141.113 | 0.193 |
| | 1/4 | 218.76007 | 218.79586 | H2CO 3(2,1)-2(2,0) | 58.594 | 80 | 141.113 | 0.193 |

Representative Frequency

- One spw must be chosen as the “representative” one
 - Representative Frequency can be defined anywhere within this
- The time estimate is calculated at this frequency
 - Sensitivity of other spws may be different
 - Be careful in regions of varying atmospheric transmission

The screenshot shows the ALMA Observing Tool interface with two sections: Baseband-3 and Baseband-4. Each section contains a table of spectral windows (spws) and a control panel below it.

Baseband-3 Table:

| | | | | | | |
|---------|---------------|---------------|-----------------------------|--|---|-----------------------|
| 1(Full) | 220.53000 GHz | 220.56608 GHz | CH3CN v=0 12(0)-11(0), F... | 468.750 MHz(637 km/s), 282.227 kHz(0.384 km/s) | 2 | <input type="radio"/> |
|---------|---------------|---------------|-----------------------------|--|---|-----------------------|

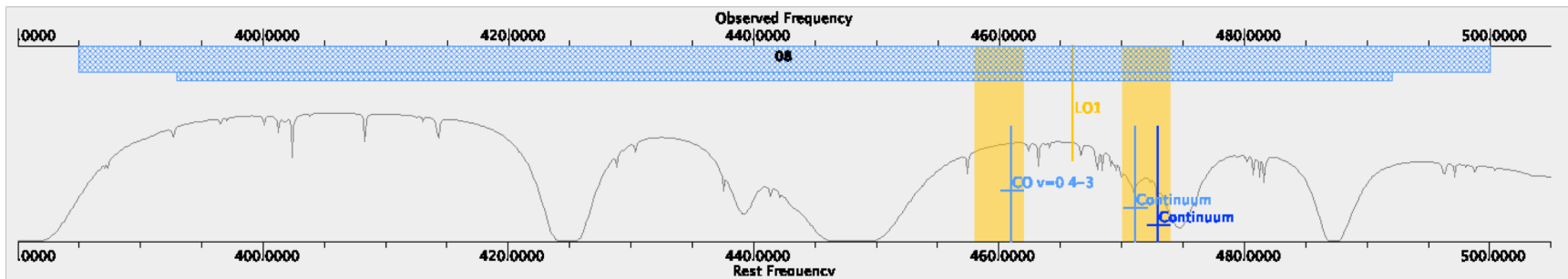
Baseband-4 Table:

| | | | | | | |
|-----|---------------|---------------|--------------------|--|---|----------------------------------|
| 1/4 | 218.47563 GHz | 218.51138 GHz | H2CO 3(2,2)-2(2,1) | 58.594 MHz(80 km/s), 141.113 kHz(0.194 km/s) | 2 | <input type="radio"/> |
| 1/4 | 218.90336 GHz | 218.93917 GHz | OCS v=0 18-17 | 58.594 MHz(80 km/s), 141.113 kHz(0.193 km/s) | 2 | <input checked="" type="radio"/> |
| 1/4 | 218.22219 GHz | 218.25789 GHz | H2CO 3(0,3)-2(0,2) | 58.594 MHz(80 km/s), 141.113 kHz(0.194 km/s) | 2 | <input type="radio"/> |
| 1/4 | 218.76007 GHz | 218.79586 GHz | H2CO 3(2,1)-2(2,0) | 58.594 MHz(80 km/s), 141.113 kHz(0.193 km/s) | 2 | <input type="radio"/> |

The control panels for both sections include buttons for "Add spectral window centred on a spectral line", "Add spectral window manually", and "Delete", along with a checkbox for "Show image spectral windows".

Varying transmission

- Band 8 is an example of where the transmission varies greatly
 - Can be difficult to place all spws in areas of good transmission



Default Single Continuum setup

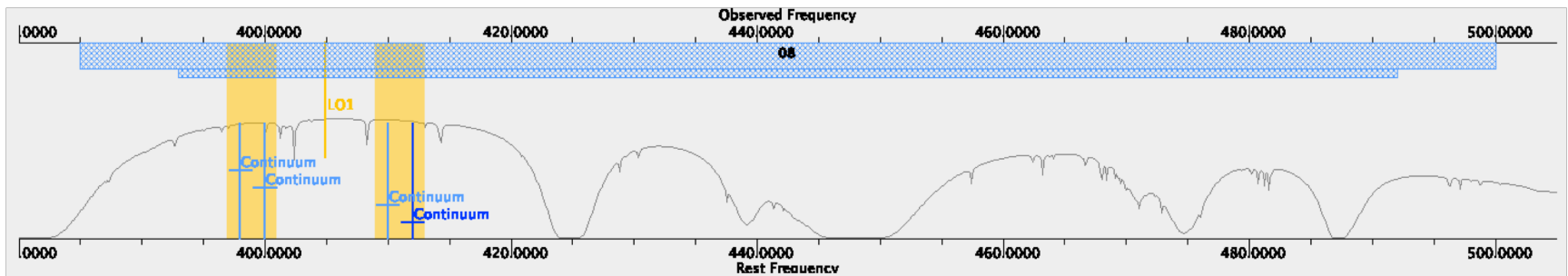


Image sidebands in Bands 9 and 10

Band 9 and 10 are Double Sideband (DSB) receivers – there is an “image” of every spw in the other sideband (reflected around LO1)

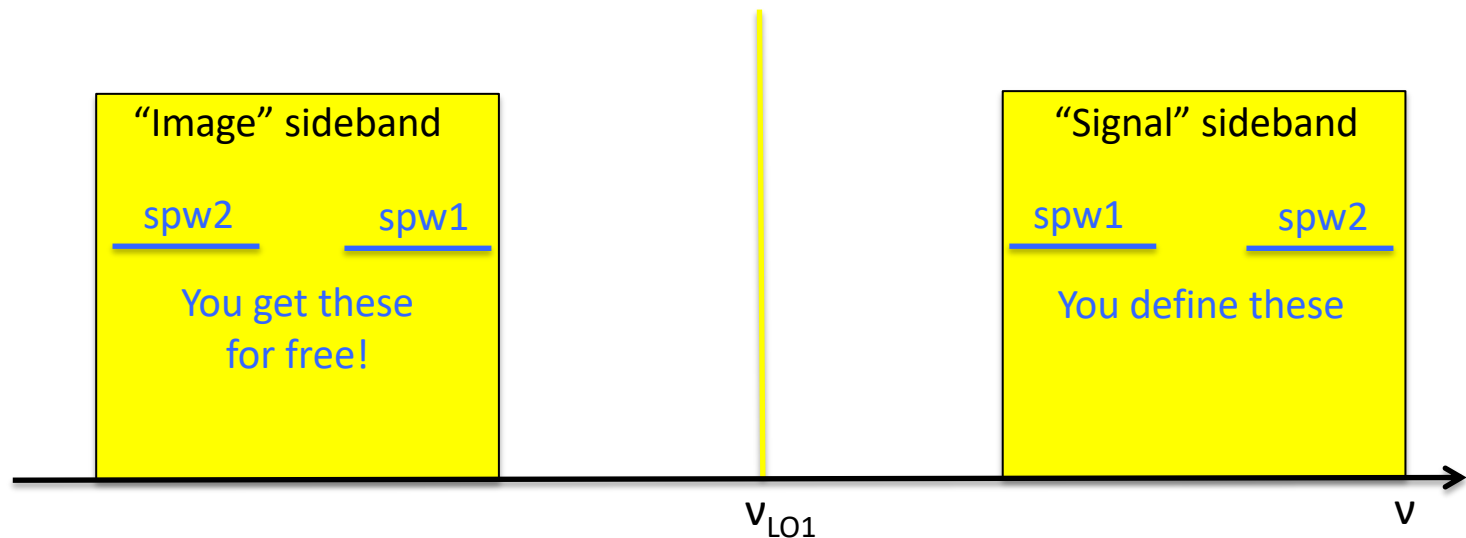


Image spws were previously suppressed by correlator, but **90-degree Walsh switching** now allows both to be recovered

90-Degree Walsh switching

Used automatically for single continuum – doubles the bandwidth (15 GHz)
Now activated by default for “Spectral Line”

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

Spectral Line

Baseband-1

| Fraction | Centre Freq (rest,lsrk) | Centre Freq (sky,bar) | Transition | Bandwidth, Resolution (smoothed) | Spec Avg. | Store Image | Representative Window |
|----------|-------------------------|-----------------------|-----------------|---|-----------|-------------------------------------|----------------------------------|
| 1(Full) | 1900.53690 GHz | 633.48566 GHz | CII 2P3/2-2P1/2 | 1875.000 MHz(887 km/s), 1.129 MHz(0.534 km/s) | 2 | <input checked="" type="checkbox"/> | <input checked="" type="radio"/> |

Don't have to keep all image spws (data rate)

Baseband-2

| | | | | | | | |
|---------|----------------|---------------|------|---|---|-------------------------------------|-----------------------|
| 1(Full) | 1860.07821 GHz | 620.00000 GHz | Test | 1875.000 MHz(907 km/s), 1.129 MHz(0.546 km/s) | ? | <input checked="" type="checkbox"/> | <input type="radio"/> |
|---------|----------------|---------------|------|---|---|-------------------------------------|-----------------------|

Calibration Setup

- This can normally be ignored
- Most useful option is for more accurate flux calibration
 - Uses a solar-system calibrator instead of a QSO
- Can define specific calibrators
 - SG becomes non-standard
 - Very rarely necessary! Calibrators are chosen automatically

Goal Calibrators



By default, calibrators will be selected automatically at runtime and a single observation will be used to calibrate the bandpass and flux scale.

- System-defined calibration (recommended)
- System-defined calibration (force separate amplitude calibration using solar-system object)
- User-defined calibration

Control & Performance

- Information about array properties shown at top
 - Gives e.g. allowed range of angular resolution
- Max. recoverable scale drives choice of smallest array
 - In example below: if LAS = 31" then the TP array is needed

Control and Performance ?

Configuration Information

| | | | | | |
|---|-----|--|--|--|-----------------------------------|
| Antenna Beamsize ($1.13 * \lambda / D$) | 12m | <input type="text" value="26.596 arcsec"/> | 7m | <input type="text" value="45.593 arcsec"/> | |
| Number of Antennas | 12m | <input type="text" value="43"/> | 7m | <input type="text" value="10"/> | TP <input type="text" value="3"/> |
| | | ACA 7m configuration | Most compact 12m configuration | Most extended 12m configuration | |
| Longest baseline | | <input type="text" value="0.049 km"/> | <input type="text" value="0.161 km"/> | <input type="text" value="16.197 km"/> | |
| Synthesized beamsize | | <input type="text" value="5.738 arcsec"/> | <input type="text" value="1.654 arcsec"/> | <input type="text" value="0.020 arcsec"/> | |
| Shortest baseline | | <input type="text" value="0.009 km"/> | <input type="text" value="0.015 km"/> | <input type="text" value="0.256 km"/> | |
| Maximum recoverable scale | | <input type="text" value="30.662 arcsec"/> | <input type="text" value="13.331 arcsec"/> | <input type="text" value="0.229 arcsec"/> | |

Control & Performance

- Define angular resolution, not configurations
 - “Any” is also possible (excludes long-baseline configurations)
 - AR determines largest configuration required
- Largest Angular Scale of source
 - Determines smallest configuration required
 - Up to two 12-m configurations plus ACA (7-m and TP) possible
- Sensitivity
 - Pretty self-explanatory
 - Can also be defined in kelvins

Time Estimate

- Shows details of the calculation
 - Assumed column of water vapour
 - On-source time
 - Calibration time
 - Required configurations
 - Clustering of sources
 - Beam ellipticity
- Details only for largest array
 - Smaller arrays use time multipliers of largest array's on-source time
 - These are derived from simulations

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 | 12.00 mJy |
| Bandwidth used for sensitivity | 0.141 MHz |
| Representative frequency (sky, first source) | 218.939 GHz |

Estimated Total time for Science Goal 1.11 d

Cluster 1 Cluster 2 Cluster 3

| Source Name | RA | Dec | Velocity |
|-------------|---------------|---------------|-------------|
| B1946+0076 | 18:49:22.3000 | -00:50:32.000 | 96.000 km/s |
| 24013+0488 | 18:33:18.5000 | -07:42:23.000 | 94.000 km/s |
| 28178-0091 | 18:43:02.6000 | -04:14:52.000 | 98.000 km/s |

Possible Configuration Combinations

| 12-m (1) | 12-m (2) | 7-m | TP | Nominal Beam(°) | Max expected axial ratio |
|----------|----------|-----|-----|-----------------|--------------------------|
| C43-2 | None | Yes | Yes | 1.03 x 1.137 | 1.5 |

Input Parameters

| | |
|---|----------------------|
| Precipitable water vapour (all sources) | 1.796mm (5th Octile) |
|---|----------------------|

Time required for 12m (1) [C43-2]

| | |
|--|-----------------------|
| Time on source per pointing (first source) | 5.04 min [4.76 min] |
| Total number of pointings (all sources) | 3 |
| Number of tunings | 1 |
| Total time on source | 15.11 min [14.08 min] |
| Total calibration time | 13.17 min |
| Other overheads | 2.42 min |
| Total time for 1 SB execution | 30.70 min |
| Number of SB executions | 1 |
| Total time to complete SB | 30.70 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 | 1.21 h |
| Total 7-m time | 2.15 h |
| TP on-source time | 2.25 h |
| Total TP time | 5.78 h |
| Total ACA time (max[t_7-m, t_TP]) | 5.78 h |

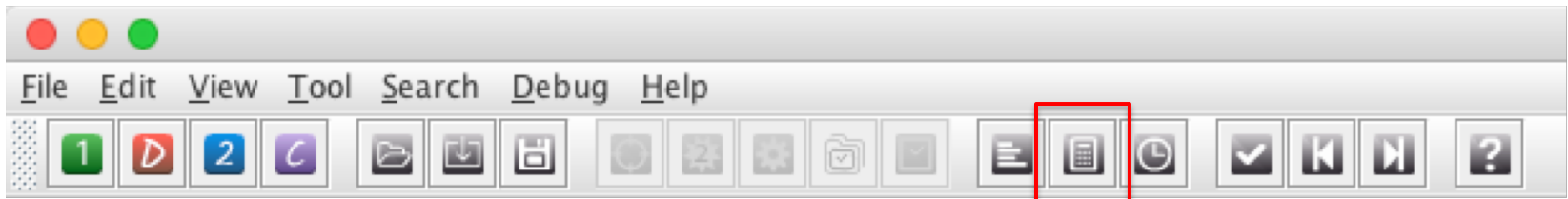
Estimated total time for cluster 1 6.29 h

Close

Time multipliers

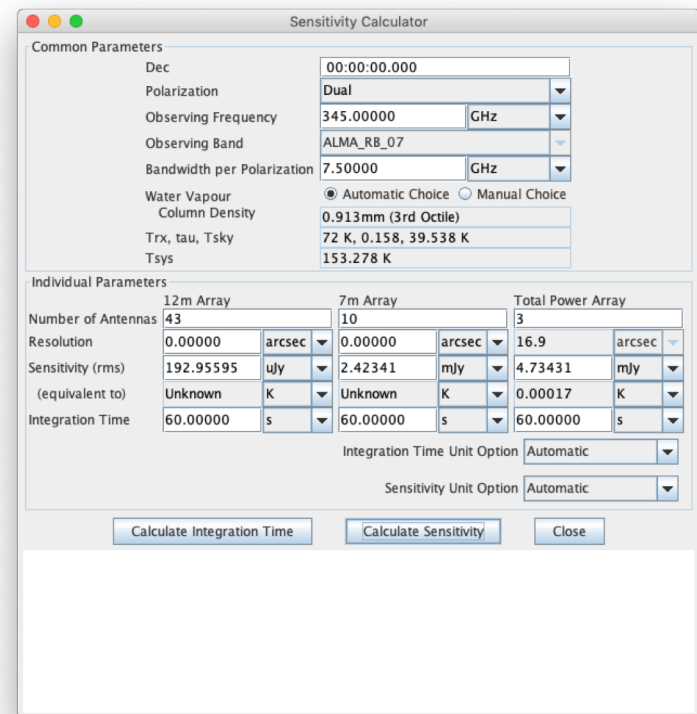
| Configurations | Time ratio |
|---------------------|-----------------|
| C43-1 : 7-m | 1 : 7.0 |
| C43-2 : 7-m | 1 : 4.66 |
| C43-3 : 7-m | 1 : 2.40 |
| C43-4 : C43-1 : 7-m | 1 : 0.34 : 2.38 |
| C43-5 : C43-2 : 7-m | 1 : 0.26 : 1.21 |
| C43-6 : C43-3 : 7-m | 1 : 0.25 : 0.60 |
| C43-7 : C43-4 | 1 : 0.23 |
| C43-8 : C43-5 | 1 : 0.22 |
| C43-9 : C43-6 | 1 : 0.21 |
| 7-m : TP | 1 : 1.7 |

Sensitivity Calculator



Allows you to **experiment** with sensitivity parameters

Parameters have no effect on **real time estimate!**



Web-based Sensitivity Calculator

Please be aware of the following limitations:

- Integration times refer only to the on-source time (no overheads are taken into account)
- For DSB receivers (B9 and 10) the contribution to the system temperature from the image sideband is assumed to be twice that in the signal sideband
- The ASC is not able to add the source contribution to the system temperature and therefore the times for particularly bright sources e.g. planets or the Sun, will be underestimated
- The effects of shadowing are not taken into account

Has some limitations compared to OT version

In order for the ASC to work, your browser must have JavaScript enabled.

Common Parameters

Declination: 00:00:00.00 ✓

Polarisation: Dual

Observing Frequency: 345 GHz

Observing Band: ALMA_RB_07

Bandwidth per Polarization: 7.500000 GHz

Water Vapour: Automatic Choice Manual Choice

Column Density: 0.913mm (3rd Octile)

Trx, tau, Tsky: 72 K, 0.158, 39.538 K

Tsys: 153.278 K

Individual Parameters

| | 12 m Array | 7 m Array | Total Power Array |
|--------------------|--------------------------|--------------------------|-------------------------|
| Number of Antennas | 43 ✓ | 10 ✓ | 3 ✓ |
| Resolution | 0 arcsec ✓ | 0 arcsec ✓ | 9.5 arcsec ✓ |
| Sensitivity (rms) | 192.95594694337473 uJy ✓ | 2.4234094057554807 mJy ✓ | 4.734306968439023 mJy ✓ |
| Equivalent to | Unknown mK | Unknown mK | 0.539 mK |
| Integration Time | 60 s ✓ | 60 s ✓ | 60 s ✓ |

Integration Time Unit Option: Automatic

Sensitivity Unit Option: Automatic

Calculate Integration Time Calculate Sensitivity

Site Map Accessibility Contact Privacy Statement ESO NRAO NAOJ

<https://almascience.eso.org/proposing/sensitivity-calculator>

Technical Justification

- Requested parameters must be justified per SG
 - Use Copy and Paste (e.g. Ctrl-C, Ctrl-V) if input is very similar
- Entered values are shown and e.g. SNRs calculated
- OT blue warnings point out **possible** problems

Requested RMS over is

For a peak flux density of , the S/N is

Achieved RMS over the total bandwidth is

For a continuum flux density of , the achieved S/N is

For a peak line flux of , the achieved S/N over 1/3 of the source line width (/ 3 =) is

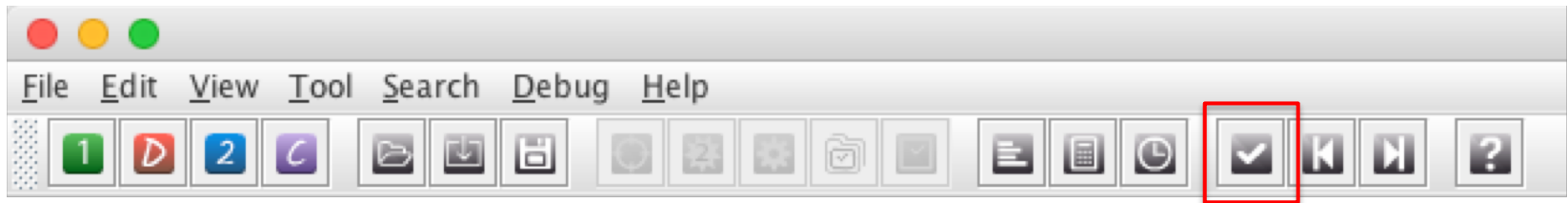
Note that one or more of the S/N estimates are < 3. Please double-check the RMS and/or line fluxes entered and/or address the issue below.

Line width / bandwidth used for sensitivity (/) =

Note that the bandwidth used for sensitivity is larger than 1/3 of the linewidth.

The S/N achieved for a resolution element that allows the line to be resolved will be lower than that reported.

Validation



| Feedback | |
|--|---|
| Validation Validation History Log | |
| 2 errors, 0 warnings : double-click on each row to be taken to the problem | |
| | Description |
| ✘ | Unable to calculate estimated array times |
| ✘ | Desired sensitivity is too small |

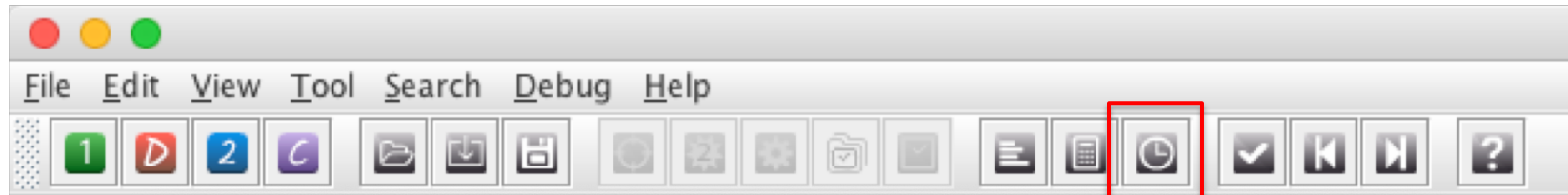
BAD! 😞

| Feedback | |
|-----------------------------------|-------------------|
| Validation Validation History Log | |
| 0 errors, 0 warnings | |
| | Description |
| ✓ | No problems found |

GOOD! 😊

Proposal can only be submitted if no validation errors are found

Project Time Summary



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. | |
| Sgr A* galactic rectangle | 22.67 min | 13.17 min | - | - | 22.67 min | 13.17 min | 22.67 min | - | - | - | 45.34 min | 13.17 min | No |
| M1 galactic rectangle | 21.84 min | 13.17 min | - | - | 21.84 min | 13.17 min | 21.84 min | - | - | - | 43.68 min | 13.17 min | No |
| M1 galactic pointings | 20.37 min | 13.17 min | - | - | 20.37 min | 13.17 min | 20.37 min | - | - | - | 40.75 min | 13.17 min | No |
| MSX/ACA | - | - | - | - | - | - | 45.14 min | 21.93 min | - | - | 45.14 min | 21.93 min | No |
| Overall | 1.08 h | 39.50 min | - | - | 1.08 h | 39.50 min | 1.83 h | 21.93 min | - | - | 2.91 h | 1.02 h | |

Data Volumes and Data Rates

| Science Goal | Data Volume | | | Avg. Data Rate | | |
|---------------------------|-------------|-----------|--------|----------------|-----------|--------|
| | 12-m (1+2) | ACA 7-m | ACA TP | 12-m (1+2) | ACA 7-m | ACA TP |
| Sgr A* galactic rectangle | 1.78 GB | 115.98 MB | - | 1.79 MB/s | 0.11 MB/s | - |
| M1 galactic rectangle | 1.72 GB | 113.75 MB | - | 1.79 MB/s | 0.12 MB/s | - |
| M1 galactic pointings | 1.88 GB | 117.19 MB | - | 1.93 MB/s | 0.12 MB/s | - |
| MSX/ACA | - | 382.84 MB | - | - | 0.16 MB/s | - |
| Overall | 5.38 GB | 729.76 MB | - | | | |

Close

Documentation

- OT-specific documentation includes
 - User and Reference Manuals
 - Troubleshooting Page
 - QuickStart Guide (highly recommended!)
- All available from:
 - Science Portal
 - *<https://almascience.eso.org/documents-and-tools>*
 - User and Reference Manuals available in OT

Contextual help

- The '?' buttons open the Reference Manual at that section

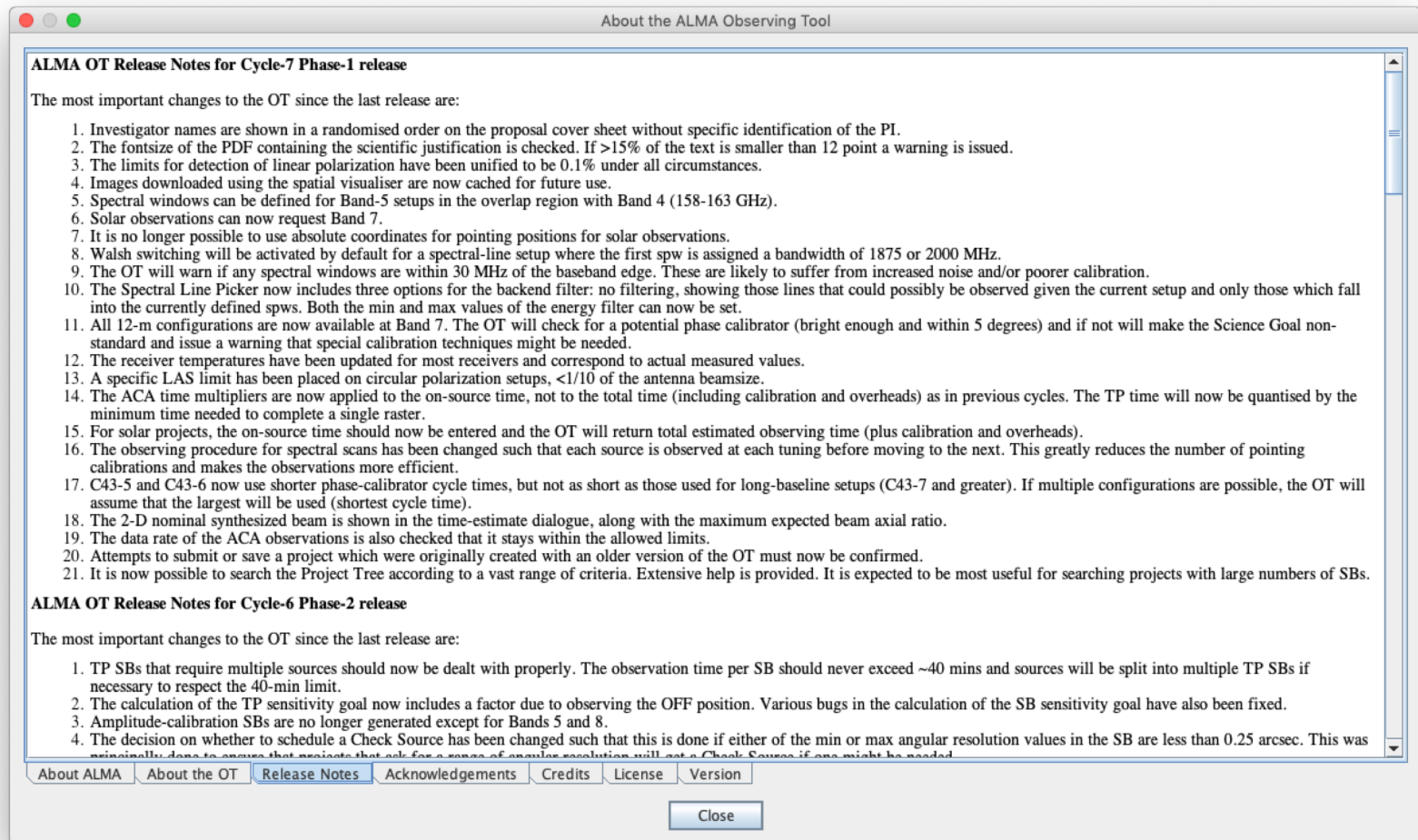
The screenshot displays the ALMA Observing Tool (Cycle7) - Test interface. The main window is titled 'Sgr A*' and shows the 'Field Setup' tab. The 'Source' field is highlighted, and a contextual help window is open over it. The help window contains the following text:

Source

- Source Name:** Source names should only contain the following characters: a-z, A-Z, 0-9, -, +, _ or a . (full stop). Characters other than these will be removed or replaced when the project is validated. Spaces are replaced by underscores.
- Resolve:** Fill in source details by searching for the entered source name in SIMBAD or NED. SIMBAD is checked first and then NED if no match was found. Check the details very carefully! Note that the so-called IAU format e.g. B02184+357, is no longer allowed - an acronym must be placed before the coordinates e.g. JVAS B0218+357.
- Choose a Solar System Object:** A number of solar system objects are recognised by the telescope control system and can be selected here. It is also possible to enter an ephemeris for any non-sideral source. The source coordinates and velocity definitions are not displayed if a solar system object is selected as the system that controls the observations has detailed ephemeris information for each object.
 - Name of Object:** Recognised objects are:
 - Stars: The Sun. This is a special target as it requires that an ephemeris be entered. This can be generated using the Solar Ephemeris Tool that is located within the Science Portal.
 - Planets: Mercury, Venus, Mars, Jupiter, Saturn, Uranus and Neptune.
 - Satellites: The Moon, Ganymede, Callisto, Io and Titan.
 - Dwarf planets: Pluto and Ceres.
 - Asteroids: Pallas, Juno and Vesta.
 - Ephemeris: Load a JPL HORIZONS format ephemeris^{5.1}. The source name will be extracted from the ephemeris and inserted into the appropriate field.
- Source Coordinates:** Note that these fields do not appear for solar-system objects.
 - System:** Only ICRS or Galactic should be chosen. ICRS is effectively the only system that is supported by the telescope control system and all calibrator positions are measured within this frame. This means that even if FKS were selected, the position will be interpreted as ICRS and the output image will be in this coordinate system. Given that all ALMA observations are implicitly made in the ICRS frame, the OT will simply change an FKS label to ICRS during SB generation. The coordinates will not be transformed, but this is not a problem as the offset between ICRS and FKS is so small (tens of mas). Therefore, the source may not appear at the expected location within the image, but the image coordinate axes will be correct. Any offset would in any case only be noticeable for very high angular resolution observations. If Galactic coordinates are entered, these will be properly converted to ICRS as part of SB generation.
 - Sexagesimal display:** ICRS (and FKS) coordinates will be displayed in sexagesimal format if this is ticked (default). Unticking this will allow input in degrees for these systems.

Release Notes

- Lists changes in each release - available from Help menu



The screenshot shows a window titled "About the ALMA Observing Tool". The main content area is titled "ALMA OT Release Notes for Cycle-7 Phase-1 release". Below this title, it states "The most important changes to the OT since the last release are:" followed by a numbered list of 21 items. The list includes changes to investigator names, PDF font sizes, polarization detection limits, image caching, spectral windows, solar observations, pointing coordinates, Walsh switching, spectral window warnings, backend filter options, 12-m configurations, receiver temperatures, LAS limits, ACA time multipliers, solar project time, observing procedure, C43-5 and C43-6 cycle times, 2-D synthesized beam, data rate, and project submission. Below the first list, there is a section for "ALMA OT Release Notes for Cycle-6 Phase-2 release" with the text "The most important changes to the OT since the last release are:" followed by a numbered list of 4 items. The list includes changes to TP SBs, TP sensitivity goal calculation, amplitude-calibration SBs, and Check Source scheduling. At the bottom of the window, there are buttons for "About ALMA", "About the OT", "Release Notes", "Acknowledgements", "Credits", "License", "Version", and "Close".

ALMA OT Release Notes for Cycle-7 Phase-1 release

The most important changes to the OT since the last release are:

1. Investigator names are shown in a randomised order on the proposal cover sheet without specific identification of the PI.
2. The fontsize of the PDF containing the scientific justification is checked. If >15% of the text is smaller than 12 point a warning is issued.
3. The limits for detection of linear polarization have been unified to be 0.1% under all circumstances.
4. Images downloaded using the spatial visualiser are now cached for future use.
5. Spectral windows can be defined for Band-5 setups in the overlap region with Band 4 (158-163 GHz).
6. Solar observations can now request Band 7.
7. It is no longer possible to use absolute coordinates for pointing positions for solar observations.
8. Walsh switching will be activated by default for a spectral-line setup where the first spw is assigned a bandwidth of 1875 or 2000 MHz.
9. The OT will warn if any spectral windows are within 30 MHz of the baseband edge. These are likely to suffer from increased noise and/or poorer calibration.
10. The Spectral Line Picker now includes three options for the backend filter: no filtering, showing those lines that could possibly be observed given the current setup and only those which fall into the currently defined spws. Both the min and max values of the energy filter can now be set.
11. All 12-m configurations are now available at Band 7. The OT will check for a potential phase calibrator (bright enough and within 5 degrees) and if not will make the Science Goal non-standard and issue a warning that special calibration techniques might be needed.
12. The receiver temperatures have been updated for most receivers and correspond to actual measured values.
13. A specific LAS limit has been placed on circular polarization setups, <1/10 of the antenna beamsize.
14. The ACA time multipliers are now applied to the on-source time, not to the total time (including calibration and overheads) as in previous cycles. The TP time will now be quantised by the minimum time needed to complete a single raster.
15. For solar projects, the on-source time should now be entered and the OT will return total estimated observing time (plus calibration and overheads).
16. The observing procedure for spectral scans has been changed such that each source is observed at each tuning before moving to the next. This greatly reduces the number of pointing calibrations and makes the observations more efficient.
17. C43-5 and C43-6 now use shorter phase-calibrator cycle times, but not as short as those used for long-baseline setups (C43-7 and greater). If multiple configurations are possible, the OT will assume that the largest will be used (shortest cycle time).
18. The 2-D nominal synthesized beam is shown in the time-estimate dialogue, along with the maximum expected beam axial ratio.
19. The data rate of the ACA observations is also checked that it stays within the allowed limits.
20. Attempts to submit or save a project which were originally created with an older version of the OT must now be confirmed.
21. It is now possible to search the Project Tree according to a vast range of criteria. Extensive help is provided. It is expected to be most useful for searching projects with large numbers of SBs.

ALMA OT Release Notes for Cycle-6 Phase-2 release

The most important changes to the OT since the last release are:

1. TP SBs that require multiple sources should now be dealt with properly. The observation time per SB should never exceed ~40 mins and sources will be split into multiple TP SBs if necessary to respect the 40-min limit.
2. The calculation of the TP sensitivity goal now includes a factor due to observing the OFF position. Various bugs in the calculation of the SB sensitivity goal have also been fixed.
3. Amplitude-calibration SBs are no longer generated except for Bands 5 and 8.
4. The decision on whether to schedule a Check Source has been changed such that this is done if either of the min or max angular resolution values in the SB are less than 0.25 arcsec. This was originally done to ensure that projects that ask for a range of angular resolution will get a Check Source if one might be needed.

Buttons: About ALMA, About the OT, **Release Notes**, Acknowledgements, Credits, License, Version, Close

Known Issues page

Known Issues

Known Issues affecting the Cycle 7 release of the ALMA Observing Tool

The following table lists those issues which are known to affect the Cycle 7 version of the Observing Tool. This will be updated to denote whether an issue has been fixed and whether this fix has made it into an updated release.

| Issue | Description | Resolved? | Deployed? |
|--------|---|-----------|-----------|
| C1_032 | Leaving the OT open for days at a time can cause an error upon saving. Saving to another file, closing the OT and re-opening produces a "ZLIB input stream" error i.e. the project is unreadable. This issue is yet to be satisfactorily characterised. | | |
| C2_009 | Placing spectral windows that are exactly as far apart as they can possibly be can cause an error, the text of which is also misleading. | | |
| C6_001 | The OT's mosaicing algorithm will not allow an even number of pointings along a single row. A custom mosaic may be used instead. | | |
| C7_001 | Band-9 with C43-7 and Walsh is restricted to no more than 122 pointings per Science Goal | | |
| C7_002 | Average data rates and volumes are incorrect for solar projects | | |
| C7_003 | The OT is assuming that each TP SB will observe the maximum allowed amount of on-source time (40 minutes) | | |

Gets update during the Call for Proposals if new issues are found

<https://almascience.eso.org/proposing/observing-tool/documents-and-tools/cycle7/known-issues>

Phase 2

- Successful PIs must submit their Phase-2 Science Goals
 - Identical to Phase-1 SGs, but in a different tab of the OT
 - Last chance to get details right!
- Scheduling Blocks are generated automatically
 - PIs don't need to worry about these – very complicated!

