

The ALMA Observing Tool in Cycle 5

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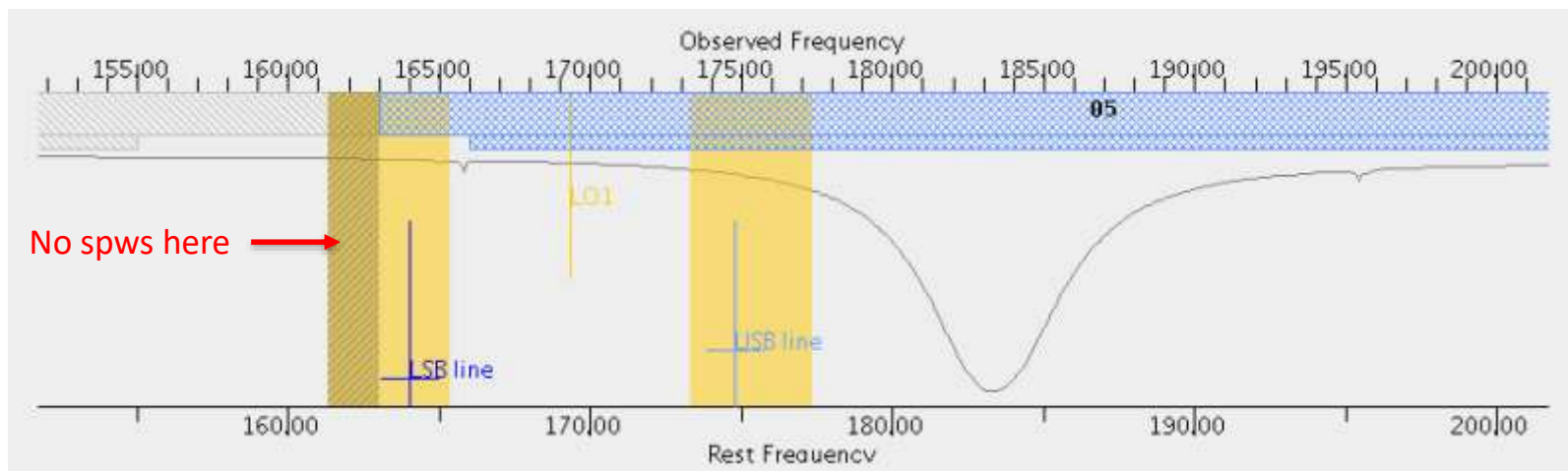
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Introduction

- New ALMA capabilities
 - Band 5
 - Polarization in Bands 4 and 5
 - 90-degree Walsh switching
- OT enhancements
 - New angular-resolution options
 - Overlaid lines are saved
 - Rest frequencies can be defined
 - Default spectral averaging (N=2)
 - Visual editors shown by default
 - New web-based Sensitivity Calculator
- Bug fixes

Band 5

Lower Sideband is allowed to go into Band 4 – lowest frequency = 158 GHz
Avoid increased noise in USB from H₂O line!



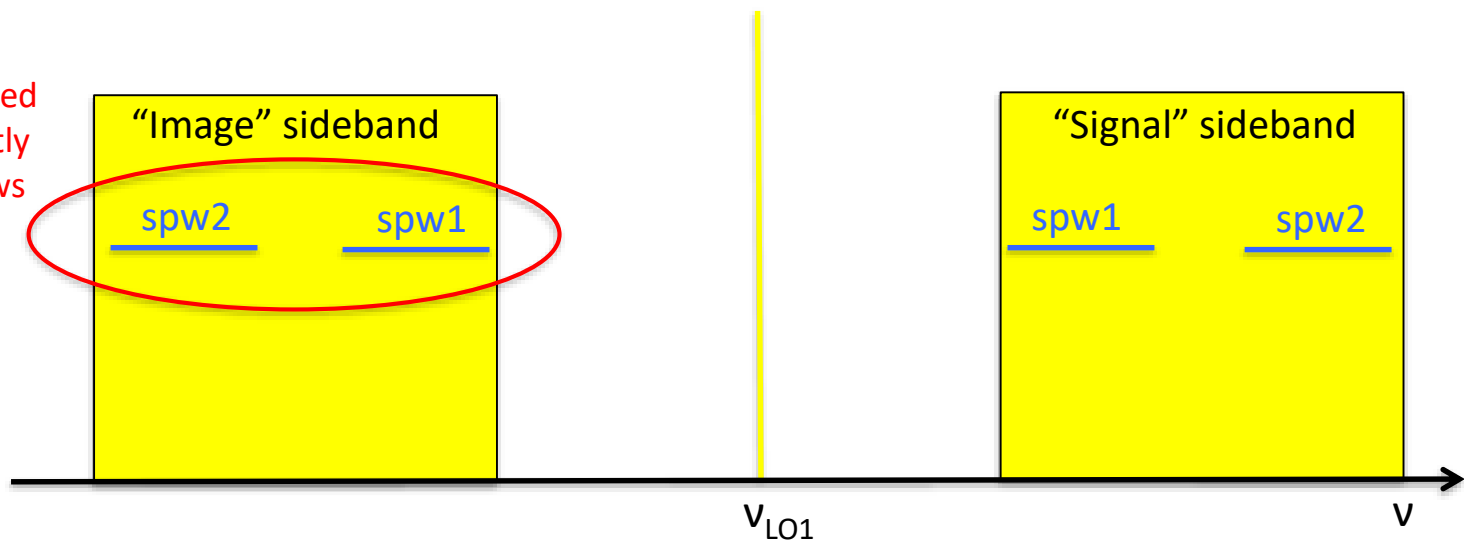
Can't define spectral windows (spw) in Band 4 (dark shading of LSB)

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 allows both to be recovered in Cycle 5

Can't be placed
independently
of signal spws



90-Degree Walsh switching

Used automatically for single continuum – bandwidth = 15 GHz!!!
Must be activated manually for “Spectral Line”

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

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"/>

Baseband-2

1(Full)	1860.07821 GHz	620.00000 GHz	Test	1875.000 MHz(907 km/s), 1.129 MHz(0.546 km/s)	2	<input checked="" type="checkbox"/>	<input type="radio"/>
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Don't have to keep all image spws (data rate)

Default spectral averaging

All FDM spws will automatically use N=2 in Cycle 5

Degrades spectral resolution by only 15%, but halves data rate (**max = 66 MB/s**)

The screenshot shows the 'Spectral Type' and 'Spectral Line' configuration panels. The 'Spectral Type' panel has radio buttons for 'Spectral Line' (selected), 'Single Continuum', and 'Spectral Scan'. Below it are checkboxes for 'Produce image sidebands (Bands 9 and 10 only)' and 'Polarization products desired' with radio buttons for 'XX', 'DUAL' (selected), and 'FULL'. The 'Spectral Line' panel contains a table for 'Baseband-1' and 'Baseband-2'. The 'Baseband-1' table has a red box around the 'Spec. Avg.' column value '2'. The 'Baseband-2' table has a red box around a dropdown menu. Below the tables are 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'.

Can set N=1 manually

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="checkbox"/>
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="checkbox"/>

Angular-resolution interface

Two new options:

- `Range` – short- (C43-1 to C43-6) or long-baseline (C43-7+) configurations only
- `Any` – any `short-baseline` configuration – LAS **must** be zero
- Stand-alone ACA – no longer selected using angular resolution

Control and Performance

Configuration Information

Antenna Beamsize ($1.13 * \lambda / D$) 12m 7m

Number of Antennas 12m 7m TP

	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="5.640 arcsec"/>	<input type="text" value="1.508 arcsec"/>	<input type="text" value="0.019 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="28.549 arcsec"/>	<input type="text" value="13.130 arcsec"/>	<input type="text" value="0.213 arcsec"/>

Desired Performance

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

arcsec to arcsec

Largest Angular Structure in source arcsec

Desired sensitivity per pointing mK equivalent to @ 1.03 "

will provide @ 1.50 "

Bandwidth used for Sensitivity Frequency Width

Science goal integration time estimate

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

Are the observations time-constrained? Yes No

Angular-resolution interface

Three new options:

- `Range`
- `Any` – any `short-baseline` configuration (C43-1 to C43-6)
- Stand-alone ACA – no longer selected using angular resolution

The screenshot displays the 'Control and Performance' window of the Cycle-5 ALMA Observing Tool. It is divided into two main sections: 'Configuration Information' and 'Desired Performance'.

Configuration Information:

Parameter	12m	7m	TP
Antenna Beamsize ($1.13 \cdot \lambda / D$)	58.227 arcsec	99.818 arcsec	
Number of Antennas	43	10	3
Longest baseline	0.049 km	0.161 km	16.197 km
Synthesized beamsize	12.505 arcsec	3.383 arcsec	0.042 arcsec
Shortest baseline	0.009 km	0.015 km	0.256 km
Maximum recoverable scale	66.647 arcsec	28.530 arcsec	0.496 arcsec

Desired Performance:

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

0.31000 arcsec to 3.00000 arcsec

Largest Angular Structure in source: 25.00000 arcsec

Desired sensitivity per pointing: 0.10000 K equivalent to 1.6378 mJy @ 1.41" will provide 22.248 mK @ 3.00"

Bandwidth used for Sensitivity: RepresentativeWindowResolution Frequency Width 1.128906 MHz

Science goal integration time estimate: Time Estimate

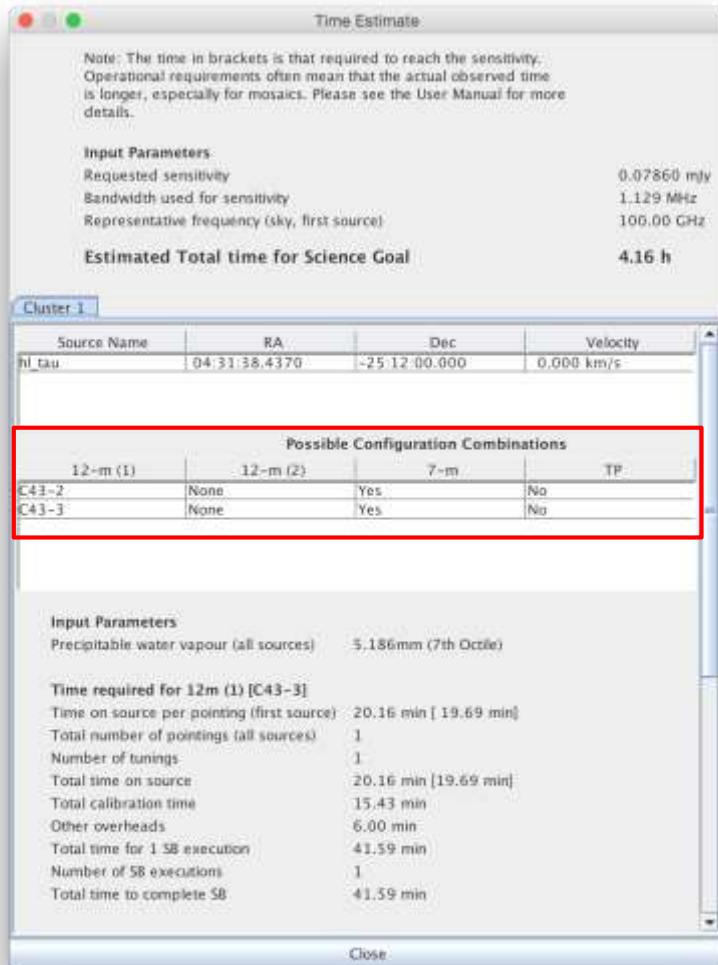
Override OT's sensitivity-based time estimate (must be justified): Yes No

Are the observations time-constrained?: Yes No

Sensitivity in K:

- $\text{Time} \propto \text{AR}^{-2}$
- Time estimate uses largest configuration (longest time)
- Kelvin sensitivity also shown for this time with largest-requested AR

Angular-resolution interface



List of possible configuration combinations is shown in the time-estimate dialogue

IMPORTANT!

Only those possibilities requiring the least number of configurations might be observed

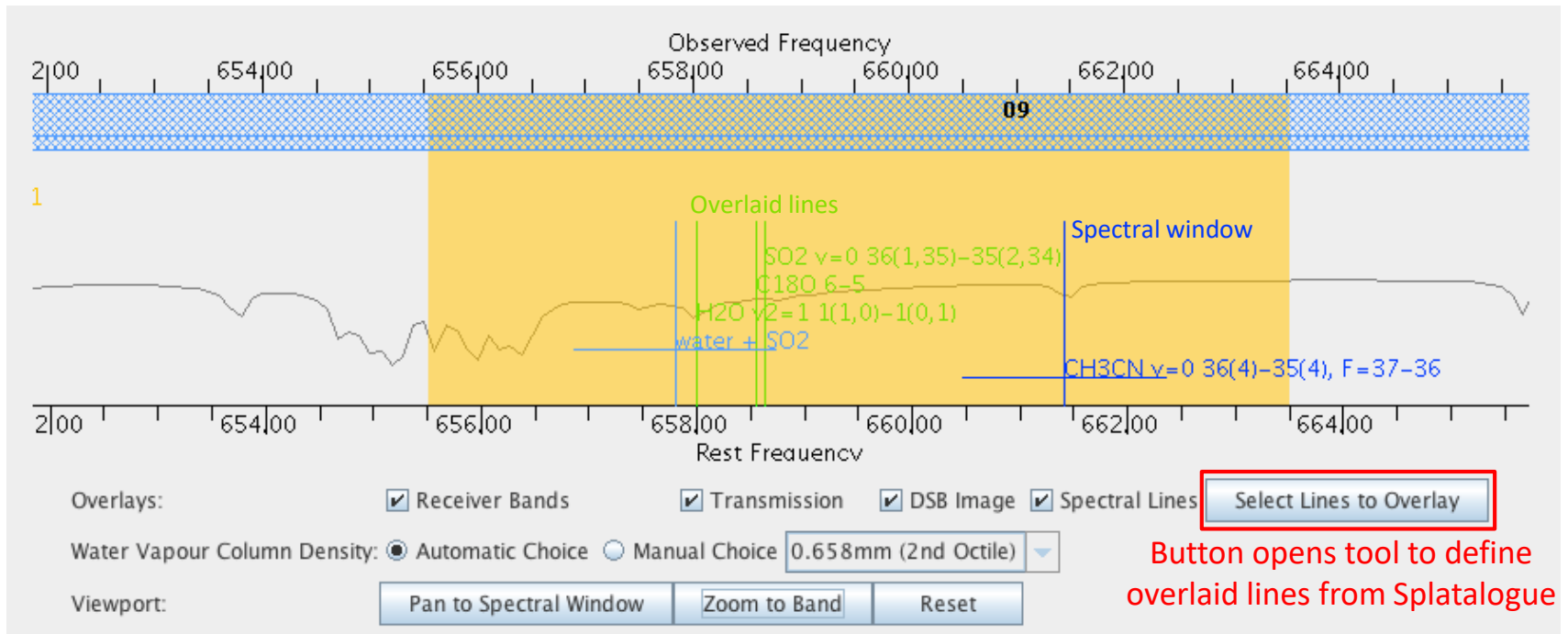
e.g.

C43-1

C43-2

~~C43-3 and 7-m array~~

Overlaid lines



Button opens tool to define overlaid lines from Splatalogue

Overlaid lines are now saved and appear automatically when the project is re-opened

Rest frequencies

New panel on Spectral Scan node of Science Goal

The screenshot displays the ALMA Observing Tool (Cycle5) interface. The main window is titled "ALMA Observing Tool (Cycle5) (C) - 4" and shows the "Spectral Setup" panel for a "Science Goal".

The "Spectral Setup" panel is divided into three sections for different basebands:

- Baseband-2:** LFSR: 561.40883 GHz, 561.44181 GHz, CH1 Ch width: 3418.1510, F: 1875.000 MHz, 850 km/s, 976.563 km/s, 0.443 km/s.
- Baseband-5:** LFSR: 562.26653 GHz, 561.00000 GHz, Continuum, 1875.000 MHz, 848 km/s, 1.128 MHz, 9.510 km/s.
- Baseband-4:** (Empty)

Each section has buttons for "Add spectral window centered on a spectral line", "Add spectral window manually", "Delete", and "Show image spectral windows".

Below the baseband sections is the "Representative Frequency" section, which includes a text description and a dropdown menu set to "857.80000 GHz".

A new section, "Rest Frequencies", is highlighted with a red box. It contains the following text: "Please set the rest frequencies of spectral lines that will be observed. These will be used during data reduction to set the velocity scale and will enhance the ALMA Science Archive. We recommend that this be done once the spectral setup is fully defined." Below this text is a button labeled "Define Rest Frequencies".

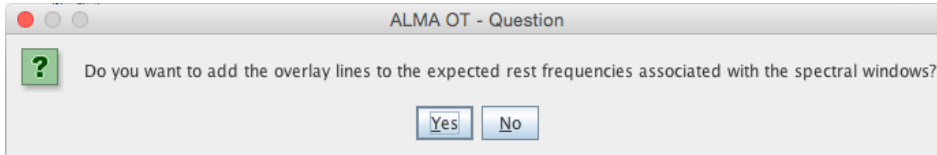
At the bottom of the interface is the "Feedback" section, which shows 4 errors and 2 warnings. The errors are:

- Two document issues - you must add a Science Case to your proposal.
- Could not contact the ALMA user database to confirm investigator details.
- Non-standard observing mode identified.
- The sensitivity justification must be at least 511 characters long.
- The justification of correlator setup must be at least 50 characters long.
- The imaging justification must be at least 50 characters long.

The suggestions for these errors are:

- Select the proposal node in the Proposal tab and add your document.
- Please check your network connection. If the problem persists, please contact ALMA support.
- One of band 6, 9 or 10 has been selected.
- Select the Science Goal's Technical justification node in the Proposal tab and edit the text.
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Rest frequencies



Overlaid lines inside spws will be added automatically

Rest-frequency list can be edited using the Rest-frequency Spectral Line Picker

Transitions used to define spws are also added automatically

The screenshot shows the 'Rest Frequency Picker' software interface. On the left, there are various filter and configuration options. The main area displays a list of transitions with columns for Transition, Description, Rest Frequency, Spw Frequency, Upper-class Energy, Lower Energy, and Class. A table at the bottom, titled 'Selected Transitions', shows a subset of these transitions with columns for Transition, Description, Rest Frequency, and My Priority.

Transition	Description	Rest Frequency	My Priority
OH16 v=1 13.12-13.11	OH16 v=1 13.12-13.11	843.85848 GHz	1
OH16 v=1 13.12-13.10	OH16 v=1 13.12-13.10	843.85848 GHz	1
OH16 v=1 13.12-13.09	OH16 v=1 13.12-13.09	843.85848 GHz	1
OH16 v=1 13.12-13.08	OH16 v=1 13.12-13.08	843.85848 GHz	1
OH16 v=1 13.12-13.07	OH16 v=1 13.12-13.07	843.85848 GHz	1
OH16 v=1 13.12-13.06	OH16 v=1 13.12-13.06	843.85848 GHz	1
OH16 v=1 13.12-13.05	OH16 v=1 13.12-13.05	843.85848 GHz	1
OH16 v=1 13.12-13.04	OH16 v=1 13.12-13.04	843.85848 GHz	1
OH16 v=1 13.12-13.03	OH16 v=1 13.12-13.03	843.85848 GHz	1
OH16 v=1 13.12-13.02	OH16 v=1 13.12-13.02	843.85848 GHz	1
OH16 v=1 13.12-13.01	OH16 v=1 13.12-13.01	843.85848 GHz	1

Resubmission of previous proposals

It is no longer necessary to indicate if your proposal is a resubmission – the observatory will identify these automatically

Scientific Category

Cosmology and the High Redshift Universe Galaxies and Galactic Nuclei ISM, star formation and astrochemistry

Circumstellar disks, exoplanets and the solar system Stellar Evolution and the Sun

Keywords (max. 2 keywords)

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

Student project ~~Resubmission of 2015.1.00001.5~~

New web-based Sensitivity Calculator

Previous NPAPI Java applet increasingly unsupported by browsers

Common Parameters

Declination: 00:00:00.00 ✓

Polarisation: Dual

Observing Frequency: 345 GHz

Bandwidth per Polarization: 7.500000 GHz

Water Vapour: Automatic Choice Manual Choice

Column Density: 0.913mm (3rd Octile)

Tr_ν, τ_ν, T_{sky}: 75 K, 0.108, 39.936 K

T_{sys}: 157.027 K

Individual Parameters

	12 m Array	7 m Array	Total Power Array
Number of Antennas	43 ✓	10 ✓	3 ✓
Resolution	0 ✓ arcsec	0 ✓ arcsec	16.9 ✓ arcsec
Sensitivity (rms)	197.67559092477822 ✓ mJy	2.4826852653365648 ✓ mJy	4.85010688201950 ✓ mJy
Equivalent to	Unknown K	Unknown K	0.174 mK
Integration Time	60 ✓ s	60 ✓ s	60 ✓ s

Integration Time Unit Option: Automatic

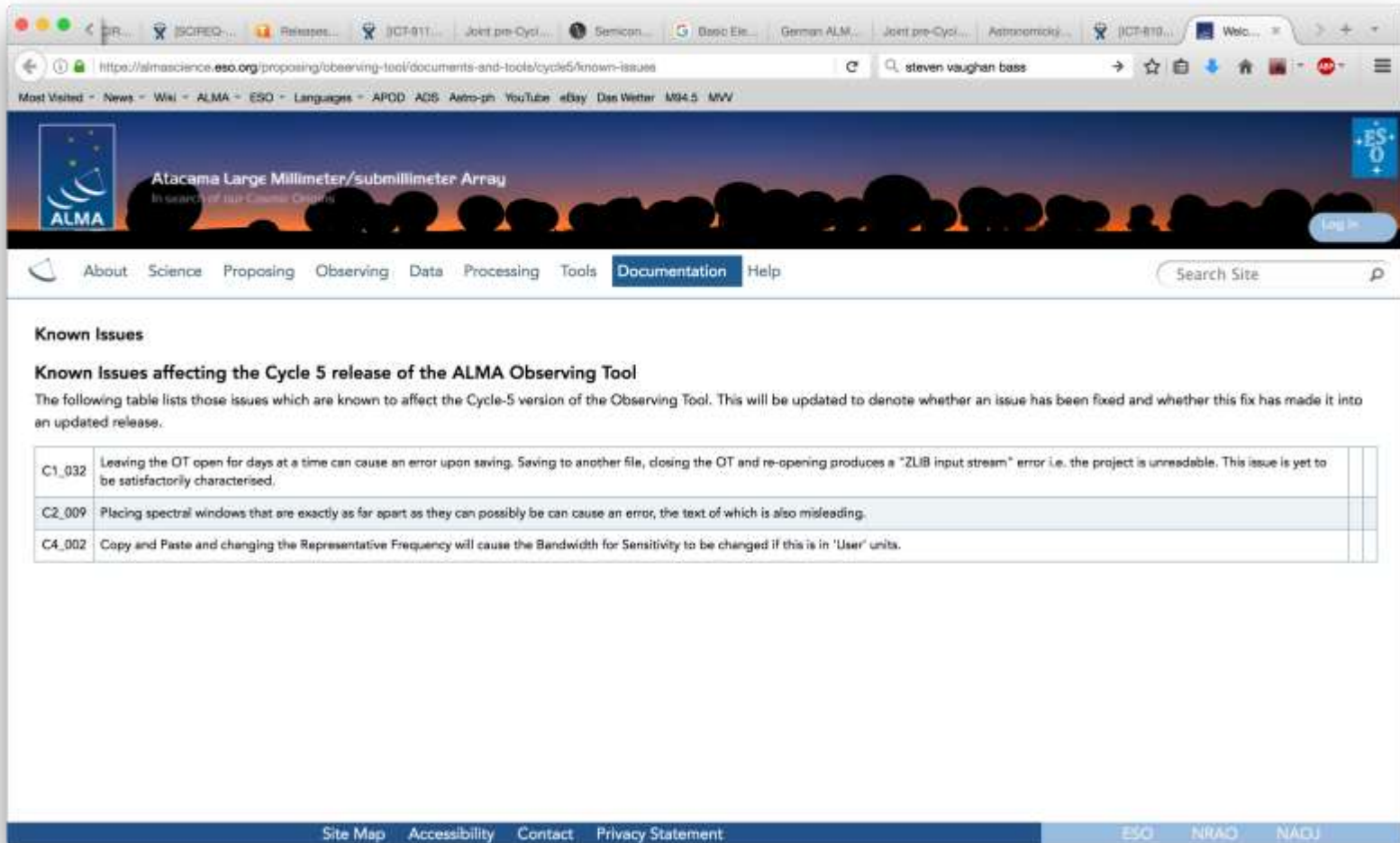
Sensitivity Unit Option: Automatic

Calculate Integration Time

Calculate Sensitivity

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

Known Issues page



The screenshot shows a web browser window displaying the 'Known Issues' page on the ALMA science website. The browser's address bar shows the URL: <https://almascience.eso.org/proposing/observing-tool/documents-and-tools/cycle5/known-issues>. The page header includes the ALMA logo and the text 'Atacama Large Millimeter/submillimeter Array'. The navigation menu includes 'About', 'Science', 'Proposing', 'Observing', 'Data', 'Processing', 'Tools', 'Documentation', and 'Help'. A search bar is located on the right side of the navigation menu.

Known Issues

Known Issues affecting the Cycle 5 release of the ALMA Observing Tool

The following table lists those issues which are known to affect the Cycle-5 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.

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.		
C4_002	Copy and Paste and changing the Representative Frequency will cause the Bandwidth for Sensitivity to be changed if this is in 'User' units.		

The footer of the page contains links for 'Site Map', 'Accessibility', 'Contact', and 'Privacy Statement', along with logos for 'ESO', 'NRAO', and 'NAOJ'.

<https://almascience.eso.org/proposing/observing-tool/documents-and-tools/cycle5/known-issues>