The ALMA Observing Tool for Cycle1: What's New?

Alan Bridger

UK Astronomy Technology Centre/STFC

New and modified features

Both newly available *ALMA* features and OT changes

- Multiple Region correlator modes
- Different handling of Representative Frequency
- New Spectral Setup interface
- Inclusion of Atacama Compact Array
- Submission improvements
- Various other improvements and bug fixes.

Disclaimer: Work is ongoing and subject to change!

Multiple Region correlator modes

- Previously it was only possible to define one spectral window per baseband
  - ALMA provides 4 x 2 GHz-wide basebands (x2pol)
  - 62.5 – 2 GHz-wide spectral windows placed within the basebands
  - 14 modes were allowed at Cycle 0
- Cycle 1 will allow multiple spectral windows per baseband
  - But they must all be the same resolution/channel spacing
  - (they are basically one mode split into multiple regions)

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Multiple Region modes in the OT

- Select a mode from drop-down list
- Change fraction from “1(full)” to ½, ¼, etc.
  - This changes the choices in the drop-down list
- Sum of fractions must be ≤ 1 per baseband
  - Not all of original mode needs to be used!
- Channel spacing (resolution) must be the same
  - A project will not validate otherwise

Fraction	Center Freq Rest	Center Freq Sky	Transition	Bandwidth,Channel Spacing
1/2	330.12000 GHz	330.12000 GHz		468.750 MHz(426 km/s), 244.141 kHz(0.222 km/s)
1/4	330.43000 GHz	330.43000 GHz		234.375 MHz(213 km/s), 244.141 kHz(0.222 km/s)
1/4	330.80000 GHz	330.80000 GHz		234.375 MHz(212 km/s), 244.141 kHz(0.221 km/s)

Select Lines to Observe... | Add | Delete

Multiple Region correlator modes

Channel spacing

Bandwidth	488 kHz	244 kHz	122 kHz	61 kHz	30 kHz	15 kHz
2 GHz	1					
1 GHz	2	1				
500 MHz	2	2	1			
250 MHz	2	2	2	1		
125 MHz	2	2	2	2	1	
62.5 MHz	2	2	2	2	2	1

Modes available from Cycle 1, for dual polarization operation

Fraction = 1

Multiple Region correlator modes

	488 kHz	244 kHz	122 kHz	61 kHz	30 kHz	15 kHz
2 GHz	1					
1 GHz	2	1				
500 MHz	2	2	1			
250 MHz	2	2	2	1		
125 MHz	2	2	2	2	1	
62.5 MHz	2	2	2	2	2	1

Modes available from Cycle 1, for dual polarization operation

Fraction = ½

Multiple Region correlator modes

	488 kHz	244 kHz	122 kHz	61 kHz	30 kHz	15 kHz
2 GHz	1					
1 GHz	2	1				
500 MHz	2	2	1			
250 MHz	2	2	2	1		
125 MHz	2	2	2	2	1	
62.5 MHz	2	2	2	2	2	1

Modes available from Cycle 1, for dual polarization operation

Fraction = ¼

Multiple Region correlator modes

	488 kHz	244 kHz	122 kHz	61 kHz	30 kHz	15 kHz
2 GHz	1					
1 GHz	2	1				
500 MHz	2	2	1			
250 MHz	2	2	2	1		
125 MHz	2	2	2	2	1	
62.5 MHz	2	2	2	2	2	1

Modes available from Cycle 1, for dual polarization operation

Fraction = ⅛

Multiple Region correlator modes

	488 kHz	244 kHz	122 kHz	61 kHz	30 kHz	15 kHz
2 GHz	1					
1 GHz	2	1				
500 MHz	2	2	1			
250 MHz	2	2	2	1		
125 MHz	2	2	2	2	1	
62.5 MHz	2	2	2	2	2	1

Modes available from Cycle 1, for dual polarization operation

Fraction = 1/16

Multiple Region correlator modes

	488 kHz	244 kHz	122 kHz	61 kHz	30 kHz	15 kHz
2 GHz	1					
1 GHz	2	1				
500 MHz	2	2	1			
250 MHz	2	2	2	1		
125 MHz	2	2	2	2	1	
62.5 MHz	2	2	2	2	2	1

Modes available from Cycle 1, for dual polarization operation

Fraction = 1/32

Independent basebands

- At Cycle 0, each spectral window had to be identical
  - Same bandwidth and channel spacing for each
- Cycle 1 removes this restriction
  - Each baseband is processed by a separate quadrant
- Each baseband can
  - Have different numbers of spectral windows
  - Have different channel spacings
  - Use a TDM or a FDM mode

Representative Frequency

- Issues with this at Cycle 0
- User can now choose which spectral window to use
  - Defaults to centre frequency as before
  - Value can be changed within window limits
  - All this is done on Spectral Setup page
    - Not on Control & Performance

Representative Frequency

- RF is used to:
  - Calculate sensitivity (opacity, resolution, receiver temperature, etc.)
  - Display antenna beam pattern
  - PWV content required influences scheduling
- It is entered by the user as a REST frequency
  - Converted to observed frequency for each source
    - These numbers are also displayed by the OT
- Improved handling of PWV reduces need to shift RF
  - OT chooses PWV octile based on time estimate and RF, not receiver band.

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New Spectral Setup interface

- Used to have 2 spectral line choices:
  - "up to 4" and ">4" spectral windows
- Merged into a single interface
  - Less confusing for the user
- Other improvements
  - Better textual guidance
  - All spectral windows visible at once
  - Which spectral window sets the representative frequency immediately clear
  - Spectral line catalogue filtering is aware of basebands

Spectral Type

Spectral Type: Choose the type of spectral observation you wish to make

- (●) Spectral line
- ( ) Single continuum (average frequency)
- ( ) Spectral scan

Polarization Products desired: ( ) SINGLE-X (●) DUAL

Spectral line

Baseband-0

Fraction	Center Freq (Rest)	Center Freq (Sky)	Transition	Bandwidth, Channel Spacing	Representative Window
1(Full)	233.00000 GHz	233.00000 GHz		117.188 MHz(151 km/s), 30.518 kHz(0.039 km/s)	( )

Select Lines to Observe in Baseband-0... | Add | Delete

Baseband-1

1/2	232.68670 GHz	232.68670 GHz	H2Ov2=1 5(5,0)-6(4,3)	468.750 MHz(604 km/s), 244.141 kHz(0.315 km/s)	( )
1/4	231.22069 GHz	231.22069 GHz	13CS v=0 5-4	234.375 MHz(304 km/s), 244.141 kHz(0.317 km/s)	(●)
1/8	231.75678 GHz	231.75678 GHz	CH2CHCN v=0 26(0,2...	117.1[illegible] 1 kHz(0.316 km/s)	( )
1/16	231.95233 GHz	231.95233 GHz	CH2CHCN v=0 24(2,2...	58.594 MHz(76 km/s), 244.141 kHz(0.316 km/s)	( )

Select Lines to Observe in Baseband-1... | Ac

Baseband-2

1/2	218.39856 GHz	218.39856 GHz	CH2CHCN v=0 23(7,1...	117.188 MHz(161 km/s), 61.035 kHz(0.084 km/s)	( )
1/4	218.40244 GHz	218.40244 GHz	CH2CHCN v=0 23(6,1...	58.594 MHz(80 km/s), 61.035 kHz(0.084 km/s)	( )
1/4	218.40245 GHz	218.40245 GHz	CH2CHCN v=0 23(6,1...	58.594 MHz(80 km/s), 61.035 kHz(0.084 km/s)	( )

Select Lines to Observe in Baseband-2... | Add | Delete

Baseband-3

1/2	218.86063 GHz	218.86063 GHz	HC3Nv7=1 J=24-23	117.188 MHz(161 km/s), 61.035 kHz(0.084 km/s)	( )
1/2	219.94944 GHz	219.94944 GHz	SO3Σ v=0 6(5)-5(4)	117.188 MHz(160 km/s), 61.035 kHz(0.083 km/s)	( )

Select Lines to Observe in Baseband-3... | Add | Delete

Representative Frequency

The representative frequency is used in conjunction with the sensitivity entered on the 'Control and Performance' page to estimate the required observing time and to set the size of the antenna beam shown in the 'Spatial Visual' editor. If the transition you are most interested in does not fall in the centre of the chosen spectral window, its frequency can be changed here. The sky equivalents of the representative frequency are shown in the targets table below.

231.22069 GHz

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Atacama Compact Array (ACA)

- Available for the first time
  - 9 7-m antennas seems likely, plus 1-2 Total Power (Zero Spacing)
- Spatial Visual Editor will show ACA antenna beams and TP OTF map
- ACA and ALMA will share the same Spectral Setup
- There is an "ACA necessity calculator"
  - Answer will depend on Largest Angular Scale and angular resolution
- User can still explicitly (de-)select ACA regardless
  - This choice will be noted for TA purposes
  - *No choice over the sensitivity goals for ACA*

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Miscellaneous

- Better (more efficient) mosaicing algorithm
- Displayed opacity curve can be changed (illustration only)
- Flag sheet for TA – notes “interesting” choices
- Better time estimates (inc. overheads)
- Various changes to submission:
  - Particularly improved (faster) querys
  - …but some others, including you cannot change PI after first submission
- More antennas, more configurations
- Changes to limits, e.g. more pointings allowed
- Various documentation updates
  - Manuals, guides, videos

Summary

- There are many changes in the Cycle 1 OT
- But it is evolution, not revolution
- Just entering final testing
- Testing may lead to further (small) changes
- Available from 31 May in the Science Portal

Questions?

www.almaobservatory.org

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI) and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.