ALMA Cycle 10 – new capabilities

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Cycle 10

- Timeline:
  - Call for Proposals: **12 April 2023**
  - Proposal submission deadline: **10 May 2023**
  - Deadline for Distributed Peer Review (DPR): **28 June 2023**
  - ALMA Proposal Review Committee (APRC): **10 July 2023**
  - Notifications to PIs: **August 2023**

Cycle 10

- Antenna configurations **C-1 to C-8**, with maximum baselines between 0.16 km and 8.5 km, schedule:
  - 1 Oct. 2023: C-8, going to C-3 by the Feb. 2024 shutdown
  - 1 Mar. 2024: C-1 going to C-6 in Jun. 2024, ending with C-3 in Sep. 2024

Cycle 10 new capabilities

- The following new technical capabilities are available in Cycle 10:
  - **Band 1** on the 12m array – Stokes I only (no polarization - Q/U/V)
  - **Spectral Scans** including **Total Power** observations
  - **4x4-bit spectral modes** – improved sensitivity on 12m array for dual-polarization
  - **Solar** observations in **full polarization for Band 3** using the 12m array
  - **Phased array** modes in **Band 1, 3, 6 and 7**
  - **VLBI in Band 1, 3, 6 and 7** (including flexible tuning)
  - **Band-to-Band** mode is possible for all High Frequency (Bands 7, 8, 9 and 10) with the **ACA and 12m array**
  - **Joint Proposals** with JWST, VLA and VLT/I

Band 1

- Band 1 on the 12m array – Stokes I only (no polarization – Q/U/V):
  - Only available from March 2024
  - Configurations **C-1** to **C-6**
  - Band 1 observations possible in day-time

Start date	Config	Longest baseline	LST: Best conditions
1-Oct-23	C-8	8.5 km	22-10
20-Oct-23	C-7	3.6 km	23-11
10-Nov-23	C-6	2.5 km	1-13
1-Dec-23	C-5	1.4 km	2-14
20-Dec-23	C-4	0.78 km	4-15
10-Jan-24	C-3	0.50 km	5-17
1-Feb-24	No observations due to maintenance		
1-Mar-24	C-1	0.16 km	8-21
26-Mar-24	C-2	0.31 km	9-23
20-Apr-24	C-3	0.50 km	11-0
10-May-24	C-4	0.78 km	12-2
31-May-24	C-5	1.4 km	13-4
23-Jun-24	C-6	2.5 km	15-6
28-Jul-24	C-5	1.4 km	17-7
18-Aug-24	C-4	0.78 km	19-8
10-Sep-24	C-3	0.50 km	20-9

TP Spectral Scans

- Spectral Scans including Total Power observations
  - Spectral scan can use the 12m, 7m arrays, and **Total Power** arrays combined, or ACA stand-alone
  - There are no more than 5 tunings per target (same band)
  - Only one pointing per target is allowed, no mosaics or offsets
  - Full polarization *cannot* be selected
  - Total power spectral scans are only permitted for Bands 1 and 3 to 8 (*not Bands 9 or 10*)

4x4-bit spectral modes

- 4x4-bit spectral modes – improved sensitivity on 12m array for dual-polarization
  - Increased sensitivity (~12%) for selected spectral line observations for the same time-on-source *(less time ~25% for same sensitivity)*

4x4 bit (less time)

Input Parameters

Requested sensitivity	2.500 mJy
Bandwidth used for sensitivity	0.195 MHz
Representative frequency (sky, first source)	229.991 GHz
Estimated Total time for Science Goal	**3.87 h**

Cluster 1

Source Name	RA	Dec	Velocity
TW_Hya	11:01:51.9053	-34:42:17.033	12.335 km/s

Possible Configuration Combinations

12-m (1)	12-m (2)	7-m	TP	Nominal Beam(")	Max expected axial ratio
C-5	C-2	No	No	0.232 x 0.246	1.5

Input Parameters

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

Time required for 12m (1) [C-5]

Time on source per pointing (first source)	1.08 h [1.07 h]
Total number of pointings (all sources)	1
Number of tunings	1
Total time on source	1.08 h [1.07 h]
Total calibration time	1.86 h
Other overheads	6.53 min
Total time for 1 SB execution	1.52 h
Number of SB executions	2
Total time to complete SB	3.05 h

Calibration Breakdown per SB execution

1 x Amplitude	2.50 min
2 x Bandpass	10.00 min
5 x Pointing	10.00 min
22 x Phase	11.00 min
4 x CheckSource	4.00 min
7 x Atmospheric	4.67 min
Calibration overheads	13.73 min

Additional Arrays

Time required for additional 12-m	49.60 min
Estimated total time for cluster 1	**3.87 h**

2x2 bit (standard)

Input Parameters

Requested sensitivity	2.500 mJy
Bandwidth used for sensitivity	0.195 MHz
Representative frequency (sky, first source)	
Estimated Total time for Science Goal	**4.48 h**

Cluster 1

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C-5	C-2	No	No	0.232 x 0.246	1.5

Input Parameters

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

Time required for 12m (1) [C-5]

Time on source per pointing (first source)	1.36 h [1.35 h]
Total number of pointings (all sources)	1
Number of tunings	1
Total time on source	1.36 h [1.35 h]
Total calibration time	2.07 h
Other overheads	7.38 min
Total time for 1 SB execution	1.78 h
Number of SB executions	2
Total time to complete SB	3.56 h

Calibration Breakdown per SB execution

1 x Amplitude	2.50 min
2 x Bandpass	10.00 min
5 x Pointing	10.00 min
28 x Phase	14.00 min
4 x CheckSource	4.00 min
8 x Atmospheric	5.33 min
Calibration overheads	16.33 min

Additional Arrays

Time required for additional 12-m	55.47 min
Estimated total time for cluster 1	**4.48 h**

4x4 bit (more sensitive)

Input Parameters

Requested sensitivity	2.230 mJy
Bandwidth used for sensitivity	0.195 MHz
Representative frequency (sky, first source)	229.991 GHz
Estimated Total time for Science Goal	**4.48 h**

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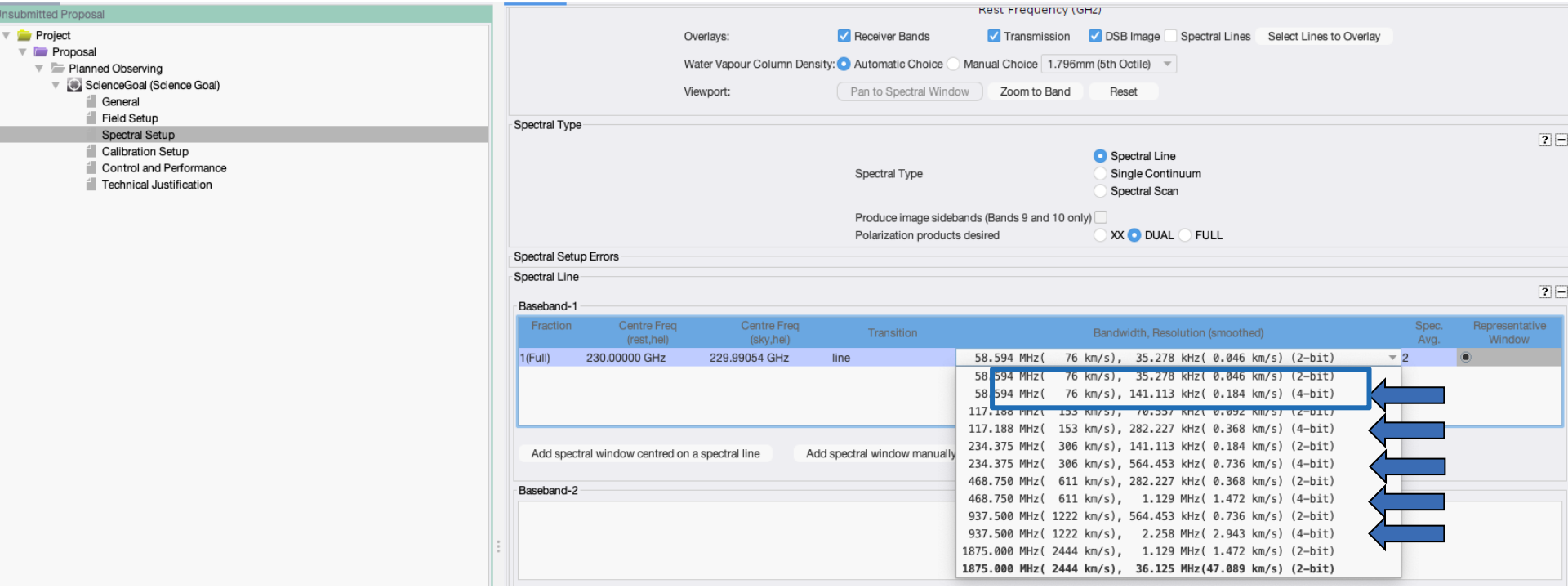
4x4-bit spectral modes

- 4x4-bit spectral modes – improved sensitivity on 12m array for dual-polarization
  - Number of channels are reduced per spectral window bandwidth (for correlator resources, not spectral averaging)
    - Or ‘less’ bandwidth for same spectral resolution setup



Solar – Full Polarization in Band 3

- Solar observation in full polarization for Band 3 using the 12m array
  - Configurations C-1 and C-4 are available at Band 3
  - Full polarization does *not* use the ACA (as per standard for other solar observations)
  - Observations are in continuum mode only
  - Total Power *are* taken in coordination with *all* 12m array observations but *only* in dual-polarization

VLBI and .P- Band 1, 3, 6, 7

- VLBI in Band 1, 3, 6 and 7
  - Band 1 and 3 are single baseband for VLBI mode
  - Band 6 and 7 flexible tuning but BW fixed to 1875MHz
  - Observations planned for March / April 2024
- Phased array modes in Band 1, 3, 6 and 7
  - For **Pulsar** observing capabilities, ALMA only, high time resolution
  - Maximum of 50 hours
  - Occurs during the period of VLBI time blocks
  - Not allowed in Large Programs

Extension of B2B to all configurations

- B2B mode is possible for all High Frequency (Band 7, 8, 9 and 10) with the ACA and 12m array
  - Automatically enabled for science goals without a suitable calibrator In-Band (*weak or distant*)
  - The OT searches the calibrator catalog at validation and provides a notification if B2B is required
  - Projects without a suitable calibrator cannot be submitted
  - Cap of 65h 12m array and 85h ACA

	ACA	C-1 & C-2	C-3 & C-4	C-5 & C-6	C-7	C-8
Band 7	15 degrees	12 degrees	11 degrees	10 degrees	7 degrees	6 degrees
Band 8	15 degrees	9 degrees	9 degrees	8 degrees	7 degrees	5 degrees
Band 9	10 degrees	9 degrees	8 degrees	7 degrees	6 degrees	4 degrees
Band 10	8 degrees	8 degrees	7 degrees	6 degrees	5 degrees	3 degrees

Joint proposals

- **ALMA Joint Proposals:** a “joint proposal” is a proposal that requests time on *two or more* separate observatories, but is submitted to a single observatory for scientific peer review.

	JWST	VLA	VLT
Max. ALMA can allocate on Partner Observatory	115 hr	5%	50 hr
Max. Partner Observatory can allocate on ALMA*	115 hr	50 hr	50 hr

* (per array)

Joint proposals

- **ALMA Joint Proposals:** a “joint proposal” is a proposal that requests time on *two or more* separate observatories, but is submitted to a single observatory for scientific peer review.

Warning: The same Joint Proposal cannot be submitted to multiple observatories, i.e., a submitted proposal cannot be under review by another observatory. Both ALMA and the partner observatories reserve the right to identify and reject such duplicate submissions.

ALMA as the Main Observatory

- The Main Observatory
  - is the leading facility, which has the ability to award observing time for the other observatories. Effectively, it is the observatory with the **most observing time.**
  - for ALMA: 12-m array time or 7-m array time if ACA-standalone proposal

- If ALMA is the Main Observatory, the proposal should be submitted to ALMA using the **ALMA OT**
  → (https://almascience.eso.org/proposing/observing-tool)

Submission and Acceptance

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- **Major change requests** after acceptance will have to be submitted to the Main Observatory. Minor changes can be submitted to the observatory where the change is required. The definition of major and minor change request is provided by each observatory.

Questions?