



ALMA Cycle 9 Capabilities

Dr. Allison Towner

Postdoctoral Associate, Univ. of Florida



New ALMA Capabilities in Cycle 9

- In Cycle 9, the following technical capabilities will be available for the first time:
 - **Fast Regional Mapping (FRM) for Solar Total Power observations.** The size of the field of view for Solar Total Power observations can be changed by PI.
 - **Spectral line Very Long Baseline Interferometry (VLBI).** This capability is offered in Band 3 only, in conjunction with the Global Millimeter VLBI Array (GMVA).
 - **Submillimeter VLBI.** A continuum VLBI capability will be offered for the first time in Band 7 (0.87 mm) in conjunction with the Event Horizon Telescope (EHT).
 - **Longer baseline high-frequency observations:** Band 8 up to C-10, Band 9 up to C-9, and Band 10 up to C-8. The band-to-band (B2B) calibration mode may be triggered for long baseline high frequency observations in order to find a suitably close and strong calibrator. Some science targets, particularly at the highest frequencies and longest baselines, may NOT BE POSSIBLE even with B2B (see Appendix 9.6 of the PG).
 - *The total time allocated to projects requiring band-to-band calibration techniques may be limited to 45 hours. For more information about band-to-band calibration see Section 4.2 of the Proposer's Guide or Section 10.5.3 of the Technical Handbook.*

New ALMA Capabilities in Cycle 9

Band-to-Band calibration – very important!

- For observations in Band 7 and higher, observations requiring C-8 to C-10 may require Band-to-Band (B2B) calibration in order to find a nearby and sufficiently bright phase calibrator to ensure phase calibration quality. The ALMA Observing Tool will automatically check the availability of suitable phase calibrators during proposal validation and will automatically trigger the B2B mode where required.
- B2B observations are subject to the availability of suitable calibrators as checked by the ALMA-OT. Some science targets, particularly at the highest frequencies and longest baselines, may not be possible even with B2B. See Chapter 10 of the Technical Handbook.
- ***A maximum of 45 hours of Cycle 9 observing time will be available for observations requiring the B2B calibration mode.***

ALMA Capabilities: Antennas, Receivers, & Configurations

- The Cycle 9 capabilities are fully described in Appendix A of the ALMA Proposers Guide available at <https://almascience.nrao.edu/documents-and-tools>. In summary:
- **Number of antennas**
 - At least forty-three (43) antennas in the 12-m Array
 - At least ten (10) 7-m antennas (for short baselines) and three (3) 12-m antennas (for making single-dish maps) in the ACA
- **Receiver bands**
 - Receiver Bands 3, 4, 5, 6, 7, 8, 9, and 10 (wavelengths of about 3.1, 2.1, 1.6, 1.3, 0.87, 0.74, 0.44, and 0.32 mm, respectively)
- **12-m Array Configurations**
 - Cycle 9 includes configurations C-1 through C-10.
 - Maximum baselines between 0.16 km and 16.2 km depending on array configuration and subject to the following restrictions:
 - The maximum possible baseline for Bands 3, 4, 5, 6, 7, and 8 is 16.2 km (C-10)
 - The maximum possible baseline for Band 9 is 13.9 km (C-9)
 - The maximum possible baseline for Band 10 is 8.5 km (C-8)
 - Files containing **representative** antenna configurations for the 12-m and 7-m arrays suitable for Common Astronomy Software Applications (CASA) simulations are available from the ALMA Science portal (<http://almascience.org/documents-and-tools/cycle9/alma-configuration-files>)

ALMA Capabilities: Line, Continuum, Mosaic, and Polarization Observations

- **Spectral line, continuum, and mosaic observations**
 - Spectral line and continuum observations with the 12-m Array and the 7-m Array in all bands
 - Single field interferometry (all bands) and mosaics (Bands 3 to 9) with the 12-m Array and the 7-m Array
 - Single-dish spectral line observations in Bands 3 to 8
- **Polarization**
 - Single-pointing, on-axis, full linear and circular polarization for both continuum and full spectral resolution observations in Bands 3 to 7 on the 12-m Array. The field of view of linear and circular polarization observations is limited to the inner one third and the inner one tenth of the primary beam, respectively.
 - Mosaicking of continuum linear polarization observations (Bands 3 to 7).
 - Up to a total of 75 hours of full polarization observations of a single field with the 7-m Array in stand-alone mode at the Main Call only (Bands 3 to 7).
 - Note that combined 7-m Array and 12-m Array polarization observations are not supported this cycle.

ALMA Capabilities: Observing Time Available and Time Allocation Constraints

- **Observing Time:**
 - 4300 hours on the 12-m Array and 4300 hours on the Atacama Compact Array (ACA), also known as the Morita Array, for successful proposals in Cycle 9 (includes DDT, Cycle 4 Carryover and resubmissions)
 - Cycle 9 *is not* expected to include a Supplemental CfP for stand-alone ACA observations. The community is encouraged to submit ACA projects in the LST range of 20h to 10h for the April 2022 deadline.
- **Observing Time (other notes):**
 - Proposals requesting more than 25 hours on the 12-m Array, including Large Programs, will have priority to fill at least 10% of the observing queue (see Section 1.4 of the PG).
 - There is no longer a cap on the total time that can be allocated to Large Programs.
 - However, Large Programs will not be allowed to exceed 50% of the available time for a given LST range in any of the Cycle 9 configurations.

ALMA Capabilities: A Note on Medium Proposals

“Medium size” proposals between 25 – 50 hours are also encouraged!

- But ALMA doesn't accept long proposals. I have a better chance of submitting a shorter proposal because it will be accepted, right?!?!?
- **WRONG!!!!**

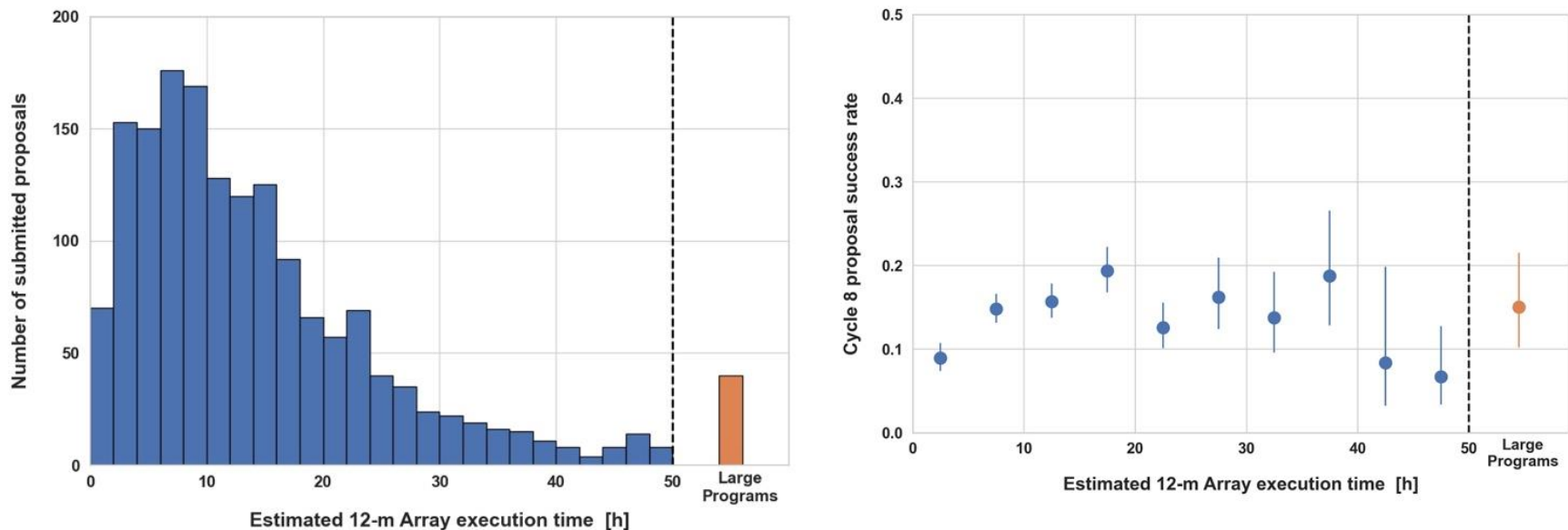


Figure 1: (Left) Number of proposals submitted as a function of the 12-m Array execution time in Cycle 7. (Right) The fraction of proposals (with 1sigma confidence intervals) that are assigned priority Grade A or B as a function of the estimated 12-m Array time.

ALMA Capabilities: Restricted Observing Modes

Standard vs Non-Standard modes??? (STILL) GONE!

- Unlike in previous cycles, there will no longer be a distinction between standard and non-standard modes so... there is no more 20% cap on the time request for non-standard modes!!!
- Proposal types in Cycle 9 will include Regular, Very Long Baseline Interferometry (VLBI), Phased Array, Target of Opportunity, and Large Programs. VLBI proposals work in concert with the Global mm-VLBI Array (GMVA) or the Event Horizon Telescope (EHT).
- **GMVA programs must also have submitted a proposal to the GMVA by its 1 February 2022 deadline.** Additional information about proposing with ALMA using the GMVA was made available in the GMVA Call for Proposals in early January 2021.

However, Large Program Observing Modes will **STILL** be restricted. They **CANNOT** include:

- Time Critical or ToO Observations
- Full Polarization observations
- Solar observations
- VLBI or Phased Array observations
- Non-standard calibrations (user-defined calibrations selected in the OT)
- Bandwidth switching projects (having less than 1 GHz aggregate bandwidths over all spectral windows)
- Band-to-Band calibration projects
- Astrometric Observations
- **NOTE: Contact your local ARC for support NOW to help with preparing your large programs. The ARCs have both proposal preparation and data processing support available for your large programs. Review the documentation off the science portal on how to prepare “value added” data products.**

ALMA Capabilities: ACA

ACA Supplemental Call:

- In Cycle 8, 2021 ALMA will offer a stand-alone ACA Supplemental Call.
- The Supplemental Call will open on 08 September 2021 and the deadline will be on 06 October 2021.
- Observations from the Supplemental Call will be scheduled for Cycle 9 from January 2022 to September 2022.
- The anticipated amount of time available will be similar to the Main Call. While stand-alone ACA proposals accepted from the Main Call will be assigned priority "A", "B", or "C", all accepted proposals from the Supplemental Call will be assigned priority "C".
- More information about the supplemental call can be found at:
<https://almascience.nrao.edu/almascience/almascience/array-supplemental-call>

NOT PLANNED FOR CYCLE 9!!!

ALMA Capabilities: Review Process

Dual-Anonymous Proposal Review

- Proposals in Cycle 9 will continue to implement a dual-anonymous process for proposal reviews. While proposers will still enter their names and affiliations in the Observing Tool, their identities will be concealed from the reviewers.
- **It will be the responsibility of the investigators to write their proposals such that anonymity is preserved.**
- Guidelines on how to prepare such proposals is available now in an ALMA Science Portal news item and in the CfP – <https://almascience.nrao.edu/proposing/call-for-proposals>

Distributed Peer Review

- Distributed peer review will be used for *all proposals other than Large Programs* in Cycle 9
- In this review system, for each submitted proposal the PI (or one of the delegated co-Is) will be responsible for reviewing up to 10 other submitted proposals, thus increasing the involvement of the ALMA community in the review process.
- Large programs will be reviewed by science review panels, as in previous cycles.
- **NOTE: Go to the Science Portal NOW! Log in and edit your preferences and areas of expertise. That is how the distributed peer review will know how to assign projects – based on your area of selected expertise!**

ALMA Capabilities

Full ALMA Operations (All Cycle 9 Capabilities plus):

- **Receiver bands:**
 - Include Bands 1 and 2
 - Band 1 summary report from 2019 June - <https://zenodo.org/record/3240351>.
 - Full ALMA Band 1 Science Case: <http://arxiv.org/abs/1310.1604>
 - Band 2 summary report from 2019 June - <https://zenodo.org/record/3240407>
- **Baselines:**
 - All observing bands out to 16 km.
- **Observing Time:**
 - Up to 4500 hours+ for successful proposals of PI programs expected on the 12m Array (includes DDT, Cycle 8+ Carryover and resubmissions)
- **Observing Modes:**
 - Full operations include full Stokes plus circular polarization at all observing bands including mosaics and Total Power

ALMA Cycle 9 Timeline

Date	Milestone
24 March 2022	Release of Cycle 9 Call for Proposals, Observing Tool, and supporting documents, and opening of the Archive for proposal submission
21 April 2022 (15:00 UT)	Proposal submission deadline for Cycle 9 Call for Proposals
1 June 2022 (15:00 UT)	Deadline to submit reviews for the distributed peer review system
August 2022	Announcement of the outcome of the proposal review process
1 October 2022	Start of ALMA Cycle 9 Science Observations
30 September 2023	End of ALMA Cycle 9

WARNING!!!!

THERE IS NO SUCH THING AS A “LATE” PROPOSAL

“My internet is down...”

“My proposal won’t validate...”

“My power went out...”

“I thought the time was 16UT not 15UT...”

“My dog ate my proposal...”

Validate early,
validate often!

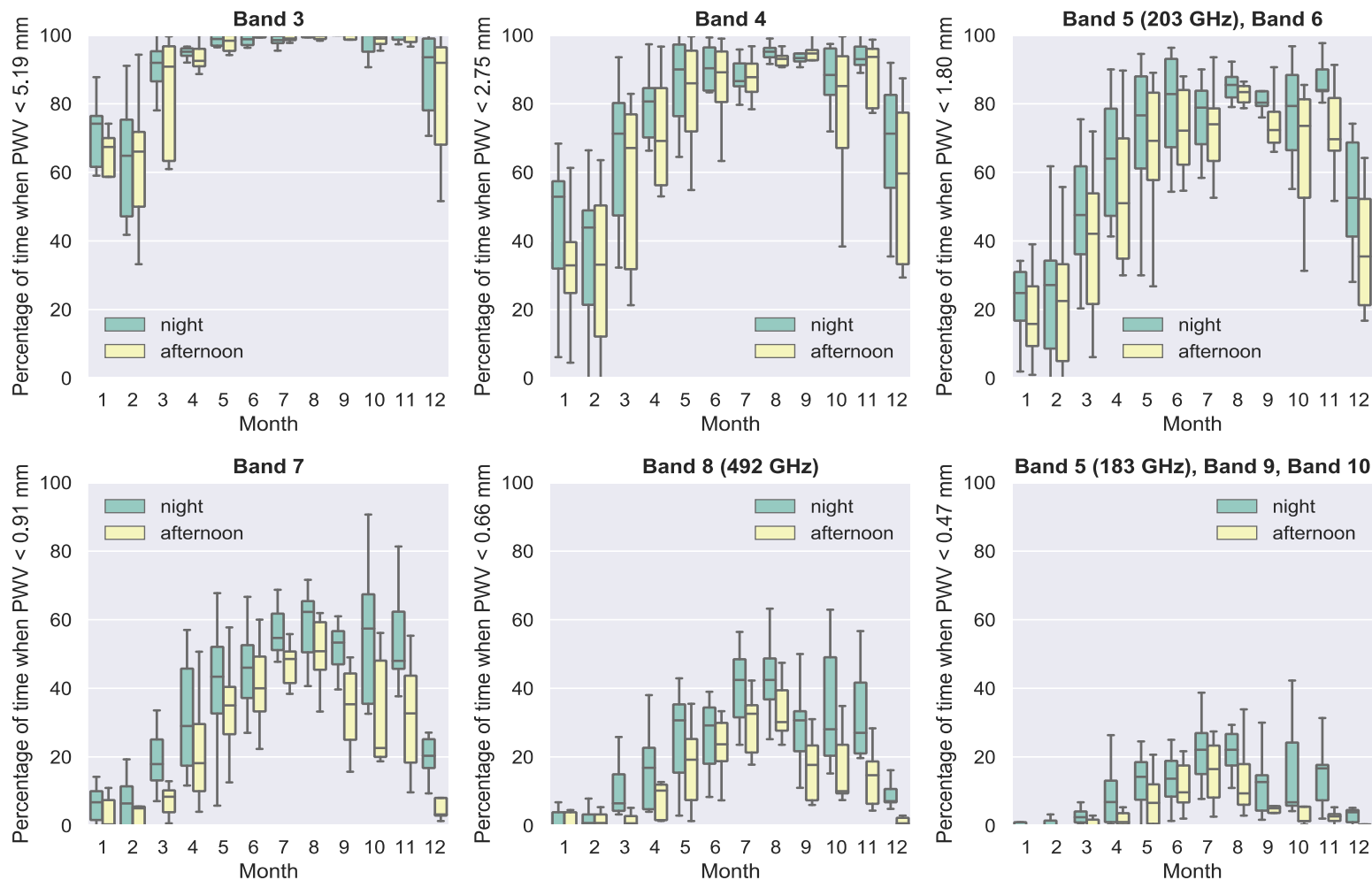
*There is no excuse for a late proposal UNLESS
the Observatory grants an extension.*

ALMA Array Configuration Schedule (Cycle 9)

- Maximum baselines in Cycle 9 will be 16.2 km in configuration C-10.
- Configurations C-9 and C-10 with maximum baselines of 13.9 km and 16.2 km, respectively, will NOT again be available until Cycle 11.
- **NOTE: No PI observing takes place in Feb!**
- The forward-looking configuration schedule (through Cycle 11) can be found at:
<https://almascience.nrao.edu/observing/observing-configuration-schedule/long-term-configuration-schedule>

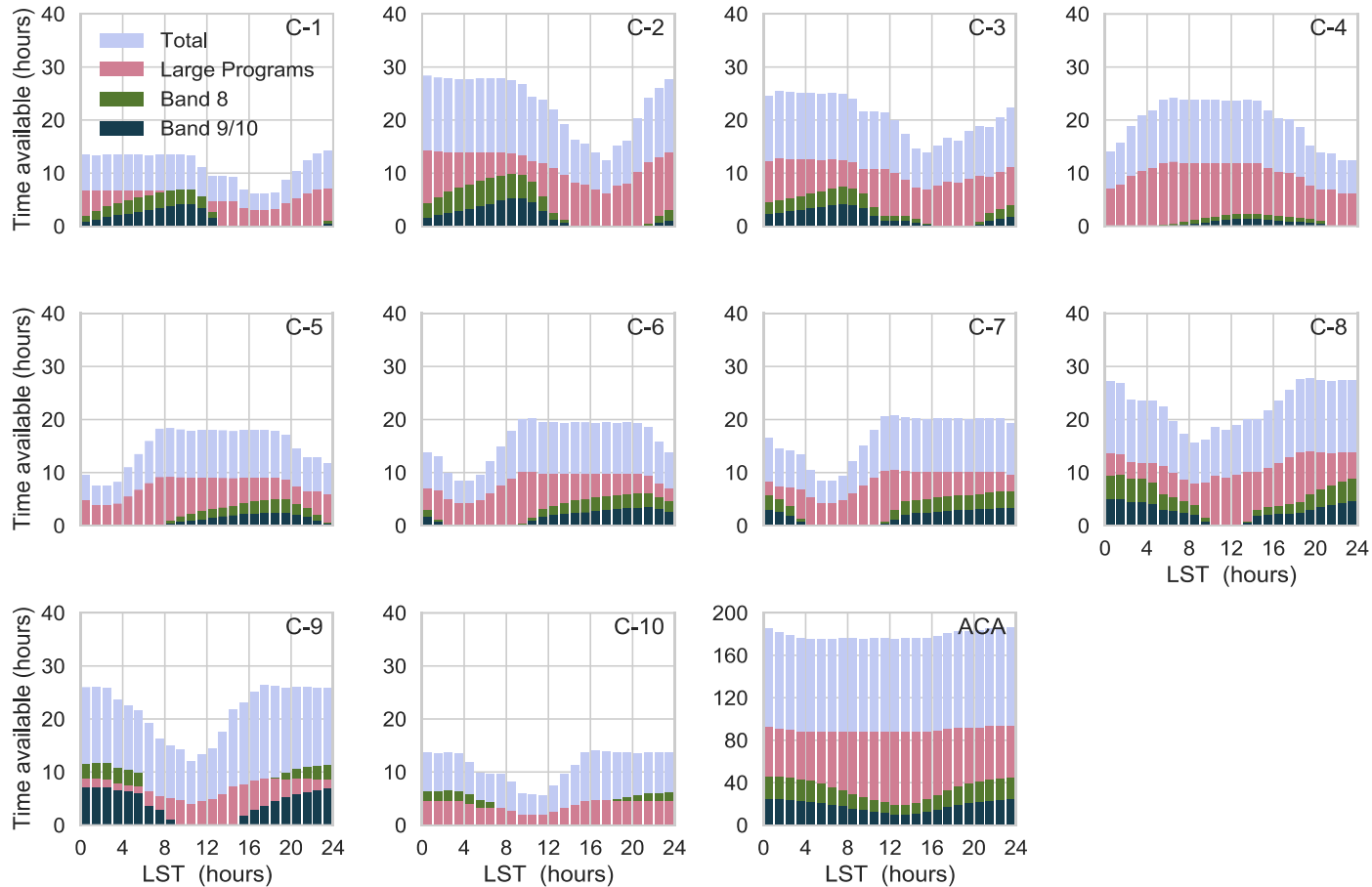
Start date	Config	Longest baseline	LST: Best conditions
1-Oct-22	C-3	0.50	22-10
20-Oct-22	C-2	0.31	23-11
10-Nov-22	C-1	0.16	1-13
30-Nov-22	C-2	0.31	2-14
20-Dec-22	C-3	0.50	4-15
10-Jan-23	C-4	0.78	5-17
1-Feb-23	No observations due to maintenance		
1-Mar-23	C-4	0.78	8-21
20-Mar-23	C-5	1.4	9-23
20-Apr-23	C-6	2.5	11-1
20-May-23	C-7	3.6	13-3
20-Jun-23	C-8	8.5	14-5
11-Jul-23	C-9	13.9	16-6
30-Jul-23	C-10	16.2	17-7
20-Aug-23	C-9	13.9	19-8
10-Sep-23	C-8	8.5	20-9

ALMA Observing Strategies (Cycle 9)



The percentage of time when the PWV is below the observing thresholds adopted for the various ALMA bands for night-time (green) and afternoon (yellow) and for an elevation of 60 degrees. The horizontal line within the box indicates the median. Boundaries of the box indicate the 25th- and 75th-percentile, and the whiskers indicate the highest and lowest values of the results. The data were obtained with the APEX weather station, ALMA measurements, and weather forecast data between September 2010 and February 2019.

ALMA Observing Strategies (Cycle 9)



Estimated observing time available per configuration for executing PI projects, based on precipitable water vapor (PWV) only. For example, approximately 24 hours are expected to be available in C-4 at LST 05 h for all observations and up to 12 h of those may be allocated to Large Programs. The time available for Large Programs is shown in pink and time for high-frequency observations in green and dark blue. While Band 9 and 10 have the same PWV limits, Band 10 will only be offered up to C-8 in Cycle 9 – in the C-9 panel the histogram labeled “Band 9/10” only applies to Band 9. The configuration schedule and, consequently, the total number of hours available per configuration may change in response to proposal pressure (Section 4.3.3 of the Cycle 9 PG).

Cycle 9 Proposal Documents and Tools

- **Cycle 9 Call for Proposals:** <https://almascience.nrao.edu/proposing/call-for-proposals>
- **Cycle 9 Observing Tool (OT – you must download this to submit a proposal!):** <https://almascience.nrao.edu/proposing/observing-tool>
- **Cycle 9 Proposer's Guide:** <https://almascience.nrao.edu/documents-and-tools/cycle9/alma-proposers-guide>
- **Cycle 9 Technical Handbook:** <https://almascience.nrao.edu/documents-and-tools/cycle9/alma-technical-handbook>
- **ALMA Primer:** <https://almascience.nrao.edu/proposing/early-science-primer>

NAASC Sources of Support

- **ALMA Helpdesk:** User support is a priority so questions are usually answered within 48 hours (with around the clock staffing in the week leading up to the proposal deadline) - <https://help.almascience.org>.
 - Also can ask for a “NAASC Chat” through the f2f department which is more than a ticket but less than a full virtual f2f visit!
- **Student Observing Support:** Successful ALMA proposals will be invited to apply for up to \$35k to support undergraduate or graduate student involvement - <https://science.nrao.edu/opportunities/student-programs/sos>
- **NAASC Financial Support for Workshop/Conferences:** The NAASC invites scientists to apply for funding in support of upcoming conferences and workshops. - <https://science.nrao.edu/facilities/alma/community1/NAASC-Conference-and-Workshop-Support>

NAASC Sources of Support

- **Page Charges:** Upon request NRAO covers page charges for authors at US institutions when reporting results from ALMA/VLA - <https://library.nrao.edu/pubsup.shtml>
- **Face-to-face Visitor Support:** Upon request NRAO will cover the travel expenses of up to 2 people from 2 teams per week to come to the NAASC to get support for data reduction, proposal preparation, etc... We also have long term visitor support as well - <https://science.nrao.edu/facilities/alma/visitors-shortterm>
- **ALMA Ambassadors:** You too can become an ALMA Ambassador! For program eligibility visit - <https://science.nrao.edu/facilities/alma/ambassadors-program>



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