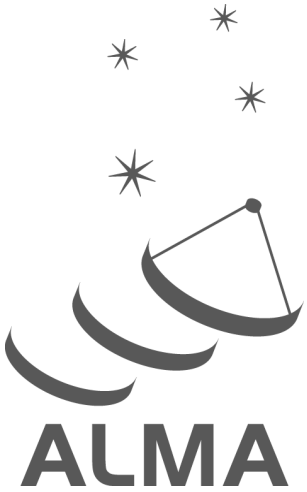
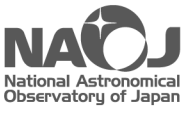
ALMA Status Update

November 2014





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Revision History:

Version	Date	Editors
Ver. 1.0	Nov 10 2014	L. Nyman, J. Hibbard, D. Espada, S. Corder, P. Andreani, K. Tatematsu, A. Remijan

Contributors

This document was produced by the Joint ALMA Observatory (JAO) with contribution from the North American, East Asian, and European ALMA Regional Centers (ARCs).

In publications, please refer to this document as:

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Table of contents

1 Summary

This report summarizes the status of Cycle 2 Early Science observations, including "Cycle 1 Transfer" projects, as of November 2014 including events since the last Status Update (published in the ALMA Science Portal on March 11, 2014). It includes a summary of observing progress, the 12-m Array configuration schedule for the rest of Cycle 2 and a summary of the number of unfinished “high priority” observations by Band, LST and requested angular resolution. The report also contains plans and references to ongoing work as part of the commissioning effort called “Extension and Optimization of Capabilities (EOC)”, and preparations for Cycle 3.

2 Current Status

Cycle 2 is the third Early Science (ES) period that was made available to the international ALMA community for Principal Investigator (PI) science on a “best efforts” basis, meaning that priority is given to the completion of the full 66 element array and the commissioning and delivery of the full ALMA capabilities. Cycle 2 PIs share risk with ALMA, and project completion cannot be guaranteed. Major new capabilities for this cycle include: Band 4 and Band 8 receivers (~150 GHz and ~460 GHz respectively), polarization (on-axis, continuum only, Bands 3, 6 and 7) and maximum baselines out to 1.5 km. Some improved user-tools became available in Cycle 2, including a webtool to access and perform searches on the ALMA Calibrator database (http://almascience.org/sc/), and the ability for PI’s (or users designated by the PI) to receive email notification of observing activity for their projects (see the helpdesk Knowledgebase article at https://help.almascience.org/index.php?/na/Knowledgebase/Article/View/272). Additionally a new power recover system was implemented that has greatly decreased the recovery time from power outages.

Because of the lower-than-expected completion percentage of Cycle 1 High Priority projects, the ALMA observatory allowed uncompleted Cycle 1 High Priority projects to transfer into Cycle 2 ("Cycle 1 Transfer"; see Cycle 1 ALMA Status Updates from October 2013 and March 2014). This involved approximately 333 h of 12-m Array observations, on top of the ~1700 h allocated to Cycle 2 projects with the highest grades (“A” and “B”) or a total of 2033 h. The priority of scheduling observations is: Cycle 2 “A” graded proposals (~10% or 170 h estimated time); "Cycle 1 Transfers" proposals (~333 h); Cycle 2 “B” graded proposals (~1530 h). An additional 800 h were allocated to Cycle 2 “Filler” (grade=C) projects. No Cycle 1 Filler projects carried over into Cycle 2.

As previously announced (see last two status updates, as well as the Cycle 2 proposers guide and various news items in the Science Portal), the observatory has currently suspended all Early Science observing in order to commission long baselines (from 3-10 km). This “long baseline campaign” will extend through the end of November 2014, followed by two months of Early Science observing. Early Science observations will be suspended again during February and March 2015 (during the “Altiplanic Winter”, when submm observing conditions are historically poor – see Figure 1 from the ALMA Proposers Guide), for the annual Engineering and software updates.

Nearly 160 refereed ALMA papers have appeared in the literature, garnering over 1500 citations. More than half of the Cycle 0 projects have accompanying publications. Many new science results have been submitted for presentation at the *“Revolution in Astronomy with ALMA - The Third Year”* science conference that will take place 8-11 December 2014 at the Tokyo International Forum in Tokyo, Japan. The conference now has over 290 registered participants, 63 scheduled talks, and 180 posters on the program (available at the conference website: http://www.almasc2014.jp).

3 Observing Progress

Cycle 2 PI observing began on June 3, 2014. Early Science (ES) observing blocks are scheduled from Wednesdays to Tuesdays on three-week cycle with two consecutive ES weeks, followed by one EOC week dedicated to commissioning and engineering activities (including maintenance, antenna and receiver integration, software tests etc) called "Extension and Optimization of Capabilities". During ES observing blocks, science observations are scheduled 16h per day on weekdays, with 24h observing on the weekends.

Tables 1 & 2 give the statistics of each of these ES blocks, separately for 12-m Array and 7-m Array observations. The Total Power mode has not yet been accepted (see Sec. 7.4 below), so no statistics are provided for the TP Array. The tables list the following information: the dates of each Observing block, the time scheduled for Early Science observing, the time associated with successful executions of PI science observations, the Science execution efficiency (the fraction of the scheduled time used for successful PI observations), and the number of antennas available for science observing averaged over the session. Additionally, for 12-m Array observations the last column gives the approximate configuration of the available 12-m antennas, using the naming convention given in the Cycle 2 Proposers Guide (where the most compact configuration is called C34-1, and the most extended is called C34-7).

Overall, we have thus far obtained 720 h of successful executions (including both 12-m Array and 7-m Array observations). The less efficient blocks correspond to Block 7 (and to some extent also Block 8) due to bad weather and to a system instability that was identified and flxed and to Block 9, when the ACA correlator was completely unavailable (now fixed).

Table 1: Cycle 2 Observing Session summary for the 12-m Array, including dates dedicated to EOC activities and the dates of future Early Science observing blocks through the end of Cycle 2

Block	Dates	Allocated time (h)	Successful Executions (h)	Science Execution efficiency (%)	Average number of antennas	Approx. 12-m Array config.
1	Jun 3-10	131.4	48.5	37%	34.2	C34-4
2	Jun 10-17	131.6	59.5	45%	34.3	C34-4
3	Jun 24-July 1	115.9	44.7	39%	31.2	C34-4
4	Jul 1-8	115.9	35.3	30%	31.4	C34-4
5	Jul 15-22	127.2	35.8	28%	33.0	C34-4/5
6	Jul 22-29	126.3	40.2	32%	29.6	C34-5
7	Aug 5-12	133.5	7.8	6%	35.0	C34-5
8	Aug 12-19	123.1	32.9	27%	33.5	C34-5/6
9	Aug 26-Sep 1	131.6	64.7	49%	34.7	C34-6
1-9	**Jun3–Sep 1**	**1134.0**	**369.4**	**33%**	**33.0**	

Table 2: Cycle 2 Observing Session summary for the 7-m Array

Block	Dates	Allocated time (h)	Successful Executions (h)	Science Execution efficiency (%)	Average number of antennas
1	Jun 3-10	131.7	58.0	44%	9.2
2	Jun 10-17	130.2	69.1	53%	9.5
3	Jun 24-July 1	113.4	50.3	44%	10.0
4	Jul 1-8	116.0	21.6	19%	9.4
5	Jul 15-22	129.8	49.1	38%	10.3

6	Jul 22-29	127.7	40.9	32%	9.2
7	Aug 5-12	100.6	22.6	44%	10.4
8	Aug 12-19	125.0	45.5	53%	9.9
9	Aug 26-Sep 1	0	0	0	0
1-9	**Jun 3–Sep 1**	**974.3**	**357.1**	**37%**	**9.7**

As of this report, ~1670 hrs of 12-m Array observations still remain in the queue (see Sec. 5). To complete these observations requires an average of 67 hrs of successful 12-m Array observations in the remaining 25 scheduled Early Science observing blocks. To meet this goal, the observing efficiency needs to be significantly increased, and/or more observing time needs to be made available. Both options are being actively pursued. An increased observing efficiency is expected due to significant improvements in the stability of the on-line system, and the project is considering adding more observing time during the ES blocks. The requirements on ACA are less severe, with an estimated 1060hrs of observations remaining in the queue. This should be met with the already-achieved observing efficiency.

The progress towards project completion is given in Tables 3 & 4, separately for both Cycle 1 and Cycle 2. Each project is comprised of several SBs, so project completion is less than the overall OUS completion rate.

Table 3: Cycle 1 Project Status Summary (through Nov 06, 2014)

State	Number of High Priority & DDT Projects	Number of Filler Projects
Accepted	198	93
With some successful observations	152 (77%)	34 (37%)
With some completed components	136 (69%)	34 (37%)
Have data being processed	30 (15%)	5 (5%)
With some data delivered	125 (63%)	31 (33%)
Completed & delivered	62 (31%)	13 (14%)

Table 4: Cycle 2 Project Status Summary (through Nov 06, 2014)

State	Number of High Priority (grade=A,B) & DDT Projects	Number of Filler Projects (grade=C)
Accepted	354	159
With some successful observations	127 (36%)	0 (0%)
With some completed components	110 (31%)	0 (0%)
Have data being processed	72 (20%)	0 (0%)
With some data delivered	53 (15%)	0 (0%)
Completed & delivered	10 (3%)	0 (0%)

4 Data reduction progress & timescales

As in early cycles, Cycle 2 data reduction is done at the JAO and the three ARCs by trained staff following standard data reduction scripts, conducting quality assurance checks, and packaging the data for delivery to PIs. Table 5 shows the median timescales for each post-observing stage from project completion to delivery, for all three Early Science data deliveries. The time for assigning reductions is longer in Cycle 1 and 2 compared to Cycle 0 since the increased observing cadence (two out of every three weeks and the addition of 24h observing periods) results in more completed projects than world-wide data reducers, resulting in a backlog of complete projects waiting for available staffing resources. The Cycle 2 time for assignment is additionally increased by four weeks as the ALMA pipeline was installed, tested, and deployed for use. Apart from this, all other timescales are significantly reduced compared to Cycle 0. This is because the data reduction staff is more familiar with the processes, and because the quality of the data is better – there have been fewer problems with the raw data coming off of the telescope than in Cycle 0 and the data quality checks have improved.

Table 5: Data Processing & Delivery Timescales for Cycles 0-2 (through Nov 06 2014)

Data Processing & Delivery times (Medians, in days)	Cycle 0	Cycle 1	Cycle 2
Days since completed to assigned for reduction	7.0	15.3	33.1
Days to process through QA2	45.0	15.9	27.5
Days from QA2 evaluation to delivery to PI	12.0	5.4	4.0
Days since completed to delivery to PI (MEDIAN)	84.5	50.2	53.7
Days since completed to delivery to PI (MEAN)	94.2	62.6	62.2

As of the date of this status update, the automated ALMA calibration pipeline was just accepted and put into action. This is expected to greatly reduce the timescale for assignment and processing through QA2 for about 60% of Early Science observations. The remaining 40% include observing modes that are not yet implemented in the pipeline (e.g. polarization, high frequency, bandwidth transfer) or projects that fail pipeline processing (low signal-to-noise calibrators, poor phase stability). These data will still be processed by experts at the JAO and ARCs. The imaging and packaging is also done manually, with plans to incorporate these steps into the pipeline by the start of Cycle 3. The availability of the automated pipeline for calibration along with the three month observing hiatus for the long baseline campaign (Sec. 2) should allow the backlog of unreduced data to be cleared out, leading to shortened timescales from project completion to assignment.

To reproduce ALMA calibrated data, users need to download the special CASA 4.2.2 tarfile that includes ALMA pipeline. This is available off the CASA webpage at http://casa.nrao.edu/casa_obtaining.shtml. As mentioned above, some data will be still be delivered that was calibrated by-hand, so there are two methods for reproducing calibrated measurement sets (see http://almascience.org/documents-and-tools/cycle-2/alma-qa2-products-v2.1 for details).

We remind all researchers that they are welcome to visit their regional ARCs or ARC nodes to work on proprietary or archival ALMA data. Visit requests should be submitted using the ALMA helpdesk (http://help.almascience.org). Researchers receiving assistance from an ARC or ARC node should add this to the standard ALMA acknowledgement (see http://almascience.org/alma-data) to be included in all publications making use of ALMA data.

5 Remainder of Cycle 2

As mentioned above, approximately 1670 h of 12-m Array observations still remain in the queue. This is comprised of 116 h of Cycle 2 'A' graded proposals, 273 h of Cycle 1 transfers, and 1280 h of Cycle 2 'B' graded proposals. The distribution of these hours across the Cycle 2 configurations1 is shown graphically in Figure 1, which plots the remaining number of hours of Cycle 1 & 2 High Priority projects needed for each Cycle 2 configuration, color-coded by ALMA frequency band. The numbers within each colored bar represent the number of hours needed in the designated configuration and observing band.

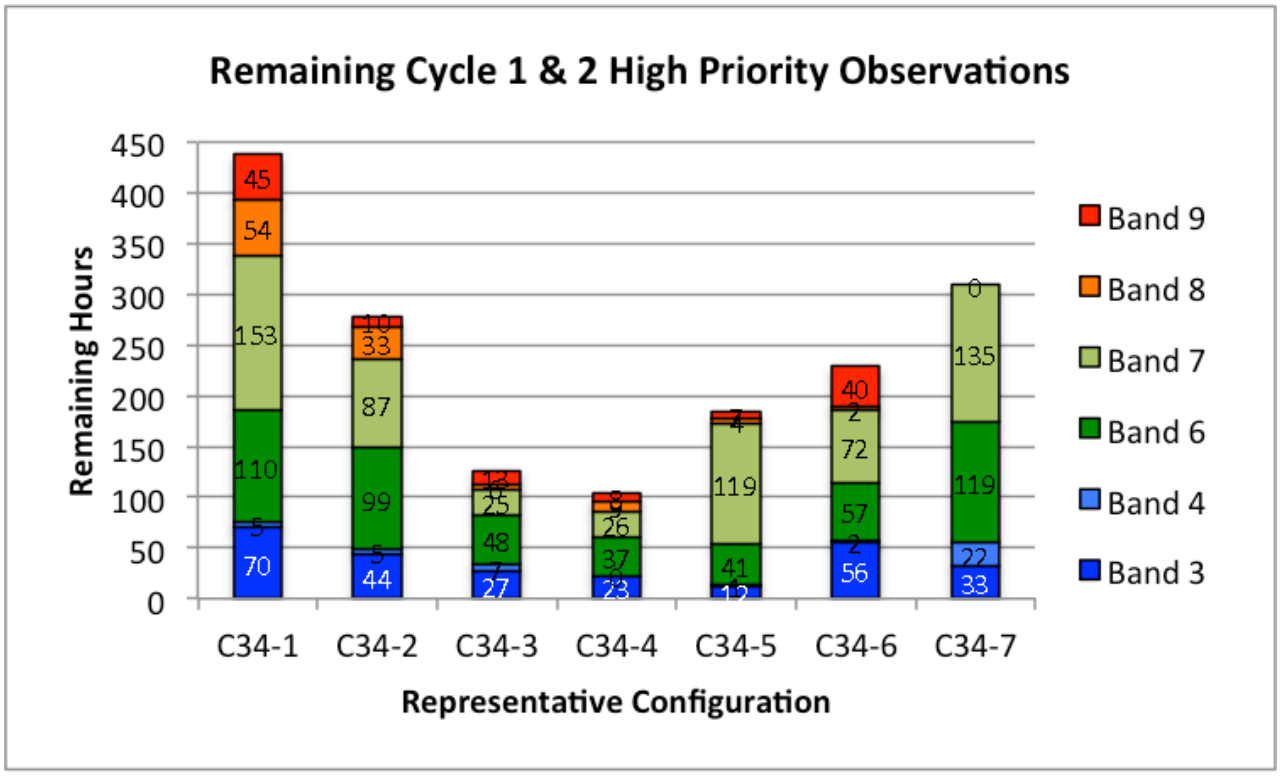

Figure 1: Histogram of the remaining number of hours needed to complete Cycle 1 & 2 High Priority 12-m Array observations for each Cycle 2 configuration. Time is assigned to the configuration that best matches the user-specified resolution, and the different colors represent the different ALMA observing bands.

This distribution was used along with information on pad and power availability and the number of antenna moves that can be accommodated each month to plan the configuration schedule for the remainder of Cycle 2, which is presented in Table 6. When science observing resumes in December 2014, the array will be in a similar configuration to C34-1, moving to C34-2 for January 2015. There will then be a two-month break for the annual engineering and software time, after which the configuration is expected to be close to C34-1, and will cycle through progressively more extended configurations thereafter. This schedule may need to be modified based on possible extended bad weather periods, including road conditions at the AOS, and no unforeseen problems with the infrastructure.

Figure 2 & 3 show the distribution of the number of hours for the remaining 12-m Array scheduling blocks binned by the mean LST of the targets in the Scheduling block. Figure 2 shows the total distribution of all

1 The configurations are considered "representative", since the array is seldom exactly in one of the advertised Cycle 2 configurations (due to antenna or receiver maintenance or other issues). But at any given time the array should be in a configuration with similar imaging properties – resolution and Maximum Recoverable Scale – as one of the representative configurations.

remaining observations color-coded by project priority. Filler projects are generally not prepared until it appears likely that they will be needed (such as LST=6-8 hr and 20-22 hr). Figure 3 shows same distribution, but only for high priority projects (Cycle 2 A & B and Cycle 1 transfers), and separated according to the Cycle 2 configuration that is best match to the individual scheduling block.

Cycle 2 will extend through the end of September 2015. Only uncompleted Cycle 2 “A” graded proposals will transfer into Cycle 3, regardless of the overall completion percentage. This means that PIs with "Cycle 1 Transfer" or Cycle 2 “B” graded proposals that remain uncompleted by the Cycle 3 proposal deadline (April 2015) should consider resubmitting these proposals.

Table 6: Planned schedule for the Early Science observing blocks for the remainder of Cycle 2, including the planned 12-m Array configuration.

Block	Planned Dates	Planned 12-m Array configuration
EOC	Sep 2 – Dec 1	EOC Long Baseline Campaign
ES-10	Dec 2 – 9	C34-1
ES-11	Dec 9 – 16	C34-1
ES-12	Dec 23 – 30	C34-1
ES-13	Dec 30 – Jan 6	C34-1
ES-14	Jan 13 – 20	C34-2
ES-15	Jan 20 – 27	C34-2
ES-16	Jan 27 – Feb 2	C34-2
EOC	Feb 3 – Mar 30	Engineering/Software time
ES-17	Mar 31 – Apr 7	C34-1
ES-18	Apr 7 – 14	C34-1
ES-19	Apr 21 – 28	C34-1
ES-20	Apr 28 – May 5	C34-3
ES-21	May 12 – 19	C34-3
ES-22	May 19 – 26	C34-4
ES-23	Jun 2 – 9	C34-4
ES-24	Jun 9 – 16	C34-5
ES-25	Jun 23 – 30	C34-5
ES-26	Jun 30 – Jul 7	C34-6
ES-27	Jul 14 – 21	C34-6
ES-28	Jul 21 – 28	C34-6
ES-29	Aug 4 – 11	C34-7
ES-30	Aug 11 – 18	C34-7
ES-31	Aug 25 – Sep 1	C34-7
ES-32	Sep 1 – 8	C34-7
ES-33	Sep 15 – 22	C34-7
ES-34	Sep 22 – 29	C34-7

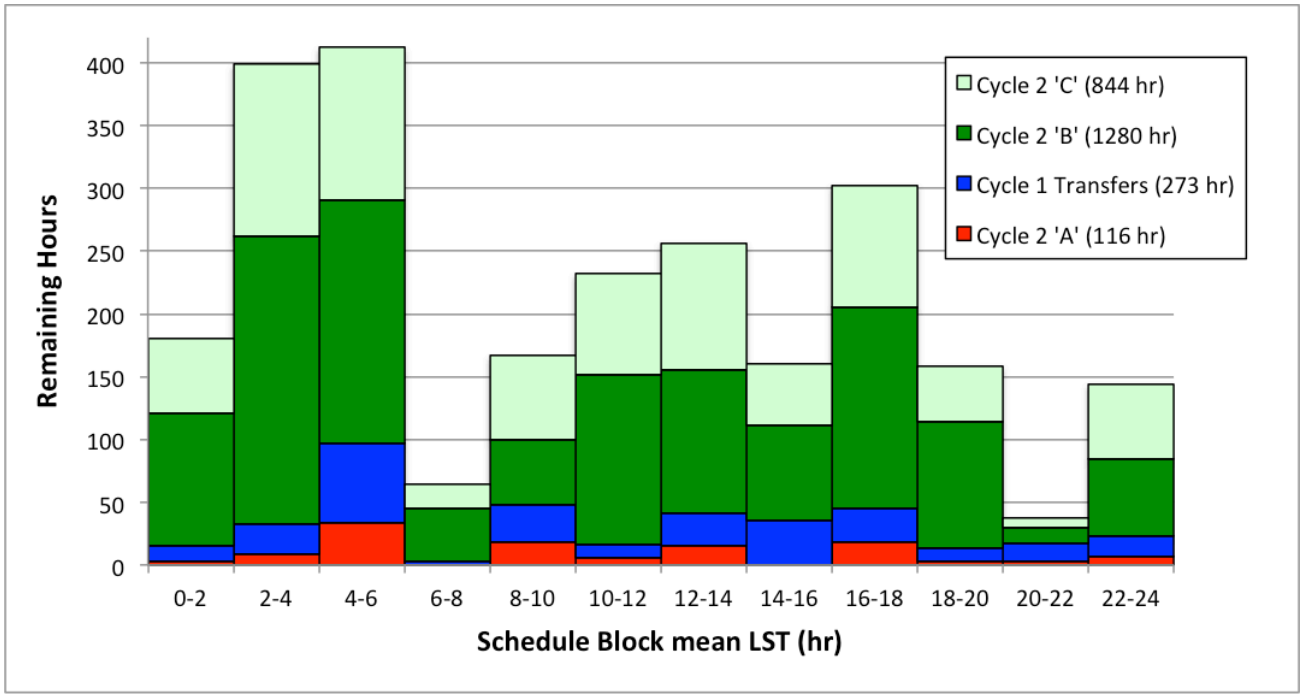

Figure 2: Number of hours of remaining ALMA 12-m Array observations as a function of the mean LST of each remaining Schedule Block, color coded by proposal priority grade. Cycle 2 'A' graded proposals have the highest scheduling priority, followed by Cycle 1 transfers, Cycle 2 'B' graded proposals, and finally by Cycle 2 'C' graded proposals or "Fillers".

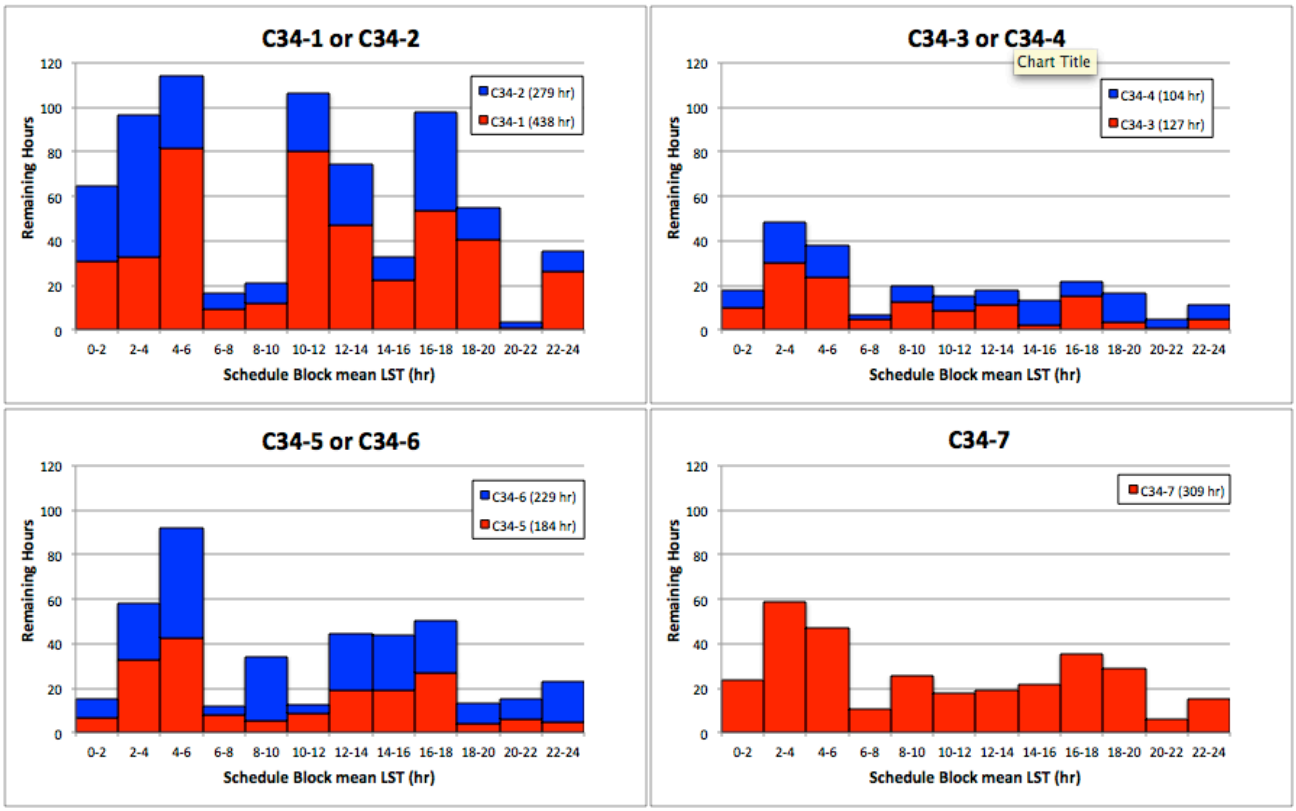

Figure 3: Number of hours of remaining ALMA 12-m Array observations for high priority projects, as a function of the mean LST of each Scheduling Block, separately by the best-matched ALMA 12-m configuration. Some projects can be observed in more than one configuration.

6 ALMA Cycle 2 Users Survey

The third ALMA user survey was conducted between the 10th of April and the 15th of May 2014. A total of 417 users (representing 10% of the users who were sent the questionnaire) responded to the survey. Users were asked about a variety of topics related to user support, from proposal preparation, submission and review process to the usability of tools such as the helpdesk, the archive or the project tracker and the interaction with the ARC/ARC nodes for ALMA proposal preparation, generation of Phase 2 products or data reduction.

Overall, the users showed a relatively high level of satisfaction. On a scale of 1 to 5 (1 being best and 5 being worst), the overall satisfaction across all ALMA regions was rated better than 2.5 for 23 topics and between 2.5 and 3.5 for the remaining 8 topics. The highest rate was given to the ARC/ARC nodes support for data reduction and proposal preparation, with an average rate of 1.55 and 1.73, respectively, followed by the smoothness of proposal submission with a rate of 1.84 and the helpdesk response time with a rate of 1.88. On the other side, the lowest rate was given to the usability of the Project Tracker, with an average rate of 3.37, followed by the usability of the archive, with an average rate of 2.85.

The ALMA observatory sincerely thanks all users that took the time to answer this survey and provide valuable comments.

7 Extension and Optimization Activities & Plans

The Extension and Optimization of Capabilities (EOC) (formerly, Commissioning and Science Verification) began under a new management structure in April 2014. It includes a specialized team of JAO staff, as well as ARC and ARC node staff on special assignments. During the regular observing season, EOC is allocated one week out of every three, alternating with Early Science observations, as well as a period of three months dedicated to the commissioning of long baselines (out to at least 10 km), which started in September 2014 and will extend through November 2014.

7.1 Capability development

Capabilities that were tested and verified by EOC staff during the past six months include:

- In coordination with DSO, acceptance of version 10.4 of the online control software to support of the start of Cycle 2 observations.
- High Precision Ephemeris Tracking tests were verified and utilized to directly compare the JPL measured position based on optical data to ALMA mm/submm observations. As a result of the work over the past several months, the comparison of the Pluto ephemeris table and the JPL Horizons ephemeris now agree to < 1mas (see Figure 4).
- Total Power Acceptance testing continued during this time to try and understand the aperture or beam efficiency, which is essential for amplitude calibration. In addition, several tests were performed to characterize the linearity of the ACA correlator and several approaches were explored to find an effective correction scheme in order to start taking TP data for Cycle 1 and 2 observing programs (see Sec. 7.4).
- A program plan for characterizing the main array during daytime observations was drafted.

- Validation of Band 4/8 imaging performance: Data reduction and imaging analysis were completed and final reports written on the imaging performance statistics. EOC did not find any significant problem regarding observations and data reduction (i.e., fluxes, positions, noise levels are within design specification).

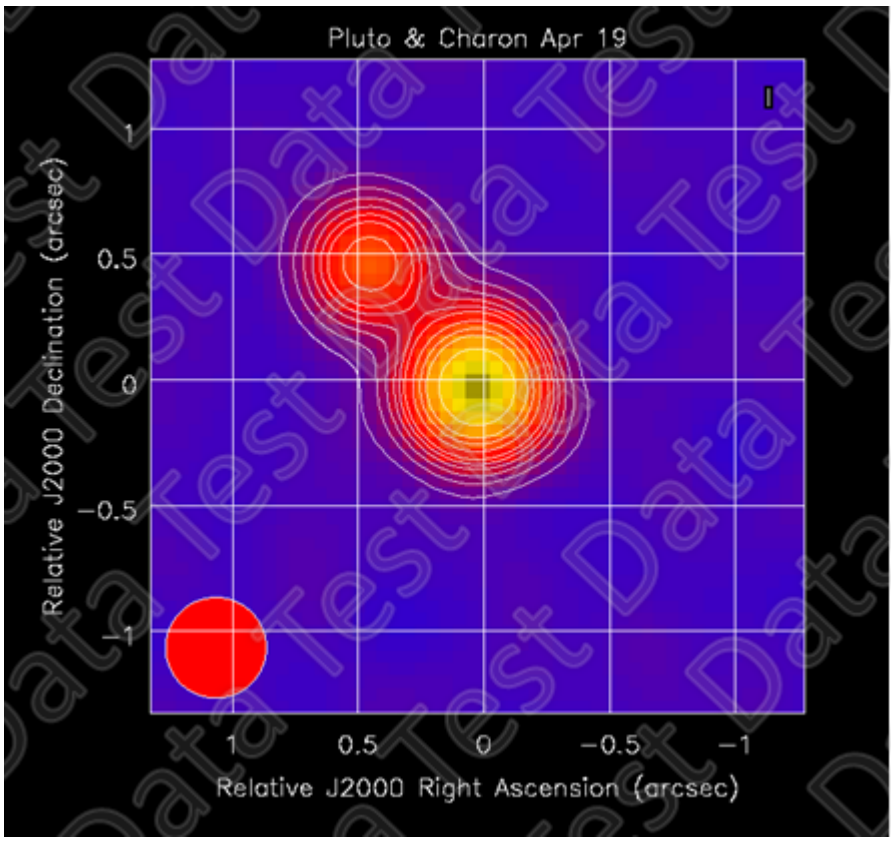

Figure 4: EOC imaging of Pluto and Charon, made in TDM (low spectral resolution) mode in ALMA Band 7 demonstrating high precision tracking with an externally supplied ephemeris.

Other items tested include:

- FDM (high spectral resolution) Polarization in Bands 3, 6 and 7
- Polarization observations using "sessions" (repeated schedule block execution, with calibrations shared between SBs)
- Online WVR (Water Vapour Radiometer) correction with mixed correlator modes
- Bandpass Stability
- Astroholography

7.2 Science Verification

EOC is also responsible for observing and reducing Science Verification (SV) data, which are made available to the scientific community from a special page linked to from the ALMA Science Portal (via the "Data" left menu item), or directly at https://wikis.alma.cl/bin/view/ScienceVerification/ScienceVerificationNoticeboard). The availability of new SV data is advertised at least two weeks in advance through "News" items posted to the Science Portal and broadcast by ARC and ARC node mailing lists. Recent SV activities include the following.

- Comet Lemmon: Data reduction and initial imaging of the Band 6 science verification data were completed and the data publicly released on September 7, 2014.
- VY Canis Majoris: Data reduction and initial imaging of the Bands 7 and 9 water maser science verification data were completed and the data publicly released on September 7, 2014.
- IRAS16293: Observations of CH_3CN and CH_3OH lines were conducted to demonstrate the Band 4 imaging capabilities. A preliminary reduction was performed and a more complete reduction and imaging effort are currently underway.
- NGC 3256: Mosaic observations of the CO(4-3) line were conducted to demonstrate the Band 8 imaging capabilities. A preliminary reduction was performed and a more complete reduction and imaging effort are currently underway.
- M 100: Observations including the 12-m+7-m+TP arrays were completed to demonstrate the data reduction and analysis procedures combining all arrays. The data combination is currently underway and work has continued on a new CASAguide describing the process.
- 3C 286: Full polarization measurements were taken and a final data analysis was performed. In addition to providing the full data reduction routine and scripts, a new CASAGuide describing the data is currently being developed.

The following five Science Verification targets have been selected to demonstrate the Long Baseline capability:

- The asteroid Juno: observations of continuum in Band 6, to demonstrate the ephemeris capability.
- The dusty variable star Mira: observations of SiO lines and continuum in Bands 3 and 6.
- The proto-stellar disk HL Tau: observations of the ^{13}CO line and continuum in Bands 3, 6 and 7.
- The quasar 3C 138: observations of continuum in Bands 3 and 6, to demonstrate the polarization capability.
- The lensed high-redshift galaxy SDP.81: observations of H_2O and CO(5-4) lines and continuum in Bands 3, 4, 6 and 7.

These targets span the five ALMA Science Categories and have been checked for conflicts against existing accepted Cycle 1 and Cycle2 proposals. Information on these targets is available on the Science Verification webpage at http://almascience.org/alma-data/science-verification.

7.3 Dedicated Campaigns

7.3.1 Installation of the new H-maser from the ALMA Phasing Project

An approved ALMA development program includes the development of phasing up of ALMA so it can be used as a single element in the millimeter VLBI network. The installation of the H maser provides a new 5 MHz standard for ALMA and enables another large step toward VLBI capabilities with ALMA. The H Maser installation and testing plan has progressed well and given the monitoring and apparent stability of the maser from its installation on 10 May, 2014, the decision was made to integrate the maser into the ALMA system during the EOC week starting 29 July. This allowed a long period of monitoring the stability of the maser before the start of the long baseline campaign in September 2014. The maser has been used since this time as the 5 MHz standard for *all* ALMA observations.

7.3.2 High Frequency Observing

The High Frequency Observing Campaign started at the beginning of June and was conducted through August 2014. The final program plan was put in place to test various, new types of calibration schema needed to optimize Band 8, 9 and 10 observations. The specific test included:

- 90 degree phase switching

- Band-to-Band phase transfer
- Bandwidth switching
- Bandpass characterization
- Baseline measurement comparison between Bands 3 and 7
- Regular baseline measurements and online-WVR correction experiments
- Single-dish sideband separation utilizing LO offsetting
- Single-dish fast scanning
- A high frequency calibrator survey
- Delivery of the suite of band 10 receivers for routine observations for Cycle 3 (see Figure 5)

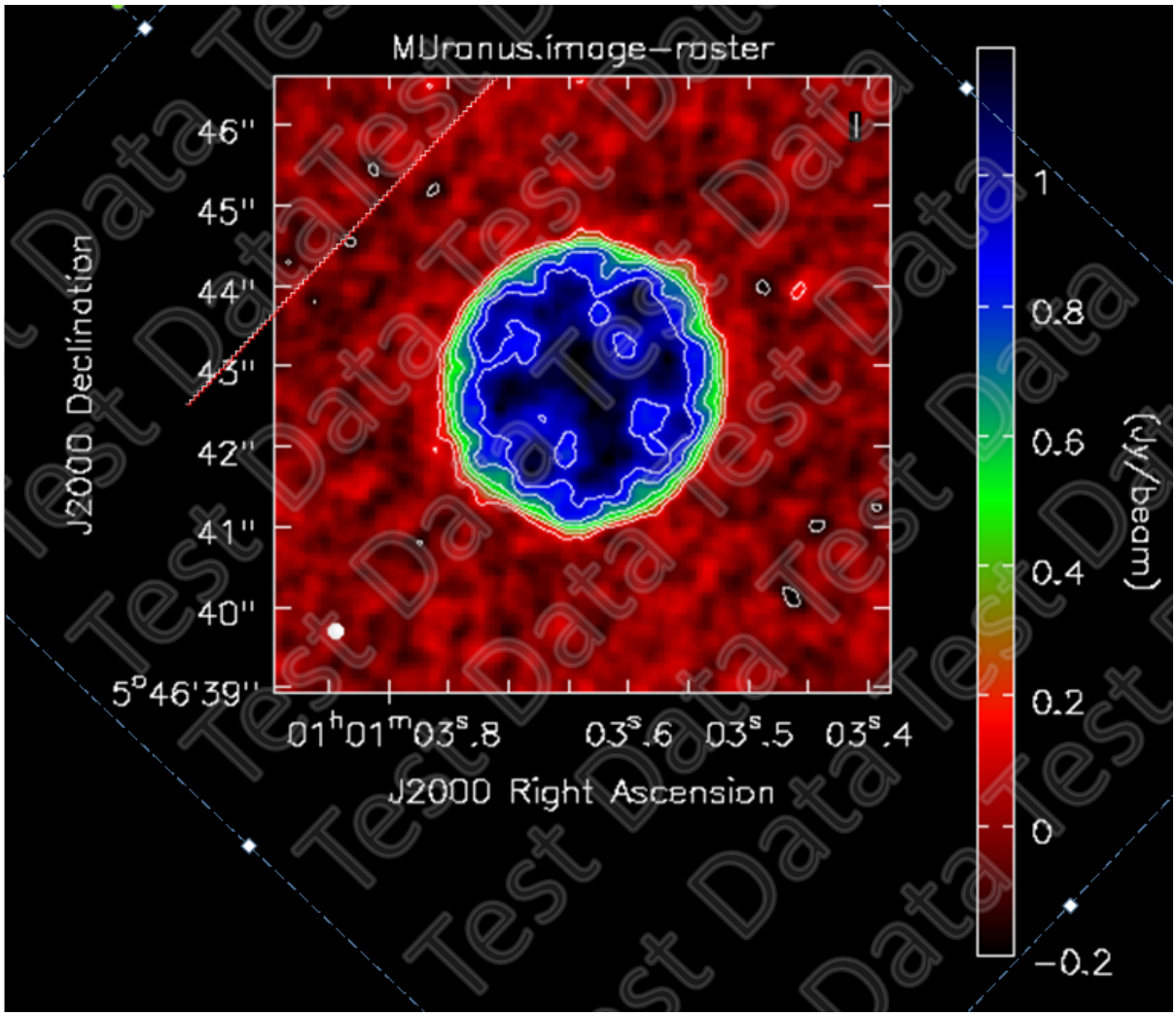

Figure 5: First interferometric image in ALMA Band 10. This image of Uranus was obtained at an observing frequency of 860 GHz using 29 antennas from the 12-m Array.

Beginning in Cycle 3, observations of the phase will be corrected online using the data from the WVR. As such, EOC has done testing to not only test the feasibility of this process online but also with comparing the baseline solutions with and without WVR corrections and at higher frequencies. Accurate baseline solutions are essential for the success of the long baseline campaign especially at frequencies higher than Band 6. Baseline runs testing this procedure were inspected and reduced. The data quality was good and weather

conditions reasonable and as such will be used to determine best baseline/WVR strategy for the high frequency and long baseline campaigns.

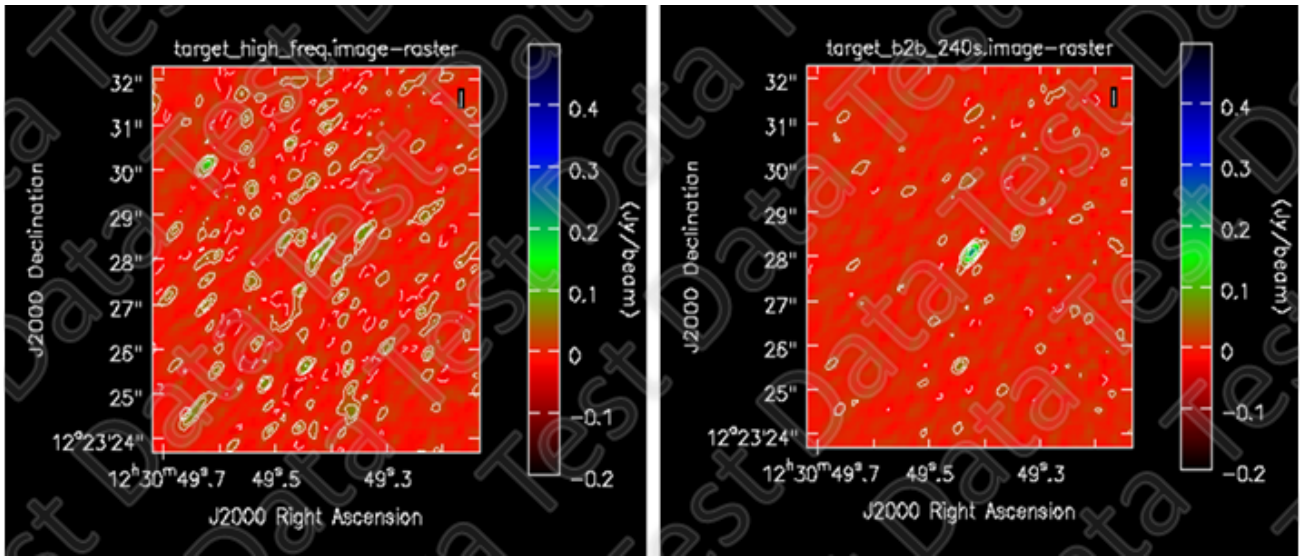

Figure 6: Demonstration of the "band-to-band" phase transfer method between ALMA Bands 6 and 9. Left: final image obtained using traditional "in band" phase transfer between a Band 9 phase calibrator and the science target. Right: final image obtained using the "band-to-band" method, whereby the Band 6 phase calibration solutions were scaled and applied to the Band 9 science target observations.

At frequencies above 300 GHz, most targets do not have bright enough phase calibrators within a radius of about 8 degrees and the use of a more distant calibrator will degrade the quality of the image. An alternative is to observe a closer calibrator that is detectable at a lower frequency, and correct its phase to that of the target frequency. Several "band-to-band" Scheduling Blocks were run in order to test the feasibility of tracking the phase variations in a lower frequency band and applying the corrections to the higher frequency band. Significant testing took place and a major milestone of the campaign occurred when the first images of the Band 6 to Band 9 phase transfer test were produced. Using the new "band-to-band" method refined by the scientific observing team at ALMA gave a clear detection of the science target (see Figure 6). The High Frequency Observing Campaign is also utilizing expertise from every executive as each executive is responsible for delivering a complete test report and full analysis of one of the capabilities listed above.

7.3.3 Long Baseline Campaign

From September through November 2014, EOC is leading the Long Baseline Observing Campaign, whose primary goal is to determine the best observation and reduction methods needed to obtain high-quality images for ALMA configurations with baselines in excess of 2 km (up to 10 km). The campaign is run and organized at the JAO, but with support from personnel from the ARCs and ARC nodes.

7.4 Delay in Capabilities

The above activities reflect a lot of work to develop new capabilities for ALMA. However, there have been some setbacks to delivering the capabilities offered for ALMA Early Science Observing. These include delays in the acceptance of Total Power observing, continuum polarization observations, and baselines longer than 1km.

Final Acceptance of Total Power capability is underway. End to end tests including three Cycle 1 projects (one for each offered band, 3, 6 and 7) have been successfully carried out and now the data are being reduced. If confirmed no major problems are found with the data during the data reduction, the acceptance

will occur at the end of November. The acceptance will set constraints on the targets that can be used as amplitude calibrators and limits on the ability to observe bright spectral line sources (e.g. masers). However, this should not directly affect any already accepted Cycle 1 and 2 TP observing programs. Hardware and software upgrades are scheduled for February 2015 to lift these restrictions and will be ready for the start of Cycle 3 observations.

Continuum Polarization observations as advertised in the Cycle 2 capabilities are fully commissioned but end to end tests still remains to be executed for final acceptance due to system instabilities in the first ES blocks and minor issues in linking executions. Final acceptance is one of the high priority tasks when Early Science observations resume in December.

In the previous status update it was mentioned that we expected to move in June to the longest baseline configuration offered in order to complete most of the Cycle 1 and a good number of Cycle 2 projects requiring 1 – 1.5 km baselines. This was postponed due to the unavailability of enough pads at baselines larger than 1 km.

7.5 EOC activites for the rest of Cycle 2

Other capabilities that will be tested during this time by EOC include:

- Continued high precision ephemeris observations of Pluto for the NASA New Horizons Mission.
- Continued high frequency observation testing in preparation for the Cycle 3 capabilities.
- Software Testing: EOC will take delivery of Cycle 3 candidate of the online control software for validation over the course of the next 6 months.
- Continue antenna integration and verification (AIV+) as array configuration changes and other AIV+ activities with the highest priority bands being Bands 4, 8 and 10 respectively.
- Polarization: Continue to test the FDM polarization capabilities in Bands 3, 6 and 7.
- ACA Correlator test items to continue to characterize the non-linearity issues and to conclude the Total Power acceptance.
- A dedicated Solar Observing Campaign is scheduled for the week of Dec 9 – 16, 2014 in anticipation for routine solar observations for Cycle 4.

Further engineering and commissioning activities will take place in February & March 2015 (when good weather is less likely due to the onset of the “Altiplanic Winter” – see Figure 1 from the ALMA Proposers Guide), including the annual maintenance of the switchgears and transformers that cannot be performed during regular array use, and work on the technical building that requires the correlator and central LO to be powered off and a major annual upgrade of the ALMA software.

8 Cycle 3 Planning

The call for ALMA Cycle 3 proposals will be issued in March 2015 with a deadline in April 2015, for an observing season that starts in October 2015. The Cycle 3 capabilities will be decided at the conclusion of the aforementioned EOC campaigns, and announced via a Science Portal news item in early December. This Cycle 3 pre-announcement will also include the precise dates for the Cycle 3 call for proposals and proposal deadline.

9 Observer information

The observatory will continue to produce periodic Status Updates. Additional information on the observatory or project status can be obtained through the Project Tracker, the ALMA Helpdesk, the Data Archive or from the Contact Scientists (see ALMA Status Update from March 2014). There will soon be a new 'ALMA status' webpage available at the Science Portal under the "Observing" menu item that will provide weather conditions and forecast, information on the array configurations and schedule, and links to observing reports for each Early Science observing block.

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