

CRC Report for CHANCO for ALMA Cycle 5

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Executive Summary

Chilean scientists who participated in the ALMA Cycle 5 Proposal Review generally felt that Chilean-led proposals were evaluated fairly against those other executives. Nonetheless, for the sixth year in a row the overall scientific ranks of Chilean proposals skewed significantly lower than other executives. This ongoing regional imbalance was exacerbated in Cycle 5 by the new scheduling procedure that ALMA implemented, whereby regional imbalances are now dealt with only after the majority of the time is scheduled and oversubscribed RAs, configurations, frequencies can potentially be blocked from Chilean use. This procedure resulted in a substantial fraction of Chilean proposals receiving C or U grades despite relatively high scientific ranks within the Chilean pool of proposals, thus limited the science that Chilean researchers can do. This bias, coupled with the longstanding tendency to award Chile far fewer grade A proposals, implies that Chileans are not getting equal access to the southern sky nor equal opportunities on carry-over proposals.

During the process, the Chilean Review Committee (CRC) also evaluated for the second time the Chilean eligibility status, resulting in discussion of some proposals within the context of “Palo Blanco” and weak past usage; under the current rules, a few proposals were singled out to make clarifications in their reports, but ultimately no proposals were rejected.

The CRC has a few recommendations moving forward to cycle 6 and beyond:

1. First and foremost, CONICYT and Universidad de Chile must negotiate with ALMA to fix the biases inherent in the current TAC process (i.e., equal access by executive fraction to all RA's, bands, and resolutions, and equal fractions of grade A, B, and C proposals). If this cannot be done, Chile should investigate implementing a separate Chilean TAC.
2. It remains critical for CONICYT and Universidad de Chile to create formal documentation specifying the tasks of the CRC, signed by the proper authorities of those institutions and made public. Moreover, all documentation regarding Chile's involvement in ALMA should continue to be made public and posted (e.g., on the current ALMA CRC page);
3. The CRC should continue to evaluate Chilean eligibility. However, the bulk of the past usage evaluations should be incorporated formally into the ALMA TAC process itself as part of the scientific evaluation. This would eliminate substantial overheads for both the CRC and proposers.

Full Report

1. Background/Introduction. The Chilean share of time on the Atacama Large Millimeter/Sub-Millimeter Array (ALMA) is administered by CONICYT and the Universidad de Chile. The time allocation has been entrusted thus far (cycles 0-5) to an international proposal review process run by the Joint ALMA Observatory (JAO) and in which Chile (CL) participates along with the other three executives: North America (NA), Europe (EU) and East Asia (EA). In what follows we briefly summarize the proposal review process, borrowing liberally from the "Guidelines for Science Assessors" document distributed by ALMA to the participants of the review process for Cycle 5.

Cycle 5 proposals are comprised of the following types:

- **Regular Proposals** refer to observations that can be fully specified by the regular proposal submission deadline and whose estimated execution time does not exceed 50 hours on the 12-m Array or 150 hours on the Atacama Compact Array (ACA) in stand-alone mode.
- **ToO Proposals** refer to observations submitted to observe targets that can be anticipated but not specified in detail.
- **Large Programs (LPs)** refer to observations with estimated execution times greater than 50 hours on the 12-m Array or 150 hrs on the ACA in stand-alone mode.
- **mm-VLBI Proposals** refer to observations made in concert with the Global Millimeter VLBI Array or the new NRAO/Event Horizon Telescope Consortium.
- **DDT Proposals** refer to observations on high-impact topics, motivated by developments that occurred after the cycle 5 submission deadline, which can be submitted anytime during Cycle 5.

Standard and non-standard mode observations were introduced in the ALMA scientific operations in Cycle 3. The fraction of the available observing time to be dedicated to non-standard mode observations is restricted to 20%. Large programs, ACA stand-alone short baseline interferometry and single-dish observations and mm-VLBI observations were all introduced in cycle 4. Large Programs, VLBI and DDT proposals are limited to maximums of 15%, 5% and 5%, respectively, of the available time in cycle 5.

The Cycle 5 review consisted of 18 ALMA Review Panels (ARPs), each with a Chair and a Deputy Chair. Fourteen (14) Science Assessors were invited to participate from Chile, spread over the 18 ARPs. There were four ARPs for each of Science Categories 1, 2, 3 and 4, and two for Category 5. The panels for Categories 1-4 contained eight Science Assessors each, while the panels for Category 5 contained nine Science Assessors each. One Chilean panelist, Franz Bauer, acted as Chair of his respective Cycle 5 ARP in Science Category 1.

The combined expertise of the Science Assessors for each panel was intended to cover the range of topics relevant to the scientific category of that panel. As in previous cycles, the proposals for cycle 5 were separated into five science categories:

1. Cosmology and the high redshift universe
2. Galaxies and galactic nuclei
3. ISM, star formation and astrochemistry
4. Circumstellar disks, exoplanets and the solar system
5. Stellar evolution and the Sun

The Science Assessors were instructed to evaluate proposals solely on their scientific merit. Science assessments were made in two stages. In Stage 1, each proposal was evaluated by all Assessors of the ARP to which it was assigned, with one assigned as Primary, barring any conflicts of interest. Based on the resulting ranking, roughly ~75% of the proposals proceeded to Stage 2, where they were reviewed and discussed face-to-face by all unconflicted members of the relevant ARP. The proposals discarded at stage 1 were considered "Triaged" proposals.

In late 2014, Universidad de Chile appointed Franz Bauer to act as chair of the Chilean Review Committee (CRC). Prior to the scientific evaluation, the CRC, which for cycle 5 was comprised of the members of ChANCo, screened submitted Chilean proposals for Chilean eligibility status based on a set of published eligibility and usage rules posted on the CRC website (http://www.das.uchile.cl/~alma_crc/) and linked to from the Cycle 5 Call for Proposals. By agreement with ALMA authorities, this evaluation must occur before the commencement of Stage 1, in the first 2.5 weeks following proposal submission. The eligibility requirements for cycle 5 were:

1. 1.- The PI must be affiliated with a Chilean Institution and reside in Chile. Residency will be determined following the [rules](#) laid out by Sociedad Chilena de Astronomia (SOCHIAS) and specifically by comparing the list of proposers against the "[Lista Blanca](#)" maintained by SOCHIAS. *Proposers must ensure that their department head puts them on this list before the Cycle 5 proposal deadline;*
2. Each proposal must have at least one permanent Chilean faculty member among the proposers (PI or co-I). This faculty member will act as sponsor and ultimately be responsible for reporting progress on accepted programs if the PI does not submit a proposal in future cycles (including this one) or leaves Chile. Support confirmation is now required via the CRC webtool;
3. Student-led proposals require a support confirmation from faculty supervisor via the CRC webtool;
4. The PI must submit a report via the CRC webtool on past ALMA usage through the Chilean executive time, summarizing the analysis and publication status from all previously observed ALMA programs as PI and possibly as sponsor (for all accepted past programs where PI will not report on it), with emphasis on Chilean participation. The rough expectation is that PIs should publish at least one Chilean-led (faculty, postdoc, or student) paper associated with roughly 50% of their completed projects for which the data have been public for >1 year. If the PI has no past usage through the Chilean executive time, this section will remain blank;
5. The PI must submit a work plan via the CRC webtool highlighting, for each submitted proposal, who will do what with respect to reduction, analysis, and paper writing, with particular emphasis on the role of the Chilean PI and co-Is. The rough expectation is that the Chilean PI/co-Is should have a strong role within the project and contribute to the growth of submm/mm astronomy within the Chilean community;
6. If the proposal is rejected on any of the above grounds, the PI will be notified and given the opportunity to appeal the CRC decision within the next 7 days (inclusive). Please note that this is an opportunity to dispute

misinterpretations of submitted information, and not necessarily a second chance to provide new information (which will be at the discretion of the CRC)..

To assess requirements 1 and 2, the CRC chair used the SOCHIAS lista blanca. Information for requirements 3-5 were submitted via the CRC webtool on April 22, 2017, two complete days after the Cycle 5 proposal deadline of April 20, 2017. A few PIs, particularly those who were co-PIs on large programs, failed to submit information by the deadline; reminders were issued to those PIs, since the wording did not specifically mention co-PIs. The CRC evaluated the information and convened a telecon on May 2, 2017 to assess all of the information, and determine which proposals, if any, failed to meet the eligibility requirements (see section 2 below). This evaluation is communicated to the relevant PIs and after the appeal process, ultimately to the ALMA authorities.

For Stage 1, each proposal was assigned a score from 1 (best) to 10 (worst) by all unconflicted Science Assessors. Once all Stage 1 reviews were completed, the scores assigned by individual assessors each ARP were normalized to the same mean and the same standard deviation, from which an average was computed. A single ranked list of all proposals was built and a "triage" line drawn. Only proposals above that line were considered in the subsequent stages of the review process, as were proposals for which the standard deviation of the individual Stage 1 scores exceeds twice the value adopted for normalization. Large Proposals will not be subject to triage. Triaged proposals could be resurrected (i.e., marked to be discussed in Stage 2) by any unconflicted ARP assessor, pending a good reason is given and approved by the overall ALMA Proposal Review Committee (APRC) Chair. In addition, the guidelines for the triage process state that "ensuring that the estimated 12-m Array time required for execution of the proposals that proceed to Stage 2 is not less for any region than thrice [3x] its nominal share of the cycle 5 available time." In parallel with the science assessments, selected proposals will be submitted for technical assessment by a small group of Technical Assessors (that is, ALMA staff members with relevant expertise); these included proposals for LPs, VLBI, band 8-10, the Sun and solar system objects, and others as deemed necessary. Technical evaluations were provided to the Science Assessors in Stage 2.

For Stage 2, all Science Assessors met in Antwerp, Belgium during the week of June 18-23, 2017 to discuss the proposals in person. Each non-triaged proposal was discussed among one ARP and reranked between 1-10. LPs in a given category were discussed by all ARPs of that category, with each ARP voting for which LPs, if any, should be passed on for further consideration. The rankings made in the ARPs for all assigned, non-triaged proposals were collated by the APRC following a proposal-weighted "round-robin" merging process. During this process, the APRC dealt with duplications and reviewed all recommendations made by the ARPs in order to produce a single ranked list of all proposals. The chairs of each ARP (which included the chair of the CRC as the Chilean representative) and the APRC chair, who was not affiliated with any ARP but oversaw the entire process, served as the members of the APRC. A special session during the APRC meeting was held to evaluate all LPs that were put forward by

the ARPs and determine which ones, if any, were compelling enough to be scheduled in cycle 5. The APRC made a final set of recommendations to the JAO, which then was concurred by the Director's Council and the chair of the CRC as the Chilean representative.

Proposals that may potentially be observed by ALMA during cycle 5 were assigned priority grades of 'A', 'B' or 'C', while those that will not be observed were designated as grade 'U'. Grade A was reserved for the top third (33%) of proposals by rank; this grade makes these proposals eligible to be carried over to Cycle 6 if they cannot be successfully completed in cycle 5. *As yet, no firm rule is in place to equitably distribute Grade A proposals amongst the partners.* Grade B proposals are high-priority proposals comprising the remaining 67% of the time. Grade C proposals, comprising up to an additional 50% of the nominal available time, correspond to so-called "filler" programs, to be observed when conditions are not suitable for A or B proposals to be observed.

2) Analysis of Review Process for Chilean Proposals. In what follows, we present some statistics pertaining to all proposals, with an emphasis on CL proposals. The CRC would like to thank ALMA for sharing the full list of grades with the CRC chair and responding to various CRC-related requests about fairness throughout the evaluation process, which allowed the CRC to assess the fate of Chilean proposals at every stage of the process.

2.1) Overall Statistics. For Cycle 5, 4000 12-m hrs and 3000 ACA hrs are expected to be available, for which 1661 unique proposals requesting 16029 total 12-m hrs and 11362 total ACA hrs were received and reviewed. These included 22 Large Proposals, 15 mm-VLBI proposals, 22 ToO proposals, 61 ACA stand-alone proposals, and 1541 regular proposals. The overall oversubscription rate for the 12-m and 7-m arrays were thus 4.0 and 3.8, respectively, although this does not account for the non-negligible fraction of the submitted proposals that were resubmissions of uncompleted Cycle 4 programs and may have been completed before the end of Cycle 4. Table 1 below breaks down these numbers by Executive.

Proposal submission by CL institution was as follows:

- Universidad de Chile (39 proposals, including 1 from the UMI and 8 from the CCJCA),
- Pontificia Universidad Católica de Chile (18 proposals),
- Universidad de Valparaíso (16 proposals),
- Universidad Diego Portales (14 proposals),
- Universidad de Concepción (9 proposals),
- Universidad Nacional Andrés Bello (2 proposals),
- Universidad de Antofagasta (2 proposals),
- Universidad de Atacama (1 proposal), and
- Universidad Autónoma (1 proposal).

	Chile (CL)	East Asia (EA)	Europe (EU)	North America (NA)	Open Skies	Total
Submitted Proposals						
Number of proposals	91	335	695	492	48	1661
12-m Array time (hours)	975	3778	6384	4568	324	16029
7-m Array time (hours)	591	3013	4106	3411	242	11362
Total Power Array time (hours)	307	2939	2391	1893	42	7572
Subscription rate						
12-m Array (4000 h offered)	2.4	4.2	4.7	3.4	N/A	4
7-m Array time (3000 h offered)	2	4.5	4.1	3.4	N/A	3.8
Total Power Array (3000 h offered)	1	4.4	2.4	1.9	N/A	2.5
Grade A & B projects						
Number of proposals	49	88	148	142	6	433
12-m Array time (hours)	364	827	1226	1252	37	3706
7-m Array time (hours)	331	450	574	941	4	2299
Total Power Array time (hours)	88	517	506	741	4	1855
Grade C projects						
Number of proposals	13	49	109	85	6	261
12-m Array time (hours)	156	434	819	685	30	2123
7-m Array time (hours)	44	409	675	276	144	1549
Total Power Array time (hours)	75	349	337	160	0	920

Table 1 – Regional distribution of all submitted proposals, and of the proposals recommended for scheduling with Grades A and B, and Grade C. Note: subscription rate does not apply for Open Skies since all regions contribute observing time for proposals from PIs who are not affiliated with any of the ALMA regions. Note: the listed number of proposals does not account for co-PIs of Large and VLBI Programs.

2.2) Chilean Eligibility Stage. The CRC evaluated all eligibility information received between April 24 and May 3 to produce ranked list, averaged over all unconflicted members. A cutoff was determined and proposals below this were individually discussed during a telecon on May 2.

CRC requirements 1 and 2 were evaluated using the SOCHIAS Lista Blanca, although it was noted that some information about eligibility dates was lacking for some PIs and revised information had to be requested for several proposers. Incomplete or incorrect information should be remedied and homogenized by SOCHIAS for future cycles.

CRC requirements 3, 4 and 5 were evaluated based on the information submitted via the CRC web form. In a few cases, the information was felt to be insufficient and further details were requested from proposers. In total, 5 proposals were not submitted on time; 3 were from first time users and 2 from Chilean co-PIs of LPs. An additional 10 proposals were placed on hold for not providing sufficient information for evaluation, while 1 proposal was flagged for weak participation in a LP. All 16 of the above proposals were provisionally rejected and the PIs contacted about the possibility to appeal the decisions. Four proposers were issued warnings regarding weak past usage. Following the 1-week appeal process, all on-hold and rejected proposals were reinstated, and on May 18, 2016, the ALMA authorities were informed that all proposals should move forward for scientific evaluation.

2.3) Stage 1 (Triage). In Stage 1, 437 proposals in total were triaged, broken down by Executive as 0 CL, 131 EA, 169 EU, 114 NA and 24 non-partner. Of the triaged proposals, 34 were afterwards resurrected, resulting in an overall triage percentage of ~26% and ~24% by number and hours, respectively. In addition, 8 proposals, broken down by Executive as 1 CL, 0 EA, 5 EU, 2 NA, and 0 non-partner, were deemed infeasible based on the rules laid out in the ALMA Proposer’s Guide for the perceived capabilities and performance of the ALMA Observatory. Likewise, 5 proposals were considered duplications of existing datasets, broken down by Executive as 1 CL, 1 EA, 2 EU, 1 NA, and 0 non-partner. Thus 0%, ~1%, and ~1% of CL proposals were respectively triaged, deemed infeasible, and considered duplications. The list of all submitted CL proposals is included as Appendix C.

2.4) Stage 2. In Stage 2, after removing the infeasible and duplicate proposals listed in section 2.3, 1224 proposals were evaluated and ranked, including 22 LPs. These are broken down by the executive of the PI in Table 2.

Executive	Regular	ToO	VLBI	ACA-only	LP
CL	82	1	0	4	0
EA	186	4	3	6	3
EU	486	7	8	11	13
NA	352	9	4	4	6
Open Skies	22	1	0	1	0

Table 2 – Regional distribution of Stage 2 proposals by type.

As in previous cycles, the ranks of Chilean proposals were skewed toward lower values than the other executive. Prior to the scheduling simulations and excluding LPs, the Chilean proposals went about 3.3, 1.7, and 1.3 times deeper into the ranked pool of proposals than the EU, NA, and EA executive to fulfill their full allocations (in terms of 12-m hours for grades A+B). These factors can be compared to those from cycle 4, which were 1.6, 1.6, and 1.3 times deeper, respectively. The total 12-m array number and time of the CL A+B proposals is 49 proposals for 364 hrs (out of 400 hrs nominally), plus 331 hrs of 7-m array time (out of 300 hrs nominally) and 70.8 hrs of non-standard mode time (out of 80 hrs nominally). A total of 262 proposals were assigned grade C, for 2122 hrs of 12-m array time. Of those, 13 proposals were from CL, for a total of 156 hrs of 12-m array time.

During the stage 2 process, the CRC chair polled each Chilean ALMA TAC member to assess the presence of regional biases within any particular panel. Despite the best efforts by ALMA to bring up issues surrounding bias prior to the start of the review process, two cases of individual bias were encountered; both were forwarded to the attention of ALMA authorities during the review and handled accordingly. Note that these biases were of a scientific nature, and not regionally based.

2.5) APRC Meeting. The APRC meeting was held on June 22-23, 2017. In attendance from CL was Franz Bauer, in his capacities as the ARP1D panel chair and the CRC chair. ALMA merged the ranked lists from each ARP in round-robin order, after renormalizing by the total number of proposals per ARP. The APRC briefly reviewed all duplications and recommendations made by the ARPs, and then discussed the 10 LPs which were put forward by more than one ARP, from both scientific merit and scheduling feasibility standpoints. Four LPs had sufficient support among APRC members to be recommended (2017.1.01355.L, PI Motte, with Chilean Co-PI Louvet; 2017.1.00161.L, PI Costagliola; 2017.1.00428.L, PI Le Fèvre, with Chilean co-PI Cassata; and 2017.1.00886.L, PI Schinnerer). Finally, the APRC provided ALMA with suggestions for improving the TAC process.

2.6) Director's Council "Meeting". The Director's Council and the Chilean representative discussed the final list of graded proposals from the JAO via email during July 22-25, 2017. In the time between the APRC and Director's Council meetings, the JAO created an observing schedule based on simulations which factored in the APRC scientific rankings and the LP recommendations, the scheduling feasibility (i.e., pressure as a function of observation configuration, time of day, band) that considers the configuration schedule and historical weather conditions, and lastly executive balance. For the first 2500 hours, the simulations maximized for scientific rank without factoring in executive balance. This limit was determined by iteration, with the philosophy to maximize the number of highly ranked proposals to be scheduled. For the remaining ~1500 hrs, the simulations attempted to re-balance time across executives to satisfy the required partner allocations. To this end, the proposals were selected from the executive that was most out of balance while still factoring in scientific rank, scheduling feasibility, and the requirement to fit within the remaining gaps in the queue. In this manner, executive balance was achieved for the full ~4000 hrs,

The final JAO version of the schedule differed substantially from the APRC ranked list due to the above factors. Unfortunately, the APRC never had a chance to see or comment on this final ranked list, which was only assigned after the face-to-face APRC meeting. Also, given that a substantial fraction of the top ranked proposals are resubmissions, the final observing schedule should be finalized only after removing all of the completed projects. This is crucially important because certain ARPs will be much more strongly affected by this culling than others. Presently, the scheduling simulations account for the removal of resubmissions only through July (vs. October), and it remains very unclear what the trickle-down effects will be on the viability of the any proposals which are currently deemed unschedulable but might not be if ALMA removed observed all resubmissions before recalculating ranks.

A total of 433 high-priority (i.e., Grade A and B) proposals totaling 3706 hr on the 12-m Array, 2299 hr on the 7-m Array, and 1855 hr on the Total Power Array have been scheduled, including four LPs recommended by the APRC. Together with an estimated ~350 hr of carry forward of Cycle 4 Grade A programs, this nearly sums up to the 4000 h of 12-m Array time expected to be available for successful PI executions in Cycle 5. Table 1 and Appendix A examine these in more detail by executive.

The top ranked proposals up to a cumulative sum of 1333 h of requested 12-m Array observing time were assigned grade A, regardless of executive. Proposals were assigned grade B up to a cumulative sum of 3700 hrs of requested 12-m Array observing time, as long as $\geq 50\%$ of the project could be added to the observing queue without oversubscribing the expected time available in the configuration and the amount of weather suitable for the requested receiver band. Proposals were assigned grade C in order to oversubscribe the configuration and time of day up to 50% of the expected available time. The Grade C programs were selected so as to ensure that ALMA does not stand idle in case the actual observation efficiency is better than assumed when assigning the A and B grades, or if the weather conditions are poorer than assumed for the scheduling exercise. While executive balance among the C programs was considered, priority was placed on ensuring that a sufficient number of backup programs are available. No attempt was made to enforce executive balance on the ACA, which was the practice in all previous cycles as well. Starting in cycle 5, the official executive balance will be made over two cycles, to further maximize efficiency and ease of scheduling.

The CL representative noted that the bottom ~85% of CL proposals were strongly affected by the scheduling simulations and argued that the JAO final schedule had a number of strong biases against Chilean proposals including: (1) the lack of executive balance among grade A and grade C proposals and (2) the lack of executive balance in a given RA range, band, or configuration, effectively blocking relatively highly ranked Chilean proposals from fitting in the queue and resulting in lower grades (C or U). Unfortunately, neither issue is specifically addressed in the ALMA EDM Document “Updated ALMA Principles of the ALMA Proposal Review Process”, and thus the argument was considered to have no standing.

The science category distribution of all submitted CL proposals versus those graded A, B or C is shown in Figure 1. In cycle 5, science categories 1 and 3 accounted for most of the CL grade A time, while there was a relatively equal split of grade B time among categories 1, 2, and 4.

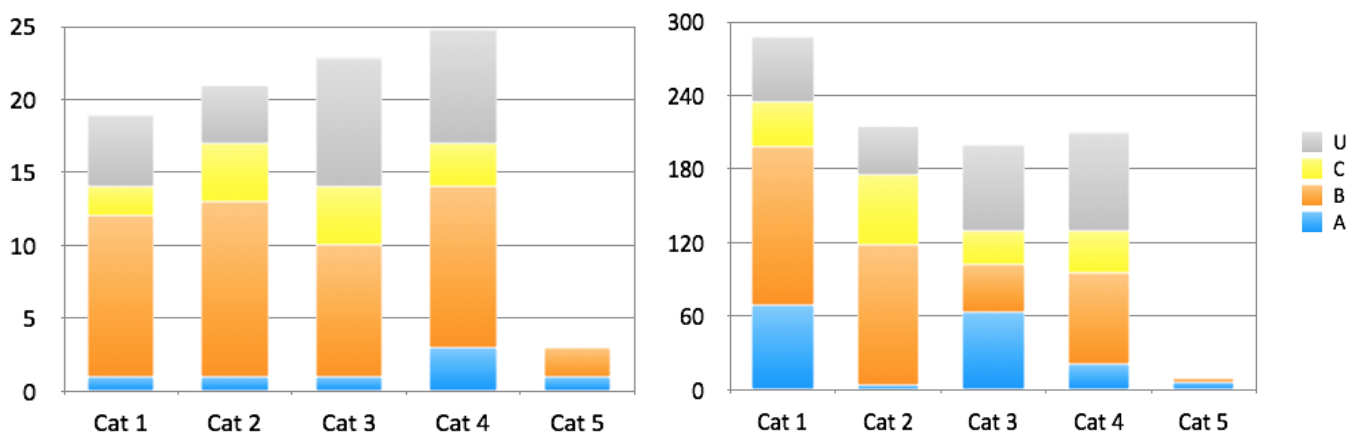


Fig 1: Distribution of CL proposals among Categories 1 through 5 by number of proposals (left) and requested hours (right). Grades: A (blue), B (orange), C (yellow), Unobserved (grey)

3) Discussion of Chilean Eligibility Process. The CRC would like to point out that ALMA has been observing for six years now, yet there still no formal documentation specifying the tasks of the CRC. Only an informal record of an agreement between CONICYT and Universidad de Chile exists, and even this has yet to be ratified by the authorities of those institutions. Ultimately, a clear and concise document should be approved and made public.

Based on CRC recommendations from Cycles 2-4, the ability to evaluate Chilean proposals regarding their engagement of and contribution to the Chilean scientific community remains an important aspect of the process. For cycle 5, a majority of the CRC felt that this Chilean evaluation process was useful and helped to deter bad actors from abusing privileged Chilean observing time. The cycle 5 rules provided the CRC with a reasonable level of information and flexibility to properly evaluate the expertise and productivity of CL PIs based on their previous publication and work records, on the number and expertise of the Chilean Co-Is, on the involvement of graduate students, and availability of local resources to judge the impact in Chile of proposals qualifying for Chilean time.

The cycle 5 evaluation led to considerable discussion surrounding a handful of submissions in which the PIs/co-PIs had poor publication records and/or weak justifications for participation in LPs. While such problematic proposals may be few in number, they could constitute a substantial fraction of Chile's overall time and result in minimal overall benefit to the Chilean community if allocated. The CRC felt that any non-Chilean led LP requesting a significant fraction of Chilean time (i.e., >2-3 times the average amongst regular proposals, or $\geq 10\%$ of the total Chilean allocation) should demonstrate substantial participation and engagement of the Chilean community. While these potential "palo blanco" proposals did not ultimately comprise a large fraction of the allocated time in cycle 5, they still constitute unloyal competition to colleagues who are making a sincere effort to carry out science with ALMA and thus reasonable efforts should be made to mitigate, if not eliminate, the phenomenon. That being said, several proposals fell into a grey area, and the CRC felt that drawing conclusions based solely on the work plan provided, without incorporating a full scientific evaluation, failed to give an appropriate and complete picture. Given this, *the CRC recommends that the evaluation of past usage and work plans be fully incorporated into the scientific evaluation. Therefore ALMA should request this information directly in the proposal tool and the ALMA TAC assessors should factor this into the ultimate scientific rank of whether the science will be carried out effectively.*

4) Discussion of ALMA Science Review Process. Chile participates in the ALMA review on essentially equal footing with the other executives, including a presence on the APRC and the Director's Council, and expects that science assessments will be carried out without regional biases. Although a few isolated incidents of scientific bias were encountered and brought to the attention of ALMA authorities, the stage 1 and 2 evaluation processes appeared to be relatively fair with respect to Chilean interests in cycle 5, in so far as participating Chilean assessors could determine. Nonetheless, as Fig. 2 shows from the APRC merged list by rank, Chilean proposals continue to dramatically skew toward lower scientific ranks than other regions, similar to past cycles. The cause of this issue remains unclear. On the one hand, a larger fraction of the

Chilean community submits ALMA proposals than any other region. This could lead to worse ranks due to non-expert proposals. Additionally, fewer Chilean proposals are triaged due to the low oversubscription, which could shift the median rank to lower values. However, excluding Chilean co-I participation in LPs (which automatically get a grade A and a top rank), there is clear deficit of Chilean-led proposals at the highest ranks compared to EU and NA proposals and, notably, the scientific ranks of Chilean proposals are systematically lower even amongst relatively well-respected submm/mm “experts” in the Chilean community. For example, there are only 2 CL-led proposals amongst the top 100 non-LP proposals and 12 CL-led ones amongst the top 350, both are clearly lower than the total fraction of submissions (i.e., 91 out of 1661, or 5.5%; see Table 1). A strong worry is that this problem stems from some form of unconscious biases (e.g., legacy, cultural, inter-group, oversubscription). *The CRC therefore recommends that ALMA take proactive steps to mitigate biases, including stronger anti-bias messaging before and during the review, as well as modifications to the proposal format (e.g., listing the proposing team in alphabetical or random order) to combat regional bias.*

This regional bias toward Chilean proposals, which manifested itself in the APRC ranked list, was compounded by the new process implemented by ALMA in cycle 5 to schedule approved proposals. Because the first 2500 hrs of ALMA cycle 5 were scheduled solely based on scientific rank and “observability”, the process effectively blocks out certain RAs, configurations, and bands from Chilean time. The extent of this bias can be seen in Figs. 3 and 4. These should show diagonal lines if all executives are performing equally. However, as in Fig. 2, it is clear that the allocation of Chilean proposals strongly lags behind the other executives, such that most observing time has already been allocated by the time ALMA begins to schedule the bulk of the CL-led proposals. This process results in a non-negligible fraction of CL-led proposals (up to ~30%) being assigned C and U grades before even 50% of the CL time is scheduled, largely due to the fact that certain RAs, non-standard time, and configurations are full. Thus ALMA is rejecting CL-led proposals MUCH higher into our executive queue than other regions. While this “science” first approach is clearly “good” for EU science, it is exceptionally “bad” for CL science.

In early versions of the ALMA EDM Document “Principles of ALMA Proposal Review Process” [e.g., AEDM 2010-078-O (Rev4)], there existed a protective clause “If there are over-subscriptions for certain RA ranges or frequencies, the JAO Head of Science Operations will aim at the goal that each of the partners and Chile receives a fair share of this time, taking into account the weather requirements and feasibility”. However, by 2016 (AEDM 2016-088-O) this clause was removed. Given the strong bias in cycle 5, *the CRC therefore strongly recommends that ALMA implement executive balance throughout the entire scheduling process and ensure that Chilean proposals receive their fair share of observing time even in the face of over-subscriptions (in any quantity).*

Finally, there is a clear discrepancy amongst the executives with regard to the allocation of A grades. For instance, ~50% of accepted EU-led proposals were assigned grade A in cycle 5, well above the nominal expectation value of 33%, compared to only 14% of accepted CL-led proposals. Even comparing the grade A fraction among all submitted proposals, the EU claims

9.7% vs. CL with 5.5%! As grade A proposals are carried over into the next cycle, the allocation of these grades imparts a strong advantage since successful proposers do not have to spend time to update and resubmit proposals, nor have to worry about evaluation from two different review panels (e.g. “double jeopardy”). Thus the CRC therefore strongly recommends that ALMA distribute A grades proportionate to executive balance.

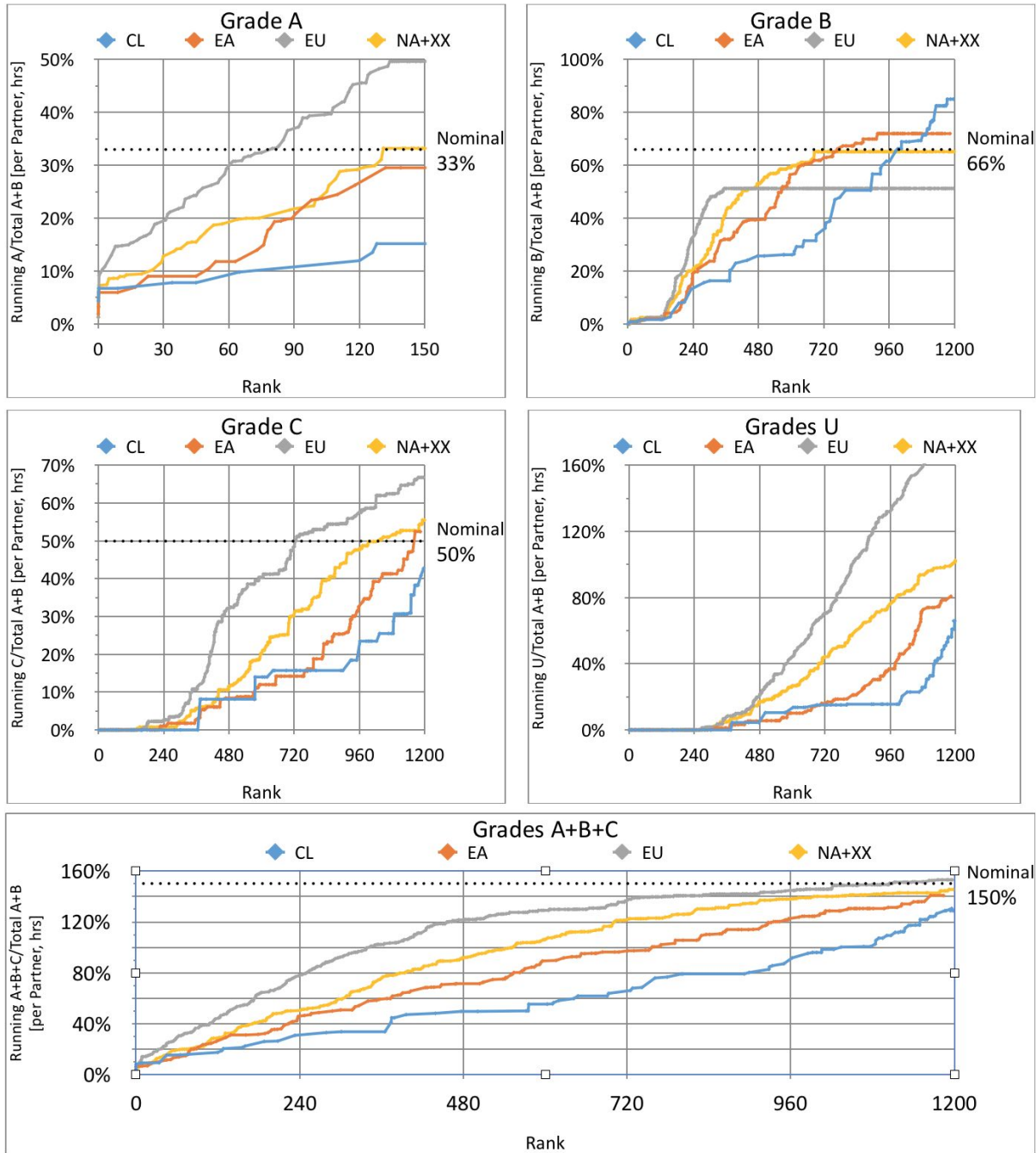


Figure 2 - Running fraction of scheduled hrs with a given grade per executive as a function of merged ALMA APCR scientific rank. Curves are cumulative, based on ascending rank and normalized by the nominal total A+B hrs expected per executive. The nominal grade A, B, and C fractions are shown as dotted horizontal lines.

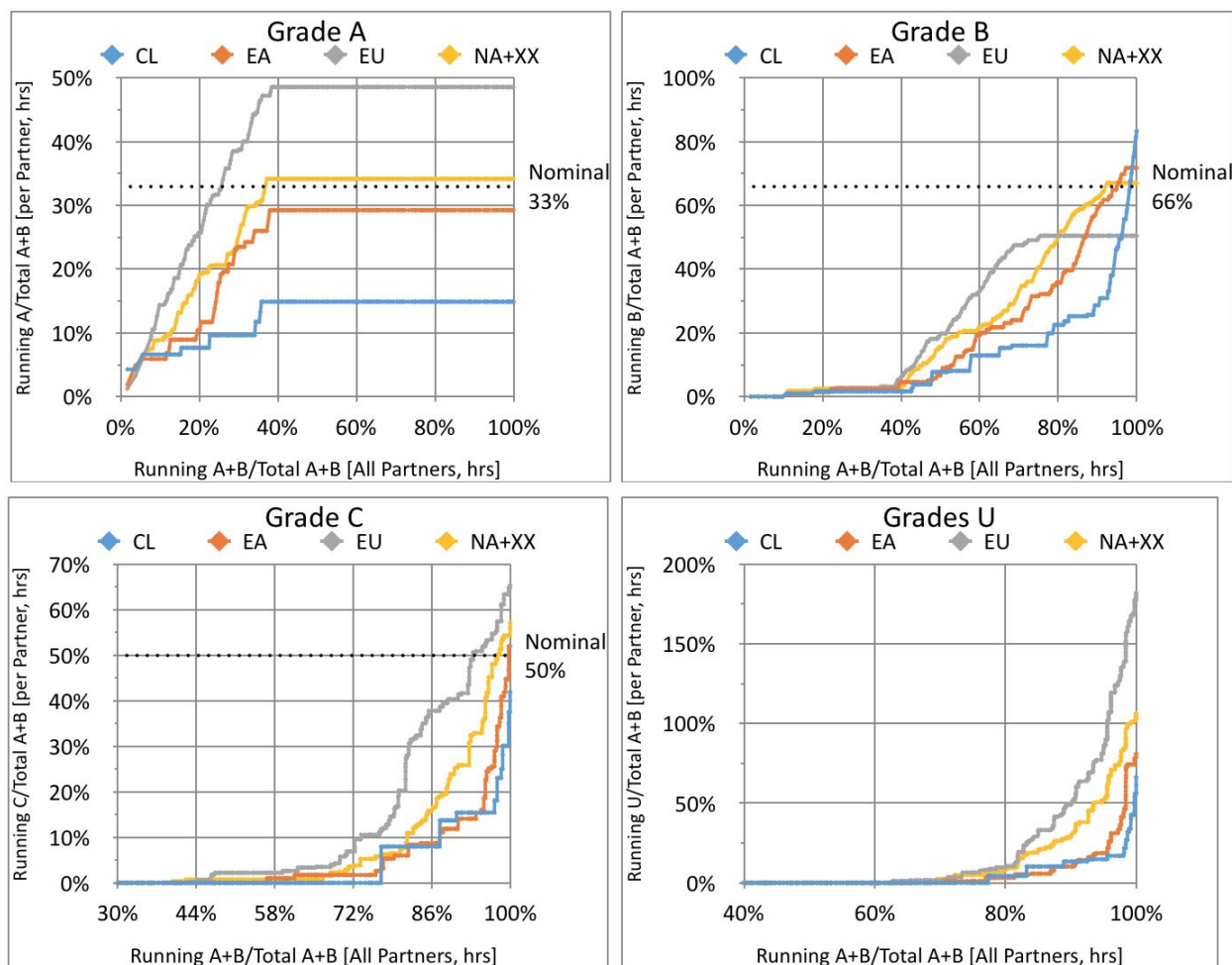


Figure 3 - Running fraction of scheduled hrs of a given grade per executive as a function of running fraction of A+B hrs amongst all executives. Curves are cumulative, based on ascending rank and normalized by the nominal total A+B hrs allocated, per executive on y-axis and total on x-axis. The nominal grade A, B, and C fractions are shown as dotted horizontal lines.

Continued participation by Chilean scientists in the ALMA review process has several advantages: (1) exposure to high-quality, cutting-edge scientific proposals, (2) exposure to knowledgeable international colleagues in similar areas, and (3) an international standard by which Chilean proposals can be evaluated and ranked. All of these help to improve the competitiveness and visibility of Chilean science on the international stage. At the same time, the yearly ALMA review process remains quite demanding for individual reviewers due to the very large number of proposals (>100) that must be evaluated by each panel member. For each reviewer, there is both considerable preparatory work in the weeks leading up to the meeting, as well as during the weeklong event itself. This represents a fractionally larger time commitment for the Chilean community compared to other executives, and thus the CRC recommends that Chile evaluate the potential for community fatigue, particularly considering all of the other outside commitments that Chilean faculty and postdocs have.

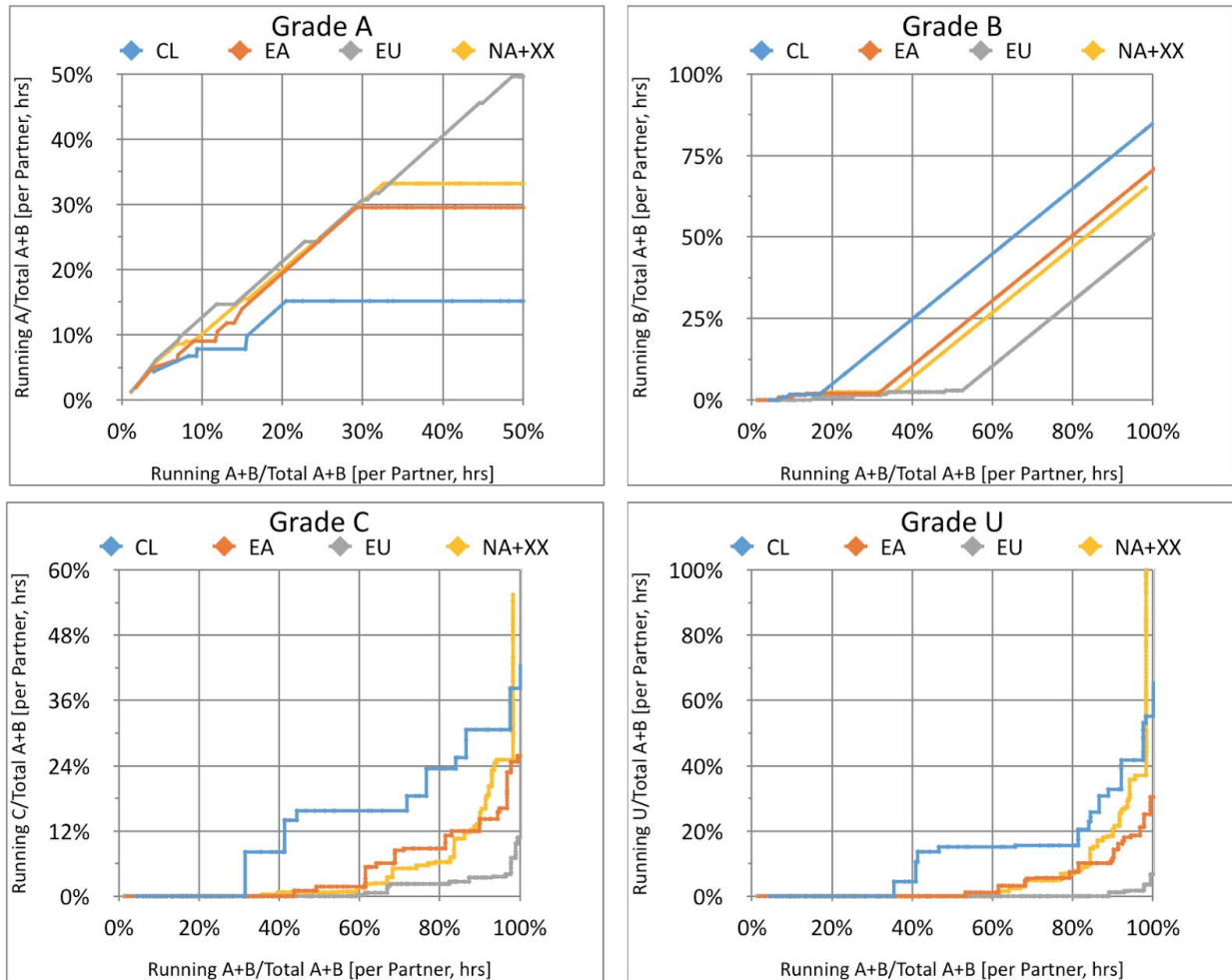


Figure 4 - Running fraction of scheduled hrs of a given grade as a function of running fraction of A+B hrs, per executive. Curves are cumulative, based on ascending rank and normalized by the nominal total A+B hrs expected per executive.

Some additional recommendations to the ALMA process:

- Given that the JAO scheduling simulation process results in substantial changes compared to the merged scientific rankings that the APRC sees, the APRC should have a chance to review and comment on the “official” JAO schedule. If these simulations cannot be run before the APRC meeting, then a telecon should be convened when they are done.
- To understand how Chilean proposals have been handled in past cycles, it is absolutely critical that ALMA provide sufficient statistics to demonstrate that the division of time in cycles 0-4 has been equitable (i.e. full list of approved programs as a function of RA, band, configuration, PWV, executive, scientific rank, completion status, etc.).
- For the process to remain fair between the different ARPs and not bias some science topics which focus on certain configurations, the ALMA schedule should only be truly finalized after all completed projects from the previous Cycle are removed, just prior to the opening of the new Cycle.

5) Conclusions and Recommendations.

Concerning the tasks of the CRC to evaluate CL proposals for eligibility and impact on Chilean science, the CRC has two recommendations in order to improve the process in Cycle 6 and beyond:

- CONICYT and Universidad de Chile need to create formal documentation specifying the tasks of the CRC, signed by the proper authorities of those institutions and made public.
- Migrate the submission of past usage and work plans into the ALMA Observation Tool itself and evaluate these items as part of the overall scientific process. This would simplify the role of the CRC to simply cross-checking the submitted proposals against the SOCHIAS lista blanca.

Regarding the evaluation of Chilean proposals and continued participation in the ALMA TAC, the CRC has several recommendations and concerns for CONICYT/UChile:

- Executive balance in the JAO simulations must be implemented from the very beginning and should factor into how the queue deals with any kind of oversubscription (e.g., RA, band, configuration, PWV, etc.). Maximizing the overall scientific rank does not maximize CL scientific rank, and consequently leads to situations where CL is not implementing the best proposed science. The current lack of such executive balance in cycle 5 has resulted in several relatively highly ranked Chilean proposals being blocked out of certain RA ranges, configurations, and bands and given grades of C or U. **This should be satisfactorily addressed for Chile to remain in the international TAC.**
- Executive balance of A grades for regular proposals should to be implemented. For the past 6 cycles, CL has received a far lower proportional share of carry over. This places an extra burden on the Chilean community, who must resubmit proposals at a much higher rate than other executives considering the size of the CL community. **This should be satisfactorily addressed for Chile to remain in the international TAC.**
- Chile should set reasonable limits (e.g., ~10-15%) on the amount of time that can be allocated to non-Chilean led LPs from the overall Chilean budget.
- Chile needs to evaluate the potential for community fatigue with regard to serving on the ALMA TAC.
- Chile should request that ALMA provide sufficient statistics to demonstrate that the division of time in cycles 0-4 has been equitable (full list of approved programs by RA, band, configuration, PWV, executive, scientific rank, completion status, etc.).
- During 2018, Chile should investigate the advantages and disadvantages of running our own national TAC for ALMA in detail. *Depending on how ALMA addresses the two bolded points above, it may be in Chile's best interest to run our own TAC to ensure that Chilean the community comes first.*