ALMA Early Science Cycle 1: Outcome of the Proposal Review Process

Proposal Review Process

In response to the Call for Proposals for Early Science Cycle 1, ALMA received 1131 valid proposals for scientific observations by the 12 July 2012 submission deadline. These proposals, referred to hereafter as "submitted proposals", were reviewed by 11 ALMA Review Panels (ARP), comprising each 7 Science Assessors. To ensure a fairly even workload between the different ARPs, they were distributed as follows across the 5 ALMA scientific categories:

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

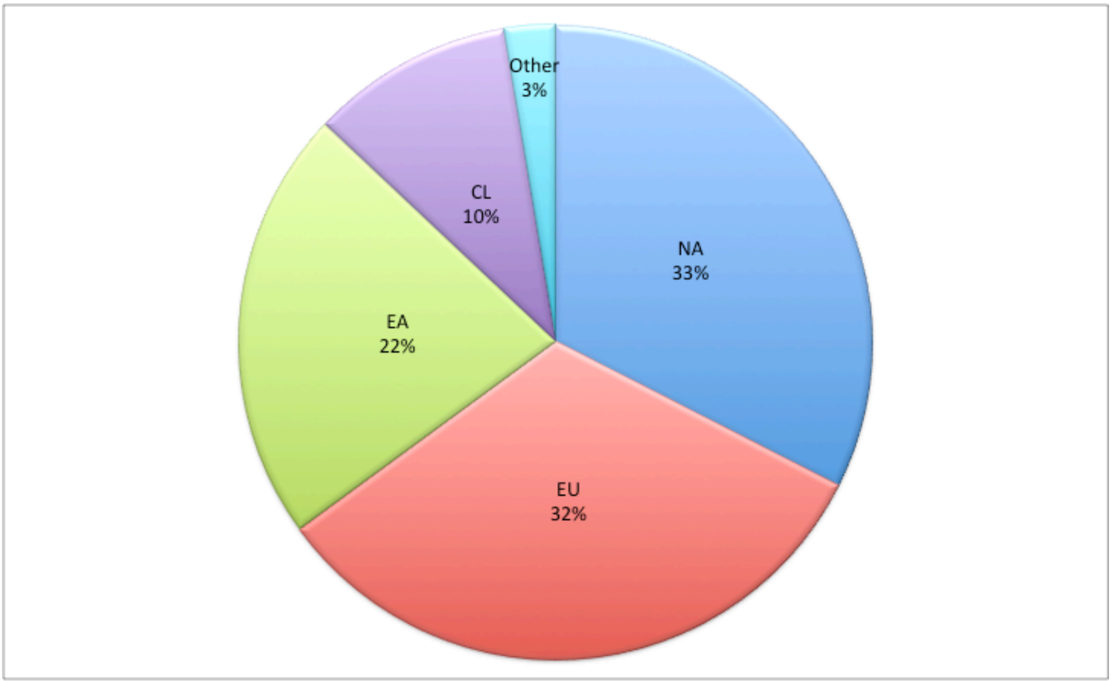

Figure 1. Regional distribution of the Science Assessors.

Table 1. Cycle 1 APRC and ARP members

APRC chair:	
Françoise Combes	Paris Observatory (France)
APRC and ARP members:	
Susanne Aalto	Chalmers University of Technology (Sweden)
Rachel Akeson	California Institute of Technology (USA)
Hector Arce	Yale University (USA)
Andrew Baker	Rutgers, The State University of New Jersey (USA)
John Bally	University of Colorado at Boulder (USA)
Felipe Barrientos	Pontificia Universidad Católica de Chile (Chile)
Maite Beltran	Arcetri Astrophysical Observatory (Italy)
Jacqueline Bergeron	Institut d'Astrophysique de Paris (France)
Michael Bietenholz	York University (Canada)
Andrew Blain	University of Leicester (UK)
Dominique Bockelee-Morvan	Paris Observatory (France)
Leo Bronfman	Universidad de Chile (Chile)
John Carpenter	California Institute of Technology (USA)
Paola Caselli	The University of Leeds (UK)
Jose Cernicharo	Centro de astrobiología (INTA-CSIC) (Spain)
Claire Chandler	National Radio Astronomy Observatory, Socorro (USA)
Tracy Clarke	Naval Research Laboratory (USA)
Leen Decin	Catholic University of Leuven (Belgium)
Asuncion Fuente	National Astronomical Observatory (Spain)
Yasuo Fukui	Nagoya University (Japan)
Gaspar Galaz	Pontificia Universidad Católica de Chile (Chile)
Guido Garay	Universidad de Chile (Chile)
Maryvonne Gerin	Paris Observatory (France)
Mark Gurwell	Harvard-Smithsonian Center for Astrophysics (USA)
Jorma Harju	Helsinki University (Finland)
Naomi Hirano	Academia Sinica Institute of Astronomy and Astrophysics (Taiwan)
Leslie Hunt	Arcetri Astrophysical Observatory (Italy)
Frank Israel	Leiden Observatory (The Netherlands)
Rob Ivison	Royal Observatory, Edinburgh (UK)
Andres Jordan	Pontificia Universidad Católica de Chile (Chile)
Seiji Kameno	Kagoshima University (Japan)
Sheila Kannappan	University of North Carolina at Chapel Hill (USA)
Hiroshi Karoji	The University of Tokyo (Japan)
Jill Knapp	Princeton University (USA)
Kotaro Kohno	The University of Tokyo (Japan)
Nario Kuno	Nobeyama Radio Observatory, NAOJ (Japan)
Darek Lis	California Institute of Technology (USA)
Ute Lisenfeld	Granada University (Spain)
Leslie Looney	University of Illinois at Urbana-Champaign (USA)
Dieter Lutz	Max-Planck-Institute for Extraterrestrial Physics (Germany)

Satoki Matsushita	Academia Sinica Institute of Astronomy and Astrophysics (Taiwan)
Tom Millar	Queen's University Belfast (UK)
Akira Mizuno	Nagoya University (Japan)
Raffaella Morganti	Netherlands Institute for Radio Astronomy (ASTRON) (The Netherlands)
Frédérique Motte	CEA Saclay (France)
Neil Nagar	University of Concepción (Chile)
Fumitaka Nakamura	National Astronomical Observatory of Japan (Japan)
Hideko Nomura	Kyoto University (Japan)
Karin Oberg	Harvard-Smithsonian Center for Astrophysics (USA)
Nagayoshi Ohashi	Academia Sinica Institute of Astronomy and Astrophysics (Taiwan)
Tomoharu Oka	Keio University (Japan)
Sadanori Okamura	Hosei University (Japan)
Hans Olofsson	Chalmers University of Technology (Sweden)
Takashi Onaka	The University of Tokyo (Japan)
Olja Panic	University of Cambridg (UK)
Alexandra Pope	University of Massachusetts at Amherst (USA)
Thomas Puzia	Pontificia Universidad Católica de Chile (Chile)
Luis-Felipe Rodriguez	National Autonomous University of Mexico (Mexico)
Seiichi Sakamoto	Japan Aerospace Exploration Agency (Japan)
Dave Sanders	University of Hawaii at Manoa (USA)
Sho Sasaki	RISE Project, NAOJ (Japan)
Joachim Saur	University of Cologne (Germany)
Marc Sauvage	CEA Saclay (France)
Peter Schilke	University of Cologne (Germany)
Eva Schinnerer	Max-Planck-Institute for Astronomy (Germany)
Matthias Schreiber	University of Valparaiso (Chile)
Nick Scoville	California Institute of Technology (USA)
Debra Shepherd	National Radio Astronomy Observatory, Socorro (USA)
Lister Staveley-Smith	International Centre for Radio Astronomy Research (Australia)
Lisa Storrie-Lombardi	California Institute of Technology (USA)
Masato Tsuboi	Japan Aerospace Exploration Agency (Japan)
Jean Turner	University of California at Los Angeles (USA)
Liese van Zee	Indiana University (USA)
Dave Wilner	Harvard-Smithsonian Center for Astrophysics (USA)
Gillian Wilson	University of California at Riverside (USA)
Christine Wilson	McMaster University (Canada)
Lucy Ziurys	Steward Observatory, University of Arizona (USA)

Science Assessors were selected on scientific expertise, taking into account regional balance. As can be seen in Figure 1, the regional distribution of the ARP members closely matches the nominal ALMA regional shares of the observing time. The 11 ARP Chairs served on the ALMA Proposal Review Committee (APRC), together with the APRC Chair, Françoise Combes, who did not belong to any ARP. The full list of Cycle 1 Science Assessors is given in Table 1.

The proposal review process was carried out as described in the ALMA Cycle 1 Proposer's Guide. At Stage 1, each proposal was evaluated by 4 Science Assessors. A ranked list of all proposals was built on the basis of the scores that they assigned. The top 70% of this ranking proceeded to Stage 2, as did those proposals with a large dispersion of the Stage 1 scores. At Stage 2, the ARPs met face-to-face in Santiago, on October 1-4, to discuss all proposals assigned to them that were still under consideration, and to rank them. On October 5, the APRC (that is, the 11 ARP Chairs and the APRC Chair) reviewed the single ranked list resulting from the merging of the individual ARP rankings, paying particular attention to the handling of proposals involving duplicated observations. The Directors' Council and the Chilean representative endorsed the scientific program based on the APRC ranking and taking into account the technical feasibility assessments performed by ALMA staff members and the nominal shares of observing time of the ALMA regions. The outcome of this process is summarized in this document. Notifications on individual proposals were emailed to the Principal Investigators (PI) on November 16.

Proposal statistics and regional distributions

Of the 1131 valid proposals submitted, 197 have been identified as having the highest priority for completion, and proposals from a further pool of 92 filler projects will be observed if circumstances allow and there are no proposals in the top priority group that can be observed. The estimated execution time of the 197 highest-priority projects amounts to 800 hours of 12-m Array usage, that is, the amount of 12-m Array time that is expected to be dedicated to science operations in Cycle 1. The filler projects account for an additional 400 hours of estimated execution time. Both groups of projects are shared across the regions in the agreed proportions of 12-m Array time based on the shares of the partners' and of the host country.

Among the 197 highest-priority projects, 38 include observations with the Atacama Compact Array (ACA); such observations are also part of 9 of the 92 filler projects. According to current estimates, their execution should require respectively 240 hours (for high priority projects) and 34 hours (for fillers) of ACA time.

Twenty proposals that would have qualified for scheduling based on their scientific rank were found to be not fully technically justified.

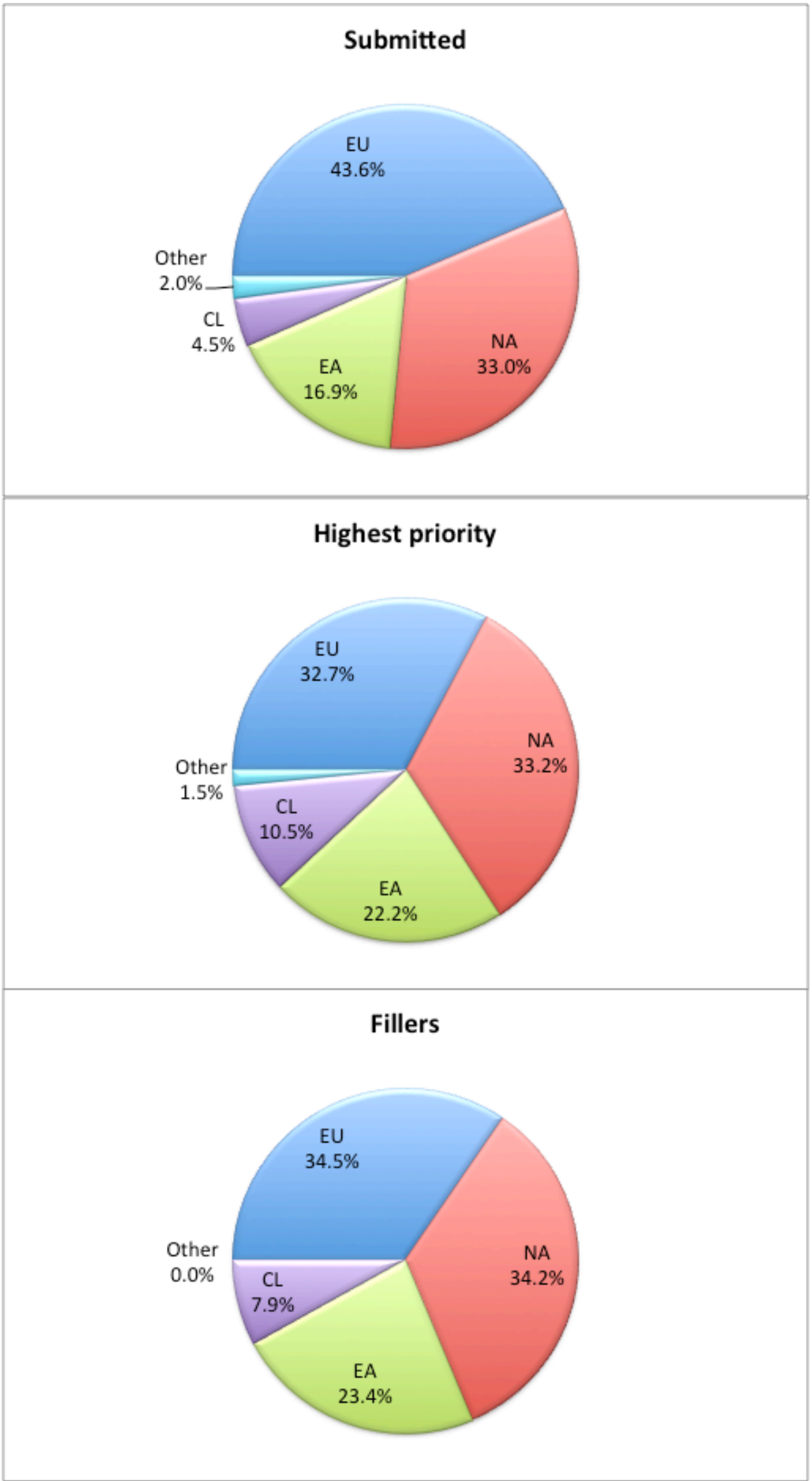

Figure 2. Regional share of estimated 12-m Array time for submitted, highest-priority and filler proposals.

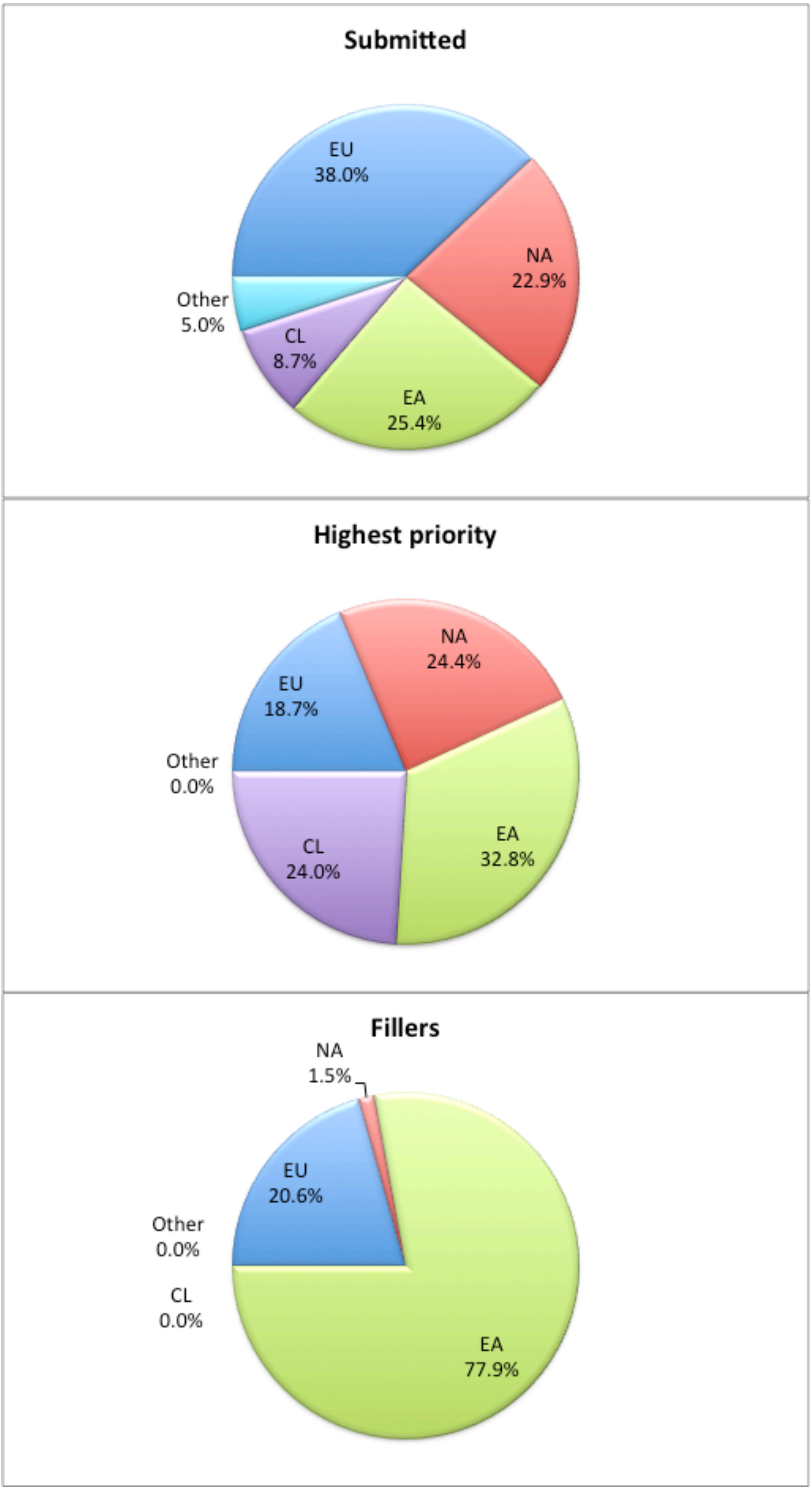

Figure 3. Regional share of estimated ACA time for submitted, highest-priority and filler proposals.

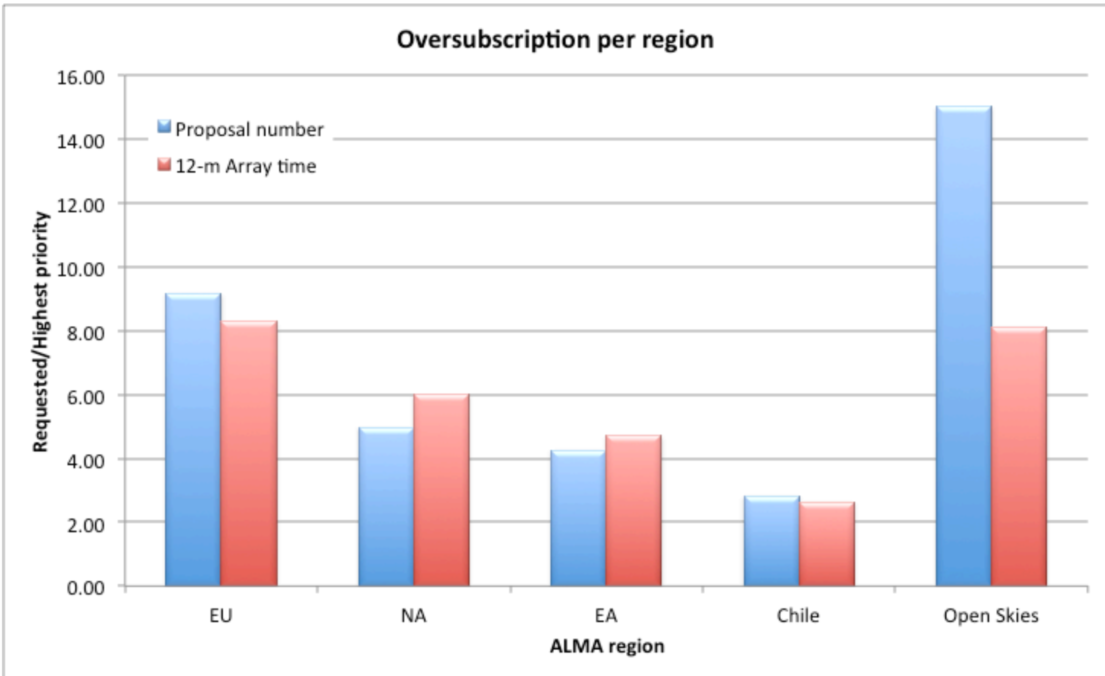

Figure 4. *Blue:* Ratio of the number of submitted proposals to the number of proposals assigned the highest priority, by region. *Red:* Ratio of the estimated amount of 12-m Array time required for execution of all submitted proposals to that required for execution of the highest priority projects.

Figure 2 shows the distribution across the ALMA regions of the estimated amount of 12-m Array time required for execution (i) of all the submitted proposals, (ii) of the highest-priority projects, and (iii) of the filler projects. Figure 3 is similar, but with respect to ACA time.

The estimated total amount of 12-m Array time that would be required for execution of all submitted proposals exceeds the 12-m Array execution time of the highest priority proposals by a factor of 6.1. This is similar to the ratio of the number of submitted proposals to that of highest-priority proposals, 5.8.

As can be seen in Figure 4, the similarity between the oversubscription factor in terms of number of proposals, on the one hand, and in terms of execution time, on the other hand, also stands when one considers the proposals region-by-region. (The apparent discrepancy for Open Skies is due to small number statistics and is not formally significant.)

The distribution of the 12-m Array execution time of the highest-priority proposals (see Figure 5) is similar to that of all submitted proposals (Figure 6). In particular, both distributions have essentially the same median value: respectively, 2.99 and 2.98 hours, as per the Observing Tool (OT) estimate.

Table 2 summarizes the main elements of information on the distribution of the proposals across the ALMA regions.

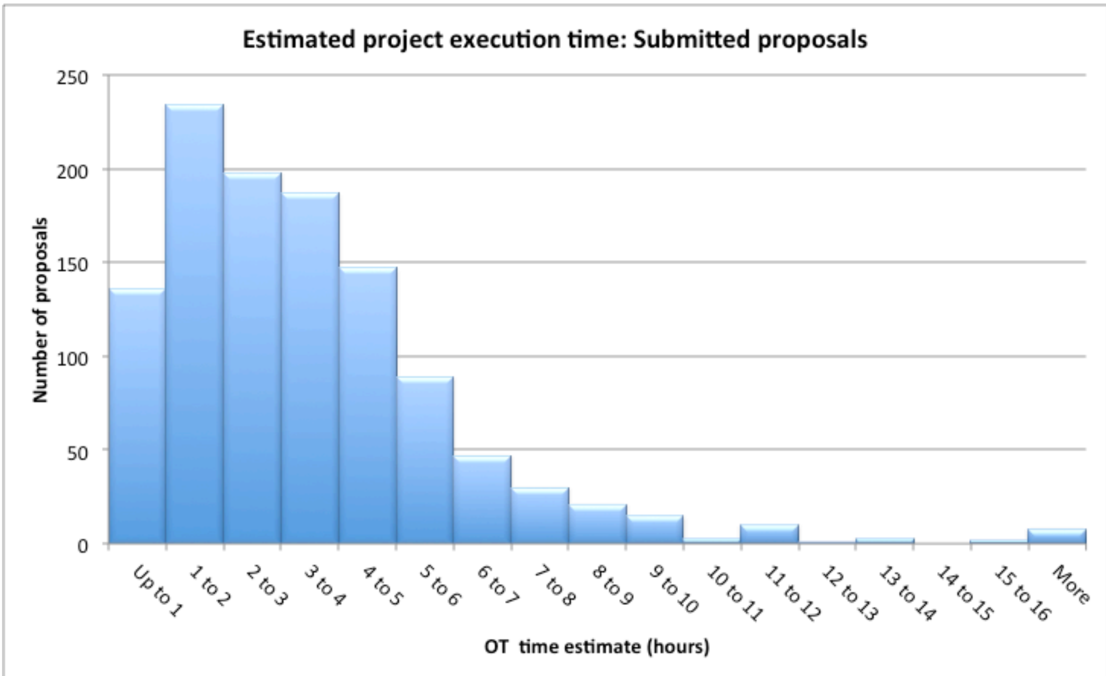

Figure 5. Distribution of the amount of 12-m Array observing time per proposal (as per the OT estimate), for the 1131 Cycle 1 proposals considered in the review process.

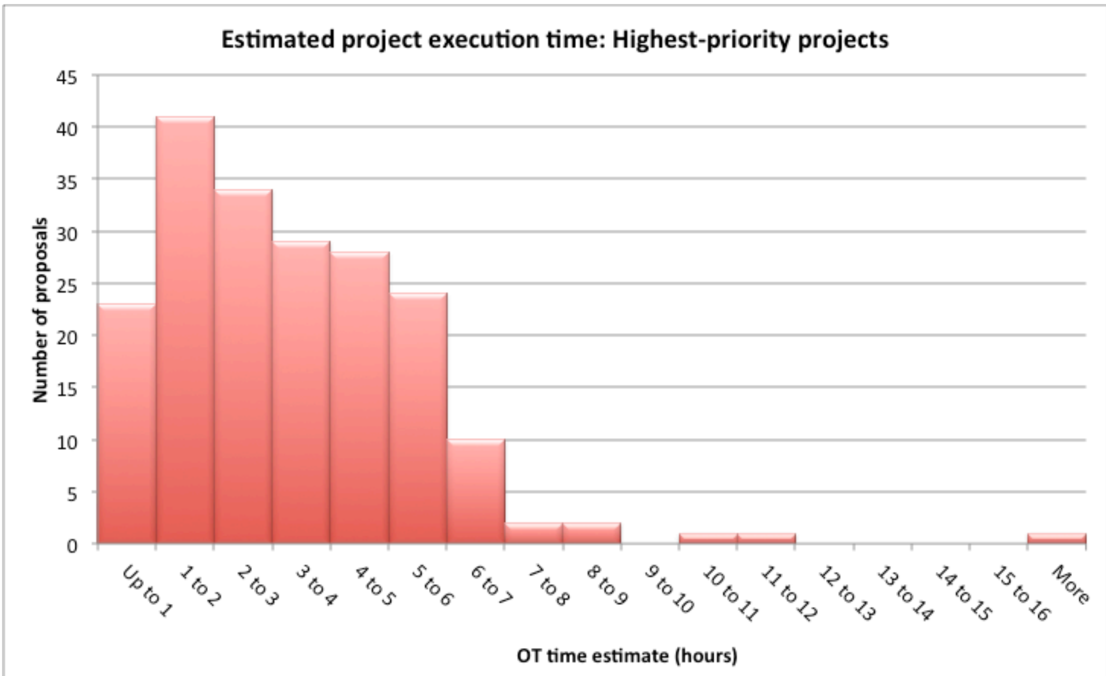

Figure 6. Distribution of the amount of 12-m Array observing time per proposal (as per the OT estimate), for the 197 Cycle 1 proposals assigned highest priority.

Table 2. Regional distribution of the submitted, highest-priority and filler projects.

	EU	NA	EA	CL	Other	Total
Submitted proposals						
Number of proposals	486	338.5	211.5	65	30	1131
Fraction of submitted proposals	43.0%	29.9%	18.7%	5.7%	2.7%	100%
Subscription rate	8.3	6.0	4.7	2.6	8.1	6.1
Highest-priority projects						
Number of proposals	53	69	50	23	2	197
Fraction of highest-priority proposals	26.9%	35.0%	25.4%	11.7%	1.0%	100%
Fraction of available 12-m Array time	32.6%	34.0%	21.5%	10.4%	1.5%	100%
Filler projects						
Number of proposals	34	28	20	10	0	92
Fraction of filler projects	37.0%	30.4%	21.7%	10.9%	0.0%	100%
Fraction of available 12-m Array time	16.5%	16.3%	10.3%	3.8%	0.0%	47%

User statistics

A total of 2852 unique users participated in the Cycle 1 Call, as either PI or Co-Investigator (Co-I) on a proposal. The 197 highest-priority proposals involve 1015 unique users and 184 unique PIs. Of the 192 users who were PIs on more than one proposal, 12 received highest priority status on more than one. The list of the highest-priority projects was published in a previous News article.

The composition of the proposing teams of the submitted proposals ranged from one single PI to 47 proposers; highest-priority projects involve between 1 and 35 authors per proposal. The mean number of proposers per submitted project was 8.5; the mean number of proposers per highest-priority project is 9.4. The distribution of the number of proposers per proposal is shown in Figure 7 for all submitted projects, and in Figure 8 for those assigned highest priority.

Table 3 shows the distribution of the country or executive of affiliation of PIs and Co-Is of submitted, highest-priority and filler proposals. Note that the total number of unique PIs is lower than the sum of the number of unique PIs per country or executive because some PIs from Taiwan submitted proposals on account of both EA and NA. For the statistics of all unique proposers (PIs and Co-Is), for Taiwan, a 50/50 executive split between EA and NA was arbitrarily adopted, since Co-Is do not have the option to select their proposal submission executive.

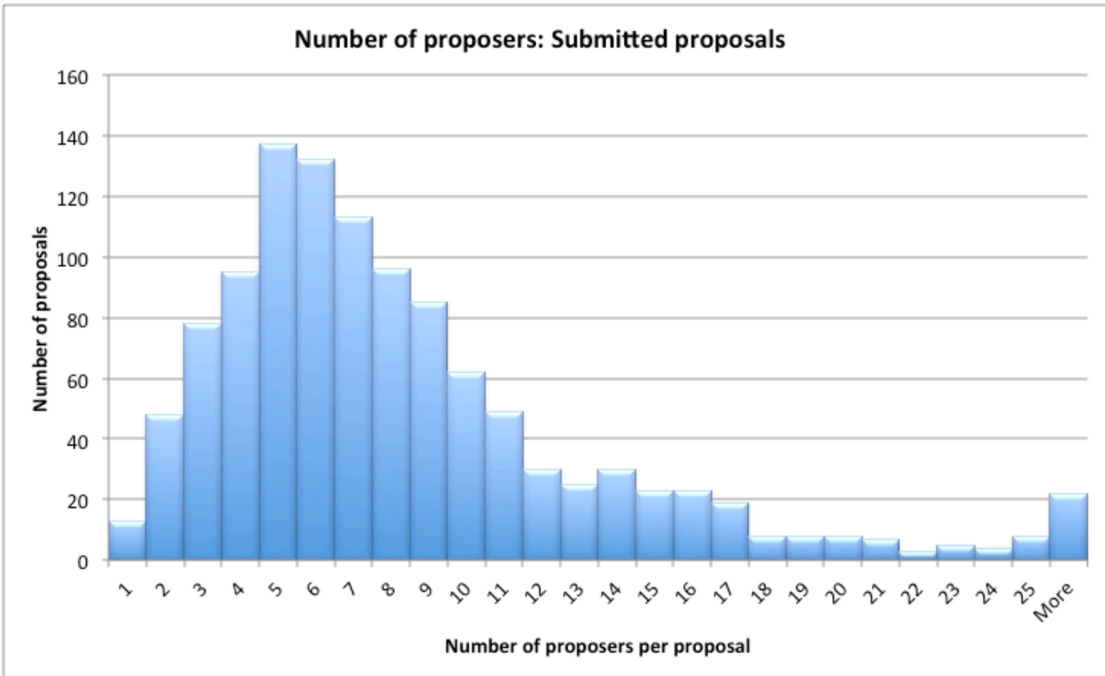

Figure 7. Distribution of the total number of proposers (PI + Co-Is) per proposal, for all Cycle 1 proposals that went through the review process.

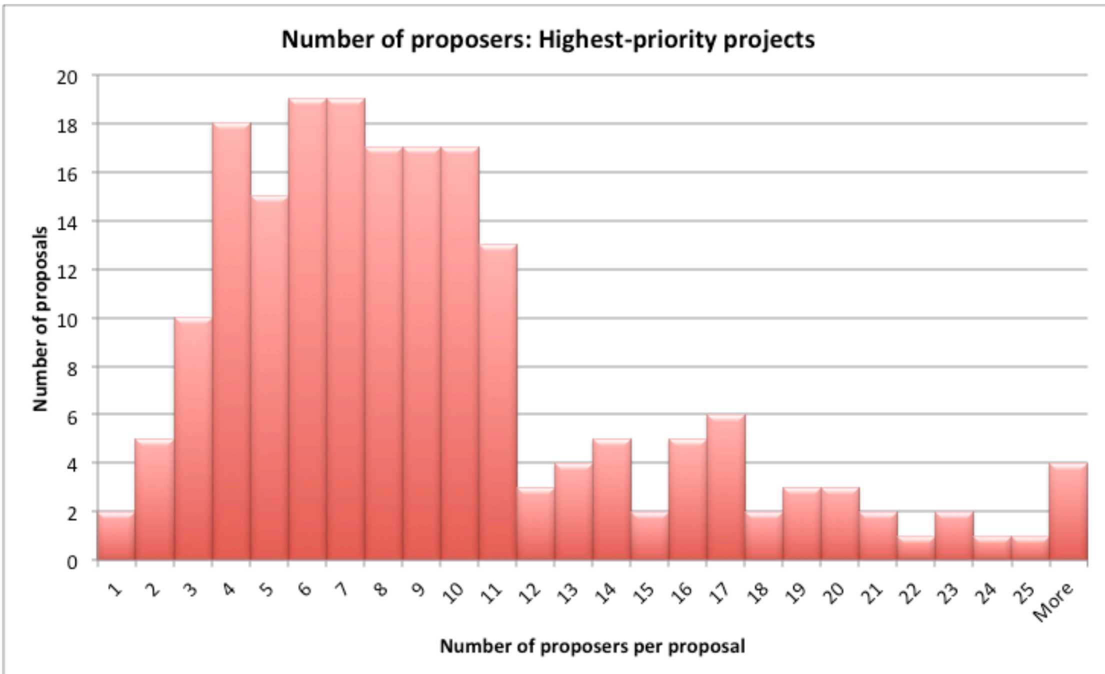

Figure 8. Distribution of the total number of proposers (PI + Co-Is) per proposal, for the Cycle 1 proposals granted highest priority.

Table 3. Distribution of the country or executive of affiliation of PIs and Co-Is or submitted, highest-priority and filler proposals.

Country/ Executive	Number of submitted proposals	Number of highest-priority projects	Number of filler projects	Number of unique Pis	Number of unique investigators
Canada	26	7	1	22	55
Chile	65	23	10	48	72
ESO countries	486	53	34	394	1341
Japan	168	40	14	123	305
Taiwan (via EA)	43.5	10	6	36.5	36.5
Taiwan (via NA)	12.5	4	0	12.5	36.5
USA	300	58	27	246	807
Open Skies	30	2	0	24	199
Total	1131	197	92	893	2852

Science categories

Figure 9 and Figure 10 show the distribution of the number of proposals per science category, respectively for all submitted proposals, and for highest-priority and filler proposals.

Although the overall proposal ranked list was built in such a way that the fraction of proposals per category in any (large enough) range of ranks is proportional to the fraction of proposals per category for the full set of submitted proposals, departures from this proportionality are introduced when this ranked list is folded with the regional time shares so as to define the groups of proposals assigned highest priority and filler status. Their origin can be understood from consideration of Figure 11, which illustrates the differences between the scientific interests of the ALMA communities of the different regions, as reflected by their Cycle 1 proposals.

Both for all submitted proposals, and for those assigned highest priority of execution or selected as filler projects, the distribution of the estimated 12-m Array time per category differs significantly from their distributions in number (compare Figure 13 and Figure 14 with, respectively, Figure 9 and Figure 10). This is primarily due to differences in the mean 12-m Array time per proposal between the different categories, and especially, the greater amount of observing time per Category 1 proposal, compared to the other categories (see Figure 12). However, the similarity of the 12-m Array time distributions between the full set of submitted proposals and the highest-priority and filler groups is coincidental, since no provision was made for this in the proposal review process.

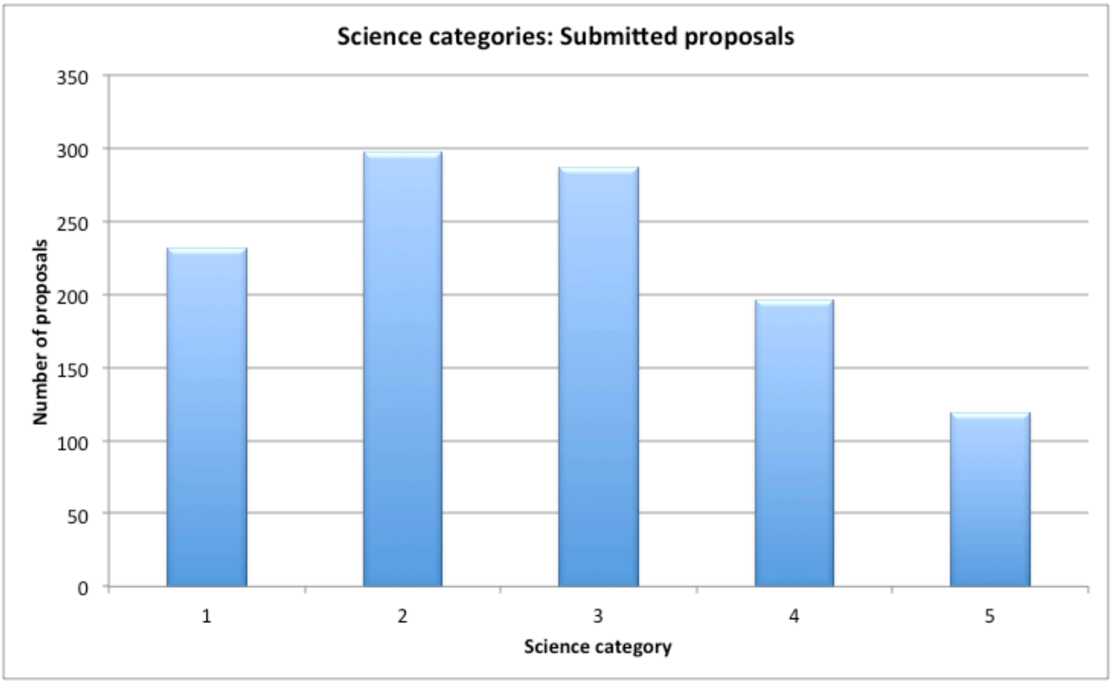

Figure 9. Distribution of the number of submitted proposals per science category.

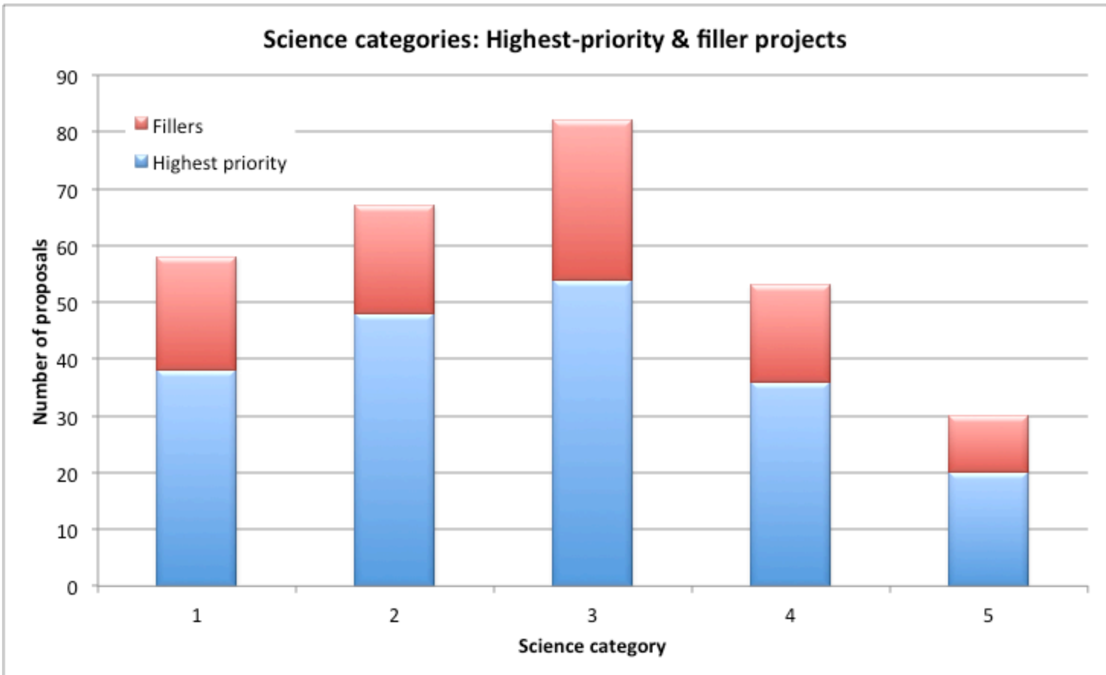

Figure 10. Distribution of the number of proposals per science category for highest priority and filler projects.

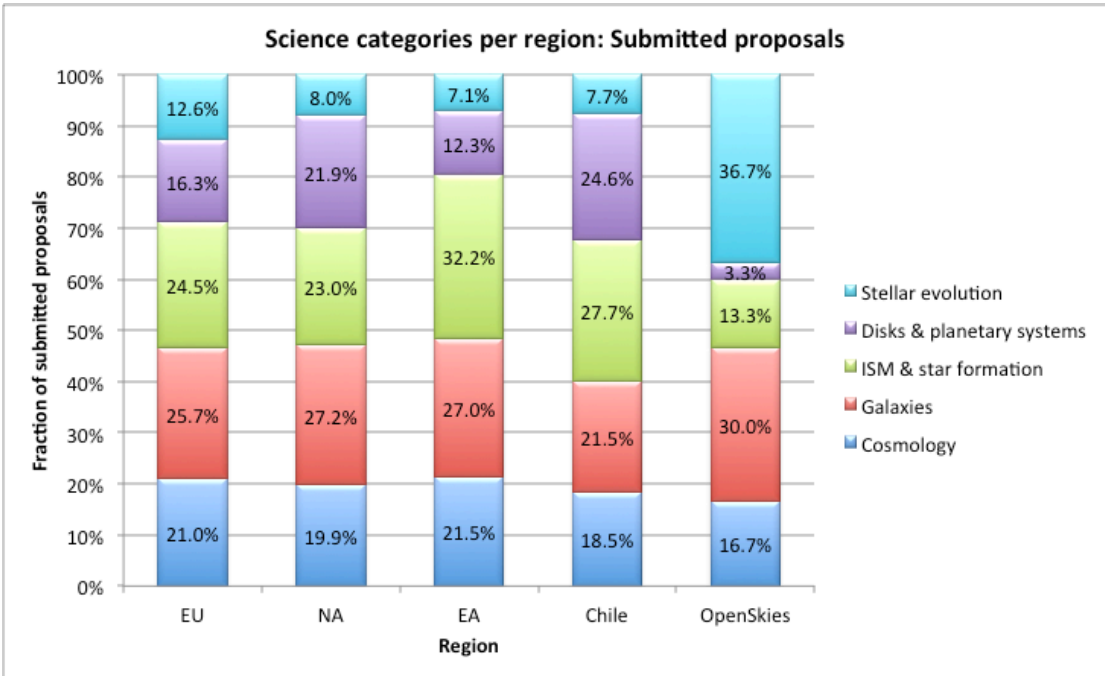

Figure 11. Distribution of submitted proposals across science categories, for each ALMA region.

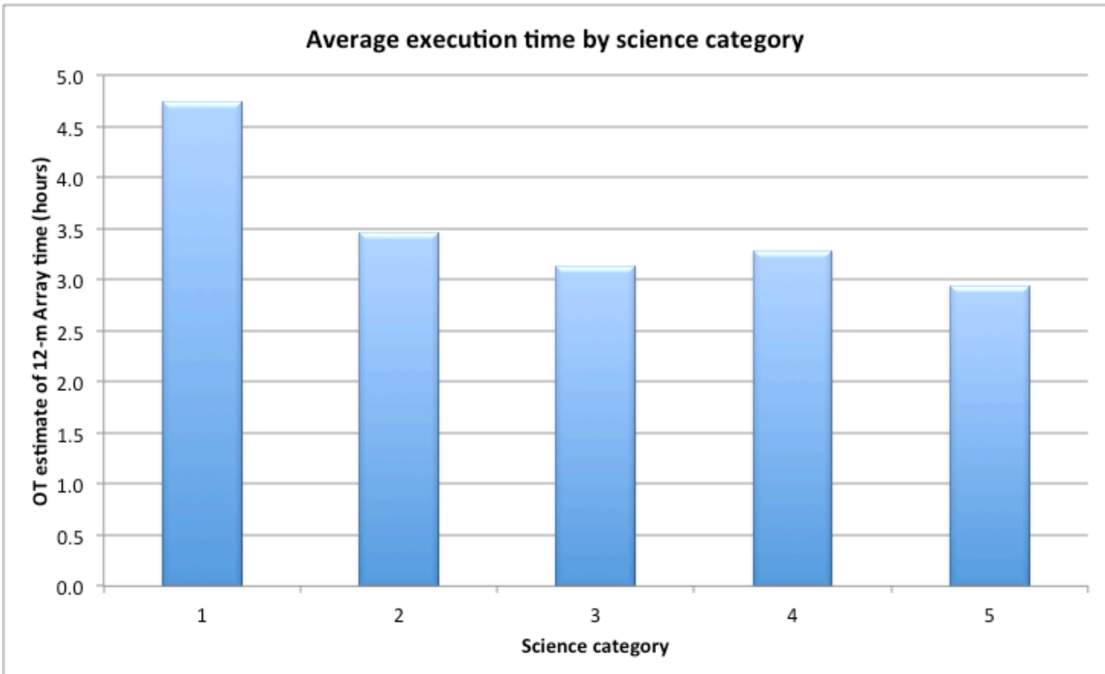

Figure 12. Distribution of the average proposal length of 12-m Array time per science category for all submitted proposals.

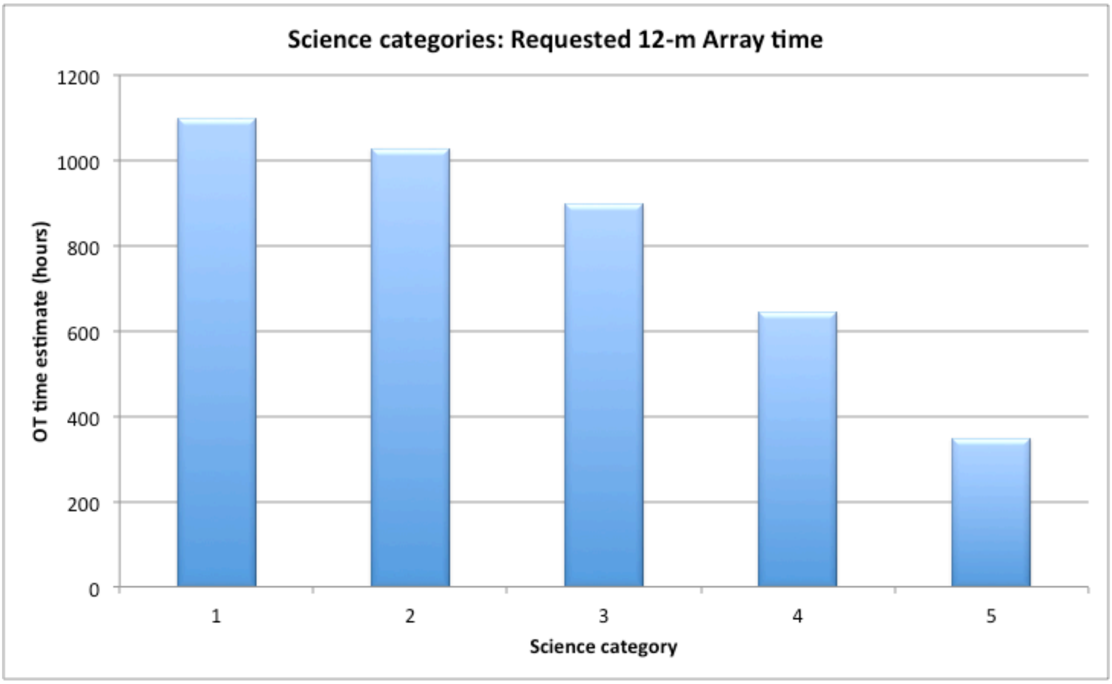

Figure 13. Total requested 12-m Array time for each scientific category.

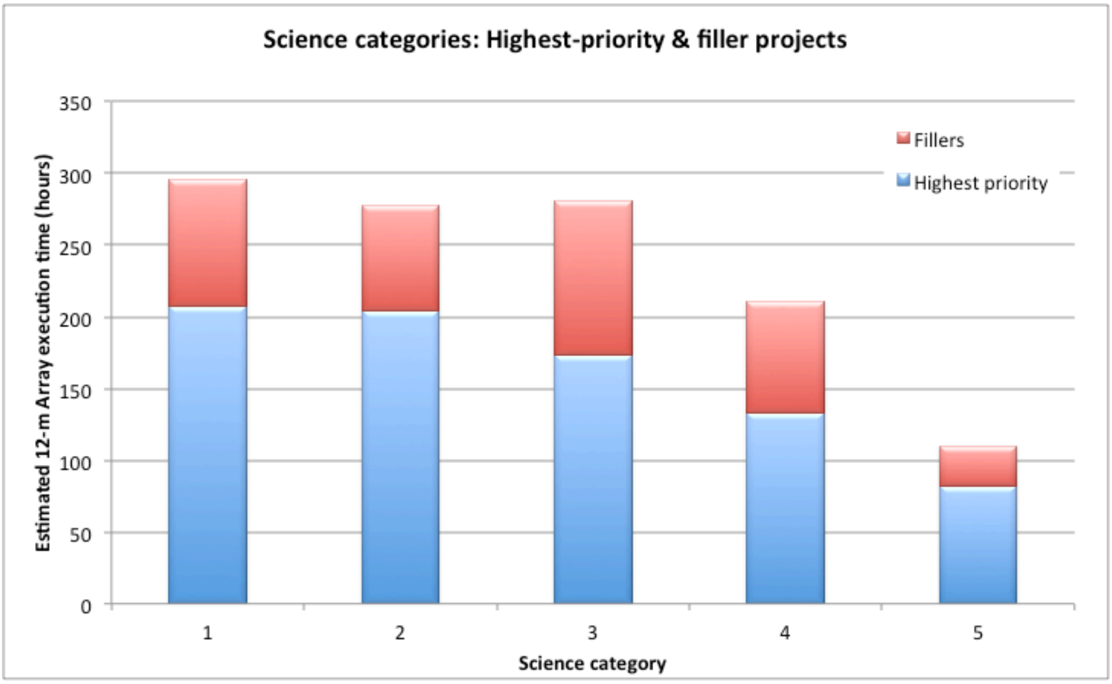

Figure 14. Distribution of the amount of 12-m Array time per science category for highest priority and filler projects.

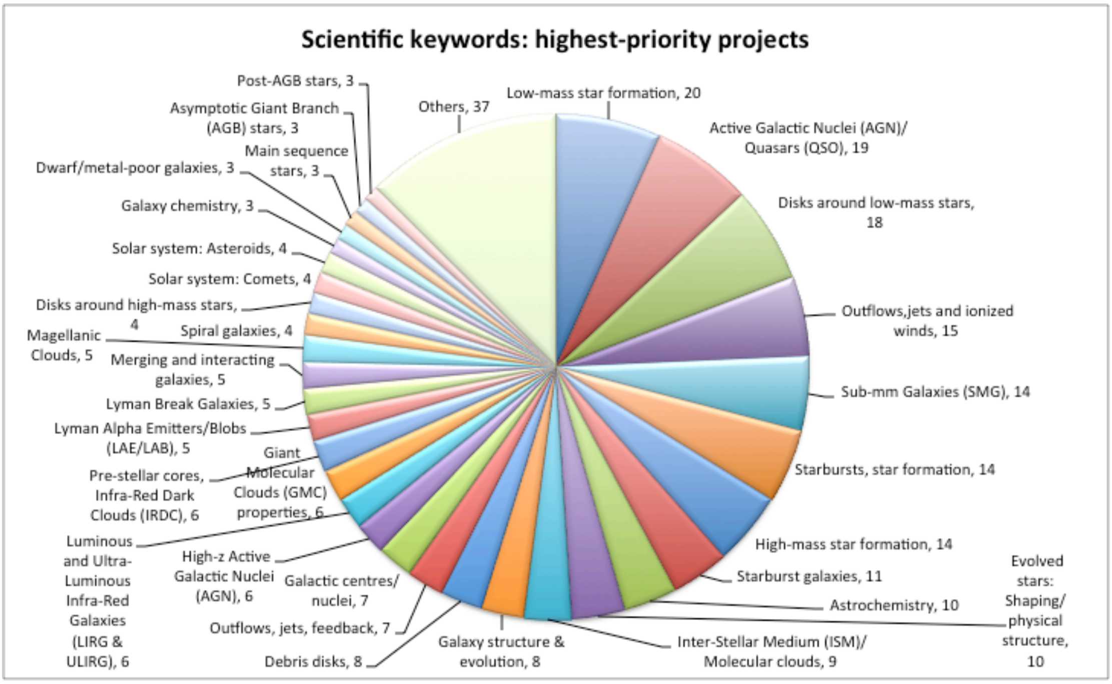

Figure 15. Breakdown of the highest-priority projects by scientific keyword, across all ALMA scientific categories. For each science keyword, the number of proposals in which it is selected is indicated.

Figure 15 illustrates the wide range of scientific topics covered by the high-priority projects. It is based on the ALMA scientific keywords specified in the proposals, counting the number of occurrences of each in the highest-priority proposals. Of the 197 highest-priority projects, 112 include a single scientific keyword, and 85 include two. The latter are counted twice (once for each keyword) in Figure 15. Keywords that are specified in less than 3 highest-priority proposals appear under “Others”. Of the 58 scientific keywords available for Cycle 1, 11 do not feature in any high-priority proposal. Table 4 gives a list of the scientific keywords most frequently occurring in the highest-priority proposals.

Table 4. Scientific keywords occurring in more than 5 high-priority proposals

Scientific keyword	Number of occurrences
Low-mass star formation	20
Active Galactic Nuclei (AGN)/Quasars (QSO)	19
Disks around low-mass stars	18
Outflows,jets and ionized winds	15
Sub-mm Galaxies (SMG)	14
Starbursts, star formation	14
High-mass star formation	14
Starburst galaxies	11
Astrochemistry	10
Evolved stars: Shaping/physical structure	10
Inter-Stellar Medium (ISM)/Molecular clouds	9
Galaxy structure & evolution	8
Debris disks	8
Outflows, jets, feedback	7
Galactic centres/nuclei	7
High-z Active Galactic Nuclei (AGN)	6
Luminous and Ultra-Luminous Infra-Red Galaxies (LIRG & ULIRG)	6
Giant Molecular Clouds (GMC) properties	6
Pre-stellar cores, Infra-Red Dark Clouds (IRDC)	6

Receiver bands

Comparison of Figure **17** with Figure 16 shows that the fraction of 12-m Array time to be dedicated to Band 3 observations as part of highest-priority or filler projects is significantly less than the fraction of Band 3 time requested in all submitted proposals. By contrast, the 12-m Array time split between the other three bands in the highest-priority and filler projects is similar to its distribution among all submitted proposals. In particular, highest-priority Band 9 projects require close to 10% of the total available 12-m Array time: this represents a good match with the fraction of the time when observing conditions are suitable for Band 9 science observations (see Figure 1 of the ALMA Cycle 1 Proposer's Guide).

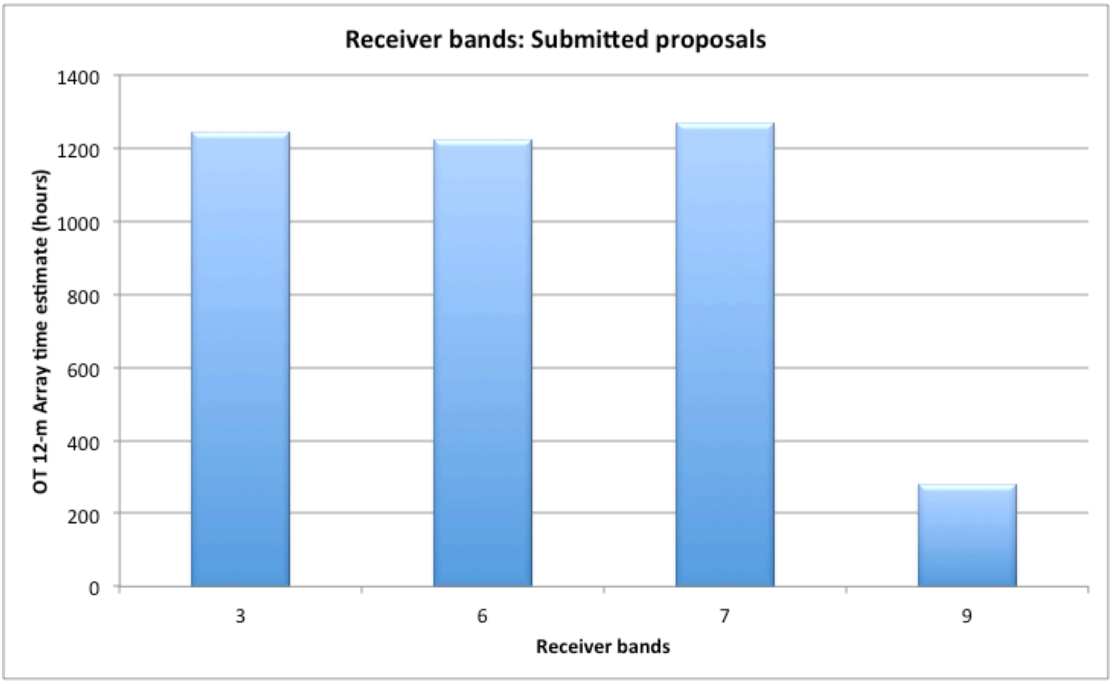

Figure 16. Distribution of the amount of 12-m Array time per receiver bands for all submitted proposals.

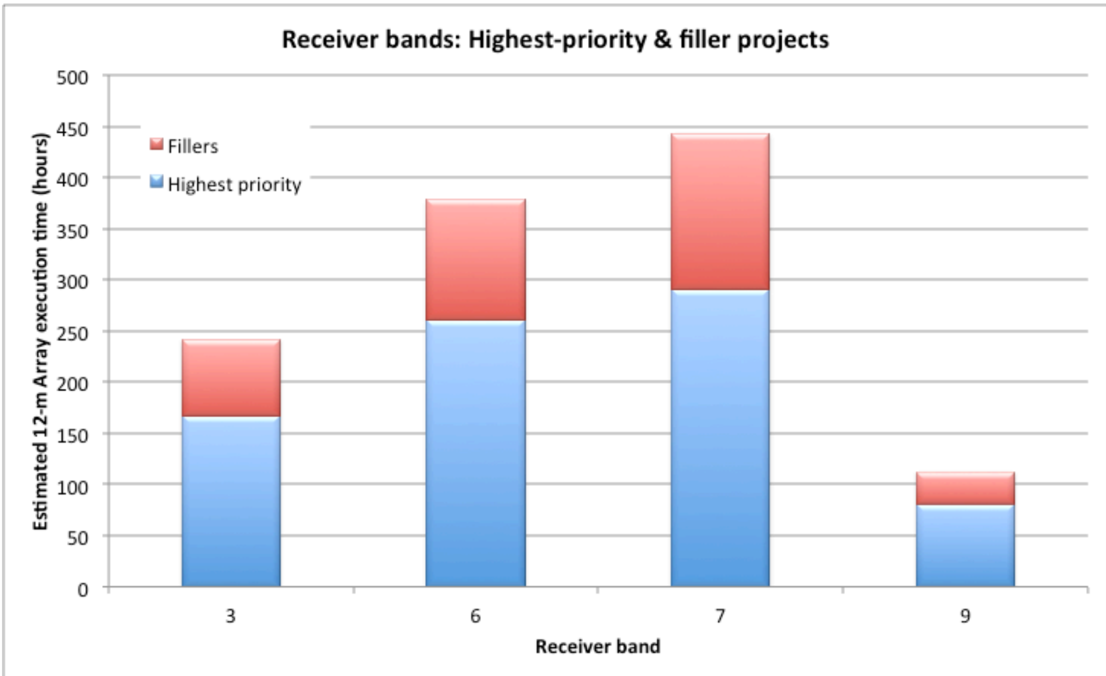

Figure 17. Distribution of the amount of 12-m Array time per receiver band for highest priority and filler projects.