

# Cycle 8, 9 science operations and Cycle 10 prospects

in addition to Alvaro's report

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East Asia ALMA Regional Center

21<sup>st</sup> December 2022



# Before we start... about discussion session

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Discussion today from 14:45-

1. Any questions regarding the talks, feedback in general from users on the ALMA operations
2. Data processing current and future: Outcome of the previous surveys, additional comments from users
  - Are you fine with no weblogs or QA2 reports?

“We have started to work on the implementation of WSU.”





# Role of the ALMA Regional Centers (ARCs)

**Joint ALMA Observatory**  
**Effective array operations:** Execution of programs under suitable conditions  
**High availability of the array for science :** Repairs, Preventive maintenance

Science operations in regional centers with **functions agreed in EA, EU, and NA, in close coordination with JAO**

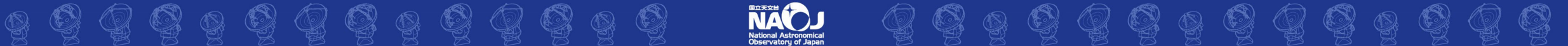
**EA ARC**  
EA ALMA users

**EU ARC**  
EU ALMA users

**NA ARC**  
NA ALMA users



ARC provide support for users in the respective regions so that they can concentrate on observing proposals and data analysis.





# East Asia ARC

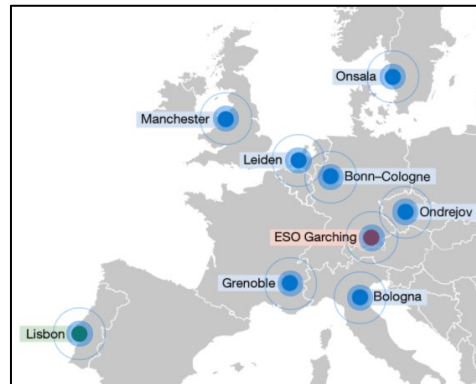


Central office is at NAOJ Mitaka:

- Core functions: Agreed on internationally
- Enhanced functions: Flexibly planned and executed in each ARC
  - ✓ Native language support
  - ✓ Realization of users' demands

Two nodes in Taiwan and Korea:

User support optimized to the individual regions in addition to the core functions of the ARC



- “Executive”: Region at the proposal submission, related to the observing time allocation
- “Preferred ARC”: Region to support the user (can change depending on the change of user's affiliation)

EU has several nodes in addition to the central office at ESO, Garching.

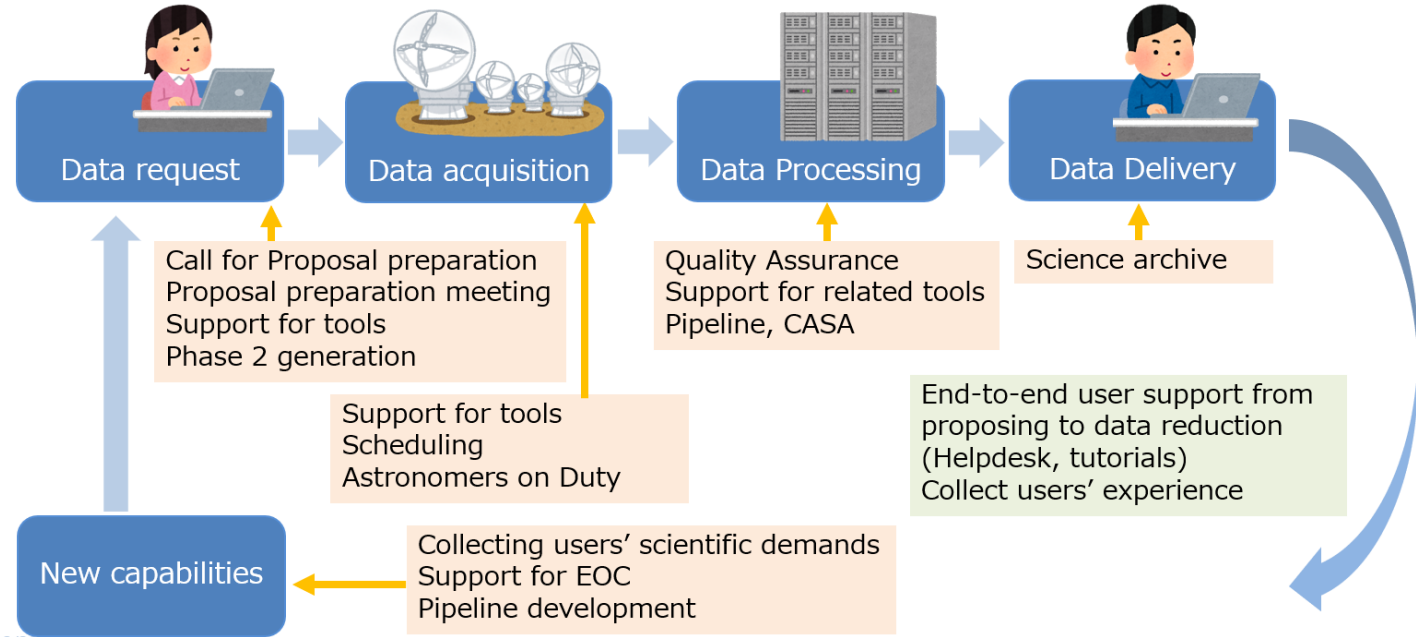
<https://www.eso.org/sci/facilities/alma/arc.html>





# Working as "one ALMA" on daily basis

- Development of the single-dish part of the Pipeline, single-dish part of CASA
- QA2, QA3, and data processing tools
- Archive, Helpdesk, Improvements for Phase 2 generation, Observing Tool, Scheduling, Science Portal etc.
- **Contribution to commissioning of new observing capabilities, to preparations of offering the new modes** (polarization, long-baseline high-freq, Solar, TP-related, ACA spectrometer, Band 1)
- Contribution in the WG to investigate the algorithm for data combination (TP, 7 m, 12 m)
- **Working on regional user-support items**



Each management team, Subsystem and working group basically consists of representatives from all the regions of ALMA.





# East Asia ALMA Regional Center (EA ARC) at NAOJ

- Misato Fukagawa
- Hiroshi Nagai
- Koichiro Nakanishi
- Shun Ishii
- Patricio Sanhueza
- Jorge Zavala
- Toshiki Saito
- Yu-Ting Wu
- Sarolta Zahorecz
- Gianni Cataldi
- Masumi Shimojo
- Satoko Takahashi
- Xiaoyang Chen
- Andrea Silva
- Yu Cheng
- Toshinobu Takagi
- Atsushi Miyazaki
- Yoshihiko Yamada
- Mika Konuma
- Takuma Izumi

CASA Users Committee:  
Yoshimasa Watanabe-san  
from Japan



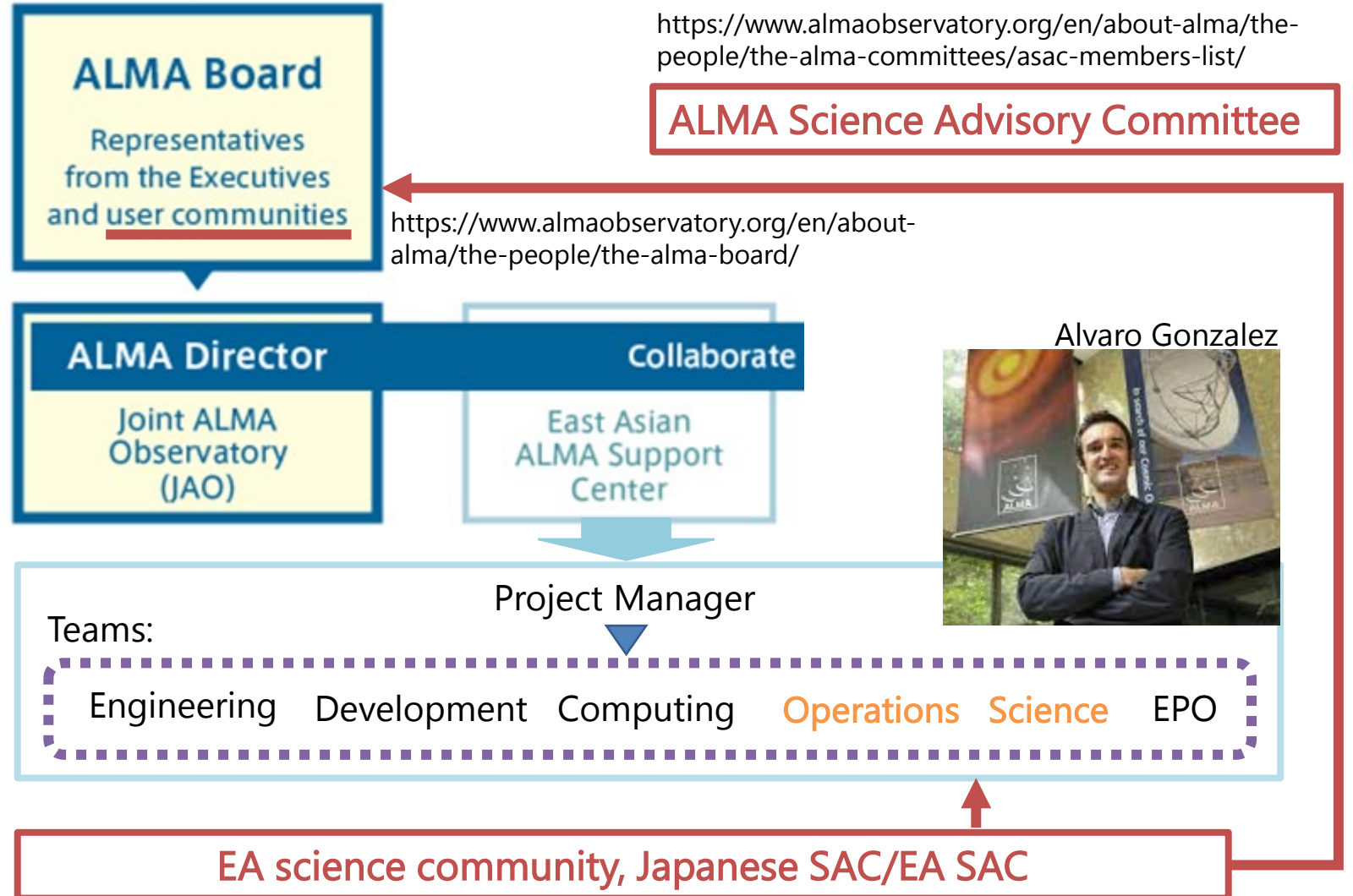


# Receiving inputs/feedback from users

## Two paths

- Regional/ALMA **Science Advisory Committees**
  - ✓ Working on the charges by the Board.  
Recommendations and advice to the Board on various issues including future science capabilities, improvements in operations
- **Various tools/opportunities**

Note: ALMA also deeply involves the community in the developments.





## Working as "one ALMA" on daily basis

Many people support the various necessary activities including software development, repair and maintenance of telescopes and instruments, and a wide variety of other tasks to produce the exciting science results.





# Cycle 8 and 9 operations

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Alvaro's talk covered

- Cycle 8 data acquisition on the 12m Array was the 2nd highest in ALMA history
- Cycle 8 data processing had excellent pipelined data KPIs (50% of datasets were delivered within 10 days)
- Cycle 9 data acquisition was ahead of target at the time of the cyberattack at the end of October



## Recovery to science observations

- Cycle 9: **ALMA has resumed performing PI science observations** following the cyberattack. The end-to-end data acquisition and processing workflow and software were successfully re-tested prior to the restart. ALMA is currently taking observations in configuration C-3. **User services are also now back online**, including access to ALMA user profiles, SnooPI, and the Cycle 9 DDT submission server.
- **Most compact configurations (C-1 and C-2) will not be visited again in Cycle 9.** Some Scheduling Blocks (SBs) requiring configuration C-2 were already observed in the days prior to the cyberattack. Projects with SBs in nominal configurations C-1 and C-2 that can still be observed in configuration C-3 will remain in the observing queue. As per usual ALMA policy, incomplete Cycle 9 Grade A projects will carry over into Cycle 10.
- Regarding Cycle 10, due to the disruption caused by the cyberattack, **the Cycle 10 pre-announcement will now be issued in the week of January 16.**





# Joint Proposal agreements for JWST, VLA, and the VLT

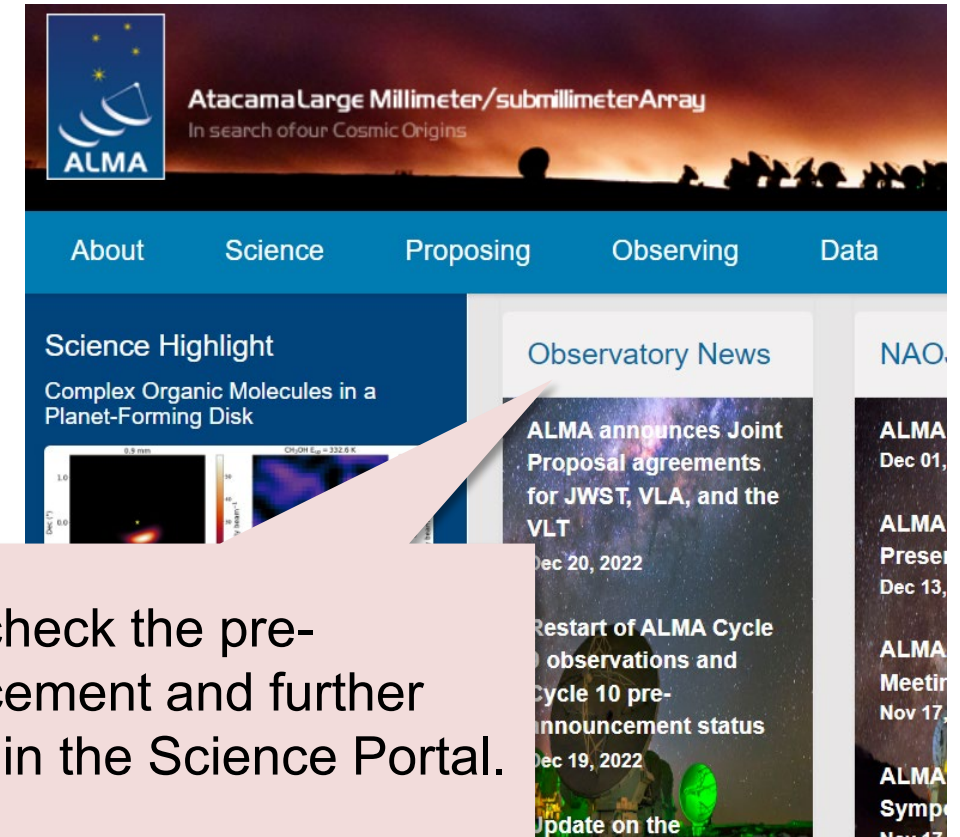
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- **Joint Proposals** are dedicated to **scientific projects that require observations with two or more observatories to achieve their scientific goals**. A Joint Proposal is submitted to a single observatory for scientific peer review, which allows one observatory to award observing time on multiple telescopes.
- For each **ALMA cycle, starting in Cycle 10, ALMA will be able to allocate up to 115 hours of JWST time, up to 50 hours on the VLT, and up to 5% of the available time on the VLA.**
- JWST will be able to allocate up to 115 hours of ALMA time (on each of the 12-m, 7-m, and Total Power Arrays) per cycle starting with JWST Cycle 2 (with the call for proposals released in November 2022), VLA and VLT will each be able to allocate up to 50 h of ALMA time per year starting with Semester 2023B for the VLA (with the call for proposals released in January 2023) and Period 112 for the VLT (with the call for proposals released in February 2023).



# Pre-announcement for Cycle 10

- The pre-announcement in January provides you a plan to assist the early proposal planning.
- Please wait for the pre-announcement on the plan for Cycle 10, e.g., which observing modes will be newly available.



ALMA announces Joint Proposal agreements for JWST, VLA, and the VLT  
Dec 20, 2022

Restart of ALMA Cycle observations and Cycle 10 pre-announcement status  
Dec 19, 2022

Please check the pre-announcement and further updates in the Science Portal.





# Note on the scheduling

- Note on the scheduling
  - Users do not have to care about the antenna configurations in OT. The scheduling is done based on the requested angular resolution.
  - What is the min/max angular resolution for the scheduling block?
    - Please see the Proposer's Guide (at the proposal planning stage) about the "range"
    - You can check in SnooPI. You can also check in the Phase 2 part in the OT.

Project Code: 2019.1.01234.S ARC node: Italian. Contact scientist: Jack Brown Download Proposal [pdf] Project report

J0305-SM\_a

2019.1.01234.S

Observing stars, planets, nebulae, open clusters, globular galaxies and galaxy clusters with ALMA

Observing Program

- SG OUS (PJ308 - environment)
  - Group OUS
  - Member OUS (PJ308-SMG1)
  - PJ308-SM\_a\_06\_TM1
- SG OUS (PJ231 - environment)
  - Group OUS
  - Member OUS (PJ231-SMG1)
  - PJ231-SM\_a\_06\_TM1
- SG OUS (J0305 - environment)
  - Group OUS
  - Member OUS (J0305-SMG2)
  - J0305-SM\_a\_06\_TM1

Scheduling Block Name: J0305-SM\_a\_06\_TM1 History

Scientific Goal Name: SG OUS (J0305 - environment)

Member ObsUnitSet: uid://A001/X1465/X1e7a History Archive query

Array: 12m

RA, Dec: 3<sup>h</sup> 5<sup>m</sup> 22.3<sup>s</sup>, -31° 49' 47.8"

Pointing information: Multiple sources, individual pointings

Band: 6

Representative Frequency, GHz: 248.69

Nominal configuration: C43-1,C43-2 Schedule

Min/Max Angular Resolution [arcsec]: 0.700 / 1.435

Progress: 150%

QA2: Report

End time	Duration [min]	Execution Block UID	QA0
2019-11-08 03:35:30	58.44	uid://A002/Xe31981/Xd084	<span>Report</span>

Execution block uid://A002/Xe31981/Xd084 Print

Temperatures [°K]		Array	
Average T <sub>sys</sub>	84.80	Number of antennas	45.0
$\sigma$	9.09	Shortest baseline	15.059 m
T <sub>sys</sub> .min	64.90	Longest baseline	500.184 m





# Regional support User Support

Taiwan node → Yu-Nung's talk  
Korea node → Jihyun's talk

Our goal: To improve the scientific productivity with ALMA in the EA community

Collect users' voices and statistics

- User surveys (archive, user end-to-end experience)
- Conversations in meetings
- Interviews



Provide support/improve usability of ALMA

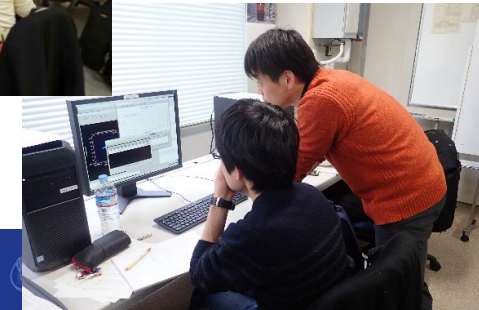
- Improvements of Archive, OT...
- Workshops, tutorials
- Enhanced services
- Budgetary support for publication
- ...



PUBLICATION  
SUPPORT



DATA REDUCTION  
SUPPORT



desk and (virtual)  
face-to-face support





# Regional support User Support

- Calibrated MS delivery
  - We offer this service for data in all the cycles (but Cycle 0 where you can get the calibrated MS from the Archive)
- Japanese material
  - Website, textbook for data reduction
- ALMA-J users email list
  - Any ALMA users can join
- Items from surveys, comments received in Users Meeting and conversations

## Supplemental website

<https://www2.nao.ac.jp/~eaarc/DATARED/index.html>

### ALMA データ解析に関する情報

研究者向けの公式情報は全て ALMA サイエンス・ポータル (<https://almascience.nao.ac.jp/>) にあります。このサイトは、なるべく日本語で情報を提供するとともに、東アジア・アルマ地域センター (EA ARC) が提供するデータ解析に関連したサービスの詳細をお知らせすることを目的としています。



#### データ解析講習会

過去の講習会の情報やテキストを掲載しています。



#### 論文出版サポート

ALMA のデータを用いた論文の出版をサポートしています。



#### 解析サポート

プロデューサーを通じてサポートや個別のサポートを行っています。

You can get a template to request calibrated MS

#### 観測プロポーザル情報

#### FAQ

#### リンク集

Next set of examples will come (Jupyter Notebook)

#### CASA の使い方

CASA の使い方を日本語で解説したガイドがあります。

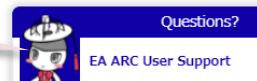
#### ALMA 入門

ALMA の概要をすばやく掴むために、観測の歴史をお知らせするページがあります。

#### MAPS TO SCIENCE

イメージの解析方法の例を研究分野ごとに示します。

The chatbot will also guide you.



Questions?

EA ARC User Support





# Regional support User Support

- Data reduction tutorials for users in Japan
  - Recent ones
    - November 2, 5 in 2021: Intermediate-level course (imaging), fully virtual using Zoon
    - July 5 and 7 in 2022: Basic-level course, fully virtual
    - February 27, 28 in 2023: Intermediate-level course, face-to-face is planned

Supplemental website

<https://www2.nao.ac.jp/~eaarc/DATARED/index.html>

NAOJ news

## ALMA データ解析に関する情報

研究者  
サイエンス  
データ

...or, you can google with  
“アルマデータ解析講習会”



### データ解析講習会

過去の講習会の情報やテキストを掲載しています。



### 論文出版サポート

ALMA のデータを用いた論文へのサポートです。



### 解析サポート

ヘルプデスクを通じたサポートや対話的サポートを行っています。



### 観測プロポーザル情報

日本語でプロポーザルについて案内しています。



### FAQ

ヘルプデスクによく寄せられる質問を集めています。



### リンク集

干渉計の原理、データ解析やCASAに関する資料を集めています。



### CASA の使い方

CASA の使い方を日本語で解説したページです。



### ALMA 入門

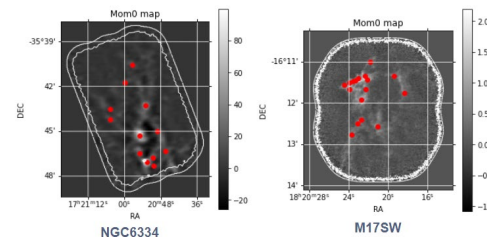
ALMA の概要をすばやく掴むために情報の探し方をお知らせするページです。



### MAPS TO SCIENCE

イメージの解析方法の例を研究分野ごとに示します。

この時、イメージ端ではコアの全体を同定できない可能性があり、また干渉計イメージの場合はイメージ端で RMS が悪化する (primary beam 補正後) といったことから、イメージの端で同定された leaf を除外します。このために RMS に対して閾値を設けています。最後に表示した moment 0 マップ上に、dendrogram で同定された leaf の位置を示しています。



#### Section 7-5. 速度方向の閾値の追加 及び ピリアル質量の見積もり

デフォルトの dendrogram の基準では速度方向の連続性の確認が不十分と考えられるので、速度方向の selection を追加で行っています。

また、検出された leaf (コア) の pixel を全て平均してスペクトルを作成し、ガウシアンフィット










# Regional support Publication support

- Publication Support program
  - Motivation
    1. Improving the scientific productivity, including papers with archival data
    2. Advertising science results in the international community
  - Publication fee, English editing fee, conference registration fee, Images in PR led by universities
    - Based on inputs in the UM, JSAC, and discussion in the project
  - **1<sup>st</sup> authors** who include the affiliation in Japan, and who **submitted (will surely submit for English editing) papers** with ALMA data
  - Post-COVID-19 (from FY2023?): conference/colloquium abroad with oral presentations (not for posters)

ALMA データ解析に関する情報

Please see here for details

ce.nao.ac.jp/) あります。この  
ンター (EA ARC) が提供するデ  
ータ解析に関連したサービスの詳細をお知  
...として提供しています。

		
<b>データ解析講習会</b>	<b>論文出版サポート</b>	<b>解析サポート</b>
過去の講習会の情報やテキストを掲載しています。	ALMA のデータを用いた論文へのサポートです。	ヘルプデスクを通じたサポートや対話的サポートを行っています。

Quality of science is good.  
Internationalization will be important in particular for the young generation.





# Science Portal – almost everything is here

<https://almascience.nao.ac.jp/>

Registration is necessary to propose observations, getting data under the proprietary period

Atacama Large Millimeter Array  
In search of our Cosmic

Navigation: About Science Proposing Observing Data Processing Tools Documentation Help

Science Highlight: Complex Organic Molecules in a Planet-Forming Disk

Observatory News: ALMA announces Joint Proposal agreements for JWST, VLA, and the VLT

NAOJ News: ALMA BEARS, ALMA at 10 years: Past, Present, and Future

ALMA Status: Configuration Schedule, Refereed publications, Last observed source NGC 7252NW

Source name: hl tau

Molecules: Lines Redshift

Project code	ALMA source name	Ra	Dec	Band	Cont. sens.	Frequency support	Release date	Publications	Ang. res.	Min. vel. res.	Array	Mosaic	Max. res.
2017.1.01178.5	HL_Tau	04:31:38.425	+18:13:57.242	5	0.042	169.06-183.37GHz	2019-10-15	2	0.327	0.231	12m		4.920
2017.1.01178.5	HL_Tau	04:31:38.425	+18:13:57.242	9	0.140	640.13-663.94GHz	2020-01-29	2	0.056	0.446	12m		1.012
2017.1.01178.5	HL_Tau	04:31:38.425	+18:13:57.242	7	0.08	330.43-348.10GHz	2018-12-15	1	0.02	0.316	12m		0.450
2017.1.01194.5	XZ_Tau	04:31:40.083	+18:13:56.863	6	0.015	230.43-248.10GHz	2018-12-15	1	0.02	0.316	12m		0.450

ALMA Science Archive

ALMA Observing Tool

Navigation: Home My Projects My Sbs User Manual Science Portal Archive Query Helpdesk

Project Summary: SC216, Name: SC216, RA: 04:31:38.425, DEC: +18:13:57.242

Observing Tool

SnooPI

John Smith, Executive, E.U. AR

2/21 PI Projects

16/177 Co-I Projects

1/5 Delegee Projects

Since 2020-03-03

QSearch Projects or Scheduling Blocks

Project status tracking tool

ALMA Science

Help Center TOO

Knowledgebase, News, Submit Helpdesk Ticket, My tickets

Welcome to the new ALMA Helpdesk User Interface

Helpdesk, knowledgebase

2023/1/

18



# Archive updates/features

## ALMA Science Archive in the Request Handler page

Search

① Search the data as usual  
“Object type” search is possible.

② After choosing the data,  
click this for checking data and  
requesting data download. The  
new window includes previews  
and links to the CARTA viewer.

Explore and download in legacy system

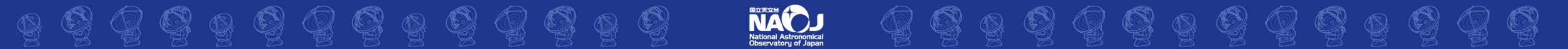
Display only: 2 selected

If you want to use  
the previous type  
of request page,  
click “Explore and  
download in  
legacy system” at  
the upper-right  
corner.

Observations

Previews of images/spectra,  
automatic search for similar proposals,  
etc. are available with a mouse over.

		h:m:s	d:m:s		Cont. sens.	Frequency support	Release date
<input type="checkbox"/>							
<input checked="" type="checkbox"/>	2015.1.00425.S	15:56:41.872	-42:19:23.701	7	0.0304	335.502..351.47 GHz	2018-06-21
<input type="checkbox"/>	2015.1.01353.S	15:56:41.873	-42:19:23.680	6	0.0255	219.501..232.892 GHz	2018-10-03





# Archive updates/features

## ALMA Science Archive in the Request Handler page

In the legacy system:

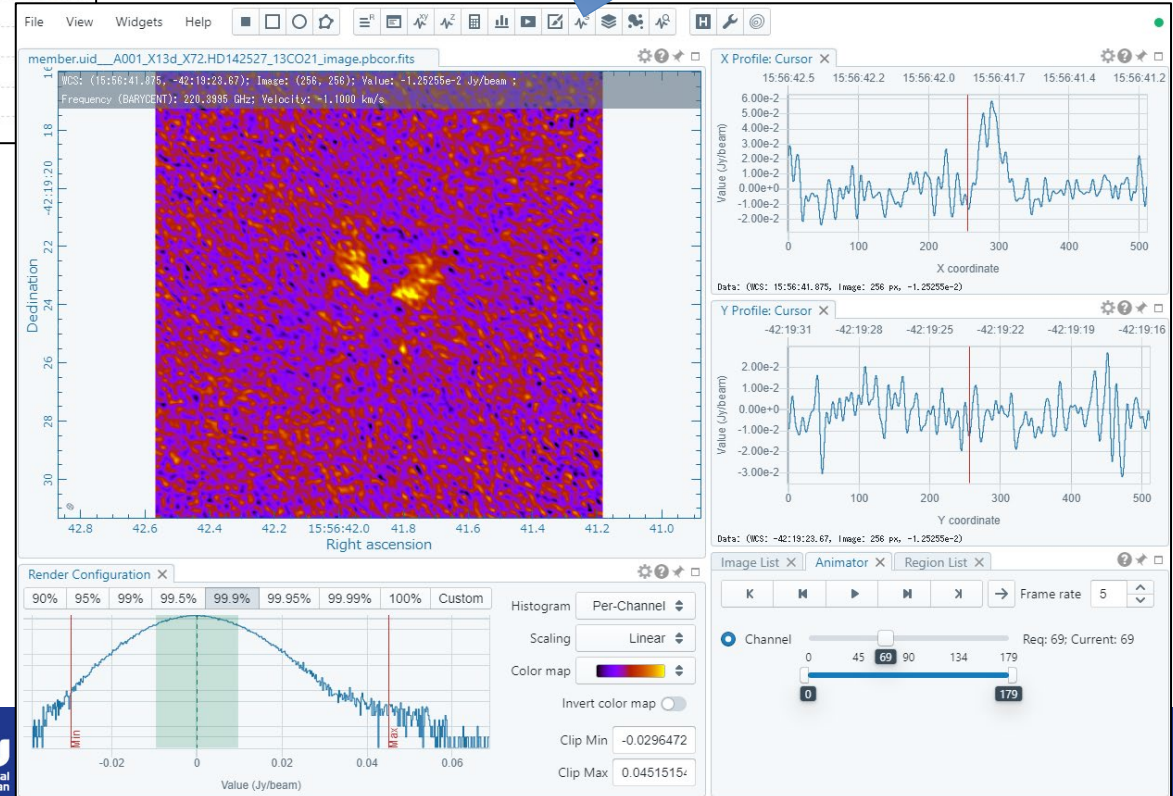
Group OUS uid://A001/X13d/X71			
Member OUS uid://A001/X13d/X72			
SB HD_14252_a_06_TE			
readme	member.uid_A001_X13d_X72.README.txt	11 KIB	
product	2013.1.00305.S_uid_A001_X13d_X72_001_of_001.tar	1 GiB	
product	member.uid_A001_X13d_X72.HD142527_13CO21_image.flux.fits.gz	52 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_13CO21_image.image.fits	180 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_13CO21_image.pbcor.fits	180 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_C18O21_image.flux.fits.gz	52 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_C18O21_image.image.fits	180 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_C18O21_image.pbcor.fits	180 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_CO21_image.flux.fits.gz	55 MiB	✓
product	member.uid_A001_X13d_X72.HD142527_CO21_image.image.fits	180 MiB	✓

Click the link icon to CARTA as a viewer

Open the file tree by clicking ▶

A new webpage automatically opens in your browser! (You do not have to install CARTA desktop version).

You can check and analyze the images/cubes without downloading the data to your local disk. (e.g., you can generate and immediately check moment maps in CARTA)

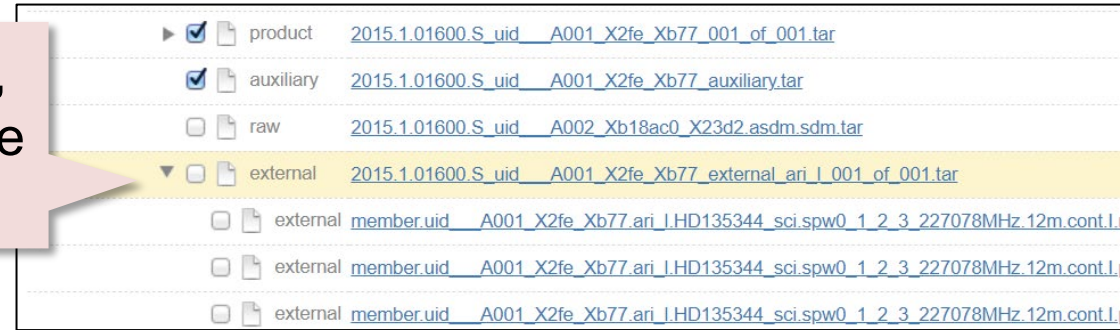




# Archive features: ARI-L

Additional Representative Images for Legacy (ARI-L):  
A uniform set of **full data cubes and continuum images** of the data from Cycles 2-4.

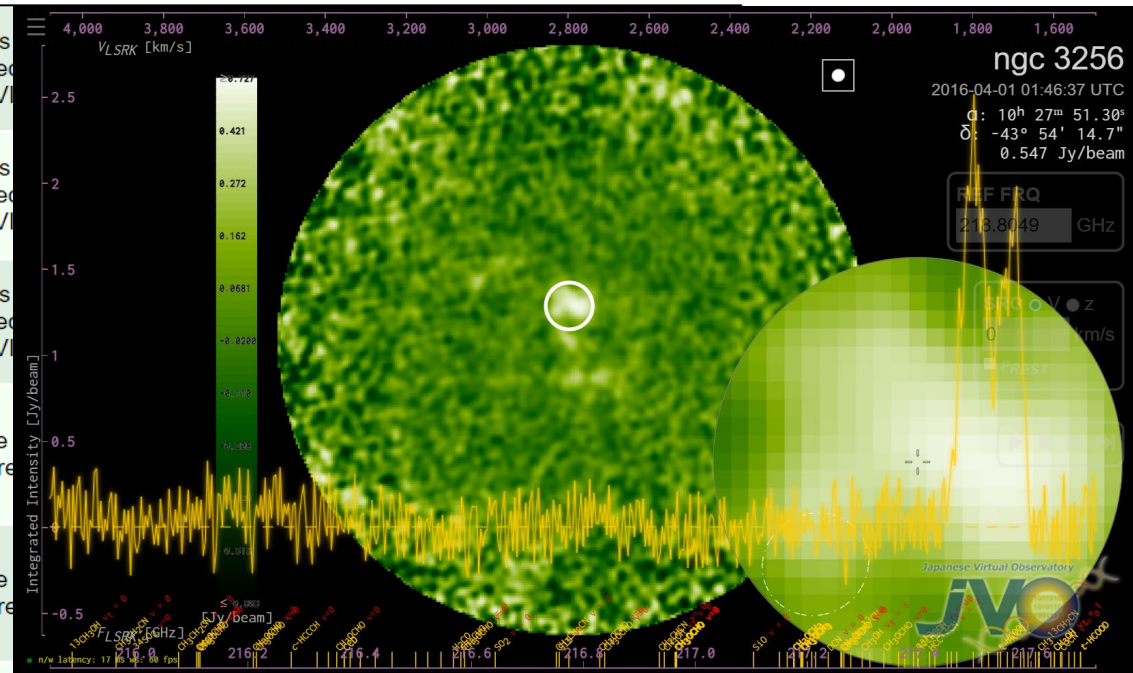
In the Request Handler page, you will see “external” with the package name “ari\_l”.



ARI-L images are also in the JVO archive in NAOJ

In the search results page, it says “ARI-L”

.T	<input type="checkbox"/>	Download WebQLv4 VO Search	ALMA official	The properties mergers detected
.T	<input type="checkbox"/>	Download WebQLv4 VO Search	ALMA official	The properties mergers detected
.S	<input type="checkbox"/>	Download WebQLv4 VO Search	ARI-L	Chemistry in the Infrared
.S	<input type="checkbox"/>	Download WebQLv4 VO Search	ARI-L	Chemistry in the Infrared





# What type of support would work for you?

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- Getting ALMA time
- Using archive data
  - Data accessibility
  - Data reduction
  - Scientific Analysis
- Strengthen the research group





# Discussion, Q&A

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- ✓ Wideband Sensitivity Upgrade
- ✓ Development efforts
- ✓ Proposal review system
- ✓ User support





# User End-to-End Experience Survey results

## ✓ Purpose

- To identify the main issues that prevent the best ALMA user experience

## ✓ Survey period

- Conferences/events with ALMA users in 2019 and early 2020

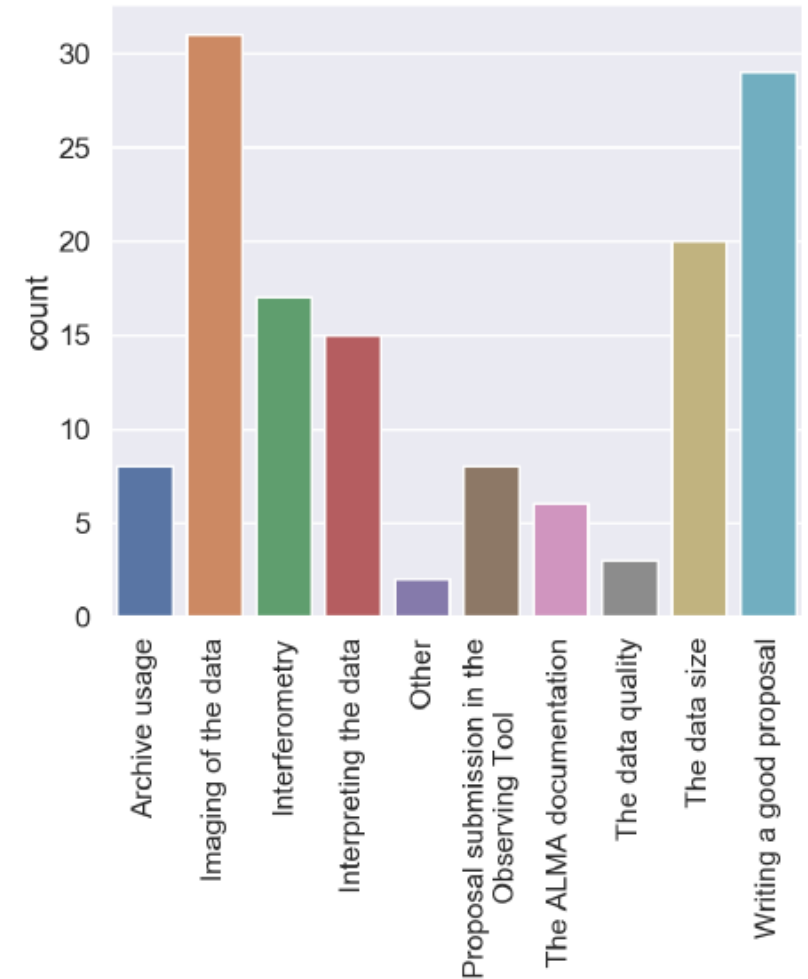
Thank you for your contribution!

## ✓ Results

- Total 106 responses. Almost all have used ALMA.
- "Imaging of the data" and "Writing a good proposal" are the most challenging aspects, followed by "Data size", "Interferometry", "Interpreting the data".

Some of the top priority items have already been implemented. e.g., archive previews, improved documentation.

What are the two most challenging aspects of using ALMA according to your experience?







# Recalling past surveys/interviews

## Interview results

Some items have been implemented already, and some are waiting for discussion or implementation.

# Redesign the User eXperience (RedUX)



**Evanthia Hatziminagoglou** (EU,ESO)  
**George Privon** (NA, NRAO)  
**Yoshito SHIMAJIRI** (EA, NAOJ)

**[Purpose] Learn from the users about the quality of the services, collect the feedback, and then improve our service.**

- Interviewed between Nov. 2020 and May 2021
- 69 interviewees (26 in EA) carried out
 

Span all levels of interferometry expertise and career stage as well as scientific profile and interests.
- The outcome will be public as Messenger Article on the middle of March .  
<https://www.eso.org/sci/publications/messenger/>
- Here, I focus on the topics concerning to EA ARC service.

*Demographic Breakdown of RedUX Interview Participants*

Category	N	% of Total
Participants	69	100
<b>Region</b>		
East Asia	26	38
Europe	27	39
North America	16	23
<b>Interferometry Expertise</b>		
Beginner	11	16
Intermediate	30	43
Expert	28	41
<b>Career Stage</b>		
Student	11	16
Postdoc	29	42
Junior faculty/staff	17	25
Senior faculty/staff	12	17
<b>Scientific Profile<sup>†</sup></b>		
Theory	13	19
Observation	65	94
– Radio	51	74
– Optical	15	22
– UV	1	1
– Infrared	21	30
– X-rays	1	1
<b>Primary ALMA Data Usage</b>		
Archival data	15	22
Data as PI or Co-I	48	70
Archival and PI/Co-I data	1	1
Have not used ALMA yet	5	7
<b>ALMA Data Reduction Experience<sup>†</sup></b>		
None	7	10
Have reduced ALMA data	55	80
Reduced other interferometric data	35	51
Reduced other (single-dish, IR, optical) data	40	58

<sup>†</sup> Multiple responses were permitted, numbers may sum to larger than the total.





# Recalling past surveys/interviews

## Interview results

Some items have been implemented already, and some are waiting for discussion/ implementation.

- Users reported **difficulties following the development of the various CASA versions, updates and bug fixes, and also difficulties with maintaining various CASA versions on their computers.**
- **Remote, centralized, user-initiated data processing** would circumvent the need for users to keep up with CASA versioning, to allow users accessing powerful computers, and to further promote archival science.
- ...

Instrumentation

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### Redesigning the ALMA User Experience from End to End

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at the RedUX interviews were distilled and concrete suggestions for improvements were passed by the RedUX WG to individual teams responsible for ALMA software components, WGs or regions, as well as to the ALMA Integrated Science Operations Team.

#### Redesigning the User eXperience (RedUX)

Based on insights gained by previous interactions with the global Atacama

from various angles simultaneously collecting feedback on all touchpoints of the user experience.

This feedback was translated into concrete suggestions, passed by the RedUX WG for implementation to the teams responsible for ALMA software components and WGs and to the ALMA Integrated Science Operations Team (Zwaan et al., 2021). Some of these suggestions, accompanied by actions under consideration globally within ALMA or locally in Europe, are presented below.

Summary has been published in the ESO messenger article.

<https://www.eso.org/sci/publications/messenger/archive/no.186-mar22/messenger-no186-20-24.pdf>





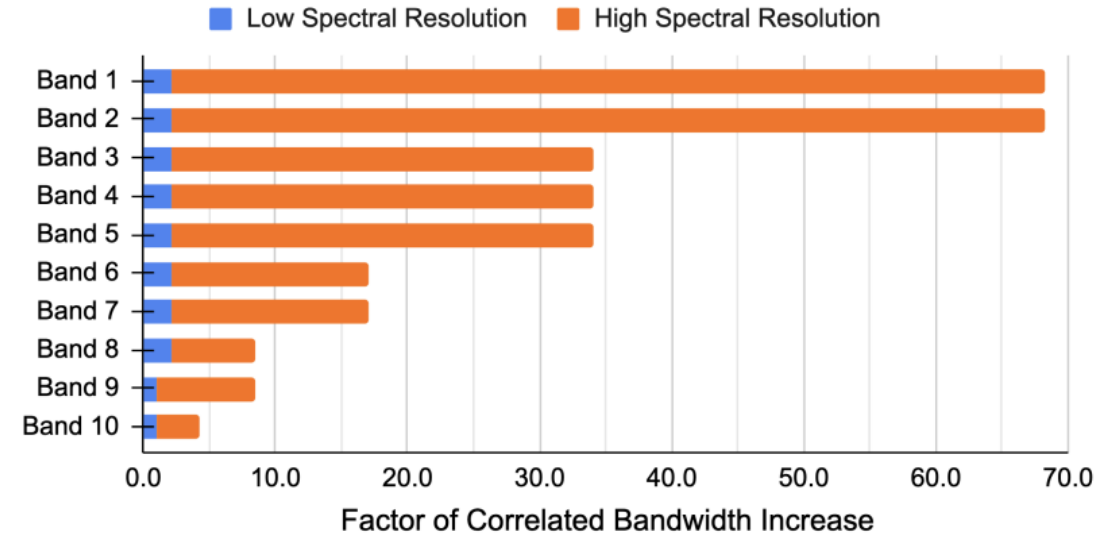
# EA ALMA Development WS in the Archive

Future of Science Archive, held in March 2022

Some points from the WS draft report:

- Astronomer will not be able to investigate data in 2030. Observatory's responsibility will increase.
- Survey result: Imaging of the data is more challenging than writing a successful proposal.
- Quick access to calibrated MS will expedite science analysis.
- Catalogue for molecular inventories, catalogues for continuum sources. Product images with different weight options, quick line identification, etc.
- Survey project creates a lot of data. Efficient data discovery is the key to synergy between opt/IR and ALMA. VO: Capability to search related data observed by the other telescope
- HSC+PFS science platform: No need to download data. Processing is done on remote science platform. Provides pipeline processed data. No raw data are available (~100 TB for raw+PL intermediate products)

Increase in Correlated Bandwidth



Carpenter et al. (2022)





# Data processing current and future

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- What data products do you need?
  - Have you checked the weblogs or QA2 reports?

