

ALMA Cycle 2 Capabilities & proposal preparation



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EUROPEAN ARC

ALMA Regional Centre || Italian

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Early Science Cycles

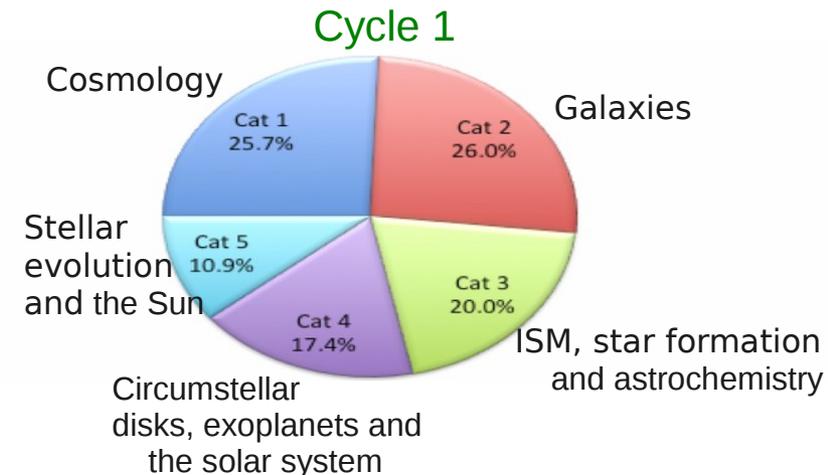
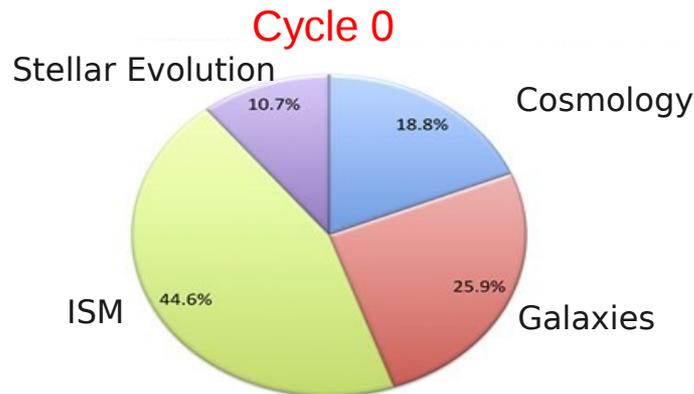
Early Science observations will be conducted on a best effort basis, with priority given to the completion of the full ALMA capabilities

| | Cycle 0 Sep. 2011 - Jan. 2013 | Cycle 1 Jan. 2013 - May. 2014 | Cycle 2 Jun. 2014 - Oct. 2015 |
|----------------------------|---|---|---|
| Telescope | | | |
| Hours dedicated to Science | 800 | 800 | 2000 (incl. some Cycle 1) |
| Antennas | > 12x12-m no ACA | > 32x12-m+9x7m+2TP | > 34x12-m+9x7m+2TP |
| Receiver bands | 3, 6, 7, 9 | 3, 6, 7, 9 | +4, 8 |
| Wavelengths [mm] | 3, 1.3, 0.8, 0.45 | 3, 1.3, 0.8 0.45 | +2, 0.7 |
| Baselines | up to 400 m | up to 1000 m | up to 1500 |
| Polarisation | single-dual | single dual | +full (with limitations) |

Proposal outcome

| | | |
|------------------|-----------|-----------|
| Submitted | 919 | 1133 |
| Highest priority | 111 | 197 |
| Filler | 51 | 92 |
| Success rate | 12% (18%) | 17% (25%) |

Highest priority
Scientific
Category
classification



Cycle 0 results

98% Highest-priority PIs received some data

69% Highest-priority fully completed

> 50 ALMA observations related papers in the last 2 months!!!

(see some of the results on <http://almascience.eso.org/alma-science>)

ES Cycle 1 status

Cycle 1 observing was originally planned to start in January 2013 and to span 10 months. At the beginning, Several months were spent giving priority to commissioning and improvements to infrastructure and overall system stability & softwares.

Hence Cycle 1 was extended from the end of October 2013 to the end of May 2014 with observations that should have begun in June 2013.

In June & July weather & power related issues led to site closures and the subsequent warming of receivers. The Cycle 1 software for 12m Array observations was finally accepted on July 24.

August brought further power issues and a workers strike resolved on September 8

PI science observing for 12m Array observations resumed in early October.

No further extension is expected for Cycle 1.

However, the overall completion likelihood for Highest Priority proposals is 56%, 43% for Filler science goals, but this is a strong function of configuration, band and LST.

Finally, about 300 hrs of Cycle 1 Highest Priority science goals are expected to remain unobserved.

Cycle 1 PI were requested to accept to be moved to Cycle 2.

A check during cycle 2 proposal acceptance will be done against duplication wrt Cycle 1 observed highest ranked projects.

Cycle 2 capabilities: arrays & resolution

| Band | Frequency range (GHz) | Wavelength Range (mm) | Maximum Recoverable Scale ^{2,3,4} with no ACA (<u>arcsec</u>) | Coarsest allowed angular resolution (<u>arcsec</u>) | Finest achievable angular resolution (<u>arcsec</u>) | ACA Maximum Recoverable Scale (arcsec) |
|------|-----------------------|-----------------------|--|---|--|--|
| 3 | 84 - 116 | 3.6 - 2.6 | 25 | 7.5 | 0.41 | 42 |
| 4 | 125 - 163 | 2.4 - 1.8 | 17 | 5.0 | 0.27 | 28 |
| 6 | 211 - 275 | 1.4 - 1.1 | 11 | 3.3 | 0.18 | 18 |
| 7 | 275 - 373 | 1.1 - 0.80 | 7.2 | 2.2 | 0.12 | 12 |
| 8 | 385 - 500 | 0.78 - 0.60 | 5.4 | 1.6 | 0.12 | 9.1 |
| 9 | 602 - 720 | 0.50 - 0.42 | 3.8 | 1.2 | 0.09 | 6.4 |

Antennas: **34 main array 9 ACA 2 Total Power (TP)**
ACA only to complement main array observations
TP only for spectral line observations
in limited frequency (e.g. no continuum & no B9)

Configurations: **smooth transitions between allowed baseline ranges**
B3-7 160-1500m
B8-9 160-1000m
(no need to choose the configuration,
only indicate the angular scales & resolution needed)

Main array and ACA (& TP) observations will be conducted and calibrated independently and combined during data reduction.

ACA is not equipped with WVR in Cycle 2, hence calibration will be limited for ACA in B9.

Cycle 2 capabilities: receivers and spectral setup

| Cycle 2 Receiver Bands | | | | | Most Compact | | | Most Extended | | |
|------------------------|-----------------|-----------------|-----------------------|----------------------------------|------------------------|-----------------------------------|---|--------------------|-----------------------------------|---|
| Band | Frequency (GHz) | Wavelength (mm) | Primary Beam (FOV; ") | Continuum Sensitivity (mJy/beam) | Angular Resolution (") | Approx. Max. Scale (") (see P.14) | Spectral Sens. ΔT_{line} (K) | Angular Resolution | Approx. Max. Scale (") (see P.14) | Spectral Sens. ΔT_{line} (K) |
| 3 | 84-116 | 2.6-3.6 | 73-53 | 0.097 | 4.4-3.2 | 31-22 | 0.08 | 0.48-0.35 | 11-8 | 6.1 |
| 4 | 125-163 | 1.8-2.4 | 49-38 | 0.11 | 3.0-2.3 | 21-16 | 0.08 | 0.32-0.24 | 7.3-5.6 | 7.0 |
| 6 | 211-275 | 1.1-1.4 | 29-22 | 0.13 | 1.8-1.4 | 12-9 | 0.10 | 0.19-0.14 | 4.3-3.3 | 8.6 |
| 7 | 275-373 | 0.8-1.1 | 22-16 | 0.22 | 1.4-1.0 | 9.5-7 | 0.17 | 0.14-0.11 | 3.3-2.4 | 14 |
| 8 | 385-500 | 0.6-0.8 | 16-12 | 0.41 | 0.97-0.75 | 6.8-5.2 | 0.32 | 0.15-0.12 | 2.4-1.8 | 14 |
| 9 | 602-720 | 0.4-0.5 | 10-8.5 | 1.69 | 0.6-0.5 | 4.3-3.6 | 1.25 | 0.15-0.08 | 1.4-1.3 | 54 |

Main array and ACA use separate correlators that offer the same setups.

Time Division Mode (high sensitivity low spectral resolution) and Frequency Division Mode (Low sensitivity high spectral resolution) are available.

For each receiver 2 sidebands separated by 8-10 GHz and up to 4 basebands per sideband are allowed.

Different correlator modes can be specified for each baseband

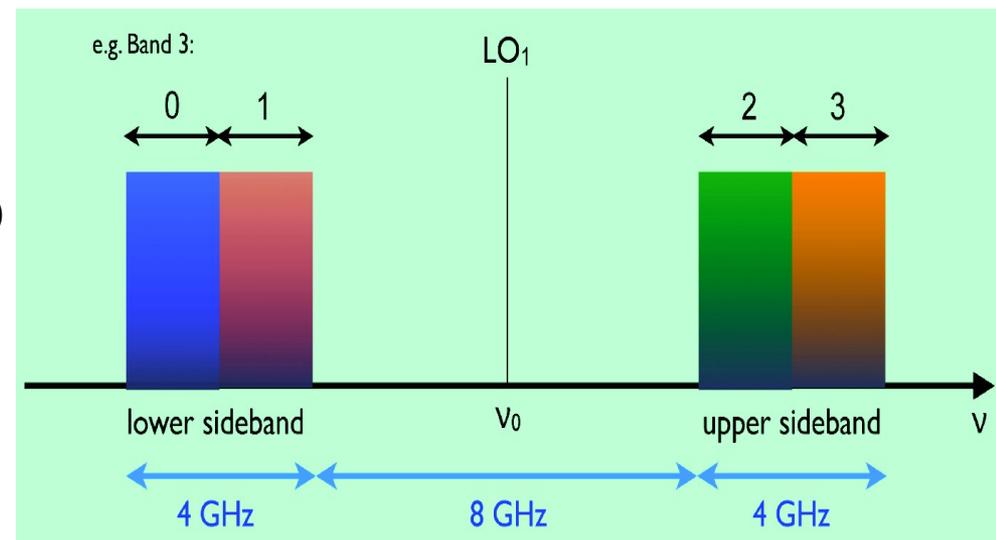
Up to 4 independent spectral windows (with up to 3840 channels) per baseband are allowed.

All spws within a given baseband must use the same correlator mode

Many channels observed at the same time imply high data rate.

Maximum data rate allowed is 60MB/s, but data rate above 6 MB/s must be technically justified.

Data can be binned to reduce data rate at correlator stage.



(see Viviana's talk)

Cycle 2: Observing modes

Science Goal (SG): Minimum proposed observational unit including targets in the same sky region that roughly share the same calibration and spectral setup

Continuum: main Array and ACA (i.e. no TP)

Spectral line: all Arrays (except for Band 9 with TP)

Spectral scan: **Spectral survey or redshift searches** available on main array

Polarization: Single + Dual in all Bands

Full Stokes:

**only main Array, continuum, B3, B6, B7,
at fixed frequencies (see table, each 1875MHz-wide TDM BB)
no ACA, no mosaics**

Sources must have angular scale $< 1/3$ primary beam_{main array}

min 3hr/SG observations for calibration issues

| Band | SPW1 (GHz) | SPW2 (GHz) | LO1 (GHz) | SPW3 (GHz) | SPW4 (GHz) |
|------|---------------|---------------|--------------|---------------|---------------|
| 3 | 90.5 | 92.5 | 97.5 | 102.5 | 104.5 |
| 6 | 224.0 | 226.0 | 233.0 | 240.0 | 242.0 |
| 7 | 336.5 | 338.5 | 343.5 | 348.5 | 350.5 |

Cycle 2: Proposal Types

- **Standard** (including also time-critical, multiple-epoch observations, and continuous monitoring of a target over a fixed time interval within Cycle 2).
- **Target of Opportunity (ToO)**: to observe targets that can be anticipated but not specified in detail. Cycle 2 proposal deadline.
For ToO and time-constrained projects tolerance of 2 weeks
- **Director's Discretionary Time (DDT)** proposals may be submitted at any time during Cycle 2
 - Proposals requiring the immediate (within 2 weeks) observation of an unexpected astronomical event
 - Proposals requesting observations on a highly competitive scientific topic
 - Follow-up observations of a program recently conducted with ALMA or any other observing facility, where a quick implementation is expected to provide breakthrough results

Cycle 2: Limitations & time available

Pointing: ≤ 150 pointings in the same Science Goal (single pointings or mosaic pointings).
Individual pointings separated $<10^\circ$ and with the same spectral setup

Observing Time: **≤ 100 hrs per proposal** as estimated by Observing Tool

Declination: Shadowing Problem:
Main Array: NO Dec < -75 deg, Dec $> +25$ deg (in compact config.)
ACA: NO Dec < -60 deg, Dec $> +20$ deg

Moving Targets allowed
No solar observations

Observatory staff will perform data quality assurance and will provide reduced data products via the ALMA Regional Centers (ARCs).

2000 hrs for Cycle 2 and highest priority Cycle 1 projects transferred to Cycle 2

The relative ranking of projects in Cycle 2 will proceed as follows:

a. **Cycle 2 “A” proposals**

(If it is not completed by the end of Cycle 2, its execution will continue in Cycle 3.)

b. Cycle 1 transfers

c. Cycle 2 “B” proposals

d. Cycle 2 “C” proposals

During scheduling, the project with the highest scientific rank is observed whenever all other factors taken into account like weather, configuration or target elevation are equal.

A proposal checklist

Have a good idea!

Estimate required configuration (CASA, Splatalogue, OST, OT)
Write the science case in pdf docs (max 4 page)

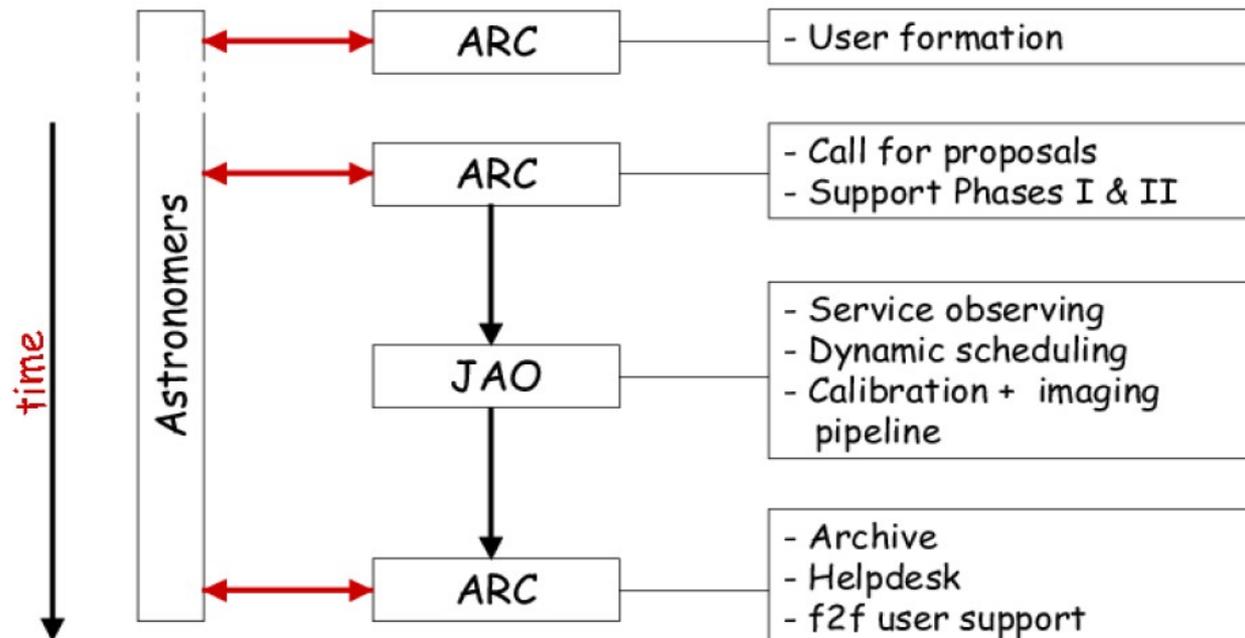
Register to the Science Portal (SP)

PHASE I – Proposal submission (OT, SP, Helpdesk)
TAC evaluation

PHASE II – Observing program submission for accepted proposals (OT, SP, Helpdesk)

Observations

Data reduction and analysis (CASA)



The science case

Science categories used to distribute the proposals for review to the most qualified assessors:

- Cosmology and high z universe
- Galaxies and galactic nuclei
- ISM, star formation and astrochemistry
- Circumstellar disks exoplanet and Solar system
- Stellar evolution and the Sun

Science case is limited to 4 pdf pages (A4, font size no smaller than 11 points) including:

- science case (recommended 2 pages)
- figures and tables
- potential for publicity

Proposals must be self-contained.

The proposal review panels will be encouraged to consider favorably proposals that best demonstrate and exploit the advertised ALMA Early Science Cycle2 capabilities, producing scientifically worthwhile results from relatively short observations (averaging a few hours), the science case should address this aspect.

Proposers are requested to consider the potential media appeal of proposed observations, with regard to scientific content and/or the quality of the visuals that could be produced and **add a statement for potential for publicity to the proposal.**

This information will not be used in the assessment of the proposal, which will be based solely on scientific merit and technical feasibility.

The technical justification

The Technical Justification for each SG is entered in a free-format text box in a dedicated OT panel and should fully justify the technical aspects of the requested observations, with particular attention paid to those parameters that most directly affect the Science Goal time estimate.

The text is limited to 4000 characters per Science Goal and should address the following aspects:

- **sensitivity**
- **imaging**
- **correlator setup**
- **calibration**
- **bandpass accuracy**
- **scheduling/time constraints:**
- **data rate**
- **special constraints on standard observing mode**
- **any non-standard choices**

Submissions & timelines

A Standard or ToO proposal can be submitted and resubmitted until the submission deadline.

Modifications of submitted proposals will not be permitted after the deadline.

If successfully submitted, a proposal receives a unique code.

For later re-submission, users must save a copy of the submitted proposal to their local disk, complete with the proposal submission code.

Do not update a previously submitted proposal using the local copy without a code as this will result in a new (duplicate) submission that will be assigned a new code.

To create a new proposal based on a previous one as a template take as starting point a local copy without a code, so as to avoid overwriting your original proposal in the Archive

| Date | Milestone |
|----------------------------|--|
| 24 October 2013 | Release of Cycle 2 Call for Proposals, Observing Tool & supporting documents |
| 24 October 2013 | Opening of the Archive for proposal submission |
| 5 December 2013 (15:00 UT) | Proposal submission deadline |
| April 2014 | Announcement of the outcome of the Proposal Review Process |
| 1 June 2014 | Start of ALMA Cycle 2 Science Observations |
| 31 October 2015 | End of ALMA Cycle 2 |

Enter the ALMA world through the ALMA Science Portal

<http://almascience.eso.org/>

The screenshot shows the ALMA Science Portal website. At the top left is the ALMA logo with the text "Atacama Large Millimeter/submillimeter Array" and "In search of our Cosmic Origins". At the top right is another ALMA logo. Below the header is a navigation bar with links for "ESO", "NRAO", and "NAOJ". A search bar is located on the right side of the navigation bar. Below the search bar are links for "Log in", "Register", "Reset Password", and "Forgot Account". The main content area features a large banner image of ALMA antennas with a galaxy in the background. Overlaid on this banner are two red text boxes: "Current call Tools and info" and "All the documents and tools Cycle 2 primer, Proposer Guide, OT Guide". To the left of the banner is a sidebar menu with categories: "About", "Science", "Proposing", "Observing", "Data", "Documents & Tools", and "Knowledgebase/FAQ". Below the sidebar is a "User Services at ARCs" section with a "Helpdesk" link. To the right of the banner is a "General News" section with several news items, including "ALMA Cycle 2 Call for Proposals is now open" and "ALMA Cycle 2 Pre-announcement".

All PI and CoI must be registered

Proposing

Documents & Tools

User Services at ARCs

- Helpdesk

Current call Tools and info

All the documents and tools Cycle 2 primer, Proposer Guide, OT Guide

General News

- ALMA Cycle 2 Call for Proposals is now open
Oct 19, 2013
- Cycle 1 Update and Transfer to Cycle 2
Oct 07, 2013
- ALMA Cycle 2 Pre-announcement
Sep 17, 2013
- ALMA Cycle 1 Status Update
Sep 10, 2013
- ALMA Cycle 0 final report
Jun 19, 2013

Access to Helpdesk for any request (FAQ, problems, F2F...)

Make your ALMA simulations (Observation Support Tool)

<http://almaost.jb.man.ac.uk/>

Submit a request for a full simulation of ALMA capabilities for your target
 Receive the results via e-mail



| | | | |
|--------------------------|---------------------------------------|--|---|
| Array | Instrument | ALMA | Queue Status • Help |
| Sky Setup | Source model | OST Library: Central point source | Choose a library source model or |
| | Upload a FITS file | <input type="text"/> Browse... | You may upload your own model |
| | Declination | -35d00m00.0s | Ensure correct formatting of this s |
| | Image peak / point flux in mJy | 0.0 | Set to 0.0 for no rescaling of sourc |
| Observation Setup | Central frequency in GHz | 90 | The value entered must be within |
| | Bandwidth in MHz | 32 | Use broad for continuum, narrow f |
| | Required resolution in arcseconds | 1.0 | OST will choose config if instrum |
| | Pointing strategy | Single | Selecting single will apply primary |
| | Start hour angle | 0.0 | Deviation of start of observation f |
| | On-source time in hours | 3 | Maximum duration is 24 hours |
| | Number of visits | 1 | How many times the observation i |
| | Number of polarizations | 2 | This affects the noise in the final n |
| Corruption | Atmospheric conditions | Good (PWV = 0.5 mm) | Determines level of noise due to w |
| Imaging | Imaging weights | Natural | This allows a resolution / sensitiv |
| | Perform deconvolution? | No (Return dirty image) | Apply the CLEAN algorithm to deconv |



Job ID: 20110330175645 / Submitted by: casasola@ira.inaf.it

Overview

Click thumbnails to view full-size images. Left: linear colour scale, right: with histogram equalization.

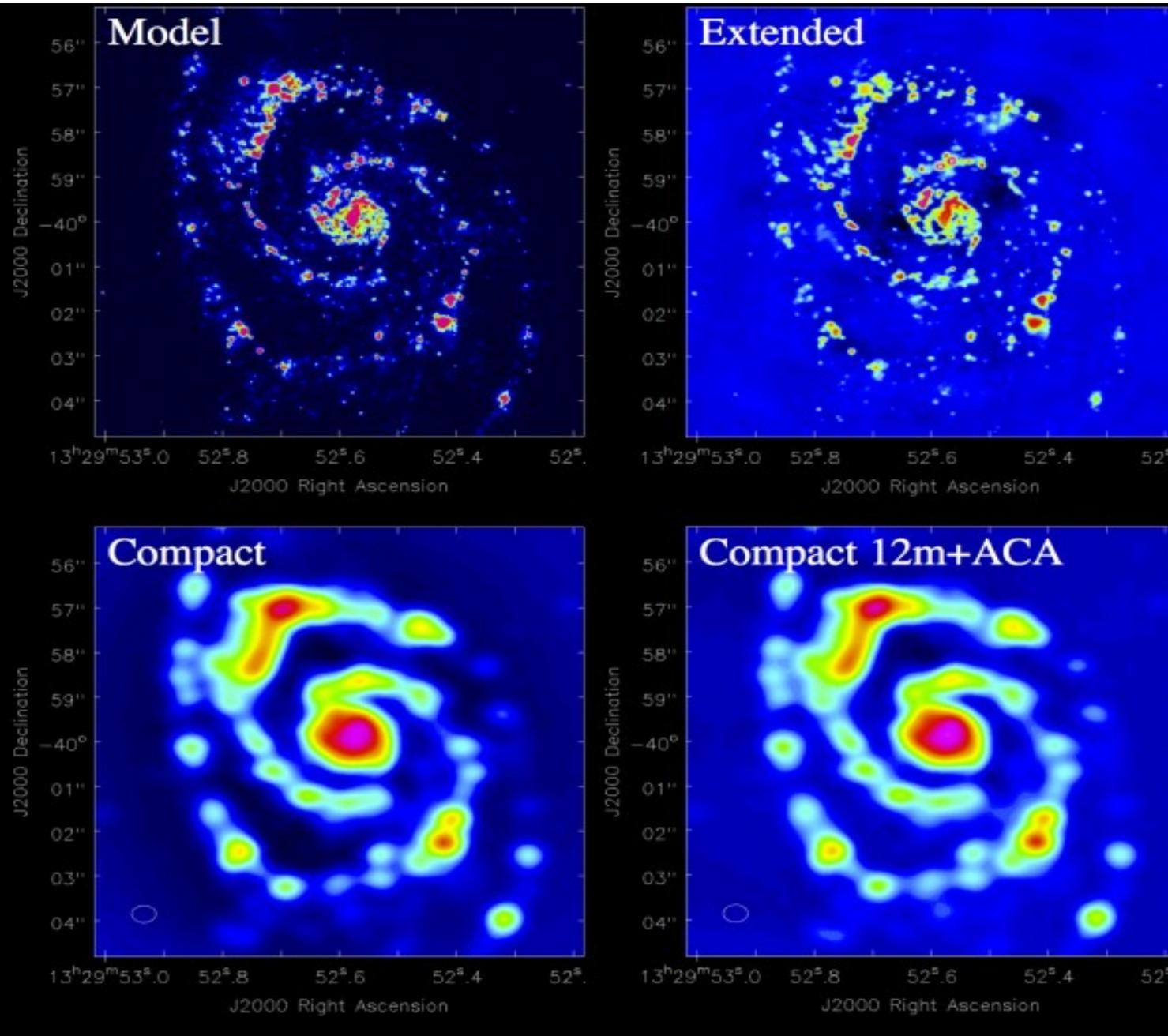
| | |
|-----------------------------|---|
| Array configuration | Early Science ALMA (Compact Cycle 0, 125 m baseline) |
| Source model | All we ever see of stars are their old photographs |
| Maximum elevation | 77.88 degrees |
| Central frequency | 90 GHz = Band 3 |
| Bandwidth | 0.032 GHz |
| Track length | 3 hours x 1.0 visits |
| System temperature | Tsys = Trec + Tsky = 37.0 + 4.42 = 44.15 K |
| PWV | 0.5 mm |
| Theoretical RMS noise | 0.000103323597098 Jy (in naturally-weighted map) |
| Restoring beam (resolution) | Major axis = 6.229 arcsec, minor axis = 5.176 arcsec, PA = 55.607 deg |

Data products

Your simulated image
[Download FITS file](#)

(see Rosita's talk)

Make your ALMA simulations (CASA simalma, simobserve, and simanalyze)



The task `simobserve` generates a data set with simulated visibilities based on an input model image.

The task `simanalyze` produces a cleaned image based on the simulated visibilities, and it generates some diagnostic images.

CASA also provides the task `simalma` that simplifies the steps needed to simulate ALMA observations that combine data from multiple arrays or multiple configurations.

Who needs CASA for simulations today and wants to access to our cluster can ask for an account

(see Rosita's talk)

The Science Goal: Sensitivity Calculator

<http://almascience.eso.org/call-for-proposals/sensitivity-calculator>

Common Parameters

| | | | |
|-----------------------------|---|-----|--|
| Dec | 00:00:00.000 | | |
| Polarization | Dual | | |
| Observing Frequency | 345.00000 | GHz | |
| Bandwidth per Polarization | 0.00000 | GHz | |
| Water Vapour Column Density | <input checked="" type="radio"/> Automatic Choice <input type="radio"/> Manual Choice | | |
| tau/Tsky | tau0=0.158, Tsky=39.538 | | |
| Tsys | 157.027 K | | |

Individual Parameters

| | 12m Array | 7m Array | Total Power Array |
|--------------------|----------------|-----------------|-------------------|
| Number of Antennas | 34 | 9 | 2 |
| Resolution | 0.00000 arcsec | 5.974554 arcsec | 17.923662 arcsec |
| Sensitivity(rms) | 0.00000 Jy | 0.00000 Jy | 0.00000 Jy |
| (equivalent to) | Infinity K | 0.00000 K | 0.00000 K |
| Integration Time | 0.00000 s | 0.00000 s | 0.00000 s |

Integration Time Unit Option: Automatic

Submit with the ALMA Observing Tool

The screenshot shows the ALMA Observing Tool interface. At the top, the title bar reads "My new idea - Observing Tool for ALMA (Early Science), version R8.0.1". The menu bar includes "File", "Edit", "View", "Tool", "Search", and "Help". The toolbar contains various icons for navigation and editing. The main interface is divided into several panels:

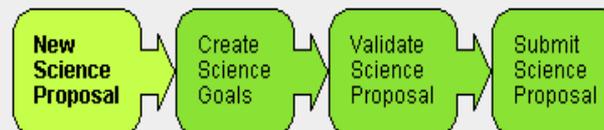
- Project Structure:** A tree view on the left showing the hierarchy of the project "My new idea", including "Proposal", "Planned Observing", and "Science Goal ()".
- Editors Panel:** A central panel with tabs for "Spectral", "Spatial", "Proposal", and "Catalog". It contains a "Proposal Information" section with fields for "Proposal Title" (My new idea) and "Proposal Cycle" (9999.4). Below this is an "Abstract" field (max. 300 words).
- Feedback Panel:** A panel at the bottom with tabs for "Problems", "Information", and "Log". It contains a table with columns for "Description" and "Suggestion".

Project Overview Panel

Contextual Help

1. Please ensure you and your co-Is are registered with the [ALMA user portal](#)
2. Create a new proposal by either:
 - Selecting *File > New Proposal*
 - Clicking on the  icon in the toolbar
 - Or clicking on this [link](#)
3. Click on the  [proposal](#) tree node and complete the relevant fields.

Phase I: Science Proposal



Click on the overview steps to view the contextual help



(see Viviana & Rosita's talks)

Get support for Cycle 2 from the Italian node!

For your proposals, data reduction with CASA and ALMA related stuff contact us and/or organize your visit to the Italian ARC node

- 3 visitor stations available
- 1 ARC node member dedicated to each visitor
- 10 TB disk space available during your visit + 3 month for download

Enjoy your ALMA Cycle 2 proposal!

Deadline: 15:00 UT on December 5, 2013

