

ALMA Observing Tools

Italian ALMA Regional Center
INAF-Istituto di Radioastronomia (Bologna)

Tutorials , April-May 2011



EUROPEAN ARC
ALMA Regional Centre || Italian

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NATIONAL INSTITUTE
FOR ASTROPHYSICS

ALMA basics

ALMA Early Science

Hints to use the ALMA tools

Support for ALMA users



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FOR ASTROPHYSICS

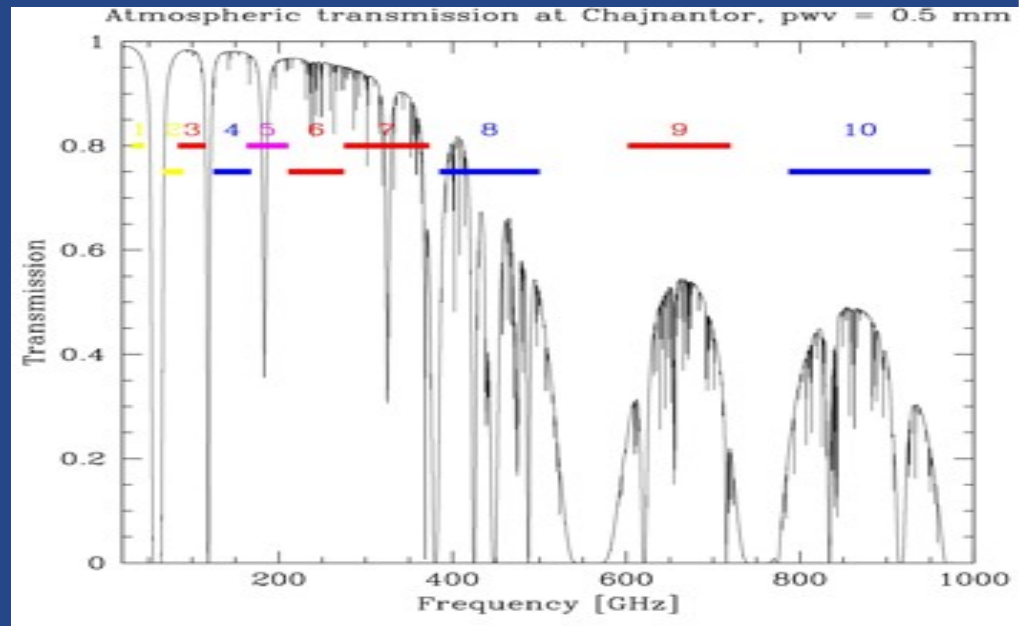
ALMA overview and Early Science



ALMA numbers

- The Atacama Large Millimeter Array is a **mm-submm reconfigurable interferometer**
- Under construction on the Chajnantor plain (**5000m**, Chile)
- Frequency range: **10 bands between 30-900 GHz** (0.3-10 mm)
- Antennas: **50x12m main array** + **(12x7m + 4x12m) ACA**

- **World wide collaboration:**
 - Europe: ESO (14 countries),
 - North America: NRAO (USA, Canada),
 - East Asia: NAOJ (Japan, Taiwan),
 - Chile
- Contributors share the observing time

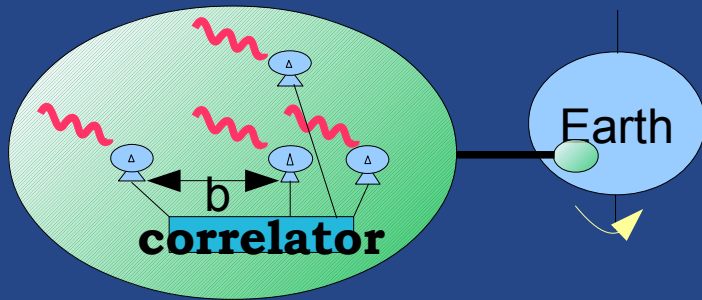


ALMA numbers

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- Located on the Chajnantor plain (**5000m**, Chile)
- Frequency range: **10 bands between 30-900 GHz** (0.3-10 mm)
- Antennas: **50x12m** main array + **(12x7m + 4x12m)** ACA
- Baselines length: **15m ->150m-16km** + **9m->50m**
- Bandwidth: **2 GHz x 4 basebands for each of 2 polarisations**
- **70 correlator modes**: 31MHz-2GHz / 8192 ch / single, dual, full polarisation product
- **Mosaic** capability



Interferometry in a nutshell

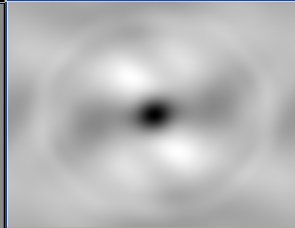
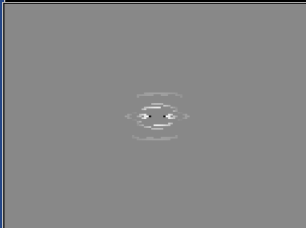


An interferometer reconstructs an image of the sky at fixed spatial scales (i.e. measures single points in the Fourier domain) corresponding to the projection of the baselines on the sky.

Imaging quality depends on the Fourier space coverage, i.e. on the number of baselines $(N(N-1)/2)$. Resolution depends on the baseline length.

Sensitivity depends on effective collecting area, integration time, bandwidth.

Water vapour effects get worse as the frequency increases



Object

Fourier space

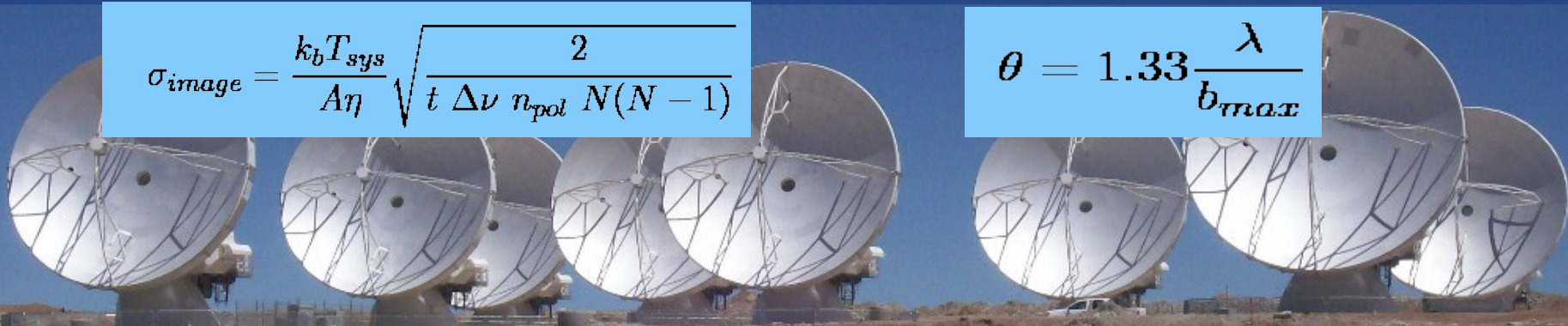
Image space

Noise in the image

Angular resolution

$$\sigma_{image} = \frac{k_b T_{sys}}{A\eta} \sqrt{\frac{2}{t \Delta\nu n_{pol} N(N-1)}}$$

$$\theta = 1.33 \frac{\lambda}{b_{max}}$$



ALMA numbers

Dry site, low pwv, low T_{sys} , high sensitivity also at submm wavelengths

>6500sqm of effective area and 1225 baselines for the 12m array
+ Short spacings with ACA

Excellent instantaneous uv coverage & high sensitivity
<0.05mJy @100 GHz in 1 hr

Up to 16km baselines, subarcsec resolution

40 mas @ 100 GHz,

5 mas @ 900 GHz

0.2" x (300/freq_GHz)x(1km/max_baseline)

FOV main array: 20.3"/(300/freq_GHz)

Flexibility in spectral and spatial studies

Noise in the image

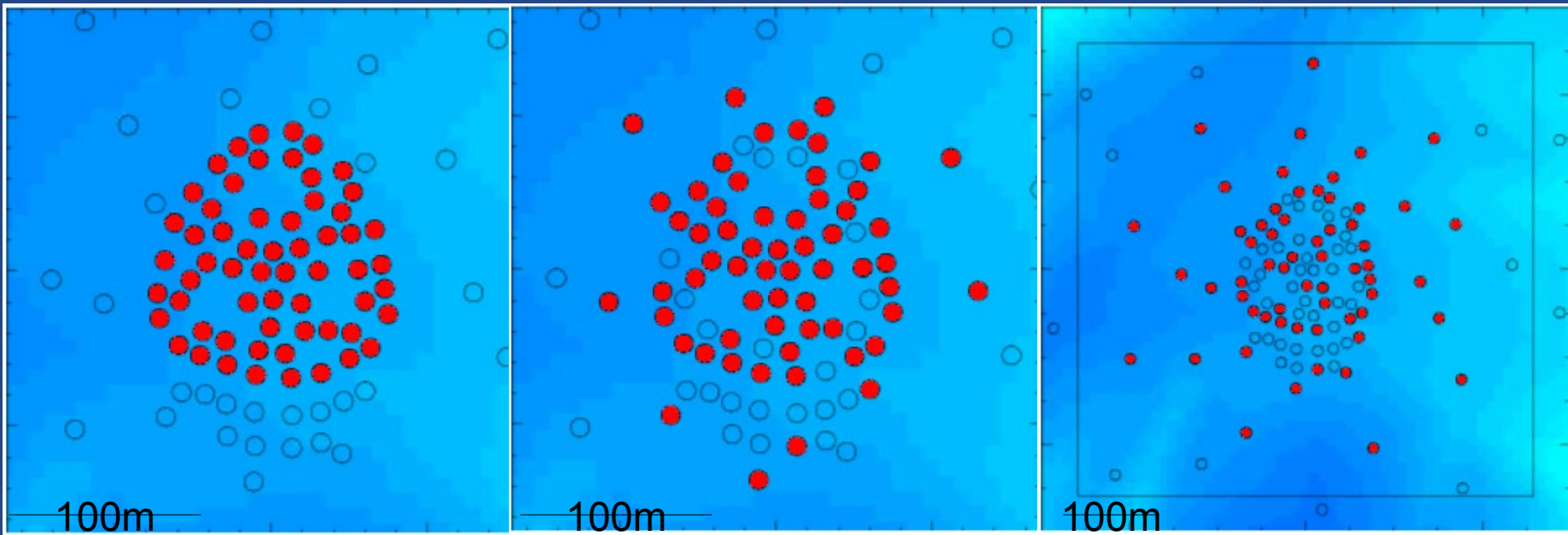
$$\sigma_{image} = \frac{k_b T_{sys}}{A \eta} \sqrt{\frac{2}{t \Delta \nu n_{pol} N(N-1)}}$$

Angular resolution

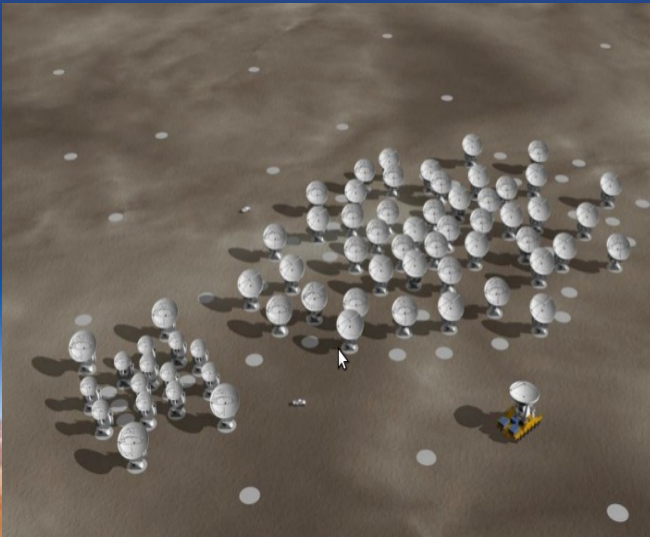
$$\theta = 1.33 \frac{\lambda}{b_{max}}$$



ALMA reconfiguration



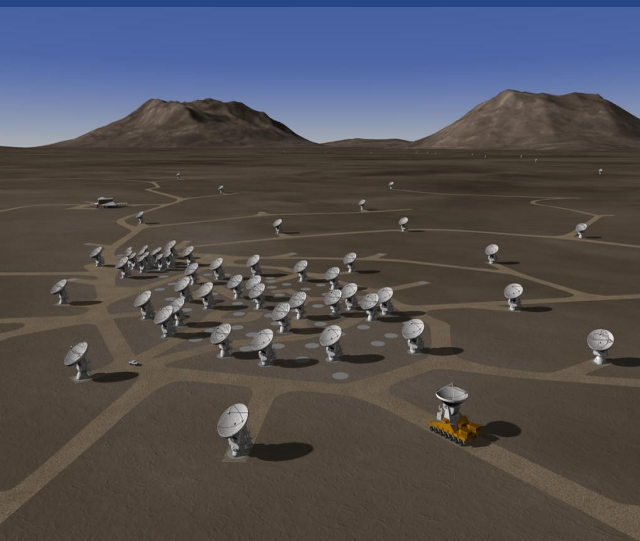
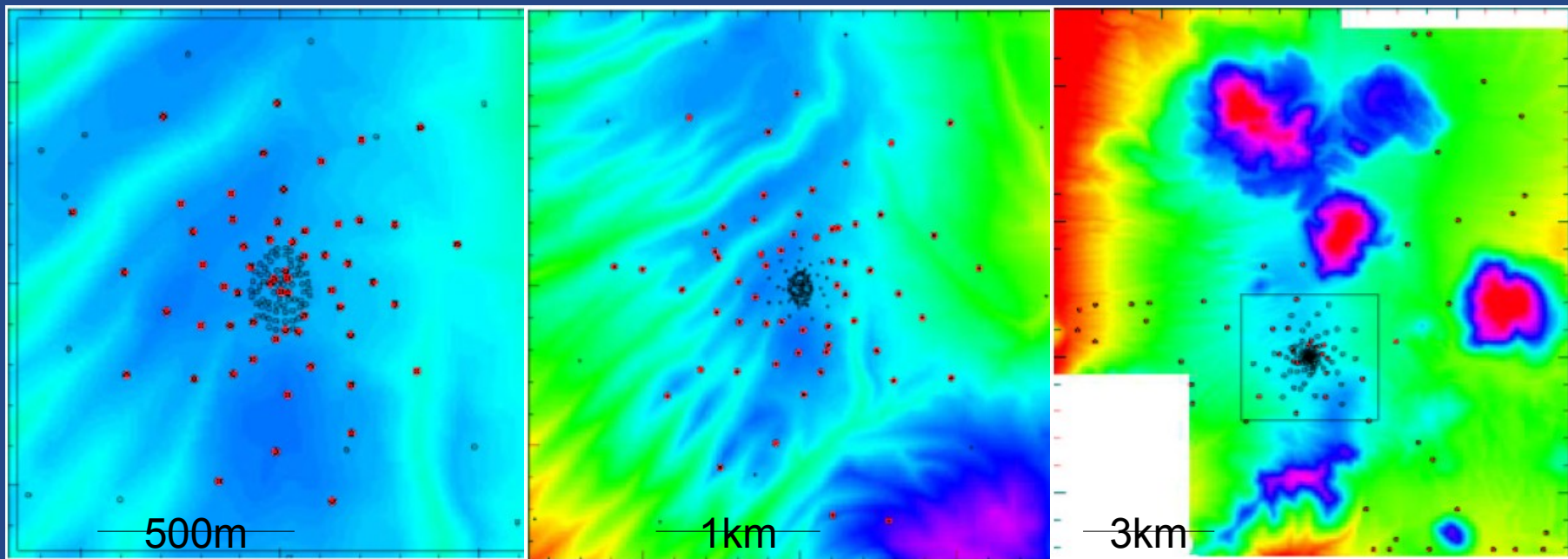
Antenna transporter



Antenna stations at 5000m



ALMA reconfiguration

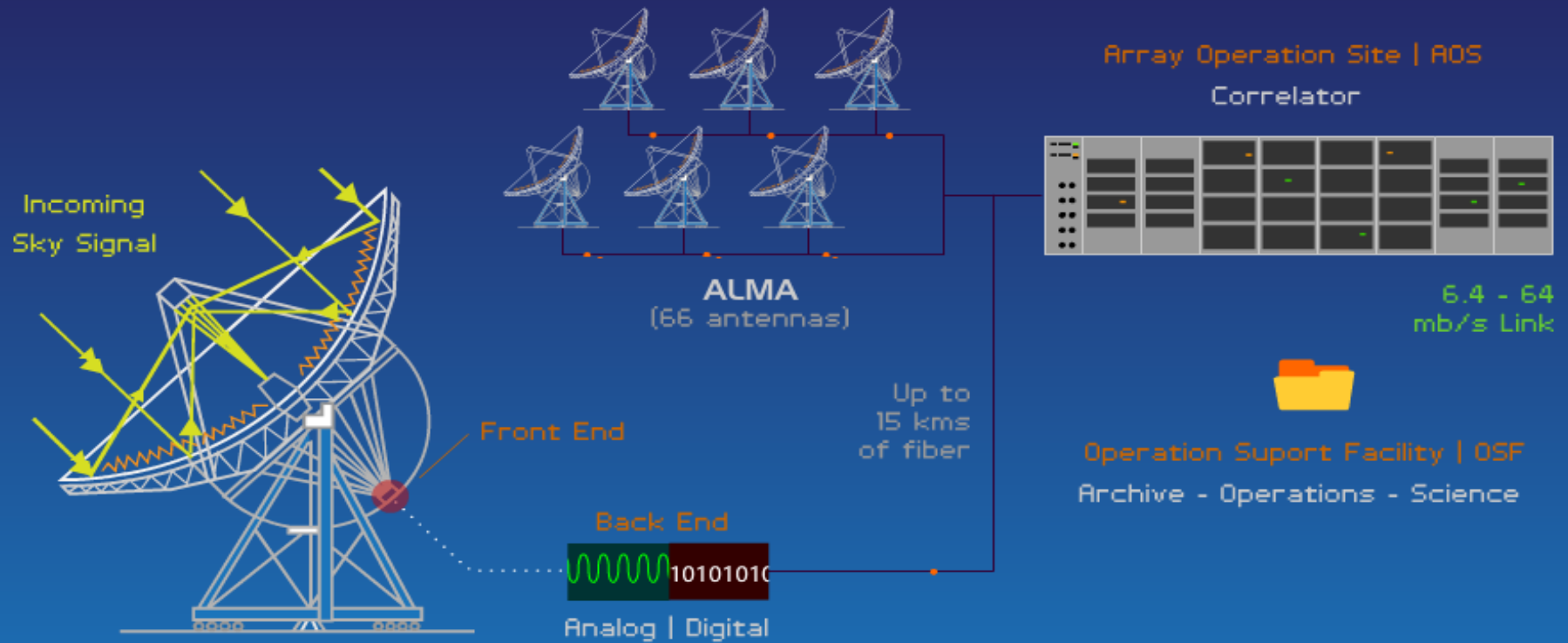


ALMA organization

- 3 sites in Chile
 - AOS: ALMA operations site (5000 m)
 - Antennas, correlator
 - OSF: Operations support facility (3000 m)
 - Labs, antenna assembly and maintenance
 - Operators, astronomers
 - SCO: Santiago central office
 - JAO (Joint ALMA observatory)
 - » Calls for proposals
 - » Running ALMA
 - » Data reduction pipeline
 - » Quality assessment
 - Archive
- ALMA Regional Centers



ALMA data flow



ALMA receivers

Heterodyne Receiver sensitive to Upper and Lower Side Bands (USB and LSB). Sidebands are mapped to a lower frequency band by mixing the sky signal with a Local Oscillator (LO). Varying LO1 changes the sidebands position.



ALMA receivers are

- 2SB (separated in the receiver):

Bands 3, 4, 5, 7, 8

Band 6

- DSB (separated in the correlator):

Bands 9, 10

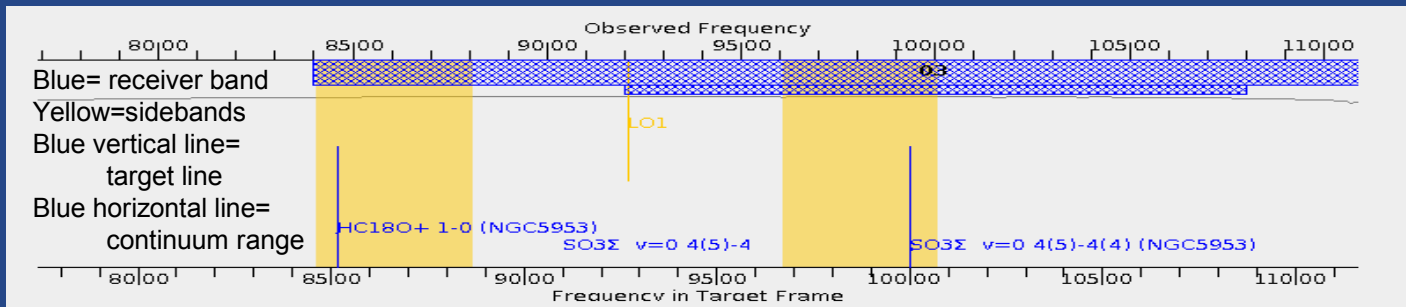
sidebands 4 GHz wide separated by 8 GHz

sidebands 5 GHz wide separated by 10 GHz

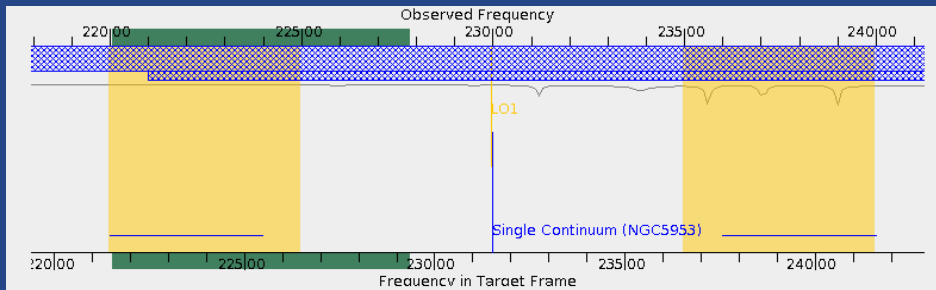
sidebands 8 GHz wide separated by 8 GHz



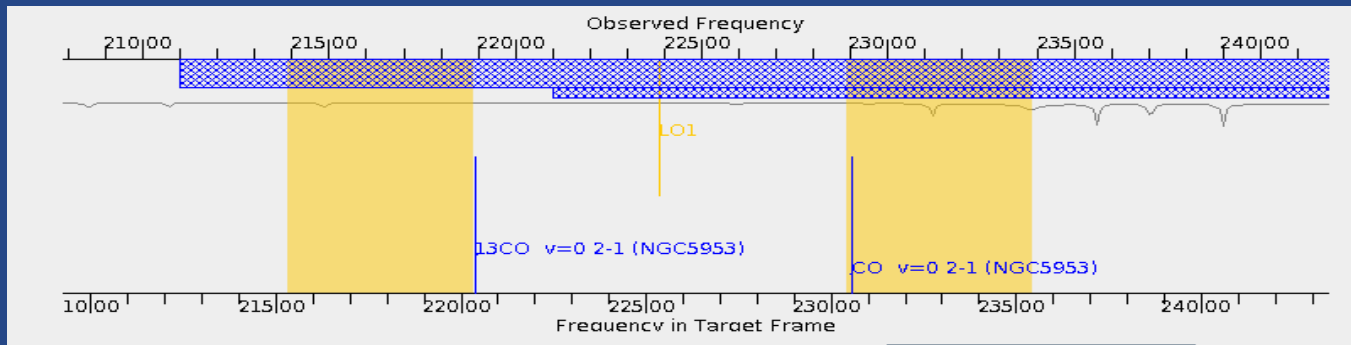
ALMA frequency setup



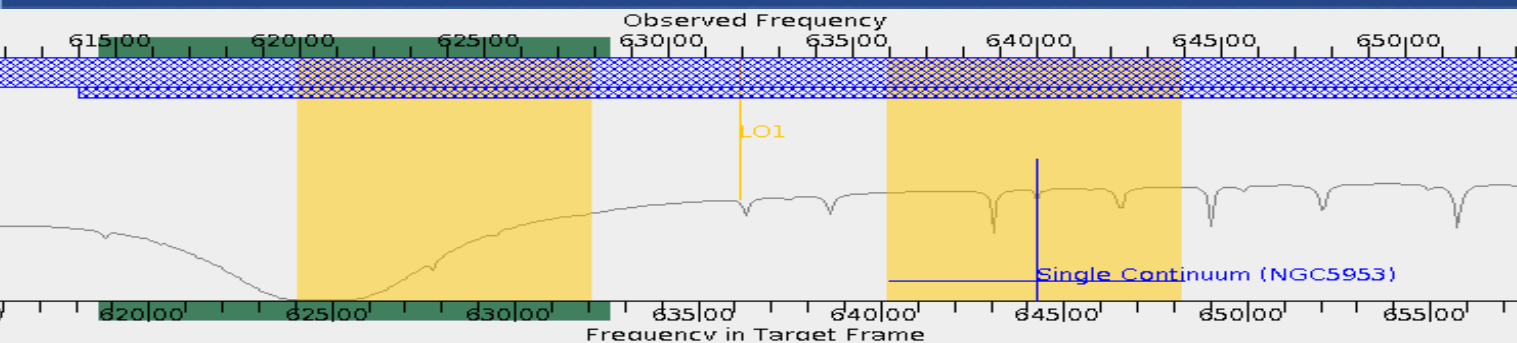
Band 3:
2 sidebands to see target lines



Band 6:
2 sidebands for 2SB continuum



Band 6:
5-10GHz separation allows 13CO and 12CO

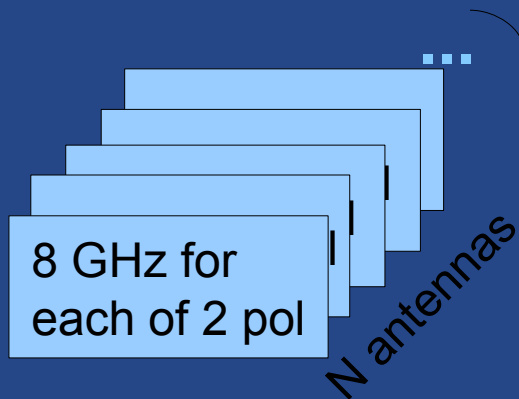


Band 9:
DSB continuum



ALMA correlator

INPUT from front ends



The 4 basebands can be setup independently
Highly flexible correlator:
>70 modes

CORRELATOR split in 4 quadrants

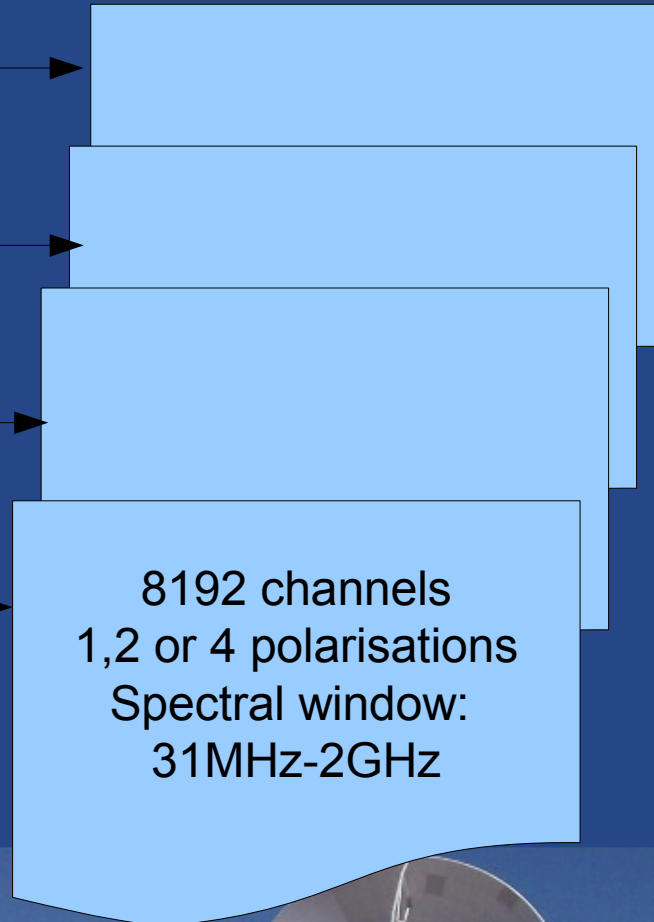
1 quadrant =
1 baseband =
2 GHz

1 quadrant =
1 baseband =
2 GHz

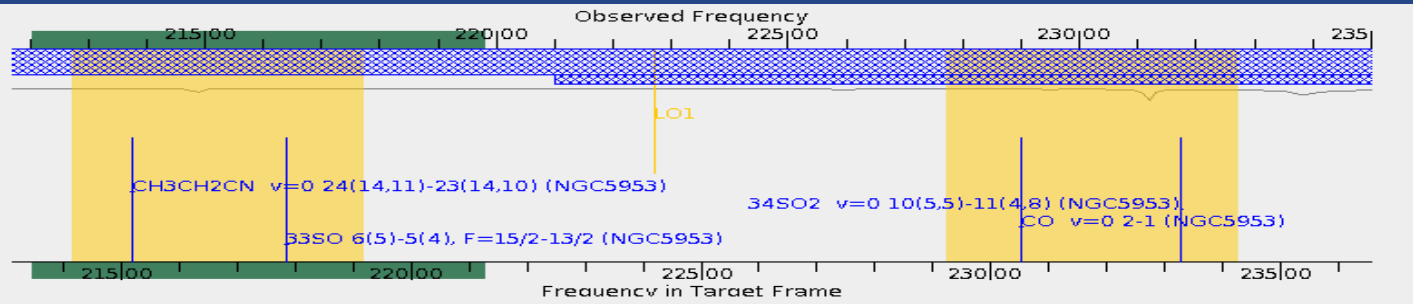
1 quadrant =
1 baseband =
2 GHz

1 quadrant =
1 baseband =
2 GHz

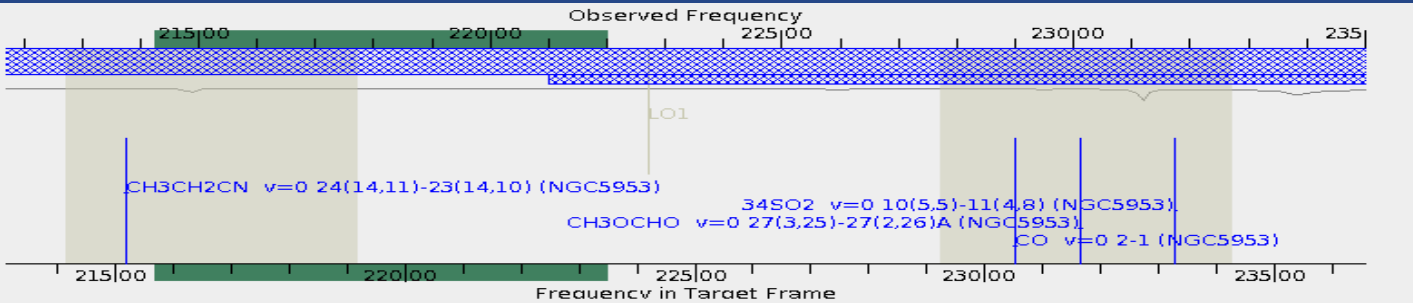
OUTPUT from each baseband



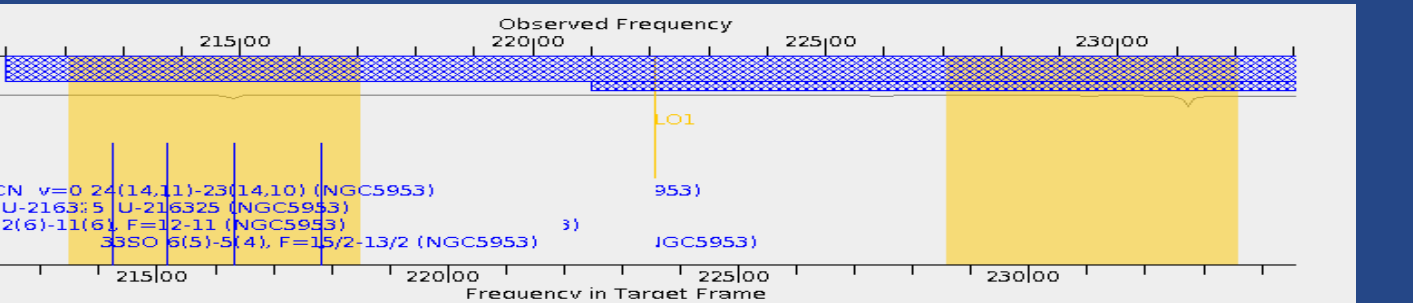
ALMA spectral windows setup



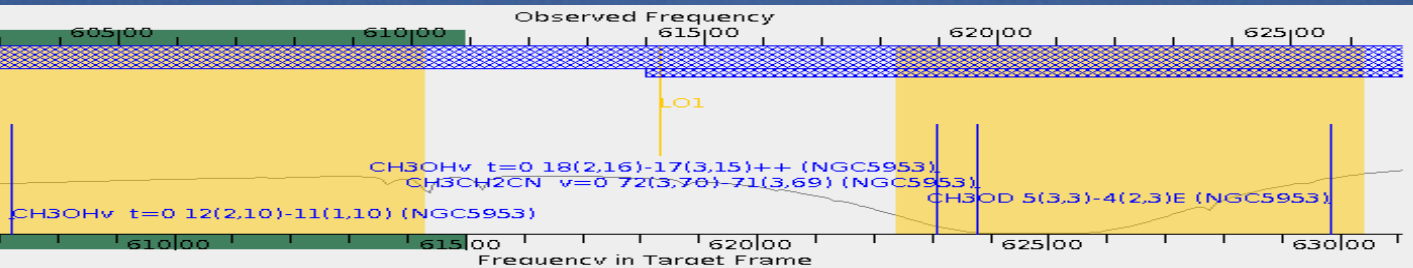
2SB:
2 basebands per
sideband



2SB:
3 basebands per
sideband
NOT ALLOWED



2SB:
4 basebands per
sideband

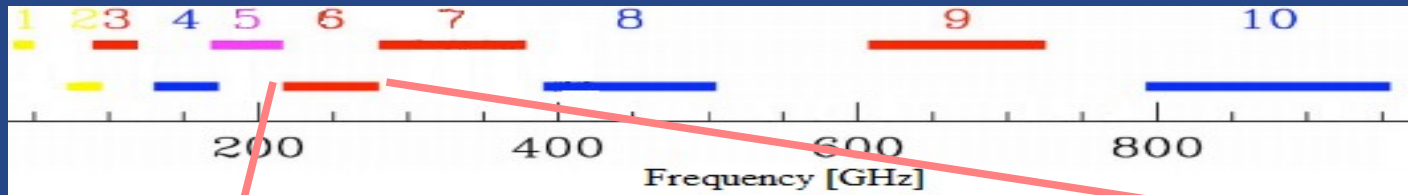


DSB:
3 basebands per
sideband
ALLOWED



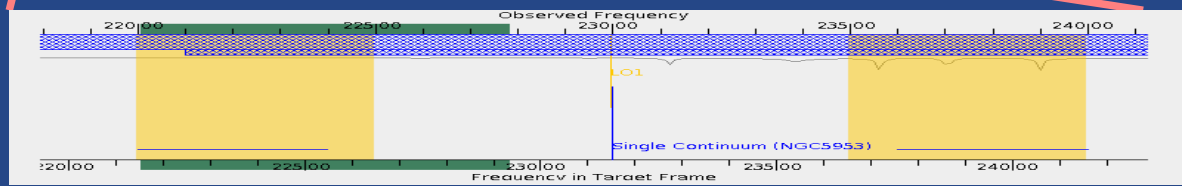
ALMA frequency settings summary

RECEIVERS
CORRELATOR

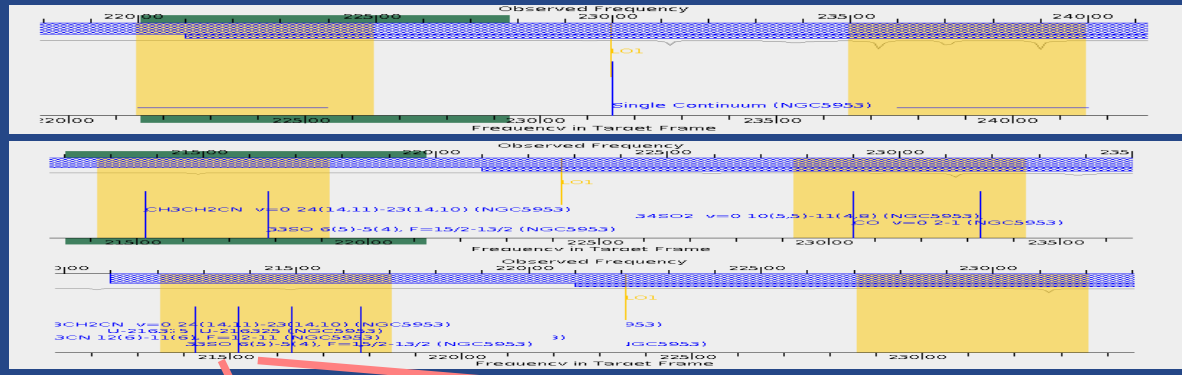


Select the band
(i.e. choose the receiver)

Fix LO1 to define the 2 sidebands



Fix LO2 to define the 4 basebands



Chose your polarisation and spectral resolution within each baseband

1 pol: up to 8192 channels (=resolution elements)
2 pol: up to 4096 channels
Full stokes: up to 2048 channels



ALMA correlator modes

Two kinds of operation

★ Time Division Mode (TMD)

Pseudo-continuum/wide spectral line

SPW always 2-GHz wide with 64-256 channels

★ Frequency Division Mode (FMD)

High-resolution spectral line

SPW can be 58.6-1875 MHz wide with up to 8192 channels

Correlator Modes for Early Science Cycle 0, dual Polarization

Pseudo-Continuum (2 GHz)	128 channels	15.6 MHz resolution	TDM
1875 MHz	3840 channels x Pol	488 kHz resolution	
938 MHz	3840 channels x Pol	244 kHz resolution	FMD
469 MHz	3840 channels x Pol	122 kHz resolution	
234 MHz	3840 channels x Pol	61 kHz resolution	
117 MHz	3840 channels x Pol	30.5 kHz resolution	
58.6 MHz	3840 channels x Pol	15 kHz resolution	

ALMA correlator summary

- 4 independent basebands
- ~70 modes:
 - 2 GHz to 31 MHz bandwidth / 8192 channels / 1,2 or 4 pol products
 - Varying sampling options (better sensitivity with degraded resolution)
 - Continuum mode
- Possibility to observe many spectral windows/baseband (with same or different resolution/width, polarisation properties...)



ALMA calibration

Phase calibration

- Bright unresolved sources (AT20G, Planck ...)
- Fast switching on calibrators within 2° every few min
- Water vapour radiometry (emission at 183GHz atmospheric line, deduce phase fluctuations on 1s timescale)
- positional accuracy $<1/10$ synthesized beam-width

Flux density scale (primary)

- No bright enough stable quasars available!
- Planets/moons can be used
- Asteroids, Radio stars
- Initial expected accuracy $<5\%$ B3, $<10\%$ B6-7, $<20\%$ B9

Bandpass calibration

- Bright unresolved sources

Leakages calibration

- Well known polarized or unpolarized sources (edges of planets/moons?). Still under characterization.



ALMA status & next milestones



Science Verification

- On-going to observe known sources to validate the output of ALMA
- Data made public (in June): not for science

Early Science

- 31 March: call for proposals and ALMA Science Portal opening
- 1 June: opening of the archive for proposal submission
- 30 June: proposal submission deadline
- 30 September 2011 - 30 June 2012:

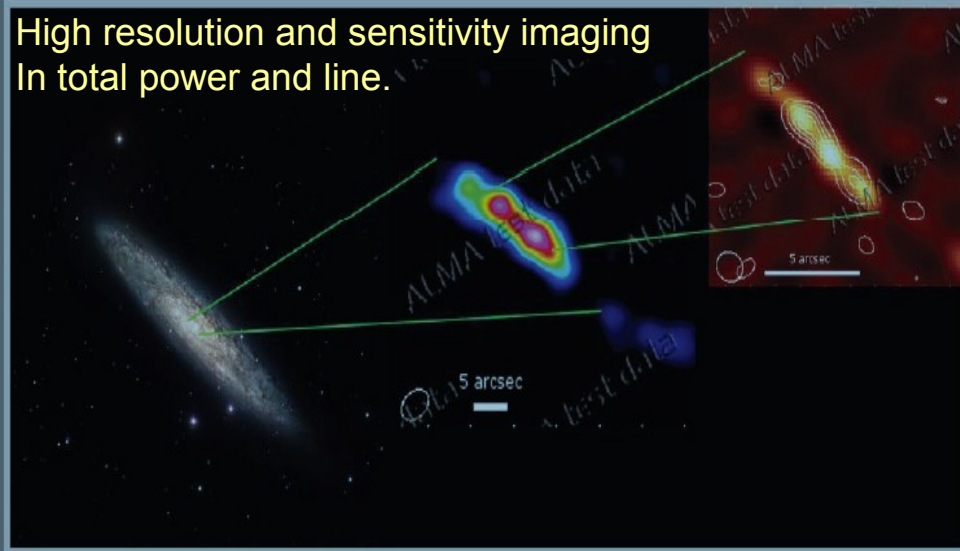
ES Phase 0 observations (500-700 h)

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



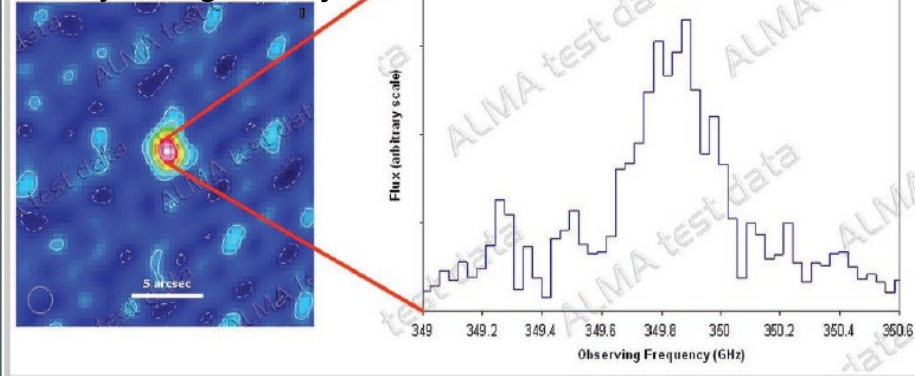
First tests of science with ALMA

High resolution and sensitivity imaging
In total power and line.



This shows the well-known spiral NGC253, with an optical image of the whole galaxy on the left (credit: ESO). The ALMA test images show dense clouds of gas in the central regions of the galaxy: (middle) the CO J = 2-1 line at 230 GHz and (right) the continuum and CO J = 6-5 line at 690 GHz.

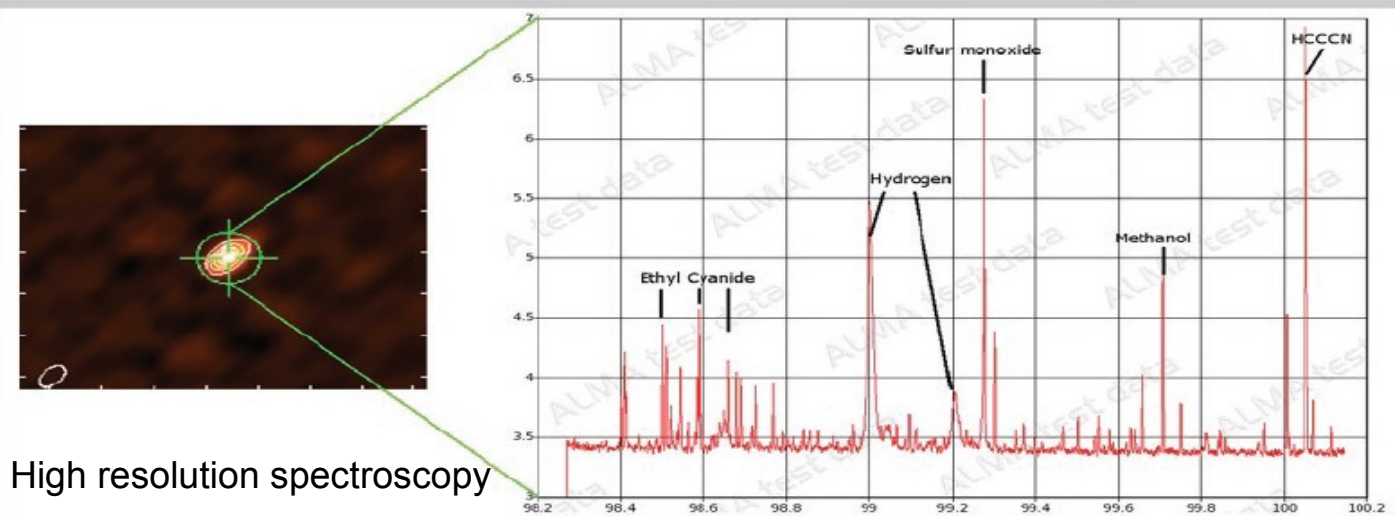
Study of high-z objects



As a test of ALMA's ability to observe broad spectral lines, we observed the quasar BRI 0952-0115, which is at a red-shift of $z = 4.43$. The object is again unresolved on short baselines, but the 158 micron line from ionized carbon is clearly detected in the spectrum, which is impressive given that this observation took only one hour in total.

ALMA 8 antennas hw/sw tests mid 2010

An example of ALMA's potential as a spectroscopic instrument: on the left is the map of the molecular "hot core" G34.26+0.15, which is unresolved with the short baselines that we are presently using, so the "image" is not very interesting whereas a section of the spectrum near 100 GHz shows a "forest" of molecular lines. A few of the chemical species that are responsible for the emission lines are identified on the plot.



High resolution spectroscopy

Full array

Early Science

Frequency range:

10 bands 30-900 GHz

4 bands (3, 6, 7, 9)

Antennas:

50x12m + ACA

16x12m (no ACA)

Sensitivity

0.15 mJy in 1 min at 230 GHz

0.5 mJy in 1 min at 230 GHz

Max baseline:

150m-16km

2 configs: 18-125m

36-400m

Resolution:

20 mas @ 230 GHz
70 correlator modes

1000 mas @ 230 GHz
14 correlator modes

Mosaic capability

Limited mosaic capabilities

Pipeline reduction in Chile

Reduction @ ARCs

Band	Lower frequency [GHz]	Upper frequency [GHz]	Type
3	84	116	2SB
6	211	275	2SB
7	275	373	2SB
9	602	720	DSB

Band	Frequency [GHz]	Angular Resolution ["]	Maximum Scale ["]	T _{bc} [mK]	Flux [mJy]	T _{bl} [K]	Field of View ["]
Properties of the Compact Configuration (baselines of ~18 m to ~125 m)							
3	100	5.3	21	0.65	0.14	0.030	62
6	230	2.3	9	1.0	0.20	0.029	27
7	345	1.55	6	1.8	0.37	0.043	18
9	675	0.80	3	15	3.2	0.27	9
Properties of the Extended Configuration (baselines of ~36 m to ~400 m)							
3	100	1.56	10.5	7.6	0.14	0.35	62
6	230	0.68	4.5	11	0.20	0.34	27
7	345	0.45	3.0	20	0.37	0.50	18
9	675	0.23	1.5	175	3.2	3.1	9



ALMA-ES correlator summary

- ~~4 independent basebands~~ Same mode for all the basebands
- ~~~70 modes:~~ 14 modes
 - 2 GHz to 31 MHz bandwidth / 8192 channels / 1,2 ~~or 4 pol~~ products
 - ~~Varying sampling options (better sensitivity with degraded resolution)~~
 - Continuum mode
- ~~Possibility to observe many spectral windows/baseband (with same or different resolution/width, polarisation properties...)~~ Only one spectral window per baseband



ALMA Tools



Fundamentals of ALMA observations

ALMA will be dynamically scheduled in service mode

Some tools: the Science Portal and the Helpdesk (SP)
 the Observing Tool (OT)
 the Splatologue
 the Common Astronomy Software Application (CASA)

Thought to be suited both for experienced and non experienced observers.

**Care about the limitations in resolution
and sensitivity for the ES!**

ALMA ES is ok for few hours, limited scope projects!

**Furthermore, experience in mm interferometry is needed
among investigators because data won't pass through the pipeline
Calibration quality is being assessed!**



ALMA project checklist

Have a good idea!

Estimate required configuration

(CASA, Splatalogue, OT, SP)

Write the proposal idea in pdf docs

(max 5 page, including tech+science)

Register to the Science Portal

(SP)

PHASE I – Proposal submission

(OT, UP, Helpdesk)

TAC evaluation

PHASE II – Observing program

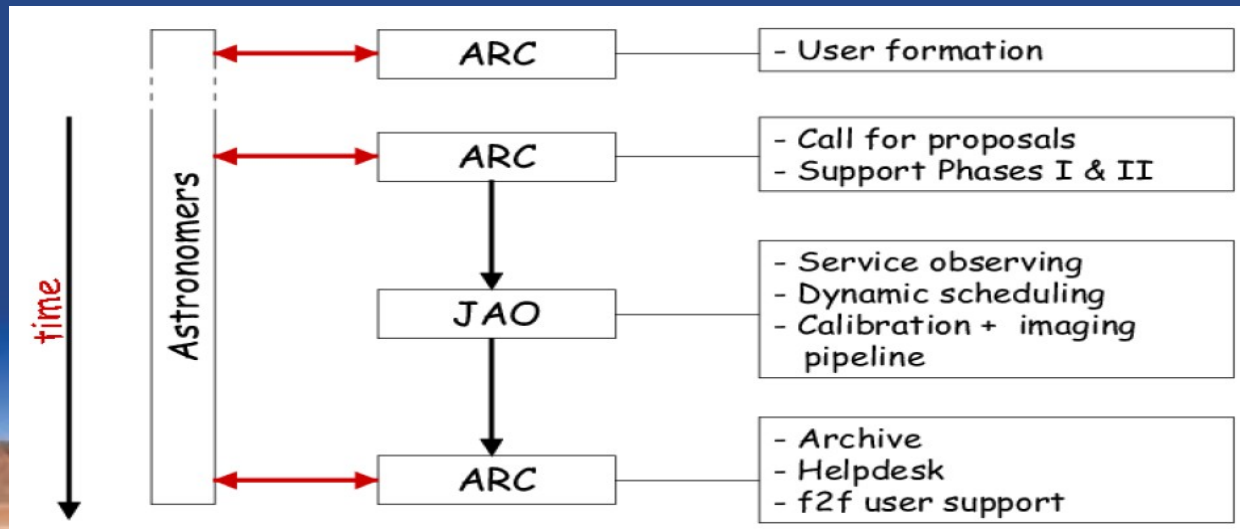
submission for accepted proposals

(OT, UP, Helpdesk)

Observations

Data reduction and analysis

(CASA)



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 sour
Observation Setup	Central frequency in GHz	90	The value entered must be within
	Bandwidth in MHz	32	Use broad for continuum, narrow
	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



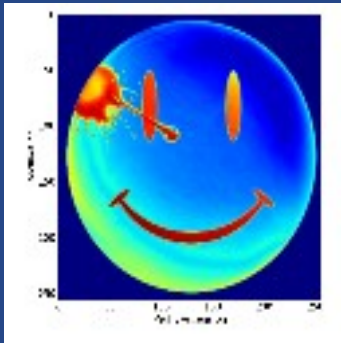
Job ID: 20110330175645 / Submitted by: casasola@ira.inaf.it

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

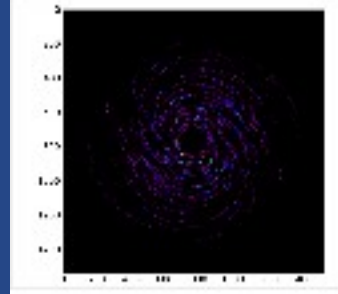
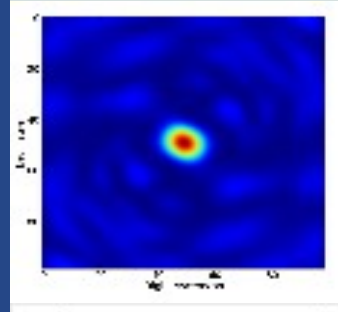
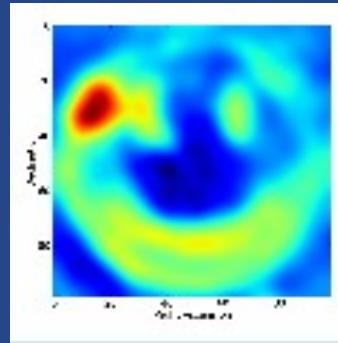


ALMA simulations (Observation Support Tool)

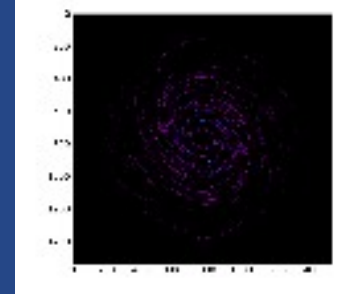
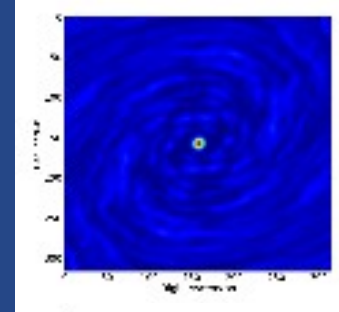
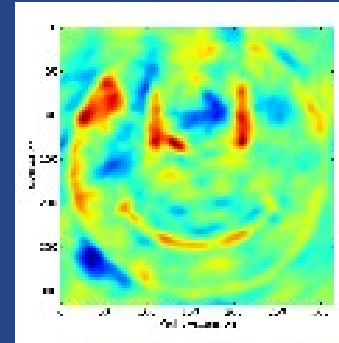


Model

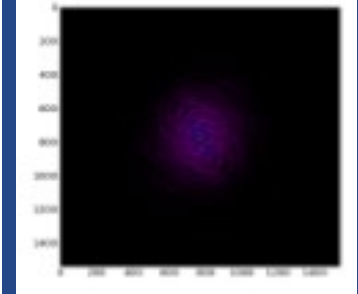
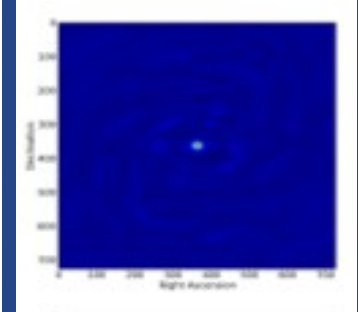
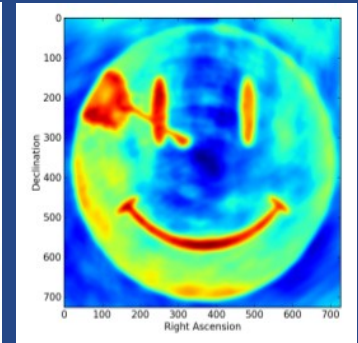
Images



B3 3h
Early Science
Compact config



B3 3h
Early Science
Extended config



B3 3h
Full ALMA
Compact config

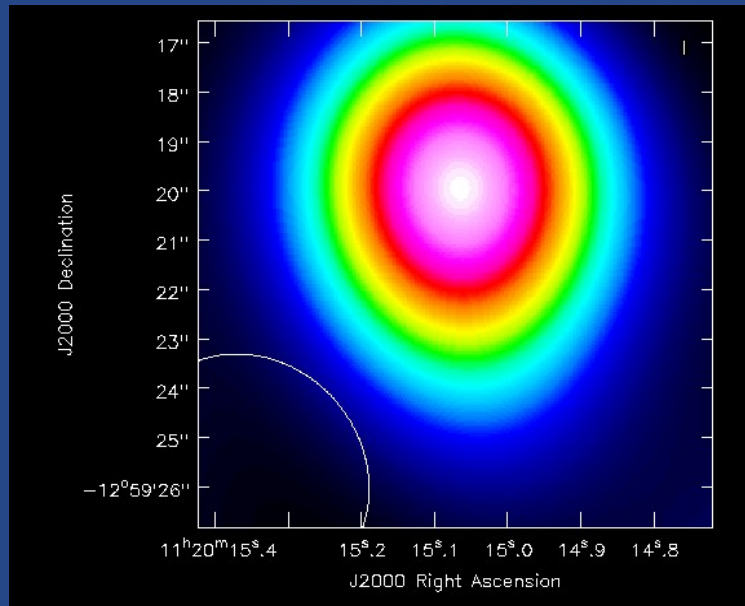
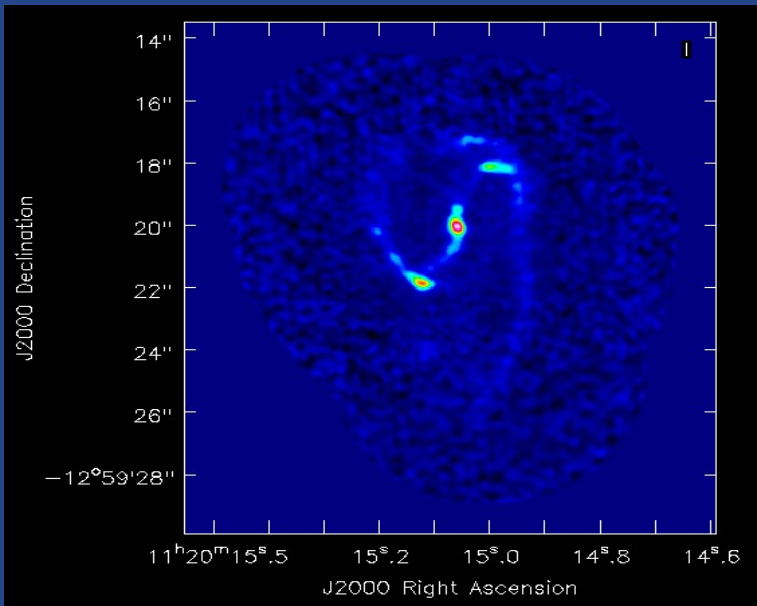
Synthesized
beam

uv coverage

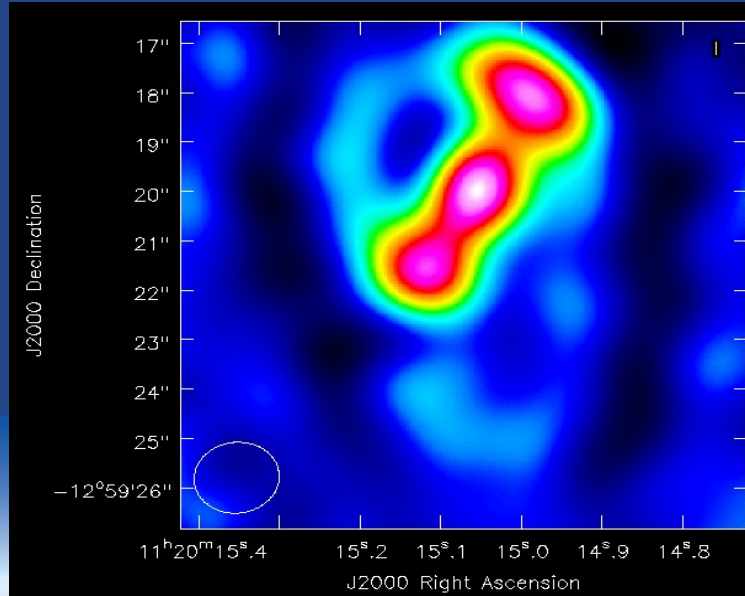
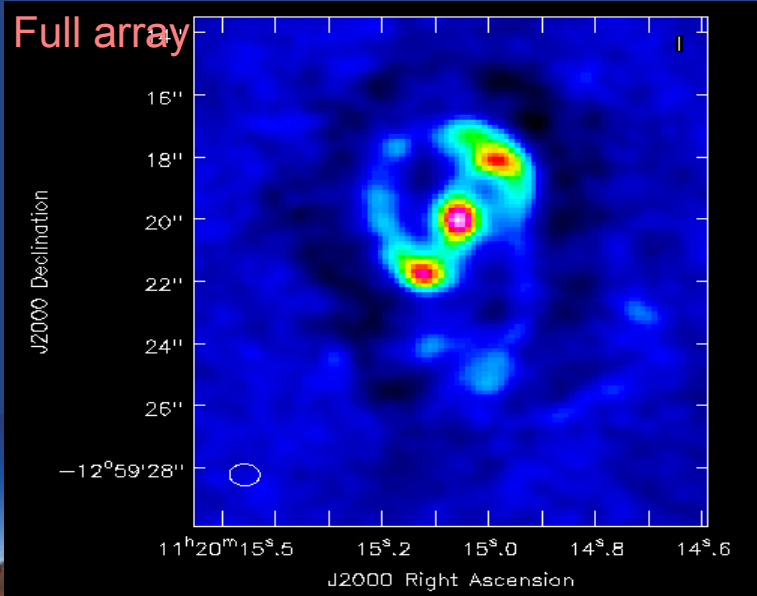


ALMA simulations (CASA simdata)

Simulation of NGC3627 @ $z=0.1$



Early Science
Baseline 250m



Early Science
Baseline 450m

The Science Goal: Sensitivity Calculator

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

Sensitivity Calculator — ALMA Scienc...

ALMA Science

Call for Proposals

Capabilities

Road Map

Proposers
Guide

Technical Guide

Observing Tool

Sensitivity
Calculator

Notice of Intent

ALMA Data

Documents &
Tools

User Services at
ARCs

- [Helpdesk](#)
- [ALMA@ESO](#)
- [ALMA@NRAO](#)
- [ALMA@NAOJ](#)

Additional information is available to users on the valid range for each parameter by hovering your mouse pointer over each field in the calculator applet (this does not currently work in Safari). [The ALMA Sensitivity Calculator Guide](#) gives a brief description of how the ASC works.

The calculator defaults to the number of antennas available during Cycle 0, but the user can select a higher number of antennas in order to compare the capability in future cycles. **The resulting integration times refer only to the on-source time and do not take any kind of overheads into account.** Furthermore, the ASC calculates the integration time/sensitivity for a single pointing. The case of pointed mosaics is discussed in the [Technical Guide](#).

A Java Plug-in must be installed in order to run the calculator. If the calculator is not displayed, then it is likely that this plug-in is not installed. Instructions for installing the plug-in may vary, depending on the browser and operating system used. A Plug-in compatible with the Java Development Kit version 1.5 or 1.6 (i.e. Java 5 or 6) is required. Users should contact their local IT department for installation help if necessary.

Common Parameters

Common Parameters

Dec	00:00:00.000	
Polarization	Dual	▼
Observing Frequency	345.0	GHz ▼
Bandwidth per Polarization	2.0	GHz ▼
Water Vapour Column Density	Calculator Chooses ▼	
tau/Tsky	tau=0,211, Tsky=55,786 K	
Tsys	176,979 K	

Individual Parameters

	12m Array	7m Array	Total Power Array
Number of Antennas	16	0	0
Resolution	3.0	5,974554 arcsec	14,936385 arcsec
Sensitivity(rms)	0.01	0,00000	0,00000
(equivalent to)	0,01258	0,00000	0,00000
Integration Time	0,79558	∞	∞

Integration Time Unit Option Automatic ▼

Calculate Integration Time

Calculate Sensitivity

The ALMA Science Portal

<http://almascience.org/>

Welcome to the ALMA Science Porta...



Atacama Large Millimeter/Submillimeter Array

In search of our Cosmic Origins



Search Site

Portals: [ESO](#) [NRAO](#) [NAOJ](#)

Registration and login

[mmassardi](#) [Log out](#) [Profile](#) [Change password](#)

Home

About ALMA

ALMA Science

Call for Proposals

ALMA Data

Documents & Tools

User Services at ARCs

Helpdesk

[ALMA@ESO](#)

[ALMA@NRAO](#)

[ALMA@NAOJ](#)

Welcome to the ALMA Science Portal at ESO

Technical info

Info about the Early Science

Details about the CfP

Sensitivity Calculator,
OT, ASC, CASA

Helpdesk

The Atacama Large Millimeter/submillimeter Array (ALMA) is a major new facility for world astronomy. When completed in 2013, ALMA will consist of a giant array of 12-m antennas, with baselines up to 16 km, and an additional compact array of 7-m and 12-m antennas to greatly enhance ALMA's ability to image extended targets. ALMA is outfitted with state-of-the-art receivers that cover atmospheric windows from 84–950 GHz (3mm – 300 micron). Construction of ALMA started in 2003 and will be completed in 2013. Science observations will start in 2011 with 16 antennas and four

General News

First general news item
Feb 23, 2011

More...

Local News

First local news item
Feb 23, 2011

More...

The ALMA Observing Tool

- Home
- About ALMA
- ALMA Science
- Call for Proposals
 - Capabilities
 - Road Map
 - Proposers Guide
 - Technical Guide
 - Observing Tool**
 - Webstart Download Page
 - Tarball Download Page
 - OT Video Tutorials
 - Troubleshooting
- Sensitivity Calculator
- Notice of Intent
- ALMA Data
- Documents & Tools

Home ▶ Call for Proposals ▶ Observing Tool

Observing Tool

The ALMA Observing Tool (OT) is a Java application used for the preparation and submission of ALMA Phase I (observing proposal) and Phase II (telescope runfiles for accepted proposals) materials. The current Cycle 0 release of the OT is configured for the Early Science Capabilities of ALMA as described in the [Cycle 0 Call For Proposals](#). Note that in order to submit proposals you will have to register with the ALMA Science Portal beforehand.

Webstart Download Page

Download & Installation

The OT will run on most common operating systems, as long as you have Java installed (and no system problems). The ALMA OT is available in two flavours: WebStart and tarball.

The **WebStart** application has the advantage that the OT is automatically installed and ready to use. Note that the WebStart does not work with the OT on Linux installations. If this is the case, the tarball installation of the OT should be used.

The **tarball** must be installed manually, however it has the advantage that it works on Linux. For Linux users we also provide a download of the OT for Windows. Please use this if you have any problems running the OT tarball installation.



First Time Users: When you use the ALMA OT Webstart for the first time, it will download a large amount of shared resources (on the order of 130 MB) to your host, taking a few minutes to do so. This will only happen the first time, or when a revised version of the OT is released. Subsequent use of the OT will be much faster.



Click logo to start.

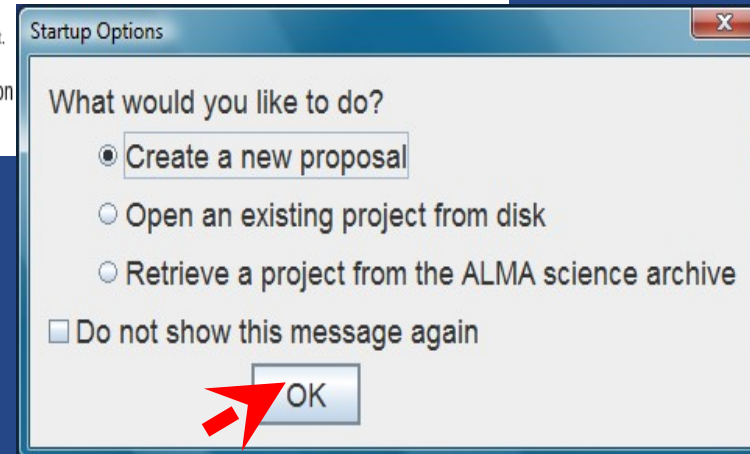
Click the OT Logo to bring up a download window, which should give you the option of saving the OT to your Desktop if you will be using it regularly.

Documentation

Extensive documentation is available to help you work with the OT and optimally prepare your proposal:

OT is a java-based client program, requires Java 1.6 (currently), runs on Linux (various distr.), MacOS (10.5-10.6), Windows (>XP).

The graphic interface allows one to get help/feedback and hints even with small knowledge of the system.



OT structure

My new idea - Observing Tool for ALMA (Early Science), version R8.0.1

File Edit View Tool Search Help

Perspective 1



Project Structure

Proposal Program

My new idea

- My new idea
 - Proposal **Proposal panel**
 - Planned Observing
 - Science Goal ()
 - Description
 - Field Setup
 - Calibration Setup Parameters
 - Spectral Setup
 - Control and Performance Parameters

Template library. Turn the keys on the JTree below & read the

Template library. Turn the keys on the JTree below & read the

Proposal **Template panel**

- Planned Observing
 - Science Goal (Band 3 100 GHz (rest frame) d
 - Science Goal (Band 3 Nyquist-sampled mosa
 - Science Goal (Band 6 Mixed 219 GHz SSB Co
 - Science Goal (Band 6 13CO J=2-1 mapping d
 - Science Goal (Band 6 Mixed simultaneous 12
 - Science Goal (Band 9 700 GHz search for pat

Editors

Spectral Spatial Proposal **Tab menu for viewer** Catalog

Proposal Information

Proposal Title: My new idea

Proposal Cycle: 9999.4

Editors Panel

Abstract (max. 300 words)

Feedback

Problems Information Log

Description	Suggestion

Feedback Panel

Overview

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

New Science Proposal → Create Science Goals → Validate Science Proposal → Submit Science Proposal

Click on the overview steps to view the contextual help

Importing And Exporting | Template Library | Need More Help? | View Phase 2 Steps

The project properties

Project - Observing Tool for ALMA (Early Science), version Cycle0-RC1

— □ ×

File Edit View Tool Search Help

Perspective 2



Project Structure

Proposal Program

(unnamed project)

- Project
 - Proposal

Editors

Spectral Spatial Project Catalog

Principal Investigator ?

Main Project Information ?

Project

Assigned Priority

Project Code

Feedback

Problems Information Log

Descripti...	Suggestion

Overview



The project properties

Project - Observing Tool for ALMA (Early Science), version Cycle0-RC1

File Edit View Tool Search Help Perspective 2

Project Structure

- Proposal
- Program

(unnamed project)

- My new idea
 - Proposal

Editors

- Spectral
- Spatial
- Proposal
- Catalog

Proposal Information

Proposal Title:

Proposal Cycle:

Abstract (max. 300 words):

Scientific Category

- Cosmology and the High Redshift Universe
- Galaxies and Galactic Nuclei
- ISM/Astrochemistry/Star Formation/protoplanetary disks/exoplanets
- Stellar Evolution/the Sun and the Solar System


Proposal Type:

Feedback

- Problems
- Information
- Log

Descripti... Suggestion

Overview



The project properties

Project - Observing Tool for ALMA (Early Science), version Cycle0-RC1

File Edit View Tool Search Help Perspective 2

Project Structure

- Proposal
- Program

(unnamed project)

- My new idea
 - Proposal

Editors

- Spectral
- Spatial
- Proposal
- Catalog

Recent Publications

Investigators

PI	Title	Full name	Email	Affiliation	ALMA ID	
		Not set	Not set	Not set	Not set	NONA

Select PI... Add Col... Remove Col Add fr

Science Case

Science Case(Mandatory, PDF, 5 pages max.) NewIdea_sciencecase.pdf Attach... De

Observatory Use Only

Feedback

- Problems
- Information
- Log

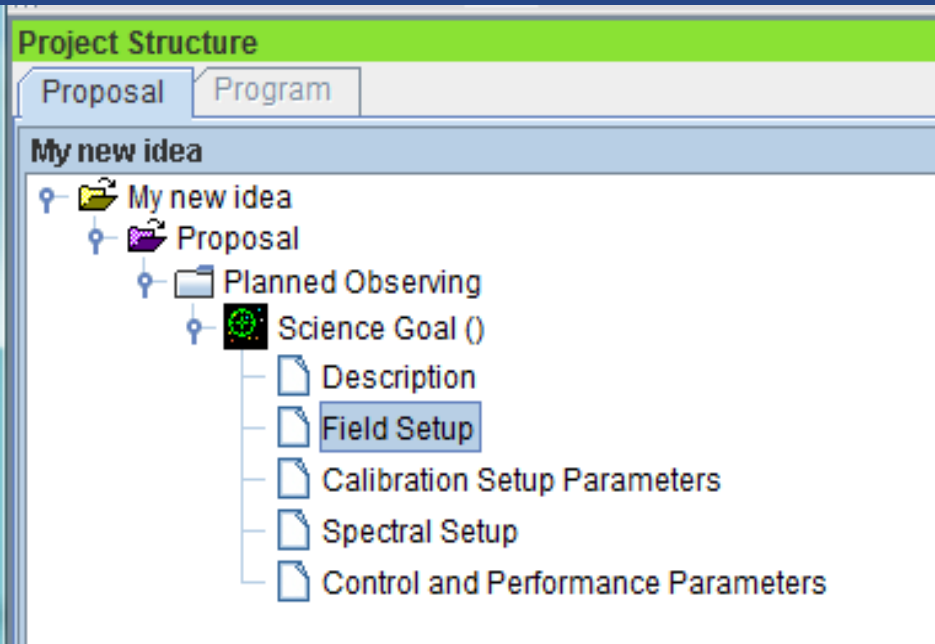
Descripti... Suggestion

Overview



The Science Goal concept

The OT divides the observing info of a project into “**Science Goals**”



- A **Science Goals** is a container of
- an optional description of the goal
 - the **Field setup** to define the observing targets
 - the **Calibration setup**
 - the **spectral setup** to define the frequency range and correlator configuration
 - the **Control and Performance parameters** to define the sensitivity and resolution goals

Divide your targets into SG according to telescope configurations, sky area...
i.e. more than one source can be in a SG, but only one instrumental configuration; more than one SG can be in a proposal



The Science Goal: Template Library

The screenshot displays the 'Project - Observing Tool for ALMA (Early Science), version Cycle0-RC1' window. The interface includes a menu bar (File, Edit, View, Tool, Search, Help) and a toolbar with various icons. The main area is divided into two panes. The top pane, titled 'Project Structure', shows a tree view for '(unnamed project)' with a 'Proposal' tab selected. Under 'My new idea', there is a 'Proposal' folder containing a 'Planned Observing' folder, which in turn contains a 'Science Goal ()' folder. This folder has five sub-items: 'Description', 'Field Setup', 'Calibration Setup Parameters', 'Spectral Setup', and 'Control and Performance Parameters'. The bottom pane, titled 'Template library. Turn the keys on the JTree below & read the ...', shows a similar tree structure. Under 'Proposal', there is a 'Planned Observing' folder containing a list of 'Science Goal' templates, such as 'Science Goal (Band 3 100 GHz (rest frame) doub...', 'Science Goal (Band 3 Nyquist-sampled mosaic c...', 'Science Goal (Band 6 Mixed 219 GHz SSB Cont...', 'Science Goal (Band 6 13CO J=2-1 mapping of 1...', 'Science Goal (Band 6 Mixed simultaneous 12CC...', 'Science Goal (Band 9 700 GHz search for pata-s...', 'Science Goal (ES Primer 1 (Molecular Gas and I...', and 'Science Goal (ES Primer 1 (Molecular Gas and I...'. The 'Spectral Setup' item in the top pane is highlighted.

A selection of hot science topics for science goal templates is on-board the OT

Possibility to drag and copy the full science goal!!!

The Target setup



The Spatial visualizer

- Always accessible through the tag menu.
- Resolves known objects.
- Add images from databases.
- Overlay mosaic pattern and details.

Editors

Spectral Spatial Field Setup Catalog

Pictor A

Source

Source Name Pictor A Resolve

Choose a Solar System Object? Name of object Mercury

System J2000 Sexagesimal display? Parallax 0.00000 mas

Source Coordinates RA 05:19:49.734 PM RA 0.00000 mas/yr

Dec -45:46:43.702 Resolved by simbad.ustrasbg.fr PM Dec 0.00000 mas/yr

Source Velocity 10078.000 km/s hel z 0.034201 Doppler Type RELATIVISTIC

Target Type Multiple single point fields 1 rectangular field

Expected Target Properties (for Technical Assessment)

Peak Flux Density 0.00000 Jy

Polarisation Percentage 0.0

Line Width 0.00000 km/s

Field Center Coordinates

PointingPattern : Offset

Offset Unit arcsec

13x 297.4, 301.8 11185.0

05:19:49.481, -45:46:37.00 (J2000)

Image filename : acheljsky7140391422431477137.fits

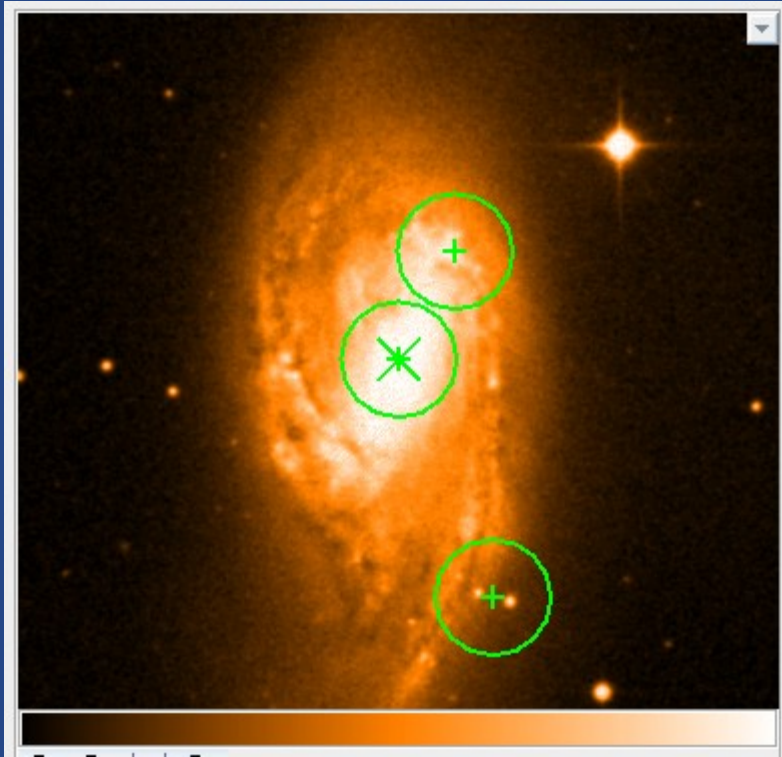
Parameters

Frequency used 0.00000 GHz Refresh

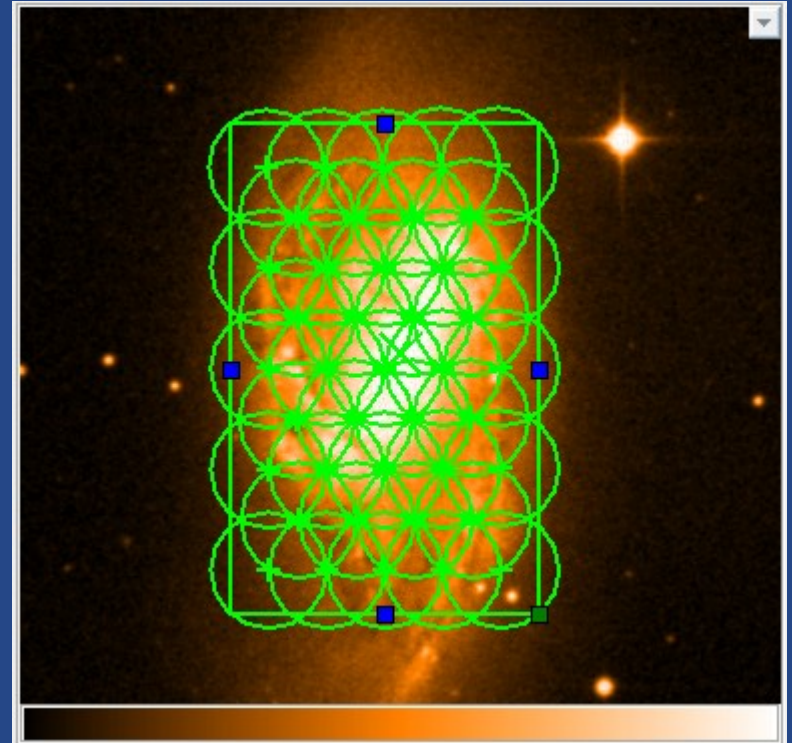
Parameters: representativeFrequency

Mosaicking

Single field pointings



Mosaic (up to 50 pointings in ES!)



The Calibration setup in the observing tool

“...We **STRONGLY** suggest that you leave this choice at 'System-defined'...”
at least for the ES Phase 0

Select calibration setup.
If "system" is selected, the ALMA system will select default calibrators.

Goal Calibrators

Select *User-defined calibration* to choose your own calibrators, or *System-defined calibration* to let the system automatically select the calibrators to be observed. We **STRONGLY** suggest that you leave this choice at 'System-defined' - the Observatory will ensure that suitable calibrators are selected.

System-defined calibration

User-defined calibration

- When first selected, the table shows a reasonable set of calibrators to include.
- *Dynamic Calibrators* are found by a source catalogue query executed at project execution time. Edit the query with *Edit Criteria...*
- *Fixed Calibrators* are calibrators specified now, at project creation time. Specify which calibrator should be observed with *Edit Target...*

Add Dynamic Calibrator... Add Fixed Calibrator... Delete Selected Calibration

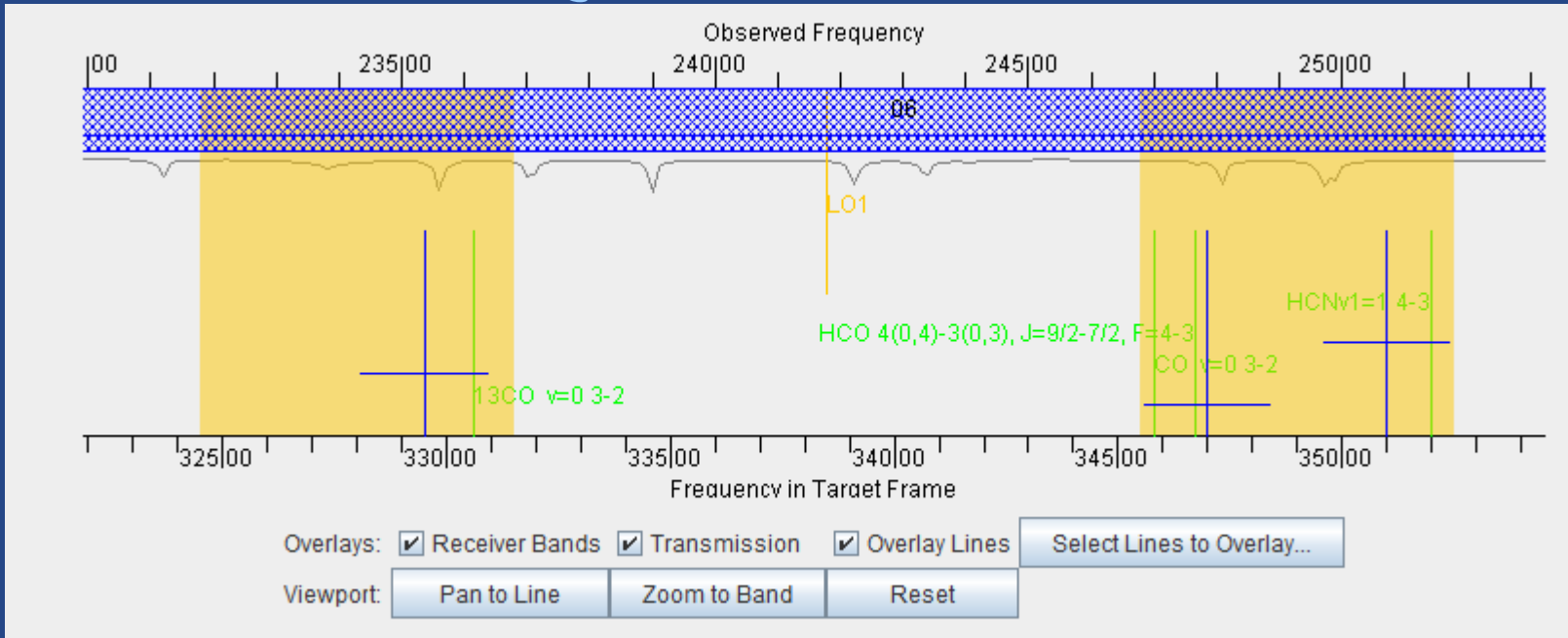
Calibration Intent	Target Type	Source Name	RA	Dec
Amplitude	Dynamic Calibrator		00:00:00.000 ± 20.00°	00:00:00.000 ± 20.00°
Pointing	Dynamic Calibrator		00:00:00.000 ± 20.00°	00:00:00.000 ± 20.00°
Phase	Dynamic Calibrator		00:00:00.000 ± 20.00°	00:00:00.000 ± 20.00°
Bandpass	Dynamic Calibrator		00:00:00.000 ± 20.00°	00:00:00.000 ± 20.00°

If user-defined calibration is necessary, care to justify it in the proposal!!!

The Spectral properties



The Spectral visualizer



Select Spectral Lines

Filter / Species: HCO

Include description in search

ALMA Band: 1 2 3 4 5 6 7 8 9 10

Sky Frequency (GHz): Min 211 Max 373

Maximum Upper-state Energy (K): 0 20 40 60 80 100

Molecule Filter / Environment: Show all molecules

Notes

- The initial database is an offline database, containing selected transitions from the full spectral line catalogue.
- Additional transitions from the full catalogue can be found by clicking Search Online.
- Search Online is only enabled when a species is given and one ALMA band is selected.
- Search Online does not (yet)

Transitions matching your filter settings

Transition	Description	Sky Freq.	Rest Freq.	Upper-state En.	Low Inten.	Sij μ^2
HCO 11(0,11)-10(1,10), J=21/2-19/2, F=10-9	Formyl Radical	243.745 GHz	341.243 GHz	274.33 K	0.5	2.39 D ²
HCO 4(0,4)-3(0,3), J=9/2-7/2, F=4-3	Formyl Radical	247.661 GHz	346.725 GHz	41.61 K	0.7	7.34 D ²
HCO+ v=0 4-3	Formylum	254.61 GHz	356.734 GHz	42.6 K	17.4	60.84 D ²

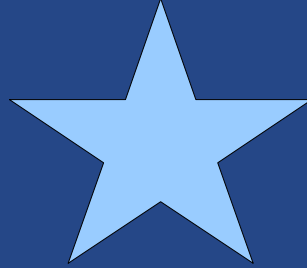
Add to Selected Transitions

Selected transitions

Transition	Description	Sky Frequency	Rest Frequency	Upper-state Energy	Low Intensity	Sij μ^2
13CO v=0 3-2	Carbon Monoxide	236.134 GHz	330.588 GHz	31.732 K	16.03	0.037 D ²
CO v=0 3-2	Carbon Monoxide	246.997 GHz	345.796 GHz	33.192 K	70	0.036 D ²
HCO 4(0,4)-3(0,3), J=9/2-7/2, F=4-3	Formyl Radical	247.661 GHz	346.725 GHz	41.61 K	0.7	7.34 D ²
HCNv1=1 4-3	Hydrogen Cyanide	251.433 GHz	352.006 GHz	4806.68 K	2.61	36.42 D ²

Search for all the lines that might fall in your observing region: It might be enough to add a spectral window to improve your results! (but care to justify it in the proposal...)

The control and performances panel



The Science Goal: Summary & tools

Field setup: Add as many targets as you want, in the same sky region
OT resolves for known objects
User ephemeris for moving bodies (comets, asteroids, TNOs)
Access online surveys for imaging
Use the interactive panel to draw on the image of your region
(or to define your mosaic)

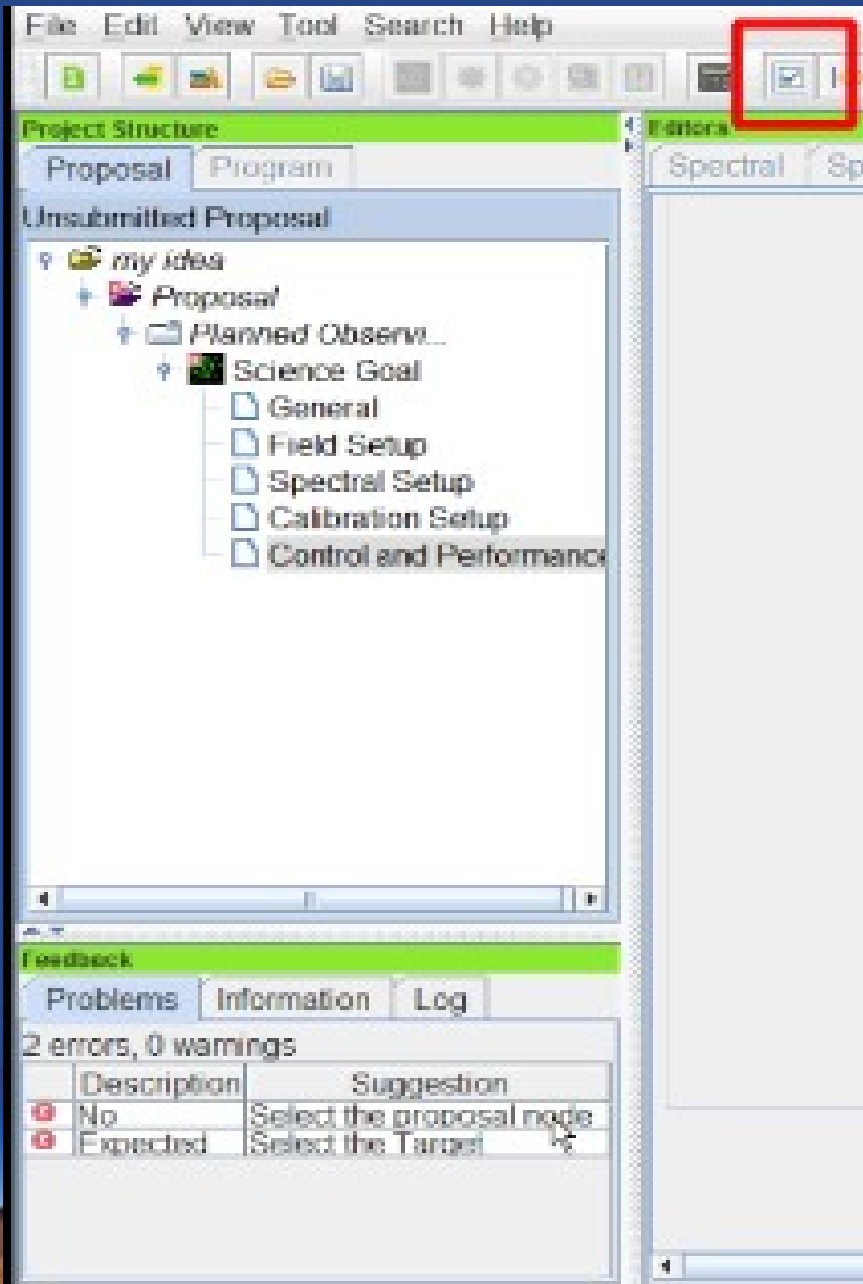
Calibration setup: Fully automatic (easy!)
User setup with access to calibrator catalogues/queries

Spectral setup: Central frequency average for continuum
Hidden LO and correlator as possible (to make it easy)
Splatalogue available to identify lines
Limited configurations available for ES (up to 4 sp.windows)

Performance control: Timing is based on sensitivity goals (or viceversa)
Resolution determines the configuration
(no need to know where antennas are)
Low number of antennas and short baseline in ES



The summary, validation and submission



The screenshot shows a software interface with a menu bar (File, Edit, View, Tool, Search, Help) and a toolbar. A red box highlights a button in the toolbar. The main window is divided into several panes:

- Project Structure:** Shows a tree view under "Unsubmitted Proposal" with nodes: "my idea", "Proposal", "Planned Observ...", and "Science Goal". Under "Science Goal" are sub-nodes: "General", "Field Setup", "Spectral Setup", "Calibration Setup", and "Control and Performance".
- Errors:** A pane on the right showing validation results.
- Feedback:** A pane at the bottom with tabs for "Problems", "Information", and "Log". It displays "2 errors, 0 warnings" and a table of errors.

	Description	Suggestion
❌	No	Select the proposal node
❌	Expected	Select the Target

Validation at any stage
Save at any stage on your PC
Archive open for submission
on 01 June 2011

The summary, validation and submission

ALMA		MARCELLA MASSARDI		None Assigned	
PROJECT TITLE:	My new idea				
PRINCIPAL INVESTIGATOR NAME:	Marcella Massardi	PROJECT CODE:	None Assigned		
SCIENCE CATEGORY:	Cosmology and the High	ESTIMATED TOTAL TIME:	0,6 h		
CO-PNAME(S): (Large Proposals only)					
CO-INVESTIGATOR NAME(S):	Viviana Casasola				
EXECUTIVE SHARES[%]	NA:	0	STUDENT PROJECT? (Yes/No)	No	
	EU:	100	RESUBMISSION? (Yes/No)	No	
	EA:	0			
	CHILE:	0			
	NONALMA:	0			
ABSTRACT					
Here is my abstract					
REPRESENTATIVE SCIENCE GOALS (UPTO FIRST 5)					
SCIENCE GOAL	POS.[J2000.0]	FREQUENCY	BAND	ANG.RES.(")	ACA?
ScienceGoal	05:19:49.734, -45:48:43.702	111,45917 GHz	3	3,0	N
Total # Science Goals : 1					
SCHEDULING TIME CONSTRAINTS (e.g. Co-ordinated observations already scheduled)					
NONE					
PICONTACT INFORMATION					
TITLE:		INSTITUTE &/OR DEPT.:	N/A		
NAME:	Marcella Massardi	ALMA EXECUTIVE:	EU		
E-MAIL:	marcella.massardi@oapd.inaf.it	ADDRESS:			
PHONE [FIRST]:					
PHONE [SECOND]:					
FAX:					

Validation at any stage
 Save at any stage on your PC
 Archive open for submission
 on 01 June 2011

Modification/withdrawal of submitted
 proposals before the deadline
 (30 June 2011 for ES P0)

A further validation is performed
 at the submission stage to guarantee
 the correctness of the projects



Proposal Review process

Proposals will be reviewed by an **international proposal review committee**.

There will at least one Review Panel for each of the **main themes**:

Cosmology and the High Redshift Universe

Galaxies and Galactic Nuclei

ISM, Star Formation/protoplanetary Disks and their Astrochemistry, Exoplanets

Stellar Evolution, the Sun and the Solar System

The **ranked proposals** from the different panels and sub-panels will be merged into a single ranked list in the ALMA Proposal Review Committee (APRC) and **assigned a letter grade A through D**:

- A the proposal will be carried over to the following cycle if it is not finished
- B the proposal should be finished during the current cycle but will not be carried over to the next cycle.
- C are 'filler' programs observed when no A or B can be scheduled
- D proposals will not be observed.



PHASE II observing programs

Investigators will be notified of the result of the ALMA Proposal Review process via email and successful investigators will be invited to submit a detailed observing plan.

The ALMA Observing Tool (OT) is used to prepare individual Scheduling Blocks (SBs, about 30min for weather reasons)

The best SBs at any moment will be observed (science, weather, project status)

These will be used by the ALMA Scheduling Software to ensure that the observations are carried out under the required weather conditions.

The ALMA Regional Centers (ARC) will provide support to investigators in the Phase II process.

Once the Phase II preparation is finished the Scheduling Blocks will be submitted to the ALMA site and scheduled according to rank and requested observing conditions.

Investigators will be able to track the status of their project with the **ALMA Project Tracker**.



...and then?

For the ALMA full array a pipeline will be operating
PIs will receive fully reduced images+raw data+scripts

For Early Science the pipeline is being assessed
“...ALMA staff will conduct quality assurance on ALMA data...”
PIs will receive raw data+ quality assessment scripts

Proposer experience in radio-mm interferometry is
required to reduce Early Science data.
Support can be requested to the ARCs.

CASA scripting helps in calibration & reduction.

Care for the huge amount of data!!!



Getting help with ALMA



Documentation & Help

Contextual Help in the overview panel

Contextual Help

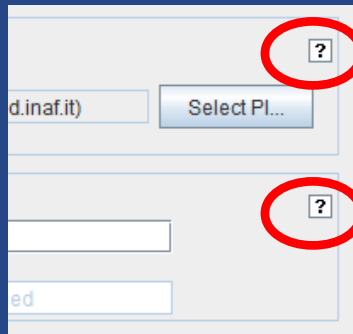
1. Please ensure you and your co-Is are registered with the [ALMA user portal](#)
2. Create a new proposal by either:
 - Selecting *File > New Proposal*
 - Clicking on the icon in the toolbar
 - Or clicking on this [link](#)
3. Click on the [proposal](#) tree node and complete the relevant fields.

Phase I: Science Proposal

New Science Proposal → Create Science Goals → Validate Science Proposal → Submit Science Proposal

Click on the overview steps to view the contextual help

Importing And Exporting Template Library Need More Help? View Phase 2 Steps



Clickable instruction for each step

<http://almascience.eso.org/document-and-tools/documents>

OT manual, cookbook, guide available on-board the OT (F1 key) and/or on-line

File Edit View Tool Search Help

ALMA Observing Tool User Manual

Project Structure

Proposal Program

My new idea

- My new idea
 - Proposal
 - Planned Observations
 - Science
 - Design
 - Field
 - Calibration
 - Special Observations
 - Conduct

Template library. Turn the

- Template library. Turn the
 - Proposal
 - Planned Observations
 - Science
 - Design
 - Field
 - Calibration
 - Special Observations
 - Conduct

Search Favourites

Contents Index

- List of Figures
- Introduction
 - Purpose
 - Reference Manual and Cookbook
 - Release Information
 - Registration and Tutorials
 - Troubleshooting, Known Issue
 - User Support
 - Credits and Acknowledgments
- Install and Run the Observing Tool
- Hardware and Software Prerequisites
- The Java Web Start Installation
- Tarball Installation
- Basic Concepts
 - The ALMA Data Flow System
 - Phase I Observing Proposals

Next Up Previous Contents Index

Next: [Hardware and Software Prerequisites](#)
Up: [ALMA-OT-UserManual](#) Previous: [Credits and Acknowledgments](#) [Contents](#) [Index](#)

Install and Run the Observing Tool

To prepare a Phase I proposal, or to specify an observing programme during the Phase II process, you need to have access to the OT

The Helpdesk

Registered users can submit questions or help requests (**tickets**) for problems with ALMA products or procedures.

Urgent issues with the proposal submission process have a dedicated category.

The tickets enrich the knowledge database, where the HD can search for help.

<https://alma-help.nrao.edu/>

ALMA - Europe - Powered by Kay...

ALMA
EUROPEAN ARC
ALMA Regional Centre

05 Apr 2011

Support Center » Knowledgebase

Knowledgebase Categories

Knowledgebase articles are categorized. Please select which category you would like to browse. You can also search the knowledgebase using the search field beside this text.

ALMA (26)

- What are the latitude, longitude and altitude of the ALMA site on Chajnantor?
- What is ALMA?
- >> more topics

Articles

- Where can I find the online ALMA observing simulator developed by the University of Manchester?** ★★★★★
Please go to: <http://almaost.jb.man.ac.uk> It's fun!
- Where are the ARC websites?** ★★★★★
The ARC websites are: Europe: <http://www.eso.org/sci/facilities/alma/> North America: <http://science.nrao.edu/alma/> East Asia:
- Must I submit a Notice of Intent for Cycle 0 Proposals?** ★★★★★
Submitting a Notice of Intent is strongly encouraged, but not required. It takes only a few minutes. Deadline for Notice of Intent is 15:00 UT on April 29, 2011. You can submit it here: <http://almascience.nrao.ac.in/call-for-proposals/notice-of-inte>

Log In

Log In

Knowledgebase Categories

ALMA (26)

Search

Search

-- Entire Support Site --


The Helpdesk



EUROPEAN ARC
ALMA Regional Centre

05 Apr 2011

Support Center

 Logged in successfully



View Tickets

Submit new tickets, view existing tickets or create new replies.



Submit a Ticket

Submit a new ticket.



Knowledgebase

Search support articles and find answers to frequently asked questions.



Downloads

View our library of file downloads and links.

My Account [\[Logout\]](#)

Logged In: **Marcella Massardi**

Search




Search

-- Entire Support Site --



Popular Knowledgebase Articles

Views

 What do I do if I can't get the OT to work?	485
 How do I arrange a visit to one of the ARCs?	382
 Can I reduce ALMA data in software packages other than CASA, and is there support for that?	307

The Helpdesk



Support Ce

Logged



Popular Kn

What d

How do

Can I r
support



EUROPEAN ARC
ALMA Regional Ce

Support Center » Submit a Ticket

Submit a Ticket

If you can't find a solution to your problem selecting the appropriate category below.

Select Category

- General Queries (EU) - Science Port reviews and assessment, Project tra
- Project Planning (EU) - Available Ca Simulators, Splatatalogue, other
- Observing Tool (EU) - Proposal Prep
- Data Reduction (EU) - CASA, pipelin
- Archive and Data Retrieval (EU) - ar
- Face to Face Support (EU) - Data re

Next »

Reset

Back

Home | View Tickets | Submit a Ticket | Kn

Submit a Ticket

If you can't find a solution to your problem in our [knowledgebase](#), you can fill in the fields below with as much detailed information as possible and send it to our agents.

General Information

Priority:

Default ▼

General

Sub-Categories:

Please specify areas of concern

- Science Portal/Registration
- Documentation
- Webpages
- Proposal reviews and assessment (science and technical)
- Project tracking
- Other

Message Details

Subject: *

adding a spectral window

Hi, I'm refining my proposal and want to add a spectral window to the LSB...

Knowledgebase suggestions

The following articles from our knowledgebase might be relevant to what you're looking for. Please take the time to read them before submitting your ticket.

- I want to observe 4 lines/bandpasses, 3 in one sideband and 1 in the other. Why can I not set this up in the OT?
Relevance: 100.00%
- What do I do if I can't get the OT to work?
Relevance: 49.58%
- When is the Cycle 0 proposal deadline and observing period?

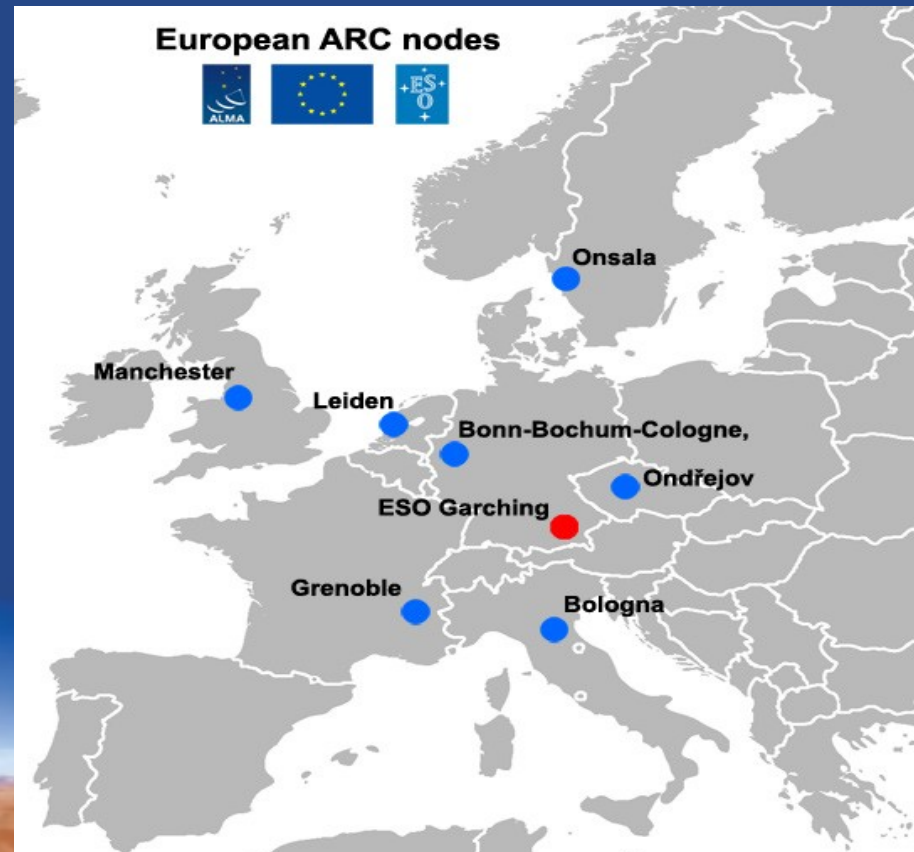
The ALMA Regional Centers (ARC)

- **Interface between JAO and users**
- 1 ARC per Partner:
 - NRAO for North America
 - NAOJ for East Asia
 - ESO for Europe
- Operation support
 - Archive replication
 - Astronomer on duty
 - Software tools
- User support
 - Community formation and outreach (schools, workshops, tutorials, ...)
 - Phase 1 (proposal preparation)
 - Phase 2 (scheduling block preparation)
 - Data analysis
 - Archive mining



The European ARC

- ESO European ARC distributed over a 7-nodes network
- ARC center at ESO: core tasks
 - Proposal handling
 - Archive
 - Data product support (ALMA data and software)
 - Helpdesk
- **ARC nodes:**
 - Face to face support
 - User formation
 - Advanced tools



The Italian ARC node

- Hosted by the IRA in Bologna
 - ARC Manager: Jan Brand
 - contribution from 6 members of IRA staff
 - 1 tenured position (Massardi)
 - 4 Post-Docs (Casasola, Mignano, Paladino, Rossetti)
 - 1 system manager (Bedosti)
 - 1 ESO ALMA co-funded fellow (Boissier)
- **User support**
 - **Face to face (ALMA software)**
 - **Polarimetry, mosaicing, GRIDDING computations...**
- Community formation
 - In 2010: community day and CASA tutorials
 - In 2011: tutorials or ALMA ES
 - **13-17 June 2011: Astrochemistry with ALMA school in Bologna**



Contact us!!!

For your proposals, data reduction, ALMA related stuff
don't struggle on your computer:
contact us and/or organize your visit to IRA-ARC node

To ask f2f help send a ticket to the central helpdesk
indicating your “favourite” ARC node

- 2 visitor stations available
- 1 ARC node member dedicated to each visitor
- 10 TB disk space available during your visit + 1 month for download
- No fundings available for visitors

Helpdesk: <https://alma-help.nrao.edu/>

Web: <http://www.alma.inaf.it>



Request for a f2f visit!!!



Support Ce

Logged



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- What d
- How do
- Can I r support



EUROPEAN ARC
ALMA Regional Centre

Support Center » Submit a Ticket

Submit a Ticket

If you can't find a solution to your problem in our selecting the appropriate category below.

Select Category

- General Queries (EU) - Science Portal/Reg reviews and assessment, Project tracking,
- Project Planning (EU) - Available Capabiliti Simulators, Splatologue, other
- Observing Tool (EU) - Proposal Preparator
- Data Reduction (EU) - CASA, pipeline proo
- Archive and Data Retrieval (EU) - archive i
- Face to Face Support (EU) - Data reduction

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Submit a Ticket

If you can't find a solution to your problem in our [knowledgebase](#), you can fill in the fields below with as much detailed information as possible and send it to our agents.

General Information

Priority:

Default

EU Visitor

Preferred ARC Node for Support: *

Italian

Type of Support Required: *

Proposal Preparation

Project ID:

Number of Visitors: *

Proposed begin and end dates for your visit: *

01 June - 08 June 2011

Areas of expertise: *

Areas of expertise relevant to your visit

extragalactic CO lines

Special Computing Requirements:

(disk space, etc.)

Permission To Access Data:

By checking this box, you give the ARC staff permission to access your data prior to the visit for preparation purposes.

Yes

Financial Support Required:

Yes

Justification for Financial Support:

This field is required if the visitor requests financial

Visit our site!!!

Web: <http://www.alma.inaf.it>


Italian ARC - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti Aiuto


[http://www.alma.inaf.it/](#)

FFSS OAPD mail apod arXiv.org NED ADS VizieR ALMA OT ALMA SP ALMA-Wiki ARC TWiki Italian ARC

Italian ARC



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Main Menu

- Home
- About us
- Local Staff
- Local Resources
- The News
- ALMA News
- Reports & Documents
- Meetings
- Jobs @ INAF

Alma Nodes

- ALMA Info
- NRAO: Alma

ASTROCHEMISTRY WITH ALMA

The Italian ALMA Regional Centre and the Osservatorio Astrofisico di Catania organize a Training School "Astrochemistry with ALMA".

The School is funded by the EU through ITN LASSIE Network and COST Action CM0805.

Date: **13 - 17 June 2011**
Venue: Research Campus, CNR Bologna

The School will consist of general introductory lectures which will present the ALMA project and its potential impact on astrochemistry.
The focus will be on chemistry in star forming regions, in envelopes of evolved stars, and in comets.

The School is open to students of all backgrounds (experimental, observational, theoretical) and is meant to provide researchers not actively involved in interferometry with a basic knowledge for a successful use of ALMA.

Last Updated on Friday, 04 February 2011 11:04
[Read more...](#)

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Who's Online

We have 1 guest online

Jobs @ INAF

- Two-year post-doctoral position at the Italian ARC

Jobs @ ESO

- 2010/0010 ARC Scientist

Completato

Summary

- **ALMA is a unique instrument in the (sub-)mm (0.3 to 10 mm) range**
 - Unequaled sensitivity
 - Large collecting area (7200 m²), excellent dry site (5000 m altitude)
 - e.g. 6 uJy in 6h @ 230 GHz
 - Great imaging capabilities
 - 50 antennas +ACA, variable configuration
 - High resolution (15km = 40 mas @ 100 GHz, 5 mas @ 900GHz)
 - Flexible spectral configuration
 - Pipeline reduced data
- **Early Science proposal submission deadline on 30th of June**
(care for the limited capabilities !!!)
 - 16 antennas, baselines up to 450m, reduced number of spectral modes
- **Tools are designed to help the experienced AND non experienced user to use ALMA.**
 - Access to the ALMA world through the Science Portal and the ALMA Observing Tool



Enjoy your ALMA proposals !!!!!

**Contact the Helpdesk and
your ARC node for support**

Web: <http://www.alma.inaf.it>

Email: help-desk@ira.inaf.it

Helpdesk: <https://alma-help.nrao.edu/>

Useful links:

ALMA SP: <http://almascience.org/>

ALMA PRIMER FOR ES: <http://almatelescope.ca/ALMAPrimer.pdf>

ALMA CFP: <http://almascience.eso.org/call-for-proposals>

