EUROPEAN ARC
ALMA Regional Centre || Italian

Using the ALMA Science Archive data

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Reasons to use archived data

- Check if data are already available for a target
- Check the feasibility of a project looking for similar targets
- Retrieving information on a large sample of objects (e.g. statistics of populations, stacking, …)
- Retrieving information on a single object but with different configuration (e.g. multifrequency studies) or in different epochs (e.g. variability studies)
- Extracting unpublished information from existing data (e.g. finding additional spectral lines, targets in the same region/time of other observations,)
- ...

	Proposal submission	Archive mining
Time to get data	✗	+
Amount of data	✗	+
Data homogeneity	+	✗
Adherence to idea	+	✗

ALMA rationale

The design of ALMA is driven by three key science goals:

- The ability to detect spectral line emission from CO or [CII] in a normal galaxy like the Milky Way at a redshift of z=3, in less than 24 hours,

-> **frequency bands, high sensitivity**
-> study of star formation in galaxies
up to high redshift, galaxy formation, ...

- The ability to image the gas kinematics in protostars and in protoplanetary disks around young Sun-like stars in the nearest molecular clouds (150 pc),

-> **high and low angular resolution**,
high spectral resolution
-> study of processes of star and
planet formation, stellar evolution and
structure, astrochemistry, ...

- The ability to provide precise high dynamic range (=|image max/image min|) images at an angular resolution of 0.1 arcsec.

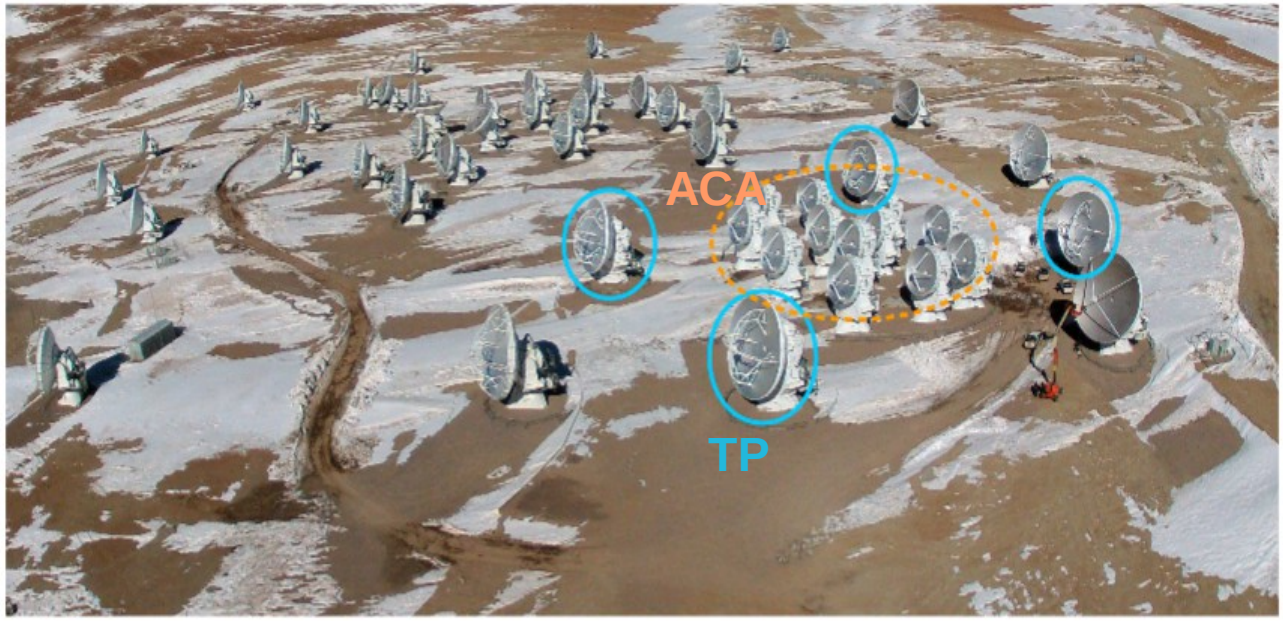
-> **high angular resolution and sensitivity**
-> galaxy dynamics, AGN core mechanisms,
imaging of exoplanets, comets,
asteroids, ...

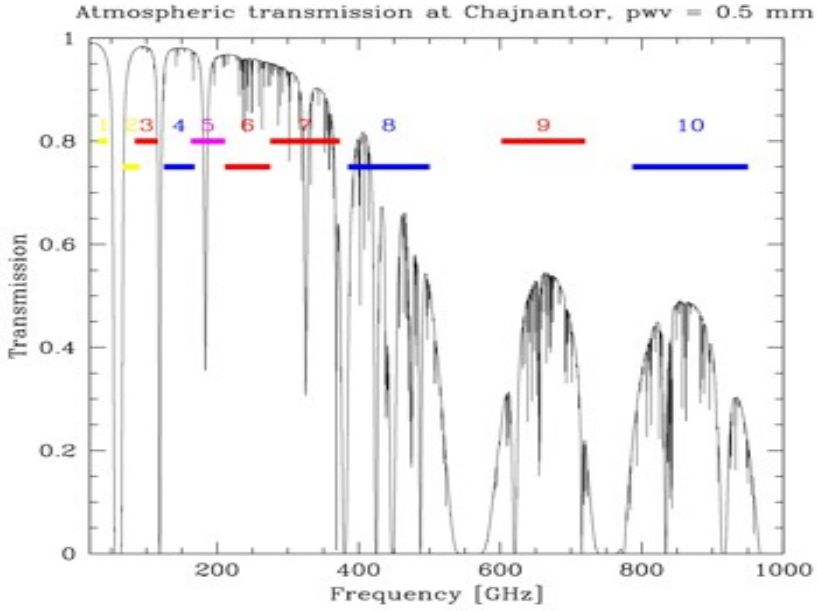
ALMA full array

The Atacama Large Millimeter Array is a **mm-submm reconfigurable interferometer**

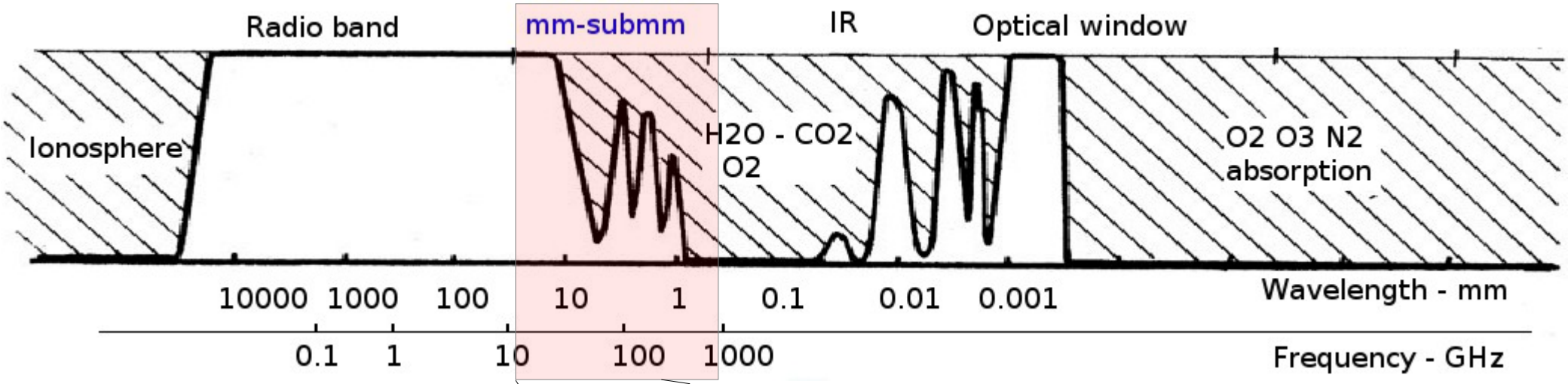
Inaugurated in March 2013 on the Chajinantor plain (**5000m**, Chile)

- Frequency range: **10 bands between 30-900 GHz** (0.3-10 mm)
- Antennas: **50x12m** main array + **12x7m** ACA **+ 4x12m** Total Power
- Baselines length: **15m ->150m-16km** + **9m->50m**
- Bandwidth: **2 GHz x 4 basebands**
- Polarimetry: Full Stokes capability
- Angular Resolution: **0.2" x (300/freq_GHz)x(1km/max_baseline)**
  40 mas @ 100 GHz, 5 mas @ 950 GHz
- Velocity resolution: **As narrow as 0.008 × (Freq/300GHz) km/s**
  ~0.003 km/s @ 100 GHz, ~0.03 km/s @ 950 GHz
- High instantaneous imaging capabilities & setup flexibility





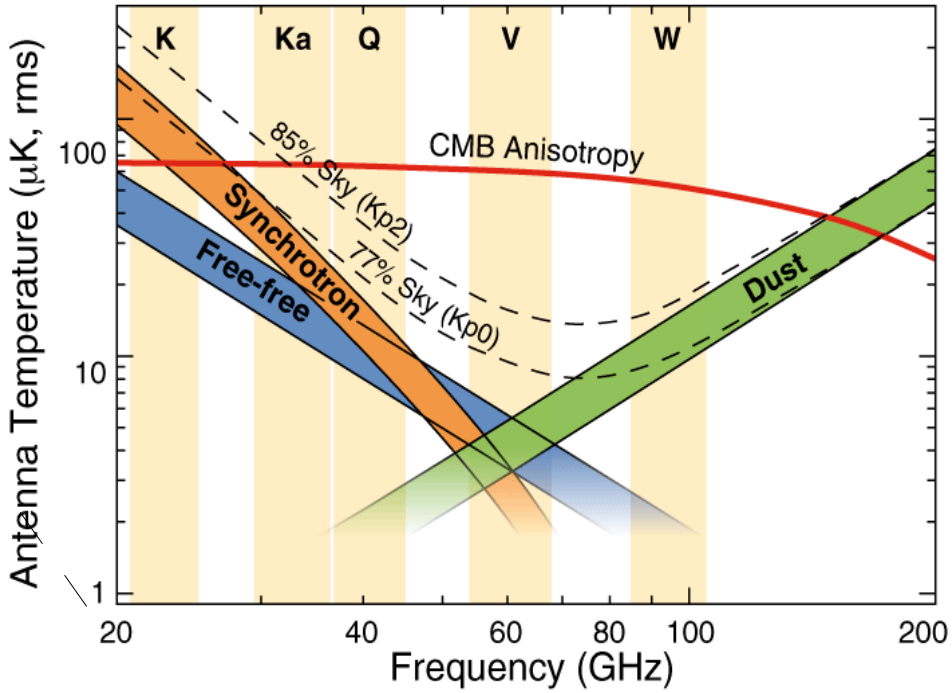
Frequency bands



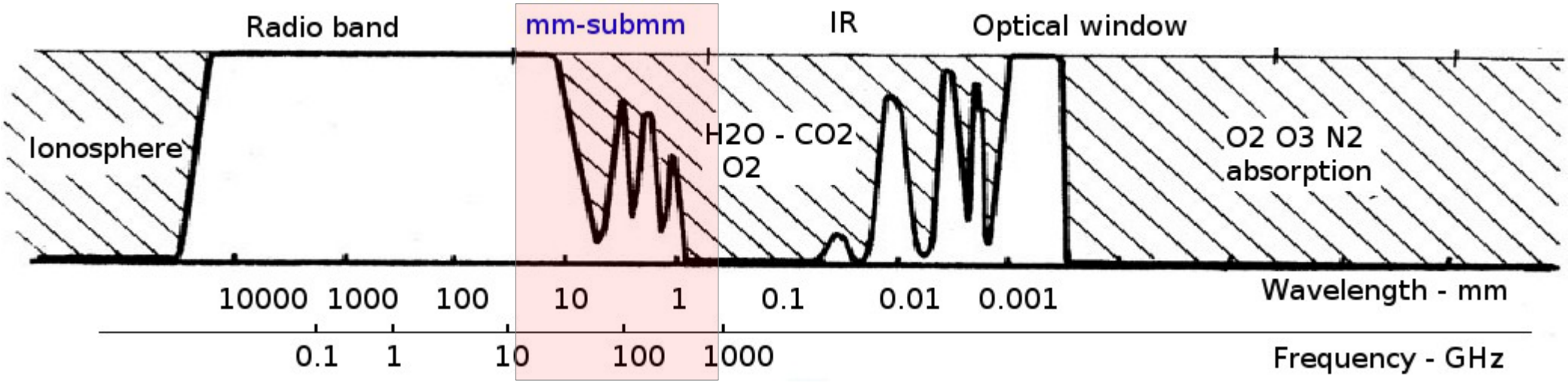
The (sub)mm band ranges between 30-1000 GHz

(Sub)mm signals: synchrotron, dust emission, molecular lines, CMB

- Includes the “cosmological windows”
- CIB constitutes about 50% of galaxy emissions
- Of this, 70% is due to dust
- Molecular clouds are associated to structure formation and dense regions
- In (sub)mm there is the peak of dust emission up to high z (negative k correction)
- Extinction is large in molecular clouds at NIR and optical bands but not in (sub)mm



Frequency bands



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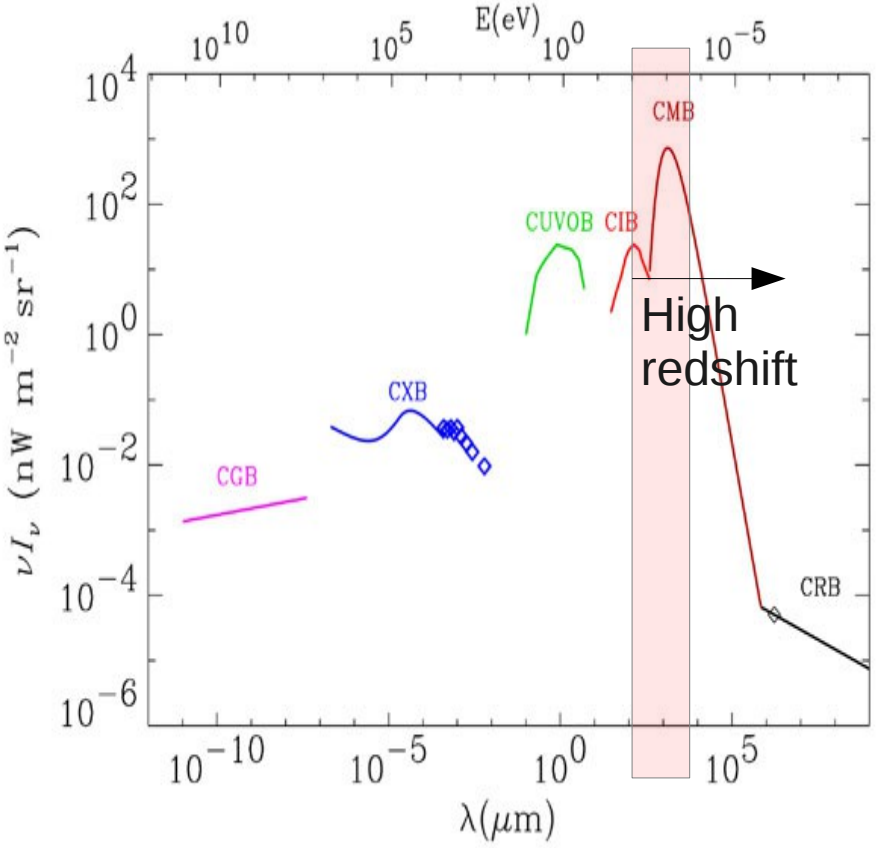
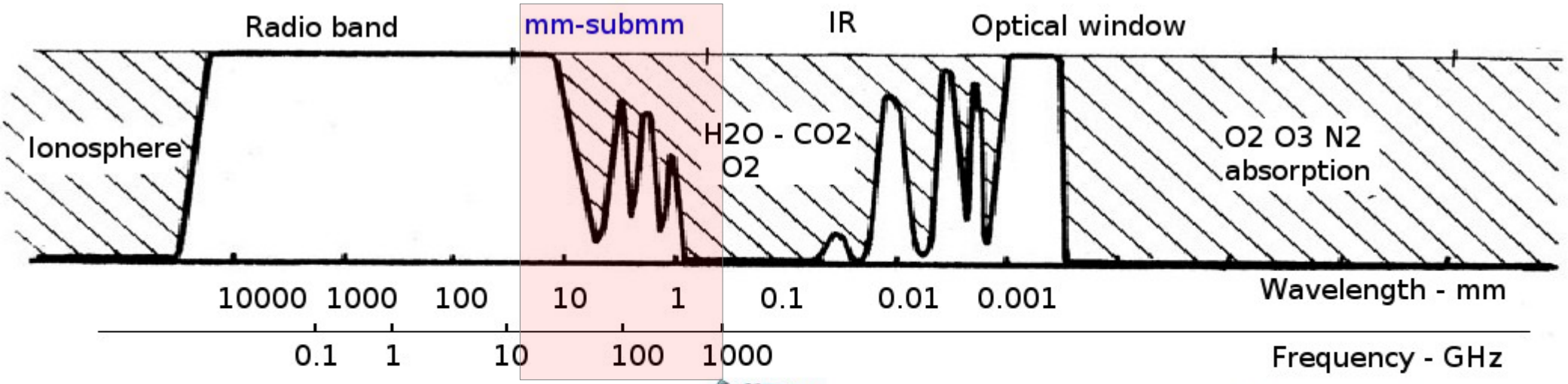
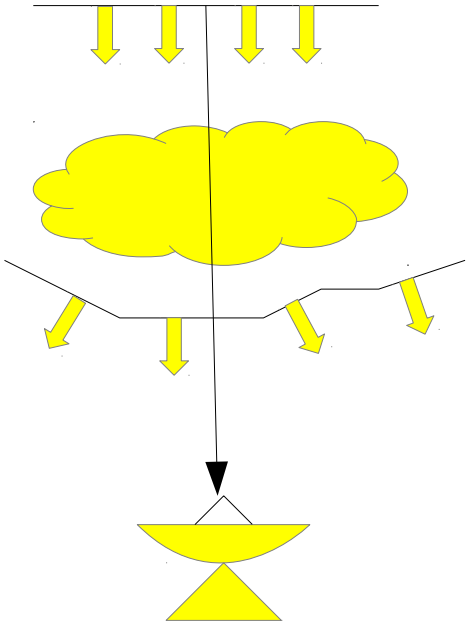


Frequency bands



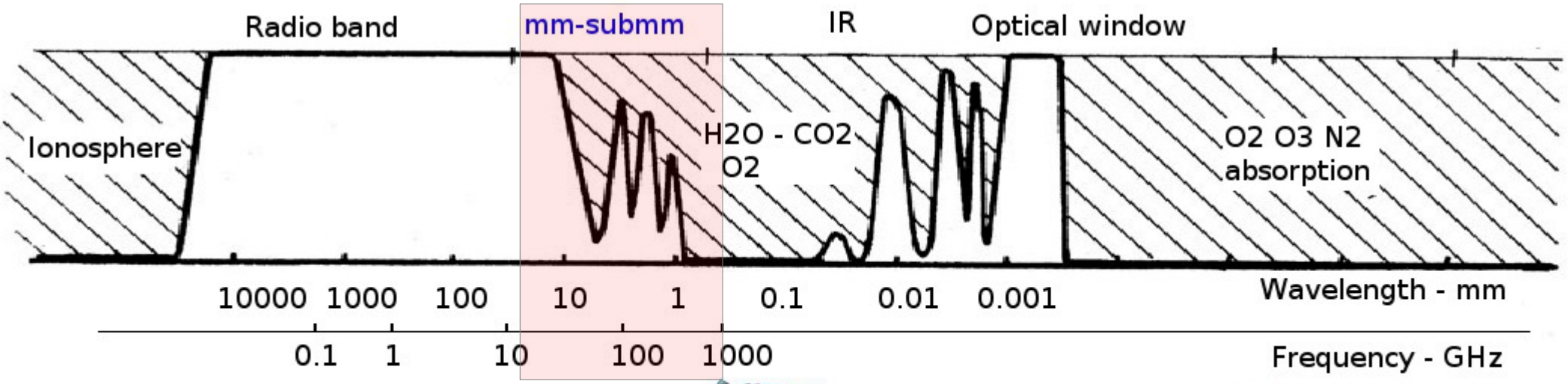
Shorter wavelengths are more sensitive to smaller obstacles.
Atmospheric effects: scattering of signal, absorption
Instrumental effects: surface accuracy
must be higher at lower wavelengths



Most typically it is observed from space/balloons but few transmissivity bands are allowed also from the ground in dry sites.

Allows higher resolution than radio bands but coherent receivers could be used

Frequency bands



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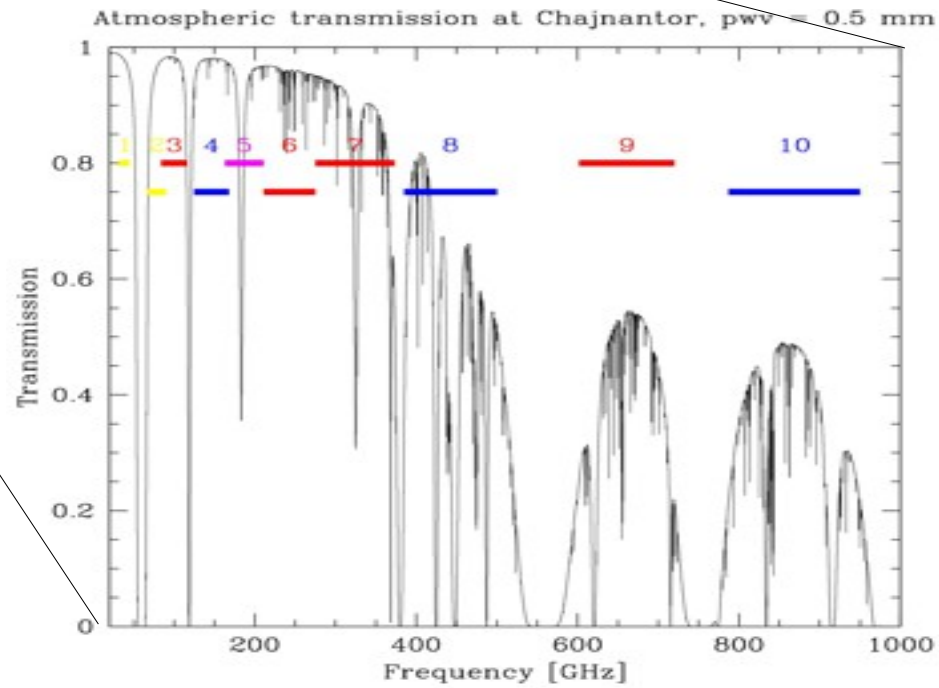
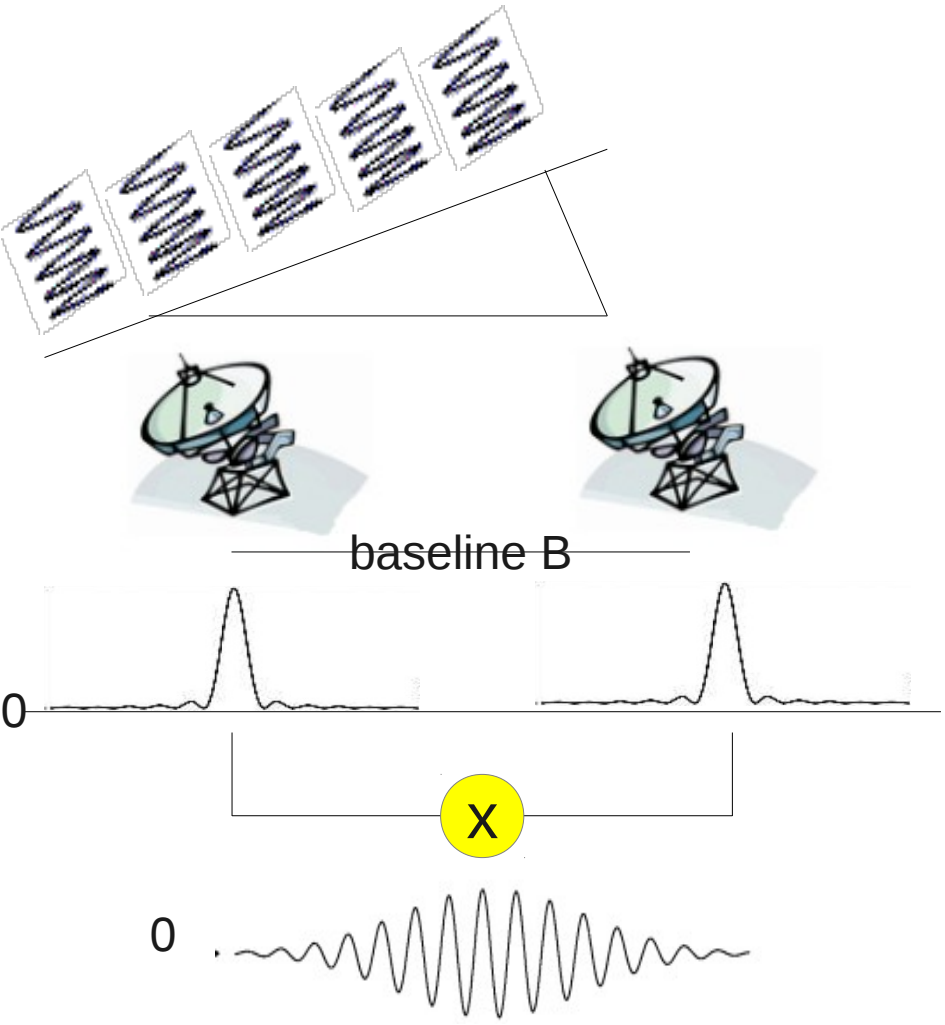


Interferometers

Coherent receivers preserve the phase of the signal and could be mounted on interferometers up to ~1THz. **Light is collected and dealt preserving its wave properties in amplitude and phase.**

Any couple of antennas equipped with coherent receivers can work as an interferometer.

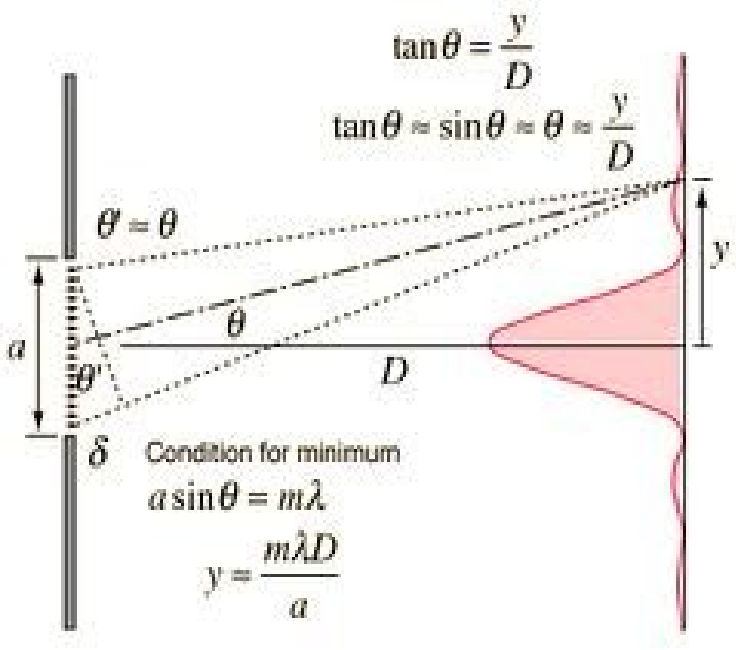


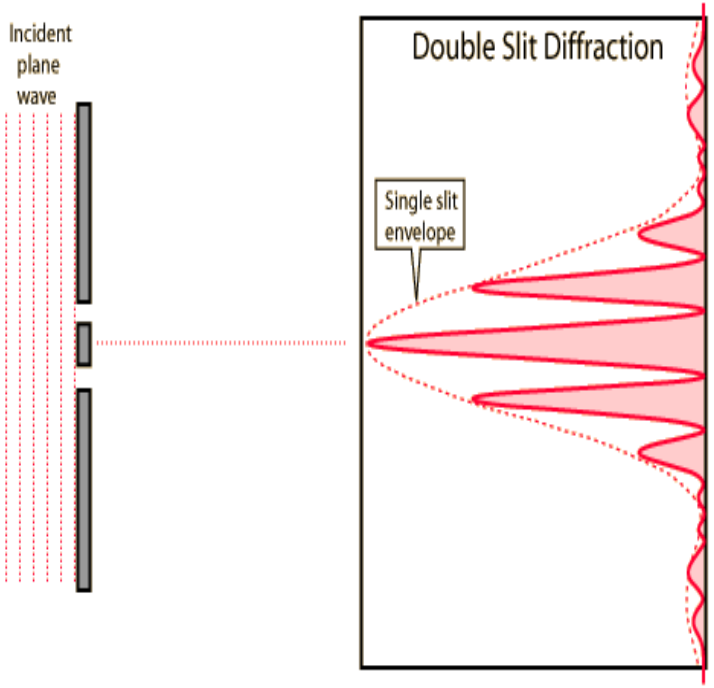
In interferometers at these bands the signal is collected and correlated (i.e. the phase is matched to reconstruct the wavefront and signals are multiplied to save only correlated signals reducing noise).

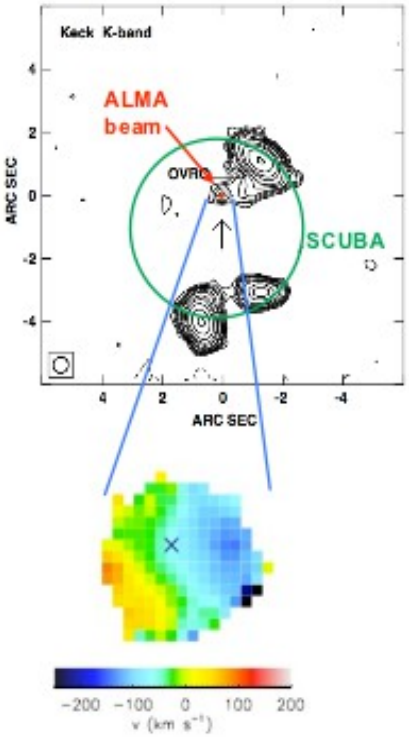
The observed signal is a diffraction pattern.

Interferometers: Resolution

Like in the “double-slit Young's experiment” where **antennas work as the apertures of diameter a at distance B (=baseline >>a) the resolution for a wavelength λ is θ=λ/B.**
This is defined as Synthesized Beam and is equivalent to that of a single dish of diameter B.







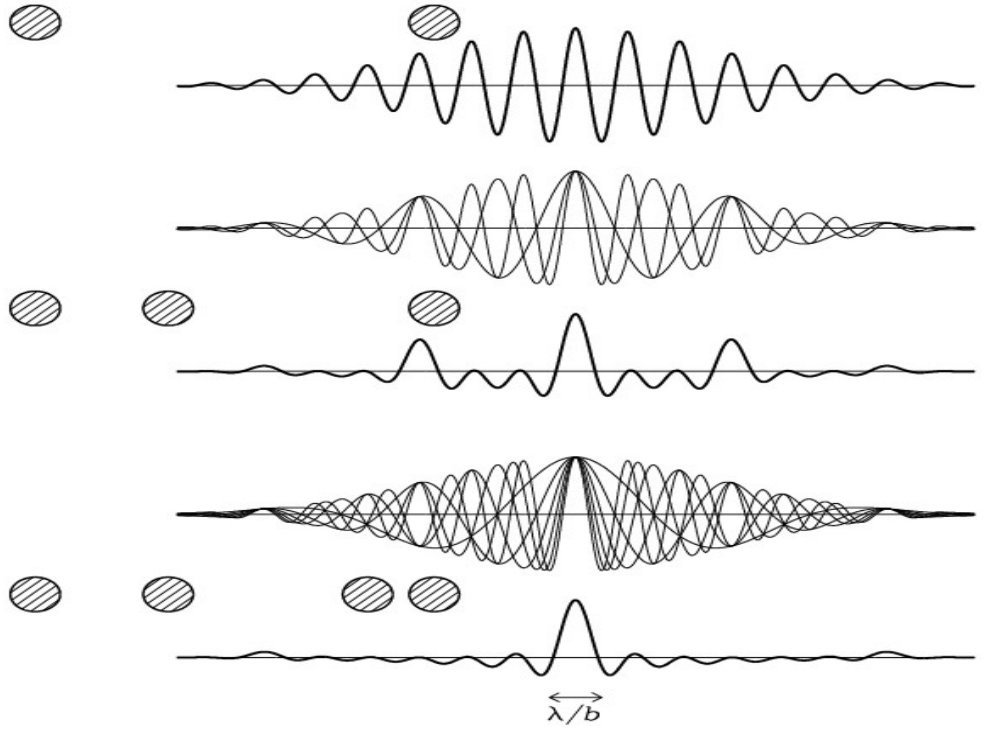
In the double slit diffraction the pattern is modulated by the single slit envelope,
i.e. the response function of an interferometer is modulated
in a region of size **FOV=λ/a**, with a the antenna radius,
also called **Field of View or Primary Beam.**

Interferometers: Aperture Synthesis

However, **only the spatial component corresponding to $\theta=\lambda/B$ is preserved, any smaller scale is smoothed, any larger scale is filtered out.**

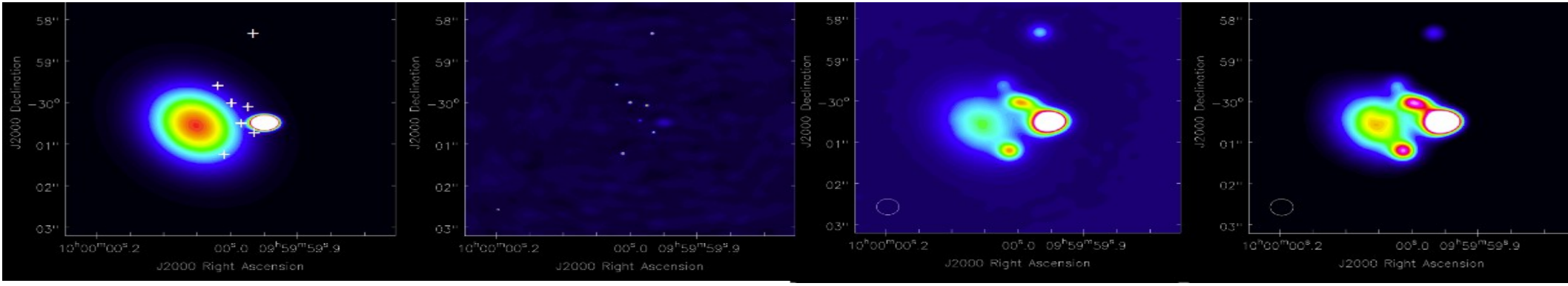
Signals from small antennas on multiple baselines can be combined to retrieve information on source structure (= **aperture synthesis**). Combination of different arrays or the same array that observe the source from a different direction (e.g. as an effect of Earth rotation) improve the structure information.

2D combination of arrays produce 2D patterns.



The telescope collects phase and amplitude for each couple of antennas for each time stamp.
Images are result of data reprocessing.

Model source | Long baselines | Short baselines | Combination

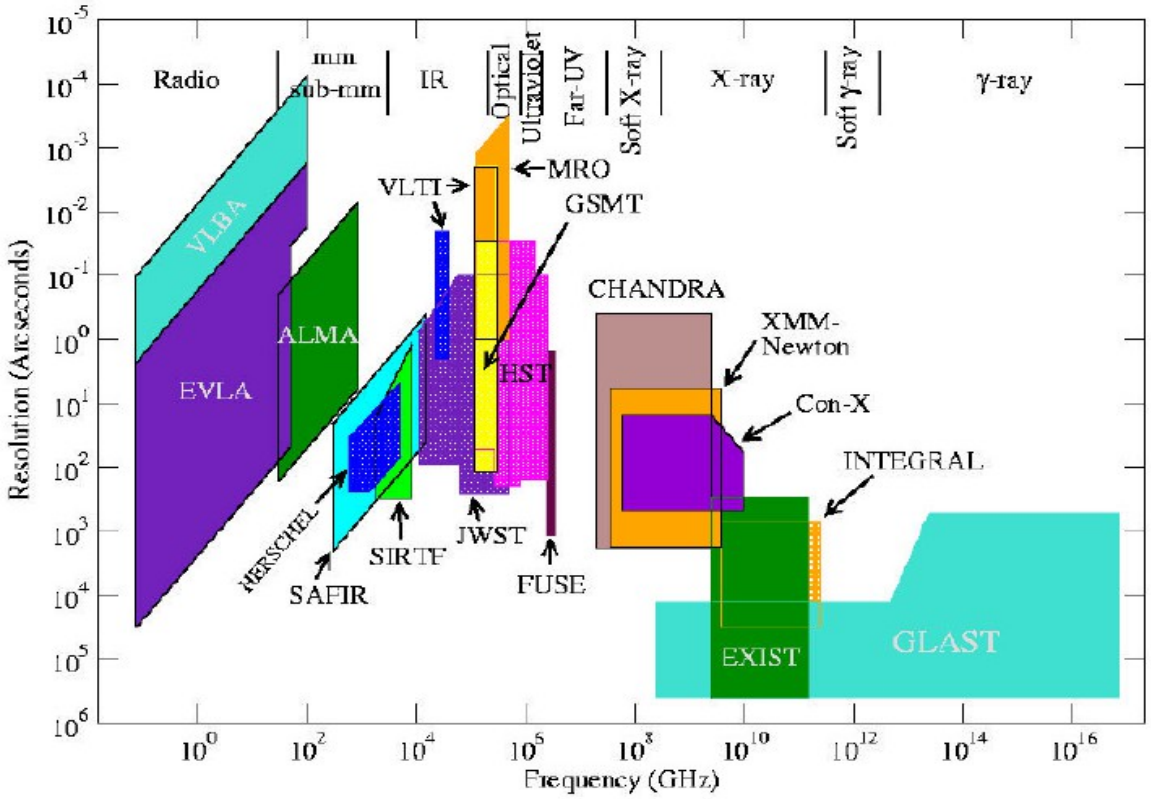


ALMA resolution

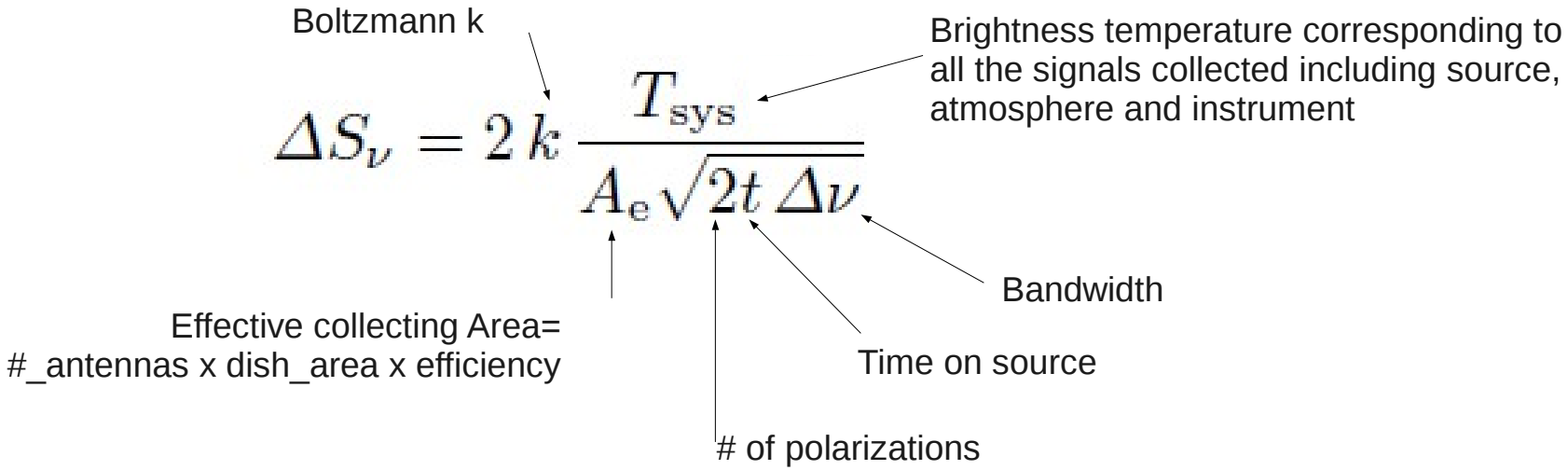
- Baselines length: **15m ->150m-16km + 9m->50m**
- Resolution: **0.2” x (300/freq_GHz)x(1km/max_baseline)**
- FOV 12m array: **17”/(300/freq_GHz)**
- FOV 7m array: **29”/(300/freq_GHz)**

Up to 16km baselines, subarc
40 mas @ 100 GHz,
5 mas @ 900 GHz

$\theta = \lambda / B$



Interferometers: Sensitivity and polarization



Sensitivity can be improved by

- getting lower Tsys (= lowering the instrumental noise or choosing sites with low water vapour levels)
- increasing the collecting area
- increasing the bandwidth and/or the integration time

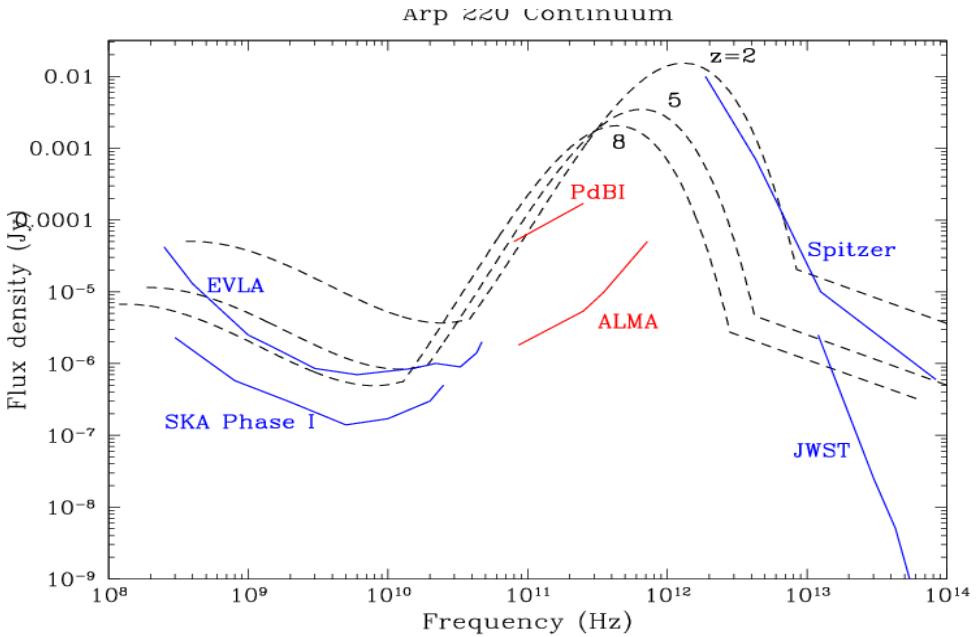
Receivers are couple of dipoles, so split the signal into 2 polarizations
By combining the independent polarizations chains it can reconstruct all the Stokes parameters.

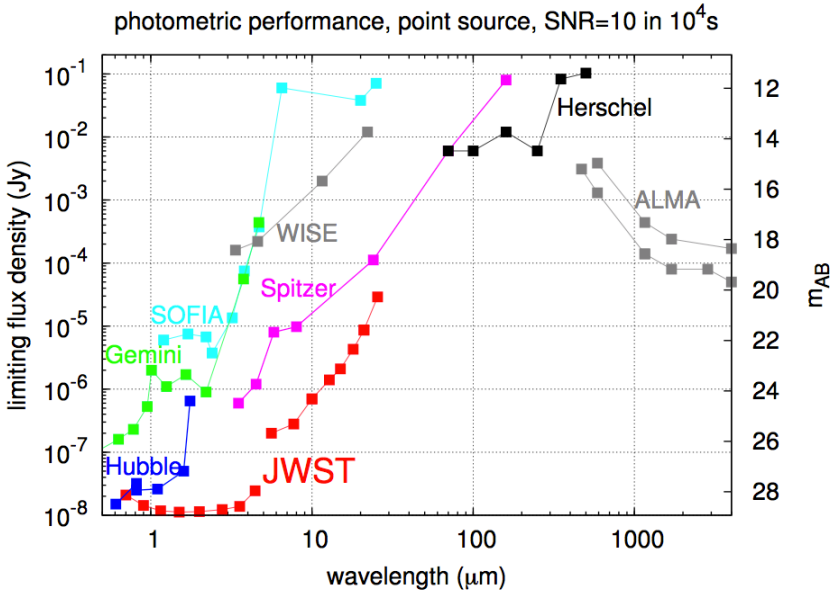
ALMA sensitivity

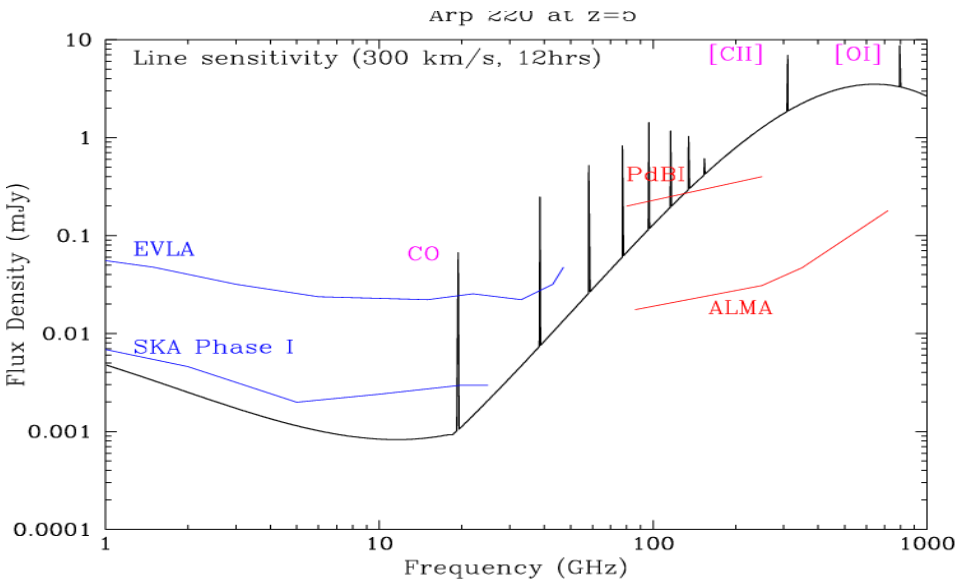
Dry site, low pwv, low Tsys, high sensitivity also at submm frequencies

>6500sqm of effective area and 1225 baselines for the 12m array + Short spacings with ACA
Excellent instantaneous imaging & high sensitivity
<0.05mJy @100 GHz in 1 hr

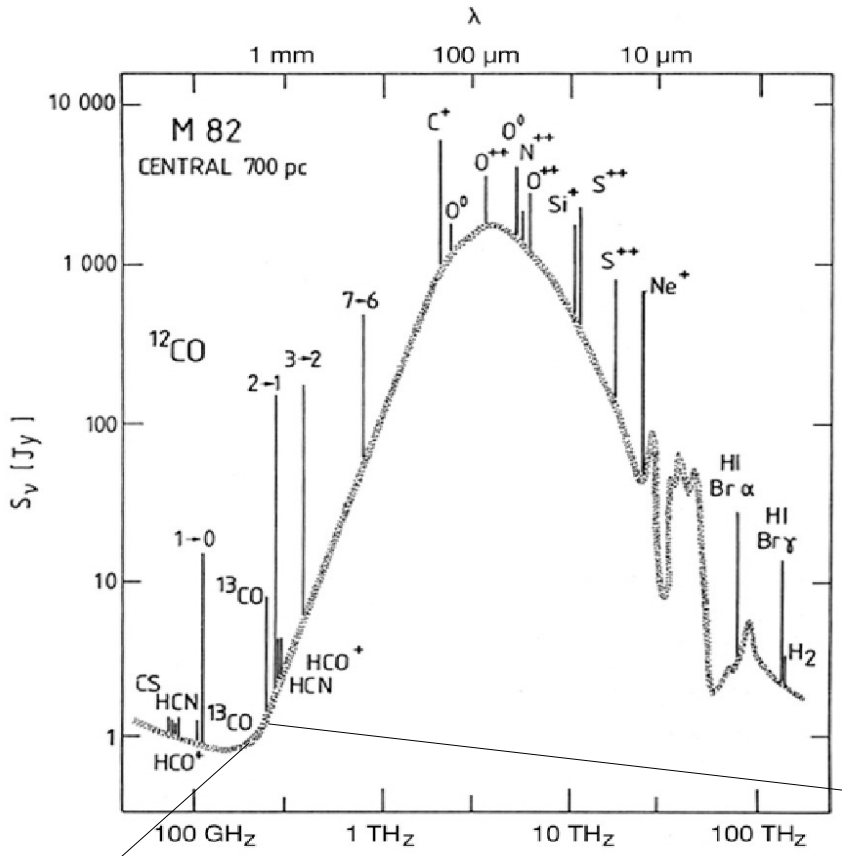
$$\Delta S_\nu = 2\,k\,\frac{T_{\rm sys}}{A_{\rm e}\sqrt{2t\,\Delta\nu}}$$

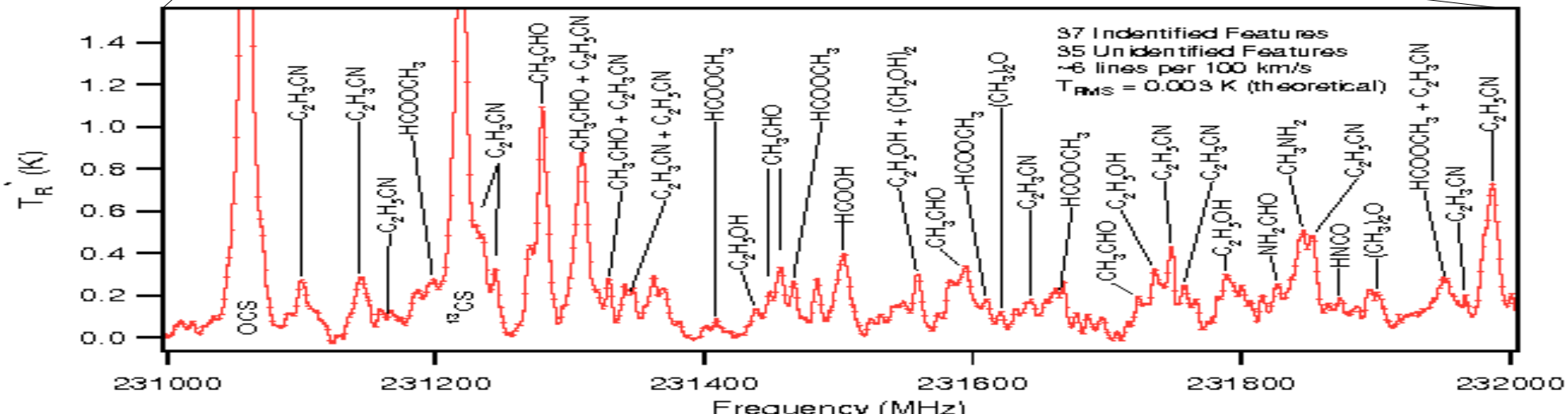






Continuum vs spectral line





Digital correlators can be set up to different bandwidth and spectral resolution.

Sensitivity is calculated then on a frequency range.

Continuum in mm-submm bands is dominated by dust and synchrotron.
Can be observed with large bandwidth and low spectral resolution (broad frequency channels)

Detailed spectra show a very rich chemistry.
The narrower are the spectral lines the higher is the spectral resolution requested to sample it.

Hence data products are 4D cubes:
Ra, dec, frequency channels, polarization products

Spectral lines position and broadening

Spectral lines are Doppler shifted if emitting cloud is moving wrt the observer.

$$1+z=\frac{\nu_{emitted}}{\nu_{observed}}$$

Variation in the line position wrt the rest frame is a measure of cosmological distances.

$$\frac{\Delta\, velocity}{c}=\frac{\Delta\nu}{\nu}$$

Spectral lines can be broadened for

- **natural broadening**: According to the uncertainty principle the uncertainty in energy, ΔE and the lifetime, Δt, of the excited state are related by ΔE/Δt>h/2
  This determines the minimum possible line width.

- **Doppler broadening**: due to intrinsic motions of (parts of) the cloud wrt the observer
  The higher the temperature of the cloud, the wider the distribution of velocities in the cloud
  Hence the emission is characterized by a velocity distributions that is described by the shape of the spectral lines with frequency A(ν). If this were the only effect the line shape would be Gaussian

- **Pressure broadening** (Collision broadening). Collisions between atoms or molecules reduce the lifetime of the upper state, Δt, increasing the uncertainty ΔE.

Spectral lines shape

The line shape is a function of the frequency and hence of the velocity A(v)

The **zeroth momentum** of the distribution is the integrated flux density

$$M_0 = \Delta v \sum_v A(v)$$

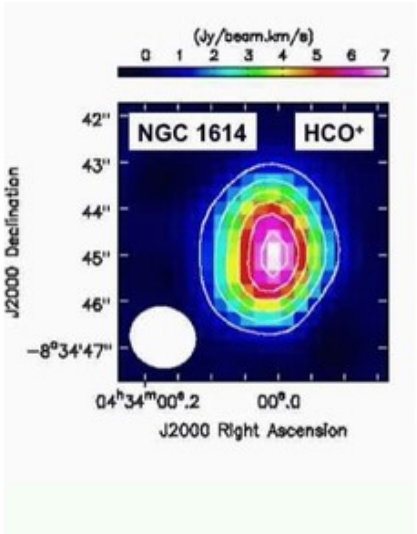
The **first momentum** of the distribution is the intensity-weighted velocity of the spectral line and hence a measure for the mean velocity of the gas.

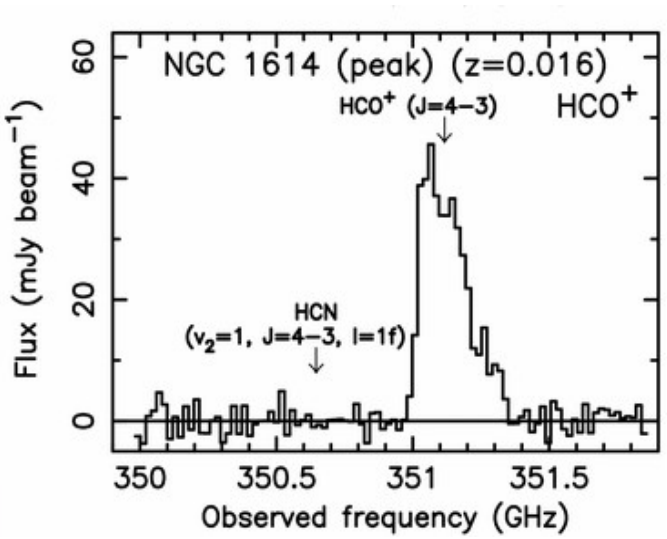
$$M_1 = \frac{\sum_v v\,A(v)}{\sum_v A(v)}$$

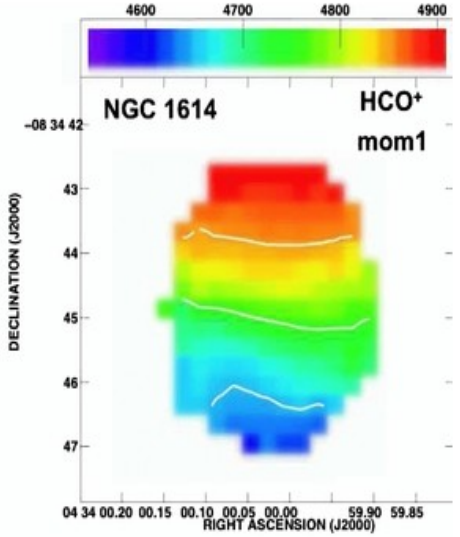
The **second momentum** is a measure for the velocity dispersion, σ, of the gas along the line of sight, i.e. the width of the spectral line

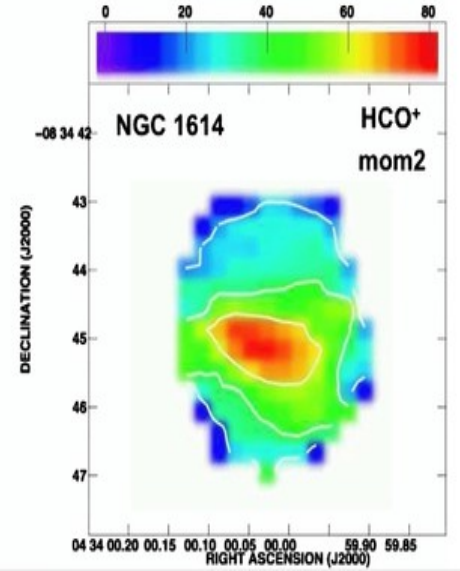
$$M_2 = \sqrt{\frac{\sum_v (v - M_1)^2 A(v)}{\sum_v A(v)}}$$

Mapping the sources in different frequency channels allows to reconstruct the spatial distribution of the velocity field









(ALMA HCO+ In NGC 1614 Imanishi et al. 2013)

Cycle 3 capabilities: receivers and spectral setup

Table A-4: Properties of ALMA Cycle 3 Receiver Bands

Band	Frequency range[1] (GHz)	Wavelength range (mm)	IF range	Type
3	84 – 116	3.6 – 2.6	4 – 8	2SB
4	125 – 163	2.4 – 1.8	4 – 8	2SB
6	211 – 275	1.4 – 1.1	5 – 10	2SB
7	275 – 373	1.1 – 0.8	4 – 8	2SB
8	385 – 500	0.78 – 0.60	4 – 8	2SB
9	602 – 720	0.50 – 0.42	4 – 12	DSB
10	787 – 950	0.38 – 0.32	4-12	DSB

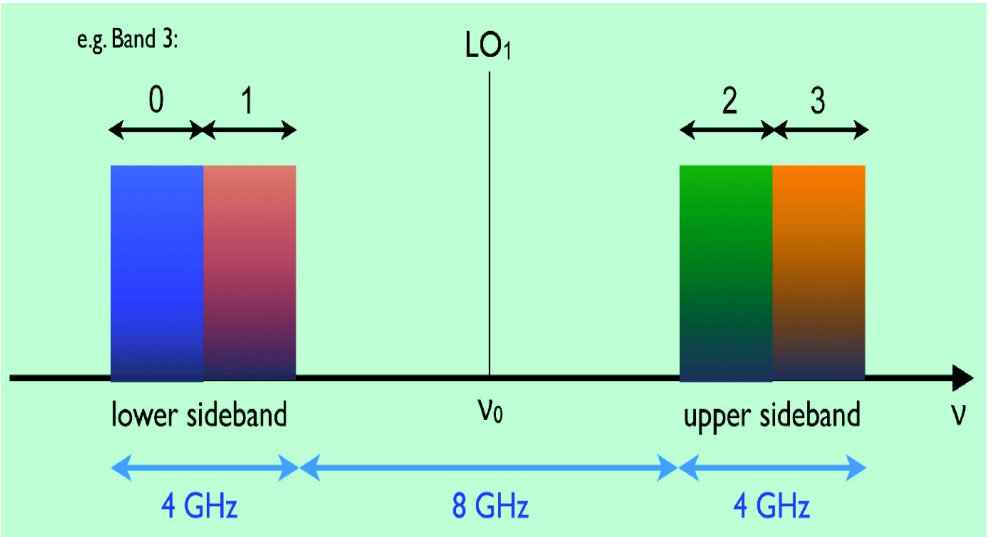
Main array and ACA use separate correlators that offer the same setups.

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 Kazi's talk)

Cycle 3 capabilities: receivers and spectral setup

Table A-5: Properties of ALMA Cycle 3 Correlator Modes, dual-polarization operation [1,2]

Bandwidth[3] (MHz)	Channel spacing[4] (MHz)	Spectral resolution (MHz)	Number of channels	Correlator mode[5]
2000[3]	15.6	31.2	128[3]	TDM
1875	0.488	0.976	3840	FDM
938	0.244	0.488	3840	FDM
469	0.122	0.244	3840	FDM
234	0.061	0.122	3840	FDM
117	0.0305	0.061	3840	FDM
58.6	0.0153	0.0305	3840	FDM

Continuum

Spectral lines

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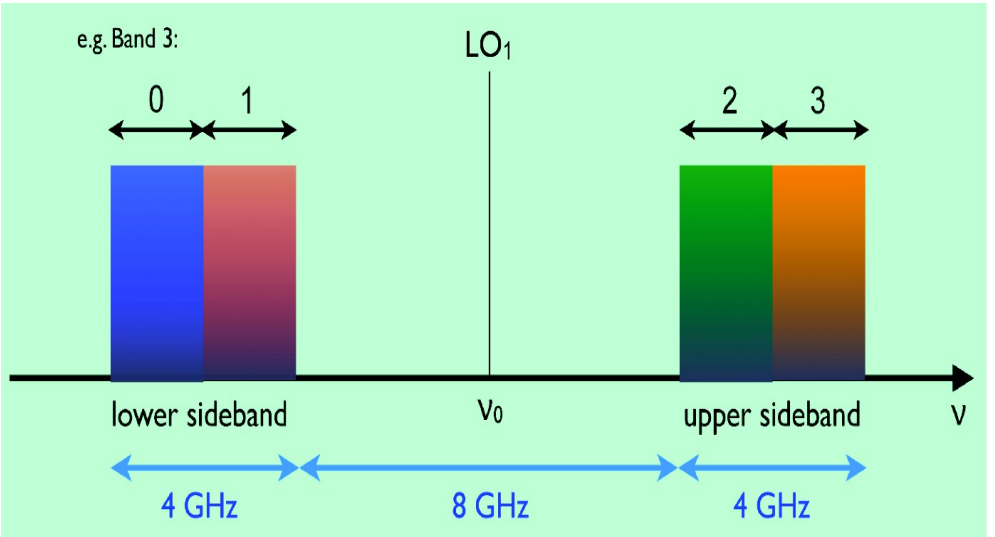
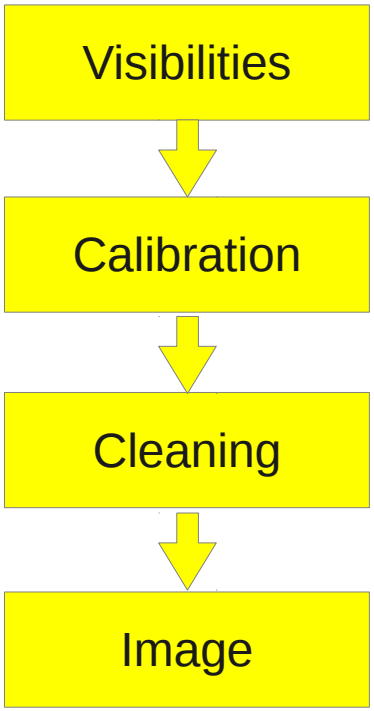


(see Kazi's talk)

Interferometers



Long story made short:
Interferometers are arrays of coherent reflectors that can simulate a single dish of size equivalent to the distance between the antennas**, that collect the amplitude and phase of the electromagnetic waves emitted on selected angular scales according to the array configuration.**
Given an array, sensitivity can be improved with larger bandwidth or longer time on source.

The collected data are not an image yet!!!
Radioastronomers call the collected values from each baseline **visibilities**.

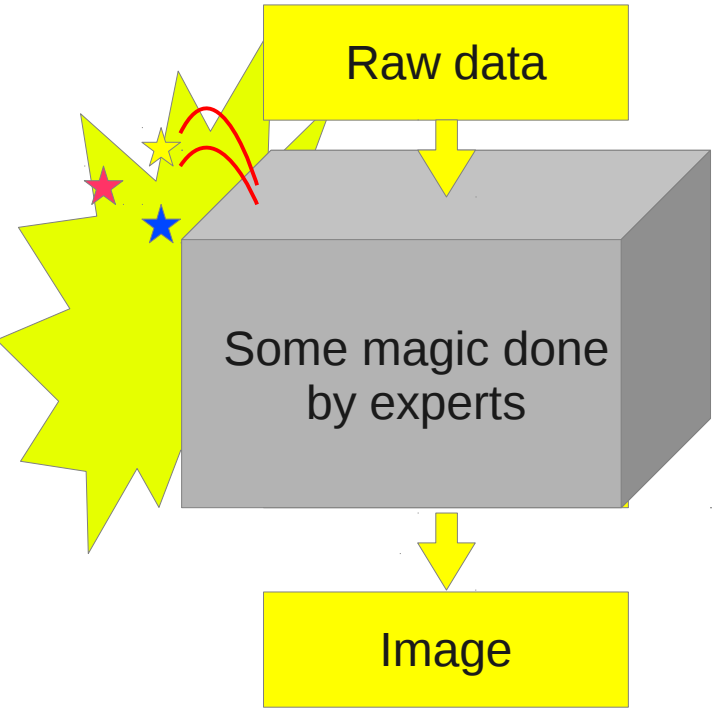
The process to generate an image includes Calibration, Inverse Fourier Transform, Deconvolutions …
too much for this talk, sorry!

For more details about interferometry and ALMA:
- **Sixth European Radio Interferometry School (ERIS2015)**,
ESO Garching, 6 - 10 September, 2015

- **ALMA School**, Italian ARC, Bologna,early 2016 (to be advertised soon!)

- Thompson, Moran, Swensson, *"Interferometry and Synthesis in Radio Astronomy"*

Interferometers



Hereafter let's assume that some experts applies some magic black box (“data reduction”) to the visibilities and generated the images.

Notice that there is not a unique “recipe” for such a magic and the “best” might change depending on the properties requested for the image
(e.g. higher dynamic range, lower noise, lower spurious features, …)

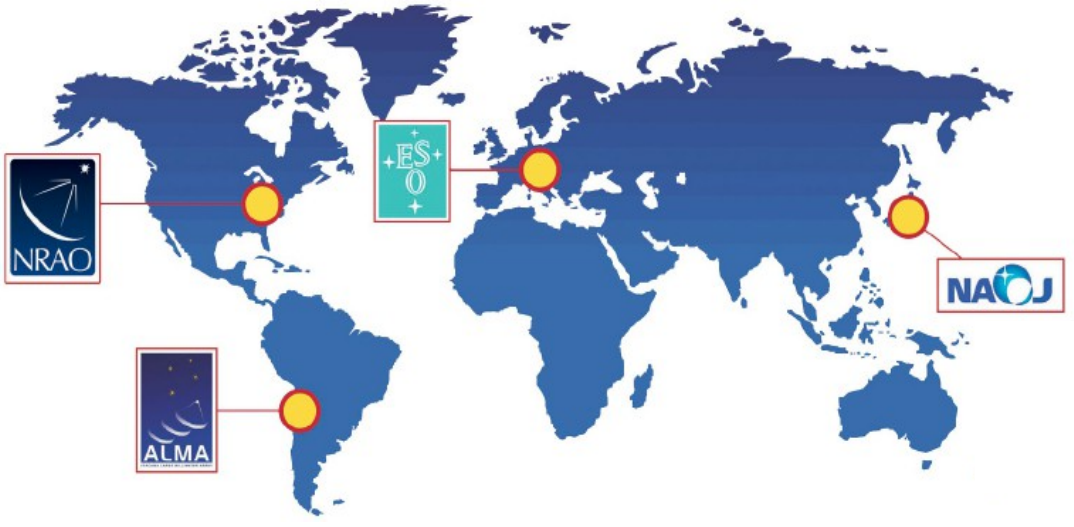
For ALMA projects you can find an expert in your ALMA Regional Centre

ALMA organization

World wide collaboration

- Europe: **ESO** (14 countries)
- North America: **NRAO** (USA, Canada)
- East Asia: **NAOJ** (Japan, Taiwan)
- Chile

Contributors share the observing time



3 Sites in Chile

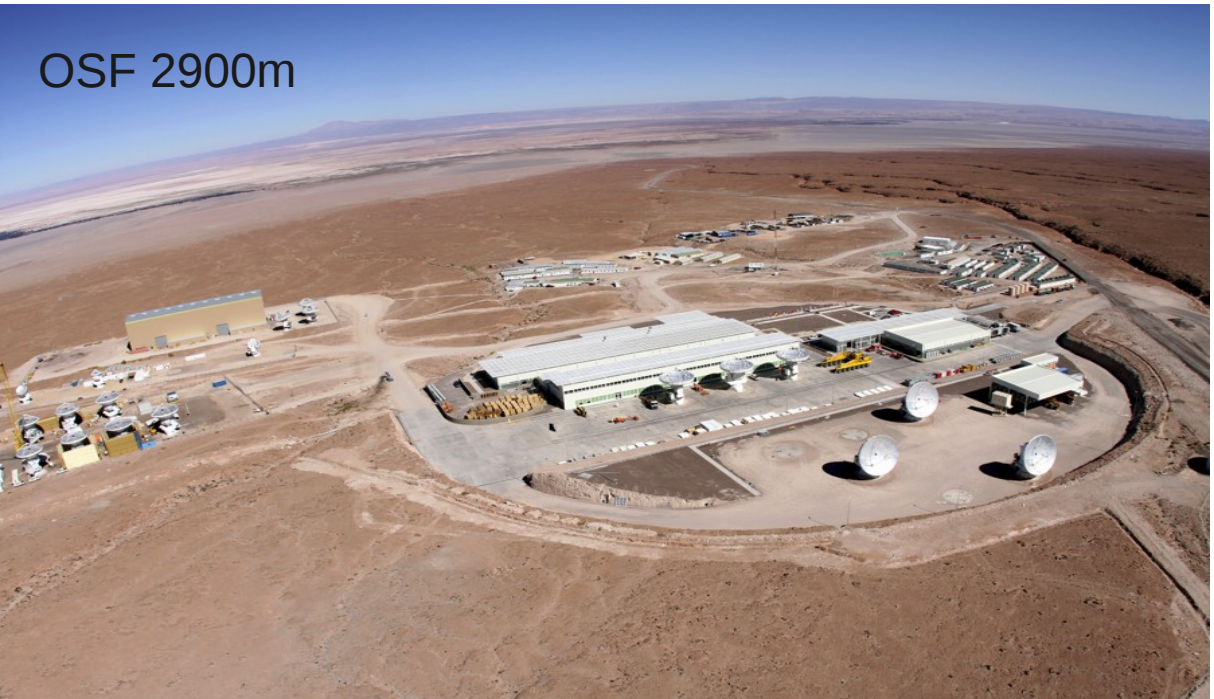
- **AOS**: ALMA Operations Site (5000m): Antennas, Correlator
- **OSF**: Operations Support Facility (3000m):
  Labs, Antenna Assembly & Maintenance Operators, Astronomers
- **SCO**: Santiago Central Office:

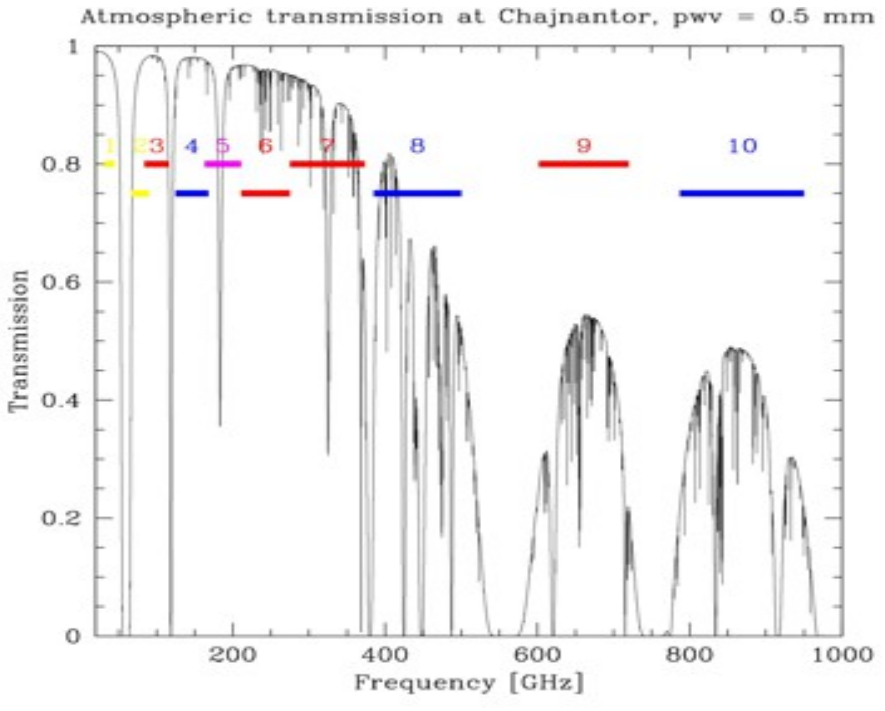
  - Call for Proposals
  - Running ALMA
  - Data Reduction Pipeline
  - Quality Assessment

ALMA sites


AOS 5000m

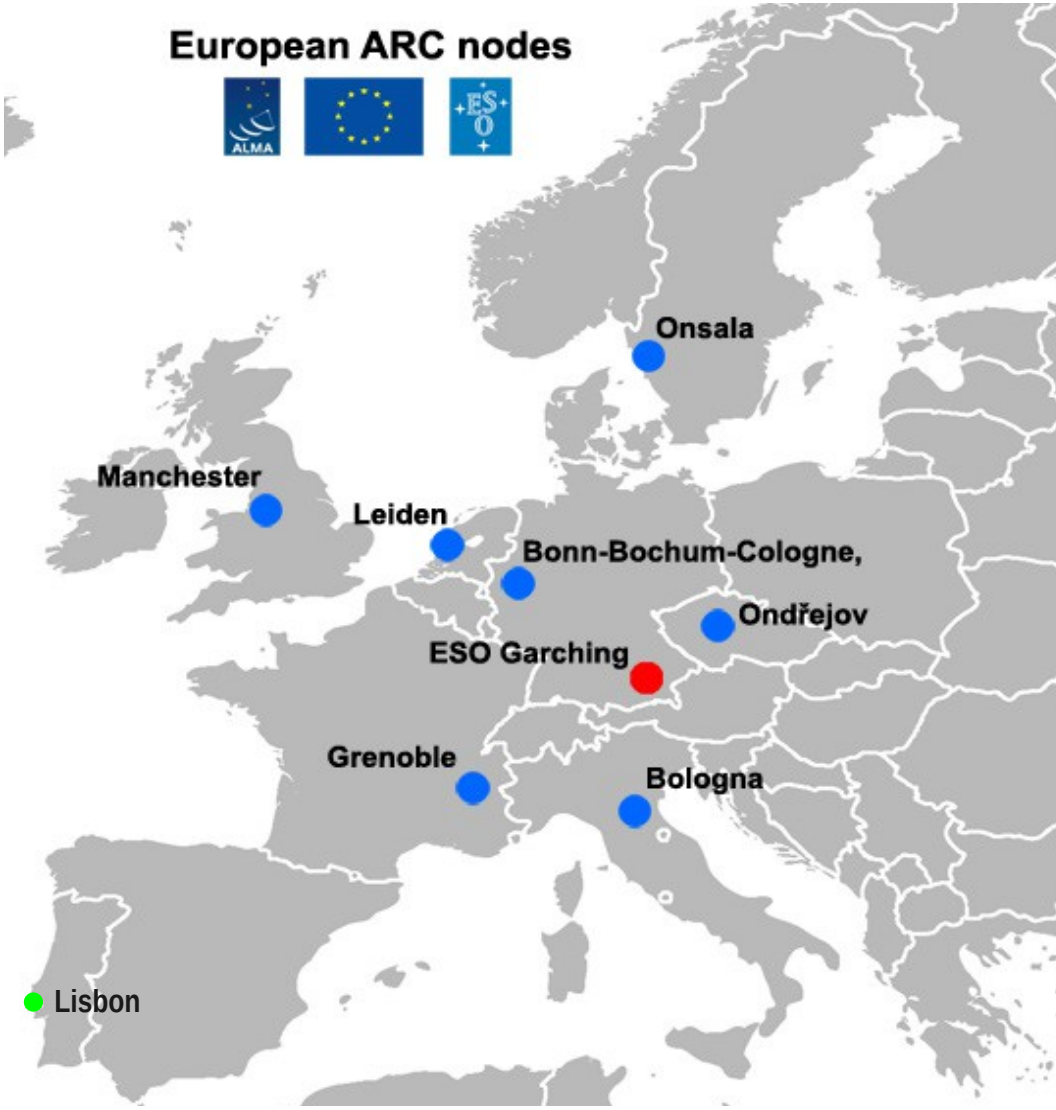

San Pedro de Atacama
13 km
28 km
Operations Support Facilities
OSF
ALMA Operations Site
AOS
Toconao


OSF 2900m


Atmospheric transmission at Chajnantor, pwv = 0.5 mm
Transmission
Frequency [GHz]
0
0.2
0.4
0.6
0.8
1
200
400
600
800
1000
1
2
3
4
5
6
7
8
9
10

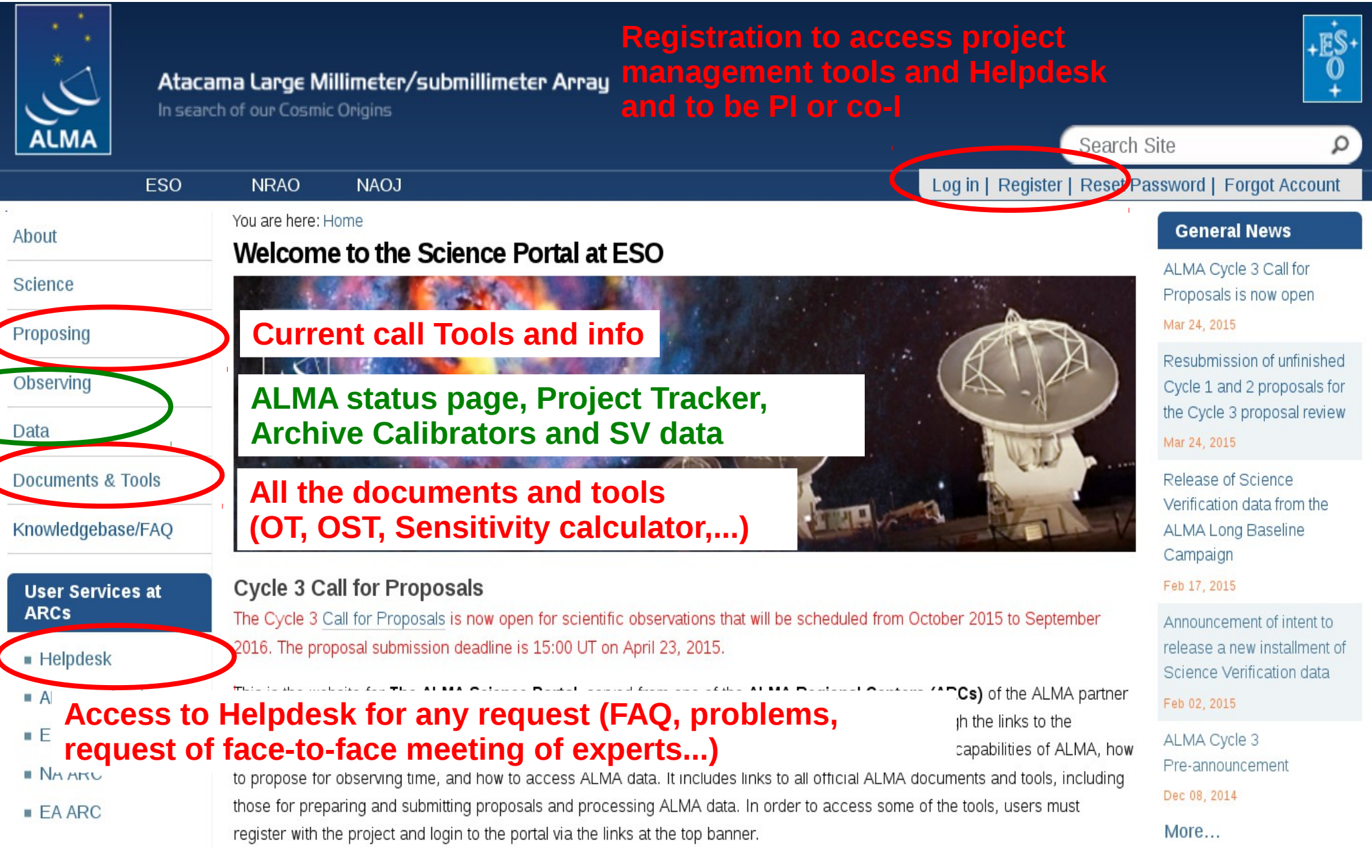
The ALMA Regional Centres (ARCs)

- **Interface between JAO and users**
- 1 ARC per Partner:
  - NRAO for North America
  - NAOJ for East Asia
  - ESO for Europe (split in 7 nodes)
- **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**
  - F2F user support, Helpdesk



Enter the ALMA world through the ALMA Science Portal

http://almascience.eso.org/



A project lifetime: phase 1 Proposal submission

PI has a good idea!	
PI estimates feasibility	Simulations are not compulsory (Sensitivity Calculator, OST, CASA)
PI splits project in Science Goals	**Minimum proposed observational unit including targets in the same sky region that roughly share the same calibration and spectral setup**
PI writes the science case in pdf and register to the Science Portal	Max 4 page, font no smaller than 12, all included (<20MB) www.almascience.org
PHASE I – Proposal submission	With the ALMA Observing Tool (OT) A copy of the project with the project ID must be saved and should be used for any resubmission within the deadline
TAC evaluation	**A**=high ranked pass to Cycle 4 if not finished **B**=high ranked but not passed over **C**=maybe filler (depends on time shares and ranking)

Early Science Cycles

Early Science observations are conducted on a best effort basis to allows community to observe with incomplete, but already superior array, with priority given to the completion of the full ALMA capabilities

Past & current ALMA Early Science cycles:

	Cycle 0 Sep. 2011 – Jan. 2013	**Cycle 1** Jan. 2013 - May. 2014	**Cycle 2** Jun. 2014 – Oct. 2015	**Cicle 3** Oct 2015 - Oct 2016
Telescope				
Hours dedicated to Science	**800**	**800**	**2000**	2100
Antennas	**> 12x12-m**	**> 32x12m +9x7m+2TP**	**> 34x12m +9x7m+2TP**	**> 36x12m +10x7m+2TP**
Receiver bands	3, 6, 7, 9	3, 6, 7, 9	**+4, 8**	**+10**
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 1500m**	**up to 10km**
Polarisation	single-dual	single dual	**full**	**full**
Proposal outcome				
Submitted	917	1133	1381	~1600
Highest priority	112	198	354 (35A, 319B)	?on going
Filler	51	93	159	?
Success rate	12% (18%)	17% (25%)	26% (37%)	?

Pressure factors (highest priority projects)

- Cycle 1: Europe: 9.1 (global ALMA: 5.8)
- Cycle 2: Europe: 4.9 (global ALMA: 3.9)

Reasons to use archived data

- Check if data are already available for a target
- Check the feasibility of a project looking for similar targets
- Retrieving information on a large sample of objects (e.g. statistics of populations, stacking, …)
- Retrieving information on a single object but with different configuration (e.g. multifrequency studies) or in different epochs (e.g. variability studies)
- Extracting unpublished information from existing data (e.g. finding additional spectral lines, targets in the same region/time of other observations,)
- **For ALMA in particular avoid the stress of competition and oversubscription**

	Proposal submission	Archive mining
Time to get data	✖	✚
Amount of data	✖	✚
Data homogeneity	✚	✖
Adherence to idea	✚	✖

A project lifetime: phase 2 Observing process

PHASE II – Observing process

Scheduling Block

Each SG is converted into a **Scheduling Block, an observational unit including targets in the same sky region and their Calibrators to be observed with the same instrumental setup.** They are the minimum set of instructions to perform an observation.

Observations

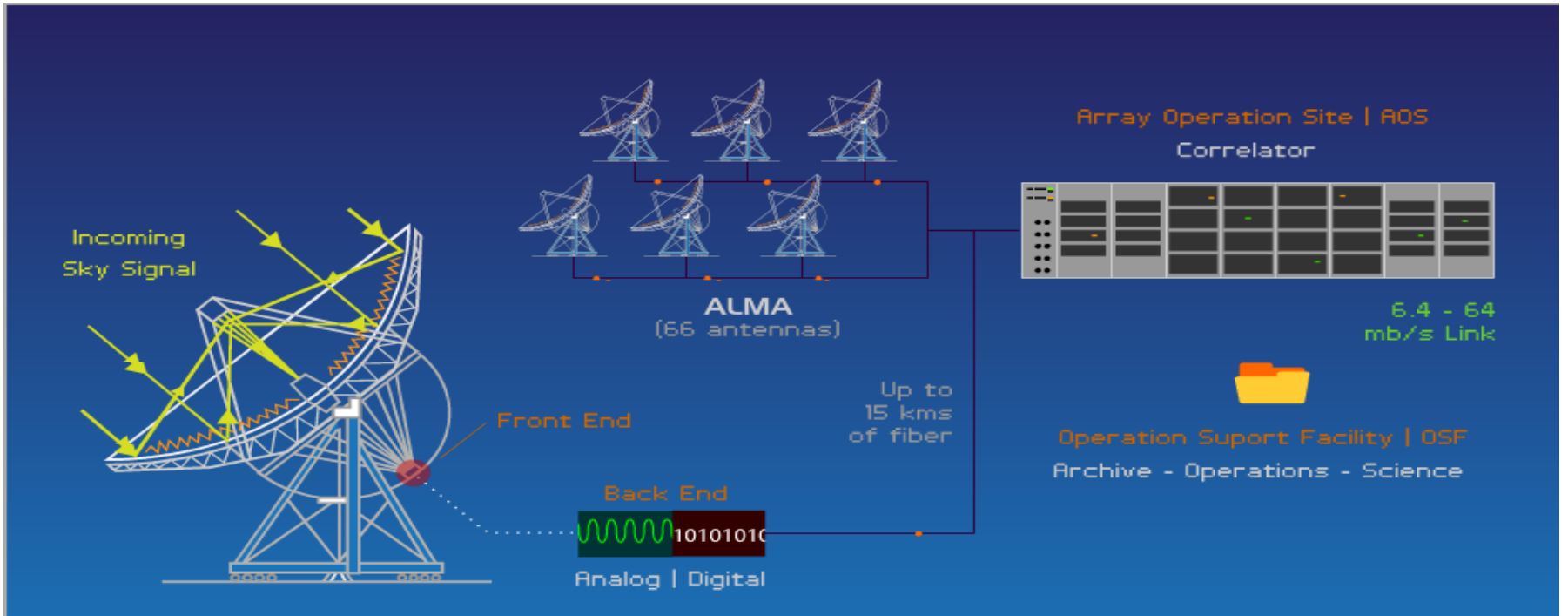
Projects are dynamically scheduled according to telescope configuration, weather, ranking, project status...

Quality assessment

QA0 and 1 = telescope conditions
QA2 = Check for PI sensitivity requests performed by ARC staff

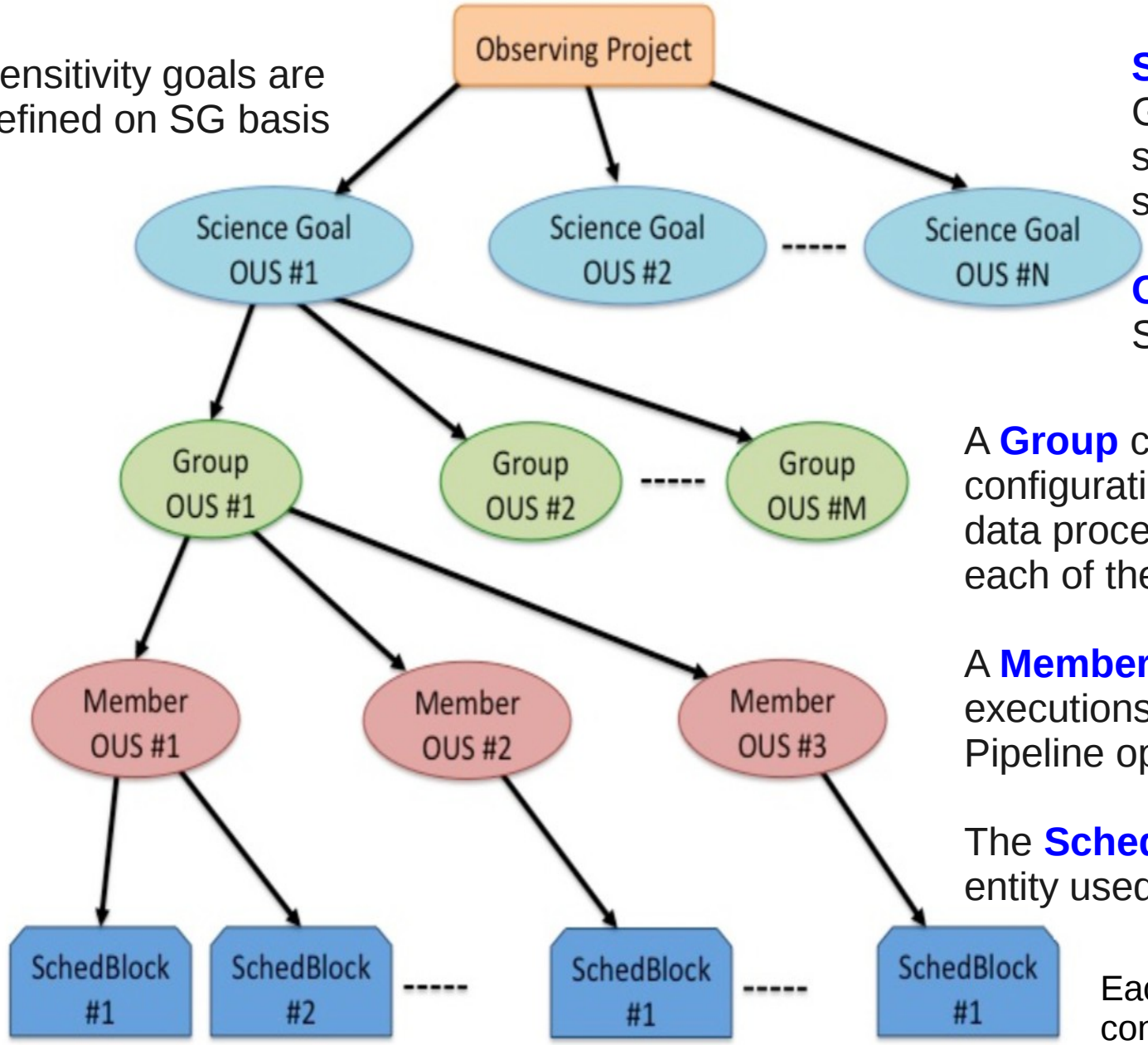
Data archival and delivery

1 yr of proprietary period before data are public through the archive



Data structure

Sensitivity goals are defined on SG basis



Science goal:
Group of sources in the same sky region that share the same spectral setup

OUS= Observing Unit Set
Smallest unit for data processing

A **Group** can contain several configurations to be combined in data processing (e.g. several arrays), each of them is a Member.

A **Member** can contain multiple executions of a Scheduling Block. Pipeline operates at this level.

The **Scheduling Block** is the smallest entity used for observing

Each repetition of a Scheduling Block constitutes an **Execution Block**

Data Quality Assessment

The goal of ALMA Quality Assurance (QA) is to deliver to the PI a reliable final data product that has reached the desired control parameters outlined in the science goals, that is calibrated to the desired accuracy and free of calibration or imaging artifacts i.e. ALMA performs **science-goal-oriented service data analysis**

ALMA QA happens on 4 levels:
QA0: near-real time verification of weather and hardware issues carried out on each execution block immediately after the observation.

QA1: verification of longer-term observatory health issues like absolute pointing and flux calibration.

QA2: offline calibration and imaging (using CASA) of a completely observed MOUS. Performed by expert analysts distributed at the JAO and the ARCs with the help of a semi-automatic CASA pipeline. **Results are archived and given to the PI.**

QA3: (optional) PIs may request rereduction, problem fixes, possibly reobservation

CASA

CASA (Common Astronomy Software Applications) is the designated data analysis package for ALMA and the JVLA.

Used for all offline processing of ALMA data.

CASA is developed by NRAO, ESO, and NAOJ (under NRAO management);
for details see http://casa.nrao.edu
and e.g., Petry et al., 2012, "Analysing ALMA data with CASA", ADASS XXI, ASP conf., 461, 849

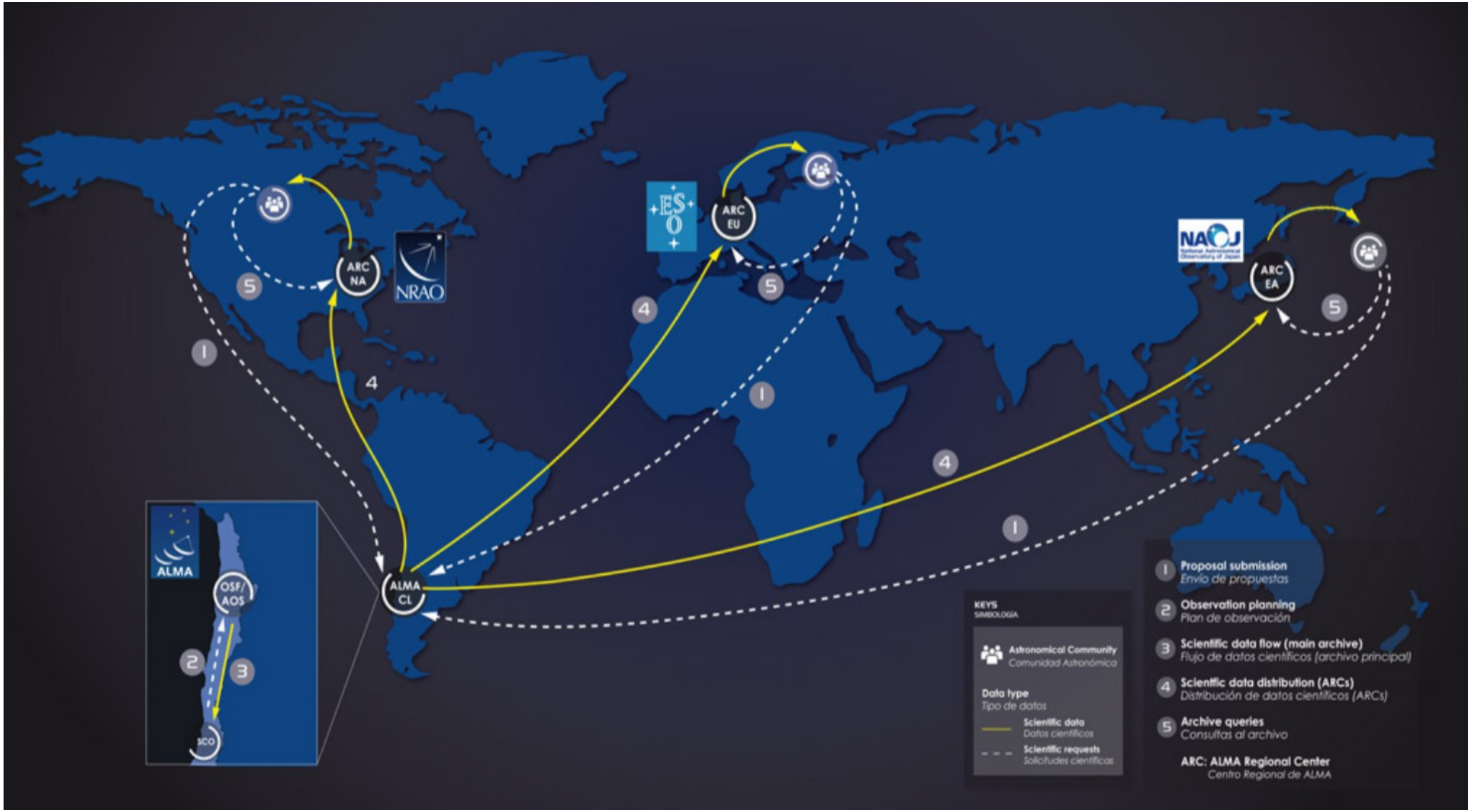
Latest release is CASA 4.3.1 .

The ALMA pipeline is an optional add-on of CASA.

Latest release with ALMA pipeline is CASA 4.2.2 .

CASA deals with data files in the Measurement Set (MS) structure.

ALMA data flow

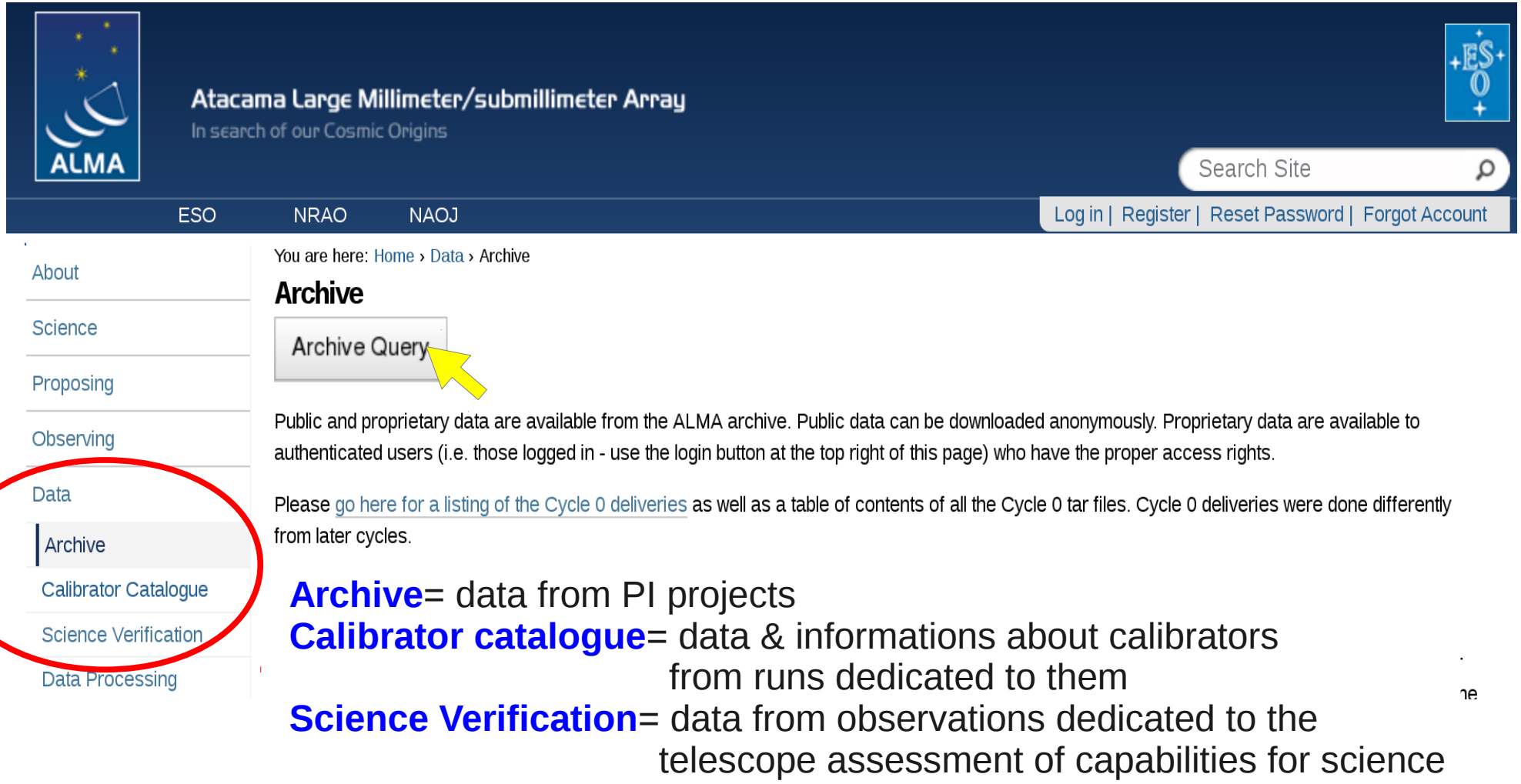


Data is collected, reduced and archived.
All the “almost” raw data is archived.

Each ARC hosts an archive mirror.

The ALMA archive

https://almascience.eso.org/alma-data/archive



Archive= data from PI projects

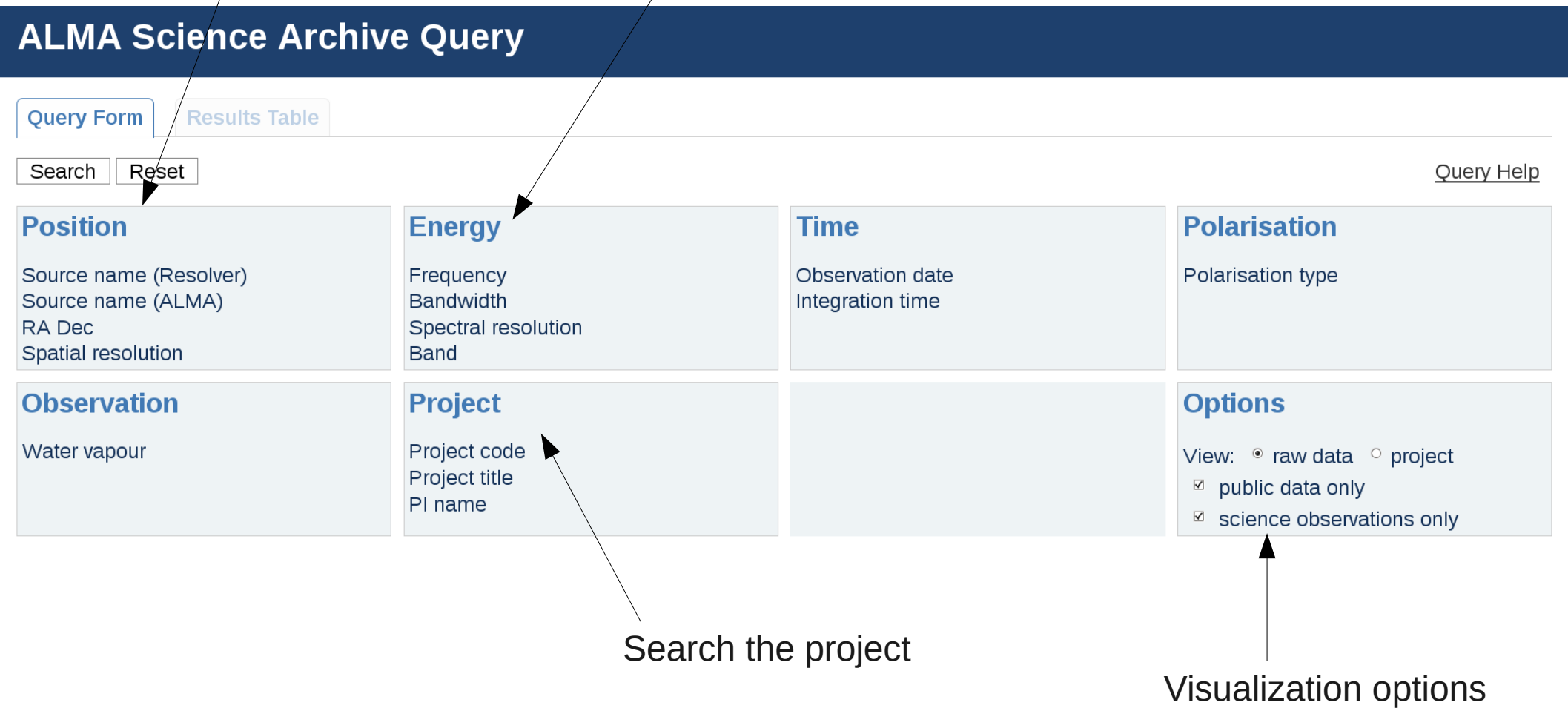
Calibrator catalogue= data & informations about calibrators from runs dedicated to them

Science Verification= data from observations dedicated to the telescope assessment of capabilities for science

The ALMA archive: query

Search per name or position or within a radius

Search the spectral setup



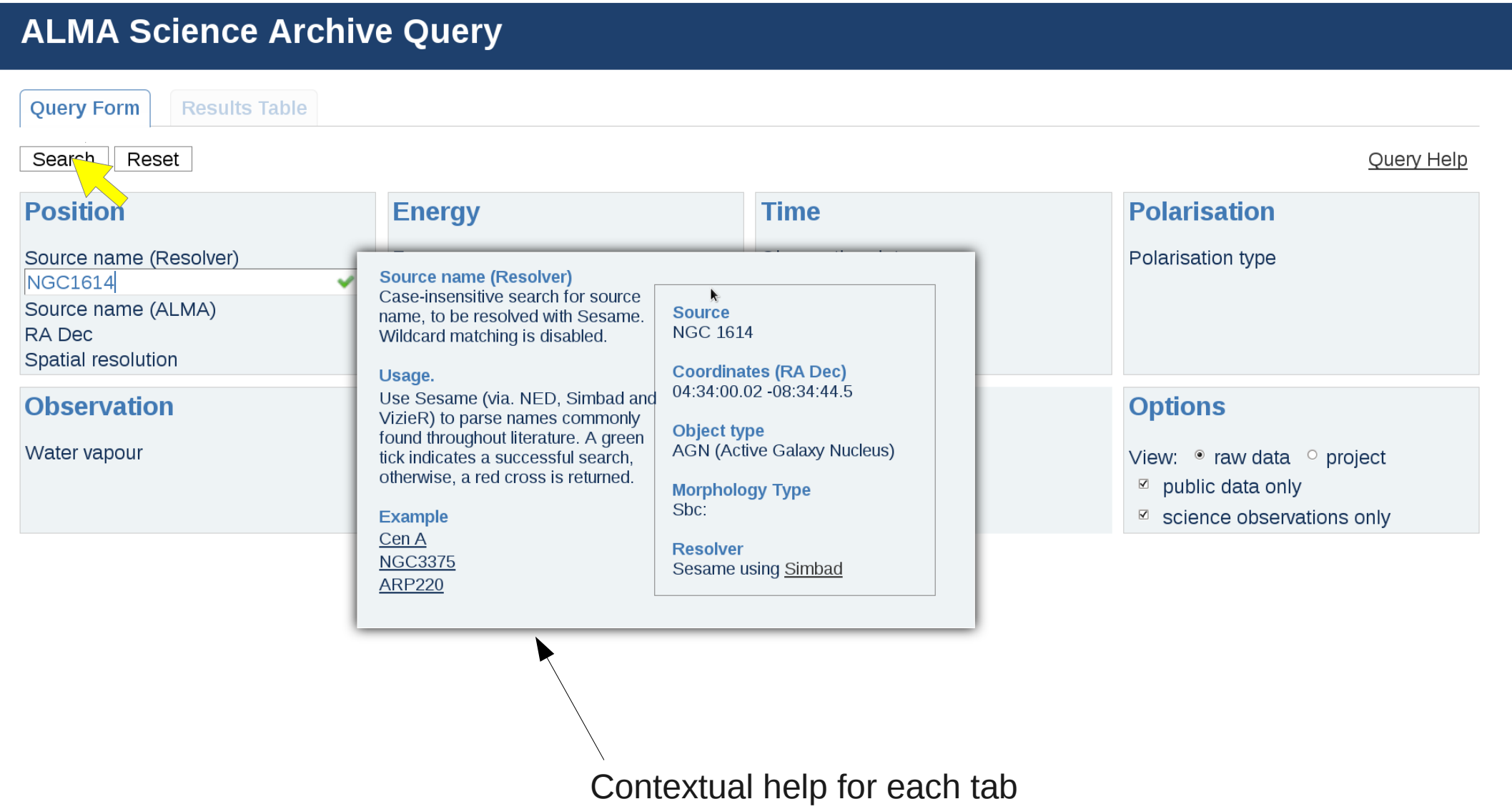
Search the project

Visualization options

The query display will change to allow more criteria!!!

The ALMA archive: help

1) Search with the criteria you need and click Search



Contextual help for each tab

The ALMA archive: result table

2) Select the project/execution blocks you need and click “Submit the download request”

ALMA Science Archive Query

Query Form | Results Table

Submit download request

Results Bookmark | Export Table | Results Help

Showing 7 rows (7 before filtering). More columns

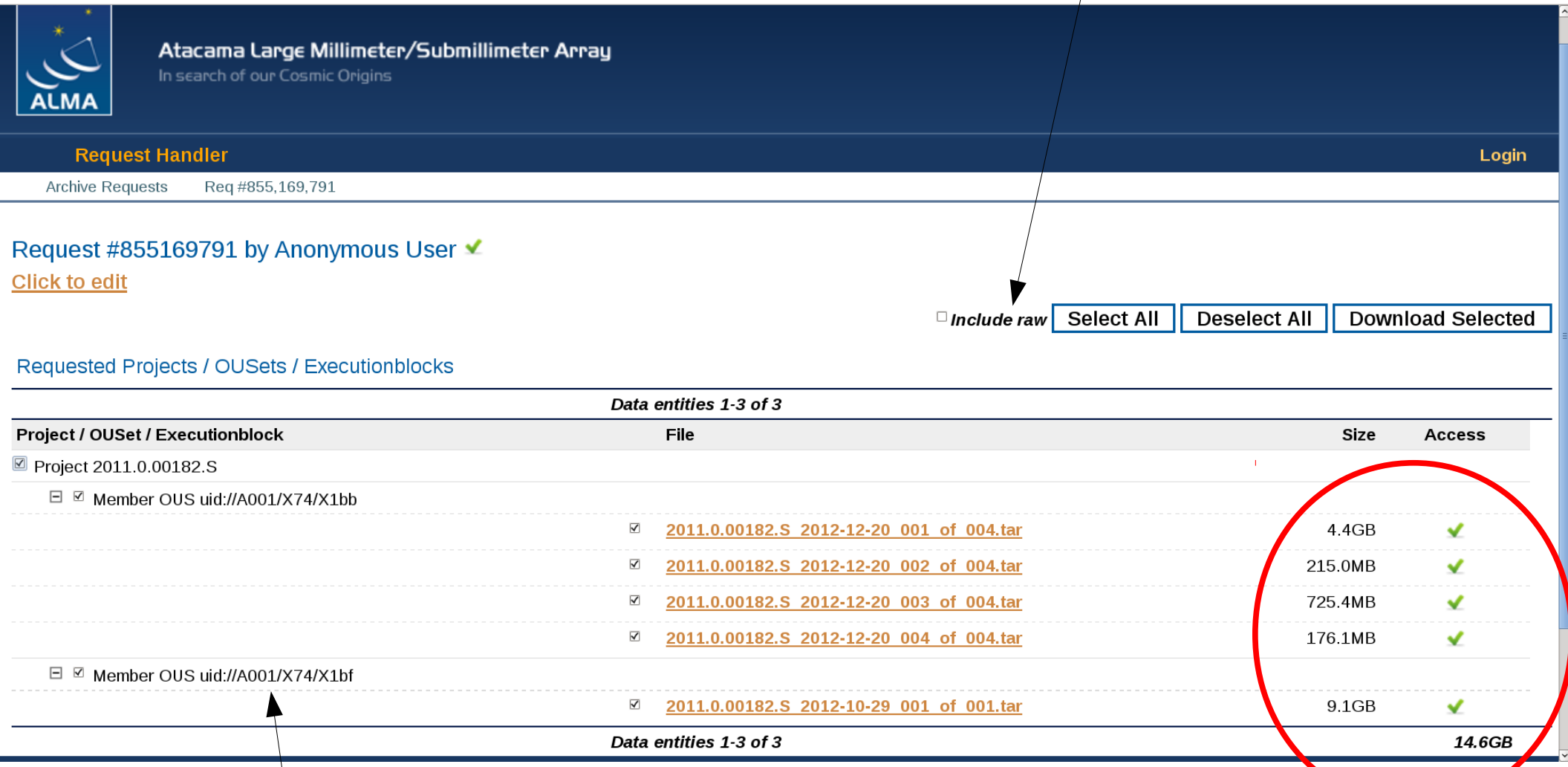
	Project code	Source name	RA	Dec	Band	Integration	*Release date*	Velocity resolution	Frequency support
Filter:								m/s	
☐	2011.0.00020.S	NGC 1614	04:34:00.03	-08:34:44.6	7	484.557	2013-01-12	834.09	344.15..357.85GHz
☐	2011.0.00020.S	NGC 1614	04:34:00.03	-08:34:44.6	7	382.854	2013-01-12	851.55	336.17..351.86GHz
☐	2011.0.00768.S	NGC1614	04:34:00.03	-08:34:44.6	7	463.612	2013-10-15	846.76	337.97..353.59GHz
☐	2011.0.00768.S	NGC1614	04:34:00.03	-08:34:44.6	7	464.391	2013-10-15	846.76	337.97..353.59GHz
☐	2011.0.00768.S	NGC1614	04:34:00.03	-08:34:44.6	7	463.991	2013-10-15	846.76	337.97..353.59GHz
☑	2011.0.00182.S	NGC 1614	04:34:00.03	-08:34:45.2	9	697.859	2013-12-21	13784.20	675.83..683.30GHz
☑	2011.0.00182.S	NGC 1614	04:34:00.03	-08:34:45.2	9	702.437	2013-12-21	13784.20	675.83..683.30GHz

The result table will soon show more details!

The ALMA archive: download manager

So far, this works only for Cycle>0

3) Select the data you want

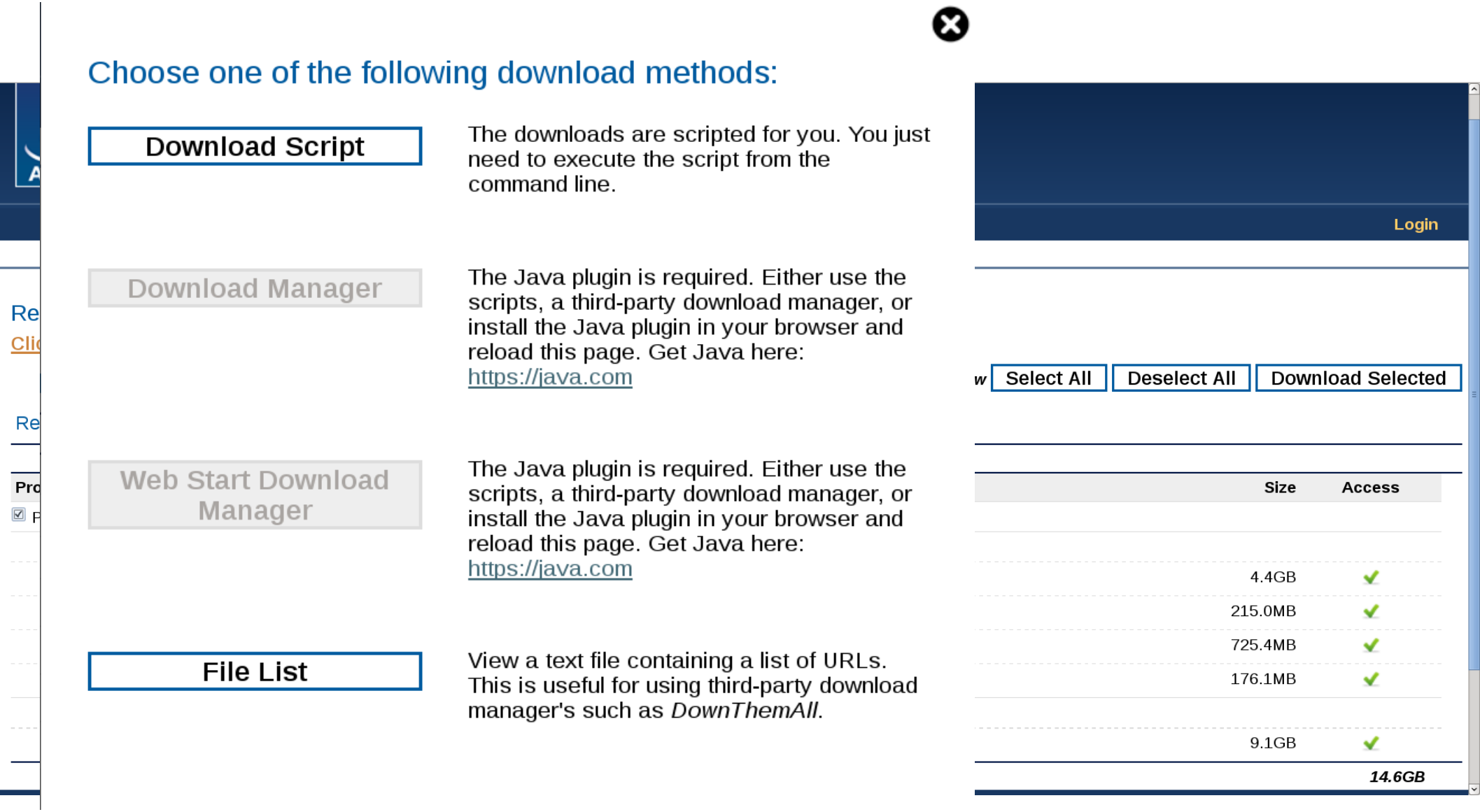


Remember that a Member OUS is the smaller data processing unit

Raw data for whole projects are typically >10GB

The ALMA archive: download manager

4) Choose the download method



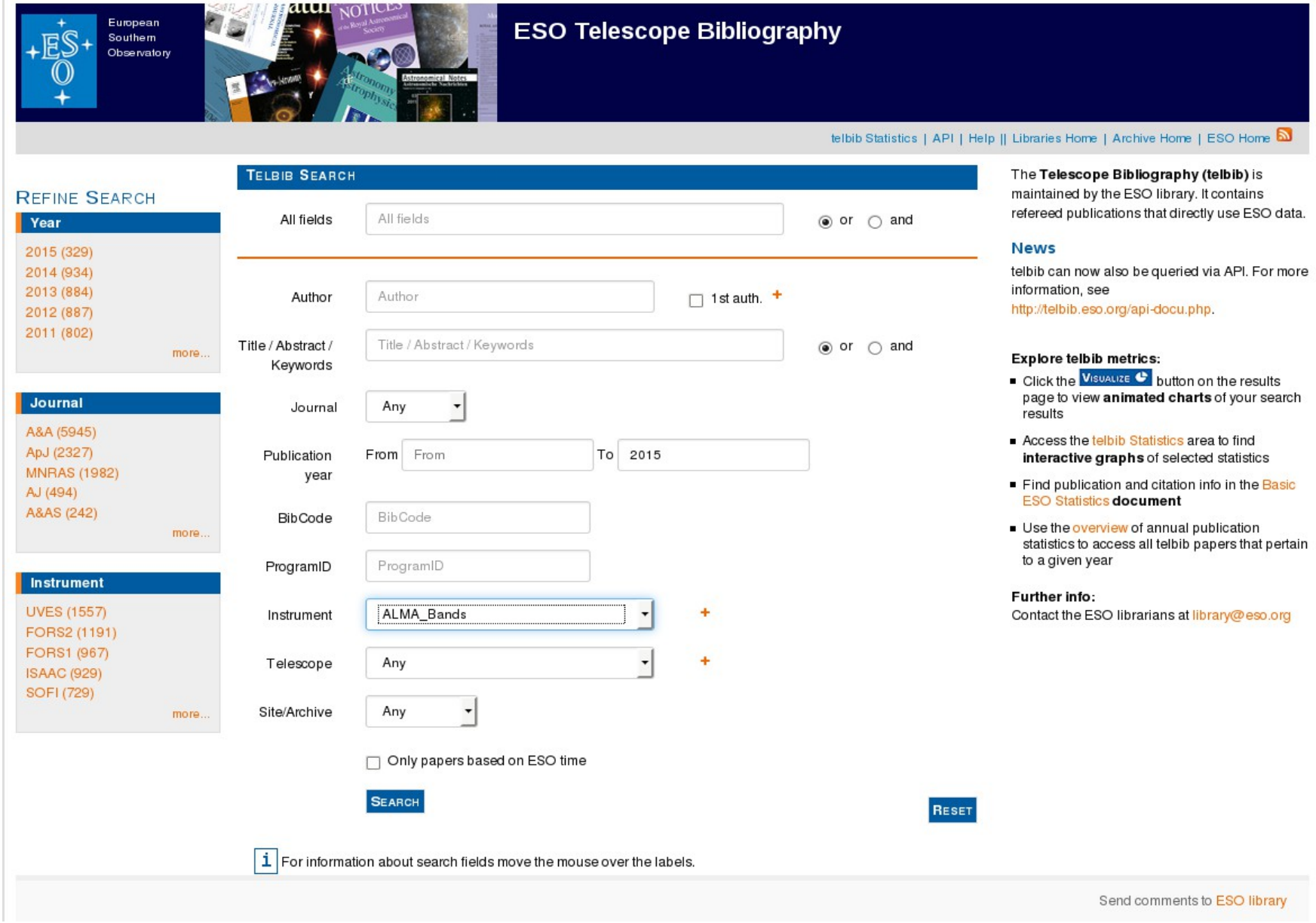
The ALMA archive: download script

```
massardi@arcbl04:~/scuola
File  Edit  View  Search  Terminal  Help
Run setup-help for setup info.

[massardi@arcbl04 ~]$ cd scuola/
[massardi@arcbl04 ~/scuola]$ sh downloadRequest855169791.sh
Downloading
https://almascience.eso.org/dataPortal/requests/anonymous/855169791/ALMA/2011.0.
00182.S_2012-12-20_001_of_004.tar/2011.0.00182.S_2012-12-20_001_of_004.tar
https://almascience.eso.org/dataPortal/requests/anonymous/855169791/ALMA/2011.0.
00182.S_2012-12-20_002_of_004.tar/2011.0.00182.S_2012-12-20_002_of_004.tar
https://almascience.eso.org/dataPortal/requests/anonymous/855169791/ALMA/2011.0.
00182.S_2012-12-20_003_of_004.tar/2011.0.00182.S_2012-12-20_003_of_004.tar
https://almascience.eso.org/dataPortal/requests/anonymous/855169791/ALMA/2011.0.
00182.S_2012-12-20_004_of_004.tar/2011.0.00182.S_2012-12-20_004_of_004.tar
https://almascience.eso.org/dataPortal/requests/anonymous/855169791/ALMA/2011.0.
00182.S_2012-10-29_001_of_001.tar/2011.0.00182.S_2012-10-29_001_of_001.tar
 in up to 5 parallel streams. Total size is 14.6GB. This may take a while ...
starting download of 2011.0.00182.S_2012-12-20_001_of_004.tar
starting download of 2011.0.00182.S_2012-12-20_003_of_004.tar
starting download of 2011.0.00182.S_2012-12-20_002_of_004.tar
starting download of 2011.0.00182.S_2012-10-29_001_of_001.tar
starting download of 2011.0.00182.S_2012-12-20_004_of_004.tar
            finished 2011.0.00182.S_2012-12-20_004_of_004.tar
            finished 2011.0.00182.S_2012-12-20_002_of_004.tar
```

The ESO telbib

http://telbib.eso.org/



The ESO telbib

REFINE SEARCH

Year

2015 (40)
2014 (97)
2013 (65)
2012 (20)

Journal

ApJ (121)
A&A (54)
MNRAS (16)
Nature (11)
PASJ (6)
more...

Instrument

ALMA_Bands (222)
LABOCA (14)
XSHOOTER (6)
FORS2 (5)
SHFI (5)
more...

NEW SEARCH | EDIT SEARCH | VISUALIZE | EXPORT

Results **1** - **25** of **222** found for (instrument:ALMA_Bands) « Previous Next »

YEAR ▼	AUTHOR	TITLE	INSTRUMENTS	ACCESS TO DATA	FULLTEXT ADS
2015	Sakai, Yusuke et al.	An ALMA Imaging Study of Methyl Formate (HCOOCH3) in Torsionally Excited States toward Orion KL	***ALMA_Bands***	2011.0.00009.SV	2015ApJ...803...97S
2015	Brouillet, N. et al.	Antifreeze in the hot core of Orion. First detection of ethylene glycol in Orion-KL	***ALMA_Bands***	2011.0.00009.SV	2015A&A...576A.129B
2015	Saito, Toshiki et al.	ALMA Multi-line Observations of the IR-bright Merger VV 114	***ALMA_Bands***	2011.0.00467.S	2015ApJ...803...60S
2015	Olofsson, H. et al.	ALMA view of the circumstellar environment of the post-common-envelope-evolution binary system HD 101584	***ALMA_Bands***	2012.1.00248.S	2015A&A...576L..15O
2015	Sakai, Takeshi et al.	ALMA Observations of the IRDC Clump G34.43+00.24 MM3: DNC/HNC Ratio	***ALMA_Bands***	2011.0.00656.S	2015ApJ...803...70S
2015	Gullberg, B. et al.	The nature of the [C II] emission in dusty star-forming galaxies from the SPT survey	***ALMA_Bands***	2011.0.00957.S, 2011.0.00958.S, 2012.1.00844.S	2015MNRAS.449.2883G
2015	Rathborne, J. M. et al.	A Cluster in the Making: ALMA Reveals the Initial Conditions for High-mass Cluster Formation	***ALMA_Bands***	2011.0.00217.S	2015ApJ...802..125R

What is in the archive?

For each project the main deliverables are

Raw Data (in CASA readable MS), Calibration Scripts and Tables

Users need to run CASA to generate the Calibrated Data.
The resulting calibrated data is considered science-ready.

Some Imaging Products are delivered too, as result of QA2 processing
(in Early Science provided on a best effort basis, not necessarily science-ready)
a) for Line Observations:
- continuum-subtracted (where needed) image cubes at the requested resolution
- a continuum image for all line-free channels (where possible)
b) for Continuum Observations:
- continuum image combining all SPWs

The main purpose is to measure the rms and verify the achievement of PI requests.

Images in the archive are provided as starting point on the way to obtain the final images and a valuable basis for archive researchers (i.e. they are not considered science-ready!!!)

What is in the archive?

When untarred, the Product Package standard directory structure contains

|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....**important** summary of the contents
| | | | |-- product/
| | | | |-- calibration/
| | | | |-- qa/
| | | | |-- script/
| | | | |-- log/
| | | | |-- raw/

What is in the archive?

When untarred, the Product Package standard directory structure contains

```
|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....................important summary of the contents
| | | | |-- product/ .....................all the imaging products
| | | | |-- calibration/
| | | | |-- qa/
| | | | |-- script/
| | | | |-- log/
| | | | |-- raw/
```

- **4D Cubes**: RA, Dec (from ca. 256x256 up to a few 1000 x a few 1000 pixels),
  Frequency (up to a few 1000 channels),
  Stokes (up to 4 channels)

for line and continuum images of the science target and some calibrators
stored as FITS files following the latest FITS standard (3.0)

- Science target images are corrected for the primary beam
(sensitivity variation across the FOV).
The PB correction is included as a separate image
- The clean mask(s) for the science targets

What is in the archive?

When untarred, the Product Package standard directory structure contains

```
|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....................important summary of the contents
| | | | |-- product/ .....................all the imaging products
| | | | |-- calibration/ .....................calibration and flagging tables
| | | | |-- qa/
| | | | |-- script/
| | | | |-- log/
| | | | |-- raw/
```

- Calibration tables (Tsys, WVR, Bandpass, Gain, Amplitude)
- Flagversions tables
- Calibrator fluxes (flux.csv)
- Pipeline metadata (*calapply.txt and *flagtemplate.txt)

These products together with the calibration scripts serve to recreate the calibrated visibilities (MS format) from the raw data. This also requires the installation of the right version of CASA.

What is in the archive?

When untarred, the Product Package standard directory structure contains

```
|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....important summary of the contents
| | | | |-- product/ .....all the imaging products
| | | | |-- calibration/ .....calibration and flagging tables
| | | | |-- qa/ .....diagnostic plots generated during calibration
| | | | |-- script/
| | | | |-- log/
| | | | |-- raw/
```

QA documentation

a) for pipeline-calibrated data

- The Pipeline Weblog – a system of webpages containing all the diagnostic plots and other information generated by the pipeline.

b) for analyst-calibrated data

- QA Reports for all the imaged data (png images and pdf files).

What is in the archive?

When untarred, the Product Package standard directory structure contains

```
|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....important summary of the contents
| | | | |-- product/ .....all the imaging products
| | | | |-- calibration/ .....calibration and flagging tables
| | | | |-- qa/ .....diagnostic plots generated during calibration
| | | | |-- script/ .....the scripts necessary to regenerate the cal. MS
| | | | |-- log/
| | | | |-- raw/
```

Data Reduction Scripts (ASCII files: Python or XML)
a) for pipeline-calibrated data
- the Python scripts needed to restore the calibrated MS or rerun the entire pipeline
- the pipeline processing request file (PPR)
- the flux equalisation script (if necessary) and the imaging script

b) for analyst-calibrated data
- CASA reduction scripts including: calibration scripts, flux equalization script (if necessary), and imaging script

In both cases, there is a master script "scriptForPI.py" which is the one the user needs to run to perform the generation of the calibrated visibilities.

What is in the archive?

When untarred, the Product Package standard directory structure contains

```
|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....important summary of the contents
| | | | |-- product/ .....all the imaging products
| | | | |-- calibration/ .....calibration and flagging tables
| | | | |-- qa/ .....diagnostic plots generated during calibration
| | | | |-- script/ .....the scripts necessary to regenerate the cal. MS
| | | | |-- log/ .....CASA log files from QA2 calibration and imaging
| | | | |-- raw/
```

What is in the archive?

When untarred, the Product Package standard directory structure contains

```
|-- project_id/
| |-- sg_ouss_id/
| | |-- group_ouss_id/
| | | |-- member_ouss_id/
| | | | |-- README .....important summary of the contents
| | | | |-- product/ .....all the imaging products
| | | | |-- calibration/ .....calibration and flagging tables
| | | | |-- qa/ .....diagnostic plots generated during calibration
| | | | |-- script/ .....the scripts necessary to regenerate the cal. MS
| | | | |-- log/ .....CASA log files from QA2 calibration and imaging
| | | | |-- raw/ .....only present when you have unpacked the raw data
```

In publications with ALMA data!

Acknoweledgement Statement:

“This paper makes use of the following ALMA data: ADS/JAO.ALMA#2011.0.01234.S. ALMA is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), NSC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ.”

(Can be found in the SP, on the ‘ALMA-Data’ page)

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