

The background features a dark blue gradient with faint, light blue circular patterns. On the left side, there is a large circular scale with tick marks and numbers ranging from 140 to 260. Several smaller circles with arrows and dashed lines are scattered across the background, suggesting a technical or scientific theme.

# PROPOSALS AND OBSERVING PLANNING

B. MARCOTE & E. ORRU'

## ROADMAP FOR A PROPOSAL



- **Where is your source(s)?**  
North/South hemisphere
- **When to observe your source?**  
Persistent in time, variable, transient/after some event
- **What kind of emission displays?**  
Continuum/spectral line, morphology/angular size



WAVELENGTH(S)



SPECTRAL RESOLUTION



SPATIAL RESOLUTION



ANGULAR SCALES TO MAP

# ROADMAP FOR A PROPOSAL



WAVELENGTH(S)

SPATIAL RESOLUTION



*What arrays can do what you want?*



*Sensitivity?*

*Are the observations feasible?*



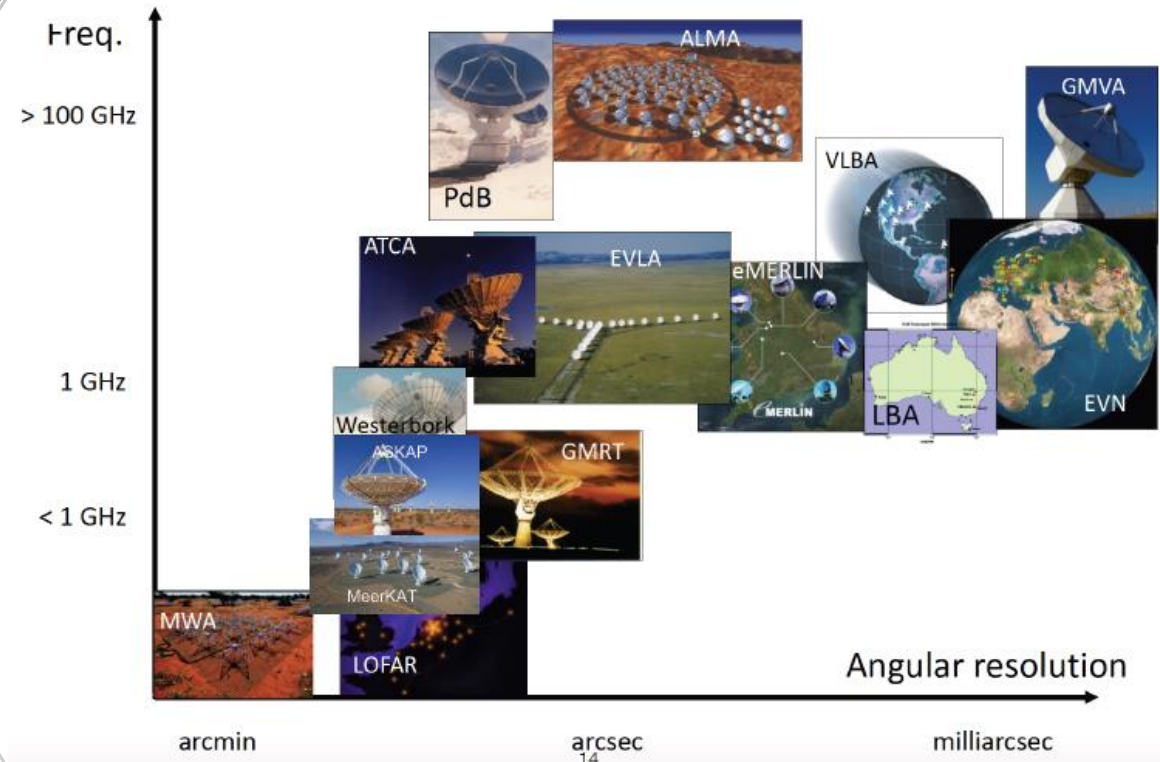
ANGULAR SCALES TO MAP

*Maximum resolution:  $\propto \lambda/D_{\max}$*

*Maximum recoverable scales:  $\propto \lambda/D_{\min}$*

*Has someone done it before?*

# WHAT WAVELENGTH/ RESOLUTION? WHICH TELESCOPE?



- LOFAR  
<https://science.astron.nl/telescopes/lofar/lofar-system-overview/technical-specification/>
- EVN  
<https://www.evlbi.org/using-evn>
- ALMA  
<https://almascience.eso.org/documents-and-tools>
- JVLA  
<https://science.nrao.edu/facilities/vla/proposing>
- NOEMA  
<https://www.iram-institute.org/EN/content-page-96-7-56-96-0-0.html>
- WSRT/APERTIF\*  
<https://science.astron.nl/telescopes/wsrt-apertif/apertif-system-overview/>
- SMA  
<http://sma1.sma.hawaii.edu/proposing.html>
- ATCA  
<http://www.narrabri.atnf.csiro.au/observing/>
- eMERLIN  
<http://www.e-merlin.ac.uk/observe.html>
- LBA (Australian Long Baseline Array)  
<https://www.atnf.csiro.au/vlbi/>

\* Not operational but archival data available



SPATIAL RESOLUTION

SPECTRAL RESOLUTION

WAVELENGTH

SENSITIVITY

SPECS OF TELESCOPES

# SENSITIVITY?

Image noise level  
( $\text{Wm}^{-2}\text{Hz}^{-1}/\text{beam}$ )

Boltzmann constant  
 $1.38 \times 10^{-23} \text{ JK}^{-1}$

System temperature (K)

Bandwidth (Hz)  
[includes number of polarizations]

Effective area of 1 antenna ( $\text{m}^2$ )

Number of antennas

Integration time (s)

$$S_{rms} = \frac{2kT_{sys}}{A_{eff} \sqrt{N_A(N_A - 1)t_{int} \Delta\nu}}$$

Don't forget the unit conversions:  $1 \text{ Jy} = 10^{-26} \text{ Wm}^{-2}\text{Hz}^{-1}$

- Key parameter is surface brightness (Jy/beam)
- Work this out from earlier observations, theory, blind guesswork
- Bandwidth  $\Delta\nu$  is important ( $\text{rms} \propto \Delta\nu^{-1/2}$ )
- Is your target resolved, or is it a point source?
- Use a sensitivity calculator to work out how long an observation you need (see next slides)
- Tutors will help you find the right tool (or to do the calculation by hand if there isn't one)
- Careful with confusion noise

# VLA

VLA Exposure Calculator	
Array Configuration	A
Number of Antennas	25
Polarization Setup	<input type="radio"/> Single <input checked="" type="radio"/> Dual
Type of Image Weighting	<input checked="" type="radio"/> Natural <input type="radio"/> Robust
Representative Frequency	5.5000 GHz
Receiver Band	C
Approximate Beam Size	0.533" (0.451" - 0.651")
Digital Samplers	<input type="radio"/> 3 bit <input checked="" type="radio"/> 8 bit
Elevation	Medium (25-50 degrees)
Average Weather	Summer
Calculation Type	<input checked="" type="radio"/> Time <input type="radio"/> BW <input type="radio"/> Noise/Tb
Time on Source (UT)	0h 6m 15s
Total Time (UT)	0h 7m 53s
Bandwidth (Frequency)	2.0000 GHz
Bandwidth (Velocity)	109,015.4393 km/s
RMS Noise (units/beam)	10.0000 $\mu$ Jy
RMS Brightness (temp)	1.4234 K
Confusion Level	0.0Jy
<input type="button" value="Help"/> <input type="button" value="Save"/>	



<https://obs.vla.nrao.edu/ect/>



# VLA

### VLA Exposure Calculator

Array Configuration	A
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# EVN (and any VLBI network)

### EVN Observation Planner

Your observing Band?   
 C band (6cm or 5 GHz)

e-EVN (real-time) mode?

Source (name or coordinates)?   
 FRB 121102   
 05h32m09.6s +33d05m13.4s

Pick Epoch  Guest Times

Start of observation (UTC)?   
 01-02-2021 (32) 00:30

Duration of the observation (hours)?   
 February 2021

Acquisition Rate (Mbps)   
 2 Gbps

Number of subbands?   
 8 subbands

Observation Setup
Summary
Elevations
UV Coverage


Here you can set up your observation. Please select which network (or networks) you want to use in your select a customized array of antennas. On the left panel you can get information from your observations: times of the observations and observe. Optionally, you can customize the configuration and correlation parameters 'advance setup'. Otherwise, default values based on your selection. Once you are ready, press the big red 'compute observation' button for a detailed summary of the planned observation and expected output in different tabs.

Note that only antennas that can observe at the selected band will be available.

Select default VLBI Network(s)?   
  EVN

Compute Observation

**Sensitivity**




The expected rms thermal noise for your target is 10.6  $\mu$ Jy/beam when no weighting is applied during imaging. Note that ~20% higher values may be expected for RFI-contaminated bands.

The achieved sensitivity implies a rms of 170  $\mu$ Jy/beam per spectral channel, or approx. 1.1 mJy/beam per time integration (2 s).

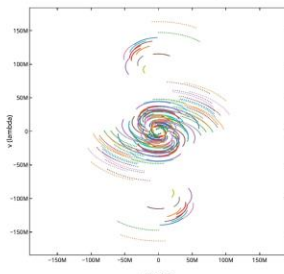
**Antennas**

13 participating antennas: Bd, Ef, Ir, Jb2, Mc, Nt, On, Sv, T6, Tr, Wb, Ys, Zc.

Note that Hh, Ur cannot observe the source during the planned observation.



Sv-Ys is the longest (projected) baseline with 3125.7 km (52.1 MA).




**EVN: European VLBI Network**

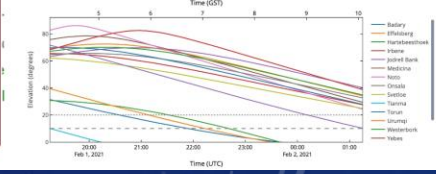
<input checked="" type="checkbox"/> Badary	<input checked="" type="checkbox"/> Effelsberg	<input checked="" type="checkbox"/> Hartebeek
<input checked="" type="checkbox"/> Jodrell Bank	<input type="checkbox"/> Kunming	<input type="checkbox"/> Lovell
<input type="checkbox"/> Metsahovi	<input checked="" type="checkbox"/> Noto	<input checked="" type="checkbox"/> Onsala
<input type="checkbox"/> Robledo-70	<input type="checkbox"/> Sardinia	<input type="checkbox"/> Sheshan
<input checked="" type="checkbox"/> Tianma	<input checked="" type="checkbox"/> Torun	<input checked="" type="checkbox"/> Urumqi
<input type="checkbox"/> Wettzell	<input checked="" type="checkbox"/> Yebes	<input checked="" type="checkbox"/> Zelenchu

**Lovell**  
Lovell Telescope  
United Kingdom 76 m

Listed for the EVN and eMERLIN.  
Can observe at 92, 49, 21, 18, 6 cm.



Source elevation during the observation



<https://obs.vla.nrao.edu/ect/>  
<https://planobs.jive.eu>



# ALMA

## Common Parameters

Declination  ✓

Polarisation  ▾

Observing Frequency  GHz ▾

Observing Band  ▾

Bandwidth per Polarization  GHz ▾

Water Vapour  Automatic Choice  Manual Choice

Column Density  ▾

Trx, tau, Tsky

Tsys

## Individual Parameters

	12 m Array	7 m Array	Total Power Array
Number of Antennas	<input type="text" value="43"/> ✓	<input type="text" value="10"/> ✓	<input type="text" value="3"/> ✓
Resolution	<input type="text" value="0"/> ✓ <input type="button" value="arcsec"/> ▾	<input type="text" value="0"/> ✓ <input type="button" value="arcsec"/> ▾	<input type="text" value="9.5"/> ✓ <input type="button" value="arcsec"/> ▾
Sensitivity (rms)	<input type="text" value="197.67559092477822"/> ✓ <input type="button" value="uJy"/> ▾	<input type="text" value="2.4826852653365648"/> ✓ <input type="button" value="mJy"/> ▾	<input type="text" value="4.85010668201959"/> ✓ <input type="button" value="mJy"/> ▾
Equivalent to	<input type="text" value="Unknown"/> <input type="button" value="K"/> ▾	<input type="text" value="Unknown"/> <input type="button" value="K"/> ▾	<input type="text" value="0.174"/> <input type="button" value="mK"/> ▾
Integration Time	<input type="text" value="60"/> ✓ <input type="button" value="s"/> ▾	<input type="text" value="60"/> ✓ <input type="button" value="s"/> ▾	<input type="text" value="60"/> ✓ <input type="button" value="s"/> ▾

Integration Time Unit Option  ▾

Sensitivity Unit Option  ▾

Calculate Integration Time

Calculate Sensitivity

<https://almascience.eso.org/proposing/sensitivity-calculator>

# LOFAR

## LOFAR Unified Calculator for Imaging (LUCI)

### Observational setup

Observation time (in seconds)

No. of core stations (0 - 24)

No. of remote stations (0 - 14)

No. of international stations (0 - 14)

Number of channels per subband

Number of subbands

Integration time (in seconds)

Antenna set

### Target setup

Target

Coordinates

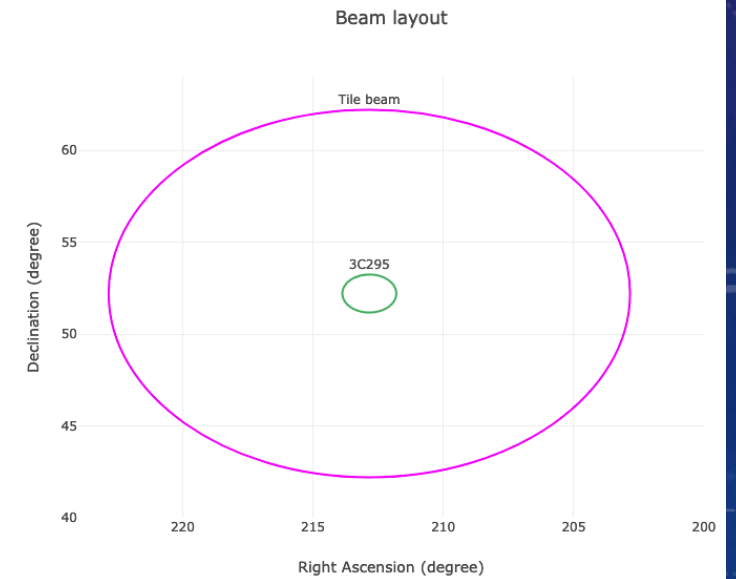
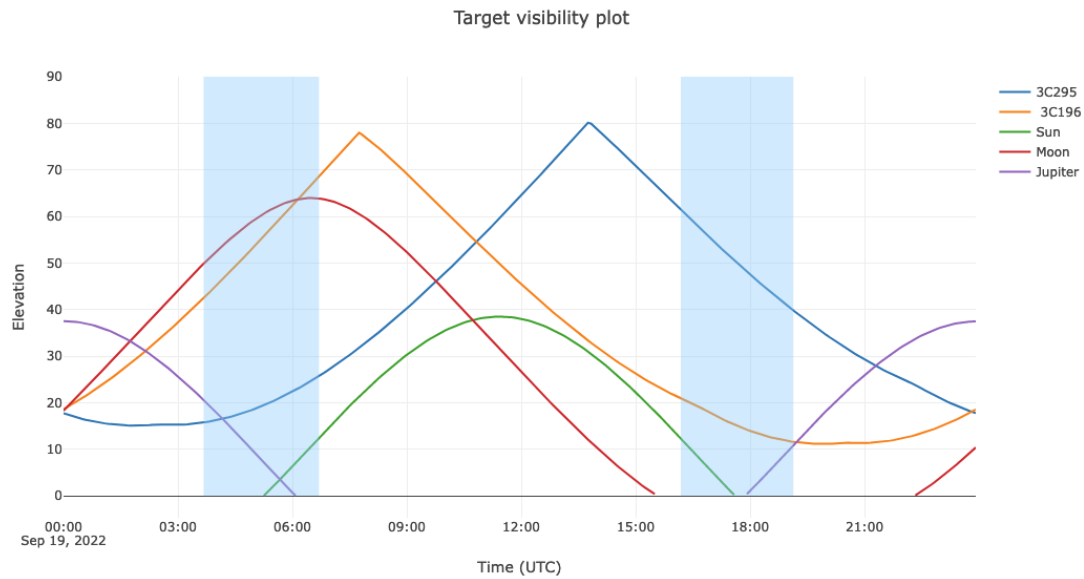
Observation date

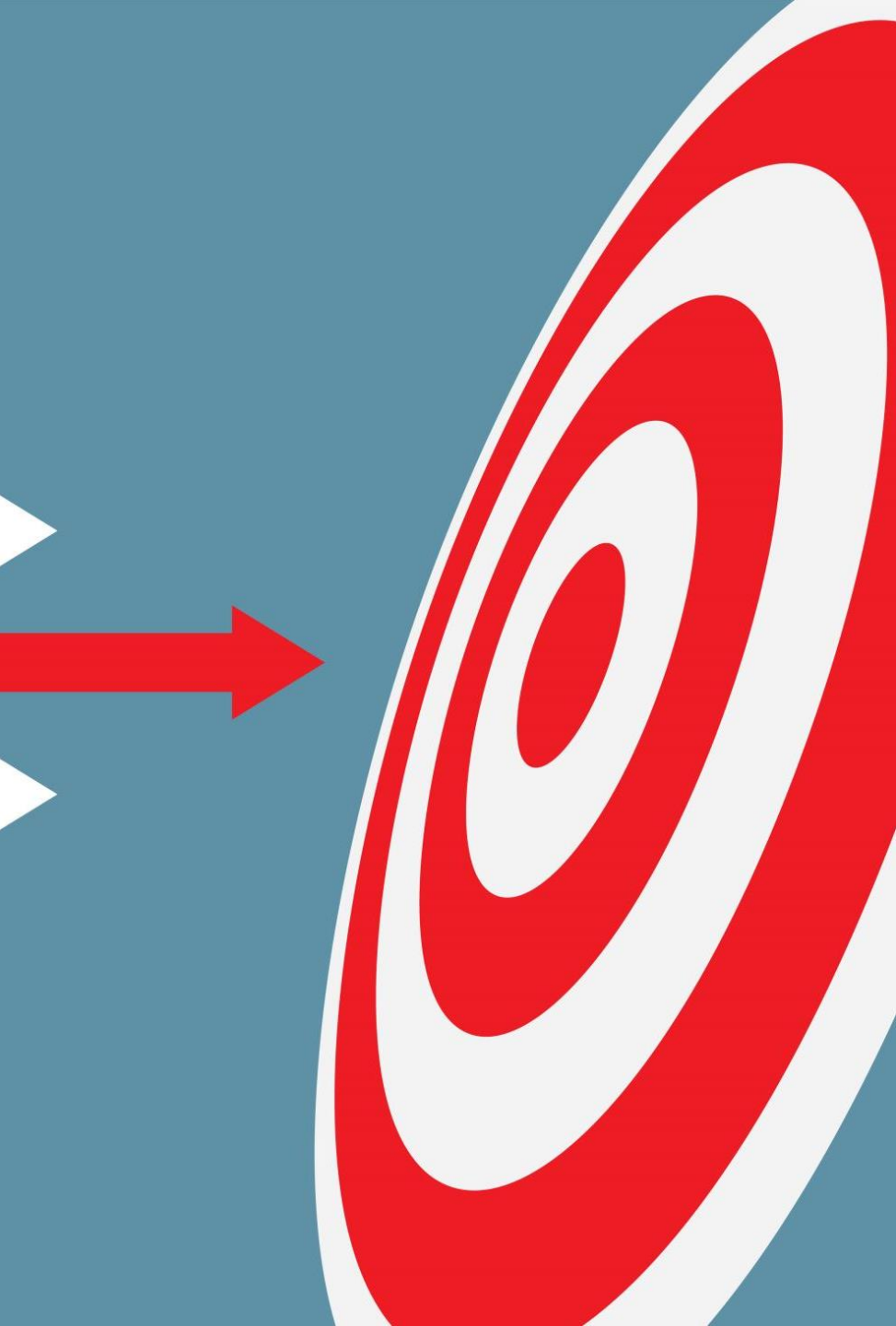
### Results

Theoretical image sensitivity (uJy/beam)

Raw data size (in GB)

**Notes:**





HOW MANY TARGETS?  
WHERE IS MY TARGET?

WHAT ARRAYS CAN DO WHAT I WANT?

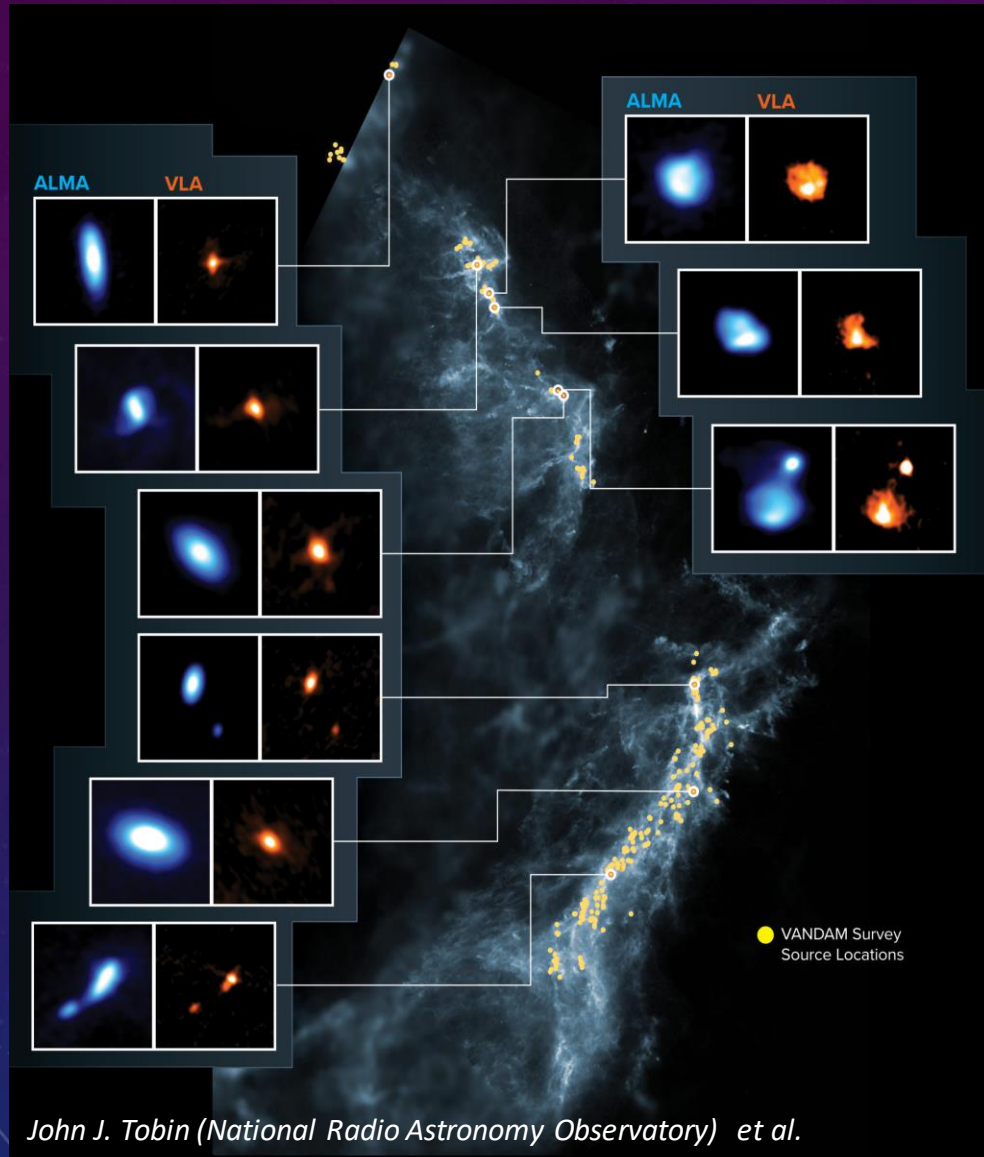
WHEN DOES THE TARGET NEED TO BE OBSERVED?

IS YOUR OBSERVATION FEASIBLE?

If not:

- Is the resolution too high?
- Too many targets?
- Wrong frequency?
- Is there a better array?
- Is the data size sustainable?





# HAS SOMEONE DONE IT BEFORE?

- Look in the literature and in the telescope archives
- Re-analyse old data
  - Better reduction with modern tools?
  - Good enough?
- Even if not good enough
  - May give a better justification
  - May be able to combine with new data

# ALMA

<https://almascience.eso.org/aq/>

**Position**

Source name

ALMA source name

RA Dec

Galactic

Target List

Angular Resolution

Maximum Recoverable Scale

**Energy**

Frequency

Band

Spectral resolution

Continuum sensitivity

Line sensitivity (10 km/s)

**Project**

Project code

Project Title

Project abstract

PI Full Name

Proposal authors

Science keyword

**Publication**

BibCode

Publication Title

Abstract

First Author

Authors

**Observation**

Observation Date

Polarisation Type

Member ous id

Object type

**Options**

Public data only

Calibration observations

40.041 -29 00 28.12

FoV: 176.04°

**Molecules**

**Lines**

**Redshift**

**Observations (58067)**

Projects (3947)

Publications (2838)

	Project code	ALMA source name	Ra	Dec	Band	Cont. sens.	Frequency support	↑ Release date	Publications	Ang. res.	Min. vel. res.	Array	Mosaic	Max. reco. scale	FOV	Scientific category	Science keyword	Int. Time	Gal. lon.
			h:m:s	d:m:s		mJy/beam				arcsec	km/s			arcsec	arcsec			s	
	<a href="#">2011.0.00191.S</a>	Fomalhaut b	22:57:38.685	-29:37:12.616	7	0.1181	<a href="#">343.08..358.84GHz</a>	2012-12-06	2	1.047	0.816	12m		10.639	16.592	Disks and planet forma...	Debris disks, Exoplanets	8709.120	20.493
	<a href="#">2011.0.00101.S</a>	GRB021004	00:26:54.680	+18:55:41.600	7	0.1136	<a href="#">337.01..353.00GHz</a>	2012-12-06	2	1.107	26.541	12m		9.257	16.878	Active galaxies	Starburst galaxies, Ga...	3749.760	114.917
	<a href="#">2011.0.00131.S</a>	R Scl	01:26:58.079	-32:32:36.424	7	0.9115	<a href="#">330.25..346.11GHz</a>	2012-12-06	5	1.043	0.846	12m	mosaic	11.517	62.007	Stars and stellar evol...	Asymptotic Giant Bran...	661.617	250.183
	<a href="#">2011.0.00397.S</a>	J063027.81-212058...	06:30:27.810	-21:20:58.600	7	0.5346	<a href="#">337.01..352.99GHz</a>	2012-12-20	3	1.183	26.541	12m		8.015	16.878	Active galaxies	Active Galactic Nuclei ...	90.720	230.024

Dates From:

YYYY-MM-DD



Dates To:

YYYY-MM-DD



Start Frequency:

GHz

End Frequency:

GHz

Coordinate Frame:

Equatorial

Equinox:

J2000

Right Ascension

Resolver

HMS

Declination

Resolver

DMS

Radius:

"

Source Name:

Telescope:

Click to Select

Array Configuration:

Click to Select

Receivers:

Click to Select

Polarizations:

Click to Select

Project Code:

Archive Filename:

PI Name:

Title Text:

Abstract Text:

Search Clear

Show only CMS data


Show only data flagged public

## EVN Data Archive at JIVE

The [EVN](#) Data Archive at [JIVE](#) contains correlated data associated with [EVN](#) observations processed at [JIVE](#). The archive includes a growing database of VLBI observations that have entered the public domain.

In addition, the archive makes available various correlator and pipeline products that give an impression of the data quality. In some cases, preliminary images of calibrators and target sources are also available. The archive allows these to be combined with external VO resources in a natural way.

Select EVN experiment

AAH01 

### Access to EVN archive

- [Show experiment AAH01](#)
- [Show catalogue of experiments](#)
- [Search archive by sourcename or position](#)
- [The Bologna archive of EVN observations.](#)

### Info

- [Increase of data since 2000](#)
- [Web statistics](#) since June 2004

Select a sourceposition from EVN experiment AAH01

Ra	Dec	Source	Image	Image
39.4684	28.8025	0234+285	sdss	evn
43.8129	0.6279	J025515+0037	sdss	evn
44.8688	-0.3333	J0259-0019	sdss	evn
49.9507	41.5117	3C84	sdss	evn

### Access to VO archives

- [Aladin Sky Atlas](#)
- [Sloan Digital Sky Survey](#)

# LOFAR

<https://lta.lofar.eu/>

The screenshot shows the LOFAR Long Term Archive website. The header includes the LOFAR logo and the text "Long Term Archive". Navigation links for "HOME", "SEARCH DATA", "BROWSE PROJECTS", and "HELP" are present. A "SIGN OUT" button is in the top right. A yellow warning banner states: "There is a known issue with retrieving files due to invalid SSL certificates at one of the LTA sites (PSNC). This is being worked on. !". The main content area is titled "Basic search" and contains a search box and a "Search" button. A sidebar on the left lists search options: "Basic search", "Advanced search", "Raw Observations", "Averaging Pipeline", "Calibration Pipeline", "Imaging Pipeline", "Long Baseline Pipeline", "Pulsar Pipeline", "Unspecified Process", and "All Observations and Pipelines". The "Basic search" section includes "Data product types" with checkboxes for "Observation" (checked), "Averaging Pipeline", "Calibration Pipeline", "Imaging Pipeline", "Long Baseline Pipeline", and "Pulsar Pipeline". It also has a "Pointing" section with fields for "Object", "Reference" (radio buttons for J2000 and B1950), "System" (radio buttons for SUN and JUPITER), "Units" (radio buttons for rad, deg, hex), "RA", "DEC", "Units" (radio buttons for rad, deg, min, sec), "Radius", and a checked checkbox for "Calculate angular distance (slower)".

# ALTA

<https://alta.astron.nl/>

The screenshot shows the ALTA - Apertif Long Term Archive website. The header includes the text "ALTA - Apertif Long Term Archive" and a "Logout (orru)" link. Navigation links for "Science" and "Help" are present. The main content area shows a search bar with "runld" entered and a "Search" button. A "Release: APERTIF\_DR1\_Imaging" dropdown menu is visible. Below the search bar is a pagination control showing "First", "Prev", "1", "2", "3", "4", "5", "6", "7", "8", "9", "10", "Next", and "Last". The main content area displays a grid of observation cards. Each card features a thumbnail image of a telescope with the text "Target Observation" overlaid. Below the thumbnail, the observation ID is displayed: "200624213 S2245+2904", "200624132 M0141+3622", "200622045 M0141+3622", and "200621042 M0141+3356". Each card also includes buttons for "Details", "Data", "Plots", "Prov", "Sky", and "API". A sidebar on the right contains "Observation Filters" and a "Set List View" button.

<https://vo.astron.nl/>



ALWAYS READ THE CALL  
FOR PROPOSALS

---

# REMEMBER THE LIMITS.....

## Observation constraints

- When is the cycle of observations for the proposed call for proposals?
- Do not observe towards the Sun (unless you are a solar astronomer!)
- Elevation of the source: indicate precisely when the source can be observed.
- Not all observing time will be on your target (calibrators). Overheads.

## Proposal constraints

- Do ask for a reasonable observing time (no more, no less).
- Multi-wavelength or multi-observatory observations?
- Are there students involved?
- Are you expert (to analyze the data) or do you need advice?

# TO CONSIDER WHEN PLANNING YOUR OBSERVATIONS

## Observing strategy (for a perfect calibration of the data)

Which calibrator sources do the science case need?

- Bandpass calibrator
- Phase-referencing observations?
- Accurate astrometry?
- Polarization measurements?
- Time-domain or phased-up observations? (pulsar ephemerides,)

## Imaging

How complex is the field? -> How much (u,v) coverage is required for a high fidelity image?

Dynamic range limits?

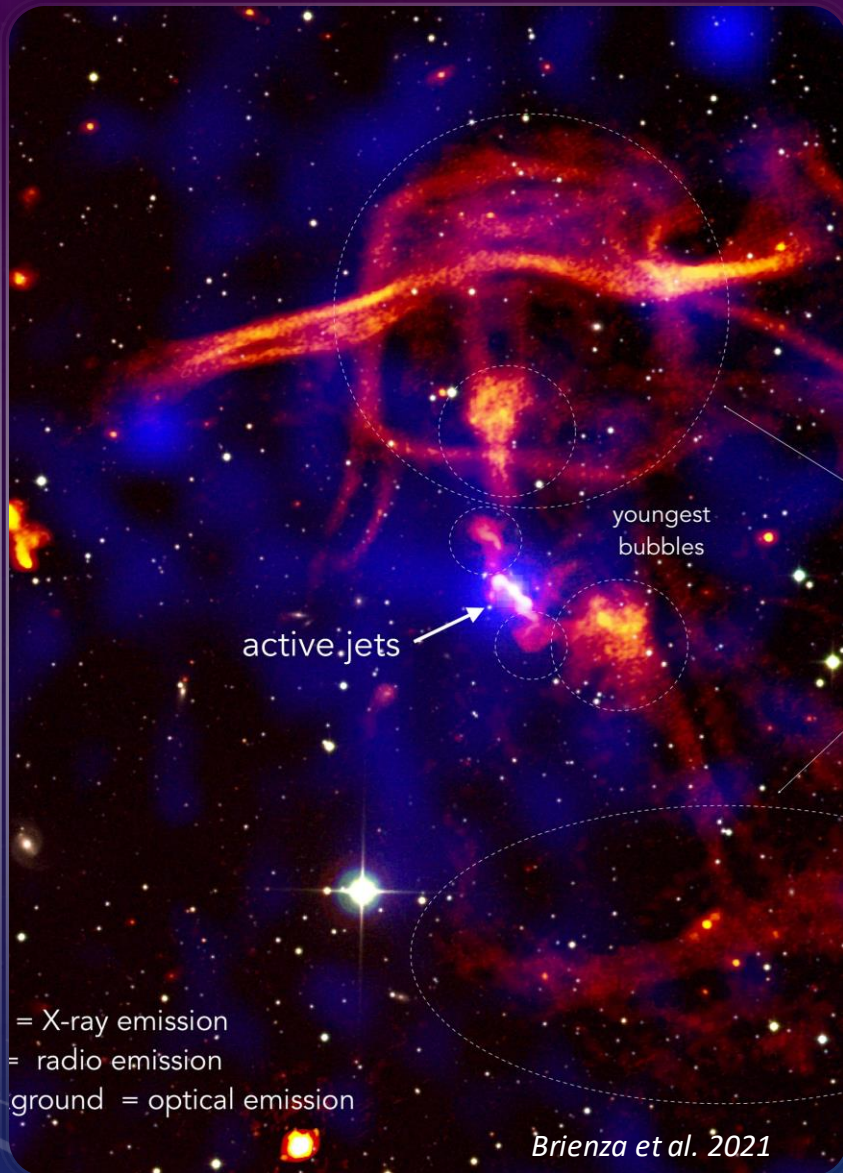
Confusion limits?

Do you need single-dish data (“zero-spacing”?)

Time and frequency resolution

## Simulations

Specially in the case of ALMA or LOFAR, you can simulate how your source



CREATE A  
DRAFT OF  
THE  
PROPOSAL

Target(s)

Wavelength

Spatial resolution

Frequency resolution

Maximum angular resolution of the target

Telescope (one or more to decide)

Minimum sensitivity