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

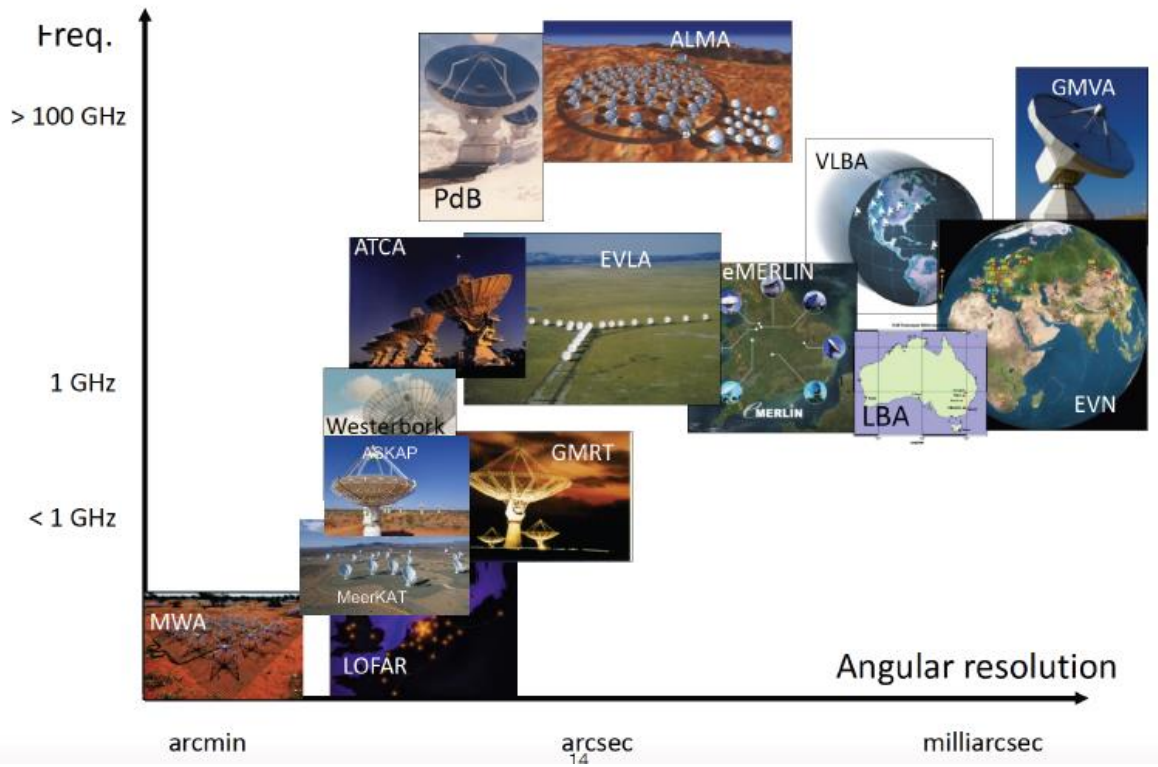
Maximum resolution: $\propto \lambda / D_{\max}$

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

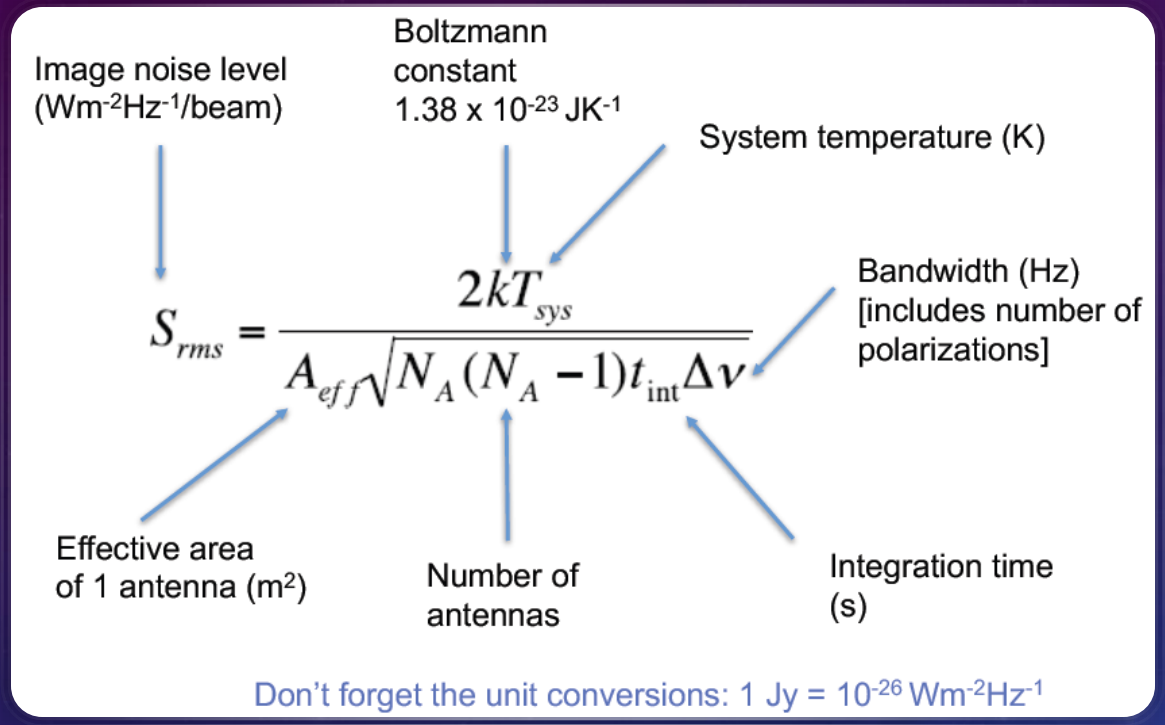
SPECTRAL RESOLUTION

WAVELENGTH

SENSITIVITY

SPECS OF TELESCOPES

SENSITIVITY?



- Key parameter is surface brightness (Jy/beam)
- Work this out from earlier observations, theory, blind guesswork
- Bandwidth Δv is important (rms ∝Δv-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	Single / Dual
Type of Image Weighting	Natural / Robust
Representative Frequency	5.5000 GHz
Receiver Band	C
Approximate Beam Size	0.533" (0.451" - 0.651")
Digital Samplers	3 bit / 8 bit
Elevation	Medium (25-50 degrees)
Average Weather	Summer
Calculation Type	Time / BW / 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 μJy
RMS Brightness (temp)	1.4234 K
Confusion Level	0.0Jy
Help	Save

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

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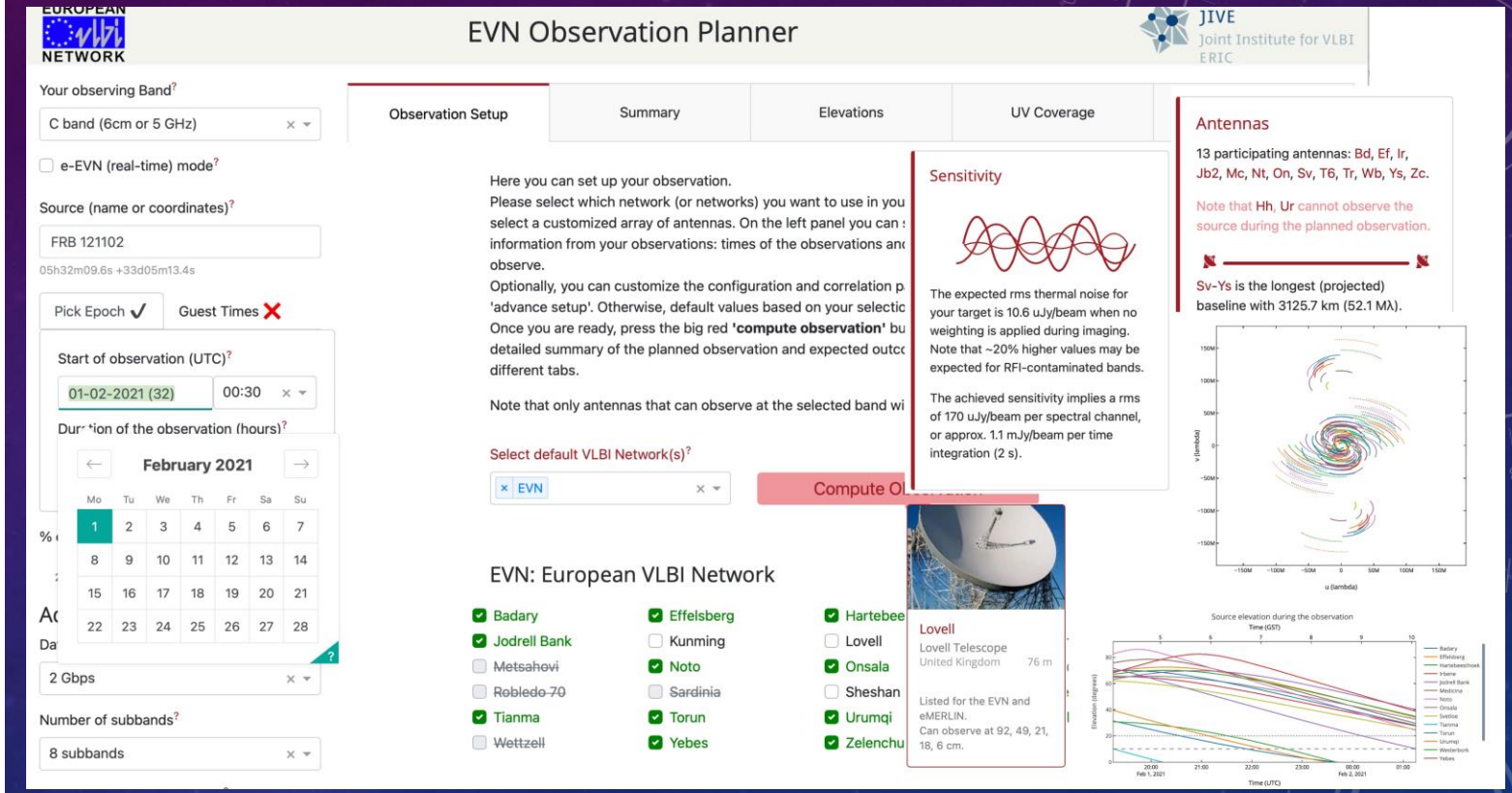
Confusion Level	0.0Jy

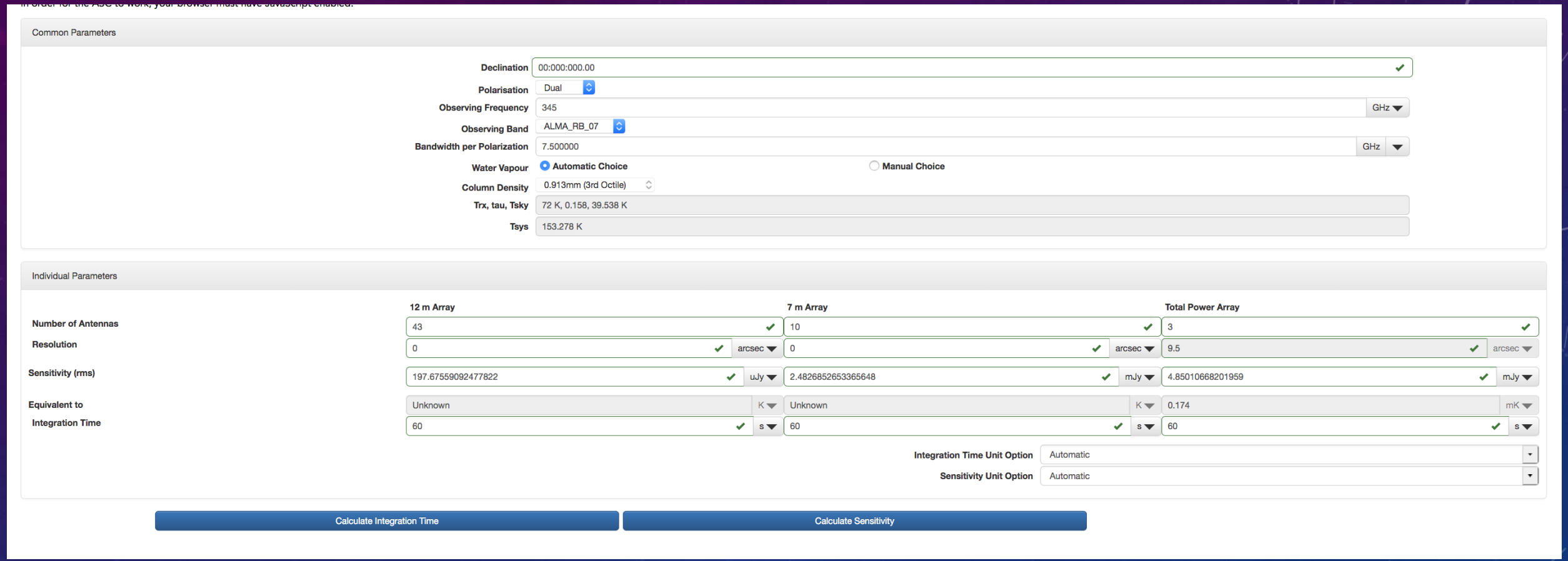
Help Save

EVN (and any VLBI network)



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

ALMA



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

LOFAR

LOFAR Unified Calculator for Imaging (LUCI)

Observational setup

Observation time (in seconds)	28800
No. of core stations (0 - 24)	24
No. of remote stations (0 - 14)	14
No. of international stations (0 - 14)	14
Number of channels per subband	64
Number of subbands	48
Integration time (in seconds)	1
Antenna set	HB

CALCULATE

Target setup

Target RESOLVE

Coordinates

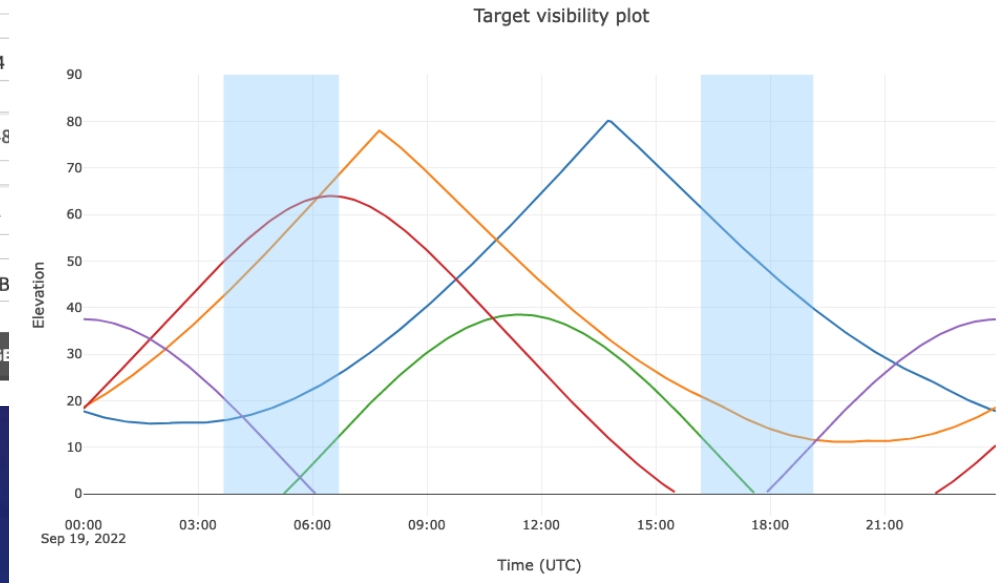
Observation date 12/07/2022

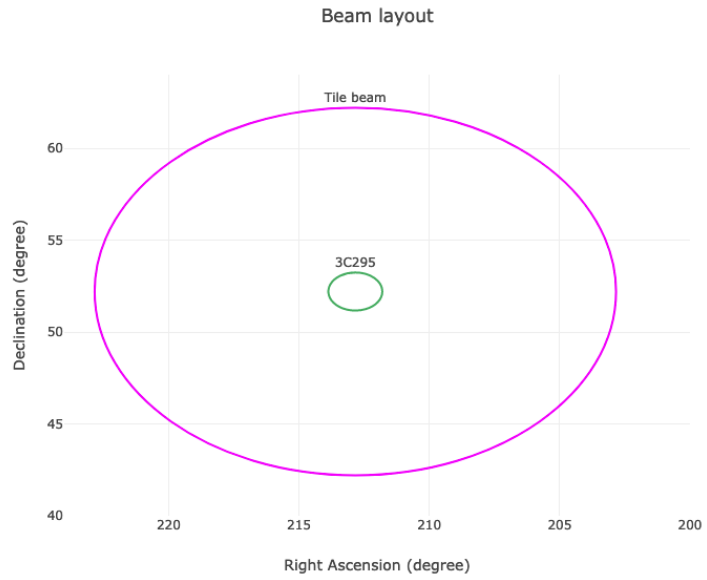
Results

Theoretical image sensitivity (uJy/beam)

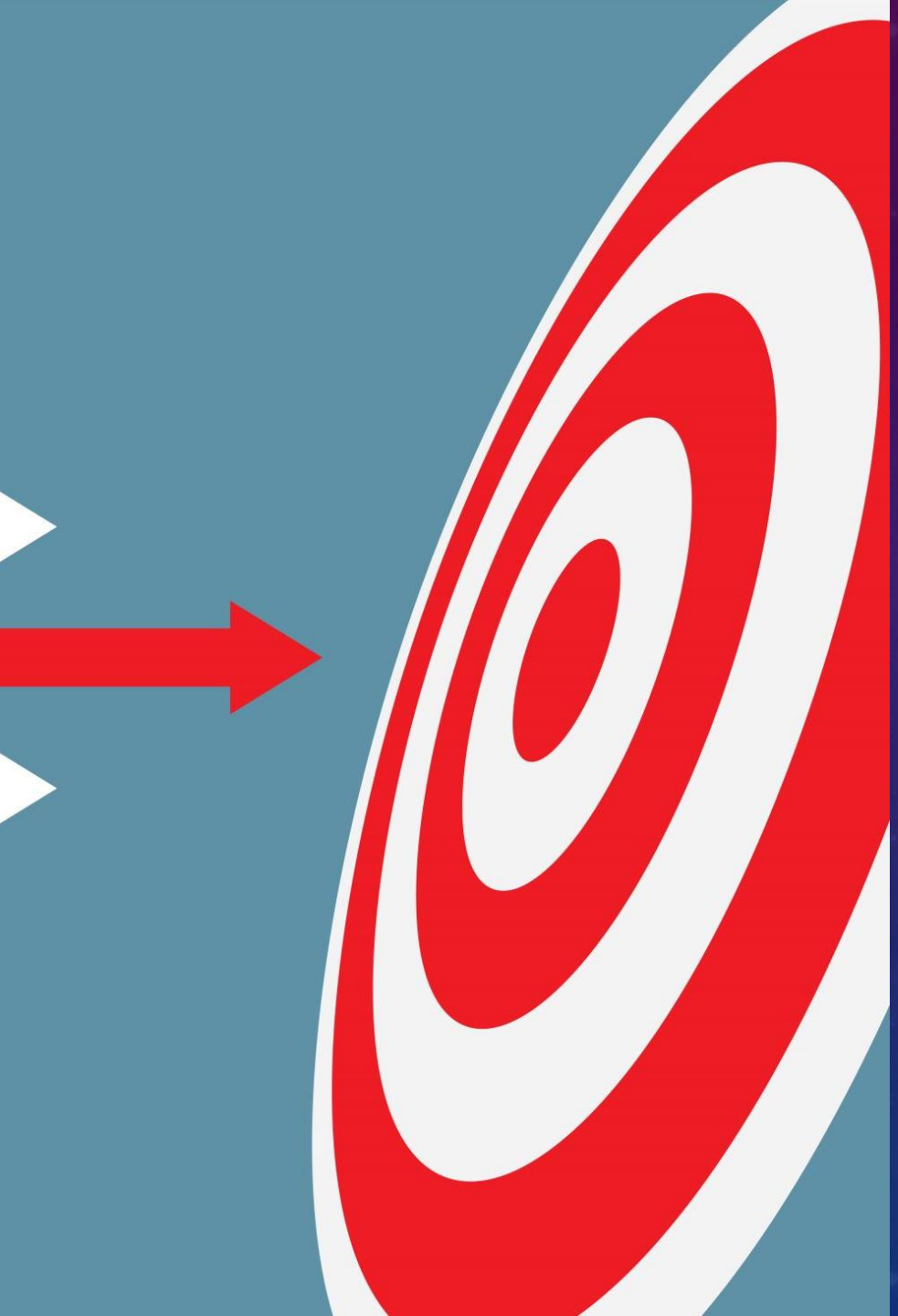
Raw data size (in GB)

Notes:





https://support.astron.nl/luci/



HOW MANY TARGETS?
WHERE IS MY TARGET?

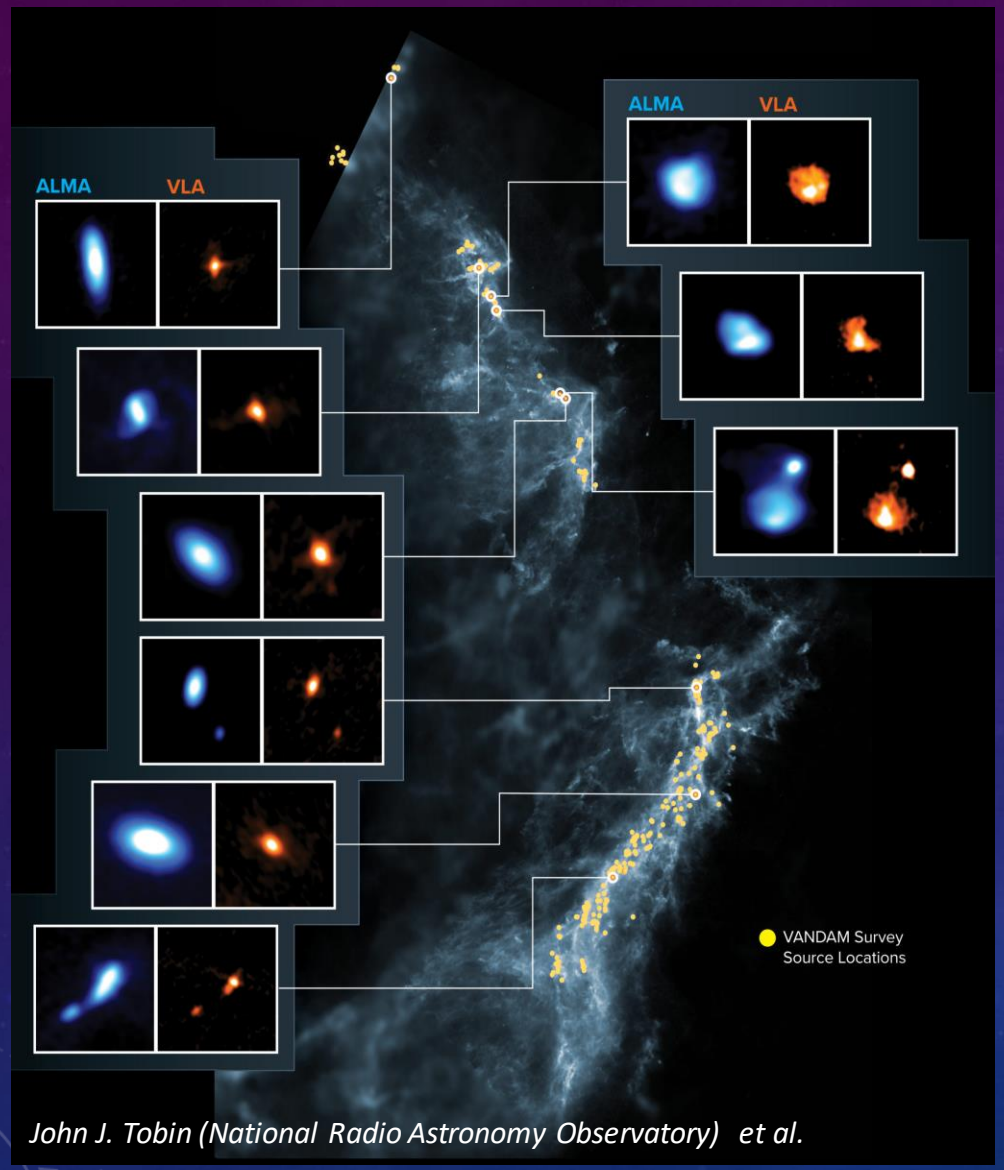
WHAT ARRAYS CAN DO WHAT I WANT?

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?



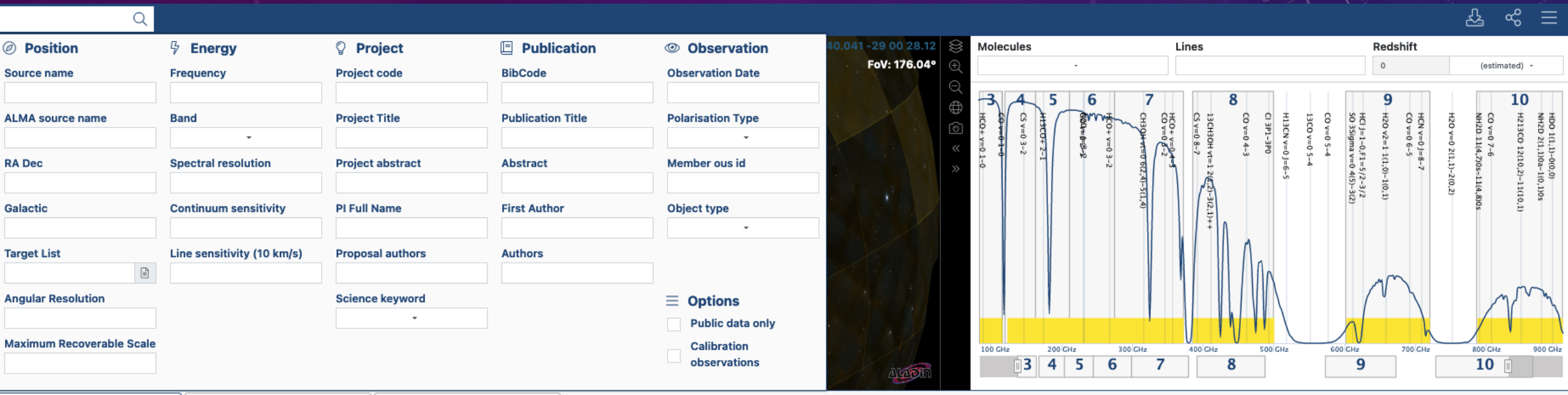
John J. Tobin (National Radio Astronomy Observatory) et al.

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/



Observations (58067) | Projects (3947) | Publications (2838)

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

VLA

https://data.nrao.edu/portal/#/

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

http://archive.jive.nl

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

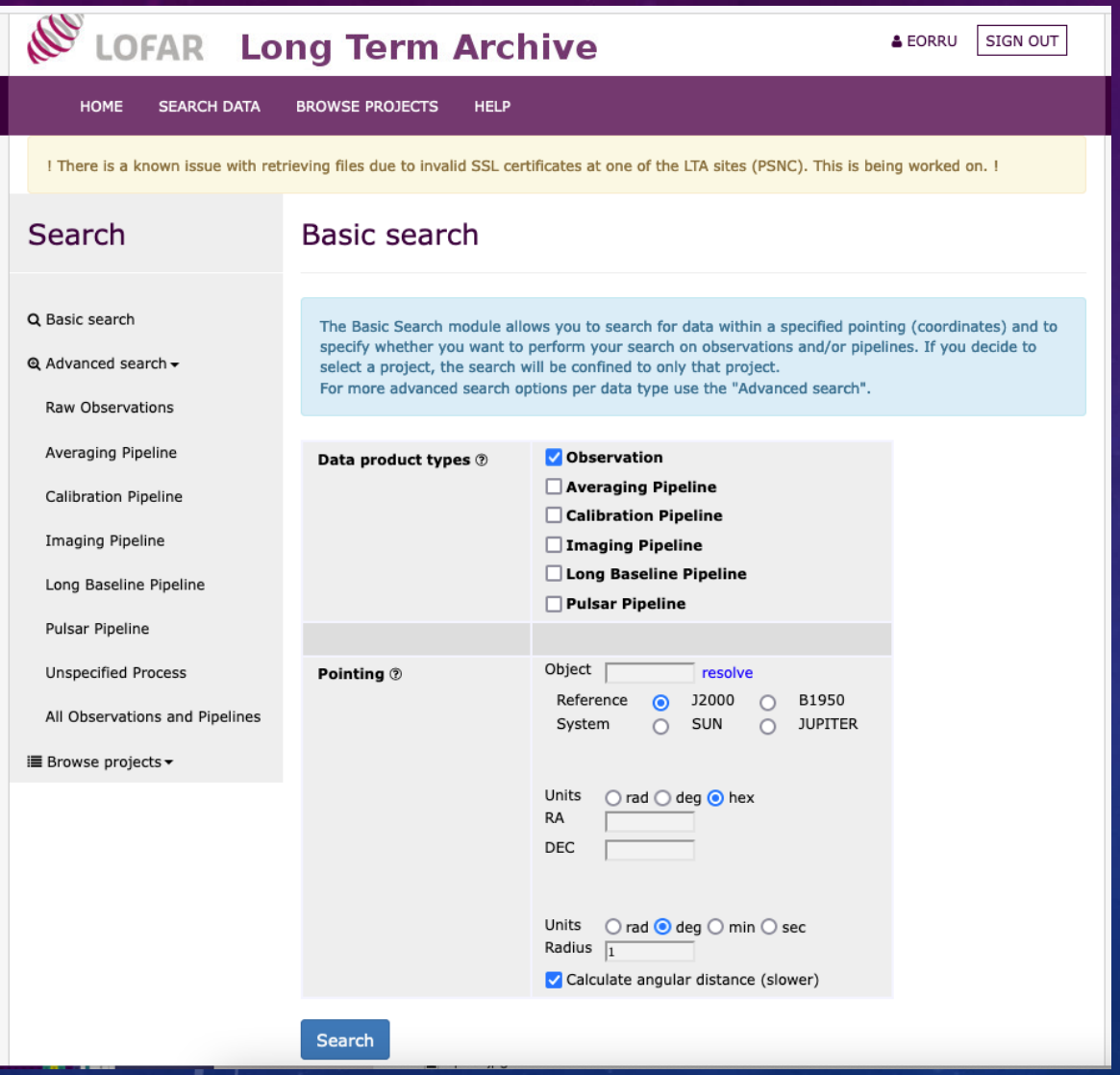
Ra	Dec	Source	Image	Image
39.4684	28.8025	0234+285	sdss	evn
43.8129	0.6279	J025515+0037	sdss	evn
44.8688	-0.3333	J0259-0019	sdss	evn
49.9507	41.5117	3C84	sdss	evn

Access to VO archives

- Aladin Sky Atlas
- Sloan Digital Sky Survey

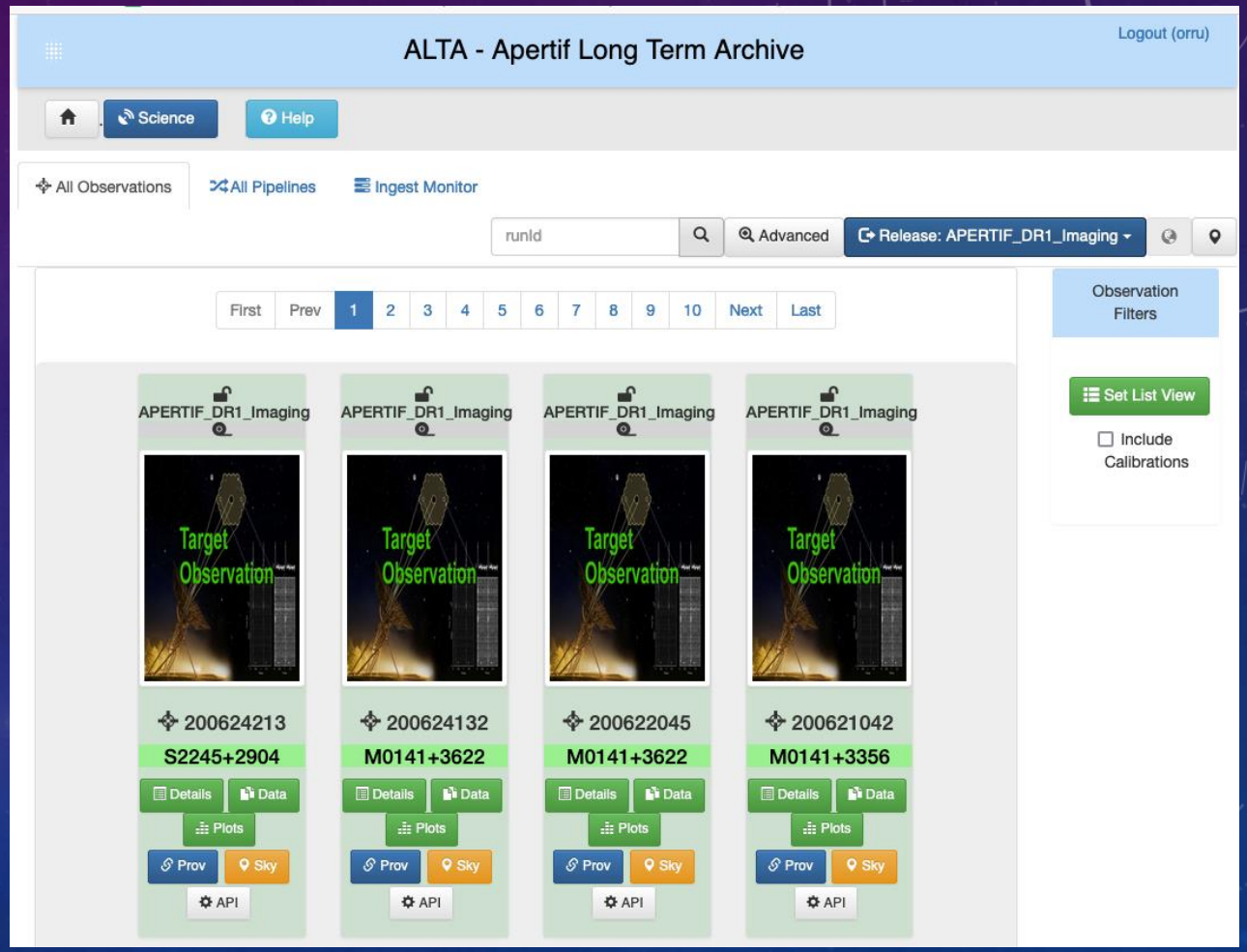
LOFAR

https://lta.lofar.eu/



ALTA

https://alta.astron.nl/



https://vo.astron.nl/

ALWAYS READ THE CALL FOR PROPOSALS

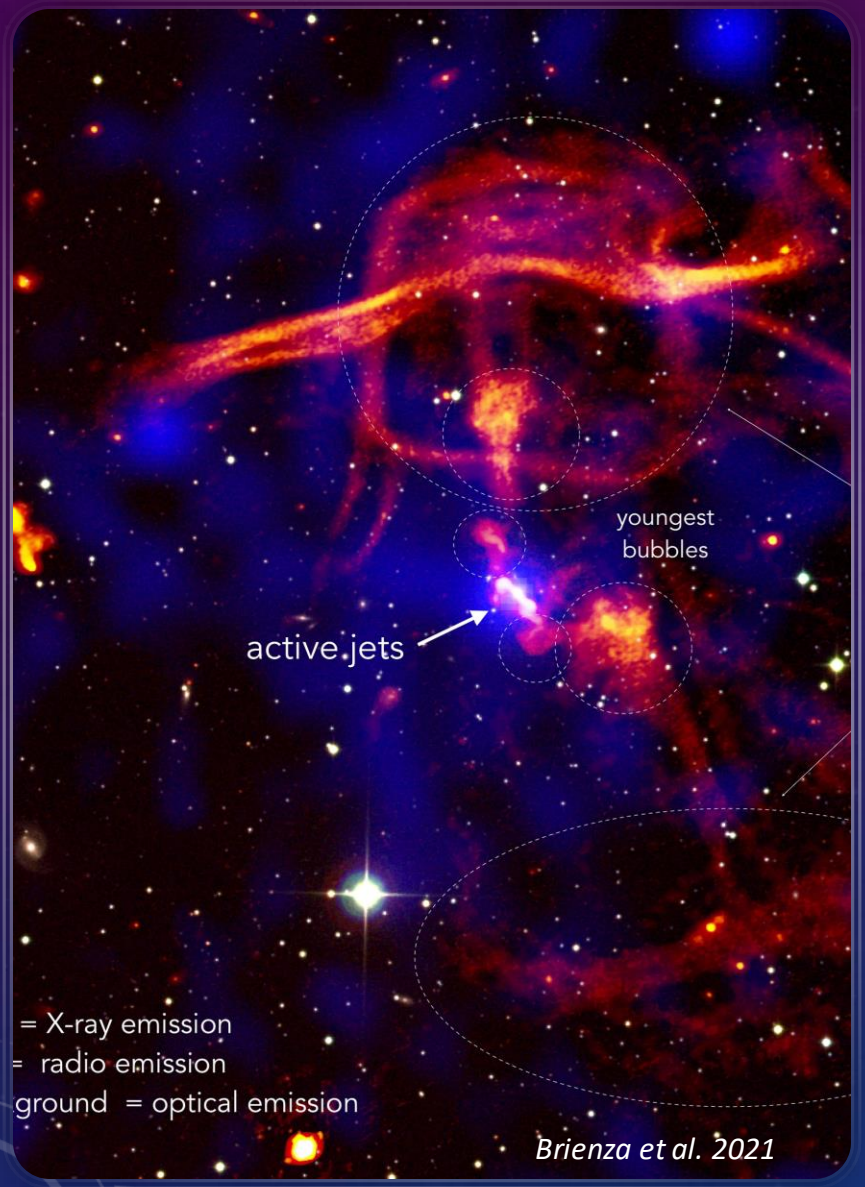
REMEMBER THE LIMITS……

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