



EUROPEAN ARC  
ALMA Regional Centre || Italian



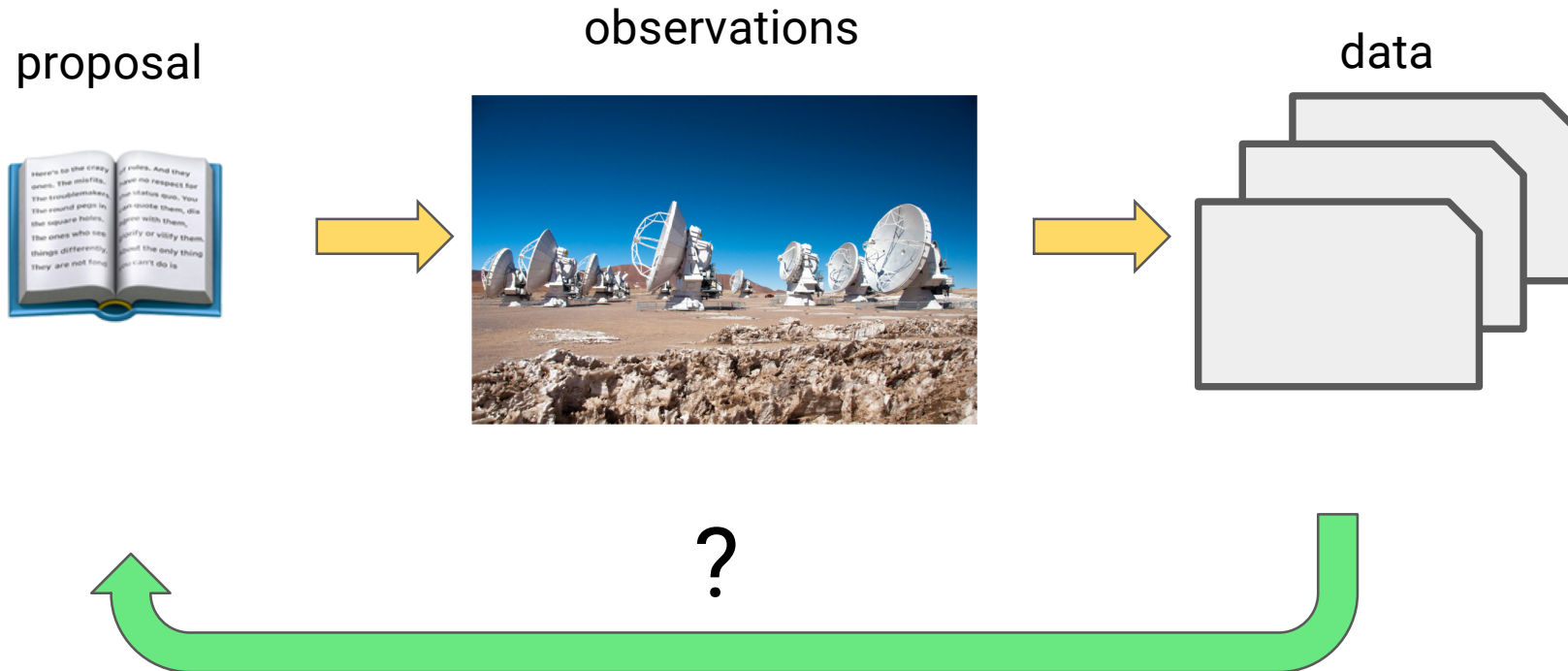
## Part III

# ALMA Simulations



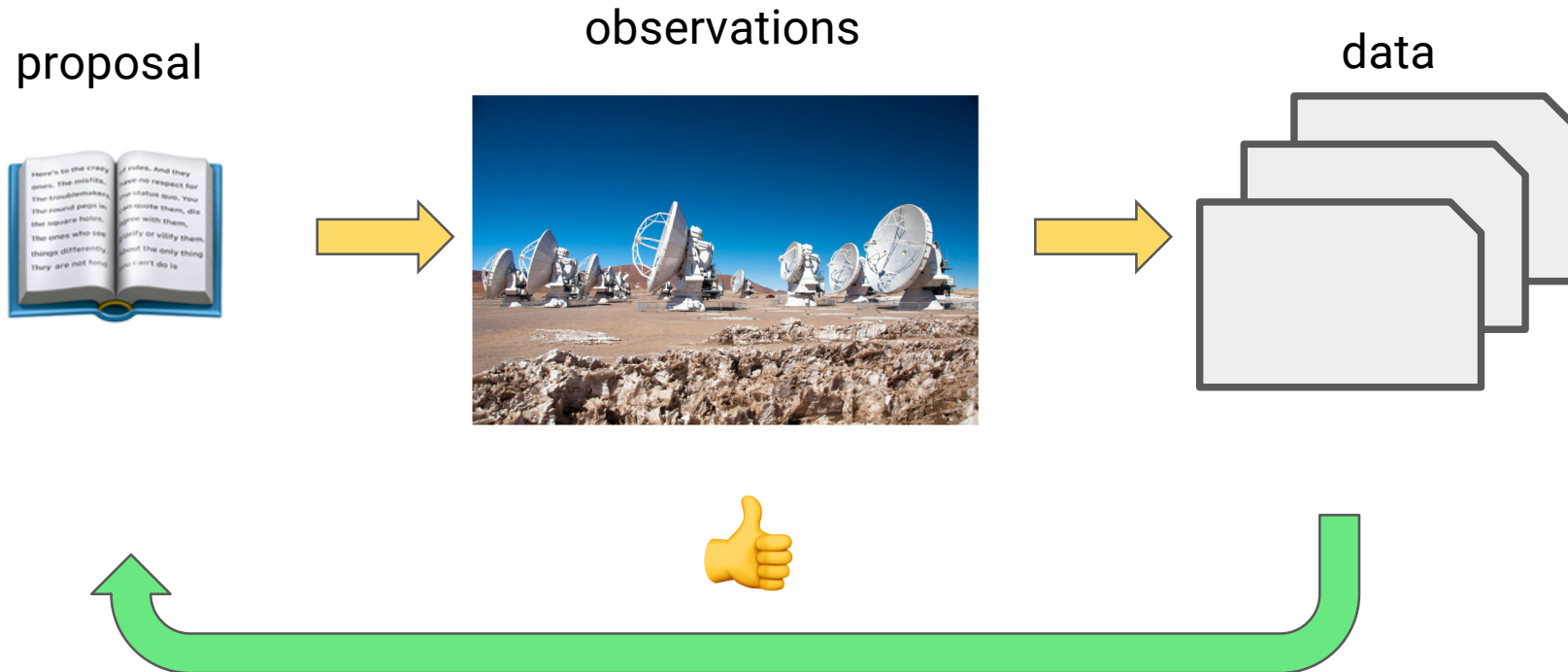
Photo credit C. Malin (ESO)

# Simulate to test the feasibility of your proposal



Simulations help testing the feasibility of the reaching your science goals  
with the observational setup chosen

# Simulate to test the feasibility of your proposal



Provide evidence that your science goals are achievable with the observations proposed strengthens your proposal!

# Interferometry: a matter of scales

Synthesis array is 'blind' to structures on angular scales both smaller and larger than the range of fringe spacings given by the antenna baseline (B) distribution.

## FOV

$$FOV = \frac{\lambda}{D}$$

## Resolution

$$\theta_{res} = \frac{\lambda}{B_{max}}$$

## Maximum scale observable

$$\theta_{MRS} = \frac{\lambda}{B_{min}}$$

## and sensitivity

$$\sigma = \frac{T_{sys}}{A_{eff} \sqrt{N(N-1) \Delta\nu \tau}}$$

**T<sub>sys</sub>** = System temperature;  
**A<sub>eff</sub>** = Effective area;  
**N** = Number of antennas;  
**Δν** = Band- /channel width;  
**τ** = Observing time;

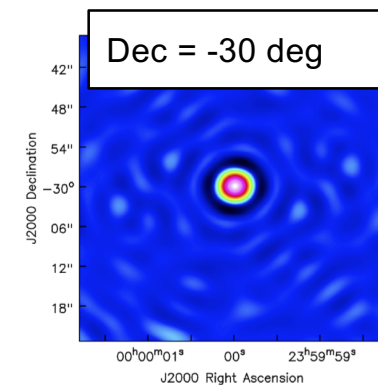
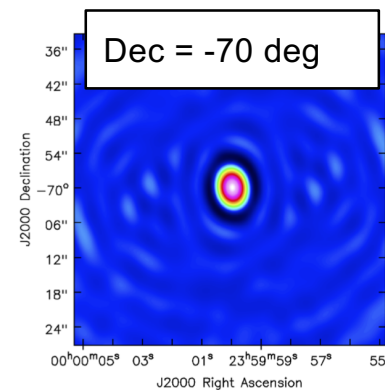
If you have any problem to set any of these quantities please contact us  
[help-desk@alma.inaf.it](mailto:help-desk@alma.inaf.it)



# Important parameters for simulating ALMA observations

## A model of your source (FITS image)

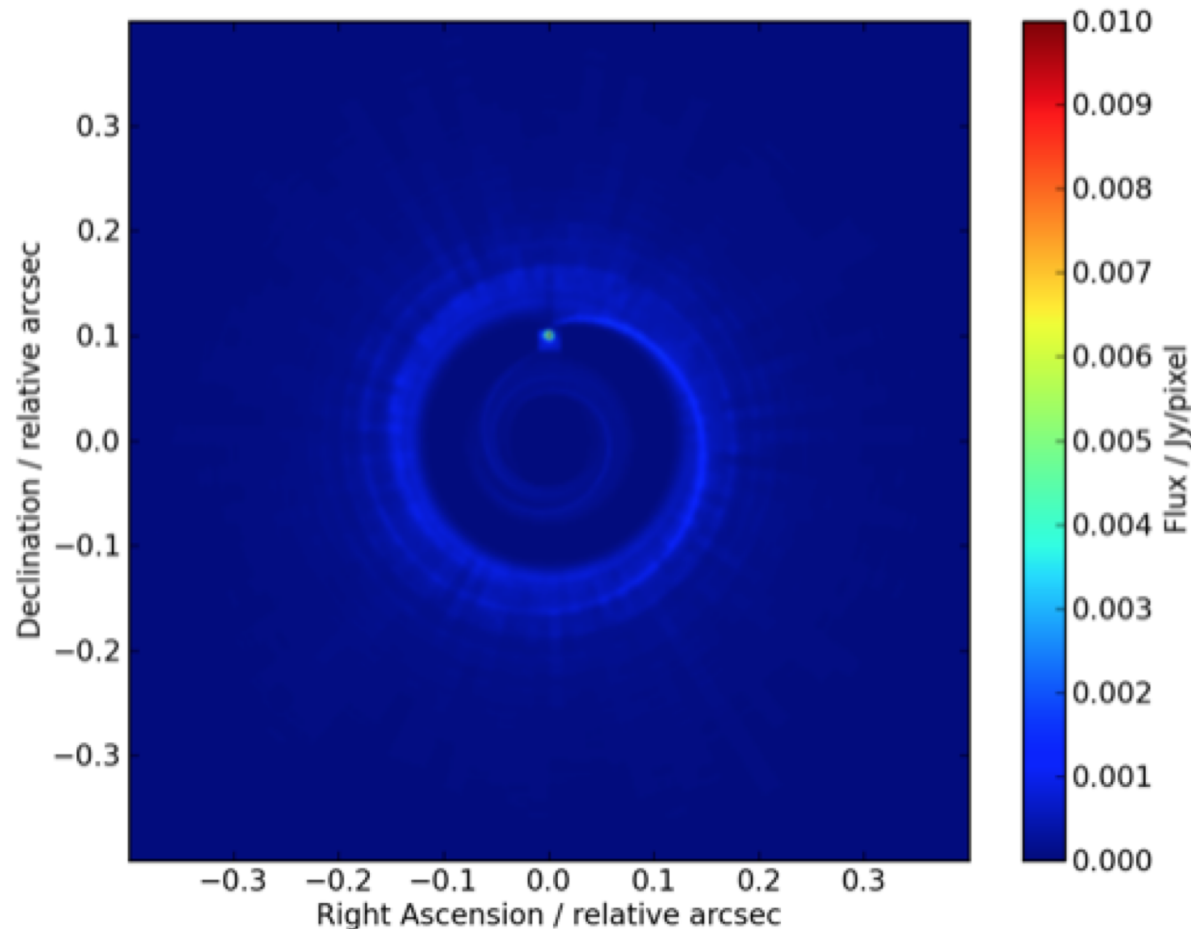
- Peak brightness in units Jy/pixel
- Target coordinates (Declination)



## Parameters to explore (not exhaustive)

- Array configuration >> angular resolution & MRS
- Observing Frequency >> angular resolution & MRS
- Time on source >>  $uv$  coverage
- Noise corruption (e.g., PWV)

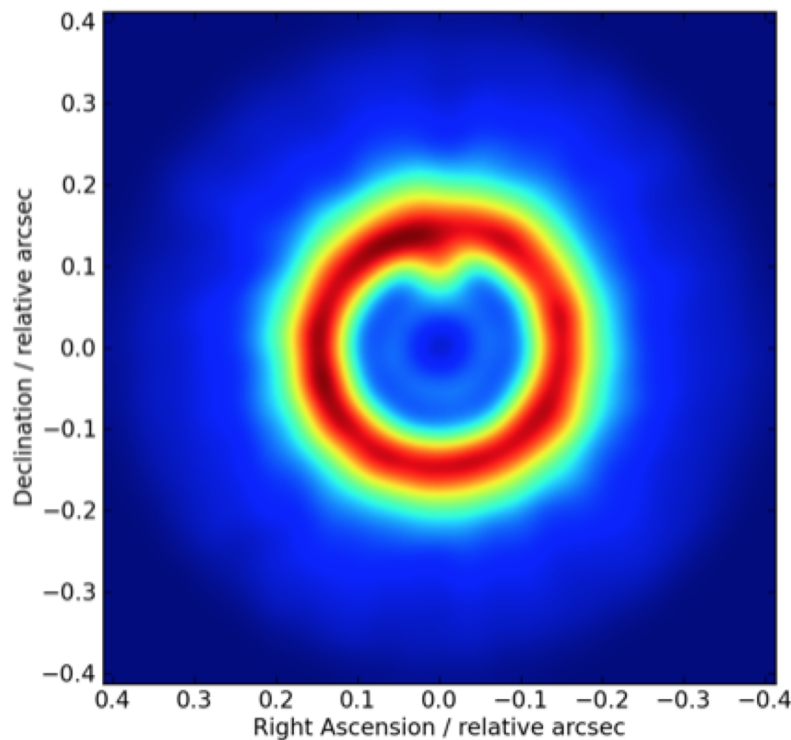
# Examples of parameters to explore via sims



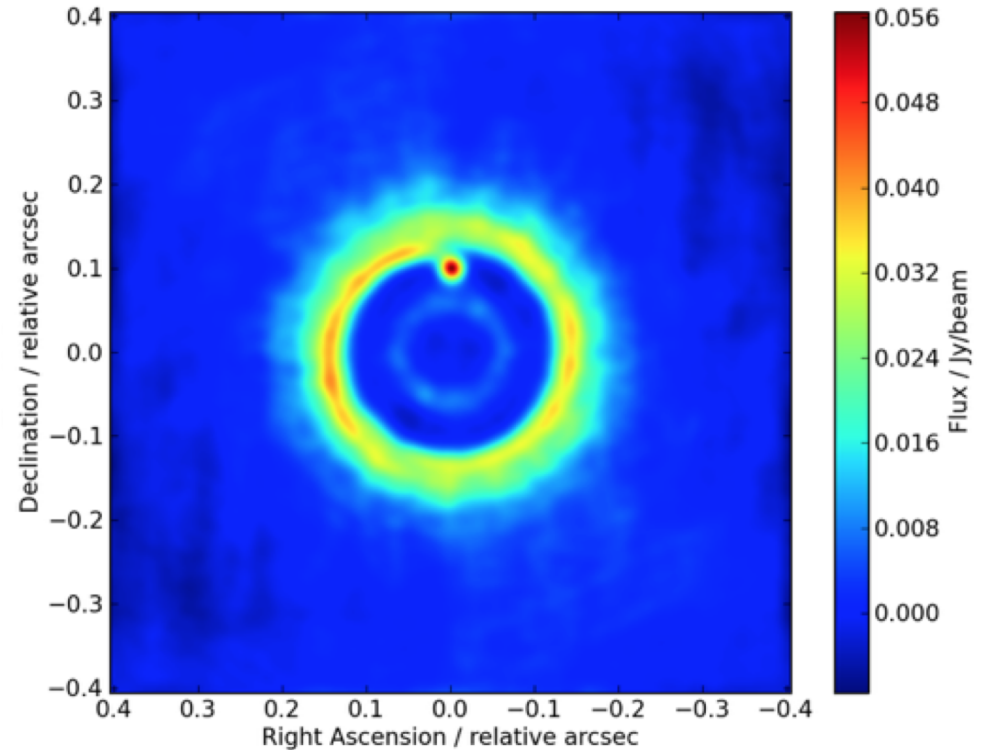
Protoplanetary disk simulation from Wolf & d'Angelo (2005) taken from the ALMA Observation Support Tool, see also the CASA Guide on simulations

# Test the array configuration

Observe the source for 100 min at 230 GHz (band 6) with arrays



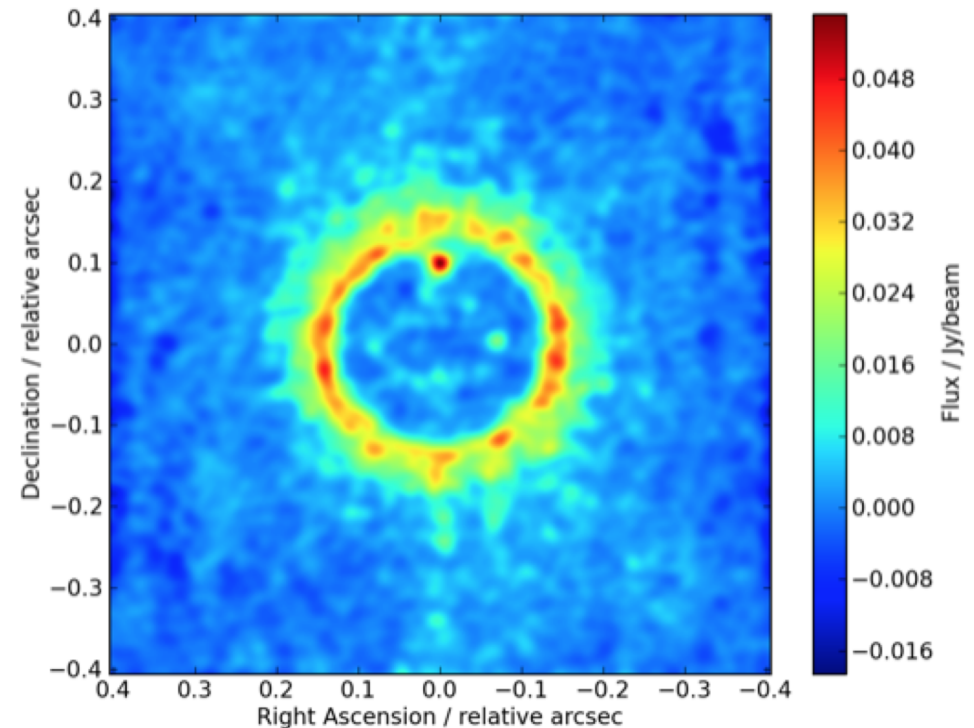
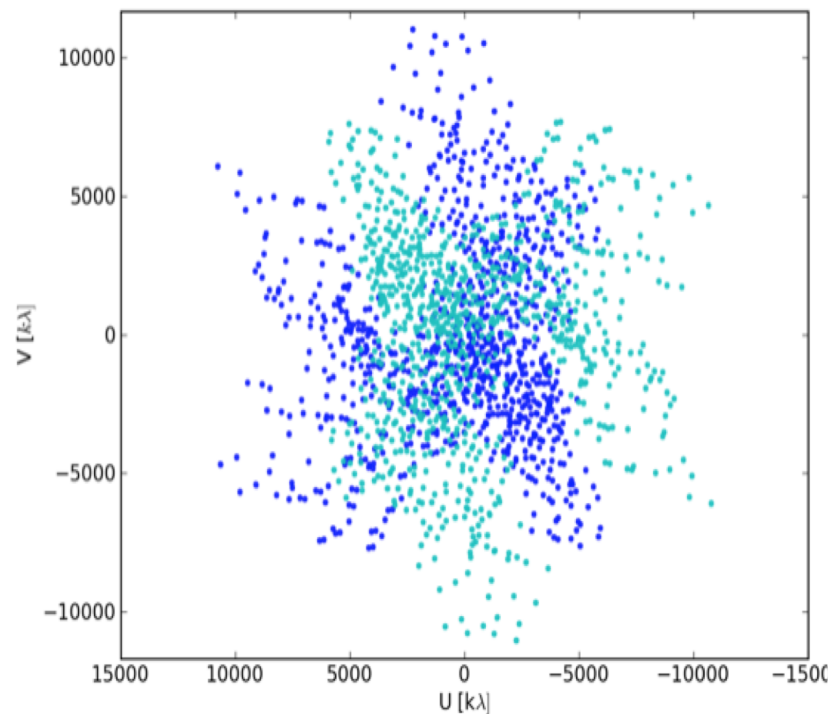
C43-8 ( $\theta = 0.054'' \times 0.058''$ )  
max baseline = 8548m



C43-10 ( $\theta = 0.021'' \times 0.024''$ )  
max baseline = 16194m

# Test the *uv*-coverage

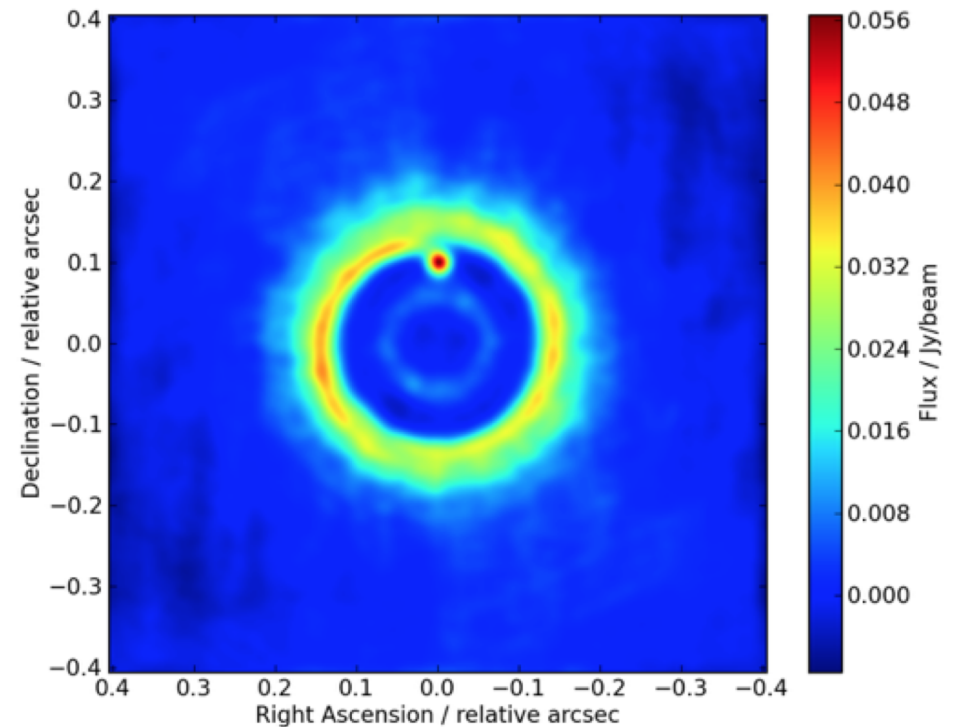
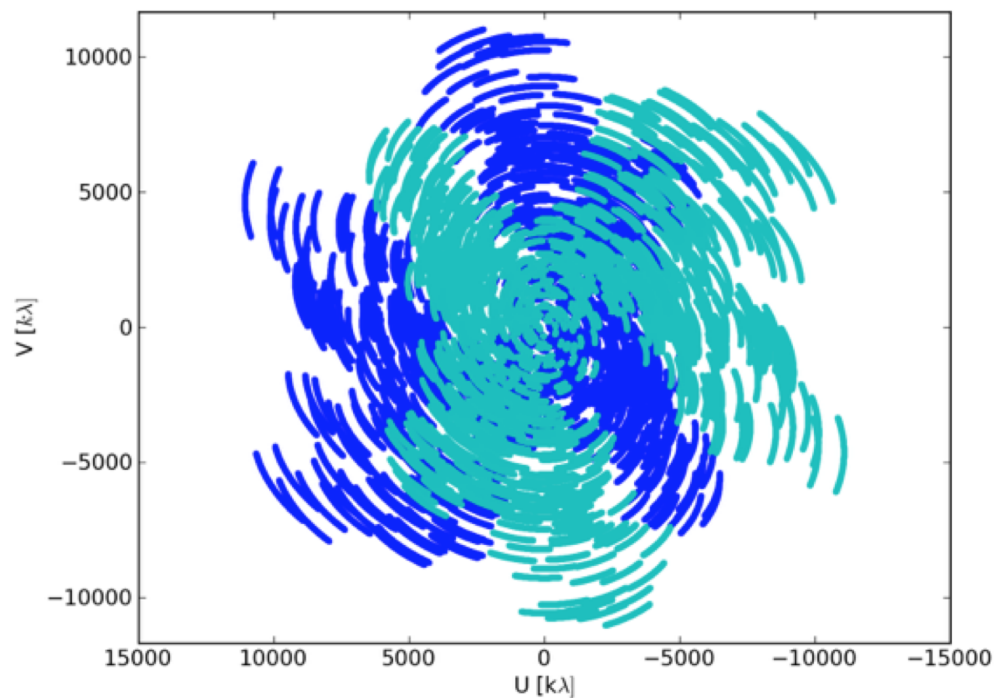
Observe the source for 1 and 100 min at 230 GHz (band 6) in C43-10  
**1 minute:**



Get your time on source from the sensitivity calculator or OT!

# Test the *uv*-coverage

Observe the source for 1 and 100 min at 230 GHz (band 6) in C43-10  
**100 minutes:**




👉 Get your time on source from the sensitivity calculator or OT!




# How to simulate ALMA observations?





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ALMA Observation Support Tool

Version 9.0

OST NEWS HELP QUEUE LIBRARY ACKNOWLEDGE ALMA HELPDESK

OST User Notice: Version 9.0 release - 24/03/2022 !!! (more info). OST Team

Array Setup:

Instrument:

Select the desired ALMA antenna configuration.  
Full ALMA means the simulations will be done with the full capabilities ALMA will achieve in the future (e.g. observing with 50 antennas, or Band 10 Configuration 10 observations); some of these may not yet be offered in the current cycle.  
Selecting cycle-specific configurations will simulate the capabilities of ALMA in that cycle, and therefore some observations might be restricted (you will be notified if this is the case). Please, refer to the [ALMA documentation](#) for each cycle capabilities.

Sky Setup:

Source model:

Choose a library source model or supply your own.

Upload:  No file selected.

You may upload your own model here (max 10MB). This must be a FITS file with the extension .fits included in the name of the file, e.g. model.fits.

# CASA Simulator tasks



## Guide To Simulating ALMA Data

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### Contents [\[hide\]](#)

- 1 Introduction: About this Document
- 2 Why Simulate ALMA Observations?
  - 2.1 A Note Regarding Use of ALMA Simulations in your Proposal
  - 2.2 Background Information for Those New to Interferometry
- 3 Sample Simulations
- 4 ALMA Simulation Tools
- 5 The OST
- 6 CASA simulation tools

Many tutorials on simulating ALMA data available in the CASA Guides:

[https://casaguides.nrao.edu/index.php/Guide\\_To\\_Simulating\\_ALMA\\_Data#ALMA\\_Simulation\\_Tools](https://casaguides.nrao.edu/index.php/Guide_To_Simulating_ALMA_Data#ALMA_Simulation_Tools)

# ALMA Observation Support Tool (OST)

**ALMA Observation Support Tool**

Version 9.0

OST NEWS HELP QUEUE LIBRARY ACKNOWLEDGE ALMA HELPDESK

OST User Notice: Version 9.0 release - 24/03/2022 !!! (more info). [OST Team](#)

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On-line easy-to-use simulation tool (also used for the sims in this presentation)

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

# ALMA Observation Support Tool (OST)



## I-TRAIN #5: Simulating ALMA Observations with the OST

11 March 2021, 11:00 CET

### Materials:

- <http://almaost.jb.man.ac.uk/>
- [presentation slides](#)
- [YouTube video](#)

Tutor: Adam Avison

I-TRAIN tutorial on the ALMA Observing Support Tool (#5) available

<https://almascience.eso.org/tools/eu-arc-network/i-train>

Questions?