ALMA simulators for Cycle 1

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The use of simulators

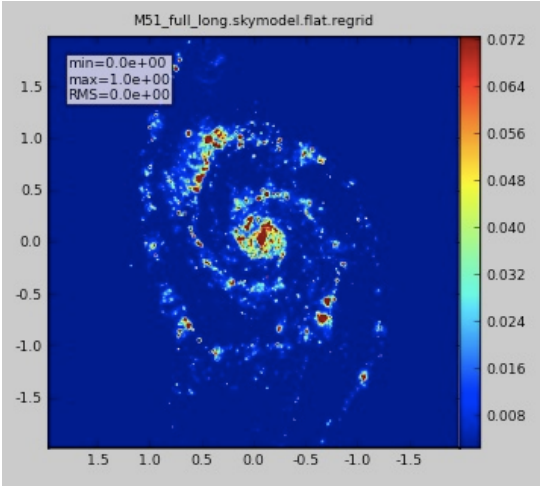
Proposers can use simulations to test their science case:
- can I do this with ALMA ? Do I need the ACA ?
- can I already do this during Cycle 1 ? Should I ?
- how to optimize my science goal ?

PIs can use simulations to interpret their (Cycle 0) data

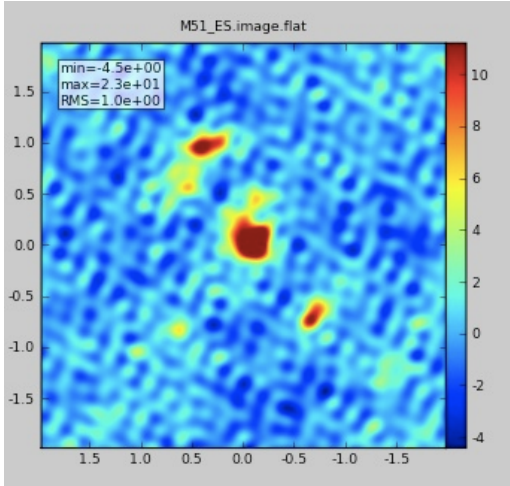
The simulation tools are also used by **the ALMA project** itself

Nearby galaxy (ALMA band 9)

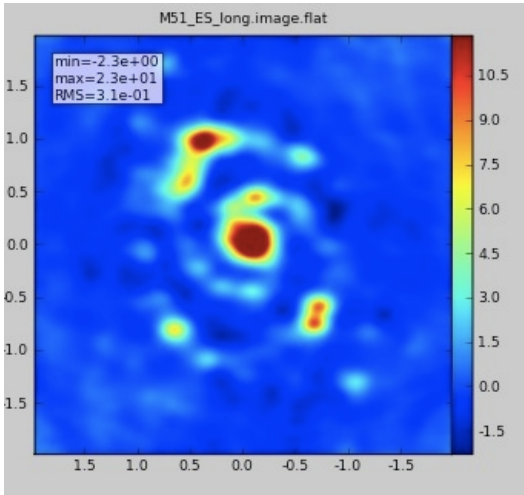
An H-alpha image of M51
provided by D. Thilker (NRAO)



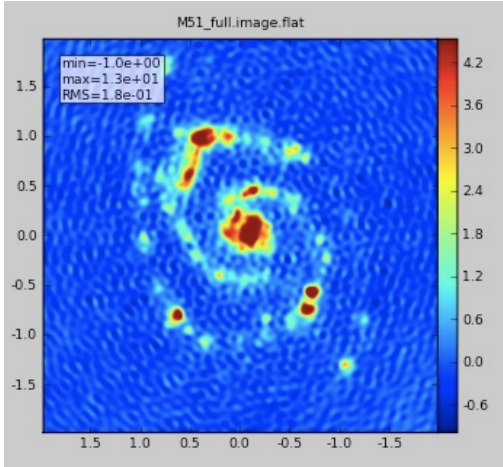
Skymodel



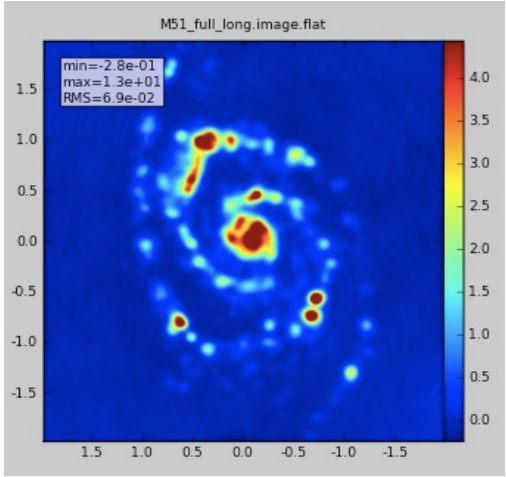
ES (30 min)



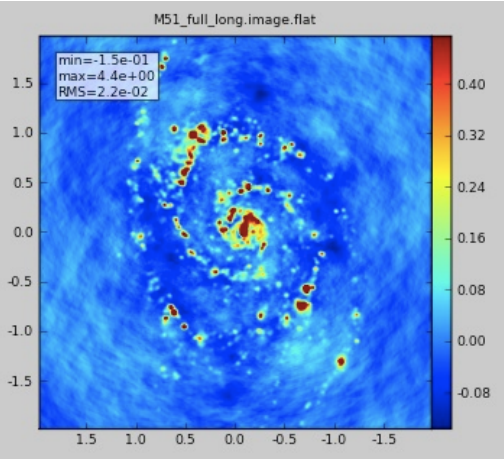
ES (4h)



Full 2 km array (30 min)



Full 2 km array (4h)



Full 6 km array (4h)

As it was for Cycle 0

Expert users: simdata (part of CASA)
Novice users: OST (webtool hosted by the UK ARC)

simdata is a CASA ***task*** used to produce mock ALMA data from an input sky model (theoretical model or previous observation).
The main work is done by the sm ***tool***: the simdata task (a Python script) is a user-friendly interface to this tool with additional work done on plotting and analysis

The OST (Observation Support Tool) is a webtool that also uses the sm ***tool*** underneath the hood, but is much simplified (hence faster) and restricted, with a website acting as a simple GUI to set parameters and run the simulation

Main changes for Cycle 1

In CASA 3.3*, simdata* has been split into two parts: *sim_observe* and *sim_analyze,* although *simdata* is still there too (for the time being ...)

In CASA 3.4, these have been renamed *simobserve* and *simanalyze,* and Cycle 1 antenna configuration have been included in the release

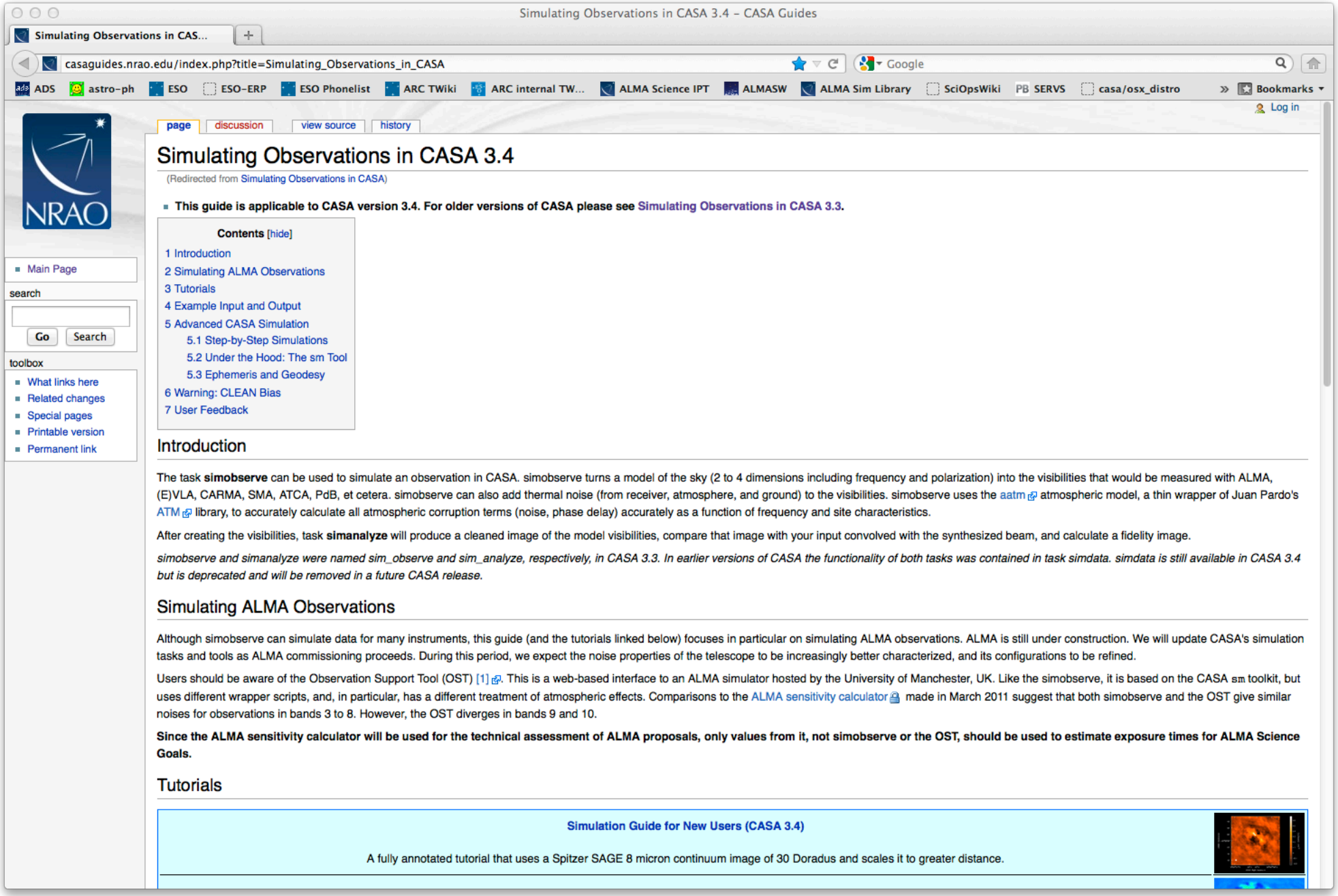
- *simobserve* produces the mock data, but does not run *clean* or any image analysis
- *simanalyze* runs *clean* on the mock data and analyses the resulting images
  (including a comparison to the input model)

Maptype 'ALMA' included, to mimic what the Observing Tool (OT) does.

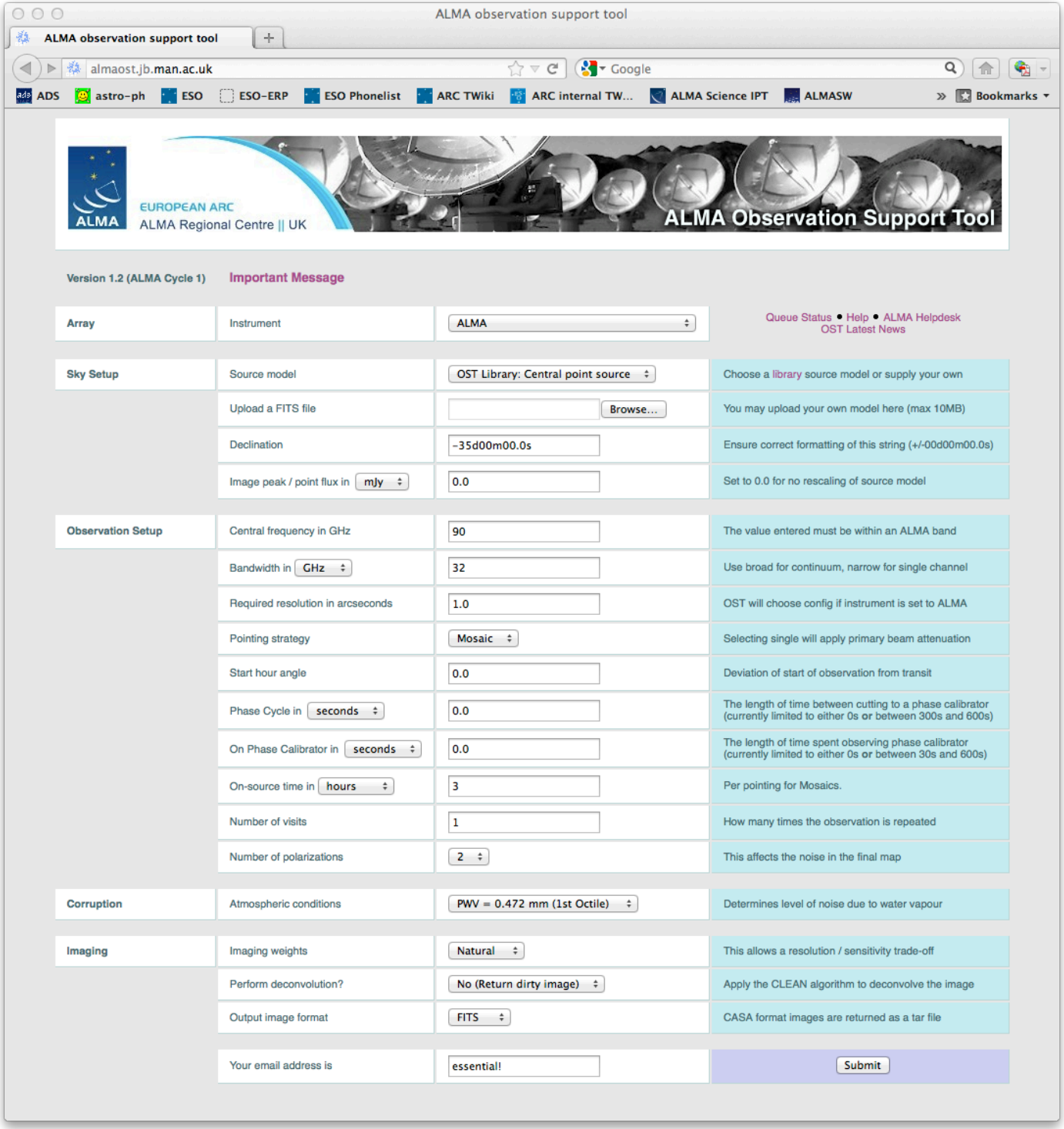
Much more help text in CASA.

Various other changes (filenames, etc.)

on-line guide to simulations using CASA

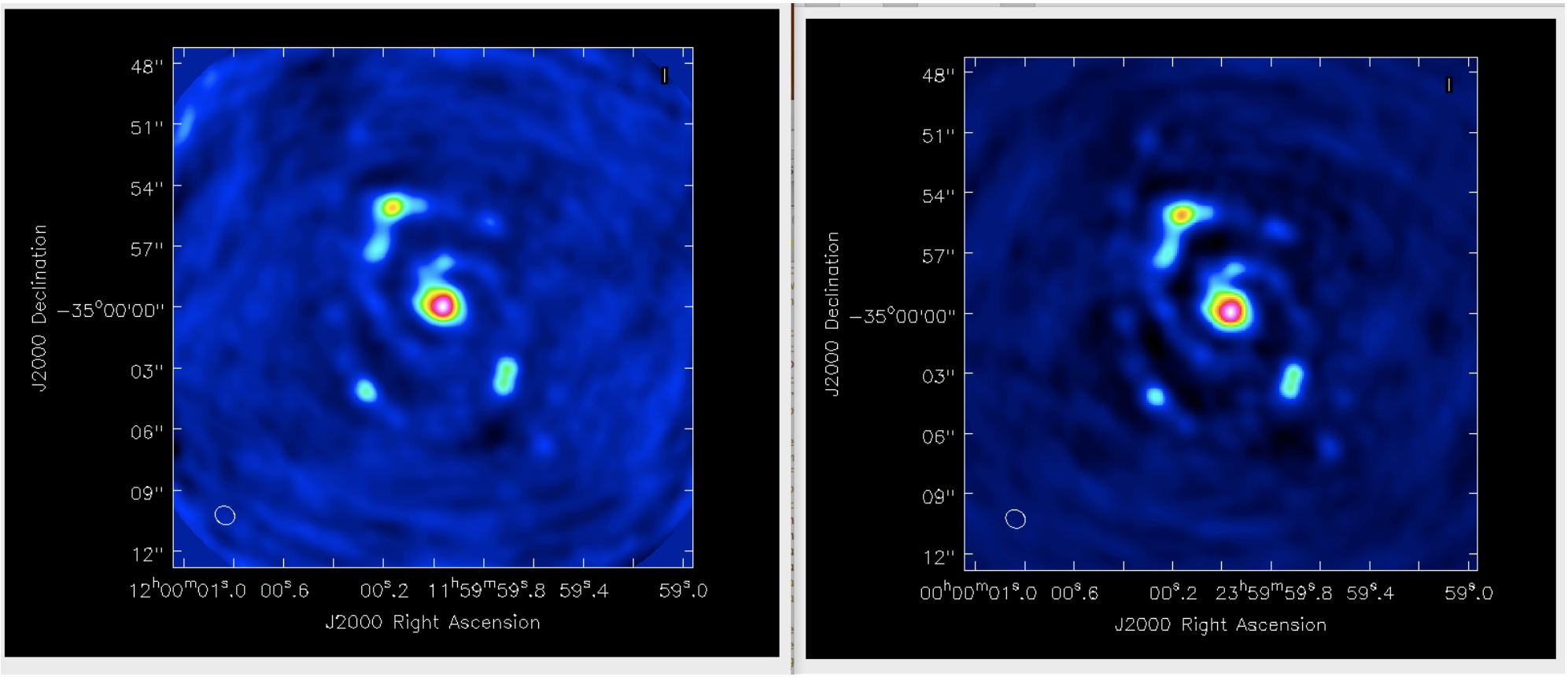


The OST (Observation Support Tool)



simobserve versus OST: images

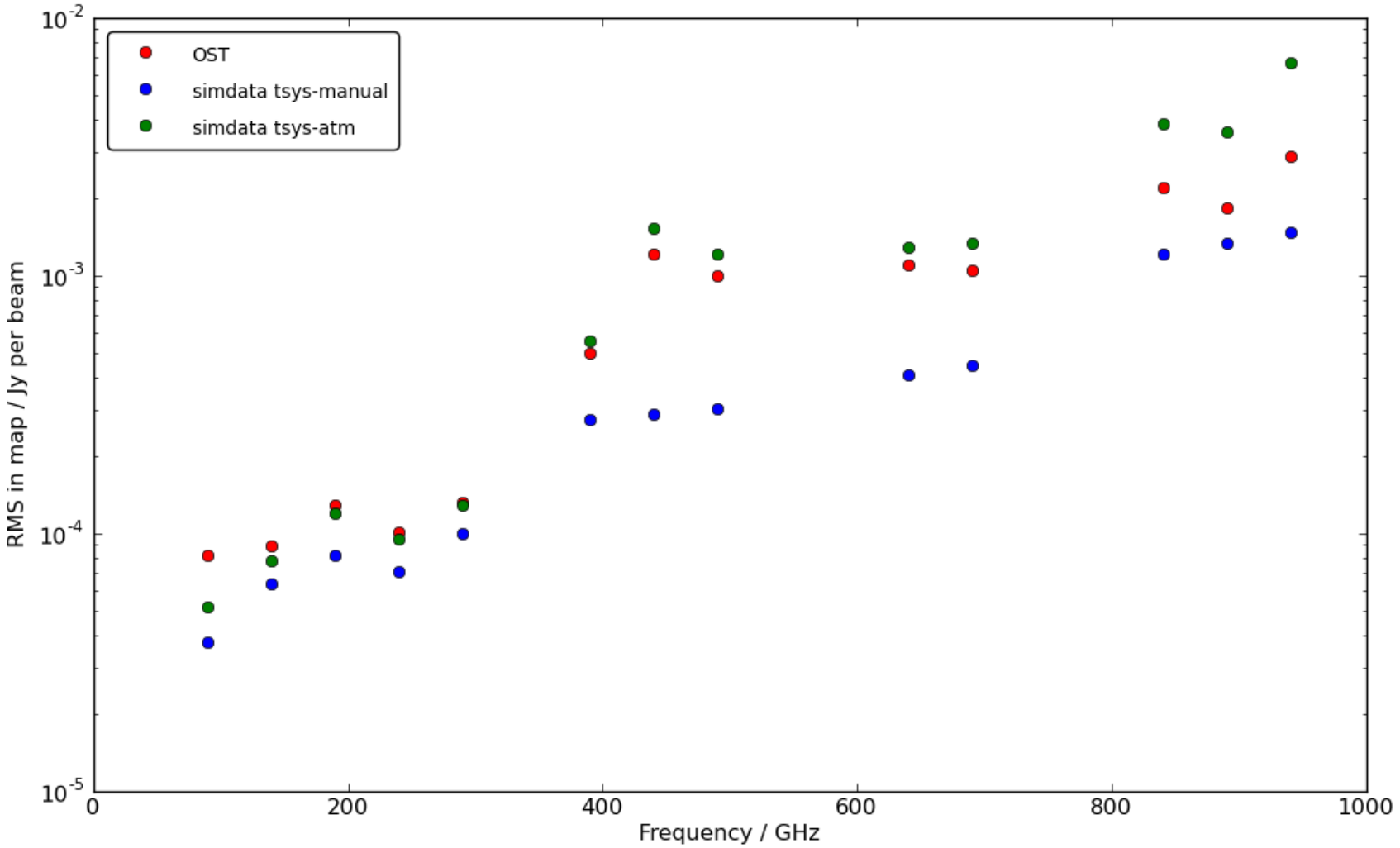
simobserve OST



M51@z=0.5, Early Science configuration, band 6

simobserve versus OST: noise levels

rms noise comparison for all ALMA bands (using pure noise maps)



ALMA+ACA+TP

Deconvolving the predicted visibilities back into an image

Many ways of doing this, including:

1) use the total power image as a model when deconvolving the ACA image, and then use the result as a model when deconvolving the 12m interferometric image (this tends to give low weight to the large spatial scales)

2) use multiscale clean, in the clean task (again using the lower resolution image as a model when deconvolving the higher resolution one)

3) create each image independently, and then use the CASA feather task to combine them entirely in the image plane

Note for proposers

In general, because the ALMA Sensitivity Calculator (ASC) will be used for the technical assessment of ALMA proposals, only values from the ASC should be used to estimate exposure times in ALMA proposals.

Representative Cycle 1 antenna configurations are included in CASA 3.4 and the OST, but the actual configuration could differ somewhat when the observation is scheduled.

Plan for simulator tutorials tomorrow

- Introductions to simobserve and the OST, plus an interferometry introduction for the ‘novice group’
- Running specific examples (including your own models), with six tutors at hand
- The ‘novice group’ session will focus a bit more on the OST, the ‘advanced group’ more on simobserve, but both will be covered during each session
- How to include the ACA in your simulations