NOTE: These demo notes assume that you have installed the latest version of the GILDAS package. This is available at

http://www.iram.fr/IRAMFR/GILDAS/

Demo:

[Launch X11]

cd simulator
mapping

[hit control-c and enter cont if necessary to unjam the graphics window]
[click MAPPING - ALMA Simulator in the window interface]
[hit control-c and enter cont if necessary to unjam the graphics window]
[arrange windows as necessary]

(You set up a simulation by choosing a model image which you will observe)

[ensure that Input model file is set to /usr/local/gildas/demo/m51ha.gdf]

(In this case, we have taken an H-alpha optical image of the spiral galaxy M51 which we will take as a millimetre wave source)

(We can choose what sort of observation we are making - The ALMA 64 antenna system ("ALMA"), the ACA 7 metre interferometric array ("ACA"), the ACA 12 metre total power array ("SD"), or various combinations of more than one array mosaiced together)

(For this first run, we choose ALMA only)
[choose ALMA only]

[choose Observation Setup - Parameters]

(In the observations setup, we can override the declination and size of our model source. In this case, we move M51 to the southern hemisphere at -23 degrees declination and shrink the image size to 15")

[check that Change Declination is set to Yes, New declination is -23, Change image size is Yes, and New image size is 15 15]

(If you wish, you can explicitly define a rectangular mosaic size and orientation, and choose whether the field centres are packed hexagonally (Circular or rectangular shape is No) or rectangularly (Yes). If you don't, the simulator will decide, based on your image size, how many fields use. In our case, one field only will be observed by ALMA)

(We then choose the observing frequency, in our case 230 GHz, and the bandwidth, say 8000 MHz (the simulator can handle only one input image at a time so it is effectively a continuum observation))

(The observing time for ALMA is defined by the hour angle range for the observation. We choose -0.15 to 0.15 as the hour angle range for our observations.

[press Dismiss]
[press Configuration Setup - Parameters]

(In the array configuration setup, we can choose the type of configuration for the ALMA and ACA 7 metre arrays. For ALMA you should use zoom. Available configurations are a, b, bc, c, d, and e, which correspond to the compact array (150 m) and zoom arrays of size 300 m, 600 m, 1 km, 1.4 km, and 2.8 km. For our observations we choose zoom c, i.e. 600 metre maximum baseline)

[choose Configuration name c]
[choose Dismiss]

(The simulator allows the user to include the effects of observing conditions. In the Pointing Errors menu, you can choose the type and size of pointing errors. We will assume no wind or thermal pointing errors, and choose random pointing errors of 0.6")

[choose Error model - Random and pointing errors 0.42" 0.42"]
[press Dismiss]
[press Amplitude conditions - Parameters]

(Here we add in the sources of amplitude errors. Let us include only thermal noise)

[select Add thermal noise to ALMA - Yes]
[select Dismiss]
[select Phase conditions - Parameters]

(We can set atmospheric phase error, WVR use, and anomalous refraction here. For simplicity let's not apply any of these)

[select Dismiss]
[select Deconvolution setup - Parameters]

(Here we choose the mosaicing and deconvolution methods and parameters, which we will leave alone)

[select Dismiss]

(We're ready to go. Press COMPUTE to run the simulation)

[press COMPUTE]

(The simulator first displays the original model image and then calculates the uv coverage, calculates phase and amplitude errors, creates visibilities with pointing errors, applies the error gains, creates and displays the dirty map. It then does the CLEANing and produces the final deconvolved image)

(The final display includes, for comparison purposes, the original model image smoothed to the interferometer resolution (TLC), the simulated image (TRC), the difference between these two (BLC), and a fidelity image (BRC))

(The fidelity image is the inverse of the fraction error in the simulated image. A fidelity of 20 is a 5% error, and a fidelity of 100 is a 1% error)

(The graph on the right gives the cumulative distribution of fidelity across all of the image pixels, i.e. the number of pixels which have fidelities above a certain value. At the bottom of the plot is the median fidelities calculated for pixels whose intensity in the original model is above a specified percentage of the peak model intensity)

[select Display results - Parameters]

(The resolution of this image is 0.35". Only 86% of the total image flux was recovered by the ALMA interferometer on its own, and the median fidelity above 1% of the model peak is 17, i.e. 6% relative error. To obtain higher fidelity imaging at the same resolution, we need to incorporate ACA and /or single dish data)

(Let's include ACA total power data)

[select Simulation kind - ALMA+SD]
[select Pointing Errors - Parameters]

(Let's use the same pointing errors for the ACA)

[choose Error model - Random and pointing errors 0.42" 0.42"]
[press Dismiss]
[press Amplitude conditions - Parameters]

(Here we add in the sources of amplitude errors. Let us include only thermal noise)

[select Add thermal noise to SD - Yes]

[select Dismiss]
[select COMPUTE]

(The fraction of recovered flux has increased to 93%, showing that the single dish data has improved the recovered fraction of the total source power somewhat. More importantly, the image fidelity has improved - the median fidelity above 1% of the model peak is now 26, i.e. a relative error of 4%. Including the ACA would improve it further, but that particular simulation seems to run unreliably on my laptop, so let's go back to the slides)