Single dish observation simulator, sdsim

➢ Preliminary task available in R3.0

➢ The task is based on existing functions of simulator (sm) tools + modifications of MS for single dish data analysis package (ASAP).

- observation mode: currently only on-source pointed observation in hexagonal grid
- noises: T_{atm}, T_{CMB}, τ_0 using sm.setnoize()…not working ?

➢ 'Calibration' & 'analysis' steps are not implemented yet

sdsim: Input parameters

Trying to be in similar shape with simdata...but

```
#   sdsim :: single dish simulation task:
modelimage           = 'M31_128.im'        #  input image name
modifymodel          =          True        #  modify model image WCS or flux scale
    refdirection     = 'direction'          #  reference direction (CRVAL): "J2000
                                            #   19h00m00 -40d00m00" or "direction"
                                            #   or "header"

    refpixel         =      'center'        #  reference pixel (CRPIX): "[100,100]"
                                            #   or "center" or "header"

    incell           = '5.0arcsec'          #  pixel size: "0.1arcsec" or "header"

inbright             =    'default'         #  set peak surface brightness in Jy/sq
                                            #   arcsec or "default"

antennalist          = 'aca.tp.cfg'         #  antenna position file
antenna              =           '2'        #  antenna ID
project              = 'simsd.M31_128'      #  root for output files
refdate              = '2008/09/22/00:00:00' #  center time/date of observation
                                            #   *see help
integration          =         '10s'        #  integration (sampling) time
startfreq            =      '100GHz'        #  frequency of first channel
chanwidth            =        '1MHz'        #  channel width
nchan                =            1          #  number of channels
direction            = ['J2000 00h00m00 -20d00m00'] #  center of image, or list
                                            #   of pointings

pointingspacing      = '1.0arcmin'          #  spacing between pointing
relmargin            =          0.5         #  space btw. pointings and edge,
                                            #   relative to pointingspacing

cell                 = '4.0arcsec'          #  output cell/pixel size
imsize               = [256, 256]           #  output image size in pixels (x,y)
stokes               =          'I'         #  Stokes params to image
noise_thermal        =          True        #  add thermal noise
    t_atm            =        300.0         #  atmospheric temperature
    tau0             =          0.3         #  zenith opacity

verbose              =          True
async                =         False        #  If true the taskname must be started
                                            #   using sdsim(...)
```
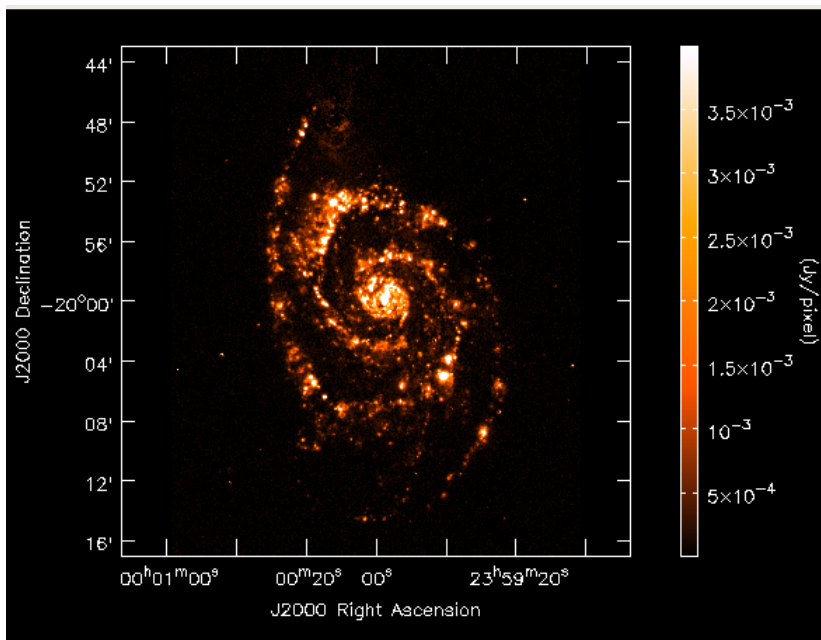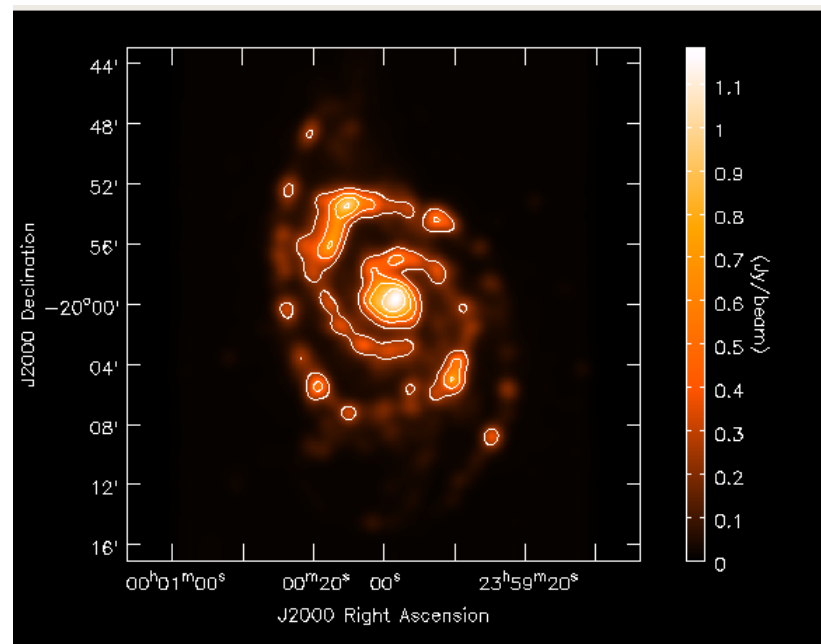
sdsim: a simulation example (w/o noise)

Model image (modified)

Simulated image (ALMA ACA)

Data manipulation
Frequency :100GHz (1MHz width band),
Resolution: 2 arcsec/pix,
Img center: J2000 00h00m00 -20d00m00
Peak intensity: 0.01 Jy/pix

Antenna: ACA02
Obs date: 2008/09/22 00:00:00
Integration: 1sec
Pointing spacing: 0.5 arcmin

Overview of future developments
(from a meeting with EA-ARC Scientists)

My first priority is developing functions to enable standard observing mode of ALMA (ACA total power antennae), i.e.,
1. Pointing observations in grid
2. On-The-Fly (OTF) observations
3. Calibration with nutator
4. Frequency switching observations (w/ and w/o OTF)

Also, efficient testing procedures are needed.

It is very important to implement various errors into the simulator, but most of them are common with synthesis simulation and I know Remy is working hard to develop them.

Important deadline for single dish simulator is 2010 Q3 (R3.2). Development for ALMA early science observations (begins in 2011 Q3) should be completed by the time.

Developments list

1. Enable calculating lattice grid point for pointing observations and enable setting off-source data using STATE table.
2. Develop tools for On-The-Fly observations (AZ-EL scan, proper scan number settings)
3. Add calibration and image analysis steps to sdsim
4. Enable loading existing single dish data as a template Measurement Set
5. Be sure all the necessary meta data and table data is generated for scantable, MS, and ASDM
6. Establish efficient testing procedures.
7. Calibration with nutator
8. Frequency switch observation
9. Enable simulating sequential observation
10. Merge sdsim to simdata.

In future…

1. Various scan patterns for OTF observation
2. Compare simulation result, e.g., observation w/ and w/o nutator or ACA
3. Multi-beam observations

Anything else?