README MoD_AbS

The software models a uniform disk with flat rotation curve. It extracts the integrated absorption line from the region of the disk in front of the continuum source. The parameters defining the disk are specified the ASCII file par.txt. The modelled spectrum is overlaid with the observed spectrum. An image is saved.

mod_abs.py can be called from terminal with the following command:

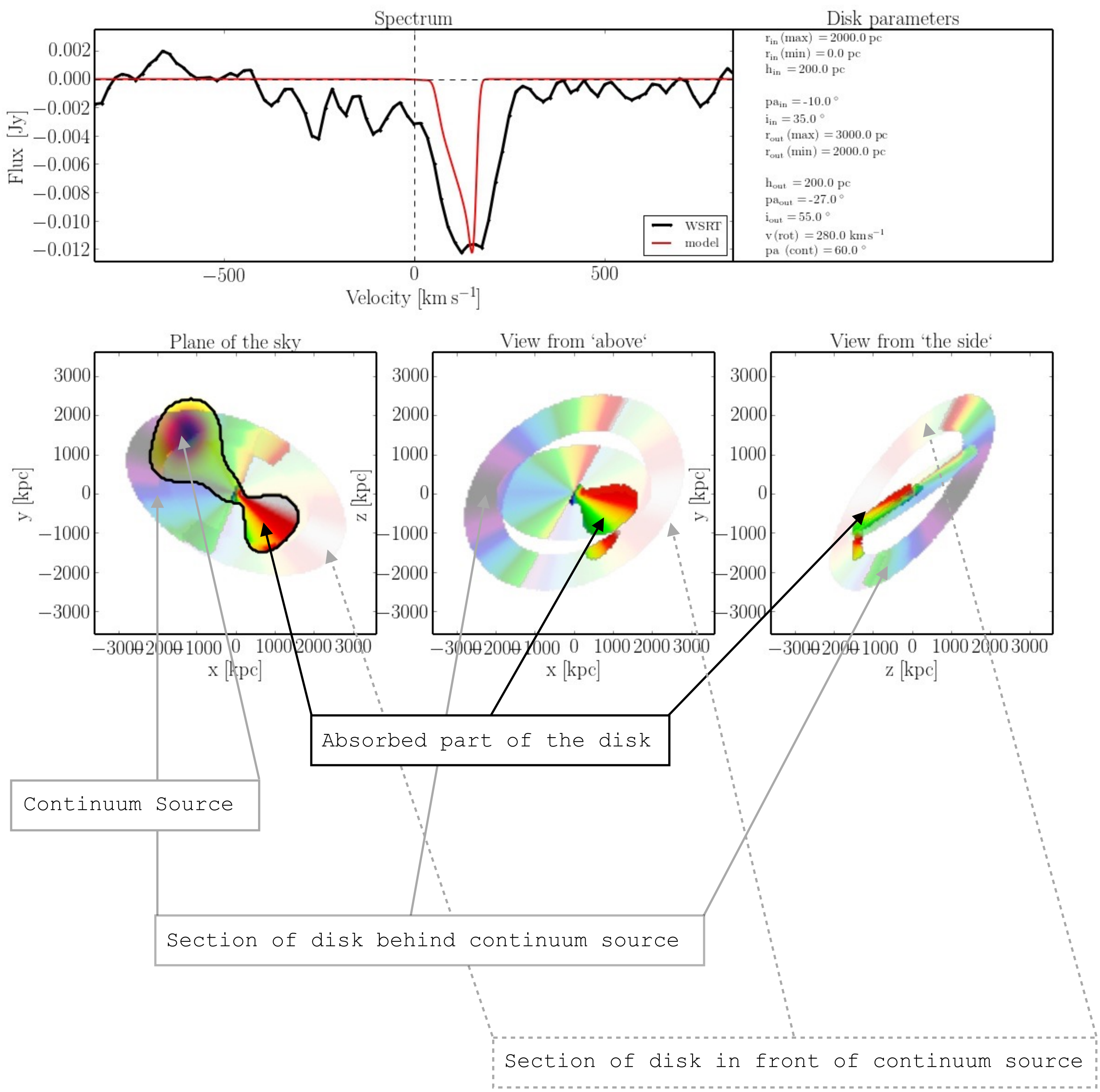
```
 >> python MoD_AbS.py 3c305/par_3c305.txt 3c305/3c305.fits 3c305/spec_3c305.txt
```

all input files files directory 3c305/ which is where MoD_AbS.py is.

```
spec_3c305.txt =  observed spectrum
                  ASCII file, 2 columns : frequency[Hz]     flux[Jy]
```

As output, a directory /output_3c305/ is created. There the images are saved.

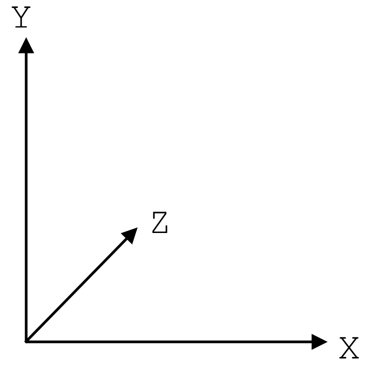
```
OUTPUT IMAGE = spec_I_PA.jpg

               # images with different PA or I are saved in different files
```



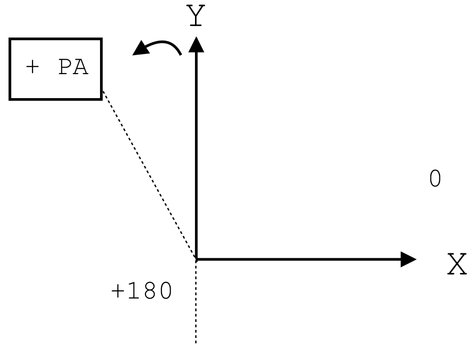
```
########################     PARAMETER FILE    #########################


### DISK 1 PARAMETERS ###

rmax[pc] =  500.        # Maximum radius of disk 1
rmin[pc] =  200.        # Minimum radius of disk 1
h0[pc] = 200.           # Thickness of disk 1
i[degrees] =+90.        # Inclination of disk 1
pa[degrees] = 0.0       # Position Angle of disk 1


### DISK 2 PARAMETERS ###

rmax_in[pc] =  0.       # Maximum radius of disk 2 — set == 0.0 for only disk 1
rmin_in[pc] =  0.       # Minimum radius of disk 2
h0_in[pc] = 0.          # Thickness of disk 2
i_in[degrees] =  +0.0   # Inclination of disk 2
pa_in[degrees] =  0.    # Position angle of disk 2


### VELOCITY PARAMETERS ###

vrot[km/s] =  100.      # Peak of the flat rotation curve of the disk
sign[-] =  -1.          # Sense of rotation
disp[km/s] =  8.        # Sigma of gaussian for convolution of spectrum
                        # set == velocity resolution of observed spectrum/2.12
vel_res[km/s] =  1.     # Velocity resolution of the modelled spectrum
                        # before convolution

### CONTINUUM PARAMETERS ###

pa_cont[degrees] =  +45.      # Position angle of continuum source
flux_cont_lim[Jy] =  0.130    # Mask for continuum
                              # Absorption only above this flux
                              # Units should be same of continuum.fits units
ra[hms] =  +14:49:21.57       # Coordinates for the center of the disk
dec[dms] =  +63:16:13.78      # in the continuum image
z[-] = 0.041639               # Redshift of the continuum source
d_l[Mpc] = 184.127            # Luminosity distance of the galaxy
                              # scales the continuum source to
                              # the dimensions of the disk
v_sys[km/s] = 12480           # Systemic velocity of the galaxy
                              # converts the spectrum.txt from frequency
                              # to velocities relative to the systemic

### RESOLUTION PARAMETERS ####


pix_res[pc] =  20.      # Spatial resolution of model at cycle 1
                        # before interpolation
pix_res_fin[pc] =  2.   # FINAL SPATIAL RESOLUTION
order[-] = 1            # order of spline for interpolation




***************
The quality of the modelled line and the speed of the software vary depending on
the chosen combination of resolution parameters.
***************
```

COORDINATE SYSTEM

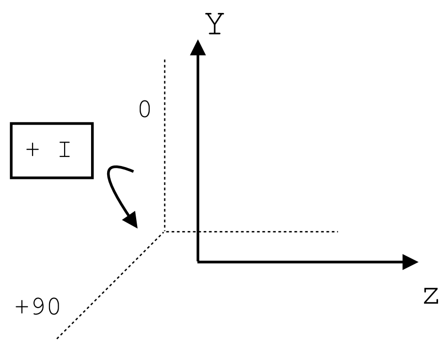
(X,Y) = Plane of the Sky
(X,Z) = View from 'Above'
(Z,Y) = View from 'a Side'



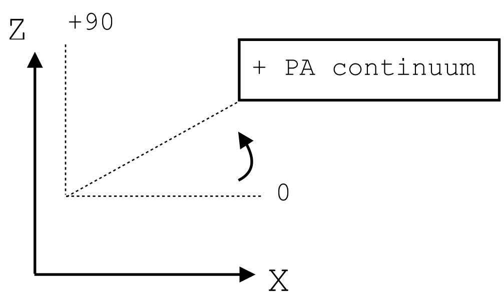
Vary POSITION ANGLE == ROTATION in (X,Y) / axis of rotation = Z



Vary INCLINATION == ROTATION in (Z,Y) / axis of rotation = X



Vary POSITION ANGLE of CONTINUUM == ROTATION in (X,Z) / axis of rotation = Y

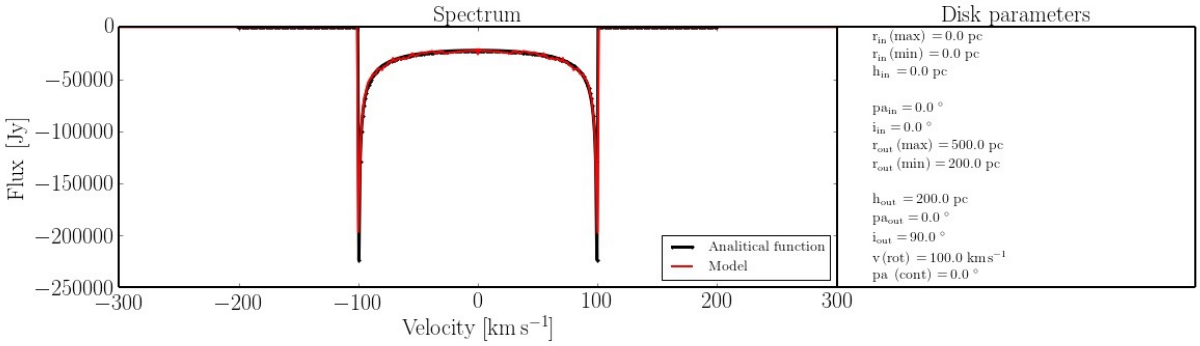


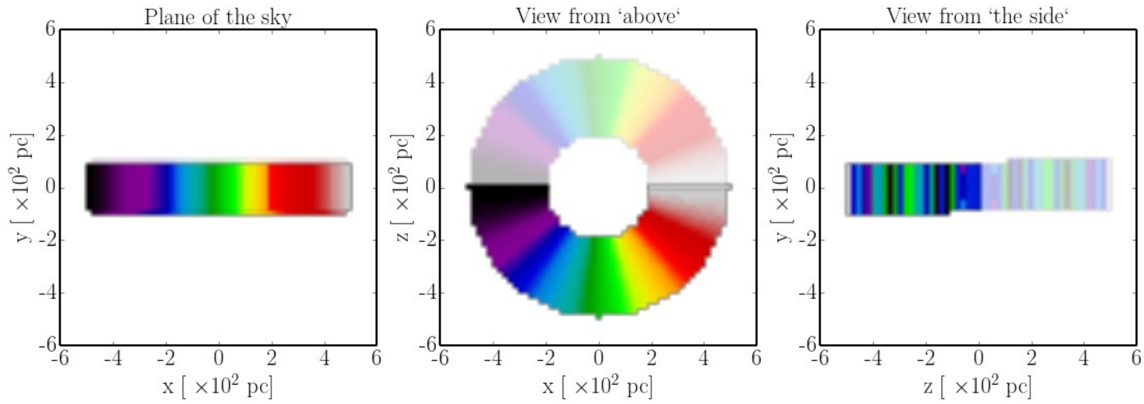
MoD_AbS_examples.py

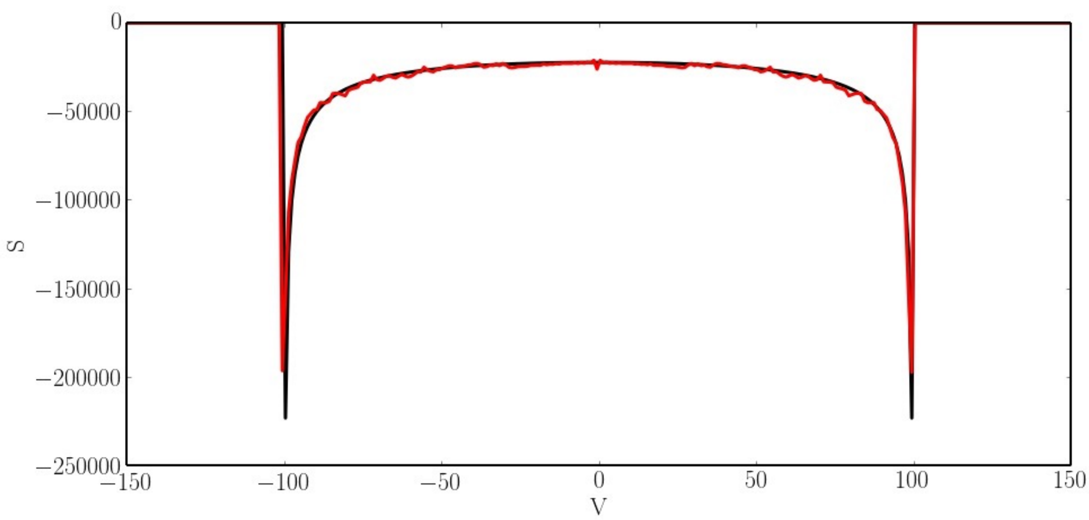
```
#### different cases of uniform absorption of a ring ####

 >> python examples/MoD_AbS_examples.py examples/par_unif.txt
```

#1 - EDGE on RING

```
      We model a RING
            Rout (max) = 500 pc
            Rout(min) = 200 pc

     Inclination Angle of Disk 1:  I = 90°
                                   edge-on disk in the plane of the sky

     [ It is possible to check the quality of the modelled absorption line
     overplaying the absorption line predicted by the analytical function for
     an edge on disk found in Stewart et al. 2014 ]

     — initial resolution: 20 pc
     — final resolution: 2 pc
     — total time: 0.620088 minutes
```

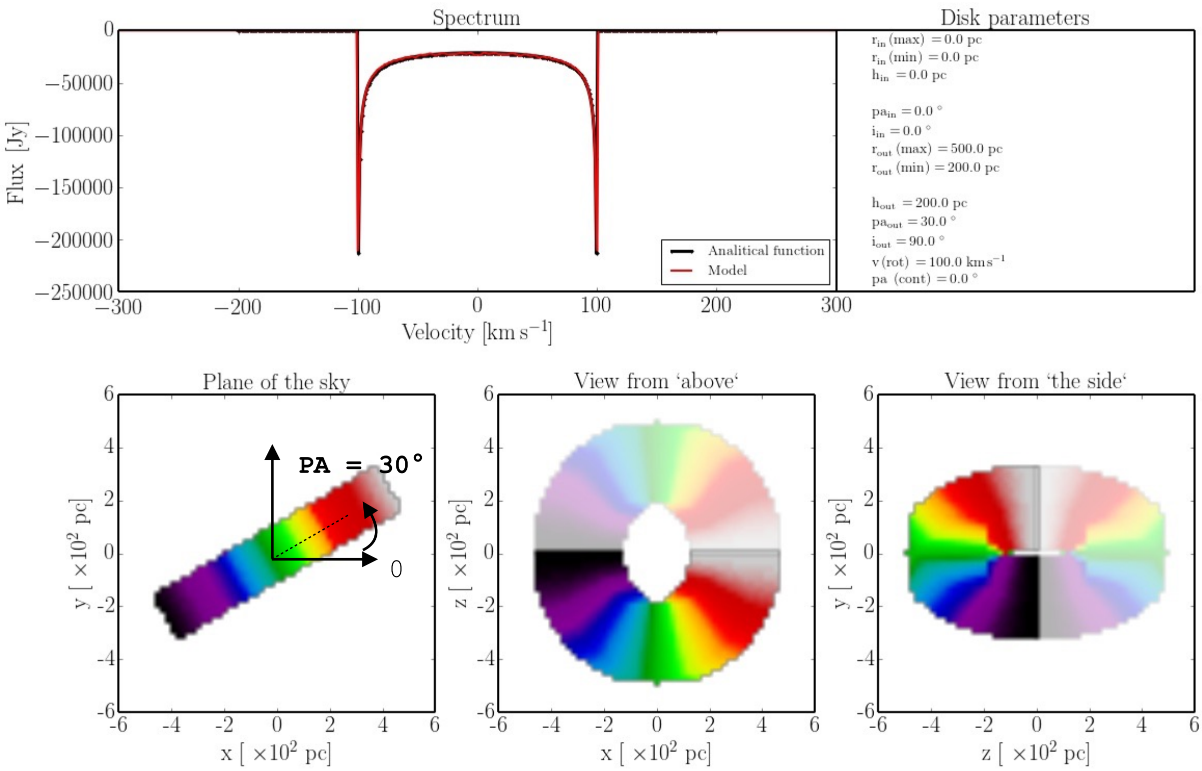






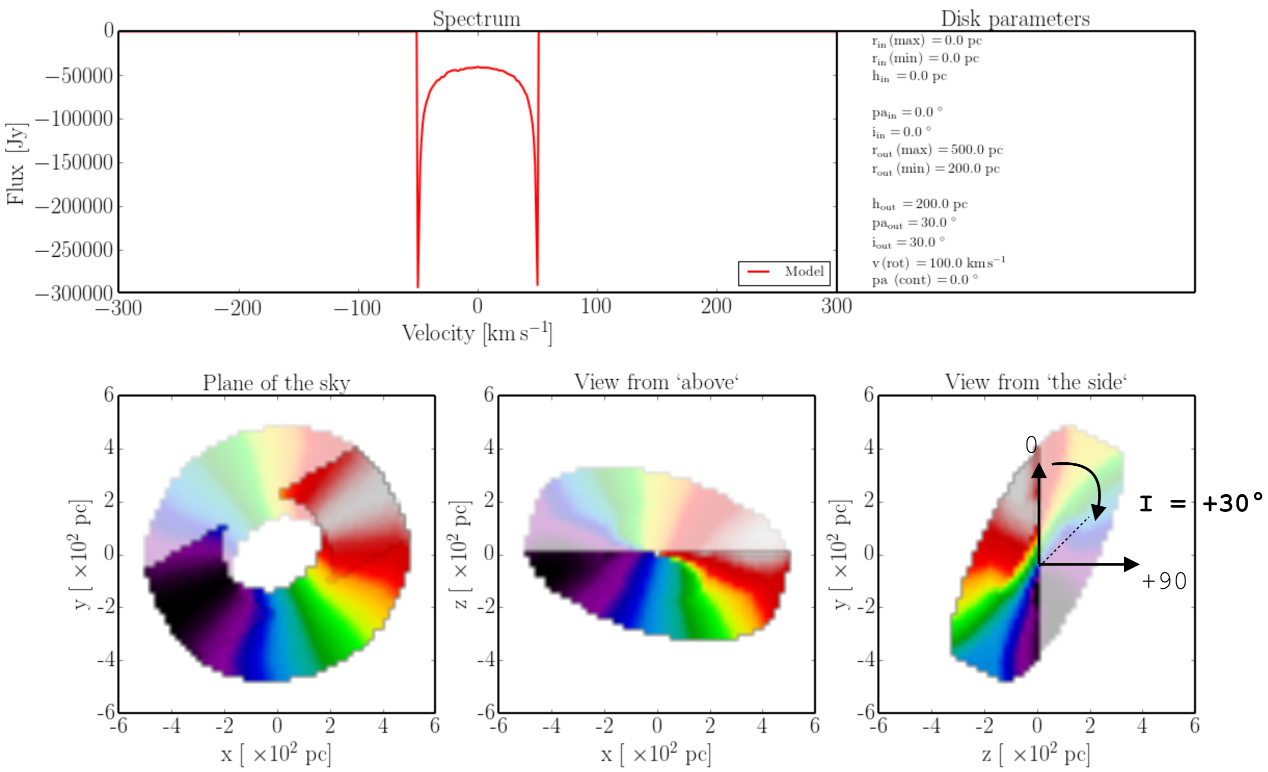
#2 - Rotate PA

With respect to the EDGE on DISK we rotate the disk to a different position angle: **PA = + 30°**



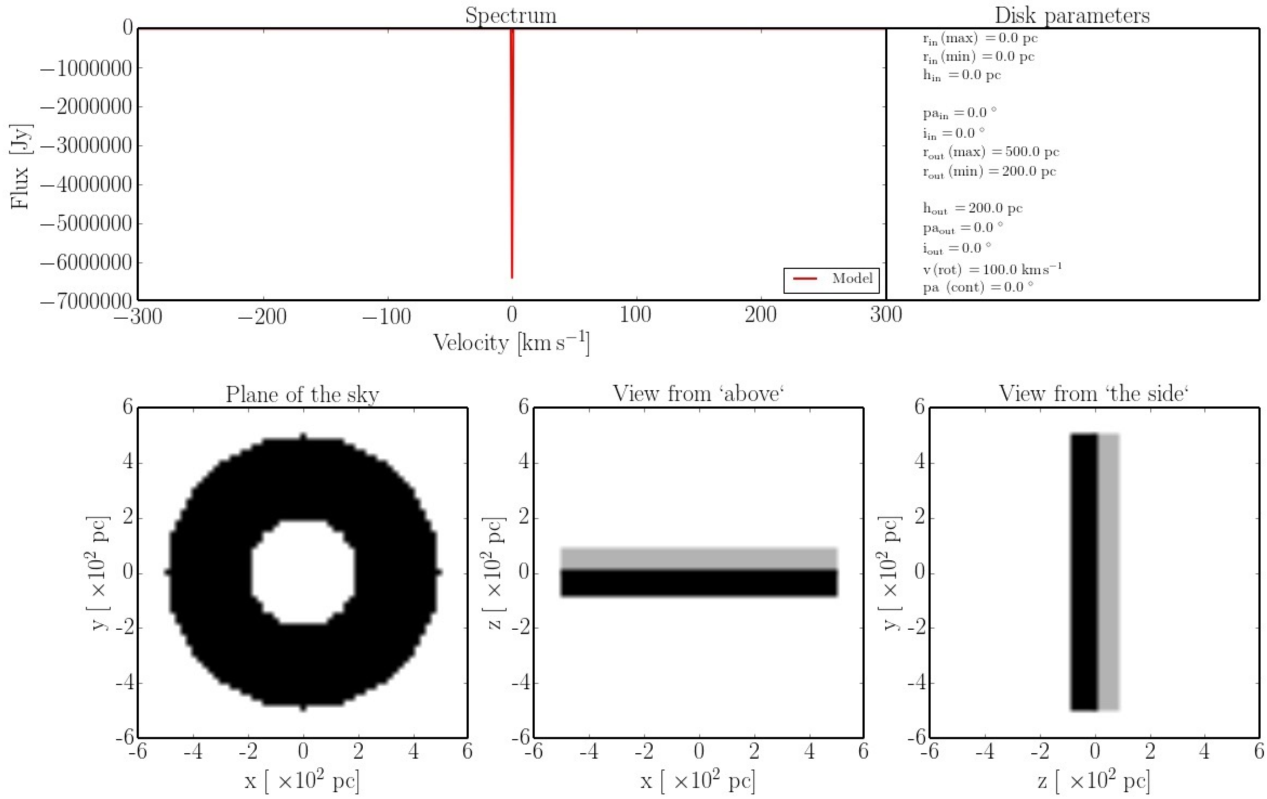
#3 - Rotate I

With respect to #1 we rotate the disk to a inclination: **I = + 30°**



#4 - FACE on RING: I = +90°

— We expect a delta-dirac at the systemic velocity of the source
— Total time: 0.559063 minutes



#5 - Change the Position Angle of the Continuum

With respect to #2 we rotate the plane of the continuum: **PA_CONT = 45°**