Manual for viewimage version 1.0

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1 preparation

1.1 System requirements

- Linux/Mac.
- For mac you need xcode.
- Qt, a cross-platform application framework(version >= 4.8).
- radmc3d.

1.2 Installing viewimage

- Install radmc3d.
- Add /bin/ to your path, if it's not already added.
- Install Qt, which contains the utility qmake.
- open a terminal.
- Goto to the RADMC3D_QT_GUI source directory.
- Run the command qmake -spec linux-g++ for linux and qmake -spec macx-g++ or qmake -spec macx-clang for mac . It will create a makefile in the source directory.
- Run the command make. It will create the RAD.MC3D_QT_GUI-build directory, with an executable file RADMC3D_QT_GUI in it. The directory is created at the same level as the source directory.
- A perl script file named viewimage is created in your /bin/.

1.3 Starting Viewimage first time

In order to run viewimage, go to the examples/run_simple_1/ directory and run the command 'viewimage'.

2 Plot Image

2.1 Initialising GUI

For GUI initialisation, following files must exist:

- Either frequency.inp or wavelength_micron.inp
- Radmc3d's executable-file in the current directory or in the search path.
- One of the amrgrid-files (amr_grid.inp/amr_grid.binp/amr_grid.uinp).

After GUI Initialisation is finished, viewimage can communicate with the radmc3d's executable.

! If GUI was not initialized, because some of the needed files were missing, the existence of the missing files will be checked each time you send a command over button rendering image (1) or rendering spectrum (4), GUI will check the conditions, those are not met to reach initialized state.

! After GUI has been initialized, you can check the existence of the needed files by selecting the first entry of history's menu (18).

2.2 Communication with radmc3d

Viewimage can communicate with radmc3d in two ways: through a pipe or using files. Communication through pipe is more efficient, as only one session of radmc3d is started and waits for commands in background. By using files for communication, each command will start a new session of radmc3d and wait until it's finished.

By Pipe modus GUI will start just one session of radmc3d and radmc3d will wait for commands in background. You can turn the pipe modus on/off at any time during runtime. (6).
Each time you send a command oder viewimage sends a command, a progress bar (26) will be shown and viewimage will wait until radmc3d has finished the calculations

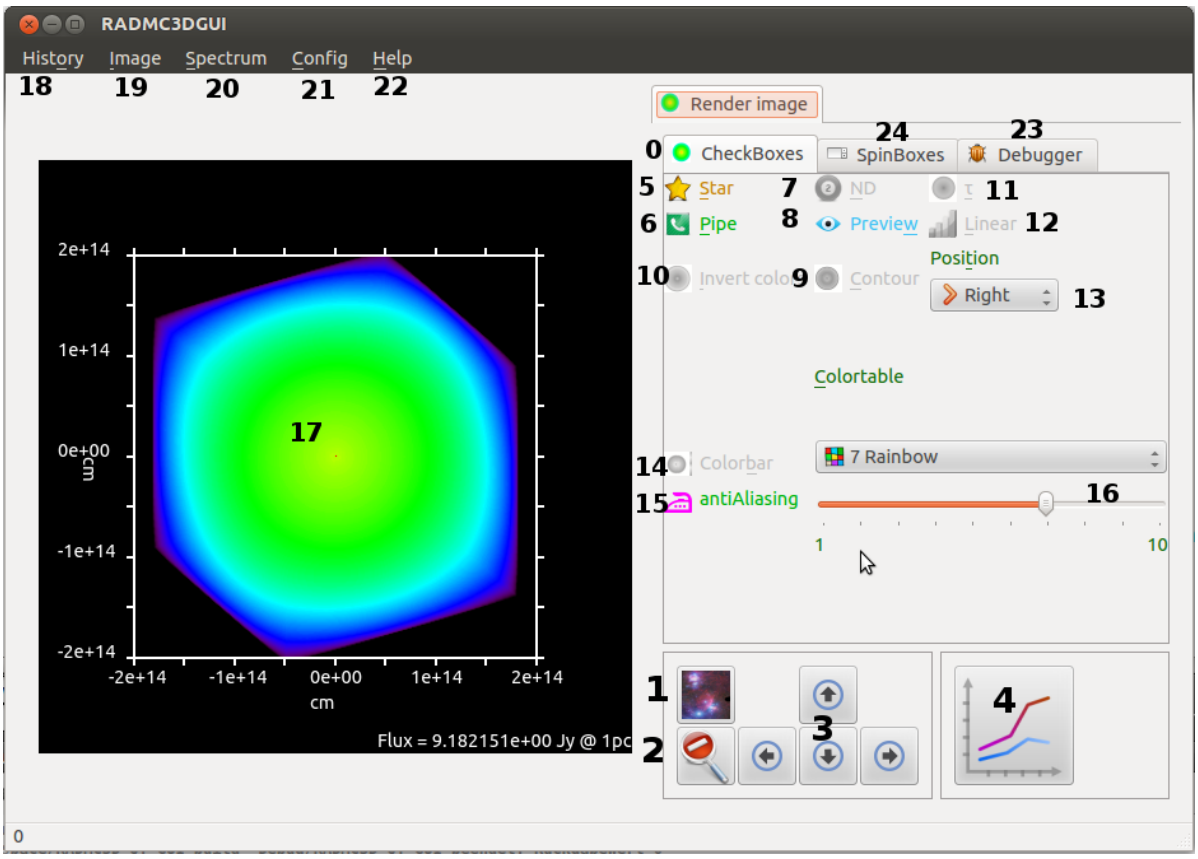

Figure 2.1: indexed color

(communication using files) or until an image/spectrum can be read from pipe (communication through pipe). GUI elements are disabled during calculation.

You can interrupt communication with radmc3d, if viewimage has not begun to read image/spectrum from pipe or viewimage has not ended to read image/spectrum from file. (25).
! If you cancel the command and kill radmc3d in pipe modus, sending the next command will start a new radmc3d session. Sometimes it is recommended to use cancel-button (25), if calculation takes a lot of time and you don't want to wait for result.

2.3 Indexed color-Modus

Pixel value is an index from the image's color table(0-255).You can load your own color table. The color table file should have the extension *.clut and should contain 3 arrays

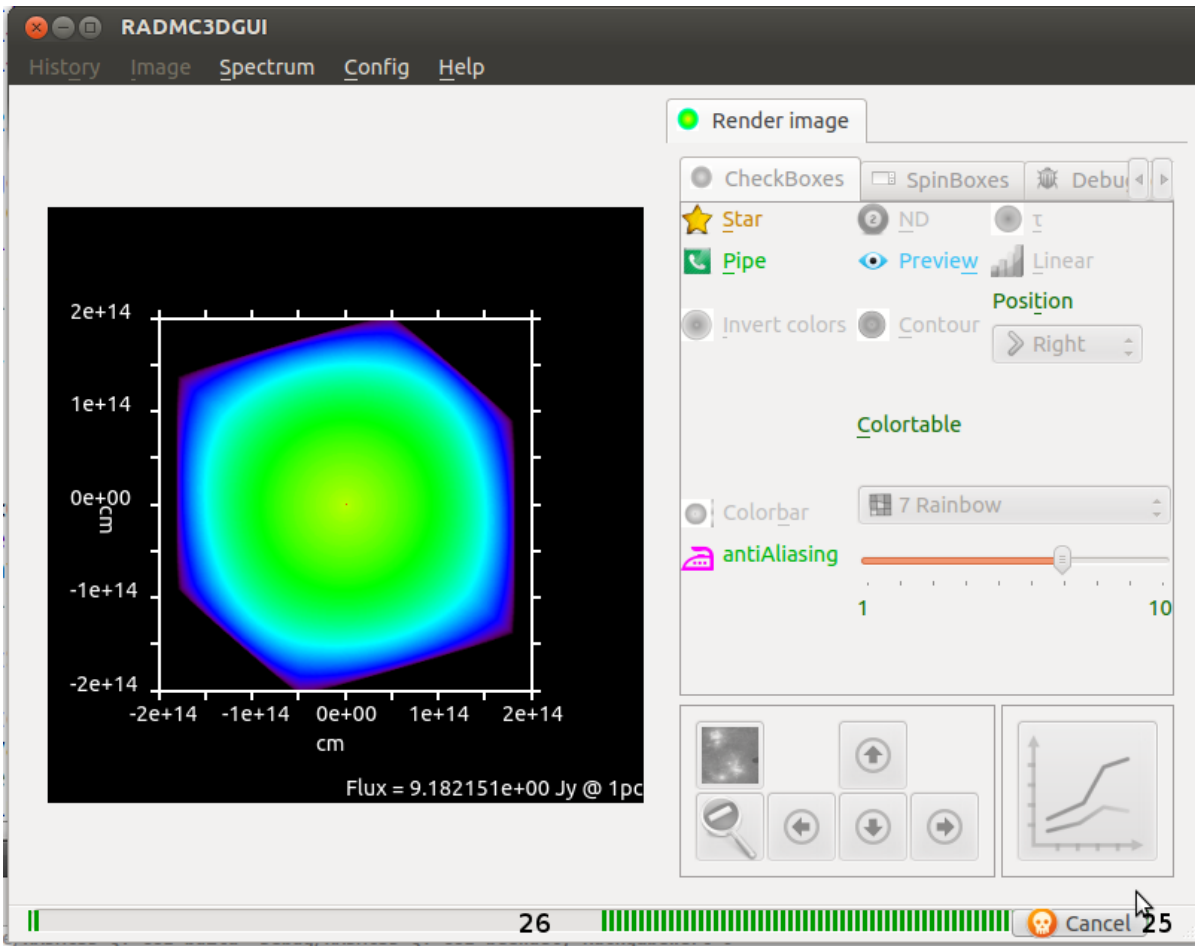

Figure 2.2: cancel-able

(red, green and blue) with 256 elements each.

red[i=0]	green[i=0]	blue[i=0]
red[i=1]	green[i=1]	blue[i=1]
.	.	.
red[i=255]	green[i=255]	blue[i=255]

Once you load a color table into a directory, viewimage will save the color table globally, so you have access to the loaded color table from other directories too. The filename will be added to color table's list 2.3. The filename should be unique, otherwise you can not add the color table twice (16) .

! In order to remove a color table from

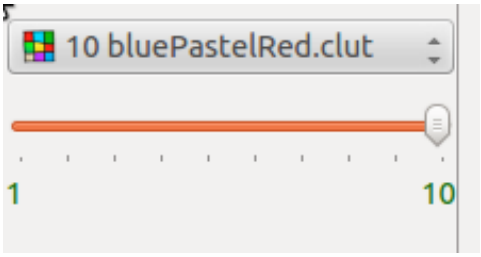

Figure 2.3: loaded color table

viewimage, you have to remove the color table file from RADMC3D_QT_GUI-build. You can change current color table with color table-slider/combo-box (16)).
Color-bar's button shows the color-bar appropriate to the current color table (14). You can invert image colors by using the invert color's button (10). Inverting colors of an 8-bit(indexed color) image means to replace color of each pixel with the color with index 255 minus index of the current color.The color table is not changed hereby.

The read image will be resized according to the size of the window. If anti-aliasing is on (15), bilinear algorithm will be used, otherwise nearest neighbour algorithm will be used . Contour lines can also be calculated by viewimage (9), viewimage uses the algorithm CONREC written by Paul Bourke and adapted to QT by Farzin Sereshti. You can specify contour level by changing number of contours(33).

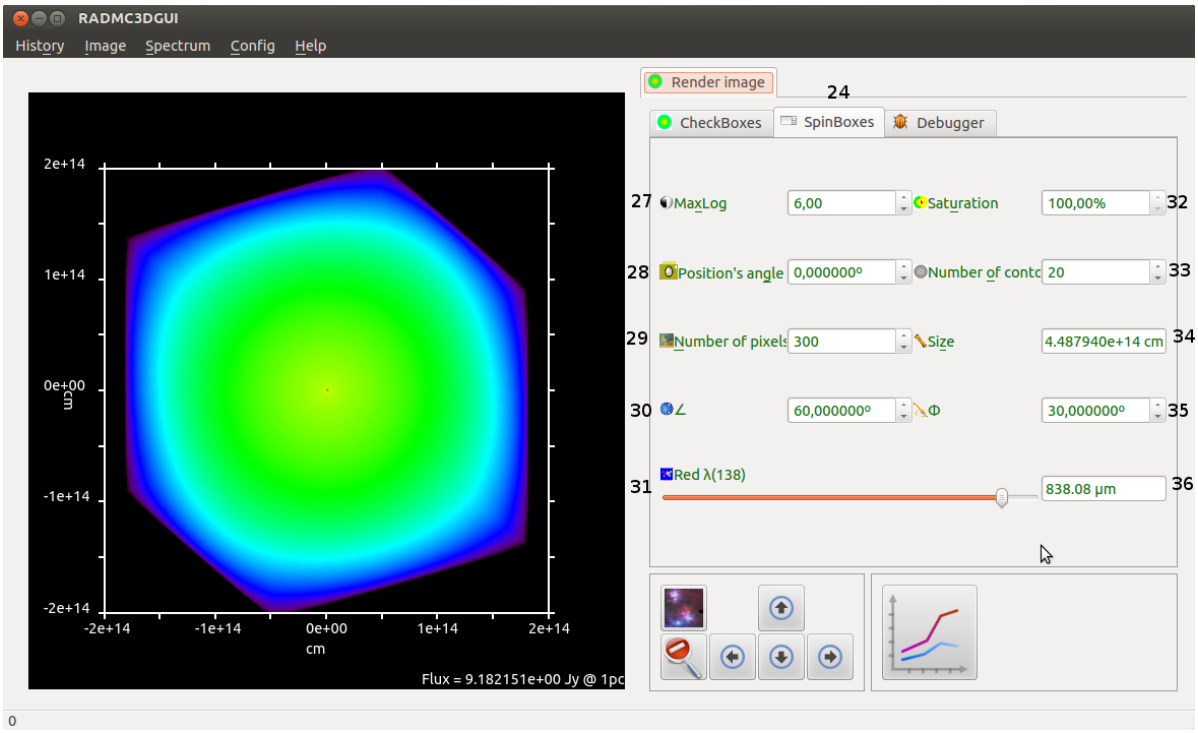

Figure 2.4: spin-boxes

The position of control elements can be changed using position-combo-box(13)). In order to get more information about input file image.out, see radmc3d's manual A.15.

Linear, if linear check-box is off: display the image using logarithmic spacing of the brightness levels. This allows you to gain more depth in the image (12)).
MaxLog: Set the maximum number of factors of 10 the log brightness color coding will span , if linear check-box is off (27).
Saturation: Allows you to enhance the contrast of very weak emission regions by saturating bright regions(32).

2.3.1 Equivalent radmc3d's commands(see radmc3d's manual)

all check-boxes can be changed in menu image(19)

check-boxes

Table 2.1: Check-boxes

GUI-ELEMENT	state	Radmc3d's equivalent command
Star (5)	☑ ☐	inclstar nostar
2ND (7)	☑	secondorder
Preview (8)	☑ ☐	nofluxcons fluxcons
τ (11)	☑ ☐	tracetau tracetnormal

spin-boxes

Table 2.2: spin-boxes

GUI-ELEMENT	Radmc3d's equivalent command
Position's angle (28)	posang
Number of pixels (29)	npix
size (34)	Sizeau/sizepc[1]
$\angle$ (30)	incl
ϕ (35)	phi
λ (31)/(36)	lambda

[1] If Size unit is cm/au, viewimage will send command sizeau, otherwise sizepc

2.4 Plot tools

Plot menu show up after clicking right mouse button.

2.4.1 Zoom/rotate

Zoom an image by drawing a rectangle(44) on plot, and clicking rendering image(1) button. You can cancel zoom by pressing escape-key, the drawn rectangle will be removed. by clicking the mouse right button on the plot and choosing the desired modus.(45/46) . You can shift the zoomed image with the key arrows or arrows button on the GUI(3). You can zoom out clicking unzoom button(2).

2.4.2 Image's value

If you move the mouse cursor over the image, viewimage will show the value at the current pixel on message bar(50) .

2.4.3 Print and save

You can save images in *.BMP *.png *.jpg *.jpeg *.xbm *.xpm formats by choosing save in the plot menu(48). You can print the current image by choosing print in the plot menu(49).

2.4.4 hide the coordinate system

You can hide the coordinate system with plot checkbox in the plot menu (47). This is useful, if you want to save or print the image 2.6.

2.4.5 Size unit

Size unit can be changed in menu config (21)->size unit(51). This command changes the unit in the coordinate system(58). Size input field(34)will calculate the size according to the current size unit. If size unit is cm or au, the radmc3d's command will be sizeau, otherwise sizepc.

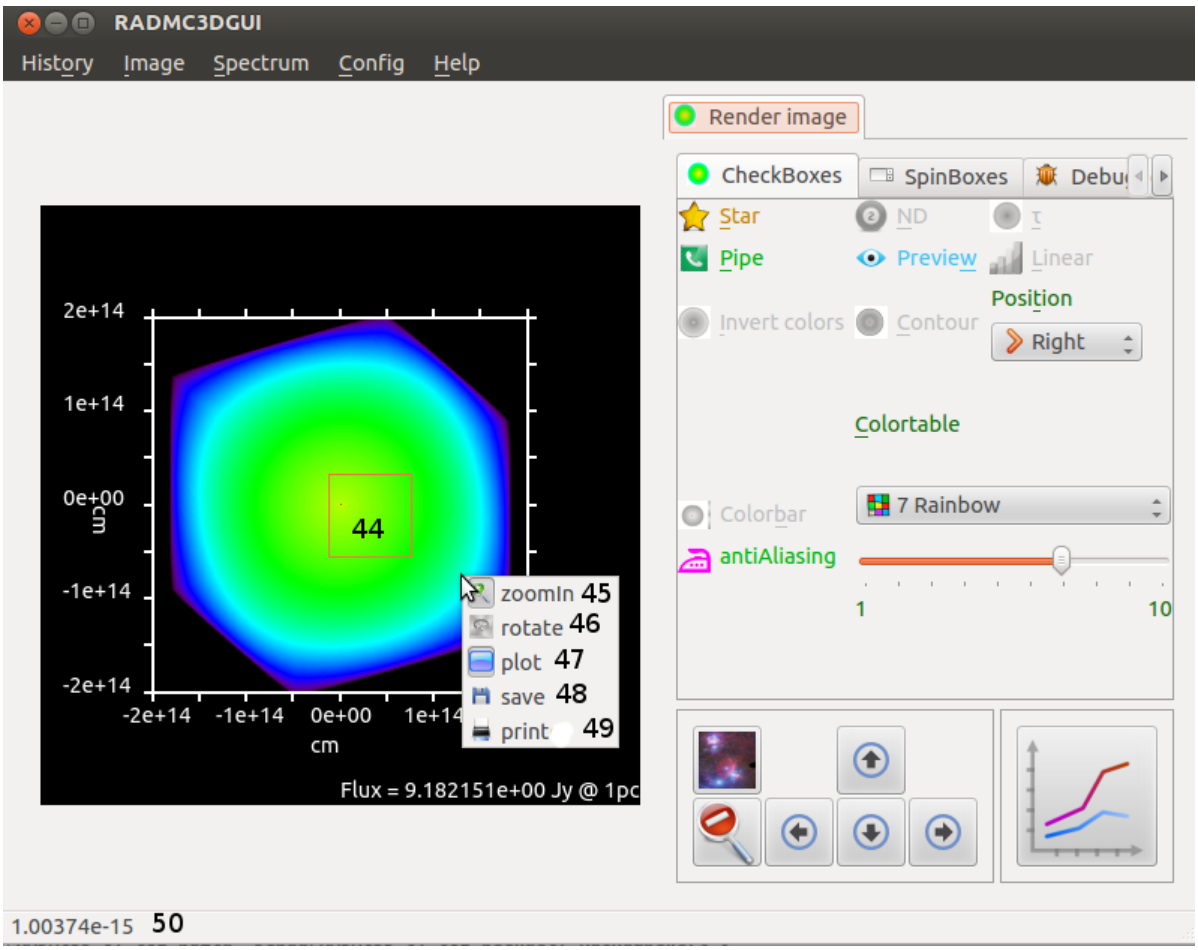

Figure 2.5: Plot image

2.5 RGB modus

RGB modus can be activated in menu config (21)->RGB modus(53). Viewimage will plot an RGB image for each color wavelength. Current wavelengthes for each color are written to camera_wavelength_micron.inp, and radmc3d command loadlambda is called. You can read each color's value at a pixel by moving mouse cursor over that pixel. These values are shown at message bar(50). You can change the current wavelength for each color(36/61/62). The flux for each color is also shown; if the image was plotted by an indexed color, flux for the red color only is shown.(59).

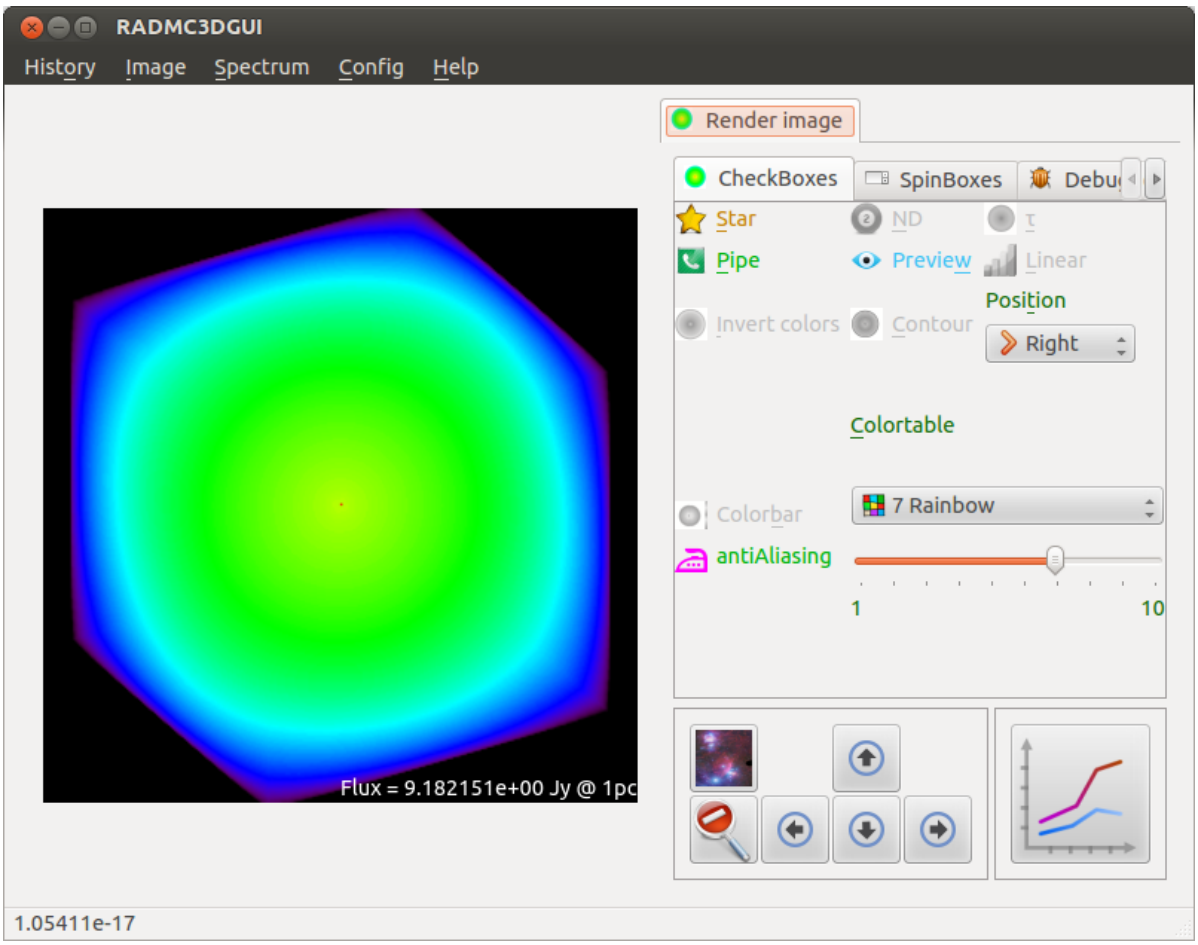

Figure 2.6: hide coordinate system

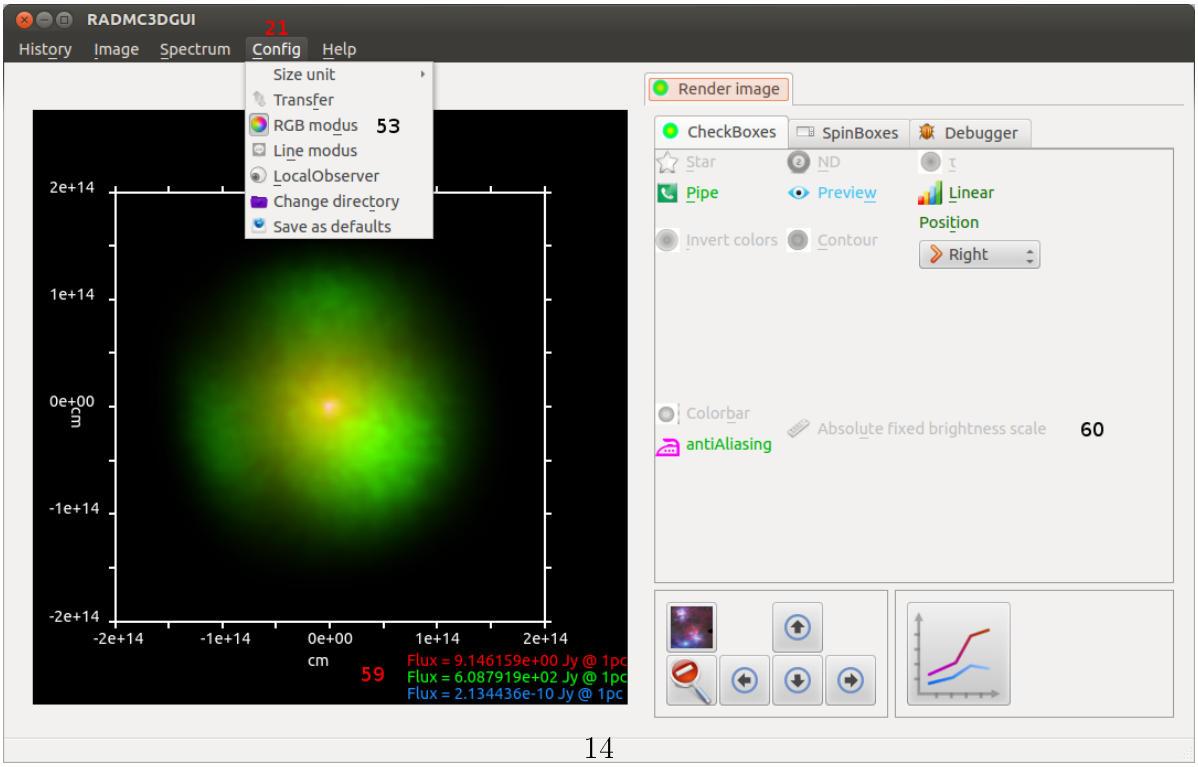

Figure 2.8: RGB-modus(check-boxes)

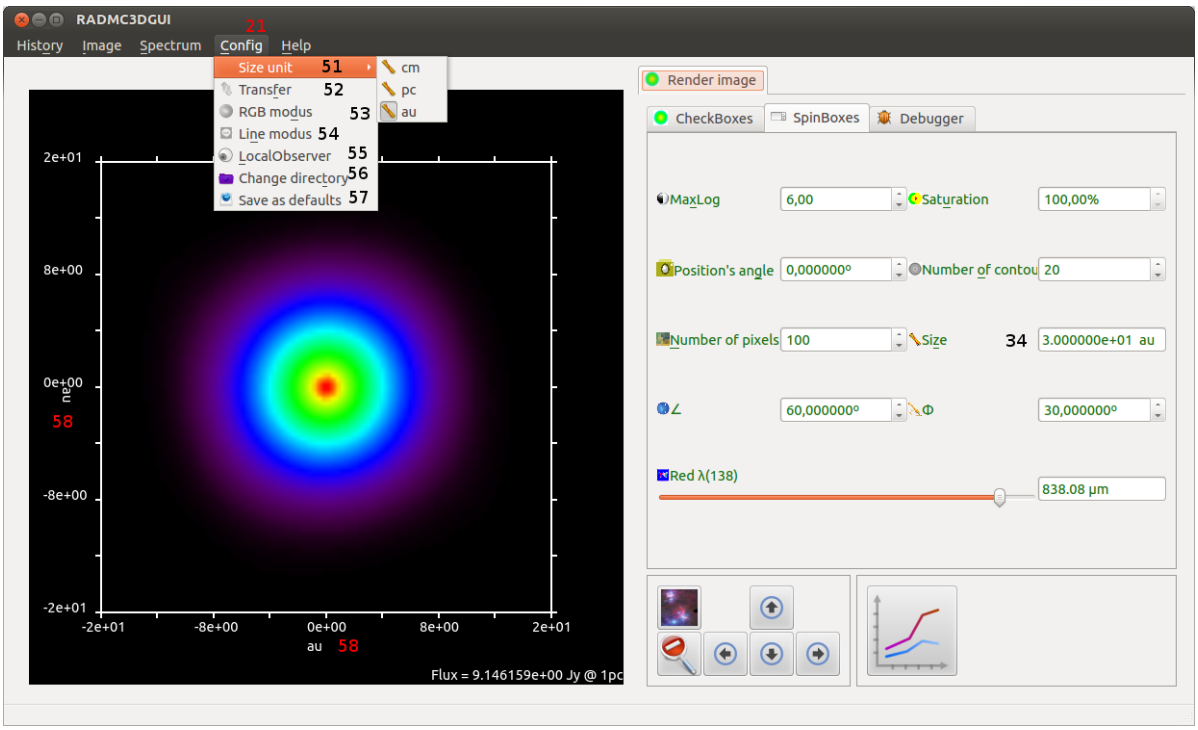

Figure 2.7: Changing size unit

2.5.1 Color tuning

Color tuning in case absolute fixed brightness scale is off(60): If color tunning is set to 1, then the brightness of all channels will be rescaled to the same value in order to get the best color depth. If color tunning is set to a 3-element array, you can directly specify the weight of each color in order to fine-tune the colors(63/64/65).

Color tuning in case absolute fixed brightness scale is on(60): you can set maximum for each color. The range of each color will be it's [(maximum-maxlog(27).):maximum] (63/64/65).

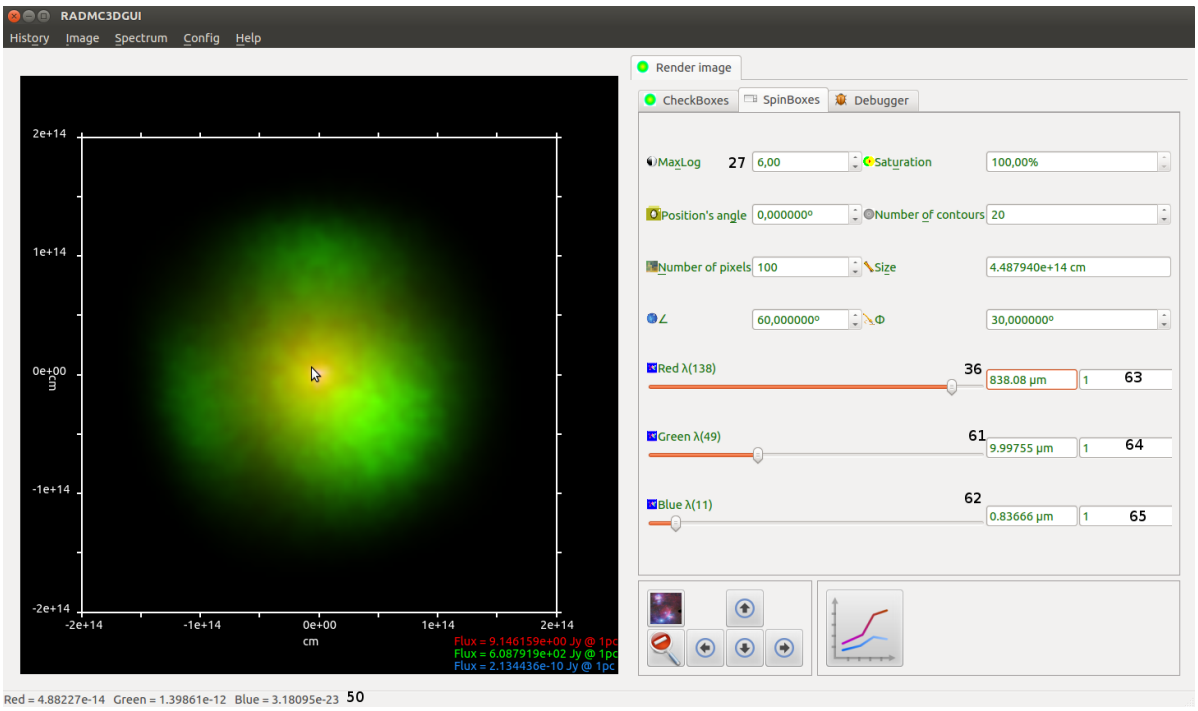

Figure 2.9: RGB-modus(spin-boxes)

2.6 Local observers inside the model (see radmc3d's manual 9.11)

You can add/remove local observer's widgets in menu config (21)->LocalObsever(55). After widgets are added, you can switch modus with Local observer's button(66). Relative observer's checkbox: Do observer position relative or absolute with respect to pointing(74).Optional scaling factor for observer's position can be changed by using spin box(75).

! Rotate and zoom functions are disabled in this modus. You can combine local observer's modus with RGB/indexed color modus.

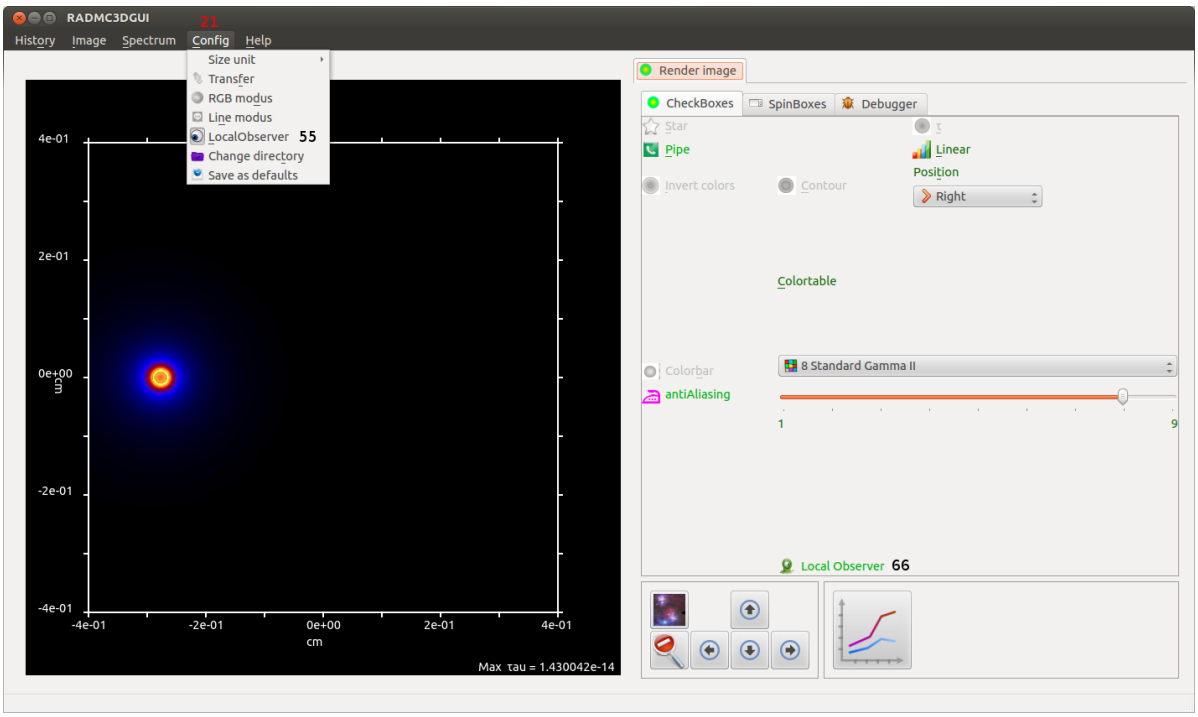

Figure 2.10: Local observer(check-boxes)

2.6.1 Spinboxes

Table 2.3: spin-boxes

GUI-ELEMENT	Radmc3d's equivalent command
View 's angle (73)	sizeradian[1]
Pointing(67/68/69)	pointau/pointpc[1]
Observer Position(70/71/72)	locobsau/locobspc

[1] If Size unit is cm/au, Viewimage will send command locobsau/pointau, otherwise locobspc/pointpc

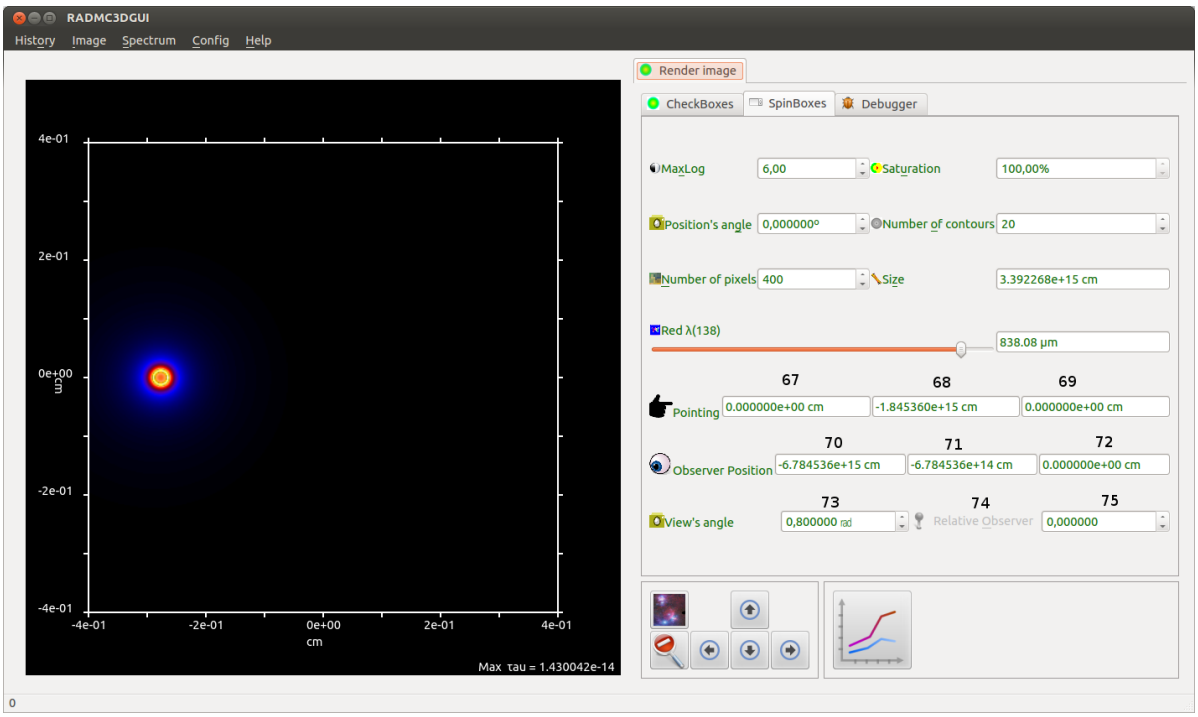

Figure 2.11: Local observer(spin-boxes)

2.7 Line modus(see radmc3d's manual 7.3)

lines.inp should be existed, if you want to activate line modus. Line modus is activated in config menu (21))->line modus(54).

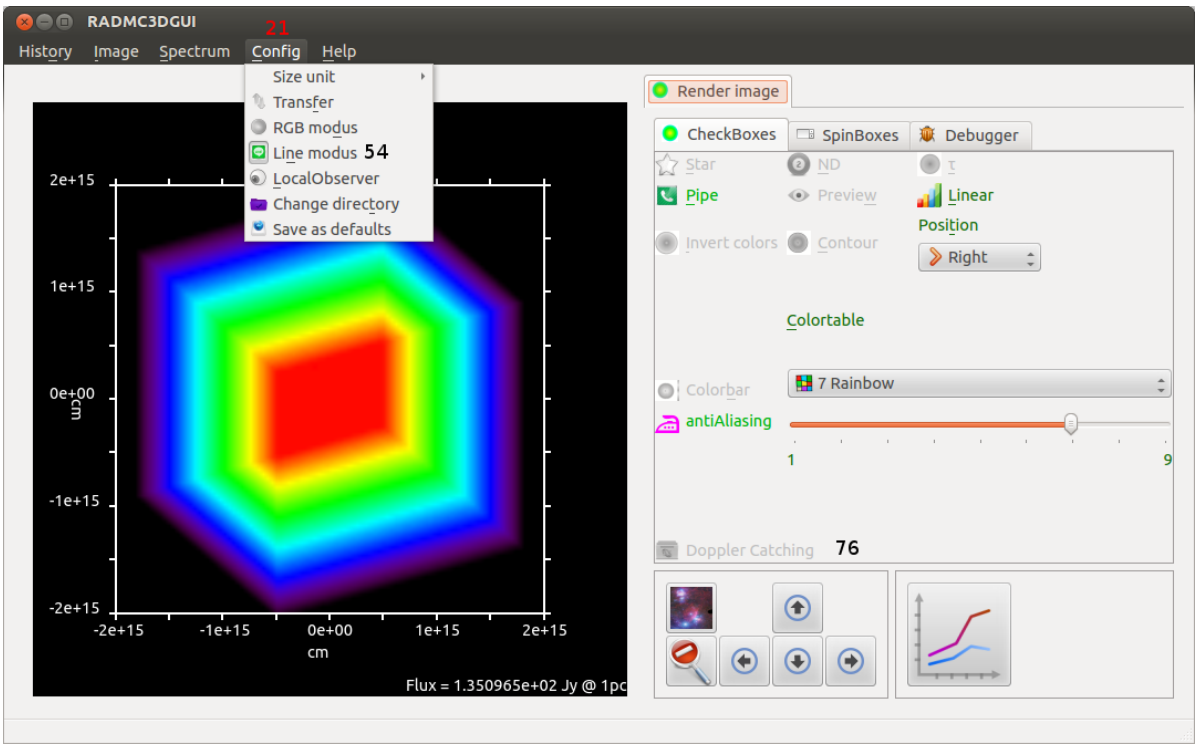

Figure 2.12: Line modus (check-boxes)

2.7.1 Spinboxes

Table 2.4: spin-boxes

GUI-ELEMENT	Radmc3d's equivalent command
Line modus (54)	inclline[1]
iMolecule(77)	imolspec[1]
iLine(78)	iline
Velocity (79)	vkms
Doppler Catching (76)	doppcatch

[1] If you change iMolecule or iLine or velocity, Viewimage will send all three commands, otherwise it will send only inclline.Inclline linelist command is sent only once after activation of line modus.

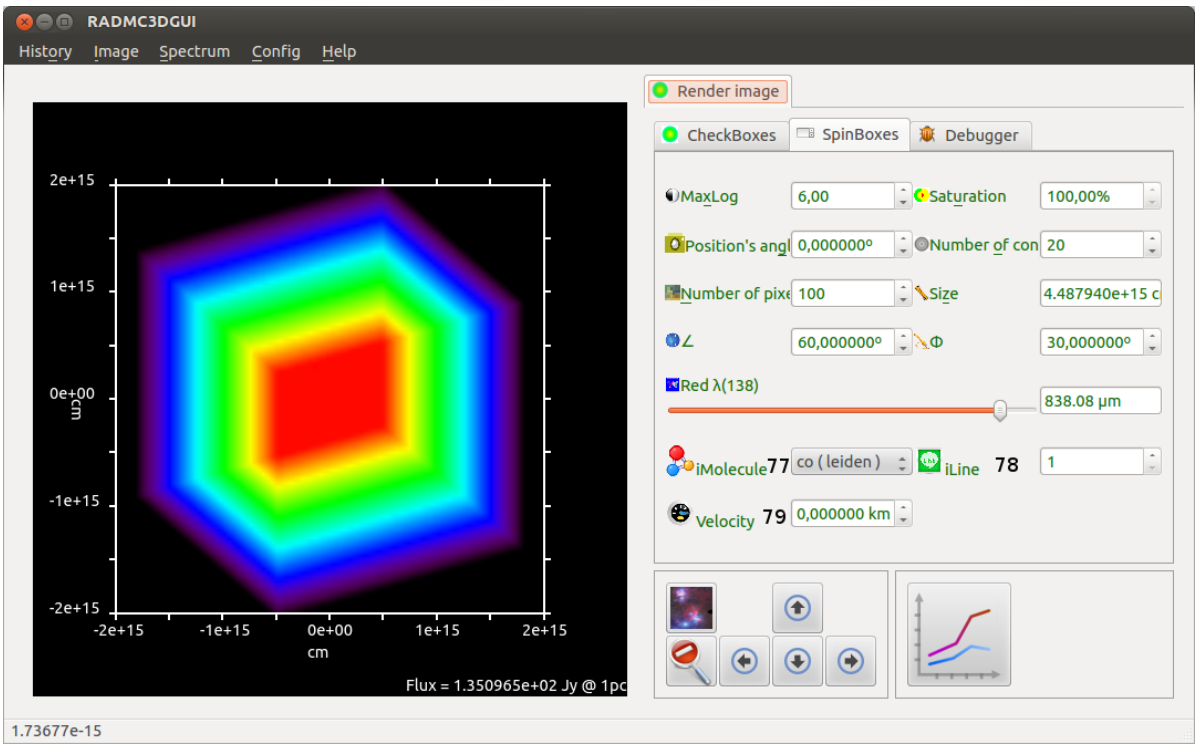

Figure 2.13: Line modus (spin-boxes)

2.8 User transfer modus

This modus can be activated in menu config(21)->transfer(52). If you have extended radmc3d and defined physical parameters, and you want to change these parameters via viewimage, you can write these parameters to the file transfer.inp.default. This file will be read by viewimage. These parameters and their values are displayed in a table widget(80). Name of the parameter is displayed in the key column(81) and the value(82) of the parameter is displayed in value column. Default column shows the default value(83) of the parameter. Parameter value can be changed in the value column. Parameter value can be changed in the value column. Parameter name and default value can not be changed. You can reset current values by clicking the button "*Reset to default values*"(84), all parameters will be set to their default values. . Each time you change a parameter, viewimage will write the parameters and their values to transfer.inp and and will eather send "*myaction*"command (if in pipe modus) or start a new session of radmc3d (if in no-child modus).

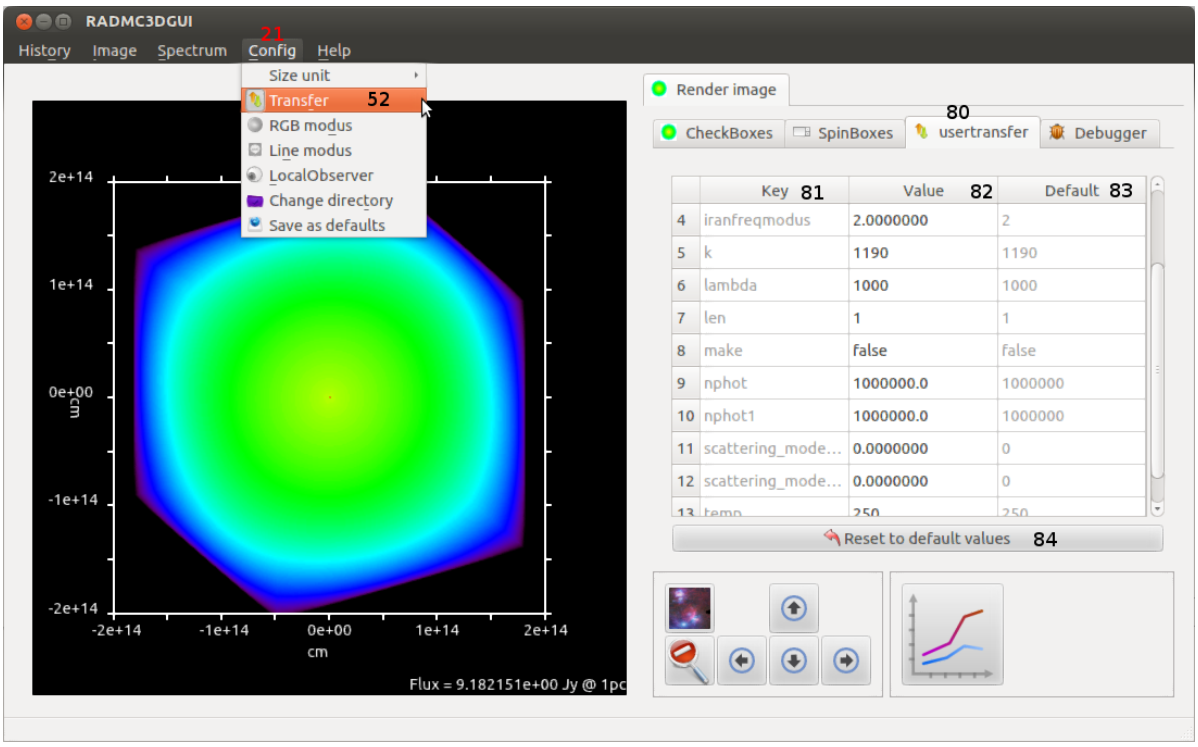

Figure 2.14: User transfer modus

2.9 Read a image

If you want to check image without communicating with radmc3d, you can read image in menu(19)->Read Image(85). After activation this menu, A dialog window will show up. This dialog shows all image files, which are in the current directory and show you the recommended format (87/88)for selected image(89). You can switch between FORTRAN formatted/unformatted format. After you have read the image you can do non-communicating actions like changing state of check-boxes Invert color, colorbar, antialiasing, linear, contour, "absolute fix brightness scale"(RGB-modus) and changing spin-boxes maxlog, saturation, color tuning(RGB-modus). Viewimage switches automatically between indexed color modus and RGB-modus according to the number of colors in the read image.

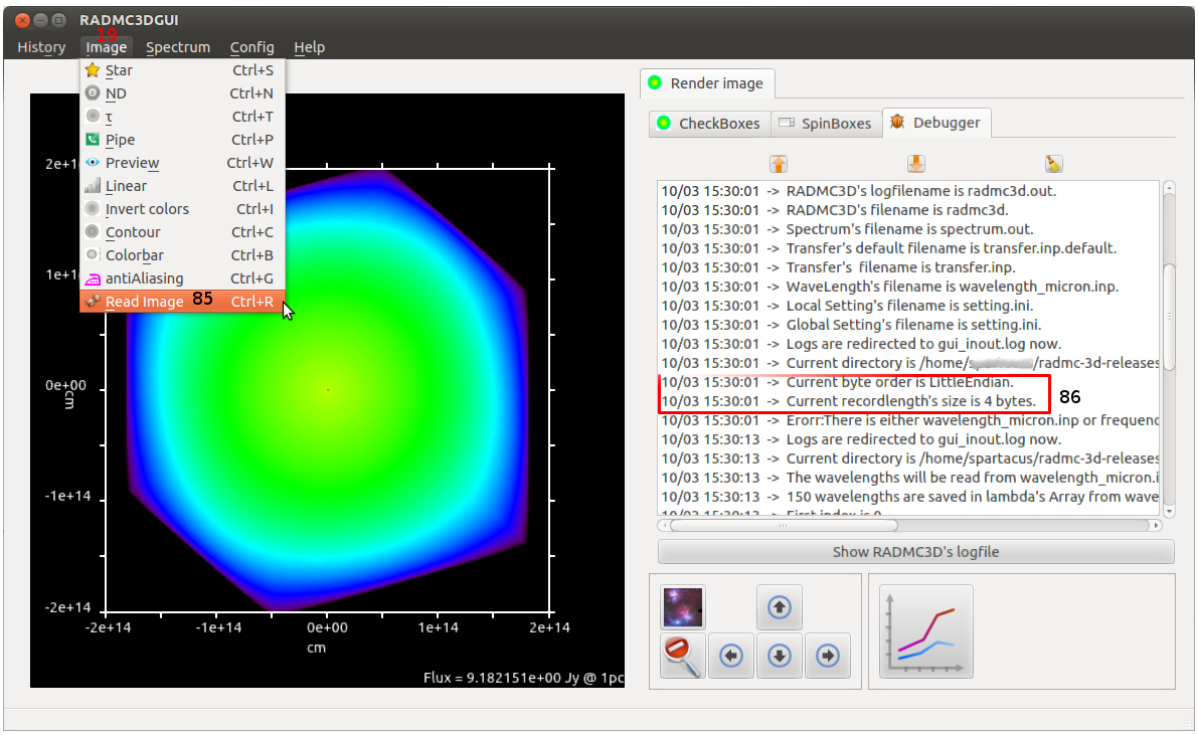

Figure 2.15: Read a Image

! By unformatted file you can specify the record-length's size and byte-order in setting.ini in viewimage's executable folder(RADMC3D_QT_GUI-build). The default value of record-length's size is 4 bytes and the byte-order is default-byte-order of your system(0 for BigEndian and 1 for LittleEndian). Change this values, only if you really know, what you are doing, because false values will crash viewimage. Viewimage has to restarted to accept changes. You can see current settings in the debugger(86) or in the file gui_inout.log.

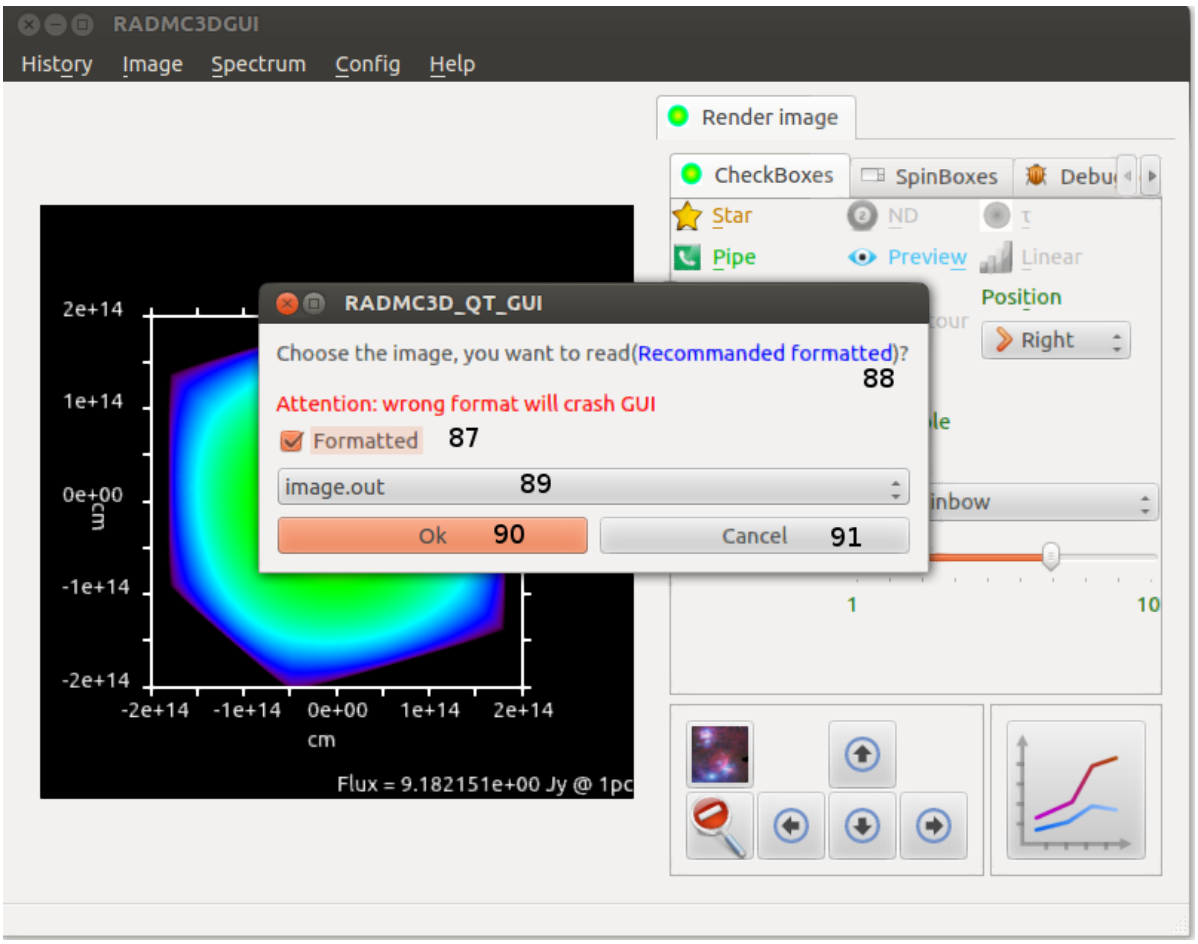

Figure 2.16: Read-image's dialog

3 Plot spectrum

3.1 Read spectrum from radmc3d

Spectrum can be plotted by using the rendering spectrum button(4). After plotting, you can change the x-title(92) and y-title(93) in the spectrum menu(20). The plot will be adapted according to the chosen unit in x-title and y-tittle. You can also switch between the logarithmic/linear(94/95)modi for x and y axis. You read the x and y values by moving the mouse over the spectrum, current position will be highlighted in a circle(101). The values will be shown in the message bar(102).

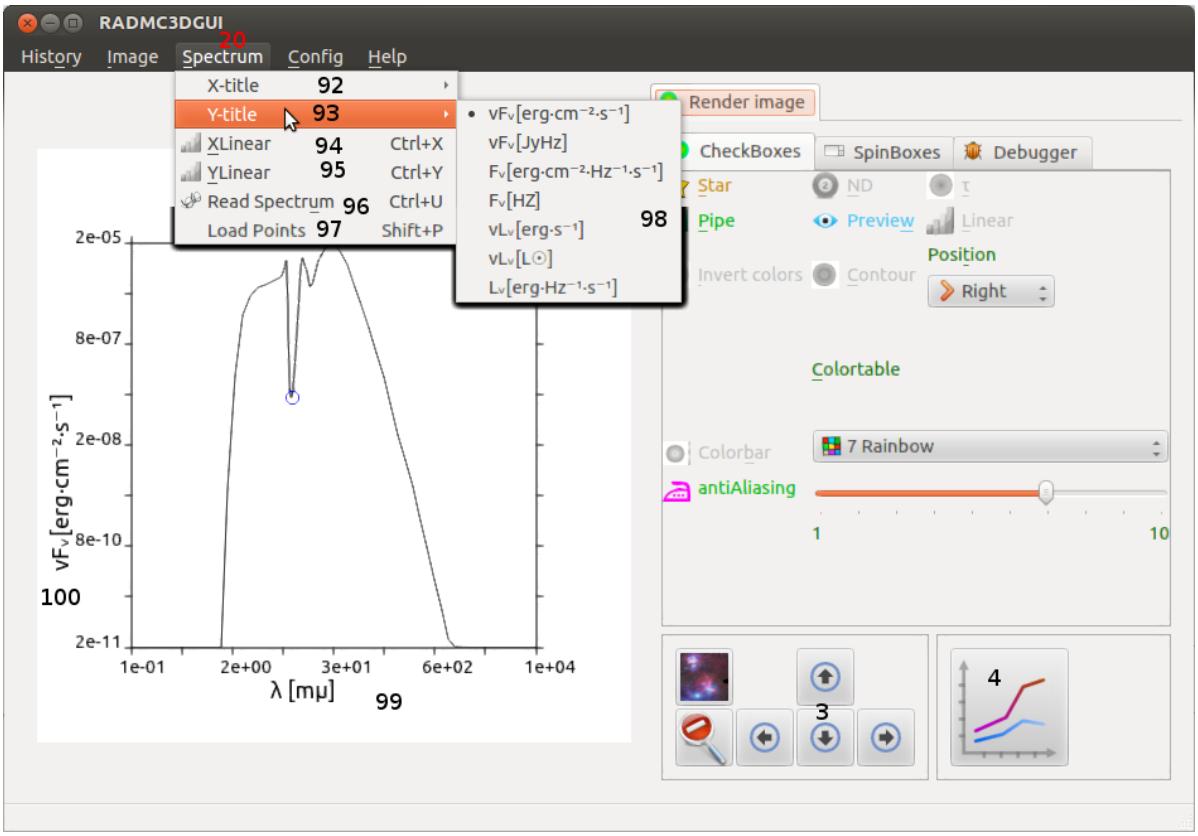

Figure 3.1: Rendering spectrum

3.2 Zoom in/out

You can zoom in/out in spectrum by clicking left mouse button and drawing a rectangle to zoom in in this area. With zoom out button(103) you are zooming out to the last zoom-state. You can shift the zoomed image with the key arrows or arrows button on the GUI(3).

3.3 Print and save

You can save images in *.BMP *.png *.jpg *.jpeg *.xbm *.xpm formats by choosing save in the plot menu(104). You can print the current image by choosing print in the plot menu(105).

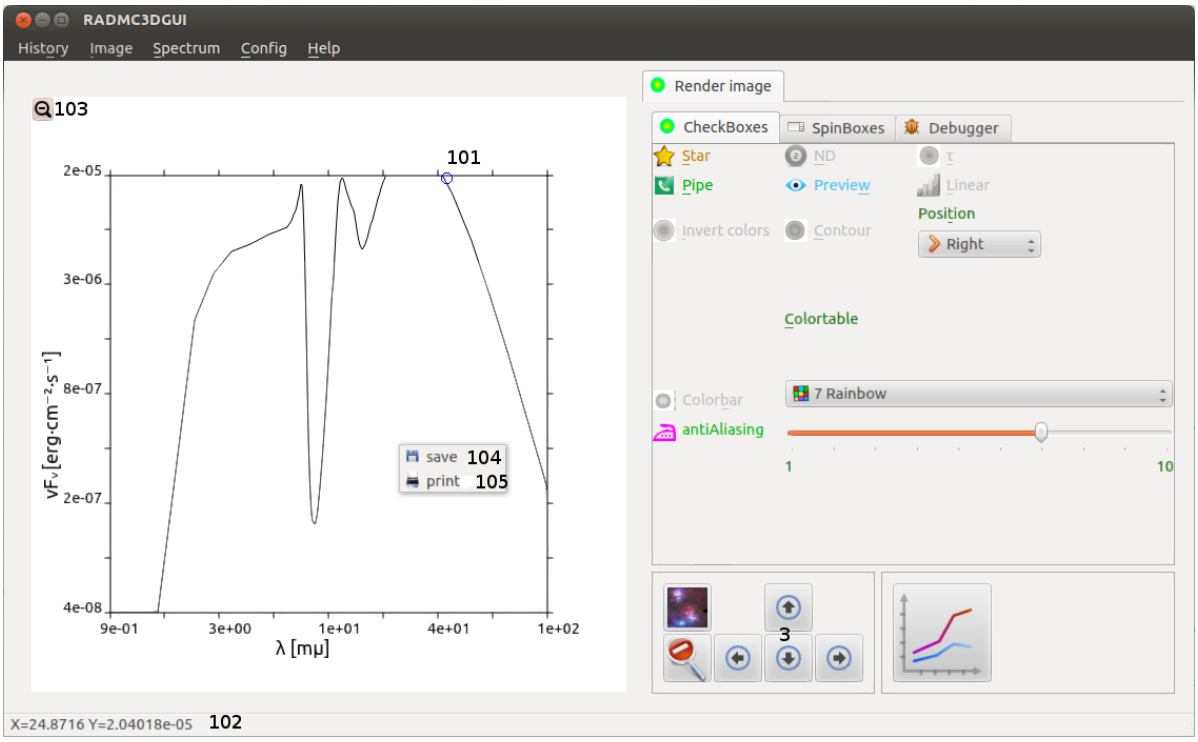

Figure 3.2: zoom in/out

3.4 Read a spectrum

If you want to check spectrum without communicating with radmc3d, you can read spectrum in menu in menu spectrum(20)->Read spectrum(96).

After activation this menu, A dialog window will show up 3.3. This dialog shows all spectrum files(106), which are in the current directory. with ok-button (107) you can proceed and with cancel-button (108) you cancel reading the spectrum. After loading, you can

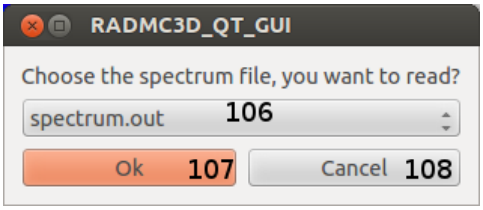

Figure 3.3: Read a Spectrum's file

change x/y-title, x/ylinear, zoom in/out
and print/save the plotted spectrum. Currently viewimage can read spectrum only in the formatted format.

3.5 Load points/error-bar

After the spectrum has been read from from file or radmc3d, you can load points or error-bars, which you want to be plotted over the spectrum((20/97). To plot points, the loaded file should have 2 columns: values in the first column are lambdas and values in the second column are fluxes.. To plot error-bars, the loaded file should have 6

$\lambda[1]$	flux[1]
.	.
.	.
$\lambda[n]$	flux[n[1]]

Table 3.1: Points-file

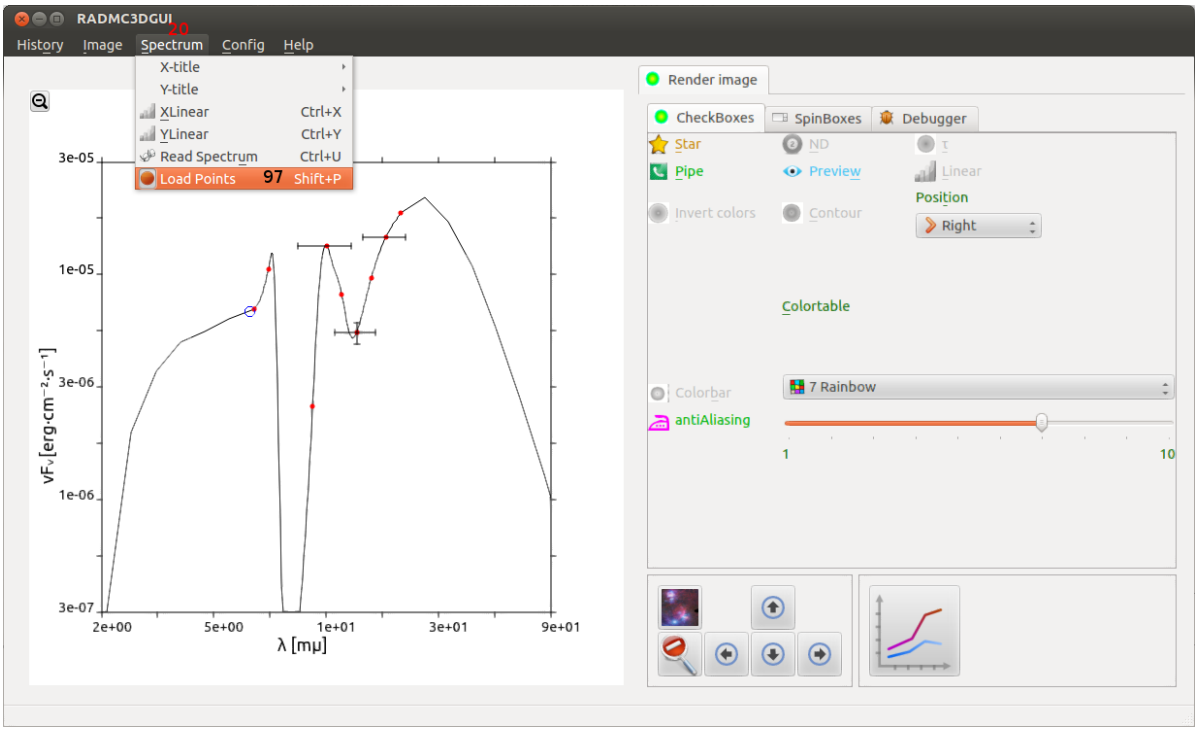

Figure 3.4: Load points/errorbar

[1] will be calculated automatically.

columns, which contain λ, fluxes, $\Delta\lambda 1$ $\Delta\lambda 2$, Δflux1 and Δflux2. Begin of error-bar(λ) will be calculated as follows: λ[i]-$\Delta\lambda$1[i]. End of error-bar(λ)will calculated λ[i]+$\Delta\lambda$2[i]. Begin of error-bar(flux) will be calculated as follows: flux[i]-Δflux1[i]. End of error-bar(flux) will be calculated as follows: flux[i]+Δflux2[i].

λ[1]	flux[1]	$\Delta\lambda$1[1]	$\Delta\lambda$2[1]	Δflux1[1]	Δflux2[1]
.	.	.	.	.	.
.	.	.	.	.	.
λ[n]	flux[n]	$\Delta\lambda$1[n]	$\Delta\lambda$2[n]	Δflux1[n]	Δflux2[n[2]]

Table 3.2: Errorbar-file

flux[i]: Flux in erg cm^{-2} s^{-1} Hz^{-1} at this wavelength as measured at a standard distance of 1 parsec (just as a way of normalization) .
lambda[i]: Wavelength in micron. It does not necessarily have to be the same as those in the wavelength_micron.inp file. The wavelength grid of a spectrum file can be completely independent of all other wavelength grids.
If $\Delta\lambda$1[i] and $\Delta\lambda$2[i] have zero value, only λ[i] will be displayed as a point.
If Δflux1[i] and Δflux2[i] have zero value, only flux[i] will be displayed as a point.
! If you want to remove the over-plotted points/errorbar again, you do that over spectrum(20)->load points(97).

[2]will be calculated automatically.

4 Settings

4.1 changing directory

You can change the current working directory in the menu config (20)->change directory(56). After changing the directory, viewimage oder GUI has to be reinitialised. (see Initialising GUI).

4.2 History

The last 5 used directories are saved in the history menu(18). To clear history, the file history in directory RADMC3D_QT_GUI-build is to be deleted. This is sometimes recommended, if you change the conditions and want to reload the GUI without closing the GUI. After the reload's dialog appears, you can proceed or cancel the reloading4.2.

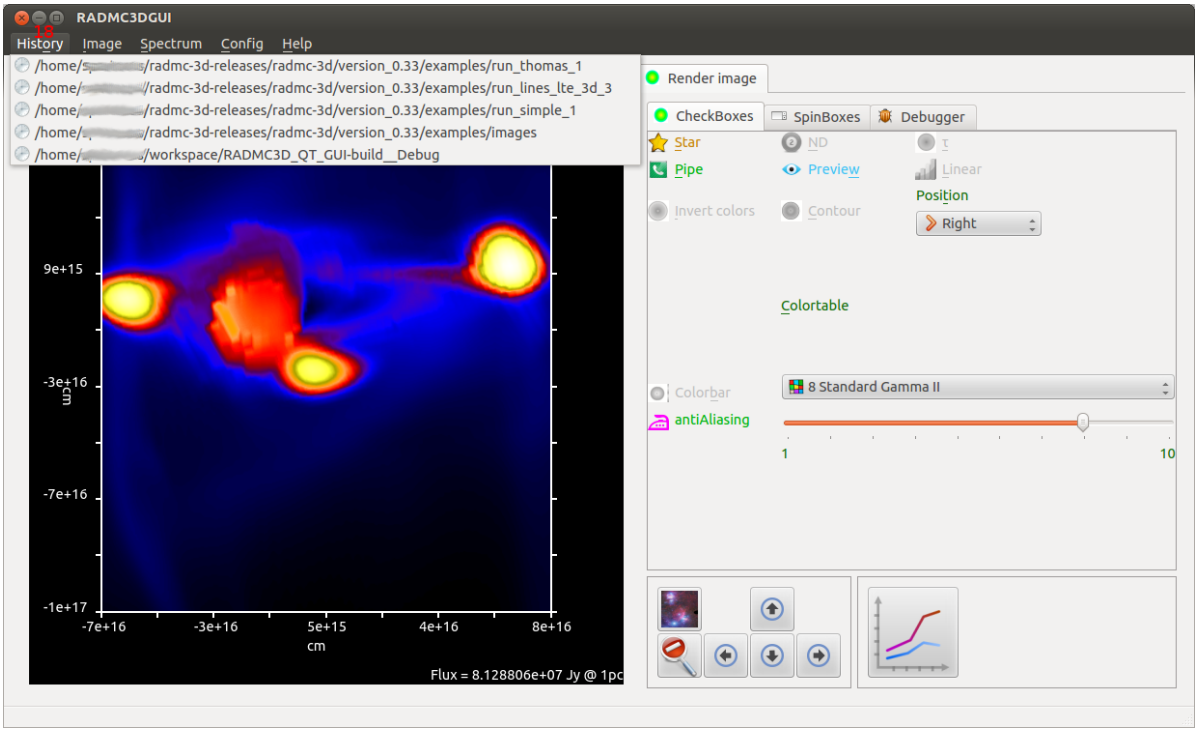

Figure 4.1: History

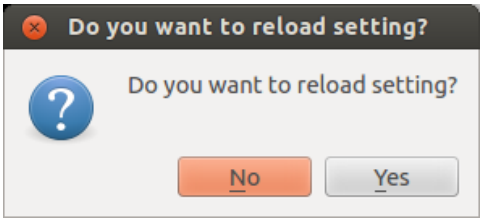

Figure 4.2: Reload

4.3 Start next time from current directory

On closing viewimage, you can choose, if you want to start next time from the current directory. That means, it is not important, f viewimage, viewimage will change automatically to the last directory. ohne which is shown last time in close-dialog 4.3

4.4 Local settings

You can save the current state of GUI-elements for current directory by closing or changing the directory4.3. Next time you change to this directory, you can load the saved state or delete it. 4.4. The state of GUI is stored in the setting.ini file in the current directory.

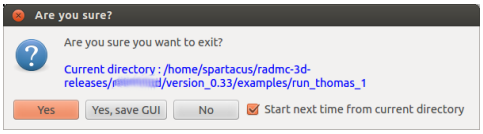

Figure 4.3: Close-dialog

4.5 Global settings

You can save the current state of GUI-elements in config(21)->save as defaults(57) for elements setting of GUI-elements. You can restore this state for every directory in your system with reset button 4.4. The global state of GUI will be stored in the file setting.ini in directory, which contains the viewimage's executable-file is(RADMC3D_QT_GUI-build).

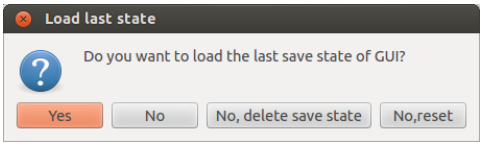

Figure 4.4: Load-dialog

5 Debugger

5.1 Debugger

All GUI-Actions are protocoled, the protocol can be shown in the debugger's tab (23). All protocoled statements are sorted by date(42).You can jump to the begin(38) and to the end of logs(39). Sometimes it is useful to clear the logs(40) to have better overview. Show radmc3d's log file-button will show you the radmc3d's log file(41). The radmc3d's log file will be shown on the top of plot(37). You can close radmc3d's log file with close button on the top of log-editor(43) or with run GUI command. If radmc3d is interrupted or there is an error, so that radmc3d can not write image/spectrum to file/pipe, viewimage will show the log file of radmc3d and viewimage's protocol. GUI-protocol is also saved in the file gui_inout.log. Radmc3d's log is saved in the file radmc3d.out.

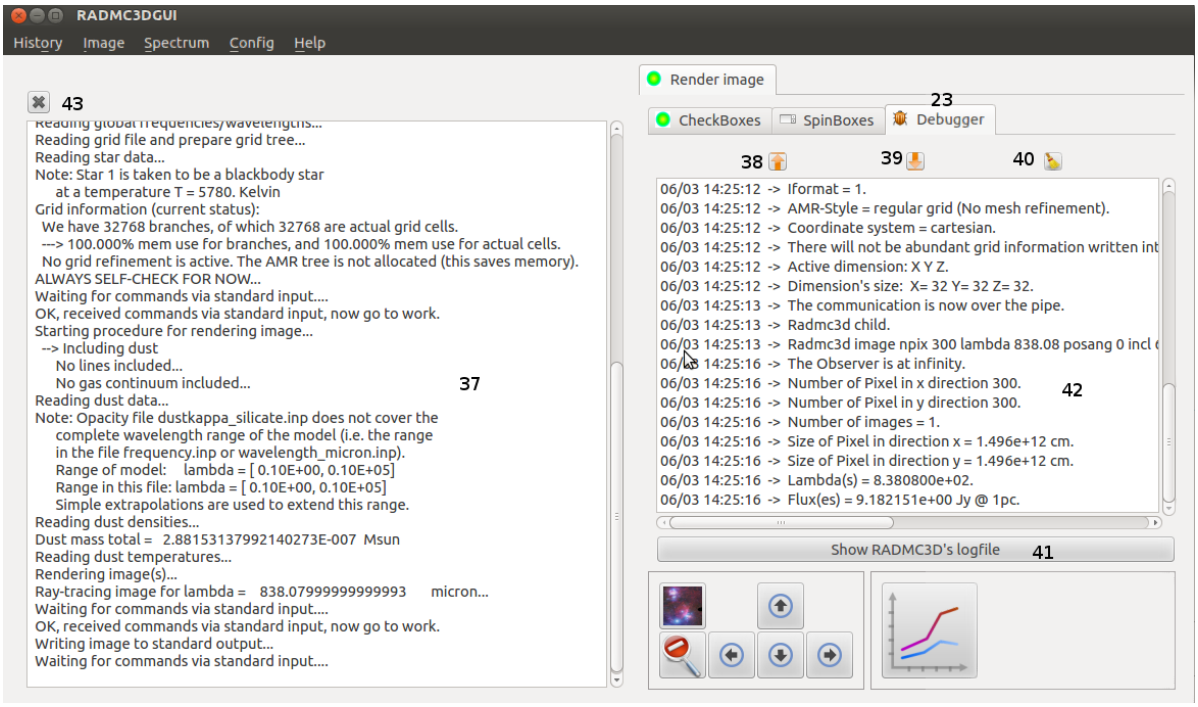

Figure 5.1: debugger

6 Help

6.1 Help

6.1.1 Radmc3d's manual

You can open radmc3d's Manual in help's menu(22)->RADMC3D's manual(109), if following condition are true

- radmc3d is installed.
- radmc3d's perl starter is in searchpath.
- radmc3d's manual-folder is on the same level as it's src-folder.

6.1.2 GUI's manual

You can open viewimage's manual in help's menu(22)->RADMC3D's manual(110).

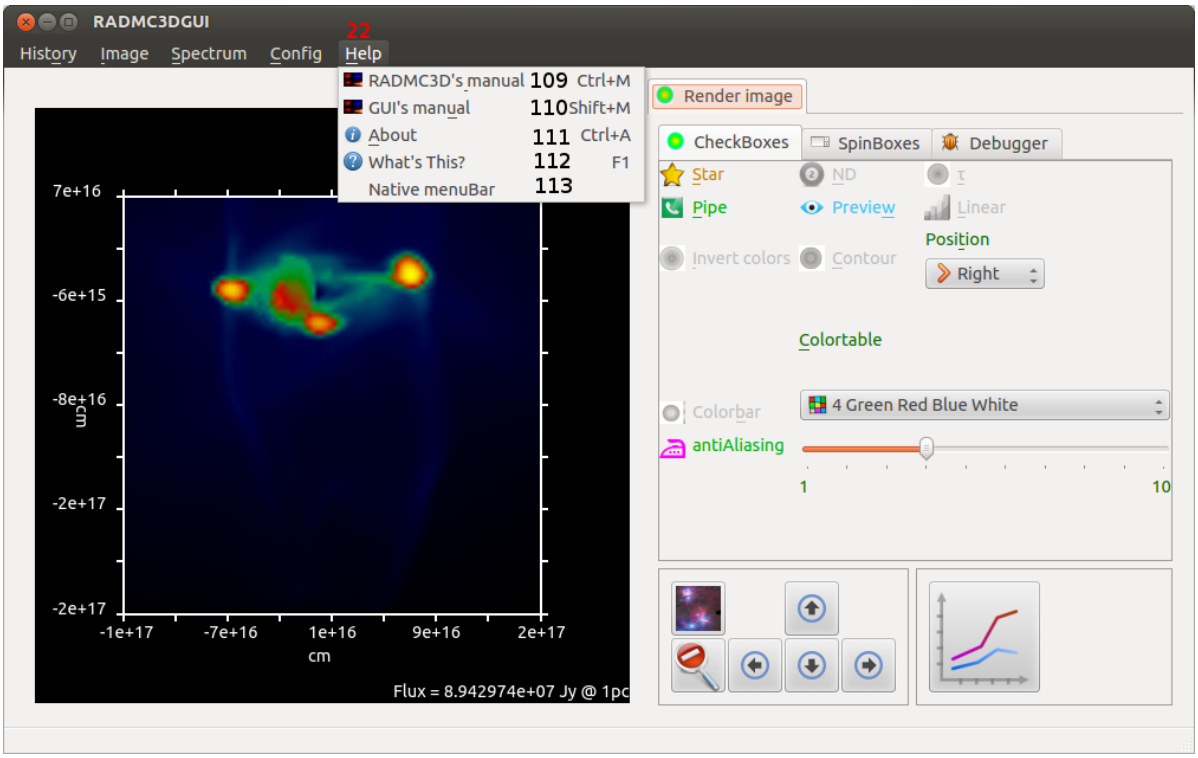

Figure 6.1: Help

6.1.3 What's this

You can get information about any GUI element by pressing F!-Key or by choosing What's this (112) in Help menu (22)and choosing that element. GUI will show you it's information after, you chose the element. 6.2.

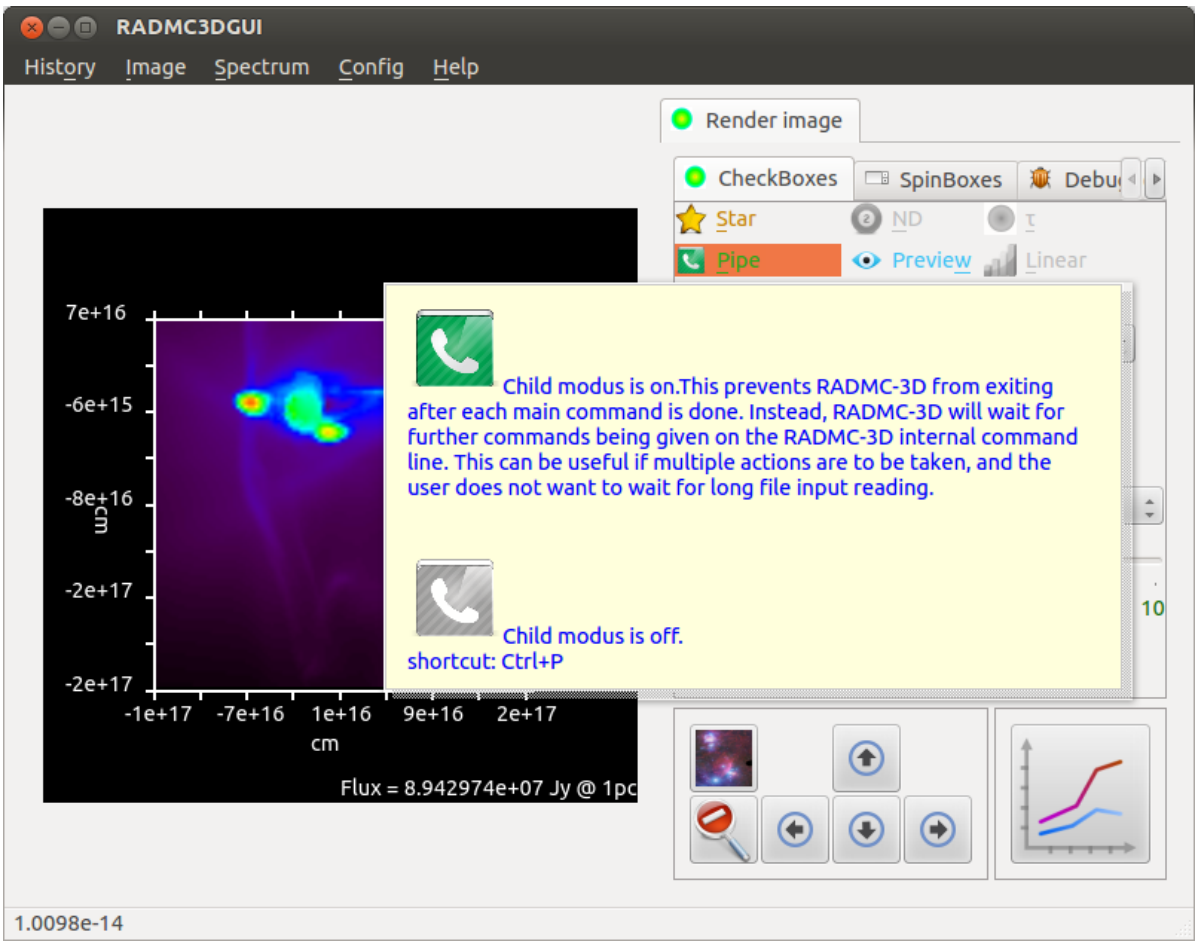

Figure 6.2: What's this

6.1.4 Native menu-bar

You can turn on/off native mebu bar in (22)->Native menu-bar(113) turn on/off native menu-bar.Native means the viewimage will adapt it's menu-bar to your operation system. You have to restart viewimage after changing this option.6.3.

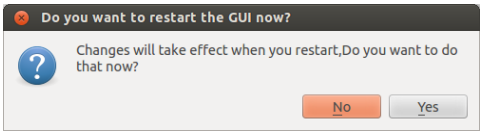

Figure 6.3: Native menu-bar's dialog