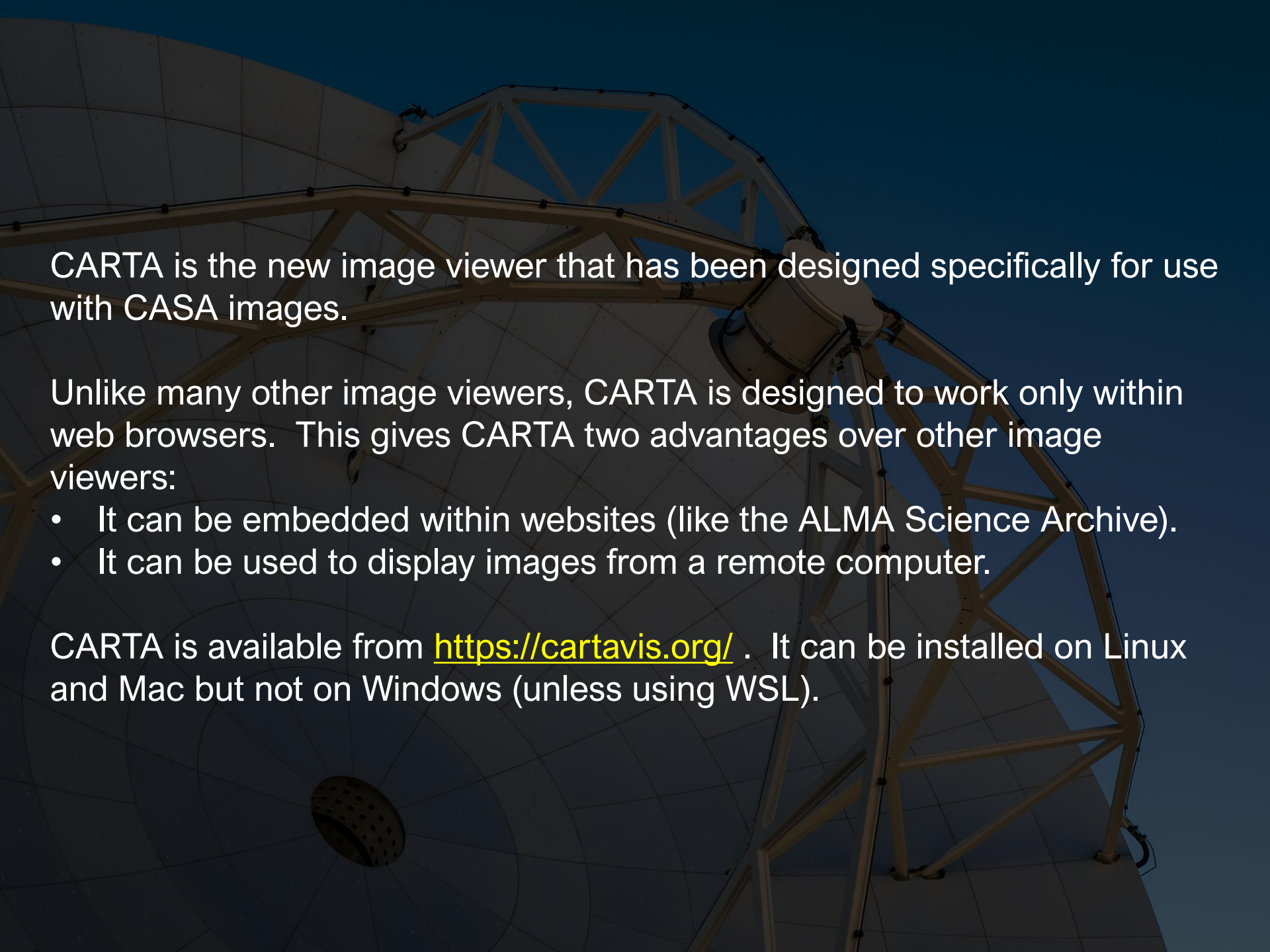


CARTA

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CARTA is the new image viewer that has been designed specifically for use with CASA images.

Unlike many other image viewers, CARTA is designed to work only within web browsers. This gives CARTA two advantages over other image viewers:

- It can be embedded within websites (like the ALMA Science Archive).
- It can be used to display images from a remote computer.

CARTA is available from <https://cartavis.org/> . It can be installed on Linux and Mac but not on Windows (unless using WSL).

When CARTA is started, it will display a file browser window. When a file is selected in this interface, CARTA will display useful information about the image.

The screenshot shows the CARTA web interface in a browser window. The browser address bar shows the URL: `172.19.193.147:3002/?token=9f1f3a86-b14d-46c0-94da-6ec676bfa1f5`. The interface includes a menu bar (File, View, Widgets, Help), a toolbar, and a main content area. A file browser window is open, displaying a list of files in a table format. The table has columns for Filename, Type, Size, and Date. The files listed are FITS files with various names and sizes, all dated 23 Sep 2024. Below the table is a search filter and a 'Fuzzy search' dropdown. The file browser window also has 'Close' and 'Load' buttons. In the background, the main interface shows a 'No image loaded' message and a 'Render Configuration' window.

Filename	Type	Size	Date
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.pt	FITS	411.8 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.pt	FITS	185.0 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.m	FITS	4.3 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.f	FITS	735.8 MB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.f	FITS	345.8 MB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.r	FITS	718.6 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.pt	FITS	411.8 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.pt	FITS	187.6 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.m	FITS	4.3 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.f	FITS	735.8 MB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.f	FITS	349.8 MB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.r	FITS	718.6 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW.	FITS	132.0 MB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW.	FITS	66.6 MB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW.	FITS	159.7 kB	23 Sep 2024
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.mfs.l.pt	FITS	411.8 kB	23 Sep 2024

When CARTA is started, it will display a file browser window. When a file is selected in this interface, CARTA will display useful information about the image.

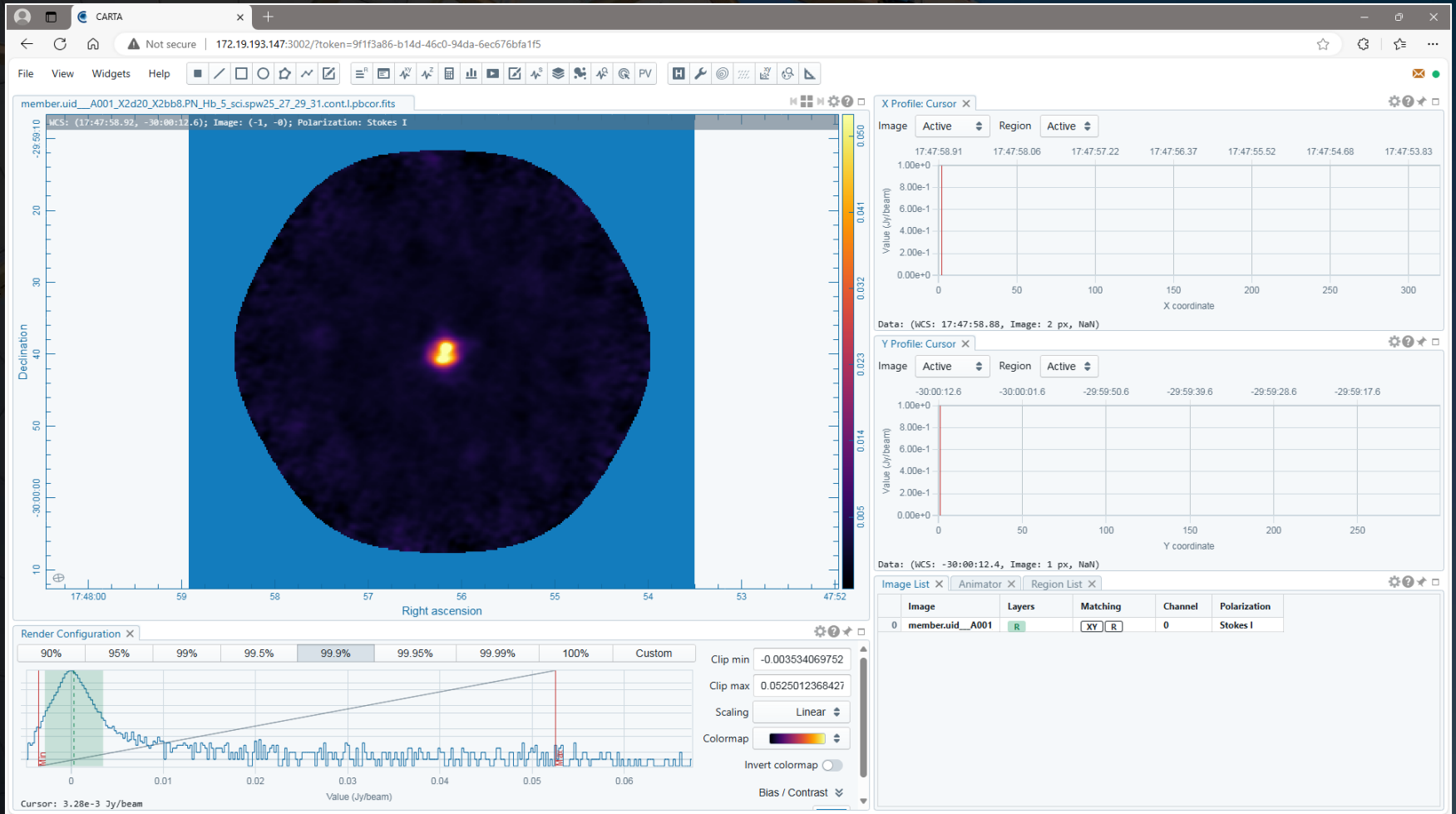
The screenshot shows the CARTA web interface in a browser window. The address bar shows the URL `172.19.193.147:3002/?token=9f1f3a86-b14d-46c0-94da-6ec676bfa1f5`. The main interface is currently empty, displaying "No image loaded" and "No file loaded". A "File Browser" window is open, showing a directory structure: `mnt > d > Linux > Demo > Working > product`. A table of files is displayed, with one file selected and highlighted in blue. A yellow arrow points to this selected file. To the right of the file list, a "File Information" panel is visible, showing details for the selected file.

Filename	Type	Size
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw27.repBW1.mask.fits.gz	FITS	159.7 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw27.mfs1.pbcor.fits	FITS	411.8 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw27.mfs1.pbcor.fits	FITS	193.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw27.mfs1.pbcor.fits.gz	FITS	4.2 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.mfs1.pbcor.fits	FITS	735.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.mfs1.pbcor.fits.gz	FITS	364.3 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.mfs1.mask.fits.gz	FITS	830.5 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25_27_29_31.cont1.pbcor.fits	FITS	414.7 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25_27_29_31.cont1.pbcor.fits.gz	FITS	189.3 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25_27_29_31.cont1.mask.fits.gz	FITS	4.9 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.mfs1.pbcor.fits	FITS	411.8 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.mfs1.pbcor.fits.gz	FITS	196.9 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.mfs1.mask.fits.gz	FITS	4.0 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.cube1.pbcor.fits	FITS	735.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25.cube1.pbcor.fits.gz	FITS	369.9 MB

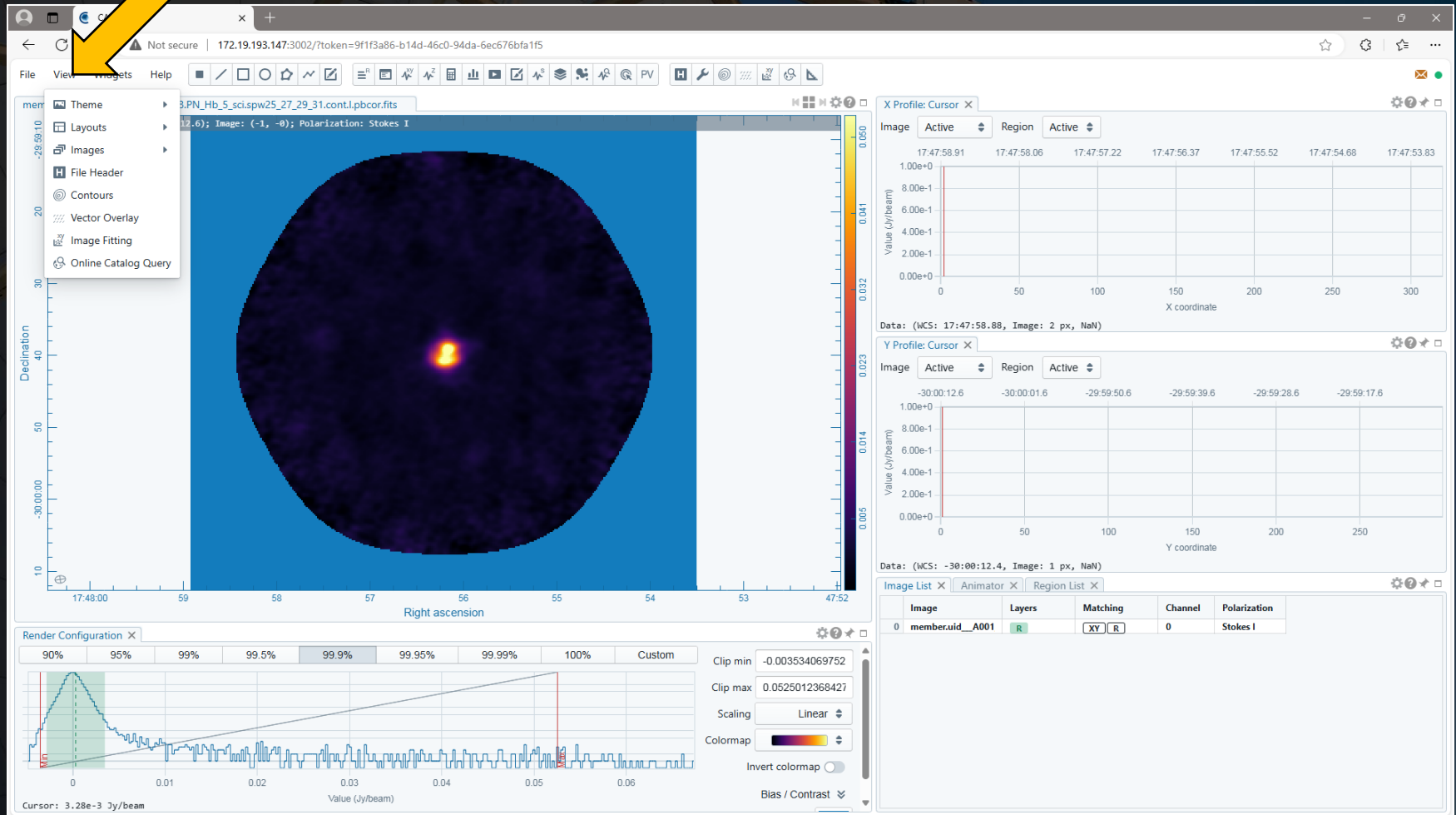
File Information

Name = member.uid__A001_X2d20_X2bb8.PN_Hb_5_scispw25_27_29_31.con
HDU = 0
Data type = float
Shape = [320, 300, 1, 1] (RA, DEC, FREQ, STOKES)
Number of channels = 1
Number of polarizations = 1
Coordinate type = Right Ascension, Declination
Projection = SIN
Image reference pixels = [161, 151]
Image reference coords = [17:47:56.2008, -029.59.39.5889]
Image ref coords (deg) = [266.984 deg, -29.9943 deg]
Pixel increment = -0.22", 0.22"
Pixel unit = Jy/beam
Celestial frame = ICRS
Spectral frame = LSRK
Velocity definition = RADIO
Restoring beam = 1.48788" X 1.04155", -81.9597 deg
RA range = [17:47:53.508, 17:47:58.911]

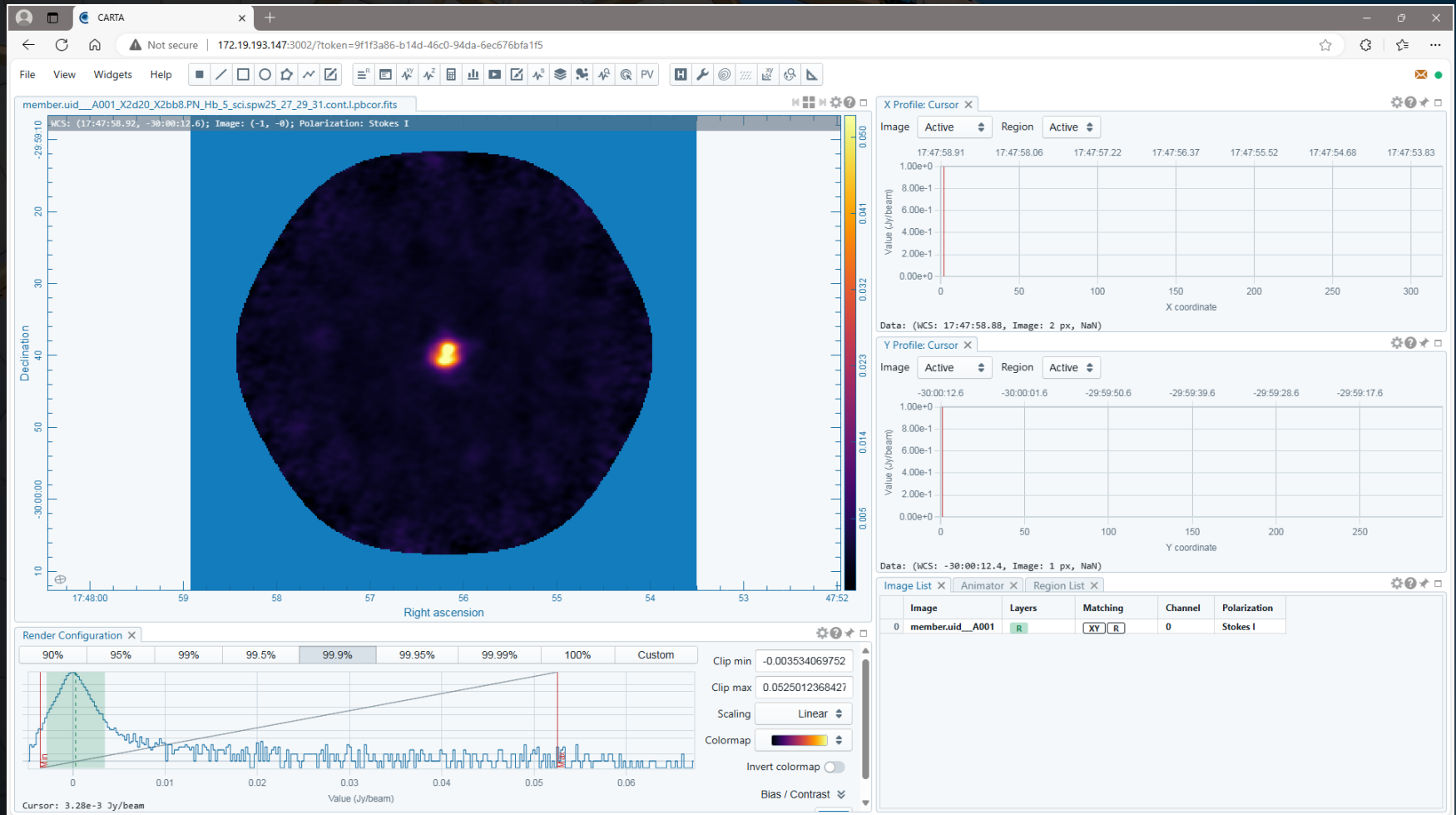
Once a file is selected, It will be possible to see CARTA's main display.



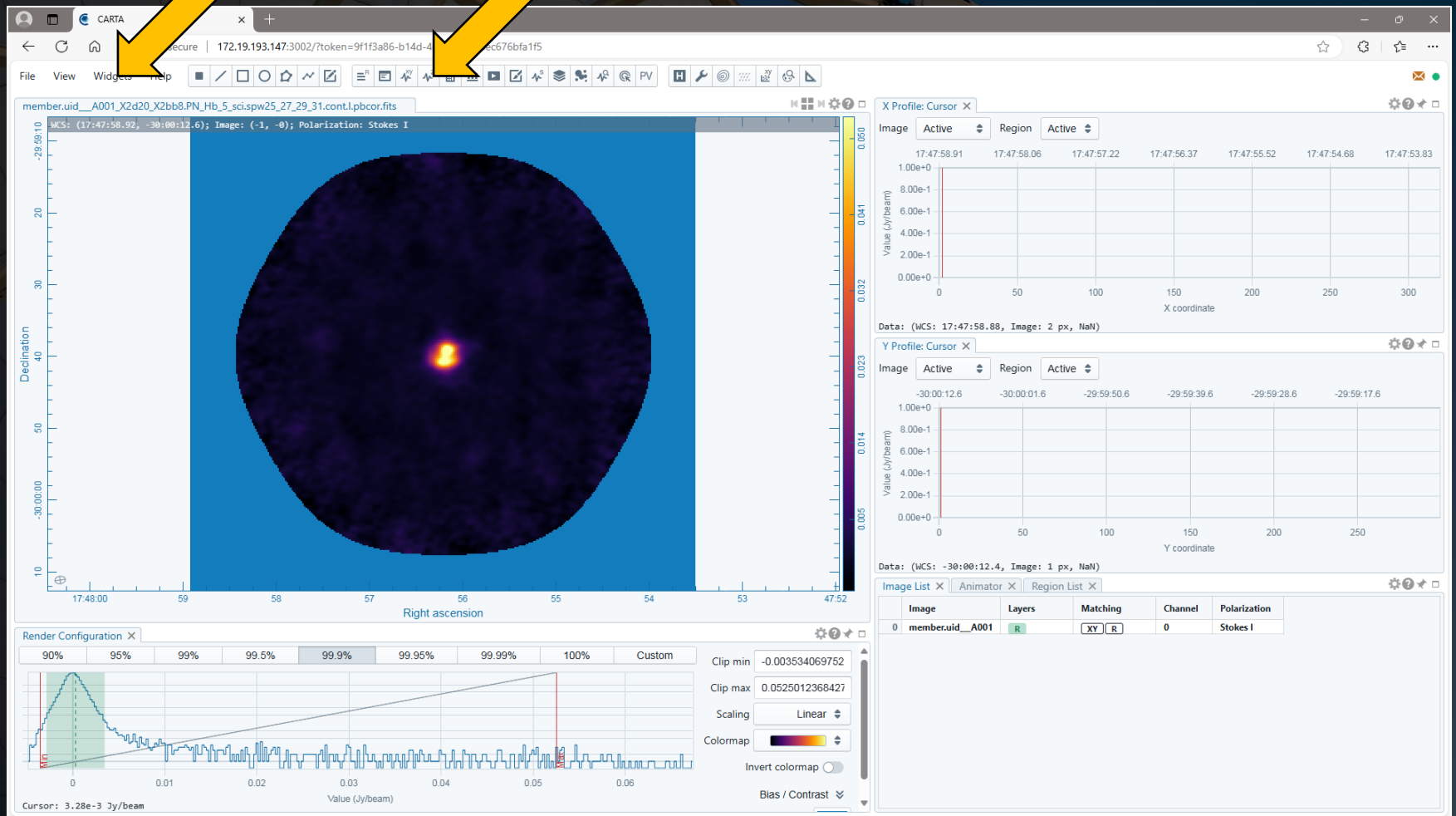
The default display features the image panel and six widgets. It is possible to select alternate panel arrangements by going to View and then Layouts in the menu bar at the top.



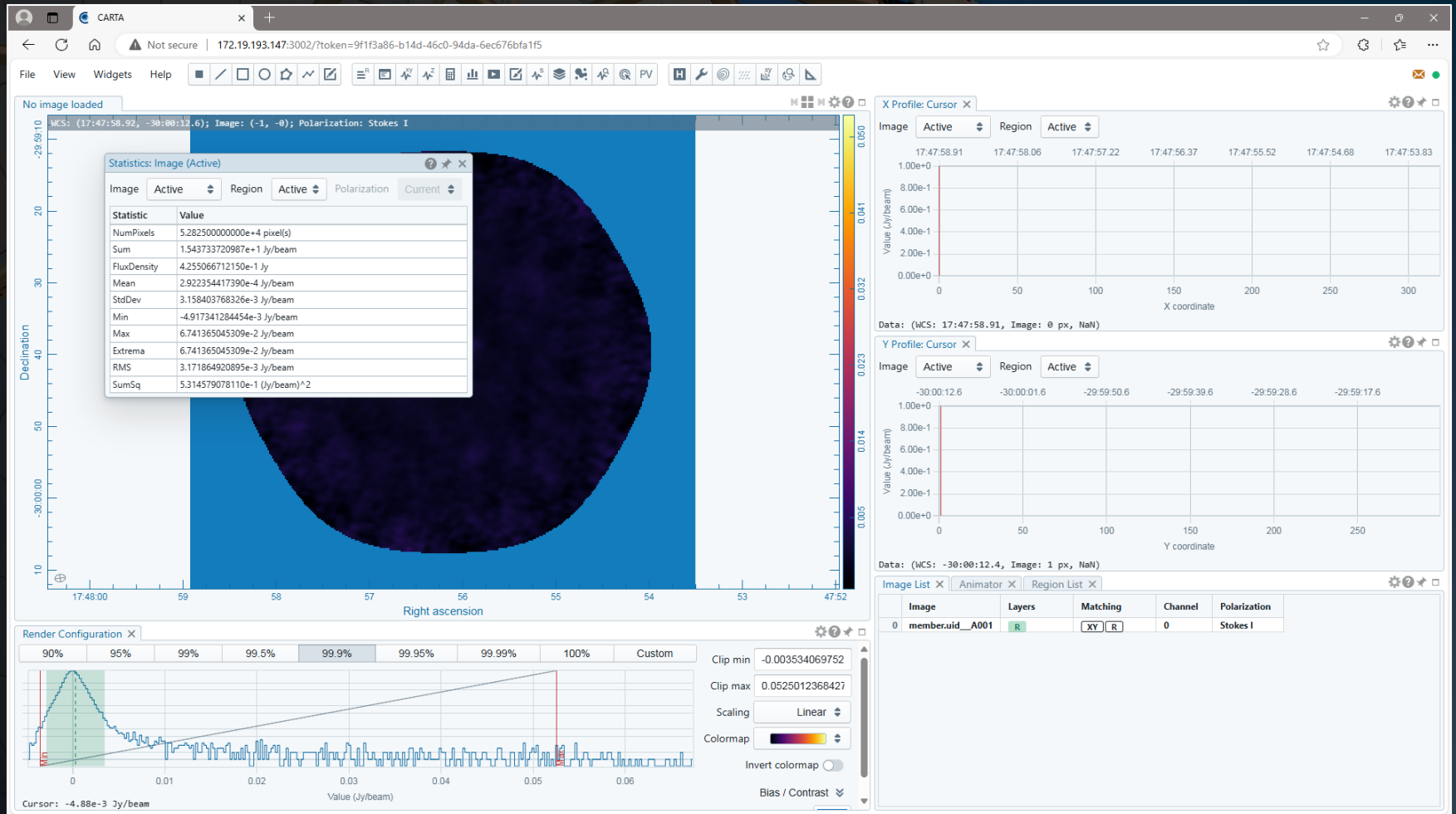
The default display features the image panel and six widgets. It is possible to select alternate panel arrangements by going to View and then Layouts in the menu bar at the top.



It is also possible to open new widgets by clicking on the various corresponding buttons in the button bar or by clicking on one of the options under Widgets in the menu bar.



It is also possible to open new widgets by clicking on the various corresponding buttons in the button bar or by clicking on one of the options under Widgets in the menu bar.



Widgets can be dragged around the screen by moving the cursor over the menu bar and holding down the left mouse button.

The screenshot displays the CARTA software interface. The main window shows a radio astronomy image with a color scale on the right ranging from -0.00013 to 0.00011. A yellow arrow points to the 'Statistics: Image (Active)' widget, which is currently active. The statistics table is as follows:

Statistic	Value
NumPixels	8.203110000000e+5 pixel(s)
Sum	1.585111254507e-2 Jy/beam
FluxDensity	2.884702004202e-4 Jy
Mean	1.932329634135e-8 Jy/beam
StdDev	3.197535761127e-5 Jy/beam
Min	-2.230609970866e-4 Jy/beam
Max	2.411469322396e-4 Jy/beam
Extrema	2.411469322396e-4 Jy/beam
RMS	3.197534396020e-5 Jy/beam
SumSq	8.387045229612e-4 (Jy/beam) ²

Below the main image is the 'Render Configuration' widget, which shows a histogram of the image values. The histogram has a green shaded region around the mean and red vertical lines for the minimum and maximum values. The 'Clip Min' is set to -0.000131531984 and the 'Clip Max' is 0.0001365914651. The scaling is set to 'Linear' and the color map is a rainbow spectrum. The 'Bias / Contrast' is also visible.

On the right side, there are two 'X Profile: Cursor' and 'Y Profile: Cursor' widgets, both showing empty plots with axes for 'Value (Jy/beam)' and 'X coordinate' or 'Y coordinate'. Below these is the 'Image List' widget, which contains a table of loaded images:

Image	Layers	Matching	Channel	Polarization
0	memberuid__A001	R	XY	R
			0	Stokes I

Widgets can be dragged around the screen by moving the cursor over the menu bar and holding down the left mouse button.

The screenshot displays the CARTA software interface. The main window shows a radio astronomy image of a source, with axes for Right ascension (53 to 59) and Declination (10 to 40). A color bar on the right indicates flux density values from 0.005 to 0.050 Jy/beam. A yellow arrow points to the 'Statistics: Image (Active)' widget, which is currently open and displays the following data:

Statistic	Value
NumPixels	5.282500000000e+4 pixel(s)
Sum	1.543733720967e+1 Jy/beam
FluxDensity	4.255066712150e-1 Jy
Mean	2.922354417390e-4 Jy/beam
StdDev	3.158403768326e-3 Jy/beam
Min	-4.917341284454e-3 Jy/beam
Max	6.741365045309e-2 Jy/beam
Extrema	6.741365045309e-2 Jy/beam
RMS	3.171864920895e-3 Jy/beam
SumSq	5.314579078110e-1 (Jy/beam)^2

Below the main image, there is a 'Render Configuration' widget with a histogram and a 'Cursor: 0.01 Jy/beam' label. To the right, there are 'X Profile: Cursor X' and 'Y Profile' widgets showing line plots of the image data. At the bottom right, there is an 'Image List' table:

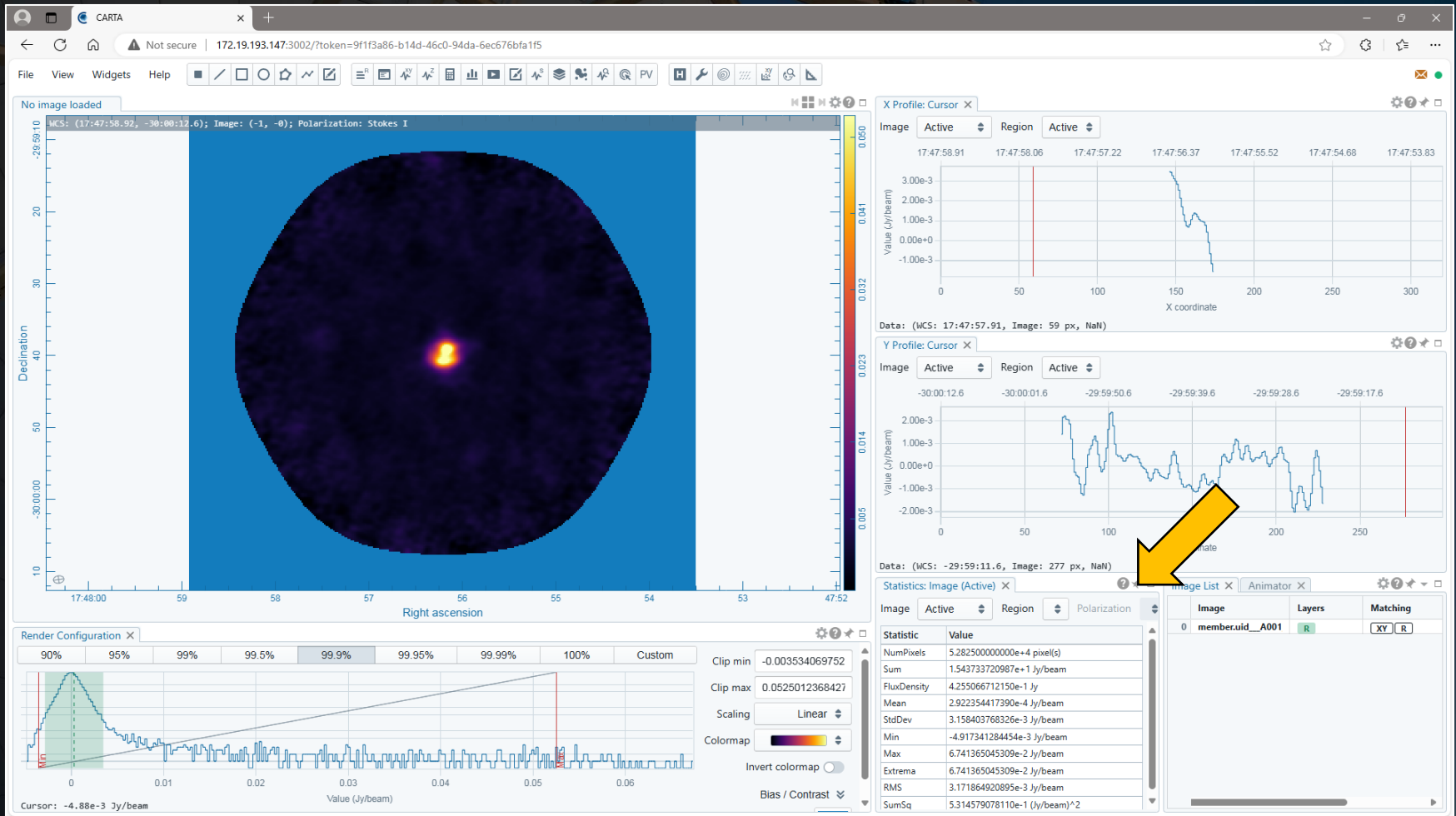
Image	Layers	Matching	Channel	Polarization
0	member.uid_A001	R	XY	Stokes I

Widgets can be fixed into place by moving the cursor over the pin icon, holding down the left mouse button, and then dragging the outline around CARTA. Widgets can be placed either in between other widgets or in the same place as others (with the widget selected using the tabs).

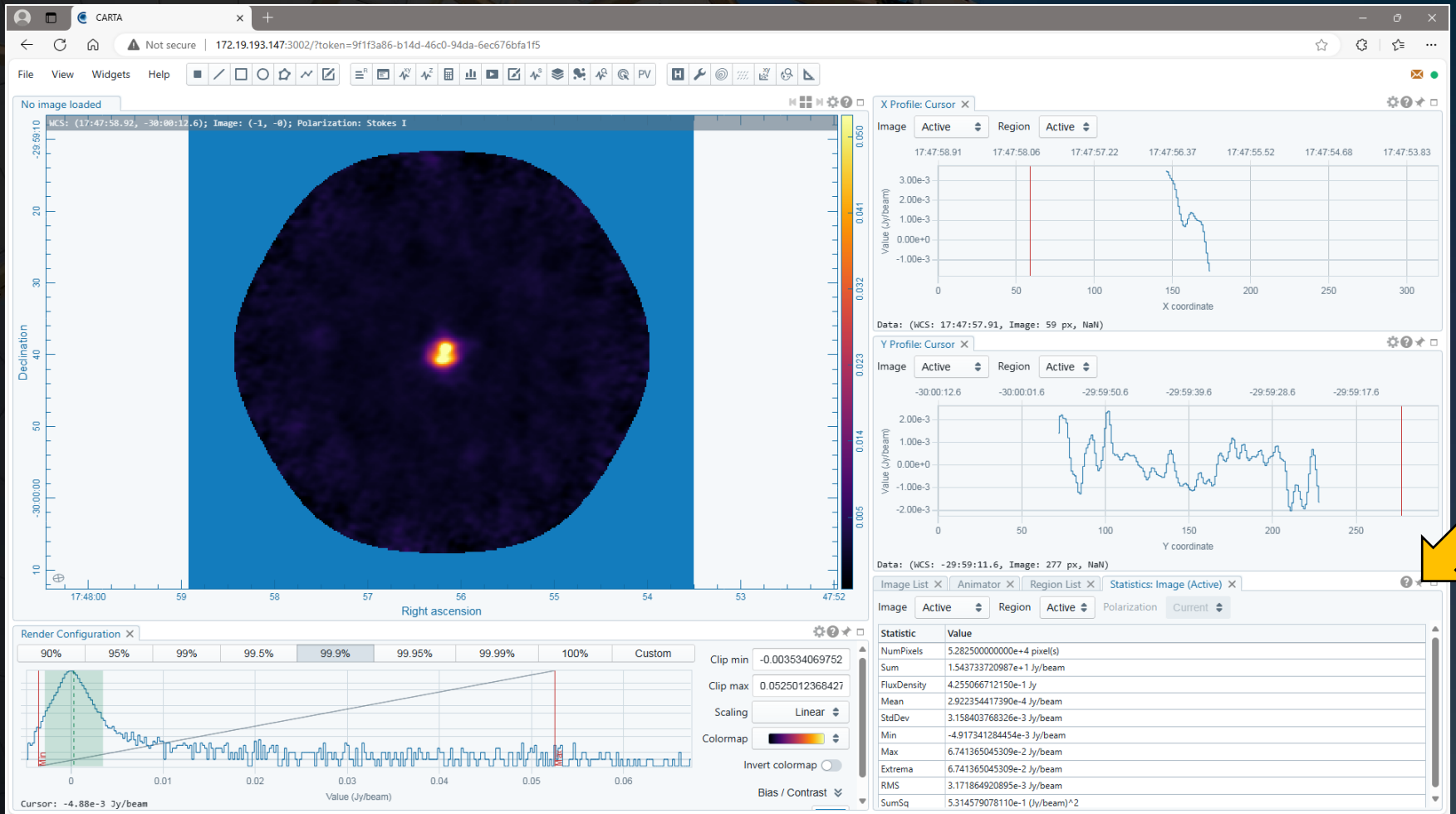
The screenshot displays the CARTA software interface. The main window shows a radio telescope image with a color scale on the right. A yellow arrow points to a pin icon on the 'Statistics: Image (Active)' widget. Below the image is a 'Render Configuration' panel with a histogram and various settings. On the right side, there are three profile plots: 'X Profile: Cursor X', 'Y Profile: Cursor X', and 'Image List X'. The 'Image List X' panel contains a table with the following data:

Image	Layers	Matching	Channel	Polarization
0	memberuid_A001	R	XY	R
			0	Stokes I

Widgets can be fixed into place by moving the cursor over the pin icon, holding down the left mouse button, and then dragging the outline around CARTA. Widgets can be placed either in between other widgets or in the same place as others (with the widget selected using the tabs).



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Left clicking on a question mark will bring up a help screen.

The screenshot shows the CARTA web interface. On the left, the 'Image List' widget is open, displaying a list of images and their properties. A help screen is overlaid on the left side of the widget, providing detailed information about the Image List Widget, including its purpose, controls, and usage instructions. The main interface shows a spectral plot with a color bar on the right, and a table of image data at the bottom right. A yellow arrow points to the gear icon in the bottom right corner of the Image List widget, indicating that clicking it will bring up a help screen.

Image List

The Image List Widget is a centralized location for basic information about all loaded images. Each entry includes the image name, rendering layers (**R** for raster, **C** for contours, and **V** for vector field), layer visibility state, spatial matching state, spectral matching state, color range matching state, channel index, and polarization type. Note that the channel index and polarization type are synchronized with the Animator Widget.

You can click the **R** button in an image entry to toggle the visibility of its raster layer. Similarly, the **C** and **V** buttons control the visibility of the image's contour and vector field layers, respectively.

The **XY** button allows you to toggle an image's spatial matching. Similarly, the **Z** button controls spectral matching, and the **R** button toggles aligning the color range with the reference image.

To change a reference image, right-click on a row to bring up the context menu. The spatial reference image, the spectral reference image, and the raster scaling reference image can be defined independently. Spectral matching defaults to the *radio velocity* convention, but an alternative spectral convention (such as frequency or channel) can be configured in the **Matching** tab of the Image List Settings Dialog (accessible through the cog icon at the top-right corner of the image list widget).

When spectrally matching in the velocity domain, it is possible to redefine the rest frequency for frequency-to-velocity conversion per image. This enables efficient comparison of distinct spectral features without the need for permanent alterations to the RESTFRQ header. You can access this functionality either through right-clicking on a row or through the **Rest Frequency** tab in the Image List Settings Dialog.

Images can also be closed from this widget: right-click on a row to access the context menu. Alternatively, to close the active image, use the **File** menu and select **Close Image**.

The order of entries in the list matches the **Image** slider of the Animator. In the multi-panel view of the Image Viewer, this list order determines the arrangement of images according to the left-right and top-down pattern. Images in the list can be rearranged through drag-and-drop: click or click and drag in the index column to select one or more rows, then hover over the selected rows in the index column until an open hand cursor appears. You can then click and drag to move the rows. Click outside the index column to clear the selection.

X Profile: Cursor X

Image	Active	Region	Active
17:47:58.91		17:47:58.06	
17:47:57.22		17:47:56.37	
17:47:55.52		17:47:54.68	
17:47:53.83			

Data: (WCS: 17:47:57.91, Image: 59 px, NaN)

Y Profile: Cursor X

Image	Active	Region	Active	
-30:00:12.6		-30:00:01.6		
-29:59:50.6		-29:59:39.6		
-29:59:28.6		-29:59:17.6		

Data: (WCS: -29:59:11.6, Image: 277 px, NaN)

Image List	Animator	Region List				
Image	Layers	Matching	Channel	Polarization		
0	member.uid_A001	R	XY	R	0	Stokes I

Left clicking on a gear icon will display settings for that window.

The screenshot displays the CARTA software interface. A gear icon in the top right corner of the main image plot is highlighted with a yellow arrow. An 'X Spatial Profile Settings: Cursor' dialog box is open, showing options for styling and computation. The main image plot shows a circular field of view with a bright source. Two profile plots are visible: 'X Profile: Cursor X' and 'Y Profile: Cursor X'. The X profile plot shows a sharp peak at X coordinate 59. The Y profile plot shows a complex profile with multiple peaks. A 'Render Configuration' dialog box is also open at the bottom left, showing a histogram of the image data and various rendering options.

X Spatial Profile Settings: Cursor

- Styling
- Smoothing
- Computation
- Coordinate: X
- Line color (Primary): [Blue]
- Line width (px): 1
- Point size (px): 1.5
- Show WCS axis:
- Show mean/RMS:
- Line style: [Solid]

X Profile: Cursor X

Image: Active Region: Active

Data: (WCS: 17:47:57.91, Image: 59 px, NaN)

Y Profile: Cursor X

Image: Active Region: Active

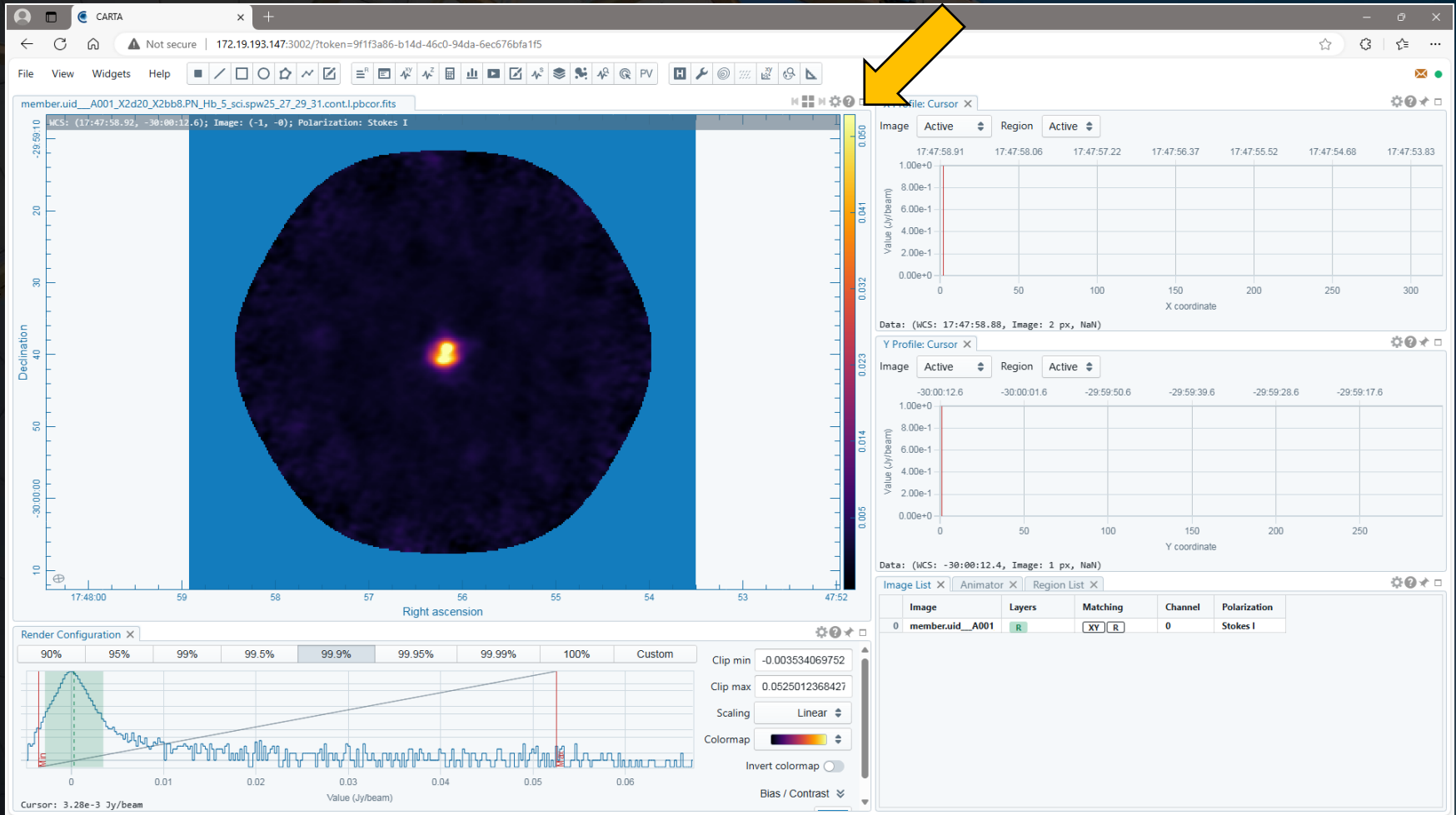
Data: (WCS: -29:59:11.6, Image: 277 px, NaN)

Render Configuration

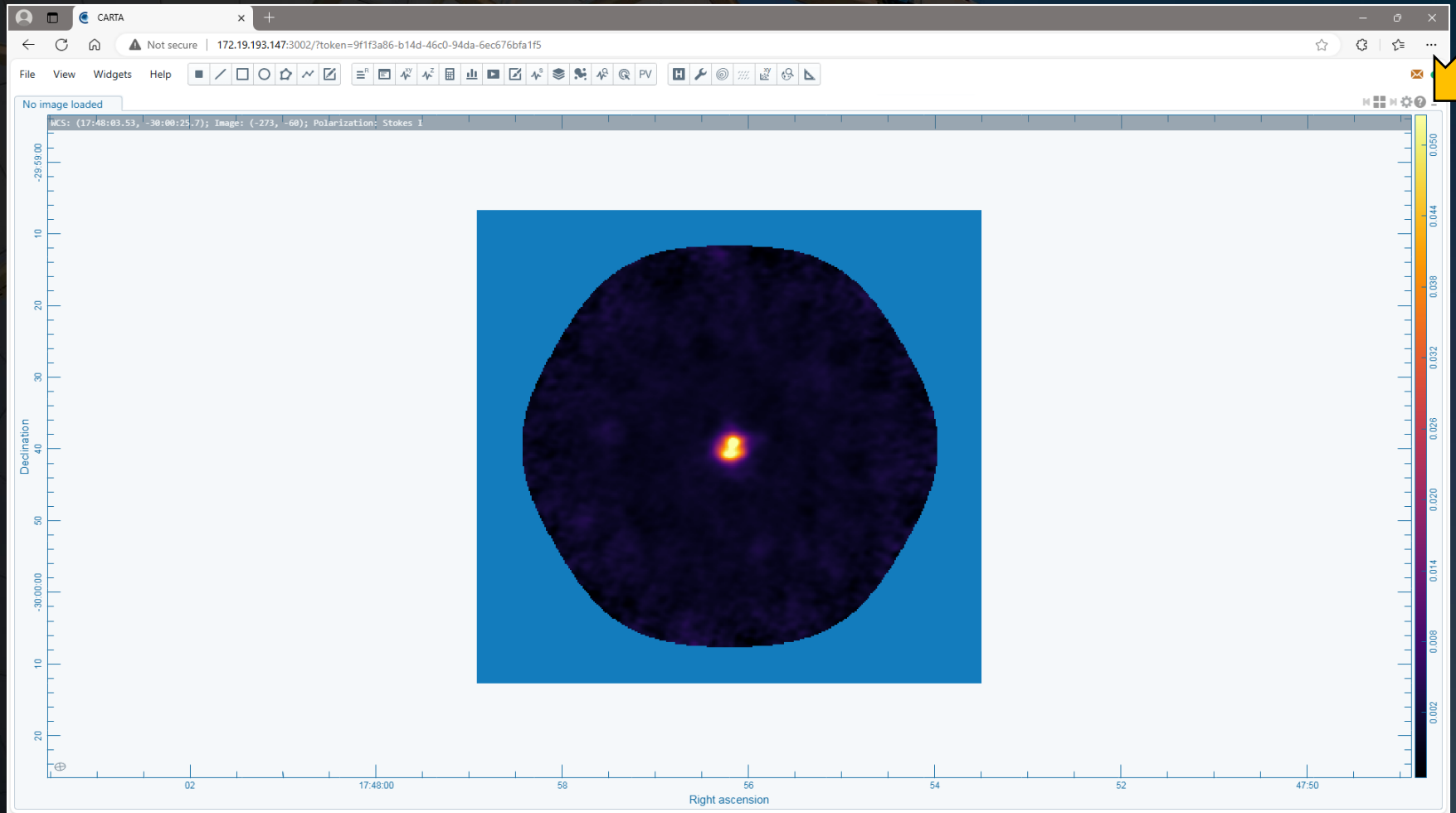
Clip min: -0.003534069752
Clip max: 0.0525012368427
Scaling: Linear
Colormap: [Colorbar]
Invert colormap:
Bias / Contrast: [Slider]

Image	Layers	Matching	Channel	Polarization
0	memberuid_A001	R	XY	Stokes I

Left clicking on the rectangle icon will maximize the widget. When a widget is maximized, left clicking on the single bar will restore the widget to its original size.



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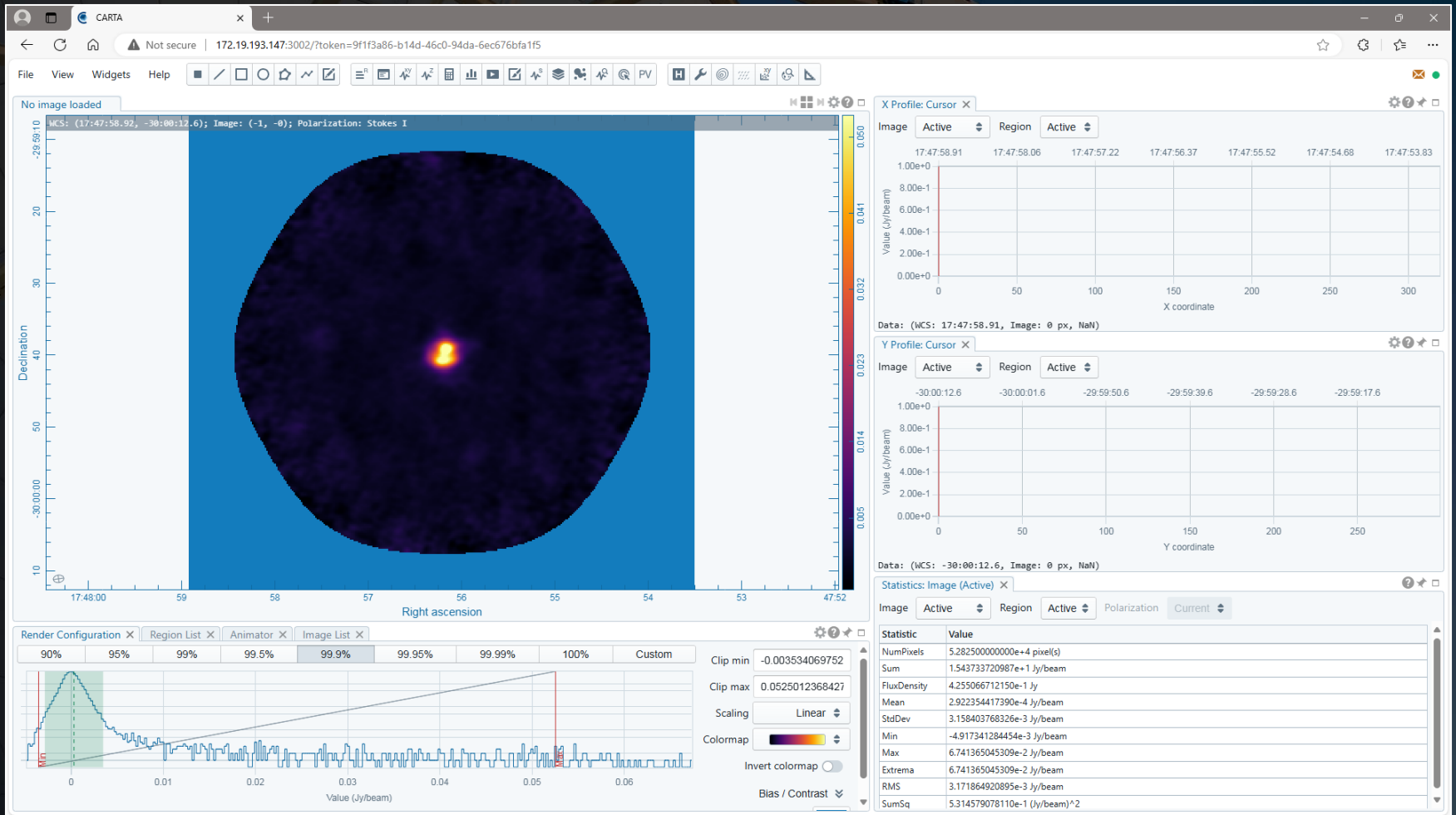


Various widget configurations can be saved by going to View, then Layouts, and then Save Layout.

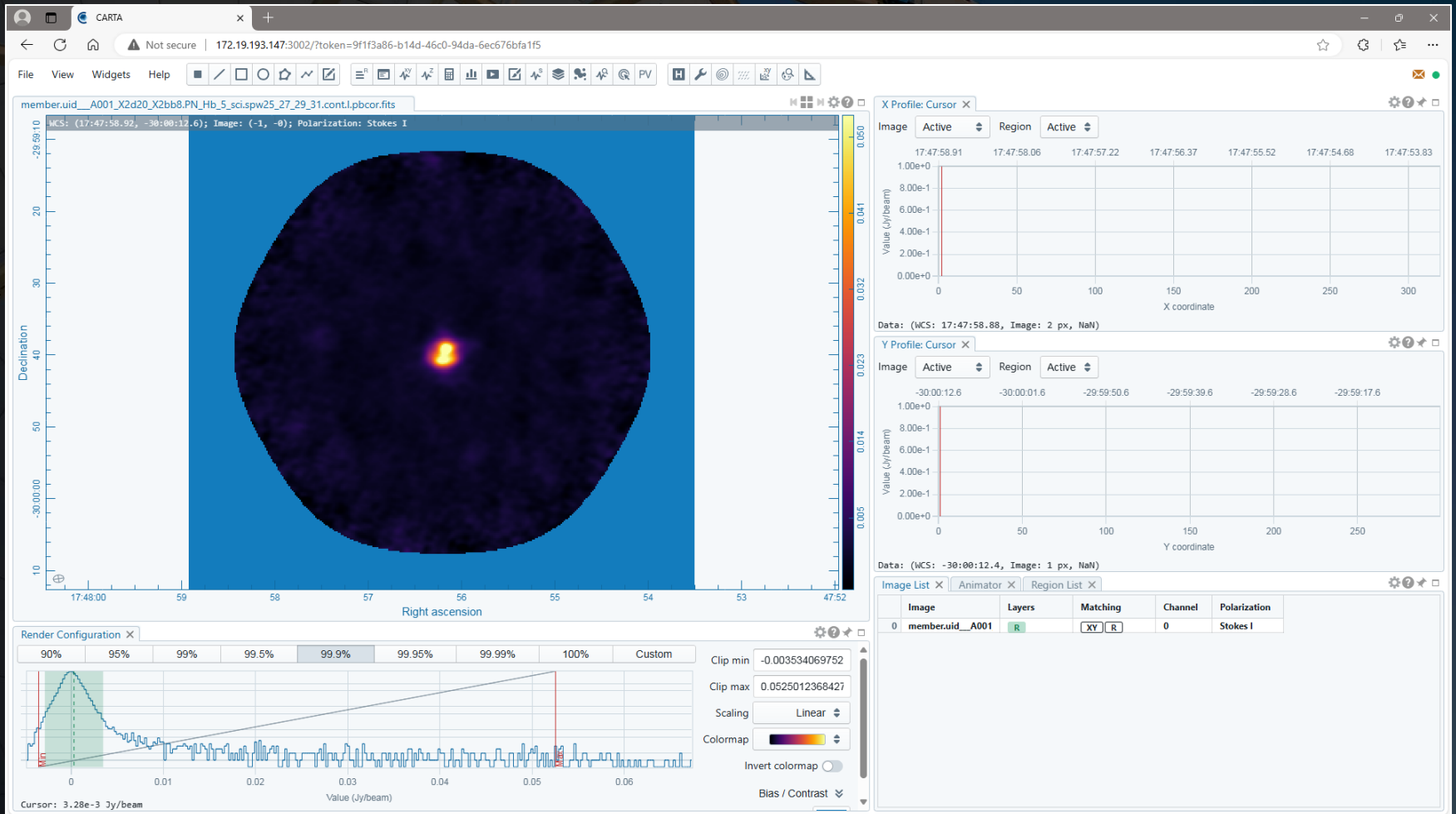
The screenshot displays the CARTA software interface. The main window shows a circular field of view with a bright source at the center. The axes are labeled 'Right ascension' (horizontal) and 'Declination' (vertical). A color bar on the right indicates intensity values from 0.000 to 0.050. The 'Render Configuration' panel at the bottom left shows a histogram of the data with a cursor at 3.28e-3 Jy/beam. The right side of the interface features two profile plots: 'X Profile: Cursor X' and 'Y Profile: Cursor X'. The 'X Profile' plot shows 'Value (Jy/beam)' vs 'X coordinate' with data points at 17:47:58.91, 17:47:58.06, 17:47:57.22, 17:47:56.37, 17:47:55.52, 17:47:54.68, and 17:47:53.83. The 'Y Profile' plot shows 'Value (Jy/beam)' vs 'Y coordinate' with data points at -30:00:12.6, -30:00:01.6, -29:59:50.6, -29:59:39.6, -29:59:28.6, and -29:59:17.6. The 'Image List' table at the bottom right shows the following configuration:

Image	Layers	Matching	Channel	Polarization
0 memberuid_A001	R	XY R	0	Stokes I

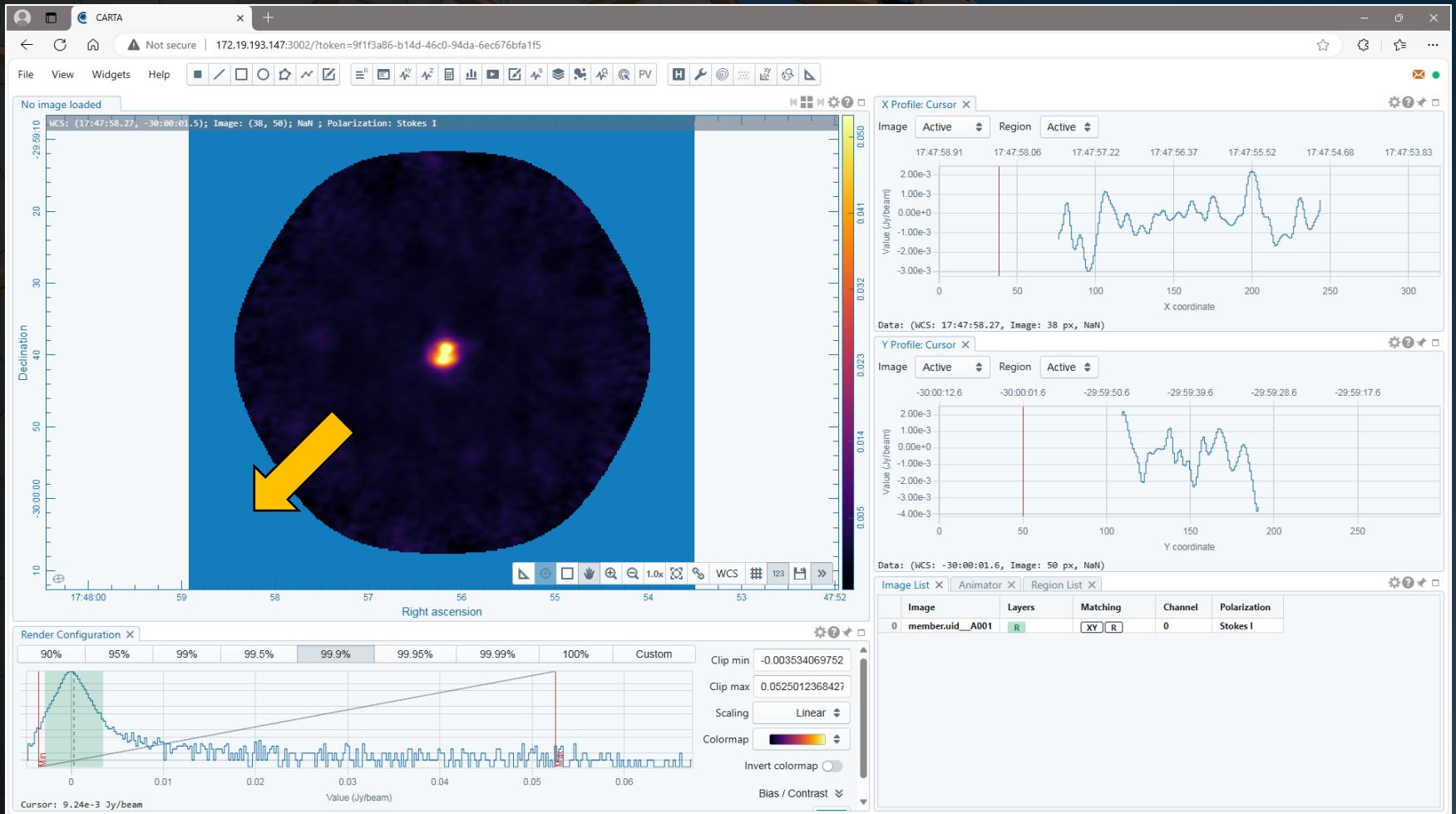
Various widget configurations can be saved by going to View, then Layouts, and then Save Layout.



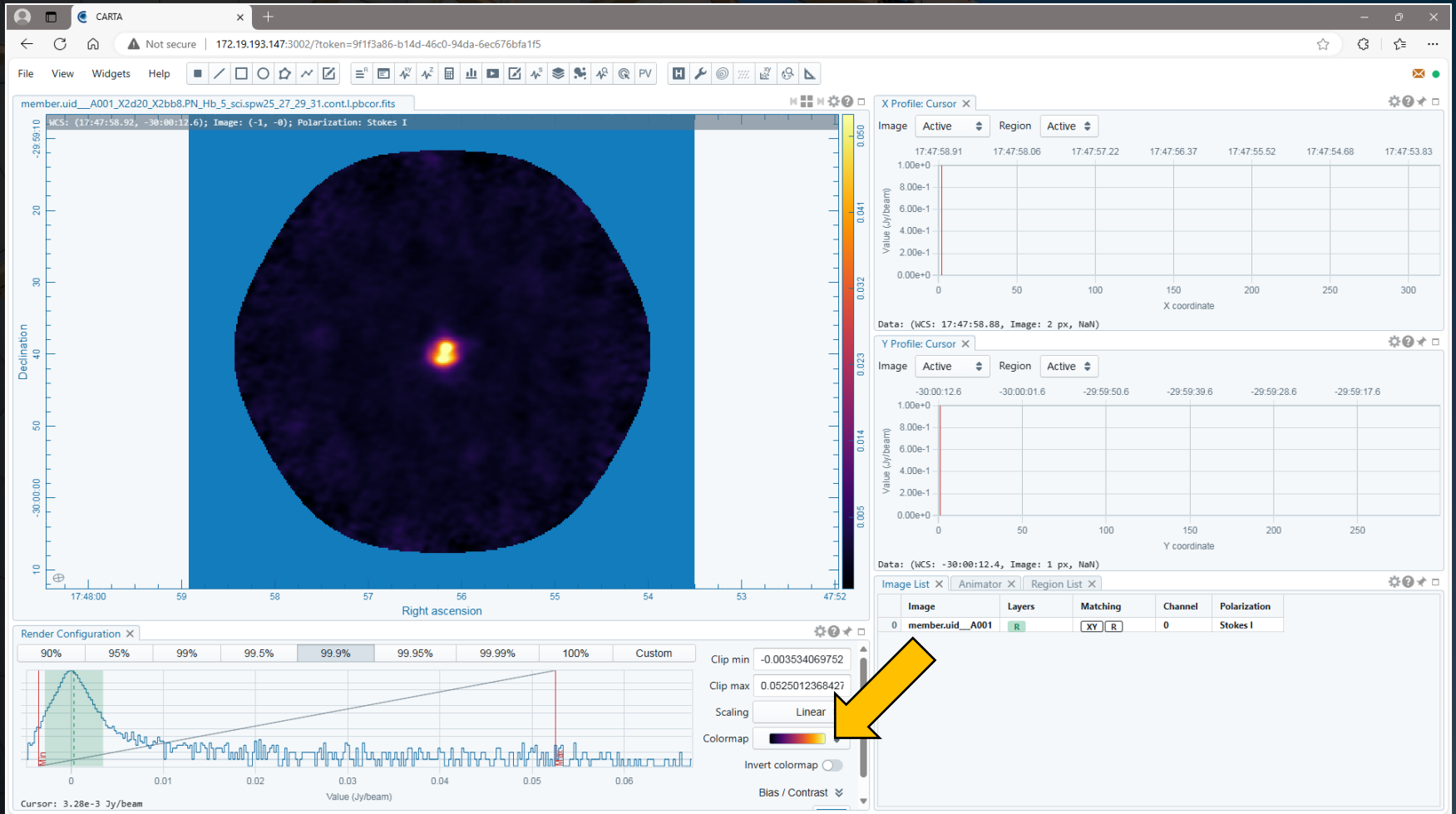
In the image panel, text at the top shows the coordinates and pixel value at the location of the cursor. The beam is visible by default in the lower left corner. The colour bar is shown on the right. Additional display tools will appear on the lower right when hovering the cursor over the window.



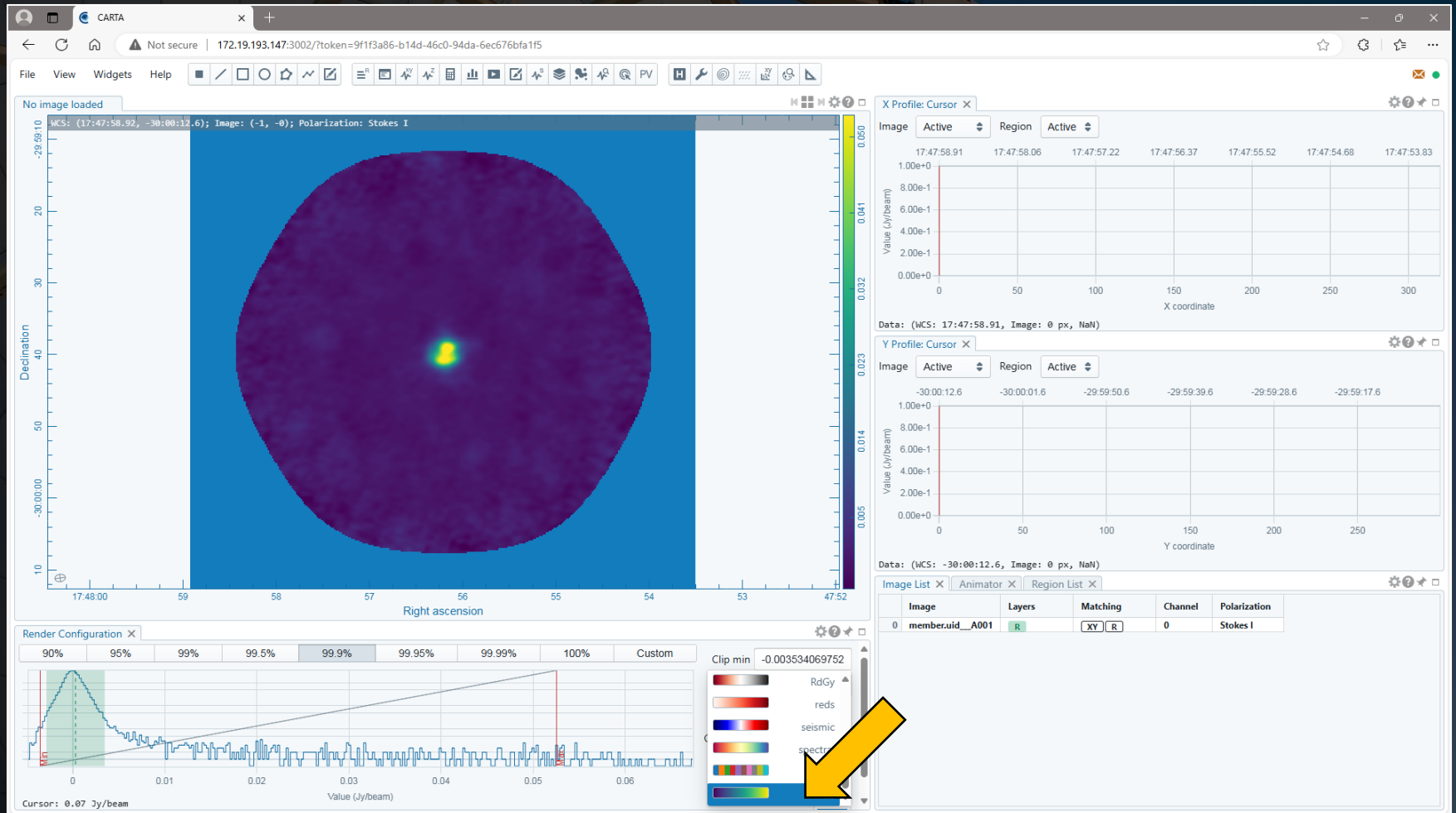
In the image panel, text at the top shows the coordinates and pixel value at the location of the cursor. The beam is visible by default in the lower left corner. The colour bar is shown on the right. Additional display tools will appear on the lower right when hovering the cursor over the window.



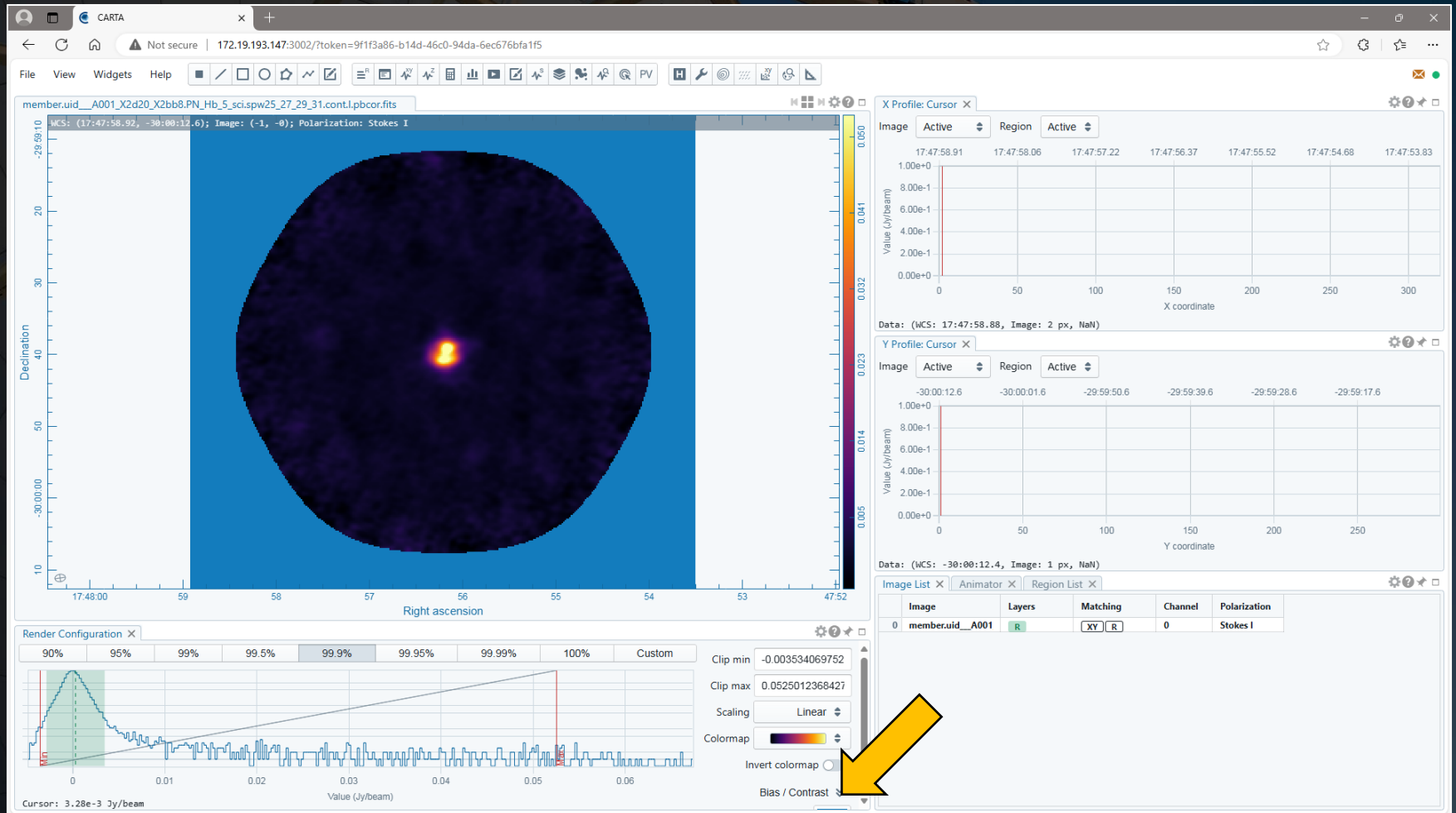
The Render Configuration widget at the bottom of the display shows how the pixel values are converted into colours. This can be used to change the minimum and maximum ranges used in the conversion, the scaling function, and the color map.



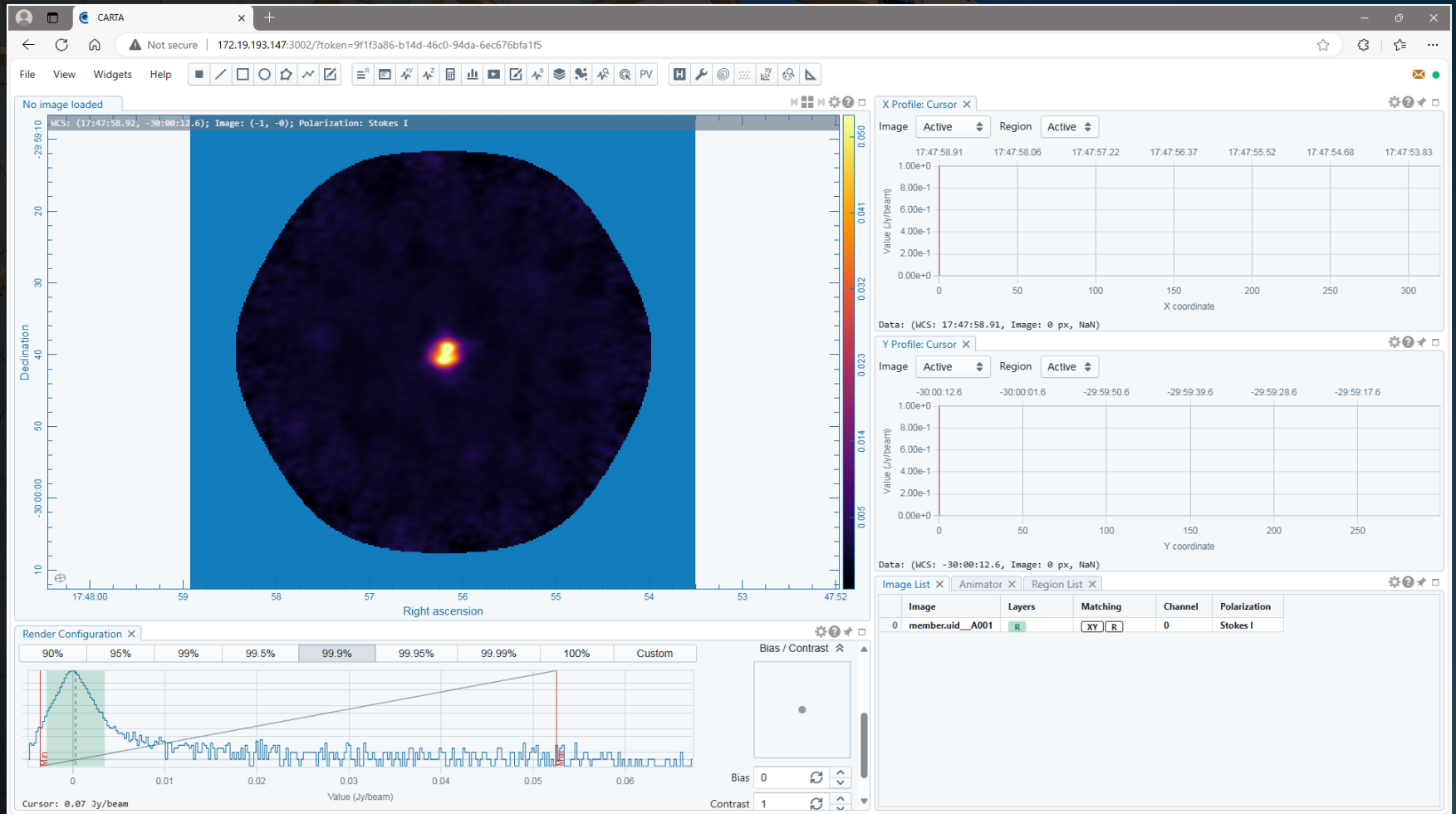
The Render Configuration widget at the bottom of the display shows how the pixel values are converted into colours. This can be used to change the minimum and maximum ranges used in the conversion, the scaling function, and the color map.



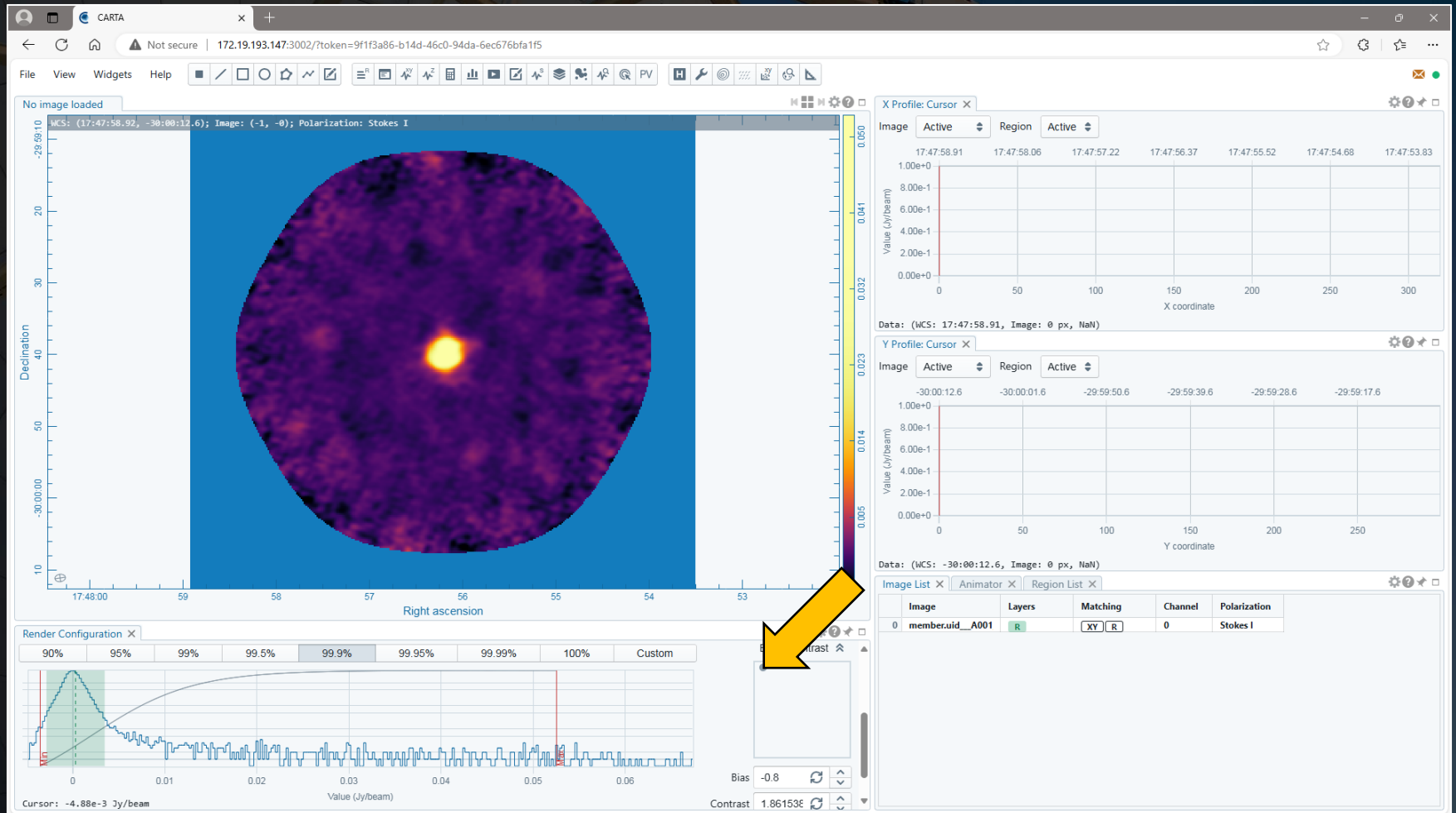
Also note that clicking on the arrows next to Bias/Contrast in the Render Configuration widget will display a box with a dot that can be moved around to change the bias and contrast as well as boxes where these values can be typed in.



Also note that clicking on the arrows next to Bias/Contrast in the Render Configuration widget will display a box with a dot that can be moved around to change the bias and contrast as well as boxes where these values can be typed in.



Also note that clicking on the arrows next to Bias/Contrast in the Render Configuration widget will display a box with a dot that can be moved around to change the bias and contrast as well as boxes where these values can be typed in.



More than one image can be loaded into CARTA by clicking on File and then Append Image and then selecting a file in the File Browser.

The screenshot shows the CARTA software interface. The 'File' menu is open, and a yellow arrow points to the 'Append Image' option. The main window displays a circular radio telescope beam with a central bright spot. Below the main window are several panels: 'Render Configuration' with a histogram and 'Bias / Contrast' controls; 'X Profile' and 'Y Profile' plots showing intensity profiles; and an 'Image List' table at the bottom right.

Image	Layers	Matching	Channel	Polarization		
0	memberuid_A001	R	XY	R	0	Stokes I

More than one image can be loaded into CARTA by clicking on File and then Append Image and then selecting a file in the File Browser.

The screenshot displays the CARTA software interface. A File Browser dialog box is open in the foreground, showing a list of files in the directory `mnt > d > Linux > Demo > Working > product`. The files are listed with columns for Filename, Type, and Size. The main window behind the dialog shows a plot of Declination vs. Right Ascension with a circular region of interest. A table titled "X Profile: Cursor X" is visible on the right, showing data points for various RA values. At the bottom, there is a "Render Configuration" section with a graph of signal intensity and a "Cursor: 0.02 Jy/beam" label.

Filename	Type	Size
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.pbcor.fits	FITS	411.8 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.pb.fits.gz	FITS	185.0 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.mask.fits.gz	FITS	4.3 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.pbcor.fits	FITS	735.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.pb.fits.gz	FITS	345.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.mask.fits.gz	FITS	718.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.pbcor.fits	FITS	411.8 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.pb.fits.gz	FITS	187.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.mask.fits.gz	FITS	4.3 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.pbcor.fits	FITS	735.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.pb.fits.gz	FITS	349.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.mask.fits.gz	FITS	718.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.pbcor.fits	FITS	132.0 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.pb.fits.gz	FITS	66.6 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.mask.fits.gz	FITS	159.7 kB

More than one image can be loaded into CARTA by clicking on File and then Append Image and then selecting a file in the File Browser.

The screenshot displays the CARTA software interface. The main window shows a radio telescope dish with a dark image loaded. The status bar at the top indicates "No image loaded" and "MCS: (17:47:58.92, -30:00:12.6); Image: (-1, -0); Polarization: Stokes I". A File Browser dialog box is open in the center, showing a list of files in the directory "mnt > d > Linux > Demo > Working > product". A yellow arrow points to the file "member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.pbcor.fits" which is selected. The File Information panel on the right shows details for the selected file, including Name, HDU, Data type, Shape, Number of channels, Number of polarizations, Coordinate type, Projection, Image reference pixels, Image reference coords, Image ref coords (deg), Pixel increment, Pixel unit, Celestial frame, Spectral frame, Velocity definition, Restoring beam, and RA range. The Render Configuration panel at the bottom left shows a plot of the beam profile with a cursor at 0.02 Jy/beam. The X Profile panel at the top right shows a plot of the image profile with a cursor at 17:47:58.91.

File Browser

mnt > d > Linux > Demo > Working > product

Filename	Type	Size
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.pbcor.fits	FITS	411.8 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.pb.fits.gz	FITS	185.0 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.mfs.l.mask.fits.gz	FITS	4.3 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.pbcor.fits	FITS	735.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.pb.fits.gz	FITS	345.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.pb.mask.fits.gz	FITS	718.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw31.cube.l.mask.fits.gz	FITS	411.8 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.pbcor.fits	FITS	718.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.pb.fits.gz	FITS	413 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.mfs.l.mask.fits.gz	FITS	413 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.pbcor.fits	FITS	735.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.pb.fits.gz	FITS	349.8 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw29.cube.l.mask.fits.gz	FITS	718.6 kB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.pbcor.fits	FITS	132.0 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.pb.fits.gz	FITS	66.6 MB
member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.mask.fits.gz	FITS	159.7 kB

File Information

Name = member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW1.pbcor.fits
HDU = 0
Data type = float
Shape = [300, 288, 382, 1] (RA, DEC, FREQ, STOKES)
Number of channels = 382
Number of polarizations = 1
Coordinate type = Right Ascension, Declination
Projection = SIN
Image reference pixels = [151, 145]
Image reference coords = [17:47:56.2008, -029.59.39.5880]
Image ref coords (deg) = [266.984 deg, -29.9943 deg]
Pixel increment = -0.23", 0.23"
Pixel unit = Jy/beam
Celestial frame = ICRS
Spectral frame = LSRK
Velocity definition = RADIO
Restoring beam = 1.60387" X 1.15327", -77.3903 deg
RA range = [17:47:53.563, 17:47:58.857]

Close Append

More than one image can be loaded into CARTA by clicking on File and then Append Image and then selecting a file in the File Browser.

The screenshot displays the CARTA software interface. The main window shows a radio astronomy image with a color scale from -0.05 to 0.05 Jy/beam. The image is centered on a region with Right Ascension (RA) from 17:47:52 to 17:48:00 and Declination (Dec) from -30:00:10 to -30:00:40. The WCS information is: (17:47:58.87, -30:00:12.7); Image: (-1, -0); Frequency (LSRK): 230.0844 GHz; Velocity: 589.9226 km/s; Polarization: Stokes I.

Below the main image is the 'Render Configuration' panel, showing a histogram of the image values. The histogram has a peak at 0 Jy/beam. The cursor is at -9.89e-2 Jy/beam. The Bias/Contrast panel shows Bias at 0 and Contrast at 1.

On the right side, there are two profile plots. The 'X Profile: Cursor' plot shows the value (Jy/beam) versus X coordinate (0 to 300). The 'Y Profile: Cursor' plot shows the value (Jy/beam) versus Y coordinate (0 to 250).

At the bottom right, the 'Image List' table shows the loaded images:

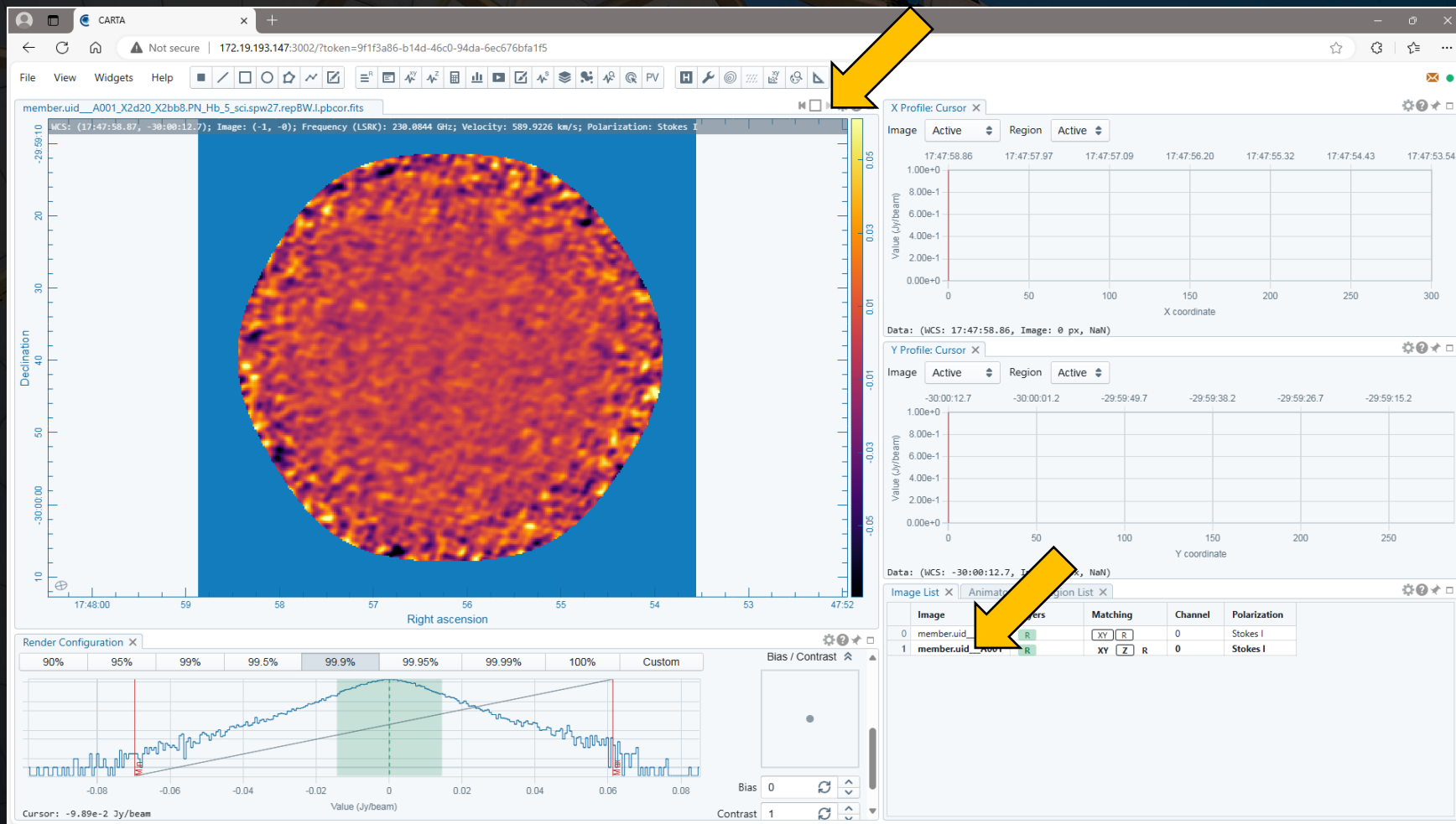
Image	Layers	Matching	Channel	Polarization
0 memberuid__A001_	R	XY R	0	Stokes I
1 memberuid__A001	R	XY Z R	0	Stokes I

Images can be displayed either individually or in a grid by clicking on an icon above the image panel.

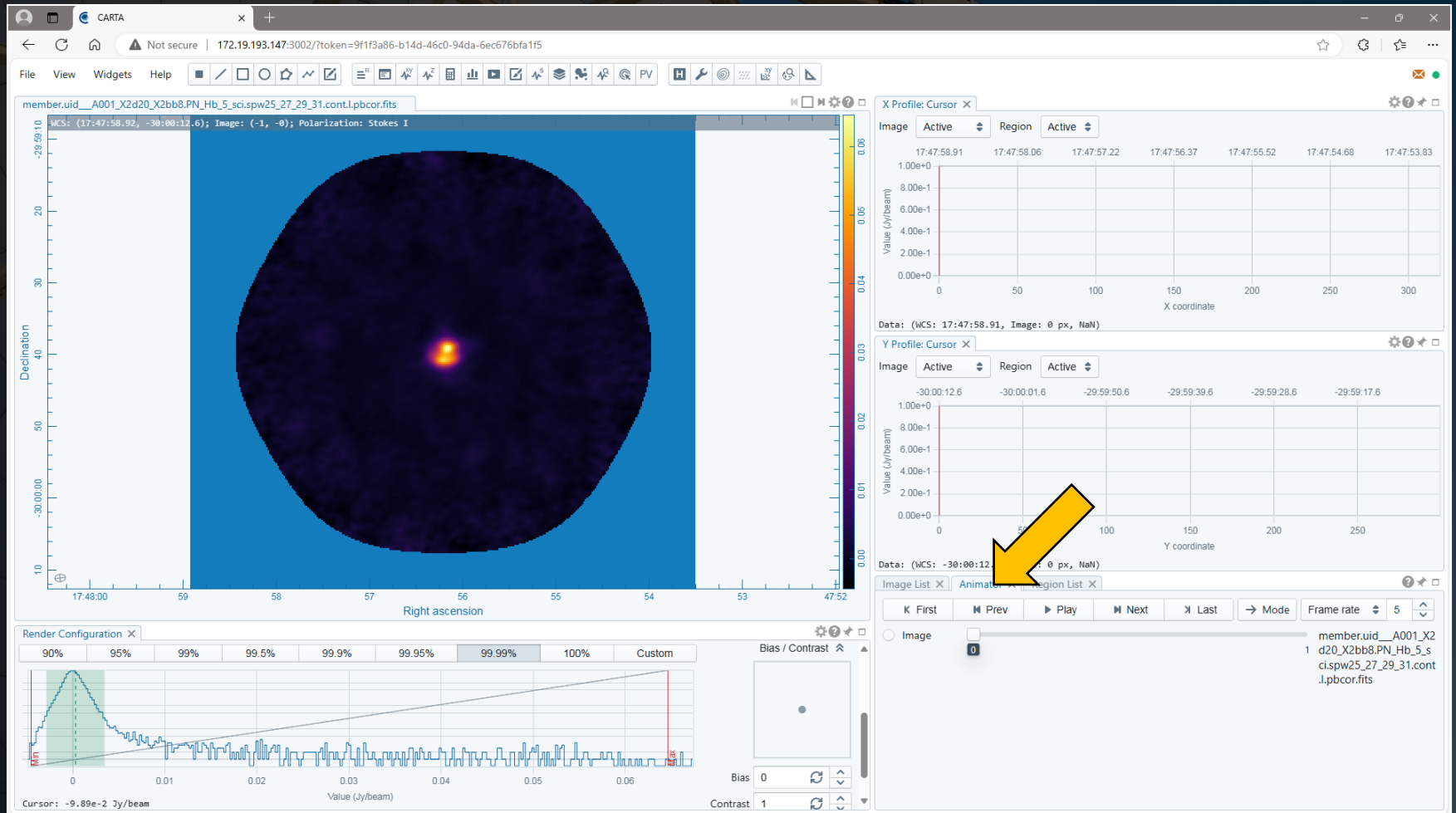
The screenshot displays the CARTA software interface. At the top, a browser window shows the URL `172.193.147.3002/?token=9f1f3a86-b14d-46c0-94da-6ec676bfa1f5`. The main interface features a toolbar with various icons, including a grid icon highlighted by a yellow arrow. Below the toolbar, two circular astronomical images are displayed side-by-side. The left image shows a bright central source, while the right image shows a noisy, textured field. Both images have axes labeled 'Right ascension' and 'Declination'. Below the images, there are several control panels: 'Render Configuration' with a histogram and a 'Cursor' value of $-9.89e-2$ Jy/beam; 'Bias / Contrast' controls; and 'X Profile' and 'Y Profile' panels showing data plots. At the bottom right, an 'Image List' table is visible.

Image	Layers	Matching	Channel	Polarization
0 memberuid__A001_	R	XY R	0	Stokes I
1 memberuid__A001	R	XY Z R	0	Stokes I

When images are displayed individually, it is possible to switch between images by clicking on the arrows above the image, by clicking on the name of an image in the Image List, or by paging between images in the Animator widget.



When images are displayed individually, it is possible to switch between images by clicking on the arrows above the image, by clicking on the name of an image in the Image List, or by paging between images in the Animator widget.



The Animator widget can also be used to move between channels in an image cube and change the Stokes parameter displayed in images from full polarization observations.

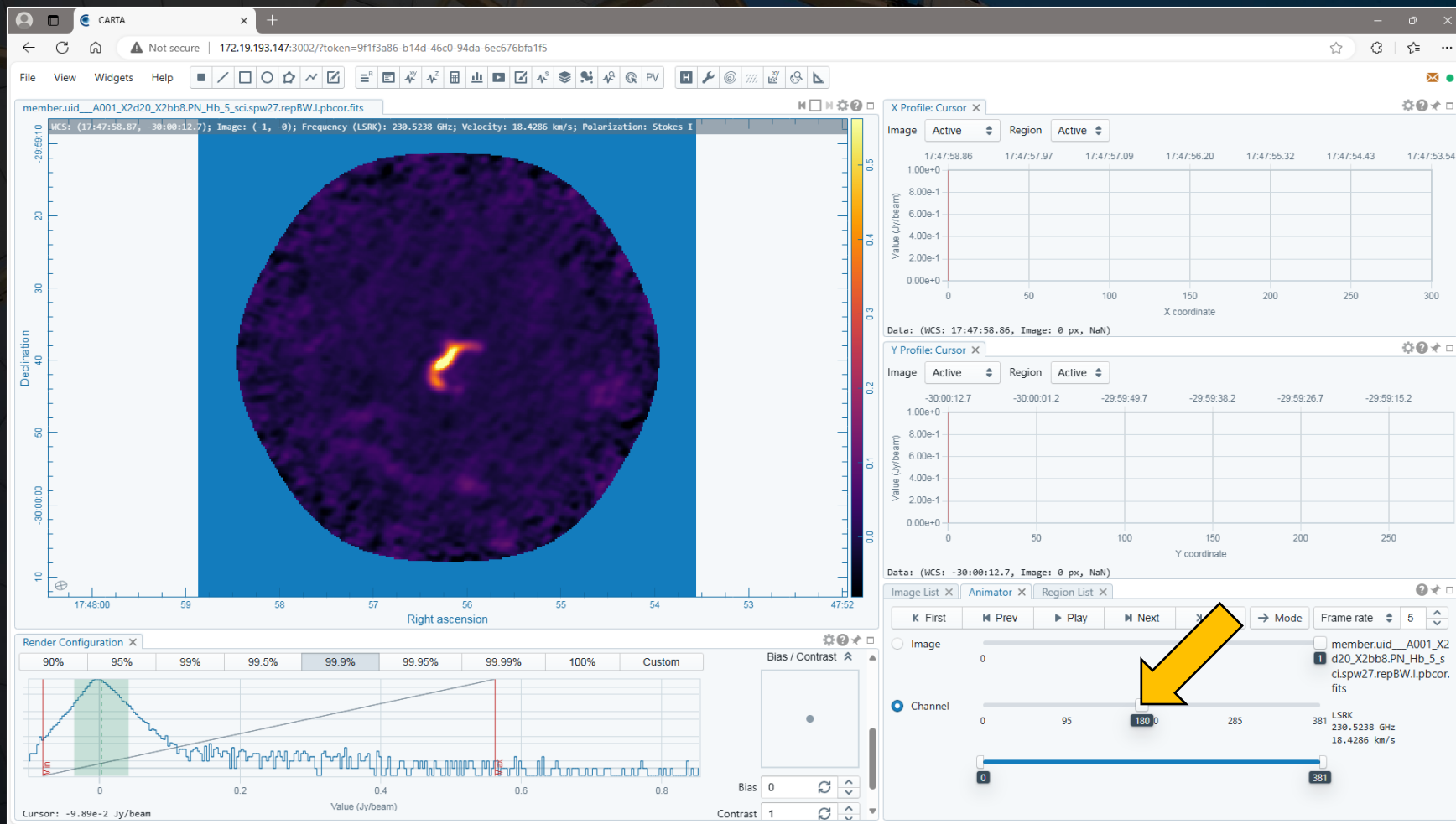


Image coordinate systems can be aligned by clicking on the XY option in the Matching column in the Image List widget.

The screenshot displays the CARTA software interface. The main window shows a radio astronomy image with a color scale from -0.05 to 0.05 Jy/beam. The axes are labeled 'Right ascension' (47.52 to 17.48.00) and 'Declination' (10 to -30.00.00). Below the image is a 'Render Configuration' panel with a histogram and a 'Bias / Contrast' panel.

On the right side, there are two profile plots: 'X Profile: Cursor X' and 'Y Profile: Cursor X'. The X Profile plot shows 'Value (Jy/beam)' vs 'X coordinate' with data points at 17:47:58.86, 17:47:57.97, 17:47:57.09, 17:47:56.20, 17:47:55.32, 17:47:54.43, and 17:47:53.54. The Y Profile plot shows 'Value (Jy/beam)' vs 'Y coordinate' with data points at -30:00:12.7, -30:00:01.2, -29:59:49.7, -29:59:38.2, -29:59:26.7, and -29:59:15.2.

At the bottom right, the 'Image List' widget is visible, containing a table with columns 'Image', 'Layers', 'Matching', 'Channel', and 'Polarization'. A yellow arrow points to the 'Matching' column for the first two rows.

Image	Layers	Matching	Channel	Polarization
0 memberuid__A001_	R	<input type="checkbox"/>	0	Stokes I
1 memberuid__A001	R	<input checked="" type="checkbox"/>	0	Stokes I

Image headers can be displayed by clicking on the icon with the H in the button bar.

The screenshot displays the CARTA software interface. A yellow arrow points to the 'H' icon in the top toolbar, which is used to display the file header. The main window shows a radio astronomy image with a color scale from 0 to 0.05. The image is titled 'member.uid_A001_X2d20_X2bb8.PN_Hb_5_sci.spw27.repBW.l.pcor.fits'. The header information is displayed in a pop-up window titled 'File Header'.

File Header

File Information Header

```
SIMPLE = T / Standard FITS
BITPIX = -32 / Floating point (32 bit)
NAXIS = 4
NAXIS1 = 300
NAXIS2 = 288
NAXIS3 = 382
NAXIS4 = 1
EXTEND = T
BSCALE = 1.000000000000E+00 / PHYSICAL = PIXEL*BSCALE + BZERO
BZERO = 0.000000000000E+00
BMAJ = 4.455180631073E-04
BMIN = 3.203540811359E-04
BPA = -7.739027682892E+01
BTYP = Intensity
OBJECT = PN_Hb_5
BUNIT = Jy/beam / Brightness (pixel) unit
RADESYS = ICRS
LONPOLE = 1.800000000000E+02
LATPOLE = -2.999433000000E+01
PC1_1 = 1.000000000000E+00
PC2_1 = 0.000000000000E+00
PC3_1 = 0.000000000000E+00
PC4_1 = 0.000000000000E+00
PC1_2 = 0.000000000000E+00
PC2_2 = 1.000000000000E+00
PC3_2 = 0.000000000000E+00
PC4_2 = 0.000000000000E+00
```

The interface also includes a 'Render Configuration' window with a plot of the image's intensity profile, showing a peak at approximately -0.01 Jy/beam. The plot is titled 'Value (Jy/beam)' and has a cursor at -9.89e-2 Jy/beam. The plot shows a blue line representing the intensity profile, with a green shaded region around the peak. The x-axis ranges from -0.08 to 0.08, and the y-axis ranges from 0 to 1.00e+0. The plot is titled 'X Profile: Cursor X' and has a y-axis labeled 'beam'.

Matching	Channel	Polarization
XY R	0	Stokes I
XY Z	0	Stokes I

Clicking on the contour icon in the button bar will open a window that can be used to generate contours. This is good when overlaying one form of emission over another.

The screenshot shows the CARTA software interface. The main window displays a radio astronomy image of a source, with a 'Contour Configuration' dialog box open in the foreground. A yellow arrow points to the contour icon in the toolbar. The dialog box is titled 'Contour Configuration' and has three tabs: 'Levels', 'Configuration', and 'Styling'. The 'Levels' tab is active, showing a histogram of the image data. The histogram has a peak at approximately 0.005 Jy/beam. The 'Generator' is set to 'start-step-multiplier'. The 'Parameters' section shows 'Start' at 1.608e-2, 'Step' at 1.263e-2, 'N' at 5, and 'Multiplier' at 1. The 'Levels' section is empty. The 'Render Configuration' window at the bottom shows a histogram of the image data with a cursor at -9.89e-2 Jy/beam. The 'Region List' window at the bottom right shows a table of regions.

Layers	Matching	Channel	Polarization
d_A001	XY [R]	0	Stokes I
A001_	XY [Z] R	0	Stokes I

Clicking on the contour icon in the button bar will open a window that can be used to generate contours. This is good when overlaying one form of emission over another.

The screenshot displays the CARTA software interface. The main window shows a radio astronomy image of a source, with axes for Right ascension and Declination. A 'Contour Configuration' dialog box is open in the foreground, showing a histogram of the image data. A yellow arrow points to the 'Generate' button in the dialog. The dialog includes fields for 'Data source', 'Levels', 'Generator', 'Parameters', and 'Levels'. The 'Levels' field shows a list of values: 1.61e-2, 2.87e-2, 4.14e-2, 5.40e-2, 6.66e-2. The 'Parameters' section shows 'Start' at 1.608e-2, 'Step' at 1.263e-2, 'N' at 5, and 'Multiplier' at 1. The 'Levels' section shows a list of values: 1.61e-2, 2.87e-2, 4.14e-2, 5.40e-2, 6.66e-2. The 'Generate' button is highlighted in green. The background image shows a bright source with a color scale from 0 to 0.06 Jy/beam. The 'Render Configuration' window at the bottom shows a histogram of the image data with a cursor at -9.89e-2 Jy/beam. The 'Region List' window at the bottom right shows a table of regions.

Layers	Matching	Channel	Polarization
d_A001	XY [R]	0	Stokes I
A001	XY [Z] R	0	Stokes I

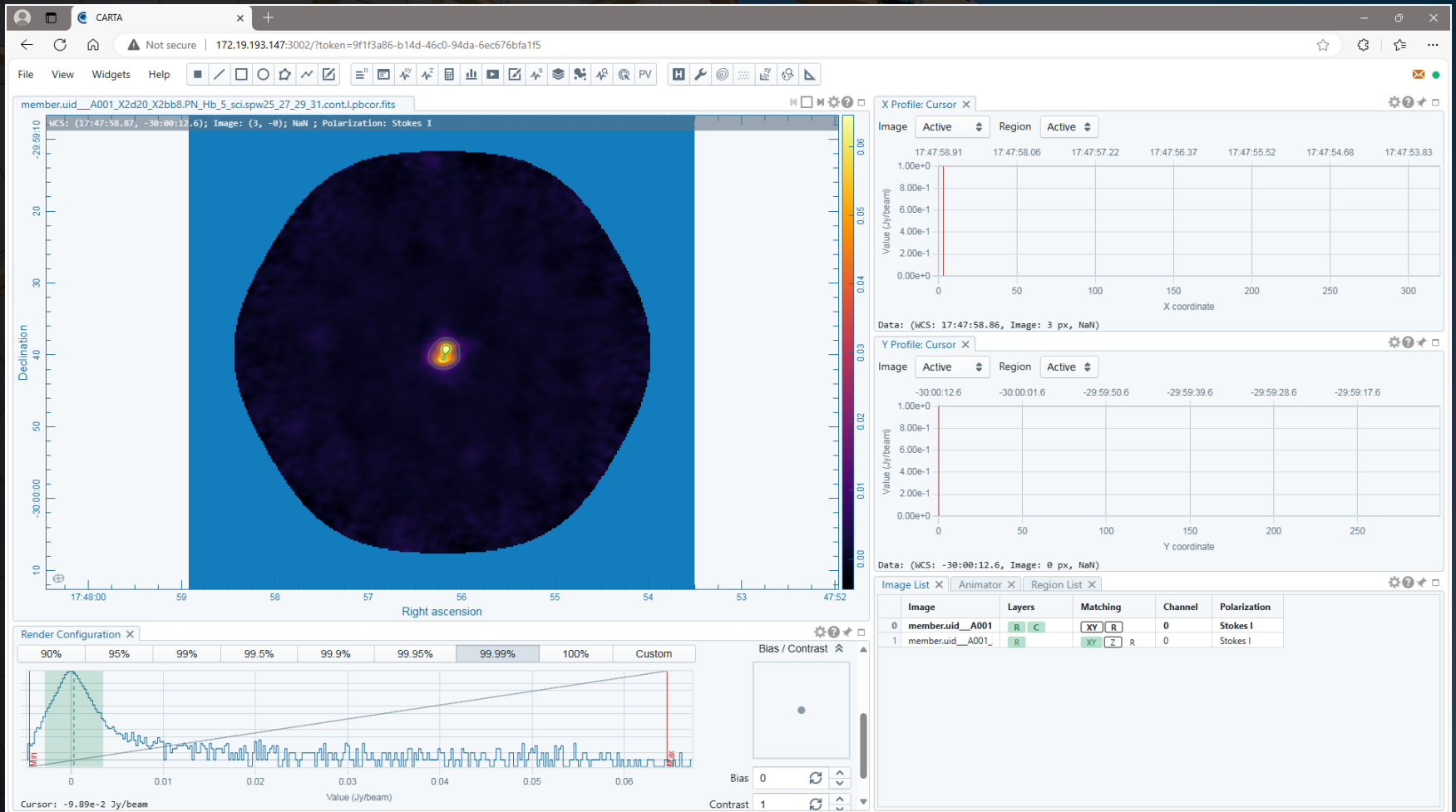
Clicking on the contour icon in the button bar will open a window that can be used to generate contours. This is good when overlaying one form of emission over another.

The screenshot shows the CARTA software interface. The main window displays a radio astronomy image with a bright source. A 'Contour Configuration' dialog box is open, showing the 'Levels' tab. The dialog box contains the following information:

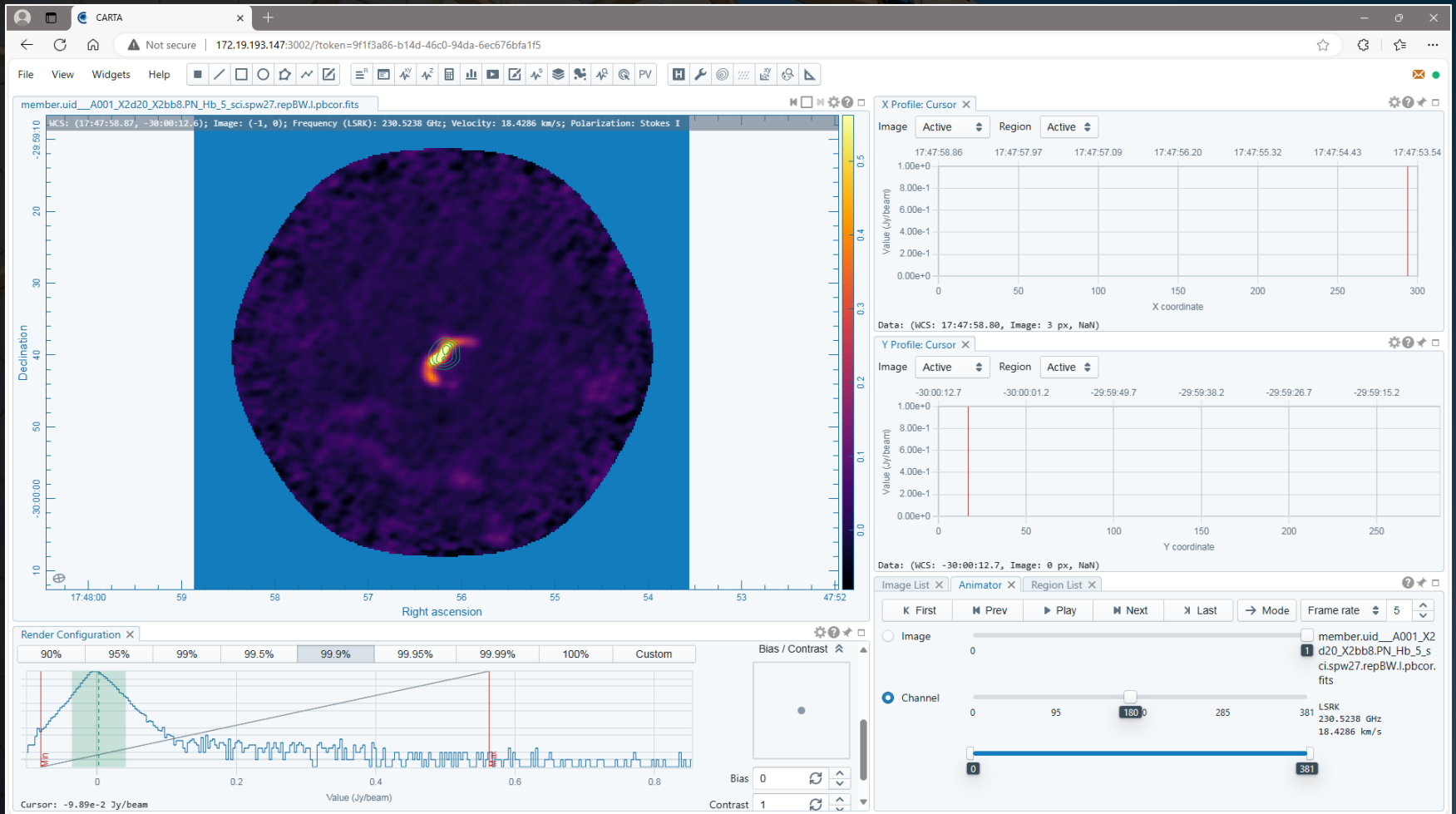
- Data: member.uid__A001_X2d20_X2bb8.PN_Hb_5_sci.spw25_27_29_31.cont.lpbcor.fits
- source: [locked icon]
- Levels: 1.61e-2 X, 2.87e-2 X, 4.14e-2 X, 5.40e-2 X, 6.66e-2 X
- Parameters: Start 1.608e-2, Step 1.263e-2, N 5, Multiplier 1
- Buttons: Clear, Apply, Close

The 'Apply' button is highlighted with a yellow arrow. The background shows the main image with axes for Right ascension and Declination, and a 'Render Configuration' window at the bottom left.

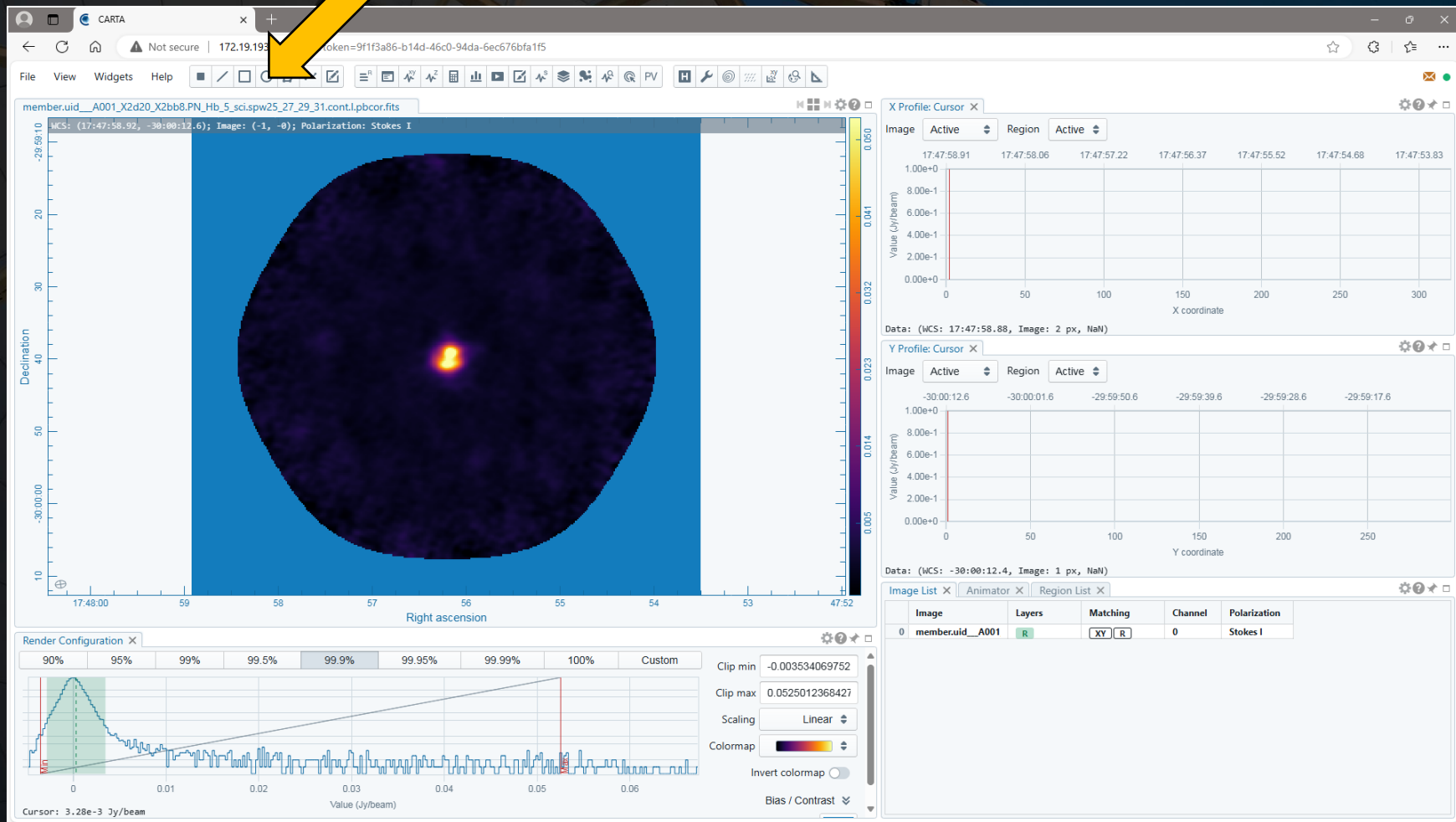
Clicking on the contour icon in the button bar will open a window that can be used to generate contours. This is good when overlaying one form of emission over another.



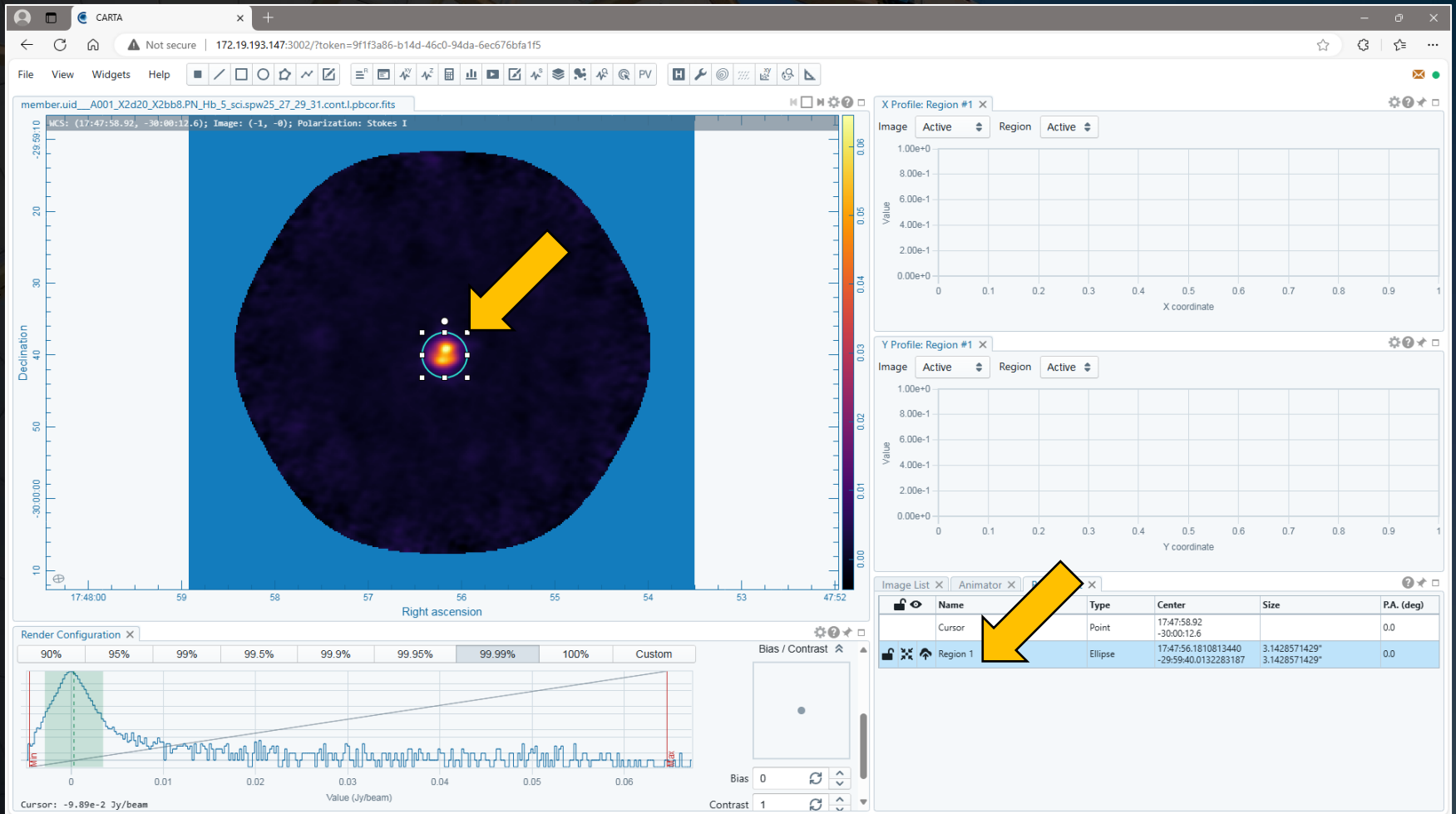
Clicking on the contour icon in the button bar will open a window that can be used to generate contours. This is good when overlaying one form of emission over another.



Regions can be drawn on the image by clicking on one of the shapes in the menu bar and then drawing that shape in the image panel. These regions can be used by several other widgets.



Double clicking on a region in an image or in the Region List widget will display information about that region.



Double clicking on a region in an image or in the Region List widget will display information about that region.

The screenshot displays the CARTA software interface. The main window shows a radio telescope image with a region of interest highlighted. An 'Editing Region 1' dialog box is open, displaying configuration details for an elliptical region. The Region List widget at the bottom right shows the region's parameters in a table.

Editing Region 1 (member.uid__A001_X2d20_X2...)

Configuration

Region name:

Coordinate: Image World

Center:
Image: (161.167 px, 148.071 px)

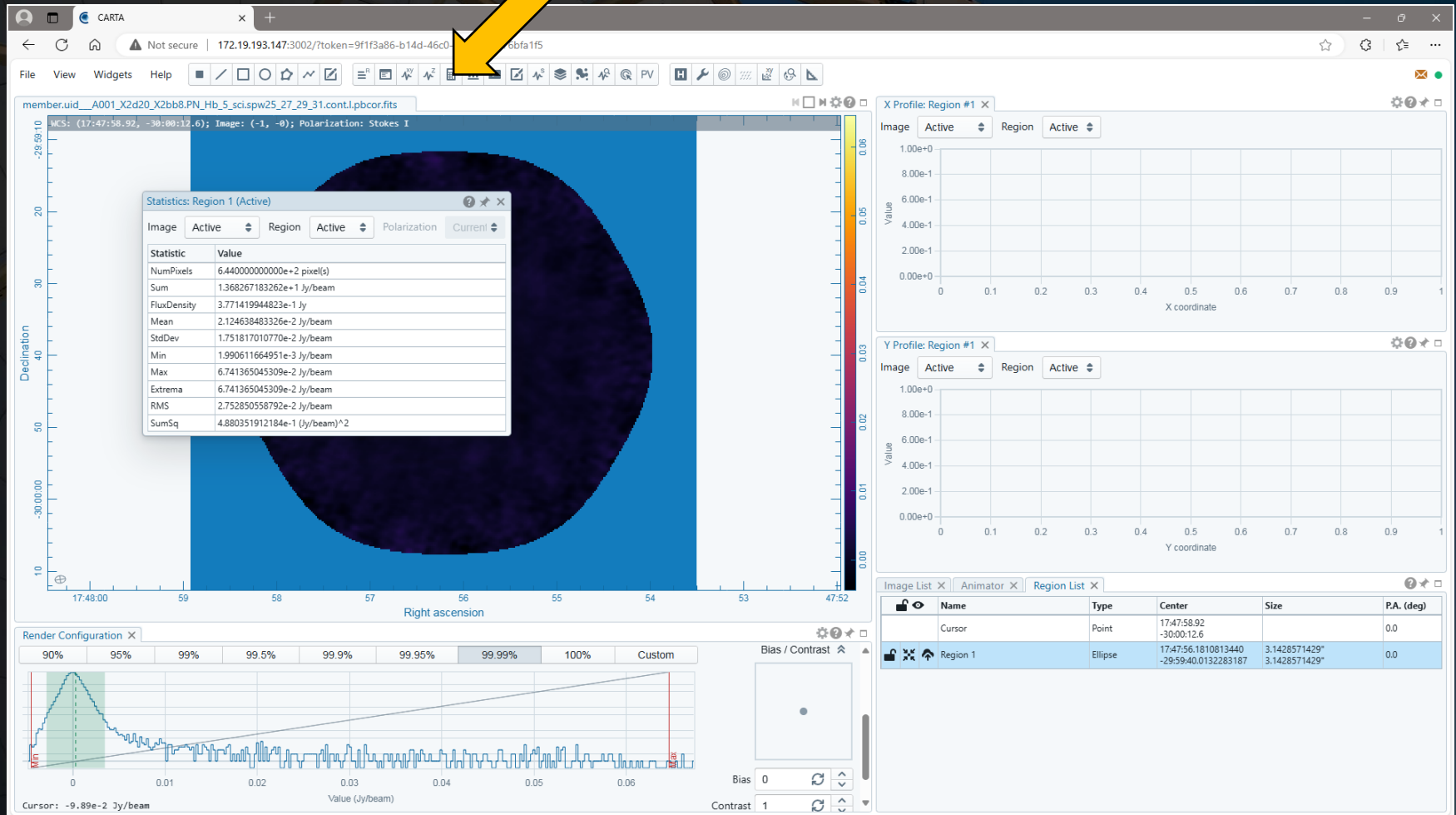
Semi-axes:
Image: (14.286 px, 14.286 px)

P.A. (deg):

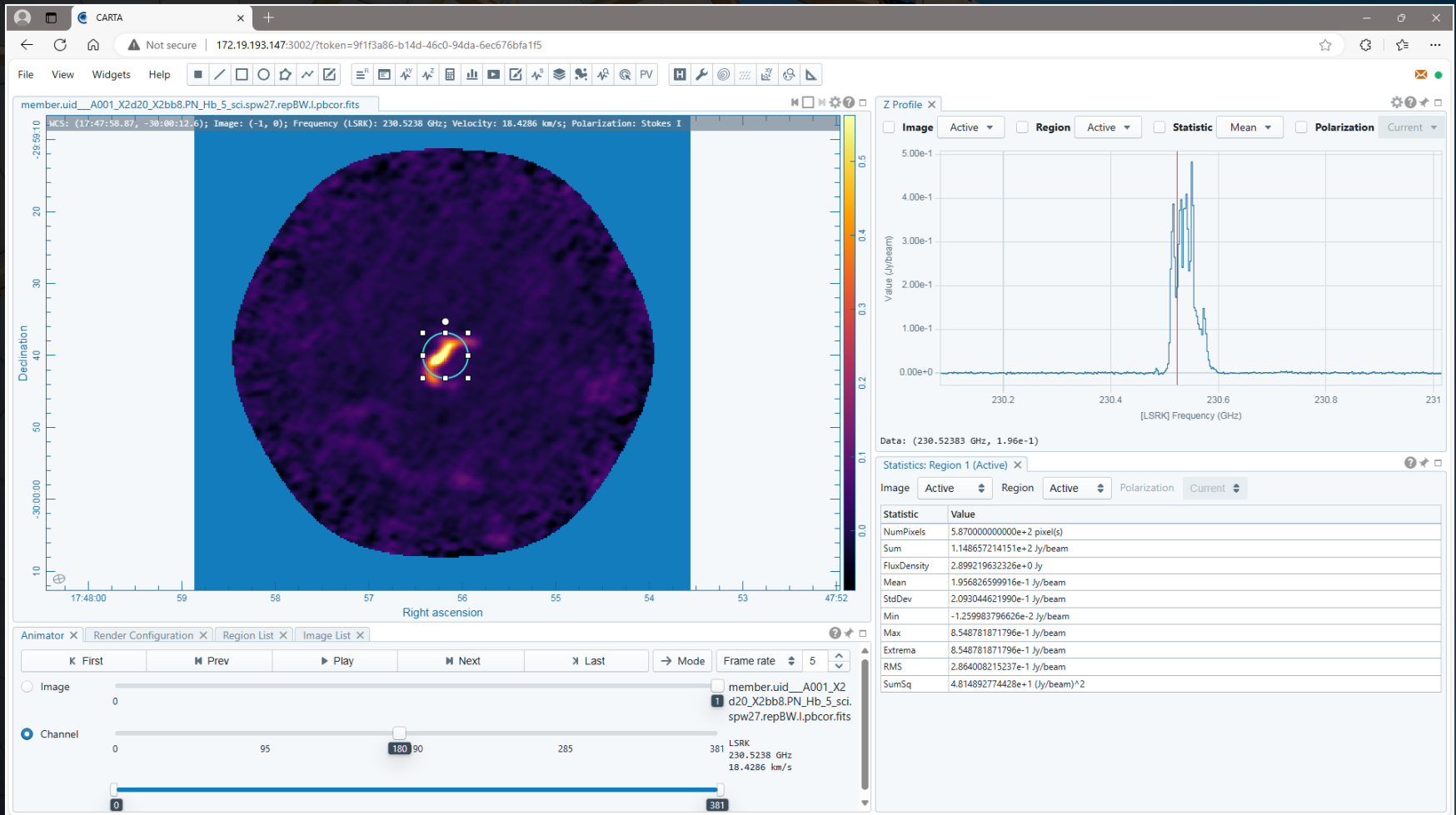
Region List

Name	Type	Center	Size	P.A. (deg)
Cursor	Point	17:47:58.92 -30:00:12.6		0.0
Region 1	Ellipse	17:47:56.1810813440 -29:59:40.0132283187	3.1428571429* 3.1428571429*	0.0

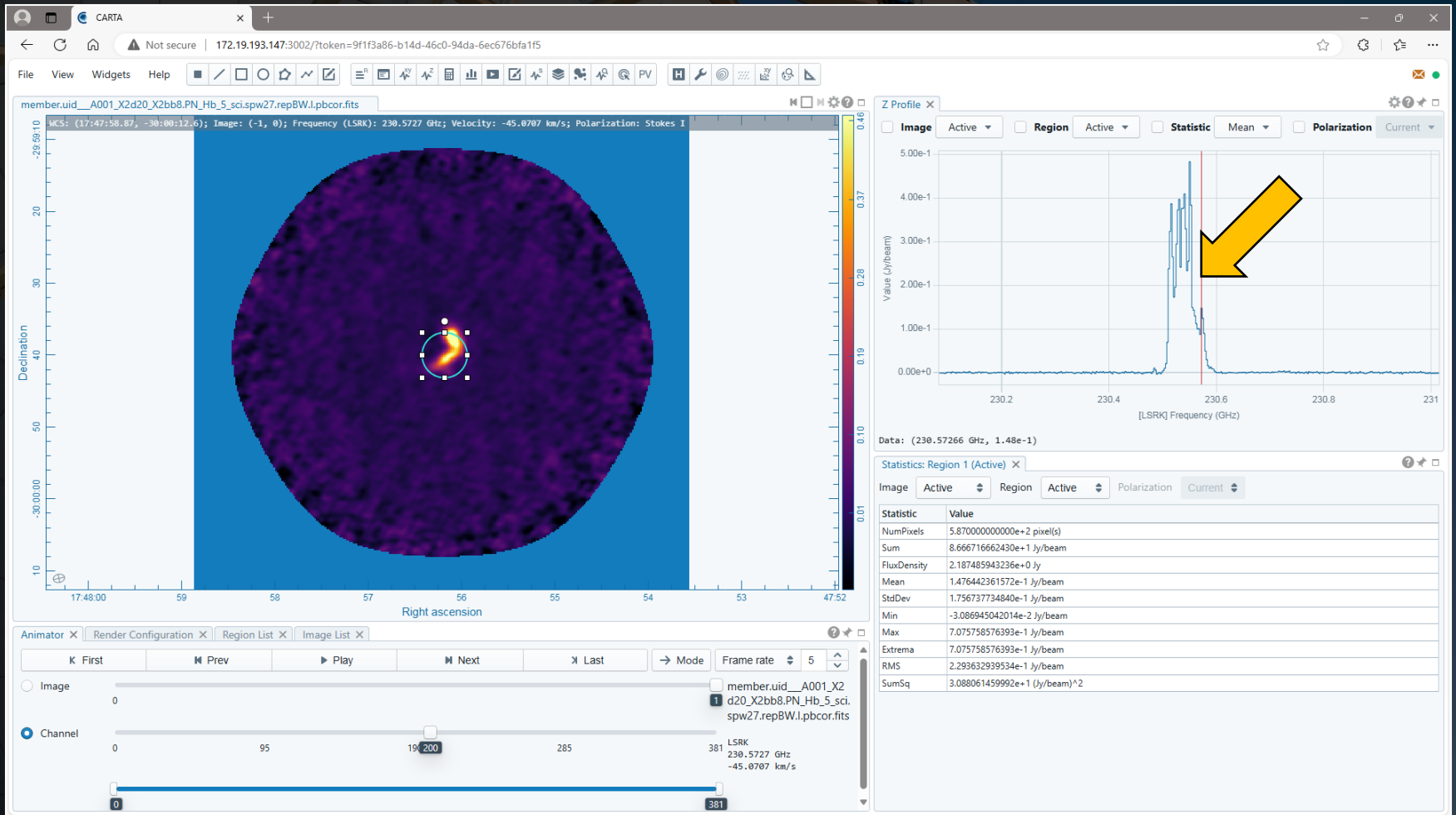
The Statistics widget will display statistical information either for the pixels within an individual region (such as a circle) or for the entire image.



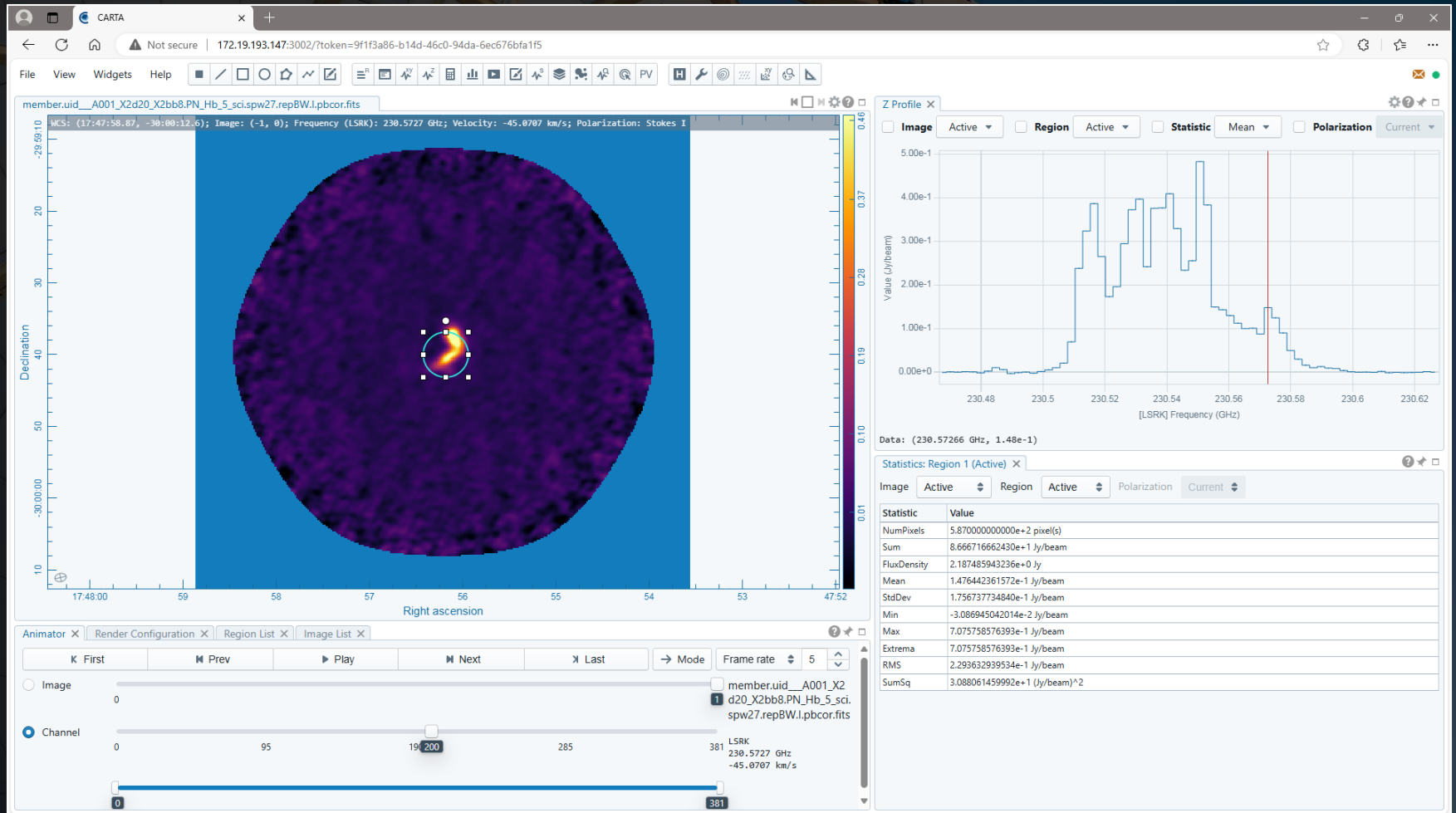
The Z Profile will show the spectrum measured within an image cube at the position of the cursor or within a region. (Because spectra can be slow to load and because the spectrum updates when the cursor is moved across an image, displaying the spectrum within a region works better.)



Left clicking on a specific location in the spectrum will display the image cube at that specific frequency.



Holding down the left mouse button and dragging within the plot of the spectrum will zoom in on that location. (Double-clicking will zoom out again.)



The moment option in the Z Profile window (accessible through settings if the button is not visible) provides an option for creating moment images. These will appear as separate images in the Image List, and it is possible to switch to and from these moment images using the Animator.

The screenshot displays the CARTA software interface. The main window shows a spectral plot of the Z Profile with a vertical red line at 230.5238 GHz. A yellow arrow points to the 'Z Profile' window title bar. A 'Z Profile Settings: Region #1 (Active)' dialog box is open, showing the 'Moments' tab. A yellow arrow points to the 'Generate' button. The 'Statistics: Region 1 (Active)' window is also visible, showing a table of statistical data.

Z Profile Settings: Region #1 (Active)

Conversion Styling Smoothing **Moments** Animating

Image (1: memb...) Active

Region (Image) Image

Coordinate Frequency (GHz)

System LSRK

Range (GHz) From 230.5 To 230.6

Mask None

Range (Jy/beam) From 0 To 1

Moments 0 x

Options Keep previous moment image(s)

Generate

Z Profile

Image Active Region Active Statistic Mean Polarization Current

Value (Jy/beam)

[LSRK] Frequency (GHz)

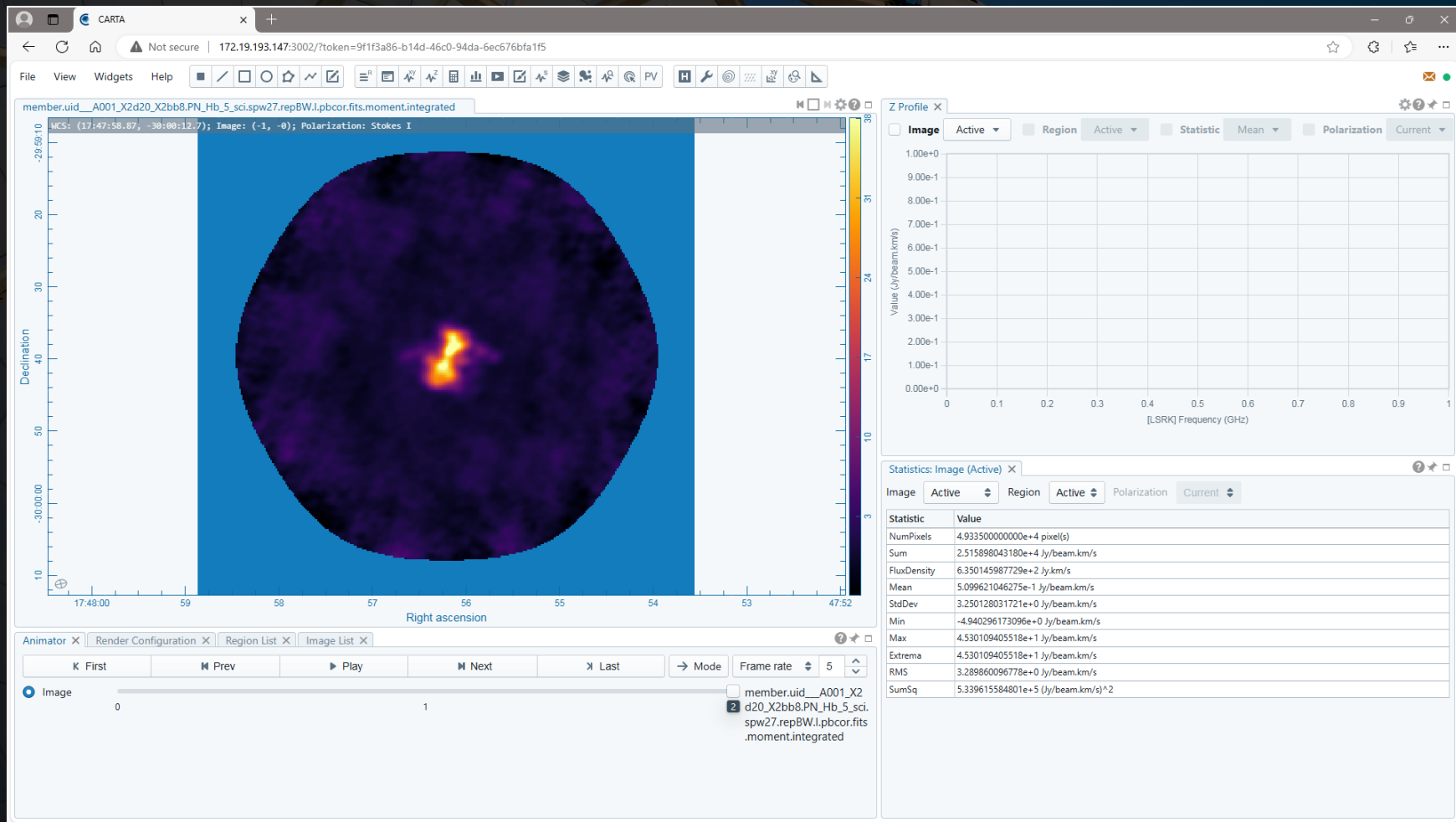
Data: (230.52383 GHz, 1.96e-1)

Statistics: Region 1 (Active)

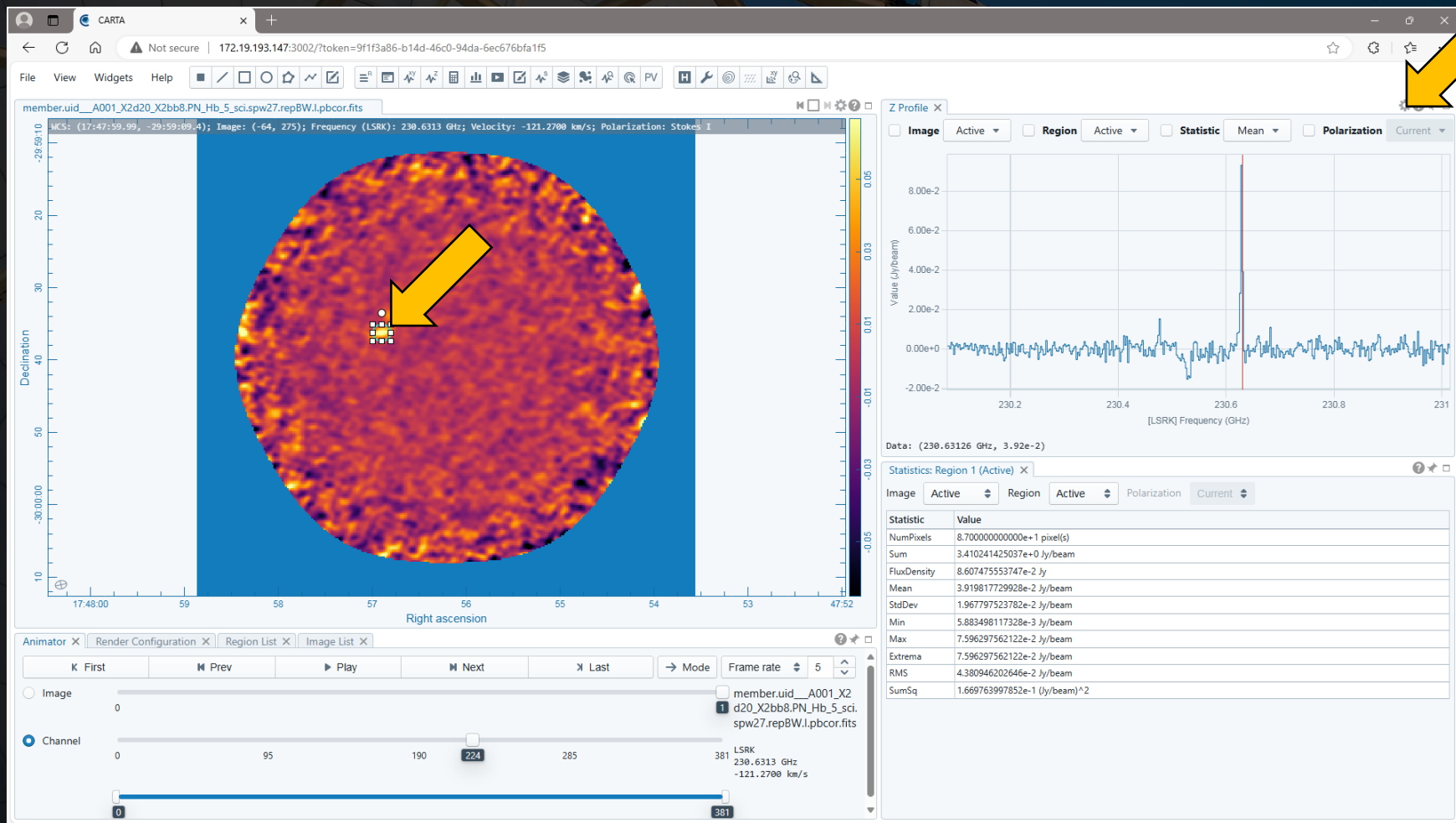
Image Active Region Active Polarization Current

Statistic	Value
NumPixels	5.870000000000e+2 pixel(s)
Sum	1.148657214151e+2 Jy/beam
FluxDensity	2.899219632326e+0 Jy
Mean	1.956826599916e-1 Jy/beam
StdDev	2.093044621990e-1 Jy/beam
Min	-1.259983796626e-2 Jy/beam
Max	8.548781871796e-1 Jy/beam
Extrema	8.548781871796e-1 Jy/beam
RMS	2.864008215237e-1 Jy/beam
SumSq	4.814892774428e+1 (Jy/beam) ²

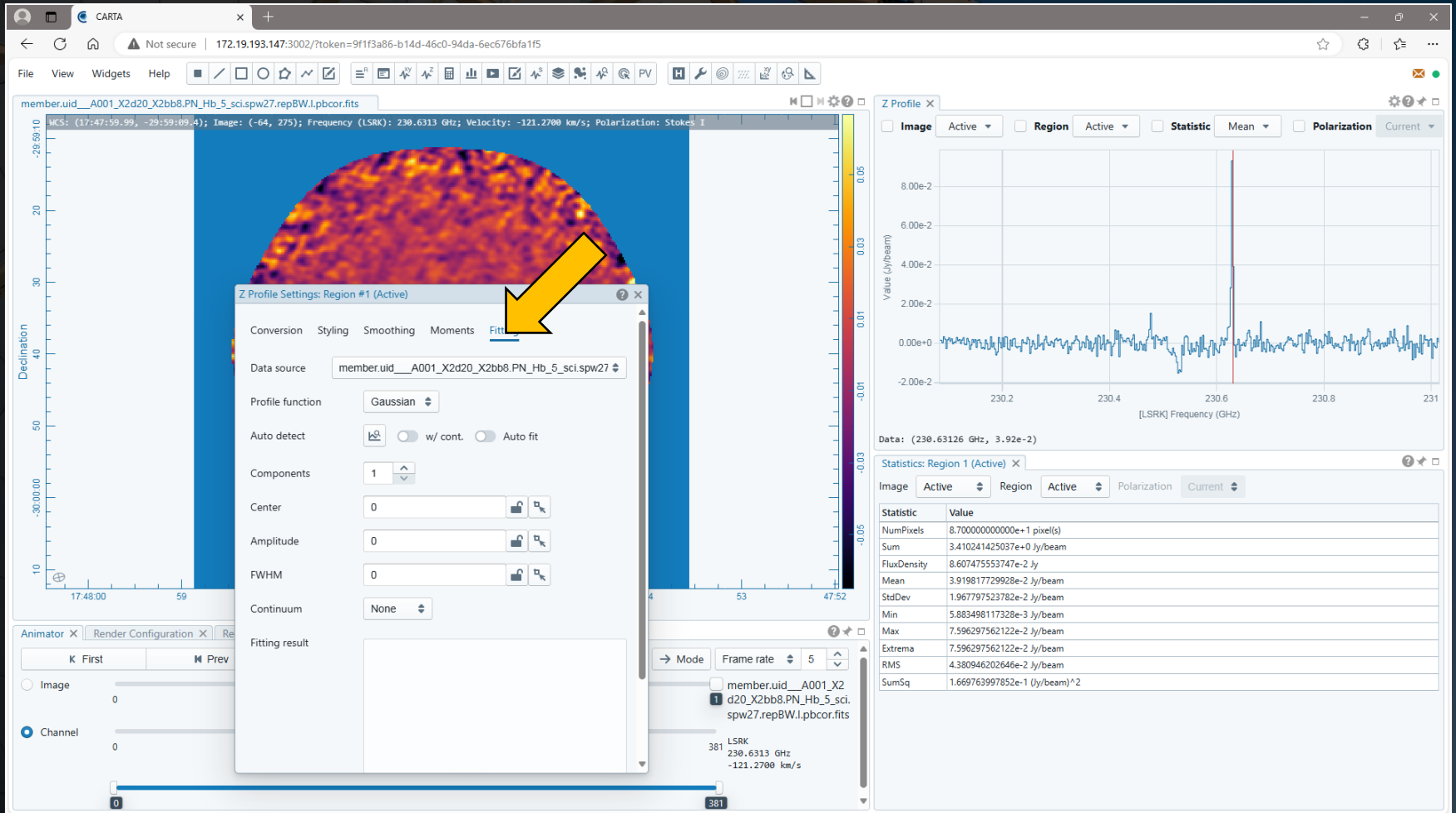
The moment option in the Z Profile window (accessible through settings if the button is not visible) provides an option for creating moment images. These will appear as separate images in the Image List, and it is possible to switch to and from these moment images using the Animator.



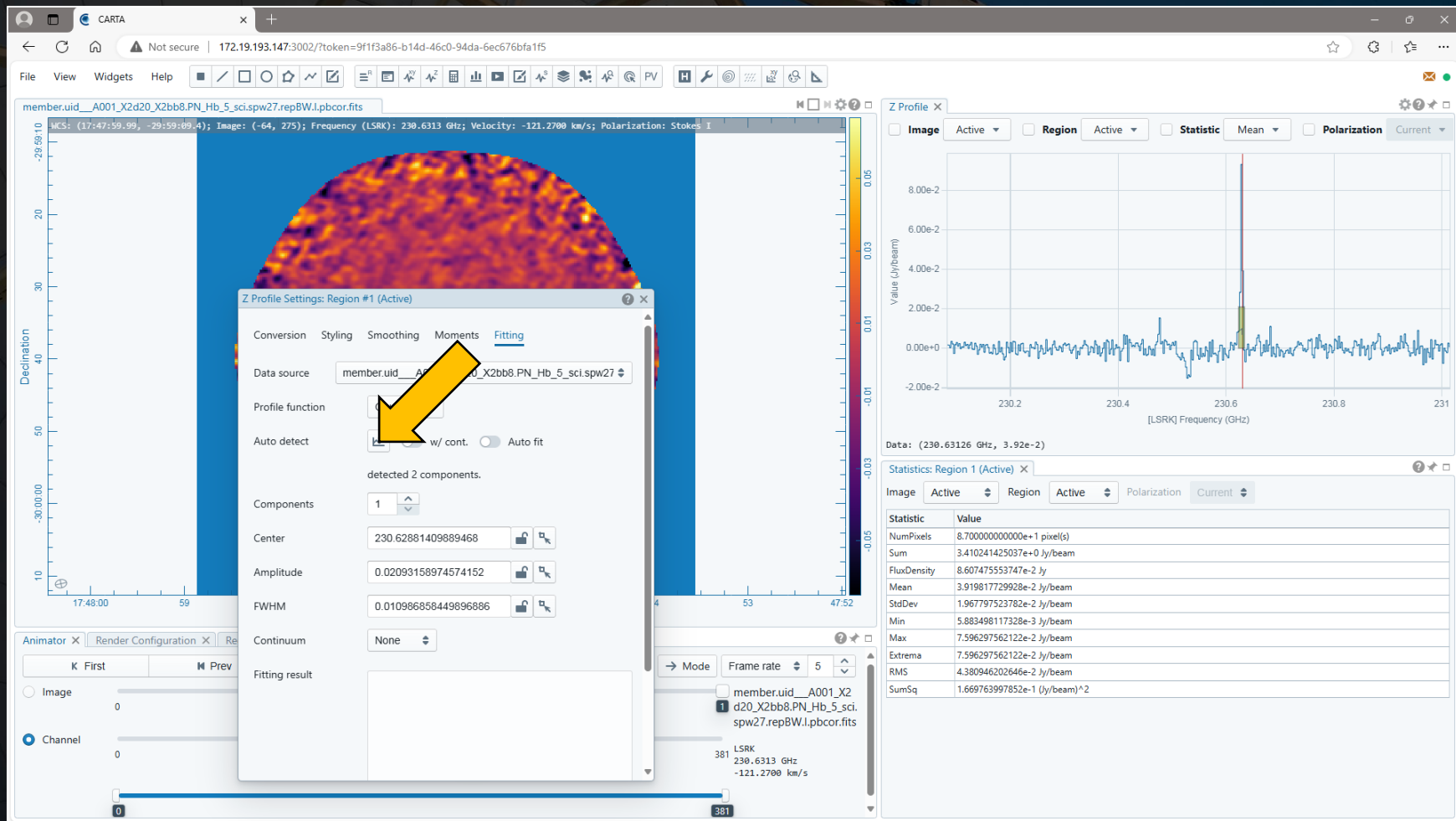
The fitting option in the Z Profile window (accessible through settings if the button is not visible) can be used to fit a spectral line, although a priori values need to be set first (or estimated using the auto detect button).



The fitting option in the Z Profile window (accessible through settings if the button is not visible) can be used to fit a spectral line, although a priori values need to be set first (or estimated using the auto detect button).



The fitting option in the Z Profile window (accessible through settings if the button is not visible) can be used to fit a spectral line, although a priori values need to be set first (or estimated using the auto detect button).



The fitting option in the Z Profile window (accessible through settings if the button is not visible) can be used to fit a spectral line, although a priori values need to be set first (or estimated using the auto detect button).

The screenshot displays the CARTA software interface. The main window shows a spectral line plot with a color scale on the right ranging from -0.05 to 0.05. A yellow arrow points to the 'Fit' button in the 'Z Profile Settings' dialog box. The dialog box is titled 'Z Profile Settings: Region #1 (Active)' and contains the following fields:

- Auto detect: w/ cont. Auto fit
- detected 2 components.
- Components: 1
- Center: 230.62881409889468
- Amplitude: 0.02093158974574152
- FWHM: 0.010986858449896886
- Continuum: None
- Fitting result: (empty text area)

At the bottom of the dialog box, there are buttons for 'Reset', 'Fit', 'Log', and 'Residual'. The 'Fit' button is highlighted by a yellow arrow.

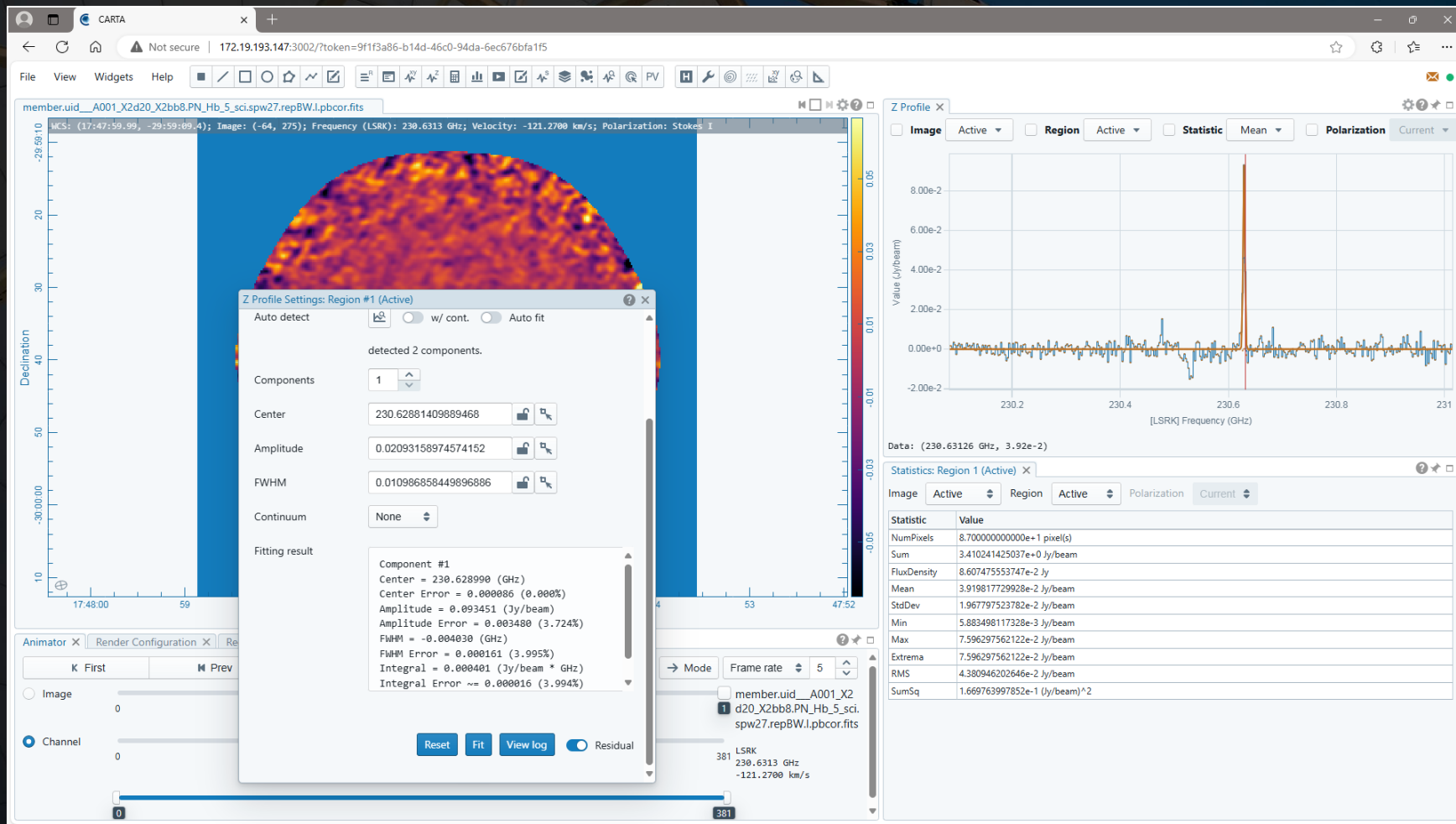
The Z Profile window on the right shows a plot of Value (Jy/beam) versus [LSRK] Frequency (GHz). The plot shows a sharp peak at approximately 230.63 GHz. Below the plot, the following statistics are displayed:

Data: (230.63126 GHz, 3.92e-2)

Statistics: Region 1 (Active) X

Statistic	Value
NumPixels	8.700000000000e+1 pixel(s)
Sum	3.410241425037e+0 Jy/beam
FluxDensity	8.60747555374e-2 Jy
Mean	3.919817729928e-2 Jy/beam
StdDev	1.967797523782e-2 Jy/beam
Min	5.883498117328e-3 Jy/beam
Max	7.596297562122e-2 Jy/beam
Extrema	7.596297562122e-2 Jy/beam
RMS	4.380946202646e-2 Jy/beam
SumSq	1.669763997852e-1 (Jy/beam)*2

The fitting option in the Z Profile window (accessible through settings if the button is not visible) can be used to fit a spectral line, although a priori values need to be set first (or estimated using the auto detect button).





CARTA also has other options, including the following:

- Display of data from user catalogues or from Simbar or Vizier
- Vector overlays
- Spectral line overlays (on spectra)
- Point source fitting
- Position-velocity plot generation
- Stokes analysis tools (including automatic creation of polarization fraction and angle images from Stokes image cubes)