



CARTA

Development update and future plan

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and the CARTA development team
CUC vf2f meeting Oct. 20-23, 2020



Releases and activities (selected)

since CUC f2f meeting 2019

v1.2 release (Aug. 28, 2019)

v2.0 release (~Spring 2021)

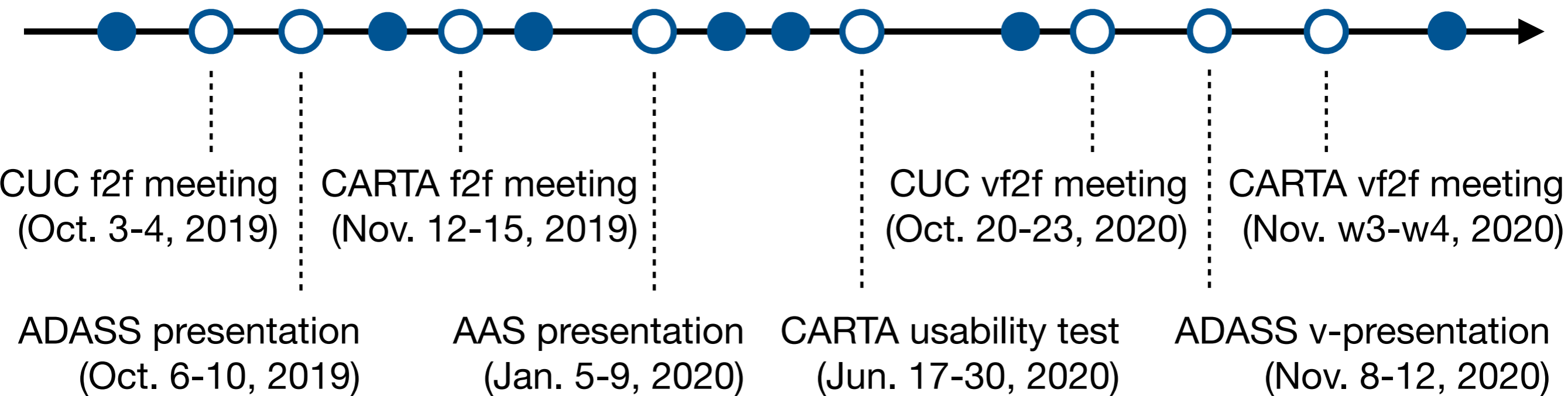
v1.2.1 patch (Oct. 30, 2019)

v1.2.2 patch (Jan. 3, 2020)

v1.3 release (Mar. 31, 2020)

v1.3.1 patch (May. 5, 2020)

v1.4 release (Sep. 17, 2020)



CUC f2f meeting
(Oct. 3-4, 2019)

CARTA f2f meeting
(Nov. 12-15, 2019)

ADASS presentation
(Oct. 6-10, 2019)

AAS presentation
(Jan. 5-9, 2020)

CARTA usability test
(Jun. 17-30, 2020)

CUC vf2f meeting
(Oct. 20-23, 2020)

CARTA vf2f meeting
(Nov. w3-w4, 2020)

ADASS v-presentation
(Nov. 8-12, 2020)

Highlight of new features

v1.2 -> v1.4 (one big step forward 🚀)

- Image matching and shared region analytics
- Spectral conversion and profile smoothing
- Moment map generator
- Basic spectral line query
- Catalogue support
- Offline help manual
- Server authentication and deployment

Highlight of new features

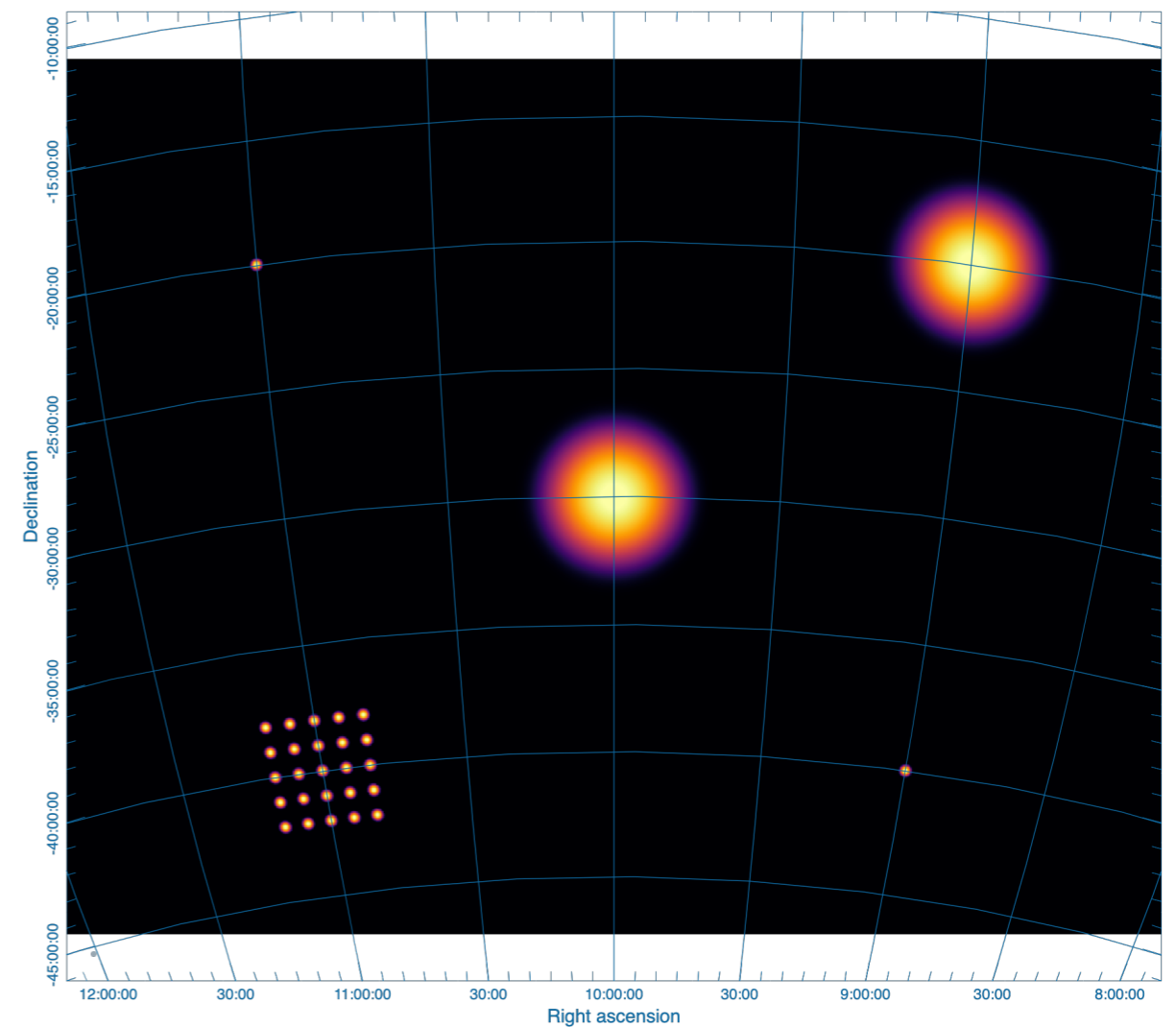
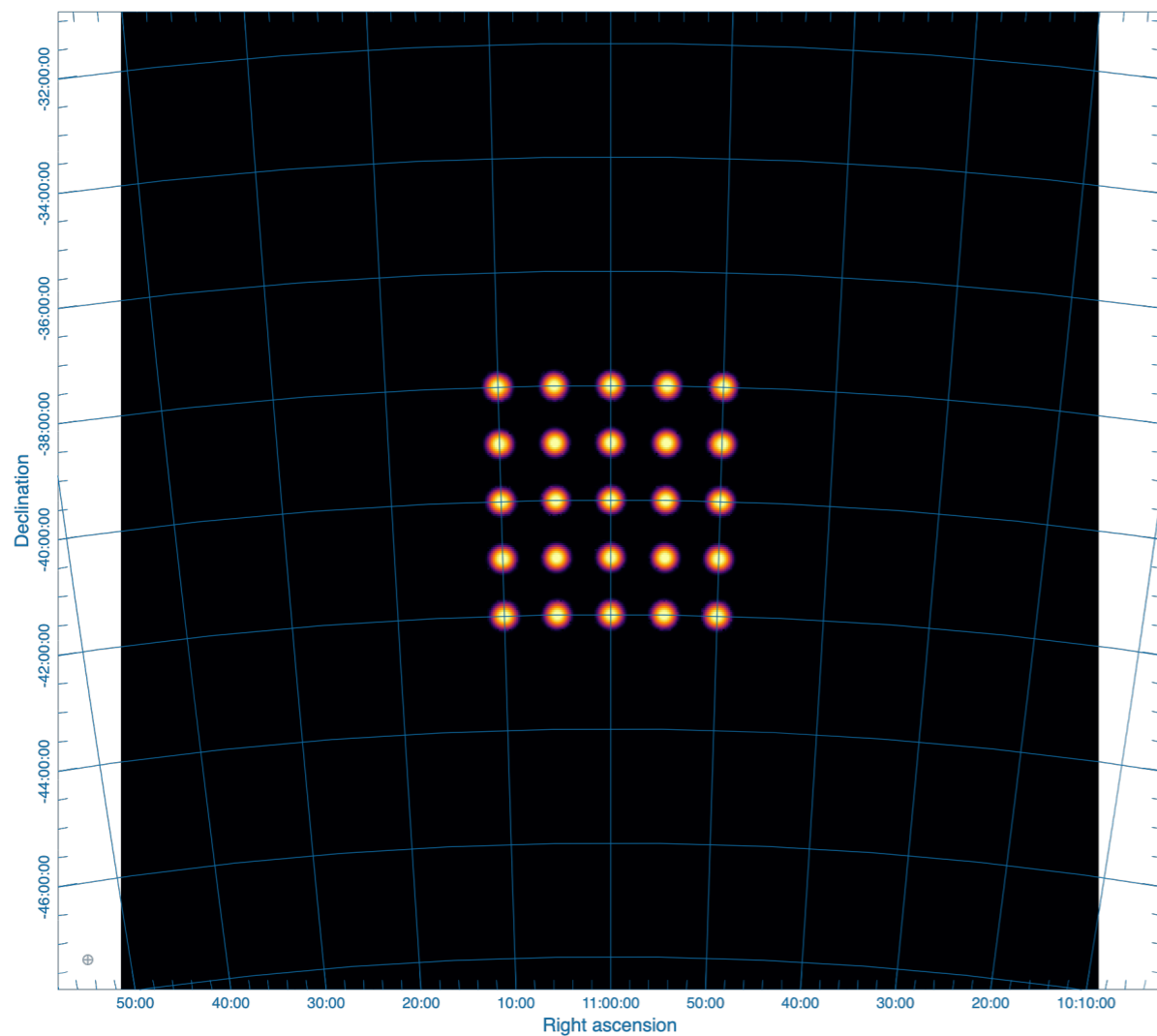
Image matching and shared region analytics

- Different raster images from similar part of sky can be “matched” spatially
- Contour images are reprojected precisely to the raster image in the view
- Spectrally, cubes can be matched with nearest interpolation
- Regions are shared among spatially matched images with conserved solid-angle (i.e., *same* part of sky regardless different projection schemes)
- Shared region analytics are supported (e.g., statistics, region spectral profile)

Highlight of new features

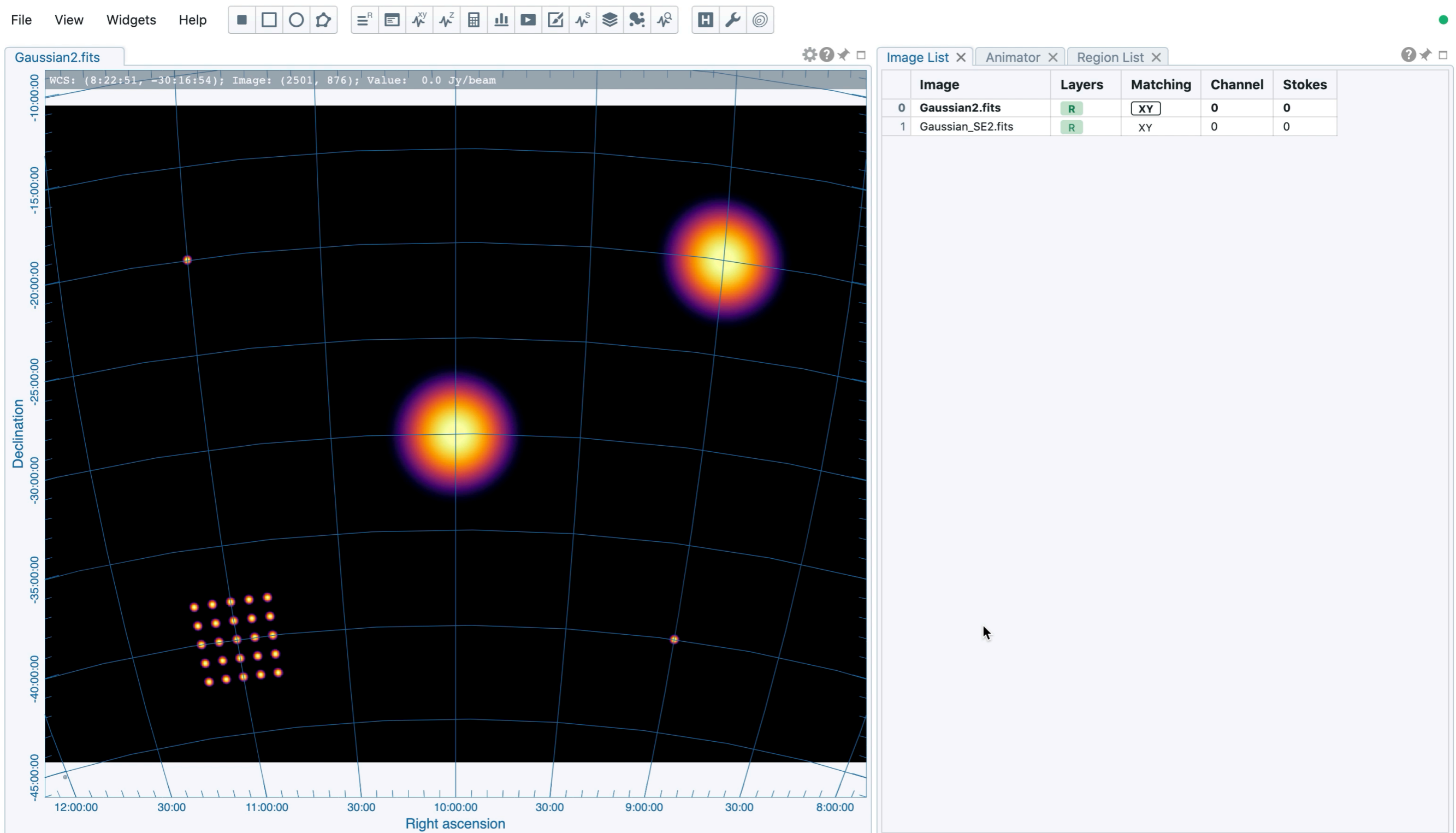
Image matching and shared region analytics

- Different raster images from similar part of sky can be “matched” spatially



Highlight of new features

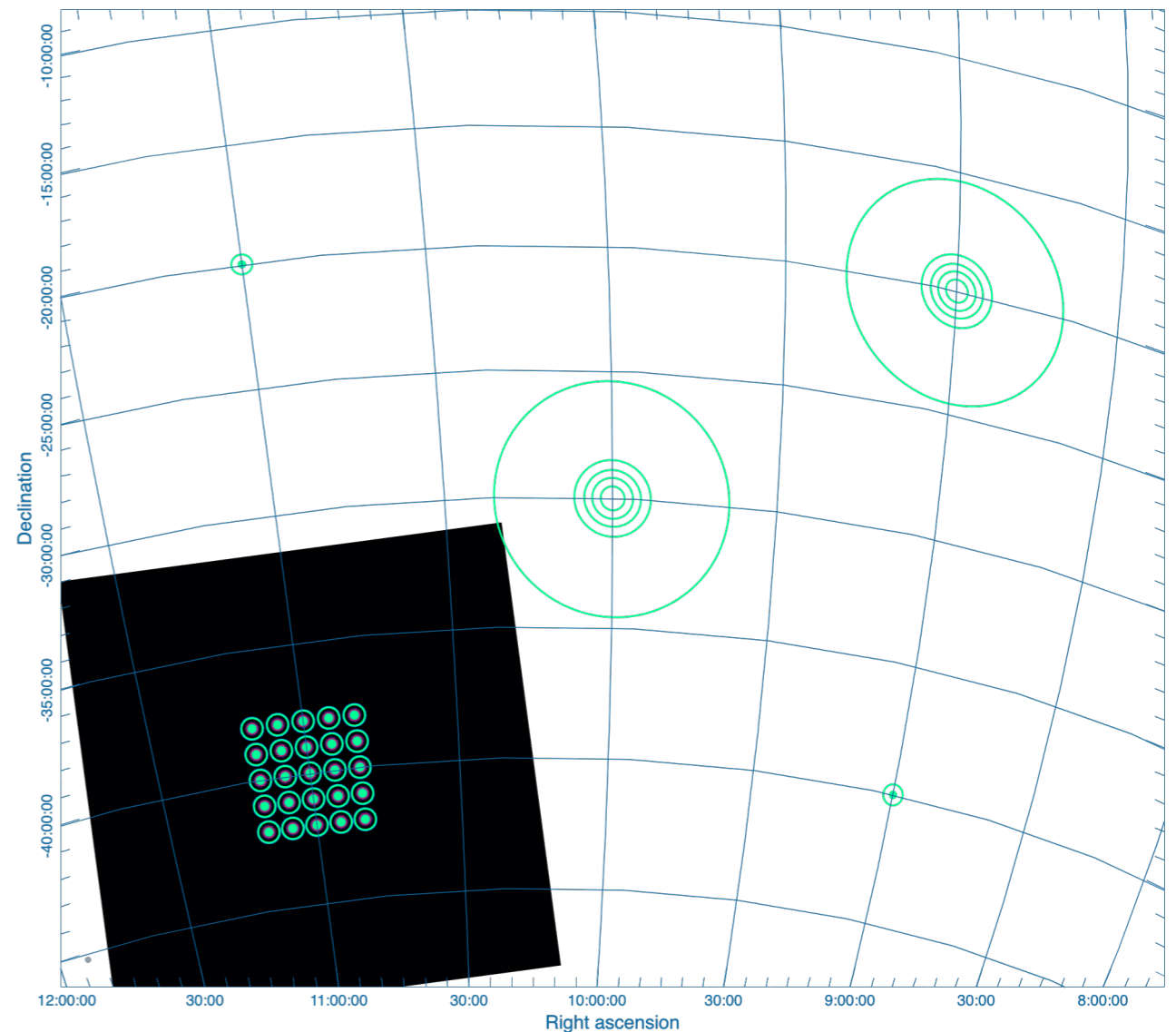
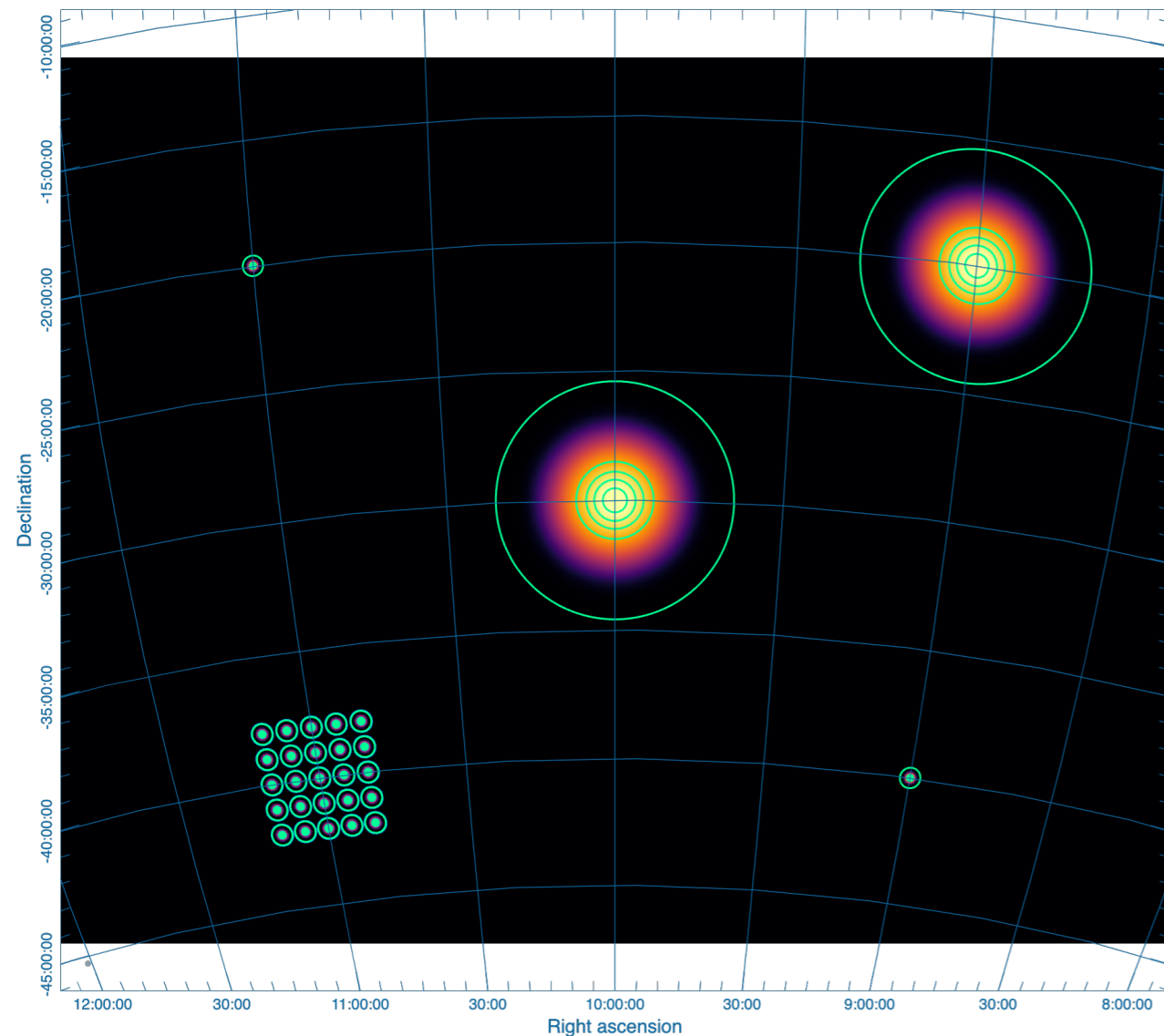
Image matching and shared region analytics



Highlight of new features

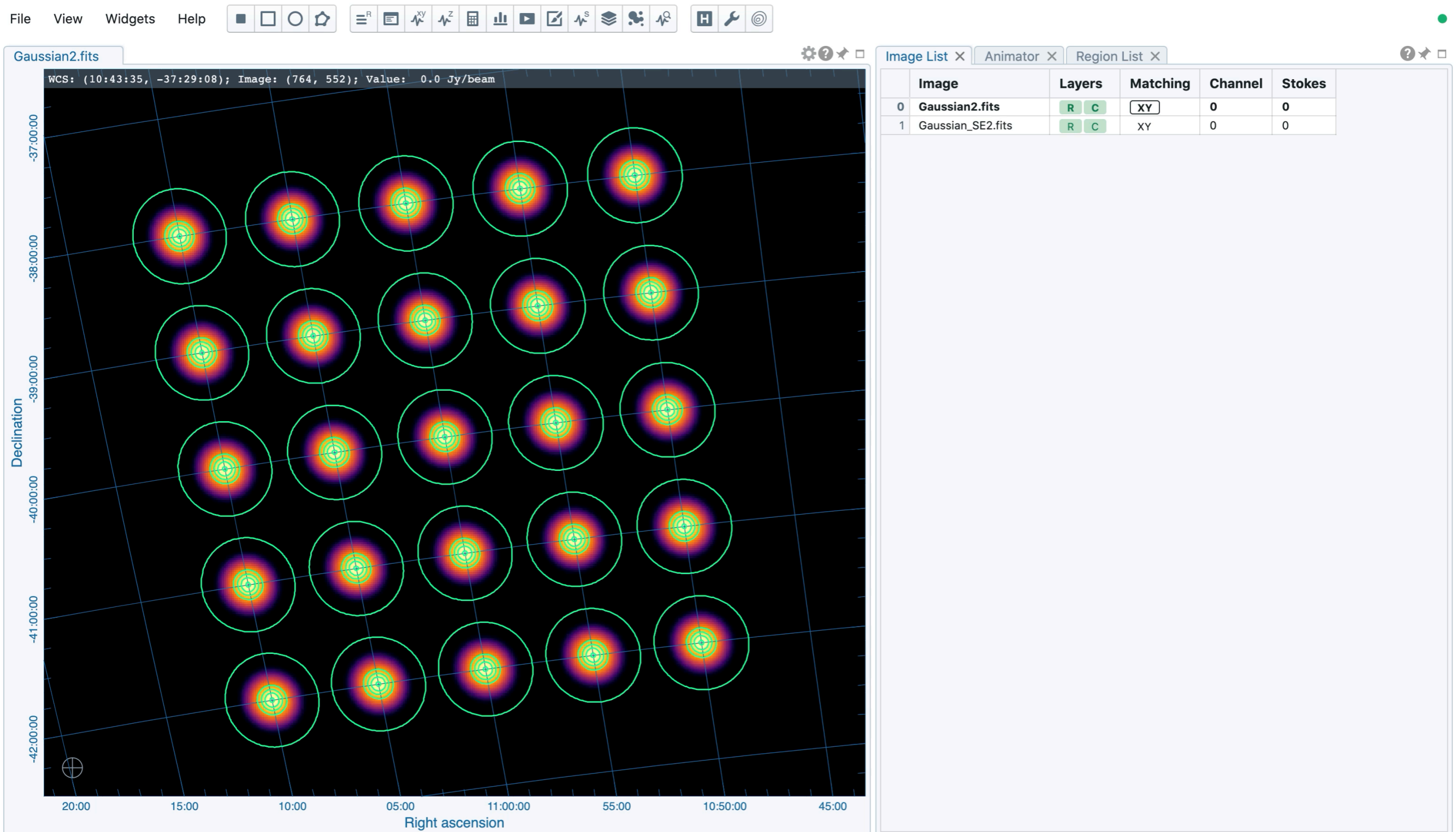
Image matching and shared region analytics

- Contour images are reprojected precisely to the raster image in the view



Highlight of new features

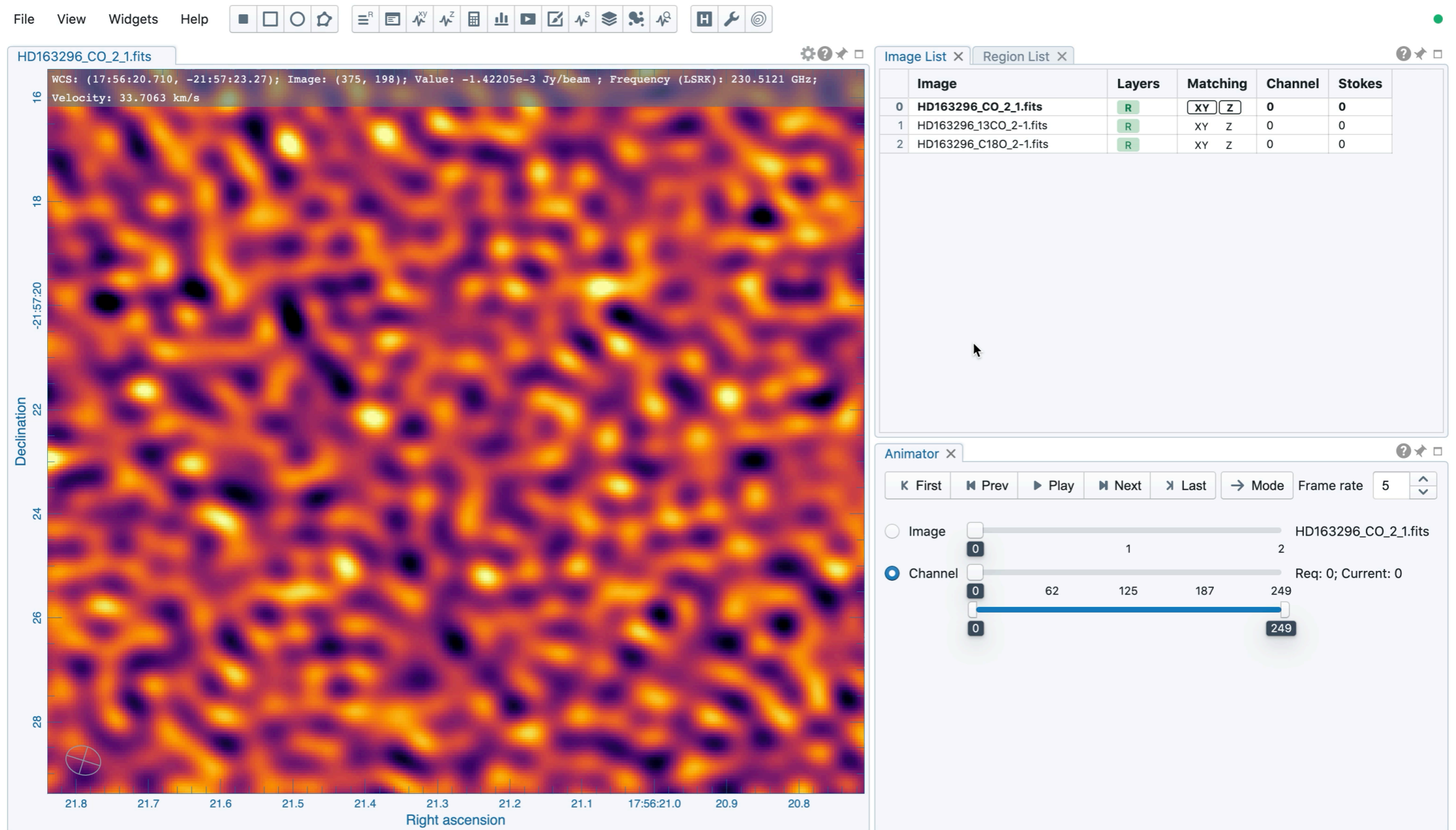
Image matching and shared region analytics



Highlight of new features

Image matching and shared region analytics

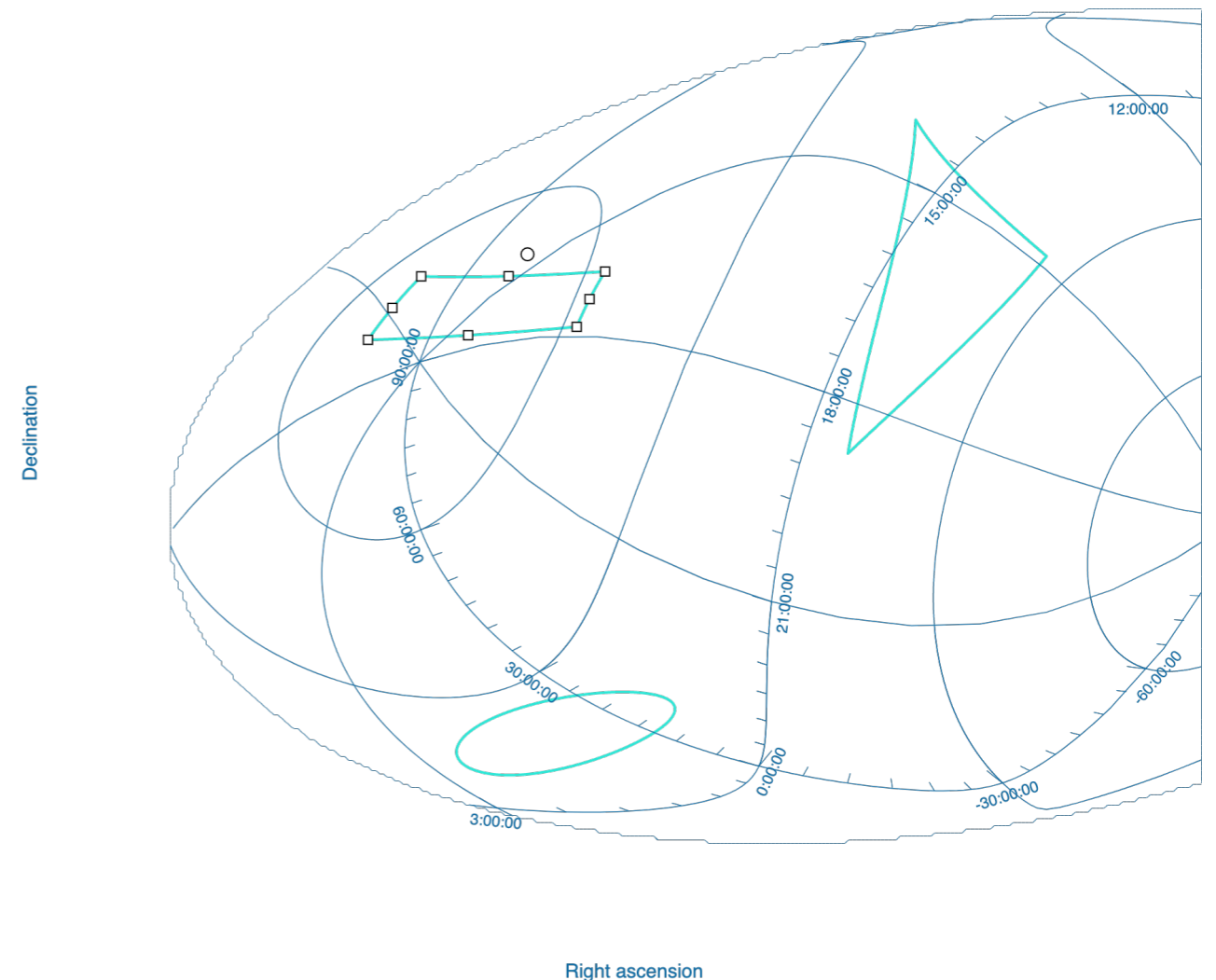
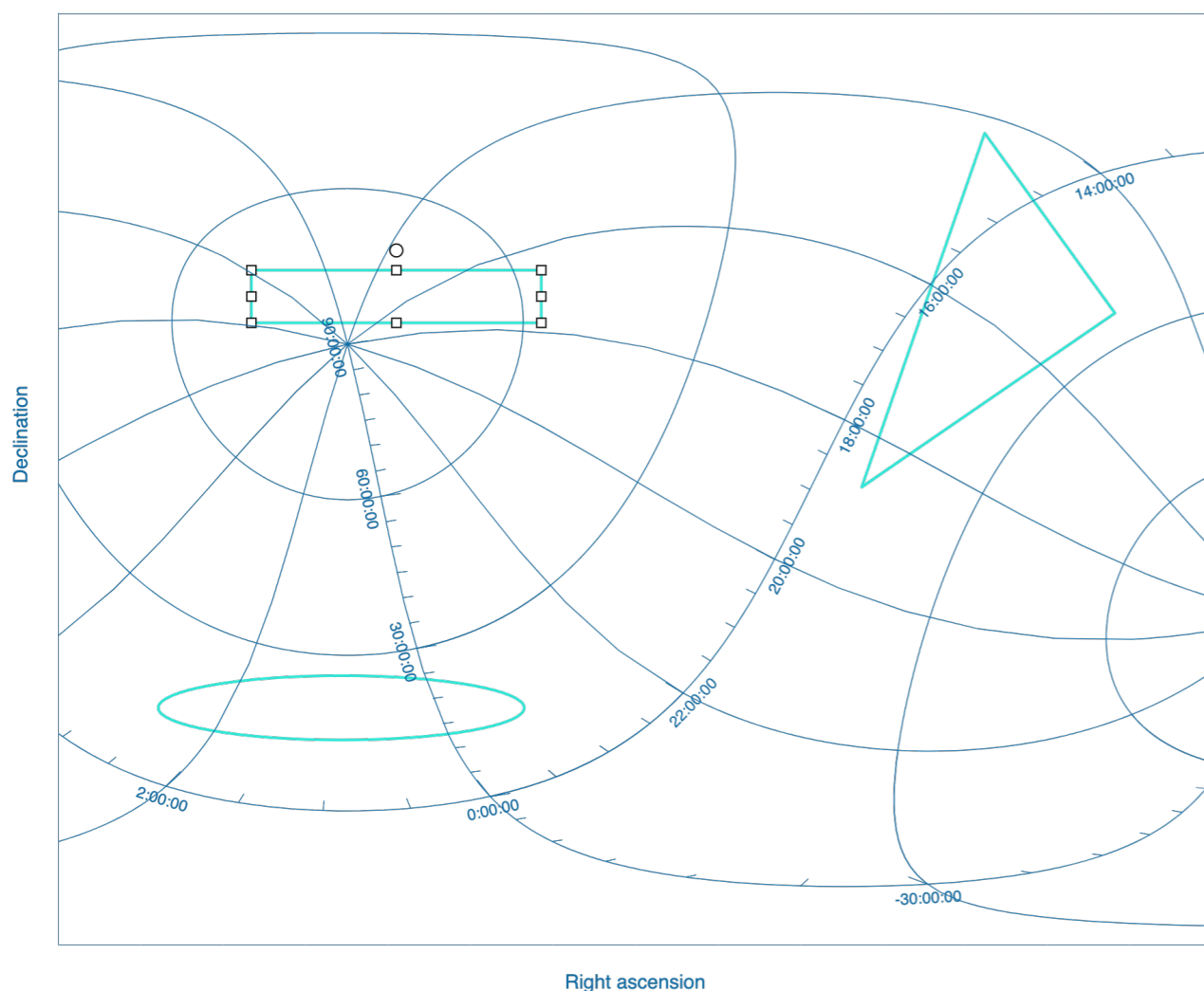
- Spectrally, cubes can be matched with nearest interpolation



Highlight of new features

Image matching and shared region analytics

- Regions are shared among spatially matched images with conserved solid-angle (i.e., *same* part of sky regardless different projection schemes)



Highlight of new features

Image matching and shared region analytics

File View Widgets Help

supermosaic.10.fits

WCS: (21:38:43, -76:13:00); Image: (35974, -6043); Value: -5.34201 K*; Velocity (LSRK): 27.3903 km/s;
Frequency: 1420.2762 MHz

Declination

Right ascension

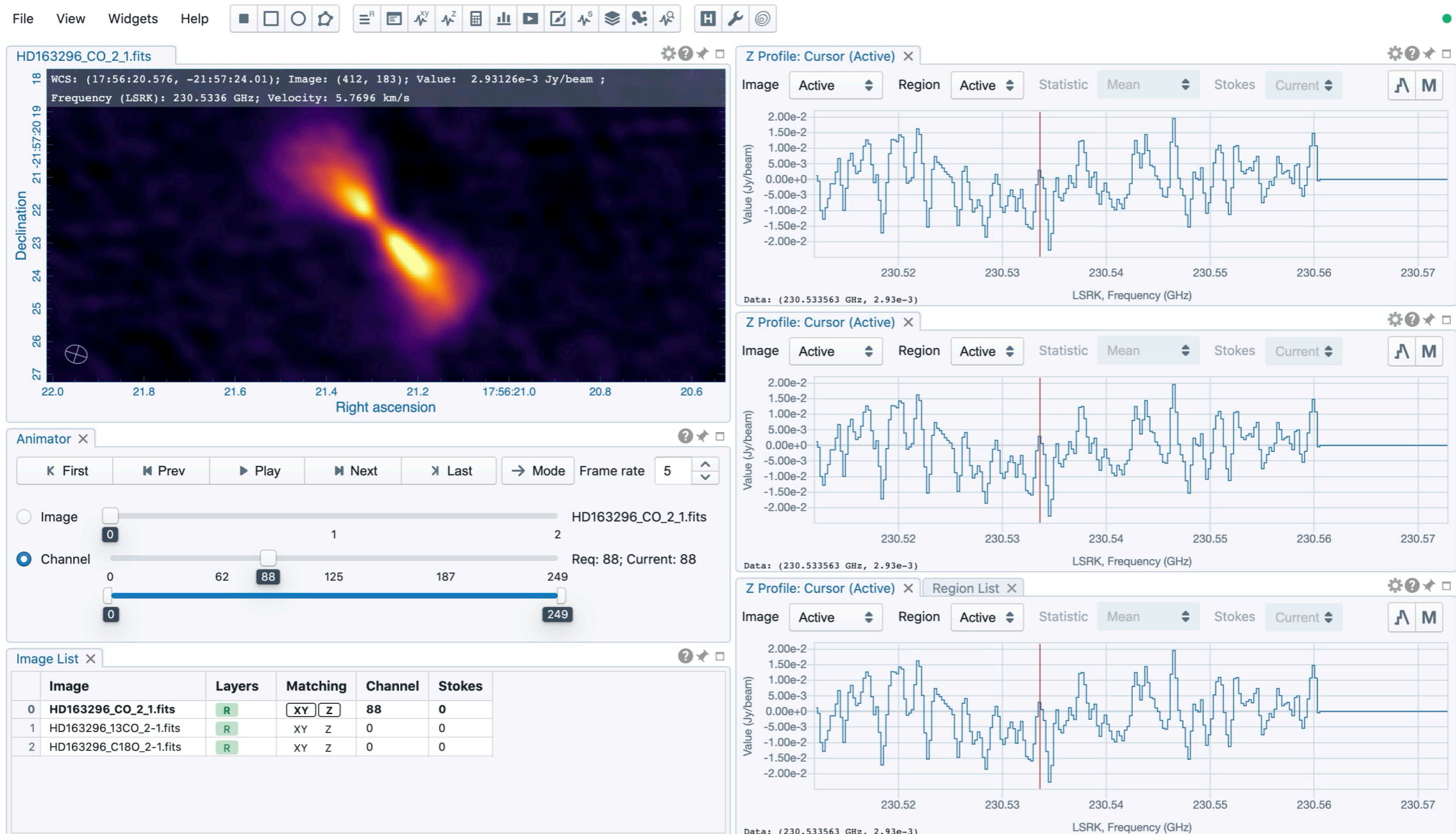
Image List Region List Animator

	Image	Layers	Matching	Channel	Stokes
0	supermosaic.10.fits	R	<input checked="" type="checkbox"/> XY <input checked="" type="checkbox"/> Z	0	0
1	spass_dr1_1902_ait_Tb.i.fits	R	XY	0	0

Highlight of new features

Image matching and shared region analytics

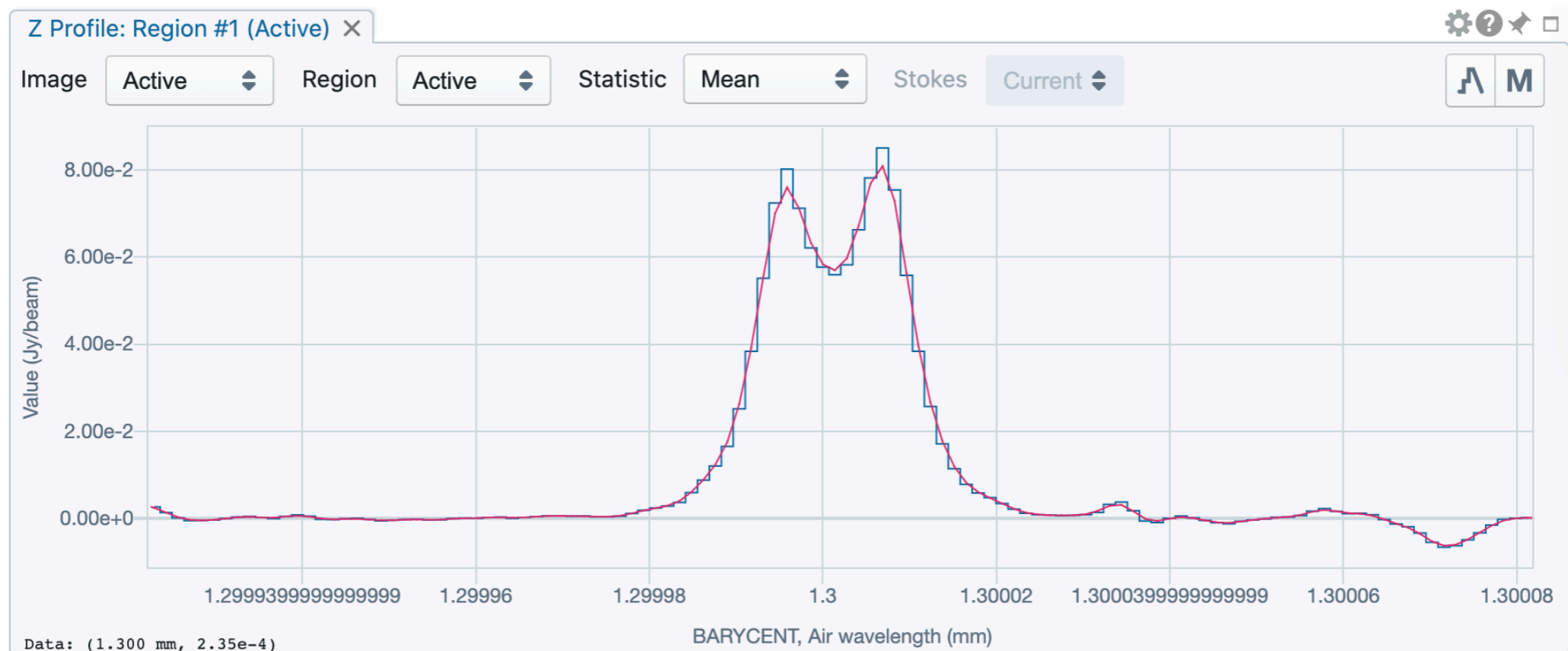
- Shared region analytics are supported (e.g., statistics, region spectral profile)



Highlight of new features

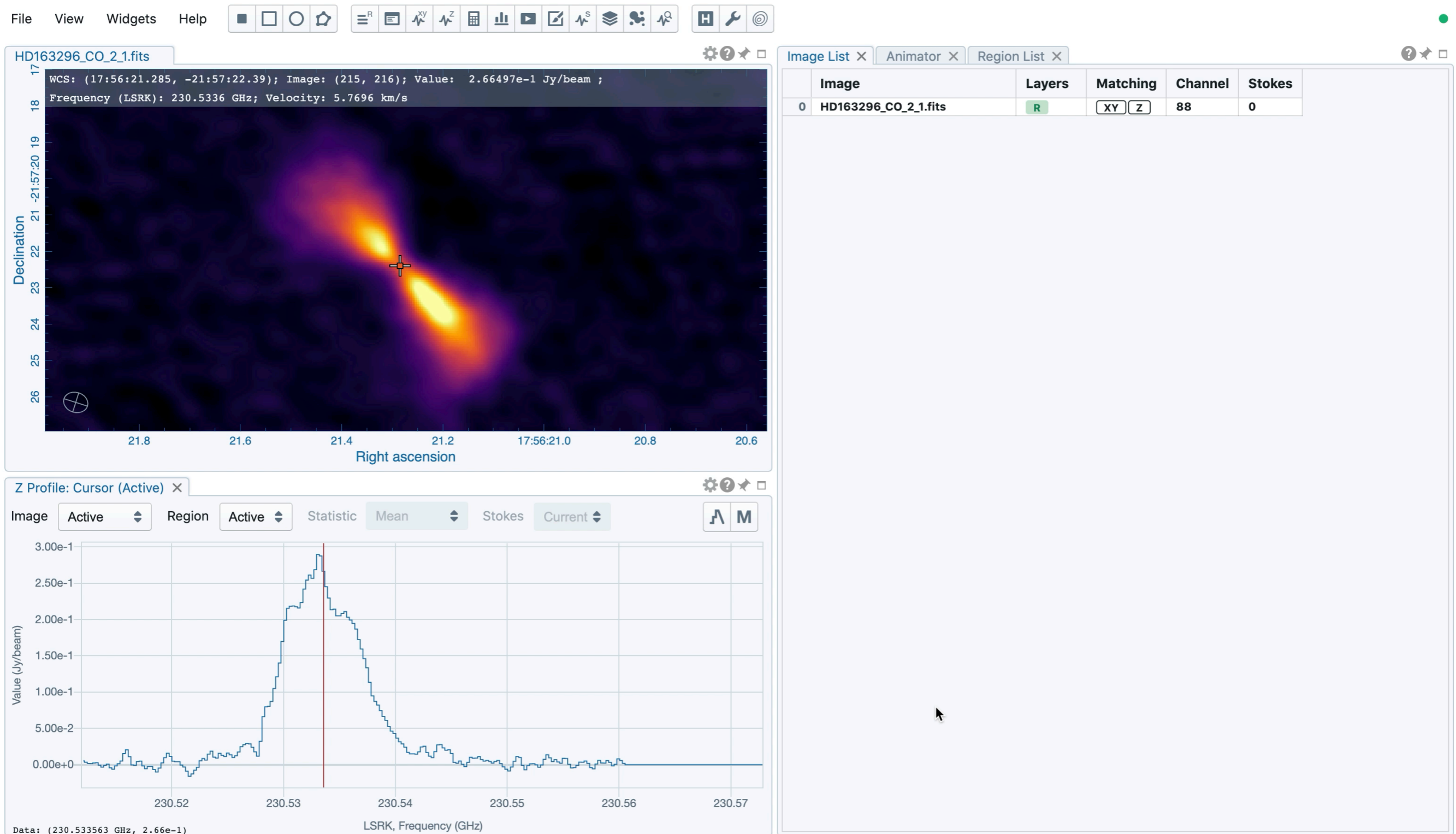
Spectral conversion and profile smoothing

- Various spectral references and conventions (e.g. LSRK, frequency in GHz \rightarrow TOPO, air wavelength in mm)
- Various smoothing schemes (e.g., hanning, binning, etc)



Highlight of new features

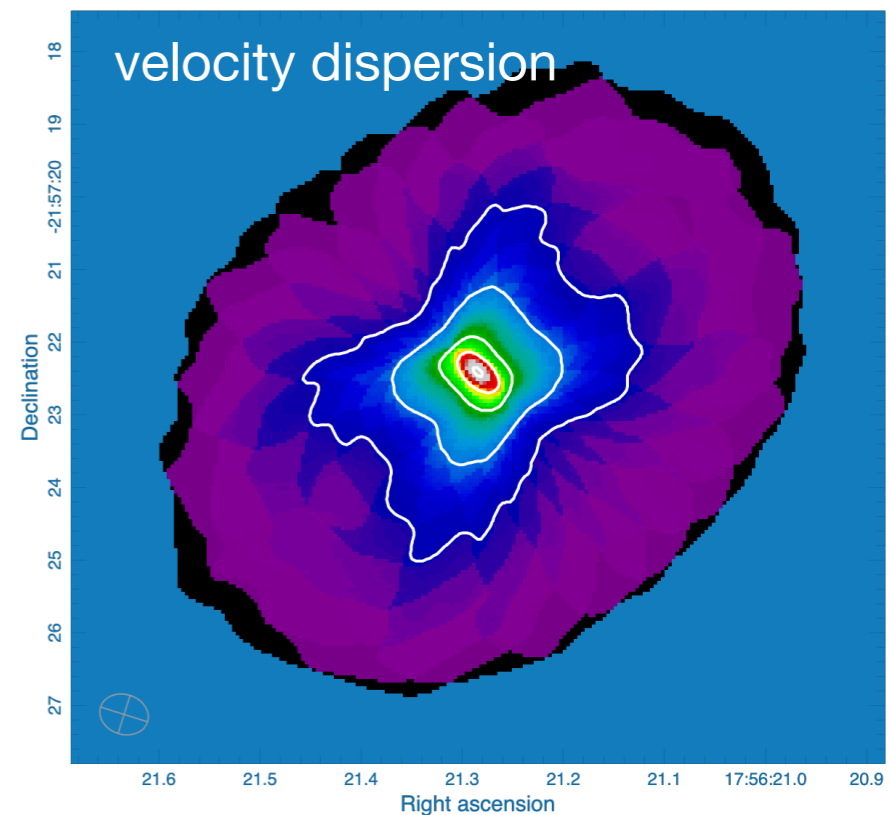
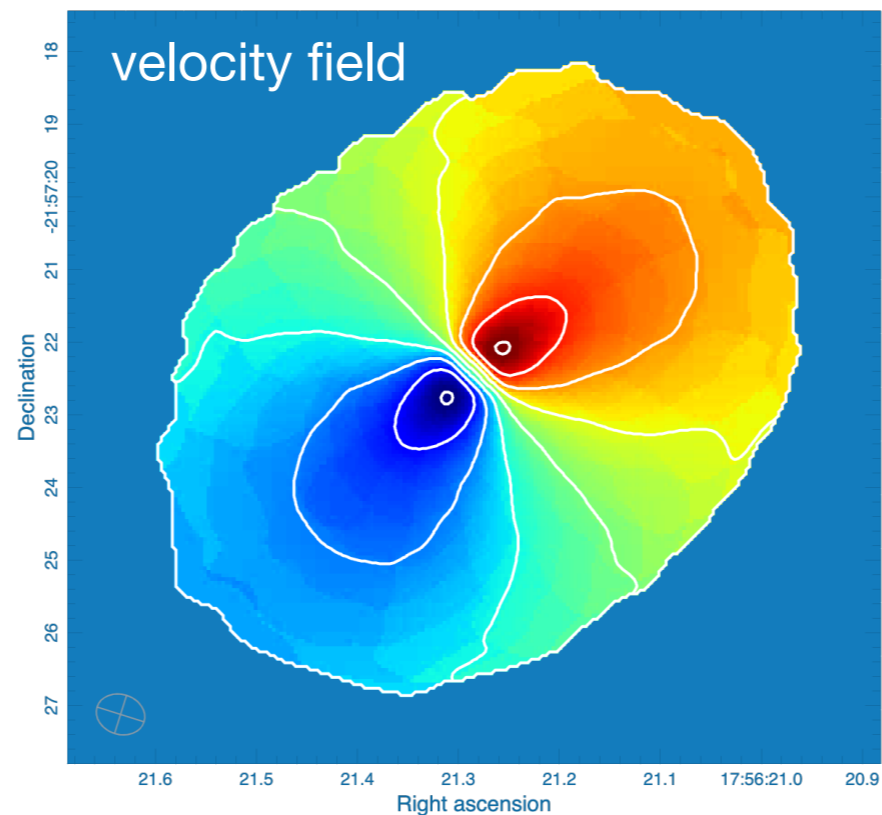
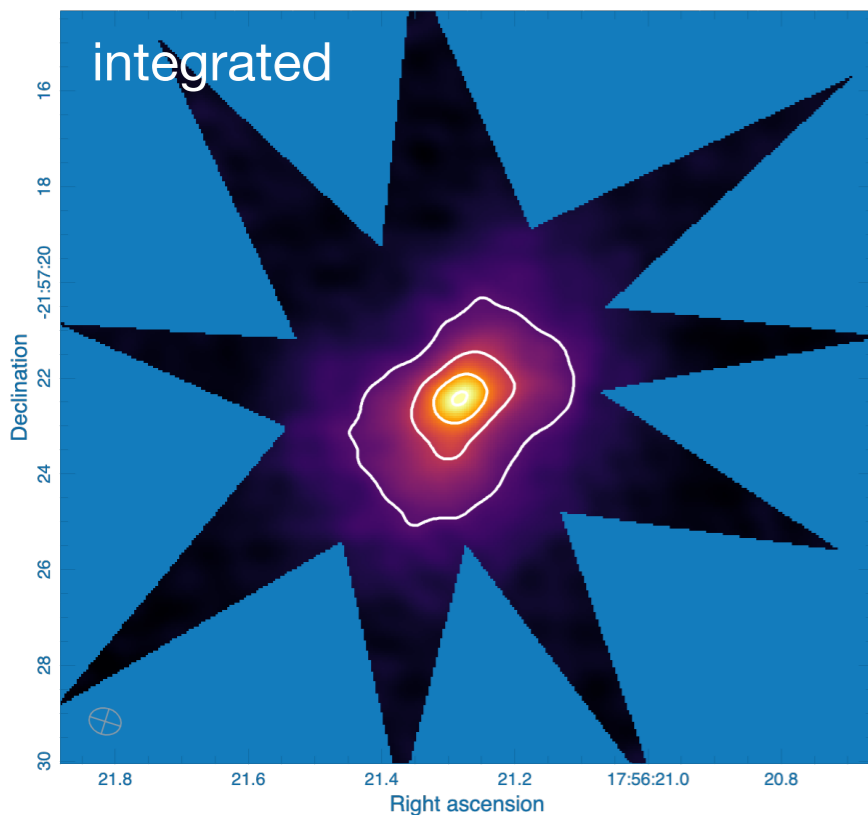
Spectral conversion and profile smoothing



Highlight of new features

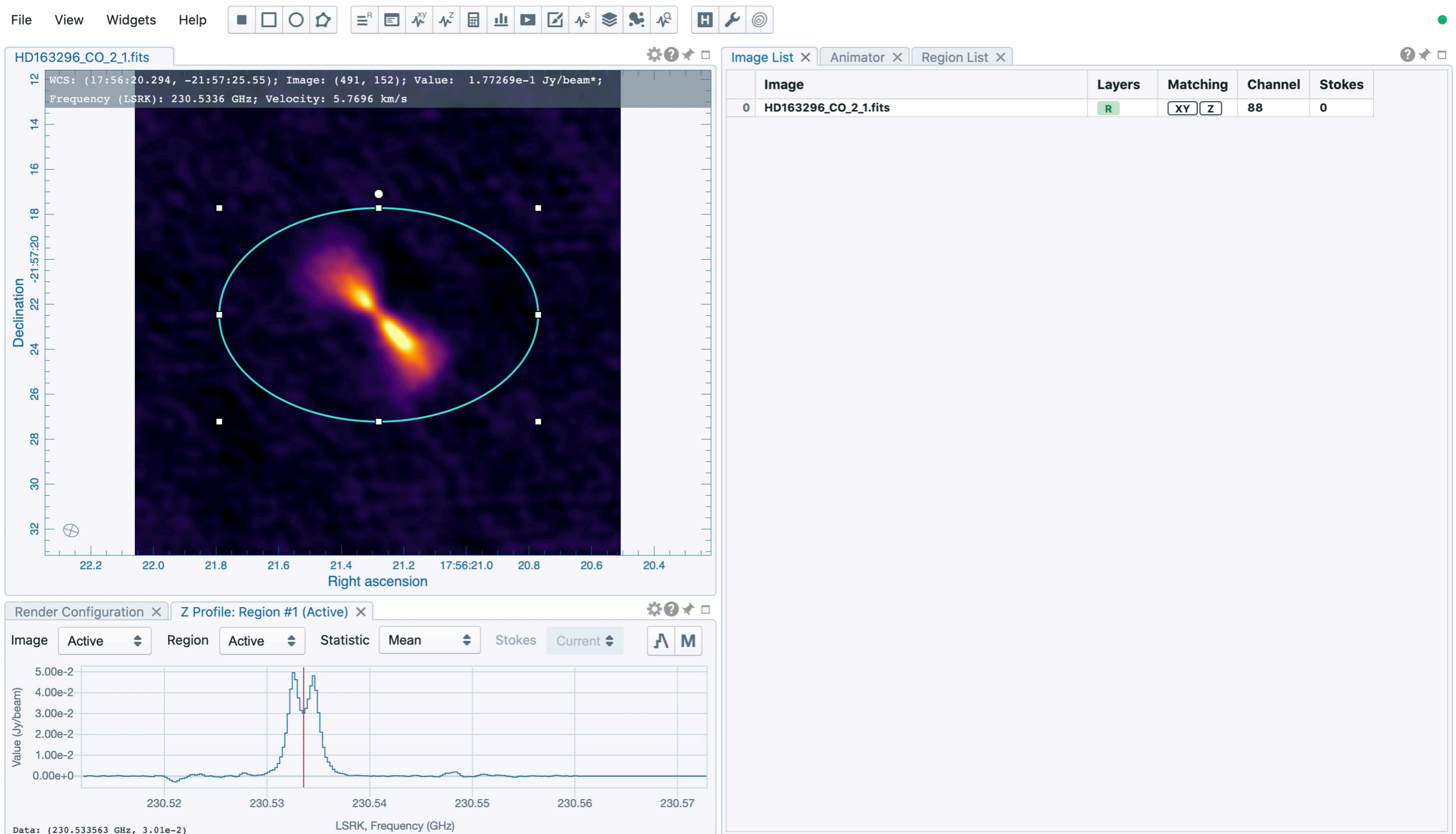
Moment map generator

- Equivalent to the CASA-immoments task with more GUI interactivity
- Progress bar and cancellable
- Save generated images as CASA or FITS format



Highlight of new features

Moment map generator



Highlight of new features

Moment map generator

File View Widgets Help

S255_IR_sci.spw29.cube.l.pbcor.fits

WCS: (6:12:54.000, 17:59:23.09); Image: (740, 1036); Value: $-9.13814e-3$ Jy/beam ;
Frequency (LSRK): 348.6036 GHz; Velocity: 417.6808 km/s

Declination
24.0
23.5
17:59:23.0
22.5
22.0

Right ascension
54.10 54.05 6:12:54.00 53.95 53.90 53.85

Image List × Animator × Region List ×

Image	Layers	Matching	Channel	Stokes
0 S255_IR_sci.spw29.cube.l.pbcor.fits	R	XY Z	0	0

Render Configuration × Z Profile: Cursor (Active) ×

Image Active Region Active Statistic Mean Stokes Current

Value (Jy/beam)
6.00e-1
5.00e-1
4.00e-1
3.00e-1
2.00e-1
1.00e-1
0.00e+0

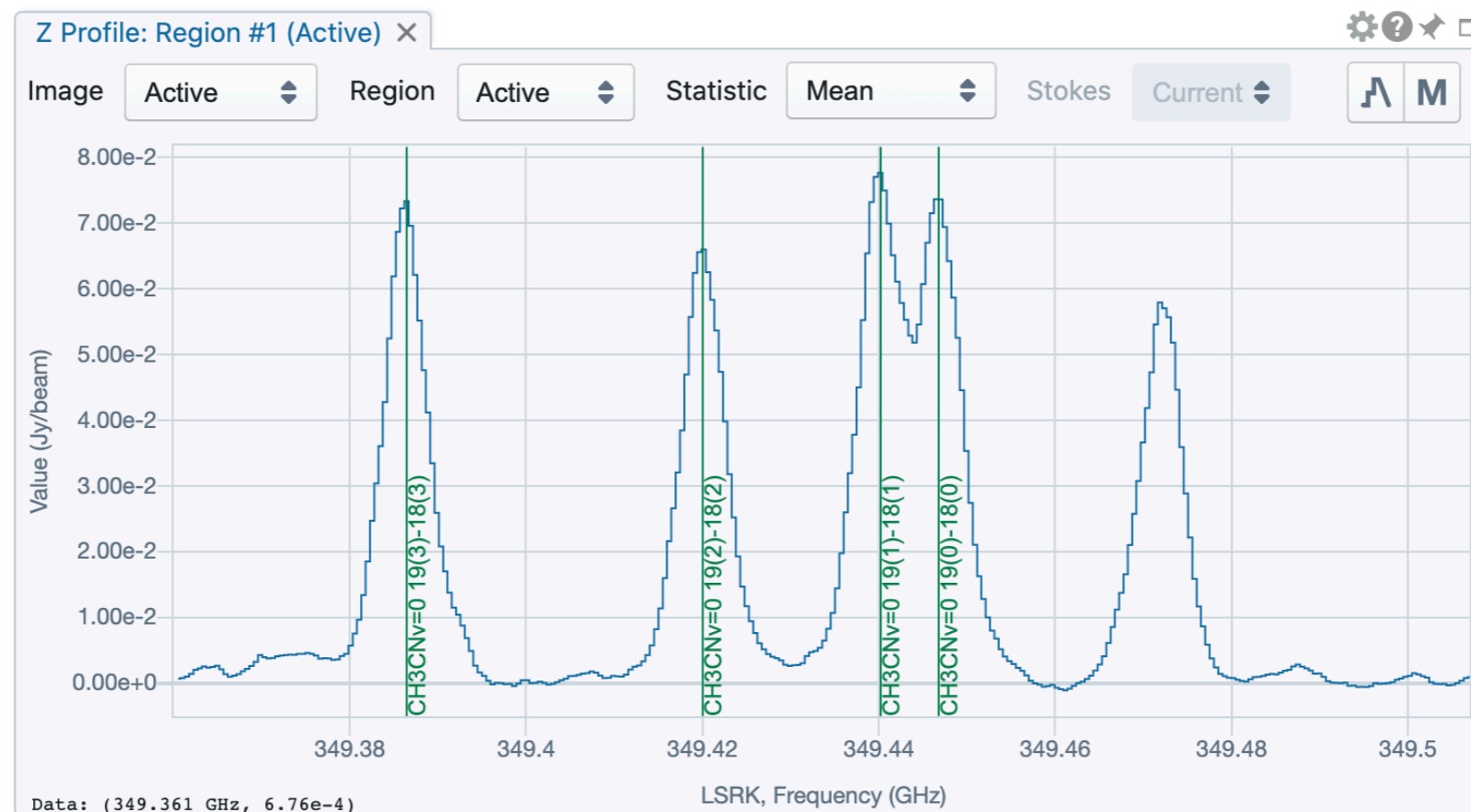
LSRK, Frequency (GHz)
348.7 348.8 348.9 349 349.1 349.2 349.3 349.4 349.5

Data: (348.604 GHz, $-9.14e-3$)

Highlight of new features

Basic spectral line query

- Remote query with the NRAO Splatalogue service
- Line ID overlay on a spectral profile plot
- Offline subset database and filtering will be available in the next release



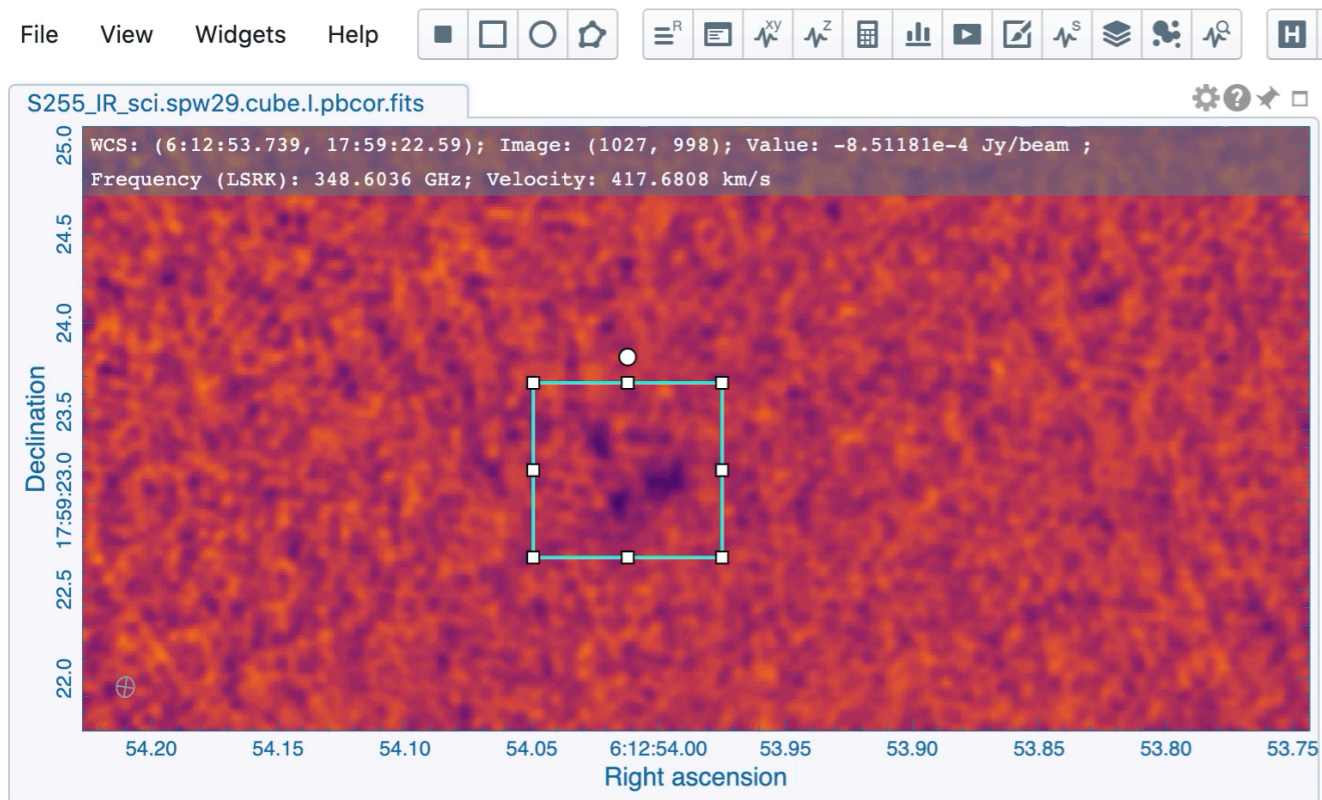
Highlight of new features

Basic spectral line query

File View Widgets Help

S255_IR_sci.spw29.cube.l.pbcor.fits

WCS: (6:12:53.739, 17:59:22.59); Image: (1027, 998); Value: $-8.51181e-4$ Jy/beam ;
Frequency (LSRK): 348.6036 GHz; Velocity: 417.6808 km/s



Decination

Right ascension

Spectral Line Query

Range From 0 To 0 MHz Intensity Limit -5 Query

Name	Display	Description
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Velocity (km/s) 0

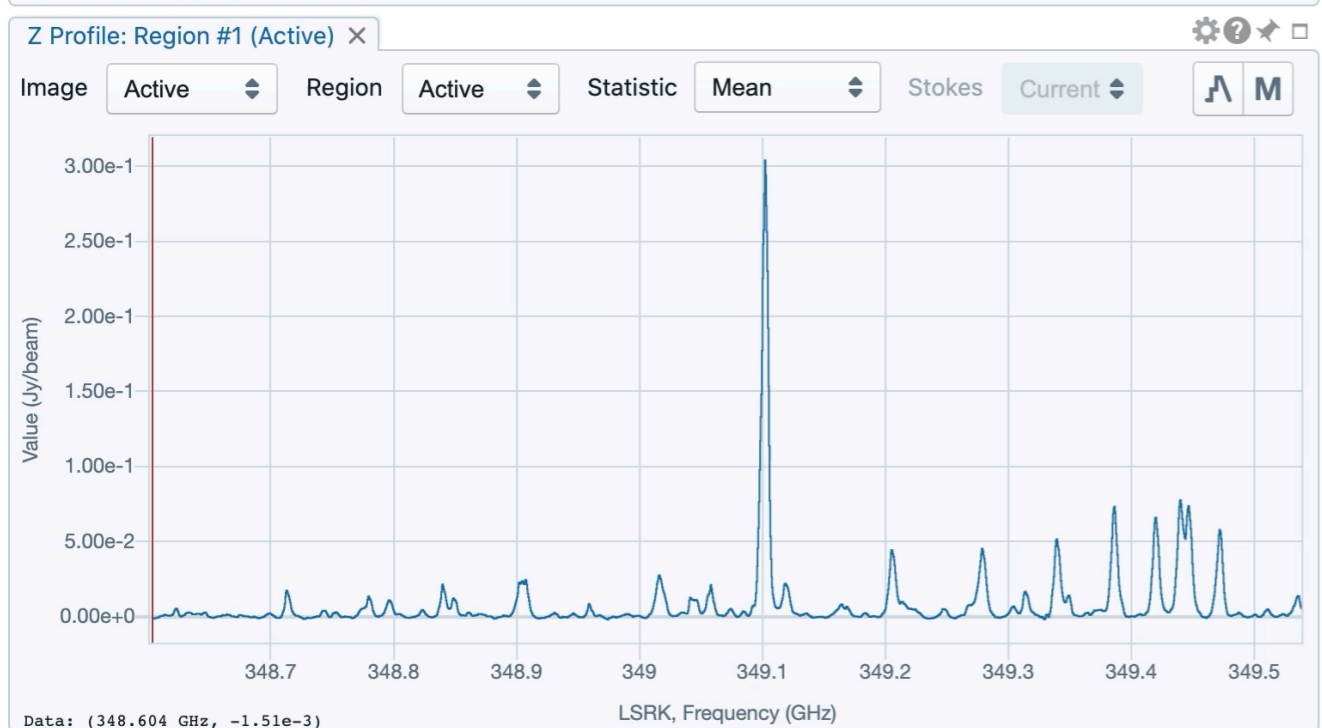


Image Active Region Active Statistic Mean Stokes Current

Value (Jy/beam)

LSRK, Frequency (GHz)

Data: (348.604 GHz, $-1.51e-3$)

Spectral Profiler spectral-profiler-0 Plot Clear

Showing 0 entries.

Highlight of new features

Catalogue support

- Support VOTable and FITS formats
- Support table filtering and sorting
- Rendering modes: image overlay, 2D scatter, and histogram
- Catalogue table, image overlay, 2D scatter, and histogram are linked.
- Fast catalog loading, filtering, and rendering
- More features will be available in v2.0+

Highlight of new features

Catalogue support

File View Widgets Help

cosmos_spitzer3.6micron.fits

WCS: (9:59:31.16, 1:34:47); Image: (5243, 923); Value: 2.64342e-4 MJy/sr

Declination

Right ascension

Catalog X





No catalog file loaded

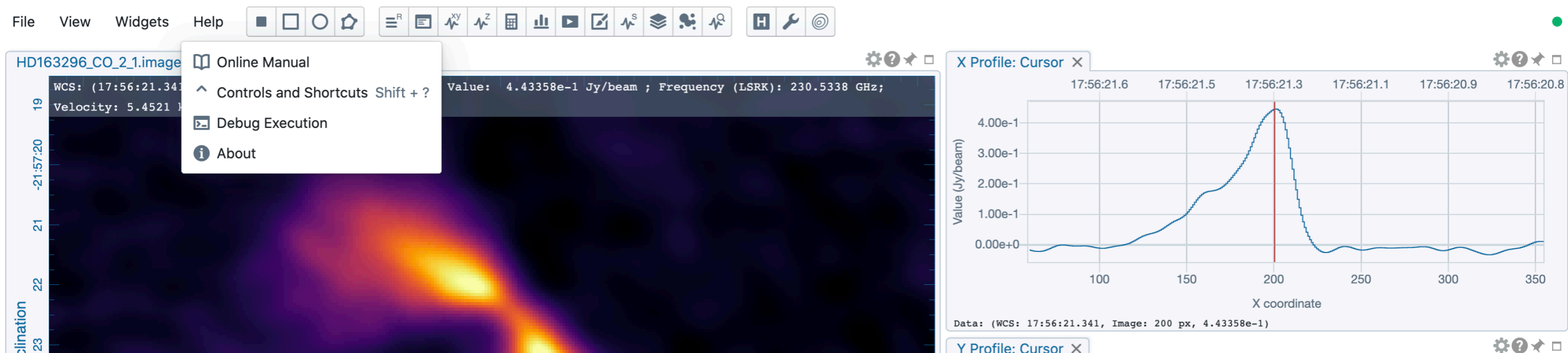
Load a catalog file using the menu

The image shows a software interface with a main window displaying an astronomical image of a star field. The image is titled 'cosmos_spitzer3.6micron.fits' and has a WCS header: 'WCS: (9:59:31.16, 1:34:47); Image: (5243, 923); Value: 2.64342e-4 MJy/sr'. The axes are labeled 'Declination' (y-axis, ranging from 1:30:00 to 3:00:00) and 'Right ascension' (x-axis, ranging from 04:00 to 9:57:00). The image shows a dense field of stars. A mouse cursor is visible near the bottom right of the image. To the right of the image is a panel titled 'Catalog X' which is currently empty, displaying a folder icon and the text 'No catalog file loaded' and 'Load a catalog file using the menu'. The top of the interface has a menu bar with 'File', 'View', 'Widgets', and 'Help', and a toolbar with various icons for image manipulation and analysis.

Highlight of new features

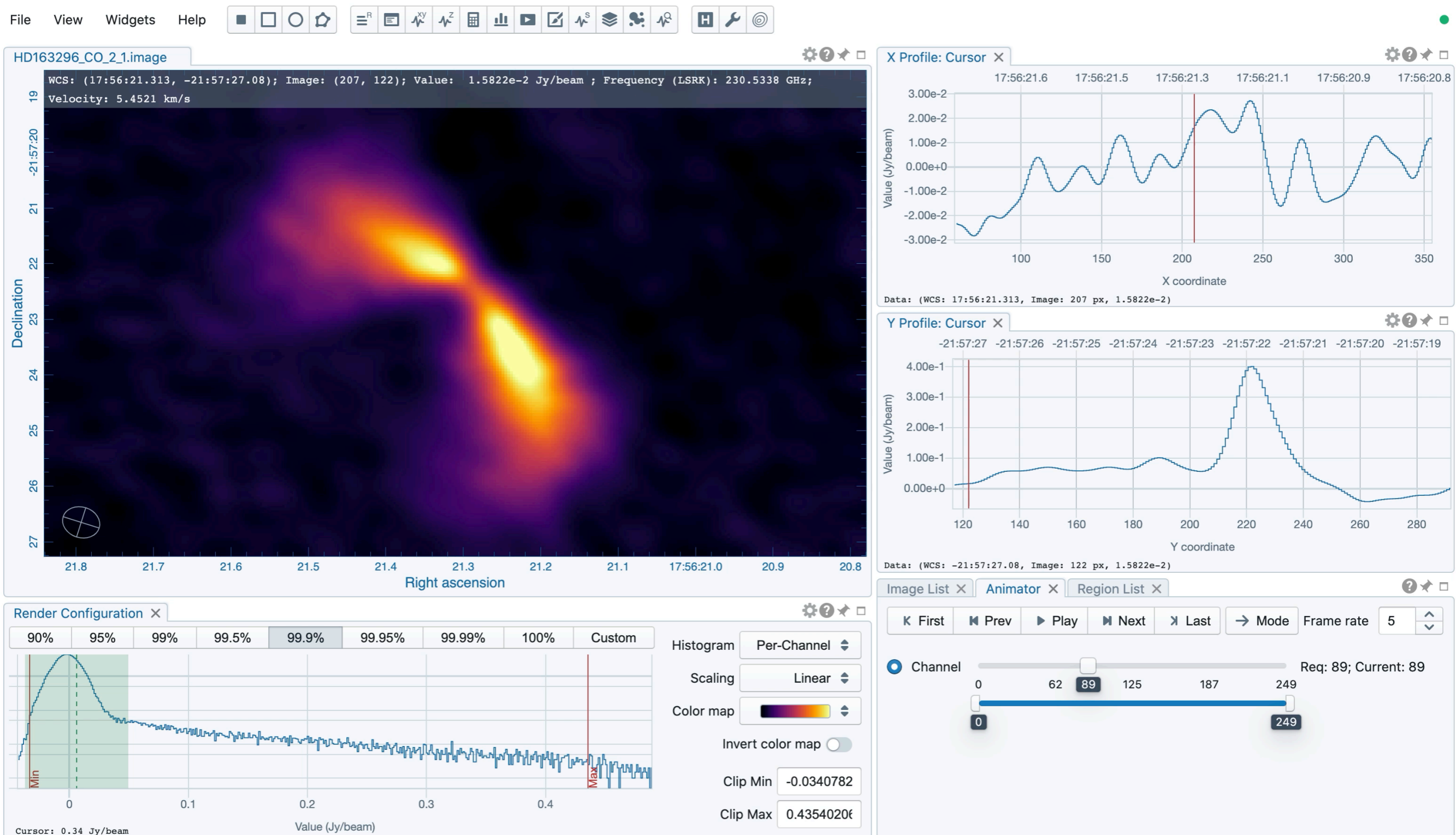
Online user manual and offline help manual

- Online user manual, with more detailed descriptions, is available via the menu “Help” -> “Online Manual”.
- An offline quick-help manual is available for each widget or dialogue. Click     to read the content.



Highlight of new features

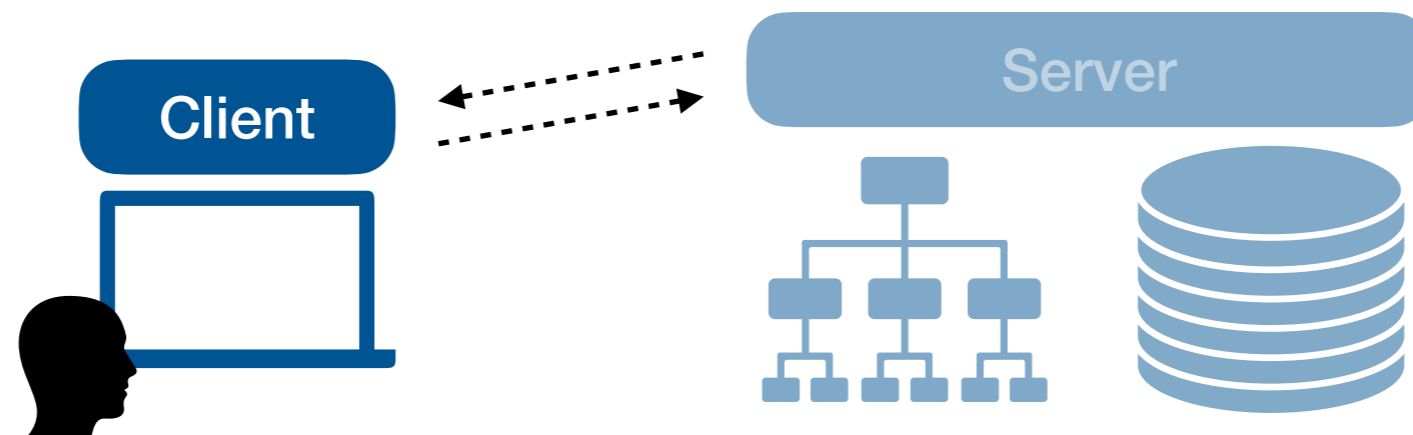
Online user manual and offline help manual



Highlight of new features

Server authentication and deployment

- Flexible authentication methods (e.g., LDAP, Google, etc)
- Simplified deployment procedures are available.



Highlight of new features

Server authentication and deployment

The image shows a Google Chrome browser window with a new tab. The address bar contains the text "New Tab" and a plus sign. Below the address bar, there are several tabs: "Apps", "CARTA-IDIA", "CARTA-master2", "CARTA mix'n'match", "CARTA builds", "CARTA-beta-test", "CARTA-master", and "CARTA_github". The main content area displays the Google logo and a search bar with the text "Search Google or type a URL". Below the search bar, there is a grid of shortcuts. The first row contains five shortcuts: "CARTA mix 'n...", "CARTA", "CARTA fronte...", "The Modern J...", and "Google Search". The second row contains five shortcuts: "CARTA v1.4", "CARTA v1.4", "CARTA v1.4", "Sign in to Git...", and "Add shortcut". In the bottom right corner, there is a "Customize" button.

Future plan

transforming to a new-generation “science-ready” tool

- New versioning
 - MAJOR.minor.patch
- Next release v2.0: “quality-of-life” release, ~Spring 2021
 - v2.0: focusing on issues (180+) since v1.0, and R&D for v3.0+
- Then next
 - v3.0: new features (e.g. PV generator) under discussion

Future plan

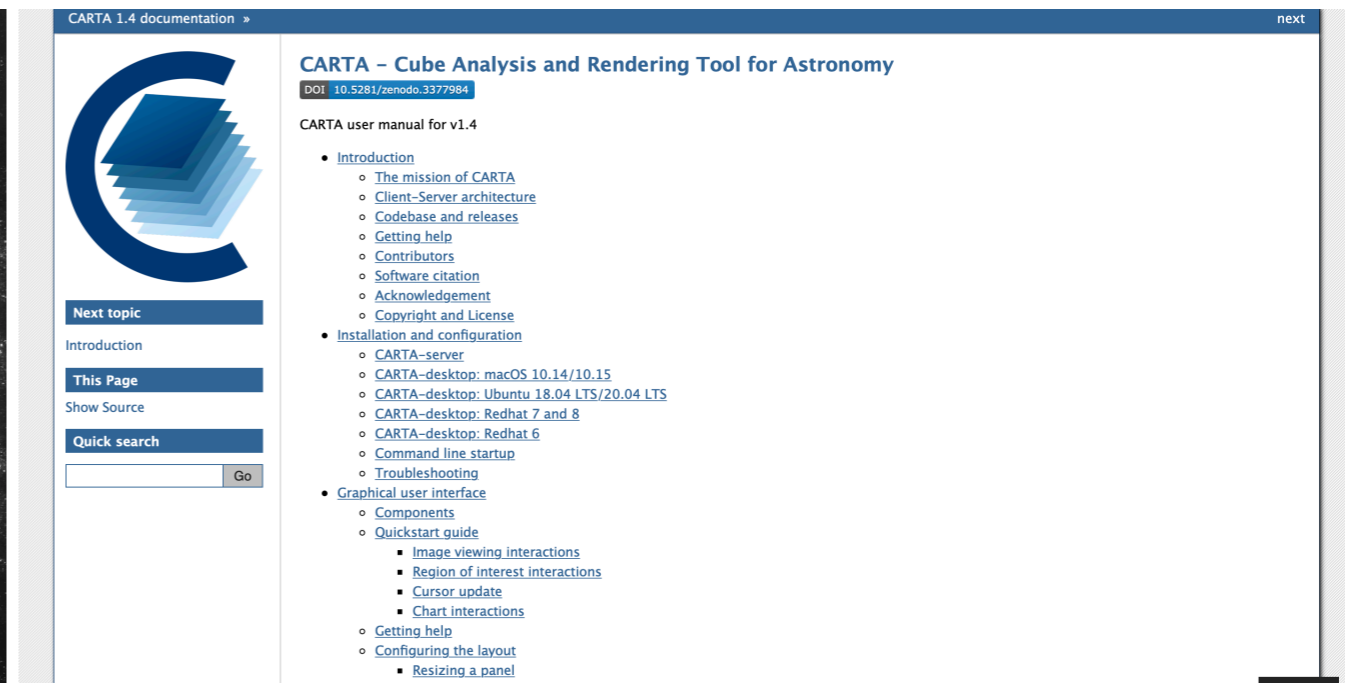
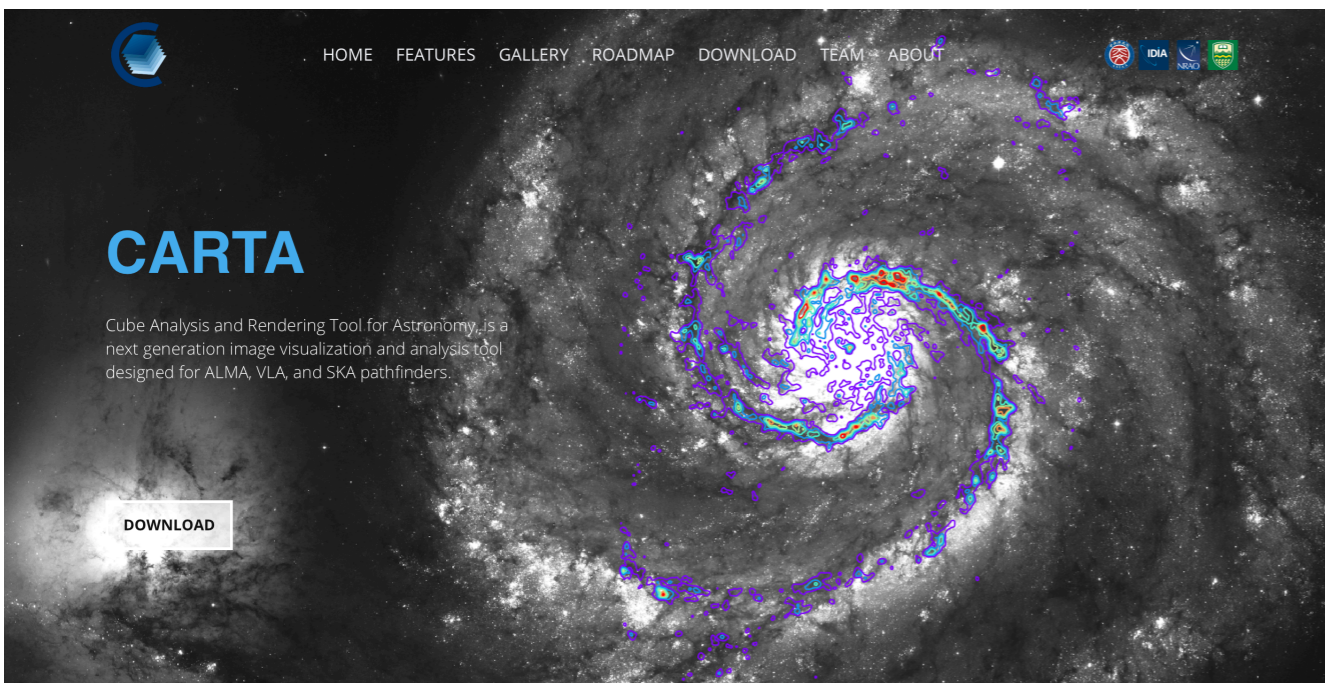
transforming to a new-generation “science-ready” tool

- Features to be implemented (non-exclusive)
 - Multi-panel view
 - Channel map view
 - Support additional image types (e.g. complex value, uv)
 - Position-velocity map generator
 - Collaborative tools (server)
 - Interactive CLEAN with CASA
 - Vector field (polarization) rendering
 - Volume (3D) rendering
 - Profile, histogram, and image fitting tools
 - Scripting interface with Python3 (ongoing)
 - More ROI support
 - Three-color (RGB) blender
 - Ultra-efficient HDF5-IDIA format
 - Distance measure tool
 - Source finder
 - VO support
 - Enhanced Stokes image support
 - Enhanced spectral line query
 - Enhanced catalogue support
 - Publication quality export
 - ...

Portals

check for additional info

- Homepage NEW
<https://cartavis.github.io>
- Online user manual
<https://carta.readthedocs.io/en/latest/>



Portals

check for additional info

- Codebase
<https://github.com/CARTAvis>
- Getting help or feature request
 - Email: carta_helpdesk@asiaa.sinica.edu.tw
 - Issue: <https://github.com/CARTAvis/carta/issues>

The screenshot shows the GitHub profile page for the organization 'CARTAvis'. The header includes the GitHub logo, a search bar, and navigation links for Pull requests, Issues, Marketplace, and Explore. Below the header, the organization's name 'CARTAvis' is displayed with a logo. A navigation bar shows 'Repositories 30', 'Packages', 'People 21', 'Teams', 'Projects', and 'Settings'. The 'Pinned repositories' section features the 'carta' repository, which is described as the source code for the frontend component of CARTA. Below this, there is a search bar for repositories, filters for 'Type: All' and 'Language: All', and a 'New' button. The 'carta-frontend' repository is also visible, showing its description, top languages (TypeScript, JavaScript, Python, CMake), and statistics like 5 forks, 7 stars, and 186 issues.

The screenshot shows the GitHub Issues page for the 'carta' repository. The header includes the GitHub logo, a search bar, and navigation links for Pull requests, Issues, Marketplace, and Explore. Below the header, the repository name 'CARTAvis / carta' is displayed with a logo. A navigation bar shows 'Code', 'Issues 16', 'Pull requests', 'Actions', 'Projects', 'Wiki', 'Security', 'Insights', and 'Settings'. A notification banner at the top reads 'Label issues and pull requests for new contributors'. Below this, there is a search bar with the filter 'is:issue is:open' and buttons for 'Labels 8', 'Milestones 0', and 'New issue'. The main content area displays a list of 16 open issues, with 16 closed issues. The issues are sorted by 'Sort' and include details like the issue title, the number of comments, and the author. A blue envelope icon is visible in the bottom right corner of the page.

Applications of CARTA

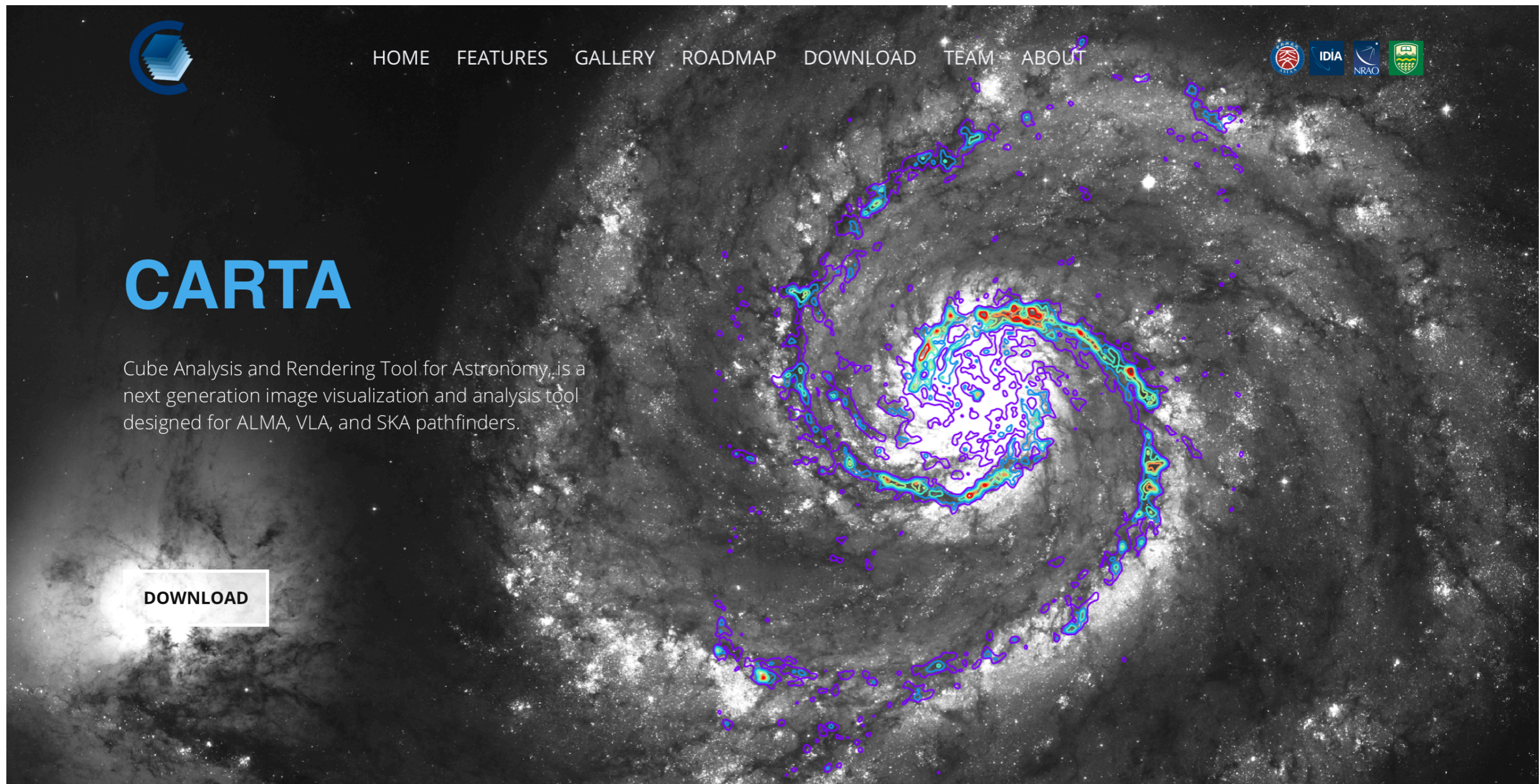
archives, telescopes, science platform, etc

- Integration of CARTA with the ALMA science archive user interface (ongoing)
- Deployment at JAO DRM group (ongoing)
- Deployment for MeerKAT
- Deployment for ASKAP
- Deployment for CIRADA
- ...

Please give CARTA a try...

in case you haven't

- <https://cartavis.github.io>



The screenshot shows the CARTA website homepage. At the top left is the CARTA logo, a blue stylized 'C' with a stack of blue squares. To its right is a navigation menu with links: HOME, FEATURES, GALLERY, ROADMAP, DOWNLOAD, TEAM, and ABOUT. On the far right of the top bar are logos for IAS, IDIA, NRAO, and another organization. The main content area features the word 'CARTA' in large, bold, light blue letters. Below it is a paragraph: 'Cube Analysis and Rendering Tool for Astronomy, is a next generation image visualization and analysis tool designed for ALMA, VLA, and SKA pathfinders.' In the bottom left corner, there is a white rectangular button with the text 'DOWNLOAD' in black. The background of the website is a dark, high-resolution image of a spiral galaxy with multi-colored contours overlaid, showing intensity variations in shades of purple, blue, green, yellow, and red.