



ilifu Online Training - Session 5 (CARTA)

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Inter-University Institute
for Data Intensive Astronomy

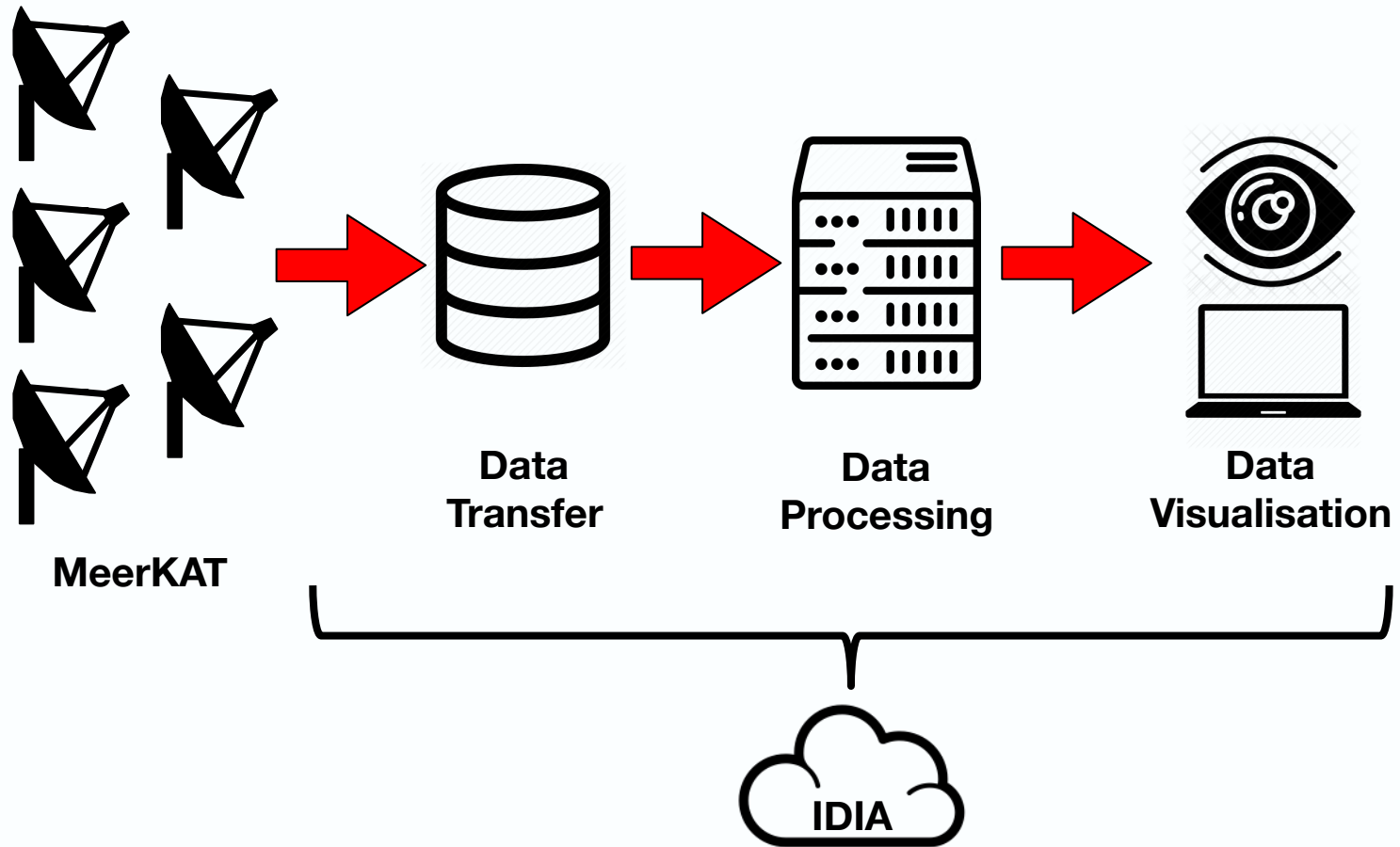


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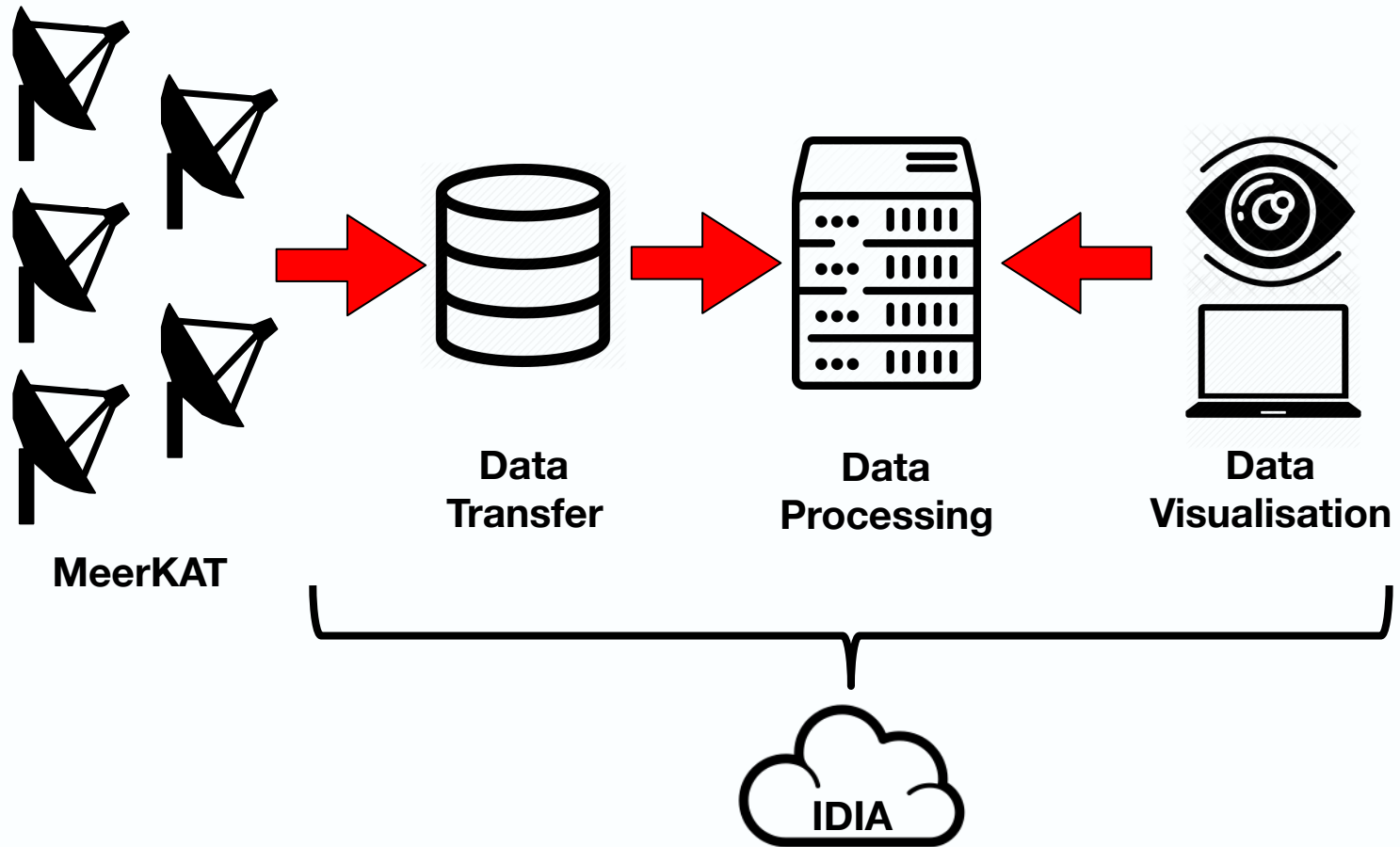
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IDIA and the MeerKAT toolbelt



IDIA and the MeerKAT toolbelt





HOME FEATURES GALLERY ROADMAP DOWNLOAD TEAM ABOUT

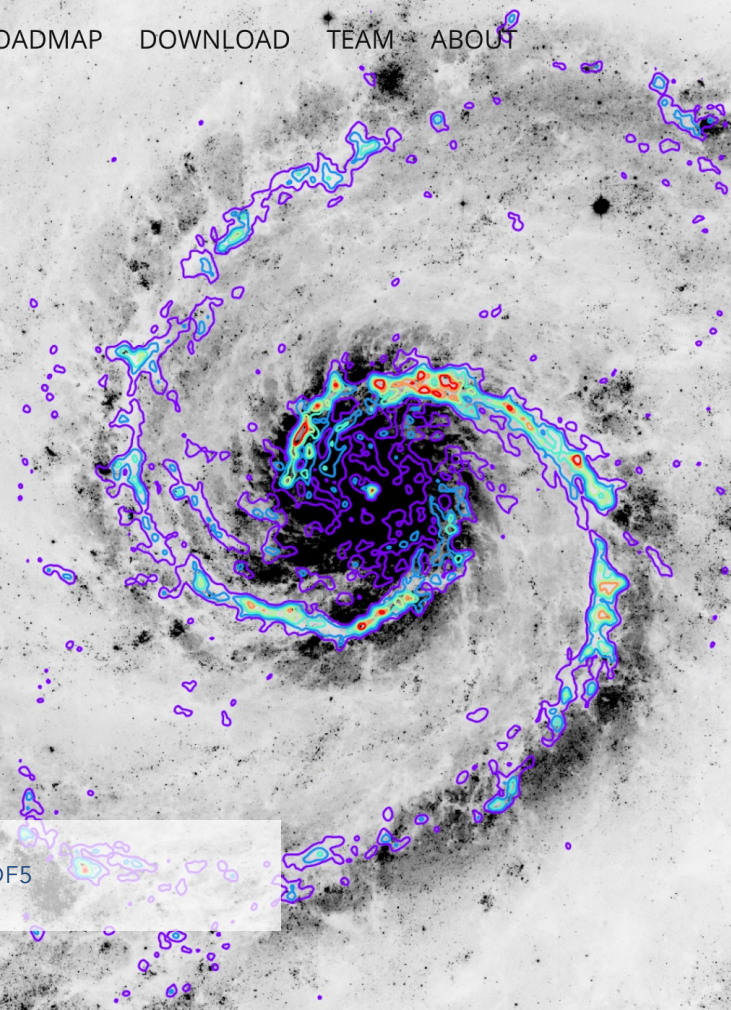


<https://cartavis.github.io>
CARTA

Cube Analysis and Rendering Tool for Astronomy, is a next generation image visualization and analysis tool designed for ALMA, VLA, and SKA pathfinders.

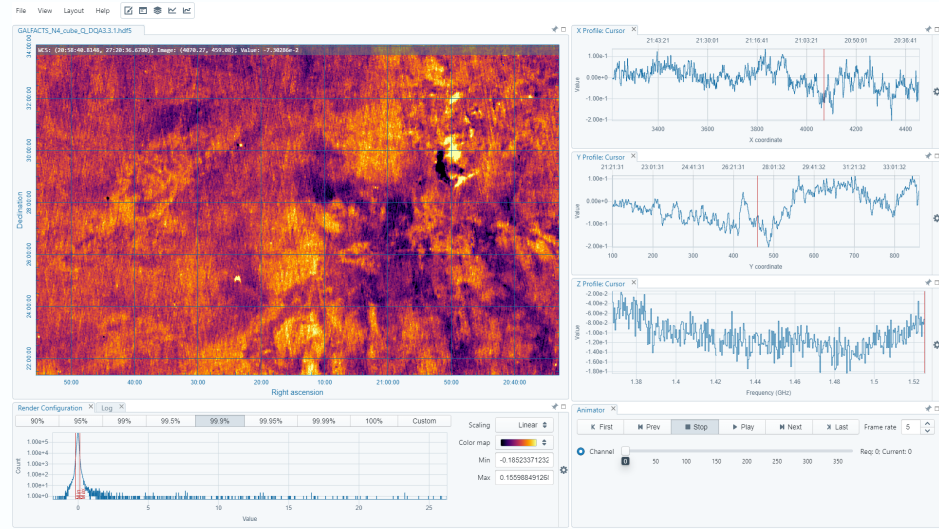
DOWNLOAD

- Cloud-based Visual analytic of remote large image cubes
- Supports many image formats: FITS, CASA, Miriad, and HDF5
- To be deployed at ALMA Regional Science Centers



CARTA

- Cube Analysis and Rendering Tool for Astronomy (CARTA)
 - IDIA (South Africa) – NRAO (US) – ASIAA (Taiwan)
 - Cloud-based remote visual analytics of large image cubes
 - Supports many image formats: FITS, CASA, Miriad, and **HDF5**
 - v6.0.0 stable release June 2026 – available here: <https://cartavis.org>
 - Deployed at ALMA Regional Centres and servers around the world



CARTA at IDIA

- docs.ilifu.ac.za/#/astronomy/astronomy_software?id=carta
- CARTA server hosted on ilifu at <https://carta.idia.ac.za>
 - Login details same as for Jupyter, emailed to you when ilifu account set up
- ~~Beta (development) server:~~ <https://carta-beta.idia.ac.za>
 - ~~Routinely updated between major releases~~
- All Astro users (carta-users) have access

CARTA HDF5 format (IDIA schema)

- Strongly recommended for large images/cubes
- Purpose-built HDF5 schema developed at IDIA
 - Efficient FITS to HDF5 converter tool developed at IDIA
- [hdf5-converter](#)
- Files go through an “ingestion process”
 - Rotated dataset (XYZ -> ZYX) cached for spectral profile generation
 - Pre-calculated statistics & histogram for image loading (slides & cubes)
 - Pre-calculated tiles for image loading
 - Mipmaps
- Can write IDIA HDF5 file to /carta_share/current/ (SSD) for performance

CARTA HDF5 format (IDIA schema)

- HDF5 converter usage:
 - `srun fits2idia -o {OUTPUT HDF5 file} {INPUT FITS file}`
- Suggested to copy straight into /carta_share subdirectory:
 - `srun fits2idia -o /carta_share/users/$USER/image.hdf5 image.fits`
- Speed-up achieved by increasing CPUs & memory allocation:
 - Up to 251 GB for node in Main partition, and 1508 GB HighMem partition
 - `srun --mem=50GB --time=5 --cpus-per-task=10 fits2idia -p -o /carta_share/users/${USER}/image.hdf5 image.fits`
 - `-p` shows simple progress bar

CARTA HDF5 format (IDIA schema)

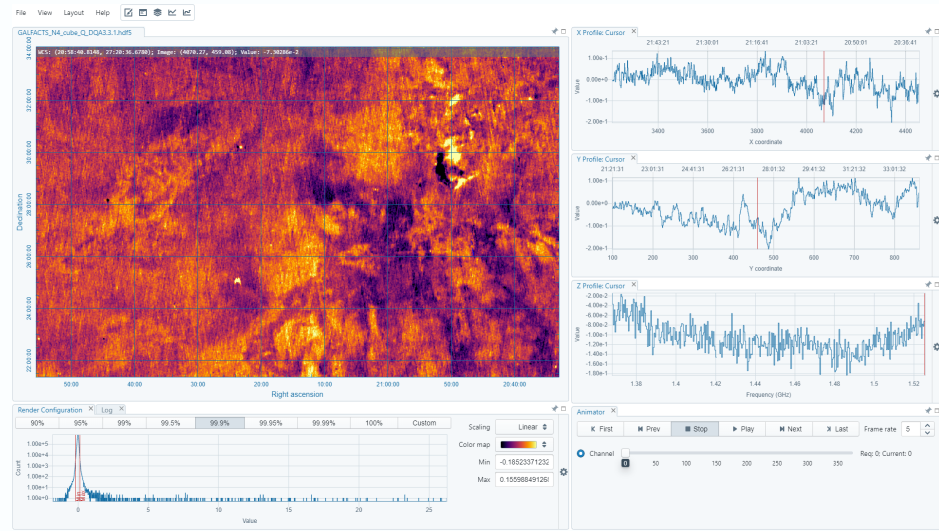
- Some large FITS cubes will exceed max memory values
 - Unable to convert to HDF5 in default mode
- Option -m will report predicted memory usage and exit:
 - `fits2idia -m image.fits`
- If exceeds 1508 GB (or 251 GB if HighMem nodes unavailable):
 - Option -s must be used, using slower but less memory-intensive method
 - Single CPU iterating through a single channel at a time
 - `srun --mem=10GB --time=01:00:00 --cpus-per-task=1 fits2idia -s -p -o /carta_share/users/${USER}/image.hdf5 image.fits`
- Predicted memory usage for slow-mode conversion reported when using both options -s and -m

CARTA at IDIA

- By default, CARTA will browse in /carta_share/users/\$USER
- Can access any files or folders in /carta_share, /scratch3, /idia and /ilifu directories that your ilifu user can access
 - /idia and /ilifu mounts read-only, so cannot export files here
 - e.g. region files, FITS cutouts or moment maps
 - Can export to /carta_share or /scratch3
- Many copies of images in /carta_share (HDF5, FITS, CASA or miriad) no longer necessary, unless for performance reasons
 - For large cubes/images, we recommend converting to HDF5 and writing to /carta_share/current (SSDs)
 - Superior performance during visualisation
 - Not necessary for all other images, as visualising directly from /idia, /ilifu or /scratch3 in any format will still result in good performance

CARTA at IDIA

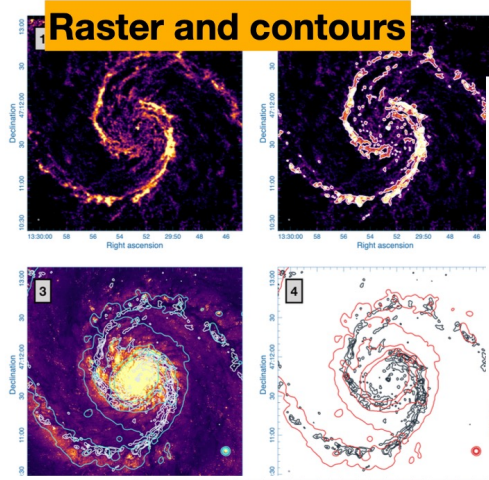
- Can move the files/folders to relevant project directory, within / carta_share/groups/, /scratch3/projects/, or /idia/projects/
 - e.g. for other project members to access specific files
 - Please request support to create relevant project directory if it doesn't exist



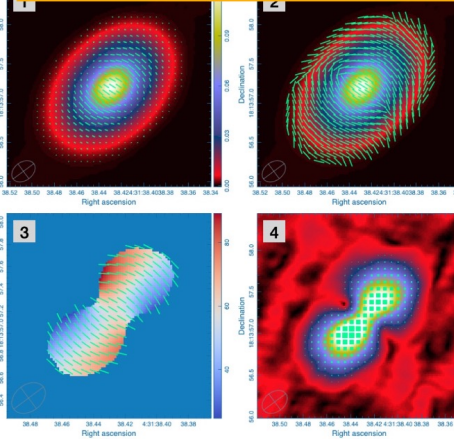
CARTA at IDIA: troubleshooting

- Please contact support@ilifu.ac.za if you don't have access
- For CARTA-specific issues
 - Contact [CARTA helpdesk](#) or file [GitHub issue](#)
- Restarting your backend
 - e.g. issues starting CARTA, or CARTA session crashes
 - File -> Server -> Restart Service or visit carta.idia.ac.za/dashboard
 - Also accessible via File -> Server -> Dashboard
 - Press the button to “Restart CARTA service”
 - Refresh your CARTA page or press the button for a “New CARTA session”
- Hard-reload white screen
 - e.g. white screen appears on IDIA CARTA server
 - Force reload (e.g. command-shift-R) page to clear cache, often a few times

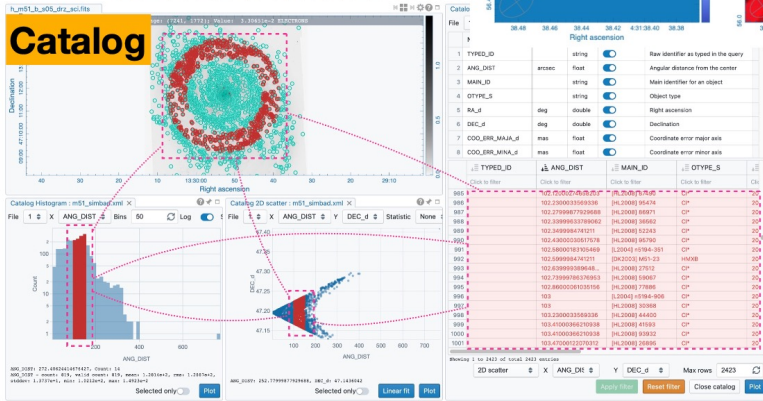
Rendering modes



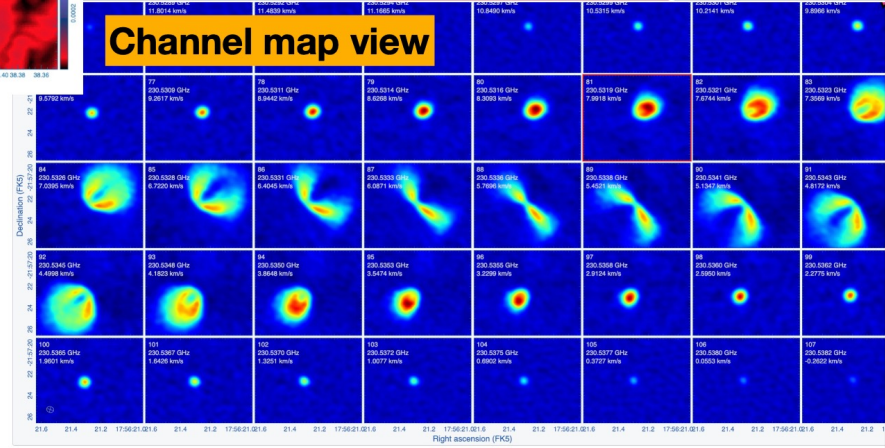
Vector field (polarization)



Catalog

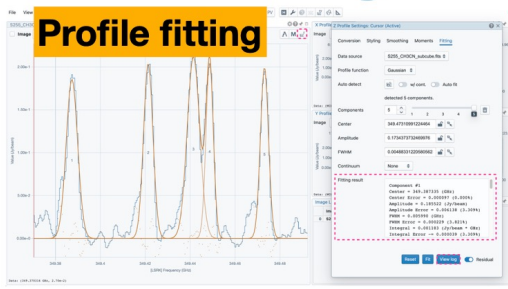


Channel map view



<https://carta.readthedocs.io/en/latest/>

Data analysis

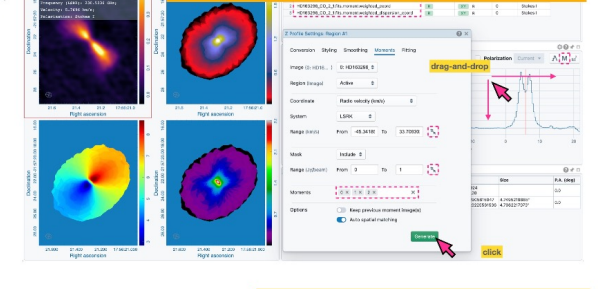


Spatial profiler

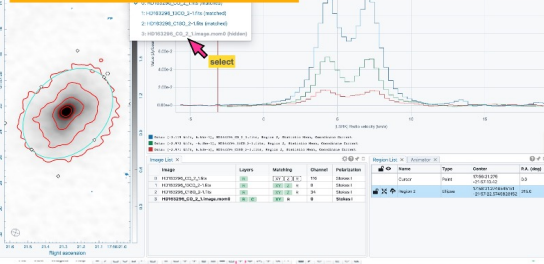


Online data query - catalog and image

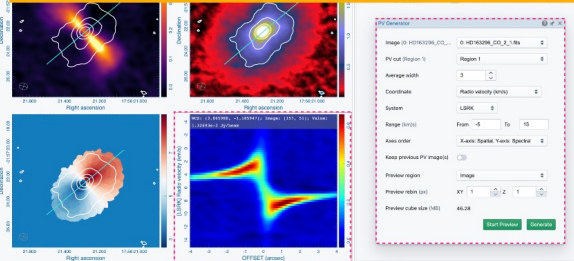
Moment map generator



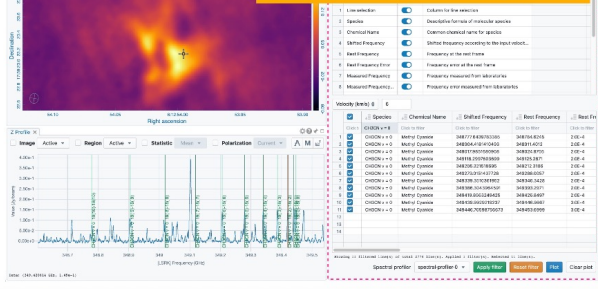
Spectral profiler



Position-velocity map generator



Spectral line query



Stokes analysis

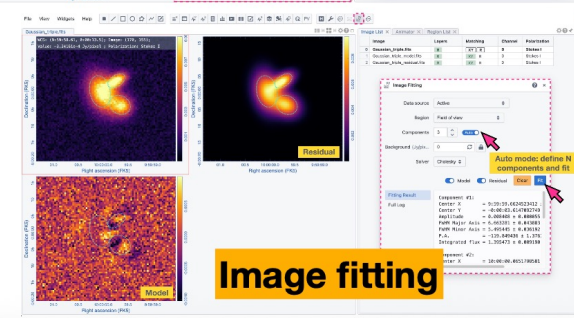
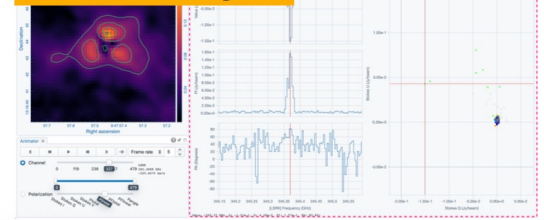


Image fitting

<https://carta.readthedocs.io/en/latest/>

CARTA demo

