

ViaLactea service

Introduction

The next-generation astronomy facilities such as the Square Kilometre Array (SKA) will provide astronomers with **massive volumes of data** and emphasize the demand for new approaches to **data storage, processing and analysis**. These new methodologies should combine visualization and data processing to enable astronomers to analyze astronomical data and extract meaningful knowledge.

To address these challenges NEANIAS presents ViaLactea, a distributed service that offers to the Astrophysics communities **highly interactive visual analytic interfaces to exploit multi-wavelength observations** of the Milky Way Galactic Plane for researching the star formation process.

The service core components are the **ViaLactea Visual Analytics (VLVA)** tool and the **ViaLactea Knowledge Base (VLKB)**.

VLVA combines different types of visualization to perform the analysis exploring the correlation between different data, for example **2D intensity images with 3D molecular spectral cubes**.

All underlying data are managed by the VLKB. The VLKB includes 2D and 3D (velocity cubes) surveys, numerical model outputs, point-like and diffuse object catalogues and allows for retrieval of all the available datasets as well as cutouts on the positional and/or velocity axis and some merging capabilities on adjacent datasets.

Available data

Although VLVA allows to load and visualize local data, one of the strengths of the ViaLactea service is its Knowledge Base.

The VLKB identifies a set of **data collections, catalogues and services enabling discovery and access** on them, initially put together and made available by the EU FP7 VIALACTEA Project.

The catalogues content (such as compact sources, filament structures and numerical Spectral Energy Distribution models) are accessible through a **Virtual Observatory enabled infrastructure based on the TAP protocol**.

The VLKB data storage contains files in FITS format. The FITS files span from 2D images in the radio continuum to 3D FITS cubes containing radio velocity spectra at specific molecular lines.

The developed service interface consists of three common services:

- **search** engine to perform data discovery,
- **cutout** engine to create sub-cubes,
- **merge** service to unite FITS-file data of adjacent areas on the sky if stored in separate files.

A **relational database** completes the VLKB resource content in terms of data information.

The public datasets in the VLKB are listed in the following table.

Name of Dataset	Type	Source	FAIR	Size (GBs)
SGPS (HI)	Fits files (datacube)	Australian Telescope Compact Array + Parkes Single Dish	Y	4.4 GB

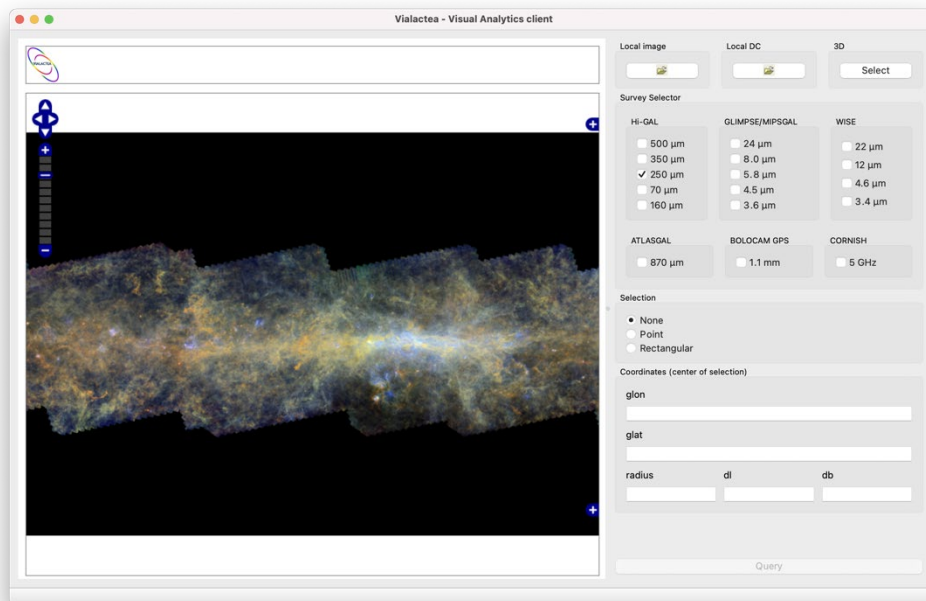
WISE (all-Bands)	Fits files (images)	Wide-field Infrared Survey Explorer (WISE)	Y	176 GB
CORNISH (5GHz)	Fits files (images)	Co-Ordinated Radio 'N' Infrared Survey for High-mass star formation	Y	84 GB
MIPSGAL (24 μ m)	Fits files (images)	Spitzer/MIPS Galactic Plane Survey	N	13 GB
Hi-GAL (all-bands)	Fits files (images)	Herschel infrared Galactic Plane Survey	Y	18 GB
FCRAO GRS	Fits files (datacube)	Boston University – FCRAO Galactic Ring Survey	N	11 GB
ThrUMMS (12CO 13CO C18O)	Fits files (datacube)	Three-mm Ultimate Mopra Milky Way Survey	N	35 GB
CGPS (HI)	Fits files (datacube)	Canadian Galactic Plane Survey	N	45 GB

How to use the service

In order to use the ViaLactea service, it is necessary to [request access](#) to the service. The access request procedure is very simple and is done through the NEANIAS Service Management System. The only requirement is to have a **Google or Microsoft account**. The status progress will be notified by email and once access is granted you will be able to use the service.

To download VLVA, simply visit the [Releases page](#) on the GitHub repository. Versions for Mac OS and Linux (distributions derived from Debian) are available. Alternatively, a **Docker container that leverages Virtual Network Computing (VNC)** allows to use the service on other platforms as well.

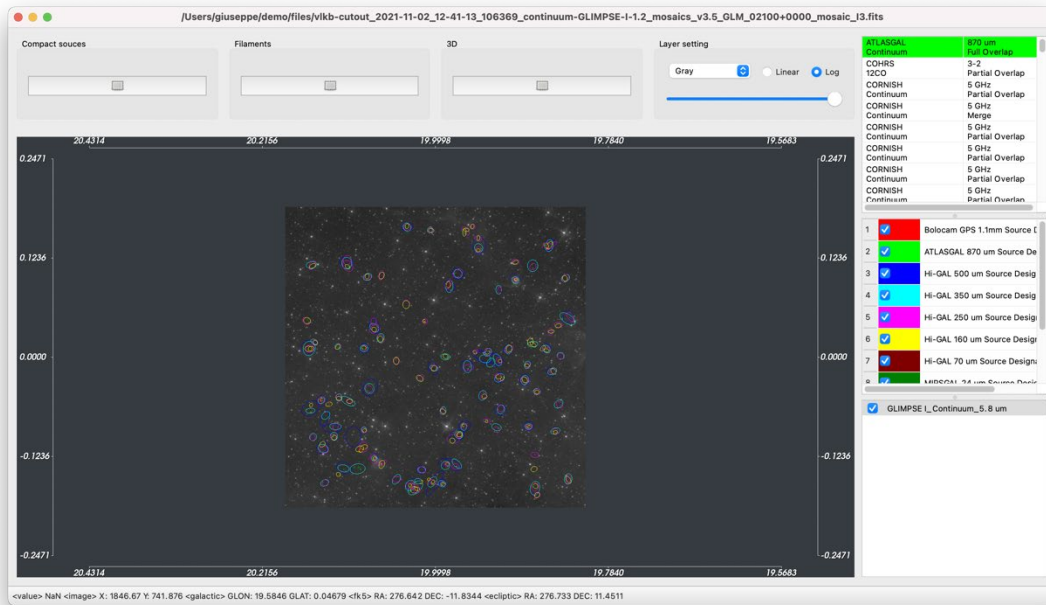
The visualization tool makes the interaction with the Knowledge Base transparent for the user, allowing to query the services through simple and intuitive graphical interfaces.



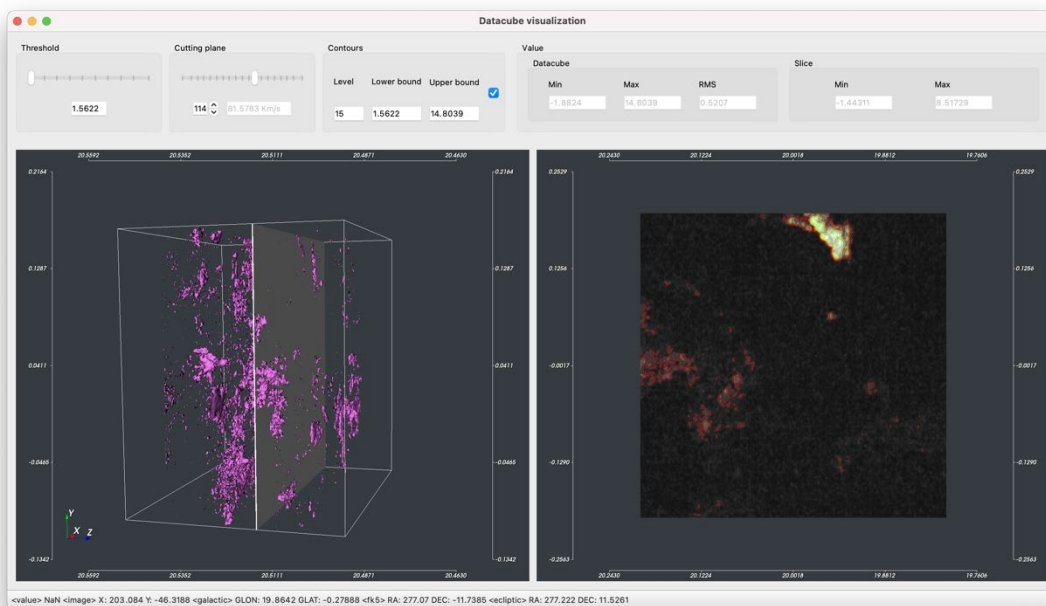
This is the starting window. An **interactive view of the Galactic Plane** allows to select a region from the map to start the analysis. Alternatively, it is possible to type the galactic coordinates and the size

of the search area in the input fields. Then you can select which surveys and wavelengths you want to download to start the analysis before clicking the Query button.

VLVA will send the request to the VLKB and then the visualization of the selected cutout(s) will open in a new window. This visualization window also allows to **query the TAP service for compact sources and filament structures**. The following image shows the visualization of compact sources retrieved from the VLKB on the 2D image.



On the top-right panel the search results are listed. From this table you can double-click on an item to download additional 2D cutouts (that will be visualized as layers on top of the current image), or velocity datacubes. In the latter case, a new window will be open to show the 3D visualization of the cube on the left side and a 2D slice visualization of a cutting plane on the right one.



Visit the online [user manual](#) to learn more about the functionalities and capabilities of ViaLactea!