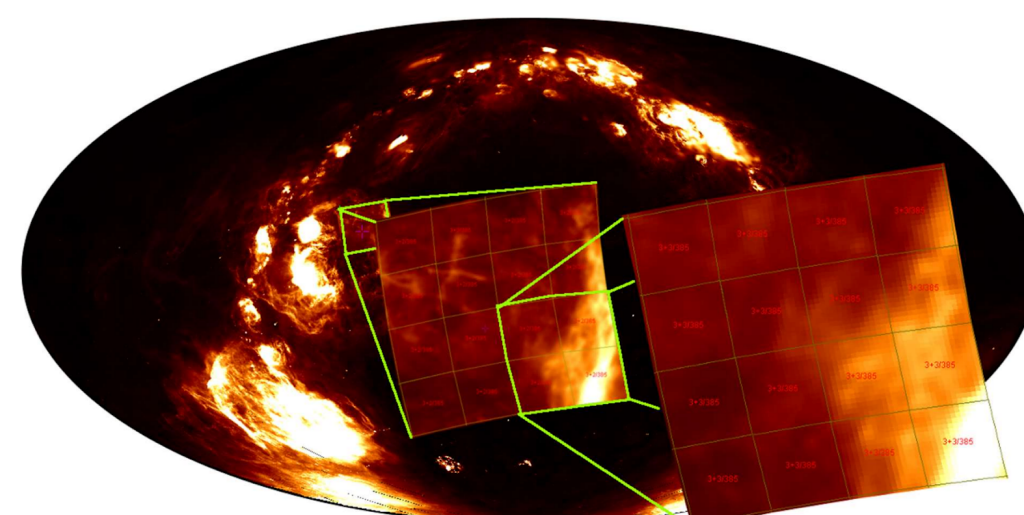




# Implementation of HiPS3D in Aladin Lite within the SRCNet framework

## I. What is the HiPS Format ?

**HiPS**, short for **H**ierarchical **P**rogressive **S**urvey, is an IVOA standard designed to make sky surveys accessible and viewable regardless of the survey's size, the network quality, or the computing resources available to the astronomer.



**HiPS** makes **Aladin Lite** to only request for HEALPix tile images located in the user's screen. Therefore, the more you zoom in the survey, the more details you see.

## II. The Challenge of New Cubic Data: HiPS Must Evolve

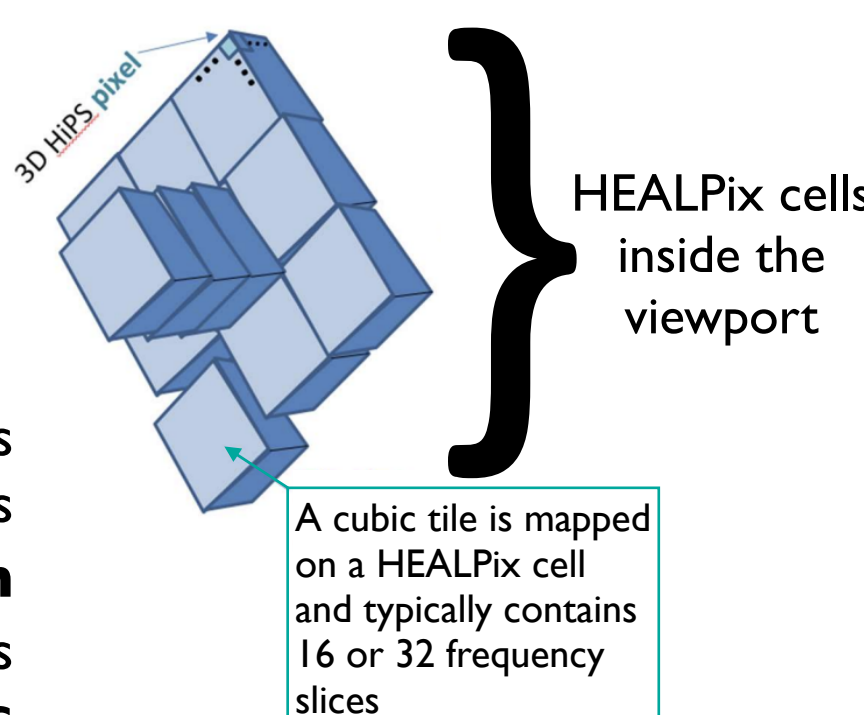
New missions such as SKA will provide vast quantities of cubic radio observational data on the 100 TB to PB scale.

A cubic extension to the HiPS standard, named **HiPS3D**, is being proposed to enable navigation within a "cubic" mosaic of observations. For more information about the HiPS3D structure, please refer to the talk 39 — "Big Data Exploration: A Hierarchical Visualisation Solution for Cubic Surveys" — Pierre Fernique, P10.



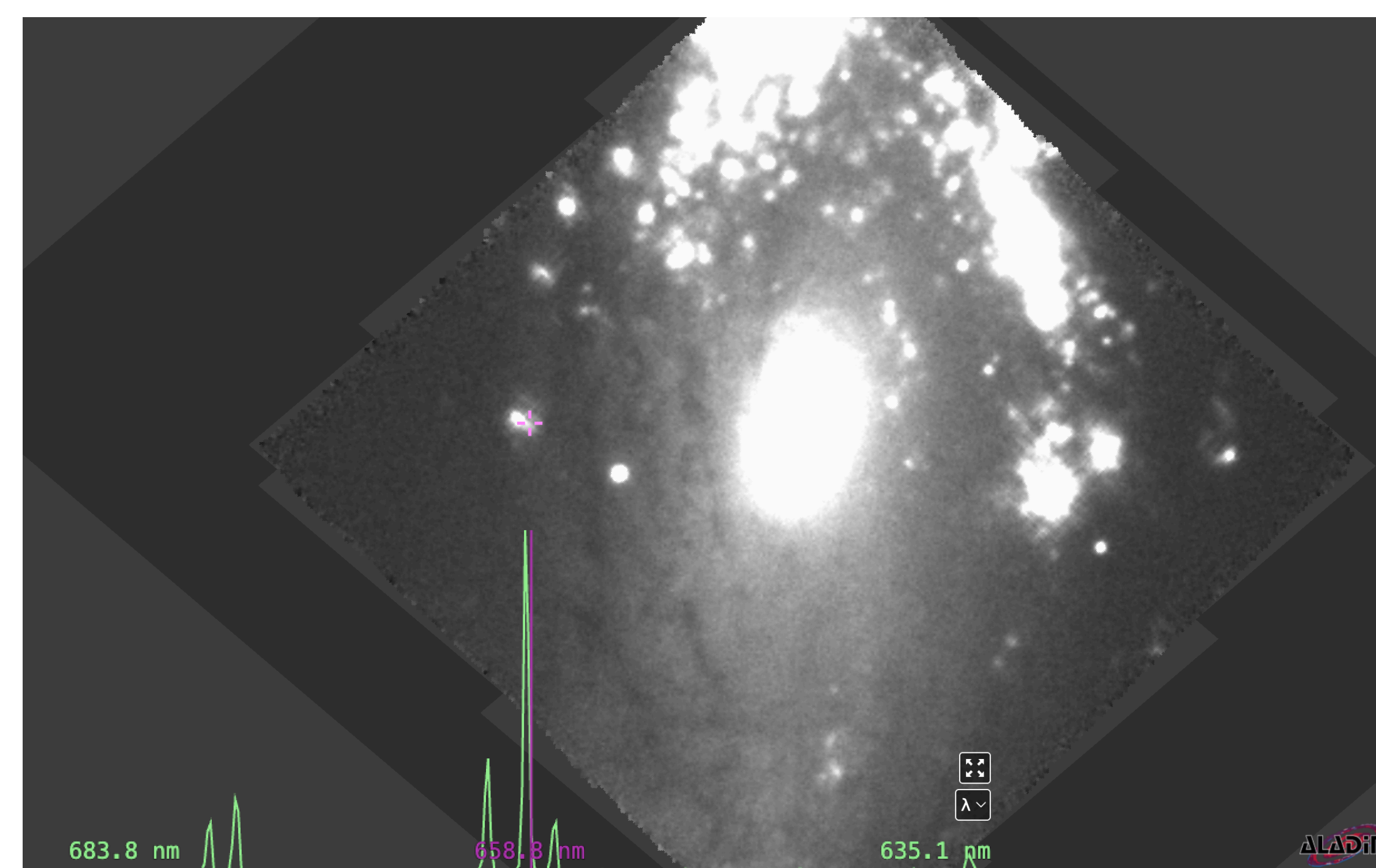
## III. Implementation notes in Aladin Lite

Similar to the standard HiPS, only the cubic tiles within the current view (in both space and frequency) are requested. Additional cubic tiles are retrieved to render the spectra beneath the reticle.

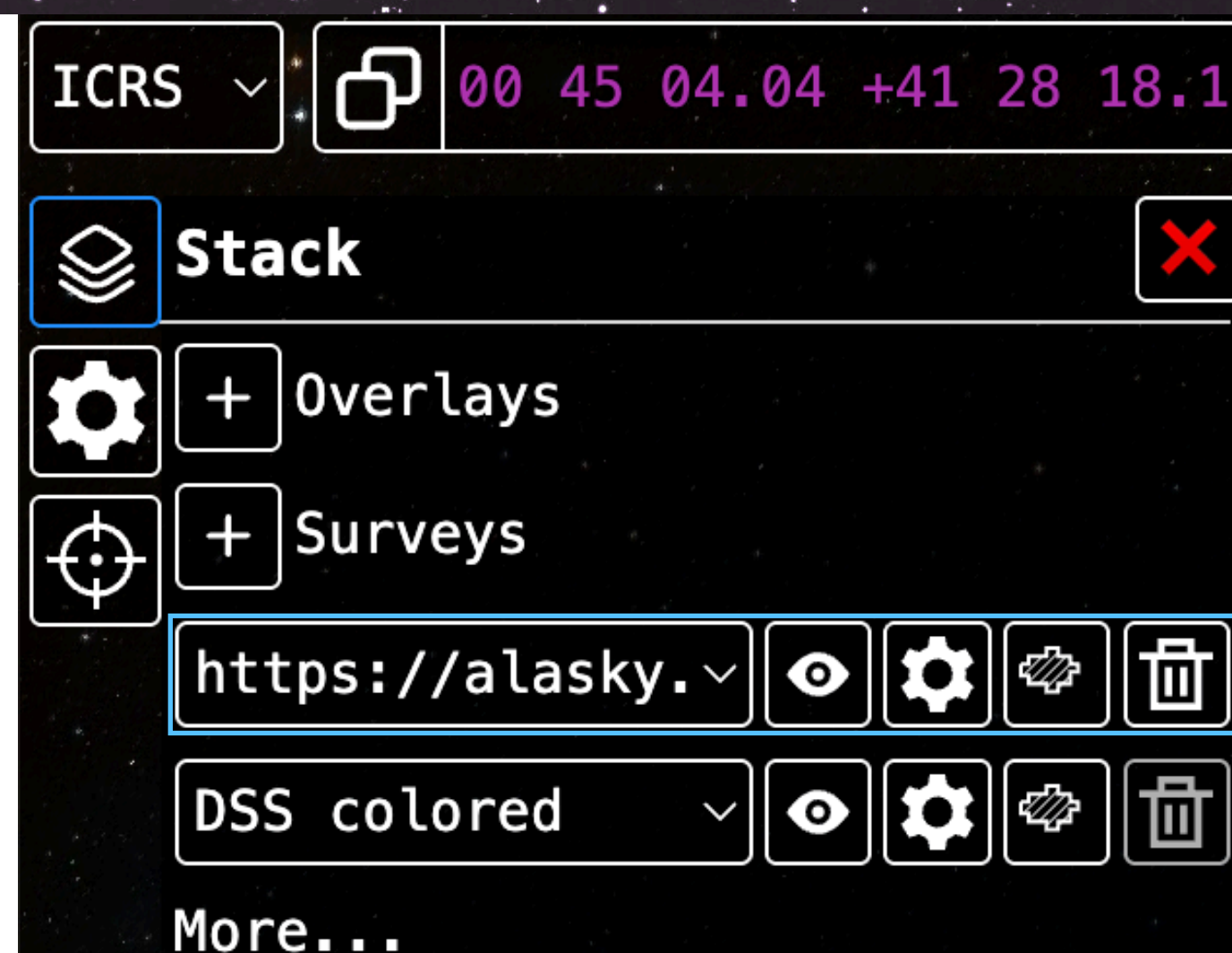


Cubic tiles are directly stored in GPU memory as **WebGL2** Texture3D objects. This core functionality has been implemented in **Rust**, using the **wasm-bindgen** crate to access the WebGL2 API from Rust. More details about the implementation can be found in **Aladin Lite's pull request #314**: <https://github.com/cds-astro/aladin-lite/pull/314>

## V. Application Example — Identifying Spectral Lines



A **HiPS3D** dataset has been precomputed from an excerpt of **MUSE** cubic data. In it, you can directly observe specific emission spectral lines of **NGC 5806**. Its redshift of approximately **0.0045535** corresponds to a wavelength shift of about **3 nm**, which allows the identification and labeling of these lines.



## IV. Display of the HiPS3D of the Local Group L-Band Survey (LGLBS)

Displayed as a normal layer on top of the DSS survey, with some transparency, and a red heat colormap

Like regular HiPS, the more you zoom, the more details you see!

A new spectral widget for exploring the survey along the frequency dimension. The view corresponds to the frequency indicated by the purple line!

Click and drag under the spectra or on the vertical line to visualize the survey in another frequency

Scale the spectra values to fit the entire window

Unit options:  
• Frequency (Hz)  
• Wavelength  $\lambda$  (m)  
• Velocity (km/s)

## VI. Visualize your data into Aladin Lite!

**HiPSgen** (included with *Aladin Desktop*) lets you generate **HiPS3Ds** directly.

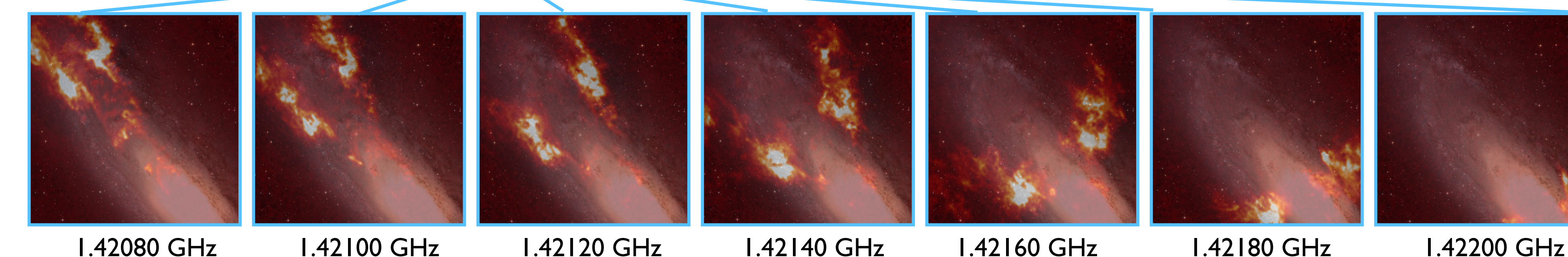
**Command example:**

```
java -Xmx2G -jar AladinBeta.jar -hipsgen -hips3d \
in=YourCube.fits out=YourHips3D id=AUTH/C/xxx INDEX
TILES PNG
```

**Key options:**

YourCube.fits → FITS cube (or directory of cubes) with spatial & frequency calibration  
YourHips3D → output directory for the HiPS3D product  
AUTH/C/xxx → identifier of your choice  
INDEX TILES PNG → actions to build HiPS3D with FITS + PNG tiles  
-hips3d → enables HiPS3D generation  
-Xmx2G → reserves 2 GB RAM

More options (resolution, overlays, etc.): [HiPSgen Manual](#)



## VII. Explore Other Cubic Surveys Converted to HiPS3D



DRAO HI Intermediate Galactic Latitude Survey (DHIGLS)



Galactic Arecibo L-band Feed Array HI (GALFA-HI)



Multi Unit Spectroscopic Explorer (MUSE) excerpt

## Conclusion

The upcoming cubic data from the **SKA** mission motivates the ongoing development of **HiPS3D** and its implementation in **Aladin Lite**. This approach provides an efficient way to **explore** and **visualize** complex 3D astronomical data directly in the browser. Using hierarchical structures and GPU-based rendering, it enables **interactive navigation** of **spectral cubes**. While still a work in progress, **HiPS3D** illustrates how existing tools can evolve to meet the challenges of next-generation cubic surveys.

## Acknowledgments

The new **HiPS3D** support implementation within **Aladin Lite** has been a work part of the SRCNet **mango** team during the **P127**.

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