

# A 3-Minute Introduction to HiPS

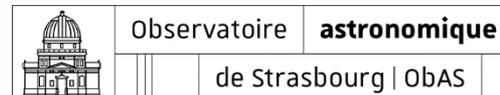
HiPS hands-on session presented during Astro-CC  
European Data Provider Forum

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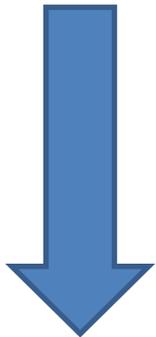
March 25-27 2026, Heidelberg



*Tutors:*  
Thomas Boch,  
Pierre Fernique,  
Manon Marchand (CDS)



# □ HiPS goal



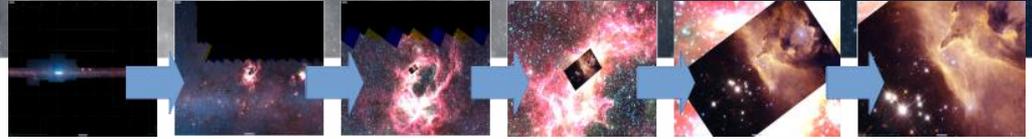
*The context:* We are in **the age of big data**: images, cubes, and catalogs!

*The question:* How can we make the data generated by our telescopes accessible **to any astronomers?**

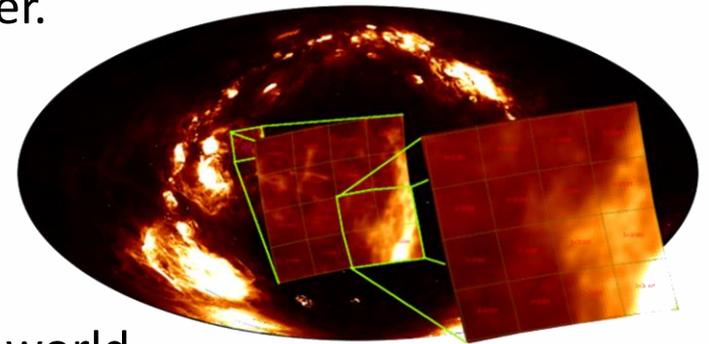
*One of the answers:* **HiPS enables the discovery, visualization, and access** of these kind of large datasets



# □ HiPS – What is it?



- The **Hierarchical Progressive Survey** method
- Described in **2015A&A...578A.114F**
- **Standardized by IVOA** in 2017
- Makes a sky survey **accessible**, visualisable and even manipulable, **whatever the size of the survey, the quality of the network and the computing power** available to the astronomer.
- **Implemented** by scientific, amateur and public visualisation tools and portals
- **1400 surveys/missions** already hipsilized, available through **25 HiPS nodes** all over the world
- **Extension to HiPS3D** (cube) – new IVOA standard in progress



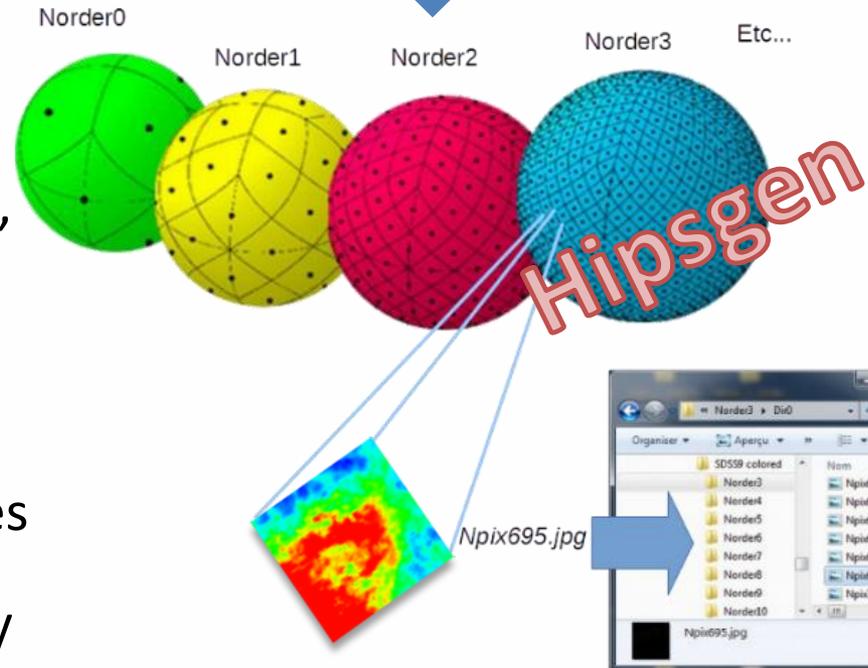
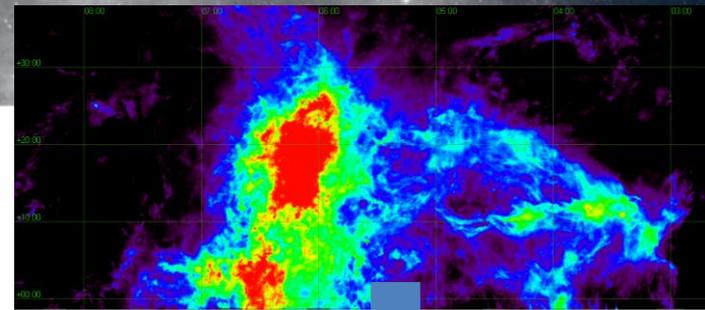
# Browse the HiPS sky already provided in hundreds of web “portals”

The image displays five different web portals used for browsing astronomical data:

- ESO portal:** Shows a star field with various filters and data columns.
- Aladin Lite:** Displays a star field with a central bright star and various survey data overlays.
- ALMA portal:** Shows a spectral plot with multiple lines and a table of data.
- SRC Net:** A search interface for the SKA Regional Centre Network, showing search filters and results.
- ESasky:** Shows a star field with a red overlay and a table of data.

# □ HiPS principles

- A collection of astronomical images stored as **hierarchical multi-resolution** tiles using the **HEALPix** sky tessellation.
- The creation of a **HiPS** consists of the generation of the **mosaic**, the **partitioning**, and then the generation of the **tree** of tiles that constitute the final HiPS.
- The resulting **tiles** are image files of the same size **grouped in directories** following a hierarchy described in the IVOA standard.



# □ What kind of HiPS?

- 3 types of HiPS have been standardized by the IVOA:
  - HiPS **image** -> for an image collections
  - HiPS **catalog** -> for a large catalog
  - HiPS **cube** (HiPS3D) -> for a cube collections
- In this tutorial, we will experiment the 3 cases

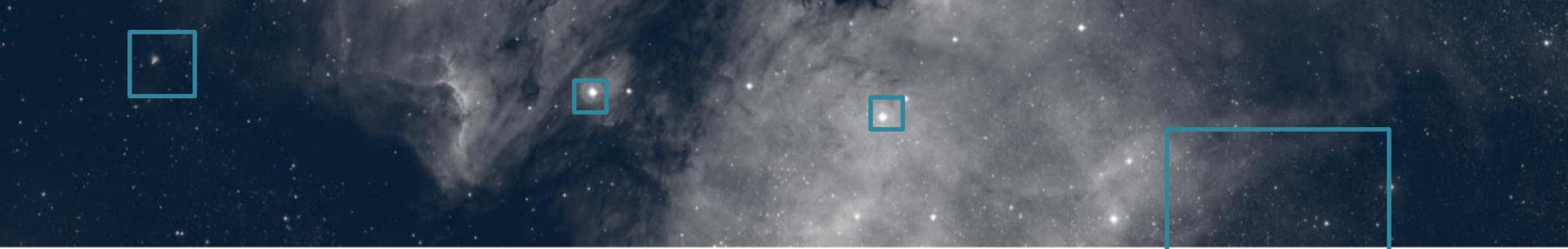
# □ The tools for the tutorial

- **Hipsgen**: image HiPS generation
- **Aladin Desktop, Aladin Lite, ipyaladin**: HiPS visualization
- **HiPS2FITS**: HiPS cutout tool
- **Fitstable-cli**: catalog HiPS generation
- **Hipsgen** (new version): HiPS3D generation

□ Let's go...

<https://cds.unistra.fr/help/tutorials-more/astrocc-edpf-hips-2026/>

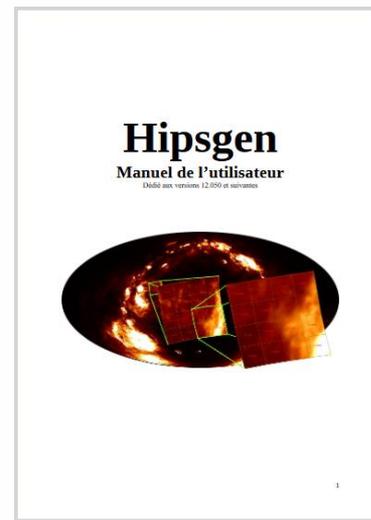
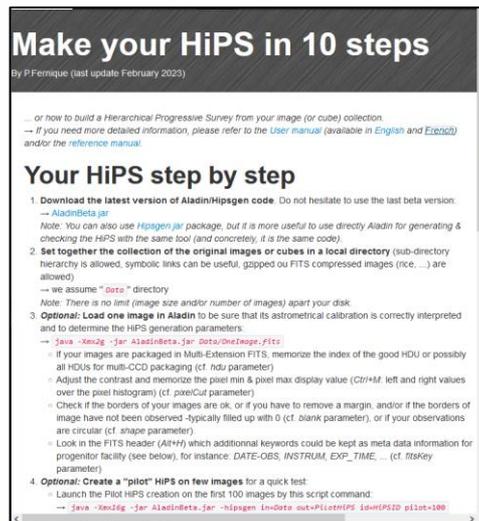
The screenshot shows a web browser window with the URL [cds.unistra.fr/help/tutorials-more/astrocc-edpf-hips-2026/](https://cds.unistra.fr/help/tutorials-more/astrocc-edpf-hips-2026/). The page title is "How to generate and visualize HiPS datasets - Astro-CC European Data Provider Forum". The main content area features a blue header with the title and a sub-header: "HiPS hands-on session presented during Astro-CC European Data Provider Forum, March 25-27 2026, Heidelberg". Below this, there is a light blue box containing the text: "How to generate and visualize HiPS datasets is a hands-on session presented in Heidelberg (Germany), during Astro-CC European Data Provider Forum on March 25 and March 26 2026." A grey box below that lists the tutors: "Tutors: Thomas Boch, Pierre Fernique, Manon Marchand (CDS)". The main heading for the first section is "1. Generate and visualize a HiPS image from a collection of images". Below this, it states "In this part, you will learn how to:" followed by a bulleted list: "• generate a HiPS from a collection of FITS images, using Hipsgen", "• visualize the created HiPS in Aladin Desktop, Aladin Lite and ipyaladin", and "• extract FITS and PNG cutouts from the generated HiPS, with the HiPS2FITS cutout script". A "Requirements" section follows, with a sub-heading "Free disk space" and the text "3GB of free disk space is required to run this section from end to end." A "Tools" section is also visible, with the text "Download tools tar and uncompress it in the tutorial directory. This will create a directory tools". On the left side of the browser window, a navigation menu is visible with the following items: Java, Python environment, Data, 1.1 HiPS image generation (with sub-items 1.1.1 First step: spatial index generation, 1.1.2 Second step: FITS tiles generation, 1.1.3 Third step: PNG tiles generation), 1.2 Visualization in Aladin Desktop, 1.3 Visualization in Aladin Lite, 1.4 Visualization in ipyaladin, 1.5 Cutouts generation, Create a single cutout, Create many cutouts from a list of positions, and 2. Optional/advanced tracks: generate a color HiPS, generate a HiPS catalogue, generate a HiPS 3D.



# Additional slides

# □ Hipsgen = CDS HiPS pixel generator

- The tool: <https://aladin.cds.unistra.fr/java/Hipsgen.jar>
- Quick start: <http://...//HipsIn10Steps.gml>
- Manual: <https://.../hips/HipsgenManuel.pdf>



# □ Hipsgen: Swiss knife

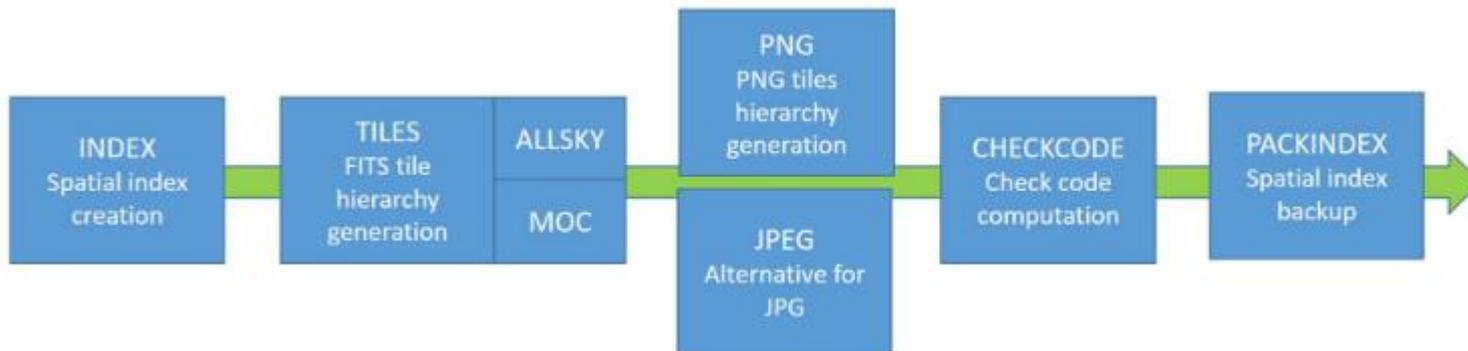
1. **Generation:** index, tiles, metadata
2. **Combined products:** RGB, concatenation
3. **Derived products:** coverages, densities, progenitors
4. **Postponed additions** of new observations
5. **Integrity management:** checksum, lint
6. **Duplication, packaging**
7. **Tree reconstruction**

# □ How it works?

- Palets of actions (cf. `java -jar hipsgen.jar -h`)
- To be launched individually or sequentially

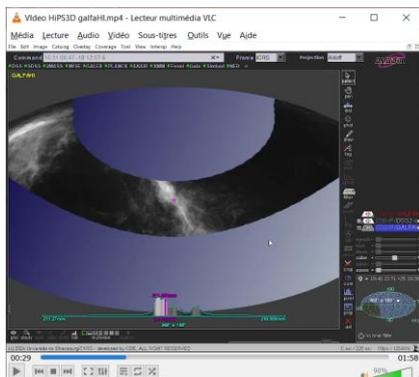
```
java -jar Hipsgen.jar -options in=repSrc out=repDst autresParams... ACTIONS
```

- By default





# HiPS3D demo/tutorial



## HiPS3D frequency discovery tutorial

Centre de Données astronomiques de Strasbourg

Auteur : Pierre Fernique

V1.98 – 26 mai 2025

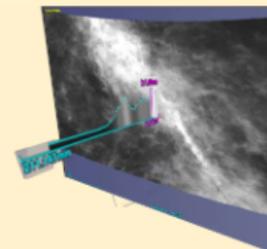
- Version française : <https://aladin.cds.unistra.fr/java/TutoHiPS3D.pdf>
- English version: <https://aladin.cds.unistra.fr/java/TutoHiPS3Den.pdf>

The aim of this tutorial is to introduce you to the possibilities offered by the new HiPS3Ds implemented by CDS over the last few weeks, which can be manipulated with the latest prototype version of Aladin Desktop.

Please note that this is an R&D version, and therefore not a final prototype (still bugs, functions that don't work yet, or not like before). So please do not use this version for anything other than this tutorial (and certainly not distribute it without informing the recipient).

### First of all, what is a HiPS3D?

A HiPS3D is a generalization of HiPS that allows you to walk around in a "cubic" mosaic of observations. Instruments like MUSE, ASKAP or SKA produce data cubes, not images. HiPS3D takes this third dimension into account, allowing you to pan and zoom both spatially (as with conventional HiPS) and in frequency (a new feature).



Note that extension to "temporal" cubes is planned (Rubin observations, for example).

If you don't have the time or the inclination to do this tutorial, you can just watch this video => <https://aladin.cds.unistra.fr/java/HiPS3D-apr25.mp4>

Once you've finished this tutorial, please don't hesitate to send us feedback (cds-question@astro.unistra.fr) with your suggestions, reviews and encouragement, as this will be very useful to us. Thanks for your time.

Here we go with the tutorial, which should take you no more than 10 minutes... but more if you enjoy it!

### Requirements

All you need is the "good" proto version of Aladin Desktop (at least v12.620). => <https://aladin.cds.unistra.fr/java/AladinProto.jar>

<https://aladin.cds.unistra.fr/java/TutoHiPS3Den.pdf>