A 3-Minute Introduction to HiPS
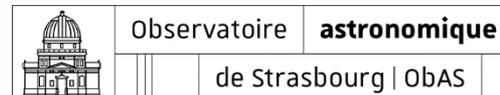
HiPS hands-on session presented during Astro-CC European Data Provider Forum
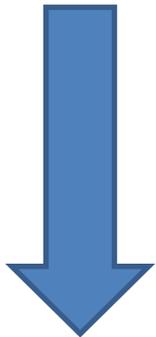
March 25-27 2026, Heidelberg

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CENTRE DE DONNÉES
ASTRONOMIQUES DE STRASBOURG

Observatoire **astronomique**
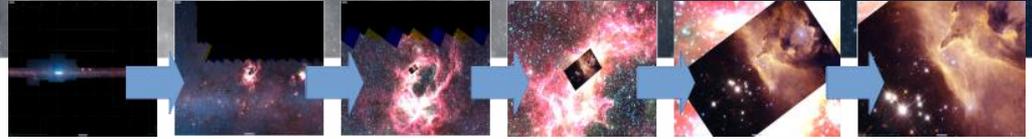de Strasbourg | ObAS

□ 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
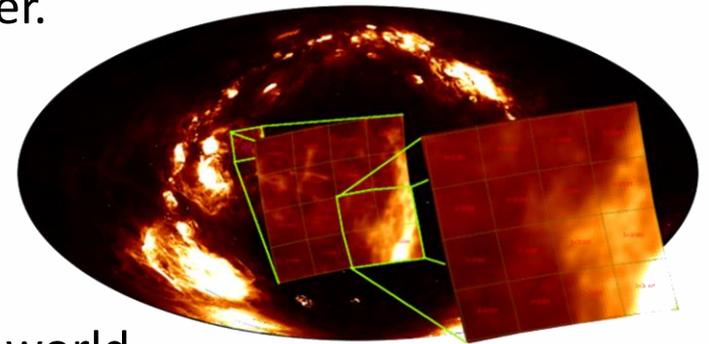
Browse the HiPS sky
already provided in hundreds of web "portals"

ESO portal

Aladin Lite

ALMA portal

ESASky

SKA SRC Net

Firefly

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.

Norder0 Norder1 Norder2 Norder3 Etc...

Hipsgen

Npix695.jpg
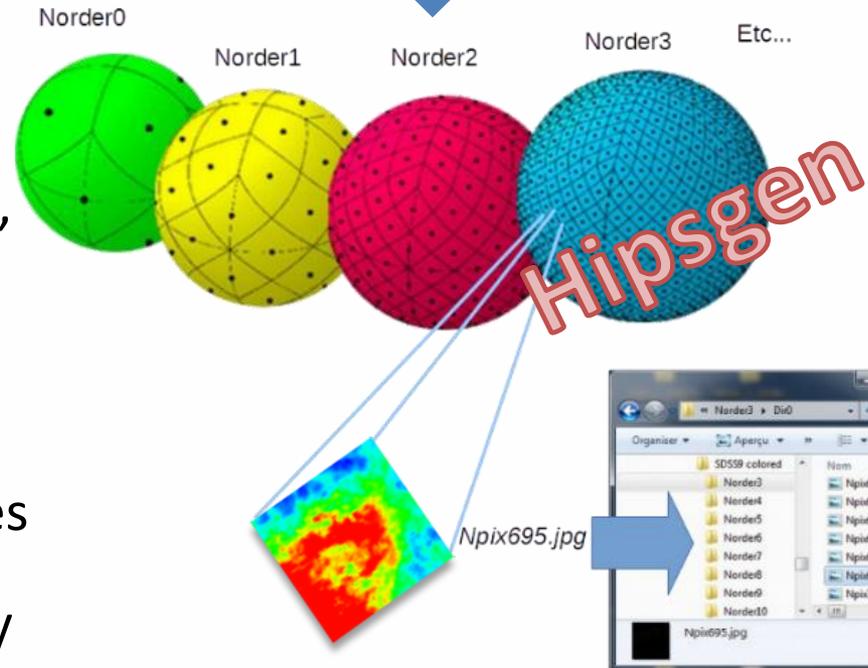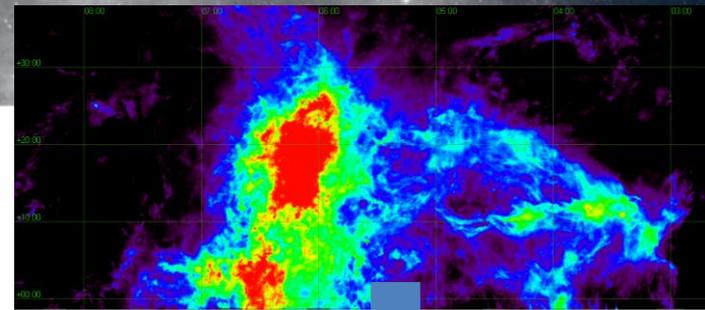
What kind of HiPS?

- 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

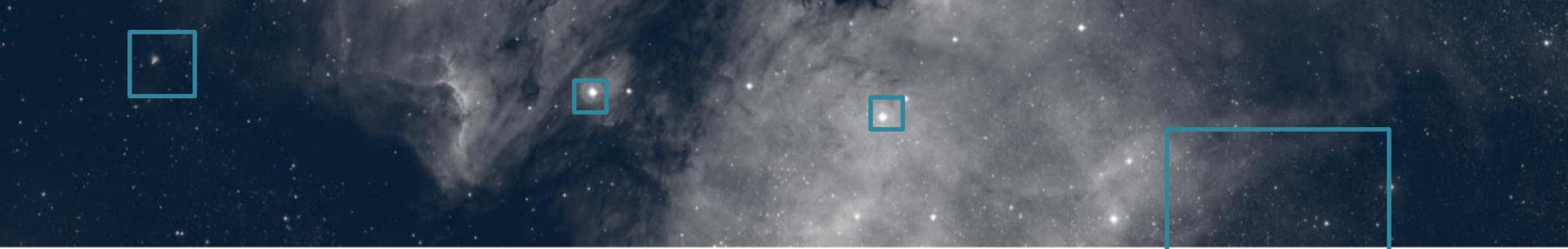- In this tutorial, we will experiment the 3 cases

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
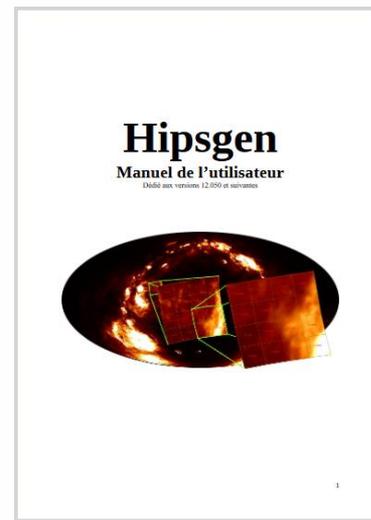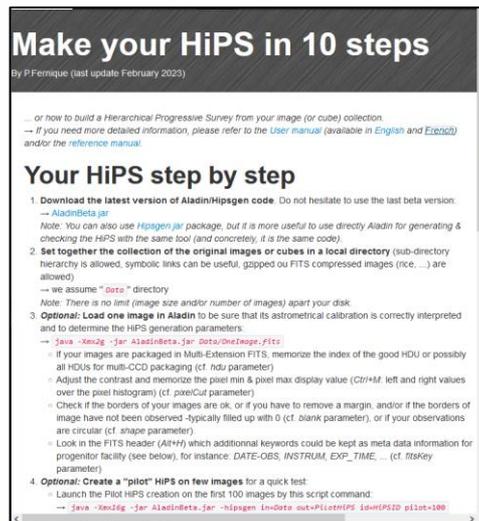
- **Hipsgen** (new version): HiPS3D generation

☐ Let's go…

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

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
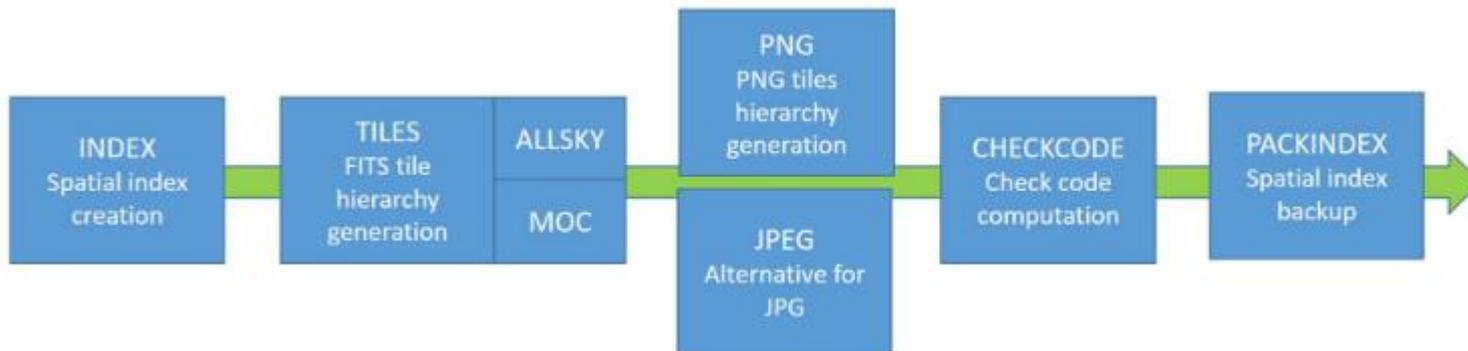
HiPS3D demo/tutorial

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

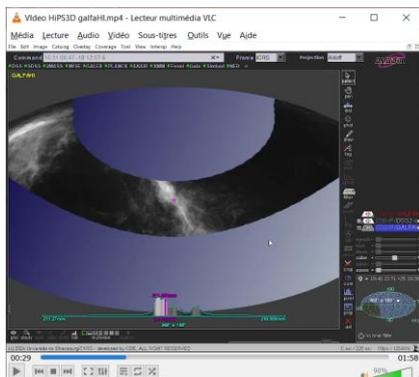The aim of this tutorial is to introduce you to the possibilities offered by the new HiPS3Ds implemented by CDS over the last few weeks, which can be manipulated with the latest prototype version of Aladin Desktop.

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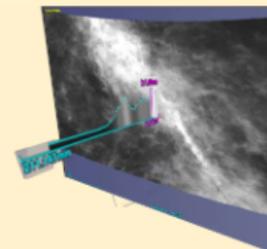
Note that extension to "temporal" cubes is planned (Rubin observations, for example).

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