The Virtual Observatory (VO) and the International Virtual Observatory Alliance (IVOA)

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IVOA members

Virtual Observatory ?

- Not an Observatory…
- Not Virtual…

- Organisation that defines **standards** to navigate through astronomy data

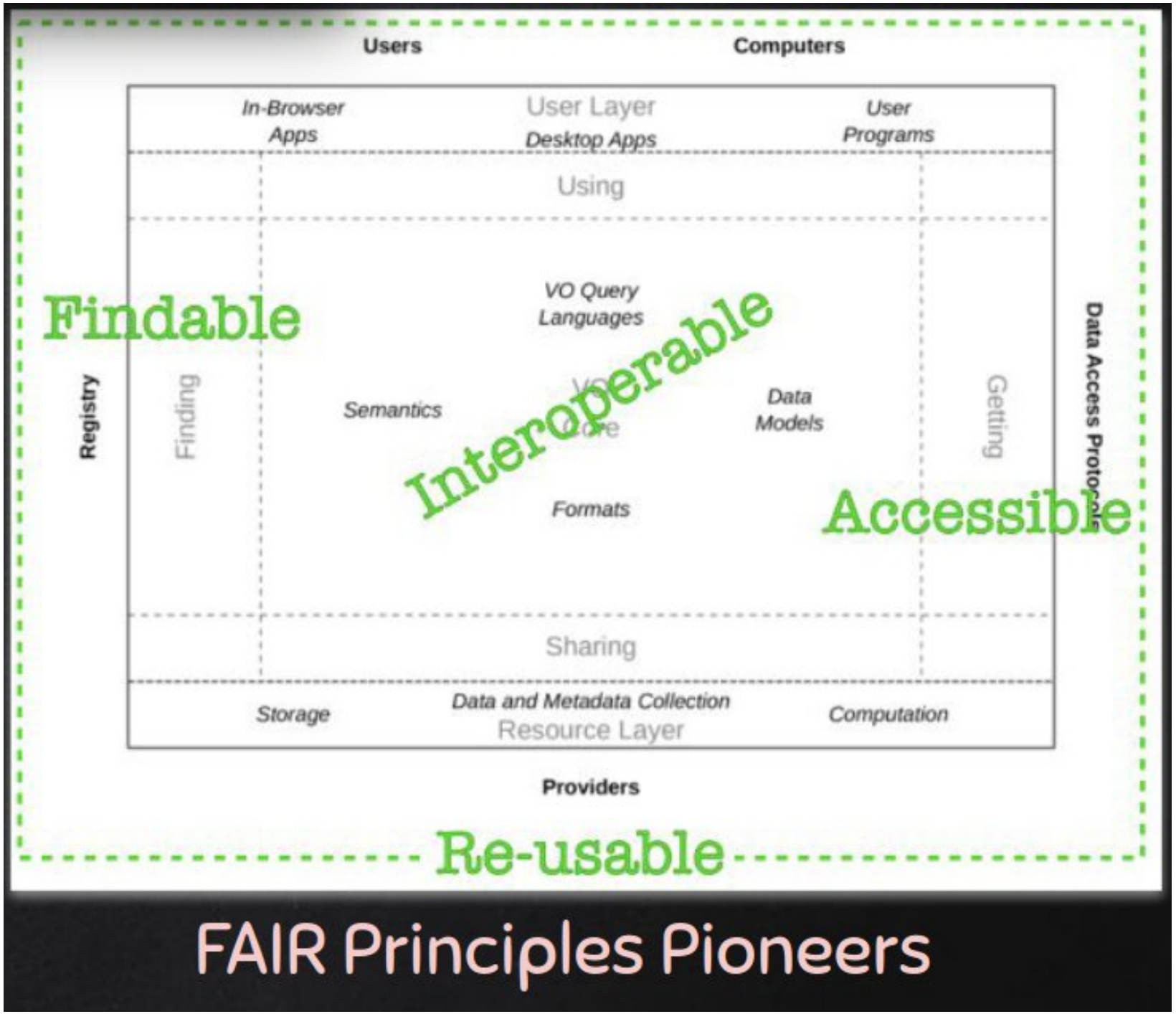
Virtual Observatory <=> Internet

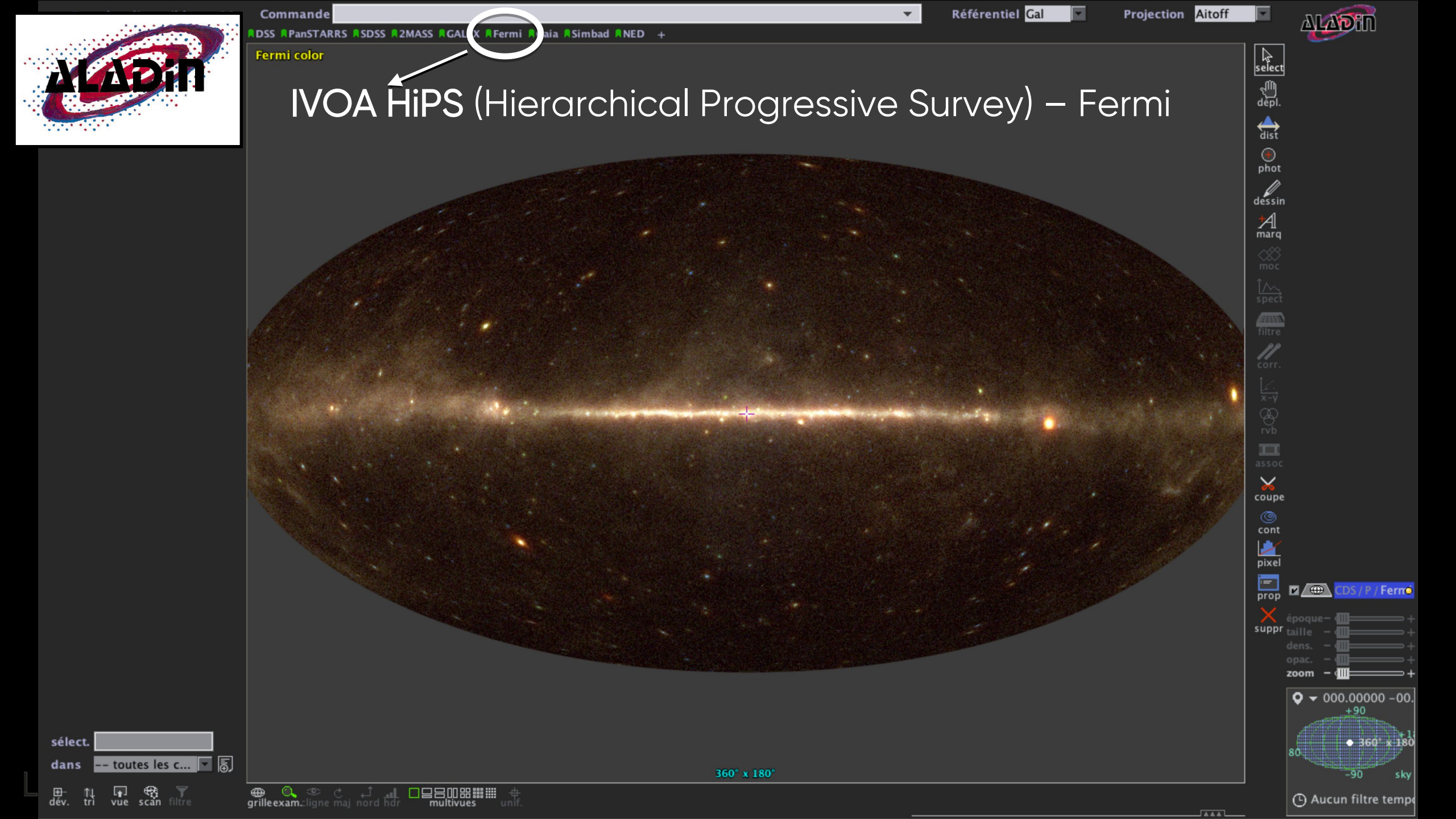
IVOA <=> W3C

International Virtual Observatory Alliance	World Wide Web Consortium
↓	↓
TAP, VOTable, ObsCore…	HTML, HTTP, RDF…

« VO » Tool <=> Web Browser

IVOA overview




Commande
Référentiel Gal
Projection Aitoff
DSS PanSTARRS SDSS 2MASS GAL X Fermi aia Simbad NED +
Fermi color
IVOA HiPS (Hierarchical Progressive Survey) – Fermi
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ALADIN sky atlas

- ▷ **Aladin overview**
- https://aladin.cds.unistra.fr/aladin.gml

Piece by piece:

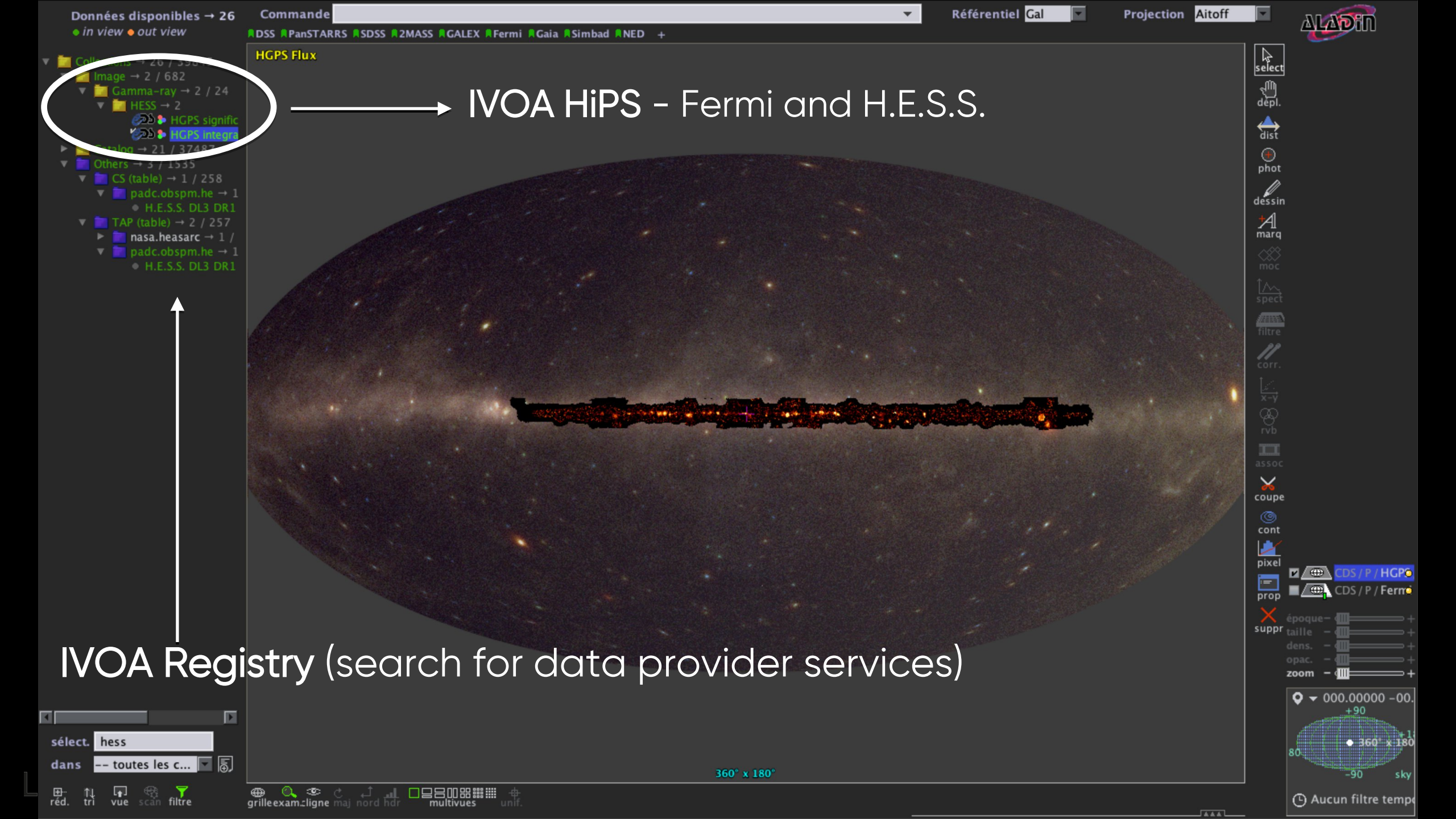
- ▷ Aladin.jar: The software
- ▷ Aladin: Unix shell script launcher
- ▷ AladinSrc.jar: Source package (see GPL v3 licence)

- ▷ brew install --cask topcat --no-quarantine

- ipyaladin allows you to embed an Aladin Lite widget in a Jupyter notebook, look at any of the 550+ available (all) sky maps, and even overlay catalogues and tables. Many image and cube surveys are already at your disposal.

- Allow to quickly visualise a sample of sources, see what these sources look like at different wavelengths - archives ready are findable and searchable

- One method of note is the Hierarchical Progressive Surveys (HiPS), which is a tiling mechanism for viewing image and cube data. The HiPS of many large image surveys and some 3D cube surveys, as well as large catalogues, are available through Virtual Observatory protocols via a network of ~20 HiPS nodes around the world. There are a number of HiPS viewers, including the ones developed by the CDS: Aladin desktop and Aladin Lite.


Données disponibles → 26
in view out view
Commande
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HGPS Flux
Image → 2 / 682
Gamma-ray → 2 / 24
HESS → 2
HGPS signific
HGPS integra
Others → 3 / 1535
CS (table) → 1 / 258
padc.obspm.he → 1
H.E.S.S. DL3 DR1
TAP (table) → 2 / 257
nasa.heasarc → 1 /
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IVOA HiPS - Fermi and H.E.S.S.
IVOA Registry (search for data provider services)
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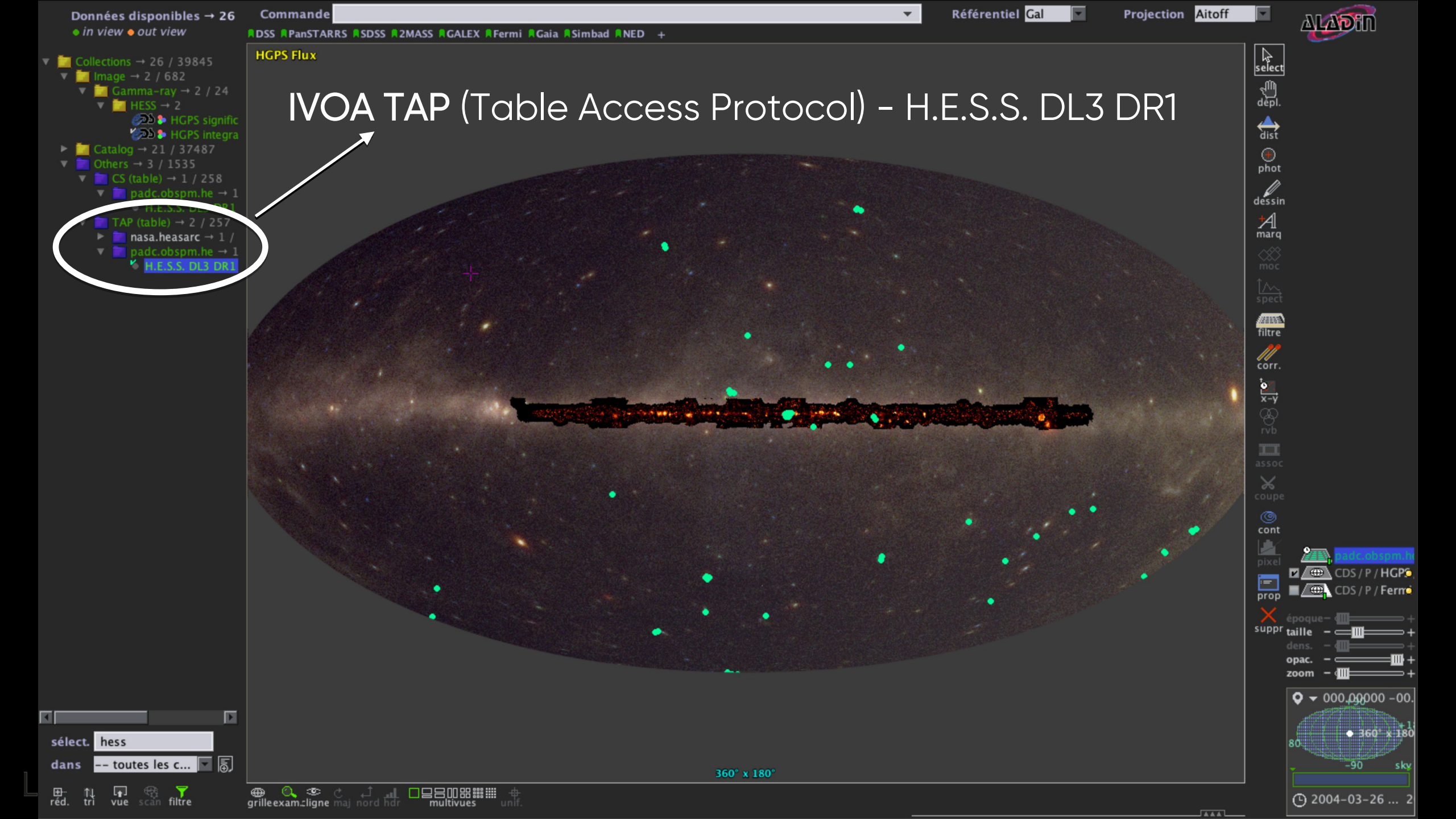
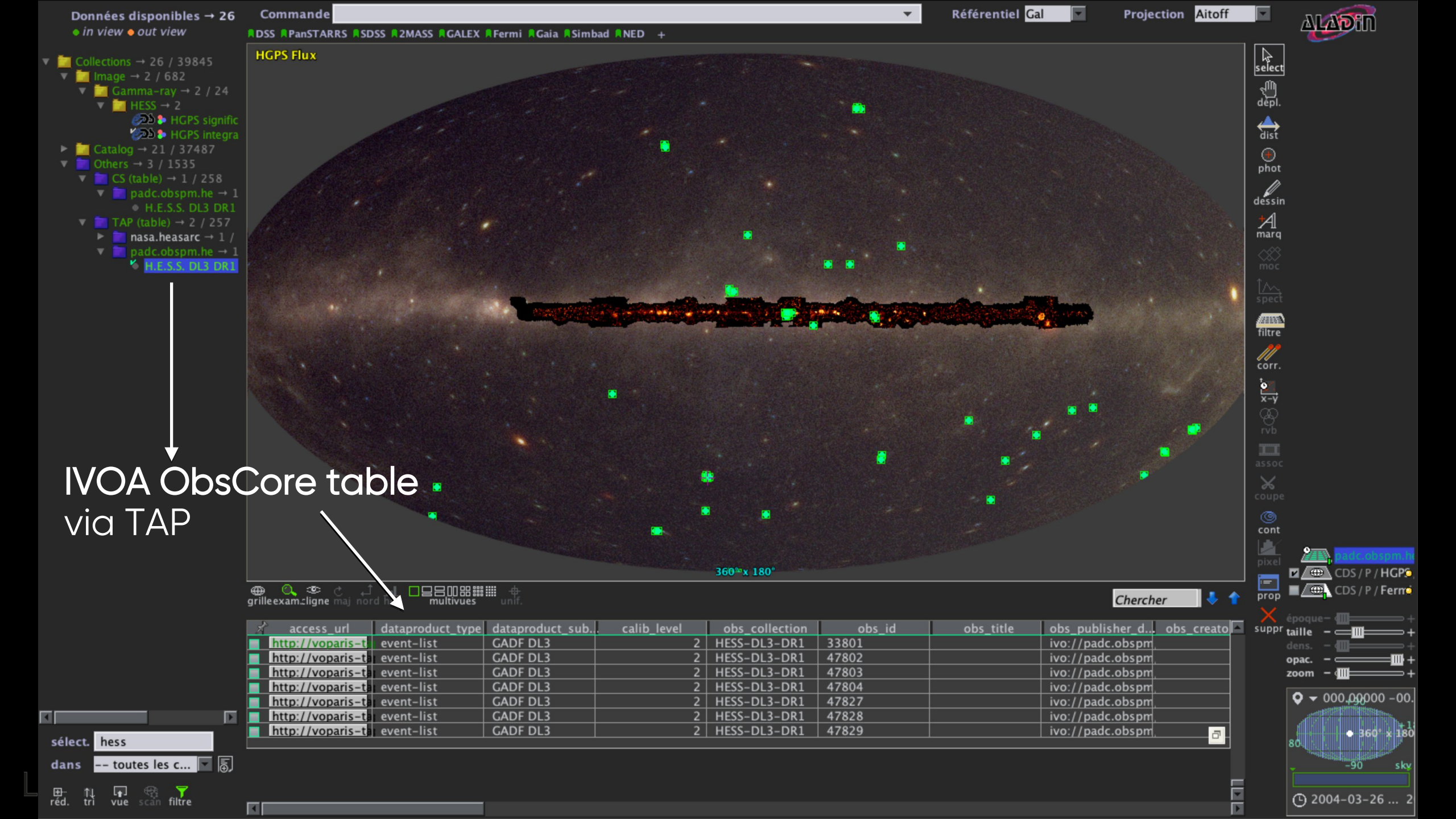
IVOA TAP (Table Access Protocol) - H.E.S.S. DL3 DR1

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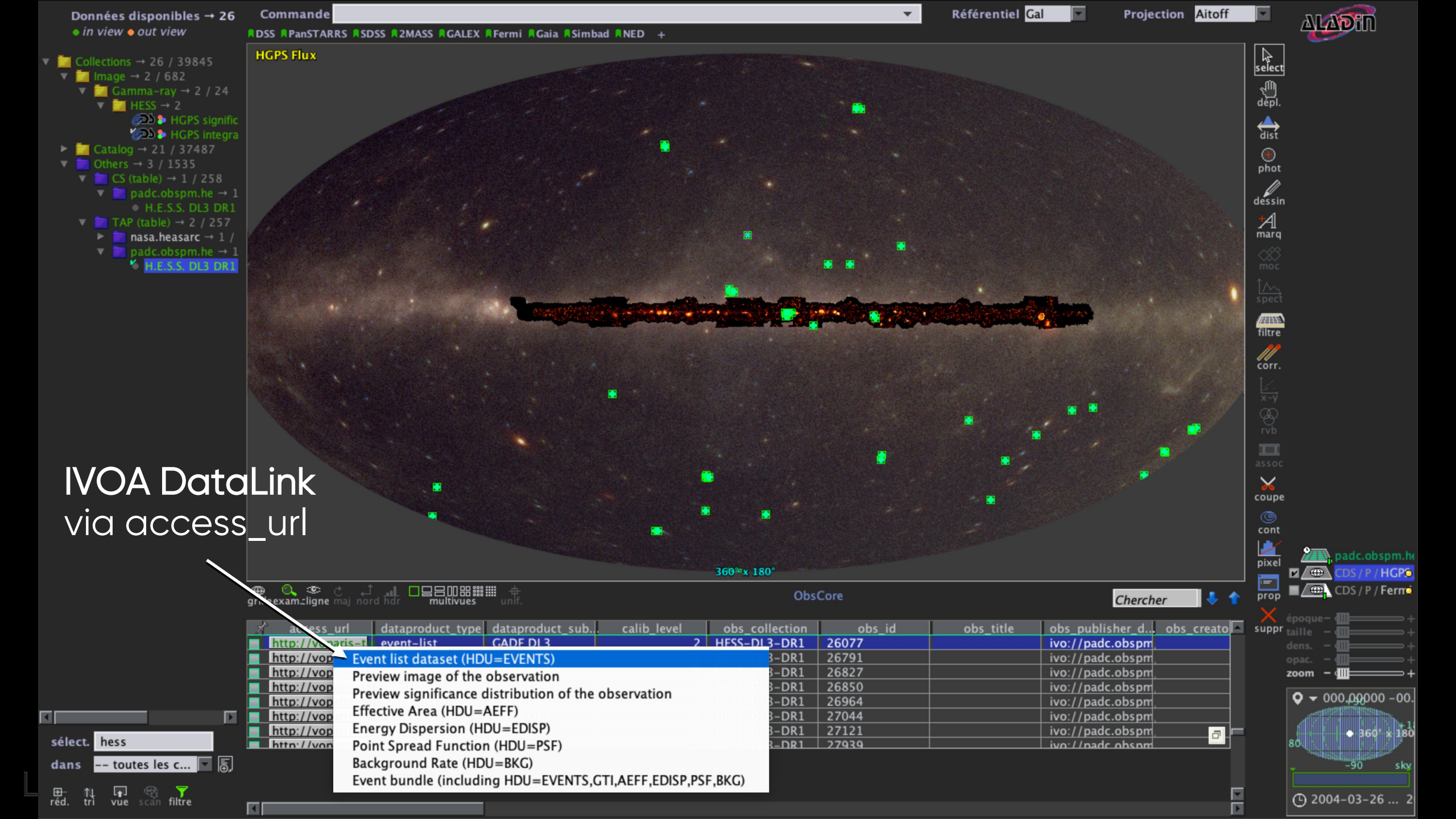
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Event list dataset (HDU=EVENTS)
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Preview significance distribution of the observation
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Energy Dispersion (HDU=EDISP)
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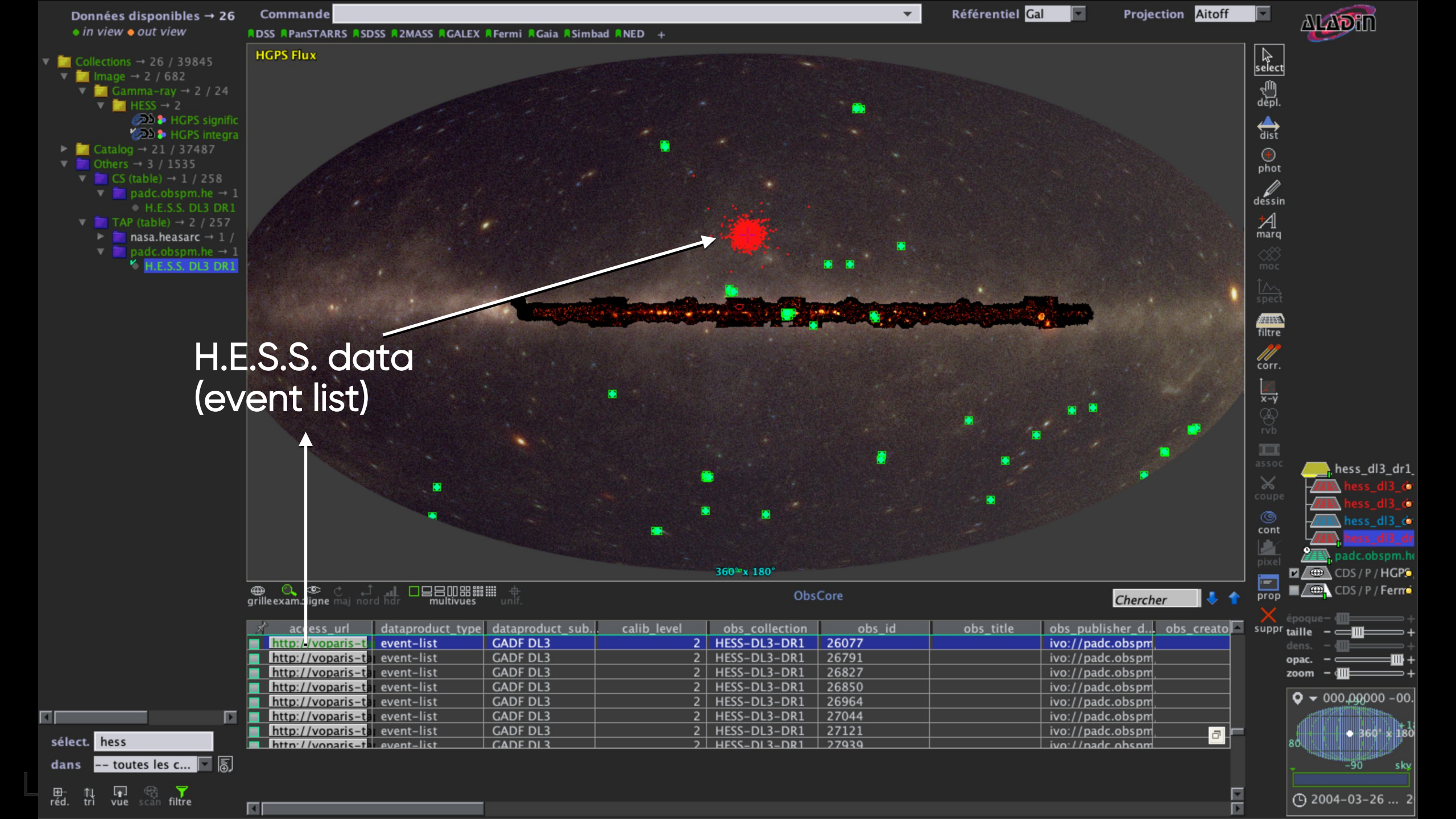
Données disponibles → 26
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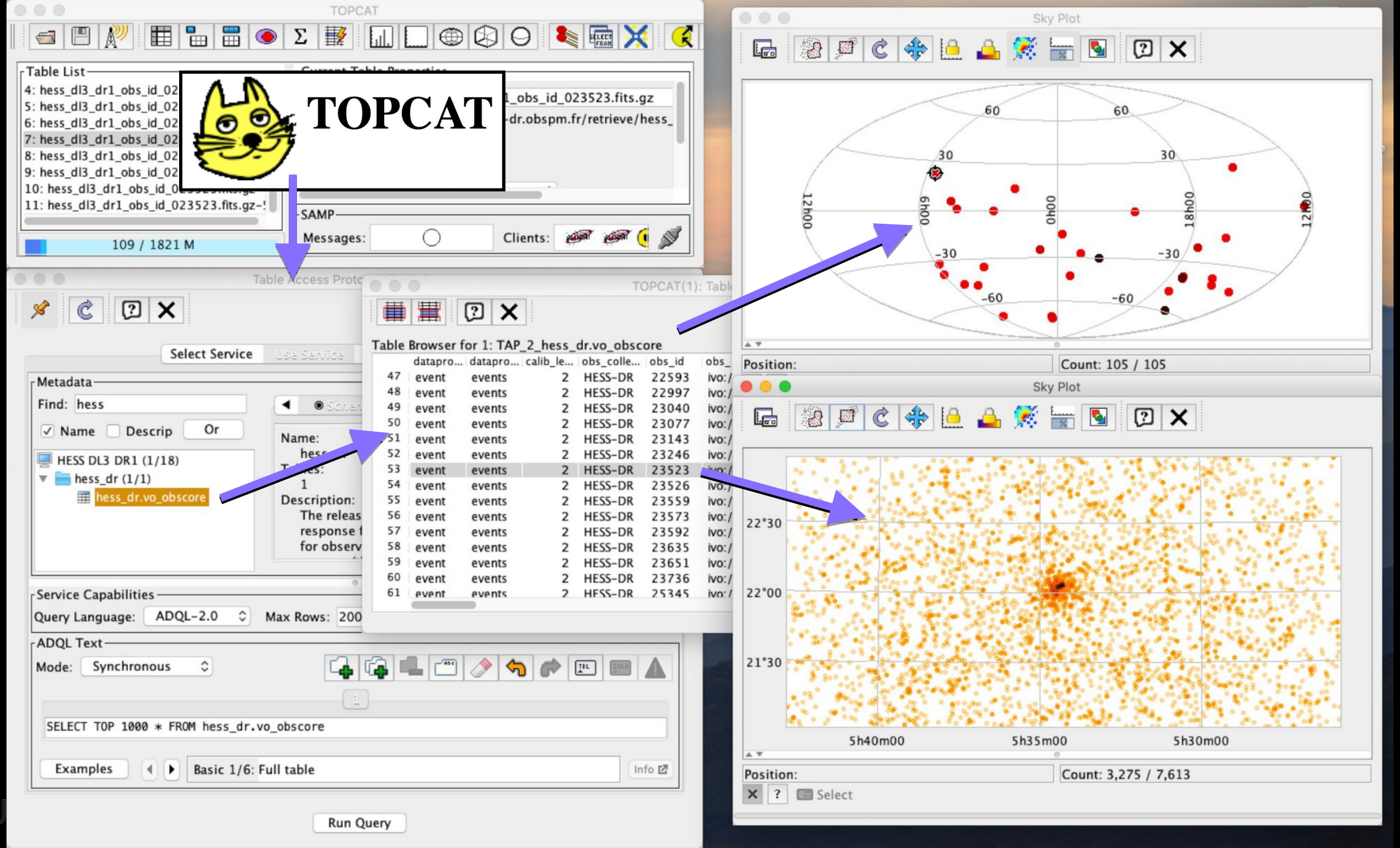
TOPCAT
Table List
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8: hess_dl3_dr1_obs_id_02
9: hess_dl3_dr1_obs_id_02
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Query Language: ADQL-2.0
Max Rows: 200
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Run Query
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Position:
Count: 105 / 105
Sky Plot
22°30
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5h40m00
5h35m00
5h30m00
Position:
Count: 3,275 / 7,613
Select

TOPCAT – Mark Taylor (Bristol, UK)

MacOS :

• If you have Homebrew:

▷ brew install --cask topcat --no-quarantine

• Otherwise download DMG file (use curl not browser):

▷ curl -OL http://www.starlink.ac.uk/topcat/topcat-all.dmg

▷ topcat -version ▷ stilts -version

Linux :

• You need Java (JRE, any version)

▷ Debian/Ubuntu: sudo apt install openjdk-21-jre, maybe xwayland too?

• Then download the JAR file and stilts script:

▷ curl -OL http://www.starlink.ac.uk/topcat/topcat-full.jar

▷ curl -OL http://www.starlink.ac.uk/stilts/stilts

▷ chmod +x stilts

▷ java -jar topcat-full.jar ▷ ./stilts -version

Debian astro installation is possible, but installs an older version (not everything will work): sudo apt install topcat stilts

CDS services in Jupyter notebooks

https://cds-astro.github.io/tutorials/1_Intro_to_CDS_services_in_notebooks.html

```
# Astronomy tools
import astropy.units as u
# Access astronomical databases
from astroquery.simbad import Simbad
from astroquery.vizier import Vizier
from astroquery.xmatch import XMatch
# Sky visualization
from ipyaladin import Aladin
```

Needed :

```
astroplan>=0.10
astropy>=6.1.5
astroquery>=0.4.9
cdshealpix>=0.6.0
ipyaladin>=0.3.0
matplotlib>=3.10.0
MOCpy>=0.15.0
pandas>=2.0.3
plotly>=5.14.0.a
pyvo>=1.4.1
regions>=0.7
specutils>=1.20.0
```