

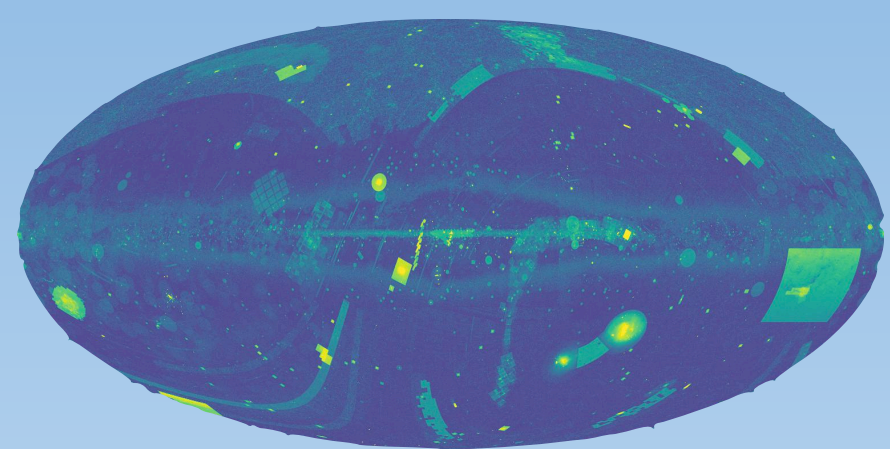
Innovative tools fostered by the HiPS ecosystem



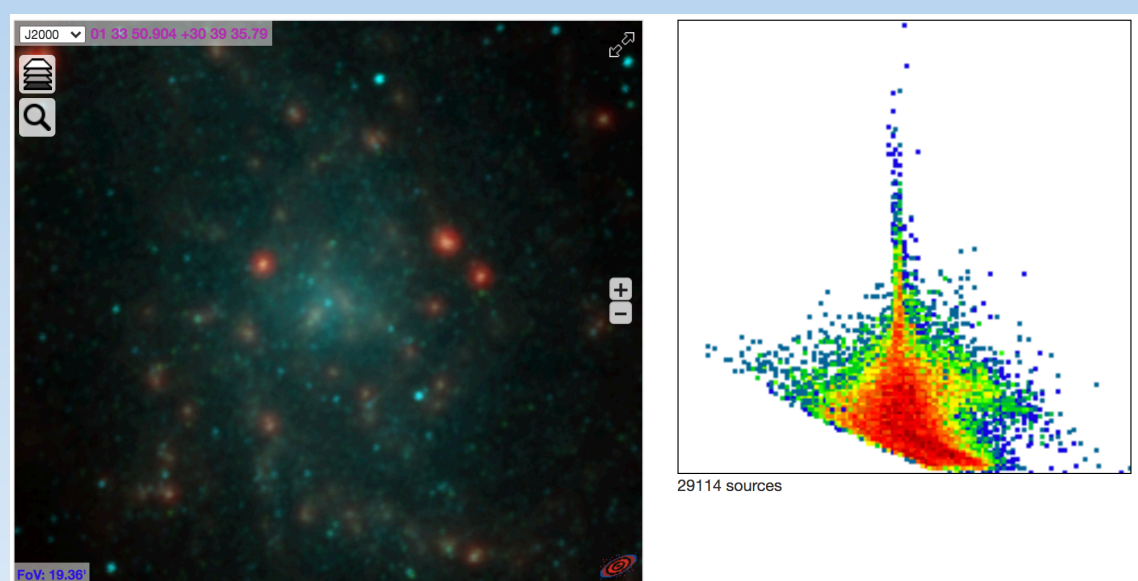
Generic data container

HiPS tiles have been used to store:

- flux
- count (density maps)
- 2D histograms
- polarization data



Density HiPS of sources published in A&A papers

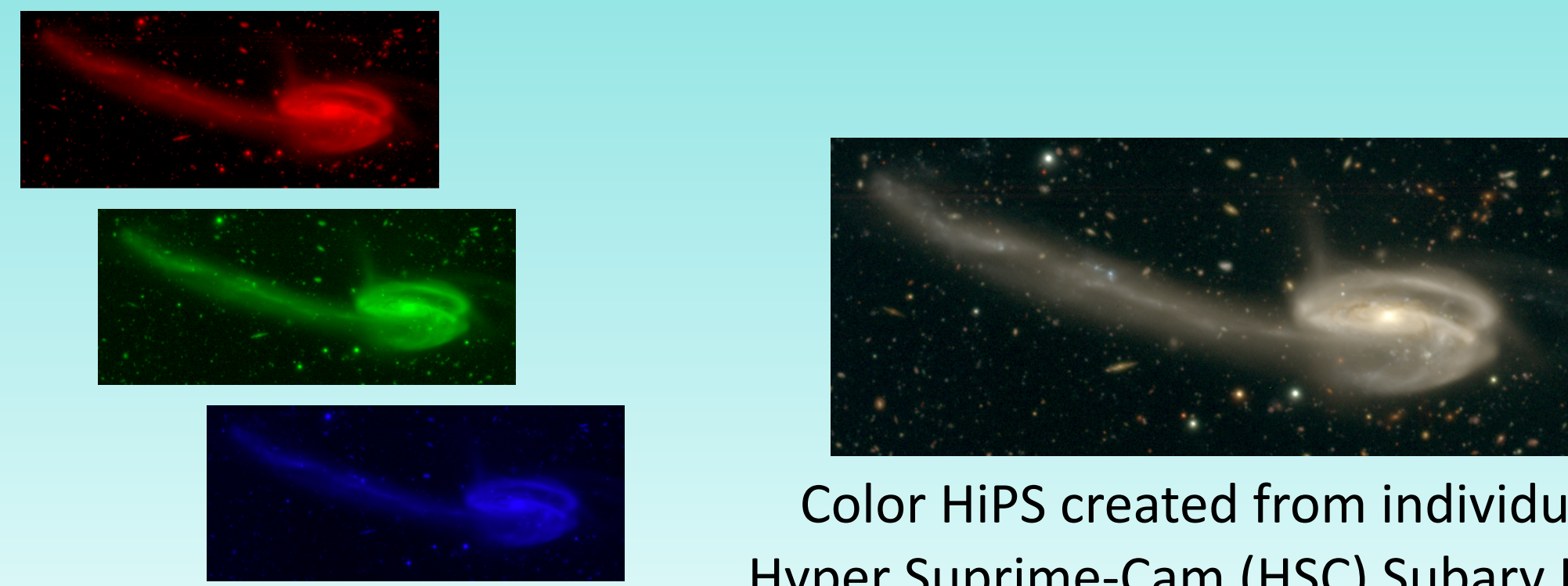


Dynamic color-magnitude diagram, stored in HiPS tiles

<http://alaska.unistra.fr/DtU17-hack/>

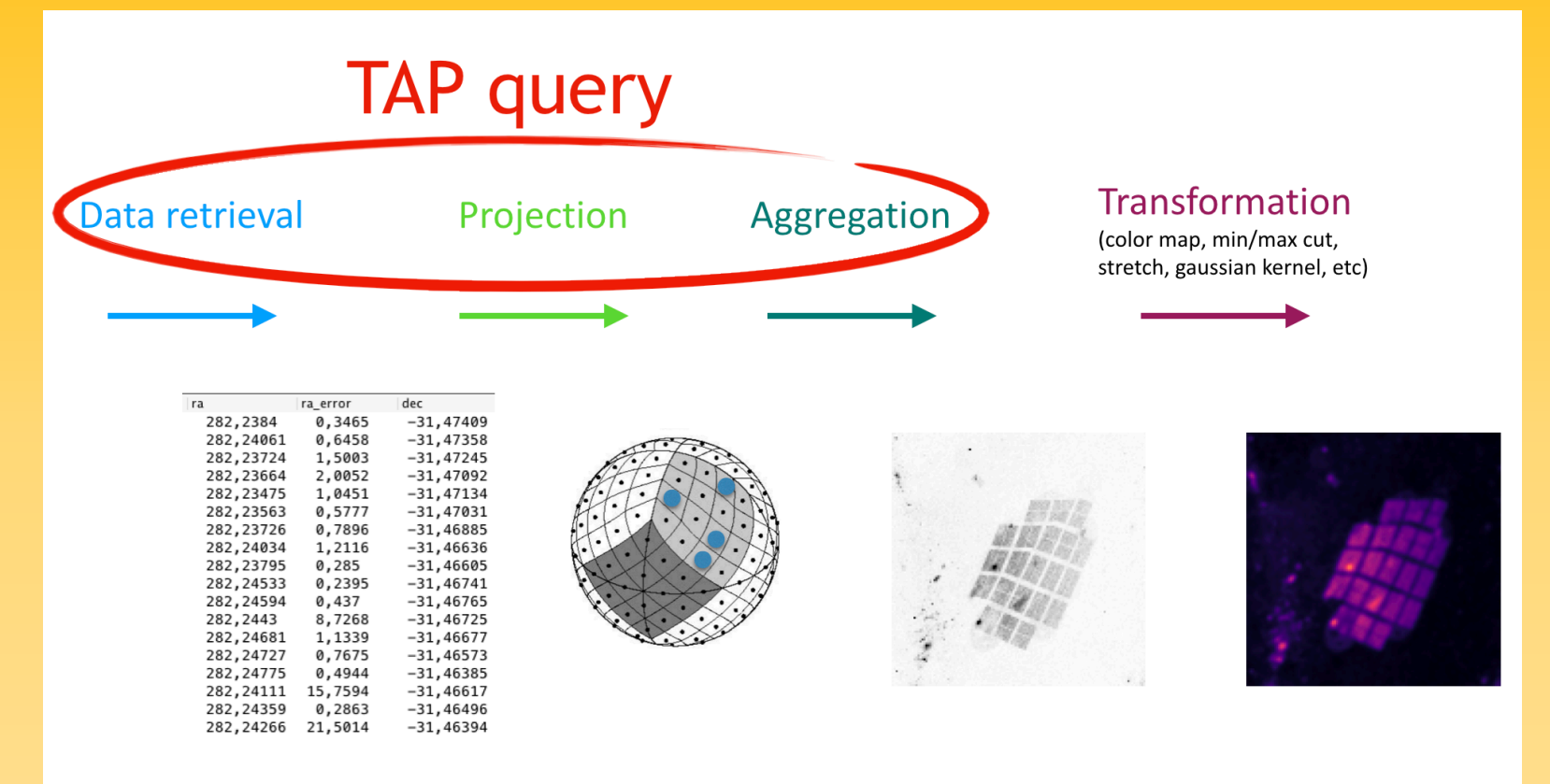
On-the-fly color HiPS generation

Tiles from different HiPS datasets can be mixed together in order to create a new color HiPS, allowing easy color combination and multi-wavelength comparison.



Color HiPS created from individual Hyper Suprime-Cam (HSC) Subary HiPS

CatTiler



We take advantage of the *HEALPix User Defined Function* available in some TAP services to generate *HiPS density tiles* from ADQL queries, possibly weighted by a given column and with additional constraints. This allows for interactive exploration of large catalogues.

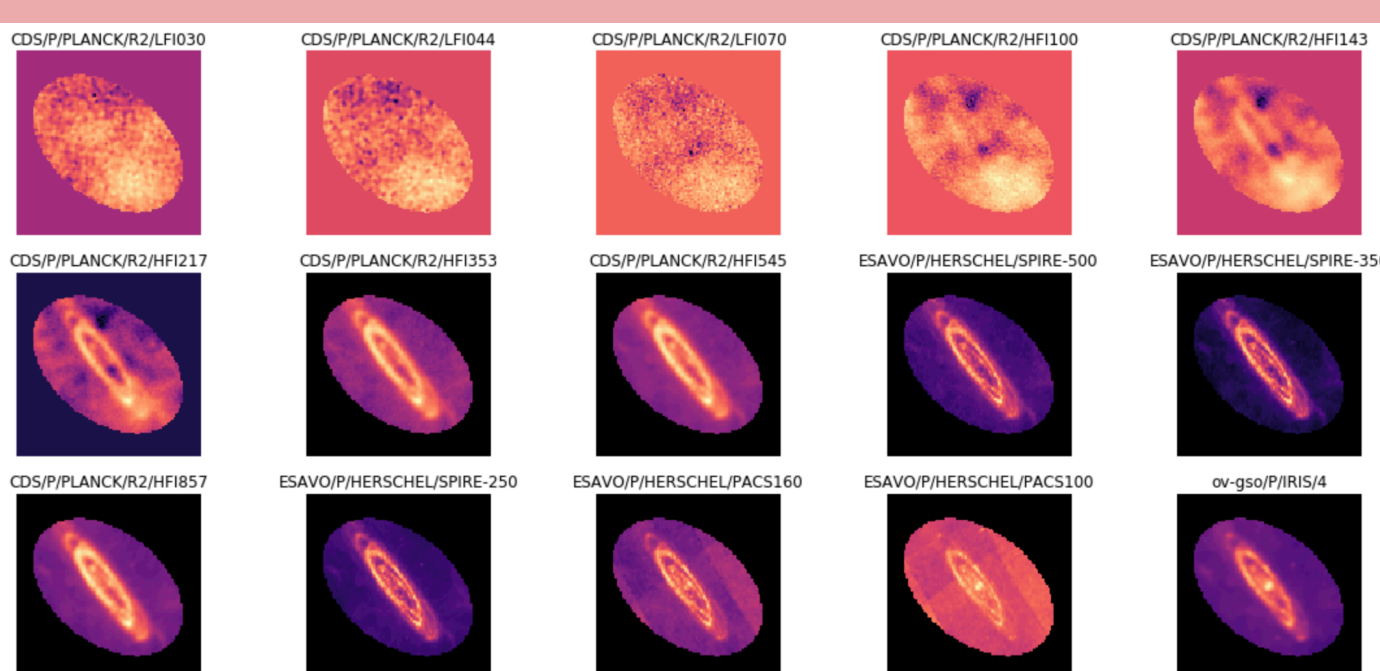
```
SELECT HEALPIX(RAJ2000, DEJ2000, 10)
AS ipix, COUNT(*) as cnt
FROM "II/246/out"
WHERE HEALPIX(RAJ2000, DEJ2000,
3)=528 AND Kmag-Jmag>1
GROUP BY ipix
```

hips2fits

—> *cutouts from HiPS*

- input: *HiPS ID + WCS*
- output: *FITS cutout*
- powered by *Astropy*, *cdshealpix*, accelerated by *Rust* and *numba*
- performance: 500k pixels per second
- easy access from *astroquery*
- available for any public HiPS

—> this code has been used to generate millions of training data cutouts for machine learning purposes



A variety of cutouts around Messier 31, generated by *hips2fits*

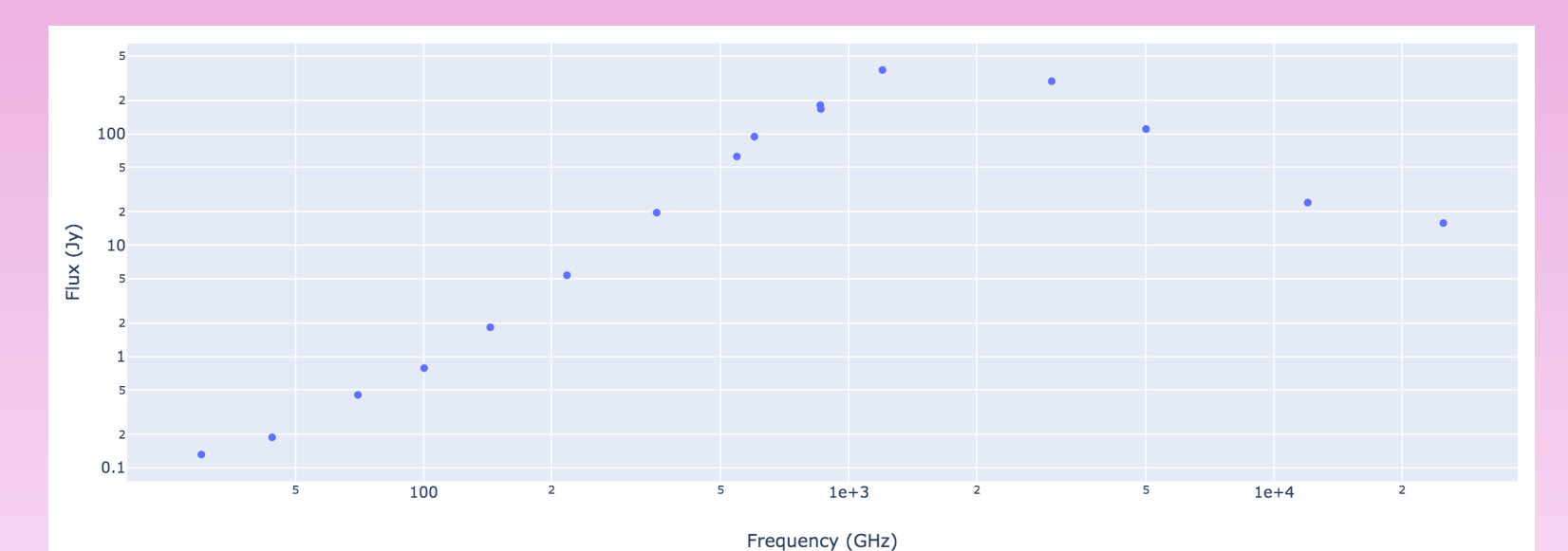
Computation on the HiPS grid

As the HiPS datasets in the same coordinates system are in the exact same grid, it is straightforward to make some computations between different HiPS datasets. This can be used for instance to provide moment-0, moment-1 and moment-2 of HiPS data cubes.

SED from FITS tiles

We have developed an early-stage prototype to extract a Spectral Energy Distribution for an arbitrary region, from FITS tiles.

The first results are promising and pinpoint the need for an accurate characterization and description of the flux unit in the HiPS metadata.



Messier 33 SED, extracted from Planck, Herschel, Spitzer and IRIS HiPS FITS tiles