



# ALADIN

# Aladin

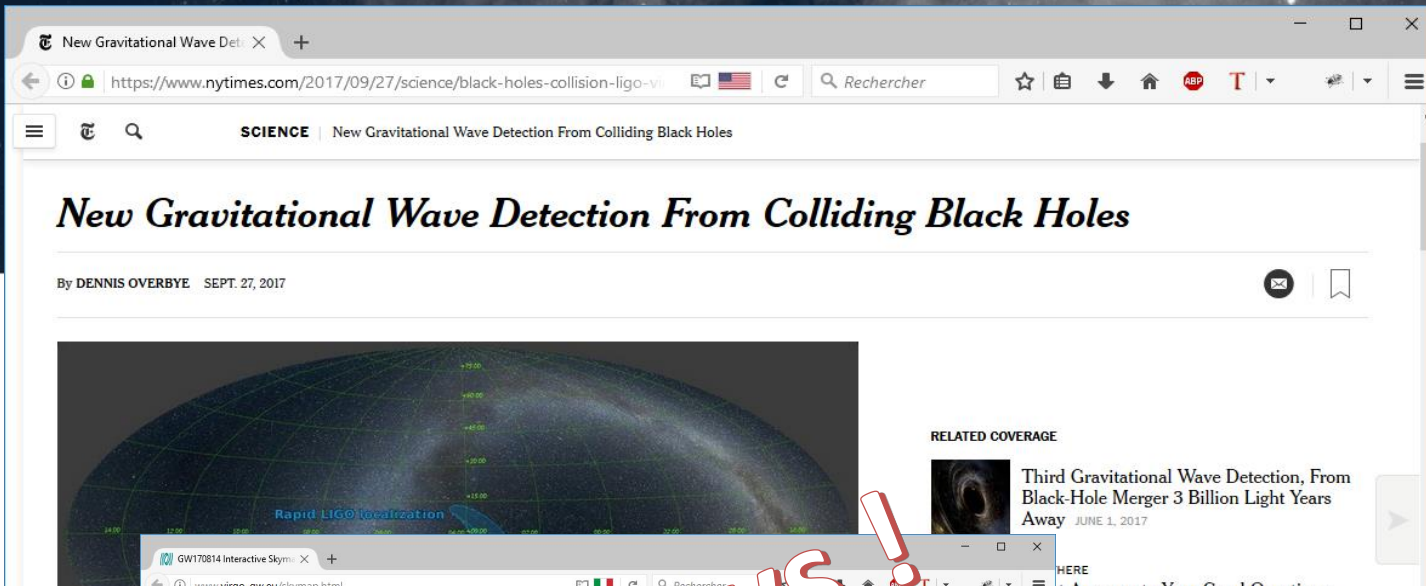
## Milestones, Statistics & Challenges

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CDS council – 10 & 11 October 2017



Pierre Fernique  
on behalf of Thomas Boch, Caroline Bot,  
François Bonnarel, Mihaëla Buga, Chaitra,  
François-Xavier Pineau, Ibrahim Yapici  
& Jean-Yves Hanguët, Thomas Keller



- Aladin Desktop
- Aladin Lite
- HiPS
- MOC

... in the New York Times, APoD, ...

**Latest news!**  
**28 September 2017**

GW170814 Interactive Skymap

coalescence of a pair of stellar-mass black holes. When we compare its position in the universe with the previous events, the localization of GW170814 is the narrowest. This new and exciting result was reached through the joint detection, coordinated by a body of more than 1,000 international scientists forming the LIGO and Virgo Collaboration (LVC).

The interactive skymap shows you the huge improvement of detection in the context of multimessenger astronomy. The tutorial explains how to use it.

32000 03 28 35.268 -35.5

Using the sky map

Click on a variable to display information relating to each

Detector	Sky localisation	Label	Pop-up info
GW170814 - L1/H1 only	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW170814 - L1/H1/V1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW170814 - refined skymap	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW150914	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW151226	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GW170104	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Backgrounds

If you want to see the extension of these sky regions through the constellations you can select an artistic background image  Constellations.

You can also select various background images at different wavelengths, combining the electromagnetic data with the gravitational-wave information:  Mellinger (default)  WISE  2MASS  DSS color  XMM  Fermi

Fov: 155.91°

Astronomy Picture of the Day

Different image or photograph of our fascinating universe is featured, along with a brief explanation written by a professional astronomer.

2017 September 28

Rapid LIGO localization

Rapid LIGO and Virgo localization

360° x 180°

LIGO-Virgo GW170814 Skymap

Illustration Credit: LIGO-Virgo Collaboration - Optical Sky Data: A. Mellinger

https://apod.nasa.gov/apod/image/1709/GW170814\_orig.png

# □ Aladin 2017 milestones

- Aladin V10 release

- Ready for ADASS (October 2017)



- V10 is a major release (in preparation since 2 years):

- All VO data available => data discovery tree based on MOCServer;
    - Integration++: query by criteria (TAP), by regions (MOC), by X-match (CDS-Xmatch);
    - “modern” Look&Feel
    - Aladin applet => Goodbye, Farewell !

- HiPS IVOA standards 1.0 (June 2017)

- HiPS => Not only at CDS anymore:

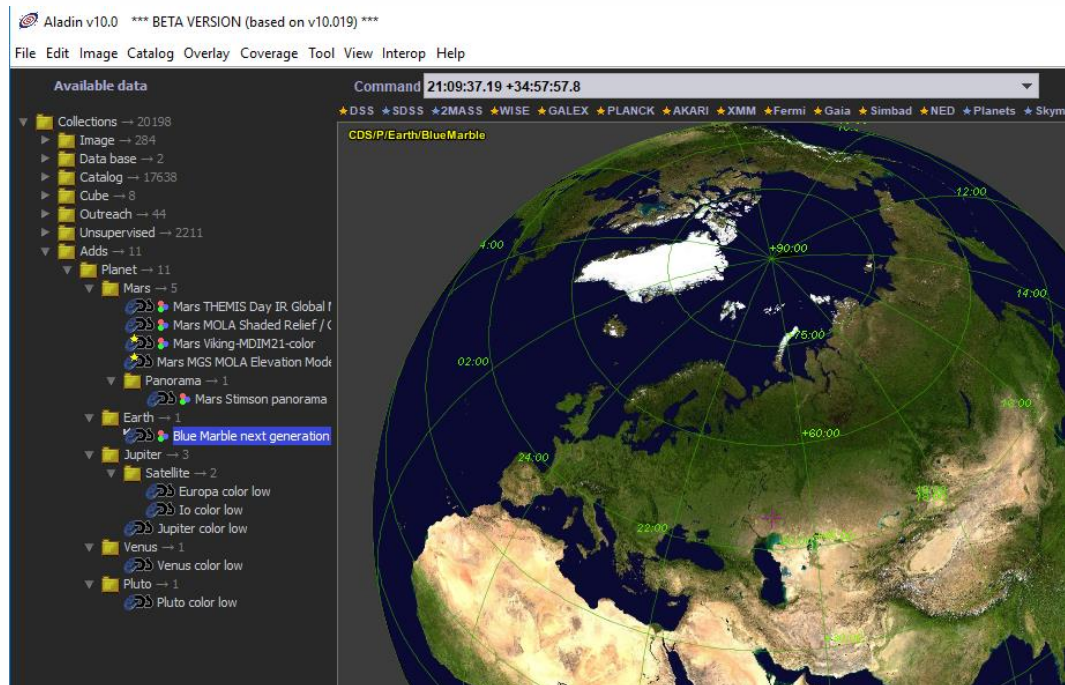
- HEASARC skyview HiPS extension (July);
    - Python astronomy package for HiPS (Google Summer of Code 2017)

# □ Aladin 2017 milestones – cont.

- **Hipsgen** (= generator of HiPS)
  - Code improvements: able to generate huge HiPS (ex: PanSTARRs 200mas/pixel, 30TB HiPS)
  - Used by all HiPS partners (ESA, JAXA, CADK, IRAP, HEASARC, ESO, ...)
- **Aladin Lite**
  - ipyaladin => allows AL integration in Python “notebook”
  - HTTPS support
- **Aladin Desktop** for the next generation of preparation tools
  - NASA APT: HST -> JWST
  - ESO GuideCamTool (next version in preparation)

# □ Aladin 2017 R&D

- **Planetology** (in the framework of Europlanet project)
  - Aladin Desktop adaptation (in progress),
  - 10 test HiPS (Mars, Venus, Earth)
- **Generic SIAv2**  
based on MocServer
  - Just beginning



# □ Aladin 2017 global indicators

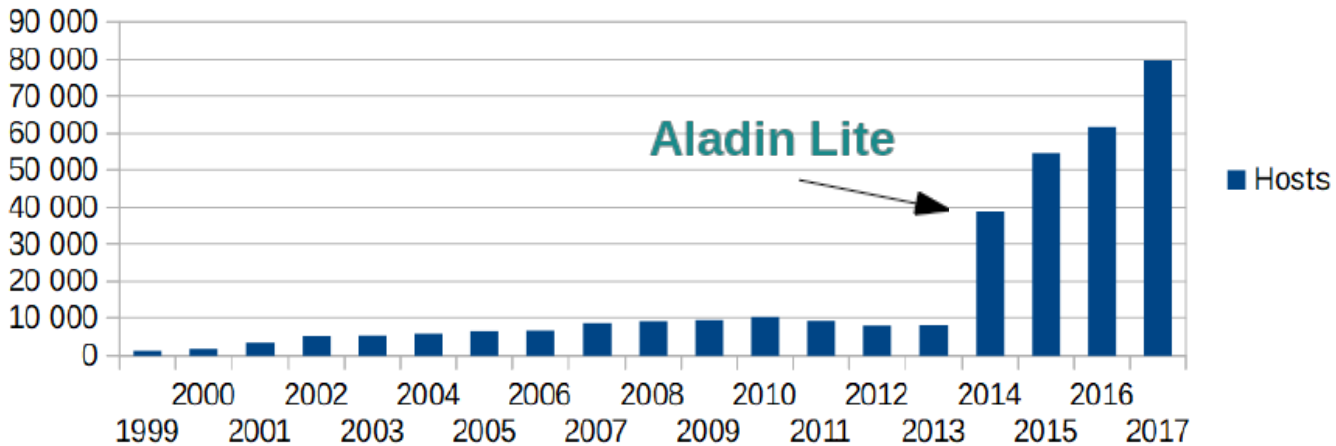
- **Audience:** +30% 80 000 hosts/month (2016: +13% 62000)
- **Usage:** +8% : 300 000 actions/day (2016: +11% 275 000)
- **Implementation (Aladin Lite):** +50% 78 web sites (2016: 52)
- **Content:** +37% HiPS 380 / 134TB (2016: 344 HiPS / 100TB)  
CDS 180/110TB+CADC 59/15To, ESAC 33/2TB, CADE 68/20GB, JAXA 6, SSC 6, ...
- **Citations** (AD+AL+HiPS reference papers): +24% 57 citations/year, total of 352

=> 2017: « *Un bon cru !* »

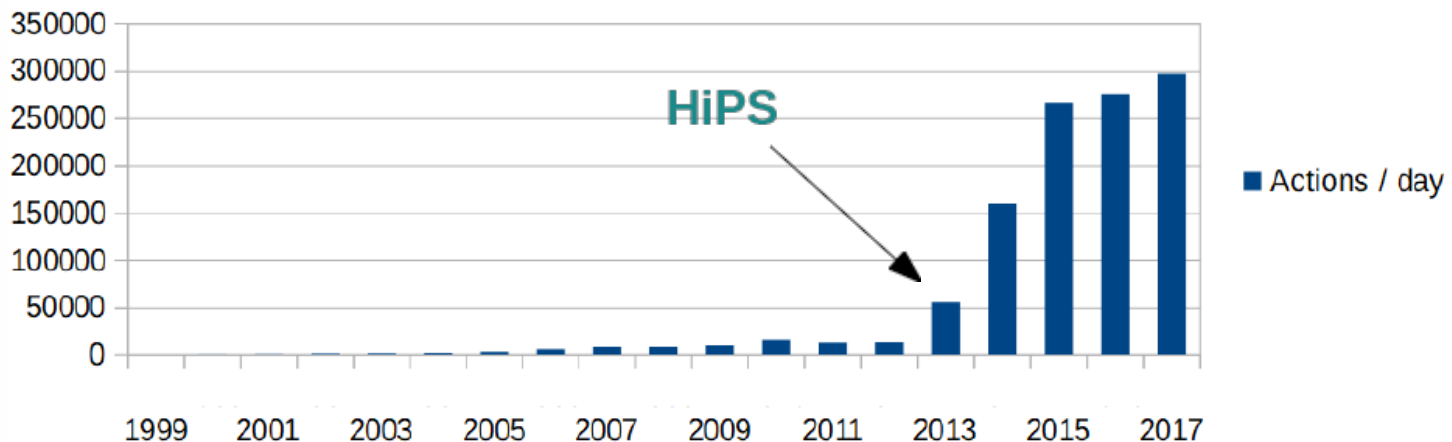


# □ Audience & Usage evolution

Hosts evolution (monthly mean)

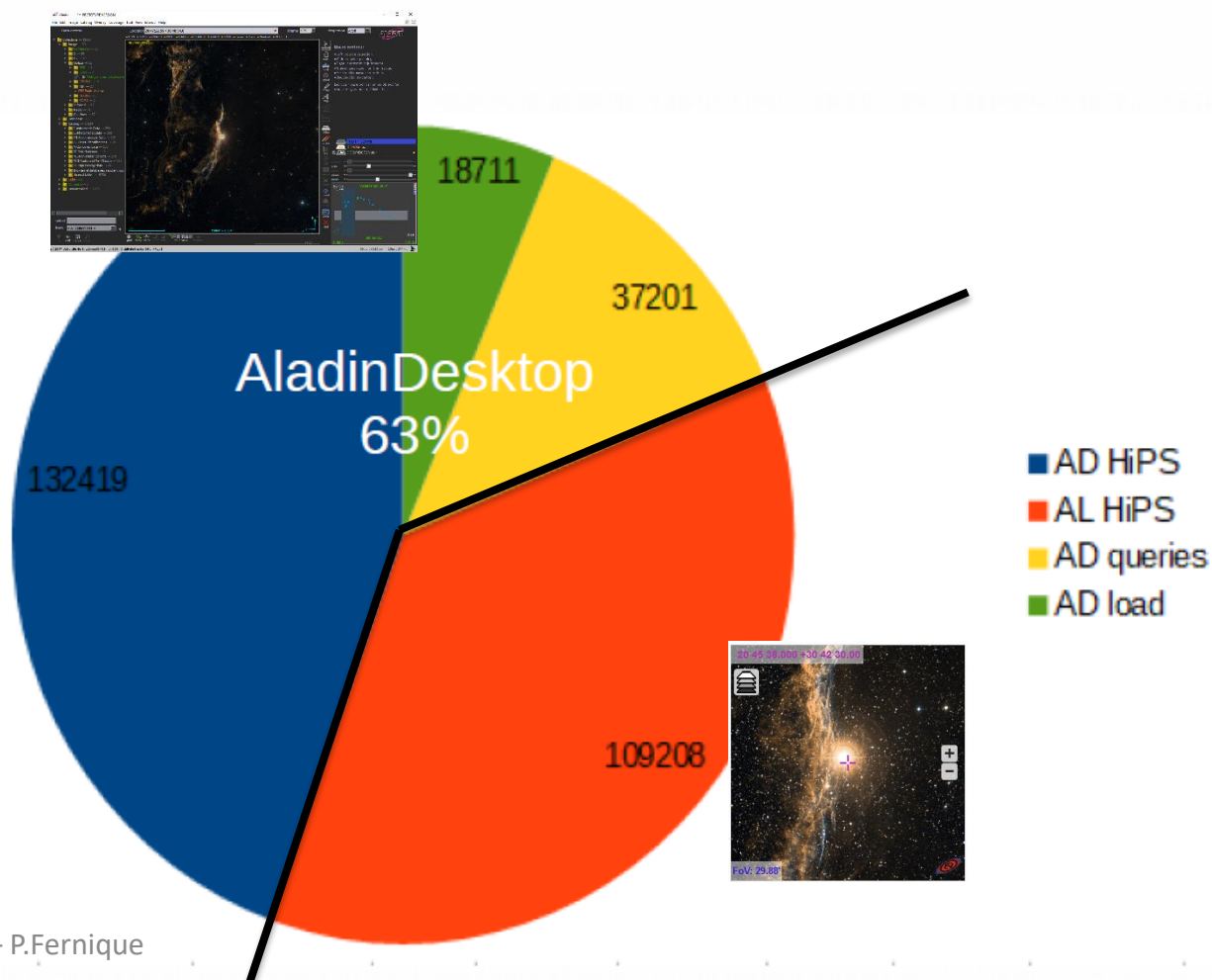


Usage evolution (daily mean)



# Usage distribution

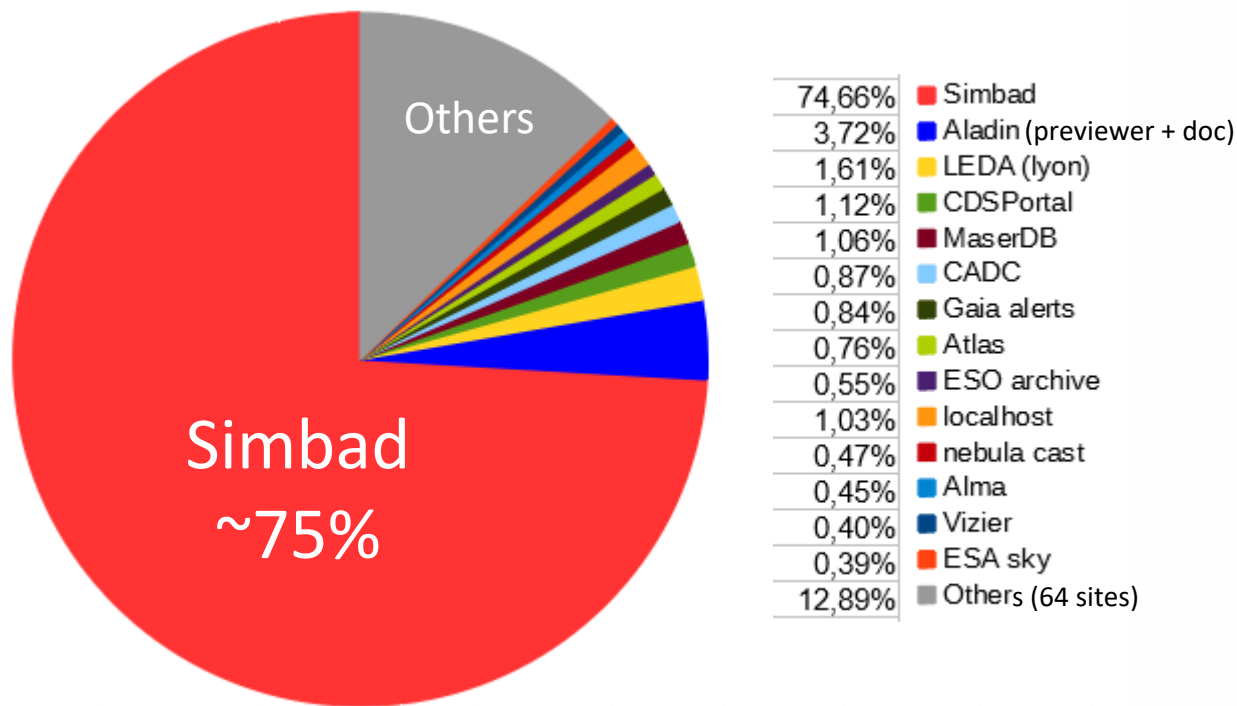
(Daily actions,  
rough estimation  
for Aladin Lite)





# □ Aladin Lite origin distribution

(percentage of startups)

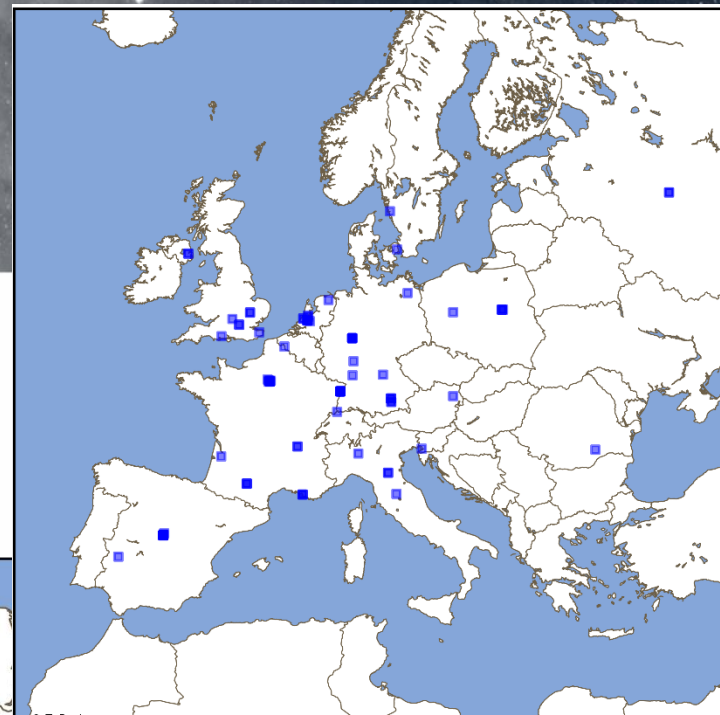
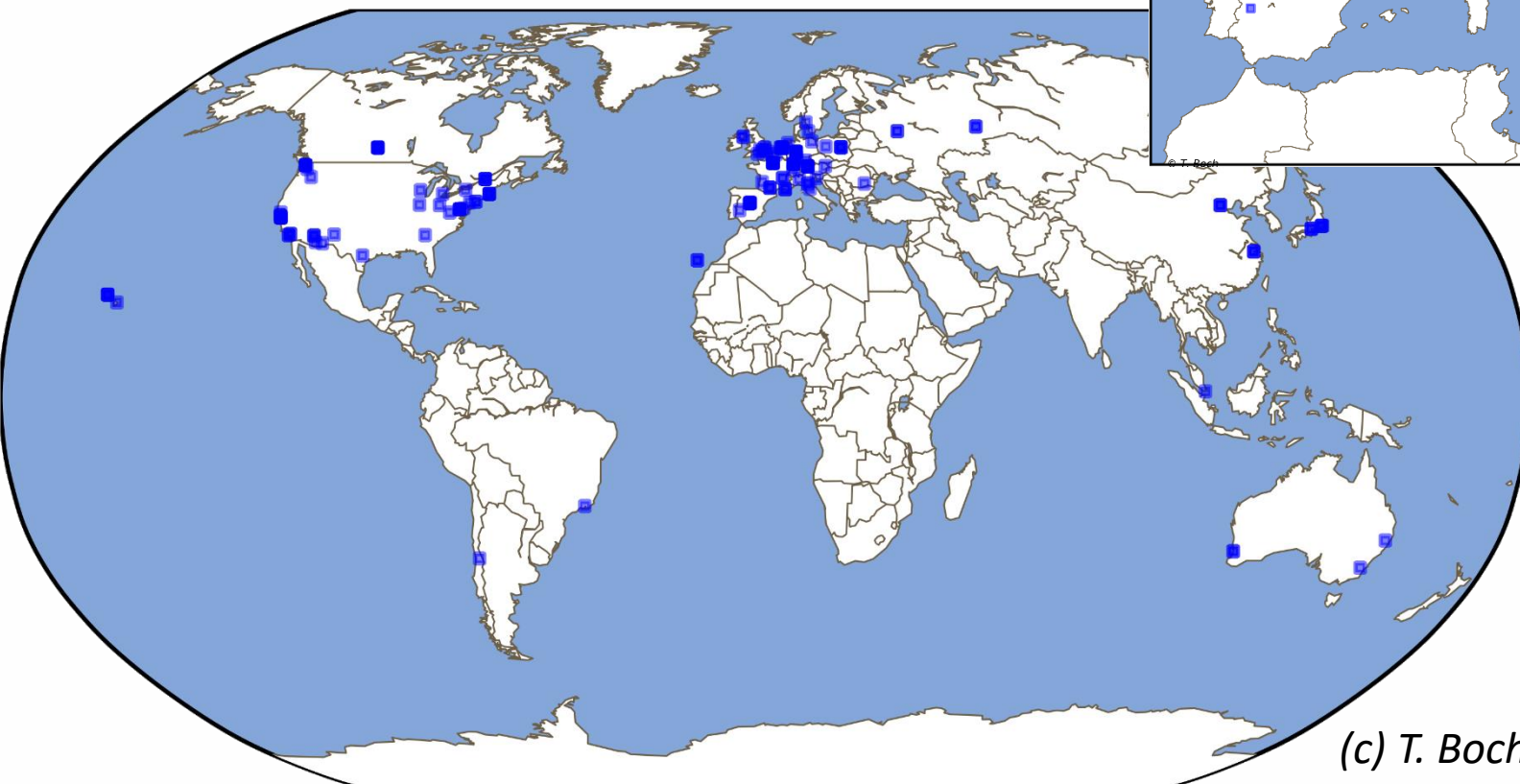


=> *Similar to 2016 repartition*

# Aladin Lite Web site implementation

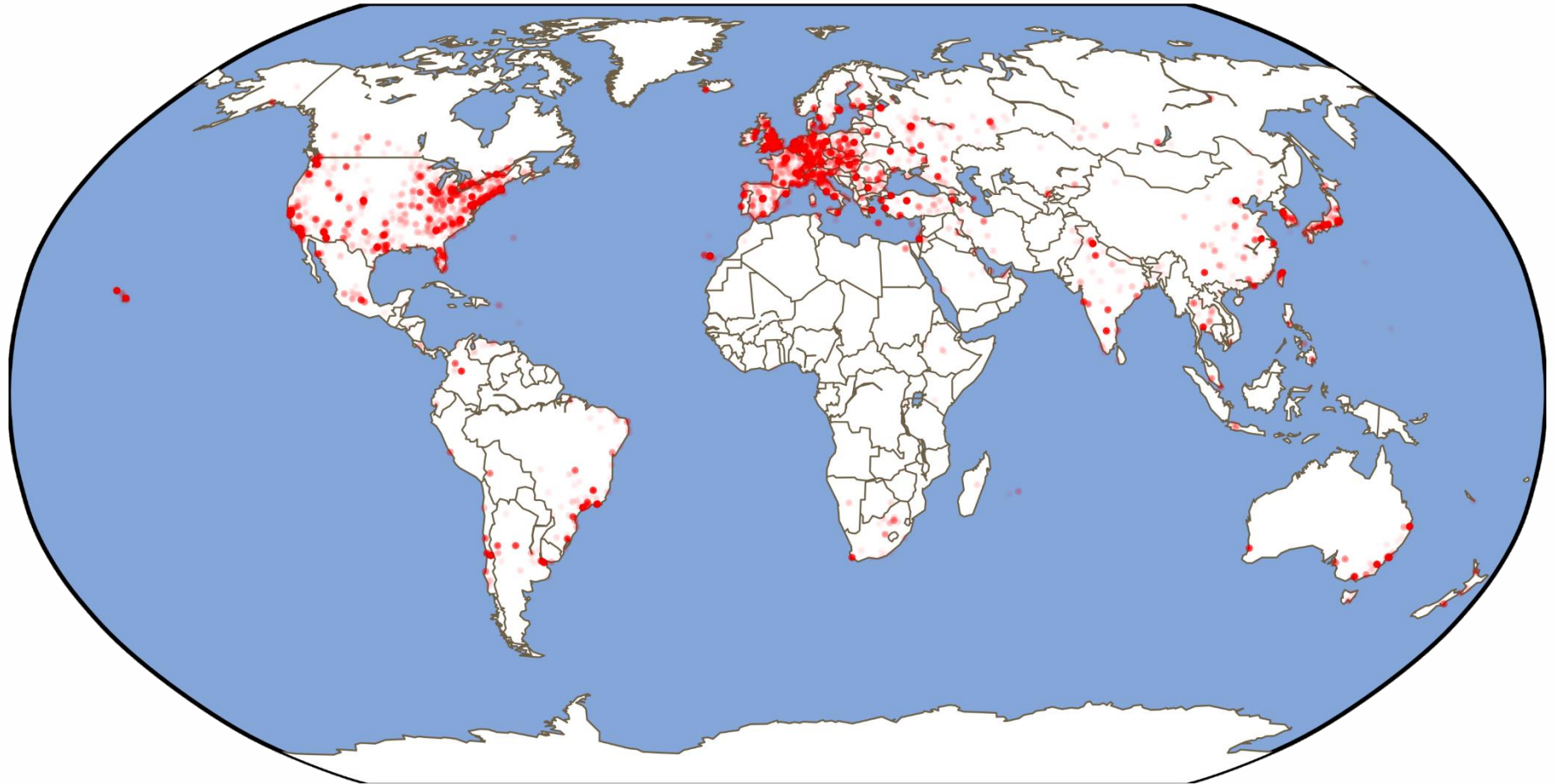


(>100 startups)

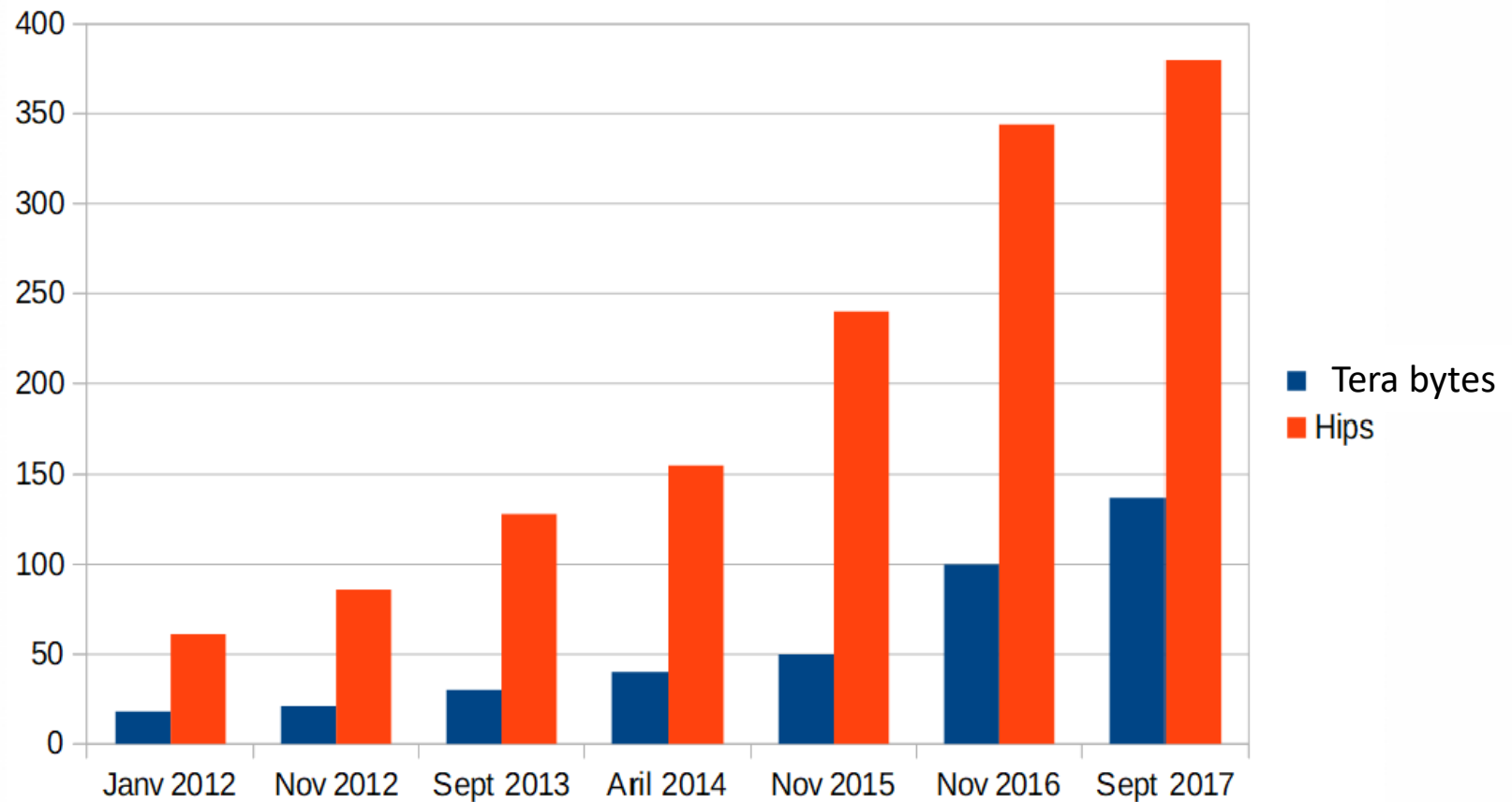


(c) T. Boch

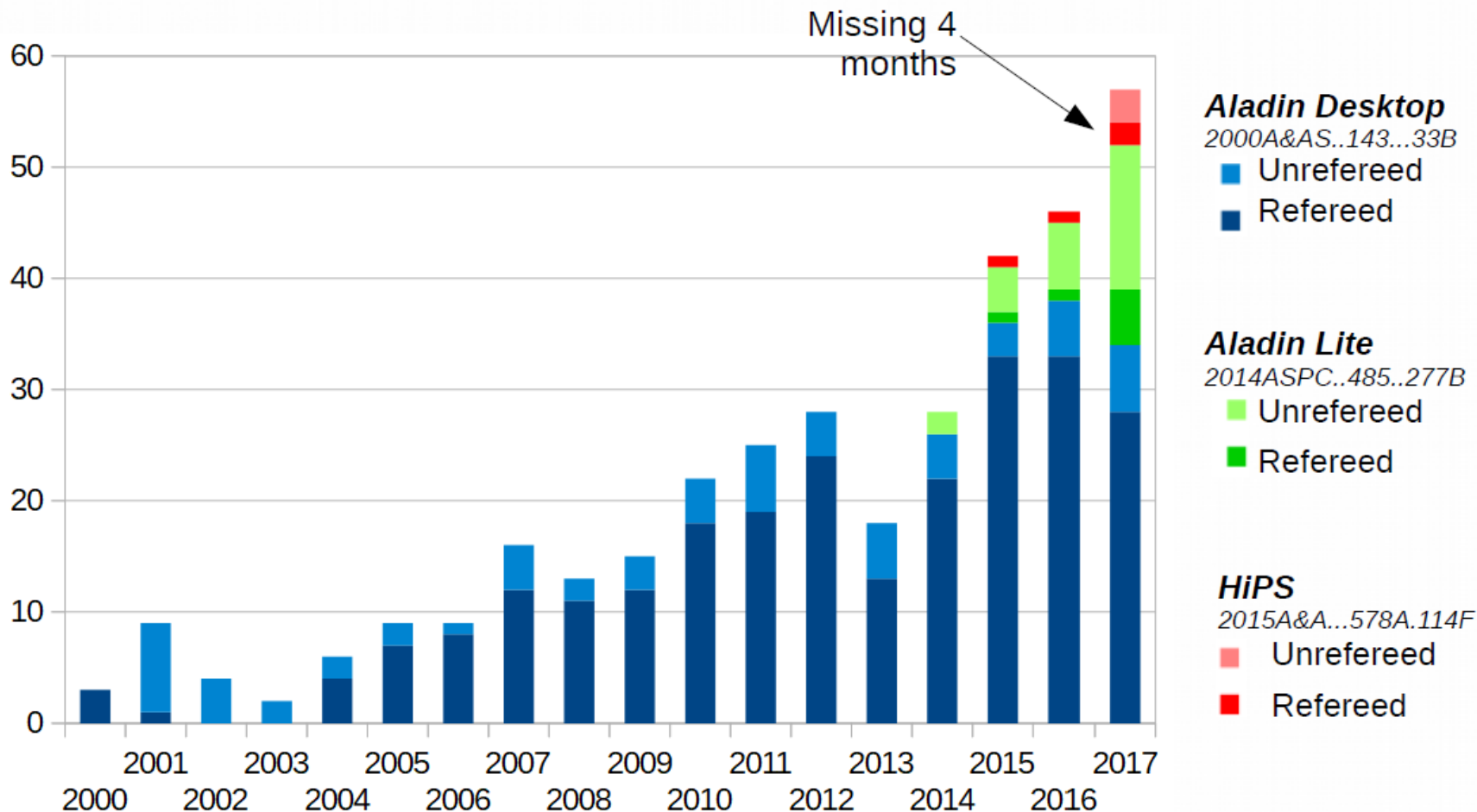
# □ Aladin Lite user localisation



# □ Content evolution



# □ Literature citations



# □ Aladin next challenges

- Aladin client evolution

- AD+AL technologies/developements ready to face to 2-3 next years (2 contexts covered: AD->desktop machines, AL-> Web navigators)
- What about mobile phone/pad ?  
=> Apps android + iOS, or AL adaptation ?

- Hips servers: to be ready for new surveys (such as Euclid)

- 1PB volume for 2019 (demand in progress)
- HTTP load: 300 000 req/day today, 1M already supported => not a problem
- Deeper usage of HiPS FITS tiles (server side HiPS tools, SIAv2, ...)

# □ Aladin use cases & demo

- Aladin v10 -> Caroline Bot
- Aladin Lite *ipyaladin* -> Thomas Boch





# ALADIN

# Aladin V10: HiPS HiPS HiPS Hooray!

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Caroline Bot

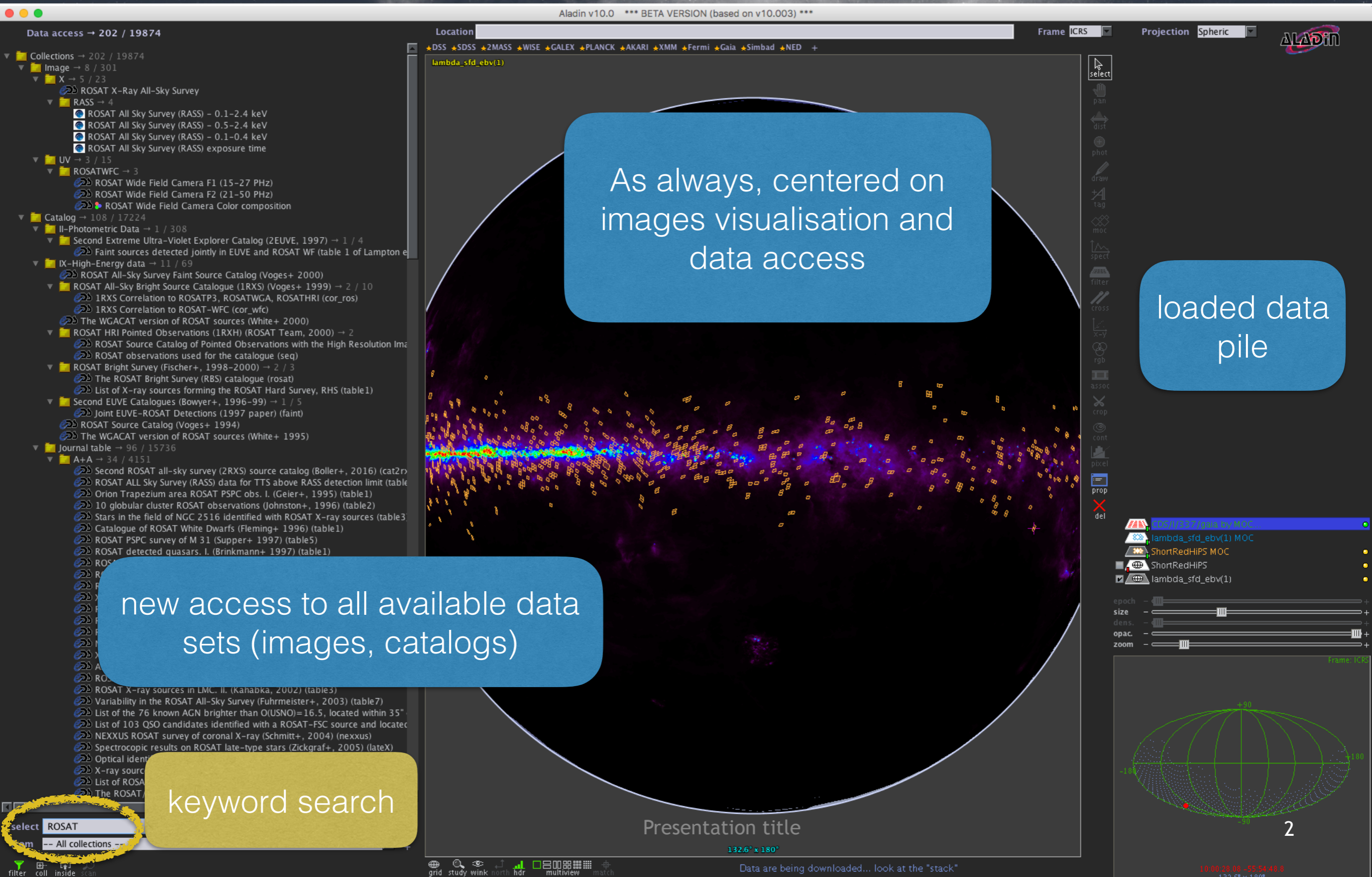
on behalf of Pierre Fernique, Thomas Boch, François Bonnarel, Mihaëla Buga, Chaitra, François-Xavier Pineau, Ibrahim Yapici & Jean-Yves Hangouët, Thomas Keller



CENTRE DE DONNÉES  
ASTRONOMIQUES DE STRASBOURG



# Aladin V10, a new interface



As always, centered on images visualisation and data access

loaded data pile

new access to all available data sets (images, catalogs)

keyword search

Presentation title

132.6° x 180°

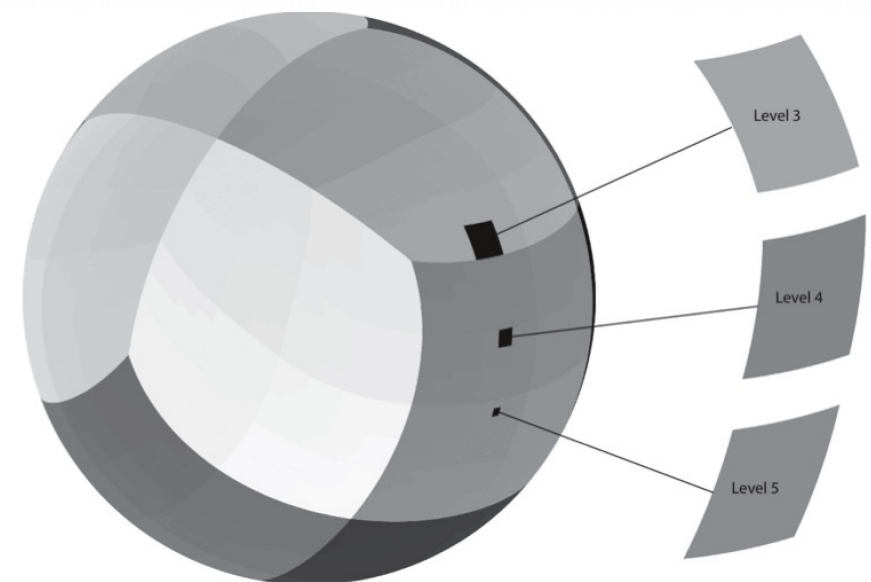
Data are being downloaded... look at the "stack"

10:00:20.08 - 55:54:48.8

# □ HiPS: Hierarchical Progressive Survey

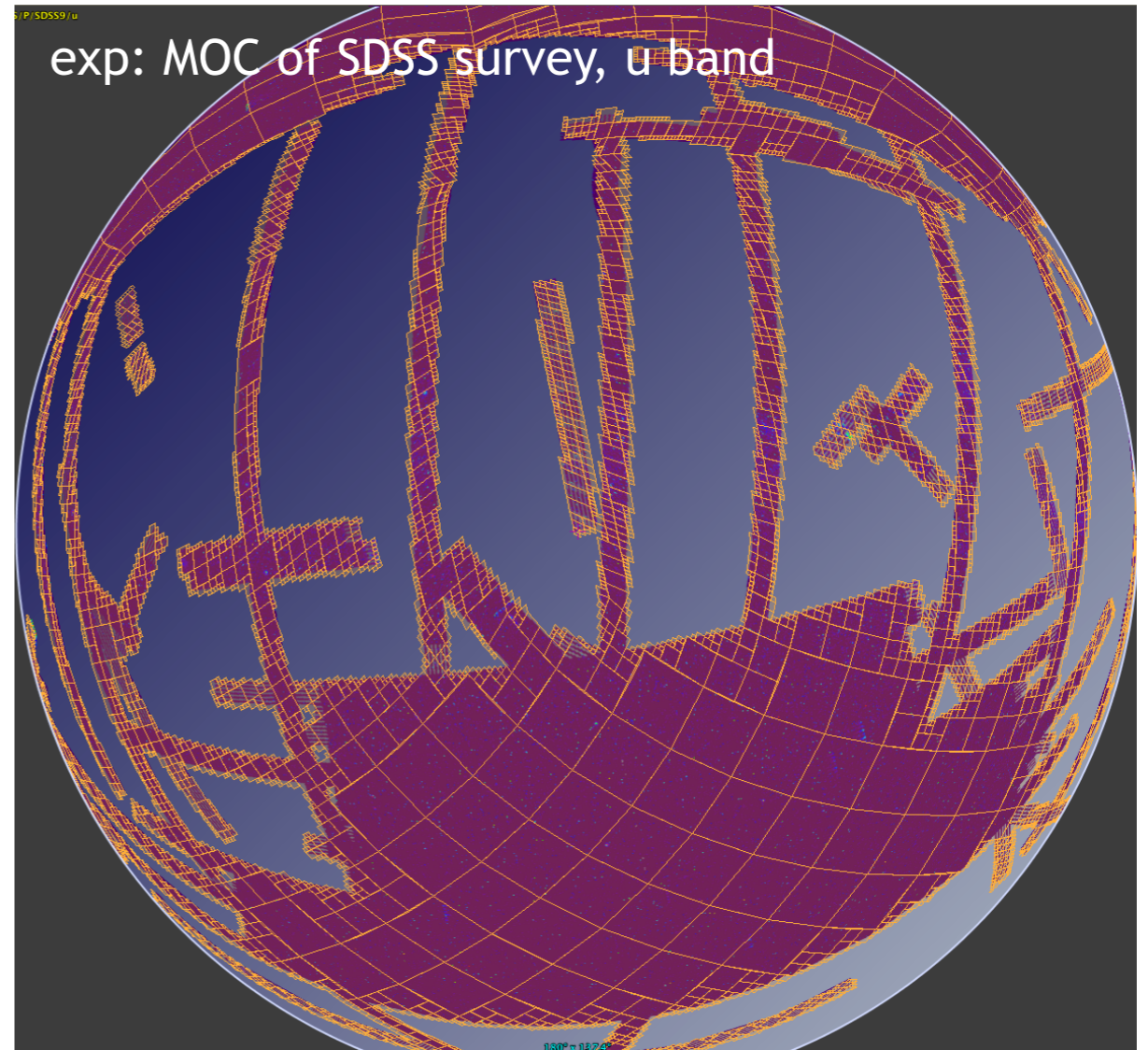
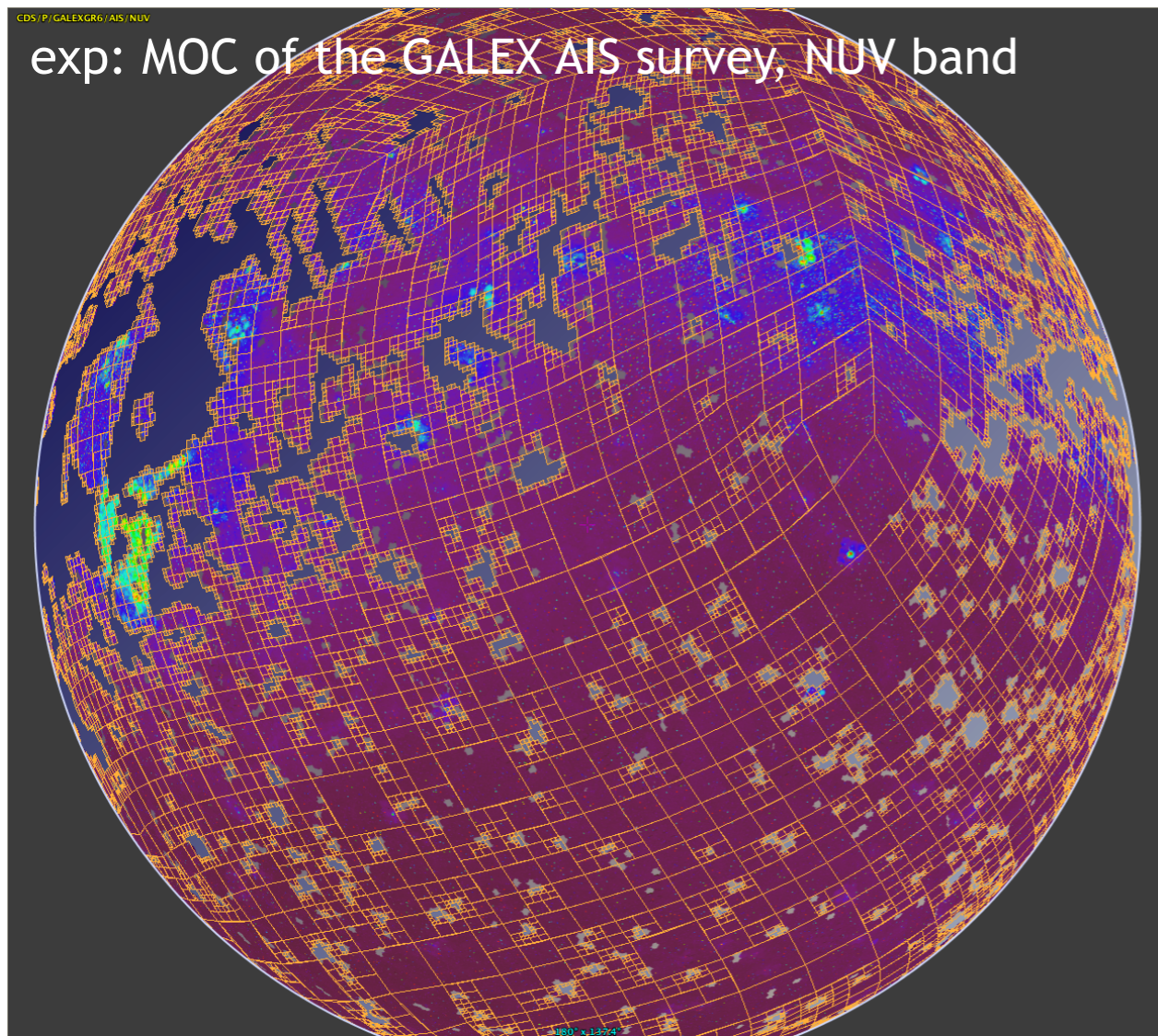


- based on HEALPix (allsky tessellation)
- Fernique et al (2015)  
2015A&A...578A.114F
- Progressive display of a survey:  
the more you zoom, the more you see
- Images survey, but also catalogs and cubes
- HiPS are build from an image collection using HiPSgen



# □ MOC: Multi-Order Coverage

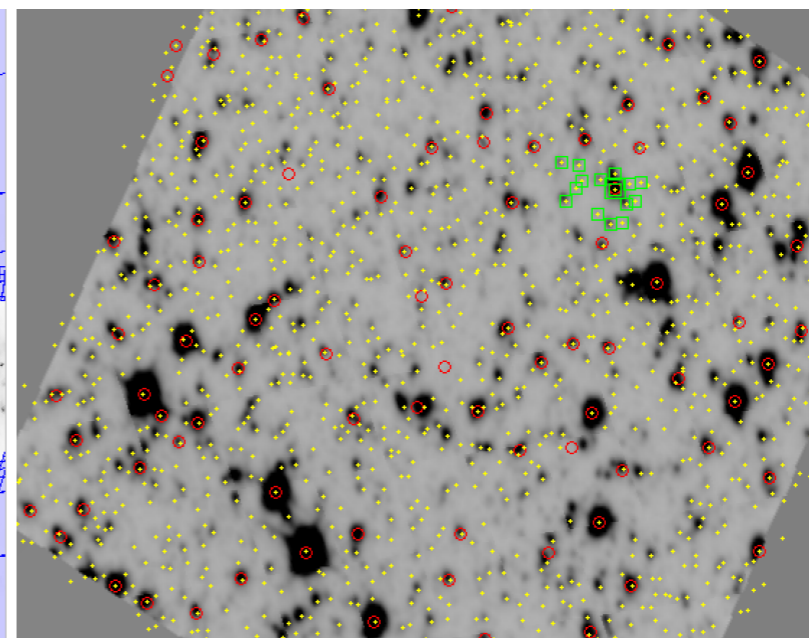
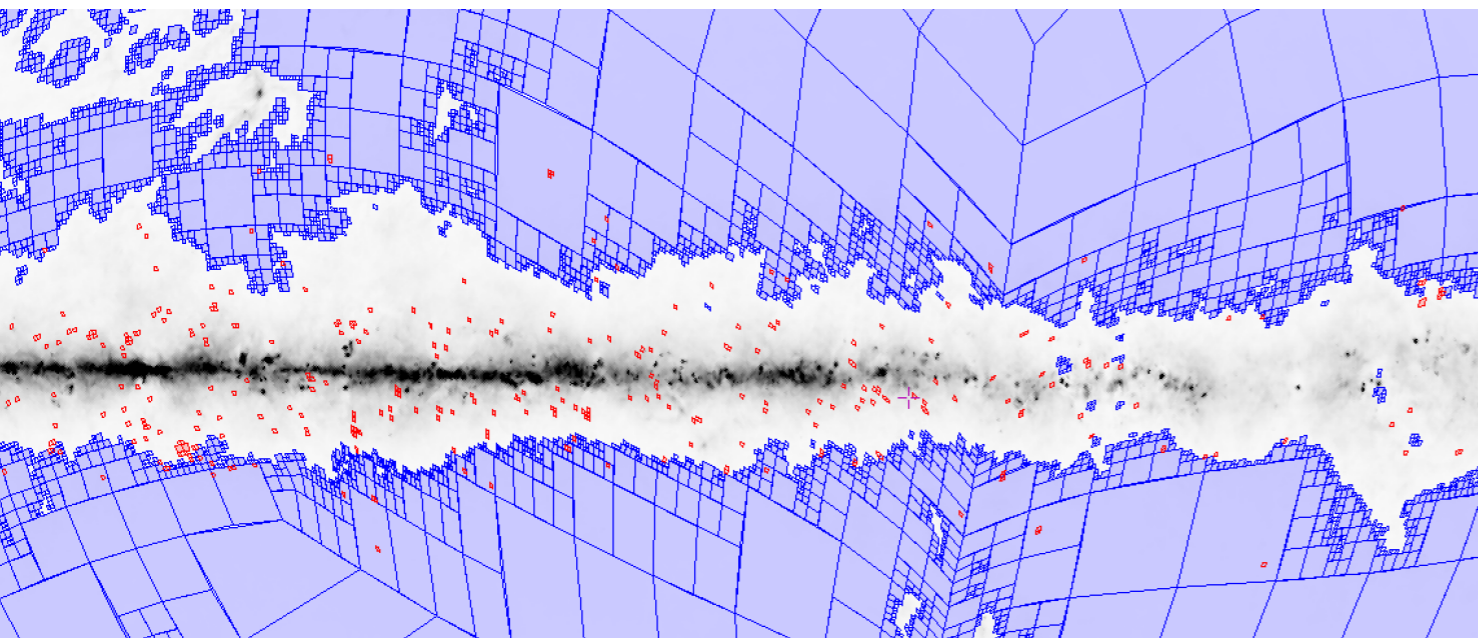
- Sky coverage of a data set



- Logical operations (intersections, unions, ...)
- Query by MOC (*"I would like data from catalog XXX in the YYY fields"*)

# □ Example/demo

- “I have a set of observations or of regions of interests (MASH survey (Parker et al. 2006-2008)). I would like to identify the regions at low extinction, find sources detected both in Gaia DR1 and WISE and visualise different parameters (color-color diagram)”

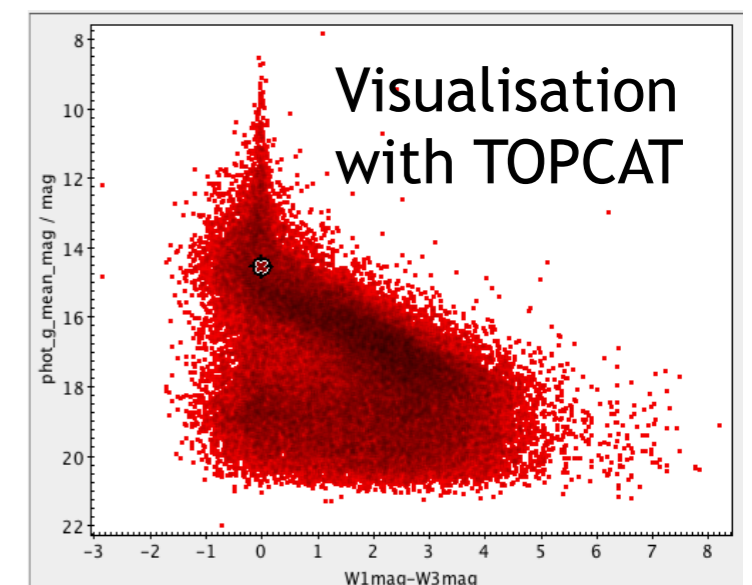


Xmatch  
Gaia-WISE

Find the sky coverage

load the Gaia catalog in the  
regions of interest

Step-by-step tutorial available on the euro-vo webpages:  
<http://www.euro-vo.org/?q=science/scientific-tutorials>



# Creating a HiPS + MOC for a set of images



Radmm # Opt IV X Y  
V/127A

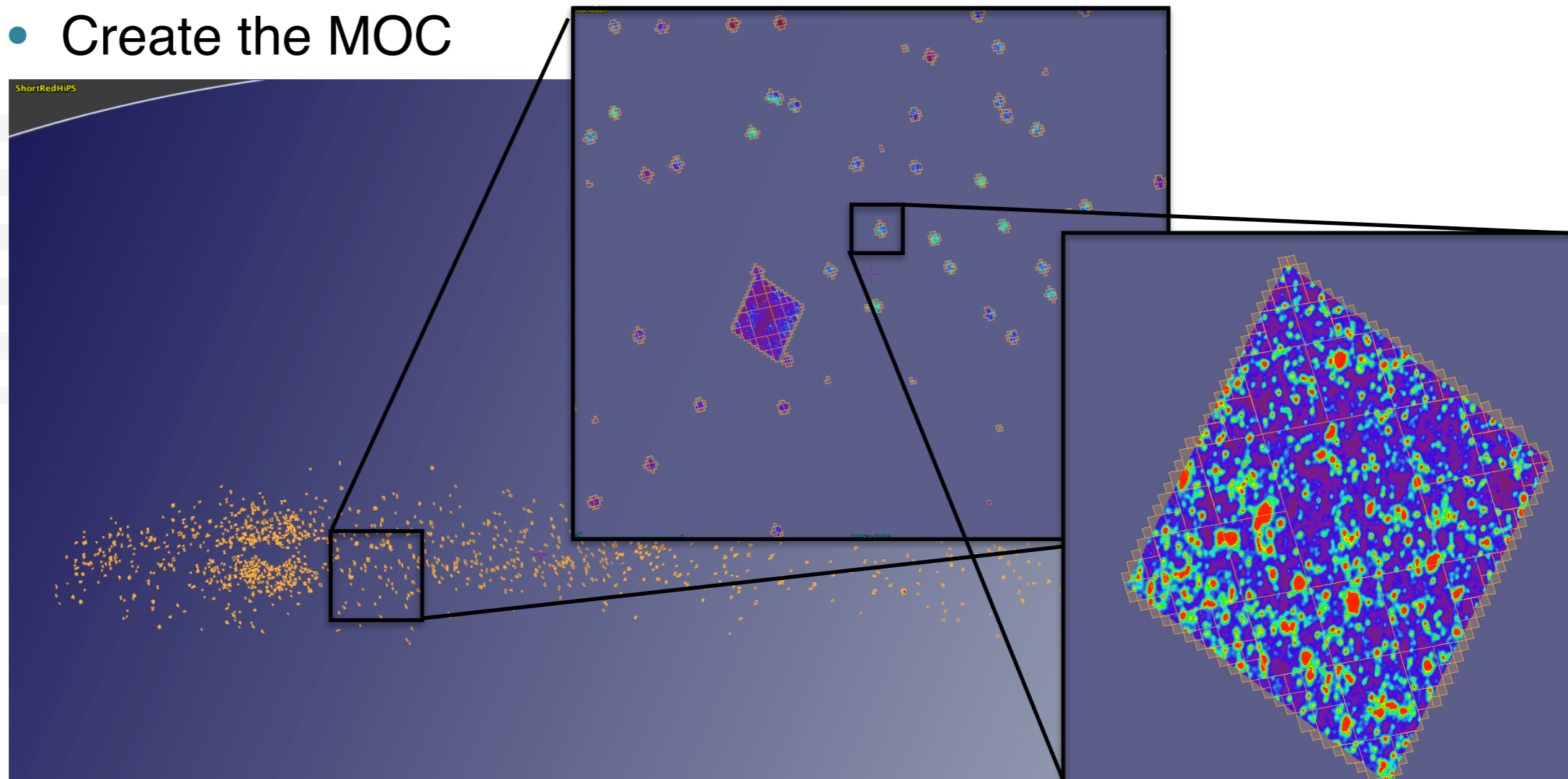
MASH Catalogues of Planetary Nebulae (Parker+ 2006-2008)

- [V/127A/mash1](#) (c)The MASH Catalog of Planetary Nebulae (paper I) (903 rows)
- [V/127A/mash2](#) (c)The MASH-II Supplement (from paper II) (335 rows)
- [V/127A/sp](#) \*List of spectra available in "sp" subdirectory (*Note*) (1657 rows)

- A set of Halpha + Short Red images in 1338 fields

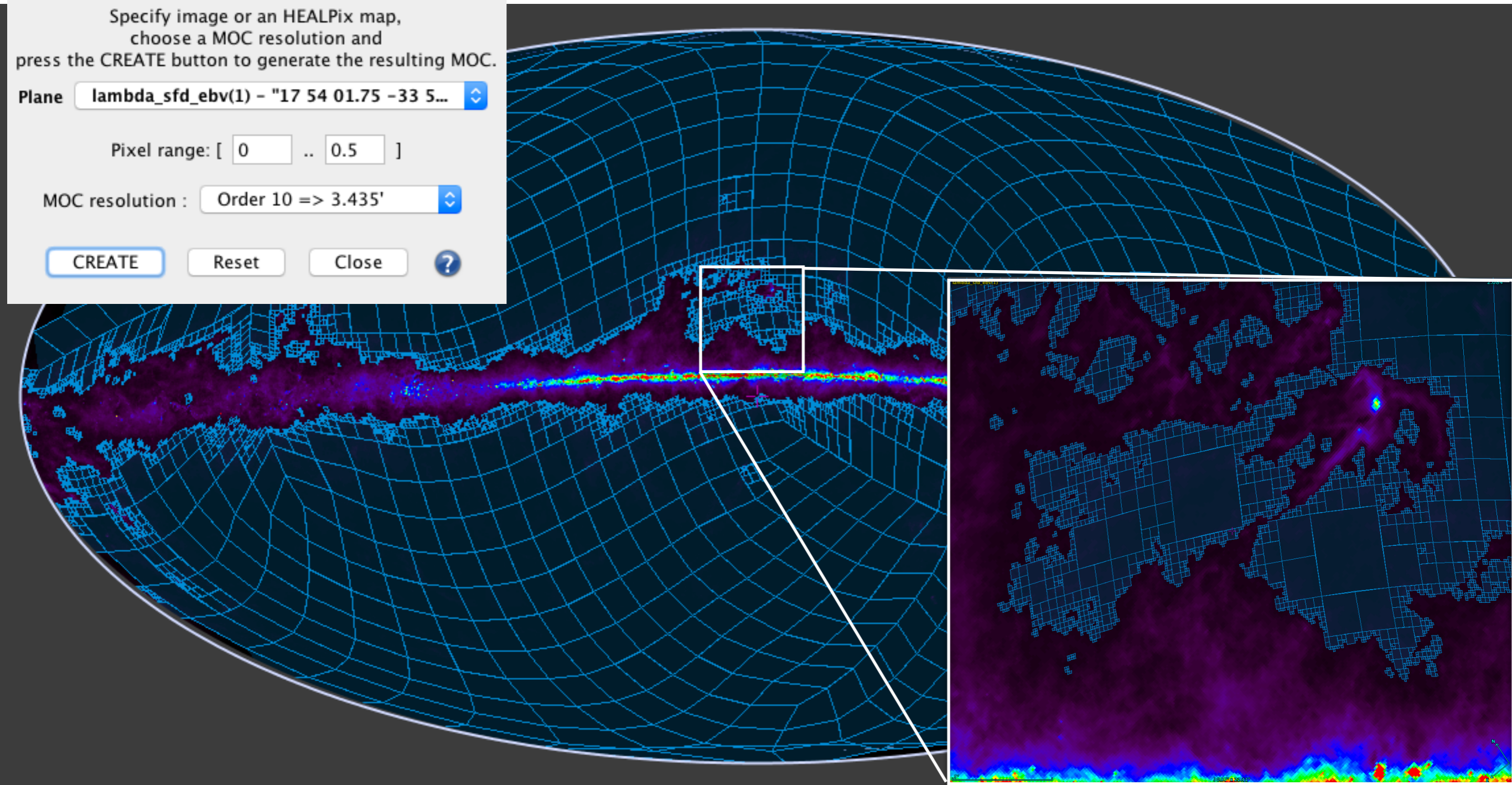
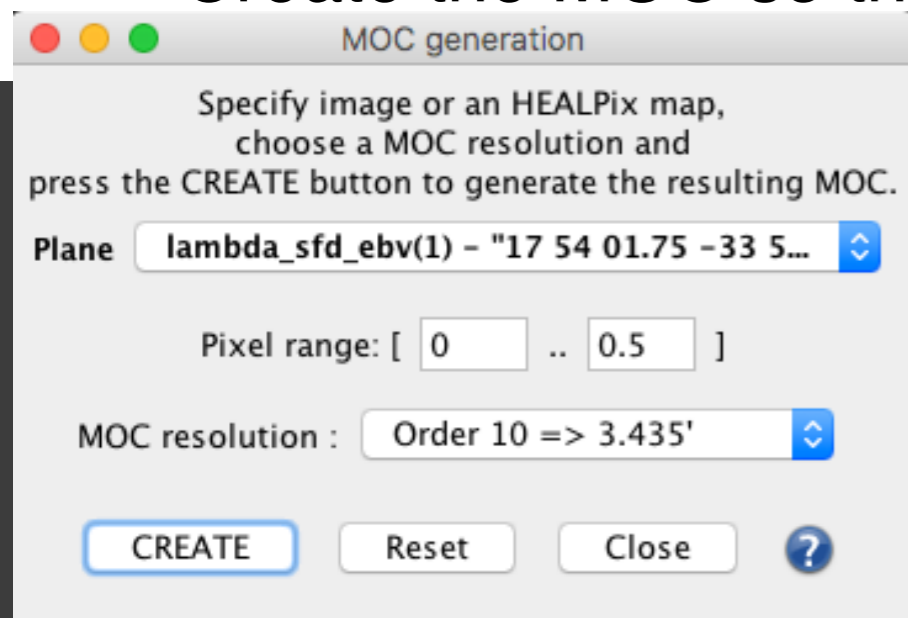
1002\_sr.fits  
1003\_sr.fits  
1004\_sr.fits  
1005\_sr.fits  
1006\_sr.fits  
1007\_sr.fits  
1008\_sr.fits  
1009\_sr.fits  
1010\_sr.fits  
1011\_sr.fits  
1012\_sr.fits  
1013\_sr.fits  
1014\_sr.fits  
1015\_sr.fits  
1016\_sr.fits  
1017\_sr.fits  
1018\_sr.fits  
1019\_sr.fits  
1020\_sr.fits

- Use HiPSgen to create a HiPS for all SR images
- Create the MOC



# □ Create a MOC given a range of fluxes in an healpix image

- Load the HEALPix image E(B-V) from Schlegel Finkbeiner & Davis (1998)
- Create the MOC so that the flux in the map is  $<0.5$  (low extinction)



# Intersection of MOCs

MOC operations

Specify one or two MOC planes,  
choose a MOC operation and  
press the CREATE button to generate the resulting MOC.

Plane `lambda_sfd_ebv(1) MOC - "17 54 01.75 -33 58 24.3"`

Plane `ShortRedHiPS MOC - "15 37 39.72 -49 37 33.0"`

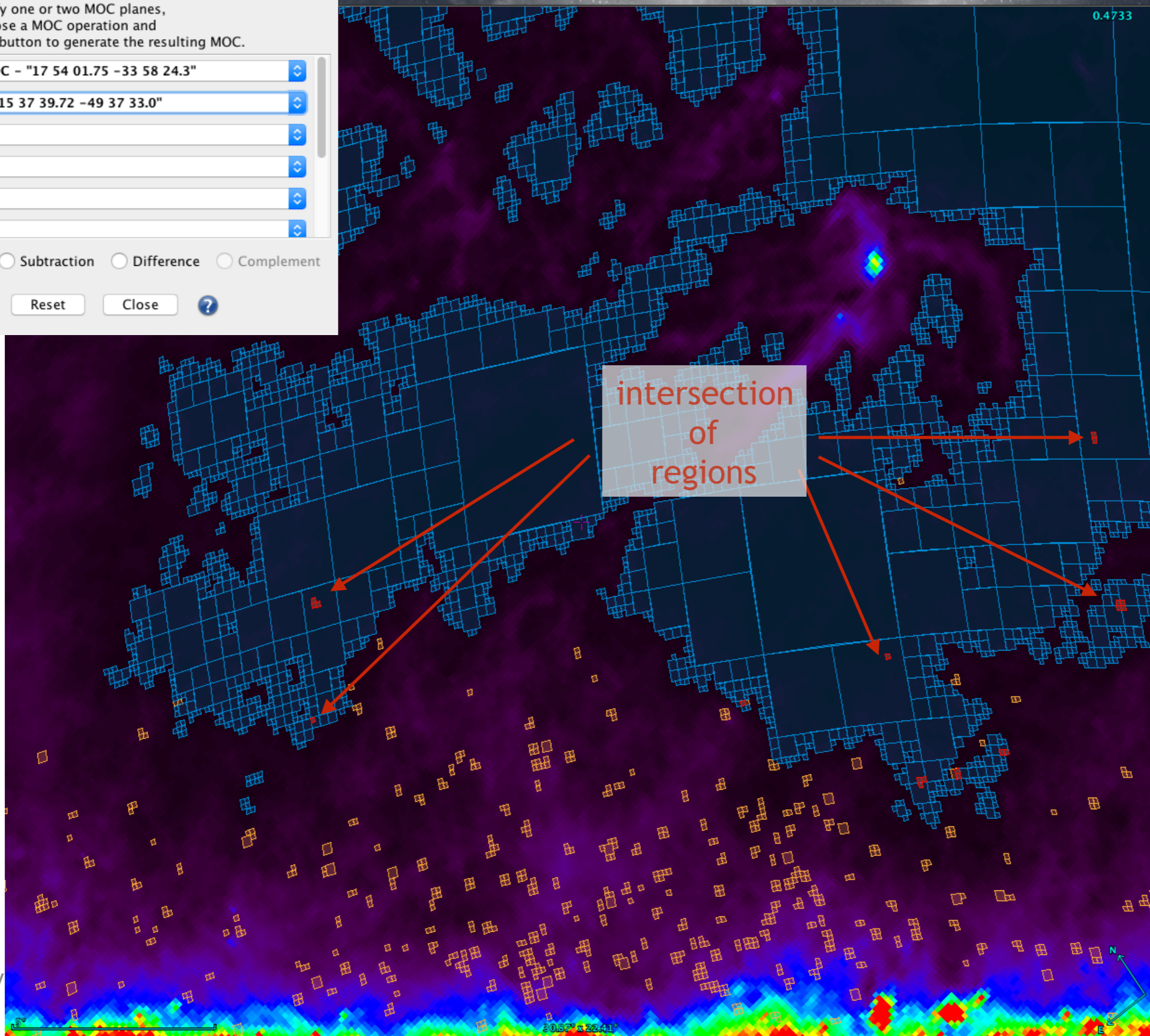
Plane `-- none --`

Plane `-- none --`

Plane `-- none --`

Plane `-- none --`

Union  Intersection  Subtraction  Difference  Complement



# Query by MOC, Fast Xmatch

Aladin v10.0 \*\*\* BETA VERSION (based on v10.003) \*\*\*

Data access → 39 / 19874

Location 17:51:25.24 -35:26:08.7

Frame ICRS Projection Spheric

lambda\_sfd\_ebv(1)

0.4955

0 0.4955 1

- Loading Gaia DR1 sources only in the regions of interest identified previously
- Fast Xmatch with the WISE catalog sources (Cutri et al. 2012)

GaiaSource data (Download Gaia Sources as vo table, fits or csv ) (gaia) (more...)

Provenance: CDS

Sky coverage: 95.36% Nb rows: 1000000000 Reference year: 2016

prog.access  in view  in region or MOC  via Xmatch  by criteria +  Coverage  Density map

CDS/I/337/gaia (more...)

select Gaia

from -- All collections --

Legend:

- CDS/I/337/gaia by MOC
- int lambda\_sfd\_ebv(1) MOCShortRedHIPS
- lambda\_sfd\_ebv(1) MOC
- ShortRedHIPS MOC
- lambda\_sfd\_ebv(1)
- ShortRedHIPS

9

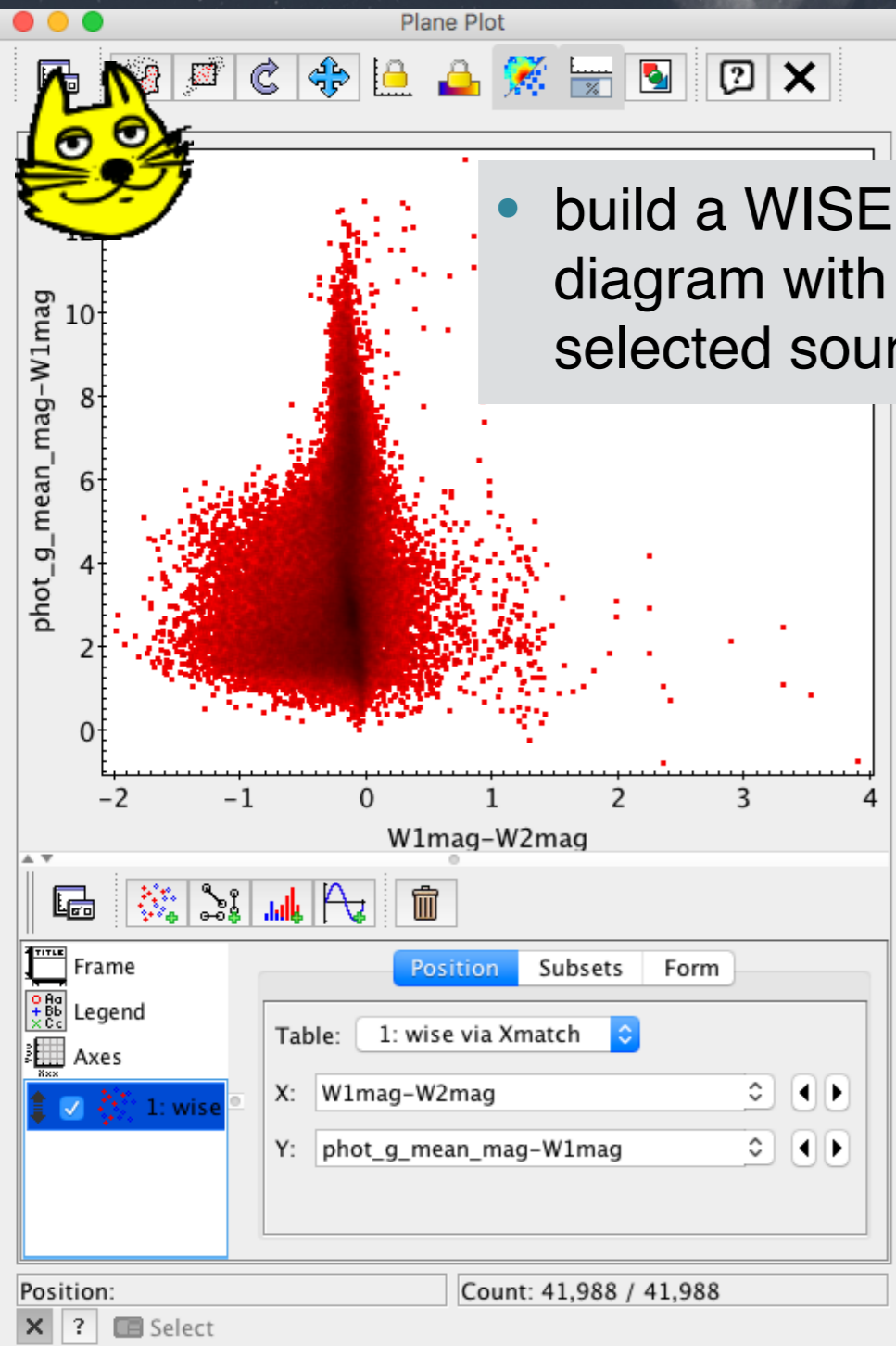
17:51:22.95 -35:40:58.0

40.27 x 29.15

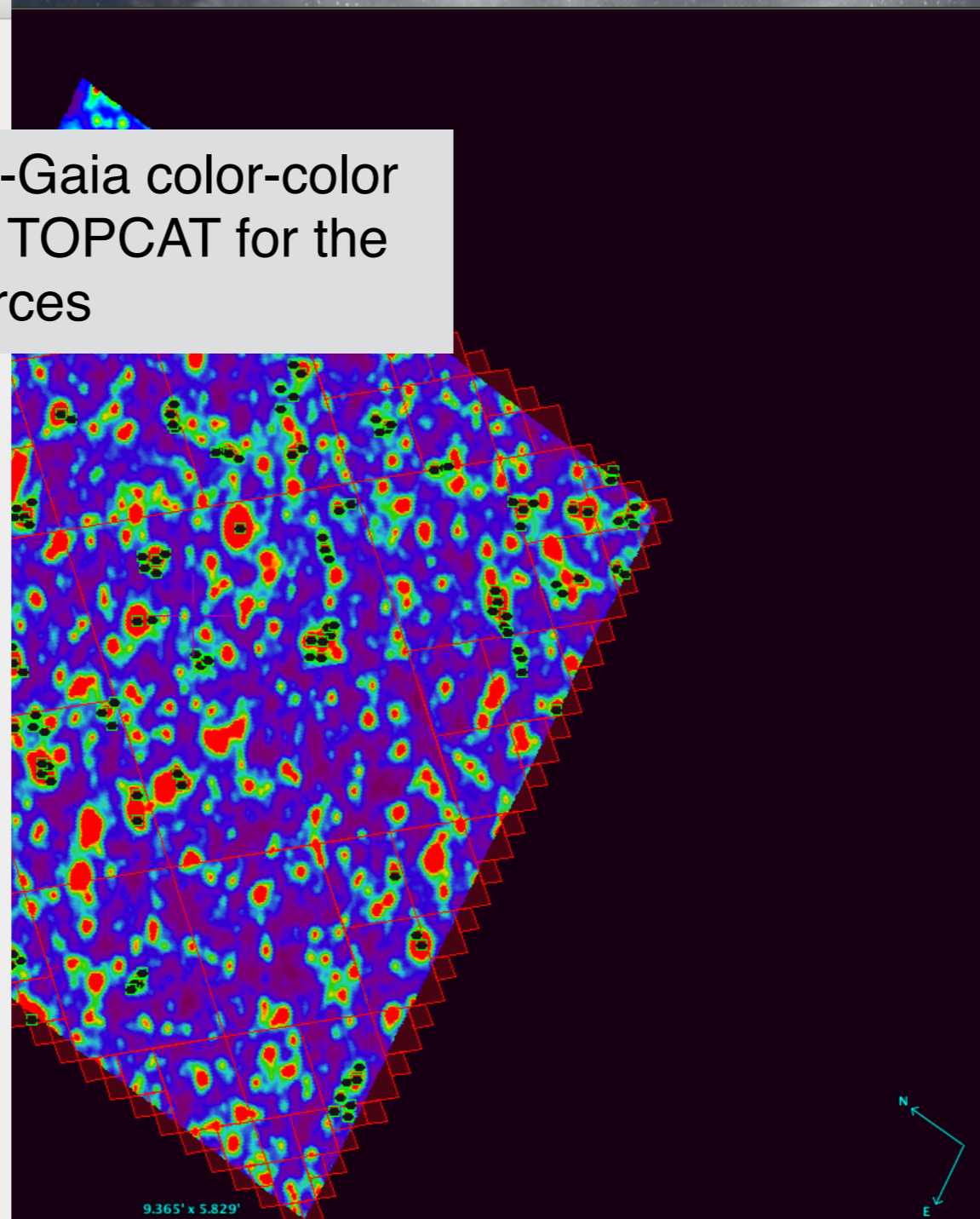
0 sel / 168704 src 146fps /



# Interoperability with VO tools



- build a WISE-Gaia color-color diagram with TOPCAT for the selected sources



- select
- pan
- dist
- phot
- draw
- tag
- moc
- spect
- filter
- cross
- x-y
- rgb
- assoc
- crop
- cont
- pixel
- prop
- del

CDS/II/311/wise via Xmatch

CDS/II/337/gaia by MO...

Int lambda\_sfd\_ebv(1)...

lambda\_sfd\_ebv(1) MO...

ShortRedHIPS MOC

ShortRedHIPS

lambda\_sfd\_ebv(1)

J2000 size dens. opac. zoom

Hide

Reticle to the initial pla

Select all objects in sel

Unselect objects

Create a scatter plot

Create a new plane wit

Delete

Delete empty/error pla

Delete all planes

Create a stack folder

Insert in a new stack fo

Collapse the selected f

Broadcast to all SAMP a

Broadcast selected tabl

Broadcast selected ima

Concatenate...

Column information...

Properties...

... all SAMP applications

topcat

angDist	_RAJ2000	_DEJ2000	ra_ep2000	dec_ep2000	errHalfMaj	errHalfMin	errPosAng	ra	dec	source_id	ref_epoch	ra_error	dec_error	parallax	parallax
3.640080	268.0241...	-35.6807...	268.0241...	-35.6807...	0.003	0.003	90.0	268.0241...	-35.6807...	40406314...	2015.0	3.274	3.144		
3.486150	268.0231...	-35.6806...	268.0231...	-35.6806...	0.004	0.003	90.0	268.0231...	-35.6806...	40406314...	2015.0	3.738	3.409		
0.827212	268.0124...	-35.6689...	268.0124...	-35.6689...	0.006	0.001	0.0	268.0124...	-35.6689...	40406314...	2015.0	0.749	5.867		
3.149078	268.0131...	-35.6684...	268.0131...	-35.6684...	0.003	0.003	90.0	268.0131...	-35.6684...	40406314...	2015.0	3.005	2.666		
3.180142	268.0149...	-35.6680...	268.0149...	-35.6680...	0.003	0.003	90.0	268.0149...	-35.6680...	40406314...	2015.0	2.677	2.526		
2.275926	268.0131...	-35.6676...	268.0131...	-35.6676...	0.007	0.004	90.0	268.0131...	-35.6676...	40406314...	2015.0	7.203	4.056		
4.213305	268.0136...	-35.6694...	268.0136...	-35.6694...	0.008	0.007	90.0	268.0136...	-35.6694...	40406314...	2015.0	7.554	6.707		
4.304178	268.0110...	-35.6697...	268.0110...	-35.6697...	0.003	0.003	90.0	268.0110...	-35.6697...	40406315...	2015.0	3.131	3.1		

# □ Conclusions



- Aladin v10 enables an advanced scientific usage thanks to HiPS and MOC standards and their hierarchical properties on the sky
- New way to explore and interact with data sets
- Fast access to the CDS Xmatch tool
- Without losing functionalities Aladin users are used to, and while keeping the interoperability with all VO compatible services
- Strong potential for new/advanced scientific usage
  
- Aladin v10 is already available as the beta version of Aladin
  - Give it a try!
  - Official release: october 2017

# ipyaladin, a Jupyter/IPython widget for Aladin Lite

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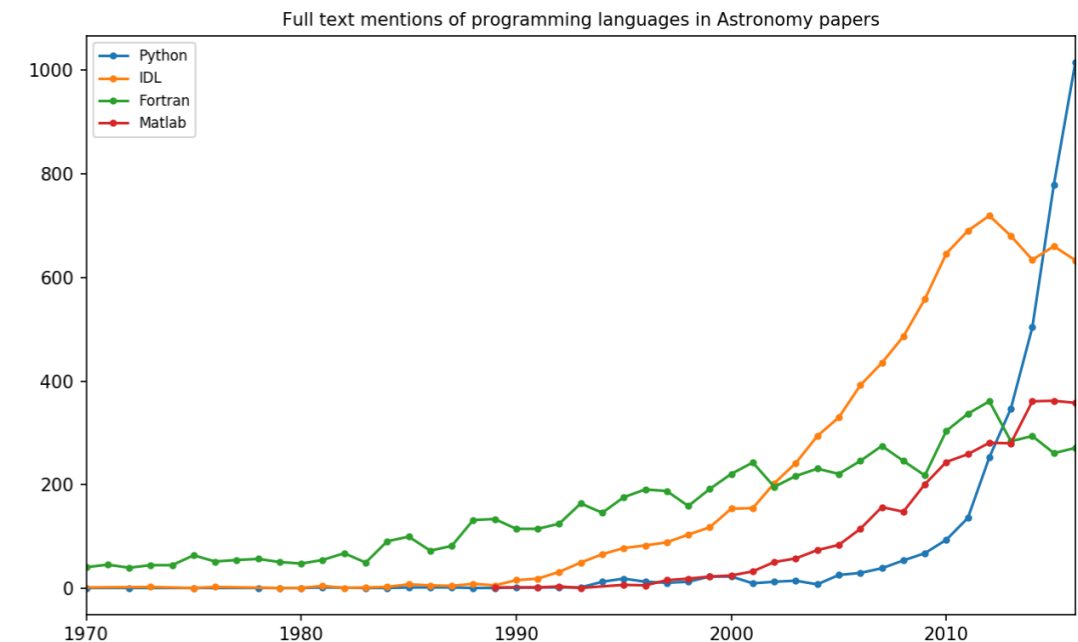
Thomas Boch, Jérôme Desroziers



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# □ Context and motivations

- Python
  - Growing community in astronomy
  - astropy, astroquery, astroML, ...
- Jupyter notebooks
  - Documents with live code, running the browser
  - "reproducible science"
- Jupyter widgets
  - Interactive HTML/JS widgets for Jupyter notebooks



# □ Version 0.1

- v 0.1 developed in two weeks and released mid-July
- Available on GitHub: [github.com/cds-astro/ipyaladin](https://github.com/cds-astro/ipyaladin)
- Installation from pip package manager:  
`pip install ipyaladin`
- Announced on Twitter



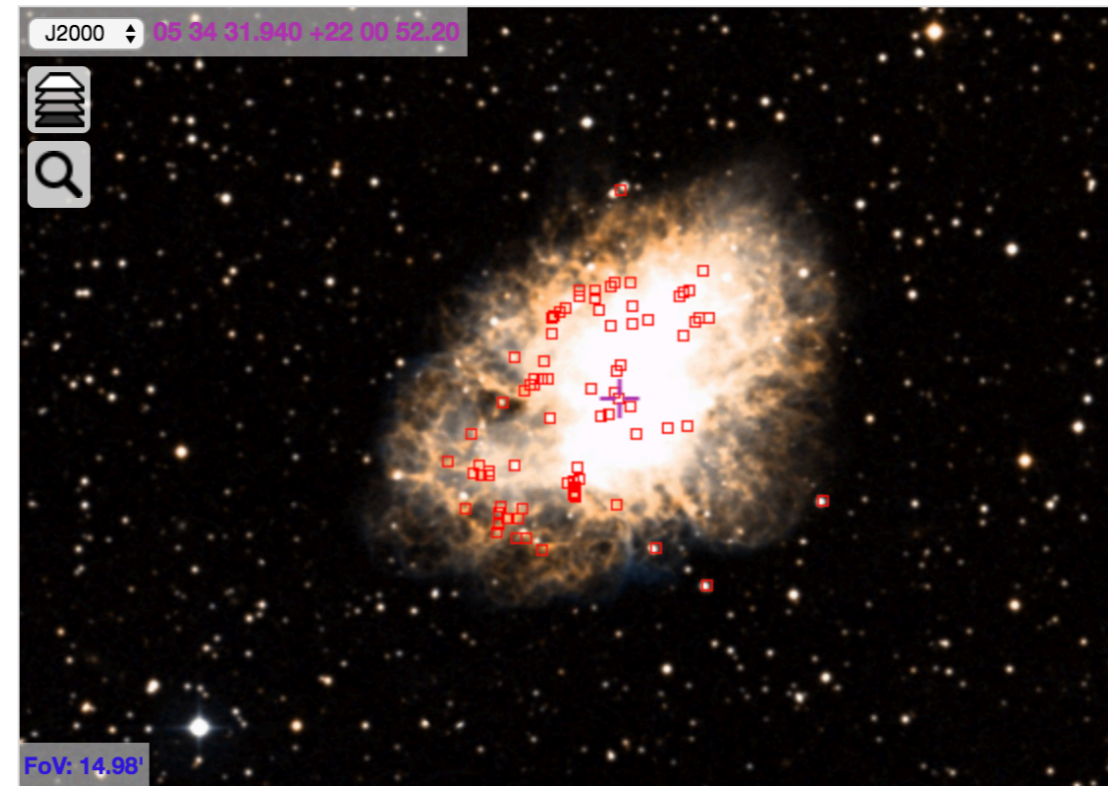
# □ Demo outline

- Simple integration
- Bi-directional communication
- Linked views
- Load an Astropy table  
Load a MOC
- Trigger some processing from actions in Aladin Lite

```
In [3]: from astroquery.simbad import Simbad  
import astropy.units as u
```

```
In [4]: Simbad.SIMBAD_URL = 'http://simbad.harvard.edu/simbad/sim-script'  
table = Simbad.query_region("m1", radius=0.05 * u.deg)
```

```
In [5]: aladin= ipyal.Aladin(fov= 0.25, target= 'm1')  
aladin
```



```
In [6]: aladin.add_table(table)
```