HiPS – IVOA standard process

Interop – may 2016 – Cape Town – South Africa

Presented by

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Plan

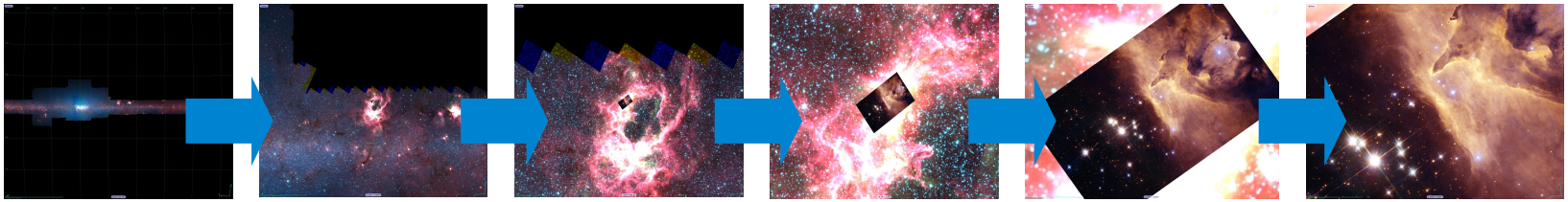
1) Recap on HiPS
2) State of the art
3) HiPS Network
4) Progress towards an IVOA standard
5) Next steps
6) Aladin Lite news and improvements

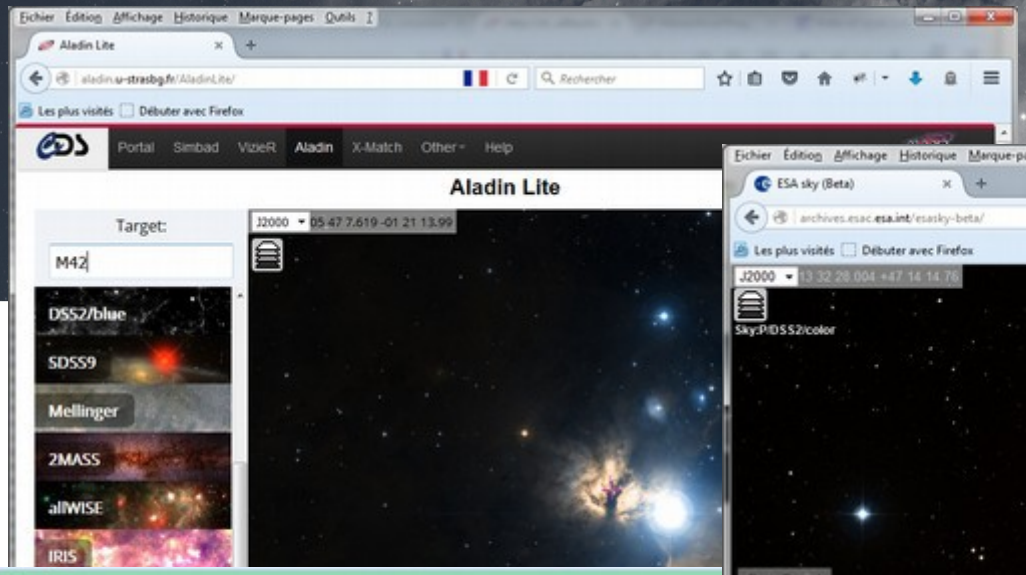
HiPS – What is it?

Hierarchical Progressive Survey

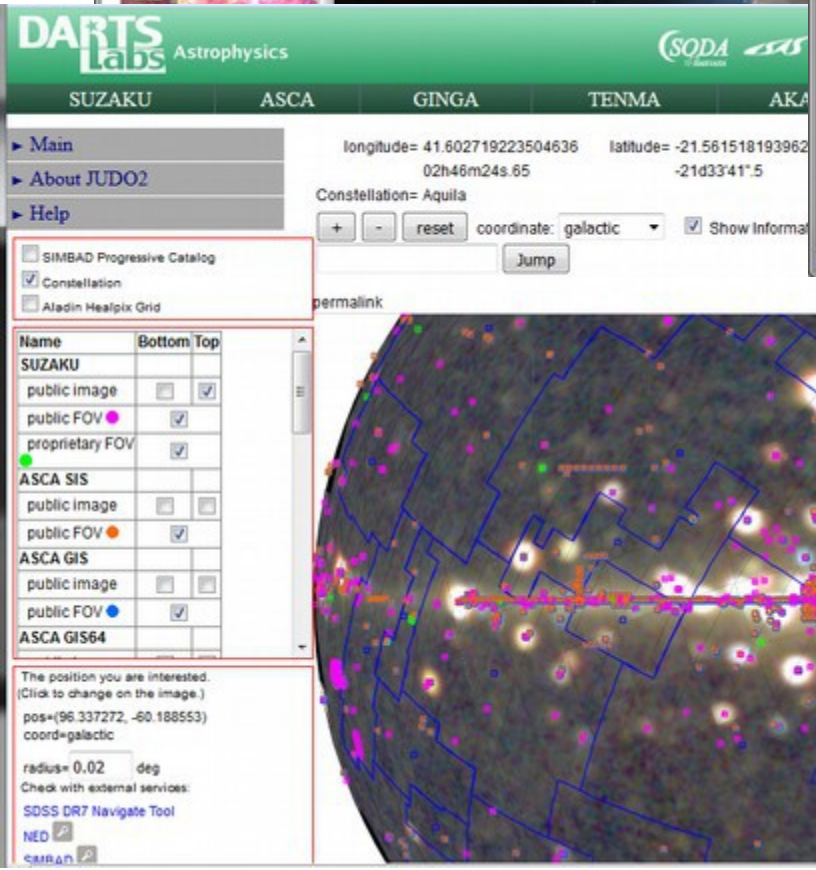
"*The more you zoom in on a particular area, the more details show up*"

- Multi-resolution HEALPix data structure
  for Images, Catalogues, 3-dimensional data cubes, ...
- Keep scientific data properties
- Seamless multi-scale visualisation
- No databases or dedicated servers required, just HTTP upon a file hierarchy




Aladin Lite
Portal
Simbad
VizieR
Aladin
X-Match
Other
Help
Aladin Lite
Target:
M42
DSS2/blue
SDSS9
Mellinger
2MASS
allWISE
IRIS


ESA sky (Beta)
Les plus visités
Débuter avec Firefox
J2000
Upload target list
Sky:P/DSS2/color
Data Panel
ESA Observations
ESA Catalogues
XMM-Newton
XMM-OM(UV)
XMM-OM(UVE)
HST
ISO
Herschel
INTEGRAL
XMM Slew
3XMM EPIC
XMM OM
Tycho-2
HSC
Close data panel
esa


DARTS Labs
Astrophysics
SODA
SUZAKU
ASCA
GINGA
TENMA
Main
About JUDO2
Help
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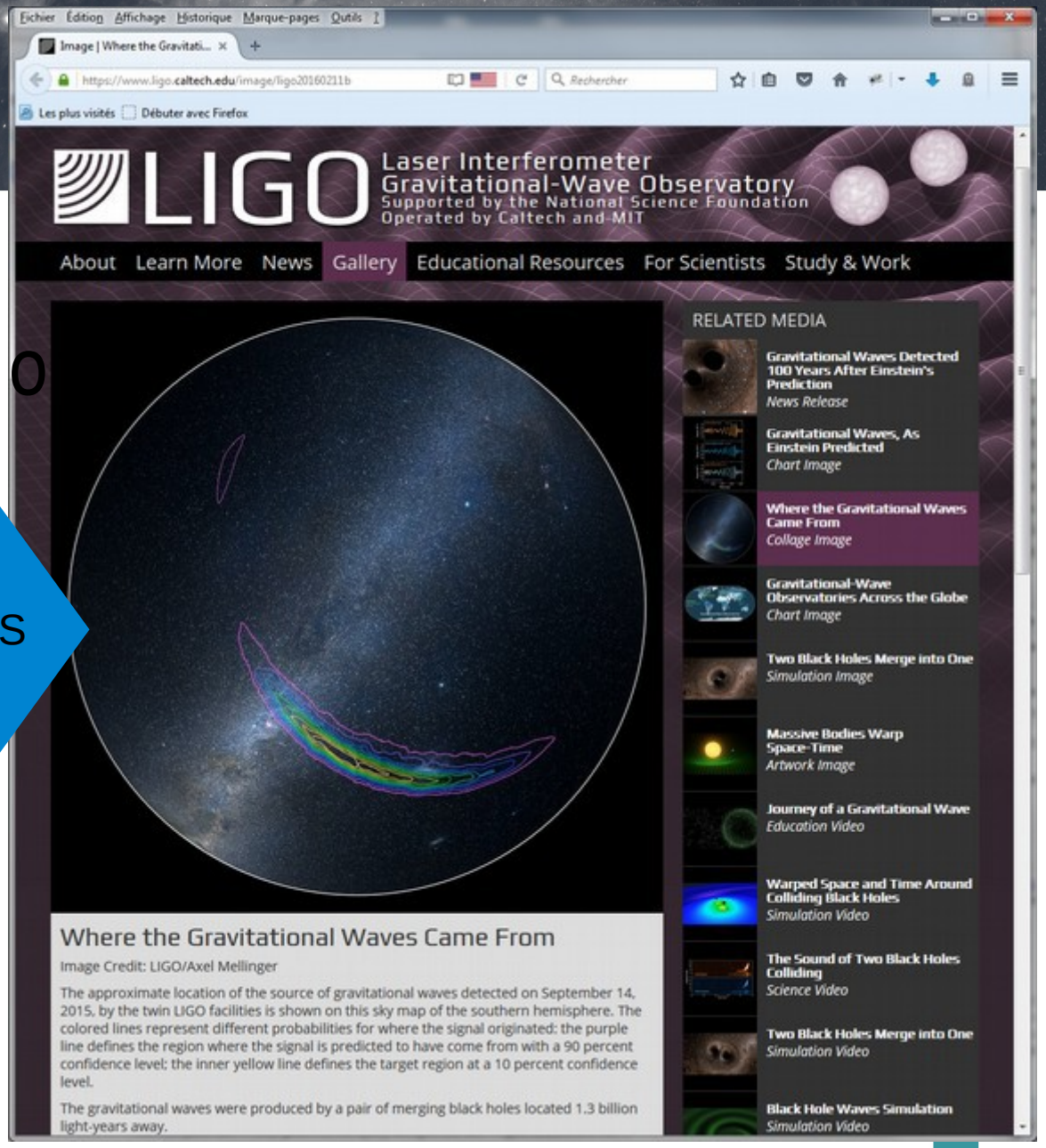
02h46m24s.65
latitude= -21.561518193962
-21d33'41".5
Constellation= Aquila
reset
coordinate: galactic
Jump
permalink
SIMBAD Progressive Catalog
Constellation
Aladin Healpix Grid
Name
Bottom
Top
SUZAKU
public image
public FOV
proprietary FOV
ASCA SIS
public image
public FOV
ASCA GIS
public image
public FOV
ASCA GIS64
The position you are interested.
(Click to change on the image.)
pos=(96.337272, -60.188553)
coord=galactic
radius= 0.02 deg
Check with external services:
SDSS DR7 Navigate Tool
NED
SIMBAD

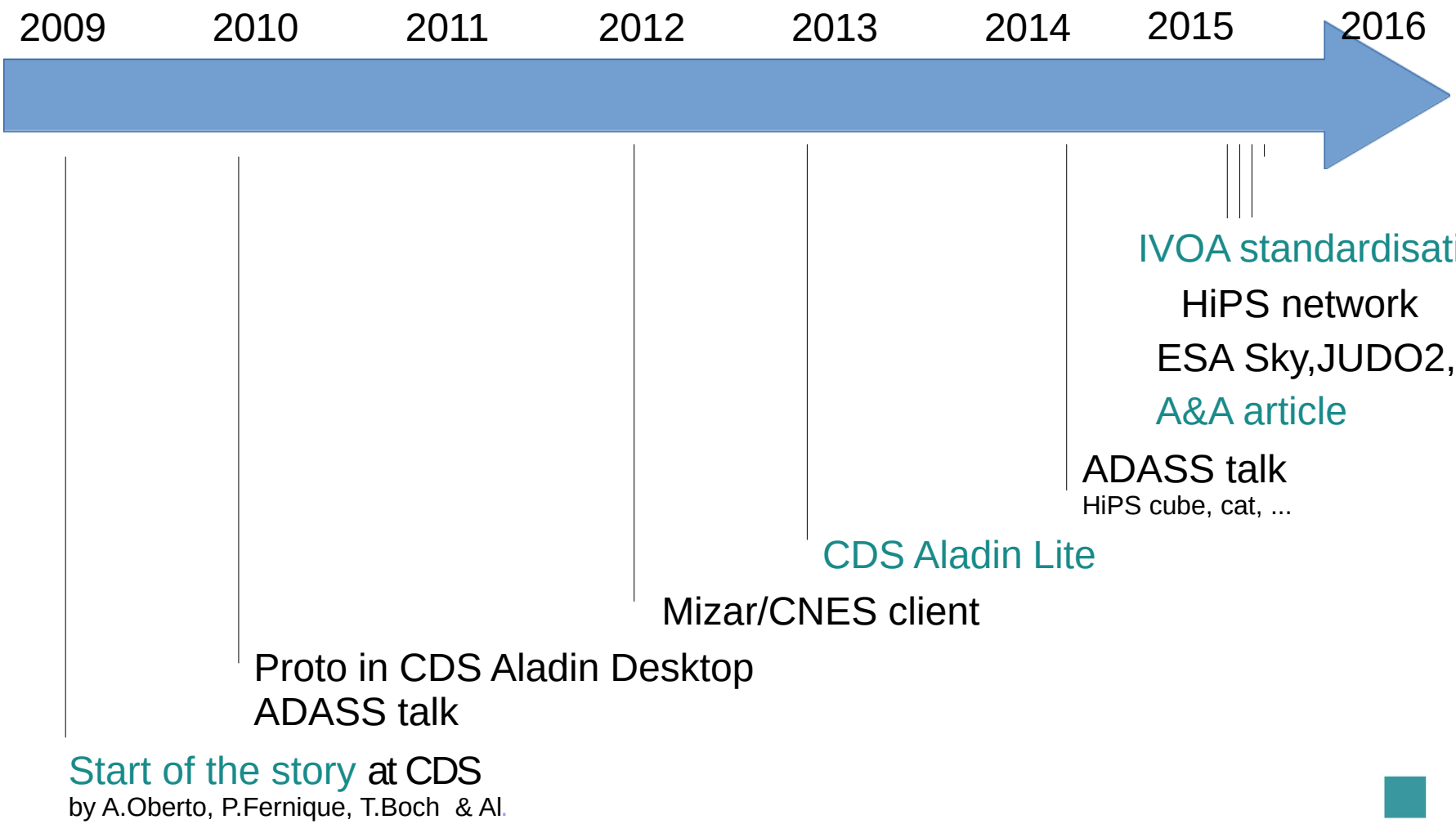

[View 82] - GALEX colored

At the forefront o science

Yes ! it is a HiPS



HiPS timeline



State of the art (May 2016)

- 300+ HiPS for 85TB data (CDS 92%, CADC 5%, ESAC 2%)
- 300 000+ HiPS tiles requested / day (+40% in 1 year, CDS only)
- More and more HiPS clients :

→ Aladin Desktop (CDS), Aladin Lite (CDS), MIZAR (CNES)
+ in dev: STScI MAST portal (NASA), openWWT, China-VO proto, …

+ Aladin Lite implementation: ESA Sky (ESAC), JUDO2 (JAXA), SkyWatch, ...
+ Aladin Lite web page integration: Simbad, VizieR, GLIMPSE360, CADE, ADS AllSky, CASSIS, Akari-Viewer, VistaOrion, ASTRODEEP, CDS portal v2…
+ Aladin Desktop Outreach usage: ArchesWalker

State of the art (May 2016)

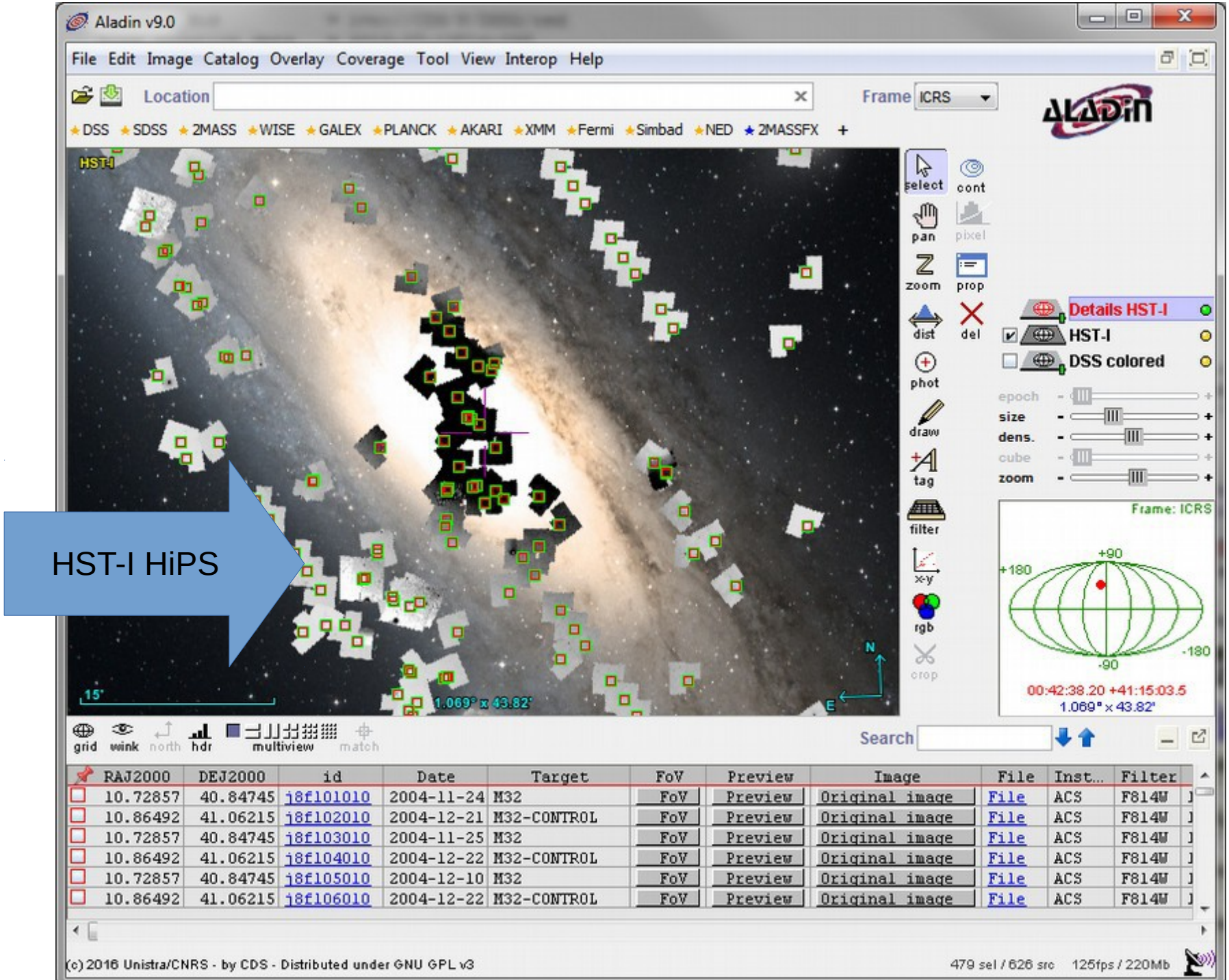
- 12+ HiPS nodes

  → CDS, SSC XMM-Newton, IAS, IRAP/CADE, IPAC, ADS, ESAC, JAXA, AMIGA, Spanish-VO, Vista-Orion, TGSSADR...

- 2 HiPS creation toolkits
  - Images & cubes: Aladin/Hipsgen (performance: 100Gpix/hour),
  - Catalogs: Hipsgen-cat
- 1 refereed paper → 2015A&A...578A.114F
- Documentation → http://aladin.unistra.fr/hips
  ("*Make your HiPS in 10 steps*", *Aladin Lite examples*, ...)

HiPS in action – one example

- **HST & HLA : 48 HiPS**
  built by D.Durand/CADC – released in Feb 2016
  - grouped by "usual filters": B, CO, H, H2O, Halpha, HBeta, I, J, NII, OII, OIII, Palpha, Palpha_c, R, SDSSg, SDSSr, SDSSz, SIII, U, UV, V, Y, wideUV, wideV (rather than wavelength ranges)
  - Tiles provided in both low and full dynamic range
  - Access to "progenitors": direct links to original data archive images
  - Incremental updates: supported by "-live" HiPSgen option


Aladin v9.0
File Edit Image Catalog Overlay Coverage Tool View Interop Help
Location
Frame ICRS
DSS SDSS 2MASS WISE GALEX PLANCK AKARI XMM Fermi Simbad NED 2MASSFX
HST-I
select cont pan pixel zoom prop dist del phot draw tag filter x-y rgb crop
Details HST-I
HST-I
DSS colored
epoch size dens. cube zoom
Frame: ICRS
+90 +180 -180 -90
00:42:38.20 +41:15:03.5
1.069° x 43.82'
15'
1.069° x 43.82'
N E
grid wink north hdr multiview match
Search
RAJ2000 DEJ2000 id Date Target FoV Preview Image File Inst... Filter
10.72857 40.84745 j8f101010 2004-11-24 M32 FoV Preview Original image File ACS F814W
10.86492 41.06215 j8f102010 2004-12-21 M32-CONTROL FoV Preview Original image File ACS F814W
10.72857 40.84745 j8f103010 2004-11-25 M32 FoV Preview Original image File ACS F814W
10.86492 41.06215 j8f104010 2004-12-22 M32-CONTROL FoV Preview Original image File ACS F814W
10.72857 40.84745 j8f105010 2004-12-10 M32 FoV Preview Original image File ACS F814W
10.86492 41.06215 j8f106010 2004-12-22 M32-CONTROL FoV Preview Original image File ACS F814W
(c) 2016 Unistra/CNRS - by CDS - Distributed under GNU GPL v3
479 sel / 626 src 125fps / 220Mb

HST-I HiPS

The HiPS philosophy

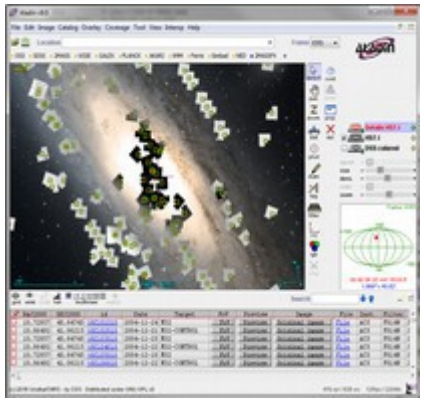
- Universal: Anybody should be able to generate HiPS (authors, projects, missions, archives, data centers...)
- Scientific trust: HiPS should be generated by the data curators (they know best their data).
- Efficient: HiPS should be distributed by several sites and mirrored/synchronized as much as possible
- Simple: from the user point of view: "click & play" !

How to build HiPS network

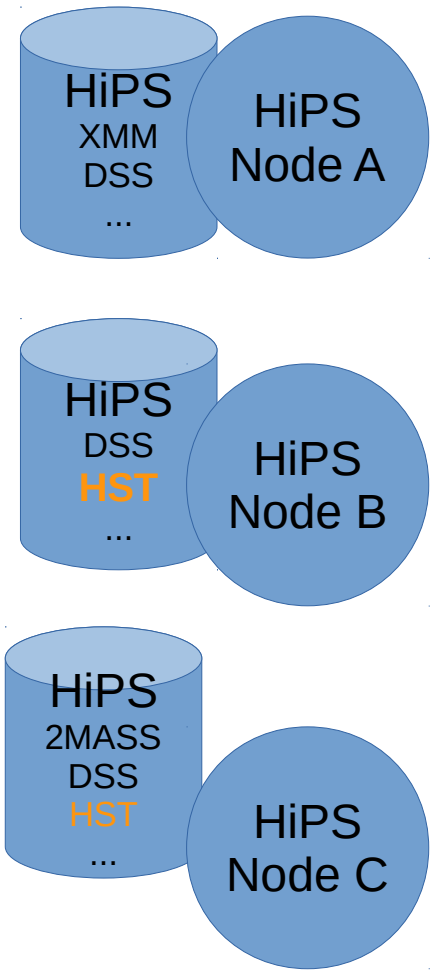
- HiPS registry = "registry" providing the list of HiPS nodes
  (CDS)
- HiPS node = HTTP server distributing HiPS and exposing its HiPS list
  (CDS, ESA, XMM-Newton, ...)
- HiPS list = list of the HiPS (with associated meta-data a la ObsCore) distributed by one HiPS node
  CDS: DSS2, SDSS, HST, AllWISE, ...

HiPS network

HiPS clients

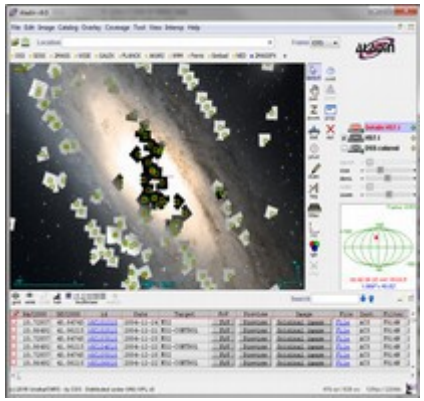


HiPS nodes



HiPS network

HiPS clients



HiPS nodes

HiPS
XMM
DSS
...
HiPS Node A

HiPS
DSS
HST
...
HiPS Node B

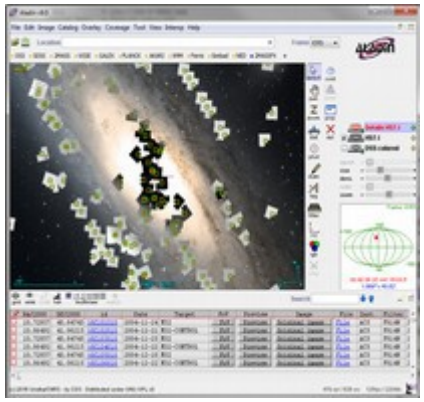
HiPS
2MASS
DSS
HST
...
HiPS Node C

HiPS registry

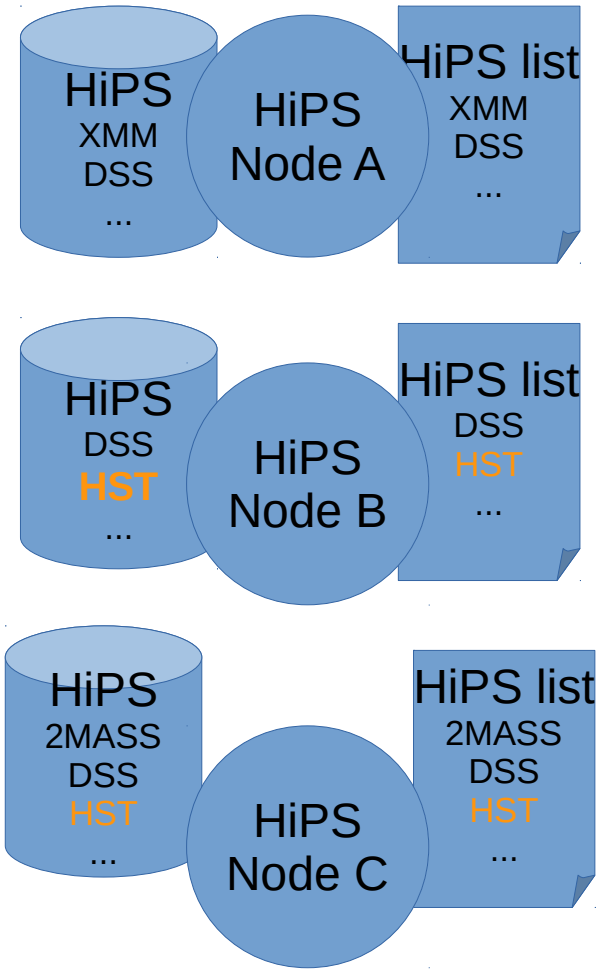
HiPS registry
- HiPS node A
- HiPS node B
- HiPS node C

HiPS network

HiPS clients



HiPS nodes

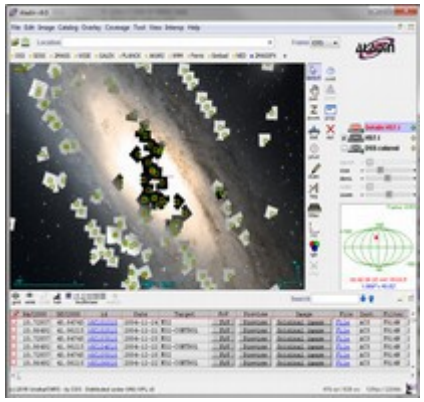


HiPS registry

HiPS registry
- HiPS node A
- HiPS node B
- HiPS node C

HiPS network

HiPS clients



HiPS nodes

HiPS
XMM
DSS
...

HiPS Node A

HiPS list
XMM
DSS
...

HiPS
DSS
HST
...

HiPS Node B

HiPS list
DSS
HST
...

HiPS
2MASS
DSS
HST
...

HiPS Node C

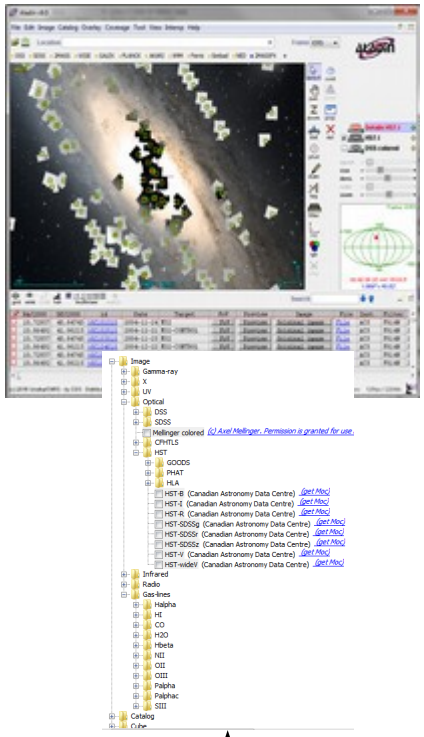
HiPS list
2MASS
DSS
HST
...

HiPS registry

HiPS registry
- HiPS node A
- HiPS node B
- HiPS node C

Aggregation
XMM: A
DSS: A,B,C
HST: B,C
2MASS: C

HiPS network



HiPS clients

HiPS nodes

HiPS
XMM
DSS
...

HiPS Node A

HiPS list
XMM
DSS
...

HiPS
DSS
HST
...

HiPS Node B

HiPS list
DSS
HST
...

HiPS
2MASS
DSS
HST
...

HiPS Node C

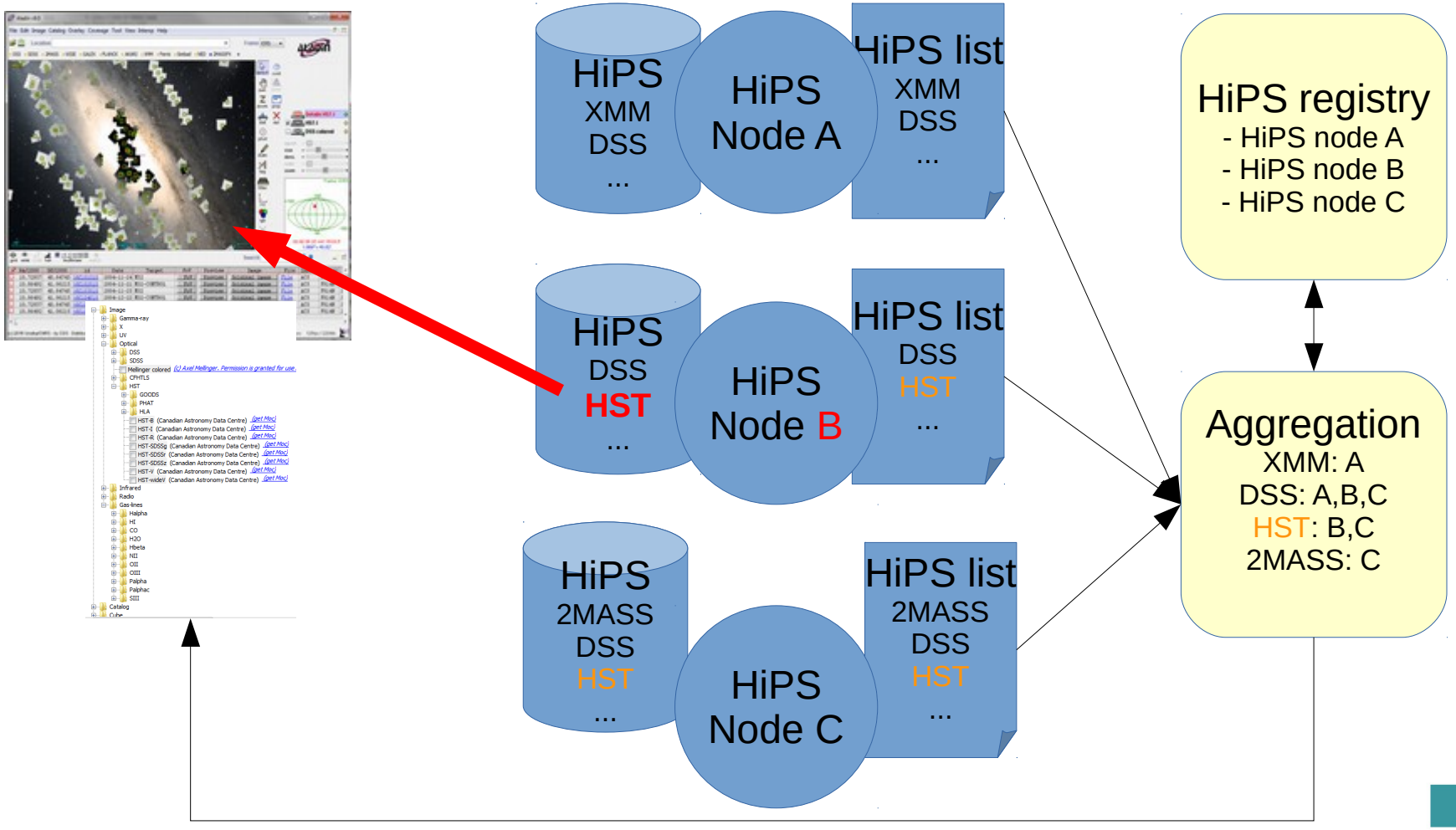
HiPS list
2MASS
DSS
HST
...

HiPS registry

HiPS registry
- HiPS node A
- HiPS node B
- HiPS node C

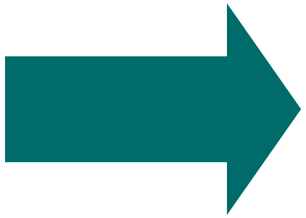
Aggregation
XMM: A
DSS: A,B,C
HST: B,C
2MASS: C

HiPS network



HiPS metadata

Properties file provided with each HiPS



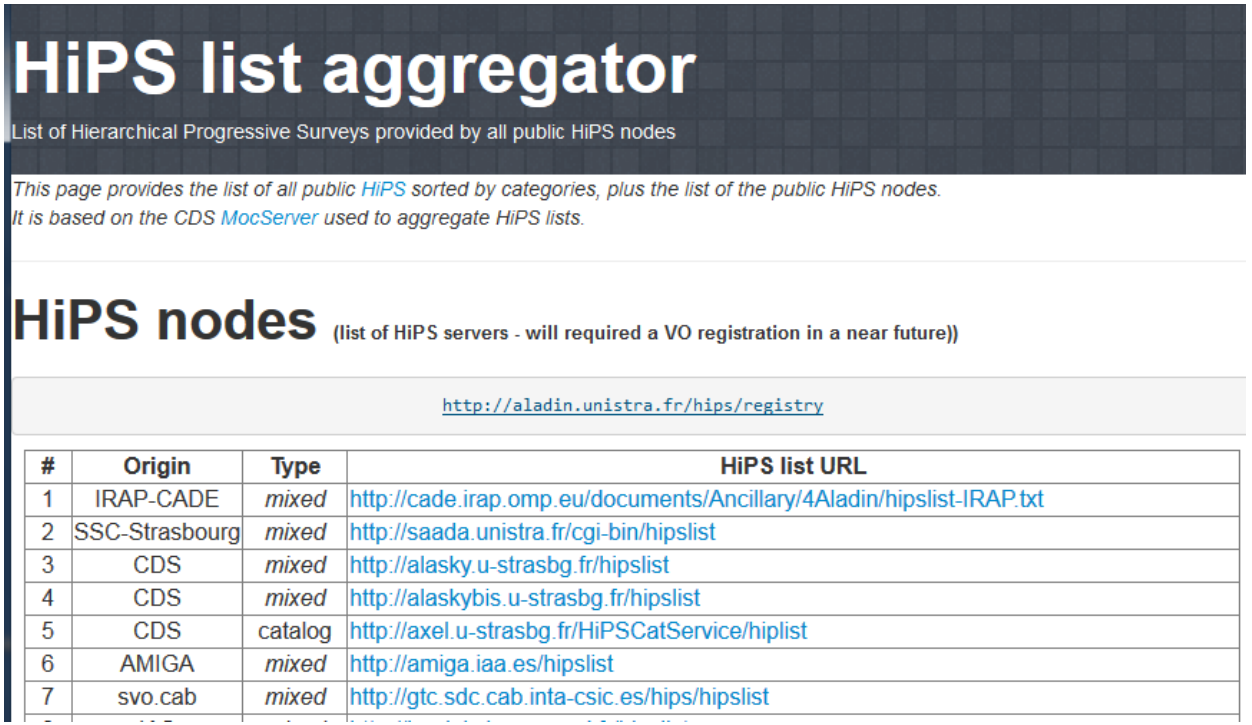
```
creator_did             = ivo://CDS/P/DSS2/color
obs_collection          = DSS colored
obs_title               = DSS2 optical HEALPix survey, color (R=red[~0.6um]/G
obs_description         = Color composition generated by CDS. This HiPS surve
obs_copyright           = Digitized Sky Survey - STScI/NASA, Colored & Healpi
obs_copyright_url       = http://archive.stsci.edu/dss/acknowledging.html
client_category         = Image/Optical/DSS
client_sort_key         = 03-00
hips_builder            = Aladin/HipsGen v8.149
hips_builder            = Aladin/HipsGen v8.133
hips_creation_date      = 2010-05-01T19:05Z
hips_release_date       = 2015-05-11T08:45Z
hips_publisher          = CDS (A.Oberto, P.Fernique)
hips_version            = 1.3
hips_order              = 9
hips_frame              = equatorial
hips_tile_width         = 512
hips_tile_format        = jpeg
dataproduct_type        = image
dataproduct_subtype     = color
hips_glu_tag            = P-DSS2-color.hpx
client_application      = AladinLite
client_application      =
moc_access_url          =
hips_service_url        =
hips_status             =
hips_rgb_red            =                                        Linear]
hips_rgb_blue           = DSS2-blue-XJ-S [4286.0 12122.5 19959.0 Linear]
hips_hierarchy          = median
hips_pixel_scale        = 2.236E-4
moc_sky_fraction        = 1
hips_service_url_1      = http://alaskybis.u-strasbg.fr/DSS/DSSColor
hips_status_1           = public mirror clonable
moc_order               = 9
obs_initial_ra          = 0
obs_initial_dec         = +0
obs_initial_fov         = 0.11451621372724685
```

http://alasky.u-strasbg.fr/DSS/DSSColor

public master clonable

CDS MocServer: HiPS list aggregator

→ http://alasky.unistra.fr/MocServer/query →
http://aladin.unistra.fr/hips/list



HiPS list aggregator

List of Hierarchical Progressive Surveys provided by all public HiPS nodes

This page provides the list of all public HiPS sorted by categories, plus the list of the public HiPS nodes.
It is based on the CDS MocServer used to aggregate HiPS lists.

HiPS nodes (list of HiPS servers - will required a VO registration in a near future))

http://aladin.unistra.fr/hips/registry

#	Origin	Type	HiPS list URL
1	IRAP-CADE	*mixed*	http://cade.irap.omp.eu/documents/Ancillary/4Aladin/hipslist-IRAP.txt
2	SSC-Strasbourg	*mixed*	http://saada.unistra.fr/cgi-bin/hipslist
3	CDS	*mixed*	http://alasky.u-strasbg.fr/hipslist
4	CDS	*mixed*	http://alaskybis.u-strasbg.fr/hipslist
5	CDS	catalog	http://axel.u-strasbg.fr/HiPSCatService/hiplist
6	AMIGA	*mixed*	http://amiga.iaa.es/hipslist
7	svo.cab	*mixed*	http://gtc.sdc.cab.inta-csic.es/hips/hipslist

IVOA HiPS standardisation

9 months

- IVOA note (oct 2015) → http://www.ivoa.net/documents/Notes/HiPS/
- IVOA Sydney agreement (nov 2015) :

  IVOA endorsement of HiPS
- Discussion (in progress)
- Identification & VO registration → agreement !
- HiPS standards (protocols+metadata) → WD in progress..
- IVOA WD in progress (ready for Trieste)

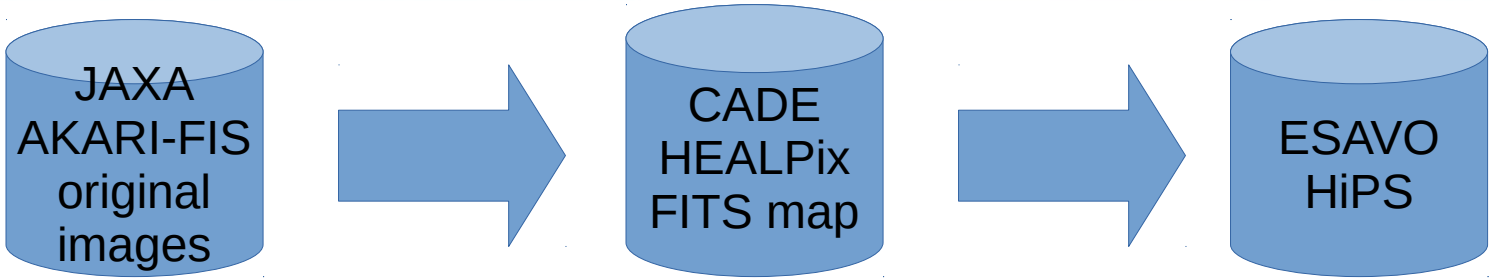
  Authors aff.: CDS, CADC, SSC, ESAC, ALMA, NASA

HiPS standardisation status

1) The IVOA HiPS standard will recommend to use a valid IVOID identifier for any generated HiPS, for instance ivo://authority_id?obs_id (ex: ivo://CDS?P/DSS2/color) with the constraint to declare ASAP the authority_id in the VO registry if it is not yet the case;
2) This identifier will be stored in the HiPS properties file under the creator_did keyword;
3) In addition, any provider can declare his HiPS in the VO registry:
   - as individual entries in the VO Registry
   - through a HiPS node which should be present in the VO Registry

Properties file

Provenance/acknowledgement example

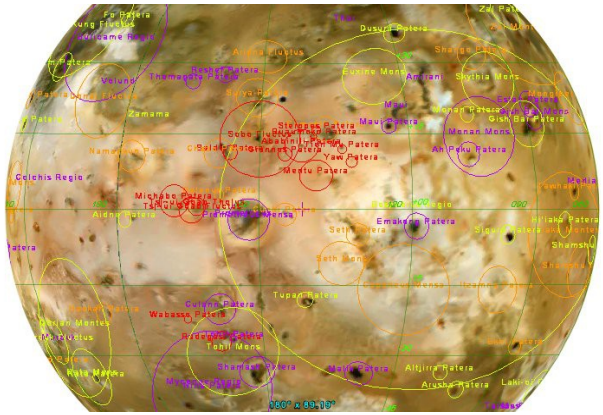



```
creator_did      = ivo://ESAVO/P/AKARI/color
obs_title        = AKARI-FIS color
obs_collection   = AKARI
obs_description = AKARI FIS All-Sky Survey HEALPIX map produced by the
Centre d'Analyse de Donnees Etendues (CADE) with the original processed
data from ISAS/JAXA.
obs_ack          = CADE/IRAP
obs_ack          = ISAS/JAXA
prov_progenitor = CADE
prov_did         = ivo://CADE/AKARI
bib_reference    = 2007PASJ...59S.389K
hips_creator     = ESAC
hips_copyright   = public
obs_copyright    = (c) JAXA - public
hips_service_url= http://skies.esac.esa.int/AKARI/color/
hips_status      = public master clonable
```

Next steps

- Finalize the IVOA WD
- Pursue the HiPS implementation

  eg: HiPS catalogs (~15 000 HiPS)
- Start the VO registry declarations

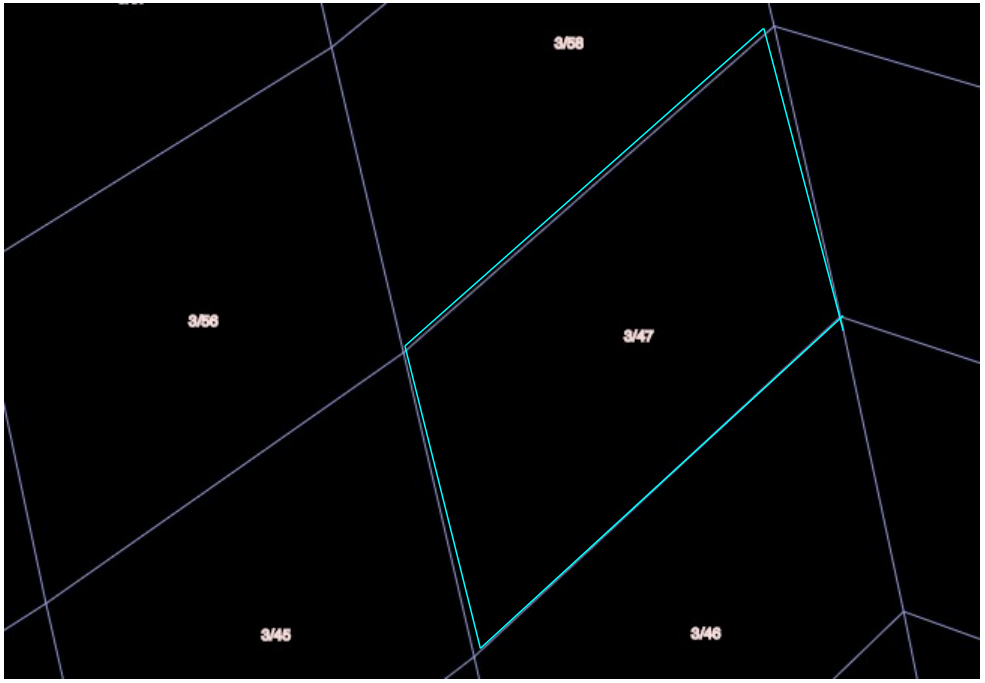


- Look for a usage statistics report protocol
- Improve/validate HiPS "live" survey (HST, DES HiPS)
- HiPS extension to planetary data (EuroPlanet project)

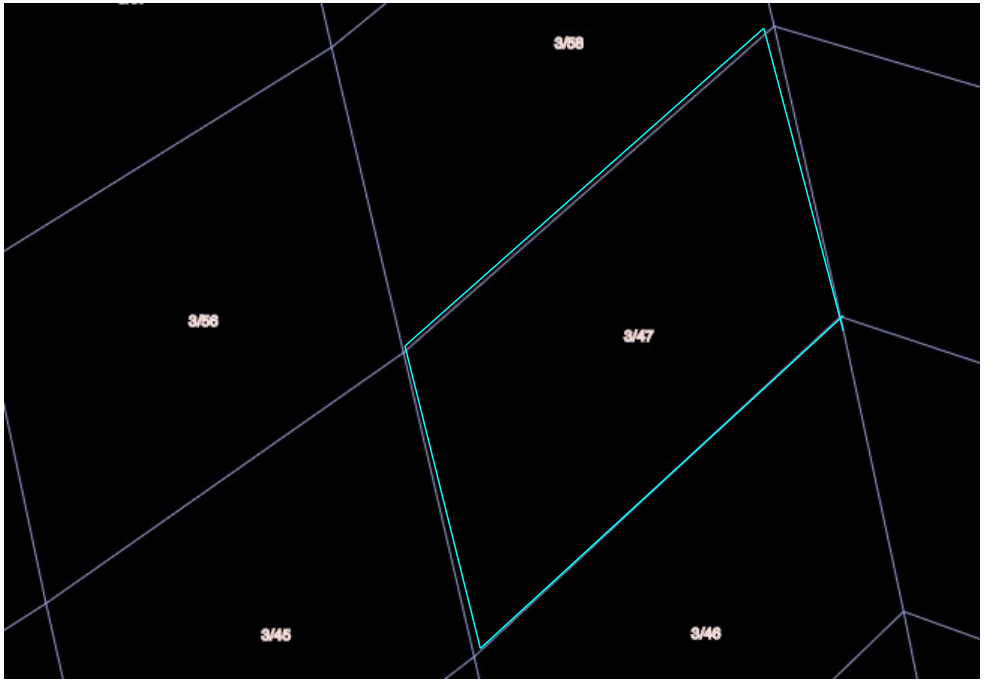
Aladin Lite news & improvements

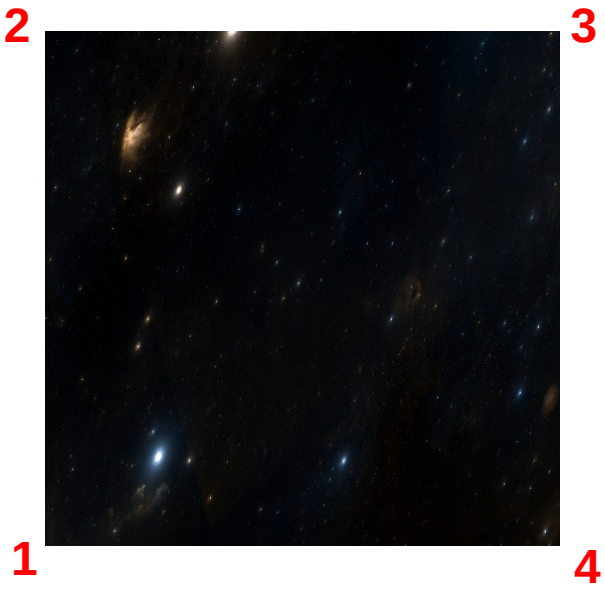
- Major improvement: fixing astrometry offsets
  - For strong-distorted tiles, affine transformation not good enough
  - Need to subdivide until deformation is acceptable
    (same algorithm as Aladin Desktop)
  - Challenges: keep performances compatible with interactivity
  - Limitations: current version of Javascript HEALPix library limited to NORDER=13
  - Improvement available in beta version
    Released in public version by end of month

Tile drawing algorithm

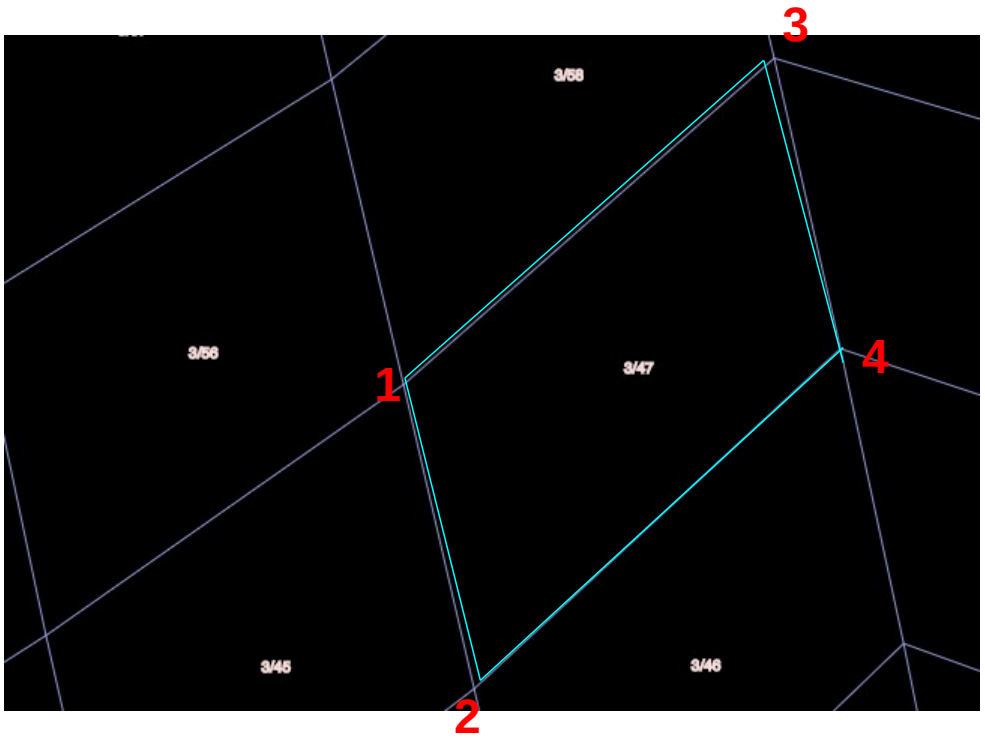


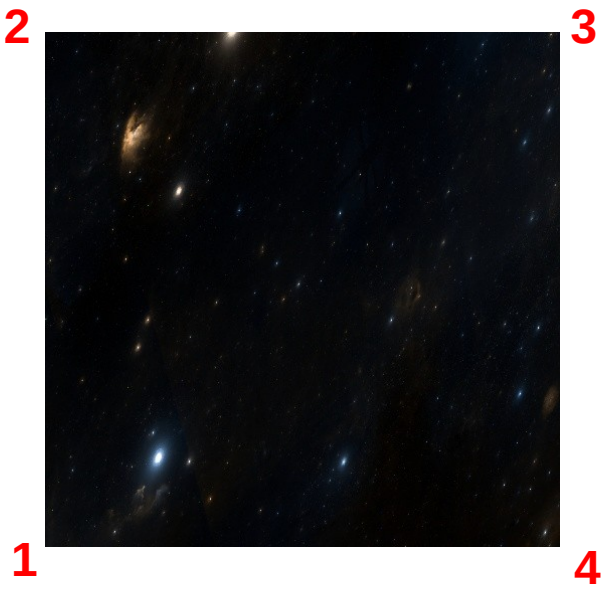
Tile drawing algorithm



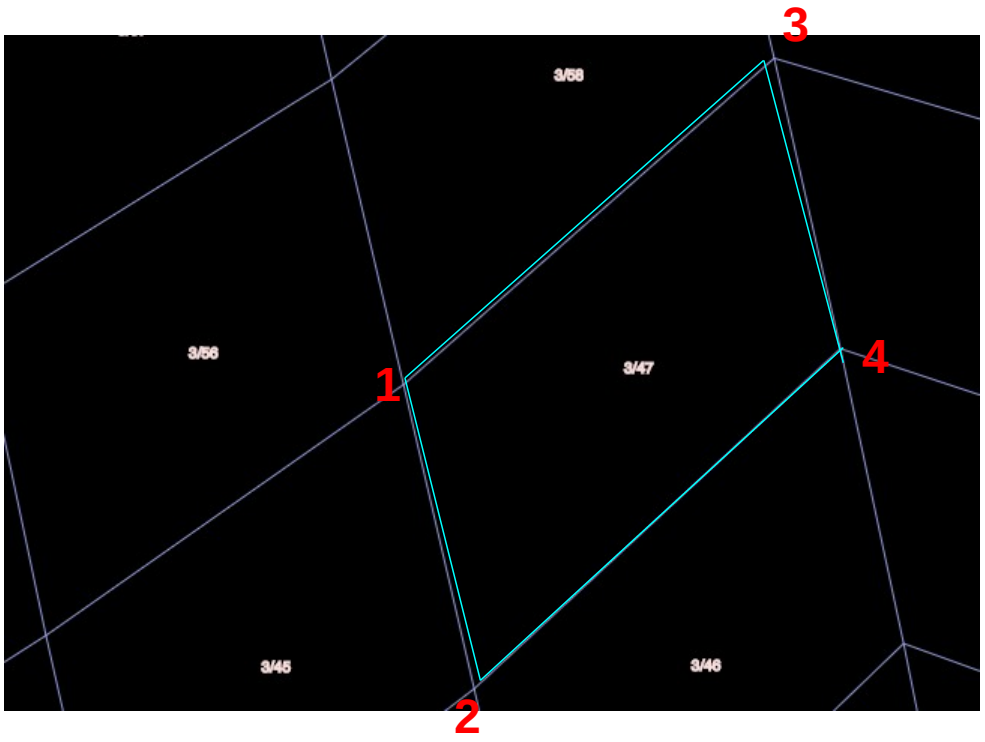


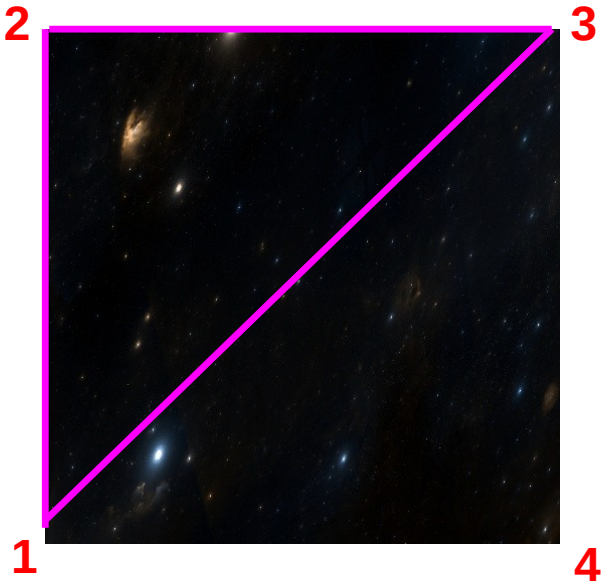
Tile drawing algorithm



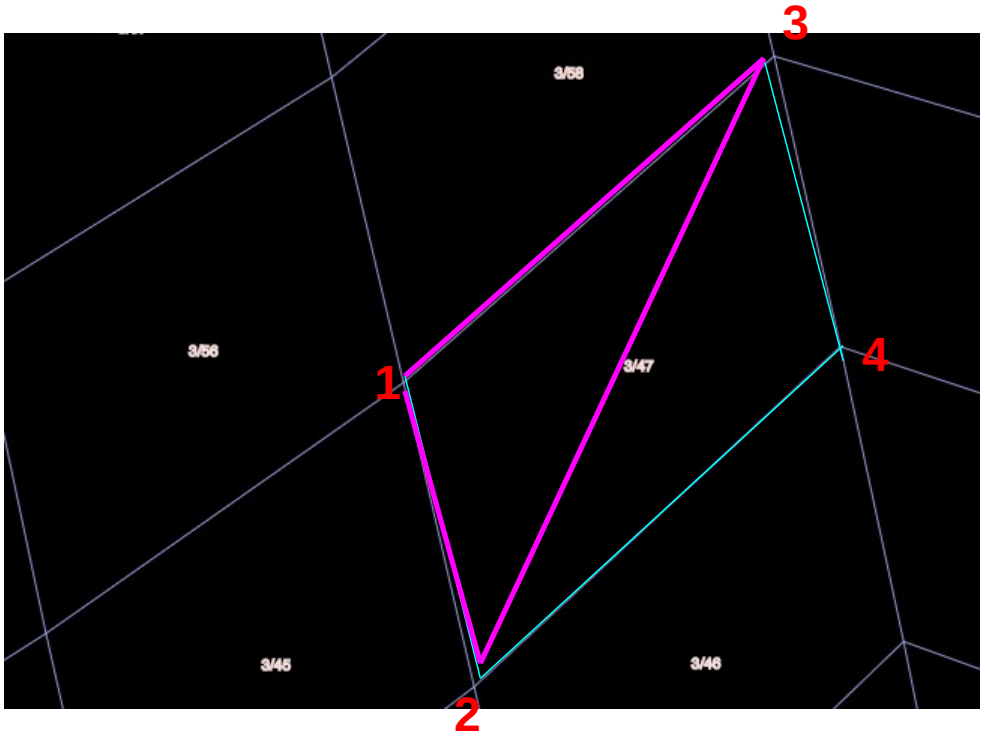


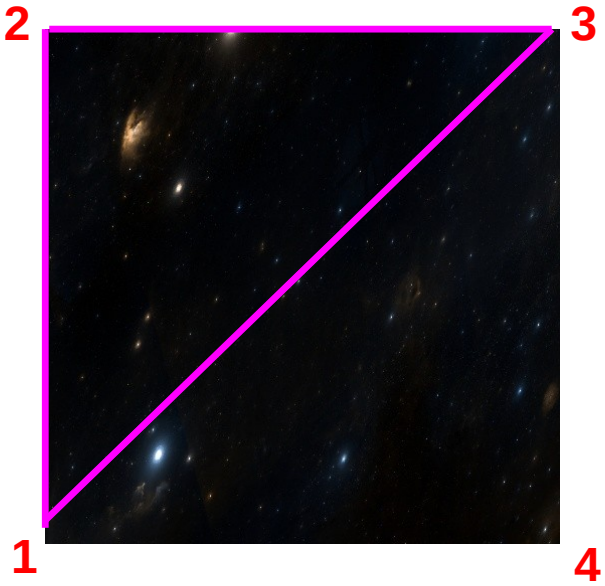
Tile drawing algorithm



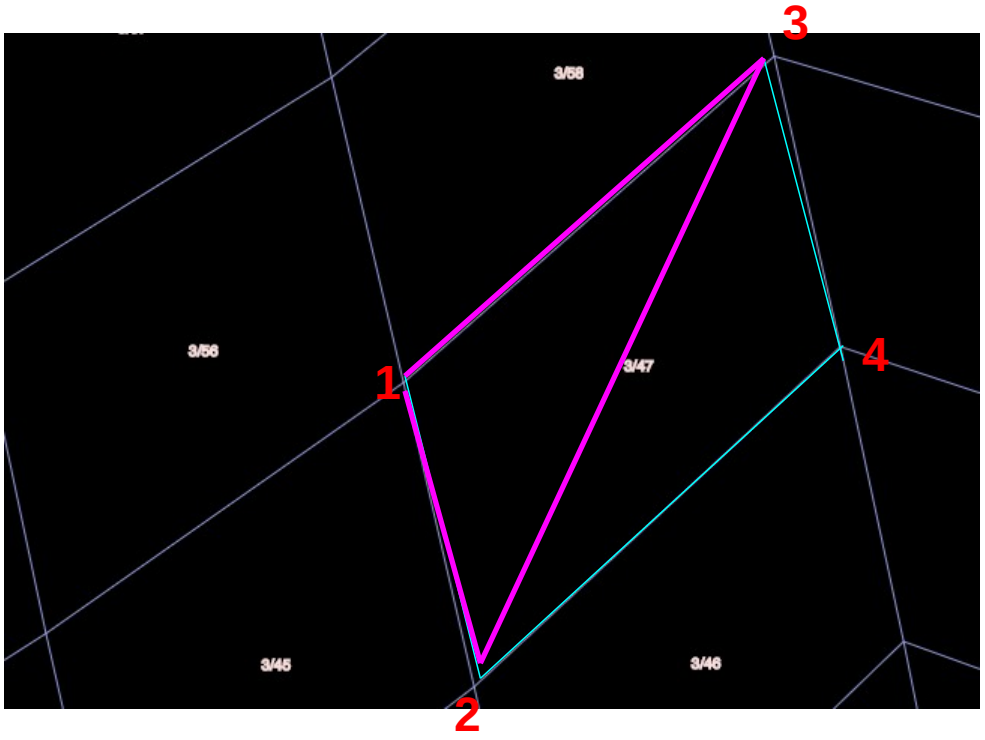


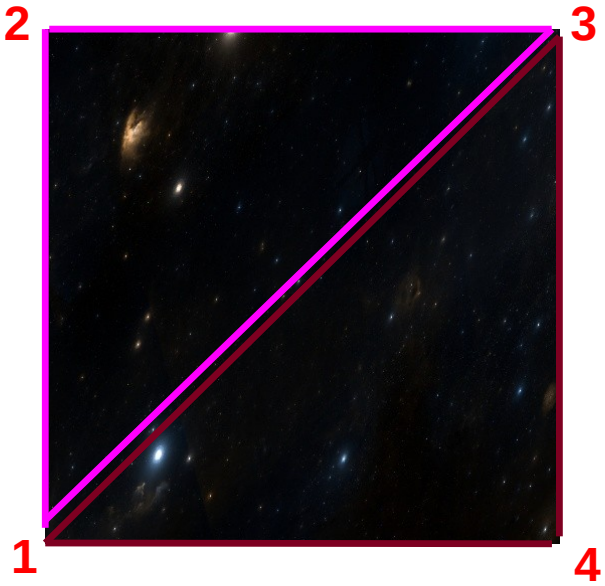
Tile drawing algorithm



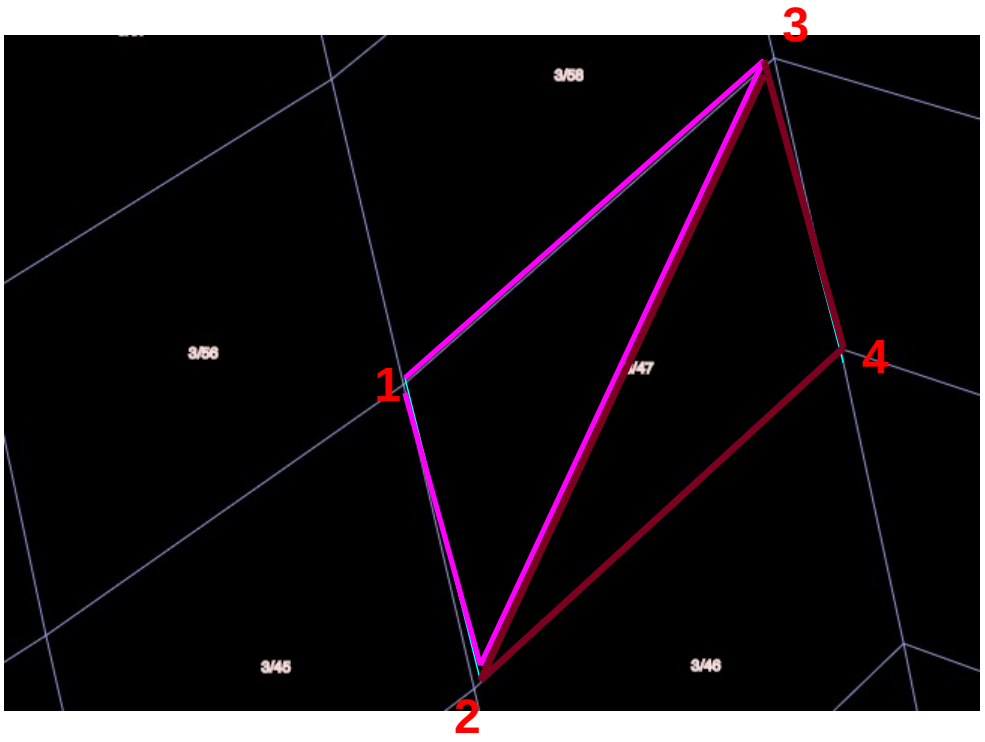


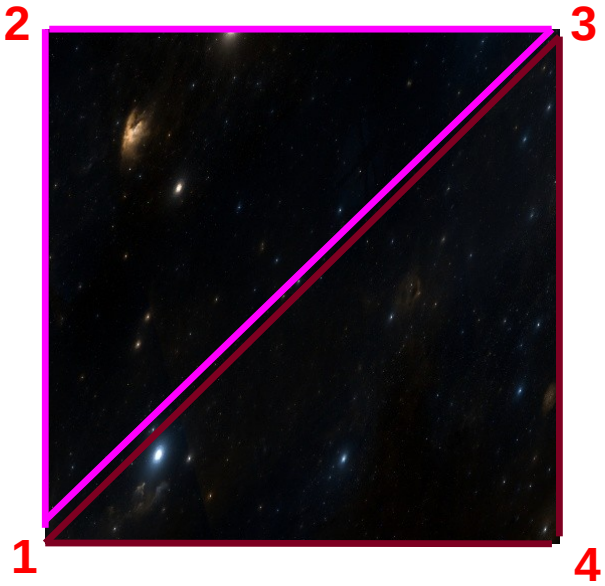
Tile drawing algorithm



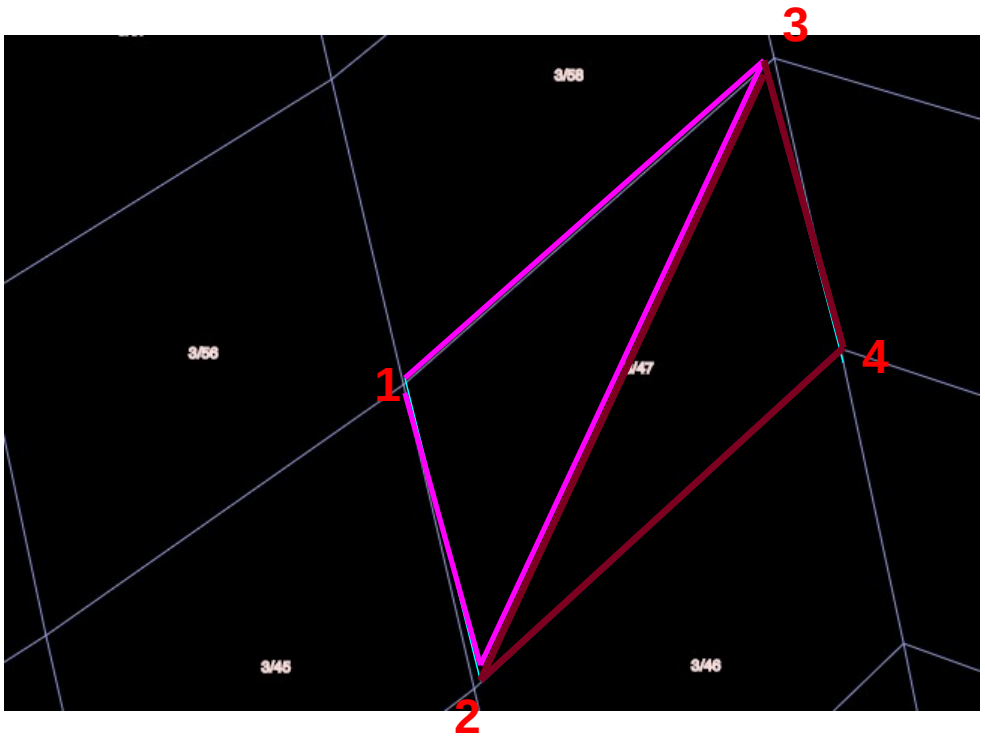


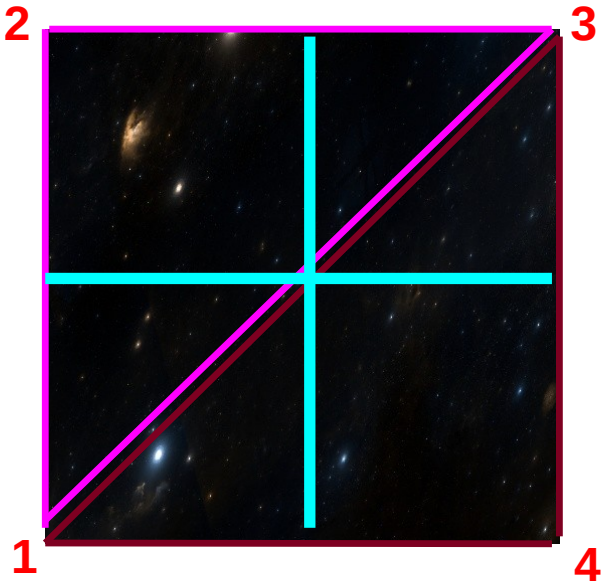
Tile drawing algorithm



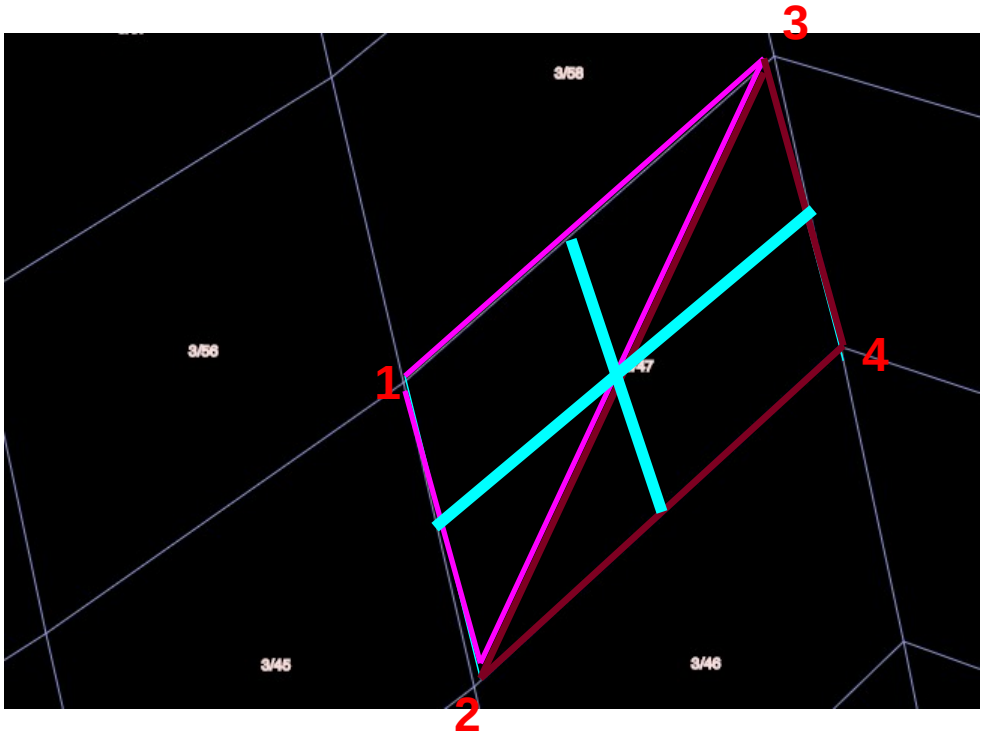


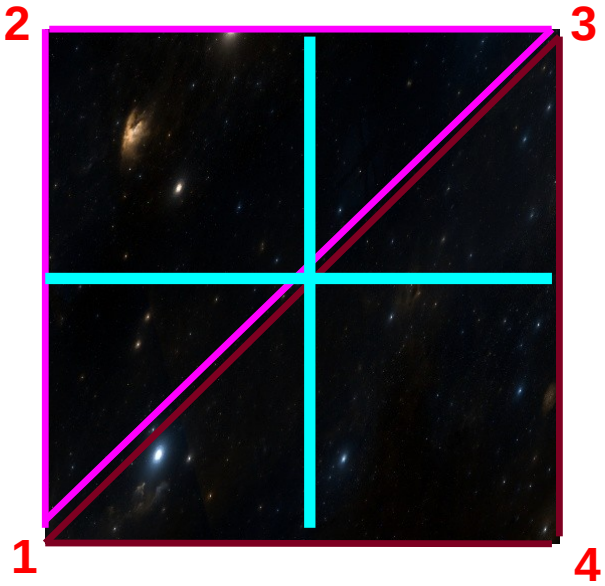
Tile drawing algorithm





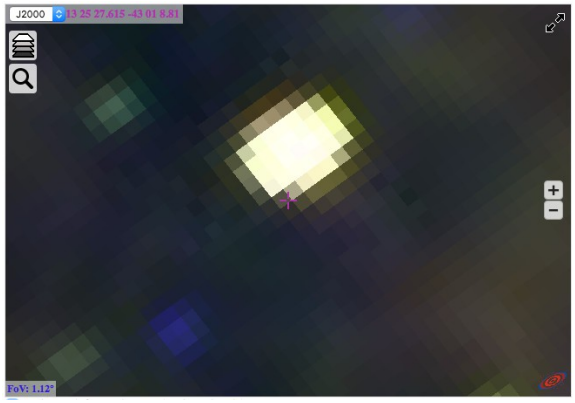
Tile drawing algorithm

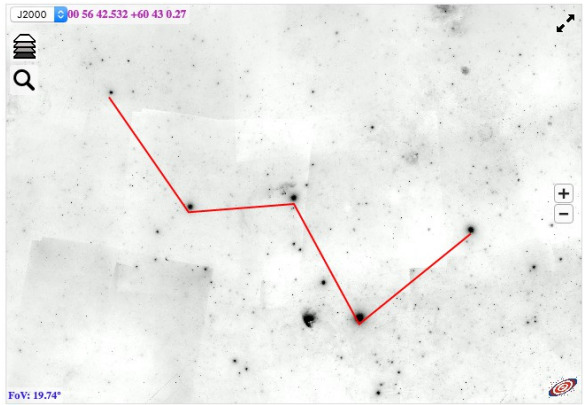




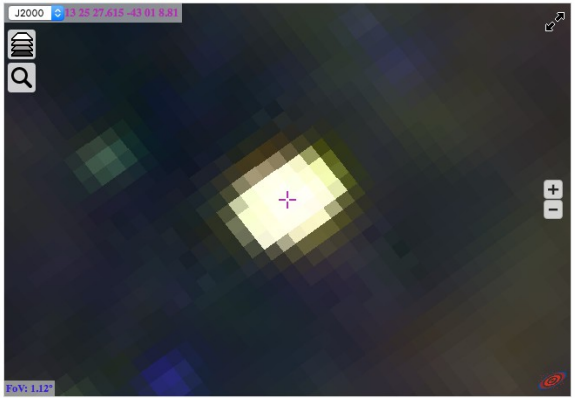
Aladin Lite news & improvements

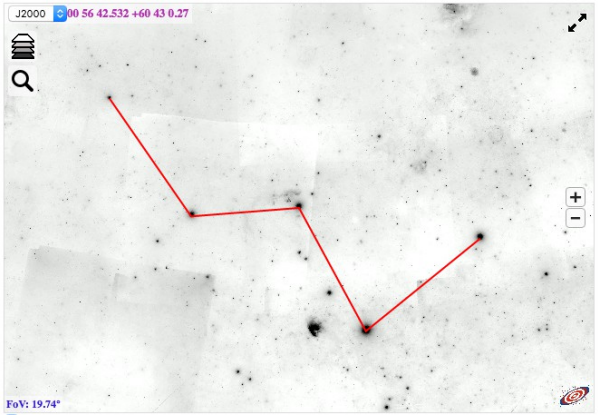
Old algorithm





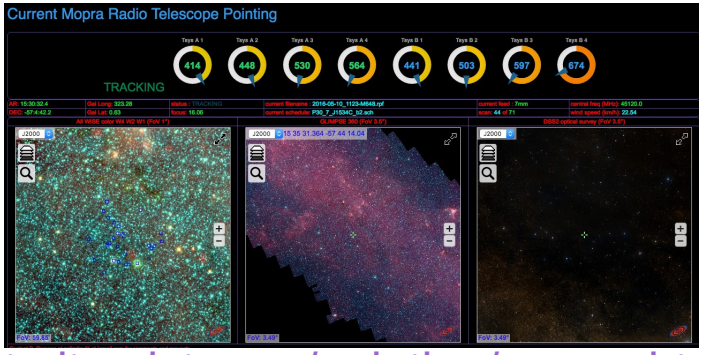
Updated algorithm





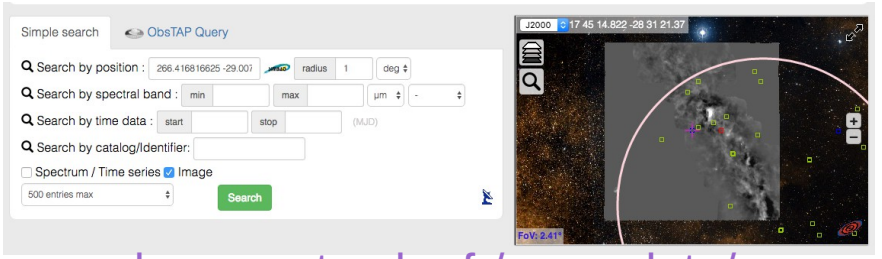
Aladin Lite news & improvements

- New sites integrating Aladin Lite
  - Visualization of Mopra Radio telescope pointing [developed by D. Romano]



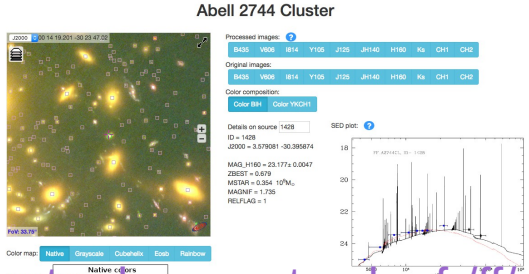
hologhost.altervista.org/pointing/mopra.html

  - VizieR associated data interface (preview of FITS image)



cdsarc.u-strasbg.fr/assocdata/

  - ASTRODEEP portal (Frontier Fields visualisation + interaction with ASTRODEEP catalogue)



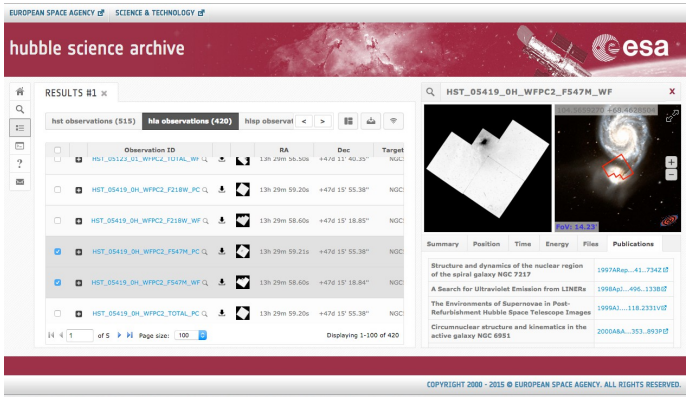
astrodeep.u-strasbg.fr/ff/

Aladin Lite news & improvements

And also:

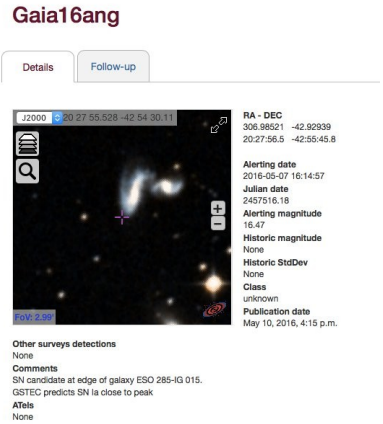
- eHST [ESAC]

  archives.esac.esa.int/ehst/



- Gaia Photometric Science Alerts

  gsaweb.ast.cam.ac.uk/alerts/home

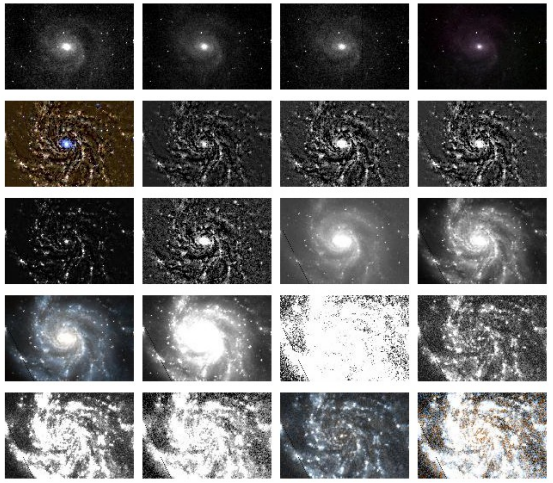


- Skywatch

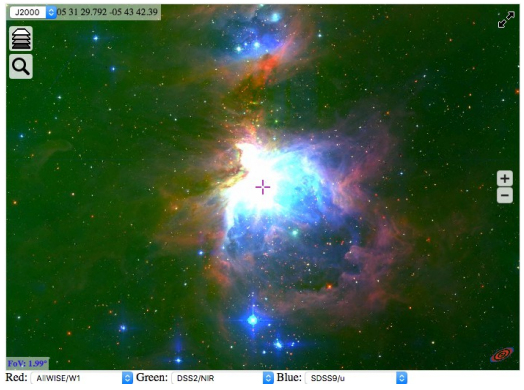
  app.skywatch.co/

Other HiPS experiments

- cutout generation from HiPS (existing Java code, internship to develop a Python library)



- On-the-fly generation of RGB HiPS from user-selected existing HiPS tiles



Thanks !
Questions ?