HiPS – Hierarchical Progressive Survey

Asterics meeting – 7 & 8 March 2016 - Edinburgh

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What's the plan ?

1)Recap on HiPS

2)State of the art

3)The HiPS Network

4)Progress towards an IVOA standard

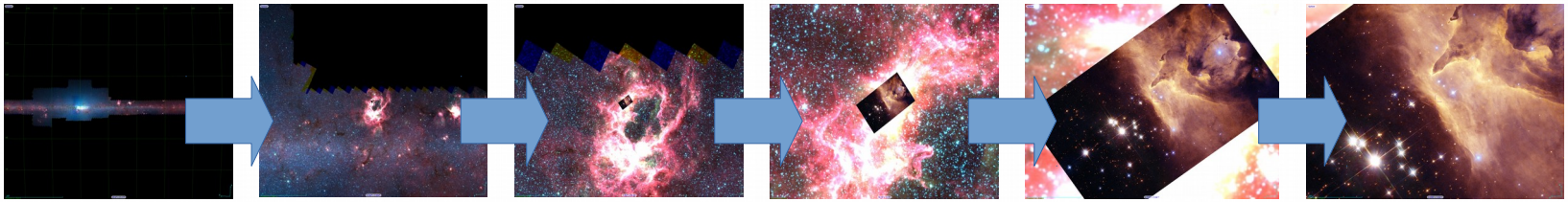
5)Next steps

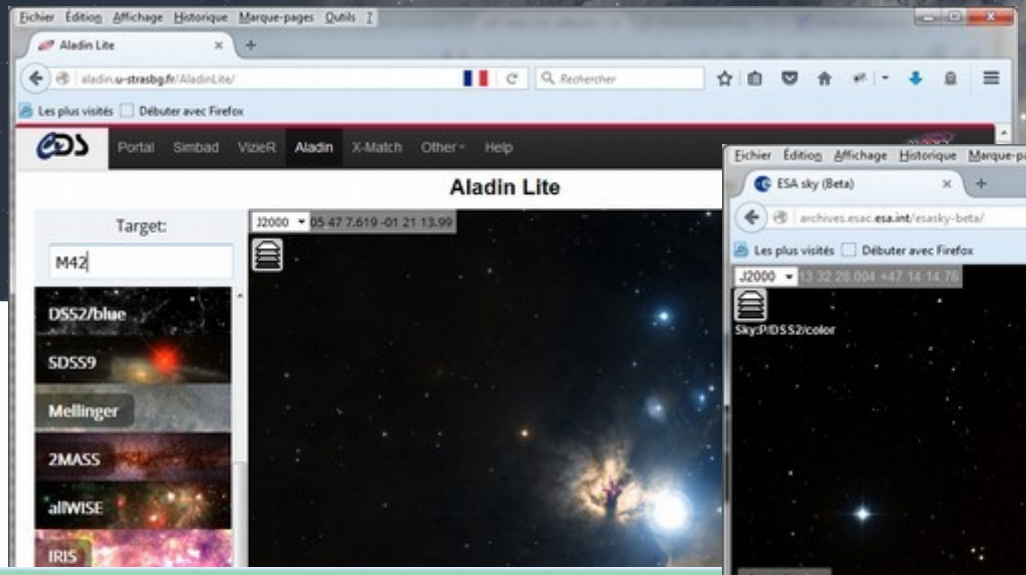
HiPS – What is it ?

Hierachical Progressive Survey

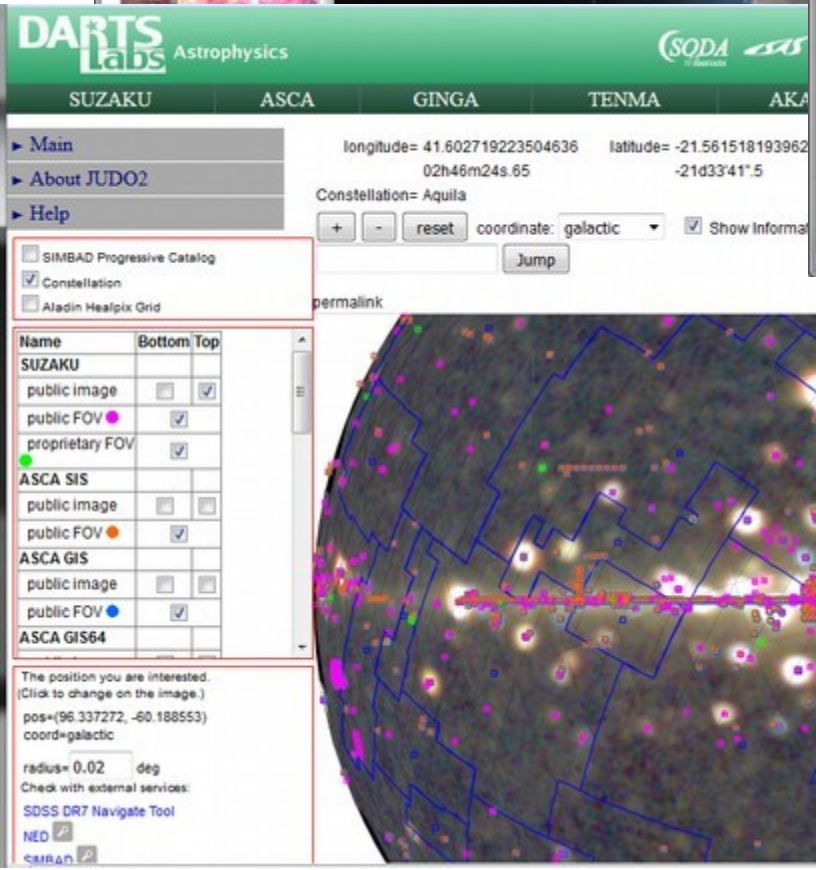
"*The more you zoom in on a particular area,the more details show up*"

- Multi-resolution HEALPix data structure
  for Images, Catalogues, 3-dimensional data cubes, ...
- Conserves scientific data properties alongside visualisation considerations
- No databases or servers, just HTTP




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


ESA sky (Beta)
Upload target list
Sky:P/DSS2/color
Data Panel
ESA Observations
ESA Catalogues
Close data panel
esa


DARTS Labs
Astrophysics
SUZAKU
ASCA
GINGA
TENMA
Main
About JUDO2
Help
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.)
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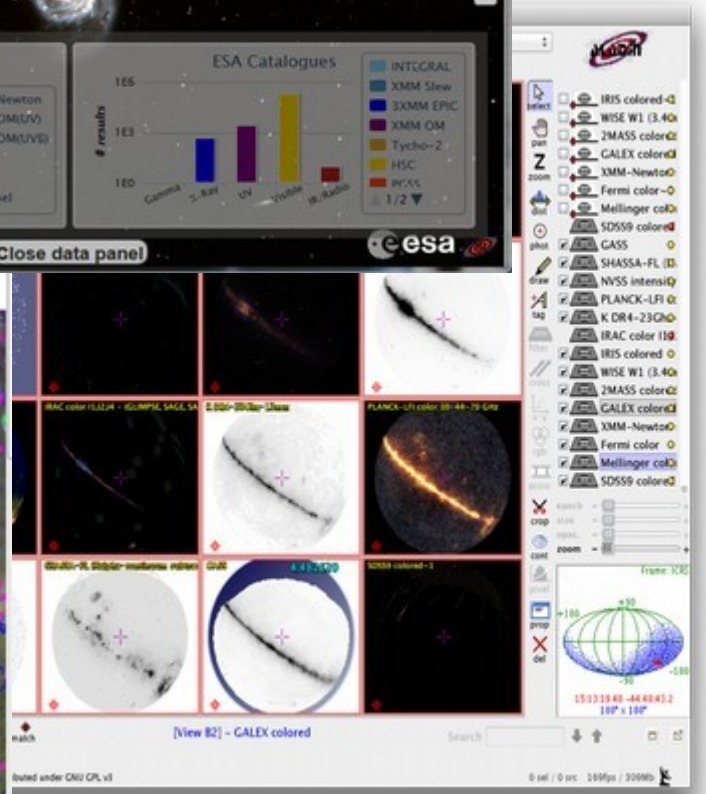
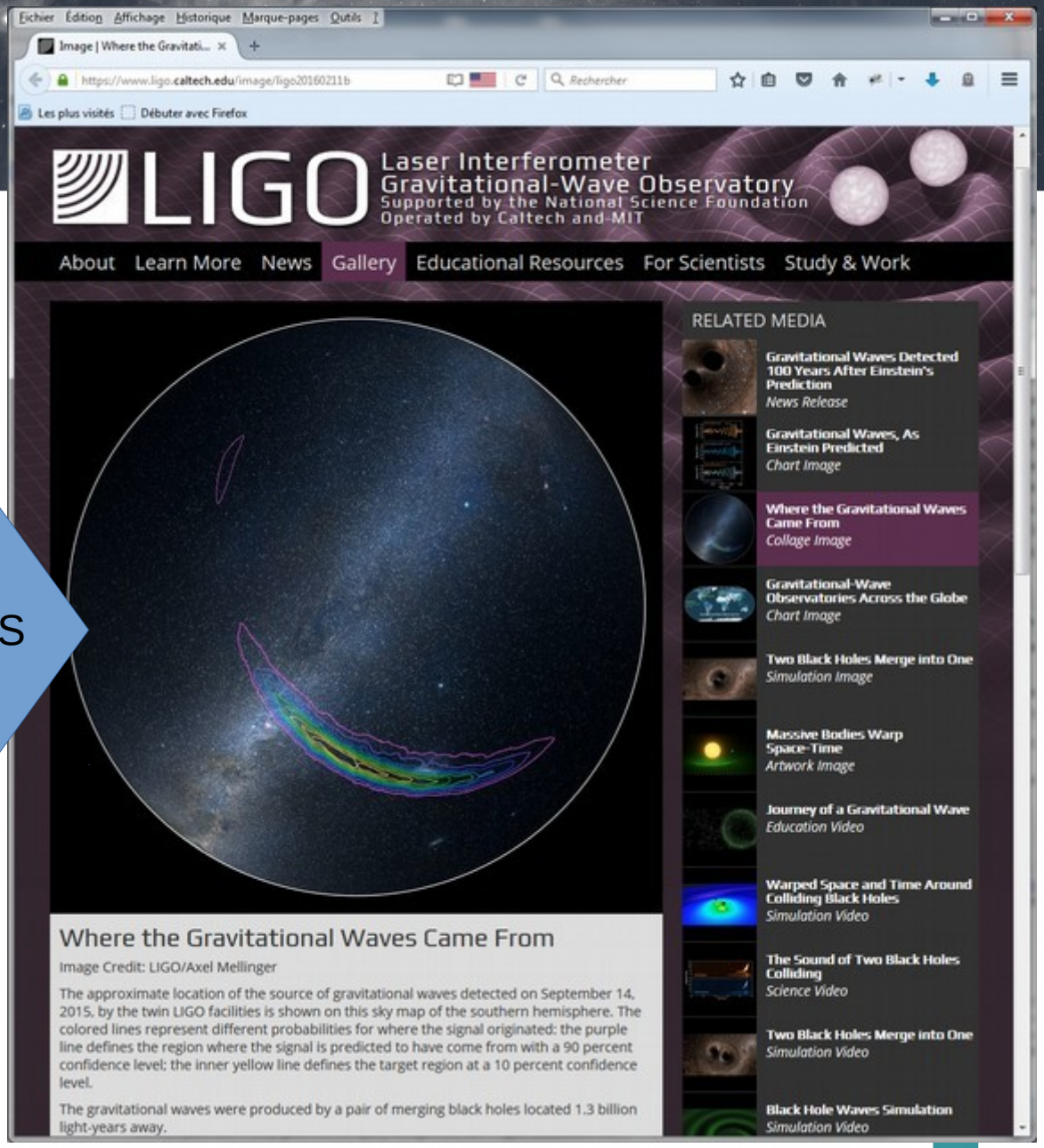
coord=galactic
radius= 0.02 deg
Check with external services:
SDSS DR7 Navigate Tool
NED


[View 82] - GALEX colored

HiPS also at the forefront of the science

Yes ! it is a HiPS



State of art (March 2016)

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

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

+ Aladin Lite implementation: ESAsky (ESAC), JUDO2 (JAXA) ...
+ Aladin Lite web page inclusion: Simbad, VizieR, GLIMPSE360, CADE, ADS allsky, CASSIS, Akari-Viewer, VistaOrion, AstroDEEP, CDS portal…
+ Aladin Desktop usage “diversion”: Arches walker

State of art (March 2016)

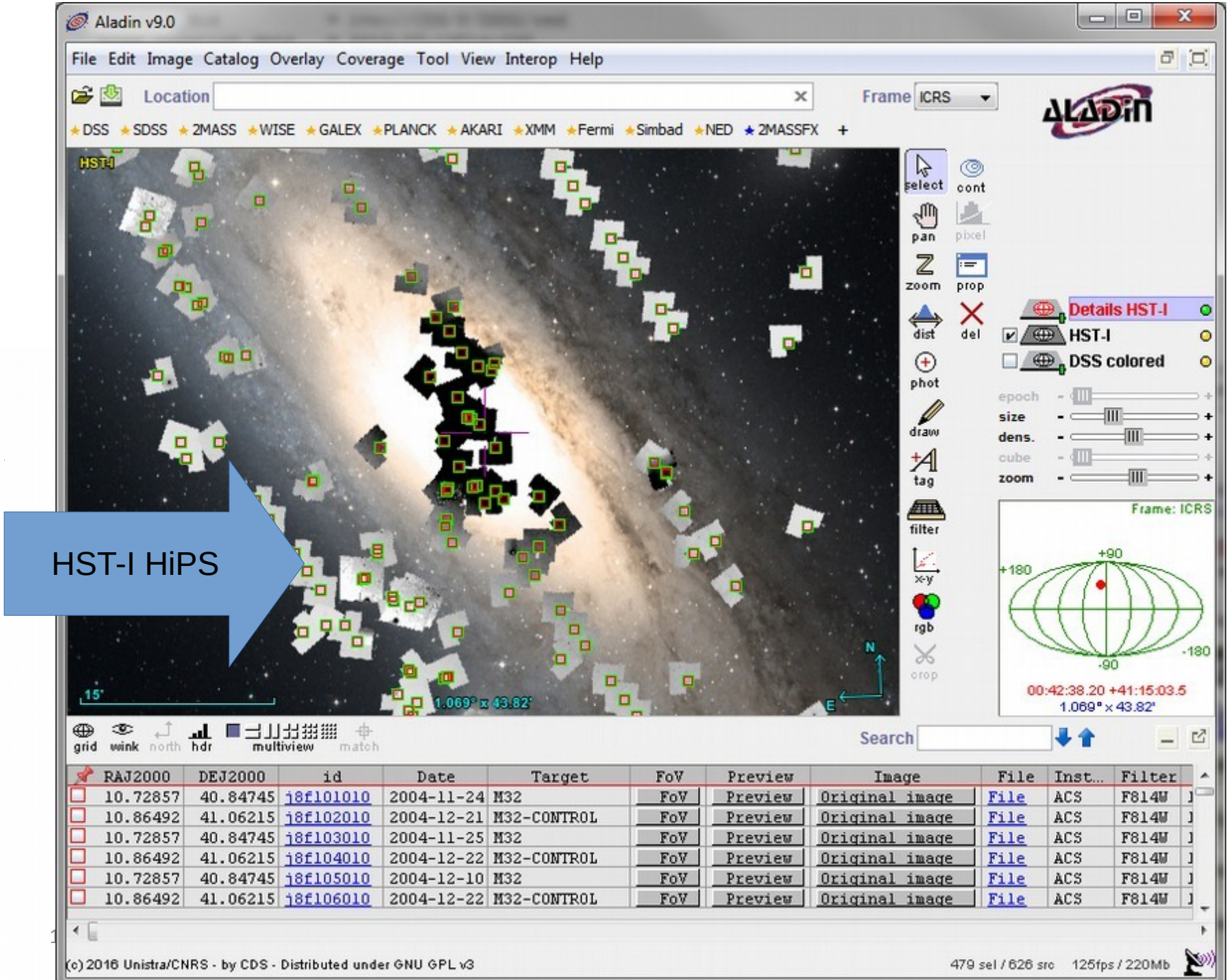
- 10+ HiPS servers

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

- 2 HiPS generators
  - Images & cubes: Aladin/Hipsgen (perf: 10h/1Tpix),
  - Catalogs: Hipsgen-cat
- 1 paper → 2015A&A...578A.114F
- More docs → http://aladin.unistra.fr/hips
  ("*Make your HiPS in 10 steps*", *Aladin Lite examples*, ...)

HiPS in action

- 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).
  - Provided both in preview tiles & in full dynamic tiles
  - Incorporate "progenitor links" facility: for accessing associated original images directly
  - Use "-live" HiPS extension: allow incremental updates


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
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cont
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filter
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rgb
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+90
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00:42:38.20 +41:15:03.5
1.069° x 43.82'
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1.069° x 43.82'
N
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hdr
multiview
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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 4 HiPS principles (in an ideal world)

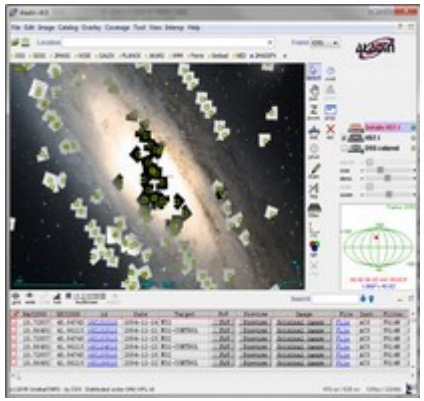
- Universality: Anybody should be able to generate HiPS (authors, projects, missions, archives, data centers...)
- Quality: HiPS should be generated by the data providers themselves (they know their data). Otherwise, archives or data centers do the job.
- Efficiency: HiPS should be distributed by several sites and mirrored/synchronized as much as possible (big data is here – think petabytes !)
- Simplicity: user point of view: just “click & play” !

How to build the HiPS network

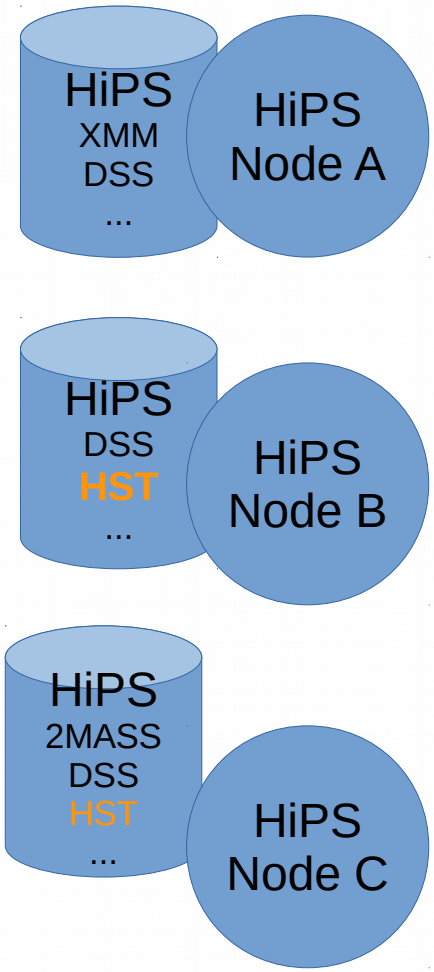
- HiPS registry = the VO registry provides the list of HiPS servers
- HiPS server = a HTTP server distributing HiPS + one HiPS list
- HiPS list = list of the HiPS (with associated meta-data a la ObsCore) distributed by each HiPS server

HiPS network

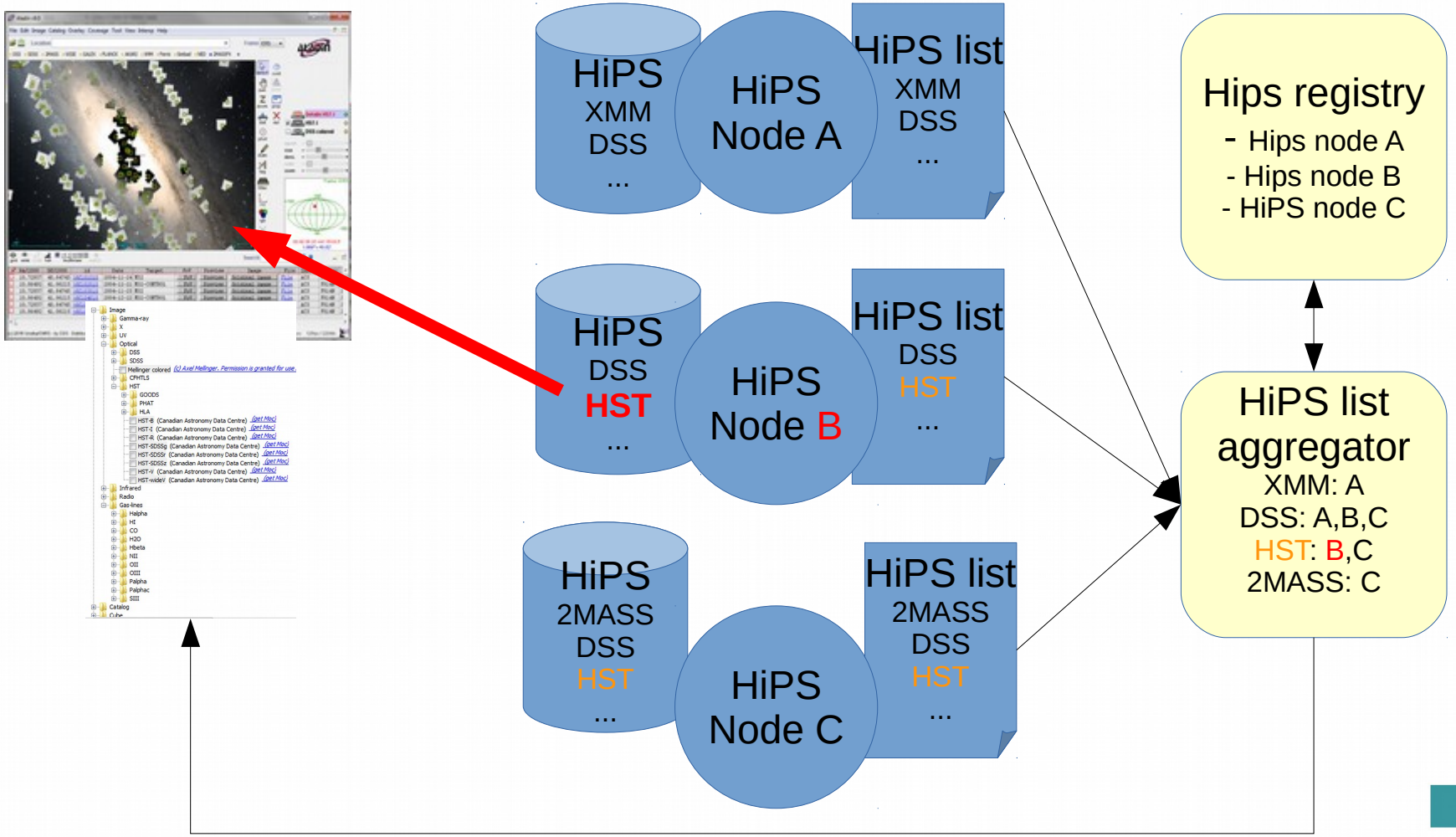
HiPS client



HiPS servers

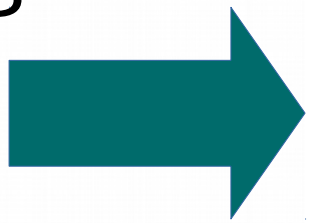


HiPS network



HiPS metadata

Properties file provided with each HiPS



creator_did = **ivo://CDS/P/DSS2/color**

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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: an example of HiPS list aggregator

→ http://alasky.unistra.fr/MocServer/query

→ http://aladin.unistra.fr/hips/list

HiPS directory

List of Hierarchical Progressive Surveys

This page provides the list of all public HiPS sorted by categories, plus the list of the public HiPS nodes.

1) HiPS images

http://alasky.unistra.fr/MocServer/query?hips_service_url=*&dataproduct_type=!catalog,!cube&get=record

#	Origin	ID	Mirror sites	Last modif	HiPS order	HiPS frame	Sky fraction	Tile format	Mode	Progen	Aladin client	Description
1	CADC	P/HST/F110W/r1	2	2013-11-28	14	equ	3.901E-5	png,jpeg,fits		yes	desktop	HST-F110W (more)
2	CADC	P/HST/F160W/r3	2	2014-11-28	14	equ	1.206E-4	png,jpeg,fits		yes	desktop	HST-F160W r3 (more)
3	CADC	P/HST/F255W/r3	2	2014-12-02	14	equ	3.831E-5	png,fits		yes	desktop	HST-F255W r3 (more)
4	CADC	P/HST/F300W/r1	2	2013-11-26	14	equ	1.175E-4	png,jpeg,fits		yes	desktop	HST-F300W (more)
5	CADC	P/HST/F450W/r3	2	2015-01-14	14	equ	1.784E-4	png,fits		yes	desktop	HST-F450W r3 (more)
6	CADC	P/HST/F475W/r3	2	2014-11-19	14	equ	8.670E-5	png,fits		yes	desktop	HST-F475W r3 (more)
7	CADC	P/HST/F555W/r3	2	2014-12-06	14	equ	1.519E-4	png,fits		yes	desktop	HST-F555W r3 (more)
8	CADC	P/HST/F606W/r3	2	2014-10-31	14	equ	4.686E-4	png,fits		yes	desktop	HST-F606W r3 (more)
9	CADC	P/HST/F625W/r3	2	2014-11-16	14	equ	3.815E-5	png,fits		yes	desktop	HST-F625W r3 (more)

IVOA HiPS standardization

7 months

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

  IVOA endorsement of the HiPS technology (in Apps Working group)
- Discussion (in progress)
- Identication & VO registration → agreement
- HiPS standards (protocols+metadata) → WD in progress..
- IVOA WD in progress (Cape Town ready ?)

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

IVOA HiPS roadmap constraints

- HiPS is already being used

  → The HiPS IVOA standardization process must be seen more like an evolution of an existing standard, rather than a new thing from scratch.

- HiPS actors are not necessary IVOA people, nor computer specialists

  → HiPS must stay as simple as possible, easily usable by any data providers (data centers, archives but also astronomers/authors)

Pleasure of standardization

- Difficulties:
  - IVOA public debates → not so motivating for HiPS actors
  - Heavy constraint on IVOID usage → obligation of an “a priori” VO registry declaration + syntax evolution by the introduction of “?” blocking char for undeclared resource
  - NO IVOA support of mirror sites
- Good news: we (partially) circumvented these issues

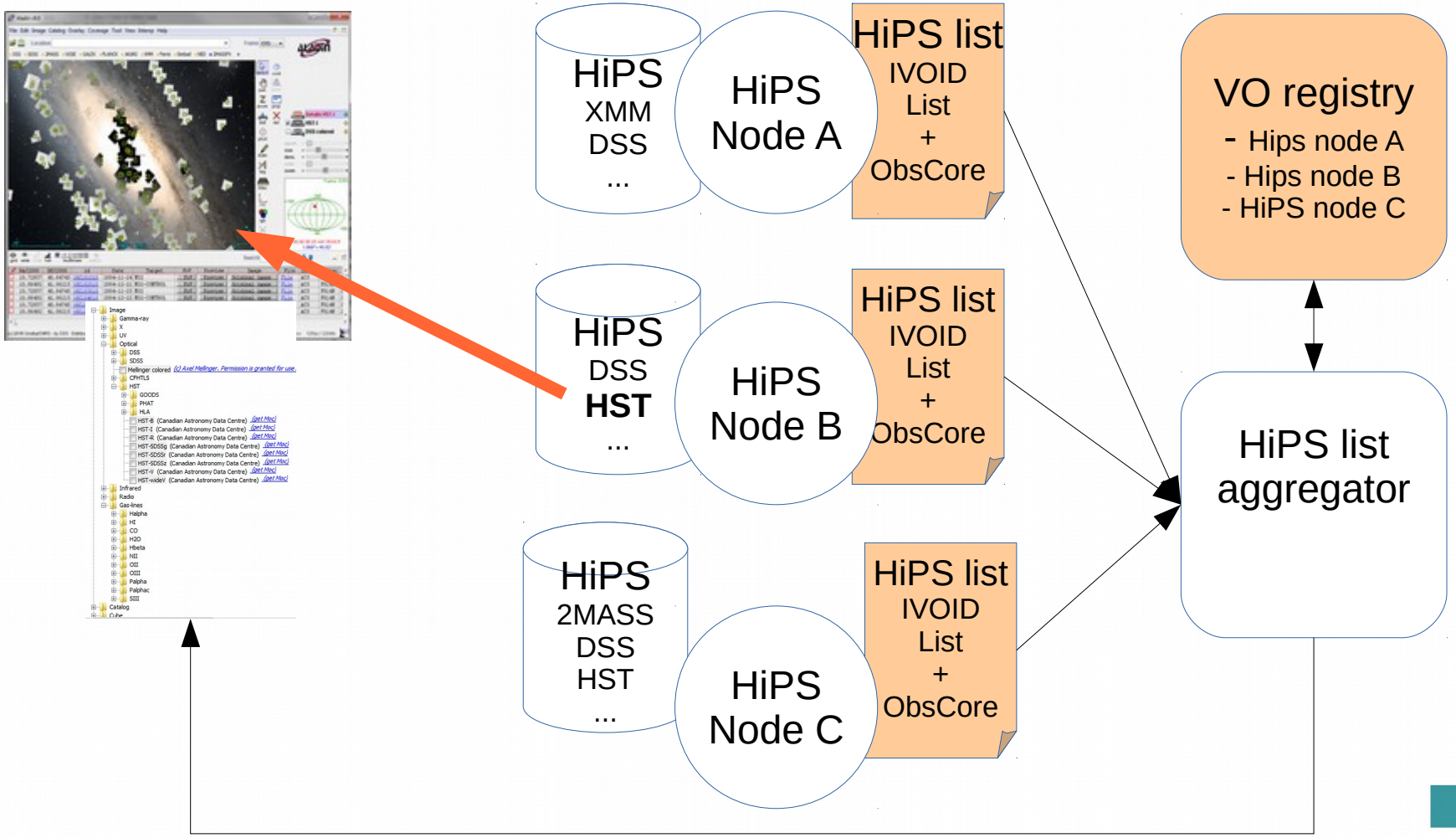
→ HiPS network should not be delayed too longer

→ The impacts should be small

IVOA agreement !

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) *Independently, any HiPS provider can - if they want - declare in the VO registry:*
   - *Their HiPS server(s) = HTTP service which publishes several HiPS : must provide their HiPS list;*
   - *Each individual HiPS.*

HiPS network in IVOA



Next steps

- Pursue the HiPS Network deployment
- Notably the HiPS catalogs (~15 000 HiPS)
- Start the VO registry declarations

- Finalize the IVOA WD
- Study a statistics report protocol

Thanks !
Questions ?