

HiPS

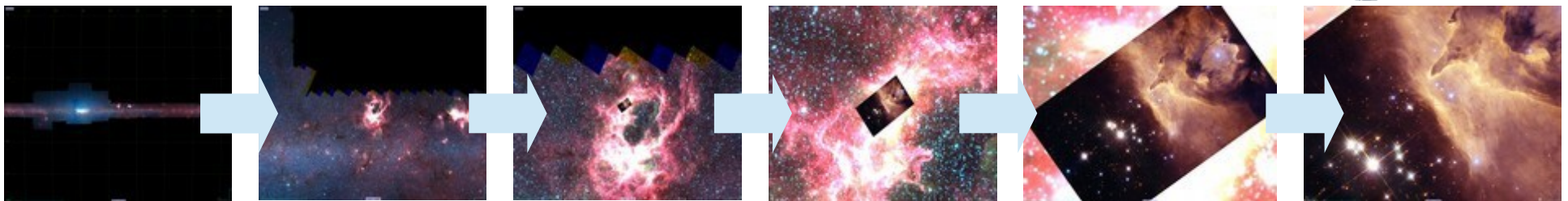


13/12/2017



□ HIPS

- **Hierarchical Progressive Survey**
- IVOA standard (since May)
- **Hierarchical** way of structuring data
- **Progressive** visualisation of astronomical **Surveys**
- 'google earth' for the sky



□ What's the plan?

1. Pixel data

1.1 Context

1.2 Hierarchical organization using HiPS

2. HiPS

2.1 Creation

2.2 Associated metadata update

☐ CDS services



Objects

Dictionary
Bibliography
Name resolver
TAP



Catalogues

Photometry service
Associated data service
FTP
TAP



Sky Atlas

Data integration
Surveys
HiPS/MOC

+ Aladin Lite Embeddable widget

□ Source of data



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File Name ↓	File Size ↓
Parent directory/	-
images/	-
qa/	-
eam.out	236707
manga-8131-12701-LINCUBE.fits.gz	170101958
manga-8131-12701-LINRSS.fits.gz	199502190
manga-8131-12701-LOGCUBE.fits.gz	115473857
manga-8131-12701-LOGRSS.fits.gz	137288154
manga-8131-12702-LINCUBE.fits.gz	168496188
manga-8131-12702-LINRSS.fits.gz	204203340
manga-8131-12702-LOGCUBE.fits.gz	114470563
manga-8131-12702-LOGRSS.fits.gz	140292208




```
> ^Cbuga@alaska3:/raid/durand/DSS$ ls  
ERsurvey  ISsurvey  Ssurvey  XIsurvey  
GRsurvey  Nsurvey  XEsurvey  XJsurvey  
INsurvey  readme    XGsurvey  XNsurvey
```

□ Type of data : pixel data



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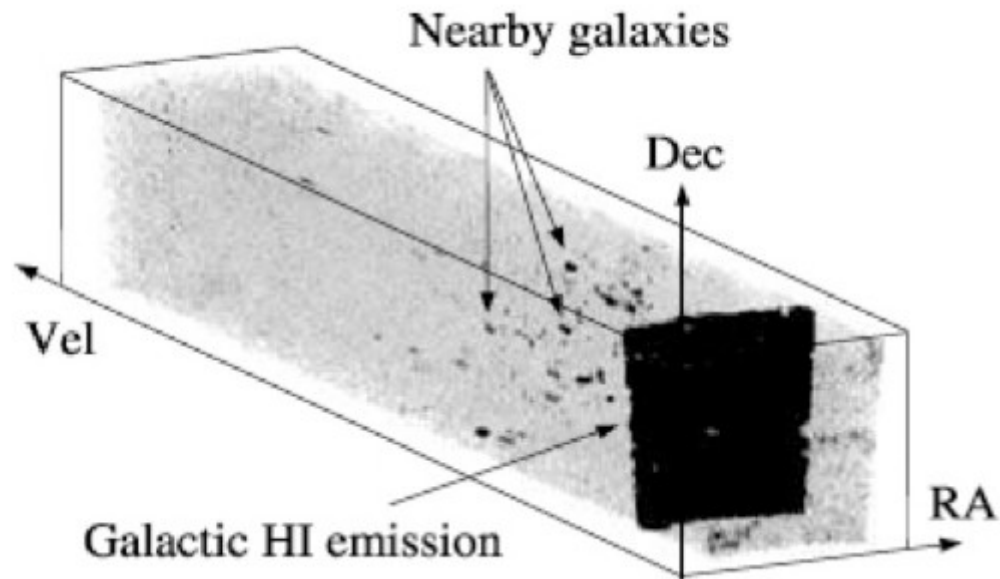


Sky Atlas
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images 2-dimensional image

cubes 3-dimensional spectro-images

□ Type of data : pixel data : cubes




Position - position - velocity cube

RA - DEC - RV cube


3D representation of a 21-cm HI data cube :

- Nearby galaxies : dark spots
- Galactic Plane : dark sheet

□ Data format



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VOTable : **tabular** data
within the **VO**

FITS : **F**lexible **I**mage **T**ransport **S**ystem :
archival data format for images, tables



1.2 Hierarchical organization using HIPS

□ What is HIPS : Hierarchical Progressive Survey

- Method of organizing big data

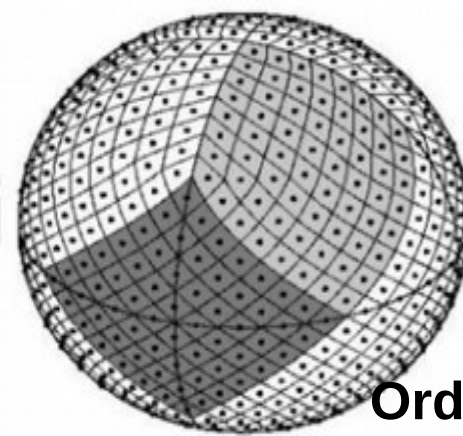
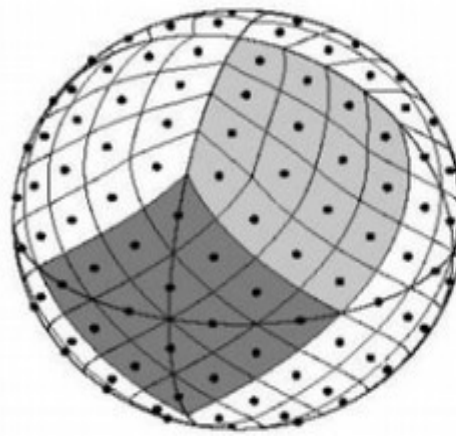
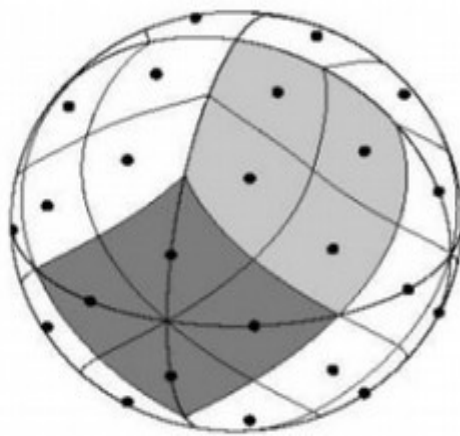
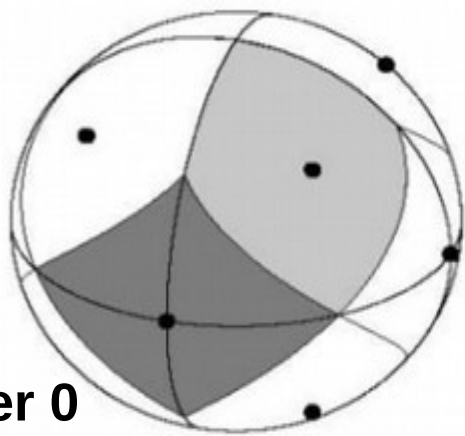
- **HEALPix** sky tessellation

Hierarchical structure: Tile \rightarrow Pixel

Equal Area cells : 12 cells (order0) \rightarrow 4 equal cells (order 1)

Latitude : Pixel centers \rightarrow rings of equal latitude

Pixelization algorithm



Order 0

Order 3

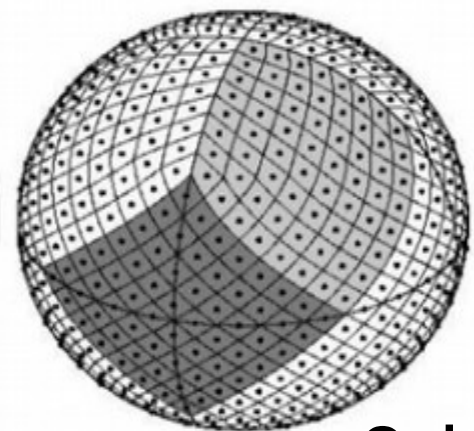
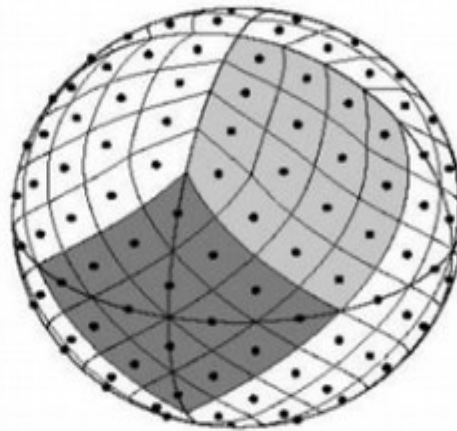
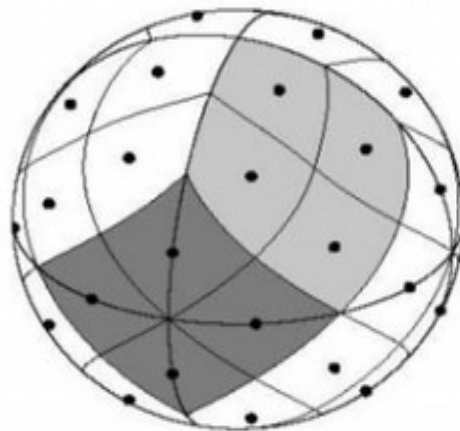
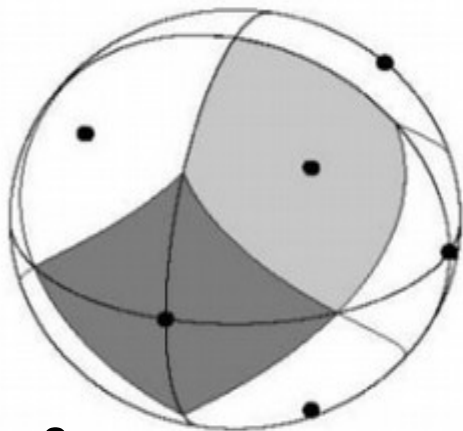
□ HIPS organization of data

- *Original astronomical data : **images**, catalogs, cube data*

HiPSgen

Sphere → Maps → Tiles → Pixels

- **HiPS** : *Collection of HEALPix maps of successive orders*



Order 0

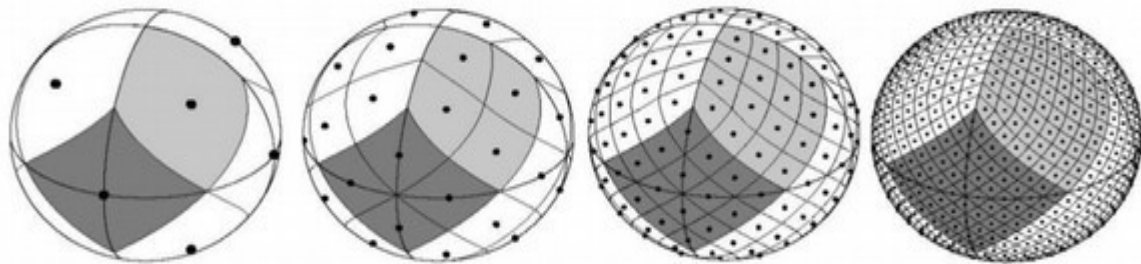
Order 3

□ What is HIPS : Hierarchical Progressive Survey

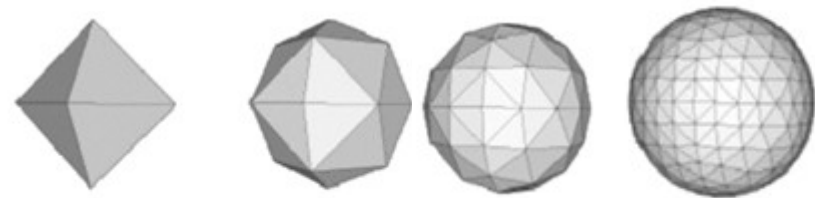
→ see Aladin

□ Tessellation usage

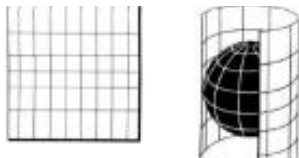
- **Curvilinear HEALPix**
CDS, others (LIGO,...)
performance/quality



- **Triangular** World Wide Telescope



- **Cylindrical** Google



□ HIPS structure

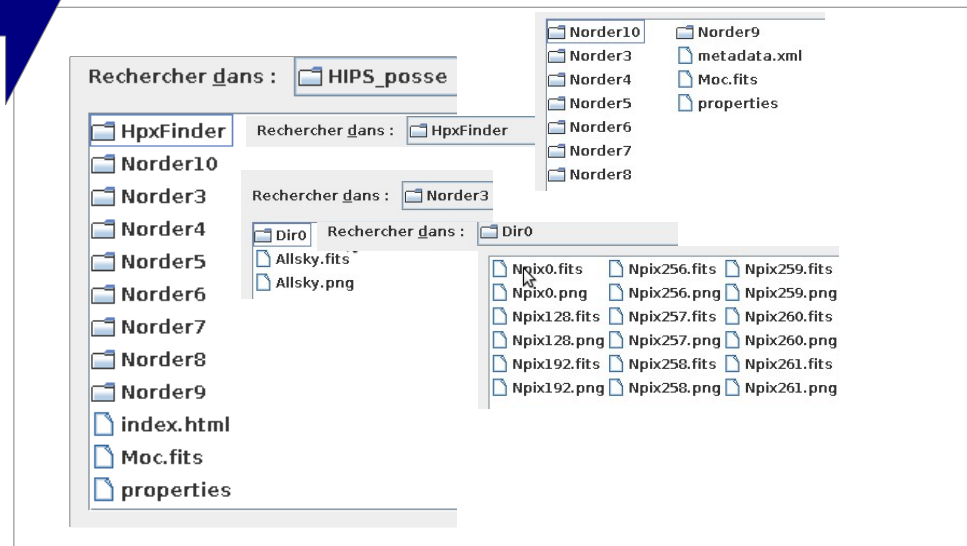
.fits original images with footprint on the celestial sphere

with header specifying the correspondence between the coordinates on the sky and the given pixel location in the image.

HIPSgen

HiPS

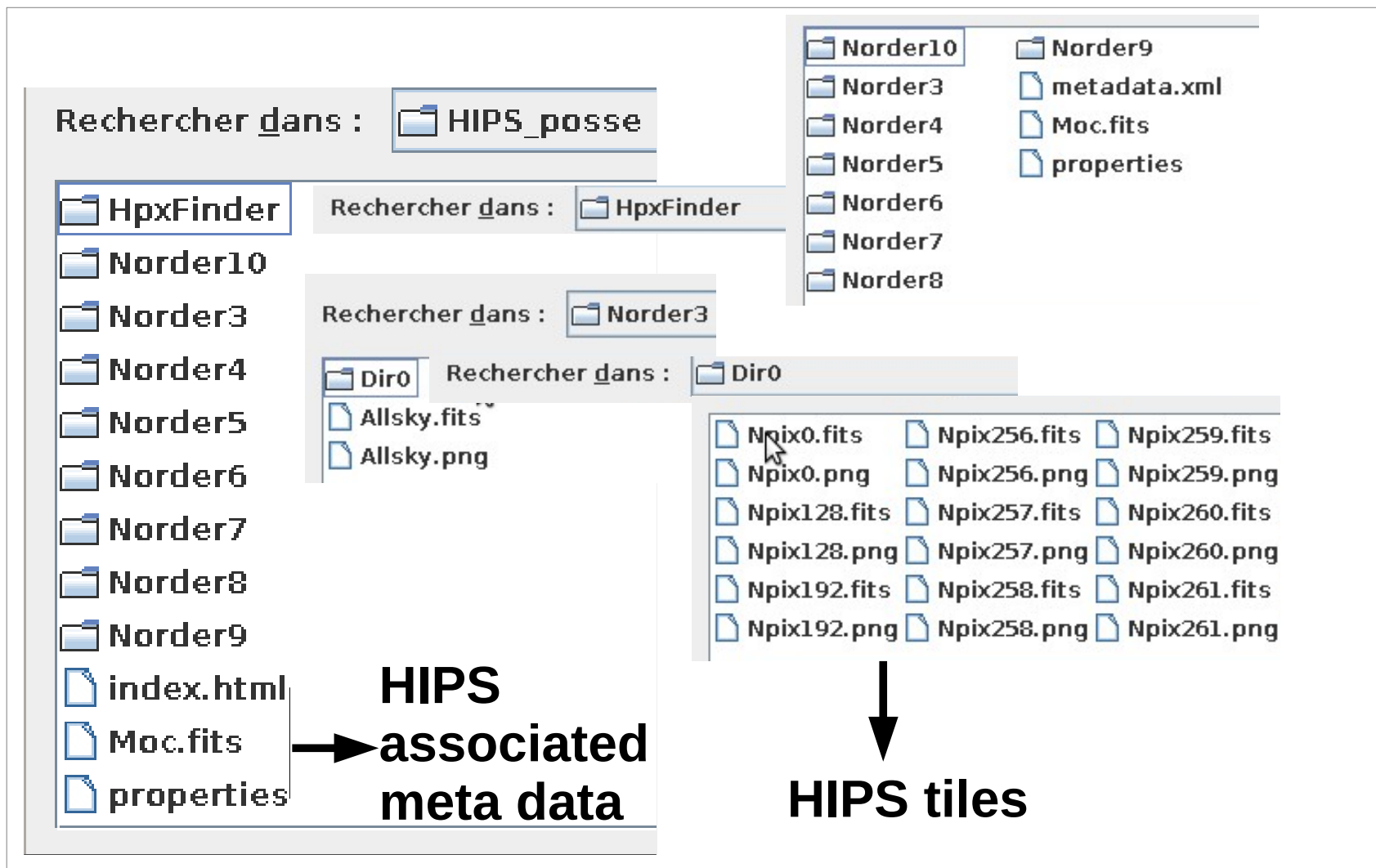
- set of HEALPix maps stored in **tiles**
- **associated metadata**



Incomplete : lack of mandatory keywords ?

- contact the data provider
- rebuild the HIPS tiles

□ HIPS structure



- Bibliography, catalogs, pixel data : management of heterogeneous Big Data at CDS by the documentalists

2. HiPS

2.1 Creation

2.2 Associated metadata update

□ Main steps

Original images

- Astronomical survey priority and data availability
- Download data from archive facilities/servers
- Prepare the data
 - « clean » images
 - organize data (resolution/filter)



Astronomical survey mapping priority and data availability



Download data from archive facilities / server



File Name ↓	File Size ↓
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manga-8131-12702-LOGCUBE.fits.gz	114470563
manga-8131-12702-LOGRSS.fits.gz	140292208

De Roy Williams <roy@caltech.edu>★

Sujet **Fwd: Re: Fwd: Re: HiPS for LIGO**

12/07/2016 18:2

Pour Pierre Fernique★, Moi★, Thomas Boch <thomas.boch@astr

Pierre et al

Can you try these new versions of the 2MASS galaxy density?

Jeremy has rebuilt the FITS files as you suggested, and provided a wider range of z values. They are in the dropbox link below, can we put in all 7 of these?

2MPZ.gz_0.001_0.01_smoothed.fits.gz

2MPZ.gz_0.01_0.02_smoothed.fits.gz

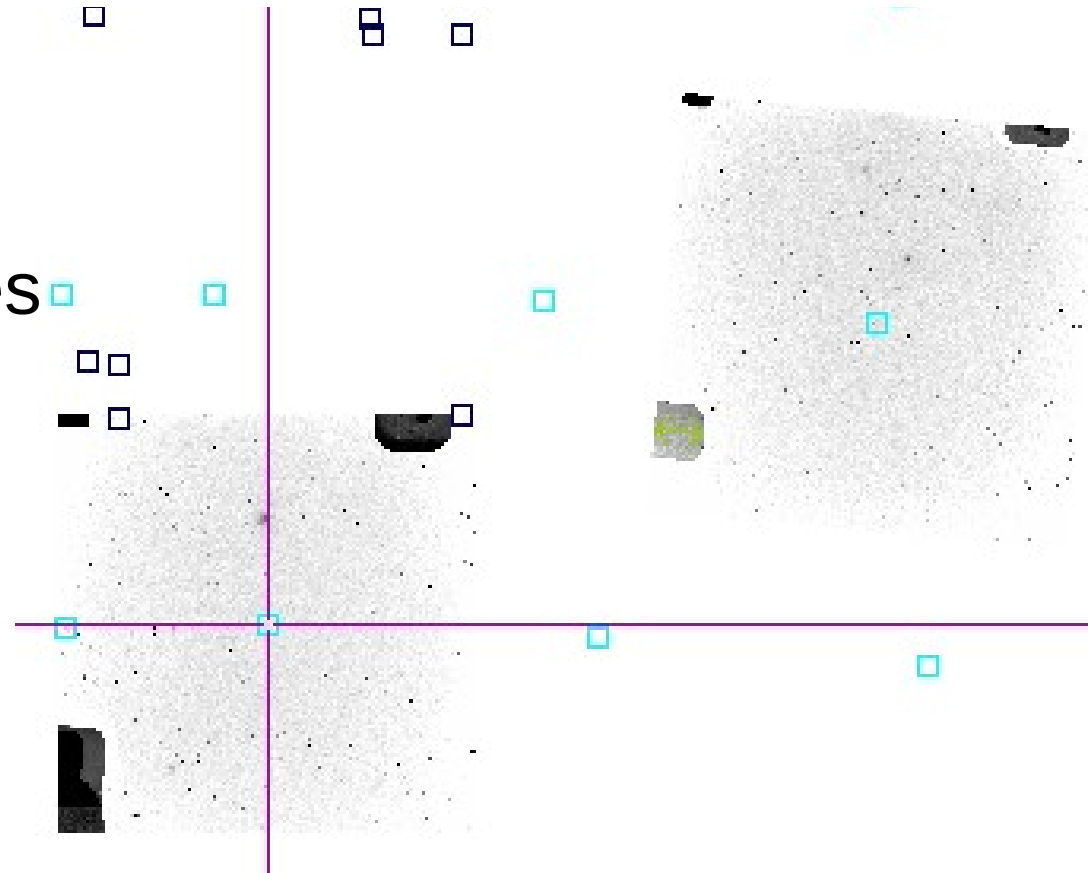
2MPZ.gz_0.02_0.03_smoothed.fits.gz



Prepare for mapping : « clean » images organize the data

Clean images :

- MAMA survey borders .
 - Quick tests with few images
 - Restart the process



Organize images :

- DSS1 Survey
 - Red : XE
 - Blue : XO + S(SERC-J) + S(SERC-EJ)

□ HIPStool parameters and actions

- **Required**

- **Original images**
- Path

- **Optional (ex:)**

- **Original images**
 - Sky background
 - Margins
 - Meta data
- **HIPS**
 - Target directory
 - Identifier
 - Tiles to build
- **Associated meta data**
 - Build the MoC
 - Handle original images associated data

HIPS generic meta data

```

creator_id      = ivo://CDS/P/MAMA/posse
obs_collection  = MAMA posse
obs_title       = MAMA posse
obs_description = During the eighties and nineties, several thou
                 sand photographic plates had been digitized with the MAMA microdensitometer
                 calibrated to meet the specific objectives of a number of national and internat
                 ional projects in a variety of scientific domains: clusters of galaxies, candi
                 dates of quasar candidates, young stellar objects, variable stars, stellar pop
                 ulations in the solar neighbourhood, tidal effects on open and globular cluste
                 rs, etc. More recently, our team (Observatoire de Paris) has undertaken a new
                 project and making available to the astronomical community three atlases: ES
                 1, ES2 and ES3 covering the southern part of POSSI-E in the R band, SRC-J in the B band.
obs_ack         = The project is conducted in partnership with the Paris
                 Data Centre and the ALADIN group (CDS).
prov_progenitor = V0 Paris Data Centre
bib_reference   = 1988CRJS....9..122A
bib_reference_url = http://adsabs.harvard.edu/abs/1988CRJS....9..122A
obs_copyright  = Observatoire de Paris
obs_copyright_url = https://www.obspm.fr/mentions-legales.html?lang=fr
t_min          = 41683
t_max          = 46796
obs_regime     = Optical
em_min         = 3.95E-7
em_max         = 5.4E-7
hips_builder   = Aladin/HipsGen v9.505
hips_version   = 1.31
hips_release_date = 2016-09-12T21:38Z
hips_frame     = equatorial
hips_order     = 10
hips_tile_width = 512

```

Rechercher dans :

HpXFinder

Norder10

Norder3

Norder4

Norder5

Norder6

Norder7

Norder8

Norder9

index.html

Moc.fits

properties →

← conversions
to be done
(MJD,m)

Properties of the plane "CDS/P/MAMA"

PlaneID: CDS/P/MAMA/posse

Description: MAMA posse ([more...](#))

Acknowledgment: The project is conducted in part

Bib. reference: [1988CRJS....9..122A](#)

Ivoid: ivo://CDS/P/MAMA/posse

HiPS creator: M.Buga [CDS]

Release date: 2016-09-12T21:38Z

Format: HIPS [See properties](#) →

Url: <http://alasky.unistra.fr/MAMA/>

HiPS properties

Best pixel resolution: 402.6mas

HEALPix NSide: 524288 (2¹⁹)

Coord.sys.: ICRS

Number of levels: 10

Tile format: PNG 8 bits pixels

Tile width: 512 pix (2⁹)

[Get full pixel dynamic \(fits\)](#)

Avg net speed: 5,29MB/s

Coverage

Time range: [1973-01-01 .. 1987-01-01]

Energy range: [3.95E-7 .. 5.4E-7]

Space: 30.13 % of sky [Coverage](#)

Original data

Provenance: VO Paris Data Centre

Copyright: [Observatoire de Paris](#)

Access: [Original images](#)

Drawing method

.projection: Sinus

.frame: Default

.longitude: ascending descending

[Apply](#) [Bookmark](#) [Close](#)

```

creator_id = ivo://CDS/P/MAMA/p
obs_collection = MAMA posse
obs_title = MAMA posse
obs_description = During the eightie
thousands original photographic plates ha
MAMA microdensitometer and calibrated to
of a number of national and international
scientific domains: clusters of galaxies,
candidates, young stellar objects, variab
populations in the solar neighbourhood, t
globular clusters, microlensing. More rec
(Observatoire de Paris) has undertaken di
available to the astronomical community t
southern part of POSSI-E in the R band, S
obs_ack = The project is con
the V0 Paris Data Centre and the ALADIN g
prov_progenitor = V0 Paris Data Cent
bib_reference = 1988CRJS....9..122
bib_reference_url =
http://adsabs.harvard.edu/abs/1988CRJS...
obs_copyright = Observatoire de Pa
obs_copyright_url =
https://www.obspm.fr/mentions-legales.htm
t_min = 41683
t_max = 46796
obs_regime = Optical
em_min = 3.95E-7
em_max = 5.4E-7
hips_builder = Aladin/HipsGen v9.
hips_version = 1.31
hips_release_date = 2016-09-12T21:38Z
hips_frame = equatorial
hips_order = 10
hips_tile_width = 512
client_category = Image/Optical/MAMA
hips_status = public master clon
hips_tile_format = png fits
hips_pixel_cut = 0.2328 1.494
    
```

- Data survey short description
- Original data source
- Bibliography
- Observation epoch
- Wavelength

Information about the HIPSgen tool used to build the HIPS



□ HIPS original images meta data

JSON tile

VO table

```

<VOTABLE version="1.2" xmlns:xsi="http://www.w3.
xmlns="http://www.ivoa.net/xml/VOTable/v1.2"
xsi:schemaLocation="http://www.ivoa.net/xml/VO
ml/VOTable/v1.2">

<RESOURCE>
  <COOSYS ID="J2000" system="eq_FK5" equinox="J2
  <TABLE name=" CDS P MAMA posse details">
    <FIELD name="RAJ2000" ucd="pos.eq.ra" ref="J
    unit="deg">
  <DESCRIPTION>Right ascension</DESCRIPTION>
  </FIELD>
  <FIELD name="DEJ2000" ucd="pos.eq.dec" ref="
    unit="deg">
  <DESCRIPTION>Declination</DESCRIPTION>
  </FIELD>

```

Original image
Meta data to be
displayed in the
VO table



Location

DSS ★ SDSS ★ 2MASS ★ WISE ★ GALEX ★ PLANCK ★ AKARI ★ XMM ★ Fermi ★ Gaia ★ Simbad ★ NED +

CDS/P/DSS2/blue

180° x 119.9°

grid study wink north hdr multiview match

Search

RAJ2000	DEJ2000	DATE-OBS	EXPOSURE	id	path	access
209.5111	24.80467	1994-02-14T10:73:00	60.0000	xj510_a0po_02_00	XJsurvey	fits

original image superposed with the HIPS

main original image meta data

Link → original image

□ BIG volume data

- **BIG calculation time for BIG volumes of data**

- pixel data may take time to be processed

30h → **749 GB** MAMA images → **3.4 TB**

7h → **271 GB** MaNGA cubes → **1.2 TB**

<20s → **few MB** LIGO HEALPix map → **few MB**

- switch SIMBAD/ Aladin

- **Handle Linux commands**

- download files from web servers
- copying big files
- disk space usage
- currently running processes

□ Complexity and diversity

- **Ask help** → **astronomers and IT specialists**

- Input data
- HIPS validation
- Chose the pertinent information for updating HIPS meta data

- **Learn new vocabulary**

- HIPS
 - Images/data cubes
 - HEALPix
 - Individual pixel/Tiles
 - Pixel center/ring
- Tables
 - Astronomical objects
 - RA/DEC