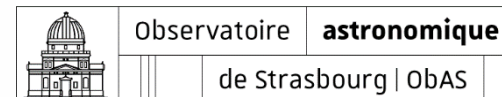# HiPS : 2 years
after the IVOA standard
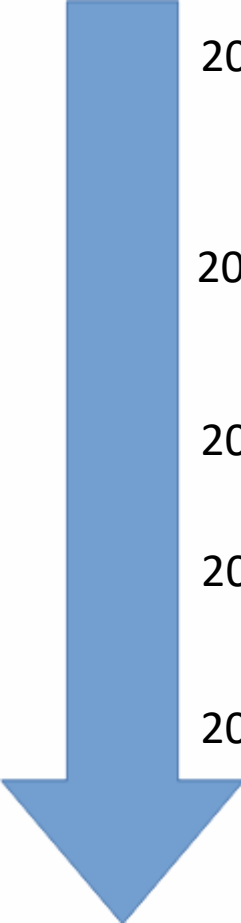
Interop Groningen – 11-13 October 2019

Pierre Fernique

HiPS key dates

2009
- **Proto** called Allsky (CDS dev.)

2015
- HiPS **IVOA endorsement** decision
(Trieste Interop)

2017
- **HiPS IVOA 1.0 REC**

2018
- HiPS network takeoff
(+ 8 HiPS nodes in a few months)

2019
- HiPS data upgrade
(low Norder generation)

☐ HiPS numbers

- ## HiPS data:
  - **815** HiPS (including **47** HiPS cats , **16** HiPS cubes, **62** planet HiPS)
    => **+20%** in one year
  - **2003** instances (masters + mirrors)
  - **320TB** of HiPS **+53%**
    - **2.32^{E}14** pixels (equivalent to a photo album of all inhabitants of the earth with one 302x302 picture per human)
    - **1.86^{E}10** cat rows

    ➡ http://aladin.u-strasbg.fr/hips/list

- ## Usage:
  - **> 650K** tile queries per day
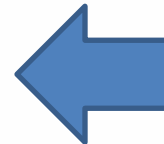   (all clients & servers – low estimation)
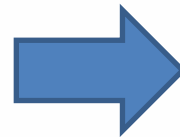
☐ HiPS generation

4 existing tools/libs available today for generating HiPS:

- Pixel HiPS:
    - CDS: java code *(P. Fernique & A. Oberto)* => Aladin/**Hipsgen** => GUI/batch
    - HEASARC: private code (?) *(Tom McGlynn)*
    - IPAC: C lang => **Montage** *(G.B Berriman, J. Good & al)*

New !
See ADASS talk

- Catalog HiPS
    - CDS: java code: **Hipsgen-cat** *(FX Pineau)*

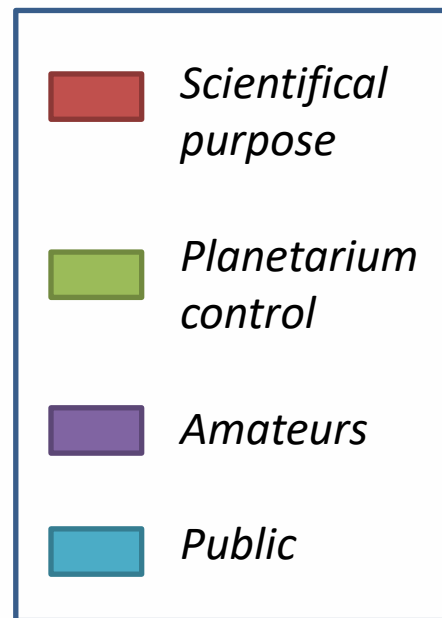# Dozens of HiPS clients covering various niches

- *Available*
  - Aladin Desktop (CDS/Java)
  - MIZAR (JS/WebGL)
  - Aladin Lite (CDS/JS)
  - ESAsky, ESOportal, JUDO2, ++ (Aladin Lite based tools)
  - HscMap   (Subaru project/WebGL)
  - Stellarium Desktop (C)
  - Stellarium Web (C -> Web assembly)
  - Stellarium mobile (?)
  - Kstar (C++)
  - Firefly (IPAC/JS+java backend)
- *Proto*
  - WWT China-VO (China-VO/C#)
- *In preparation*
 - Aladin Lite WebGL (CDS/JS/WebGL/RUST)
  - Digistar (?)

Scientifical purpose

Planetarium control

Amateurs

Public

Some HiPS clients links

- **Aladin Desktop** – http://aladin.u-strasbg.fr/java/Aladin.jnlp
- **MIZAR** - http://sitools2.github.io/MIZAR/
- **Aladin Lite** – http://aladin.u-strasbg.fr/AladinLite
- **ESASKY** - http://sky.esa.int
- **ESO science portal** - http://archive.eso.org/scienceportal/home
- **HscMap** - https://github.com/michitaro/hscMap - https://hsc-release.mtk.nao.ac.jp/hscMap-pdr2/app/
- **Stellarium Desktop** - https://stellarium.org
- **Stellarium Web** - https://stellarium-web.org
- **Firefly** - https://github.com/Caltech-IPAC/firefly
- **Kstar** - https://edu.kde.org/kstars/

Advanced HiPS tools & libraries

- HiPS computed on the fly
  - **HiPS generation by TAP** requests (CatTiler proto– T.Boch Paris Interop)
  - **HiPS RGB on the fly** (operational CDS)
- **HiPSpy library** => https://github.com/hipspy
- **HiPS2fits** CDS server:
  - HiPS cutout service generating FITS images, computing bilinear interpolation from HiPS tiles for any user-provided WCS projection.
  - Available since last week
    => http://alasky.u-strasbg.fr/hips-image-services/hips2fits
- Validator tools:
  - **HiPS validator**: java -jar Hipsgen.jar out=TrgDir LINT
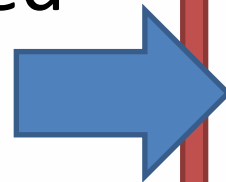 - HiPS list checker: java -jar Hipslint.jar HipsListURL

The HiPS network world map
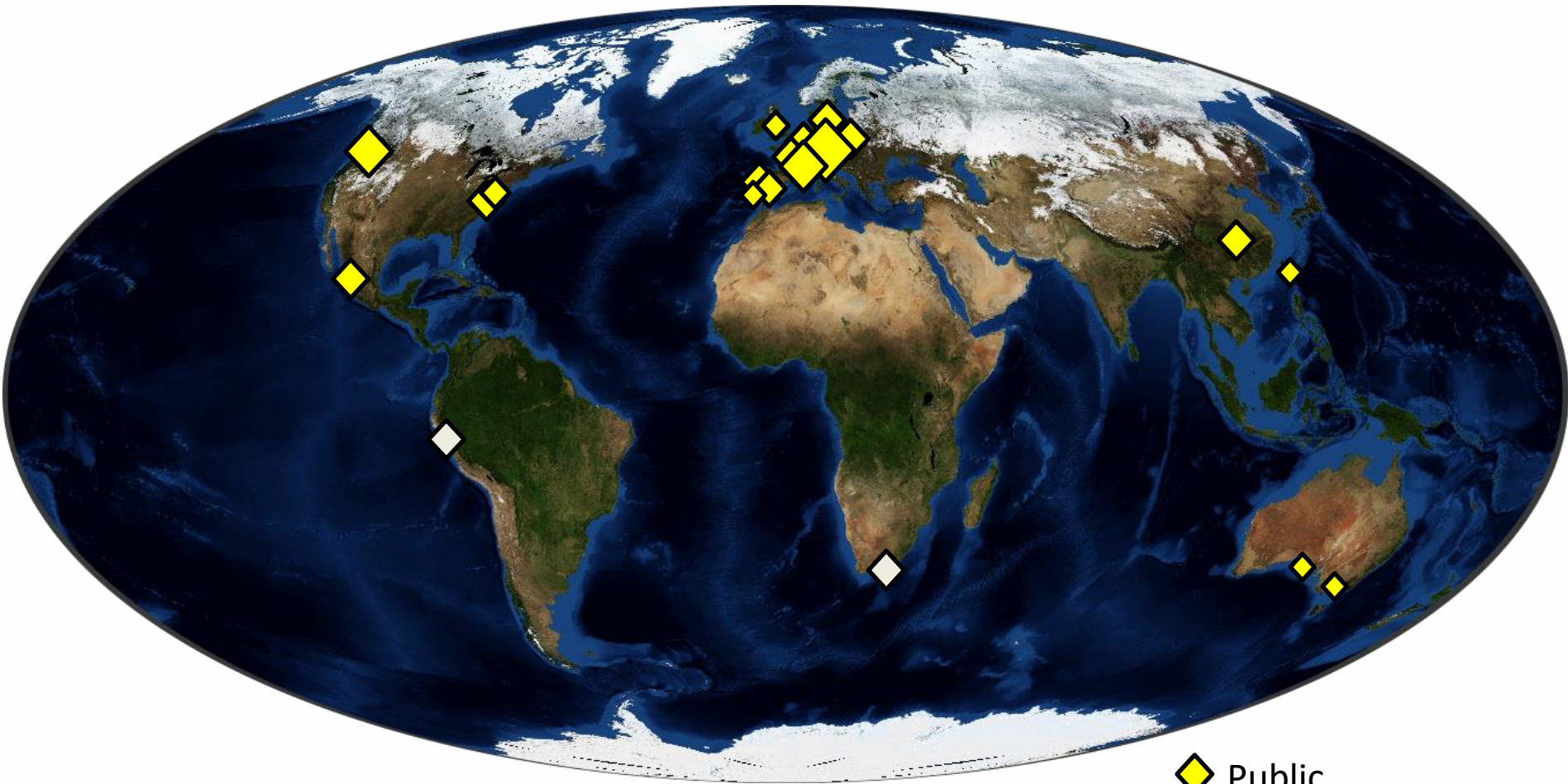
◇ Public
◇ In project

HiPS nodes

- **20** HiPS nodes (stable compared to last year)

  CFA, WFAU, CASDA, PADC, IPAC, ANU, LEIDEN, IRAP, SSC, CDS , AMIGA, SVO, IAS, ESAC, JAXA, CADC, HEASARC, China-VO…

+ dozens of undeclared HiPS nodes (private, project oriented…)

www.sternwarte.uni-erlangen.de
www.eaobservatory.org
www.eao.hawaii.edu
www.atnf.csiro.au
mill.astro.puc.cl
lofar.strw.leidenuniv.nl
gtc.sdc.cab.inta-csic.es
erosita.mpe.mpg.de
elenchically.net
datalab.noao.edu
darts.isas.jaxa.jp
archive-new.nrao.edu
ada.physics.usyd.edu.au:8021
ada.physics.usyd.edu.au:8020
192.168.56.1:80
192.168.56.100:80
192.168.2.45

The big upgrade (not so big)

May-2018

- Proposal (Victoria Interop):
  - **Discourage "low resolution enablers"** usage (allsky file)
  - **Generate low HiPS orders** [0 to 2]
  - *Goal: simplify the HiPS client display algorithm*

Jul-2018
Apr-2019

- Implemented in **Hipsgen** for new HiPS (Jul 2018)
  + Hipsgen **UPDATE** for upgrading old HiPS (Apr 2019)

Jun-2019

- **Applied** by CDS (Apr-June 2019) during the installation of our new disk storage system

Aug-2019

- Followed **by most of the HiPS providers** (still missing 3 sites)

- **Synchronization** of mirrors still **in progress** (still missing 8 sites)

News | *WWT-ChinaVO new HiPS viewer already based on this simplication*

IVOA HiPS Implementation in the Framework of Worldwide Telescope

- The CDS is presently processing a big update all its HiPS by adding the low HiPS orders (Norder0 to 2).
- Fifty main used HiPS have been updated by now, others will be updated within this month.
- With this update, the low orders data can be loaded and rendered by WWT, which means less computer memory consume and faster data displaying.
- China-VO will also update his HiPS to be compatible with the HiPS network.
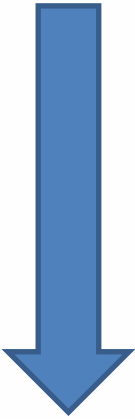
HiPS network status (11 Oct 2019)

	Node	# HiPS	# Masters	Mirrors OutOfDate	Mastrs with warnings	Masters with errors	Compliant with HiPS 1.0
1	cfa.harvard.edu	1	1		1		100%
2	wfau.roe.ac.uk	2	2		2	1	50%
3	CASDA/hipsserver	7		14			
4	PADC/hipsserver	42		0			
5	IPAC/hipsserver	23		2			
6	ANU/hipsserver	1		2			
7	Leiden/hipsserver	2	2		2	1	50%
8	IRAP/hipsserver	258	258		242	1	100%
9	SSC/hipsserver	4	4				100%
10	CDS/hipsmaster	731	370	484	188	65	82%
11	CDS/hipsslave	549		78	0		
12	CDS/hipscat	41	41		41		100%
13	AMIGA/hipsserver	2	2		2		100%
14	svo.cab/hipsserver	1	1		1		100%
15	IAS/hipsserver	27	13		13	2	85%
16	ESAC/hipsserver	82	66	6	53	8	88%
17	JAXA/hipsserver	21	21	14	15	12	43%
18	CADC/hips	166					
19	HEASARC/hipsserver	26	26	0	26	9	65%
20	China-VO/hipsserver	17	8	18	8	4	50%
	TOTAL	**2003**	**815**	618	594	103	

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	TOTAL	**2003**	**815**	618	594	103	

Most current errors

1. Tile width not conform to `hips_tile width`
2. `hips_status error` redundant definition
3. Tile format error (expecting .fits found gzip)

Automatically fixed by Hipsgen UPDATE

5. Mandatory keyword missing (`creator_did, hips_service_url, hips_order, obs_title, …`)
6. Not ISO date
7. Metadata.xml file missing
8. Properties file missing

i13

And now,
open questions…

Q1: Do we have to improve the HiPS REC 1.0 standard?

- No demand

- The big upgrade operate last 6 months has helped for the emergence of new clients without requiring standard upgrade
  => Do we have to move from optional low order to mandatory?
  => Do we have to remove allsky file option?

- Still have problems for the declaration of HiPS nodes is the VO registry
  => clearly too complex (only 4 declarations)
  => Do we have to declare them by procuration ?

Q2: How to manage public & planetarium usage ?

- Technically, **it is managable** as the HiPS network based on HTTP backend is extremelly robust, but...
  - Convince them to use HiPS network "**correctly**" (ex: 65% of Stellarium queries could be avoid)
  - **Mirror** some HiPS on their own HiPS node => share the impact on HiPS servers
  - Use **cache** mechanism (ex: planetarium usage)
  - Create **categories** for HiPS nodes (science, outreach...) ?
  - Take care of **Copyrights** and **Acknowledgements**

Q3: Is HiPS becoming a standard (as FITS) for the astronomical community ?

- We have now most of the surveys available in a common space grid (HEALpix), with the full pixel dynamic:
  => **Gold in our hands for interoperability** and comparison tools.

- It is adopted by recent & new missions: LOFAR, TESS, LSST, EUCLID, WFIRST …

- But often just as a kind of preview (ex: LSST will be not available in HiPS at the nominal resolution, do we know if FITS tiles will be generated ?...)

HiPS is more than preview