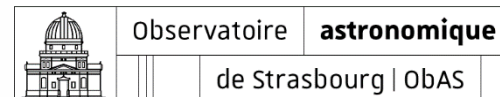


HiPS : 3 years after the REC

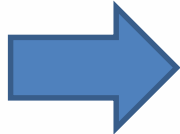
Interop Granada (virtual) – 17-19 November 2020

Pierre Fernique, Matthieu Baumann
& all other HiPS contributors




□ HiPS numbers



- HiPS data:
 - **1034** HiPS (including **50** HiPS cats (+3) , **17** HiPS cubes (+1), **67** planet HiPS (+3))
=> **+26%** in one year (+20% last year)
 - **2483** instances (masters + mirrors)
 - **370TB** of HiPS **+19%**
 - **3.34^{E14}** pixels (~330 000 billions of pixels)
 - **1.82^{E10}** cat rows (~20 billions of rows)
- Usage:  <http://aladin.u-strasbg.fr/hips/list>
 - **around 800K** tile queries per day (+15%)
(all clients & servers [excepted Stellarium Web]) – low estimation)

□ HiPS generation

3 existing tools available today for generating HiPS:

- Pixel HiPS:
 - CDS: java code (*P. Fernique & A. Oberto*)
=> Aladin/**Hipsgen** => GUI/batch
 - IPAC: C lang
=> **Montage** (*G.B Berriman, J. Good & al*) 
- Catalog HiPS
 - CDS: java code: **Hipsgen-cat** (*FX Pineau*)

Other materials:

- HEASARC: HiPS tile generation (*Tom McGlynn*)
- CDS : python code => HiPS color generation (*Thomas Boch*)

□ HiPS clients



- Available

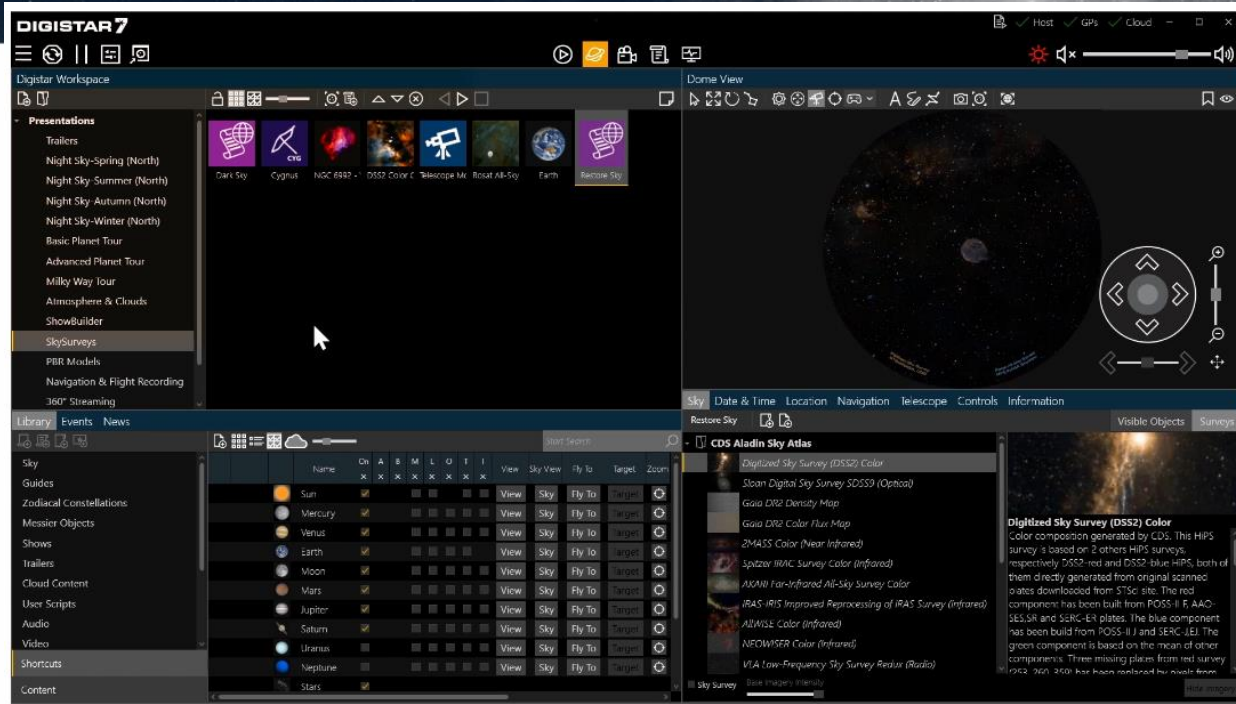
- ■ ■ — Aladin Desktop (CDS/Java)
- — MIZAR (JS/WebGL)
- ■ ■ — Aladin Lite (CDS/JS)
- ■ ■ — ESAsky, ESOportal, JUDO2, ++ (Aladin Lite based tools)
- — HscMap (Subaru project/WebGL)
- ■ ■ — Stellarium Desktop (C)
- ■ ■ — Stellarium Web (C -> Web assembly)
- ■ ■ — Stellarium mobile (?)
- ■ ■ — Kstar (C++)
- — Firefly (IPAC/JS+java backend)
- — **Digistar**
- ■ ■ — **WWT** (AAS/C#)

- Proto

- ■ ■ — WWT China-VO (China-VO/C#)
- ■ ■ — **Aladin Lite v3** (CDS/JS/WebGL/RUST)

■	Scientific purpose
■	Planetarium control
■	Amateurs
■	Public

□ New HiPS tools (2020)



Digistar 7 from



WWT from



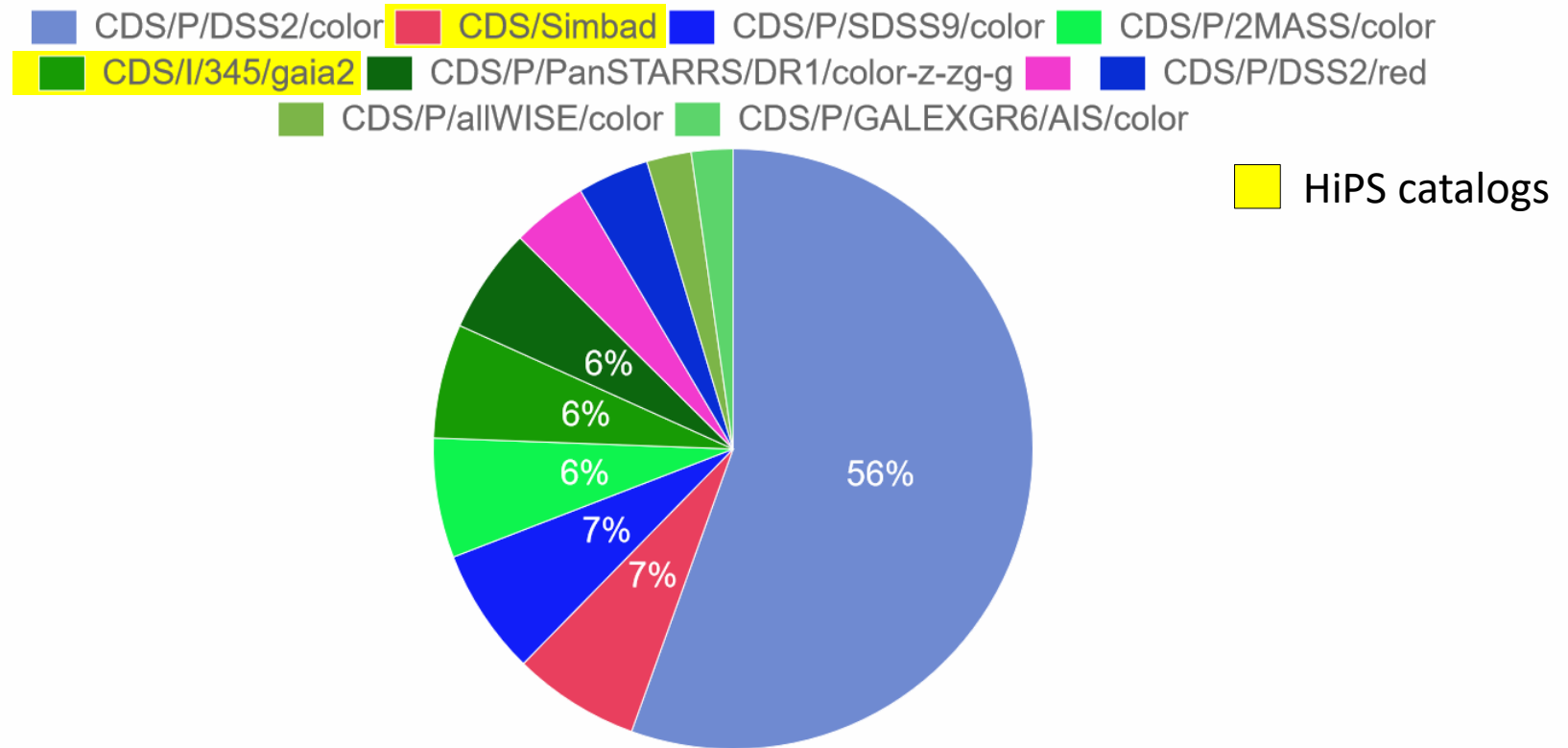
□ Some HiPS clients links

- **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/>
- **Digistar** - <https://www.es.com/ips-2020-presentation/>
- **WWT AAS** - <http://worldwidetelescope.org/home/>
- **Aladin Lite V3** - <http://aladin.unistra.fr/AladinLite/v3-preview/>

HiPS top 10

A partial stats based on Aladin Desktop

Top10 HiPS loaded in Aladin Desktop

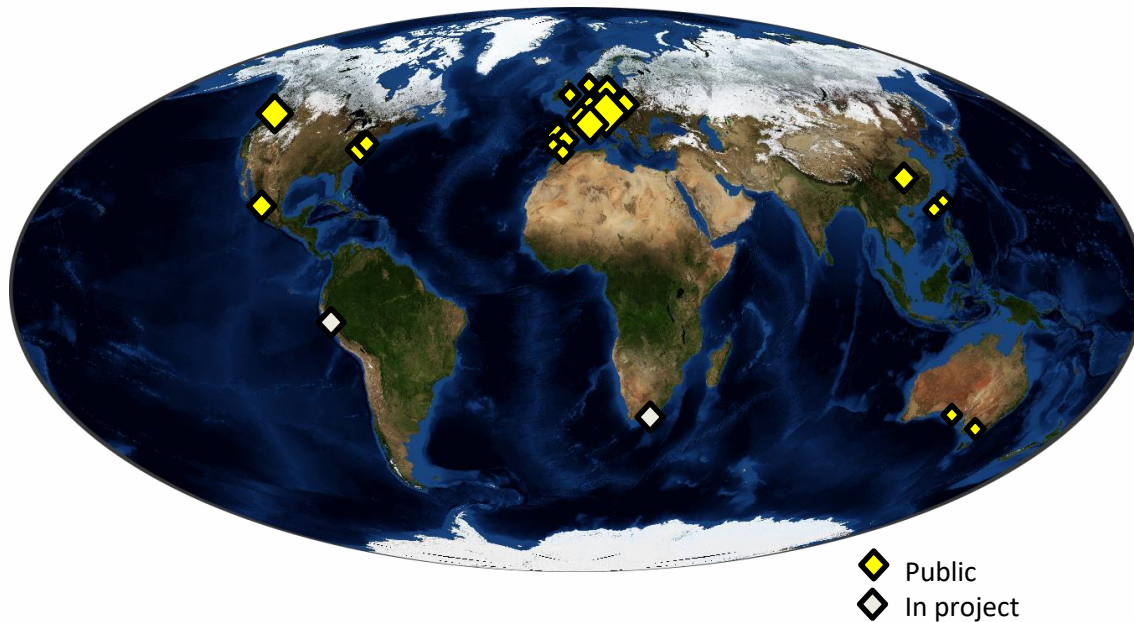


□ HiPS nodes (= HiPS servers)

- **23** HiPS nodes (+3 compared to last year)

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

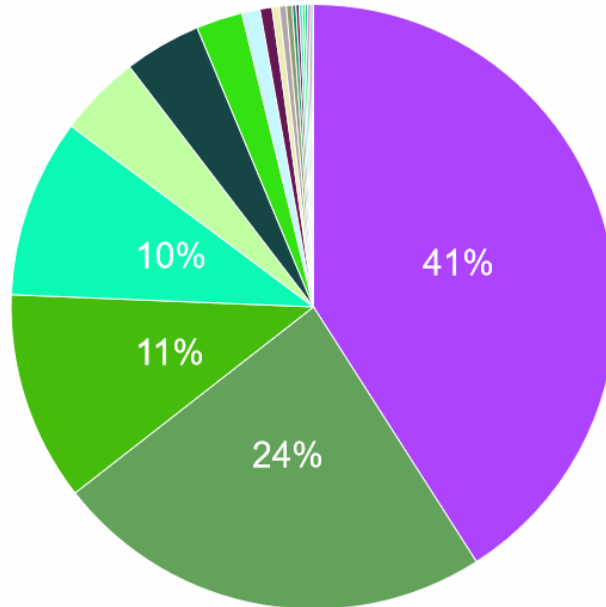
=> The 3 new nodes: **ASTRON, JVO, CEFC**



HiPS nodes stats

A partial usage stats based on Aladin Desktop

Repartition of hips nodes used by Aladin Desktop



□ HiPS Validators

- **HiPS validator** => check 1 HiPS

⇒ java -jar Hipsgen.jar out=TrgDir LINT

- **HiPS list checker** => check a HiPS server

⇒ java -jar Hipslint.jar HipsListURL

⇒ <http://aladin.u-strasbg.fr/hips/Hipslint.jar>

□ Hips network scanning...

- A simple perl script using **Hipslint.jar** verifier
- ~2 hours for scanning the 2500 HiPS instances

```
check-2020-11-17.txt - Notepad2
File Edit View Settings ?
1
2 Scanning hips.astron.nl [url=http://hips.astron.nl/hipslist]...
3 . 1 hips.astron.nl/ASTRON/P/tgssadr Master 2warn
4 . 2 hips.astron.nl/ASTRON/P/apertif_dr1 Master 4warn
5
6 Scanning jvo [url=http://jvo.nao.ac.jp/hips/hipslist.txt]...
7 . 1 jvo/P/spcam/ALL Master 2warn
8 . 2 jvo/P/spcam/W-A-Y Master 2warn
9 . 3 jvo/P/spcam/W-C-IC Master 2warn
10 . 4 jvo/P/spcam/W-C-RC Master 2warn
11 . 5 jvo/P/spcam/W-J-B Master 2warn
12 . 6 jvo/P/spcam/W-J-U Master 2warn
13 . 7 jvo/P/spcam/W-J-V Master 2warn
14 . 8 jvo/P/spcam/W-J-VR Master 2warn
15 . 9 jvo/P/spcam/W-S-G+ Master 2warn
16 . 10 jvo/P/spcam/W-S-I+ Master 2warn
17 . 11 jvo/P/spcam/W-S-R+ Master 2warn
18 . 12 jvo/P/spcam/W-S-Z+ Master 2warn
19 . 13 jvo/P/spcam/W-S-ZB Master 2warn
20 . 14 jvo/P/spcam/W-S-ZR Master 2warn
21
22 Scanning CEFC A [url=https://archive.cefca.es/catalogues/hips_list.html]...
23 . 1 CEFC A/P/j-plus/J-PLUS-DR2 Master 1warn
24 . 2 CEFC A/P/mini jpas/MINI J-PAS-PDR201912 Master 1warn
25 . 3 CEFC A/P/j-plus/J-PLUS-DR1 Master 1warn
26 . 4 CEFC A/I/j-plus/J-PLUS-DR2 Master 14err 3warn
27 . 5 CEFC A/I/mini jpas/MINI J-PAS-PDR201912 Master 14err 3warn
28 . 6 CEFC A/I/j-plus/J-PLUS-DR1 Master 14err 3warn
29
30 Scanning cfa.harvard.edu [url=https://cdfaftp.cfa.harvard.edu/hipslist]...
31 . 1 cxc.harvard.edu/p/cda/hips/allsky/rgb Master 3warn
32
33 Scanning wfau.roe.ac.uk [url=http://surveys.roe.ac.uk/hips71/hipslist]...
34 . 1 wfau.roe.ac.uk/P/UHSDR1/J Master 1err 3warn
35 . 2 wfau.roe.ac.uk/P/UHSDR1/J Master 2err 1warn
36 . 3 wfau.roe.ac.uk/P/UKIDSS/GCS/Z Master 7err 2warn
37 . 4 wfau.roe.ac.uk/P/UKIDSS/GCS/Y Master 7err 2warn
38 . 5 wfau.roe.ac.uk/P/UKIDSS/GCS/J Master 1warn
39 . 6 wfau.roe.ac.uk/P/UKIDSS/GCS/H Master 7warn
40 . 7 wfau.roe.ac.uk/P/UKIDSS/GCS/K1 Master 1warn
41 . 8 wfau.roe.ac.uk/P/UKIDSS/GCS/K2 Master 1err 2warn
42 . 9 wfau.roe.ac.uk/P/UKIDSS/LAS/Y Master 3warn
43 . 10 wfau.roe.ac.uk/P/UKIDSS/LAS/J1 Master 2warn
44 . 11 wfau.roe.ac.uk/P/UKIDSS/LAS/J2 Master 1err 3warn
45 . 12 wfau.roe.ac.uk/P/UKIDSS/LAS/H Master 4warn
46 . 13 wfau.roe.ac.uk/P/UKIDSS/LAS/K Master 2warn
47
48 Scanning CASDA/hipsserver [url=https://casda.csiro.au/hips/hipslist]...
49 . 1 CDS/P/NVSS Mirror
50 . 2 CDS/P/SUMSS Mirror
51 . 3 CDS/P/DSS2/color Mirror
52 . 4 CDS/P/2MASS/color Mirror
53 . 5 CDS/P/SPITZER/color Mirror
54 . 6 CDS/P/UKIDSS/LAS/color Mirror
Ln 1: 6 091 Col 1 Sel 0 449 Ko ANSI LF INS Default Text
```

State of the HiPS network (17 nov 2020)

	Node	# HiPS	# Masters	Mirrors OutOfDate	Masters with warnings	Masters with errors	Compliant with HiPS 1.0
1	<i>hips.astro.nl</i>	2	2		2		100%
2	<i>jvo</i>	14	14		14		100%
3	<i>CEFCA</i>	6	6		6	3	50%
4	<i>cfa.harvard.edu</i>	1	1		1		100%
5	<i>wfau.roe.ac.uk</i>	13	13		13	6	54%
6	<i>CASDA/hipserver</i>	7		14			
7	<i>PADC/hipserver</i>	42					
8	<i>IPAC/hipserver</i>	23		2			
9	<i>ANU/hipserver</i>	1					
10	<i>Leiden/hipserver</i>	2	2		2	1	50%
11	<i>IRAP/hipserver</i>	430	430		430	15	97%
12	<i>SSC/hipserver</i>	4	4		1		100%
13	<i>CDS/hipsmaster</i>	917	391	34	188	111	72%
14	<i>CDS/hipslave</i>	915		36	0		
15	<i>CDS/hipscat</i>	41	41		41		100%
16	<i>AMIGA/hipserver</i>	2	2		2		100%
17	<i>svo.cab/hipserver</i>	1	1		1		100%
18	<i>IAS/hipserver</i>	27	13		13	2	85%
19	<i>ESAC/hipserver</i>	82	66	8	59	1	98%
20	<i>JAXA/hipserver</i>	28	28	16	20	16	43%
21	<i>CADC/hips</i>	166					
22	<i>HEASARC/hipserver</i>	26	26		26	9	65%
23	<i>China-VO/hipserver</i>	18	9	18	9	5	44%
	TOTAL	2768	1049	128	828	169	

□ Most current errors

1. Moc.fits file missing
2. Mandatory keyword missing (`creator_id`, `hips_service_url`, `hips_order`, `obs_title`, ...)
3. Not ISO date
4. Tile width not conform to `hips_tile width`
5. Properties file missing
6. `min_order` not conform

□ Most current warnings

1. Recommended keyword missing (`em_min`, `em_max`, `t_min`, `t_max`, `obs_regime`, `prov_progenitor`, ...)
2. Not conform vocabulary for `obs_regime`
3. FITS tile gzipped (deprecated)

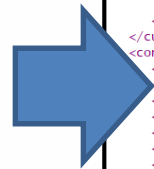
4. Moc.fits in galactic (deprecated – but still required for Aladin Desktop 9 and 10)
=> advise: wait 1 more year before fixing

□ VO registry declarations

7 declarations on 23 public HiPS nodes

May be too tedious (XML level)

=> **Suggestion:** A **dedicated interface** would be welcome on Euro VO registry or other generic VO registry



```
<ri:Resource xmlns:ri="http://www.ivoa.net/xml/RegistryInterface/v1.0"
  xmlns:vr="http://www.ivoa.net/xml/VOResource/v1.0"
  xmlns:vs="http://www.ivoa.net/xml/VODataService/v1.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  created="2019-07-08T00:00:00Z"
  status="active"
  updated="2019-07-18T00:00:00Z"
  xsi:schemaLocation="http://www.ivoa.net/xml/VOResource/v1.0 http://www.ivoa.net/xml/VOResource/v1.0
http://www.ivoa.net/xml/VODataService/v1.0 http://www.ivoa.net/xml/VODataService/v1.0
http://www.ivoa.net/xml/RegistryInterface/v1.0 http://www.ivoa.net/xml/RegistryInterface/RegistryInterface-1.0.xsd"
  xsi:type="vr:Service">
  <validationLevel validatedBy="ivo://archive.stsci.edu/nvoregistry">2</validationLevel>
  <title>Chandra HiPS Service</title>
  <shortName>CXC hips service</shortName>
  <identifier>ivo://cxc.harvard.edu/hips</identifier>
  <curations>
  <publisher ivo-id="ivo://cxc.harvard.edu/cxo">
  Chandra X-ray Observatory
  </publisher>
  <creator>
  <name>Chandra X-ray Center</name>
  </creator>
  <contact>
  <name>Chandra Data Archive, Chandra X-ray Center</name>
  <address>60 Garden Street MS 67, Cambridge, MA 02138, USA</address>
  <email>archelp@cfa.harvard.edu</email>
  </contact>
  </curations>
  <content>
  <subject>X-ray astronomy</subject>
  <subject>galaxies</subject>
  <subject>quasars</subject>
  <subject>stars</subject>
  <subject>X-ray</subject>
  <subject>photometry</subject>
  <subject>spectroscopy</subject>
  <subject>variability</subject>
  <description>The Chandra X-ray Observatory Data Archive provides a reference survey via the HiPS protocol. For
  detailed information on the Chandra observatory and datasets see: http://cxc.harvard.edu/ for general Chandra
  information; http://cxc.harvard.edu/cda/ for the Chandra Data Archive; http://cxc.harvard.edu/csc/ for Chandra source
  catalog information.
  </description>
  <referenceURL>http://cxc.harvard.edu/cda/</referenceURL>
  <type>Archive</type>
  <contentLevel>Research</contentLevel>
  <contentLevel>University</contentLevel>
  <contentLevel>Community college</contentLevel>
  <relationships>
  <relationshipType>derived-from</relationshipType>
  <relatedResource ivo-id="ivo://cxc.harvard.edu/cda">Chandra Data Archive</relatedResource>
  </relationships>
  </content>
  <!-- HiPS server registration http://www.ivoa.net/documents/HiPS/20170519/REC-HIPS-1.0-20170519.pdf section 5.3.1 --
  <capability standardID="ivo://ivoa.net/std/hips#hips11st-1.0">
  <interface role="std" xsi:type="vs:ParamHTTP">
  <accessURL use="full">https://cdfatp.cfa.harvard.edu/hips11st</accessURL>
  </interface>
  </capability>
  </ri:Resource>
```

□ A big concern

HiPS is more than preview

Please ! Do no remove your FITS tiles!

- Cutouts from HiPS => hips2fits
 - SED from FITS tiles
- On-the-fly color HiPS generation
 - ⇒ See ADASS Poster P9-170:

<https://wiki.ivoa.net/internal/IVOA/InterOpNov2020Ops/P9-170.pdf>

=> Demonstration Matthieu Baumann

Aladin lite V3 blender