

Web-based approach to Data Management

My first 25 years of data handling via RDBMS and web-oriented systems



Why web-based tools?

Kwds: Collaborative data-driven science – Bringing analysis to data – Accessibility – Science for all

- A **browser** can be seen as a VM
- No (user) code maintenance required
- Client-server architecture (e.g. **Node.JS**)
- Advanced graphics (e.g. **WebGL**)
- Can handle large data sets residing on the server / cloud
- Co-existence of relational and No-SQL DBs (e.g. **MongoDB**)
- Code implemented in various languages (not just Python)
- User friendly \Rightarrow not just for professional astronomers
- Real-time or batch processing



CARTA as a reference case

Cube Analysis and Rendering Tool for Astronomy

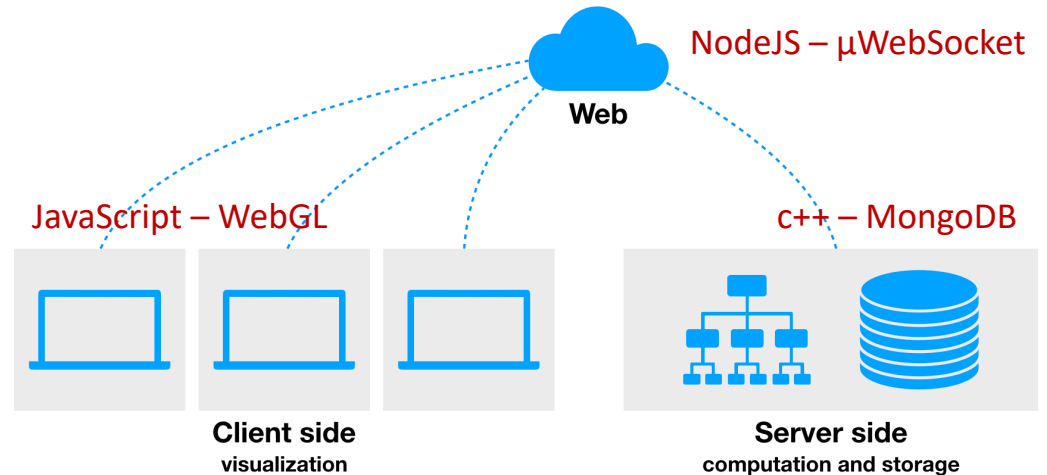
<https://carta.readthedocs.io/en/4.1/>

- Image visualization and analysis tool designed for **ALMA**, **VLA**, **MeerKAT** and **ASKAP** as well as **SKA**
- CARTA uses a **client-server architecture** suitable for visualizing images with large file sizes (GB to TB)
- CARTA is mainly built in **C++**, **TypeScript**, and **JavaScript** and **various third-party libraries**

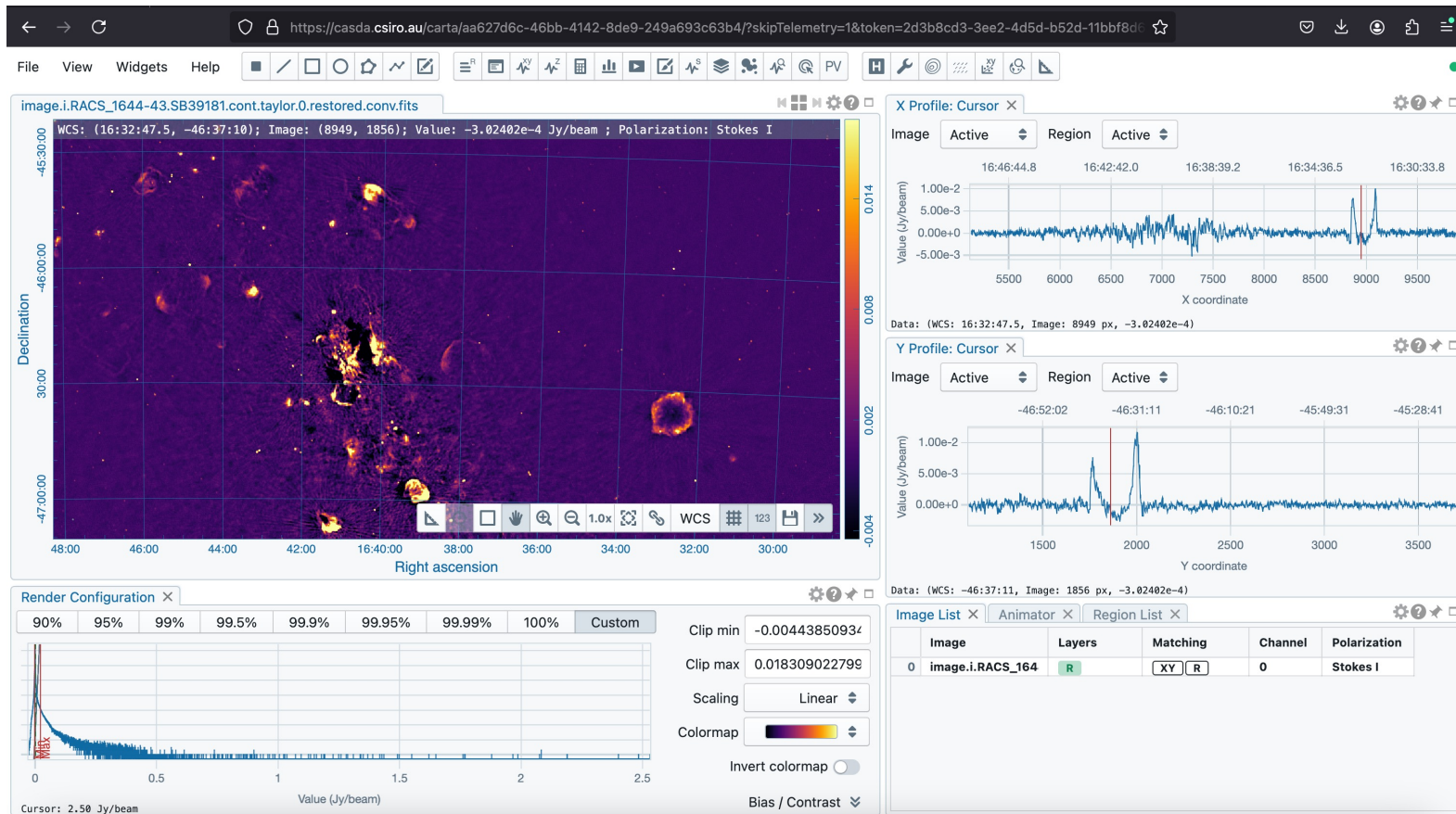
Note:

CARTA is fundamentally a **web application** with **three** main components:

- **carta_backend**
- **carta_frontend**
- **carta-controller**



The source code of CARTA is available on [GitHub](#).



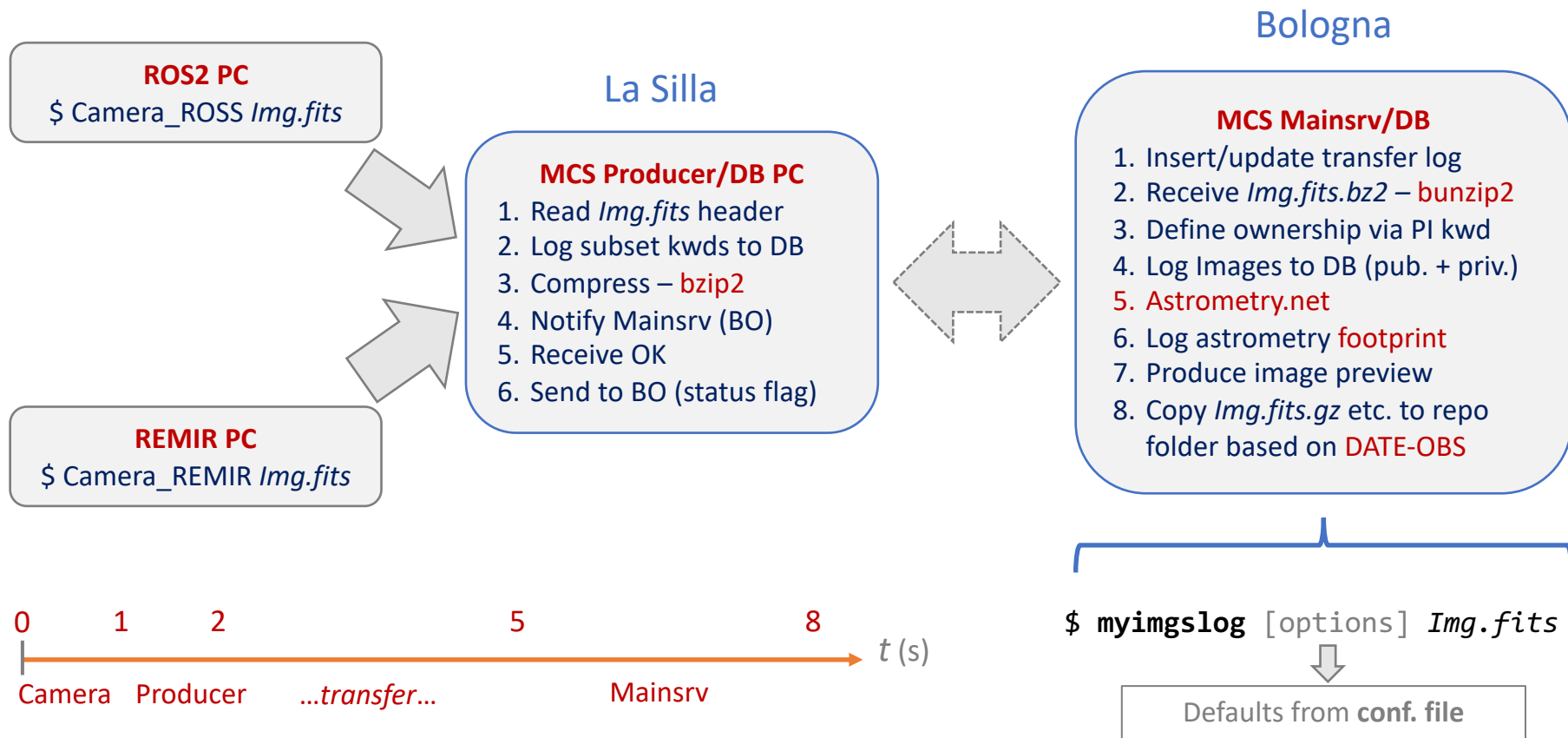
Web-based data management tools

Project / Observatory specific tools (e.g.)

- **CASDA:** data.csiro.au/domain/casda (CARTA viewer)
- **XMM-Newton:** nxsa.esac.esa.int/nxsa-web/#search
- **SciServer:** www.sciserver.org
- **SDSS:** skyserver.sdss.org/dr18

Multi-mission / generic tools (e.g.)

- **ESASky:** sky.esa.int/esasky
- **ESO science portal:** archive.eso.org/scienceportal
- **MAST:** archive.stsci.edu
- **CADC:** www.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/en
- **SIMBAD/VizieR:** simbad.cds.unistra.fr – vizier.cds.unistra.fr



rem.oas.inaf.it/DB

Custom

- MCS: github.com/gcalderone/MCS
- DIF / SID: github.com/lnicastro/DIF – github.com/lnicastro/SID
- MyRO: github.com/lnicastro/MyRO
- Catalogues: catsweb.oas.inaf.it

+ G. Calderone - OATS

Public

- DB server ⇒ MySQL (MariaDB)
- Web server ⇒ Apache
- Languages ⇒ C++, PHP, HTML5, CSS3, JavaScript

Main JS packages: JQuery, Aladin Lite, JS9, amCharts

DB course: astrordbms.oas.inaf.it

Live images counting: ROSS/2: **1824837** + **125620** dark/bias + **79131** flat frames / REMIR: **3894483** + **173634** flat frames

Log in

User name

Password

Access the **REM-Public archive**
for images older than about 1.5 years

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Browse the [ROS2](#) and [REMIR](#) observation log

Get the **ROS2** master [BIAS](#) and [FLAT](#)

Please read the [INAF Data Policy Document](#) | « [REM live with the t-REM-o-meter and WEBcam](#) »

REM images browser:
Read the usage permission rules.

Credits

Written by L. Nicastro
Version: 0.9b, 12-Oct-2017

Public data archive browser

To get access, please first click on the square with a color closer to this



Information about the ROSS/REMIR images at the [REM web site](#)

Please read the [INAF Data Policy Document](#)

Live images counting: ROSS/2: 1824837 + 125620 dark/bias + 79131 flat frames / REMIR: 3894483 + 173634 flat frames

🔒 Log in

User name

Password

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[Get the ROS2 master BIAS and FLAT](#)

Please read the [INAF Data Policy Document](#) | « REM live with the t-REM-o-meter and WEBcam »

REM-ROS2 normalised and bias subtracted monthly Master Flats

→ [Master Bias](#)

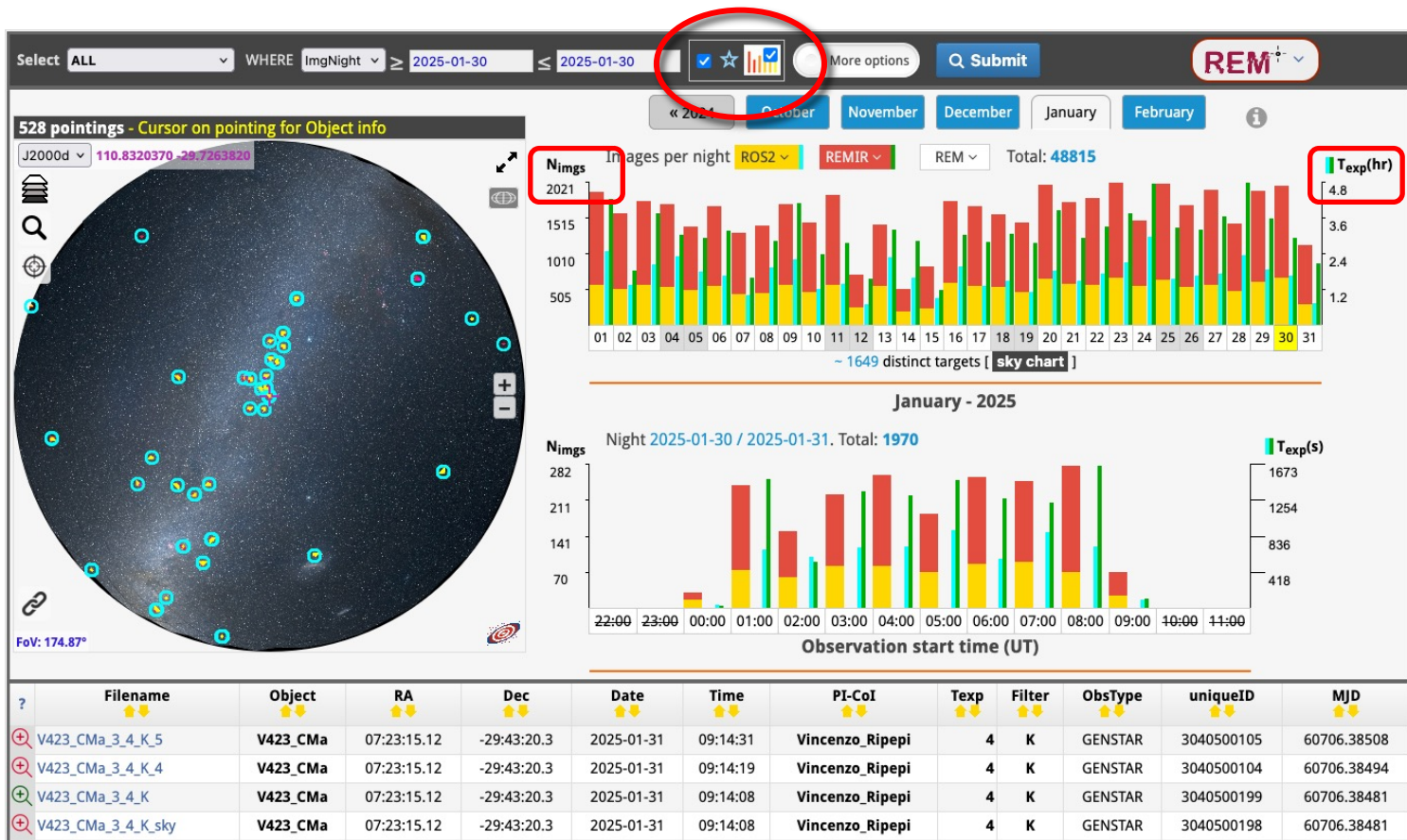
Goto to year: [2013](#), [2014](#), [2015](#), [2016](#), [2017](#), [2018](#), [2019](#), [2020](#), [2021](#), [2022](#), [2023](#)

2025 ("s" version → gain = 1.0)

Month	BL (z)	BR (r)	UL (i)	UR (g)
January	JPG FITS	JPG FITS	JPG FITS	JPG FITS

2024 ("s" version → gain = 1.0)

Month	BL (z)	BR (r)	UL (i)	UR (g)
December	JPG FITS	JPG FITS	JPG FITS	JPG FITS
November	JPG FITS	JPG FITS	JPG FITS	JPG FITS
October	JPG FITS	JPG FITS	JPG FITS	JPG FITS
September	JPG FITS	JPG FITS	JPG FITS	JPG FITS
August	JPG FITS	JPG FITS	JPG FITS	JPG FITS
July	JPG FITS	JPG FITS	JPG FITS	JPG FITS
June	JPG FITS	JPG FITS	JPG FITS	JPG FITS
May	JPG FITS	JPG FITS	JPG FITS	JPG FITS



Select ALL WHERE ImgNight \geq 2019-04-21 \leq 2019-04-21 More options Submit REM

ProximaCenb - H: 217.358441, -62.678319 (l=313.910, b=-1.914)

J2000 14 29 25.760 -62 40 42.99

March April May June

MIR REM Total: 32976

90 distinct targets [sky chart]

April - 2019

2818434. ProximaCenb_4_2_J preview (-JS9) Tools RefCats

Object: ProximaCenb (GENSTAR) PI: Red_dots

RA: 14:29:42.96 Dec: -62:40:45.8 Date: 2019-04-22 UT: 08:50:57
 Gl: 313.94 Gb: -1.927 MJD: 58595.36872

Filter: J Exp.: 2 s

ObsID: 220096 SubID: 1 DithID: 99
 ObID: 228097 PropID: 9

REMIH Co-added image

Inserted on: 2019-04-22 19:20:43 UT. PI user name: rdots

Calibrated source catalogue is available: [retrieve - View \(?\)](#)

REM **/Ross/ImgsDBArchive/20250220/IMG2025049ULs140.fits.gz**

Close this window

File Edit View Zoom Scale Color Regions WCS Analysis Help **Overlay ref. catalogue: 177 objs**

APASS9 x2 /2 z1 center

1698.000 07:51:54.234 -24:23:03.44 (FK5) 507.500 361.500 (physical)

3dPlot (JS9)

x2 /2 4

id: apass9
pos: 117.976850 -24.383689

grey 50% linear (241.84,606.70) FK5

REM images browser: Read the usage permission rules. Credits Written by L. Nicastro Version: 0.9b, 12-Oct-2017

REM **/Ross/ImgsDBArchive/20250220/IMG2025049ULs140.fits.gz**

Close this window

File Edit View Zoom Scale Color Regions WCS Analysis Help **Overlay ref. catalogue: 177 objs**

APASS9 x2 /2 z1 center

18913.000 07:51:54.348 -24:23:01.32 (FK5) 509.500 357.500 (physical)

apass9 close

id:	14337607
htmlID:	6: 40704
RAJ2000:	117.976849
DEJ2000:	-24.383688
e_RAJ2000:	0.471
e_DEJ2000:	0.219
Field:	20161223
Nr Observations:	4
Nr Images:	18
B-V:	1.416
e_B_V:	0.03
Vmag:	10.994
e_Vmag:	0.024

id: apass9
pos: 117.976850 -24.383689

grey 50% linear (241.84,606.70) FK5

REM images browser: Read the usage permission rules. Credits Written by L. Nicastro Version: 0.9b, 12-Oct-2017

TOCats & TOCatsweb

A tool for fast access to astronomical surveys and object catalogues by using hierarchical scheme techniques to split the celestial sphere, in particular the HEALPix scheme.

The screenshot displays the TOCats web interface. At the top, it shows the browser title "TOCats - HiPS catalogues browser, V.2.1 - Developed using DIF and Aladin Lite v3" and the user "gwsusr@bogws". The main interface is divided into several sections:

- Map:** A large circular map of the sky showing a field of stars. A legend indicates "31 objects in the field" and "Green SNRs ATNF PSRCat v2.5.1".
- Table:** A table of objects with columns for Label, RA, Dec, S1400, and Sep. The first few rows are:

Label	RA	Dec	S1400	Sep
B1610-50	243.54704	-50.80097	4.1	654.36
J1550-5418	237.725516	-54.306698	4	953.09
B1509-58	228.48255	-59.136	1.43	1371.4
J1119-6127	169.80958	-61.46375	1.09	3057.6
J1734-3333	263.6121	-33.556	0.71	707.13
J1357-6429	209.26012	-64.49172	0.52	1999.7
J1617-5055	244.3721	-50.92033	0.27	638.94
J1818-1607	274.500806	-16.13139	0.2	1903.9
B0540-69	85.04667	-69.331714	0.1	4079.3
J1124-5916	171.1625	-59.2719	0.08	3063.2
- Object Information Panel:** A detailed view of the selected object "psrcat: 16:14:11.29 -50:48:03.5 (243.547040, -50.800970)". It lists various parameters such as NAME: B1610-50, S1400: 4.1, Sep: 654.36', and other identifiers like r_NAME, PSRJ, RAJ, eRAJ, r_RAJ, wmp+00, etc.

catsweb.oas.inaf.it

TOCats three main components

1. A relational **DBMS**, with hierarchically structured tables containing various types of catalogues and associated metadata
2. A **web service** that makes images and catalogues easily queryable and accessible from a browser or a script
3. A repository of Hierarchical Progressive Surveys (**HiPS**) with images and object density maps

TOCats & TOCatsweb – *main components*

Built on

- **MySQL:** dev.mysql.com
- **DIF:** github.com/Inicastro/DIF
- **Aladin Lite:** aladin.cds.unistra.fr/AladinLite/doc
- **Hipsgen:** aladin.cds.unistra.fr/hips
- **DataTables:** datatables.net
- **amCharts:** www.amcharts.com

... and

- **Web server** ⇒ Apache
- **Languages** ⇒ C++, PHP, HTML5, CSS3, JavaScript, Python
- **+ JS packages** ⇒ JQuery, JS9, **custom code**

- ~ **110 public** catalogues (Opt/IR/NIR/Radio/UV/X- γ)
- ~ **100 private** catalogues
- ~ **20 TB** (raid 1)
- **10 projects**

TOCats & TOCatsweb – capabilities

- Combine **DIF** managed catalogues with **HiPS** public and private surveys and
- Handle extended sources / **footprint**
- Retrieve the catalogue's data in multiple formats from the interface or a script (**API**)
- Accessible from **VO tools** (e.g. TOPCAT)
- One click external tools access
- Add **your project** and implement your **plug-in tools** to handle any type of data
- Take advantage of all the **Aladin Lite v.3** capabilities:
 - Multi-surveys view (**jpg, png, fits**)
 - FITS files (etc.) drop-in
 - HIPS2FITS tool
 - Etc.

Note:

Aladin Lite is being upgraded continuously

The screenshot displays the TOCats web interface. At the top, the title bar reads "TOCats – HiPS catalogues browser, V. 2.0 – Developed using DIF and Aladin Lite v3". The user is logged in as "gwsusr@bogws". A search bar contains "Where optional SQL clause". The main view shows a multi-survey image with 13 objects in the field. A table lists the objects with columns for RA, Dec, Fint, and Sep. A detailed view of the selected object "racsd1" is shown on the right, including its ID, Gaussian ID, Source ID, Title, SBID, Obs Start Time, N Gauss, RA, Dec, E_RA, E_Dec, Total flux, and Peak flux. A "Click & share" button is visible at the bottom, and a share URL is provided in a red box.

RA	Dec	Fint	Sep
206.535423	-37.967455	1260.803	3.4418
206.572026	-37.977223	1260.803	2.2289
206.532695	-37.975933	1260.803	3.7408
206.543585	-37.972238	1260.803	3.18
206.542924	-37.981355	1260.803	3.4653
206.60163	-37.971277	1260.803	1.2456
206.580565	-37.971423	1260.803	1.6982
206.566012	-37.975629	1260.803	2.3751
206.542896	-37.973059	1260.803	3.23
206.594666	-37.972902	1260.803	1.4197

Selected objects:

- 1. racsd1: 13:46:08.50 -37:58:02.8 (206.535423, -37.967455)
Fint: 1260.803 Sep: 3.4418'

Share URL: <https://catsweb.oas.inaf.it/?catname=racsd1&coords=206.605001,-37.950688&radius=5.465&survey=racs>

TOCats & TOCatsweb – use cases

Import local MOC, REG and CSV files

ds9 REGION file

```
ellipse(71.11583,-67.97030, 0.022,0.015,80) #text={J0444-6758}  
tag={candidate} color=red  
  
ellipse(71.80072,-69.32124, 0.032,0.05,320) #text={J0447-6918}  
tag={MCSNR} color=cyan  
  
circle(72.10489,-67.00686, 0.045) #text={J0448-6700}  
tag={MCSNR} color=green  
  
ellipse(72.391666,-69.05944, 0.031,0.029,0) #text={J0449-6903}  
tag={MCSNR} color=cyan  
  
circle (72.330,-69.33889, 0.027) #text={J0449-6920}  
tag={MCSNR} color=green  
  
ellipse(72.55166,-68.30133, 0.126,0.10,105) #text={J0450-6818}  
tag={candidate} color=red  
  
circle (72.6125,-70.8375, 0.053) #text={J0450-7050}  
tag={MCSNR} color=green  
  
ellipse(72.94051,-67.29002, 0.081,0.047,60) #text={J0451-6717}  
tag={candidate} color=magenta  
... ..
```

LMC

The screenshot shows the TOCats web interface. At the top, the title is "TOCats – HIPS catalogues browser, V.2.1 – Developed using DIF and Aladin Lite v3". The user is logged in as "nicastro@eross". The main view is a star field with several colored regions overlaid. A table of objects is displayed on the right, with columns for Label, RA, Dec, S1400, and Sep. The table shows 28 objects in the field. A red box highlights the "Upload", "MOC", "REG", and "CSV" buttons in the top navigation bar. Another red box highlights the "External Tools" section at the bottom, which includes buttons for SIMBAD, ESO Portal, VizieR, DSS, Legacy Survey, SkyMapper, HIPS2FITS, and others. A yellow box highlights the "External tools" text at the bottom right. A green box highlights a selected object in the table: "psrcat: 05:11:56.50 -65:08:36.5 (77.985420, -65.143470)".

Label	RA	Dec	S1400	Sep
J0523-7125	80.95275	-71.43127	1	100.52
J0511-6508	77.98542	-65.14347	0.31	284.66
J0540-7125	85.1283	-71.42539	0.3	130.93
B0529-66	82.46208	-66.87775	0.213	176.15
J0519-6932	79.94549	-69.539856	0.13	23.669
J0556-67	89.10417	-67.48333	0.12	225.19
J0534-6703	83.6507	-67.0636	0.116	172.59
B0540-69	85.04667	-69.331714	0.1	90.702
J0543-6851	85.9696	-68.857	0.087	120.33
B0456-69	73.9481	-69.85953	0.083	143.91

External tools

TOCats & TOCatsweb – use cases

Euclid-NISP J footprint

The screenshot displays the TOCats web interface. At the top, it shows the INAF logo and the title "TOCats – HiPS catalogues browser, V. 2.1 – Developed using DIF and Aladin Lite v3". The main area is a star field with an orange grid overlay. A search bar at the top left contains the coordinates "83.024902 -41.328938" and a zoom level of "1047.70". The right side of the interface features a table of object data, a search bar, and a pagination control.

Ref. Cat. BSC Options

Show entries Search:

Label	RA	Dec	Vmag	Sep
Alp Car	95.987917	-52.695833	-0.72	861.18
Alp Col	84.912083	-34.074167	2.64	444.38
Tau Pup	102.484167	-50.614722	2.93	979.56
1Zet CMa	95.078333	-30.063333	3.02	893.63
Bet Col	87.74	-35.768333	3.12	400.18
Nu Pup	99.440417	-43.196111	3.17	736.25
Alp Dor	68.499167	-55.045	3.27	1003.1
41Ups4Eri	64.47375	-33.798333	3.56	988.41
13Gam Lep	86.115833	-22.448333	3.6	1143.5
52Ups2Eri	68.8875	-30.562222	3.82	940.47

Showing 1 to 10 of 273 entries

Previous 2 3 4 5 ... 28 Next

Share URL of current view (refreshed at each Redraw):
<https://catsweb.oas.inaf.it/?catname=bsc&coords=83.024902,-41.328938>

TOCats & TOCatsweb – use cases

Transient sources in the
Euclid SelfCal field

VIS
SelfCal

INAF TOCats – HiPS catalogues browser, V. 2.1 – Developed using DIF and Aladin Lite v3

268.835716 65.24417 53.40

DB Table: candidates – 0.04751 objs/deg²

Ref. Cat. Candidates

	RA	Dec	MagAUTO	Sep
1116	SELFCAL_VIS_240928_230101_6		21.4661	3450
686	SELFCAL_VIS_240415_231001_162		21.6761	3480.4
1169	SELFCAL_VIS_240514_230101_119		22.3568	3472.2
1120	SELFCAL_VIS_240928_230101_10		22.3724	3463.7
603	SELFCAL_VIS_240720_231001_20		22.4317	3494.5
1115	SELFCAL_VIS_240514_230101_5		22.4988	3473.4
106	SELFCAL_VIS_240415_230803_138		22.5289	3462.2
1112	SELFCAL_VIS_240514_230101_2		22.5557	3463.4
16	SELFCAL_VIS_240320_230803_16		22.6897	3496.3
825	SELFCAL_VIS_231025_231001_934		22.7962	3489.1

Showing 1 to 10 of 1,209 entries

Selected objects

1. candidates: 17:50:18.20 +65:05:05.5 (267.575833, 65.084849)
ID: SELFCAL_VIS_240928_230101_6 MagAUTO: 21.4661 Sep: 3450 (58")

Select & center here Select Tools

TOCats & TOCatsweb – use cases

Transient sources in the Euclid SelfCal field

VIS
SelfCal

External Tools

Photometry plot VizieR SpeCats

CDS portal SIMBAD VizieR

ESO Science Portal ESA-Sky Portal CADC CFHT

NED DSS SDSS X-id

SDSS img Legacy Survey WISE

PanSTARRS-1 SkyMapper 2MASS

NVSS

euclidsnt custom tools

SELFICAL_VIS_240928_230101_6 (psn) observed on 20240928T18h10m:

[Show: PNG | PLOT | PLOT + PNG]

User's plug-ins More to be added...

Selected objects

1. ● candidates: 17:50:18.20 +65:05:05.5 (267.575833, 65.084849)
ID: SELFICAL_VIS_240928_230101_6 MagAUTO: 21.4661 Sep: 3450' (58')

Dec	MagAUTO	Sep
65.084849	21.4661	3450
65.560026	21.6761	3480.4
65.289201	22.3568	3472.2
65.162954	22.3724	3463.7
65.726994	22.4317	3494.5
65.285382	22.4988	3473.4
65.144618	22.5289	3462.2
65.145174	22.5557	3463.4
65.733501	22.6897	3496.3
65.727871	22.7962	3489.1

TOCats & TOCatsweb – use cases

1. Import GW event Multi-Order Skymap (MOS), either local or giving its URL
2. Identify NED-LVS and GLADE 2.4 sources in a given probability region

The screenshot displays the TOCatsweb interface. At the top, the title bar reads "INAF TOCats – HiPS catalogues browser, V.2.1 – Developed using DIF and Aladin Lite v3". The user is logged in as "gwsusr@bogws" and can sign out. The main interface is divided into several sections:

- Navigation and Search:** A search bar at the top right contains the query "Where Kmag < 13". Below it, a dropdown menu for "Ref. Cat." is set to "GLADE2.4 in MOC".
- Table of Objects:** A table lists 58 objects with columns for Label, RA, Dec, Kmag, and Sep. The first row is highlighted in blue.
- Object Details:** A sidebar on the right shows details for the selected object "glade24_inmoc", including its ID, PGC number, and various error metrics.
- Skymap:** The central area shows a skymap with a yellow grid and 58 objects marked with colored circles. A status bar at the bottom of the skymap indicates "58 objects in the field".
- Base Image Layer Selection:** A panel at the bottom left allows users to select different image layers, such as "DSS color", "SDSS9 color", "2MASS", etc.

Label	RA	Dec	Kmag	Sep
13094770-2323017	197.448776	-23.383831	9.33	199.46
13074762-2259440	196.948456	-22.995575	11.241	165.01
12585080-1832030	194.711685	-18.534184	11.554	132.01
13054109-2054574	196.421219	-20.915966	11.669	56.923
12592776-1919378	194.865677	-19.32719	11.688	84.392
12572906-1756196	194.371109	-17.938797	11.69	172.18
13033561-2023072	195.898376	-20.385355	11.695	28.467
13092581-2228467	197.357544	-22.47965	11.703	153.96
12593391-1924008	194.891296	-19.400244	11.781	79.793
13031036-1957099	195.793198	-19.952755	11.791	44.216

Showing 1 to 10 of 58 entries

Previous 1 2 3 4 5 6 Next

Selected objects

1. glade24_inmoc: 13:09:47.71 -23:23:01.8 (197.448776, -23.383831)
TMASS_name: 13094770-2323017 Kmag: 9.33 Sep: 199.46' (3.3')

Share URL of current view (refreshed at each Redraw):
https://catsweb.oas.inaf.it/?catname=glade24_inmoc&where=Kmag<13&project_name=bogws&private_key=BOG

TOCats & TOCatsweb – use cases

FRBs and their host galaxies

The screenshot displays the TOCatsweb interface, a HIPS catalogues browser. The main view shows a galaxy field with 112 objects in the field. A table of host galaxies is visible, with columns for Label, RA, Dec, z, and Sep. A detailed view of a specific FRB host galaxy is shown, including its coordinates, redshift, and other parameters. The interface also includes a search bar, a table of objects, and a list of selected objects.

INAF TOCats – HIPS catalogues browser, V. 2.1 – Developed using DIF and Aladin Lite v3

frbusr@frbhosts Sign out

253.645 -42.362 5400.0 Where SQL clause DB Table: hosts_main – 0.001100 objs/deg² Upload

J2000 253.6450000 -42.3620000 FOV: 347.06° MOL

Ref. Cat. Hosts Main table Options

Label	RA	Dec	z	Sep
20200428A	293.75	21.9	0.000e+0	4449.2
20200120E	149.477975	68.816883	1.300e-4	8035.1
20181030A	158.59625	73.76498	0.00385	7901.5
20200723B	190.15383	-5.132769	0.008469	4027.4
20171020A	333.853125	-19.58528	0.00867	4191.8
20220319D	32.17004	71.03601	0.0112	8688
20221022A	48.58875	86.86583	0.0149	8111.2
20240210A	8.777	-28.2721	0.023686	5252.9
20181220A	348.69821	48.3421	0.02746	7388.4
20181223C	180.9207	27.54767	0.03024	5803.4

Showing 1 to 10 of 112 entries

Previous 1 2 3 4 5 ... 12 Next

Selected objects

- 2. hosts_main: 22:15:24.75 -19:35:07.0 (333.853125, -19.585280)
FRB: 20171020A z: 0.00867 Sep: 4191.8 (70°)
Select & center here Select Tools
- 1. hosts_main: 12:40:36.92 -05:07:58.0 (190.153830, -5.132769)
FRB: 20200723B z: 0.008469 Sep: 4027.4 (67°)
Select & center here Select Tools

hosts_main

id: 2
FRB: 20171020A
GalID: ESO 601-G036
RA(J2000): 22:15:24.75
Dec(J2000): -19:35:07.0
RA_deg: 333.853125
Dec_deg: -19.58528
err RA: 1
err Dec: 1
ref coord: Mahony2018
E(B-V): 0.0234
z: 0.00867
err z: 5.000e-4
ref z: Meyer2004
P_host: 0.98
ref P_host: Lee-Waddel2023
Semiaxis_a: 25
err Semiaxis_a: 1
Semiaxis_b: 12
err Semiaxis_b: 1
PosAngle: 133
err PosAngle: 0
Reff: -999
err Reff: 0.000e+0
Reff_kpc: -999
err Reff_kpc: 0.000e+0
ref morph: Laubert1989
g-Mag: 15.382
err g-Mag: 0.003
ref g-Mag: Lee-Waddel2023
r-Mag: 15.141
err r-Mag: 0.002
ref r-Mag: Lee-Waddel2023
i-Mag: 15.102
err i-Mag: 0.002
ref i-Mag: Lee-Waddel2023

Open list server fields to retrieve (comma separated) Share URL of current view (refreshed at each Redraw):
https://catsweb.oas.inaf.it/?cataname=hosts_main&cc=0&ra=253.645&dec=-42.362&radius=5400.000&project_name=frbhosts&private

TOCats & TOCatsweb – use cases

FRB 20200723B

The screenshot displays the TOCats web interface. The main window shows a galaxy field with a cyan ellipse highlighting a region. A green box highlights a specific object, FRB 20200723B. The interface includes a search bar, a table of objects, and a detailed view of the selected object.

INAF TOCats – HiPS catalogues browser, V. 2.1 – Developed using DIF and Aladin Lite v3

frbusr@frbhosts Sign out

190.15383 -5.132769 4.18 Where SQL clause DB Table: frb_params – 54.15 objs/deg² Upload

J2000 12 40 36.919 -05 07 57.97 FoV: 10.13' SIN

Ref. Cat. FRBs params Options

Max objects 10000

Multi Cat. view HiPS Cats Reg. shown **Lab. shown**

TabFid names Manual Refresh HPX barycenter

HPX borders off

Toggle columns Sky view follows pointer

[Id - Label - RA - Dec - Mag - Nobjs - HPXid - Sep]

Show 10 entries Search:

Label	RA	Dec	DM	Sep
20200723B	190.158333	-5.135	243.99	0.30055

Showing 1 to 1 of 1 entries Previous 1 Next

Selected objects

1. FRB: 20200723B DM: 243.99 Sep: 0.30055' (18'')

Select & center here Select Tools

1 objects in the field

Hosts Main table FRBs params

Base image layer quick selection

frb_params

_id: 33

FRB: 20200723B

RA(J2000): 12:40:38

Dec(J2000): -05:08:06

RA_deg: 190.158333

Dec_deg: -5.135

err RA: 30

err Dec: 60

ellipse_params: 30,60,90

ref coord: Shin2024

DM: 243.99

err DM: 0.06

DM MW: 33.2

ref DM: Shin2024

RM:

err RM:

ref RM:

offset_ang:

err offset_ang:

offset_lin:

err offset:

ref offset:

Repeater: n

Notes: probably one-off (no indication in the Ref.)

healpixID_nest_3: 408

TOCats & TOCatsweb – use cases

eROSITA SNRs

The screenshot displays the TOCatsweb interface for the SNRs project. The main view is a sky map showing a field of 427 objects. The interface includes a navigation bar with the INAF logo, project name, version, and user information. A search bar and a 'Sign out' button are also present. The map shows a field of objects with a red circle highlighting a specific source. The table below the map lists the objects with their IDs, SNR values, and coordinates.

View: Main table Reference catalogue

Options

Show 10 entries

_id	SNR	RAJ2000	DEJ2000	MajDia
297	DEM_L_316b_LMC_Maggi	86.75	-69.716667	1.44
1	G000.0+00.0_GREEN	266.433333	-29	3.48
298	G000.1-00.1_UMANI	266.625	-28.858333	1.44
2	G000.3+00.0_GREEN	266.5625	-28.633333	15
166	G178.2-04.2_GREEN	81.270833	28.183332	72
167	G179.0+02.6_GREEN	88.416667	31.083334	69.96
168	G180.0-01.7_GREEN_S147	84.75	27.833334	180
332	G181.1+09.5_GREEN	96.666667	32.5	74.04
169	G182.4+04.3_GREEN	92.041667	29	50.04
170	G184.6-05.8_GREEN_Crab	83.629167	22.016666	6.96

Showing 1 to 10 of 227 entries

Share URL of current view (refreshed at each Redraw):
https://catsweb.oas.inaf.it/SNRs/?catname=hard_sources&project_name=eross&...

A tool for investigating ESO-VST multi-epoch visits of GW sky regions and search for transients

Preliminary tasks

- [Hipsgen](#) the collected VST sky survey
- DB insert extracted [source catalogues](#)
- DB insert identified variable objects ([transient source candidates](#))

Web tool

- Browse sky: compare with existing [surveys](#) and [catalogues](#)
- Extract and inspects FITS stamps ([JS9](#))
- Plot transients [LC](#)
- Mark and [annotate](#) candidates

GRAWITA: VSTbrowse – GW170814

grawita.inaf.it/VSTbrowse/GW170814/

VST variable sky browser - Version 0.2a - Developed using DIF.

Catalog: VST_r_20170814_mrg - 243398 objs

Filter cats: Filter list string **Filter** HPX order: 5 - c.: 43.5000, -42.5000 - r.: 16.46°

WHERE ex. mag_auto < 19 Max objs: 1000 **Overlay** X Clear Hide all Show all Go to start Enlarge Shrink Remove all

VST20170814 Get FITS of FoV 300 pix **Candidates:** G337515_04jul2019_all - 2344 objs Show X Clear Reload

J2000 02 53 60.000 -42 30 0.00

Toggle column [eMag - Area - a - b - FWHM - Ellip - Flags] Draw objs when entries shown Show 10 entries

N	RA	Dec	Mag	eMag	Area	a	b	FWHM	Ellip	Flags
1563	39.352109651	-52.541242825	6.3795	0	110091	275.223	15.208	388.4	0.945	52
734	40.527363239	-38.381728114	6.511	0	66563	145.239	17.704	304.43	0.878	22
716	43.393416503	-38.434521105	6.6753	0	66264	119.567	14.758	252.19	0.877	22
1284	40.535012896	-46.522233723	6.7411	0	70023	127.727	14.518	258.53	0.886	22
2387	45.980081348	-43.897565366	7.0302	0	55073	99.404	12.851	214.58	0.871	22
948	44.201684355	-35.378210472	7.0389	0	56571	104.522	13.551	225.94	0.87	20
2321	35.72726099	-51.088766627	7.0847	0	41204	77.613	11.195	176.97	0.856	23
1071	40.834428162	-40.527451606	7.216	0	49020	57.19	13.655	167.77	0.761	20
1121	44.909449306	-32.507220742	7.2368	0	54263	69.627	14.409	190.16	0.793	20
3	39.78181753	-52.934055612	7.317	0	44049	71.892	11.778	174.7	0.836	20

Showing 1 to 10 of 49 entries Previous 1 2 3 4 5 Next

There are 49 objects in the field.

TOCats **Gaia DR3** Show X Clear

JS9

Super-menu to control all windows below

File Edit View Zoom Scale Color Regions WCS Analysis Help

View in a raw Use first window only

GRAWITA: VSTbrowse – GW170814

grawita.inaf.it/VSTbrowse/GW170814/

The screenshot displays the GRAWITA VSTbrowse interface. At the top, the logo and version information are shown. Below, there are search and filter controls. A central panel shows a star field with a red box highlighting a list of VST IDs on the left. To the right, a table lists candidate objects with columns for N, RA, Dec, Mag, eMag, Area, a, b, FWHM, Ellip, and Flags. A 'Super-menu to control all windows below' is visible, and at the bottom, a row of five window thumbnails is shown, with a red box around them.

grawITA
VST variable sky browser - Version 0.2a - Developed using DIF.

Catalog: VST_r_20170814_mrg - 243398 objs Filter cats: Filter list string Filter HPX order: 5 - c.: 43.5000, -42.5000 - r.: 16.46°

Max objs: 1000 Overlay X Clear Hide all Show all Go to start Enlarge Shrink Remove all

Candidates: G337515_04jul2019_all - 2344 objs Show X Clear Reload

Toggle column [eMag - Area - a - b - FWHM - Ellip - Flags] Draw objs when entries shown

N	RA	Dec	Mag	eMag	Area	a	b	FWHM	Ellip	Flags
1563	39.352109651	-52.541242825	6.3795	0	110091	275.223	15.208	388.4	0.945	52
734	40.527363239	-38.381728114	6.511	0	66563	145.239	17.704	304.43	0.878	22
716	43.393416503	-38.434521105	6.6753	0	66264	119.567	14.758	252.19	0.877	22
1284	40.535012896	-46.522233723	6.7411	0	70023	127.727	14.518	258.53	0.886	22
2387	45.980081348	-43.897565366	7.0302	0	55073	99.404	12.851	214.58	0.871	22
948	44.201684355	-35.378210472	7.0389	0	56571	104.522	13.551	225.94	0.87	20
2321	35.72726099	-51.088766627	7.0847	0	41204	77.613	11.195	176.97	0.856	23
1071	40.834428162	-40.527451606	7.216	0	49020	57.19	13.655	167.77	0.761	20
1121	44.909449306	-32.507220742	7.2368	0	54263	69.627	14.409	190.16	0.793	20
3	39.78181753	-52.934055612	7.317	0	44049	71.892	11.778	174.7	0.836	20

Showing 1 to 10 of 49 entries Previous 1 2 3 4 5 Next

There are 49 objects in the field.

Overlay Reference Catalogue Overlay Simbad objects

Gaia DR3 Show X Clear

Super-menu to control all windows below

File Edit View Zoom Scale Color Regions WCS Analysis Help

View in a raw Use first window only

VST20170814 VST20170816 VST20170818 VST20170819 - no data VST20170824

JS9

GRAWITA: VSTbrowse – G337515

grawita.inaf.it/VSTbrowse/G337515/

The screenshot displays the Grawita VSTbrowse interface. At the top, the catalog is set to 'VST_r_20190703_mrg - 133145 objs'. The main view shows a star field with a selected object 'VST J004226.78-245625.2' highlighted. To the right, a plot shows the magnitude and FWHM of this object over time, with data points and error bars. Below the plot is a table of objects with columns for ID, RA, Dec, mag, MJDSTART_1, X_IMAGE_1, and Y.

Candidates: res_photpipe_s190814bv_106_247 - 6 of v

VST J004226.78-245625.2 - RA, Dec: 10.6116229603, -24.940346284

Plot Data:

Date of observation	PSF mag	FWHM (pix)	SRP mag
Aug 17	22.0	8.0	22.2
Aug 18	22.1	7.5	21.5
Aug 21	22.2	8.5	21.6
Sep 07	22.1	8.0	21.1

Table Data:

ID	RA	Dec	mag	MJDSTART_1	X_IMAGE_1	Y
VST J004321.69-242257.0	10.8403776142	-24.3825073125	21.462	58711.273809194	4411.608841835794	1483
VST J004326.70-242043.4	10.8612717141	-24.3453892966	21.723	58711.273809194	4083.4037531679187	154
VST J004354.49-242149.5	10.9770534158	-24.3637764135	21.938	58711.273809194	2276.4865391045305	1515
VST J004226.78-245625.2	10.6116229603	-24.940346284	21.962	58711.273809194	7988.58540632637	527
VST J004328.29-242049.2	10.867914728	-24.3470173013	22.024	58711.273809194	3979.756097809178	1544
VST J004059.39-241904.3	10.247468017	-24.3178805733	22.937	58711.273809194	13672.80080669113	159

amCharts

TOCats

GRAWITA: VSTbrowse – G337515

grawita.inaf.it/VSTbrowse/G337515/

The screenshot displays the Grawita VSTbrowse interface. At the top, the logo and version information are shown: "GrawITA VST variable sky browser - Version 0.2a - Developed using DIF." Below this, the main navigation area includes a "Catalog:" dropdown set to "VST_r_20190703_mrg - 133145 objs", a "Filter" button, and HPX coordinates "HPX order: 6 @ 38.3000, -5.0000 274.40'". A search bar contains "WHERE ex. mag_auto < 19" and "Max objs: 1000". A toolbar offers actions like "Overlay", "Clear", "Hide all", "Show all", "Go to start", "Enlarge", "Shrink", and "Remove all".

The central panel shows a star field with a field of view (FoV) of 11.46' and a resolution of 300 pixels. The field is labeled "G337515_04jul2019_all". Below the field, there are controls for "Overlay Reference Catalogue" and "Overlay Simbad objects".

A red box highlights the "Candidates:" dropdown menu, which is currently set to "G337515_04jul2019_all - 2344 objs". Below this, a table lists the candidates with columns for ID, RA, Dec, mag, MJDSTART_1, X_IMAGE_1, and Y. The table shows 21 entries, with the current view displaying entries 30 to 41. The table is sorted by magnitude (mag) in descending order.

ID	RA	Dec	mag	MJDSTART_1	X_IMAGE_1	Y
VST J023234.47-051533.0	38.143648132	-5.25917690575	21.788	58668.410230968	9873.569115996059	421
VST J023235.82-044456.2	38.9742571811	-4.74894699228	21.784	58668.412182825	12838.308529660235	1296
VST J023751.75-062127.6	39.4636913424	-6.35769014238	21.78	58668.406311051	4432.404707087255	2527
VST J023521.73-052847.6	38.8405434946	-5.47989176756	21.775	58668.412182825	15114.57129223021	430
VST J023537.71-045547.1	38.9071403768	-4.92975549117	21.768	58668.412182825	13984	
VST J023919.06-062526.7	39.8294296056	-6.42409788889	21.762	58668.40827506	15388	
VST J023147.76-054511.0	37.9490045086	-5.75305925621	21.734	58668.404346115	13169.088605269822	1288
VST J023756.18-061552.5	39.4841125907	-6.26459065211	21.731	58668.406311051	4136.000000295432	411
VST J023225.07-051716.4	38.1044902922	-5.28790681861	21.728	58668.410230968	10543.408080880676	

Showing 21 to 30 of 2,344 entries. Navigation: Previous 1 2 3 4 5 ... 235 Next.

Toggle column [eMag – Area – a – b – FWHM – Ellip – Flags] Draw objs when entries shown

N	RA	Dec	Mag	eMag	Area	a	b	FWHM	Ellip	Flags
1053	40.45124	-3.20734	6.235	0	81351	278.465	10.642	326.81	0.962	52
700	39.4243	-3.38101	6.59	0	105319	339.304	12.851	396.44	0.962	52

JS9 – web-based DS9

js9.si.edu

A custom implementation

cats.oas.inaf.it/js9/

Direct server image link

cats.oas.inaf.it/js9/?file=Images/SHS_cutout-hips_9deg.fits

The screenshot displays the JS9 web viewer interface. At the top, the title bar reads "JS9 web viewer - Input file: Images/SHS_cutout-hips_9deg.fits". Below this, a navigation menu shows "Rootdir / Survey / Telescope:" with radio buttons for "Images" (selected), "SMGPS", and "Others". A dropdown menu below shows the current file path: "Images / SHS_cutout-hips_9deg.fits - 49.44 MB".

The main interface includes a menu bar with options: File, Edit, View, Zoom, Scale, Color, Regions, WCS, Analysis, Help. The central area shows a large astronomical image with a color scale at the bottom labeled "viridis 14.222199999999999% linear (2550.97,3969.17) FK5". The image contains a complex structure of yellow and green filaments against a dark blue background.

On the right side, there is a panel titled "Overlay ref. catalogue:" with a dropdown menu set to "Gaia DR3". Below this, there are two smaller image thumbnails. The top thumbnail shows the main image with a red box highlighting a specific region. The bottom thumbnail shows a zoomed-in view of the stars in that region, with a color scale at the bottom labeled "x2 x1/2 [4]".

At the bottom right of the interface, the text "L. Nicastro 2018 – 2021" is visible.

JS9 – web-based DS9

js9.si.edu

A custom implementation

cats.oas.inaf.it/js9/

Direct server image link

cats.oas.inaf.it/js9/?file=Images/SHS_cutout-hips_9deg.fits

JS9 web viewer - Input file: Images/SHS_cutout-hips_9deg.fits
Rootdir / Survey / Telescope: Images SMGPS Others
Images / SHS_cutout-hips_9deg.fits - 49.44 MB

File Edit View Zoom Scale Color Regions WCS Analysis Help

Overlay ref. catalogue:
Gaia DR3

Optical/IR

- 2MASS
- 2MASS_XS
- APASS9
- APOGEE stellar params
- ATLAS-REFCAT2
- BSC
- CatNorth QSO Cands
- DES DR2
- DESI LS dr8
- DESI LS Gal. clusters
- Gaia DR2
- Gaia DR3
- Gaia DR3 GalCands
- Gaia DR3 QsoCands
- Galaxy Zoo DESI
- GCNS
- GLADE
- GLADE v2.3
- GLADE v2.4
- GLADE+
- GSC2.3
- GWGC
- HETDEX srcs v3.2

viridis 14.222199999999999% linear (2550.97,3969.17) FK5

L. Nicastro 2018 - 2021

JS9 – web-based DS9

js9.si.edu

A custom implementation

cats.oas.inaf.it/js9/

Direct server image link

cats.oas.inaf.it/js9/?file=Images/SHS_cutout-hips_9deg.fits

JS9 web viewer - Input file: Images/SHS_cutout-hips_9deg.fits
Rootdir / Survey / Telescope: Images SMGPS Others
Images / SHS_cutout-hips_9deg.fits - 49.44 MB

File Edit View Zoom Scale Color Regions WCS Analysis Help

2650:329° 08:48:06.484 -43:17:01.74 (physical) 13297.99,2605.682

id: psrcat
pos: 131.988875 -43.282444

Overlay ref. catalogue: 17 objs
ATNF PSRcat v2.5.1

psrcat close

_id:	445
Seq:	445
NAME:	J0847-4316
r_NAME:	ml+06
PSRJ:	J0847-4316
r_PSRJ:	ml+06
RAJ:	8.799258333333333
eRAJ:	0.05
r_RAJ:	mlk+09
DECJ:	-43.28244444444444

x2 x1/2 [4]

viridis 14.222199999999999% linear (2550.97,3969.17) FK5

L. Nicastro 2018 – 2021

Discussion items for this meeting (part.)

- Development of web tools (JS libs, node.js, WebGL, ...)
- Development of *Instrument agnostic* libraries / pipelines
- Co-existence of relational and No-SQL DBs
- Move the code, not the data (**products** ok)
- Is it Python good for all? It is the present, and the future?
- Semantic queries \Rightarrow AI for astronomy?

Projects and **Facilities** drive (custom) SW development strategies, but:

- Does (or shall) INAF have the **resources** / **capabilities** to invest in SW development / homogenization?
- Is INAF attractive for **SW engineers**?

rem.oas.inaf.it/DB

catsweb.oas.inaf.it

cats.oas.inaf.it/js9