

The FRB host galaxies catalogue

A community powered repository

The project: who

Keywords: *Community powered archive* – *Accessibility* – *Science for all*

A joint effort

FRB-Italy people

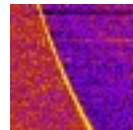
- M. Cinus - [OAC](#)
- L. Nicastro - [OAS](#)
- E. Palazzi - [OAS](#)
- D. Pellicciari - [IRA](#)
- S. Savaglio - [UniCal](#)

Fast and Fortunate for FRB Follow-up (F⁴)

GitHub FRB project

(<https://github.com/FRBs/FRB>)

- T. Eftekhari - [NW Uni., IL](#)
- M. Glowacki - [Curtin Uni., AUS](#)
- J. X. Prochaska - [UC Santa Cruz, CA](#)

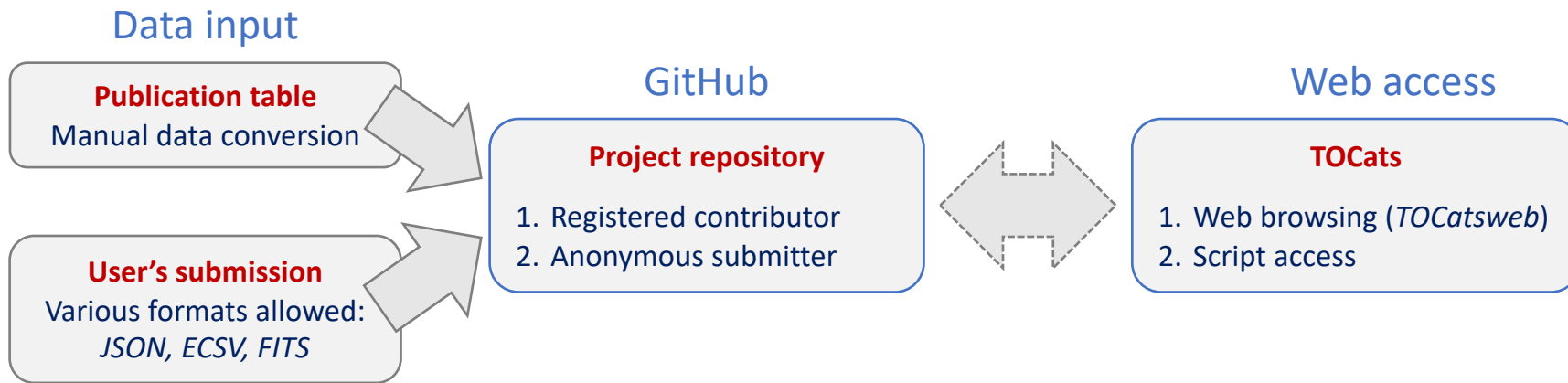


The project: motivation

Keywords: *Community powered archive* – *Accessibility* – *Science for all*

Reliability & Durability

- **Repository** & **DB tables** supervised and managed $\Rightarrow$ **periodic version release**
- **Peer-review** $\Rightarrow$ content provided and validated by the community
- Access and select data subset in **any language** (not just Python) + **Web**



The project: implementation

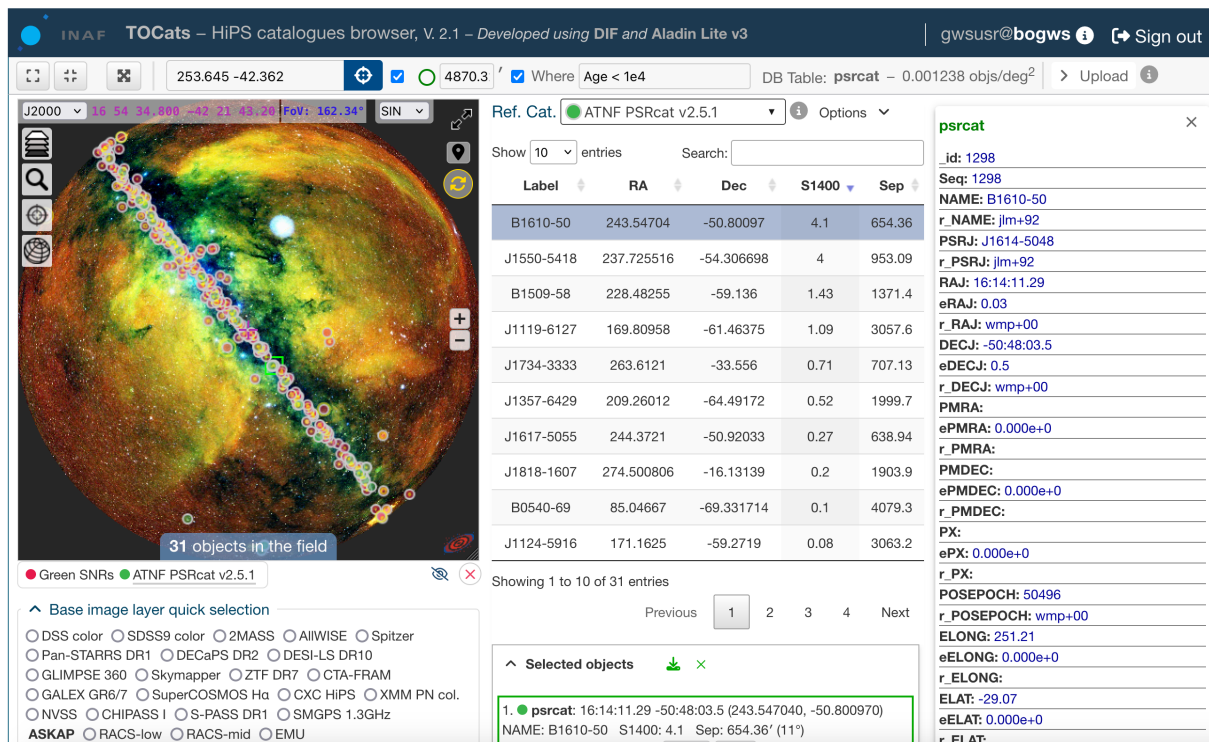
Keywords: *Community powered archive – Accessibility – Science for all*

Implementation

- The **initial phase** foresees the collection of the existing data
- Three set of host galaxy parameters: **measured**, **derived** and **FRB related**
- Management of user-feed new data via public **GitHub**
- User browsing and retrieval via **relational DB + Web tool** $\Rightarrow$ HTTPS protocol
- **User friendly** $\Rightarrow$ usable also by non professional astronomers
- Available through the existing **frb-hosts.org** website
- It will complement existing general-purpose FRB archives, such as **TNS** and **Blinkverse**

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.



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/lnicastro/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, version 2.0, developed using DIF and Aladin Lite v3. The interface is divided into several sections:

- Top Bar:** Includes the INAF logo, the title "TOCats – HiPS catalogues browser, V. 2.0 – Developed using DIF and Aladin Lite v3", a user profile for "gwsusr@bogws" with a "Sign out" button, and a search bar with the text "Where optional SQL clause".
- Left Panel:** Contains a "Base image layer quick selection" menu with options like "DSS color", "SDSS9 color", "2MASS", "AllWISE", "Spitzer", "Pan-STARRS DR1", "DECaLS DR5", "GALEX GR6/7", "GLIMPSE 360", "Skymapper", "ZTF DR7", "CTA-FRAME", "SuperCOSMOS Ha", "CXC HiPS", "XMM EPIC RGB", "XMM PN col", "NVSS", "ASKAP RACS", "ASKAP EMU", "CHIPASS I", "S-PASS DR1", "ROSAT", "Tot.", "Soft", "Hard", "eRASS1", "AllSky rgb", and "DE rgb". Below this is an "Objects density map" section with "lin" and "log" options.
- Center Panel:** Shows a multi-survey view of a galaxy cluster. A red box highlights the "Where optional SQL clause" search bar. Below the image, a table lists 13 objects in the field. The table has columns for RA, Dec, Fint, and Sep. The first object is RA: 206.535423, Dec: -37.967455, Fint: 1260.803, Sep: 3.4418.
- Right Panel:** Contains a detailed information panel for the selected object, "racsd1". It lists various parameters including ID, Gaussian ID, Source ID, Title, SBID, Obs. Start Time, N. Gauss, RA, Dec, E_RA, E_Dec, Total flux, Total flux Source, Peak flux, E_Peak flux, Maj, Min, PA, DC, DC Min, DC PA, S Code, Separation Title, Centre, Gal Ion, and Gal Lat. A red box highlights the "Options" button.
- Bottom Bar:** Includes a "Click & share" button and a "Share URL of current view" section with a URL: <https://catsweb.oas.inaf.it/?catname=racsdr1&coords=206.605001,-37.950688&radius=5.465&survey=racs>.

Click & share

Share URL of current view (refreshed at each Redraw):

<https://catsweb.oas.inaf.it/?catname=racsdr1&coords=206.605001,-37.950688&radius=5.465&survey=racs>

TOCats & TOCatsweb – FRB Host galaxies catalogue

Not yet released



Accessible only to
registered users

6 DB tables

4 primary + 2 derived

137 objs, 122 cols

Note: Data uncertainties
and origin (refs.) are
mandatory for all the
measured and (most of)
the derived parameters

8 unknown z

$z_{\max} = 1.35$

The screenshot displays the TOCats web interface, version 2.1, developed using DIF and Aladin Lite v3. The main panel shows a deep-field image of a galaxy cluster with 138 objects marked. The interface includes a search bar, a table of objects, and a detailed view of a selected object.

Table: Hosts full params

Label	RA	Dec	z	Sep
20200428A	293.75	21.9	0.000e+0	7057.3
20200120E	149.477975	68.816883	1.300e-4	3054.5
20181030A	158.59625	73.76498	0.00385	3259.4
20250316A	182.447857	58.848902	0.006354	3997.2
20200723B	190.15383	-5.132769	0.008469	6429.3
20171020A	333.853125	-19.58528	0.00867	6973.7
20220319D	32.17004	71.03601	0.0112	2786.9
20221022A	48.58875	86.86583	0.0149	3257.1
20231229A	26.46775	35.107831	0.019	2771.5
20240210A	8.777	-28.2721	0.023686	5601

Selected objects

2. ● hosts_full: 02:08:40.81 +71:02:09.6 (32.170040, 71.036010)
FRB: 20220319D z: 0.0112 Sep: 2786.9 (1.2e+2)

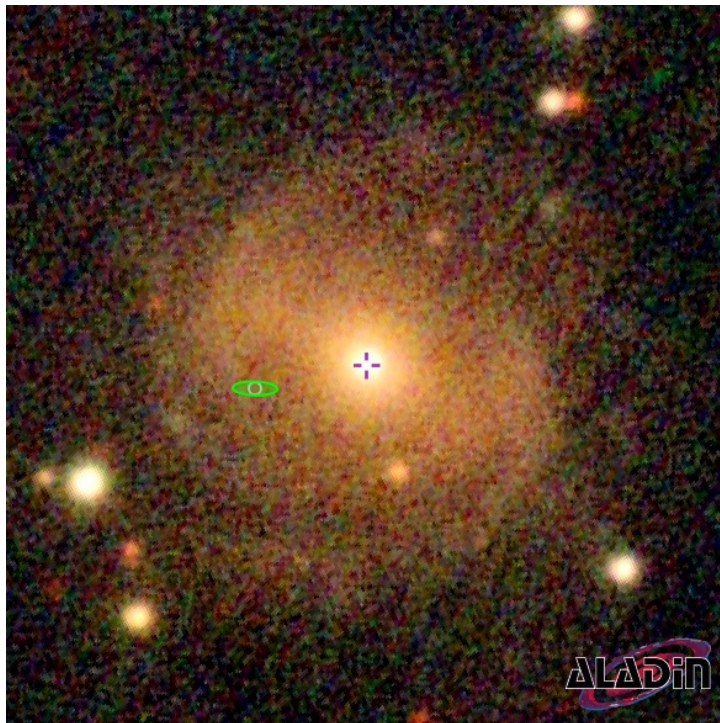
1. ● hosts_full: 22:15:24.75 -19:35:07.0 (333.853125, -19.585280)
FRB: 20171020A z: 0.00867 Sep: 6973.7 (1.2e+2)

Open list server fields to retrieve (comma separated) order by

Share URL of current view (refreshed at each redraw):
https://catsweb.oas.inaf.it/?catname=hosts_full&where_only=where=not null&project_name=frbhosts&private_key=FRBHC

FRB Hosts catalogue – *details*

Host+FRB detailed view
(work in progress)



INAF TOCats - HiPS catalogues browser, V 2.1 - FRBHosts tool Close

FRB 20220319D

_id	54	FRB	20220319D	GAID	IRAS 02044+7048	RAJ2000s	02:08:40.81
DEJ2000s	71:02:09.65	RA_deg	32.17004	Dec_deg	71.03601	errRA	--
errDec	--	ref_coord	Law2024	z(B-V)	0.6932	z	0.0112
err_z	0.0001	ref_z	Sharma2024	P_host	0.99	ref_P_host	Sharma2024
Semixaxis_a	11.8	err Semixaxis_a	--	Semixaxis_b	11.8	err Semixaxis_b	--
PosAngle	23	errPosAngle	3	Ref	11.8	errRef	0.9
Ref_kpc	2.7	errRef_kpc	0.2	Morphology	Sp	ref_morph	Raw2023
g-Mag	13.63	err_g-Mag	0.02	ref_g-Mag	Sharma2024	r-Mag	13.25
err_g-Mag	0.01	ref_r-Mag	Law2024	i-Mag	13	err_i-Mag	0.01
ref_j-Mag	Sharma2024	z-Mag	12.81	err_z-Mag	0.01	ref_z-Mag	Sharma2024
y-Mag	--	err_y-Mag	--	ref_y-Mag	--	j-Mag	12.53
err_j-Mag	0.02	ref_j-Mag	Sharma2024	H-Mag	12.35	err_H-Mag	0.02
ref_H-Mag	Sharma2024	K_s-Mag	12.55	err_K_s-Mag	0.02	ref_K_s-Mag	Sharma2024
[OII] flux	--	err [OII] flux	--	Hbeta flux	--	err Hbeta flux	--
[OIII 4959] flux	--	err [OIII 4959] flux	--	[OIII 5007] flux	--	err [OIII 5007] flux	--
[NII 6549] flux	--	err [NII 6549] flux	--	Halpha flux	--	err Halpha flux	--
[NII 6583] flux	--	err [NII 6583] flux	--	[SII 6717] flux	--	err [SII 6717] flux	--
[SII 6731] flux	--	err [SII 6731] flux	--	ref_line_flux	--	Notes_host	Nickname: Mark
helpID_neat_3	57	D_L(Planck)	50.241517	Scale at z	0.239	logMstar	9.93
err_logMstar	0.07	ref_Mstar	Raw2023	SFR-SED	0.42	errSFR-SED	0.02
ref_SFR-SED	Sharma2024	SFR_Halpha	--	errSFR_Halpha	--	ref_SFR_Halpha	--
sSFR-SED	1.370e-10	err_sSFR-SED	--	sSFR-Ha	--	err_sSFR-Ha	0.000e+0
log(sSFR-SED)	-10.307	err_log(sSFR-SED)	--	log(sSFR-Halpha)	-999	err_log(sSFR-Halpha)	--
Z-gas-emis	--	errZ-gas	--	ref_Z-gas	--	Z-SED	--
errZ-SED	--	ref_Z-SED	--	Age	5.35	errAge	0.52
ref_Age	Sharma2024	Notes_param	Raw2023 derives a SFR μ 1.8+0.7 Msun/yr from the galaxy SED fitting				

SIMBAD biblio for FRB 20220319D

[SIMBAD link](#)

20220319D.(Mark)

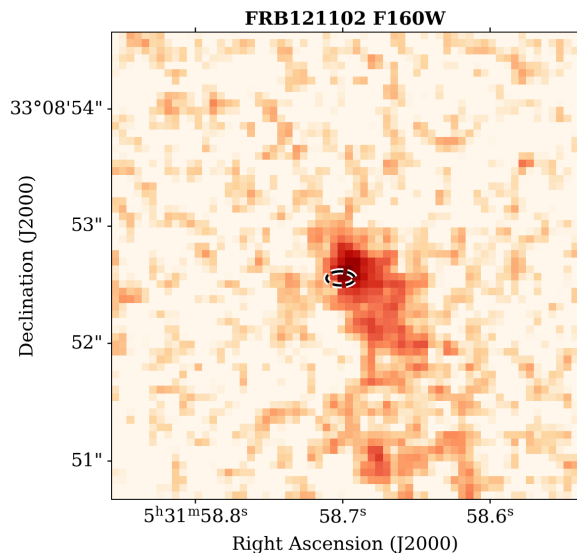
20220319D

5"

L. Nicastro 9 INAF-OAS, 2025

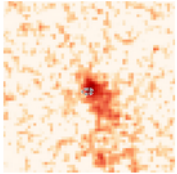
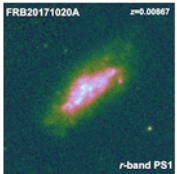
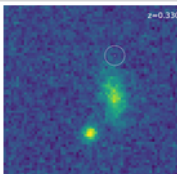
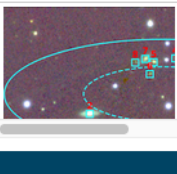
FRB Hosts catalogue – *list server*

Full or partial
(row/column) listing



INAF TOCats – HIPS catalogues browser, v. 2.1 – FRBHosts tool

138 objects listed from table **hosts_full**

QL	_id	FRB	GalID	RAJ2000s	DEJ2000s	RA_deg	Dec_deg	errRA	errDec	ref_coord	E(B-V)	z	err_z
	1	20121102A	J053158.68+330852.4	05:31:58.68	+33:08:52.4	82.9945	33.14789	0.014	0.014	Bassa2017	0.6727	0.19273	0.0008
	2	20171020A	ESO 601-G036	22:15:24.75	-19:35:07.0	333.853125	-19.58528	1	1	Mahony2018	0.0234	0.00867	0.0005
	3	20180301A	PSO J093.2268+04.6703	06:12:54.43	+04:40:12.9	93.226792	4.67025	0.2	0.2	Bhandari2022	0.3946	0.3304	0.0001
													

Click & zoom

ADS link

L. Nicastro © INAF-OAS, 2025

FRB Hosts catalogue – *FRB 20200723B*

INAF TOCats – HiPS catalogues browser, V. 2.1 – Developed using DIF and Aladin Lite v3 | frbusr@frbhosts | Sign out

190.158333 -5.135 5.0 Where frb="20200723B" DB Table: frb_params – 34.72 objs/deg² Upload

ICRS 12 40 38.00 -05 08 06.0 SIN

NGC 4602

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 – DM – Nobjs – HPXid – Sep]

Show 10 entries Search:

Label	RA	Dec	DM	Sep
20200723B	190.158333	-5.135	243.99	0

Showing 1 to 1 of 1 entries Previous 1 Next

Selected objects

1. ● frb_params: 12:40:37.00 -05:08:06.0 (190.158333, -5.135000)
FRB: 20200723B DM: 243.99 Sep: 0'

Select & center here Select Tools

frb_params

id: 33

FRB: 20200723B

FRB_RA: 12:40:38

FRB_Dec: -05:08:06

FRB_RA_deg: 190.158333

FRB_Dec_deg: -5.135

FRB_semi_a: 60

FRB_semi_b: 30

FRB_PA: 0

FRB_ref_coord: Shin2024

DM: 243.99

errDM: 0.06

DM_MW: 33.2

ref_DM: Shin2024

RM:

errRM:

ref_RM:

Offset_ang:

errOffset_ang:

Offset_lin:

errOffset:

ref_Offset:

Repeater: n

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

healpix_nest_3: 408

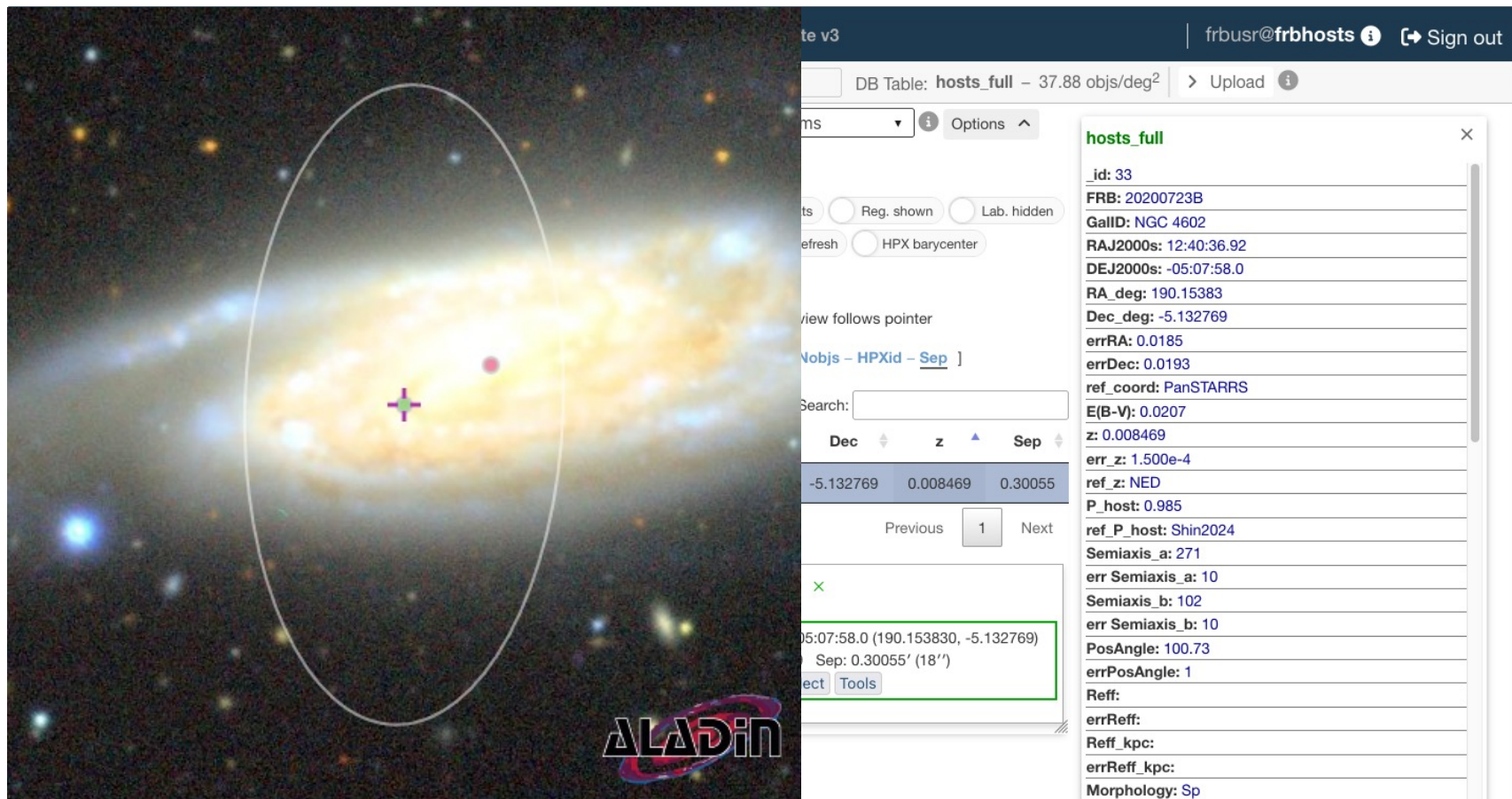
Hosts full params ● FRBs params ●

Base image layer quick selection

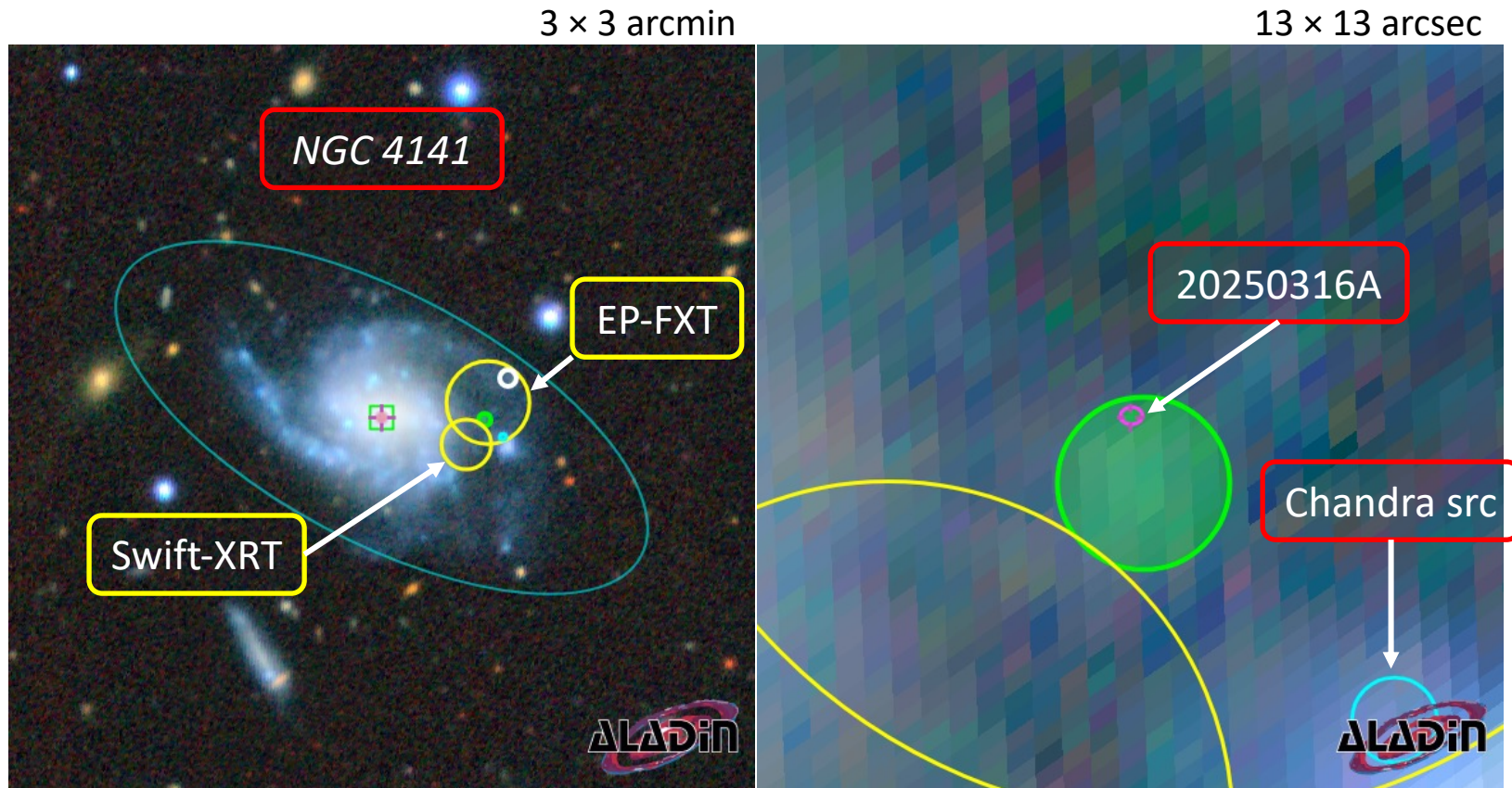
DSS color SDSS9 color 2MASS AllWISE Spitzer

Pan-STARRS DR1 DECaPS DR2 **DESI-LS DR10** BASS DR3

FRB Hosts catalogue – *FRB 20200723B*



FRB Hosts catalogue – FRB 20250316A



FRB Hosts catalogue – *script query*

Retrieve table data as **VOTable**, **HTML**, **csv**, **tsv**, **JSON**

curl query (**csv** output):

```
curl -o myhosts.csv  
"https://cats.oas.inaf.it/hosts_full/radius=30&ra=26.5&dec=35.5&project_name=frbhosts&private_key=secret&csv"
```

Python query (**HTML** output, sorted by **z**):

```
import requests  
url =  
"https://cats.oas.inaf.it/hosts_full/radius=30&ra=26.5&dec=35.5&project_name=frbhosts&private_key=secret&orderby=z&html"  
response = requests.get(url)  
print(response.text)
```

Note: Direct, SQL DB queries possible on demand

Discussion on going

Non-exhaustive list ...

- Which “**observed**” parameter should be mandatory?
- Which “**derived**” parameters should be reported / computed?
- Which **FRB** parameters should we list?
- Multiple figures for the same parameter (e.g. SFR / distance / reference / etc.)?
- Should we convert multi-photometric mags to a common filter set?
- Which parameter uncertainties should be non-symmetric (upper-lower)?
- Should we have all the archival data into the DB or just a subset?
- How do we handle **versioning** and **updates** of the archive and DB tables?
- Should we accept data submission when **no paper reference** exists yet?
- More **technical**: how do we store and define the parameters **metadata**?

catsweb.oas.inaf.it