The FRB host galaxies catalogue

A community powered repository

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The project: who

Keywords: Community powered archive – Accessibility – Science for all

A joint effort

FRB-Italy people

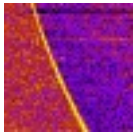
- M. Cinus - OAC
- L. Nicastro - OAS
- E. Palazzi - OAS
- D. Pelliciari - IRA
- S. Savaglio - UniCal

Fast and Fortunate for FRB Follow-up (F^4)

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

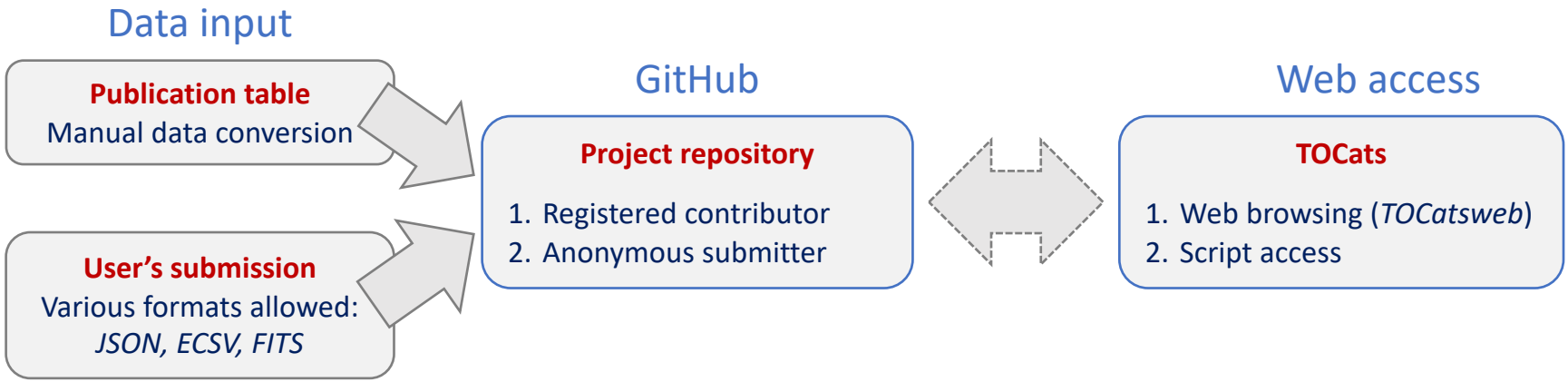


The project: motivation

Keywords: Community powered archive – Accessibility – Science for all

Reliability & Durability

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



The project: implementation

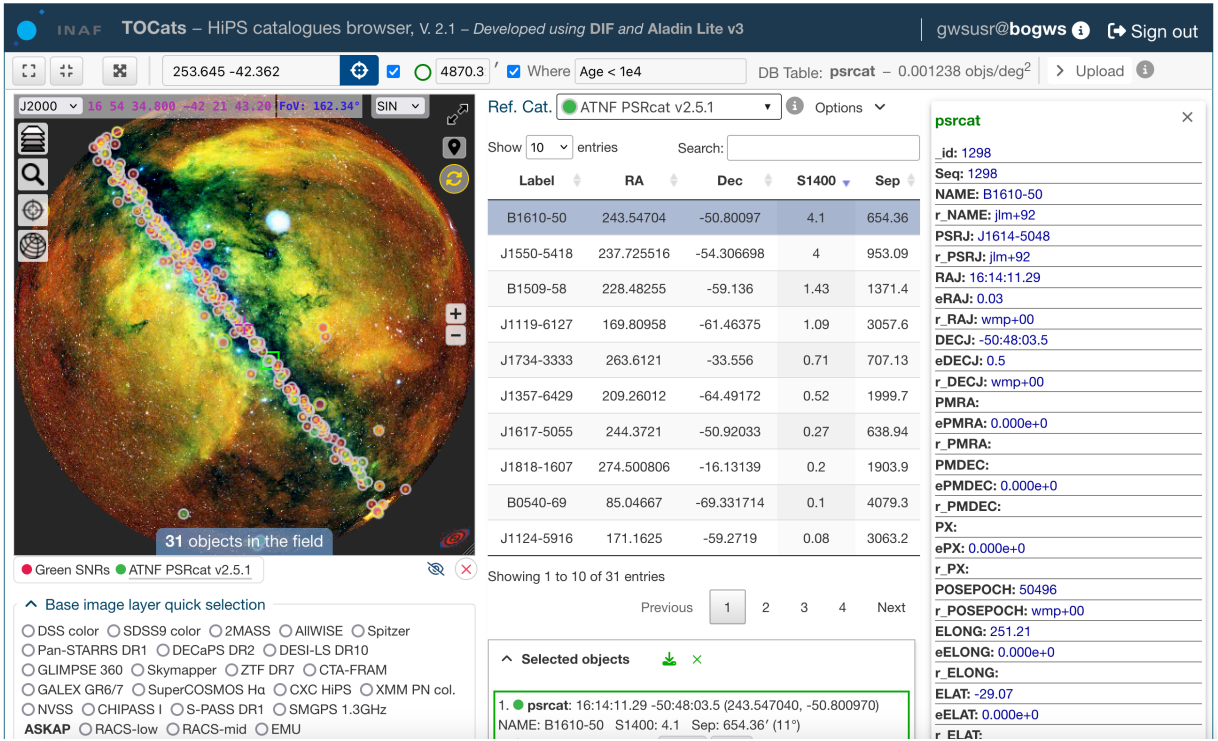
Keywords: Community powered archive – Accessibility – Science for all

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 ⟹ HTTPS protocol
- User friendly ⟹ 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

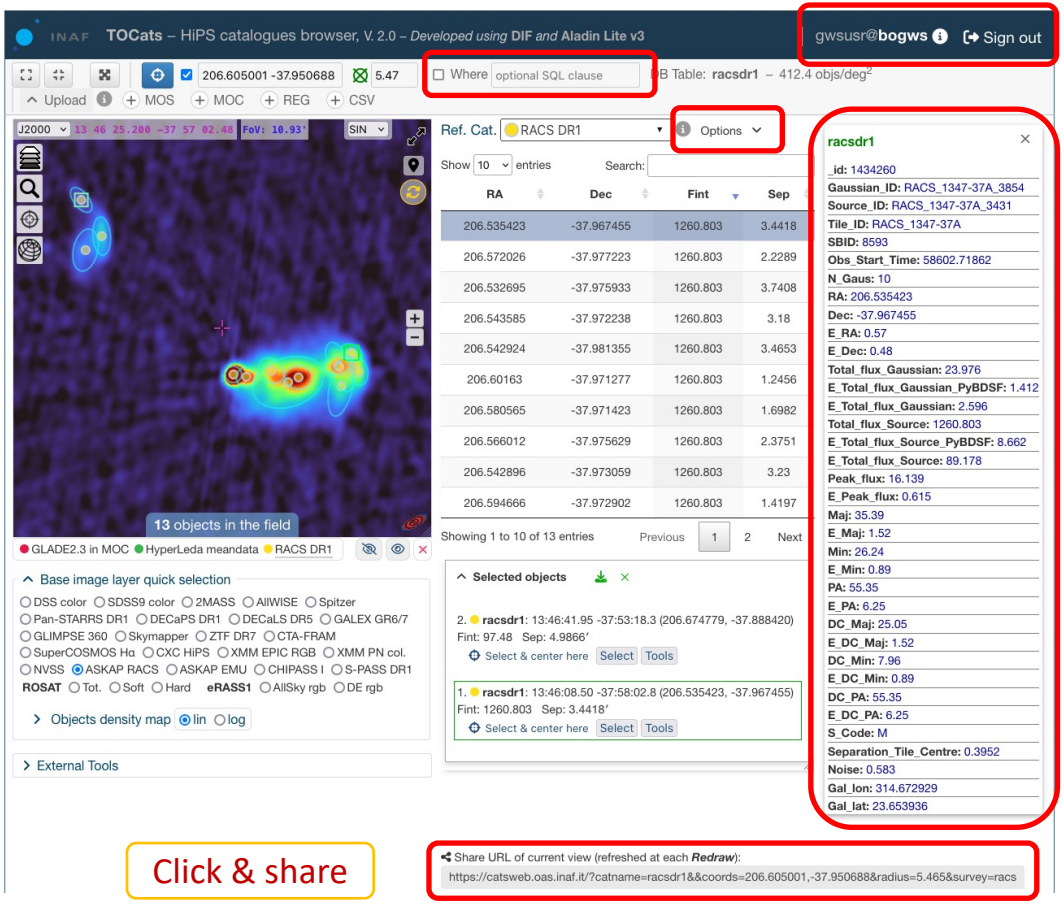
- ~ 110 public catalogues (Opt/IR/NIR/Radio/UV/X-γ)
- ~ 100 private catalogues
- ~ 20 TB (raid 1)
- 10 projects

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



TOCats & TOCatsweb – *FRB Host galaxies catalogue*

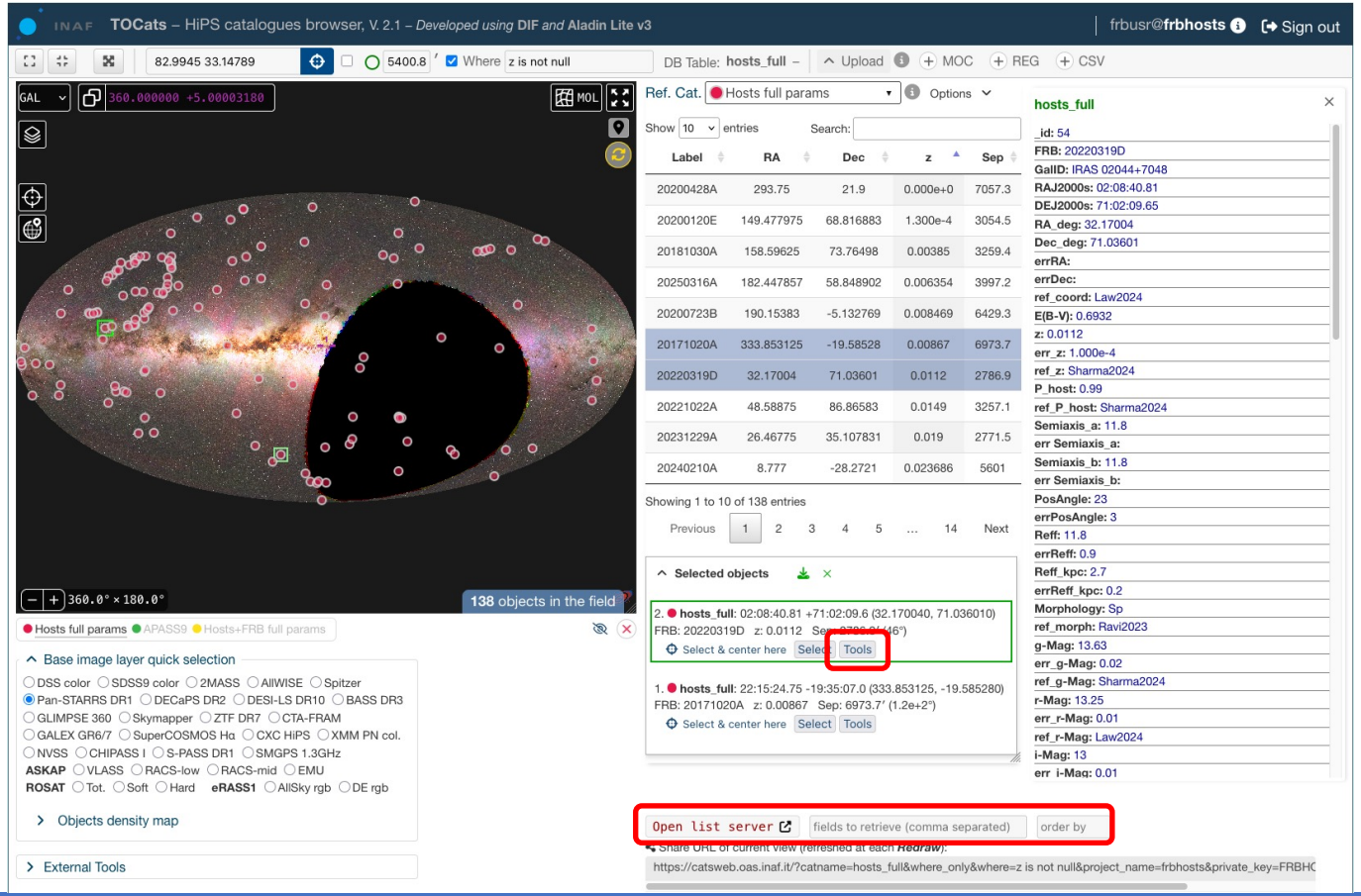
Not yet released

Accessible only to registered users

6 DB tables
4 primary + 2 derived
137 objs, 122 colums

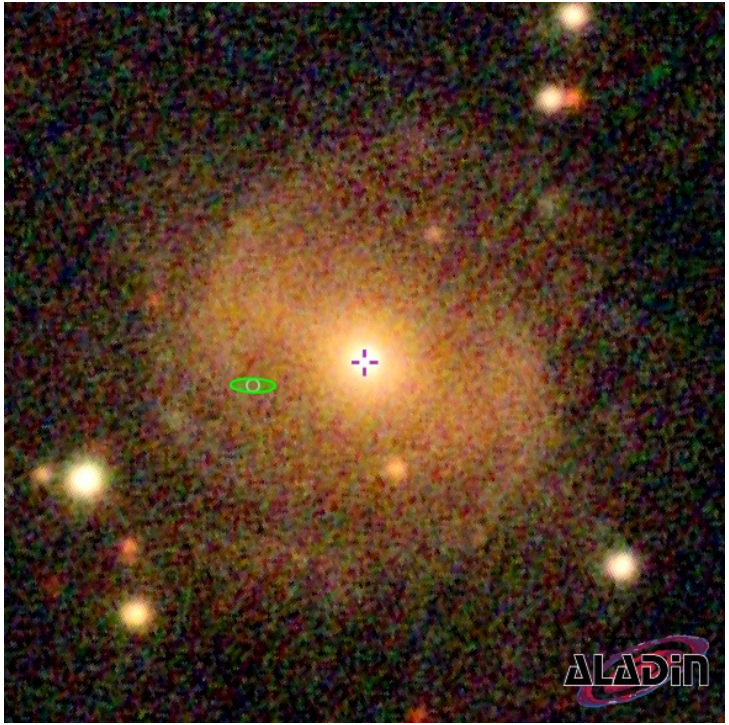
Note: Data uncertainties and origin (refs.) are mandatory for all the measured and (most of) the derived parameters

8 unknown z
Z_{max} = 1.35



FRB Hosts catalogue – *details*

Host+FRB detailed view
(work in progress)



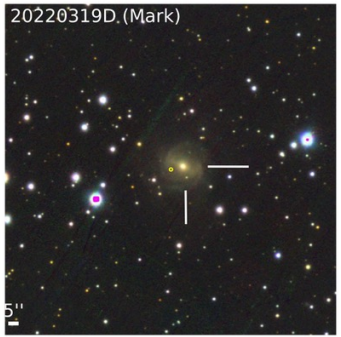
INAF **TOCats** – HiPS catalogues browser, V. 2.1 – *FRBHosts tool* Close

FRB 20220319D

_id	54	FRB	20220319D	GalID	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	E(B-V)	0.6932	z	0.0112
err_z	0.0001	ref_z	Sharma2024	P_host	0.99	ref_P_host	Sharma2024
Semiaxis_a	11.8	err Semiaxis_a	--	Semiaxis_b	11.8	err Semiaxis_b	--
PosAngle	23	errPosAngle	3	Reff	11.8	errReff	0.9
Reff_kpc	2.7	errReff_kpc	0.2	Morphology	Sp	ref_morph	Ravi2023
g-Mag	13.63	err_g-Mag	0.02	ref_g-Mag	Sharma2024	r-Mag	13.25
err_r-Mag	0.01	ref_r-Mag	Law2024	i-Mag	13	err_i-Mag	0.01
ref_i-Mag	Sharma2024	z-Mag	12.81	err_z-Mag	0.01	ref_z-Mag	Sharma2024
y-Mag	--	err_y-Magg	--	ref_y-Magg	--	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
healpID_nest_3	57	D_L(Planck)	50.241517	Scale at z	0.239	logMstar	9.93
err_logMstar	0.07	ref_Mstar	Ravi2023	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	Ravi2023 derives a SFR=1.8+-0.7 Msun/yr from the galaxy SED fitting				

SIMBAD biblio for **FRB 20220319D**

SIMBAD link



20220319D

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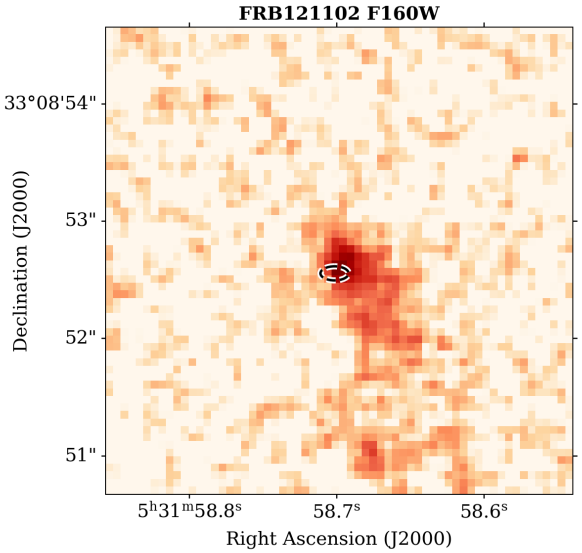
FRB Hosts catalogue – *list server*

Full or partial
(row/column) listing



INAF **TOCats** – HiPS catalogues browser, v. 2.1 – *FRBHosts tool* Close

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
FRB20171020A z=0.00867 r-band PS1	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
z=0.3304	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

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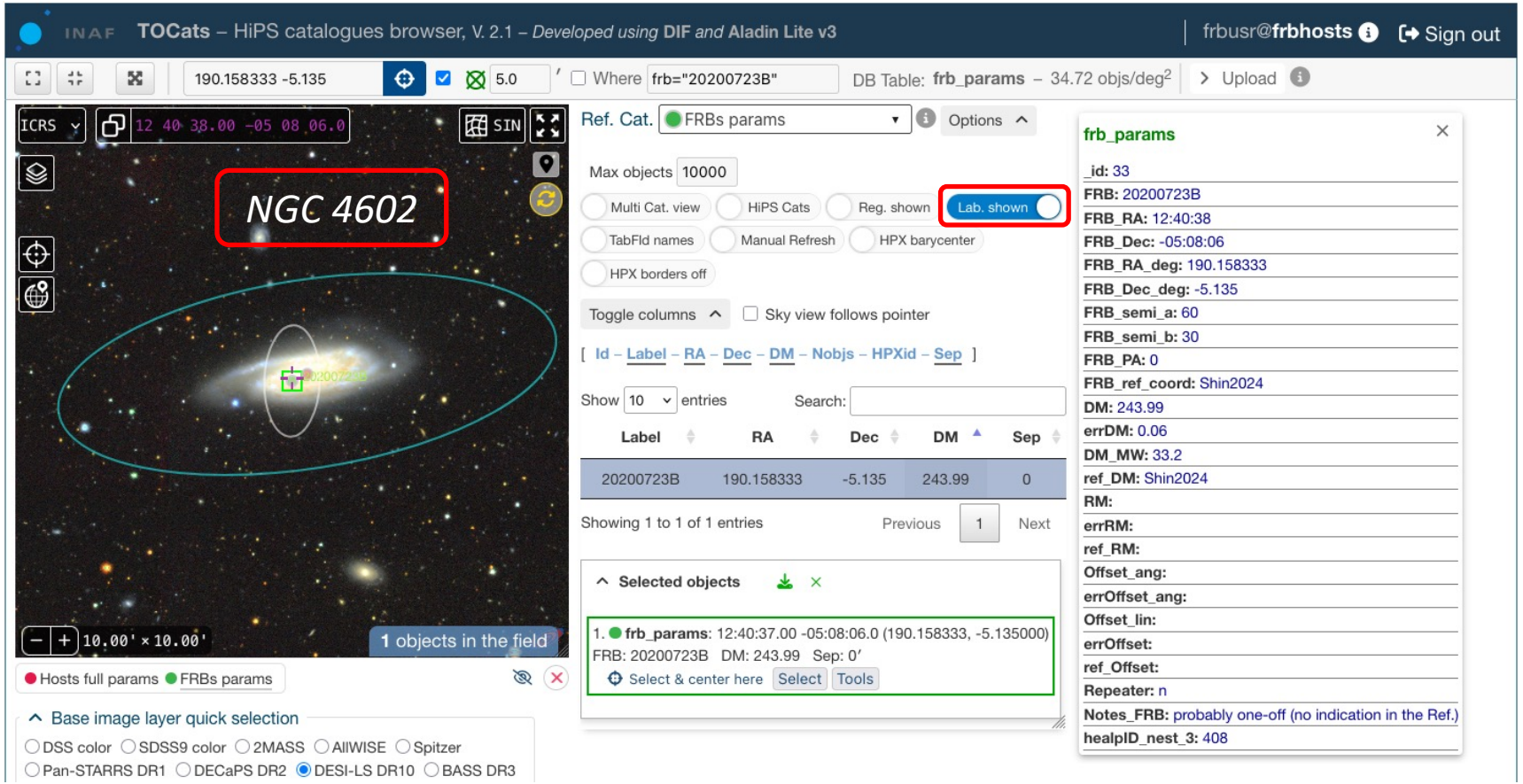
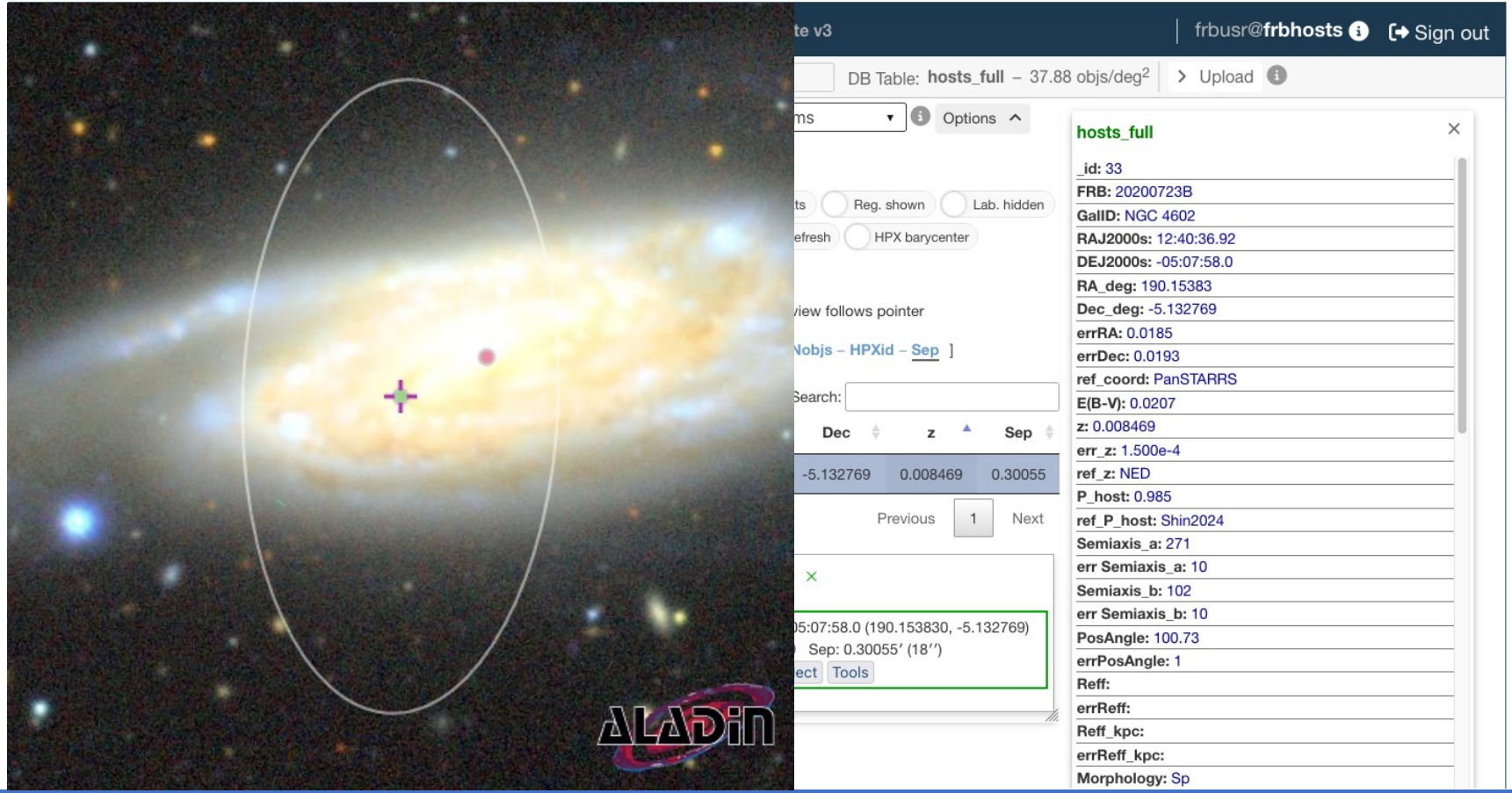
Click & zoom

ADS link

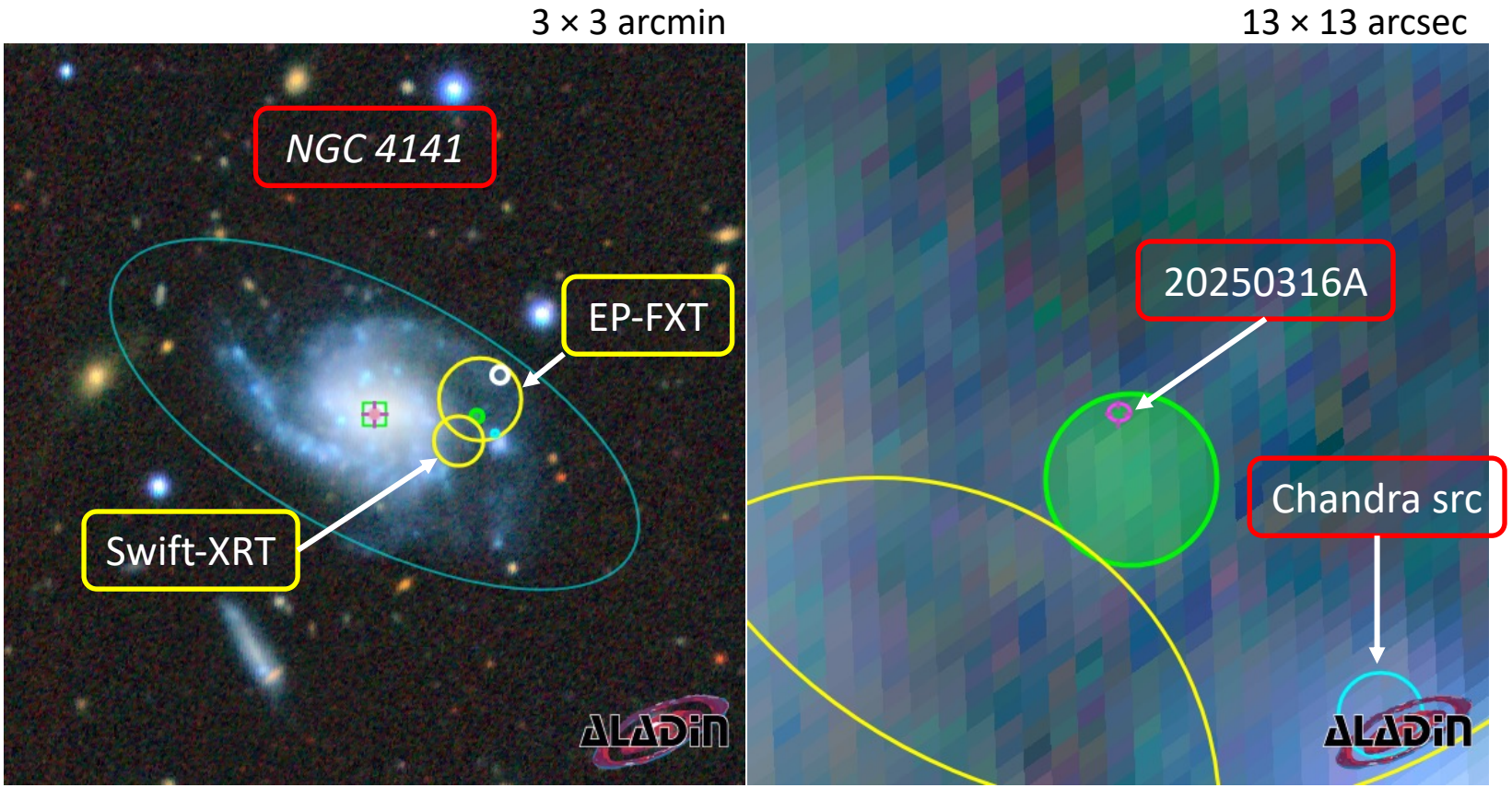
FRB Hosts catalogue – *FRB 20200723B*



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?

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