

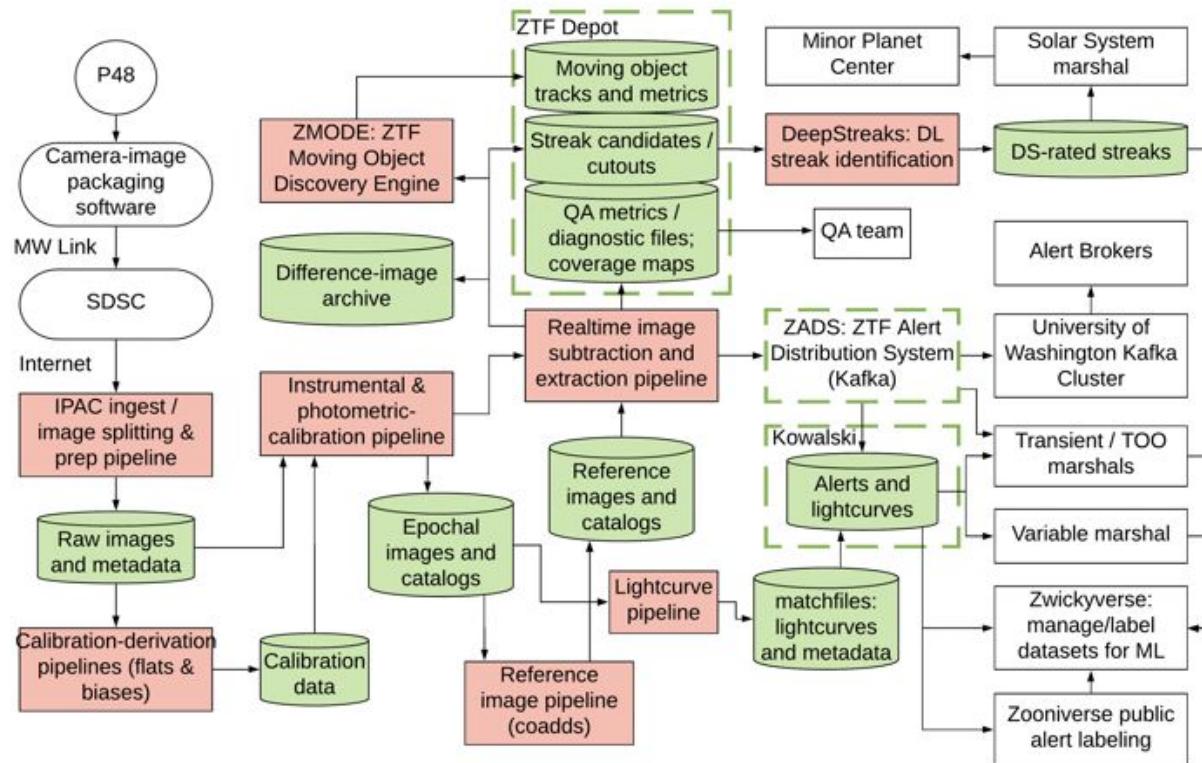
# Fritz: science data platform for ZTF-II

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<https://duev.space>

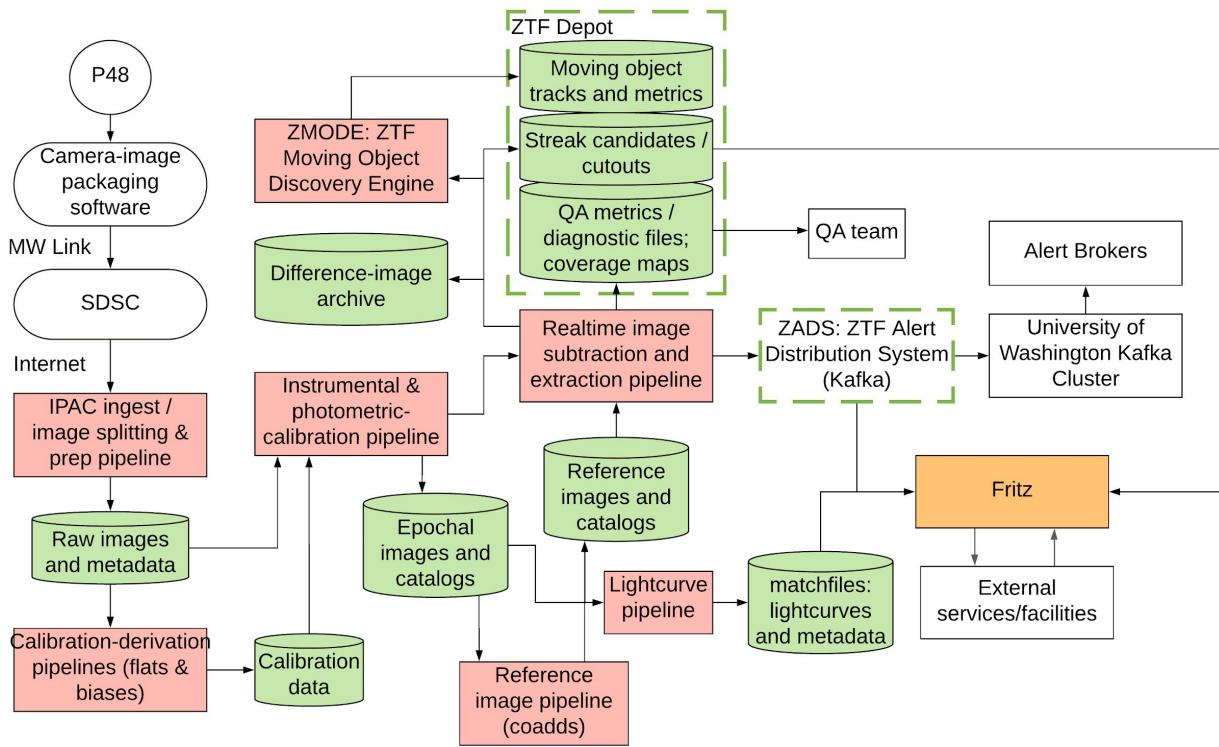
# ZTF-I: data/processing flow



ZTF acts as a discovery engine. Discoveries are followed-up using a wide range of instruments (including ZTF itself)

Single night	8h40m	Nominal survey	3 x 260 n
# on-sky exposures	~700	Volume of data products	~3.2 PB
Raw image data	~1 TB	Volume of ref images	~60 TB
Real-time data products	~4 TB	# CCD quad ref images	~ $2.8 \times 10^5$
# unvetted 5o alerts	~ $10^5 - 10^6$	Volume of matchfiles	~50 TB
# ML-vetted alerts	~ $10^3 - 10^5$	# matchfiles	~ $2.8 \times 10^5$
# unvetted streaks	~ $10^4 - 10^6$	# single-epoch PSF-fit source measurements	~800 B
# ML-vetted streaks	~ $10^2 - 10^3$	# single-epoch aperture source measurements	~230 B

# ZTF-II: data/processing flow



ZTF acts as a discovery engine. Discoveries are followed-up using a wide range of instruments (including ZTF itself)

Single night	8h40m	Nominal survey	3 x 260 n
# on-sky exposures	~700	Volume of data products	~3.2 PB
Raw image data	~1 TB	Volume of ref images	~60 TB
Real-time data products	~4 TB	# CCD quad ref images	~ $2.8 \times 10^5$
# unvetted 5o alerts	~ $10^5 - 10^6$	Volume of matchfiles	~50 TB
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# unvetted streaks	~ $10^4 - 10^6$	# single-epoch PSF-fit source measurements	~800 B
# ML-vetted streaks	~ $10^2 - 10^3$	# single-epoch aperture source measurements	~230 B

# Fritz: science data platform for ZTF-II

- Multi-survey data archive and alert broker
- Marshal for transient, variable, and Solar system science cases
- Workhorse for ML applications/active learning: classification and labeling at scale
- Follow-up observation management: robotic and classical facilities

Initiated in Feb 2020  
Beta up in Sep 2020  
MVP live in Nov 2020

The screenshot displays the Fritz web application interface. On the left is a dark sidebar with navigation links: Dashboard, Sources, Candidates, Alerts, Groups, Observing Runs, About, and a search bar labeled "Source". The main content area is divided into several sections:

- Recently Saved Sources:** Shows three recent saves with small thumbnail images and details: ZTF20acpbifl (α, δ: 22h38m01.69s +26d20m24.74s), ZTF20acpogof (α, δ: 20h51m50.51s -26d17m56.39s), and ZTF20acpiwzt (α, δ: 21h36m10.54s -23d11m26.54s). Each entry shows a timestamp of "34 minutes ago".
- Top Sources:** A list of top sources categorized by time: DAY, WEEK, MONTH, 6 MONTHS, YEAR. It includes entries like ZTF20acmzoxo (Ia) and ZTF20abcyzomt (IIIP).
- News Feed:** A feed of new source saves from various users, each with a timestamp. For example, "New source saved" by "ZTF20acpbifl" 34 minutes ago.
- P48:** A weather forecast section for P48, showing current conditions: 9.6°C with 52% humidity & clear sky, sunset 2 hours ago, sunrise in 12 hours. It also includes a "FORECAST" and "WEBCAM" link.
- My Groups:** A sidebar showing "Dima's Lab" and "Sitewide Group".

<https://fritz-marshall.org/>

# Fritz: core dev team



Joshua Bloom



Michael Coughlin



Arien Crellin-Quick



Dmitry Duev



Daniel Goldstein



Matthew Graham



Mansi Kasliwal



Guy Nir



Kyung Min Shin



Leo Singer



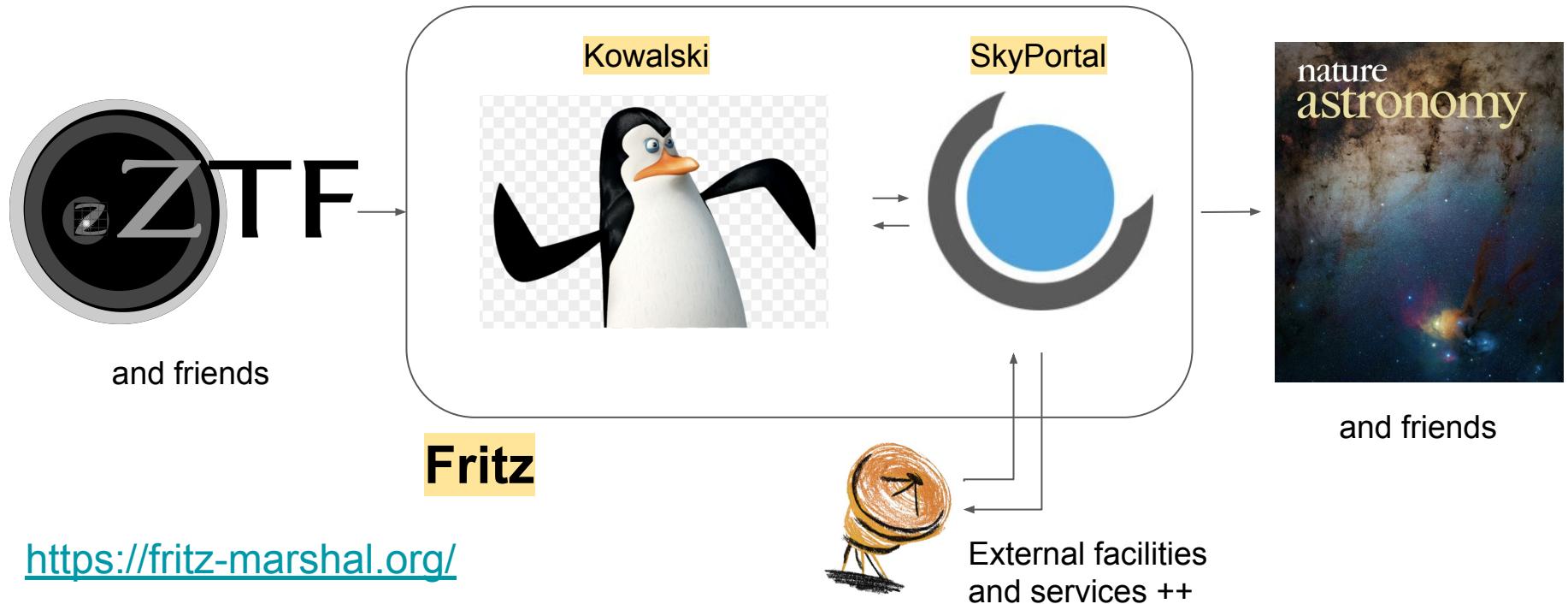
Stéfan van der Walt



[Caltech + UC Berkeley ++]

# Fritz: Schematic overview

Observe → Mine/Discover → Study and Characterize → Profit!



# Fritz: features

- Open source (free to use, modify, and distribute)
- API-first system: rich APIs for machine usage
- Powerful alert stream enhancement/filtering capabilities
- Extendible & scalable design: async Python backends, React/Redux frontend
- Fine-grained access control
- Authentication via OAuth
- Real-time Slack-like messaging, notifications
- Rich visualization capabilities
- Follow-up management
- Distributed computation via Dask
- Docker compose or Kubernetes deployment
- Well-tested, extensive docs, CI/CD

Python

```
import requests

token = 'ea70a5f0-b321-43c6-96a1-b2de225e0339'

def api(method, endpoint, data=None):
    headers = {'Authorization': f'token {token}'}
    response = requests.request(method, endpoint, json=data, headers=headers)
    return response

response = api('GET', 'http://localhost:5000/api/sysinfo')

print(f'HTTP code: {response.status_code}, {response.reason}')
if response.status_code in (200, 400):
    print(f'JSON response: {response.json()}'')
```

Command line (curl)

```
curl -s -H 'Authorization: token ea70a5f0-b321-43c6-96a1-b2de225e0339' http://
```

Response

In the above examples, the SkyPortal server is located at <http://localhost:5000>. In case of success, the HTTP response is 200:

```
HTTP code: 200, OK
JSON response: {'status': 'success', 'data': {}, 'version': '0.9.dev0+git20200'}
```

# Fritz: features

- Open source (free to use, modify, and distribute)

skyportal / skyportal

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master 14 branches 0 tags

Go to file Add file + Code

About Collaborative platform for time-domain astronomy

skyportal.io

variable-stars transient-astronomy machine-learning collaborative-research

Releases Create a new release

Packages Publish your first package

Contributors 18

Languages Python 63.7% JavaScript 35.3% CSS 1.0% Shell 0.2% Dockerfile 0.1%

Readme.md

This repository contains the source code for the Skyportal platform.

fritz-marshall

Marshal for the ZTF2 survey

Repositories 6 Packages People Teams Projects Settings

Find a repository... Type: All Language: All

Customize pins New

Top languages Python 90 HTML 10

Updated 15 hours ago

People 11

Invite someone

fritz

The Zwicky Transient Facility Phase II Marshal.

astrometry broker marshal time-domain variable-stars transient-astronomy ztf

Updated 15 hours ago

fritz-beta-feedback

A place for beta testers to discuss issues or request new features related to the Fritz Marshal

Updated 2 days ago

skyportal

Forked from skyportal/skyportal

Collaborative platform for time-domain astronomy

Updated 16 days ago

doc

Generated documentation

HTML 27 PDF 0 Updated 20 days ago

fritz-marshall.github.io

Deployed website

HTML 9 PDF 0 Updated on May 18

dmitryduev / kowalski

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master 4 branches 0 tags

Do file Add file + Code

About Kowalski: a tool for time-domain astronomy

Readme MIT License

Releases No releases published Create a new release

Packages Publish your first package

Contributors 4

dmitryduev Dmitry Duev dannigoldstein Danny Goldstein stefan Stefan van der Walt

Languages Python 99.0% Dockerfile 1.0%

readme.md

Kowalski

Published on June 20, 2023 by the Zwicky Transient Facility

# Fritz: features

- API-first system: rich APIs for machine usage

Python

```
import requests

token = 'ea70a5f0-b321-43c6-96a1-b2de225e0339'

def api(method, endpoint, data=None):
    headers = {'Authorization': f'token {token}'}
    response = requests.request(method, endpoint, json=data, headers=headers)
    return response

response = api('GET', 'http://localhost:5000/api/sysinfo')

print(f'HTTP code: {response.status_code}, {response.reason}')
if response.status_code in (200, 400):
    print(f'JSON response: {response.json()}'
```

Command line (curl)

```
curl -s -H 'Authorization: token ea70a5f0-b321-43c6-96a1-b2de225e0339' http://
```

Response

In the above examples, the SkyPortal server is located at <http://localhost:5000>. In case of success, the HTTP response is 200:

```
HTTP code: 200, OK
JSON response: {'status': 'success', 'data': {}, 'version': '0.9.dev0+git20200
```

The screenshot displays two main sections of Fritz's API documentation:

- Add a new source:** This panel shows the schema for creating a new source. It includes fields for name, ra\_dia, dec\_dia, ex\_err, offset, and redshift. Request samples and responses are also provided.
- Query Kowalski:** This panel shows the schema for querying the Kowalski database. It includes fields for query\_type (set to 'aggregate'), query\_search, query\_document, and query\_limit. Request samples and responses are also provided.

## OpenAPI specs:

<https://skyportal.io/docs/api.html>

<https://kowalski.caltech.edu/docs/api>

# Fritz: features

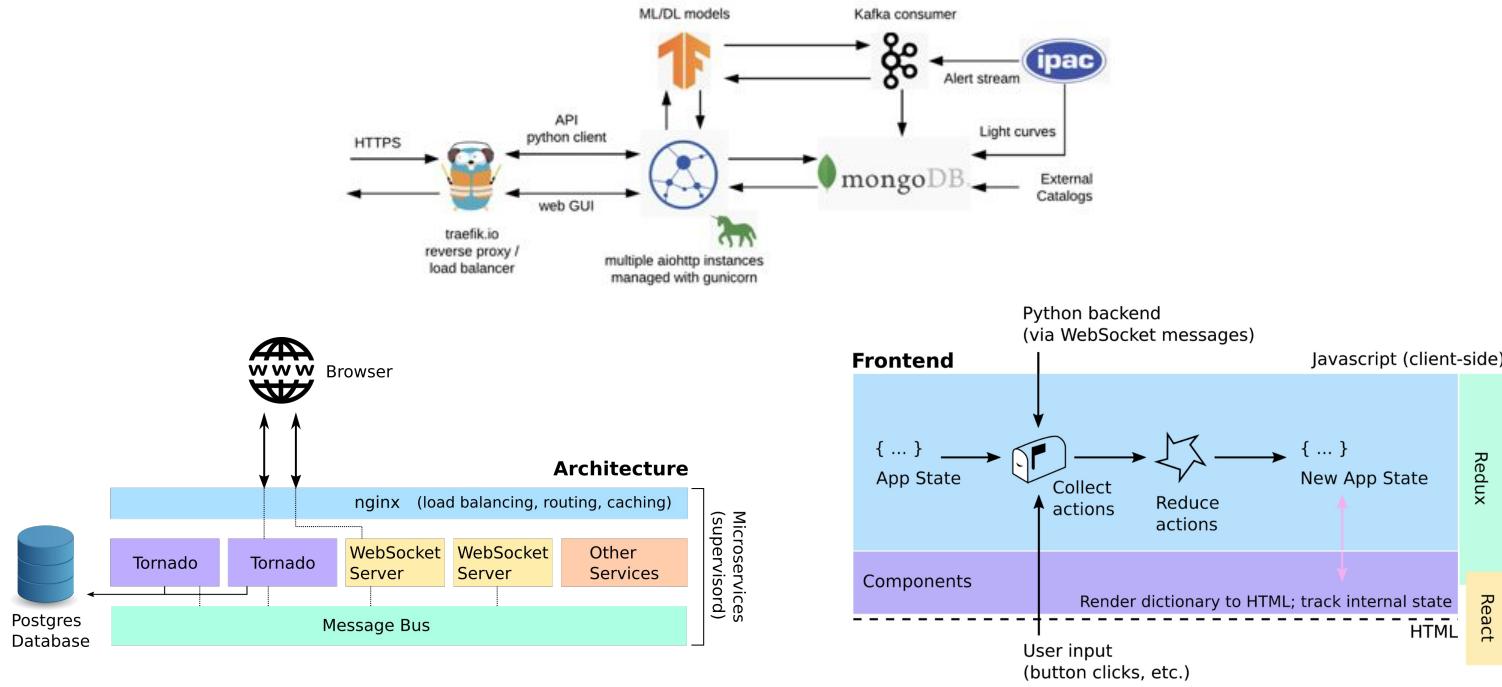
- Fast, robust access multi-survey data archive
  - ZTF alert stream
  - ZTF light curves + features + SCoPe classifications
  - >30 external catalogs
  - Multiple ML models
  - Cross-matches
  - ~100M queries/day typical load
- Powerful alert stream enhancement & filtering capabilities
  - MongoDB aggregation pipelines
  - Public alert DBs for filter design/debugging
  - Filtering enhanced data
  - Automated checks, no filter code audit
  - [Can post results from external brokers]

The screenshot shows the MongoDB Compass interface. On the left, there's a sidebar with 'Favorites' and 'Recents' sections. The main area displays a connection string for a 'fritz-test-shard-00-00-us06x' cluster, with a timestamp of 'JUL 12, 2020 12:24 AM'. Below this, there's a text input field for 'Paste your connection string (SRV or Standard)' and a 'CONNECT' button. To the right, there are several informational links: 'How do I find my connection string in Atlas?', 'If you don't already have a cluster, you can create one for free using MongoDB Atlas.', 'CREATE FREE CLUSTER', 'How do I format my connection string?', and 'See example'.

The screenshot shows the Fritz web application. The top navigation bar includes 'Dashboard', 'Sources', 'Candidates', 'Alerts', 'Groups', 'Observing Runs', and 'About'. The main content area has a 'Filter: high\_db' section with a dropdown menu showing 'Active' and 'Active version: brawt 2020-11-19T01:56:05'. Below this is a 'Save new version' section with a 'Version: diff' dropdown set to 'perkvp: 2020-11-07T07:54:32'. Two code snippets are shown side-by-side, each with a 'Select source to diff' button. The left snippet is labeled 'Active version: perkvp: 2020-11-07T07:54:32' and the right snippet is labeled 'Active version: brawt: 2020-11-19T01:56:05'. At the bottom, there's a JSON representation of the diffed data and a list of fields: '\_id', 'schemavsn', 'publisher', 'objectId', 'candid', 'candidate: Object', 'jd', 'fid', 'pid', 'diffmaglim', '...', 'prv\_candidates', 'cutoutScience', 'cutoutTemplate', 'cutoutDifference', and 'coordinates'.

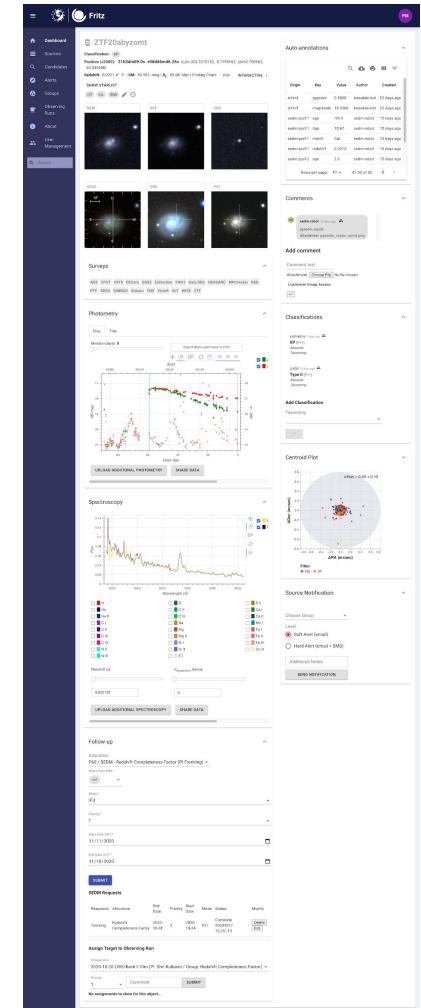
# Fritz: features

- Extendible & scalable design: async Python backends, React/Redux frontend



# Fritz: features

- Fine-grained access control
  - ACLs, Roles
  - Groups (>30 as of this morning; ~200 users)
- Authentication via OAuth
- Real-time Slack-like messaging, notifications (email/text)
- Rich visualization capabilities
- Follow-up observations management (TOM)
  - Both robotic and classical facilities (SEDM end-to-end)
- Distributed computation via Dask
- Docker compose or Kubernetes deployment
  - Everything containerized / versioned
  - Production deployment: Local + GCP
- Well-tested, extensive docs, CI/CD, staging



**Fritz**

**Dashboard**

- Sources
- Candidates
- Alerts
- Groups
- Observing Runs
- About

**Source**

**Recently Saved Sources**

- ZTF20acpbifl (a,b) 22h38m01.68s +26d20m24.74s 34 minutes ago
- ZTF20acpgof (a,b) 20h51m58.51s +26d17m56.39s 34 minutes ago
- ZTF20aboyzmt (a,b) 21h34m09.0s +08d46m46.26s 34 minutes ago

**Top Sources**

- ZTF20acmzoxo (a,b) 23h04m49.23s +16d51m29.97s
- ZTF20aboyzmt (a,b) 21h34m09.0s +08d46m46.26s
- ZTF20acplwzt (a,b) 23d36m18.54s +23d11m26.54s

**News Feed**

- New source saved ZTF20acpbifl 34 minutes ago
- New source saved ZTF20acpgof 34 minutes ago
- New source saved ZTF20aboyzmt 34 minutes ago
- New source saved ZTF20acplwzt 34 minutes ago
- New source saved ZTF20acpgif 3 hours ago

**1051** New Sources Last 7 days

**My Groups**

- Dima's Lab
- Sitewide Group

**P48**

It is 9.6°C with 52% humidity & clear sky. Sunset 2 hours ago, sunrise in 12 hours

**FORECAST WEBCAST**

**Fritz**

**ZTF20babycmt**

**Autonotifications**

**Comments**

**Add comment**

**Surveys**

**Photometry**

**Classifications**

**Growth Plot**

**Spectroscopy**

**Source Notification**

**Follow-up**

**EDDM Requests**

**Assign Target to Observing Run**

**Fritz**

**Interactive Finder for ZTF20abapvgz**

**ZTF20abapvgz**

**ZTF20abapvgz Finder (2020-11-12T08:44:26.839776)**

**ZTF20abapvgz** 36.57422,-1.83626  
02h26m15.83171,-09d50m39.3862s  
**ZTF20abapvgz\_01, mag<18.33**  
36.57422,-1.83626  
02h26m15.83171,-09d50m39.3862s  
10.411° E 1.164° Nts ZTF20abapvgz  
**ZTF20abapvgz\_02, mag<17.35**  
36.57422,-1.83626  
02h26m15.83171,-09d50m39.3862s  
46.311° W 9.161° Nts ZTF20abapvgz  
**ZTF20abapvgz\_03, mag<15.87**  
36.59349,-1.83626  
02h26m23.39815,-09d50m32.775s  
72.119° W 83.159° Nts ZTF20abapvgz

**PRINT**

**Fritz**

**Dashboard**

- Sources
- Candidates
- Alerts
- Groups
- Observing Runs
- About

**Source**

**Previously Saved**

**ID: ZTF20acdtscy**

**Previously Saved**

**Saved groups:** dlab

**Last detected:** 07:43:29 2020-11-12

**Coordinates:** 02h35m03.61s +01d13m35.84s (a,b) 38.911, 1.227  
Gal. Coords (lb) 168.623 -52.396

**DLAB-ACAI\_H**

**DLAB-HIGH\_DR8**

**ID: ZTF20acpcpref**

**kowalski.ZTF\_alerts**

**Documents**

**Aggregations**

**Schema**

**Explain Plan**

**Indexes**

**Validation**

**Output after Success stage (Sample of 1 document)**

```

1: {
  "objID": "ZTF20abjfu7ufv",
  "r": 11.171881432054573,
  "t": 11.171881432054573,
  "fid": "new",
  "score": 8.403049480168074482,
  "rscore": 8.403049480168074482,
  "rsize": 10.4117337357782778,
  "rscore": 10.4117337357782778,
  "dist": 0.35097735737827787,
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  "dist34": 0.35097735737827787
}

```

**SHOW 3 MORE FIELDS**

**DEMO**