European Broker Initiative

https://rubinobservatory.org/for-scientists/data-products/alerts-and-brokers

European Broker teams meet regularly - roughly every two months - hosted by Fink. Recent Topics include:

Schema updates and schema wrangling
LSST Operational Rehearsals
LSST Commissioning
  How have brokers managed with early commissioning data?
  What about image stamps?
How will we get larger images for the brokers from LSST?

Broker provided Lasair Annotations
Chaining filters

Dealing with LSST alert cutouts

Ongoing discussions about alert stamp storage.

Lasair used to store in CephFS but became too
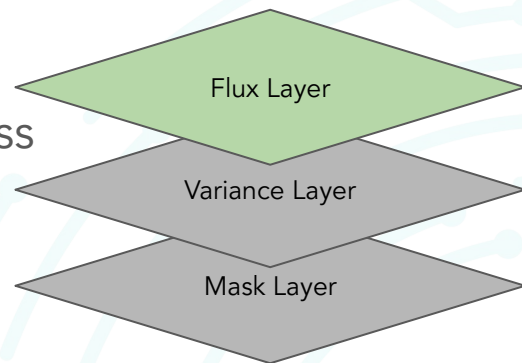slow & difficult to manage.
Fink stores alerts in Parquet files.

Implement a shared alert image stamp curation and access
Even with only 1 layer + lz4 compression ~ 7K
100M alerts == 300M stamps ~ 2TB
just 10 days of alerts (without replication)

Flux Layer

Variance Layer

Mask Layer

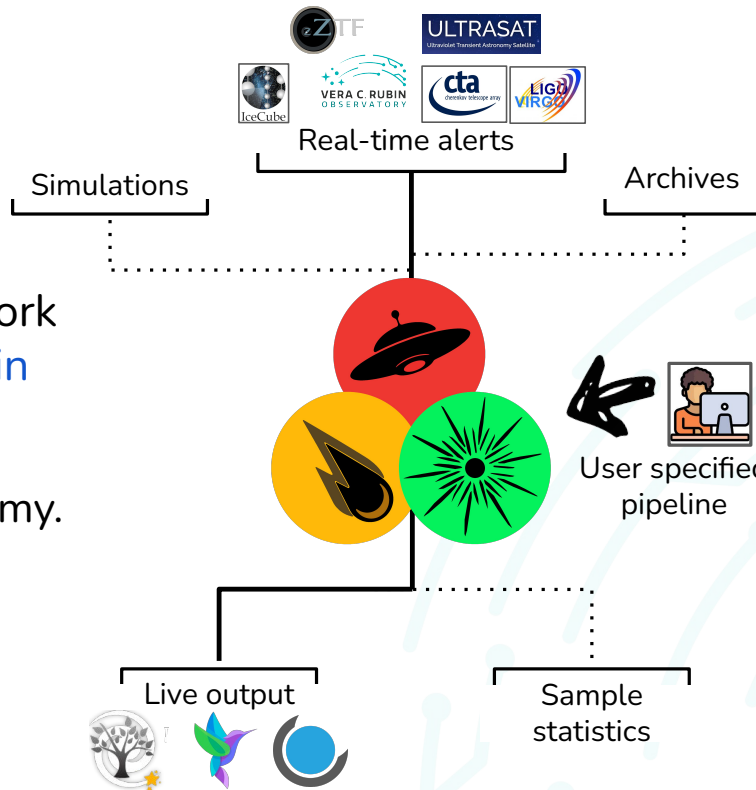What do we do for cutout images older than the Broker cache?
Retrieve them from the Prompt Product Database? (Still to be specified.)

AMPEL

Analysis and workflow framework for high throughput time-domain astronomy.

Realizes code-to-data in astronomy.
https://ampelproject.github.io/ampelastro/

Real-time alerts

Simulations

Archives

User specified pipeline

Live output

Sample statistics

AMPEL and LSST

- **Real-time transient classification.**
  - 1st place in ELAsTiCC challenge
- **Hosting dedicated science pipelines.**
  - Cosmology / lensed transients.
  - Multi-messenger programs.
  - Infant transients.
- **Access data.**
  - Kafka substreams through Hop.SCIMMA
  - Infant event Slack channel.
  - Through other brokers (e.g. Lasair annotator)
  - … build your own pipeline!

Contact: ampel-info@desy.de
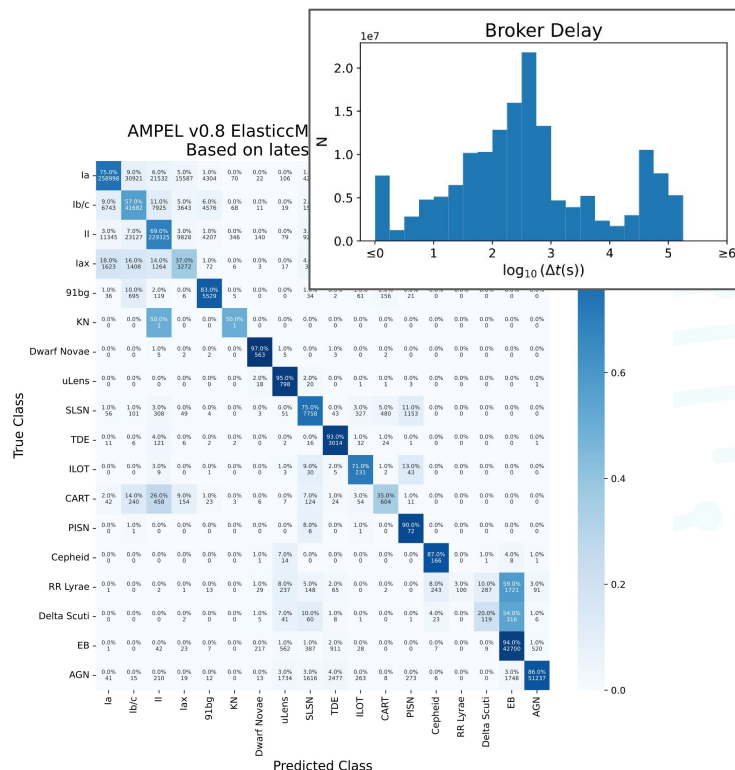
Fink in a nutshell

- Fink is a community-driven **broker** (https://fink-broker.org)
- As of 2025: 100+ collaborators, 15 countries
- Services deployed on large OpenStack clouds (UPSaclay & CC-IN2P3)
- Scalable to millions of alerts per night
- Machine learning, xmatch, and custom filtering capabilities
- Operating 24/7 since 2019, serving 100+ unique users per day (scientists, follow-up facilities & amateurs)

ML Model Wrangling

Goal: improve ML integration in Fink for LSST

https://fink-portal.org/

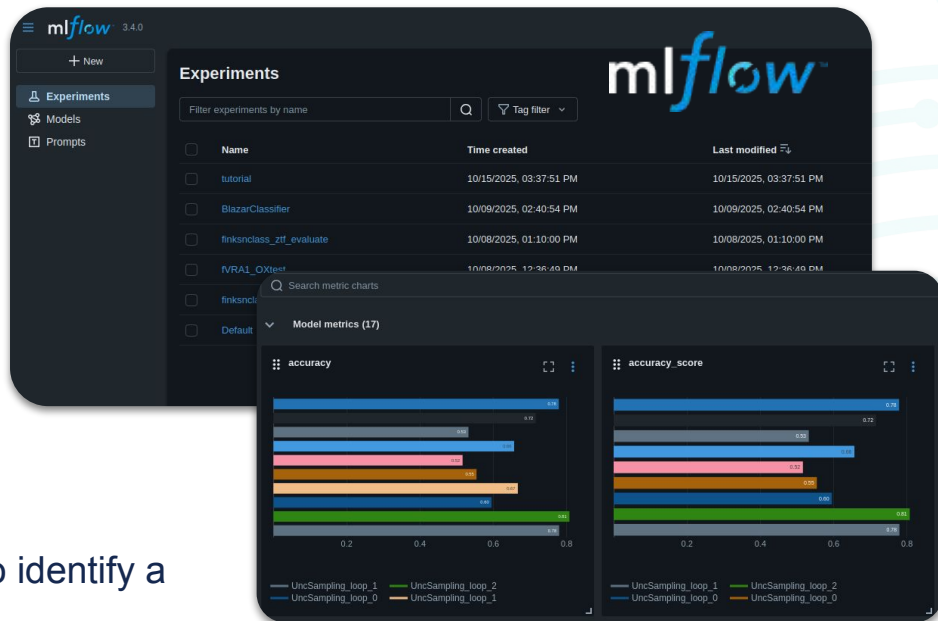**1st step:** deployment of a centralised platform for users and broker to better interact.

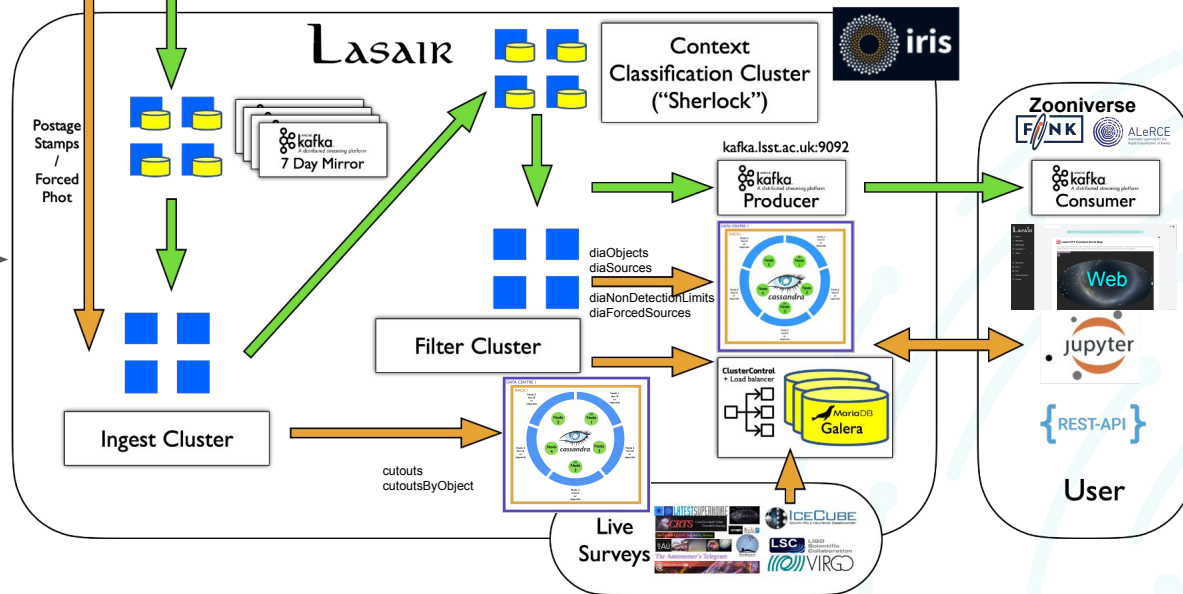**Training & model production (users)**
- Keeping track of metrics
- Version and compare models
- Experiment before going to full stream

Production & deployment (broker)
- Containerisation for each model
- Automated deployment of latest models

First hackathon happened in Oxford 10 days ago to identify a solution, and implement a Proof of Concept.
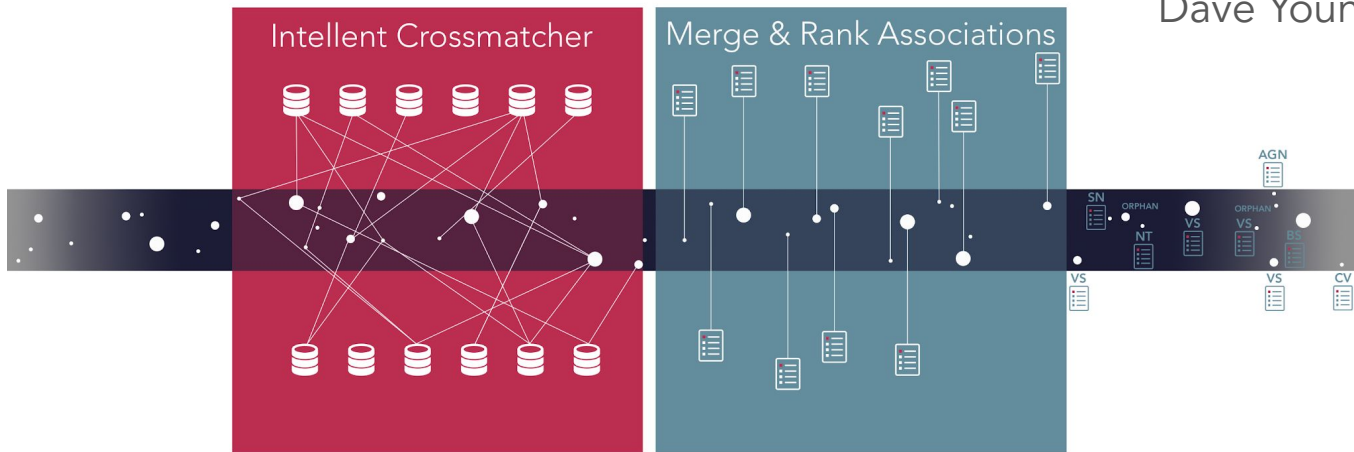
Lasair

10^7 LSST Alerts per day == ZTF × 30

10^6 ZTF Alerts per day (in reality, up to 3×10^5)

Kafka
Not Kafka

Automated Deployment

Postage Stamps / Forced Phot

Context Classification Cluster ("Sherlock")

iris

kafka.lsst.ac.uk:9092

Producer

Zooniverse

Consumer

Web

Jupyter

{REST-API}

User

Full Stream

Producer

7 Day Mirror

Filter Cluster

diaObjects
diaSources

diaNonDetectionLimits
diaForcedSources

cassandra

ClusterControl + Load balancer

MariaDB Galera

Ingest Cluster

cassandra

cutouts
cutoutsByObject

Live Surveys

IceCube

LSC

VIRGO

Sherlock - Annotates incoming alerts

https://github.com/thespacedoctor/sherlock

Dave Young

Intellent Crossmatcher

Merge & Rank Associations

Sherlock is a decision tree algorithm that mines a library of historical and ongoing astronomical survey data in an attempt to predict the nature of the object based on the resulting crossmatched associations found.

Sherlock Contextual Classification ⓘ
Prediction: **Nuclear Transient**

The transient is synonymous with *S2T1014797*; an r=18.56 mag galaxy found in the GSC/DESI catalogues. Its located 0.7" from the galaxy core.

Sherlock Catalogues

Source-agnostic(ish) all-sky surveys:

- Gaia DR3,
- PanSTARRS DR1 + T&M s/g scores
- GSC v2.3,
- SDSS DR12 PhotoObjAll Table,
- SDSS DR12 SpecObjAll Table,
- 2MASS catalogues
- DESI Legacy Survey DR10

Smaller source-specific catalogues:

Dave Young

- Million Quasars Catalog v8,
- SDSS DR12 QSO Table,
- Downes Catalog of CVs,
- Ritter Cataclysmic Binaries Catalog v7.21,
- LASr galaxy catalogue
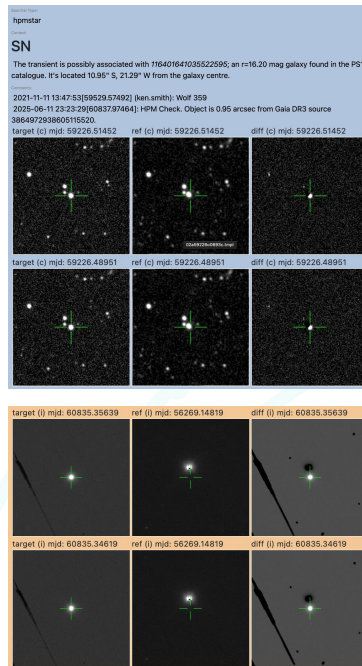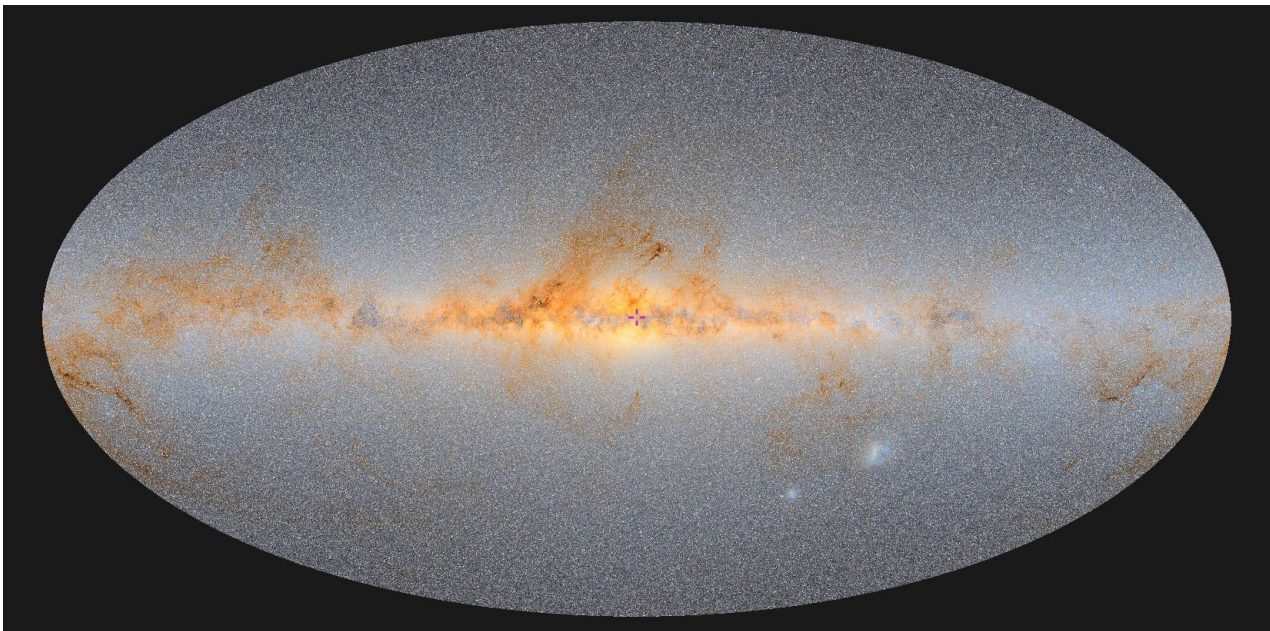- NED-D Galaxy Catalogue v17.1.2
- ...

Remote query and caching of NASA/IPAC Extragalactic Database (NED)
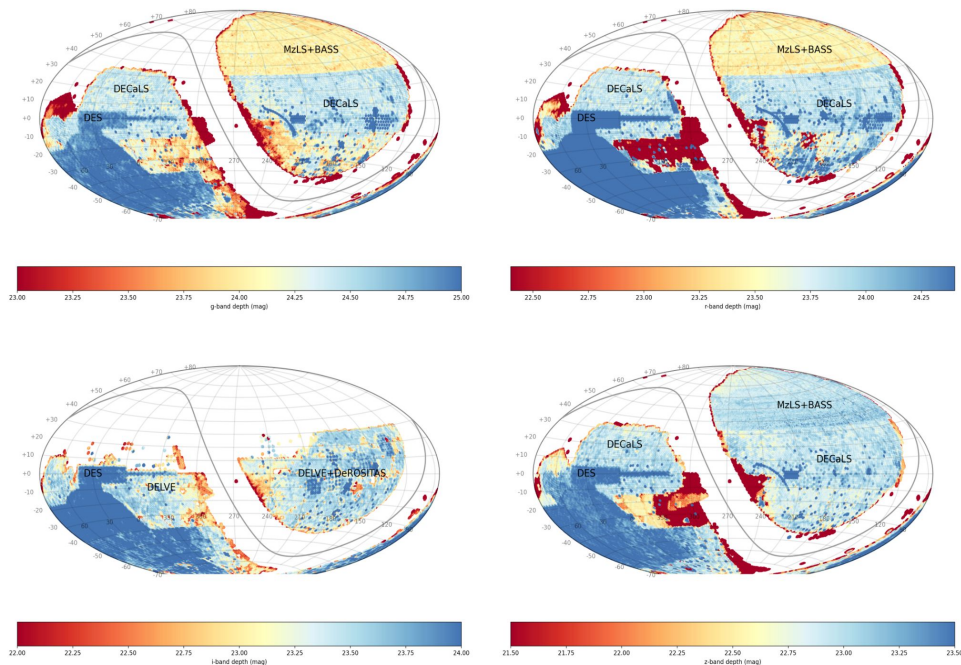
3.8 TB locally queried MySQL Database (Compressed MyISAM).
Multiple copies in QUB, Edinburgh and Oxford
LSST DP2?

Sherlock updates

Integrated into ATLAS, Pan-STARRS and VERA C. RUBIN OBSERVATORY transient surveys

hpmstar

SN

The transient is possibly associated with *1*16401641035522595; an r=16.20 mag galaxy found in the PS1 catalogue. It's located 10.95" S, 21.29" W from the galaxy centre.

2021-11-11 13:47:53[59529.57492] (ken.smith): Wolf 359
2025-06-11 23:23:29[60837.97464]: HPM Check. Object is 0.95 arcsec from Gaia DR3 source 3864972938605115520.

Sherlock updates - DESI Legacy Survey

2.7B rows, fully integrated, now testing in atlas, Pan-STARRS & VERA C. RUBIN OBSERVATORY
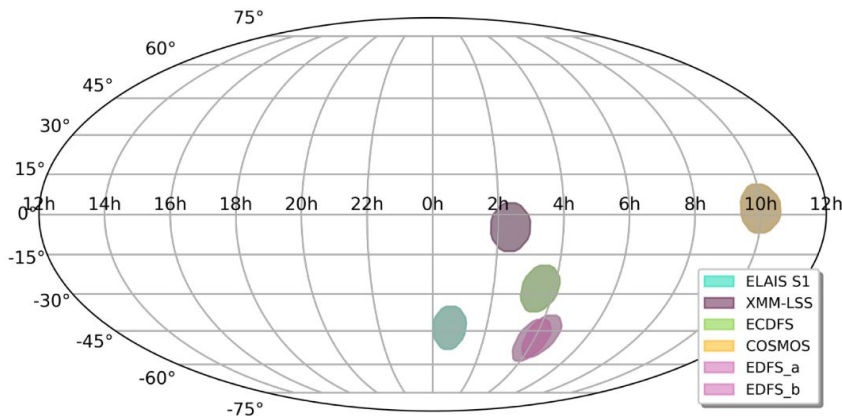
Sherlock updates - Deep Drilling Fields

IDENTIFYING TRANSIENT HOSTS IN LSST'S DEEP DRILLING FIELDS

Josh Weston

- LSST Deep Drilling Field Mini Survey probes six Rubin pointings at higher cadence and depth than the WFD survey.

- Program will provide a higher-redshift sample of Type Ia supernovae for constraining cosmological parameters and a large number of distant transients (hopefully rarer ones too).

- To effectively maximize DDF science results we require efficient cross-matching of transients with their hosts and sufficient data to make these matches.

LSST Deep Drilling Fields

Legend: ELAIS S1, XMM-LSS, ECDFS, COSMOS, EDFS_a, EDFS_b

Not fully integrated into Sherlock yet

Josh Weston

We have identified ~70 catalogues focused on the Deep Drilling Fields; of these, 56 have more than 1000 records and 44 more than 10,000. Of these, 28 have redshift measurements (spectroscopic and/or photometric).

These catalogues have been ranked according to the variety of information available within them:

A for spectroscopic redshifts, B for photometric redshifts, C for no redshifts. + for morphology and type flags; - for neither.

https://github.com/joshgithubbin/Sherlock-DDF/wiki
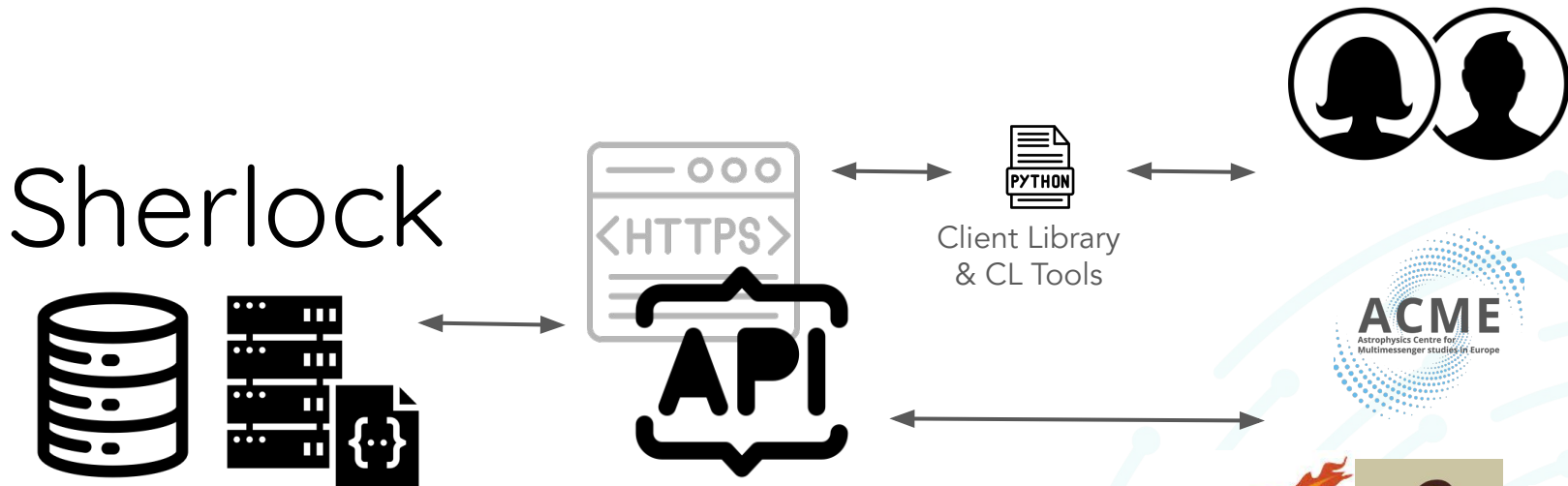
Lestrade Autowiki

Catalogues:

▼A+

- COSMOS2025: The COSMOS-Web galaxy catalog of photometry, morphology, and physical parameters from JWST, HST and ground-based imaging

- MIGHTEE: the continuum survey Data Release 1

We will create an Open API and client library so everyone can access Sherlock's classification algorithm & the underlying source data associated with each transient.

"Closed" API already exists in Lasair

# Sherlock and Multimessenger Alerts

Multi Messenger Watchmaps

A multi-messenger watchmap is based on a region file (MOC format) which defines a specific portion of the sky. Eacl as *matched* against that watchmap.

Watchmaps from multi-messenger streams that Lasair consumes.

ID-version	Image	Area90	Type
S240406ao		946.933055	LVK:Terrestrial
S240408q		970.223454	LVK:Terrestrial
S240409bd		757.042868	LVK:Terrestrial
S240411ao		663.67145	LVK:Terrestrial

'MS240401n' Associations

J2000d 71.5429687 -6.354347 AIT

3D match

2D match

90% 10% 50%

20.00° × 15.00°
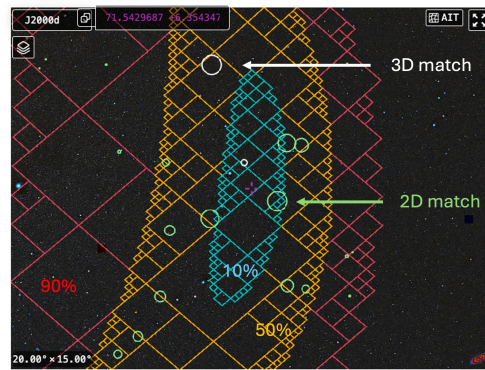
You clicked on 1999351943947882200

2024-04-09 09:25:16	
2024-04-11 07:38:31	

Export

Alerts ingested from GCN Kafka Stream crossmatched against incoming Alerts

Good context information allows us to identify candidate host galaxies.

L∀S∀IR Annotators

FastFinder (Fulton et al, in prep)

Classification = FAST if the incline rate or decline rate in any filter exceeds the corresponding threshold:
- Incline rate -- ≥ 0.75 mag/d with $\geq 3\sigma$ confidence.
- Decline rate -- ≥ 0.25 mag/d with $\geq 3\sigma$ confidence.

Classification = SLOW if there is no appreciable light curve evolution:
- Incline rate $\approx$ Decline rate ≈ 0 mag/d.

Classification = SN otherwise.

FAST and SN classifications are suffixed with an "(I)" if features are implied.

NEEDLE (https://ui.adsabs.harvard.edu/abs/2024MNRAS.531.2474S/abstract)
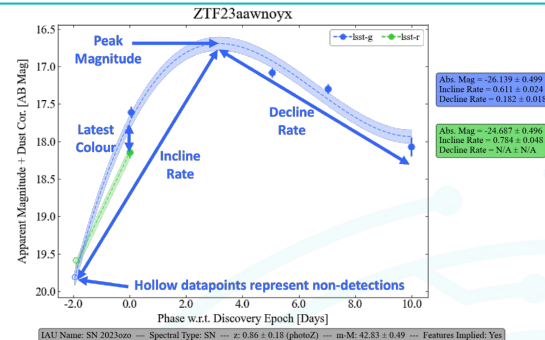
NEural Engine for Discovering Luminous Events (NEEDLE): identifying rare transient candidates in real time from host galaxy images

Xinyue Sheng,[1]★ Matt Nicholl,[1] Ken W. Smith,[1] David R. Young,[1] Roy D. Williams,[2] Heloise F. Stevance,[3] Stephen J. Smartt,[3,1] Shubham Srivastav,[3,1] Thomas Moore[1]

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[2] Institute for Astronomy, University of Edinburgh, Royal Observatory, Blackford Hill, EH9 3HJ, UK
[3] Department of Physics, University of Oxford, Denys Wilkinson Building, Keble Road, Oxford OX1 3RH, UK

Annotators feed Lasair key/value pairs and an overall classification back via the API, then users can receive a feed of the annotations from multiple sources.

```
WHERE objects.objectId=sherlock_classifications.objectId
AND objects.objectId=watchlist_hits.objectId
AND watchlist_hits.wl_id=1
AND watchlist_hits.name=crossmatch_tns.tns_name
AND objects.objectId=needle.objectId
AND needle.topic="needle"
AND objects.jdmax > jdnow()-7
AND (NEEDLE.classification = "SLSN-I"
    OR NEEDLE.classification ="TDE")
AND (objects.rmag < 19.2
    OR objects.gmag < 19.2)
AND objects.decmean > -40
AND (objects.objectId LIKE CONCAT("ZTF", DATE_FORMAT(NOW(), "%y"), "%")
    OR objects.objectId LIKE CONCAT("ZTF", DATE_FORMAT(CURRENT_DATE - INTERVAL 1 YEAR, "%y"), "%"))
```

Summary

Recent "Finking Ahead" workshop at Oxford

Sherlock developments for common broker usage

Common infrastructure discussions - especially stamps & Sherlock

Sharing of common commissioning experience

Exploitation of each other's functionality

Rubin Broker Summit 15-19/June/2026:
https://www.institut-pascal.universite-paris-saclay.fr/en