Fink, a new generation broker for the LSST community

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The Rubin Observatory Legacy Survey of Space and Time (aka LSST)

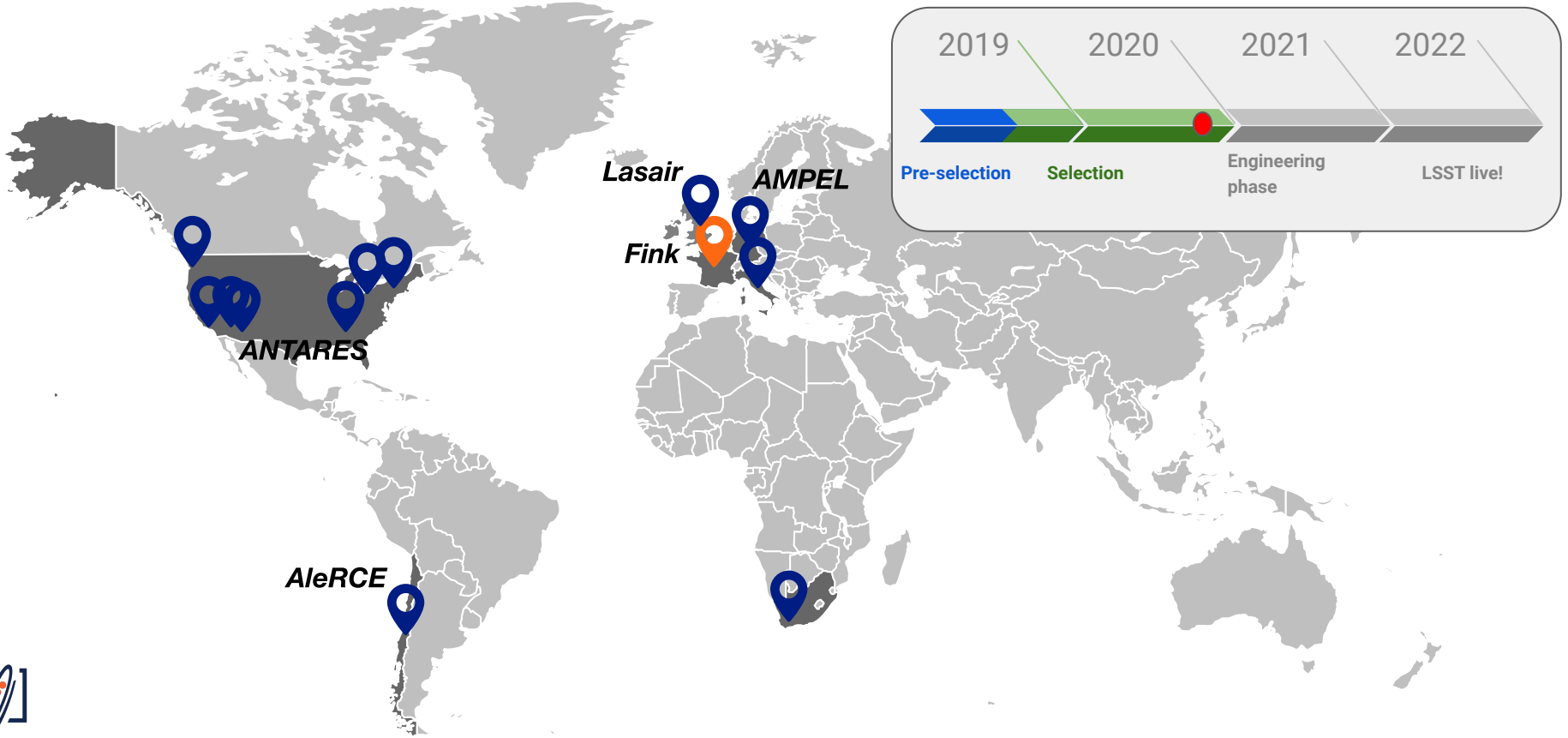
In a nutshell:

- Telescope: 6.7-m equivalent
- World's largest CCD camera: 3.2 Gpixels

In numbers:

- 10-year survey, starting 2022+
- 1,000 images/night = 15TB/night
- 10 million transient candidates per night
  - **Alerts are public!**
  - Data stream: 1TB/night
  - Only community brokers will receive the full stream, and then redistribute interesting parts to the community.

Broker landscape (2020)



Fink scientific objectives

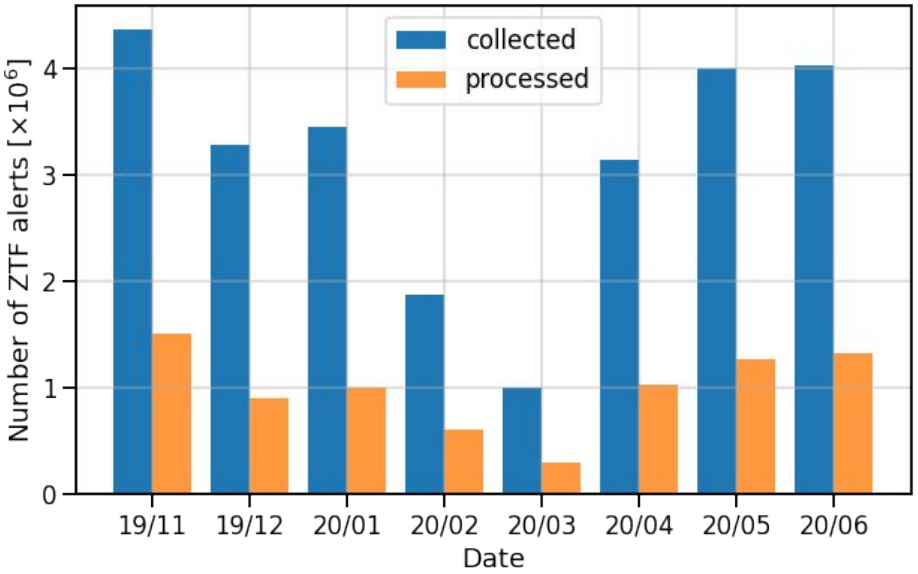
- Fink is a community-driven effort, open to anyone
- Current fields of expertise
  - Supernovae
  - Kilonovae
  - Microlensing
  - Multi-messenger astronomy (GRB, X, neutrino, GW)
  - Anomaly detection
- We are open to new contributions!
  - Recent: Solar System & ISO
  - … <your project here!>

https://arxiv.org/abs/2009.10185

Processing ZTF data

We can already test Fink on real alert data

- MoU with Zwicky Transient Facility (ZTF), “pathfinder” for LSST.
- ~100,000 alerts per night (~10GB/night)



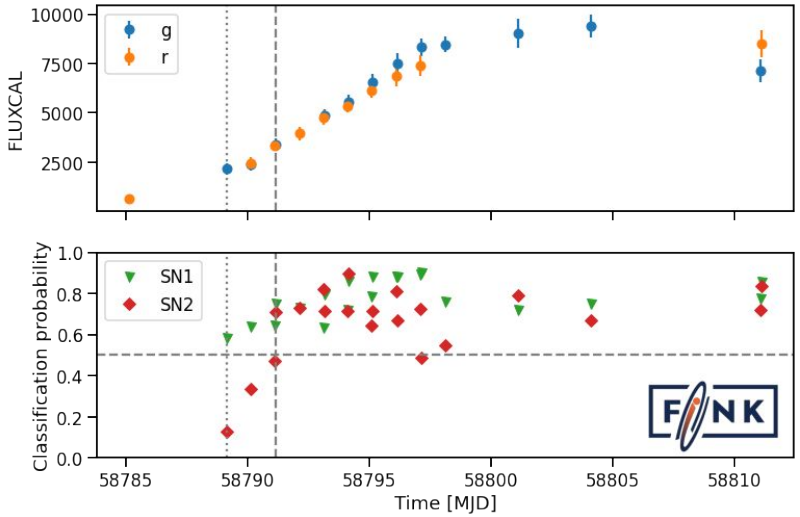
Alert content

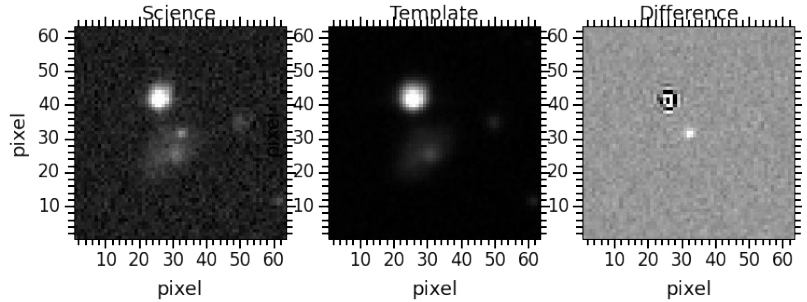
Alerts based on Difference Image Analysis

Each ZTF alert contains

- Information about the new detection (magnitude, position, ...)
- Neighbours information (Gaia, Panstarrs)
- Historical information if the object has been seen previously
- Small images around the detection (30x30 pixels)

LSST alert content will be similar.





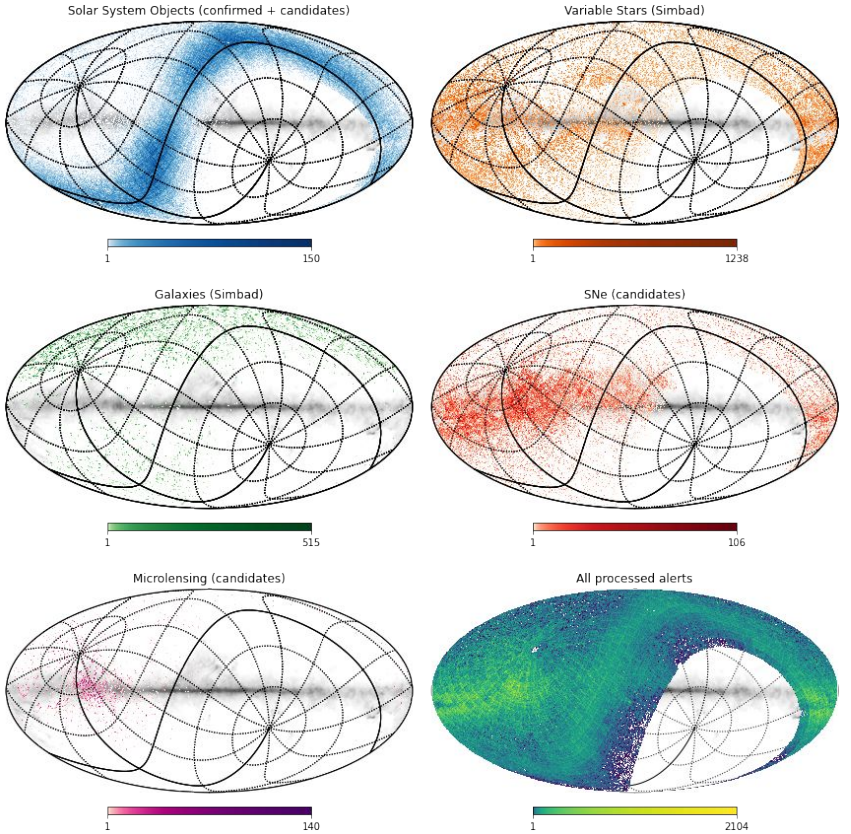
Fink science output

More than 30 million alerts collected, and 8 million alerts processed in 1 year.

Cross-matching (e.g. with CDS xmatch service) + **classification** (machine learning based algorithms)

Several categories out

- Supernovae & core-collapse
- Microlensing
- Variable stars
- Solar System objects
- ….



Coordination & interoperability

Identifying interesting LSST alerts is only part of the story: we need coordination with other facilities, follow-up resources and existing networks.

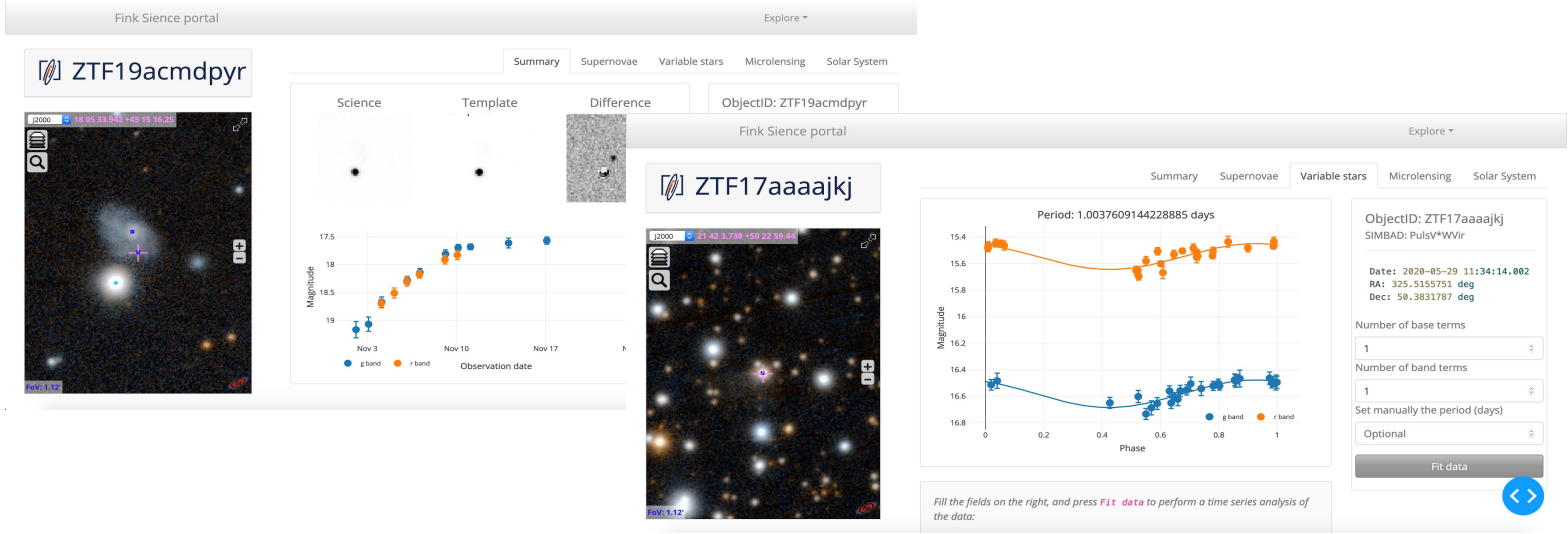
- Your expertise is important to us!
- Discussions and work with teams from: SVOM, GRANDMA, CTA, Integral, KM3NET, …
  - 2009.10185: Work on GRB (Fermi/SWIFT-ZTF) to prepare SVOM-LSST

We will regularly publicize a prioritized list of targets for each science case that should be followed in order to improve future estimates.

- How to integrate this in the current landscape given the scale?
- How to coordinate with existing follow-up resources (+ToO) and surveys?
- Contact us contact@fink-broker.org to integrate your science case in Fink.

Accessing Fink data

- Live streams
  - Personalisable filters to select objects/parameters of interest
- Science Portal (under construction): *online in November 2020*
  - Exploration of the full Fink data set (alerts + added values)
  - All data will remain accessible for the full survey duration



What is happening now?

The selection of community alert brokers is underway.

- Proposal submission in December 2020 - Selection in Q2 2021

Community preparation on pathfinders (e.g. ZTF) and LSST sample alerts

- Allow science users/collaboration/telescope to understand alert contents
  - *How do I extract data from an alert packet?*
  - *Has LSST made the right choices for what information to include?*
- Allow science users and alert brokers to define projects together
  - *How do I find events of interest to me?*
- Allow alert brokers to understand alert stream protocols
  - *How do I connect to the alert stream?*
  - *How do I redistribute best to the community (interoperability)*

Take away

Fink is a broker designed to tackle LSST alert big data challenges

- Enabling science by applying state-of-the-art technology.

Technology Readiness Level (TRL) 6/9.

- Still under development (deadline: December 2020)
- Fink is already processing ZTF data stream (MoU 2020).
- First science modules deployed and testing capabilities beyond expectations: SNe, GRB, microlensing, …

We need you!

- Full broker proposal (end 2020).
- We are open to new contributions! https://fink-broker.org/joining.html


FINK
https://fink-broker.org
LSST Project/NSF/AURA