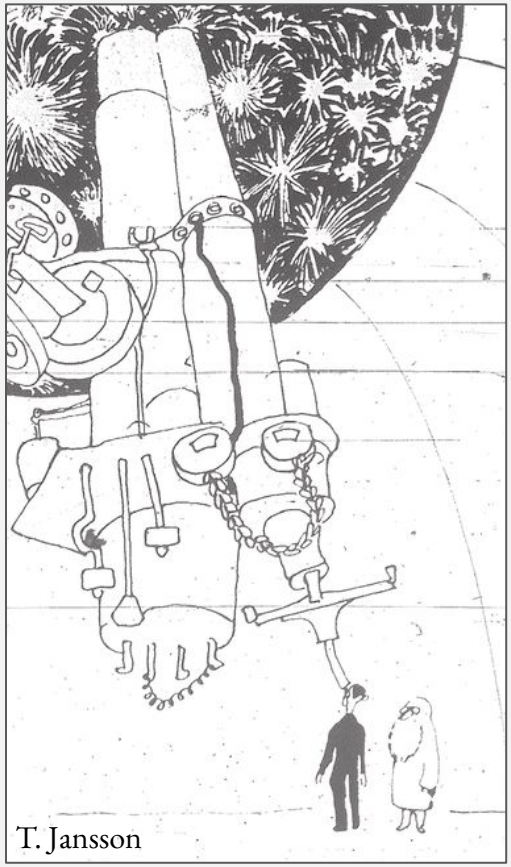
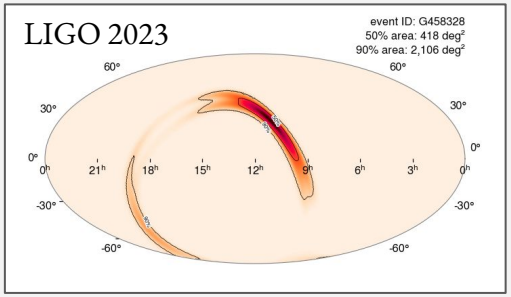
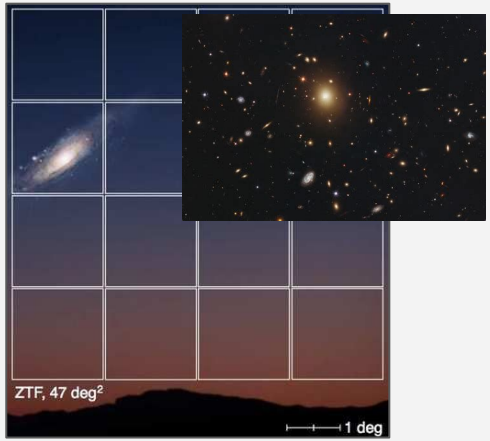


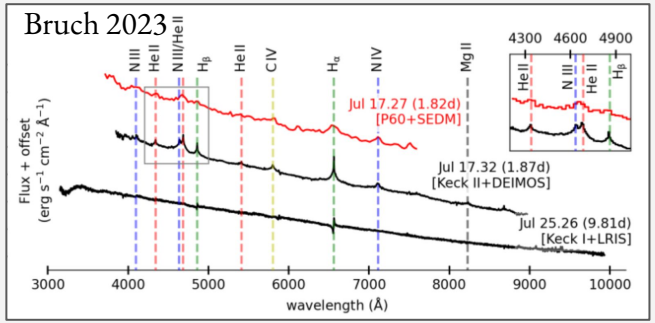
Dynamical archives

Multi-messenger / Optical

A multi-messenger cartoon



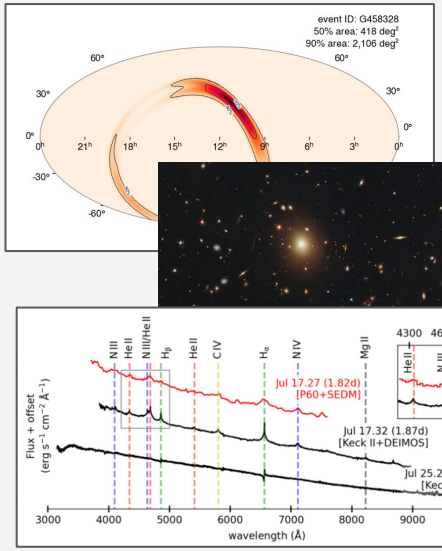


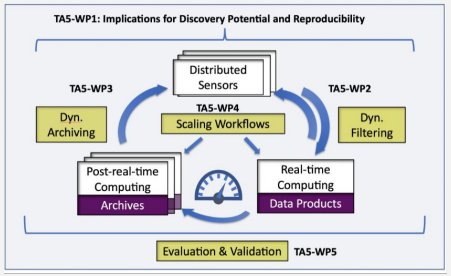


Trigger (t_0, "energy") → Optical (position, evolution) → Follow-up (composition)

Thousands of potential counterparts, if one even exists.
Multiple theoretical models.

Use cases mapped to TA5





Real-time reactions
Telescope triggers...

Could [x] be a possible physical model?
x ~ from observations / theory / rates
Take all obs into account.

Optimized follow-up
Ranked candidate lists
Future surveys / instruments

A demonstrator dynamical archive

User supplies a counterpart model + filter parameters. Automatic archive processing yields:

- Scores
- Cost

A demonstrator dynamical archive

User supplies a counterpart model + filter parameters. Automatic archive processing yields:

- Scores
  - ... in terms of identifying real astrophysical events
  - ... likelihood of trigger on events simulated from model
- Cost
  - Processing (algorithms executed)
  - DB (documents inserted)
  - Follow-up triggers (external cost)

A demonstrator dynamical archive

User supplies a counterpart model + filter parameters. Automatic archive processing yields:

- Scores
- Cost

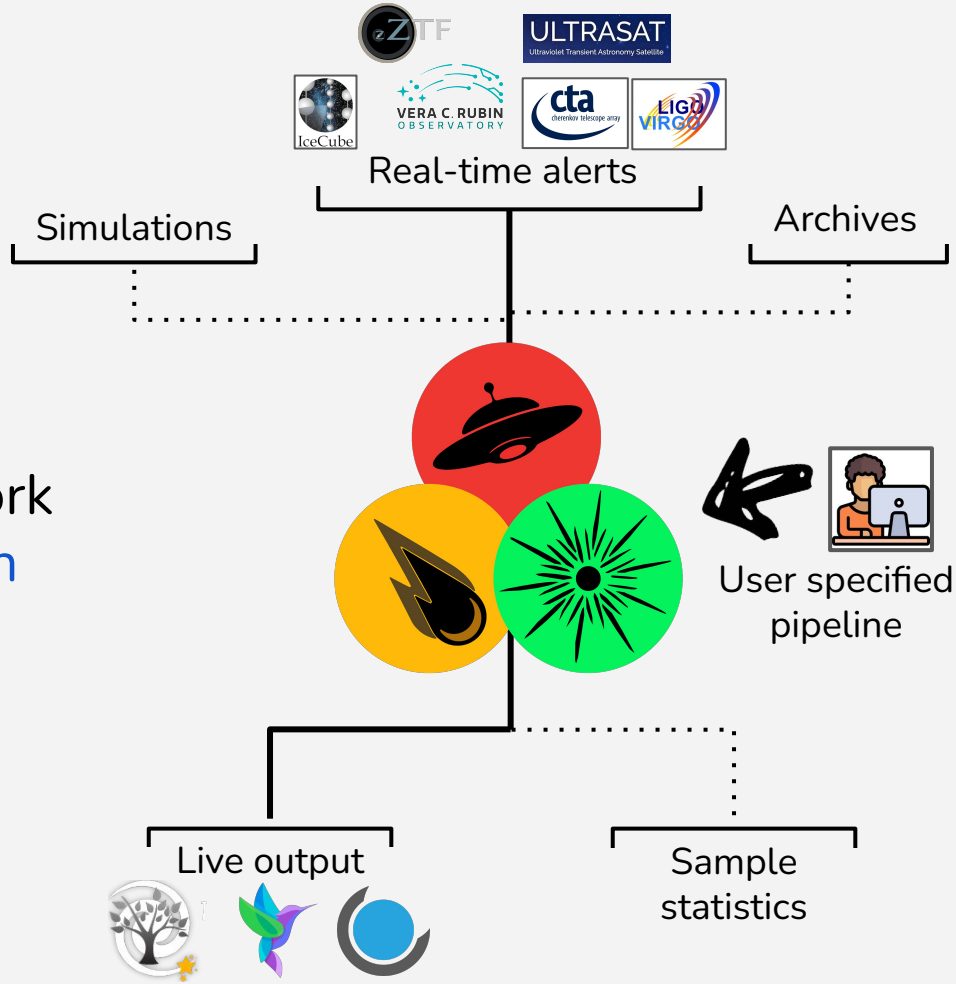
A sufficiently “good” archive query can directly be transformed into real-time filter.

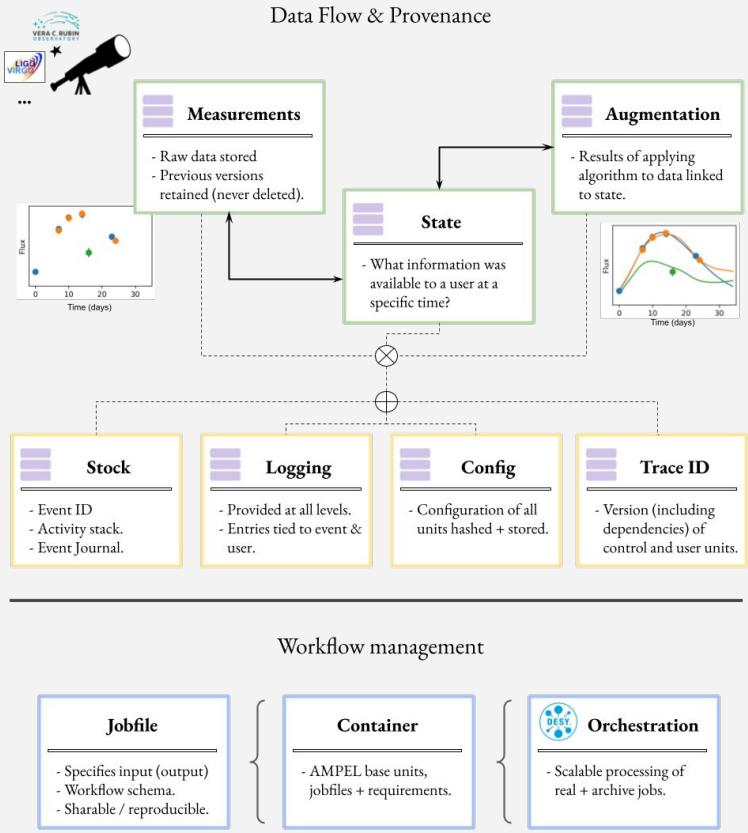
AMPEL

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

Realizes code-to-data in astronomy.

https://github.com/AmpelAstro





AMPEL4TA5 today

Modularity / Flexibility

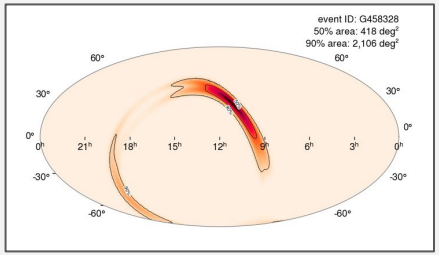
- Model plug-in
- Same setup for offline / online
- Core modules astro “agnostic”

Provenance

- Automatic version/config store
- Built in log classes
- Reproducible workflows
- Deduplication

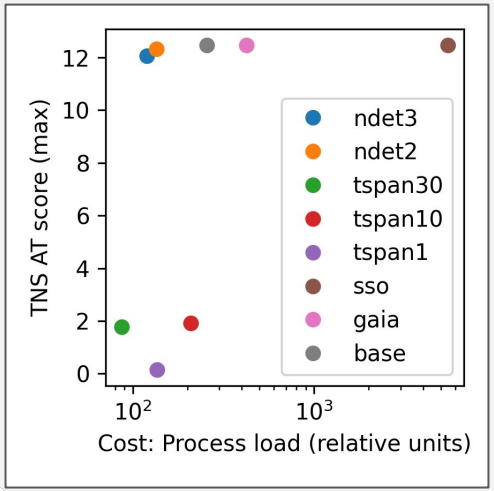
Operational

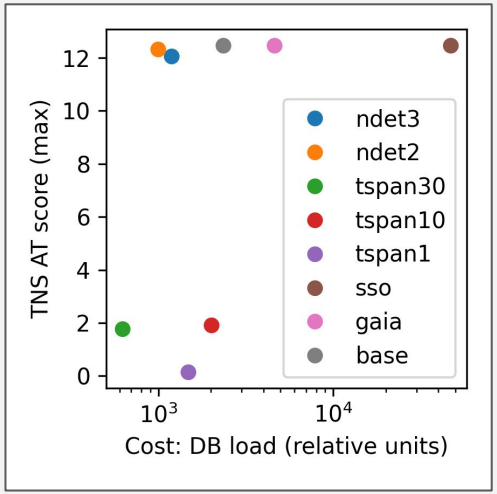
- Data archives
- LSST / ZTF / Ultrasat broker
- Dev + cluster workflow environments

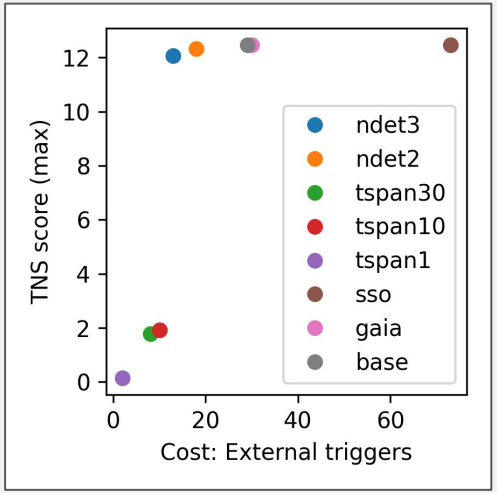


Test runs for S231213ap

Searched ZTF archive for TNS counterparts.
Cost metrics: T2 calculations requested, DB load & obs triggers.







A demonstrator dynamical archive

Required development:

- Base class for scoring
- System for batch execution and evaluation
- Benchmark samples (MM, infant, cosmology)
- Simulation to alert generation to processing loop

Questions

- Changes to be ready for scalable workflows?
- Can a more general information metric be defined?
- Used as a provenance host for other archives?
- Can this be made more broadly useful?