



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

# Update on the Vera C. Rubin Observatory - LSST alert stream

Markus Hundertmark

27.3.2026 Astro-CC Heidelberg

# Global Data Journey

via high-speed networks

20 terabytes of data  
**every night**

SLAC/USDF

HQ Site (NOIRLab)

UK Data Facility

French Data Facility

2

SLAC processes data **up to 7 million per night (since Feb 2026)**

New 3200-megapixel image  
**every ~40 seconds**

3

Data → Europe  
(further processing)

1

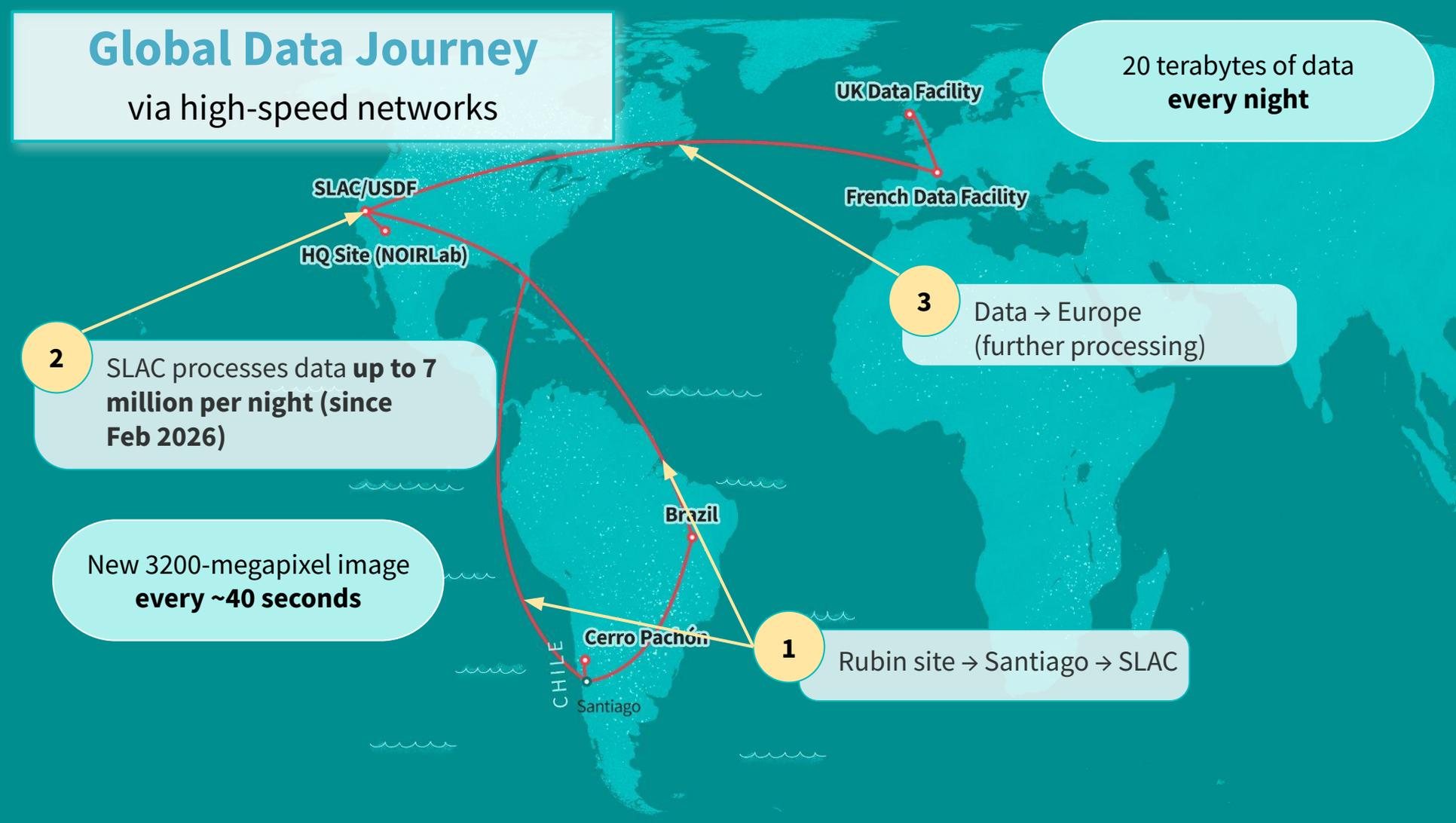
Rubin site → Santiago → SLAC

Brazil

Cerro Pachón

Santiago

CHILE



# Difference Image Analysis (DIA)

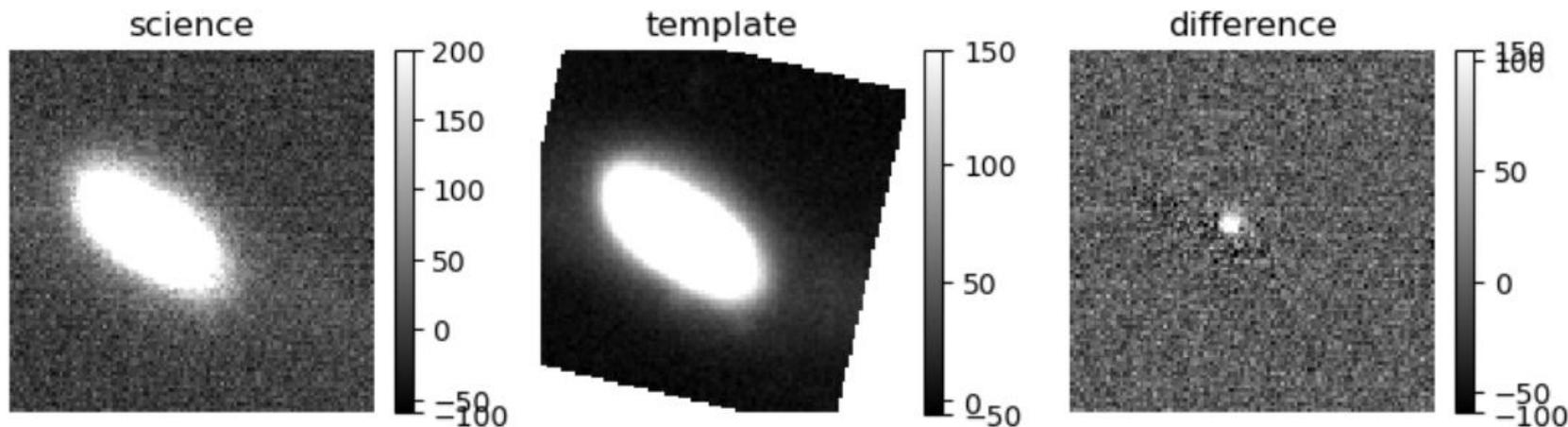


UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

A packet of information for each source detected with **signal-to-noise ratio > 5** in a difference image by Alert Production

**500 petabytes** generated  
by Rubin in 10 years (15 PB  
catalog)

DiaObject 611255759837069401, MJD=60623.26



**Figure 4:** The cutout triplet for the first detection of this DiaObject, a candidate SN Ia. cf. <https://dp1.lsst.io/tutorials/api/api-102-1.html>

# Prompt Products



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

Produced by Rubin

## Prompt Products

Near-real-time processed data released  
within minutes to days



**Alerts (within minutes):** Notify scientists  
of detected sky changes



**Catalogs (~24 hours):** Databases of  
information about detected objects



**Raw & Processed Images (~80 hours):**  
Available to data-rights holders

<https://dp1.lsst.io/tutorials/api/api-102-1.html>

Up to 7 million alerts per night  
~mid-2026



# Data products and timeline



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

[Please check the early science timeline \(living page\)](#)

**Data Preview 0** (DP0; available now) Simulations

**Data Preview 1** (DP1; available now) LSST Commissioning Camera (e.g. Malanchev. et al 2025)

**Data Preview 2** (DP2; **by Sep 2026**) LSSTCam data - including first look → science-grade data

**Data Release 1** (DR1; **by ~Jun 2028**) based on the first year of data taken as part of the 10-year LSST survey → full suite of data products



## 6.2.1. *IVOA Services*

Rubin has adopted a **Virtual Observatory (VO)**-first design philosophy, prioritizing compliance with **IVOA** standard interfaces to foster interoperability, standardization, and collaboration.

# Rubin Science Platform (RSP) aspects



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

Portal aspect

HiPS, as [IVOA-standard protocol](#), is one of the ways in which Rubin Observatory will make available its survey data to data rights holders.

Jupyter notebook aspect

With TAP query examples

API aspect

The RSP TAP service is also accessible remotely, from outside the RSP, allowing users to query data using external software such as [PyVO](#), [TOPCAT](#), or custom scripts. To access TAP from external software, users **must** generate an RSP access token.

# Rubin Schema browser



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

## Science Data Model Schemas

This schema browser provides a view on a curated subset of the Rubin Observatory's database schemas for user-facing data products (the Science Data Model, or SDM). These pages are rendered directly from the latest revisions of schema definition YAML files maintained in the [sdm\\_schemas](#) GitHub repository.

Schemas available here for browsing include:

- [ObsTAP](#) (image metadata, DP1+)

ObsCore v1.1 attributes in ObsTAP realization

[...]

**Cf. [Alert Production Database](#) with**

[DiaForcedSource](#), [DiaObject](#), [DiaObjectLast](#), [DiaObject\\_To\\_Object\\_Match](#), [DiaSource](#)

# For building lightcurves

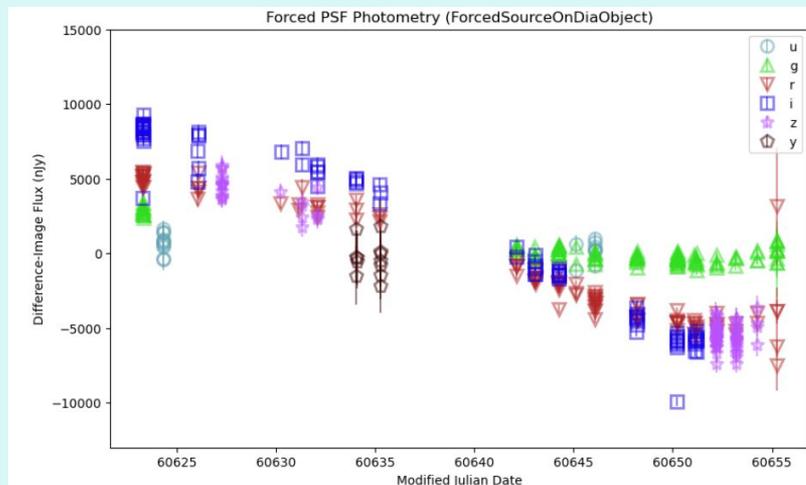


- Decide what kind of photometry is in focus
- Working examples and TAP queries can be found e.g. at [306.1. Transient light curves — DP1](#)

The `diaObjectId` of the transient explored in this notebook is  
611255759837069401.

```
DiaObjID = DiaObj['diaObjectId'][0]
```

```
query = "SELECT fsodo.coord_ra, fsodo.coord_dec, "\  
        "fsodo.diaObjectId, fsodo.visit, fsodo.band, "\  
        "fsodo.psfDiffFlux, fsodo.psfDiffFluxErr, "\  
        "fsodo.psfFlux as psfFlux, fsodo.psfFluxErr, "\  
        "vis.expMidptMJD "\  
        "FROM dpl.ForcedSourceOnDiaObject as fsodo "\  
        "JOIN dpl.Visit as vis ON vis.visit = fsodo.visit "\  
        "WHERE fsodo.diaObjectId = "+str(DiaObjID)  
print(query)
```



# Navigating the Alert Stream

Alert brokers provide crucial extra info - e.g. catalog matches, classification



Alerce



Antares



AMPEL



Fink



Lasair



Babamul

 Pitt-Google Broker

# The 4th aspect - Example TAP service



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386



## ALeRCE TAP service

ALeRCE TAP service provides access to multi-survey astronomical object catalogs including astrometric and statistical information from multiple time-domain surveys

Please check out our [site help](#).

### Services available here

By Rank

By Subject

- [ALeRCE Multi-Survey Object Catalog](#)

Multi-survey astronomical object catalog containing astrometric and statistical information from multiple surveys. This table provides aggregated properties for astronomical objects including position, detection statistics, and temporal coverage.

# Alert package selected TAP functions



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

[alerce\\_tap.forced\\_photometry](#) – queryable through [TAP](#) and [ADQL](#)

Generic forced photometry measurements across multiple surveys, containing basic position and timing information. For detailed survey-specific forced photometry measurements, see the corresponding survey-specific tables.

[alerce\\_tap.lsst\\_detection](#) – queryable through [TAP](#) and [ADQL](#)

Individual LSST Difference Image Analysis sources, containing detailed measurements from difference imaging including PSF photometry, aperture photometry, trail and dipole fitting for moving objects, shape moments, forced photometry on science and template images, and extensive quality flags for pixels and measurements.

[alerce\\_tap.lsst\\_dia\\_object](#) – queryable through [TAP](#) and [ADQL](#)

Summary catalog of transient and variable objects detected in LSST difference imaging. Contains aggregated photometric measurements across all bands (u, g, r, i, z, y), including PSF flux statistics, forced photometry fluxes, and temporal information for each detected DIA object.

[alerce\\_tap.lsst\\_forced\\_photometry](#) – queryable through [TAP](#) and [ADQL](#)

LSST forced photometry measurements extracted at DIA object positions on individual visit images, including PSF flux and forced science flux with uncertainties, and temporal processing metadata.

[alerce\\_tap.lsst\\_mpc\\_orbits](#) – queryable through [TAP](#) and [ADQL](#)

Complete orbital solutions from the Minor Planet Center for solar system objects, including Keplerian orbital elements, non-gravitational parameters (Yarkovsky, SRP, A1-A3), observational arc statistics, fit quality metrics, and Earth MOID calculations.

# Alert package structure



## Columns

Sorted by DB column index. [\[Sort alphabetically\]](#)

Name	Table Head	Description	Unit	UCD
oid	Oid	Object identifier	N/A	meta.id;src
sid	Sid	Survey identifier	N/A	meta.id
measurement_id	Measurement_id	Measurement identifier	N/A	meta.id
mjd	Mjd	Modified Julian Date	d	time.epoch
ra	Ra	Right ascension	deg	pos.eq.ra;meta.main
dec	Dec	Declination	deg	pos.eq.dec;meta.main
band	Band	Photometric band	N/A	instr.bandpass
created_date	Created_date	Date record was created	N/A	time.creation

Columns that are parts of indices are marked like this.

# Thank you, for your attention!



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

## LSST-EUROPE8

[Home](#) [Welcome](#) [Venue](#) [Committees](#) [Program](#) [Call for Abstracts](#)

[Registration](#)

# LSST-EUROPE8

## Legacy Survey of Space and Time

September 27 - October 2 2026 | Ensana Thermal Margaret Island,  
Hungary

We are still working on our website. Stay tuned for updates!

[RubinObservatory.org](https://RubinObservatory.org)

     @VRubinObs

  @rubin\_observatory

  @RubinObservatory

185

Days

5

Hours

38

Minutes

25

Seconds