VERA C. RUBIN OBSERVATORY

Two years at Rubin Observatory

ComCam Commissioning & RSP

M-Y Chun, 2025-01-23, Sky Survey workshop, High1

U.S. National Science Foundation
U.S. Department of ENERGY | Office of Science
NOIRLab AURA SLAC NATIONAL ACCELERATOR LABORATORY

Why I joined LSST and spended last 2 year

International Data Right Holders

- Cash -> In-kind contribution
- Approved the Korean in-kind contribution
  - International Data Archive Center (IDAC)
  - KMTNet Telescope Time
  - Contribution on the commissioning - Senior Staff, Post-Docs

A long-standing relationship between LSST and me

- Early 2000 : A candidate of Korean Very Large Optical Telescope project
  - Make a clone of LSST and Install in the Northern Hemisphere
  - Review the LSST doc and Attended LSST workshop at Seattle, Sep. 2004
- 2010 : The first priority project at 2010 Decadal survey -> confident in completion
- Attend the Rubin Project and Community Workshop (PCW) : 2021, 2022, 2023
- I was convinced that LSST would be a game changer in optical astronomy.

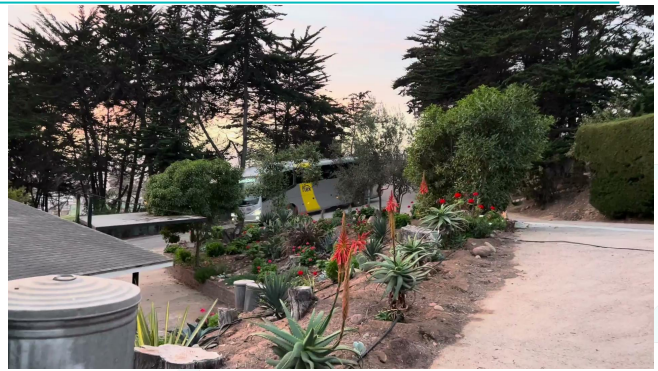
Recinto AURA at La Serena



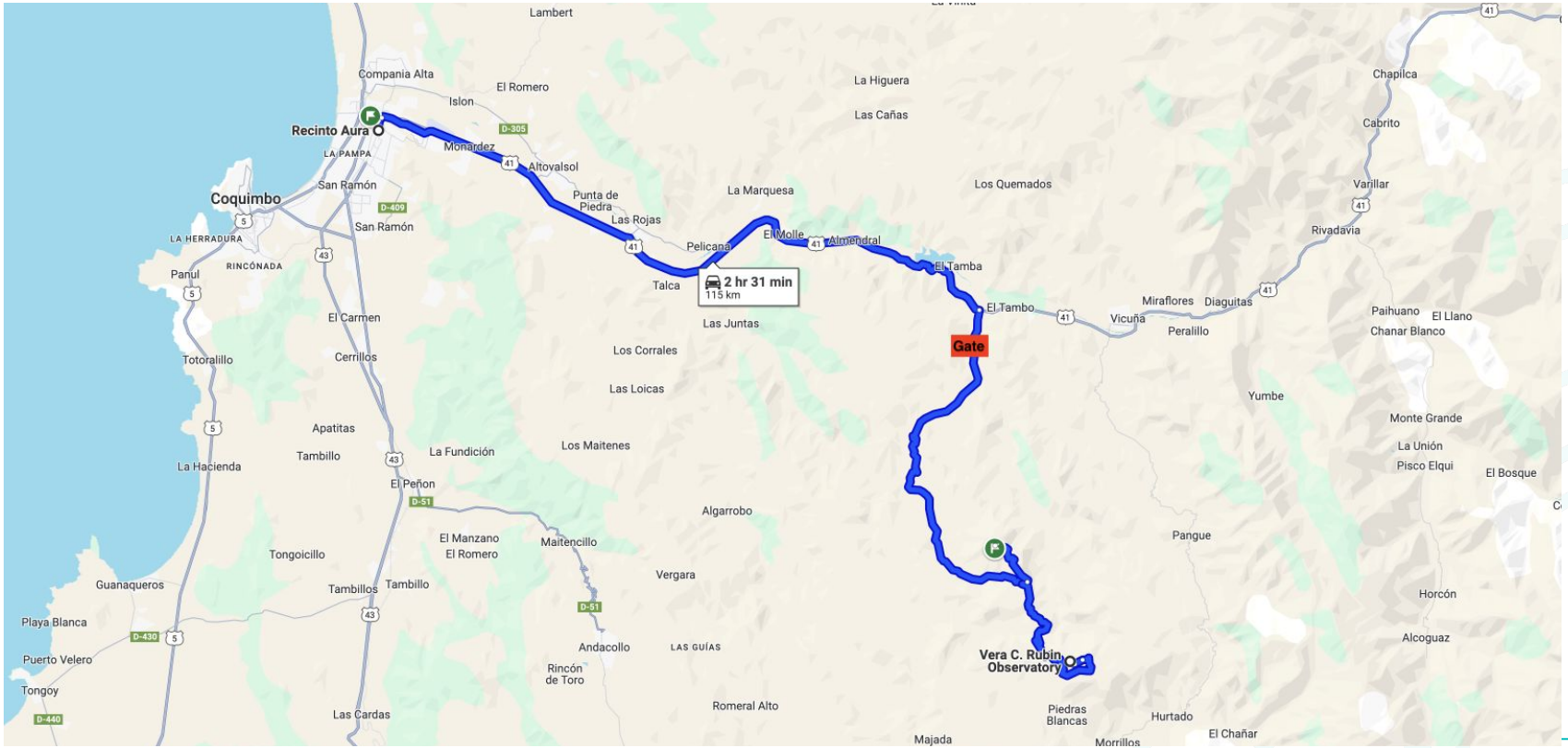


Recinto AURA and Bus to Rubin site



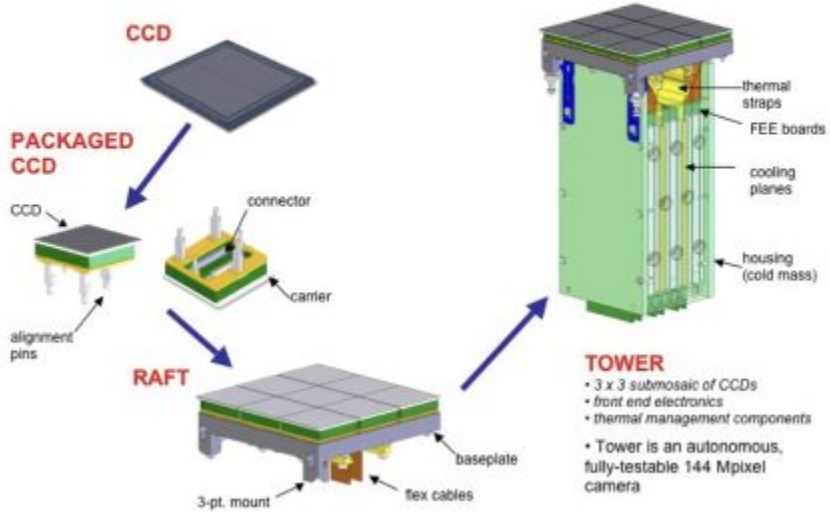


Route from AURA office to Rubin Site



ComCam vs LSSTCam

Sensor to Raft/Tower Configuration



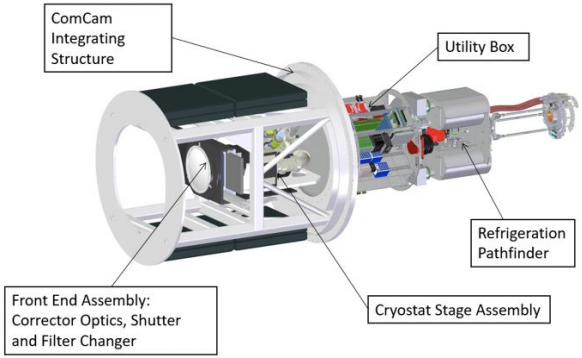
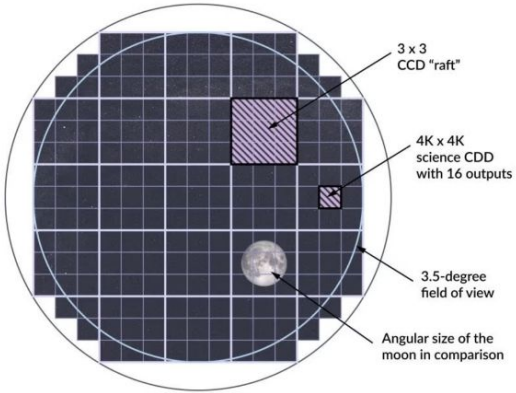
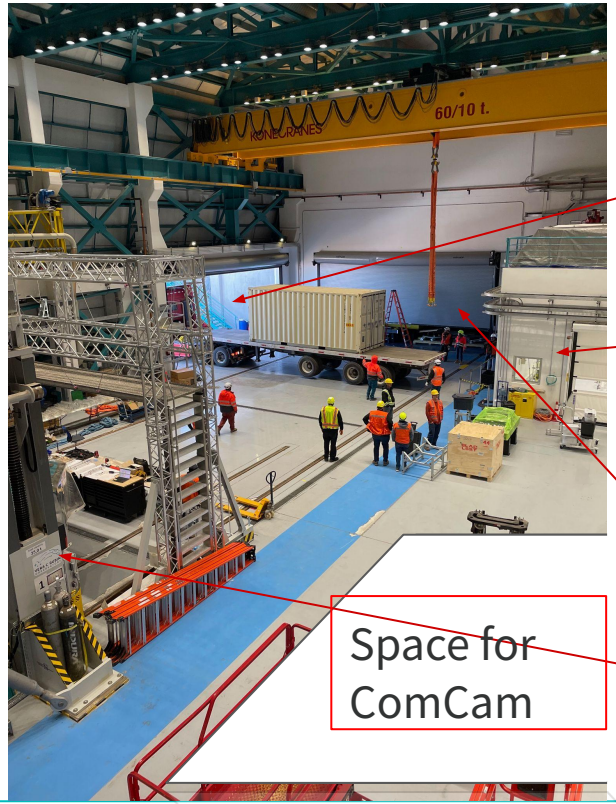


Figure 1. ComCam



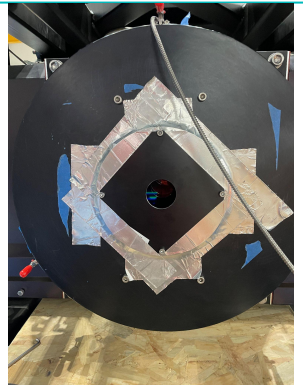
ComCam at L3

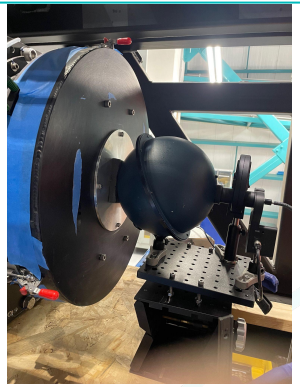

60/10 t.
Big entrance
Clean Room
Lift to L7
Space for ComCam
Coating Chamber

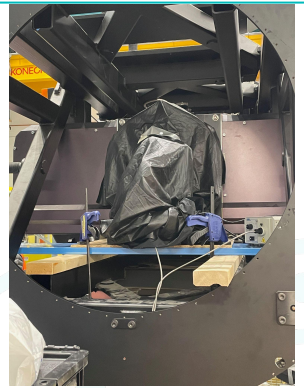


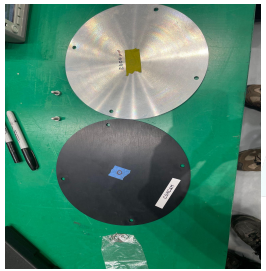
ComCam at L3 with me - Cal. system

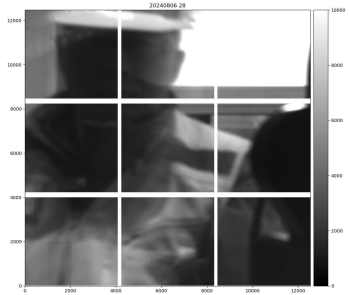










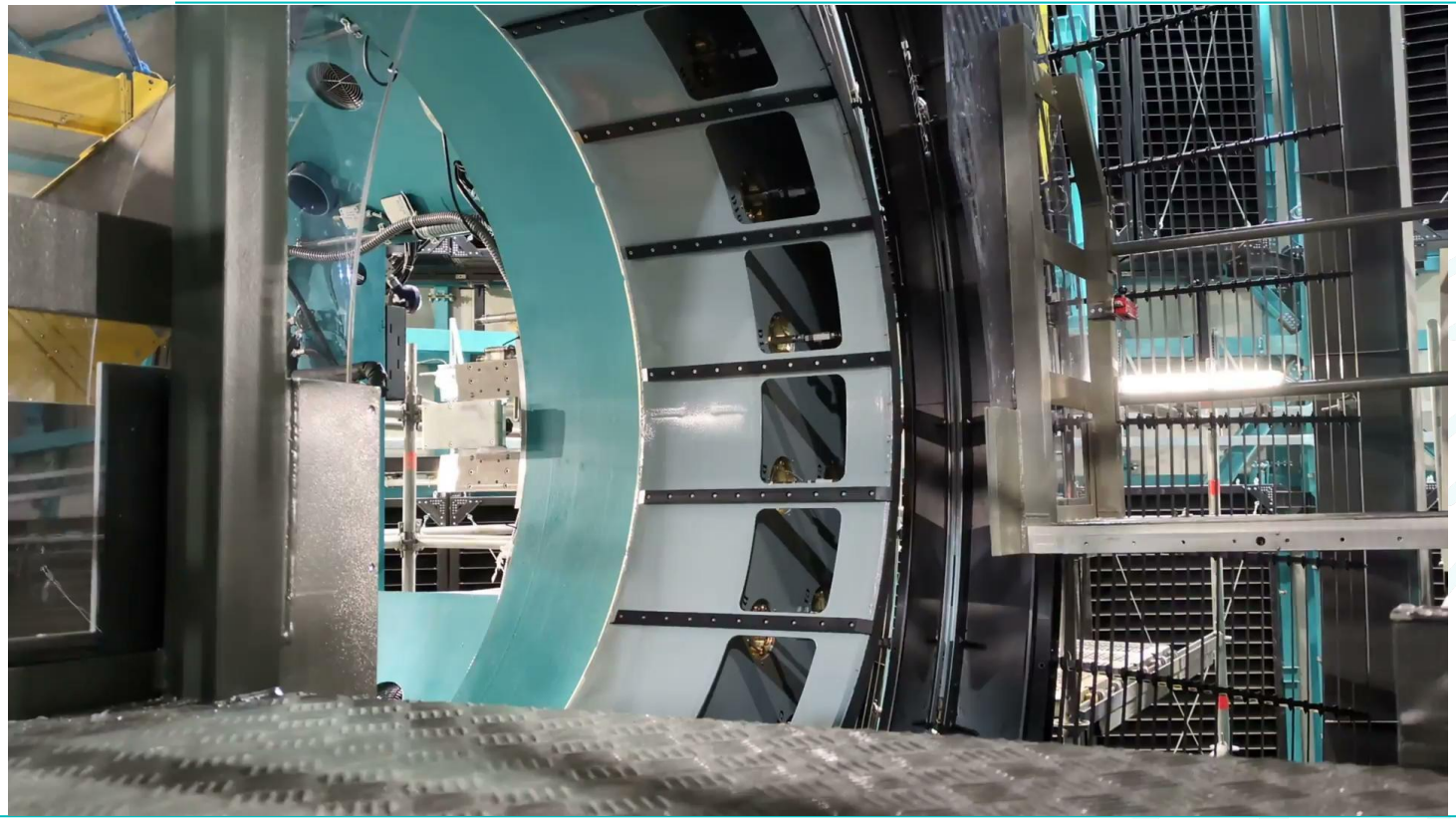


CamCam at TMA (2024-8-23)





ComCam at TMA (time slip)



ComCam Commissioning

OBS Periods : 2024-10-24 ~ 2024-12-13

TMA performance : 10% (1 deg/sec),

tracking drift : 0.2 arcsec/sec (spec : 0.04?) This morning IQ workshop

Locations of Target Fields during On-sky Commissioning Campaign with ComCam

- Extended Chandra Deep Field South (ECDFS) : (ra, dec) = (53.13, -28.10)
- Euclid Deep Field South (EDFS) : (ra, dec) = (59.10, -48.73)
- Low Ecliptic Latitude Field (Rubin SV 38 7) : (ra, dec) = (37.86, 6.98)
- Low Galactic Latitude Field (Rubin SV 95 -25) : (ra, dec) = (95.00, -25.00)
- 47 Tuc Globular Cluster (47 Tuc) : (ra, dec) = (6.02, -72.08)
- Fornax Dwarf Spheroidal Galaxy (Fornax dSph) : (ra, dec) = (40.00, -34.45)

RSP, Jupyter Notebook, survey prog.

Welcome | comcam_science_surveys_progress.ipynb

comcam_science_surveys_progress.ipynb > ...

+ Code | + Markdown | Run All | Clear All Outputs | Outline | ... | Select Kernel

ComCam Science Programs Survey Progress

Keith Bechtol (2024-11-25, at Slack channel #dm-pipeline-embargo)

mychun (2024-11-25, re-typing)

```python
import numpy as np
import matplotlib.pyplot as plt
%matplotlib widget
```

Python

```python
import os
#os.environ["no_proxy"] += ",.consdb"
from lsst.summit.utils import ConsDbClient

client = ConsDbClient("http://consdb-pq.consdb:8080/consdb")
```

Python

All ComCam Exposures

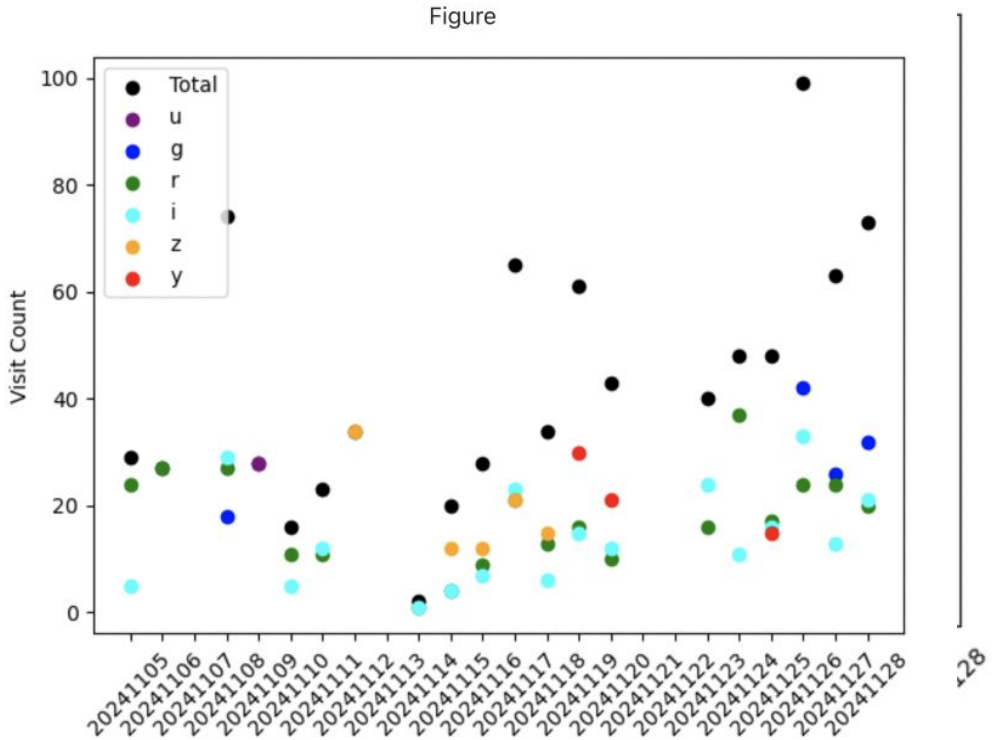
```python
instrument = 'lsstcomcam'
visits_query= f'''
SELECT * FROM cdb_{instrument}.exposure
'''
visits = client.query(visits_query).to_pandas()
```

Python

```python
for img_type in np.unique(visits['img_type']):
    print(img_type, np.sum(visits['img_type']== img_type))
```

Python

... ACQ 16



Early Science Program (RTN-011)

Rubin Early Science Data Release Scenario

Data Product	Jun 2021	Jun 2022	Jun 2023	Oct 2024 – Jul 2025	Nov 2025 – May 2026	May 2026 – Jan 2027	May 2027 – Jan 2028	May 2028 – Nov 2028
	DP0.1	DP0.2	DP0.3	DP1	DP2	DR1	DR2	DR3
	DC2 Simulated Sky Survey	Reprocessed DC2 Survey	Solar System PPDB Simulation	ComCam or early LSSTCam Data	LSSTCam Science Validation Data	LSST First 6 Months Data	LSST Year 1 Data	LSST Year 2 Data
Raw Images	●	●	–	●	●	●	●	●
DRP Processed Visit Images and Visit Catalogs	●	●	–	●	●	●	●	●
DRP Coadded Images		●	–	–	●	●	●	●
Object and ForcedSource Catalogs	●	●	–	–	●	●	●	●
DRP Difference Images and DIASources	–	●	–	–	●	●	●	●
DRP ForcedSource Catalogs including DIA output	–	●	–	–	●	●	●	●
PP Processed Visit Images	–	–	–	–	–	●	●	●
PP Difference Images	–	–	–	–	–	●	●	●
PP Catalogs	–	–	–	–	●	●	●	●
PP SSP Catalogs	–	–	●	–	●	●	●	●
DRP SSP Catalogs	–	–	–	–	–	●	●	●

DRP - Data Release production

PP - Prompt Production

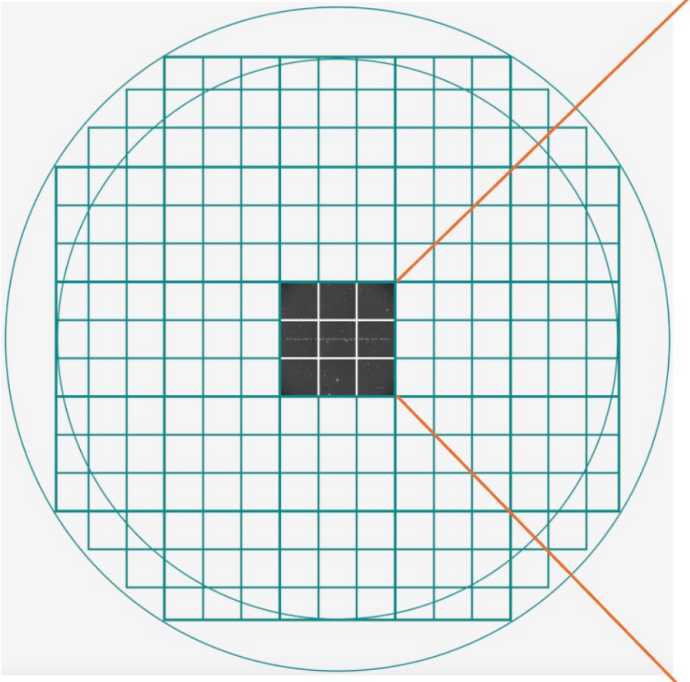
TABLE 1: Summary of data products expected in each data preview and early survey data release.

AAS 245 Rubin Town Hall

Link of presentation file : AAS 245 Rubin Town Hall
https://docs.google.com/presentation/d/1IRLzq4-NhqDhDc8vGIc2ZICR9bQuH8LG1hJcUBpG-RU/edit?usp=sharing

First Engineering Image with ComCam

LSST Camera field of view



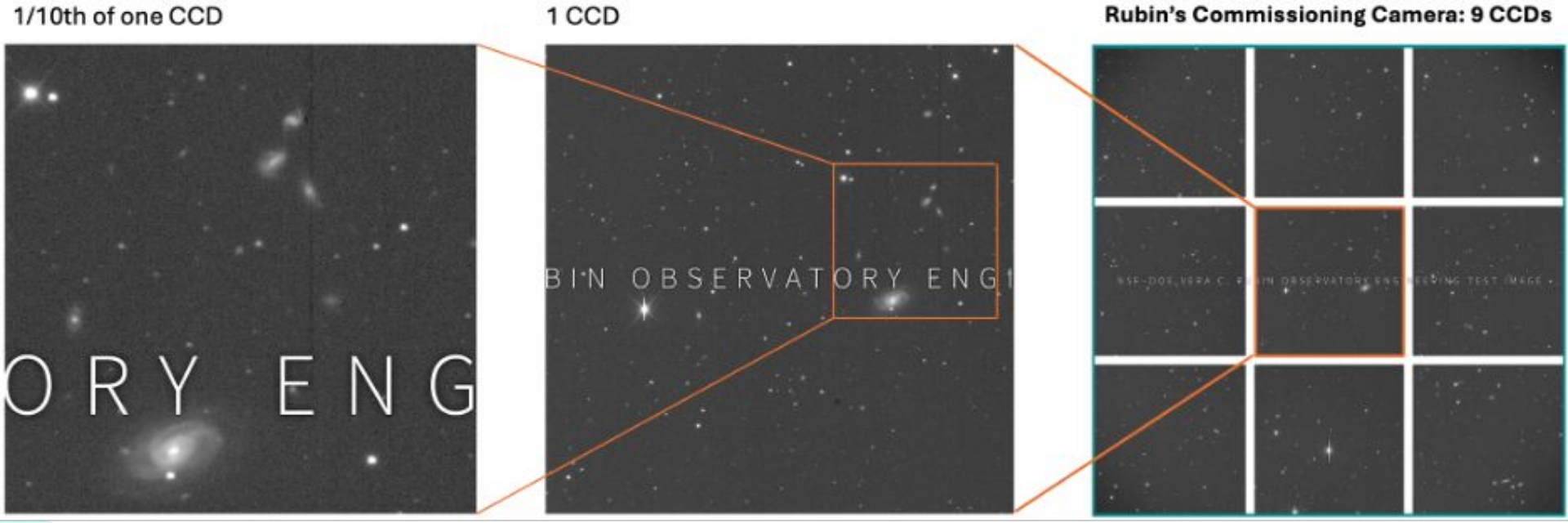
189 science 4k x 4k CCDs, 3200 Megapixels

Commissioning camera: 9 CCDs with 144 Megapixels

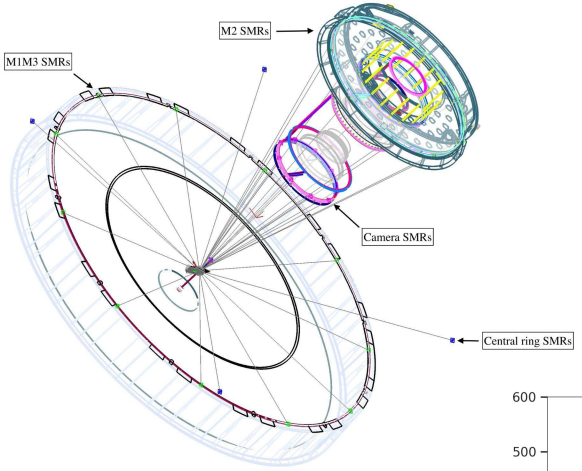


One of the first Rubin on-sky images from Oct 24, 2024

First Engineering Image detail (ignore the watermark)

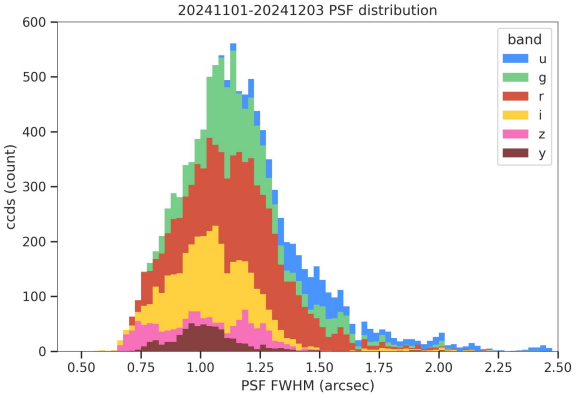


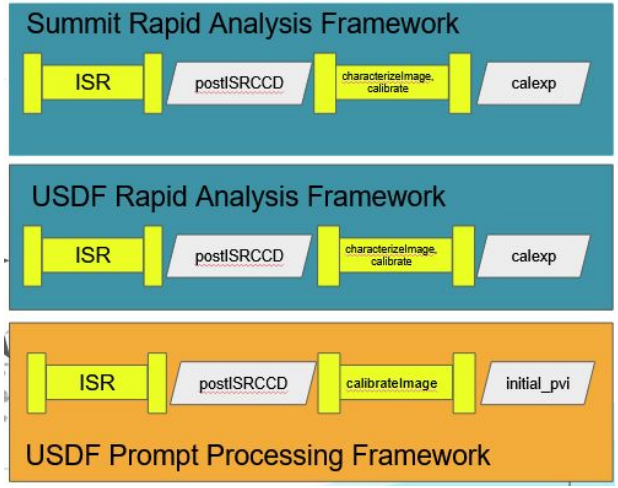
For 7 weeks the Test Campaign Achieved our Goals



Active Optics:
Wavefront Sensing, Force Balance, Alignment, closed loop control

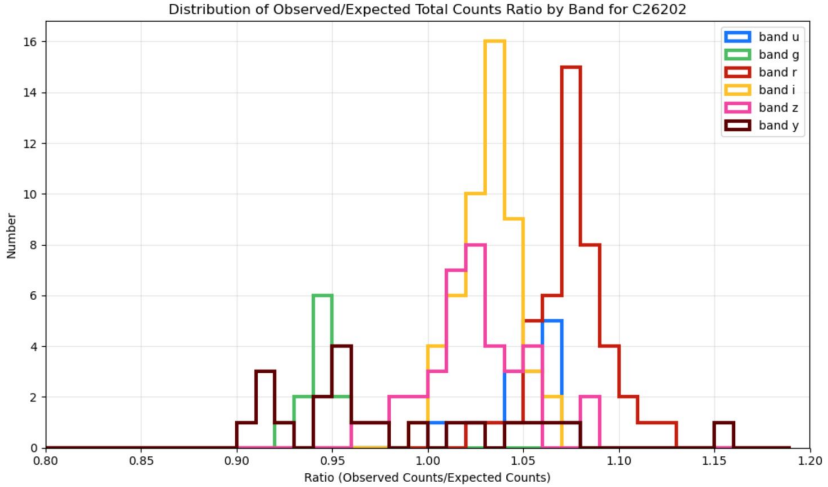
Image Quality:
Multiple filters, consistency





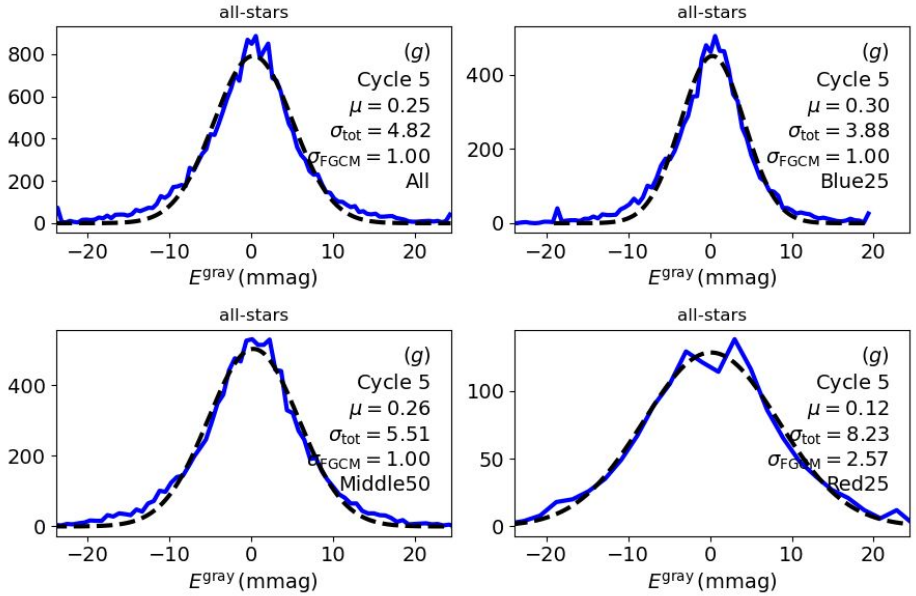
Data Pipelines:
ISR, Fast look, Data flow timing…

Testing and Commissioning Hardware and Software



Throughput: Quantitative measures of throughput

Photometric Calibration:
Repeatability, illumination, Airmass,



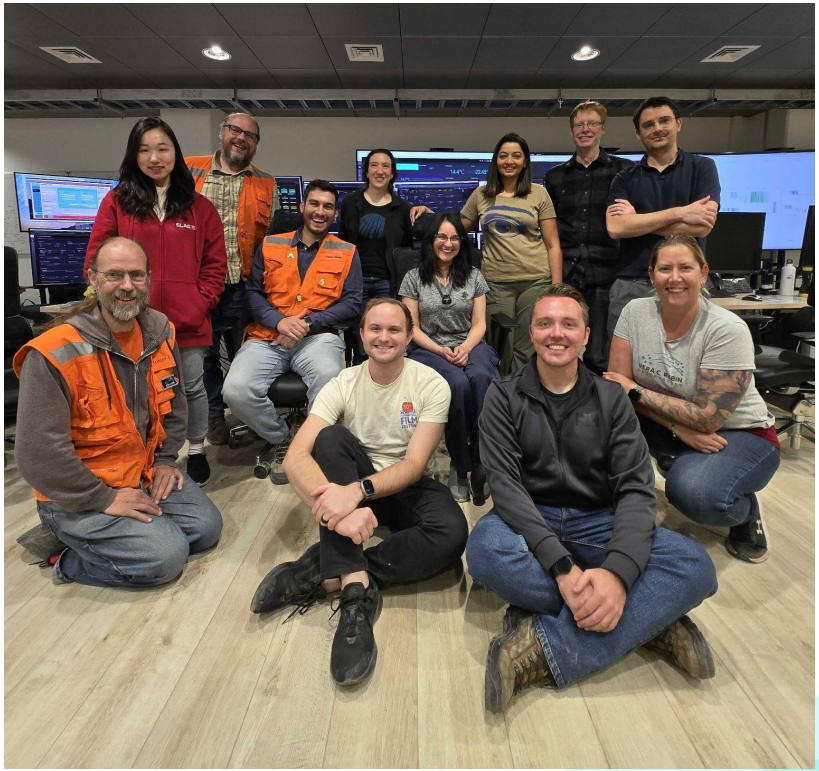
Incredible 7 week Campaign to prepare for LSSTCam!

Weekly on Sky Commissioning summaries on Community.org

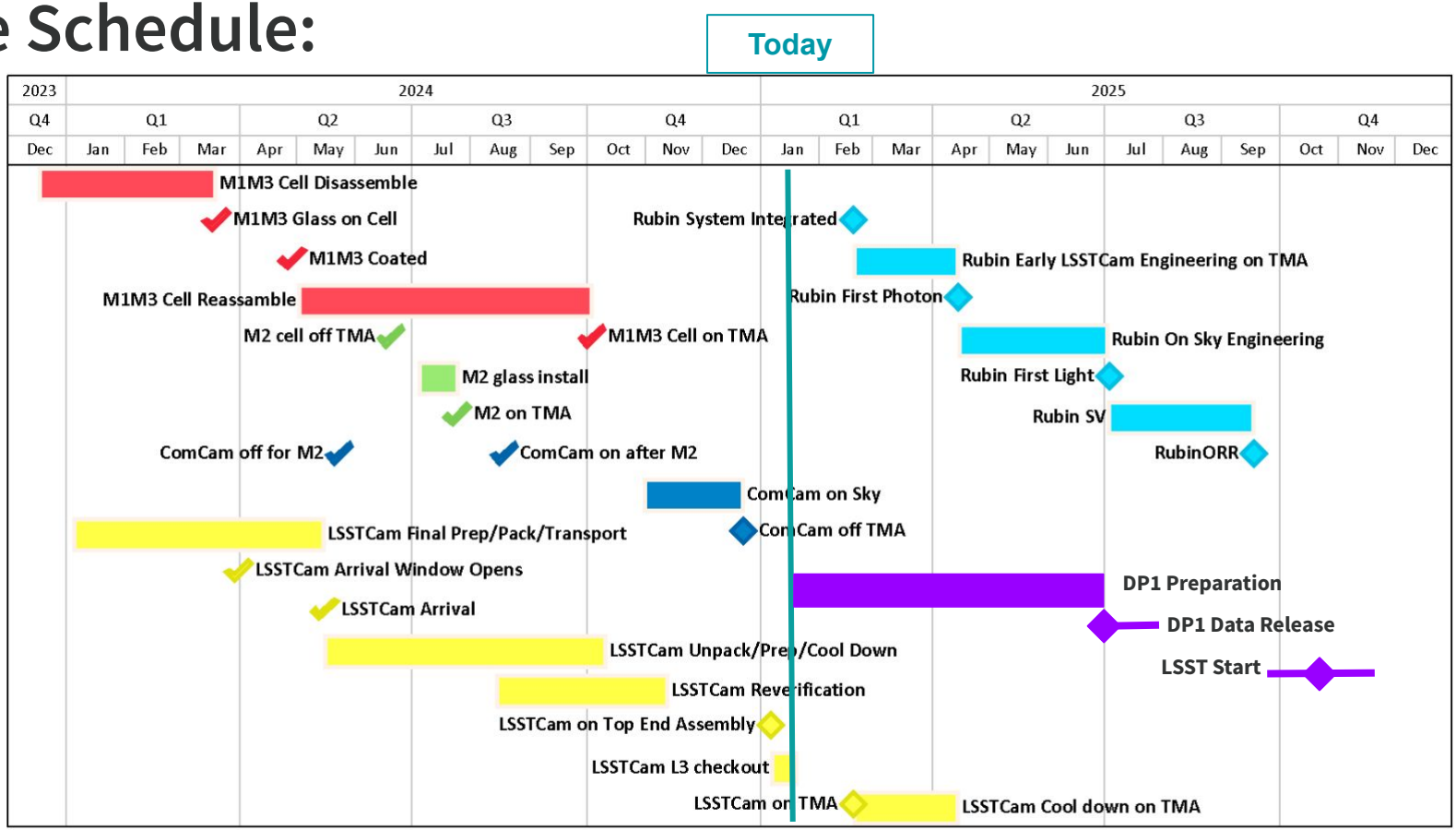
ComCam on-sky campaign Interim report is available (sitcomtn-149)

The campaign produced incredible data for engineering and system commissioning but it also is the data set for Data Preview 1

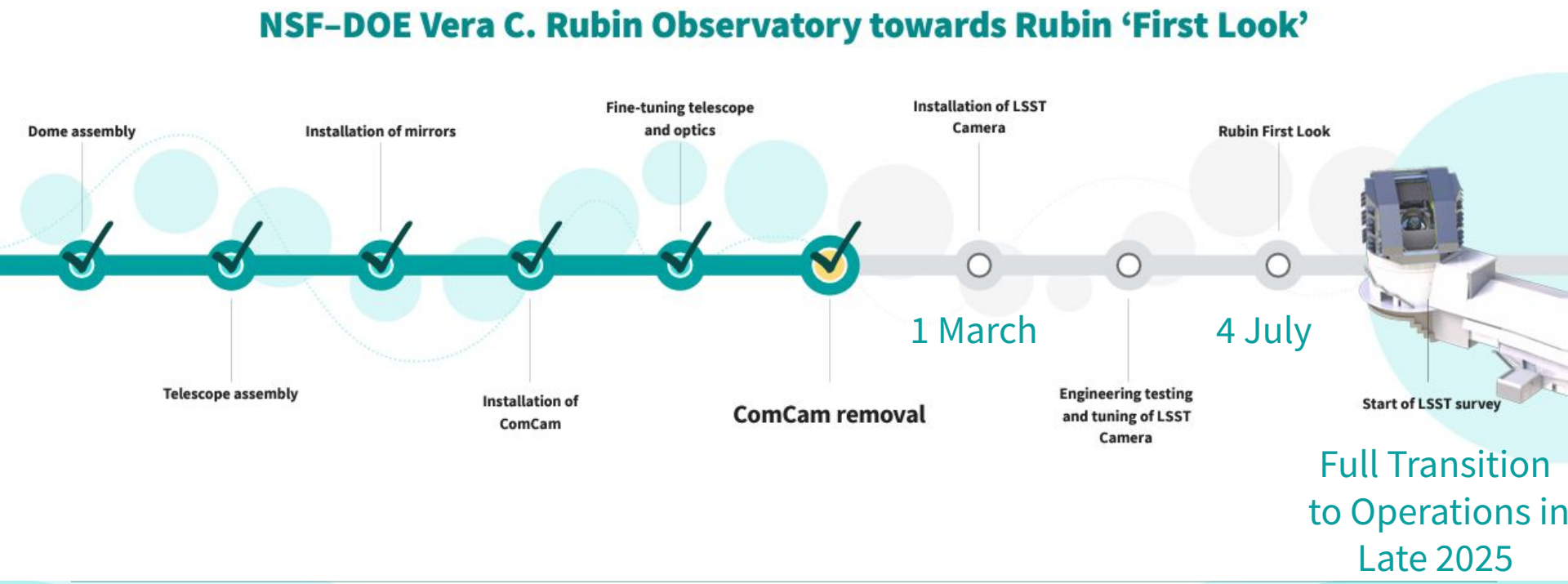
An amazing accomplishment made possible by efforts from every single team member!!!!



The Schedule:



What to Expect in 2025

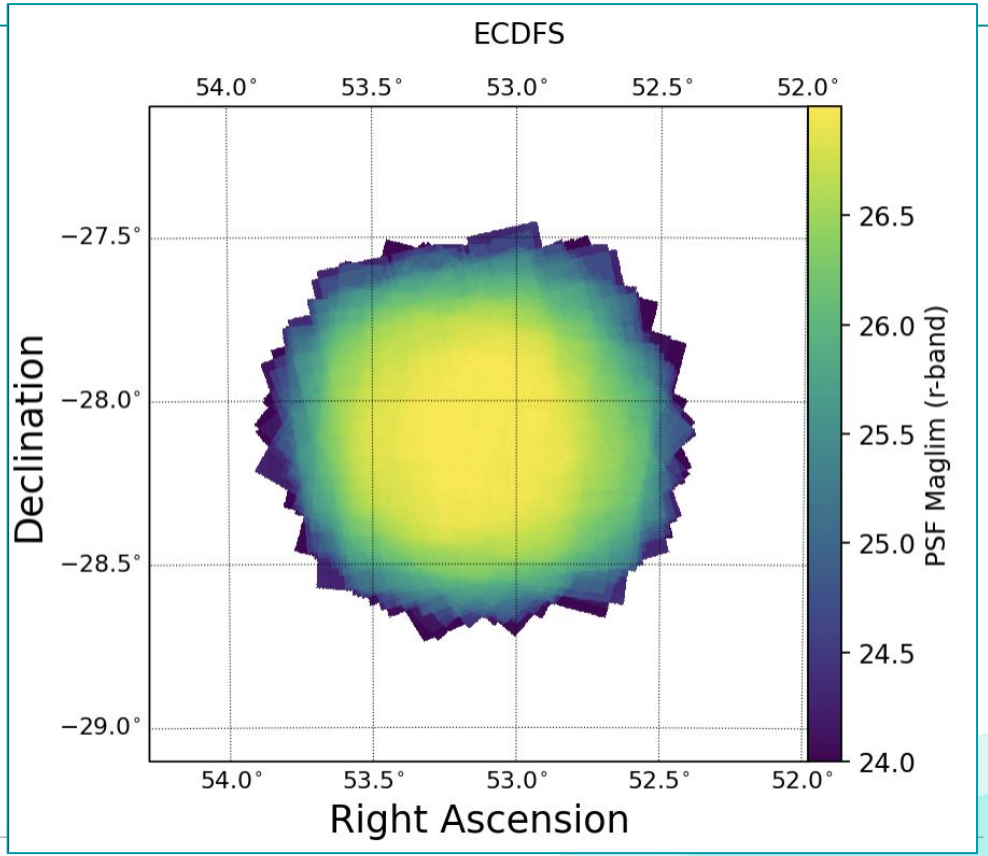



On the road and close to Operations …

Early Science with DP1

ComCam data taking and processing exceeded expectations. An interesting data set for early science analysis preparation will be available to the community.

Target	u	g	r	i	z	y
47 Tuc	6	10	33	19	0	5
Rubin SV 38 7	0	44	55	57	27	0
Fornax dSph	0	5	26	13	0	0
ECDFS	53	230	257	177	177	30
EDFS ComCam	20	61	90	42	42	20
Rubin SV 95 -25	33	86	97	29	60	11
Seagull	10	37	49	3	13	0



Early Science with DP1, DP2 and Alert Production

RTN-011 update is in progress following a highly successful ComCam campaign

- DP1: Expect coadded images. Stretch goals: Forced source Catalogs, all Difference Image Analysis (DIA) data products
- DP2: Baseline is 100 sq deg to 10 yr depth in *ugrizy* plus a 1000 sq deg pilot survey to 1 year depth in *griz*
- Alerts to begin in SV phase at low latency, and then ramp up on latency and sky coverage through Year 1. PVIs + catalogs available in year 1 of survey before DP2.

Rubin Early Science – Data Release Scenario

Data Product	DC2 Simulated Sky Survey	Reprocessed DC2 Survey	Solar System PPDB Simulation	ComCam Data	LSSTCam Science Validation Data	LSST First 6 Months Data	LSST Year 1 Data	LSST Year 2 Data
	Jun 2021	Jun 2022	Jun 2023	Jun 2025 – Jul 2025	Mar 2026 – May 2026	Sep 2026 – Jan 2027	Sep 2027 – Jan 2028	Sep 2028 – Nov 2028
	DP0.1	DP0.2	DP0.3	DP1	DP2	DR1	DR2	DR3
Raw Images	●	●	–	●	●	●	●	●
DRP Processed Visit Images and Source Catalogs	●	●	–	●	●	●	●	●
DRP Coadded Images and Object Catalogs	●	●	–	●	●	●	●	●
DRP ForcedSource Catalogs	●	●	–	●	●	●	●	●
DRP Difference Images and DIA Catalogs	–	●	–	●	●	●	●	●
DRP SSP Catalogs	–	–	●	–	●	●	●	●

TABLE 1: Summary of Data Release data products expected in each data preview and early LSST data release. A dark teal dot denotes confirmed data products whereas a gray dot denotes data products that currently remain a stretch goal.

Data coming soon for our community!

Rubin Operations Survey and Data Release Timeline

Nominal LSST Start Date: October 2025

Event	Date Range
Data Preview 1 (DP1)	Jun 2025 – Jul 2025
Rubin First Alerts (RFA)	Jul 2025 – Sep 2025
Start of LSST (SVY)	Sep 2025 – Nov 2025
Start Regular Alert Production (RAP)	Sep 2025 – Nov 2025
Data Preview 2 (DP2)	Mar 2026 – May 2026
Data Release 1 (DR1)	Sep 2026 – Jan 2027
Data Release 2 (DR2)	Sep 2027 – Jan 2028

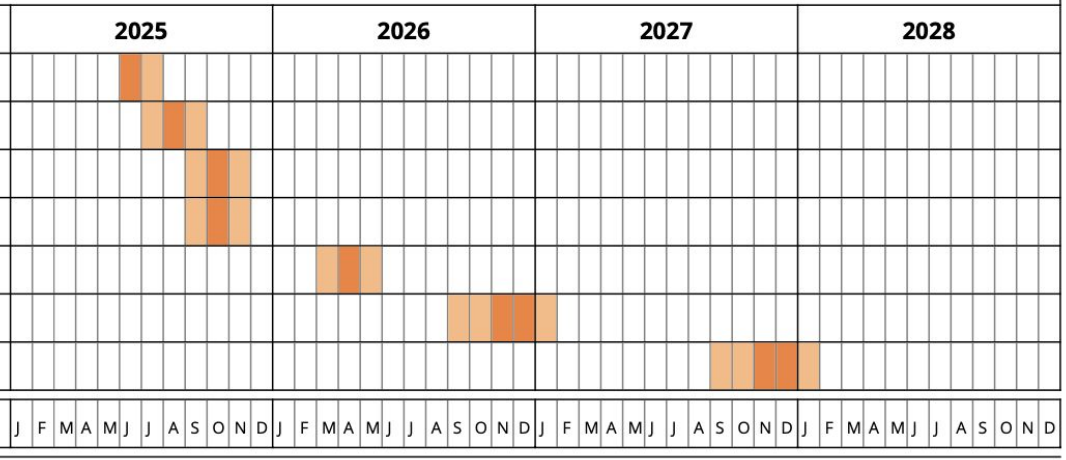


TABLE 3: Rubin Operations Key Milestones for Early Science

“For Scientists” webpages: what to expect, and when

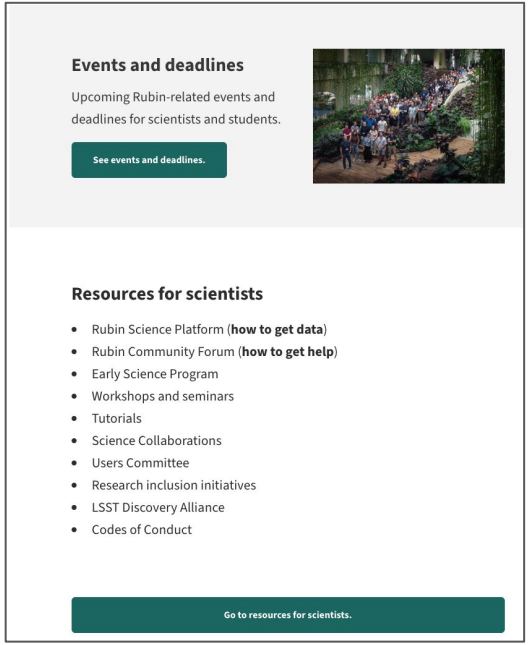
Data and resources available now.

Visit the new “For Scientists” webpages: rubinobservatory.org/for-scientists

Get an account in the Rubin Science Platform (RSP): rsp.lsst.io

Access the “Data Preview 0” simulations via the RSP: dp0.lsst.io

Ask questions in the Rubin Community Forum: community.lsst.org



Learning opportunities with Data Preview 0.

- Work through DP0 tutorials at your own pace.
  - Extragalactic & Galactic science: dp0-2.lsst.io
  - Solar System science: dp0-3.lsst.io
- Attend weekly Rubin Science Assemblies, Thursdays 9am Pacific.
  - Alternating weeks of guided tutorials and drop-in ‘office hour’ Q&A sessions.
  - rubinobservatory.org/for-scientists/events-deadlines

For Scientists: what to expect, and when

New data and resources to be added this year.

“Data Preview 1” based on Commissioning Camera data.

- expected release between June & July 2025 concurrent with a Data Academy (see below)
- access will be via the Rubin Science Platform
- data products will include processed visit images and source catalogs and coadded images
    - locations of targeted fields: community.lsst.org/t/9609
- DP1 resources will include documentation, tutorials, and a virtual seminar series

Alerts and Prompt Products from LSST Science Camera data.

- expected to begin between September & November 2025
- Prompt Products Database (PPDB) access will be via the Rubin Science Platform
- alerts access will be via participating brokers
    - resources will include documentation, tutorials, and virtual seminars
    - Community Alert Filters with the ANTARES Broker: rtn-090.lsst.io

For Scientists: what to expect, and when

Opportunities for learning and networking in 2025.

Weekly Rubin Science Assemblies, Thursdays 9am Pacific (virtual).

- Alternating weeks of guided tutorials and drop-in 'office hour' Q&A sessions.
- rubinobservatory.org/for-scientists/events-deadlines
- Thu Jan 23: "*Data Preview 0 Review: Thank You Delegates!*"
- Thu Feb 6: "*Looking forward to Data Preview 1*"
- Mar - May will feature DP1 prep sessions targeted for each of the LSST Science Collaborations.

Rubin Data Academy, June 2025 (virtual)

- One-week intensive virtual course on Rubin data access and analysis.
- Students are particularly encouraged to participate.
- **Our Goal is to have DP1 available for this academy. To be confirmed.**

Data Preview 1 Orientation & Onboarding Sessions (virtual)

- Quickstart sessions will coincide with the release of DP1.

Rubin Community Workshop, July 28 - Aug 1 2025 (Tucson AZ; hybrid)

LSST Science is for Everyone!

*mlg3k@uw.edu

Research inclusion remains a priority.

Rubin S3P: Supporting Science at SUIs Program

- SUI = Small/Underserved Institute
- One-on-one interviews available for faculty, to quickstart Rubin research.
- Custom virtual tutorials are available for research groups (students welcome!).
- Contact Gloria Fonseca Alvarez or Melissa Graham* to get started.

Users Committee Listening Sessions

- The UC solicits feedback and recommends improvements to the LSST data products, tools, and services.
- Their biannual meetings always start with a user listening session; the next one is Mon Apr 28, 8am Pacific.
- rubinobservatory.org/for-scientists/committees-teams/users-committee

Accessibility Initiatives

- Ensuring resources are accessible by neurodivergent and hearing- and vision-impaired astronomers.
- Pursuing external consultants on universal design and accessibility.
- Enabling Spanish-language translations for science resources (documentation, tutorials).

Thanks for your attention

It’s your time with data on sky

