

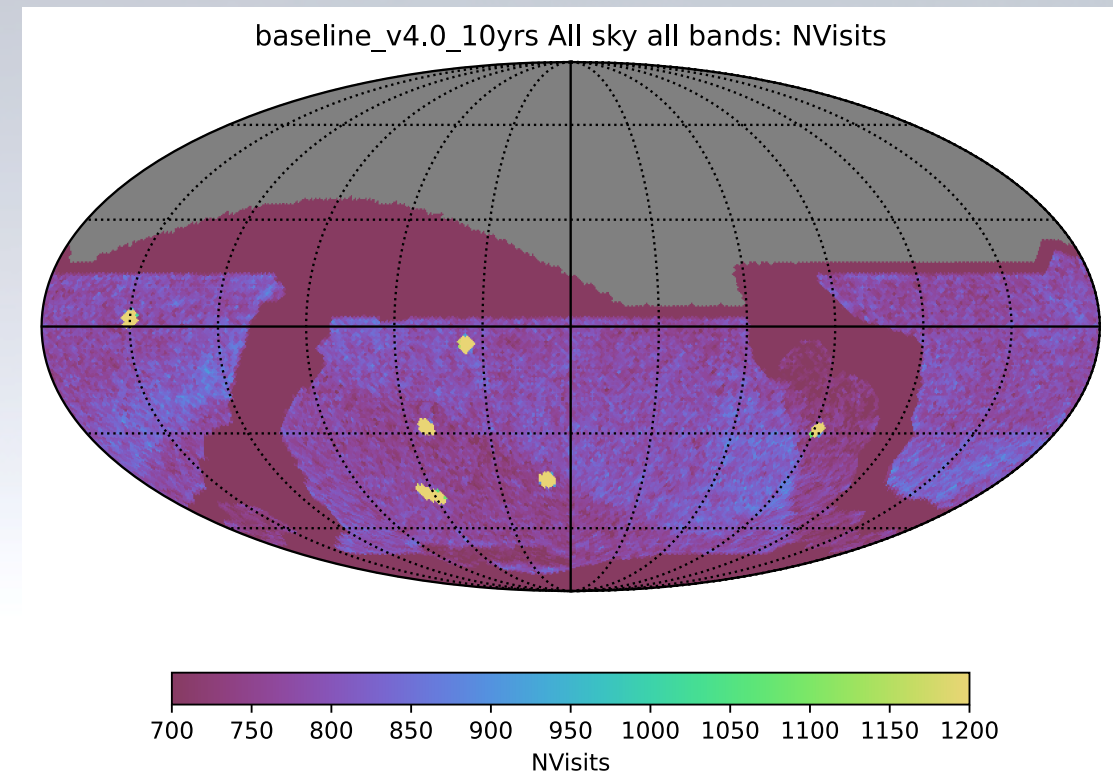
# LSST

**Yousuke Utsumi (NAOJ ATC based at Chile / Vera C. Rubin Observatory)**

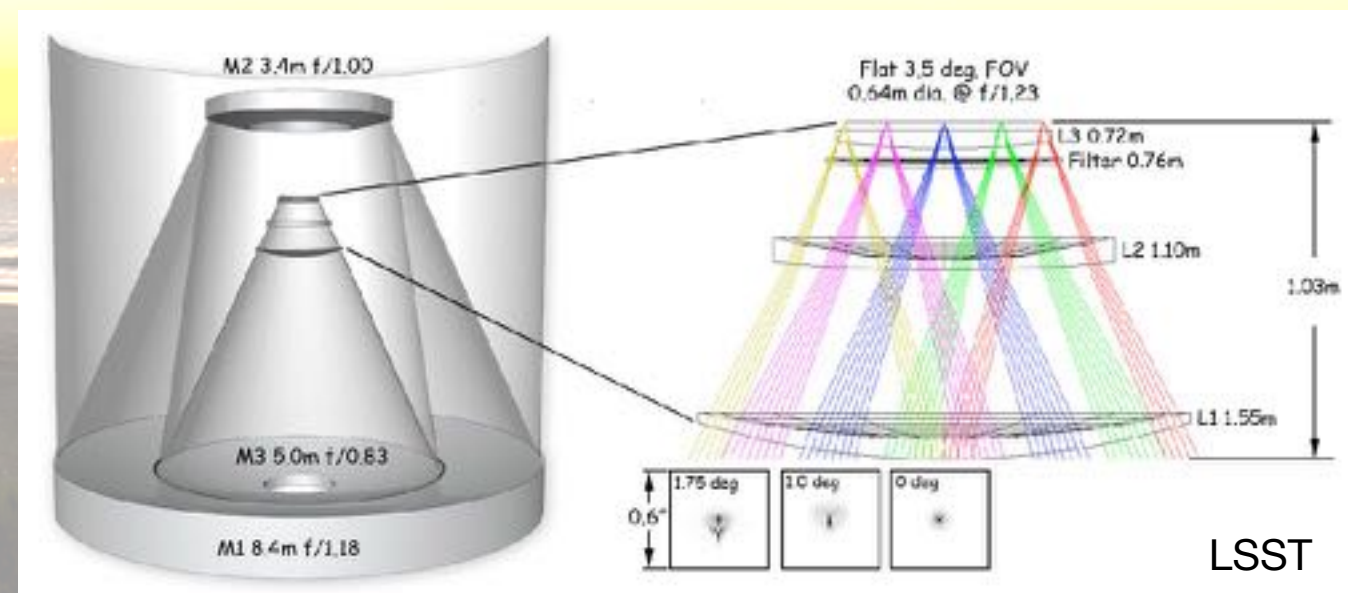


# Vera C. Rubin Observatory's LSST survey

- “Legacy Survey of Space and Time”
  - 10 years southern sky survey
    - **Deep** ~ 26.8 mag
    - **Wide** ~ 20000deg<sup>2</sup>
    - **Fast** ~ 800 visits per field
  - “Well-understood source catalog of stars and galaxies”
- 0.41 arcsec
- Characterization
  - 3 Mirror systems (r, i, o, g)
  - 3.5deg in diameter
- **LSST Camera**
  - 201 CCDs; 3.2G pixel in total
  - ~2 sec readout
  - 3 lenses
  - ugrizy “curved” filters

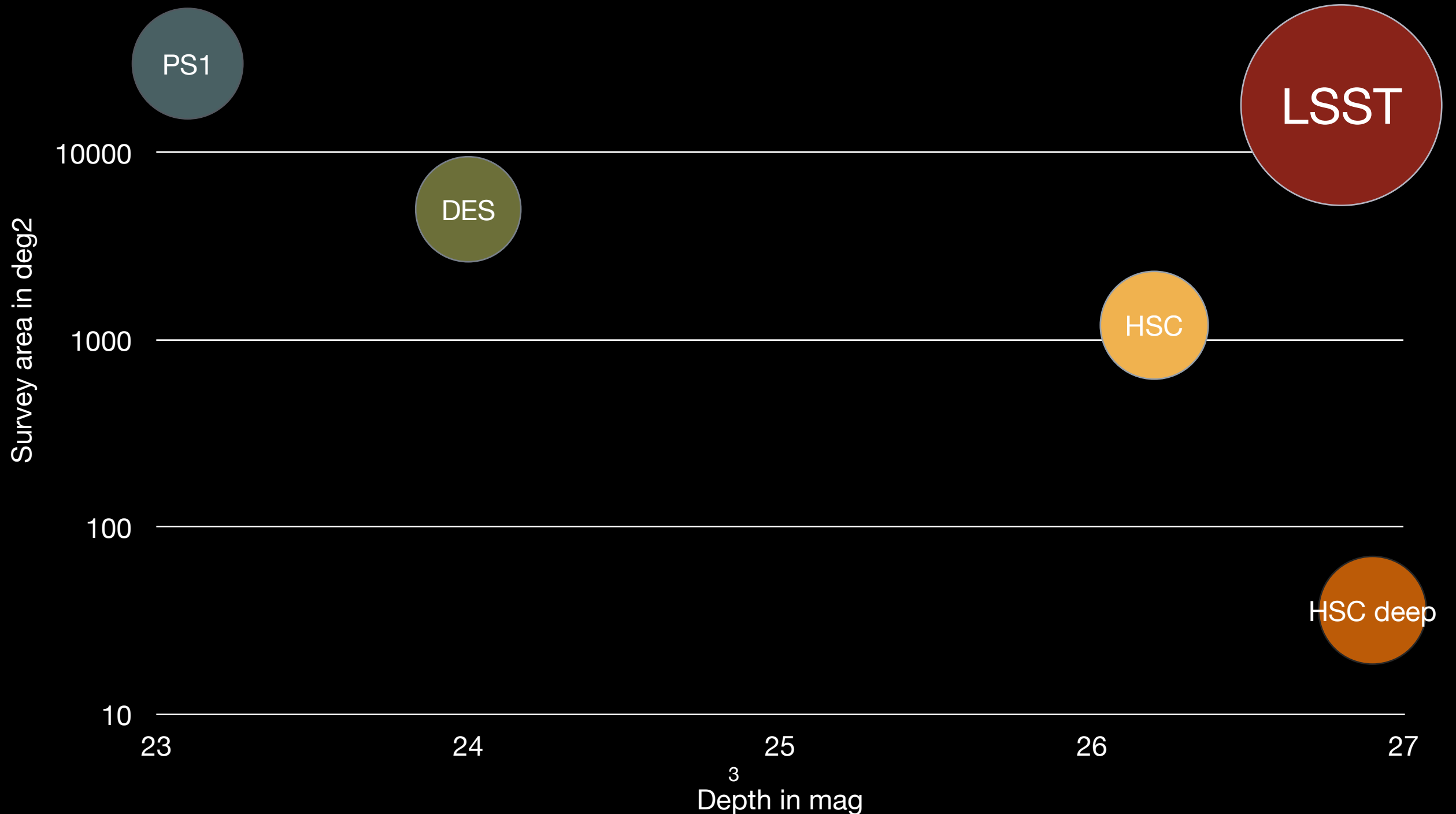


[pstn-055.lsst.io](http://pstn-055.lsst.io)

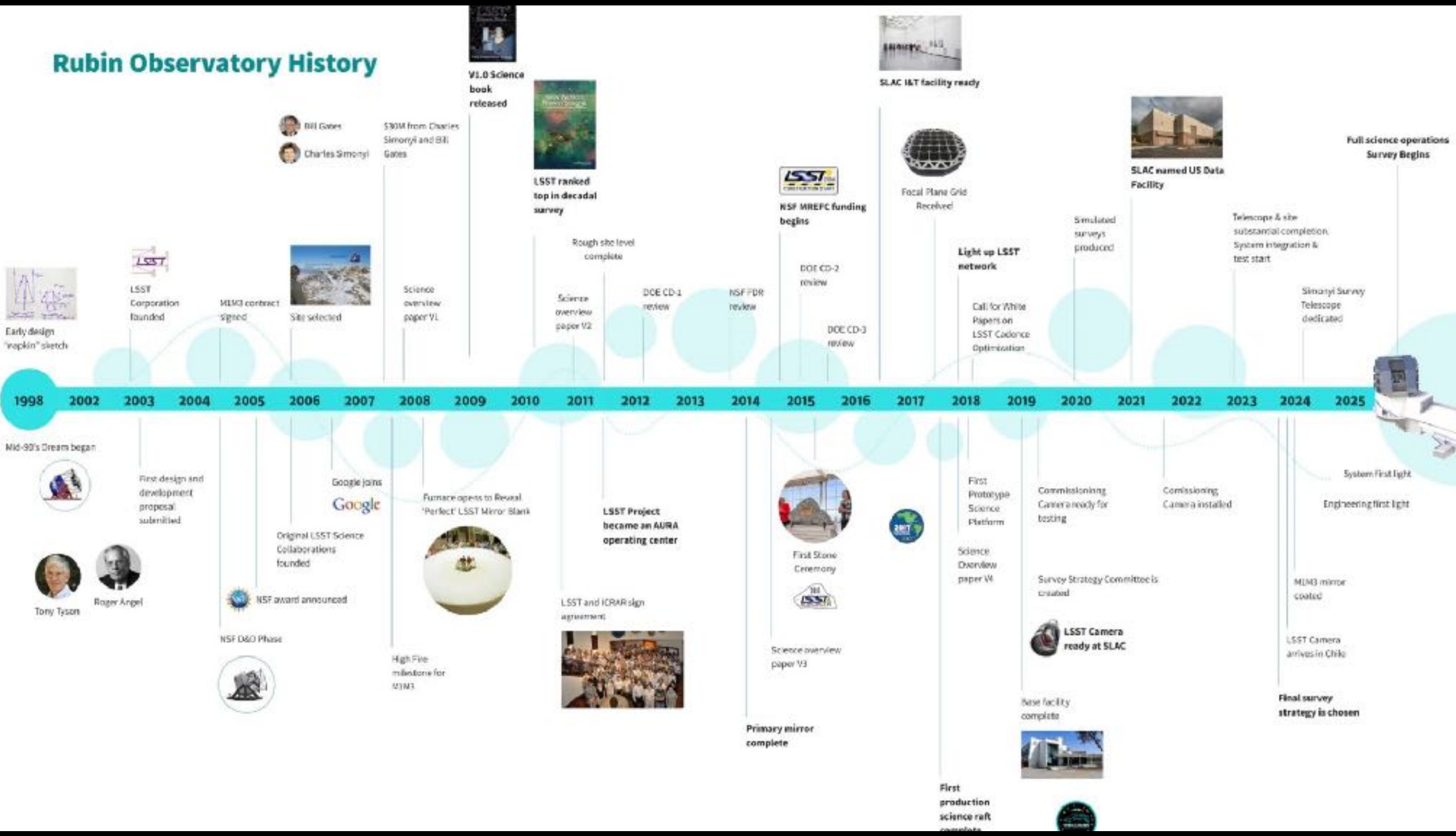


# Vera Rubin Observatory's LSST survey

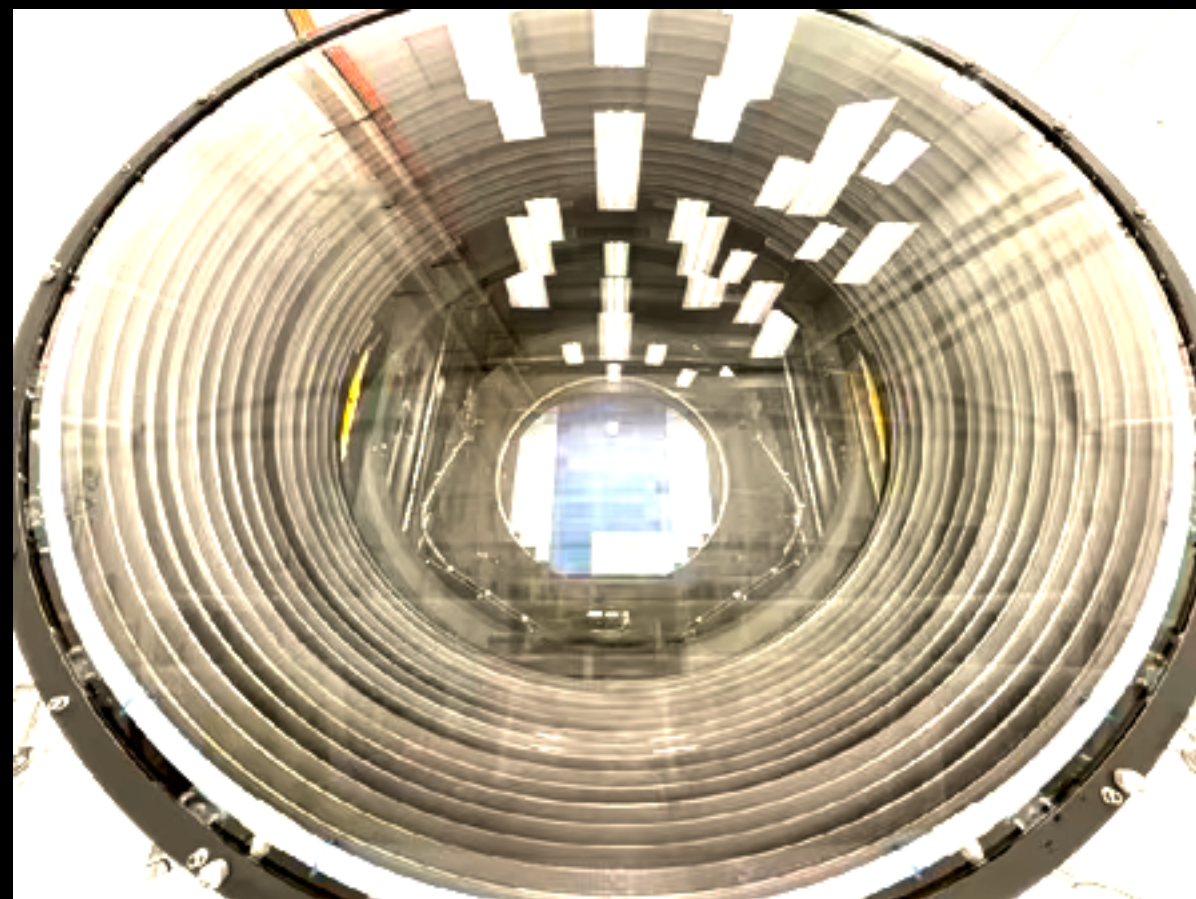
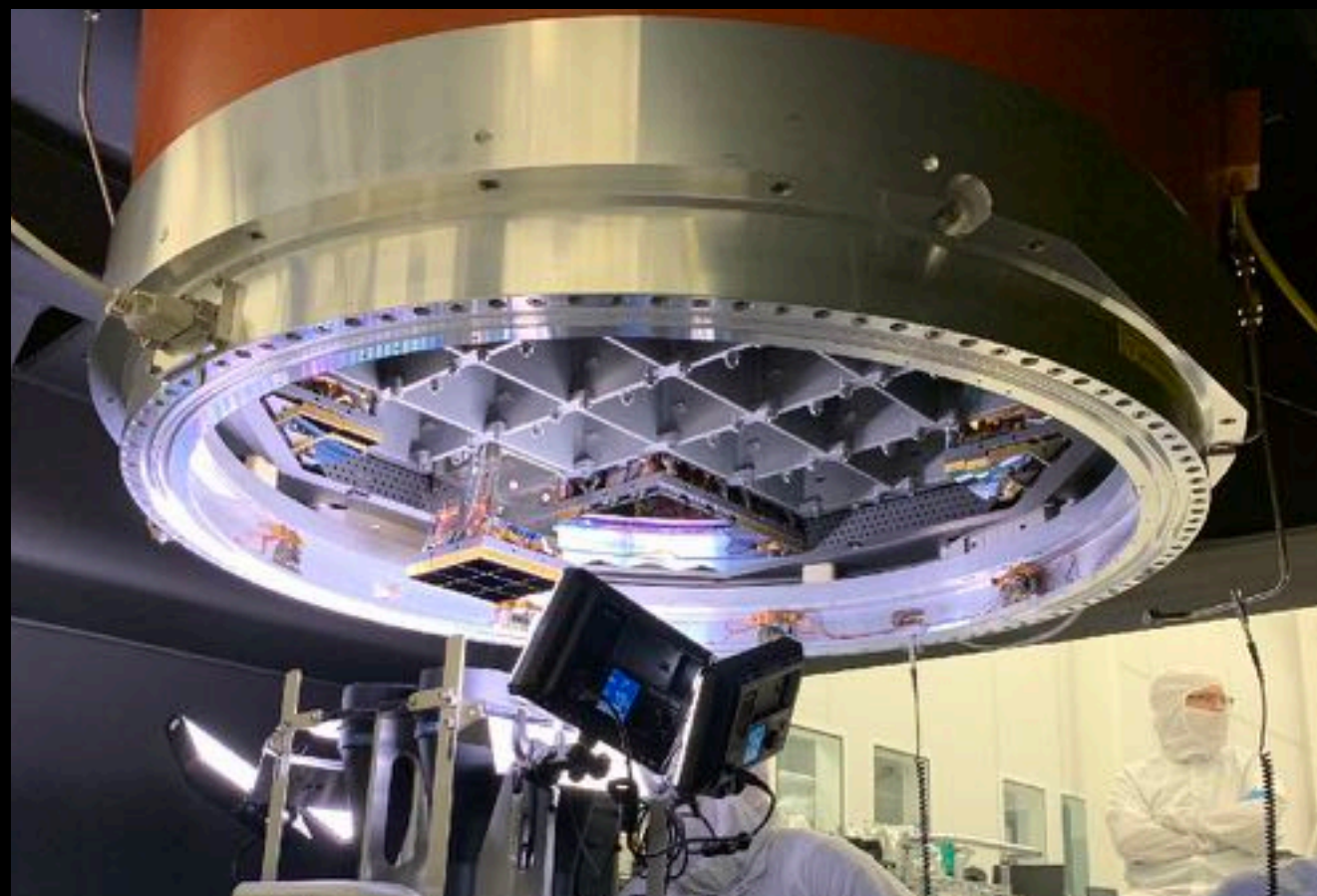
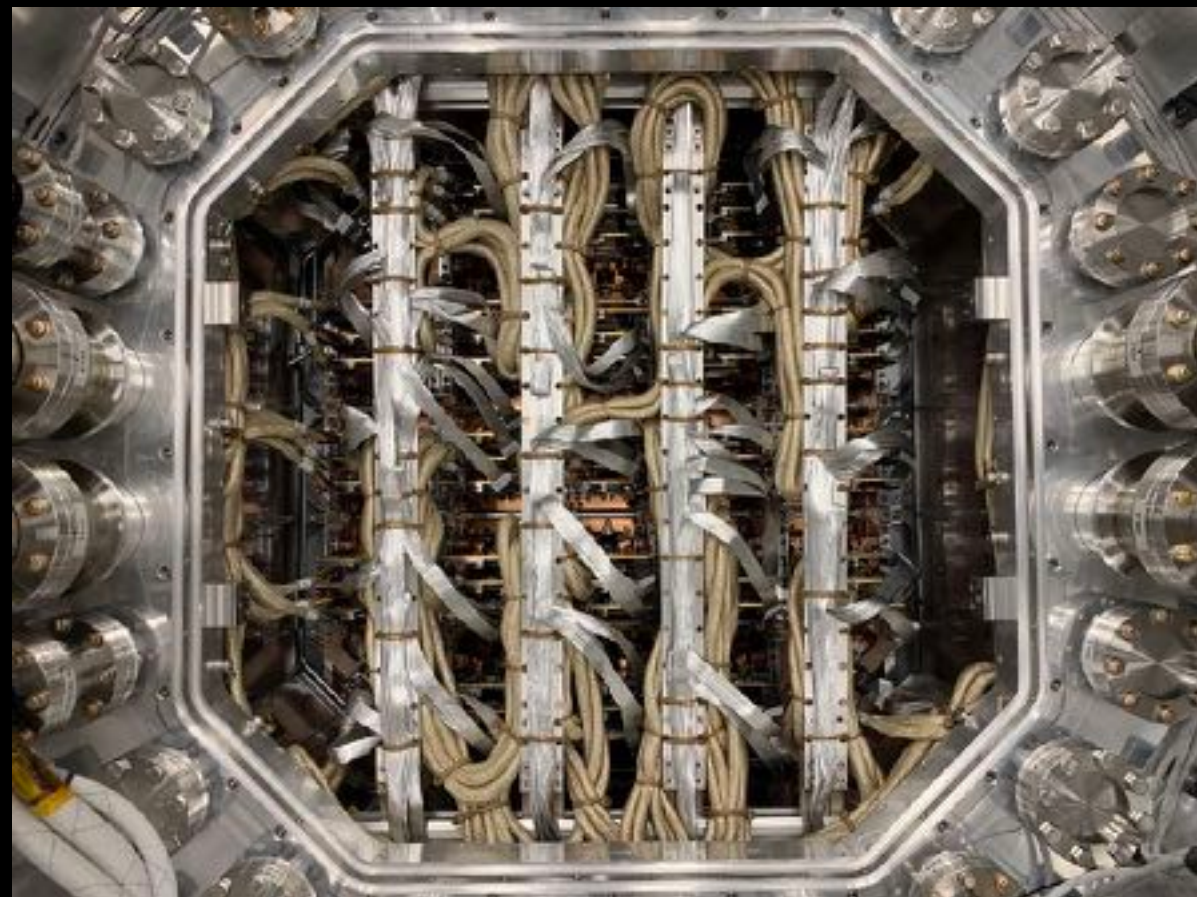
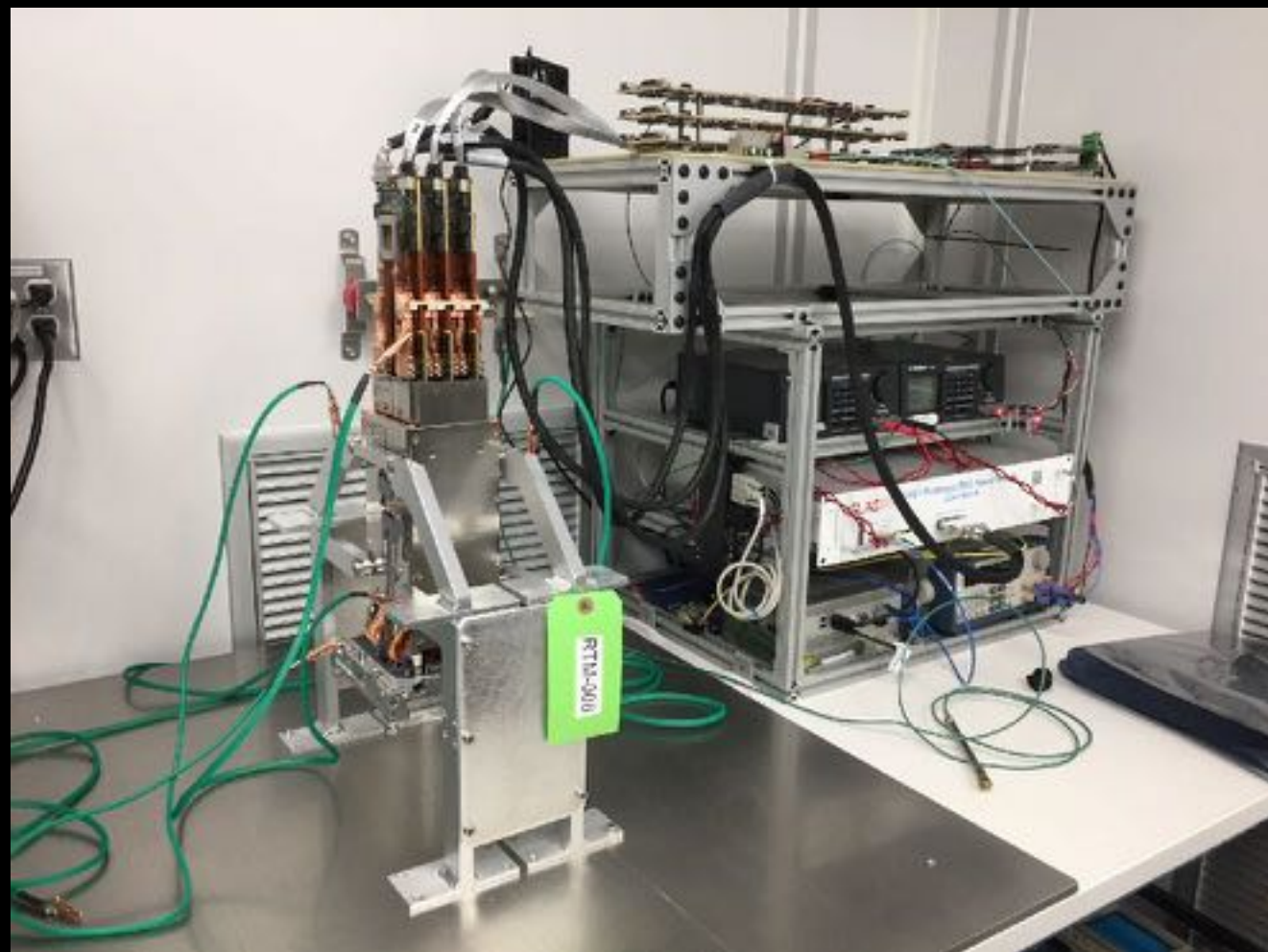
The size is proportional to Etendue



# Rubin Observatory History

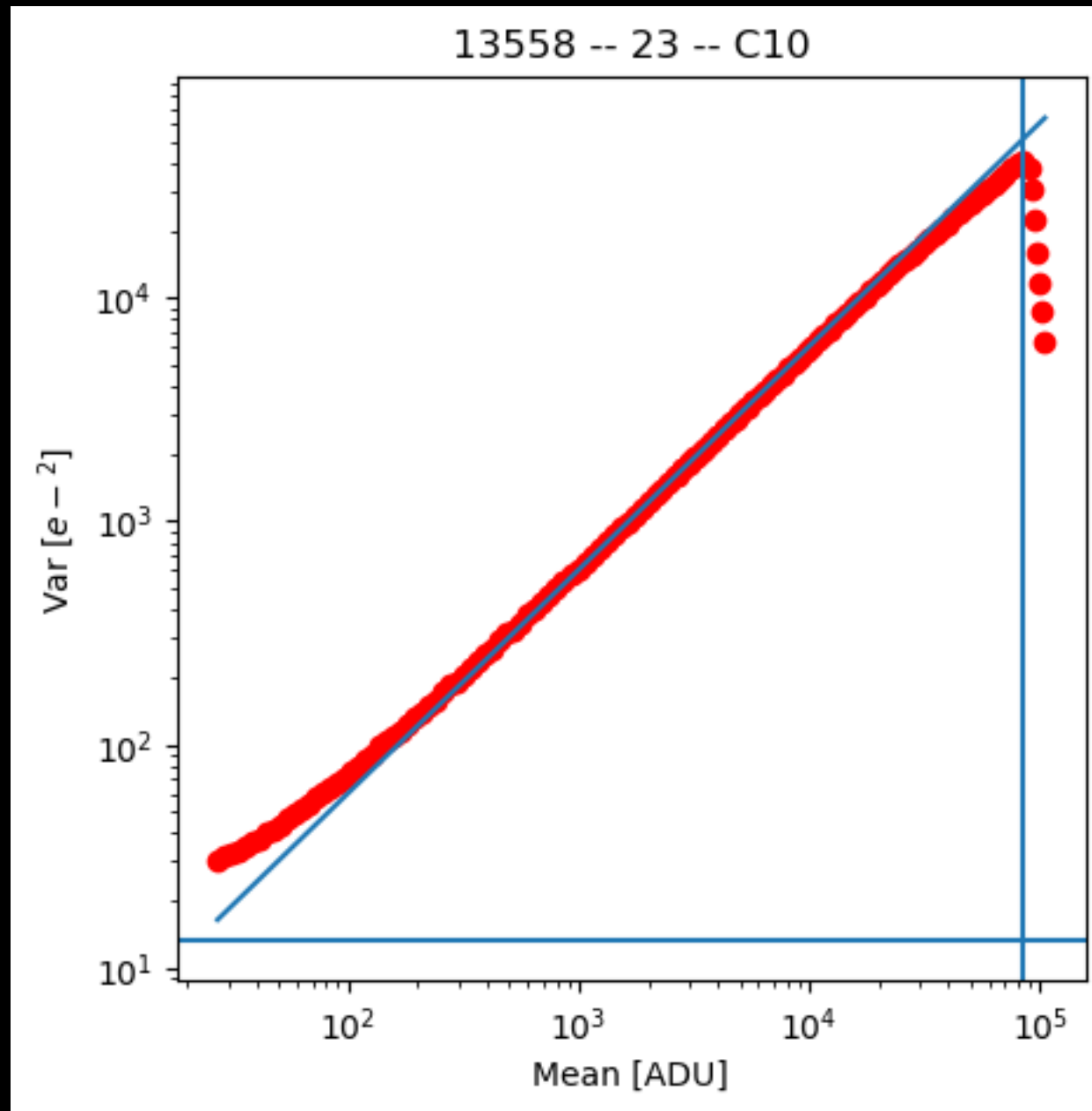




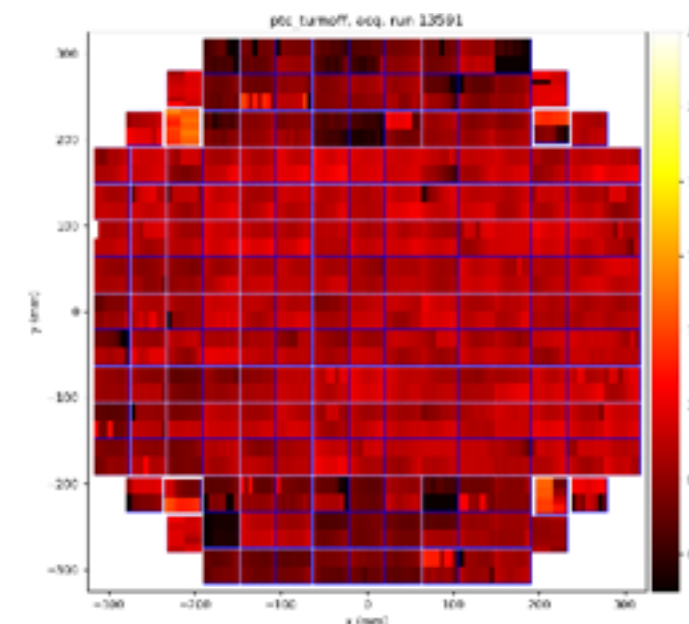
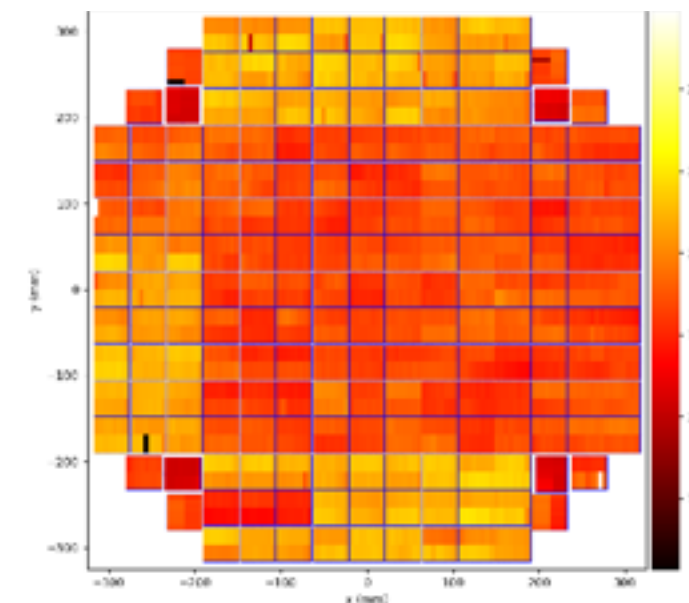
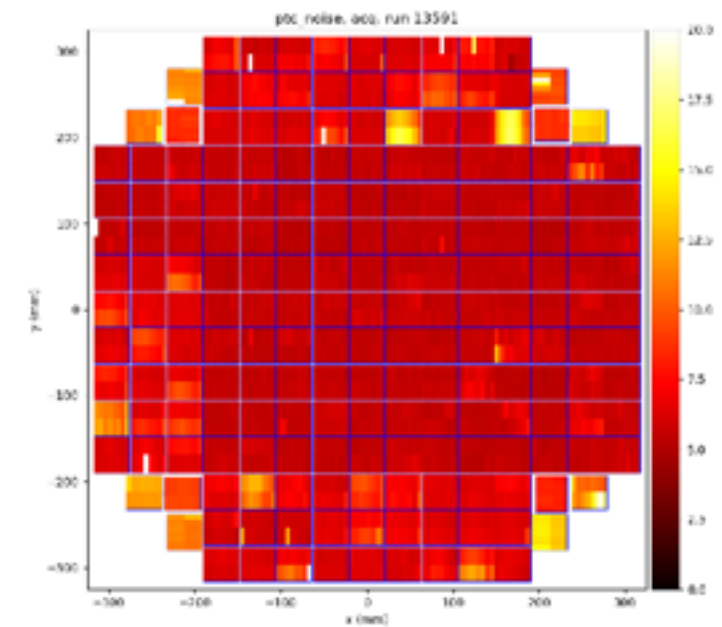




# Electro-Optical Testing



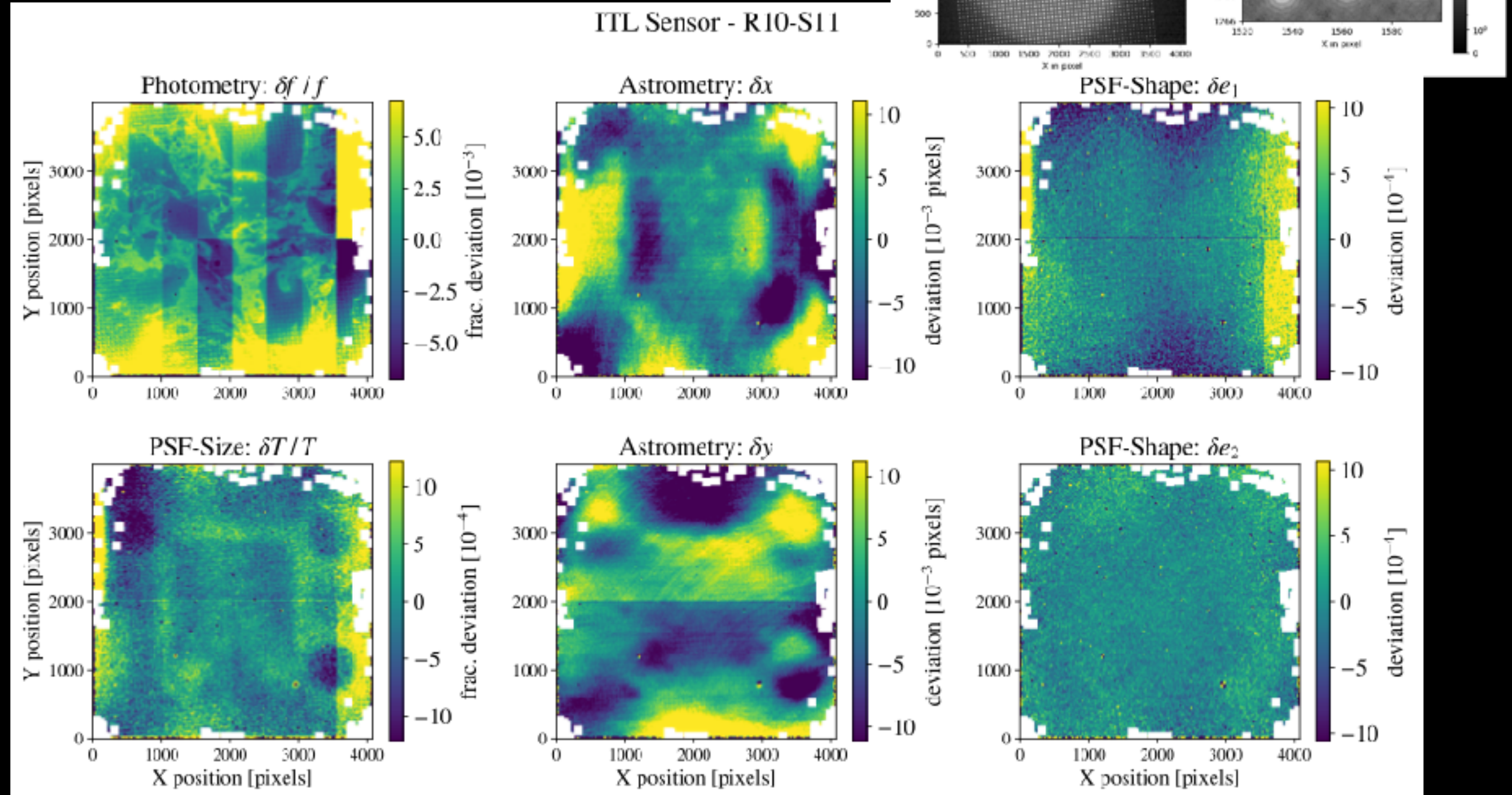
- Dense samplings in flux to characterize the sensors
- Dynamical response of CCDs: noise, gain, “full well”, “features”
- Deviation from the straight line is “Brighter Fatter” effect (Broughton et al. 2024)





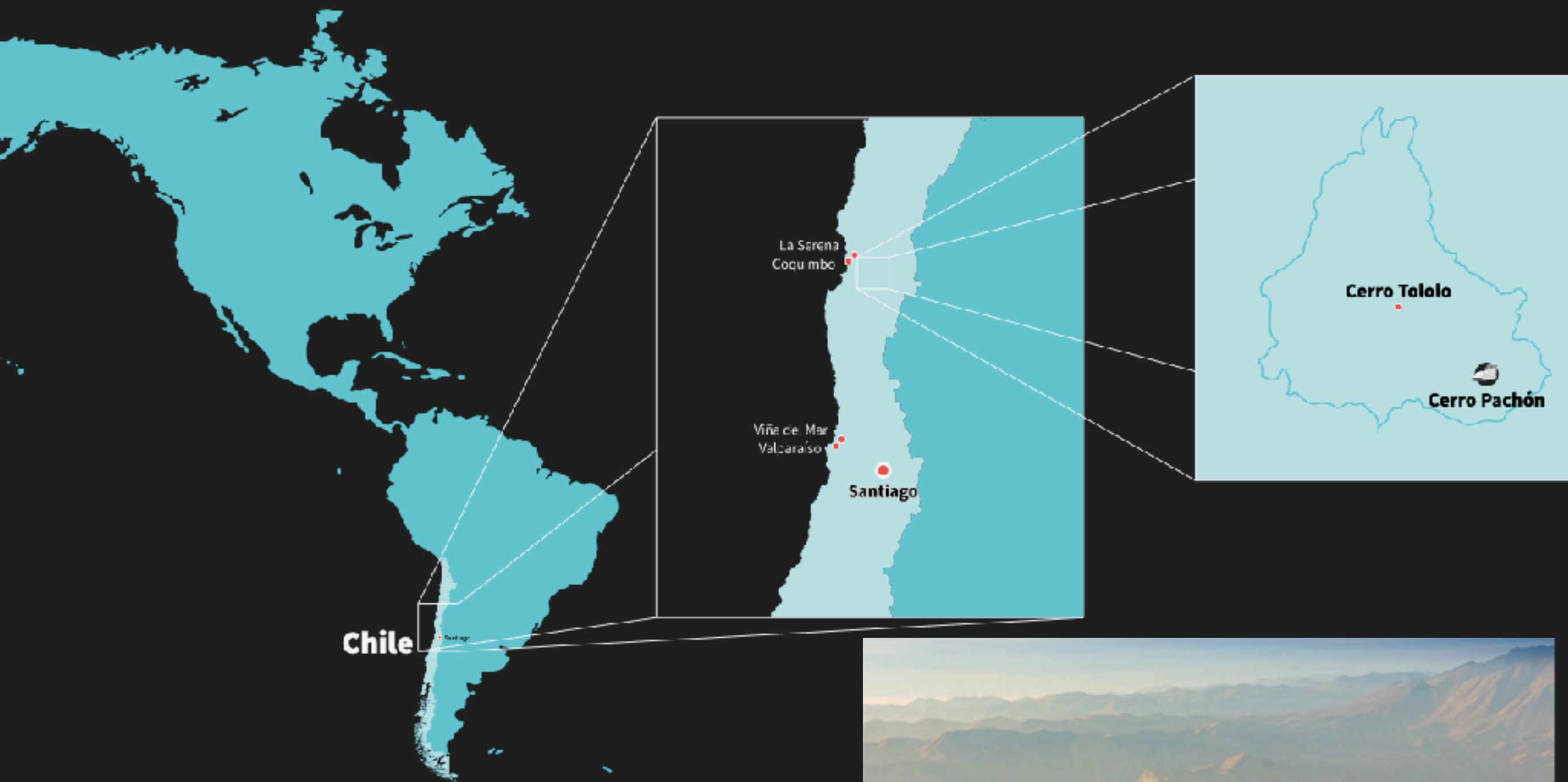
# Spot measurements

2000 images of 2400 spots were collected



- **Laser annealing / Coffee stain** pattern have impact on flux
- **Tree-ring** has some effect on measurements — lateral electric field shifts (generally as small as 0.01% level)
- Midline breaks / Stress from back support structure

Esteves et al. (2023)



View of Rubin Observatory at sunset in May 2024, on Cerro Pachón in Chile. Credit: Olivier Danin/LAC National Accelerator Laboratory

Rubin Observatory's location. Credit: RUBINOBS/NOIRLab/SLAC/NSF/DOE/AURA





Olivier Bonin/SLAC National Accelerator Laboratory



Olivier Bonin/SLAC National Accelerator Laboratory



Travis Lange/SLAC





Vera C. Rubin Observatory  
Systems Engineering

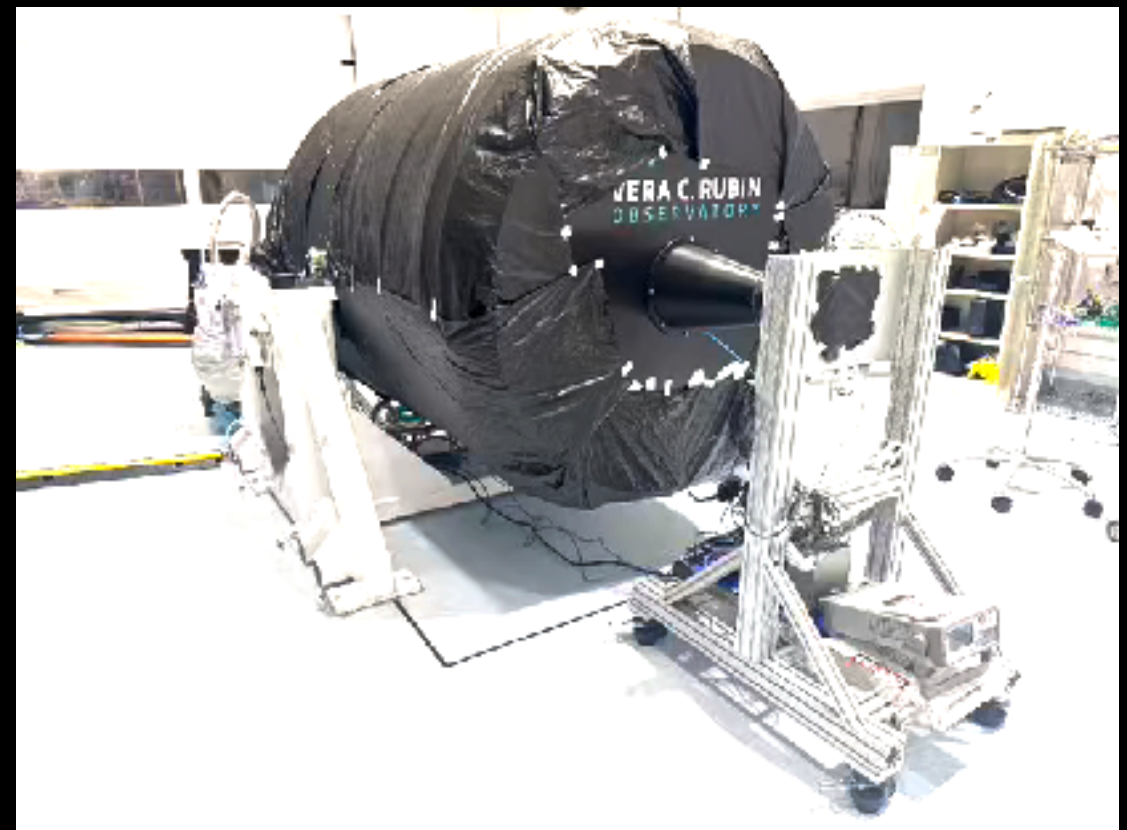
## LSST Camera Electro-Optical Test (Run 7) Results

The LSST Camera group: Pierre Antilogus, Pierre Astier, John Banovetz, Johan Bregeon, James Chiang, Seth Digel, Kevin Fanning, Yassine Faris, Thibault Guillemain, Tony Johnson, Claire Juramy, Craig Lage, Shuang Liang, Sean MacBride, Stuart Marshall, Homer Neal, Daniel Polin, Andrew Rasmussen, Aaron Roodman, Eli Rykoff, Brian Stalder, Gregg Thayer, Tony Tyson, HyeYun Park, Yousuke Utsumi, Zhuoqi Zhang

SITCOMTN-148

Latest Revision: 2025-05-10

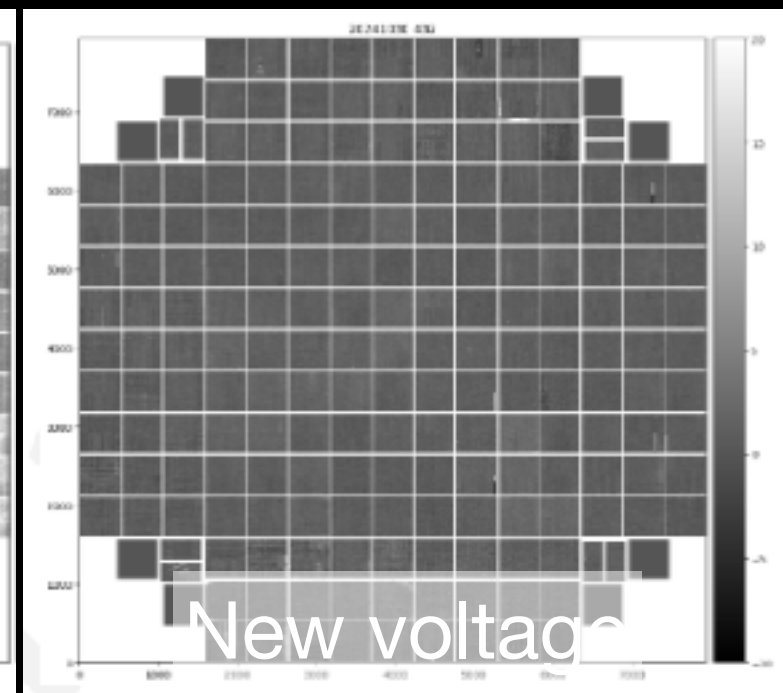
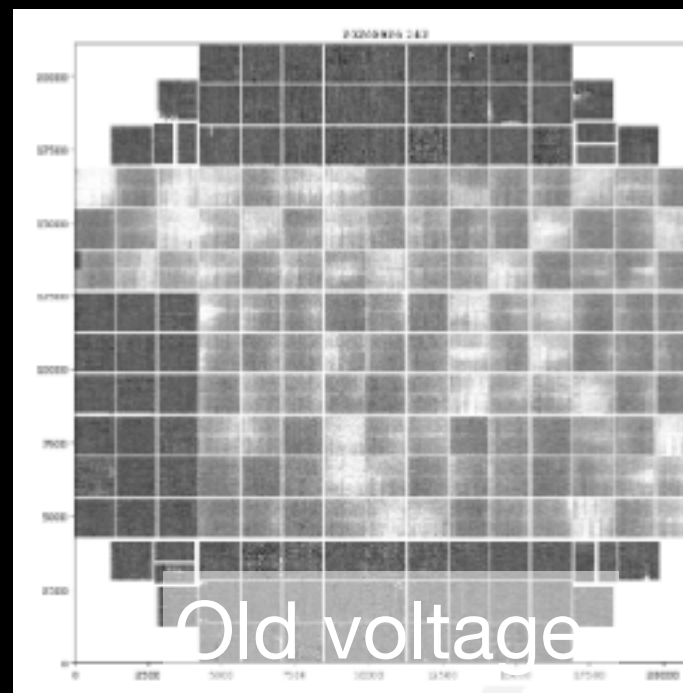
**DRAFT**





# Camera Testing

- Sep. 2024 — Dec. 2024; 56k exposures
- **Revivification**
  - Does the Camera perform still?
- **Optimization**
  - Mitigated Persistence!
  - Improvement of clear
- **Characterization**
  - Treering, defects behaviors, Phosphorescence, etc....
- Report is publicly available online <http://sitcomtn-148.lsst.io>





# Camera installation in Mar 2025





News | Preparing for the greatest cosmic movie ever made



## Preparing for the greatest cosmic movie ever made

April 11, 2025

Now that NSF-DOE Vera C. Rubin Observatory's LSST Camera has been installed, what's next?

Yousuke Utsumi, Camera Operations Scientist and Associate Professor at the National Astronomical Observatory of Japan, knows the team is up to the challenge. *"The work on the camera is progressing well, and we are confident that any issues that came up, even the most unexpected ones, will be resolved."*



## IEEE Spectrum How the Rubin Observatory Will Reinvent Astronomy

Q Type to search

I sit down with Yousuke Utsumi, a camera operations scientist who exudes the mixture of excitement and exhaustion that I'm getting used to seeing in the younger staff. "Today is amazingly quiet," he tells me. "I'm happy about that. But I'm also really tired. I just want to sleep."

Just yesterday, Utsumi says, they managed to finally solve a problem that the camera team had been struggling with for weeks—an intermittent fault in the camera cooling system that only seemed to happen when the telescope was moving. This was potentially a very serious problem, and Utsumi's phone would alert him every time the fault occurred, over and over again in the middle of the night. The fault was finally traced to a cable within the telescope's structure that used pins that were slightly too small, leading to a loose connection.

Header image







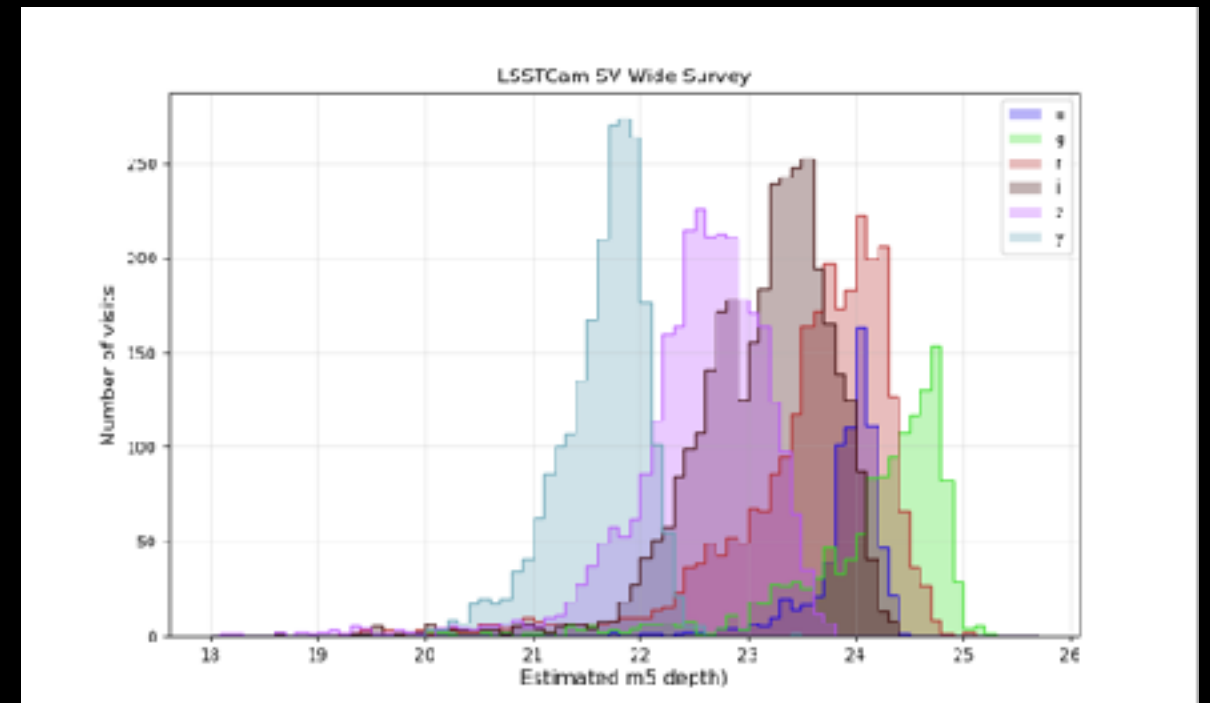
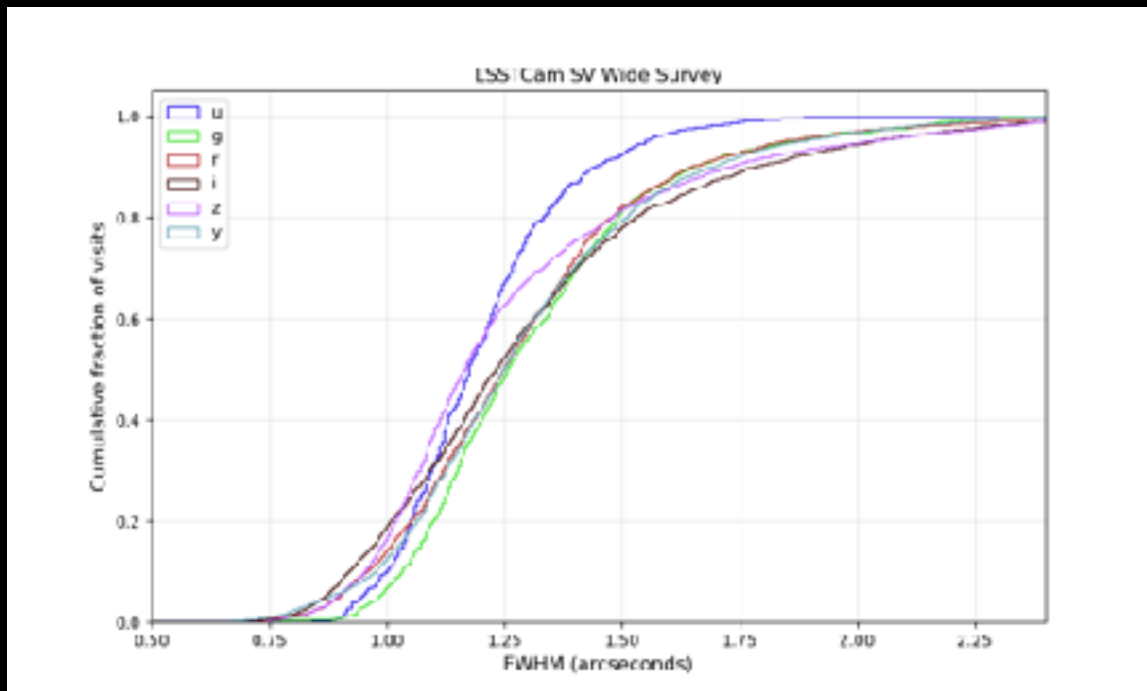
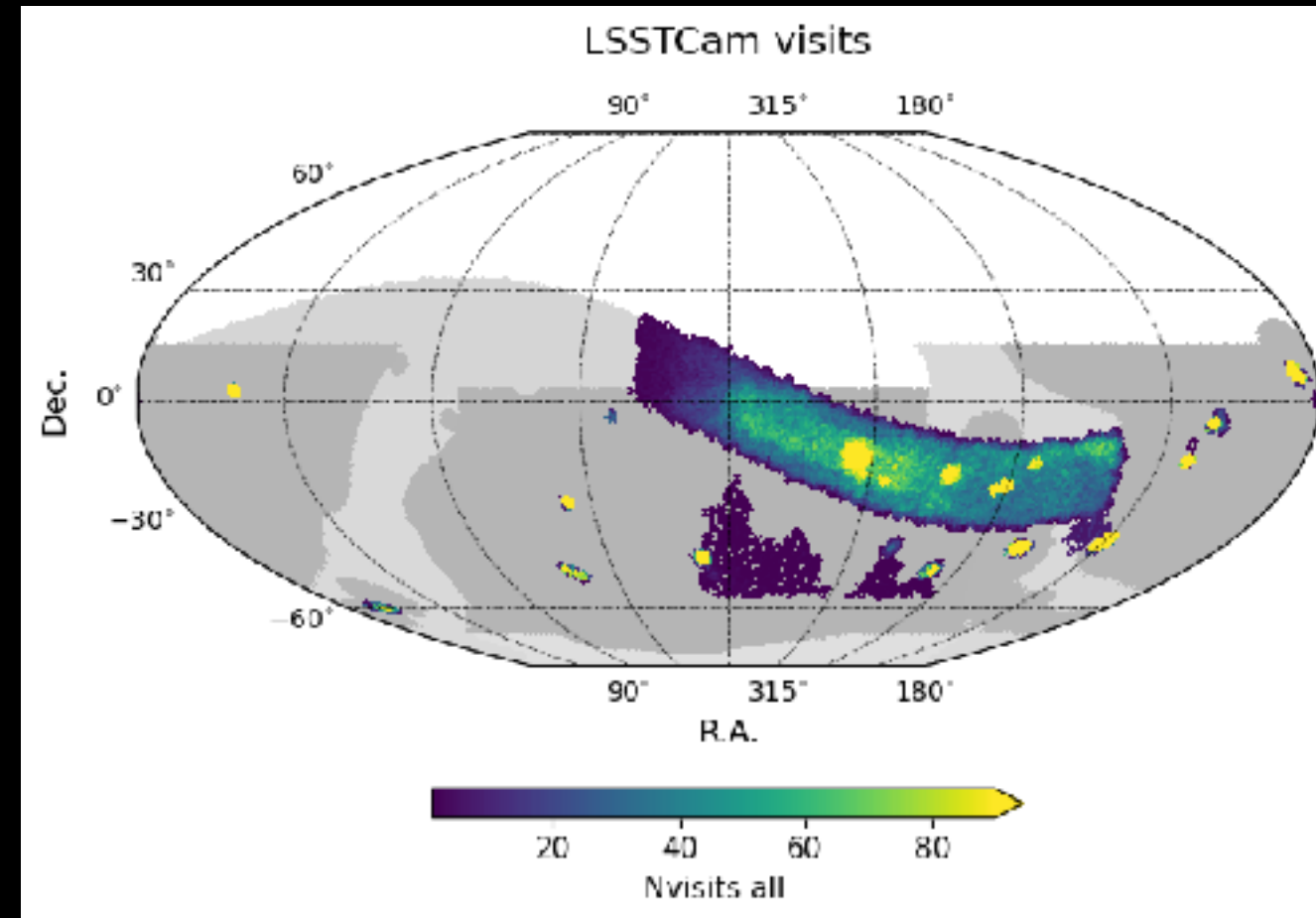






# Commissioning

- Improving Camera operation in real (severe) conditions
- Improving delivered image quality reliability
  - AOS (Active Optics System)
  - M1M3 thermal control
  - Dome seeing
- Telescope Mount Assembly
- Calibration system
- Scheduler
- Science Validation Survey
- ToO (gcn:41595)





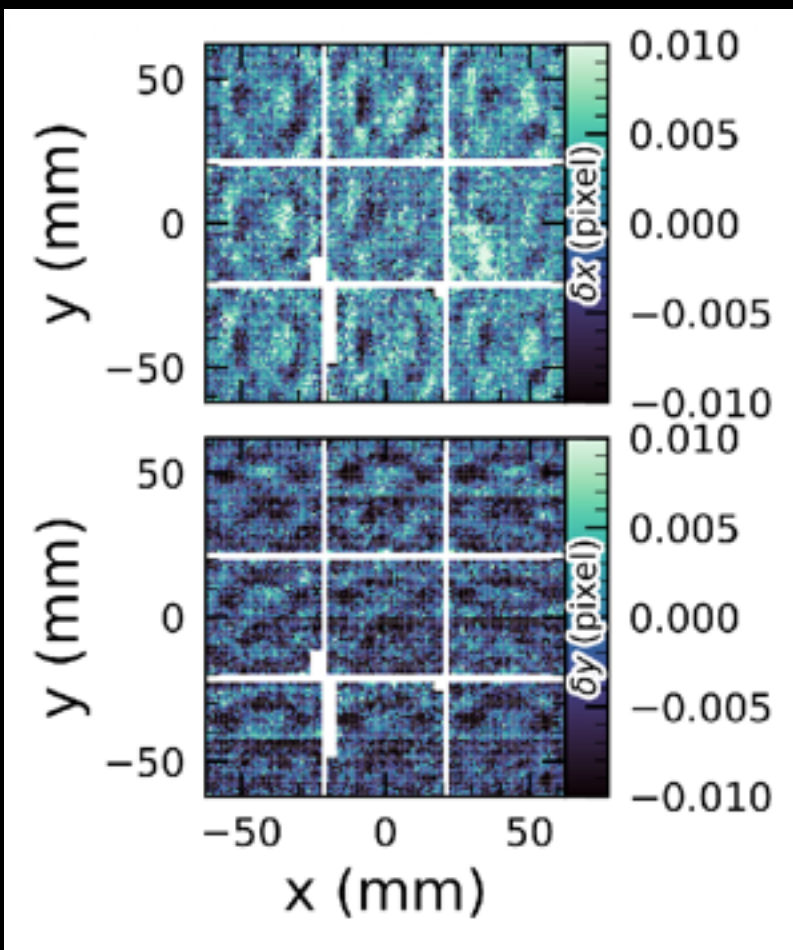
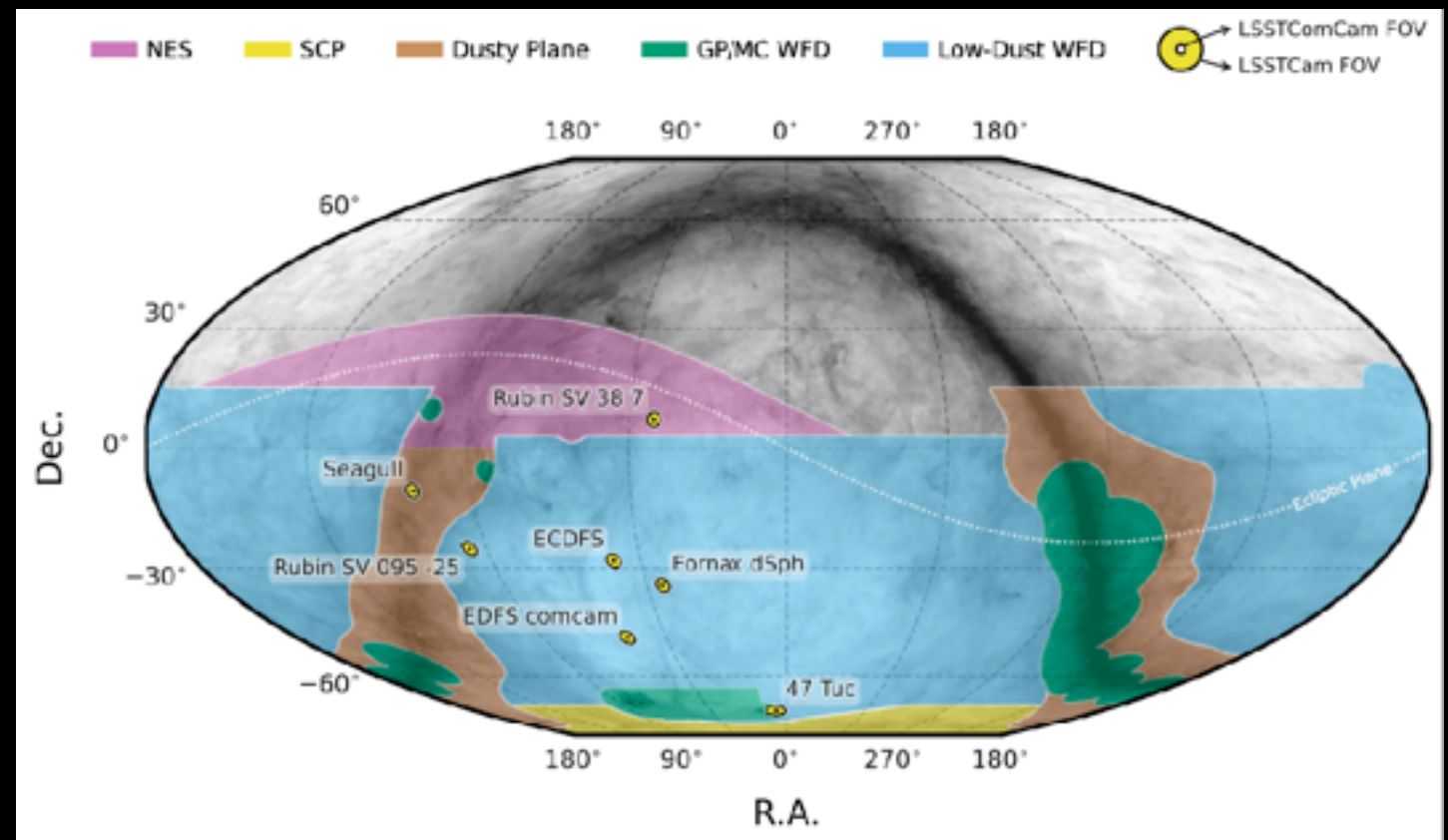
# Data Release

- Data Preview 1 (Released June 30, 2025): Images taken by Commissioning Camera; 7 fields between Oct 24 and Dec 11 2024)
- Data Preview 2 (Expected by May 2026): science-grade commissioning data from the full LSST Science Camera
- Data Release 1 (Expected by January 2027?): the first DR of 10 years survey



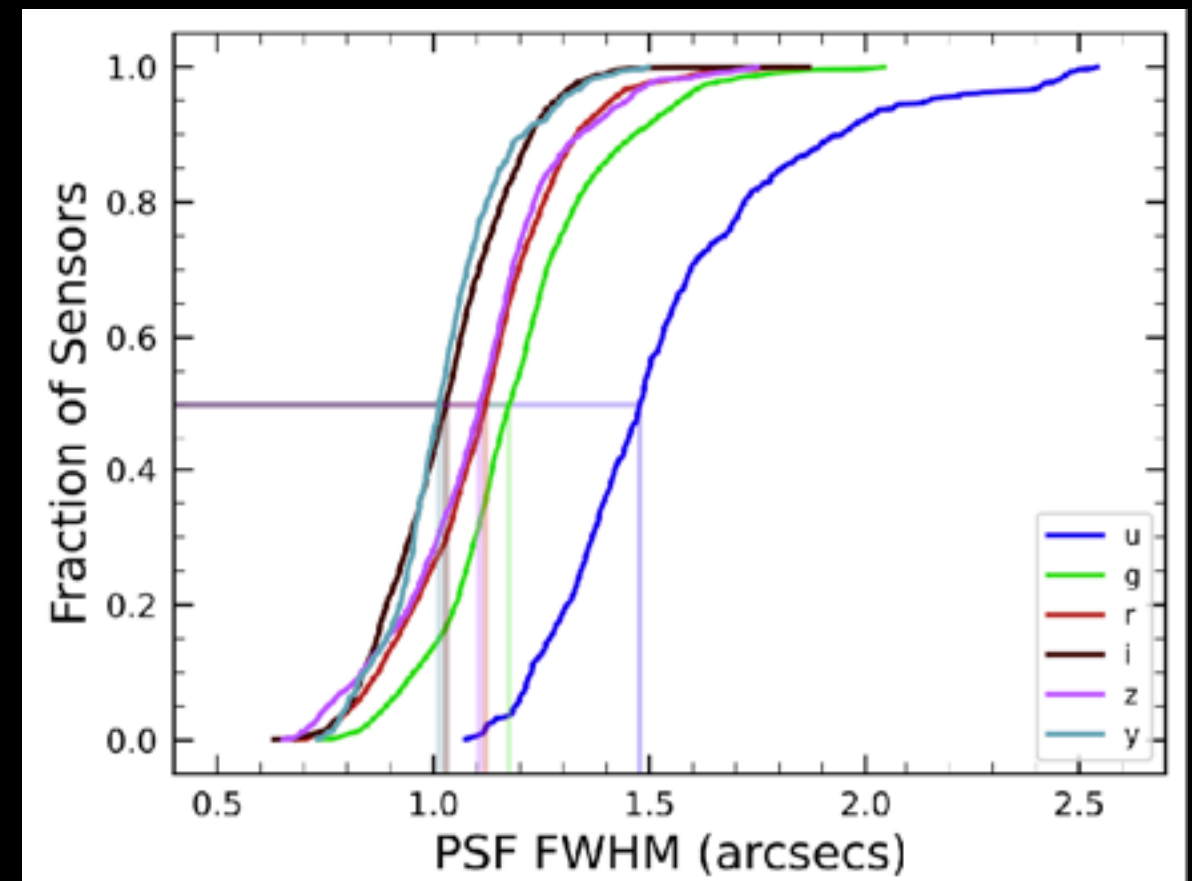
# DP1

- ComCam (1 Raft Camera)
- 15deg2 in ugrizy
- 2.3M sources
- <https://rtn-095.lsst.io/>



Astrometric residual

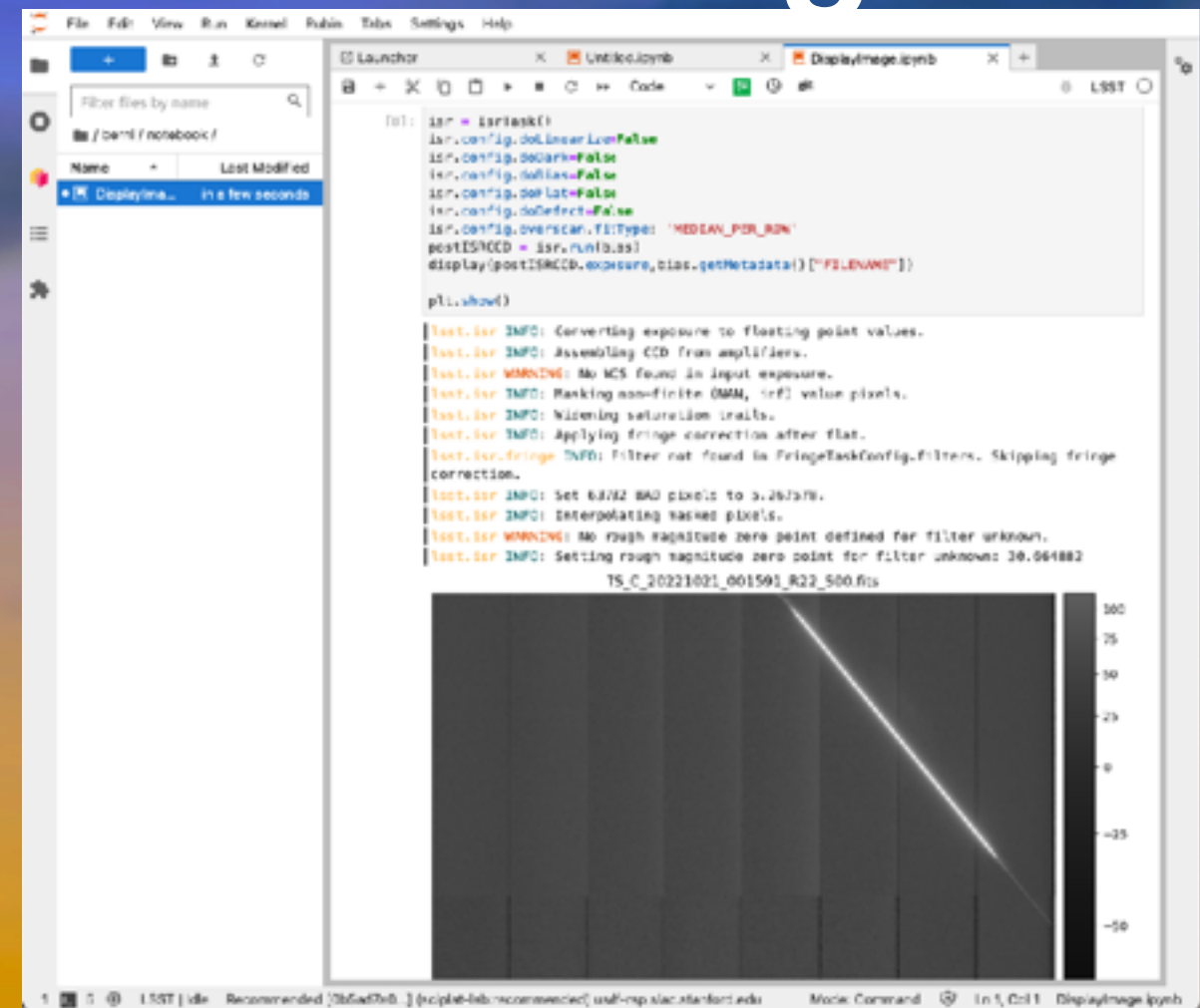
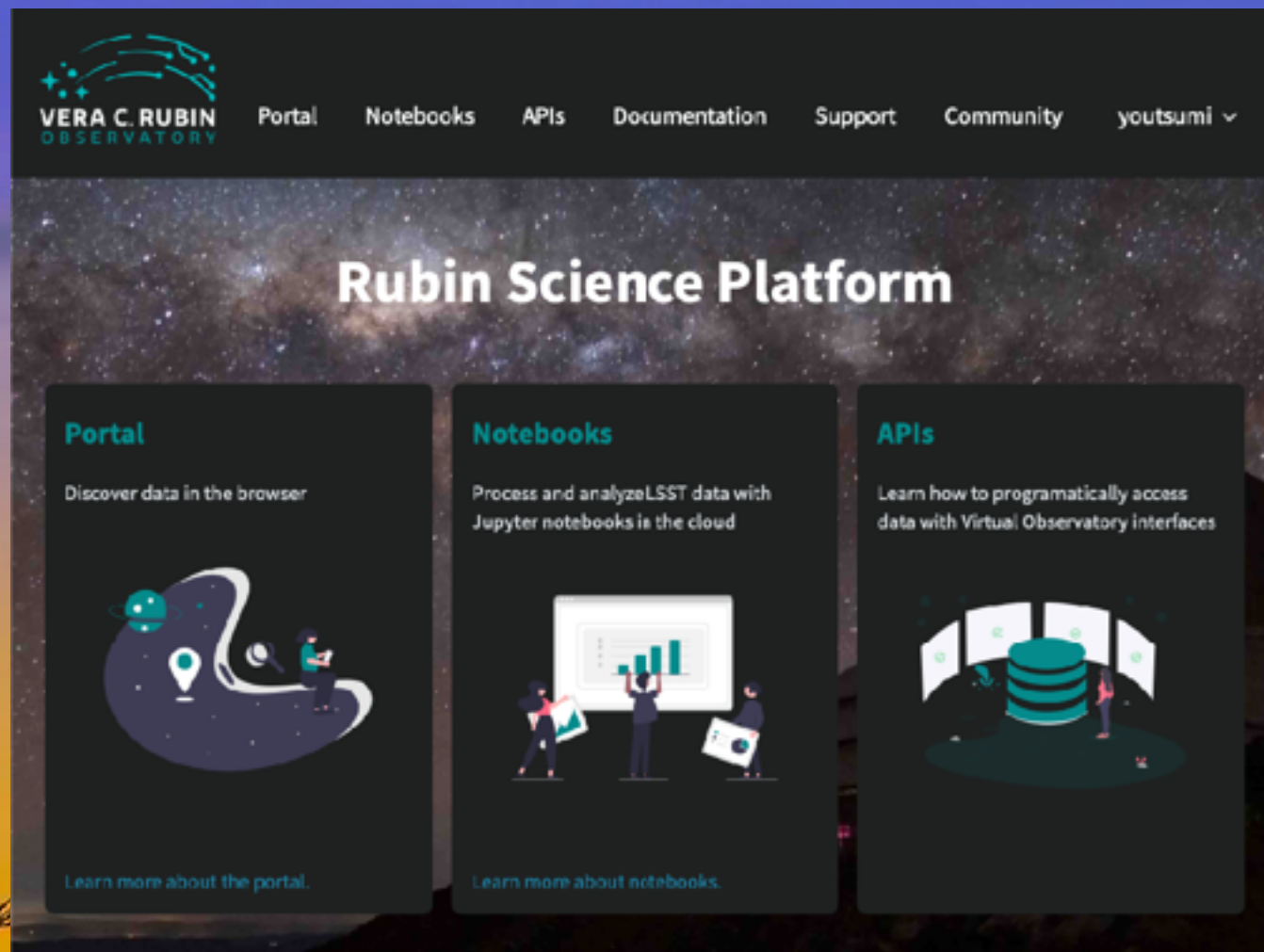
Survey fields



Seeing distribution



# How to access data - Data Rights

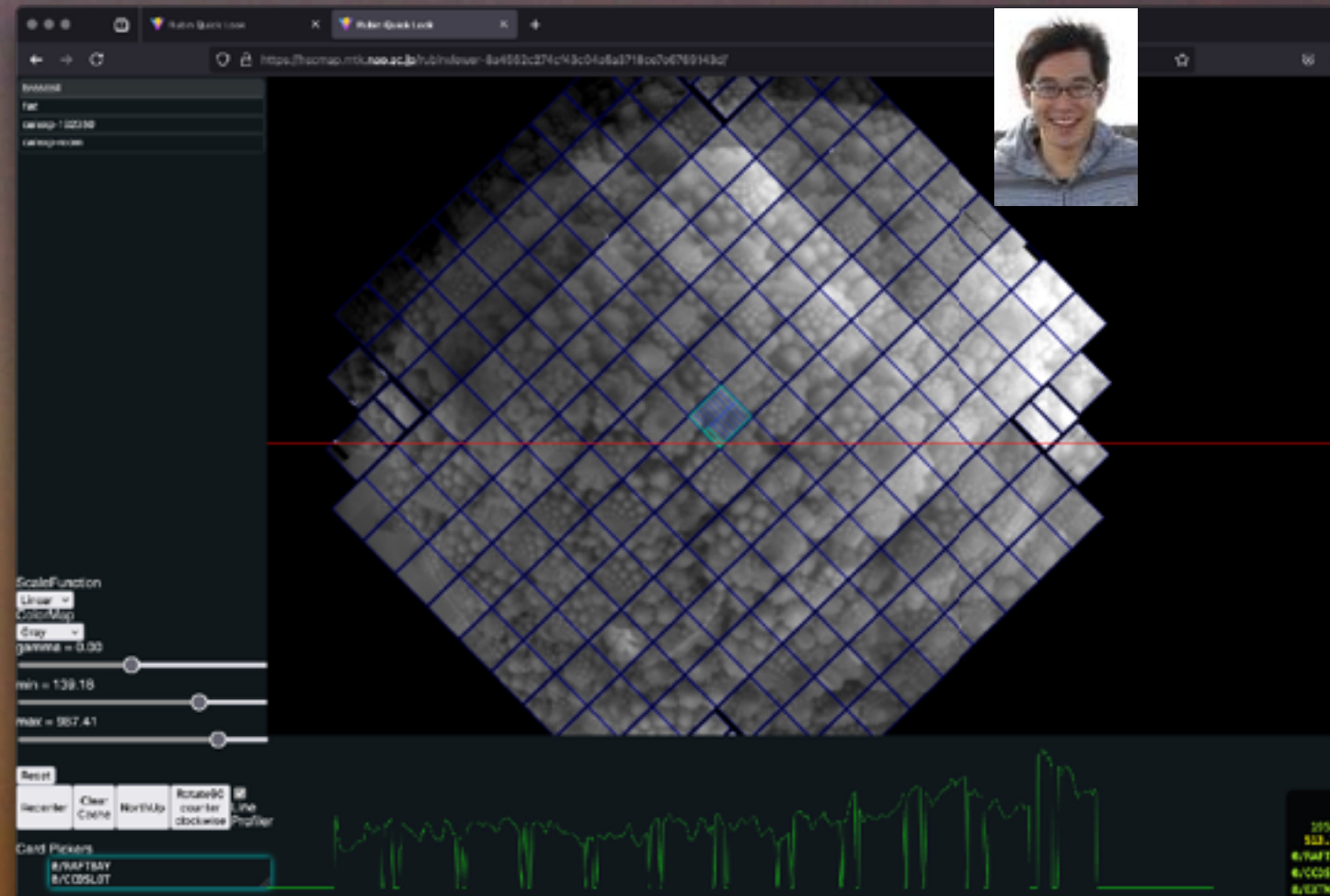


- Raw data: 60PB; Catalog 20PB; Processed image: ~several hundreds PB
- Rubin will provide for DRH (Data Right Holders) access data from pixels to catalogs through the **Rubin Science Platform** on Google Cloud (VO, Jupyter notebook, APIs...)
- Transient alert stream will be made public through **alert brokers**; however alert database will be restricted
- Data will be public after 2 years, at least through CADC



# JP In-kind contribution programs

- 50 Subaru nights over 10 years: “guarantee HSC/PFS time in exchange for premium weight factor (10 PI → 20 PI)” UM 2022 SAC chair report
- Workforce (commissioning, software development, community scientist, science collaboration)
- Computing resources
- PFS data products (transient follow-up, photo-z training set from a filler and SSP)
- Majority of DRHs based on NAOJ’s resources will be provided to the community through an open call (Oguri-san’s talk).





# Summary

- Rubin Observatory and LSST Camera have a long history of development
- Efforts to understand the instrumentation have been made
- First Photon has been captured on April 15, 2025
- **Legacy Survey of Space and Time** is about to start
- Japanese community has many seats for accessing Rubin Data in the proprietary period