Rubin Observatory

Operations Overview

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NSF NOIR Lab AURA SLAC U.S. DEPARTMENT OF ENERGY

We are the Vera C. Rubin Observatory!

Mission

Rubin Observatory

The Vera C. Rubin Observatory mission is to *create a vast astronomical dataset and web-based analysis environment for unprecedented discovery of the deep and dynamic universe.*

Vision

Rubin Observatory

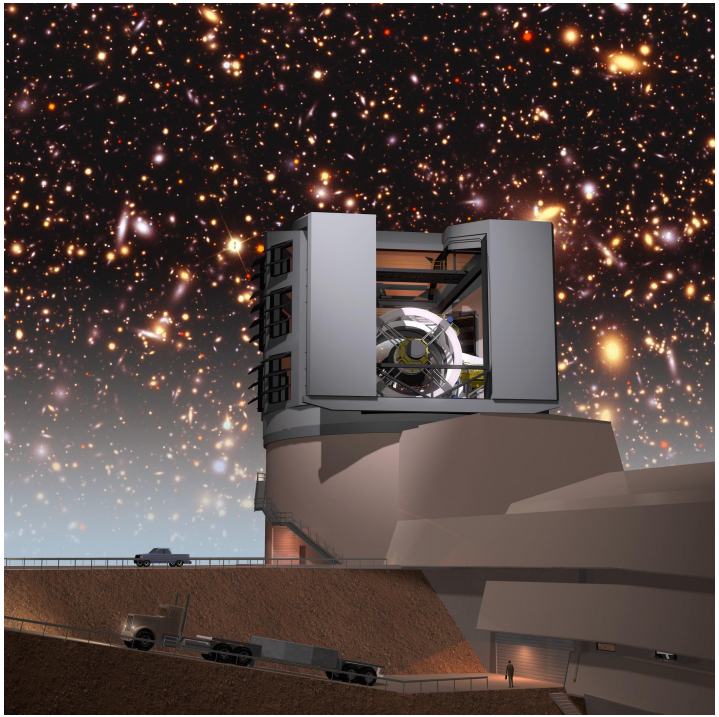
By acquiring, processing, and making available the vast dataset collected with the Vera C. Rubin Observatory, the Legacy Survey of Space and Time will provide the community with the data to address some of the most fundamental questions in astrophysics, advance the field of astronomy, and engage the public in the discovery process.

Rubin's Legacy Survey of Space and Time

Rubin Observatory

- Unprecedented astronomical survey
- Covers the southern sky every three nights
- Relentless observing for 10 years due to begin in 2022

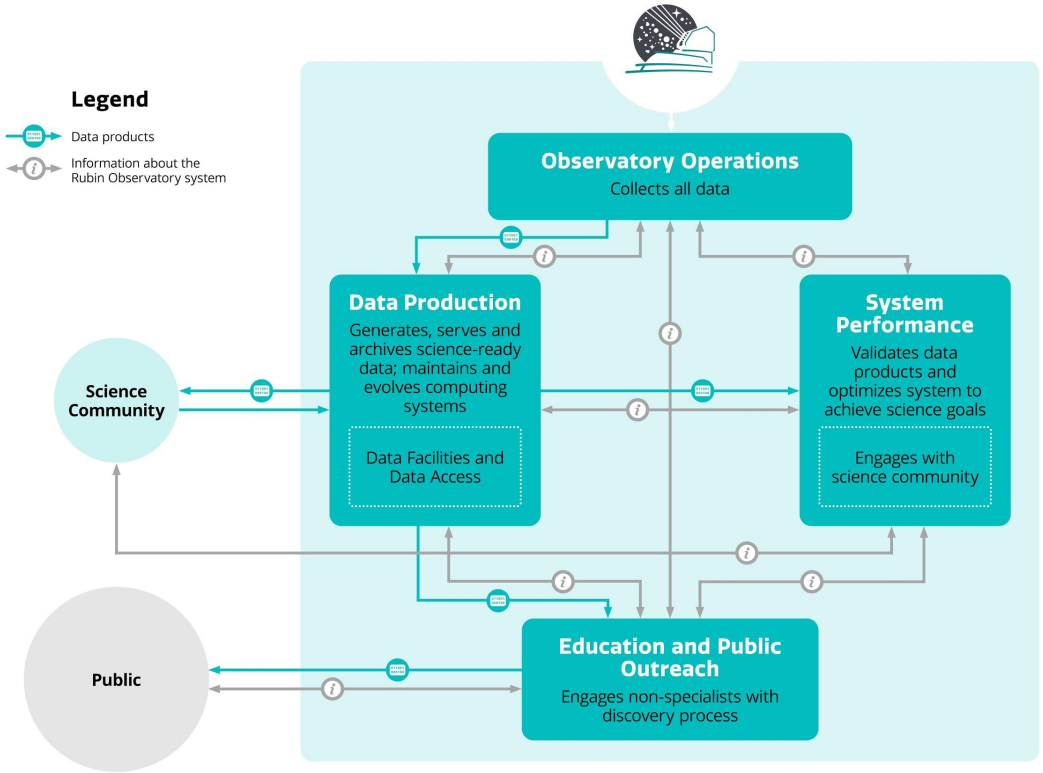
- 40 billion Objects
- 20 TB of data per night
- 10 million transient alerts per night served by community brokers
- Annual data releases
- 15 PB final catalog
- 500 PB of image data



[Charge Questions: 1, 2]

The information flow through the Rubin system drives the design of its organization

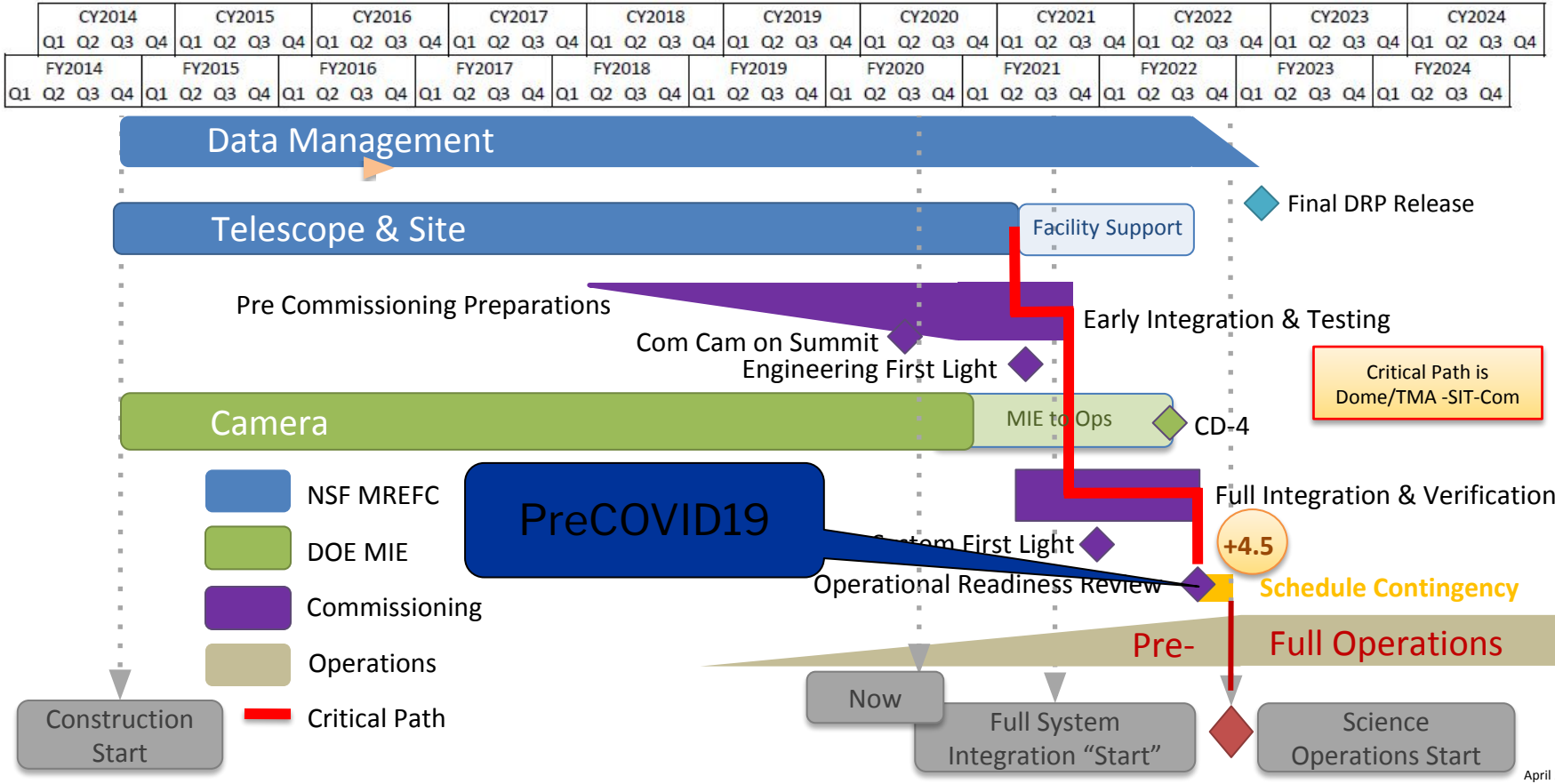
Rubin Observatory



- **Observe** sky, keep going
- **Produce data**
  - Check results
  - Emit Alerts
  - Release catalogs
- Support community and learn from them,
  - **Optimize** survey and system
- Inform and engage the **public**

[Charge Question: 4]

Rubin Schedule – 4.5 Months Contingency



Pre-operations "Data Previews" will support development of our data production and community support system

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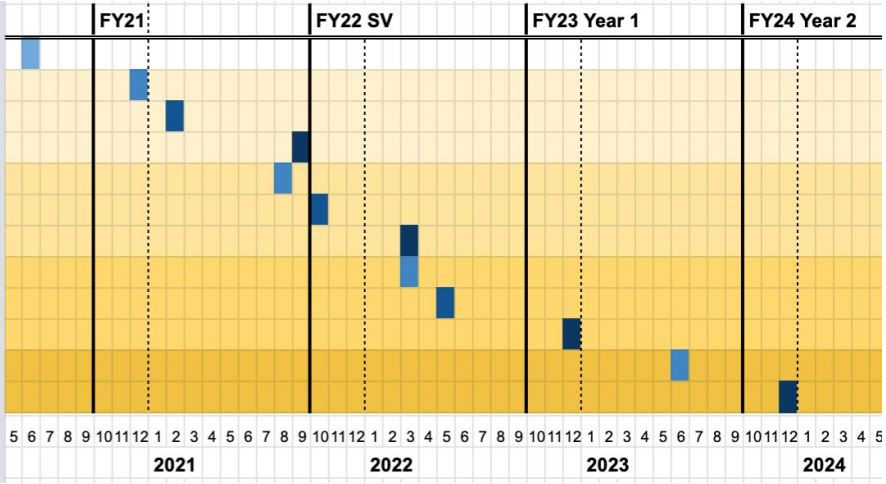
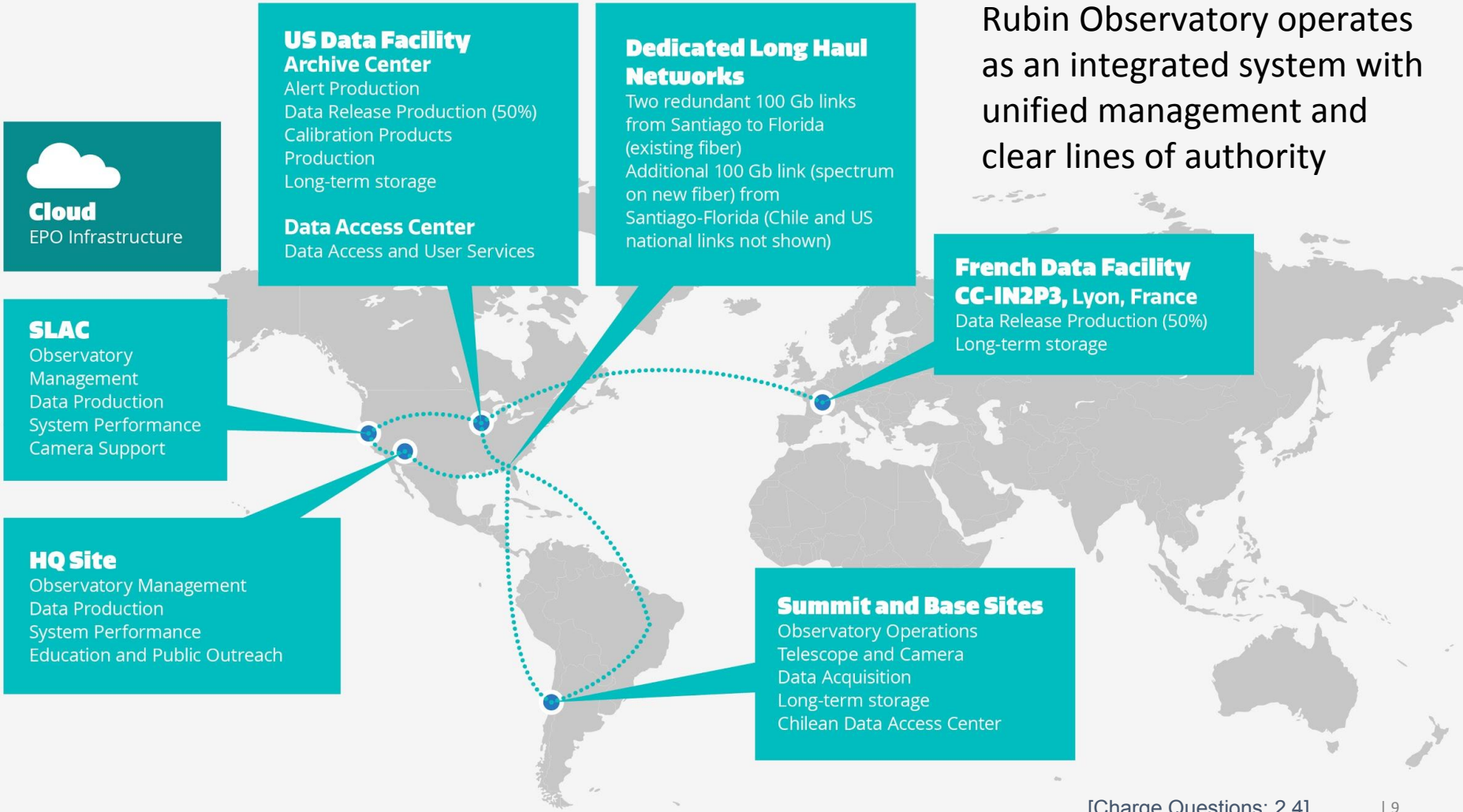
Milestone	Forecast Date	Description
DP0 Hosting	2020-06-30	Host simulated images and catalogs, for LSP/Qserv testing and comparisc
DP0 Start	2020-12-15	Project begins early DRP-like processing of simulated/precursor survey im
DP0 Early Access	2021-02-13	Images and low level catalogs made available with little support.
DP0 Data Release	2021-09-30	Catalogs released to community and supported.
DP1 Start	**2021-08-07**	Project begins early DRP-like processing of ComCam data, Ops team sha
DP1 Early Access	**2021-10-06**	ComCam images and low level catalogs made available with little support.
DP1 Data Release	**2022-03-08**	ComCam catalogs released to community and supported.
DP2 Start	**2022-03-31**	Project begins DRP processing of LSSTCam SV images, Ops team shadc
DP2 Early Access	**2022-05-30**	LSSTCam SV images and low level catalogs made available with little sup
DP2 Data Release	**2022-12-15**	LSSTCam SV catalogs released to community and supported.
DR1 Start	**2023-06-30**	Ops team begins DR1 DRP processing.
DR1 Release	**2023-12-15**	DR1 catalogs released to community.



- We are planning a sequence of three pre-survey data releases, the "Data Previews," in order to develop our capabilities to produce, verify and release LSST data.
- We are collaborating with the LSST DESC to use their large scale simulated LSST dataset in DP0, throughout FY21.
- DP1 and DP2 will involve releasing and supporting commissioning data

[Charge Questions: 3,6,9]

Rubin Observatory operates as an integrated system with unified management and clear lines of authority



[Charge Questions: 2,4]

The summit is where it all starts

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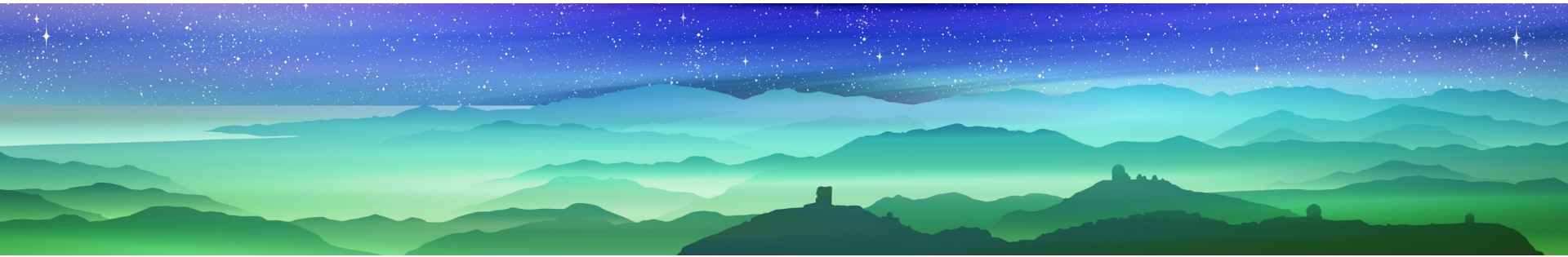
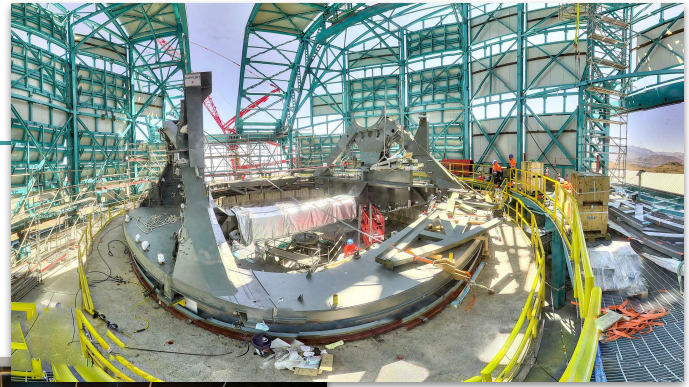
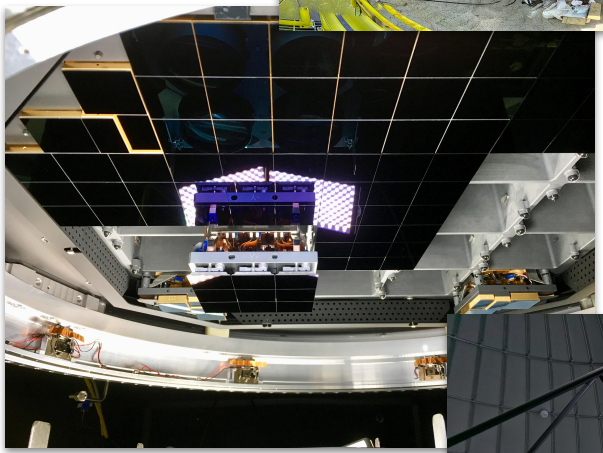
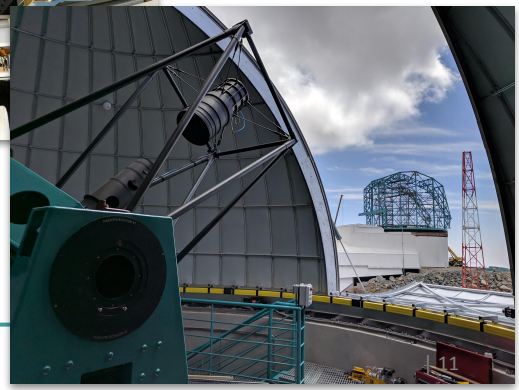
- The Summit Facility on the El Peñón has an elevation of 2,650 meters and sits southwest of Cerro Pachón's summit ridge
- 70-75% of nights per year are observable
- The summit includes modest computing resources to support acquisition of scientific and engineering data from the camera, telescope, and other Rubin Observatory subsystems



Chilean Summit and Base Facilities







Telescope

- 6.5-m effective aperture
- 5 sec telescope slew and settle
- 6 filters: *ugrizy*

Camera

- 9.6 square degrees
- 2 sec read out time
- 2 sec shutter open/close

Auxiliary/Calibration Telescope

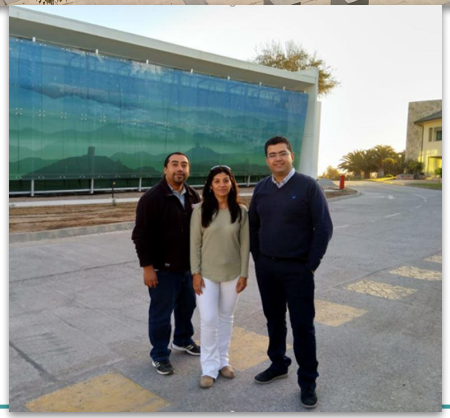
- 1.2-m telescope
- Spectrometer measures atmospheric transmission

Base Facility in La Serena

Rubin Observatory

The La Serena Recinto has been updated and is now a modern facility for all of NOIRLab. The new building includes:

- Office space
- Meeting rooms
- A remote control room for remote scientific and technical support of operations on the summit
- A computing facility housed in a 5,000+ square-foot shared computing center
- the Chilean Data Access Center (DAC) and a backup data archive of the entire LSST data set.



[Charge Questions: 2]

How the data moves

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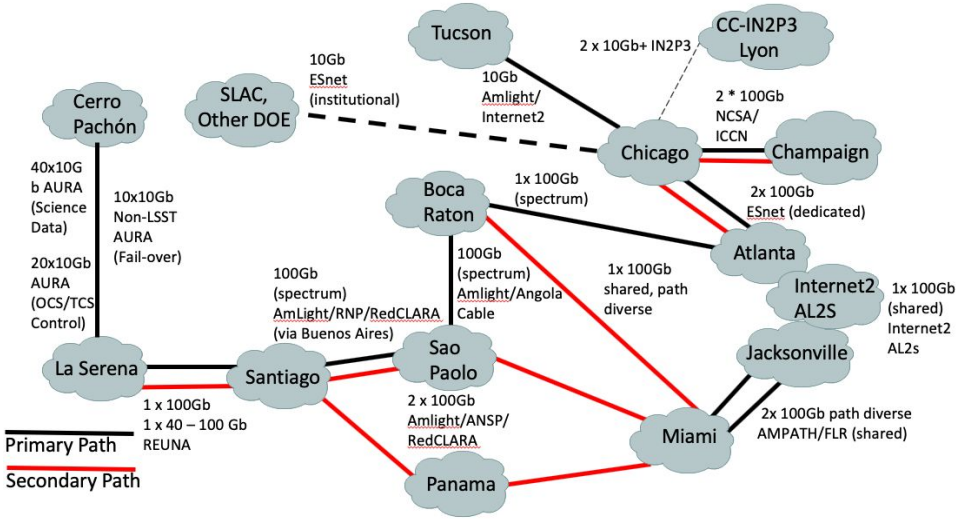
The wide area networks transfer data among the distributed observatory sites, and also provide connectivity to data centers.

- 100 Gb/s network capacity from summit to the US Data Facility with 100 Gb/s backup
- The system has redundancy and "diverse" paths in every link from Santiago to the USDF



network paths and capacities

Integrated teams retain expertise from construction throughout the operations plan

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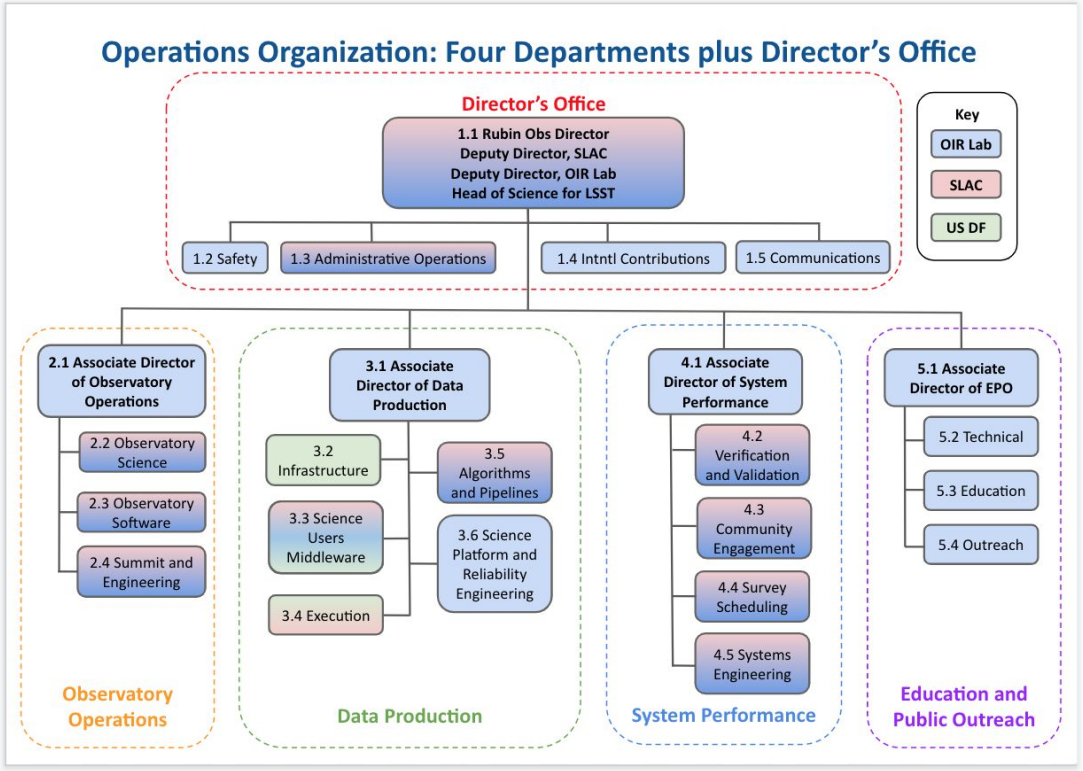
NOIRLab:

- Telescope & Site
- Sys Eng
- DM Science Platform
- Scheduling
- EPO

SLAC:

- LSSTCam
- DM Middleware



[Charge Question: 4a]

The US Data Facility will be connected with other, international DFs within Data Production

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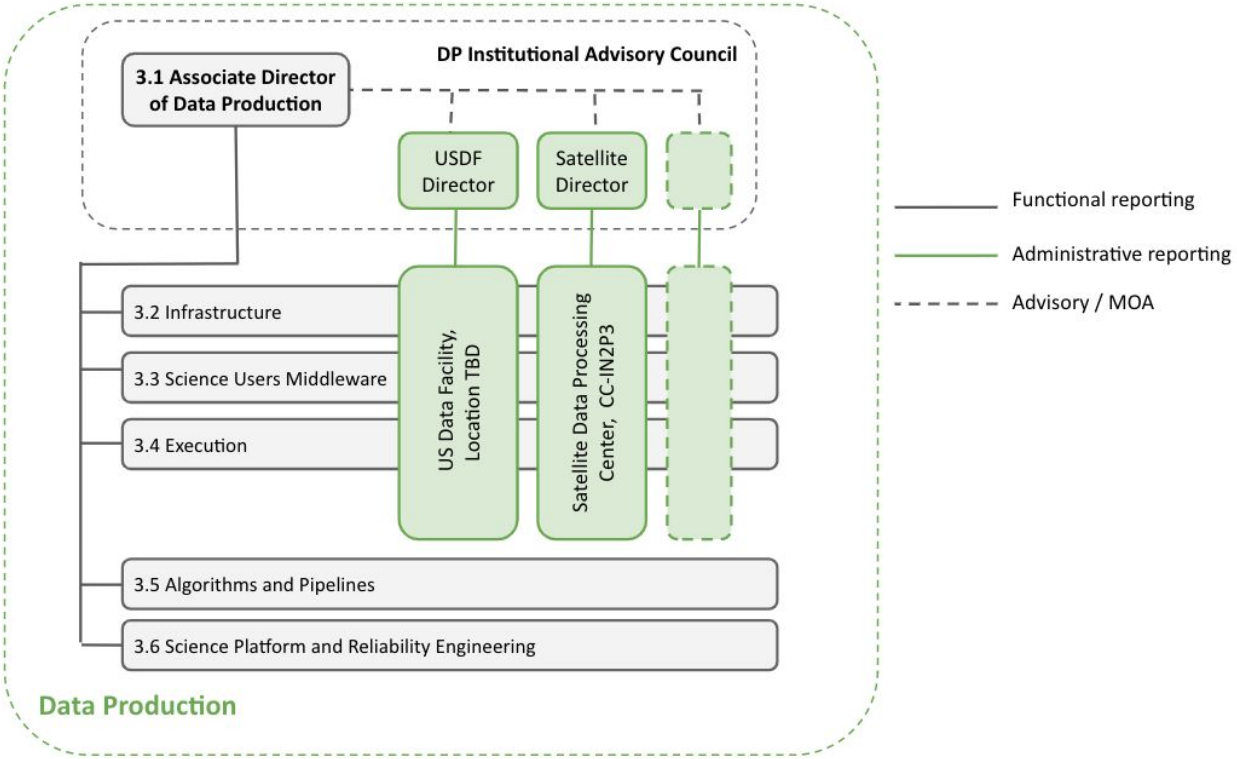
Multiple data facilities in one integrated Data Production dept.

Satellite Data Processing Center at CC-IN2P3 will do 50% of annual DRP

We are exploring a UK DF taking on up to 25% of DRP with associated cost offsets (few $M per year), while planning against a US+France only baseline.



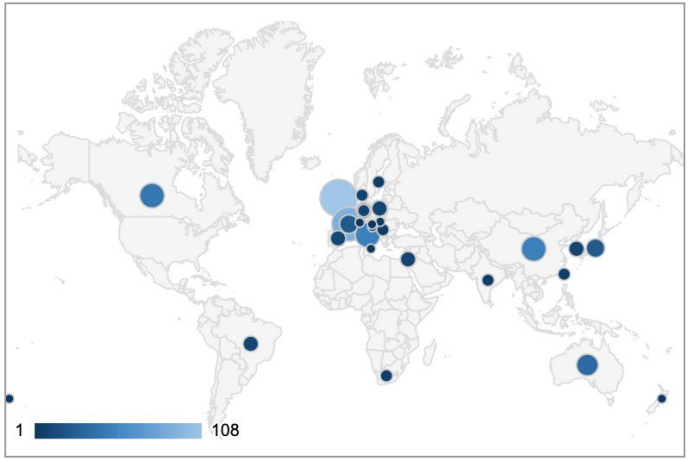
[Charge Question: 4b]

An international program of in-kind contributions will add value while offsetting some operations costs

Rubin Observatory

41 international (non-US and Chile) groups are seeking data rights for 580 PIs in return for in-kind contributions to Rubin and LSST:

- follow-up time, complementary datasets, science infrastructure, observatory (and commissioning) enhancements, some operations cost offsets (UK)
- $170M equivalent value, but only a few $M per year in ops cost offsets. *The in-kind program will primarily boost US LSST science*



- Community-centered Contribution Evaluation Committee established and evaluating proposed contributions through FY20
- International Program Coordinators within Director's Office to help track
- Agency-level Resource Board to oversee program, solve problems together

[Charge Question: 4b]

Operations Team on Track

Rubin Observatory

- Identifying staff, including leadership
- Operations Objectives understood
- Robust preliminary plan in hand that can be improved in 2.5 (or more) years left
- In-kind contribution process launched
- Challenges being addressed