

Rubin Observatory Status

Bob Blum

Director of Operations (Acting), NSF's NOIRLab



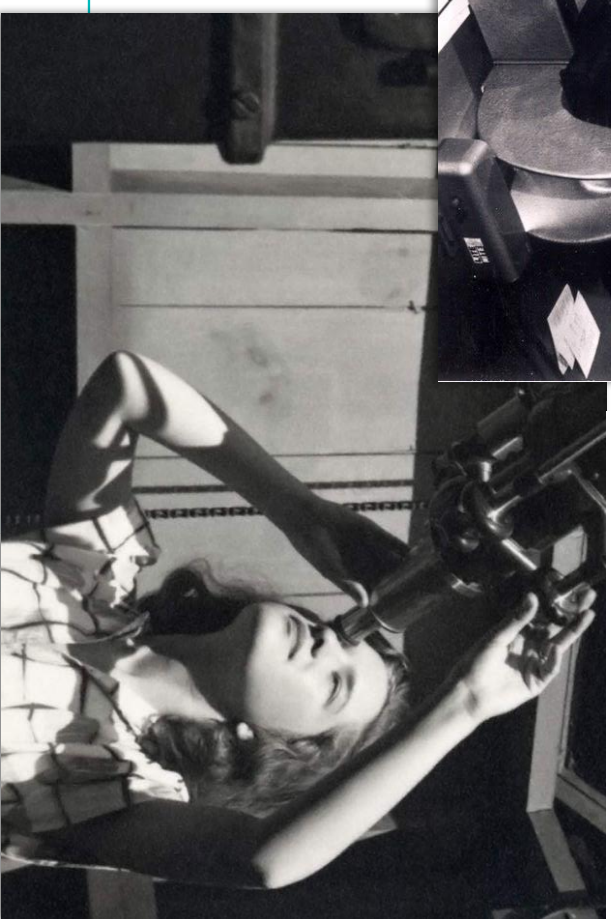
Vera Rubin Brought Dark Matter to Light

Made essential contributions that influenced the entire science community and our study of dark matter

Used state-of-the-art technology in new ways to answer exciting scientific questions

Advocated for women and more inclusivity in science

To honor her legacy, please use Rubín Observatory, not VRO



It's been an interesting year ...

As for nearly everything else in the world, the Covid-19 pandemic has had a major impact on the Rubin Observatory construction project, and so then on operations planning.

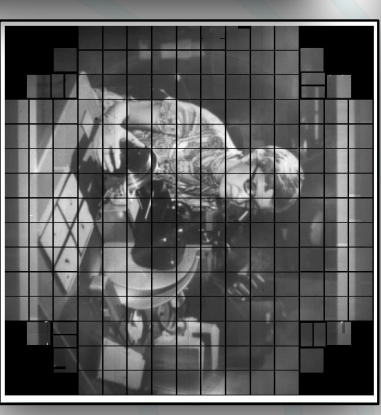
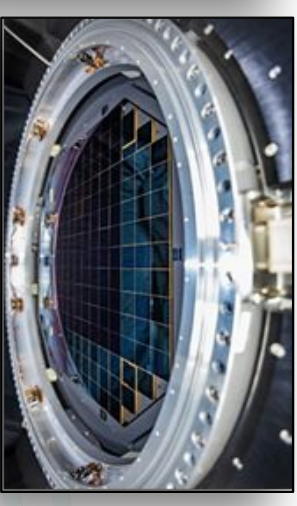
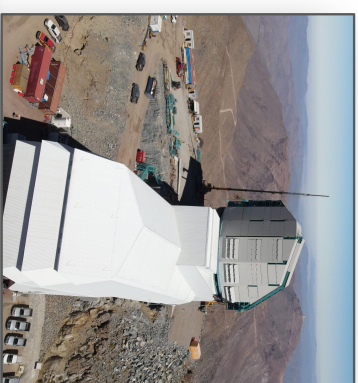
We were forced to suspend all activity on the summit facility in Chile in mid-March (2020). Our prime contractors engaged in assembling the dome and telescope mount assembly went home (to Europe in both cases), and getting them back into Chile has been one of the major challenges we have faced in the ensuing months.

Work at SLAC National Accelerator Laboratory on the camera was also impacted. The Lab shut down nearly completely from March until May, and has allowed only a limited number of essential personnel back on site ever since.

Vera C. Rubin Observatory

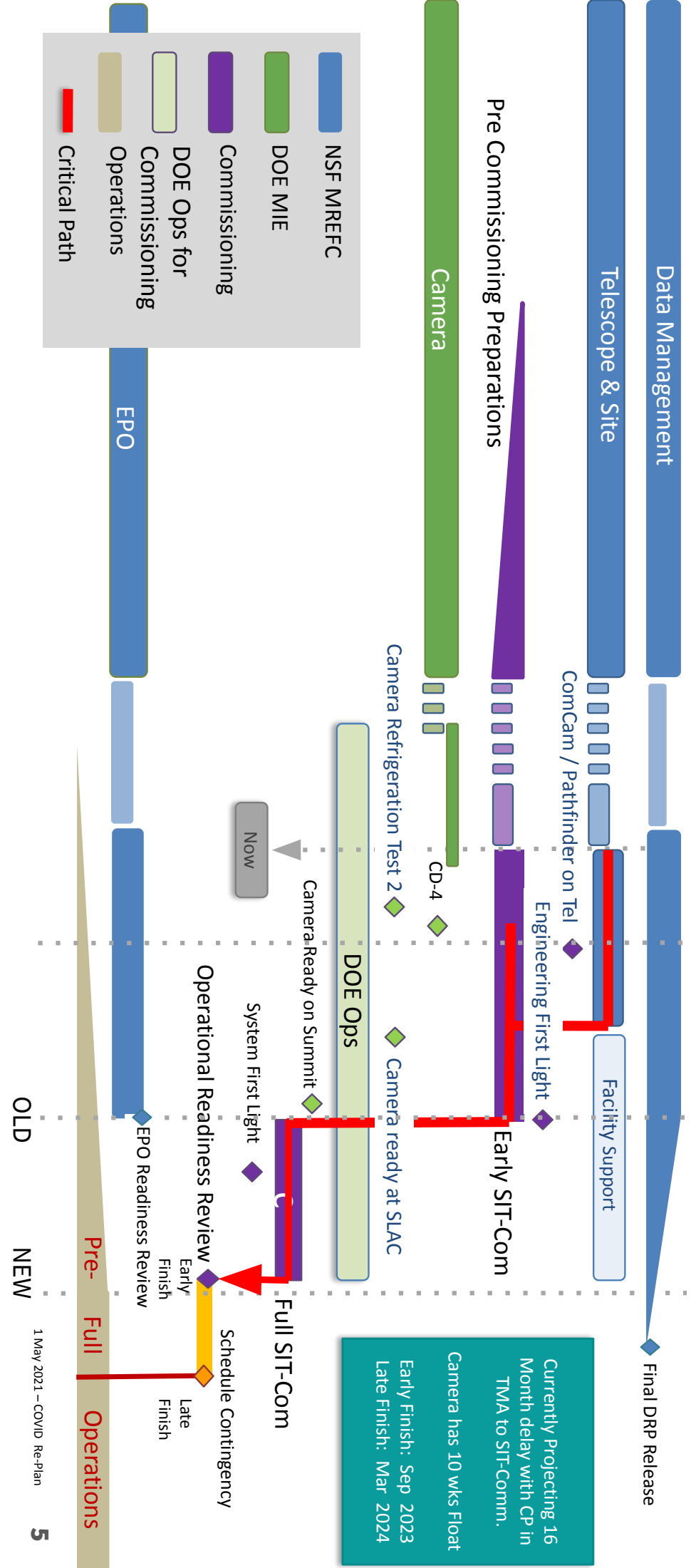
Current First light and Survey Schedule

- Engineering First Light ~ late 2022
- LSSTCam first light ~ First half 2023
- Rubin Operations is planning for full survey operations **not earlier than** October 1, 2023
- Execute 10 year Legacy Survey of Space and Time: 2024 - 2033



Current Schedule

	CY2017				CY2018				CY2019				CY2020				CY2021				CY2022				CY2023				CY2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
FY2017																																
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	

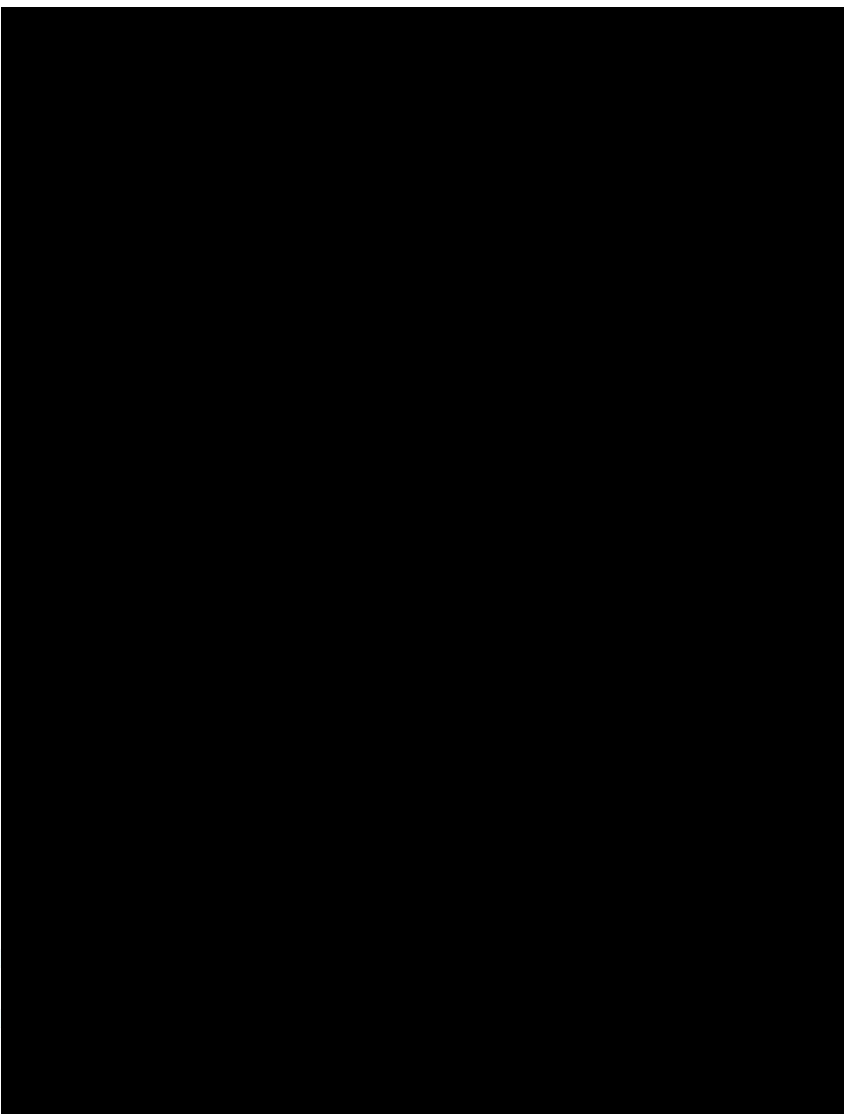


Currently Projecting 16 Month delay with CP in TMA to SIT-Comm.
 Camera has 10 wks Float
 Early Finish: Sep 2023
 Late Finish: Mar 2024

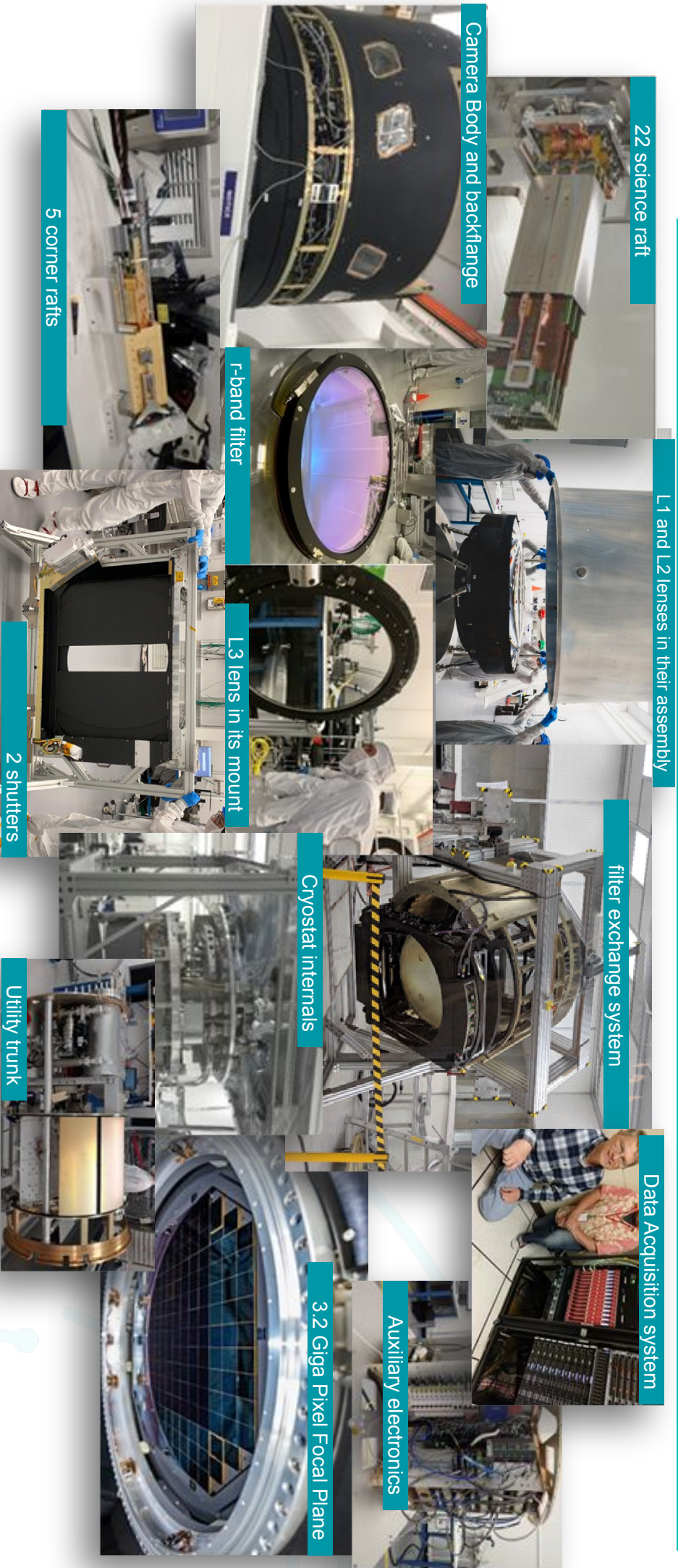
Telescope and Site Progress



Telescope Mount Top End Assembly

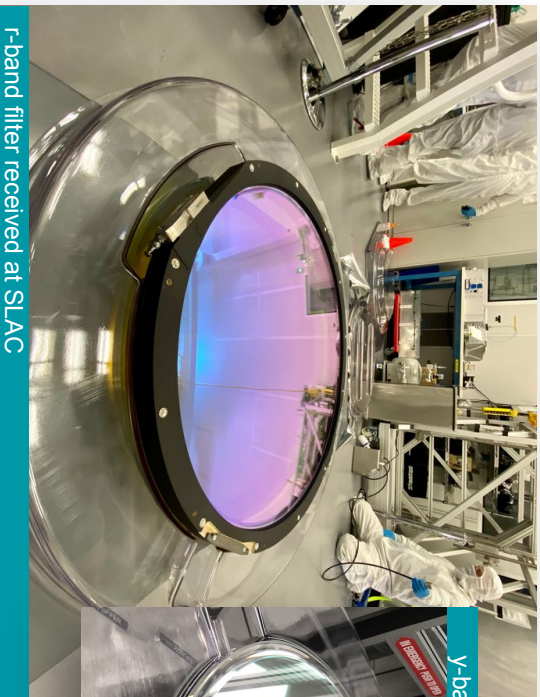


All Camera hardware has been fabricated at the sub-system level except for some of the filters



Filter Progress (MIE)

Filter	Coarse Grinding	Fine Grinding	Polishing	Finishing	Coating	Coating Metrology	Mounting Frame	in Delivery
r	Done	Done	Done	Done	Done	Completed	Completed	Completed
i	Done	Done	Done	Done	Done	Completed	Completed	Completed
z	Done	Done	Done	Done	Done	Completed	Completed	Completed
y	Done	Done	Done	Done	Done	Completed	Completed	Completed
g	Done	Done	Done	Done	Done	1st Surface Complete		
u	Done	Done	Done	Done	Done	Pending		



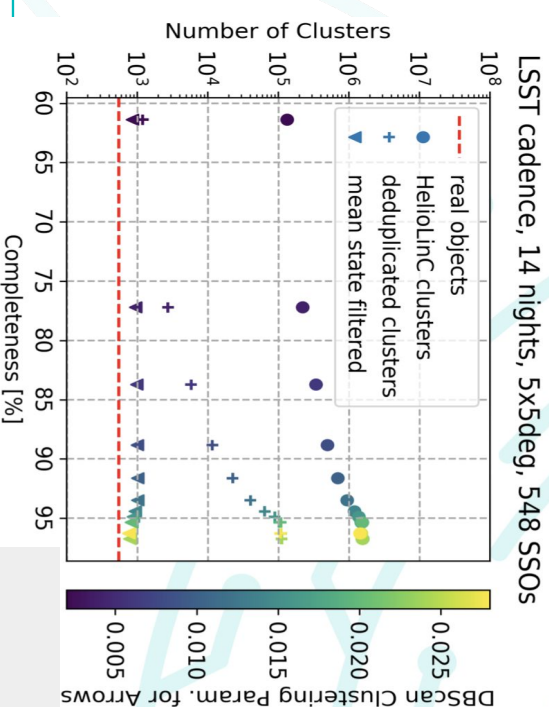
- **Progress:**
 - 4 filters have now been fully coated and have been accepted from the vendors.
 - r-band filter has been assembled accepted and delivered to SLAC in March 2021. z and i-band have been assembled and are ready to ship.
 - g-band filter first surface coated
- **Remaining Work**
 - On track to complete delivery of all filters to SLAC by end of May 2021.
- **Remaining risks**
 - Schedule time to complete the sensitive u-band filter. No impact to broader project

DM Status

- Version 21.0.0 of the Science Pipelines was released.
- Crowded fields processing - how are we doing? - will be DMTN-171
- Minor planet center data exchange workshop mentioned last time see DMTN-180
- DMTN-049, Roadmap for serving photometric redshifts shared with the community ([workshops and call for LORs; see community.lsst.org](#))
- DRP pipelines Gen3 ready and should be verified by June (for DP0.2 freeze)

NCSA now ingests many streams of data with AuxTel back on sky: ComCam (Summit), SLAC BOT and CCS, NCSA Test Stand Auxtel and ComCam.

Prototype linking algorithm
 Heliolinc2 now reaching 95% completeness for solar system objects.



SITCOM Site View of Integration Status

Chile:

- ComCam + PathFinder at functioning at Level-3
- Camera Cart Assembly testing Hexapod/Rotator & CCW
- Mirror Systems verification tests of M1M3 and M2
- Commissioning Computing Cluster HW installed
- Engineering & Facilities Database operational and recoding data for verification analysis
- Command script processing
- AuxTel (addressing technical issues)

Tucson

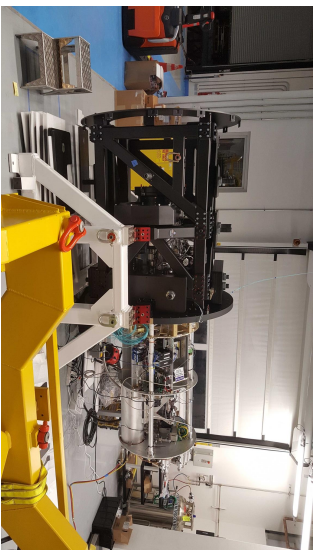
- Software test stand (needed before NCSA move)
- Calibration integration

SLAC

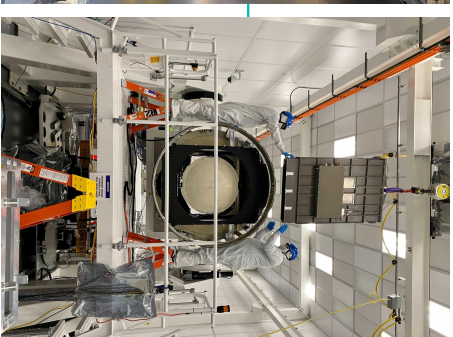
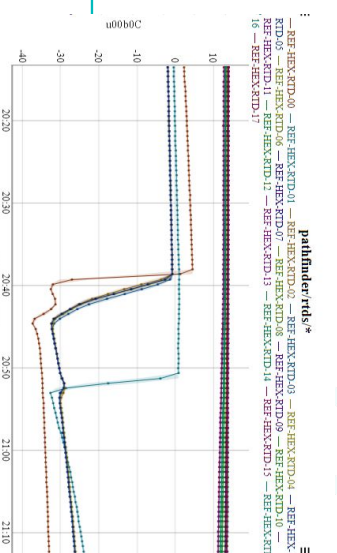
- LSSTCam I&T (presentations presented at this meeting)
- Shipping verification test (currently delayed)

NCSA

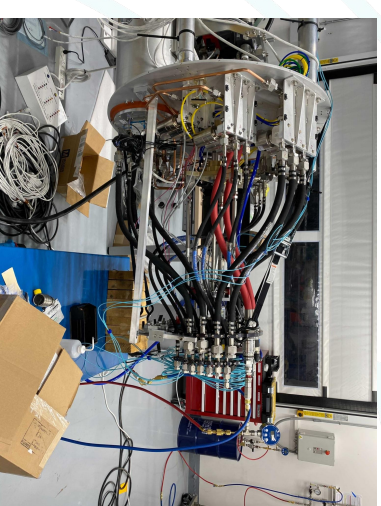
- System software test stand (will eventually be moved to Chile)
- Gen-3 Butler
- Rubin Science Platform
- Engineering & Facilities database mirror



Comcam + refrigeration PathFinder integrated at Level-3 - ComCam running in stable state for past few months

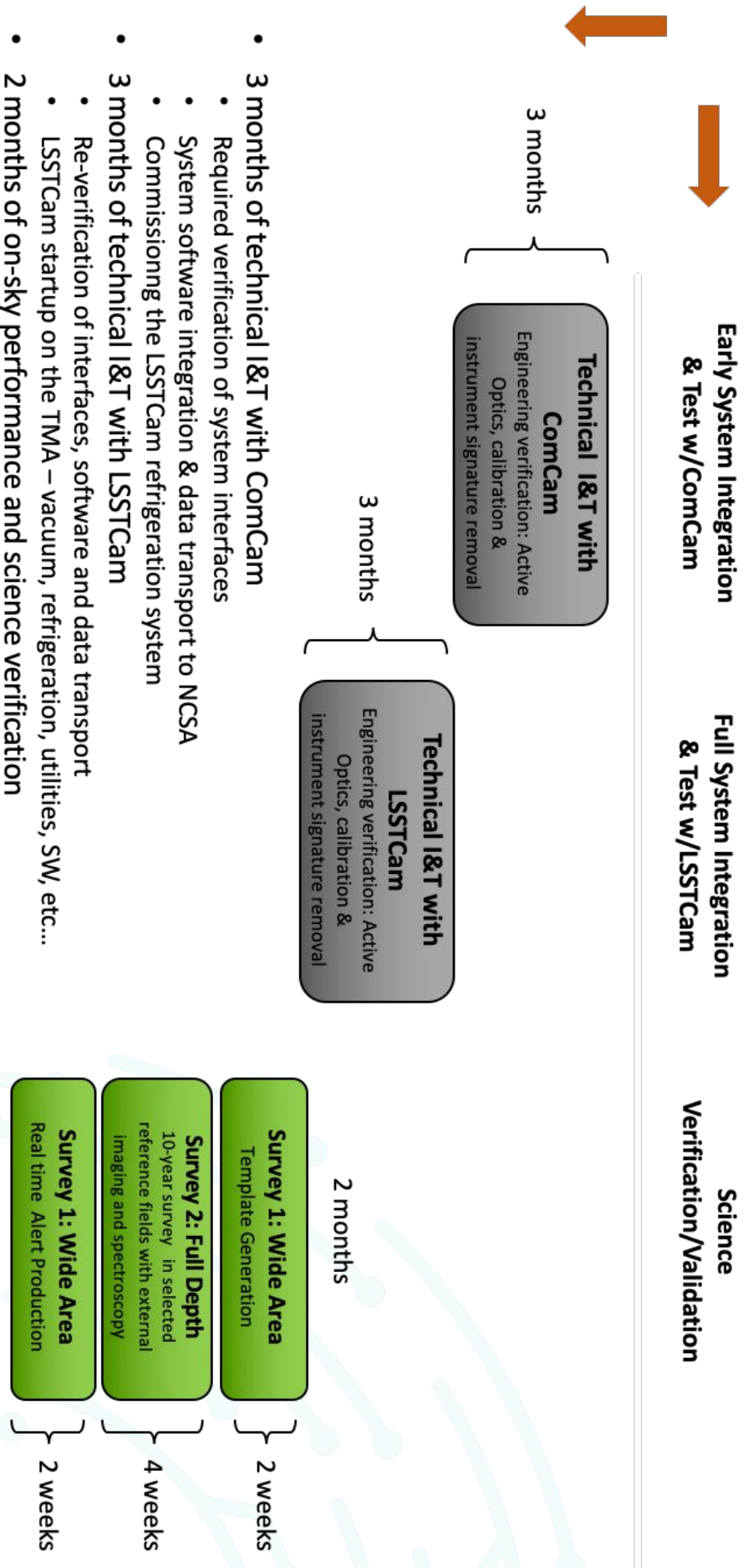


LSSTCam shipping test preparations (left, center) and filter exchange procedure test (right)












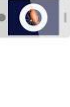


PathFinder plumbed and ready at Level-3 - Cold system turned on this week for functionality test - <-30C achieve in ~2min - next up heat load testing

Commissioning Time On-Sky: No Change in Plan



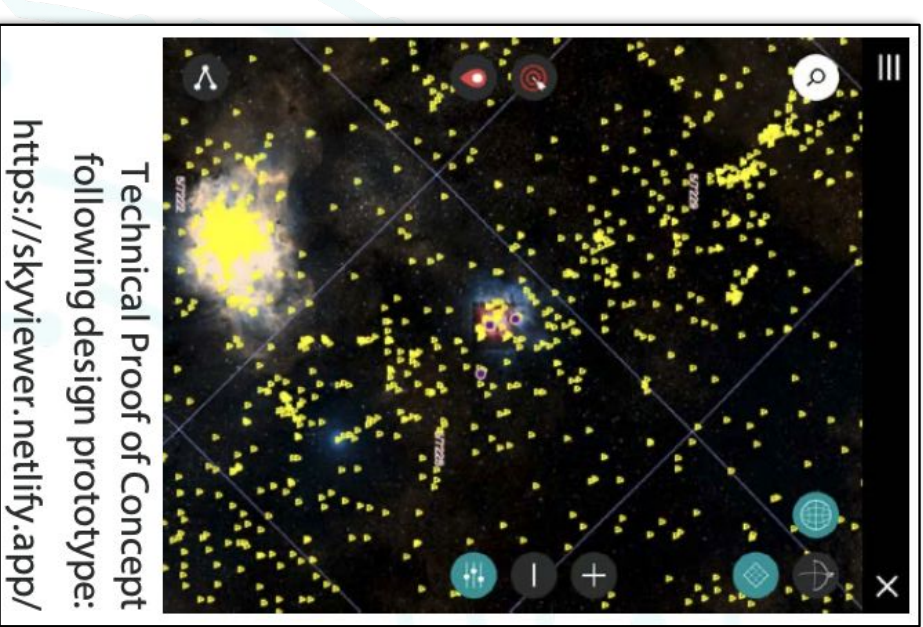
EPO is building a program directly connected to Rubin data

Rubin Observatory Education and Public Outreach Deliverables

Formal Educators (Middle & high school, college intro)	Science-Interested General Public	Citizen Science Principal Investigators	Informal Science Centers
 <p>Free data-driven online investigations</p>	 <p>Dedicated website in Spanish and English</p>	 <p>Opportunities to initiate CS projects through the Rubin Science Platform</p>	 <p>Alert Stream highlights</p>
 <p>Educator support materials</p>	 <p>Science news highlights via traditional and social media</p>	 <p>Promotion of CS projects on the Rubin Observatory website</p>	 <p>Free multimedia gallery</p>
 <p>Professional development</p>	 <p>Interactive visualization tools</p>	 <p>Principal Investigator support</p>	 <p>Planetarium video clips</p>

EPO will finish on time and move into ops in 2023

- Team continues to make excellent progress in difficult conditions
- Back-end developer and Content Strategist recently hired and making great progress with final deliverables
- Visual identity is supporting the details for final efforts
- Some technical challenges remain but team is well positioned to succeed and validate all deliverables in FY22.
- Start of EPO Operations in FY23 within NOIRLab Communications, Education, and Engagement team.



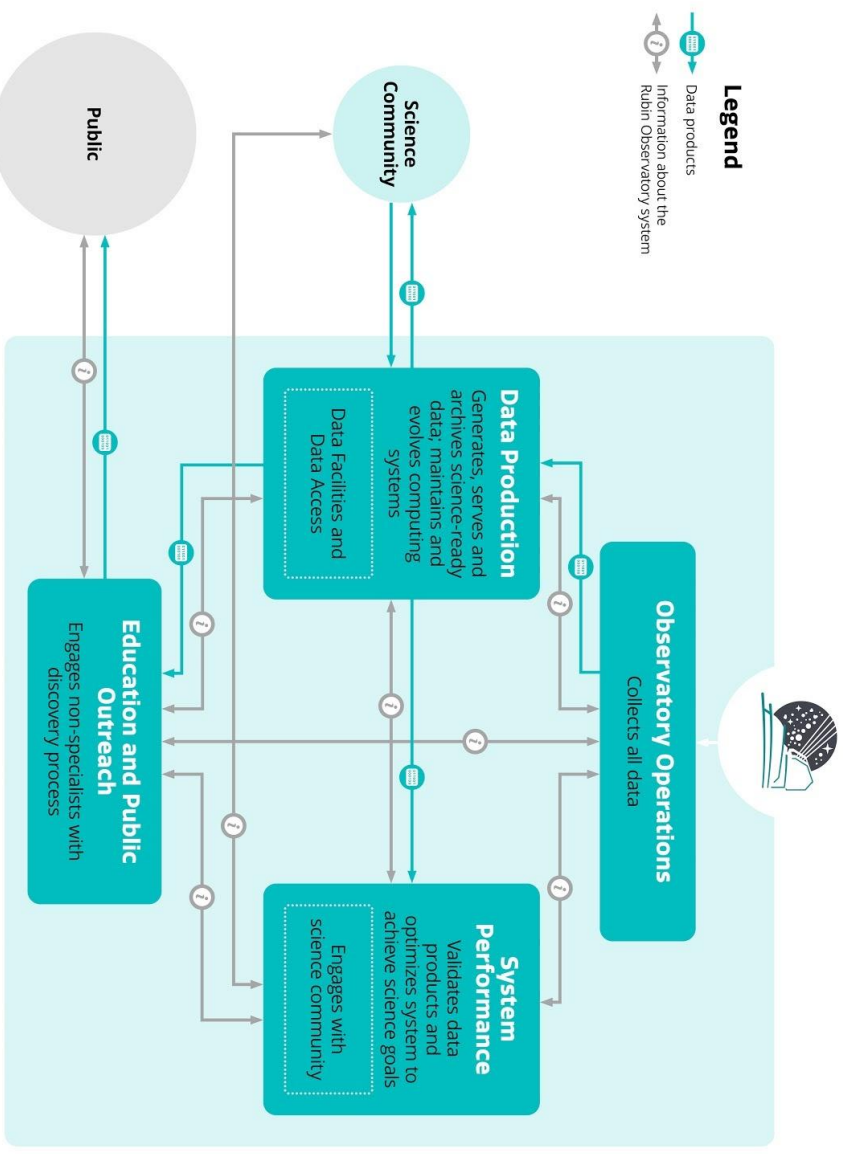
Operations is happening now

- Operations Planning
- Community Engagement
- Data Preview 0 (DP0) coming
- Cadence Studies Ongoing with the Community
- In kind program advancing



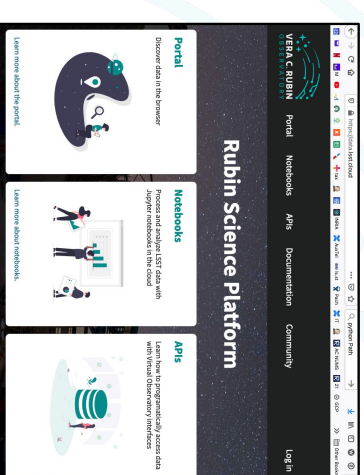
Pre Operations in 2021

- Pre Operations is active
- Planning for Operations for Legacy Survey of Space and Time October 2023
- Full survey proposal and detailed plan for Operation this year (check in with us at AAS 239)
- Team ramping up, 100 people (40 FTE) this year at NOIRLab, SLAC, UW, Princeton, NCSA, BNL, FNAL ...
- Data Preview for the community



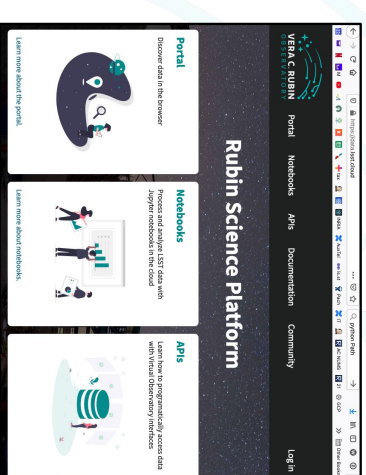
Operations Status

- 5 year proposal for Rubin (NSF) funding in full development.
 - FY23, FY24 - FY27 (last year pre ops and 4 years full survey operations)
 - Detailed plan reviewed in April 2020 being updated
 - Budget profile presented to agencies in March, holding to that. Total ask is ~ \$860M
 - Proposal due December 17, 2021. Joint Review of Rubin Plan plus NSF review of NOIRLab and all programs.
- FY22 - FY23 explicitly sync'd with MREFC. Planning for full start of operations October 1, 2023 (compare MREFC early finish late September 2023). Will adapt to Construction schedule as it happens.
- Data Preview 0 (DP0) this June in the Google Cloud IDF with Rubin Science Platform (see slides below, O'Mullane)!



Operations Status

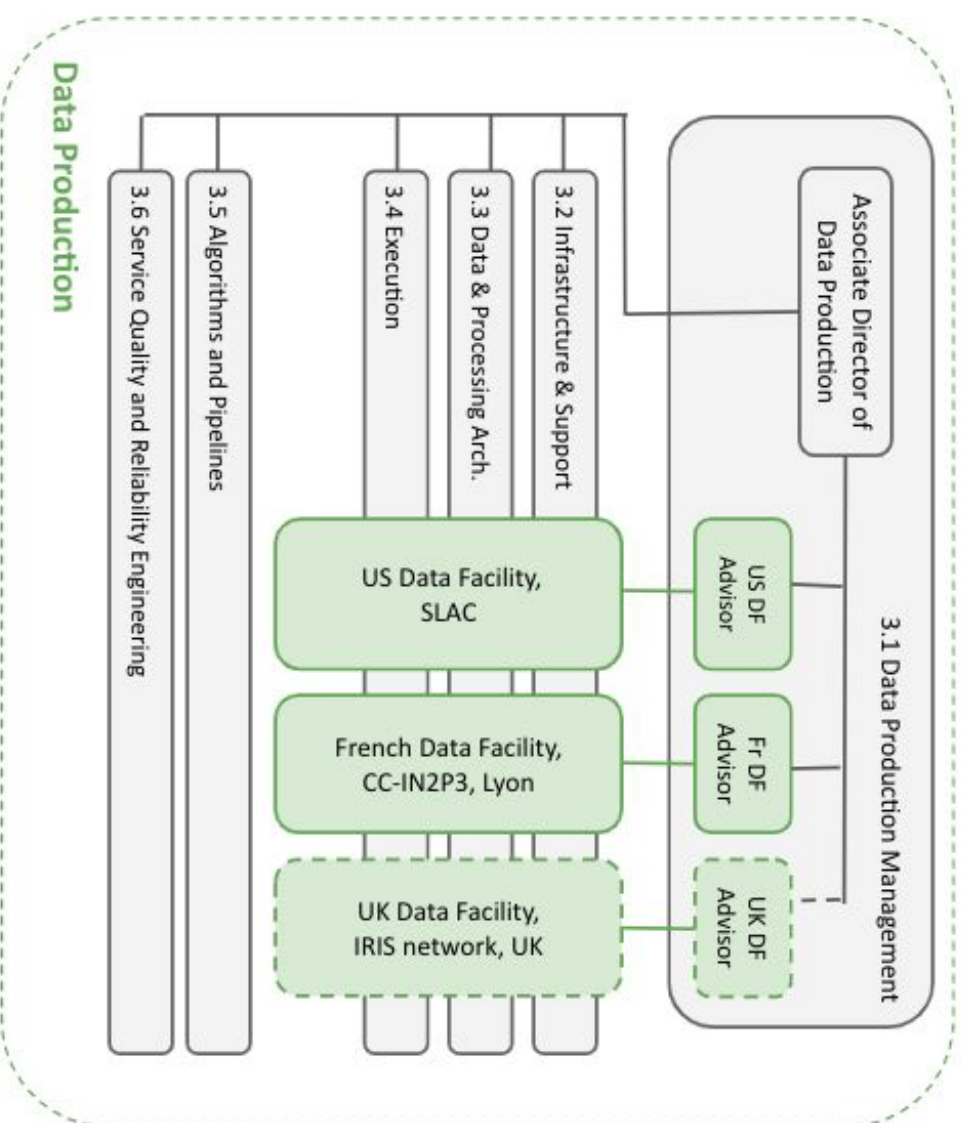
- In kind program well advanced. Awaiting approval of Rubin Management Board of Rubin Recommended Program.
- In kind includes:
 - UK Data Facility, alongside French DF (see slides below from Wil O’Mullane)
 - UK IDAC, as part of an international network of ~14 Independent Data Access Centers
 - Contributions of dedicated and directable effort, developing software and providing community support in Rubin teams and the LSST Science Collaborations
- Staff transition to Operations well in hand and on track.



Data Production as a Matrixed, International, Multi-center Department

Multiple data facilities

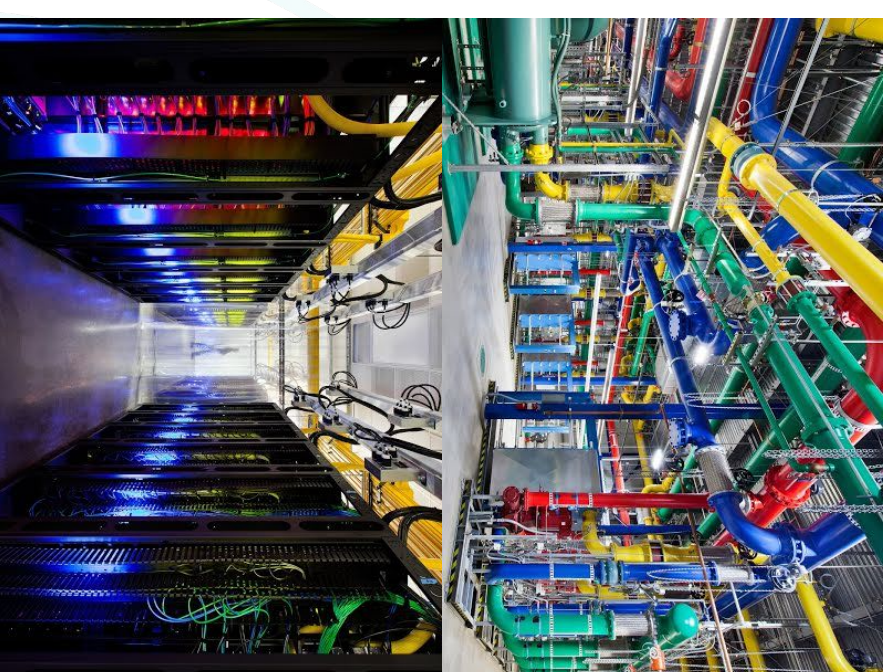
- United States Data Facility (USDF)
- French Data Facility at CC-IN2P3
 - 50% of data release processing
- UK Data Facility
 - 25% of data release processing
- Independent Data Access Centers (IDACs)
 - Most serve only a subset of data
- Cloud - based Interim Data Facility on Google (pre ops).



Interim Data Facility on Google Cloud

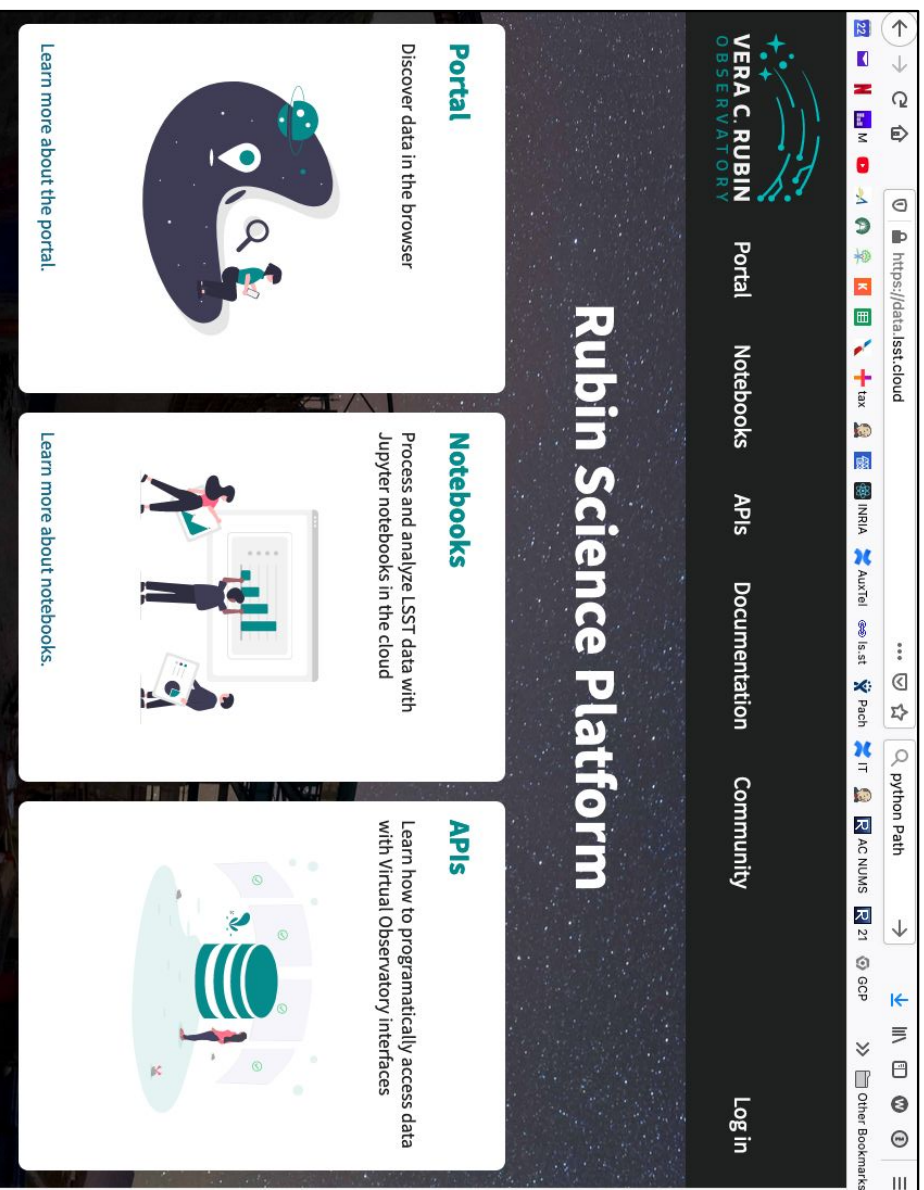


- To mitigate the risks of — and the delay imposed by — the USDF selection process, we have set up an Interim Data Facility (IDF).
- Cloud hosting seen as best option, on the basis of maximising flexibility and minimising investment in hardware and new staff.
- Cloud contract has been tendered, Google were selected as a provider for 3 years of service.
- We are migrating some existing services to GCP to support Data Previews



Slide: Hsin-Fang Chiang

Data Preview 0 (Melissa Graham talk next)



- Science platform is up as planned for internal use. (Due March) data.lsst.cloud
- Qserv is up and the DC2 catalogs are loaded. (Due April)
- PANDAs on IDF (for DP0.2 see also [RTN-013](#))
 - Have run 30K jobs (due April)
- Image access (Gen3 Butler) due in May but should be sooner.
- Data product documentation from CET (due June)
 - Underway dp0-1.lsst.io

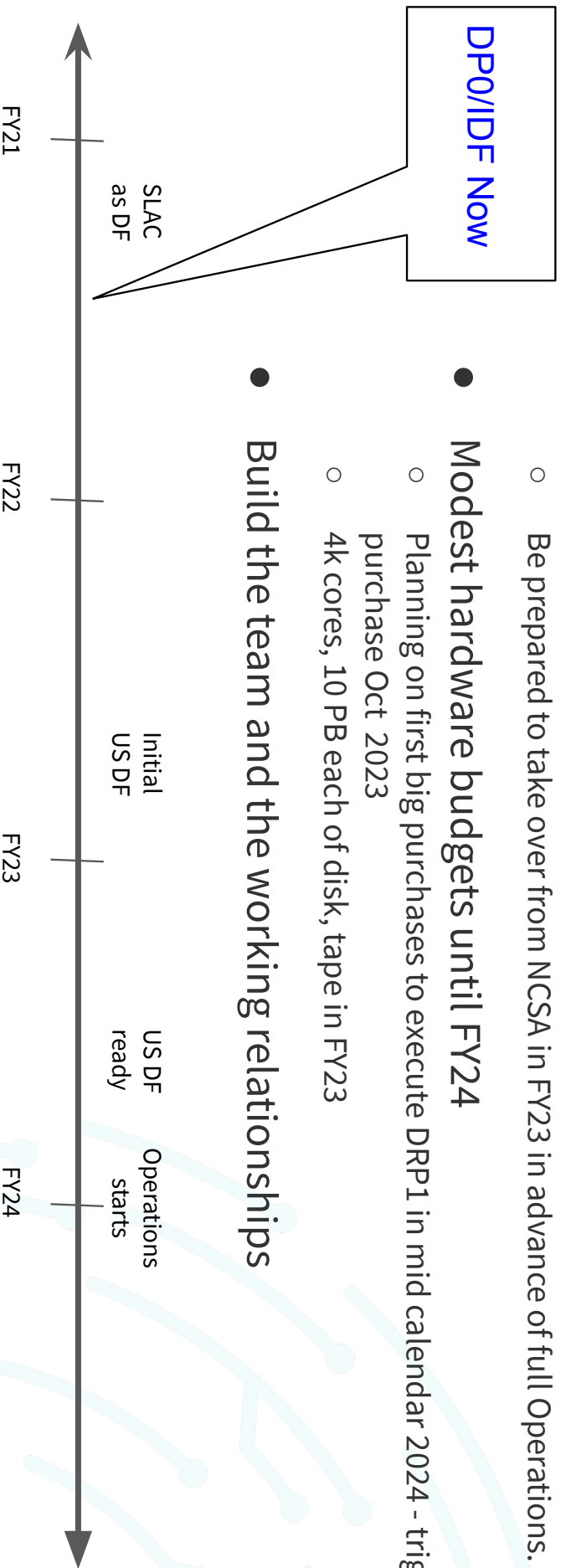
US Data Facility: it's SLAC!

- All prompt processing, 25% of data release processing, full archive, and data access services to the US and international community.
- To be in the SLAC Shared Science Data Facility (S3DF) at SLAC
- Cloud-based Interim Data Facility will be used for pre-ops activities.
- Working on transition plan (FY22 - FY23)
- FRDF and UKDF participating in discussions



Pre-Ops - Now through FY23

- US DF goals
 - Start ramping up now - be prepared to install initial services here in ~1 year
 - Parallel NCSA functions in FY22
 - Be prepared to take over from NCSA in FY23 in advance of full Operations.
- Modest hardware budgets until FY24
 - Planning on first big purchases to execute DRP1 in mid calendar 2024 - trigger purchase Oct 2023
 - 4k cores, 10 PB each of disk, tape in FY23
- Build the team and the working relationships



Slide: Richard Dubois

LSST Cadence Optimization

Cadence refers to how often fields are revisited, both within a given night and in between nights, for the Wide-Fast-Deep “Main Survey.” DDFs and other mini surveys have distinct cadences too, and all these are part of an integrated “survey strategy.”

2020: Formation of the LSST Survey Cadence Optimization Committee (SCOC), who is charged to recommend specific survey cadences to be adopted for commissioning, early science, and the 10-year survey.

[Apr 15, 2021 Deadline: Submit Cadence Notes to the SCOC.](#)

- SCOC requests input from the science community
 - primarily regarding 100+ new *Operations Simulation* (OpSim) runs and metrics
 - call for Cadence Notes: ls.st/doc-36755
 - Initial survey strategy December 2021
- 38 notes received**

Resources

Read: “Survey Strategy and Cadence Choices for the LSST”

ls.st/pstn-051

Read: The Survey Cadence Optimization Committee (SCOC)

ls.st/55y

Watch: The First SCOC-Science Collaborations Workshop (Dec 2020)
<https://ls.st/agenda1>

Participate: Write a Cadence Note for the SCOC.
ls.st/doc-36755

Summary

- Telescope and facility making progress. Next 6 months will be critical to staying on track with rebaseline (COVID is still the big unknown).
- Camera recent progress is encouraging and shows the camera is expected to exceed its performance requirements
- DM and EPO making good progress
- Operations plans and activities continue to advance including robust in kind program



End of presentation