# Objectives for the meeting

- Define the objectives of the LSST wrt cadence
- Start the discussion of how the LSST scheduling algorithms and challenges map to the techniques adopted by other fields
- Understand which approaches might be adopted by the LSST, and to learn the best practices for developing, testing and optimizing a scheduler

# LSST in a nutshell

- The LSST will be a large, wide-field, ground-based optical/near-IR survey of half the sky in ugrizy bands to r~27.5 based on 1000 visits over a 10-year period

- Alerts of detected changes on the night sky will be published within 60 sec of the observation as the survey progresses

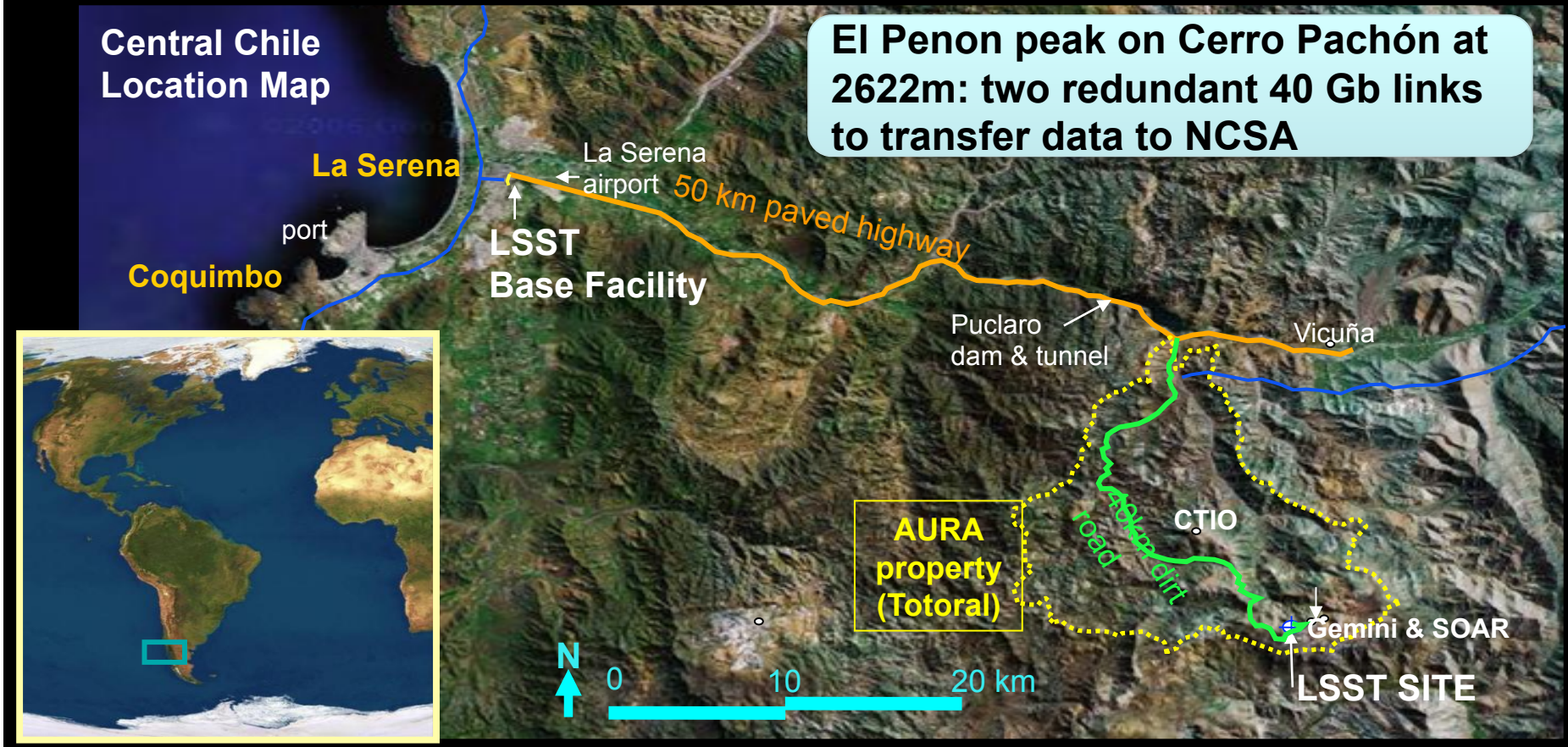
- LSST will enable a wide variety of complementary scientific investigations: from searches for small bodies in the solar system, to precision astrometry of the Galaxy, to systematic measures of cosmology using gravitational weak lensing.

- Much of the science of the LSST will be *systematics* limited

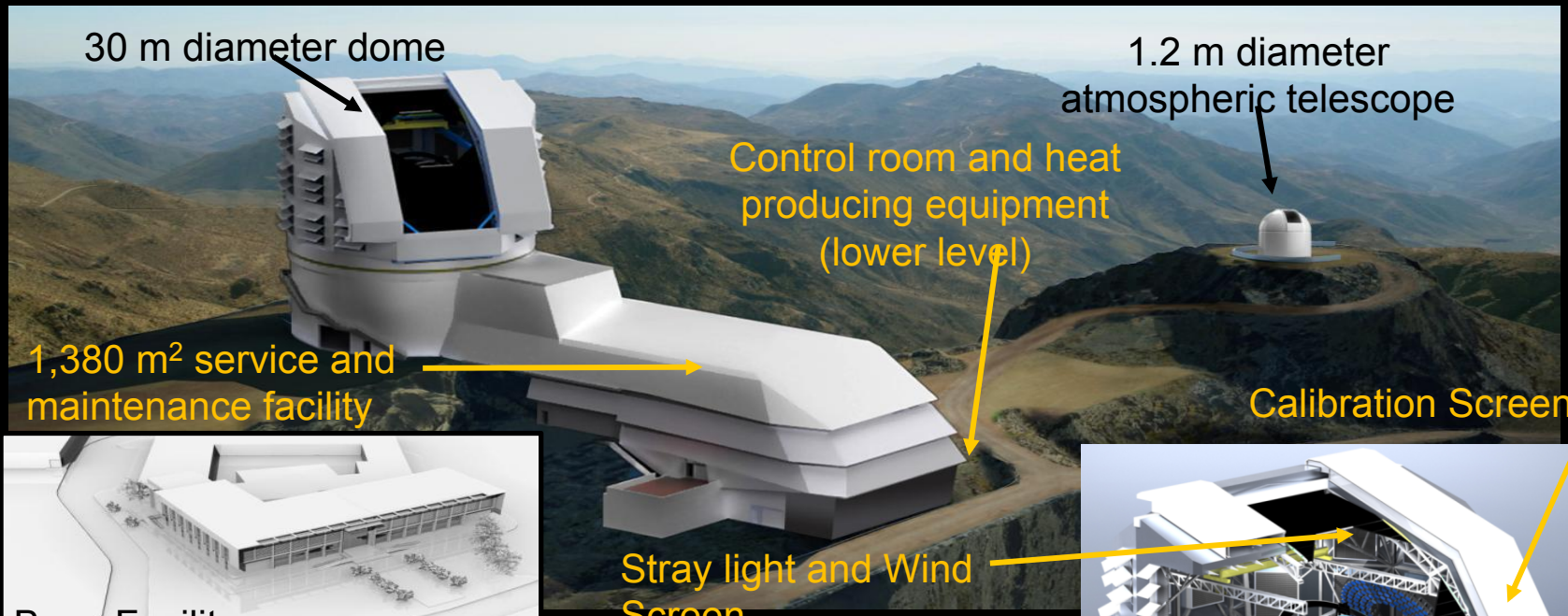
# Summary of high level requirements

| Survey Property | Performance |
|---|---|
| Main Survey Area | 18000 sq. deg. |
| Total visits per sky patch | 825 |
| Filter set | 6 filters (ugrizy) from 320 to 1050nm |
| Single visit | 2 x 15 second exposures |
| Single Visit Limiting Magnitude | u = 23.9; g = 25.0; r = 24.7; I = 24.0; z = 23.3; y = 22.1 |
| Photometric calibration | < 2% absolute, < 0.5% repeatability & colors |
| Median delivered image quality | ~ 0.7 arcsec. FWHM |
| Transient processing latency | < 60 sec after last visit exposure |
| Data release | Full reprocessing of survey data annually |

# The LSST Site and Base Facilities

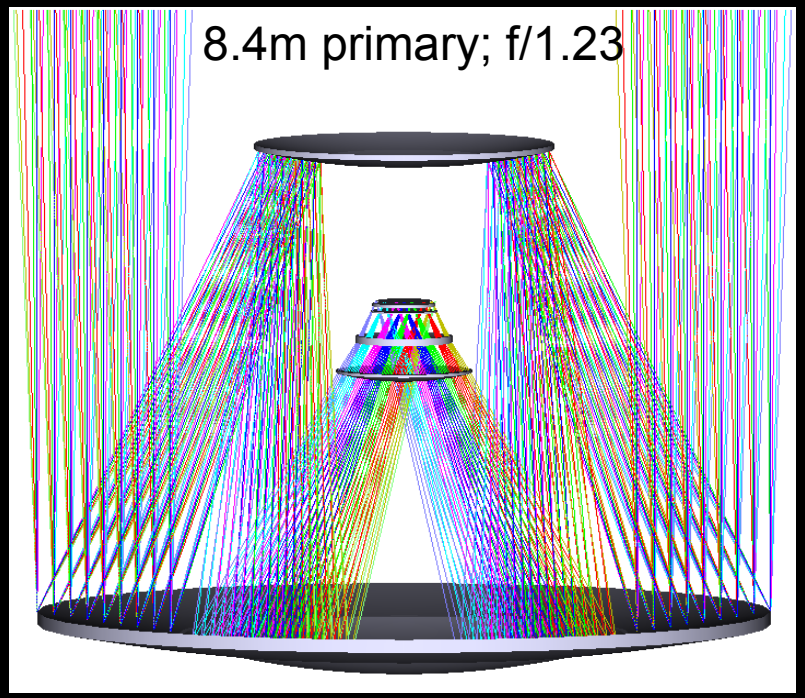


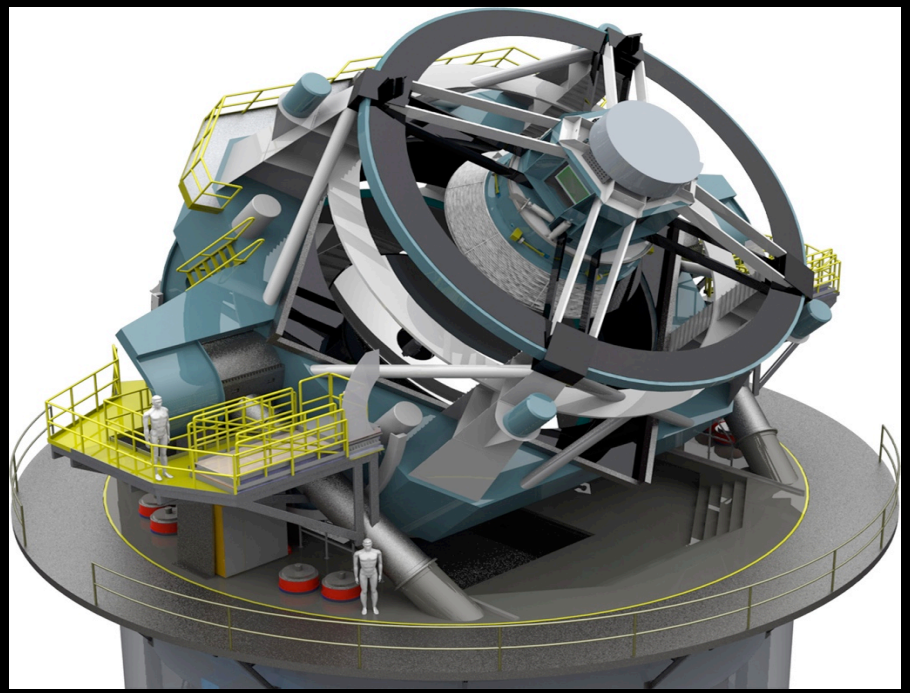
# 8.4m survey and 1.2m atmospheric telescope




Facilities, and hardware to collect the light, control the survey, calibrate conditions, and support all LSST summit and base operations.

# Optical design of the LSST

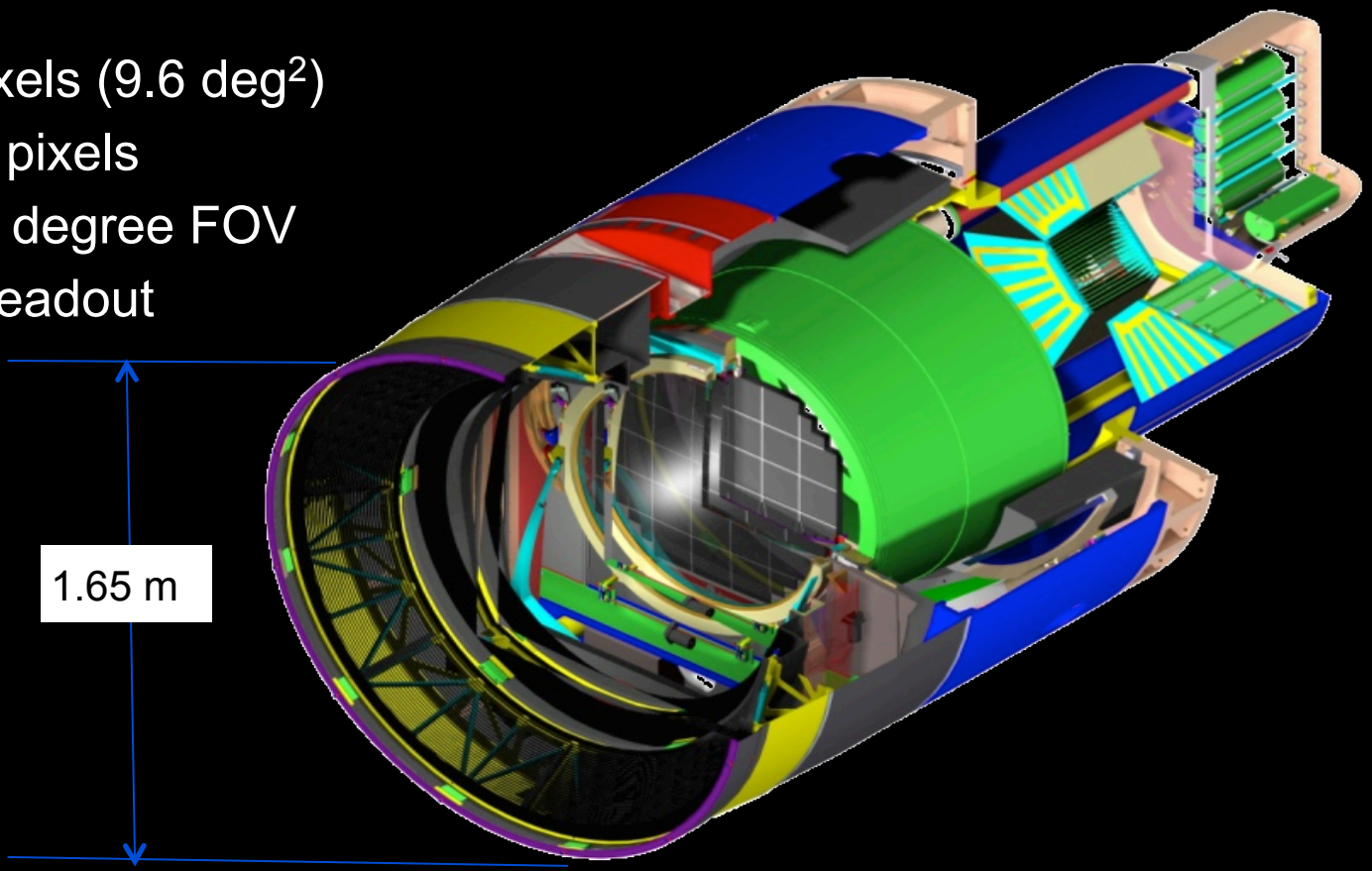


350 tons (60 tons optical system).Three-mirror design (modified Paul-Baker system) delivering 0.35 arcsec or better from the optical system and an etendue of 319 $m^2$ $deg^2$

# LSST camera: A 3.2 Gigapixel camera

- 3.2 Gigapixels (9.6 deg$^2$)
- 0.2 arcsec pixels
- 9.6 square degree FOV
- 2 second readout
- 6 filters

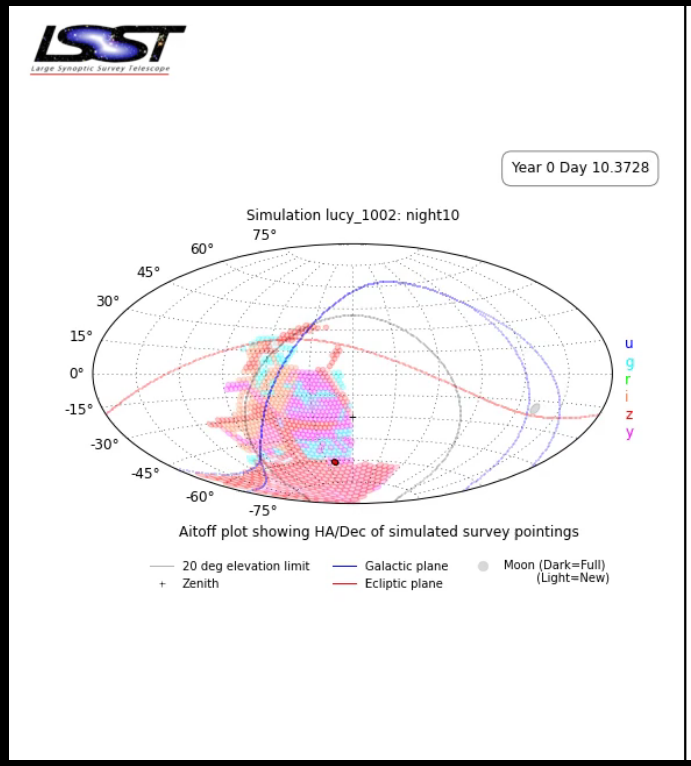


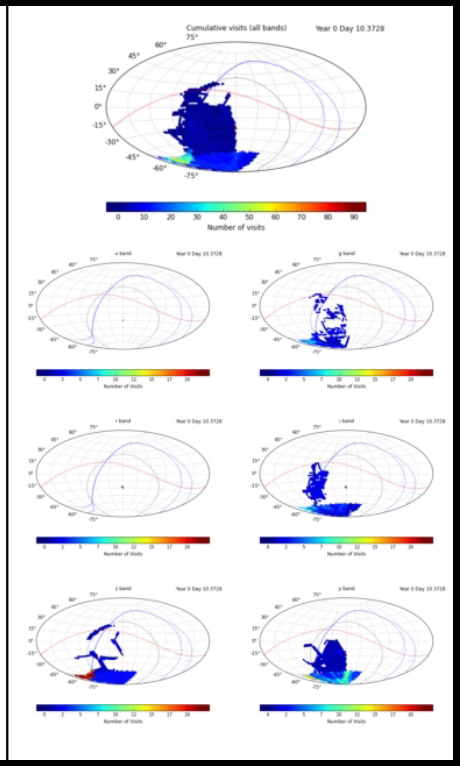
# Science goals of the LSST

- **Constrain dark energy and dark matter**
- **Mapping the Milky Way and Local Volume**
- **Exploring the Transient Sky**
- **Inventorying the Solar Systems**

The techniques associated with these four themes stress the system design in complementary ways. By designing the system to to accomplish these specific goals we ensure that LSST will in fact enable a very broad range of science.

# Observing the sky




1 visit every 39 seconds
~6s slew and settle time

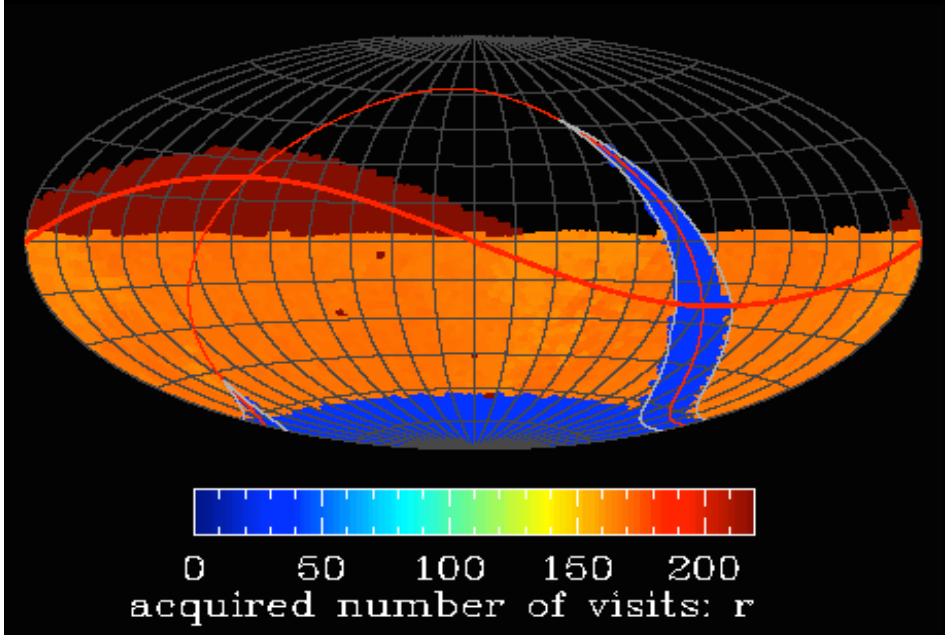
Revisit after 15-60 minutes

Visit pairs every 2-3 nights

~2.75x$10^6$ visits in 10 years
(~1000 per night)

Lynne Jones 2015

# LSST footprint (825 visits per field)




**Total Visits per unit area and Visits per filter (Main survey)**

| | u | g | r | i | z | y |
|---|---|---|---|---|---|---|
| **Nb Visit** | 56 | 80 | 184 | 184 | 160 | 160 |
| **1 visit mag** | 23.9 | 25.0 | 24.7 | 24.0 | 23.3 | 22.1 |
| **10 year** | 26.1 | 27.4 | 27.5 | 26.8 | 26.1 | 24.9 |

90% of survey is 18,000 sq degree main survey
10% of survey is NES, SCP, Galactic plane, ***deep drilling fields***, others

# LSST data volume and scientific yields

- Two 6.4-gigabyte images (one visit) every 39 seconds (15TB per night)
- ~1000 visits each night, ~300 nights a year
- Up to 450 calibration exposures per day

Raw Data

- Can detect >10 million real time events per night, for 10 years
- Changes detected, transmitted, within 60 seconds of the observation

Level 1

- Observe ~38 billion objects (24B galaxies, 14B stars)
- Collect ~5 trillion observations (“sources”) and ~32 trillion measurements (“forced sources”) in a 20 PB catalog

Level 2

- User databases and workspaces (“mydb”)
- Making the LSST software available to end-users
- Feeding the data back to the community

Level 3

# Construction and commissioning of LSST