LSST Scheduler Workshop
Introduction and Goals

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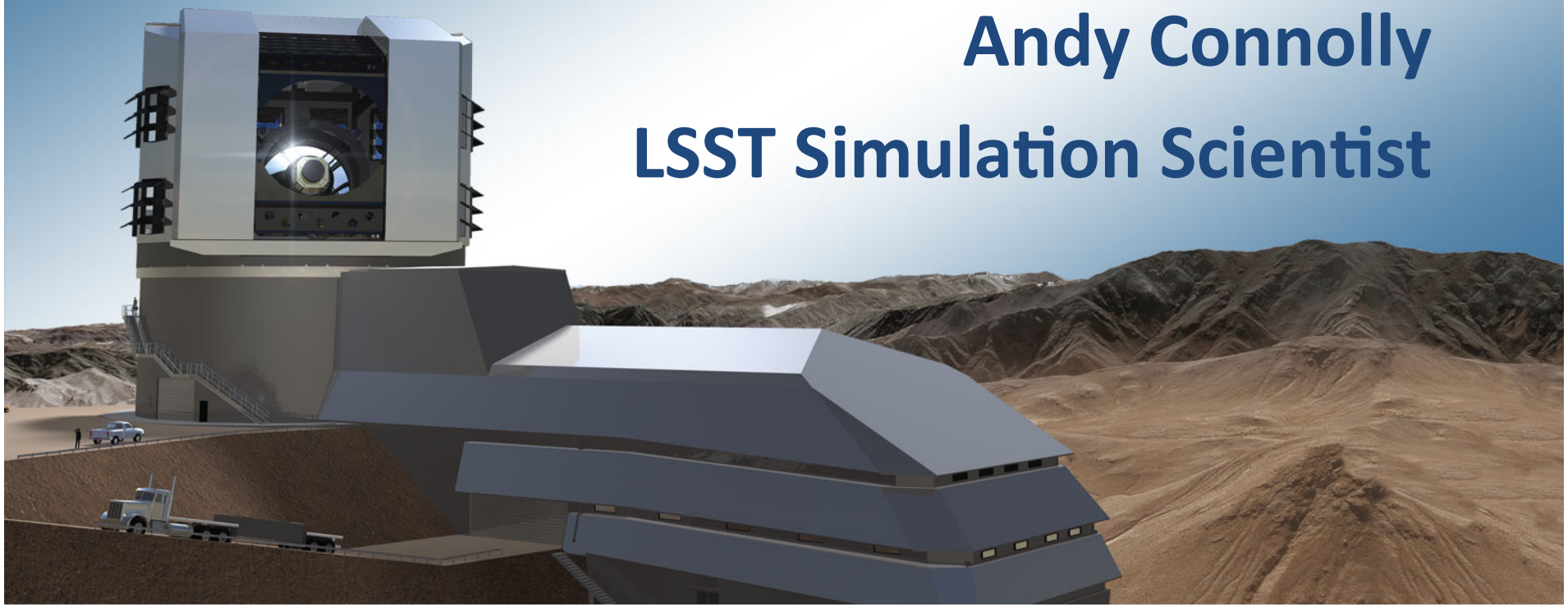


Why cadence matters?

- The LSST supports a broad range of science objectives
- Many of these science objectives are driven by how we sample the sky (e.g. SN light curves, proper motion accuracy)
- Cadence is set by these competing science proposals, sky brightness, weather, engineering performance, visibility of the survey fields
- Optimization of such a survey is an open and active areas for research

Objectives for the meeting

- Describe the parameters and metrics that will drive the cadence of the LSST observations
- Understand how the LSST scheduling algorithms and requirements map to techniques adopted by other fields and what might be adopted by the LSST
- To learn the best practices for developing, testing and optimizing a scheduler

This represents the start of the discussion

Agenda

- Wednesday 18th March
  - Introduction, Objectives and Overview of LSST (Connolly)
  - LSST science requirements related to scheduler development (Ivezic)
  - Analysis tools and metrics for the scheduler (Jones)
  - The LSST scheduler algorithms (Delgado)
  - The Operations Simulator performance and status (Cook)
  - Lessons learned from scheduler development at Las Cumbras (Saunders)
  - Lessons learned from scheduler development for JWST (Giuliano)
  - Optimization in operations research (Vanderbei)

Agenda

- Thursday 19th March
  - **Scheduling algorithms and going beyond a simple greedy approach (discussion led by Delgado)**
  - Required input data for the scheduler (discussion led by Reuter)
  - **Development and assessment of metrics and grammars for a variety of science proposals (discussion led by Jones**)
  - Optimizing a single cost function: is this realistic for the LSST (discussion led by Ivezic)

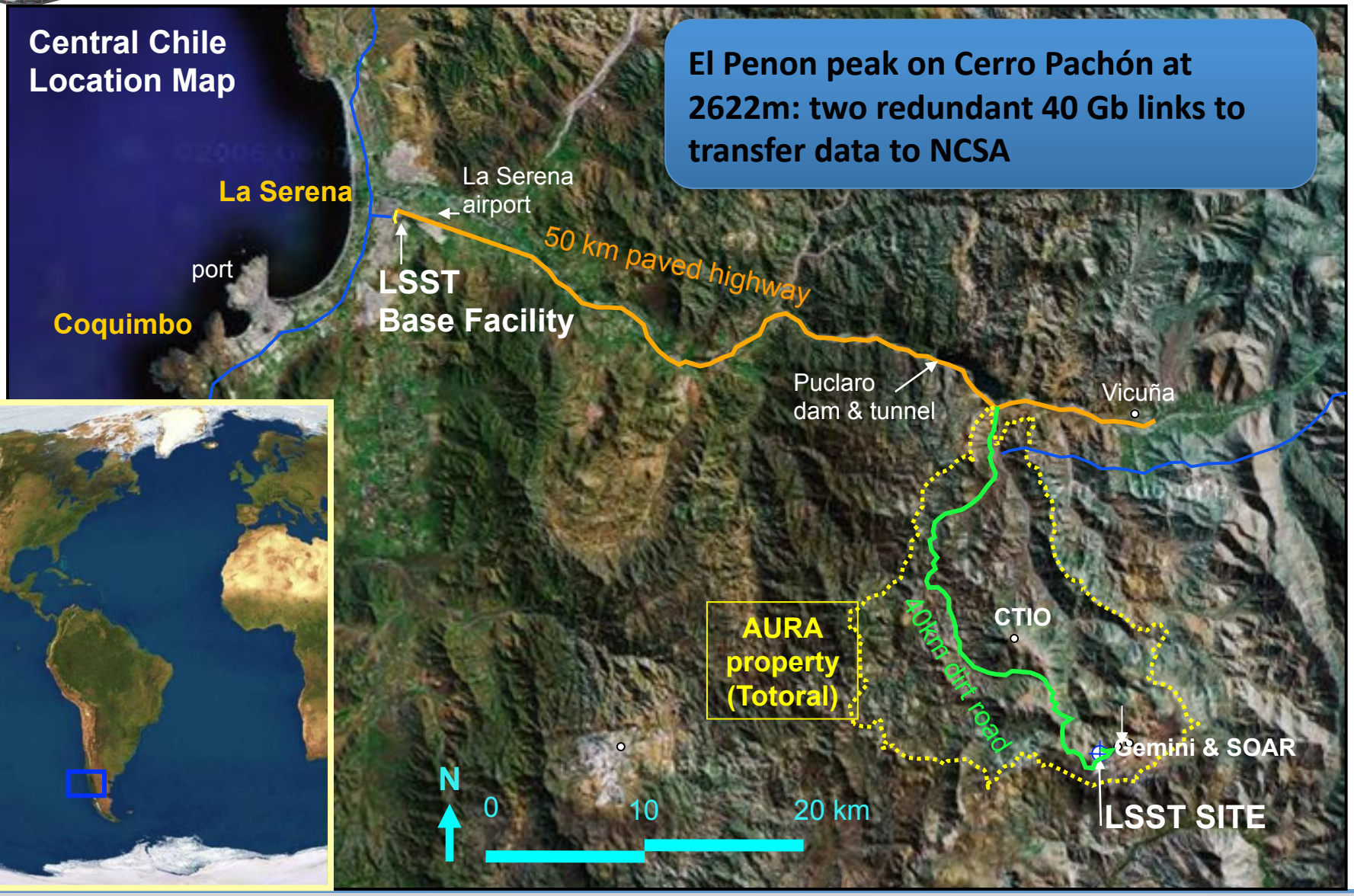
LSST in a nutshell

- 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

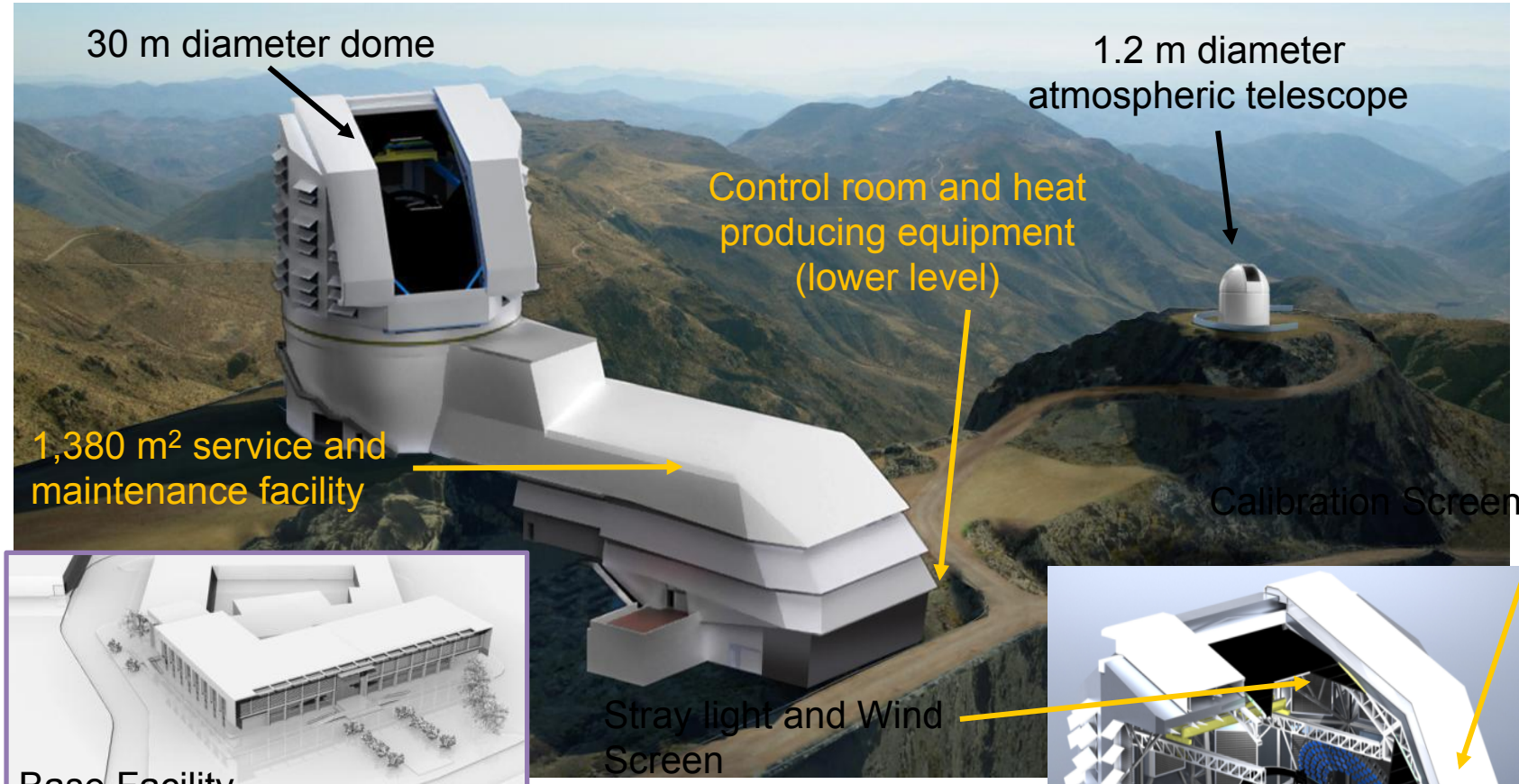
Summary of high level requirements

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

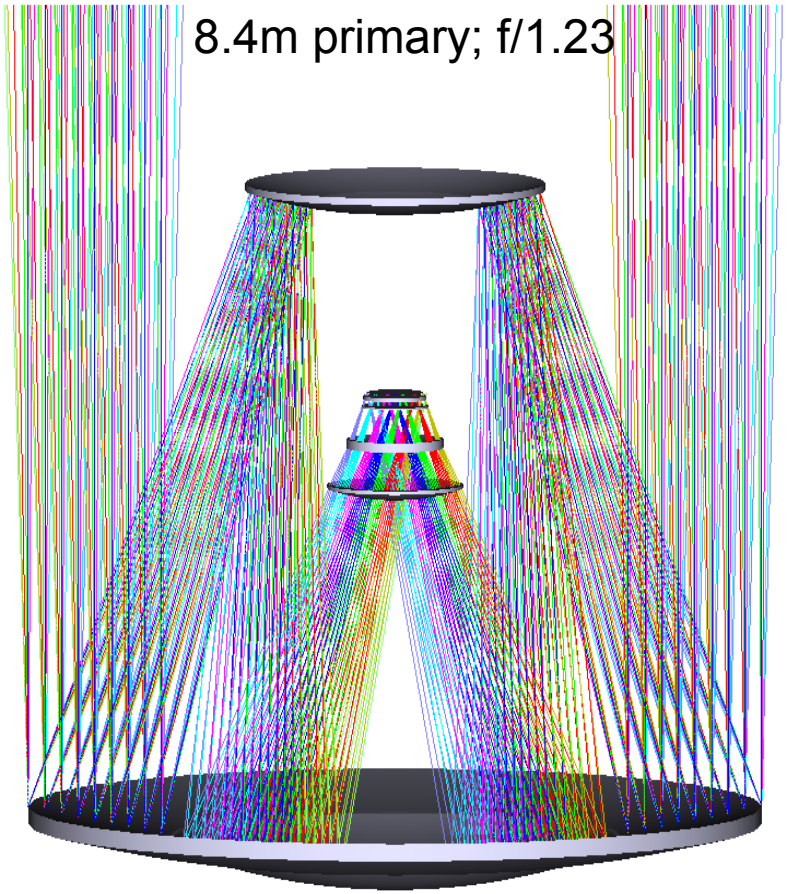


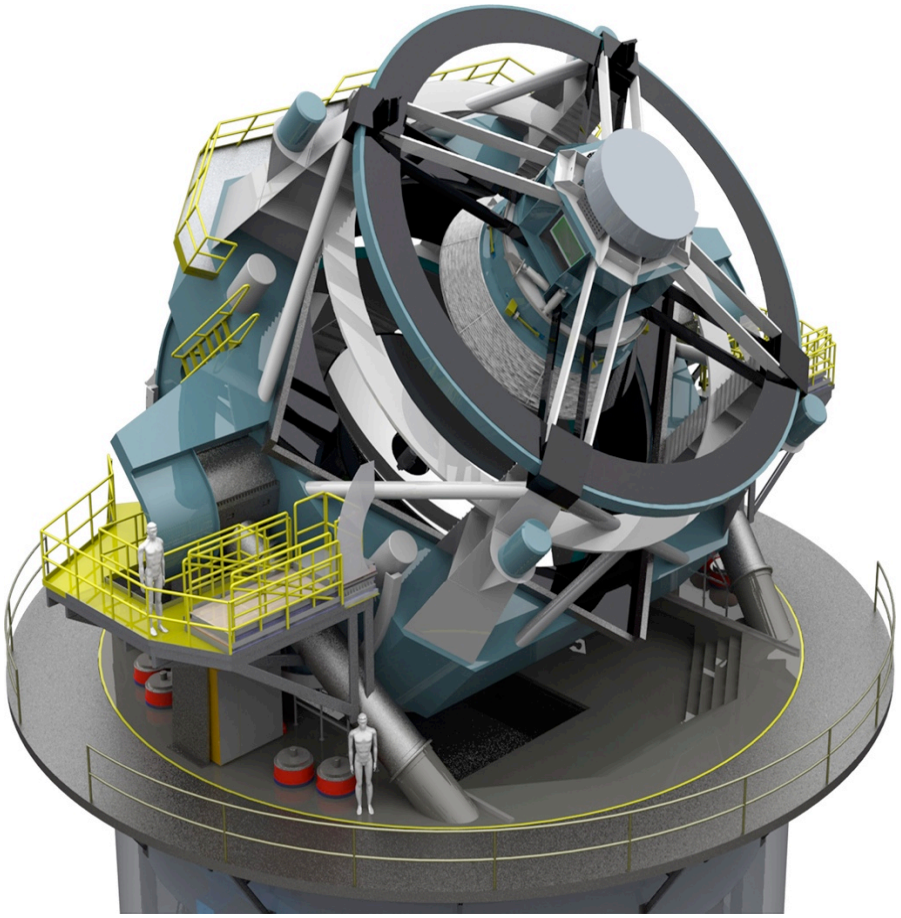
8.4m survey and 1.2m atmospheric telescope



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

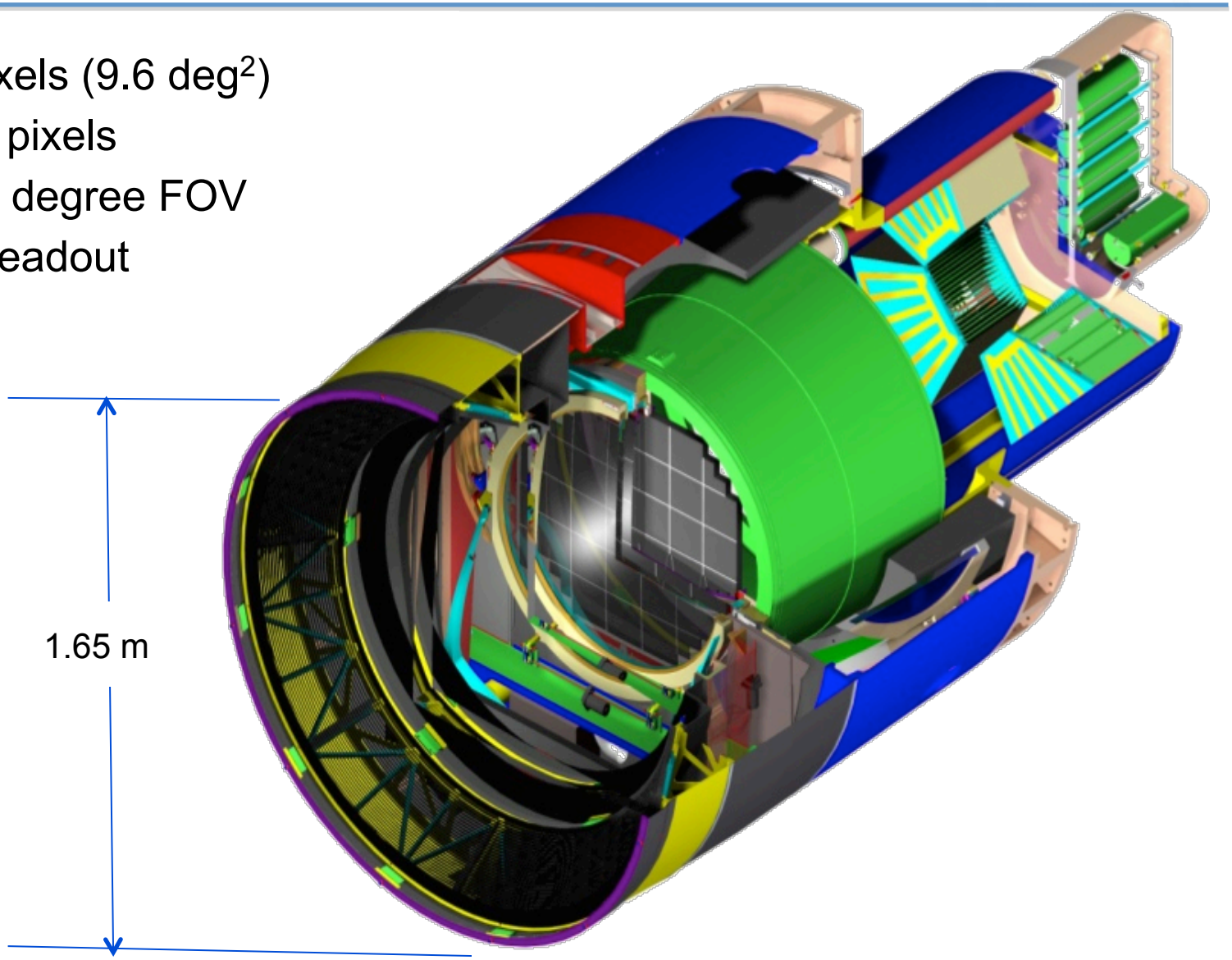




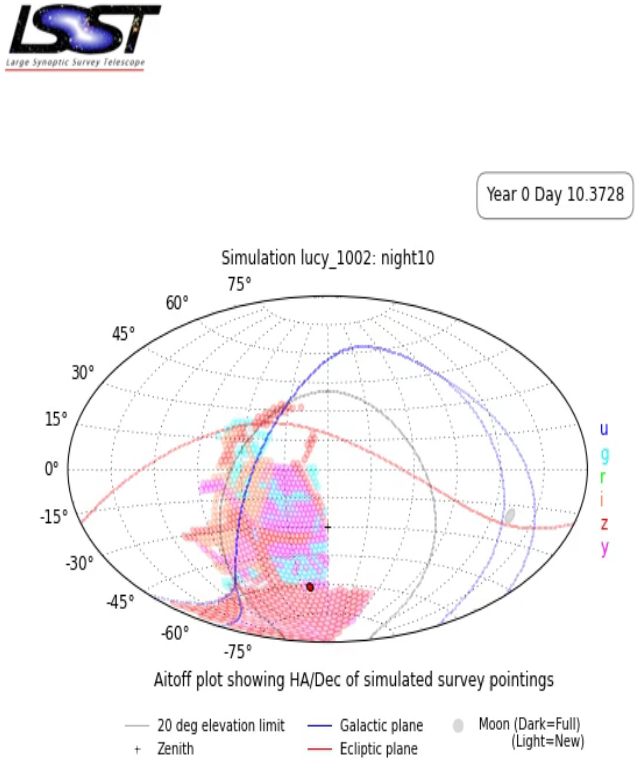
350 tons (60 tons optical system).Three-mirror design (modified Paul-Baker system) delivering 0.35 arcsec or better from the optical system and an etendue of 319 m^2 deg^2

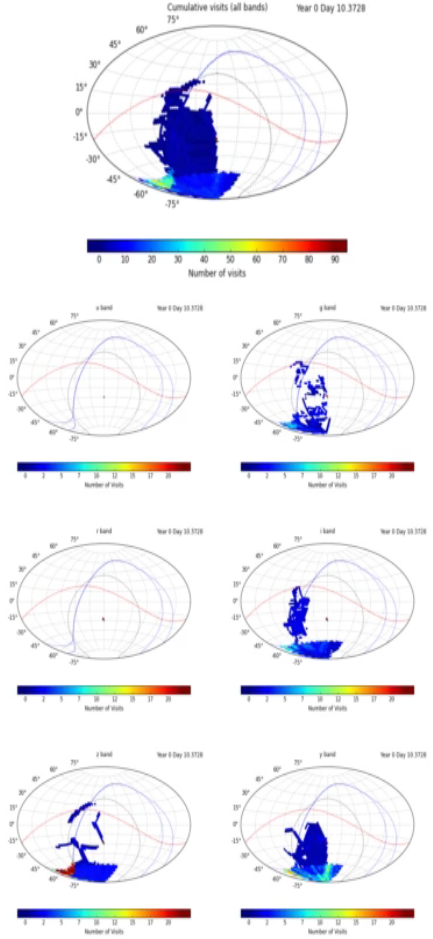
LSST camera: A 3.2 Gigapixel camera

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

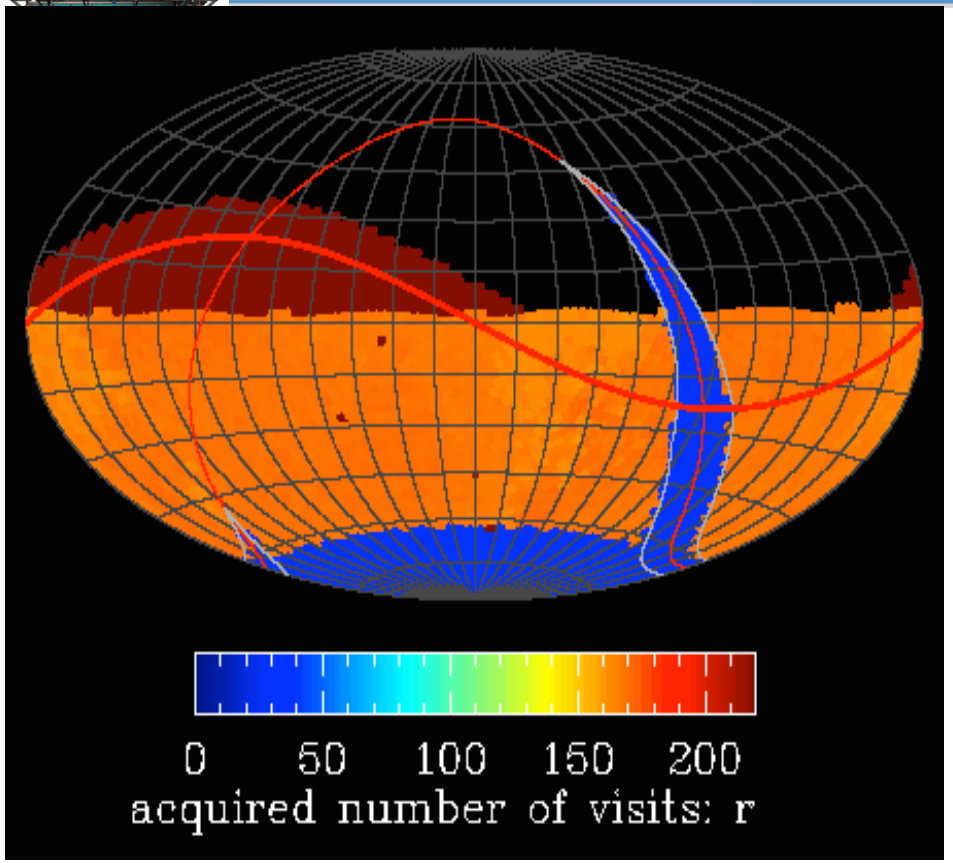


Observing the sky





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