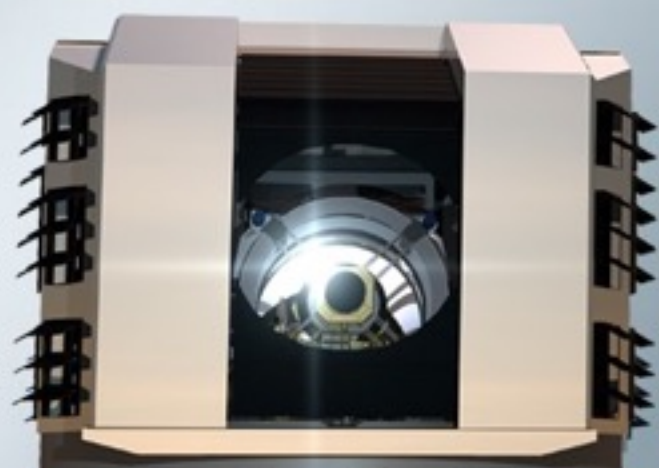




The Large Synoptic Survey Telescope: Data Management Pipelines and Products

Webinar for the Inter-institutional Laboratory
for e-Astronomy in Brazil (LineA)
Thursday April 19 2018

Melissa L. Graham
LSST DM Science Analyst
University of Washington
Seattle WA USA





The Large Synoptic Survey Telescope

An Overview

LSST Data Management: Pipelines and Products Overview

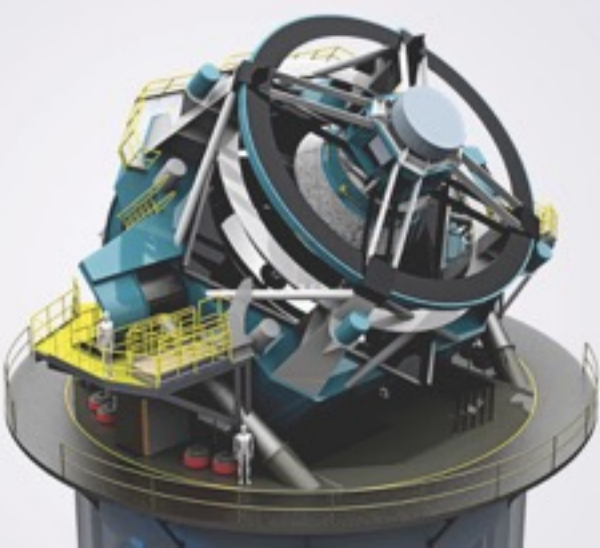
Data Management System Science
DM Data Products & Pipelines
LSST Science Platform

LSST Special Programs

Open Opportunities
Observational Boundaries
Call For Proposals

LSST Data Management: Resources and Participation

LSST DM Communications
LSST Community Forum
LSST Science Collaborations
Future LSST-Related Meetings





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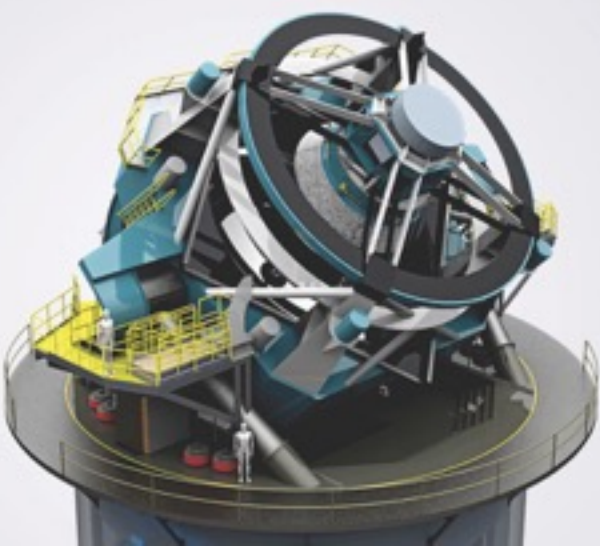
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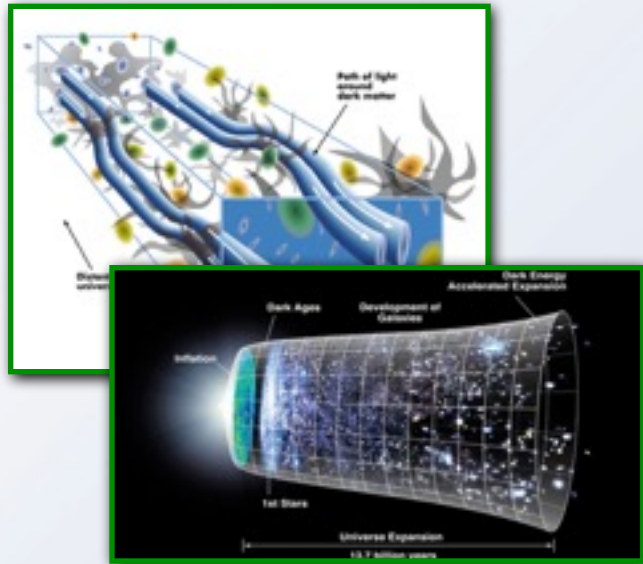
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“From Science Drivers to Reference Design” Ivezic et al. (2008), arXiv:0805.2366

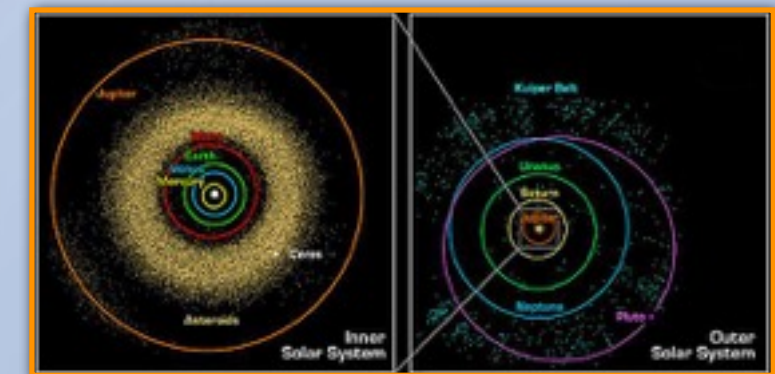
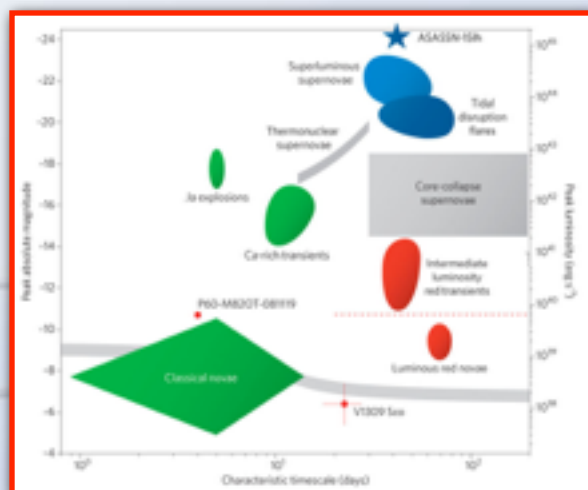
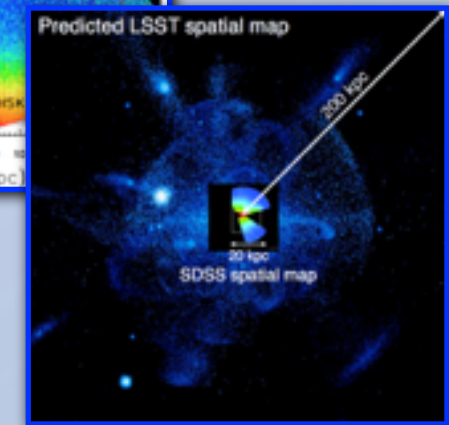
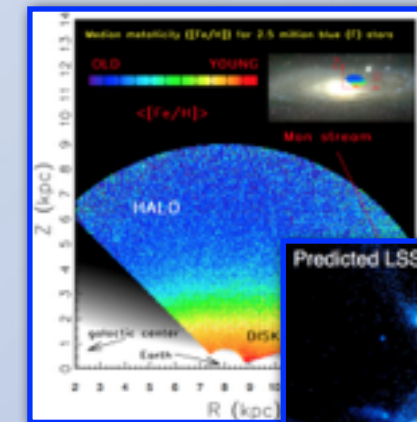


- **Cosmology:**
 - weak lensing
 - baryon acoustic oscillations
 - type Ia SN dark energy

- **Milky Way:**
 - spatial maps of stellar characteristics
 - reach well into the halo

- **Transient & Variable Phenomena**
 - fill in variability phase-space
 - physical mechanisms

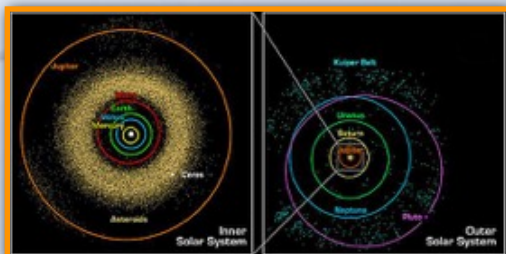
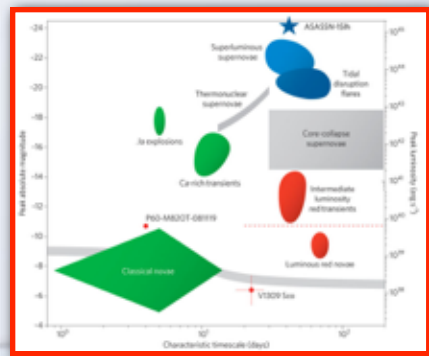
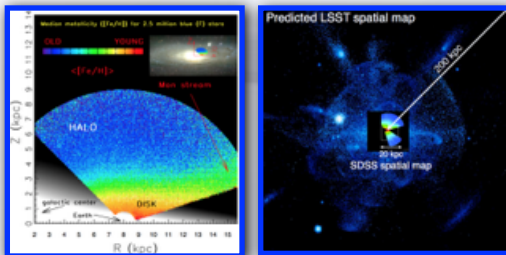
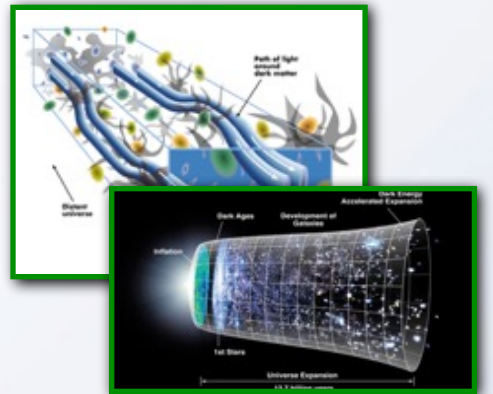
- **Solar System Small Objects**
 - object inventory, dynamics
 - potentially hazardous asteroids
 - (U.S. Congressional mandate for NASA to find 90% of near earth objects with diameter >140m)



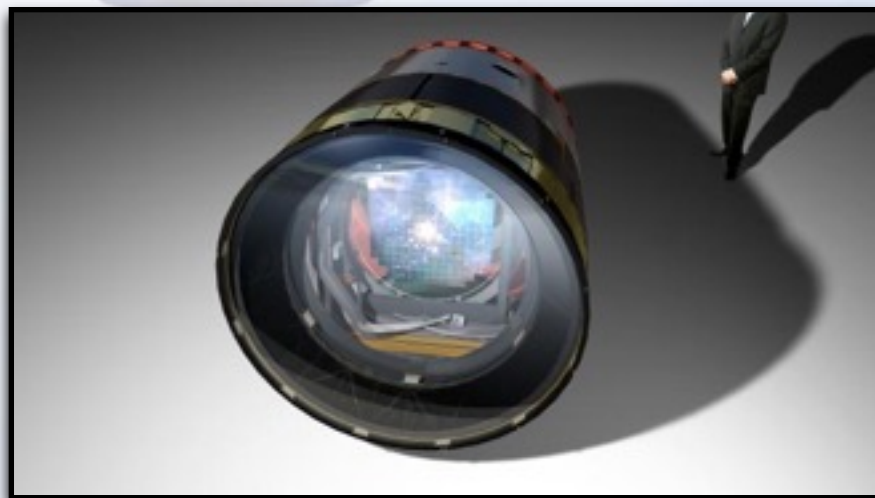
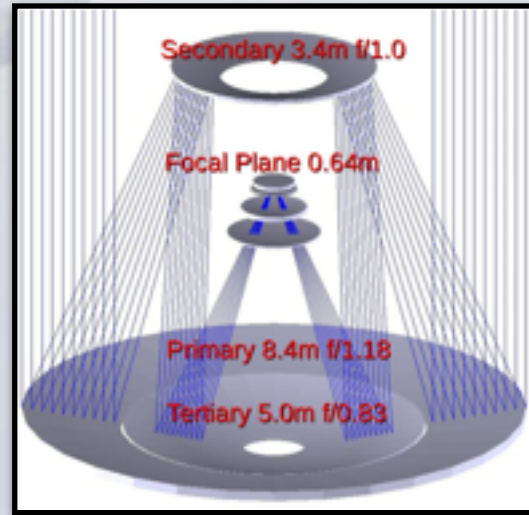
“From Science Drivers to Reference Design” Ivezic et al. (2008), arXiv:0805.2366

These science goals drive the LSST design: they can all be met with a deep, wide-area, multi-band survey of the full southern sky with an 8m-equivalent telescope doing 30 second exposures all night every night for 10 years.

These science goals also drive the design of the pipelines and products: prompt difference imaging and alerts, yearly releases of deep co-adds and catalogs, fully calibrated data products available through a dedicated user interface.



LSST Overview: Survey Design



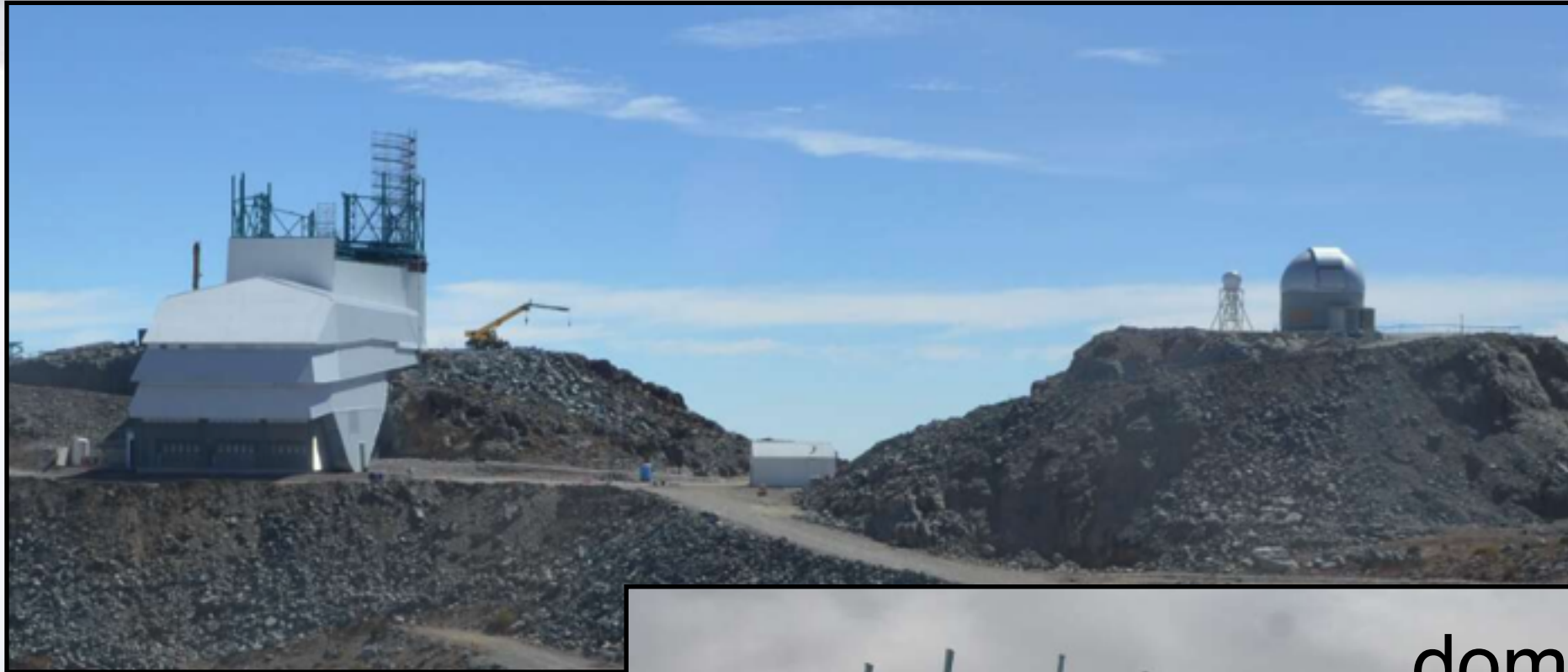
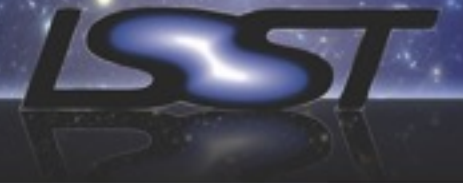
Hardware

primary mirror	8.4 m
field of view	9.6 deg ²
pixel size	10 μm, 0.2"
number of pixels	~3.2 Gpix
filters	<i>ugrizy</i>

Main Survey (Wide-Fast-Deep)

single-visit exposure	30s (2x15s)
single-visit depth	23.9,25.0,24.7,24.0,23.3,22.1
single-visit saturated	14.7,15.7,15.8,15.8,15.3,13.9
survey visits/field	56, 80,184,184,160,160 (824)
survey full depth	26.1,27.4,27.5,26.8,26.1,24.9
survey full area	18000 ^o 2
first light	2020
survey start	2022

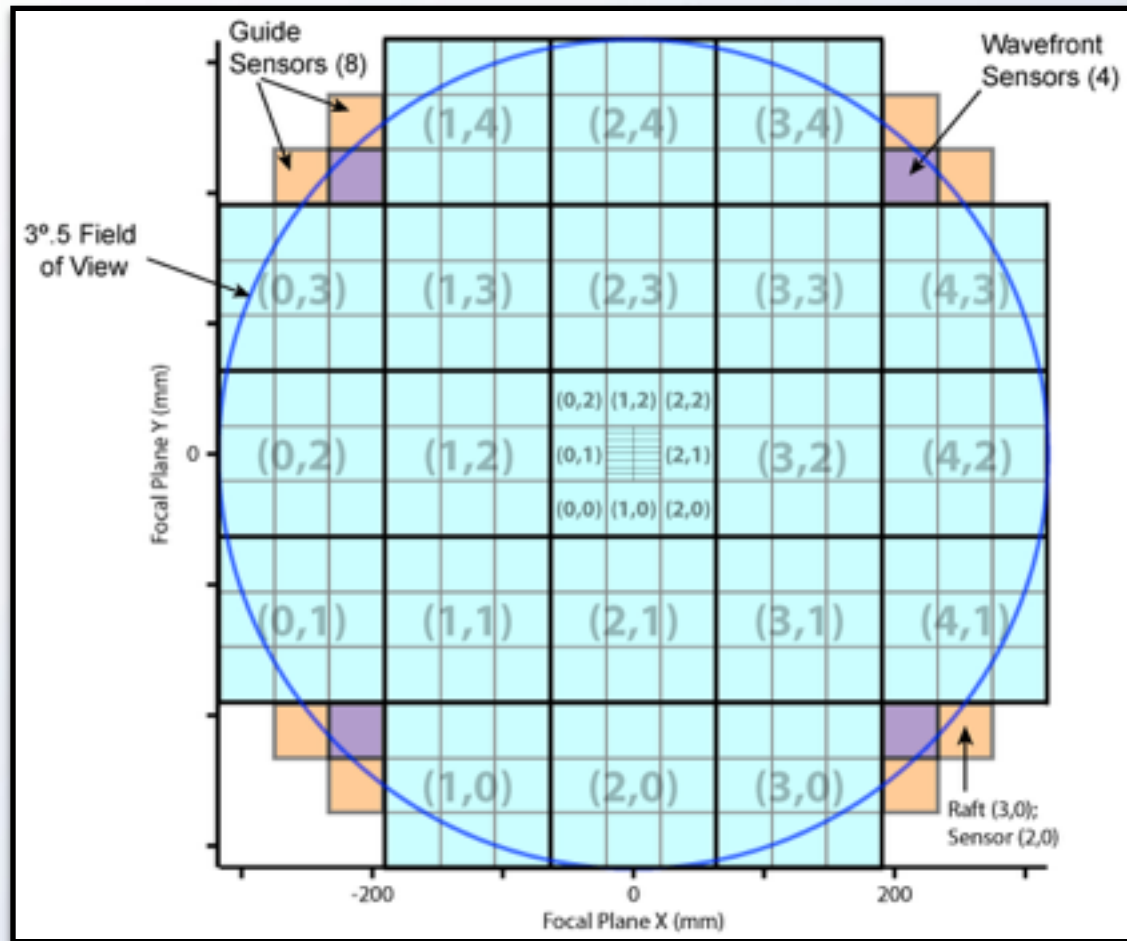
LSST Overview: Survey Design



Wed Apr 18



dome completion
planned for mid-2018



Commissioning Camera

- single-raft “ComCam”
- expect on summit late-2019

Science Camera

- two companies are supplying CCDs
- the first CCDs are delivered, in testing
- camera integration and testing starts 2018
- expect on summit early-2021

The issue: Universal Cadence leads to a visit every ~ 3 days in *any* filter, every ~ 15 days in a single filter, and some science goals require more frequent sampling.

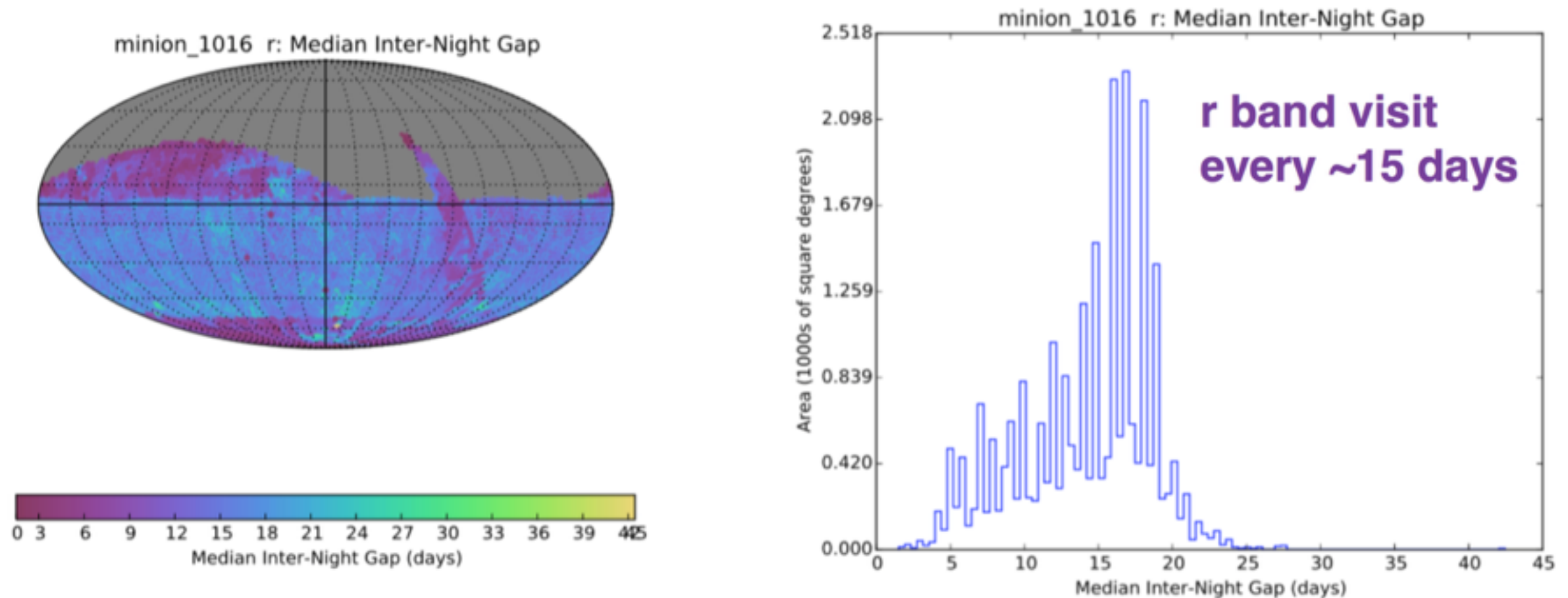


Figure 2.9: The median inter-night gap for r band visits is shown in Aitoff projection for all proposals and all filters for candidate Baseline Cadence [minion_1016](#). On average, fields in the main survey get revisited in the r band about every two weeks.

A *living* document for the community to communicate to the LSST Project the impact of observing strategy on science, now and through Operations.

arXiv.org > astro-ph > arXiv:1708.04058

Search or Article

(Help | Advanced search)

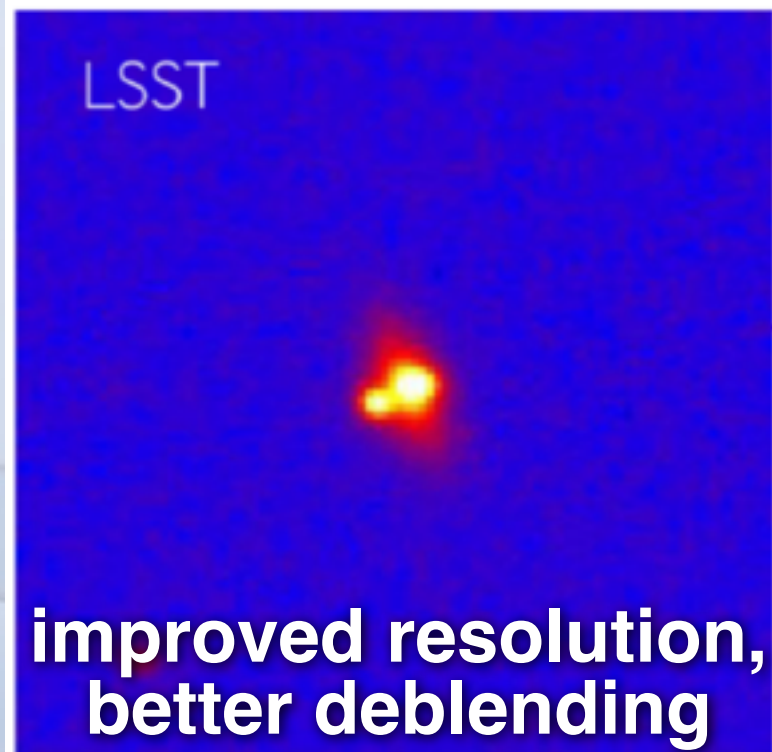
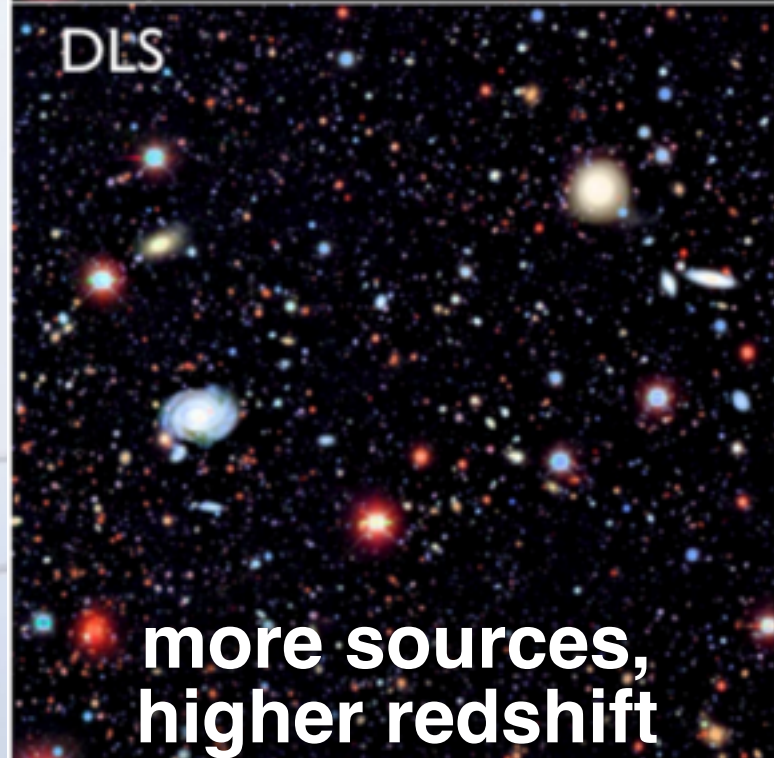
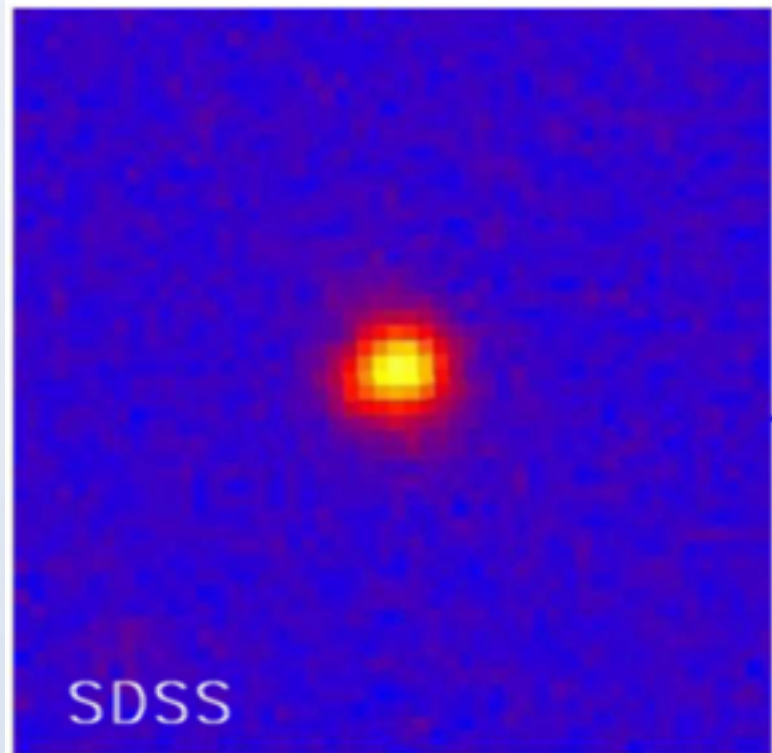
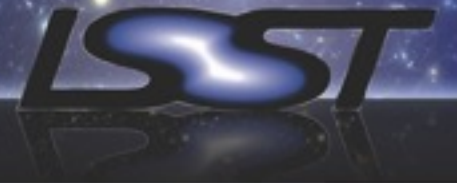
Astrophysics > Instrumentation and Methods for Astrophysics

Science-Driven Optimization of the LSST Observing Strategy

LSST Science Collaborations: Phil Marshall, Timo Anguita, Federica B. Bianco, Eric C. Bellm, Niel Brandt, Will Clarkson, Andy Connolly, Eric Gawiser, Zeljko Ivezic, Lynne Jones, Michelle Lochner, Michael B. Lund, Ashish Mahabal, David Nidever, Knut Olsen, Stephen Ridgway, Jason Rhodes, Ohad Shemmer, David Trilling, Kathy Vivas, Lucianne Walkowicz, Beth Willman, Peter Yoachim, Scott Anderson, Pierre Antilogus, Ruth Angus, Iair Arcavi, Humna Awan, Rahul Biswas, Keaton J. Bell, David Bennett, Chris Britt, Derek Buzasi, Dana I. Casetti-Dinescu, Laura Chomiuk, Chuck Claver, Kem Cook, James Davenport, Victor Debattista, Seth Digel, Zoheyr Doctor, R. E. Firth, Ryan Foley, Wen-fai Fong, Lluís Galbany, Mark Giampapa, John E. Gizis, Melissa J. Graham, Carl Grillmair, Phillipe Gris, Zoltan Haiman, Patrick Hartigan, et al. (52 additional authors not shown)

(Submitted on 14 Aug 2017)

LSST Overview: Survey Design



Nightly alerts on ~10 million time-domain events, and final catalogs of ~32 trillion observations of ~40 billion objects over 10 years.



**more sources,
higher redshift**

**improved resolution,
better deblending**

**more low surface
brightness features**



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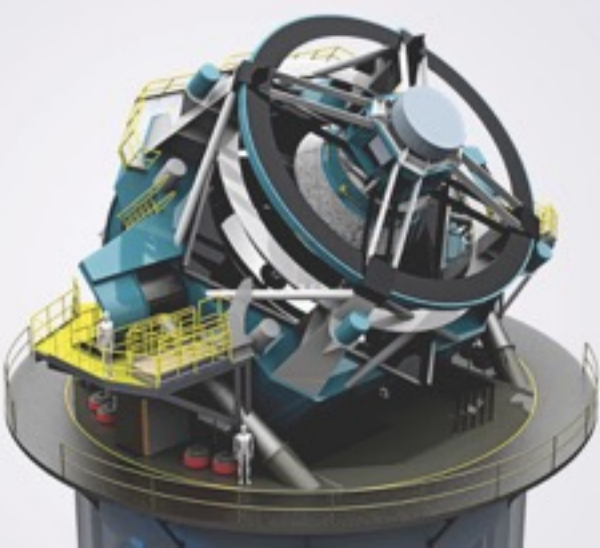
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LSST Data Management

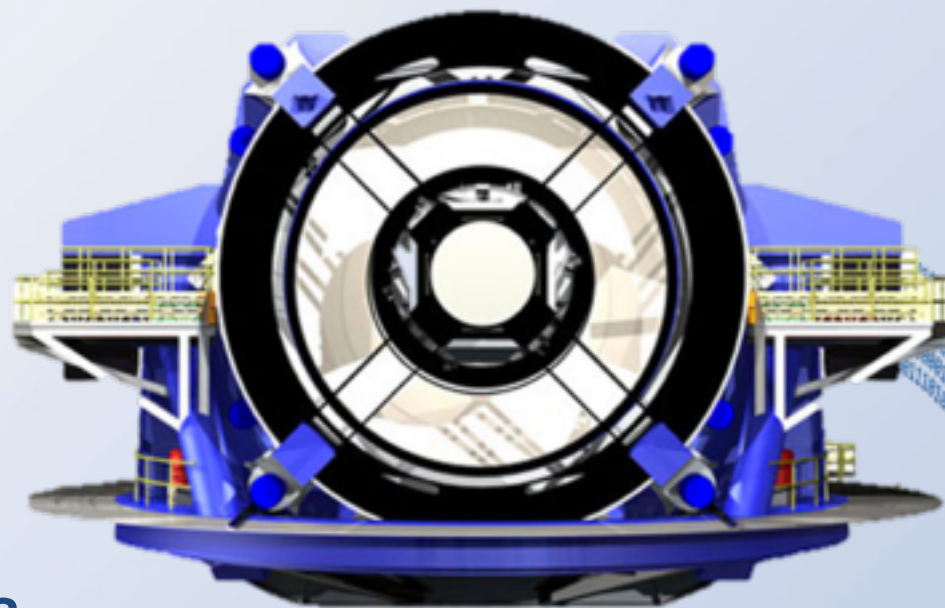


**Data Release Data Products
via Annual Data Releases**



11 data releases in 10 years
Final database catalog: 15 PB

**Prompt Data Products
via Alert Streams**



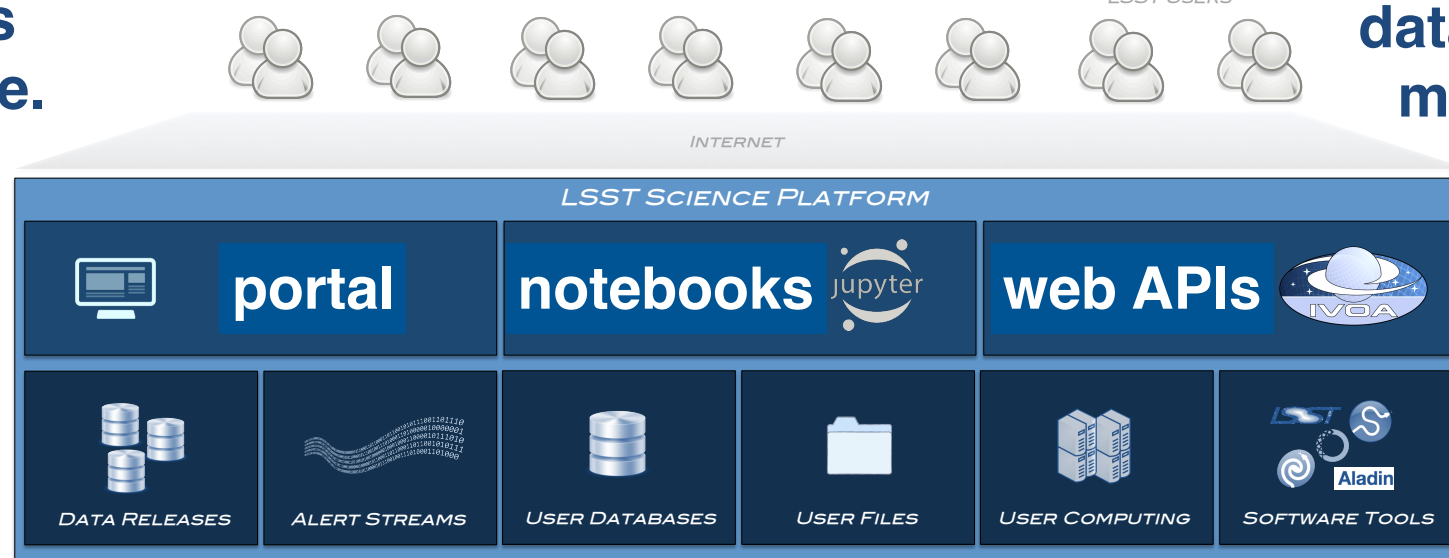
Average $\sim 10^6$ per night
Real-time latency: 60 sec

Last 2 data releases available.

LSST Science Platform

LSST USERS

Alerts database and mini-broker.



Data access via Data Access Centers & Services

Large Synoptic Survey Telescope ↳ Data Management ↳ System Science Team

Mandate: the scientific validation of the planned DM deliverables to ensure that the DM pipelines and products are designed to meet the overall LSST scientific goals.

1. Work with the science community to understand their needs and how they will be met by DM.
2. Identify scientific opportunities and risks related to the DM subsystem and initiate change.
3. Evaluate the scientific impact of proposed changes to DM deliverables driven by e.g., schedule.

Cheat Sheet

Validation: *do the specifications capture the customer's needs.*

Verification: *does the product meet the specifications.*



LSST Data Management Requirements Documentation “Flow-Down”

LSST Science Requirements Document (SRD) ls.st/lpm-17

LSST DM Subsystems Requirements (DMSR) ls.st/lse-61

DM Science Pipelines Design (DMSP) ls.st/lm-151

LSST Data Products Definitions Document (DPDD) ls.st/lse-163

LSST Data Products Categories (DPC) ls.st/lse-291

LSST Science Platform Vision Document (SPVD) ls.st/lse-319

Everything regarding DM data products is from these documents.

Prompt

*Previously "Level 1"
data products*

Real-time difference image analysis (DIA).

A stream of $\sim 10^6$ time-domain events per night (Alerts), detected, characterized, and distributed within 60 seconds.

A catalog of orbits for ~ 6 million bodies in the Solar System.

Data Release

*Previously "Level 2"
data products*

Processed single-epoch and deep co-added images, and reprocessed DIA products.

A database of $\sim 7 \times 10^{12}$ detections ($\sim 30 \times 10^{12}$ measurements) for $\sim 37 \times 10^9$ objects (20×10^9 galaxies and 17×10^9 stars), produced annually and accessible online.

User Generated

*Previously "Level 3"
data products*

User-produced added-value data products, e.g., deep KBO/NEO catalogs, variable star classifications, shear maps, etc.

Enabled by services and computing resources at the Data Access Centers and via the LSST Science Platform.

World Public

World Public data can be shared with anyone, with or without data rights.

Alerts: The full stream will be delivered to a limited set of community brokers who can share the Alerts with anyone.

Data Releases after 2 years: Could be accessed through collaboration with data rights holders, or by paying the “cost of shipping and handling”.

Education and Public Outreach: Limited data subsets for citizen science.

Proprietary

Proprietary data cannot be shared, and requires data rights.

Alerts Database: An archive of all issued Alerts.

Prompt Images and Catalogs: Difference images and source catalogs that are created and made available in real time (60s to 24h latency).

Annual Data Releases: Image stacks and source catalogs.

LSST Science Platform: Data portal, analysis toolkit, help-desk service, computational resources for user processing, an Alerts filtering service.

Definitions of Terms

Standard Visit — an LSST observation (i.e., 2x15 second images)
Processed Single Visit Image — reduced, combined standard visit
Template Image — a transient-free co-add of 6-12 months depth
Coadded Image — a stack of images (i.e., median-combined)

DIA — Difference Image Analysis

DIASource — single detection on a single DIA image

DIAObjects — association of DIASources, by coordinate

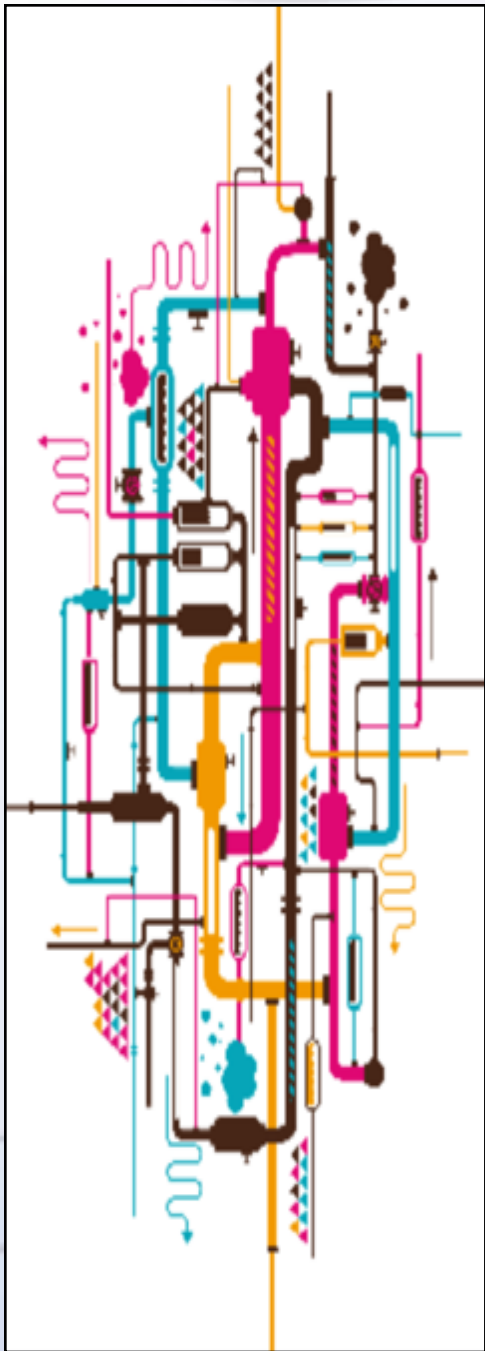
Alert — packet of information about a $|\text{SNR}| > 5$ DIASource

DRP — Data Release Pipeline

Source — single detection in any image (single visit or coadd)

Object — association of Sources, by coordinate

ForcedSource — aperture photometry in a single visit image at the location of an Object or DIAObject, regardless of its SNR



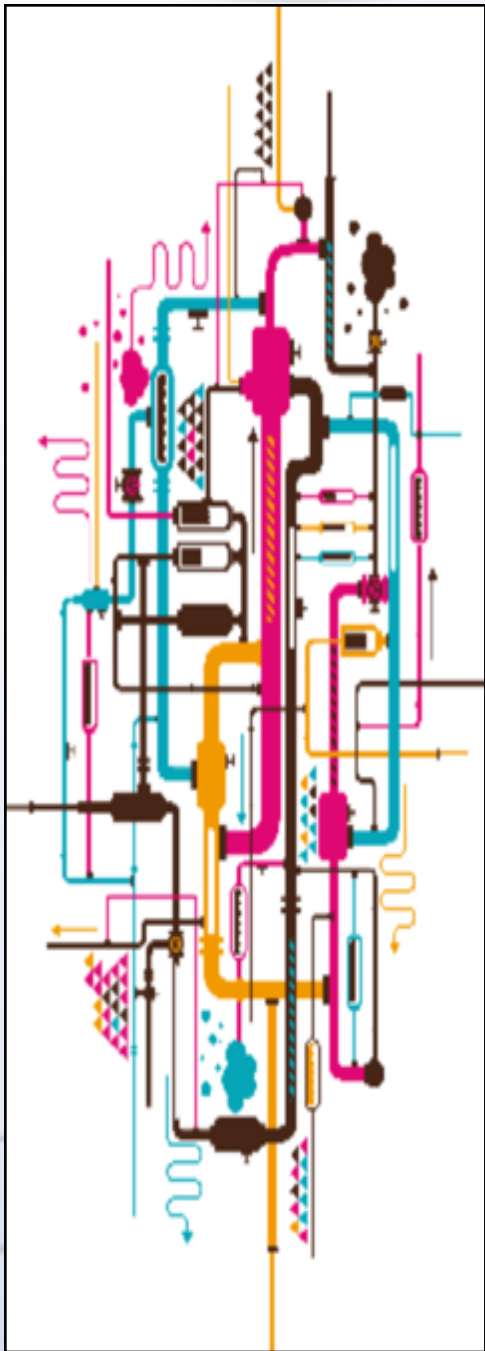
Difference Imaging Analysis and Alert Generation Pipeline

What happens within ~60 seconds of shutter close?

- single visit image is processed and differenced with template
- source detections with $|S/N| > 5$ become a DIASource
- DIASource characterization (PSF, flux, shape, etc.)
- DIASource association with existing DIAObject or SSOObject *or* the creation of a new DIAObject
- DIAObjects detected in past ~12 months get forced photometry
- DIAObject characterization parameters updated (e.g., variability)
- an Alert is issued to the Stream (one per DIASource)
- DIA catalogs are updated in the US Data Access Center

Which tasks are completed within ~24 hours?

- forced photometry in past 30 days of images for all new DIAObjects
- processed images become available in the US Data Access Center
- Moving Object Pipeline Software (MOPS) runs on DIASource catalog



DIA Catalog Contents (non-exhaustive)

What kinds of measurements are provided?

DIASource

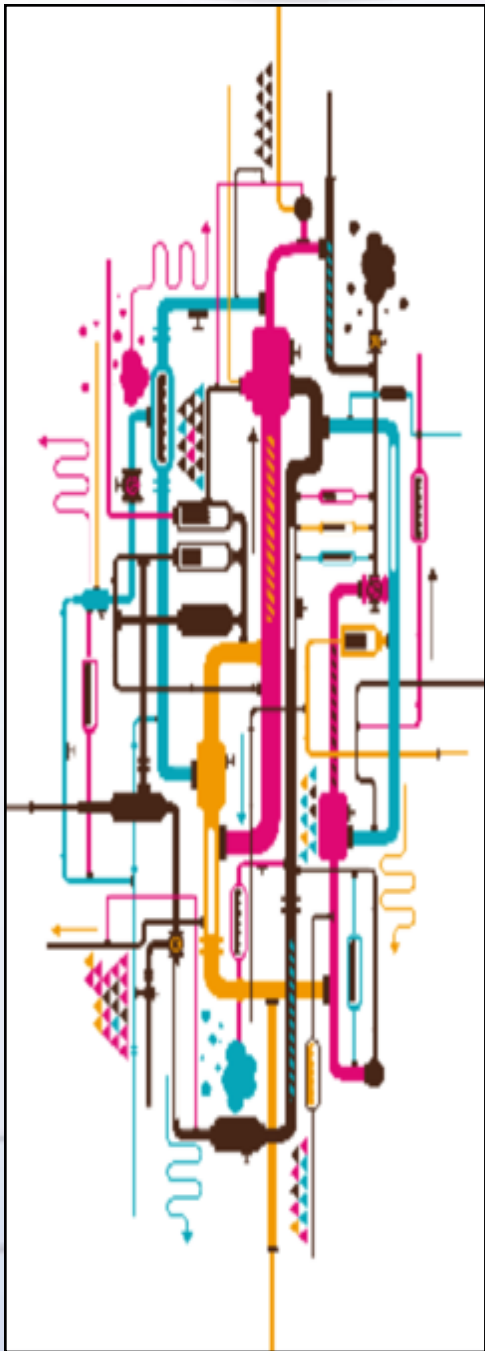
- coordinates, and association with DIAObject or SSObject
- time of mid-exposure at location on CCD
- flux in the difference and visit images (PSF, aperture)
- shape parameters (trails, dipoles, FWHM, extendedness)
- parent/child deblending flags

DIAObject

- time-averaged coordinates; parallax & proper motion
- fluxes by filter, time-averaged and single-visit
- periodic and non-periodic variability features
- association with Data Release object catalog (CoAdds)

See also the Database Schema Browser:

<https://lsst-web.ncsa.illinois.edu/schema/index.php?sVer=baseline>



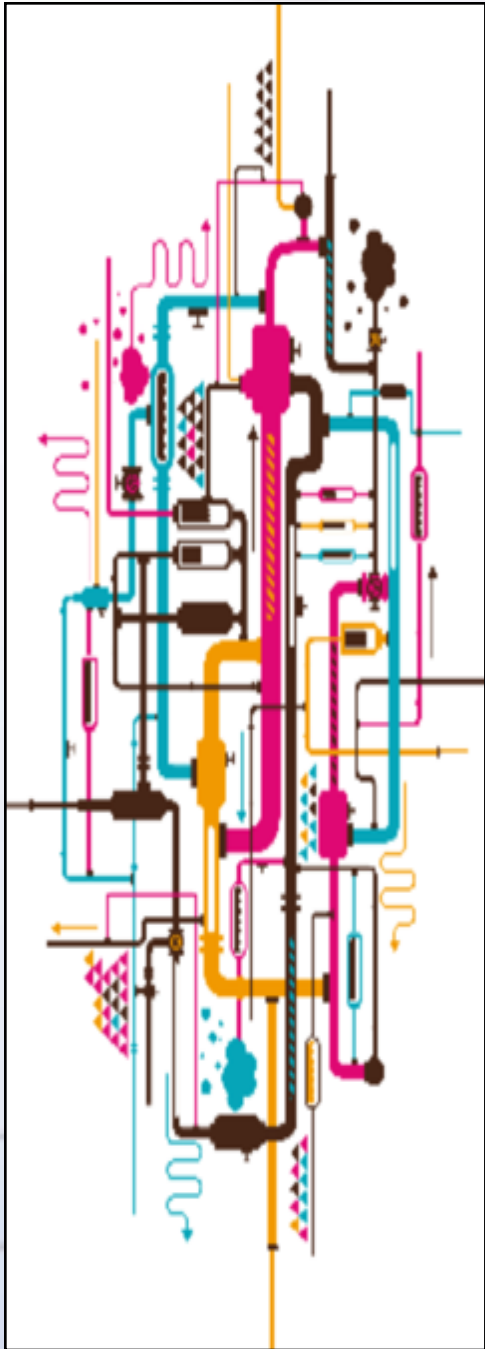
DIA Alert Contents (non-exhaustive)

What is an **Alert** packet?

- formatted text file containing schema and data
- full record of the triggering DIASource
- entire associated DIAObject or SSOBJECT records
- last 12 months of DIASource records
- matching Object IDs from latest Data Release Object
- image stamps
 - ↳ *at least 6"x6"; difference and template; flux, variance, and mask; includes meta-data such as WCS, zero-point, PSF*
- 1 per DIASource; VOEvent packet format (or similar)

What is an **Alert Broker**?

The primary end-points of LSST's event streams, and how users will classify and filter events into subsets for their science goals. LSST will provide a basic, limited capacity alert filtering service for astronomers via the Science Platform, the "mini-broker".



Moving Objects Processing Software (MOPS)

MOPS

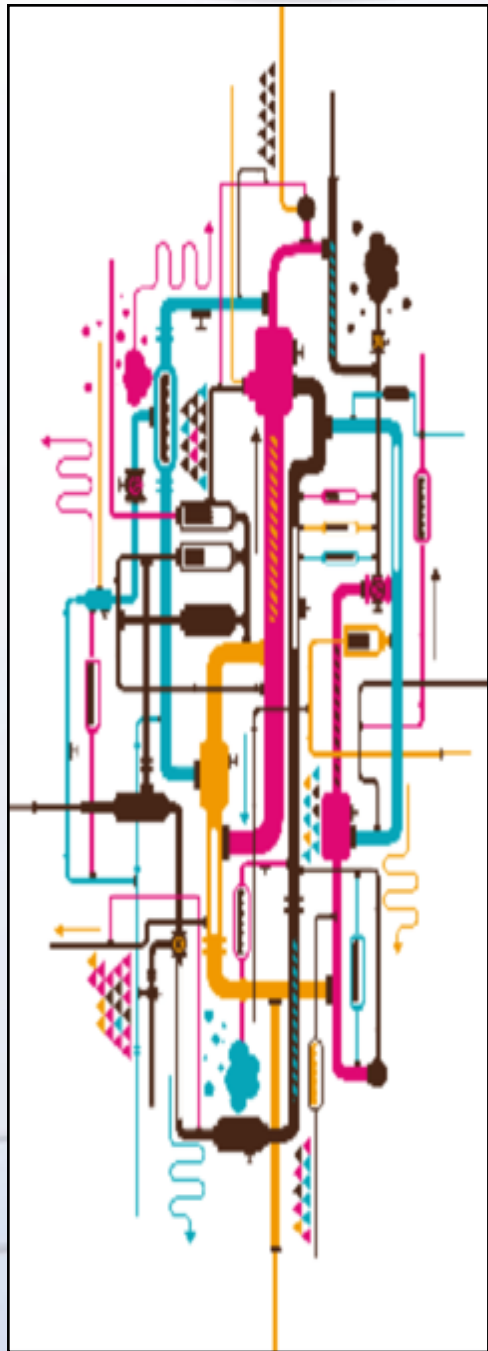
- runs in the day with the DIALSource catalog
- source association to link detections, find moving objects
- uses orbital fits to reject mislinkages
- interfaces with the Minor Planets Center for orbit refinement

SSObject Catalog Contents

- orbital parameters and uncertainties
- mean absolute magnitude per filter
- G_1 and G_2 slope parameters

See also “LSST Solar System Science: MOPS Status, the Science, and Your Questions”, by Mario Juric.

<https://www.slideshare.net/MarioJuric/lsst-solar-system-science-mops-status-the-science-and-your-questions>



DIA Products: Prompt vs. Data Release

There are actually two versions of the products of difference imaging analysis:

Prompt (“living” data products)

- updated in real time with every readout
- contains last ~12 months of data
- variability parameters based on past 12 months
- associations with the “Yearly” DIA catalog products

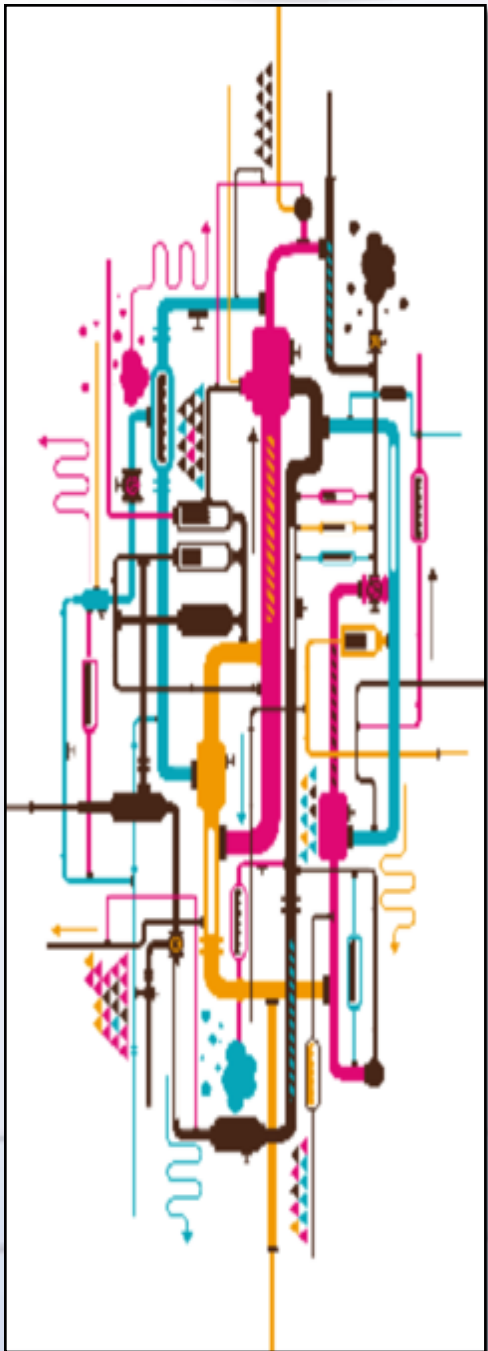
Data Release

- full LSST data set reprocessed with latest codes
- variability parameters based on full survey to date
- forced photometry for all objects in all epochs
- same types of products as the “Living” versions

To meet different science needs:

e.g., real-time follow-up

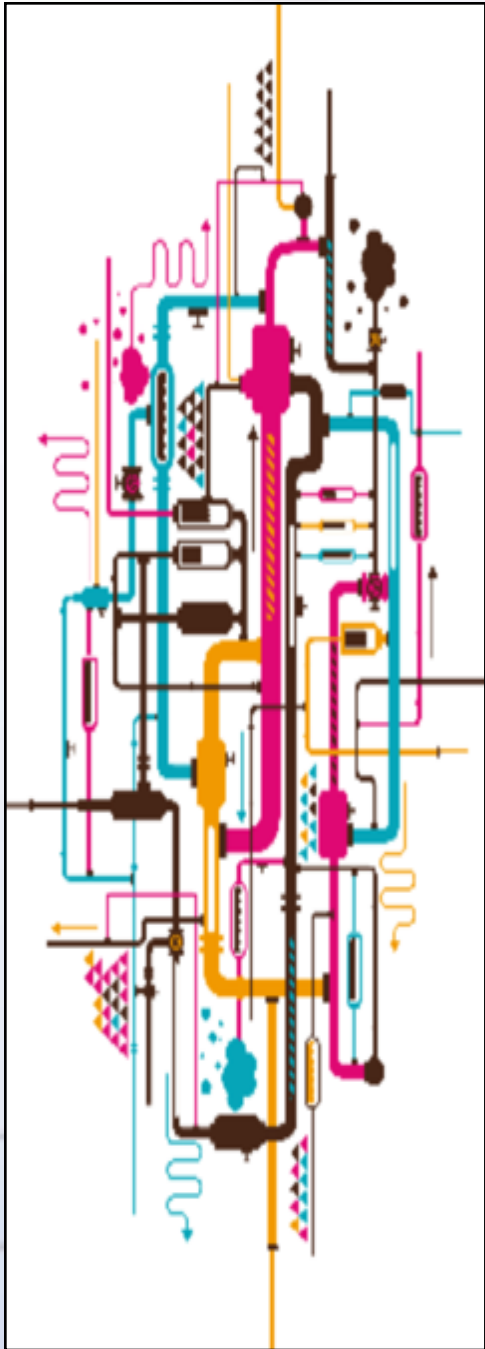
e.g., rates, population studies



Data Release Pipeline (DRP) Images

What kinds of images are produced annually?

- raw data and calibration frames
- processed single-visit images
- stacked images (CoAdds):
 - short-period (e.g., yearly)* and full survey
 - best seeing and deepest (unless equivalent)
 - for each filter *ugrizy*, and a multi-color*
- transient-free template images



**not persisted, but used for measurements in the catalogs; can be recreated by users*

Data Release Pipeline (DRP) Catalogs

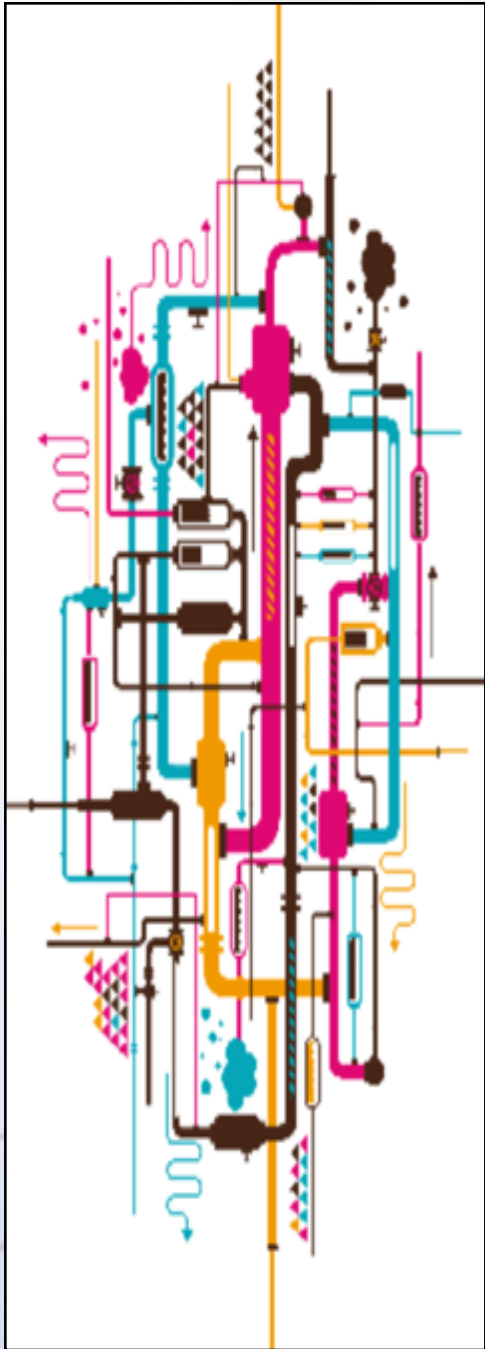
What kinds of measurements are provided?

Source (and ForcedSource)

- coordinates, fluxes in single-visit images
- deblending (parent/child identifiers)
- model fits (bulge/disk, exponential, petrosian, kron)
- surface brightness, extendedness parameters
- color (seeing-independent)

Object

- association of Sources (plus ForcedSources)
- similar characterization parameters as Source
- photometric redshift
- periodic and nonperiodic variability characterization
- proper motions and parallaxes



Data Management and User Processing

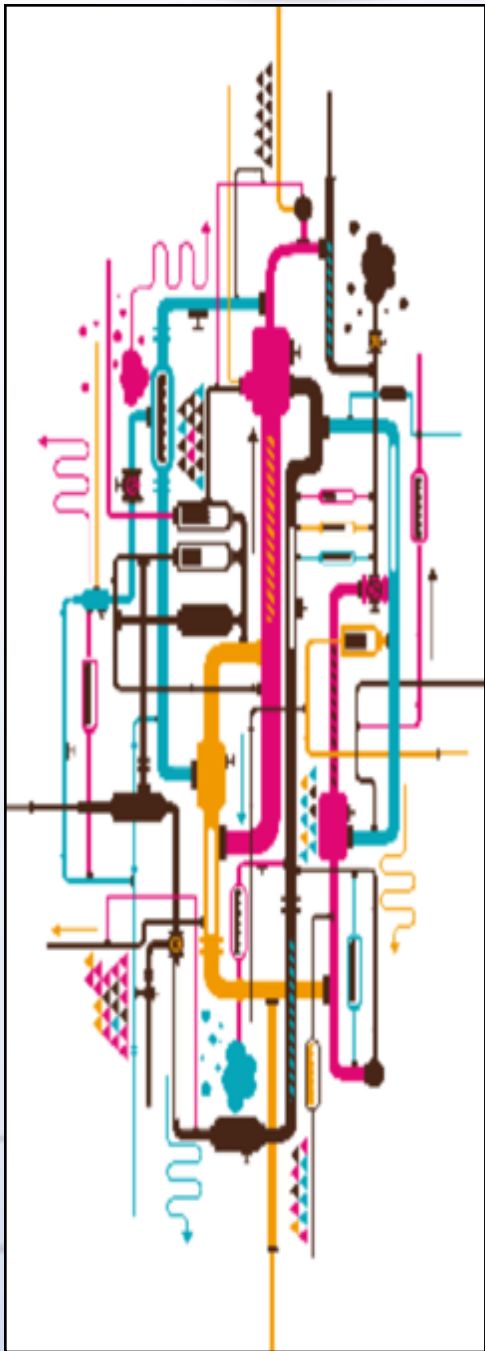
LSST will not write unique algorithms for re-processing main survey data for alternative science goals,

— *but* —

LSST will make the Software Stack source code available to the community for user-generated pipelines

— *and* —

LSST will commit ~10% of its computing resources toward enabling user-driven analysis and data product creation in the US DAC.



User-facing tools will look familiar.

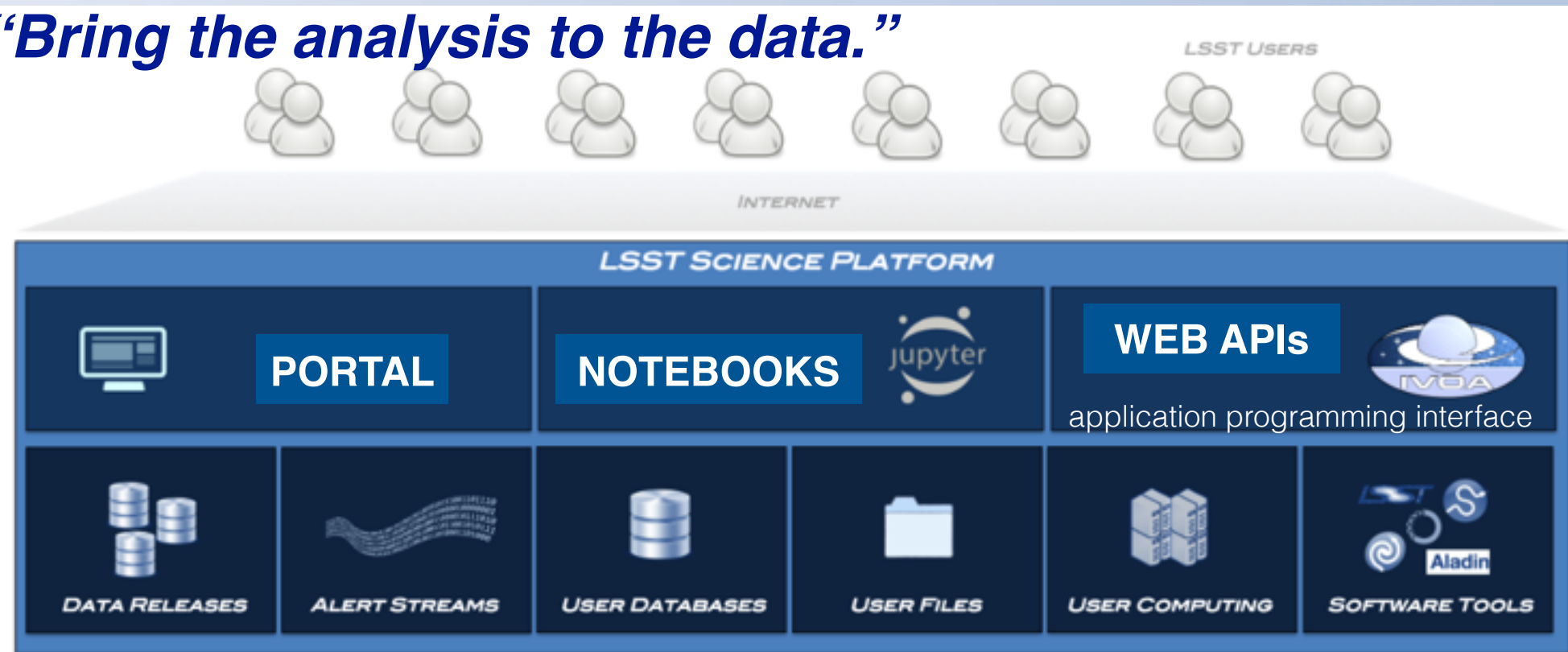
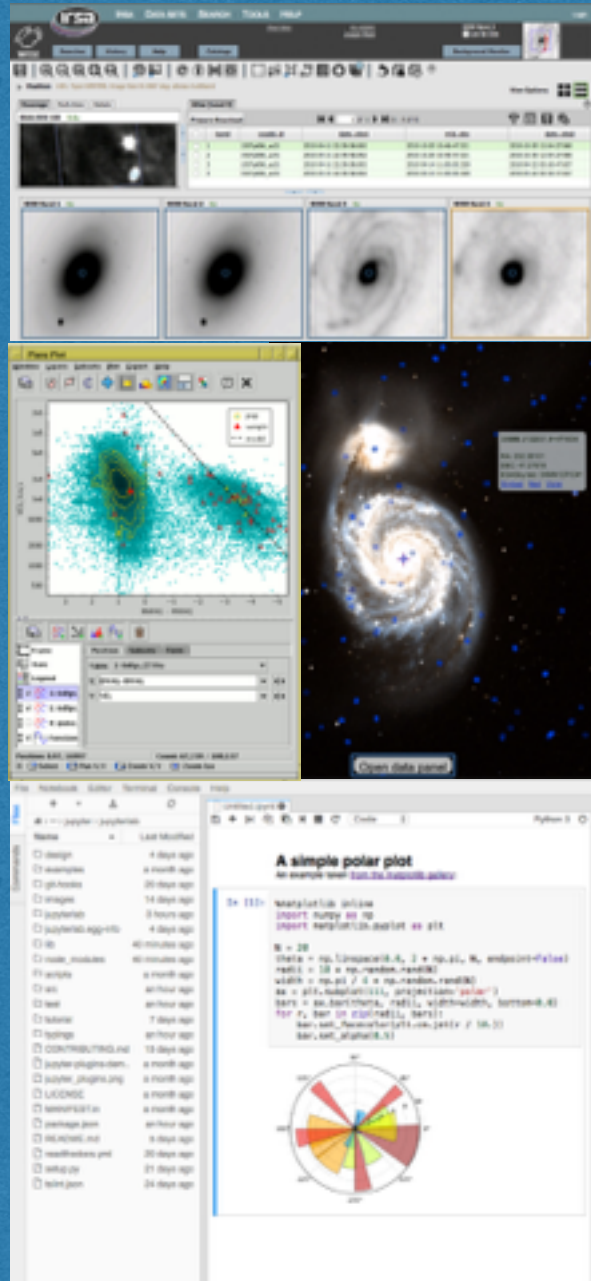
What is the LSST Science Platform?

A toolkit, a workspace, and a portal to the data.

- no need to download the data products
- tools for browsing, visualization, analysis
- use of pre-installed code libraries
- computational resources for query/processing

View demos at <http://ls.st/bgt>

“Bring the analysis to the data.”





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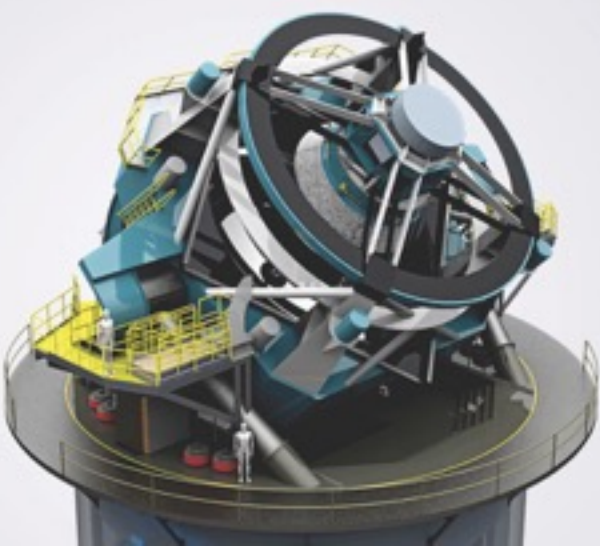
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WFD

Wide-Fast-Deep

DDF

Deep Drilling Field

MS

Mini-Survey

What is a Special Program?

Anything not in the “wide-fast-deep” main survey: different areas, survey strategies, non-standard visit images, etc.

Why do Special Programs exist?

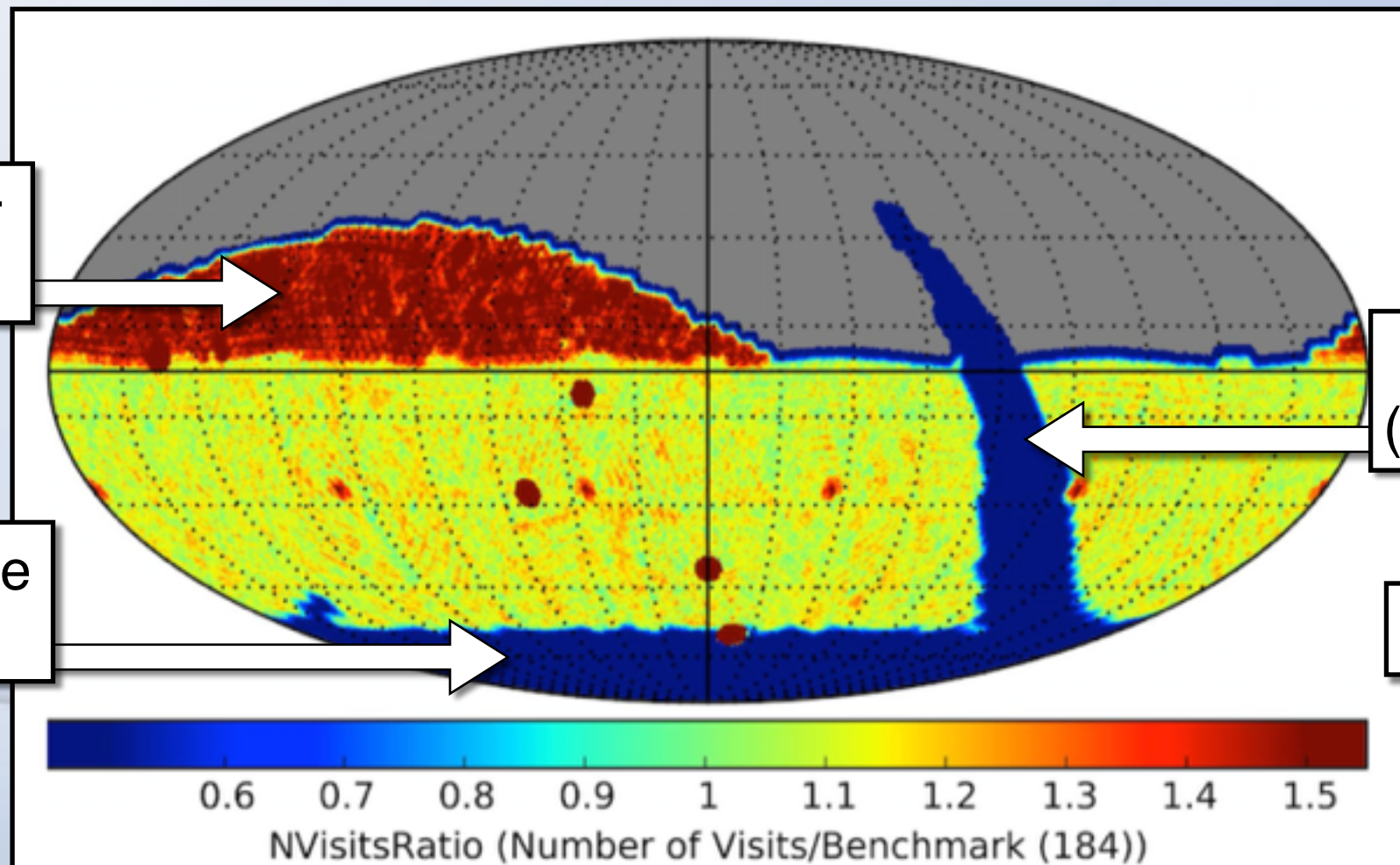
Special Programs provide additional or improved science results with the ~10% of observable time not taken up by the WFD main survey.

North Ecliptic Spur
(solar system)

South Celestial Pole
(LMC, SMC)

Galactic Plane
(stars and planets)

DDF examples

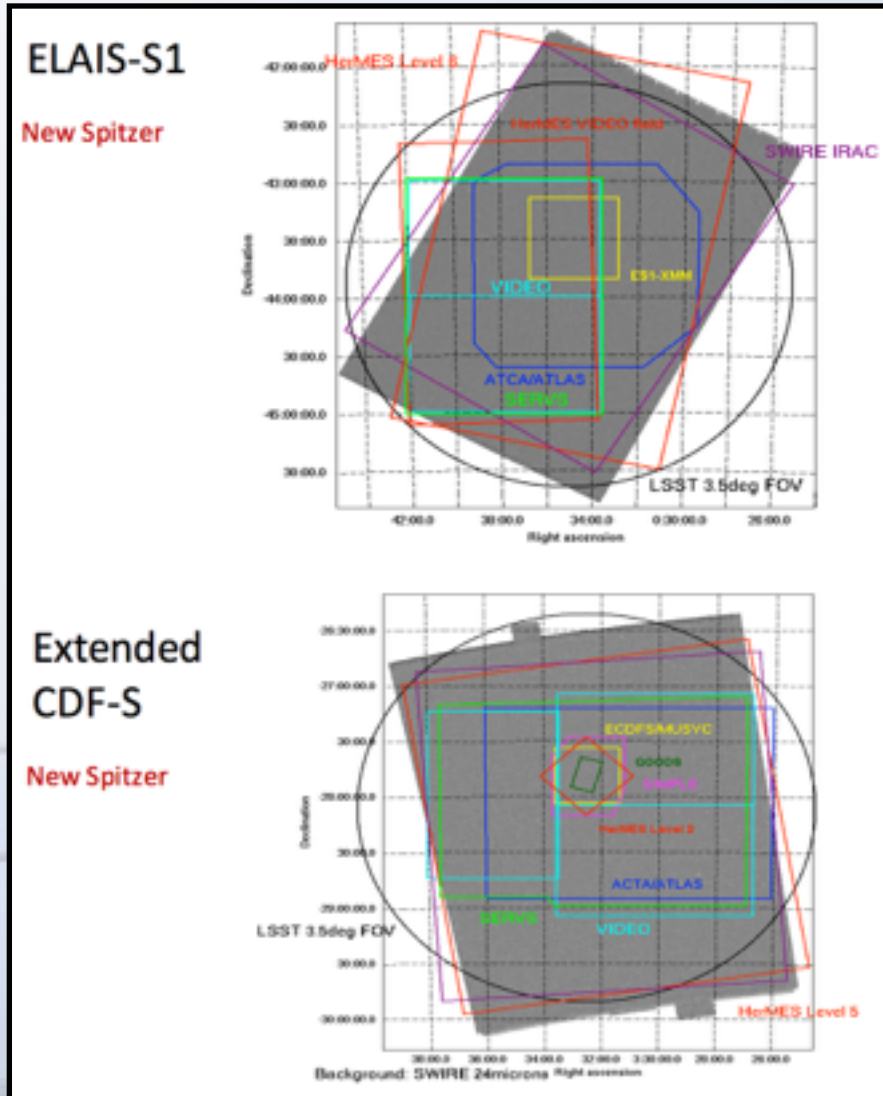


Nominal DDF Observing Strategy:

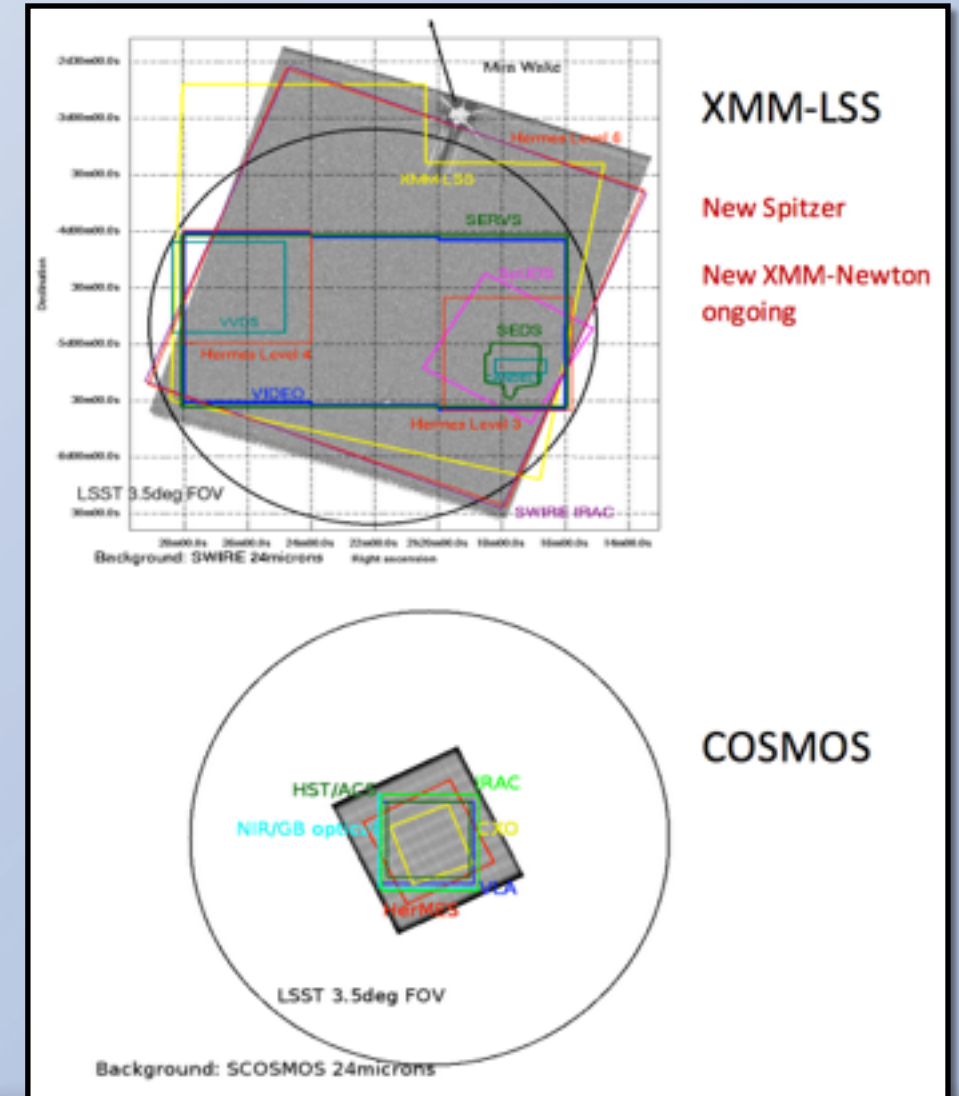
Ivezic et al. (2008) describes a nominal DDF data set as, e.g.: ~50 x 15s exposures in *griz*, every two nights for four months.

single image limit $r < 24.5$
 nightly stack limit $r < 26.5$
 full stack limit $r < 28.0$

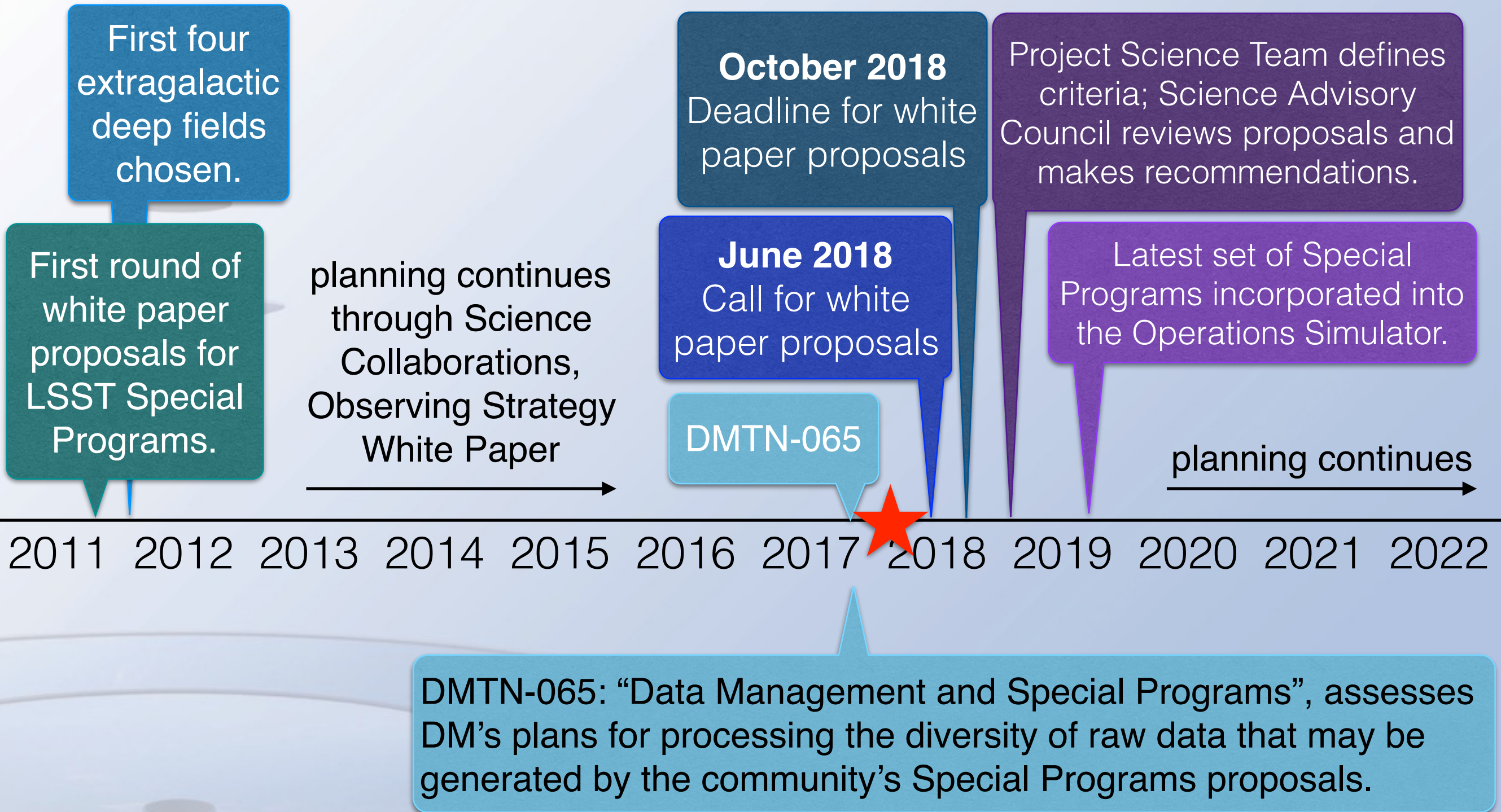
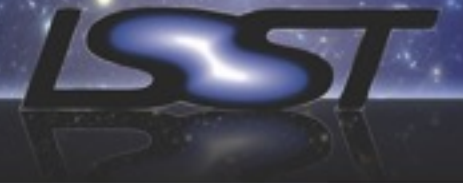
Assuming a conservative 60% completion rate (weather) yields ~7.5 hours of DDF data, stacked with the ~1.5 hours of WFD data.



Four approved extragalactic deep fields:
 ELAIS-S1
 XMM-LSS
 Extended CDF-S
 COSMOS



LSST Special Programs



What is set and what is open to community* proposals?

Set

- the positions of the four pre-existing deep drilling fields

Open

- additional deep drilling fields
- refined observing strategies** for existing deep drilling fields
- optimized survey areas for the NES, South Pole, and Galactic Plane
- refined observing strategies** for the NES, South Pole, and Galactic Plane
- additional mini-surveys areas and observing strategies
- refined observing strategies for the wide-fast-deep main survey

Estimated timeline (TBC):

call in ~June 2018

due in ~Oct-Nov 2018

*Not limited to science collaboration members.

**OpSim runs for proposed DDF/MS expected by late 2019.

What is the format and expected content of these white papers?

To be formalized when the call is announced in June — but in addition to science goals and observing strategy, data processing needs should be discussed.

How will these white papers be evaluated and decisions be made?

Proposals would be reviewed by the Science Advisory Council based on criteria set by the Project Science Team, and recommendations would be made to the LSST Director. Individual proposals may be combined in new observing strategy simulations, which would be released to the community for analysis.

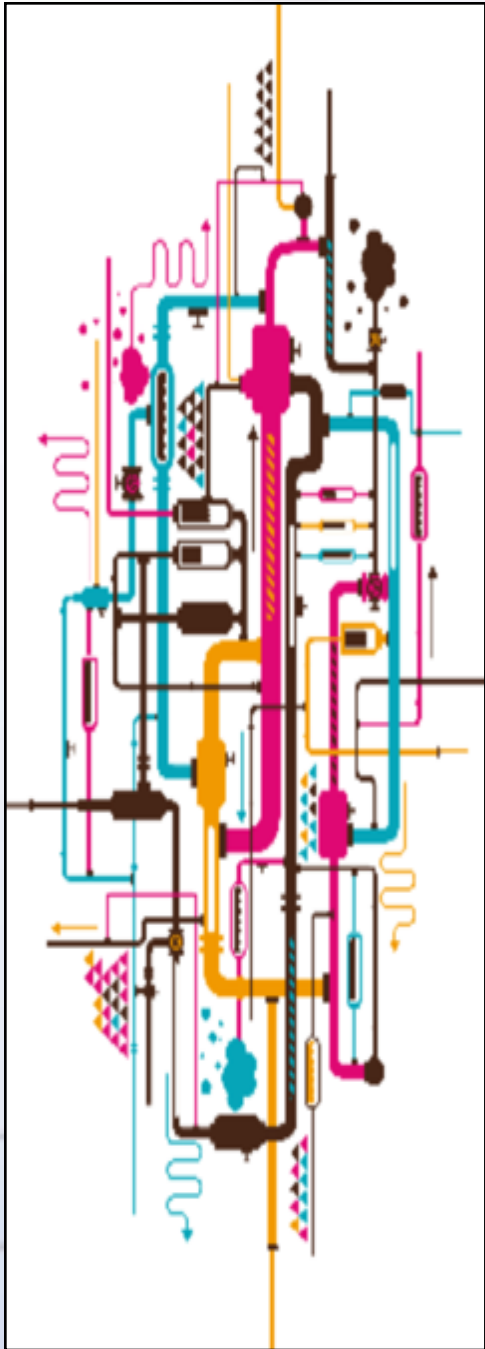
How do these white paper proposals fit in with the `living' Observing Strategy White Paper?

The next round of DDF/MS white papers will be a separate communication channel from the existing OSWP, but could be incorporated later (e.g., in 2019 with the new OpSim runs that include Special Programs).

Data Management and Special Programs

LSST-DM will:

- **not** write unique algorithms for processing SP data
- allocate 10% of its computational resources for processing SP data
- incorporate SP data into the prompt and data release products when scientifically beneficial
- reconfigure pipelines to generate separate imaging and catalog products for SP data, whenever possible
- make the Software Stack source code available to the community
- allocate an additional $\sim 10\%$ of the LSST computing resources for user-driven analysis and data product creation in the US DAC





Deep Drilling Fields and Data Management

■ Science



MelissaGraham LSST

3  Sep '16

On behalf of the LSST Data Management team, we would like to open up this forum to discuss the processing of proposed "Deep Drilling" and/or "Mini-Survey" programs. This conversation between the science community and the LSST DM team was inspired by the breakout session on "Deep Drilling Fields and Other LSST Mini-Surveys" at the LSST Project and Community Workshop in 2016. The relevant DM-DDF issues are outlined in Gregory Dubois-Felsmann's talk from that session (available at <https://zenodo.org/record/61402#.V8mcXJN96Rs> ³), or from the breakout session website <https://project.lsst.org/meetings/lsst2016/agenda/deep-drilling-fields-and-other-lsst-mini-surveys> ⁵), including these questions that we encourage the community to keep in mind while designing their DDF and Mini-Survey proposals:

1. What additional processing beyond that currently planned by the DM team (alerting relative to an annually created template) would greatly enhance the DDF science goals?
2. Are there DDF or Mini-Surveys specific aspects of the Level 3 system that would add significant value if provided? "Level 3" is the LSST-provided capability that enables non-DM, user-driven, processing of LSST data at the LSST Archive center (or remotely).
3. Are there aspects of the Science User Interface & Tools (SUIT) that need to be developed in order to enhance the usefulness of DDF data products
4. To what degree should the DDF or Mini-Survey imaging could/should be incorporated into the main survey's deep stacks and associated data products (as opposed to being processed as separate data products)?

The following resources may also be of use to the community:

1. LSST Data Products Definitions Document (DPDD). <http://ls.st/dpdd>
2. The LSST Data Management System, Juric et al. (2015), <http://arxiv.org/pdf/1512.07914v1.pdf> ¹

Option to contact DM and the LSST user community regarding LSST Special Programs through this Community forum.



The Large Synoptic Survey Telescope

An Overview

LSST Data Management: Pipelines and Products Overview

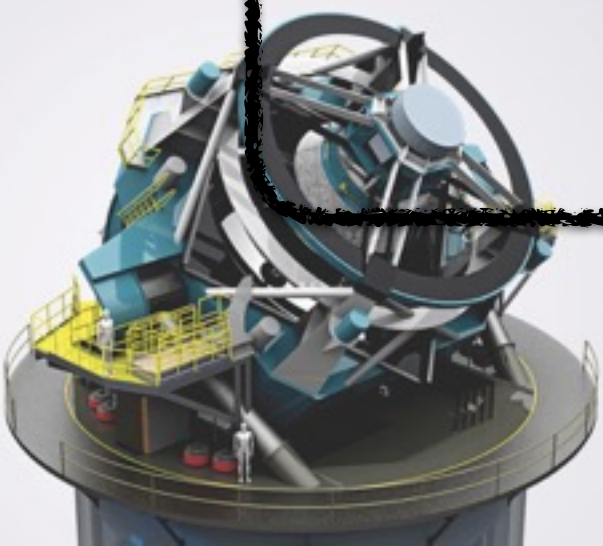
Data Management System Science
DM Data Products & Pipelines
LSST Science Platform

LSST Special Programs

Open Opportunities
Observational Boundaries
Call For Proposals

LSST Data Management: Resources and Participation

LSST DM Communications
LSST Community Forum
LSST Science Collaborations
Future LSST-Related Meetings





Main webpage

GALLERY [↗](#) PUBLIC & SCIENTISTS PROJECT TEAM [↗](#) LSST CORPORATION [↗](#)

LSST
Large Synoptic Survey Telescope
Opening a Window of Discovery on the Dynamic Universe

SEARCH

ABOUT SCIENCE GOALS **PARTICIPATE** GALLERY NEWS FOR SCIENTISTS

This telescope will produce the deepest, widest, image of the Universe:

- 27-ft (8.4-m) mirror, the width of a singles tennis court
- 3200 megapixel camera
- Each image the size of 40 full moons
- 37 billion stars and galaxies
- 10 year survey of the sky
- 10 million alerts, 1000 pairs of exposures, 15 Terabytes of data .. every night!

Surrogate Mirror Installation
November 9, 2017 - At CAID Industries in Tucson, the Surrogate Mirror has now been mounted to the Primary/Tertiary Mirror (M1M3) Cell. This is a significant

A Day in the life of LSST Construction Part 3
For one day, Thursday, September 14, 2017, everyone working on LSST was encouraged to submit an interesting picture representing their work in order to chronicle the LSST construction effort. We wanted to involve as many people in different parts of the

Options for participation in LSST.

Participate in LSST

Now that LSST has received its [federal construction start](#), the [Project Office](#) is focused on building the facility and the role of engaging the community to Enable Science from LSST during operations has been taken on by the [LSST Corporation](#). There are many ways for you to participate in LSST now:



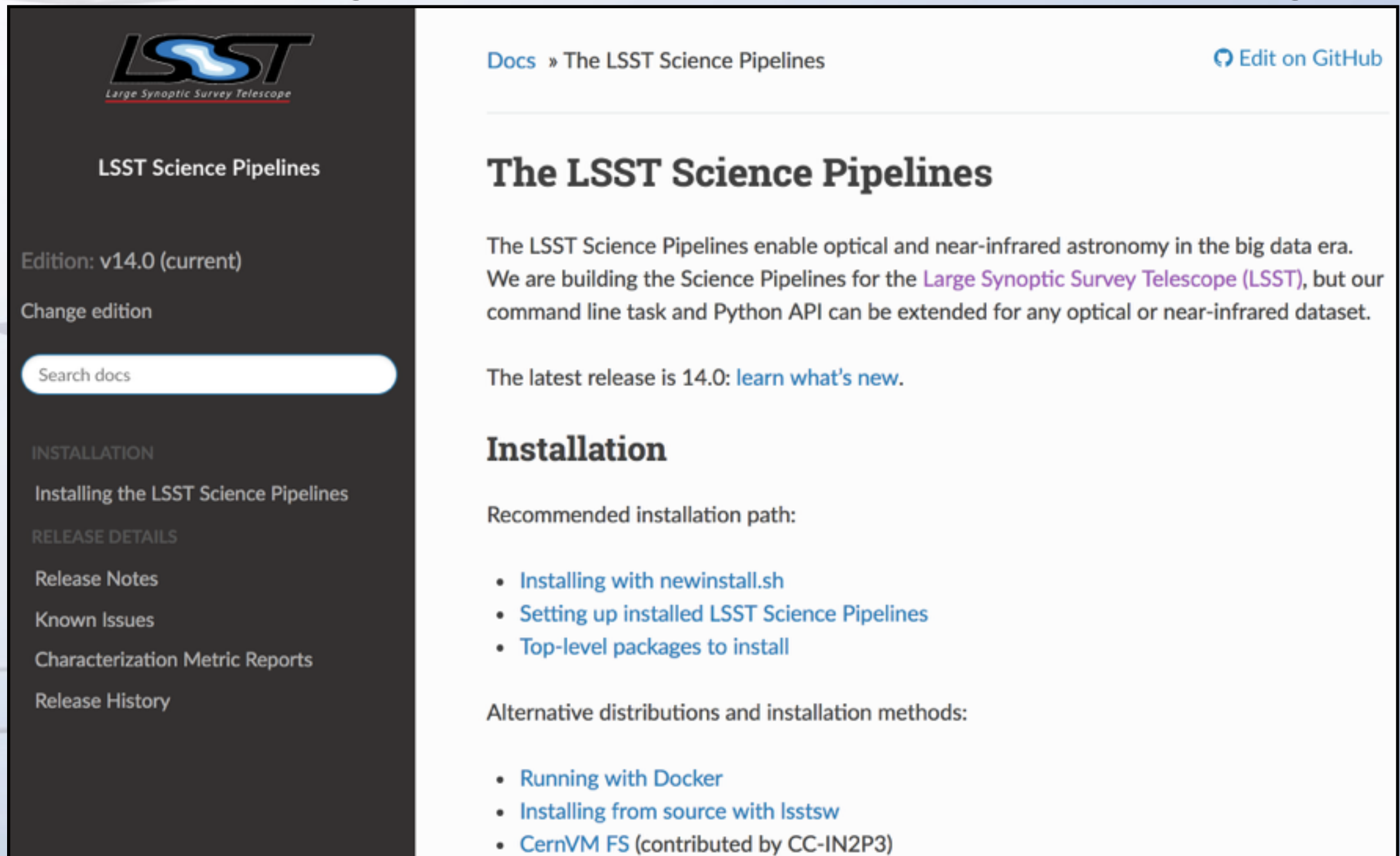
- [LSST Communications Code of Conduct \(PDF\)](#)
- Be informed by subscribing to our [Project Digest](#)
- Or join the [Scientists Mailing List](#)
- The [community.lsst.org](#) forum is available for technical discussion and community-based software support
- Read the community white paper on the [LSST Observing Strategy](#) in arxiv and contribute to the living document in [GitHub](#).
- Become an [Institutional Member of LSSTC](#)
- Become an [International Contributor to support Operations](#)
- Join a [Science Collaboration](#)
- Interact with the [LSST Science Advisory Committee](#)
- Visit the LSST [Data Management Website](#) for information on downloading the Open Source Software stack and access data sets; begin by reading the [User's Guide](#)
- Visit the LSST [Simulation Website](#) for information on the LSST Image and Operations Simulations efforts.
- Join the Team - [LSST is Hiring](#)
- There are also opportunities for [Doing Business with LSST](#)



Key LSST information for scientists.

A screenshot of the LSST website's 'For Scientists' page. The page has a dark blue header with navigation links: 'GALLERY', 'PUBLIC & SCIENTISTS', 'PROJECT TEAM', and 'LSST CORPORATION'. Below the header is the LSST logo and the text 'Large Synoptic Survey Telescope Opening a Window of Discovery on the Dynamic Universe'. A secondary navigation bar includes 'ABOUT', 'SCIENCE GOALS', 'PARTICIPATE', 'GALLERY', 'NEWS', and 'FOR SCIENTISTS'. The main content area has a breadcrumb trail: 'Home / For Scientists / LSST Information for Scientists'. On the left, there is a sidebar with links: 'Key Numbers', 'Publications', 'Survey Strategy', 'Deep Drilling Fields', 'Filter Throughputs', 'Simulations', 'Software Stack', 'Science Advisory Committee', 'Science Collaborations', and 'LSSTC Enabling Science'. The main content area features a large heading 'LSST Information for Scientists' followed by two news items. The first item, dated September 12, 2017, discusses the LSST observing strategy and mentions a living white paper on GitHub. The second item, dated August 10, 2017, discusses the Project Science Team's discussions with Science Collaboration chairs.

Data Management software development webpage.



The screenshot shows the LSST Science Pipelines documentation webpage. On the left is a dark sidebar with the LSST logo and navigation links. The main content area has a white background with a breadcrumb trail, a title, an introduction paragraph, a link to the latest release, a section on installation, and a list of installation methods.

LSST
Large Synoptic Survey Telescope

LSST Science Pipelines

Edition: v14.0 (current)

Change edition

Search docs

INSTALLATION

- Installing the LSST Science Pipelines

RELEASE DETAILS

- Release Notes
- Known Issues
- Characterization Metric Reports
- Release History

Docs » The LSST Science Pipelines [Edit on GitHub](#)

The LSST Science Pipelines

The LSST Science Pipelines enable optical and near-infrared astronomy in the big data era. We are building the Science Pipelines for the [Large Synoptic Survey Telescope \(LSST\)](#), but our command line task and Python API can be extended for any optical or near-infrared dataset.

The latest release is 14.0: [learn what's new](#).

Installation

Recommended installation path:

- [Installing with newinstall.sh](#)
- [Setting up installed LSST Science Pipelines](#)
- [Top-level packages to install](#)

Alternative distributions and installation methods:

- [Running with Docker](#)
- [Installing from source with lsstsw](#)
- [CernVM FS \(contributed by CC-IN2P3\)](#)



Community Forum

New Data Management Initiative: “Data Q&A” Forum

For your science questions regarding data products and pipelines.

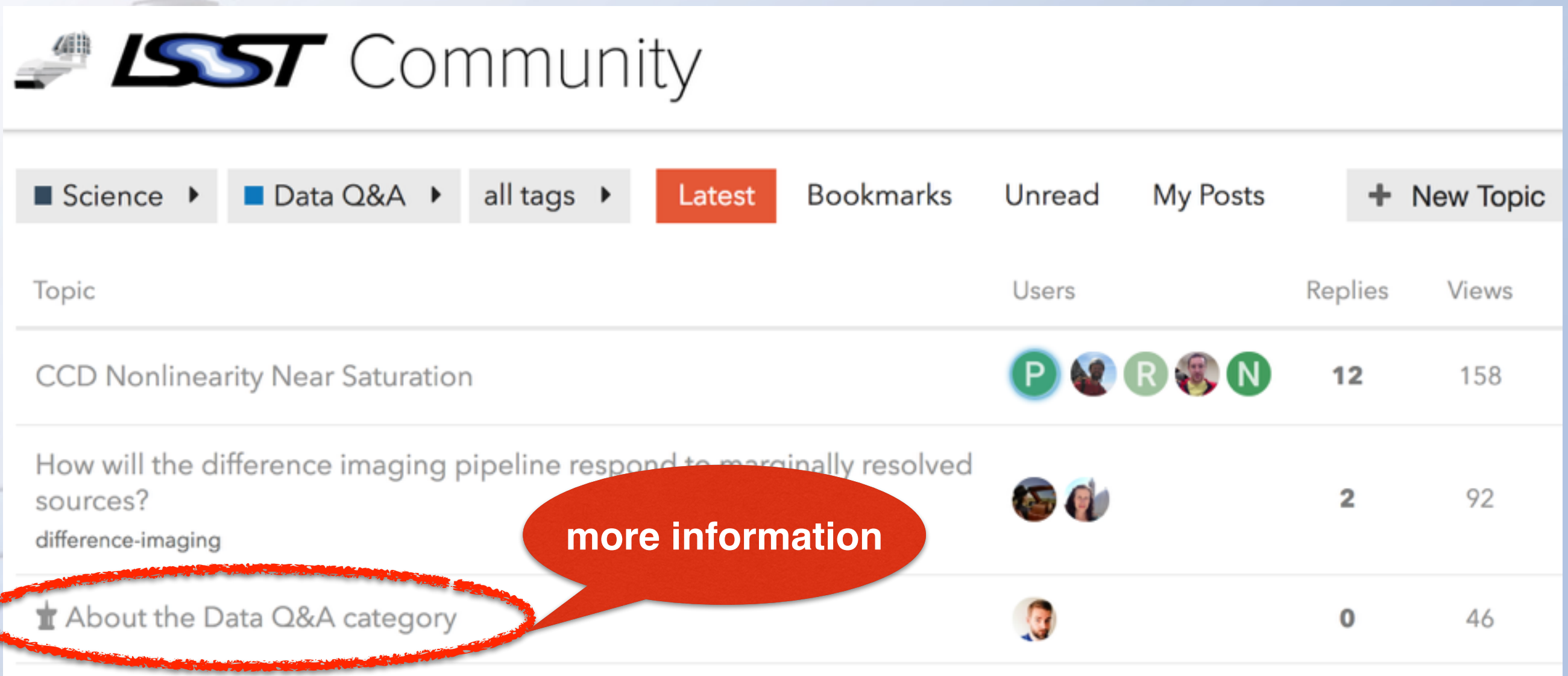
The screenshot shows the LSST Community forum interface. At the top, there is a navigation bar with tabs for 'Science', 'Data Q&A', 'all tags', 'Latest', 'Bookmarks', 'Unread', 'My Posts', and '+ New Topic'. Below the navigation bar, there is a table of forum topics with columns for 'Topic', 'Users', 'Replies', and 'Views'.

Topic	Users	Replies	Views
CCD Nonlinearity Near Saturation		12	158
How will the difference imaging pipeline respond to marginally resolved sources? difference-imaging		2	92
📌 About the Data Q&A category		0	46


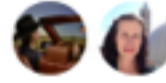

Community Forum

New Data Management Initiative: “Data Q&A” Forum

For your science questions regarding data products and pipelines.



The screenshot shows the LSST Community forum interface. At the top, there is a navigation bar with tabs for Science, Data Q&A, all tags, Latest (highlighted in red), Bookmarks, Unread, My Posts, and a + New Topic button. Below the navigation bar is a table of forum topics. The table has columns for Topic, Users, Replies, and Views. The first topic is "CCD Nonlinearity Near Saturation" with 12 replies and 158 views. The second topic is "How will the difference imaging pipeline respond to marginally resolved sources?" with 2 replies and 92 views. The third topic is "About the Data Q&A category" with 0 replies and 46 views. A red speech bubble with the text "more information" points to the "About the Data Q&A category" topic, which is also circled in red.

Topic	Users	Replies	Views
CCD Nonlinearity Near Saturation		12	158
How will the difference imaging pipeline respond to marginally resolved sources? difference-imaging		2	92
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Community Forum

New Data Management Initiative: “Data Q&A” Forum

For your science questions regarding data products and pipelines.

The screenshot shows the LSST Community Forum interface. At the top, there is a navigation bar with the LSST logo and the text 'Comm'. Below this, there are several menu items: 'Science', 'Data Q&A', 'Tags', 'Latest', 'Bookmarks', 'Unread', 'My Posts', and '+ New Topic'. The 'Data Q&A' and '+ New Topic' items are circled in green. A green speech bubble points to the 'Data Q&A' menu with the text 'select categories', and another green speech bubble points to the '+ New Topic' button with the text 'make a new topic'. Below the navigation bar, there is a table of forum topics. The table has columns for 'Topic', 'Users', 'Replies', and 'Views'. The first row shows a topic titled 'CCD Nonlinearity Near Saturation' with 12 replies and 158 views. The second row shows a topic titled 'How will the difference imaging pipeline respond to marginally resolved sources?' with 2 replies and 92 views. The third row shows a topic titled 'About the Data Q&A category' with 0 replies and 46 views. This last row is circled in red, and a red speech bubble points to it with the text 'more information'.

Topic	Users	Replies	Views
CCD Nonlinearity Near Saturation	P, R, N	12	158
How will the difference imaging pipeline respond to marginally resolved sources? difference-imaging		2	92
📌 About the Data Q&A category		0	46

There are currently 8 collaborations:

- Dark Energy
- Transients & Variable Stars
- Galaxies
- Stars, Milky Way & Local Volume
- Solar System
- Active Galactic Nuclei
- Strong Lensing
- Informatics & Statistics

SC Coordinator: Federica Bianco

Science Collaboration membership is limited to data rights holders.



NEW!

Data Management Subsystem
Science Team members are
assigned as liaisons to each
Science Collaboration.



community.lsst.org



all categories ▾ all tags ▾ **Latest** Categories

Topic

Welcome to community.lsst.org

community.lsst.org is a place for the astronomy community to discuss the Large Synoptic Survey Telescope's ongoing development and get help with using LSST's software today. What's here Community members can read, pos... [read more](#)

Meetings

- working group monthly videocons
- collaboration meetings, hackathons

Community Forums

- discussions regarding scientific preparation

Observing Strategy White Paper

- science collaborations analyzing survey simulations

Science Roadmaps

Data Challenges (tool development)

Assessment of Follow-up Capabilities

LSSTC Data Science Fellowship Program

- preparing students (hosting opportunities exist)

Science-Driven Optimization of the LSST Observing Strategy

Prepared by the LSST Science Collaborations,
with support from the LSST Project.

Phil Marshall,¹ Scott Anderson,² Timo Anguita,³ Ruth Angus,⁴ Iair Arcavi,⁵ Humna Awan,⁶ Federica B. Bianco,⁷ Rahul Biswas,⁸ Keaton J. Bell,⁹ Eric C. Bellm,¹⁰ David Bennett,¹¹ Niel Brandt,¹² Chris Britt,¹³ Derek Buzasi,¹⁴ Dana I. Casetti-Dinescu,¹⁵ Laura Chomiuk,¹⁶ Will Clarkson,¹⁷ Chuck Claver,¹⁸ Andy Connolly,¹⁹ Ken Cook,²⁰ James Davenport,²¹ Victor Debattista,²² Seth Digel,²³ Zohbeyr Doctor,²⁴ Wen-fai Fong,²⁵ Eric Gawiser,²⁶ Mark Giampapa,²⁷ John E. Gizis,²⁸ Melissa L. Graham,²⁹ Carl Grillmair,³⁰ Zoltan Haiman,³¹ Patrick Hartigan,³² Suzanne Hawley,³³ Željko Ivezić,³⁴ C. Johns-Krull,³⁵ Lynne Jones,³⁶ Shashi Kanbur,³⁷ Vassiliki Kalogera,³⁸ Vinay Kashyap,³⁹ Vishal Kasliwal,⁴⁰ Peter Kurczynski,⁴¹ Michael C. Liu,⁴² Michelle Lochner,⁴³ Michael B. Lund,⁴⁴ Ashish Mahabal,⁴⁵ Raffaella Margutti,⁴⁶ Tom Matheson,⁴⁷ Peregrine McGehee,⁴⁸ Soren Meibom,⁴⁹ Josh Meyers,⁵⁰ Dave Monet,⁵¹ David Nidever,⁵² Knut Olsen,⁵³ Eric Neilsen,⁵⁴ Matthew T. Penny,⁵⁵ Christina Peters,⁵⁶ Radosław Poleski,⁵⁷ Gordon Richards,⁵⁸ Stephen Ridgway,⁵⁹ Jeonghee Rho,⁶⁰ Jason Rhodes,⁶¹ David Rubin,⁶² Samuel Schmidt,⁶³ Ohad Shemmer,⁶⁴ Avi Shporer,⁶⁵ Colin Slater,⁶⁶ Nathan Smith,⁶⁷ Marcelles Soares-Santos,⁶⁸ Keivan Stassun,⁶⁹ Jay Strader,⁷⁰ Michael Strauss,⁷¹ Rachel Street,⁷² Christopher Stubbs,⁷³ Paula Szkody,⁷⁴ David Trilling,⁷⁵ Virginia Trimble,⁷⁶ Tony Tyson,⁷⁷ Miguel de Val-Borro,⁷⁸ Stefano Valenti,⁷⁹ Kathy Vivas,⁸⁰ Robert Wagoner,⁸¹ Lucianne Walkowicz,⁸² Beth Willman,⁸³ Peter Yochim,⁸⁴ Bevin Ashley Zauderer,⁸⁵

Project Science Team seminars to the Science Collaborations

Monthly up-to-date live stream talks on a variety of topics by request from the Science Collaborations; slides/recordings at <https://www.lsst.org/scientists>.



What to Expect of the LSST Archives: The LSST Science Platform



LSST Plans for Cadence Optimization



Status of the LSST Image Simulations



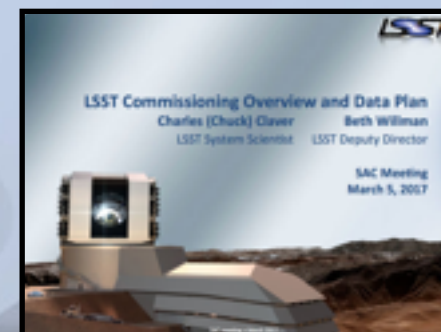
Data Management's Plans for Crowded Stellar Fields



Simulated Observatory Control System (SOCS) and Scheduler Progress



Education and Public Outreach



LSST Commissioning Overview



Future Meetings

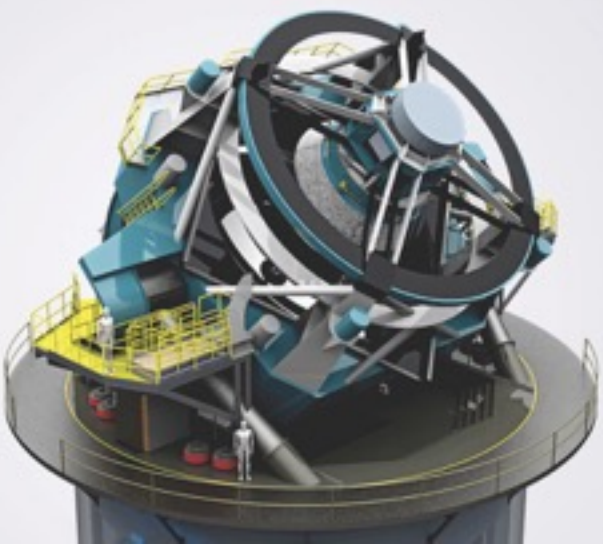
LSST@Europe

June 11-15 2018, Lyon France

europe2018.lsst.fr — Late registration closes May 11 2018

LSST Project and Community Workshop

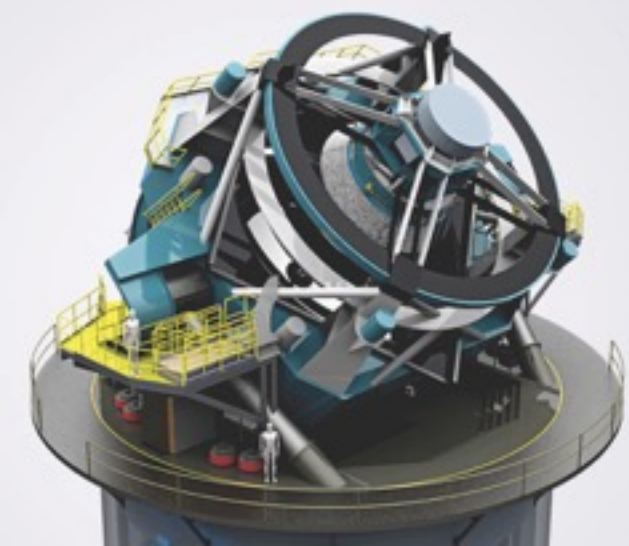
August 13-17 2018, Tucson AZ USA



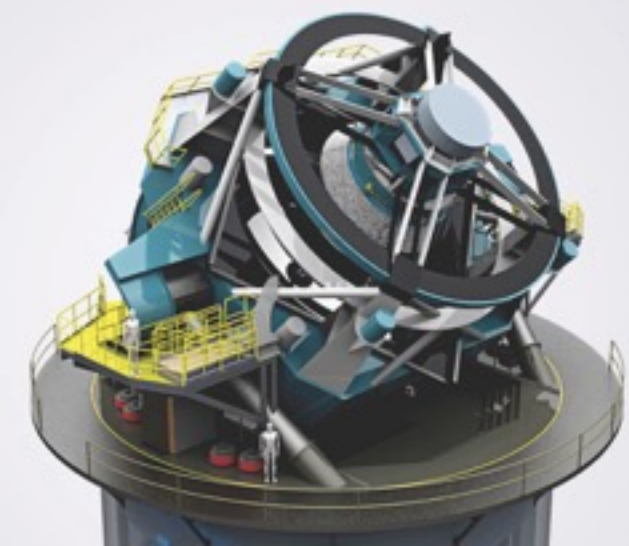


Obrigada a todos!

Please feel free to contact me at mlg3k@uw.edu with any data products/pipelines science questions, or to use the “Data Q&A” Community Forum.



extra slides



Early Verification
with ComCam
~3 months

Early Science Verification

- starts mid-2020 with **ComCam**
- resumes early-2021 with the **LSST Camera**

Early Verification
with LSST Camera
~2 months+

Wide-Area Alert Survey
template generation
~3 weeks

Science Verification starts in mid-2021 with two operational readiness mini-surveys:

Wide-Area Alert Production to cover e.g., a 1600 deg² stripe with a range of source densities, produce real-time alerts.

10-Year Depth Survey: to cover e.g., a 300 deg² field with 825 visits, reaching LSST full-depth equivalent.

10 Year Depth Survey
In fields overlapping external
imaging and spectroscopy.
~6 weeks

Wide-Area Alert Survey
alert production
~3 weeks

Final science verification will be followed by an 8 week shut down for the Operations Readiness Review, early-2022.

Slide of additional information about Special Programs

Additional Mini-Survey Concepts:

Mini-Moons (temporary earth-orbiting asteroids)
Meter-Sized Impactors (small earth-crossing asteroids)
Twilight Survey (short exposures for bright objects)
Gravitational Wave Counterparts (extragalactic)

See also Chapter 10 of the Observing Strategy White Paper:

<https://github.com/LSSTScienceCollaborations/ObservingStrategy/tree/pdf/whitepaper>

“Simulations, Metrics, and Merit Functions for DDF/MS”, Steve Ridgway, LSST AHM, Aug 2016:

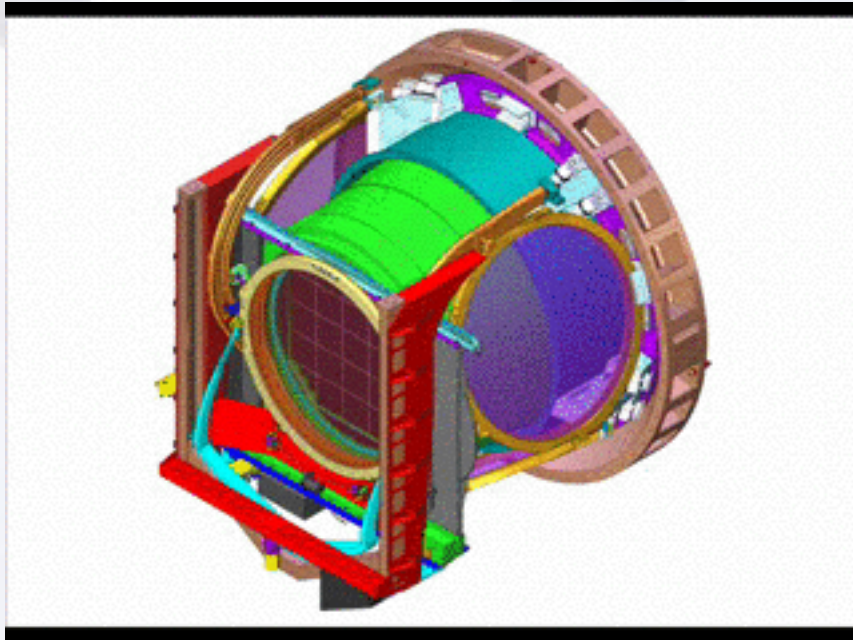
https://project.lsst.org/meetings/lst2016/sites/lst2016/files/Ridgway-SimulationsMetrics_1.pdf

Neil Brandt’s LSST AHM 2016 talk:

<https://project.lsst.org/meetings/lst2016/sites/lst2016/files/Brandt-DDF-MiniSurveys-01.pdf>

<https://www.lsst.org/scientists/survey-design/ddf>

2011 DDF Whitepapers: <https://project.lsst.org/content/whitepapers32012>



Filter Changes

The maximum time for filter change is 120 seconds (30 seconds for the telescope to reorient the camera to its nominal zero angle position on the rotator, and 90 seconds to the camera subsystem for executing the change; OSS-REQ-0293, [ls.st/lse-30](#)).

The minimum time between filter changes has no restrictions from e.g., thermal tolerances. However, based on overheads and efficiency, it is recommended to keep the filter change rate lower than once every 10 minutes.

The maximum total number of filter changes is 100,000 over 15 years, an average of 18 changes per night.

The maximum number of filter swaps in/out of the carousel is 3000 in 15 years, or once every two nights.

Last three points are from Steve Ritz and Zeljko Ivezic, to be incorporated into public-facing documents soon.

Exposure Times

The minimum exposure time is 1 second, with a stretch goal of 0.1 seconds (OSS-REQ-0291, [ls.st/lse-30](#)).

1) The minimum exposure time needed to create an image with a PSF that is well-formed enough for difference imaging is a separate question we will consider in later slides.

2) Assuming a 1 second exposure can be reduced and calibrated, its detected point sources will span $13 < r < 21$ magnitudes, whereas a 15 second exposure saturates at $r \sim 15.8$ mag.

The maximum exposure time is not restricted.

However, a 2x150 second image would saturate at $r \sim 18.3$, perhaps leaving too few stars overlapping with e.g., templates or WFD images, for astrometric and photometric calibrations; additionally, the impact on CR rejection routines is untested for long exposures.



Transients and Variable Stars Science Collaboration

Chairs: Federica Bianco and Rachel Street

Private wiki for SC members to collaborate.

The screenshot shows a wiki page for the Transients and Variable Stars Science Collaboration. The page title is "Transients and Variable Stars". The main content area is highlighted with a green border and contains the following text:

Current Collaboration Activities & Announcements

- **Collaboration Roadmap for Transient and Variable Star Science with LSST** - we are developing a roadmap for work during LSST's construction phase that will best enable transient/variable star science once the survey begins.
- **TVS Roadmapping Workshop (Mar 24-25, 2016, ANL)**
 - Classification
 - Stellar subgroups
 - Explosive subgroups

Below this section, there is a welcome message: "Welcome to the Transients and Variable Stars Science Collaboration! Current chairs are Ashish Mahabal (at nyu.edu)".

You can reach all members of the TVS SC at lsst-transient@lsstcorp.org. A list of members can be found here.

On the right side of the page, there is a list of science collaborations:

- **Blazars**
- Cosmological
- Classification/Characterization
- Distance Scale
- Fast Transients
- Galactic
- Gravitational Waves
- Interacting Binaries
- Magnetically Active Stars
- Microlensing Subgroup
- Multiwavelength Characterization/Counterparts
- Non-degenerate Eruptive Variables
- Pulsating Variables
- Supernovae Subgroup
- Tidal Disruption Events
- Transiting Planets (Roadmap outline in place!)

On the left side, there is a navigation menu with the following items:

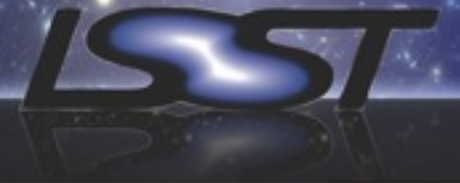
- Main page
- Papers Under Review
- Recent changes
- Help

Below the navigation menu, there is a section for "science collaborations" with the following items:

- Solar System
- Stars & Milky Way
- Transients/Variables
- Supernovae
- Galaxies
- Active Galactic Nuclei
- Strong Lensing
- Weak Lensing
- Large Scale Structure
- Informatics & Statistics
- EPO
- DESC

At the bottom of the page, there is a "Contents [hide]" section with the following items:

- 1 Scientific Subgroups
- 2 Science Projects
- 3 Development Groups
- 4 Meetings
- 5 Goals & Activities
 - 5.1 Near term (2016)
 - 5.2 Intermediate term (2017-2020)



Transients and Variable Stars Science Collaboration

Recent activity on the Community forum

The screenshot shows the LSST Community forum interface. At the top, there is a navigation bar with the LSST logo and the word "Community". Below this, there are several tabs: "Science", "all", "tvs", "Latest" (highlighted in red), "Bookmarks", "Unread (1)", and "My Posts". The main content area displays a list of forum topics. Each topic row includes the topic title, a category icon (a dark blue square with the word "Science"), and a row of user avatars. The topics listed are:

Topic	Category	Users
List of current photometric time-series surveys? tvs	Science	P, [Avatar], [Avatar]
Microlensing with LSST science, milkyway, tvs, microlensing	Science	R, [Avatar], [Avatar]
Data Challenge to characterize transient and variable objects tvs	Science	T, [Avatar], [Avatar], [Avatar], J

<https://community.lsst.org/tags/c/sci/tvs>