LARGE SYNOPTIC SURVEY TELESCOPE

Large Synoptic Survey Telescope (LSST)
Data Management

Data Management Releases for Verification/Integration

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LDM-564

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Abstract

This document describes release management at a high level and specific features for upcoming releases.

Change Record

Version	Date	Description	Owner name
1.0	2017-08-18	Initial version. Approved in RFC-373.	W. O'Mullane
	2018-03-16	Synchronize milestones with PMCS.	J.D. Swinbank
1.1	2018-06-18	Update release plan with baseline. Approved in RFC-497	J.D. Swinbank
1.2	2018-07-17	Provide text for L2 milestones which do not contain L3 milestones. Approved in RFC-501.	J.D. Swinbank
1.3	2019-07-12	Update schedule based on month end May 2019 data. Add LDM-503-10a release.	J.D. Swinbank
TBD	XXXX-XX-XX	Update schedule based on month end February 2020 data.	J.D. Swinbank

Document source location: `https://github.com/lsst/LDM-564`

Contents

Data Management Releases for Verification/Integration

1 Introduction

1.1 Scope

This document covers releases of software from the Data Management Subsystem of LSST for verification/integration tests. It discusses the delineation between the Data Facility as an operational entity and DM producing and testing software. It does not cover the normal releases to the community of the software stack - see `https://developer.lsst.io/` for that.

2 Release Management

This section outlines the current understanding of the release management process. Complete definition is pending the appointment of the DM Release Manager.

2.1 Preparation of Releases

DM develops code in GitHub following its developer guidelines and coding standards [1]. This includes automated testing and continuous integration. Tested releases are tagged by SQuaRE weekly and major releases are made each cycle (six months).

There are specific packages and systems deployed together to form the high level components of DM as depicted in Figure 1. The orchestration of deployments on multiple machines is facilitated by the use of containers and machine readable configurations. DM prepares Docker containers and Puppet configurations for deploying these systems on Kubernetes enabled clusters. These artifacts are tagged as part of the release.

In addition, specific releases with features required to support the LDM-503 test milestones will be tagged and released in advanced of each verification test. The preliminary feature lists for these releases are defined in Section 3.

[1] `https://developer.lsst.io/`

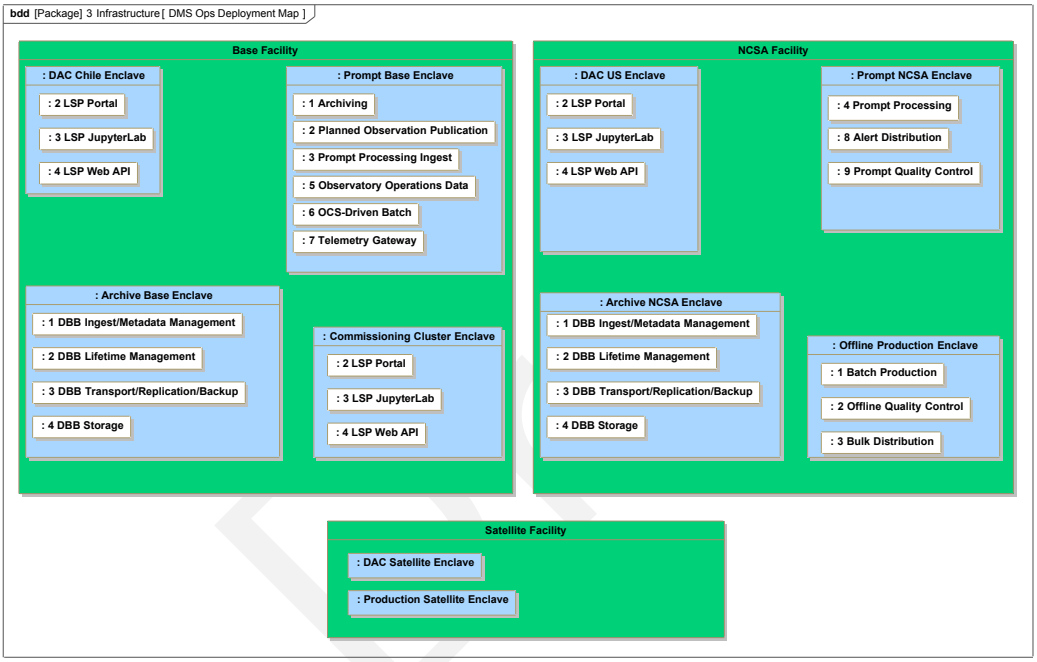

FIGURE 1: DM components as deployed during Operations. For details, refer to LDM-148.

2.2 Deployment of Releases

Although DM will provide ready-to-install products, these will be further tested before being deployed. Hence, releases will initially be installed on test systems at NCSA and will undergo smoke testing before they are made available in the production environment. This will serve as an operational validation of the release.

Once smoke tested, the Docker containers will be made available in the NCSA Docker repository. Using this secure internal repository, operators may deploy containers for specific releases in the operational environment.

2.2.1 Levels of Operational Validation

Certain containers will be used to provide kernels and supporting libraries for the JupyterLab environment. Multiple versions of these containers can be made available simultaneously — for example, providing a series of minor releases of the software stack — with the user selecting which to deploy for their particular use case. Since they will not be deployed as part of the core operational system, acceptance testing can be relatively minimal.

Some containers will be made available on development systems in support of ongoing development of the code. Again, these should be made available rapidly, with security checking and validation testing kept to a minimum.

Similarly, during Commissioning, availability of containers on the Commissioning Cluster should be on the order of hours (not days). The level of smoke testing and the time to availability of a container may need to be compressed in Commissioning.

Containers to be used for prompt or batch processing on operational systems, on the other hand, must be rigorously validated.

3 Functionality in DM releases

This is currently not an exhaustive feature list, but rather gives an indication at a high level of the features in each release which will be verified by the corresponding verification test

campaign. As the test plans are written this will become a list of requirements to be tested for that release and thus begin to fill out the verification control database (currently to be in Jira).

In the feature lists below, the corresponding internal milestone is given in parenthesis.

Each section here is a test milestone from LDM-503 — the same labels are used. The timeline is in the DM schedule using the same labels and depicted in Figure 2

3.1 Science Platform with WISE data in PDAC: LDM-503-01

Due: 2017-11-30; completed 2018-05-30.

- DM-SUIT-3: Time series analysis tool for WISE data *(Due: 2016-09-30; completed 2017-11-30)*
- DM-SUIT-2: Search WISE coaded data single exposure images in PDAC (the images are from IRSA at IPAC, not NCSA) *(Due: 2017-07-31; completed 2017-11-30)*
- DM-SQRE-1: Project internal Jupyter notebook service *(Due: 2017-08-31; completed 2017-11-01)*
- DM-DAX-1: WISE data ingest to PDAC *(Due: 2017-11-30; completed 2017-11-01)*
- DM-SUIT-1: Search and display WISE sources (objects) in PDAC *(Due: 2017-11-30; completed 2017-11-30)*
- DM-SUIT-4: Multiple data traces in chart space *(Due: 2017-11-30; completed 2017-11-30)*

3.2 Alert generation validation: LDM-503-03

Due: 2017-11-30; completed 2017-12-01.

- DM-AP-1: Basic single frame measurement pipeline. *(Due: 2017-08-31; completed 2017-11-01)*
- DM-AP-2: Alard & Lupton-style image differencing. *(Due: 2017-08-31; completed 2017-11-01)*

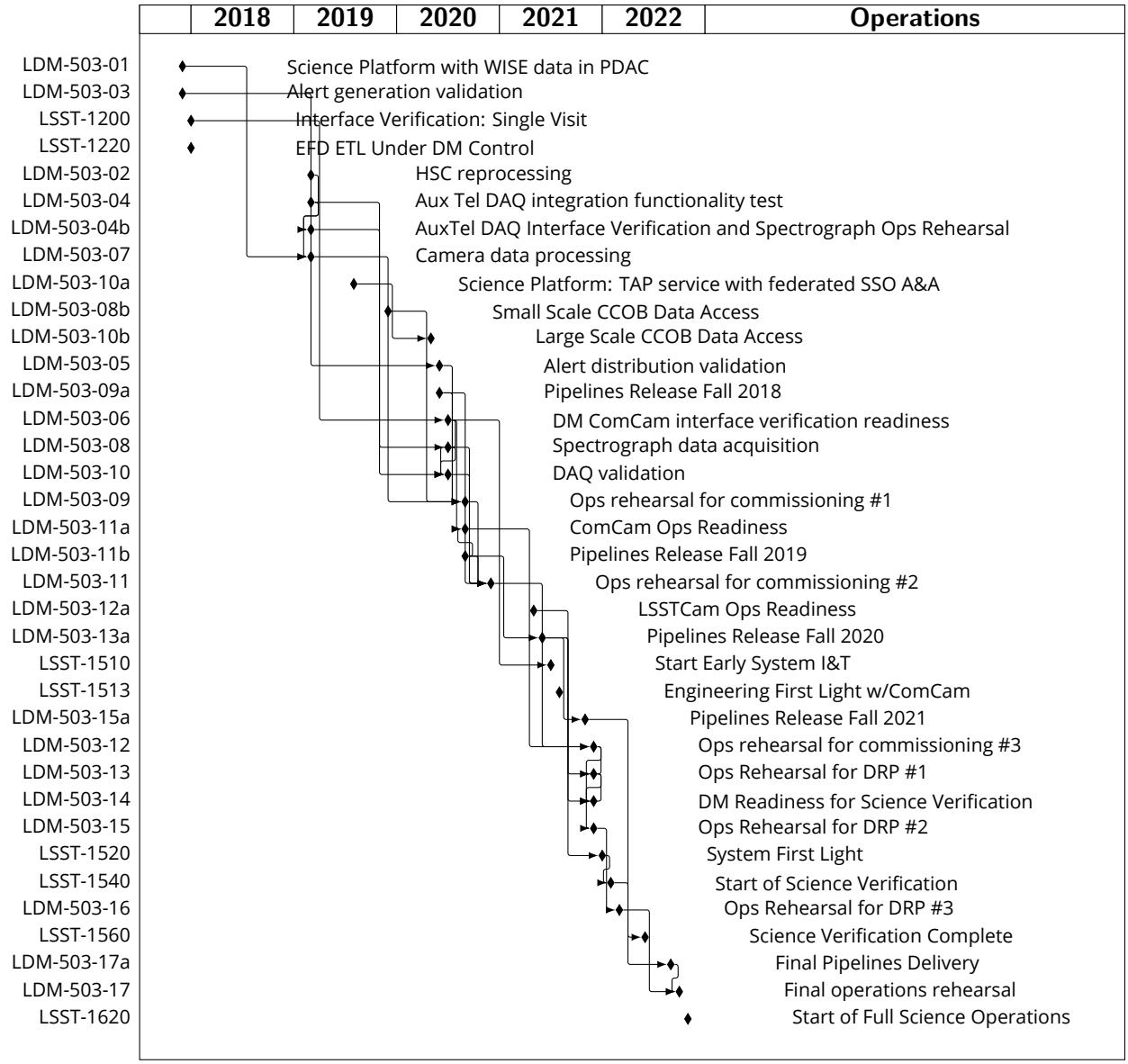

FIGURE 2: DM level 2 milestones (LDM-503-x) in the LSST schedule.

- DM-AP-3: Point source & dipole measurement on difference images. *(Due: 2017-08-31; completed 2017-11-01)*
- DM-AP-4: DIASource association *(Due: 2017-08-31; completed 2017-11-01)*
- DM-AP-5: DIAObject generation *(Due: 2017-08-31; completed 2017-11-01)*
- DM-DAX-6: Prototype level 1 database *(Due: 2017-11-30; completed 2017-11-01)*

3.3 HSC reprocessing: LDM-503-02

Due: 2019-02-28; completed 2017-12-01.

- DM-DRP-1: HSC merger complete: all functionality deployed for the most recent HSC data release processing is now available within the LSST stack. *(Due: 2017-05-31; completed 2017-11-01)*
- DM-NCSA-1: Provide regular reprocessing service for HSC data *(Due: 2017-05-31; completed 2017-11-01)*
- DM-NCSA-2: Provide access to results of regular reprocessing (NB the form this takes depends upon available DAX functionality) *(Due: 2017-05-31; completed 2017-11-01)*
- DM-AP-1: Basic single frame measurement pipeline. *(Due: 2017-08-31; completed 2017-11-01)*
- DM-DRP-2: Basic visualization and quality assessment tools operational on HSC-scale data volumes. *(Due: 2019-02-28; completed 2017-11-01)*
- DM-NCSA-3: Provide database for metadata, provenance, location and demonstrate ingest at small scale *(Due: 2019-02-28; completed 2017-11-01)*

3.4 Aux Tel DAQ integration functionality test: LDM-503-04

Due: 2019-02-28; completed 2018-06-29.

- DM-NCSA-4: Minimal support for the small operational schema including file metadata and provenance for every file, and record of in *(Due: 2019-02-28; completed 2018-06-29)*

3.5 Aux Tel DAQ interface Integration Verification and Spectrograph Operations Rehearsal: LDM-503-04b

Due: 2019-02-28; completed 2018-06-29.

- DM-NCSA-27: Deliver header service code *(Due: 2017-12-29; completed 2017-12-01)*
- DM-NCSA-6: Ability to transfer files originating from Tucson to NCSA and ingest files at NCSA, including metadata and provenance *(Due: 2018-03-05; completed 2018-10-31)*
- DM-NCSA-5: Level 1 archiving system able to acquire pixel data from the Aux Tel DAQ, header metadata via OCS, assemble FITS image, *(Due: 2018-03-30; completed 2018-05-31)*
- DM-NCSA-7: Capability to paint displays for Tucson and NCSA *(Due: 2018-03-30; completed 2018-06-29)*

3.6 Camera data processing: LDM-503-07

Due: 2019-02-28; completed 2019-01-17.

- DM-DRP-4: Calibration product generation in support of basic ISR. *(Due: 2017-05-31; completed 2017-12-01)*

3.7 Science Platform: TAP service with federated SSO A&A: LDM-503-10a

Due: 2019-07-29; currently incomplete.

- DM-DAX-2: Query service supporting IVOA TAP protocol, w/ support for asynchronous queries *(Due: 2017-07-31; currently incomplete)*

3.8 Small Scale CCOB Data Access: LDM-503-08b

Due: 2019-11-08; completed 2019-07-15.

No new functionality is associated with this milestone, which represents a refined or improved version of earlier deliveries.

3.9 Large Scale CCOB Data Access: LDM-503-10b

Due: 2020-04-22; currently incomplete.

No new functionality is associated with this milestone, which represents a refined or improved version of earlier deliveries.

3.10 Alert distribution validation: LDM-503-05

Due: 2020-05-29; completed 2018-07-17.

- DM-NCSA-9: Test instance of alert distribution hosting service and L1 database in Development & Integration Enclave *(Due: 2018-08-31; completed 2019-05-31)*
- DM-NCSA-8: Alert Filtering Service receives alert streams *(Due: 2020-05-29; currently incomplete)*

3.11 Pipelines Release Fall 2018: LDM-503-09a

Due: 2020-05-29; completed 2019-04-12.

- DM-AP-2: Alard & Lupton-style image differencing. *(Due: 2017-08-31; completed 2017-11-01)*
- DM-AP-3: Point source & dipole measurement on difference images. *(Due: 2017-08-31; completed 2017-11-01)*
- DM-DRP-16: Global photometric fitting (e.g. Burke et al. Forward Global Calibration Method). *(Due: 2018-01-31; completed 2018-05-31)*
- DM-DRP-32: Object classification system available. *(Due: 2018-03-30; completed 2018-10-31)*
- DM-AP-7: Basic instrument signature removal (ISR) capability. *(Due: 2018-06-29; completed 2018-06-29)*
- DM-DRP-3: PSF-homogenized coadd construction. *(Due: 2018-06-29; completed 2017-11-01)*

- DM-DRP-38: Camera package supporting the Commissioning Camera. *(Due: 2018-06-29; completed 2018-06-29)*
- DM-DRP-5: Camera package supporting the LSST Camera. *(Due: 2018-06-29; completed 2018-06-29)*
- DM-DRP-7: Coordinate transformation tool provided for use with the Collimated Beam Projector. *(Due: 2018-07-12; completed 2018-07-05)*
- DM-AP-9: JOINTCAL1: Jointcal at a functional level *(Due: 2018-07-20; completed 2018-11-29)*
- DM-DRP-17: Simultaneous photometric and astrometric fitting to multiple exposures. *(Due: 2018-07-20; completed 2018-11-29)*
- DM-AP-6: Alert format defined & queue system available. *(Due: 2020-05-29; completed 2018-07-31)*
- DM-DAX-8: Scatter-gather support in PipelineTask *(Due: 2020-05-29; currently incomplete)*

3.12 DM ComCam interface verification readiness: LDM-503-06

Due: 2020-06-03; currently incomplete.

- DM-NCSA-10: Sustained archiving service that is OCS commandable *(Due: 2018-09-25; completed 2019-05-31)*
- DM-NCSA-11: Verified acquisition of raw and crosstalk-corrected exposures at raft scale, incl. correct metadata *(Due: 2019-07-29; currently incomplete)*

3.13 Spectrograph data acquisition: LDM-503-08

Due: 2020-06-22; currently incomplete.

- DM-DRP-6: Camera package supporting the Auxiliary Telescope. *(Due: 2017-08-31; completed 2018-01-31)*
- DM-NET-2: Mountain - Base Network Functional 2 x 100 Gbps *(Due: 2018-03-27; completed 2018-04-02)*

- DM-NET-3: Initial Network Ready (Summit) *(Due: 2018-09-28; completed 2018-03-05)*
- DM-NET-6: Summit LAN installed *(Due: 2018-09-28; completed 2018-04-02)*
- DM-NCSA-13: Header Writing Service for Spectrograph use case *(Due: 2019-05-14; completed 2019-05-31)*
- DM-NCSA-15: Batch Processing Service for offline spectrograph data processing *(Due: 2020-05-29; currently incomplete)*
- DM-NCSA-14: Data Backbone endpoints in Chile for ingestion and access, distribution over WAN, ingest at NCSA into custodial file sto *(Due: 2020-06-22; currently incomplete)*

3.14 DAQ validation: LDM-503-10

Due: 2020-06-22; currently incomplete.

No new functionality is associated with this milestone, which represents a refined or improved version of earlier deliveries.

3.15 Ops rehearsal for commissioning #1: LDM-503-09

Due: 2020-08-31; currently incomplete.

- DM-DAX-2: Query service supporting IVOA TAP protocol, w/ support for asynchronous queries *(Due: 2017-07-31; currently incomplete)*
- DM-SQRE-2: Notebook service capabilities are suitable for the commissioning team to develop notebooks for its needs *(Due: 2018-11-30; currently incomplete)*
- DM-DAX-5: Database ingest in support of HSC reprocessing (ie, large catalog ingest) *(Due: 2019-02-28; currently incomplete)*
- DM-SUIT-5: Search and display processed HSC data *(Due: 2019-02-28; currently incomplete)*
- DM-NCSA-16: Perform ISR processing on ComCam-scale data. *(Due: 2019-03-29; currently incomplete)*
- DM-DAX-9: Provenance system *(Due: 2020-08-31; currently incomplete)*

3.16 ComCam Ops Readiness: LDM-503-11a

Due: 2020-08-31; currently incomplete.

- DM-NCSA-16: Perform ISR processing on ComCam-scale data. *(Due: 2019-03-29; currently incomplete)*
- DM-SUIT-10: SUIT deployment procedure *(Due: 2019-05-31; currently incomplete)*
- DM-NCSA-20: ComCam Archiving Service *(Due: 2019-09-06; currently incomplete)*
- DM-NCSA-22: Information in consolidated database available to QA portal *(Due: 2020-05-29; currently incomplete)*
- DM-NCSA-21: L1 Offline Processing Service, Raft Scale, ComCam *(Due: 2020-06-30; currently incomplete)*

3.17 Pipelines Release Fall 2019: LDM-503-11b

Due: 2020-08-31; currently incomplete.

- DM-DRP-14: Insertion of simulated sources into the data stream to check pipeline performance. *(Due: 2017-11-30; completed 2017-12-01)*
- DM-DRP-18: Initial multi-band deblending algorithm available. *(Due: 2017-11-30; completed 2017-12-01)*
- DM-DRP-9: Data reduction pipeline for the Auxiliary Telescope. *(Due: 2018-10-15; completed 2019-03-25)*
- DM-DRP-19: QA metrics are generated during pipeline execution. *(Due: 2018-11-29; completed 2018-12-13)*
- DM-AP-8: Advanced ISR, including ghost and linear feature masking, correction for the Brighter-Fatter effect and compensation for pixel response non-uniformity. *(Due: 2019-01-04; completed 2019-01-17)*
- DM-DRP-15: All varieties of coadd required for object detection and characterization are now produced during normal pipeline operation (although not necessarily at the ultimately required level of fidelity). *(Due: 2020-08-31; completed 2018-11-30)*

3.18 Ops rehearsal for commissioning #2: LDM-503-11

Due: 2020-11-30; currently incomplete.

- DM-NCSA-16: Perform ISR processing on ComCam-scale data. *(Due: 2019-03-29; currently incomplete)*
- DM-NET-4: Base LAN installed *(Due: 2019-07-15; currently incomplete)*

3.19 LSSTCam Ops Readiness: LDM-503-12a

Due: 2021-04-02; currently incomplete.

No new functionality is associated with this milestone, which represents a refined or improved version of earlier deliveries.

3.20 Pipelines Release Fall 2020: LDM-503-13a

Due: 2021-05-31; currently incomplete.

- DM-AP-11: Difference imaging includes noise decorrelation and correction for differential chromatic refraction. *(Due: 2019-11-27; currently incomplete)*
- DM-DRP-26: Overlap resolution at tract & patch boundaries. *(Due: 2020-04-27; currently incomplete)*
- DM-DRP-27: Object generation: association and assembly of (DIA, coadd, etc) sources to form objects. *(Due: 2020-04-27; currently incomplete)*
- DM-DRP-28: Difference images are now a first-class data product during data release processing. *(Due: 2020-04-27; currently incomplete)*
- DM-DRP-25: Prototype multi-epoch fitting system available. *(Due: 2020-05-01; currently incomplete)*
- DM-DRP-22: Template generation integrated with Data Release Production pipelines. *(Due: 2020-06-01; currently incomplete)*

- DM-AP-14: Alert filtering system available. *(Due: 2020-10-23; currently incomplete)*
- DM-AP-12: Difference imaging is now agnostic to the PSF of the template image. *(Due: 2020-10-30; currently incomplete)*
- DM-AP-13: Trailed source measurement on difference images. *(Due: 2020-10-30; currently incomplete)*
- DM-DRP-30: Forced photometry is now performed on individual processed visit images during data releases. *(Due: 2020-11-30; currently incomplete)*
- DM-DRP-34: Selection maps are generated during data releases. *(Due: 2020-11-30; currently incomplete)*

3.21 Pipelines Release Fall 2021: LDM-503-15a

Due: 2021-10-28; currently incomplete.

- DM-AP-15: Alert distribution system fully integrated. *(Due: 2021-06-02; currently incomplete)*
- DM-AP-17: Moving object processing system (MOPS) available. *(Due: 2021-09-20; currently incomplete)*
- DM-AP-16: Full integration of the Alert Production system within the operational environment. *(Due: 2021-10-28; currently incomplete)*

3.22 Ops rehearsal for commissioning #3: LDM-503-12

Due: 2021-11-30; currently incomplete.

- DM-SQRE-3: Notebook service stable for commissioning and other internal project users *(Due: 2020-02-27; currently incomplete)*

3.23 Ops rehearsal for data release processing #1 (ComCam data): LDM-503-13

Due: 2021-11-30; currently incomplete.

- DM-STAFF: Staffing Checkpoint *(Due: 2019-11-27; currently incomplete)*
- DM-NCSA-23: Operational processes for preparing for & producing a data release defined and tested *(Due: 2020-10-23; currently incomplete)*

3.24 DM Readiness for Science Verification: LDM-503-14

Due: 2021-11-30; currently incomplete.

- DM-SQRE-4: Notebook service ready for verification & validation *(Due: 2021-06-16; currently incomplete)*

3.25 Ops rehearsal for data release processing #2: LDM-503-15

Due: 2021-11-30; currently incomplete.

- DM-NCSA-25: Demonstrate operational coordination with and processing at satellite CC-IN2P3 satellite computing facility *(Due: 2021-11-02; currently incomplete)*
- DM-NCSA-24: Production batch service for data release processing *(Due: 2021-11-29; currently incomplete)*

3.26 Ops rehearsal for data release processing #3: LDM-503-16

Due: 2022-02-28; currently incomplete.

- DM-NCSA-26: Demonstrate full delivery of Data Facility ConOps *(Due: 2022-02-28; currently incomplete)*

3.27 Final Pipelines Delivery: LDM-503-17a

Due: 2022-08-31; currently incomplete.

No new functionality is associated with this milestone, which represents a refined or improved version of earlier deliveries.

3.28 Final operations rehearsal: LDM-503-17

Due: 2022-09-30; currently incomplete.

No new functionality is associated with this milestone, which represents a refined or improved version of earlier deliveries.

4 References

[1] **[LDM-148]**, Lim, K.T., Bosch, J., Dubois-Felsmann, G., et al., 2018, *Data Management System Design*, LDM-148, URL https://ls.st/LDM-148

[2] **[LDM-503]**, O'Mullane, W., Swinbank, J., Jurić, M., Economou, F., 2018, *Data Management Test Plan*, LDM-503, URL https://ls.st/LDM-503

5 Acronyms

Acronym	Description
AP	Alert Production
Alert	A packet of information for each source detected with signal-to-noise ratio > 5 in a difference image during Prompt Processing, containing measurement and characterization parameters based on the past 12 months of LSST observations plus small cutouts of the single-visit, template, and difference images, distributed via the internet.
Alert Production	The principal component of Prompt Processing that processes and calibrates incoming images, performs Difference Image Analysis to identify DIASources and DIAObjects, packages and distributes the resulting Alerts, and runs the Moving Object Processing System.
CC	Change Control
CCOB	Camera Calibration Optical Bench

Camera	The LSST subsystem responsible for the 3.2-gigapixel LSST camera, which will take more than 800 panoramic images of the sky every night. SLAC leads a consortium of Department of Energy laboratories to design and build the camera sensors, optics, electronics, cryostat, filters and filter exchange mechanism, and camera control system.
Collimated Beam Projector	The hardware to project a field of sources onto discrete sections of the telescope optics in order to characterize spatial variations in the telescope and instrument transmission function, and to monitor filter throughput evolution during the survey. Images obtained using the CBP will be used in calibration.
Commissioning	A two-year phase at the end of the Construction project during which a technical team a) integrates the various technical components of the three subsystems; b) shows their compliance with ICDs and system-level requirements as detailed in the LSST Observatory System Specifications document (OSS, LSE-30); and c) performs science verification to show compliance with the survey performance specifications as detailed in the LSST Science Requirements Document (SRD, LPM-17).
DAQ	Data Acquisition System
DAX	Data Access Services
DIA	Difference Image Analysis
DIAObject	A DIAObject is the association of DIASources, by coordinate, that have been detected with signal-to-noise ratio greater than 5 in at least one difference image. It is distinguished from a regular Object in that its brightness varies in time, and from a SSObject in that it is stationary (non-moving).
DIASource	A DIASource is a detection with signal-to-noise ratio greater than 5 in a difference image.
DM	Data Management
DRP	Data Release Production
Data Backbone	The software that provides for data registration, retrieval, storage, transport, replication, and provenance capabilities that are compatible with the Data Butler. It allows data products to move between Facilities, Enclaves, and DACs by managing caches of files at each endpoint, including persistence to long-term archival storage (e.g. tape).

Data Management	The LSST Subsystem responsible for the Data Management System (DMS), which will capture, store, catalog, and serve the LSST dataset to the scientific community and public. The DM team is responsible for the DMS architecture, applications, middleware, infrastructure, algorithms, and Observatory Network Design. DM is a distributed team working at LSST and partner institutions, with the DM Subsystem Manager located at LSST headquarters in Tucson.
Data Management Subsystem	The subsystems within Data Management may contain a defined combination of hardware, a software stack, a set of running processes, and the people who manage them: they are a major component of the DM System operations. Examples include the 'Archive Operations Subsystem' and the 'Data Processing Subsystem'".”
Data Release Production	An episode of (re)processing all of the accumulated LSST images, during which all output DR data products are generated. These episodes are planned to occur annually during the LSST survey, and the processing will be executed at the Archive Center. This includes Difference Imaging Analysis, generating deep Coadd Images, Source detection and association, creating Object and Solar System Object catalogs, and related metadata.
EFD	Engineering Facilities Database
Enclave	Individually defined portions of the computational resources at the Summit, Base, NCSA, and Satellite Facilities, such as the Prompt Enclave, the Archive Enclave, etc.
FITS	Flexible Image Transport System
HSC	Hyper Suprime-Cam
I&T	Integration and Test
IPAC	No longer an acronym; science and data center at Caltech
IRSA	Infrared Science Archive
ISR	Instrument Signal Removal
IVOA	International Virtual-Observatory Alliance
LAN	Local Area Network
LDM	LSST Data Management (Document Handle)
LSST	Large Synoptic Survey Telescope
MOPS	Moving Object Processing System
NCSA	National Center for Supercomputing Applications
NET	Network Engineering Team

OCS	Observatory Control System
Object	In LSST nomenclature this refers to an astronomical object, such as a star, galaxy, or other physical entity. E.g., comets, asteroids are also Objects but typically called a Moving Object or a Solar System Object (SSObject). One of the DRP data products is a table of Objects detected by LSST which can be static, or change brightness or position with time.
Operations	The 10-year period following construction and commissioning during which the LSST Observatory conducts its survey
Operations Rehearsal	A data management system prototype project employing the same methods, tools, personnel, and technologies as the real system in order to introduce and validate new algorithms, functionality, and infrastructure. Previously referred to as a data challenge.
PDAC	Prototype Data Access Center
PMCS	Project Management Controls System
PSF	Point Spread Function
PipelineTask	A special kind of Task that can read its inputs and write its outputs using a Butler, in addition to being able to have them passed in and out directly as Python objects. PipelineTasks may be connected together dynamically and executed by a generic workflow system. PipelineTasks typically (but not always) delegate most of their work to nested regular Tasks.
QA	Quality Assurance
RFC	Request For Comment
Raft	The sensors in the LSST camera are packaged into replaceable electronic assemblies, called rafts, consisting of 9 butted sensors (CCDs) in a 3x3 mosaic. Each raft is a replaceable unit in the LSST camera. There are 21 science rafts in the camera plus 4 additional corner rafts with specialized, non-science sensors, making for a total of 189 CCDs per focal plane image. The 21 science rafts are numbered from ”0,1” through ”0,3”, ”1,0” through ”3,4”, and ”4,1” through ”4,3”. (In other words, the 25 combinations from ”0,0” through ”4,4” minus the four corners which are non-science.)
Release	Publication of a new iteration of an existing document following approval of changes through the change control process. Upon release, the new iteration becomes the current baseline and the preferred version in the archive.
SQuaRE	Science Quality and Reliability Engineering

SUIT	Science User Interface and Tools
Science Platform	A set of integrated web applications and services deployed at the LSST Data Access Centers (DACs) through which the scientific community will access, visualize, and perform next-to-the-data analysis of the LSST data products.
Science Verification	The second phase of Commissioning for the LSST Construction Project, Science Verification demonstrates the system's compliance with the survey performance specifications detailed in the LSST Science Requirements Document (SRD, LPM-17). These activities are based solely on the measured 'on-sky' performance of the LSST system.
Scope	The work needed to be accomplished in order to deliver the product, service, or result with the specified features and functions
Summit	The site on the Cerro Pachón, Chile mountaintop where the LSST observatory, support facilities, and infrastructure will be built.
TAP	Table Access Protocol
TBD	To Be Defined (Determined)
Template	A co-added, single-band image of the sky that is deep, and created in a manner to remove transient or fast moving objects from the final image. Constituent images for templates may be selected from a limited range of quality parameters, such as PSF size or airmass. Such images are used to perform Difference Image Analysis in order to detect variable, transient, and Solar System astrophysical objects.
Validation	A process of confirming that the delivered system will provide its desired functionality; overall, a validation process includes the evaluation, integration, and test activities carried out at the system level to ensure that the final developed system satisfies the intent and performance of that system in operations
Verification	The process of evaluating the design, including hardware and software - to ensure the requirements have been met; verification (of requirements) is performed by test, analysis, inspection, and/or demonstration
Visit	A sequence of one or more consecutive exposures at a given position, orientation, and filter within the LSST cadence. See Standard Visit, Alternative Standard Visit, and Non-Standard Visit,DM TS Sims,, Education and Public Outreach (EPO),The LSST subsystem responsible for the cyberinfrastructure
WAN	Wide Area Network

WISE	Wide-field Survey Explorer
algorithm	A computational implementation of a calculation or some method of processing.
epoch	Sky coordinate reference frame, e.g., J2000. Alternatively refers to a single observation (usually photometric, can be multi-band) of a variable source.
metadata	General term for data about data, e.g., attributes of astronomical objects (e.g. images, sources, astroObjects, etc.) that are characteristics of the objects themselves, and facilitate the organization, preservation, and query of data sets. (E.g., a FITS header contains metadata).
patch	An quadrilateral sub-region of a sky tract, with a size in pixels chosen to fit easily into memory on desktop computers.
pipeline	A configured sequence of software tasks (Stages) to process data and generate data products. Example: Association Pipeline.
provenance	Information about how LSST images, Sources, and Objects were created (e.g., versions of pipelines, algorithmic components, or templates) and how to recreate them.
stack	a grouping, usually in layers (hence stack), of software packages and services to achieve a common goal. Often providing a higher level set of end user oriented services and tools
tract	A portion of sky, a spherical convex polygon, within the LSST all-sky tessellation (sky map). Each tract is subdivided into sky patches.