



Vera C. Rubin Observatory  
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.

Draft

## Change Record

| Version | Date       | Description                                                                                     | Owner name    |
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| 1.0     | 2017-08-18 | Initial version. Approved in RFC-373.                                                           | W. O'Mullane  |
|         | 2018-03-16 | Synchronize milestones with PMCS.                                                               | J.D. Swinbank |
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| 1.5     | 2021-06-03 | Update schedule for 2021 reviews approved in RFC-781                                            | W. O'Mullane  |

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## Contents

|                                                                                                                 |          |
|-----------------------------------------------------------------------------------------------------------------|----------|
| <b>1 Introduction</b>                                                                                           | <b>1</b> |
| 1.1 Scope . . . . .                                                                                             | 1        |
| <b>2 Release Management</b>                                                                                     | <b>1</b> |
| 2.1 Preparation of Releases . . . . .                                                                           | 1        |
| 2.2 Deployment of Releases . . . . .                                                                            | 3        |
| 2.2.1 Levels of Operational Validation . . . . .                                                                | 3        |
| <b>3 Functionality in DM releases</b>                                                                           | <b>3</b> |
| 3.1 Science Platform with WISE data in PDAC: LDM-503-01 . . . . .                                               | 4        |
| 3.2 Alert generation validation: LDM-503-03 . . . . .                                                           | 4        |
| 3.3 HSC reprocessing: LDM-503-02 . . . . .                                                                      | 7        |
| 3.4 Aux Tel DAQ integration functionality test: LDM-503-04 . . . . .                                            | 7        |
| 3.5 Aux Tel DAQ interface Integration Verification and Spectrograph Operations Rehearsal: LDM-503-04b . . . . . | 8        |
| 3.6 Camera data processing: LDM-503-07 . . . . .                                                                | 8        |
| 3.7 Science Platform: TAP service with federated SSO A&A: LDM-503-10a . . . . .                                 | 8        |
| 3.8 Small Scale CCOB Data Access: LDM-503-08b . . . . .                                                         | 8        |
| 3.9 Alert distribution validation: LDM-503-05 . . . . .                                                         | 9        |
| 3.10 Pipelines Release Fall 2018: LDM-503-09a . . . . .                                                         | 9        |
| 3.11 Large Scale CCOB Data Access: LDM-503-10b . . . . .                                                        | 10       |
| 3.12 DM ComCam interface verification readiness: LDM-503-06 . . . . .                                           | 10       |
| 3.13 Spectrograph data acquisition: LDM-503-08 . . . . .                                                        | 10       |
| 3.14 DAQ validation: LDM-503-10 . . . . .                                                                       | 11       |
| 3.15 ComCam Ops Readiness: LDM-503-11a . . . . .                                                                | 11       |
| 3.16 Ops rehearsal for commissioning #1: LDM-503-09 . . . . .                                                   | 11       |
| 3.17 Pipelines Release Fall 2019: LDM-503-11b . . . . .                                                         | 12       |
| 3.18 Science Platform ready for DP0: LDM-503-14a . . . . .                                                      | 13       |
| 3.19 Ops rehearsal for commissioning #2: LDM-503-11 . . . . .                                                   | 13       |

|                                                                                                                                              |           |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 3.20 Pipelines Release Fall 2020: LDM-503-13a . . . . .                                                                                      | 13        |
| 3.21 Pipelines Release Spring 2022: LDM-503-15a . . . . .                                                                                    | 14        |
| 3.22 Gen3 parity demonstrated: LDM-GEN3 . . . . .                                                                                            | 14        |
| 3.23 Science Platform ready for DP0.2 with Image Services: LDM-503-RSPa . . . . .                                                            | 14        |
| 3.24 Engineering Facility Database at the summit capturing and enabling access to<br>all telemetry with M1/M3 active: LDM-503-EFDa . . . . . | 14        |
| 3.25 Ops rehearsal for commissioning #3: LDM-503-12 . . . . .                                                                                | 15        |
| 3.26 Ops rehearsal for data release processing #1 (ComCam data): LDM-503-13 . .                                                              | 15        |
| 3.27 EFD/telemetry data replicated at the LDF, stored in InfluxDB. aggregated into<br>parquet files: LDM-503-EFDb . . . . .                  | 15        |
| 3.28 DM Readiness for Science Verification Surveys: LDM-503-14 . . . . .                                                                     | 15        |
| 3.29 Ops rehearsal for data release processing #2: LDM-503-15 . . . . .                                                                      | 15        |
| 3.30 Pipelines Release Spring 2023: LDM-503-16a . . . . .                                                                                    | 16        |
| 3.31 LSSTcam On Sky Readiness: LDM-503-12a . . . . .                                                                                         | 16        |
| 3.32 Ops rehearsal for data release processing #3: LDM-503-16 . . . . .                                                                      | 16        |
| 3.33 EFD data is queriable through TAP in the Science Platform: LDM-503-EFDc . . .                                                           | 16        |
| 3.34 Final operations rehearsal: LDM-503-17 . . . . .                                                                                        | 16        |
| 3.35 Science Platform ready for Science Verification: LDM-503-RSPb . . . . .                                                                 | 17        |
| 3.36 Final Pipelines Delivery: LDM-503-17a . . . . .                                                                                         | 17        |
| <b>4 References</b>                                                                                                                          | <b>17</b> |
| <b>5 Acronyms</b>                                                                                                                            | <b>17</b> |

# Data Management Releases for Verification/Integration

## 1 Introduction

The dates in this document are the forecast dates for the proposed rebaseline - as in Figure 3.

### 1.1 Scope

This document describes the major DM functionality which is expected to be available at major<sup>1</sup> milestones during the construction project, as described in LDM-503. In doing so, it is intended to provide guidance to the system integration and verification teams.

## 2 Release Management

All software releases from the DM Subsystem are carried out following the Release Management Policy, LDM-672. Technical details of the application of this policy are described in DMTN-106.

### 2.1 Preparation of Releases

DM develops code in GitHub following its developer guidelines and coding standards<sup>2</sup>. This includes automated testing and continuous integration. Tested releases are tagged by SQuaRE weekly and major releases are made periodically.

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.

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<sup>1</sup>"level 2"

<sup>2</sup><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 testing before they are made available in the production environment. This will serve as an operational validation of the release.

### 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 coadded 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*)
- DM-AP-3: Point source & dipole measurement on difference images. (*Due: 2017-08-31; completed 2017-11-01*)

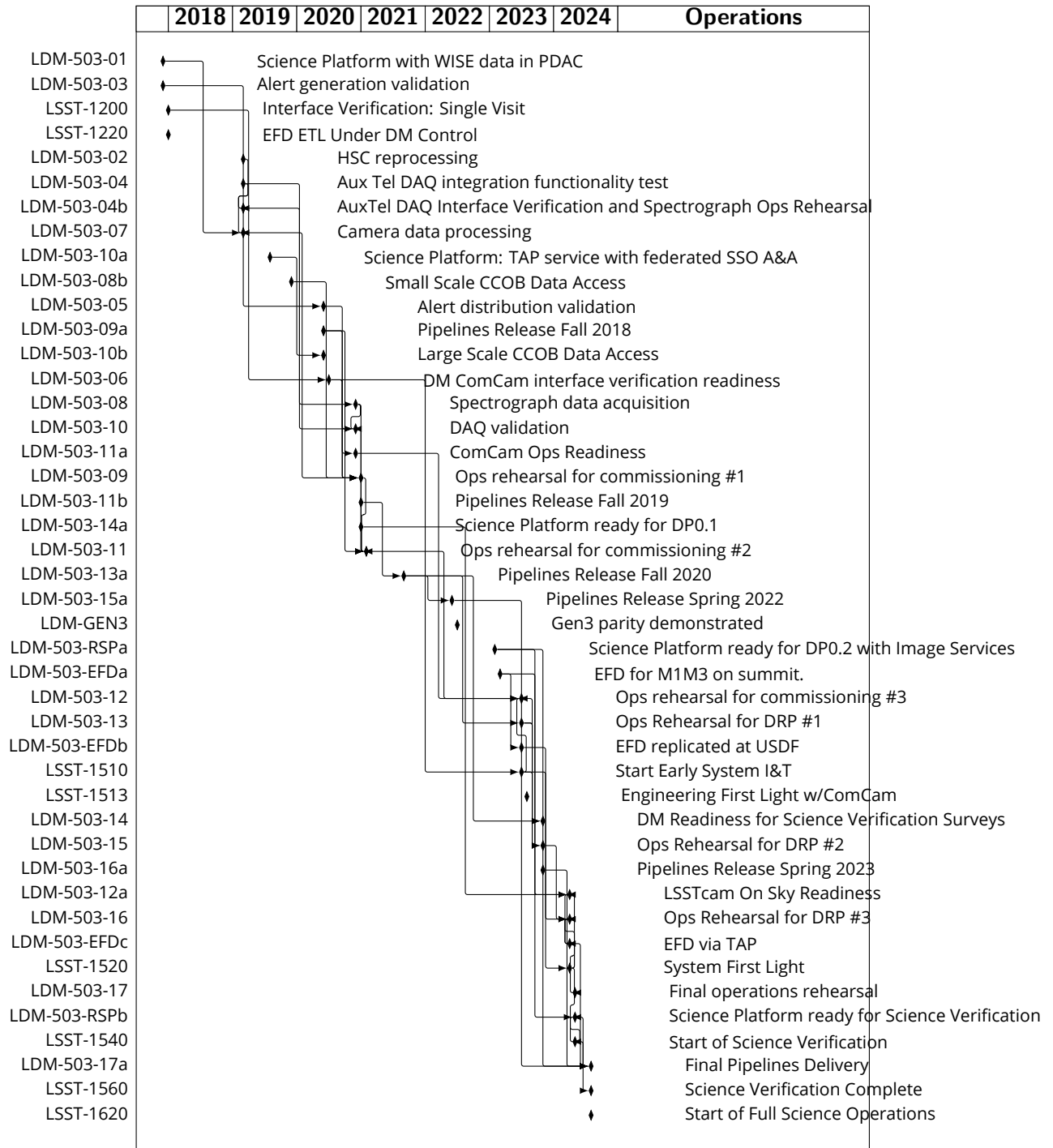


FIGURE 2: DM level 2 milestones (LDM-503-x) in the LSST schedule.

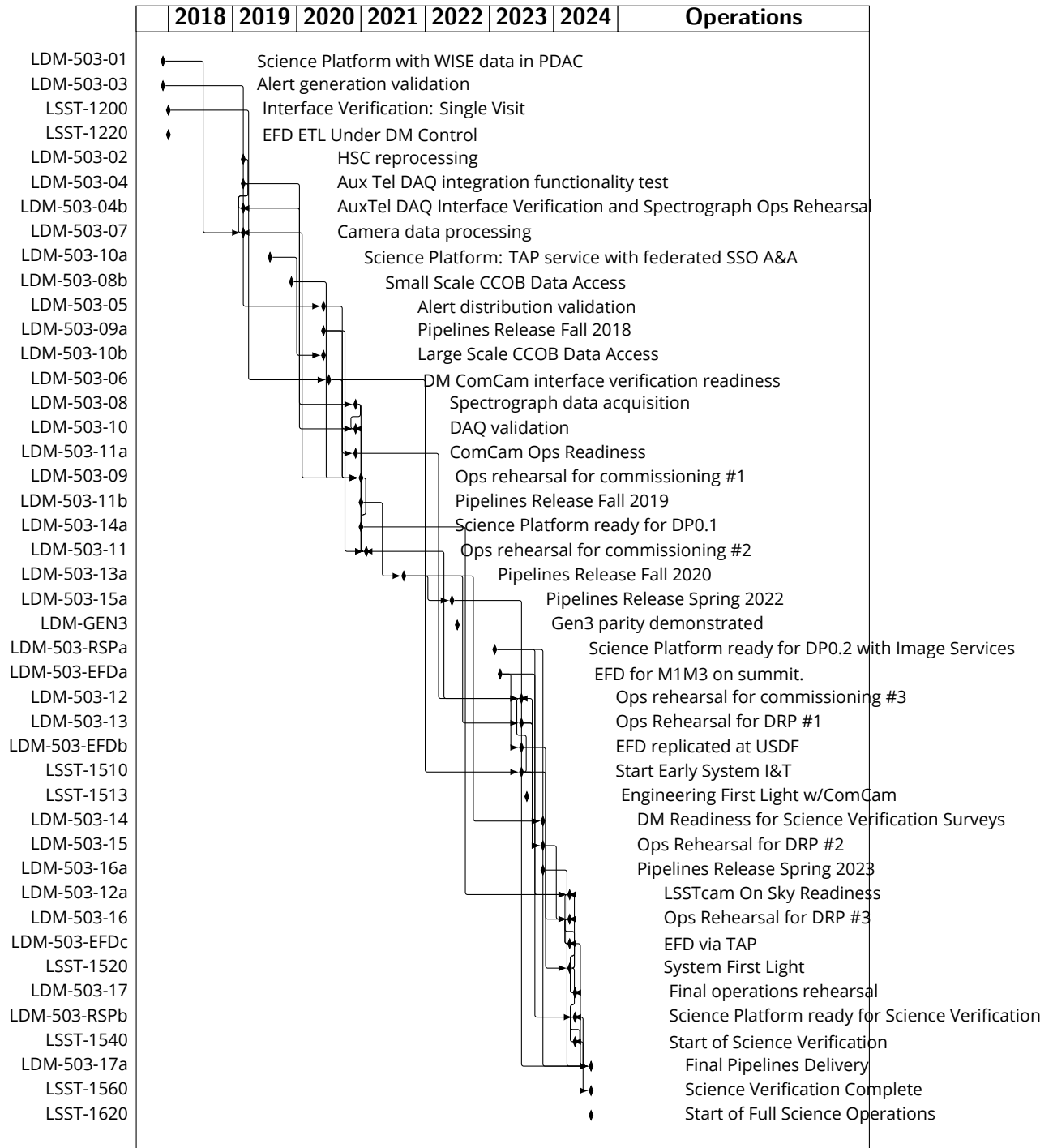


FIGURE 3: DM level 2 milestones (LDM-503-x) in the LSST rebaseline schedule.

- 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; completed 2019-12-31.*

- DM-DAX-2: Query service supporting IVOA TAP protocol, w/ support for asynchronous queries (*Due: 2017-07-31; completed 2019-11-29*)

### 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 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-AP-18: Alert packet generation (*Due: 2020-05-29; completed 2020-05-29*)

### 3.10 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*)

### 3.11 Large Scale CCOB Data Access: LDM-503-10b

*Due: 2020-05-29; completed 2020-04-22.*

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

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

*Due: 2020-06-03; completed 2020-06-30.*

- 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; completed 2020-06-30*)

### 3.13 Spectrograph data acquisition: LDM-503-08

*Due: 2020-11-30; completed 2019-12-31.*

- 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-14: Data Backbone endpoints in Chile for ingestion and access, distribution over WAN, ingest at NCSA into custodial file sto (*Due: 2020-06-22; completed 2021-11-17*)
- DM-NCSA-15: Batch Processing Service for offline spectrograph data processing (*Due: 2020-11-30; completed 2020-05-29*)

### 3.14 DAQ validation: LDM-503-10

*Due: 2020-11-30; completed 2020-06-22.*

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

### 3.15 ComCam Ops Readiness: LDM-503-11a

*Due: 2020-11-30; completed 2020-12-31.*

- DM-NCSA-16: Perform ISR processing on ComCam-scale data. (*Due: 2019-03-29; completed 2019-06-13*)
- DM-SUIT-10: SUIT deployment procedure (*Due: 2019-05-31; completed 2020-06-30*)
- DM-NCSA-20: ComCam Archiving Service (*Due: 2019-09-06; completed 2020-06-30*)
- DM-NCSA-22: Information in consolidated database available to QA portal (*Due: 2020-11-30; completed 2020-08-31*)

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

*Due: 2020-12-01; completed 2019-10-07.*



- DM-DAX-2: Query service supporting IVOA TAP protocol, w/ support for asynchronous queries (*Due: 2017-07-31; completed 2019-11-29*)
- DM-SQRE-2: Notebook service capabilities are suitable for the commissioning team to develop notebooks for its needs (*Due: 2018-11-30; completed 2019-11-29*)
- DM-DAX-5: Database ingest in support of HSC reprocessing (ie, large catalog ingest) (*Due: 2019-02-28; completed 2019-02-28*)
- DM-NCSA-16: Perform ISR processing on ComCam-scale data. (*Due: 2019-03-29; completed 2019-06-13*)
- DM-SUIT-5: Search and display processed HSC data (*Due: 2022-07-01; completed 2022-06-30*)

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

*Due: 2020-12-01; completed 2020-11-30.*

- 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: 2020-11-30; completed 2018-11-30*)

### 3.18 Science Platform ready for DP0: LDM-503-14a

*Due: 2020-12-01; completed 2021-09-30.*

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

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

*Due: 2021-01-04; completed 2021-09-30.*

- DM-NCSA-16: Perform ISR processing on ComCam-scale data. (*Due: 2019-03-29; completed 2019-06-13*)
- DM-NET-4: Base LAN installed (*Due: 2019-07-15; completed 2020-01-31*)

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

*Due: 2021-08-31; completed 2021-07-31.*

- DM-AP-11: Difference imaging includes noise decorrelation and correction for differential chromatic refraction. (*Due: 2019-11-27; completed 2019-10-01*)
- DM-DRP-22: Template generation integrated with Data Release Production pipelines. (*Due: 2020-06-01; completed 2021-03-31*)
- DM-DRP-30: Forced photometry is now performed on individual processed visit images during data releases. (*Due: 2020-11-30; completed 2021-02-01*)
- DM-DRP-34: Selection maps are generated during data releases. (*Due: 2020-11-30; completed 2021-05-24*)
- DM-AP-13: Trailed source measurement on difference images. (*Due: 2021-08-31; completed 2021-10-29*)
- DM-DRP-26: Overlap resolution at tract & patch boundaries. (*Due: 2021-08-31; completed 2021-02-01*)

- DM-DRP-28: Difference images are now a first-class data product during data release processing. (*Due: 2021-08-31; completed 2021-04-14*)

### 3.21 Pipelines Release Spring 2022: LDM-503-15a

*Due: 2022-05-05; completed 2022-02-28.*

- DM-AP-12: Difference imaging is now agnostic to the PSF of the template image. (*Due: 2022-09-01; currently incomplete*)
- DM-DRP-27: Object generation: association and assembly of (DIA, coadd, etc) sources to form objects. (*Due: 2022-09-01; currently incomplete*)

### 3.22 Gen3 parity demonstrated: LDM-GEN3

*Due: 2022-06-01; completed 2022-05-31.*

- DM-DAX-13: Generation 2 middleware retired (*Due: 2022-06-01; completed 2022-05-31*)

### 3.23 Science Platform ready for DP0.2 with Image Services: LDM-503-RSPa

*Due: 2023-01-27; currently incomplete.*

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

### 3.24 Engineering Facility Database at the summit capturing and enabling access to all telemetry with M1/M3 active: LDM-503-EFDa

*Due: 2023-02-14; completed 2021-09-30.*

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

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

*Due: 2023-06-30; currently incomplete.*

- DM-SQRE-3: Notebook service stable for commissioning and other internal project users (*Due: 2020-02-27; completed 2020-01-30*)

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

*Due: 2023-06-30; currently incomplete.*

- DM-STAFF: Staffing Checkpoint (*Due: 2019-11-27; completed 2019-11-29*)

### 3.27 EFD/telemetry data replicated at the LDF, stored in InfluxDB. aggregated into parquet files: LDM-503-EFDb

*Due: 2023-06-30; currently incomplete.*

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

### 3.28 DM Readiness for Science Verification Surveys: LDM-503-14

*Due: 2023-10-13; currently incomplete.*

- DM-SQRE-4: Notebook service ready for verification & validation (*Due: 2023-09-08; currently incomplete*)

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

*Due: 2023-10-13; currently incomplete.*

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

### 3.30 Pipelines Release Spring 2023: LDM-503-16a

*Due: 2023-10-18; currently incomplete.*

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

### 3.31 LSSTcam On Sky Readiness: LDM-503-12a

*Due: 2024-03-14; currently incomplete.*

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

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

*Due: 2024-03-14; currently incomplete.*

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

### 3.33 EFD data is queriable through TAP in the Science Platform: LDM-503-EFDc

*Due: 2024-03-14; currently incomplete.*

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

### 3.34 Final operations rehearsal: LDM-503-17

*Due: 2024-04-19; currently incomplete.*

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

### 3.35 Science Platform ready for Science Verification: LDM-503-RSPb

*Due: 2024-04-19; currently incomplete.*

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

### 3.36 Final Pipelines Delivery: LDM-503-17a

*Due: 2024-07-10; currently incomplete.*

- DM-DAX-9: Butler Provenance System (*Due: 2024-03-14; currently incomplete*)

## 4 References

- [1] **[DMTN-106]**, Comoretto, G., 2019, *DM Release Process*, DMTN-106, URL <http://DMTN-106.lsst.io>
- [2] **[LDM-672]**, Comoretto, G., Guy, L., 2019, *LSST Software Release Management Policy*, LDM-672, URL <http://LDM-672.lsst.io>
- [3] **[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>
- [4] **[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 |

|        |                                                                                                                                                |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------|
| CCOB   | Camera Calibration Optical Bench                                                                                                               |
| ComCam | The commissioning camera is a single-raft, 9-CCD camera that will be installed in LSST during commissioning, before the final camera is ready. |
| DAQ    | Data Acquisition System                                                                                                                        |
| DAX    | Data Access Services                                                                                                                           |
| DIA    | Difference Image Analysis                                                                                                                      |
| DM     | Data Management                                                                                                                                |
| DMTN   | DM Technical Note                                                                                                                              |
| DPO    | Data Preview 0                                                                                                                                 |
| DRP    | Data Release Production                                                                                                                        |
| EFD    | Engineering and Facility Database                                                                                                              |
| ETL    | extract-transform-load                                                                                                                         |
| 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                                                                                                     |
| L1     | Lens 1                                                                                                                                         |
| L2     | Lens 2                                                                                                                                         |
| L3     | Lens 3                                                                                                                                         |
| LAN    | Local Area Network                                                                                                                             |
| LDF    | LSST Data Facility                                                                                                                             |
| LDM    | LSST Data Management (Document Handle)                                                                                                         |
| LSST   | Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)                                                                     |
| M1     | primary mirror                                                                                                                                 |
| M1M3   | Primary Mirror Tertiary Mirror                                                                                                                 |
| M3     | tertiary mirror                                                                                                                                |
| NCSA   | National Center for Supercomputing Applications                                                                                                |
| NET    | Network Engineering Team                                                                                                                       |
| OCS    | Observatory Control System                                                                                                                     |
| PDAC   | Prototype Data Access Center                                                                                                                   |

|        |                                                                                                                 |
|--------|-----------------------------------------------------------------------------------------------------------------|
| PMCS   | Project Management Controls System                                                                              |
| PSF    | Point Spread Function                                                                                           |
| QA     | Quality Assurance                                                                                               |
| RFC    | Request For Comment                                                                                             |
| SQuaRE | Science Quality and Reliability Engineering                                                                     |
| SUIT   | Science User Interface and Tools (LSST Data Management WBS element and team, responsible for LSP Portal Aspect) |
| TAP    | Table Access Protocol                                                                                           |
| USDF   | United States Data Facility                                                                                     |
| WAN    | Wide Area Network                                                                                               |
| WISE   | Wide-field Survey Explorer                                                                                      |

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