Vera C. Rubin Observatory
Software Test Report

LVV-P105: Survey Strategy Acceptance Test Campaign Test Plan

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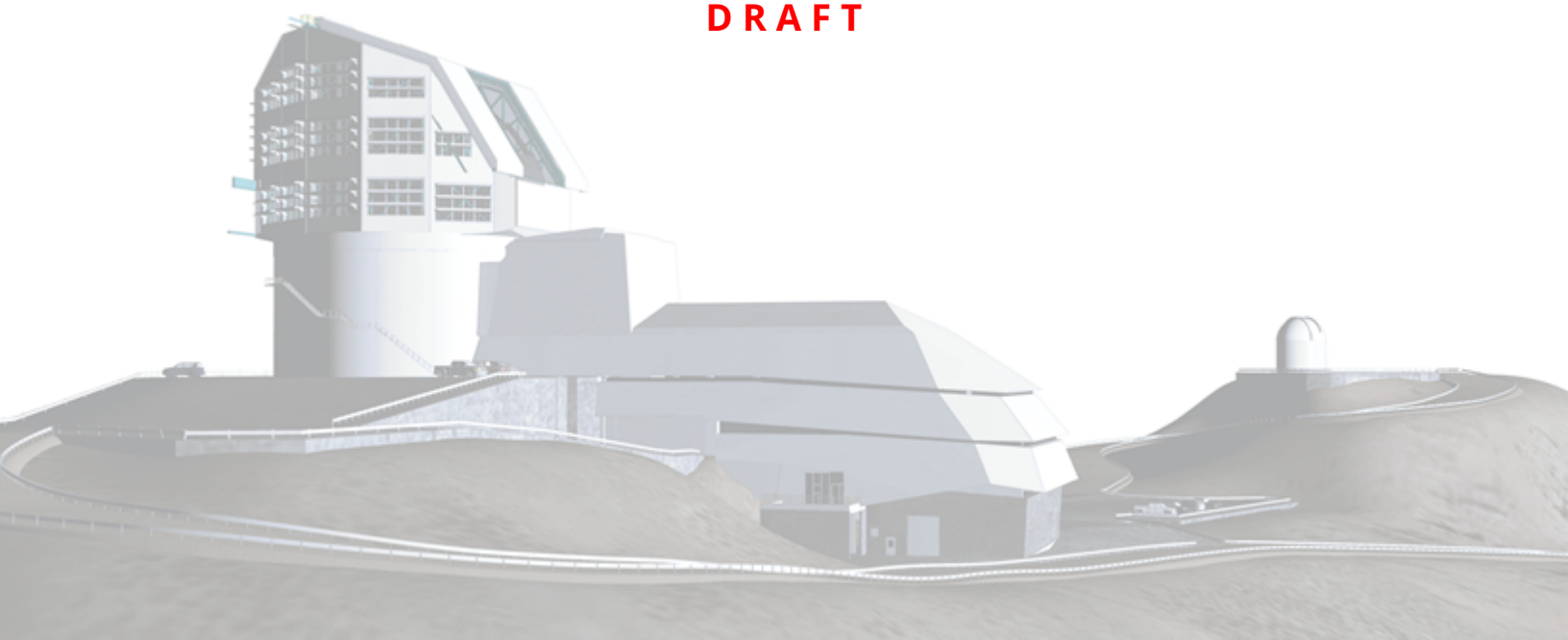
PSTR-001

Latest Revision: 2023-10-10

DRAFT



Abstract

This is the test plan for **Survey Strategy Acceptance Test Campaign**, an LSST milestone pertaining to the Project System Engineering and Commissioning.
This document is based on content automatically extracted from the Jira test database on 2023-10-10 . The most recent change to the document repository was on 2023-10-10.

Change Record

Version	Date	Description	Owner name
	2023-06-05	First draft	Lynne Jones

Document curator: Lynne Jones
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Version from source repository: e2b1f91

Contents

LVV-P105: Survey Strategy Acceptance Test Campaign Test Plan

1 Introduction

1.1 Objectives

The primary goal of this acceptance test campaign is to verify those requirements pertaining to the survey design.

1.2 System Overview

This test campaign is intended to verify that the Survey Strategy satisfies the requirements on the design of survey outlined in the LSST Science Requirements Document (SRD), ensuring that the survey strategy will deliver the science goals of LSST.

1.3 Document Overview

This document was generated from Jira, obtaining the relevant information from the LVV-P105 Jira Test Plan and related Test Cycles (LVV-C259 LVV-C264).

Section 1 provides an overview of the test campaign, the system under test (Survey Strategy), the applicable documentation, and explains how this document is organized. Section 2 provides additional information about the test plan, like for example the configuration used for this test or related documentation. Section 3 describes the necessary roles and lists the individuals assigned to them.

Section 4 provides a summary of the test results, including an overview in Table 2, an overall assessment statement and suggestions for possible improvements. Section **??** provides detailed results for each step in each test case.

The current status of test plan LVV-P105 in Jira is **Draft** .

1.4 References

[1] **[LSE-29]**, Claver, C.F., The LSST Systems Engineering Integrated Project Team, 2017, *LSST System Requirements (LSR)*, LSE-29, URL https://ls.st/LSE-29

[2] **[DMTN-140]**, Comoretto, G., 2021, *Documentation Automation for the Verification and Validation of Rubin Observatory Software*, DMTN-140, URL https://dmtn-140.lsst.io/, Vera C. Rubin Observatory Data Management Technical Note

[3] **[DMTN-178]**, Comoretto, G., 2021, *Docsteady Usecases for Rubin Observatory Constructions*, DMTN-178, URL https://dmtn-178.lsst.io/, Vera C. Rubin Observatory Data Management Technical Note

[4] **[LSE-160]**, Selvy, B., 2013, *Verification and Validation Process*, LSE-160, URL https://ls.st/LSE-160

2 Test Plan Details

2.1 Data Collection

Observing is not required for this test campaign.

2.2 Verification Environment

Verification will be performed using the V3.2 simulations of the survey cadence.

2.3 Entry Criteria

Availability of simulations for baseline survey v3.2, availability of rubin_sim v1.3 or better.

2.4 Related Documentation

2.5 PMCS Activity

Primavera milestones related to the test campaign:

- None

3 Personnel

The personnel involved in the test campaign is shown in the following table.

	T. Plan LVV-P105 owner:	**Lynne Jones**	
	T. Cycle LVV-C259 owner:	**Lynne Jones**	
Test Cases	**Assigned to**	**Executed by**	**Additional Test Personnel**
LVV-T2846	Lynne Jones	Lynne Jones	
LVV-T2847	Lynne Jones	Lynne Jones	
LVV-T2848	Lynne Jones	Lynne Jones	
LVV-T2851	Lynne Jones	Lynne Jones	
LVV-T2850	Lynne Jones	Lynne Jones	
LVV-T2849	Lynne Jones	Lynne Jones	
	T. Cycle LVV-C264 owner:	**Lynne Jones**	
Test Cases	**Assigned to**	**Executed by**	**Additional Test Personnel**
LVV-T2879	Lynne Jones		
LVV-T2884	Lynne Jones		
LVV-T2862	Lynne Jones		
LVV-T2881	Lynne Jones		
LVV-T2859	Lynne Jones		
LVV-T2861	Lynne Jones		
LVV-T2863	Lynne Jones		
LVV-T2865	Lynne Jones		
LVV-T2864	Lynne Jones		
LVV-T2883	Lynne Jones		
LVV-T2869	Lynne Jones		
LVV-T2876	Lynne Jones		
LVV-T2868	Lynne Jones		
LVV-T2875	Lynne Jones		
LVV-T2866	Lynne Jones		
LVV-T2867	Lynne Jones		
LVV-T2877	Lynne Jones		
LVV-T2878	Lynne Jones		
LVV-T2842	Lynne Jones		

4 Test Campaign Overview

4.1 Summary

T. Plan LVV-P105:	**Survey Strategy Acceptance Test Campaign**	Draft
T. Cycle LVV-C259:	**Survey Strategy Acceptance Test Campaign**	Done
Test Cases	**Ver.**	
LVV-T2846	1	
LVV-T2847	1	
LVV-T2848	1	
LVV-T2851	1	
LVV-T2850	1	
LVV-T2849	1	
T. Cycle LVV-C264:	**Survey Scheduling Acceptance Test Campaign - General Capabilities and Reporting**	Not Executed
Test Cases	**Ver.**	
LVV-T2879	1	
LVV-T2884	1	
LVV-T2862	1	
LVV-T2881	1	
LVV-T2859	1	
LVV-T2861	1	
LVV-T2863	1	
LVV-T2865	1	
LVV-T2864	1	
LVV-T2883	1	
LVV-T2869	1	
LVV-T2876	1	
LVV-T2868	1	
LVV-T2875	1	
LVV-T2866	1	
LVV-T2867	1	
LVV-T2877	1	
LVV-T2878	1	
LVV-T2842	1	

Table 2: Test Campaign Summary

4.2 Overall Assessment

Not yet available.

4.3 Recommended Improvements

5 Detailed Tests

5.1 Test Cycle LVV-C259

Open test cycle *Survey Strategy Acceptance Test Campaign* in Jira.

Test Cycle name: Survey Strategy Acceptance Test Campaign
Status: Done

This test cycle comprises all the test cases for the verification of the survey strategy

5.1.1 Software Version/Baseline

rubin_sims version 1.3 or newer

5.1.2 Configuration

Not provided.

5.1.3 Test Cases in LVV-C259 Test Cycle

5.1.3.1 LVV-T2846 - Verify survey will cover Asky = 18000 square degrees to a median number of Nv1Sum = 825 visits per pointing.

Version **1**. Open *LVV-T2846* test case in Jira.

Verify that the planned survey strategy will result in sky coverage meeting Asky area to a median number of Nv1Sum visits.
The values of Asky and Nv1Sum used in LVV-308 are the design goals for the survey.
The median number of visits refers to the median number of visits per pointing, when calculated across Asky area and is reported via MAF as fO_Nv Median.
The area on sky are which the minimum (although not median) number of visits per pointing is Nv1Sum can also be calculated, and is reported via MAF as fO_Area.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
Execute "SkyCoverage" notebook in PSTR-001	

Expected Result
Asky >= 18000 sq degrees (15000 sq degrees minimum)
Nv1Sum >= 825 visits per pointing (750 minimum)

5.1.3.2 LVV-T2847 - Verify survey will cover RVA1 = 2000 square degrees at timescales between fastRevisitMin = 40s to fastRevisitMax = 1800 seconds nearly uniformly.

Version **1**. Open *LVV-T2847* test case in Jira.

Verify that the survey strategy will result in coverage of RVA1 at timescales between fastRevisitMin and fastRevisitMax in a satisfactory manner.
The original statement of "near uniformity" over this time span does not account for the peak in this timescale caused by standard pairs of visits; (40s to 1800s=30 minutes; current pairs are acquired at between 20-30 minutes). The intent was to make sure that there was sufficient coverage at timescales below the pair timing, rather than strictly providing "uniform" coverage. The metrics in rubin_sim.maf have been written to account for the intent of the requirement -- that there are a significant fraction of visits in the timespan 40s - 20 minutes, as well as visits between 20 - 30 minutes.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
Execute SkyCoverage notebook in PSTR-001	

Expected Result
RVA1 >= 2000 sq degrees

5.1.3.3 LVV-T2848 - Verify that the survey strategy distributes observations such that the median proper motion accuracy per coordinate across the main survey area will be at least SIGpm = 1.0 mas for sources r<24.

Version **1**. Open *LVV-T2848* test case in Jira.

Verify the survey strategy distributes observations such that the median proper motion accuracy per coordinate across the main survey area will be at least SIGpm = 1.0 mas for sources r<24.
Survey simulations can estimate astrometric accuracy at r=24.0 for each visit, and then estimate the accuracy of a fit for proper motion (accounting for parallax factor) using the time distribution of the visits at each point in the main survey.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
Execute "Parallax_ProperMotion" notebook in PSTR-001	

Expected Result
SIGpm <= 1.0 mas (2.0 mas minimum)

5.1.3.4 LVV-T2851 - Verify the average time between successive visits over the full set of survey observations, through a survey simulation.

Version **1**. Open *LVV-T2851* test case in Jira.

Verify the average expected time between successive visits, as predicted by survey simulations.

Survey simulations use a model of the telescope to estimate slew times (including filter change times), coupled with scheduler choices for each successive visit. The times between successive visits can be evaluated from these simulations.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
	Execute "Time_Between_Visits" notebook in PSTR-001

Expected Result
aveVisitInterval < 10 s

5.1.3.5 LVV-T2850 - Verify the median expected time between successive visits, as predicted by survey simulations.

Version **1**. Open *LVV-T2850* test case in Jira.

Verify the median expected time between successive visits, as predicted by survey simulations.

Survey simulations use a model of the telescope to estimate slew times (including filter change times), coupled with scheduler choices for each successive visit. The times between successive visits can be evaluated from these simulations.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
Execute "Time_Between_Visits" notebook in PSTR-001	
Expected Result	
medVisitInterval < 5 s	

5.1.3.6 LVV-T2849 - Verify the survey strategy distributes observations such that the parallax uncertainty across the main survey area will be no more than SIGpar = 3.0 mas, or SIGparRed = 6.0 mas in y band for sources r<24.

Version **1**. Open *LVV-T2849* test case in Jira.

Verify the survey strategy distributes observations such that the parallax uncertainty across the main survey area will be no more than SIGpar = 3.0 mas, or SIGparRed = 6.0 mas in y band for sources r<24.

Survey simulations can estimate astrometric accuracy at r=24.0 for each visit, and then estimate the uncertainty in resulting parallax fits using the time distribution of the visits at each point in the main survey.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description

Execute "Parallax_ProperMotion" notebook in PSTR-001

Expected Result
SIGpar <= 3.0 mas (6.0 mas minimum)
SIGparRed <= 6.0 mas (10.0 mas minimum)

5.2 Test Cycle LVV-C264

Open test cycle *Survey Scheduling Acceptance Test Campaign - General Capabilities and Reporting* in Jira.

Test Cycle name: Survey Scheduling Acceptance Test Campaign - General Capabilities and Reporting
Status: Not Executed

This test cycle includes all of the survey strategy metric and process related pieces.

5.2.1 Software Version/Baseline

rubin_sim version XX

5.2.2 Configuration

Not provided.

5.2.3 Test Cases in LVV-C264 Test Cycle

5.2.3.1 LVV-T2879 - Verify the requirement to support planning of the survey on 10 year timescales.

Version **1**. Open *LVV-T2879* test case in Jira.

Verify the requirement to support planning of the survey on 10 year timescales.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Evaluate the notebooks at <github repo>
See also PSTN-051

Test Data

simulation data

Expected Result

Step 2 Description

Verify that outputs useful for 10 year survey planning are created.

Expected Result

5.2.3.2 LVV-T2884 - Verify a baseline survey strategy is established and that tools and software are available to monitor the performance of the survey relative to the baseline.

Version **1**. Open *LVV-T2884* test case in Jira.

Verify a baseline survey strategy is established and that tools and software are available to monitor the performance of the survey relative to the baseline.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Confirm that a baseline survey strategy exists.

Test Data

simulation data

Expected Result

Step 2 Description

Run notebook at <github repo> to demonstrate that observations can be compared with baseline survey strategy expectations.

Expected Result

5.2.3.3 LVV-T2862 - Verify that a process exists to allow the periodic adjustment of the survey priorities.

Version **1**. Open *LVV-T2862* test case in Jira.

The requirement that the operation of the LSST Observatory shall allow for periodic adjustment of the survey priorities based on community input requires that a process exists to allow the periodic adjustment of the survey priorities.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description

Expected Result

5.2.3.4 LVV-T2881 - Verify that the feature based scheduler can generate observations in an automated manner based on parameters that produce a survey meeting the LSR requirements spelled out in LSE-29.

Version **1**. Open *LVV-T2881* test case in Jira.

Verify that the feature based scheduler can generate observations in an automated manner based on parameters that produce a survey meeting the LSR requirements spelled out in LSE-29.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run notebook at <github repo>

Test Data

simulated data

Expected Result

Step 2 Description

Inspect that observations are generated

Expected Result

5.2.3.5 LVV-T2859 - Verify that the observatory system provides the ability to define a set of scientific objectives associated with performance metrics.

Version **1**. Open *LVV-T2859* test case in Jira.

Verify that we have provided the ability to define a set of scientific objectives associated with

performance metrics.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description

Expected Result

5.2.3.6 LVV-T2861 - Verify that the observatory system will acquire observations guided by performance metrics associated with scientific objectives.

Version **1**. Open *LVV-T2861* test case in Jira.

Verify that the observatory system will acquire observations guided by performance metrics associated with scientific objectives.

Confirm that the metrics are used to determine a survey strategy, and this survey strategy is used to choose scheduler behavior which guides acquisition of observations.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Confirm output illustrates changes in survey strategy

Expected Result

5.2.3.7 LVV-T2863 - Verify that the survey strategy can be modified at periodic intervals in response to changing scientific objectives.

Version **1**. Open *LVV-T2863* test case in Jira.

The requirement that the operation of the LSST Observatory shall allow for periodic adjustment of the survey priorities based on community input requires that the survey strategy can practically be modified at periodic intervals.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
Run notebook at <github repo>	

Test Data
simulation data

Expected Result

Step 2	Description
Run simulation, halt simulation, modify survey strategy, resume simulation.	

Expected Result

Step 3	Description
Verify that change in survey strategy results in change in scientific outcomes.	

Expected Result

5.2.3.8 LVV-T2865 - Verify the ability to create periodic status reports on the progress of the survey for the community.

Version **1**. Open *LVV-T2865* test case in Jira.

Verify the ability to create periodic status reports on the progress of the survey for the community.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Verify that progress report for the community is created.

Expected Result

5.2.3.9 LVV-T2864 - Verify the ability to create periodic status reports on the progress of the survey for the operations staff.

Version **1**. Open *LVV-T2864* test case in Jira.

Verify the ability to create periodic status reports on the progress of the survey for the operations staff.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description
Run notebook at <github repo>	

Test Data
simulation data

Expected Result

Step 2	Description
Verify that a status report for operations staff is created.	

Expected Result

5.2.3.10 LVV-T2883 - Verify the requirement that the scheduler can adjust its observations and scientific priorities.

Version **1**. Open *LVV-T2883* test case in Jira.

Verify the requirement that the scheduler can adjust its observations and scientific priorities.

Preconditions:

Final comment:

Detailed steps :

Step 1	Description

Run notebook at <github repo>

Test Data
simulation data

Expected Result

Step 2 Description
Verify that observations generated by the scheduler change with changing parameters and reflect changes in scientific priorities.

Expected Result

5.2.3.11 LVV-T2869 - Verify the requirement to adjust the survey design as needed to accomplish its goals given these priorities and performance.

Version **1**. Open *LVV-T2869* test case in Jira.

Verify the requirement to adjust the survey design as needed to accomplish its goals given these priorities and performance.
See also tests for LVV-683

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run notebook at <github repo>

Test Data
simulation data

Expected Result

Step 2 Description
Verify that the survey properties can be modified and result in changes in survey performance.

Expected Result

5.2.3.12 LVV-T2876 - Verify the requirement to assess the impacts of survey strategy changes resulting from changes in scientific priorities

Version **1**. Open *LVV-T2876* test case in Jira.

Verify the requirement to assess the impacts of survey strategy changes resulting from changes in scientific priorities.
Show that changing scientific priorities can change survey strategy, along with evaluating the impacts.
(aka the SCOC process and inputs).

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

See also PSTN-051, and other documents underlying the SCOC process.
Run notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Verify that changing metrics as a result of changing survey strategies can be analyzed for overall impact.

Expected Result

5.2.3.13 LVV-T2868 - Verify the requirement to communicate with the scientific community and establish survey priorities.

Version **1**. Open *LVV-T2868* test case in Jira.

Verify the requirement to communicate with the scientific community and establish survey priorities.
See also test cases for LVV-738

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

This requirement is satisfied by the creation of the SCOC. See its charge and current work establishing survey priorities with the community.

Expected Result

5.2.3.14 LVV-T2875 - Verify the requirement to create performance evaluation tools to predict the final results of a ten year survey based on the actual survey completed to date

Version **1**. Open *LVV-T2875* test case in Jira.

Verify the requirement to create performance evaluation tools to predict the final results of a ten year survey based on the actual survey completed to date.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run the notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Verify that simulations can predict range of ten year performance based on survey data to a particular date.

Expected Result

5.2.3.15 LVV-T2866 - Verify the requirement to monitor the scientific progress of the survey

Version **1**. Open *LVV-T2866* test case in Jira.

Verify the requirement to monitor the scientific progress of the survey.
See also test cases for LVV-758 and /LVV-759

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Verify that progress report on scientific progress is created.

Expected Result

5.2.3.16 LVV-T2867 - Verify the requirement to monitor the technical progress of the survey.

Version **1**. Open *LVV-T2867* test case in Jira.

Verify the requirement to monitor the technical progress of the survey.
See also test cases for LVV-758 and /LVV-759

Preconditions:

Final comment:

Detailed steps :

Step 1 Description
Run notebook at <github repo>

Test Data
simulation data

Expected Result

Step 2 Description
Verify that progress report on technical progress is created.

Expected Result

5.2.3.17 LVV-T2877 - Verify the requirement to support planning of the survey on nightly timescales.

Version **1**. Open *LVV-T2877* test case in Jira.

Verify the requirement to support planning of the survey on nightly timescales.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run the notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Verify that outputs for nightly operational planning are produced

Expected Result

5.2.3.18 LVV-T2878 - Verify the requirement to support planning of the survey on yearly timescales.

Version **1**. Open *LVV-T2878* test case in Jira.

Verify the requirement to support planning of the survey on yearly timescales.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description

Run the notebook at <github repo>

Test Data

simulation data

Expected Result

Step 2 Description

Verify that outputs useful for yearly evaluation and planning are created.

Expected Result

5.2.3.19 LVV-T2842 - Verify the scheduler can respond to previous survey performance.

Version **1**. Open *LVV-T2842* test case in Jira.

Verify the scheduler responds to previous survey performance.

Previous survey performance here is interpreted as variations in previous sky coverage, for example responding after a month-long shutdown where no visits were acquired.
The time required to respond to previous survey performance will depend on how significant the change in previous survey performance was; in general small difference in previous survey performance are not significant and large differences will require a longer time period to recover. For this test, we will only look at the scheduler response over longer timescales such as after one year or end of survey.

Preconditions:

Final comment:

Detailed steps :

Step 1 Description
Identify data sets.

Expected Result

Step 2 Description
Run Jupyter notebook < >

Expected Result

Step 3 Description
Confirmed expected results.

Expected Result

A Documentation

The verification process is defined in LSE-160. The use of Docsteady to format Jira information in various test and planing documents is described in DMTN-140 and practical commands are given in DMTN-178.

B Acronyms used in this document

Acronym	Description
DMTN	DM Technical Note
LSE	LSST Systems Engineering (Document Handle)
LSR	LSST System Requirements; LSE-29
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
LVV	LSST Verification and Validation
MAF	Metric Analysis Framework
PMCS	Project Management Controls System
PSE	Project Systems Engineering
PSTN	Project Science Technical Note
SCOC	Survey Cadence Optimization Committee
SNR	Signal to Noise Ratio
SRD	LSST Science Requirements; LPM-17
WFD	Wide Fast Deep