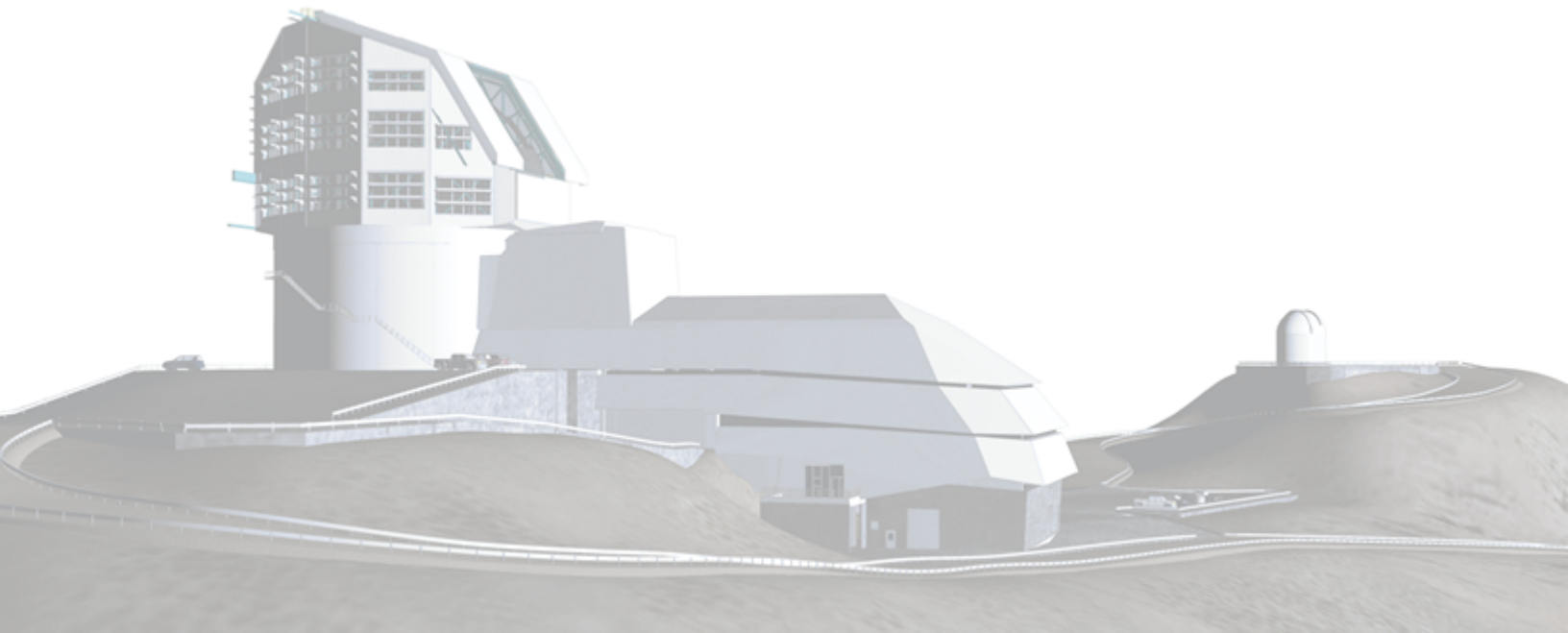

Vera C. Rubin Observatory
Software Test Report

LVV-P105: Survey Strategy Acceptance Test Campaign Test Plan and Report

Lynne Jones

PSTR-001

Latest Revision: 2024-10-23

Abstract

This is the test plan and report 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 2024-10-23 . The most recent change to the document repository was on 2024-11-01.

Change Record

Version	Date	Description	Owner name
	2023-06-05	First draft	Lynne Jones
1.0	2024-10-23	Closeout OPSIM-1075	Lynne Jones

Document curator: Lynne Jones
Document source location: `https://github.com/lsst-dm/PSTR-001`
Version from source repository: 2607158

Contents

LVV-P105: Survey Strategy Acceptance Test Campaign Test Plan and Report

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).

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 5 provides detailed results for each step in each test case.

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

1.4 References

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

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

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

[4] **[PSTN-053]**, Ivezic, Z., 2022, Survey Cadence Optimization Committee's Phase 1 Recommendation, URL https://pstn-053.lsst.io/,
Vera C. Rubin Observatory Project Science Technical Note PSTN-053

[5] **[LSE-160]**, Selvy, B., 2013, Verification and Validation Process, URL https://ls.st/LSE-160,
Vera C. Rubin Observatory LSE-160

[6] **[PSTN-055]**, The Rubin Observatory Survey Cadence Optimization Committee, 2023, Survey Cadence Optimization Committee's Phase 2 Recommendations, URL https://pstn-055.lsst.io/,
Vera C. Rubin Observatory Project Science Technical Note PSTN-055

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

No additional documentation provided.

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	

4 Test Campaign Overview

4.1 Summary

T. Plan LVV-P105:	**Survey Strategy Acceptance Test Campaign**			Completed
T. Cycle LVV-C259:	**Survey Strategy Acceptance Test Campaign**			Done
Test Cases	**Ver.**	**Status**	**Comment**	**Issues**
LVV-T2846	1			
Execution	LVV-E2927	Not Executed		
Execution	LVV-E3243	Pass	The requirement here comes from LSE-29, which is intended to be flowed down from the SRD. The SRD clearly defines minimum requirements, as well as these design requirements, but the flow-down did not capture the minimums. We pass the minimum requirements from the SRD.	
LVV-T2847	1			
Execution	LVV-E2928	Pass		
Execution	LVV-E3244	Pass		
LVV-T2848	1			
Execution	LVV-E2929	Not Executed		
Execution	LVV-E3245	Pass	The requirement here comes from LSE-29, which is intended to be flowed down from the SRD. The SRD clearly defines minimum requirements, as well as these design requirements, but the flow-down did not capture the minimums. We pass the minimum requirements from the SRD.	
LVV-T2851	1			
Execution	LVV-E2930	Not Executed		
Execution	LVV-E3247	Pass		
LVV-T2850	1			
Execution	LVV-E2931	Not Executed		
Execution	LVV-E3249	Pass		
LVV-T2849	1			
Execution	LVV-E2932	Not Executed		

Execution	LVV-E3246	Pass	The requirement here comes from LSE-29, which is intended to be flowed down from the SRD. The SRD clearly defines minimum requirements, as well as these design requirements, but the flow-down did not capture the minimums. We pass the minimum requirements from the SRD.

Table 2: Test Campaign Summary

4.2 Overall Assessment

Not yet available.

4.3 Recommended Improvements

Not yet available.

5 Detailed Test Results

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**. Status **Approved**. 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:

Execution status:

Final comment:

Detailed steps results LVV-C259-LVV-T2846 LVV-E2927-3322:
Note: Steps "Not Executed" and with No Result are not shown in this report.
Detailed steps results LVV-C259-LVV-T2846 LVV-E3243-3638:
Note: Steps "Not Executed" and with No Result are not shown in this report.

Step LVV-E3243-1 Step Execution Status: **Pass**

Description
Execute "SkyCoverage" notebook in PSTR-001

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

Actual Result

```
Asky is 18454.4. Minimum requirement is 15000, Design requirement is 18000.
Nv1Sum is 805.0. Minimum requirement is 750. Design requirement is 825.
```

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**. Status **Approved**. Open *LVV-T2847* test case in Jira.

Verify that the survey strategy will result in coverage of RVA1 at timescales between fastRe-

visitMin 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:

Execution status:

Final comment:

Detailed steps results LVV-C259-LVV-T2847 LVV-E2928-3323:
Note: Steps ”Not Executed” and with No Result are not shown in this report.
Detailed steps results LVV-C259-LVV-T2847 LVV-E3244-3639:
Note: Steps ”Not Executed” and with No Result are not shown in this report.

Step LVV-E3244-1 Step Execution Status: **Pass**

Description
Execute SkyCoverage notebook in PSTR-001

Expected Result
RVA1 >= 2000 sq degrees

Actual Result

```
RVA1 - Area meeting rapid revisit requirement : 29316.7. Design requirement is 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**. Status **Approved**. 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 the the parallax factor) using the time distribution of the visits at each point in the main survey.

Preconditions:

Execution status:

Final comment:

Detailed steps results LVV-C259-LVV-T2848 LVV-E2929-3324:
Note: Steps "Not Executed" and with No Result are not shown in this report.
Detailed steps results LVV-C259-LVV-T2848 LVV-E3245-3640:
Note: Steps "Not Executed" and with No Result are not shown in this report.

Step LVV-E3245-1 Step Execution Status: **Pass**

Description
Execute "Parallax_ProperMotion" notebook in PSTR-001

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

Actual Result

```
Median proper motion uncertainty over the top 18k square degrees (approximately equivalent to the 'WFD') under SRD seeing and d
SIGpm = 1.31 mas.
```

```
The design requirement is 1.0 mas, the minimum requirement is 2.0 mas.
```

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**. Status **Approved**. 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:

Execution status:

Final comment:

Detailed steps results LVV-C259-LVV-T2851 LVV-E2930-3325:
Note: Steps "Not Executed" and with No Result are not shown in this report.
Detailed steps results LVV-C259-LVV-T2851 LVV-E3247-3642:
Note: Steps "Not Executed" and with No Result are not shown in this report.

Step LVV-E3247-1 Step Execution Status: **Pass**

Description
Execute "Time_Between_Visits" notebook in PSTR-001

Expected Result
aveVisitInterval < 10 s

Actual Result

```
aveVisitInterval: Mean slew time is  7.89 seconds
Requirement is 10 seconds
```

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

Version **1**. Status **Approved**. 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:

Execution status:

Final comment:

Detailed steps results LVV-C259-LVV-T2850 LVV-E2931-3326:
Note: Steps "Not Executed" and with No Result are not shown in this report.
Detailed steps results LVV-C259-LVV-T2850 LVV-E3249-3644:
Note: Steps "Not Executed" and with No Result are not shown in this report.

Step LVV-E3249-1	Step Execution Status: **Pass**

Description
Execute "Time_Between_Visits" notebook in PSTR-001

Expected Result
medVisitInterval < 5 s

Actual Result

```
medianVisitInterval: Median slew time is  4.81 seconds
Requirement is 5 seconds
```

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**. Status **Approved**. 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:

Execution status:

Final comment:

Detailed steps results LVV-C259-LVV-T2849 LVV-E2932-3327:
Note: Steps "Not Executed" and with No Result are not shown in this report.
Detailed steps results LVV-C259-LVV-T2849 LVV-E3246-3641:
Note: Steps "Not Executed" and with No Result are not shown in this report.

Step LVV-E3246-1 Step Execution Status: **Pass**

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)

Actual Result

```
Median parallax uncertainty over the top 18k square degrees (approximately equivalent to the 'WFD') under SRD seeing and depth
SIGpara = 5.03 mas
The design requirement is 3.0 mas, the minimum requirement is 6.0 mas.
```

```
Median parallax uncertainty over the top 18k square degrees under SRD seeing and depth conditions, for sources with SNR=10 visi
SIGparaRed 6.41 mas
The design requirement is 6.0 mas, the minimum requirement is 10.0 mas.
```

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.

The process for survey strategy design extends beyond the requirements in the SRD and LSR, and responds to the recommendations from the Survey Cadence and Optimization Committee (SCOC). More information at `https://survey-strategy.lsst.io/scoc/index.html`

The SCOC recommendations on survey strategy included in the baseline survey strategy here (baseline_v3.2) are defined in PSTN-053 and PSTN-055.

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