



Vera C. Rubin Observatory  
Project Science Team

# Survey Cadence Optimization Committee's Phase 3 Recommendations

the SCOC

PSTN-056

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## Abstract

The final recommendation of the SCOC for the Survey Strategy prior to the start of LSST

## Change Record

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1	YYYY-MM-DD	Unreleased.	Federica Bianco and the Survey Cadence Optimization Committee

*Document source location:* <https://github.com/lstt-pst/pstn-056>

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# Survey Cadence Optimization Committee's Phase 3 Recommendations

## 1 Introduction

With unprecedented engagement with the scientific community at large, the Vera C. Rubin Observatory (hereafter Rubin) has designed a process of incremental improvements on the survey strategy to maximize the overall scientific throughput of the Legacy Survey of Space and Time (LSST). The high-level requirements for the LSST are set by four science pillars: probing dark energy and dark matter, building an unprecedented inventory of the Solar System, mapping the Milky Way and Local Volume, and exploring the transient universe. The requirements set by these science cases are defined in Ivezić & The LSST Science Collaboration (LPM-17), but significant flexibility in survey cadence remains within these requirements. The optimization of the survey strategy process is aimed at maximizing science for the four science pillars and increase the portfolio of LSST science by tuning the survey strategy and cadence within these requirements.

As part of this process, the Survey Cadence Optimization Committee has been stood up by Rubin's Science Advisor Committee in 2018 to solicit review and integrate community feedback at large and make recommendations for the implementation of the LSST survey strategy to Director of Operations. This document constitutes the third SCOC recommendation, resulting from phase 3 process of survey design process and the last recommendation leading to the start of LSST. Review of the survey strategy will continue throughout the 10-years of LSST with the SCOC reviewing the survey throughput and community recommendation and renewing its recommendation on an annual basis.

Phase 3 recommendation responds directly to the question left open in The Rubin Observatory Survey Cadence Optimization Committee (PSTN-055) and updates and refines previous recommendations (The Rubin Observatory Survey Cadence Optimization Committee (PSTN-055) and Ivezić (PSTN-053)).

The documentary is structured as follows....

The question identified in The Rubin Observatory Survey Cadence Optimization Committee (PSTN-055) Section 4 are included here for the readers' convenience in section 2

The topics that the SCOC should focus on in the next round of deliberations follow in ??.

?? describes the process of interaction with the community and iterative optimization of the LSST in Operations.

## 2 Open questions from PSTN-055

- The SCOC recommends that the investigation of the filter swapping schemes on the filter wheel continue. After the November 2022 workshop a few experiments in swapping  $u, z$ , and  $y$  instead of  $u$  and  $z$  were implemented in v2.99 simulations. More work is needed to understand the impacts of this decision on the DDFs as well as on the WFD. Filter pairing prescriptions for the observation pairs should also be explored in some more depth.
- The current SCOC recommendation is to implement a rolling cadence with a half-sky rolling scheme and a 0.9 rolling weight. However, rolling impacts the uniformity of static data releases which, as experts in the community have highlighted, is necessary for static sky science in general and cosmology in particular. This issue may be resolved or mitigated at the software level in the creation of coadds and catalogs, rather than at the scheduler level. The community should specify the desired and necessary requirements for uniformity to enable the exploration of data processing solutions to this problem. Depending on the feasibility of a solution to ensure sufficient uniformity, the SCOC recommendation on rolling may be re-evaluated.
- The SCOC is not ready to finalize a recommendation for the filter balance in the Galactic Plane, or for a final Galactic Plane/Bulge footprint, or the rolling scheme to be implemented on the Galactic Plane. The SCOC will work with the SMWLV and TVS SCs to ascertain the best solutions for Galactic science on filter balance and footprint. These decisions should, however, not impact decisions relating to the WFD and the time spent collectively on Galactic regions should not change. Galactic Plane pencil-beam surveys need to be defined more clearly to assess if they would ultimately result in “nano-surveys”, which will require a fraction of time too small to be optimized at this stage, or to evaluate the possibility of incorporating them in a final Galactic Footprint recommendation.
- While the SCOC recommends the filter balance as implemented starting in `baseline2.0` should not be changed, it is possible that rebalancing the exposure time to compensate for performance and throughput in some filters as compared to others or shortening exposures in filters where the throughput exceeds expectations enabling the collection

of more images in that filter (or overall) would lead to enhanced LSST science. The SCOC cannot finalize this recommendation at this time due to missing information about the characteristics of the system-as-built.

- The SCOC will continue working in 2023 with the community to identify the specific intra-night cadence that maximizes the science throughput of the DDF survey, while not impacting the science performed by other surveys.
- The SCOC shall work in coordination not only with the scientific community but also with the leadership of Rubin and the Euclid mission to identify cadence requirements, co-observing strategies, and paths to produce the data products that will enhance science through the coordinated observing of the EDFs.
- The SCOC recommends the decisions on the ToO strategy be based on a recommendation to be delivered by science experts and Rubin experts in 2023 in a dedicated workshop.
- The SCOC awaits commissioning assessments of the viability of collecting images in a single 1x30s exposure in all filters (rather than 2x15s), which would lead to an increase in efficiency. The SCOC has thus far seen favorably a potential switch to a single 1x30s exposure and the associated efficiency gain. If commissioning reveals that a 1x30s exposure is indeed technically viable, the SCOC should review the benefits (and potential drawbacks) of visits in a single exposure and, if adopted, reassess its recommendations in the light of this increased efficiency.
- The SCOC recommends implementing a detailed coordination plan with the Early Science Rubin team to reach a final recommendation on the strategy to be implemented in the first year of the survey, including a scheme for the construction of templates.

## A References

[PSTN-053], Ivezić, 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

**[LPM-17]**, Ivezić, Ž., The LSST Science Collaboration, 2018, LSST Science Requirements Document, URL <https://ls.st/LPM-17>,  
Vera C. Rubin Observatory LPM-17

**[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

## B Acronyms

Acronym	Description
DDF	Deep Drilling Field
LPM	LSST Project Management (Document Handle)
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
PST	Project Science Team
PSTN	Project Science Technical Note
SCOC	Survey Cadence Optimization Committee
TVS	Transients and Variable Stars Science Collaboration
ToO	Target of Opportunity
WFD	Wide Fast Deep