



# SCOC work plan towards a future v3 baseline and the Phase 2 Recommendation

Željko Ivezić, for SCOC

The 2<sup>nd</sup> SCOC Workshop, November 16, 2021



# Outline

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- 1) Welcome to the 2<sup>nd</sup> SCOC Workshop
- 2) Post-workshop input
- 3) SCOC process and timeline
- 4) Draft SCOC Phase 1 recommendations

## **Code of conduct:**

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<https://project.lsst.org/meetings/scoc-sc-workshop2/coc>

All sessions will be recorded. As a presenter or participant of the meeting, your image and/or your voice may appear in recordings that may be publicly accessible.



# The 2<sup>nd</sup> SCOC Workshop

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## **Agenda** (Pacific time zone)

### **Day 1: Nov 16, 2021:**

Session 1 (9:00AM-10:30AM): SCOC draft Phase 1 report and path to Phase 2 report.

Break: 10:30AM-10:45AM

Session 2 (10:45AM-1:00PM): Analysis of v2 Survey Cadence Simulations and SC feedback

### **Day 2: Nov 17, 2021:**

Session 3 (9:00AM-10:30AM): Improvements to Simulations and Analysis Tools

Break: 10:30AM-10:45AM

Session 4 (10:45AM-1:00PM): Community feedback

# The 2<sup>nd</sup> SCOC Workshop

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**Day 1: Nov 16, 2021:**

**Session 1 (9:00AM-10:30AM): SCOC draft Phase 1 report and path to Phase 2 report.**

SCOC work plan towards a future v3 baseline and the Phase 2 report: Zeljko Ivezic (30 min)

Simulations v2.0 and v2.1: Peter Yoachim (30 min)

MAF metrics: Lynne Jones (30 min)

**Session 2 (10:45AM-1:00PM): Analysis of v2 Survey Cadence Simulations and SC feedback**

Comparison of 1.7.1 and v2.0 baselines: Lynne Jones (15 min)

Metric trends in v2.0 simulations: Peter Yoachim (15 min)

Science Collaborations feedback for draft Phase 1 SCOC report: SC representatives, 105 min (7x15 min) (Zeljko moderating)



# The 2<sup>nd</sup> SCOC Workshop

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**Day 2: Nov 17, 2021:**

**Session 3 (9:00AM-10:30AM): Improvements to Simulations and Analysis Tools**

Refactored rubin\_sim codebase: Lynne & Peter (30 min)

A tutorial session: Lynne & Peter (60 min)

**Session 4 (10:45AM-1:00PM): Community feedback**

Deep Drilling Fields discussion, Convener: Saurabh Jha and Humna Awan (45 min)

AGN, TVS microlensing, and Strong Lensing: together we stand! Convener: Angelica Kovacevic (30 min)

Missing metrics for Galactic science, Convener: Will Clarkson (30 min)

Targets of Opportunity discussion, Convener: Rachel Street (30 min)

## Post-workshop input

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The SCOC always welcomes and appreciates your input!

Given the limited time for discussions at this workshop, the SCOC invites you (Science Collaborations and everyone else) to submit up to a page of reflections, comments or other input relevant to SCOC's work.

**Please send your input by Nov 24, 2021 to Zeljko ([ivezic@uw.edu](mailto:ivezic@uw.edu))**

## Why SCOC?

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“We want to make the Rubin Observatory Legacy Survey of Space and Time (LSST) as “good” as it can be given the observing system, observing conditions, science drivers, and scientists invested in its mission and legacy.”

**SCOC: expert, transparent, diverse, inclusive**

More information at:

<https://www.lsst.org/content/charge-survey-cadence-optimization-committee-scoc>

[https://docushare.lsst.org/docushare/dsweb/Get/Document-36747/Workshop1\\_Session1\\_Ivezic.pdf](https://docushare.lsst.org/docushare/dsweb/Get/Document-36747/Workshop1_Session1_Ivezic.pdf)

## SCOC charge

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The SCOC will be a standing committee through the life of the Rubin Observatory operations. The SCOC tasks include:

- 1) make specific recommendations for the cadence choices for the full 10-year survey (LSST)
- 2) help communicate these recommendations to the science community
- 3) make specific recommendations for “Early Science” observations
- 4) during operations, track survey progress and make recommendations for changes in survey strategy



# SCOC membership and SC liaison information

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Franz Bauer, Universidad Católica, Chile, AGN

Sarah Brough, University of New South Wales, Galaxies

Renee Hlozek, University of Toronto, Transients and Variable Stars

Zeljko Ivezic, Rubin Observatory/University of Washington, chair, Informatics and Statistics

Lynne Jones, Rubin Observatory (ex officio)

Mansi Kasliwal, Caltech, Transients and Variable Stars

Knut Olsen, NSF's NOIRLab, SMWLV

Hiranya Peiris, University College London/Stockholm University, DESC

Meg Schwamb, Queen's University Belfast, Solar System

Dan Scolnic, Duke University, DESC

Colin Slater, University of Washington, Transients and Variable Stars

Jay Strader, Michigan State University, SMWLV

Peter Yoachim, Rubin Observatory/University of Washington (ex officio)

## Cadence optimization schedule: short term

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SCOC draft phase 1 report ready	Aug 5, 2021
Workshop to receive feedback	Nov 16-17, 2021
SCOC phase 1 report delivered	Dec 15, 2021
Simulations of initial baseline strategy	Mar 1, 2022
Workshop to fine-tune baseline strategy	Summer 2022
Simulation of the final strategy	Fall 2022
SCOC phase 2 report delivered	Dec 15, 2022

For a handout, see <https://www.lsst.org/sites/default/files/for-scientists/SCOChandoutWorkshop2.pdf>

## Cadence optimization schedule: long term

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SCOC phase 2 report delivered

Dec 15, 2022

Modifications to enable “early science”

Dec 15, 2023

Start of LSST Operations

Early 2024

**The simulation of the final strategy will be available well ahead of the start of operations. The SCOC anticipates further input!**

[See ls.st/esp](#) for RTN-011 about Early Science planning

SCOC will work during 2023 on absorbing commissioning input and optimizing the so-called [early science modifications](#) (i.e. for the final optimization at  $\sim < 10\%$  level we need real performance parameters).

## SCOC draft phase 1 report

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**The draft is publicly available as <https://pstn-053.lsst.io>**

For full context and details please read the draft.

Today I will briefly cover high-level conclusions (using paraphrased questions from Cadence Notes solicitation).

For a handout, see

<https://www.lsst.org/sites/default/files/for-scientists/SCOChandoutReport1.pdf>

## SCOC draft phase 1 report

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This document will be finalized and delivered to the Operations Director (Bob Blum) by December 15, 2021, after further discussions and interactions with all the stakeholders.

**The final version will serve as a guide for the concluding round of survey cadence simulations.**

These simulations, to be delivered during early calendar year 2022, will inform the phase 2 survey strategy recommendation **which will define the baseline strategy** for starting the Rubin Observatory's Legacy Survey of Space and Time (LSST). (modulo “early science” modifications)

## A note about metrics

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Many cadence notes were qualitative or did not have quantitative metrics ready that were fully incorporated into the Metric Analysis Framework (MAF). Without these metrics in MAF, they cannot be automatically run by the Rubin Observatory Scheduler Team when the new cadence simulations are available.

The SCOC strongly encourages the community to liaise with the Rubin Observatory scheduler team (led by Lynne Jones and Peter Yoachim) to finalize metrics currently in development.

**Metrics that are not incorporated into MAF before the end of 2021 risk not being included in the SCOC's Phase 2 deliberations.**

## A note about metrics

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**The SCOC strongly encourages the community to contribute science-motivated metrics**, particularly to aid in evaluating the benefits or impacts of intra-night (e.g., presto-color and long visit gaps) and rolling cadence.

The potential gains related to adding any of the micro-surveys (and thus removing time from the core survey) generally also need additional metrics.

Metrics which bear on the survey footprint and its impact on evaluating Galactic structure would also be extremely helpful, for determining the extent of the WFD region in the Bulge and the coverage in the GP mini-survey.

## SCOC draft phase 1 report: your input

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Based on 39 Cadence Notes, available from:

<https://www.lsst.org/content/survey-cadence-notes-2021>

The SCOC is very thankful to all Cadence Notes coauthors!

Thank you, thank you, thank you!

**The support for cadence optimization process by many members of Science Collaborations is extremely valuable and highly appreciated!**

## SCOC draft phase 1 report: how did we get there?

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Based on 39 Cadence Notes, and the following process, modeled after NSF proposal review panels:

- 1) For each of the 7 questions, we had 3 SCOC members read all 39 CNs; one of them was a “group leader” or a “primary reporter”; they produced “summary reports”
- 2) We had a series of telecons where group leaders presented their findings to the entire SCOC
- 3) SCOC recommendations were reached by consensus, sometimes quickly and sometimes after an extensive discussion

**Again, Cadence Notes coauthors provided crucial input to this process!**

# SCOC draft phase 1 report: structure

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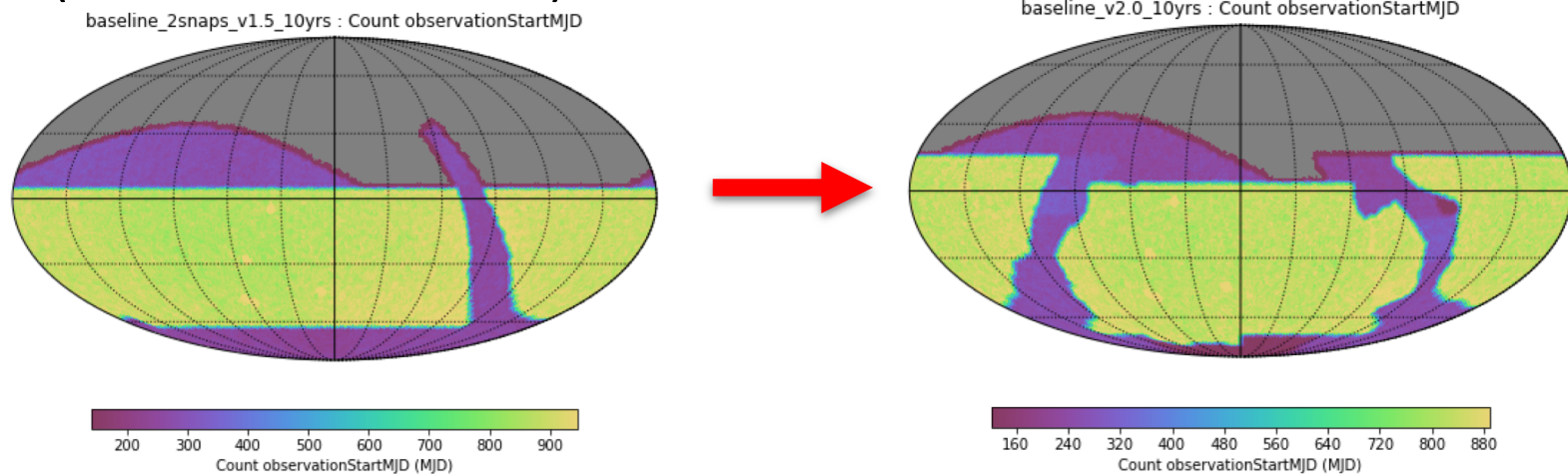
The document is structured in three parts:

- 1) Background and information about SCOC process
- 2) Phase 1 SCOC recommendations**  
structured around the 7 questions published in the  
2021 Cadence Notes solicitation
- 3) Detailed discussion of Phase 2.0 Survey Simulations

## SCOC draft phase 1 report

**Q1:** Are there any science drivers that would strongly argue for, or against, increasing the WFD footprint from 18,000 sq. deg. to 20,000 sq.deg.? Note that the resulting number of visits per pointing would drop by about 10%.

**The exact location of footprint is important.** Consensus to use a limit on dust extinction (with Dec boundaries).



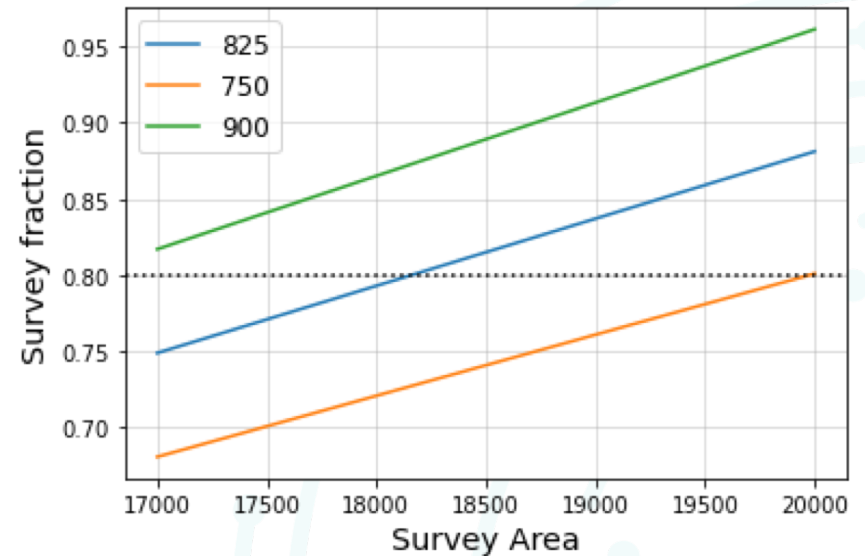
## SCOC draft phase 1 report

**Q1:** Are there any science drivers that would strongly argue for, or against, increasing the WFD footprint from 18,000 sq. deg. to 20,000 sq.deg.? Note that the resulting number of visits per pointing would drop by about 10%.

### Approximately:

- 80% for WFD regions
- 8% for Galactic plane
- 5% for NES
- 5% for DDF
- 2% for ToO etc.

Still being optimized!



## SCOC draft phase 1 report

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**Q2:** Assuming that current system performance estimates will hold up, how should we use this **potential** additional observing time (which may be as much as 10% of the survey observing time)?

There are 9 proposals for the so-called micro-surveys that add up to 12% of time. For comparison, about 5% of time is allocated for DDFs currently. **A new family of simulations will be produced to better understand quantitative tradeoffs.**

Note: we need to wait until commissioning to measure the actual performance. The purpose of this simulations-based exercise is to develop tools and thinking to enable rapid decision making by the end of commissioning.

## SCOC draft phase 1 report

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**Q3:** Are there any science drivers that would strongly argue for, or against, the proposal to change the u band exposure from 2x15 sec to 1x50 sec?

There are strong reasons to **switch to 1 snap in u band** visits. With new simulations we will investigate 1x30 sec and 1x50 sec, while keeping either the number of u band visits unchanged, or the total observing time allocated to u band unchanged.

## SCOC draft phase 1 report

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**Q4:** Are there any science drivers that would strongly argue for, or against, further changes in observing time allocation per band (e.g., skewed much more towards the blue or the red side of the spectrum)?

**There are no strong arguments for significantly changing the default per-band allocation of observing time.** Detailed per-band optimization of specific regions, such as the North Ecliptic Spur and Galactic Plane/Bulge, will be left for phase 2 optimization of the adopted baseline strategy.

## SCOC draft phase 1 report

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**Q5:** Are there any science drivers that would strongly argue for, or against, obtaining two visits in a pair in the same (or different) filter?

Based on the science-driven input provided, **the SCOC recommends that pairs of visits be obtained with different filters** to improve color constraints for sources that vary on time scales longer than several day (e.g. supernovae; obtained mixed-filter nightly visit pairs provides a significant boost in their discovery rates). The detailed determination of which filters to use in each pair will be made during the next phase of survey strategy optimization, additional metrics tied to the related science return would be beneficial.

## SCOC draft phase 1 report

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**Q6:** Are there any science drivers that would strongly argue for, or against, the rolling cadence scenario?

Our main recommendation is to **continue to explore a rolling cadence**: there are no strong arguments for rejecting this idea at this stage.

A task force including the Project Cadence Optimization Team (Lynne Jones and Peter Yoachim) and Science Collaboration members interested in rolling cadence (including but not limited to Cadence Notes authors Graham, Frohmeier, Hernitschek, Schwamb, Lochner, Bellm) will discuss efficient computation of metrics for the latest family of simulations, and potentially additional modified rolling cadence simulations.

## SCOC draft phase 1 report

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**Q7:** Are there any science drivers pushing for or against particular dithering patterns?

Note: small camera rotations are executed in all sims in order to align the two visits from a pair, and visits to deep drilling fields.

**There are no strong arguments for changing the implemented dithering pattern.** However, it is possible that weak lensing systematics and analysis of low surface brightness features will require a different scheme but details will not be known until some commissioning data are in hand and analyzed.

# SCOC draft phase 1 report: top recommendations

- define WFD footprint using ISM dust extinction
- adopt 1 snap for u-band visits
- obtain pairs of visits with different filters
- continue to explore rolling cadence scenarios

Onward to baseline v3!

