Vera C. Rubin Observatory
Rubin Observatory Operations

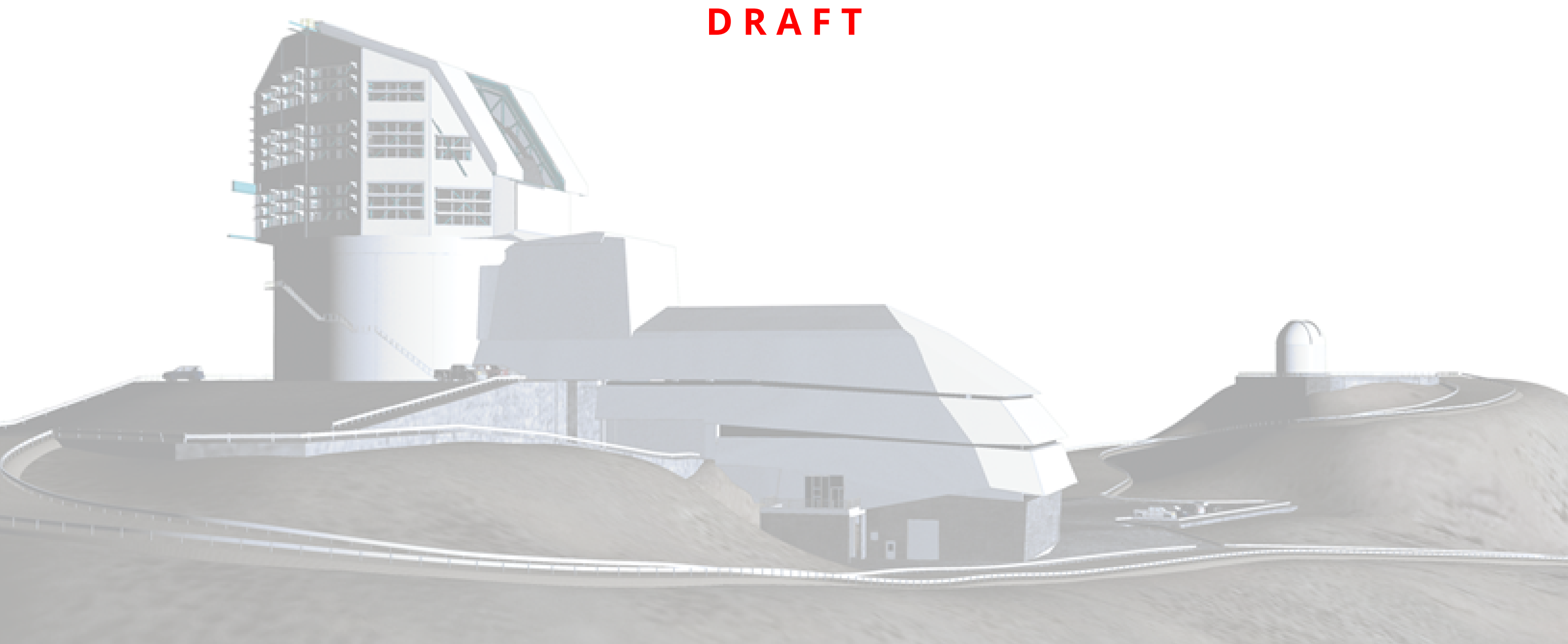
Criteria to start the Legacy Survey of Space and Time

Robert Blum, Charles F. Claver Željko Ivezić, Phil Marshall

RTN-093

Latest Revision: 2025-09-18

DRAFT



VERA C. RUBIN OBSERVATORY

Abstract

This document concisely captures the criteria that must be satisfied to begin regular survey operations for the Legacy Survey of Space and Time (i.e. to begin execution of the planned 10 year survey strategy currently documented in PSTN-056). It is expected that the survey will start in late 2025 1-2 months after the beginning of the formal Operations phase at the completion of construction. The survey can start based on quantitative criteria described herein. The system contribution to the delivered image quality must be $\geq 0.4''$ and the effective survey speed must be 1.01 or better. Both of these are attainable given our experience and knowledge of the current on sky system.

Change Record

Version	Date	Description	Owner name
1	2025-02-28	01.0	Robert Blum
1	2025-09-01	02.0 Criteria and Schedule updates	Robert Blum

Document source location: `https://github.com/lsst/rtn-093`

Contents

Criteria to start the Legacy Survey of Space and Time

1 Introduction

By the end of October 2025 the Rubin Observatory will be substantially completed having passed its Construction Completeness Review #3 (CCR3) and Operations Readiness Review #2. This will signify the formal handover of activities from the construction project to Rubin Operations. In practice, this means the Operations team (see Blum, RDO-018) will assume day-to-day responsibility of the Observatory and its regular operations: running the facility on Cerro Pachón each night, transferring data over the long haul network to the US Data Facility (USDF), processing and archiving the data, and delivering data products to the user community via realtime alerts and scheduled data releases.

At the time of handover the construction team will have demonstrated the overall Rubin Observatory system is *capable of meeting its required science driven technical performance as articulated in the Science Requirements Document* **?**, *LSST System Requirements* **?** *and Observatory System Specifications* **?** *documents. It is expected that improvements to processes, sub-system reliability and performance consistency will be necessary in advance of formally beginning the execution of the the 10–year Legacy Survey of Space and Time (LSST). The survey strategy and it's associated cadence in the 10–year period (currently allowing for modest assumed degradation in year 1) are detailed by the Survey Cadence Optimization Committee (SCOC, Rubin's Survey Cadence Optimization Committee et al., PSTN-056).*

In this technote, we define the set of key performance criteria that the Operations team, in consultation with operations partners SLAC and NOIRLab, the post-handover Construction team, the Rubin Management Board, funding agencies, and the science advisory committee will use to guide the decision to begin the LSST.

The formal handover from construction to operations is scheduled to occur on October 25th, 2025. The primary science program for the Rubin Observatory – the Legacy Survey of Space and Tinmme – will begin after the handover to Operations and when the key "start" criteria have been met. It is expected that the LSST will begin in ernest prior to the close of calendar year 2025.

Formal transition of construction staff into the Rubin Operations organization (derived jointly from NSF's NOIRLab under AURA and DOE's SLAC Rubin Operations) will be on October 1, 2025. See *section 4 below for the current schedule.*

2 System Performance

Handover means that the system will have passed the NSF and DOE Construction Completeness Review #3 (CCR3). Noting the formal close out of the MREFC grant and AURA cooperative agreement occurs with CCR4. The as delivered system will be capable of delivering images that satisfy the construction design requirements derived from the Science Requirements Document (SRD: Ivezić & The LSST Science Collaboration (LPM-17)). These requirements are defined in the LSST System Requirements (LSR: **?***) and Observatory System Specifications (OSS: Claver & The LSST Systems Engineering Integrated Project Team (LSE-30)) documents. Following the final phase of commissioning which includes science validation (SV) observations, the state of the system will be assessed and the readiness of the system and team to begin the survey will be made. Further optimization by the Operations team will be planned to ensure the system operates reliably at the needed level of performance capabilities.*

Rubin has developed a high level set of metrics summarizing the system performance with respect to overall survey efficiency. We need to simultaneously ensure that both 1) the system is producing viable science quality images and data products and 2) that the observing and acquisition of this data is efficient. To this end, we gauge the overall system survey capabilities in a 2–parameter space shown in Figure 1, marking the system + atmospheric contribution to delivered image quality versus the dimensionless survey efficiency or speed, fE – integrated Normalized Étendue. The combined summary Normalized Étendue metric (fE) is the product of 4 unitless f-metrics that gauge system contributions to the "survey speed", these are: 1) fS – System Sensitivity captures overall efficiency of recording photons from the sky and is driven by optical transmission, sensor quantum efficiency, sky brightness and image quality; 2) fA - Fill Factor captures the recorded area of the focal plane array relative to the area delivered by the optical system; 3) fO Observing Efficiency captures the efficiency with which available observing time is scheduled and utilized for survey observations and 4)SA System Availability a final factor that captures overall operational efficiency that takes into account weather and observatory downtime. If the system is producing appropriate image quality and the system and team are acquiring data efficiently, we can confidently start the LSST. The "start" criteria quantify the threshold in the 2-parameter performance space that is needed to achieve this goal.

All these f–factors are dimensionless and normalized by the corresponding SRD derived design val-

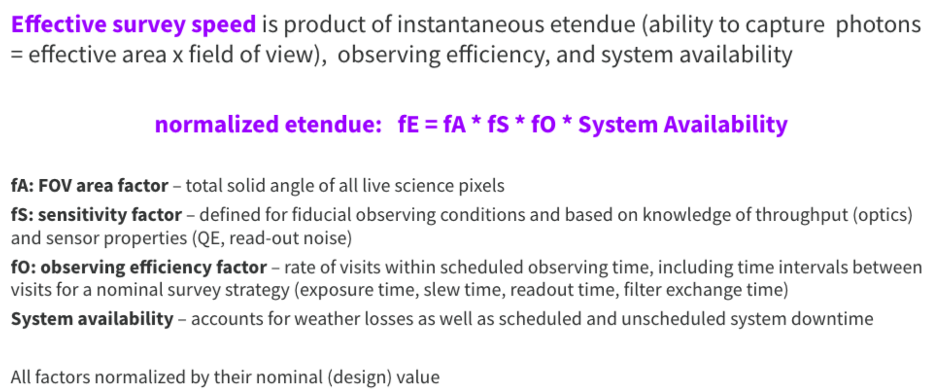


FIGURE 1: Dimensionless survey efficiency factor, fE. System Availability is the most uncertain at this time. The current state of each factor is discussed below and the quantitative criteria for starting the LSST with respect to each factor is assessed.

ues. They can be traded against each other as time gained or lost. For example, deterioration in the mirror reflectivity can be easily translated to factor fS, and traded against time (e.g. time lost to recoating, the system efficiency), or against loss of sensor area (fA). The key point is that it is possible to define a simple measurable quantity (fE) that is an excellent numerical approximation for LSST science goals. Thus, we can think of the effective speed of executing the LSST (in units of the nominal speed) in terms of recognizable elements: fE = effective area $\times$ effective FOV $\times$ cadence $\times$ 1-downtime.

In Figure 2, we show the state of our understanding of the image quality and survey speed before we went on sky with LSSTCam. The red star in the diagram is the design performance corresponding to 0.35$''$ system contribution to delivered image quality (DIQ as measure in the focal plane). The white circle is a forecast based on expectations before we went on sky. We believe there is nothing limiting us reaching that circle, but the current performance is not there yet.

There are three regions defined in the diagram, green, light grey and dark grey, representing broad levels of operational performance towards meeting the 10–year LSST objectives. Clearly we want to be in the green shaded region and to the lower right in that space. The boundaries of the green box are defined by the design specification (upper) and stretch goals (lower) for the system image quality contribution. The light gray space is unacceptable for science and the dark gray space covers the area where SRD minimum specifications are met for depth, area of LSST, and visits, but fails to meet the specification for minimum system contribution to the DIQ (0.4$''$).

As of CCR2/ORR1, the current values for the f factors are given in the following table. For fA, the value is set by the number of science pixels available (each with 0.2 $\times$ 0.2 arcsec^2 on the sky). Accounting

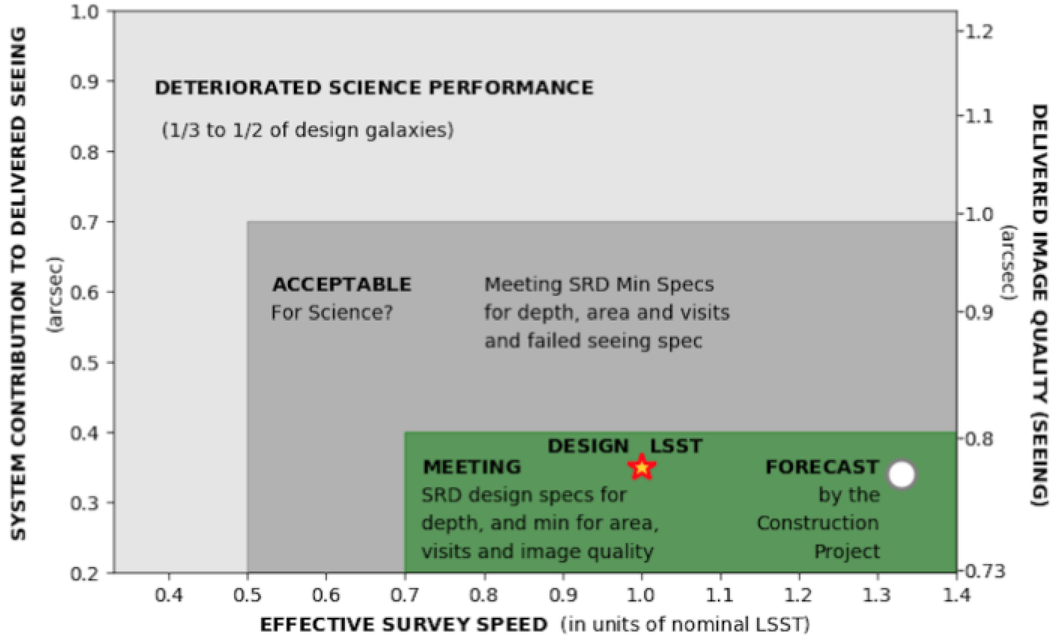


FIGURE 2: Image quality versus effective survey speed, fE. The system contribution to the image quality is shown on the left vertical axis and the delivered image quality including the atmosphere (added in quadrature) is on the right. The LSST design is accomplished with nominal speed 1.0 and system contribution to DIQ of 0.4′′ in this diagram. Current performance is assessed below. The white circle is representative of where we want to drive the performance, but we have not reached it yet.

for the active pixels meeting specifications, the factor is fully 99%. The fS factor includes read noise, QE, vignetting, optical throughput (filter, lens transmission, mirror reflectance) and DIQ (so DIQ affects both axes in our diagram). The observing efficiency factor, fO, is a function of how many visits of the right exposure time can be observed given telescope performance (how fast we move and settle). Finally, system availability is defined as the open shutter science time compared to the total elapsed time working on the on sky programs. Presently, if we consider only times when we are in the science data taking mode (doing LSST like observations) we have sustained 85% availability over a week long period. If we consider other system tuning in the denominator mixed with the science SV observations, the availability is about 75%.

The range of performance between what has been achieved over periods of SV and the best performance is shown in Figure 3. The goal of further optimization is to use the available technical "knobs" to tune the performance and make it more reliable. These are at a high level, the active optics system (AOS) and associated wavefront analysis, thermal control of the M1M3 cell, thermal control of the top end assembly (volume around M2), and the dome ventilation (active control of louvers and installation of the air distribution ducting). All of these are under active work and progress has

TABLE 1: Current f factor status

factor	Description	Sustained Performance	Demonstrated Capability
DIQ	System Contribution (PSF FWHM)	0.6″	0.4″
fA	FoV area factor	0.99	0.99
fS	Sensitivity factor	0.94	1.30
fO	Observing Efficiency	0.97	1.05
SA	System Availability (up and taking data)	0.75	0.85
fE	Normalized Étendue	0.68	1.15

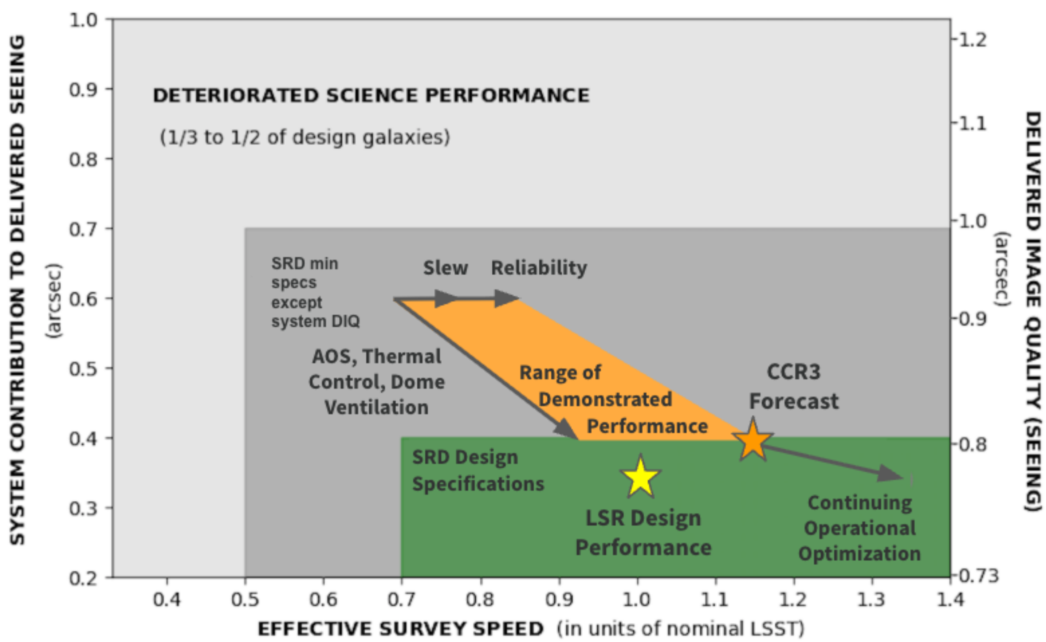


FIGURE 3: Image quality versus effective survey speed, fE with performance presented at CCR2-ORR1. Upper left of the orange performance region is sustained over week long periods in SV. The best performance (capability) is represented by the lower right vertex of the region. This forecast to be the typical performance by CC3. This may or may not happen depending on teh progress made in the remaining month of on sky work.

been made on a number of fronts not yet reflected in Figure 3. Mostly because the time available on sky has been limited since CCR2/ORR1.

The current capability and reliability of the system as described in Table 1 and Figure 3 form the basis of optimization criteria described in the next section that the Operations team will use to gate *starting the LSST.*

3 Criteria to begin the LSST

Armed with an understanding of the as–built system performance as outlined above and the Operations team readiness, we will use a set of objective criteria to gate the start of the LSST. These criteria will be concise and easily understandable so that the community of scientists, Rubin staff and other stakeholders counting on Rubin and the survey can have confidence the Observatory is on track.

The criteria articulated below are meant only to provide gating guidance signifying the survey start. There will likely be key processes within the overall system, including data management and processing where further work for improvements are required or desired after handover (beyond the construction project requirements). Unless these would prevent acquisition and saving of science quality data, thereby delaying the survey start, they are not discussed or enumerated here. These and other criteria (TBD) will be used to gage and monitor the overall performance of the Observatory and progress towards the 10–year survey objectives going forward, with nominal $T = 0$ *defined by when start criteria described herein are met.*

The initial set of criteria developed by Operations team were discussed with the Science Advisory Committee and community at the 2024 Rubin Community Workshop. These criteria have evolved since that meeting and are presented here in the table below.

The initial boundary conditions for determining the start criteria are that the construction project has successfully acomplished its own Construction Completeness Criteria (Claver et al. (SITCOMTN-005)) and has passed the third Construction Completeness Review (CCR3). Successful completion of CCR3 means NSF and DOE have accepted the system as the one that was intended to be built and will operate to conduct the 10-year LSST science program.

The survey start criteria cover a range of contexts. The criteria are not meant to be comprehensive with respect to gauging and monitoring LSST's scientific progress and success. They are intended to serve as a guide for the confident commencement of the survey – effectively establishing what will be referred to as LSST $T = 0$*. Most of the defined criteria look to be well in hand based on what we know about commissioning progress and system performance as reported at CCR2/ORR1. Of the 8 criteria enumerated we have identified what we call "The Big 3", namely: Delivered Image Quality separated into two primary contributors – (1) the interior dome environment plus (2) the hardware system (optics, tracking etc..), and (3) the survey speed or Normalized Étendue. These are discussed in more detail in the notes below.*

TABLE 2: Survey Start Criteria

Item	Criterion	Description	Status
1	LSSTCam Maintenance	Before the completion of SV, it is understood whether or not off TMA Camera maintenance will be needed within the first year of Operations.	No off TMA maintenance required.
2	SRD	All science requirements that can be verified with SV data are verified or expected to be verified within 3 months of completion of SV.	Status at CCR3
3	Dome	The dome environment is not limiting typical performance.	Not controlled until after Handover
4	Calibration	All necessary calibration data products are available at the time any LSST data are obtained or can be obtained after the fact without invalidating the observed data for inclusion in the LSST.	Status at CCR3
5	DIQ	The "System" contribution to the measured Delivered Image quality is better than or equal to $0.45''$	Currently $0.6''$ system contribution
6	Normalized Étendue (*eF*)	Survey Speed is > 0.7.	Currently 0.68
7	Cadence	The scientific merits and technical feasibility of the planned survey scheduler algorithms for DR1 have bee reviewed and verified.	In progress
8	Early Science	DP2 observations are completed as planned (Guy et al., RTN-011).	Status at CCR3

Item 1 is already met. We do not expect to have to remove the camera for maintenance before we begin the survey. Item 2 is needed to ensure some key aspects of the system don't need verification before we embark on the LSST. Some long term SRD requirements need a significant amount of data to finally validate. But we can be assured data being taken are going to be valid for the LSST if the requirements that can be validated with SV data have been. This will be confirmed at CCR3. The calibration system (item 4) is in the advanced stages of validation. By CCR3, we can be assured no outstanding calibration needs will limit the taking of images for the LSST. For item 7, the Survey Cadence Optimization Committee has delivered to the Operations Directorate one (or more) proposed survey cadence algorithms to be implemented using the Feature Based Scheduler. The scientific merits and technical feasibility of the proposed algorithm(s) will have been reviewed (If more than one proposal is provided a selection is made). This selection will be the core algorithm adopted through LSST observations leading to the first data release DR1. Remaining minor adjustments to the adopted algorithms are expected to be made as needed. The adopted cadence algorithm has been verified with simulations using as–built performance, by on-sky operations using the Feature Based Scheduler. Once SV data taking is complete, we will know the content of DP2 (item 8) and be able to decide whether or not any significant augmentations are critical for community preparation prior to data release 1 (DR1; see Guy et al., RTN-011).

3.1 Dome Environmental Control

The dome will be the last major subsystem to be completed. Indeed it will not be done until mid 2026. The critical aspects that are needed are: to install, provide control for, and optimize the actuators for the dome louvers and the installation of the HVAC ductwork used for daytime thermal conditioning of the dome interior. There are 40 louvers, and some large fraction need to be operable (open at fractions consistent with telemetry in real time for temperatures and wind). The first actuators are installed now and one louver has been opened at night. Still more will need to be brought on line after the handover to meeting the system image quality criterion (we currently expect 12 will be operable after handover). If the louvers limit us to worse than typical min SRD system DIQ performance, we won't be able to start the LSST until they are largely deployed and in routine operation.

There are large ducts that will provide conditioned air distribution supplied by the main air handlers inside the facility. This system is designed to pre-condition the internal dome environment during daytime hours to minimize thermal discontinuities at the start of each night caused by diurnal heating. This system is designed improve our ability to maintain the enclosure at closer to the anticipated mean nighttime temperature during the (earlier) day time. Maintaining thermal equi-

librium in the environment in and around the telescope is critical to optimum DIQ during the night. The ducts are necessary but not sufficient. We will also need to gain experience in forecasting the coming night's temperature to be able to use the air conditioning effectively (i.e. to set the system to hit the right target).

Further use of available temperature sensors on the telescope and in the dome will help on going analyses aimed at improving the AOS and thermal control of the optics in real time.

The total contribution to DIQ from the dome environment is modest. Including all sources of turbulence generated by the facility, the budget to contribute to the DIQ is only 0.09′′. Clearly all systems for controlling these contributions need to be working well and reliably. The observatory will need to rely on the ability to characterize parts of the DIQ coming from this environment. Thus we will prioritize reliable operation and calibration of our DIMM, in-dome seeing monitors, as well as the atmospheric profiler on Cerro Pachó, RINGSS.

3.2 Deleivered Image Quality (DIQ)

The single most important gain needed to get to the LSST start is clearly the typical DIQ. We will not start the LSST until the sustained performance of the system contribution to DIQ is $\leq$ 0.45′′. This criteria is the combination of both the telescope + LSSTCam optics and the degradations caused from any thermal non-equilibrium. Currently the very least the active optics contributes to the system has been measured at 0.33′′. The target for the active optics contribution is 0.25′′ indicating there is room for improvement. In addition to the active optics contribution, much of the remaining improvement needed to meet the system DIQ start criterion will come from system thermal control (mostly the dome environment).

Improving the system contribution to the DIQ requires continued effort on the control of optics and the dome environment. Putting this together with the criteria above results in the region of the performance diagram we can use to gate starting the LSST as depicted in Figure 4. The survey can begin once the system contribution to DIQ is 0.45′′ or less and the effective survey speed is 1.01 or better (see Table 1 and assume System Availability is 75%).

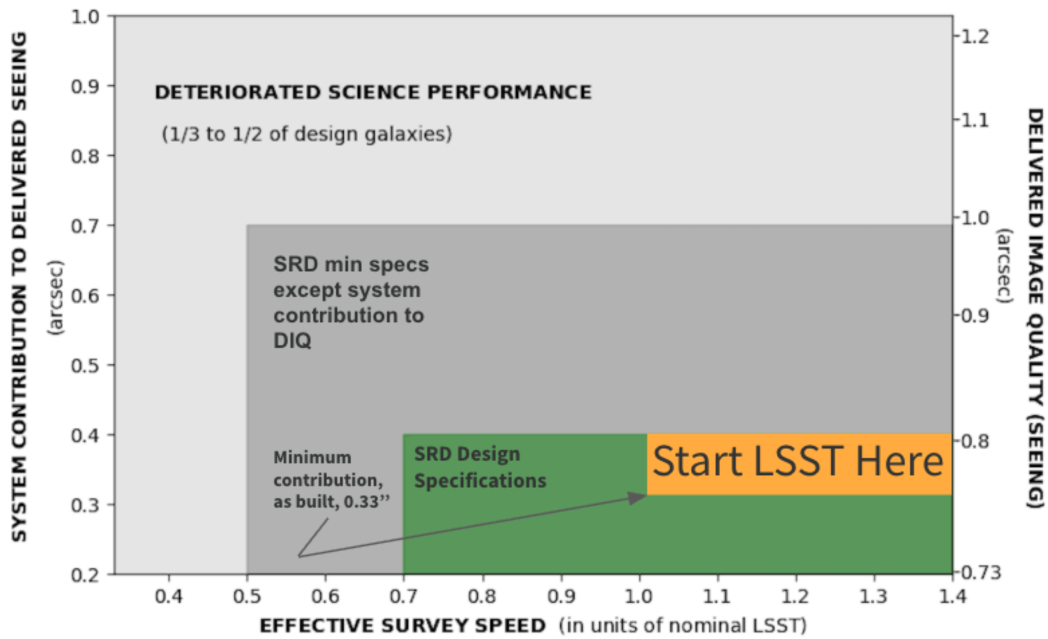


FIGURE 4: Image quality versus effective survey speed or Normalized Étendue. The large orange rectangle represents the region in this space within which we can confidently start the LSST.

3.3 Normalized Étendue

Much of the effective speed (Normalized Étendue) is already demonstrated to be sufficient to start the LSST, The field of view factor, fA, is excellent and stable. The sensitivity factor, fS, is also very good. This factor has the potential to help overall performance because of its dependence on delivered image quality. Getting the system contribution from 0.6 to 0.4 (coupled with site free air atmospheric seeing of 0.7′′) would raise fS from 0.94 to 1.3. Apart from this, all the optics are delivered as is the focal plane. The performance of all these components is excellent and can be maintained. The observing efficiency or fO is also in good shape. The telescope dynamic performance (slew speed, acceleration, and jerk) is sufficient for the LSST planned cadence.

The TMA is capable of accelerating more than we currently operate it. Higher acceleration requires improvements in the control of dynamic loads on the M1M3 glass via force actuators. However the current performance with glass is captured in the scheduler simulator and is only a modest hit to overall survey speed. We will continue to work on improved dynamic control even as we operate for LSST. Slew and settle performance are well understood and adequate. Modest gains on fO are forecast for the rest of SV and early operations. We expect the current value to go from 0.97 to 1.05.

This leaves the System Availability, Current performance of 0.75 needs to be improved. Doing only science like observations we have reached 85% at times. We need to continue to improve on procedures and reliability of systems throughout the summit facility as we go forward. This means training for faster troubleshooting and fault recovery, making communications on the telescope system bus more reliable, improving reliability of telescope, dome, and camera functions. These have all seen marked progress as expected though out system integration, test, and commissioning. We will assume current performance of 75% conservatively.

Using the combined SRD minimum specifications the lowest Normalized Étendue allowed is 0.7. This level is nearly in hand; see Table 1 and the "Sustained Performance values". We will start the LSST consistent with System Availability of 75% which leads to fE ˜1.0 using the Demonstrated Capability column f factors in Table 1. However, the actual value will be better given that we expect the System Availability to improve significantly.

4 Schedule

The Project and Operations teams will complete several reviews as described below in order to closeout the construction phase, handover to Operations, and demonstrate readiness to begin the LSST. The first of these, Construction Completeness Review (CCR) 1, was held in October, 2024. CCR2 took place in July, 2025. Concurrent to CCR2, the Operations team went through the Operations Readiness Review (ORR) 1. Both reviews were run in parallel with the same NSF–DOE review panel convened to review and report out for the Observatory as a whole. A modest set of recommendations were made and Construction and Operations are addressing them.

Construction Closeout and Operations Readiness Reviews:

- *CCR1 – readiness for the start of on-sky commissioning, as exemplified by substantial completion and integration of subsystems, and evidenced by direct measurement of the optical throughput of the integrated system*
- *CCR2 – capability to support LSST science goals, as exemplified by the System First Light technical milestone, and evidenced by delivered single-visit image quality (including active control of optics)*
- *CCR3 – reliability to initiate the LSST survey, as exemplified by the Science Validation Surveys, and evidenced by the readiness of Rubin Observatory Operations to accept the as-built Observatory*
- *CCR4 – closeout of the Construction project, as exemplified by service of scientifically validated survey-scale data products as part of the Operations Early Science Program, and evidenced by completed scope of system-level requirement verification, reporting, and final accounting*

As of September 2025, the science validation phase of Construction is nearly complete. SV and system optimization will run through September 22. The facility will then shut down until October 24 to complete the remaining large integration activities that are required before starting regular operations. It is known that a number of activities will continue in operations managed by the construction project. These activities are captured in the "punch list". It is expected approximately 10 FTE of effort in FY26 going through at least June will be required to finish the punch list.

CCR3/ORR2 will be held in October at the end of the observatory shut down. The combined review will be held with Observatory, partner, and agency staff. No review panel will be present. The team *will present the status of the observatory following SV and the shutdown activity, the plans for the punch list, and the plans for early operations regarding continued optimization and readiness to start the LSST.*

Following CCR3/ORR2 and the concurrent "Handover", the Operations team will begin to regularly run the system, taking responsibility for the observatory on October 25th. The priority for the Operations team is to drive the system to the state captured by the criteria in this document and start the LSST. Figure 5 shows the current milestones for the Project and Operations. The period after CCR3/ORR2 is uncertain, but likely will involve continued pre–survey optimization.

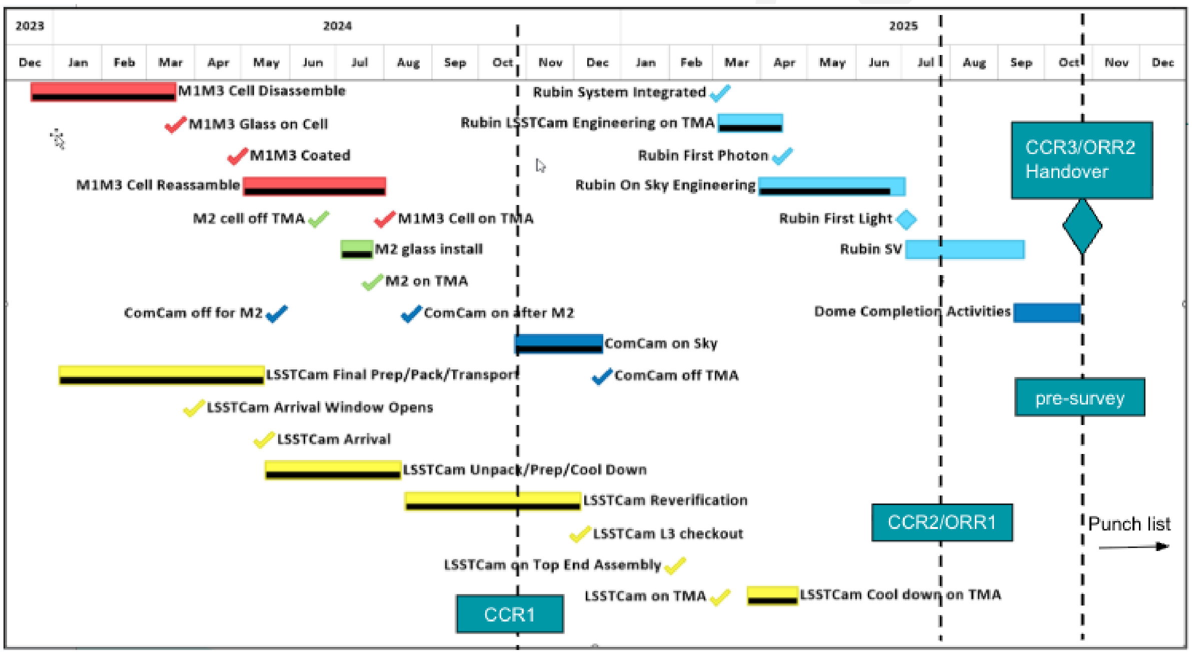


FIGURE 5: Rubin Observatory Schedule as of September 01, 2025. Formal completeness reviews including operations readiness are shown in the Figure and described above. Handover to the Operations is set for October 25, 2025 and pre-survey optimization will continue until the performance criteria described in this document are met for starting the LSST. In parallel, some activities and work by the Construction team will continue in FY26. Some of these activities will positively impact on sky performance.

5 References

[RDO-018], *Blum, R., 2021,* PLAN for the OPERATIONS of the VERA C. RUBIN OBSERVATORY, *Data Management Operations Controlled Document RDO-018, NSF-DOE Vera C. Rubin Observatory, URL* https://docushare.lsstcorp.org/docushare/dsweb/Get/RDO-18

[SITCOMTN-005], *Claver, C., Bauer, A., Bechtol, K., et al., 2025,* Construction Completeness and Operations Readiness Criteria, *Commissioning Technical Note SITCOMTN-005, NSF-DOE Vera C. Rubin Observatory, URL* https://sitcomtn-005.lsst.io/

[LSE-30], *Claver, C.F., The LSST Systems Engineering Integrated Project Team, 2018,* Observatory System Specifications (OSS), *Systems Engineering Controlled Document LSE-30, NSF-DOE Vera C. Rubin Observatory, URL* https://ls.st/LSE-30

[RTN-011], *Guy, L.P., Bechtol, K., Bellm, E., et al., 2025,* Rubin Observatory Plans for an Early Science Program, *Technical Note RTN-011, NSF-DOE Vera C. Rubin Observatory, URL* https://rtn-011.lsst.io/, *doi:10.71929/rubin/2584021*

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

[PSTN-056], *Rubin's Survey Cadence Optimization Committee, Bianco, F.B., Jones, R.L., et al., 2025,* Survey Cadence Optimization Committee's Phase 3 Recommendations, *Project Science Technical Note PSTN-056, NSF-DOE Vera C. Rubin Observatory, URL* https://pstn-056.lsst.io/, *doi:10.71929/rubin/2585402*

6 Acronyms

Acronym	Description
AOS	Active Optics System
AURA	Association of Universities for Research in Astronomy
CCR	Construction Completeness Review
CCR1	Construction Completeness Review 1
CCR2	Construction Completeness Review 2
CCR3	Construction Completeness Review 3

CCR4	*Construction Completeness Review 4*
DIMM	*Differential Image Motion Monitor*
DIQ	*Delivered Image Quality*
DOE	*Department of Energy*
DP2	*Data Preview 2*
DR1	*Data Release 1*
FOV	*field of view*
FTE	*Full-Time Equivalent*
FWHM	*Full Width at Half-Maximum*
FY26	*Fiscal Year 2026*
FoV	*Field of View (also denoted FOV)*
HVAC	*Heating, Ventilation, and Air Conditioning*
LPM	*LSST Project Management (Document Handle)*
LSE	*LSST Systems Engineering (Document Handle)*
LSR	*LSST System Requirements; LSE-29*
LSST	*Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)*
LSSTCam	*LSST Science Camera*
M1M3	*Single piece of glass for Primary Mirror/Tertiary Mirror*
M2	*Secondary Mirror*
MREFC	*Major Research Equipment and Facility Construction*
NOIRLab	*NSF's National Optical-Infrared Astronomy Research Laboratory;* `https://noirlab.edu`
NSF	*National Science Foundation*
ORR	*Operations Readiness Review*
ORR1	*Operations Readiness Review 1*
ORR2	*Operations Readiness Review 2*
OSS	*Observatory System Specifications; LSE-30*
PSF	*Point Spread Function*
PSTN	*Project Science Technical Note*
QE	*quantum efficiency*
RDO	*Rubin Directors Office*
RINGSS	
RTN	*Rubin Technical Note*
SA	*System and Services Acquisition*

SCOC	*Survey Cadence Optimization Committee*
SLAC	*SLAC National Accelerator Laboratory*
SRD	*LSST Science Requirements; LPM-17*
SV	*Science Validation*
TBD	*To Be Defined (Determined)*
TMA	*Telescope Mount Assembly*
US	*United States*
USDF	*United States Data Facility*