

Rubin Science Advisory Council meeting, August 7, 2023

At the Project and Community Workshop: Tucson and on Zoom

In what follows, findings and recommendations are indicated in *italicized bold-face*. While most of what follows is based on the August 7 meeting, some of the recommendations follow from discussions and presentations that took place later during the PCW.

SAC members attending: Franz Bauer, Márcio Catelan, Simona Mei, Will Clarkson, Michael Strauss, Mansi Kasliwal, Charles Liu, Niel Brandt, Josh Simon, Anže Slosar, Katrin Heitmann, Burçin Mutlu-Pakdil, Henry Hsieh.

We had a number of Project and Operations team leaders and members in attendance and giving presentations, including Željko Ivezić (Project Director), Bob Blum, Phil Marshall (Operations Director and Deputy Director), Leanne Guy (Project Scientist for Data Management), Blake Mason (EPO team), Aprajita Verma (Rubin International Program Coordinator) and others. Roughly 60 other people were also in attendance (both in person and on zoom).

We are happy to welcome a number of new members of the SAC, including Simona, Katrin, Burçin, and Henry, as well as Ashley Villar and Melissa Brucker.

The plans for Early Science with Rubin. The discussion was led by Leanne Guy; her slides are available [here](#) (see also her more extensive and detailed [presentation on the same subject](#) later in the week).

Early science in this context is defined as science done with data through and including the first formal data release (DR1). DR1 in turn is based on the first six months of full operations. The formal description of the early science plans is found in the document [Rubin Observatory Plans for an Early Science Program](#) (RTN-011), which is updated regularly to reflect the Project's current understanding. Another useful document is [the system on-sky test plan](#).

Rubin Operations will formally start when the construction project passes its Operational Readiness Review (ORR). The final part of the commissioning will be a phase of Science Verification (SV) observations. Depending on the final content of the data acquired in SV, Operations may decide to do more early science observations, using up to two months of time, to ensure that a solid data set exists for DP2, that the operations team has sufficient experience running the full system and is deemed to be appropriately efficient in data taking to start the ten-year LSST. The Project will not be able to predict whether we will need to use these two months following ORR until commissioning is well underway. In any case, all commissioning data, including the science verification surveys, will be included in Data Preview 2. The timing of DP2 will be considerably more certain a year from now.

The SAC thanks Leanne and the Project for clarifying many of the concerns the SAC raised in previous meetings about the planning of the science verification and its relationship to the Operations Readiness Review and the start of the 10-year LSST. Further communication of the details of the commissioning and science verification plans will be essential both over the next year and as the commissioning gets underway. The SAC has one specific question at this point: if the commissioning goes faster than had been planned, and we're ready to start science verification earlier than currently scheduled, would science verification be extended? Or would the Operations Readiness Review just be held earlier than currently planned?

The new timeline presented in the [PCW opening plenary](#) is predicated upon the LSST Camera being shipped to Chile by November 2023, with the “first photon” (the first exposure on the sky with the full camera) occurring roughly nine months later, operations starting in mid-to-late 2025, with the first data release (DR1), based on the first six months of the LSST, roughly one year later. The SAC notes that this timeline, while in agreement with that presented at <http://ls.st/dates>, seems inconsistent with that described on the [schedule posted on the Rubin website](#). The former suggests a start of the survey in mid/late 2025, while the latter states January 2025. Thus, it seems that the best case scenario now represents a 6-9 month delay versus the schedule from Dec 2022. The SAC was concerned both by this delay, and by the fact that it is not yet reflected in the on-line schedule on the public website. **The SAC urges the Project to update the schedule on the website, and to explain the updated schedule to the community via the Rubin Digest or other communication tools.**

Due to mandates from the US government, commissioning data cannot be distributed to data rights holders until after a 30-day embargo. And once full operations start, the embargo is 80 hours (a bit more than 3 days). In practice, this does not affect the yearly data releases, nor does it affect the alert product (with its 60-second latency); rather, this is the delay by which the individual nightly images (and the catalogs from them) can be released to data rights holders.

Alert production will ramp up as templates are generated, from the science verification surveys and the first year of operations. Indeed, the Project anticipates that there will be templates in all six filters over the entire Rubin footprint by the end of the first year. The alerts will be made available through the community alert brokers; integrating them into the data stream will be an important part of the commissioning exercise. The SAC was concerned that the template images themselves, needed to interpret alerts during early science, would not be available during SV, in part because of the 30-day embargo on SV images (see below).

The SAC recommends that the Project develop a specific plan to make the template images relevant for alerts released during science verification.

The Community Event Brokers will be the principal conduit by which the scientific community will gain access to the alerts. It has been a while since the community has gotten an update on the status of the 7 approved alert brokers. There was discussion some months ago about feeding them Rubin-style simulated alerts, but as far as members of the SAC were aware, this

has not yet happened. There are also concerns that some of the alert brokers will provide limited access to their output, e.g., putting the alerts behind a paywall.

The SAC recommends that the Project prepare a community-facing description of the current status and readiness of the Community Event Brokers to handle the stream of data during Early Science and beyond. This description should also include a discussion of accessibility, and the extent to which any given Broker's outputs are freely available.

Opportunities for joint processing of Rubin data with Euclid; discussion led by Bob Blum. (Note: no slides accompanied this discussion).

The opportunity to carry out joint analyses between the ESA Euclid mission and Rubin is very exciting, offering many important scientific opportunities. There are similar scientific synergies with the Nancy Grace Roman Telescope. We commend the Rubin team for engaging the community to prepare a [comprehensive document](#) describing Rubin-Euclid Derived Data Products, and establishing a Memorandum of Understanding (MOU) with Euclid. We are pleased to know that a joint DDP team will be established soon.

The data will be shared between the two consortia in the so-called Euclid South Deep Drilling Field, two adjacent Rubin pointings which will each be observed by Rubin to roughly half the depth of the other DDFs. Note that the agreement includes just the Euclid imaging data; the Euclid spectroscopic data are not included in the MOU.

However, ***the SAC is concerned that there is not yet any computational or software resources at the project or agency level to carry out the joint processing tasks.*** A task force has been established that will evaluate the resource needs. Joint analyses and processing can occur at different levels:

- At the catalog level – this would require relatively few resources and is clearly a worthwhile goal;
- At the pixel level – this is likely to require significant code development and substantial computational power. The SAC stresses the importance of doing so. ***We recommend carrying out the following tasks in preparation for such an endeavor:***
 - ***Establish and evaluate a set of quantitative metrics that describe the scientific gain of pixel level vs. catalog level joint analysis.***
 - ***If the evaluation of these metrics suggests that pixel level joint analysis indeed has major benefits (as we suspect it will), carefully estimate the resource needs (computing and effort).***
 - ***After having established the cost, negotiate with Euclid (and NASA) how the cost will be split. It will be important to identify new resources to support this effort, as opposed to putting an unfunded mandate on the community to carry out this analysis, or reducing support for other scientifically important endeavors that Rubin and its scientific community are carrying out.***

Finally, data sharing and publication policies need to be carefully and fully developed. The data that are shared and any newly derived data products need to be made available to the full Rubin and Euclid community and eventually need to be publicly released.

Status of the Rubin website, discussion led by Blake Mason. *(No slides accompanied this discussion).*

Blake is one of the web developers of the new <http://rubinobservatory.org>. The content of this website is an EPO product, and it looks great, with (among other things) detailed lesson plans for educators, and all materials available (or soon to be available) in both English and Spanish. They plan to port the information currently on <http://lsst.org> that is meant for professional scientists to the new website at some point. The SAC expressed concern that there was considerably less attention paid to the content of the For Scientists page, but we were told that this was the purview of the Community Science Team, led by Melissa Graham. (An additional challenge is that the EPO team is currently working without a team leader; apparently they are actively looking for a person to fill that role). There is quite a bit of relevant information at <http://lsst.io>, which collects together a number of important technical documents, including (but not limited to) descriptions of the Data Previews, the Rubin Science Pipelines, and the Rubin Science Platform.

In the past, the SAC has expressed concern about the difficulty of finding relevant information across multiple channels. It has recommended the development of a Google-like search engine of Rubin documentation across all relevant platforms (<http://lsst.org>, <http://lsst.io>, <http://community.lsst.org>, archived mailing lists, Slack channels, and posted documents) for scientists to find the information they need. The Project has pointed out the technical challenges of implementing such a search, and the fact that the provenance of what a search would find would be unclear (e.g., does this document from 3 years ago reflect the current policies and understandings of the Project?). Rather, the CST includes two document specialists charged with developing content for the Rubin website, and identifying important materials posted on Slack and the community web page. The SAC would like to learn more about this process, and will likely request a status report from the CST and the document specialists in the coming months.

The SAC commends the EPO team for the development of <http://rubinobservatory.org>. However, it remains concerned about the development and integration of web materials directed to professional scientists, and more generally the status of the documentation for the science community. The SDSS community has developed much of its on-line documentation in a series of 'documentation hack weeks', in which relevant individuals gather to write documentation in intensive sessions; the Project should consider a similar model.

In-kind contributions, [presentation](#) and discussion led by Aprajita Verma and Phil Marshall.

There are now 153 different in-kind contributions planned from 43 different teams from many different countries, as listed [here](#). They are still going through the formal agreement step whereby the individuals involved are granted Rubin data access, but this should just be a matter of time (see below). The in-kind contributions come in a variety of different forms in practice,

ranging from promises of telescope time to software/programming expertise. While it seems that these contributions have been quite useful to the science collaborations and to the project in a variety of ways, there were some frustrations:

- The communication between the in-kind teams working with the science collaborations, and the chairs of those science collaborations, is less than ideal. Each team is supposed to have a liaison to communicate the progress they are making to the science collaboration, but it seems that in many cases, these communications aren't reaching the chairs.
- There is not always a good match between the expertise of those contributing software to the software task at hand. This is in part a reflection of the steep learning curve in some parts of the Rubin software environment, but there needs to be a better job of matching individuals' specific expertise to the tasks that need doing. In many cases, Science Collaboration members needed to devote a lot of time into training in-kind contributors, so the gain from their contributions was less than it would have been otherwise.

The SAC recommends that there be more coordination between the Science Collaborations and the in-kind contributions: each in-kind contributor should prepare a yearly report, which is sent explicitly to the relevant science collaboration chairs. And further work is needed to match in-kind contributors to the tasks needed by the science collaborations.

- Some in-kind contributions are in the form of telescope time. It seems that the details of how this will be used is unclear. It is to be managed by NOIRLab, to be made available to the world-wide community under the Open Skies policy. As we understand it, this telescope time is not restricted to projects related to Rubin science, and the resulting data are not available to Rubin data-rights holders. Is there any sense in which the Chilean community will get access to this time, e.g., following the usual rule whereby Chilean astronomers get 10% of the time for telescopes in Chile?

The SAC is concerned that there is a missed opportunity to use this contributed telescope time to carry out projects that will directly benefit the Rubin science community. For example, spectroscopic calibration of Rubin photometric redshifts, observations of Rubin fields in different filters, follow-up of transient and variable sources discovered by Rubin, and so on. The SAC would like to hear from NOIRLab representatives regarding the current thinking on how this telescope time will be allocated in practice.

Phil described the status of the data rights agreements. Rubin is developing templates from which the agreements can be developed; there are several dozen such agreements in progress. The agreements include a clause whereby a junior scientist (and senior too?) who has data rights through one of these agreements will retain them for two years if they subsequently move to an institution that would otherwise not have data rights.

Rubin is planning a rolling call for proposals for in-kind contributions, continuing (I think) throughout the life of the survey. They are soliciting such proposals from US and Chilean teams as well.

The SAC discussed several topics in addition to those covered in the public meeting, including identifying issues to be addressed in future SAC meetings.

- ***The SAC commends the Survey Cadence Optimization Committee (SCOC) for the significant progress it has made on developing the Rubin survey strategy, and communicating the results to the scientific community. We encourage the SCOC to continue to post updates to their recommendations, with clear statements about which remaining issues are in play.***
- The SAC is keenly interested in the discussion underway in the SCOC about the desirability to have uniform-depth coadds prepared for the Wide-Fast-Deep survey in the yearly data releases. We do not offer a recommendation at this time, but are eager to be involved in discussions on the relevant scientific drivers for such coadds, and how Rubin's Data Management team can address these concerns.
- The scientific community is eager for a resolution to the question of whether a 30-second visit will consist of 2x15 sec exposures. ***The SAC recommends that this decision be made as early as possible during commissioning, with input as appropriate from the community, including the science collaborations.*** The 30-second exposures will saturate at a fainter magnitude than the 15-second ones, meaning that the dynamic range of the survey would be somewhat less with the longer exposures. ***This could be addressed (at least for the static sky) with relatively infrequent full coverage of the Rubin footprint with much shorter exposures (1-2 seconds); the SAC endorses that this be included in the SCOC plans.***
- ***The SAC would like an update on plans for generating photometric redshifts of galaxies, especially early in the survey. Is it the Data Management team's responsibility to implement fiducial photo-z algorithms? When will the first photo-zs be made available?***
- ***The SAC would also like an update on the algorithms developed for difference imaging, and the tests that have been done (and will be carried out during commissioning) to demonstrate their performance.***