



Training resources for LSST:UK DAC users

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Author(s) inc. institutional affiliation	Bob Mann, Stelios Voutsinas & Roy Williams (Edinburgh)
Reviewer(s)	Gavin Ramsay (Armagh), Seb Hoenig (Southampton)

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Table of Contents

Version History	2
1 Executive Summary	4
2 Introduction	5
2.1 UK DAC development	5
2.2 Purpose	6
2.3 Glossary of Acronyms	6
3 User Documentation for the UK DAC	7
4 Documentation Release 1 (June 2020)	7
4.1 Lasair	7
4.2 The LSST Science Platform	8
4.3 The DocR1 documentation set	8
4.4 Reviewing the DocR1 documentation set	8
4.5 Feedback from the review of the DocR1 documentation set	8
5 Conclusions	10

List of Figures

1 A graphical overview of the UK Data Access Centre.	5
2 The LSST Science Platform[5].	7

1 Executive Summary

This document describes an initial release of documentation for users of current and future services accessed via the UK’s LSST Data Access Centre (DAC). For the purposes of this document, this release is known as DocR1[1].

This deliverable was included, and its date set, in the LSST:UK Science Centre (LUSC) Phase B proposal, which was submitted in November 2018. Since then, planning for the UK DAC has developed greatly. The Phase B DAC Roadmap[2] envisages the deployment of four releases of DAC services – UKDAC0 to UKDAC3 – before the start of Rubin Observatory operations: UKDAC0 is an internal release for the use of the UK DAC team alone, with sets of test users being provided access to from UKDAC1 (in October 2020) onwards.

In view of the development of the Roadmap, it was decided that we should focus this deliverable on the documentation available *now* (i.e. June 2020) with the goal of gaining feedback from the reviewers of this report (and others) as to the additional documentation that should be in place at the release of UKDAC1. DocR1 is necessarily limited in scope, given that the UK DAC is still being developed. It primarily comprises existing documentation for Lasair[3], the alert broker being developed in WPs 2.3 and 3.2 of the LUSC Phase B programme. The current version of the broker is *Lasair-ZTF*, which is consuming the real-time alert stream from the Zwicky Transient Facility (ZTF, [4]) and providing an expanding range of analysis services to a userbase that is already relying on them to support their science. The second component of DocR1 is a very preliminary set of documentation for the LSST Science Platform (LSP, [5]), which is the set of data services to be provided by the Rubin Observatory to support analysis of LSST data products. The UK DAC will deploy the LSP, tailored to some extent for local needs and the specific computational infrastructure on which it is running in the UK, but it is expected that the bulk of the documentation on the LSP used by UK astronomers will be provided by the Rubin Observatory Data Management (DM) team. That user documentation has not yet been published, so all that is included in DocR1 for the LSP are some links to existing DM documents – *e.g.* design documents and some example analysis scripts – together with a small amount of material created to aid the internal evaluation by the UK DAC team of UKDAC0.

While the content of DocR1 is necessarily limited in scope, it has been implemented within a new *Documentation*[6] space on the LSST:UK wiki, which will develop, over the phased deployment of the UKDAC n releases into an information portal for users of the UK DAC, aggregating the suite of user documentation to be provided by the DM team and UK-specific documentation, such as for the Lasair broker. The intention in setting up this wiki space now, despite the paucity of user documentation that can currently be held within it, is that it can develop in both form and content in the light of feedback from the test users of the UKDAC n releases, in preparation for providing support to the wider UK data rights community once LSST data starts to become available.

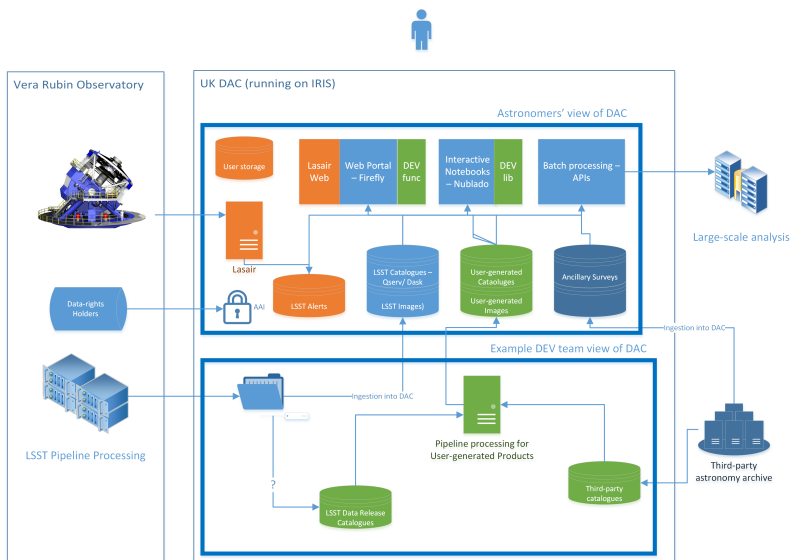


Figure 1: A graphical overview of the UK Data Access Centre.

2 Introduction

The scale of the LSST data products necessitates the provision of significant computational resources to facilitate their analysis. The Rubin Observatory DM team will operate a Data Analysis Centre for US astronomers and the intention, since the inception of LSST:UK, has been that the UK will also run a DAC – ideally, as part of an international DAC network, federated with the DAC(s) operated by the DM team, but, if not, then, at the very least, running the same software, which the DM team is developing open-source.

Discussions regarding the potential international network of DACs have progressed over a number of years, leading to the publication by Rubin Observatory of a *Proposed Policy for independent Data Access Centers*[7], and the place of the UK DAC in any such network should become clear with agreement of the UK’s in-kind contribution to Rubin Observatory operations. That agreement is expected to take effect by mid-2021, but, fortunately, development of the UK DAC can proceed in advance of that, as its basic parameters are already known: it will deploy the DAC software provided by the DM team, which is already available in preliminary form from the DM team’s software repositories; it will also include the Lasair alert broker, which is already being operated, in prototype form, by the DAC team; and it will be deployed on computational infrastructure provided through the STFC-funded IRIS[8] initiative.

2.1 UK DAC development

The UK DAC team have developed a Roadmap for the phased deployment of UK DAC services through the course of LUSC Phase B (*i.e.* July 2019 - March 2023), built around the concept illustrated in the Figure 1. As indicated in the central panel of that figure, the UK DAC comprises two categories of services, namely those (in the upper section of that panel) that serve data to DAC users and those (in the lower section) that support the development (DEV) activities in the LUSC programme, which will themselves create User-Generated Products for later publication. This document is solely concerned with the user-facing part of the UK DAC, with the plans for the integration of the DEV activities outlined in Deliverable D2.1.1[9].

The Roadmap also outlines a four-phase release of services in the UK DAC, starting, in May 2020 with UKDAC0, an initial deployment of LSP software solely for evaluation by the DAC team, through to UKDAC3 in December 2022, which should provide a close approximation to

the UK DAC that will publish the first LSST Data Release.

2.2 Purpose

The first test users will be invited to access UKDAC1, which is due to be released in October 2020. One focus for DAC development during the second and third quarters of 2020, therefore, is addressing lessons learnt from the internal evaluation of UKDAC0 to help shape a UKDAC1 system that can support interaction with the UKDAC1 tests from 2020Q4.

As indicated in Figure 1, the UK DAC will also host the Lasair event broker, which has been operating – in prototype form, processing the ZTF alert stream – since 2018. The Lasair website includes an expanding set of user documentation, which is being developed incrementally with feedback from the Lasair-ZTF user community.

The purpose of this report, and the associated online material[1], is, therefore, to present a very preliminary set of UK DAC documentation – primarily covering Lasair-ZTF, but with some material relating to the LSP – for a review that will guide the development of a fuller set of documentation to support use of UKDAC1.

2.3 Glossary of Acronyms

DAC: Data Access Centre

DM: (Rubin Observatory) Data Management

DocR1: Documentation Release 1 (June 2020)

LSST: Legacy Survey of Space and Time

LUSC: LSST:UK Science Centre

ZTF: Zwicky Transient Facility

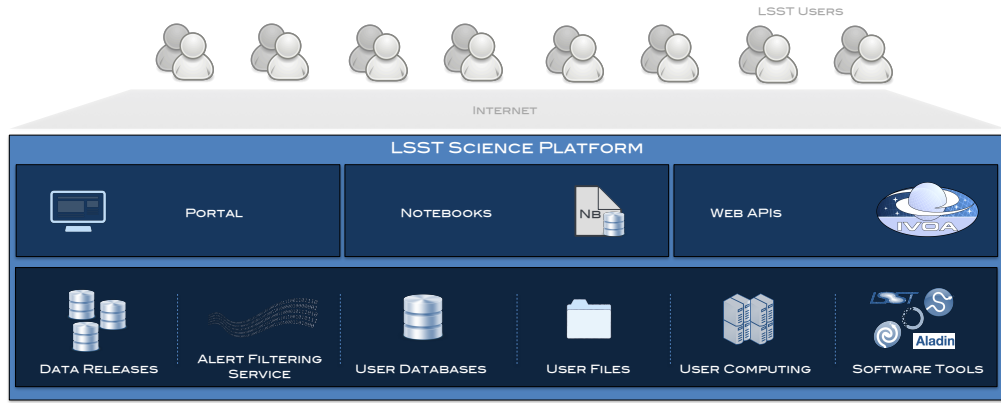


Figure 2: The LSST Science Platform[5].

3 User Documentation for the UK DAC

As described above, the bulk of the user-facing software deployed in the UK DAC will be provided by the Rubin Observatory DM team and will mirror what they will deploy in the US DAC(s); the core of that software suite is the LSST Science Platform, which is outlined in Section 4.2 below. Some additional documentation is likely to be required to address UK-specific aspects of the LSP deployment in the UK DAC, but the hope is that its integration within an international DAC network would make it as similar (at least from a user’s perspective) as possible, with the ideal situation being that users could use resources associated within *any* node in the international DAC network seamlessly, without necessarily knowing which they were logged into.

It is expected, therefore, that the bulk of the user-facing documentation for the UK DAC will be common LSP documentation provided by the Rubin Observatory DM team. Additional documentation will, however, be required for services developed through the LUSC DEV programme that do not form part of the Rubin Observatory DAC software suite, most notably that relating to the Lasair event broker.

In view of that, it is our intention to provide users of the UK DAC with a single online information portal – <https://lsst-uk.atlassian.net/wiki/spaces/DOC/overview> – giving them access to the DAC documentation that they require (including links to the services themselves), irrespective of where they originate. This information portal will be developed incrementally during the course of Phase B, to match the developing suite of UK DAC services and the increasing availability of documentation from the Rubin Observatory.

4 Documentation Release 1 (June 2020)

The first release of UK DAC documentation (DocR1, [1]) contains documentation on two pieces of software, the Lasair event broker and the LSST Science Platform. These are outlined below, before more detail is provided on the DocR1 documentation set itself.

4.1 Lasair

Lasair[3] is the event broker being developed by the LUSC Phase B WP2.3 and WP3.2 teams in QUB and Edinburgh for selection as an LSST Community Broker¹. Since 2018 it has been processing the live alert stream from the Zwicky Transient Facility, and providing users with an

¹See <https://www.lsst.org/scientists/alert-brokers>

increasing array of analysis services, ranging from simple webforms to a Jupyter Notebook[10] interface supporting sophisticated programmatic analysis.

4.2 The LSST Science Platform

As illustrated in Figure 2, the LSST Science Platform (LSP), comprises three *aspects*:

- A **Portal Aspect**, based on the IPAC Firefly[11] web interface for interactive data exploration;
- A **Notebook Aspect**, called *Nublado*, providing a Jupyter Notebook environment for programmatic analysis; and
- A **Web API Aspect**, which will expose LSST data products using standard IVOA interfaces, supporting large-scale remote analysis workflows.

The current DAC software suite has been deployed on IRIS hardware to provide UKDAC0, which makes the Portal and Notebook Aspects available for evaluation by the UK DAC team, and at least these two aspects will be available for the test users of UKDAC1.

4.3 The DocR1 documentation set

The DocR1 documentation set is linked from the top-level UK DAC documentation page <https://lsst-uk.atlassian.net/wiki/spaces/DOC/overview>.

This features links to:

- The Lasair Cookbook: a set of recipes for basic analysis operations run on Lasair-ZTF;
- a link to the existing set of example Jupyter Notebooks on the Lasair website; and
- an initial set of LSP tutorials and documentation, which constitute a placeholder for future, more comprehensive documentation on the LSP, but include links to existing LSP documentation from the DM team, plus a little locally-generated documentation written to support the internal evaluation of UKDAC0.

4.4 Reviewing the DocR1 documentation set

The UK DAC Roadmap summarises the intended contents and functionality of UKDAC1, and it is hoped that the reviewers of this document will approach this and the online DocR1 documentation set with an eye to what they would want to see as the documentation suite supporting the test users of UKDAC1. This feedback – taken together with the internal evaluation of UKDAC0 – will then guide the further development of the user-facing side of the UK between now and the release of UKDAC1.

4.5 Feedback from the review of the DocR1 documentation set

Seb Hoenig and Gavin Ramsay reviewed the DocR1 documentation set, along with v0.1 of this report (identical to the current version up to, and including, Section 4.4), and provided a number of useful feedback points, which we present below, along with our responses:

- **F1: Linkage should be made between “*some of the higher level science goals of LSST to the various parts in the science documentation and/or tools documented*”.**

The current version of the LSST:UK Science Requirements Document (v3.0, 29/APR/20) does include some requirements that make such links between high-level science goals and the specification of these tools and their documentation, but we shall ask the LSST:UK

Project Scientist, Stephen Smartt, to consider whether further such links should be included in its next release.

- **F2:** Mention should be made of how the documented components “*would transition into Phase C with full LSST operation, how they will be maintained, and how dependent their legacy aspect will be on Phase C/D funding (plus mitigation plans)*. The DAC and Lasair are part of LSST:UK’s proposed in-kind contribution package. As the outcome of this process is not known yet, a short assessment of the risk of either of these components not being supported as part of the package (and mitigation) would help at this stage”.

The existence of a UK DAC has been a core component of the strategy for UK involvement in LSST since its inception and a dedicated DAC operations funding line was included in baseline programme for Phases C and D submitted as part of the Phase A proposal. In practice, as the reviewer notes, the exact level of funding for the DAC during Rubin operations will largely be determined by the UK’s in-kind contribution to Rubin Observatory operations. That is still under negotiation, but agreement that the UK DAC will be funded to, at least, the minimal level specified in [7] is likely to be required for the UK DAC to accepted as a member of the Rubin DAC network, as envisaged in the UK in-kind Letter of Intent. Similarly, Lasair has also been a key component of LSST:UK planning from the outset, and its acceptance as one of the Community Brokers that will receive the full Rubin alert stream would entail an obligation to continue to fund it adequately during operations, and, again, that is likely to be reflected in the UK in-kind agreement. The documented components will remain, therefore, amongst the highest priority elements of the LUSC programme for Phases C and D, with their future funding likely to be secured during the next six months, as part of the UK in-kind package, and to be reported on more formally in a later DAC deliverable – D2.1.3: (DAC) *Operational plan for full operation of telescope* – due by 2022-11-30.

- **F3:** Since Lasair and other DAC tools documented in DocR1 will, eventually, be available to an international community of users, their development “*would benefit from bringing international stakeholders in advising roles on board. Natural points of contacts would be the LSST Science Collaborations who are the beneficiaries of some of the in-kind contributions.*”

This is likely to come about as part of inclusion of this work in the UK in-kind package, since the Deliverables from WPs included there are likely to be subject to acceptance criteria specified by the Science Collaborations on behalf of the wider Rubin community, which will naturally lead to the inclusion of advice from that wider range of stakeholders during the design and development work towards those Deliverables.

- **F4:** The documentation assumes a level of familiarity with Python, which may not be possessed by all users, so links to some beginner guides would be useful.

The reliance of some tools – e.g. the Jupyter Notebook services provided by Lasair and the LSST Science Platform – on assumed Python knowledge will be highlighted in the documentation provided for UKDAC1 and subsequent releases, and links to some introductory material can be included.

- **F5:** The text in the Lasair Cookbook is minimal, which may not be sufficient for all users.

This comment will be forwarded to the Lasair development team for consideration in the design of future Lasair releases.

- **F6:** “*JSON is not a format which many astronomers are used to. Output to csv, ascii or fits format would be a definite plus.*”

This comment will be forwarded to the Lasair development team for consideration in the design of future Lasair releases.

- **F7: The process for obtaining email notification that a source in a Lasair watchlist has gone into outburst could be more clearly documented.**

This comment will be forwarded to the Lasair development team for consideration in the design of future Lasair releases.

- **F8: Some of the initial draft documentation on the LSP “*seems to have been written from a developer point of view and not a potential user*”. In particular, introductory text on Firefly and Nublado “*is essential to describe what you might use...these tools for*”. The example was given of the TESS² as providing documentation “*written with the actual user in mind rather than highlighting the nuts and bolts which should be hidden from the user as much as possible*”.**

It is helpful to be pointed towards these TESS resources as examples of good practice. For the UK DAC deployment of the LSST Science Platform, we shall largely be dependent on the basic user documentation to be provided by the Rubin Observatory staff, but Lasair user documentation will be more fully under our control and we can endeavour to ensure that it is produced with the end-user in mind. Part of the intention with the phased release of UK DAC services, as set out in [2] is to allow for the phased release, and review, of documentation, so there should be further opportunities for feedback to guide its development.

5 Conclusions

This document has explained the motivation for DocR1, the initial release of UK DAC documentation, and set the context for its review, describing how the feedback from that review will guide the development of the documentation suite to be provided for the test users of UKDAC1 in 2020Q4.

²e.g. <https://heasarc.gsfc.nasa.gov/docs/tess/data-access.html>
<https://heasarc.gsfc.nasa.gov/docs/tess/software.html>
<https://outerspace.stsci.edu/display/TESS/6.0+-+Data+Search+Tutorials>

References

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- [2] [LSST:UK Phase B DAC Roadmap](#), 2020
- [3] [Lasair web site](#), 2018-2020
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- [10] [Project Jupyter](#), 2020
- [11] [Firefly](#), 2020