



Vera C. Rubin Observatory
Data Management

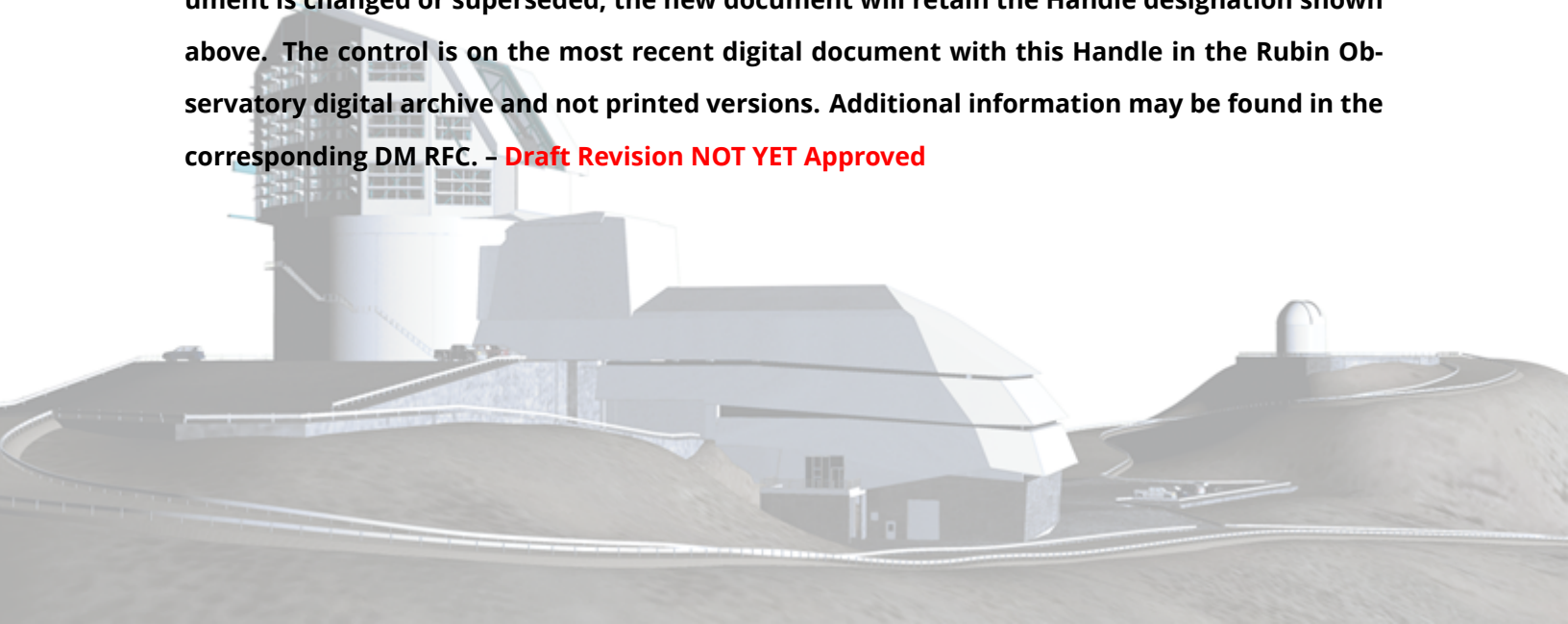
Chilean Data Access Center

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LDM-572

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Abstract

This document describes the Chilean Data Access Center.

Draft

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	2017-08-20	Initial version.	W. O'Mullane, D. Petravick
1.0	2017-12-12	Approved in RFC-419.	W. O'Mullane, T. Jenness
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3.0 proposed	2026-09-15	Update for ops, and networks, budget calculation	W. O'Mullane, C. Silva

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1 Introduction

The Memorandum of Understanding with Chile [Document-11622] roughly defines a Data Access Center (DAC) at the Base Facility in Chile. In this document we would like to begin to specify more precisely what this Data Access Center would look like and the full range of services it will provide. This should be seen as a discussion document to allow our Chilean colleagues to collaborate with us to define the Chilean DAC.

2 The Chilean DAC

Initially the thought was that the Chilean DAC should be very similar to the US DAC at SLAC. However we now have a hybrid US DAC [2]. It is unclear what the Google analogy would be in a Chile DAC, We could deploy the Rubin Science Platform (RSP) in Chile as the interface to the system, but the google RSP will probably be more functional and more available.

It was considered more interesting to make the Chile DAC more a compute facility with HT-Condor access to Data.

There was mention of interest in a copy or rapid access to the Prompt Product Database (PPDB). That remains under development and was not originally considered for replication though there seems to be interest in that.

In 2026 a Chile DAC implementation committee was setup. This committee will discuss and agree the various purchases for the Chile DAC. In the first interactions an interesting in GPU was expressed.

The DAC will require software, some hardware, and of course data to function as a DAC. We go through these in the following sections.

2.1 Software and Services

The Chile DAC will be administered by Rubin's Chile DevOps team, any support from Chile community would be welcome as the DevOps team is under resourced (as of 2025).

2.1.1 Accounts and Access

Users will need a VPN to access the Chile DAC. The 2026 purchase includes OpenVPN licenses for DAC users. The VPN will require local accounts for each user with appropriate access controls via IPA.

During the FY26 purchasing cycle, we acquired licenses for 50 concurrent VPN users; the committee estimates actual concurrent usage will be closer to 20 users but we decided on some margin.

Since we have to create these accounts anyway granting access to the DAC with them will be more straight forward than connecting to the Chile grid for authentication. This will require lodging ssh keys with IPA and setting up 2FA. We have discussed with the Chile community creating individual accounts for users there is no issue with this for now.

If we still wish to get the authentication system of the Chilean Grid integrated with the Chile DAC system [LSE-279] we will need to work with the Chile community. There is a use case to be able to access Grid resources from the DAC using the same credentials, however users usually also know how to use different credentials across systems fairly seamlessly. This may be a heavy lift.

2.1.2 Science Platform

Deployment of the Science Platform in Chile is a potential overhead for maintenance to keep up with the Google deployment. We may decide this is the correct approach but a conversation is needed to make the tradeoff with RSP access on Google directly. The Science Platform gives access, through the Notebook Aspect, to several versions of the LSST Software Stack allowing processing of image data and catalogs. If the RSP is not deployed we would have to handle local accounts in the DAC and provide container builds to run pipelines via e.g. Cern-VMFS as is done in USDF. This would be making the Chile DAC a batch access site as in DMTN-223

While users of the Chilean DAC will have access to the US DAC, *user workspace data* is bound to the site where it was created. Any data transfer would have to be done with e.g. sftp.

2.2 Hardware and infrastructure

The Chilean MOU provides for a DAC which is 10% of the size of the US DAC. The Data Release 2¹ user computing resources at the US DAC are currently intended to comprise [DMTN-135]:

- Computing: 2,400 cores ($\approx$ 18 TFLOPs)
- File storage: $\approx$ 4 PB (user file workspace: VOSpace or equivalent)
- Database storage: $\approx$ 3 PB (user database workspace)

Hence the Chilean DAC would at a minimum have:

- Computing: 240 cores ($\approx$ 1.8 TFLOPs)
- File storage: $\approx$ 400 TB (user file workspace: VOSpace or equivalent)
- Database storage: $\approx$ 300 TB (user database workspace)

This raises an immediate problem - 10% of the data base is not very useful unless we bring only the Object catalog. We shall discuss further in section 3.

In addition see subsection 2.3. There will be additional computing capacity as required to support the operation of the Data Access services themselves as well as the Portal.

In the operations proposal [LDO-31] we included funding for the Chilean DAC over the operations lifetime. We must keep in mind this is a proposal and funding is not guaranteed.

This budget would also have to cover some labor to look after machines so it cannot all be spent on hardware.

2.2.1 Calculating the Chile DAC budget

[Document-11622] states there should be "Chilean access to 10% of global LSSTC-funded "community resources" (Community resources are the resources which comprise the Data

¹Data Release 2 was used as a reference because the compute and storage resources required to support it were covered by the MREFC construction budget. Since the move to SLAC, this is no longer the case.

Access Centers, dedicated to support of community science. These do not include the operational resources required for effective production of the fundamental data products LSST will be responsible for producing.)”

To solidify this statement based on our budgetary knowledge in 2026 we produced Table 1 which sums 10% of resources which support the community. A team like SQuARE of course supports our own team as much as the community so 10% there is generous.

Table 1: These are the budget numbers that inform the Chile DAC budget.

Year	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
10% USDAC Cloud DAC+dev (K\$)	\$126.88	\$145.20	\$184.00	\$184.00	\$184.00	\$184.00	\$184.00	\$184.00	\$184.00	\$184.00	\$184.00
10% of ON Prem US DAC (K\$)	\$149.06	\$168.73	\$213.05	\$2.10	\$2.18	\$1.04	\$1.08	\$1.11	\$1.15	\$1.19	\$0.62
10% CST	\$150.17	\$181.93	\$149.90	\$125.76	\$129.53	\$133.41	\$137.42	\$141.54	\$145.78	\$118.78	\$119.48
10% Square	\$298.24	\$297.58	\$293.46	\$277.84	\$286.17	\$294.76	\$303.60	\$264.03	\$271.95	\$280.11	\$243.23
Total	\$724.35	\$793.44	\$840.40	\$589.70	\$601.88	\$613.21	\$626.10	\$590.68	\$602.89	\$584.08	\$547.33
Total 10 yrs (\$K)	\$7,114.07										

2.2.2 2025 and 2026 purchases

In 2025 we already purchased some nodes but did not manage to rack them until 2026. The 2025 purchases were made with minimal Chile community input due to the expediency needed to get the orders in.

While the committee endorsed the FY25 purchasing cycle, they recommended consulting them on subsequent purchases. Accordingly, the FY26 purchasing cycle was reviewed with the implementation committee, which introduced changes such as prioritizing GPUs over storage

The current situation is listed in Table 2 and already far exceeds the original estimates.

Table 2: This table lists the current/proposed nodes in the DAC - 2026 nodes are ordered using the FY27 budget.

Category	Hardware	Count
Network 100Gb Switches	ARISTA 7280R3	2
Network IPMI Switches	ARISTA 7010TX	3
Network 25Gb Switches	ARISTA 7050X3	4
Latent storage	AMD EPYC 9135 5th Gen - Dual 16-Cores - 500TB per node - 192 GB RAM - 10Gb interface	8
Fast storage	AMD EPYC ZEN4 9535 - Dual 64-Cores - 30TB per node - 384 GB RAM - 100Gb interface	12
Compute	AMD EPYC ZEN4 9535 - Dual 64-Cores - 384 GB RAM - 25Gb interface	6
GPU1	8 × RTX PRO 6000 - 1TB Ram - 32TB - 100Gb interface	1
GPU2	8 × H200/NVLink-capable server - 1TB Ram - 32TB - 100Gb interface	1
vpn	OpenVPN License	50
Cables	MTP-12 / OM4	
Rack	APC Netshelter SX	2
2025		
Compute	AMD EPYC ZEN4 9554 - Dual 64-core - 384GB RAM - 25Gb interface	15
Fast Storage	AMD EPYC ZEN4 9554P - Dual 64-core - 30T per node - 384GB RAM - 100Gb interface	18
Latent Storage	AMD EPYC 9124 4th Gen - Dual 16-core - 500TB per node - 192GB RAM - 10Gb interface	48

Network 100Gb Switches	ARISTA 7280R3	2
Network IPMI Switches	ARISTA 7010TX	5
Network 25Gb Switches	ARISTA 7050X3	8
Total Compute Cores	Dual 64 cores	2688
Total Raw Storage	Fast and Latent - TB	28740

2.2.3 Networks

Access to the DAC will require network connectivity, and there are currently two possible ways to provide it.

The most direct option is to use the existing 10 Gbps Internet connection provided through NOIRLab. This would require only minor network changes and could be made available relatively quickly, allowing DAC access to be enabled without depending on changes to the Rubin long-haul network (LHN).

A second option is to use capacity from the 40 Gbps backup link operated in coordination with REUNA. This could provide higher bandwidth for the Chilean community, but it would require more substantial network changes, including additional hardware such as a firewall, changes to the current routing configuration, and coordination with REUNA to enable and manage this traffic.

The bandwidth available through this link would be managed using a priority scheme, with DAC traffic treated as one of several traffic classes. When higher-priority traffic is present, DAC traffic may be limited or queued. When capacity is available, DAC traffic would be transmitted on an “as available” basis. Implementing this option as part of the initial DAC deployment would therefore substantially delay its availability.

For this reason, the current approach is to provide DAC access through the 10 Gbps Internet connection, while continuing to evaluate and prepare the use of the 40 Gbps backup link as a future higher-bandwidth option, if this is the direction the community wishes to pursue.

2.3 Data

At least the LSST raw data and possibly data products from Data Releases, will be stored on disk at the Base Facility. The types of data and modes of access are indicated in Table 3. The

TABLE 3: Primary data products and their retention methods. Virtual here means generated on request.

Data product	Mode of retention
Raw Images	Files
Coadded Images	Files
Difference Images	Files
Objects	Relational Tables
Sources	Relational Tables
Forced Sources	Relational Tables
DIA objects	Relational Tables
DIA sources	Relational Tables
SS Objects	Relational Tables
Alerts	Key-Value Store (TBC)
External Catalogs	Relational Tables
Postage Stamp Images	Virtual
Processed Visit Images	Virtual
Observatory Metadata	Relational Tables
Observatory Metadata	Files

table includes “virtual data products” which are recreated on demand rather than retained in persisted form. The storage and other resources required to support the released data products are in addition to the user workspace resources described above in subsection 2.2.

We can experiment with DP2 to see which products are most useful at the Chilean DAC.

3 Proposal for the Chilean DAC

This is based on providing storage and compute above the level discussed in subsection 2.2, sufficient to store raws and CoAdds. The total storage and compute is shown in Table 4. The cost is based on Rome processors.

Table 4: This table summarizes the compute and storage estimates used to cost the Chilean DAC.

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Chilean DAC Fast Storage (TB)	267	435	622	795	937	1080	1222	1364	1507	1649	
Chilean DAC Latent Storage (TB)	10500	18391	25950	31007	36063	41120	46177	51234	56291	61348	
Cores (Chilean DAC)	103	187	280	373	466	560	653	746	840	933	

This does not include storage and compute for Qserv, queries to Qserv would be serviced via the USDF. There is enough storage for raw images, LSSTCam CoAdds and some other images

or catalogs but not everything. The baseline, which may be discussed, is to store the raw images in the DAC. The best use of the storage should be further discussed - i.e. some sort of caching of image files may be more useful than trying to have all of any specific data set. The object store backed butler would in effect make access to images in USDF fairly seamless. The sizes of the image data sets are given in DMTN-135 but a few key numbers are reproduced here in Table 5.

Table 5: This table summarizes some key data volumes used in DMTN-135. All Sizes TB.

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
LSSTCam Raw Images	6982	11798	16614	21430	26246	31062	35878	40694	45510	50326	
LSSTCam Output Images	1967	5338	8428	11800	15171	18542	21913	25285	28656	32027	
LSSTCam Output Coadd Images	3018	5718	8100	8100	8100	8100	8100	8100	8100	8100	
LSSTCam Output Parquet	4651	12624	23919	35879	47839	59799	71758	83718	95678	107637	
Diff DAC Latent to Raw+Coadd	500	875	1236	1477	1717	1958	2199	2440	2681	2922	

4 Conclusion

We have started to put hardware in La Serena that will result in a useful scientific archive and data analysis service in the Base Facility in Chile. This should enable local science activities and also provide seamless access to further resources at the USDF. Discussion with the local community is on going and with the implementation committee in place as of 2025 we are in regular contact.

5 References

- [1] **[LDO-31]**, Blum, R., et al., 2020, *OBSOLETE NOW RDO-018 – LSST Operations Proposal*, Data Management Operations Controlled Document LDO-31, NSF-DOE Vera C. Rubin Observatory, URL <https://ls.st/LDO-31>, Superseded by RDO-018
- [2] **[DMTN-287]**, O'Mullane, W., 2024, *Rubin's Hybrid On Premises-Cloud Data Access Center*, Data Management Technical Note DMTN-287, NSF-DOE Vera C. Rubin Observatory, URL <https://dmtn-287.lsst.io/>
- [3] **[DMTN-223]**, O'Mullane, W., 2025, *User batch - possibilities and plans.*, Data Management

Technical Note DMTN-223, NSF-DOE Vera C. Rubin Observatory, URL <https://dmtn-223.lsst.io/>

- [4] **[DMTN-135]**, O'Mullane, W., Dubois, R., Butler, M., Lim, K.T., 2023, *DM sizing model and cost plan for construction and operations.*, Data Management Technical Note DMTN-135, NSF-DOE Vera C. Rubin Observatory, URL <https://dmtn-135.lsst.io/>
- [5] **[Document-11622]**, Smith, W., Vera, V.P., 2011, *Supplementary and Clarifying Agreement between the Universidad de Chile and AURA covering the use of the LSST on Cerro Pachon*, Informal Construction Document Document-11622, NSF-DOE Vera C. Rubin Observatory, URL <https://ls.st/Document-11622>
- [6] **[LSE-279]**, Withers, A., 2017, *Concept of Operations for Unified LSST Authentication and Authorization Services*, Systems Engineering Controlled Document LSE-279, NSF-DOE Vera C. Rubin Observatory, URL <https://ls.st/LSE-279>

6 Acronyms

Acronym	Description
AURA	Association of Universities for Research in Astronomy
DAC	Data Access Center
DAX	Data Access Services
DIA	Difference Image Analysis
DM	Data Management
LDM	LSST Data Management (Document Handle)
LSE	LSST Systems Engineering (Document Handle)
LSP	LSST Science Platform (now Rubin Science Platform)
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
MOU	Memo Of Understanding
MREFC	Major Research Equipment and Facility Construction
NCSA	National Center for Supercomputing Applications
NLHPC	National Laboratory for High Performance Computing Center
NSF	National Science Foundation
OPS	Operations

PB	PetaByte
REUNA	Red Universitaria Nacional
RFC	Request For Comment
SS	Subsystem Scientist
TB	TeraByte
TBC	To Be Confirmed
US	United States
USD	United States dollar

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