CMB-S4

CHILE - DAQ INTERFACE CONTROL DOCUMENT

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Document release signatures

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REVISION HISTORY

Version Letter	Revision Date	Author: Notes
v1	6/29/20	Initial draft
v2	5/7/21	Revised draft
v3	7/17/23	Revised draft with more detailed definitions

REFERENCED & APPLICABLE DOCUMENTS

The requirements in the following documents apply, but this document supersedes if there is a conflict.

Reference used within this doc	Version	Title & Description, including Document number if applicable	Notes, relevant part of document

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1. Purpose and Scope

This document defines and describes the interfaces between WBS 1.08 Data Acquisition and Control (DAQ) and WBS 1.10 Chile Site Infrastructure, Integration & Commissioning.

Overview: The DAQ system includes computer workstations and servers and networking equipment that will require WBS 1.10 to provide physical location of the computer systems in workspaces, temperature/heat management of the hardware and the workspaces, data connectivity and distribution. DAQ/Control does provide site-wide equipment monitoring, but does **not** provide a personnel and equipment safety alarm system (though will monitor such a system).

DAQ is responsible for:

1. Design of physical computing elements;
2. Providing operational requirements and documentation;
3. Procurement of DAQ site equipment, such as: servers, GPS clock unit, GPS coax cable, DAQ specific network switches, Uninterruptible Power Supplies (UPSs), and the racks themselves;
4. Procurement of three workstations
5. Packing the system for shipping to and installation in Chile, including detailed packing lists with contents, origin, weight, etc.;
6. Software infrastructure to interface with and monitor the DAQ;
7. Any tools/fasteners/parts required for system installation and operation;
8. Providing U.S. support & infrastructure to the installation and operation of the DAQ system.

Chile Site Infrastructure is responsible for:

1. Installing the DAQ system on-site in Chile;
2. Connections to site network, including building-to-building fibers and associated hardware;
    a. Demarcation is top-of-rack switch (supplied by DAQ), Site will provide one connection per rack to external network, cable raceways & cabling outside of the racks.
    b. Connection to internal network will be provided via DAQ servers (outside scope of this document);
3. Providing separate raceways for power and data cables;
4. Providing power, building space, and facility-level support (such as cooling);
    a. demarcation for power is the power entry into the DAQ equipment, DAQ provides in-rack UPS, Site provides out of rack power connection;
5. Inventory management for equipment, spares and tools
6. Physical security of the components that are installed on-site

Scope not covered by this ICD:

1. Network Security

2. Abbreviations and Definitions

2.1 Abbreviations

DAQ	Data Acquisition and Control
DM	Data Management
GPS	Global Positioning System
HEF	High Elevation facility
HVAC	Heating, Ventilation, and Air Conditioning
IAM	Identity and Access Management
ISO	International Organization for Standardization
LAT	Large Aperture Telescope
LATR	Large Aperture Telescope Receiver
LEF	Low Elevation Facility
masl	Meters above sea level

NEMA	National Electrical Manufacturers Association
OCS	Observation Control System
PDU	Power Distribution Unit
SCO	Santiago CMB-S4 Office
SLA	Service Level Agreement
UPS	Uninterruptible Power Supply
TBC	To Be Confirmed
TBD	To Be Determined
TCS	Telescope Control System
US	United States of America

2.2 Definitions

1. Low Elevation Facility (LEF): facility located at or near San Pedro de Atacama at approx. 2400 masl for the board & lodging of CMB-S4 personnel, office management, temporary storage and minor maintenance and technical work.
2. High Elevation Facility (HEF): it is the observatory site on Cerro Toco at 5200 masl, which includes the telescopes and all observatory operational and support infrastructure.
3. Site: refers to the Chile Infrastructure and Integration & Commissioning Group.

3. Mechanical/Structural Interfaces

3.1 Physical Accommodations for Workstations

CH-DAQ-110 Office Space for Workstations

1. Site shall provide an office space that includes at least 6 workstation desks for users, standard size, in the HEF office area,

CH-DAQ-120 Dedicated DAQ Workstation Desks

2. A minimum of 3 of the workstation desks shall be dedicated as permanent stations with access to the control system displays, and real-time data quality monitoring.

CH-DAQ-130 DAQ Hardware

3. DAQ shall provide computing hardware, monitoring displays, Ethernet switches and interface devices.

3.2 Physical Accommodations for Readout Crates

CH-DAQ-210 Space for Readout Crates in the High bay Lab

4. Readout crates and power supplies shall be located in the telescope structures in standard electronics racks. This is inside the LAT and is not an interface with Site except that it must be accommodated in the High Bay Lab if the LATR is being cooled and tested inside the High Bay Lab.

CH-DAQ-220 Fiber Optic Connection to Readout Crates in the High bay Lab

5. Fiber optic cables shall be used to connect the readout transceivers to the computing crates and DAQ servers. This is inside the LAT and is not an interface with Site except that it must be accommodated in the high bay lab if the LATR is being cooled and tested inside the high bay lab.

3.3 Physical Accommodations for Servers

CH-DAQ-310 DAQ Electronics Rack Space

6. All DAQ servers will be housed together in standard electronics racks in a contiguous space. The footprint of this hardware shall allow 2 standard electronics racks (600 mm wide x 1092 mm deep) in a contiguous space.

CH-DAQ-320 DAQ System Location

7. The DAQ system will be located in an independent room in the HEF Office Building. It can be co-located with the DM infrastructure.

CH-DAQ-330 DAQ Server Maximum Quantity

8. Quantity x [TBC] servers will serve as DAQ for the LAT units.

CH-DAQ-340 DAQ Server Maximum Weight

9. The floor must be able to support a maximum total weight of 600 kg for 2 standard 24" x 36" racks.

CH-DAQ-350 DAQ Rack Maximum Height

10. DAQ shall provide a standard EIA-310 compliant four-post rack. The cabinet width shall be no more than 600mm, the width of the rack shall be no more than 1010mm, and the height of the rack shall be no more than 2100mm.

CH-DAQ-360 DAQ System Maintenance Workspace

11. A desk/workspace shall be co-located with the DAQ server rack to be used for server maintenance: 1 person + 1 desk; flexible workspace. If this co-located with the DM workspace, this workspace can be the same as the one provided to DM.

CH-DAQ-370 DAQ System General Storage Space

12. A storage space for hardware and spares shall be provided of xxx dimensions (volume) (TBD). Items in this storage will need to survive the survival ambient environmental temperatures.

3.4 Electrical Power

CH-DAQ-410 Chile Site Input Voltage Standard

13. Power shall be supplied to each DAQ rack via a 3-phase 400 VAC, 50 Hz, outlet [TBC] rated for 50 A [TBC] dedicated breaker. The outlet will be NEMA or equivalent (TBD) receptacle twist lock.

CH-DAQ-420 Power for DAQ Servers

14. DAQ servers will consume (TBD) W (XX A at 240 VAC) (TBC) as documented in the electrical power budget (CMB-S4 Electrical Power Needs (CMBS4-doc-XXXX)).

CH-DAQ-430 Power for DAQ Workstations

15. DAQ workstations will consume (TBD) W (XX A at 240 VAC) (TBC) as documented in the electrical power budget (CMB-S4 Electrical Power Needs (CMBS4-doc-XXXX)).

CH-DAQ-440 DAQ Independent Power Circuit

16. Computing power circuits shall be used only for computing (e.g., HVAC, wall plugs on separate circuits).

CH-DAQ-450 DAQ Redundant Circuit

17. Need for redundant supply circuits is TBD.

CH-DAQ-460 DAQ Rack Power Connections

18. The number of required power connections shall be no more than 2 (maximum number of racks needed in any configuration option is currently 2), one for a PDU in each rack supplied by DAQ. Potential need for 4 connections to support redundant power supplies/maintenance on power infrastructure is TBD?

CH-DAQ-370 DAQ UPS

19. DAQ will procure UPS and its software control that allow 180 minute back-up of all network infrastructure and 60 minute back-up of all computing that is not required for network access. The UPSs will comply with all site ambient environmental requirements.

3.5 Physical Accommodations for GPS

CH-DAQ-510 GPS Antenna Supply

20. DAQ shall provide a GPS antenna and provide description of mounting interface.

CH-DAQ-520 GPS Antenna Location

21. Site shall provide a mounting location for a GPS antenna at the top of the High-Bay Lab Building (TBC) with a data connection from that antenna to the computing rack within the office area.

CH-DAQ-530 GPS Cable Route

22. Site shall provide an appropriate 50-Ohm low-loss coax cable to be installed between the GPS antenna and the DAQ electronics rack. The connector types on the two ends shall be TBD.

3.6 Safety and Security

CH-DAQ-610 DAQ System Fire Protection

23. Fire Protection: site shall provide fire alarm and protection in the DAQ spaces. Fire alarms shall have an independent path from the DAQ software to alert of the safety issue. Site will work with DAQ to provide a secondary alarms system for the fire monitoring within the DAQ software.

CH-DAQ-620 Computing Room Physical Security

24. Site shall provide physical security of the Computing Room through TBC (doors, ceiling, windows).

CH-DAQ-630 DAQ Hardware Physical Security

25. DAQ shall provide racks that provide physical security for the DAQ components, which can be managed by on-site personnel.

4. Data Interfaces

CH-DAQ-710 Fiber Optic Connection at HEF

26. Site shall provide fiber connections between all buildings and structures to specified locations within those structures. The fibers shall be capable of transporting 10Gbps Ethernet over the necessary distances taking into account any splices or disconnects.

CH-DAQ-720 Ethernet and Power Connections in Buildings

27. Site provides ethernet jacks and outlets in office and lab areas. DAQ is responsible for review and approvals of quantity and locations.

CH-DAQ-730 Fiber Optic Connection to readout Crates

28. Site provides duplex fiber optic connection to all Readout Crates (quantity TBC), including a minimum of 6 spare pairs.

CH-DAQ-740 Network Connections

29. DAQ provides network switches and Site provides terminated fiber optic cable at all specified locations. Site shall provide a suggested set of locations, and DAQ shall approve before implementation. Site shall provide an SPF+ transceiver that is compatible with the fiber type and termination and capable of 10Gbps signaling.

CH-DAQ-750 Network Fiber Callouts

30. DAQ provides network fiber callouts but not details of the network design.

CH-DAQ-760 Timing Signal

31. DAQ provides a timing signal that is distributed on the same fibers as the network connectivity to PTP-enabled switches.

CH-DAQ-770 No Copper Communication Wiring

32. No copper communication cables are allowed to the outside of any building due to the risk of lightning strikes.

CH-DAQ-780 Site Safety and Security Interfaces

33. DAQ shall provide monitoring capability (for visibility but not active security) for the following: (1) Vehicle monitoring devices to be specified, (2) Site Cameras, other items to be defined.

5. Thermal Interfaces

Site external temperature range is defined in the environmental requirements. For the purposes of this document -20 °C to +20 °C [TBC].

CH-DAQ-810 Workstation Heat/Temperature

34. Temperatures in rooms/buildings that house DAQ networking equipment and/or general use workstations will be maintained between xx C and xx C [TBC], with an average temperature of xx C [TBC].

CH-DAQ-820 Server Heat/Temperature

35. Temperature in the room that houses the DAQ servers will be maintained between xx C and xx C [TBC], with an average temperature of xx C [TBC].

CH-DAQ-830 DAQ Cold Start Interface

36. DAQ shall provide the cold start scripts for all servers and workstations.

CH-DAQ-840 Site Cold Start Interface

37. Site shall provide cold start specifications for all other equipment to DAQ.

6. List of Site Administrative Requirements

6.1 Labor

CH-DAQ-910 Site Labor

38. Site shall provide all labor to physically deploy the DAQ scope in Chile:
    a. Initial system receiving, unpacking, storage, intra Chile transport, installation;
    b. Ongoing "pair of hands" when needed;
    c. Hardware shipping (inbound and outbound), replacement storage for hardware;
    d. Disposal of end-of-life materials;
    e. Large equipment such as lifting fixtures;
    f. UPS monitoring and maintenance.

CH-DAQ-920 DAQ Labor in Chile

39. DAQ labor to physically deploy the following DAQ scope in Chile:
    a. Some personnel associated with DAQ will deploy to the site to support I&C of the DAQ equipment. This deployment will be supported and managed by WBS 1.10.

CH-DAQ-930 Site IT Administration

40. Site IT within the Chile 1.10 WBS shall provide all labor and capabilities for the administration of the below activities. The design of these systems shall be provided to site by DAQ, DM or L1 as appropriate:
    a. Linux operating system administration;
    b. Network administration from server connections, through top-of-rack DM switches;
    c. Resource management administration (e.g., batch queues of other resource schemes);
    d. Storage systems administration;
    e. Backup/disaster recovery administration;
    f. Central Identity and Access Management (IAM).

6.2. Shipping & Receiving

CH-DAQ-935 Packing & Shipping Procedure

41. DAQ packaging procedure to be reviewed by Site.

CH-DAQ-936 Packing

42. DAQ shall package all equipment in appropriate containers and provide detailed packing lists to Site with appropriate anticipation as specified in the Chile importation procedure.

CH-DAQ-940 Shipment Size and Weight

43. All DAQ components shipped to Chile shall fit within a standard sea container. There are no restrictions beyond standard ISO shipping weights and dimensions to allow standard sea, air or road transport. Oversize loads need to be evaluated to ensure that transportation is possible.

CH-DAQ-945 Shipping

44. Site arranges International shipping of DAQ equipment to the Chile Observatory site.

CH-DAQ-950 Shipping and Import to Chile Procedures

45. All shipping to Chile shall follow the "Chile Shipping, Import to Chile, and Customs Procedures" (refer to Appendix A of "CMB-S4 Chile Site Construction Plan" (CMBS4-doc-697)). This procedure addresses:
    a. All import/export to/from Chile shall be done and are the responsibility of the Santiago CMB-S4 Office.
    b. CMB-S4 has special conditions and privileges for goods imported to Chile in order to avoid paying customs duties.
    c. Documentation required to import/export to/from Chile.
    d. Classification of the imported goods within the Chile State Department categories.
    e. Shipping package markings
    f. Consumables that are readily available for purchase in Chile shall not be included in the shipments. Their presence may delay the import processing through the Chile State Department.

CH-DAQ-960 Chile Site Shipment Packing Materials

46. Crates, boxes and other shipments shall not use packing materials that may contain pests, such as untreated wood. The presence of these materials may delay customs clearance and will require special disposal methods.

CH-DAQ-970 Site Shipment Shock Standard

47. Cargo shall be packed to the following shock standard (TBD).

CH-DAQ-980 Site Shipment Vibration Standard

48. Cargo shall be packed to the following vibration standard (TBD).

CH-DAQ-990 Site Shipment Do Not Freeze

49. DAQ cargo that cannot be allowed to freeze during shipping (electronics, gaskets, etc.) shall be marked as "Do Not Freeze (DNF)" and packed separately from cargo that does not have this restriction.

CH-DAQ-995 Site External Storage

50. Site will provide space to store large cargo in a patio without temperature control, both outside or within a sea container warehouse. Cargo will be able to be stored at the HEF or temporarily at the LEF.

8. Tools and Spares List

CH-DAQ-1100 Tools for Installation and Maintenance

DAQ shall provide all tools necessary for installation and maintenance of the equipment, including equipment to lift servers and heavy objects into racks..

9. List of Hardware at Each Location that contains a DAQ interface on-site

This hardware list is outside the scope of this ICD. A separate document will contain a table of all items on the network, and define which of them is equipment that links to a DAQ system, and which of them WBS 1.10 is responsible for mounting and connecting.

11. Installation and Commissioning

Installation and Commissioning of DAQ will be managed by the 1.10 WBS with the assistance of personnel and documentation provided by DAQ.