Chile Site Infrastructure, Integration & Commissioning Status

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CMB-S4 Collaboration Meeting
May 9-13, 2022

Technical Highlights / Progress made in the last year

- May 2021: Successful Conceptual Design Review (Indico Page, Closeout Document: doc-741)
  - Included design of site by a Chilean architect with cost estimate included
- Complete all necessary environmental and natural hazard reviews of the baseline site. (doc-699, doc-804, doc-803, doc-805, doc-831)
- Full scrub of cost and schedule with list of cost items to review in FY22 based on Simons Observatory actuals and updated schedule planning
- Drafted Integration & Commissioning Plan for the LAT Systems (doc-730)
  - project review complete, change control board review under way
  - See separate talk by Tyler Natoli on Thursday
- Response to information requests for Analysis of Alternatives (AoA) underway.
- Started meetings between University of Chicago and Universidad de Chile to negotiate the convenio that will govern CMB-S4 as an international astronomy organization in Chile
- Formally initiated discussion with the land administration body, Parque Astronómico Atacama.
- Presentation of our baseline design at the recent Chajnantor Working Group meeting of the observatories in the area
- Continued discussions with REUNA and the Parque about implementing the high-bandwidth connection to the baseline site
- Participated in the internal requirements review, including re-structuring the requirements into two levels with a clear flowdown from higher-level requirements.

Scope - WBS Dictionary To Level 4

Level	WBS#	WBS Title	Sponsor	Summary/Description
2	1.10	Chile Site Infrastructure, I&C		
3	**1.10.01**	**Project Management**	**NSF**	**High-Level management of the Chile project office, based partially in the US**
3	**1.10.02**	**Chile Project Office**	**NSF**	**Local management of all Chile activities: regulatory compliance, human resources, vendor contracts, procurements, interfacing with the Chilean government.**
4	1.10.02.01	Chilean Agreements	NSF	Manage Chile agreements with key stakeholders
4	1.10.02.02	Project Payments	NSF	Perform agreed payments to key stakeholders in Chile
4	1.10.02.03	Site Maintenance	NSF	Manage the operation and maintenance of the Chile sites
4	1.10.02.04	Procedural Documents	NSF	Establish the environment, health & safety policies and procedures of the Chile activities
4	1.10.02.05	Site Equipment	NSF	Procure and maintain all equipment required by the Chile Project Office to perform its duties
4	1.10.02.06	Human Resources	NSF	Perform the human resources management activities required in Chile
4	1.10.02.07	Santiago Office Outfitting	NSF	Rent, outfit and maintain an office in Santiago to perform the main Chile business activities
3	**1.10.03**	**Chile Design and Construction**	**NSF**	**Perform all design and construction activities of the Chile infrastructure**
4	1.10.03.01	Civil	NSF	Design and build all Chile civil infrastructure
4	1.10.03.02	Power Generation & Distribution	NSF	Design and build all Chile power generation infrastructure
4	1.10.03.03	Data/Communications	NSF	Design and build all Chile data/communications infrastructure
4	1.10.03.04	Site Monitoring	NSF	Design and build all Chile site monitoring infrastructure
4	1.10.03.05	Cooling System	NSF	Design and build all Chile cooling system infrastructure
3	**1.10.04**	**LAT Integration and Commissioning**	**DOE/NSF**	**Perform integration and commissioning of the LATs**
4	1.10.04.01	I&C Requirements Definition	NSF	Establish all requirements for the Chile instrument
4	1.10.04.02	Major Equipment Imported to Chile	NSF	Import all equipment to Chile
4	1.10.04.03	I&C Implementation	DOE/NSF	Integrate the receivers and commission the Chile LATs

Business office in Santiago, Construction management team, and management of low-elevation facility in or near San Pedro de Atacama

Design activities by vendors (Chile and international), construction and installation activities on-site at the HEF

I&C planning is based on project requirements.

Chile Organization & Team

10.01, 10.02, and 10.03: L2 scientist and CAM have brought their experience with civil construction of ALMA and the design of Simons Observatory to plan 10.03 Chile Design and Construction and 10.02 the project office.

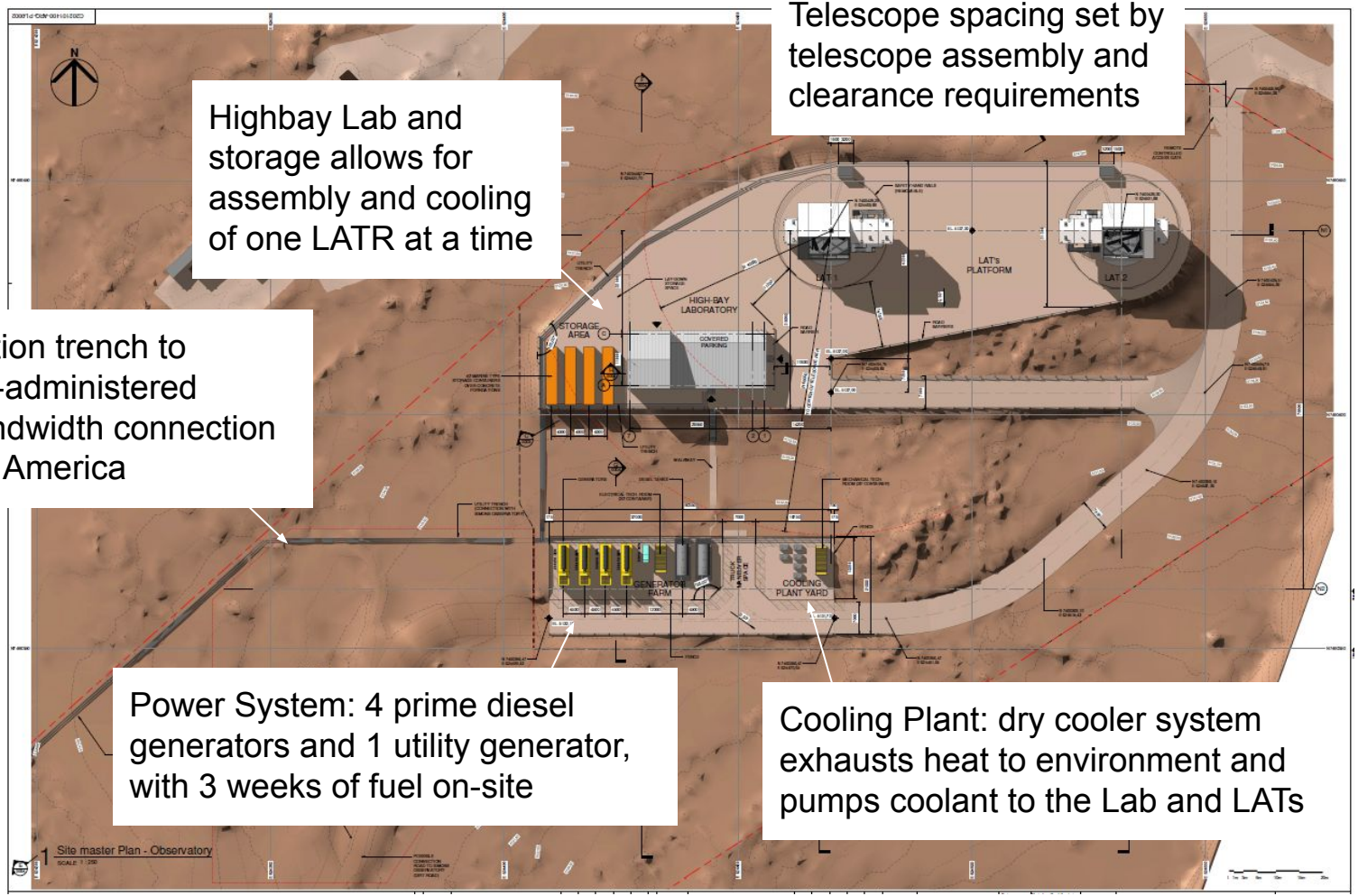
10.02: Roberto Ibáñes brought his expertise in environment and safety to draft our EH&S documents and run our baseline studies.

10.03: Alberto Montealegre of Montealegre Beach Arquitectos supplied the site master plan with fully costed cut sheets

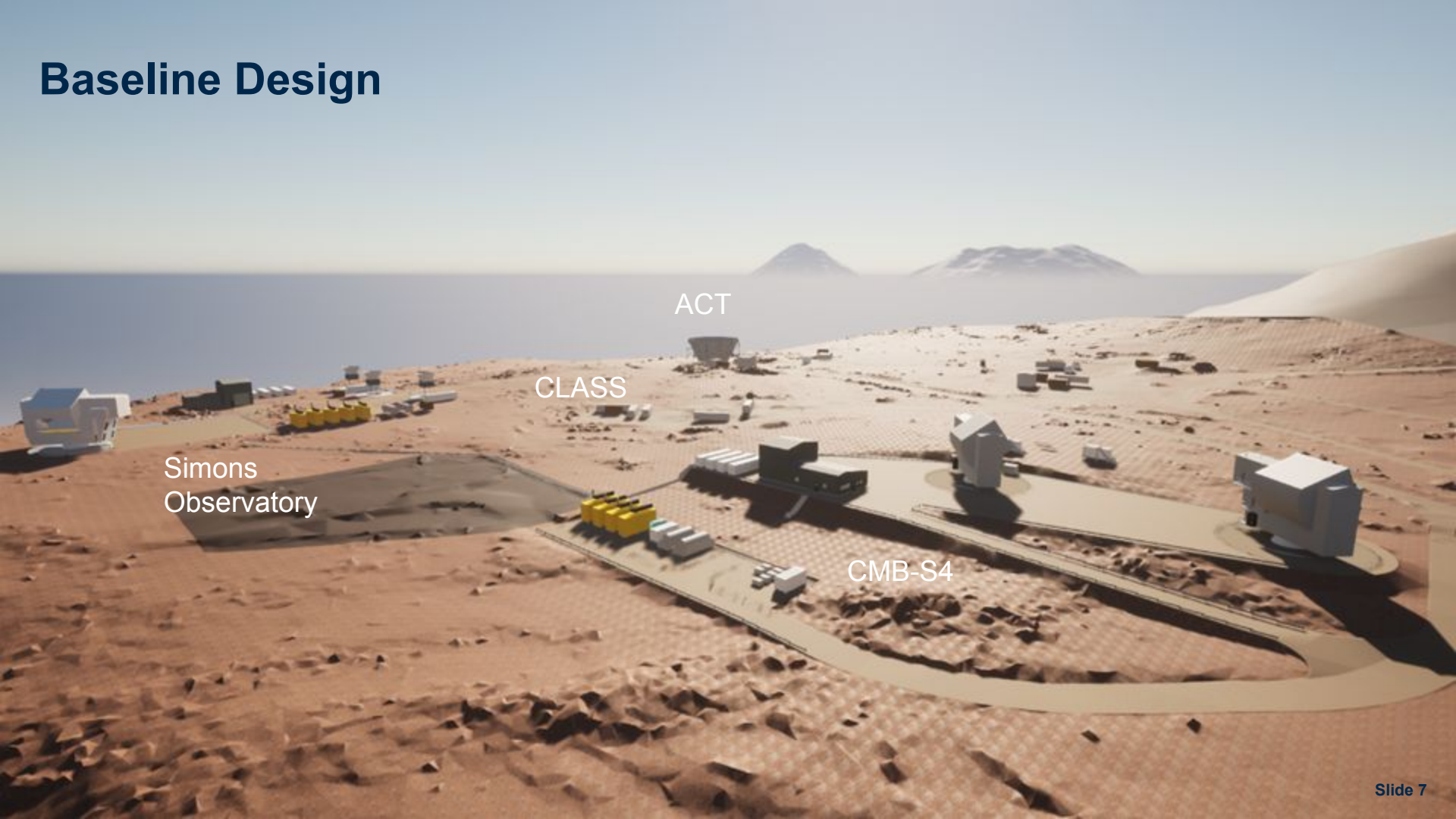
10.04: Tyler Natoli is also L3 lead for South Pole LAT Integration and Commissioning and is developing both those plans based on his Stage 3 experiment experience.

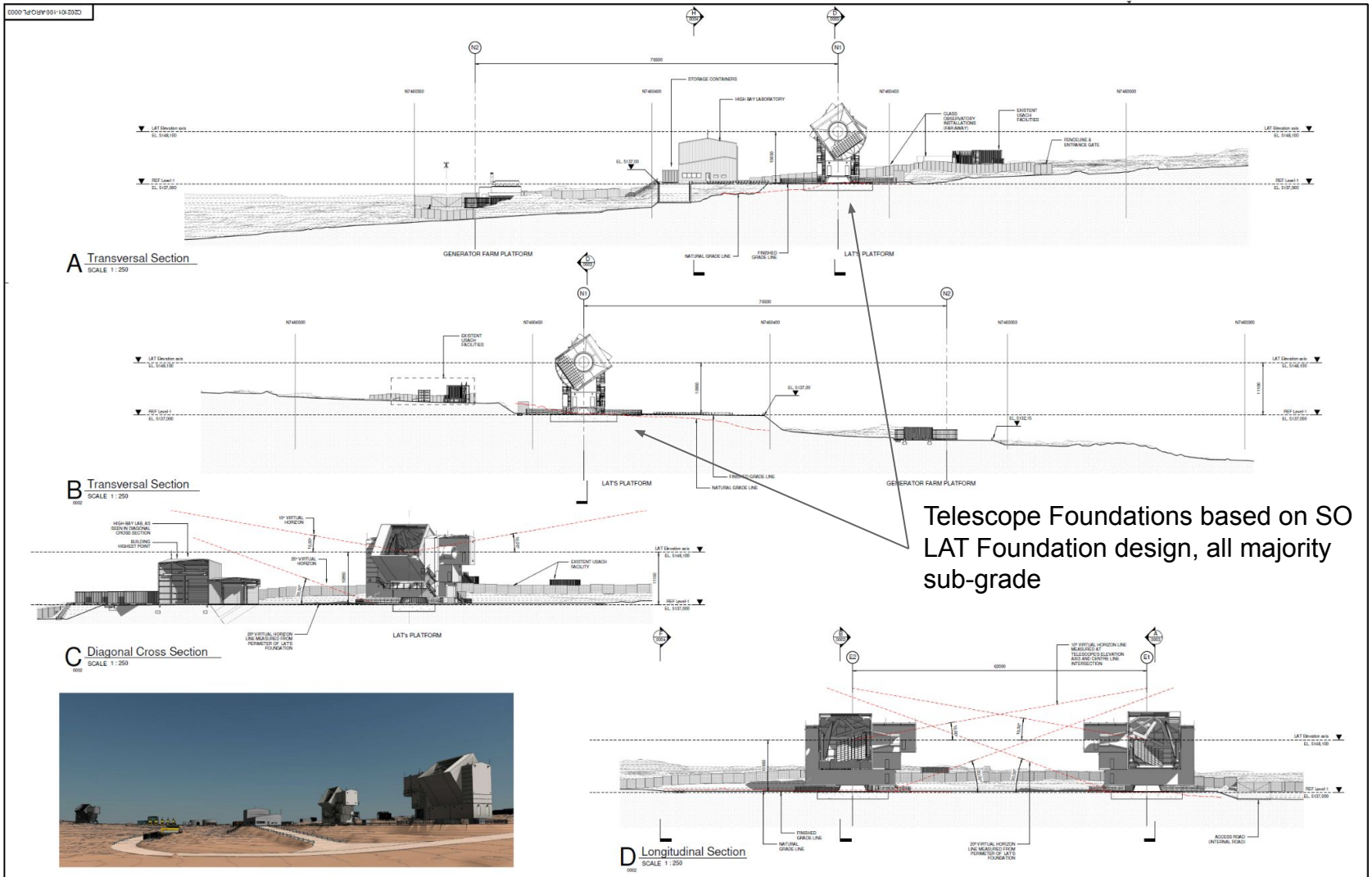
Key Driving Requirements

- **Observing Efficiency:** preparing for robust operation of the site to ensure maximum uptime. Puts requirements on power generation, access infrastructure, remote monitoring, etc.
- **Utility requirements:** Electrical power, cooling, internet access, compressed air. Requirements are well-developed enough for conceptual design now, and can be
- **Foundation Requirements:** LAT foundation design based on observing and survival loads under specified environmental and seismic conditions
- **Optical Interference Requirements:** set the spacing between LATs and all other infrastructure on the site
- **Integration and Commissioning Requirements:** Space for assembly of all items, support for the number of people needed on-site which is the highest population expected on-site, and infrastructure to support all I&C equipment.


Telescope spacing set by telescope assembly and clearance requirements
Highbay Lab and storage allows for assembly and cooling of one LATR at a time
Connection trench to REUNA-administered high-bandwidth connection to North America
Power System: 4 prime diesel generators and 1 utility generator, with 3 weeks of fuel on-site
Cooling Plant: dry cooler system exhausts heat to environment and pumps coolant to the Lab and LATs
HIGH-BAY LABORATORY
STORAGE AREA
COVERED PARKING
LAT's PLATFORM
LAT 1
LAT 2
GENERATOR FARM
COOLING PLANT YARD
Site master Plan - Observatory

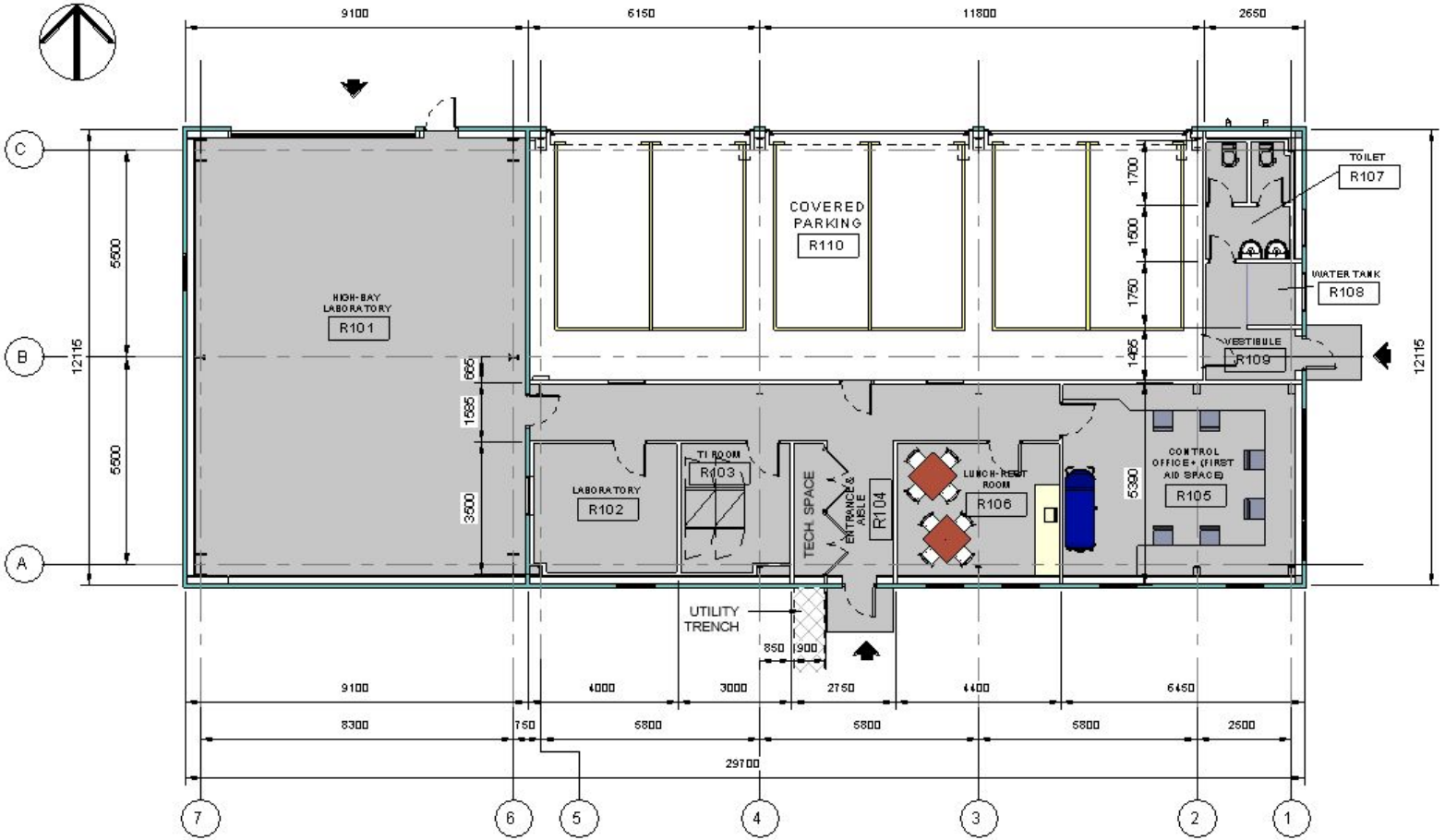
Baseline Design





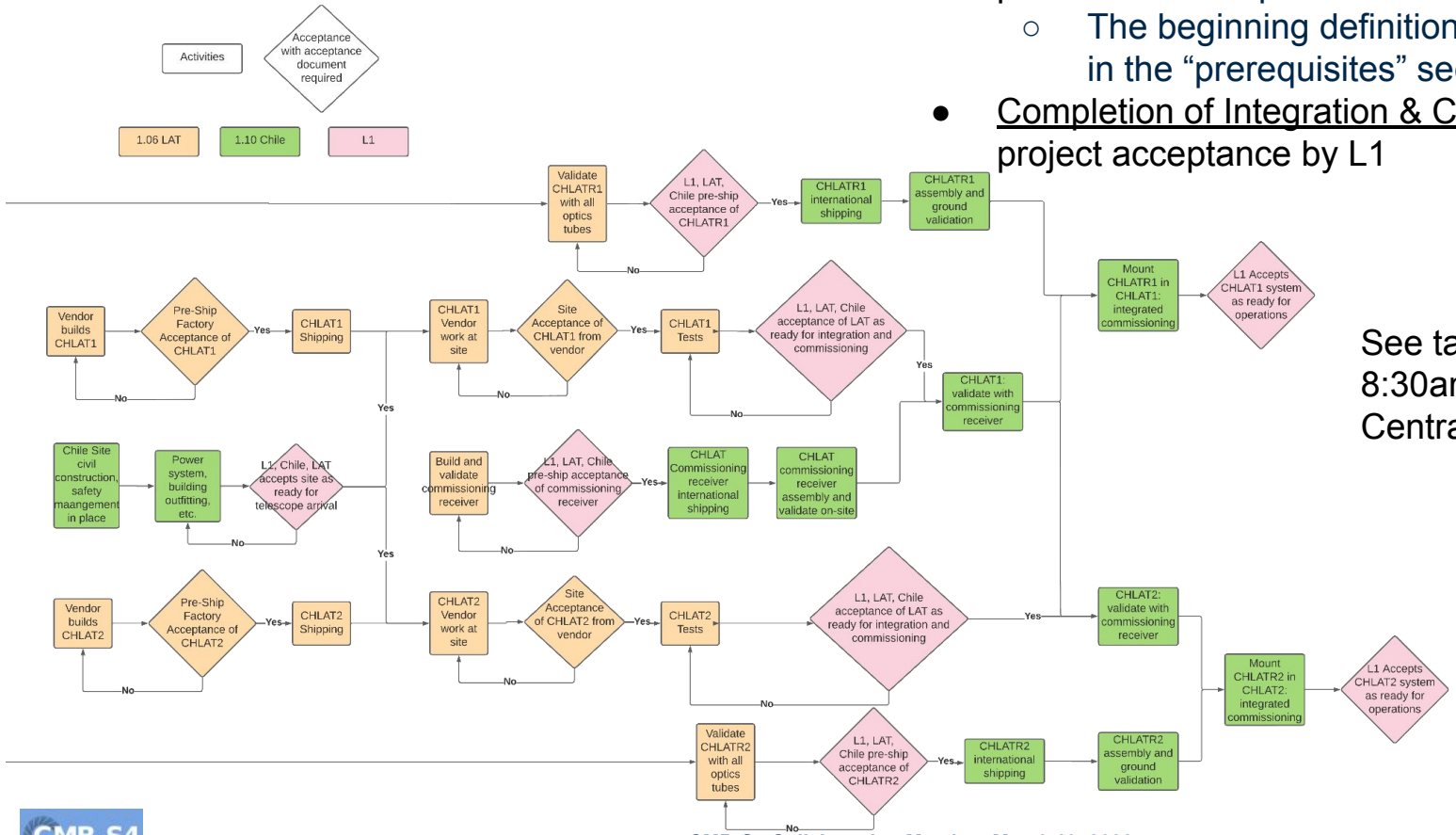
Telescope Foundations based on SO LAT Foundation design, all majority sub-grade

High-Bay Lab & Offices



Integration & Commissioning

- Tasks within WBS 1.10 in **green**
- Handoff with LAT mediated by L1 at acceptance points shown as pink diamonds
  - The beginning definition of these handoffs is in the "prerequisites" section of doc-730
- Completion of Integration & Commissioning is at project acceptance by L1



See talk on Thursday at 8:30am Pacific / 10:30am Central on the I&C Plan

Plans through FY22

- Support the AoA through its completion
- Complete site trade study (specific site within the Atacama area), in the context of the AoA (see discussion Wednesday morning)
- Complete the Power Generation trade study, in the context of the AoA and other photovoltaic studies and proposals in the region
- Negotiate the terms of the convenio with U. Chile so that it can move forward to getting signatures in FY23, and we can establish a Chilean Presidential Decree in FY23 or FY24.
- Offer assistance where necessary for implementation of the high-bandwidth connection to the site
- Continue coordination with the observatories in the area.