1.11 South Pole Site Infrastructure, Integration and Commissioning Status

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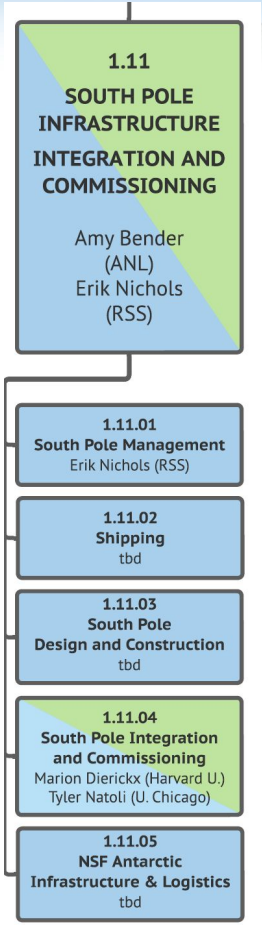
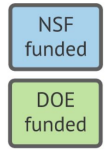
CMB-S4 Collaboration Meeting
April 3-6, 2023

Outline

- SP Site I&C Team
- Scope/Scope changes
- Technical overview/progress/status
  - Site Layout
  - SAT Towers
  - MAPO
  - LAT High Bay
  - Construction Plan
  - LAT/SAT M&O
  - LAT/SAT I&C
- Development path

South Pole Site I&C Team





Additional working group contributors:

Brad Benson
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Mauricio Pilleux
Clem Pryke
Joe Saba
Ben Schmitt
Jeff Zivick

Scope

Deliverables:

- Design, procurement, construction of site infrastructure and buildings.
- Shipping of all items from Port Hueneme to South Pole
- **Installation of LAT and SAT telescopes**
- **Integration and commissioning all facilities & hardware within**.

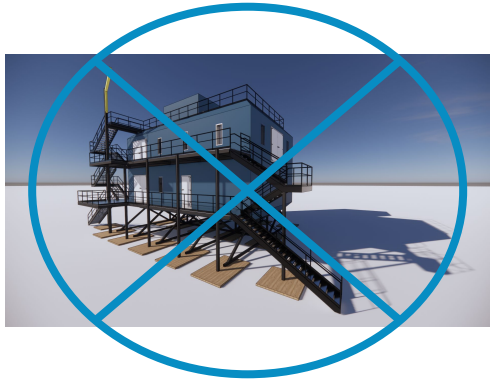
Much of the current efforts focuses on planning (as opposed to prototype design in other subsystems)

Level 3	Level 4
1.11.01 South Pole Project Management	1.11.01.01 Control Account Management
	1.11.01.02 Travel
	1.11.01.03 Milestones
	1.11.01.04 Procurement
1.11.02 South Pole Shipping	1.11.02.01 Control Account Management
	1.11.02.02 Inventory Tracking Control System
	1.11.02.03 Equipment and Material Shipping
	1.11.02.04 SAT Ship to South Pole
	1.11.02.05 LAT Ships to South Pole
1.11.03 South Pole Design, Construction and Installation	1.11.03.01 Design, Construction and Installation Project Management
	1.11.03.02 Design
	1.11.03.03 Construction and Installation
1.11.04 South Pole Integration and Commissioning	1.11.04.01 South Pole I&C Management
	1.11.04.02 South Pole LAT Integration and Commissioning
	1.11.04.03 South Pole SAT Integration and Commissioning

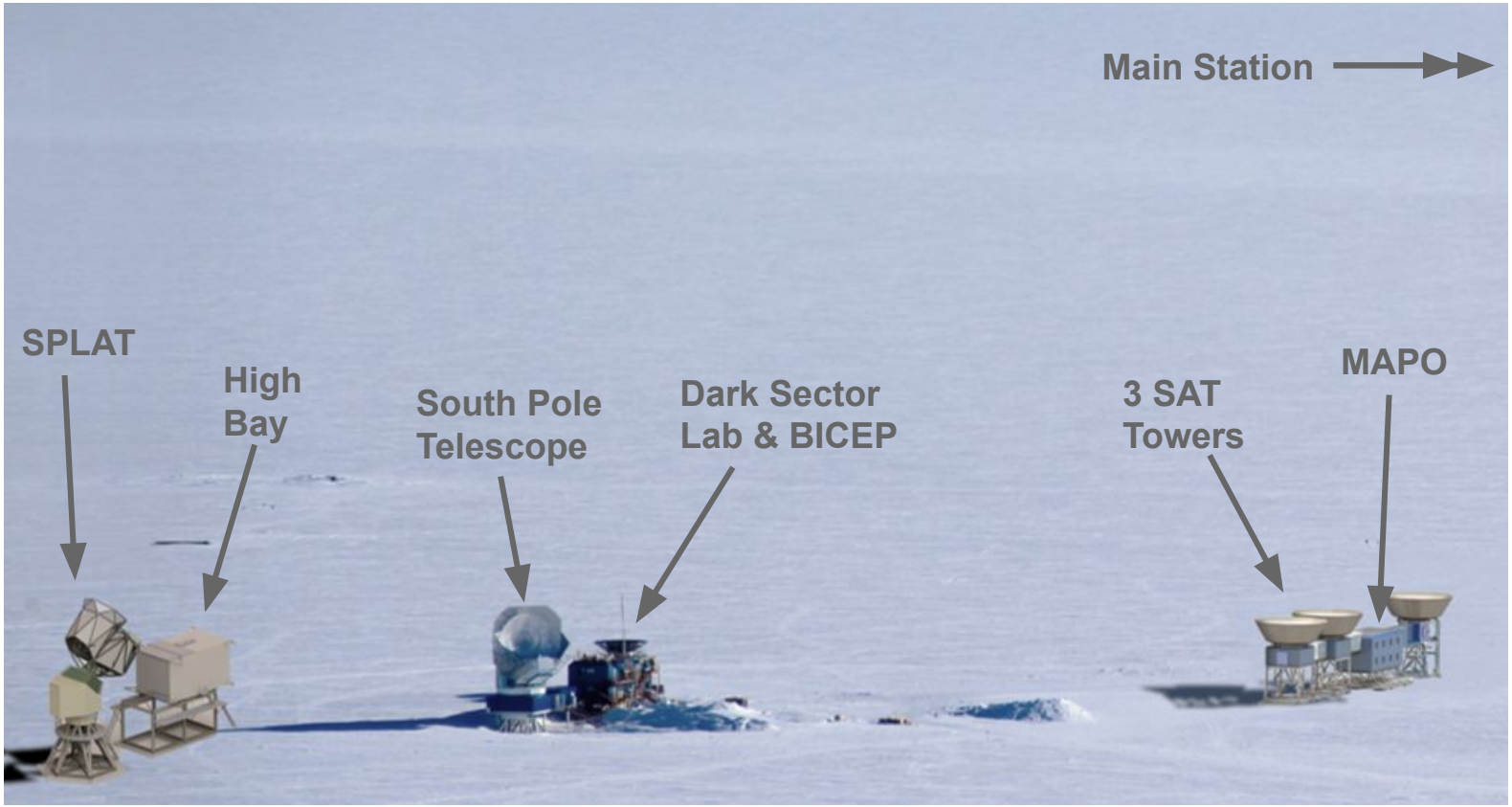
.01 Ice pads
.02 Electrical Distribution
.03 Data Communication Equipment
.04 Small-aperture Telescopes
.06 Martin A. Pomerantz Observatory
.07 South Pole LAT
.08 LAT Highbay
.09 Data Management System
.10 Crane

Scope Changes

- Analysis of Alternatives selected Alternative 1: 3 SATs (9 optics tubes) + 1 LAT at the South Pole
  - Reduced Baseline plan from 6 SATs
  - Removed need for Lab Building
  - Discussions made clear need to reduce site electrical power/fuel consumption
    - Site-wide power budget led by SE
    - Discussions of possible cold winter high-bay
  - Reduced fuel, personnel, & cargo impact to SP site with new Baseline
- Changes have been updated in schedule, budget, site layout, etc.
- Renewable energy power generation plan is in development - See earlier talk

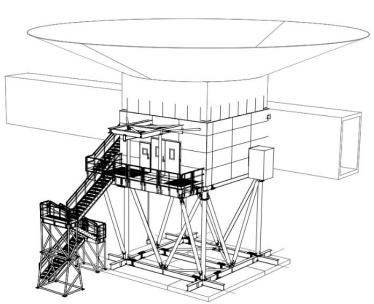


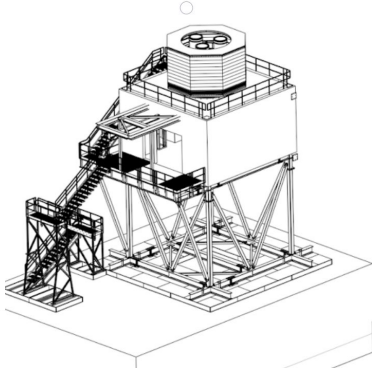
New site layout

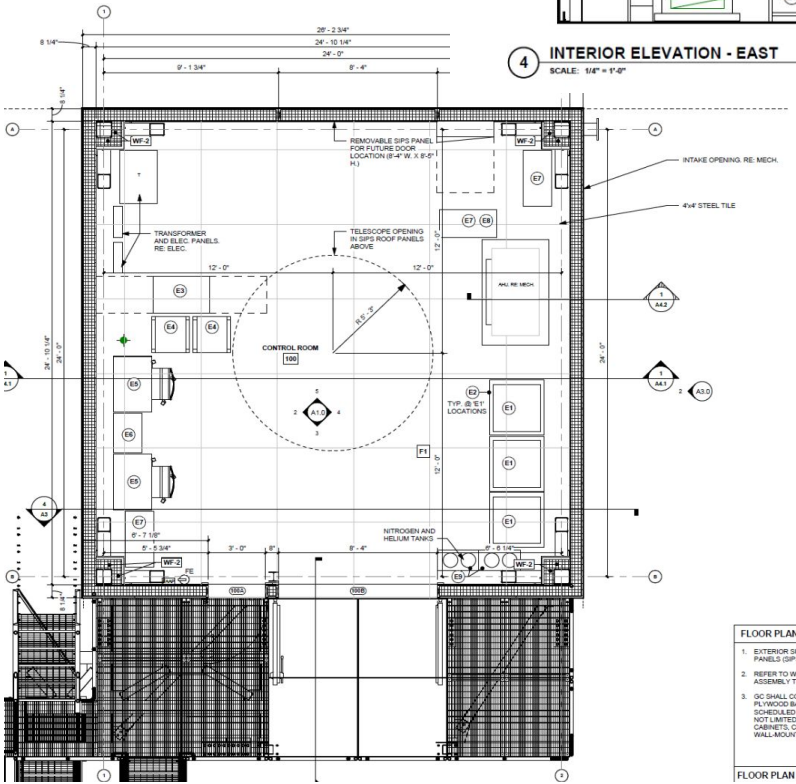


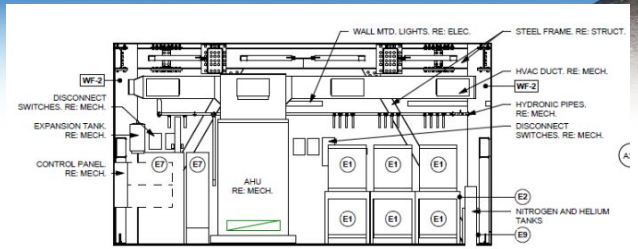
SAT Tower and Control Room Status

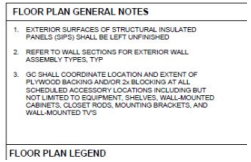
- SP Sites has determined that the BART tower design meets CMB-S4 requirements, and has adopted the design.
- BART tower/control room design completing now.





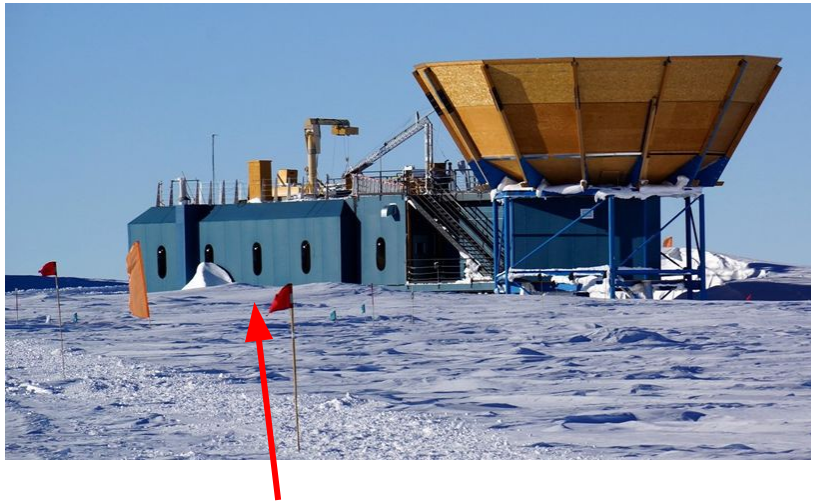




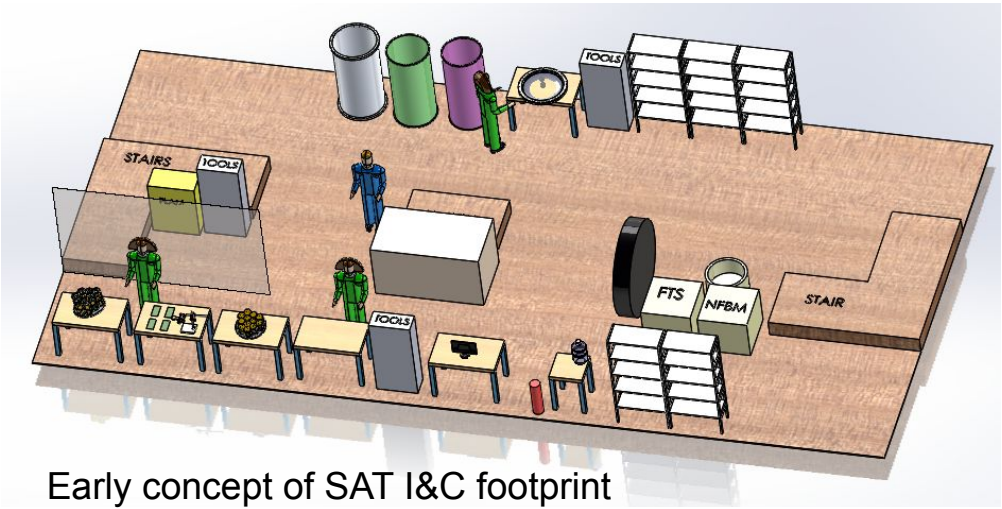


MAPO Status

- Plan to use Martin A. Pomerantz Observatory (MAPO) blue lab building for SAT I&C workspace and DAQ/DM system location.
- Schedule and budget planned for interior upgrades (conceptual).
- Baseline assumes MAPO will be raised by NSF/ASC so that SAT towers can connect via walkways.
    - FY23 AIR MREFC budget includes lifting equipment for South Pole blue buildings



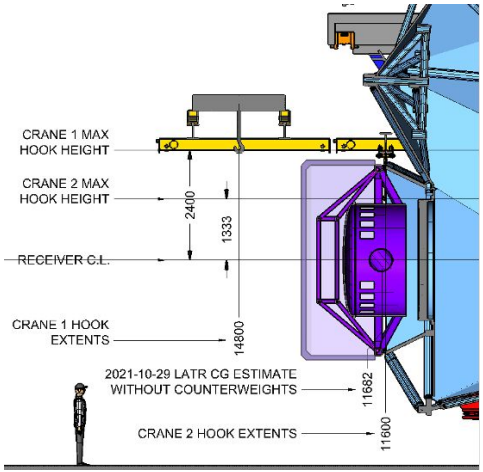
MAPO

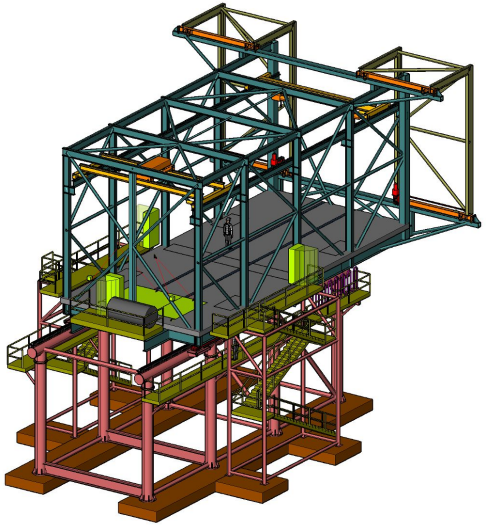


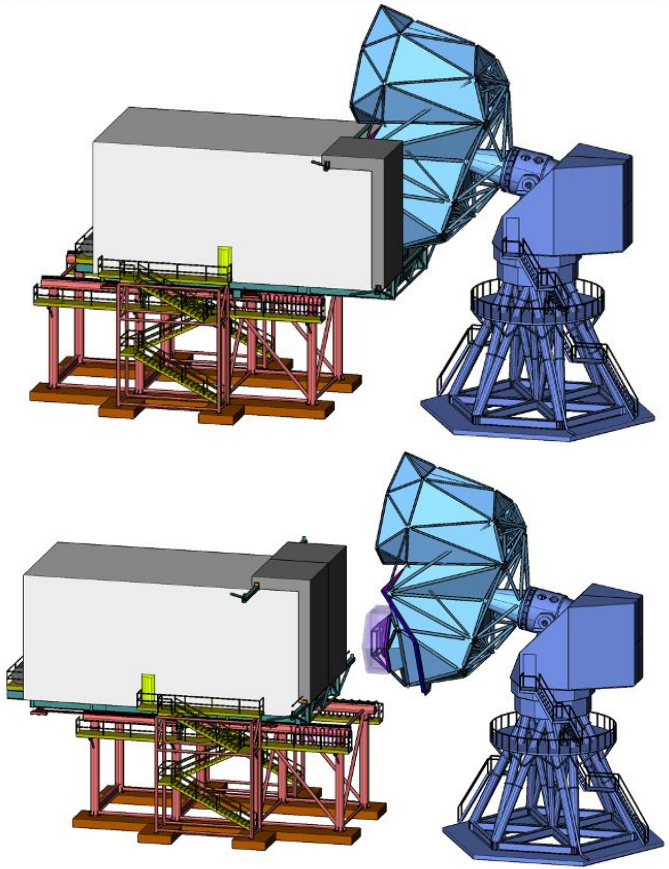
Early concept of SAT I&C footprint

LAT High Bay Status

- Preliminary design complete
- Sliding building couples to LAT for LATR installation and maintenance
- LATR will be assembled in the high bay
- 2 crane system to bring cargo into the high bay and to install the LATR on the LAT







Construction Plan

- Construction project takes place over multiple seasons
  - Summers: building exterior construction
  - Winters: building interiors and I&C
- Onsite personnel profiles
  - ~40 per summer
  - <20 in max winter, others are significantly less
- New crane for LAT assembly, and expeditious construction activities

	PY1	PY2	PY3	PY4	PY5	PY6
LAT	Snow pad	Electric and Data Cables	LAT High Bay	LAT Tower	LAT Mount/Tipping/ LATCR I&C	LATR I&C
SAT	Snow pad	Electric and Data Cables/MAPO	SAT 2 + 3 Towers/Control Rooms	SAT 2 + 3 Mounts/GSs	SAT 1 I&C	SAT 2+3 I&C

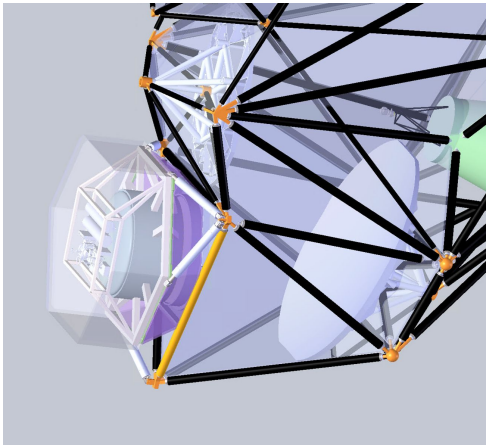
LAT & SAT Maintenance & Operations Planning

- Working on a maintenance list for SPLAT & SAT operations.
  - Considering standard preventative maintenance and corrective maintenance (failure repair).
  - Frequency and duration of maintenance will feed into **observation efficiency** working group.
  - Locations of required access for summer and winter tasks can help inform equipment locations.
- Links:
  - South Pole LAT/LATR Maintenance Tasks
  - South Pole SAT Maintenance Tasks

Example excerpt

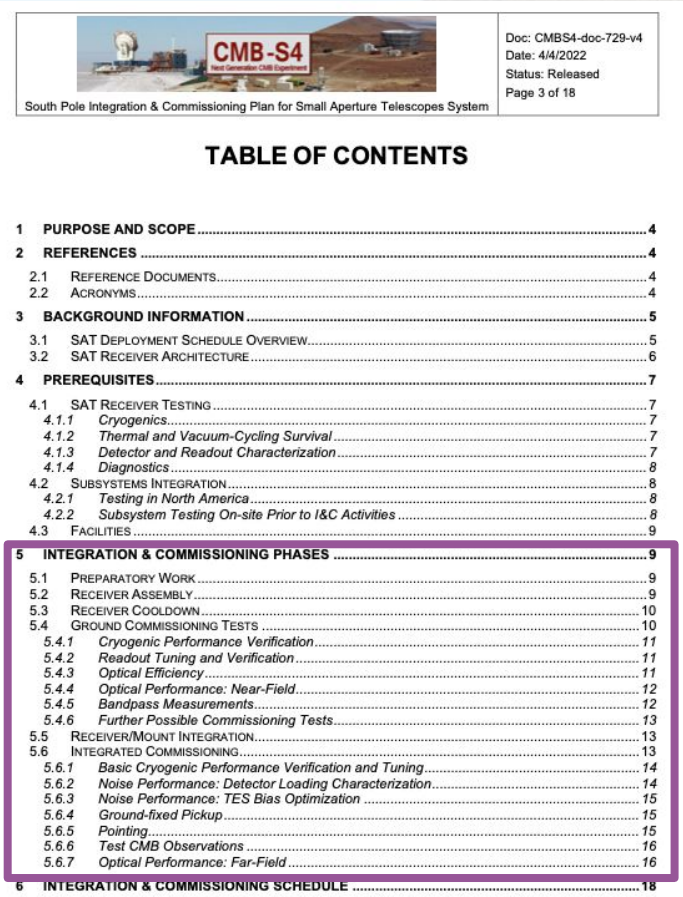
Task	Frequency	Normal (NM), expected (EF), or unexpected failure (UF)	Telescope stoppage time	Equipment needed
Helium compressors refill	~monthly	NM	None	Helium manifold
Helium compressor adsorber swap	Every 20,000 operating hours (~2.2 years)	NM	~hours	Spare adsorber
Helium guard channels refill	~monthly	NM	None	Helium manifold
Helium rotatory joint swap	Every 3-6 months	NM	~1 hour	Spare HRJ and seals

LATR enclosure



I&C Plan for SATs

- Initial version approved by project and under change control (CMBS4-doc-729-v4).
- Includes:
  - Goals, description, prerequisites and resources needed for each task.
  - Task-based schedule, on a per-SAT basis.
- Major phases:
  - Receiver Assembly (Takes place inside each SAT tower, using hoisting capabilities of the SAT mount.)
  - Receiver Cooldown
  - Ground Commissioning Tests (Validation of performance before loading onto telescope mount.)
  - Receiver/Mount Integration
  - Integrated Commissioning



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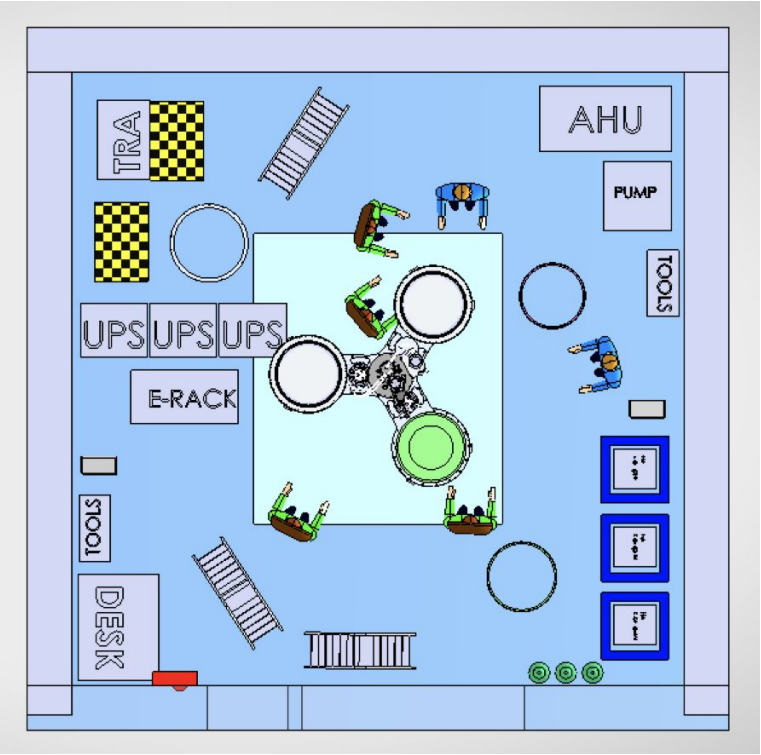
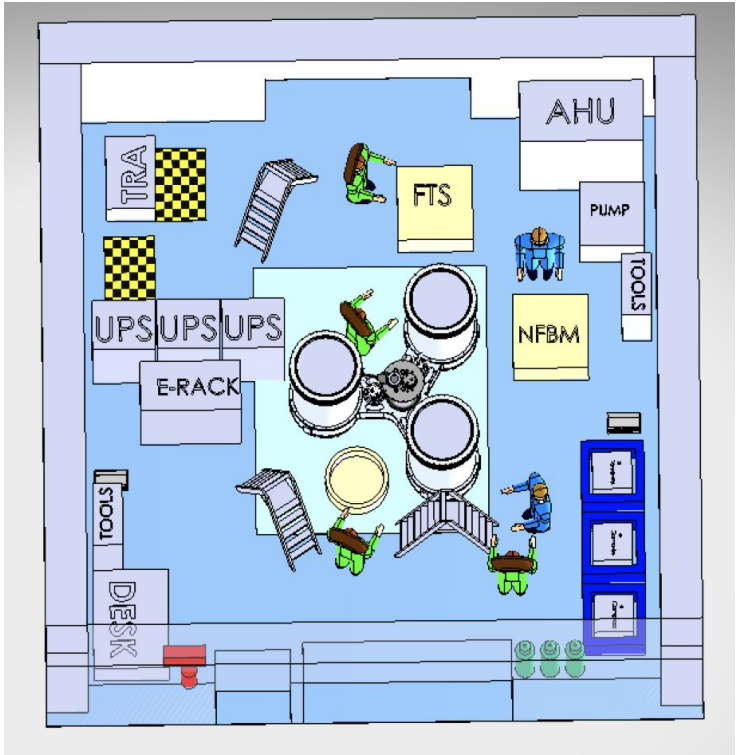
CMB-S4 I&C in the BART Tower





I&C Plan for LAT

- Initial version approved by project and under change control (CMBS4-doc-730)
  - Excerpt of contents shown on the right
- Includes a task-based schedule based on stage 3 experience
- Major components
  - LATR Assembly high bay
  - LATR cooldown and ground commissioning in the high bay
  - Install LATR on the LAT
  - Full integrated commissioning with the LATR installed on the LAT

Chile & South Pole Integration & Commissioning Plan for Large Aperture Telescopes Systems

Doc: CMBS4-doc-730-v4
Date: 4/25/2022
Status: Released
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Development Path

- Focus on updating Interface Control & Requirement documents for initial approval by change control board
- LAT tipping structure construction planning
- MAPO interior renovation detailed plan
- Possible update to freezable high bay design
- Incorporate renewable energy power generation into L2
- Iteration and refinement of I&C plans
- Further develop site safety plan
- Engage with NSF-OPP-AIL

Slack: #southpolewg
Email: southpolesite@cmb-s4.org
Working group meetings: every other Thursday at 3pm central

Backup

Detailed Site Layout