

CMB-S4 2021 Spring Collaboration Meeting South Pole LAT High Bay

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SPLAT High bay Overview

Purpose

The SPLAT "High Bay" is a structure dedicated to providing a protected and environmentally conditioned workspace for installation, removal, testing or maintenance of the SPLAT Receiver (SPLATR) and associated electronics.

The interior space includes a gantry crane for handling the LATR, a loading area for large heavy parts, and enough space for complete disassembly of the receiver.



Operating Modes

The High Bay has three general modes of operation

- 1. Chamber retracted with all doors closed
 - Allows full unimpeded motion of the SPLAT regardless of Elevation position or Boresight rotation
- 2. Chamber moved forward ~6m with telescope in docking position
 - Enables installation and removal of Receiver as well as general maintenance and testing of Receiver and associated electronics
- 3. Rear doors and floor plates removed for equipment loading and unloading (with or without docked telescope)
 - Gives access to chamber for installation and removal of equipment from sleds or equipment transport







General Layout and Facilities

- The enclosure is a rectangular box 8m high x 8m wide x 14.3m long, supported by 4 rollers running on tracks on a simple steel space frame
- The space frame sits on a wooden raft which sits on an icepad. It has an open structure to discourage snow buildup, and to give access to delivery sleds below gantry crane
- Rear access doors and a removable floor panels accommodate equipment transfer into and out of the enclosure
- Front access doors and a partially retractable roof provide clearance to mate with the telescope structure
- A side door gives safe access to the enclosure under the gantry crane rails
- Insulated side walls support only the roof and wind loading, so can be constructed of lightweight materials.
- Facility heated by boiler running on AN-8 fuel
- Glycol heat exchange system with multiple connections to cool PTC's and readout electronics
- Compressed air system for dilution fridge

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High Bay Mechanisms

Gantry Crane

- A Gantry crane sits on rails that extend the full length of the enclosure
- The gantry has an electric drive for travel along the rails, but a manual trolley across width of enclosure to eliminate side loads
- The rails are elevated 100in above the floor so wall space available for access doors, electrical panels, cabinets etc.
- The trolley hoist has a capacity of at least 5t to support the full weight of the receiver

Enclosure Drive

- The high bay enclosure is supported by 4 rollers which run on tracks on the spaceframe foundation. Roller assemblies also include lateral and uplift rollers to handle forces estimated at 60kN (for 35m/s survival wind)
- Roller assemblies are exposed, but equipped with scrapers to remove ice from the tracks
- Enclosure drive is machine-screw jack, mounted in a well under the enclosure floor, with draw wire encoder and limit switches

Door Drives

- Front and Rear Double doors, and sliding roof door all driven by machine screw jacks with draw-wire encoders and limit switches.
- All screw jacks accessible from inside of high bay, protected from elements and easily serviceable





Design Challenges

Thermal Seals

- Seals are critical to maintaining the enclosure at working temperature
- Assuming the seals block only 95% of gap between enclosure and telescope, conservative estimate of 70 kW heat load required to maintain 10C internal temperature during winter
- Improving seals could decrease this requirement significantly
- Typical materials used in inflatable seals lose compliance at low temperatures, alternative materials need to be found and tested
- Seals must accommodate gradual misalignment between High Bay and Telescope over time ~ a few inches per decade based on SPT experience
- Dark Sector Lab has 71kW boiler that uses 2.4gph AN-8

<u>lce buildup</u>

- Enclosure drive rails are largely exposed, and likely to Accumulate ice over time.
- No experience with similar moving structures at South Pole

