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

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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.
**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.
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

Ice buildup

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