SAT Calibration

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Key Requirements (Design Drivers)

Calibration equipment used for

- Component-level testing during cryostat/optics prototyping
  - E.g. optics stack sidelobe testing
- Verification of SAT performance during commissioning
  - Full-system-level
- Measuring basic instrument parameters to well-defined precision
  - Needed to make CMB maps: bandpasses, beam shapes, pol angles…
- Probing instrumental systematics
  - Needed to constrain *r*: deep beam maps, sidelobe pickup…

Each use case sets a different requirement on individual pieces of calibration hardware, e.g.:

- To verify that “T→P leakage in the FOV is less than XXX level”...
- …the far-field thermal chopper must present a load of (250-77 K) with a 24” aperture and spin at 16 Hz (to match or improve on BK beam measurement performance)

Equipment to Build

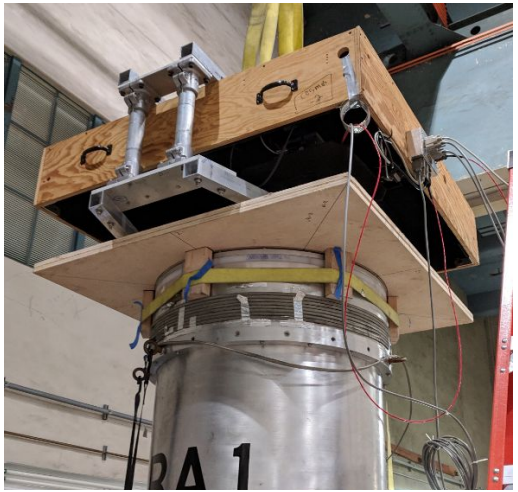
1.07.06.01	Hardware interfaces design	**1.07.06.07**	Far-field flat mirror
1.07.06.02	Aperture-filling load	**1.07.06.08**	Far-field thermal chopper
1.07.06.03	Near-field beam mapper	**1.07.06.09**	Amplified microwave source
1.07.06.04	Fourier transform spectrometer	**1.07.06.10**	Helmholtz coil
1.07.06.05	Near-field polarization calibrator	**1.07.06.11**	RF sources and monitoring
1.07.06.06	Calibration mast	**1.07.06.12**	Star camera

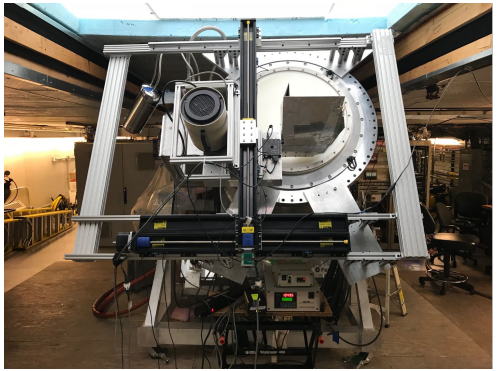
Needed for NA test build, then (possibly) at Pole

Needed at Pole

Equipment Needed for Prototyping and NA Integration

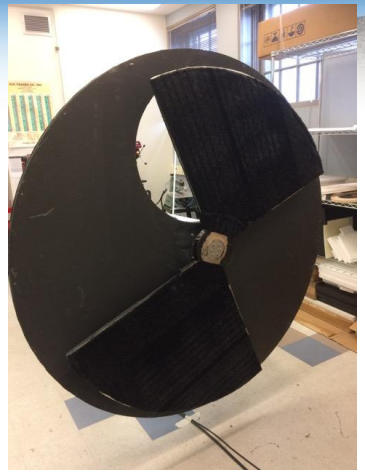
- Design work for lab-based equipment beginning now
  - Aperture-filling load
  - Near-field beam mapper
  - Fourier Transform spectrometer
  - Near-field pol cal
  - Helmholtz coil
- Designs can be straightforwardly adapted from existing equipment
  - Some R&D (e.g. FTS optical coupling)
- Hardware interfaces design - cryostat mounting, electrical connections, etc.
- Working with Sites group to ensure that roof can accommodate anticipated equipment
- Working with I&C to outline calibration activities and delineate responsibilities

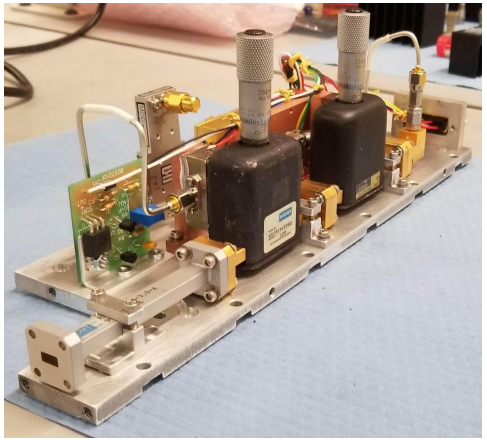




Equipment Needed in the Field

- For field-based equipment needed to probe systematics in the *r* measurement at extreme map depths…
  - Far-field thermal chopper
  - Mast
  - Flat mirror
  - Amplified microwave sources
- …we are using archival data and performing *in situ* tests to determine whether the current strategies are sufficient
  - How long of a calibration campaign do we need?
  - Does any equipment need significant redesign? Systematics?
  - Far-field beam maps [Clara], sidelobes [Rito, Christos, Colin +]





Next Steps

- Design work starting now
  - Lab-based calibration equipment (thermal load, near-field beam mapper)
  - Mechanical interface to cryostat
  - **What can be shared with LATs?**
    - **FTS, amplified sources** are good candidates
- Connect systematics sensitivity studies to calibrator design
- Identify tests/prototyping that can be coordinated with BA/SO in NA and in the field
- AoA consideration
  - If SATs are sited in Chile, is a similar beam mapping campaign feasible (masts, etc.)? Do the required calibration depths change?
  - Additional component-level calibration for HWP?