Workshop Plan
and
Weiss Report Overview

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CMBPol study goals for systematics

Either:

(a) convince ourselves and decadal community that systematics are not going to limit CMBpol's effectiveness,

or

(b) identify the worrisome systematics, and propose a program for overcoming them.

This workshop's goals

1. Review the list of systematics,
2. Document where things stand in terms of understanding them (days 1 and 2),
3. Try to understand how those feed into an all-sky measurement (mostly day 3).
4. Figure out what still needs to happen to accomplish goal (a).

Our hope:

- The proceedings of this workshop will document the details of all this.
- The systematics section of the study report will be a high-level summary, and will refer to the proceedings for details.

This workshop's format

Morning and early afternoon:

- talks
- dedicated "note-takers" taking notes on specific systematics we will have to address in the final report.

Late afternoon:

- Panel discussion to review and revise those notes.

Those notes will feed heavily into the systematics section of the final report.

Categories of systematics

(for notes and afternoon discussions)

1. Beam issues

Crosspolar beam	E->B
Main beam asymmetry (before differencing)	dT->B
Sidelobes	dT->B
etc	

2. Pointing issues

Polarization angle errors	E->B
Pointing errors (on Q/U)	E->B
Pointing errors before differencing	T->B
etc	

3. Calibration issues (including gain, bandpass and freq response)

Relative calibration errors	dT->B
Gain drift before differencing	T->B
Band shape errors, including modulator effects	foregrounds->B
etc	

4. Environmental stability issues

Optics and spillover T variations	dTopt -> B
Scan modulated cold stage variations	dTcs -> B
etc	

5. Other issues

Instrumental polarization	dT->B
? (look for additions that don't fit in above categories)	

The “notetakers”

	Monday	Tuesday	Wednesday
Beams	Page	Page	Page
Pointing	Kogut	Kogut	Kogut
Calibration	Staggs	Staggs?	
Environment	Lawrence	Lawrence	Lawrence
Other	Timbie	Timbie	Timbie

Weiss Report Basics

DOE/NASA/NSF "Task Force on CMB Research"

Started in 2004, final report in July, 2005 - 3 years ago.

Final report available at:

arXiv:astro-ph/0604101

http://www.nsf.gov/mps/ast/tfcr.jsp

Members:

Bock, Church, Devlin, Hinshaw, Lange, Lee, Page, Partridge, Ruhl, Tegmark, Timbie, Weiss, Winstein, Zaldarriaga

Weiss Report

Technical Recommendations

T1) We recommend technology development leading to receivers that contain a thousand or more polarization sensitive detectors, and adequate support for the facilities that produce these detectors.

T2) We recommend a strategy that supports **alternative technical approaches** to detectors and instruments.

T3) We recommend funding for **development of technology and for planning for a satellite mission** to be launched in 2018.

T4) We recommend strong **support for CMB modeling, data analysis** and theory.

Systematics Section

For r = 0.01, B-mode signal rms is about 30nK.

Weiss report estimated control of various parameters required to ensure each individual systematic effect contributed rms < 3nK.

No attempt to discuss effects as a function of ell, eg low-ell bump vs. high-ell bump.

(TFCR believed you need to get both)

Weiss report table

Table 6.1: Instrument Performance Goals

Parameter	Effect	Goal	Method
Cross-Polar Beam response	E →B	< 0.003	Rotate Instrument, Wave Plate
Main lobe ellipticity (0.5° beam)	dT → B	$< 10^{-4}$	Rotate Instrument, Wave Plate
Polarized sidelobes (response at Galaxy)	dT → B	$< 10^{-6}$	Baffles/shielding/measure
Instrumental polarization	dT → B	$< 10^{-4}$	Rotate Instrument, Wave Plate
Polarization angle	E → B	< 0.2 °	Measure
Relative pointing (of differenced samples)	dT → B	< 0.1″	Dual-polarization pixels
Relative calibration	dT → B	$< 10^{-5}$	Modulators
Relative calibration drift (scan synchronous)	T → B	$< 10^{-9}$	Modulators
Lyot Stop Temperature (10% spill, scan synch.)	dT_{opt} → B	dT_{opt} < 30 nK	Measure
Cold stage T drifts (scan synch.)	dT_{CS} → B	dT_{CS} < 1 nK	Improve uniformity, measure

TABLE 6.1 *Performance goals for a CMB* **B***-mode measurement. The first eight parameters describe instrumental effects that transform various sky signals into false* **B***-mode signals; here we use* **T** *to indicate intensity,* **E** *to indicate the* **E***-mode polarization signal, and* **dT** *to indicate CMB temperature anisotropies. The listed "Goal" is the level at which an individual instrumental effect will begin to cause a 10% contamination (in units of temperature) of an* **r** *= 0.01* **B***-mode signal in the most naïve experimental design. Clever scan strategies and partial correction of known levels of contamination can relax these requirements. See the text for more details.*

Systematics Table
sent out for this workshop

Systematic	Effect	
Crosspolar beam	$E \rightarrow B$	*Not dT -> B*
Polarization angle errors	$E \rightarrow B$	
Pointing errors (on Q/U)	$E \rightarrow B$	
Main beam asymmetry (before differencing)	$dT \rightarrow B$	*Total power beam*
Sidelobes	$dT \rightarrow B$	
Instrumental polarization	$dT \rightarrow B$	*Sky side of modulator*
Relative calibration errors	$dT \rightarrow B$	*Before differencing*
Pointing errors before differencing	$T \rightarrow B$	
Gain drift before differencing	$T \rightarrow B$	
Optics and spillover T variations	$dT_{opt} \rightarrow B$	
Scan modulated cold stage variations	$dT_{CS} \rightarrow B$	
Band shape errors, including modulator effects	foregrounds $\rightarrow$ B	*Not in Weiss report* (covers this row and the next)
Others?	?	

Suzanne Staggs adds: absolute calibration, beam measurement quality, space-specific issues (noisy belt, charge accumulation, etc)