Lessons Learned from ABS

For ABS collaboration

Based on arXiv:1801.01218

Lessons Learned from ABS

- HWP works
  - It improves on 1/f noise and mitigates systematic errors.
- HWP did not degrade sensitivity.
- 150 GHz works in Chile and very low 1/f can be achieved.
- Pioneered TRUCE detector in field. Improvement needed.
  - Each was ~500 uK√s and ABS had only effectively ~200 of them.
  - They were first of this kind in field (probably similar time as SPTpol)
- Excellent agreement with Planck on same patch and can recover faint foreground signals in a clean patch.

What can we learn from ABS error bar?

- Turning array sensitivity into error bar in power spectrum.
  - Including the 1/f (or $1/\ell$) noise behavior; ~2mHz knee frequency achieved.
  - Demodulated timesteram is mapped with very moderate filtering.
- Field size 2400 deg.^{2}.
  - This is a good size. This can be bigger.
- Caveat: ABS did not have optimal scan size (~7deg. on sky)
  - ABS achieved excellent low-ℓ performance even with this small scan width.
  - This can be improved in future experiments, which will improve $1/\ell$ noise.
- Data selection efficiency after removing already bad channels.

What can we learn from ABS error bar?

ABS data selection table

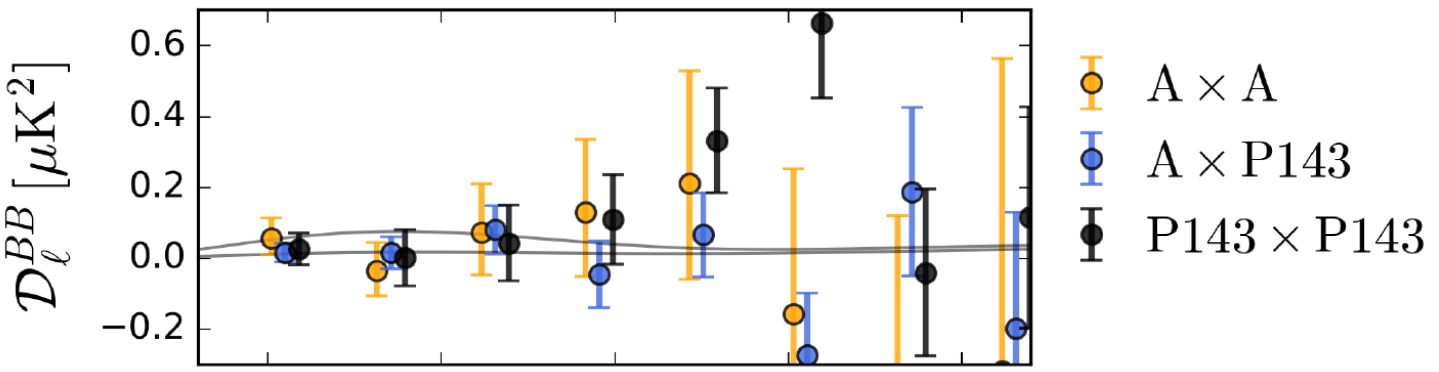
Cut Name	Number TES CESes	TES-hrs	% Cut
(Total Number)	1,024,102	1,148,462	0%
Nominal Telescope Operation	908,184	1,059,268	7.8%
Non-Zero Responsivity	666,348	777,208	26.6%
Detectors Biased and Operating Properly	606,650	708,725	8.8%
No Excess Glitches	520,711	606,916	14.4%
Nominal SSS	483,748	564,098	7.1%
Gaussian and Stable	446,676	520,169	7.8%
Nominal White Noise Properties	418,763	487,277	6.3%
Detectors Not Under Excess Loading	407,912	475,094	2.5%
Cut CES if < 150 timestreams	396,047	461,237	2.9%

Start from here

Don't include this

What can we learn from ABS error bar?

- Observing time (Field A): 2389h
- Field size: 2400 deg.^{2}
- Band center: ~145GHz
- Typical array NEQ: 41 uK√s
  - Typical number after data selection
- Beam FWHM: 32’



By Steve Choi

Comparing BB error bars

- Analytic formula for bandpower error: $\Delta C_\ell = \sqrt{\frac{2}{(2\ell+1)\Delta\ell f_{\rm sky} t_\ell}}(C_\ell + N_\ell)$
- t_ℓ represents mode loss from transfer function.
- Plotted quantity below includes contribution from the fraction of sky and the filtering of the data
  - That is, empirical “noise bias” with transfer function penalty and sky size accounted for.