CMBP Imager Update July 24, 2017

Goal

- Define an imaging instrument for CMBP with sufficient detail to enable
 - meaningful trade-offs between instrument parameters (resolution, frequency coverage, noise level) and science deliverables
 - detailed design and costing by JPL's Team-X

Imager WG Admin

- 20 members in mailing list
- Regular weekly telecons since July 1 (Monday 1 pm CT)

Imager Starting Assumptions

- Medium aperture (>~1 m)
- Reflector based
- Arrays of detectors + muxed readouts
 - baseline: multi-chroic bolometers

Imager Starting Points

• EPIC-IM

- 1.4 m aperture, actively cooled telescope, 11,094 TES, 0.9 uK*arcmin (Descope: passively cooled telescope)
- CORE
 - 1.2 m aperture, passively cooled telescope, 2100 KIDS, 1.7 uK*arcmin











Initial Questions / Goal

- Which optical system to use?
- How large can it be?
- What is the impact of the size of the optics on the scan strategy, or other satellite systems?
- Develop baseline focal plane model

Which Optical System

- Cross-Dragone:
 - large FOV, but strong hard-toavoid near lobe
- Open Dragone:
 - smaller FOV (0.75*cross), no near lobe, cold stop, larger reflectors





How Large Can it Be?

- Find maximal spin and precession angles possible for a given aperture size?
- alpha + beta = 95 deg
- For 1.4 m, alpha = 22 deg
- +7 deg in alpha per 20 cm reduction in aperture diameter





How Large Can it Be?

- Alpha =~ beta preferred due to scan uniformity considerations (liteBIRD memo + Gorski analysis - ongoing)
- Perhaps use deployable shades? JPL assessing.



Focal Plane Model

Input from Tech Group:

- TES, Multi-chroic, up to 555 GHz
- Three color/pixel
- Monochromatic, absorber coupled, PSBs @666, 799 GHz
- Single mode beam size at all frequencies

Sun-shade

CMBP 30 K Bands			
Frequency	FWHM	PolWeight	Initial NERSC
(GHz)	(arcmin)	(uk*arcmin)	
21	40.6	50	SO/S4 (20, 0.3)
25	34.1	33	
30	28.4	22.4	SO/S4 (30, 0.3)
36	23.7	15	
43	19.7	9.1	LB (40, 0.3)
52	16.4	7	LB (50, 0.3)
62	13.7	5	LB (60, 0.23)
75	11.4	4	LB (78, 0.28)
90	9.5	3.2	LB (89, 0.23)
107	7.9	2.9	LB (100, 0.23)
129	6.6	2.7	CO (130, 0.3)
155	5.5	2.6	CO (160, 0.3)
186	4.6	3.6	CO (195, 0.3)
223	3.8	5.3	CO(220, 0.3)
267	3.2	9	LB (280, 0.3)
321	2.7	16.0	CO (340, 0.3)
385	2.2	32	CO (390, 0.3)
462	1.8	75	CO (450, 0.3)
555	1.5	220.0	CO (520, 0.3)
666	1.3	1100	CCAT (669, 0.11)
799	1.1	10000.0	CCAT (862, 0.11)

Near Term Goals

- Finalize choice of optical system (Early Sept.)
- Finalize initial focal plane + noise model (Early Sept.)
- (Enable science and foregrounds trade studies)
- Work on cooling approach, readout, and overall power demands

• First instrument session is in December.

Backup Slides