The Status of the Planck Surveyor: 7 months before Launch

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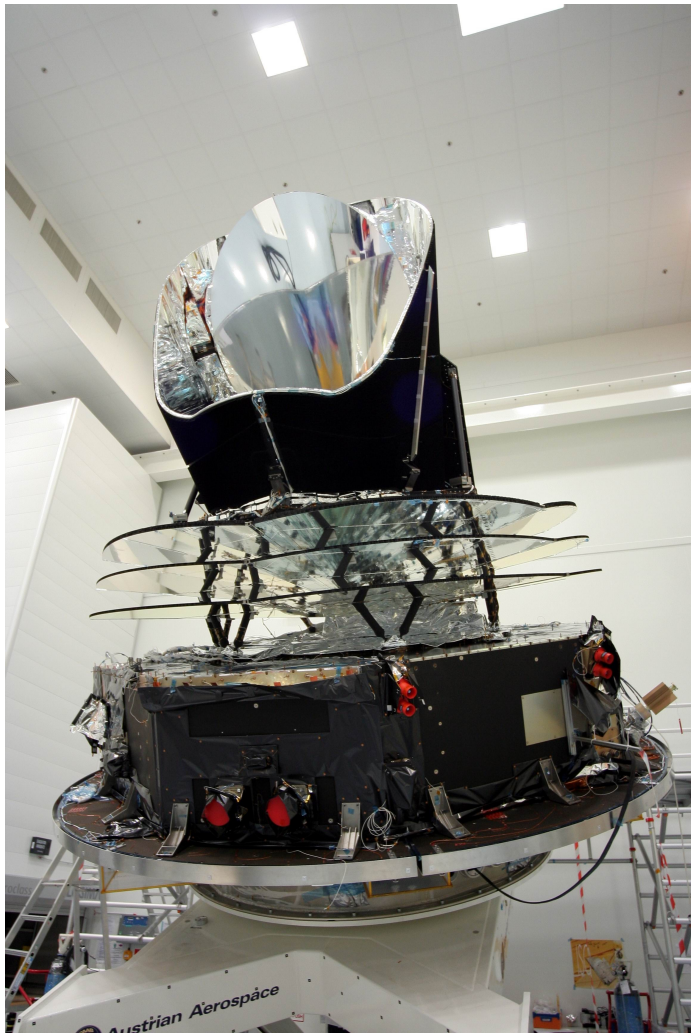
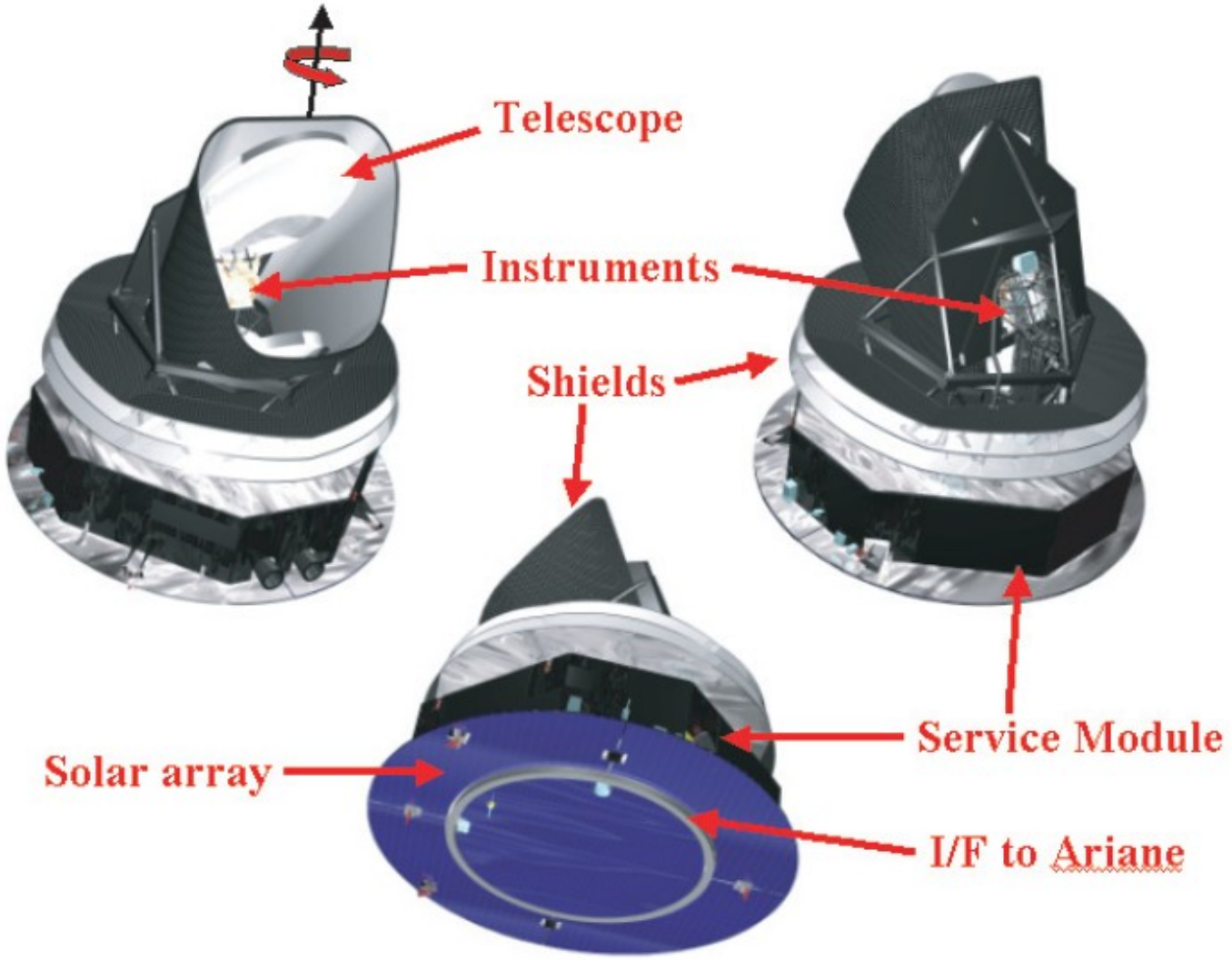
The Planck Surveyor

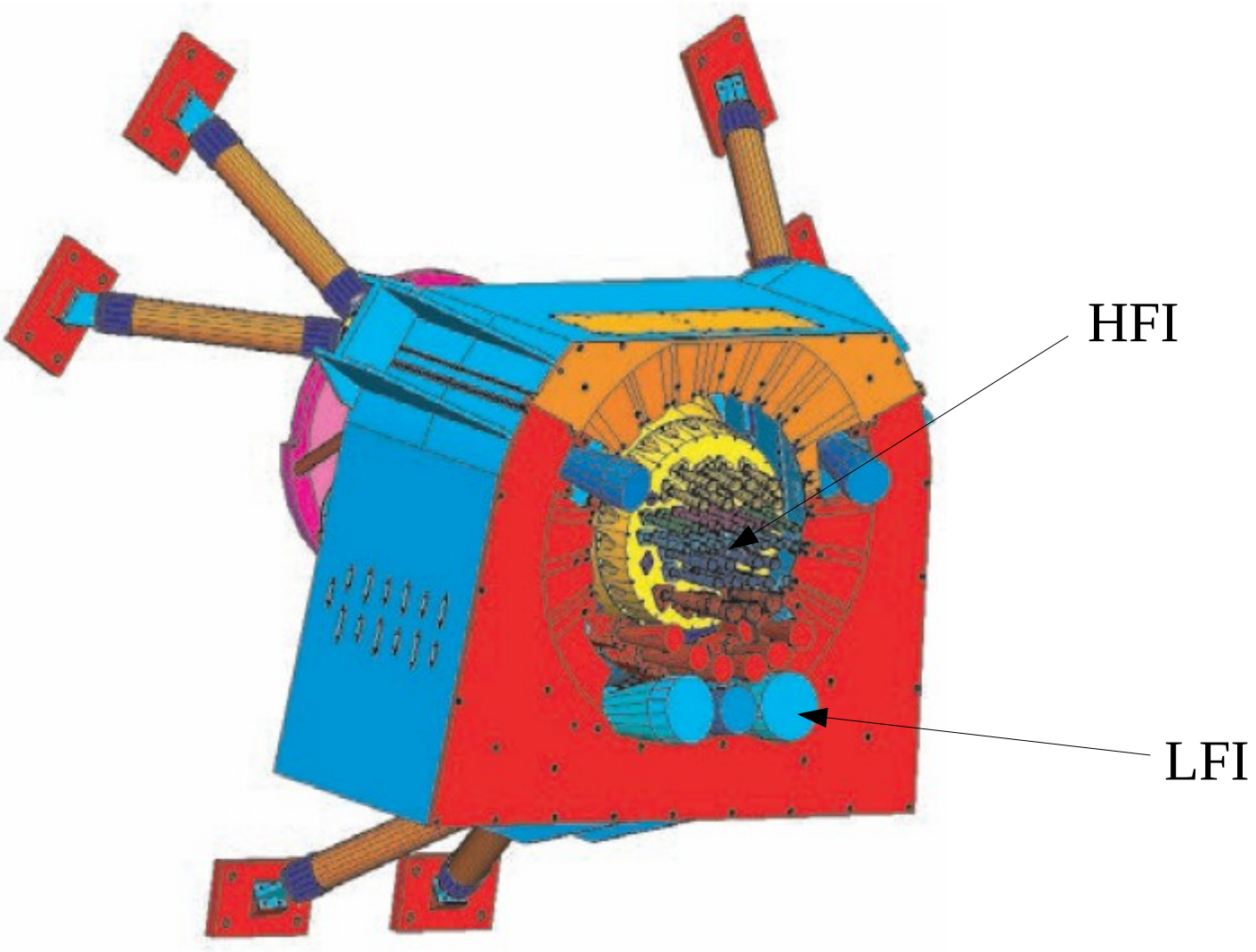
- European Space Agency space mission (contributions from NASA & CSA)
- Two instruments: High Frequency Instrument, Low Frequency Instrument
- Launch Date: October 31, 2008



Planck Spacecraft

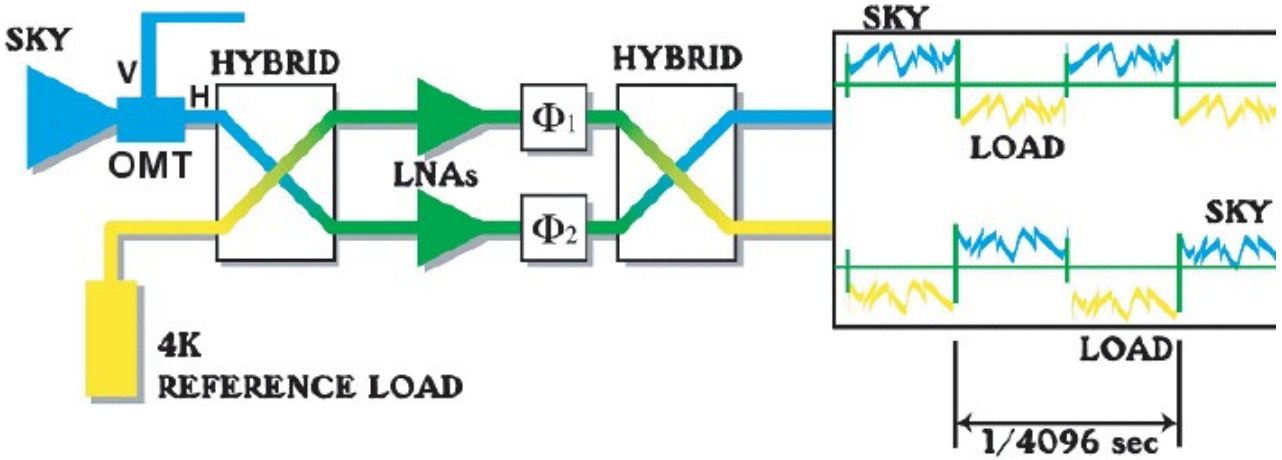


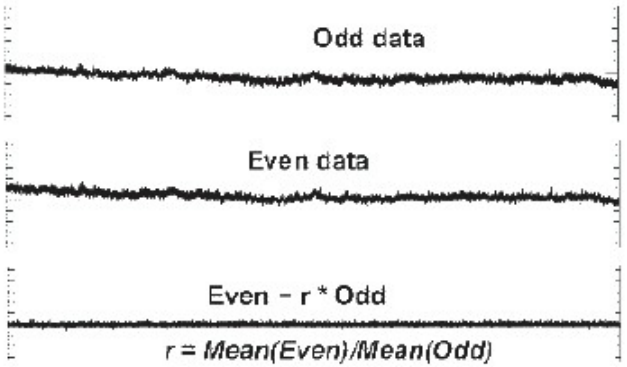
Planck Instruments



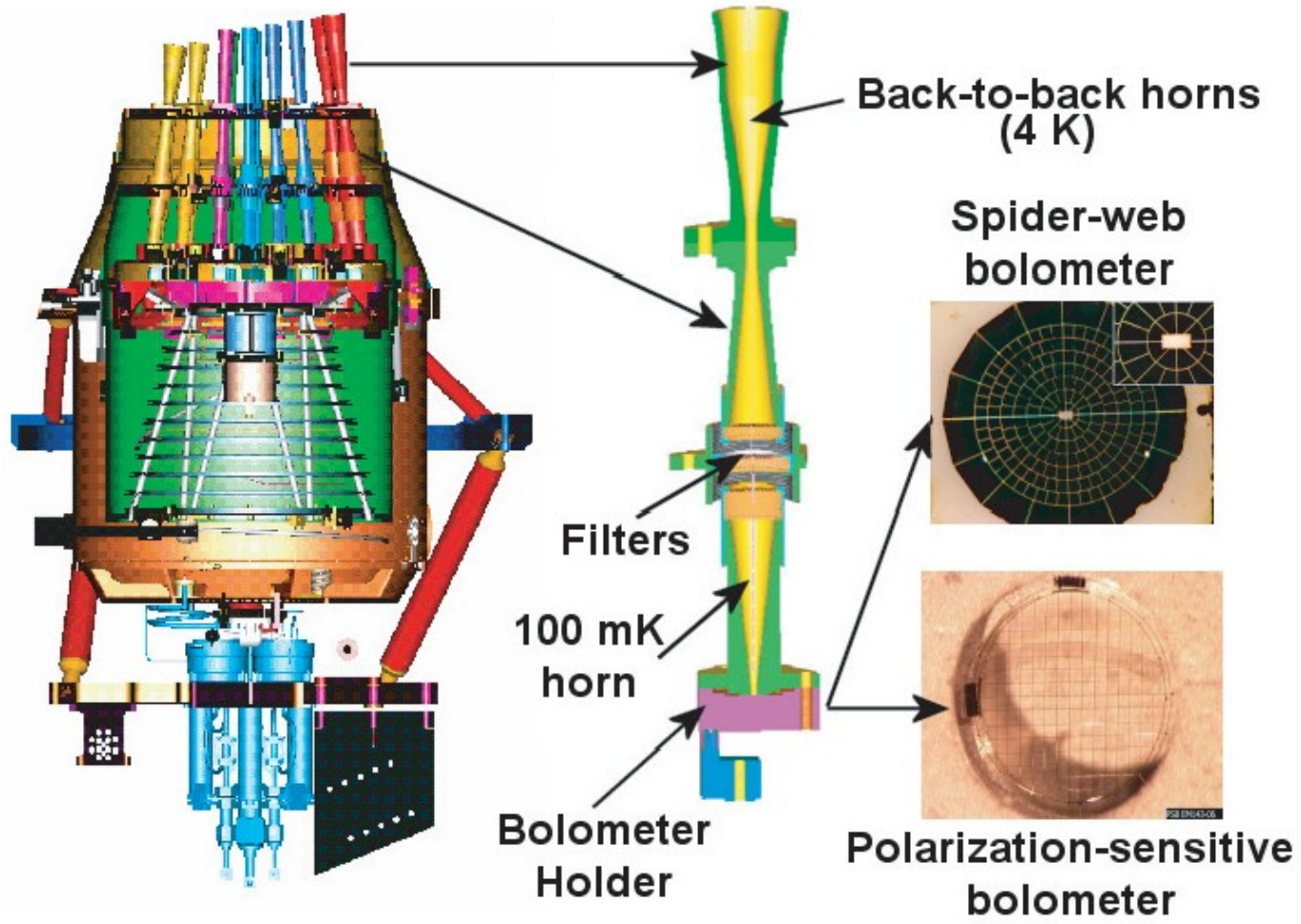
Low Frequency Instrument

- 2x30 GHz feeds, 3x44 GHz feeds, 4x70 GHz feeds

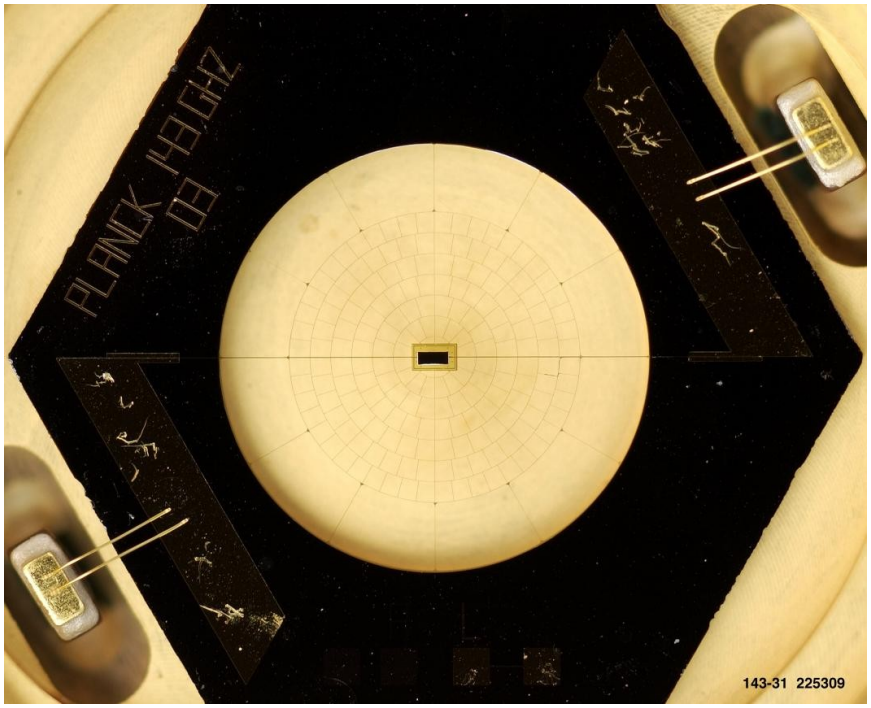


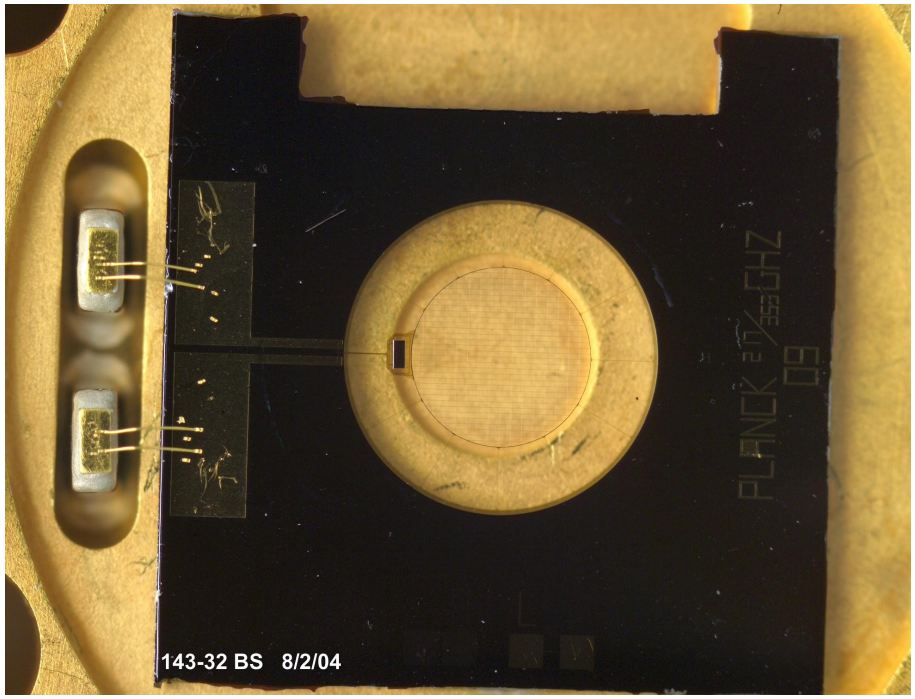


High Frequency Instrument



HFI Detectors





- JPL fabricated: micro machined spider-web and polarization sensitive absorbers, NTD germanium thermistors
- Spider-web bolometers as used in Boomerang-1998, ACBAR, Archeops
- PSB's as used in Boomerang-2003, BICEP,QUAD

HFI predicted performance

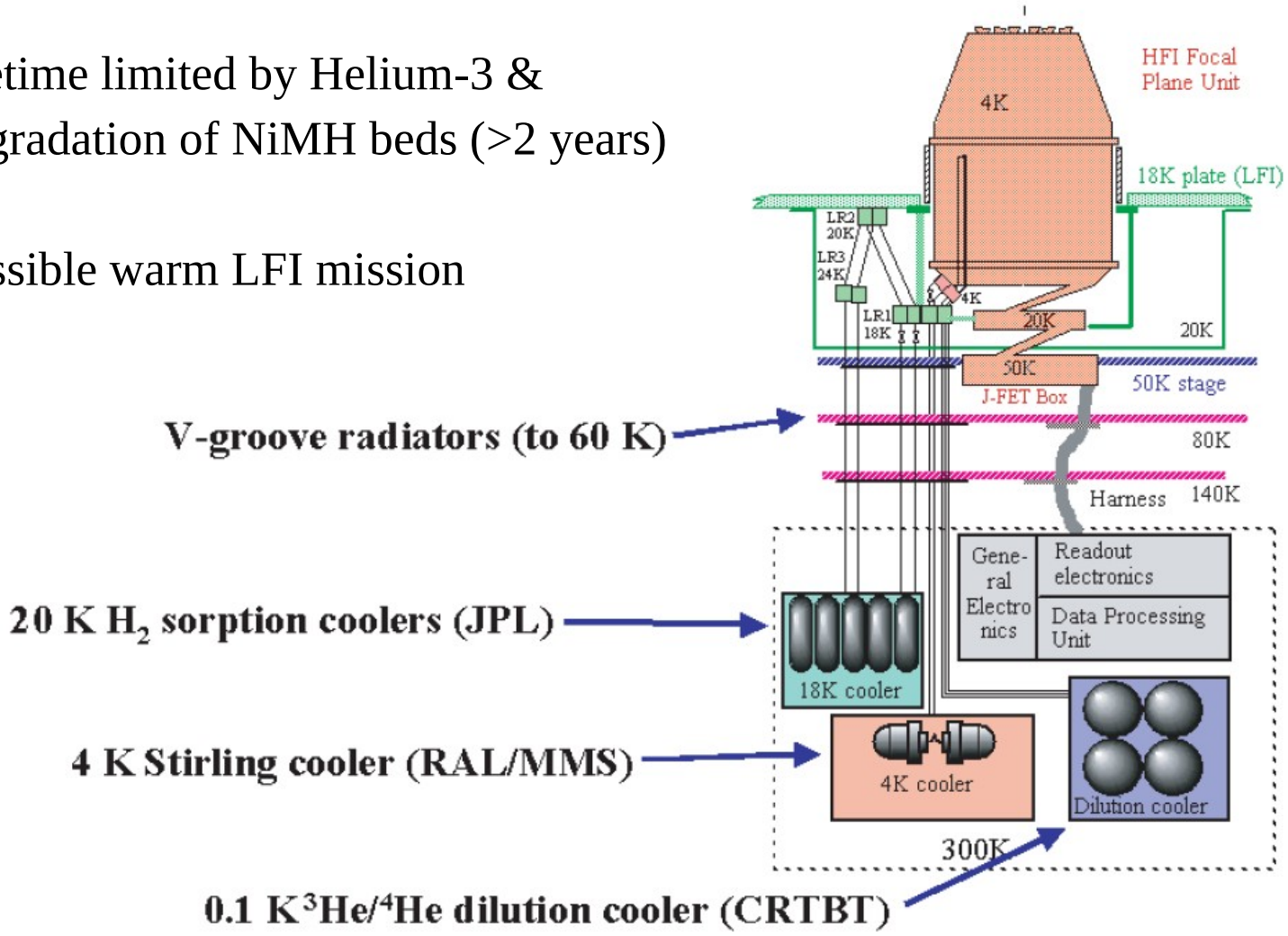
HFI Performance Goals[a]

Instrument Characteristic	Center Frequency [GHz]					
	100	143	217	353	545	857
Spectral resolution $\nu/\Delta\nu$	3	3	3	3	3	3
Detector technology	Spider-web and polarisation-sensitive bolometers					
Detector temperature	0.1 K					
Cooling system	20 K Sorption Cooler + 4 K J-T + 0.1 K Dilution					
Number of spider-web bolometers	0	4	4	4	4	4
Number of polarisation-sensitive bolometers	8	8	8	8	0	0
Angular resolution [FWHM arcminutes]	9.5	7.1	5.0	5.0	5.0	5.0
Detector Noise-Equivalent Temperature [$\mu K s^{0.5}$]	50	62	91	277	1998	91000
$\Delta T/T$ Intensity [b] [$10^{-6}\mu K/K$]	2.5	2.2	4.8	14.7	147	6700
$\Delta T/T$ Polarisation (U and Q)[b] [$10^{-6}\mu K/K$]	4.0	4.2	9.8	29.8	...	...
Sensitivity to unresolved sources [mJy]	12.0	10.2	14.3	27	43	49
ySZ per FOV [10^{-6}]	1.6	2.1	615	6.5	26	605

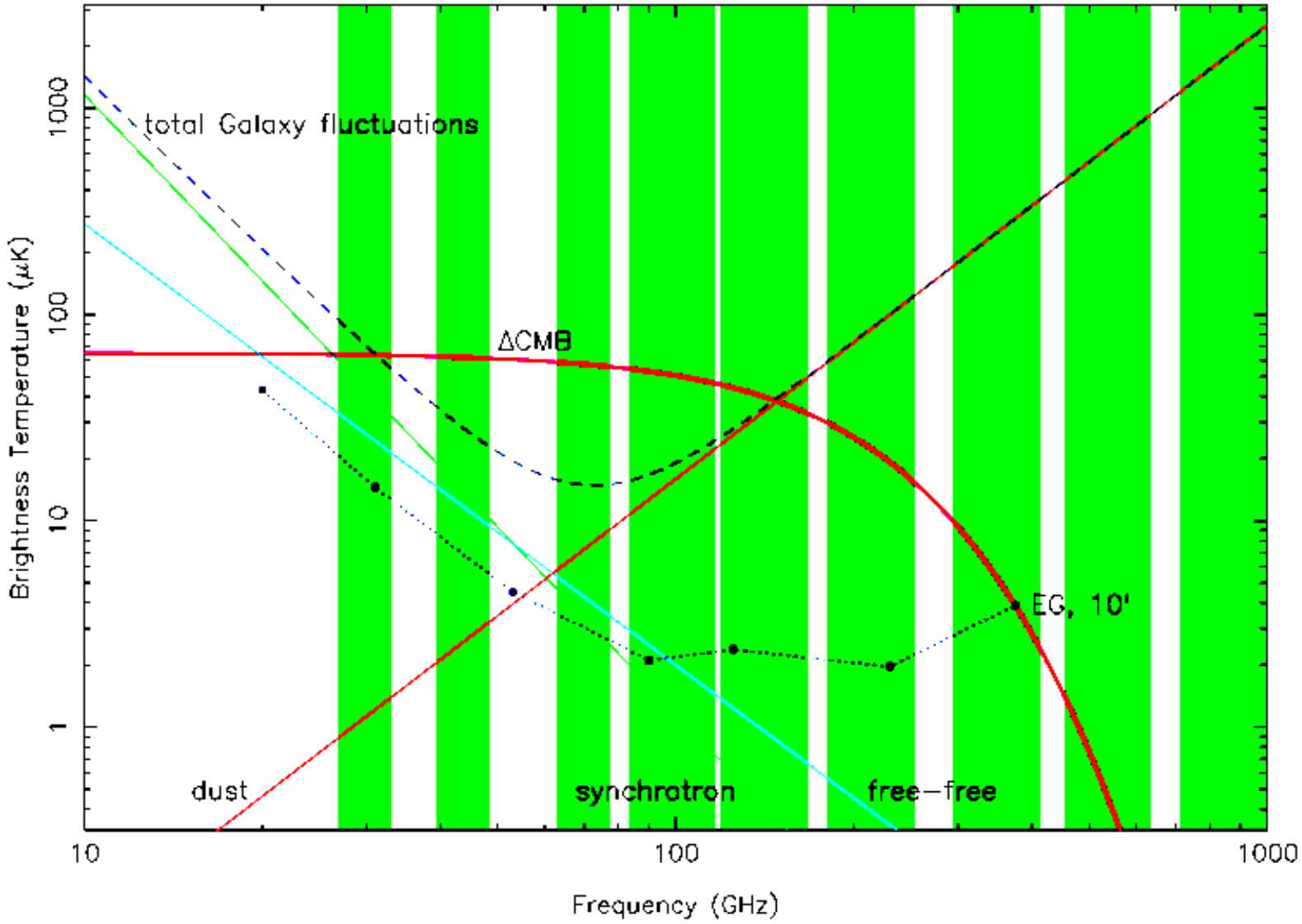
Cryogenics

lifetime limited by Helium-3 &
degradation of NiMH beds (>2 years)

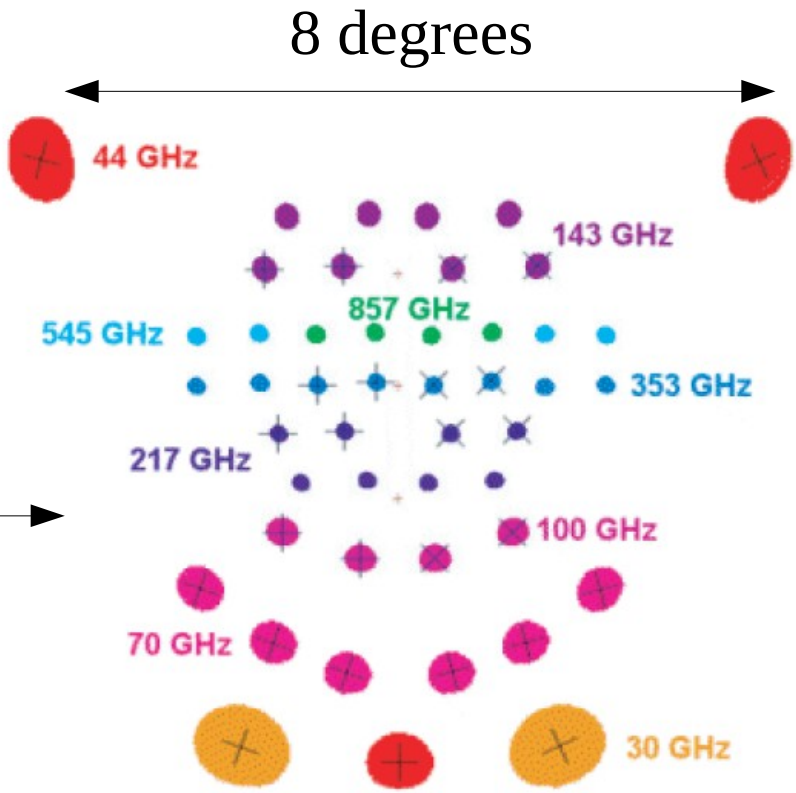
possible warm LFI mission



Planck bands



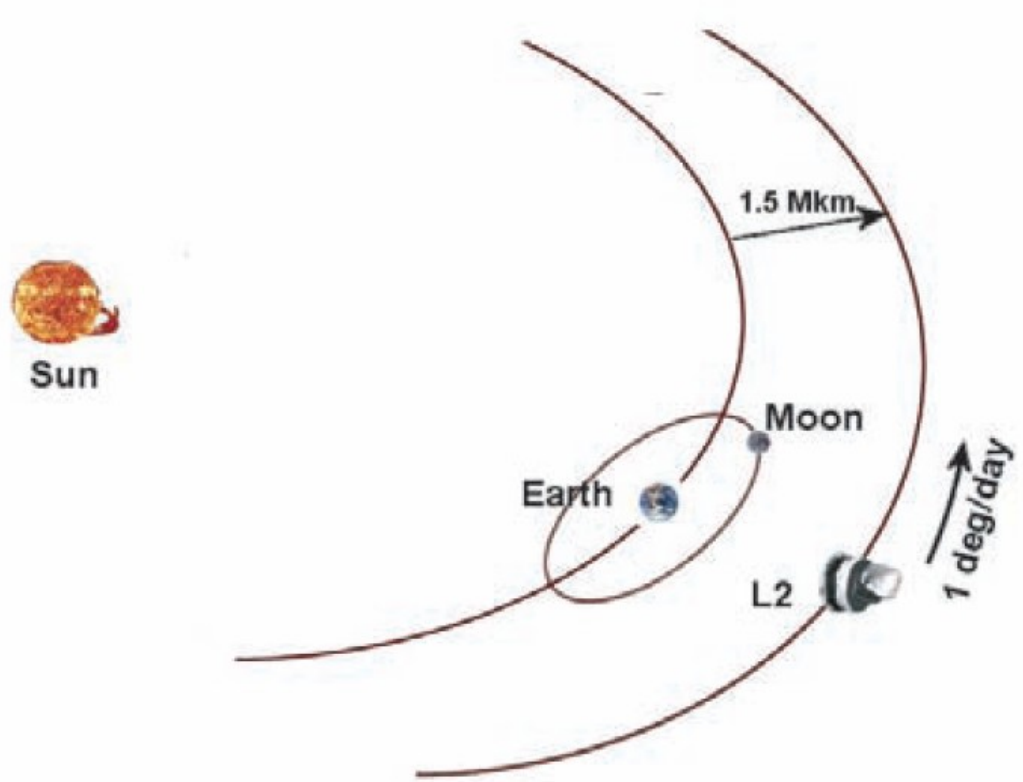
Planck's beams on the sky

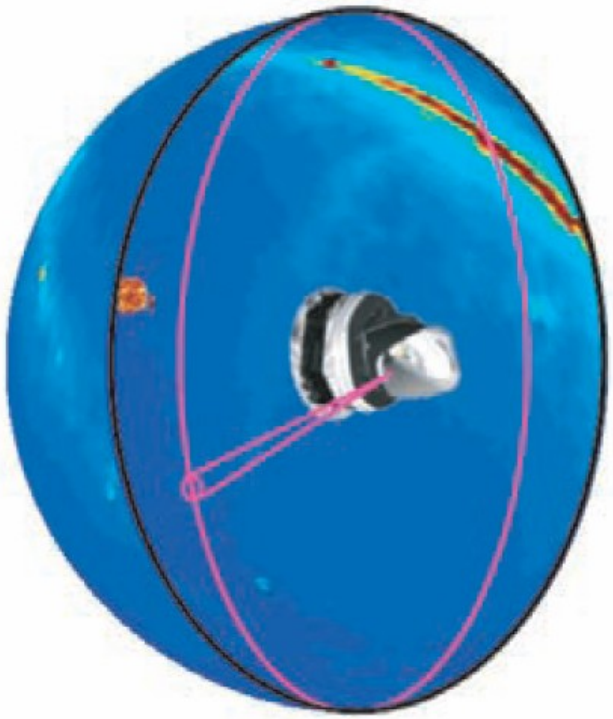


SUMMARY OF PLANCK INSTRUMENT CHARACTERISTICS

	LFI			HFI					
INSTRUMENT CHARACTERISTIC									
Detector Technology	HEMT arrays			Bolometer arrays					
Center Frequency [GHz]	30	44	70	100	143	217	353	545	857
Bandwidth ($\Delta\nu/\nu$)	0.2	0.2	0.2	0.33	0.33	0.33	0.33	0.33	0.33
Angular Resolution (arcmin)	33	24	14	10	7.1	5.0	5.0	5.0	5.0
$\Delta T/T$ per pixel (Stokes I)[a]	2.0	2.7	4.7	2.5	2.2	4.8	14.7	147	6700
$\Delta T/T$ per pixel (Stokes Q &U)[a]	2.8	3.9	6.7	4.0	4.2	9.8	29.8	...	...

Planck's scan strategy

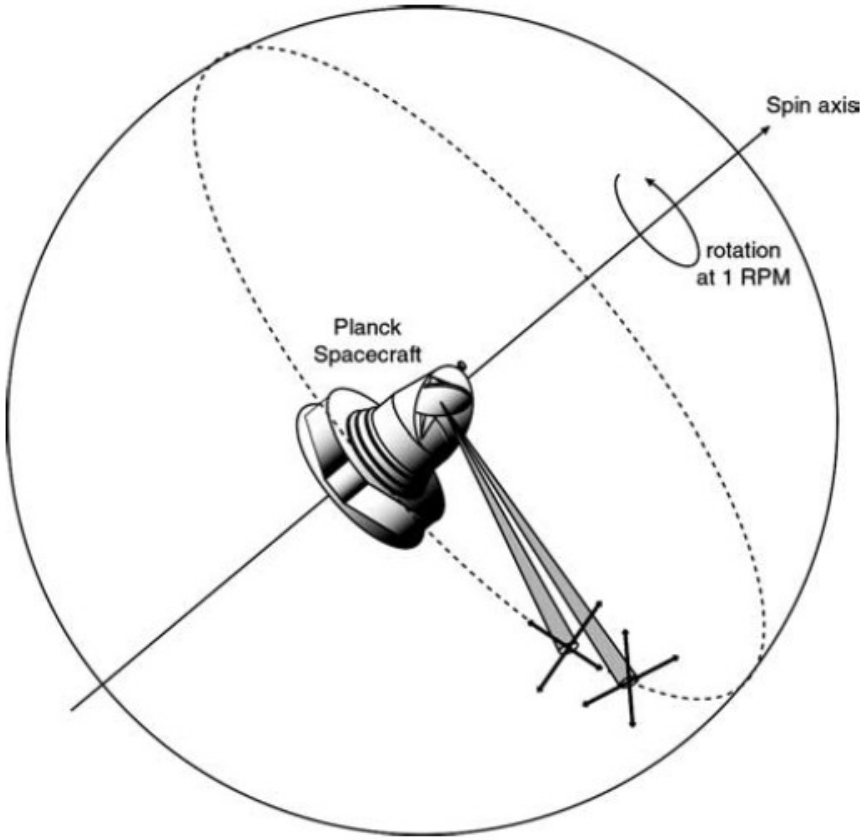




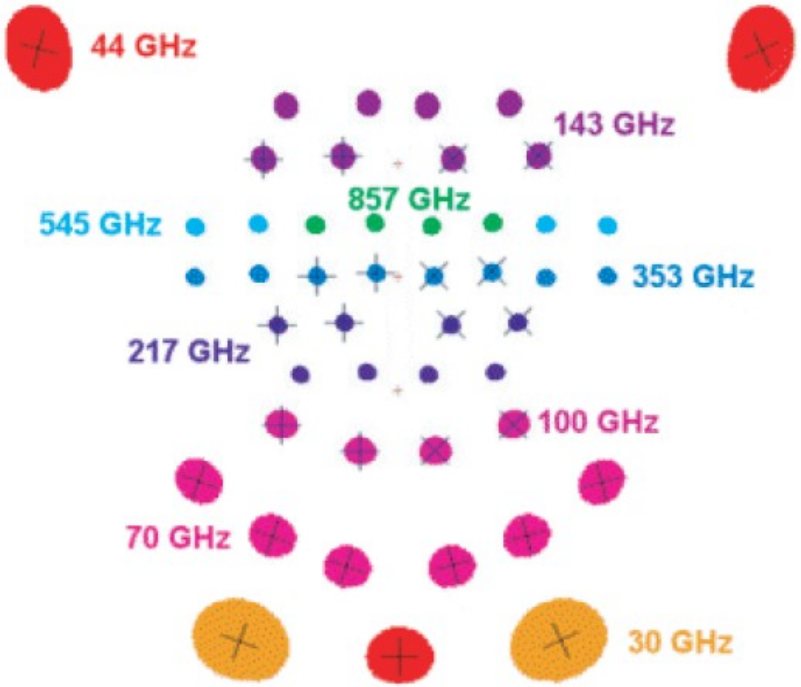
original idea: spin axis fixed for 1 hour, repoint by 2.5'

see dipole at 1rpm

Polarimetry with Planck



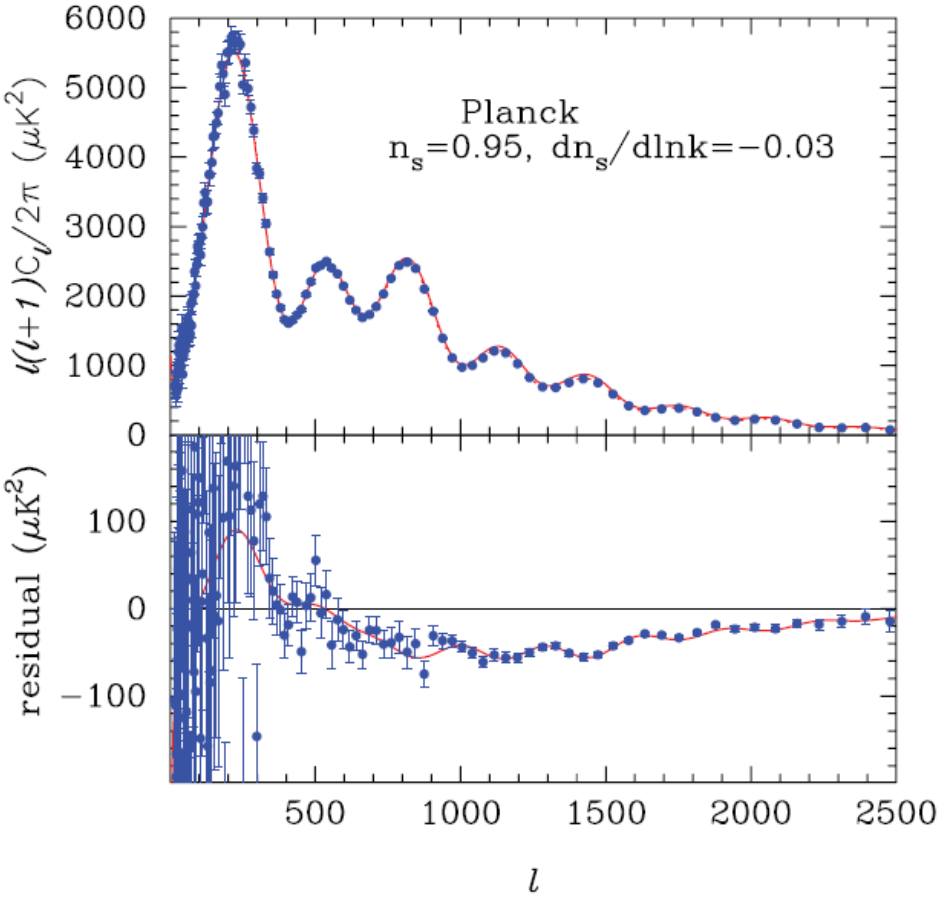
polarization modulation **only** by scan



from: Delabrouille, Astrophysics & Space Science 290 (2004)

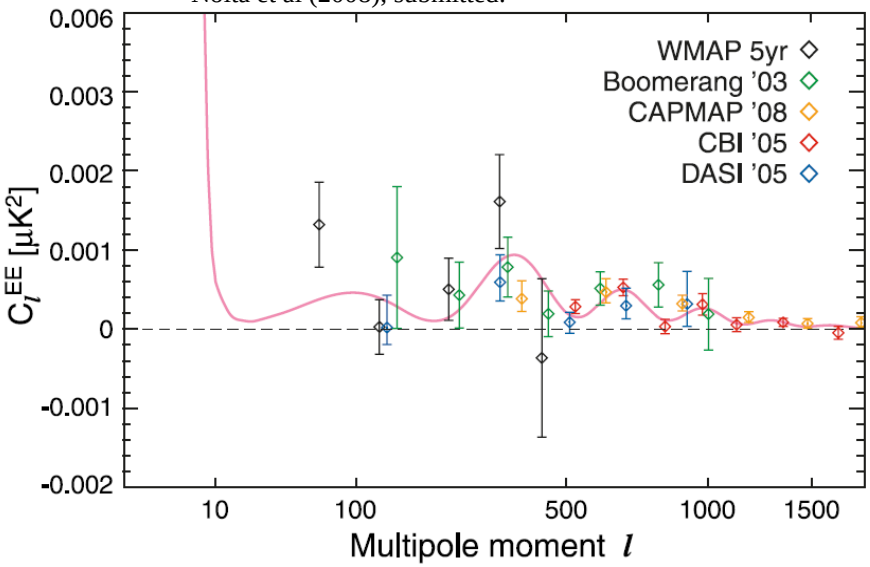
The Power of Planck

- Temperature anisotropies
  - Cosmic variance limited ell<2500
- Polarization
  - Cosmic variance limited measurement of <EE> ell<1000
- Secondary Anisotropies
  - lensing
  - Sunyaev-Zeldovich
- Extragalactic Science
  - radio, dusty galaxies, IRB
- Galactic Science
  - 7 polarized bands from 22 to 353
  - dust physics, magnetic fields

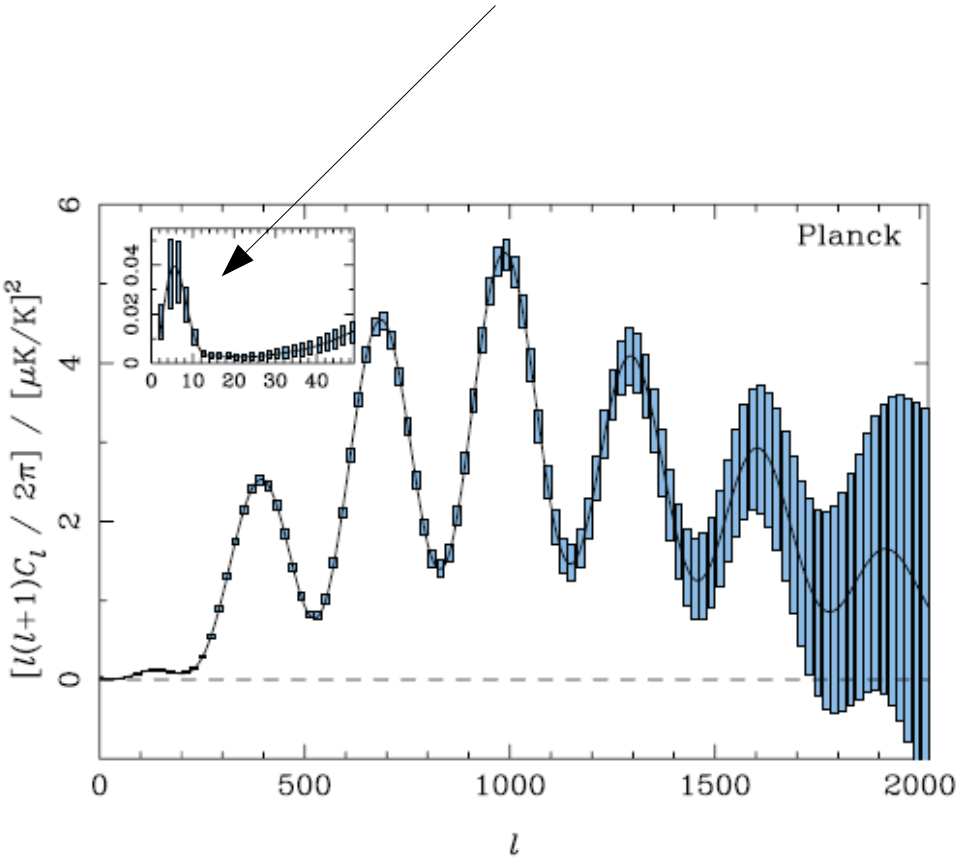


E-mode polarization

Nolta et al (2008), submitted.

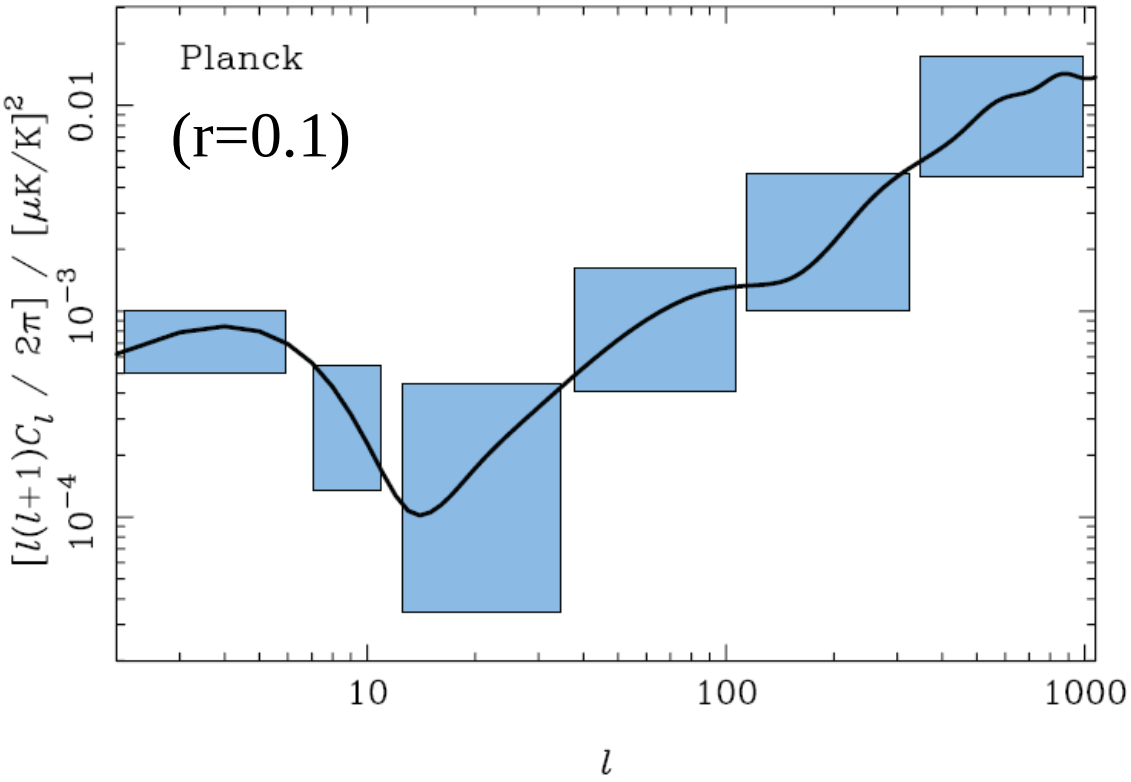


reionization bump



Sensitivity to B-modes: the ideal case

- **Assuming no systematics:**



Canadian Contributions to Planck

- Scientific participation in Consortium, Core Teams, Working Groups
- DRAO Planck Deep Field
- CSA-funded activities:
  - Quick-Look analysis software (kst)
  - Trend Analysis pipeline for HFI

Schedule

- **Full cryovac tests of spacecraft & all instruments: May-June 2008**
- **Launch October 31, 2008**
- **Survey begins ~Jan 2009**
- **First public data product (Early Release Compact Source Catalog) ~July 2010**
- **Eventually: full sky maps, TOD's, etc.**

For more information:

Planck: The Scientific Programme (2005)

http://www.rssd.esa.int/index.php?project=Planck