Contribution to the framework document of the HIFI/Herschel Calibration group

Carsten Kramer

KOSMA, Universität zu Köln

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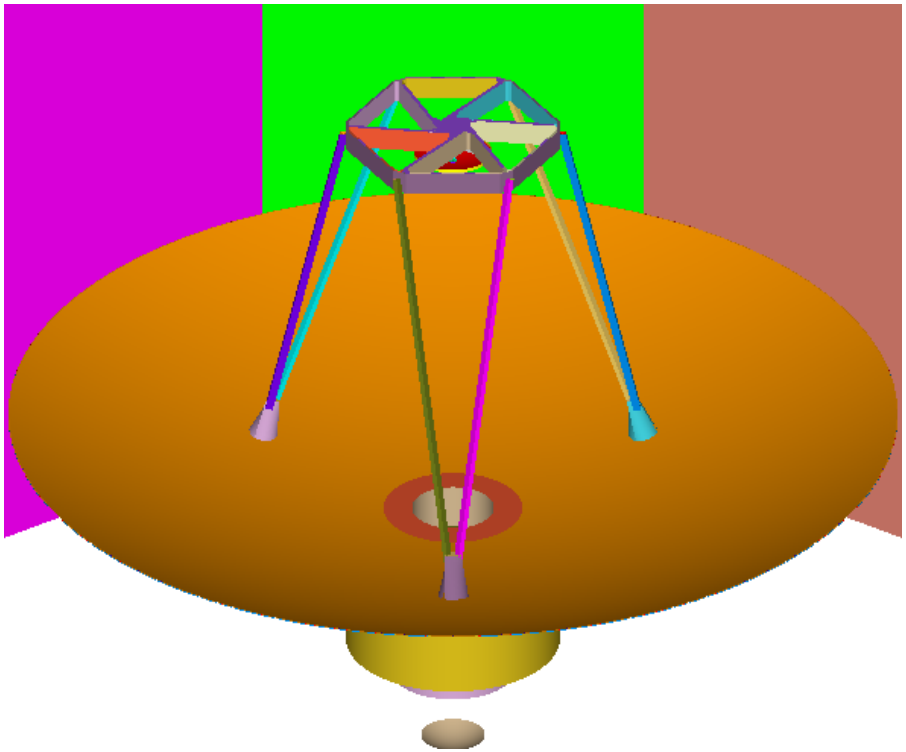
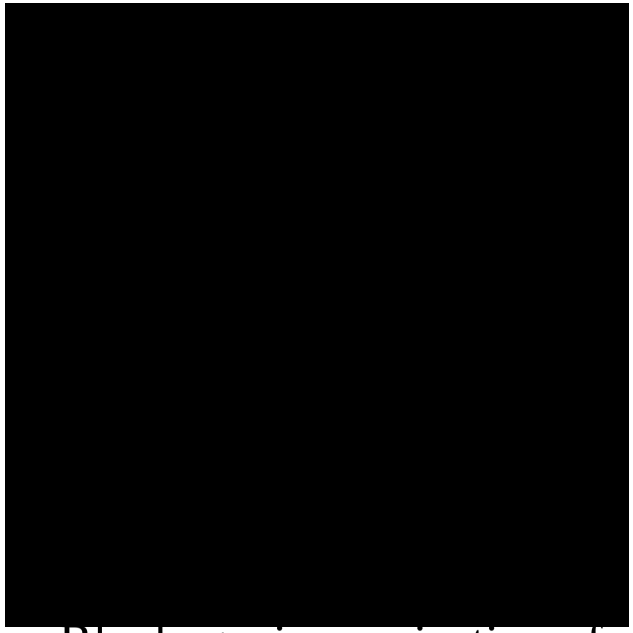
Beam properties of HIFI/Herschel

Primary and secondary optics





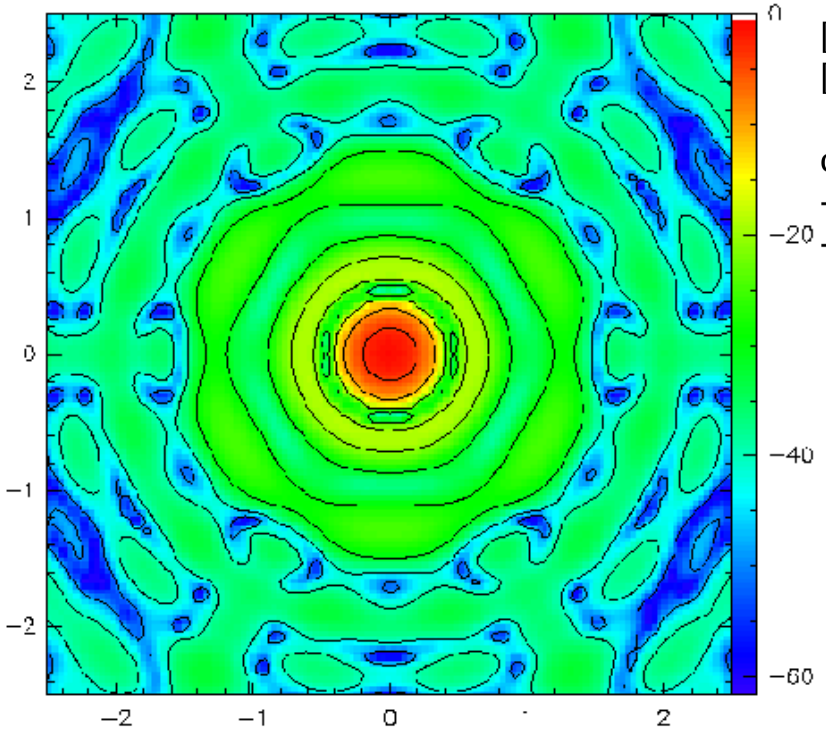
Blockage, i.e. projection of hexapod, secondary, and secondary frame

Diameter of primary: 3.5m
Effective aperture diameter: 3.28m
Diameter of secondary: 308.1mm (0.9% of effective aperture)
Diameter of central hole in primary: 560mm (3%)
+spider legs + hexapod structure: (7.7%)

Beam properties of HIFI/Herschel

Estimate of the expected beam pattern

(Urs Graf & CK, preliminary results.)



[arcmin]
[dB]

contourlevels:
-3dB,-10dB,-20dB,
-30dB,...

One of the important parameters: the main beam efficiency:

B_{eff}=72% assuming an edge taper of 11dB, effective aperture of 3.28m

B_{eff}=57% at 1.9THz assuming a surface error of 6μm rms (specification is 3microns!)

i.e. more than 30% of detected radiation from outside the main beam.

Beam properties of HIFI/Herschel

Plans to measure the beam pattern
Possible primary calibrators

Body	Date	D	ν	T_B	$S_{\nu,tot}$	$S_{\nu,beam}$	T_A^{SSB}	SNR	t_{int}^{20dB}	t_{int}^{30dB}
		["]	[THz]	[K]	[Jy]	[Jy]	[K]	1 sec	[sec]	[sec]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Saturn	15/ 4/2008	18.1	1.90	135.0	63203.	27593.	94.57	935.	11msec	1sec
Mars	1/ 1/2008	15.4	1.90	210.4	81752.	43431.	148.86	1471.	5msec	462msec
Mars	1/ 9/2008	3.9	1.90	196.1	4747.	4537.	15.55	154.	423msec	42sec
Uranus	1/ 1/2008	3.4	1.90	39.8	246.	238.	0.82	8.	154sec	257min
Ceres	8/10/2002	0.7	1.90	169.0	124.	124.	0.43	4.	9min	944min

(Assumptions: Bandwidth=1 GHz, T_{sys}(SSB)=1600K, white noise, A_{eff}=56%, HPBW=11arcsec)

Specific selection criteria:

- Aperture efficiency: strong point-source (Mars at times, Uranus, Ceres)
- Beam efficiency: strong source filling the beam
- Beam pattern: very strong source, point-like, no good models needed: Mars

General selection criteria:

- good models (extrapolation to 2 THz):
  Uranus (e.g. R.Moreno), Mars? (e.g. Forget), Asteroids?? (e.g.Hughes)
- few atmospheric lines: Uranus
- Visibility !!!

Beam properties of HIFI/Herschel

The best observing mode

Stability time of the total system:

Allan time = 150sec at 1MHz resolution (from SWAS experience)

✕-15sec at 1GHz resolution

Double-Beamswitched Observations

but: maximum throw is 3 arcmin only

OTF-DBS for beam pattern observations ?