
Image quality of HMI

Richard Wachter, Jesper Schou
and the HMI calibration team

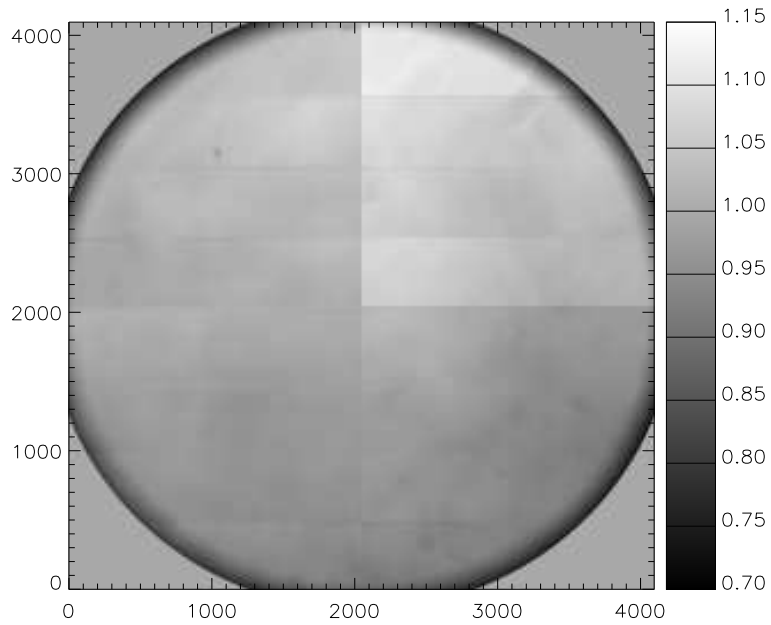
HEPL, Stanford University

HMI flatfield

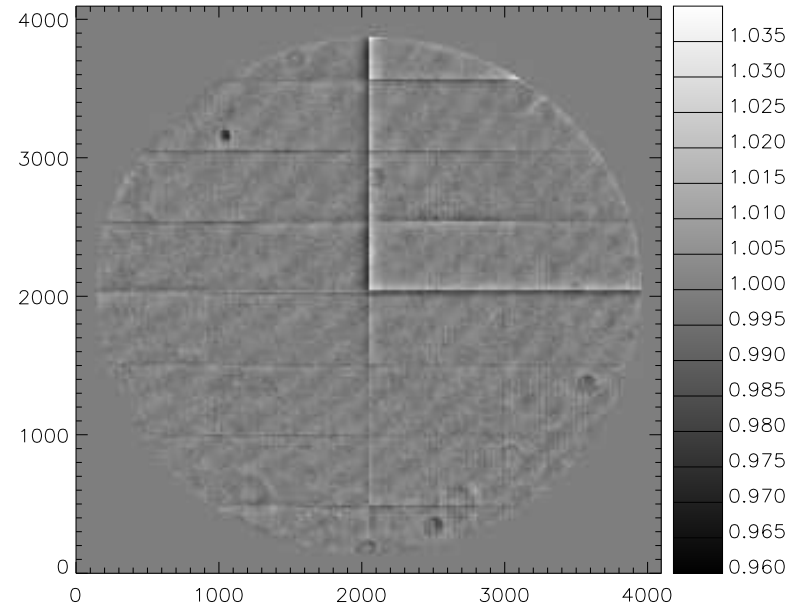
Three different ways of obtaining the flatfield:

- Large scales: Spacecraft offpoint (or leg) flatfield (see Kuhn, Lin, & Loran 1991, PASP)
- Medium scales: PZT flatfield
- Small scales: Rotational flatfield (see: Wachter & Schou, Solar Physics 2009)

Front camera flatfield

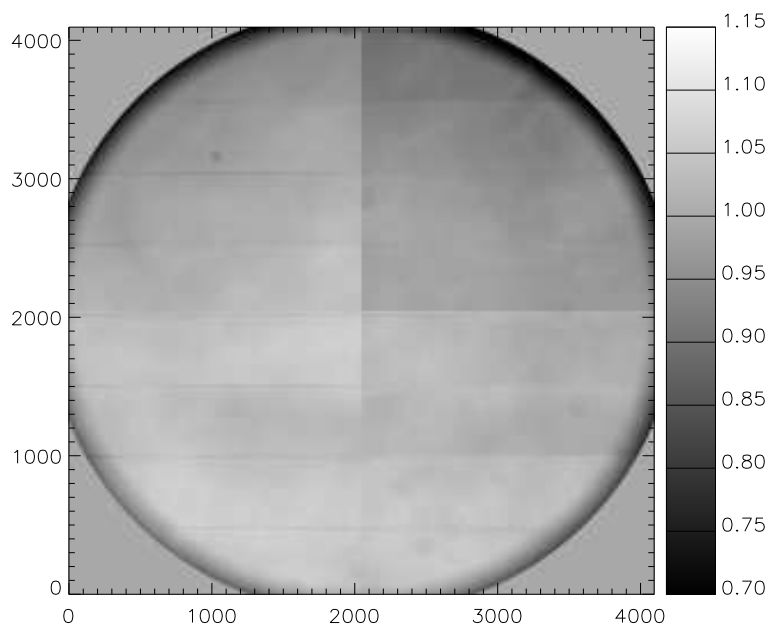


Offpoint flatfield

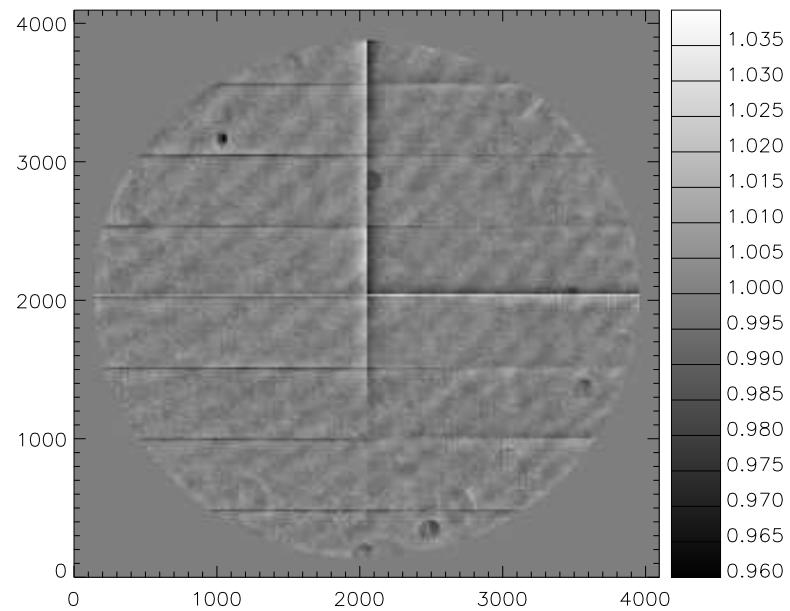


PZT flatfield

Side camera flatfield



Offpoint flatfield



PZT flatfield

Flatfield accuracy

Large scale flatfield: $\approx 1\%$ estimated from residuals

on ground: Vignetting

in space: Doppler shift due to spacecraft motion, Solar Activity

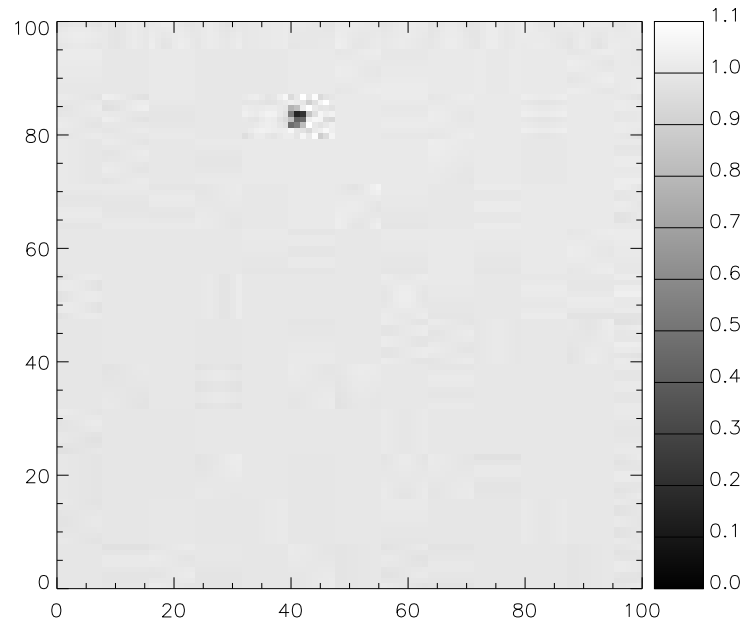
PZT flatfield: $\gtrsim 0.2\%$ estimated from simulations

Photon Noise, Interpolation Errors

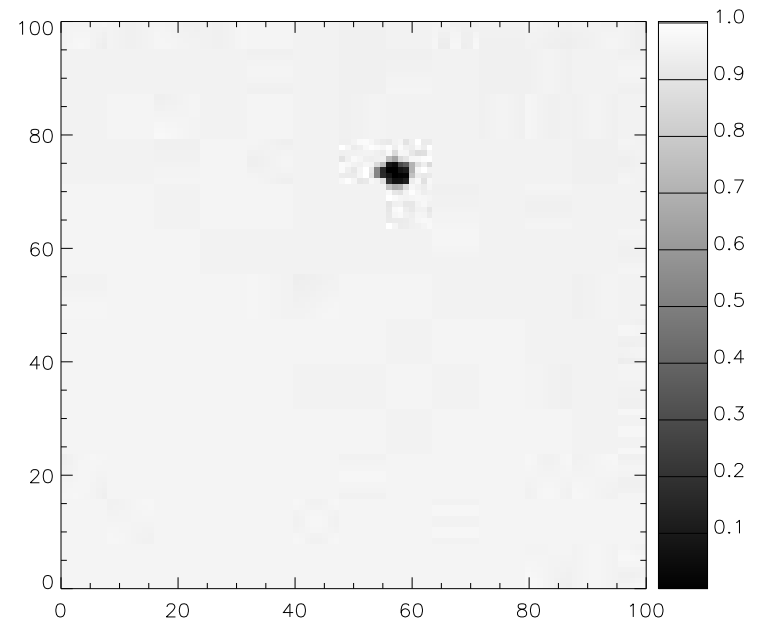
Rotational flatfield: 0.1% estimated from MDI high-res data

temporal changes of granulation and solar activity

Dust specs



Front camera



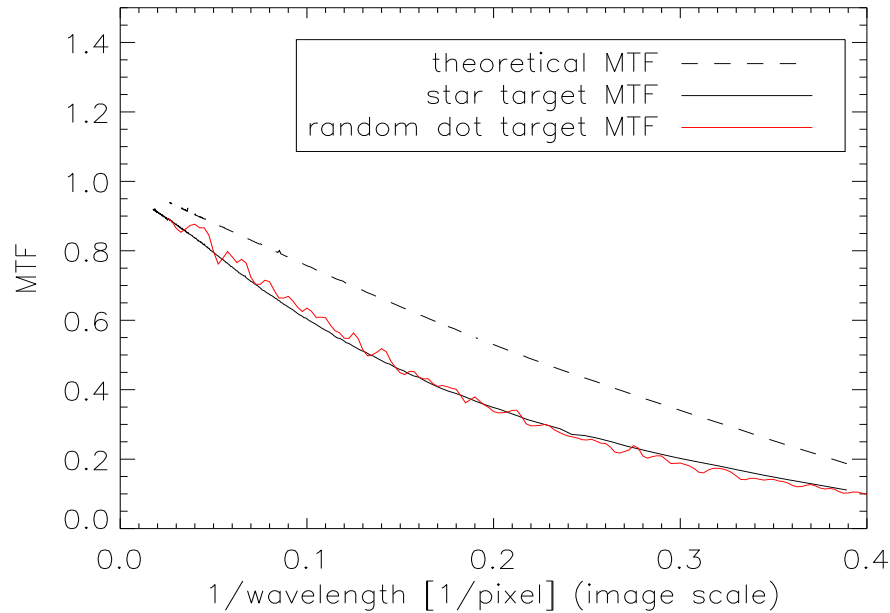
Side camera

Field curvature

Field curvature: Field dependence of the Focus

- Focus gradient from bottom to top: ≈ 0.5 steps for side camera
- Focus gradient from left to right: ≈ 0.0 steps
- Field curvature from center to edge: ≈ 0.4 steps

MTF



Combined Stim Tel and

Instrument:

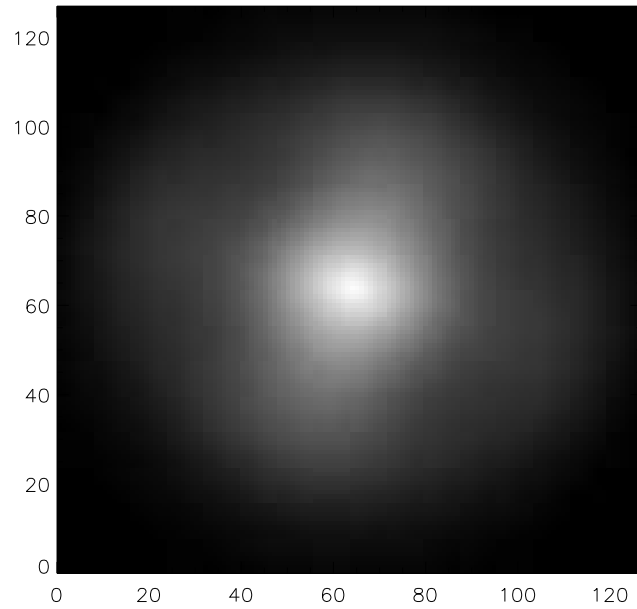
Strehl ratio: 0.8

Main uncertainty:

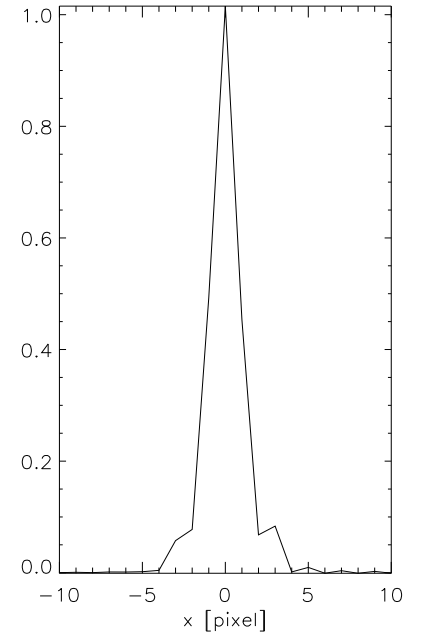
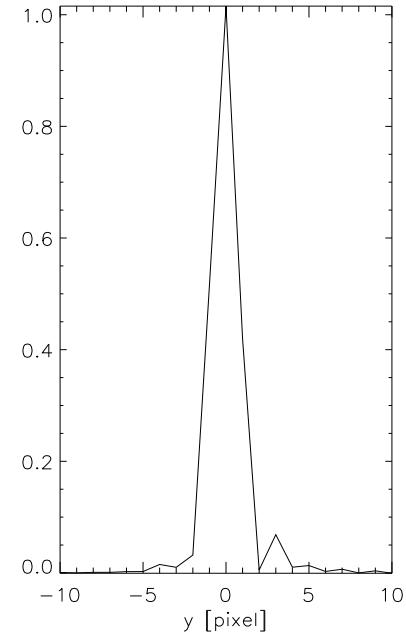
Air currents, Jitter

MTF for best focus

Point spread function from Phase Diversity Measurement

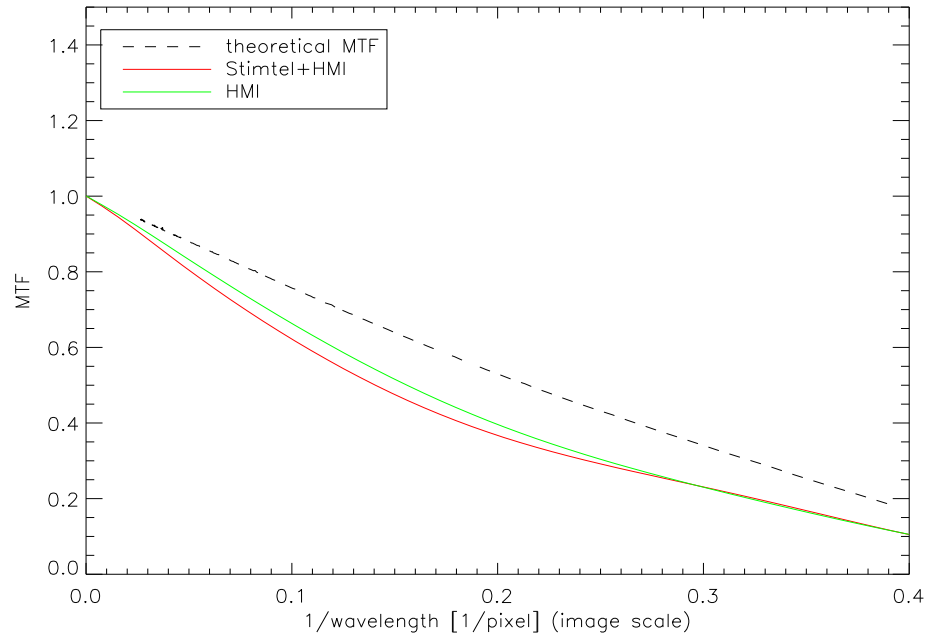


MTF front camera



cuts through PSF

MTF in Orbit



In space:
Phase diversity measurements

Eclipse

Camera alignment

Date	x [pix]	y [pix]	rot [deg.]
08-13-2009	-8.3	5.0	0.083
09-10-2008	-7.9	4.2	0.082
06-19-2008	-6.6	5.0	0.081
02-18-2008	-6.6	5.5	0.082
02-14-2008	-6.4	5.7	0.081
01-30-2008	-6.2	5.3	0.082
11-03-2007	-6.1	4.3	0.079
11-02-2007	-6.2	4.3	0.080
10-28-2007	-6.7	3.5	0.080
10-14-2007	-4.5	4.5	0.082
