

HMI Instrument Status

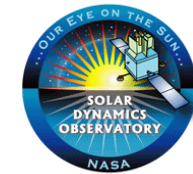
Jesper Schou

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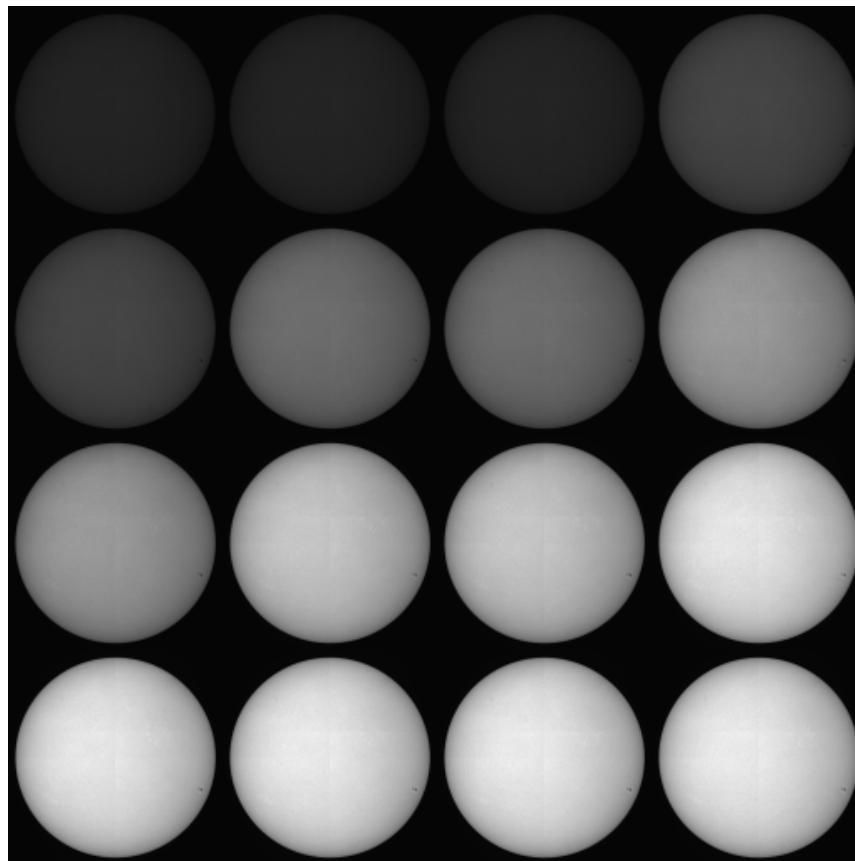
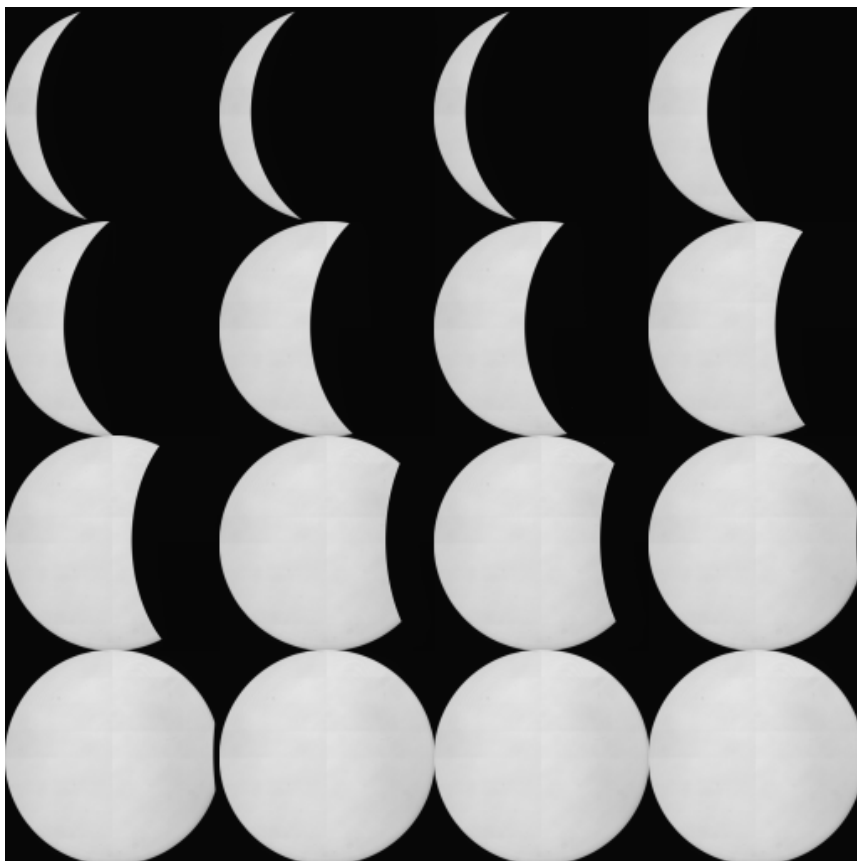
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Overview



- The damned thing works!
- Any questions?





Overview



- **Calibration Status**
 - Image quality
 - Wavelength dependence
 - Polarization
 - Miscellaneous
- **Outstanding issues and plans**



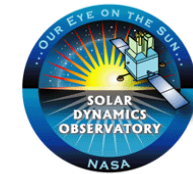
Observing Scheme



- **Make I, Q, U, V, LCP, RCP from filtergrams**
 - Identify bad pixels
 - Correct for flat field and exposure time
 - Fill in space
 - Correct for solar rotation and jitter (spatial interpolation)
 - Correct for acceleration effects and fill in time (temporal interpolation)
 - Nyquist criterion almost fulfilled for Doppler and LOS
 - Nyquist is grossly violated for vector measurements in case of long framelists
 - Clever tricks exist
 - Apply demodulation matrix
- **MDI-like and/or least squares for Doppler and LOS**
- **Fast and/or full inversion for vector field**
 - First average in time if desired



Framelist Example



5 Position Framelist

Time(s)	0	8	16	24	32	40	48	56	64	72
Tuning	I1	I2	I3	I4	I5	I1	I2	I3	I4	I5
Doppler pol.	L R	L R	L R	L R	L R	L R	L R	L R	L R	L R
Vector pol.	1 2	1 2	1 2	1 2	1 2	3 4	3 4	3 4	3 4	3 4

- **Time:** Time of first exposure at given wavelength since start of framelist execution
- **Tuning:** I1, I2, ... specify the tuning position
- **Doppler pol.:** Polarization of image taken with Doppler camera
 - L and R indicate left and right circular polarization
 - Used for Doppler and line of sight field
- **Vector pol.:** Polarization of image taken with vector camera
 - 1, 2, 3, 4: Mixed polarizations needed to make vector magnetograms
 - Used for vector field reconstruction
- **T data from the two cameras may be combined**

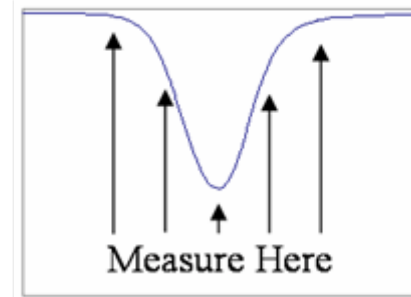
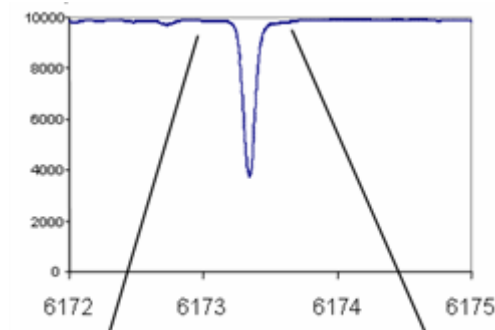




Image Quality and Wavelength Dependence



- **Too complicated for me to figure out**
 - So, what to do?



Image Quality and Wavelength Dependence



Delegate!



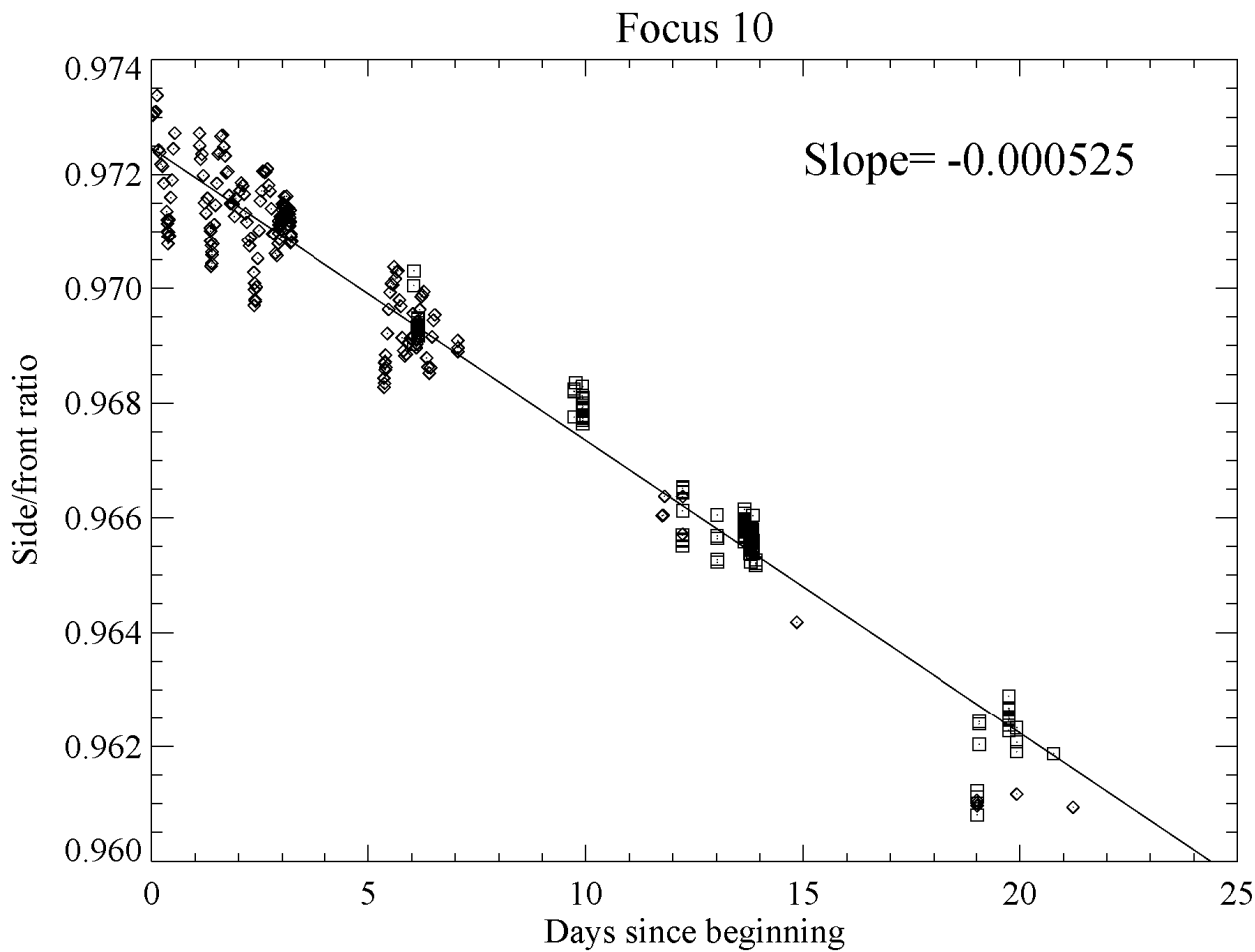
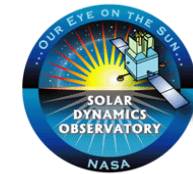
Polarization



- **Status**
 - Things look good
 - Instrumental polarization appears low, about 0.02%
- **To do**
 - Better estimate and correct for instrumental polarization
 - Decide on exact settings and order
 - Min crosstalk
 - Min wear
 - Zero point for temperature dependence

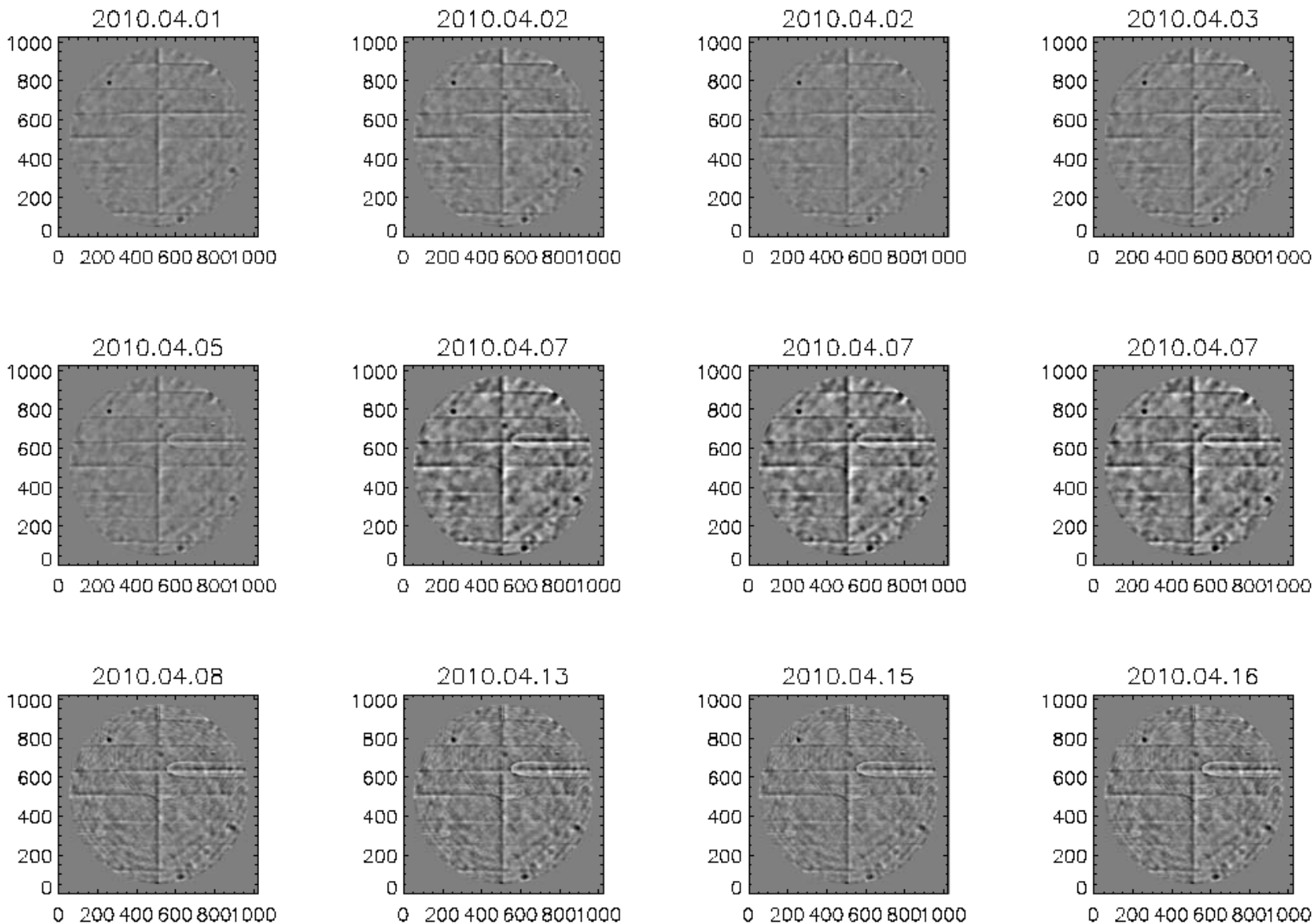


Miscellaneous – LED Ratio





More LED Ratio





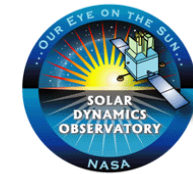
Framelist Choices Polarization Scheme



- **Options 1 and 2 – Cameras not combined**
 - Same polarimetric noise per unit time
 - Option A (LCP/RCP on one, Mod A on other) is relatively fast (vector@90s)
 - Some Stokes parameters are made from differences over long time intervals (40-50s)
 - Significant acceleration effects
 - Option C (LCP/RCP on one, Mod C on other) is slower (vector@135s)
 - But all differences are close in time (4s)
 - Almost no acceleration effects
- **Options 3 and 4 – Cameras combined**
 - Depends on ability to combine the cameras
 - Option L (LCP/RCP on one, linear on other) only vector combined (vector@90s)
 - Better polarimetry than 1 and 2
 - Calibrations on vector camera does not impact Doppler continuity
 - Option X (Mod A divided on cameras) combines to make both (vector@45s)
 - Even better polarimetry
 - Also better Doppler
 - But calibrations interrupt Doppler
- **Time averaging helps**



Framelist Examples – Polarization Scheme



Option 1 **A**

Time(s)	0	...	32	40	...	72
Tuning	I1	...	I5	I1	...	I5
Doppler	L R	L R	L R	L R	L R	L R
Vector	1 2	1 2	1 2	3 4	3 4	3 4

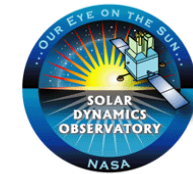
Option 2 **C**

Time(s)	0	...	32	40	...	72	80	...	112
Tuning	I1	...	I5	I1	...	I5	I1	...	I5
Doppler	L R	...	L R	L R	...	L R	L R	...	L R
Vector	A B	...	A B	C D	...	C D	L R	...	L R

L=LCP, R=RCP, 1, 2, 3 and 4 combinations of I, Q, U and V,
 A=I-Q, B=I+Q, C=I-U, D=I+U.



Framelist Examples – Polarization Scheme



Option 3 **L**

Time(s)	0	...	32	40	...	72
Tuning	I1	...	I5	I1	...	I5
Doppler	L R	L R	L R	L R	L R	L R
Vector	A B	A B	A B	C D	C D	C D

Option 4 **X**

Time(s)	0	...	32
Tuning	I1	...	I5
Camera 1	1 2	1 2	1 2
Camera 2	3 4	3 4	3 4



Outstanding Issues



- **To combine or not to combine - that is the question!**
- **Better polarization and potentially Doppler if combined**
 - But
 - Flatfield
 - LED ratio drift
 - Detune difference
 - Roll angle variability
 - PSF/MTF/OTF difference including focus difference
 - ...
- **Some other issues**
 - ISS gain
 - Camera gain
 - Image center
 - Window temperature
 - Affect focus and depolarization
 - Polarization
 - Order, settings,



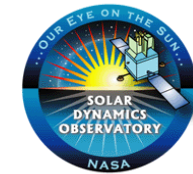
Plans



- **No combination for Doppler**
 - So no X
- **Probably no combination for vector**
 - So probably A or C
- **May change later**
- **Run calibrations once in a while**
 - Darks
 - Focus
 - Detunes
 - Flat fields
 - PZT
 - Offpoint
 - Roll maneuvers
 - ...



Conclusion - Continued



- **Instrument works!**
- **Some issues to resolve**
- **Have lots of data:**
 - Type A: 129 hours
 - Type C: 192 hours
 - Type L: 44 hours
 - Type M: 13 hours
 - Type X: 25 hours
 - Sim M: 1.4 hours
 - Fast Q: 23 hours
 - Fast V: 22 hours
 - Fast H: 20.5+ hours
 - Roll: 18 hours
 - Offpoint: 24 hours
 - Various: ?? hours
 - Total 562 hours