

EVE – AIA Cross-Calibration

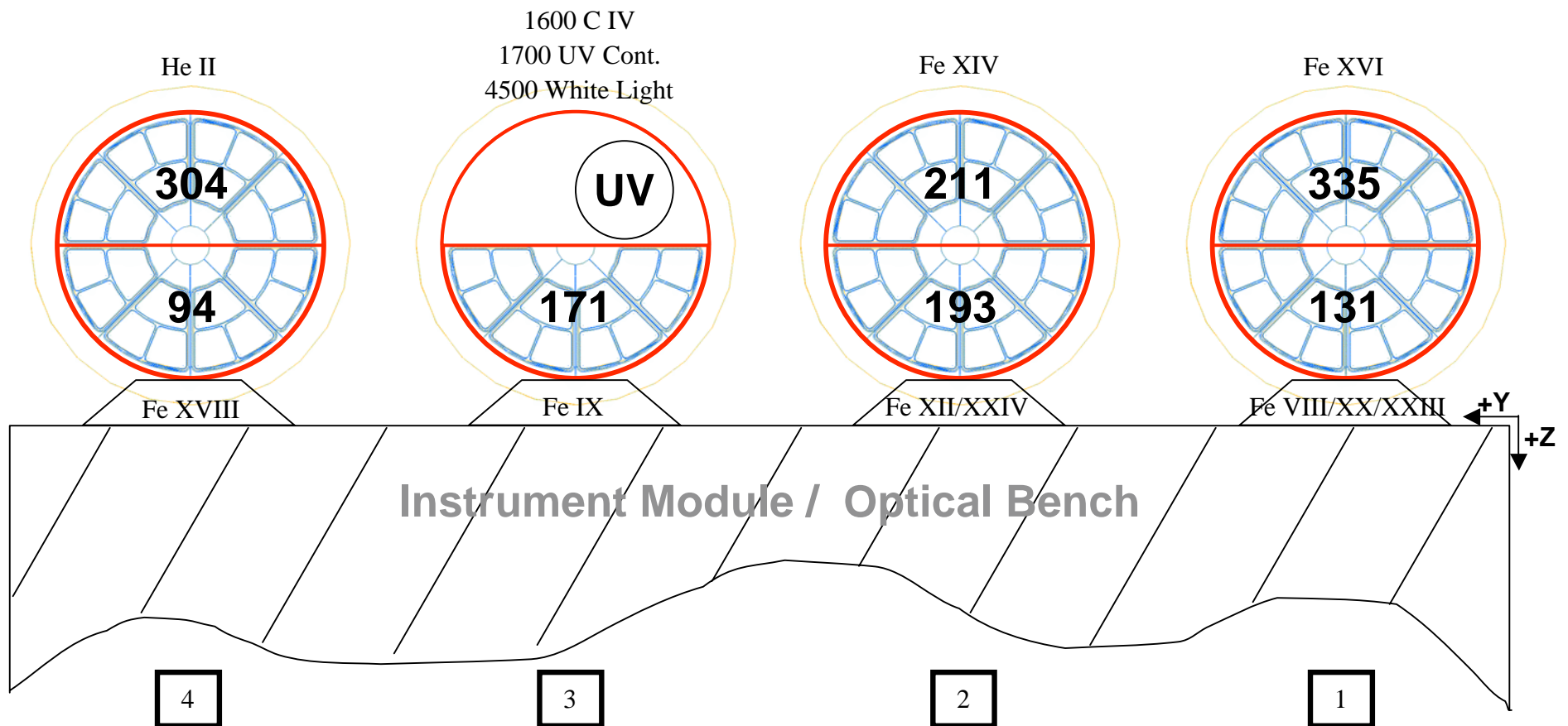
EVE Workshop

9-11 November, 2005

AIA Channels



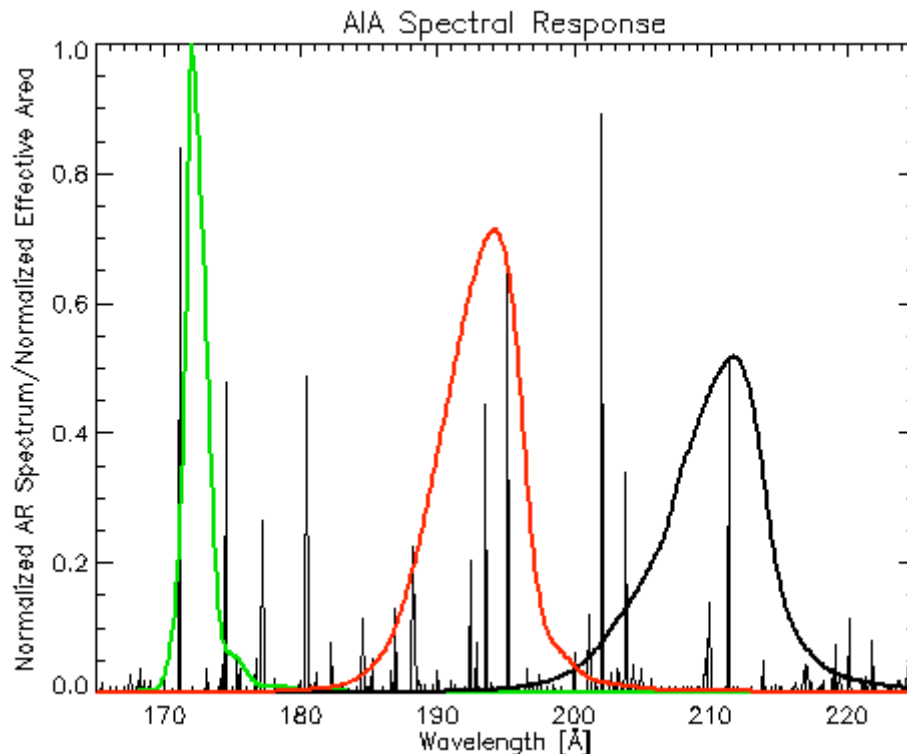
- AIA takes images in 7 EUV and 3 UV channels



AIA Spectral Response



- Spectral response $\eta(\lambda)$ (effective area) of AIA channels determined by component-level calibration measurements
- Temperature response of AIA channels calculated using calibrated spectral response and solar spectral emissivity $F(\lambda, T)$ from CHIANTI:



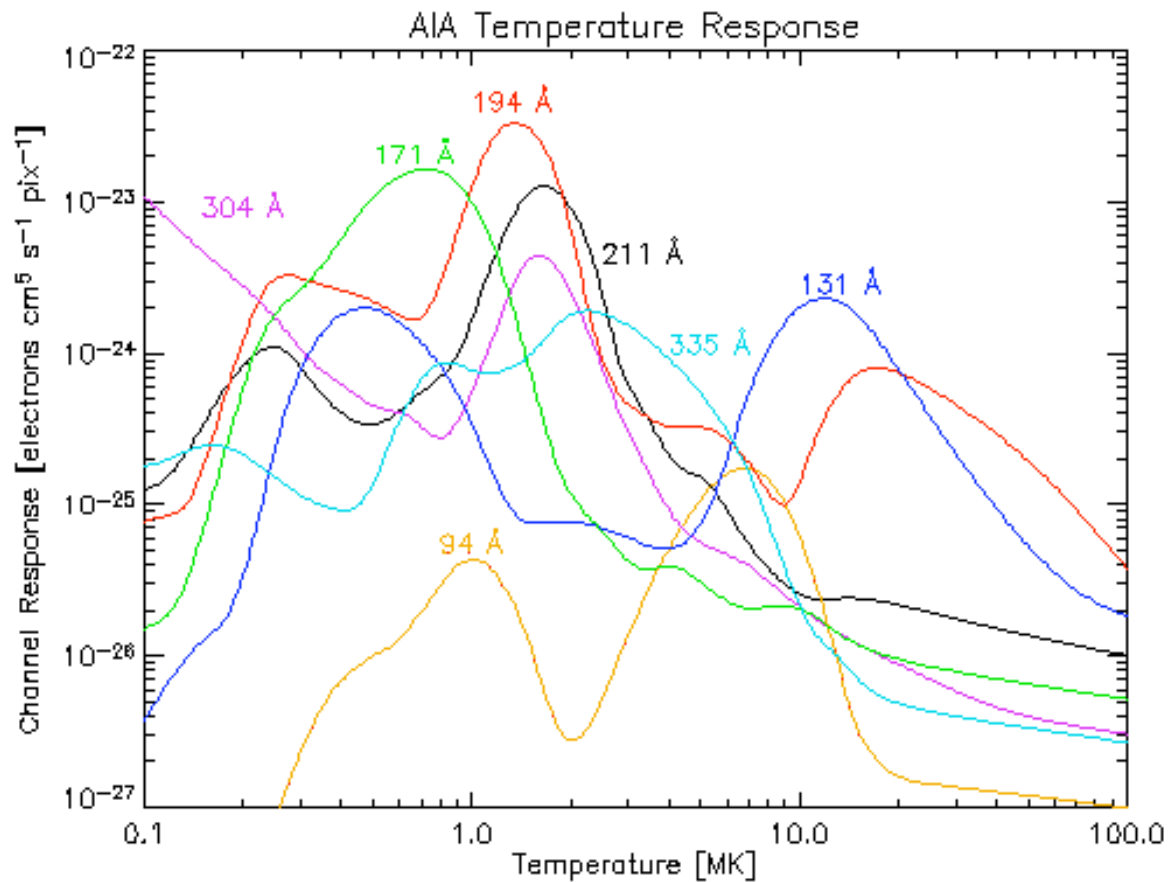
$$R(T) = \int_0^{\infty} \varepsilon_{pix}(\lambda) F(T, \lambda) d\lambda$$

Spectral response of 3 AIA channels over a simulated active region spectrum

AIA Temperature Response



- Temperature response used to extract spatially resolved DEMs
- DEM reconstruction is highly sensitive to error, so calibration is critical



Cross-Calibration

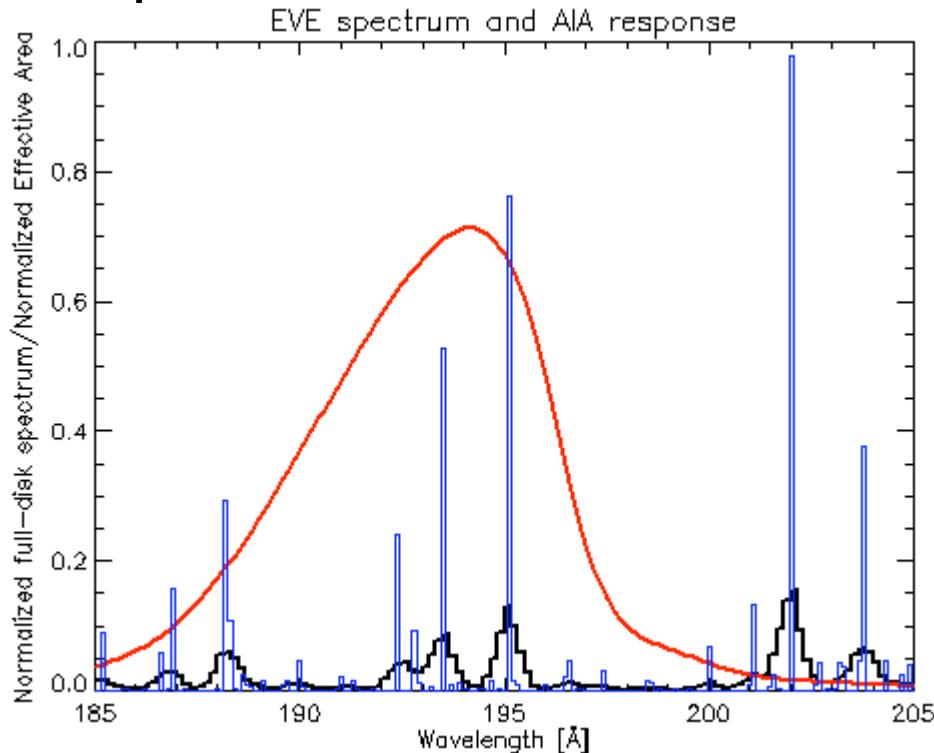


- Estimated BOL relative calibration accuracy for AIA is 15%
 - Absolute calibration is more difficult
 - Calibration will change due to contamination, degradation, etc.
 - Therefore, cross-calibration with EVE is highly desirable
- Basic cross-calibration procedure:
 - Use EVE MEGS-A measurements of full-disk solar spectral irradiance to predict a full-disk count rate in each AIA channel
 - Compare EVE-predicted count rate with measured full-disk count rate, and adjust channel calibration accordingly

Spectral Resolution



- Spectral resolution of $\sim 1 \text{ \AA}$ results in calibration errors
 - Less than 1% for longer-wavelength (broad) channels
 - Up to 25% for 171 and 94 \AA
- Can be corrected by modeling higher-resolution spectrum

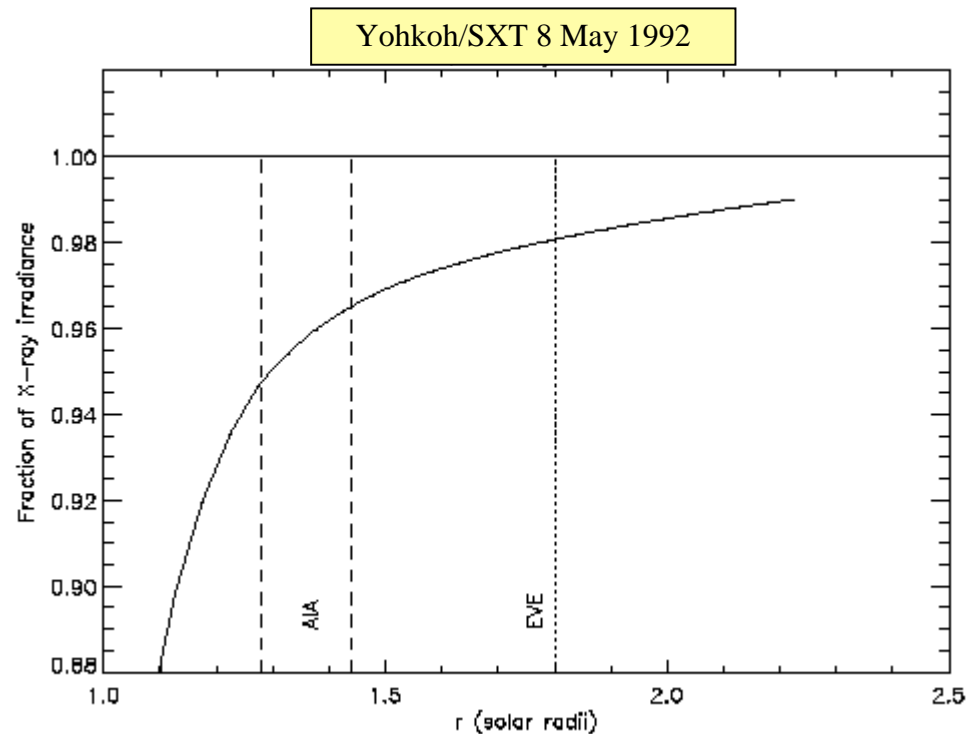


Simulated full-disk spectrum (10% AR, 90% QS) shown in blue. Blurred with 1 \AA FWHM gaussian and binned at 6 pixels/ \AA in black. Response of AIA 194 channel shown in red. Folding the black spectrum through the red instrument response results in errors of 1-25% compared to using the blue spectrum.

Field of View



- AIA field of view is 41 arc-minutes (to edge of CCD) / 46 arc-minutes (vignetting circle)
 - 1.3-2.0 pressure scale heights (at $T = 3.0$ MK)
- Based on Yohkoh observations, we estimate that AIA will observe ~ 96 % of the total coronal radiance
 - Higher fraction for lower-temperature lines
 - Depends on size and location of particular structures



Estimated X-ray radiance at 3 MK as observed by Yohkoh/SXT as function of limb height.