



Atmospheric Imaging Assembly
AIA

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AIA Plate Scale Analysis

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Revision History {If Needed}

Revision	Date	Description of Change
-0.1	2010 March 11	Initial Draft

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1. Goal

The goal of this activity is to determine the plate scale in arcseconds per pixel through image analysis.

2. Overview: Design of Observations and Analysis

During off-pointing maneuvers, a series of three or more images will be taken in each passband including white light. A solar limb will be calculated for each image at each off-point position. The calculated limb will then be used to define a solar center in each image. The distance in pixels from sun center at sun center pointing and sun center at the off-pointing position will be calculated for each bandpass image. Using the radius of the white light sun as an axiom, and assuming that the telescopes move as a rigid structure, the plate scale for each passband can be determined by the following formula; $P_x = P_{wl} (d_{wl}/d_x)$, where P_x is the plate scale of the x th passband, P_{wl} is the plate scale of the white light image, and d_{wl} and d_x are the distances in pixels between the calculated center of the sun in sun center pointing position and the off-pointed positions in the passband, respectively.

3. Details of Required Observations

This analysis requires a minimum of two images to be taken at each off-pointing position in every passband. Three or more images would be ideal. To mitigate potential sources of error, the images from each passband should be taken as close together in time as operational constraints allow. Two or more images in each passband at the sun centered pointing should be taken before and after each series of off-pointing maneuvers.

4. Details of Analysis Technique

This technique of determining the plate scale of an instrument is based on Auchere, DeForest and Artzner (2000). This technique proved useful in determining the plate scale of the EIT telescope in each of its passbands.

5. Results

The plate scale calculation is based on the method described by Auchere, DeForest, & Artzner (2000), in which they calculate the EIT plate scale based on the MDI and EIT off-pointing observations.

The data we used for the AIA plate scale calculation are the HMI-AIA flat-fielding data taken on April 7, 2010. We used the level1 data downloaded from the JSOC website. The limb-fitting routine is the manual limb fitting code developed by Trae Winter.

The white light data we used are:

Time1: 2010-04-07 15:08:17 UT

Time2: 2010-04-07 15:59:17 UT

To ensure the same pointing, we select the EUV/UV data taken closest in time to the white light data. The result is shown in Table1. To get the error bar, for each channel we do limb fitting three times and calculate the plate scale three times. The plate scale for each channel listed in the table is the mean value, and the error is the standard variation obtained using the IDL ‘moment’ function. The same ‘moment’ function is used for calculating the average plate scale.

Table1: Plate Scale of AIA images at all ten wavelengths and the average over the wavelength.

ATA	Wavelength (Angstrom)	Plate Scale (arcsec/pixel)	
		Rsun=695.55 Mm	Rsun=695.508 Mm
1	131	0.6005 ±0.0017	0.6000 ±0.0017
	335	0.6006 ±0.0019	0.6002 ±0.0019
2	193	0.5990 ±0.0028	0.5986±0.0028
	211	0.5998 ±0.0022	0.5994±0.0022
3	171	0.5995 ±0.0018	0.5991±0.0018
	1600	0.6097 ±0.0016	0.6093 ±0.0016
	1700	0.6136 ± 0.0027	0.6132 ±0.0027
	4500	0.5994 ±0.0004	0.5990 ±0.0004
4	94	0.5999 ±0.0018	0.5995 ±0.0018
	304	0.5996 ±0.0034	0.5991 ±0.0034
Aver	all channels	0.6022 ±0.0051	0.6017 ±0.0051
	Without 1600, 1700	0.5998±0.0051	0.5994 ±0.0051

6. References

Auchere, F., DeForest, C.E., and Artzner, G. 2009. ApJ, **529**, L115-L117