Determination of Videomagnetograph Pixel Scales

Method NSO/Kit Peak produces at least one full-disk magnetogram everyday and its medium resolution copy (2.30 arc sec/pix) is available through FTP. A method was devised to determine the pixel scales of BBSO videomagnetograph based on comparisons with Kit Peak full-disk magnetograms. We introduce four parameters s_x, s_y, x_o, and y_o which defines a linear mapping of a Kit Peak magnetogram over the image coordinate system of a BBSO magnetogram

$$i = s_x l + x_0 \quad (1)$$

$$j = s_y m + y_0 \quad (2)$$

where l and m are the coordinates of data points in BBSO magnetograms with the origin at the center of image and with a unit of pixels. Here i and j are the coordinates of the corresponding points in Kit Peak magnetograms. The parameters are determined by minimizing

$$H = \sum (B_{lm} - K_{ij})^2 \quad (3)$$

over s_x, s_y, x_0 and y_0, where B_{lm} is the BBSO magnetogram and K_{ij} is the re-mapped Kit Peak magnetogram. Figure 1 shows an example of a BBSO magnetogram and the corresponding re-mapped Kit Peak magnetogram.

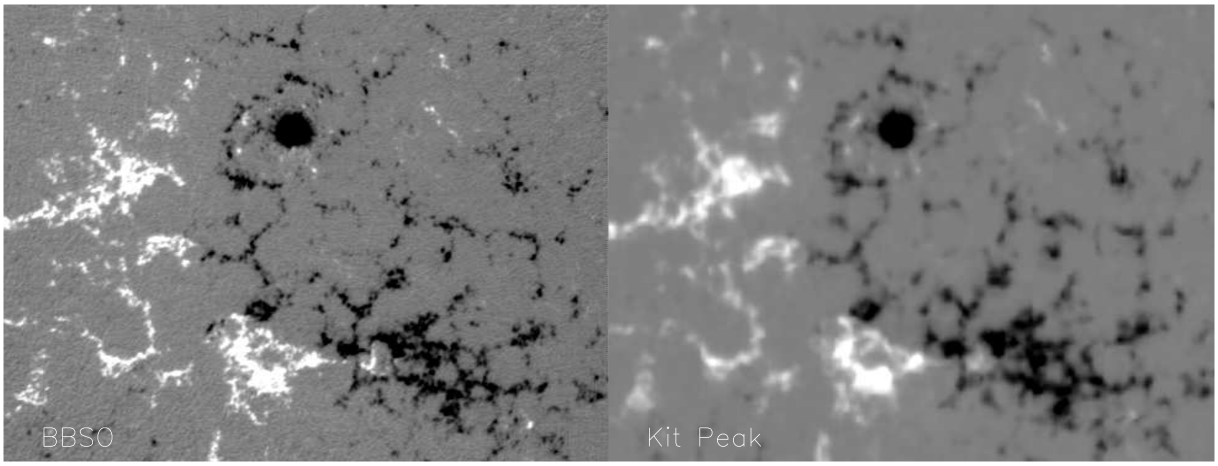

Fig. 1.— A comparison of a BBSO magnetogram and the corresponding re-mapped Kit Peak magnetogram.

Result We applied this technique to the data on 1998 July 1. Results obtained from 4 magnetograms of active regions and one magnetogram of an quiet area are given in Table 1. The results show that it is possible to determine the pixel scales with a good accuracy. Note also that the pointing accuracy of the 10 inch refractor is a few tens of arc seconds, and changes with time.

Table 1: Pixel scales and coordinate offset values determined on 1998 July 1. All the values are in unit of arc seconds.

File #	Region	Δx	Δy	$x_{\rm off}$	$y_{\rm off}$
16	AR	0.801	0.633	37	9
22	AR	0.806	0.639	33	9
31	AR	0.803	0.633	32	15
37	AR	0.800	0.631	30	20
98	QS	0.808	0.634	15	19
		0.804±0.003	0.633±0.004		