Lunar and Planetary Laboratory
The University of Arizona

Memorandum

Subject: **Mapping an EUV image into space**	
Author: Bill Sandel & Bob King	Date: 7 August 2002

This memo tells how to determine the look direction for a particular pixel in an EUV image.

The natural coordinate system defined by 1) the –x axis is the satellite spin axis, and 2) the –z axis points toward Earth. A point in an EUV image is then defined by a spin phase angle ϕ and an elevation angle ρ as shown in Figure 1. In performing the time-delayed-integration calculations for each photon, the on-board software maps both the coordinates ϕ and ρ linearly (in pixels) in offset from the center of the image.

To compute a direction vector (v_x, v_y, v_z) of modulus unity corresponding to a particular image pixel at (ϕ, ρ), we use

$$v_x = \sin \rho,$$

$$v_y = \cos \rho \sin \phi, \text{ and}$$

$$v_z = -\cos \rho \cos \phi.$$

This vector can then be transformed to a geophysically-interesting coordinate system by using the known position of the spin axis and Earth relative to IMAGE.

As a concrete example, we consider the point in the schematic EUV image in Figure 2. We assume that the image is as displayed by euv_imtool in the standard, not zoomed, window. The image so displayed has been doubled in both directions, so that the image size is 280 horizontal × 300 vertical pixels, instead of the natural size of 140 × 150 pixels. We assume that the center of Earth has been determined to be at pixel coordinates (140, 150), and that the field point is at pixel coordinates (230,270). Then we have, for the point in Figure 2,

$$\rho = (0.6 \text{ degrees/pixel})(230 \text{ pixels} - 140 \text{ pixels})/2 = 27°, \text{ and}$$

$$\phi = (0.6 \text{ degrees/pixel})(270 \text{ pixels} - 150 \text{ pixels})/2 = 36°.$$

(The factor of 2 in the denominators of the two equations above accounts for the pixel doubling in euv_imtool's display and readout routines.)
Then we have

$$v_x = \sin (27°) = 0.454,$$

$v_y = \cos(27°) \sin(36°) = 0.524$, and

$v_z = -\cos(27°) \cos(36°) = -0.721$.

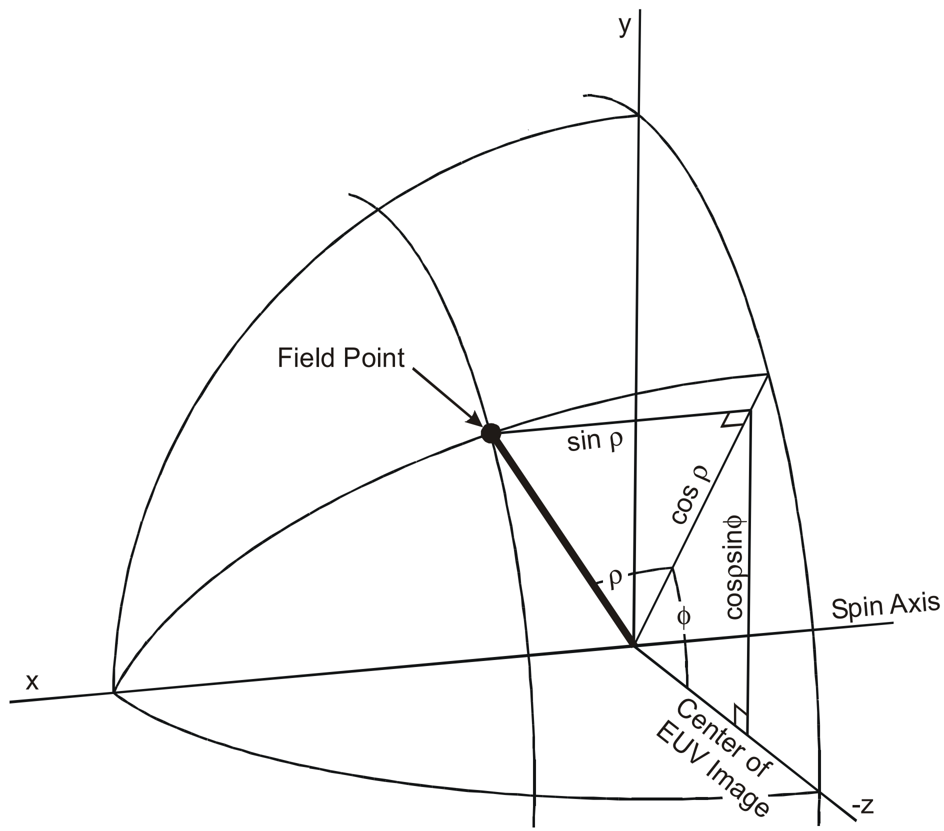

Figure 1

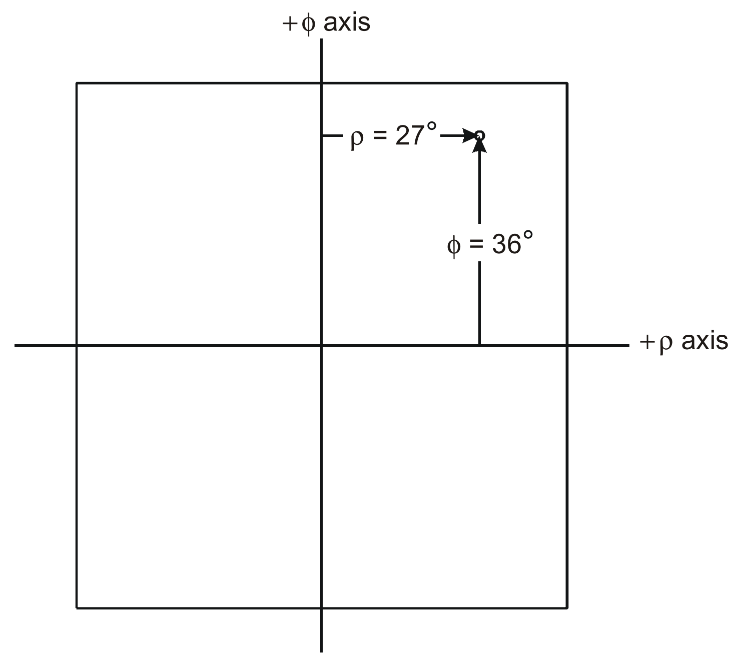

Figure 2