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A determination of the pointing history during FOS scans of Mars

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We have used pointing software, developed earlier for a comparison with the PASS software, to analyze scans of Mars performed at intervals since June 1992. The impetus for performing these calculations was to assist GOs in analyzing their results. An output of our software, not available in the PASS alignment reports, is the instantaneous RA and DEC corresponding to a given V2 and V3 in the telescope field of view. For these sets of data the V2 V3 positions are those of the Faint Object Spectrograph's paired apertures as recorded in the Science Instrument Aperture File in the Project Data Base. We present results for the Blue side A and B apertures at positions (129.35, 161.61) and (-128.93, 158.66) respectively.

To relate the telescope pointing to Mars, we have obtained from the Moving Object Support System (MOSS) the position history of Mars throughout each observation as seen from the telescope. The positions provided incorporated the parallax corresponding to the exact position of HST and the correction which allows for the time light takes to travel from Mars to Earth. We requested that the velocity aberration not be accounted for in the MOSS data because we apply that in our own calculation. The other inputs are the FGS star selector values and the total telescope velocity obtained from the Observatory Monitoring System.

For each observation two plots are given. The first shows the apparent motion of Mars and the positions of the apertures on the sky throughout each observation. The second shows the position of each aperture relative to the moving center of Mars, the deviation being measured in arcsec. If the RA and DEC of Mars, expressed in degrees, are labelled α_m and δ_m, while the values for the aperture are α_a and δ_a, the North deviation is simply $3600(\delta_a-\delta_m)$. The East deviation is calculated as $-3600\ (\alpha_a-\alpha_m)\cos(\delta_m)$. The negative sign is included to provide a conventional astronomical display in which an increasing RA, or a more easterly position, is to the left in the plot. Also included is an outline indicating the apparent size of Mars at the time of each observation.

We have analyzed pointing information for 27th June 1992, 24th August 1992, 2nd January 1993 and 9th April 1993. The June 1992 plot indicates that Mars was missed by about 4 arcsec on the first scan and observed near its limb on the second scan. Aperture A captured a complete chord but aperture B commenced about halfway along. The August 1992 and April 1993 observations appear to have captured complete chords on all scans, while the January 1993 might be about 0.5 arcsec short of a complete scan with the B aperture. These assessments are made without reference to the light curves.

The MOSS positions are correct to within about 0.1 arcsec. The accuracy of the calculated aperture positions is limited by that of the Guide Star Catalog, the RMS value of which is given as 0.7 arcsec for the Northern hemisphere. The series of observations were all in the Northern hemisphere. The aperture location accuracy depends somewhat on its position relative to the two guide stars. In the best of circumstances the aperture would be more or lless between the guide stars and the measurement error would be that of the average position, 0.5 arcsec. If FGSs 1 and 2 are used, the three positions form roughly an equilateral triangle and the aperture location error is larger. In general the accuracy of about 0.7 arcsec may be assumed. Hence, the comment about the January B-scan is not completely reliable. In general, comparing the light curves from the A and B scans will probably permit further refinement of the pointing estimates.