Description of the EPOCh Stellar Transit Observations

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The EPOCh stellar transit observations utilized a broad optical band, extending from 350 to 1000 nanometers (clear filter number 6), of the HRIV CCD. Each resulting image data file represents a single 50-second exposure, using a subarray mode. The units of the archived raw images are raw data counts while units of the archived calibrated images are Watts per square meter per steradian per micron. (Both raw and calibrated data files are archived at MAST and PDS.) In most instances, the subarray size is 128x128 pixels. But sometimes during transit and/or secondary eclipse, a 256x256 subarray size was used. The larger subarray size ensured that pointing jitter did not cause the star to fall beyond the edges of the subarray. The stellar images are defocused (a permanent on-orbit property of the telescope) to about 10 pixels (4 arcsec) FWHM. The calibrated HRIV CCD images have been bias-subtracted with removal of electronic crosstalk and transfer smear and nominally flat-fielded, using flat-field calibration exposures of an integrating sphere made on the ground before launch. However, the CCD detector has changed in space, and the ground flat-field calibration is not adequate for precision stellar photometry. Instead, the EPOCh team used an independent bootstrap procedure, fitting aperture photometry to a 2-D spline to define corrections to the flat-field calibration.

Note also that the spacecraft clock is affected by a systematic drift relative to ground clocks, due to the changing thermal environment of the spacecraft. The EPOCh team has calibrated the spacecraft clock versus ground clocks, and the corrected times were computed by the EPOCh team for each transiting system (giving Julian Date, and Barycentric Julian Date, corresponding to each file name). However, the computation was eventually implemented in the mission's automated data pipeline, and the EPOCh team verified the resulting values were consistent with theirs. Thus the Barycentric Julian Date (when light from the target reaches the solar system barycenter) is provided by the KPKSSBJT keyword in the FITS headers of raw and calibrated data files archived at MAST and PDS.