

New Mars Exploration Rover Panoramic Camera (Pancam) Version 2 Radiance-Factor (IOF) Calibrated RDRs.
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This is a brief summary of how new Version 2 radiance-factor calibrated ("IOF"; an estimate of reflectance) RDRs for the Mars Exploration Rover Pancam investigation (Bell et al., 2003) have been updated relative to the existing Version 1 IOF calibrated RDRs previously archived in the PDS. Specifically, these modified processing steps below were applied to the original Pancam EDRs, compared to the steps used to create the original Version 1 IOF calibrated RDRs (documented in Bell et al., 2006):

(A) Raw EDRs were first recalibrated to absolute radiance ("RAD") units ($\text{W/m}^2/\text{nm/sr}$) using the new Version 2 RAD calibration process (updated bias, dark current, and flatfield corrections plus corrections to the ELEVATION label keyword) described in the `pancam_rad_v2_summary` document associated with the new Version 2 release of the Pancam calibrated RAD files (see: https://pds-geosciences.wustl.edu/mer/mer2-m-pancam-3-radcal-sci-v2/mer2pc_1002/calib/pancam_rad_v2_summary.txt).

(B) The standard procedure for calibration of Pancam images to IOF (an acronym for the quantity I/F , where I = the measured scene radiance from the RAD files and F = the solar irradiance at the top of the Martian atmosphere) relies on the fact that the Pancam calibration target has seven different Regions of Interest (ROIs) with known laboratory-derived reflectance properties; extracting the observed radiances from these ROIs in the RAD calibrated images and performing a linear fit between radiances and lab ROI reflectances at each wavelength results in coefficients that convert the RAD data to estimated IOF (Bell et al., 2006). In the Version 2 Pancam IOF calibration process, the calibration target ROIs have been modified across the entire duration of both rover missions to avoid the use of areas of the calibration target with abnormal levels of windblown dust during various phases of the missions. This resulted in a new set of refined radiance to reflectance (IOF) coefficients.

(C) The calibration targets accumulated low levels of airfall dust continuously throughout both rover missions. For most of the missions the dust covering was transparent enough that a straightforward two-stream radiative transfer model was used to correct for the dust cover and "remove" its influence on the RAD to IOF coefficients derived in Step (B) above. In the Version 2 Pancam IOF calibration process, the initial Version 1 calibration target dust model correction was replaced with a much more rigorous and refined dust model correction (Kinch et al., 2015).

(D) Most calibration target observations were taken, by design, very close in time to the images they were intended to calibrate. In some cases, however, the calibration target sequence failed to be properly acquired or down-linked, or time or power or other concerns did not allow an accompanying calibration target sequence to be run. In the Version 1 Pancam IOF calibration process, the calibration pipeline did not optimize the choice of which calibration target to use for the best IOF calibration of each Pancam sequence, and simply chose the one that was closest in time. The result was that the calibration target used may have been acquired at a completely different time of day and viewing geometry than the sequence that it ultimately calibrated. In the Version 2 Pancam IOF calibration process, the pipeline was modified to use the best choice of calibration target by balancing the difference in time and viewing geometry between calibration target sequence and the sequence that it ultimately calibrated.

New Version 2 Pancam calibrated IOF RDRs were created using these calibration improvements for all MER-A (Spirit) and MER-B (Opportunity) Pancam RDRs.

References cited:

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