Microscopic Imager

The Athena Microscopic Imager (MI) is a high-resolution imaging system mounted on the IDD. The camera body is identical to the ones used by Pancam, so the field of view is 1024×1024 pixels in size and the instrument has the same basic radiometric performance characteristics as Pancam. There is a single broad-band filter, so imaging with the Microscopic Imager is monochromatic.

The MI optics employ a simple, fixed focus design at f/15 that provides ±3 mm depth-of-field at 30μm/pixel sampling. The field of view is therefore 31×31 mm at the working distance. The focal length is 20 mm, and the working distance is 63 mm from the front of the lens barrel to the object plane. The object-to-image distance is 100 mm. Preflight geometric calibration will thoroughly characterize the geometric distortion of the system.

The spectral bandpass of the MI optical system is 400-680 nm. At best focus, the modulation transfer function of the optics is at least 0.35 at 30 lp/mm over this bandpass. Radiometric calibration of the Microscopic Imager will be performed with a relative (pixel-to-pixel) accuracy of ≤5%, and an absolute accuracy of ≤20%. Calibration measurements will be obtained every 10 nm over the instrument's full spectral bandpass. The MI signal to noise ratio will be at least 100 for exposures of 20% full well over the spectral bandpass and within the calibrated operating temperature range (-55 to +5º C).

No onboard radiometric calibration target is provided for inflight calibration of the MI. It is likely that the MI will be able to view the Compositional Calibration Target, and that this target will provide fiducial marks that can be use to perform a focus check. The MI will be able to acquire unfocussed images of the martian sky, providing flat fields.

The MI will be mounted on the Instrument Deployment Device (IDD), allowing it to be placed against surfaces that can also be examined by the other Athena instruments. The IDD will have a minimum controllable motion along a science target's surface normal vector of 2±1 mm RMS, allowing it to image a rough surface in a sequence of images. After placing the MI in position for imaging, the motion of the IDD damps down to an amplitude of less than 30 microns (*i.e.*, less than one MI pixel) within 15 seconds. Whenever the MI is not in use, the MI optics are protected from contamination by a transparent cover. Preflight calibration imaging will establish the transmission properties of the cover. The cover is opened only for MI imaging sequences. A contact sensor attached to the MI will be used to detect rock and other hard surfaces, to help ensure accurate positioning and protect the MI from accidental damage.

The MI acquires images using only solar or skylight illumination of the target surface. Stereoscopic observations and mosaics can be obtained by moving the MI between successive frames. Stereo images and images taken at various distances from the target will be used to derive the 3-dimensional character of the target surface. Optical sections will also be combined to produce an image of the target that is well-focused across the entire frame.