Processing Approaches for optimal Science Exploitation of the Chemcam Remote Microscopic Imager (RMI) on-board Curiosity

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The Remote Microscopic Imager (RMI) camera operating on Curiosity as part of the Chemcam instrument [1] combines a camera head inherited from the CIVA experiment [2] on board ROSETTA and optics with focus adjustment capabilities developed at IRAP so as to provide imaging capabilities from 1 m to infinity. The FOV is 6 cm at 3 m. RMI provides excellent context images for LIBS analyses, with unambiguous identification of laser spots (see companion abstract [3]). There has been strong interest within the MSL science team for the imaging capability of RMI as it proved quite complementary to Mastcam and Navcam for imaging distant rocks and soils at very high resolution. A detailed analysis of the performances of RMI and of processing approaches which maximize its science return is therefore of major interest for MSL. Due to the variable focus optics, the photometric efficiency (flat field) decreases by more than a factor of 2 from the center to the edges. In this contribution, we focus on the camera head, drawing from tests performed on the ground and in flight with the CIVA and RMI cameras. The S/N and intrinsic flat field of the CCD are excellent. An automatic time exposure selection procedure inherited from CIVA is implemented on Chemcam. Adequate processing methods make it possible to recover from overexposure when the automatic time exposure procedure was not implemented. It is also possible to correct very effectively a smearing effect during frame transfer, which provides a significant contribution to the signal when the exposure time is less than 20 msec. Distance information and high spatial resolution ($\sim$ 2 pixels) can be reliably obtained over the FOV with series of images taken at increasing focal distances ("z-stacks") with two independent methods.

References: [1] Maurice S. et al. (2012) Space Sci. Rev. 170, 95-166 ; [2] Bibring J-P. et al. (2007) Space Sci. Rev. 128, 397-412; [3] Le Mouélic S. et al. (EGU 2013).