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Image enhancement of the Super Resolution Channel (SRC) of the Mars Express HRSC experiment

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The SRC or Super Resolution Channel is the framing imaging subsystem of the HRSC experiment on the ESA Mars Express spacecraft, designed to show high-resolution detail within the broad swath of the HRSC push-broom camera. By December 2008, it had obtained about 7500 images.

The quality of the SRC images proved lower than the design expectation: the thermal conditions of the camera in space caused a distortion of the optics, seen in images as blurring and ghosting. Analysis of star images demonstrated that the point-spread function was asymmetrical with offset secondary intensity peaks. Close to pericentre, where the spacecraft ground track velocity is around 3.5 km/s, an exposure time of 0.6 ms is needed to avoid motion-smear in the image. Operation of the camera has shown that the optimal trade-off between motion-smear and an acceptable SNR is found at considerably higher exposure times, around 5 ms.

Trials at improving the images with respect to both the thermal distortion and the motion-smear were made using the Richardson-Lucy algorithm, an iterative procedure for recovering an image blurred by a known point spread function.