

README for the software provided along the paper:
M.Vulovic, B. Rieger, L.J. van Vliet, A.J. Koster, R.B.G. Ravelli,
*A Toolkit for the Characterisation of CCD Cameras for Transmission Electron
Microscopy, Acta Cryst.* (2010). D66, 97-109 [[doi:10.1107/S0907444909031205](https://doi.org/10.1107/S0907444909031205)].

The algorithms to characterise CCD detectors have been implemented in DipImage, a publicly available software toolbox (www.diplib.org) for Matlab (The MathWorks, Inc.)

The following images are required:

- 1) Dark reference images (with the column valves closed, *i.e.* there was no beam)
- 2) White reference images (with uniform illumination of the detector)
- 3) The normalized images of a beam stop or diffraction aperture (MTF edge method)

The images should be saved with the following name convention:

- 1) Bin%d_Exp%05.2f_dark%02d for dark reference images
- 2) Bin%d_Exp%05.2f_gain%02d for white reference images

where %d and %05.2f stand for the syntax of printf in C or Matlab, .e.g.
Bin2_Exp01.00_white01 for binning 2, exposure time of 1 second and white image number 1.

Have a look at the file `example1.m` which shows the processing of the provided images.

Changes in Version 2 of the TEM CCD software:

The function `ex_slice` was changed to be compatible with Dipimage 2.3. The first version of TEM CCD software works with all Dipimage versions before 2.3.

	FUNCTION (m.file)	Description
1	<code>remout</code>	Remove outliers and writes output images in the same folder
2	<code>lsq</code>	Makes a linear least square fit of the intensity against integration (exposure) times of each pixel in a stack of images; computes offset and slope of the fit
3	<code>average</code>	Calculates an average background or white reference image for a certain exposure time and binning
4	<code>averagesame</code>	Averages the images within the stack with the same exposure time; writes out the average image

5	<code>corr_raw</code>	Corrects a raw image for the bias and gain
6	<code>ef_gain</code>	Calculates average variance and average intensity within stacks of uniformly illuminated images with different exposure times; plots the effective detector gain
7	<code>r_square</code>	Calculates the coefficient of determination to check how well the estimated regression line fits the data
8	<code>readout_noise_pix</code>	Calculates the readout noise image from the stack of dark images acquired with the lowest possible integration time and writes it out
9	<code>mtf_noise</code>	MTF via noise method
10	<code>mtf_edge</code>	Calculates MTF via straight edge (beam stop)
11	<code>mtf_edgeAperture</code>	Calculates MTF via diffraction aperture
12	<code>dqe</code>	Calculates Detector Quantum Efficiency

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