Image information and processing

Anders Kaestner, Laboratory for Neutron Scattering and Imaging

Imaging produces a considerable amount of data during an experiment. This is also true for neutron imaging, and in order to obtain quantitative information from the raw acquisitions, it is mostly required to apply a chain of image processing operations to the data. The choice of operations depends on the experiment type. A very coarse categorization divides the data into experiments producing 2D or 3D information. The latter requires the use of a CT reconstruction algorithm.

In this lecture, you will learn more about how to work with imaging data and the principles behind this processing. The focus will be on the principle of computed tomography, and the related processing of the projection data as this has many operations in common with 2D data. This part of the lecture will include preprocessing of the projection data to remove different kinds of artifacts and biases introduced by the background and acquisition hardware.

In a neutron imaging experiment, there is always a balance between the neutron count and the resolution in time. Thus, the signal to noise ratio is relatively low as the experimentalist mostly wants the highest resolution in time and space, allowing a lower neutron dose per pixel. The low neutron dose results in noisy data, which can be hard to interpret. The signal to noise ratio can be improved by applying denoising filters but often at the cost of increased blur and lost image details.

In the second part of this lecture, you will get an introduction to basic image statistics and thresholding and some linear and non-linear denoising filters to improve the segmentation performance.