Contrast enhancement of sample features through energy selective imaging

In this experiment, you will investigate a metal sample using energy selective neutron imaging at the cold neutron imaging beamline ICON. Using the energy selective approach makes it possible to probe material structure in a way that is not possible when the full neutron spectrum is used as mostly done for neutron imaging experiments. The reason is that the coherent neutron scattering in a polycrystalline sample result in different neutron cross sections depending on the used neutron energy. In theory, there will be discrete steps in the cross-section values at the Bragg edges. In practice, we do not have sufficient energy resolution at ICON to see this pattern, but will only see smooth fluctuations. Therefore, in the experiment, you will identify two neutron energies that provides the highest sample contrast and make a tomography scan for each energy. This will provide three-dimensional information about the distribution of attenuation coefficients in the sample, which will reveal the distribution of different material features in the sample. After the acquisition, you will also reconstruct the projection data and visualize the results.

Literature:

Steven Peetermanns, Energy-selective neutron imaging for materials science, PhD Thesis EPFL, 2015.
https://infoscience.epfl.ch/record/205011/files/EPFL_TH6514.pdf