Nearly all imaging methods in materials science produce two-dimensional (2-D) information. While it is possible to derive 3-D information from such images through stereological considerations, it is often desirable to obtain a full 3-D insight into a particular microstructure. In this talk, we will review recent progress in the area of (1) collecting 2-D data from which 3-D reconstructions can be made, and (2) the conversion process itself, i.e., how one can take 2-D slices or 2-D tomographic projections and turn them into accurate representations of the original object.

We will start from 2-D observations, either slices obtained through serial sectioning by means of focused ion beam microscopy or robotized metallography, or projections obtained by means of x-ray and electron beams. Then we introduce a number of basic processing steps that will allow for the conversion of 2-D slices into a 3-D data stack, using Ni-based superalloys and a fifty year old data set on a pearlite colony as examples.

Next we will consider the basic concepts of tomographic techniques and apply them to data obtained in the Lorentz TEM observation mode for patterned permalloy islands. We will conclude this talk with an overview of the current and future experimental capabilities in the MSE department.